



AIRPLANE MAINTENANCE MANUAL

CARD 1 OF 8

PA-46-350P



(S/N's 4636001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

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Member
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Manufacturers Association

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	June 19, 1996	All
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CR981223	December 23, 1998	1, 2, 3, 4, 5, and 6
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CR050730	July 30, 2005	1, 2, 3, 4, 5, 6, 7 and 8
PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

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3. Effectivity

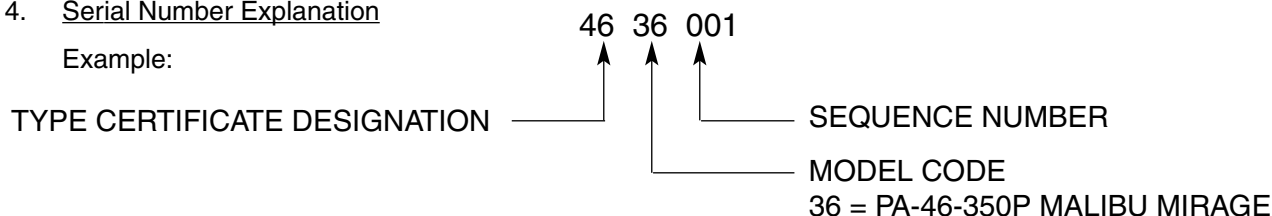
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. **System/Chapter** - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. **Sub-System/Section** - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. **Unit/Subject** - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or) S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

**(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP,
AND ALL HYDRAULIC COMPONENTS:**

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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(23) PROPELLER AND 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

Propeller
Overhaul Instructions: Manual No. 113

Composite Blade
Maintenance: Manual No. 135

Propeller Owner's
Manual: Manual No. 115

Aluminum Blade
Inspection, Repair,
and Overhaul Instructions: Manual No. 133

(24) RADAR (WEATHER), RDR - 2000:

Vendor Address:	Honeywell (Bendix/King) (See Autoflight, above)

Maintenance Manual:	Bendix/King ART 2000 P/N 006-05332-0001

(25) RADIO COOLING BLOWER:

Vendor Address:	Globe Motors 2275 Stanley Ave. Dayton, Ohio 45404 http://www.globe-motors.com/home.html	PH: (937) 228-3171 FAX: (937) 229-8531

(26) STARTER:

Vendor Address:	Electro Systems, Inc. (See Alternator, above)

(27) TURBOCHARGER:

Vendor Address:	Turbocharging Systems Worldwide HQ Building #10, Ste. 200 23326 Hawthorne Blvd. Torrance, CA 90505 http://www.alliedsignal.com/turbos/products/index.html	PH: (310) 791-9101 FAX: (310) 534-5941

(28) VACUUM PUMP:

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

(29) VACUUM REGULATORS:

Vendor Address:	Parker Hannifin Corp. (see "Fuel Boost Pump," above)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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4

AIRWORTHINESS LIMITATIONS

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AIRWORTHINESS LIMITATIONS

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

1. The following limitations, related to fatigue life of the airplane and its components, have been established for the PA-46-350P:
 - A. Refer to Chart 1 for Structural Inspection and Replacement.
 - B. The safe life limit of propeller blades is unlimited.
2. Refer to 5-20-00 for Piper's recommended Inspection Program.
3. Life Limited Parts Marking and Disposition

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

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

CHART 1
STRUCTURAL INSPECTION AND REPLACEMENT

(PIR-TCDS A25SO, Rev. 12.)

COMPONENT	LIFE (Flight Hours)	INSPECTION INTERVALS (Flight Hours)
Wing and Associated Structure	15,580	N/A
Pressurized Structure	10,145	N/A

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CHAPTER

5

TIME LIMITS / MAINTENANCE CHECKS

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GENERAL

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

- A. The recurring maintenance schedule for the PA-46-350P Malibu Mirage is available in two forms: an Annual / 100 Hour Inspection Program, which is provided in 5-20-00 (and is available separately as P/N 767-011), and a Progressive (50 Hour) Inspection Program, which will be available only in manual form as P/N 767-013.
- 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 should periodically check with his Piper Service Center or A & P mechanic to see whether he has the latest issued AD against his airplane. 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 Distributors world wide.

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TIME LIMITS

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

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SCHEDULED MAINTENANCE

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

1. Description

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

The recurring maintenance schedule for the PA-46-350P Malibu Mirage is available in two forms: an Annual / 100 Hour Inspection Program, which is provided in paragraph 4, and a Progressive (50 Hour) Inspection Program, which will be available separately.

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

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

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

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

2. Definitions

- A. Inspections - Must be performed only by Certified Mechanics who are qualified on this aircraft, utilizing acceptable methods, techniques and practices to determine physical condition and detect defects.
 - (1) Routine Inspection - Consists of a visual examination or check of the aircraft and its components and systems without disassembly.
 - (2) Detailed Inspection - Consists of a thorough examination of the appliances, the aircraft and the components and systems with such disassembly as is 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 the event 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.

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

NOTE: Dates stamped on individual components at the time of manufacture are typically applied to determine shelf life- i.e. the maximum time allowed from manufacture/ assembly/cure until actually installed in an aircraft and are not relevant.

Do not, however; ignore markings applied to life-limited parts when removed with time and/or cycles remaining on them.
 - (2) Aircraft time flight hours, or aircraft hours are the Hobbs Time shown on, or calculated from the installed Hour Meter.

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3. Inspection Requirements

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

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

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

B. Progressive Inspection

The Progressive Inspection Program is designed to permit the best utilization of the aircraft by scheduling inspections through the use of a planned inspection schedule. This schedule will be published in a separate manual form, which, when available, may be ordered from Piper Distributors under P/N 767-013. Refer to Piper Customer Service Info Aerofiche revision checklist for availability and to ensure obtaining latest issue.

NOTE: The PA-46-350P Malibu Mirage 50 Hour Progressive Inspection Manual (P/N 767-013) referenced above will not be a stand-alone document. The Progressive Inspection Manual will constitute a snapshot of the Airworthiness Limitations and Inspection sections of the Instructions for Continued Airworthiness (ICA) and will be current only at the time of printing. Use it as follows:

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

C. Overlimits Inspections

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

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4. Annual / 100 Hour Inspection Procedure

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

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

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

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

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

To help in the performance of periodic inspections, Inspection Report forms are available through Piper Dealers as P/N 767-011.

NOTE: Service centers conducting Part 91 Annual / 100 Hour Inspections can use the Inspection Report Form (P/N 767-011), as a working check-off list, provided they verify its currency against an up-to-date copy of the ICA (i.e. - this Maintenance Manual, Chapters 4 and 5).

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

B. Special Inspections (5-30-00)

- (1) Per Flight Hour
- (2) Per Calendar Year
- (3) Per Special Operation / Operating Environment

C. Unscheduled Maintenance (5-50-00)

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5. Scheduled Maintenance

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

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
A. PROPELLER GROUP		
<u>WARNING:</u> USE EXTREME CAUTION WHEN ROTATING PROPELLER BY HAND; PROPELLER MAY KICK BACK. PRIOR TO ROTATING PROPELLER ENSURE BOTH MAGNETO SWITCH(S) ARE OFF (GROUNDED). IF MAGNETO(S) ARE NOT GROUNDED, TURNING PROPELLER MAY START ENGINE.		
1. Inspect spinner and spinner bulkhead for cracks	O	O
2. Remove and inspect spinner and spinner bulkhead for cracks		O
3. Inspect blades for cracks, nicks and gouges	O	O
4. Inspect for grease and oil leaks	O	O
5. Inspect propeller mounting bolts and safety. (Check torque if safety is broken.)		O
6. Inspect hub parts for cracks, corrosion, and wear	O	O
7. Rotate blades and check for tightness in hub pilot tube		O
8. Check condition of propeller deicer system (if installed)		O
9. If installed, inspect propeller deice slip rings, brush block and brush length, replace as required		O
10. Lubricate propeller. (See appropriate Hartzell Owner's Manual and Lubrication Chart, 12-20-00.)		O
11. Install spinner		O
B. ENGINE GROUP		
<u>WARNING:</u> GROUND MAGNETO PRIMARY CIRCUIT BEFORE WORKING ON ENGINE.		
<u>NOTE:</u> Read Note 5, 50 and 51 before completing this group.		
1. Remove engine cowling	O	O
2. Clean and check cowling for cracks, distortion, and loose or missing fasteners	O	O
3. Compression check while engine is warm		O
4. Drain oil sump while engine is warm	O	O
5. Inspect oil temperature sender unit for leaks and security		O
6. Inspect cylinder head temperature probe and wires for security		O
7. Inspect oil lines and fittings for leaks, security, chafing, dents, and cracks		O
8. Clean and inspect oil radiator cooling fins		O
9. Change full flow (cartridge type) oil filter element, check element for foreign particles. (See 12-10-00.)	O	O
10. Fill engine with oil. (See 12-10-00.)	O	O
11. Clean engine. (See Note 7.)		O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
B. ENGINE GROUP (cont)		
12. Inspect condition of spark plugs, clean and adjust gap as required.....		O
<u>NOTE:</u> If fouling of spark plugs is apparent, rotate bottom plugs to upper plugs.		
<u>NOTE:</u> Piper does not recommend that Iridium spark plugs be cleaned using abrasive or glass bead materials unless otherwise required by the applicable manufacturer.		
<u>NOTE:</u> Refer to latest revision of Champion Aviation Technical Bulletin 85-10 for servicing Champion Iridium "S" spark plugs.		
13. Inspect spark plug cable, lead spring, and silicone collar for corrosion, deposits, and condition.....		O
14. Check ignition harnesses and insulators for high tension leakage and continuity		O
15. Check cylinders for cracked or broken fins. (See Note 8.).....		O
16. Inspect rocker box covers for evidence of oil leaks, if leaks are detected replace gasket and torque cover screws to 50 in-lbs.....	O	O
17. Inspect wiring to engine and accessories. Replace damaged wires and clamps. (See Note 10.)		O
18. Inspect terminals for security and cleanliness.....	O	
19. Check magneto main points for clearance. (See 74-10-00, Magnetos, 100 Hour Inspection.)		O
20. Inspect magnetos for oil leaks.....		O
21. Check magneto to engine timing. (See Note 6.).....	O	O
22. Inspect security of injector nozzle and sense line. (See Note 9.)		O
<u>NOTE:</u> Clean injector nozzles as required. (Clean with acetone only.)		
23. Remove air filter and clean per 12-10-00, replace as required. (See Note 28.)	O	O
24. Inspect intake ducts for leaks and all wires that form duct must be in place and secure		O
25. Inspect condition and operation of alternate air door and box		O
26. Inspect alternate air door assembly (flapper valve plate) for cracks and condition		O
27. Inspect flexible hoses for condition. (See Note 15.)	O	O
28. Inspect fuel system for leaks including flow dividers, lines, and fittings. (See Note 39.)		O
29. Check fuel pumps for operation and pressure. (See 28-20-00; 73-30-00, Fuel Pump, Pressure Operational Check; and Note 22.)		O
30. Check condition of vacuum pumps and security of hoses		O
31. Check throttle, mixture, and propeller governor controls for travel and operating condition. (Ensure full stop to stop travel.).....		O
32. Check mixture control cable for heat damage and routing.....		O
33. Inspect exhaust stacks for cracks, hot spots, and security. Inspect gaskets for leakage and condition. (Replace gaskets as required.)	O	O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
34. Inspect exhaust pipe and heat exchanger (Refer to 81-20-00, Turbocharger and Exhaust System Visual Inspection.)	O	O
35. Inspect exhaust heat shield and cross-over tubes for cracks and condition		O
36. Inspect breather tube for obstructions, coking, and security		O
37. Check security and condition of oil separator.....		O
NOTE: On left-hand tailpipe, disconnect breather tube hose connection. Remove lower tube assembly from tailpipe at slip joint. Remove any contaminate buildup.		
38. Inspect crankcase for cracks, leaks, and security of seam bolts.....		O
39. Inspect engine mounts for cracks, corrosion, and loose mounting bolts. (See 100 Hour Engine Mount Inspection, 71-20-00.).....		O
40. Inspect engine mount heat shield for cracks, corrosion and condition.		O
41. Check all engine baffles for cracks and security		O
42. Inspect rubber engine shock (isolator) mounts for deterioration. Replace as required		O
43. Inspect firewall for cracks, condition, and security		O
44. Check condition of firewall sealing		O
45. Inspect alternator(s) for cracks, condition, and security		O
46. Inspect condition and tension of alternator drive belts (Refer to 24-30-00.).....		O
47. Inspect starter for cracks, condition, and security. (See Note 43.)		O
48. Check air conditioning system for evidence of refrigerant leakage. (Refer to 21-50-00.).....		O
NOTE: If cooling system has leaked refrigerant or is discharged, the compressor oil level must be checked. Environmental regulations may prohibit adding refrigerant until the cause of the loss has been determined and repaired.		
49. Inspect condition and tension of compressor drive belt. (Refer to 21-50-00.).....		O
50. Inspect security of compressor mounting.....		O
51. Inspect compressor clutch security and condition of wiring		O
52. Check engine accessory case and components for leakage, condition, and security		O
53. Inspect bleed air ducts for condition and security		O
CAUTION: DO NOT LUBRICATE TEFLON LINERS IN CONTROL CABLES.		
54. Lubricate all controls per Lubrication Chart, 12-20-00		O
55. Inspect sonic nozzle for condition and security		O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
C. TURBOCHARGER GROUP		
1. Visually inspect system for oil leaks, exhaust system leaks and general condition. (See Note 20 and 81-20-00, Turbocharger and Exhaust System Visual Inspection.)	O	O
2. Inspect the compressor wheel for nicks, cracks, or broken blades		O
3. Check for excess bearing drag or wheel rubbing against housing		O
4. Inspect turbine wheel for broken blades or signs of rubbing		O
5. Inspect oil inlet and outlet ports in center housing for leaks.....		O
6. Inspect turbo gaskets for leaks.....	O	O
7. Inspect turbo clamp for cracks and torque. (If the clamp nut is removed, replace with a new nut (P/N 755-657). Torque the nut on installation and recheck torque after first engine run.)	O	O
8. Inspect mounts for cracks, corrosion, clearance, and security		O
9. Check wastegate actuator linkage, rod ends, springs, butterfly, and bushings for condition. Replace as required		O
10. Inspect drain line from actuator for presence of oil	O	O
11. Inspect induction and exhaust components for worn or damaged areas, loose clamps, cracks, and leaks. (See Note 45.)	O	O
12. Inspect intercooler clips for condition and security. (See 81-20-00, Intercooler Attachment Clips Inspection/Replacement.)	O	O
13. Inspect turbo and controller system oil lines for leaks and security	O	O
14. Inspect for oil leakage from controller and sense lines	O	O
15. Install engine cowling	O	O
D. CABIN AND COCKPIT GROUP		
1. Remove inspection covers and panels (seats and carpet must be removed for access to inspection covers on cabin floor).....		O
2. Inspect cabin entrance door and emergency exit door seals		O
3. Inspect cabin door and emergency exit for proper rigging, and check retainer pins and striker plates for bending, cracks, proper engagement, pulled or sheared fasteners and bending of the frame web. (See Note 33.)		O
CAUTION: WITH CREW SEATS OCCUPIED AND AT THE LOWEST VERTICAL POSITION, CHECK SEATS FOR PROPER ENGAGEMENT OF PINS TO SEAT TRACK.		
4. Inspect crew seats for proper vertical and horizontal operation. (See Note 30.)...	O	O
5. Inspect seats, seat belts, shoulder harnesses, security brackets, and bolts. (See Restraint System - Inspection, 25-10-00.) (See Notes 17 and 26.).....		O
6. Inspect electric trim operation and indicators for full travel, binding, damage, and correct control deflection.....		O
7. Check rudder pedals and toe brakes for travel, binding, and security. (See Note 31.).....		O
8. Inspect parking brake for condition, security and operation. (See Note 19.).....		O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
9. Inspect control wheels, column, and switches for damage, operation, and full travel. (See Notes 11 and 41.)		O
10. Inspect push pull tubes, torque tubes, levers, pillow blocks, bellcranks, and connections for condition and security. (See Note 38.)		O
11. Check operation of strobe, landing, navigation, cabin, and instrument lights	O	O
12. Inspect condition of instruments, lines, hoses, and attachments		O
13. Check pneumatic and electric gyro instruments (overhaul or replace as required)		O
14. Check or replace vacuum regulator filter		O
15. Inspect pitot/static and alternate static lines, hoses for condition and security		O
16. Inspect altimeter and transponder for installation/certification per latest revision of AC 43.13-1 and tested/inspected per FAR's 91.411 and 91.413, respectively		O
17. Inspect and test ELT per FAR 91.207. (See Testing ELT, 25-60-00.)		O
18. Check operation and security of fuel selector valve linkage at fuel selector	O	O
19. Check condition of safety wire on screw attaching valve cam		O
20. Check operation of cabin heat and defrost controls		O
21. Inspect all knobs, switches, and levers for security of attachment and condition		O
22. Check condition of environmental system ducts		O
<u>WARNING:</u> BE SURE SKIN AND CLOTHING ARE FREE OF GREASE, OIL, OR OTHER PETROLEUM PRODUCTS BEFORE CHECKING OR PERFORMING MAINTENANCE ON ANY COMPONENT OF THE OXYGEN SYSTEM.		
23. Inspect crew and passenger oxygen systems per 100 Hour Inspection, Fixed Oxygen Generator System, 35-20-00. (See Note 42.)		O
24. Check flap and main landing gear switches for operation, security, and condition		O
25. Check fluid in hydraulic reservoir. Fill as required	O	O
26. Inspect hydraulic power pack for condition, leaks, and security. (See Note 24.)		O
27. Inspect all fluid lines for leakage, condition, and security. (See Note 15.)	O	O
28. Inspect electrical panel components and circuit breakers for condition and security of installation. (See Notes 18 and 34.)	O	O
29. Inspect forward side of outflow and safety valves for condition and security. Remove and clean per 21-30-00		O
<u>NOTE:</u> Outflow and safety valves may require cleaning prior to 100 hour intervals, if heavy smoking or dusty conditions exist.		
30. Inspect filters on controller and safety valve for contamination. Clean or replace as required. (Refer to 21-30-00.)		O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION		Inspection Interval (Hrs)	
		50	100
D. CABIN AND COCKPIT GROUP (cont.)			
31. Inspect aft face of F.S. 100.00 bulkhead and forward face of F.S. 273.746 bulkhead for bulging, cracks, dents, loose, or missing fasteners, condition and security of components.....			O
32. If installed, inspect portable fire extinguisher minimum weight as specified on nameplate. (See Note 25.)			O
33. Inspect avionics compartment, components, and wiring for condition, security, and operation. (See Notes 40 and 49.).....			O
34. Inspect control cable boots for condition and security.....			O
35. Check air conditioning evaporators (if installed).....			O
36. Lubricate per Lubrication Chart, 12-20-00			O
37. Install inspection covers and panels.....			O
E. FUSELAGE AND EMPENNAGE GROUP			
NOTE: Check that all fuselage and empennage drain holes are clear and open.			
1. Remove inspection covers and panels.....			O
2. Inspect skins, bulkheads, frames, stringers, and longerons for damage or irregularities (i.e. - cracks, distortion, dents, corrosion and excessive paint build up); structural defects (i.e. - loose or missing rivets); misrigging or structural imbalance; and attachment points for missing or worn hardware			O
CAUTION: PRESSURIZED FLIGHT IS PROHIBITED WITH DISCOLORATION, CRACKS, OR CRAZING.			
3. Inspect windshield and windows for nicks, scratches, cracks, crazing, and discoloration			O
4. Inspect avionics compartment, components, and wiring for condition, security, and operation.....			O
5. Inspect control cable boots for condition and security.....			O
6. Check fuel sump drains for water and proper operation.....	O		O
7. Drain static lines. (Refer to 34-10-00.).....			O
8. Inspect antennas/coaxial cables for condition and security			O
9. Inspect dorsal fin for condition and security			O
10. Inspect vertical fin and rudder for surface damage or irregularities (i.e. - skin cracks, distortion, dents, corrosion, and excessive paint build up); structural defects (i.e. - loose or missing rivets); misrigging or structural imbalance; hinge damage, excessive wear, freedom of movement and proper lubrication; and attachment points for missing or worn hardware			O
11. Check rudder hinges and attachments for damage and operation			O
12. Check rudder hinge bolts for excessive wear.....			O
13. Check rudder trim mechanism installation			O
14. Check vertical fin attach points and wiring			O
15. Check forward vertical fin attach fittings for corrosion and damage. (See 55-30-00, Attach Fittings Corrosion Control.)			O
16. Inspect condition of deice system (if installed)			O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
17. Inspect horizontal stabilizer and elevator for surface damage or irregularities (i.e. - skin cracks, distortion, dents, corrosion, and excessive paint build up); structural defects (i.e. - loose or missing rivets); misrigging or structural imbalance; hinge damage, excessive wear, freedom of movement and proper lubrication; and attachment points for missing or worn hardware		O
18. Check elevator hinge bolts, trim tab hinges, and attachments for damage and operation. (See 55-20-00, Elevator Trim Tab Rods Corrosion Control.)		O
19. Check elevator and trim tab hinge bolts and bearings for excessive wear		O
20. Check horizontal stabilizer attachments		O
21. Check forward and aft horizontal stabilizer attach fittings for corrosion and damage. (See 55-10-00, Attach Fittings Corrosion Control)		O
22. Check elevator trim mechanism installation		O
23. Inspect battery, battery compartment, and vent system for water, corrosion, etching, condition, and security. Flush compartment as required		O
24. Inspect external power supply receptacle, battery relay, fuses, and vent blower assembly for cleanliness, corrosion, condition, and security. (See Notes 13 and 21.)		O
25. Check fuel filter. Clean or replace as required.....	O	O
26. Inspect deice system pneumatic valves and lines for condition and security (if installed)		O
27. Check baggage compartment door, latches, and hinge for operation, condition, and security		O
28. Check baggage compartment upholstery for condition		O
29. Check baggage compartment light and switch for operation, condition, and security		O
30. Inspect ELT battery for condition/date per FAR 91.207. (See Note 12.).....		O
31. Inspect ELT installation and antenna for condition and security. Replace antenna if bent or damaged		O
32. Check fluid level in hydraulic reservoir. Fill as required		O
33. Inspect all fluid lines for leakage, condition, and security. (See Note 15.)		O
34. Check autopilot servo and controls (if installed) per manufacturer's instructions.....		O
35. Check aileron, rudder, elevator, autopilot trim cables, terminals, turnbuckles, guides, fittings, and pulleys for safety, condition, and operation. (See Note 16.) ..		O
36. Check all electronic installations for security and operation		O
37. Inspect heater ducting for obstruction, condition, and security		O
38. Check air conditioning evaporators and clean fins		O
39. Inspect electric windshield for general condition, correct fit, distortion, cracking, delamination, security, and proper operation		O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
E. FUSELAGE AND EMPENNAGE GROUP (cont.)		
CAUTION: THE FLUX DETECTOR IS SECURED TO THE MOUNTING BRACKET WITH BRASS SCREWS. ENSURE ONLY BRASS SCREWS ARE USED WHEN REINSTALLING.		
40. Inspect flux detector		O
41. Check outflow and safety valves for cleanliness, looseness, and condition		O
NOTE: Outflow and safety valves may require cleaning prior to 100 hour intervals, if heavy smoking or dusty conditions exits.		
42. Inspect all hoses and lines for leakage, condition, and security. (See Note 15.)		O
43. Lubricate per Lubrication Charts, 12-20-00		O
44. Install inspection covers and panels		O
NOTE: Ensure correct hardware is used when reinstalling vertical fin dorsal fairing over flux detector.		
F. LANDING GEAR GROUP		
1. Check oleo struts for proper extension and evidence of fluid leakage. (See Landing Gear, 12-10-00.)	O	O
CAUTION: WHEN AIRCRAFT HAS OPTIONAL RADAR POD INSTALLED ON RIGHT WING, ENSURE THAT JACK DOES NOT COME INTO CONTACT WITH RADAR POD.		
2. Place airplane on jacks. (Refer to 7-10-00.)		O
3. Remove inspection covers and panels		O
4. Inspect nose gear steering control and travel		O
5. Inspect nose gear installation for condition and security. (See Notes 27, 35 and 36.)		O
6. Inspect nose gear trunnion for cracks and condition	O	O
7. Inspect nose wheel steering cam and rotator for cracks		O
8. Check squat switch for security and adjustment		O
9. Inspect tires for cuts, uneven or excessive wear, and slippage	O	O
10. Remove wheels and clean, check and repack bearings		O
11. Inspect wheels for cracks, corrosion, and broken bolts		O
12. Inspect brake disc/linings for wear, condition, and security	O	O
13. Check tires for proper pressure. (Refer to 12-10-00, Tires and 6-00-00, Chart 1.)	O	O
14. Check brake hydraulic lines for leakage, condition, and security		O
15. Inspect hydraulic lines, electrical leads, and attaching parts for condition and security (i.e. - routing, chafing, damage, wear, etc.)		O
16. Check brake reservoir for proper fluid level, leaks, condition, and security	O	O
17. Inspect gear fork for damage		O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
18. Inspect struts for fluid/pressure leaks and scoring		O
19. Check torque links, bolts, and bushings. Rebush as required		O
20. Check gear struts, trunnion pins and attachments for condition and security		O
21. Inspect bolt, bushings, trunnion pins, and attachments for condition and security. Rebush as required		O
22. Check retraction actuators and attachments for condition and security		O
23. Check condition and security of flexible hydraulic lines to actuator. (Replace flexible hoses as required -- see Note 15.)		O
24. Inspect main and nose gear doors, and rod assemblies for corrosion, security, and freedom of movement		O
25. Check locking actuator for operation and adjustment. (See Note 23.)		O
26. Inspect nose gear door actuator for operation and adjustment		O
27. Check warning horn and lights for operation		O
28. Lubricate per Lubrication Chart, 12-20-00		O
29. Inspect wiring and wiring harness for condition, security, damage, chafing, and corrosion. Check switches for adjustment, security and operation		O
30. Check actuating cylinders for leakage and security. (See Note 23.)		O
31. Perform gear retraction and extension operation check. (Per Landing Gear Retraction System Functional Test, 32-30-00.)		O
32. Place weight of aircraft on landing gear. (DO NOT REMOVE JACKS.)		O
33. Check anti-retraction system on gear lever for proper operation		O
34. Install inspection covers and panels	O	O
<u>WARNING:</u> DO NOT REMOVE JACKS UNTIL IT HAS BEEN DETERMINED THAT THE LANDING GEAR IS DOWN AND LOCKED AND ANTI-RETRACTION SYSTEM HAS BEEN CHECKED.		
35. Ensure all gears are down and locked, then remove jacks		O
36. Check wheel alignment		O

G. WING GROUP

1. Remove inspection covers and panels		O
2. Check surfaces, skins, and tips for damage and loose or missing fasteners. (See Note 44.)	O	O
3. Inspect forward and aft wing spar to fuselage attach fittings for corrosion and condition. (See Note 14 and 57-40-00, Attach Fittings Corrosion Control.)		O
4. Inspect aileron 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, excess wear, freedom of movement and proper lubrication; and attachment points for missing or worn hardware		O
5. Inspect aileron bellcranks for damage and operation		O
6. Inspect aileron cables, terminals, turnbuckles, fittings, guides, pulleys, and bellcranks for safety, condition, and operation. (See Note 16.)		O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION		Inspection Interval (Hrs)	
		50	100
G. WING GROUP (cont.)			
7. 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
8. Inspect the flap actuation system rod end bearings for binding or seizing of the ball bearings. Pay particular attention to the rod end bearings attached to the inboard bellcrank assembly located in each main gear well (See Notes 32 and 48.)			O
9. Inspect static discharge wicks for security of attachment and condition			O
<u>WARNING:</u> PHYSICAL MANIPULATION OF LIFT TRANSDUCER ON PA-46-350P AIRPLANES MAY RESULT IN ERRONEOUS STALL WARNINGS NECESSITATING CALIBRATION OF SYSTEM. SEE CHAPTER 27.			
10. Inspect lift transducer for security of attachment, spring centering of switch blade, and corrosion. Check heat element for operation			O
11. Inspect wing inspection light for broken lens, security, wiring, and attachment (if installed)			O
12. Lubricate per Lubrication Chart, 12-20-00			O
13. Check condition of hydraulic, fuel, and pneumatic hoses and lines. (Refer to Note 15.).....			O
14. Check condition and security of wiring and connectors			O
15. Check fuel tanks and lines for leaks.....			O
<u>NOTE:</u> Any fuel leaks within the wing will show at the lower wing root fairing, between wing and fuselage.			
16. Check fuel filler cap, O-ring, and receptacle for condition	O		O
17. Check fuel tanks marked for proper octane rating.....	O		O
18. Check radome for erosion, cracks, or delamination (if installed).....			O
19. Inspect condition of pneumatic deicer (if installed)			O
20. Inspect wing tip navigation lights for broken lenses, security, wiring, and attachment. (See Note 37.).....	O		O
21. If installed, inspect SpeedBrakes per 50 Hour Inspection, 27-60-00	O		
22. Install inspection covers and panels.....			O

H. SPECIAL INSPECTION

See 5-30-00.

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION		Inspection Interval (Hrs)	
		50	100
I. OPERATIONAL INSPECTION			
- ENGINE OFF			
1. Check electronic equipment operation		O	O
2. Check operation of flight controls		O	O
3. Check operation of flaps.....		O	O
4. Check and self-test Transicoil EMIS Instrument Stack. (See 77-40-00, Dual Analog Module Indicator, Performance.).....		O	O
- ENGINE RUNNING			
5. Check fuel pump and fuel tank selector		O	O
6. Check fuel quantity and flow gauges.....		O	O
7. Check oil pressure and temperature		O	O
8. Check manifold pressure.....		O	O
9. Check tachometer		O	O
10. Check alternator output on #1 alternator and #2 alternator		O	O
11. Check parking brake and toe brakes.....		O	O
12. Check vacuum gauge and standby vacuum pump.....		O	O
13. Check gyros for noise and roughness		O	O
14. Check cabin heat and defroster operation		O	O
15. Check magneto switch operation		O	O
16. Check magneto RPM variation.....		O	O
17. Check throttle and mixture operation		O	O
18. Check propeller smoothness.....		O	O
19. Check constant speed propeller action		O	O
20. Check engine idle.....		O	O
21. Check alternate air.....		O	O
22. Check air conditioning compressor clutch operation.....		O	O
23. Check cabin pressure controller. (See Operational Inspection, Cabin Pressure Controller, 21-30-00.).....			O
J. GENERAL			
1. Aircraft conforms to FAA Specifications		O	O
2. All Airworthiness Directives, Service Bulletins, Letters, and Instructions complied with. (See Notes 46 and 47.)		O	O
3. Current FAA Pilot's Operating Handbook is in the aircraft. (See Note 29.)		O	O
4. Appropriate entries made in the Aircraft and Engine Log books.....		O	O
5. Registration Certificate is in the aircraft and properly displayed		O	O
6. Radio Station FCC Licenses is in the aircraft and properly displayed.....		O	O
7. Aircraft Equipment List, Weight and Balance and FAA Form 337 (if applicable) are in the aircraft and in proper order		O	O
8. Operational inspection and run-up completed		O	O
9. Aircraft cleaned and lubricated after wash, as required		O	O

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K. NOTES

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

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

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

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

3. Piper Service Bulletins are of special importance and Piper considers compliance mandatory. In all cases, see Service Bulletin/Service Letter Index P/N 762-332 or Service Bulletin/Service Letter Aerofiche Set P/N 1762-331 to verify latest revision.
4. Piper Service Letters are product improvements and service hints pertaining to servicing the airplane and should be given careful attention.
5. Inspections given for the power plant are based on the engine manufacturer's operator's manual (60297-27) 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. On new engines, check after the first 25 hours of operation, then at each subsequent 50 hour inspection.
7. Cover or remove all filters, plug all openings, cover the ignition lead at the spark plug and magneto. Solvent will contaminate the air and fuel filters and will corrode the springs in the ignition leads.
8. Check cylinders for evidence of excessive heat which is 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 the appearance of seepage at the cylinder head and barrel attachment area are 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 should be replaced.

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9. Check security of injector nozzles after the first 50 hours of engine operation, then at each subsequent 100 hours of engine operation.
10. In S/N's 4636001 thru 4636089 only, verify compliance with Piper Service Bulletin No. 1000.
11. In S/N's 4636001 thru 4636110 only, verify compliance with of Piper Service Bulletin No. 1021 or installation of Kit No. 766-654.
12. In S/N's 4636001 thru 4636153 only, verify compliance with Piper Service Bulletin No. 1020.
13. In S/N's 4636001 thru 4636126 only, verify compliance with Piper Service Bulletin No. 1014.
14. In S/N's 4636001 thru 4636175 only, verify compliance with of Piper Service Bulletin No. 1027 or installation of Kit No. 766-656.
15. Flexible hose replacement times are in-service times. In-service dates must be determined by (1) the date the aircraft was licensed, if new or (2) the date entered in the logbook for the replacement hose placed in service. Do not use the date stamped on the hose, as time may be included for shelf life, and not in-service use.
16. 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 damage or frayed cables.
 - (a) See Control Cable Inspection, 27-00-00, or the latest edition of FAA AC 43.13-1.
 - (b) At fifteen (15) years time-in-service, begin Cable Fittings 100 Hour Special Inspection, 27-00-00.
17. In S/N's 4636001 thru 4636011 only, verify compliance with Piper Service Bulletin No. 990.
18. In S/N's 4636001 thru 4636131 only, verify compliance with Piper Service Bulletin No. 1017.
19. In S/N's 4636021 thru 4636190 only, verify compliance with Piper Service Letter No. 1023.
20. In S/N's 4636001 thru 4636198 only, verify compliance with Piper Service Bulletin No. 1029 and Lycoming Service Bulletin No. 534.
21. In S/N's 4636001 thru 4636215 only, verify compliance with Piper Service Bulletin No. 1034.
22. In S/N's 4636001 thru 4636221 only, in airplanes which have not installed a Lear Romec P/N RG9080-J4A/M engine driven fuel pump, verify compliance with latest revisions of Piper Service Bulletin No. 1035, Lycoming Service Bulletin No. 529A, and Crane/Lear Romec Service Bulletin No. 101SB020. See also FAA AD 98-18-12.
23. In S/N's 4636001 thru 4636030 only, verify compliance with Piper Service Bulletin No. 994 or Parker Hannifin Service Bulletin No. 7049.
24. In S/N's 4636001 thru 4636043 only, verify compliance with Piper Service Bulletin No. 964B or Cleveland ESB 7029A or Cleveland SB 7047.
25. In S/N's 4636001 thru 4636013 only, verify installation of Kit No. 766-613 per Piper Service Bulletin No. 993.
26. In S/N's 4636001 thru 4636088 only, verify compliance with Piper Service Bulletin No. 999.
27. In S/N's 4636001 thru 4636093, 4636095, 4636096 and 4636099 only, verify compliance with Piper Service Bulletin No. 1001.
28. In S/N's 4636001 thru 4636284 only, verify compliance with Piper Service Bulletin No. 1041 or Airborne Service Letter No. 56.
29. In S/N's 4636248 thru 4636309 only, verify compliance with Piper Service Bulletin No. 1046.
30. In S/N's 4636001 thru 4636313 only, verify compliance with Piper Service Bulletin No. 1054.
31. In S/N's 4636001 thru 4636313 only, verify compliance with Piper Service Bulletin No. 1060.

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K. NOTES (cont)

32. In S/N's 4636001 thru 4636313 only, verify compliance with Piper Service Bulletin No. 1062.
33. In S/N's 4636021 thru 4636313 only, verify installation of Kit No. 767-305 per Piper Service Bulletin No. 1066.
34. In S/N's 4636300 thru 4636313 only, verify installation of Kit No. 767-301 per Piper Service Bulletin No. 1067A.
35. In S/N's 4636001 thru 4636313 only, verify compliance with Piper Service Bulletin No. 1075A.
36. In S/N's 4636001 thru 4636313 only, verify compliance with Piper Service Bulletin No. 1087B.
37. In S/N's 4636314 thru 4636323 only, verify installation of Kit No. 767-335 per Piper Service Bulletin No. 1108.
38. In S/N's 4636314 thru 4636347 only, verify installation of Kit No. 767-364 per Piper Service Bulletin No. 1126.
39. In S/N's 4636001 thru 4636343 only, verify compliance with Piper Service Bulletin No. 1134 or Lycoming SB 557 or Precision Airmotive SB PRS-105.
40. In S/N's 4636160, 4636248 thru 4636272, 4636274 thru 4636336, and 4636338 only, verify compliance with Piper Service Bulletin No. 1135.
41. In S/N's 4636132 thru 4636348 only, verify compliance with Piper Service Bulletin No. 1139A.
42. In S/N's 4636001 thru 4636344 only, verify compliance with Piper Service Bulletin No. 1140.
43. In S/N's 4636001 thru 4636326 only, in airplanes which have installed Lycoming starter P/N 31B22474, verify installation of Kit No. 767-337 per Piper Service Letter No. 1053.
44. In S/N's 4636001 thru 4636338 only, verify installation of Kit No. 767-352 or 767-353 per Piper Service Letter No. 1057.
45. Each 100 hours, perform V-Band Coupling 100 Hour Inspection, 81-20-00.
46. In S/N's 4636350 thru 4636351 only, verify compliance with Piper Service Bulletin No. 1151E.
47. In S/N's 4636362 and up, for airplanes delivered from the factory in bare metal, verify compliance with Piper Service Letter No. 1089.
48. In S/N's 4636001 thru 4636368 only, verify compliance with Piper Service Letter No. 1097.
49. In S/N's 4636001 thru 4636334 only, verify compliance with Garmin Service Bulletin No. 0204 per Piper VSP No. 142.
50. In S/N's 4636001 and up, for airplanes with engines affected by Lycoming SB 554, verify compliance with same per Piper VSP No. 148.
51. In S/N's 4636001 thru 4636313 only, verify engine serial number against those listed in Lycoming Special Advisory 59-800 and verify compliance with same per Piper VSP No. 127.

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SPECIAL INSPECTIONS

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

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

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

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

1. Per Flight Hour

First 50 Hours

- ☐ Check security of injector nozzles.

Each 250 Hours

- ☐ Replace Turbine Inlet Temperature (TIT) probe. See TIT Gauge, Probe Replacement, 77-20-00, and FAA Airworthiness Directive (AD) 99-15-04.
- ☐ Comply with the latest revisions of Textron Lycoming Service Bulletins No. 521 and 531.

Each 400 Hours

- ☐ Inspect Airborne pressure manifold every 400 hours. (See Pressure Manifold Check Valve Testing, 30-10-00.)

Each 500 Hours

- ☐ [For airplanes equipped with Aero Accessories, Inc. Tempest Dry Air Pumps only](#), beginning at 500 hours time-in-service, and each 100 hours thereafter, inspect engine-driven vacuum pump vane wear per Vacuum Pump(s), Inspection, 37-10-00.
- ☐ [For airplanes equipped with Parker Hannifin Airborne Dry Air Pumps only](#), replace engine-driven vacuum pump.
- ☐ Replace central gyro filter. (Replace filter at more frequent intervals if heavy contamination is noted.)
- ☐ Check cabin pressurization system operation. (See 21-00-00, Pressurization System Test.)
- ☐ Check condition of exterior bearings.
- ☐ Drain wing fuel tanks.
- ☐ Check fuel transmitters and electrical connectors for cleanliness, condition, and security.
- ☐ Every two (2) years or after 500 hours, whichever occurs first, check that fuel transmitter floats (mounted on forward access panels #2 and #5 from the wing tip) are secure and that fuel strainers (three in each wing tank) are secure and unobstructed. Strainers maybe inspected by removing the forward and aft access covers, fifth in from the wing tip.
- ☐ Check fuel tank sealing material.

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Each 500 Hours (cont.)

- ☐ Remove propeller; remove sludge from propeller and crankshaft.
- ☐ Remove and flush oil radiator.
- ☐ Inspect magneto(s) distributor block for cracks, burned areas or corrosion. (See 74-10-00, Magnetos, 500 Hour Inspection and Cleaning.)
- ☐ Replace engine air filter.
- ☐ Coin-tap erosion shield on composite blades. (See latest revision Hartzell Composite Blade Manual No. 135.)

Each 1000 Hours

- ☐ Replace engine compartment flexible hoses (fuel, oil, etc.) as required; but not to exceed 1000 hours time-in-service, eight (8) years, or engine overhaul, whichever comes first.
- ☐ Coin-tap the entire blade on composite blades. (See latest revision Hartzell Composite Blade Manual No. 135.)
- ☐ Inspect condition of bolts used with flap rollers and aileron hinges. (Replace as required.)
- ☐ Inspect flap tracks for security of attachment, damage, condition, and corrosion.
- ☐ If installed, remove SpeedBrake cartridges and return to Precise Flight Inc. for clutch lubrication and spring replacement.

Each 1500 Hours

- ☐ Replace flexible bleed air lines (high temp) each 1500 hours time-in-service or every seven (7) years, whichever occurs first.

Each 2000 Hours

- ☐ Each 2000 hours or seven (7) years, whichever occurs first, remove interior 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 2000 hours, or as specified in the latest revision of Lycoming Service Instruction No. 1009, overhaul or replace engine.
- ☐ At engine overhaul, each 2000 hours, or as specified in the latest revision of Hartzell Service Letter No. 61, whichever comes first, overhaul or replace the propeller governor.
- ☐ Overhaul or replace Hartzell propellers each five or six years or each 2000 or 2400 hours. (Refer to latest revision of Hartzell Service Letter No. 61 to determine specific requirements for individual airplanes.)
- ☐ At engine overhaul or each 2000 hours, whichever comes first, overhaul or replace alternators.

Each 2400 Hours

- ☐ Overhaul or replace Hartzell propellers each five or six 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 5000 Hours

- ☐ If installed, remove SpeedBrake cartridges and return to Precise Flight Inc. for drive assembly replacement.

Each 7500 Hours

- ☐ Replace engine mount bolts located at the firewall (F.S. 95.00).

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2. Per Calendar Year

Each Thirty (30) Days

- ☐ Check standby attitude indicator emergency power supply (in radar pod aft compartment) for condition and security. Self-test unit using integral test switch - see 34-20-00. Hand-tighten electrical connector.
- ☐ Inspect battery, battery compartment, and vent system for water, corrosion, etching, condition, and security. Flush compartment as required.
- ☐ If installed, check portable fire extinguisher for condition and charge. Verify nozzle is unobstructed and safety seal is intact. Determine charge by "hefting" extinguisher.

Each Ninety (90) Days

- ☐ Check fuel filter. Clean or replace as required.

Each Six (6) Months

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

Each Twelve (12) Months

- ☐ Lubricate Hartzell 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.
- ☐ If installed, each twelve (12) calendar months, conduct SpeedBrake Annual Inspection per Annual Inspection, 27-60-00.

Each Two (2) Years

- ☐ Every two (2) years or after 500 hours, whichever occurs first, check that fuel transmitter floats (mounted on forward access panels #2 and #5 from the wing tip) are secure and that fuel strainers (three in each wing tank) are secure and unobstructed. Strainers maybe inspected by removing the forward and aft access covers, fifth in from the wing tip.
- ☐ Test and inspect the static pressure system and altimeters. Ensure compliance with the requirements of FAR 43, Appendix E. (See FAR 91.411.) If optional Meggitt EFIS installed, see Appendix 1, grid 4K1.
- ☐ Test and inspect the transponder. Ensure compliance with the requirements of FAR 43, Appendix F. (See FAR 91.413.)
- ☐ For airplanes equipped with the Avidyne FlightMax Entegra EFIS: swing the magnetic compass and recalibrate the magnetometer(s) every (2) years. See Magnetometer(s), 34-20-00.

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Each Five (5) Years

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

- ☐ Remove and hydrostatically test oxygen cylinder every five (5) years. (i.e. - standard weight cylinders - ICC or DOT 3AA1800.)
- ☐ Inspect the Attach Fittings and Push Rods listed below. Repair or replace as required and, when finished, reapply Dinitrol AV8 Corrosion Inhibiting Compound (P/N 89500-800).
 - ☐ Fwd and aft wing spar to fuselage attach fittings. (See Attach Fittings Corrosion Control, 57-40-00.)
 - ☐ Fwd vertical fin attach fittings. (See Attach Fittings Corrosion Control, 55-30-00.)
 - ☐ Elevator trim tab push rods. (See Elevator Trim Tab Push Rod Corrosion Control, 55-20-00.)
 - ☐ Fwd and aft horizontal stabilizer attach fittings. (See Attach Fittings Corrosion Control, 55-10-00.)
- ☐ Overhaul or replace Hartzell propellers each five or six years or each 2000 or 2400 hours. (See 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 or six 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 Seven (7) Years

- ☐ Each 2000 hours or seven (7) years, whichever occurs first, remove interior panels, and headliner and conduct detailed inspection of aircraft structure (skin, bulkheads, stringers, etc.) for condition and security. Inspection of structure concealed by headliner may be accomplished by alternate means (i.e. - through the use of a borescope) without removing the headliner, providing access is obtained to all concealed areas and borescope provides sufficient detail to adequately accomplish the inspection.
- ☐ Replace flexible bleed air lines (high temp) each 1500 hours time-in-service or every seven (7) years, whichever occurs first.

Each Eight (8) Years

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

Each Ten (10) Years

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

Each Twelve (12) Years

- ☐ Replace Fixed Oxygen Generators at twelve (12) years from date of manufacture as indicated on the unit data plate.

Each Twenty (20) Years

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

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3. Per Specific Operation / Operating Environment

A. **Operation in High Dust or Industrial Pollution Environment**

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

Item	Inspection	Inspection Interval
☐ 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 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.

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B. 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; switches and wiring for condition.	200 Hours.

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

☐ Engines with more than 50 hours total time.	Each five days, pull prop through five complete revolutions. Each 30 days, fly aircraft for 30 minutes or, ground run until oil temperature is in the green arc. Avoid excessive ground run.	Each 5 days and each 30 days.
☐ Engines with less than 50 hours total time.	Each day, pull prop through five complete revolutions. Each 30 days, fly aircraft for 30 minutes or, ground run until oil temperature is in the green arc. Avoid excessive ground run.	Daily and each 30 days.
☐ Instruments and Wiring.	Inspect for proper seal of cases and corrosion.	100 Hours.
☐ Interior.	Inspect upholstery, seat belts, seats and rugs for corrosion and integrity.	100 Hours.

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

C. Operation in Extreme Cold

Item	Inspection	Inspection Interval
☐ Hydraulic, Pneumatic and Environmental.	Check all fittings and attachments for security and leaks.	First 100 Hour, then as required.

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D. Operation from Soft or Unusual Terrain

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

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UNSCHEDULED MAINTENANCE CHECKS

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

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

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

1. Lightning Strike

Item	Inspection	Inspection Interval
☐ Propeller.	Refer to latest Hartzell Service Letter. Overhaul prior to return to service.	Each occurrence, before further flight.
☐ Propeller Deice System. (Opt. 3-blade only.)	Replace MOV module(s).	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), see 24-30-00.	Each occurrence, before further flight.
☐ All exterior surfaces, skins, and structure.	Inspect for burns, evidence of arcing, and damage on surfaces and bearings. Check for correct material properties in the area of the strike path. Degauss engine mount. Replace or repair affected areas/parts.	Each occurrence, before further flight.
☐ System Components.	Inspect instrumentation, hydraulic, vacuum, pitot/static, and fuel systems, for damage and correct operation.	Each occurrence, before further flight.
☐ Static Wicks.	Replace.	Each occurrence, before further flight.
☐ Bearings.	Inspect all control surface hinges and bearings, and landing gear and wheel bearings for pitting and damage. Replace as required.	Each occurrence, before further flight.

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

Item	Inspection	Inspection Interval
☐ Engine.	See latest revision of Textron-Lycoming Service Bulletin 369J and Overhaul Manual.	Each occurrence, before further flight.
☐ Propeller.	Propeller overspeed exceeding certified max RPM. Comply with latest revision of Hartzell Service Letter HC-SL-61-251 and Standard Practice Manual 202A.	Each occurrence, before further flight.
☐ Engine Mount and Attachments.	Inspect for distortion and damage. Replace or repair as required.	Each occurrence, before further flight.

3. Severe Turbulence, Hard or Overweight Landing

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

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

Item	Inspection	Inspection Interval
☐ Landing Gear Struts. (Not required for severe turbulence.)	Cracks, signs of overstress deformation, loose or damaged trunnion mounts. Axles for cracks, bending or flat spots. Damaged oleos and seals, hydraulic leaks and landing gear alignment.	Each occurrence, before further flight.
☐ Wheels, Tires, Brakes. (Not required for severe turbulence.)	Cracks, chips, loose or cracked mounting bolts, alignment of slippage marks, sidewall distress, hydraulic or air leaks. Inspect the wheels (dye penetrant method) and wheel bolts (magnetic particle method).	Each occurrence, before further flight.
☐ Wheel Wells and Landing Gear attach points. (Not required for severe turbulence.)	Buckling, cracks, overstress, wing skin buckling, actuator and side brace damage and condition. Magnaflux landing, gear attachment and drag link bolts.	Each occurrence, before further flight.
☐ Wings.	Wing attach bolts for slippage, damage and overstress. Upper and lower wing skins for wrinkles, cracks, popped or loose rivets.	Each occurrence, before further flight.

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

Item	Inspection	Inspection Interval
☐ Wings (cont.).	Remove access plates and inspect for internal damage to ribs, stringers and sparwebs; and fuel tanks for damage, attachment, and leaks.	
☐ 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. Forward and aft pressure bulkheads for buckling, cracks and damage. Avionics, instruments and accessories installation for security and operation. Perform ground pressurization check. (See 21-30-00 - Pressurization System Test.)	Each occurrence, before further flight.
☐ Empennage.	Skins for buckling wrinkles, loose or missing rivets. Elevator, rudder, vertical fins and horizontal stabilizer for security of attachment and overstress of bolts. Ribs, stringers for buckling, cracks and damage.	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. Inspect the wheels (dye penetrant method) and wheel bolts (magnetic particle method.)	Each occurrence, before further flight

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

Item	Inspection	Inspection Interval
☐ Flap bellcranks.	Inspect for distortion. Replace as required. (See Flap Bellcrank Distortion Inspection, 27-50-00.)	Each occurrence, before further flight.
☐ Flaps.	Inspect for damage to the skin and attach points. Replace as required.	Each occurrence, before further flight.

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5. Flood Damage, Immersion in Water

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

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

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

Item	Inspection	Inspection Interval
☐ Airframe	Clean silt and contaminants from airframe.	If immersed, each event, before further flight.
☐ Tubular Structures (i.e. - Engine Mounts, etc.)	Check for internal corrosion. Clean and represerve as required. (See 71-20-00 - Engine Mount Corrosion Inspection, Immersion in Water.)	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, Shimmy Dampeners, etc.	Check all limit switches, replace non-sealed type. Jack airplane and cycle landing gear 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.

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5. 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-2070 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.
☐ Propellers	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.
☐ Electrical Systems	Replace all circuit breakers and switches (except sealed landing gear limit switches). Replace all solenoids, relays and master contactors. Replace battery.	If immersed, each event, before further flight.

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5. Flood Damage, Immersion in Water (continued)

Item	Inspection	Inspection Interval
Electrical Systems (cont.)	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 flap time delay relays, alternator inop. switches, windshield heat timers, low fuel warning switches, etc. Clean, dry and bench check per appropriate maintenance manual. Replace de-icer timers. Clean and check prop de-icer brush holders. Clean and check voltage regulators and overvoltage relays. Replace as necessary Clean and check all strobe light power supplies. Refer to appropriate maintenance manual. Replace all fuel senders, trim tab sender pots, flap position senders, etc. Clean, inspect and check heated pitot 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 inspection and operational checks. Bench check alternator and voltage regulator(s) (See 24-30-00).	Each occurrence, before further flight.
☐ Autopilot System	Bench check in accordance with appropriate maintenance manual. Pay particular attention to clutch settings.	If immersed, each event, before further flight.

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5. 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 and Bleed Air Systems	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 Systems	Remove access panels and clean fuel tank (wet wing) and clean all associated lines and pumps and header tanks. 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 blowers. Clean and inspect all distribution boxes, ducting and valves. Inspect and check system control cables. Replace corroded or binding cables. Clean and inspect air conditioning evaporator, condenser, and compressor.	If immersed, each event, before further flight.
☐ Pressurization Systems	Remove and replace all system controls and valves.	If immersed, each event, before further flight.
☐ Oxygen Systems	Disconnect all lines from source and outlets; clean all fittings and lines per MIL-I-5585A. Remove and clean regulator valve per appropriate Scott publication. Replace pressure gauge. Replace oxygen generator units.	If immersed, each event, before further flight.

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5. 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.
Avionics Systems (cont.)	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 inspection and operational checks. Bench check alternator and voltage regulator(s) (See 24-30-00).	Each occurrence, 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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CHAPTER

6

DIMENSIONS AND AREAS

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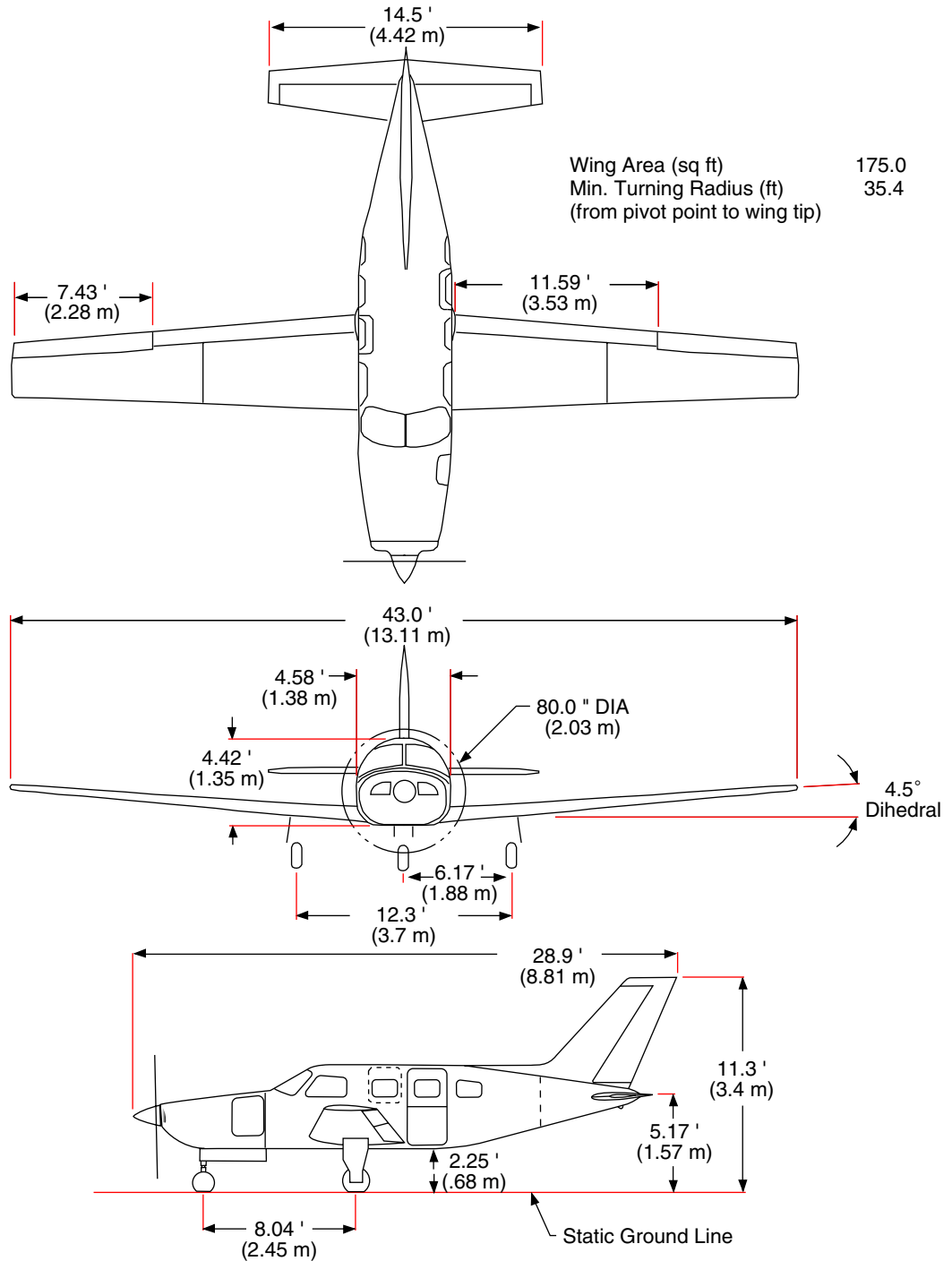
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GENERAL

The principal airplane dimensions are shown in Figure 1, and the leading particulars/principal dimensions are listed in Chart 1. The airplane serial number is located on the Manufacturers Aircraft Association (MAA) plate, which is located below the tailcone at approximately F.S. 311.50. The engine serial number plate is located on the right side of the engine between cylinders 1 and 3.



Three View (PA-46-350P)
Figure 1

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1. Leading Particulars and Principal Dimensions

**Chart 1 (Sheet 1 of 2)
Leading Particulars and Principal Dimensions**

MODEL	PA-46-350P
ENGINE	
Manufacturer	Textron Lycoming Motors
Model	TIO-540-AE2A
FAA Type Certificate	
Rated Horsepower (Sea Level)	350
Rated RPM	2,500
Oil Specification	Refer to 12-10-00 and latest revision of Textron Lycoming Service Bulletin "Fuel and Oil Grades".
Oil Sump Capacity	12.0 quarts
Fuel Specification	100 or 100LL (Aviation Grade)
Fuel Injection System	Textron Lycoming Motors
Magnetos (Pressurized)	Slick
Left	6363
Right	6360
Magneto Timing	20° BTC
Magneto Breaker Point Clearance	.008 - .012 (Using "E"-gap method)
Spark Plugs (Shielded):	Refer to latest revision of Textron Lycoming Service Bulletin No. 1042
Spark Plug Gap Setting	.019
Firing Order	1, 4, 5, 2, 3, 6
Starter (24 volt)	
Electrosystems	MHB 4016 or MHB 6016
Alternator - (2) Belt Driven (24 volt)	
Prestolite (70 amp) (S/N's 4636001 thru 46360131)	ALV-8421LS
Electrosystems (75 amp) (S/N's 4636132 and up)	ES4039-LS
Voltage Regulator (2)	
Lamar Inc.	B-00382-1

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Chart 1 (Sheet 2 of 2)
Leading Particulars and Principal Dimensions

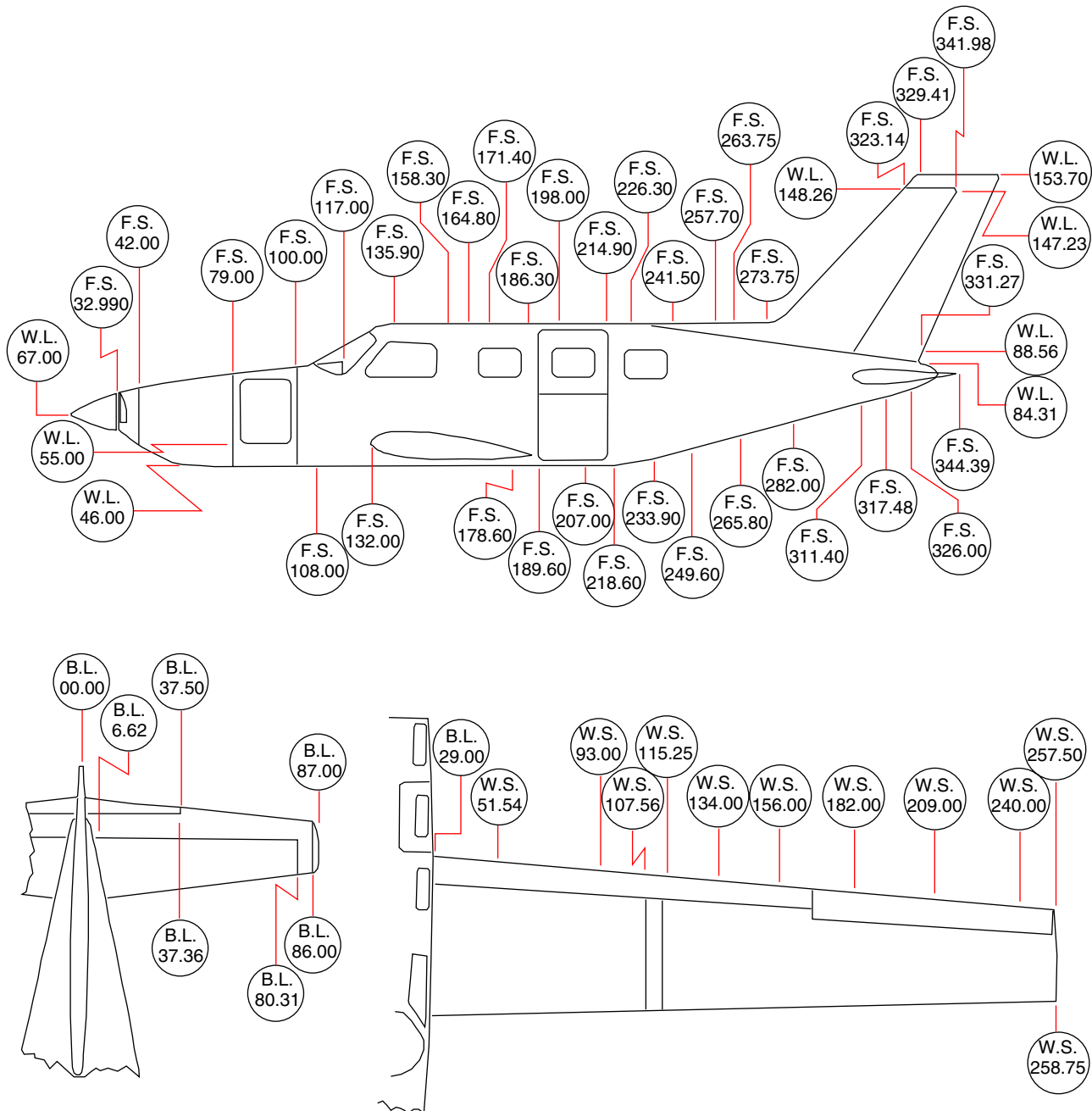
MODEL	PA-46-350P	
PROPELLER		
Manufacturer	Hartzell	
Type	Constant Speed	
Hub	HC-I2YR-1BF	HC-I3YR-1E *
Blade	F8074 Standard F8074K Optional	7890K
Diameter (Inches)		
Minimum	79	80
Maximum	80	80
Blade Angle, Low Pitch (High RPM)	17.6° ± 0.2°	13.65° ± 0.15°
Blade Angle, High Pitch (Low RPM)	40.0° to 41.0°	38.7° ± 0.5°
Governor Model	Hartzell - V-5-2	
FUEL SYSTEM		
Fuel Tank Capacity (Gal.)	61 per wing	
Total Fuel Onboard (Gal.)	122	
Total Usable Fuel (Gal.)	120	
Fuel		
Minimum Grade	100 / 100LL (Aviation Grade)	
LANDING GEAR		
Type	Retractable - Hydraulic	
Shock Strut Design	Combination Air and Oil	
Turning Radius	35.4 ft	
Nose Gear Travel	30° Left and Right	
Wheel, Nose	McCauley D-30500, Cleveland 40-77B	
Wheel, Main	Parker Hannifin 40-120C	
Brakes	Cleveland 30-83A	
Tire, Main	6.00 x 6, 8 ply rating	
Tire, Nose	5.00 x 5, 6 ply rating	
Tire Pressures	Main - 55 psi Nose - 50 psi	

* - Optional on S/N's 4636132 and up.

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2. Station References

To locate various airplane components that require maintenance and servicing, a method using wing fuselage station, wing station, buttock line and waterline designations is frequently used in this manual. Fuselage stations (F.S.), buttock lines (B.L.), and waterlines (W. L.) are reference points measured by inches in the vertical or horizontal direction from a given reference line. These points indicate station locations of airplane structural members.



Station References
Figure 2

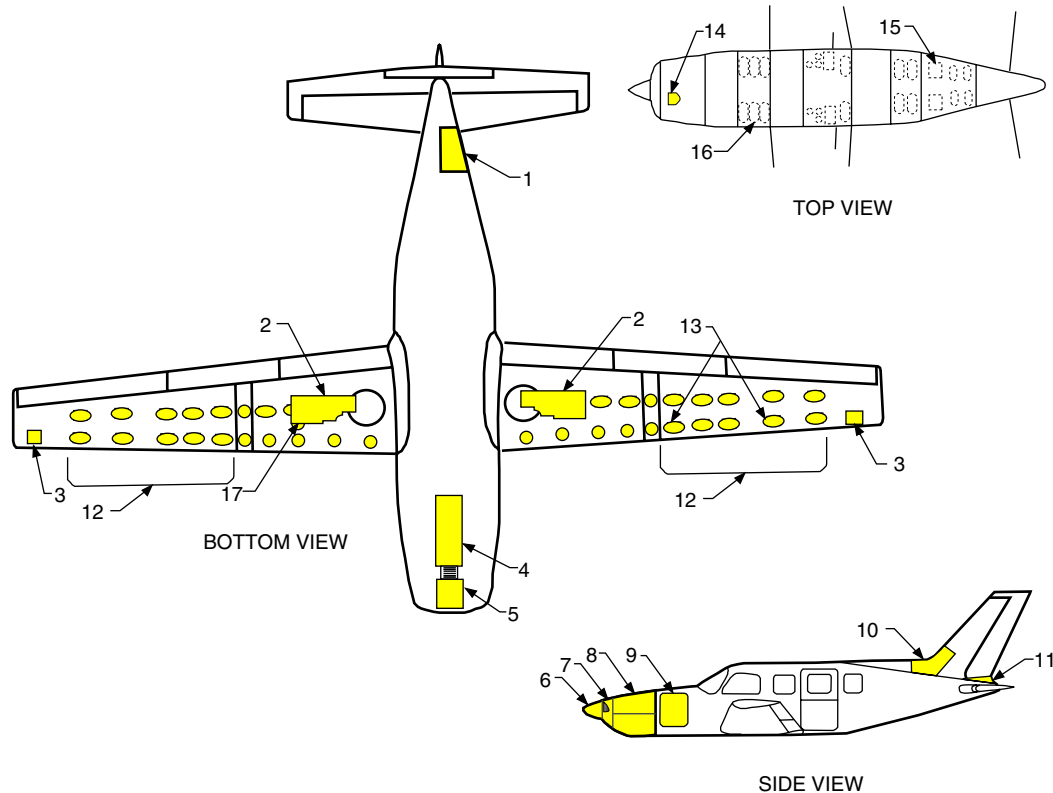
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3. Access and Inspection Provisions

Airplane access and inspection provisions are shown in Figure 3. Components to be serviced or inspected through each opening are identified in the illustration by an assigned index reference number. All access plates and panels are secured by metal fasteners or screws.

NOTE: Review Consumable Materials, 91-10-00, for sealant requirements before removing any access plates or panels.

Gain access to floor panel attachment screws by removing seats and carpeting. To enter aft section of the fuselage, remove access panels on the lower side of the fuselage, aft of station 265.00.



1. Elevator Trim Jackscrew	6. Propeller Attaching Bolts
Elevator Up Stop	7. Alternator(s)
Elevator Sector	Deicer Brush Block
Rudder Sector	8. Engine
Rudder Stops	Oil Filter
Emergency Locator Transmitter	Fuel Filter
Elevator Cable Turnbuckles	9. Battery, External Power Supply Plug
Condenser and Condenser Fan	Brake Reservoir
2. Collector Tank	Vacuum Regulator(s)
Main Landing Gear Actuator	5. 10. ELT Antenna
Flap Bellcranks	11. Elevator Trim Tab Adjustment
Up Limit Switch	12. Fuel Tank Access Cover (Wet Wing)
Squat Switch (L/H side)	13. Fuel Transmitters
3. Strobe Power Supply	14. Oil Dipstick
4. Nose Landing Gear Actuator	15. Hydraulic Pump/Reservoir
Steering Bellcrank	16. Annunciator Dimmer Assy.
Steering Bungee	17. O. A. T. Sensor
5. Induction Air Filter	

Access and Inspection Provisions
Figure 3

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7

LIFTING AND SHORING

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JACKING

1. General

Jacking the airplane is necessary to service the landing gear and other operations. The jacking operation can be performed by using tripod jacks; in other situations (emergency, post-accident lifting), slings or airbags should be used.

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

2. Jacking

CAUTION: DISABLE LIFT DETECTOR, WINDSHIELD HEAT, AND PITOT HEAT PRIOR TO JACKING AIRCRAFT.

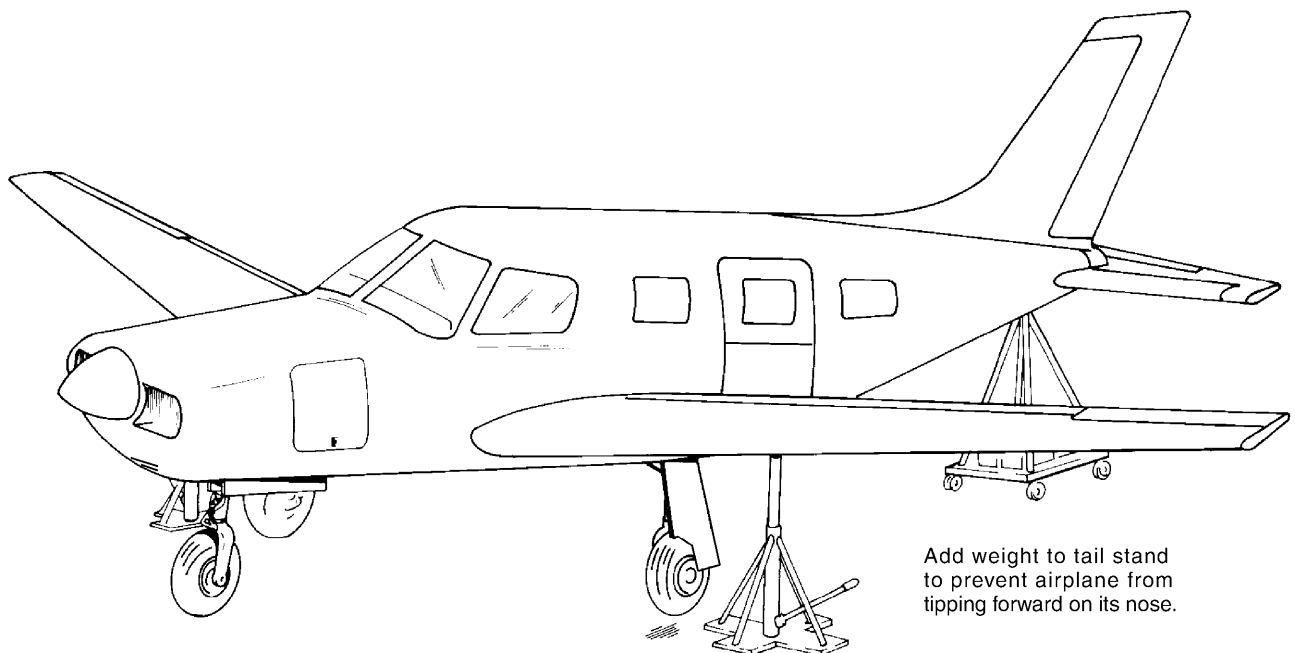
CAUTION: WHEN THE AIRCRAFT HAS OPTIONAL RADAR POD ON RIGHT WING INSURE JACK DOES NOT COME IN CONTACT WITH RADAR POD

A. Align jacks under wing with respective pads on the wing main spar.

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

B. Attach tail stand with approximately 400 pounds ballast to the tail skid.

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



Jacking Arrangement
Figure 1

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8

LEVELING AND WEIGHING

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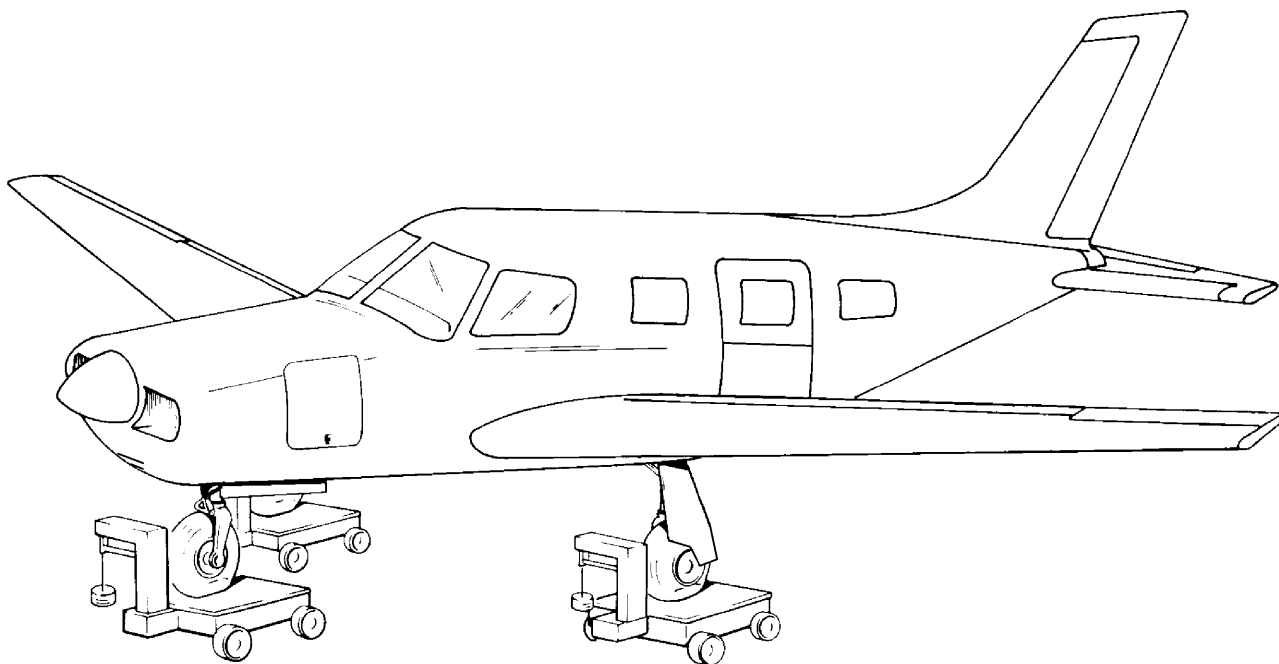
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WEIGHING

The airplane may be weighed by the following procedure:

- A. Position a scale and a ramp in front of each of the three wheels.
- B. Secure the scales from rolling forward, tow the airplane up onto the scales and block the wheels.
- 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 the paragraph titled Leveling.
- E. Fill engine with oil to full capacity.
- F. Place pilot and copilot seats in fifth notch aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors should be closed.
- G. Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.
- H. With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare weight, if any, from each reading.



Weighing
Figure 1

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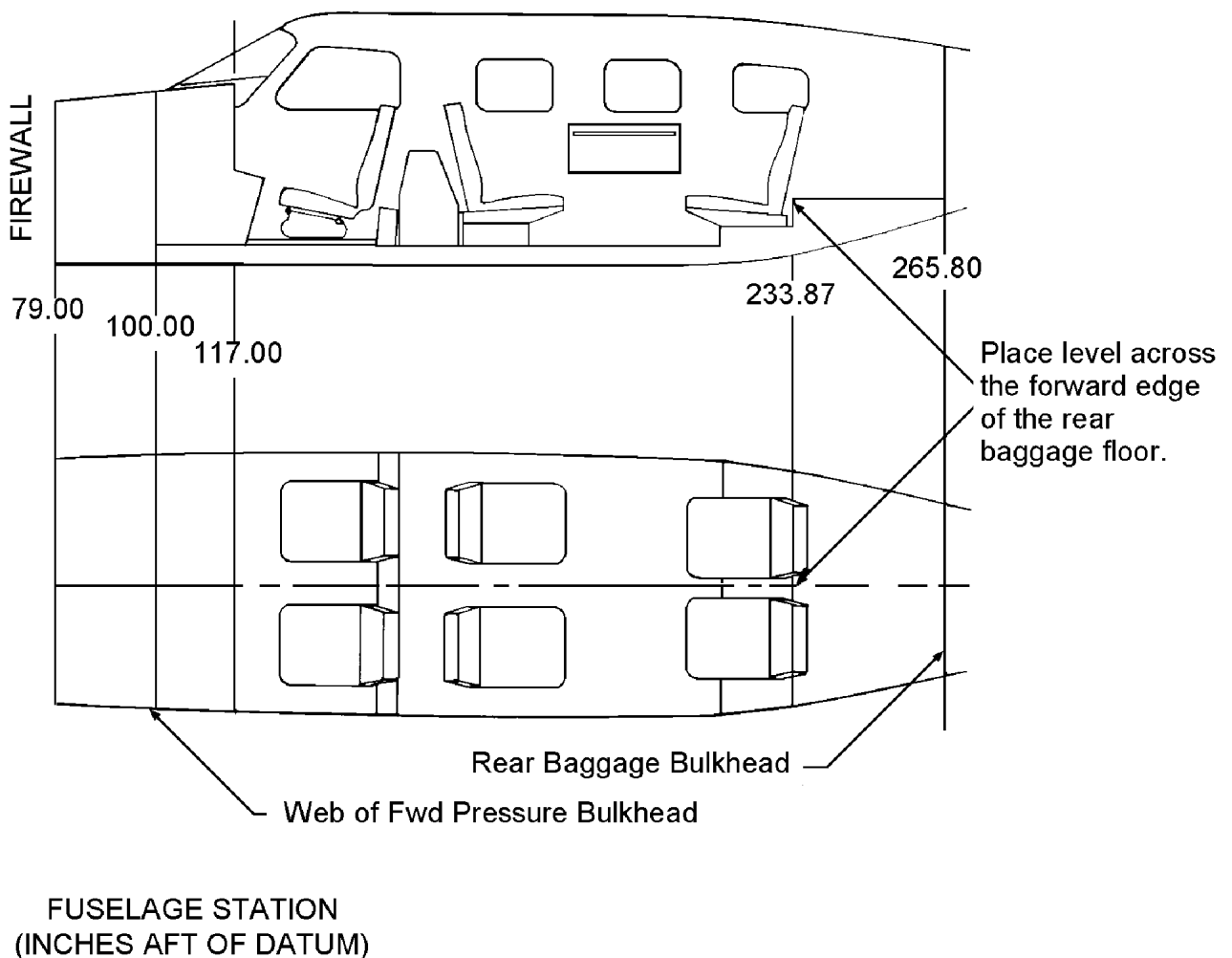
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LEVELING

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

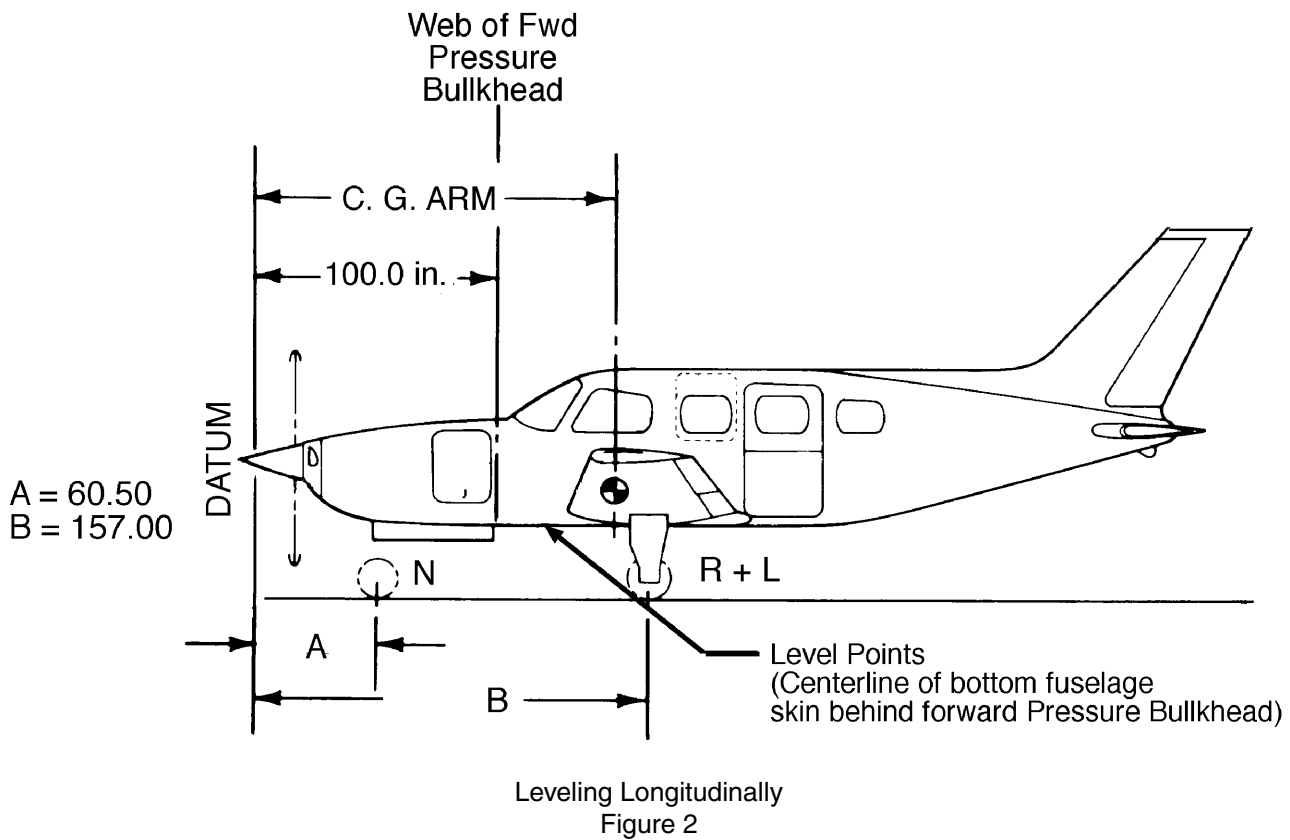
NOTE: Always level the airplane laterally first, then level the airplane longitudinally.

- A. To laterally level the airplane, place a level across the forward edge of the rear baggage compartment. If the airplane is resting on its gear, raise or lower one wing tip by deflating the main gear tire on the high side of the airplane until the bubble of the level is centered. If the airplane is on jacks, adjust either wing jack until the bubble of the level is centered.



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- B. To longitudinally level the airplane, place a level against the centerline of the bottom fuselage skin, behind the forward pressure bulkhead and adjust the jacks until the level is centered. Should the airplane be either on scales or on the floor, first insert a 3.4 inch spacer on each of the main gear struts and a 3.0 inch spacer on the nose gear strut. Level airplane by deflating (or inflating, as required) the nose wheel tire to center the bubble in the level.



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TOWING AND TAXIING

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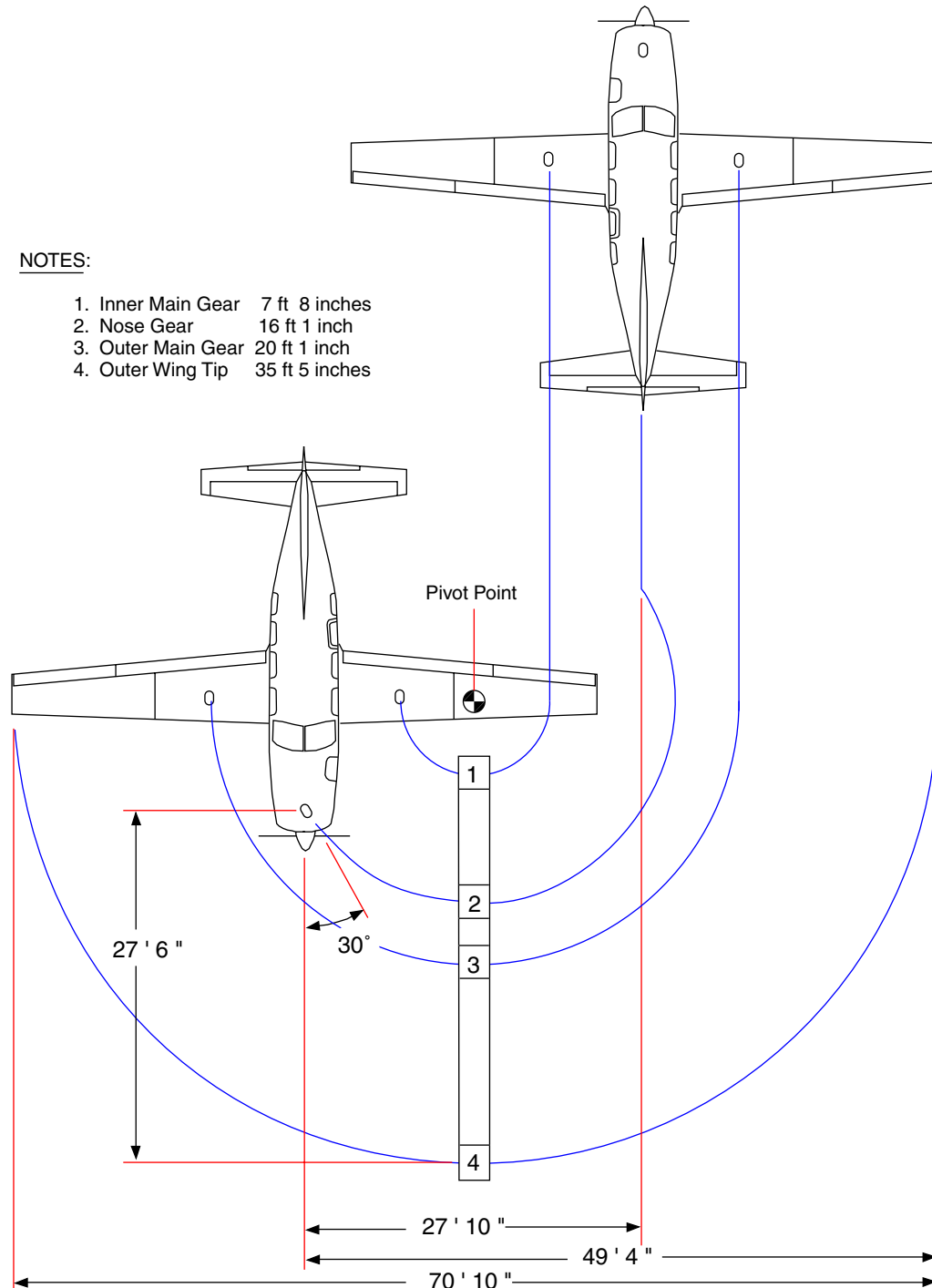
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GENERAL

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

NOTES:

1. Inner Main Gear 7 ft 8 inches
2. Nose Gear 16 ft 1 inch
3. Outer Main Gear 20 ft 1 inch
4. Outer Wing Tip 35 ft 5 inches



Turning Radius and Limits
Figure 1

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TOWING

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

The airplane may be moved by using the nose wheel steering bar that is stowed in the forward baggage area or by using power equipment that will not damage or cause excess strain to the nose gear steering assembly. The stem on the bar is inserted in the hollow of the nose wheel axle at its right side.

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 should ride in the pilot's seat to maintain control by use of the brakes.

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TAXIING

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

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

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

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

- A. Taxi forward a few feet and apply brakes to determine their effectiveness.
- B. Taxi with propeller set in low pitch, high RPM setting.
- C. While taxiing, make slight turns to ascertain the effectiveness of steering.

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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CHAPTER

10

PARKING AND MOORING

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

CHAPTER 10

LIST OF EFFECTIVE PAGES

<u>CHAPTER SECTION</u>	<u>PAGE</u>	<u>DATE</u>	<u>CHAPTER SECTION</u>	<u>PAGE</u>	<u>DATE</u>
10-List of	1	Jul 30/05			
Effective Pages	2	Jul 30/05			
10-Table of Contents	1	Jul 30/05			
	2	Jul 30/05			
10-10-00	1	Jul 30/05			
	2	Jul 30/05			
10-20-00	1	Jul 30/05			
	2	Jul 30/05			

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

CHAPTER 10 - PARKING AND MOORING

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>SECTION</u>	<u>PAGE</u>	<u>grid no.</u>
<u>PARKING</u>	10-10-00	1	1G15
Parking		1	1G15
Locking Airplane		1	1G15
<u>MOORING</u>	10-20-00	1	1G17

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

PARKING

1. Parking

When parking the airplane, ensure 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 must be moored according to sub-system section on mooring below.

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

2. Locking Airplane

The cabin and baggage compartment doors are provided with a key lock on the outside. These locks use the same key. A separate key is provided for the optional locking gas cap.

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PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

MOORING

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

The airplane is moored to ensure its security and protection under various weather conditions. To moor the airplane, use the following procedures:

- A. Head airplane into wind, if possible.
- B. Block wheels.
- C. Lock aileron and elevator controls with front seat belts.

CAUTION: WHEN USING ROPE OF NON-SYNTHETIC MATERIAL, LEAVE SUFFICIENT SLACK TO AVOID DAMAGE TO AIRPLANE.

- D. Secure wing tie down ropes to retractable tie down rings (located on underside of wings, outboard of the main gear) and to tail tie down ring at approximately 45 degrees.

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

- E. Install pitot tube cover.

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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CHAPTER

11

REQUIRED PLACARDS

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

CHAPTER 11

LIST OF EFFECTIVE PAGES

<u>CHAPTER SECTION</u>	<u>PAGE</u>	<u>DATE</u>	<u>CHAPTER SECTION</u>	<u>PAGE</u>	<u>DATE</u>
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11-Table of Contents	1	Jul 30/05			
	2	Jul 30/05			
11-20-00	1	Feb 7/06			
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	13	Feb 7/06			
	14	Feb 7/06			
	15	Feb 7/06			
	16	Feb 7/06			
	17	Jul 30/05			
	18	Jul 30/05			

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

CHAPTER 11 - REQUIRED PLACARDS

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>SECTION</u>	<u>PAGE</u>	<u>GRID NO.</u>
<u>EXTERIOR PLACARDS AND MARKINGS</u>	11-20-00	1	1H1
<u>INTERIOR PLACARDS AND MARKINGS</u>	11-30-00	1	1H9
Meyercord Decals		14	1G1

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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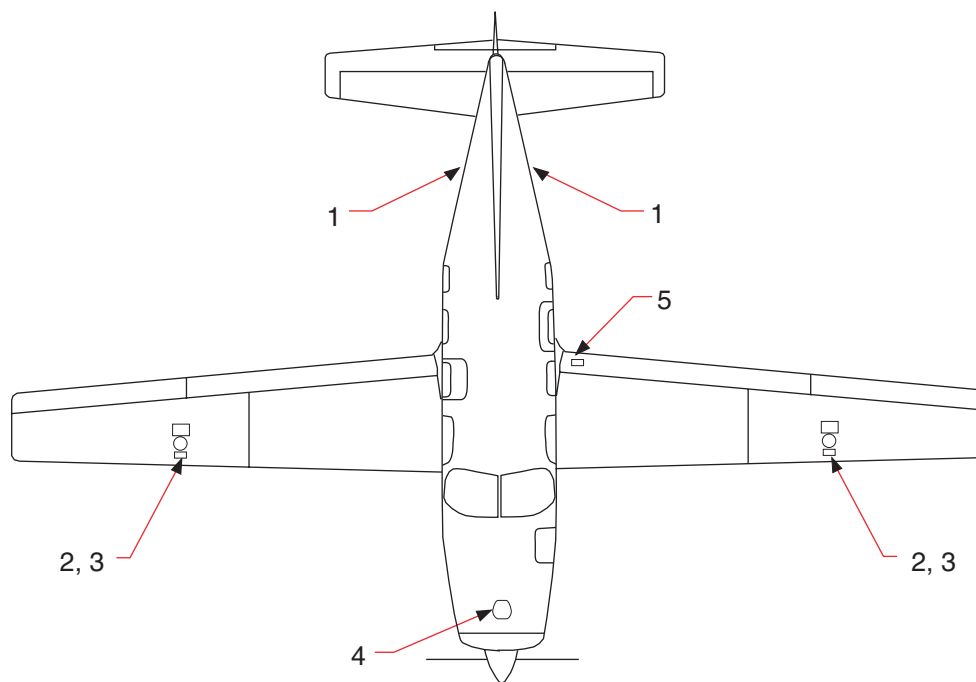
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

EXTERIOR PLACARDS AND MARKINGS

The airplane nameplate placard (i.e. - Item 7, Figure 1) is located below the tailcone at approximately F.S. 311.50. The placard identifies the airplane by its model number and serial number. Should a question arise concerning the care of the airplane, it is important to include the airplane serial number in any correspondence to The New Piper Aircraft, Inc.

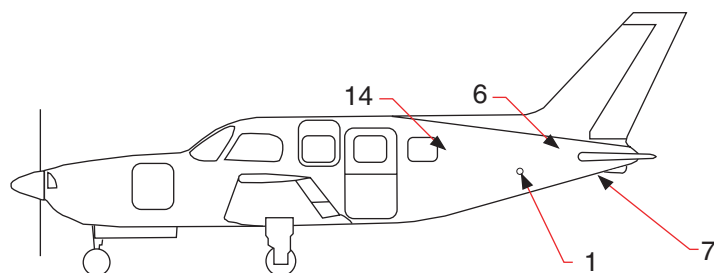
NOTE: Any time an airplane is repainted or touched up, inspect all placards to ensure that they are not covered with paint, are legible, and securely attached.

NOTE: Item numbers refer to Decal and Placard detail views shown in Sheets 3 thru 6.



89502 AW

TOP VIEW

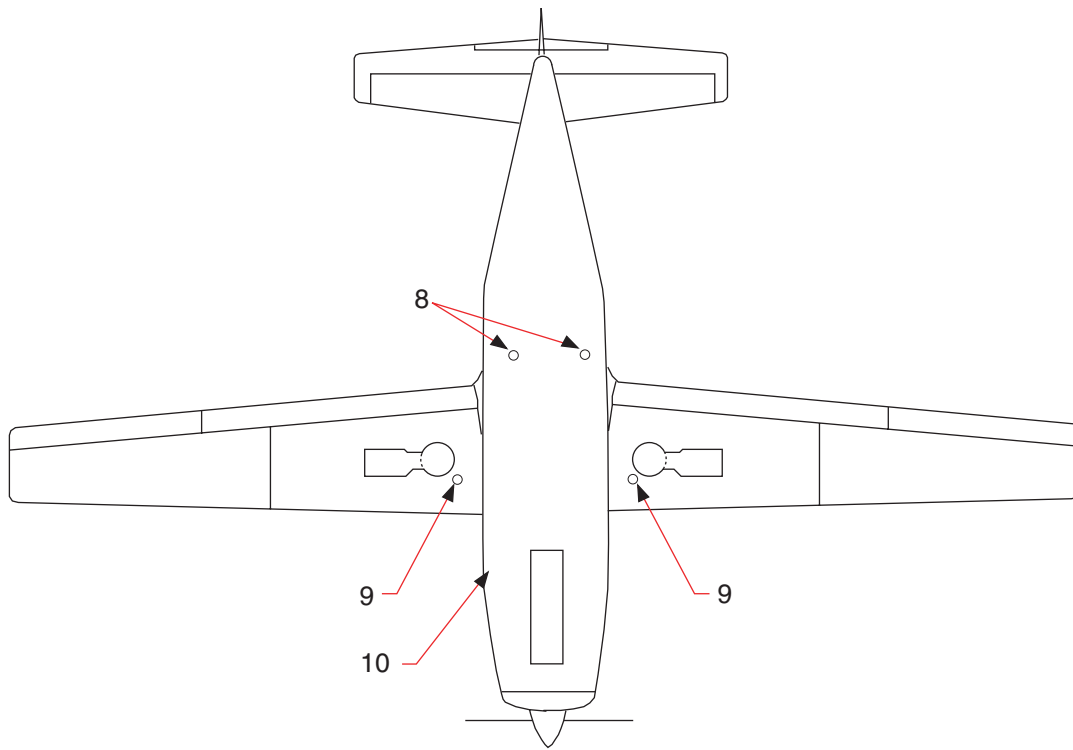


SIDE VIEW

Exterior Placards and Markings
Figure 1 (Sheet 1 of 6)

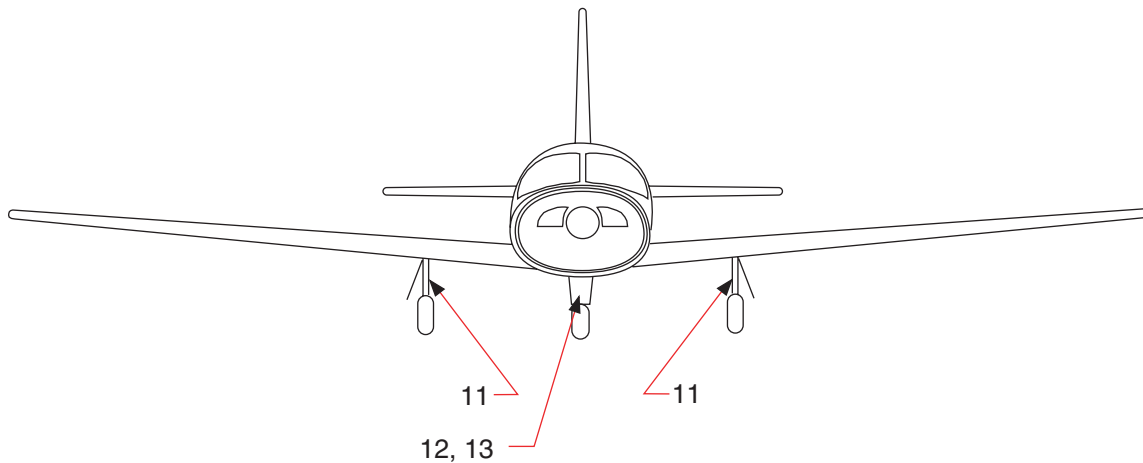
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

NOTE: Item numbers refer to Decal and Placard detail views shown in Sheets 3 thru 6.



89502 AW

BOTTOM VIEW



FRONT VIEW

Exterior Placards and Markings
Figure 1 (Sheet 2 of 6)

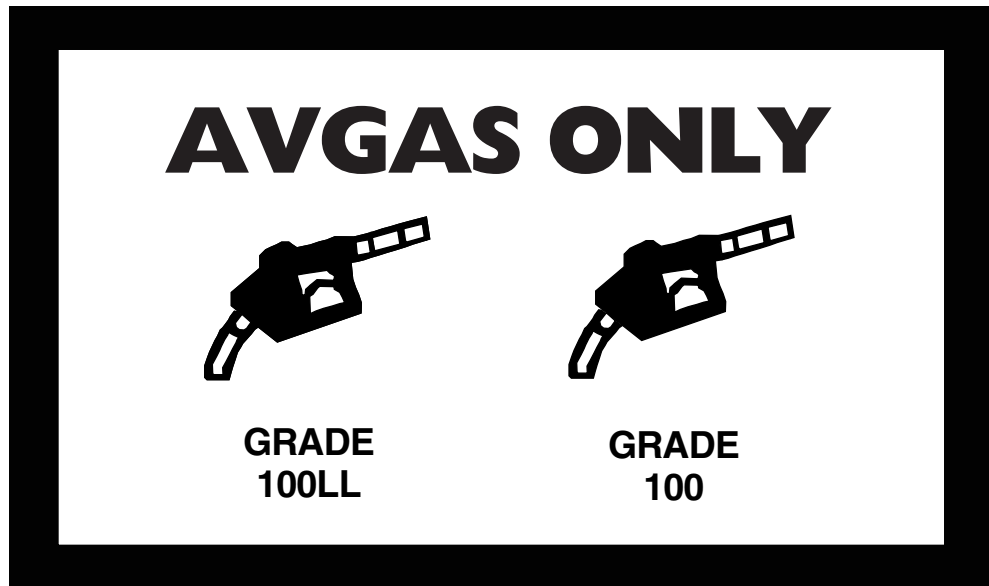
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

STATIC VENTS
KEEP CLEAN

Decal #1

DURING FUELING AND DEFUELING OPERATIONS,
ATTACH GROUNDING CABLE TO GROUND ATTACH
PIN LOCATED ON MAIN STRUT.

Decal #2



Decal #3

* RECOMMENDED SAE GRADE OIL	
AVERAGE	MIL-L-22851
AIR TEMP.	ASHLESS DISPERSANT
ALL TEMPS	15W-50W OR 20W-50W
ABOVE 80° F	60
ABOVE 60° F	40 OR 50
30° F TO 90° F	40
0° F TO 70° F	30, 40 OR 20W-40
BELOW 10° F	30 OR 20W-30
* REFER TO LATEST REV OF LYCOMING S.I. 1014	

Placard #4

Exterior Placards and Markings
Figure 1 (Sheet 3 of 6)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



Placard #5



Decal #6

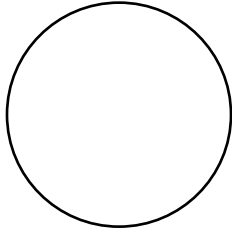
TC			PC	
MANUFACTURED BY THE NEW PIPER AIRCRAFT, INC. VERO BEACH, FLORIDA				
MODEL				
SERIAL NO.				
PLATE NO.				
PIPER PART NO. 100697-3				

Placard #7

Exterior Placards and Markings
Figure 1 (Sheet 4 of 6)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

DRAIN



Decal #8

**FUEL SUMP
DRAIN**

Decal #9

**FUEL FILTER
DRAIN - PUSH**

Decal #10

GROUND ATTACH POINT

Decal #11

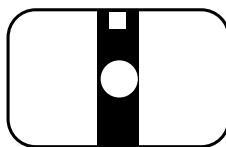
**STRUT AND TIRE
SERVICE INSTRUCTIONS**

PLACE AIRPLANE ON JACKS AND EXTEND STRUT COMPLETELY. RELEASE AIR AND REMOVE AIR VALVE. SLOWLY COMPRESS THE STRUT. SLOWLY FILL COMPRESSED STRUT WITH MIL-H-5606 HYDRAULIC FLUID THROUGH THE FILLER OPENING UNTIL IT REACHES THE TOP OF THE FILLER PLUG HOLE. MANUALLY COMPRESS AND EXTEND STRUT SEVERAL TIMES TO REMOVE TRAPPED AIR. ADD FLUID EACH TIME IF REQUIRED. REPLACE VALVE AND, WITH NOSE GEAR STILL CLEAR OF GROUND, INFLATE STRUT TO 110 PSI AIR PRESSURE. INFLATE NOSE TIRE TO 50 PSI AIR PRESSURE. REMOVE JACKS FROM AIRPLANE (NORMAL NOSE GEAR STRUT EXTENSION IS 1.70 INCHES WITH APPROX. 720 LBS. STATIC LOAD ON NOSE GEAR).

Placard #12

Exterior Placards and Markings
Figure 1 (Sheet 5 of 6)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



Decal #13



Decal #14
(S/N's 4636349 thru 4636363 only)

Exterior Placards and Markings
Figure 1 (Sheet 6 of 6)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

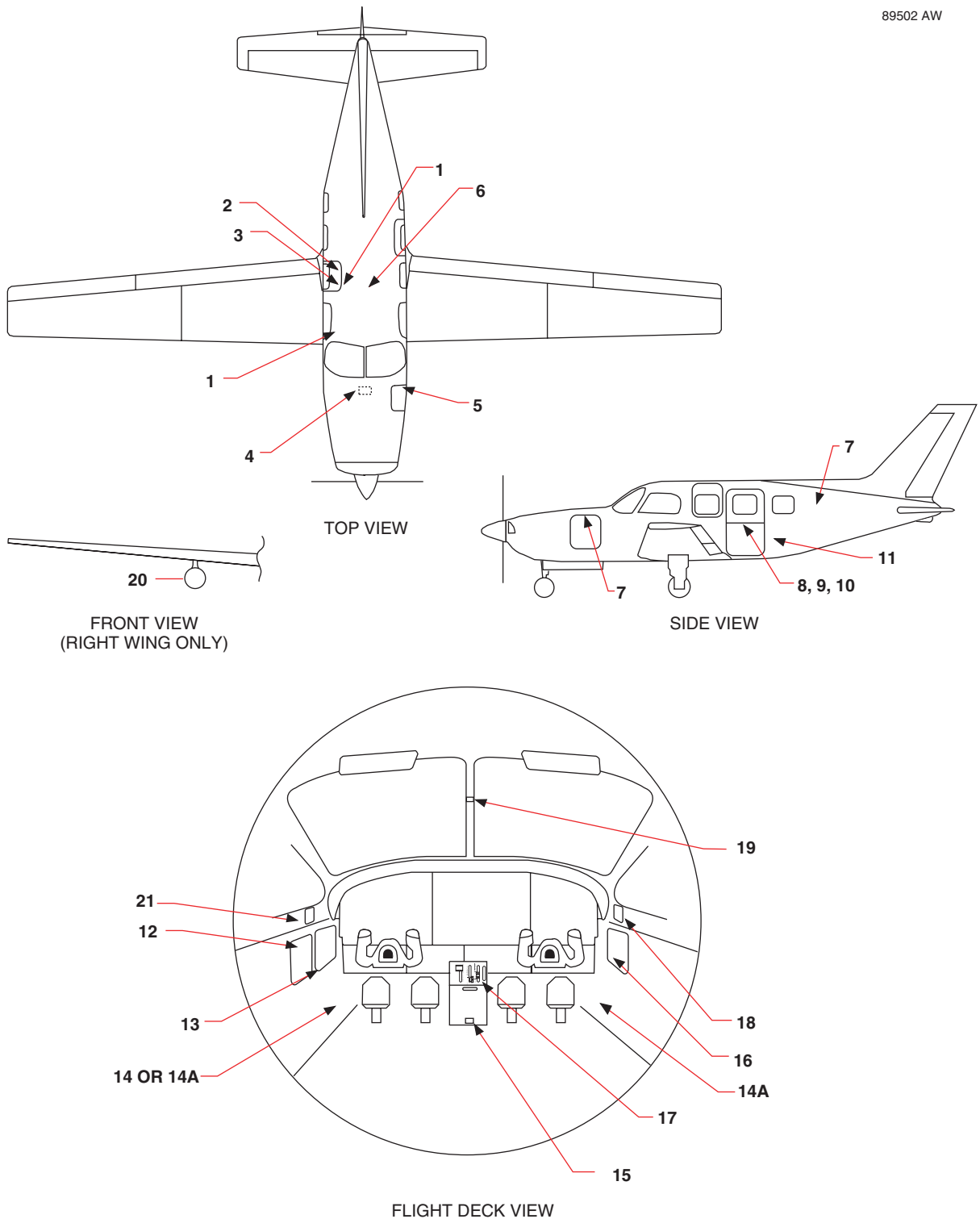
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

INTERIOR PLACARDS AND MARKINGS

NOTE: Item numbers refer to Decal and Placard detail views shown in Sheets 2 thru 7.

89502 AW



Interior Placards and Markings
Figure 1 (Sheet 1 of 7)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

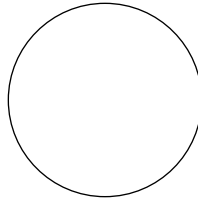
**EMERGENCY OXYGEN
IN DRAWER UNDER SEAT**

**PULL MASK OUT OF DRAWER FULLY
AT FULL EXTENSION GIVE CORD A TUG
MAXIMUM DURATION — 15 MINS**

**SEE POH
NO SMOKING WHILE IN USE**

Decal #1

EMERGENCY EXIT



REMOVE GLASS

Decal #2

**TABLE MUST BE STOWED
DURING TAKE-OFF & LANDING**

Decal #3

FLUID LEVEL LINE

BRAKE FLUID RESERVOIR

**FILL TO FLUID LEVEL LINE WITH PETROLEUM
BASE (RED) HYDRAULIC OIL ***

*** UNIVIS #40 OR MIL-H-5606 OR EQUIVALENT**

Placard #4

Interior Placards and Markings
Figure 1 (Sheet 2 of 7)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

EXTERNAL POWER
28 VOLTS D.C.
TURN MASTER SWITCH
AND ALL EQUIP. OFF
BEFORE INSERTING
OR REMOVING PLUG.

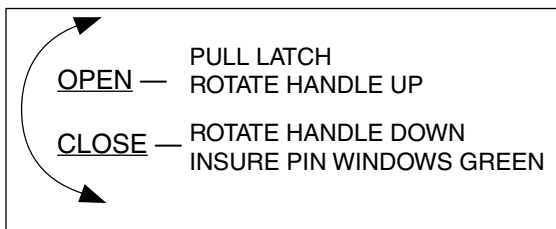
Decal #5

FIRE
EXTINGUISHER

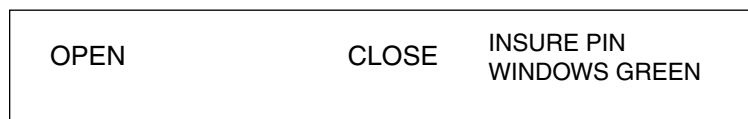
Decal #6

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS.

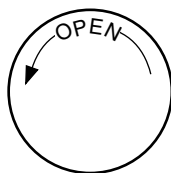
Decal #7



Decal #8



Decal #9



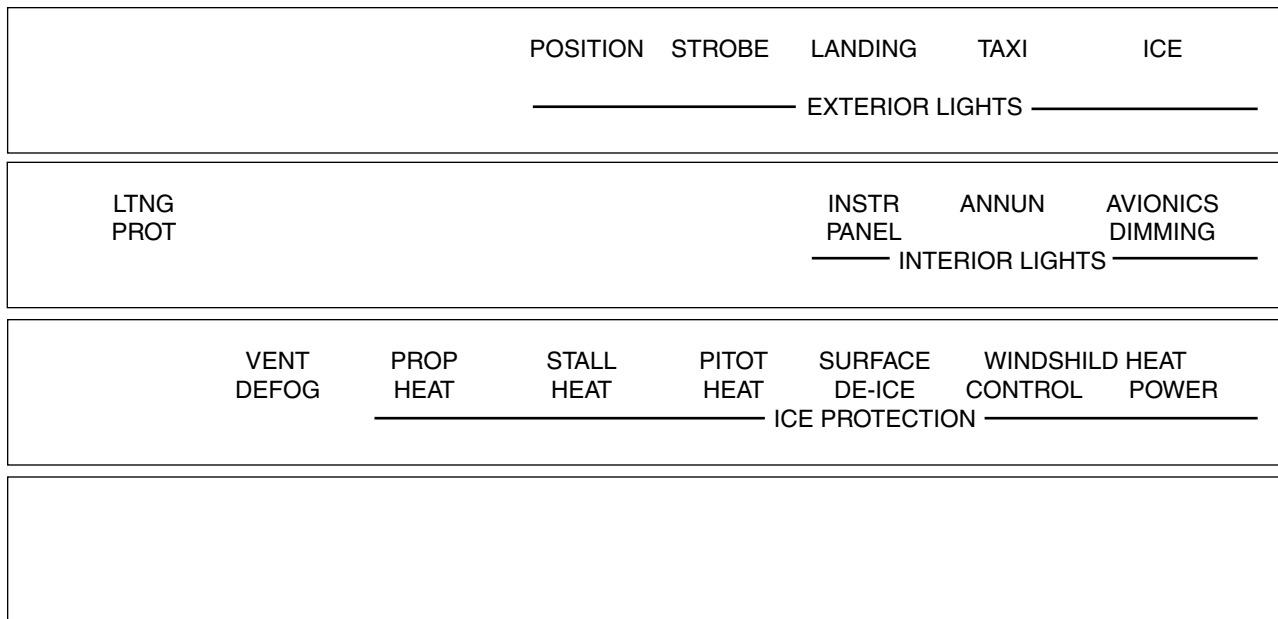
Decal #10

COURTESY LIGHT
RESET

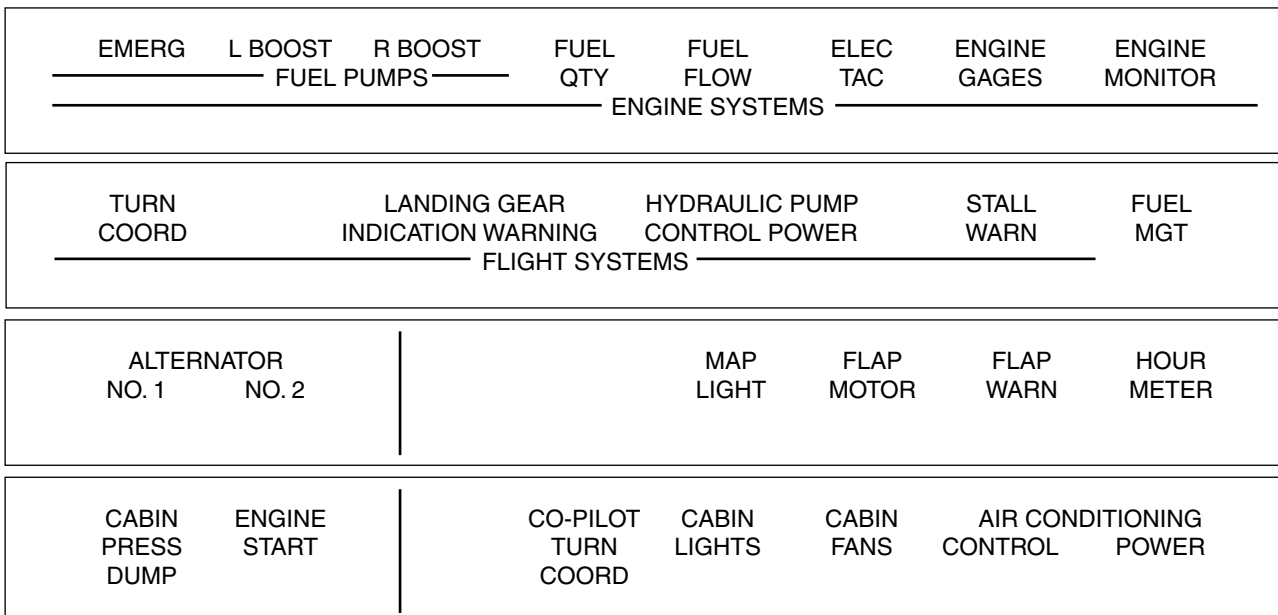
Decal #11

Interior Placards and Markings
Figure 1 (Sheet 3 of 7)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



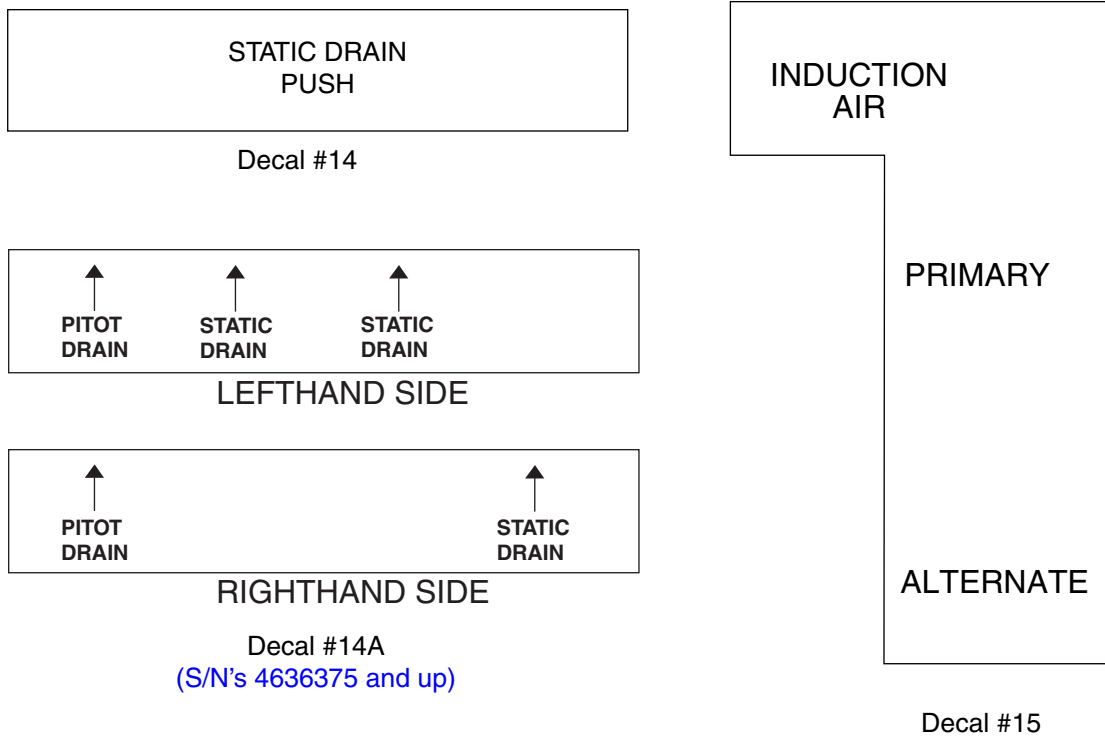
Decal #12
(Typical)



Decal #13
(Typical)

Interior Placards and Markings
Figure 1 (Sheet 4 of 7)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

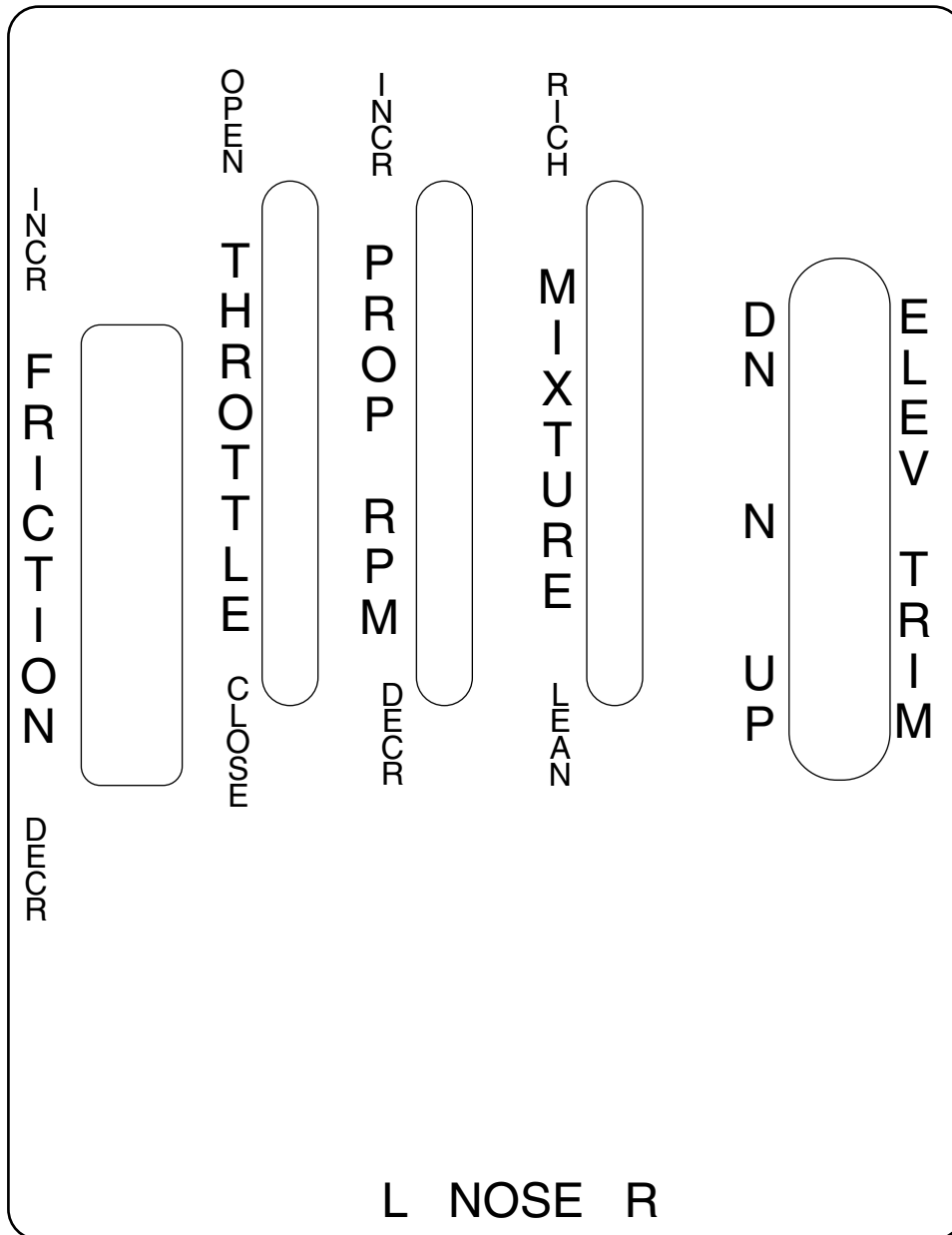


DME 1	SPEAKER AMP	NAV 1	COMM 1	COMM 2	NAV 2	HEAD SET AMP	DME 2
RMI	ENCODER 1	XPDR 1	ADF 1	ADF 2	XPDR 2	ENCODER 2	GPS
PITCH TRIM	AUTO PILOT	COMPASS	RADAR ALT			STORM SCOPE	RADAR
		AVIONICS COOLING	LORAN	BUS TIE	FLITE PHONE	INV	

Decal #16
(Typical)

Interior Placards and Markings
Figure 1 (Sheet 5 of 7)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



Silkscreen #17

Interior Placards and Markings
Figure 1 (Sheet 6 of 7)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

THE MARKINGS AND PLACARDS INSTALLED IN THIS AIRPLANE CONTAIN OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THE NORMAL CATEGORY. OTHER OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THIS CATEGORY ARE CONTAINED IN THE AIRPLANE FLIGHT MANUAL. NO AEROBATIC MANEUVERS, INCLUDING SPINS, APPROVED.

THIS AIRCRAFT APPROVED FOR V.F.R., I.F.R., DAY AND NIGHT ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH THE AIRPLANE FLIGHT MANUAL.

WARNING

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

WARNING

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

PRESSURIZED LANDING NOT APPROVED.

Placard #18

CAUTION

COMPASS
CAL. MAY
BE IN ERROR
WITH ELECT.
EQUIPMENT
OTHER THAN
AVIONICS ON.

Placard #19

MAX WEIGHT 5 LBS (2.2 KGS)

Placard #20
(100700-037)
(Mounted inside radome door.)

**ALTERNATE STATIC SOURCE
(LOCATED BELOW PANEL)
UP - ALTERNATE
DOWN - PRIMARY**

See Figure 2,
Decal #4, for
S/N's 4636001
thru 4636374

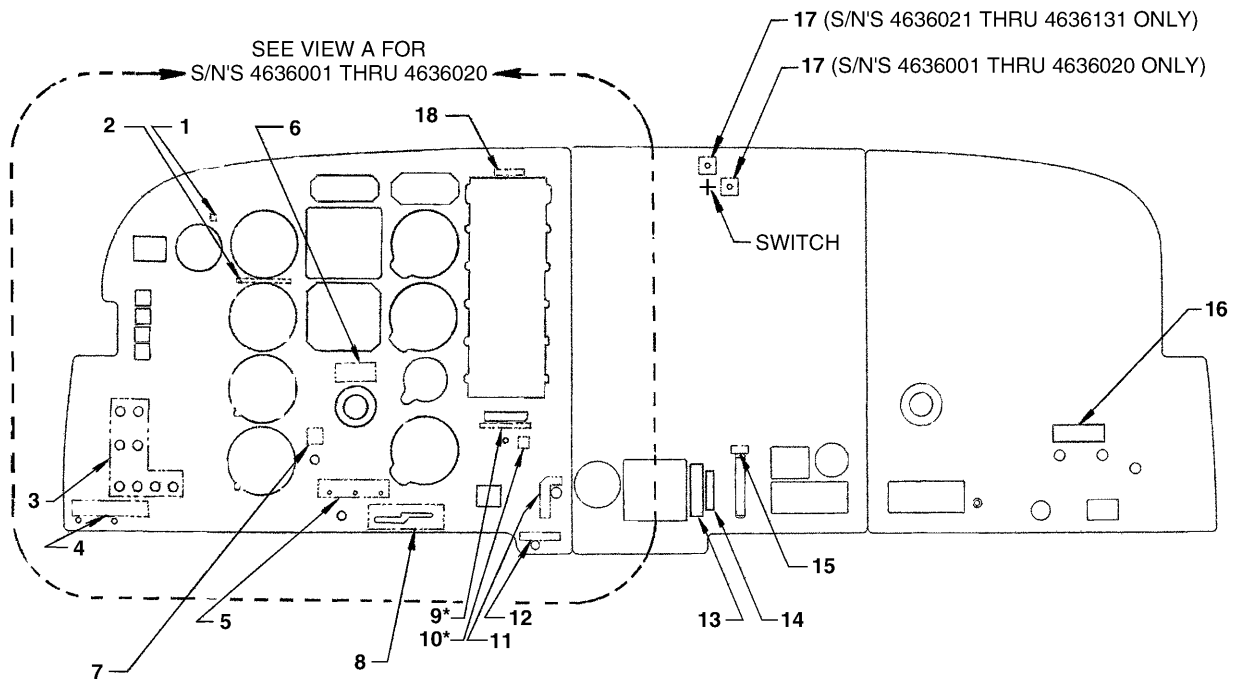
Placard #21
(84967-304)
(Mounted below pilot's side window.)
(S/N's 4636375 and up)

Interior Placards and Markings
Figure 1 (Sheet 7 of 7)

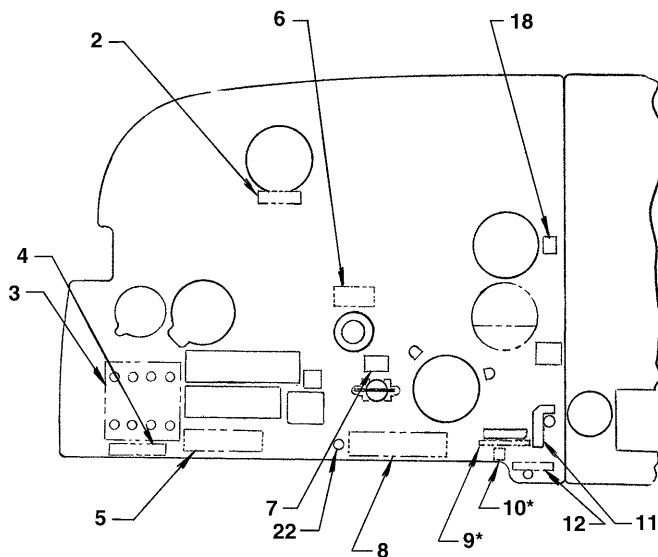
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



NOTE: Item numbers refer to Decal and Placard detail views shown in Sheets 4 thru 7.



VIEW A
(S/N'S 4636001 THRU 4636020 ONLY)

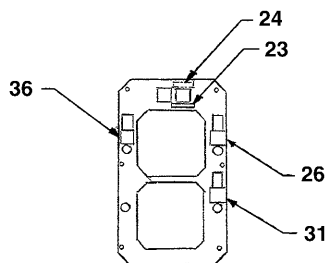
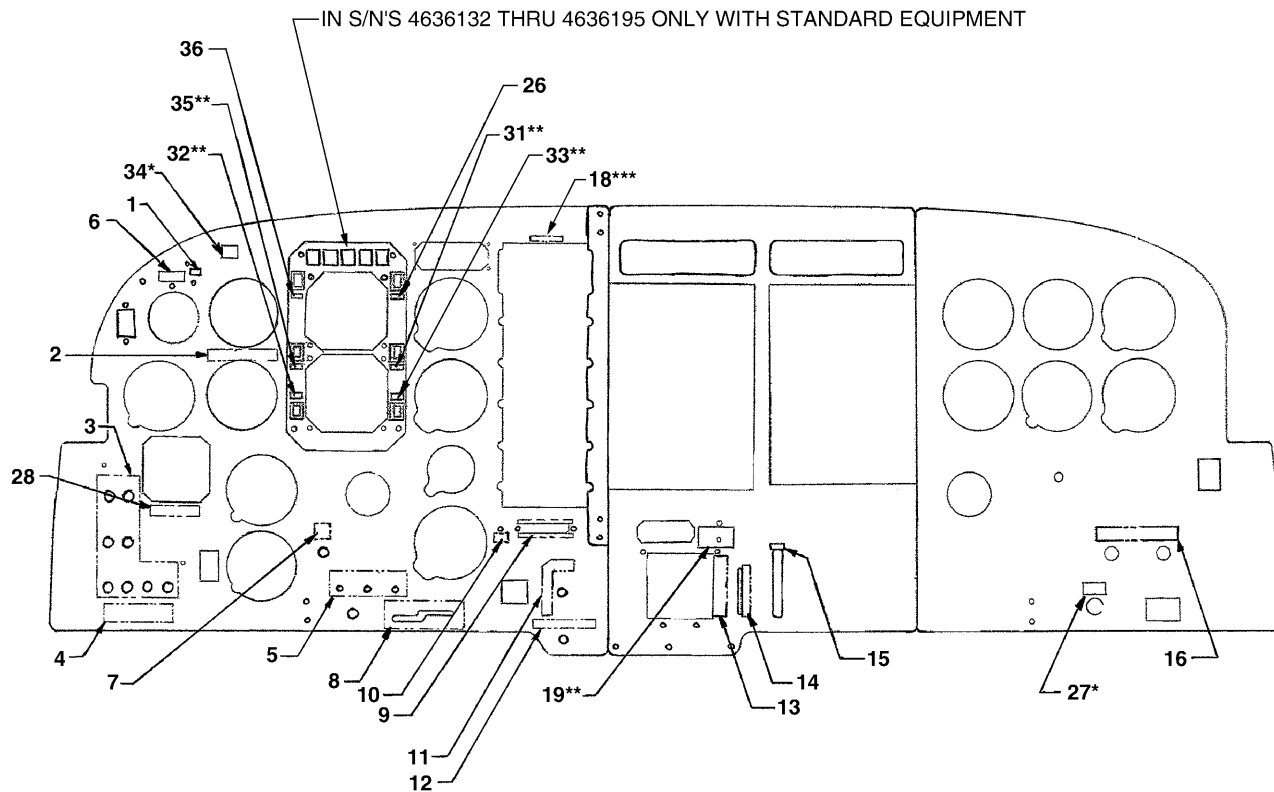
* NOT INSTALLED WITH
SIX (6) CYLINDER CHT GAUGE OPTION.

89502 AU

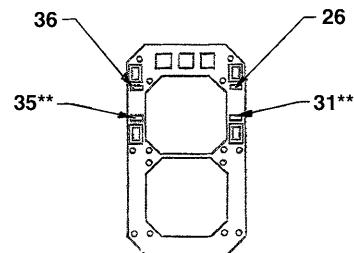
Interior Placards and Markings
Figure 2 (Sheet 1 of 8)

[Effectivity](#)
[4636001 thru 3636131](#)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



S/N'S 4636248 THRU 4636313,
LESS 4636299



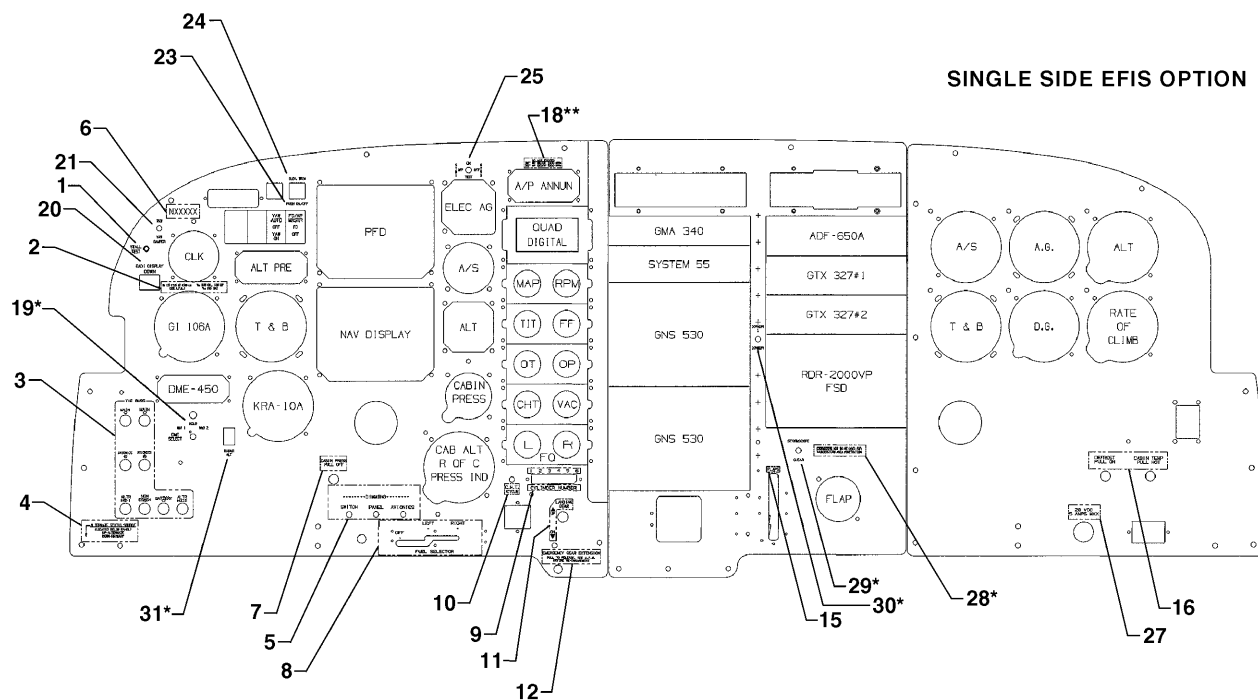
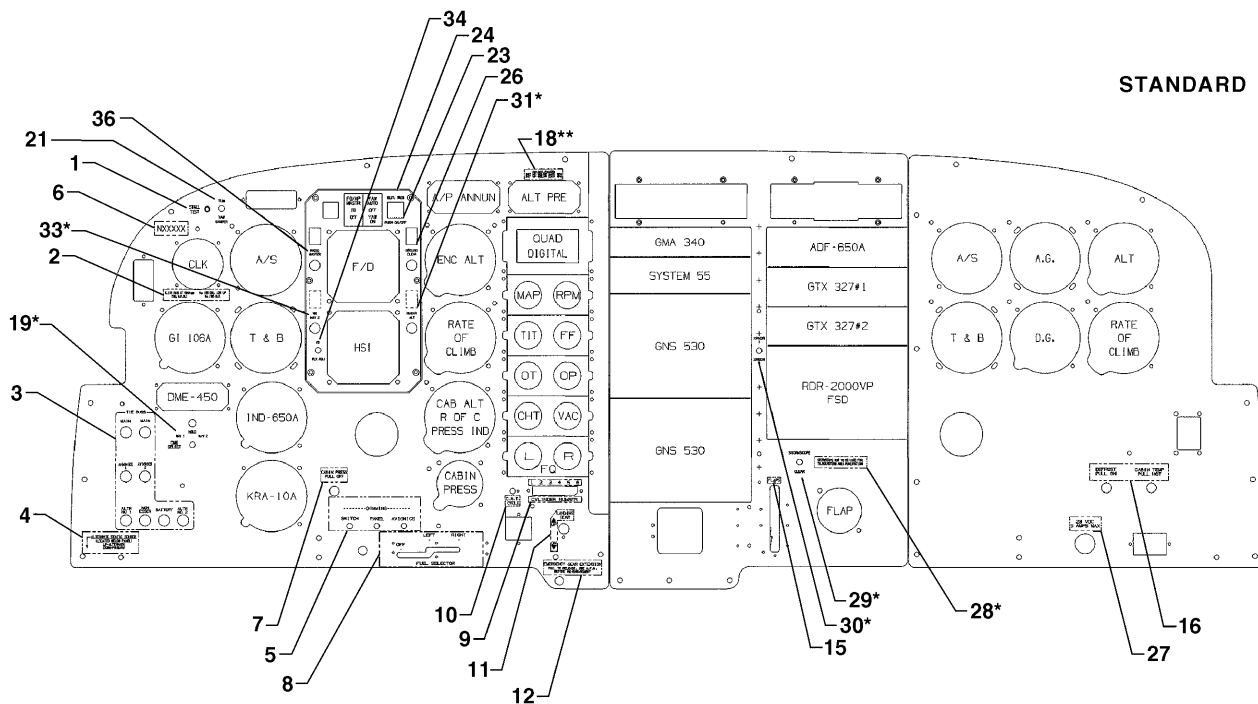
S/N'S 4636132 THRU 4636195,
WITH EFIS 40 OPTION ONLY

- * S/N'S 4636248 THRU 4636313, LESS 4636299, ONLY.
- ** INSTALLED WITH OPTIONAL EQUIPMENT.
- *** INSTALLED WITH TWO (2) BLADE PROPELLER OPTION ONLY.

Effectivity
4636132 thru 4636313,
less 4636299

Interior Placards and Markings
Figure 2 (Sheet 2 of 8)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

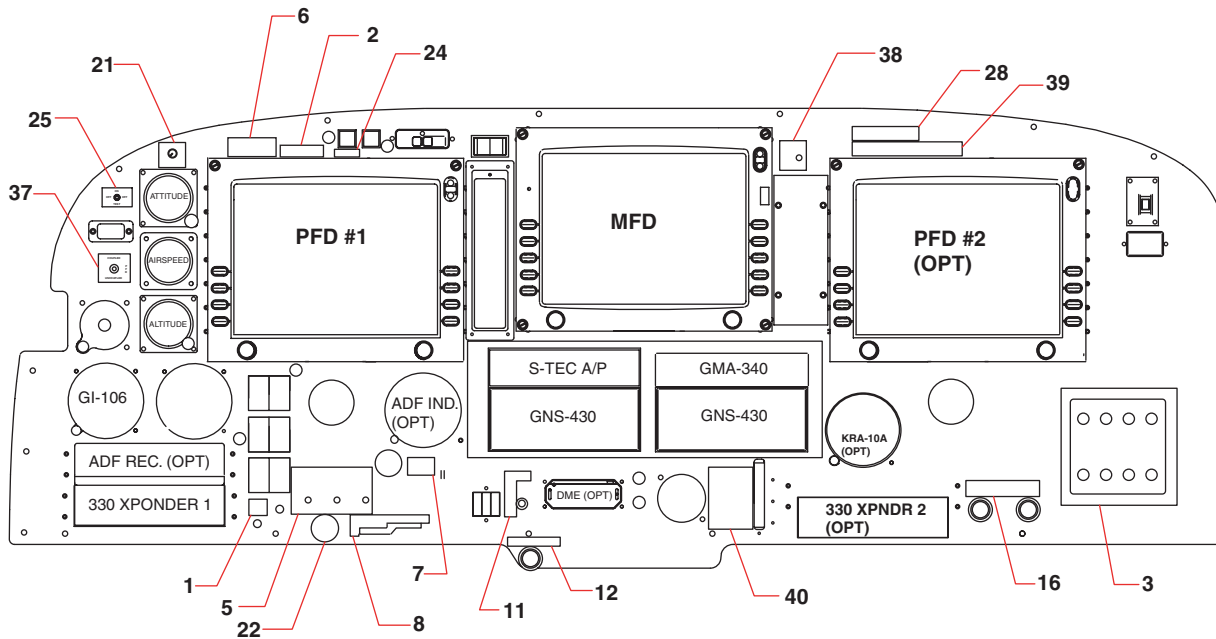


* INSTALLED WITH OPTIONAL EQUIPMENT.
** INSTALLED WITH TWO (2) BLADE PROPELLER OPTION ONLY.

Interior Placards and Markings
Figure 2 (Sheet 3 of 8)

[Effectivity](#)
[4636299,](#)
[4636314 thru 4636374](#)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

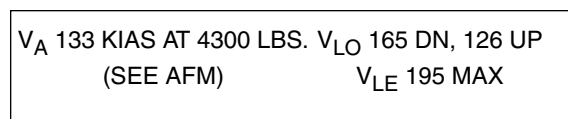


S/N's 4636375 and up

NOTE: Part numbers shown in Sheets 4 thru 8 are reference only. See parts catalog to order.



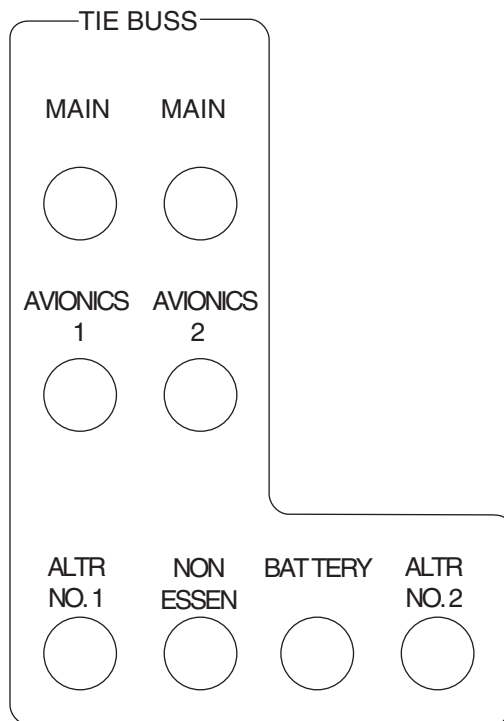
Placard #1
(84967-100)



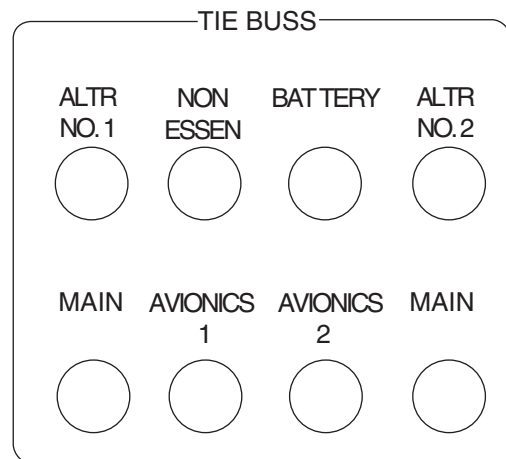
Placard #2
(See appropriate POH for specific limitations.)
(84967-093 - S/N's 4636001 thru 4636020,
84967-209 - S/N's 4636021 thru 4636195,
84967-258 - S/N's 4636196 thru 4636374,
84967-336 - S/N's 4636375 and up.)

Interior Placards and Markings
Figure 2 (Sheet 4 of 8)

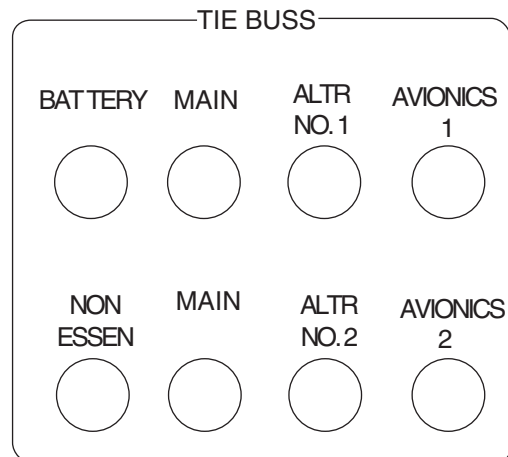
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



S/N'S 4636021 THRU 4636374 ONLY
(84967-186 - S/N's 4636021 thru 4636131,
84967-228 - S/N's 4636132 thru 4636374.)



S/N'S 4636001 THRU 4636020 ONLY
(84967-091)



S/N'S 4636375 AND UP
(84967-337)

Decal #3

**ALTERNATE STATIC SOURCE
(LOCATED BELOW PANEL)
UP-ALTERNATE
DOWN-PRIMARY**

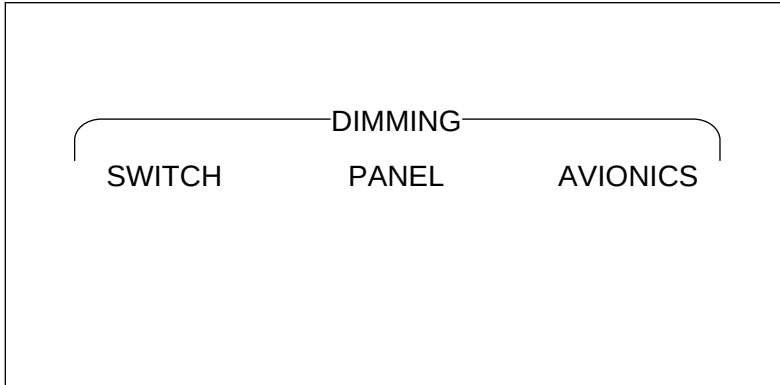
See Figure 1,
Placard #21, for
S/N's 4636375
and up.

Decal #4
(84967-022)

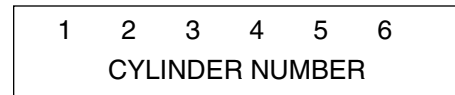
(S/N's 4636001 thru 4636374 only)

Interior Placards and Markings
Figure 2 (Sheet 5 of 8)

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Decal #5
(84967-101)



Decal #9
(84967-109)
(In S/N's 4636132 & up, cut decal in half and install above and below indicator.)

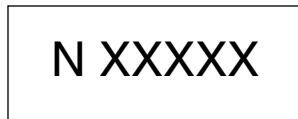
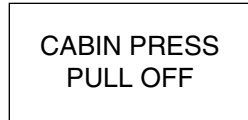
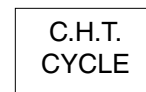


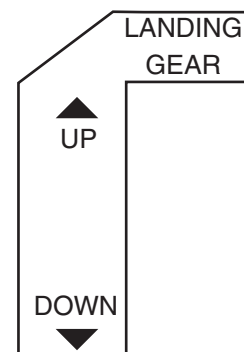
Plate #6
(19099-000)



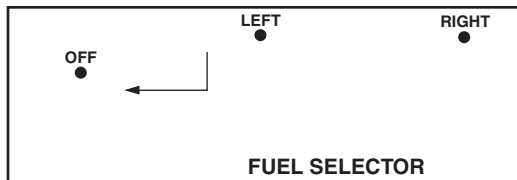
Decal #7
(84967-107)



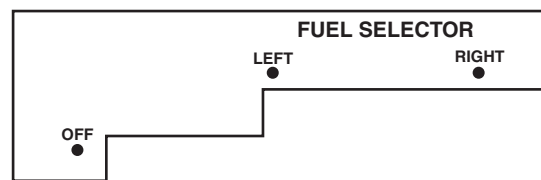
Decal #10
(84967-110)



Decal #11
(84967-111)



S/N'S 4636001 thru 4636374 original equipment
(84967-024)



S/N'S 4636375 and up;
Service replacement for 4636001 thru 4636374
(84967-024)

Decal #8

Interior Placards and Markings
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EMERGENCY GEAR EXTENSION
PULL TO RELEASE. SEE A.F.M.
BEFORE RE-ENGAGEMENT.

Decal #12
(84967-015)

FLAPS

Decal #15
(84967-002)

AMP
ALTR
#1

SYST
VOLT

AMP
ALTR
#2

Decal #13
(84967-098)

0

10

20

36

Decal #14
(84967-099)

DEFROST
PULL ON

CABIN TEMP
PULL HOT

Decal #16
(84967-097)

PRESS TO
TEST

Decal #17
(84967-106)

DO NOT EXCEED

36" MP
BELOW 2400 RPM

32" MP
BELOW 2300 RPM

S/N's 4636001 thru 4636020 only
(84967-195)

DO NOT EXCEED

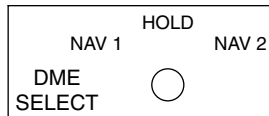
36" MP BELOW 2400 RPM
32" MP BELOW 2300 RPM

S/N's 4636021 and up
(84967-208)

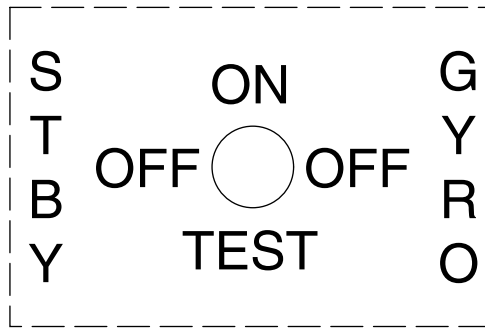
Decal #18

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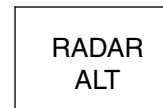
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Placard #19
(84967-244)



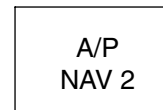
Placard #25
(84967-267)



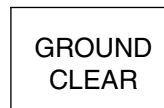
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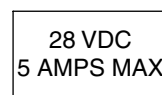
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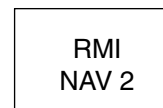
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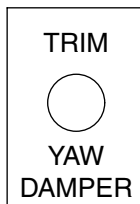
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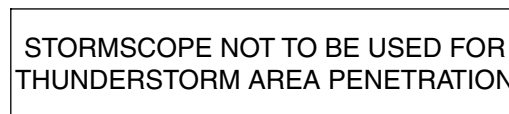
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(84967-259)



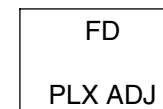
Placard #33
(84967-243)



Placard #21



Placard #28
(84967-049)

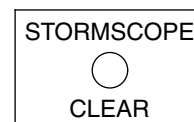


Placard #34
(84967-247)

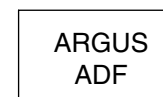
84967-256 - S/N's 4636314 thru 4636374,
and 4636299
84967-317 - S/N's 4636375 and up)



Placard #22
(35669-081)



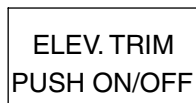
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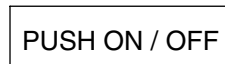
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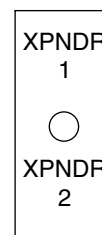
84967-215 - S/N's 4636314 thru 4636374,
and 4636299)



(84967-316 - S/N's 4636375 & up)
Placard #24



Placard #23
(84967-216)



Placard #30
(84967-270)



Placard #36
(84967-239)

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Meyercord Decals

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

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

A. Removal

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

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

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

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

B. Installation

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

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CHAPTER

12

SERVICING

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GENERAL

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

1. Aircraft Finish Care

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

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

A. Dupont Imron 6000 Paint System

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

New Piper aircraft delivered in 1999 and later (i.e. - Mirage S/N's 4636187 and up), use the new Dupont Imron 6000 paint system. The guidelines outlined below must be followed to prevent damage to the finish and ensure long paint life.

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

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

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B. Cleaning

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

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

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

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

2. Cleaning

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

B. Engine Compartment

Before cleaning the engine compartment:

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

CAUTION: DO NOT SPRAY SOLVENT IN TO THE ALTERNATOR(S), STARTER, AIR INTAKE, AND ALTERNATE AIR INLETS.

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

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

- (4) Lubricate controls, bearing surfaces, etc, per Lubrication Chart, 12-20-00.

C. Windshield and Windows (Except Pilot's Windshield, see below.)

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

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

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

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- (3) Remove oil and grease with a cloth dampened with Plexiglas Polish and Cleaner, P/N 403D or similar substance conforming to Federal Specification (P-P-560) or kerosene.
- (4) Rinse windows thoroughly and dry with soft lint-free cloth.
- (5) A superficial scratch or mar in plastic can be removed by polishing out the scratch with jeweler's rouge.
- (6) When windows are clean, apply a thin coat of polishing wax. Rub lightly with a soft cloth. Do not apply wax to heated windshields with electrical heating elements.
- (7) Apply REPCON repellent or equivalent to windows and windshield to improve visibility during flights through rain. Apply only according to manufacturer's instructions. (Refer to 91-10-00, Consumable Materials.)

D. Pilot's Windshield

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

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

The surface of the pilot's windshield should be cleaned in a manner that will protect the special water repellent coating.

- (1) Flush with clean water to remove excessive amounts of dirt and other substances. Adhered particles should be dislodged using fingers or fingernails.
- (2) Use only clean materials such as a soft cloth or clean sponge or soft paper towel (such as Kaydry® Wipers). Wash with a 50/50 solution of isopropanol and water. Alternative cleaning solutions that can be used if isopropanol is not available include:
 - (a) 50/50 solution of rubbing alcohol and water.
 - (b) Mild liquid detergents (such as Ivory Dishwashing Liquid or Joy® Dishwashing Liquid mixed 1/4 oz. per gallon of water).
 - (c) Windex® Glass Cleaner

NOTE: Do not use any abrasive materials (such as pumice or any strong acids or bases as these materials may damage the coating.

- (3) Flush thoroughly with clean water and dry. Wipe dry with strokes in one direction using only clean materials such as a damp soft cloth, damp sponge, or soft paper towel (such as Kaydry® Wipers).

NOTE: Do not apply any polish or wax to the glass surface.

E. Landing Gear

- (1) Struts and Torque Links

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

- (a) Place can under gear to catch waste.
- (b) Spray (low pressure only) or brush gear area, as required, with solvent or mixture of solvent and degreaser.
- (c) Allow solvent to remain on gear for 5 to 10 minutes. Rinse gear with additional solvent and allow to dry.
- (d) Remove cover from wheel and remove catch can.
- (e) Lubricate gear per Lubrication Chart, 12-20-00.

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(2) Wheels and Brakes

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

- (a) Hand wash wheels and brakes with a mild soap and water solution.
- (b) Rinse with low pressure spray.
- (c) Lubricate gear per Lubrication Chart, 12-20-00.

F. Surface Deice Equipment

The deice boots should be cleaned when the aircraft is washed using a mild soap and water solution.

In cold weather, wash the boots with the airplane inside a warm hangar if possible. If the cleaning is to be done outdoors, heat the soap and water solution before taking it out to the airplane. If difficulty is encountered with the water freezing on boots, direct a flow of warm air along the region being cleaned, using a portable type ground heater.

As an alternate cleaning solvent, use benzol or non-leaded gasoline. Moisten the cleaning cloth in the solvent, scrub lightly and then with a clean dry cloth, wipe dry so that the cleaner does not have time to soak into the rubber.

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

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

G. Interior

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

- (1) Vinyl interior surfaces may be cleaned with a damp cloth and mild soap and water solution.
- (2) Leather may be cleaned with a mild hand soap and water solution or with a saddle soap. Follow the precautions which apply to the cleaning of any fine leather product. Avoid saturation and never use detergents or harsh cleaning solutions on leather.

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

- (3) Wood laminated surfaces should be maintained using only a high grade furniture wax.
- (4) All upholstery fabrics are Scotchguard treated and may be cleaned as follows:

Spilled oily and watery liquids will generally bead up on the fabric and can be blotted away leaving little or no stain. Blot spills up as quickly as possible with an absorbent cloth, tissue or sponge. If the material is a solid or semi-solid, such as butter, remove the excess by gently scraping with a table knife. Often, blotting will remove all traces of stain but if the staining agent is not completely removed by blotting, the following techniques are suggested:
- (5) Water-based stains such as ketchup, milk, ice cream, coffee:
 - (a) Wipe the stain with a cloth wet with water containing a detergent or ammonia (4 fluid ounces of ammonia to one gallon of water). Repeat if necessary.
 - (b) Oil based stains such as salad dressing, butter or mayonnaise may be removed by either of the following procedures:

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- (c) Apply "Texize K-2R Spot Remover" by spraying or rubbing into the fabric and let dry. Vacuum off the residual powder. Repeat if necessary or wet a cloth with a solvent type spot cleaner such as "Energine" or "Renuzit" and wipe or gently rub the stained area. Turn cloth and rewet with solvent often. Repeat until stain disappears.
- (d) To remove residual detergent left on the fabric, wipe the entire fabric surface with a cloth dampened with water. The cloth should be rinsed in clean water several times. This procedure will ensure that the treatment will continue to function.

H. Carpets

WARNING: SOLVENT CLEANERS REQUIRE ADEQUATE VENTILATION.

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

I. Cleaning and Maintenance of Relief Tube System

CAUTION: THE CORROSIVE AFFECTS OF URINE ON PAINTED AND UNPAINTED SURFACES CANNOT BE UNDERSTATED. CORROSION MAY APPEAR IN SURROUNDING AREAS IF CLEANING IS DEFERRED FOR EVEN ONE DAY!

For airplanes equipped with a relief tube system, the corrosive effects of urine or other liquids poured through the system are extreme and heightened attention to the cleanliness of this system is indicated, both inside and outside the aircraft. In the interior, the funnel tube assembly, rubber hose and surrounding sheet metal must be cleaned at the termination of each flight, if the system has been used. Likewise, attention to the exterior of the aircraft is equally important and exterior surfaces must be cleaned as described below.

(1) Interior

CAUTION: SHOULD SPILLAGE EXTENDING INTO THE FUSELAGE BE EVIDENT, PROMPT MAINTENANCE ACTION IS REQUIRED TO ENSURE URINE SPILLAGE IN THE FUSELAGE STRUCTURE IS NEUTRALIZED. REMOVE PANELS TO ACCESS THE FLOOR STRUCTURE AS REQUIRED.

- (a) After each use of the relief tube, the area surrounding the relief tube should be examined for spillage and cleaned according to the procedures in paragraphs E (4) and E (5), above. Clean the area inside the box and access door, funnel, and tube using mild soap and water. After cleaning, flush with clean water to ensure that no soapy residue remains. Dry system thoroughly.
- (b) Prepare to flush the relief tube assembly by placing a catch can underneath the relief tube outlet. Flush tube by pouring a solution of baking soda (10%) and water through the tube, flushing out the entire system. Flush again with at least 1/2 gallon of clean water. Low pressure (LP) shop air may be blown through the relief tube system to dry it.

(2) Exterior

Exterior bottom painted surfaces of the airplane must be cleaned from the firewall to the tip of the tail, including the bottom of the tail surfaces, at termination of each flight during which the relief tube system was used. Cleaning should occur per paragraph C, above, with the exception that after completion of washing, a solution of baking soda (10%) and water should be applied to the entire area and allowed to remain for a few minutes. The area must then be thoroughly rinsed with clean water. Dry the area thoroughly and inspect for paint chipping and/or corrosion. Touch up paint as necessary.

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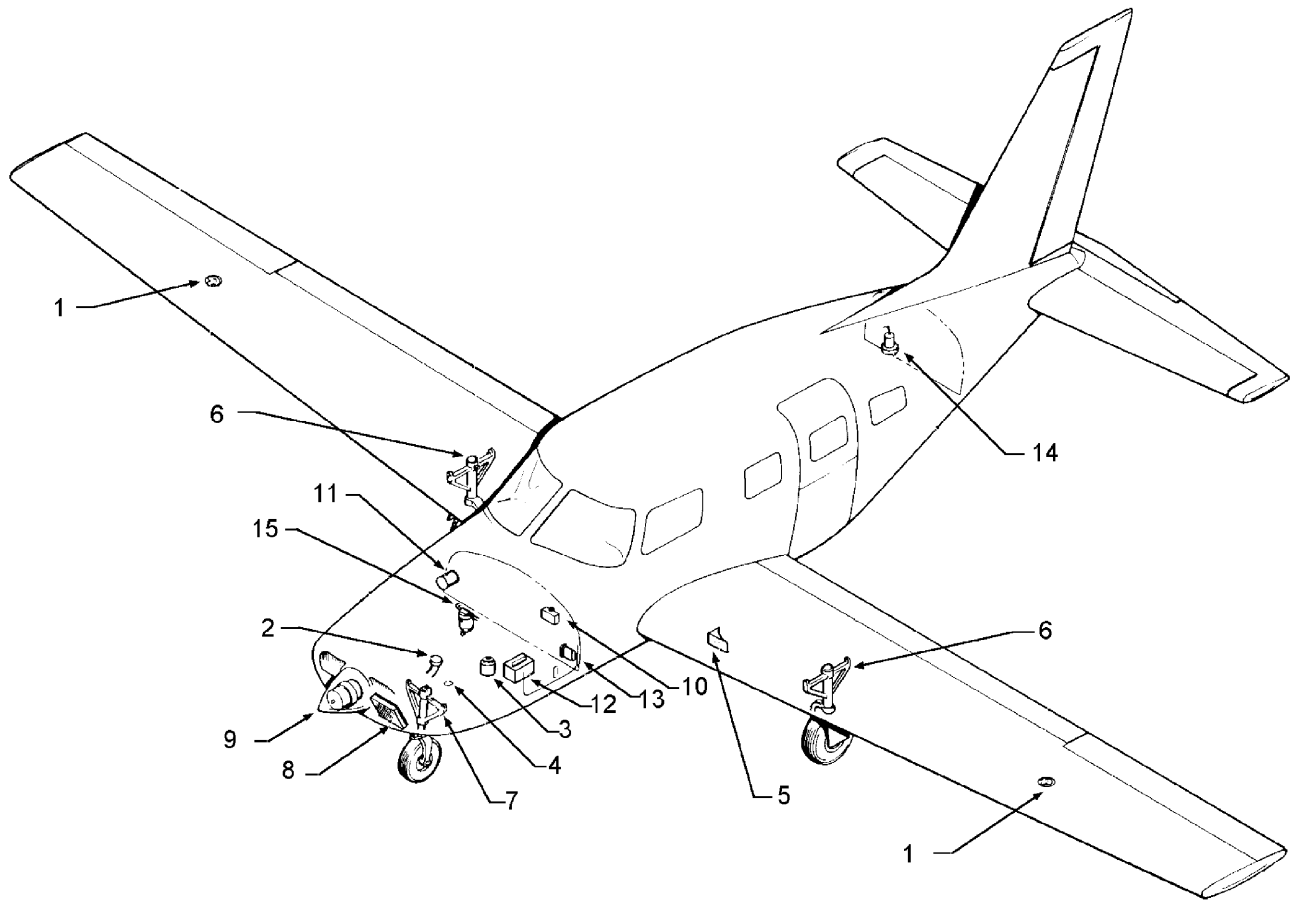
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REPLENISHING

1. Service Points



1. FUEL TANK FILLERS
2. ENGINE OIL FILLER
3. ENGINE OIL FILTER
4. ENGINE OIL DRAIN
5. FUEL DRAIN (L/H SHOWN)
6. MLG FILLER VALVE
7. NLG FILLER VALVE
8. INDUCTION AIR FILTER
9. PROPELLER HUB
10. BRAKE RESERVOIR
11. GYRO AIR FILTER
12. BATTERY
13. EXTERNAL POWER RECEPTACLE
14. HYDRAULIC PUMP/RESERVOIR
15. FUEL FILTER/DRAIN

Service Points
Figure 1

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2. Fuel System

At intervals of 50 hours or 90 days, whichever comes first, clean the fuel strainer screen, located in the fuel bowl mounted on the lower right side of the forward baggage compartment, below the floors, and clean the screen in the inlet side of the injector. Remove and clean the fuel strainer screen in accordance with the instructions outlined in 28-00-00. Additional fuel system service information may also be found in Chapter 28. Inspection intervals of the various fuel system components may be found in 5-20-00.

A. Filling Fuel Cells

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, A GROUND WIRE ATTACHED FROM EACH MAIN GEAR GROUNDING PIN TO SEPARATE APPROVED GROUNDING STAKES SHOULD BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

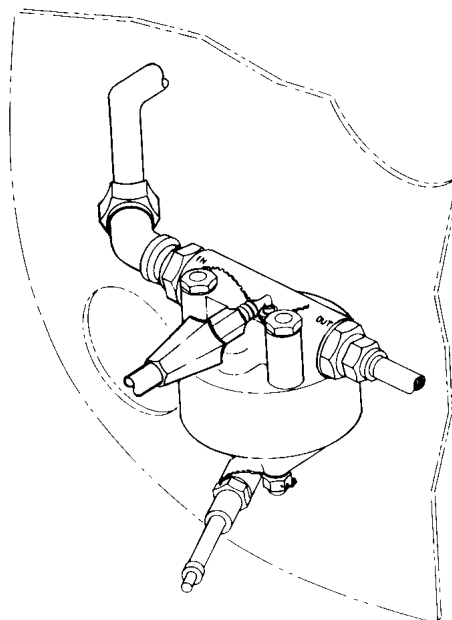
Observe all required precautions for handling gasoline. Fill the fuel tanks with the fuel as specified on the placard adjacent to the filler neck. Each wing tank has a capacity of 61 U.S. gallons, for a total capacity of 122 U.S. gallons. Two U.S. gallons are considered unusable fuel.

B. Draining Moisture From Fuel System

CAUTION: WHEN DRAINING ANY AMOUNT OF FUEL, CARE SHOULD BE TAKEN TO ENSURE THAT NO FIRE HAZARD EXISTS BEFORE STARTING THE ENGINE.

The fuel tanks and fuel strainer should be drained daily prior to first flight and after refueling to avoid the accumulation of water or sediment. Each fuel header tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. The fuel strainer with a quick drain valve is located on the lower right side of the forward baggage compartment. Drain fuel tanks and strainer per the following:

- (1) Drain each tank through its individual quick drain located at the lower inboard rear corner of the header tank, making sure that enough fuel has been drained to ensure that all water and sediment is removed.
- (2) Place a container under the fuel strainer drain. Drain the fuel strainer by opening the quick drain on the strainer.
- (3) Examine the contents of the container placed under the fuel strainer drain for water and sediment, then dispose of the contents.
- (4) After refueling, delay sump sampling by several minutes. This will permit water and contaminants to flow to the sump drains for detection.



Fuel Strainer
Figure 2

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C. MIL-I-27686 Fuel Anti-icing Inhibitors

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

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

CAUTION: THIS ADDITIVE SHOULD NOT BE USED AS A REPLACEMENT FOR PREFLIGHT DRAINING OF THE FUEL SYSTEM DRAINS.

The MIL-I-27686 Fuel Anti-Icing Inhibitor, primarily is an anti-icing agent, however it also has excellent microbiological sludge deterrent characteristics. It is very soluble in water, and only slightly soluble in fuel, which mandates that the blending with fuel be accomplished in a precise manner. Such a device permits injection of the agent into a flowing stream of fuel to ensure even disbursement. When blending the additive, the concentration should not be less than 0.10 percent or more than 0.15 percent by volume. Except for the information contained herein and in the Pilot's Operating Handbook, the manufacturer's mixing or blending instructions should be carefully followed.

D. Draining Fuel System - Complete

Fuel may be drained from the system by opening the valve at the inboard end of each fuel tank. The drain valve requires the drain cup pin to hold the valve open. The remaining fuel in the system may be drained through the filter bowl.

3. Brake System

The brake system contains a hydraulic fluid reservoir through which the brake system is periodically serviced. Fluid is drawn from the reservoir by the brake master cylinders to maintain the volume of fluid required for maximum braking efficiency. Spongy brake pedal actions is often an indication that the brake fluid reservoir is running low on fluid or air. When repairs to brake system components or bleeding the system are required, refer to instructions in 32-40-00.

A. Filling Brake System Reservoir

The brake system reservoir must be filled with hydraulic fluid (MIL-H-5606) to the level marked on the reservoir. The reservoir, located on the left side of the aft wall of the forward baggage compartment, must be checked at every 50 hour inspection and replenished as necessary. Access to the reservoir is through the door on the upper right portion of the nose section. If fluid level is low, it must be filled with filtered hydraulic fluid (MIL-H-5606). No adjustment to the brakes is necessary, but they must be checked periodically per instructions given in 32-40-00.

B. Draining Brake System

To drain the brake system, disconnect the supply hose from the fitting on the bottom of the cylinder and open the bleeder valve at the top of the cylinder. This will empty the piston chamber. Pump the desired brake pedal to clear the line of fluid. To clean system, flush with denatured alcohol.

NOTE: If brake system is drained, parts replaced, or line connections broken, pressure fill and bleed system per procedure in 32-40-00. Procedure assures air is not trapped in system.

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4. Landing Gear Oleo Struts

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

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

Air-oil type oleo struts should be maintained at proper strut tube exposure for best oleo action. Nose gear strut piston tube exposure is $1.7 \pm .25$ inches. Main gear strut piston tube exposure is $3.5 \pm .25$ inches - **except in S/N's 4636196 and up** where $3.4 \pm .25$ inches is required. Measure with the airplane sitting on a level surface under normal static load. (Empty weight of 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 oscillates 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 or nitrogen as described in Inflating Oleo Struts. 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 Filling Oleo Struts. For landing gear and/or oleo strut repair procedures, refer to 32-10-00 and 32-20-00.

A. Filling Oleo Struts

To fill the nose or main gear oleo strut with fluid (MIL-H-5606), whether it be the addition of a small or large amount, proceed as follows:

- (1) Raise the airplane on jacks.
- (2) Place a pan under the gear to catch spillage.
- (3) At the filler plug, relieve air pressure from the strut housing chamber by removing the cap from the air valve and depressing the valve core.
- (4) There are two methods by which the strut chamber may be filled. They are as follows:

(a) **METHOD I.**

- 1 Remove the valve core from the filler plug at the top (or side) of the gear strut housing. Allow the filler plug to remain installed.
- 2 Attach one end of a clean plastic hose to the valve stem of the filler plug and submerge the other end in a container of hydraulic fluid.

NOTE: An air-tight connection is necessary between the plastic tube and the valve stem. Without such a connection, a small amount of air will be sucked into the oleo strut during each sequence, resulting in an inordinate amount of air bubbles and a prolonged filling operation.

- 3 Fully compress and extend the strut thus drawing fluid from the fluid container and expelling air from 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.
- 4 When air bubbles cease to flow through the hose, compress the strut fully and remove the hose from the valve stem.
- 5 With the strut compressed, remove the filler plug to determine that the fluid level is visible up to the bottom of the filler plug hole.
- 6 Reinstall the core in the filler plug and apply thread lubricant (Parker No. 6PB) to the threads of the filler plug and install the plug in the top of the strut housing. Torque the plug from 350 to 400 inch pounds.

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(b) METHOD II.

- 1 Remove the filler plug from the top (or side) of the gear strut housing.
- 2 Raise the strut piston tube until it is fully compressed.
- 3 Pour 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 Apply thread lubricant (Parker No. 6PB) to the threads of the filler plug. Reinstall the filler plug and torque from 350 to 400 inch pounds.
- 7 With the airplane raised, compress and extend the gear strut several times to ascertain that the strut actuates freely. The weight of the gear fork and wheel should extend the strut.
- 8 Clean off overflow of fluid and inflate the strut as described in Inflating Oleo Struts.
- 9 Check that fluid is not leaking around the strut piston at the bottom of the housing.

B. 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 until the correct inches of piston is exposed with normal static load (empty weight of the airplane plus full fuel and oil) on the gears. 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.

NOTE: Moisture free compressed air may be used in lieu of nitrogen gas on a temporary basis; however, the strut should be deflated and serviced with nitrogen as soon as possible.

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.)

If the airplane is on jacks, ensure that the struts are fully extended. Inflate the nose gear strut to 110 ± 11 psi and the main gear struts to 250 ± 25 psi. This is the preferred method.

5. 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.

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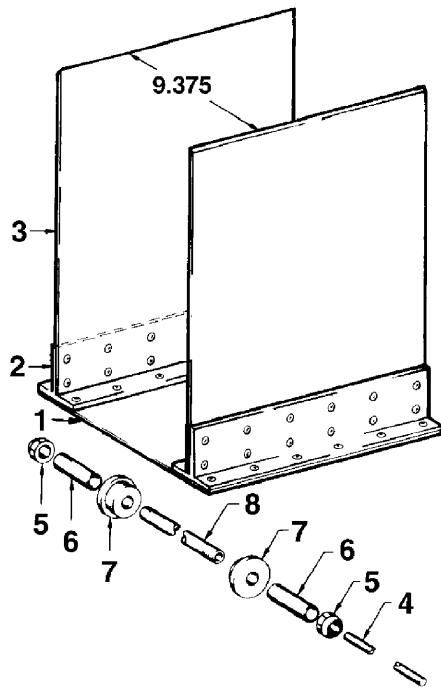
- A. Several basic characteristics of tubeless aircraft tires may be mistaken for problems:
- (1) Tire growth in the first 12 to 24 hours after inflation will result in a seemingly severe pressure drop. Simply inflate, wait for another 24 hours, then check pressure. It will probably be within specs.
 - (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 Chart 1 (Sheet 2 of 2), 6-00-00. When checking tire pressure, examine tires for wear, cuts, bruises, and slippage. 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 B; allow to dry for 20 - 30 minutes before handling.
 - (4) Remove agent on wheel assembly with cleaning solvent.
 - (5) Apply as conditions dictate.

6. 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. Balance the tire as follows:

- A. Mount the tire and tube (if one is used) on the wheels, but do not install the securing bolts. Install the wheel bearings in the wheels; then, using the -7 bushings, -6 spacers, and -5 nuts, install the wheel/tire assembly on the -8 pipe. Secure the -5 nuts finger tight so that the wheel halves touch each other. Be sure the bolt holes are aligned. Insert the -4 axle through the -8 pipe and place the wheel in the center of the balancer. Make sure the axle is only on the chamfered edges of the balancer and that it is at 90° to the sides of the balancer.
- B. Release the tire. If it is out of balance it will rotate, coming to rest with the heaviest point on the bottom. Tape a ounce patch across the top center of the tire. Rotate the tire 45° and release it again. If the tire returns to the same position, add a 1 ounce patch and again rotate the tire and release it. Continue this procedure until the tire is balanced.
- C. 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 centerline of the tire and aligned with the chalk marks on the sidewall. Burnish the patches to remove trapped air, etc.
- D. When reassembling the wheel, powder the inside of the tire. Mount the tire on the valve side of the wheel in the same position it was in when it was balanced. Install the other wheel half, aligning the chalk marks. Install the bolts and tighten to required torque, then inflate the tire to the pressure specified in Chart 1, 6-00-00. and recheck the balance. The wheel should not be more than ounce out of balance.

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USE THE FOLLOWING LIST OF MATERIALS TO MAKE THE BALANCER

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

Tire Balancer
Figure 3

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7. Hydraulic System

The general condition of the hydraulic pump and landing gear actuating cylinders should be checked. Ensure that there are no leaks and that the line fittings are tight. The cylinder rods are to be free of all dirt and grit. To clean the rods use a rag soaked in hydraulic fluid and carefully wipe them. All the hydraulic lines should also be checked for leaks, kinks, and corrosion. Check the tightness of the attachment fittings.

Repair and inspection procedures for the hydraulic pump, cylinders and various components may be found in 29-10-00 of this manual.

Servicing Hydraulic Pump/Reservoir

The fluid level of the reservoir of the combination pump and reservoir should be checked every 50 hours by viewing the fluid through the transparent reservoir on the hydraulic pump. Access to the pump is through view port in rear baggage compartment panel behind rear seat.

Should fluid be below the full mark, add fluid MIL-H-5606 through the filler hole until full. Ensure that the landing gears are down and the flaps up when filling the reservoir. Reinstall the filler plug and tighten.

8. Engine Lubrication

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

A. General

- (1) The engine oil and oil filter should be changed every 50 hours of engine operation (or less, depending upon dust, humidity or engine conditions) or every 4 months, whichever comes first.
- (2) For new, overhauled or re-manufactured engine, use ashless dispersant oil conforming to MIL-L-22851 specifications. After 25 hours, change oil and filter.
- (3) It is recommended after the first 25 hours of engine operation that the operator continues to use ashless dispersant oil conforming to MIL-L-22851 specifications.
- (4) The Textron Lycoming engine is provided with a wet sump pressure oil system having a capacity of twelve (12) quarts. The minimum safe quantity of oil in the sump is 2-3/4 quarts. Single or multi viscosity aviation grade oils, in accordance with latest issue of Textron Lycoming Service Instruction 1014, are required. (See 11-20-00, Figure 1, Placard #4)

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

- (5) Refer to 81-20-00, Turbocharger Pre-Lubrication, for information on prelubricating the turbochargers after the engine oil change.

B. Draining Oil Sump

The engine should be warmed to operating temperature to ensure complete draining of the used oil.

An oil quick drain valve is located on the lower left side of the oil sump. To drain the oil, install a suitable length of inch I.D. hose on the outlet port. Remove the safety wire from the locking device, push "IN" and lock to begin draining. After all oil has drained from the sump, pull "OUT" and lock the outlet port closed. Safety wire the drain outlet port closed ("OUT" position). Remove the drain hose and service with the correct grade and amount of oil. Check for oil leakage and correct oil level after ground run-up.

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C. Oil Filter - Full Flow

- (1) Change the oil filter after the first 25 hours of engine operation for new, overhauled or re-manufactured engines and there after every 50 hours of engine operation; this is accomplished by removing the lockwire from the bolt head at the end of the filter, loosening the bolt, and removing the filter assembly from the adapter.
- (2) 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 particles of metallic shavings might be found, these are generally of no consequence and should not be confused with particles produced by impacting, abrasion or pressure. Evidence of internal engine damage found in the oil filter justifies further examination to determine the cause.
- (3) Install new oil filter as follows:
 - (a) Before installing the new filter, lubricate the gasket on the filter with engine oil, then install it. Tighten slightly more than hand tight or to 1 full turn after gasket makes contact. Do not over torque.
 - (b) Run the engine and check for oil leaks; then install lockwire between nut on filter and oil filter adapter assembly.

D. Filling Oil Sump

The oil sump should normally be filled with oil to the 12 quart mark on the engine dipstick. The quantity of oil required for the engine may be found in 6-00-00. The specified grade of oil may be found on the oil filter access door or in the latest revision of Textron Lycoming Service Instruction 1014. To service the engine with oil, open the access door and remove the oil filler cap.

9. Electrical System

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

Battery

Access to the 24-volt battery is gained by opening the forward baggage door and removing the left floor of the forward baggage compartment. The battery should be checked for proper fluid level. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use water only. A hydrometer check will determine the percent of charge in the battery.

Inspect overflow sump for presence of battery fluid. Fluid in the sump is not a normal condition and indicates either a battery or charging system problem. If fluid is present, the electrical system must be serviced to eliminate the cause and the neutralizer media in the sump jar replaced.

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

10. Power Plant

Regularly check the engine compartment for oil and fuel leaks, chafing of lines, loose wires and tightness of all parts. Maintenance instructions for the power plant may be found in Chapter 71 of this manual and in the appropriate manufacturer's manuals.

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11. Propeller

The spinner, back plate and propeller surfaces should be cleaned and inspected frequently for nicks, scratches, corrosion and cracks. Minor nicks and scratches may be removed per instructions in 61-10-00 or the appropriate Hartzell Blade Manual (for composite blades see latest revision Hartzell Composite Blade Manual No. 135). The face of each blade should be painted when necessary with a flat paint to retard glare. To prevent corrosion, wipe surfaces with a light oil or wax.

In addition, propellers should be inspected for grease or oil leakage and freedom of rotation on the hub pilot tube. To check freedom of rotation, rock the blade back and forth through the slight freedom allowed by the pitch change mechanism. Lubricate the propeller at 100-hour intervals per the appropriate Hartzell Owner's Manual.

Additional service information for the propeller may be found in 61-10-00.

12. Induction Air Filter

A. Removal

The induction air filter is located in the forward portion of the lower engine cowls.

Remove the filter as follows:

- (1) Remove the induction air panel from the nose cowl and from the lower engine cowls.
- (2) Remove the filter assembly from the induction box assembly.
- (3) Clean or replace the filter.

B. Installation

After cleaning and inspection, install the filter element and cover in reverse order of removal instructions.

C. Cleaning and Inspection

- (1) The filter should be cleaned daily when operating in dusty conditions, and if any holes or tears are noticed, the filter should be replaced immediately. For replacement filter, refer to Parts Catalog.
- (2) Remove the filter element and blow out with compressed air from gasket side or wash in warm water and mild detergent and allow to dry.
- (3) The filter housing can be cleaned by wiping with a clean cloth soaked in suitable quick drying type solvent. When the housing is dry, reinstall in accordance with Installation of Air Filter.

13. Alternate Air Door

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

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

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**CHART 1
THREAD LUBRICANTS**

TYPE OF LINE	TYPE OF LUBRICANT
Brake	MIL-H-5606, Tite Seal 3-Y3
Deicer (Air)	TT-A-580 (JAN-A-669), Anti-Seize Compound (White Lead Base)
Freon	TT-A-580 or MIL-T-5544, Anti-Seize Compound
Fuel	MIL-T-5544, Anti-Seize, Graphite Petrolatum
Oil	MIL-G-6032, Lubricating Grease (Gasoline and Oil Resistant)
Oxygen	MIL-T-5542, Thread Compound, Anti-Seize and Sealing, Ribbon Dope Thread Sealant, Permacel 412
Pitot and Static	TT-A-580 (JAN-A-669), Anti-Seize Compound (White Lead Base)
NOTE: Lubricate engine fittings only with fluid contained in particular lines.	

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SCHEDULED SERVICING

1. Airframe Lubrication

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

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

- A. Use only recommended lubricants. Where general purpose lubricating oil is specified, but unavailable, clean reciprocating engine oil is a satisfactory substitute.
- B. Check components for evidence of excessive wear and replace as necessary.
- C. Removal all excess lubricants from components to prevent collecting dirt and sand in quantities capable of causing excessive wear or damage to bearing surfaces.

2. Application of Grease

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

- A. If a reservoir is not provided around a bearing, apply lubricant sparingly and wipe off excess.
- B. Remove wheel bearings from wheel hub and clean thoroughly with suitable solvent. When repacking with grease, ensure lubricant enters space between rollers in retainer ring. Do not pack grease into wheel hub.
- C. Use extra care when greasing Hartzell propeller hub to avoid blowing clamp gaskets. Remove one grease fitting while applying grease to other fitting. Uneven greasing effects propeller balance.

3. Application of Oil

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

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

- A. Apply oil sparingly. Never apply more than enough to coat bearing surfaces.
- B. Do not oil control cables.

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4. Lubrication Charts

The lubrication charts consist of individual illustrations for the various aircraft systems. Each component to be lubricated is indicated by a number, the type of lubricant and the frequency of application. Special instructions are listed at the beginning of the lubrication charts and with the applicable component illustration.

The following lubricants, MIL-G-23827 and MIL-G-81322, contain chemicals which may be harmful to painted surfaces.

**CHART 1
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 EXCESSIVELY CONTAMINATED, DAMAGED, OR PUNCTURED.

 2. LUBRICATION POINTS - WIPE CLEAN OR GREASE, OIL, DIRT, ETC., BEFORE LUBRICATING.

 3. BEARING AND BUSHINGS - CLEAN EXTERIOR WITH A DRYING TYPE SOLVENT PRIOR TO LUBRICATING.

 4. WHEEL BEARINGS - CLEAN OLD GREASE FROM WHEEL HOUSING, OUTER RACE AND BEARING ASSEMBLY USING DRYING TYPE SOLVENT. PACK GREASE BETWEEN ROLLERS AND CONE. GREASE OUTER ROLLER PERIMETER. DO NOT PACK GREASE IN WHEEL HOUSING.

 5. OLEO STRUTS, HYDRAULIC PUMP RESERVOIR, AND BRAKE SYSTEM RESERVOIR - FILL PER INSTRUCTIONS ON UNIT OR IN MAINTENANCE MANUAL.

 6. PROPELLER - REMOVE ONE OF THE TWO GREASE FITTINGS FOR EACH BLADE. APPLY GREASE THRU FITTING UNTIL FRESH GREASE APPEARS AT HOLE OF REMOVED FITTING. SEE LATEST REVISION OF HARTZELL MANUAL NO. 202.

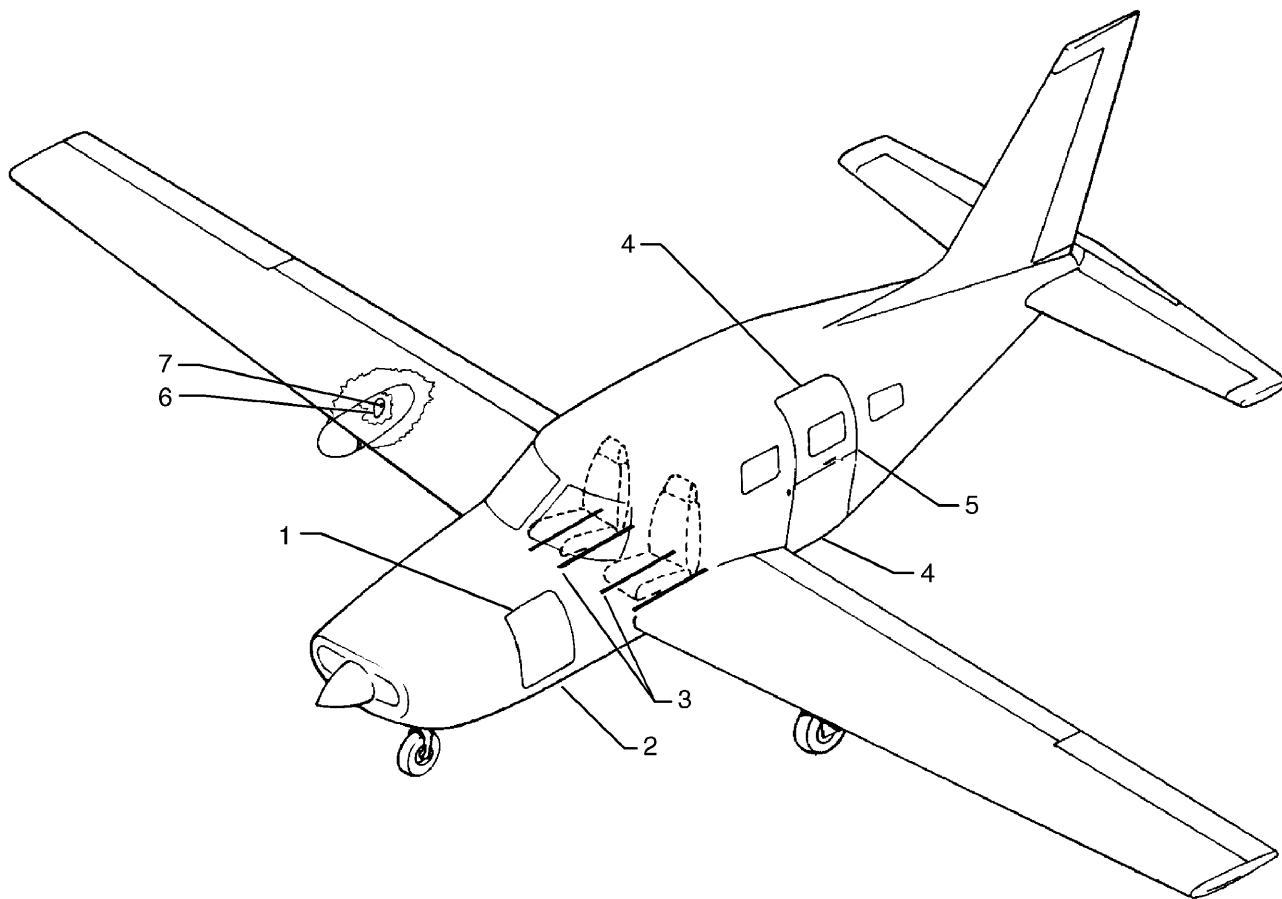
 7. BUNGEE - LUBRICATE SPRINGS IF BUNGEE IS DISASSEMBLED.
-

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**CHART 2
LUBRICATION CHART (Cabin Door, Baggage Door, and Seats)**

COMPONENT	LUBRICANT	FREQUENCY
1. BAGGAGE DOOR HINGE (Special Instruction #2)	MIL-PRF-7870C	100 HRS
2. BAGGAGE DOOR LATCH MECHANISM (Special Instruction #2)	DRY LUBRICANT	100 HRS
3. PILOT AND COPILOT SEAT ADJUSTMENTS	MIL-PRF-7870C	100 HRS
4. CABIN DOOR HINGES (Special Instruction #2)	MIL-PRF-7870C	100 HRS
5. CABIN DOOR LATCH MECHANISM (Special Instruction #2)	DRY LUBRICANT	100 HRS
6. ACCESS DOOR - HINGE * (Special Instruction #2)	MIL-PRF-7870C	100 HRS
7. ACCESS DOOR - LATCH * (Special Instruction #2)	DRY LUBRICANT	100 HRS

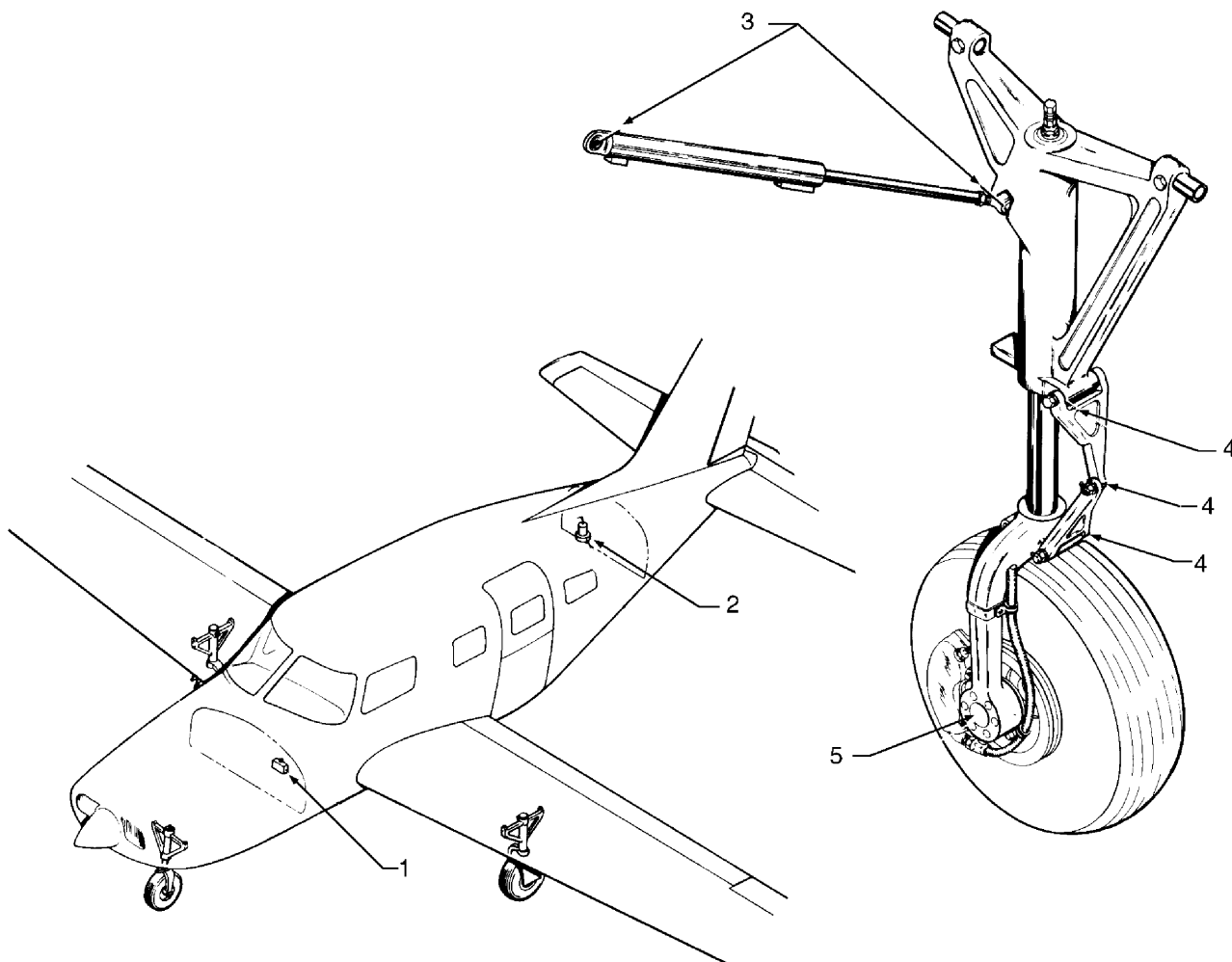
* If installed.



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**CHART 3
LUBRICATION CHART (Main Landing Gear and Hydraulic System)**

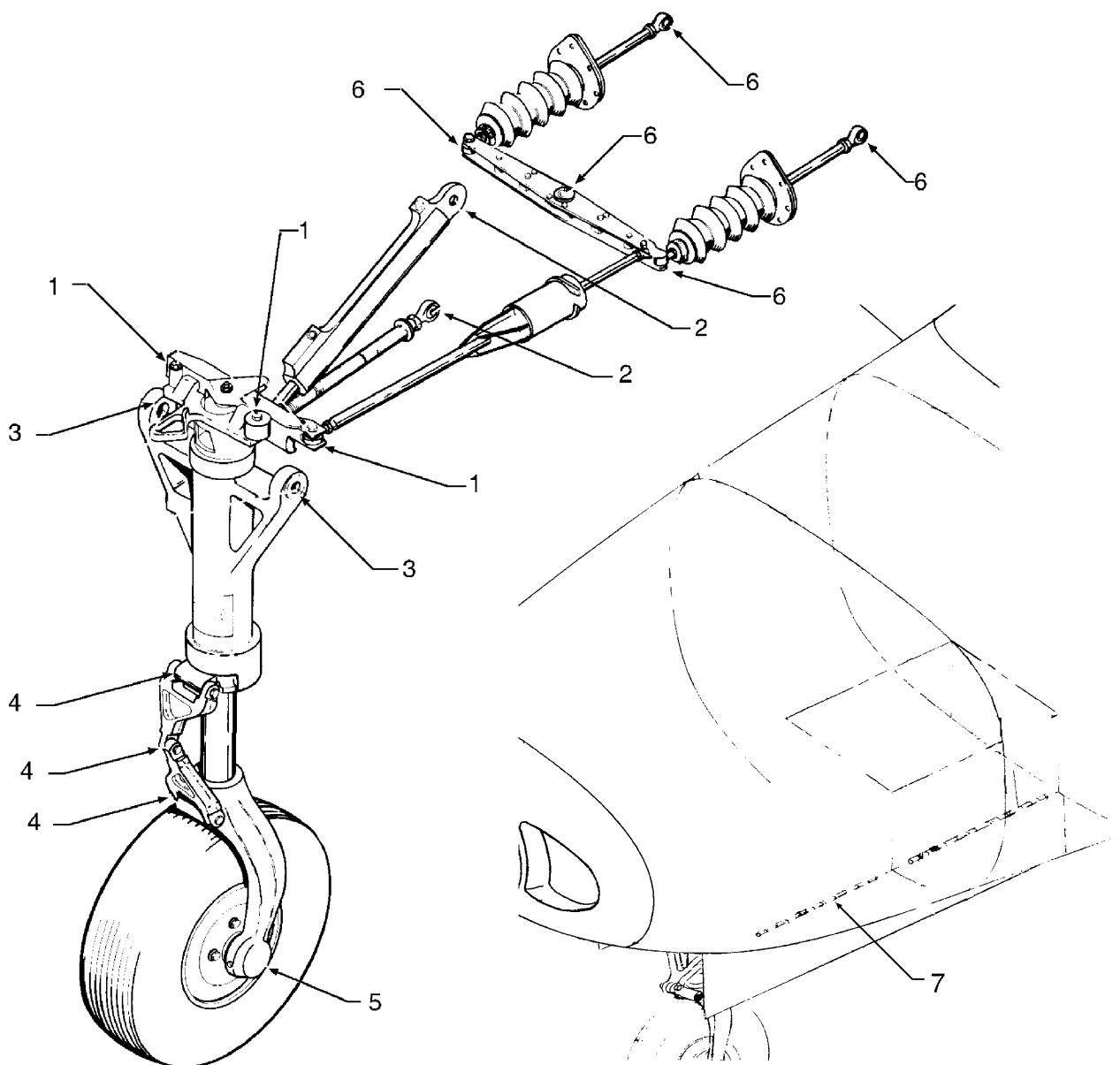
COMPONENT	LUBRICANT	FREQUENCY
1. BRAKE RESERVOIR (Special Instruction #5)	MIL-H-5606	50 HRS
2. HYDRAULIC PUMP/RESERVOIR (Special Instruction #5)	MIL-H-5606	50 HRS
3. RETRACTION CYLINDER ROD END BEARINGS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
4. MAIN GEAR TORQUE LINKS (Special Instruction #2)	MIL-PRF-7870C	100 HRS
5. MAIN GEAR WHEEL BEARINGS (Special Instruction #4)	MIL-G-81322	100 HRS



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**CHART 4
LUBRICATION CHART (Nose Gear)**

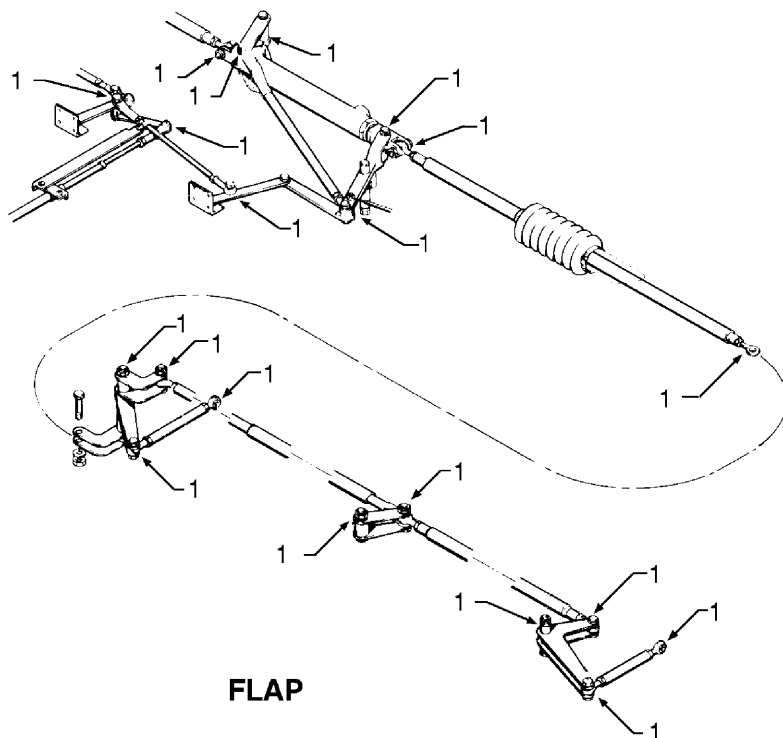
COMPONENT	LUBRICANT	FREQUENCY
1. STEERING BELLCRANK PIVOT POINTS AND ROD ENDS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
2. RETRACTION CYLINDER AND ASSIST SPRING ROD END BEARINGS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
3. NOSE GEAR PIVOT POINT (Special Instruction #2)	MIL-G-7711	100 HRS
4. TORQUE LINK ASSEMBLY (Special Instruction #2)	MIL-PRF-7870C	100 HRS
5. NOSE WHEEL BEARINGS (Special Instruction #4)	MIL-G-81322	100 HRS
6. STEERING BELLCRANK AND ROD ENDS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
7. NOSE GEAR DOOR HINGE (Special Instruction #2)	MIL-PRF-7870C	100 HRS



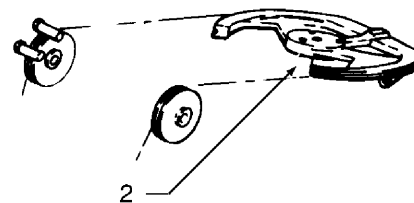
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**CHART 5
LUBRICATION CHART (Control System - Sheet 1 of 3)**

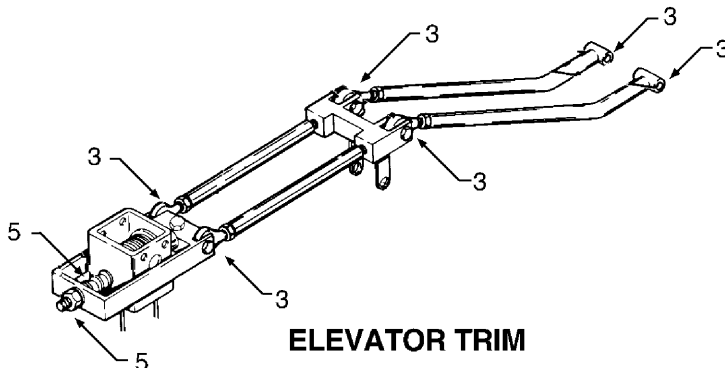
COMPONENT	LUBRICANT	FREQUENCY
FLAP TRACKS AND ROLLERS (Special Instruction #2)	MIL-G-23827	100 HRS
1. FLAP CONTROL ROD END BEARINGS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
2. RUDDER CONTROL SECTOR (Special Instruction #3)	MIL-PRF-7870C	100 HRS
3. ELEVATOR TRIM ROD END BEARINGS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
4. ELEVATOR SECTOR AND CONTROL ROD END BEARINGS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
5. ELEVATOR TRIM SCREW (Special Instruction #2)	MIL-G-23827	100 HRS



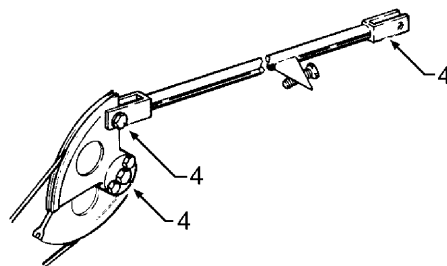
FLAP



RUDDER SECTOR



ELEVATOR TRIM



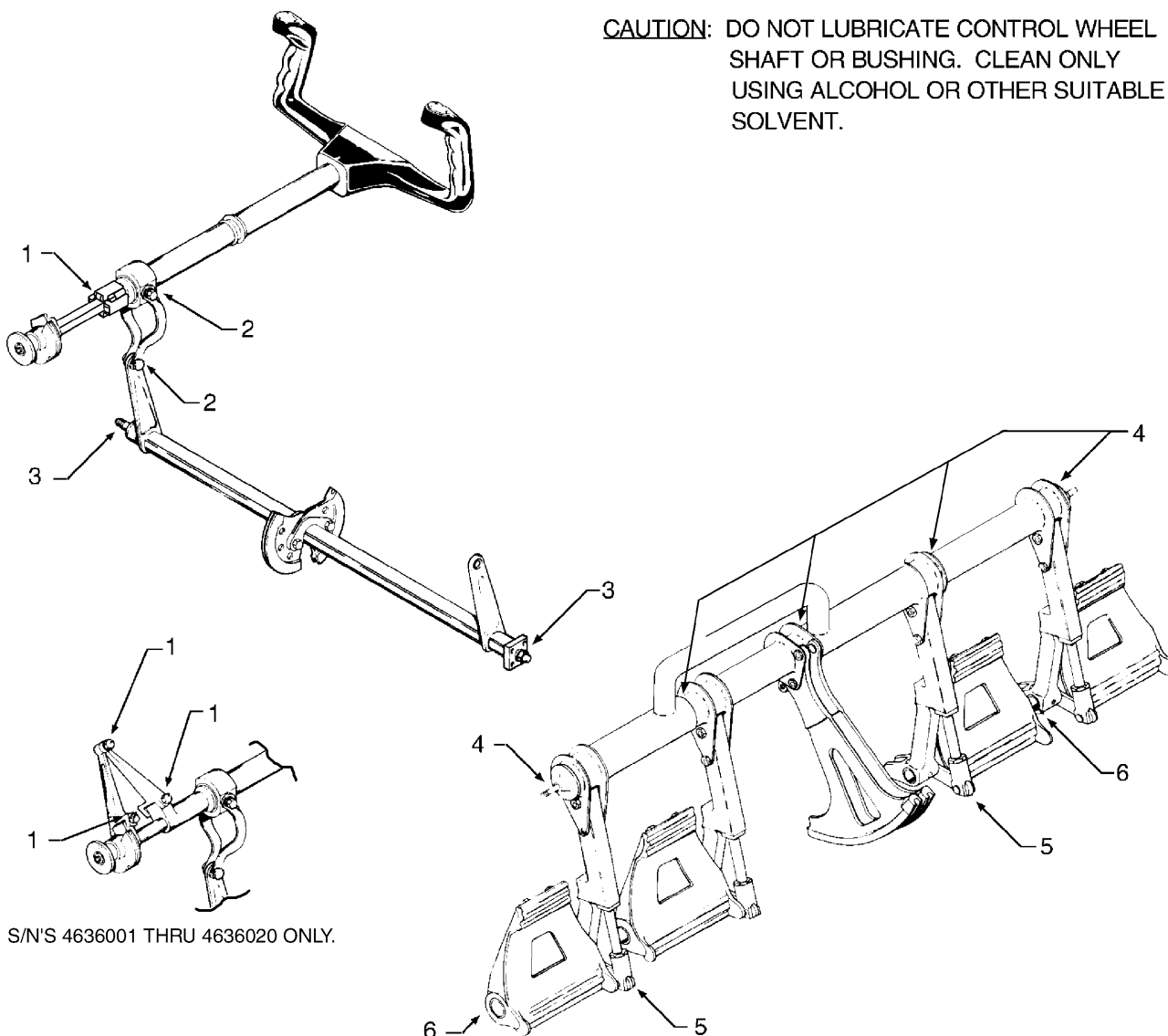
ELEVATOR

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**CHART 5
LUBRICATION CHART (Control System - Sheet 2 of 3)**

COMPONENT	LUBRICANT	FREQUENCY
1. AILERON TORQUE ROLLER ASSEMBLY (Special Instruction #3)	MIL-PRF-7870C	100 HRS
1. AILERON TORQUE ARM ASSEMBLY (Special Instruction #3)	MIL-PRF-7870C	100 HRS
2. CONTROL COLUMN ATTACHMENT ARM (Special Instruction #3)	MIL-PRF-7870C	100 HRS
3. ELEVATOR TORQUE TUBE ASSEMBLY (Special Instruction #3)	MIL-PRF-7870C	100 HRS
4. RUDDER TORQUE TUBE ASSEMBLY (Special Instruction #2)	MIL-PRF-7870C	100 HRS
5. BRAKE ROD ENDS (Special Instruction #2)	MIL-PRF-7870C	100 HRS
6. BUSHING, RUDDER PEDAL MOUNT (Special Instruction #3)	MIL-PRF-7870C	100 HRS
* AILERON, ELEVATOR, RUDDER AND TRIM CABLES (Special Instruction #2) (Grease cables where they pass through a fair lead or over a pulley.) (Not shown.)	MIL-G-23827	100 HRS

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

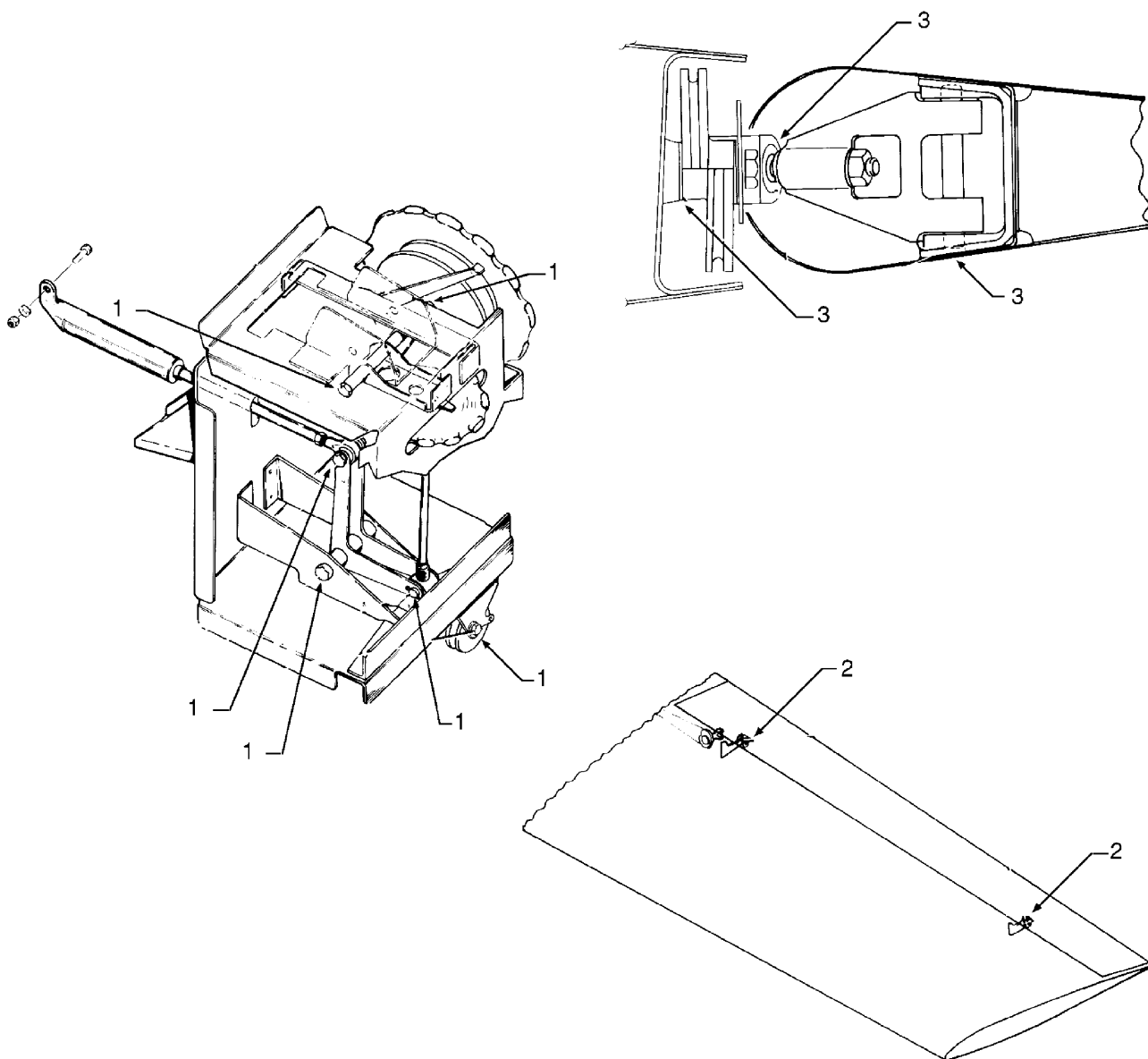


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**CHART 5
LUBRICATION CHART (Control System - Sheet 3 of 3)**

COMPONENT	LUBRICANT	FREQUENCY
1. PULLEYS AND TRIM WHEELS (Special Instruction #3)	MIL-PRF-7870C	100 HRS
2. AILERON HINGES (Special Instruction #3)	MIL-PRF-7870C	100 HRS
3. AILERON SECTOR (Special Instruction #2)	DRY LUBRICANT	100 HRS
* AILERON, ELEVATOR, RUDDER AND TRIM CABLES (Special Instruction #2) (Grease cables where they pass through a fair lead or over a pulley.) (Not shown.)	MIL-G-23827	100 HRS

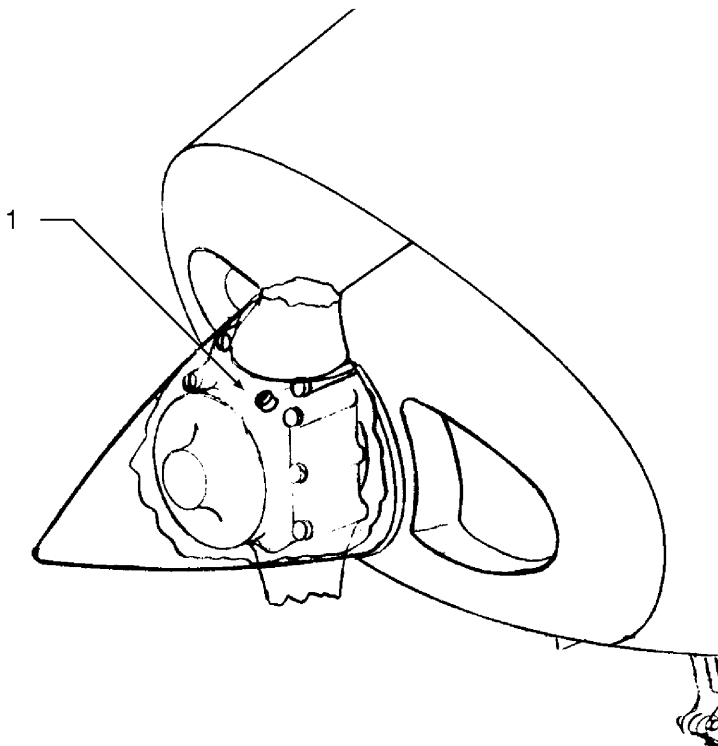


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CHART 6
LUBRICATION CHART (Propeller)

COMPONENT	LUBRICANT	FREQUENCY
1. COMPOSITE BLADE PROPELLERS (Special Instruction #6)	AEROSHELL 6 GREASE	100 HRS / 12 MONTHS (whichever comes first)
1. ALUMINUM BLADE PROPELLERS (Special Instruction #6)	AERO SHELL 6 GREASE	100 HRS / 12 MONTHS (whichever comes first)

NOTE: If annual operation is significantly less than 100 hours, calendar lubrication intervals should be reduced to six months.



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CHAPTER

20

STANDARD PRACTICES - AIRFRAME

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CHAPTER 20

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CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

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GENERAL

1. Description

This chapter contains general information pertaining to standard aircraft hardware installation and removal practices, as well as general information on corrosion control and painting issues.

For standard repair practices of a minor nature, see 51-70-00 and AC 43.13-1 (latest revision).

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

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

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

2. Torque Wrenches

Torque wrenches should be checked daily and calibrated by means of weights and a measured lever arm to ensure that inaccuracies are not present. Checking one torque wrench against another is not sufficient and is not recommended. Some wrenches are quite sensitive 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 1.)

T = Torque desired at the part.

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

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

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

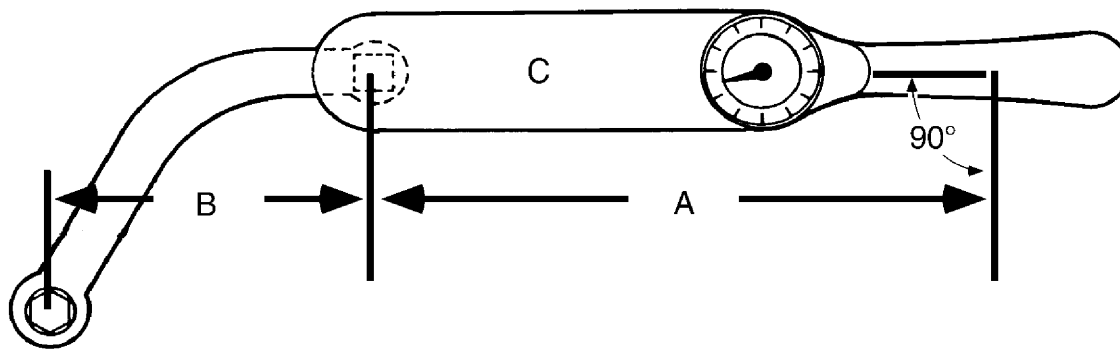
The formula:
$$C = \frac{A \times T}{A + B}$$

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

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

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

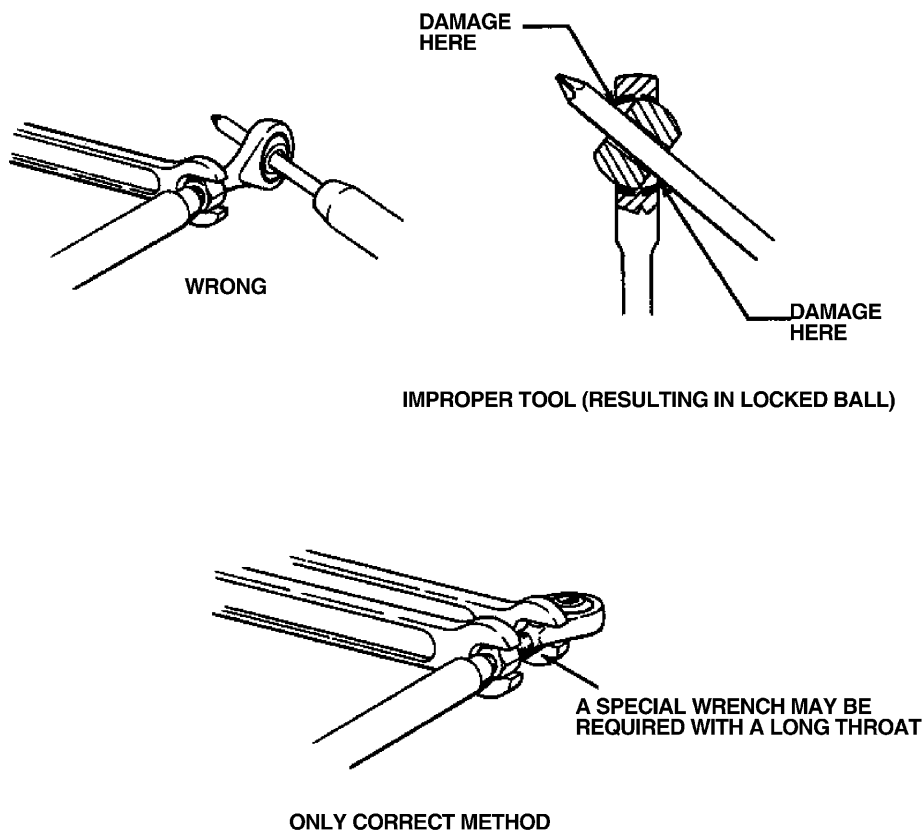
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Torque Wrench Formula
Figure 1

3. Installing Rod End Bearings

Install rod end bearings as shown in Figure 2.



Installing Rod End Bearings
Figure 2

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4. Removing Cherrylock Rivets

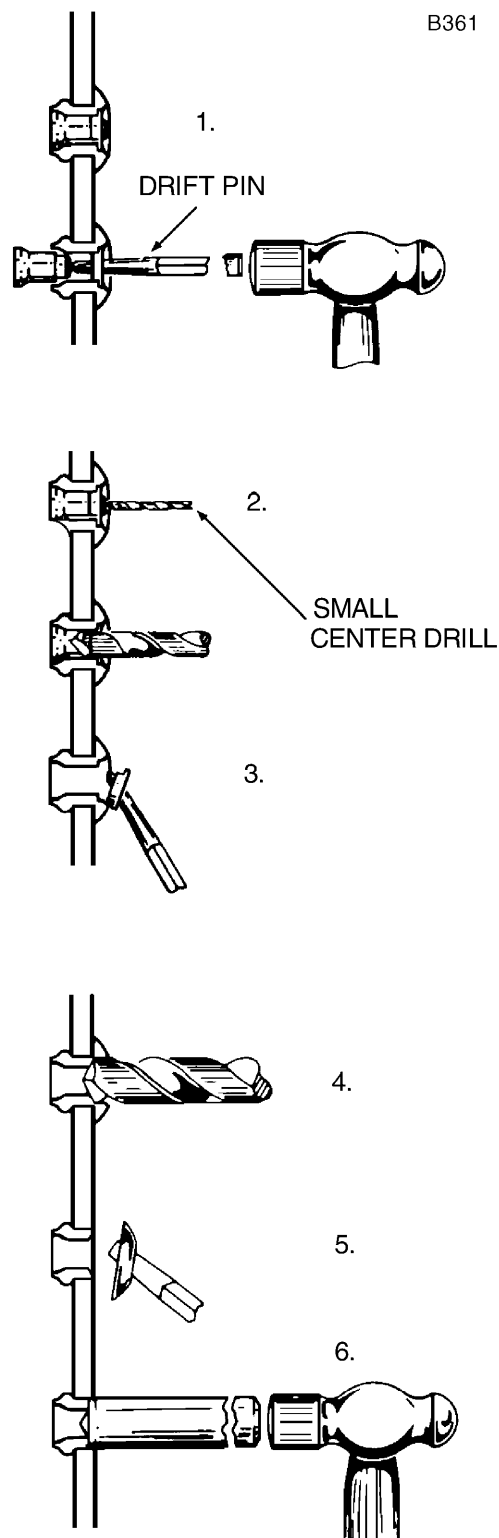
Use following procedure to remove cherrylock rivets:

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

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

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

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



Removing Cherrylock Rivets
Figure 3

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5. Identification of Fluid Lines (Refer to Figure 4.)

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

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

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

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

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

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

6. Inspection of Flexible Hoses

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

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

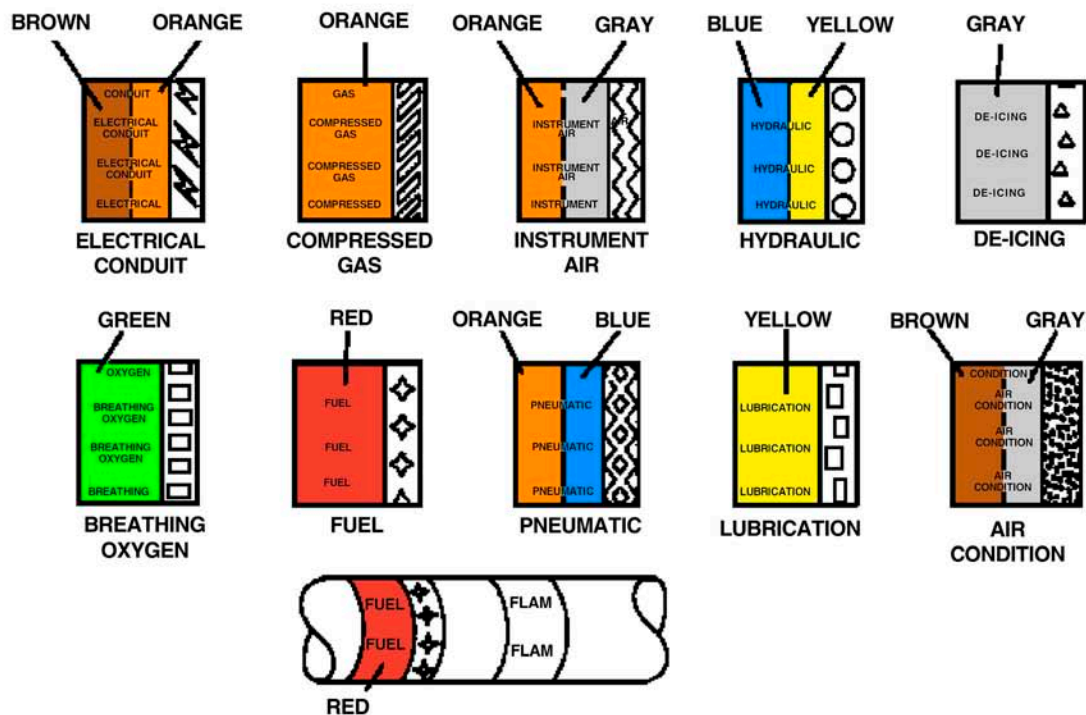
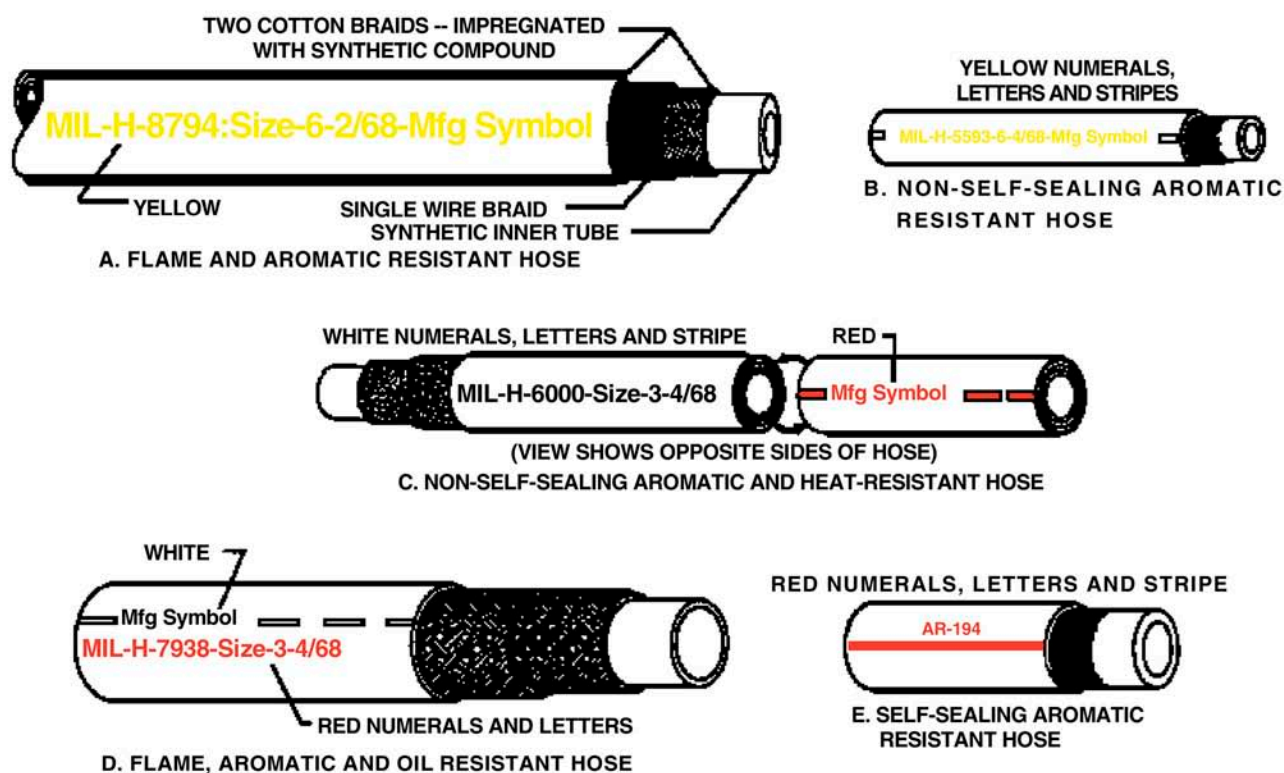
- A. Check each installation to be sure the hose is not kinked, twisted, or distorted. Check for evidence of abrasion, cuts, and broken wires. Random broken wires are acceptable since wire breaks sometimes occur during manufacture. Discard hose if two or more broken wires are found per plait (braid)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

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

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

**CHART 1
BALL DIAMETERS FOR TESTING HOSE RESTRICTIONS**

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



Hose, Tube, and Line Markings

Figure 4

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7. Flared Tube Assemblies (Refer to Figure 5.)

When any fitting containing conical seals is disconnected the following steps must be performed when connecting the fitting.

- A. Lubricate threads of nut with a substance compatible with the fluid that is to be contained in the line

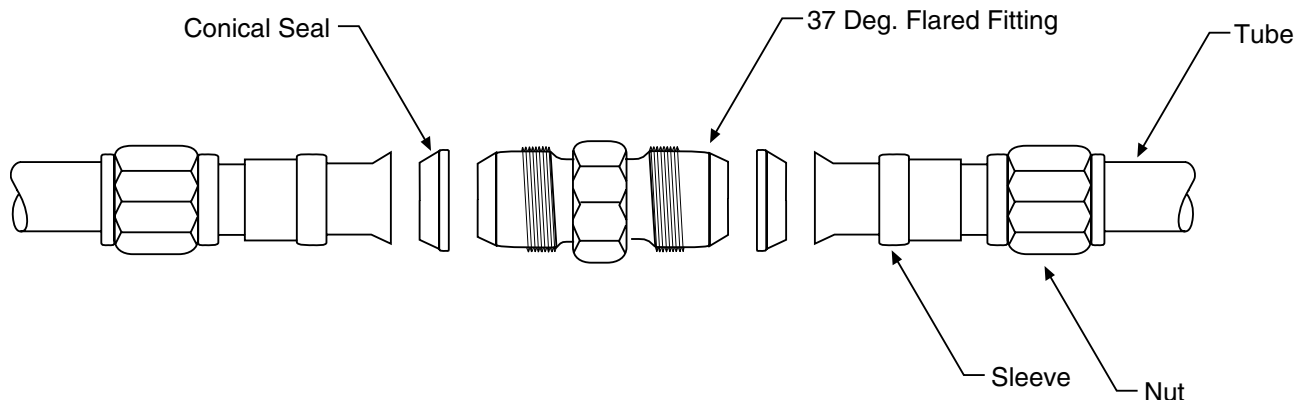
NOTE: Conical seals are never to be reused. If a connection is broken the seals must be replaced.

- B. Install new conical seals

CAUTION: ANGULAR MISALIGNMENT BETWEEN TUBE AND FITTING WILL OVER-STRAIN SLEEVE AND NUT DURING TORQUE -UP. APPLY TORQUE ONLY AFTER TUBE CENTER LINE IS SQUARELY MATED TO THE FITTING CENTER LINE.

NOTE: Apply torque on back portion of nut next to shoulder to minimize distortion of thread.

- C. Tighten fitting one (1) to one and one half (1 1/2) hex flats from position of sharp torque rise (finger tight).



Conical Seals
Figure 5

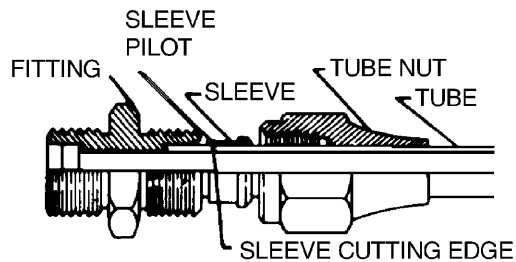
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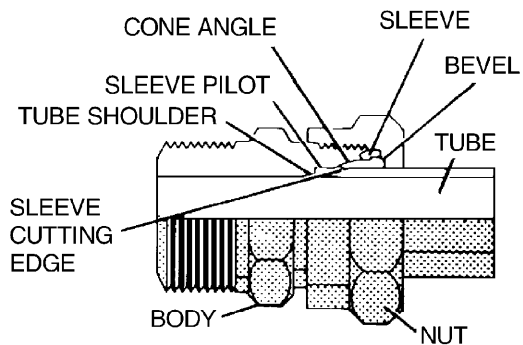
TUBING AND HOSE LUBRICANTS

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

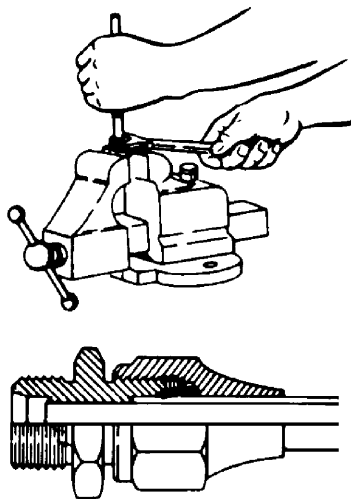
* SEE 35-10-00.



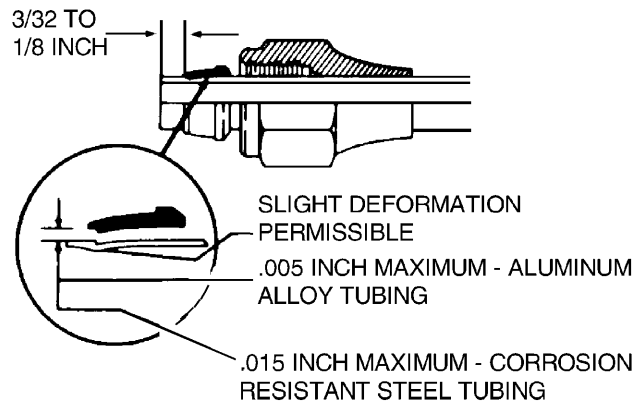
STEP 1



FLARELESS-TUBE FITTING



STEP 2



STEP 3

Flareless Tube Fittings
Figure 6

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8. Flareless Tube Assemblies

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

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

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9. Support Clamps

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

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

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

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

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

10. Dye Penetrant Inspections

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

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

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CHART 2
MAXIMUM DISTANCE BETWEEN SUPPORTS FOR FLUID TUBING

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

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PAINTING

1. Painting Safety

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

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

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

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

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

2. Polyurethane Paint Safety

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

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

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

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

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

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

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3. Paint Application

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

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

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

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

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

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

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

4. Painting Sequence

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

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

5. Color Matching

See aircraft logbooks for color codes.

6. Trim and Registration Numbers

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

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

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

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7. Paint System Compatibility

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

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

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

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

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

8. Common Paint Troubles

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

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

9. Storage

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

10. Painting Facility

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

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

11. Aircraft Finish Care

See Aircraft Finish Care, 12-00-00.

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AIRPLANE MAINTENANCE MANUAL

CARD 2 OF 8

PA-46-350P



(S/N's 4636001 AND UP)

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Technical Publications

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2926 Piper Drive
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Manufacturers Association

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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	June 19, 1996	All
PR980101	January 1, 1998	1, 2, 3, 4, 5, and 6
CR981223	December 23, 1998	1, 2, 3, 4, 5, and 6
PR000201	February 1, 2000	1, 2, 3, 4, 5, and 6
PR010515	May 15, 2001	1
CR050730	July 30, 2005	1, 2, 3, 4, 5, 6, 7 and 8
PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

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3. Effectivity

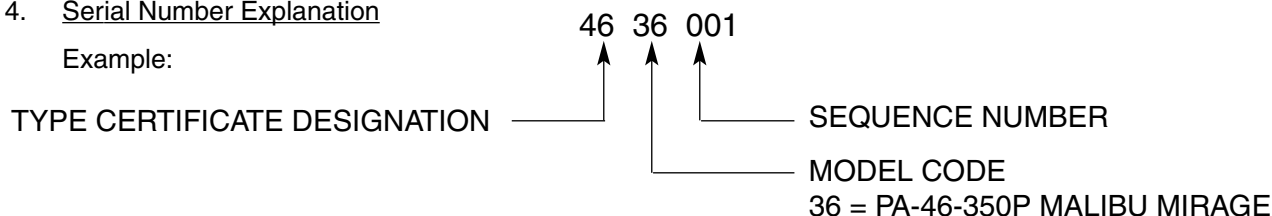
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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(23) PROPELLER AND 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

Propeller
Overhaul Instructions: Manual No. 113

Composite Blade
Maintenance: Manual No. 135

Propeller Owner's
Manual: Manual No. 115

Aluminum Blade
Inspection, Repair,
and Overhaul Instructions: Manual No. 133

(24) RADAR (WEATHER), RDR - 2000:

Vendor Address:	Honeywell (Bendix/King) (See Autoflight, above)

Maintenance Manual:	Bendix/King ART 2000 P/N 006-05332-0001

(25) RADIO COOLING BLOWER:

Vendor Address:	Globe Motors 2275 Stanley Ave. Dayton, Ohio 45404 http://www.globe-motors.com/home.html	PH: (937) 228-3171 FAX: (937) 229-8531

(26) STARTER:

Vendor Address:	Electro Systems, Inc. (See Alternator, above)

(27) TURBOCHARGER:

Vendor Address:	Turbocharging Systems Worldwide HQ Building #10, Ste. 200 23326 Hawthorne Blvd. Torrance, CA 90505 http://www.alliedsignal.com/turbos/products/index.html	PH: (310) 791-9101 FAX: (310) 534-5941

(28) VACUUM PUMP:

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

(29) VACUUM REGULATORS:

Vendor Address:	Parker Hannifin Corp. (see "Fuel Boost Pump," above)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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GENERAL

The environmental system consists of an engine bleed air and conditioning system, cabin air distribution system, pressurization and control system, ventilating air system and air conditioning system (if installed).

The engine bleed air system provides the air supply for pressurizing the cabin. Temperature of the bleed air is controlled using an air to air heat exchanger which utilizes ambient air to cool the bleed air, hot air from an exhaust shroud to heat the bleed air, or a mixture of ambient and hot air to obtain the bleed air temperature necessary to maintain the desired cabin comfort level.

The cabin pressurization and control system consist of an outflow valve (isobaric), safety valve, cabin altitude and rate selector, electrically operated vacuum solenoid valve, surge tank and associated inter-connecting plumbing and wiring. Cabin altitude, differential pressure, and rate of change are displayed on a single 3-inch diameter indicator. Pilot warning (displayed on the annunciator panel) is provided to indicate a cabin altitude above 10,000 feet.

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DISTRIBUTION

The cabin air distribution system consists of left and right side panel ducting, windshield defrost, foot warmer (if installed) and ventilation blowers. The side panel ducts provide for overall air distribution throughout the length of the cabin as well as individual controllable air outlets at each seat (eyeball outlets). The defrost control will allow part of the bleed air to be diverted to the windshield defrost outlet. Separate and individual controls for the two foot warmer outlets (if installed) are also provided. The outlets are located between the rudder pedals on each side of the cockpit. The ventilation blowers supply airflow to the portion of the sidewall ducts containing the individual seat outlets (eyeballs).

Cabin ventilating air, for ground and unpressurized flight operation, is supplied from the ambient air source to the bleed air heat exchanger through a ram air selector valve and check valve. This will supplement air flow primarily in ground operation. This air source is capable of being heated by mixing with hot air from the exhaust shroud.

1. Ground Blower

A vane-axial ground blower is installed in the left duct below the forward baggage compartment floor. This blower supplements air flow during ground operation. Flapper-type check valves are located at the forward pressure bulkhead.

A. Removal

- (1) Loosen the two clamps that secure the flexible adapter ducts to the blower.
- (2) Loosen the two clamps that secure the flexible adapter ducts to the inlet and outlet ducts.
- (3) Slide the aft flexible adapter duct rearward over the outlet duct.
- (4) Disconnect the electrical leads from the blower.
- (5) Slide the blower aft and down to remove it.

B. Installation

- (1) Position blower in place, ensuring that the airflow arrow is pointing aft.
- (2) Slide the aft flexible adapter duct forward onto blower and secure it with the clamp.
- (3) Secure the forward flexible adapter duct to the blower with the clamp.
- (4) Tighten clamps that secure the flexible adapter ducts to the inlet outlet ducts.
- (5) Connect leads from the blower.

2. Cabin Recirculation Blowers

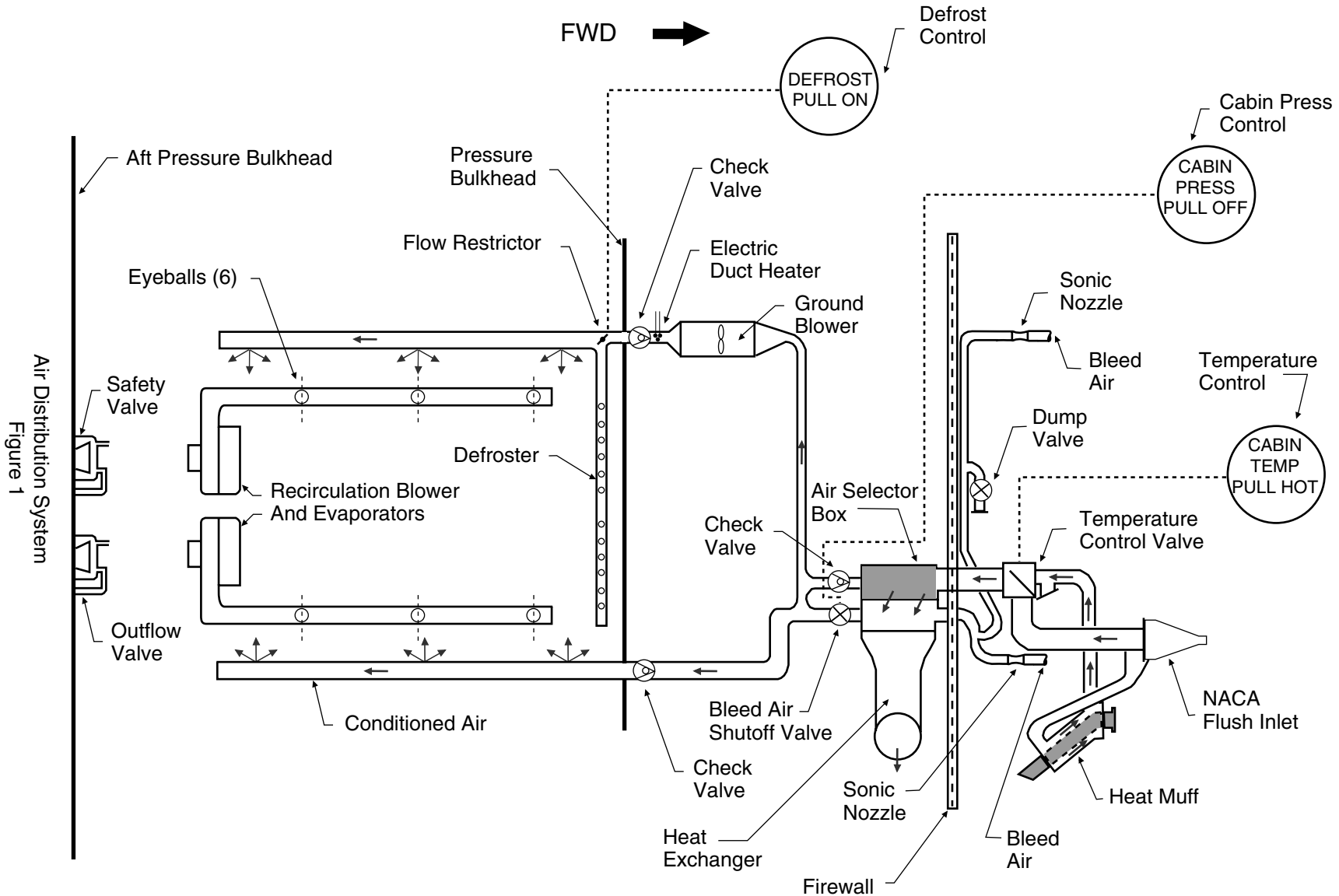
The left and right cabin recirculation blowers are beneath the rear baggage compartment floor between F.S. 233.87 and F.S. 241.50.

A. Removal

- (1) Remove the rear seats, the rear baggage compartment carpet, and the two large access panels in the rear baggage compartment floor.
- (2) Disconnect the duct from the outboard side of the blower.
- (3) Disconnect the electrical lead going to the blower motor.
- (4) Remove the bolts, nuts and washers that attach the blower to the evaporator shell.
- (5) Remove the blower from its cavity.

B. Installation

- (1) Position the blower in place on the evaporator shell and secure it with the bolts, nuts and washers.
- (2) Connect the electrical leads going to the blower motor. (See Chapter 91 for electrical schematic.)



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- (3) Connect the duct to the outboard side of the blower.
 - (4) Reinstall access panels, carpeting, and rear seats.
3. Bleed Air Check Valve (See Figure 1.)
 - A. Removal
 - (1) On left hand side, remove the six bolts attaching cabin air supply tube and auxiliary electric heater to forward pressure bulkhead.
 - (2) Break seal and remove check valve.
 - (3) On right hand side, loosen band clamps on flexible hoses connecting bleed air tubes.
 - (4) Remove the six bolts connecting cabin air supply tube and bleed air supply tube to forward pressure bulkhead.
 - (5) Break seal and remove check valve.
 - B. Installation
 - (1) Apply GE RTV 1508 sealant to mating surface of check valves.
 - (2) On left hand side, position valve and gaskets (with flapper on aft side) between auxiliary heater and forward pressure bulkhead.
 - (3) Secure valve, auxiliary heater, and cabin air supply tube to forward pressure bulkhead with six bolts.
 - (4) On right hand side, position valve and gaskets (with flapper on aft side) between bleed air supply tube and forward pressure bulkhead.
 - (5) Secure valve, bleed air supply tube, and cabin air supply tube to pressure bulkhead with six bolts.
4. Avionics Cooling Blower (See Figure 2.)

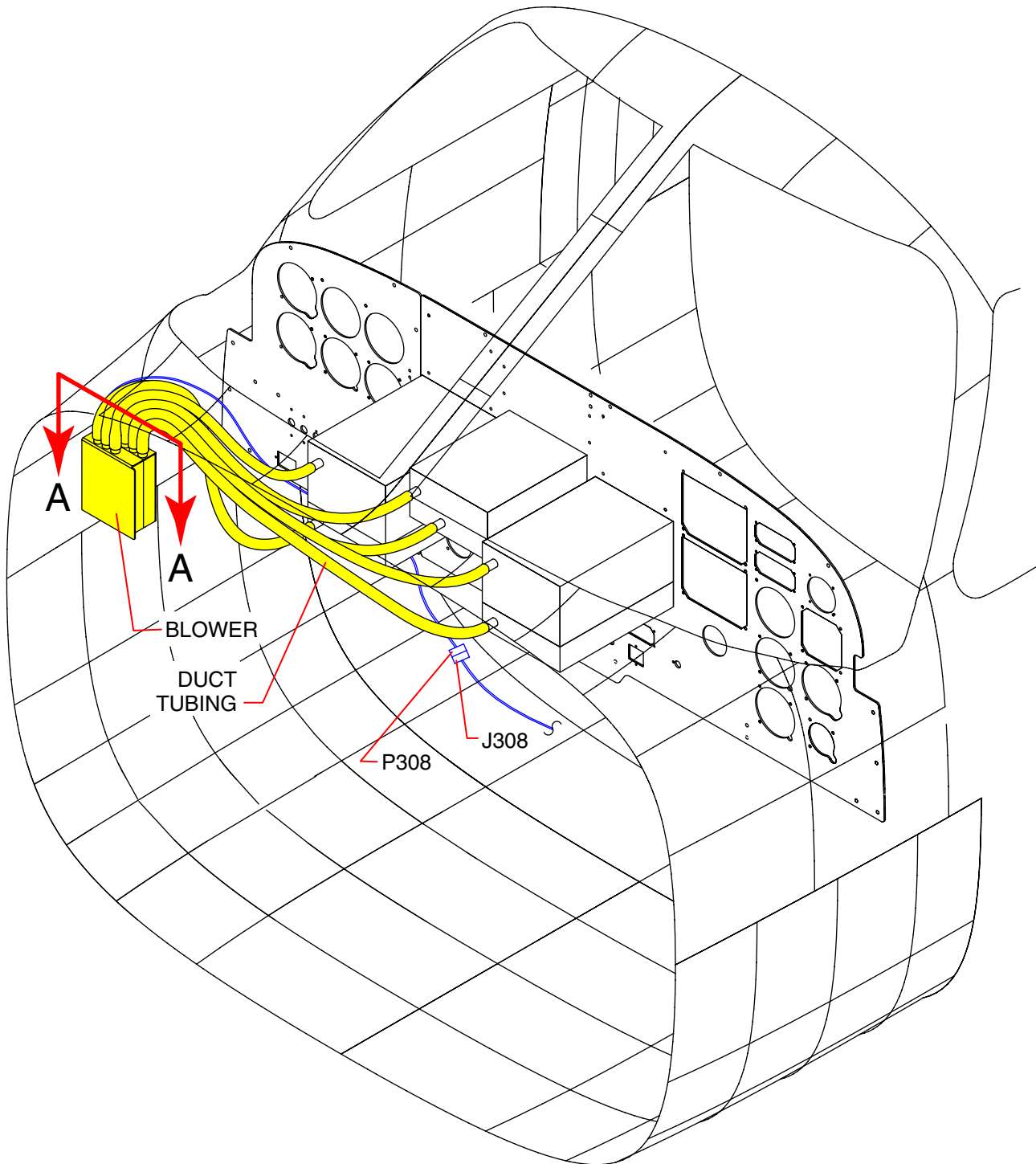
The avionics cooling blower is installed on the right side of the fuselage, behind the instrument panel, at FS 108.00. The cooling air is directed through ducts to installed avionics equipment.

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

 - A. Removal
 - (1) Remove ducts from top of blower. (Ducts are held in place by Ty-Raps.)
 - (2) Disconnect blower motor wires at connector.
 - (3) Remove screws, washers and nuts that attach the blower assembly to its mounting bracket.
 - B. Installation
 - (1) Attach the blower assembly to the mounting bracket with the screws, washers and nuts.
 - (2) Reconnect the blower motor wires.
 - (3) Attach the ducts to the tops of the blower assembly. Ensure that the duct ends overlap the ports on top of the blower one-half inch minimum. Secure with Ty-Raps.
5. Muffin Fan

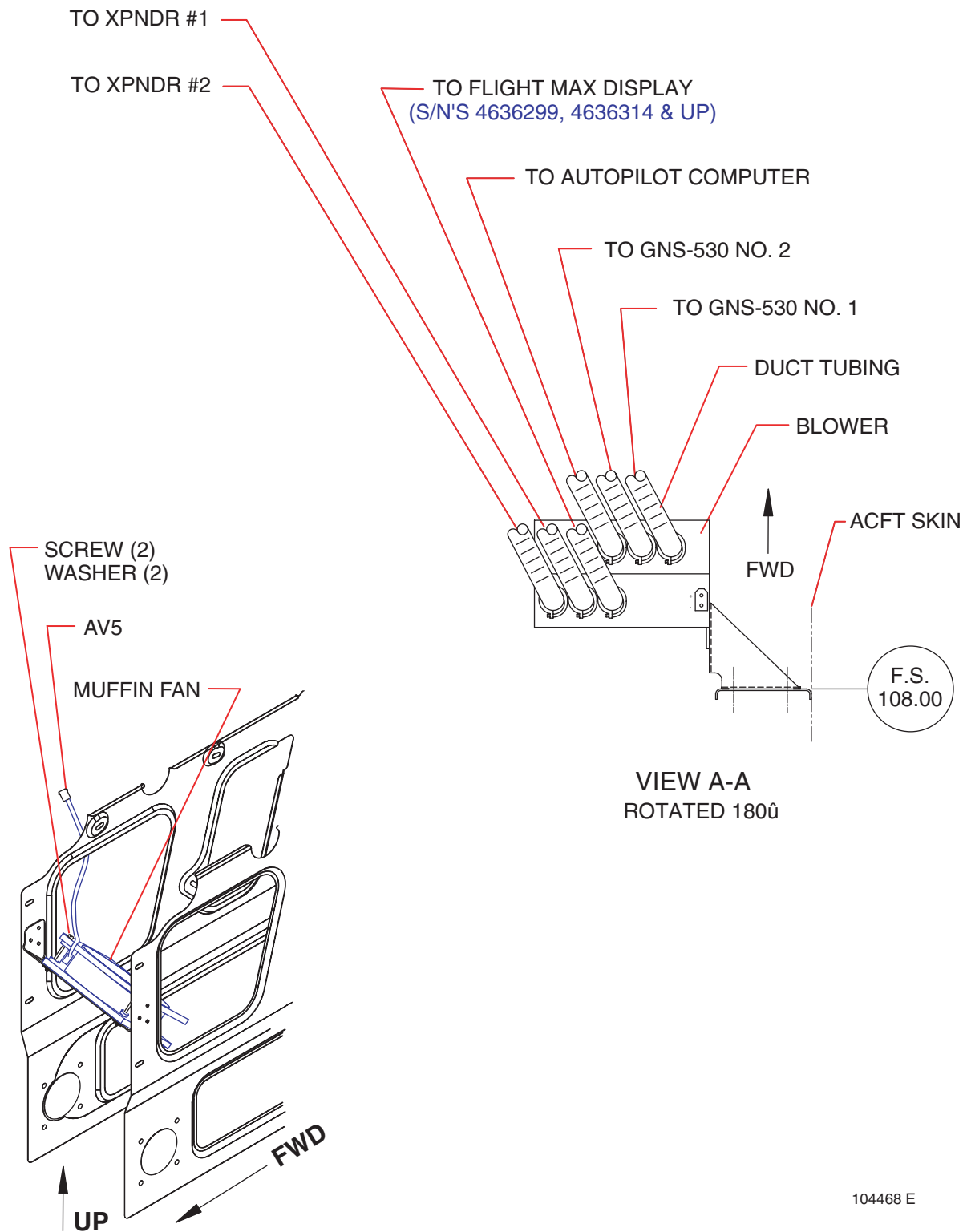
In S/N's 4636314 and up, in airplanes equipped with the Single Side EFIS option, a muffin fan is installed in the control pedestal as shown in Figure 2, Sheet 2.

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Avionics Cooling
Figure 2 (Sheet 1 of 2)

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Avionics Cooling
Figure 2 (Sheet 2 of 2)

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PRESSURIZATION CONTROL

1. General

The cabin pressurization and control system consist of an outflow valve (isobaric), safety valve, cabin altitude and rate selector, electrically operated vacuum solenoid valve, surge tank and associated inter-connecting plumbing and wiring. Cabin altitude, differential pressure, and rate of change are displayed on a single 3-inch diameter indicator. Pilot warning (displayed on the annunciator panel) is provided to indicate a cabin altitude above 10,000 feet.

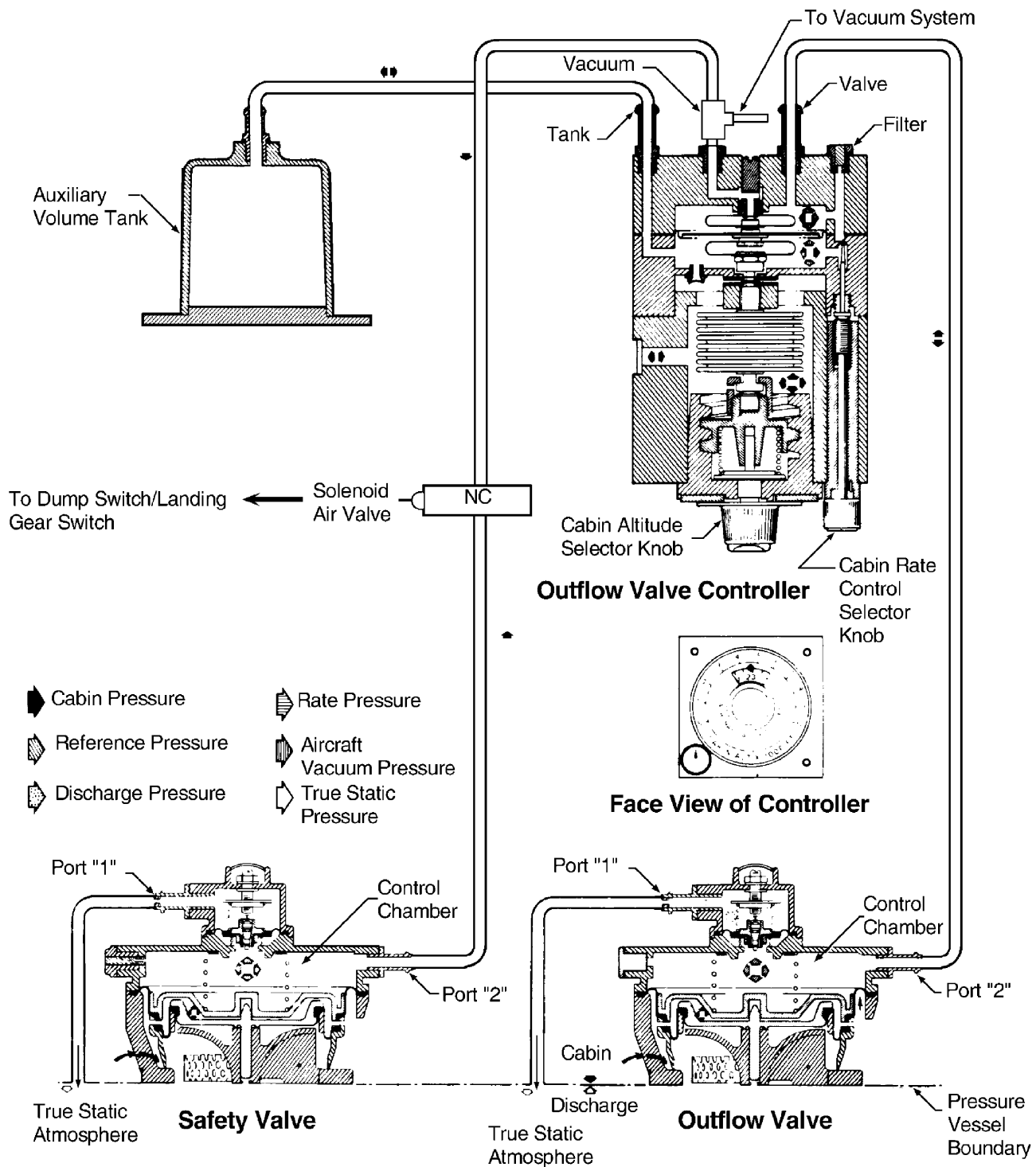
The cabin safety valve is held open on the ground with the engine operating by a vacuum applied to the control chamber of the safety valve. The vacuum regulator of the vacuum system provides a vacuum of 4.8-5.2 in. mercury referenced to cabin pressure. This vacuum holds the safety valve open while on the ground through the action of the landing gear squat switch, which energizes the vacuum relief solenoid valve to the open position. A cabin dump switch is also provided to rapidly depressurize the cabin in flight, by energizing the vacuum relief valve solenoid valve.

See Chapter 91 for electrical schematics.

2. Troubleshooting

See Chart 1.

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Cabin Pressure Control System
Figure 1

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**CHART 1 (Sheet 1 of 3)
TROUBLESHOOTING (PRESSURIZATION SYSTEM)**

Trouble	Cause	Remedy
Cabin will not pressurize.	Blocked safety valve cabin air filter or orifice.	Replace filter and check orifice.
	Blocked controller cabin air filter with orifice.	Clean filter and check orifice on controller.
	Internal malfunction in the isobaric valve.	Remove and replace isobaric valve.
	Internal malfunction in the safety valve.	Remove and replace safety valve.
	Internal malfunction in the controller.	Remove and replace controller.
	Defective landing gear safety switch.	Remove and replace switch.
	Dump switch incorrectly positioned or defective.	Replace switch.
	No pressure to door seal.	Check and repair door seal or door seal valve.
	Excessive leakage in pressurization ducts.	Locate leak and tighten connections.
	Excessive cabin leakage.	Locate and repair leak.
Cabin pressurizes to full positive differential pressure after takeoff.	Solenoid valve malfunctions in the open position.	Replace valve.
	Vacuum tube not connected to controller.	Connect vacuum tube.
	Malfunction in aircraft vacuum supply.	Check aircraft vacuum supply.
	Rupture in volume tank.	Replace tank.
	Internal malfunction in the outflow isobaric valve.	Remove and replace valve.
	Internal malfunction in the controller.	Remove and replace controller.

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**CHART 1 (Sheet 2 of 3)
TROUBLESHOOTING (PRESSURIZATION SYSTEM)**

Trouble	Cause	Remedy
Cabin altitude decreases below selected altitude.	Low aircraft vacuum supply.	Check aircraft vacuum supply.
	Minor leak in tube between controller and volume tank or in volume tank.	Remove and replace tube or volume tank.
	Minor leak in tube between controller and isobaric valve or in isobaric valve.	Remove and replace tube or isobaric valve.
	Minor leak in the controller.	Remove and replace controller.
Minimum rates unbalanced. Down rate faster than up rate.	Minor leak in tube between controller and volume tank or in volume tank.	Remove or replace tube or volume tank.
	Minor leak in the controller.	Remove and replace controller.
Pressurized operation before takeoff and after landing.	Solenoid valve malfunction in the closed position.	Replace valve.
	Landing gear safety switch/ dump switch malfunction in the open position.	Remove and replace switch.
	Broken wiring to the solenoid valve.	Repair wiring.
	Loose or damaged pneumatic tube between solenoid valve and safety valve.	Check tube connections or replace damaged tube.
	Internal malfunction in the safety valve.	Remove and replace valve.
Cabin exceeds full positive differential calibrated setting.	True static atmosphere tube blocked or not connected on isobaric valve and safety valve.	Securely connect or remove blockage from the true static atmosphere tube on isobaric valve and safety valve.
	Loose or damaged pneumatic tubing from port "1" of safety and isobaric valve to atmosphere.	Repair or replace tubing.
Cabin climbs and descends at a fixed rate regardless of rate selection.	Internal malfunction in controller.	Remove and replace controller.

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**CHART 1 (Sheet 3 of 3)
TROUBLESHOOTING (PRESSURIZATION SYSTEM)**

Trouble	Cause	Remedy
Cabin rate exceeds selected rate valve during aircraft climb to cruise altitude.	Malfunction in controller.	Remove and replace controller.
	Defective cabin rate of climb indicator.	Remove and replace indicator.
Cabin pressure rapidly increases or decreases with reselection of cabin altitude.	Malfunction in controller.	Remove and replace controller.
Cabin altitude exceeds selected value.	Loss of airflow into cabin.	Repair bleed air supply.
	Internal malfunction in isobaric valve.	Remove and replace valve.
	Internal malfunction in safety valve.	Remove and replace valve.
	Internal malfunction in controller.	Remove and replace controller.
	Excessive cabin leak rate.	Seal leaks.
Cabin pressure will not maintain control setting.	Defective outflow valve.	Remove and replace valve.
	Defective safety valve.	Remove and replace valve.
	Defective cabin altitude controller.	Remove and replace cabin altitude controller.
	Pressurization duct leakage.	Locate leak and tighten connection.
	Cabin leakage	Locate and repair leak.
	Defective cabin altitude pressure gauge.	Remove and replace gauge.
	Foreign matter on isobaric outflow control valve or safety valve seats.	Clean valve seats.
	Leak in outflow isobaric valve control line.	Locate leak and tighten connection.
Cabin pressure excessively high.	Isobaric outflow valve static line clogged.	Clean static line.
	Defective cabin over pressure switch.	Remove and replace switch.
	Safety valve static vent clogged.	Clean vent line.
	Defective safety valve.	Remove and replace valve.

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3. Components

A. Cabin Outflow Valve / Cabin Safety Valve (See Figure 2.)

The outflow valve consists of two sections, a head section and a base section. The head section contains port "2" (controller connection) and a plugged cabin air port. Mounted on the head is the differential control, which contains port "1" (true static atmosphere connection with orifice). The base assembly encloses a poppet outflow valve which seats on a surface of the base assembly when in the closed position.

The safety valve consists of two sections, a head section and a base section. The head section contains port "2" depressurization connection and a cabin air filter with orifice. Mounted on the head is a differential control which contains port "1" (true static atmosphere connection with orifice). The base assembly encloses a poppet outflow valve which seats on a surface of the base assembly when in the closed position.

(1) Removal

- (a) Disconnect the two lines from the valve being removed.
- (b) Remove the three nuts which secure the valve to the aft pressure bulkhead.
- (c) Remove the valve from the pressure bulkhead.

(2) Installation

- (a) When reinstalling outflow and/or safety valve, the gasket dimension shown in Detail A of Figure 2 must be met to ensure proper sealing. To provide proper clearance between nuts and gasket face, adjust for clearance as follows:
 - 1 Remove nuts using a deep socket and remove enough shims to meet dimensional requirements. A minimum of one shim is required each place for installation of nut.
 - 2 Install nuts and tighten.
 - 3 Apply a drop of locking compound, MIL-S-22473-EV, to the top of nuts between nuts and studs.
- (b) Position the valve on the rear pressure bulkhead.
- (c) Install the three nuts which hold the valve to the aft pressure bulkhead. Torque nuts to 20 in. lbs.
- (d) Reconnect the two lines to the valve.

(3) Servicing

Routine maintenance of the valves is limited to the replacement of the filter in the safety valve and cleaning of the seats in both valves.

Using Joy detergent or isopropyl alcohol, clean the seats of either valve thoroughly.

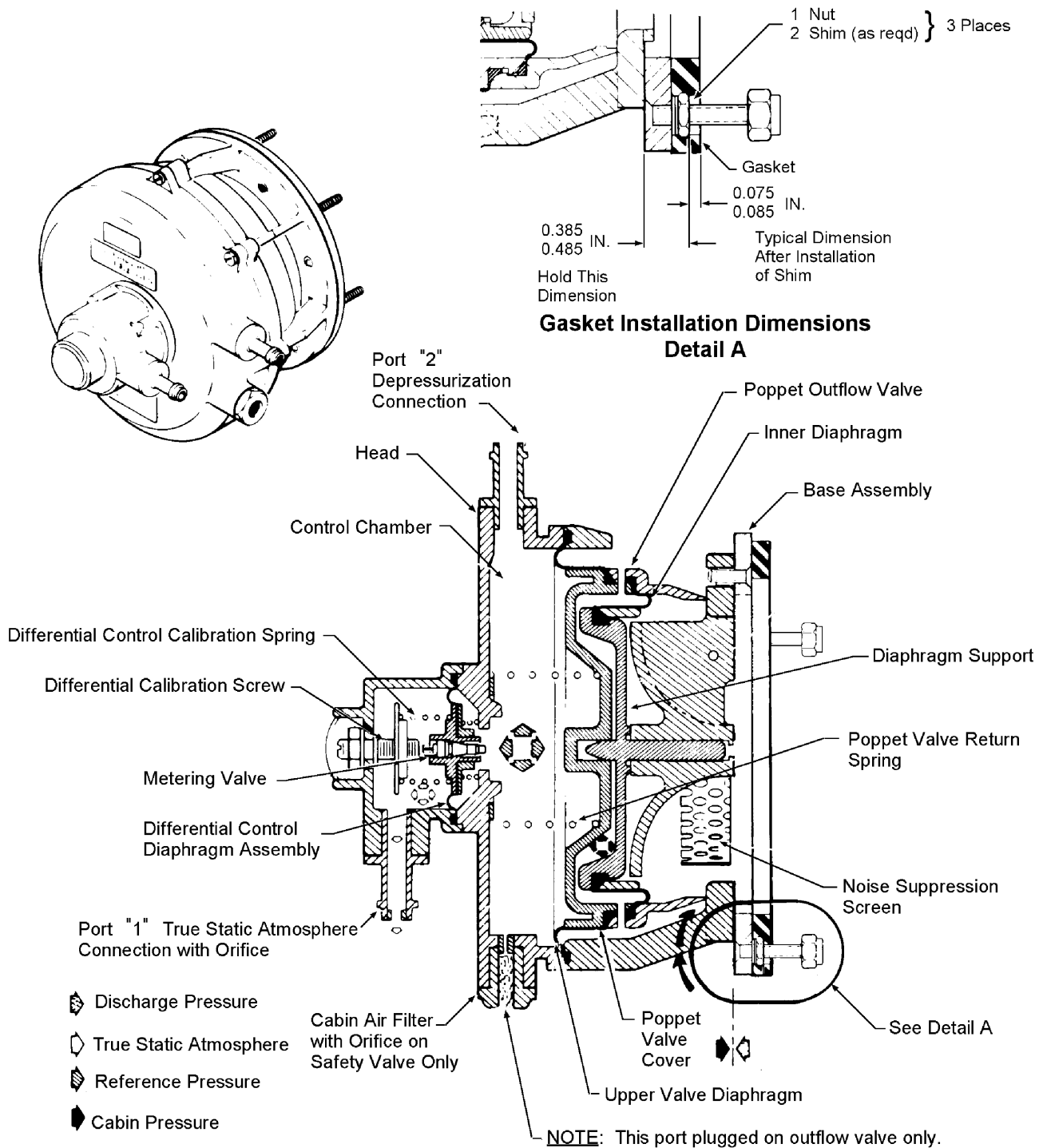
B. Auxiliary Volume Tank

This is a small sealed chamber located close to the controller; and when connected to the controller, it provides additional volume to the rate pressure chamber in the controller, thus providing greater accuracy of the cabin rate-of-control.

C. Vacuum Regulator (See also 37-10-00.)

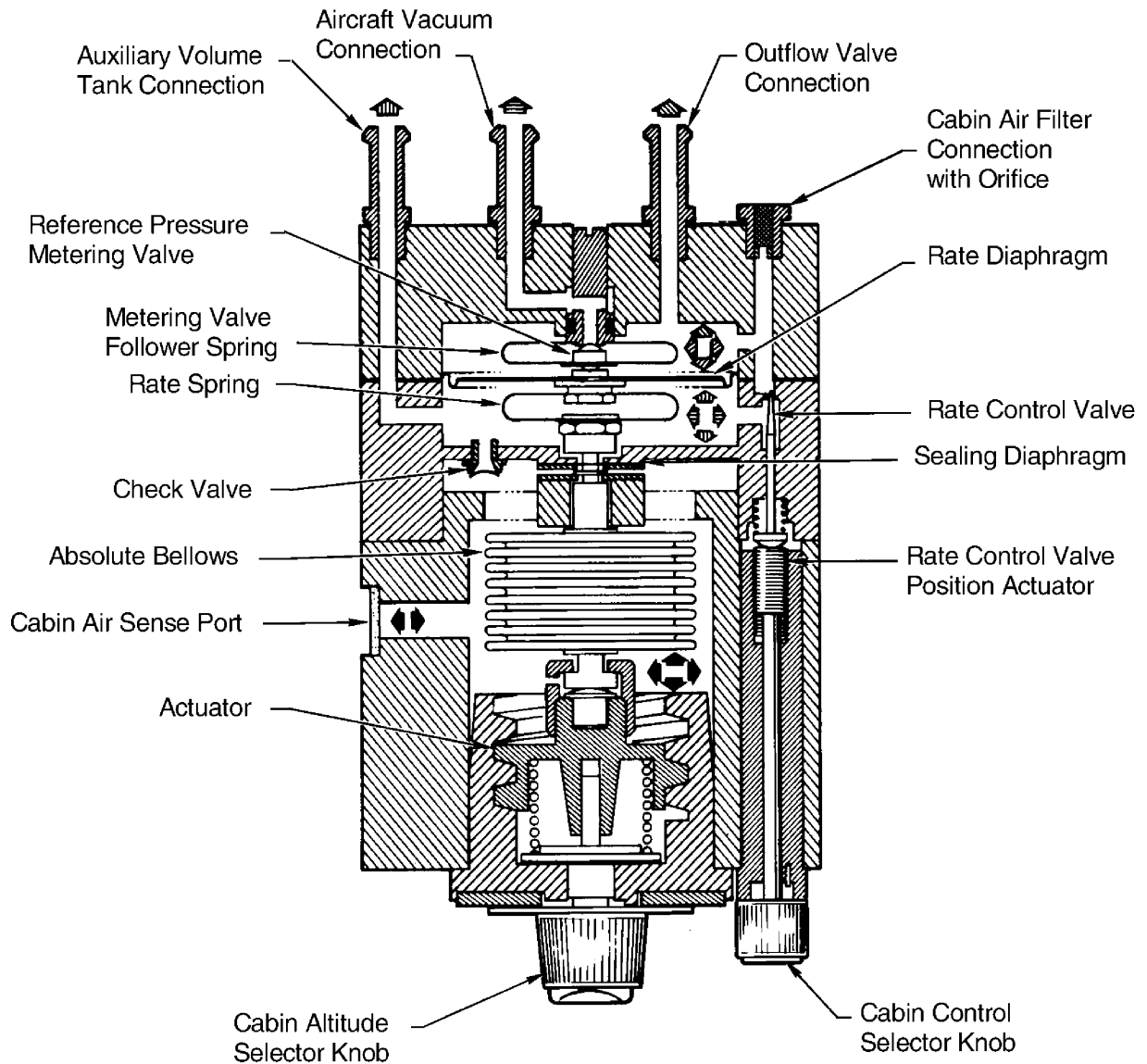
Vacuum to operate the safety valve and controller is obtained from the vacuum system which utilizes its own regulator. The regulator, set to provide 4.8 to 5.2 inches of mercury (relative to cabin pressure), is incorporated in the system between the vacuum-driven instruments and the pump.

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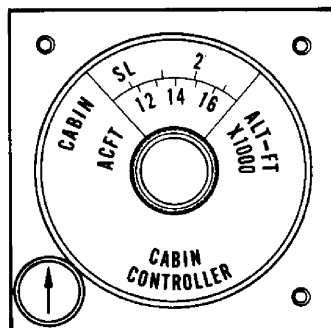


Safety and Outflow Valves
Figure 2

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- ◆ Cabin Pressure
- ◆ Rate Pressure
- ◆ Reference Pressure
- ◆ Aircraft Vacuum Pressure



Face View of Controller

Cabin Pressure Controller
Figure 3

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D. Cabin Pressure Controller (See Figure 3.)

(1) Description

The body of the controller is composed of three elements. The lower element forms a chamber which is open to cabin pressure and houses the absolute bellows. It also is the face of the controller, and has the cabin altitude selector knob and the cabin rate control knob. The middle element, when assembled to the lower element, completes the cabin pressure chamber and seals the cabin pressure chamber from the rest of the controller with a sealing diaphragm. The opposite side of the middle element forms a rate pressure chamber which houses the rate spring. The upper element, when assembled to the rate diaphragm and other two elements, forms a reference pressure chamber which houses the reference pressure metering valve and metering valve follower spring. This element also contains the various air connections for installation of the controller into the cabin pressure control system.

(2) Operational Check

(PIR-Garrett Report No. 4-360.)

This check verifies minimum ΔP operation, cabin altitude control, and cabin pressure rate-of-change control are operational.

- (a) Close and secure cabin door.
- (b) Rotate cabin rate control selector knob to the 9 o'clock position.
- (c) Rotate cabin altitude selector knob until CABIN ALT indicates approximately 500 feet above field altitude.
- (d) Set brakes, start engine, and establish a steady cabin air inflow.
- (e) Pull landing gear warning circuit breaker and note that safety valve closes and outflow valve remains open.
- (f) Rotate cabin altitude selector knob counterclockwise until CABIN ALT indicates approximately 1500 feet below field altitude or until it reaches its stop. Cabin pressure will increase on rate-of-change operation.
- (g) Rotate cabin rate control selector knob counterclockwise and note a reduction in cabin pressurization rate-of-change.
- (h) Rotate cabin rate control selector knob clockwise and note an increase in cabin pressurization rate-of-change. Return selector knob to the 9 o'clock position.
- (i) Allow cabin pressure to stabilize at the selected value.
- (j) Rotate cabin altitude selector knob until CABIN ALT indicates approximately 500 feet above field altitude.
- (k) Rotate cabin rate control selector knob counterclockwise and note a reduction in cabin pressurization rate-of-change.
- (l) Rotate cabin rate control selector knob clockwise and note an increase in cabin pressurization rate-of-change; then, allow cabin pressure to return to field altitude and outflow valve to move to the full-open position.
- (m) Push-in landing gear warning circuit breaker and note that safety valve also fully opens.
- (n) Shutdown engine.

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E. Vacuum Relief Solenoid Valve

(1) Description

The solenoid valve is mounted on the left-hand side of the F.S. 108.00 bulkhead at W.L. 57.00. This valve is normally closed. It is in the control line between the cabin pressure controller vacuum port and the safety valve. When energized, vacuum is applied to the diaphragm of the safety valve, holding it open. The vacuum relief solenoid valve is open under either of the following conditions:

- (a) On the ground with the landing gear squat switch energized.
- (b) In flight whenever the cabin dump switch is in the DUMP position.

(2) Removal

- (a) Gain access to the solenoid valve.
- (b) Disconnect the lines from the valve.
- (c) Remove the screws and washers that attach the valve to the bulkhead. Remove the valve.

(3) Installation

- (a) Secure the valve to the bulkhead with the screws and washers.
- (b) Reconnect the lines to the valve.
- (c) Tighten the nuts finger tight plus one and one-half turns.

F. Bleed Air Dump Valve

The bleed air dump valve is just forward of the firewall (F.S. 79.00) and above the bleed air crossover duct assembly. It is actuated by the cabin pressure control knob on the instrument panel.

A. Removal

- (1) Disconnect control cable from top of bleed dump valve.
- (2) Remove bolts, nuts and washers that secure the bleed dump valve to the duct and exhaust duct/cable support.
- (3) Remove bleed dump valve.

B. Installation

- (1) Position bleed dump valve in place.
- (2) Ensure that gaskets are installed between bleed dump valve and ducts.
- (3) Install bolts (heads pointing inboard) through duct flange, bleed dump valve, control cable support and exhaust duct flange. Secure bolts with nuts and washers.
- (4) Attach control cable rod end to dump valve arm.

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4. Rigging Bleed Air and Bleed Air Condition System

A. Rig cabin pressure system as follows:

- (1) Push cabin pressure control knob into the instrument panel.
 - (a) Verify that bleed dump valve is in closed position.
 - (b) Verify that air selector valve and bleed air shutoff valve are in open position.
- (2) Pull cabin pressure control knob out from instrument panel.
 - (a) Verify that bleed dump valve is in open position.
 - (b) Verify that air selector valve and bleed air shutoff valve are in closed position.

B. Rig cabin air temperature system as follows:

- (1) Push control cable knob into the instrument panel.
- (2) Verify that the cabin temperature control valve is open for ram air flow and closed to the heat muff hot air flow.

5. Pressurization System Test

(PIR-PPS60144-2, Rev. E.)

WARNING: DO NOT APPLY ELECTRICAL POWER ON BUS UNLESS AIRCRAFT IS ON JACKS AND STRUTS ARE FULLY EXTENDED.

A. Equipment Required

Pressurization Test Cart (commercially available)

B. Procedure

NOTE: Remove cowling before beginning.

- (1) Plug cabin altimeter indicator (3-in-1 indicator) sensing port (marked "C.P").
- (2) Disconnect vacuum line at the tee on the rear of the cabin pressurization controller. Cap tee and plug vacuum line.

CAUTION: IMPROPER SETTING WILL CAUSE DAMAGE TO CABIN PRESSURIZATION CONTROLLER.

- (3) Turn rate selector on cabin pressurization controller full clockwise. Turn cabin altitude selector full counter-clockwise.
- (4) Ensure that pilot's storm window emergency exit, and cabin door are properly installed and secured closed. Strap or net cabin door.

NOTE: Perform the following steps outside aircraft by monitoring test stand operation and inspecting gauge through cockpit window.

- (5) Connect instrument line connector port on test cart to the 1/4 inch bulkhead fitting on forward pressure bulkhead.
- (6) Disconnect flexible connectors at bleed air supply connections on firewall. (See Figure 1, 21-20-00 and Figure 1, 21-40-00.)
- (7) Connect test cart air outlet port to either left or right flexible connector. Plug opposite flexible connector.

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WARNING: DO NOT OCCUPY CABIN DURING TESTS.

CAUTION: TEST STAND OPERATOR MUST CONTINUALLY MONITOR STAND OPERATION DURING ALL TIMES THAT CABIN IS PRESSURIZED. DURING INITIAL PRESSURIZATION, ENSURE BY INSPECTION THROUGH COCKPIT WINDOW THAT AIRCRAFT AND CABIN ALTITUDE, AIRSPEED, AND RATE OF CLIMB INDICATORS ARE STABLE AND UNAFFECTED BY CABIN PRESSURE. ANY OF THE ABOVE INSTRUMENTS BEING AFFECTED INDICATES A LEAK IN THE STATIC SYSTEM. CORRECT BEFORE PROCEEDING.

- (8) Start airflow into fuselage slowly and at a rate not to exceed 1,500 feet per minute rate of change in cabin altitude.
- (9) When cabin differential gauge indicates one (1) pound per square inch differential (psid), maintain only sufficient airflow to hold one (1) psid. Inspect complete cabin structure, bleed air system, outflow and safety valves, etc. Identify major leaks for corrective sealing/repair.
- (10) Continue to pressurize the cabin at a rate not to exceed 1,500 feet per minute until a maximum cabin differential of 5.25 psid occurs. Determine airflow required to maintain 5.25 psid and record. If airflow exceeds 40 SCFM*, or a major leak is occurring in one or more places, or if excessive noise is found, identify for corrective sealing.

$$* \text{ SCFM} = \text{CFM obs} \left[\left(\sqrt{\frac{P \text{ obs} + 29.92}{29.92}} \right) \left(\sqrt{\frac{520 \text{ } ^\circ\text{F}}{T \text{ obs} + 460 \text{ } ^\circ\text{R}}} \right) \right]$$

Where: P obs = PSID observed x 2.036
T obs = Temperature (°F) observed
CFM obs = Cubic Feet per Minute observed
SCFM = Standard Cubic Feet per Minute (flow)

NOTE: If cabin will not pressurize above 1 psid due to excessive leakage:

- (a) Disconnect cabin controller line at outflow valve.
- (b) Pressurize to not more than 5.25 psid to identify all leaks.
- (c) Repair leaks.
- (d) When an acceptable leak rate is achieved, depressurize cabin.
- (e) Connect cabin controller line to outflow valve.

WARNING: DO NOT EXCEED 5.60 MAXIMUM DIFFERENTIAL PRESSURE IN NEXT STEP. EXCESSIVE PRESSURE CAN CAUSE STRUCTURAL DAMAGE OR PERSONAL INJURY.

- (11) Continue to pressurize the cabin at a rate not to exceed 1,500 feet per minute until either the outflow or safety valve starts to relieve. Note differential pressure and which valve operated. Correct operating range is 5.50 ± 0.1, - 0.15 psid.
- (12) Lower cabin pressure to 4.0 ± 0.2 psid.
- (13) Plug the ambient sensing port of the valve which operated above.

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WARNING: DO NOT EXCEED 5.60 MAXIMUM DIFFERENTIAL PRESSURE IN NEXT STEP. EXCESSIVE PRESSURE CAN CAUSE STRUCTURAL DAMAGE OR PERSONAL INJURY.

- (14) Slowly increase cabin pressure at a rate not to exceed 1,500 feet per minute and observe the differential pressure at which the remaining valve starts to relieve. Record. Correct operating range is $5.50 + 0.1, - 0.15$ psid.
- (15) Lower cabin pressure to 4.0 ± 0.2 psid.
- (16) Unplug the ambient sensing port of the valve which operated first and was subsequently plugged.

WARNING: DO NOT EXCEED 5.60 MAXIMUM DIFFERENTIAL PRESSURE IN NEXT STEP. EXCESSIVE PRESSURE CAN CAUSE STRUCTURAL DAMAGE OR PERSONAL INJURY..

- (17) Repeat step 11. Verify that the same valve operates first and that it operates within the correct pressure range (i.e. - $5.50 + 0.1, - 0.15$ psid).
- (18) Depressurize cabin at a rate not exceeding 1,500 fpm.
- (19) Remove instrument line connector and pressurization outlet connections installed in steps (5) thru (7). Plug 1/4 inch fitting in forward pressure bulkhead used for instrument line connector.
- (20) Unstrap (or remove net from) cabin door.
- (21) Inside cabin, remove plug installed in cabin altitude indicator sensing port (i.e. - "C.P."). Unplug, uncap, and reconnect vacuum line and tee at controller.
- (22) Turn rate and cabin altitude selectors on cabin controller full counterclockwise.
- (23) Reconnect left and right flexible connectors at firewall to bleed air supply lines.
- (24) Reinstall cowling.

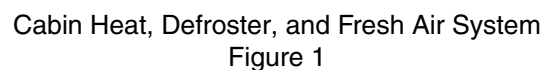
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HEATING



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1. Heat Exchanger/Air Selector Valve/Plenum Assembly

A. Removal

- (1) Loosen band clamp and remove flexible hose from bottom of fiberglass discharge plenum.
- (2) Loosen band clamps and remove flexible hose from bleed air supply manifold (part of heat exchanger/selector valve assembly).
- (3) Disconnect and remove cabin pressurization control cable and bleed air dump cable from air selector valve/heat exchanger assembly.
- (4) Remove the four bolts and washers that secure heat exchanger/selector valve assembly brackets to mounting brackets on baggage compartment skin.
- (5) Remove six bolts, nuts, and washers from the two inch diameter bleed air tube at the firewall.
- (6) Remove the four bolts attaching air temperature control valve to forward side of firewall.
- (7) Remove assembly from aircraft.

B. Installation

- (1) Align assembly in proper position as shown in Figure 1.
- (2) Attach air temperature control valve to forward side of firewall with four bolts.
- (3) Attach six bolts and hardware to the two inch diameter bleed air tube at the firewall.
- (4) Secure heat exchanger/selector valve assembly brackets to mounting brackets on baggage compartment skin with four bolts and washers.
- (5) Connect cabin pressure control cable and bleed air dump cable to air selector valve/heat exchanger assembly.
- (6) Attach flexible hose to bleed air supply manifold (part of heat exchanger/selector valve assembly) and tighten band clamps.
- (7) Attach flexible hose to bottom of fiberglass discharge plenum and tighten band clamp.

2. Air Selector Valve

NOTE: Remove heat exchanger/air selector valve/plenum assembly before individually removing air selector valve.

A. Removal

- (a) Loosen closure assembly (arm) and slide it to the right, off of the selector crank assembly.
- (b) Remove the four bolts that attach the check valve assembly (including gaskets) to the air selector valve.
- (c) Remove the twelve screws attaching the air selector valve to the heat exchanger.
- (d) Remove selector valve from heat exchanger.

B. Installation

- (a) Position air selector valve onto heat exchanger.
- (b) Attach air selector valve to heat exchanger with twelve screws.
- (c) Attach check valve assembly (including gaskets) to air selector valve with four bolts.
- (d) Slide closure assembly (arm) onto the selector crank assembly and tighten.

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3. Heat Exchanger

NOTE: Remove heat exchanger/air selector valve/plenum assembly before individually removing heat exchanger.

A. Removal

- (a) Remove four bolts and hardware attaching bleed air shutoff valve to heat exchanger.
- (b) Remove twelve screws attaching heat exchanger to selector valve.
- (c) Remove twelve screws attaching heat exchanger to plenum.
- (d) Remove heat exchanger from assembly.

B. Installation

- (1) Align heat exchanger into proper position.
- (2) Attach heat exchanger to plenum with twelve screws.
- (3) Attach heat exchanger to selector valve with twelve screws.
- (4) Attach bleed air shutoff valve to heat exchanger with four bolts and hardware.

4. Plenum

NOTE: Remove heat exchanger/air selector valve/plenum assembly before individually removing plenum.

A. Removal

- (1) Remove twelve screws attaching plenum to heat exchanger.
- (2) Remove plenum.

B. Installation

- (1) Seal plenum to heat exchanger with RTV 106 sealant.
- (2) Install plenum to heat exchanger with twelve screws.

5. Defroster

A. Removal

- (1) Remove closeout panel covering magnetic (float) compass and windshield defroster by removing compass deviation and removing screw securing deviation card holder and close out panel
- (2) Remove the four screws and nylon spacers securing defroster to windshield post.
- (3) Loosen clamps securing defrost hoses to defroster. Remove hoses.
- (4) Remove defroster.

B. Installation

- (1) Connect defrost hoses to appropriate fittings on defroster. Tighten clamp screws.
- (2) Position defroster at windshield post. Secure with four nylon spacers and screws
- (3) Position closeout panel in appropriate position over defroster and magnetic (float) compass
- (4) Position compass deviation card holder in proper location. Be sure screw hole in deviation card holder aligns with screw hole in closeout panel. Secure both in position with brass screw previously removed.

NOTE: Only a brass screw may be used to secure compass card holder and close out panel to windshield post.

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C. Rigging

- (1) Push defroster control knob in.
- (2) Ensure that the defroster restrictor valve is fully open.

6. Bleed Air Shutoff Valve

A. Removal

- (1) Disconnect control linkage to shutoff valve.
- (2) Loosen bleed air flexible hose band clamps.
- (3) Remove four bolts and hardware attaching shutoff valve (including gaskets) to heat exchanger.
- (4) Remove valve.

B. Installation of Bleed Air Shutoff Valve

- (1) Align shutoff valve into proper position.
- (2) Attach shutoff valve (including gaskets) to heat exchanger with four bolts and hardware.
- (3) Tighten bleed air flexible hose band clamps.
- (4) Connect control linkage to shutoff valve.
- (5) Check rigging of shutoff valve.

7. Auxiliary Cabin Heater

A. Removal

- (1) Loosen clamps attaching flex adapter to aft side of blower.
- (2) Slide adapter forward over blower.
- (3) Remove the six bolts attaching cabin air supply tube and auxiliary heater to forward pressure bulkhead.
- (4) Disconnect electrical leads to heater.
- (5) Remove heater.

B. Installation

- (1) Apply GE RTV 1508 sealant to gasket.
- (2) Position heater and gasket on forward side of bleed air check valve at forward pressure bulkhead.
- (3) Secure heater, check valve, and cabin air supply tube to forward pressure bulkhead with six bolts.
- (4) Slide flexible blower adapter duct aft over heater and secure with band clamps.
- (5) Connect electrical leads.

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COOLING

1. General

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

WARNING: REFRIGERANT R12 IS USED IN S/N's 4636001 THRU 4636186 ONLY. REFRIGERANT HFC-134A IS USED IN S/N'S 4636187 AND UP. ANYONE SERVICING THE AIR CONDITIONING SYSTEM MUST BE FAMILIAR WITH THE REFRIGERANT, LUBRICANT, AND COMPONENTS USED IN THAT PARTICULAR SYSTEM.

This installation consists of a compressor with its special brackets, two evaporator modules and blowers, a condenser, a receiver dehydrator, a manifold assembly which incorporates dual pressure switches, high and low service ports, and related plumbing.

The evaporators filter, dehumidify and cool the air. The evaporator modules are mounted underneath the floor between the ribs at F.S. 233.87 and F.S. 241.50 along with the blowers, expansion valves, ducting, service ports, and related tubing.

The compressor is a five cylinder, rotary, piston type which is supported by special brackets at the forward, left area of the engine. A V-belt connected to the starter ring gear pulley, drives the compressor through a magnetic clutch.

The condenser is located in the aft fuselage. Air is drawn through the condenser and vented overboard by means of a blower and duct.

The manifold assembly incorporates high and low service ports, a high pressure switch, and a low pressure switch that control the condenser head pressure by engaging or disengaging the compressor via a magnetic clutch.

The air conditioning system uses refrigerant HFC-134a, except in S/N's 4636001 thru 4636186 only - which use R-12. The refrigerant enters the compressor as a vapor. The compressor pressurizes the heat-laden vapor until its pressure and heat reach a point much hotter than the outside air. The compressor then pumps the vapor to the condenser where it cools and changes to a liquid. The liquid then passes to the receiver-dehydrator. The receiver-dehydrator's function is to filter, remove any moisture and ensure a steady flow of liquid refrigerant into the evaporators through the expansion valves. The expansion valves are temperature controlled metering valves which regulate the flow of liquid refrigerant to the evaporators. Inside each evaporator the liquid refrigerant changes state to a gas and, in doing so, absorbs heat. The evaporators then absorb the heat from the air passing over the coils. From the evaporators, the refrigerant vapor returns to the compressor where the cycle is repeated.

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

2. Troubleshooting

See Chart 1.

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

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

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CHART 1 (Sheet 2 of 4)
TROUBLESHOOTING (AIR CONDITIONING SYSTEM)

Trouble	Cause	Remedy
High suction pressure.	Expansion valve not closing. Evaporator flooded. Suction line frosted to compressor.	Replace expansion valve.
	Compressor drive belt slipping.	Adjust belt tension.
	Magnetic clutch slipping.	Check electrical circuit for correct voltage to clutch coil. Clean clutch surfaces of oil.
	Leaking or broken compressor valves.	Replace compressor.
System produces no cooling.	Electrical	
	Blown fuse in control head.	Replace fuse.
	Open circuit breaker.	Reset circuit breaker.
	Broken or disconnected electrical wire.	Check all terminals for loose connections; check wiring for hidden breaks.
	Broken or disconnected ground wire.	Check ground wire to see if loose, broken, or disconnected.
	Clutch coil burned out or disconnected.	Check current flow to clutch, replace if inoperative.
	Thermostat sensing element defective.	Check thermostat and cabin comfort control panel.
	Blower motor disconnected or burned out.	Check current flow to blower motor. Repair or replace if inoperative.
	Mechanical	
	Loose or broken drive belt.	Replace drive belts and/or tighten to specifications.
	Compressor partially or completely frozen.	Remove compressor for service or replacement.
	Expansion valve stuck in open position.	Replace expansion valve.

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**CHART 1 (Sheet 3 of 4)
TROUBLESHOOTING (AIR CONDITIONING SYSTEM)**

Trouble	Cause	Remedy
System produces no cooling. (continued)	Refrigeration	
	Broken refrigerant line.	Examine all lines for evidence of breakage by external stress or rubbing wear.
	Leak in system.	Evacuate system, apply static charge, leak test system, and repair leak as necessary.
	Compressor shaft seal leaking.	Replace compressor.
	Clogged screen or screens in receiver dehydrator or expansion valve; plugged hose or coil.	Repair as necessary.
System will not produce sufficient cooling.	Electrical	
	Blower motor sluggish in operation.	Remove blower motor for service or replacement.
	Mechanical	
	Compressor clutch slipping.	Remove clutch assembly for service or replacement.
	Obstructed blower passage.	Examine entire passage for obstruction. Correct as necessary.
	Insufficient air circulation over condenser coils; fins clogged with dirt or bugs.	Clean condenser coils.
	Evaporator filter clogged.	Clean with cleaning solvent to remove cigarette tars.
	Refrigeration	
	Insufficient refrigerant in system.	Recharge system until bubbles disappear in receiver dehydrator and gauge readings stabilize to specifications.

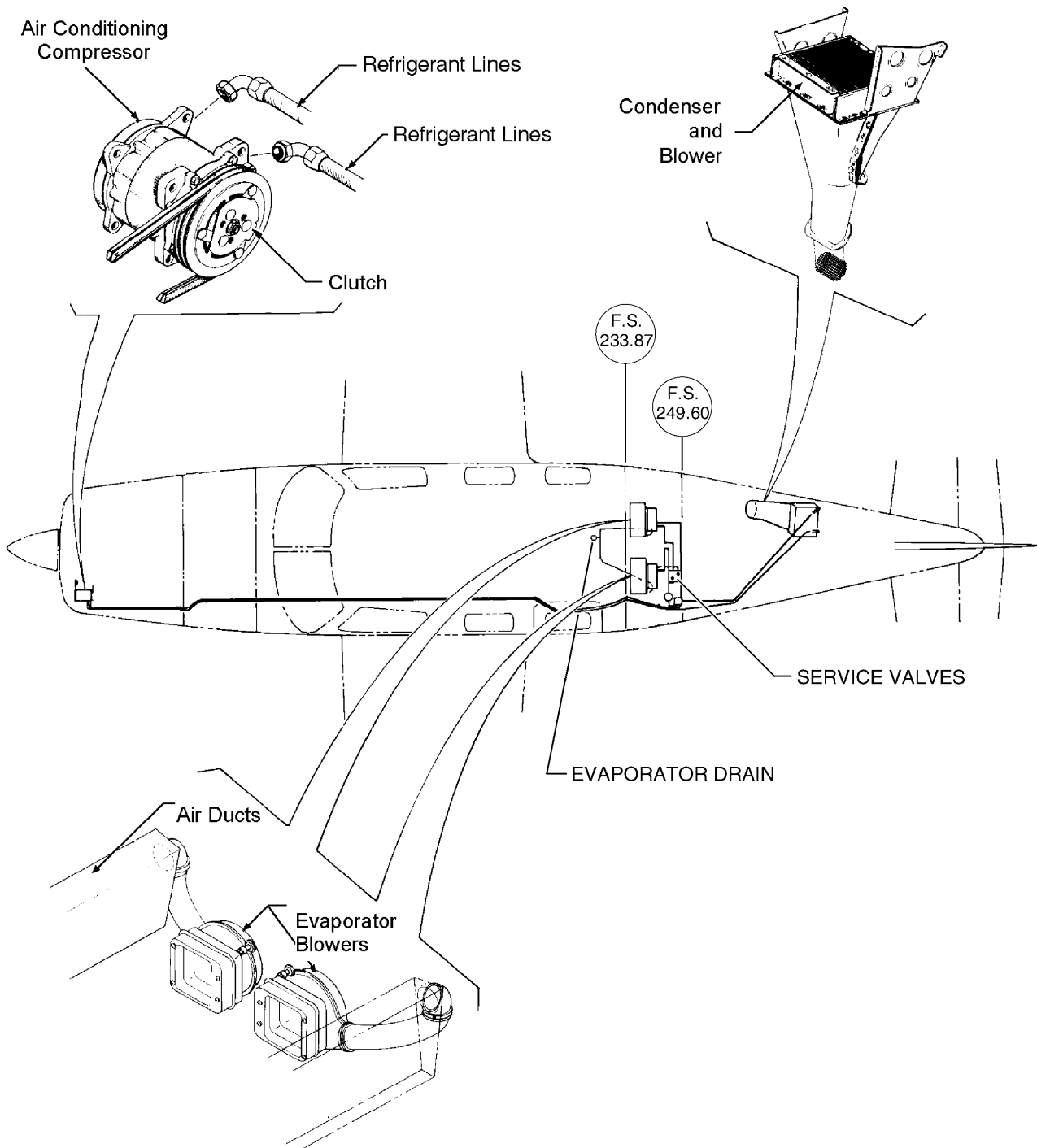
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**CHART 1 (Sheet 4 of 4)
TROUBLESHOOTING (AIR CONDITIONING SYSTEM)**

Trouble	Cause	Remedy
System will not produce sufficient cooling. (continued)	Refrigeration (continued)	
	Clogged screen in expansion valve.	Purge system and replace expansion valve.
	Clogged screen in receiver dehydrator.	Purge system; replace receiver dehydrator.
	Excessive moisture in system.	Purge system; replace receiver dehydrator.
Excessively noisy system.	Air in system.	Purge, evacuate and charge system. (Replace receiver dehydrator)
	Mechanical	
	Loose or excessively worn drive belt.	Tighten or replace as required.
	Noisy clutch.	Remove clutch for service or replacement as necessary.
	Compressor noisy.	Check mountings and repair; remove compressor for service or replacement.
	Compressor oil level low.	Fill with correct amount of specified oil.
	Electrical	
	Defective winding or improper connection in compressor clutch coil.	Replace or repair as necessary.
	Refrigeration	
	Excessive charge in system.	Discharge excess refrigerant until high pressure gauge drops within specifications.
	Low charge in system.	Check system for leaks; charge system.
	Excessive moisture in system.	Replace dehydrator; purge, evacuate, and charge system.

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Air Conditioning System
Figure 1

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3. Servicing Cooling System

(PIR-PPS50003-4, Rev. C.)

NOTE: The maximum refrigerant capacity is 2.75 pounds. The total refrigerant capacity required is determined separately for each system and is the amount that will result in bubble-free operation at the sight gauge, as specified in the post charging operational check.

A. Definitions

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

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

(1) Description

The service valves are installed to Test, Bleed (Discharge), Evacuate and Charge the air conditioning system. This airplane is equipped with inline service valves mounted on the manifold assembly. All normal air conditioning service should be performed at the manifold assembly mounted valves.

NOTE: Service valves are also located on the compressor in S/N's 4636001 thru 4636186 only. However, use of these valves in servicing is not recommended.

NOTE: In S/N's 4636001 thru 4636186 only, the service valves are screw-on type Schrader valves.

In S/N's 4636187 and up, the service valves are quick-disconnect type Schrader valves.

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

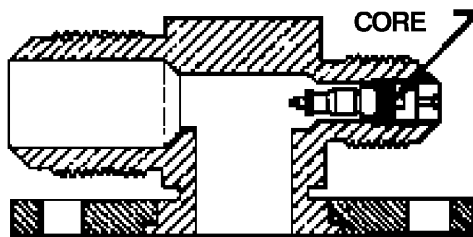
(2) Replacement

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

The valves on the compressor, when installed, are sealed with a gasket placed beneath the service port. Lubricate the gasket with refrigerant oil of the type used in the compressor, place the valves on the compressor. Torque the port from 9 to 12 ft. lbs.

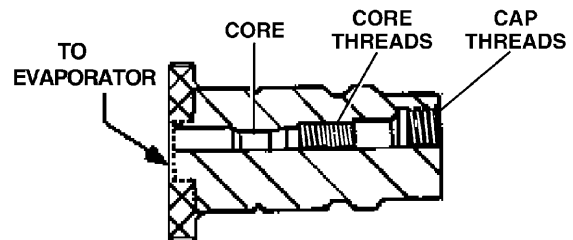
When installing the valves on the manifold assembly, lubricate the threads with Tite Seal 3 (Do not apply to the first two threads).

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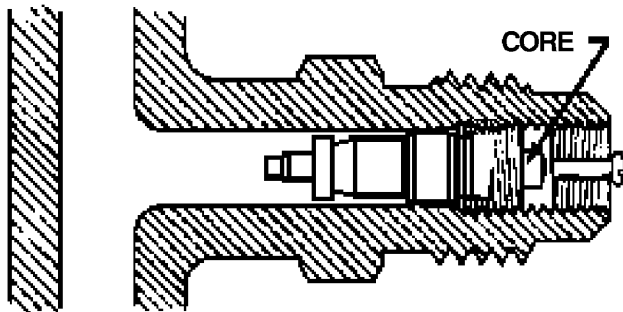


COMPRESSOR VALVE

(NOT RECOMMENDED FOR NORMAL SERVICING)

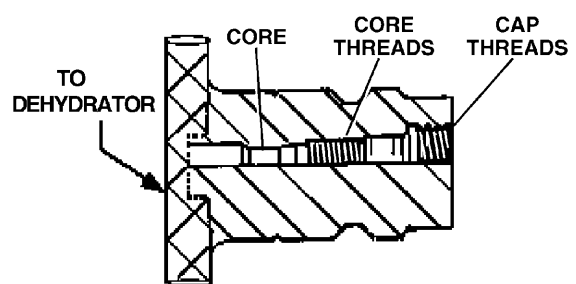


LOW SIDE (PRESSURE) VALVE



INLINE SERVICE VALVE

(S/N'S 4636001 THRU 4636186 ONLY)



HIGH SIDE (PRESSURE) VALVE

(S/N'S 4636187 AND UP)

Service Valves
Figure 2

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C. Malfunction Detection

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

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

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

Detection of system malfunction is made easier with knowledge of the relationship between temperature and pressure of the refrigerant (R-12 or HFC-134a). They are in close proximity between the pressures of twenty and eighty pounds per square inch (psi). A glance at the temperature-pressure chart (i.e. - Chart 2) will show that there is only a slight variation between the temperature and pressure of the refrigerant in the lower range.

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

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

It must be pointed out that the actual temperature of the air passing over the coils of the evaporator will be several degrees warmer than the fins, allowing for a temperature rise caused by the loss in the fins and tubing of the evaporator.

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

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

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

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**CHART 2
TEMPERATURE vs. PRESSURE**

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

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D. Special Servicing Procedures

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

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

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

(1) Refrigerant Safety Precautions.

WARNING: REFRIGERANTS R12 ("FREON") AND HFC-134A ARE ODORLESS AND COLORLESS IN EITHER THE LIQUID OR GASEOUS STATE. REFRIGERANT FOR CHARGING REFRIGERATION SYSTEMS IS SUPPLIED IN PRESSURIZED CONTAINERS (APPROX. 70 PSI AT 70°F) IN LIQUID FORM. SINCE THIS MATERIAL IS ESSENTIALLY INERT AT ROOM TEMPERATURES THE DANGERS ARE PRIMARILY ASSOCIATED WITH THE PRESSURE AND THE REFRIGERATION EFFECTS OF THE RELEASE AND SUBSEQUENT EVAPORATION OF THIS PRESSURIZED LIQUID.

WARNING: WEAR SUITABLE EYE PROTECTION WHEN HANDLING REFRIGERANT DUE TO THE POSSIBILITY OF FREEZING OF THE EYE IF CONTACTED BY ESCAPING LIQUID REFRIGERANT. IF LIQUID REFRIGERANT DOES STRIKE THE EYE, THE FOLLOWING ACTIONS SHOULD BE TAKEN:

- (1) DO NOT RUB THE EYE.
- (2) Splash large quantities of cool water into the eye to raise the temperature.
- (3) Tape on an eye patch to avoid the possibility of dirt entering the eye.
- (4) Rush to a physician or hospital for immediate professional aid.
- (5) DO NOT ATTEMPT TO TREAT IT YOURSELF.

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

WARNING: DO NOT DISCHARGE LARGE QUANTITIES OF REFRIGERANT INTO CLOSED ROOMS. IT MAY DISPLACE MOST OF THE AIR IN THE ROOM AND THIS COULD CAUSE OXYGEN STARVATION. GASEOUS REFRIGERANT IS HEAVIER THAN AIR AND FLOWS TO THE BOTTOM OF A CONTAINER.

WARNING: DO NOT DISCHARGE REFRIGERANT INTO AN OPEN FLAME OR ONTO A VERY HOT SURFACE (500°F). POISONOUS PHOSGENE GAS IS GENERATED BY THE ACTION OF THE HEAT ON REFRIGERANT R12.

WARNING: DO NOT APPLY DIRECT FLAME OR OTHER HIGH HEAT SOURCE TO A REFRIGERANT CONTAINER DUE TO THE HIGH PRESSURES WHICH WILL RESULT. IF ANY HEATING IS DONE TO REFRIGERANT CONTAINERS THE CONTAINER PRESSURE SHOULD BE MONITORED AND KEPT BELOW 150 PSI.

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(2) System Servicing Precautions.

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

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

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

NOTE: A very strong acid (HCL) is formed when R-12 comes in contact with moisture. When HFC-134a comes in contact with moisture it absorbs it into the system, which will lead to system failure.

WARNING: USE ONLY APPROVED REFRIGERATION OIL IN THE COMPRESSOR:

-- MINERAL OIL FOR R12 SYSTEMS (S/N'S 4636001 THRU 4636186 ONLY);
AND,

-- POLYALKYLENE GLYCOL (PAG) FOR HFC-134a SYSTEMS (S/N'S 4636187
AND UP).

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

WARNING: NEVER INTRODUCE ANYTHING BUT PURE REFRIGERANT AND THE APPROPRIATE REFRIGERANT OIL INTO A SYSTEM.

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

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

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

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

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

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

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

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

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**CHART 3
RECOMMENDED TORQUE SPECIFICATIONS**

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

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

E. Servicing the System (with a Charging Stand)

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

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

(1) Discharging (Bleeding/Purging) the System

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

This procedure is for a Robinair 34700 or similar charging stand/recovery station, see Figure 3. Required only if the system contains refrigerant.

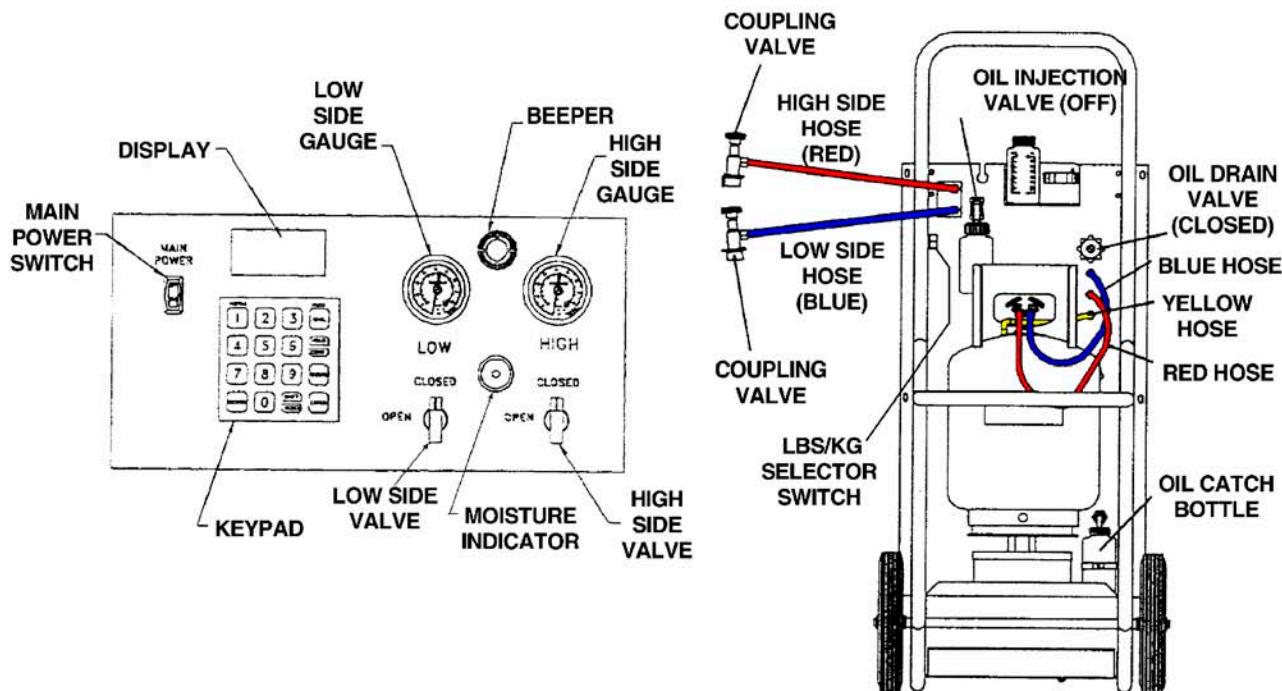
NOTE: The term "Discharge," as used throughout this section, in no sense implies or suggests discharging refrigerant to atmosphere. In all cases when discharging, an environmentally approved refrigerant recovery station is to be used.

- (a) Gain access to service valves by removing rear access panel.
- (b) Remove protective caps from access valves.
- (c) Connect high side (red) hose to air conditioner high side service valve. On systems equipped with quick disconnect connections, open coupler valve.
- (d) Connect low side (blue) hose to air conditioner low side service valve. On systems equipped with quick disconnect connections, open coupler valve.

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- (e) Check the low side gauge (GAUGE 1) and high side gauge (GAUGE 2) to determine that there is pressure in the system. If there is no pressure, there is no refrigerant in the system to recover.
- (f) Check that the oil drain valve is closed.
- (g) Open both the low side and high side valves on control panel.
- (h) Open the red GAS (vapor) valve and the blue LIQUID valve on the charging station's refrigerant tank.
- (i) Slowly open the oil drain valve to see if system oil separator contains oil. If it does, let oil drain into the oil drain bottle (located at the bottom of the rear side of the charging station) until separator is empty.
- (j) Close the oil drain valve. Dispose of collected oil in an environmentally accepted manner. Return collection bottle to its place on the charging stand.
- (k) Plug unit into a proper voltage outlet. Turn MAIN POWER switch ON.
- (l) Press the RECOVER key on charging station keypad.
- (m) To assure complete recovery of refrigerant:
 - (a) Wait 5 minutes. Observe pressure gauges for a rise above zero.
 - (b) If a rise occurs, press the HOLD/CONT key.
 - (c) Repeat as necessary until system maintains pressure for two minutes.
- (n) **Slowly** open oil drain valve. Drain oil into the oil catch bottle. When all recovered oil has been completely drained, close oil drain valve.

NOTE: Drain oil separator after each job. Display will indicate OIL (OUNCES) or OIL (GRAMS) as a reminder.

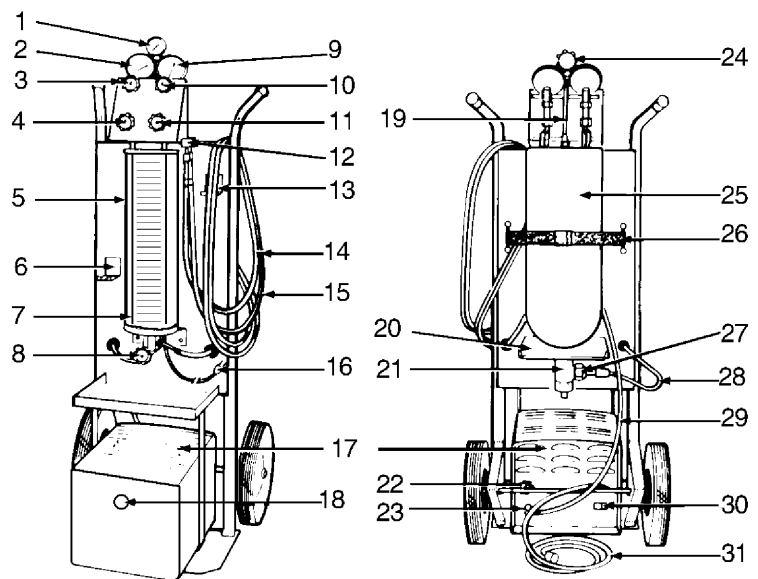


Robinair 34700 Charging Stand
Figure 3

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- (o) Measure the amount of oil in the catch bottle. The same amount of new oil must be added to the system before charging the system.
- (p) To enter diagnostic mode, simultaneously press the SHIFT/RESET and ENTER keys. To display amount of refrigerant recovered by the unit, press the 3 key. The panel display will read the amount of recovered refrigerant in pounds or kilograms.
- (q) Simultaneously press the SHIFT/RESET and ENTER keys to clear internal counter. Press SHIFT/RESET to return to the main menu.

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



Kent Moore J23500 Charging Stand
Figure 4

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(2) Evacuating the System

If the system has been operated in a discharged condition or anytime the system has been open to atmospheric pressure, the receiver-dehydrator must be replaced and the system evacuated to remove any trapped air and moisture which has entered it. A vacuum pump capable of pulling 29 inches of mercury or better should be used. As the pressure in the air conditioning system is lowered, the boiling temperature of the water (moisture) that may be present is also lowered. This then forces any moisture, in the form of water vapor, out of the system. Chart 4 demonstrates the effectiveness of moisture removal under a given vacuum.

(a) Using a Kent Moore J23500 or similar charging stand: (See Figure 4.)

Turn aircraft power OFF before beginning.

- 1 Remove the access panel at the rear of the cabin floor to gain access to the service valves on the manifold assembly.
- 2 Remove the protective caps from the high and low side service ports on the manifold assembly.
- 3 Close all valves on the charging stand.
- 4 Remove the protective cap from the vacuum pump outlet.
- 5 Connect the blue and red hoses to the service ports (see Figures 1 and 2).
- 6 Start the vacuum pump.
- 7 Open the valve on the vacuum pump. Open the low pressure control valve and the vacuum control valve on the charging stand.
- 8 After five minutes of pump operation, the high pressure gauge should indicate slightly below zero.
 - a If it doesn't, stop the pump and eliminate the blockage in the system replacing the faulty component, then repeat steps (1) - (8).
 - b If it does, open the high pressure control valve on the charging stand and continue to evacuate the system.
- 9 Operate the vacuum pump for fifteen minutes, or until the compound gauge indicates 24 to 26 in. Hg. whichever occurs first.

**CHART 4
USING VACUUM TO EVACUATE MOISTURE**

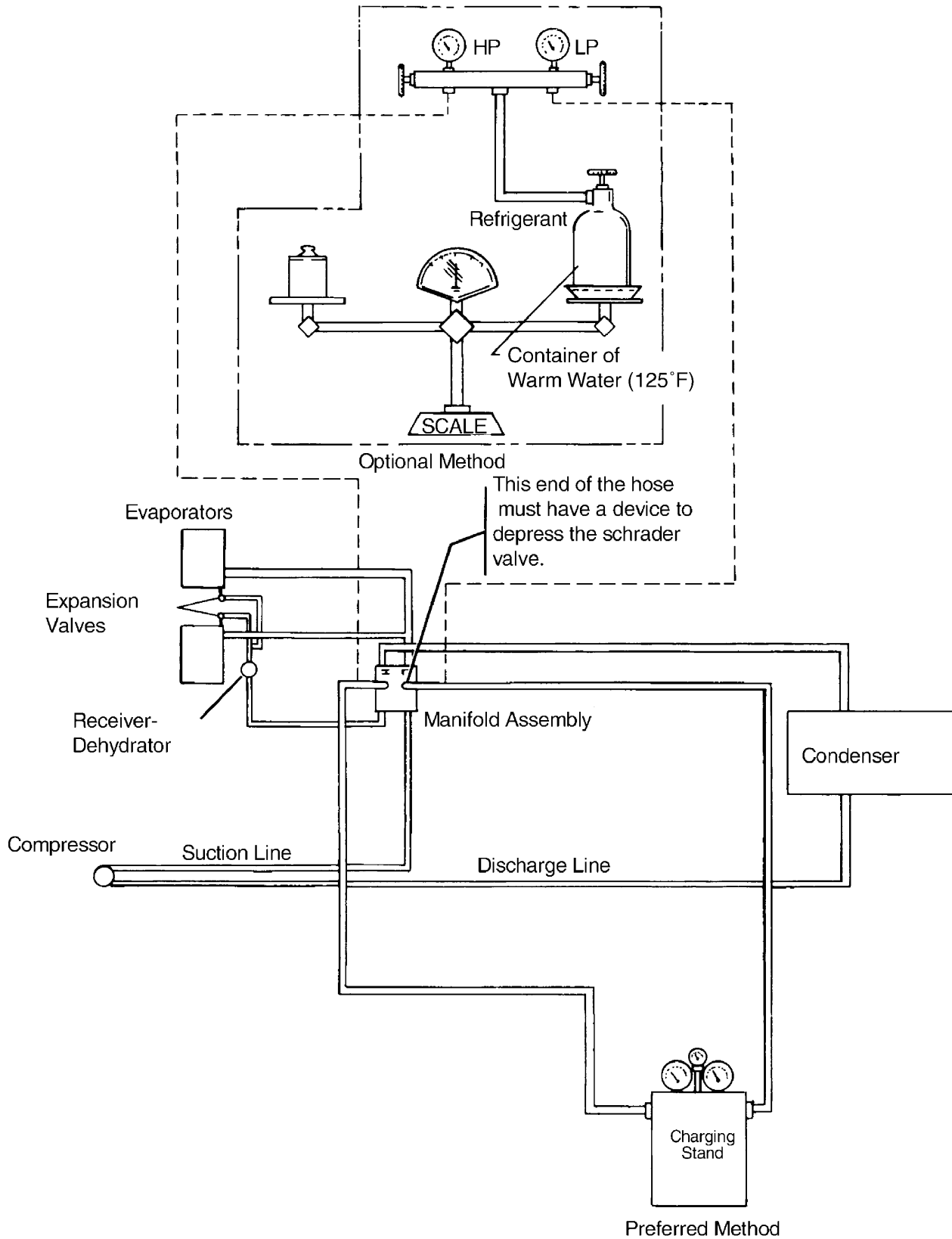
	System Vacuum	Boiling Point of Water (°F)
COMPOUND GAUGE READING IN INCHES OF MERCURY VACUUM	27.95	101
	28.74	84
	29.53	52
	29.76	29
	29.84	15
	29.88	1

NOTE: Compound gauge reading will be approximately one inch lower, numerically, for each 1000 feet elevation above sea level.

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- 10 Close the low pressure control valve and the high pressure control valve on the charging stand. Stop the vacuum pump and observe the compound gauge. If the gauge rises at a rate faster than 1 in. Hg. in 5 minutes, there is a leak in the system. Locate and fix the leak. Repeat the evacuation steps above.
 - 11 Open the low pressure control valve and the high pressure control valve on the charging stand. Continue pumping and hold the system pressure below 26 in. Hg. for a minimum of 30 minutes. All the pumping time specified above may be included in the 30 minutes provided that no leaks or blockages are noted, and provided that the system is not opened by removal or disconnection of components.
 - 12 Close the low pressure control valve, the high pressure control valve and the vacuum control valve. Stop the vacuum pump and perform the charging procedure immediately.
- (b) Using a Robinair 34700 or similar charging/recovery stand: (See Figures 3 and 6.)
- Turn aircraft power OFF before beginning.
- 1 Remove access panel at rear of cabin to gain access to service valves.
 - 2 Remove protective caps from the high and low side service ports on the evaporator unit.
 - 3 Close both the low side and high side valves on charging unit.
 - 4 Connect the blue and red hoses to the service ports (see Figures 1 and 2). On systems equipped with quick disconnect connections, open coupler valves.
 - 5 Open blue (low side) valve (1) on unit's control panel.
 - 6 Open both the red GAS (vapor) valve and the blue LIQUID valve on the tank.
 - 7 Program the length of evacuation time.
 - a Press the VACUUM key on control panel key pad.
 - b Display will show unit is in VACUUM mode.
 - c Refer to operator's manual for further detail.
 - 8 Enter the required time in minutes and seconds (30:00 minutes minimum) by pressing appropriate keys and then ENTER on keypad. The display will show selected time in minutes and seconds. Example: one hour and fifteen minutes (1:15) would be entered as 7500. The display will show 75:00. Thirty minutes is entered as 3000. the display will show 30:00.
 - 9 To start the vacuum pump press the VACUUM key on keypad again.
 - 10 Vacuum sequence will continue for the programmed time. Digital display will then show CPL, indicating that the evacuation is completed.
 - 11 If, after 5 minutes of pump operation, the RED gauge does not indicate a little below zero:
 - a Stop the pump by pressing the 1 key or the SHFT/RESET key.
 - b Eliminate blockage in the system by replacing faulty parts.
 - c Repeat steps (1) through (8) above.
 - 12 After 5 minutes of pump operation, when RED gauge indicates a little below zero, open red (high side) valve (2), and continue evacuation.
 - a System vacuum should attain 24 to 26 inches of mercury (in. Hg.) in 10 to 15 minutes.
 - b Allow pump to hold system vacuum at or below 26 in. Hg. for a minimum of 15 minutes.
 - c Failure to achieve or hold a vacuum at or below 26 in. Hg. indicates a leak in the system. Perform Leak Detection, below, to locate and repair all leaks.

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Charging Hookup
Figure 5

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- 13 When evacuation sequence has continued for the programmed length of time and the panel display reads CPL (complete), close both the low side valve (1) and the high side (2) valves.
 - 14 Perform charging procedure immediately. (See Charging the System, below.)
- (3) Leak Detection (See Figures 3 and 4.)
- (a) Using Nitrogen
 - 1 Prepare aircraft so as to provide access to all air conditioning components and fitting connections being leak checked.
 - 2 Ensure that aircraft and ground power are OFF or disconnected.
 - 3 Close all valves on the charging station.
 - 4 Remove the protective caps from the high and low side service ports on the evaporator unit.
 - 5 Connect the blue and red hoses to the service ports as shown in Figure 5.
 - 6 Slowly pressurize the system to 200 psig max. with nitrogen and turn off the nitrogen source. Ensure gages used have a 0-400 psig range.
 - 7 Monitor pressure on the charging station gauge for 20 minutes. A leak free system will maintain the 200 psig pressure for 20 minutes.
 - 8 If there is no pressure drop for 20 minutes, slowly release nitrogen pressure and disconnect the nitrogen source from the evaporator assembly. Re-install the pressure switch per drawing requirements. The leak check procedure is completed.
 - 9 If there is a pressure drop, find leak(s) by applying a soap solution to all connections.
 - 10 Rework system as required to stop leaks and repeat Leak Check Procedure.
 - (b) Using HFC-134a (PIR-PPS50003-4, Rev. A.)

A leak may be located while a charging stand is hooked up to the system as follows:

 - 1 Ensure that there is at least one pound of refrigerant in the charging cylinder.
 - 2 Open the high pressure control valve and the refrigerant control valve on the charging stand. Allow one pound of refrigerant to enter the system.
 - 3 Close the high pressure control valve and the refrigerant control valve.

CAUTION: USE A THICK SOLUTION OF SOAP AND WATER TO CHECK FOR LEAKS INSTEAD OF THE PROPANE LEAK DETECTOR THAT IS PROVIDED WITH SOME BRANDS OF CHARGING STANDS.

 - 4 Locate leak(s) using an electronic leak detector designed to detect HFC134a refrigerant. Or, use soap and water in a thick solution.
 - 5 Tighten/re-tighten fittings as necessary to stop leak(s). If leaks are due to damaged or worn components, proceed with refrigerant recovery/system discharge, perform repairs or component replacement and repeat leak detection procedure.
 - 6 Discharge the system.

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

 - 7 Evacuate the system.
 - 8 Immediately recharge the system as described in Charging the System, below.

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(4) Charging the System

NOTE: The following assumes the charging stand is already connected to the airplane as described in Evacuating the System, above.

NOTE: A Post Charging Operational Check is required immediately upon completion of charging. Accordingly, choose a location where engine run-up is allowed and set up the airplane and the charging stand with the airplane headed into the wind.

(a) Using a Kent Moore J23500 or similar charging stand (see Figures 4 and 5).

Ensure aircraft power is OFF before beginning.

- 1 Open the valve at the base of the charging cylinder and fill the charging cylinder with sufficient refrigerant to charge the system. If refrigerant stops filling the cylinder, open the bleed valve at the top of the charging cylinder to relieve head pressure and allow refrigerant to continue filling the charging cylinder.
- 2 Close the bleed valve and the valve at the base of the charging cylinder.
- 3 Turn the charging cylinder sight glass to match the pressure reading on the charging cylinder pressure gauge. Keep the sight glass in this position during the remainder of the charging operation.
- 4 Connect the heating element plug to a 110 volt power outlet.
- 5 With the low pressure control valve (3) closed, open the refrigerant control valve (11) and the high pressure control valve (10).
- 6 Allow the correct amount of refrigerant to enter the high side of the system.
- 7 Close the high pressure control valve (10) and the refrigerant control valve (11).
- 8 Perform Post Charging Operational Check, below.

(b) Using a Robinair 34700 charging station or equivalent (See Figures 3 and 6.)

CAUTION: THE FOLLOWING PROCEDURE APPLIES TO ROBINAIR 34700 OR SIMILAR CHARGING STATION. SEE OPERATOR'S MANUAL OF CHARGING STATION BEING USED, FOR DETAILED INSTRUCTIONS FOR CHARGING SYSTEM.

- 1 Check that main power switch is OFF.

CAUTION: DO NOT PLACE ANY WEIGHT, INCLUDING HANDS AND/OR FEET, ON REFRIGERANT TANK OR SCALE DURING CHARGING PROCESS. ANY WEIGHT DISTURBANCE WILL CAUSE AN INDIRECT TRANSFER OF REFRIGERANT.

- 2 Check that the LBS/KG selector switch on back of unit is in desired measurement mode.

NOTE: You may enter the amount of refrigerant to be charged when the unit is turned ON. The unit will store the amount in memory until it is turned off.

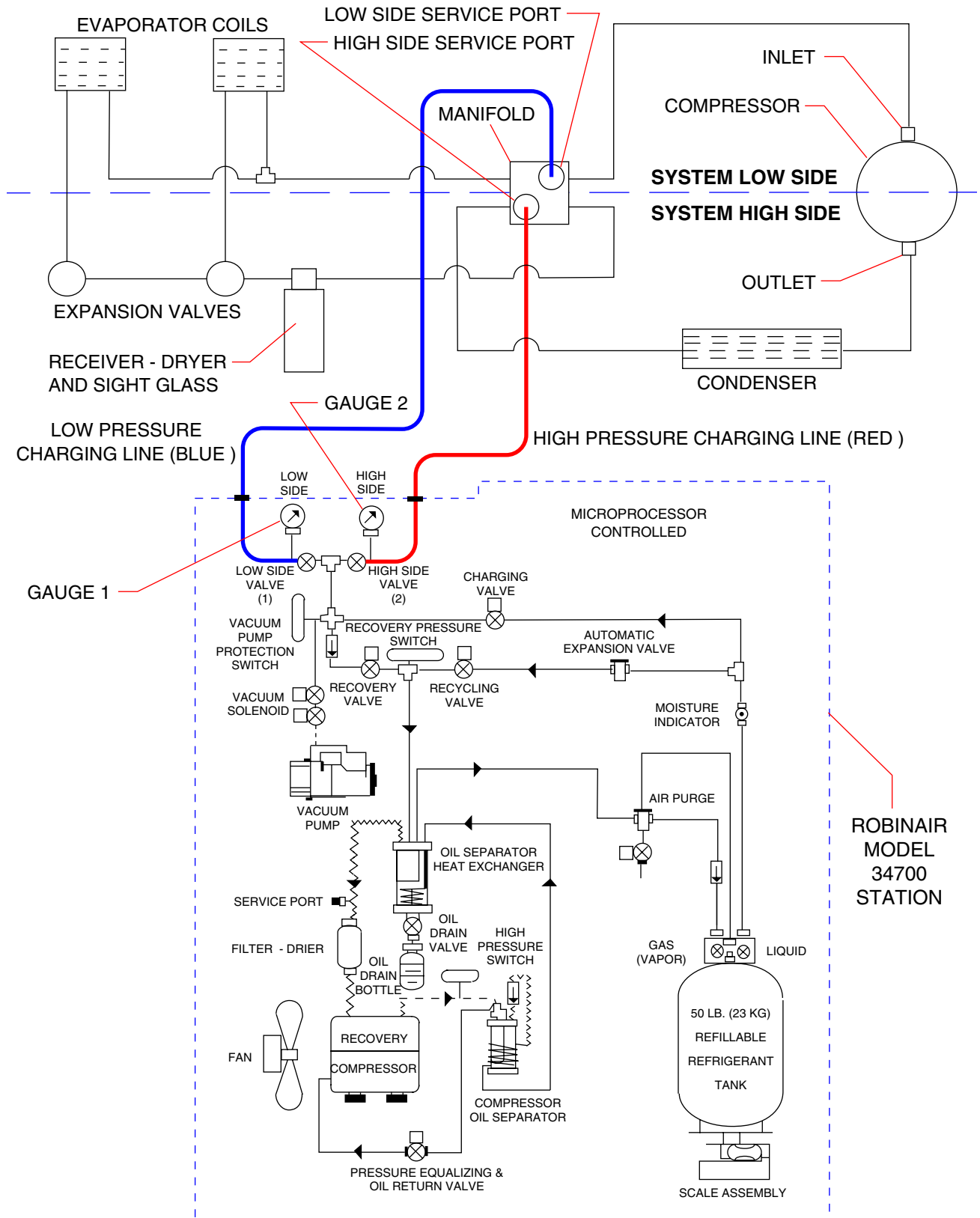
- 3 Open the low side (blue) valve on the unit's control panel.
- 4 If the messages PROGRAM and CHARGE do not display, press the CHG key to enter the PROGRAM mode.

CAUTION: ADD REFRIGERANT THROUGH THE LOW PRESSURE SIDE ONLY.

NOTE: The amount of refrigerant required must be determined for each airplane. It is the amount that will result in bubble-free operation at the system sight gauge. 1.5 lbs. is the nominal amount of refrigerant for the PA-46-350P.

- 5 Enter amount of refrigerant required to charge the system by pressing the appropriate number keys and ENTER on keypad.

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Robinair 34700 Charging Station Hose Hookup
Figure 6

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- 6 To begin charging process, press CHG key on keypad.
 - a The digital display will read AUTOMATIC and show the amount of refrigerant programmed for the charge.
 - b As the solenoid opens, it will make an audible sound.
 - c The display will count down to zero, and display message CPL, when charging is complete.
 - 7 Close low side (blue) valve. Check that the high (red) valve is also closed. Also close coupler valves.
 - 8 Perform Post Charging Operational Check, below.
- (5) Post Charging Operational Check

NOTE: The following assumes the charging stand is already connected to the airplane as described in Evacuating the System, above.

This procedure can also be used to top off a partially charged system with refrigerant.

- (a) Using a Kent Moore J23500 or similar charging stand (See Figures 4 and 5 - numbers in parentheses refer to Figure 4.)
 - 1 Ensure that the low pressure control valve (3) and the high pressure control valve (10) are closed.

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE. ENSURE AIRPLANE IS HEADED INTO WIND.
 - 3 Activate the system and operate the engine at 1,000 rpm for 2 minutes. Then operate the engine at 2,000 rpm for 2 minutes.
 - 4 Check the sight gauge on the receiver-dehydrator during the engine operation at 1,000 and 2,000 rpm. Any indication of bubbles passing the sight gauge indicates that additional refrigerant is required.
 - 5 If additional refrigerant is required, add it slowly through the refrigerant control valve (11) and the low pressure control valve (3) until the sight glass remains free of bubbles. Regulate the flow of refrigerant with the low pressure control valve. Do not allow the compound gauge (2) to exceed a reading of 40 psi.
 - 6 With the engine operating of 1,000-1,500 rpm, the low and high side gauges should indicate as shown in Chart 5.
 - 7 With the charge properly established, stop the engine.
 - 8 Close the low pressure control valve (3) and the refrigerant control valve (11).
 - 9 Remove the charging stand. Replace all protective caps, covers, and access panels.

**CHART 5
AMBIENT TEMPERATURE INDICATION**

Gauge	Ambient Temperature	Indication
Low Pressure	All	10 to 35 psig
High Pressure	Up thru 75°F	125 psig min to 175 psig max
High Pressure	Over 75°F	150 psig min to 275 psig max

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- (b) Using a Robinair 34700 charging station or equivalent (See Figures 3 and 6 - numbers in parentheses refer to Figure 6.)

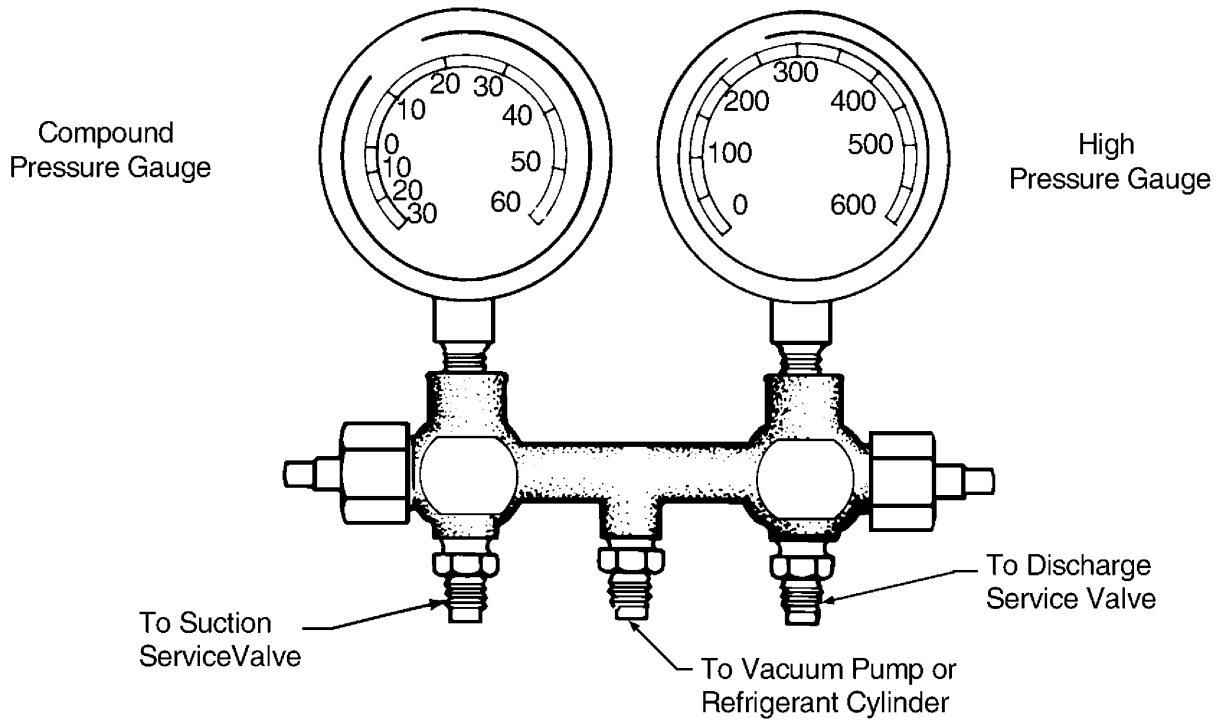
CAUTION: THE FOLLOWING PROCEDURE APPLIES TO ROBINAIR 34700 OR SIMILAR CHARGING STATION. SEE OPERATOR'S MANUAL OF CHARGING STATION BEING USED, FOR DETAILED INSTRUCTIONS FOR CHARGING SYSTEM.

- 1 Ensure that the low pressure control valve (1) and the high pressure control valve (2) are closed.
- 2 Ensure coupler valves are open.

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE. ENSURE AIRPLANE IS HEADED INTO WIND.

- 3 Activate the system and operate the engine at 1,000 rpm for 2 minutes. Then operate the engine at 2,000 rpm for 2 minutes.
- 4 Check the sight gauge on the receiver-dehydrator during the engine operation at 1,000 and 2,000 rpm. Any indication of bubbles passing the sight gauge indicates that additional refrigerant is required.
- 5 If additional refrigerant is required, add it slowly through the low pressure control valve (1) until the sight glass remains free of bubbles. Regulate the flow of refrigerant with the low pressure control valve. Do not allow the gauge (1) to exceed a reading of 40 psi.
- 6 With the engine operating of 1,000-1,500 rpm, the low (1) and high (2) side gauges should indicate as shown in Chart 5.
- 7 With the charge properly established, stop the engine and close the coupler valves.
- 8 Close the low pressure control valve (1).
- 9 Remove the charging stand. Replace all protective caps, covers, and access panels.

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Test Gauge and Manifold Set
Figure 7

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F. Servicing the System (with a Manifold Set)

(1) Test Gauge and Manifold Set

The proper testing and diagnosis of the air conditioning system require that a manifold gauge set (or a charging stand) be attached to the system. This set consists of two gauges mounted to a manifold. One gauge is a high pressure gauge used in the discharge side of the system. The other is a low pressure gauge used in the suction side of the system. The manifold is a device having fittings for both gauges and connection hoses with provisions for controlling the flow of refrigerant through the manifold. (See Figures 7 and 8.)

The center port of the manifold set is used for charging or evacuation procedures, or any other service that may be necessary.

Both the high or low side of the manifold have hand shut-off valves. When the hand valve is turned all the way in, in a clockwise direction, the manifold is closed. The pressures on that side of the system will, however, be recorded on the gauge above the hose.

Cracking the hand valve, in the counterclockwise direction, opens the systems to the middle service port of the manifold set. This is desirable only when it is necessary to let refrigerant out of or into the system. (See Figures 7 and 8.)

(2) Evacuating the System (See Figure 9.)

- (a) Ascertain that all system pressure is released.
- (b) Connect the manifold set hoses to the service ports and vacuum pump as shown in Figure 9.
- (c) Close the high side (pressure) and low side (suction) hand valves on the manifold set.
- (d) Start the vacuum pump.
- (e) Open the low side manifold set hand valve. The low side gauge should show a vacuum.
- (f) After five minutes of pump operation the high side gauge should indicate slightly below zero. If it does not, stop the pump and eliminate the blockage in the system by replacing the faulty component, then repeat the previous evacuation steps.
- (g) Operate the vacuum pump for fifteen minutes or until the low side gauge indicates 24 to 26 In. Hg. whichever occurs first.
- (h) Close the low side hand valve, stop the vacuum pump and observe the low side gauge. If the gauge rises at a rate faster than 1 In. Hg. in 5 minutes, there is a leak in the system. Locate and repair the leak (per the following instructions), then repeat the previous evacuation steps.
- (i) With both the low and high side valves open, continue the pumping and hold the system below 26 In. Hg. for a minimum of 30 minutes. All the previous pumping time may be included in the 30 minutes provided that no leaks or blockages are noted, and provided that the system is not opened by removal or disconnection of components.
- (j) Close the low and high side hand valves, stop the vacuum pump and perform the charging procedure immediately.

(3) Leak Detection (See Figure 10.)

- (a) Close both the low side and high side valves on manifold hand set.
- (b) Disconnect manifold hand set middle port (yellow) hose from low side port on charging stand and connect it to a container of R12 or HFC134a refrigerant, as appropriate.
- (c) Open refrigerant container service valve.
- (d) Open the manifold hand set high side valve until a pressure of 50 psig is reached on low side gauge. Close high side valve.
- (e) Locate leak(s) using an electronic leak detector designed to detect R12 and/or R134a refrigerant, as appropriate. Or, use soap and water in a thick solution.

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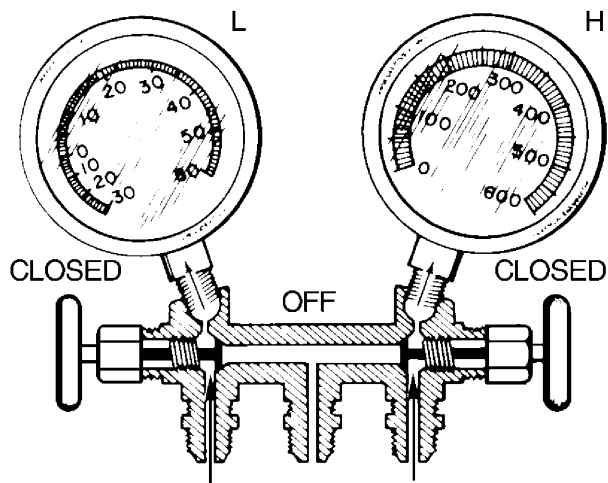


DIAGRAM A

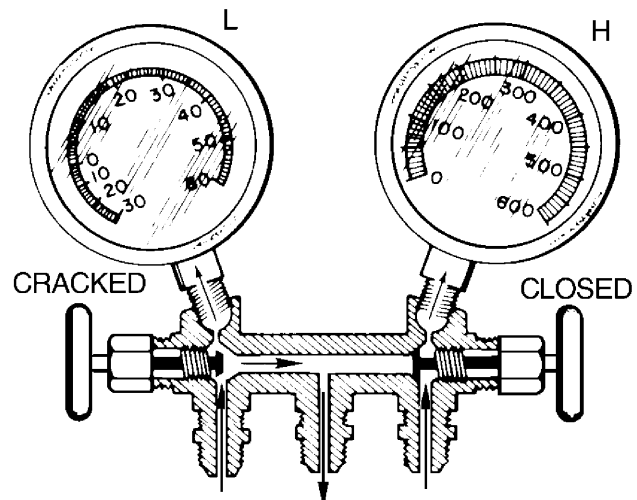


DIAGRAM B

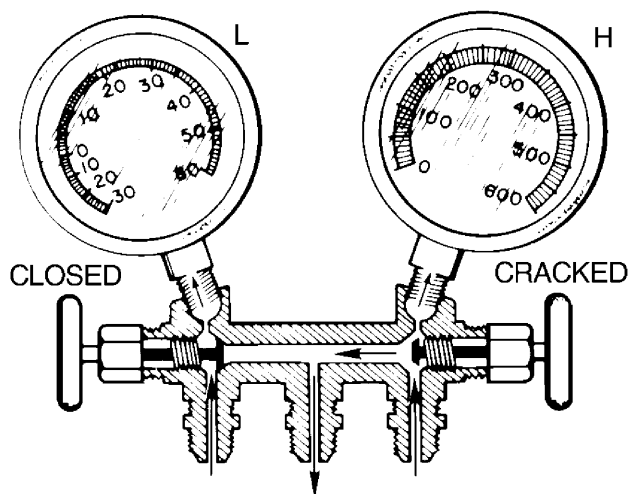


DIAGRAM C

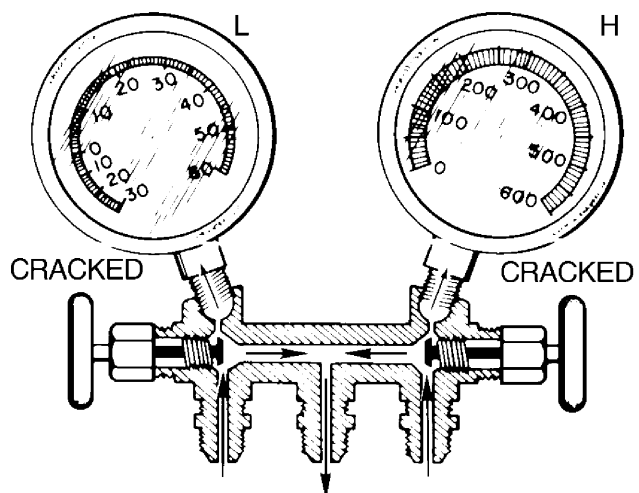
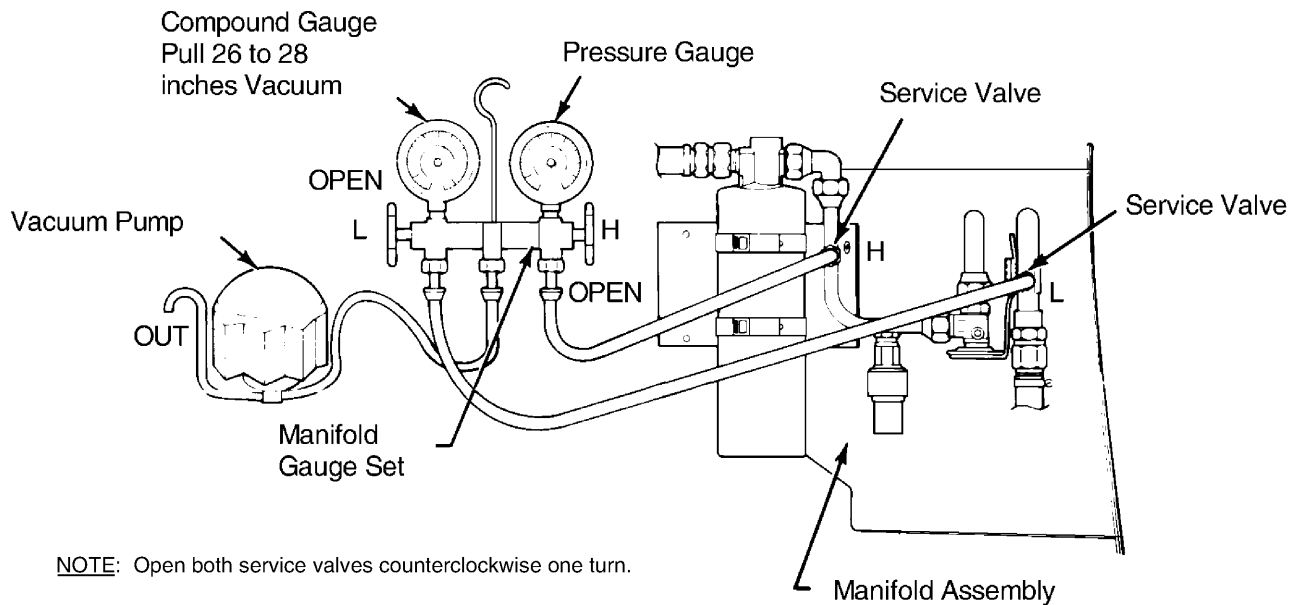


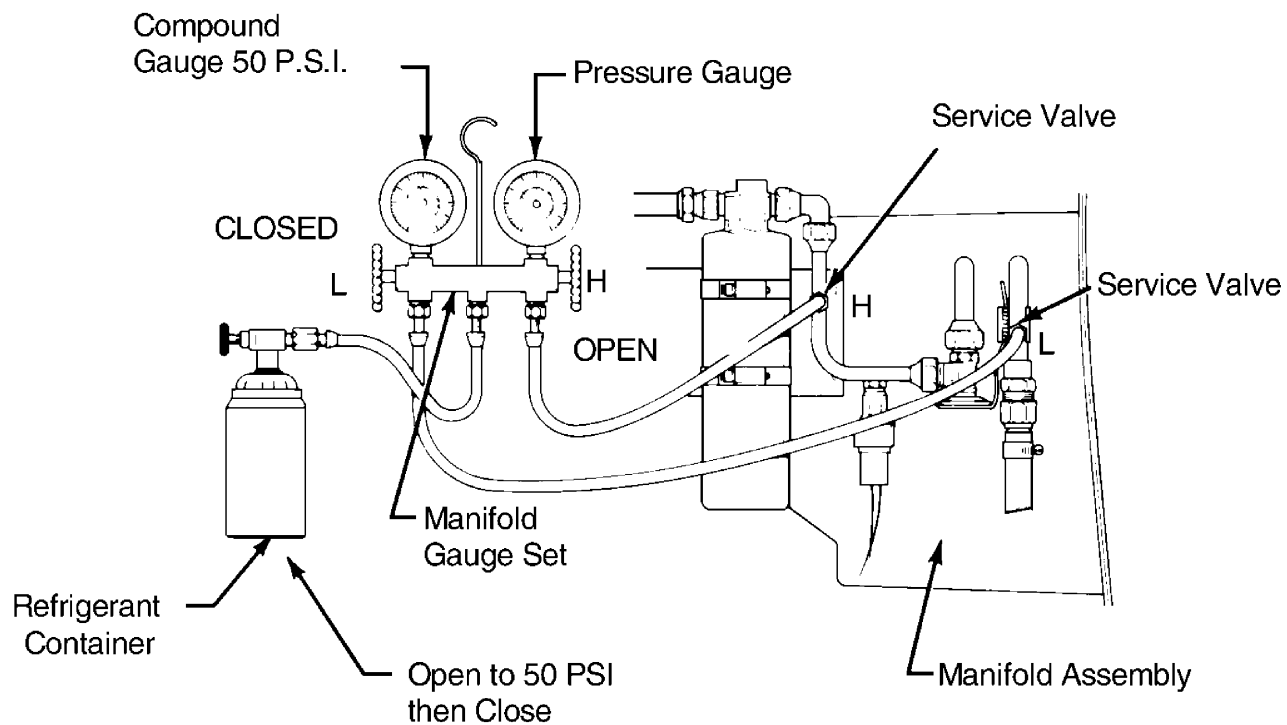
DIAGRAM D

Manifold Set Operation
Figure 8

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Evacuation Hookup
Figure 9



Leak Test Hookup
Figure 10

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- (f) Tighten/re-tighten fittings as necessary to stop leak(s). If leaks are due to damaged or worn components, proceed with refrigerant recovery/system discharge, perform repairs or component replacement and repeat leak detection procedure.
- (g) Check that the both high side and low side valves on the manifold hand set are closed.
- (h) Close service valve on refrigerant container. Disconnect yellow manifold hand set center hose from refrigerant container.
- (i) On systems equipped with quick disconnect connections, close coupler valves. Disconnect manifold hand set red and blue hoses from airplane service ports. Remove manifold hand set.
- (j) Recover remaining refrigerant from system using the Robinair 34700 (or other approved) charging station (ref. paragraph 3.C.(1)). Any quantity of oil recovered from aircraft must be measured and an equal amount of new oil (mineral oil or P. A. G., as appropriate) must be added to system before recharging.
- (k) On systems equipped with quick disconnect connections, close coupler valves. Disconnect charging/test station from service ports.
- (l) Perform evacuation procedure per Evacuating the System, above.
- (m) Immediately charge system per Charging the System, above or below.

(4) Charging the System

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

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE.

- (a) Keep the system under the vacuum established during the evacuating procedure with both hand valves in the closed position. Disconnect evacuation set-up, if not already disconnected.
- (b) Attach a container of the appropriate refrigerant to the manifold set and open the container service valve.
- (c) Loosen the center hose at the manifold set until a hiss can be heard. Allow the gas to escape for 2 to 3 seconds, then tighten the connection.
- (d) Open the high side manifold set hand valve, observe the low side gauge, then close the high side hand valve. The low side gauge should immediately change from an indication of a vacuum to an indication of pressure. If it does not, the system is blocked, and the blockage must be corrected before proceeding.
- (e) Start the engine and operate it at 1000 rpm.
- (f) Adjust the airplane air conditioning controls for maximum cooling, high blower speed.
- (g) Keep the refrigerant cylinder in an upright position. A slug of liquid refrigerant entering the system would damage the compressor.
- (h) Open the low side manifold set hand valve and allow 1.5 pounds of refrigerant in the gas state to enter the system.
- (i) Close the low side manifold set hand valve.
- (j) Proceed with the Post Charging Operation Check, below.

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(5) Post Charging Operational Check

This procedure can also be used to top off the system with refrigerant.

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE.

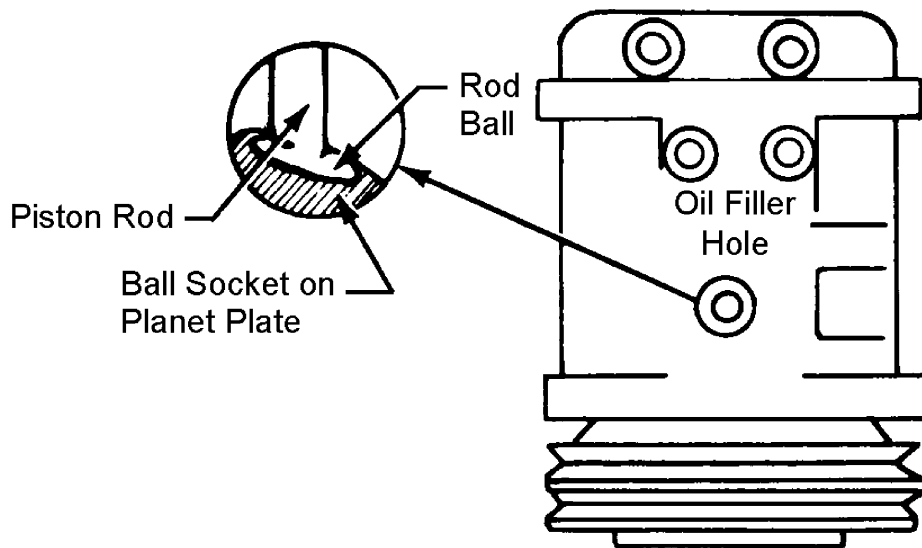
NOTE: Head the airplane into the wind during these checks.

- (a) With the manifold set installed, and both hand valves closed, actuate the system and operate the engine at 1,000 rpm for two minutes, then operate the system at 2,000 rpm for 2 minutes.
- (b) Check the system sight gauge (on the receiver-dehydrator) during operation at 1,000 and 2,000 rpm. Any indication of bubbles passing the sight gauge indicates that additional refrigerant is required.
- (c) Add additional refrigerant slowly through the low side manifold set hand valve until the sight glass remains free of bubbles.
- (d) Close the low side hand valve and refrigerant container valve.
- (e) With the engine operating at 1,000 to 1,500 rpm, the gauges should indicate as shown in Chart 6.
- (f) Once the charge is properly established, stop the engine, close the refrigerant container service valve. Remove the manifold set and replace all protective caps, covers, and access panels.

**CHART 6
AMBIENT TEMPERATURE INDICATION**

GAUGE	AMBIENT TEMPERATURE	INDICATION
Low Pressure	All	10 to 35 psig
High Pressure	Up thru 75°F	125 psig min to 175 psig max
High Pressure	Over 75°F	150 psig min to 275 psig max

TOP VIEW



Positioning Sanden Compressor Internal Parts
Figure 11

G. Compressor

The engine driven compressor is mounted on the forward, left section of the engine. A V-belt connected to the starter ring gear pulley drives the compressor through a magnetic clutch.

(1) Compressor Service

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

Maintenance to the Sanden compressor is limited to Removal and Installation of Compressor, checking the compressor oil level and replacement of worn drive belt. Contact Sanden International, for special tools and instructions for detailed compressor maintenance. (Refer to the Vendor List in the Introduction Section for the address, and phone number.)

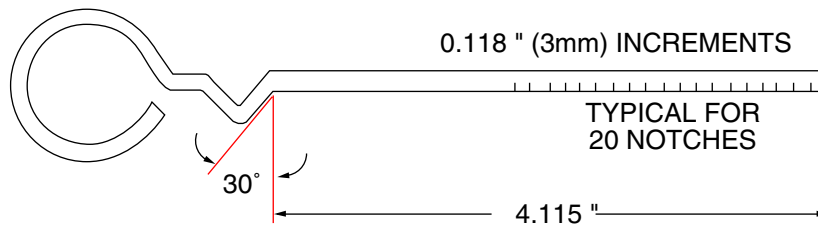
CAUTION: AN IMPORTANT FACTOR IN AIR CONDITIONING SERVICING IS CLEANLINESS. TAKE CARE TO PREVENT DIRT OR FOREIGN MATERIAL FROM ENTERING THE SYSTEM. ALL HOSE AND TUBING ENDS SHOULD BE CAPPED IMMEDIATELY. ANY LUBRICATION REQUIRED IN THE ASSEMBLY OF THE COMPONENTS SHOULD BE REFRIGERANT OIL OF THE TYPE USED IN THE COMPRESSOR.

(2) Removal

Remove the compressor as follows:

- Be sure the air conditioning circuit protector is in the off position.
- Remove upper engine cowl and left hand half of nose bowl cowl.
- Disconnect the electrical leads to the magnetic clutch on the compressor.
- Discharge the air conditioning system to an appropriate environmentally approved refrigerant recovery station. See Servicing the System, Discharging, above.

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Fabricated Dipstick for Sanden Compressor Oil Check
Figure 12

- (e) Remove the suction and discharge lines from the connections on the compressor.

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

- (f) Remove forward, left hand engine baffles as required.
- (g) Loosen compressor attach bolts to relieve belt tension.
- (h) Remove belt.
- (i) Support compressor and remove the attachment bolts.

(3) Installation

Install the compressor as follows:

- (a) Place compressor in mounting brackets and install attach bolts.
- (b) Install compressor drive belt. Rotate compressor drive belt. Adjust belt tension (see below).
- (c) Check oil level in compressor. (See Checking Compressor Oil Level, below.)
- (d) Connect the discharge and suction lines to their respective fittings.
- (e) Install engine baffles.
- (f) Evacuate and charge the system per instructions given above.

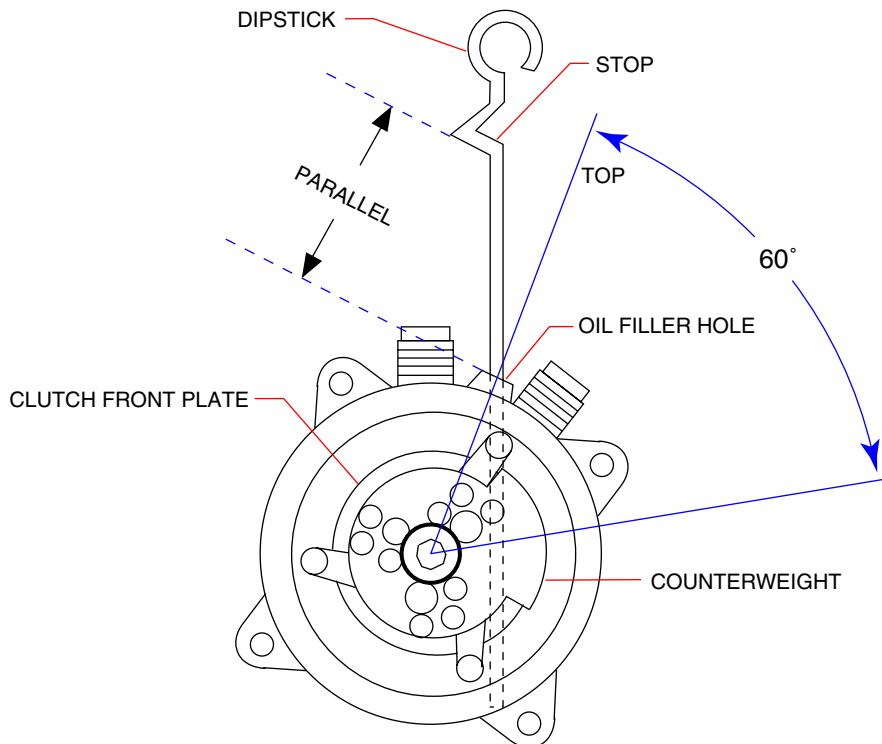
(4) Checking Compressor Oil Level

Whenever a system component has been replaced or there is an obvious leak, use the following procedure to check the compressor oil level (after making necessary repairs):

- (a) Run compressor for 10 minutes at engine idle rpm.
- (b) Recover all refrigerant from the system. See Servicing the System, Discharging, above. Be careful not to lose oil.
- (c) Determine the compressor mounting angle by positioning the angle gauge (Sanden P/N 32448 or a propeller protractor) across the flat surfaces of the two front mounting ears.
- (d) Center the bubble and read the mounting angle to the closest degree.
- (e) Remove the oil filler plug.
- (f) While looking through the oil filler plug hole and observing the internal parts (see Figure 11), rotate the counterweight. Stop the counterweight in the position shown in Figure 13 as the internal parts are moving to the rear of the compressor (discharge stroke).

NOTE: This step clears the internal parts to allow the dipstick to be inserted to full depth.

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Sanden Compressor Mounting Angle
Figure 13

- (g) Insert the dipstick to its stop position (Refer to Figure 13). The stop is the angle near the top of the dipstick.
 - 1 The point of the angle must be to the left if the mounting angle is to the right.
 - 2 The bottom surface of the angle must be flush with the surface of the oil filler hole.
- (h) Remove the dipstick and count the increments of oil.
- (i) Use Chart 7 to determine the correct oil level for the mounting angle of the compressor.
- (j) If the increments read on the dipstick do not match the table, add or subtract oil to obtain the mid-range value.
- (k) Install the oil filler plug, first checking that the sealing O-ring is not twisted. Ensure that the seat and O-ring are clean.
- (l) Torque the plug from 6 to 9 foot-pounds (0.8 to 1.2 kg-m). Do not over tighten the plug to stop a leak, If plug leaks, remove it, and install a new O-ring.
- (m) Recharge the system per Servicing the System, Charging, above.
- (5) Adjustment of Drive Belt Tension

NOTE: An alternate method of checking belt tension is by measuring the torque required to "slip" the belt at the small pulley. See Chart 8.

Adjust the A/C compressor belt tension as follows:

- (a) Initial adjustment of a new belt requires a mid-span deflection of .31 IN. at 14 lbs. load.
- (b) Service adjustment of a used belt is a mid-span deflection of .31 IN. at 10 lbs. load.

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**CHART 7
SANDEN SD 505 COMPRESSOR MOUNTING ANGLE/OIL LEVEL**

Mounting Angle Degree	Acceptable Oil Level In Increments
0	4-6
10	6-8
20	8-10
30	10-11
40	11-12
50	12-13
60	12-13
90	15-16

**CHART 8
SLIP TORQUE**

Belt Width	Belt Condition	'Slip' Torque
3/8	NEW	12 FT.LBS. ±1
3/8	USED	8 FT. LBS. ±1
1/2	NEW	14 FT. LBS. ±1
1/2	USED	10 FT. LBS. ±1

H. Refrigerant Lines and Routing

NOTE: In S/N's 4636187 and up (i.e. - HFC-134a equipped), hoses are nylon-lined.

The refrigerant lines in this airplane are flexible high pressure hoses and should be handled accordingly. The hoses in the power plant area are routed so as to provide maximum protection from heat and abrasion.

From the firewall, the hoses are routed underneath the battery, underneath the left cabin floor back to the manifold assembly, receiver-dehydrator and evaporators. From these components, the lines continue back to the condenser.

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

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I. Evaporator/Blower Assembly

The two evaporators are located beneath the floor aft of the rib at F.S. 233.87.

(1) Removal

- (a) Discharge the system into an appropriate, environmentally-approved, refrigerant recovery station.
- (b) Remove the refrigerant lines from the inboard side of the evaporator.
- (c) Disconnect the duct from the lower outboard side of the blower.
- (d) Remove the nuts and washers that secure the evaporator/blower assembly to the F.S. 233.87 rib.
- (e) Disconnect the electrical leads from the motor.
- (f) Remove the evaporator/blower assembly.

(2) Installation

- (a) Position the evaporator/blower assembly on the rib at F.S. 233.87 and secure it there with the nuts and washers.
- (b) Connect the electrical leads to the motor.
- (c) Connect the duct to the lower outboard side of the blower.
- (d) Connect the refrigerant lines to the inboard side of the evaporator.
- (e) Charge the system.

J. Expansion Valve

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

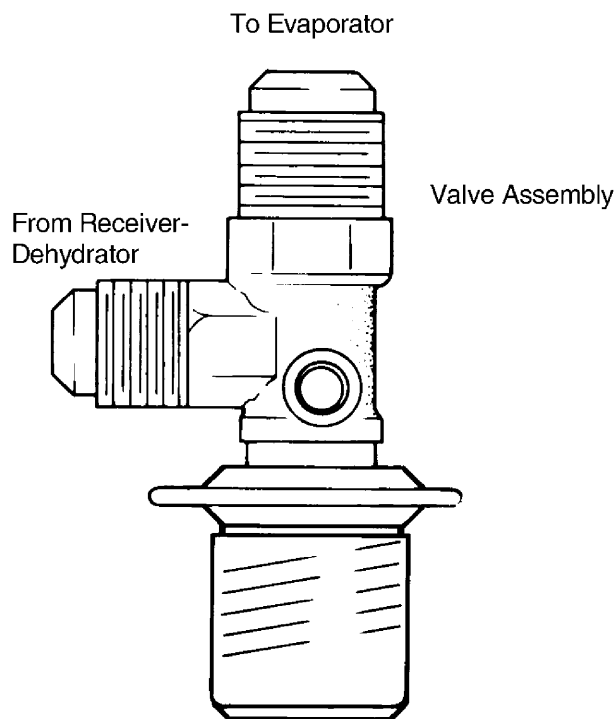
(1) Removal

The expansion valves are located on the upper inboard corners of the evaporator assemblies between the receiver-dehydrator and the evaporator inlet.

- (a) Remove the necessary access panels and discharge system into an appropriate, environmentally-approved, refrigerant recovery station.
- (b) Uncouple all related tube fittings. (see Special Servicing Procedures, above.)

(2) Installation

- (a) Install the expansion valve in the inlet line of the evaporator core by coupling the related fittings. (In R-12 systems only, seal all couplings with sealant (i.e. - Loctite Refrigerant Sealant) applied to tube flanges only.) Torque fittings per Chart 3.
- (b) Evacuate and charge the system. Check for leaks. (See Servicing the System, above.)
- (c) Reinstall any access panels that were previously removed.



Expansion Valve
Figure 14

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K. Condenser

The condenser, blower motor and exhaust duct assemblies are located in the aft fuselage between F.S. 282.00 and F.S. 292.00 (forward of the aft fuselage access panel).

(1) Removal

- (a) Remove the aft fuselage access panel.
- (b) Discharge the air conditioning system.
- (c) Disconnect and cap the lines going to the condenser. Cap inlet and outlet ports on the condenser.
- (d) Remove the screws which secure the lower end of the duct to the fuselage skin forward of the aft fuselage access panel.
- (e) Remove the bolts, washers, screws and nuts that secure the upper end of the duct to the supports and to the condenser assembly.

NOTE: With the bolts and screws removed from the duct assembly, there is no support for the condenser and it is free to fall.

- (f) Carefully position the duct out of the way and remove the condenser.

(2) Installation

- (a) Remove caps from lines and ports on condenser.
- (b) Position condenser between brackets and align the bolt holes in the supports, condenser and upper end of the duct. Install the bolts, washers, screws and nuts.
- (c) Secure the lower end of the duct to the fuselage skin with the screws.
- (d) Reconnect the lines to the condenser.

NOTE: Whenever the air conditioning system has been open to the atmosphere, it is recommended that the receiver-dehydrator be replaced.

- (e) Evacuate and recharge the system per instructions in this section.
- (f) When the system is completely charged, check it for any leaks.
- (g) Reinstall the aft fuselage access panel.

L. Condenser Blower Motor Assembly

The condenser blower motor assembly is located in the condenser exhaust duct. Access to the motor is through the rear fuselage access panel and the removable access panel on the aft side of the duct assembly.

(1) Removal

- (a) Remove the aft fuselage access panel.
- (b) Remove the bolts, washers and nuts that secure the duct access panel to the duct, condenser and condenser support. Remove the duct access panel.
- (c) Disconnect the electrical leads from the blower motor.
- (d) Lift the blower motor and bracket from the duct.

(2) Installation

- (a) Position the blower motor and bracket assembly in the duct.
- (b) Connect the electrical leads to the blower motor.
- (c) Secure the duct access panel to the duct, condenser and condenser supports with the bolts, washers, screws and nuts.
- (d) Reinstall the aft fuselage access panel.

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M. Receiver - Dehydrator

The receiver-dehydrator is located beneath the floor on the left hand side. It is aft of the left evaporator module. The receiver-dehydrator is mounted to the aft side of the frame at F.S. 241.50.

The receiver-dehydrator should be replaced if the air conditioning system has been operating with a leak that would have allowed air to enter the system if the receiver-dehydrator is left open to the atmosphere, it should be replaced due to the loss of effectiveness of the drying compound it contains.

(1) Removal

- (a) Discharge the system into an appropriate, environmentally-approved, refrigerant recovery station.
- (b) Remove the two refrigerant lines that connect to the top of the receiver-dehydrator. Cap the lines.
- (c) In S/N's 4636187 and up, disconnect wiring to receiver-dehydrator mounted pressure switches.
- (d) Loosen the two clamps that secure the receiver-dehydrator and lift the receiver-dehydrator from its mount.

(2) Installation

- (a) Place the receiver-dehydrator in its mount.
- (b) Connect the two refrigerant lines to the top of the receiver-dehydrator.
- (c) Secure the receiver-dehydrator to its mount by tightening the two clamps around the receiver-dehydrator body.
- (d) In S/N's 4636187 and up, connect wiring to receiver-dehydrator mounted pressure switches.
- (e) Service the air conditioning system.

N. Manifold Assembly

The manifold assembly is located behind the receiver-dehydrator and is mounted to the forward face of the frame at F.S. 249.60.

The manifold assembly has the high pressure switch screwed into the high pressure port that goes through the manifold body and the low pressure switch screwed into the low pressure port that passes through the manifold body.

Two service valves are located on the top side of the manifold body. These service valves, and not the compressor mounted service valve, should be used for any hook ups when servicing the system. See Service Valves, above.

(1) Removal

- (a) Discharge the air conditioning system into an appropriate, environmentally-approved, refrigerant recovery station.
- (b) Disconnect the four refrigerant lines that go to the manifold assembly.
- (c) In S/N's 4636001 thru 4636186 only, disconnect wiring to manifold-mounted pressure switches.
- (d) Remove the two screws that secure the manifold to its mounting bracket and remove the manifold assembly.

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- (2) Installation
 - (a) Secure the manifold assembly to its mounting bracket with the two screws. The "H" for stamping should be forward.
 - (b) In S/N's 4636001 thru 4636186 only, connect wiring to manifold-mounted pressure switches.
 - (c) Connect the four refrigerant lines to the manifold assembly.
 - (d) Service the air conditioning system.
- O. Pressure Switches

In S/N's 4636001 thru 4636186 only, separate high and low pressure switches are located underneath the manifold assembly. See paragraph L, above.

In S/N's 4636187 and up, the high and low pressure switches have been incorporated into a single housing and are located on the receiver-dehydrator.

In either case, they control the system pressure by energizing or de-energizing the compressor clutch.

 - (1) Removal
 - (a) Discharge the air conditioning system into an appropriate, environmentally-approved, refrigerant recovery station.
 - (b) Gain access to the manifold assembly or receiver-dehydrator.
 - (c) Remove the electrical connections from the switch.
 - (d) Turn the switch out of the manifold or receiver-dehydrator body.
 - (e) Plug the switch hole in the manifold or receiver-dehydrator body.
 - (2) Installation
 - (a) Remove the plug from the switch hole in the manifold or receiver-dehydrator body.
 - (b) Lubricate the switch threads and packing with refrigerant oil and install the switch in the manifold or receiver-dehydrator body.
 - (c) Service the air conditioning system.
 - (d) Check operation of the switches.

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TEMPERATURE CONTROL

Cabin Air Temperature Control Valve

A. Removal

- (1) Disconnect the hose from between the heat muff and the duct on the left side of the cabin temperature control valve.
- (2) Disconnect the duct between the air inlet scoop and the under side of the cabin temperature control valve.
- (3) Disconnect the cabin temperature control valve flapper control cable from the cabin temperature control valve.
- (4) Remove the four bolts that attach the cabin air temperature valve to the air selector valve (through the firewall).
- (5) Remove the valve from the airplane.

B. Installation

- (1) Position the cabin temperature control valve in place.
- (2) Attach the cabin temperature control valve to the air selector valve through the firewall with four bolts. Ensure that the gasket is installed between the valves and firewall.
- (3) Attach the cabin temperature control valve flapper control cable to the cabin temperature control valve.
- (4) Connect the duct from the air inlet scoop to the under side of the cabin temperature control valve.
- (5) Connect the hose from the heat muff to the duct on the left side of the cabin temperature control valve.

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CHAPTER

22

AUTOFLIGHT

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CHAPTER 22

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AUTOPILOT

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

1. General (See Figure 1.)

An Autopilot/Flight Director (APFD) system is installed as standard equipment in the PA-46-350P.

A. S/N's 4636001 thru 4636247, less 4636160, (1995 - 1999)

A Bendix/King Autopilot/Flight Director (AP/FD), manufactured by then Allied Signal (now Honeywell), was installed in these airplanes. Maintenance information for those systems is not included in this manual. Follow the service literature published by the AP/FD equipment manufacturer. This includes mechanical service such as: adjusting bridle cable tension, servo removal and installation, servo clutch adjustments, etc.

King/Allied Signal technical support, parts support, and service literature can be obtained from:

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

B. S/N's 4636160, 4636248 and up (2000 and up):

The S-TEC System 55/55X is installed in these airplanes. Maintenance information for this system only is provided herein.

2. S-TEC System 55 / 55X

A. S-TEC System 55 (2000)

This system was adopted in 2000 and is installed as standard equipment in S/N's 4636160, 4636248 thru 4636313 only.

B. S-TEC System 55X (2002 and up)

This system was adopted in 2001 and is installed as standard equipment in S/N's 4636314 and up.

NOTE: No model year 2001 PA-46-350P airplanes were built.

NOTE: In S/N's 4636299 and 4636333 & up, for airplanes equipped with the Single Side EFIS Option or Avidyne Entegra Electronic Flight Information System (see 34-20-00); many of the individual components listed below (i.e. - HSI, Deviation Indicators, etc.) are replaced by the Primary Flight Display (PFD). See Figure 1 and the Avidyne AFM Supplement.

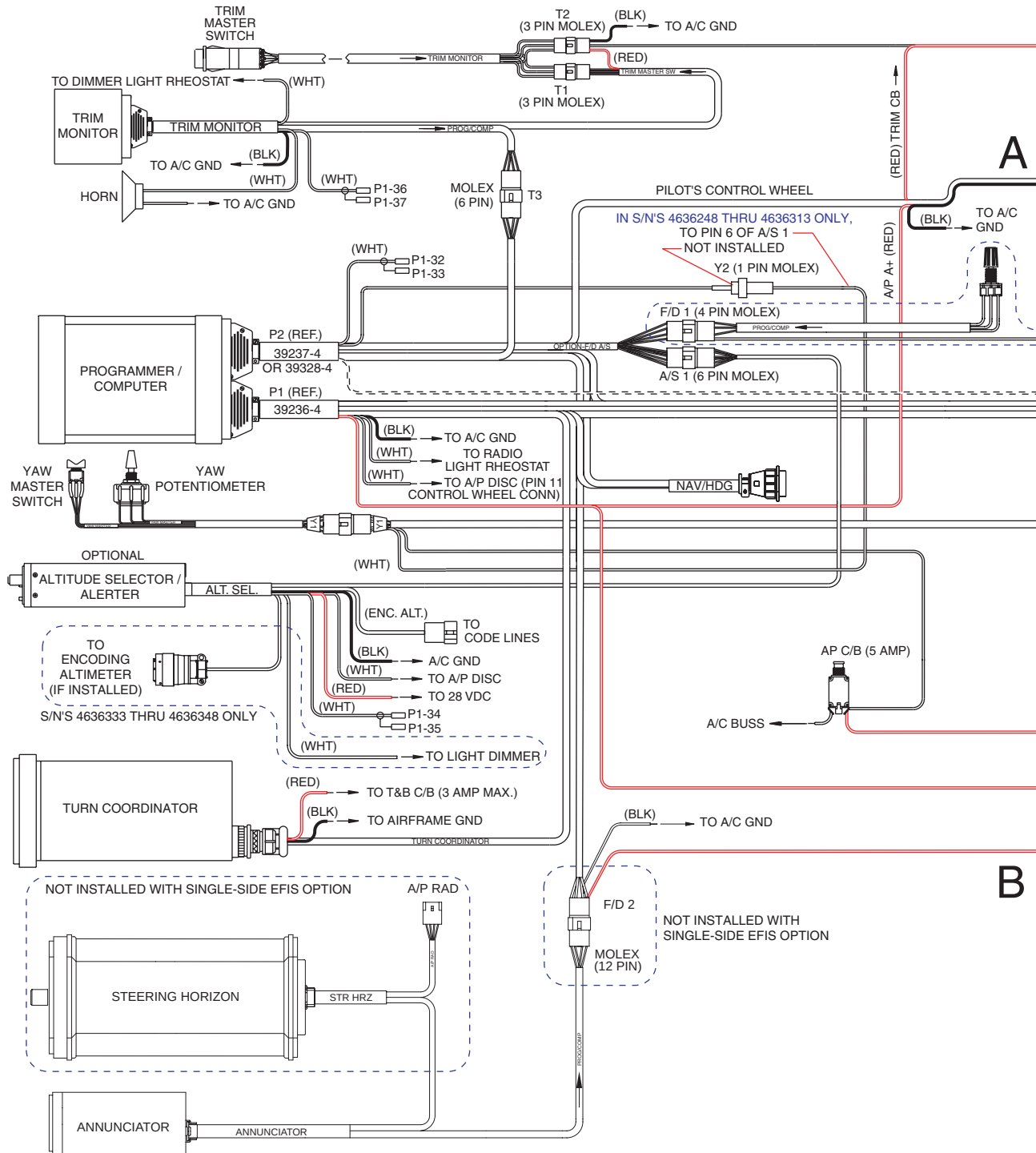
C. Description

The S-TEC System 55/55X is a rate based autopilot that controls the roll and pitch axis of the aircraft. The autopilot's main function is to convert pilot commands to logic signals for the roll and pitch computers. As the pilot enters the desired mode by pressing the appropriate mode selector switch, the computer acknowledges the mode, causing the appropriate annunciator to illuminate.

The Roll Computer receives select input signals from the Directional Gyro (DG) or Horizontal Situation Indicator (HSI), VHF Omnidirectional Radio (VOR), Localizer (LOC) or Global Positioning System (GPS), Deviation Indicators, and the Turn Coordinator. It then computes roll servo commands for stabilization, turns, navigation intercepts, and tracking.

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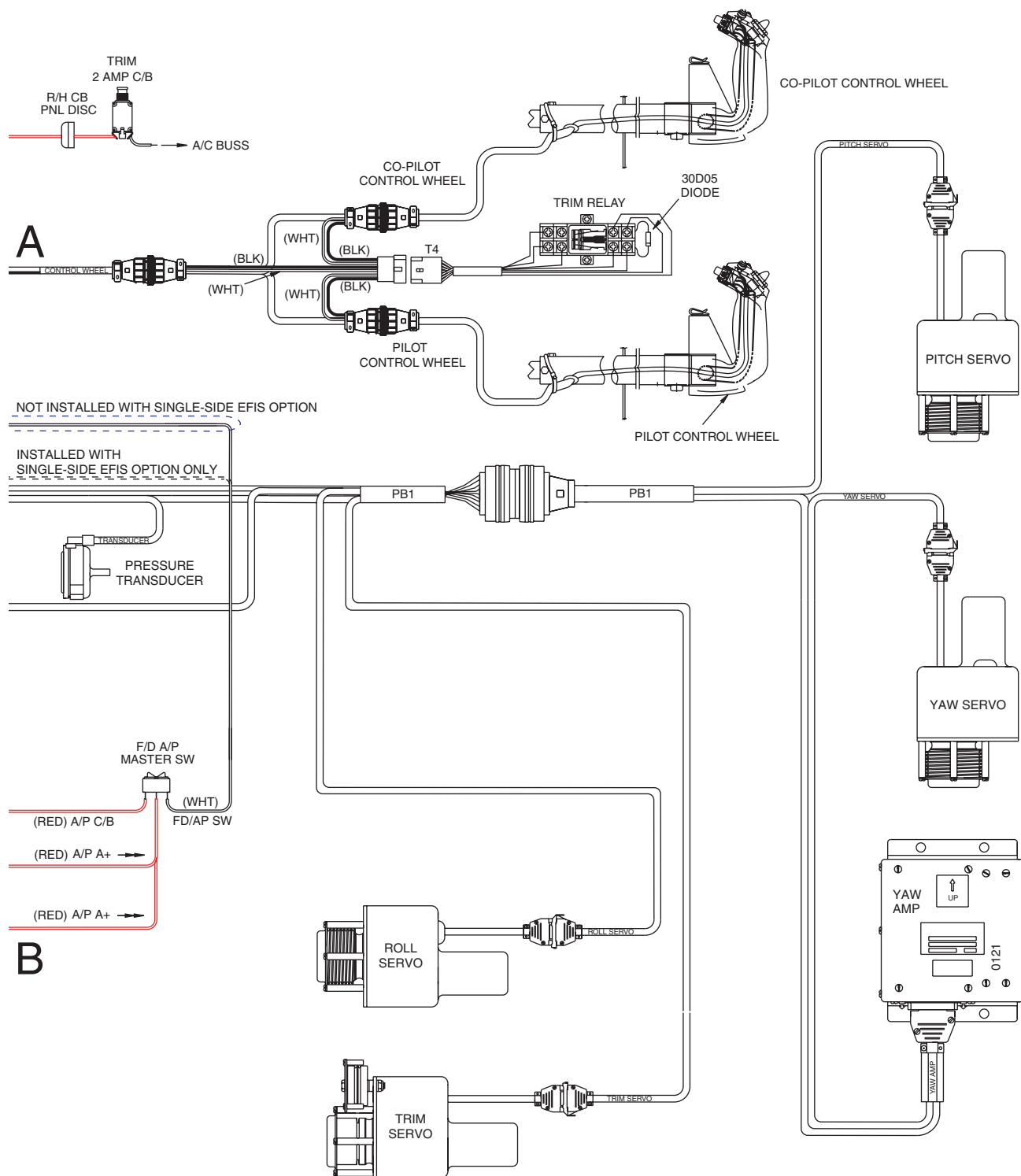
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Effectivity
4636160,
4636248 thru 4636374

S-TEC System 55/55X Autopilot/Flight Director Installation
Figure 1 (Sheet 1 of 5)

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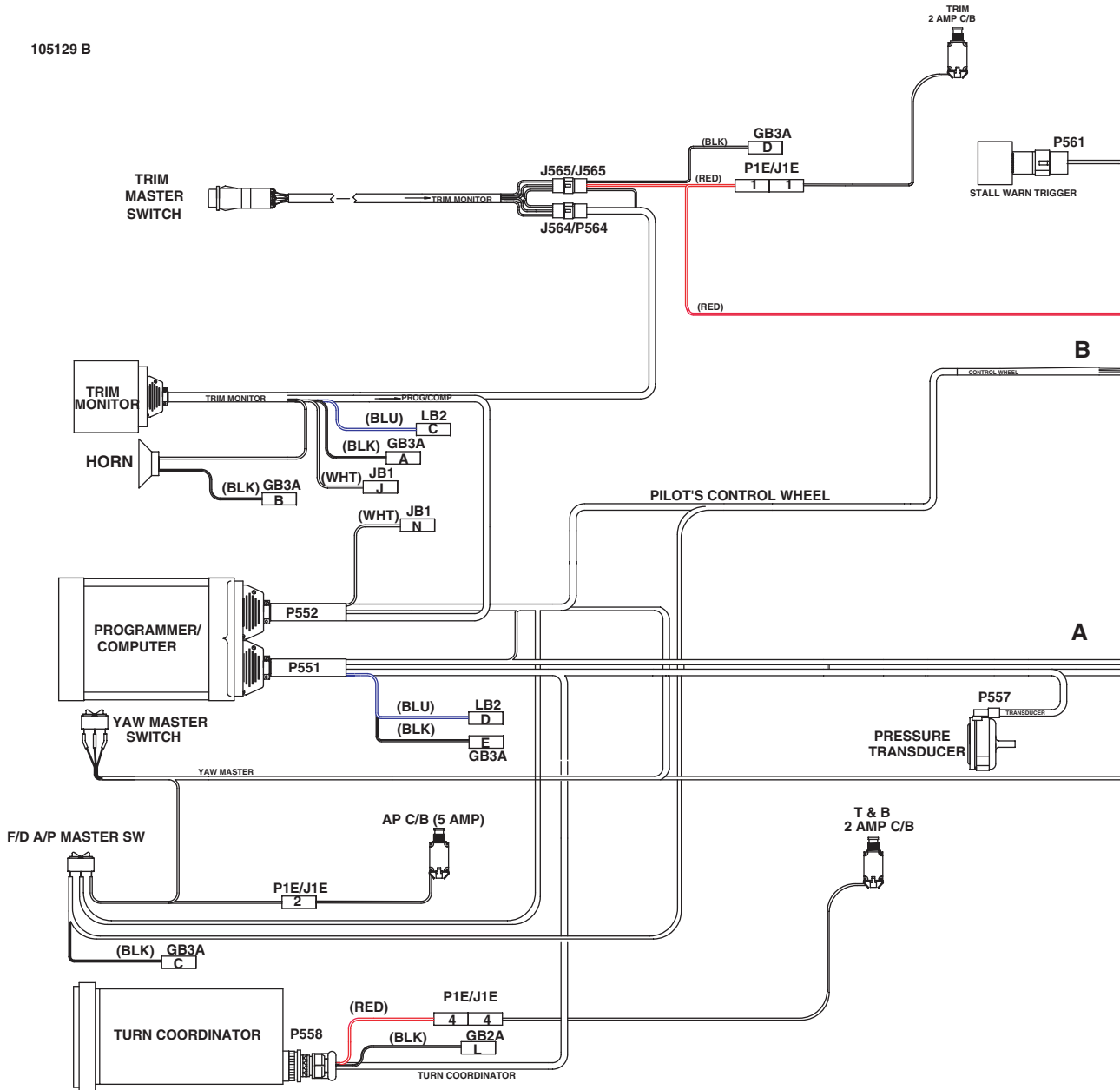


S-TEC System 55/55X Autopilot/Flight Director Installation
Figure 1 (Sheet 2 of 5)

Effectivity
4636160,
4636248 thru 4636374

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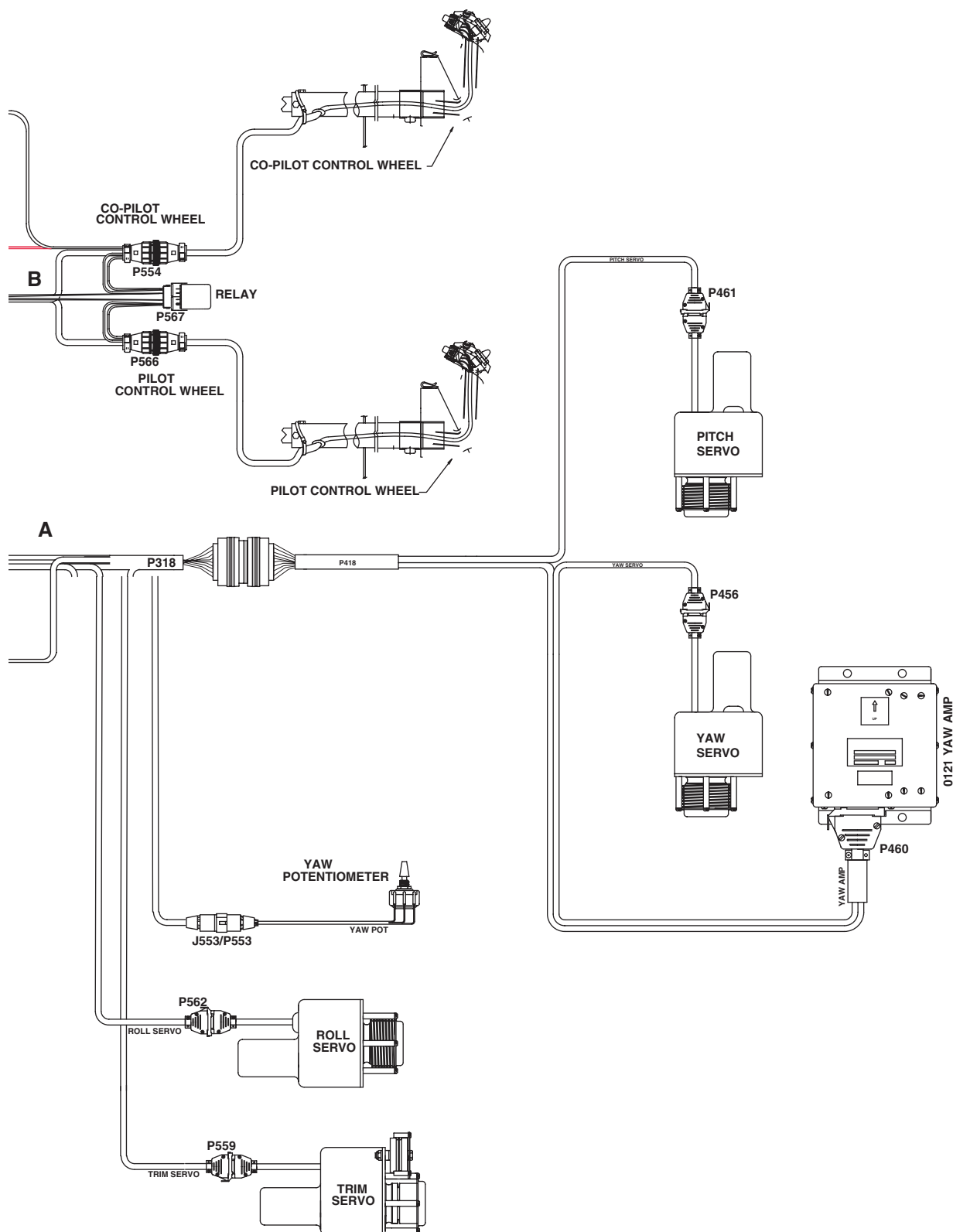
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Effectivity
4636375 and up

S-TEC System 55/55X Autopilot/Flight Director Installation
Figure 1 (Sheet 3 of 5)

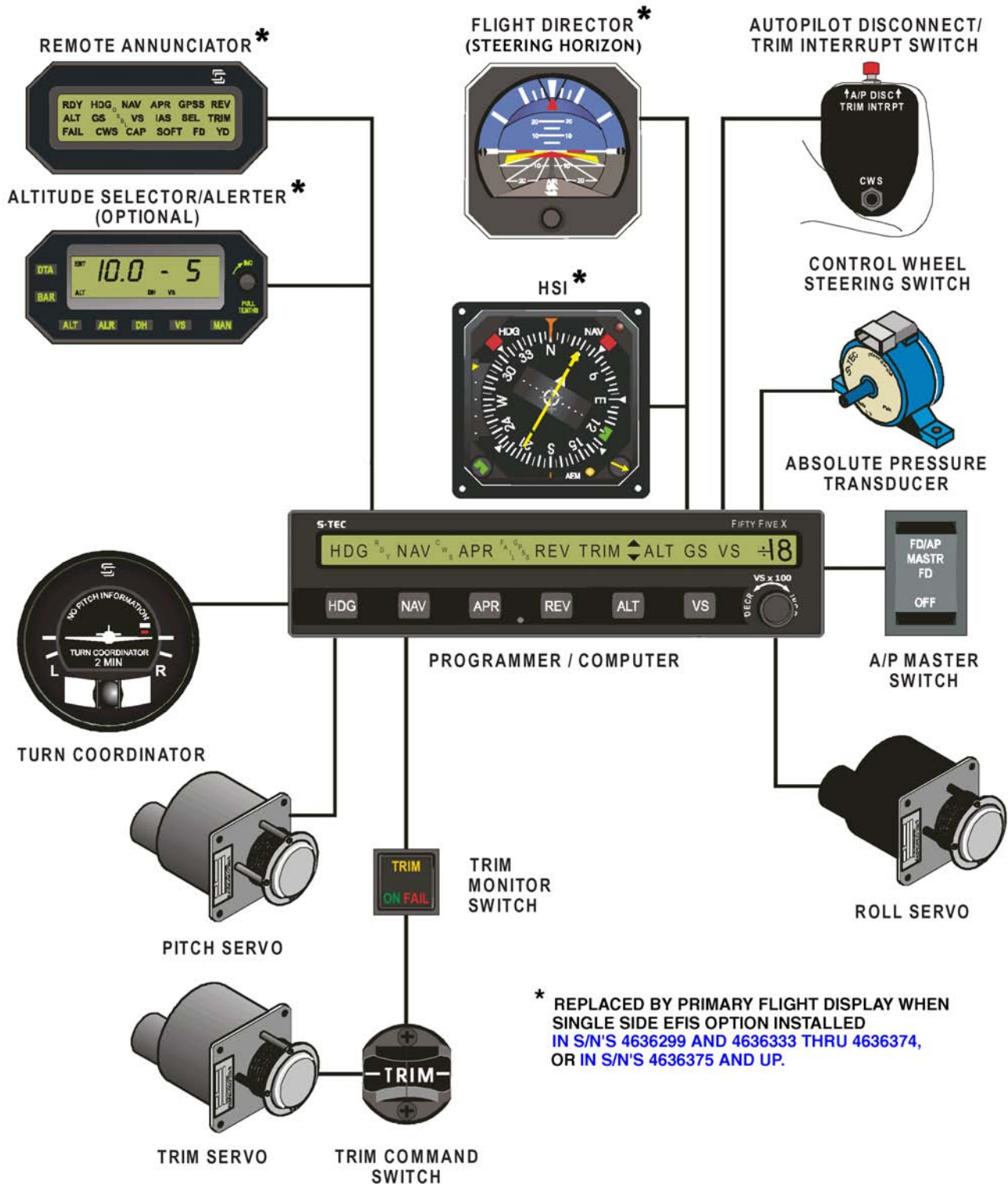
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S-TEC System 55/55X Autopilot/Flight Director Installation
Figure 1 (Sheet 4 of 5)

Effectivity
4636375 and up

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S-TEC System 55/55X Autopilot/Flight Director Installation
Figure 1 (Sheet 5 of 5)

Effectivity
4636160,
4636248 and up

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The Pitch Computer receives select input signals from the Altitude Pressure Transducer, Accelerometer, Glideslope Deviation Indicator and Altitude Selector/Alerter (if installed). It then computes pitch servo commands for vertical speed, altitude hold and glideslope intercept and tracking. Sensing for trim annunciation or automatic stabilator trim is provided by the pitch servo. Drive for the stabilator trim servo is provided by the pitch computer.

A typical S-TEC System 55/55X Autopilot installation includes the following:

(1) Panel Mounted:

Programmer/Computer, Turn Coordinator, Annunciator, D.G. or HSI, altitude selector/alerter, and Steering Horizon.

(2) Remote Mounted:

Roll Servo, Pitch Servo, Trim Servo, Trim Monitor, A/P Disconnect switch, and Altitude (Pressure) Transducer.

Servo installations use aluminum brackets to secure the servos to the airframe. Attachment to the airplane's primary flight control and trim systems is accomplished with bridle cables and extension attachments.

D. Troubleshooting

System functionality can be determined using functional checks described in the AFM Supplement and autopilot Pilot's Operating Handbook. More detailed troubleshooting should be accomplished by authorized S-TEC Dealers, holding the appropriate FAA certification, with required test equipment and service data.

E. GPSS (System 55X only.)

The Global Positioning System Steering (GPSS) is a function of the 55X autopilot only. In the GPSS mode, the converter receives ground speed and bank angle digital signals that are calculated and converted to a commanded turn rate. The turn rate is then scaled and converted to a DC heading error signal that is compatible with S-TEC autopilots. The end result is an autopilot that can be directly coupled to the roll steering commands produced by the GPS Navigator, eliminating the need for the pilot to make any further adjustments to the HSI course arrow or the DG's heading bug.

F. System Operation

Operation of the autopilot and other systems is described in the FAA-approved Airplane Flight Manual Supplement (AFMS) - see airplane Pilot's Operating Handbook (POH), Section 9. Specialized controls, annunciation, operation and interpretation are covered in this supplement and in the S-TEC Autopilot POH that supplements the approved AFMS.

G. Maintenance

Except as provided in 5-20-00, servicing and/or maintenance of the autopilot system is On-Condition.

NOTE: Servicing of S-TEC System 55/55X Autopilot installations is best accomplished by approved S-TEC dealers holding the appropriate FAA-certification. Locations of and access to the components installed are described and depicted individually below. Removal and replacement of components is generally indicated by functional checks provided in the AFM Supplement, S-TEC Autopilot POH and/or below.

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H. Post-Maintenance Operational Checkout

Complete the following checkout procedure after any maintenance to the system is performed.

NOTE: The Systems 55/55X incorporate a SELF-TEST that requires a 100% pass rate before the autopilot can be engaged.

NOTE: In S/N's 4636299 and 4636333 & up, for airplanes equipped with the Single Side EFIS Option or Avidyne Entegra Electronic Flight Information System (see 34-20-00), references below to the remote annunciator, flight director and HSI are to those functions in the Primary Flight Display (PFD).

- (1) Apply aircraft power.
- (2) Avionics Master Switch ON
- (3) Autopilot Master Switch Set to FD / AP

NOTE: Observe that all segments of the Programmer / Computer display and annunciators illuminate for five (5) seconds during test. Satisfactory completion of the SELF-TEST is indicated when the Ready (RDY) annunciator remains on at the end of the five (5) second self-test. Should a fault be detected, the FAIL annunciator will remain on at the conclusion of the self-test and the autopilot will not operate.

- (4) Trim Master (ON / OFF) Switch ON
- (5) HDG and VS switches PRESS / RELEASE
Ensure that HDG and VS illuminate on the Fifty Five X annunciator.
- (6) VS Knob ROTATE CW
Pitch control (i.e. - the control yoke) should move slowly out (pilot may have to assist a heavy yoke).
- (7) VS Knob ROTATE CCW
Pitch control should move slowly in.
- (8) A/P DISC Trim Interrupt Switch (on control yoke) PRESS
Verify the autopilot disconnects.
- (9) HDG Mode ENGAGE
- (10) DG or HSI HDG bug MOVE LT / RT
Roll control should follow the HDG bug.

NOTE: If HSI equipped, center the course arrow under the lubber line and push the NAV button. Move the course arrow on the HSI left then right. Roll control should follow the course arrow. Channel a valid VOR signal and move course arrow just enough to deflect the left / right needle one (1) or two (2) dots. Roll control should follow the Course Deviation Indicator (CDI) left / right needle during the test. (This test is only valid if the left / right needle is centered with the course arrow under the lubber line.)

NOTE: If DG equipped, center the HDG bug under the lubber line. Channel a valid VOR signal. Move the OBS to cause left / right CDI needle deflection. The roll control should follow the left / right needle movement.

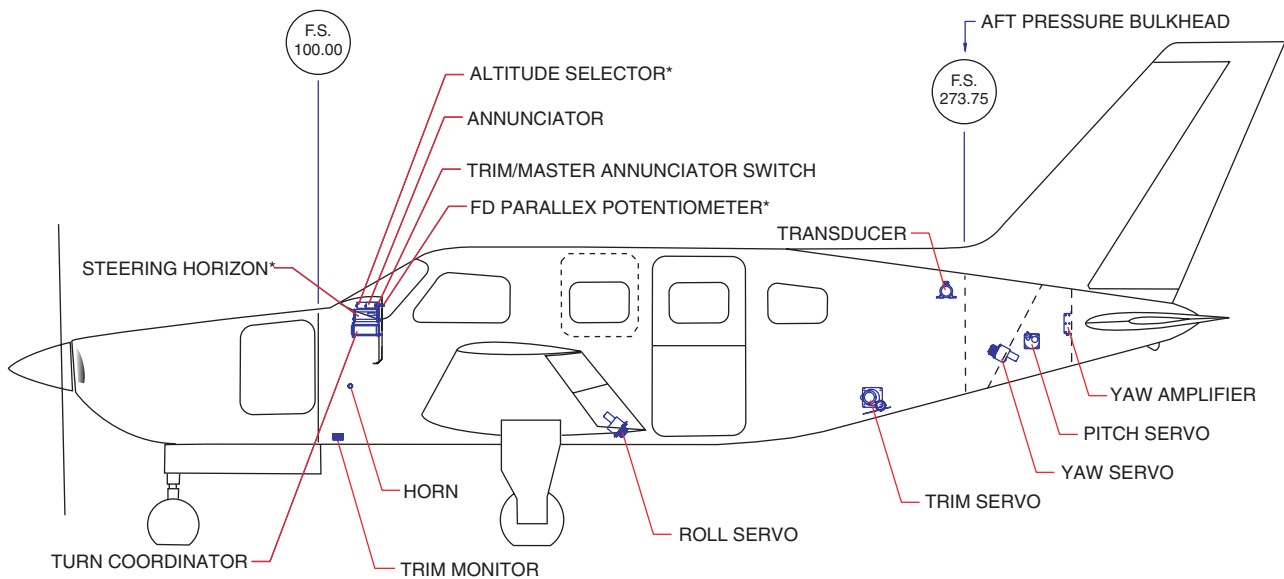
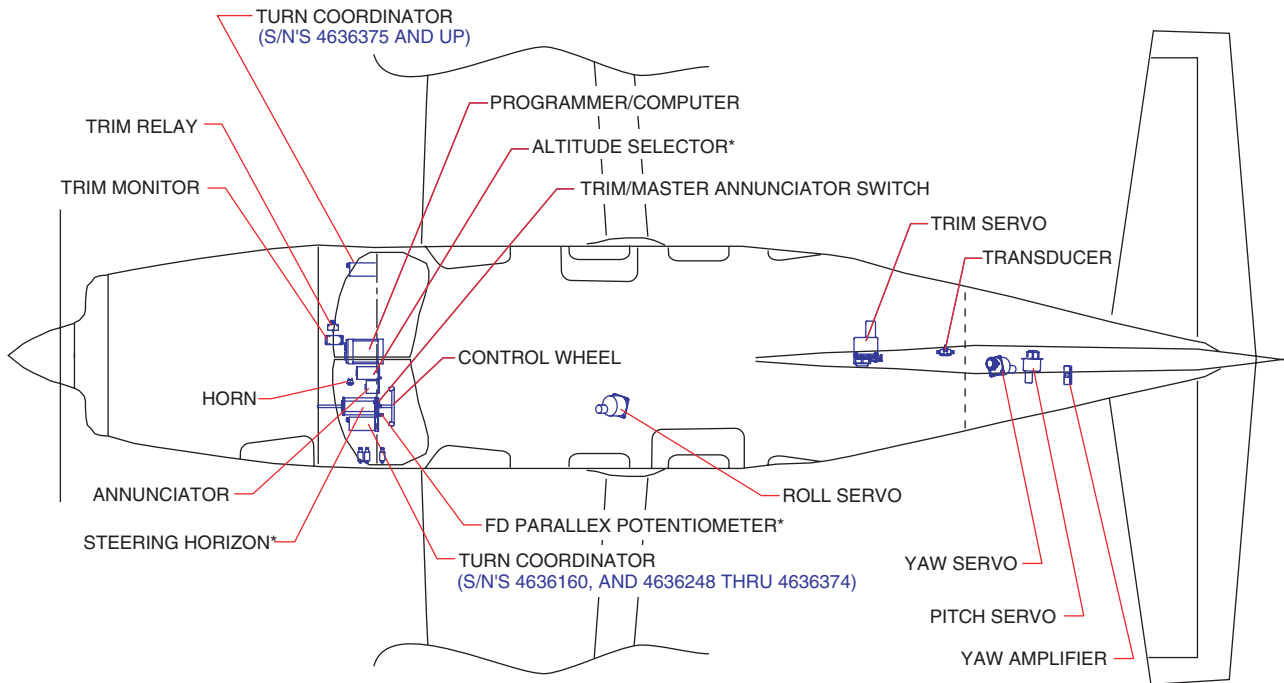
- (11) REV Mode button PUSH
Roll control should respond opposite to the course arrow and CDI left / right needle inputs.

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- (12) Altitude Hold (ALT) button PUSH
Slowly pull out (nose up) on the pitch control (i.e. - control yoke). Autotrim should run nose down with TRIM flashing on the remote annunciator and the autopilot computer / programmer after approximately 3 seconds. Slowly move control yoke forward (nose down). After 3 seconds, autotrim should move nose up with TRIM flashing on the remote annunciator and the autopilot computer / programmer after approximately 3 seconds.
- (13) Trim Master (ON / OFF) Switch OFF
- (14) Manual Electric Trim Test:
- (a) Trim Master (ON / OFF) Switch ON
- 1 Move each segment of the Manual Electric Trim Command Switch FWD and AFT.
Trim should not run.
- 2 Move both segments of the Trim Command switch FWD.
Trim should run nose down.
- 3 Move both segments of the Trim Command switch AFT.
Trim should run nose up.
- (b) Re-trim aircraft for takeoff and check controls for freedom of movement. Be sure the autopilot and trim servos are dis-engaged.
- (15) Flight Director Test:
- (a) Autopilot Master Switch SELECT FD
Note the roll, pitch and trim servos are disengaged. The steering bar should be in view on the attitude indicator.
- (b) HDG Mode ENGAGE
MOVE HDG bug 45 degrees left. The roll steering bar should slowly indicate a left steering command. Repeat the same test for the right side.
- (c) VS Mode ENGAGE
SELECT 1500 FPM rate of climb. Note the pitch steering bar moves slowly up. Repeat the same test for the down direction.
- (d) Autopilot Master Switch SELECT FD / AP
The servos should re-engage.
- (e) Trim Master ON / OFF Switch ON
- (f) Manual Electric Trim Command Switch MOVE FWD or AFT
The autopilot should disconnect.

NOTE: The Manual Electric Trim Command Switch will disconnect the autopilot only if there is a Pitch Mode engaged.

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*COMPONENTS NOT INSTALLED IN S/N'S 4636375 AND UP

Component Locator
Figure 2

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3. Components

A. Panel-Mounted Components

The flight director, HSI, autopilot programmer/computer, altitude selector/alerter (if installed), remote annunciator, and turn coordinator are either face-mounted or rack-mounted in the instrument panel. See 39-10-00 for removal and installation instructions.

B. Component Locator

See Figure 2.

C. Trim Monitor

The trim monitor is mounted on the underside of the fwd-most access panel in the cockpit floor at the co-pilot's feet.

(1) Removal

- (a) Remove carpet to expose access panel.
- (b) Remove screws holding access panel to floor and open access panel to expose trim monitor and autopilot harness.
- (c) Disconnect autopilot harness.
- (d) Remove screws (4) holding trim monitor to access panel and remove trim monitor.

(2) Installation

- (a) Place trim monitor in position on underside of access panel and secure with screws (4).
- (b) Connect autopilot harness.
- (c) Place access panel in position and secure with screws.
- (d) Replace carpet over access panel.
- (e) Check system operation - perform Manual Electric Trim Test under Post-Maintenance Operational Checkout, above.

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D. Roll Servo (See Figure 3.)

The roll servo is mounted underneath the left aft facing passenger seat or the entertainment cabinet, whichever is installed.

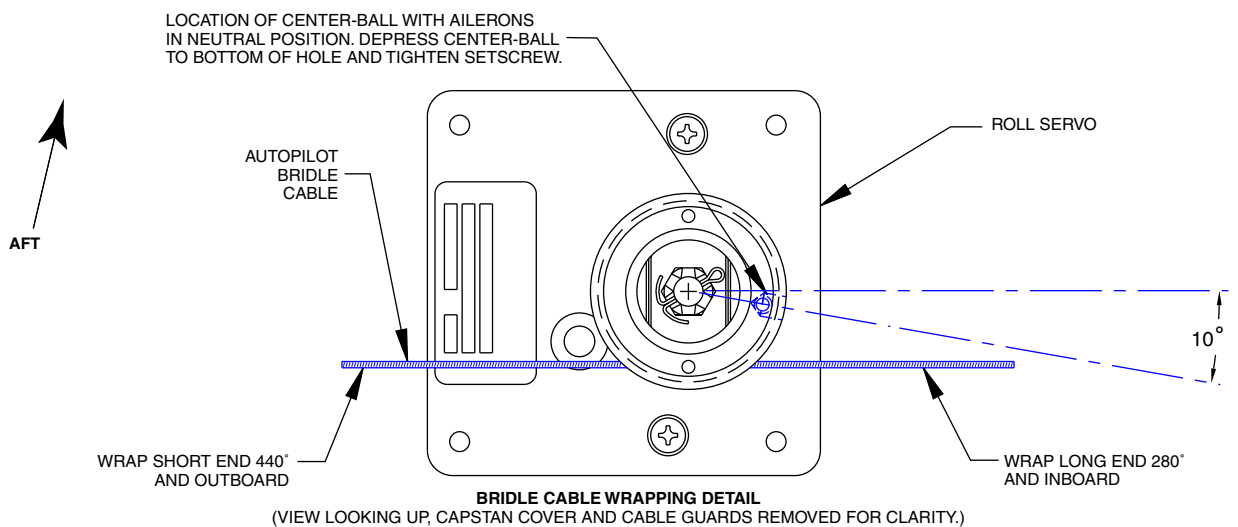
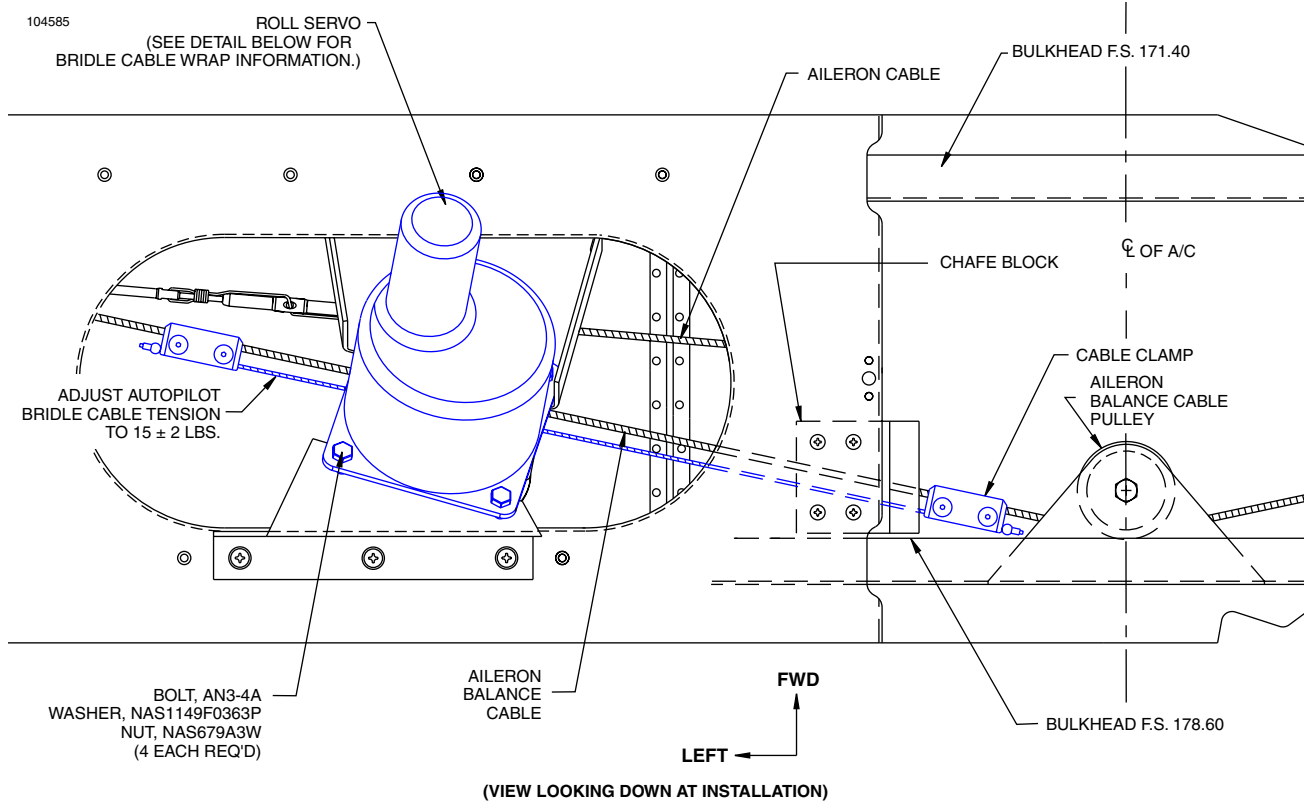
(1) Removal

- (a) Remove the aft facing passenger seat or entertainment cabinet, whichever is installed.
- (b) Remove adjacent carpet.
- (c) Remove screws securing centerline floor access panel and remove access panel.
- (d) Disconnect autopilot harness.
- (e) Remove nuts and bolts (2 ea.) securing each cable clamp (2) and remove cable clamps from aileron balance and autopilot bridle cables.
- (f) Remove nuts, washers, and bolts (4 ea.) securing roll servo to mounting brackets and remove roll servo with attached bridle cable.

(2) Installation

- (a) Rig ailerons per Aileron Control Rigging and Adjustment, 27-10-00.
- (b) Lock the control wheels together in the aileron neutral position using a suitable tool.
- (c) Lock the ailerons in neutral position using a suitable contour fixture at the inboard ends of the ailerons. Neutral position is defined by wing loft contour at this location.
- (d) Remove screws (4) and remove capstan cover and cable guards from servo.
- (e) Adjust roll servo clutch torque per Servo Clutch Torque Adjustment, below.
- (f) Wrap autopilot bridle cable, align capstan, and and tighten center-ball setscrew as shown in Figure 3.
- (g) Replace cable guards and capstan cover, secure with screws (4).
- (h) Position servo as shown in Figure 3 and install and secure nuts, washers, and bolts (4 ea.) holding servo to mounting brackets.
- (i) Position cable clamps (2) as shown in Figure 3 and tighten nuts and bolts (2 ea.). Adjust cable clamps in or out along the aileron balance cable to obtain a bridle cable tension as shown in Figure 3. Torque cable clamp bolts as specified in Figure 3.
- (j) Remove the locking fixtures. Aileron neutral position should be maintained at 0 ± 1 degree with the control wheels in neutral.
- (k) Use the pilot's control wheel to move the ailerons and verify aileron travel at the primary stops (at the aileron drive sectors on the wing spars) remains 18 ± 1 degree up and down.
- (l) Use the pilot's control wheel to hold the ailerons firmly against the primary stops. Verify the secondary aileron stops (on the forward pressure bulkhead) retain a cushion (gap) of 0.09 ± 0.03 inch in each direction.
- (m) If either step (i) or (j) reveal the aileron controls out of rig, repeat steps (a) thru (j), above.
- (n) Connect autopilot harness.
- (o) Check autopilot system for binding and proper operation, see Post-Maintenance Operational Checkout, above.
- (p) Check aileron controls for free and correct movement.
- (q) Replace centerline floor access panel and secure with screws.
- (r) Replace carpeting.
- (s) Replace the aft facing passenger seat or entertainment cabinet, whichever is installed.

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Roll Servo Installation
Figure 3

Effectivity
System 55X shown
System 55 similar

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E. Pressure Transducer

The pressure transducer is mounted just forward of the aft pressure bulkhead (F.S. 273.75) slightly to the right of the aircraft centerline and just below the aircraft upper skin. Access is through the cabin rear closeout panel.

(1) Removal

- (a) Disconnect the transducer from the static-system by cutting the Ty-wrap and pulling the static hose off of the transducer hose barb.
- (b) Disconnect the autopilot harness.
- (c) Remove screws, washers, and nuts (2 ea.) and remove transducer.

(2) Installation

- (a) Place transducer in position on bracket. Secure to bracket with screws, washers, and nuts (2 ea.)
- (b) Slide the static hose over the transducer hose barb and secure with a Ty-wrap.
- (c) Connect the autopilot harness.

F. Trim Servo (See Figure 4.)

The trim servo is located on the centerline underneath the baggage compartment floor, just forward of F.S. 249.60.

(1) Removal

- (a) Remove rear seats. Remove carpet and access panels from baggage compartment floor.
- (b) Remove the centerline access panels in the cabin floor to expose the plastic tube that protects the trim cables.
- (c) Remove the pins from both ends of the plastic tube.
- (d) Slide the tube forward.
- (e) Rotate the elevator trim control wheel until the right trim cable turnbuckle clears the aft end of the tube.
- (f) Tie a pull rope to the right trim cable forward of the exposed turnbuckle.
- (g) Tie a pull rope to the right trim cable aft of the idler pulley.
- (h) Tie-off both pull ropes to maintain tension on the left trim cable and the extreme forward and aft segments of the right trim cable (i.e. - forward of the turnbuckle and aft of the idler pulley).

NOTE: Tension must be applied to the trim cables to prevent the cables from unwrapping from the trim wheel drum or the trim actuator, and to prevent the cables from fouling at any of the pulleys.

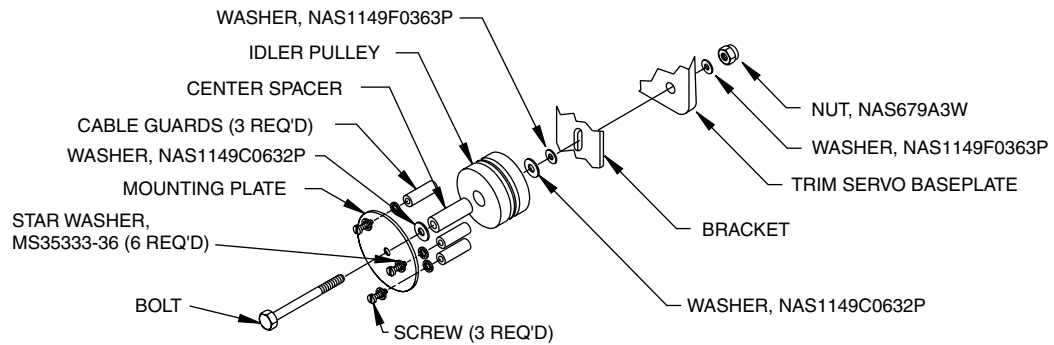
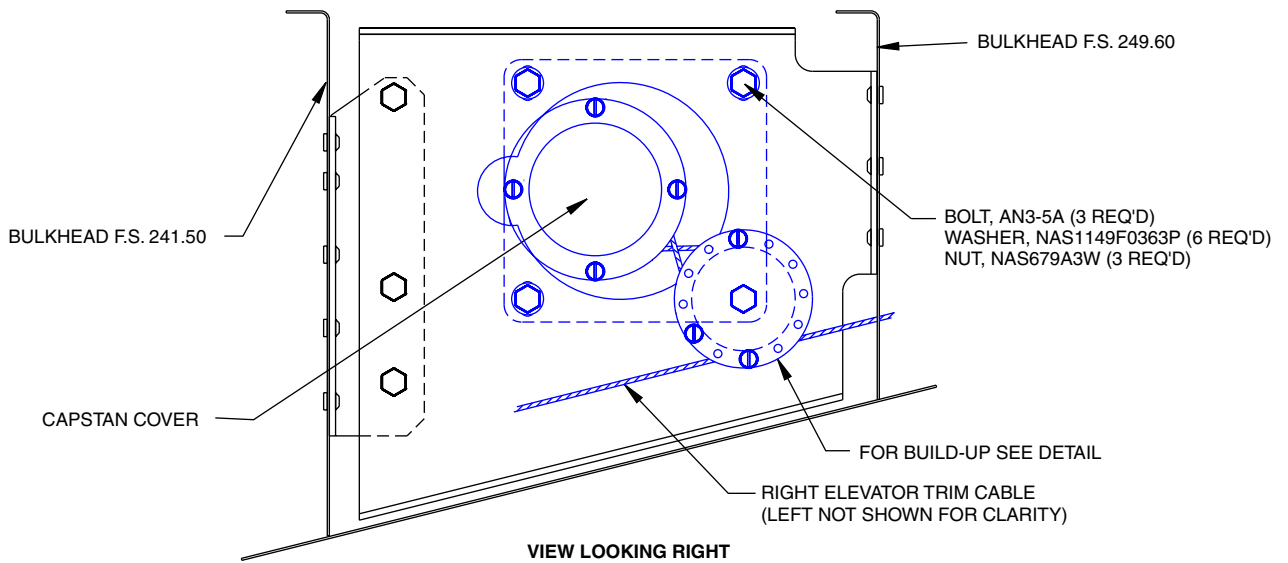
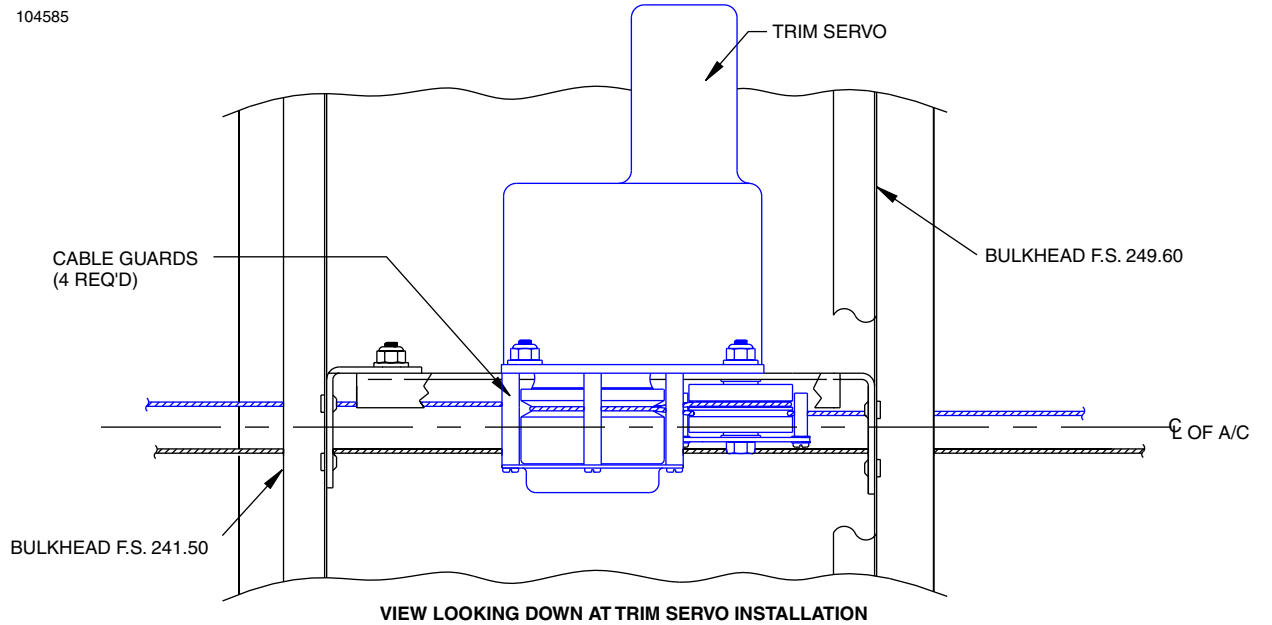
- (i) Slack off the exposed turnbuckle to relieve tension on the right trim cable segment between the turnbuckle and idler pulley.
- (j) Disconnect the autopilot harness.
- (k) Remove the capstan cover and cable guards (4) by removing the retaining screws (4).
- (l) Remove the bolt, nut, and washer securing the idler pulley to the trim servo baseplate and mounting bracket and remove the idler pulley components.

NOTE: The idler pulley breaks down into the following components upon removal of the bolt, above: mounting plate/cable guard assembly, idler pulley, and two washers.

- (m) Remove the remaining bolts, nuts, and washers (3 ea.) securing the trim servo to its mounting bracket and remove the trim servo.

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Trim Servo Installation
Figure 4

Effectivity
System 55X shown
System 55 similar

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(2) Installation

- (a) Adjust trim servo clutch torque per Servo Clutch Torque Adjustment, below.
- (b) With the capstan cover and cable guards removed, position the trim servo as shown in Figure 4. Secure with bolts, nuts, and washers (3 ea. - i.e. - top two and bottom forward).
- (c) Assemble the idler pulley cable guards (3) to the mounting plate with screws (1 ea.) and star washers (2 ea.). Place the center bolt through the mounting plate/cable guard assembly and slide a washer over the threaded end and up against the mounting plate. Set the mounting plate/cable guard/bolt assembly aside.
- (d) Drape the slack left trim cable over the servo capstan.
- (e) Place thumb and forefinger on top of the capstan over the trim cable in its groove. Pressing the trim cable into its groove, slide thumb and forefinger down around opposite sides of the servo capstan and pull the trim cable slack to the lower rear quadrant.
- (f) Holding the trim cable in that position, install the capstan cover and cable guards as shown in Figure 4.
- (g) Hold the idler pulley on the forward side of the trim servo and align it with the left trim cable. Move the idler pulley down to the left trim cable forward of the trim servo and capture the trim cable in the left cable groove on the bottom of the idler pulley.
- (h) Slide the idler pulley along the trim cable, underneath the servo capstan, and bring it approximately to its installed position (see Figure 4). At this point, the forward portion of the trim cable should be routed under, around the rear, and over the top of the idler pulley and under, around the front, and over the top of the capstan.
- (i) Holding the idler pulley in this position, reach to the rear and pull the aft portion of the trim cable under the idler pulley and seat it in the right cable groove on the idler pulley. The left trim cable should now be routed as shown in Figure 4.
- (j) Place the spacer inside the idler pulley.
- (k) Position the mounting plate/cable guard/bolt assembly as shown in Figure 4 and slide the bolt through the spacer inside the idler pulley.
- (l) Place a washer over the bolt end and put the bolt through the trim servo mounting bracket and baseplate. Secure with a nut and washer, taking care to ensure that the cable guards are positioned, and the left trim cable is routed, as shown in Figure 4.
- (m) Rig elevator trim per Elevator Trim Controls Rigging, 27-30-00.
- (n) Connect the autopilot harness.
- (o) Check autopilot system for proper operation.
- (p) Check elevator trim controls for free and correct movement.
- (q) Replace access panels and carpet in cabin and baggage compartment floors.
- (r) Replace rear seats.

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G. Yaw Servo (See Figure 5.)

The yaw servo is located in the unpressurized aft fuselage.

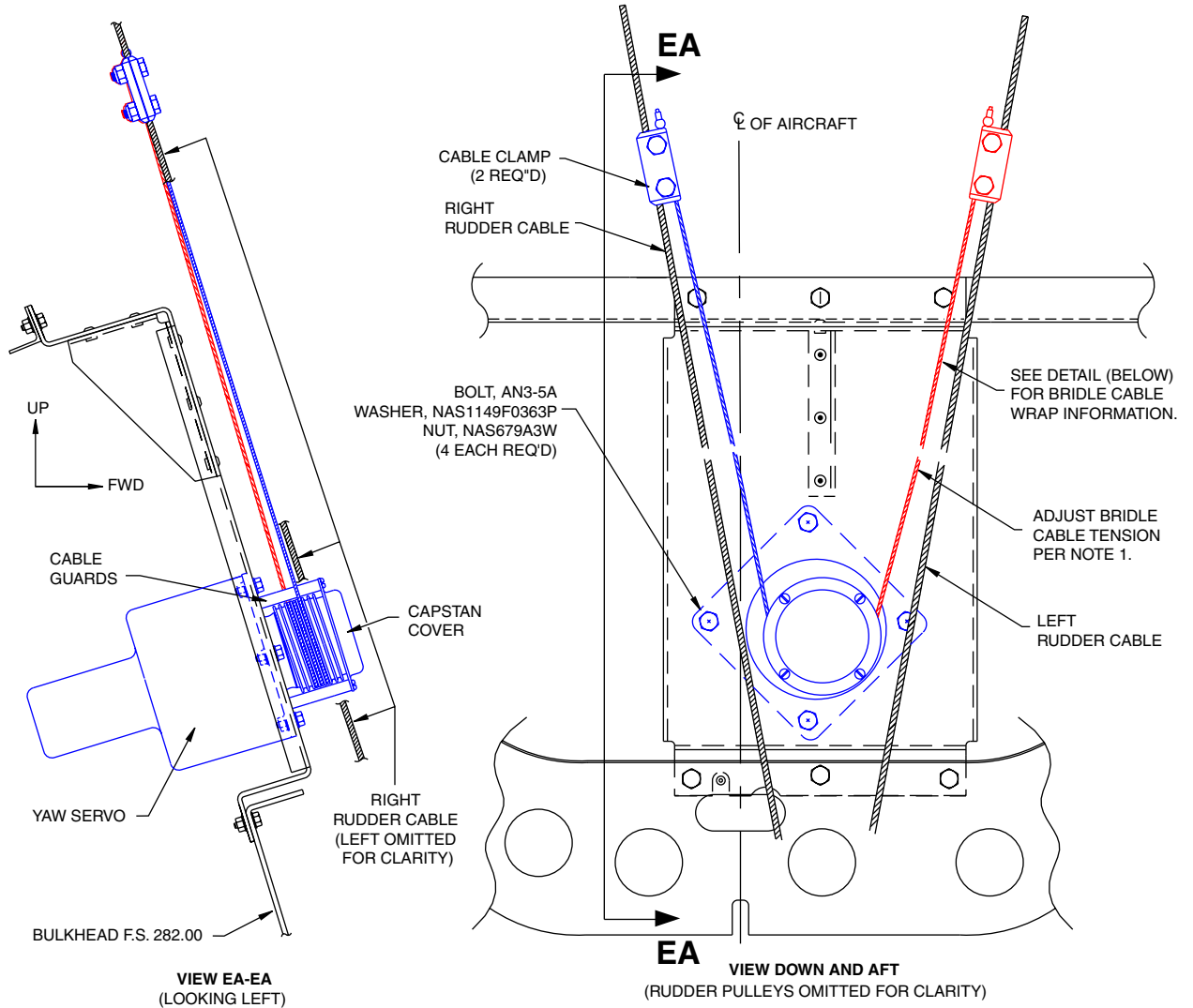
(1) Removal

- (a) Remove the aft fuselage access panel (see #1, Figure 3, 6-00-00).
- (b) Disconnect autopilot harness.
- (c) Remove nuts and bolts (2 ea.) securing each cable clamp (2) and remove cable clamps from rudder cables and autopilot bridle cables.
- (d) Remove nuts, washers, and bolts (4 ea.) securing yaw servo to mounting brackets and remove yaw servo with attached bridle cable.

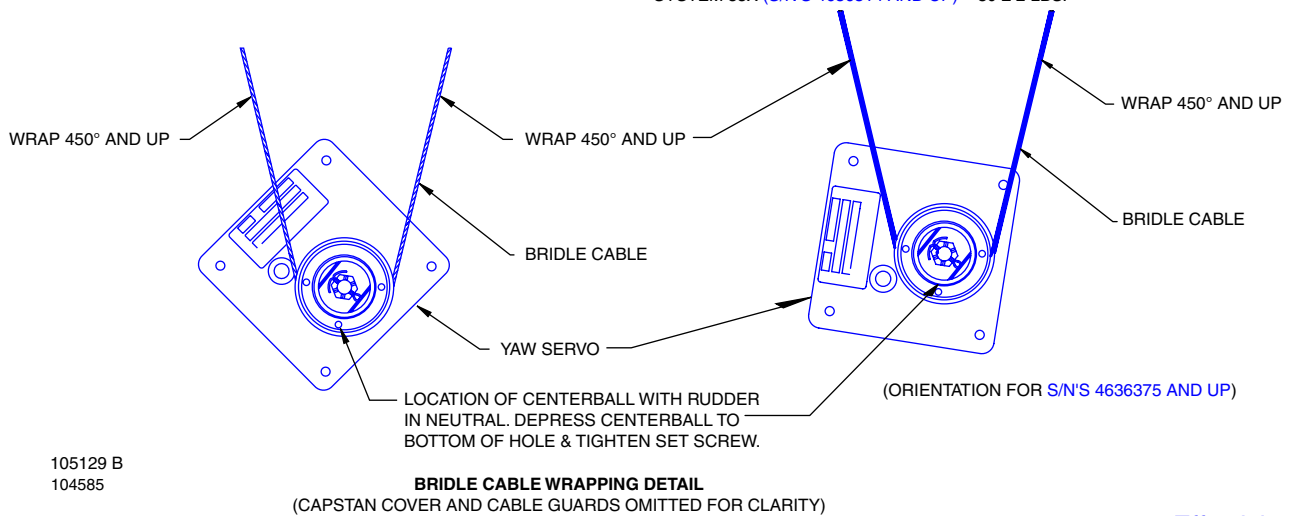
(2) Installation

- (a) Rig rudder controls per Rudder Control Rigging, 27-20-00.
- (b) Lock rudder in its neutral (streamlined) position.
- (c) Remove screws (4) and remove capstan cover and cable guards from servo.
- (d) Adjust yaw servo clutch torque per Servo Clutch Torque Adjustment, below.
- (e) Wrap autopilot bridle cable, align capstan, and and tighten center-ball setscrew as shown in Figure 5.
- (f) Replace cable guards and capstan cover, secure with screws (4).
- (g) Position yaw servo as shown in Figure 5 and secure with bolts, nuts, and washers (4 ea.)
- (h) Remove tape or clip holding bridle cable on capstan and attach left and right autopilot bridle cables to the left and right rudder cables with cable clamps (2).
- (i) Evenly adjust the cable clamps up the rudder cables until the tension on both left and right autopilot bridle cables is as specified in Figure 5.
- (j) Connect autopilot harness.
- (k) Remove rudder lock.
- (l) Check autopilot system for binding and correct operation.
- (m) Check rudder controls for free and correct movement.
- (n) Replace and secure the aft fuselage access panel.

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NOTE 1: SYSTEM 55 (S/N'S 4636160 AND 4636248 THRU 4636313 ONLY) = 15 ± 2 LBS.
SYSTEM 55X (S/N'S 4636314 AND UP) = 30 ± 2 LBS.



Yaw Servo Installation
Figure 5

Effectivity
System 55X shown
System 55 as noted

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H. Pitch Servo (See Figure 6.)

The pitch servo is located in the unpressurized aft fuselage.

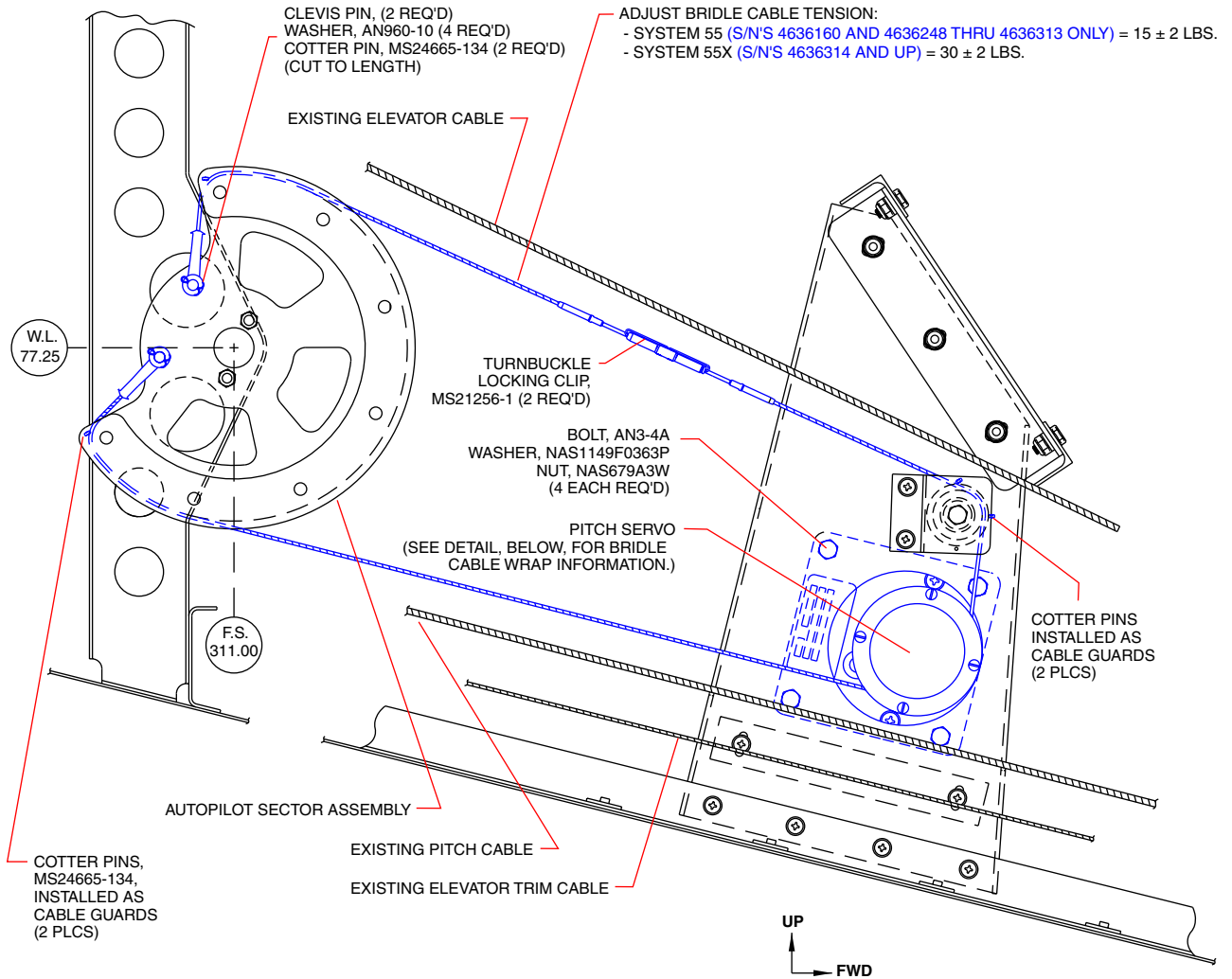
(1) Removal

- (a) Remove the aft fuselage access panel (see #1, Figure 3, 6-00-00).
- (b) Disconnect autopilot harness.
- (c) Remove locking clips (2) from turnbuckle in autopilot bridle cable. Let the upper segment of the autopilot bridle cable remain on top of the autopilot sector assembly.
- (d) Remove cotter pins (cable guards) (2) holding the lower segment of the autopilot bridle cable on idler pulley and remove the bridle cable from the idler pulley.
- (e) Remove cotter pin (cable guard) holding the autopilot bridle cable to the bottom of the autopilot sector assembly.
- (f) Remove cotter pin, clevis pin, washers (2), and autopilot bridle cable fork end from autopilot sector assembly.
- (g) Remove nuts, washers, and bolts (4 ea.) securing pitch servo to mounting brackets and remove pitch servo with attached bridle cable.

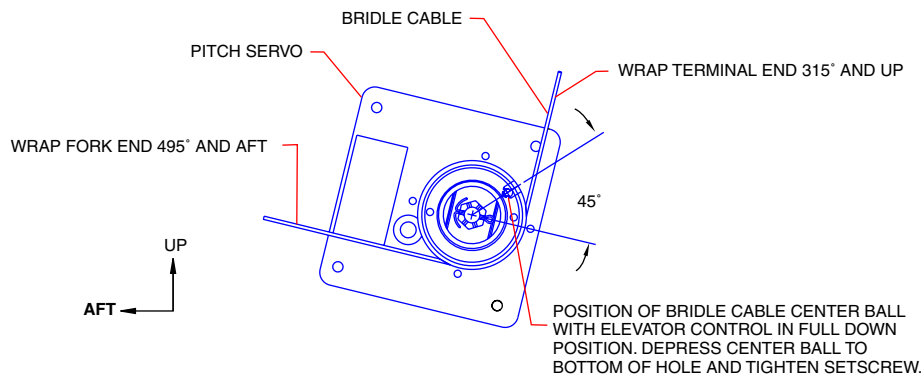
(2) Installation

- (a) Rig elevator controls per Elevator Controls Rigging, 27-30-00.
- (b) Remove screws (4) and remove capstan cover and cable guards from servo.
- (c) Adjust pitch servo clutch torque per Servo Clutch Torque Adjustment, below.
- (d) Wrap autopilot bridle cable, align capstan, and and tighten center-ball setscrew as shown in Figure 6.
- (e) Replace cable guards and capstan cover, secure with screws (4).
- (f) Position pitch servo as shown in Figure 6 and secure with bolts, nuts, and washers (4 ea.).
- (g) Position autopilot bridle cable fork end on autopilot sector assembly and secure with clevis pin, washers (2), and cotter pin.
- (h) Ensuring bridle cable is in bottom groove of sector assembly, insert and secure cotter pin (cable guard).
- (i) Loop bridle cable over idler pulley and install cotter pins (cable guards) (2).
- (j) Connect bridle cable turnbuckle and adjust cable tension as specified in Figure 6.
- (k) Install bridle cable turnbuckle locking clips (2).
- (l) Connect autopilot harness.
- (m) Check autopilot system for binding and correct operation.
- (n) Check elevator controls for free and correct movement.
- (o) Replace and secure the aft fuselage access panel.

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**VIEW LOOKING LEFT FROM CENTERLINE OF AIRCRAFT
(ELEVATOR SECTOR OMITTED FOR CLARITY)**



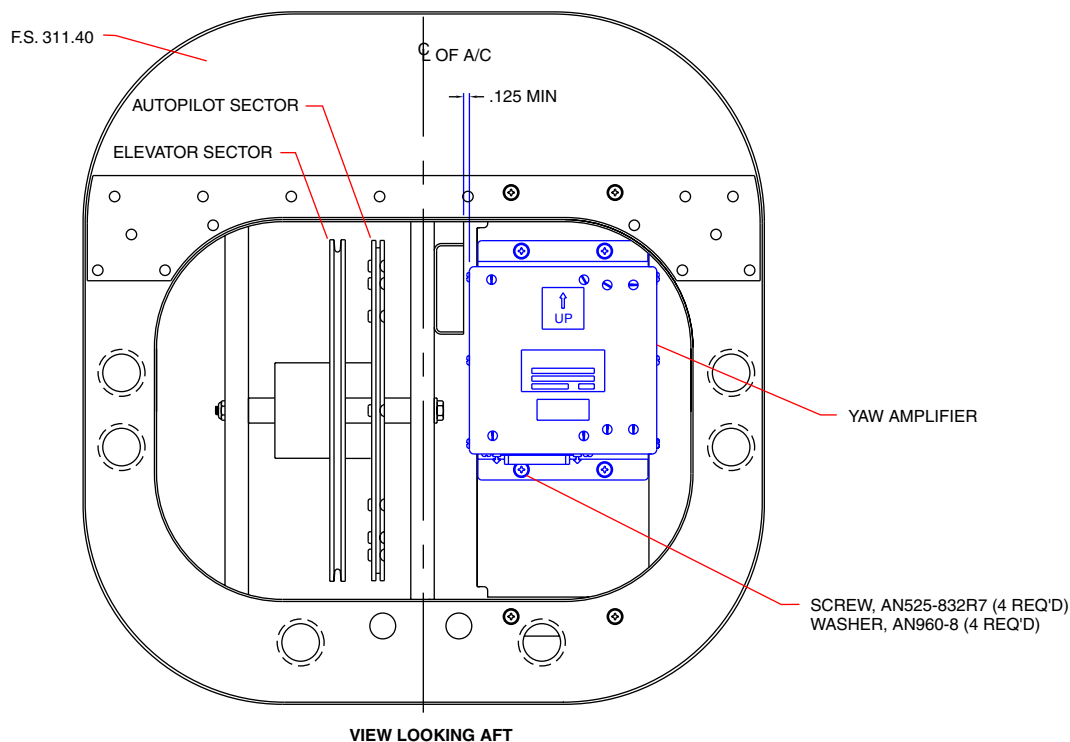
**BRIDLE CABLE WRAPPING DETAIL
(CAPSTAN COVER AND CABLE GUARDS OMITTED FOR CLARITY)**

**Pitch Servo Installation
Figure 6**

Effectivity
System 55X shown
System 55 as noted

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Effectivity
System 55X shown
System 55 similar

VIEW LOOKING AFT
Yaw Amplifier Installation
Figure 7

I. Yaw Amplifier (See Figure 7.)

The yaw amplifier is located in the unpressurized aft fuselage.

(1) Removal

- (a) Remove the aft fuselage access panel (see #1, Figure 3, 6-00-00).
- (b) Disconnect autopilot harness.
- (c) Remove screws and washers (4 ea.) and remove the yaw amplifier.

(2) Installation

- (a) Position yaw amplifier and secure with screws and washers (4 ea.)
- (b) Connect autopilot harness.
- (c) Check autopilot system for correct operation.
- (d) Replace and secure the aft fuselage access panel.

(3) Post-Installation Ground Checks

- (a) Level aircraft laterally per 8-20-00.
- (b) Center trim pot on instrument panel.
- (c) Align the cap on the yaw trim pot knob (on instrument panel) so that the white line is centered vertically.
- (d) Adjust the pot in the yaw amplifier (located under plug in top of amplifier) to provide a null (i.e. - no servo action) at the yaw servo.

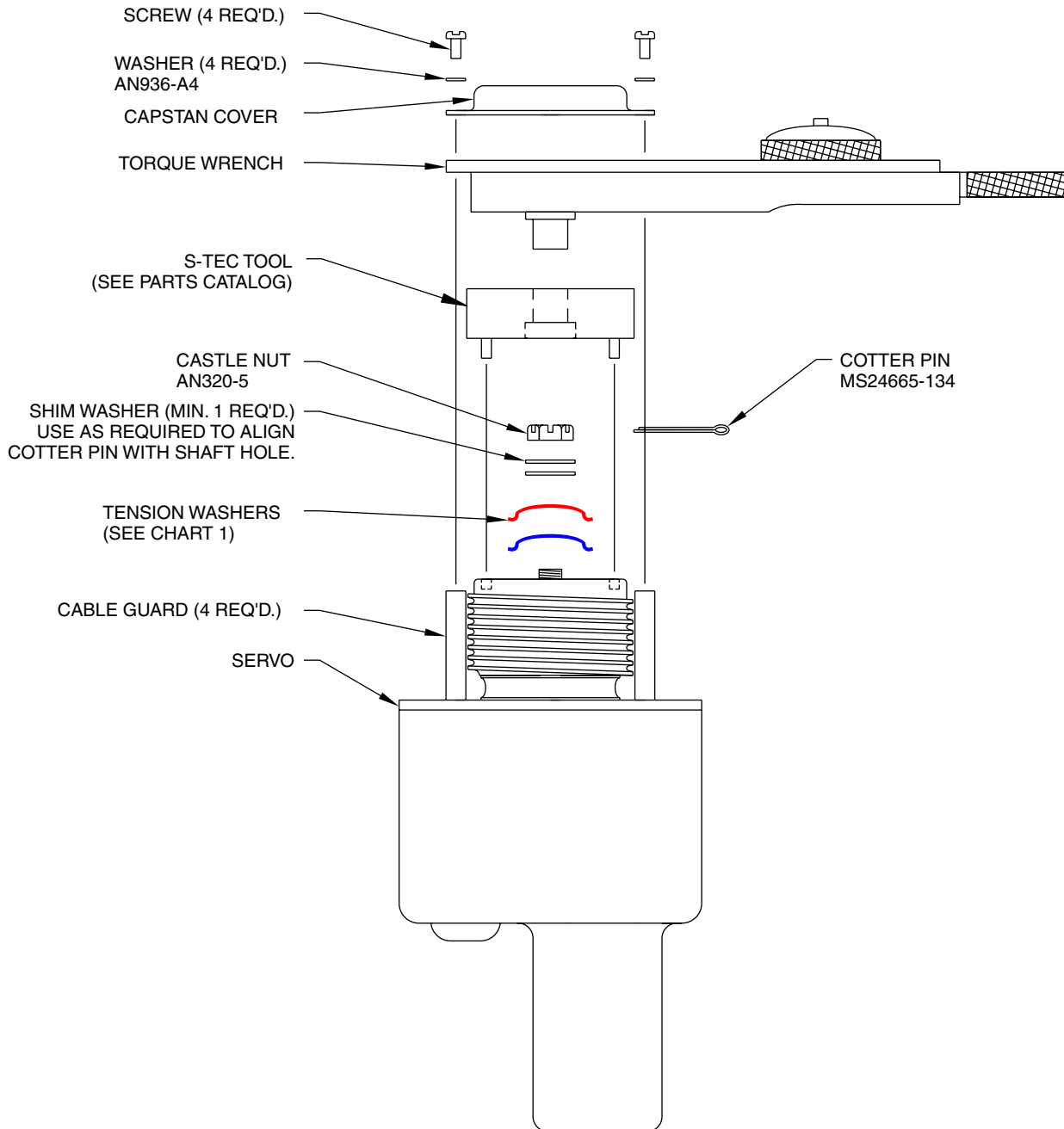
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- (e) Align the cap on the yaw trim pot knob (on instrument panel) so that the white line is centered vertically.
 - (f) Check operation of yaw trim pot by turning trim pot both left and right and verify rudder pedal movement in the same direction (i.e. - turning trim pot left causes left rudder pedal depression, etc.)
4. Servo Clutch Torque Adjustment (See Figure 8.)
- A. Remove servo per instructions under specific servo, above.
 - B. Place servo in a holding fixture (i.e. - vice) with capstan up.
 - C. Remove capstan cover, cable guards, and cable.
 - D. Check capstan torque by attaching the capstan adjusting tool (special tool - see parts catalog) to the capstan and using a currently calibrated torque wrench as shown in Figure 8.
 - (1) Acceptable torque is specified in Chart 1.
 - (2) If adjustment is required, proceed as follows.
 - E. Remove cotter pin from end of servo shaft and remove castle nut, shim washers, and tension washers.
 - F. Replace tension washers as required (see Chart 1).
 - G. Replace shim washers and castle nut.
 - H. Tension castle nut so that capstan torque is as specified in Chart 1.

CHART 1
AUTOPILOT SERVO CLUTCH TORQUE

SERVO	TORQUE (In. Lbs.) System 55/55X	WASHERS System 55/55X
Roll	40 ± 2*	Three P/N 1253-1 (Blue)
Pitch	27 ± 2*	One P/N 1253 (Red) Two P/N 1253-1 (Blue)
Trim	21 ± 2*	Three P/N 1253 (Red)
Yaw	30 ± 2*	One P/N 1253 (Red) Two P/N 1253-1 (Blue)
* ± 3 in S/N's 4636375 and up		

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Servo Clutch Torque Adjustment
Figure 8

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CHAPTER

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COMMUNICATIONS

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CHAPTER 23

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GENERAL

1. Avionics Master Switch

Avionics Bus #1 and #2 are fed direct from the tie bus via the avionics master solenoids which in turn are energized by the avionics master switch. Refer to Chapter 24 and to schematics in 91-24-30.

2. Ground Clearance Switch (Optional)

The ground clearance switch furnishes power to the Comm 1 and speaker panel direct from the battery bus through the ground clearance relay. Refer to 91-23-00 for schematic interface and troubleshooting.

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AUDIO INTEGRATING

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.)

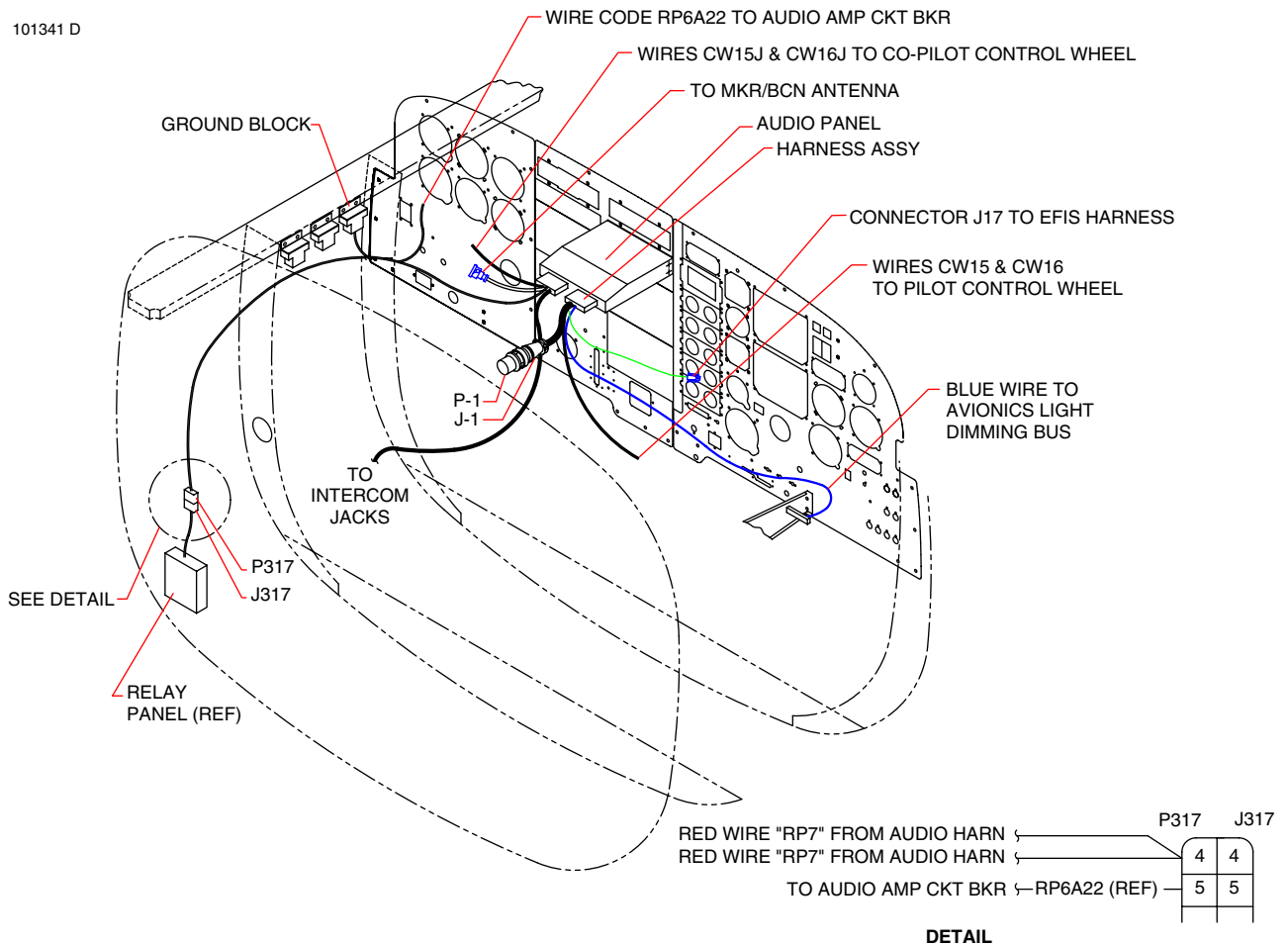
The Garmin GMA-340 Audio Panel is installed as standard equipment in S/N's 4636248 and up. It integrates the audio switching, amplifier, and intercom system with a marker beacon receiver. Maintenance of the GMA-340 is "on condition" only and, with the exception of swapping complete units, should be performed only by a qualified avionics shop in accordance with the GMA-340 Audio Panel Maintenance Manual (Garmin P/N 190-00149-02).

Information provided in this manual is intended to aid the removal and installation of the GMA-340 unit and its associated wiring and to permit basic system functional test and adjustment. In addition, a detailed electrical schematic is provided in 91-23-50.

1. Removal and Installation (See Figure 1.)

See 39-10-00 - Avionics, Removal and Installation.

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GMA-340 Audio Panel Installation
Figure 1

[Effectivity](#)
4636248 and up

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2. System Functional Test (See Figure 2.)

A. On Ground

The following known good equipment is required prior to performing this test: microphone, headset, speaker and avionics receivers.

(1) Lamp Test

- (a) Apply power to the unit by rotating the pilot intercom knob clockwise.
- (b) The test button checks the internal LED annunciator and marker beacon lamps. Press TEST to confirm operation of the LED's. Cover the photocell with a finger and observe that the LED annunciators dim automatically. Check the front panel back-lighting and dimming function. Each annunciator contains a lamp for illumination.

(2) Fail-safe Operation Check

- (a) Turn the unit off by rotating the pilot intercom knob counterclockwise.
- (b) Check fail-safe operation by exercising the COM 1 microphone, microphone key and audio over the headphones.
- (c) Turn the unit back on to continue testing.

(3) Transceiver Operational Check

- (a) Perform a ramp test radio check by exercising the installed transceivers, microphone, microphone key and audio over the headphones and speaker.
- (b) Verify that communications are loud and clear and push-to-talk (PTT) operation is correct.

(4) Intercom System (ICS) Check

- (a) Set the intercom to the ALL mode (Crew and Pilot LED's off).
- (b) Plug in headsets at each ICS position.
- (c) Adjust squelch and volume for each position and verify that the ICS is working properly.
- (d) Check Pilot and Copilot ICS positions for isolation and proper operation of volume and squelch controls.
- (e) Press the PA button. Verify that microphone audio is heard over the speaker.

(5) Aircraft Receivers Check

- (a) Select the audio source corresponding to each installed avionics unit and check for audio over the headsets.
- (b) Check for Pilot/Copilot audio isolation when pressing the COM 1/2 button.
- (c) Press the SPKR button and verify that any selected audio is heard over the speaker.

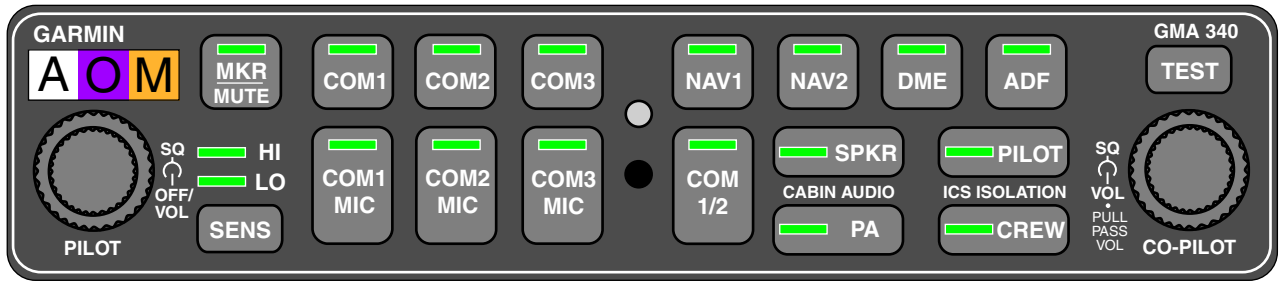
(6) Music System Check

Connect a stereo music source to MUSIC 2. Press the CREW button to set the ICS to the crew mode. Verify that stereo audio is heard in the passenger headsets only.

B. In Flight

Verify proper operation of the marker lamps and marker audio, including the marker audio mute function. Check proper operation of the marker sensitivity selection (using the SENS button) by flying towards the outer marker position initially using HI sensitivity. When the OM audio is just barely audible in the headset, switching to LO sensitivity should reduce or eliminate the audio.

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GMA-340 Audio Panel
Figure 2

[Effectivity
4636248 and up](#)

3. Adjustment (See Figure 3.)

CAUTION: USE ONLY A 2 MM (MAX BLADE WIDTH) FLAT-BLADE NONCONDUCTIVE SCREW DRIVER AS AN ADJUSTMENT TOOL. BE CAREFUL WHEN INSERTING ADJUSTMENT TOOL THROUGH THE TOP COVER. THE UNIT MAY BE DAMAGED IF AN ADJUSTMENT TOOL IS ACCIDENTALLY FORCED AGAINST UNINTENDED COMPONENTS OR CIRCUIT BOARD PATHS.

The following adjustments can be made through access holes in the top cover of the GMA 340:

A. Marker beacon audio level.

Counter-clockwise adjustment increases the marker audio level.

B. Marker beacon sensitivity.

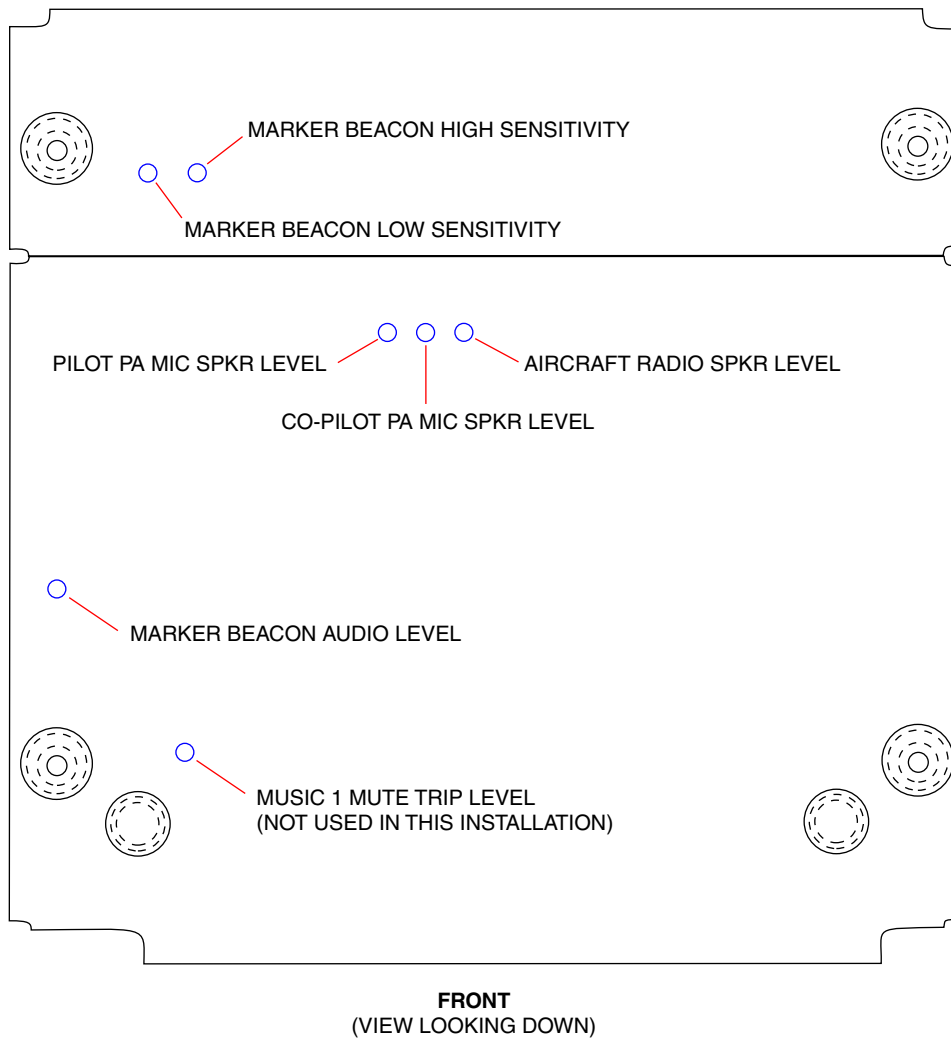
Clockwise (CW) adjustment increases the sensitivity. LOW sensitivity can be adjusted without affecting HIGH sensitivity setting. Adjusting HIGH sensitivity will, however, affect the LOW sensitivity. If the HIGH sensitivity setting is adjusted, then the LOW sensitivity setting should be checked and adjusted afterwards, as needed. If your GMA-340 top cover does not have the marker beacon sensitivity adjustment access holes as indicated in Figure 3, and you need to adjust the sensitivity, contact Garmin for instructions.

C. Aircraft radio speaker output level.

D. Pilot PA microphone speaker output level.

E. Copilot PA microphone speaker output level.

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[Effectivity](#)
4636248 and up

GMA-340 Audio Panel Adjustments
Figure 3

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STATIC DISCHARGING

Static Wicks

This airplane is equipped with 16 static wicks: three on the outboard end of each aileron, three on the outboard half of each side of the elevator; two on the right-hand side of the rudder and one on the left-hand side of the rudder and one in the center of the elevator trim tab.

To aid in dissipating static electricity buildup, the ailerons, elevator and rudder are bonded to either the control's hinge or spar.

When replacing the jumper assemblies (bonding straps), secure the end of the jumper that mounts to the control's hinge or spar as follows: (see also 51-80-00)

- A. Clean an area of 1 1/2 times the diameter of the jumper's washer down to bare metal.
- B. Attach the jumper and washer to the control's hinge or spar.
- C. Seal the cleaned area with zinc chromate primer and acrylic lacquer.

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CHAPTER

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ELECTRICAL POWER

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GENERAL

This section contains information to assist in servicing the electrical power distribution systems and components. This chapter does not include autopilot or avionics service information. Refer to Chapter 91 for electrical systems schematics.

The electrical system is 28 Vdc, negative ground, consisting of:

A.	Two 70-amp, Prestolite alternators (S/N's 4636001 thru 4636131)	standard, or
	Two 75-amp, Electrosystems alternators (S/N's 4636132 and up)	standard
B.	Two Lamar Alternator Control Units	standard
C.	One Digital volt meter	standard
D.	Two ammeters	standard
E.	Dual main power distribution bus/tie bus	standard
F.	One 10 amp-hour lead acid battery-manifold type-Gill	standard
G.	One acid recovery jar with venting overboard	standard
H.	External power provisions	standard
I.	Visual annunciation with alternator "OUT" sensors	standard

Each of the dual alternators provides 28 Vdc electrical power. Both are negative grounded. The 10 amp-hour lead acid battery is located beneath the floor of the forward baggage compartment, pilot's side. The battery is hard wired directly to the battery bus. An external power circuitry is provided for ground operational requirements. The manifold-type battery is vented overboard through an acid recovery system.

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DC GENERATION

1. Alternator System (Refer to Figure 1)

The PA-46-350P uses a dual 70-amp (S/N's 4636001 thru 4636131) or 75-amp (S/N's 4636132 and up) alternator system, consisting of two belt driven alternators that feed their individual positive outputs to the main bus through separate 60-amp (S/N's 4636001 thru 4636131) or 80-amp (S/N's 4636132 and up) main bus circuit breakers. Shunts in each alternator output feed total current flow to the respective ammeter. Each ammeter circuit is protected by two 5-amp fuses.

2. Main Electrical Bus

Operational check of bus isolation diodes

- A. Turn on external or battery power.
- B. Check to see that landing gear indication circuit breaker is in.
- C. Check to see that gear position lights are on.
- D. Pull one of the Main circuit breakers. The gear position lights should remain on.
- E. Reset the Main circuit breaker that was pulled in Step D. Pull the other Main circuit breaker. The gear position lights should remain on.
- F. If gear position lights are inoperative when either Main circuit breaker is pulled, troubleshoot the Main electrical bus system.

3. Avionics Bus

A separate avionics bus is provided. This bus is powered through a main bus tie and controlled by the avionics master switch.

4. Voltage Regulation and Control

WARNING: USE ONLY AN INSULATED SCREWDRIVER TO MAKE THIS ADJUSTMENT.

Voltage regulation and control is provided for both alternators by Lamar solid-state alternator control units that regulate voltage through control of field voltage and automatic overvoltage protection. The only adjustment is the voltage adjust potentiometer located under the removable cover plug.

System voltage should be set at 28.5 Vdc maximum. Should an overvoltage condition occur, the unit can be reset by cycling the alternator switch "OFF" and back to "ON". The Lamar alternator low output sensor will activate the alternator output warning lamp on the annunciator panel. If an overvoltage trip occurs, an alternator is switched off or an abnormally low voltage exists due to a faulty system.

5. Troubleshooting

See Chart 1.

A simple in-aircraft check can be made to determine if an alternator warning light illumination is caused by either a low voltage or an overvoltage condition. Turn both alternator switches "OFF" and then back "ON" again, one at a time. If the alternator annunciator(s) extinguish(es), the system(s) can be considered normal and can be verified so by the ammeter indication. In any case, either alternator system output can be read on the appropriate ammeter.

NOTE: Illumination of the alternator warning annunciator at low engine idle speeds, with high electrical loads on the systems, may occur and are considered normal, especially if the battery is requiring a heavy charge. Under such conditions, the annunciator will extinguish at an increased rpm, as the battery charge returns to normal and the electrical load is reduced.

6. Distribution

See Figure 1.

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**CHART 1 (Sheet 1 of 5)
TROUBLESHOOTING (ELECTRICAL SYSTEM)**

Trouble	Cause	Remedy
Zero output indicated on ammeter regardless of rpm (refer to alternator system test procedure).	Open field circuit.	With the battery switch turned on, check for battery voltage from the airplane's main bus through the entire field circuit to the alternator field terminal. Measure the voltage from the ground (-) to the following points (+) in sequence: bus bar, 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. (See wiring schematic, Chapter 91.)
	Open output circuit.	With the battery switch turned on, check for battery voltage from the airplane's main bus through the entire output circuit to the alternator battery post. Measure voltage from ground (-) to the following points (+) in sequence: bus bar, output current limiter, ammeter, and alternator battery post. Interruption of voltage through any of these points isolates the faulty component or wire which must be replaced. (See wiring schematic, Chapter 91.)

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**CHART 1 (Sheet 2 of 5)
TROUBLESHOOTING (ELECTRICAL SYSTEM)**

Trouble	Cause	Remedy
Zero output indicated on ammeter regardless of rpm. (continued)	Open field winding in alternator.	Disconnect field terminal of alternator from field wiring and check for continuity from field terminal to ground with ohmmeter (20-100 ohms) depending on brush contact resistance.
		CAUTION: TURN MAGNETO SWITCH TO OFF BEFORE TURNING PROP.
		(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.
	Shunt load resistor 5 amp fuse open.	Replace fuse after continuity check to ground.
Output indicated on ammeter does not meet minimum values specified in alternator control unit test procedure.	Faulty voltage regulator.	Start engine, turn on load (ref. alternator test procedure), set throttle at 2300 RPM. Check voltage at buss bar [convenient check point, remove cigar lighter and check from center contact (+) to ground (-). Voltage should be 28 volts minimum. If voltage is below this value, replace regulator.

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CHART 1 (Sheet 3 of 5)
TROUBLESHOOTING (ELECTRICAL SYSTEM)

Trouble	Cause	Remedy
Output indicated on ammeter does not meet minimum values specified in alternator control unit test procedure. (continued)	High resistance connections in field or output circuit.	Check visually for loose binding posts at the various junction points in system, alternator battery post, lugs on ammeter, connections at voltage regulator, circuit breaker, etc. (See wiring schematic, Chapter 91.) Examine crimped terminal ends for signs of deterioration at crimp or strands of broken wire at crimp. Tighten any loose binding posts or replace bad wire terminals.
	Open rectifier.	If any of the rectifiers 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.
Field circuit breaker trips.	Short circuit in field circuit.	Disconnect field wiring at terminal of alternator. Turn on master switch. If breaker continues to trip, proceed to disconnect each leg of field circuit, working from the alternator towards the circuit breaker until breaker can be reset and will hold. Replace component or wire which was isolated as defective. (See wiring schematic, Chapter 91.)

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**CHART 1 (Sheet 4 of 5)
TROUBLESHOOTING (ELECTRICAL SYSTEM)**

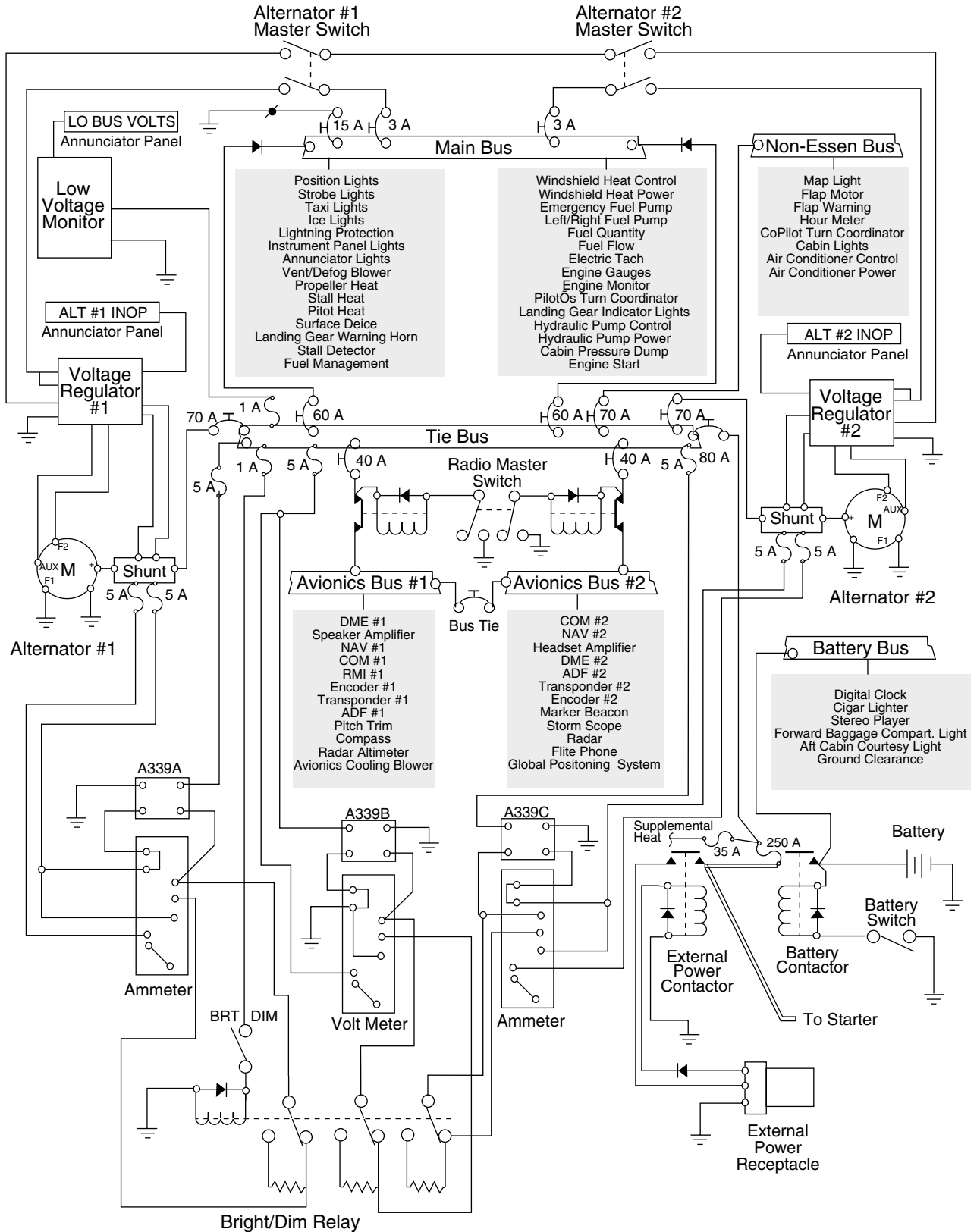
Trouble	Cause	Remedy
Field circuit breaker trips. (continued)	Short circuit in field winding of alternator	Disconnect field wiring at terminal of alternator. Turn on master switch. Reset breaker, and if breaker fails to retrip, this isolates short circuit to field of alternator itself. Check brush holders for shorting against frame. If there are no obvious signs of a physical short circuit at field terminal or brush holder, replace alternator. NOTE: Intermittent short circuit. Internal short circuiting of the field can occur at various positions of the rotor, therefore, reconnect field, reset breaker. CAUTION: TURN MAGNETO SWITCH TO OFF BEFORE TURNING PROP. Pull propeller slowly by hand turning alternator rotor through 360° of travel. Observe circuit breaker for signs of tripping.
Excessive ammeter fluctuation.	Excessive resistance in field circuit.	Check all connections and wire terminals in field circuit for deterioration such as loose binding posts, broken wire strands at terminals, etc. Tighten all connections and replace faulty terminals.

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**CHART 1 (Sheet 5 of 5)
TROUBLESHOOTING (ELECTRICAL SYSTEM)**

Trouble	Cause	Remedy
Excessive ammeter fluctuation. (continued)	High field circuit resistance.	If problem persists, jump across the terminals of the following components one at a time until the faulty unit is isolated. a. Field 5-amp (alternator circuit protector). b. Alternator switch. c. Overvoltage relay.
	Defective voltage regulator.	Replace voltage regulator.
	Faulty grounds.	Completely clean all corrosion from grounding points.

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DC Power Distribution, Dual Alternator (Typical)
Figure 1

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7. Alternators

Electrical power for the 28 Vdc, negative ground, dual fed split bus electrical system is supplied by two belt driven, parallel connected 28Vdc: 70-amp Prestolite alternators, No. ALV-8421-LS (S/N's 4636001 thru 4636131); or, 75-amp Electrosystems alternators, No. ES4039-LS (S/N's 4636132 and up).

Voltage regulation is provided by a solid state voltage regulator, which automatically monitors and controls alternator output by controlling the alternator field winding current. Also, an overvoltage control is provided to shut down alternator output should an overvoltage condition occur. The alternator's output can also be shut off manually by individual alternator ON-OFF switches, which interrupts field winding voltage to the voltage regulator.

CAUTION: DO NOT MANUALLY OPERATE (PULL) THE ALTR1 OR ALTR2 CIRCUIT BREAKER WHEN THE ENGINE IS RUNNING AND THE ALTERNATOR IS OPERATING PROPERLY.

Over current protection is provided by the 70-amp (S/N's 4636001 thru 4636131) or, 80-amp (S/N's 4636132 and up) tie bus ALTR 1 and ALTR 2 circuit breakers. Two ammeters, located on the lower center section of the instrument panel, are fed from taps on each shunt resistor, and indicate the individual electrical load of each alternator. Should an overvoltage condition occur in either alternator, its voltage regulator will shut off the field winding voltage of that alternator, thus overvoltage relays are not required. When either alternator fails, or is selected OFF, the appropriate ALTERNATOR INOP annunciator light will illuminate.

A. Alternator Belt Tension

- (1) 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 each 100 hours thereafter, or whenever any work is performed that would affect belt tension.
- (2) Adjust the alternator belt tension as follows:
 - (a) Adjust the belt to obtain a tension of 45 pounds for a new belt or 23 to 34 lbs for an old belt.

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 previously used.

- (b) Run the engine for a 15 minute period at idle.
- (c) Shut down engine and recheck the belt tension. New belt tension should fall back to desired tension of 23 to 34 lbs. Old belts reinstalled should retain the 23 to 34 lbs tension.
- (d) This tension check should be made at every 100 hours or annual inspection, whichever occurs first.

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B. Alternator Control Units (Voltage Regulators)

The system uses two Lamar B-00382-1 alternator control units (voltage regulators).

(1) Adjusting Voltage Regulator Units

The only adjustment necessary to maintain the alternator system is the adjustment of the voltage control on the voltage control unit. A voltage of 28.8 Vdc is automatically maintained. All other adjustments are made at the time of installation and need not be reset.

(2) Bench Tests (Lamar B-00382-1)

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

(a) Set-up

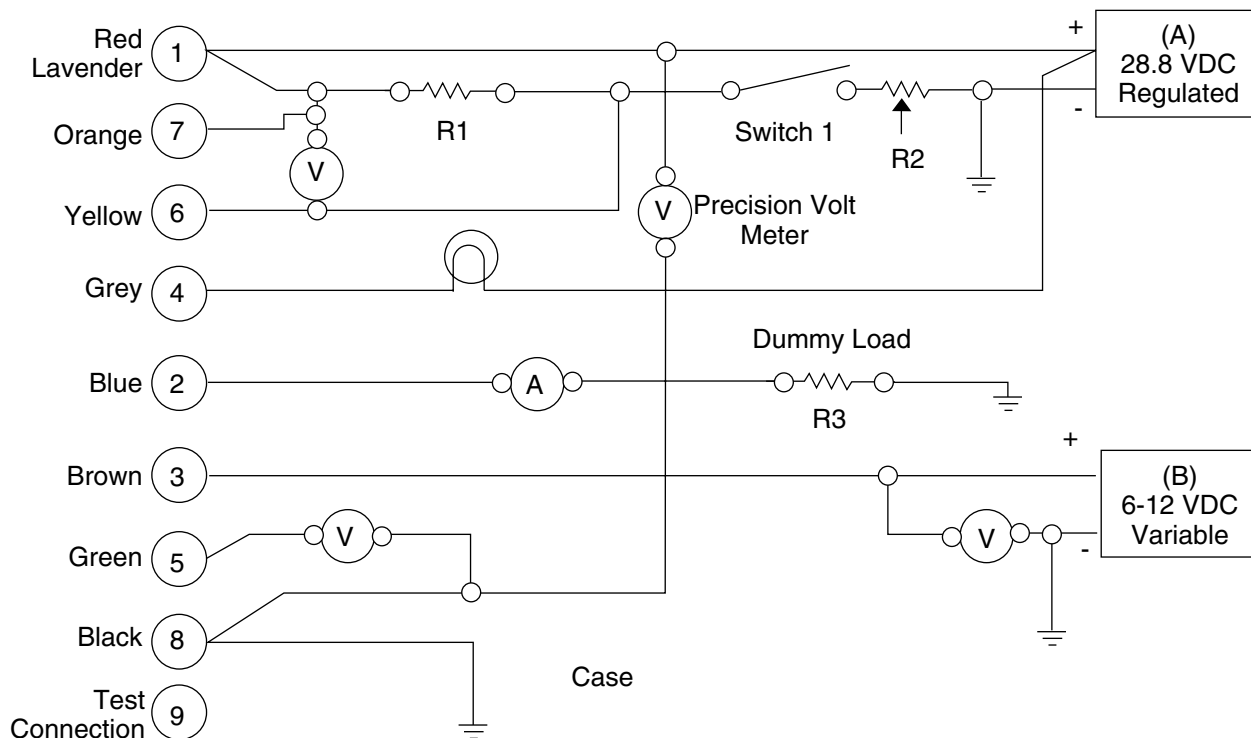
- 1 Remove unit from aircraft.
- 2 Set up the following equipment as shown in Figure 2:
 - Power: Pure dc regulated power supply (A) 28.8V 5A
Adjustable 6-12V power supply (B) 0.05A
 - Resistors: R1 1
R2 650 fine adjustment
R3 7.2 dummy load 4A
 - Ammeter: 0-5A dc
 - Voltmeters: Precision meter between pins 1 and 8;
between pin 3 and power (B) ground;
50 MV precision meter between shunts at pins 6 and 7.
 - Switch: Between R1 and R2
 - Indicator: 28V light (Mazda #1829 or equivalent)
- 3 Set up load resistance as follows:
 - a Jumper pins 1 and 2.
 - b Set dummy load resistance for 4A 28.8V (approximately 7.2).
 - c Remove jumper.

(b) Voltage Regulator Test

- 1 Turn power off.
- 2 Mate unit with test connector.
- 3 Open switch #1.
- 4 Apply regulated power supply (A). Hold constant @ 28.8 V $\pm$ 0.025 V.

NOTE: Power supply should be adequate for load. If fluctuation occurs, assist with 28 V battery to stabilize current.
- 5 Allow unit a 2 minute warm up.
- 6 Reset adjustment on alternator control unit for 1.0 A field current.
- 7 Decrease power supply (A) to approximately 28.6 V until ammeter shows 3 A field current.
- 8 Check alternator inoperative indicator by varying power supply (B) to 10.25 $\pm$ 0.75 V.

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Bench Test of Alternator Control Unit - Lamar #B-00382-1
Figure 2

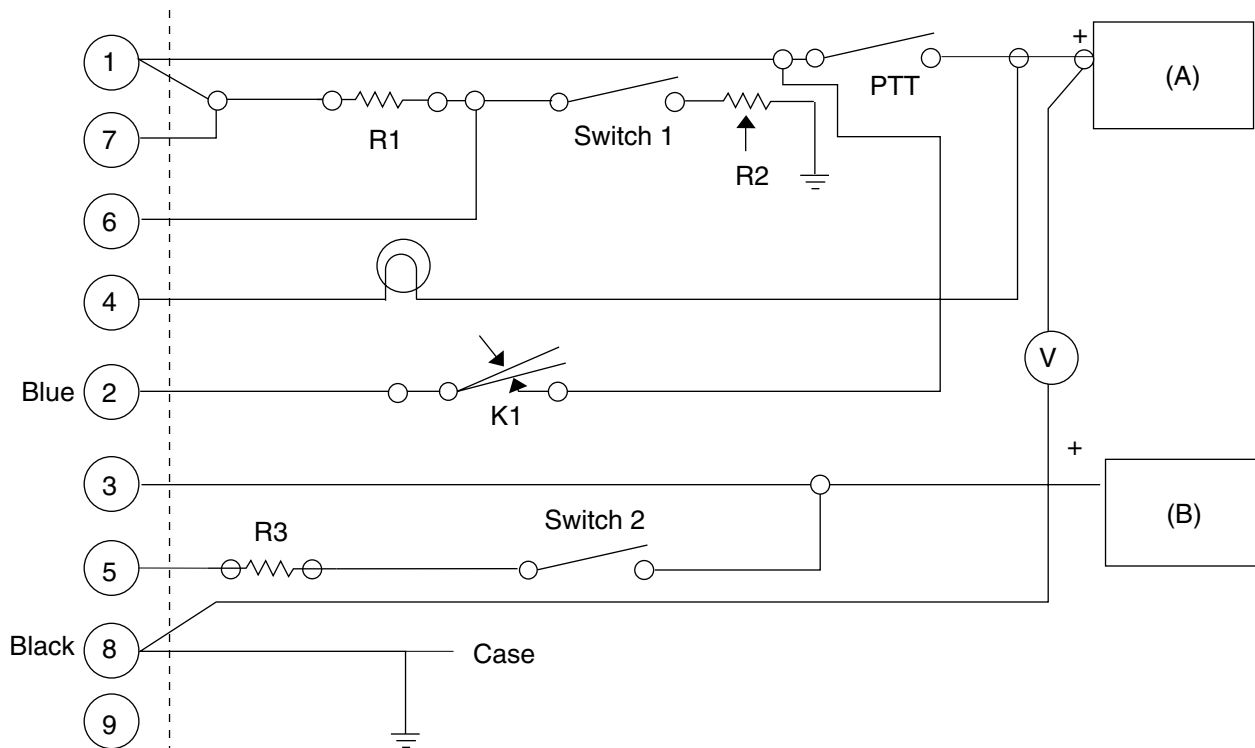
(c) Equalizer Test

- 1 Apply voltmeter at pins #5 and #8 (equalizer and ground). Equalizer voltage should read $5.75 \text{ V} \pm 0.1 \text{ V}$.

NOTE: Equalizer voltage outside 5.65 - 5.85 V limits may still be acceptable because of meter calibration differences and temperature. If error is several times the stated 0.1 V tolerance, have the unit rechecked by a fully equipped test facility.

- 2 Set R2 for maximum resistance (650).
- 3 Close switch #1.
- 4 Adjust R2 for 50 MV across R1.
- 5 Read equalizer voltage.
- 6 Subtract from reading in step 1. Difference should be $10.0 \text{ V} \pm 0.25 \text{ V}$.

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Overvoltage Test of ACU
Figure 3

(d) Overvoltage Protection Test (refer to Figure 3)

- 1 Revise connections as follows:
 - a Disconnect dummy load.
 - b Add 28 V relay (K1). No other connections should be on pin #2.
 - c Add a press-to-test (PTT) switch between power supply (A) and pin #1.
 - d Add resistor R3 and switch #2.
- 2 Open switches #1 and #2. Set power supply (B) at 11 V.
- 3 Set power supply (A) at 31.8 V. Depress PTT and hold for 5 seconds. No activation should occur.
- 4 Increase power (A) to 32.2 V. Depress PTT. Relay should activate almost instantly.
- 5 Close switch #2. Increase power to 33.8 V. Depress PTT for 5 seconds. No activation should occur.
- 6 Increase power to 34.5 V. Depress PTT. Relay should activate almost instantly.

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8. Battery (Lead-Acid)

Service includes the entire battery system consisting of the battery, acid recovery jar, vents, and battery compartment. These services shall be completed every 50 operating hours or 30 days, whichever occurs first, and at every 100 hour inspection.

A. Troubleshooting

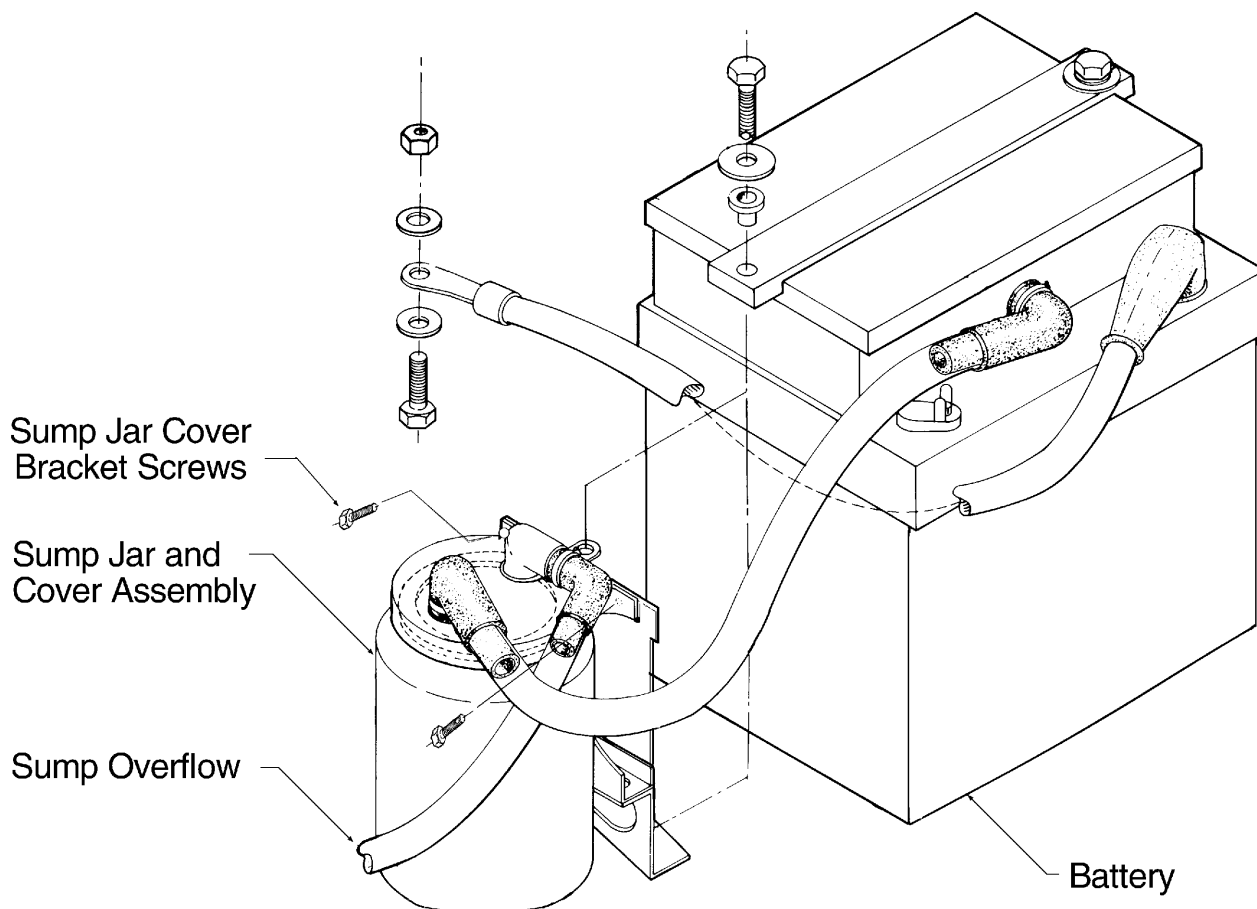
See Chart 2.

B. Removal

- (1) Remove battery access plate from floor of forward baggage compartment.

CAUTION: REMOVE NEGATIVE CABLE FIRST, BEFORE EXPOSING AND LOOSENING POSITIVE TERMINAL WING NUT, TO AVOID SHORT CIRCUITS AND ELECTRICAL BURNS.

- (2) Pull back rubber battery terminal boots, loosen wing nuts and disconnect battery cables.
(3) Remove vent hose at battery manifold.
(4) Remove battery hold down bolts. Lift battery manifold cover off battery and place cover away from carpeting etc, due to acid contamination on inside surface.



Battery System Installation
Figure 4

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**CHART 2 (Sheet 1 of 2)
TROUBLESHOOTING (BATTERY SYSTEM)**

Trouble	Cause	Remedy
Battery installed with reversed polarity.	Battery charged backwards.	Remove battery. Connect load, such as landing light lamp or similar load, and discharge battery. Recharge with correct polarity and test each cell for signs of damage due to reversed charging. Reinstall with corrected polarity.
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.		
Battery will not hold charge.	Battery worn out.	Replace battery.
	Standing too long.	Remove and recharge battery if left in unused airplane one week or more.
	Equipment left "ON" accidentally.	Remove and recharge.
	Impurities in electrolyte.	Replace battery, clean and recharge acid recovery jar.
	Short circuit (ground) in wiring.	Check wiring.
Battery life is short.	Broken cell partitions.	Replace battery, clean and recharge acid recovery jar.
	Overcharge due to level of electrolyte being below tops of plates.	Maintain electrolyte level. Clean and recharge acid recovery jar.
	Heavy discharge.	Replace battery, clean and recharge acid recovery jar.
	Sulfation due to disuse.	Replace battery, clean and recharge acid recovery jar.
	Impurities in electrolyte.	Replace battery, clean and recharge acid recovery jar.
Cracked cell.	Hold down was loose.	Replace battery and tighten, clean and recharge acid recovery jar.
	Frozen battery.	Replace battery, clean and recharge acid recovery jar.

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**CHART 2 (Sheet 2 of 2)
TROUBLESHOOTING (BATTERY SYSTEM)**

Trouble	Cause	Remedy
Electrolyte runs out of vent plugs.	Too much water added to battery.	Drain and keep at proper level. Clean and recharge battery, vents and acid recovery jar.
Excessive corrosion inside container.	Spillage from over-fillings.	Use care in adding water.
	Vent lines leaking or clogged.	Replace vent lines. Also, clean and recharge acid recovery jar.
Battery freezes.	Discharged battery.	Replace battery, clean and recharge acid recovery jar.
	Water added and battery not charged immediately.	Always recharge battery at least 1/2 hour when adding water in freezing weather.
	Leaking cell.	Replace battery. Clean and recharge acid recovery jar.
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.	Cracked jar (one cell only).	Replace battery. Clean and recharge acid recovery jar.
Battery Disconnect Solenoid does not operate.	Open circuit.	Repair wiring.
	Open-circuited solenoid coil.	Replace unit.
Battery Disconnect Solenoid intermittent operation.	Short-circuited coil.	Replace coil.
	Loose electrical connection.	Clean and tighten electrical connections.
	Badly burned points.	If points cannot be dressed down, replace the unit.

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- (5) Lift battery out of compartment.
- (6) Remove the vent hose that connects through the firewall from the acid recovery jar cover.
- (7) Remove the two screws securing acid recovery jar cover to bracket. Slide the acid jar assembly upward off of the battery hold-down bar. Keep the jar upright in a vertical position.

C. Installation

- (1) Keeping the jar upright in a vertical position, slide the acid jar assembly and bracket downward on to the battery hold-down bar. Secure recovery jar cover to bracket with the two screws previously removed.
- (2) Install the vent hose that connects through the firewall at the acid recovery jar end.
- (3) Place the battery into the compartment.
- (4) Place battery manifold cover on battery and install battery hold down bolts.
- (5) Install vent hose at battery manifold.
- (6) Push rubber battery terminal boots back on, tighten wing nuts and connect battery cables.
- (7) Install battery access plate to floor of forward baggage compartment.

D. Cleaning

(1) Battery

- (a) Remove all accumulated contamination from the battery exterior with a stiff bristle brush. (Do not use a metal brush or abrasive materials.) Wipe exterior of battery and interior of manifold, including manifold top cover, with a cloth saturated with a solution of bicarbonate of soda mixed - one part soda to twenty parts of water. (Check that cell plugs are tight - do not allow soda solution to enter any cells.)
- (b) Wash entire battery with clear water and dry thoroughly.
- (c) Wash down the battery support and floor area, hold down supports, connectors and cable ends with a soda solution followed by clear water. Dry entire area and component parts thoroughly. Apply fresh acid resistant paint if required.

(2) Acid Recovery Jar and Vent Lines

- (a) Visually inspect all vent lines for kinks, cracks, flexibility, and loose connections. Replace only with special hoses from parts manual. (DO NOT REPLACE WITH ORDINARY RUBBER HOSE.)
- (b) Slowly pour the soda solution into the vent hose, still attached to the firewall fitting, using a small funnel. The solution will flow out the bottom fuselage vent.
- (c) Follow with a final purge of clear water to flush the vent line and then blow dry with low pressure air. This ensures that the vent line is not kinked or restricted and that it is neutralized.
- (d) Wipe down the lower fuselage area surrounding the vent with soda solution and clear water. Apply a fresh coat of high quality aircraft wax to entire area.
- (e) Unscrew the bottom of the recovery jar and separate from the top. Remove jar pad and empty jar contents into suitable container for safe disposal.
- (f) Thoroughly wash and neutralize the jar, pad, top (including bracket), and the short length of vent hose still attached to the jar top with a soda solution and a clear water rinse.
- (g) Thoroughly dry all components and recharge the jar with 0.75 of bicarbonate of soda. Place dry jar pad in the jar on top of the soda charge.
- (h) Screw jar back together and keep it in a vertical position.
- (i) Install in aircraft per preceding installation instructions.

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E. Charging - (Gill Model G-243)

CAUTION: WEAR EYE PROTECTION WHEN CHARGING A BATTERY - DO NOT TAKE CHANCES. MAKE SURE THE CHARGING AREA IS WELL VENTILATED. IF CENTRAL AIR CONDITIONING IS USED, THE BATTERY CHARGING AREA SHOULD BE VENTED TO THE OUTSIDE AIR TO PREVENT HYDROGEN GASSES FROM BEING CIRCULATED THROUGHOUT THE BUILDING.

The National Electric Code forbids charging batteries installed in aircraft or within 10 feet of fuel tank areas. The battery must be removed from the aircraft for charging. Further, an aircraft battery should not be allowed to deteriorate to the point where safety of flight is jeopardized. The batteries emergency capacity should be sufficient to power the essential bus for a minimum of thirty minutes.

- (1) Remove cell plugs and ensure that vents in plugs are open and that vent valves operate freely.
- (2) Check that the electrolyte level in each cell is at the bottom of the split ring.
- (3) A hydrometer check of each cell should be accomplished. (See Hydrometer Reading and Battery Charge, below.)
- (4) It is recommended that vent caps be left on the battery while charging. In addition a wet cloth should be placed over the vent caps within the manifold.
- (5) The battery may be charged at any rate, in amperes, not to exceed that point which would produce bubbling and gassing of the electrolyte or a cell temperature of 115° F in any case.

NOTE: If a cell temperature reaches the 115° F. limit, the charging rate shall be reduced and the charge completed at 3 amperes or less. DO NOT CHARGE AT A HIGHER RATE WHEN CELLS ARE GASSING. Refer to Gill Service Manual G.S.M.-682 for alternate charging methods and service procedures.

**CHART 3
SPECIFIC GRAVITY TEMPERATURE CORRECTION**

Electrolyte Temperature		Correction	
°C	°F		
60	140	1.024	Add To Reading
55	130	1.020	
49	120	1.016	
43	110	.012	
38	100	.008	
33	90	.004	
-----27	-----80	-----.000	
23	70	-.004	Subtract From Reading
15	60	-.008	
10	50	-.012	
5	40	-.016	
-2	30	-.020	
-7	20	-.024	
-13	10	-.028	
-18	0	-.032	
-23	-10	-.036	
-28	-20	-.040	
-35	-30	-.044	

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- (6) If a constant current (recommended) charge is available, the charge should be started at 3 amperes and reduced in half if and when cells start gassing until fully charged.
- (7) As charging occurs, if any cells sputter or flood, the electrolyte level is too high and the excess must be removed. In any case the electrolyte level shall be adjusted at the end of the charge. The level will rise due to acid returning to the electrolyte mix, normal gassing, and expansion due to temperature rise.
- (8) Thoroughly clean battery after charging to prevent remaining acid bridges which can form during charging.

NOTE: Never allow lead acid batteries or tools used on them to be near Ni-Cad batteries and Ni-Cad battery tools.

F. Hydrometer Reading and Battery Charge

Whenever checking the battery, ascertain that all connections are clean and tight and that the fluid level is above the baffle plates. If it is necessary to add fluid, fill cell with distilled water to the bottom of the split ring. After adding water, charge the battery until gassing before taking a hydrometer reading. Otherwise, the water and electrolyte will not be mixed, giving a false reading. Temperatures different from the established norm will effect the hydrometer readings. Refer to Chart 3 for the temperature corrections. Specific gravity values for a fully charged battery are shown in Chart 4.

To adjust low specific gravity, charge the battery (see Charging, above) until it is gassing and until the specific gravity rises no higher over a 3-hour period. Then remove some electrolyte and replace with 1.300 specific gravity electrolyte. Repeat this step if, after one hour of charging, the specific gravity is still too low. **DO NOT ADJUST A CELL THAT DOES NOT GAS.**

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

To adjust high specific gravity, charge the battery (see Charging Battery) until it is gassing and until the specific gravity rises no higher over a 3-hour period. Remove some electrolyte and replace with distilled water. Repeat this step if, after one hour of charging, the specific gravity is still too high.

**CHART 4
ELECTROLYTE TEMPERATURE CORRECTIONS**

Electrolyte Temperature	Specific Gravity
47° F	1.280 to 1.300
77° F	1.280 to 1.290
107° F	1.260 to 1.280
Temperature change of 30° F changes the reading 0.010.	

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**CHART 5
DISCHARGE RATES**

TELEDYNE Battery Type	Volts	(5 HRS.) Ampere Hours
GILL-G243	24	15.5

G. Discharge

The capacity of a storage battery is measured in units of ampere hours, which is the product of the electrical current in amperes multiplied by the time in hours. Although current may be obtained after the end of the time, the voltage of the battery has dropped to a point beyond which it is not very useful. The ampere hours which may be obtained from a battery are greater for a long low-rate or intermittent rate discharge than for a short high-rate discharge because the voltage will drop faster at the higher discharge rate. The maximum permissible rate of discharge is limited only by the current-carrying ability of the wiring, motor, or other apparatus to which the battery is connected or by the current-carrying ability of the cell terminals and connectors and not by the plates themselves. Recommended discharge rates are listed in Chart 5.

H. Temperature Considerations

Operation of storage batteries beyond their ambient temperature or charging voltage limits will result in excessive cell temperatures leading to electrolyte boiling, rapid deterioration of the cell, and finally battery failure. The relationship between the maximum charging voltage and the number of cells in the battery is also significant, since this will determine (for a given ambient temperature and state of charge) the rate at which energy is absorbed as heat within the battery. The maximum voltage per cell should not exceed 2.35 - volts, and the maximum temperature should not exceed 115° F.

Low electrolyte temperatures temporarily reduce the battery capacity and the freezing point depends on the specific gravity. To prevent freeze damage, maintain the specific gravity at a reasonably high level as indicated by Chart 6.

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

**CHART 6
ELECTROLYTE FREEZING POINTS**

Specific Gravity	Freezing Point	
	°C	°F
1.300	-70	-95
1.275	-62	-80
1.250	-52	-62
1.225	-37	-35
1.200	-26	-16
1.175	-20	-4
1.150	-15	5
1.125	-10	13
1.100	-8	19

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I. Repairs, Storage, and Service Tips

The internal parts of the battery have been designed to wear at approximately the same rate, making it uneconomical to replace any of the parts with new ones. Replacing the entire battery is simpler and cheaper.

Before storing the battery, it should be properly charged, the vent plugs put tightly in place, and the leads disconnected to prevent use during idle periods. The battery should be charged at intervals during the idle period. Before returning the battery to service, it should be thoroughly charged. The battery will be sufficiently charged when, after a 3-hour period, the specific gravity does not rise any higher with the electrolyte gassing and a charging rate of 1-1/2 amperes.

Long battery life and trouble-free service is obtained from the battery if the following simple tips are observed:

- (1) Keep it clean.
- (2) Keep it charged.
- (3) Maintain proper electrolyte levels.
- (4) Keep specific gravity equal among all cells.

J. Preparing New Dry-Charged Battery for Installation

CAUTION: PRIOR TO INSTALLING A NEW DRY-CHARGED BATTERY, FOLLOW THE PREPARATION INSTALLATION INSTRUCTIONS FURNISHED WITH THE BATTERY BY TELEDYNE.

The Teledyne, dry-charged, Model GILL/G-243 Battery shall be stored as received from Teledyne. Do not remove vent seals, add acid, nor attempt to charge a dry-charged battery until the time arrives to install the battery into an airplane.

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EXTERNAL POWER

Emergency Starting through External Power Receptacle

CAUTION: DO NOT CONNECT EXTERNAL POWER PLUG TO AIRCRAFT'S EXTERNAL POWER RECEPTACLE WITH A DISCHARGED OR "RUN-DOWN" AIRCRAFT BATTERY, UNLESS THE AIRCRAFT'S BATTERY MASTER SWITCH IS TURNED "OFF" AND LEFT "OFF".

- A. Place ground power unit on the pilot's side of the nose in full view of pilot's window. Upon connecting ground power to the aircraft, the External Power Contactor will energize immediately, supplying electrical power to all aircraft electrical buses.
- B. With Battery Master Switch left in the "OFF" position, turn "OFF" all unnecessary electrical loads as in a normal start.

CAUTION: EXERCISE GREAT CARE DISCONNECTING GROUND POWER PLUG. DISCONNECT THE PLUG ONLY FROM THE PILOT'S SIDE OF THE AIRPLANE.

- C. Start engine and move ground power unit well away from aircraft.
- D. Turn "ON" Battery Master Switch.
- E. Observe Ammeter indicates Alternator electrical power is available.
- F. With the alternator on-line, observe charging current on ammeters.
- G. Do not take-off until charging current falls below 20 AMPS.

NOTE: The aircraft battery must be removed from the airplane if it is to be charged with a ground power dc supply.

**CHART 1
CAPACITY RATINGS AT DISCHARGE RATES**

Battery = Teledyne/Gill G243 (24 Volts)		
Capacity Ratings		
1 Hour (Amp Hours)	Emergency (30 minutes) (Amps)	Cold Cranking (60 Seconds) (Amp @ 0°F)
10	17	150
Definitions		
1 Hour:	The ampere hours shown divided by one hour is the rate of discharge to 1.5-volts per cell.	
Emergency:	The amperes shown is the rate of discharge for 30 minutes to a cut-off voltage of 1.75-volts per cell.	
Cold Cranking:	The amperes shown in discharge current used to crank an engine for 30 seconds at 0° F to 1.2-volts per cell.	

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ELECTRICAL LOAD DISTRIBUTION

1. Emergency Operation

NOTE: All equipment will be operational with only one alternator functioning. To prevent overload with only one alternator functioning, turn off non-essential equipment and any other equipment necessary to reduce the load to less than 70 amps (S/N's 4636001 thru 4636131) or 75 amps (S/N's 4636132 and up).

CAUTION: DO NOT MANUALLY OPERATE (PULL) THE ALTR1 OR ALTR2 CIRCUIT BREAKER WHEN THE ENGINE IS RUNNING AND THE ALTERNATOR IS OPERATING PROPERLY.

- A. With engine operating, turn Alternator No. 2 OFF. Check the appropriate ALTERNATOR INOP light is illuminated.

CAUTION: SHOULD THE LOW BUS VOLTAGE LIGHT ILLUMINATE WHILE ENGAGING ELECTRICAL EQUIPMENT, IMMEDIATELY REDUCE ELECTRICAL LOAD TO LESS THAN:

-- 70 AMPS in S/N's 4636001 THRU 4636131, OR

-- 75 AMPS in S/N's 4636132 AND UP

- B. Turn ON essential electrical equipment, one unit at a time. Essential electrical equipment may consist of:

<u>1.</u> Instrument Panel Lights.	<u>12.</u> Landing Gear Indicator Lights
<u>2.</u> Annunciator Lights	<u>13.</u> Hydraulic Pump Control
<u>3.</u> Landing Gear Warning Horn	<u>14.</u> Hydraulic Pump Power
<u>4.</u> Stall Detector	<u>15.</u> One Communication Transceiver
<u>5.</u> Fuel Management	<u>16.</u> One Navigation receiver.
<u>6.</u> Left and Right Fuel Pumps	<u>17.</u> Speaker Amplifier
<u>7.</u> Fuel Quantity	<u>18.</u> One Transponder
<u>8.</u> Electric Tachometer	<u>19.</u> Compass
<u>9.</u> Engine Gauges	<u>20.</u> Avionics Cooling Fan
<u>10.</u> Engine Monitor	<u>21.</u> Any other equipment that may be
<u>11.</u> Pilots Turn Coordinator	essential for flight operations

- C. Turn Alternator No. 2 ON; turn Alternator No. 1 OFF. Check to be sure that all equipment that was supported by the No. 1 Alternator is supported by the No. 2 Alternator.

- D. If necessary, the non-essential bus, and it's related equipment, can be eliminated by pulling the non-essential 70-amp circuit breaker on the Tie Bus Circuit Breaker panel.

- E. Upon completing the foregoing checks, be sure that all electrical switches are OFF and all circuit breakers have been reset.

2. Electrical Load

See Chart 1.

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CHART 1 (Sheet 1 of 3)
ELECTRICAL SYSTEM LOAD DISTRIBUTION

Bus	Component / System	Electrical Load	No. Units	Duty Cycle	CB Amps	Max. Drain Amps (28 Vdc)
TIE	Master Contactor	Relay	1	Cont.	N/A	.60
TIE	Volt/Amp/Pwr Supply		1	Cont.		1.20
	Volt / Ammeter Solid State	Meter Inductive	1/2	Cont.	N/A	N/A
M	Vent / Defog Blower	Blower Motor	1	Int.	10	7
		Relay	1			.35
M	Stall Warn. Heat	Heating Element	2	Int.	25	16.10
		Relay	2	Int.		.35
M	Heated Windshield	Heating Elements	2	Int.	25	HI 20.74/ LO 13.59
M		Relay	2	Int.		
M		Controller and Relay	1	Int.	5	1.40
M	Pitot Heat	Heating Elements	1	Int.	10	3.2
		Relay	1	Int.		.07
M	Propeller Heat 3-Blade	Heating Elements	3	Int.	20	16
	2-Blade		2	Int.	20	10
		Timer	1	Int.		
		Relay	1	Int.		.29
M	Surface Deice	Timer	1	Int.	5	1.85
M	Alternator Field 1/2	Voltage Regulator Solid State	2	Cont.	3.0	1.50
M	Starter	Contactor	1	Int.	5.0	1.47
		Motor	1	Int.		185.0
M	Annunciator Panel	Lamps	1	Int.	3	.46
M	Fuel Pump	Motor	2	Int.	5	4.0
M	Hydraulic Pump	Motor	1	Int.	25	26.0
M		Relay	1		.35	.35
		Control	1		3	
M	Strobe Light	Light	2/3	Int.	5	4.0
M	Landing Light	Lamp - (250W)	1	Int.	10	9.0
		Relay			.29	.29
M	Taxi Lights	Lamps - (50W)	2	Int.	5	1.75
		Relay	1			
M	Position Lights	Lamps	2	Cont.	5	1.5
M	Wing Inspect. (Ice) Light	Lamp	1	Int.	3	2.3
	Map Lights	Lamps	2	Int.	3	.60
M	Instrument Lights	Lamps	28	Cont.	5	2.00
M	Gear Position Lights	Lamps	3	Cont.	3	.24
M	Stall and Gear Warning Horn	Horn	1	Int.	3	.25
M	Avionics Cooling	Blower Motor	1	Cont.		0.50
M	Eng. Gauge Cluster ⁽¹⁾	Oil Pressure	1	Cont.	3	.30
		Oil Temperature				
		Cylinder Head Temperature				
M	Cylinder Head Scanner	All Cylinder Head Temperatures	1	Cont.	1.5	.25
M	CHT/VAC Ind.			Cont.		0.25
M	MAP/RPM Ind.			Cont.		0.25
M	Oil Press/Oil Temp Ind.			Cont.		0.25
M	TIT/ FF Ind.			Cont.		0.25
M	E. L. Panels Inverter			Cont.		0.50
M	Electric Flaps			Int.		6.00

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CHART 1 (Sheet 2 of 3)
ELECTRICAL SYSTEM LOAD DISTRIBUTION

Bus	Component / System	Electrical Load	No. Units	Duty Cycle	CB Amps	Max. Drain Amps (28 Vdc)
M	Emergency Fuel Pump			Int.		4.50
M	Fuel Quantity (L & R)			Cont.		0.25
M	Ignition			Int.		3.50
M	Regular Alt. #1			Cont.		0.07
M	Regular Alt. #2			Cont.		0.07
M	Turn Coordinators			Cont.		0.60
NE	Cabin Heat	Heater	1	Int.	35 Fuse	33.0
NE		Relay	1			.35
NE	Cabin Lights	Lamps	4	Int.	5	.30
NE	Air Conditioning	Condenser Blower	1	Int.	25	16.00
NE		Cabin Fans	2	Int.	15	9.71
NE		Control, Clutch, and Relay	1	Int.	5	2.29
NE	Avionics Lighting			Cont.		1.00
NE	Cabin Dump Solenoid			Int.		0.29
NE	CD Player			Cont.		0.20
NE	Hourmeter			Cont.		0.05
NE	Ice Detector			Cont.		1.00
NE	Inverter			Int.		2.70
AVI	Transicoil EMIS	Quad Digital Indicator ⁽²⁾	1	Cont.	3	.14
	Digital Indicators	Enhanced Digital Indicator ⁽³⁾	1	Cont.	3	.14
AVI	Transicoil EMIS	Oil Pressure/Oil Temperature	1	Cont.	5	.50
	Analog Indicators ⁽⁴⁾	MAP	1	Cont.	3	.25
		RPM	1	Cont.	3	.25
		TIT	1	Cont.	3	.25
		Fuel Flow	1	Cont.	3	.25
		CHT	1	Cont.	3	.25
		Fuel Quantity	1	Cont.	5	.50
AVI	#1 KX-155A COMM/NAV			Cont.		0.06/6.0
AVI	#2 KX-155A COMM/NAV			Cont.		0.06/6.0
AVI	Argus 7000			Cont.		0.54
AVI	Avionics #1 Contactor			Int.		0.70
AVI	Avionics #2 Aontactor			Int.		0.70
AVI	Clock DVR 3001-XT			Cont.		0.10
AVI	KAS-297 Alt. Alert			Cont.		0.70
AVI	KCS-55A Compass			Cont.		1.60
AVI	KEA-130A Encoding Alt.			Cont.		0.24
AVI	KEA-346 Encoding Alt.			Cont.		0.24
AVI	KFC-150 Autopilot			Int.		8.73
AVI	KLN-90B GPS			Cont.		1.00
AVI	KN-40			Cont.		1.00
AVI	KN-63 DME			Cont.		0.60
AVI	KN-72 Converter			Cont.		0.05
AVI	KR-87 ADF			Cont.		0.45
AVI	KRA-10A Radar Altimeter			Cont.		0.20
AVI	KT-76C Transponder			Cont.		0.70
AVI	PMA 6000 M-S			Cont.		1.00
AVI	RDR-2000 Radar			Cont.		4.30
AVI	SG-465			Cont.		3.20

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**CHART 1 (Sheet 3 of 3)
ELECTRICAL SYSTEM LOAD DISTRIBUTION**

Bus	Component / System	Electrical Load	No. Units	Duty Cycle	CB Amps	Max. Drain Amps (28 Vdc)
AVI	Vibrator			Int.		2.00
AVI	WX-1000 Stormscope			Cont.		1.00
AVI	Yaw Damper			Int.		1.80
<u>Notes:</u> (1) S/N's 4636001 thru 4636020 only. (2) S/N's 4636021 thru 4636131 only. (3) S/N's 4636132 and up. (4) S/N's 4636021 and up. <u>General:</u> "Bus" Abbreviations: AVI = Avionics, M = Main, NE = Non-Essential, TIE = Tie Avionics listed above include optional installations. "# Units" default value is one. "Duty Cycle" = Intermittent or Continuous. Annunciator Control bulbs (.04 EA.) are normally OFF. Windshield Heat Relays and High and Lo are each 50% duty cycle. Prop Feather engages at engine shutdown. Rudder Trim is 20% duty cycle. S-TEC Autopilot draws 0.68 for 50% and 0.90 for 50% when in cruise; and 0.68 during takeoff and landing.						

3. Volt / Ammeter

The volt / ammeter combination indicator consists of two ammeters and a volt meter mounted in one case. The ammeters indicate amperage load on each alternator. The voltmeter indicates total system voltage. The best troubleshooting approach to determine this instruments condition, is to compare the readings with a known good meter.

Should rapid and steady state ammeter needle oscillation occur, first thoroughly clean all traces of corrosion from all grounding points throughout the electrical power distribution system. This is not to be confused with normal ammeter fluctuations showing changing current flow within the aircraft's electrical system. The combined ammeter readings indicates the total current flow, except for the engine starter.

The voltmeter portion of the instrument shows main bus voltage. Should the instrument fail to indicate correctly, substitute a known good voltmeter before condemning the instrument. Placing a good voltmeter in parallel with the indicator is the best practice.

CHAPTER

25

EQUIPMENT / FURNISHINGS

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CHAPTER 25

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CHAPTER 25 - EQUIPMENT / FURNISHINGS

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FLIGHT COMPARTMENT

1. Pilot's / Copilot's Vertically Adjustable Seat

A. Removal

- (1) Remove front stops from seat tracks.
- (2) Lift lever underneath front lip of seat.
- (3) Slide seat off of tracks.

B. Installation

CAUTION: WITH SEAT OCCUPIED AND AT LOWEST VERTICAL POSITION, CHECK SEAT FOR PROPER ENGAGEMENT OF PINS TO SEAT TRACK.

- (1) Lift lever under front lip of seat and slide seat onto tracks.
- (2) Install front stops on seat tracks.

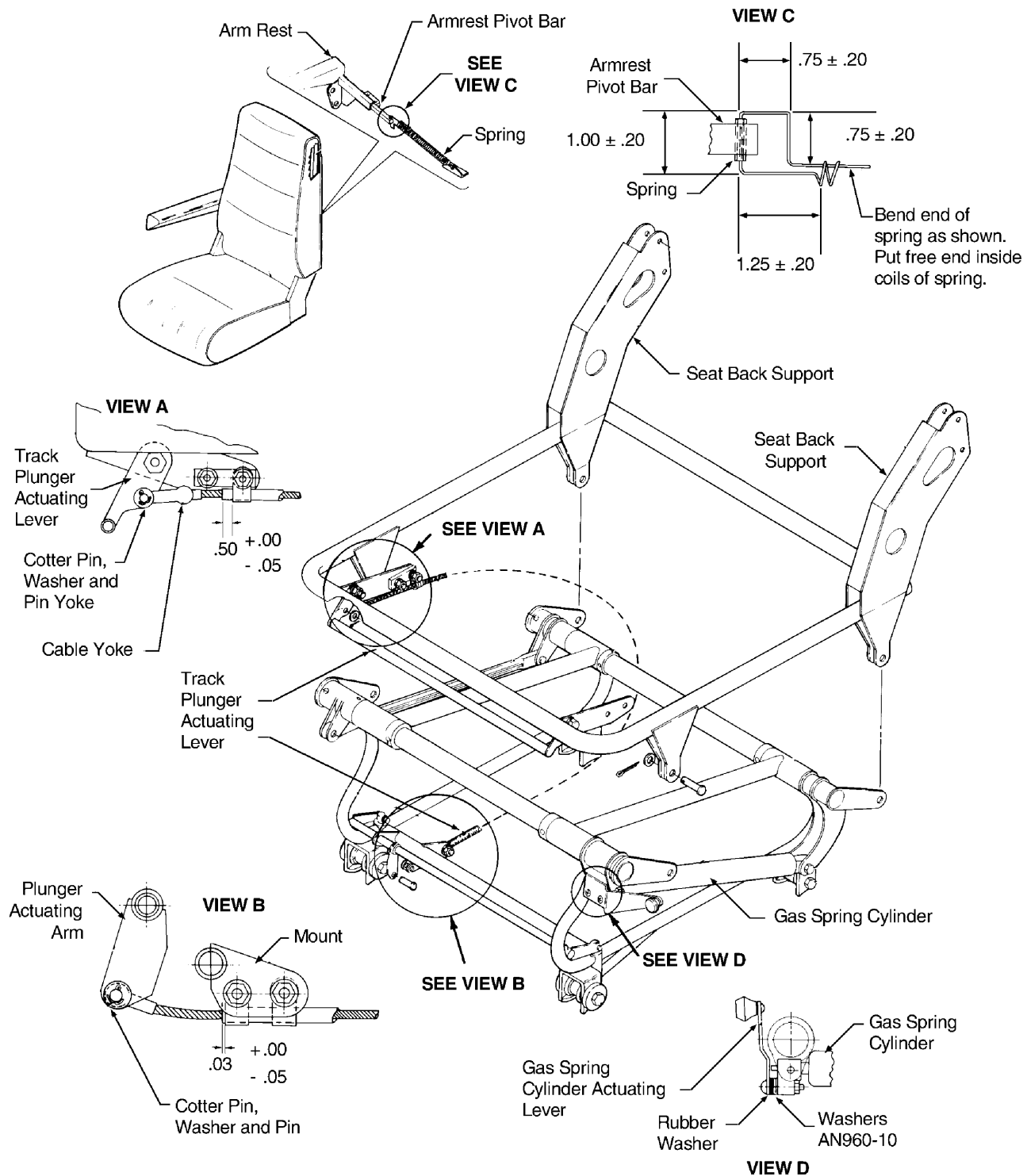
C. Disassembly

- (1) To remove the armrest from the seat back:
 - (a) Reach up inside seat and carefully remove spring from armrest pivot bar.
 - (b) Remove bushing from armrest pivot bar.
 - (c) Slide armrest and pivot bar assembly from seat back.
- (2) To remove the seat back assembly from the seat assembly:
 - (a) Remove nuts, bolts and washers from upper part of seat back support.
 - (b) Remove seat back.
- (3) To remove seat track plunger cable:
 - (a) Remove cotter pin, washer and pin that secures cable yoke to track plunger actuating lever.
 - (b) Remove the clamps which secure the upper portion of the cable sheath to the bottom of the seat frame.
 - (c) Remove the cotter pin, washer and pin that secure the remaining end of the cable to the plunger actuating arm.
 - (d) Remove the two clamps which secure the cable sheath end to the mount on the lower seat frame cross member.
- (4) To remove the gas spring cylinder from the seat:
 - (a) Remove the two bolts and washers that secure the upper end of the gas spring cylinder to the adapter on the seat frame.
 - (b) Remove the nut, bolt and washer that secures the lower end of the gas spring cylinder to the rear seat tube assembly.

D. Assembly

- (1) To install the gas spring cylinder in the seat:
 - (a) Attach the lower end of the gas spring cylinder to the rear seat tube assembly with nut, bolt and washer.
 - (b) Attach the upper end of the gas spring cylinder to the adapter on the seat frame with two bolts and washers.

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Pilot's / Copilot's Vertically Adjustable Seats (Typical)
Figure 1

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- (2) To install the seat track plunger cable:
 - (a) Attach the cable sheath end to the mount on the lower seat frame cross member with the two clamps. Ensure that the cable end protrudes .03 (+.00/-.05) inch from the end of the forward clamp. (See View B of Figure 1)
 - (b) Attach the lower end of the cable to the plunger actuating arm with the pin, washer and cotter pin.
 - (c) Attach the upper end of the cable sheath to the bottom of the seat frame with the clamp. Ensure that the cable end protrudes .50 (+.00/-.05) inch from the clamp. (See View A of Figure 1)
 - (d) Attach the cable yoke to the track plunger actuating lever with the pin, washer and cotter pin.
 - (3) To install the seat back assembly:
 - (a) Position seat back in place.
 - (b) Secure seat back with bolts, nuts and washers inserted in upper part of hinge.
 - (4) To attach the armrest to the seat back:
 - (a) Slide armrest and pivot bar assembly into seat back.
 - (b) Place bushing into pivot bar.
 - (c) Attach spring to armrest pivot bar.
2. Lumbar Support (Refer to Figure 2.)
- A. Description
- The pilot and co-pilot seats incorporate a Lumbar support feature. The installation consists of an inflatable bladder attached to the seat back filler and a inflation bulb located under and on the inboard side of each pilot and co-pilot seat.
- B. To remove the Lumbar bladder for repair or replacement:
- (1) Remove seat from airplane.
 - (2) Loosen velcro securing seat back filler cover.
 - (3) Remove only enough of seat back filler cover to expose lumbar bladder.

NOTE: Inflation tube may be removed before or after bladder is removed from seat back filler. Tube is not glued to nipple attachment; it can be removed by carefully pulling on tube.
 - (4) Remove inflation tube from bladder.

CAUTION: DO NOT USE A CHEMICAL SOLVENT TO REMOVE BLADDER. SOLVENT MAY DAMAGE SEAT BACK FILLER

CAUTION: TO AVOID OR MINIMIZE DAMAGE TO SEAT BACK FILLER DURING REMOVAL, USE ONE HAND TO RETAIN SEAT BACK FILLER IN PLACE, WHILE GENTLY REMOVING BLADDER WITH OTHER HAND.
 - (5) Starting at either right or left edge of bladder, carefully and slowly pull bladder and pad assembly from seat back filler.

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C. To assemble pad and bladder:

CAUTION: CARE MUST BE TAKEN WHEN USING THE APPROVED SOLVENTS AS THEY HAVE A LOW FLASH POINT. SOLVENTS SHOULD NOT BE USED IN CLOSE AREAS WHERE APPLICATOR CANNOT GET SUFFICIENT FRESH AIR FOR BREATHING.

NOTE: Acetone cleans well but evaporates so fast that it is difficult to wipe dry before solvent evaporates.

(1) Surfaces to be joined shall be clean, dry, and oil free. Abrade rubber or plastic surfaces lightly with Scotch Brite™ or fine sand paper and then clean with solvent again.

(a) Surfaces shall be thoroughly cleaned by wiping with a clean cloth wet with solvent followed by wiping dry with a clean cloth before the solvent evaporates. The cleaning operation shall be repeated using a new clean cloth until all soil and grease is removed as evidence by a clean cloth after wiping. Clean cloths and clean solvent shall be used in the cleaning operation.

(b) APPROVED SOLVENTS:	Acetone	193-035
	Citra-Safe	279-112
	Safe Care	193-051
	Dupont 2319S/Plastic Prep.	279-081
	Isopropyl Alcohol	179-918

(2) Apply a layer of 3M Scotch Grip 2210 or Delta Laboratories Contact Adhesive B-10161 (P/N 179-853) cement to smooth side of bladder pad.

(3) Apply a layer of 3M Scotch Grip 2210 or Delta Laboratories Contact Adhesive B-10161 (P/N 179-853) cement to back side of bladder (side away from inflation tube nipple).

(4) Allow the adhesive to dry for 15 minutes minimum, 60 minutes maximum.

NOTE: If the adhesive is allowed to dry more than 60 minutes, another coat may be applied to one of the surfaces, and then bonded after 15 minutes minimum. Both surface do not need to be tacky to achieve a bond.

(5) Attach bladder pad to bladder.

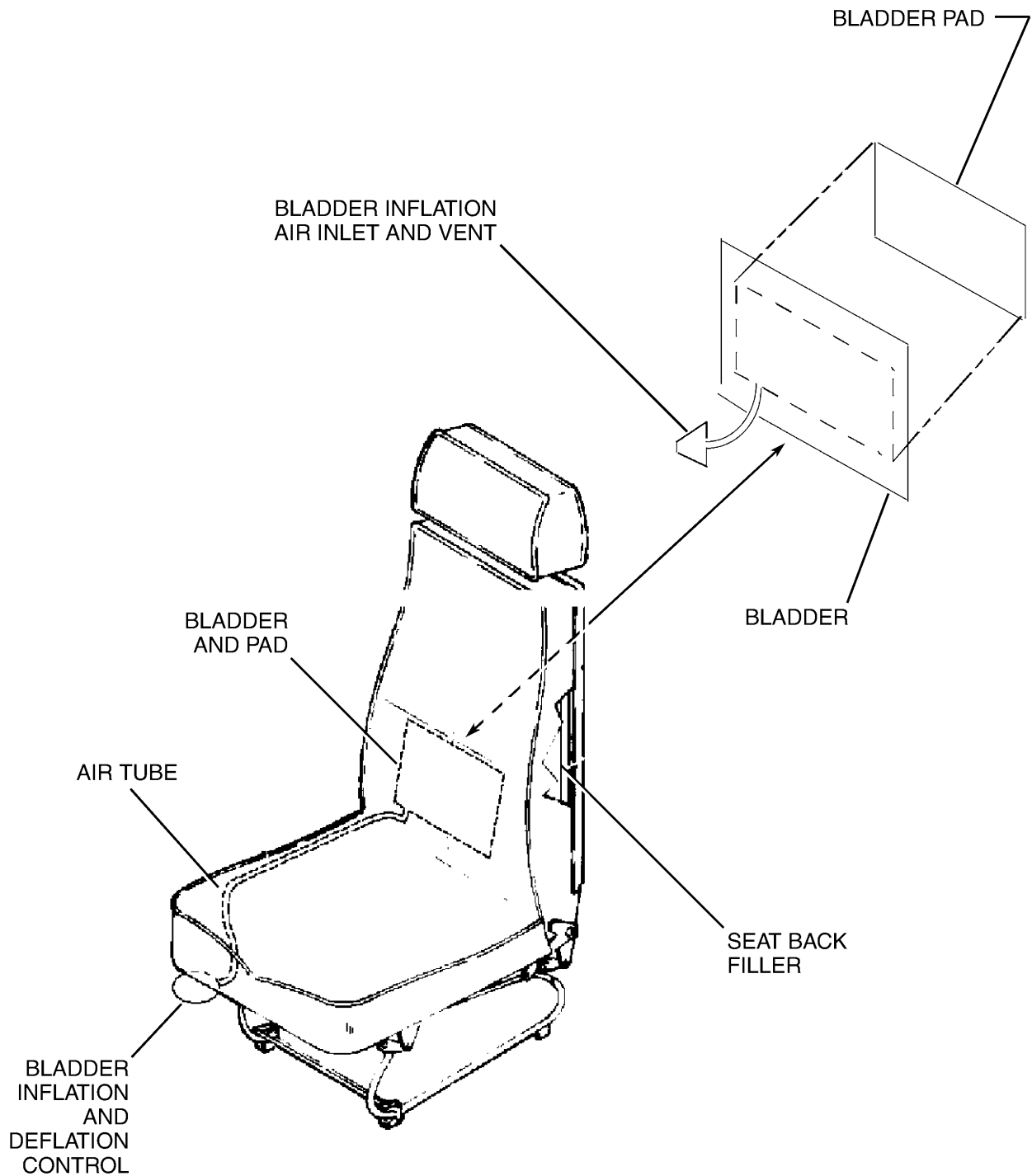
(a) Assemble materials when adhesive is dry to touch, but tacky under slight pressure. Position the surfaces to be joined carefully before allowing adhesive to adhesive contact.

NOTE: Repositioning after contact will not be possible without destroying the bond. If this occurs, the adhesive shall be removed and the process repeated.

(b) Press firmly into position over the entire area of the bond.

NOTE: While cement does not set immediately, there is no need to wait before attaching bladder and pad to seat back filler.

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Lumbar Seat Bladder Installation
Figure 2

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D. To install Lumbar bladder

CAUTION: CARE MUST BE TAKEN WHEN USING THE APPROVED SOLVENTS AS THEY HAVE A LOW FLASH POINT. SOLVENTS SHOULD NOT BE USED IN CLOSE AREAS WHERE APPLICATOR CANNOT GET SUFFICIENT FRESH AIR FOR BREATHING.

NOTE: Acetone cleans well but evaporates so fast that it is difficult to wipe dry before solvent evaporates.

- (1) Surfaces to be joined shall be clean, dry, and oil free. Abrade rubber or plastic surfaces lightly with Scotch Brite™ or fine sand paper and then clean with solvent again.
 - (a) Surfaces shall be thoroughly cleaned by wiping with a clean cloth wet with solvent followed by wiping dry with a clean cloth before the solvent evaporates. The cleaning operation shall be repeated using a new clean cloth until all soil and grease is removed as evidence by a clean cloth after wiping. Clean cloths and clean solvent shall be used in the cleaning operation.

(b) APPROVED SOLVENTS:	Acetone	193-035
	Citra-Safe	279-112
	Safe Care	193-051
	Dupont 2319S/Plastic Prep.	279-081
	Isopropyl Alcohol	179-918

- (2) Apply a layer of 3M Scotch Grip 2210 or Delta Laboratories contact adhesive B-10161 (P/N 179-853) cement to rough side of bladder pad.
- (3) Apply a layer of 3M Scotch Grip 2210 or Delta Laboratories contact adhesive B-10161 (P/N 179-853) cement to seat back filler where bladder is to be located.
- (4) Allow the adhesive to dry for 15 minutes minimum, 60 minutes maximum.

NOTE: If the adhesive is allowed to dry more than 60 minutes, another coat may be applied to one of the surfaces, and then bonded after 15 minutes minimum. Both surface do not need to be tacky to achieve a bond.

- (5) Assemble materials when adhesive is dry to touch, but tacky under slight pressure. Position the surfaces to be joined carefully before allowing adhesive to adhesive contact.

NOTE: Repositioning after contact will not be possible without destroying the bond. If this occurs, the adhesive shall be removed and the process repeated.

- (6) Press firmly into position over the entire area of the bond.
- (7) Install seat back filler cover and secure velcro fastenings.
- (8) Install seat in airplane.

3. Carpets

The carpets are individually fastened to the floor with Velcro fasteners and adhesive (Hysol EA9309 NA).

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4. Restraint System

A. Inspection

(1) In S/N's 4636001 thru 4636247 only:

(a) Shoulder Harness

- 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

- 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.

(2) In S/N's 4636248 and up:

Integrated Shoulder Harness / Lap Belt (Schroth)

- (a) Inspect ends and attachment points for condition and security.
- (b) Inspect harness web material for condition and wear over its entire length. Particularly look for wear and fraying where harness web passes in and out of inertial reel and in and out of the adjusting buckle. If excessively worn, replace.
- (c) Check inertia reel mechanism by pulling sharply on strap. Verify reel will lock in place under sudden stress.

B. Inertial Reel Adjustment

The inertial reel locking feature prevents the shoulder strap from extending and holds occupant in place. For normal movement strap will extend and retract as required. If required, adjust inertial reel as follows:

- (1) Allow harness to wind up on reel as much as possible.
- (2) On end of reel, pry off plastic cover over spring. Make sure spring does not come out of plastic cover. Set aside plastic cover.
- (3) Unwind the harness completely. Measure and mark the harness 24 inches from the reel center.
- (4) Wind harness onto reel until the 24 inch mark is reached. Hold reel and place cap with spring over reel shaft end.
- (5) Align slot in shaft with spring tang. Wind spring 6 1/2 turns and snap plastic cover into holes in reel end shaft.
- (6) Release harness and allow harness to wind up. Extend harness several times to check reel for smooth operation.
- (7) Hold inertia reel with reel completely wound and inertia mechanism end up. Pry off plastic cover over mechanism and set reel aside.
- (8) Install nut in plastic cover so that stud in cover is flush with nut surface. Position cover over reel and snap cover into place. Extend harness several times to ensure reel operates smoothly.

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PASSENGER COMPARTMENT

1. Aft Facing Passenger Seats (See Figure 1.)

A. Removal

- (1) Disconnect the upper end of the gas spring support from the bracket on the outboard side of the seat back.
- (2) Remove the bolts and washers that secure the seat pedestal to the floor.
- (3) Remove the seat.

B. Installation

- (1) Position seat on floor.
- (2) Secure seat pedestal to floor with bolts and washers.
- (3) Connect the upper end of the gas spring support to the bracket on the outboard side of the seat back.

C. Gas Spring Support

WARNING: DO NOT ATTEMPT TO DISASSEMBLE THE GAS SPRING.

(1) Removal

- (a) Disconnect the upper end of the gas spring support from the bracket on the outboard side of the seat back.
- (b) Disconnect the lower end of the gas spring support from its lower bracket by removing the cotter pins, washers (if any) and pins from the gas spring support's attach stop.
- (c) Remove the gas spring support.

(2) Installation

- (a) Place the gas spring support in position.
- (b) Connect the lower end of the gas spring to its lower bracket with the washers (if any), pins and cotter pins.
- (c) Connect the upper end of the gas spring to its upper support (on the outboard side of the seat back) with the bolt, washer, nut and cotter pin.

2. Forward Facing Passenger Seats (Not Shown)

A. Removal

- (1) Remove the seat bottom filler assembly from the seat bottom pan assembly to gain access into the interior of the pan.
- (2) Disconnect the cable from the forward end of the seat back actuator and remove the seat back actuator from the channel as follows:
 - (a) Remove the forward bolt from the channel and remove the seat back release cover from the channel.
 - (b) Remove the two cotter pins from the retaining pins in the stop assembly and remove the retaining pins from the stop assembly.
 - (c) Remove the nut, bolt and washers from the aft end of the seat back actuator. Lift the actuator from the channel.
- (3) Remove the bolts that hold the channel, seat back supports and armrest supports to the bottom of the seat pan. Lift the seat back with its supports from the seat assembly.

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- (4) The armrest may be removed from the side of the pan assembly by removing the nuts, bolts and washers that attach the armrest to the armrest support/side of the pan assembly.
- (5) Remove the pan assembly from the floor.

B. Installation

- (1) Position the pan assembly on the floor.
- (2) Attach the armrest (if previously removed) to the side of the pan with the nuts, bolts and washers.
- (3) Secure the channel to the outboard side of the pan bottom/floor with the aft three bolts and washers.
- (4) Secure the armrest support and the seat back assembly support to the inboard side of the pan bottom with the bolts and washers. Install the forward inboard bolt.
- (5) Install the seat back actuator into the channel as follows:
 - (a) Position the seat back actuator into the channel.
 - (b) Slide the bolt into the aft holes in the channel, placing on the bolt (in order): washer (if required), bushing, aft fitting of seat back actuator, roller, washer (if required) and nut.
 - (c) Insert a pin in each side of the stop assembly and secure them with cotter pins.
 - (d) Secure the seat back release cover to the forward portion of the channel with the nut and bolt.
 - (e) Attach the cable assembly to the forward end of the seat back actuator.
- (6) Attach the seat back/seat back support to the bottom of the pan assembly and aft portion of channel.
- (7) Reinstall the seat bottom filler assembly on the seat bottom pan assembly.

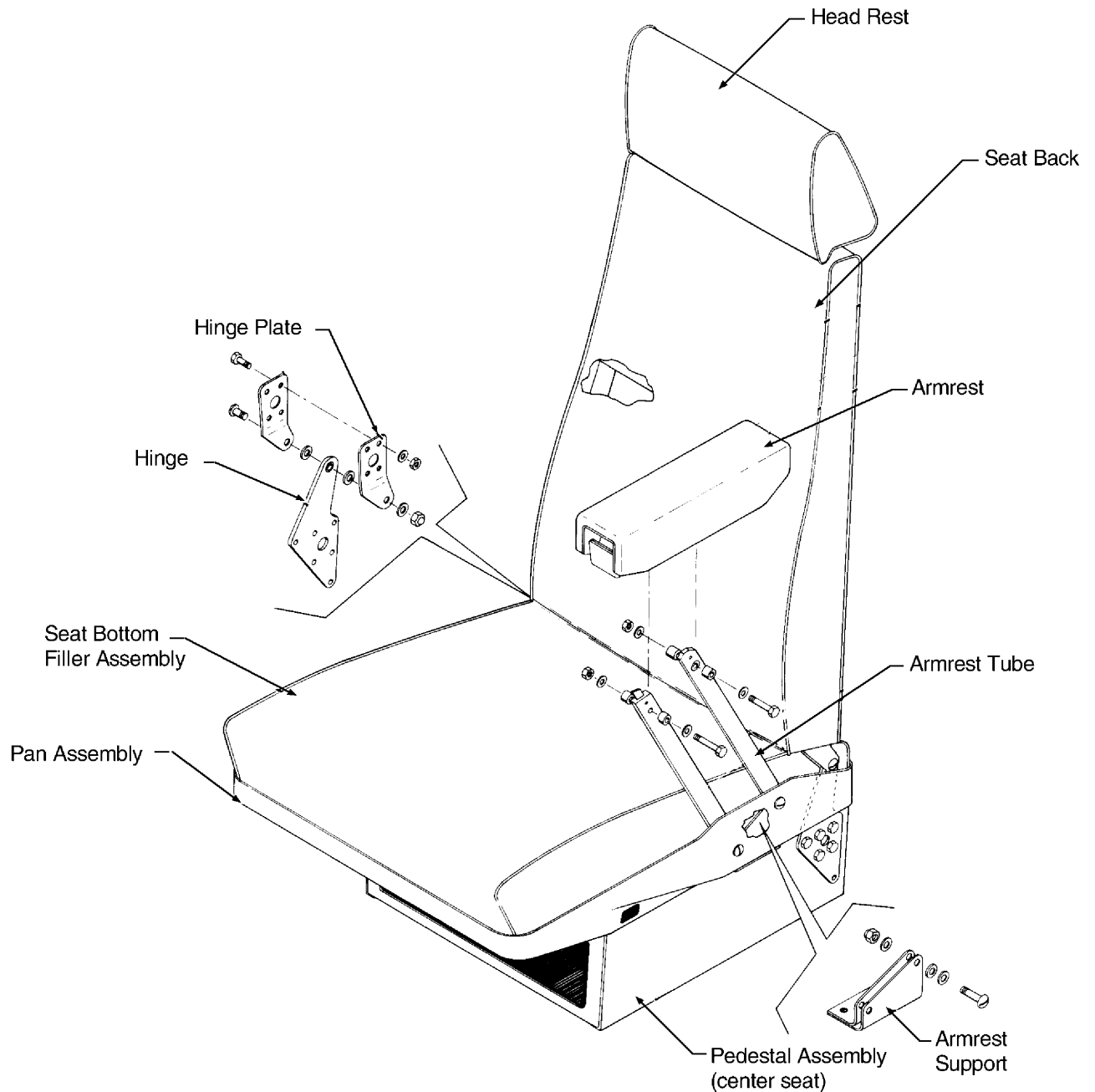
3. Cabinets (Optional)

The two cabinets are located between the crew seats and the forward passenger seats. They are secured to the floor by four bolts and washers (torque to 20-25 in. lbs.).

4. Conference Table (Optional)

The conference table is located between the center and aft passenger seats on the right side panel just below window level opposite the cabin door. The table assembly is secured by 3 screws and washers.

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Passenger Seats - Aft Facing
Figure 1

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CARGO COMPARTMENTS

Aft Baggage Net

The lower edge of the aft baggage net is secured to the F.S. 233.87 frame by four screws. The upper edge of the baggage net is secured to two stud assemblies (one on either side of the interior). The studs are located slightly aft of the shoulder harness inertia reel for the aft seat.

In the stowed position, the net may be rolled and left on the baggage floor at the base of the aft seat backs.

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EMERGENCY

1. Artex 110 Emergency Locator Transmitter

A. Description

The Artex ELT-110 transmits on 121.5 MHz and 243.0 MHz, and is designed to meet or exceed the requirements of TSO C91a and FAR Part 91. Electrical power for the ELT transmissions is totally supplied by its own self-contained battery. The battery must be replaced if the transmitter has been used in an emergency situation or if accumulated test time exceeds one hour, or no later than the replacement date marked on the transmitter label, whichever comes first.

The Artex 110 cannot be accidentally activated by dropping the unit, handling it roughly, or during shipping. However, when properly mounted, and locked into its mounting tray, the E. L. T. will activate in a crash, regardless of the cockpit remote switch and E. L. T. switch position. The normal position of the E. L. T. switch is in the down or OFF position. The normal position of the remote cockpit switch is in down or ARM position.

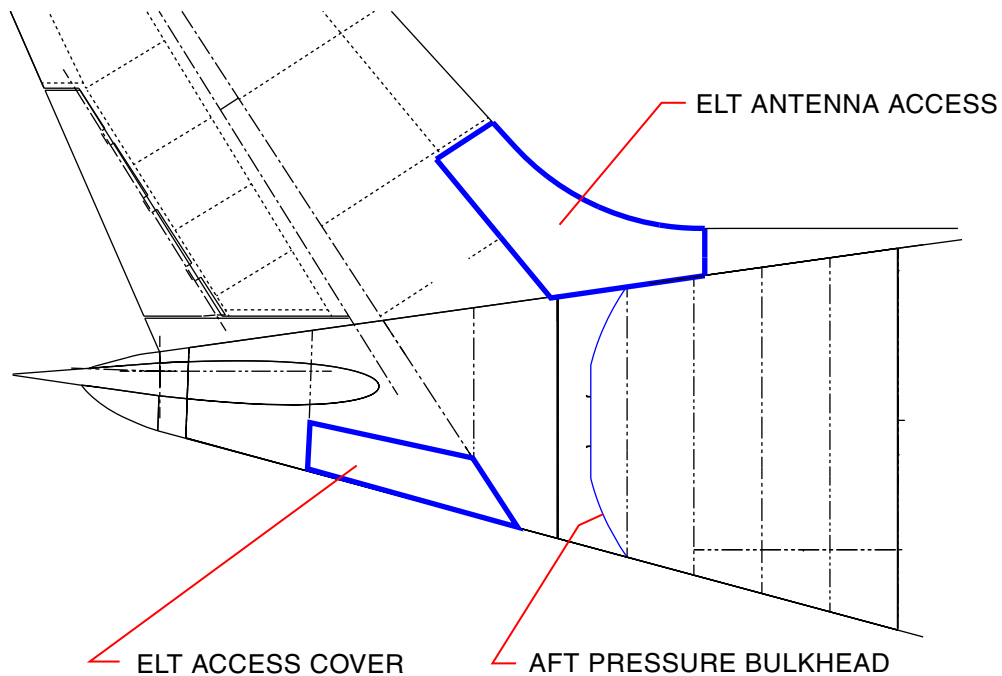
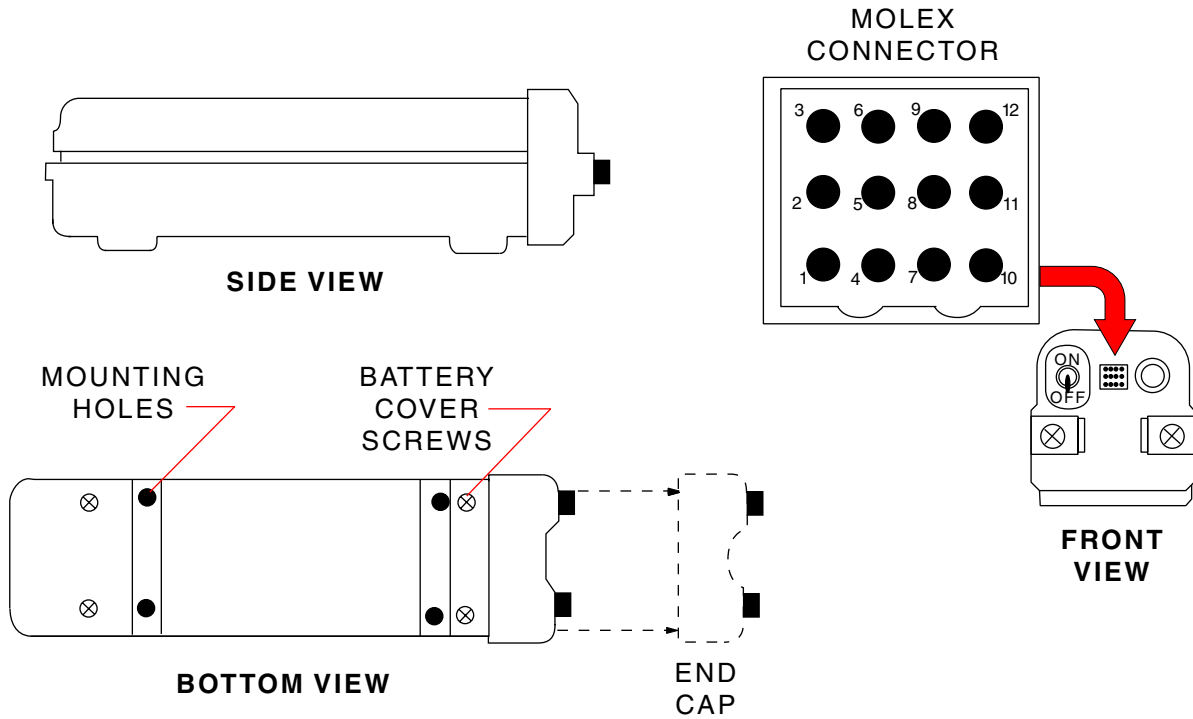
Whenever the E. L. T. is activated, a red light located just above the remote cockpit switch will blink to alert the pilot or maintenance personnel. Should the E. L. T. be activated accidentally, it must be reset. To reset:

- (1) Position the remote cockpit switch to ON, then immediately reposition it to ARM, or;
- (2) Position the switch on the E. L. T. to ON, then immediately reposition it to OFF.

B. Battery Removal and Installation (Refer to Figure 1)

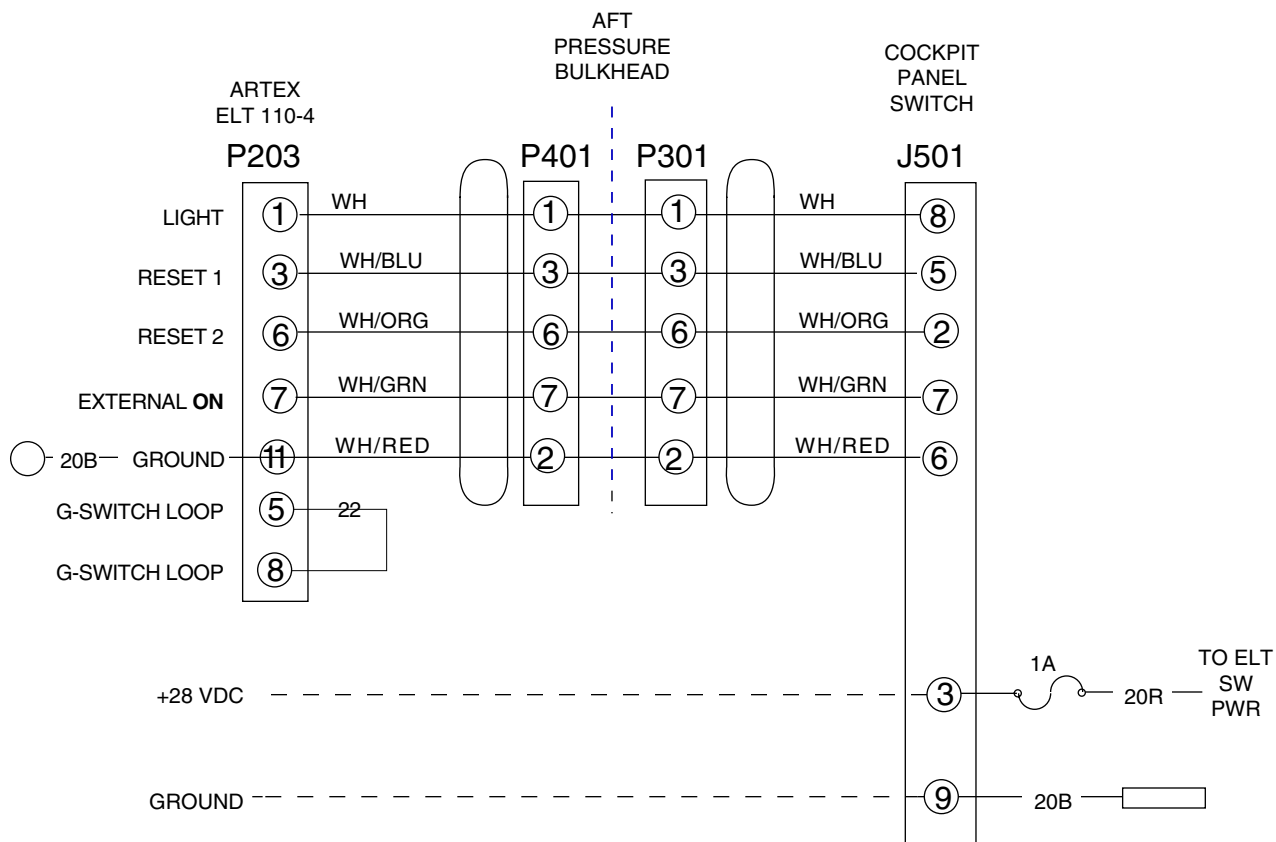
- (1) Disconnect and remove positive cable from battery.
- (2) Remove E. L. T. from the airplane by:
 - (a) Loosening the two screws on the front of the mounting tray and pull mounting tray cap off.
 - (b) Disconnecting coax (antenna) cable.
 - (c) Disconnecting the Molex cable from the E. L. T. unit.
 - (d) Remove unit from airplane.
- (3) Remove the four screws on the bottom of the E.L.T. securing the battery pack.
- (4) Disconnect battery pack connector from main unit.
- (5) Remove battery pack from unit.
- (6) Securely plug in new battery pack connector to main unit.
- (7) Immediately reset unit by positioning unit switch to ON, then to OFF.
- (8) Fit new battery pack into place. Ensure all gaskets are properly aligned.
- (9) Replace the four screws. Dress wires away from standoffs to avoid pinching wires between standoffs and the battery pack.
- (10) Install unit into mounting tray:
 - (a) Connect molex and coax cables to ELT unit.
 - (b) Install mounting tray cap and secure to front of mounting tray with the two screws.
- (11) Install positive cable to battery.
- (12) Test transmitter.

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Artex 110 E. L. T.
Figure 1

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Artex 110 E. L. T. Wiring Schematic
Figure 2

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C. Emergency Locator Transmitter Testing

The transmitter operates on the emergency frequencies of 121.5 and 243.0 MHz; both of these frequencies are monitored by the various FAA installations. Before performing any operational test of the ELT, the following precautions should be observed:

CAUTION: TESTING OF AN ELT SHOULD BE CONDUCTED IN A SCREEN ROOM OR METAL ENCLOSURE TO ENSURE THAT ELECTROMAGNETIC ENERGY IS NOT RADIATED DURING TESTING. IF A SHIELDED ENCLOSURE IS NOT AVAILABLE, TESTING MAY BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:

- (1) Test should be no longer than three audio sweeps.
- (2) Test should be conducted only within the time period made up of the first five minutes after any hour.
- (3) If the operational tests must be made at a time not included within the first five minutes after the hour, the test should be coordinated with the closest FAA Tower or Flight Service Station.

CAUTION: CONSULT FAA ADVISORY CIRCULAR AC 20-81 FOR DETAILED INFORMATION CONCERNING UNSHIELDED TESTING.

- (4) Turn the airplane master switch ON.
- (5) Tune airplane communications receiver to 121.5 MHz. Check that aircraft battery and radio master switches are ON.
- (6) Position ELT cockpit switch to ON. The ELT should immediately begin signaling and the panel light should immediately come ON. Although the light may illuminate after a few seconds, failure of the light to immediately come ON indicates trouble with the G-Switch circuit, pins 5 and 8 on tray connector, and that the unit is not working properly. Repairs should be done only by a licensed aviation radio repair shop.

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CHAPTER

26

FIRE PROTECTION

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CHAPTER 26

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	4	Jul 30/05			

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CHAPTER 26 - FIRE PROTECTION

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EXTINGUISHING

WARNING: AFTER DISCHARGE OF EXTINGUISHER AVOID EXPOSURE TO SMOKE, VAPORS AND OTHER BY-PRODUCTS OF FIRE. DO NOT INCINERATE EXTINGUISHER.

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

Portable Fire Extinguisher

A. Description

A portable, disposable, Class 2B:C fire extinguisher (Model No. A600) is installed as standard equipment. Containing 1.2 lbs. (550 grams) of Halon 1211/1301 blend, the extinguisher is located either in the top of the right-hand pyramid cabinet (if installed) or on the floor just aft of the spar carry thru and behind the co-pilot's seat (see Figure 1). When floor-mounted, the extinguisher is secured by a quick release bracket.

To operate the extinguisher, remove it from the quick-release bracket, hold it upright in either hand by the handgrip, with the spray nozzle pointing forward. Remove the safety pin, direct the nozzle towards the base of the fire source, depress the lever. Maximum extinguishing effect is obtained if the fire fighter uses side to side motion and keeps moving in towards the base of the fire source as it is extinguished. Releasing the lever closes a secondary seal inside the operating head. This interrupts the flow of extinguishant, thus retaining part of the charge, for dealing with a flash back or re-ignition should they occur, without waste or leakage. A partly or totally discharged extinguisher should be replaced immediately after use.

B. Inspection

Disposable type fire extinguishers should be maintained and inspected in accordance with the nameplate instructions.

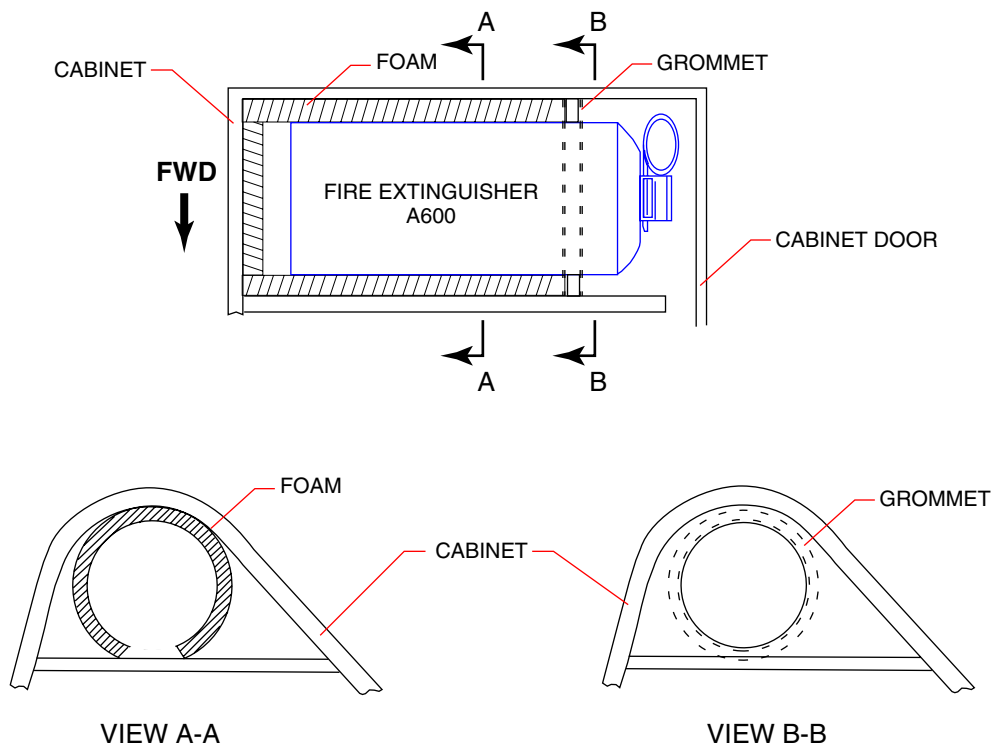
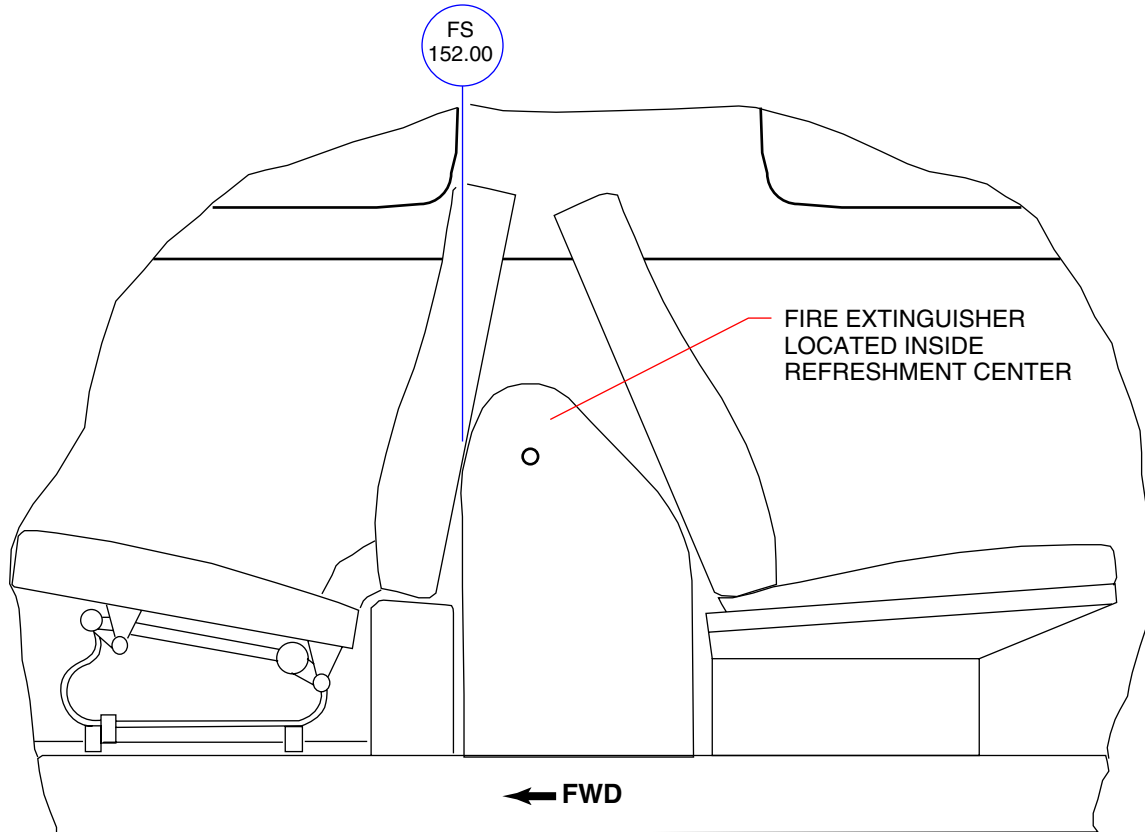
(1) Monthly

Inspect monthly or more frequently. Ensure nozzle is not obstructed and safety seal is intact. Inspection is a "quick check" that an extinguisher is available and will operate. It is intended to give reasonable assurance that the extinguisher is fully charged and operable. This is done by seeing that it is in its designated place, that it has not been actuated (discharged) or tampered with, and that there is no obvious physical damage or condition to prevent operation. Determine fullness by weighing or "hefting."

(2) 100 Hour / Annual

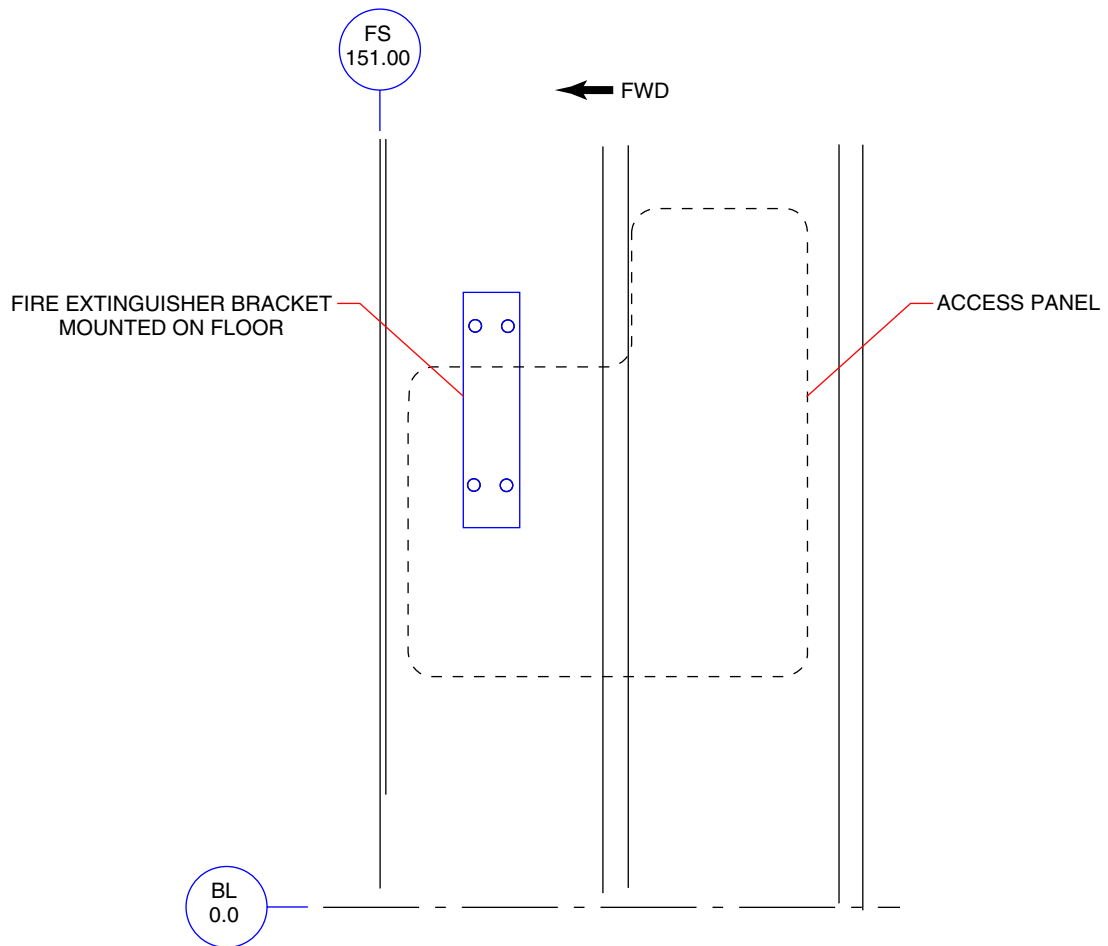
Each 100 hours or annually, whichever comes first, weigh the extinguisher. Replace and return to manufacturer if gross weight is below the minimum specified on the nameplate.

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Fire Extinguisher Locator
Figure 1 (Sheet 1 of 2)

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Fire Extinguisher Locator
Figure 1 (Sheet 2 of 2)

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AIRPLANE MAINTENANCE MANUAL

CARD 3 OF 8

PA-46-350P



(S/N's 4636001 AND UP)

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Technical Publications

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2926 Piper Drive
Vero Beach, Florida 32960
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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	June 19, 1996	All
PR980101	January 1, 1998	1, 2, 3, 4, 5, and 6
CR981223	December 23, 1998	1, 2, 3, 4, 5, and 6
PR000201	February 1, 2000	1, 2, 3, 4, 5, and 6
PR010515	May 15, 2001	1
CR050730	July 30, 2005	1, 2, 3, 4, 5, 6, 7 and 8
PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

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3. Effectivity

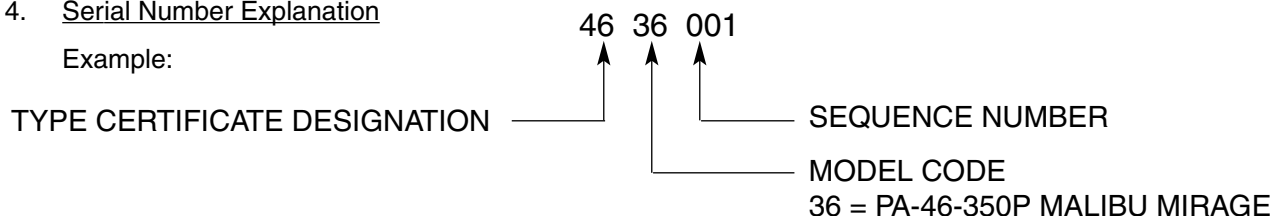
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or) S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

**(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP,
AND ALL HYDRAULIC COMPONENTS:**

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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(23) PROPELLER AND 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

Propeller
Overhaul Instructions: Manual No. 113

Composite Blade
Maintenance: Manual No. 135

Propeller Owner's
Manual: Manual No. 115

Aluminum Blade
Inspection, Repair,
and Overhaul Instructions: Manual No. 133

(24) RADAR (WEATHER), RDR - 2000:

Vendor Address:	Honeywell (Bendix/King) (See Autoflight, above)

Maintenance Manual:	Bendix/King ART 2000 P/N 006-05332-0001

(25) RADIO COOLING BLOWER:

Vendor Address:	Globe Motors 2275 Stanley Ave. Dayton, Ohio 45404 http://www.globe-motors.com/home.html	PH: (937) 228-3171 FAX: (937) 229-8531

(26) STARTER:

Vendor Address:	Electro Systems, Inc. (See Alternator, above)

(27) TURBOCHARGER:

Vendor Address:	Turbocharging Systems Worldwide HQ Building #10, Ste. 200 23326 Hawthorne Blvd. Torrance, CA 90505 http://www.alliedsignal.com/turbos/products/index.html	PH: (310) 791-9101 FAX: (310) 534-5941

(28) VACUUM PUMP:

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

(29) VACUUM REGULATORS:

Vendor Address:	Parker Hannifin Corp. (see "Fuel Boost Pump," above)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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5		TIME LIMITS/MAINTENANCE CHECKS	1C9
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12		SERVICING	1I3
	00	General	
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	20	Painting	
21		ENVIRONMENTAL SYSTEMS	2C1
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	20	Distribution	
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	10	Aileron and Tab	
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	60	Speedbrakes	

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GENERAL

1. Description and Operation

The airplane is controlled in flight by the use of three primary control surfaces, consisting of ailerons, elevator and rudder. Operation of these controls is through movement of the dual control wheels and rudder pedals. On the forward end of each control wheel is a quadrant assembly to which the aileron control cables are fastened. Also connected to the control wheel push-pull tubes are interconnect arms to the elevator torque tube located behind the instrument panel. Mounted on this torque tube are sectors to which the elevator control cables are fastened; thus the forward and aft movement of the control wheels in turn moves the torque tube and sectors thus transmitting movement thru the control cables to the elevator.

The rudder controls are driven from dual rudder pedals through torque tubes which have dual sectors connected and control cables from these sectors to the rudder sector located in the aircraft tail section. Provisions for elevator and rudder trim are provided by adjustable trim mechanisms. The trim controls and indicators are in the pedestal located on the instrument panel. Elevator trim is through cables routed to the elevator trim screw located in the tail cone which drives dual actuators to the trim tab. The rudder trim is controlled by a trim wheel and screw assembly connected to a bungee assembly connected to the rudder torque tube behind the instrument panel.

The ailerons and rudder are interconnected through a spring system which is activated only when controls are out of harmony. In normal coordinated flight it is inactive.

2. Standard Practices and Procedures

Tips for the removal, installation and rigging of the various 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. When referring to marking cable end, 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.
- G. 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 Advisory Circular 43.13-1, latest revision.
- H. 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 of an inch thread engagement.
- I. When installing rod end jamnuts, refer to 20-00-00, Figure 2, for proper installation method.

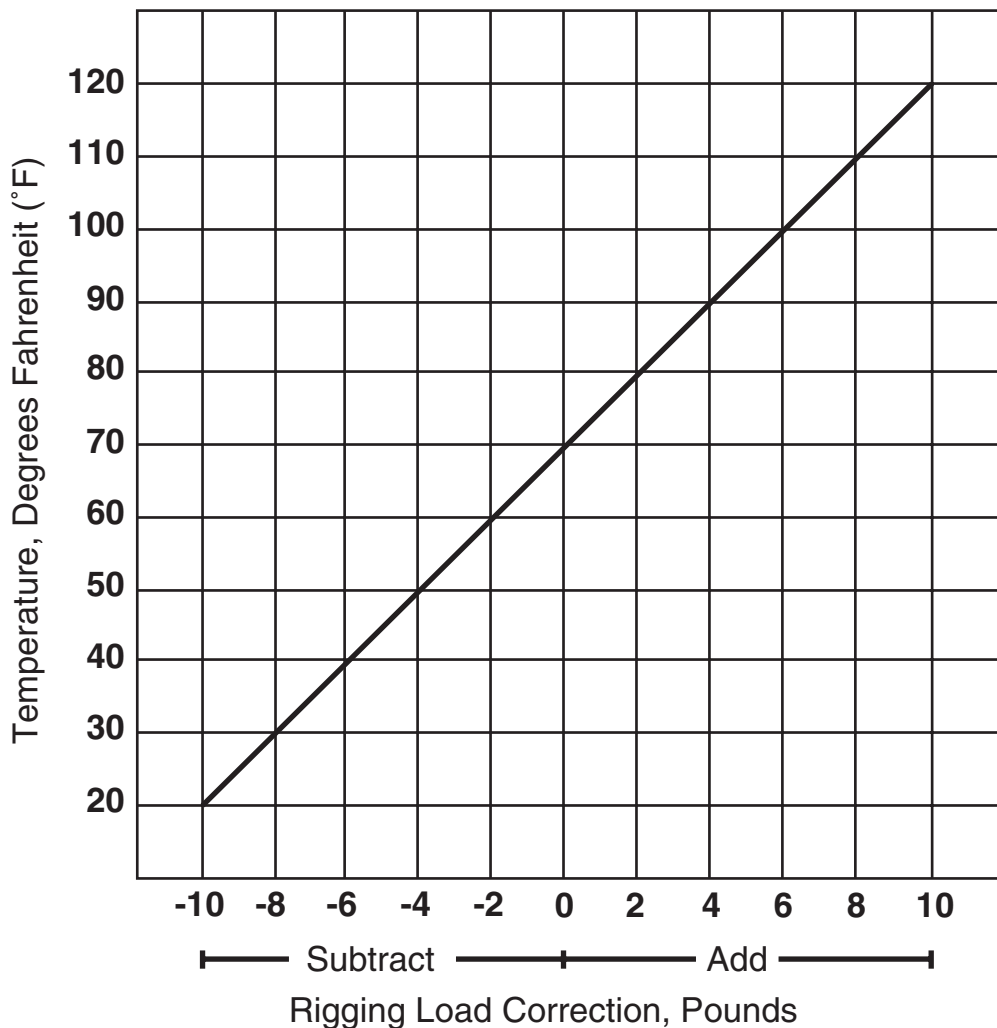
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- J. After completion of adjustments, each jam nut must be tightened securely.

NOTE: Cable rigging tensions specified must be corrected to ambient temperature in the area where the tension is being checked, using Chart 1. On new airplanes, it is suggested that cables initially be tensioned 25 to 30 percent over nominal tension, then loosened to the "High Side" of the tolerance. This will aid in maintaining specified tension after flight testing.

- K. Torque all nuts in the flight control system (including nose wheel steering), refer to Recommended Nut Torques Chart in Chapter 91.
- L. Check all cable ball ends for proper seating in retainers after setting cable tension.

**CHART 1
CABLE TENSION vs. AMBIENT TEMPERATURE**



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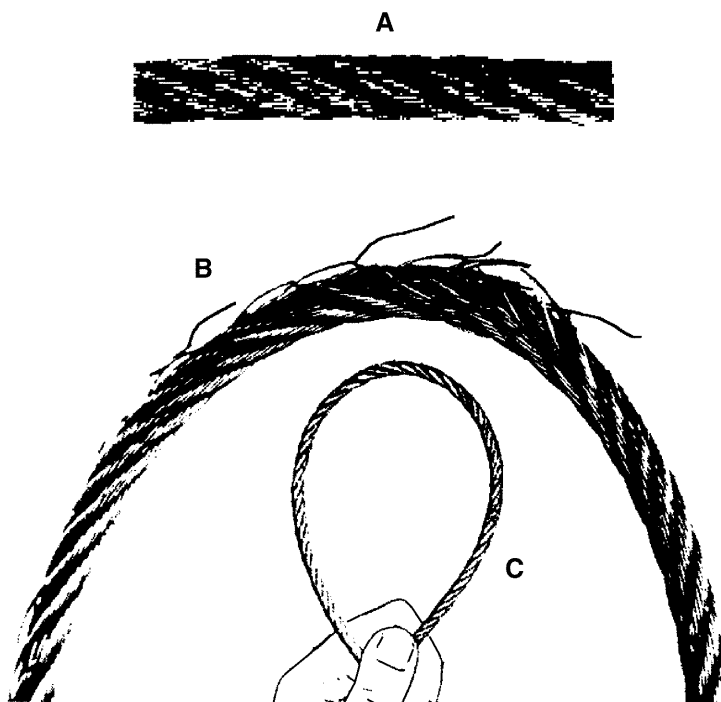
3. Control Cable Inspection

Aircraft control cable systems are subject to a variety of environmental conditions and forms of deterioration that, with time, may be easy to recognize as wire/strand breakage or the not-so-readily visible types of wear, corrosion, and/or distortion. The following data may help in detecting the presence of these conditions:

A. Cable Damage

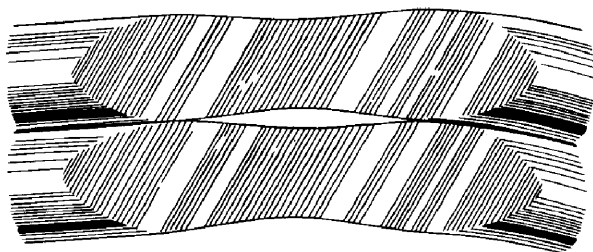
Critical areas for wire breakage are sections of the cable which pass through fairleads and around pulleys. To inspect each section which passes over a pulley or through a fairlead, remove cable from aircraft to the extent necessary to expose that particular section. Examine cables for broken wires by passing a cloth along length of cable. This will clean the cable for a visual inspection, and detect broken wires, if the cloth snags on cable. When snags are found, closely examine cable to determine full extent of damage.

The absence of snags is not positive evidence that broken wires do not exist. Figure 1A shows a cable with broken wires that were not detected by wiping, but were found during a visual inspection. The damage became readily apparent (Figure 1B) when the cable was removed and bent using the techniques depicted in Figure 1C.

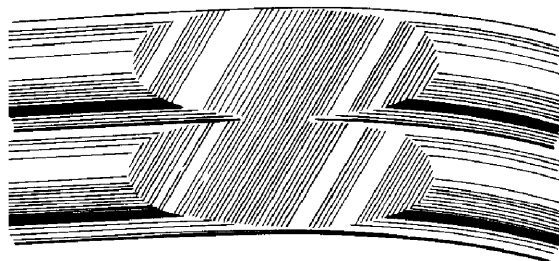


Control Cable Inspection
Figure 1

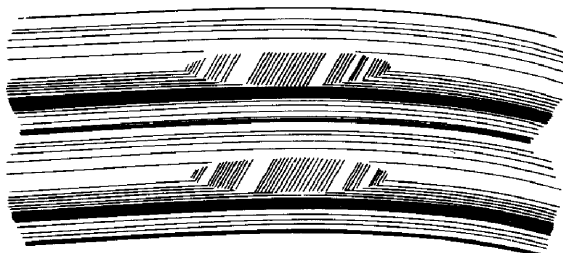
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**INDIVIDUAL OUTER WIRES
WORN MORE THAN 50%**



**INDIVIDUAL OUTER WIRES WORN
MORE THAN 40 - 50 %
(NOTE BLENDING OF WORN AREAS)**



**INDIVIDUAL OUTER WIRES WORN LESS THAN 40%
(WORN AREAS INDIVIDUALLY DISTINGUISHABLE)**

External Cable Patterns
Figure 2

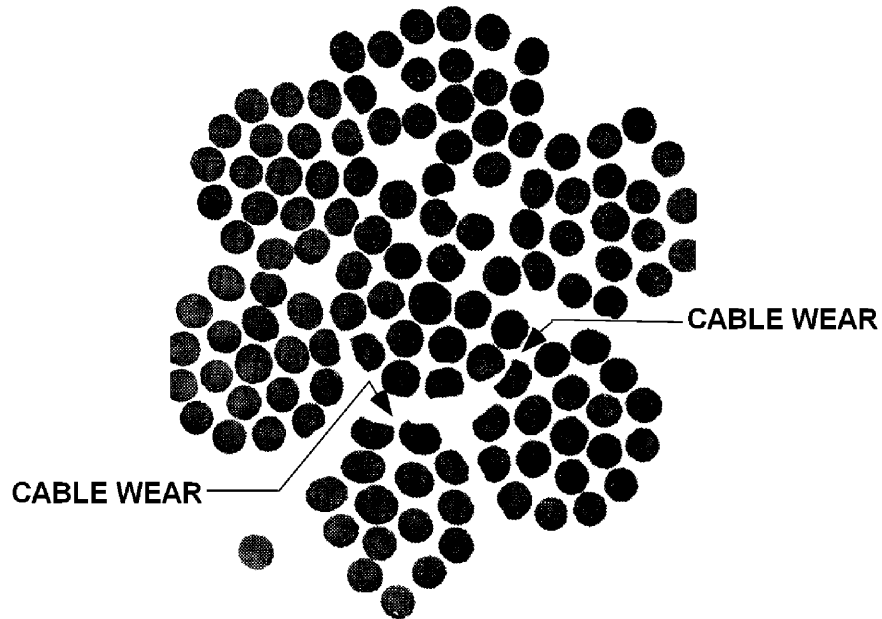
B. External Wear Patterns

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 2.

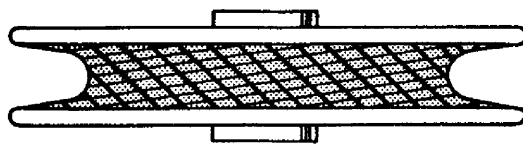
C. Internal Cable Wear

As wear is taking place on the exterior surface of a cable, the same condition is taking place internally, particularly in the sections of the cable which pass over pulleys and quadrants. This condition, shown in Figure 3, is not easily detected unless the strands of the cable are separated. Wear of this type is a result of the relative motion between inner wire surfaces. Under certain conditions the rate of this type wear can be greater than that occurring on the surface.

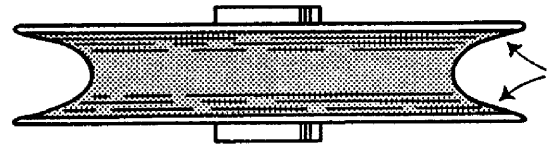
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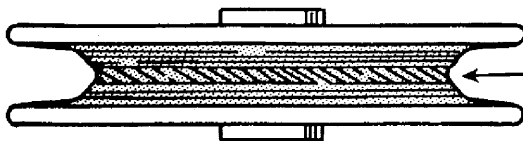
Internal Cable Patterns
Figure 3



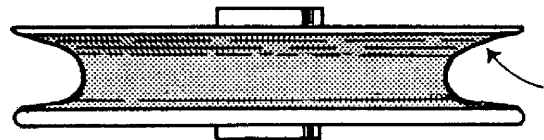
EXCESSIVE CABLE WEAR



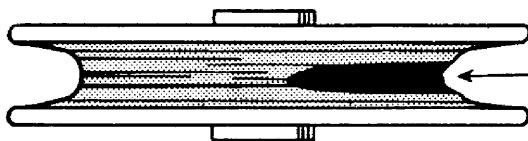
PULLEY MISALIGNMENT



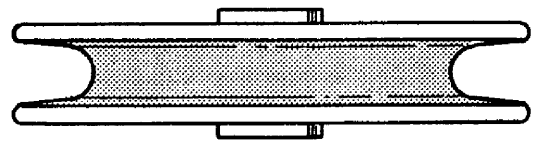
PULLEY TOO LARGE FOR CABLE



CABLE MISALIGNMENT



FROZEN BEARING



NORMAL CONDITION

Pulley Wear Patterns
Figure 4

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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.

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.

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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 4.

4. Special Tools

These tools are used at the factory and are recommended where the following rigging and/or alignment procedures specify "use a suitable tool." Order them through any Piper Dealer.

<u>Tool (Tool Number)</u>	<u>Piper P/N</u>
Rudder Pedal Neutral Alignment Tool (HF 622724)	762-151
Elevator / Elevator Trim Travel Tool (HF 689259)	762-144
Nose Wheel Centering (i.e. - Neutral) Tool (HF 622722)	762-147
Aileron and Flap Travel Tool - Left Wing (CKJ 622719)	762-149
Aileron and Flap Travel Tool - Right Wing (CKJ 622720)	762-150
Rudder Travel Tool (TL 622721)	762-153
Control Wheel Neutral Tool (HF 622725)	N/A

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5. Fin Type Control Cable Air Seals (Refer to Figure 5.)

This airplane is equipped with ten fin type control cable air seals. Six seals (one for each control cable going to the empennage) are located on the aft pressure bulkhead. Two seals are located in each wing root for the aileron cables.

A. Drawing Cables Through

It is not necessary to completely remove the seal from the bulkhead in order to draw a cable turnbuckle through the seal.

To draw a cable turnbuckle through the seal.

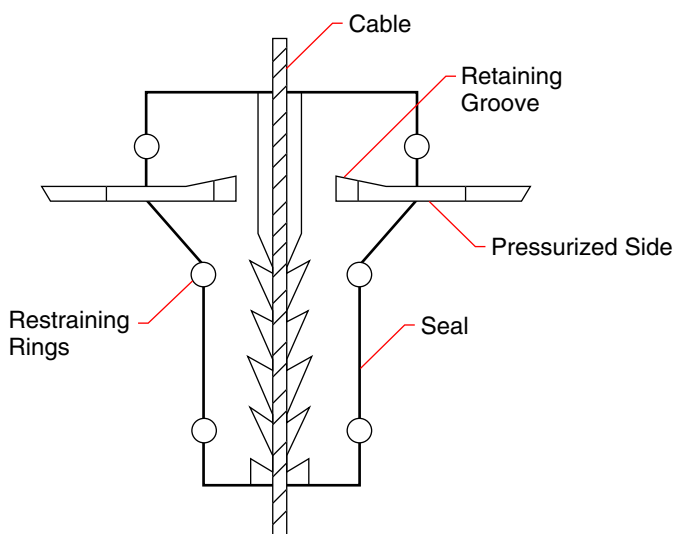
- (1) Remove the three seal clips (per seal).
- (2) Grease the cable and turnbuckle with MIL-G-21164 grease.
- (3) Slowly pull the cable through the seal.

B. Removal

- (1) Remove the three seal clips (per seal).
- (2) Compress the seal and pull it from the hole in the bulkhead.
- (3) Remove the seal from the cable.

C. Installation

- (1) Fill the cable air seal with MIL-G-21164 grease.
- (2) Apply MIL-G-21164 grease to the full travel of the cable section that passes through the seal when the control is actuated.
- (3) Apply a light coat of MIL-G-21164 on the external small end and tapered section of the seal for ease of insertion.
- (4) Place the seal on the cable, on the non-pressurized side of the bulkhead with the small end of the seal pointing towards the bulkhead.
- (5) Insert the seal in the bulkhead hole so that the bulkhead sheet is entirely within the seal retaining groove.
- (6) Install the proper retaining rings on the seal, two on the small end and one on the large end.



Fin Type Control Cable Air Seal
Figure 5

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AILERON AND TAB

1. Troubleshooting

See Chart 1.

2. Control Wheel

A. S/N's 4636001 thru 4636020 only.

NOTE: In these airplanes, the control wheel and tube can be removed as a unit, see Control Column, S/N's 4636001 thru 4636020, below. Disassembly of the control wheel from the tube is not normally required.

(1) Removal

- (a) Remove two screws from bottom of control wheel and remove cover/pad assembly to gain access to locknut.
- (b) Remove control wheel attachment bolt, spacer, washer, and locknut. Note build up to facilitate reinstallation.
- (c) Slide control wheel off of tube.
- (d) If not already done, disconnect control wheel switches wiring harness.

(2) Installation

- (a) Connect control wheel switches wiring harness.
- (b) Slide control wheel onto tube.
- (c) Position and secure control wheel attachment bolt, spacer, washer, and locknut.
- (d) Position cover/pad assembly and secure with two screws from bottom of control wheel.

B. S/N's 4636021 thru 4636131 only.

(1) Removal

- (a) Remove two screws from bottom of control wheel and remove cover/pad assembly to gain access to locknut.
- (b) Remove control wheel attachment bolt, spacer, washer, and locknut. Note build up to facilitate reinstallation.
- (c) Slide control wheel off of tube.
- (d) If not already done, disconnect control wheel switches wiring harness.

(2) Installation

- (a) Connect control wheel switches wiring harness.
- (b) Slide control wheel onto tube.
- (c) Position and secure control wheel attachment bolt, spacer, washer, and locknut.
- (d) Position cover/pad assembly and secure with two screws from bottom of control wheel.

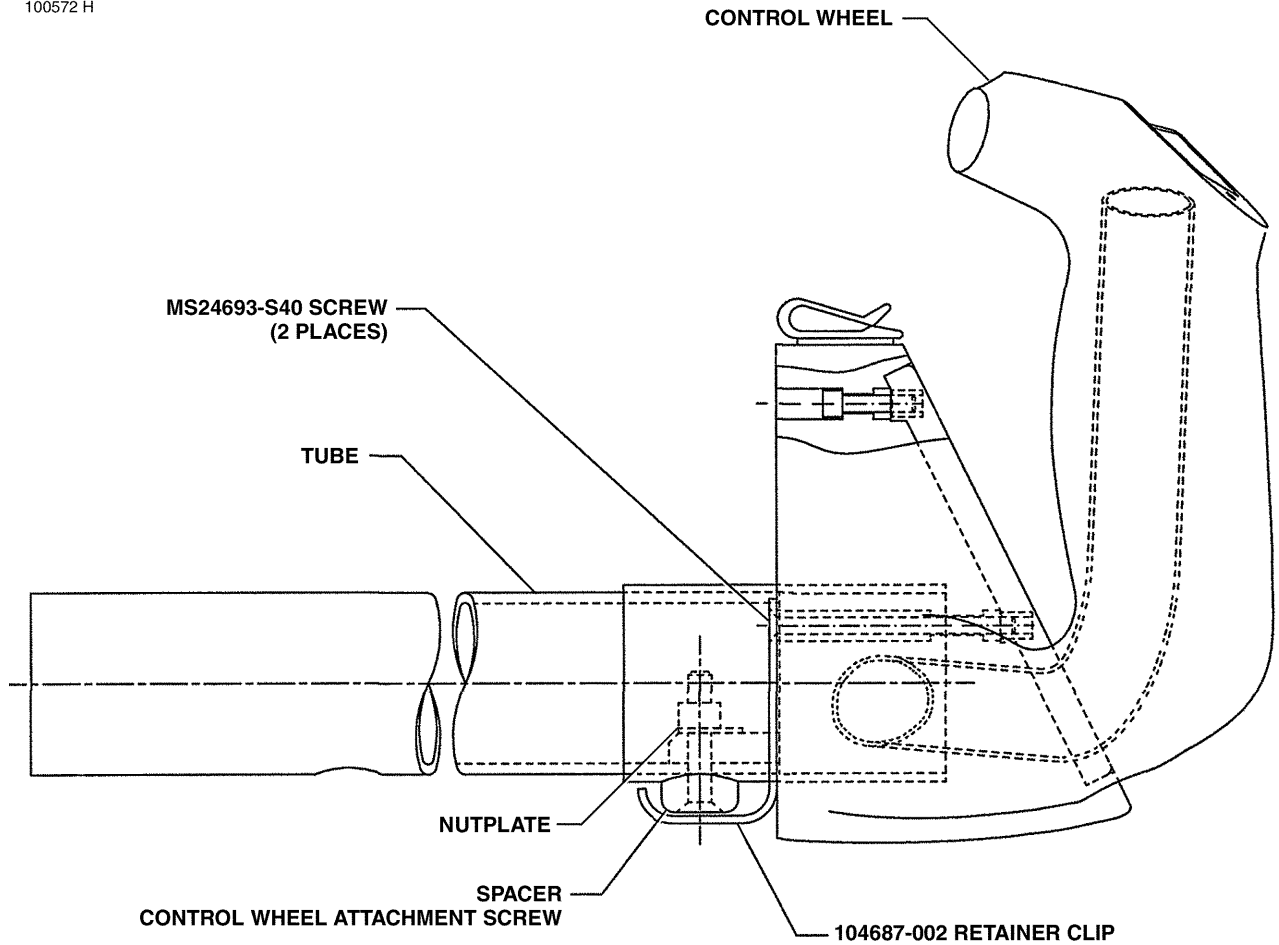
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**CHART 1
TROUBLESHOOTING AILERON CONTROL SYSTEM**

Trouble	Cause	Remedy
Lost motion between control wheel and aileron.	Cable tension too low.	Adjust cable tension.
	Linkage loose or worn.	Check linkage and tighten or replace.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
Resistance to control wheel rotation.	System not lubricated properly.	Lubricate system.
	Cable tension too high.	Adjust cable tension.
	Control column horizontal cable improperly adjusted.	Adjust cable tension.
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Bent aileron and/or hinge.	Repair or replace aileron and/or hinge.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Control wheels not synchronized.	Incorrect control column rigging.	Re-rig control column.
Control wheels not horizontal when ailerons are neutral.	Incorrect rigging of aileron system.	Re-rig aileron system.
Incorrect aileron travel.	Aileron stops not adjusted properly.	Adjust stops.
Correct aileron travel cannot be obtained by adjusting stops.	Incorrect rigging of aileron cables, and/or control wheel.	Re-rig controls.
Control wheel stops before control surfaces reach full travel.	Incorrect rigging between control wheel and control cables.	Re-rig controls.

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Control Wheel Installation
Figure 1

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C. S/N's 4636132 and up. (See Figure 1.)

The retainer clip (P/N 104687-002) and MS24693-S40 screws (2 ea.) are factory installed in S/N's 4636345 and up. S/N's 4636132 thru 4636344 must individually procure and retrofit the retainer clip and screws.

(1) Removal

- (a) Remove two (2) screws and retainer clip.
- (b) Remove control wheel attachment screw and spacer.
- (c) Slide control wheel off of tube.
- (d) Disconnect control wheel switches wiring harness.

(2) Installation

- (a) Degrease aft end of tube and inside of control wheel using acetone or naphtha. Allow to dry.
- (b) Degrease control wheel attachment screw, the spacer, and the nutplate (inside the tube) using acetone or naphtha. Allow to dry.
- (c) Prime inside of control wheel with Loctite 7649 (Piper P/N 279-073). Allow to dry.
- (d) Connect control wheel switches wiring harness.
- (e) Install control wheel onto tube using Loctite 271 (Piper P/N 279-128). Take care to ensure screw hole in control wheel aligns with screw hole in tube.

NOTE: This step must be accomplished promptly due to short cure time.

- (f) Prime threads of control wheel attachment screw with Loctite 7649 (Piper P/N 279-073). Allow to dry.
- (g) Install control wheel attachment screw (with spacer) into nutplate using Loctite 271 (Piper P/N 279-128).

NOTE: This step must be accomplished promptly due to short cure time.

- (h) Position retainer clip to capture spacer and control wheel attachment screw. Secure with screws (2), being careful not to over tighten the screws and damage the logo medallion.

3. Control Column (See Figure 3.)

A. S/N's 4636001 thru 4636020 only.

(1) Removal

(a) Control wheel and tube:

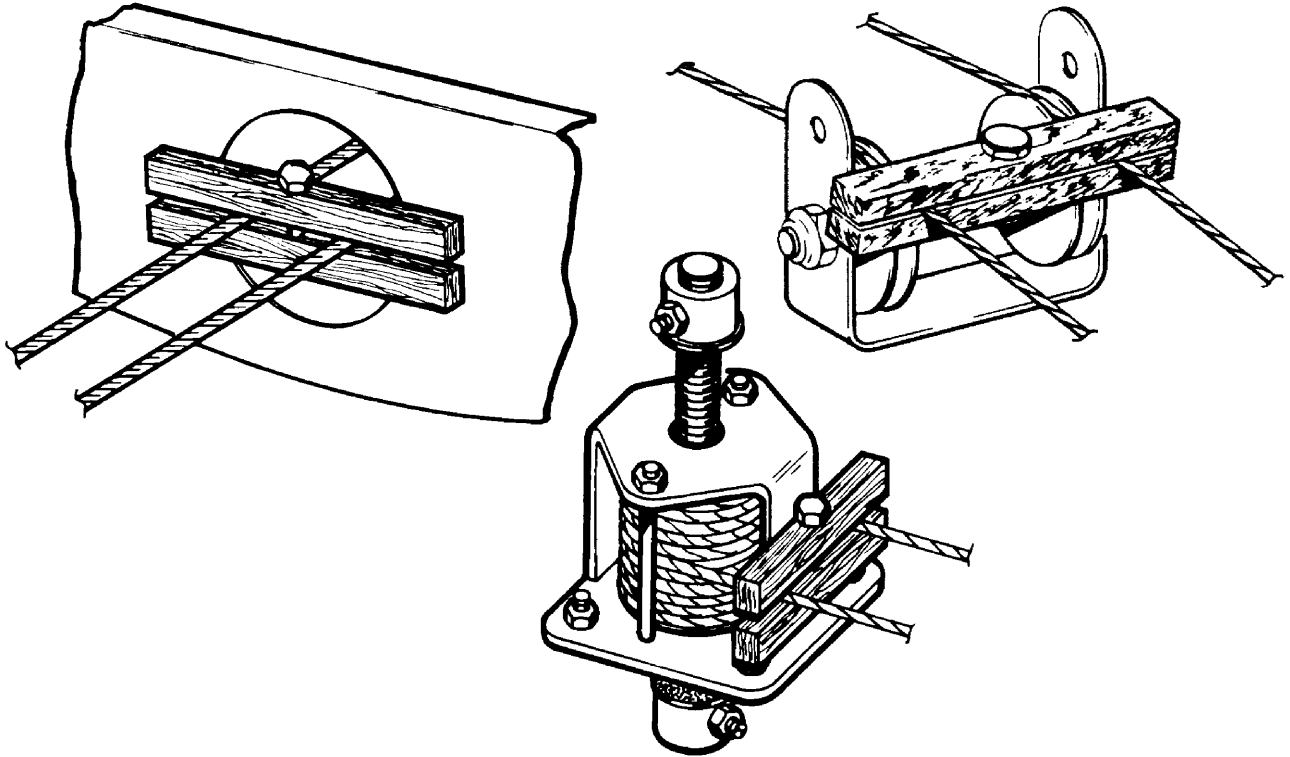
- 1 Remove the four cap screws securing the tube and control wheel to the guide assembly. Note the relation of the tube to the guide.
- 2 Pull the wheel and tube out from the instrument panel.
- 3 If not already done, disconnect control wheel switches wiring harness.

(b) Forward control column assembly:

CAUTION: LOOSEN BALANCE CABLES BEFORE REMOVING CONTROL COLUMN, TO PREVENT STRUCTURAL DAMAGE.

- 1 Block (see Figure 2) the aileron primary cables at the pulleys mounted on the pressure bulkhead (F.S. 100.00) prior to loosening the balance cable between the control wheels.
- 2 Loosen the clamps securing the protective tube over the control wheel balance cable turnbuckle. Slide the tube to one side and loosen the turnbuckle to relieve tension on the cables.

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Cable Blocking Methods
Figure 2

- 3 Remove the screws securing the cable retainers, both primary and balance, to the aileron quadrant at the forward end of the control columns.
- 4 Remove the nut and bolt securing the arms to the elevator torque tube behind the instrument panel.
- 5 Disconnect the control wheel switches electrical harness (if installed).
- 6 Remove the bolt, washers, and nut securing the control column tube to the quadrant shaft and separate the tube from the shaft. Make a note of washer buildup for reinstallation.

NOTE: The control column stop assy is fitted over the tube, secured by the same bolt, and will be removed with the tube.

- 7 The control column can now be removed from under the instrument panel.

(2) Installation

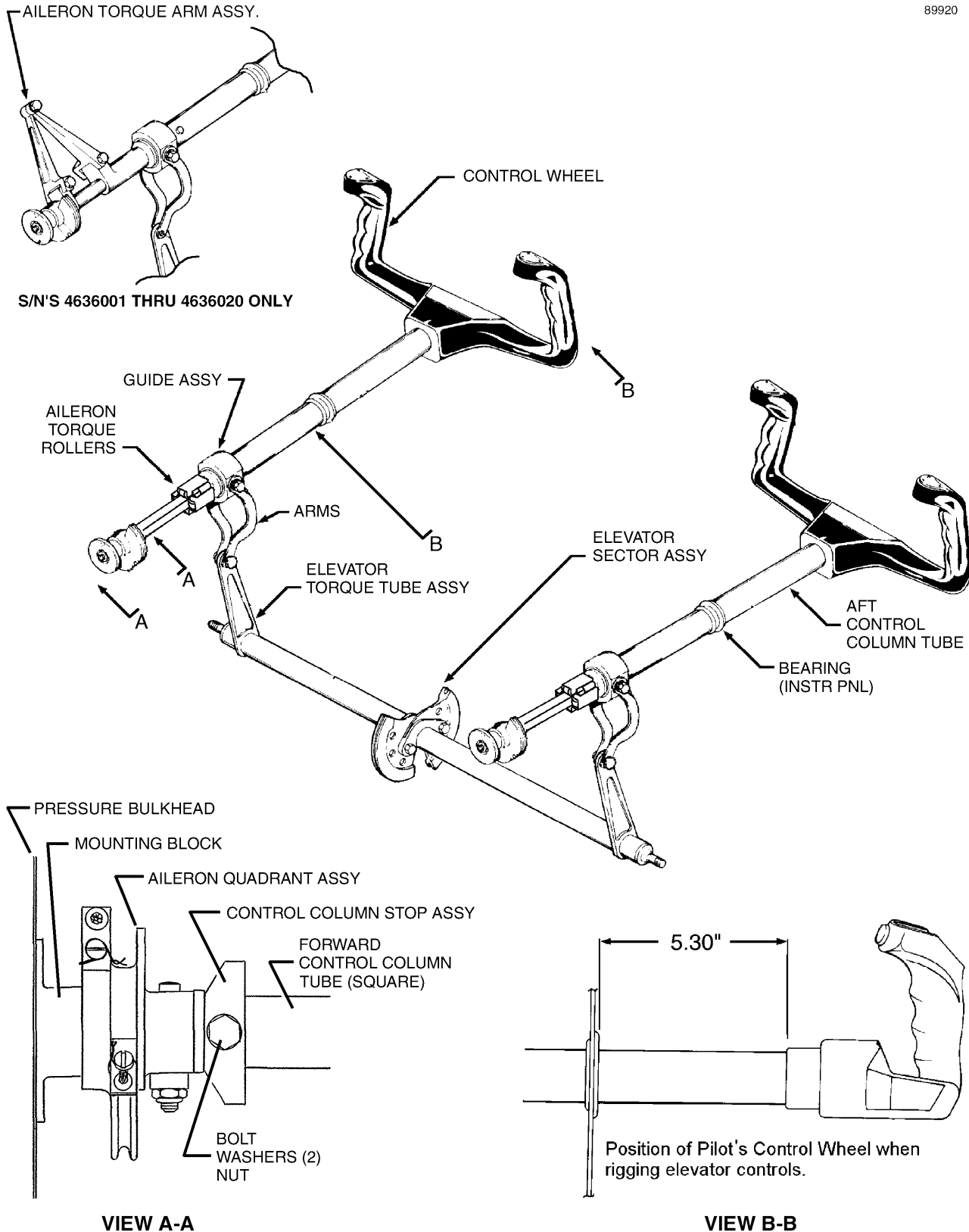
(a) Forward control column assembly:

NOTE: First, ensure that the nut attaching control column rod to mount on forward end of control column is tightened to a torque of 40 to 45 inch-pounds.

- 1 Position the forward portion of the control column assembly in place behind the face of the instrument panel.
- 2 Ensuring the control column stop assembly is in place over the forward end of the control column tube, slide the tube over the quadrant shaft. Secure the control column tube and control column stop assembly to the quadrant shaft with bolt, washers, and nut.

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Control Column Installation
Figure 3

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- 3 Attach the arms on the control column to the arm on the elevator torque tube. (The bolt beads should point outboard.)
- 4 Reconnect the control wheel switches electrical harness (if installed.)
- 5 Attach the primary and control wheel balance cables to the aileron quadrant at the forward end of the control column assembly and secure each cable end retainer (i.e. - lockplate) with a screw (see note below). Safety the cable end retainer screws with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

- 6 Remove the aileron primary cable blocks from the pulleys at F.S. 100.00.
- 7 Rig the aileron control system in accordance with instructions given in this chapter. Ensure that turnbuckles are safetied with locking clips and that protective tube is installed over turnbuckle on the control wheel balance cable.

(b) Control wheel and tube:

- 1 Connect the control wheel switches wiring harness.
- 2 Slide the wheel and tube assembly into the instrument panel.

NOTE: If bearing on instrument panel is loose when inserting wheel and tube assembly, use LOC-498-50 or LOC-495-50 Super Bond adhesive to bond bearing onto instrument panel.

- 3 Secure the tube and control wheel to the guide assembly with the four cap screws. Safety the screws.
- 4 Rig the aileron control system in accordance with instructions given in this chapter.

(c) Check the system for proper operation and freedom from binding.

B. [S/N's 4636021 and up.](#)

(1) Removal

(a) Control wheel:

Remove control wheel as described for the appropriate serial number range under Control Wheel, above.

(b) Forward control column assembly:

CAUTION: LOOSEN BALANCE CABLES BEFORE REMOVING CONTROL COLUMN, TO PREVENT STRUCTURAL DAMAGE.

- 1 Block (see Figure 2) the aileron primary cables at the pulleys mounted on the pressure bulkhead (F.S. 100.00) prior to loosening the balance cable between the control wheels.
- 2 Loosen the clamps securing the protective tube over the control wheel balance cable turnbuckle. Slide the tube to one side and loosen the turnbuckle to relieve tension on the cables.
- 3 Remove the screws securing the cable retainers, both primary and balance, to the aileron quadrant at the forward end of the control columns.
- 4 Remove the nut and bolt securing the arms to the elevator torque tube behind the instrument panel.
- 5 Disconnect the control wheel switches electrical harness (if installed).

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- 6 Remove the bolt, washers, and nut securing the control column tube to the quadrant shaft and separate the tube from the shaft. Make a note of washer buildup for reinstallation.

NOTE: The control column stop assy is fitted over the tube, secured by the same bolt, and will be removed with the tube.

- 7 The control column can now be removed by lifting the forward end and sliding the assembly forward until the tube clears the instrument panel.

(2) Installation

(a) Forward column assembly:

NOTE: Check bearing on instrument panel for security. If it is loose, use LOC-498-50 or LOC-495-50 Super Bond adhesive to bond bearing onto instrument panel.

- 1 Place the control column assembly under and behind the instrument panel, keeping the forward end raised until the aft end of the tube can be inserted into the bearing in the instrument panel. Slide the assembly aft and lower the forward end to its installed position.
- 2 Ensuring the control column stop assembly is in place over the forward end of the control column tube, slide the tube over the quadrant shaft. Secure the control column tube and control column stop assembly to the quadrant shaft with bolt, washers, and nut.
- 3 Attach the arms on the control column to the arm on the elevator torque tube. (The bolt heads should point outboard.)
- 4 Reconnect the control wheel switches electrical harness (if installed.)
- 5 Attach the primary and control wheel balance cables to the aileron quadrant at the forward end of the control column assembly and secure each cable end retainer (i.e. - lockplate) with a screw (see note below). Safety the cable end retainer screws with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

- 6 Remove the aileron primary cable blocks from the pulleys at F.S. 100.00.

(b) Control wheel:

Install control wheel as described for the appropriate serial number range under Control Wheel, above.

- (c) Rig the aileron control system in accordance with instructions given in this chapter. Ensure that turnbuckles are safetied with locking clips and that protective tube is installed over turnbuckle on the control wheel balance cable.

- (d) Check the system for proper operation and freedom from binding.

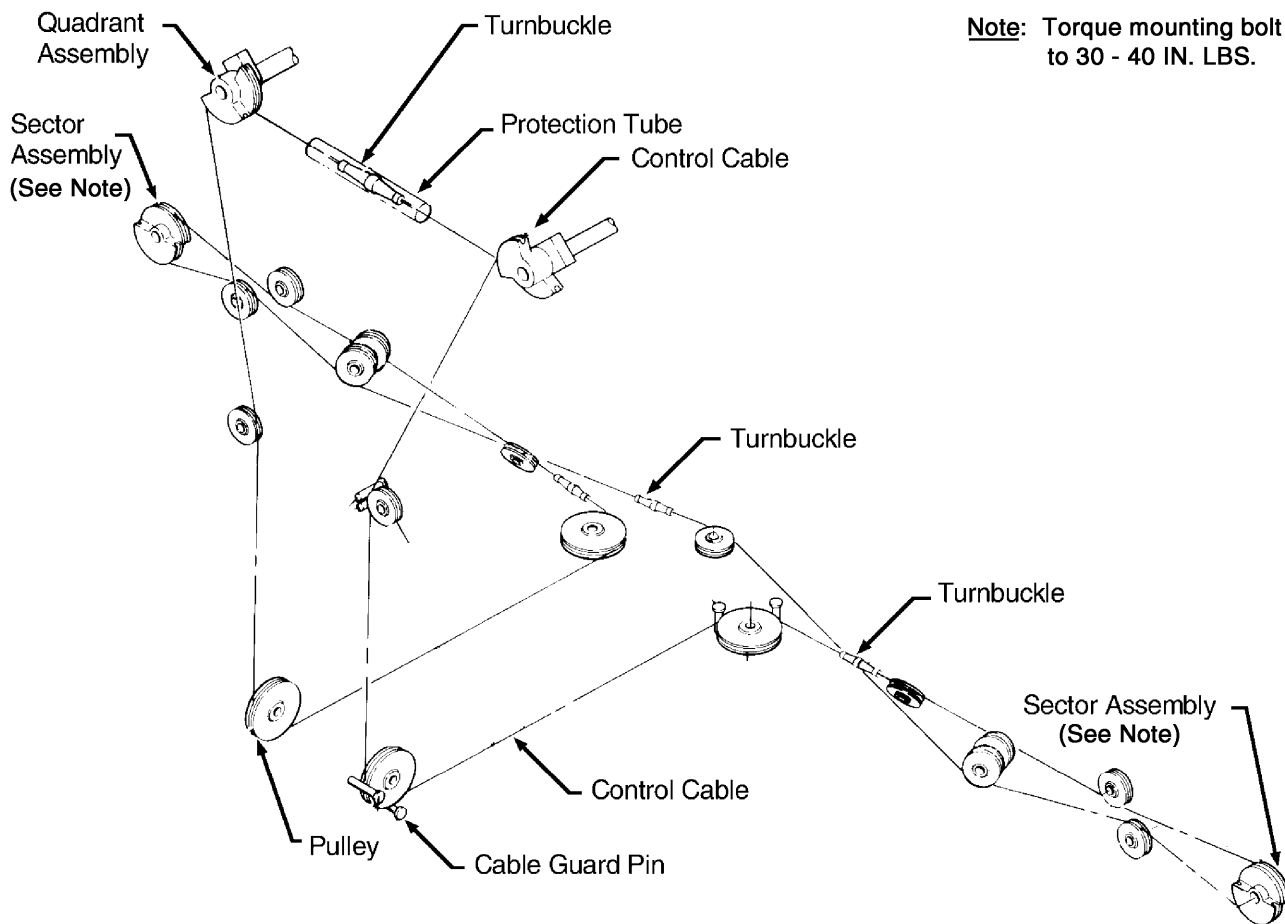
3. Aileron Control Cables (See Figure 4.)

A. Removal

- (1) For removal of any control cables in the fuselage or wings, first determine which cables are to be removed and then proceed with the appropriate set of instructions which follow.
- (2) To remove either right or left primary control cables that are located in the fuselage, the following procedures may be used.

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- (a) Remove access panels from the cabin floor at fuselage station 171.43. This will allow you access to either turnbuckle.
 - (b) Separate the primary control cable at the turnbuckles.
 - (c) Remove the access panels from the cockpit floor and then remove pulley cable guards from pulleys located in front of the pressure bulkhead.
 - (d) Disconnect the primary cables from the control column quadrant assemblies.
 - (e) Draw the cables back through the floor.
- (3) To remove the primary control cable in either wing, proceed as follows:
- (a) Remove the access panel from the cabin floor at fuselage station 171.43.
 - (b) Separate the primary cable at the turnbuckle within the fuselage and disconnect the opposite end at the sector out in the wing located aft of the rear spar at wing station 175.498.
 - (c) Remove the cable guards at the pulleys located along the aft side of the wing rear spar.
 - (d) Remove the control cable from the fuselage by removing the retaining rings on the fin type air seal and pulling the cable from the fuselage.



Note: Torque mounting bolt to 30 - 40 IN. LBS.

Aileron Controls
Figure 4

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- (4) Either balance cable may be removed by the following procedure:
- (a) Remove the access panels from the cabin floor.
 - (b) Separate the balance cables at the turnbuckle located below the right side of the cabin floor at F.S. 171.43.
 - (c) Disconnect the balance cable from the sector in the wing located at wing station 175.498 along the aft side of the rear spar.
 - (d) Remove the cable guards at the pulleys along the wing rear spar.
 - (e) Remove the control cable from the fuselage by removing the retaining rings on the fin type air seal and pulling the cable from the fuselage.

B. Installation

- (1) The installation of either the right or left primary control cable, located in the fuselage may be accomplished as follows:
- (a) Draw the cable through the floor, and around the pulleys at the forward pressure bulkhead.
 - (b) Connect the cable end to the quadrant assembly at the forward end of the control column and secure the cable end retainer (i.e. - lockplate) with a screw (see note below). Safety the cable end retainer screw with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

- (c) Ensure that the cable is properly placed around the pulley and install cable guards.
- (d) Route cable around the pulley at fuselage station 171.43 and install cable guard.
- (e) Connect cable turnbuckle to primary cable end from wing, and ensure proper rigging of system.
- (f) Install all access panels removed.

- (2) The primary control cable in either wing may be installed by the following procedure:

NOTE: Make sure that fairlead P/N 89637-003 attaching nuts and washers are installed against the aft wing spar just outboard of flap actuator push rod cutout, not on fairlead.

- (a) Draw the central cable along the wing rear spar, ensuring proper routing around the pulleys.
- (b) Connect the end of the primary cable to the aileron sector at wing station 175.498 and secure the cable end retainer (i.e. - lockplate) with a screw (see note below). Safety the cable end retainer screw with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

- (c) Install the fin type cable air seal on the cable and install the seal in the bulkhead.
- (d) Route the cable through the fuselage.

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- (e) Connect the turnbuckle to the primary cable within the fuselage, and ensure proper rigging of system.
- (f) Install all access panels removed.
- (3) Either balance cable may be installed by the following procedure:
 - (a) Connect the cable end to the sector in the wing at wing station 175.498 and secure the cable end retainer (i.e. - lockplate) with a screw (see note below). Safety the cable end retainer screw with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

- (b) Route the cable along the rear spar ensuring its proper routing through the pulleys.
- (c) Route the cable through the fuselage and then place the retainer rings on the seal. (Refer to Figure 5, 27-00-00.)
- (d) Connect the balance cable turnbuckle ends together and rig the ailerons as required. Check complete system for operation, see Caution under Rigging and Adjustment.
- (e) Install all access panels removed.

C. Rigging and Adjustment

(PIR-PPS50056-2, Rev. M.)

- (1) Lock the control wheels together in the aileron neutral position using a suitable tool.
- (2) Lock the ailerons in neutral position using a suitable contour fixture at the inboard ends of the ailerons. Neutral position is defined by wing loft contour at this location.
- (3) Adjust the aileron control cables to a tension of 30 ± 5 pounds.
- (4) Remove the locking fixtures. Aileron neutral position should be maintained at $0 + 1, - 0$ degree with the control wheels in neutral.
- (5) Use the pilot's control wheel to move the ailerons and adjust the aileron travels at the primary stops (at the aileron drive sectors on the wing spars) to give the ailerons their 18 ± 1 degree up and down movement. Total freeplay measured at the aileron inboard trailing edge shall not exceed .120 inches.
- (6) Use the pilot's control wheel to hold the ailerons firmly against the primary stops. Adjust the secondary aileron stops (on the forward pressure bulkhead) to maintain a cushion (gap) of 0.09 ± 0.03 inch in each direction.

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.

- (7) Check system for proper operation.

4. Aileron Tab

A fixed trim tab is located on the trailing edge of the right aileron. The tab is ground adjustable only.

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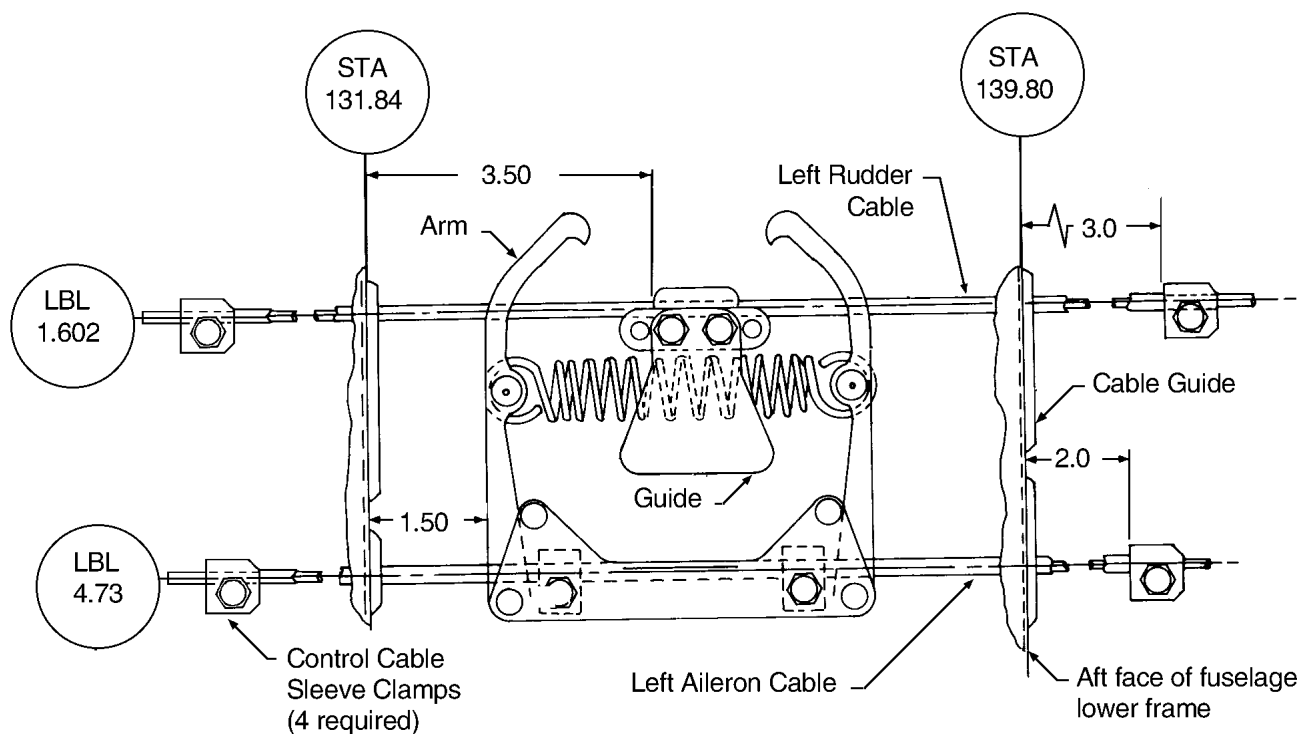
5. Aileron - Rudder Interconnect (See Figure 5.)

The aileron - rudder interconnect installation is located underneath the floor between the frames at F.S. 131.84 and F.S. 139.80. The aileron - rudder interconnect is bolted to the left aileron cable. The aileron - rudder interconnect guide is bolted to the left rudder cable.

The aileron-rudder interconnect is rigged and adjusted as follows:

NOTE: All aileron and rudder rigging must be completed prior to rigging the aileron - rudder interconnect.

- A. Gain access to the aileron rudder interconnect.
- B. Lock the aileron and rudder systems in neutral (with the control wheels and rudder pedals neutral, the rudder is 2° right of 0°).
- C. Ensure that the aft cable clamp on the left rudder cable is positioned 3.00 inches from the aft face of the F.S. 139.80 fuselage frame.
- D. Ensure that the aft cable clamp on the left aileron cable is positioned 2.00 inches from the aft face of the F.S. 139.80 fuselage frame.
- E. Ensure that the forward side of the forward arm of the aileron - rudder interconnect is positioned 1.50 inches from the aft face of the F.S. 131.84 fuselage frame.
- F. Ensure that the forward side of the guide (on the left rudder cable) is positioned 3.50 inches from the aft side of the F.S. 131.84 fuselage frame.
- G. Check full control movement after adjustment to ensure freedom of operation.



Aileron - Rudder Interconnect Installation
Figure 5

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RUDDER AND TAB

1. Troubleshooting

See Chart 1.

**CHART 1
TROUBLESHOOTING RUDDER CONTROL SYSTEM**

Trouble	Cause	Remedy
Lost motion between rudder pedals and rudder.	Cable tension too low.	Adjust cable tension.
	Linkage loose or worn.	Check linkage and tighten or replace.
	Broken pulley.	Replace pulley.
	Bolts attaching forward or aft sectors are loose.	Tighten sector bolts.
Excessive resistance to rudder pedal movement.	System not lubricated properly.	Lubricate system.
	Rudder pedal torque tube bearing in need of lubrication.	Lubricate torque tube bearings.
	Cable tension too high.	Adjust cable tension.
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Incorrect rudder travel.	Rudder sector stop incorrectly adjusted.	Re-rig sector stops.
	Nose wheel contacts stops before rudder.	Re-rig nose wheel stops.
Trim control knob moves with excessive resistance.	System not lubricated properly.	Lubricate system.

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2. Rudder Pedal Assembly

To change bearings on rudder bar assembly, follow these steps:

- A. Remove nut and washers from end of rudder bar assembly.
- B. Remove nuts, bolts and washers that secure the bearing block to the tube support bracket.
- C. Remove bearing.
- D. Replace bearing using the shrink fit process. Bond the bearing with Loctite 290.
- E. Securing bearing block to tube support bracket with nuts, bolts and washers.
- F. Place two washers over the threaded end of the rudder bar and secure with the nut.

3. Rudder Controls

A. Removal

(1) To remove the rudder torque tube sectors:

- (a) Loosen cables.
- (b) Remove the screw which secures the rudder cable end retainer (i.e. - lockplate) to the sector.
- (c) Remove the nuts, bolts and washers that attach the sector to the rudder torque tube.
- (d) Remove the sector.

(2) To remove the forward rudder control cables.

- (a) Remove the screw which secures the rudder cable end retainer (i.e. - lockplate) to the rudder bar sector. Remove the cable from the sector.
- (b) Remove the aft fuselage access panel.
- (c) Disconnect the rudder turnbuckles by the rudder tube sector in the aft section of the fuselage.
- (d) At the aft pressure bulkhead, pull the control cable through the fin type air seal. (Refer to Figure 5, 27-00-00.)
- (e) Pull the cable aft and remove it from the airplane.

(3) To remove the aft rudder cable.

- (a) Remove the screws and washers that secure the two cable guard plates at both sides of the sector. Remove the safety plates.
- (b) Disconnect the turnbuckles if not previously accomplished.
- (c) Remove the cotter pins from the rear of the sector and remove the aft cable from the sector.

(4) To remove the rudder torque tube sector:

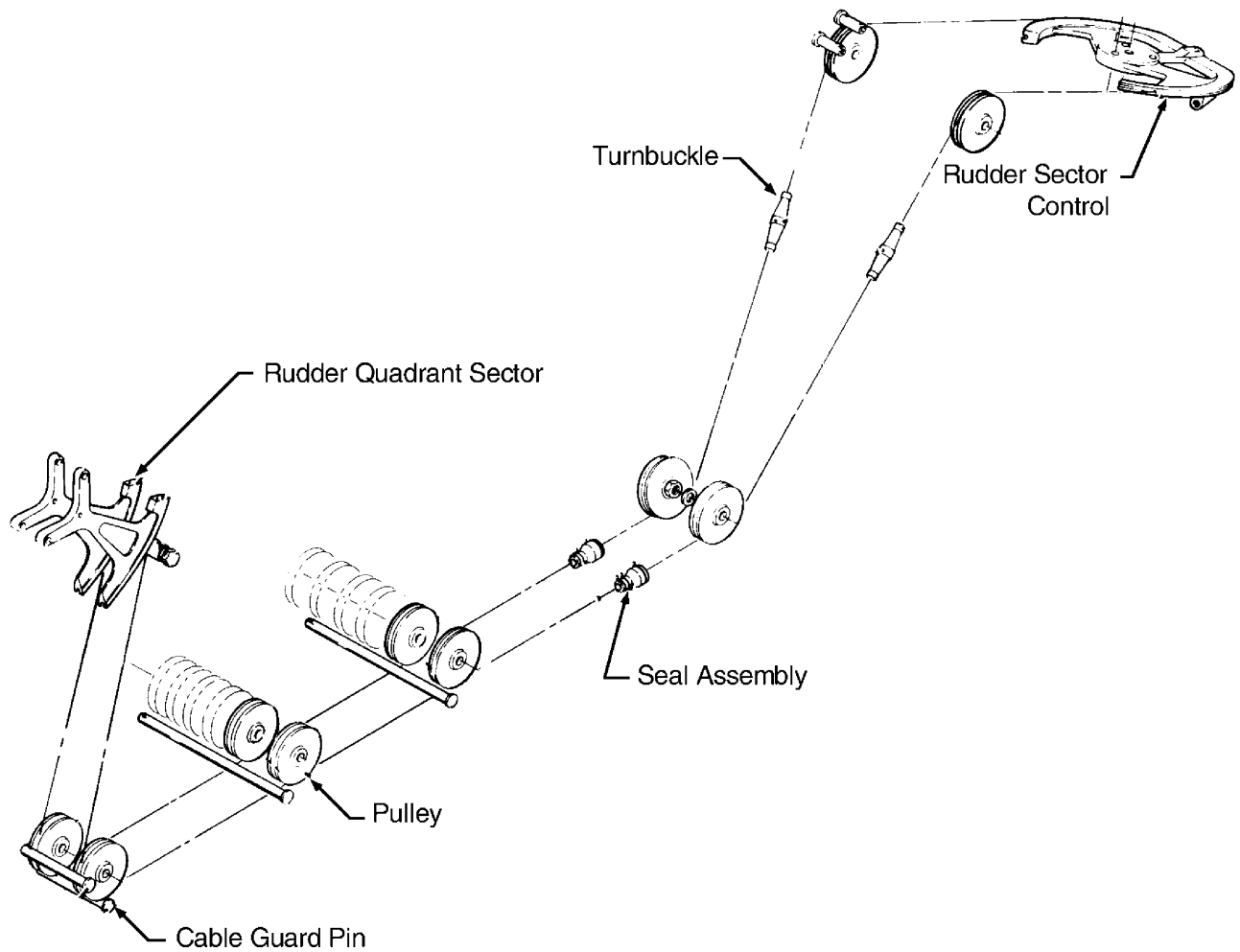
- (a) Remove the aft rudder cable if not previously accomplished.
- (b) Remove the nuts, bolts and washers that attach the rudder sector to the rudder torque tube.
- (c) Remove the rudder sector.

B. Installation

(1) To install the rudder torque tube sector:

- (a) Position the sector on the torque tube.
- (b) Attach the sector to the torque tube with nuts, bolts and washers.

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Rudder Controls
Figure 1

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- (2) To install the rudder bar sector:
 - (a) Position the sector on the rudder bar assembly.
 - (b) Secure the sector to the rudder bar assembly with nuts, bolts and washers.
- (3) To install the aft rudder cable:
 - (a) Position the cable on the sector.
 - (b) Install the two guard plates with screws and washers. Replace the cotter pins in the rear of the sector.
 - (c) Attach the aft cable to the forward cables at the turnbuckles. Safety the turnbuckles with locking clips.
- (4) To install the forward rudder cable:
 - (a) Push the cable through the fin type air seal. (See Figure 5, 27-00-00.) Thread the cable forward through the airplane.
 - (b) Connect the forward and aft rudder cables at the turnbuckles in the aft end of the airplane.
 - (c) Attach the forward ends of the forward cables to the rudder bar sector and secure the cable end retainer (i.e. - lockplate) with a screw (see note below). Safety the cable end retainer screw with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

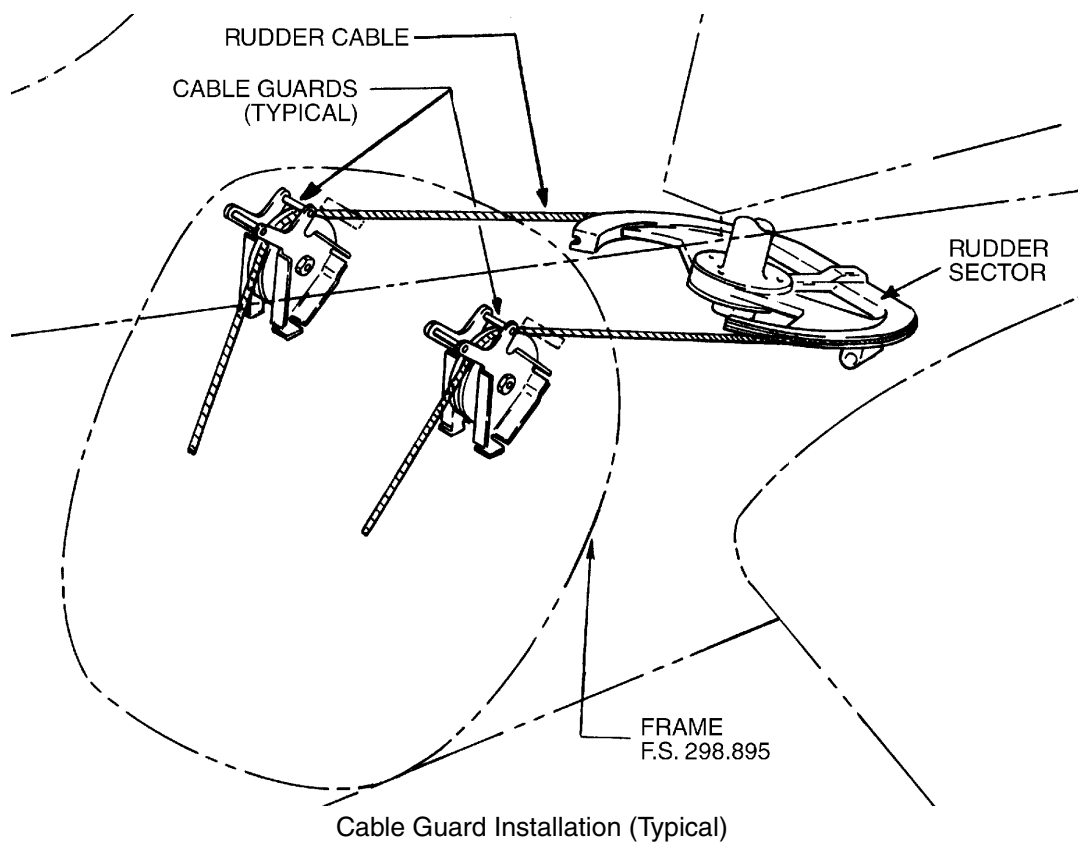


Figure 2

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- (5) Ensure that all pulley cable guards have been properly installed (i.e. - with the cables routed inside/under the cable guards - see Figure 2).
- (6) Set the rudder cable tension and check the rigging per instruction in this chapter.
- (7) After setting the cable tension, check all cable ball ends for proper seating in the retainers.
- (8) Check the system for proper operation. See the Caution under Rigging and Adjustment.
- (9) Rig the rudder control system.

C. Rigging and Adjustment

(PIR-PPS50056-2, Rev. M.)

- (1) Use a suitable tool to check the rudder travel for its proper travel (perpendicular to the hinge line) left and right from the zero degree position (streamlined with the vertical stabilizer). The left travel should be 26 ± 1 , -0 degrees and the right travel should be 30 ± 1 , -0 degrees. Adjust the stops on the rudder sector as required.
- (2) Move the rudder 2 degrees right of the zero degrees (streamlined) position. Lock the rudder in this position.
- (3) Lock rudder pedals together, in alignment with each other, at F.S. 105.700. See 32-20-00, Figures 4 and 5.
- (4) Disconnect bungee from forward steering arm.
- (5) Install a suitable tool which will lock the nose wheel in alignment with the longitudinal axis of the aircraft.
- (6) Adjust clearance between rollers on the nose gear and forward steering arm from 0.010 to 0.030 inch by loosening the steering arm mounting nut and using the adjuster underneath the steering arm mount plate. (See Figure 3, 32-20-00.)

NOTE: Measure the gap with the steering arm parallel to the steering horn rollers. While measuring this clearance, the gear should be down and locked and the airplane's weight should be on the gear.

- (7) Torque the steering arm mounting nut and the adjuster jam nuts.
- (8) Ensure that the two steering pushrods are holding the steering bellcrank perpendicular to B.L. 0.00 (refer to 32-50-00, Steering Pushrods Installation, if adjustment is necessary).
- (9) Reconnect the steering bungee between the steering arm and the steering bellcrank. Adjust length as required so that there is no load on the bungee springs while the nose wheel is aligned with the longitudinal axis of the airplane. Tighten jam nuts.
- (10) Adjust the rudder cable turnbuckles to obtain 40 ± 5 pounds of tension with the rudder set at 2 degrees right of neutral. Adjust the cables evenly to avoid uneven strain on airplane components.
- (11) Remove any centering tools that had been previously installed.
- (12) Place the airplane on jacks (refer to 7-10-00).
- (13) Depress each of the pilot's rudder pedals until the rudder sector firmly contacts its stops. Adjust the forward stops (on the bellcrank in the nose gear tunnel) to provide 0.06 to 0.09 inch clearance in each direction.

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.

- (14) Check the system for binding and proper operation.
- (15) Remove the airplane from jacks.

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4. Rudder Trim Controls

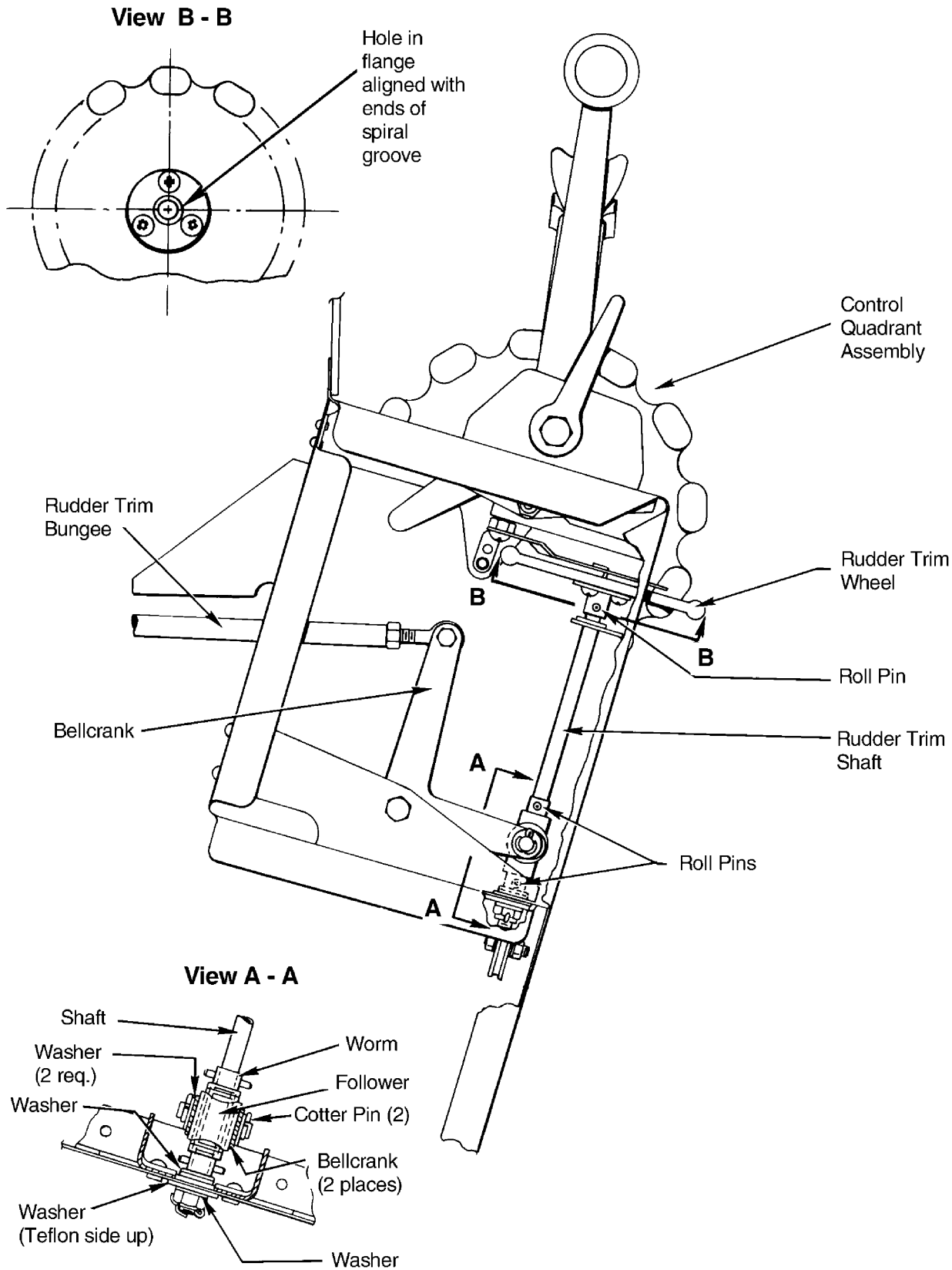
A. Removal

- (1) To remove rudder trim controls in console:
 - (a) Remove access panel on left side of pedestal.
 - (b) Remove nut, washer and teflon-faced washer from bottom of rudder trim control shaft.
 - (c) Remove cotter pins and washers from the follower; remove the bellcrank arms from the arms on the follower.
 - (d) Rotate the trim wheel until roll pins in shaft point fore and aft. Drive roll pins out (three places).
 - (e) Remove the three screws which hold the wheel to the shaft.
 - (f) Slide the wheel aft through the wheel slot in the console.
 - (g) Slide the rudder trim control shaft down and out of the console.
 - (h) Remove the follower, worm and washer from inside the console.
- (2) To remove the rudder trim bungee:
 - (a) Remove the nut, bolt and washers that secure rod end to bellcrank in console.
 - (b) Remove nut, bolt, cotter pin and washers that secure bungee housing to rudder bar assembly. Remove bungee from airplane.
- (3) To disassemble rudder trim bungee:
 - (a) Note length of trim bungee.
 - (b) Cut safety wire and remove the two clips from the housing.
 - (c) Slide shaft assembly from housing.

B. Installation

- (1) To assemble the rudder trim bungee assembly:
 - (a) Slide forward clip onto housing.
 - (b) Lubricate shaft at each end of spring with Aero Lubriplate (white) and insert shaft assembly into housing. Install aft clip.
 - (c) Check for 0.020 inch max. end play. Add 62833-127 washers as required between forward clip and end of spring on the shaft assembly to bring the end play into tolerances.
 - (d) Ensure that length of trim bungee is correct (as recorded in step (3), Removal, above).
- (2) To install rudder trim bungee:
 - (a) Attach the housing end of the bungee to the rudder bar assembly. Secure with bolt, washers and nut. The thin washer goes under the nut. Safety the nut with a cotter pin.
 - (b) Attach the rod end of the bungee to the bellcrank. Safety the nut with a cotter pin.
- (3) To install the rudder trim controls in the console:
 - (a) Slide the rudder trim control shaft partially up through the hole in the support bracket in the console.
 - (b) Place over the shaft, in order, the washer and worm. Screw the follower onto the worm. Slide the shaft all the way up into the upper hole.
 - (c) Align the holes in the worm and the holes in the shaft. Install roll pins in the hole.
 - (d) Place trim wheel flange on top of the shaft. Align holes in shaft and flange. Install roll pins.
 - (e) Slide wheel into slot on face of console. Align ends of spiral groove with roll pin hole in flange. Secure wheel to flange with screws and washers.
 - (f) On bottom of rudder trim shaft, place the teflon-faced washer (teflon side up) and washer.

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Rudder Trim Installation
Figure 3

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- (g) Install nut and washer on end of shaft. The shaft should rotate freely with minimum end play. Install the cotter pin.
- (h) Attach bellcrank arms to follower with washers and cotter pins.
- (i) Rig the rudder trim system.

C. Rigging and Adjustment

(PIR-PPS50056-2, Rev. M.)

- (1) Ensure rudder rigging is correct per Rudder Controls - Rigging and Adjustment, above.
- (2) Using a suitable tool, set rudder at 3 degrees to left of 0.
- (3) Disconnect bungee from bellcrank in pedestal.
- (4) Mark rudder trim wheel and count revolutions for full travel, stop to stop.
- (5) Set trim wheel and trim indicator at midpoint of trim wheel travel with rudder set 3 degrees to the left of 0.
- (6) Adjust length of bungee rod as required to reconnect it with no load on the bungee springs.
- (7) Check full range travel to ensure that indicator guide pin does not reach either end of spiral groove in trim wheel before the stop is engaged (at roll pin on worm).

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 TRIM RIGGING AND ADJUSTMENT, VERIFY THAT THE RUDDER MOVES LEFT WHEN THE RUDDER TRIM WHEEL IS TRIMMED LEFT; AND, THAT THE RUDDER MOVES RIGHT WHEN THE RUDDER TRIM WHEEL IS TRIMMED RIGHT.

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ELEVATOR AND TAB

1. Troubleshooting

See Chart 1.

**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING ELEVATOR CONTROL SYSTEM**

Trouble	Cause	Remedy
Lost motion between control wheel and elevator.	Cable tension too low.	Adjust cable tension.
	Linkage loose or worn.	Check linkage and tighten or replace.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly.
Resistance to elevator control movement.	System not lubricated properly.	Lubricate system.
	Cable tension too high.	Adjust cable tension.
	Binding control column.	Adjust and lubricate.
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Incorrect elevator travel.	Elevator stops incorrectly adjusted.	Adjust stop screws.
Correct elevator travel cannot be obtained by adjusting stops.	Elevator cables incorrectly rigged.	Re-rig elevator cables.
Lost motion between trim control wheel and trim tab.	Cable tension too low.	Adjust cable tension.
	Cables not in place on pulleys.	Install cables properly.
	Broken pulley.	Replace pulley.
	Linkage loose or worn.	Check linkage and tighten or replace.

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**CHART 1 (Sheet 2 of 2)
TROUBLESHOOTING ELEVATOR CONTROL SYSTEM**

Trouble	Cause	Remedy
Trim control wheel moves with excessive resistance.	System not lubricated properly.	Lubricate system.
	Cable tension too high.	Adjust cable tension.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables properly.
	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.
	Cables crossed or routed incorrectly.	Check routing of control cable.
Trim tab fails to reach full travel.	System incorrectly rigged.	Check and/or adjust rigging.
Trim indicator fails to indicate correct trim position.	Trim indicator unit not adjusted properly.	Adjust trim indicator.

2. Elevator Torque Tube Bearing Changes

- A. Remove nut and washers from end of elevator torque tube assembly.
- B. Remove nuts, bolts and washers that secure the bearing block to the tube support bracket.
- C. Remove bearing.
- D. Replace bearing using the shrink fit process. Bond the bearing with Loctite 290.
- E. Secure bearing block to tube support bracket with nuts, bolts and washers.
- F. Place two washers over the threaded end of the elevator torque tube and secure with nut.

3. Elevator Controls

A. Removal

- (1) To remove elevator torque tube quadrant:
 - (a) Remove elevator downspring.
 - (b) Remove the two quadrant cable guards.
 - (c) Loosen cables.
 - (d) Remove the screw which retains the elevator cable lockplates.
 - (e) Remove the cable end retainer (i.e. - lockplate) screws and remove the cables.
 - (f) Remove the bolts, nuts and washers that secure the quadrant to the elevator torque tube.
 - (g) Remove the quadrant.

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- (2) To remove the elevator forward cable assemblies:
 - (a) Disconnect the elevator cable turnbuckles (located forward of the aft elevator quadrant).
 - (b) Remove the screw that secures the elevator cable end retainers (i.e. - lockplates) to the forward quadrants (on the elevator torque tube).
 - (c) Pull the cables aft through the fuselage after removing the cable guards at the elevator pulleys and the fin type control cable air seal clips.
- (3) To remove the aft elevator cable assemblies:
 - (a) Disconnect the cable turnbuckles (located forward of the aft elevator quadrant).
 - (b) Cut safety wire on cable end retainer (i.e. - lockplate) screws. Remove screws.
 - (c) Remove cable guards and remove cables.
- (4) To remove the elevator aft quadrant:
 - (a) Remove the elevator aft cable assemblies from the quadrant (refer to step 3).
 - (b) Remove the bolt, nut, washers and bushings which secure the quadrant assembly to the bulkhead (note position of bushings as removed).
 - (c) Remove the quadrant assembly.

B. Installation

- (1) To install the elevator aft quadrant:
 - (a) Position the elevator quadrant in place.
 - (b) Refer to Figure 1 for correct placement of hardware on bolt when installing rear quadrant.
 - (c) Attach cables to quadrant assembly and secure the cable end retainers (i.e. - lockplate) with screws (see note below). Safety the cable end retainer screws with MS20995-C32 safety wire. Ensure the safety wire is installed so that the wire is inside and clear of the elevator pushrod fork through the full travel of the quadrant.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

- (d) Adjust cable guards to be 0.01 ± 0.01 inch from the edge of the quadrant.
 - (e) Refer to steps (5) and (6).
- (2) To install the elevator torque tube quadrant:
 - (a) Position the quadrant assembly on the torque tube.
 - (b) Secure quadrant with bolt, nut and washer (two places).
 - (c) Attach cables to quadrant assembly and secure the cable end retainers (i.e. - lockplate) with screws (see note below). Safety the cable end retainer screws with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.

- (d) Adjust cable guard to provide 0.08 ± 0.01 inch of clearance from the edge of the quadrant.

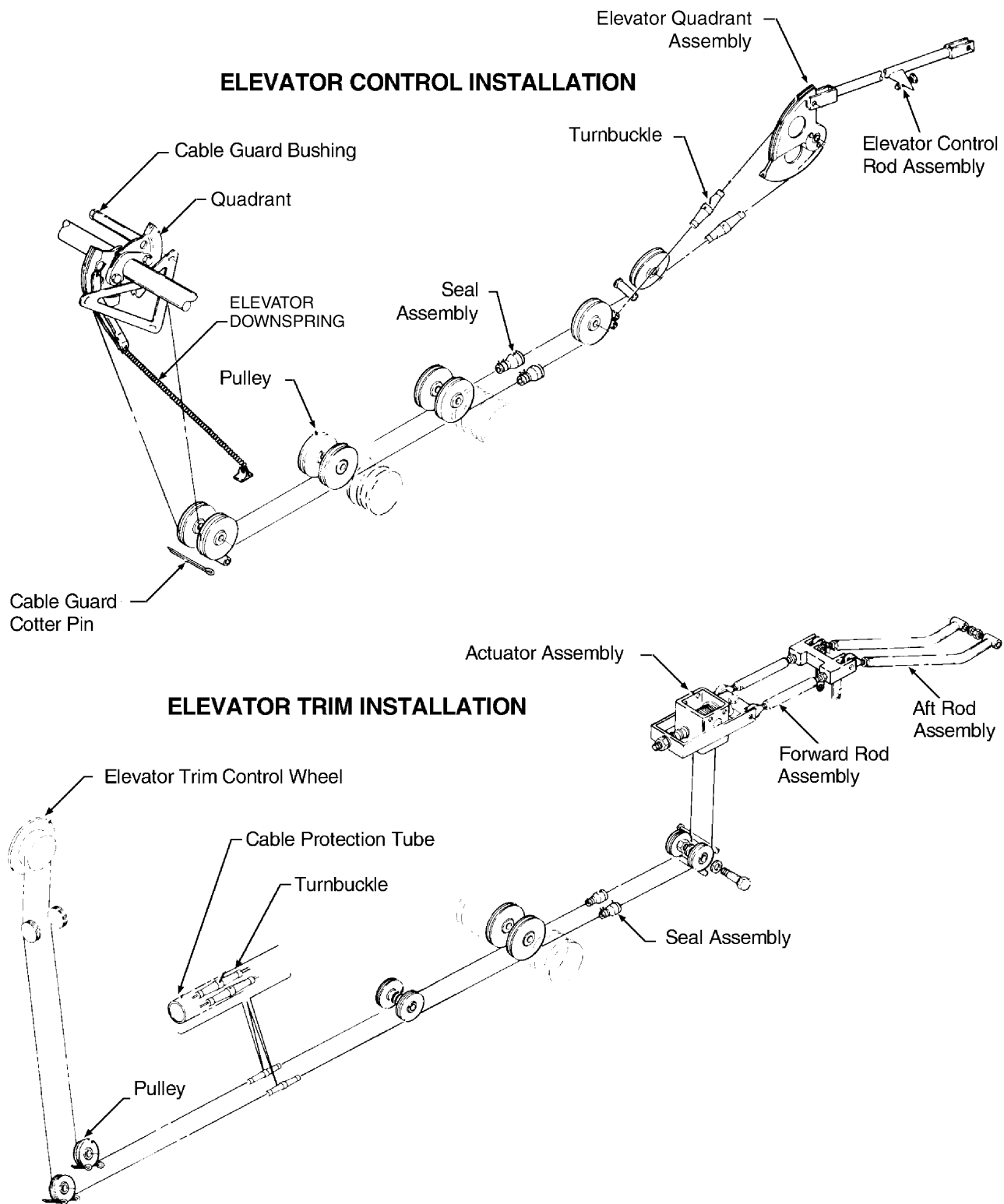
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- (e) Refer to steps (5) and (6).
- (f) Attach the elevator downspring.
- (3) To install the elevator forward cable assemblies:
 - (a) Insert the cables through the fin-type air seals on the aft pressure bulkhead and draw them forward through the fuselage, positioning them on the proper pulleys.
 - (b) Attach cables to forward quadrant and secure the cable end retainers (i.e. - lockplate) with screws (see note below). Safety the cable end retainer screws with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.
 - (c) Adjust cable guards so that there is 0.08 ± 0.01 inch of clearance from edge of the quadrant.
 - (d) Attach forward cable assemblies to aft cable assemblies at the turnbuckles located just forward of the aft quadrant.
 - (e) Ensure that all cable guards are in place.
 - (f) Refer to steps (5) and (6).
 - (g) Attach the elevator downspring.
- (4) To install the elevator aft cable assemblies:
 - (a) Attach cables to quadrant and secure the cable end retainers (i.e. - lockplate) with screws (see note below). Safety the cable end retainer screws with MS20995-C32 safety wire.

NOTE: As of early 2006, the original MS35265-42 fillister head screw has been replaced by a higher strength MS24674-8 (P/N 520-036) socket head screw. In earlier airplanes, anytime the cable end retainer screws are removed, if the original fillister head screws are still installed, they must be replaced with the socket head screws upon reassembly. Additionally, when using the MS24674-8 (P/N 520-036) socket head screws, torque to 12 to 15 in.-lbs.
 - (b) Attach the rear cables to the forward cables at the turnbuckles.
 - (c) Reinstall cable guards and adjust them to provide 0.01 ± 0.01 inch of clearance from the edge of the quadrant.
 - (d) Refer to steps (5) and (6).
- (5) Set cable tension.
- (6) Check control system for proper rigging and operation.
- (7) Attach the elevator downspring (refer to Figure 1).

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Elevator and Elevator Trim Installation
Figure 1

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C. Rigging and Adjustment

(PIR-PPS50056-2, Rev. M.)

NOTE: The neutral position of the elevator is when the leading edges of the aerodynamic balances are lined up with the leading edges of the horizontal stabilizer.

- (1) Adjust the elevator stops to obtain the travel specified in Chart 2.
- (2) Lock the elevator in its neutral position.
- (3) Position the pilot's control wheel with the forward face of the wheel mounting boss 5.30 inches aft of the instrument panel aft face and secure with a suitable tool. (See Figure 3, 27-10-00.)
- (4) Adjust the cable turnbuckles evenly to obtain 30 ± 5 lbs. cable tension.
- (5) Remove the locking devices from the control wheel and elevator.
- (6) With the elevator held against the trailing edge down primary (aft) stop, push the pilot's wheel full forward. The control wheel travel between the primary (aft) and secondary (forward) stops should be 0.30 ± 0.10 inch. There is no adjustment on the secondary stop.

NOTE: If necessary, use the cable rigging turnbuckles to bring the control wheels into their neutral position.

- (7) With the elevator physically held against the trailing edge up primary (aft) stop, adjust the secondary stop on the channel ahead of the instrument panel to provide a cushion (gap) of 0.06 - 0.09 inch. Lock the jamnut.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF ELEVATOR. 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 ELEVATOR RIGGING AND ADJUSTMENT, VERIFY THAT THE REAR EDGE OF THE ELEVATOR MOVES UP WHEN THE WHEEL IS PULLED BACK; AND, THAT THE REAR EDGE OF THE ELEVATOR MOVES DOWN WHEN THE WHEEL IS PUSHED FORWARD.

- (8) Check system for binding and proper operation.

**CHART 2
ELEVATOR RIGGING POSITIONS**

Elevator Trailing Edge Up	Elevator Trailing Edge Down	Elevator Tab Elevator Neutral Trailing Edge Up	Elevator Tab Elevator Neutral Trailing Edge Down
$23.5^\circ \pm .5^\circ$	$14.5^\circ \pm .5^\circ$	$19^\circ + 0^\circ, - 1^\circ$	$24.5^\circ + 0^\circ, - 1^\circ$

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4. Elevator Trim Controls

A. Trim Wheel and Cables

(1) Removal

To remove elevator trim controls in the console:

- (a) Remove access panel on left side of console.
- (b) Disconnect elevator trim cables by:
 - 1 Remove the center access panels on the floor to gain access to the plastic tube that protects the elevator trim cables.
 - 2 Remove the pins from both ends of the plastic tube.
 - 3 Slide the tube forward.
 - 4 Rotate the elevator trim control wheel until one of the trim cable turnbuckles clears the aft end of the tube.
 - 5 Tie a pull rope forward of the exposed turnbuckle on the forward cable.

NOTE: Tension must be applied to the ends of the trim cables as soon as the turnbuckles are disconnected to prevent the cables from unwrapping from the trim wheel drum or the trim actuator, and to prevent the cables from fouling at any of the pulleys.

- 6 Disconnect the cables, keeping tension on both ends of cable.
- 7 Have an assistant in the cockpit rotate the elevator trim control wheel until the opposite elevator trim turnbuckle clears the aft end of the plastic tube. Keep tension on both ends of the disconnected cable while the assistant is rotating the trim wheel.
- 8 Have the assistant tie another pull rope forward of the turnbuckle on the remaining cable.
- 9 Have the assistant disconnect his cables, keeping tension on both ends of the cable.
- 10 Transfer the cable ends to one man. Have him keep tension on all four cable ends.
- 11 Have the remaining man slide the plastic tube aft until the cables are exposed aft of the F.S. 124.125 frame.
- (c) Remove the nut and washer from trim wheel pivot bolt.
- (d) Push the trim wheel pivot bolt out the right hand side of the quadrant.
- (e) Remove the trim wheel from the console, pulling the control cable along with it.
- (f) To disassemble the elevator trim wheel:
 - 1 Remove the three screws which attach the cable drum to the wheel.
 - 2 Remove the cable from the drum.

(2) Installation

- (a) To assemble the elevator trim wheel:
 - 1 Place the cable ends in the drum.
 - 2 Secure the cable drum to the wheel with the three screws.
 - 3 Wrap the cable ends around the drum 3 1/4 turns in opposite directions.
- (b) Position the trim wheel/cable in place in the console.
- (c) Slide the trim wheel pivot bolt through the pivot holes in the trim wheel and the rudder trim indicator bracket.
- (d) Secure the pivot bolt with the nut and washer.

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- (e) Connect the elevator trim cables by:
 - 1 Have the assistant keep tension on the trim cables while the cable blocks at F.S. 207.00 and F.S. 124.125 are removed.
 - 2 Slide the plastic tube forward.
 - 3 Connect one set of cables at the turnbuckles and remove the pull rope. Keep tension on the remaining cables.
 - 4 Have the assistant rotate the elevator trim control wheel until the remaining (unconnected) turnbuckle clears the aft end of the tube.
 - 5 Connect the remaining cables and remove the pull rope. Set cable tension to 12 ± 2 pounds.
- NOTE:** Both the up and down cable turnbuckle assemblies should be within 0.10 of an inch of the same length upon completion of adjustment.
- 6 Slide the tube in place and insert the pins in both ends of the tube.
- 7 Check to ensure that the cables have not loosened on the trim drum or actuator. Check that they have not fouled on any of the pulleys.
- 8 Check the system for restrictions or binding.
- 9 Reinstall the floor access panels that were previously removed.
- (f) Ensure that the pulley cable guards are installed at all elevator trim cable pulleys.
- (g) Replace the access panel on the console.
- (h) Check operation of elevator trim controls. See Caution under Rigging.

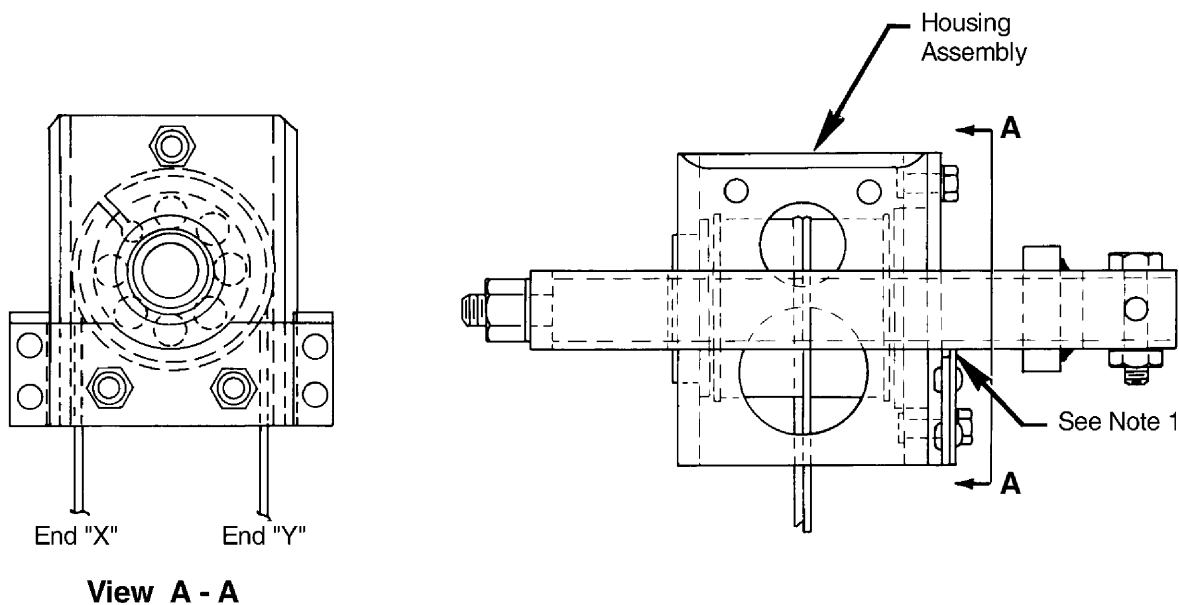
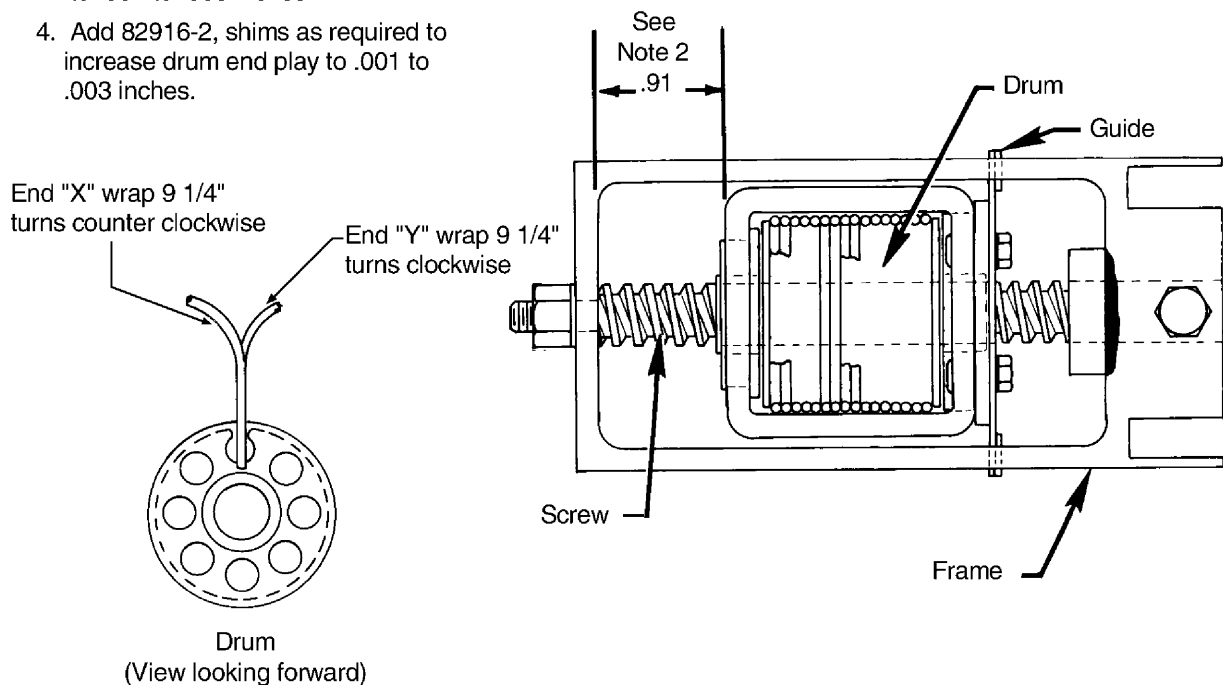
B. Elevator Trim Actuator

- (1) Removal
 - (a) Block the cables at the actuator drum.
 - (b) Disconnect the trim cable turnbuckles (inside the plastic tube under the floor). (See Elevator Trim Controls, Removal, above.)
 - (c) Cut safety wire and remove bolts that attach actuator to elevator trim forward rod assembly.
 - (d) Remove four bolts and washers that secure the actuator to its supporting bracket.
 - (e) Remove actuator and trim cable from aircraft.
- (2) Installation
 - (a) Position actuator/trim cable assembly on actuator bracket. Fasten in place with bolts and washer.
 - (b) Attach elevator trim forward rod assembly to actuator with bolts and washers. Safety bolts.
 - (c) Connect the trim cables. (See Elevator Trim Controls, Installation, above.)
 - (d) Ensure that cables are in pulleys and that pulley cable guards are installed.
 - (e) Attach three cable clips (per seal) to the fin type control cable air seals in the aft pressure bulkhead.
 - (f) Set cable tension.
 - (g) Check system for smooth and proper operation.

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NOTES:

1. With the frame contacting the guide on one side check for .025/.005 clearance.
2. Cable end "Y" should be 17.5 inches longer than cable end "X" prior to fastening the actuator screw in position.
3. Add 59486-2, -3, or -4, washers as required to reduce drum end play to .001 to .003 inches.
4. Add 82916-2, shims as required to increase drum end play to .001 to .003 inches.



Elevator Trim Actuator Assembly
Figure 2

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(3) Disassembly

- (a) Remove nut and washer from the end of the actuator screw.
- (b) Remove the bolt, nut and washer that secures the actuator screw to the actuator frame.
- (c) Turn the screw out of the housing assembly and then out of the frame.
- (d) Remove the drum from the housing assembly by removing the bolts which secure the aft retainer to the housing.
- (e) Unwrap cable from drum (if desired).

(4) Assembly

- (a) Place trim cable in slot in trim drum. Cable end Y should be 17.5 inches longer than cable end X.
- (b) Wrap each end of the cable nine and one-quarter turns toward the center of the drum. One series of wraps should be clockwise and the other series should be counterclockwise. Hold the cable in place.
- (c) Insert the drum into the housing assembly.
- (d) Secure the aft retainer and guide to the aft side of the housing with the screws, nuts and washers.

NOTE: Refer to Figure 2 for information on setting trim drum end play.

- (e) Place the housing/drum assembly into the actuator frame.
- (f) Insert the actuator screw through the frame and then into the housing/drum assembly.
- (g) Rotate the screw until the housing/drum assembly is positioned as shown in Figure 2. Cable end "Y" should be 17.5 inches longer than cable end "X" after installation and wrapping on the drum before fastening the screw in position.
- (h) Attach the aft end of the actuator screw to the actuator frame by installing the bolt, nut and washer. The bolt shank should point in the same direction as the cable ends.
- (i) Attach the forward end of the actuator screw to the frame with the nut and washer.
- (j) Check for free, smooth full range travel.

C. Elevator Trim Tab Push Rod Corrosion Control

Inspect elevator trim rods and reapply Dinatrol AV 8 each five years. See 55-20-00, Elevator Trim Tab Push Rod Corrosion Control.

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D. Rigging and Adjustment

(PIR-PPS50056-2, Rev. M.)

NOTE: The neutral position of the elevator tab is with the tab trailing edge lined up with the elevator trailing edge.

- (1) Check the tension of the elevator trim tab cables. Adjust the tension to 12 ± 2 pounds. The up and down cable turnbuckle assemblies should be within 0.10 inch of the same length upon completion of adjustment.

NOTE: Obtain access to the turnbuckles by rolling the trim wheel to the "full nose up" position and sliding the tube that surrounds the cables fore and aft, as required.

- (2) Place the elevator tab in the neutral position and set the tab indicator at the neutral position using a suitable locating fixture.
- (3) Move the elevator trim wheel aft (nose up) until the positive stop (spacer) on the actuator frame engages the trim drum housing. Check to ensure that the tab indicator guide pin has not bottomed out in its slot in the trim wheel.

CAUTION: DO NOT ADJUST THE TWO AFT CURVED RODS WHICH ATTACH TO THE TAB. THESE RODS MUST NOT BE CHANGED FROM THEIR ORIGINAL LENGTH OF 9.12 INCHES BETWEEN THE CENTERS OF THE ROD END HOLE AND THE MOUNTING BUSHING HOLE. A CHANGE IN THEIR LENGTH WOULD ALTER THE PROPER TAB OPERATING GEOMETRY.

- (4) Set the tab to the Elevator Tab (Elevator Neutral) Trailing Edge Down angle specified in Chart 2, by adjusting the two straight rods which penetrate the aft fuselage bulkhead. The rods must be within 0.010 inch of the same length upon completion of adjustment. Lock the jam nuts on the rods.
- (5) Move the elevator trim wheel forward (nose down) until the elevator tab is at the Elevator Tab (Elevator Neutral) Trailing Edge Up angle specified in Chart 2. Check to ensure that the tab indicator guide pin has not bottomed out in its slot in the trim wheel. Set the adjustable stop mounted on the stabilizer spar to maintain the specified tab angle. Lock the jam nut.
- (6) Operate the elevator through its full travel range with the tab set at both full nose up and full nose down positions. Operation should be smooth and free.
- (7) With the tab neutral and the elevator held securely against each stop, determine the free play of the tab. Total free play measured at the tab trailing edge should not exceed 0.06 inch.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF ELEVATOR 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 ELEVATOR TRIM RIGGING AND ADJUSTMENT, VERIFY THAT THE ELEVATOR TAB MOVES UP WHEN THE TRIM WHEEL IS TRIMMED DOWN; AND, THAT THE ELEVATOR TAB MOVES DOWN WHEN THE TRIM WHEEL IS TRIMMED UP.

- (8) Check system for proper operation.

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5. Stall Warning System

A. Description and Operation

WARNING: PHYSICAL MANIPULATION OF LIFT TRANSDUCER ON PA-46-350P AIRPLANES MAY RESULT IN ERRONEOUS STALL WARNINGS NECESSITATING CALIBRATION OF SYSTEM.

The stall warning system's major components consist of a lift transducer located in the leading edge of the left wing, the sensing source of the transducer protrudes into the air stream and during flight is positioned by local airflow velocity and direction. By correlating lift with airflow characteristics at the stagnation point on the wing, the lift transducer measures changes in angle-of-attack, or airspeed deviations from an airspeed represented by a reference angle-of-attack.

The output signal, combining angle-of-attack and local dynamic pressure, enters the lift computer which contains power regulators, signal processor and control circuitry. Provisions are included for monitoring the entire stall warning system.

B. Lift Detector Assembly

(1) Removal

- (a) Remove the four screws which hold lift detector to leading edge of wing.
- (b) Pull lift detector partially out of opening in wing and disconnect wires at connector.
- (c) Remove lift detector.

(2) Installation

- (a) Connect wires from detector to harness.
- (b) Position lift detector in the opening in the wing and secure with the four screws.
- (c) Check lift detector for operation per Stall Warning Functional Test.

C. Dual Warning Unit (Horn)

(1) Removal

- (a) Disconnect wires coming from warning unit.
- (b) Remove the four screws and washers that secure the unit to the bulkhead.

(2) Installation

- (a) Position dual warning unit on the bulkhead and secure with screws/washers.
- (b) Connect electrical leads to unit (refer to electrical schematic in 91-27-30).

D. Stall Warning Functional Test

(PIR-PPS-60089-2, Rev. E)

- (1) Locate the stall warning test switch on the pilot's instrument panel and the lift transducer which is located in the inboard left wing leading edge.
 - (a) Activate the test switch.
 - (b) Verify that the transducer vane moves forward (up); the stall warning activates.
- (2) Locate the stall warn heat switch on the center instrument panel (if installed).

CAUTION: DO NOT ACTIVATE STALL WARN HEAT SWITCH FOR MORE THAN FIVE (5) SECONDS.

- (a) Depress left main gear uplock switch.
- (b) Activate the stall warn heat switch.
- (c) Check that the lift transducer vane and mounting plate become warm.

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E. Force Applicator Kit Test

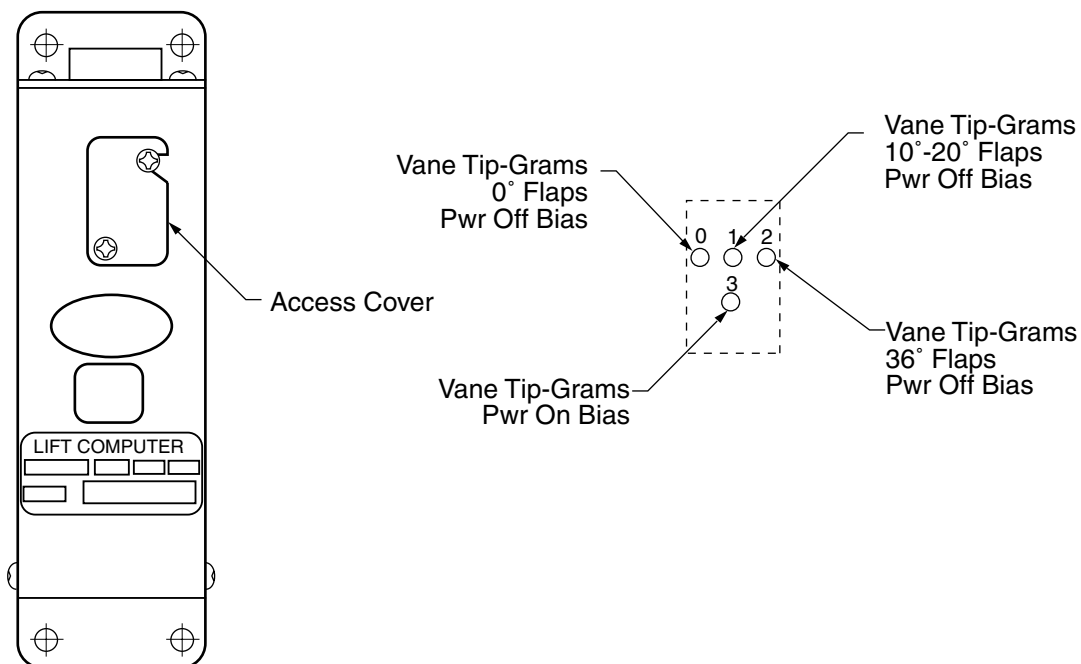
The lift computer is factory set by Safe Flight Instrument Corp. to produce the required outputs to activate the stall horn. Final adjustments are then made to each installation by Piper during flight test. At the completion of individual system adjustment by Piper the actual tip gram value will be recorded in the aircraft logbook as follows:

Tipgrams $\pm 1/2$			
POWER	STALL WARNING	TIP GRAMS	
	FLAPS	ACTUAL SETTINGS	EXAMPLE
Off	Full Up 0°	x.x	(+1.5)
Off	10°-20°	x.x	(+1.0)
Off	Full Down 36°	x.x	(0)
On	Full Up 0°	x.x	(+0.5)
On	10°-20°	x.x	(0)
On	Full Down 36°	x.x	(-0.75)

Should it become necessary to check the values shown in the airplane log book, use Safe Flight Instrument Corp's. Force Applicator Kit, P/N 1952-1, to measure the "tip-grams" of force settings required at the lift transducer vane to energize the signal.

- (1) Attach the positioner to the lift transducer cavity as shown in Figure 2-1 in Safe Flight's Force Applicator Kit operation manual. The squat switch shall be in the in-flight condition.
 - (a) Position the cockpit pedestal power lever to the power off position and flaps to the full up position. The prestall horn shall activate at tip grams recorded in the airplane log book.
 - (b) Place the cockpit pedestal power lever in the power off position and flaps to the 10°-20° position. The prestall horn shall activate at tip grams recorded in the airplane log book.
 - (c) Place the cockpit pedestal power lever in the power off position and the flaps at the full (36°) down position. The pre-stall horn shall activate at tip grams recorded in the airplane log book.
- (2) To make necessary adjustments, remove the access plate from the lift computer. Locate the four adjustment screws number "0, 1, 2, and 3" (refer to Figure 3).

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Lift Computer "Tip Grams" Adjustment
Figure 3

F. Flap Switch Input Test

(PIR-PPS60089-2, Rev. E.)

- (1) Set flap to 0° with aircraft power on.
- (2) Remove electrical connector P376 from lift computer.
- (3) With continuity tester monitor pins 4 and 5 of P376. Verify open circuit.
- (4) Move flap position switch to 10°. Verify continuity between pins 4 and 5.
- (5) Move flap position switch to 20°. Verify continuity between pins 4 and 5.
- (6) Move flap position switch to 36°. Verify open circuit between pins 4 and 5. Verify continuity between pins 4 and 6.
- (7) Move flap position switch back to 20°. Verify open circuit between pins 4 and 6. Verify continuity between pins 4 and 5.
- (8) Move flap switch to 0°. Verify open circuit between pins 4 and 5.
- (9) If all tests pass reinstall P376 on lift computer. If all do not pass verify flap microswitch installation and adjustment. Repeat steps 3 thru 8.

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G. Stall Warning Flight Test Procedure

(PIR-FTP2001-8, Rev. E.)

NOTE: Required whenever a "replacement" wing is installed.

This test is performed with gear down, flaps set as indicated, and power ON = 31 In. Hg. @ 2400 RPM. Fly airplane and at a rate of 1 KT/SEC maximum record the following warning and stall speeds:

Flaps	Power	Trim Speed	Desired Warning	Maximum Warning	Record Warning / Stall
0°	IDLE	110	6 - 9	5 - 10	_____/_____
0°	ON	110	6 - 9	5 - 10	_____/_____
20°	IDLE	100	6 - 9	5 - 10	_____/_____
20°	ON	100	6 - 9	5 - 10	_____/_____
36°	IDLE	90	6 - 9	5 - 10	_____/_____
36°	ON	90	6 - 9	5 - 10	_____/_____

- (1) Verify that the stall warning system performs within the following limits:
 - (a) Maximum: stall warning begins at 5 to 10 KIAS prior to stall and continues until stall occurs.
 - (b) Desired: stall warning begins at 6 to 9 KIAS prior to stall and continues until stall occurs.
- (2) If the stall warning system fails to perform within the limits above, adjust the system and refly the test.
- (3) If not able to adjust the stall warning system sufficient to achieve the limits above, recheck the "replacement" wing installation to ensure it is installed and rigged correctly.

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FLAPS

1. Flap Drive System (Refer to Figure 1)

The flaps are driven by an electric motor-actuator unit. The motor-actuator is mounted below the floor at fuselage station (F.S.) 167.97. Remove the seat, cabinet (if necessary), and floor boards to gain access to the motor.

The drive system contains two movable micro-switches on a cam mechanism (one each for up and down flap movement), warning horn micro-switch on cam bracket, current sensor, relay, and mechanical linkages. A removable cover on the right forward floor gives access to the switches. The sensor and relay are located on a plate assembly aft of motor. The cover is secured with velcro tabs for easy removal.

Pushrods are connected to the actuator at both ends. These pushrods extend out through the fuselage and connect to bellcranks in the wings at wing station (W.S.) 29.00. Additional pushrods extend out along the wing rear spar to an idler arm at W.S. 64.00 and on to another bellcrank at W.S. 93.00. Pushrods connected to the bellcranks at W.S. 64.00 and W.S. 93.00 connect the flaps to complete the drive system.

To ensure a good pressure seal at the fuselage exit points of the flap drive pushrods, a bellows is connected to the pushrods and tube assemblies which are part of the fuselage structure, thus sealing the opening and preventing any air loss from the pressurized cabin.

The flap selector provides four positions: Full up (0°), 10°, 20°, and full down (36°). All positions are preselected by the flap control lever on the instrument panel. A flap position warning system is provided to warn when the flaps are extended to or beyond the approach position without the landing gear fully extended and locked.

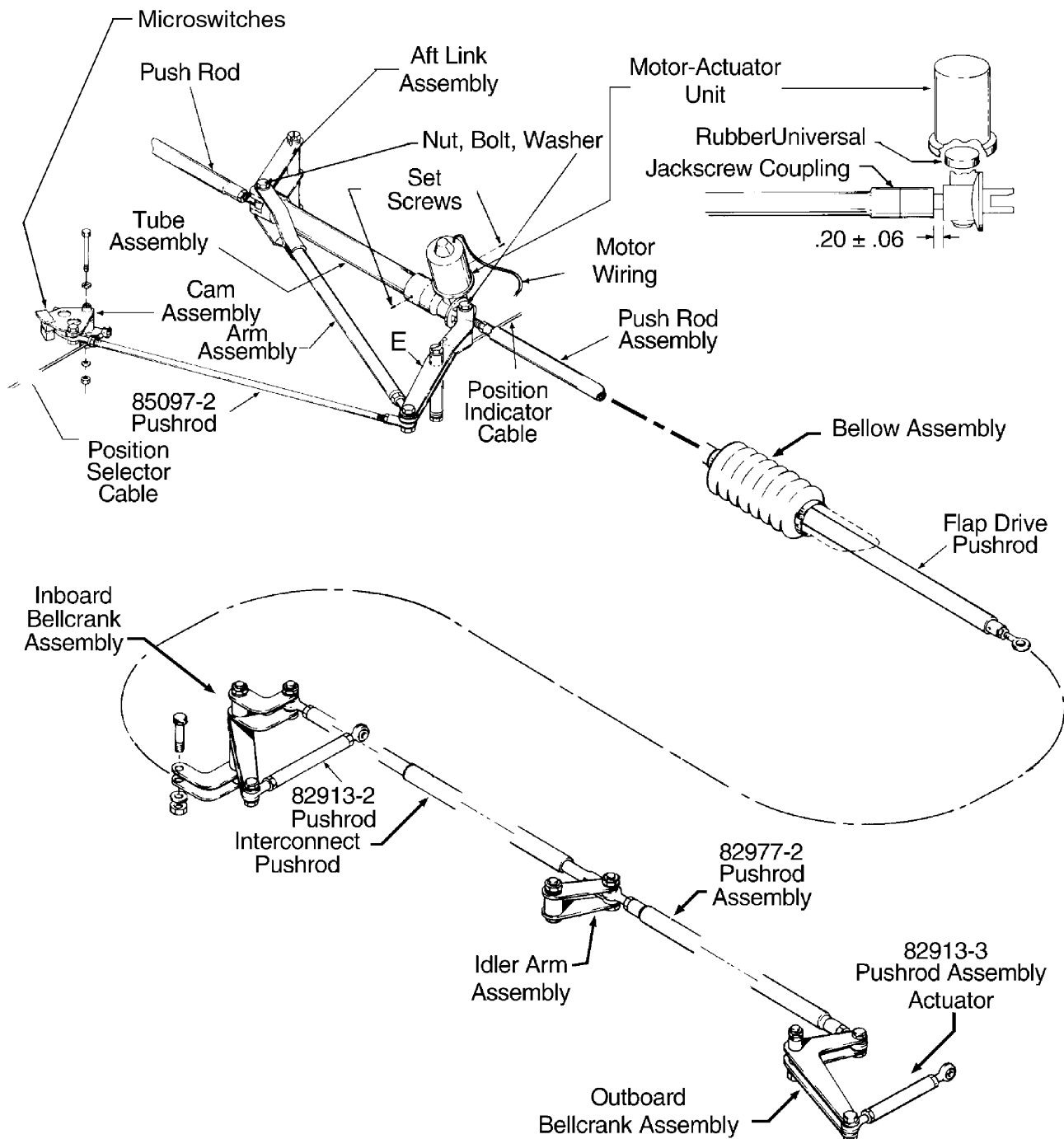
2. Troubleshooting

See Chart 1.

CHART 1
TROUBLESHOOTING FLAP CONTROL SYSTEM

Trouble	Cause	Remedy
Flaps fail to extend or retract.	Motor-Actuator inoperative.	No electrical power to motor. Check circuit breaker.
Flaps not synchronized or fail to move evenly when retracted.	Incorrect rigging of system.	Adjust flaps.

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Flap Motor-Actuator and Drive System
Figure 1

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3. Flap Controls

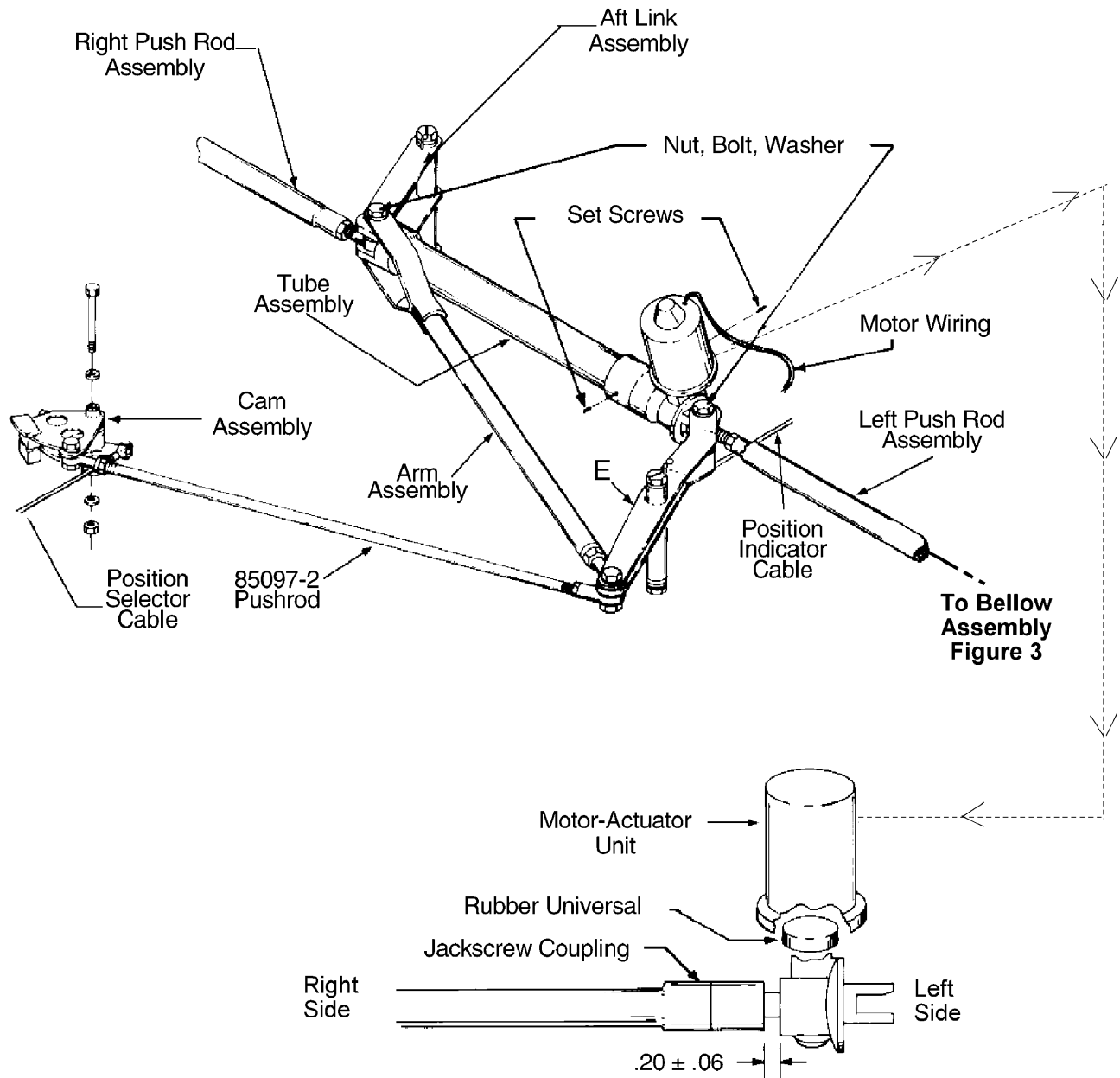
A. Removal

- (1) To remove link "E": (See Figure 2.)
 - (a) Disconnect the flap position indicator cable clamp (PS1001-6-3) 7 from link "E" by removing the MS35206-243 screw and MS20365-832C nut.
 - (b) Remove the MS21042-4 nut, AN4-13A bolt, and NAS1149F0463P washer that secures link "E" to the connecting arm assembly clevis and push rod link clevis.
 - (c) Remove the AN4-16A bolt, MS21042-4 nut, NAS1149F0463P washer, and two 82695-96 bushings that secures link "E" to the pushrod and the motor-actuator unit.
 - (d) Remove safety wire from AN4H30 bolt that secures link "E" to its support bracket. Remove the bolt, AN310-4 nut, NAS1149F0463P and 940-416L washers (under nut), and MS24665-132 pin.
 - (e) Remove link "E".
- (2) To remove the aft link assembly: (See Figure 2.)
 - (a) Remove the AN24-34A bolt, MS21042-4 nut, two 82695-97 bushings, and NAS1149F0432P, two AN960-616, and two AN960-616L washers that secure the aft link assembly to the tube assembly and arm assembly.
 - (b) Remove safety wire from AN4H34 bolt that secures the aft link to its support bracket. Remove the bolt, AN310-4 nut, two NAS1149F0463P washers (under nut), and MS24665-132 pin.
 - (c) Remove link.
- (3) To remove the flap drive pushrod assembly: (See Figures 2 and 3.)
 - (a) Loosen appropriate hose clamp on small end of bellows.
 - (b) For left flap drive pushrod:
 - 1 Remove the MS21042-4 nut, AN 4H30 bolt, two each 82695-96 bushings and AN 960-416 washer securing pushrod clevis to link "E" and the actuator- motor assembly.
 - 2 Remove NAS464-P5A9 bolt, and MS 21042-5 nut that secures the pushrod clevis to the left inboard bellcrank assembly.
 - (c) For right flap drive pushrod
 - 1 Remove AN24-24A bolt, two 82695-97 bushings, one NAS1149F0463P washer two each AN960-616 and AN960-616L washers, and MS21042-4 nut securing pushrod clevis to the tube assembly, the aft link assembly, and the arm assembly.
 - 2 Remove NAS 464-P5A9 bolt, and MS 21042-5 nut that secures the pushrod clevis to the right inboard bellcrank assembly.
 - (d) Slide pushrod from flap drive housing and remove.
- (4) To remove the 85097-2 pushrod assembly: (See Figure 2.)
 - (a) Remove AN4-13A bolt, NAS1149F0463P washer, and MS21042-4 nut connecting the pushrod assembly to link "E."
 - (b) Remove AN24-15A bolt, two NAS1149F0463P washers, and MS21042-4 nut connecting the pushrod assembly to the cam assembly.
 - (c) Remove the 85097-2 pushrod assembly.

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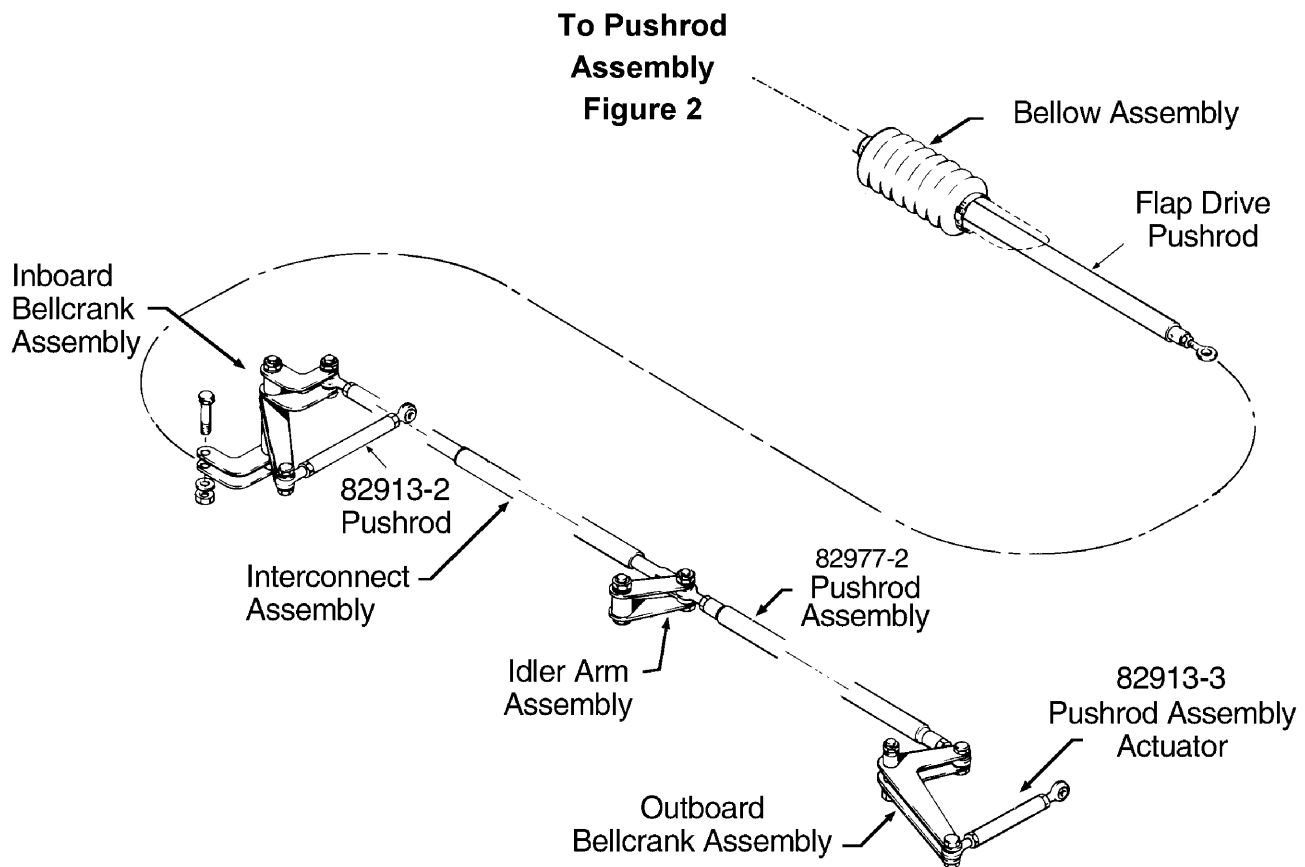
- (5) To remove arm assembly: (See Figure 2.)
 - (a) Remove AN4-13A bolt, NAS1149F0463P washer, MS21042-4 nut connecting the arm assembly to link "E".
 - (b) Remove the AN24-34A bolt, MS21042-4 nut, two 82695-97 bushings, and NAS1149F0432P, two AN960-616, and two AN960-616L washers that secure the arm assembly to the tube assembly and aft link assembly.
 - (c) Remove arm assembly.
- (6) To remove the inboard bellcrank: (See Figure 3.)
 - (a) Remove the NAS 464-P549 bolt and MS 21042-5 nut that secures the bellcrank to the flap drive pushrod.
 - (b) Remove the AN4-11 bolt, the AN310-4 nut, the NAS1149F0463P washers, and the MS24665-132 pin that secures the bellcrank to the interconnect pushrod assembly.
 - (c) Remove the NAS464-P4A8 bolt, the MS21042-4, and the NAS1149F0463P washer that secures the bellcrank to the 82913-2 pushrod.
 - (d) Remove the AN4-45 bolt, AN310-4 nut, 82695-38 bushing, and MS24665-132 pin that secures the bellcrank to its support bracket.
 - (e) Remove bellcrank.
- (7) To remove the 82913-2 inboard flap actuator pushrod assembly: (See Figure 3.)
 - (a) Remove the NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0463P washer, that secures the pushrod to the bellcrank.
 - (b) Remove the AN4-12A bolt, MS21042-4 nut, and two NAS1149F0463P washers, that secures the pushrod to the support bracket on the flap.
 - (c) Remove the pushrod.
- (8) To remove the flap interconnect pushrod assembly: (See Figure 3.)
 - (a) Remove the AN310-4 nut, AN4-11 bolt, NAS1149F0463P washer, and MS24665-132 pin that secures the pushrod to the inboard bellcrank assembly.
 - (b) Remove the AN310-4 nut, AN4-13 bolt, two NAS1149F0463P washers, MS24665-132 pin and two 82695-39 bushings that secures the pushrod to the 82977-2 pushrod assembly.
 - (c) Remove the pushrod.
- (9) To remove the idler: (See Figure 3.)
 - (a) Remove the AN310-4 nut, AN4-31 bolt, two NAS1149F0463P washers, MS24665-132 pin and two 82695-39 bushings that secures idler arm assembly to the interconnect pushrod assembly and the 82977-2 pushrod assembly clevis.
 - (b) Remove the AN310-4 nut, AN4-16 bolt, two NAS1149F0463P washers, MS24665-132 pin and 82695-40 bushing that secures the pushrod to its support bracket.
 - (c) Remove the idler arm assembly.
- (10) To remove the 82977-2 pushrod assembly: (See Figure 3.)
 - (a) Remove the AN310-4 nut, AN4-31 bolt, two NAS1149F0463P washers, MS24665-132 pin and two 82695-39 bushings that secures 82977-2 pushrod assembly clevis to the idler arm assembly.
 - (b) Remove the NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer, that secures the pushrod to the outboard bellcrank assembly.
 - (c) Remove the 82977-2 pushrod assembly.

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Flap Motor-Actuator and Drive System - Fuselage Components
Figure 2

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Flap Motor-Actuator and Drive System - Wing Components
Figure 3

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- (11) To remove outboard bellcrank assembly: (See Figure 3.)
 - (a) Remove the NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer, that secures the 82977-2 pushrod to the outboard bellcrank assembly.
 - (b) Remove the NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer, that secures the 82913-3 pushrod assembly actuator to the outboard bellcrank assembly.
 - (c) Remove the AN4-20 bolt, AN310-4 nut, two NAS1149F0463P washers, 82695-37 bushing, and MS24665-132 pin that secures the outboard bellcrank assembly to the support bracket on the flap.
 - (d) Remove the outboard bellcrank assembly.
 - (12) To remove outboard actuator pushrod assembly: (See Figure 3.)
 - (a) Remove the NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer, that secures the pushrod to the bellcrank.
 - (b) Remove the AN4-12A bolt, MS20364-428C nut, two 82695-42 bushings, and two NAS1149F0463P washers, that secures the pushrod to the support bracket on the flap.
 - (c) Remove the pushrod.
- B. Installation**
- (1) To install outboard actuator pushrod assembly: (See Figure 3.)
 - (a) Ensure that the pushrod assembly measures 4.53 inches between the centers of the rod end holes. (Rod ends should be evenly spaced and locknuts loose)
 - (b) Attach rod end of pushrod assembly to outboard bellcrank arm with NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer.
 - (c) Position pushrod's aft rod end bearing on flap support. Install AN4-12A bolt (with head pointing outboard), two NAS1149F0432P washers (under nut), and MS20364-428C nut.
 - (2) To install the outboard bellcrank: (See Figure 3.)
 - (a) Position bellcrank in support.
 - (b) Install AN4-20 bolt (head pointing down), 82695-37 bushing, two NAS1149F0463P washers (under nut), and AN310-4 nut. Tighten nut until support arms seat on bushing, then tighten one to two more castellations. Ensure that bellcrank operates freely and install cotter pin.
 - (c) Check for a maximum of 0.035 inch vertical end play of bellcrank. NAS1149F0532P washers may be added as required between the bearing surfaces of the bellcrank and the bellcrank lower supporting bracket, maintaining bellcrank freedom of rotation after pushrod installation.
 - (d) Attach the 82913-3 pushrod assembly actuator to the outboard bellcrank assembly. Install NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer.
 - (e) Attach the 82977-2 pushrod to the outboard bellcrank assembly by installing a NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer.
 - (3) To install the 82977-002 pushrod assembly: (See Figure 3.)
 - (a) Ensure that the pushrod assembly measures 24.70 inches between the centers of the rod end holes.
 - (b) Attach outboard end of the pushrod to the outboard bellcrank assembly by installing NAS 464-P4A8 bolt, MS21042-4 nut, and NAS1149F0432P washer.
 - (c) Attach the inboard end of the 82977-2 pushrod assembly clevis to the idler arm assembly with two 82695-39 bushings, AN4-31 bolt (head pointing down), two NAS1149F0463P washers (under nut), AN310-4 nut, and MS24665-132 pin

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- (4) To install the idler: (See Figure 3.)
 - (a) Place idler in position.
 - (b) Install AN4-16 bolt (head pointing down), 82695-40 bushing, two NAS1149F0463P washers (under nut), and AN310-4 nut. Tighten nut until support arms seat on bushing, then tighten one to two more castellations. Ensure that idler operates freely and install cotter pin.
 - (c) Check for a minimum of 0.035 inch vertical end play of idler. AN960-516 or AN960-516L washers may be added as required between the bearing surfaces of the idler and the idler lower supporting bracket. Install MS24665-132 cotter pin.
 - (d) Connect flap drive interconnect pushrod and flap interconnect pushrod to idler arm assembly by installing AN4-31 bolt (head pointing down), two 82695-39 bushings, two NAS1149F0463P washers (under nut), and AN310-4 nut. Tighten nut until idler arms seat on bushing, then tighten one to two more castellations. Ensure that idler operates freely, then install MS24665-132 cotter pin.
- (5) To install flap interconnect pushrod assembly: (See Figure 3.)
 - (a) Ensure that the pushrod measures 32.12 inches between the centers of the rod end hole and clevis hole.
 - (b) Position the flap drive interconnect pushrod rod end into the flap 82977-2 pushrod assembly clevis. Install the two 82695-39 bushings. Position this assembly into the idler arms and secure with AN4-13 bolt (head pointing down), two NAS1149F0463P washers (under nut), and AN310-4 nut. Tighten nut until the idler arms seat on the bushing and then tighten one to two more castellations. Check that the idler operates freely and install MS24665-132 cotter pin.
 - (c) Place remaining rod end of pushrod between arms on inboard bellcrank. Place two NAS1149F0463P washers under bolt and one NAS1149F0463P washer under nut. Install AN4-11 bolt (head pointing down), AN310-4 nut, and MS24665-132 cotter pin.
- (6) To install the inboard flap 82913-2 actuator pushrod assembly: (See Figure 3.)
 - (a) Ensure that pushrod measures 4.86 inches between the centers of the rod end bearings. (Rod ends should be evenly spaced and locknuts loose).
 - (b) Attach rod end of the pushrod assembly to the outboard bellcrank arm with the NAS464-P4A8 bolt, NAS1149F0463P washer, and MS21042-4 nut.
 - (c) Position the pushrod aft rod end bearing on the flap supports. Place one 82695-42 bushing on each side of the bearing. Install the AN4-12A bolt (head pointing outboard), NAS1149F0463P washers (under nut), and MS20364-428C nut.
- (7) To install the inboard bellcrank: (See Figure 3.) (PIR-85068 AJ.)
 - (a) Position bellcrank on support bracket.
 - (b) Install AN4-45 bolt (head pointing down), 82695-38 bushing and AN310-4 nut. Tighten the nut until the bracket arms seat on the bushing, then tighten one to two more castellations.
 - (c) Check for a maximum of 0.035 inch vertical end play of the bellcrank. Use NAS1149F0432P washers to reduce end play to a minimum and allow free rotation without any binding on top as required. Use NAS1149F0632P washers to reduce end play to a minimum and allow free rotation without any binding on bottom as required. Install MS24665-134 cotter pin.
 - (d) Attach flap interconnect pushrod to upper arms on bellcrank. Use NAS1149F0432P washers as required (Max 4 top, 4 bottom permitted), maintaining neutral alignment of bearing within the bellcrank. Secure pushrod with AN4-11 bolt (head pointing down), one NAS1149F0463P washer (under nut), and AN310-4 nut. Install MS24665-134 cotter pin.

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- (e) Attach inboard flap actuator 82913-2 pushrod to long arms on bellcrank with NAS464-P4A8 bolt, MS21042-4 nut, and NAS1149F0463P washer.
- (f) Attach flap drive pushrod to lower arms on bellcrank with the NAS464-P549 bolt and MS21042-5 nut.
- (8) To install the flap drive pushrod assembly: (See Figures 2 and 3.)
 - (a) Adjust the pushrod(s) being installed to measure as follows (rod end holes - center to center):
 - right pushrod = 27.34 inches
 - left pushrod = 18.58 inches.
 - (b) Slide the pushrod through appropriate flap drive housing.
 - (c) For left flap drive pushrod:
 - 1 Position flap drive pushrod clevis in center of U bracket on actuator-motor assembly. Insert the two 82695-96 bushings. Place U shaped clevis on link "E" over actuator-motor bracket. Secure with 4H30 bolt, NAS1149F0463P washer (under nut), and MS21042-4 nut.
 - 2 Secure other end of pushrod to the left inboard bellcrank assembly with a NAS464-P5A9 bolt, and MS21042-5 nut.
 - (d) Attach right flap drive pushrod:

Position flap drive pushrod in U shaped bracket on end of tube assembly. Insert the two 82695-96 bushings. Position the U shaped bracket on end of arm assembly over bushings with one each NAS1149F0463P and AN960-616L washers between bushings and arm assembly bracket. Secure with the AN24-24A bolt, placing NAS1149F0463P washer under bolt head. Install MS21042-4 nut.
 - (e) Tighten the hose clamp on the small end of the bellows.
- (9) To install the aft link assembly: (See Figure 3.)
 - (a) Position aft link on mounting brackets. Secure with AN4H34 bolt, two NAS1149F0463P washers (under nut), and AN310-4 nut. Tighten nut finger tight plus one or two castellations. Insure that the aft link operates freely. Install MS24665-132 cotter pin and safety with MS20995C32 wire.
 - (b) Install two 82695-97 bushings in hole in tube assembly. Move aft link arms over hole in tube assembly. Move arm assembly yoke over hole, placing one each AN960-616 and AN960-616L washers between yoke and aft link arms. Insert AN24-34A bolt through yoke, arms, and actuator. Secure bolt with NAS1149F0432P washer and MS21042-4 nut.
- (10) To install "E" link: (See Figure 2.)
 - (a) Position link "E" between support brackets.
 - (b) Install AN4H30 bolt, one each NAS1149F0463P and NAS1149F0432P washers (under nut), and AN310-4 nut. Tighten nut finger tight plus one to two castellations. Ensure that the link is free to pivot, then install MS24665-132 cotter pin. Safety with MS20995C32 wire.
 - (c) Secure link "E" to the pushrod and the motor-actuator unit with two 82695-96 bushings, AN916-416 washer, AN4-16A bolt, and MS21042-4 nut.
 - (d) Secure link "E" to connecting arm assembly clevis and push rod link clevis with NAS1149F0463P washer, AN4-13A bolt, and MS21042-4 nut.
 - (e) Attach the flap position indicator cable clamp (PS10017-6-3) link "E" with MS35206-243 screw and MS21042-4 nut. Secure cable to clamp.

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C. Flap Motor-Actuator (See Figure 2.)

(1) Removal

- (a) Lower flaps to the full down position

WARNING: PULL ELECTRIC FLAP CIRCUIT BREAKER, DISCONNECT BATTERY, AND CHECK THAT NO EXTERNAL POWER IS CONNECTED TO AIRPLANE IN ORDER TO INSURE THAT NO ELECTRICAL POWER IS BEING APPLIED TO FLAP SYSTEM.

- (b) Disconnect flap actuator motor wiring.
(c) Remove MS21042-4 nut, NAS1149F0463P washer, AN4-16A bolt, and two 82695-96 bushings connecting left end of actuator left flap drive pushrod and "E" link.
(d) Remove AN24-24A bolt, two 82695-97 bushings, one NAS1149F0463P washer two each AN960-616 and AN960-616L washers, and MS21042-4 nut securing right pushrod clevis to the tube assembly, the aft link assembly, and the arm assembly.
(d) Remove motor-actuator and attached tube from aircraft.
(e) Remove the two MS51966-112 set screws from actuator jackscrew coupling.
(f) Unscrew tube from actuator.

NOTE: Motor and actuator remain together as one unit.

(2) Installation

WARNING: PULL ELECTRIC FLAP CIRCUIT BREAKER, DISCONNECT BATTERY, AND CHECK THAT NO EXTERNAL POWER IS CONNECTED TO AIRPLANE IN ORDER TO INSURE THAT NO ELECTRICAL POWER IS BEING APPLIED TO FLAP SYSTEM.

NOTE: It may be necessary to rotate the flap motor-actuator coupling by hand to extend actuator jackscrew to full down position.

- (a) Insert actuator into push tube and secure with the two MS51966-112 set screws.
(b) Install actuator-push tube assembly to right pushrod clevis to the tube assembly, the aft link assembly, and the arm assembly. Secure with AN24-24A bolt, two 82695-97 bushings, one NAS1149F0463P washer one each AN960-616 and AN960-616L washer between bushings and arm assembly bracket, and MS21042-4 nut.
(c) Connect the left flap drive pushrod clevis in center of U bracket on actuator-motor assembly. Insert the two 82695-96 bushings. Place U shaped clevis on link "E" over actuator-motor bracket. Secure with 4H30 bolt, NAS1149F0463P washer (under nut), and MS21042-4 nut.
(d) Connect flap motor-actuator wiring.
(e) Connect battery terminals.
(f) Check flap rigging and operation (refer to Rigging Flaps).

4. Flap System Rigging

(PIR-PPS50056-2. Rev. M.)

WARNING: PULL ELECTRIC FLAP CIRCUIT BREAKER, BEFORE BEGINNING.

CAUTION: DO NOT ADJUST PRESET LENGTH OF COMPONENTS UNLESS SPECIFIED BELOW.

A. Before rigging flaps

- (1) If necessary, disconnect flap pushrods from wing bellcranks.
(2) Rig flaps before lubricating flap tracks.

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- (3) Check that the length of the arm assembly (Figure 2) is 14.92 inches. If necessary to reset, adjust the rod end on arm assembly.

B. Rigging flaps

- (1) Check the jack screw set dimension is 0.20 ± 0.06 inches as shown in Figure 2. If adjustment is necessary, hand turn jack screw by grasping rubber universal on motor shaft.
- (2) Check that selector lever is in up (0°) position on instrument panel.
- (3) Position limit switches at null point by adjusting clevis end of selector cable.
- (4) Set circuit breaker. Motor should not run. Move selector lever to 10° position. Motor should run and extend jack screw. Return to up position. Jack screw should return to the 0.20 ± 0.06 inch dimension.
- (5) Hold flap trailing edge at approximately W.S. 93.00. Cycle flaps by hand through full travel several times. Flap rollers should operate smoothly in the track without a tendency to grab or bind.
- (6) Keep flap rollers firmly bottomed out in forward end of center and inboard flap track slots. Attach flap rods to wing bellcranks. Outboard flap rod is to be snug, allowing no flap end play. Inboard rod is to be snugged and then tightened one half turn.
- (7) Move selector lever to Full flaps down position. Verify flap position of $36^\circ +0^\circ, -1^\circ$. Right and left flap shall be within one (1) degree of each other.

NOTE: Maintain a slight up pressure on the underside of flap trailing edge when checking this position.

- (8) Move selector lever to the Full up position. Verify flap position of $0^\circ \pm 1^\circ$.

NOTE: Maintain a slight up pressure on the underside of flap trailing edge when checking this position.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF FLAPS. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF FLAP RIGGING AND ADJUSTMENT, VERIFY THAT THE FLAPS MOVE UP WHEN THE SELECTOR LEVER IS UP; AND, THAT THE FLAPS MOVE DOWN WHEN THE SELECTOR LEVER IS DOWN.

- (9) Check system for proper operation.

5. Flap System Adjustment

Use the following procedure to adjust flap system:

- A. To align flaps within one (1) degree of each other, adjust the inboard rod end on either the left or right pushrod assembly (i.e. - 82977-2, Figure 1).

NOTE: Maintain a slight up pressure on the underside of the flaps when checking flap travel.

- B. The outboard rod end of the pushrod 85097-2 (see Figure 2) bolts to a slot in the cam assembly. To increase flap travel, move that rod end forward in the slot. To decrease flap travel, move that rod end aft in the slot. Adjust rod end as required to allow the cam assembly to activate the warning horn switch.

NOTE: It is acceptable to have up to 3/16th inch vertical end play at flap trailing edge in the 0° flap position, measured at center of flap track.

- C. After any adjustment to the flap system, check for proper operation. See Caution under Rigging.

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6. Flap Position Indicator and Flap Warning System Functional Test

(PIR-PPS50056-2, Rev. M.)

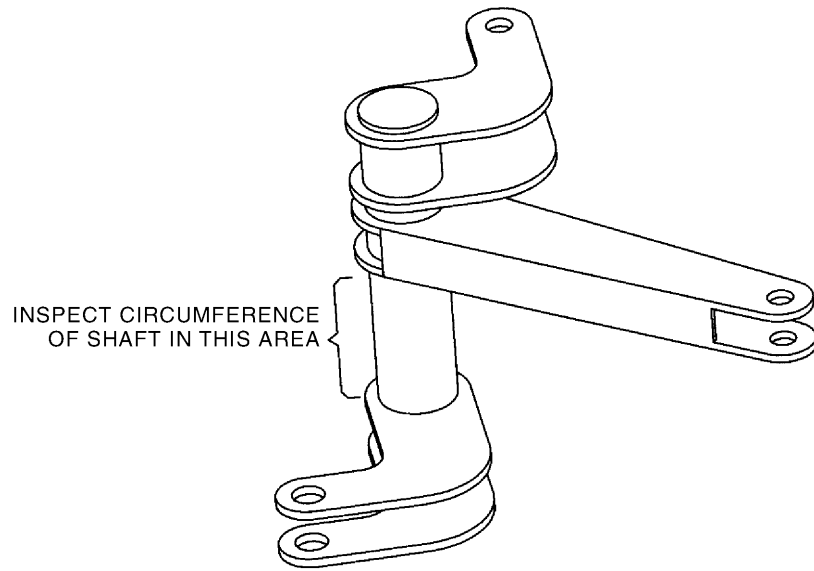
- A. Rig the flaps as described above.
- B. Place the airplane on jacks and fully retract the landing gear.
- C. Place flap handle in 10° position. Flaps shall extend to first mid position and landing gear warning horn does not sound.
- D. Place flap handle in 20° position. Flaps shall extend to second mid position and warning horn sounds.
- E. Place flap handle in full down position. Flaps shall extend fully, and warning horn sounds.
- F. Place flap handle in full up position. Flaps shall travel to up position and warning horn should stop sounding.
- G. Extend landing gear until fully down and locked. Remove airplane from jacks.
- H. Move flap handle thru 10°, 20° and full down position, the warning horn should not sound. Check the flap indicator to confirm the indicator correctly follows the flap handle and correctly displays the appropriate flap position.

7. Flap Bellcrank Distortion Inspection

If flaps have been extended at or above V_{FE} , inspect the flap bellcranks for evidence of distortion.

- A. Access the flap bellcrank through the main landing gear wheel well. The bellcrank is outboard the wing root rib at W.S. 29.00 and adjacent to the aft spar.
- B. If the paint is cracked or peeling anywhere along the bellcrank (see Figure 4), torsional movement may have occurred.
- C. Remove the paint with a commercially available paint stripper, such as Cee-Bee E2012 or E2060.
- D. Using a dye penetrant method of inspection per latest revision of AC 43.13-1.
 - (1) Inspect for cracks at either arm on the bellcrank shaft near the welds.
 - (2) Inspect for cracks on the shaft itself as shown in Figure 4.
- E. If no cracks are found, repaint the bellcrank(s) and reinstall.
- F. If cracks are found:
 - (1) Replace the cracked bellcrank with a new part as follows:
 - (a) Lefthand side = 82905-010 bellcrank assembly.
 - (b) Righthand side = 82905-011 bellcrank assembly.
 - (2) Inspect the rest of the flap system for distortion or damage to the extension rods and rod ends.
- G. Make a logbook entry.

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Flap Bellcrank Distortion Inspection
Figure 4

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SPEEDBRAKES

WARNING: DO NOT PUT FINGERS IN HOLES OF EXTENDED SPEEDBRAKE BLADES. IF POWER TO THE SYSTEM IS INTERRUPTED, THE SPEEDBRAKE BLADES WILL CLOSE WITH SUFFICIENT FORCE TO AMPUTATE FINGERS.

1. Description and Operation

A Precise Flight SpeedBrake 2000 System is available as an option on S/N's 4636187 and up. When installed, the system provides expedited descents at low cruise power, glide path control on final approach, and an aid to the prevention of engine shock cooling.

The system consists of wing mounted electric SpeedBrake Cartridges, an asymmetric logic switching unit, an annunciator light, a 3-amp circuit breaker, and a yoke mounted actuator switch. Operation is simple ON or OFF, when power is supplied to the cartridges, the blades extend; when power is interrupted, powerful springs retract the blades.

**CHART 1
TROUBLESHOOTING SPEEDBRAKE SYSTEM**

Trouble	Cause	Remedy
SpeedBrake fails to retract, and pulling circuit breaker returns brakes to stowed.	Retract Microswitch fails to operate	Replace or repair Microswitch - if Microswitch is OK, use schematic to find break in wiring.
	Switch inoperative	Replace or repair switch - if switch OK use schematic to find break in circuit.
	Motor and Asymmetric Logic Control Unit failed.	Replace Asymmetric Logic Control Unit.
<u>CAUTION:</u> DO NOT PUSH SPEEDBRAKE BLADES DOWN, IF THEY FAIL TO RETRACT. FORCING SPEEDBRAKE BLADES DOWN WILL DAMAGE THE UNIT.		
SpeedBrake fails to retract, and pulling circuit breaker fails to return the brakes to stowed.	Clutch Failure	Pull brakes apart slightly, if this does not provide remedy replace clutch assy.
	Spring Failure	Replace Spring.
SpeedBrake fails to extend <u>NOTE:</u> If one SpeedBrake fails to extend, the Logic Interconnect Box will cut clutch power to the other SpeedBrakeCartridge after 4 seconds - the cartridge motor, however will continue to run.	Extend Microswitch fails to operate.	Replace or repair Microswitch - if Microswitch is OK, use schematic to find break in wiring.
	Clutch Inoperative.	Replace Clutch Assembly.
	Switch Inoperative.	Replace or repair switch - if switch OK, use schematic to find break in circuit.
	Motor and Asymmetric Logic Control failed.	Replace Asymmetric Logic Control Unit.

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2. Troubleshooting

See Chart 1, above.

3. Inspections

A. 50 Hour Inspection (See Figure 1.)

- (1) Inspect Cap Strip Cover Screws and Top Attachment Screws for security. If loose, remove screws and reinstall using Locktite 242. Torque to eight (8) in. lbs.
- (2) Inspect drain tube for obstructions or debris.

B. Annual Inspection

- (1) Remove SpeedBrake Cartridge as described under SpeedBrake Cartridges, Removal, below.
- (2) Clean and inspect unit for damage, corrosion, looseness, and proper operation.
- (3) Lubricate worm and worm gear with graphite.
- (4) Reinstall SpeedBrake Cartridge as described under SpeedBrake Cartridges, Installation, below.

4. SpeedBrake Cartridges

WARNING: DO NOT PUT FINGERS IN HOLES OF EXTENDED SPEEDBRAKE BLADES. IF POWER TO THE SYSTEM IS INTERRUPTED, THE SPEEDBRAKE BLADES WILL CLOSE WITH SUFFICIENT FORCE TO AMPUTATE FINGERS.

CAUTION: DO NOT PUSH SPEEDBRAKE BLADES DOWN, IF THEY FAIL TO RETRACT. FORCING SPEEDBRAKE BLADES DOWN WILL DAMAGE THE UNIT.

The SpeedBrake Cartridges (which are in each wing between W.S. 93.00 and 107.50) consist of a gearmotor and clutch assembly driving the interconnected blades through a worm gear set. The blades are loaded to the retracted position by a constant force spring.

The SpeedBrake cartridge also contains two microswitches; one for the retracted position and one for the extended position. The microswitches control gearmotor power, gearmotor direction, signals the cockpit annunciator and signals the logic-switching unit.

A. Removal

- (1) Remove access plates and covers.
NOTE: If installed, the radome on the right wing will need to be removed first.
- (2) Disconnect wiring harness.
- (3) Pull the drain tube up through the wing skin.
- (4) Remove the spring clip on each side of the SpeedBrake cartridge and remove the cartridge.

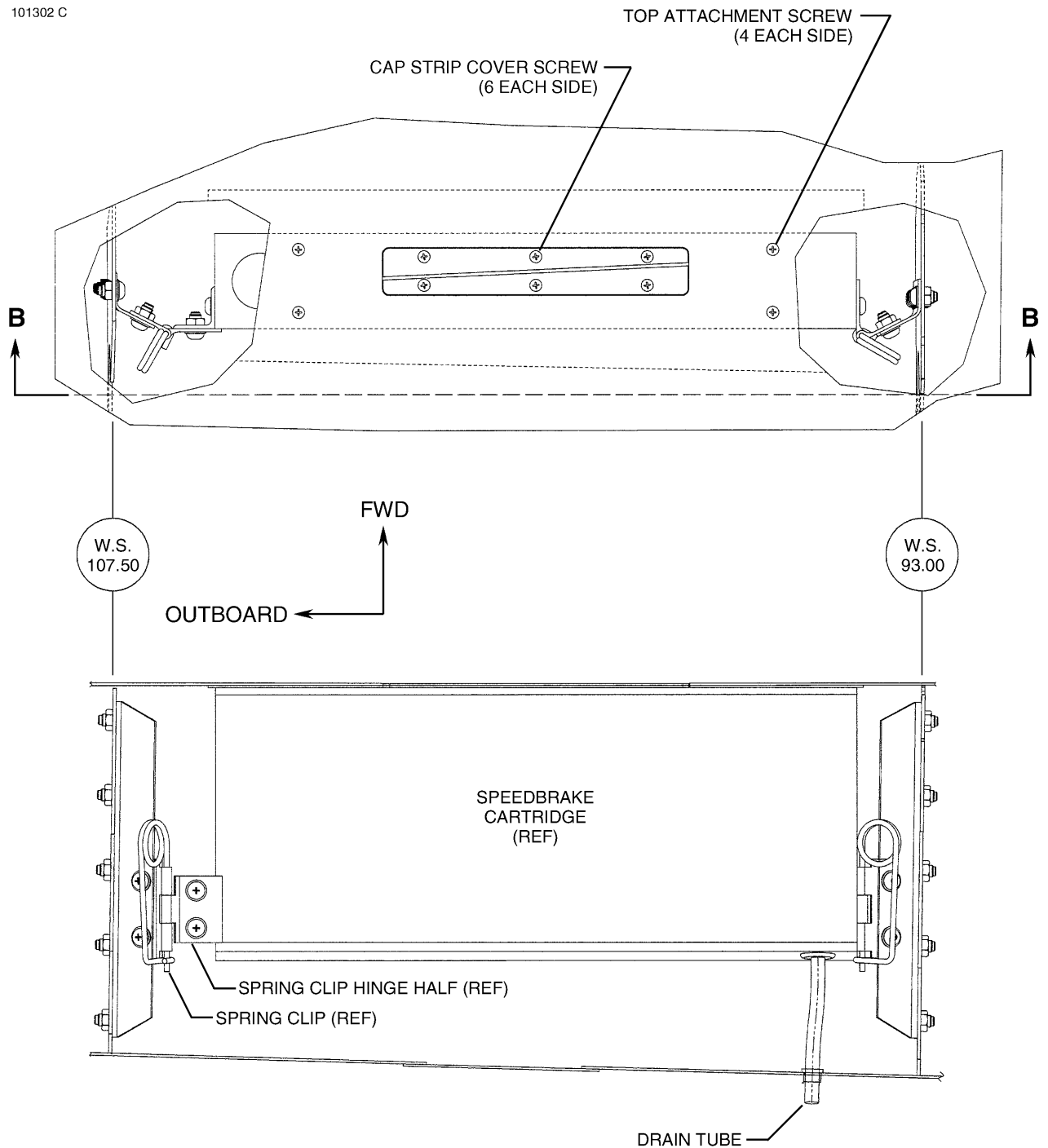
B. Installation

- (1) Insert the SpeedBrake cartridge through the access hole ensuring that the spring clip hinge halves are on the aft side of the cartridge.
- (2) Position the cartridge aligned with and between the spring clip hinge halves on the mounting brackets. Secure with spring clips.
- (3) Feed the drain tube through the wing skin.
- (4) Connect the wiring harness.
- (5) Reinstall access plates and covers.

NOTE: If required, reinstall the radome on the right wing.

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101302 C



VIEW B-B

SpeedBrake 50 Hour Inspection
Figure 1

Effectivity
4636187 and up,
If Installed

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5. Asymmetric Logic Switching

The Asymmetric Logic Switching Unit (which is located under the rear co-pilot floor closeout) monitors SpeedBrake Cartridge position and will cut power to both SpeedBrake Cartridge clutches causing instant blade retraction. This happens for two conditions:

- A. Both SpeedBrake Cartridge fails to extend completely within four (4) seconds, or
- B. One SpeedBrake Cartridge is contacted after extension (birdstrike, large hail etc).

NOTE: The gearmotors will continue to run after clutch power has been disconnected, with the SpeedBrake switch in the ON position.

6. SpeedBrake Switch

The control yoke-mounted SpeedBrake Switch controls SpeedBrake extension and retraction.

7. SpeedBrake Annunciator

The SpeedBrake Annunciator is mounted (separately) on the instrument panel above the pilot's airspeed indicator. It illuminates after both SpeedBrakes are extended and extinguishes after both SpeedBrakes are stowed.

8. Testing

A. Basic Functional Test

A properly operating SpeedBrake system should function as specified below:

- (1) Turn on aircraft power.
- (2) Switch SpeedBrakes ON. Full deployment should occur in no more than 2.5 seconds.

WARNING: DO NOT PUT FINGERS IN HOLES OF EXTENDED SPEEDBRAKE BLADES. IF POWER TO THE SYSTEM IS INTERRUPTED, THE SPEEDBRAKE BLADES WILL CLOSE WITH SUFFICIENT FORCE TO AMPUTATE FINGERS.

- (3) Verify motor stop. Verify full blade extension. Proper blade position is $87^{\circ} \pm 2^{\circ}$.

CAUTION: DO NOT PUSH SPEEDBRAKE BLADES DOWN, IF THEY FAIL TO RETRACT. FORCING SPEEDBRAKE BLADES DOWN WILL DAMAGE THE UNIT.

- (4) Switch SpeedBrakes OFF. Full retraction should occur in no more than 2.0 seconds.
- (5) Verify motor stop. Verify full blade retraction. Proper blade position is $0^{\circ} \pm 2^{\circ}$.
- (6) Repeat steps (2) thru (5) several times to verify proper operation.
- (7) Turn off aircraft power.

B. Speedbrake Cartridge Tester

Precise Flight offers a speedbrake cartridge test connector which is used to conduct a more precise functional test. The cartridge test connector is available from your Piper Distributor as P/N 762-138 and is used as follows:

- (1) Turn aircraft power OFF.
- (2) Remove left speedbrake access panel.
- (3) Disconnect left speedbrake cartridge from wiring harness.
- (4) Connect the cartridge test connector to the left speedbrake wiring harness.

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- (5) Turn aircraft power ON and operate speedbrake system.

WARNING: DO NOT PUT FINGERS IN HOLES OF EXTENDED SPEEDBRAKE BLADES. IF POWER TO THE SYSTEM IS INTERRUPTED, THE SPEEDBRAKE BLADES WILL CLOSE WITH SUFFICIENT FORCE TO AMPUTATE FINGERS.

CAUTION: DO NOT PUSH SPEEDBRAKE BLADES DOWN, IF THEY FAIL TO RETRACT. FORCING SPEEDBRAKE BLADES DOWN WILL DAMAGE THE UNIT.

- (6) With the right speedbrake extended, press on the extended blades to simulate air loading.
- (a) If the blades drop, turn aircraft power OFF, replace the right speedbrake, and start with step (5), above.
 - (b) If the blades remain extended, turn aircraft power OFF, remove the cartridge test connector from the left speedbrake wiring harness, and reconnect the wiring harness to the left speedbrake cartridge.
- (7) Turn aircraft power ON and operate speedbrake system.

WARNING: DO NOT PUT FINGERS IN HOLES OF EXTENDED SPEEDBRAKE BLADES. IF POWER TO THE SYSTEM IS INTERRUPTED, THE SPEEDBRAKE BLADES WILL CLOSE WITH SUFFICIENT FORCE TO AMPUTATE FINGERS.

CAUTION: DO NOT PUSH SPEEDBRAKE BLADES DOWN, IF THEY FAIL TO RETRACT. FORCING SPEEDBRAKE BLADES DOWN WILL DAMAGE THE UNIT.

- (8) Press on the extended blades of the left speedbrake to simulate air loading.
- (9) If the blades on both the left and right speedbrakes drop, turn aircraft power OFF, replace the left speedbrake, and start with step (7), above.
- (10) When the blades on both speedbrakes remain extended, the test has been completed successfully.

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CHAPTER

28

FUEL

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GENERAL

WARNING: DURING ANY FUEL SYSTEM MAINTENANCE, USE A GROUND WIRE ATTACHED FROM EACH MAIN GEAR GROUNDING PIN TO SEPARATE APPROVED GROUNDING STAKES TO PREVENT THE ACCIDENTAL DISCONNECTION OF AIRPLANE GROUNDING.

Fuel System

A. Description

The fuel system consists of an integral fuel tank in each outboard wing section, having a usable capacity of 60 U.S. gallons for a total usable capacity of 120 U.S. gallons. The fuel tanks are part of the wing structure - i. e. - a wet-wing configuration. Each tank has an anti-icing fuel vent and forward and aft fuel supply lines with finger screens. Fuel flows from these finger screens thru lines to a one (1) U.S. gallon collector tank located in each wing wheel well area. Installed in each collector tank is an electrically driven centrifugal fuel boost pump which is activated in conjunction with the fuel selector control in the cockpit. A sump drain is also located in each collector tank.

Fuel leaving the left or right collector/sump tank flows to a selector valve which is located on the right fuselage side behind the copilot's seat in a non-pressurized compartment. All fuel lines passing through the pressurized cabin are metal tubes surrounded by plastic cushion and encased by a second metal tube. This second tube is sealed from the cabin environment to preclude fuel from entering the cabin area or pressurized cabin air from entering fuel lines in the event of a leak.

The selector valve is cable controlled by a thumb-sized handle (just below the fuel quantity gauges) with detents at the OFF, LEFT, and RIGHT positions. Selecting LEFT or RIGHT directs fuel flow to the engine from the tank selected. To select OFF the fuel selector must be moved to the left tank position, moved down against spring pressure, then moved to the far left, or OFF position.

Fuel flows from the fuel selector valve forward to the fuel filter located below the baggage floor on the right side. The filter drain is a nylon tube located on the right side of the aircraft, forward of the wing. Fuel flows from the filter, forward through the emergency fuel pump and fire wall, into the engine compartment, to the engine driven fuel pump.

B. Troubleshooting

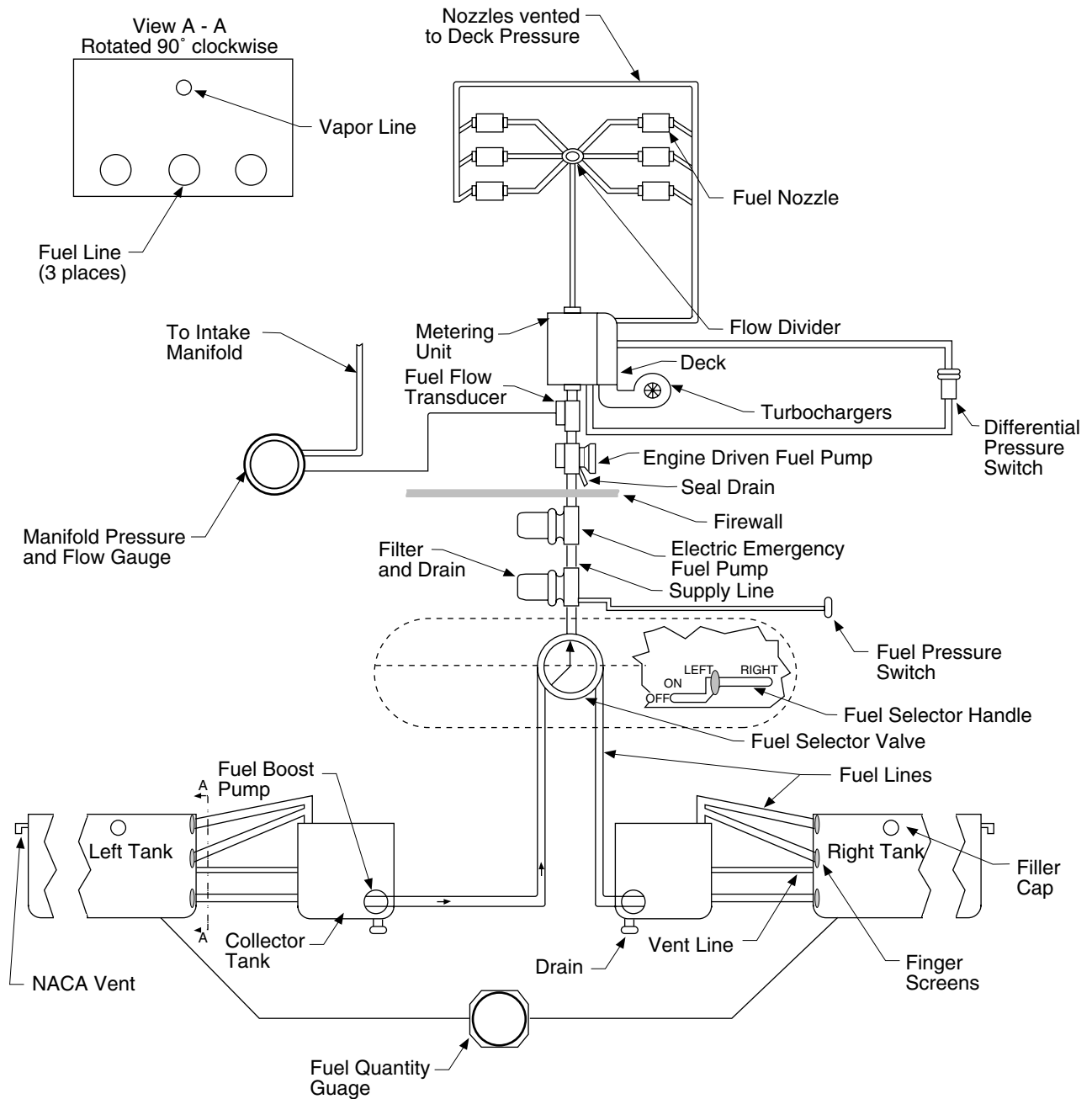
Chart 1 lists troubles which may occur in the mechanical or electrical portions of the fuel system, the probable cause and suggested remedy. When troubleshooting, first check from the fuel supply or power source to the item effected.

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**CHART 1
TROUBLESHOOTING FUEL SYSTEM**

Trouble	Cause	Remedy
Failure of fuel to flow.	Fuel line blocked.	Flush fuel system.
	Fuel vent cap blocked.	Check and clean vent hole in cap.
	Mechanical or electrical fuel pump failure.	Check and replace if necessary.
	Fuel selector valve in improper position.	Reposition as required.
	Damaged fuel selector valve.	Check for obstructions in the fuel selector leverage mechanism. 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.
Lower pressure or pressure surges.	Obstruction in inlet side of pump.	Trace lines and locate obstruction.
	Air in line to pressure gauge.	Bleed line.

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Fuel System
Figure 1

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STORAGE

The wing tanks are an integral part of the outboard wing sections. The liquid tight wing tanks are formed by bonding the wing skins with the ribs and stringers (i.e. - wet-wings). Holes in the ribs and spar permit movement of the fuel within the wings. There are ten access covers on the underside of each wing for access to the sealed portion of the tank.

1. Access Covers

In S/N's 4636021 thru 4636379, wet-wing access covers are sealed with sealant and secured with screws.

In S/N's 4636380 and up, the wet-wing access covers use integral O-rings and are secured with screws.

NOTE: In S/N's 4636380 and up, the early plain access covers can be used if the newer O-ring access covers are not available, but they then must be installed using sealant as described for S/N's 4636021 thru 4636379 under Installation, below.

A. Removal

- (1) Drain all fuel from the wing tank being serviced.
- (2) Ensure electrical power is "OFF".
- (3) Remove the access cover as follows:
 - (a) In S/N's 4636021 thru 4636379, remove the screws securing the access cover. With a suitable tool, pry the access cover away from the wing, taking care not to damage the mating surfaces - especially on the wing. When the access cover becomes free, carefully lower the cover and sender out of the wing until the electrical connection can be reached and disconnected.
 - (b) In S/N's 4636380 and up, remove the screws securing the access cover and carefully lower the cover and sender out of the wing until the electrical connection can be reached and disconnected.

B. Installation

- (1) Ensure electrical power is "OFF".
- (2) In S/N's 4636021 thru 4636379, apply Products Research Co. (PRC) PR1428-B-2 (or PR1403G-B-2) sealant and install the access cover on the wing with screws. Allow sealant to cure 72 hours before refilling tanks.
- (3) In S/N's 4636380 and up, hold the access cover in position and secure with screws. Torque the screws in a standard X-pattern until a torque of 25-30 in.-lbs. is achieved.

2. Leak Evaluation

Routine monitoring of the fuel storage system and prompt attention to any anomalies discovered will ensure trouble-free operation. Most fuel leaks will be identified by the pilot during pre-flight inspection and will generally consist of a stain or leak around the vent scoop, filler, drain valves, and wing surface in the wet-wing or along the plumbing lines in the wing or engine compartment. The following provides criteria for evaluating various categories of leaks and the maintenance action required.

A. Wing tanks.

WARNING: CAREFULLY EXAMINE ANY LEAKAGE TO ENSURE THAT IT IS NOT PROGRESSING TO A CRITICAL AREA OF THE AIRPLANE AND THAT THERE IS NO POSSIBILITY OF FUEL BEING BLOWN INTO THE FUSELAGE AREAS.

- (1) Upper wing surface.

The airplane may be released for flight with a fuel leak in the upper wing surface provided the required fuel load will allow the fuel level to remain below the leak area.

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**CHART 1
WET-WING FUEL LEAK EVALUATION**

FUEL TANK LEAKAGE LOCATION	HEAVY STAIN	RUNNING AND SEEP	SEEP	RUN	DRIPPING
Upper Wing Surface	1	1	2	3	4
Rear of Fwd. Spar	1	2	3	3	4
Behind Leading Edge	2	2	3	4	4
Lower Wing Surface	1	2	3	4	4
REQUIRED ACTION					
1. No repair action required, frequent inspections must be made to assure that leak does not progress. 2. No immediate repair required. Frequent inspection must be made to assure that leak does not progress. Repair must be made within the next 100 hours. 3. Flight may be continued to base or to repair facility for repair at pilot's discretion. 4. Immediate repair required.					

- (2) Lower wing surface.

Aircraft may be released for flight with fuel leaks in the lower wing skin as follows: (See Figure 1) Stain (Detail A), Seep (Detail B), and Heavy Seep (Detail C).

- (3) Fuel leakage from the integral fuel tanks (i.e. - wet-wing) can be divided into the five categories shown in Figure 1. Each category is identified by a visual examination of the wetted area around the source of leakage over time.

To evaluate a leak, clean all wetted area in the vicinity of a leak. Wait two (2) hours and reexamine the leak area and apply the following criteria to identify the leak category and required maintenance action. (See Figure 1 and Chart 1.)

- (a) A stain (Detail A) is evaluated as a leak where fuel wets an area around the apparent leak source such that the wetted area width is not over two (2) inches.
- (b) A seep (Detail B) is defined as a leak where the fuel wets an area around the apparent leak source such that the wetted area width is not over six (6) inches. The fuel must not run, flow, drip, or have any resemblance to any one of these conditions.
- (c) A heavy seep (Detail C) is a leak where fuel appears to spread very slowly and covers an area larger than the six (6) inches specified under seep, but does not flow, run or drip.
- (d) A run (Detail D) is defined as a leak where the fuel is dripping at a rate of less than ten (10) drops per minute or flowing slowly. A leak of this type is readily identifiable as fuel will appear immediately after wiping the area clean.
- (e) A running or dripping leak (Detail E) is any leak in excess of the run leak (Detail D). This type requires immediate repair of the leak.

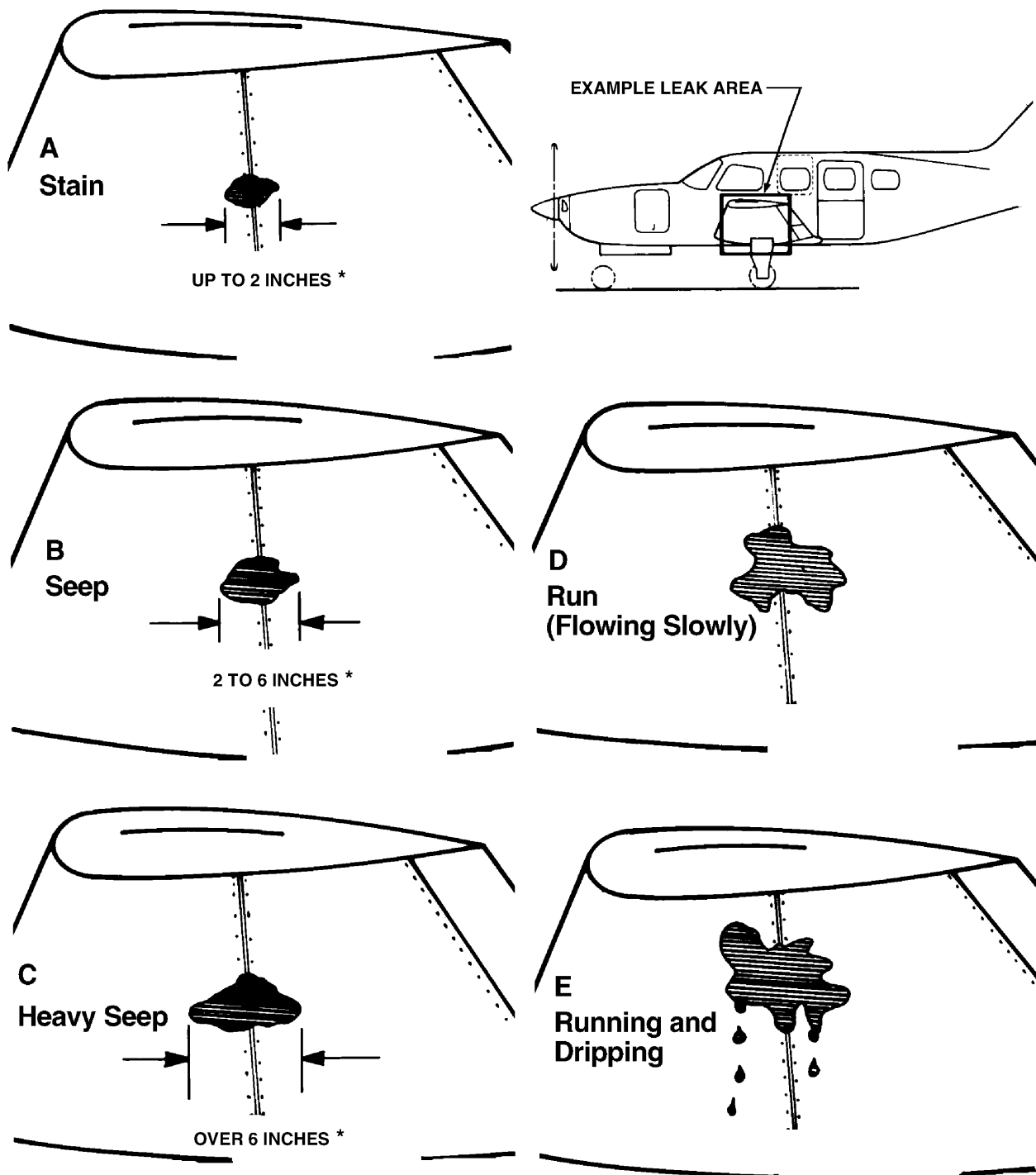
NOTE: These five (5) categories are based on reexamination of the leak two (2) hours after the wetted area has been thoroughly cleaned.

B. Fuel plumbing.

WARNING: EVIDENCE OF FUEL LEAKAGE IN THE ENGINE COMPARTMENT MUST BE REPAIRED AND THE AREA CLEANED PRIOR TO STARTING ENGINE.

All such leaks must be repaired before further flight.

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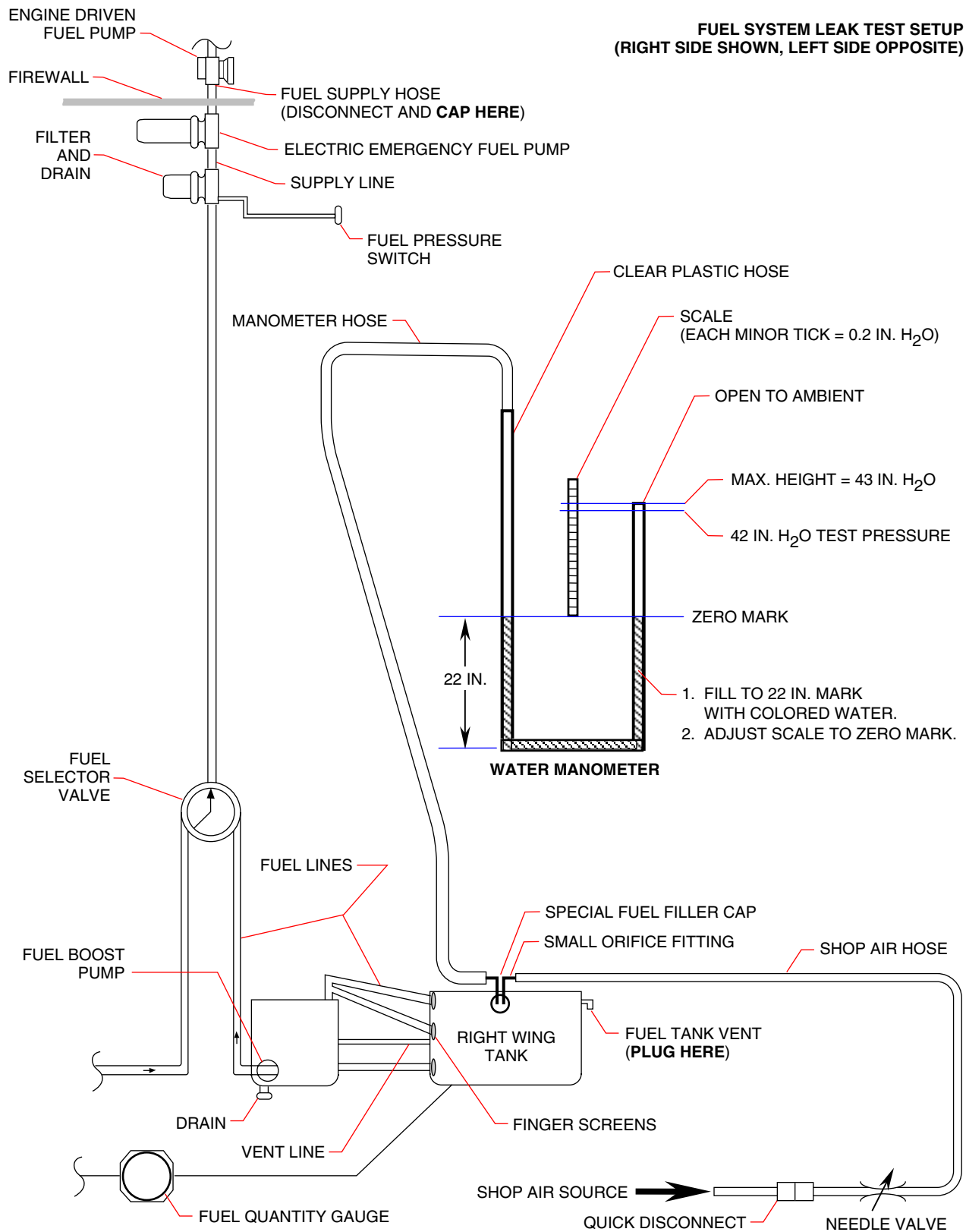
* MEASUREMENT TAKEN TWO (2) HOURS AFTER LEAK WETTED AREA THOROUGHLY CLEANED.

Categorizing Fuel Leaks in the Wet-Wing
Figure 1

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Fuel System Leak Test Setup
Figure 2

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3. Fuel System Leak Test

(PIR-PPS60049-2, Rev. B.)

A. Set Up

- (1) Locate the airplane and remove appropriate cowlings, and access plates and panels to provide access to the fuel lines and fuel system components.
- (2) Make available appropriate caps and plugs for closing lines and vents.
- (3) Prepare a mild solution of soap and water for leak detection. Use only Colgate-Palmolive Co., Liquid M Mild 1 Hand Soap in this solution.

B. Test Fixture (See Figure 2.)

Construct or procure a test fixture with the following features:

- (1) A quick-disconnect fitting for quickly removing shop air.
- (2) A needle valve to shut-off shop air and hold pressure in the fuel system.
- (3) A special fuel filler cap with fittings to accept shop air input (small orifice) and output to a water manometer.

NOTE: The shop air fitting must incorporate a small orifice (approximately 0.025 inch) to restrict shop air inflow and minimize the chance of over-pressurizing the system. Mark the small orifice fitting to identify it from the other fitting.

- (4) Appropriate hoses to connect shop air and the manometer to the special fuel filler cap.

NOTE: To minimize the chance of cross-connecting shop air and the manometer to the wrong fitting, these hoses should be semi-permanently connected to the special fuel filler cap.

- (5) The water manometer must be marked in inches at two-tenths of an inch intervals, have a height of no more than 43 inches, and must be open to the ambient air as a safety.

C. Procedure

NOTE: Possible areas for leaks in the system are all fuel system hoses, lines and component connections, wet-wing and collector tank access covers, fuel tank fillers and tank skin joints.

NOTE: Use appropriate caps for closing open lines and vents. Use soap and water mixture spray to check for leaks.

- (1) Defuel the aircraft.
- (2) Disconnect fuel supply hose from engine-driven fuel pump and cap hose.
- (3) Check left wing system as follows:

- (a) Install special fuel filler cap on left wing fuel filler.

NOTE: Verify that shop air hose is connected to the fitting with the small orifice and manometer hose is connected to the other fitting.

- (b) Verify needle valve is fully closed and connect shop air to the quick disconnect fitting.
- (c) Plug left wing fuel tank vent.
- (d) Set fuel selector handle on LEFT tank position.

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WARNING: IF MANOMETER FAILS TO RISE, CLOSE NEEDLE VALVE IMMEDIATELY AND DETERMINE CAUSE.

CAUTION: TO PREVENT FUEL TANK DAMAGE, DO NOT EXCEED 42 IN. H₂O (1.5 PSI).

- (e) Slowly open needle valve and watch manometer for a rise in pressure.
- (f) Allow manometer to rise to a test pressure of $42 \pm \frac{1}{4}$ In. H₂O and close needle valve.
- (g) Disconnect shop air and monitor leakage rate. A maximum leakage rate of $\frac{1}{2}$ In. H₂O in five (5) minutes is permissible. If the leakage rate exceeds this, detect the leak location and repair. Use soap solution as required.
- (h) At the end of the five (5) minute period, turn the fuel selector valve handle rapidly to the RIGHT position, the OFF position, and back to the LEFT position. The right wing system should not pressurize during this test.

NOTE: Moving the selector valve handle rapidly reduces the pressure lost when the left and right ports overlap as the tanks are switched.

- (i) Remove plug from left wing fuel tank vent and allow pressure to exhaust to ambient. Watch the manometer and verify that the vent relief valve closes between 27.7 In. H₂O (1.0 PSI) and 2.8 In. H₂O (0.1 PSI).
- (j) Remove all caps, plugs, and test equipment. Proceed to right wing system check or reinstall fuel supply hose to engine-driven fuel pump, if finished.

(3) Check right wing system as follows:

- (a) Install special fuel filler cap on right wing fuel filler.

NOTE: Verify that shop air hose is connected to the fitting with the small orifice and manometer hose is connected to the other fitting.

- (b) Verify needle valve is fully closed and connect shop air to the quick disconnect fitting.
- (c) Plug right wing fuel tank vent.
- (d) Set fuel selector handle on RIGHT tank position.

WARNING: IF MANOMETER FAILS TO RISE, CLOSE NEEDLE VALVE IMMEDIATELY AND DETERMINE CAUSE.

CAUTION: TO PREVENT FUEL TANK DAMAGE, DO NOT EXCEED 42 IN. H₂O (1.5 PSI).

- (e) Slowly open needle valve and watch manometer for a rise in pressure.
- (f) Allow manometer to rise to a test pressure of $42 \pm \frac{1}{4}$ In. H₂O and close needle valve.
- (g) Disconnect shop air and monitor leakage rate. A maximum leakage rate of $\frac{1}{2}$ In. H₂O in five (5) minutes is permissible. If the leakage rate exceeds this, detect the leak location and repair. Use soap solution as required.
- (h) At the end of the five (5) minute period, turn the fuel selector valve handle rapidly to the LEFT position, the OFF position, and back to the RIGHT position. The left wing system should not pressurize during this test.

NOTE: Moving the selector valve handle rapidly reduces the pressure lost when the left and right ports overlap as the tanks are switched.

- (i) Remove plug from right wing fuel tank vent and allow pressure to exhaust to ambient. Watch the manometer and verify that the vent relief valve closes between 27.7 In. H₂O (1.0 PSI) and 2.8 In. H₂O (0.1 PSI).
- (j) Remove all caps, plugs, and test equipment. Reinstall fuel supply hose to engine-driven fuel pump.

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DISTRIBUTION

Fuel distribution consists of the collector tanks, two electric boost pumps, an emergency electric fuel pump, fuel selector and switches, inline filter, and engine driven fuel pump.

1. **Collector Tanks**

A. **Description**

Each collector tank is accessible through the main landing gear wheel well access panel. The collector tank contains the electric boost pump, flapper valves and drain valve.

NOTE: Because both collector tanks are the same, only one removal/installation sequence will be given.

B. **Electric Fuel Pump**

(1) **Removal**

- (a) Defuel the wing tank of the appropriate side.
- (b) Ensure selector valve is in the OFF position.
- (c) Drain remaining fuel from the collector tank.
- (d) Remove the access panel from the collector tank and lower wing forward of the collector tank.
- (e) Disconnect the electrical connection to the pump and the fuel line from the pump. Cap the open line to prevent any possible contamination.
- (f) Remove the four nuts securing the collector tank and remove the tank.
- (g) Remove the two screws securing the pump to the tank and remove the pump.

(2) **Installation**

- (a) Position fuel pump with gasket into the tank and secure in place with the two pump mounting screws.
- (b) Install tank into place and secure with the four nuts.
- (c) Remove the protective cap from the fuel line and connect to the fuel pump outlet.
- (d) Connect the electrical connector to the pump leads.
- (e) Ensure collector tank is clean, then install the tank access cover. Seal the access cover using MIL-S-8784.
- (f) Reinstall the access panel on the lower wing.

**CHART 1
ELECTRIC FUEL PUMP SPECIFICATIONS**

DESCRIPTION	AIRBORNE 2C6-7	AIRBORNE 1B9-4 EMERGENCY
Voltage (Vdc)	28	28
Current (Amps)	4.0 (Max.)	6.0 (Max.)
Fuel Flow	0 - 340 PPH	0 - 375 PPH
Fuel Pressure	7 (MIN.) - 12 (MAX.)	35 (MIN.) - 47 (MAX.)
Proof pressure (Zero external leakage)	60 PSI	60 PSI

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2. Fuel Selector Valve

CAUTION: NO FIELD DISASSEMBLY OR REPAIR OF FUEL SELECTOR VALVES IS AUTHORIZED. MAINTENANCE IS LIMITED TO REMOVAL AND REPLACEMENT OF THE WHOLE UNIT.

A. Description

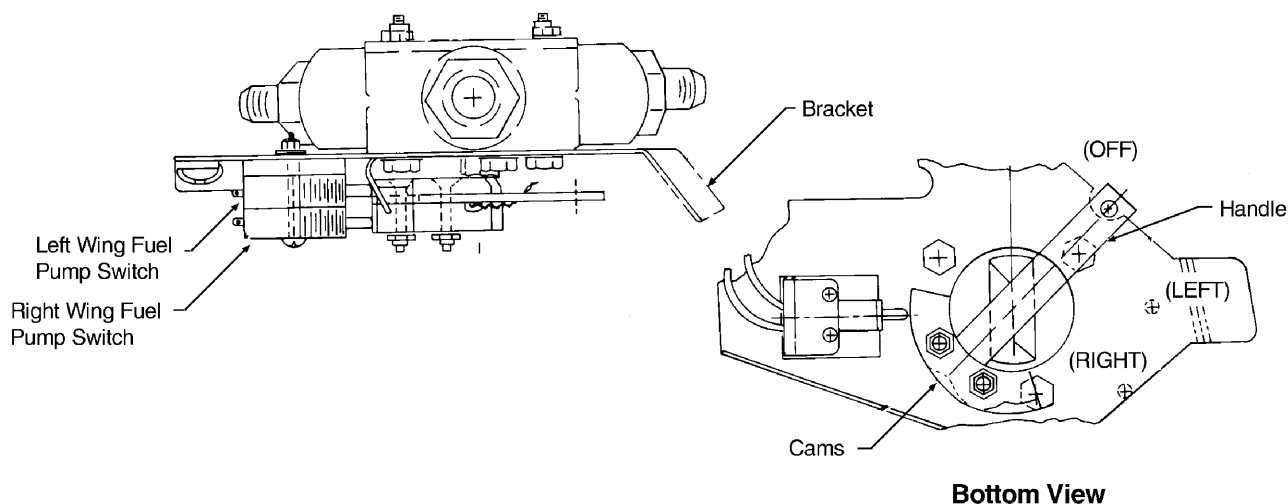
The selector valve is located behind an access panel (pressure closeout plate) on the right hand side of the fuselage interior. The valve is mounted aft of the F.S. 139.8 frame in a compartment that is sealed off from the pressurized interior.

B. Removal

- (1) Drain both fuel tanks. (Refer to 12-10-00, Draining Fuel System.)
- (2) Gain access to the pressure closeout panels on the right hand side of the fuselage interior.
- (3) Loosen the hose clamps which secure the fuel line pressure seal halves to the fuel line going to the left tank.
- (4) Remove the screws and washers that secure the base of the pressure closeout plate to the frames. Slide the pressure closeout plate inboard along the fuel line going to the left tank.
- (5) Disconnect the fuel selector cable from the actuating arm on the bottom of the fuel selector valve.
- (6) Disconnect the switches electrical connector.
- (7) At the fittings on the valve, remove the three fuel lines that connect to the valve.
- (8) Remove the screw that holds the fuel selector support to the frame.

C. Installation

- (1) Position the fuel selector valve in the compartment. Secure the valve support to the frame with the screw.
- (2) Attach the three fuel lines to the valve.
- (3) Reconnect the switches' electrical connector.
- (4) Reconnect the fuel selector cable to the actuating arm on the bottom of the fuel selector valve.
- (5) Secure the base of the pressure closeout plate to the frames with screws and washers.



Fuel Selector Switch and Valve
Figure 1

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- (6) Tighten the hose clamps on the fuel line pressure seal halves which are on the fuel line going to the left tank.
- (7) Fill the fuel tanks and check for proper operation of the fuel selector valve.

D. Switches Adjustment

With the selector valve/switch removed from the airplane:

- (1) Ensure that the switch has a pin overtravel of 0.06 in.
- (2) When the handle is moved to its various positions, ensure that:
 - (a) The left switch should make contact (closed circuit) when the handle is in its mid position. The left switch should be an open circuit when the handle is in the off and right positions.
 - (b) The right switch should make contact (closed circuit) when the handle is in the right position. The right switch should be an open circuit when the handle is in the off and left positions.
- (3) Ensure that the plungers point to the axis of handle rotation. Adjust the switches on the cam by moving them towards or away from the cam, not by twisting the switches to one side.

3. Fuel Selector Cable Adjustment

Adjust fuel selector cable so that the fuel selector arm will be in the (center) detent position when the selector knob, located on the instrument panel, is moved to the left tank (center) position from the right tank position. Visually check the fuel selector arm and cam to confirm proper adjustment. Properly adjusted, the selector knob will not reach the instrument panel slot travel limits when resting in the right tank and off positions. Travel should be equal distance from center $\pm .10$.

4. Fuel Filter

NOTE: For routine filter servicing, refer to 12-10-00, Fuel System.

A. Removal

Access to the fuel filter is through the forward baggage compartment, right side floor panel access cover.

- (1) Ensure fuel selector control is in the OFF position.
- (2) Remove the forward baggage compartment carpet.
- (3) Open the right side floor access panel.
- (4) Drain all fuel from the filter bowl, thru the outside drain valve.
- (5) Disconnect and cap both fuel lines at the filter assembly.
- (6) Cut safety wire and remove the two mounting bolts from the filter and remove assembly from airplane.

B. Installation

- (1) Position filter into airplane with the inlet port facing the outboard skin and the drain valve inserted in the lower opening of the fuselage.
- (2) Secure the filter assembly to its mounting bracket with two bolt and washer sets. Torque to standard value and safety with 0.020 wire per MIL-W-6713.
- (3) Remove protective caps from fuel lines and connect to filter assembly.
- (4) Position fuel selector control to one of the ON positions and check fittings for leaks. Upon completion of check return selector to the OFF position.
- (5) Install the floor access panel and secure in place.
- (6) Install the baggage compartment carpet.

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5. Fuel Drain Valve

A. Description

Fuel drain valves are located under each inboard wing. They are actuated either: by pushing up on the screwdriver slot for fuel check or by removal of the entire valve for rapid draining.

NOTE: Nut and nut retainer are secured inside tank and do not need to be removed.

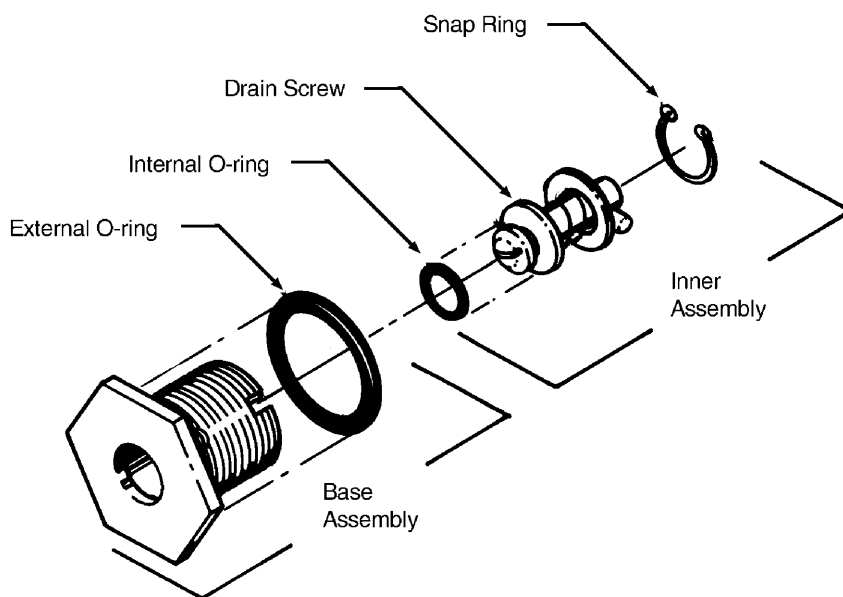
B. O-ring Replacement

- (1) Drain fuel by turning hexagonal base of drain valve. Remove drain valve from wing.
- (2) Remove external O-ring located on hexagonal base.
- (3) Remove snap ring to release inner assembly.
- (4) Remove inner assembly by pushing up on drain screw with a screwdriver.
- (5) Remove internal O-ring.
- (6) Soak replacement O-rings in hydraulic fluid and coat with fluid compatible gel.
- (7) Install O-rings.
- (8) Replace inner assembly. Replace snap ring.
- (9) Install drain valve in wing.

6. Electric Boost Pump

These pumps are located in each collector tank built into each wing wheel well area. Access to each pump is through the wheel well and removal of the sealed access cover on the side of the collector tank.

NOTE: Wing tank and collector tank must be drained prior to removal of the collector tank access cover. Refer to Collector Tank for removal and installation instructions for the electric boost pump.



Fuel Drain Valve
Figure 2

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7. Emergency Fuel Pump

The emergency fuel pump is mounted on brackets attached to the forward, right hand side of the forward pressure bulkhead below the floor.

A. Removal

- (1) Turn fuel selector to OFF position.
- (2) Disconnect electrical leads.
- (3) Drain fuel from engine to shutoff valve through fuel filter drain valve.
- (4) Disconnect fuel supply hose from emergency fuel pump fitting.
- (5) Disconnect fuel supply hose from fuel filter inlet.
- (6) Disconnect pressure switch fuel hose from fuel filter.
- (7) Remove safety wire and two mounting bolts from fuel filter.
- (8) Remove safety wire and three mounting bolts from emergency fuel pump.
- (9) Remove emergency fuel pump and filter assembly from aircraft.
- (10) Loosen jam nut at fuel pump inlet fitting.
- (11) Remove emergency fuel pump.

B. Installation

NOTE: Be sure to replace O-rings at inlet and discharge pump fittings.

- (1) Position emergency fuel pump onto filter and tighten jam nut at emergency fuel pump inlet fitting.
- (2) Position emergency fuel pump and filter assembly into place in aircraft.
- (3) Secure emergency fuel pump to mounting brackets with three mounting bolts and safety wire.
- (4) Secure fuel filter to mounting bracket with two mounting bolts and safety wire.
- (5) Connect pressure switch fuel hose to fuel filter.
- (6) Connect fuel supply hose to fuel filter inlet.
- (7) Connect fuel supply hose to emergency fuel pump fitting.
- (8) Connect electrical leads.
- (9) Check system for leaks.

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INDICATING

NOTE: Serial numbers (S/N's) 4636021 and up incorporate Integrated Engine Instrumentation Systems. See Chapter/Section 77-40-00 for more information.

1. Fuel Quantity Senders

NOTE: Two fuel quantity senders are mounted in each fuel tank and transmit electrically the quantity of the fuel in each tank, to the fuel quantity gauge/indicator mounted in the instrument panel.

The senders are located within the wing tank at W.S. 125.00 and 195.50. Both units are mounted on pedestals which are part of the forward access covers in the lower surface of the wing tank.

A. Removal

CAUTION: IN S/N'S 4636021 AND UP, INBOARD AND OUTBOARD FUEL QUANTITY SENDERS IN EACH WING MUST BE REPLACED AS A MATCHED SET.

IN S/N'S 4636021 THRU 4636379, ORDER KIT NO. 766-673 (L.H. WING) AND/OR KIT NO. 766-674 (R.H. WING) AS REQUIRED. (EACH KIT CONSISTS OF ONE INBOARD AND ONE OUTBOARD SENSOR.)

IN S/N'S 4636380 AND UP, ORDER KIT NO. 767-521 (L.H. WING) AND/OR KIT NO. 767-520 (R.H. WING) AS REQUIRED. (EACH KIT CONSISTS OF ONE INBOARD AND ONE OUTBOARD SENSOR.)

NOTE: Kits No. 766-673 and 766-674 can be used in S/N's 4636380 and up, but must be installed using sealant as described for S/N's 4636021 thru 4636379 under Installation, below.

- (1) Drain all fuel from the wing tank being serviced.
- (2) Ensure electrical power is "OFF".
- (3) Using a temporary marker or tape, mark the sender access cover to indicate aircraft forward.
- (4) Remove the sender access cover as follows:
 - (a) In S/N's 4636021 thru 4636379, remove the screws securing the access cover. With a suitable tool, pry the access cover away from the wing, taking care not to damage the mating surfaces - especially on the wing. When the access cover becomes free, carefully lower the cover and sender out of the wing until the electrical connection can be reached and disconnected.
 - (b) In S/N's 4636380 and up, remove the screws securing the access cover and carefully lower the cover and sender out of the wing until the electrical connection can be reached and disconnected.
- (5) Note the position of the sender unit to its mounting pedestal prior to removing the sender from the access cover/pedestal.

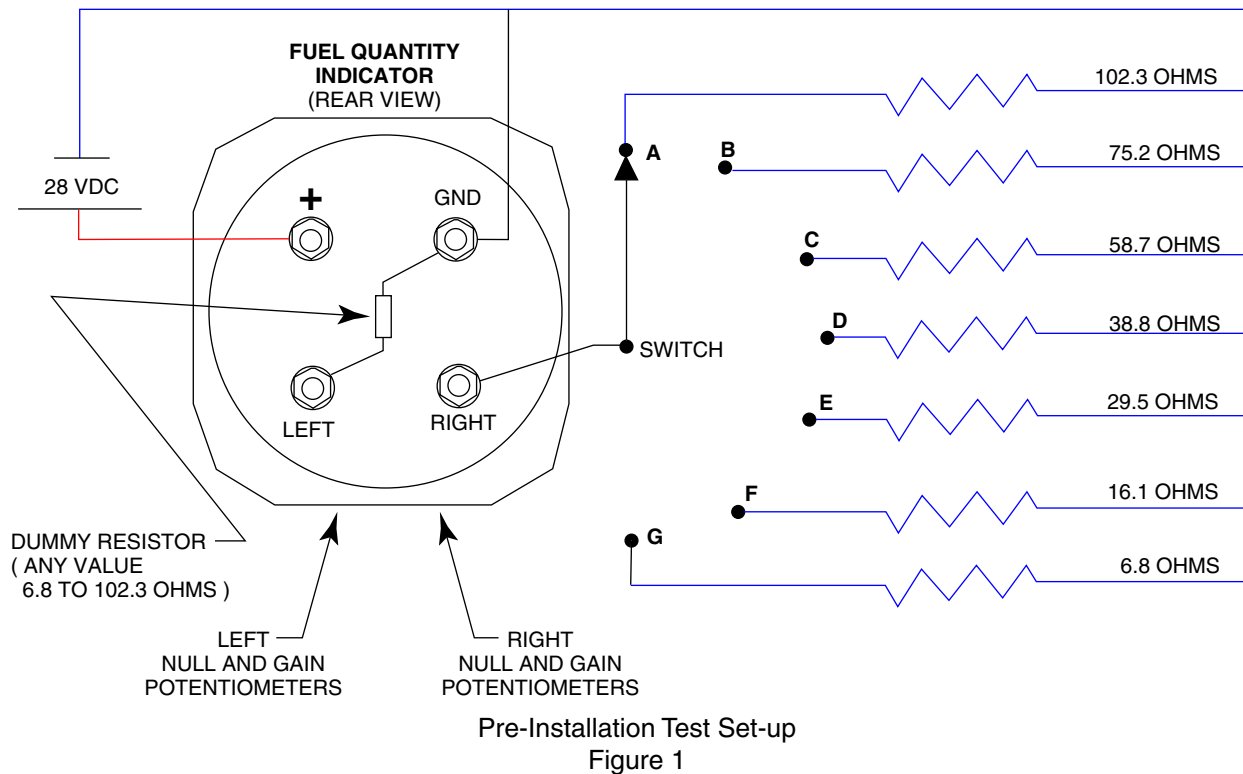
B. Installation

- (1) Install sender unit on its mounting pedestal on the bracket (if previously removed). Ensure the sender unit is properly positioned on the bracket.
- (2) Connect the electrical leads (from inside the tank) to the sender assembly.

CAUTION: ENSURE THAT WIRES ARE ROUTED ON FORWARD SIDE OF SENDER PRIOR TO SECURING SENDER PLATE TO WING.

- (3) In S/N's 4636021 thru 4636379, ensure that the sender unit/access cover is properly positioned in relation to the wing, apply Products Research Co. (PRC) PR1428-B-2 (or PR1403G-B-2) sealant and install the sender unit/access plate on the wing with screws. Allow sealant to cure 72 hours before refilling tanks.
- (4) In S/N's 4636380 and up, ensure that the sender unit/access cover is properly positioned in relation to the wing, and install the sender unit/access plate with screws. Torque the screws in a standard X-pattern until a torque of 25-30 in.-lbs. is achieved.

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2. Fuel Quantity Gauge Accuracy Test (S/N's 4636001 thru 4636020 only.)

(PIR-PPS60032-8, Rev. B.)

A. Pre-installation check.

Prior to installation, bench test the gauge as follows:

- (1) Install dummy resistor across left or right sender as shown in Figure 1.
- (2) Connect resistance decade across sender terminals not used by dummy resistor.
- (3) Apply 28 ± 1 VDC to the positive and negative terminals at the rear of the gauge and through the resistance decade as shown in Figure 1.
- (4) Low end adjustment: Select position "G" on resistor decade. Verify that instrument needle points to "E." If not, adjust respective "NULL" potentiometer to center needle on "E" radial.
- (5) High end adjustment: Select position "A" on resistor decade. Verify that instrument needle points to "F." If not, adjust respective "GAIN" potentiometer to center needle on "F" radial.
- (6) Full range check: After low and high end adjustments have been made, verify that for each resistive value the gauge indication is as specified in Chart 1.

B. Post-installation functional check.

- (1) Set up:
 - (a) Level the airplane ± 1 degree laterally and longitudinally. See 8-20-00.
 - (b) Place the battery switch in the OFF position.
 - (c) Connect the external power supply unit.
 - (d) Adjust the power supply to provide 28 ± 1 VDC.
 - (e) Continue with procedure below, record test results when completed.

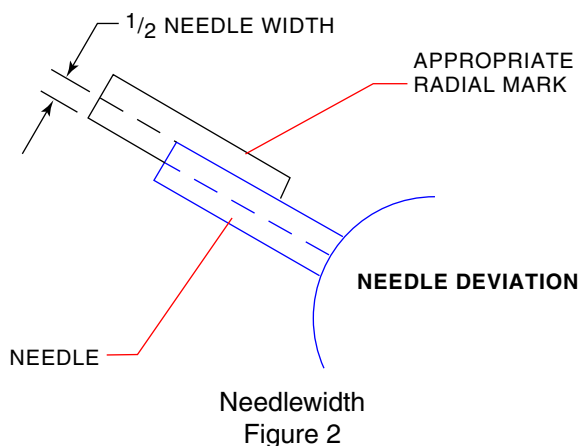
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**CHART 1
PRE-INSTALLATION GAUGE CHECK**

SWITCH* POSITION	RESISTANCE IN OHMS	GAUGE INDICATION	TOLERANCE** (NEEDLEWIDTHS)
G	6.8	E	+ 0, - 1/2
F	16.1	5	± 1/2
E	29.5	10	± 1/2
D	38.8	15	± 1/2
C	58.7	30	± 1/2
B	75.2	45	± 1/2
A	102.3	F	± 1/2
* - SEE FIGURE 1 ** - SEE FIGURE 2			

**CHART 2
FULL RANGE CHECK**

TOTAL FUEL QUANTITY (US GAL) (INCLUDES 1 GAL UNUSABLE)	GAUGE INDICATION	TOLERANCE* (NEEDLEWIDTHS)
1	E	+ 0, - 1
6	5	± 3/4
11	10	± 3/4
16	15	± 1
31	30	± 1 1/2
46	45	± 1 1/2
60	F	± 1 1/2
* - SEE FIGURE 2.		



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- (2) Low end gauge check: With the tanks completely dry, turn the fuel selector to Left or Right. Add one gallon (unusable) fuel to each tank. Check that the needle of each gauge points to "E." If not, adjust the respective "NULL" potentiometer until the needle centers on "E" (± 0 , $-1/2$).
- (3) High end gauge check: With the tanks full, check that the needle of each gauge points to "F." If not, adjust the respective "GAIN" trim potentiometer until the needle centers on "F."
- (4) Full range gauge check, use either of the following methods:
 - (a) With the tanks full, defuel each tank fifteen gallons at a time until 15 gallons is reached and then, five gallons at a time until empty. Check the gauge indication at each increment against the tolerances specified in Chart 2.
 - (b) Starting with the tanks empty, add fuel to each tank to the increments specified in Chart 2. Check the gauge indication at each stage against the tolerances specified in Chart 2.

NOTE: With either of the above methods, be sure and vibrate the tank by hand bumping its lower surface and vibrate the gauge by finger tapping the glass at each measurement point.

3. Fuel Quantity Calibration

A. Fuel Quantity Gauge Calibration (S/N's 4636021 thru 4636374.)

(PIR-PPS60032-13, Rev. N.)

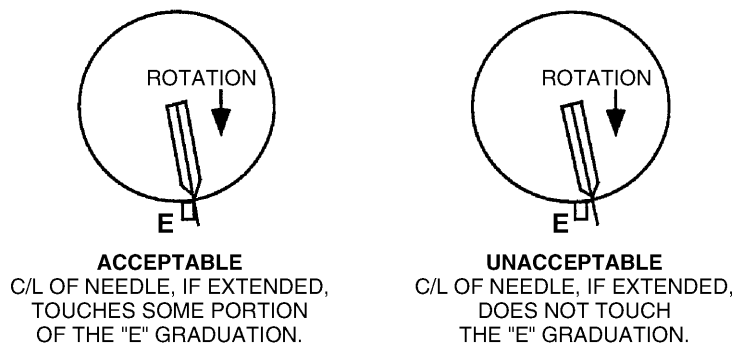
NOTE: S/N's 4636021 thru 4636374 - Review Chapter/Section 77-40-00: Transicoil Electronic Module Instrument System (EMIS) to ensure a basic understanding of the system components and their operation before proceeding

NOTE: S/N's 4636021 thru 4636131 only - If utilizing resistance measurements from Table 2, it will be necessary to connect a digital ohmmeter per Table 2. To troubleshoot outputs from fuel tank senders, disconnect harness from back of gauge and read resistance across the appropriate pins.

- (1) Set up:
 - (a) Level the airplane ± 1 degree laterally and longitudinally. See 8-20-00.
 - (b) Place the battery switch in the OFF position.
 - (c) Connect the external power supply unit.
 - (d) Adjust the power supply to provide 28 ± 1 VDC.
 - (e) Continue with procedure below, record test results in Chart 4 when completed.
- (2) Non-Programable Transicoil EMIS Gauge (S/N's 4636021 thru 4636131 only)

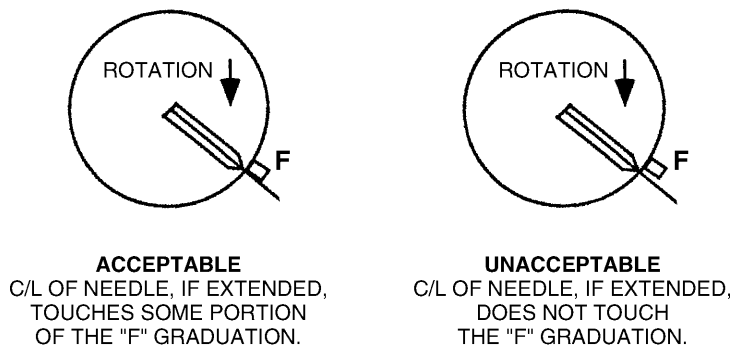
NOTE: The programable Transicoil EMIS Gauge (P/N 602-222) installed in S/N's 4636132 thru 4636374 as original equipment is backwardly compatible and may be found installed in S/N's 4636021 thru 4636131 as a service spare. These modules can be identified by the absence of potentiometers and the presence of a calibration switch on the left side of the module. If found, calibrate per Programable Transicoil EMIS Gauge, below, substituting Quad Digital Indicator (QDI) for each reference to the Enhanced Digital Indicator (EDI).

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"E" (Empty) Needle Tolerance

Figure 3



"F" (Full) Needle Tolerance

Figure 4

(a) Low End Gauge Check

CAUTION: USE NON-CONDUCTIVE BLADE SCREWDRIVER TO ADJUST POTENTIOMETERS.

With both tanks completely dry, add one gallon (unusable) fuel to each tank. After the measured amount has been put in the tank, vibrate the tank by bumping its lower surface. Adjust potentiometers marked "Z" (clockwise to lower reading) until the analog pointers are at the center of the "E" (empty) graduations. Allow indicators to stabilize for 30-40 seconds. Readjust as required. Check digital readout for a "0" gallon indication. If digital does not indicate "0", readjust appropriate "Z" potentiometer until both analog and digital read zero.

NOTE: The potentiometers are in cavities on the right and left sides of the fuel quantity module (right potentiometer adjusts right gauge, left adjusts left gauge).

NOTE: Needles on analog gauges must not go below the "E" (empty) graduations. See Figure 3. Tolerance on "E" (empty indication) is ± 0 gallons.

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**CHART 3
FUEL QUANTITY MODULE DUAL ANALOG INDICATOR CALIBRATION RESISTANCE**

Calibration Points - GAL	E-0	5	15	30	45	F-60
Minimum Ohms	1.75	13.6	32.15	52.55	72.85	98.75
Nominal Ohms	6.75	18.6	42.15	62.55	80.85	108.75
Maximum Ohms	11.75	28.6	51.15	70.55	90.85	113.75
Acceptable Tolerance	±5	-5/+10	-10/+9	-10/+8	-8/+10	-10/+5

(b) Full End Gauge Check

Add 60 gallons of fuel to each tank. After the measured amounts have been put in tanks, vibrate the tanks by bumping their lower surfaces. Adjust "S" (span) potentiometers (counter-clockwise to lower reading) so the analog needles point to "F" (full) graduations. Turn "S" potentiometers so digital indicators read 58 gals. Turn "S" potentiometers in opposite direction until digital readings just change from 59 to 60 gals. At this point turn the "S" potentiometers 1/4 turn more in the increasing reading direction. Permissible to have analog needles touching top edges of (F) graduations after the adjustments have been made. Allow indicators to stabilize for 30-40 seconds. Readjust as required. Check digital readout for 60 gallon indication. If digital does not indicate "60", readjust "S" (span) potentiometer so both analogs and digital read 60.

NOTE: The potentiometers are in cavities on the right and left sides of the fuel quantity module (right potentiometer adjusts right gauge, left adjusts left gauge).

NOTE: Needles on analog gauges must not go above "F" (full) graduations. See Figure 4.

(3) Programable Transicoil EMIS Gauge (S/N's 4636132 thru 4636374)

(a) Initiation of Calibration Mode.

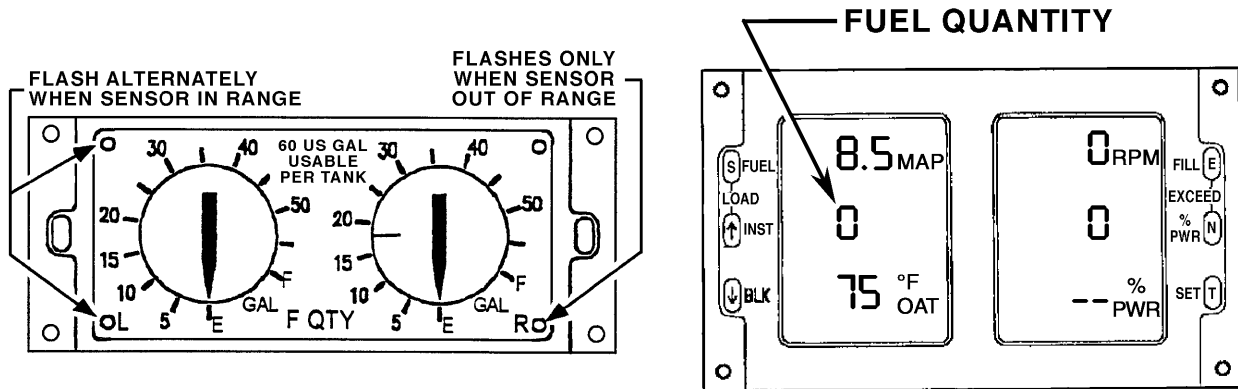
The left and right Fuel Quantity Module Analog Indicators are calibrated individually. The following instructions specifically address the left indicator.

- 1 If fuel quantity indicator is installed in instrument panel, remove gauge from panel far enough to move calibration switch on left side of the module from "RUN" to "CAL" position (move switch toward front of gauge). This will place left fuel quantity instrument in auto-calibration mode.

NOTE: Instrument power must be maintained to the Enhanced Digital Indicator (EDI) and Fuel Quantity Module during the entire process. Any interruption of power to the Fuel Quantity Module will reset the calibration sequence to 0.

- 2 When the calibration switch is moved to "CAL" position, the EDI is automatically selected and a fuel quantity will be displayed in the left window. Also, the yellow LED for the tank being calibrated will be flashing.
- 3 If the sensor input resistance from the left tank is within tolerance for the first calibration step (E-0) as specified in Chart 3, then the green and yellow LED's will flash alternately. If the left sensor is out-of-range, only the yellow LED will flash on the left indicator. See Figure 5.

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(Both shown at "E-0" Calibration Step.)

Fuel Quantity Module Dual Analog Indicator

Enhanced Digital Indicator (EDI)

Figure 5

(b) Calibration Procedure

NOTE: The select button (see Figure 6) on the front of the fuel quantity module analog indicator being calibrated will be used to set the calibration points and advance to the next step.

- 1 Add one (1) gallon (unusable) fuel to the left tank and allow the instrument and fuel to settle for two (2) minutes.

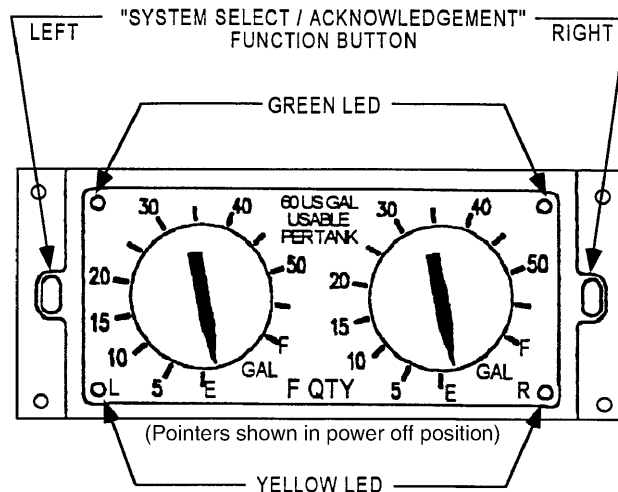
NOTE: At each calibration step, vibrate the tank by bumping its lower surface.

- 2 After two (2) minutes, the green and yellow LED's on the module indicator will be flashing alternately, the EDI will display "0" and the analog gauge will display "E" (see Figure 5).
- 3 Press the left "SEL" button and hold for two (2) seconds. If the sensor is in tolerance for the step being recorded, the LED's will stop flashing and remain on, the external alarm will sound and the EDI display and the fuel quantity module pointer will advance to the next step. The external alarm will continue to sound as long as the "SEL" button is held.

NOTE: If the sensor is out-of-range for the calibration step being programmed, then pressing the left "SEL" button will not advance the module to the next step.

- 4 The calibration step sequence is: "E", 5, 15, 30, 45, and "F".
- 5 When the module advances to the next step, normally only the yellow LED will flash until fuel is added.
- 6 Add the appropriate amount of fuel for the fuel point displayed. Do not press the left "SEL" button when the green LED starts to flash. Allow the fuel and module to settle for two (2) minutes, then press the left "SEL" button and advance to the next step.
- 7 When 60 gallons of fuel have been added and a two (2) minute settling time has passed, press the left "SEL" button. When you release the button, only the green LED will be flashing. This indicates that the calibration is finished.

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Fuel Quantity Module Dual Analog Indicator
Figure 6

- 8 Reset the left indicator calibration switch (on the left side of the fuel quantity module) from "CAL" to "RUN" (i.e. - move it towards the rear of the module). This will return the module to normal operating mode.
 - 9 Repeat calibration steps (1) and (2) for the right fuel quantity module analog indicator. The right indicator calibration switch is on the right side of the fuel quantity module.
 - 10 Reinstall the fuel quantity module in the instrument panel.
- (4) Complete procedure as follows:
- (a) If used, disconnect the digital ohmmeter.
 - (b) Disconnect the external power supply unit.
 - (c) Replace access covers.
- B. Fuel Quantity Indicator Calibration ([S/N's 4636375 and up.](#)) (PIR-PPS60226, Rev. NEW.)
- (1) Setup:
 - (a) Level the airplane per 8-20-00.
 - (b) Drain the fuel tanks per 12-10-00, Fuel System, Draining Fuel System - Complete.
 - (2) From the MFD Maintenance page, depress the Line Select Key (L4) to access the Engine Setup page.
 - (3) Depress the "Fuel Cal" button (L1) to enter Fuel Calibration page.
 - (4) Depress the "Begin Cal" button (R3) and follow the on-screen calibration procedure for left and right tank zero fuel (1.0 + .1-0 gal. unusable) and full calibration (60 + 0-1 gal. usable) points. Wait approximately 3 minutes for fuel level to stabilize.

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- (5) Use the Right Knob to select the current calibration point. The selected calibration point is highlighted and the value displayed is the current reported fuel quantity from the DAU. A message at the bottom of the screen prompts the operator to add the appropriate amount of fuel and then to select the "Accept Value" button (R3) once the value reported from the DAU has stabilized.

NOTE: If the DAU reported value is not within 2.5 gallons of the test point value, a message "DAU reported Fuel Quantity Out of Tolerance" will be presented and the value will not be accepted.

- (6) Once all points have been calibrated, the operator presses "Calibration Complete" to cause the calibration factors to be computed and applied to the DAU reported fuel quantity.
- (7) Other options from the Calibration Underway state are to "Restore Last Cal" and "Clear Cal".
 - (a) Pressing "Restore Last Cal" causes the calibration values from the last completed calibration to be restored and the state to change to Calibrated.
 - (b) Pressing "Clear Cal" causes all calibration values to be cleared and the state to change to "Not Calibrated". An "Are You Sure?" prompt will give the operator a chance to reconsider the decision to either "Restore Last Cal" or "Clear Cal".
- (8) When the calibration procedure has been completed, press the Save button. If you decide not to save the changes, pressing the Cancel button from the Underway state causes the current calibration session to be aborted with any unsaved interim calibration values being discarded. Changes will not take effect until the MFD has been restarted.

NOTE: The "empty" and "full" fuel readings on this setup page will NOT display zero (0) or 60 gallons usable fuel for respective empty and full calibration points. However, the appropriate zero and full (60 U.S. gallons) will be displayed on the MFD in normal operation mode (not maintenance setup.)

- (9) Verify DAU Status Box reads: DAU(s) configured for Piper PA-46-350P (Mirage).
- (10) Verify Calibration Status Box reads:
 - "Left Fuel Tank: Calibrated"
 - "Right Fuel Tank: Calibrated"

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4. Fuel Gauge Full Range Check (S/N's 4636021 thru 4636374.)

NOTE: Full Range Check for S/N's 4636001 thru 4636020 only, is provided under Fuel Quantity Gauge Accuracy Test, above.

- A. Set up per Fuel Quantity Gauge Calibration, Set up, above.
- B. Non-programable Transicoil EMIS Gauge (S/N's 4636021 thru 4636131 only).

NOTE: The programable Transicoil EMIS Gauge (P/N 602-222) installed in S/N's 4636132 thru 4636374 as original equipment is backwardly compatible and may be found installed in S/N's 4636021 thru 4636131 as a service spare. These modules can be identified by the absence of potentiometers and the presence of a calibration switch on the left side of the module. If found, full range check per Programable Transicoil EMIS Gauge, below.

- (1) Defuel both fuel tanks. As fuel level decreases to 5 +0/-1 gals, verify the low fuel alarms sound.
- (2) When defueling is complete, verify that the needles on analog gauges are pointing to the areas of the "E" graduations as described in Fuel Quantity Gauge Calibration, Non-Programable Transicoil EMIS Gauge, above. If pointers are out of prescribed range, vibrate the tanks by bumping their lower surfaces. Repeat Fuel Quantity Gauge Calibration, Non-Programable Transicoil EMIS Gauge, above, if the pointers do not return to the prescribed range.
- (3) When pointers are adjusted correctly, fill each tank with 5 gals of fuel (after (1) gal. unusable has been added) and record data in Chart 4.
- (4) Fill tanks in 15, 30, 45 and 60 gal. increments and record data in Chart 4. Vibrate the tanks by bumping their lower surfaces at each calibration point.
 - (a) While filling the tanks, check operation of imbalance fuel annunciator light by adding 10 +1/-0 gals more to right tank than left. Light should illuminate.
 - (b) Reverse procedure and fill left tank with 10 +1/-0 gals more fuel than right. Again, light must illuminate. (Tanks do not need to be drained for this check). 60 seconds required from time imbalance exists until light illuminates.
- (5) Finish filling tanks to 60 gals capacity each. Tolerance on gauge readings at each increment between "E" and "F" but not including "E" and "F" is ± 2 gallons.
- (6) After refueling verify that needles on analog gauges are pointing to the areas of the "F" graduations as described in Fuel Quantity Gauge Calibration, Non-Programable Transicoil EMIS Gauge, above.

C. Programable Transicoil EMIS Gauge (S/N's 4636132 thru 4636374).

- (1) Defuel both fuel tanks. As fuel level decreases to 5 +0/-1 gals, verify the low fuel alarms sound.
- (2) When defueling is complete, verify that the needles on analog gauges are pointing to the areas of the "E" graduations as shown in Figure 3 when tanks are empty. Tolerance on "E" (empty indication) is ± 0 gallons. If pointers are out of prescribed range, vibrate the tanks by bumping their lower surfaces. If pointers are out of the prescribed range after vibrating tanks, one or both senders in the tank in question may have to be replaced.
- (3) When pointers are indicating correctly, fill each tank with 1 gal (unusable) fuel. Indicators must read "E" as described in Figure 3. Record data in Chart 4.
- (4) Fill tanks in 5, 15, 30, 45 and 60 gal. increments and record data in Chart 4. Vibrate the tanks by bumping their lower surfaces at each calibration point.
 - (a) While filling the tanks, check operation of imbalance fuel annunciator light by adding 10 +1/-0 gals more to right tank than left. Light should illuminate.
 - (b) Reverse procedure and fill left tank with 10 +1/-0 gals more fuel than right. Again, light must illuminate.

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**CHART 4
FUEL CALIBRATION WORKSHEET**

FUEL CALIBRATION					LEFT TANKS	RIGHT TANKS
TANK CAPACITY (GALLONS)	RESISTANCE (OHMS) ¹					
	CONNECTOR P336 ^{**}					
	LEFT PINS ^{***}	RIGHT PINS ^{***}	GAUGE READINGS ²		TOLERANCE (GALS) (ON GAUGE READING)	
			ANALOG	DIGITAL		
0.0	7.1	6.4			±0	
(1) Gal. Unusable	7.1	6.4			±0	
5	17.9	19.3			±2	
15	42.6	41.7			±2	
30	64.2	60.9			±2	
45	81.5	80.2			±2	
60	109.4	108.1			+0, -1	
** This connector is located behind instrument. *** For pin locations, refer to Fuel Quantity Electrical Schematic (S/N's 4636021 and up) in Chapter 91-28-40. 1 - Reference only - not a required measurement. Data applicable to S/N's 4636021 thru 4636131 only. 2 - Allowed 2 gallon spread between analog and digital readings except at "0", "(1) gal unusable" and "Full". Digital and analog must read the same at "0", "(1) gal unusable" and "Full".						

- (5) Finish filling tanks to 60 gals capacity each. Tolerance on gauge readings at each increment between "E" and "F", but not including "E" and "F" is ± 2 gallons. "E" and 1 gal unusable have a tolerance of ± 0 gal. "F" has tolerance of +0/-1 gal.
- (6) After refueling verify that needles on analog gauges are pointing to the areas of the "F" graduations as described in Figure 4.
- D. Complete procedure as follows:
- (1) If used, disconnect the digital ohmmeter.
 - (2) Disconnect the external power supply unit.
 - (3) Replace access covers.

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CHAPTER

29

HYDRAULIC POWER

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GENERAL

1. Description and Operation

The hydraulic system components covered in this chapter consist of the combination hydraulic pump/reservoir 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 system. The brake system and landing gear are covered in Chapter 32. The flap system in this aircraft is electric and is covered in Chapter 27.

WARNING: PRIOR TO CHECKING OUT THE HYDRAULIC SYSTEM, PLACE THE AIRPLANE ON JACKS. (REFER TO JACKING, 7-10-00.)

The hydraulic system provides the power to operate the landing gear using an electrically driven hydraulic pump operating at 1350 to 1400 maximum psi. The hydraulic pump is located behind the aft baggage compartment with access through a removable panel. The pump has a fluid sight gauge for ease of checking fluid level, as an integral part of the unit. A relief valve in the pump prevents system pressure from exceeding 1600 psi during pump operation. A thermal relief valve prevents hydraulic pressure from exceeding 2600 psi when the landing gear is down and locked and airplane is on the ground.

The landing gear selector is an electrical switch that commands the pump to operate in either the up or down position. The gear is held in the up position by hydraulic pressure. Emergency gear extension is accomplished by a free fall function of the gear selector valve which releases gear up hydraulic pressure, allowing the gear to extend and lock.

2. Troubleshooting

If trouble develops in landing gear, place the airplane on jacks (refer to Jacking, 7-10-00), and proceed to find the cause of the trouble. A hydraulic system operational check is provided under Hydraulic System Testing, 29-10-00. See also Landing Gear Retraction System Functional Test, 32-30-00. When the trouble has been recognized, the first step is to isolate the cause. After isolation of a particular cause or problem, refer to the individual Chapter pertaining to that subject matter, i.e. Landing Gear: Chapter 32.

Hydraulic system troubles are not always traceable to one cause. It is possible that a malfunction may be the result of more than one trouble in the system. Start with the most obvious and most probable reasons for the trouble, check each possibility and, by process of elimination, isolate the troubles.

3. Hydraulic System Leading Particulars

See Charts 1 and 2.

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**CHART 1
HYDRAULIC SYSTEM LEADING PARTICULARS (PARKER HANNIFIN)**

Hydraulic Pump, Electrically Driven, Reversible	
Flow Rate @ 1350 psi	1 gpm
Hydraulic Fluid	MIL-H-5606
Normal Operating Pressure	1350 psi
Relief Valve (Thermal)	Opens at 2600 +0 /- 50 psig
Relief Valve (Pressure)	Opens at 1600 +0 /- 50 psig
Pressure Switch	
Open	1350 - 1400 psig max.
Close	1170 psig min.
Electrical Characteristics	
Voltage	24 - 28 Vdc
Operating Current @ 1350 psig	55 Amps Max. @ 27 Vdc
Operating Time	Gear Up 7 - 8 sec
	Gear Down 7 - 8 sec
Overload Protection	25 Amp Circuit Breaker

**CHART 2
HYDRAULIC SYSTEM LEADING PARTICULARS (FRISBY)**

Hydraulic Pump, Electrically Driven, Reversible	
Flow Rate @ 1350 psi	1 gpm
Hydraulic Fluid	MIL-H-5606
Reservoir Capacity	30 cu. in. (.49 liters)
Normal Operating Pressure	1350 psi
Relief Valve (Thermal)	Opens at 2525 ± 75 psig
Relief Valve (Pressure)	Opens at 1600 +0 /- 50 psig
Pressure Switch	
Open	1350 - 1400 psig max.
Close	1170 psig min.
Electrical Characteristics	
Voltage	24 - 28 Vdc
Operating Current @ 1350 psig	55 Amps Max. @ 27 Vdc
Operating Time	Gear Up 7 - 8 sec
	Gear Down 7 - 8 sec
Overload Protection	25 Amp Circuit Breaker

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MAIN

1. Description

The PA-46-350P is equipped with a electrically driven, reversible hydraulic pump. The pump is mounted on a floor bracket just forward of the aft pressure bulkhead. It is not always necessary to remove the pump for repairs or to replace the fill plug.

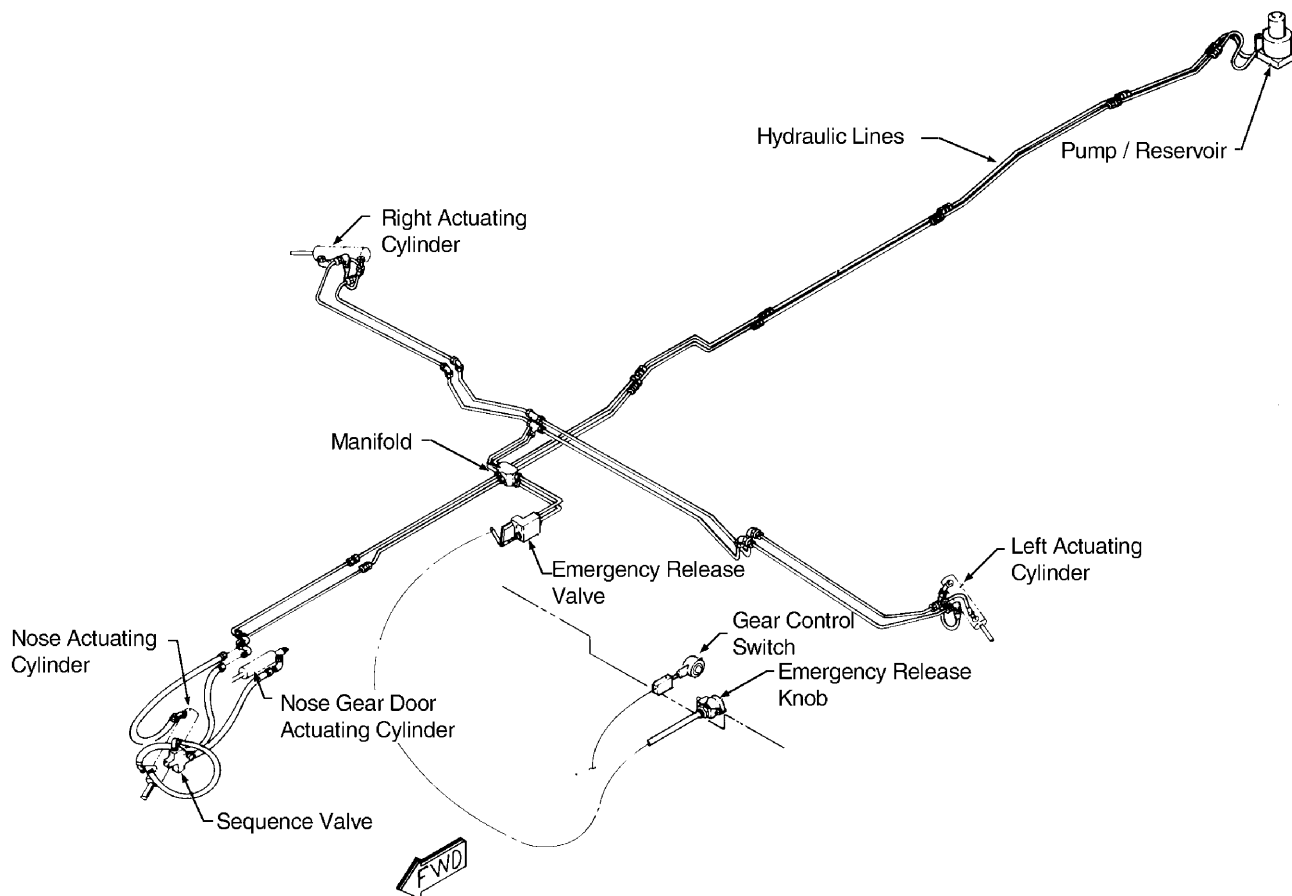
2. Hydraulic Pump (Parker Hannifin) (S/N's 4636001 thru 4636313 only.) (See Figure 3.)

WARNING: PLACE AIRPLANE ON JACKS PRIOR TO CHECKING OUT THE HYDRAULIC SYSTEM.
(REFER TO 7-10-00)

A. Removal

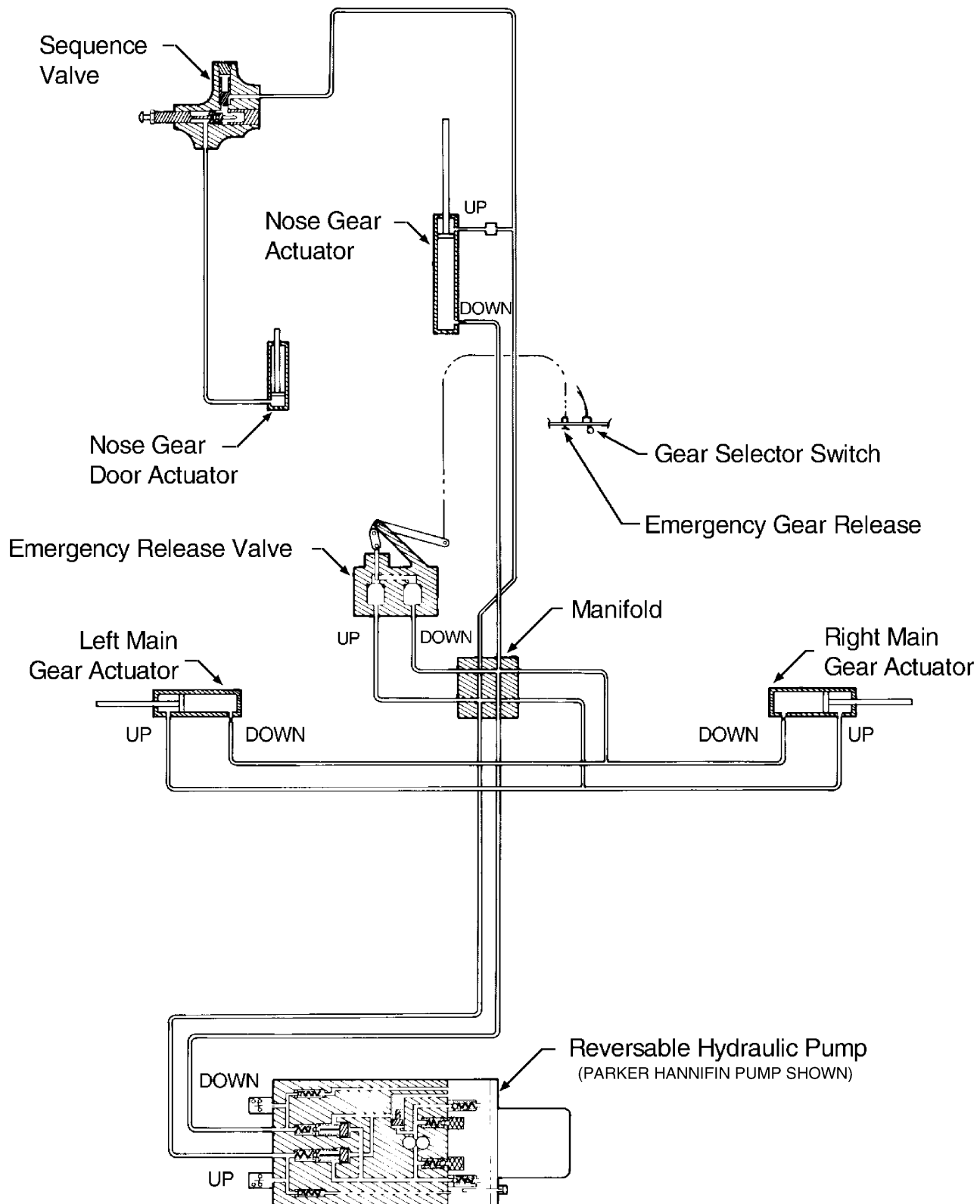
The hydraulic pump is located on a floor bracket just forward of the aft pressure bulkhead assembly.

- (1) Place airplane on jacks (refer to 7-10-00, Jacking).
- (2) Reduce hydraulic pressure as follows:
 - (a) Place gear switch in up position.
 - (b) Allow gear to retract until pressure drops.
 - (c) Pull hydraulic pump circuit breaker.



Hydraulic System Installation
Figure 1

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Fluid Diagram of Hydraulic System
Figure 2

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- (3) Set BATT MASTER switch to OFF position.
- (4) Disconnect aft baggage net assembly.
- (5) Remove access panel aft of baggage compartment.
- (6) Disconnect electrical wires and tie to pump.
- (7) Disconnect and rapidly cap hydraulic lines and hoses.
- (8) Remove four sets of mounting bolts, washers, rubber washers, and nuts.
- (9) Remove pump from airplane to a clean bench.
- (10) Drain reservoir into a suitable container.

B. Installation

WARNING: BE SURE AIRPLANE IS ON JACKS BEFORE TESTING HYDRAULIC SYSTEM.

- (1) Place pump assembly in aircraft.
NOTE: Align pump assembly so that sight glass is visible.
- (2) Install four sets of mounting bolts, washers, and rubber washers.
- (3) Uncap and reconnect hydraulic lines.
- (4) Fill reservoir with hydraulic fluid.
- (5) Set BATT MASTER switch on.
- (6) Reset hydraulic pump circuit breaker.
- (7) Cycle landing gear in accordance with Landing Gear Retraction Functional Test, 32-30-00. Verify that the gear operates smoothly and there are no leaks.

C. Disassembly (See Figures 3, 4, and 5.)

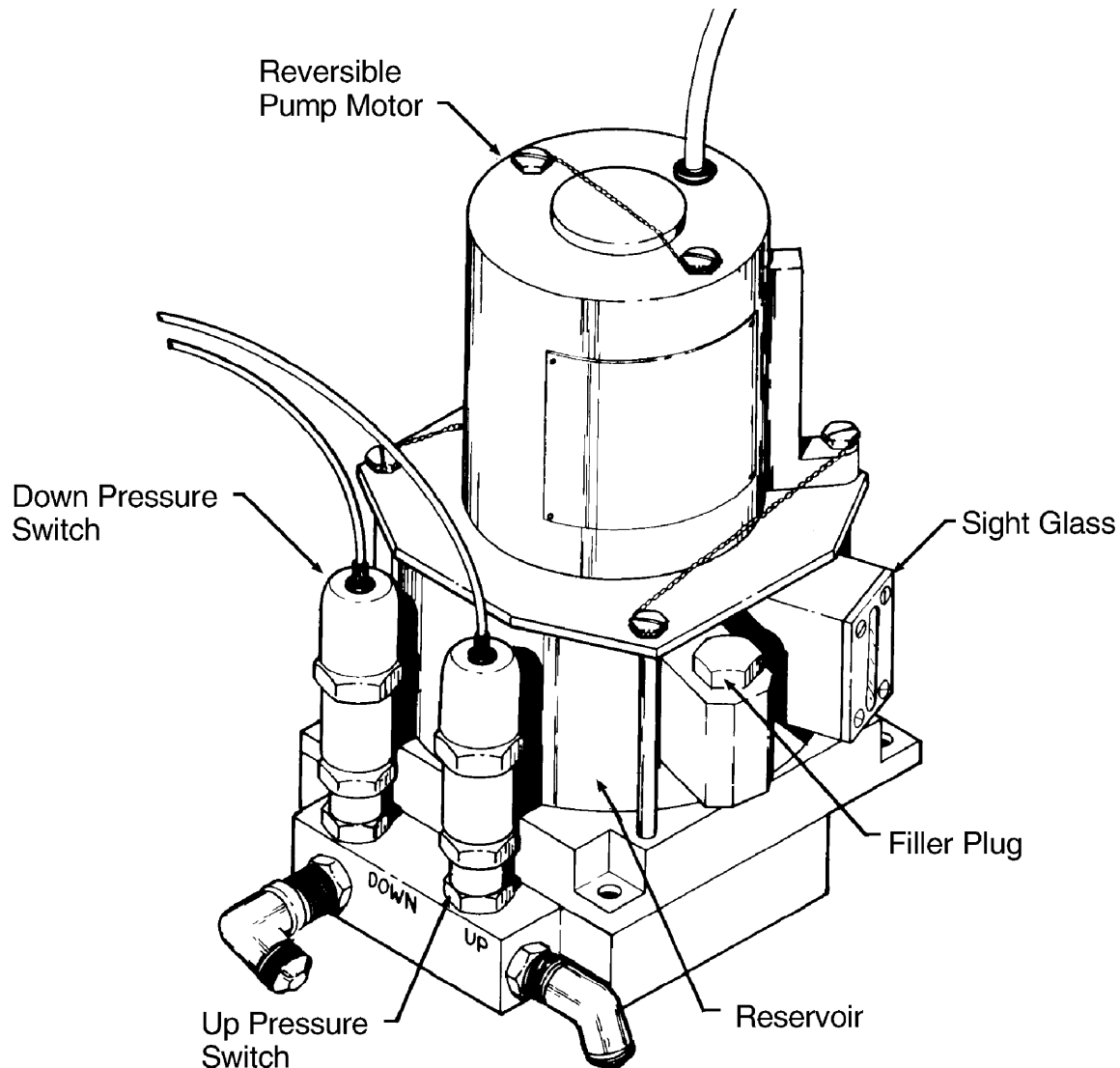
NOTE: Pump may not require complete disassembly. Follow steps (1) thru (8) as needed for access to air vent, motor, pump, reservoir, pressure relief valves, and O-rings. Sight glass may be removed (step (4)) without removing other parts.

NOTE: Follow steps (9) thru (13) as needed (prior steps not necessary) for removal of pressure switches, elbow/restrictor fittings, upper manifold, and lower manifold.

NOTE: Drain pump prior to disassembly. Mark pump assembly along length for ease in aligning parts.

- (1) Remove air vent by removing lockwire, bolt, and washer. Discard O-ring.
NOTE: Hold cap plate down while removing hardware to prevent spillage of any remaining hydraulic fluid.
- (2) Remove three bolts and washers from cap plate.
- (3) Remove coupler, O-ring, motor and plate. Motor and plate remain as one unit.
NOTE: If necessary, separate motor from plate by removing screws. Check and replace shaft seal on plate as needed. Do not disassemble motor.
- (4) Remove reservoir. If necessary, remove sight glass by removing four screws and gasket. Discard gasket.
NOTE: Perform steps (5), (6), (7), or (8) only as needed for parts beneath reservoir: pump, filters, O-rings, and pressure relief valves.
- (5) Remove pump by removing lockwire, four screws, and four washers that secure oil deflector and pump.
- (6) Remove intake filters by removing retaining rings.

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Hydraulic Pump (Parker Hannifin)
Figure 3

[Effectivity](#)
4636001 thru 4636313

- (7) Remove small O-rings under filters and large O-ring on upper manifold.
- (8) Remove pressure relief valves from upper manifold.
NOTE: Follow steps (9) thru (13) as needed to remove pressure switches and manifolds.
- (9) Remove pressure switches. Discard O-rings.
- (10) Remove elbow and restrictor fitting by loosening nut(s), unscrewing elbow(s) from lower manifold, and discarding O-ring(s).
NOTE: Upper and lower manifolds must be replaced as a set in pump serial numbers 156 and up. These can be distinguished by gold color instead of gray in earlier models. Refer to PA-46-350P Parts Catalog.
- (11) Remove and discard large O-ring from upper manifold if not already performed in step (10).

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- (12) Separate upper and lower manifolds, if necessary, by removing lockwire, four screws, and washers.
- (13) Remove and discard O-rings between upper and lower manifolds.
- D. Assembly (See Figures 3, 4, and 5.)

WARNING: USE MEK IN WELL-VENTILATED AREA. KEEP AWAY FROM FLAME OR HEAT. AVOID CONTACT WITH SKIN OR EYES.

CAUTION: DO NOT SOAK ELECTRICAL PARTS.

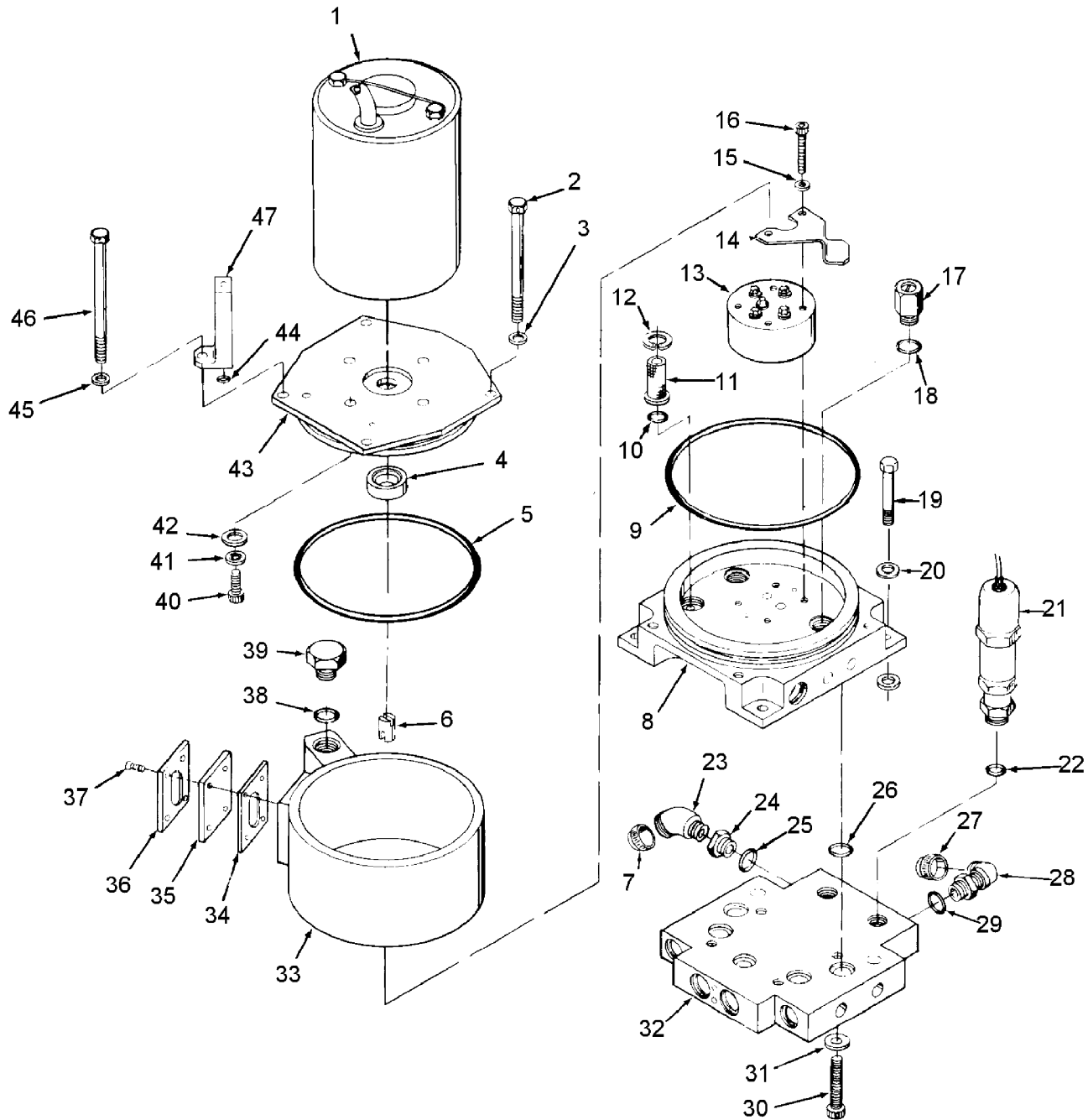
CAUTION: DO NOT REUSE LOCKWIRE OR O-RINGS. COAT REPLACEMENT O-RINGS WITH HYDRAULIC FLUID.

- (1) Check and replace parts as needed. If necessary, clean with MEK or other suitable solvent.
- (2) Replace O-rings between upper and lower manifolds. Secure manifolds with screws and washers. Torque 45 - 55 in.-lbs. in a crossing pattern in four steps: 20, 30, 40 and 50 in.-lbs. Install lockwire.
- (3) Install pump, oil deflector, four screws, and washers. Take care in aligning. (See Figures 4 and 5.) Torque screws 10 - 14 in.-lbs. Secure with lockwire.
- (4) Install pressure relief valves and O-rings. Torque 65 - 70 in.-lbs.
- (5) Replace O-rings at intake filters. Install intake filters. Secure with retaining rings.
- (6) If replacing sight glass, install gasket, glass, and cover onto reservoir with four screws. Torque 8 - 12 in.-lbs.
- (7) Install O-ring onto upper manifold.
- (8) Install reservoir. Align carefully on manifold. (See Figures 4 and 5.)
- (9) If cap plate and motor have been separated:
 - (a) Install new shaft seal onto cap plate.
 - (b) Assemble cap plate to motor with four screws, washers, and seals.
 - (c) Torque 25 - 35 in.-lbs.

CAUTION: DO NOT ALLOW LOCKWIRE TO INTERFERE WITH MOTOR SHAFT.

- (d) Lockwire screws. (See Figure 5.)
- (10) Install O-ring on cap plate assembly.
- (11) Install coupler onto hydraulic pump shaft.
- (12) Align cap plate bolts with threaded inserts of upper manifold. Lift plate and turn coupler so that slot aligns with motor shaft.
- (13) Install cap plate assembly onto reservoir so that coupler and motor shaft engage. Align bolt holes with threaded inserts.
- (14) Secure with bolts and washers. Torque 25 - 35 in.-lbs. Secure with lockwire.
- (15) Install O-ring in air vent assembly. Secure air vent to cap plate assembly with bolt and washer. Torque 25 - 35 in.-lbs. Secure with lockwire.
- (16) Replace O-rings for pressure switches. Install pressure switches. Torque pressure switches 65 - 70 in.-lbs.
- (17) Install O-rings for elbow fittings. Thread elbow fittings into UP and DOWN ports in lower manifold so that fittings point downward. Torque nut to 65 - 70 in.-lbs.

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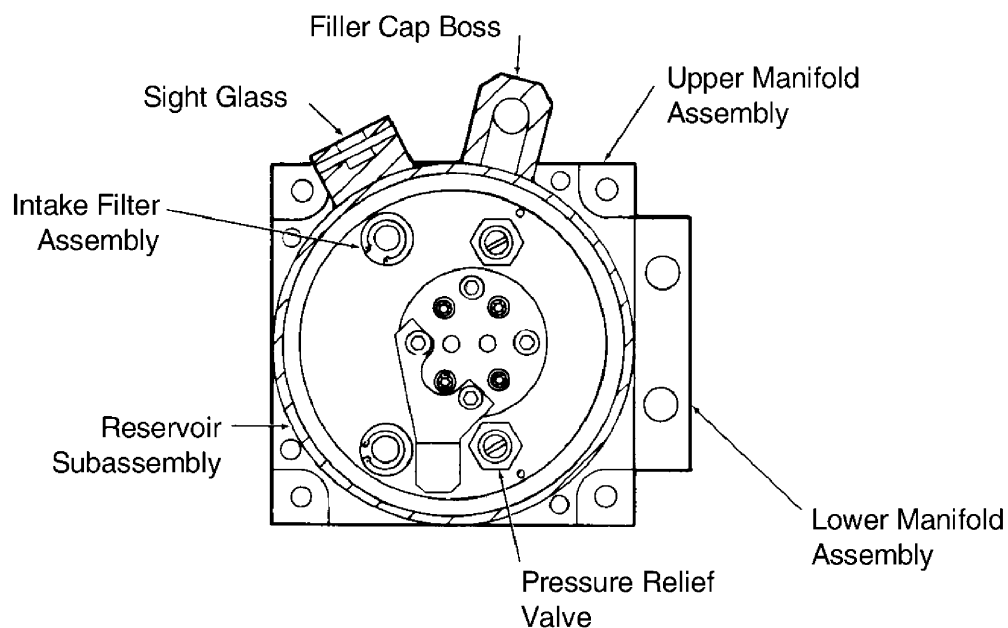
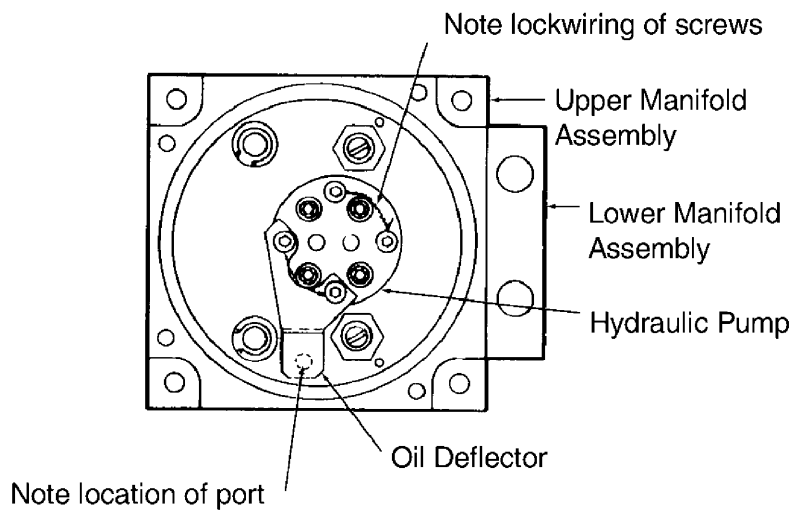
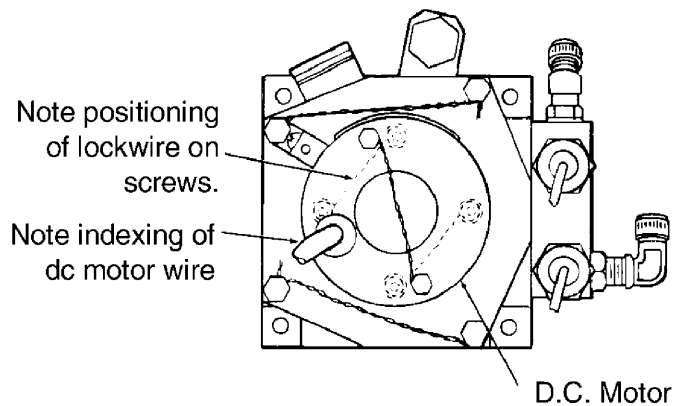


1. D.C. MOTOR	13. HYDRAULIC PUMP	25. O-RING	37. SCREW
2. BOLT	14. OIL DEFLECTOR	26. O-RING	38. O-RING
3. WASHER	15. WASHER	27. PROTECTIVE CAP	39. FILLER CAP
4. SHAFT SEAL	16. SCREW	28. 90° ELBOW	40. SCREW
5. O-RING	17. PRESSURE RELIEF VALVE	29. O-RING	41. WASHER
6. COUPLER	18. O-RING	30. SCREW	42. STAT-O-SEAL
7. PROTECTIVE CAP	19. MOUNTING BOLT	31. WASHER	43. CAP PLATE
8. UPPER MANIFOLD	20. WASHER	32. LOWER MANIFOLD	44. O-RING
9. O-RING	21. PRESSURE SWITCH	33. RESERVOIR	45. WASHER
10. O-RING	22. O-RING	34. GASKET	46. BOLT
11. INTAKE FILTER	23. 45° ELBOW	35. SIGHT GLASS	47. AIR VENT ASSEMBLY
12. RETAINING RING	24. NUT	36. SIGHT GLASS COVER	

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Hydraulic Pump (Parker Hannifin) - Disassembled
Figure 4

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Hydraulic Pump (Parker Hannifin) - Subassembly Alignment
Figure 5

[Effectivity](#)
4636001 thru 4636313

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3. Hydraulic Pump (Frisby) (S/N's 4636314 and up.) (See Figure 6.)

CAUTION: THE HYDRAULIC PUMP IS NOT SERVICEABLE IN THE FIELD. REPLACE WITH NEW OR FACTORY REBUILT UNIT. RETURN DEFECTIVE AND OVERLIMIT UNITS TO THE FACTORY FOR REBUILD.

A. Removal

WARNING: PLACE AIRPLANE ON JACKS PRIOR TO WORKING ON THE HYDRAULIC SYSTEM. (REFER TO 7-10-00)

The hydraulic pump is located on a floor bracket just forward of the aft pressure bulkhead assembly.

- (1) Place airplane on jacks (refer to 7-10-00, Jacking).
- (2) Reduce hydraulic pressure as follows:
 - (a) Place gear switch in up position.
 - (b) Allow gear to retract until pressure drops.
 - (c) Pull hydraulic pump circuit breaker.
- (3) Set BATT MASTER switch to OFF position.
- (4) Disconnect aft baggage net assembly.
- (5) Remove access panel aft of baggage compartment.
- (6) Disconnect electrical wires and tie to pump.
- (7) Disconnect and rapidly cap hydraulic lines and hoses.
- (8) Install vent screw, washer, and warning tag.
- (9) Remove four sets of mounting bolts, washers, rubber washers and nuts.
- (10) Remove pump from airplane to a clean bench.
- (11) Drain reservoir into a suitable container.

B. Installation

WARNING: BE SURE AIRPLANE IS ON JACKS BEFORE BLEEDING AND TESTING HYDRAULIC SYSTEM.

- (1) Place pump assembly in aircraft.

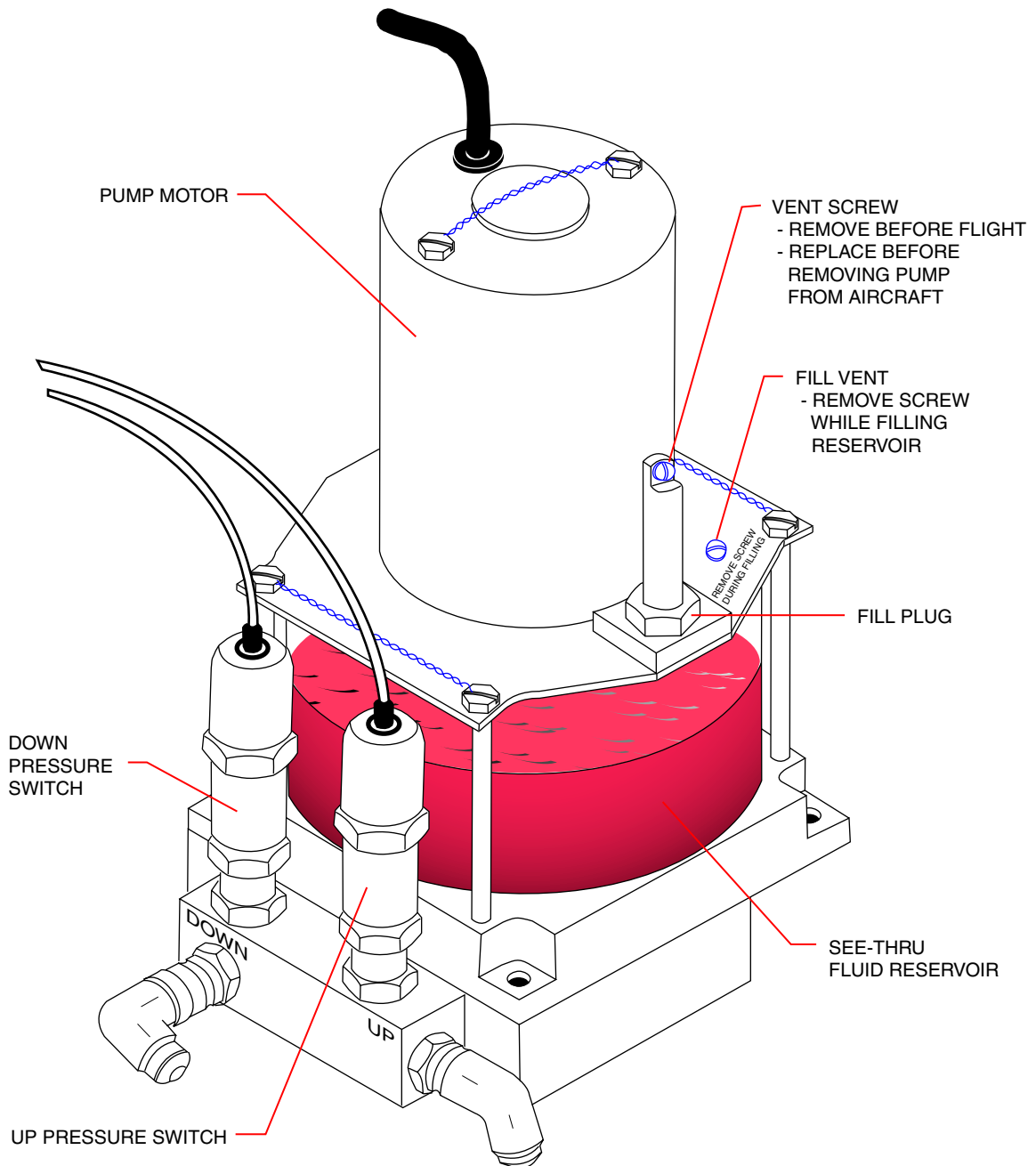
NOTE: Align pump assembly so that fill plug is to the front.
- (2) Install four sets of mounting bolts, washers, and rubber washers.
- (3) Uncap and reconnect hydraulic lines.
- (4) Fill reservoir with hydraulic fluid.

NOTE: Do not overfill. Add fluid only when level falls below the "L" mark. When filling, allow fluid level to stabilize before comparing fluid level to fill marks. Overfilling will result in excess fluid being expelled from reservoir vent pipe.

- (5) Remove vent screw, washer and warning tag.
- (6) Set BATT MASTER switch on.
- (7) Reset hydraulic pump circuit breaker.
- (8) Bleed hydraulic system per Bleeding Hydraulic System, below.
- (9) Conduct Landing Gear Retraction System Functional Test, 32-30-00. Verify that the gear operates smoothly and there are no leaks.

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102559 B



Hydraulic Pump (Frisby)
Figure 6

[Effectivity](#)
4636314 and up

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C. Testing

(1) Normal Operation Test (See Figure 7.)

Connect the hydraulic pump into a system as shown in Figure 7 to check normal pump operation. Maintain 27-28 VDC during all testing.

- (a) Fill pump reservoir to full line ("F" mark on the reservoir) with clean filtered MIL-H-5606 hydraulic fluid. Ensure that pump vent is open (remove screw, washer and warning tag, if installed). With the shut-off valve open, run the pump in the gear "UP" position for approximately 10 seconds. Slowly close the valve to build up 50-100 psig, and bleed air from the "UP" side of the system. Refill reservoir as required to keep fluid level between "F" and "L" marks during all testing.

NOTE: Do not overfill. Add fluid only when level falls below the "L" mark. When filling, allow fluid level to stabilize before comparing fluid level to fill marks. Overfilling will result in excess fluid being expelled from reservoir vent pipe.

- (b) With the shut-off valve in the open position, apply power to the pump with the gear switch in the gear "UP" position. Allow the pump to operate approximately 15 seconds. Slowly close the shut-off valve. The pressure switch shall turn the pump off at 1400 psig maximum. Continue to supply electrical power to the pump and observe for pressure drop and no pump operation for 5 minutes. Except, if the pump operates once momentarily during this five minute period there shall be no repeated pump operation during the subsequent fifteen minutes.
- (c) Repeat (b), above, with the gear switch in the gear "DOWN" position.
- (d) With the shut-off valve open, the gear selector switch in the gear "DOWN" position and the pressure switch disconnect switch in the "DOWN" position, allow the pump to operate approximately 10 seconds. Slowly close the shut-off valve. Observe the maximum pressure indicated and immediately shut pump off. The maximum pressure shall be at least 1550 psig but not more than 1800 psig. With the pump off observe that the pressure does not fall below 1350 psig in 5 minutes.
- (e) Repeat (4), above, with the gear switch and pressure switch disconnect switch in the gear "UP" position. The maximum pressure shall be at least 1550 psig but not more than 2000 psig.

NOTE: If pump is not installed in an aircraft, reinstall vent screw, washer, and warning tag upon completion of test.

(2) Thermal Relief Valve Operation Test

- (a) Fill pump reservoir to full line ("F" mark on the reservoir) with clean filtered MIL-H-5606 hydraulic fluid. Ensure that pump vent is open (remove screw, washer and warning tag, if installed).
- (b) With a suitable pump and calibrated gauge, slowly apply hydraulic pressure individually to the pump "UP" and "DOWN" outlet ports. The first indication of pressure relief shall occur at 2450 to 2600 psig for both "UP" and "DOWN" sides of the pump assembly.

NOTE: If pump is not installed in an aircraft, reinstall vent screw, washer, and warning tag upon completion of test.

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4. Bleeding Hydraulic System

(PIR-PPS60033-7, Rev. G/-13, Rev. NEW.)

WARNING: BE SURE AIRPLANE IS ON JACKS BEFORE BLEEDING AND TESTING HYDRAULIC SYSTEM.

A. Set up

- (1) Place the airplane on jacks per 7-10-00.
- (2) Connect a 28 Vdc regulated power source capable of supplying a minimum of 50 amperes to the aircraft electrical system.

NOTE: With power supplied through the auxiliary power plug the batt-master switch should remain in the "OFF" position. The APU circuit bypasses the batt-master switch to energize the ship power circuits.

NOTE: Before starting test, check for adequate clearance of nose gear lights, sequence valves, actuators, hoses, etc.

NOTE: Never operate the emergency gear release piston with the hydraulic pump circuit breaker "IN".

- (3) During all tests, add clean filtered MIL-H-5606 (Revision "F" or higher) hydraulic fluid to the reservoir as necessary to keep fluid level at the "F" (full) mark on the sight gauge with the gear down.

B. Procedure

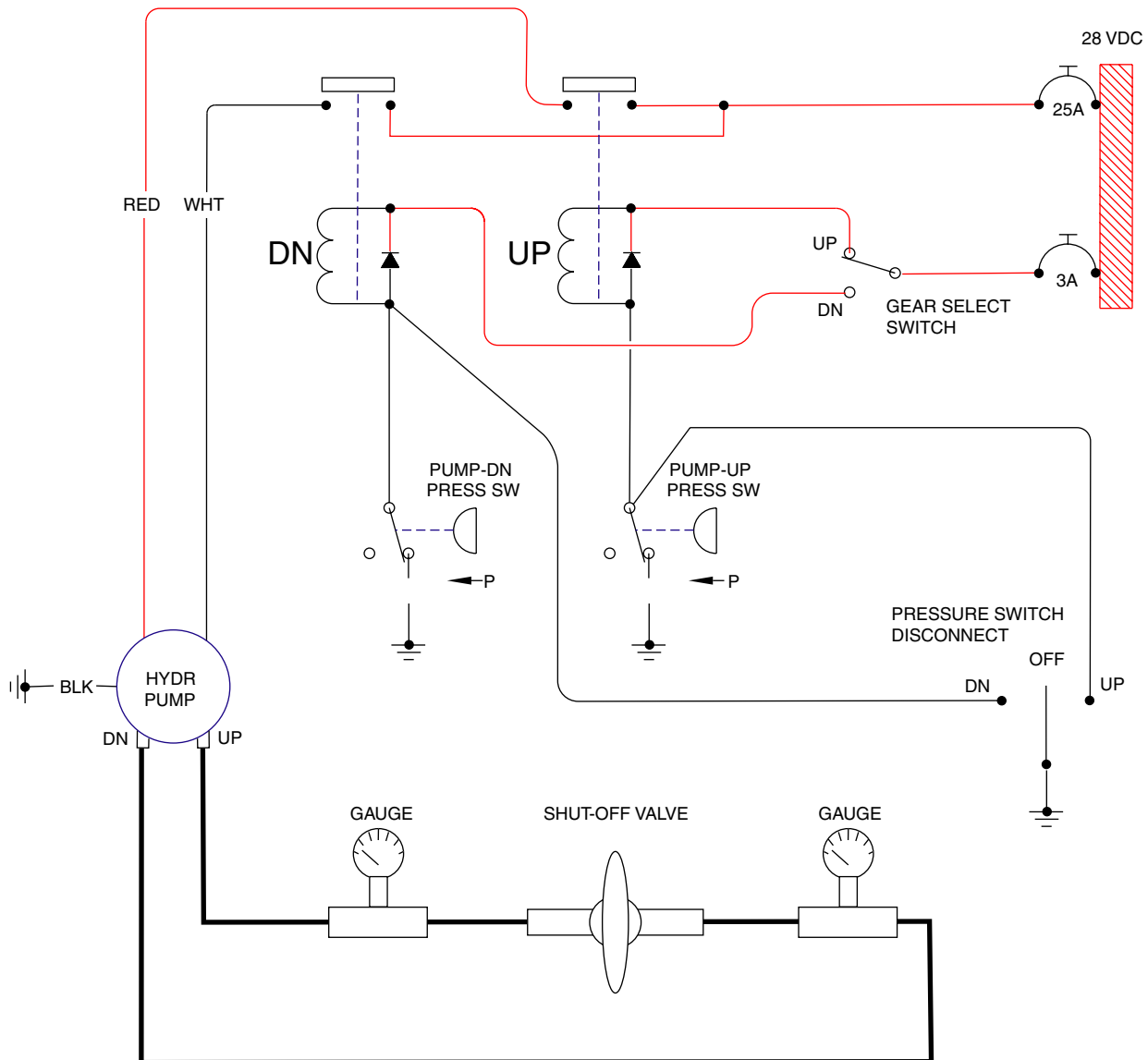
CAUTION: DO NOT PULL THE EMERGENCY GEAR RELEASE KNOB WHILE THE HYDRAULIC PUMP IS OPERATING. ALWAYS PULL THE HYDRAULIC PUMP CIRCUIT BREAKER BEFORE TESTING THE EMERGENCY GEAR RELEASE SYSTEM. FAILURE TO COMPLY WILL DAMAGE THE EMERGENCY GEAR RELEASE VALVE.

CAUTION: DO NOT OVERFILL AND DO NOT ALLOW HYDRAULIC FLUID LEVEL TO DROP BELOW THE "L" (LOW) MARK ON THE SIGHT GAUGE WITH THE GEAR IN THE DOWN POSITION.

NOTE: Follow this sequence below to reduce foaming. Add fluid to reservoir as needed.

- (1) Disconnect rod assemblies between nose gear doors and door actuating torque tube assembly to prevent door actuation.
- (2) Screw the sequence valve plunger adjustment screw all the way IN.
- (3) In S/N's 4636001 thru 4636313 only (i.e. - airplanes equipped with Parker Hannifin hydraulic pumps only):
 - (a) With the gear down, pull OUT the emergency gear release knob.
 - (b) Place the gear selector in the UP position. Operate pump for 10 to 15 seconds.
 - (c) Return the gear selector to the DOWN position. Push the emergency gear release knob IN.
- (4) Operate the gear through at least five (5) complete cycles, adding fluid to the reservoir as required.
- (5) Starting with the gear down, pull the hydraulic pump circuit breaker and place the gear selector switch in the UP position.
- (6) Using the circuit breaker as a switch, allow the gear to retract until the nose gear is about half way up and then pull the circuit breaker.

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Effectivity
4636314 and up

Hydraulic Pump (Frisby) Test Set-up
Figure 7

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- (7) Loosen the "B" nut on hose assembly at nose gear door actuator. Depress plunger on sequence valve to purge air from line.

NOTE: Move nose gear downward if necessary to create sufficient pressure and flow to completely bleed air from the line.

Repeat as necessary until all air is removed and then retighten the "B" nut.

- (8) Loosen the "B" nuts at the main gear UP fittings. Move the main gears downward to bleed air from the actuators. Tighten the "B" nuts.
- (9) Push IN the circuit breaker and complete the retraction cycle.
- (10) Place gear selector in DOWN position and loosen "B" nut on DOWN fittings on all three gear actuators to bleed any trapped air. Retighten "B" nuts.

NOTE: Pump may run intermittently during bleeding procedure.

- (11) In S/N's 4636001 thru 4636313 only (i.e. - airplanes equipped with Parker Hannifin hydraulic pumps only):
- (a) With the gear down, pull OUT the emergency gear release knob.
 - (b) Place the gear selector in the UP position. Operate pump for 10 to 15 seconds.
 - (c) Return the gear selector to the DOWN position. Push the emergency gear release knob IN.
- (12) Operate the landing gear through at least three (3) complete cycles.

5. Hydraulic Lines - Removal and Installation

- A. Remove damaged hydraulic lines by disconnecting the fittings at each end and where it is secured by brackets. See Figure 1 as an aid in locating the attaching brackets and bends in the lines.
- B. Provide a small container for draining the line.
- C. Install new or repaired line in the reverse order of removal.
- D. Bleed system and lines.
- E. Check fluid level in reservoir.

6. Hydraulic System Testing

WARNING: BE SURE AIRPLANE IS ON JACKS BEFORE BLEEDING AND TESTING HYDRAULIC SYSTEM.

WARNING: SET BATT MASTER SWITCH TO THE OFF POSITION BEFORE INSERTING OR REMOVING EXTERNAL POWER SUPPLY PLUG.

The hydraulic system should be tested to check that it functions properly after performing any service or repairs. It is suggested that the airplane be connected to an outside power source in order to conserve the battery. See also Landing Gear Retraction System Functional Test, 32-30-00.

- A. Place airplane on jacks (refer to 7-10-00).
- B. With the gear down, place the BATT MASTER switch to the on position, and circuit breaker closed. Place the landing gear selector in the UP position. Pump should immediately operate and gear retract. The red gear unsafe light on the instrument panel should illuminate, until the gear is fully retracted. The hydraulic pump should stop after full gear retraction.
- C. Place the gear selector in the DOWN position. The gear should extend and lock. The gear down lights on the instrument panel will illuminate when all three gears are locked in the down position. Inspect hydraulic system for leakage.

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- D. Recycle landing gear to check that it functions properly.

WARNING: PRIOR TO REMOVING THE AIRPLANE FROM THE JACKS, TURN MASTER SWITCH ON AND VERIFY THAT ALL THREE GREEN LIGHTS ARE ILLUMINATED. THIS WILL INDICATE THE LANDING GEAR IS DOWN AND LOCKED.

- E. Remove airplane from jacks.

7. Hydraulic Pump / Reservoir Servicing

- A. Parker Hannifin

The fluid level of reservoir of the combination pump and reservoir is checked every 50 hours by viewing fluid levels in the sight gauge. If fluid is below the fill-line, remove filler plug and fill with MIL-H-5606 hydraulic fluid. Install filler plug and tighten.

- B. Frisby

Check fluid level in reservoir every 50 hours by viewing fluid level directly. If fluid is below the fill-line (i.e. - the "L" mark), remove fill plug and fill vent screw and add MIL-H-5606 hydraulic fluid. Ensure that the landing gear is down when filling the reservoir. Re-install fill plug and fill vent screw and tighten.

NOTE: Do not overfill. Add fluid only when level falls below the "L" mark. When filling, allow fluid level to stabilize before comparing fluid level to fill marks. Overfilling will result in excess fluid being expelled from reservoir vent pipe.

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CHAPTER

30

ICE AND RAIN PROTECTION

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GENERAL

1. Description and Operation

The ice protection system is made up of six separate systems: an optional pneumatic wing deice system, an optional electrical propeller heat system, an optional electrically heated windshield, standard heated stall warning, standard heated pitot, and a wing inspection light installation. The systems can be installed individually or in any combination. The systems are controlled from a control panel on the right instrument panel.

The pneumatic system utilizes boots to displace ice from the leading edges of the flight surfaces. The boots are inflated by the vacuum pumps. See 37-10-00 for pump maintenance. Along with the boots and related plumbing, the system also utilizes a flow valve assembly which incorporates three deicer flow valve assemblies, three pressure switches, a check valve, a vacuum manifold, and a vacuum manifold/check valve assembly.

Boots are attached to the leading edge of the wings, vertical stabilizer, and elevator. The boots are made up of a fabric-reinforced rubber containing built-in span-wise inflation tubes. The boots are secured to the leading edges with cement and are connected to the plumbing through the skin by flexible or aluminum air connections.

The propeller heat system consists of an electrically heated boot bonded to each blade, a slip ring assembly connected to the hub of the propeller, a timer, a circuit breaker, a control switch located on the deice switch panel; and, in S/N's 4636001 thru 4636131 only, a dedicated ammeter and shunt. In S/N's 4636132 and up, the BFG timer is replaced by a Moritz unit.

The B. F. Goodrich propeller heat system installed on this airplane uses a single element type heater boots. In this type system each heater has one electrothermal heating element. When the PROP HEAT switch on the instrument panel is turned ON, the timer directs power through the modular brush assembly and slip ring to all the heating elements for approximately 90 seconds. The timer then switches power off for approximately 90 seconds. This cycle will continue as long as the PROP HEAT switch is in the ON position. In S/N's 46360132 and up only, there is a test mode which uses a squat switch relay to turn the propeller heat off if the airplane remains on the ground more than 30-45 seconds after PROP HEAT is switched ON. When the airplane becomes airborne, PROP HEAT exits the test mode and enters in-flight mode.

NOTE: In S/N's 4636001 thru 4636131 only, heating may begin at either phase of the cycle depending on the timer position when the switch was turned off from previous use.

When installed, the heated windshield consists of an electrically heated left windshield. Circuit protection is provided by the windshield heat CONTROL and POWER breakers in the ICE PROTECTION section of the pilot's circuit breaker panel.

Heated pitot and stall warning systems are standard on the airplane. These systems are operated by switches on the deice panel. Other components of the systems include a heated pitot head with a 10-amp circuit breaker and a heated lift detector with a 25 amp circuit breaker.

To aid the pilot in inspecting the leading edge of the left wing for any ice formation, a wing inspection light may be installed in the left hand side of the fuselage. Information on the wing inspection light may be found in Chapter 33 (Lights).

NOTE: For wiring schematics not found in this chapter, refer to Chapter 91.

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2. SMARTboot™ Ice Detection System (S/N's 4636132 thru 4636313 only.)

The optional pneumatic wing deice system, as installed in S/N's 4636132 thru 4636313 only, incorporates the B.F. Goodrich SMARTboot™ Ice Detection System. This system advises the pilot of icing conditions on the empennage of the airplane. Electrical sensors integrated directly into the surface of the pneumatic de-icers on the vertical fin and right horizontal stabilizer advise the presence of ice and appropriate time to de-ice.

NOTE: The system is installed as and performs only an advisory function.

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AIRFOIL

1. Pneumatic Deice System

The pneumatic system utilizes boots to displace ice from the leading edges of the flight surfaces. The boots are inflated by the vacuum pumps. See 37-10-00 for pump maintenance. Along with the boots and related plumbing, the system also utilizes a flow valve assembly which incorporates three deicer flow valve assemblies, three pressure switches, a check valve, a vacuum manifold, and a vacuum manifold/check valve assembly.

Boots are attached to the leading edge of the wings, vertical stabilizer, and elevator. The boots are made up of a fabric-reinforced rubber containing built-in span-wise inflation tubes. The boots are secured to the leading edges with cement and are connected to the plumbing through the skin by flexible or aluminum air connections.

The system is controlled from a control panel on the right side of the instrument panel.

2. Troubleshooting

See Chart 1.

3. Components

A. Deice Boots

See Deicers (Boots) (Pneumatic Deice System), below.

B. Deice Flow Valve Assembly

The deice flow valve assembly is located behind the firewall on the right hand side of the airplane. It is mounted to the lower fuselage.

(1) Removal

- (a) Disconnect the electrical leads to the individual deice valves at the (three) connectors.
- (b) Disconnect the five hoses from the deice flow valve assembly.
- (c) Remove the bolts which secure the deice flow valve assembly to the lower fuselage. Remove the deice flow valve assembly.

(2) Installation

- (a) Position the deice flow valve assembly on the lower fuselage and secure it with the bolts.
- (b) Reconnect the five hoses to the deice flow valve assembly.
- (c) Reconnect the electrical leads from the (three) deice valves.

C. Pressure Control Valve

The pressure control valves are located on the forward right hand side of the firewall.

(1) Removal

- (a) Disconnect the two hoses from the pressure control valve (on the forward side of the firewall).
- (b) Disconnect the electrical leads from the valve at the electrical connector.
- (c) Remove the screws and washers that secure the valve to the firewall and remove the valve.

(2) Installation

- (a) Position the valve in place on the firewall and secure it with the previously removed screws and washers.
- (b) Reconnect the two leads to the valve.
- (c) Reconnect the two hoses to the valve.

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**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING PNEUMATIC DEICE SYSTEM**

Trouble	Cause	Remedy
Deicers do not inflate. Engine operating at minimum cruise 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.
	Pressure regulator valves not functioning.	Make electrical test. Check for sticking poppet. Clean. Ensure that both vent ports on solenoid valves are open.
	Lines blocked or not connected.	Blow out lines and inspect connections. Make air leakage test.
Deicers do not inflate or inflate slowly.	Pressure regulator valves clogged.	Remove and clean.
Deicers inflate slowly (normal time - 6 seconds).	Lines partially blocked or not connected securely.	Blow out lines and inspect connections. Make air leakage test.
	Deflate solenoid valves not functioning properly.	Ensure that both vent ports on solenoid are open.
	System pressure not being reached.	Check performance to manufacturer's specifications.
	Deicer puncture.	Repair per specification or replace.
Deicers deflate slowly.	Lines partially blocked.	Inspect and blow out lines.
	Deflate solenoid valve not functioning properly.	Ensure that both vent ports on solenoid are open.

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**CHART 2 (Sheet 1 of 2)
TROUBLESHOOTING PNEUMATIC DEICE SYSTEM**

Trouble	Cause	Remedy
Deicers inflate, indicator light does not function. (Check that deicer boot switch is ON.)	Indicator lamp burned out.	Replace lamp.
	System pressure not being reached.	Check "Deicers Inflate Slowly" above.
	Pressure regulator valve switch not functioning.	Make electrical test and replace if required.
	Wires loose or broken.	Make electrical test. Repair or replace broken wires.
	Poor grounding of pressure regulator valve switch.	Check for proper ground.
Deicer boots do not hold their form in flight or vacuum to the system is inadequate.	Deflate valve not functioning properly	Remove and trouble-shoot valve. Replace if necessary.
	Vacuum line restricted.	Disconnect line from instruments, deflate valve, and blow out line.
	Broken line.	Inspect system and repair.

D. Vacuum Manifold/Check Valve

The vacuum manifold/check valve is located aft of the forward pressure bulkhead, slightly to the right of the airplane centerline.

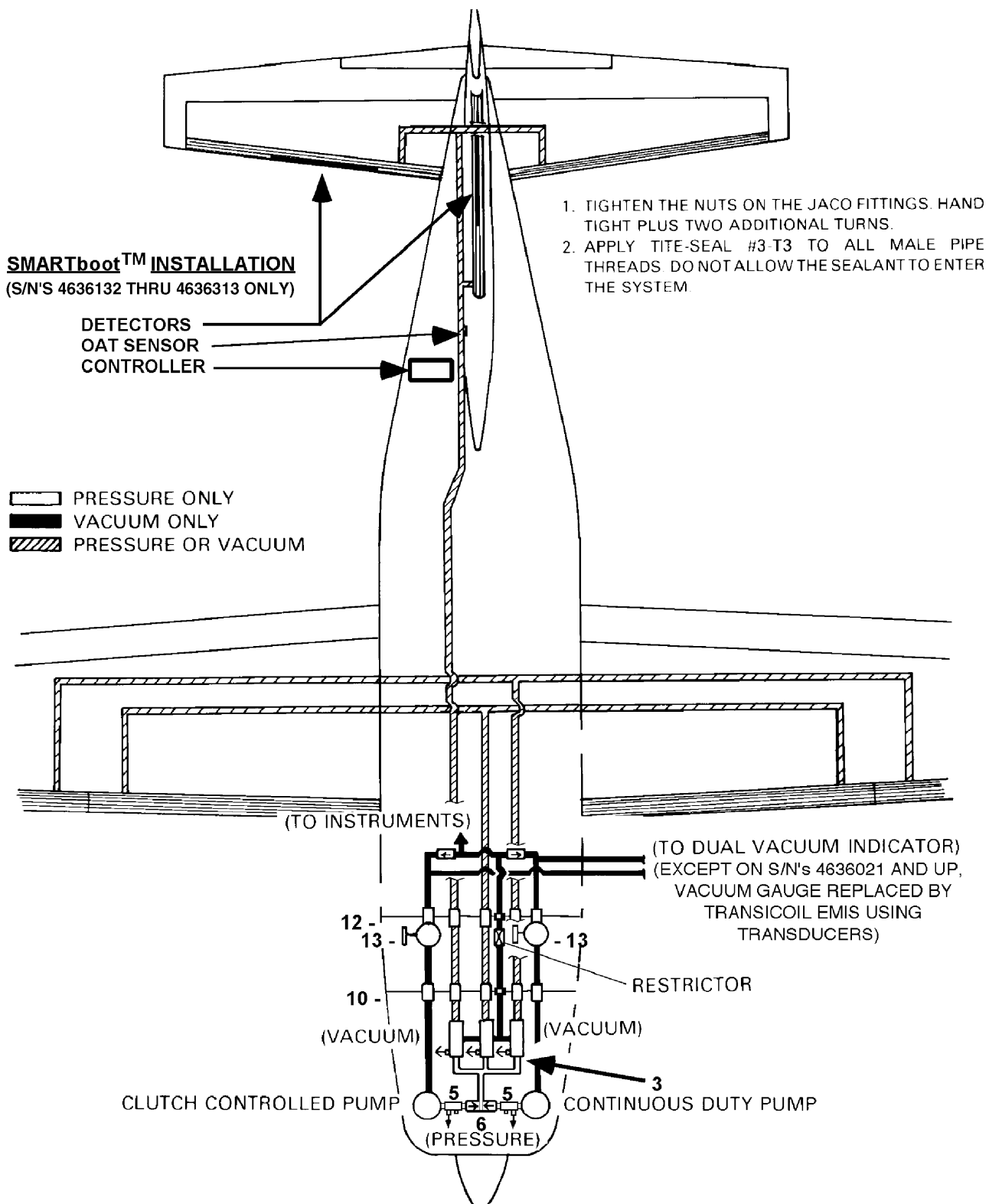
(1) Removal

- (a) Disconnect the three (or four) hoses from the manifold body.
- (b) For the forward manifold, remove the screw which secures the manifold bracket to the pressure bulkhead.
- (c) Remove the vacuum manifold/check valve assembly.

(2) Installation

- (a) Position the vacuum manifold/check valve in place.
- (b) Secure the forward vacuum manifold/check valve in place with the previously removed screws.
- (c) Reconnect the three (or four) hoses to the manifold body.

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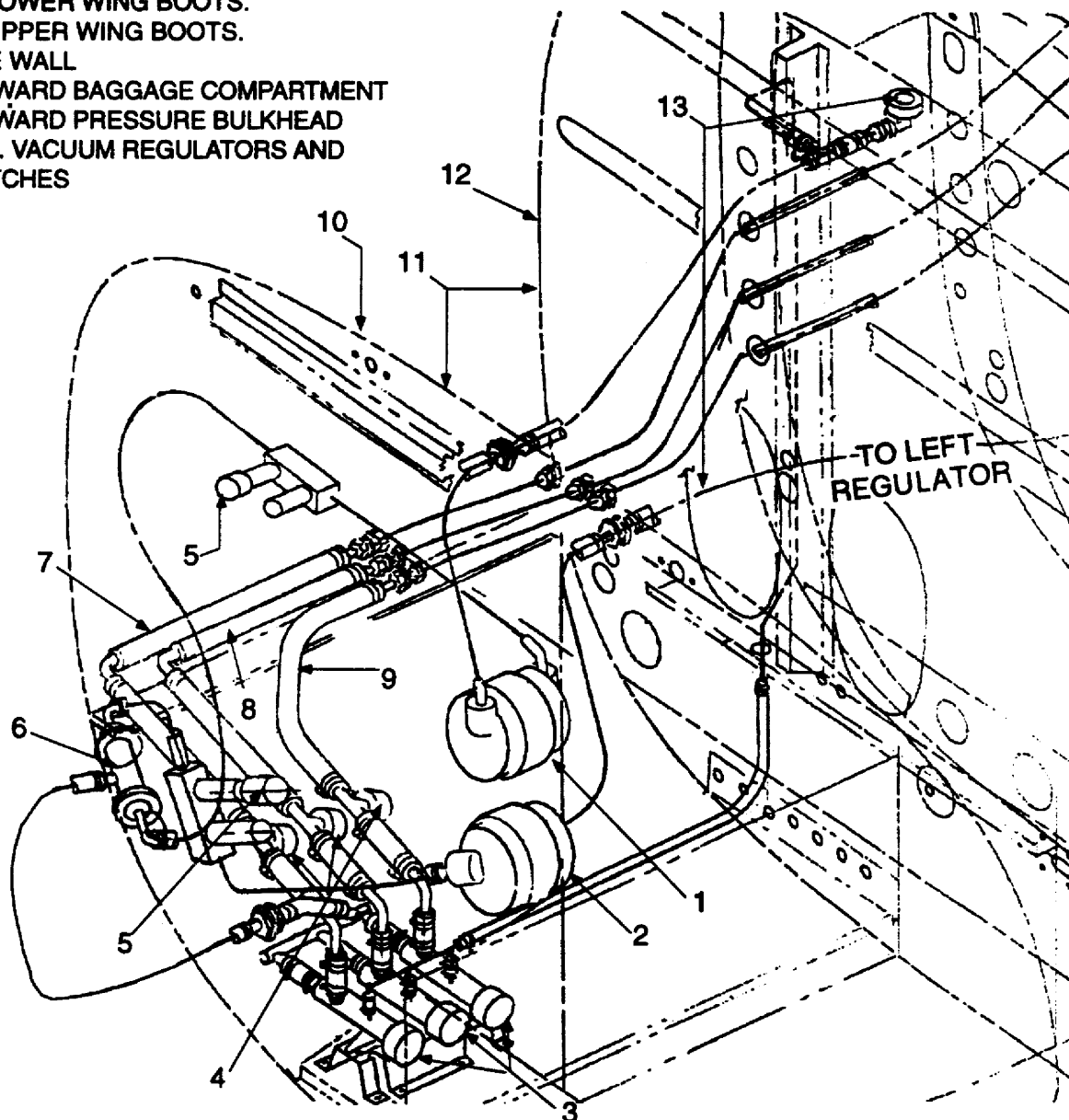
Fluid Diagram of Pneumatic Deicer System
Figure 1 (Sheet 1 of 2)

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1. UPPER VACUUM PUMP (ON BACK SIDE OF ENGINE).
2. LOWER VACUUM PUMP (ON BACK SIDE OF ENGINE).
3. FLOW VALVE ASSEMBLY.
4. PRESSURE SWITCHES
5. PNEUMATIC PRESSURE CONTROL VALVES
6. PNEUMATIC MANIFOLD / CHECK VALVE ASSEMBLY.
7. TO EMPENNAGE BOOTS.
8. TO LOWER WING BOOTS.
9. TO UPPER WING BOOTS.
10. FIRE WALL
11. FORWARD BAGGAGE COMPARTMENT
12. FORWARD PRESSURE BULKHEAD
13. L. R. VACUUM REGULATORS AND SWITCHES

NOTE

ITEMS 1 AND 2 LOCATED ON REAR RIGHT SIDE OF ENGINE. ITEMS 3 AND 4 LOCATED UNDER FLOOR IN BAGGAGE COMPARTMENT. ITEM 5 AND 6 LOCATED ON ENGINE (RIGHT) SIDE OF FIREWALL ITEM 13 LOCATED ON BAGGAGE COMPARTMENT SIDE OF PRESSURE BULKHEAD.



Fluid Diagram of Pneumatic Deicer System
Figure 1 (Sheet 2 of 2)

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E. Pressure Manifold/Check Valve

The pressure manifold/check valve is located on the forward side of the firewall to the right.

(1) Removal

- (a) Disconnect the three hoses from the pressure manifold/check valve.
- (b) Remove the screw that secures the pressure manifold/check valve to the firewall.
- (c) Remove the pressure manifold/check valve.

(2) Installation

- (a) Position the pressure manifold/check valve on the forward side of the firewall. Secure it with the screws.
- (b) Reconnect the three hoses to the pressure manifold/check valve.

(3) Testing

- (a) Remove pressure manifold/check valve by disconnecting vacuum pump discharge lines and the pressure line to the pressure control valve.
- (b) Connect a line from a regulated air source to the pressure control manifold at the pressure control valve connection.
- (c) Slowly apply 20 psig of air pressure to the pressure manifold/check valve.
- (d) Close off regulated air.
- (e) Check for leaks by noting the pressure drop in the pressure manifold/check valve. A pressure drop of not more than 5 psig in 10 seconds is permitted.
- (f) If air flows through the pressure manifold/check valve and out the vacuum pump discharge side of the manifold, the diaphragm is ruptured and the manifold must be replaced.
- (g) If unit passes leak test, or if a new manifold is required, install in the airplane by connecting both vacuum pump discharge and the pressure control valve hoses.

F. Timer

The pneumatic system timer is mounted to the upper right hand corner of the forward side of the F.S. 108.00 frame.

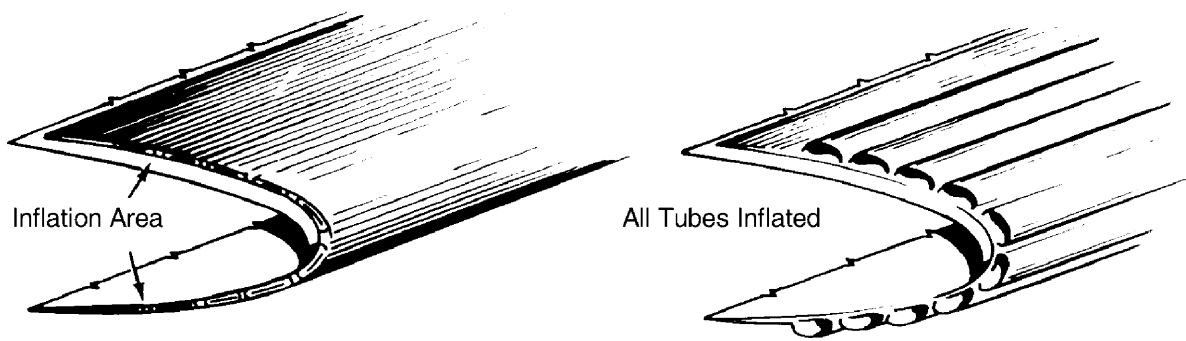
(1) Removal

- (a) Disconnect the electrical leads from the timer at the connector.
- (b) Remove the screws, nuts and washers that secure the timer to the frame. Remove the timer.

(2) Installation

- (a) Position the timer on the F.S. 108.00 frame. Secure it in place with the screws, nuts and washers.
- (b) Reconnect the electrical leads at the connector.

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Pneumatic Deicer Boot Operation
Figure 2

4. Deicers (Boots) (Pneumatic Deice System)

Boots are attached to the leading edge of the wings, vertical stabilizer, and elevator. The boots are made up of a fabric-reinforced rubber containing built-in span-wise inflation tubes. The boots are secured to the leading edges with cement and are connected to the plumbing through the skin by flexible or aluminum air connections.

WARNING: CEMENTS AND SOLVENTS USED TO REMOVE AND INSTALL DEICERS ARE EXTREMELY FLAMMABLE AND TOXIC. EXTINGUISH OPEN FLAMES. AVOID SPARKS. USE IN WELL-VENTILATED AREA. AVOID SKIN CONTACT AND/OR PROLONGED BREATHING OF VAPORS. CONSULT MSDS FOR ADDITIONAL SAFETY INFO.

CAUTION: DISPOSE OF UNUSED MEK AND OTHER CHEMICALS AND SOLVENTS IN A MANNER CONSISTENT WITH LOCAL LAWS AND/OR ENVIRONMENTAL PROTECTION AGENCY REGULATIONS.

CAUTION: DO NOT USE MEK ON SMARTBOOT™ INSTALLATIONS (VERTICAL FIN AND RIGHT STABILIZER) AS MEK WILL ATTACK ESTANE® MATERIAL. USE TOLUENE INSTEAD.

NOTE: Goodrich Black Standard Pneumatic De-Icer Installation, Maintenance & Repair Manual, ATA Report No. 30-10-31, provides approved, alternate procedures for removing and installing deice boots. Reference to it is highly recommended. It can be obtained online at <http://www.goodrich.com/TechPubs>.

A. Removal.

See Chart 2, below, for required materials.

NOTE: Disconnect line fittings from boot fittings.

- (1) Starting at one corner 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.
- (2) Using a pressure handle squirt can filled with solvent, separate the deicer boot from the surface for a distance of four (4) inches all the way along the upper trailing edge.
- (3) 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.

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**CHART 2 (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) (Black Estane® or Neoprene Deicers) Edge Sealer Kit (74-451-K) (Black Estane® Deicers only)

* use Pure Bristle brush ** Piper P/N 912-018 *** Neoprene deicers only

Solvents

CAUTION: DO NOT USE MEK ON ESTANE® (I.E. - SMARTBOOTS™) DEICERS INTENDED FOR REUSE OR CONTINUED USE.

Item

Where Used

Toluene	Leading edge and deicer cleaning solvent
Toluene, or	Leading edge stripping solvent
Peerco #321 stripper, or	
Methyl Ethyl Ketone (MEK)	
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 chalk line
Hook knife (74-451-45)	3M EC 801 filler
FASTpatch™ Primer - 1/2 oz. crush tube (74-451-190)	

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**CHART 2 (Sheet 2 of 2)
REQUIRED MATERIALS - PNEUMATIC DEICER - INSTALLATION / REMOVAL / REPAIR**

Goodrich Part No.	Goodrich Kits 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-K	1	Edge Sealer Kit (Black Estane® Deicers only)
74-451-117-1	1 qt.	Sealer/Cement
74-451-120	4 oz.	Accelerator
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 (Black Estane® or Neoprene Deicers)
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

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- (4) 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.
- (5) Use Toluene or Peerco #321 to clean the dry cement off the exposed wing area, and clean the area thoroughly with MEK (methylene ketone).

B. Installation.

See Chart 2, below, for required materials.

(1) Leading Edge Preparation.

- (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: Masking accurately will eliminate the need for cleaning off excess cement later.

- (b) Remove paint and primer in masked area with stripper or sand painted/primered 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.
- (e) On wings only, 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.

(2) Deicer Preparation.

CAUTION: DO NOT USE MEK TO CLEAN SMARTBOOTS™ OR ESTANE® AS MEK WILL ATTACK ESTANE® MATERIAL.

Moisten a clean cloth with Toluene and carefully clean the rough, back surface of the boot at least twice. Change cloths often to avoid recontaminating the cleaned area.

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(3) 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 LEADING EDGE PREPARATION, 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 (b), above.

(4) 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 three (3) to four (4) inches wide by eighteen (18) to thirty-six (36) inches long. 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.

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- (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:
 - 1 apply one line on deicer surface one-sixteenth (1/16) to one-eighth (1/8) inch from edge; and,
 - 2 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 edge sealer using one of the following methods, appropriate to the deicer installed:
 - 1 A-56-B (Neoprene deicers only.)
 - a 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.
 - b 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.
 - c Mix edge sealer (A-56-B cement) thoroughly. If desired, dilute with Toluene, not to exceed 20% by volume.
 - d 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.
 - e Remove tape immediately after applying edge sealer - i.e. - before edge sealer dries.
 - 2 Edge Sealer Kit No. 74-451-P (See Figure 3.)
 - a Apply masking tape on deicer surface around deicer and cutouts at least 1/4 inch from edge.
 - b Apply masking tape on leading edge at least one and three-quarters (1 3/4) inch outboard of edge of masking tape applied to deicer and outboard of exposed 1300L cement. Form neat, straight lines to border edge sealer application.
 - c For neoprene deicers, brush one even coat of primer on leading edge and deicer between tape lines.
 - d For Estane[®] deicers, brush one even coat of primer on leading edge surface only, between the deicer edge and the masking tape. Do not get primer on deicer surface. Let dry thirty (30) minutes.

- e Mix cement and accelerator per instructions on container.
- f Apply one even brush coat of edge sealer to surfaces between tape lines. Let dry fifteen (15) minutes.

CAUTION: DO NOT ALLOW MEK TO COME CONTACT SURFACES OTHER THAN BACKSIDE OF EDGE SEALER STRIP AS IT WILL ATTACK ESTANE[®] DEICER MATERIAL. DO NOT SATURATE EDGE SEALER STRIP DURING TACKIFICATION FOR SAME REASON.

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- 3 Edge Sealer Kit No. 74-451-K (Estane® deicers only.)
- a 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.
 - b 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.
 - c Mix only the amount of edge sealer that can be used in a four (4) hour period. Mix cement and accelerator per instructions on container.
 - d Apply one 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.
 - e Remove tape immediately after applying edge sealer - i.e. - before edge sealer dries.
- (5) 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.
- (6) Adhesion Test.
- (a) 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 one (1) x four (4) 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.**
- (b) 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:
 - 1 Carefully lift one corner of deicer in question sufficiently to attach a spring clamp.
 - 2 Attach a spring scale to this clamp and pull with force 180° to the surface and in such a direction that the boot tends to be removed on the diagonal.
 - 3 If a force of five pounds per inch of width can be exerted under these conditions, the installation shall be considered satisfactory. Remember, the width increases as the corner peels back.
 - 4 Re-cement corner following previous procedure.
 - 5 Failure to meet this requirement shall 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.

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C. Inspection.

Perform the following inspection when:

- (1) For an uninstalled deicer:
 - (a) The deicer has been stored for more than 84 months.
 - (b) There is evidence of damage to original packaging.
 - (c) The deicer is not in original packaging.
 - (d) There is evidence that deicer was not stored properly.
- (2) For an installed deicer if damage or age is suspected of affecting deicer performance.
- (3) Procedure

CAUTION: INSTALLATION OR CONTINUED USE OF A DEICER IN CONDITIONS SPECIFIED IN (1) OR (2), 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 Chart 3.

- (a) 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.

CAUTION: REVIEW REPAIR LIMITS, BELOW, TO DETERMINE IF REPAIR IS PERMITTED.

- (b) Repair surface damage detected per Repair Procedure, below.
- (c) Inflate deicer with regulated air source to correct operating pressure (see Chart 3). Check inflation time. Deicer should inflate to operating pressure within six (6) seconds.
- (d) 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 for deicers with system operating pressure of 14 psi or higher.
- (e) 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.

CAUTION: REVIEW REPAIR LIMITS, BELOW, TO DETERMINE IF REPAIR IS PERMITTED.

- (f) 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).
- (g) If deicer passes all tests, its usability is on condition and the decision to install is at user's discretion.

**CHART 3
PNEUMATIC BOOT OPERATING PRESSURES**

Deicer	Operating Pressure (PSI)	Inflation Sequence
Wing	14 - 15	Alternating (Upper and Lower tubes inflate separately)
Vertical Fin	10 - 12	Simultaneous
Horizontal Stabilizer	10 - 12	Simultaneous

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D. Maintenance

- (1) Visually inspect deicers frequently for abrasion, erosion, cracking, tears, pinholes, foreign object damage (FOD), debonding and other damage. Repair damage immediately, see Repairs, below.
- (2) 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.
- (3) Goodrich Corp. offers a family of deicer treatment products which reduce weathering effects, enhance appearance, and enhance performance. Their use is recommended, see below.

(a) 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.

- 1 One quart covers 90 square feet of deicer, following these directions.
Thoroughly clean deicer surface with mild soap and water. Rinse with clean water and let dry.
- 2 Use isopropyl alcohol to remove substances that cannot be removed with soap and water. Repeat Step 1, above.
- 3 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.

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4 Repeat Step 3, above, so that three even coats have been applied with 5-10 minutes dry time between each coat.

5 Let dry 24 hours before flying aircraft or applying Icx[®] II or ShineMaster[®] products.

(b) 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.

1 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.

2 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.

3 Repeat Step 2, above, once or twice to obtain desired shine.

(c) Icx[®] II Application.

Icx[®] II is an ice adhesion inhibitor that enhances deicer performance by lowering adhesion strength between ice and deicer surface. During icing season, apply Icx[®] II every 50 flight hours.

NOTE: Icx[®] II is not a cure-all for icing problems. Icx[®] will not prevent or remove ice formations. Its only function is to keep ice from initially getting a strong foothold, thus making removal easier.

NOTE: Icx[®] 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 Icx[®] II is applied too heavily, result can be sticky surface that collects dust and dirt, reducing efficiency of Icx[®] II. Residue should be completely removed before reapplication.

1 Clean deicer surface using mild soap and water.

2 Rinse with clean water and let dry.

3 Clean with isopropyl alcohol to remove substances not removed with soap and water.

4 Repeat Steps 1 and 2, above.

5 Apply Icx[®] II with clean cloth or pad. Apply lightly and wipe in single continuous back and forth motion spanwise on deicer.

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(d) Application in Combination.

AgeMaster[®] No. 1, ShineMaster[®] and Icx[®] II are specifically designed to use together to provide maximum deicer care, appearance and performance.

- 1 Clean deicer surface to remove previous coatings, dirt, grease, oil and other contamination. ShineMaster[®] Prep cleaner should be used to remove ShineMaster[®] treatment.
- 2 Apply AgeMaster[®] No. 1, see above, and let dry at least 24 hours.
- 3 Apply ShineMaster[®] cosmetic treatment, see above, and let dry to touch.
- 4 Apply Icx[®] II, see above.
- 5 Icx[®] II may be removed with alcohol or warm, soapy water, then reapplied without affecting ShineMaster[®] cosmetic treatment.
- 6 Icx[®] II and/or ShineMaster[®] cosmetic treatment can be removed without affecting AgeMaster[®] No. 1.
- 7 Icx[®] II and/or ShineMaster[®] cosmetic treatment must be removed before reapplying AgeMaster[®] No. 1.

E. Repair Limits.

CAUTION: PNEUMATIC DEICERS 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:

- (1) The following patch limits are established:
 - (a) Three (3) small patches per 12 inch square (Small patch is 2-1/2" X 1-1/4"); or,
 - (b) Two (2) medium patches per 12 inch square (Medium patch is 5" X 2-1/2"); or,
 - (c) One (1) large patch per 12 inch square (Large patch is 5" X 10"); or,
 - (d) Two (2) small patches and one (1) medium patch per 12 inch square.
- (2) No more than 20 pinhole repairs are allowed per 12 inch square.

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F. Repair Procedures.

CAUTION: REVIEW REPAIR LIMITS, ABOVE, TO DETERMINE IF REPAIR IS PERMITTED.

See Chart 2 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.

- (1) 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 as follows:

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.

- (a) 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.
- (b) 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.
- (c) Use buffing shield or patch as template to outline damaged area. Buff deicer surface with medium grit emery cloth or equivalent.
- (d) Wipe deicer surface with cloth dampened with Toluene or alcohol and let dry.
- (e) Apply one coat of primer to deicer surface. Let dry to touch (5-10 min.).
- (f) Remove paper backing from patch and press patch on primed deicer surface. Roll with rubber roller.
- (g) Let dry 30 minutes before inflating deicer.
- (h) Patch refurbishment:
 - 1 To replace loose or damaged patch, remove old patch by peeling off deicer.
 - 2 Remove adhesive remaining on deicer with Scotch Brite™ soaked in alcohol.
 - 3 Install new patch.

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- (2) Tube Area Damage: Use Kit No. 74-451-AA (see application instructions, under Scuff Damage, 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, as follows:

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.

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.

- (a) 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.
- (b) Isolate repair area with buffing template. Buff isolated area with Scotch Brite™ or equivalent.
- (c) Wipe isolated area with lint-free cloth dampened with alcohol or equivalent cleaning solvent and allow to dry.
- (d) Secure application template with hole centered over pinhole.
- (e) 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.

- (f) 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.

- (g) 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.

- (h) Allow two (2) hours dry time prior to flying the aircraft or inflating deicer.

- (3) 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:

- (a) Peel and trim the loose surface ply to the point where the adhesion of surface ply to the deicer is good.
- (b) Proceed with patch application per 74-451-AA patch kit application instructions, under Scuff Damage, above.

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G. 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. Apply the kit as follows:

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.

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.

- (1) 74-451-L kit covers 40-50 square feet of deicer surface.
- (2) Wash deicer surface with mild soap and warm water to remove contamination.
- (3) Remove ShineMaster[®] cosmetic treatment with ShineMaster[®] Prep cleaner.
- (4) Lightly sand surface with Scotch Brite[™] fine grade abrasive material or equivalent.
- (5) Clean surface with clear water and dry with lint free cloths to remove soap residue and loose particles raised from sanding.

CAUTION: DO NOT USE MEK ON ESTANE[®] SURFACE DEICERS AS MEK WILL ATTACK ESTANE[®].

- (6) Wipe surface twice with cleaning solvent. Use MEK or Toluene on neoprene deicers; use only Toluene on Estane[®] deicers.
- (7) Apply masking tape to leading edge against edges of deicer.
- (8) Apply primer:
 - (a) For Estane[®] deicers, skip to step (9).
 - (b) For neoprene deicers only:
 - 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.
- (9) Apply protective coat:
 - (a) For Estane[®] deicers, use protective coat alone.
 - (b) For neoprene deicers, mix protective coat with two (2) ounces accelerator.
 - (c) Apply one even coat of protective coat. If desired, a second coat of protective coat may be applied within fifteen (15) minutes to one (1) hour of first coat.
- (10) Remove masking tape as application is made, about every three (3) feet.
- (11) Aircraft may be flown and deicer inflated after 4 hours dry time.
- (12) Do not use AgeMaster[®] No. 1 after 74-451-L kit application.
- (13) Deicers coated with 74-451-L kit may be repaired with 74-451 AA patch kit or 74-451-AE inhole repair kit.

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5. Pneumatic Deice System Adjustments and Test

(PIR-PPS60054-5, -6, -7.)

WARNING: DURING ANY ENGINE OPERATION SPECIFIED HEREIN, EXERCISE CAUTION TO AVOID HARM OR DAMAGE TO PERSONNEL AND EQUIPMENT BY THE PROPELLER AND PROPELLER BLAST.

- A. Start the engine and operate at 2,500 rpm (except in S/N's 4636021 thru 4636131 - use 2,000 rpm).
- B. Remove the vacuum hose (suction side) from the right vacuum regulator and adjust the left vacuum regulator to provide a vacuum gauge indication of: 4.8 (min.) (S/N's 4636132 and up); or, 4.8 to 5.0 (S/N's 4636001 thru 4636131) inches Hg. of vacuum on the analog gauge and record the reading. In S/N's 4636021 and up, verify the VACUUM No. 1 INOP annunciator is illuminated and the VACUUM No. 2 INOP annunciator is not. In S/N's 4636001 thru 4636020, the left indicator button in the vacuum gauge shall be in (indicating pump is operating). Reconnect the right vacuum regulator.
- C. Remove the vacuum hose (suction side) from the left vacuum regulator and adjust the right vacuum regulator to provide a vacuum gauge indication of: 4.8 (min.) (S/N's 4636132 and up); or, 4.8 to 5.0 (S/N's 4636001 thru 4636131) inches Hg. of vacuum on the analog gauge and record the reading. In S/N's 4636021 and up, verify the VACUUM No. 2 INOP annunciator is illuminated and the VACUUM No. 1 INOP annunciator is not. In S/N's 4636001 thru 4636020, the right indicator button in the vacuum gauge shall be in (indicating pump is operating). Reconnect left vacuum regulator.
- D. In S/N's 4636132 and up, with both regulators connected and both vacuum pumps operating, adjust the left and right regulators equally to obtain a vacuum gauge analog indication of 4.80 inches of Hg. Verify that the vacuum gauge indicates from 4.80 to 5.20 inches Hg. with engine operating at idle and 2,000 rpm.

In S/N's 4636001 thru 4636131, check that vacuum gauge indication does not exceed 5.2 inches Hg. with both pumps operating and both regulators connected. If indication exceeds 5.2 inches, readjust the left and right vacuum regulators, per B and C above, to provide an indication of no more than 5.2 inches Hg.
- E. Check all surface boots and ensure they are down tight against the wing and tail surfaces.
- F. Using a vacuum (or combination pressure/vacuum) gauge connected to a hypodermic needle, measure the vacuum in the pneumatic system by inserting the needle in either right or left wing hose connections located on cabin side of the forward pressure bulkhead.
- G. Remove the vacuum gauge and install a pressure gauge at the same point. (This is not required if pressure/vacuum gauge is used.)
- H. Disconnect one of the vacuum pump pressure hoses from the pressure manifold (fwd of the firewall) and cycle the SURFACE DE-ICE switch ON to activate the system and check for air indication of 14 - 0, + 2 pounds per square inch on the pressure gauge. Reconnect the disconnected pressure hose and disconnect the other pump's pressure hose from the pressure manifold and repeat the system cycle to check for air indication of 14 - 0, + 2 psig. Reconnect pump pressure hose.
- I. Cycle the SURFACE DE-ICE switch ON to activate the system and check for air indication of 14 - 0, + 2 pounds per square inch on the pressure gauge.
- J. Visually check all boots for proper operation. All cells shall inflate fully. Each segment cycle time shall be 6 + 2 seconds. Cycle sequence is tail, lower wing, upper wing. The SURFACE DE-ICE annunciator light shall illuminate and: in S/N's 4636021 and up, neither VACUUM No. 1 INOP nor VACUUM No. 2 INOP annunciator shall illuminate; in S/N's 4636001 thru 4636020, both left and right indicator buttons in the vacuum gauge shall be in during boot operation.
- K. Remove the pressure or pressure/vacuum gauge connected in step (f) or (g) above, respectively.

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6. SMARTboot™ Ice Detection System (S/N's 4636132 thru 4636313 only.)

A. Description

The optional pneumatic wing deice system, as installed in S/N's 4636132 thru 4636313 only, incorporates the B.F. Goodrich SMARTboot™ Ice Detection System. This system advises the pilot of icing conditions on the empennage of the airplane. Electrical sensors integrated directly into the surface of the pneumatic de-icers on the vertical fin and right horizontal stabilizer advise the presence of ice and appropriate time to de-ice.

NOTE: The system is installed as and performs only an advisory function.

The addition of the B.F. Goodrich SMARTboot™ Ice Detection System does not change the form, fit or function of the other approved de-icing systems installed in the Malibu Mirage.

36-inch electrical sensors are vulcanized directly into, and flush with, the surface ply of the pneumatic de-icer boots for the vertical fin and the right horizontal stabilizer. These sensors are located in the leading edge of the de-icer boots, are made from the same type of elastomeric material, and do not change the ice adhesion or the erosion resistance of the boots. Additionally, the sensors are flush with the surface of the de-icer boots and there is no change to airflow or icing characteristics of the leading edge surfaces.

All wiring from the sensor to the electrical connector is contained within the de-icer and routed through non-inflatable regions of the boot to the same location as the air connection for the de-icer to eliminate the need for any additional installation holes. Inside the wing, the wiring harness is again routed through the same space as the air lines.

The presence of ice and appropriate time to deice are measured by the sensor installed within the vertical fin deicer only. The sensor within the right horizontal stabilizer deicer advises the status of the detection system (ice detect fail annunciator).

These annunciators located within the annunciator panel make up the visual cues of the deice detector / deicer system. The "select de-ice" annunciator illuminates when approximately 1/4 inch of ice has accumulated on the sensor located on the vertical fin. The surface de-ice annunciator will illuminate to advise the pilot of proper boot inflation. The ice detect fail annunciator will illuminate when a fault is detected in the ice detection system.

To conduct a self test of the system while on the ground turn the battery master switch on. This will supply power to the system for a complete system self test. During the self test, the select de-ice and the ice detect fail annunciators will flash momentarily in sequence, activate all at once, and then extinguish.

The green "select De-ice" annunciator is activated when the ice thickness reaches approximately 1/4 inch or greater over the surface of the sensor in the vertical fin boot. When this occurs, the pilot may choose to inflate the deice boots by pressing the "surface de-ice" switch or choose to wait until more ice forms on the wings.

If the ice is removed from the empennage following inflation, the "select De-ice" annunciator will extinguish. If less than 90% of the ice cap located over the sensor within the right horizontal deicer has been removed, the "select De-ice" annunciator will remain illuminated. If a fault should develop with either the sensor or controller, the amber "ice detect fail" annunciator will illuminate.

Because the sensors are installed in the empennage and the smaller radius surfaces there tend to accumulate ice faster, the "select De-ice" annunciator will occasionally illuminate before the main wing has accumulated 1/4 to 1/2 inch thickness of ice.

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B. Verification

NOTE: This test can be performed without engine operation.

- (1) Pull ICE DETECTOR circuit breaker.
- (2) Disconnect the OAT sensor located in the vertical fin fairing. Install a 90 ohm ($\pm 5\%$) resistor across pins A and B of the connector of the 3E3176-1 wire harness. Install a wire between pins B and C so that they are common.
- (3) Activate the system circuit breaker and check the operation through the cockpit annunciator panel.

NOTE: Following activation of the system circuit breaker, the amber SELECT DE-ICE and amber ICE DETECT FAIL annunciators will flash momentarily in sequence, activate all at once, and then extinguish as the controller performs its self-check.

- (4) Push the annunciator test switch and verify that the amber SELECT DE-ICE, amber ICE DETECT FAIL, and the green SURFACE DE-ICE lights illuminate.
- (5) Align the five wires of the 3E3302-1 test strip over the five sensors in the vertical fin boot and tape in place or thoroughly saturate two cloths (small dish towel size) with tap water and place over the vertical fin sensor.
- (6) The amber SELECT DE-ICE light should illuminate.

NOTE: The amber SELECT DE-ICE light may take approximately ten minutes to illuminate while the controller steps through the ice thickness measurement functions. Make sure the wet cloths remain in contact with the sensor and remain saturated or the 3E3302-1 test strip wires remain aligned with the fin boot sensor wires.

- (7) Disconnect connector J1 from the controller box. Be careful not to disconnect connector J2 from the controller box. The amber ICE DETECT FAIL light should begin flashing immediately.
- (8) Reconnect the J1 connector. Remove the resistor and shunt wire from the 3E3181-1 connector, reattach the OAT sensor. Deactivate and reset the system circuit breaker. The amber ICE DETECT FAIL light should extinguish.
- (9) Remove the wet cloths or 3E3302-1 test strip from the vertical fin.
- (10) Return the airplane's wiring, de-ice plumbing, and panels to original configuration.

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PITOT AND STATIC

Heated Pitot Head

A. Description.

The standard pitot ice protection consists of a heated pitot head located on the lower side of the left wing, a switch on the De-ice Switch Panel (S/N's 4636001 thru 4636131 only) or Environmental / Deice Switch Panel (S/N's 4636132 and up), a 10-amp circuit breaker, a relay and the circuit wiring.

B. Removal, Installation and Testing.

See 34-10-00.

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WINDOWS AND WINDSHIELDS

Heated Windshield (See Figure 1.)

When installed, the heated windshield consists of an electrically heated left windshield. Circuit protection is provided by the windshield heat CONTROL and POWER breakers in the ICE PROTECTION section of the pilot's circuit breaker panel.

A. Troubleshooting

See Chart 1.

B. Testing

CAUTION: AMBIENT TEMPERATURE OF WINDSHIELD MUST BE BELOW 115° F.

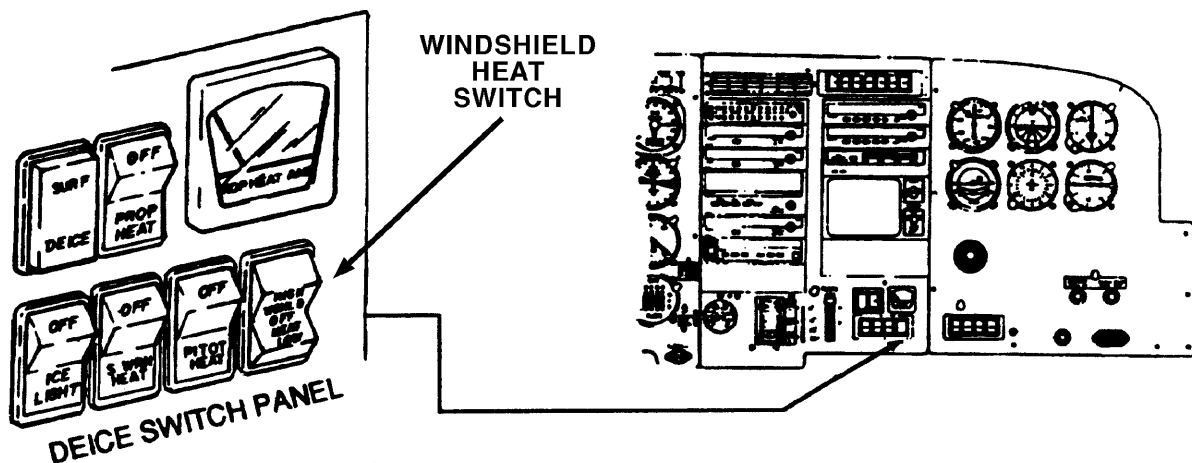
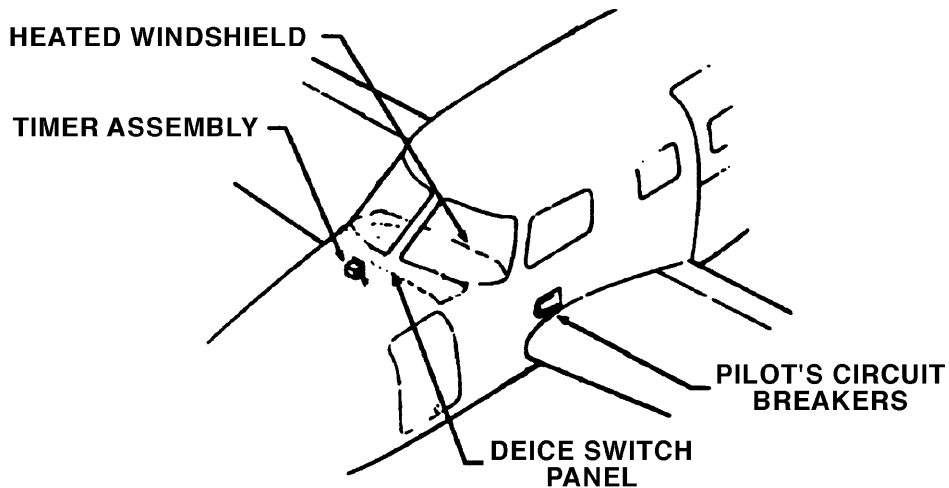
CAUTION: DO NOT ALLOW HEATED WINDSHIELD TO BE ON HIGH POSITION FOR MORE THAN 20 SECONDS FOR TESTING OR GROUND OPERATION. HEAT DISTORTION OF THE WINDSHIELD COULD RESULT.

- (1) With engine running at 1,500 rpm (or, at idle for S/N's 4636001 thru 4636020 only), battery master ON, and one alternator ON: position windshield heat switch to LOW. The ammeter should indicate an increase.
- (2) Position windshield heat switch to HIGH. The ammeter should indicate an additional increase.
- (3) If heated windshield does not perform as indicated, see Chart 1.

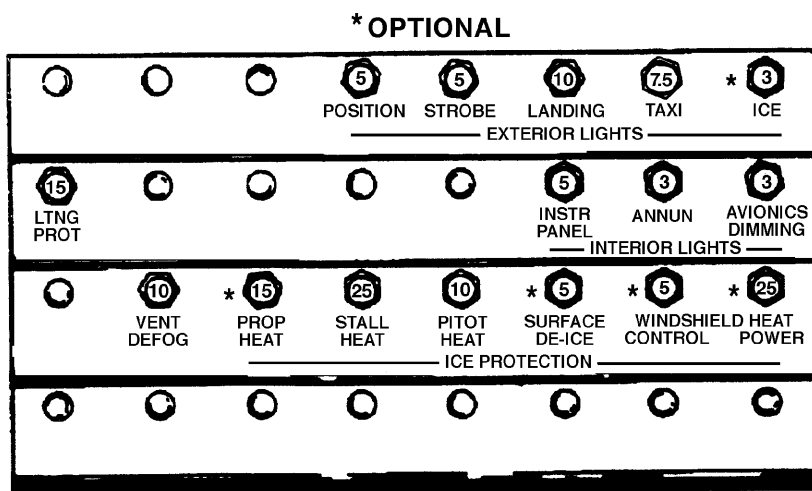
**CHART 1
TROUBLESHOOTING HEATED WINDSHIELD SYSTEM**

Trouble	Cause	Remedy
Windshield fails to heat or no change between LOW and HIGH position	Circuit breaker tripped	Reset circuit breaker.
	Relay failure	Replace relay.
	Controller failure	Replace controller.
	Broken wire in harness.	Repair broken wire.
	Cannon plug loose or dirty.	Clean and re-engage cannon plug.
	Switch defective.	Replace switch.
	Poor connection on terminal strip.	Tighten screws on terminal strip in console.
CAUTION: SEVERE OVERHEATING OF WINDSHIELD COULD RESULT IN WARPING AND DISTORTION.		
Windshield overheats	Timer shorted.	Replace timer-temperature control.
	Windshield heat left on too long.	Manually turn windshield heat off.

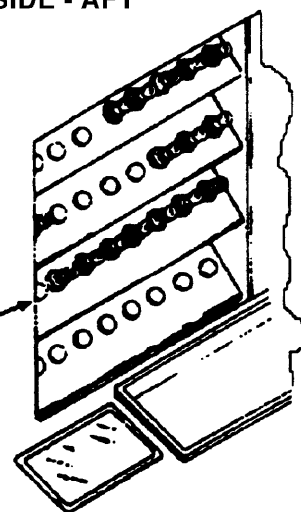
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CIRCUIT BREAKERS - PILOT SIDE - AFT



AFT PANEL



[Effectivity](#)
4636021 thru 46360131 shown

Windshield Heat
Figure 1

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PROPELLERS

1. Propeller Heat System

A. Description and Operation

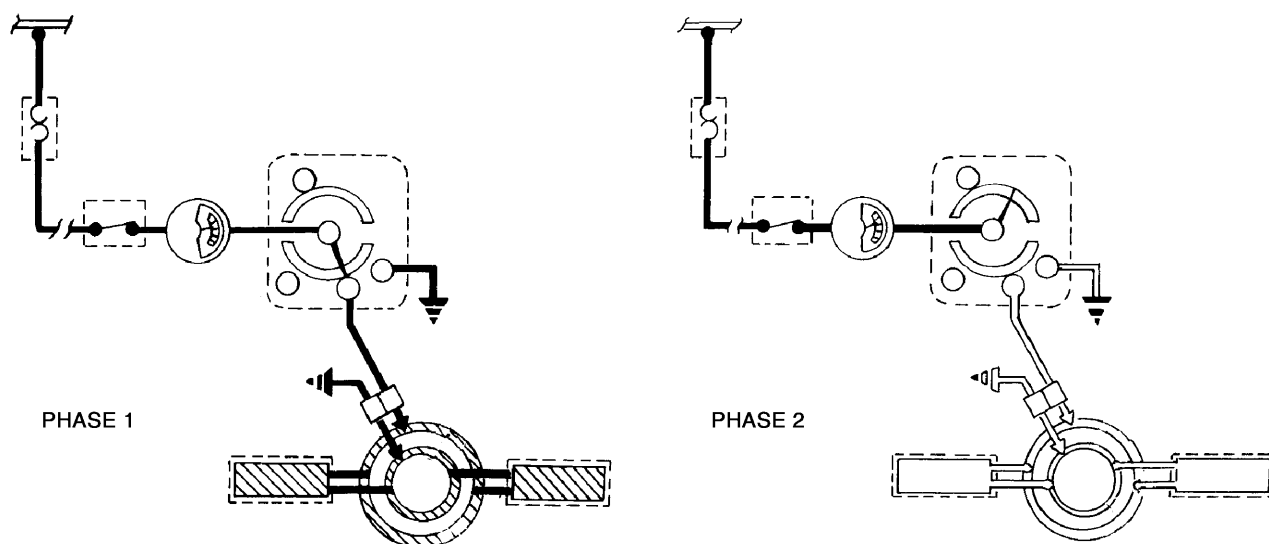
The Goodrich Corporation propeller heat system installed on this airplane uses single element deice boots. In this system each deicer has one electrothermal heating element. When the PROP HEAT switch is turned ON, the timer directs power through the modular brush assembly and slip ring to all the heating elements on the propeller for approximately 90 seconds. The timer then switches power off for approximately 90 seconds (see Figure 1 and 91-30-60). This cycle will continue as long as the PROP HEAT switch is in the ON position **except in S/N's 4636132 and up**.

In S/N's 4636132 and up, the PROP HEAT system employs a Moritz timer and a squat switch relay to create a ground test mode which interrupts power to the boots after an initial 30-45 seconds as long as the squat switch indicates weight on the wheels. During the 30-45 second test cycle, the PROP HEAT switch will flash at a fast rate and the ship's ammeter will show an increase. In flight, the PROP HEAT switch flashes at a slow rate during the 90 second off cycle and is continuously illuminated during the 90 second ON cycle.

The propeller heat system consists of the following:

In S/N's 4636001 thru 4636131: electrically heated deicers bonded to the propeller blades; slip ring assemblies connected to the propeller hub to distribute power to the propeller deicers; a modular brush assembly which transfers electrical power to the rotating slip rings; a timer to cycle power to the deicers; a propeller heat ammeter to indicate that the system is functioning correctly; an external ammeter shunt, a manual ON-OFF switch; and a circuit breaker.

In S/N's 4636132 and up: electrically heated deicers bonded to the propeller blades; slip ring assemblies connected to the propeller hub to distribute power to the propeller deicers; a modular brush assembly which transfers electrical power to the rotating slip rings; when equipped with the optional composite 3-blade propeller only - a metal oxide varistor (MOV) module to protect the propeller; a timer to cycle power to the deicers; an LED equipped manual ON-OFF switch; a circuit breaker; and a squat switch relay.



Prop Heat Cycle Sequence
Figure 1

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CHART 1 (Sheet 1 of 4)
TROUBLESHOOTING PROPELLER HEAT SYSTEM

Trouble	Cause	Remedy
Ammeter shows zero current both phases of the timer 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 or switch faulty.	If no voltage at C/ B output with voltage at input and C/B does not reset, replace C/B. If voltage is OK at output, check switch in same manner. If voltage is OK at switch output, go to next step.
	Ammeter faulty. (If either or both deicers heat with ammeter at zero, replace the ammeter.)	Test for voltage up to and out of ammeter. If low 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 after one minute, 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 in contact of brush to slip ring.

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**CHART 1 (Sheet 2 of 4)
TROUBLESHOOTING PROPELLER HEAT SYSTEM**

Trouble	Cause	Remedy
Ammeter shows normal current part of cycle, low current rest of cycle.	Open or high resistance in deicer or slip ring leads.	Disconnect deicer leads to check resistance. If not OK, replace faulty deicer. If satisfactory, locate and fix open in slip ring leads. Check deicer wire harness leads for continuity. Ohmmeter needle must not flicker when leads are stretched or flexed. Replace as required.
	High resistance in circuit with low current.	Check for contact of brush to slip ring. Check wiring from timer to deicers for loose or corroded connections and partially broken wiring. Correct as required.
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 output and input satisfactory, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
Ammeter shows excess current over entire cycle.	High resistance up to timer.	Check for partially broken wire, loose or corroded connection in wiring from aircraft supply to timer input.
	Ammeter faulty.	Test for voltage up to and out of ammeter. If low output / input satisfactory, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
Ammeter shows excess current over entire cycle.	Ground between ammeter and timer.	Disconnect harness at timer. Use ohmmeter to check Pin B (of harness) to ground. If ground indicated, locate and correct.

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**CHART 1 (Sheet 3 of 4)
TROUBLESHOOTING PROPELLER HEAT 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 is indicated, locate and correct.
	Ground between brush block and deicers.	If no short exists at brush - slip ring contact, check for ground from slip ring lead to propeller assembly while flexing slip ring and deicer leads. If a ground is indicated, locate and correct.
	Short between two adjacent circuits.	Check for cuts or low resistance between circuits. If any, locate and correct.
	Timer faulty.	Test timer.
Ammeter does not "flick" approximately every 90 seconds.	Timer ground open, timer not cycling.	Disconnect harness at timer and check with ohmmeter from Pin G (of harness) to ground. If no circuit, fix open per schematic diagram.
	Timer contacts are welded (caused by short circuit in system).	Test timer. If timer does not cycle with voltage at Pin B, replace timer but be sure short causing original failure has been located and corrected.
Ammeter flicks between 90 second phase periods.	Loose connection between aircraft power supply and timer input.	Trace wiring from power source to timer input to insure that the electrical contacts at each connection in the circuit are good.
	Loose or poor connection timer to deicers.	If trouble occurs in part of cycle, find which deicer is affected and check for rough or dirty slip rings causing brush to "skip." Also, check for loose or poor connection. (If both deicers are affected, check ground circuit.)
	Timer cycles erratically.	Test timer.

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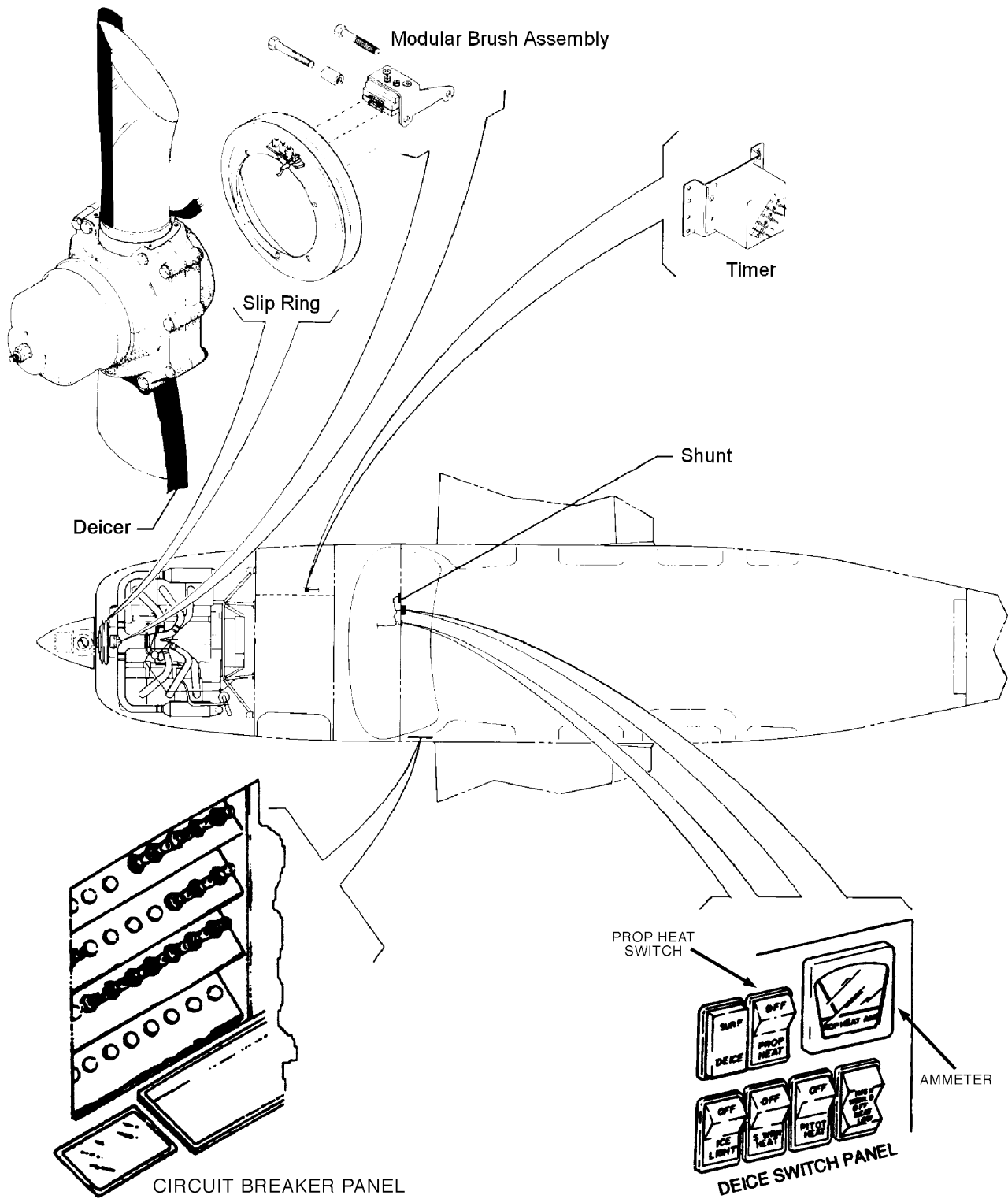
**CHART 1 (Sheet 4 of 4)
TROUBLESHOOTING PROPELLER HEAT SYSTEM**

Trouble	Cause	Remedy
Radio noise or interference with deicers on.	Brushes "arcing."	Check brush alignment as shown in Figures 3 and 5. Look for rough or dirty slip rings. If either condition exists, clean, machine or replace slip ring assembly, as required. Check slip ring alignment.
	Loose connection.	Refer to "Ammeter flicks between 90 second phase period."
	Switch or circuit breaker faulty.	Place jumper wire across switch or circuit breaker. If radio noise disappears, replace the switch or circuit breaker.
	Wiring located too close to radio equipment or associated wiring.	Relocate deicer wiring at least 8 inches away from radio equipment and wiring.
Rapid brush wear or frequent breakage.	Brush block out of alignment.	Check brush alignment. Correct as required.
	Slip ring wobbles.	Check slip ring alignment with dial indicator as shown in Figure 5.

B. Troubleshooting

See Chart 1. See also Testing, below.

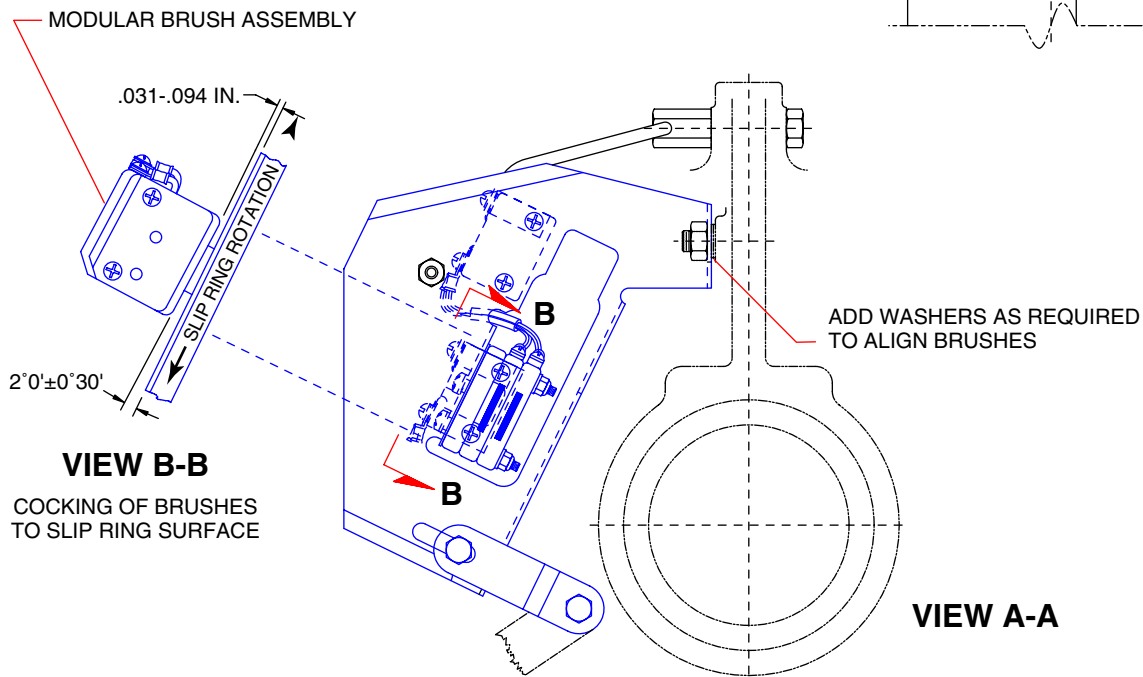
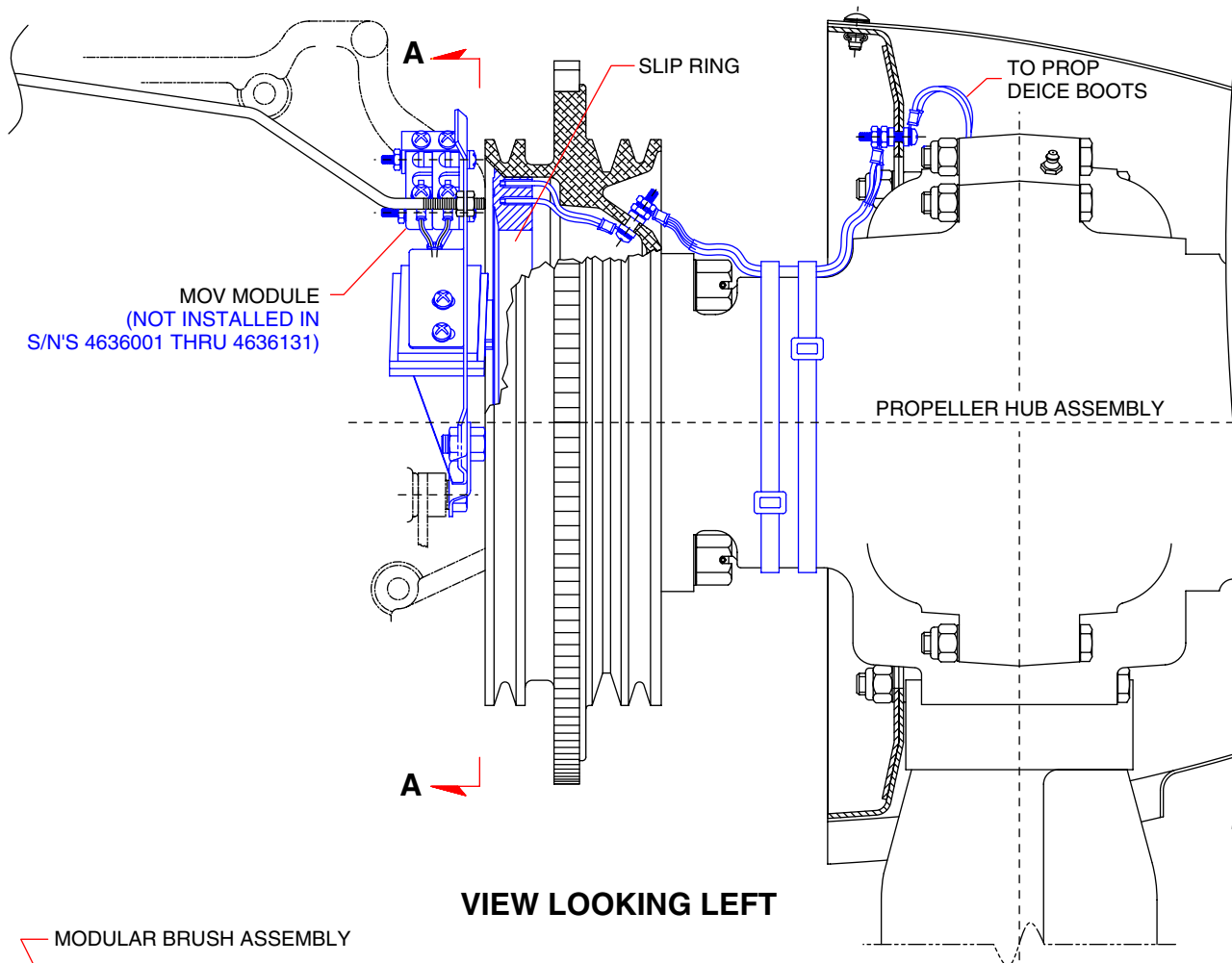
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Propeller Heat System Installation
Figure 2

[Effectivity](#)
4636001 thru 4636131 shown

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Modular Brush Assembly Alignment
Figure 3

101124A

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2. Components

NOTE: Do not attempt internal repairs of the timer, ammeter or switch. If inoperative, these components must be replaced. For any other repair or maintenance problems not covered herein, inquire at De-Icing & Specialty Systems Division of the Goodrich Corporation.

A. Deicers (i.e. - Heater Boots)

WARNING: CEMENTS AND SOLVENTS USED TO REMOVE AND INSTALL DEICERS ARE EXTREMELY FLAMMABLE AND TOXIC. EXTINGUISH OPEN FLAMES. AVOID SPARKS. USE IN WELL-VENTILATED AREA. AVOID SKIN CONTACT AND/OR PROLONGED BREATHING OF VAPORS. CONSULT MSDS FOR ADDITIONAL SAFETY INFO.

CAUTION: PROPELLER DEICER REPAIR IS LIMITED TO REFURBISHMENT OF EDGE SEALER. SEE LATEST REVISION OF HARTZELL MANUAL NO. 133 (61-13-33 - ALUMINUM BLADES) OR HARTZELL MANUAL NO. 135 (61-13-35 - COMPOSITE BLADES), AS APPROPRIATE.

GOODRICH PROPELLER DE-ICERS ARE NOT REPAIRABLE. DEICER SURFACE DAMAGE, SUCH AS PUNCTURES, CUTS, SCUFFS, EROSION, THAT EXPOSES THE WIRE OR ETCHED ELEMENT IS GROUNDS FOR REPLACEMENT, AS ADDITION OF REPAIR MATERIAL COULD AFFECT DEICER PERFORMANCE.

CAUTION: DISPOSE OF UNUSED MEK AND OTHER CHEMICALS AND SOLVENTS IN A MANNER CONSISTENT WITH LOCAL LAWS AND/OR ENVIRONMENTAL PROTECTION AGENCY REGULATIONS.

(1) Inspection and Testing

See Inspections, below, and Testing, below.

If tests or inspection show the deicer to have an open circuit, to be the wrong resistance or it has visible damage, remove it and install a new deicer.

NOTE: Replacement deicers may be ordered from the Goodrich Corporation.

(2) Removal and Installation

NOTE: The following applies to factory propeller installations only.

(a) For Two (2) Blade (Aluminum) Propeller Installations

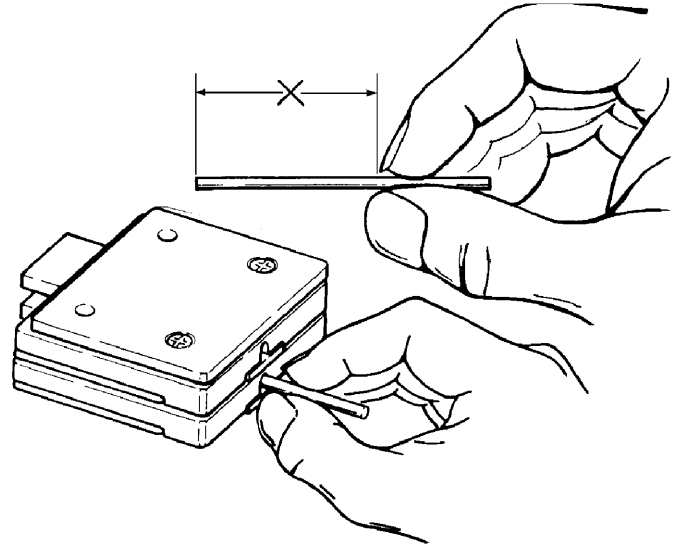
See latest revision of Hartzell Aluminum Blade Overhaul Manual, Manual No. 133 (61-13-33).

(b) For Three (3) Blade (Composite) Propeller Installations

See latest revision of Hartzell Maintenance Manual for Composite Propeller Blades, Manual No. 135 (61-13-35).

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During measurement only 1/16th inch of brush should be allowed to protrude from brush block. This is the normal position of the brush when installed on the aircraft.



Modular Brush Assemblies	X Dimension Must Replace
Modules having brushes with rods	23/64 IN.
Modules having brushes without rods	1 25/64 IN.

Measuring Brush Assemblies
Figure 4

B. Brush Modules

(1) Replacement

Brush wear may be measured as shown in Figure 4. The X - dimension given (in inches) indicates when the brushes must be replaced.

NOTE: Brushes are not offered individually as replacements. When a brush wears out, the module containing it should be replaced.

- Remove the modular brush assembly from the aircraft, by removing the attachment hardware, and disconnecting the engine wire harness.
- Remove assembly screws and separate modules and spacers.

NOTE: The part number of each module is etched into the surface of the plastic housing; replace with the same part number module.

- Restack modules and spacer as shown in Figure 3.

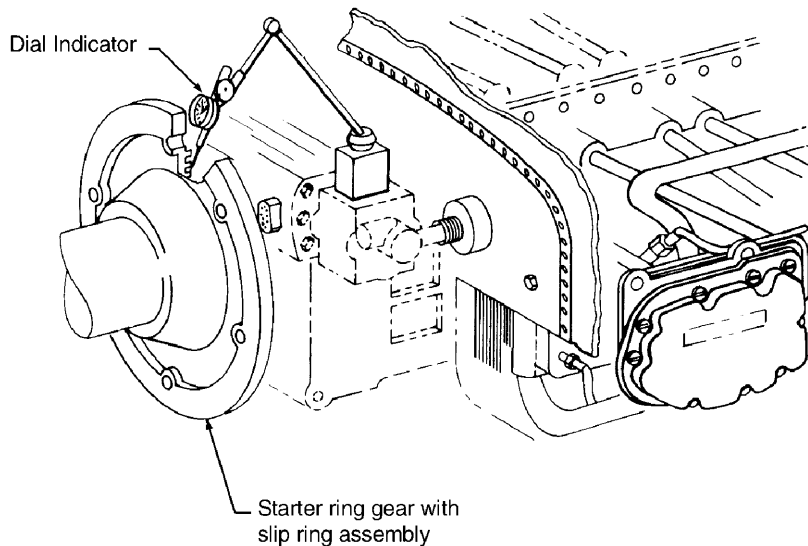
NOTE: Ascertain flat washer is positioned between star washer and housing.

- Reconnect aircraft wire harness and ensure adjacent ring terminals are not touching.
- Install assembly on aircraft and check adjustment.

(2) Alignment

Any time the brush block assembly is removed or replaced, alignment at reinstallation must be checked as described under Inspections, below, and as shown in Figure 3.

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Suggested Use of Dial Indicator
Figure 5

C. Metal Oxide Varistor (MOV) Module (See Figure 3.) ([S/N's 4636132 and up.](#))

The MOV module must be replaced in the event of a lightning strike.

- (1) Disconnect electrical leads, noting their relative position to facilitate reconnection. Loosen and remove screws holding module in position. Remove module.
- (2) Position new module, place screws in position, tighten. Connect electrical leads.

D. Slip Ring Assembly

(1) Replacement

Slip ring assemblies that are open or shorted electrically, cracked or damaged structurally, or which have damaged surfaces beyond the scope of minor repair or clean up, should be replaced.

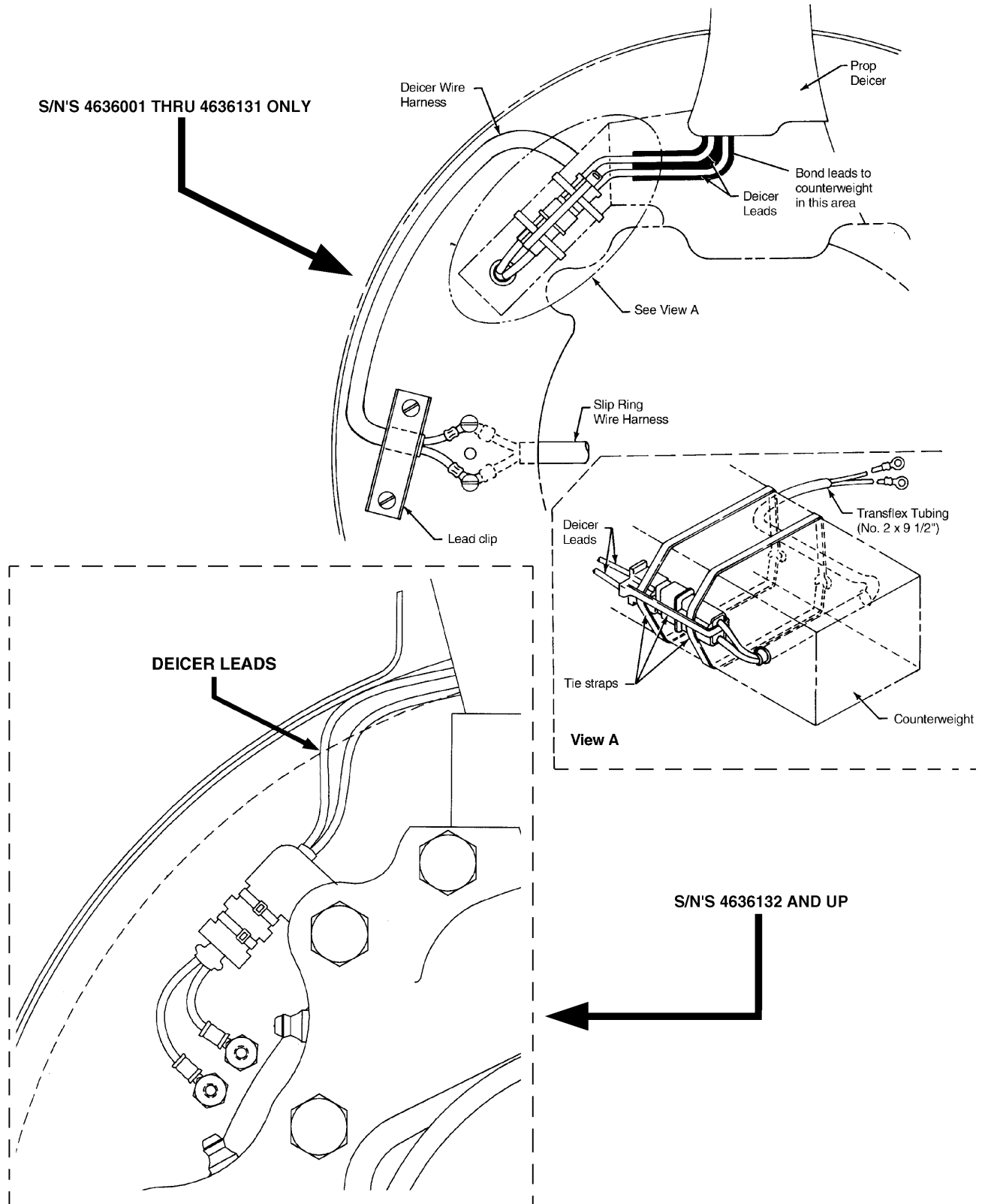
(2) Alignment

Excessive slip ring run-out will result in severe arcing between the slip ring and brushes and will cause rapid brush wear. If the run-out is not corrected, rapid deterioration of the slip ring and brush contact surfaces will result and lead to eventual failure of the heating system. Check the slip ring run-out with a dial indicator securely attached to the engine with the pointer resting on the slip ring. (See Figure 5.) Rotate the propeller slowly noting the run-out indicated on the gauge. The total run-out must not exceed 0.005 inch $\pm$ 0.0025 inch and 0.002 inch in any 4 inch interval of slip ring travel.

NOTE: Some error may be induced in the readings by pushing in or pulling out on the propeller. Care must be taken to exert a uniform push or pull.

Small amounts of run-out may be corrected by varying the torque on the slip ring mounting bolts between 40 to 100 inch-pounds to obtain the required flatness.

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Deicer Wiring Harness Installation
Figure 6

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E. Deicer (Heater Boot) Wiring Harness

The propeller deicer wiring harness is secured to the propeller counterweight as follows:

- (1) Insert the deicer wire harness thru the 9/32 IN. diameter hole in the prop counterweight.
- (2) Connect the plugs of the prop deicers and the deicer wire harness as shown in Figure 6.
- (3) Install tie strap (P/N MS3367-1-9) between the leads along the length of the plugs. Do not tighten at this time.
- (4) Install both tie straps (P/N MS3367-2-9) under the tie strap installed in the previous step and around the counterweight. Do not tighten at this time.
- (5) Install transflex tubing over deicer wire harness.
- (6) Route transflex tubing under both tie straps (P/N MS3367-2-9) and tighten tie straps.
- (7) Tighten the tie strap around the plugs.
- (8) Install the terminals on the deicer wire harness.
- (9) Install the terminals of the harness to the screws on the spinner bulkhead and tighten the lead clip over the harness.
- (10) To assure balance of the propeller assembly, the original balancing weights or their equivalents must be reinstalled. The weights must be left in the original position on the propeller hub. The restrainer and weights should not interfere with any part of the propeller assembly under any condition. If for any reason balance weights were removed, reinstall safety wire on screws. The deicer wire harness must be installed on the propeller as just described.

3. Testing

A. Resistance Test

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 deicer resistances individually. Individual deicer 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.

B. Ammeter

(1) Using the Ammeter

Whether in flight or during ground testing, the ammeter can be used to indicate the general nature of most electrical problems. The troubleshooting chart is primarily based on the use of the ammeter and assumes that the user does understand all normal operating modes of the system.

NOTE: When troubleshooting, first use the "ammeter test," below, and "heat test" (see Inspections - 50 Hour) to determine which circuits are involved. Use circuit diagram for assistance to check voltages or continuity.

- (a) 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.
- (b) A considerable number of timers that have been returned for repair proved to be fully workable when tested. Accomplish the test described under "BFG Timer," below, before concluding that the timer is defective.
- (c) Defective wiring in propeller mounted components may be indicated by normal current readings in ground checkouts (propeller not rotating) but low current with propeller rotating at cruise RPM.

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**CHART 2
DEICER ELECTRICAL RESISTANCE**

	Maximum	Minimum
Two (2) Blade Propeller		
Single Blade	4.90	4.70
Both Blades in Parallel	2.45	2.35
Three (3) Blade Propeller		
Single Blade	4.56	4.12
All Blades in Parallel	1.52	1.37

- (2) Ammeter Test
- (a) Check ammeter by connecting calibrated test ammeter or volt-ohmmeter with ammeter scale, into de-icing system circuit between bus bar and system ammeter. Activate system and check amperage reading on test ammeter. Reading should agree with reading on system ammeter. Deactivate system and remove test ammeter or volt-ohmmeter. If readings are different, and deicing system operates satisfactorily, replace system ammeter.
 - (b) If the timer and ammeter tests are satisfactory, circuit breaker and switch are functioning correctly. If testing is unsatisfactory, and timer and ammeter check out satisfactorily, repair or replace circuit breaker and/or switch.
- C. Propeller Deicers (i.e. - Heater Boots)
- (1) Final Electrical Check
- (a) Verify that deicers are installed so that blades can be moved throughout the entire blade pitch range without placing deicer leads or straps under tension. Make certain that all terminals are tight. Do not over torque.
 - (b) Check the electrical resistance between terminals or between the slip rings. The reading should be per Chart 2.
- (2) Functional Check
- (a) **S/N's 4636001 thru 4636131 only:**
 - CAUTION: DO NOT OPERATE PROPELLER HEAT EQUIPMENT WITH ENGINE NOT RUNNING FOR MORE THAN 30 SECONDS.**
 - 1 Lock brakes, with engine operating at 2,000 rpm, turn PROP HEAT switch ON.
 - 2 De-ice ammeter shall indicate in the green range (8 to 12 amps). Cycle time is 90 seconds ON and 90 seconds OFF.
 - 3 Turn PROP HEAT switch OFF. Turn engine OFF.

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(b) **S/N's 4636132 and up:**

- 1 Lock brakes, with engine operating at 2,000 rpm, and one alternator ON, turn PROP HEAT switch ON.
- 2 Verify that the green PROP HEAT switch flashes rapidly for 30 seconds, indicating the deicer is in the ON cycle. After approximately 30-45 seconds, the flash rate should reduce, indicating the deicer is in the OFF cycle. The switch will continue to flash at the reduced rate as long as the airplane remains on the ground or until the PROP HEAT switch is deselected. Verify that the PROP DE-ICE FAIL annunciator does not illuminate.
- 3 Verify that the ship's total amperage (LH and RH combined) shows an increase of approximately 15 amps with the 3-bladed propeller, or 10 amps with the 2-bladed propeller, when the PROP HEAT is cycled ON.
- 4 Turn PROP HEAT switch OFF. Turn engine OFF.
- 5 Test PROP DE-ICE FAIL annunciator as specified in Chapter 31.

D. BFG Timer (**S/N's 4636001 thru 4636131 only.**)

Field experience indicates that too often the timer is considered at fault when the true trouble lies elsewhere. Before removing a timer as defective, perform this test:

- (1) Disconnect wire harness at timer and, with PROP HEAT switch ON, check voltage from Pin B of harness plug to ground. If system voltage is not present, the fault is not in the timer. If system voltage is present at Pin B, check ground circuit using ohmmeter from Pin G to ground. If no circuit is shown, the fault is in ground lead, not in timer. If ground connection is open, the timer step switch will not change position.
- (2) When power and ground circuits have been checked, connect a jumper wire from Pin B of harness to B contact of timer socket to power timer. Connect a jumper wire from Pin G of harness to G contact of timer socket to complete the power circuit. Now use voltmeter from ground to the timer socket and check that timer is cycling to deliver system voltage to the C contact. Voltage must be delivered for approximately 90 seconds.
- (3) 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.

4. Inspections

A. 50 Hour

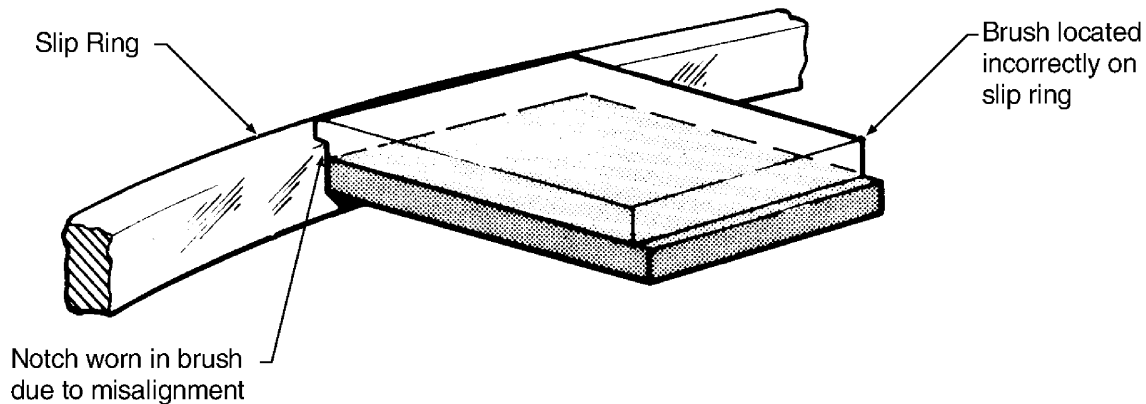
(1) **S/N's 4636001 thru 4636131 only:**

- (a) Lock brakes and operate engine at near takeoff power. Turn PROP HEAT 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 90 seconds, as the step switch of the timer operates. Any movement of the needle other than the normal 90 second flicker indicates a short or open that must be located and corrected.
- (b) Perform "heat test" as follows: with engine stopped, turn PROP HEAT switch ON and feel deicer on propellers for proper sequence of deicer operation. The deicers should cycle ON for 90 seconds, then OFF for 90 seconds and repeat. Temperature rise should be noticeable and each deicer should warm for about 90 seconds. Local hot spots indicate surface damage of deicers requiring replacement of deicer.
- (c) Remove spinner dome and engine cowling. With assistant observing deicer ammeter and with PROP HEAT switch ON, flex all accessible wiring, particularly the deicer wire harness, leads from slip ring assembly and the firewall electrical connectors and their wiring. Any movement of the ammeter needle other than the "90 second flicker" of cycling indicates a short or open that must be located and corrected.

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- (2) S/N's 4636132 and up:
- (a) Lock brakes, with engine operating at 2,000 rpm, and one alternator ON, turn PROP HEAT switch ON.
 - (b) Verify that the green PROP HEAT switch flashes rapidly for 30 seconds, indicating the deicer is in the ON cycle. After approximately 30-45 seconds, the flash rate should reduce, indicating the deicer is in the OFF cycle. The switch will continue to flash at the reduced rate as long as the airplane remains on the ground or until the PROP HEAT switch is deselected. Verify that the PROP DE-ICE FAIL annunciator does not illuminate.
 - (c) Verify that the ship's total amperage (LH and RH combined) shows an increase of approximately 15 amps with the 3-bladed propeller, or 10 amps with the 2-bladed propeller, when the PROP HEAT is cycled ON.
 - (d) Turn PROP HEAT switch OFF. Turn engine OFF.
 - (e) Perform "heat test" as follows: with engine stopped, turn PROP HEAT switch ON and within 30 seconds feel deicer on propellers to verify ON cycle. Within 30-45 seconds of switching ON, the system will shut itself OFF - verify that this occurs. Temperature rise should be noticeable. Local hot spots indicate surface damage of deicers requiring replacement of deicer.
- B. 100 Hour
- (1) Remove cowling. Conduct appropriate 50 Hour Inspection, above.
 - (2) Check for radio noise or radio compass interference by operating the engine at near takeoff power with radio gear ON while turning PROP HEAT switch ON and OFF. If noise or interference occurs with PROP HEAT switch ON and disappears when switch is OFF, refer to troubleshooting chart.
 - (3) Ascertain that all clamps, clips, mountings and electrical connections are tight. Check for loose, broken or missing safety wire.
 - (4) Deicers: Closely check deicers for wrinkled, loose or torn areas, particularly around the outboard end. Check that terminals and terminal studs are not shorting out to each other or the propeller hub. Inspect wire harness for evidence of chafing or shorting. Ensure that all clamps and tie straps are properly installed. Look for abrasion or cuts, especially along the leading edge and the flat or thrust face. If deicer 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 (see Deicers (Propeller Deice System), below).
- NOTE:** Operate propeller from full low pitch (high RPM) to feathering and check that deicer lead wires do not come under tension or are pinched by propeller blade (refer to Figures 3 and 6).
- (5) Slip Rings: Check slip rings for gouges, roughened surface, cracks, burned or discolored areas, and for deposits of oil, grease or dirt.
- CAUTION:** DISPOSE OF UNUSED MEK AND OTHER CHEMICALS AND SOLVENTS IN A MANNER CONSISTENT WITH LOCAL LAWS AND/OR ENVIRONMENTAL PROTECTION AGENCY REGULATIONS.
- (a) Clean greasy or contaminated slip rings with CRC 2-26 solvent or with Stoddard solvent. If Stoddard solvent is used, wipe off with a clean cloth dampened with MEK to avoid leaving a film.
 - (b) If uneven wear is found or if wobble is noticed, set up a dial indicator as shown in Figure 5 and check alignment of the slip rings to the propeller shaft as explained in this section.

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Centering Brushes on Slip Rings
Figure 7

- (6) Modular Brush Assemblies - Brushes: Examine mounting brackets and housing for cracks, deformation or other physical damage.

- (a) Test that each brush rides fully on its slip ring over 360°. Figure 7 shows the wear pattern if this condition is not corrected. If alignment is off, shim where brush block is mounted to bracket or adjust mounting bracket support arm.

NOTE: The shim is a series of laminates and may be peeled for proper alignment of brushes to slip ring

- (b) Check for proper clearance of brush block to slip rings (see Figure 3). Loosen mounting screws and move in elongated holes to correct block position and tighten securely.
- (c) Visually check brush block for 2° angle of attack (see Figure 3). If not, loosen mounting screws and twist block, but be sure to hold clearance limits shown when tightening.

- 1 Note direction of slip ring rotation.
- 2 Place template against face of brush assembly.
- 3 Slide brush assembly and remove template.

- (7) System Wiring

Visually inspect wiring from brush blocks through firewall, to timer, to ammeter, to switch and to aircraft power supply for breaks or damage. In such case, check continuity through affected harness. Use the wiring diagram to trace circuitry.

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**GRIDS 3K12 THRU 3L24
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AIRPLANE MAINTENANCE MANUAL

CARD 4 OF 8

PA-46-350P



(S/N's 4636001 AND UP)

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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	June 19, 1996	All
PR980101	January 1, 1998	1, 2, 3, 4, 5, and 6
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PR000201	February 1, 2000	1, 2, 3, 4, 5, and 6
PR010515	May 15, 2001	1
CR050730	July 30, 2005	1, 2, 3, 4, 5, 6, 7 and 8
PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

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3. Effectivity

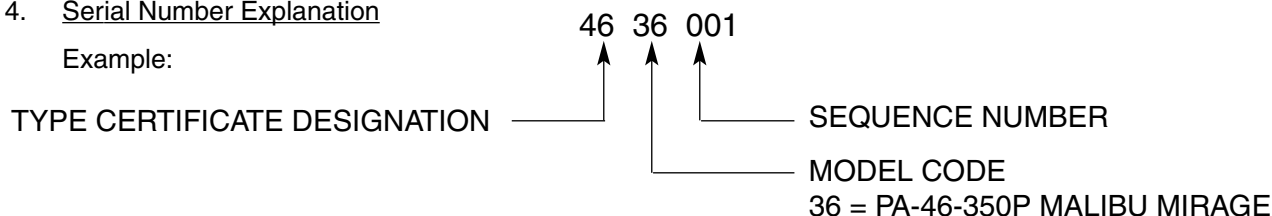
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or) S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

**(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP,
AND ALL HYDRAULIC COMPONENTS:**

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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5		TIME LIMITS/MAINTENANCE CHECKS	1C9
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	50	Unscheduled Maintenance Checks	
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7		LIFTING AND SHORING	1F1
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	20	Exterior Placards and Markings	
	30	Interior Placards and Markings	
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	20	Scheduled Servicing	

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	20	Painting	
21		ENVIRONMENTAL SYSTEMS	2C1
	00	General	
	20	Distribution	
	30	Pressurization Control	
	40	Heating	
	50	Cooling	
	60	Temperature Control	
22		AUTOFLIGHT	2F11
	10	Autopilot	
23		COMMUNICATIONS	2G19
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	50	Audio Integrating	
	60	Static Discharging	
24		ELECTRICAL POWER	2H11
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	30	DC Generation	
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25		EQUIPMENT/FURNISHINGS	2I23
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51		STRUCTURES	5F1
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CHAPTER

31

INDICATING / RECORDING SYSTEMS

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CENTRAL WARNING SYSTEMS

1. Annunciator

The annunciator panel is located in the upper center section of the instrument panel and consists of a group of warning lights as follows: (shown with optional equipment).

ALTERNATOR NO. 1 INOP	When either alternator fails or is selected OFF, the appropriate
ALTERNATOR NO. 2 INOP	annunciator light will illuminate.
ANNUNCIATOR INOP	Illuminates if the annunciator fail relay switch is faulty and/or the ANNUN circuit breaker trips.
BOOST PUMP	Illuminates when the fuel boost pump in the tank being used fails to generate sufficient pressure. In normal operation, will also illuminate briefly when switching tanks. Neither BOOST PUMP will function when the fuel selector is set to OFF or is positioned between the LEFT and RIGHT detents.
CABIN ALTITUDE	Illuminates if cabin pressure altitude exceeds 10,000 feet.
DOOR AJAR	Illuminates if either the forward baggage door or the cabin door is not closed and latched.
FLAPS	Illuminates when the flap motor protection circuit breaker trips.
FUEL PRESS	Illuminates when the engine-driven fuel pump fails to generate sufficient pressure.
FUEL IMBALANCE	S/N's 4636021 and up. Illuminates if a fuel quantity difference of greater than 10 gallons is detected for more than 60 seconds between the left and right tanks. Remains lighted until the imbalance is corrected.
GEAR WARN	On the ground - illuminates when the landing gear selector is placed in the UP position with the aircraft weight still on the gear. In the air - illuminates when the gear is in transit; when all three gear are not fully down and locked, or when the gear is not fully UP but the gear doors are closed; when the throttle is reduced below 14 inches of manifold pressure and the landing gear are not in the DOWN position; or if the flaps are extended more than 10° and the landing gear are not in the DOWN position.
HYDRAULIC PUMP	Indicates the hydraulic pump is being supplied with electrical power. Normally illuminated only during landing gear operation.
ICE DETECT FAIL	S/N's 4636132 thru 4636313 only. Illuminates if a fault develops in either the ice detection sensor or controller.
LOW BUS VOLTAGE	Illuminates when system voltage drops below 25 ± 0.3 Vdc. Normally on when just the airplane's battery or an external 28 Vdc battery is used for electrical power.
OIL PRESS	Illuminates if oil pressure is below 24 PSI. As oil pressure drops, there may be as much as an 8 PSI lag (dead band) before the light comes on.
OXYGEN	Illuminates whenever one of the oxygen generators has been activated. Remains lighted until the expended oxygen generator(s) is/are replaced.

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PITOT HEAT OFF/INOP	S/N's 4636021 thru 4636374. Self-explanatory.
L PITOT HEAT R PITOT HEAT	S/N's 4636375 and up. Illuminates when the appropriate pitot system fails.
PROP DE-ICE FAIL	S/N's 4636132 and up only. Illuminates if a fault develops in the PROP HEAT system.
SELECT DE-ICE	S/N's 4636132 thru 4636313 only. Illuminates when the SMARTboot™ Ice Detection system calculates the ice buildup on the vertical fin boot in excess of 1/4 inch. Will remain illuminated until at least 90% of the ice cap has been removed from the right horizontal stabilizer boot. This annunciator is advisory only.
STALL WARN FAIL	Illuminates if the lift computer fails and/or the STALL WARN circuit breaker trips.
STARTER ENGAGE	Illumination during engine cranking is normal. Illumination at any other time indicates a problem.
SURFACE DE-ICE	Illuminates when the de-ice boots inflate, i.e. - when the SURFACE DE-ICE switch is depressed and the pneumatic de-ice system cycles in sequence: tail, lower wing, upper wing.
VACUUM NO. 1 INOP VACUUM NO. 2 INOP	S/N's 4636021 and up. If either vacuum pump fails, the appropriate annunciator light will illuminate.
WINDSHIELD HEAT FAIL	Illuminates when an overtemperature condition exists or the windshield temperature sensor fails. In normal operation, may also illuminate briefly when switching from HIGH to LOW windshield heat.

2. Annunciator Removal and Installation

See 33-10-00.

3. Lamp Replacement

See 33-10-00.

4. Wiring

See 33-10-00 and 91-31-50.

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ALTERNATOR NO. 1 INOP	BOOST PUMP	FUEL PRESS	LOW BUS VOLTAGE	CABIN ALTITUDE	STALL WARN FAIL
ALTERNATOR NO. 2 INOP	GEAR WARN	DOOR AJAR	FLAPS	STARTER ENGAGE	WINDSHIELD HEAT FAIL
OXYGEN	—————	OIL PRESS	HYDRAULIC PUMP	SURFACE DE-ICE	ANNUNCIATOR INOP

Annunciator Panel
Figure 1

[Effectivity
4636001 thru 4636020](#)

VACUUM NO. 1 INOP	VACUUM NO. 2 INOP	—————	—————	—————	FUEL IMBALANCE
ALTERNATOR NO. 1 INOP	BOOST PUMP	FUEL PRESS	LOW BUS VOLTAGE	CABIN ALTITUDE	STALL WARN FAIL
ALTERNATOR NO. 2 INOP	GEAR WARN	DOOR AJAR	FLAPS	STARTER ENGAGE	WINDSHIELD HEAT FAIL
OXYGEN	PITOT HEAT OFF / INOP	OIL PRESS	HYDRAULIC PUMP	SURFACE DE-ICE	ANNUNCIATOR INOP

Annunciator Panel
Figure 2

[Effectivity
4636021 thru 4636131](#)

VACUUM NO. 1 INOP	VACUUM NO. 2 INOP	OIL PRESS	HYDRAULIC PUMP	PITOT HEAT OFF / INOP	FUEL IMBALANCE
ALTERNATOR NO. 1 INOP	BOOST PUMP	FUEL PRESS	LOW BUS VOLTAGE	CABIN ALTITUDE	STALL WARN FAIL
ALTERNATOR NO. 2 INOP	GEAR WARN	DOOR AJAR	FLAPS	STARTER ENGAGE	WINDSHIELD HEAT FAIL
PROP DE-ICE FAIL	OXYGEN	SELECT DE-ICE	ANNUNCIATOR INOP	ICE DETECT FAIL	SURFACE DE-ICE

Annunciator Panel
Figure 3

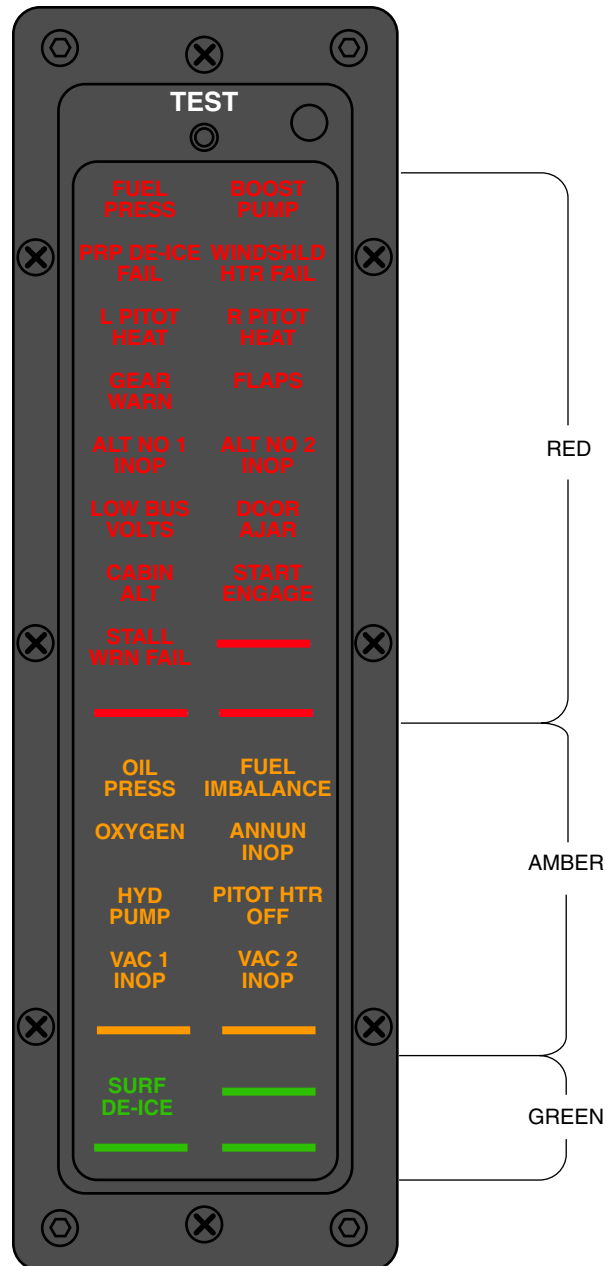
[Effectivity
4636132 thru 4636313,
less 4636299](#)

VACUUM NO 1 INOP	VACUUM NO 2 INOP	OIL PRESS	HYDRALIC PUMP	PITOT HEAT OFF/INOP	FUEL IMABLANCE
ALTERNATOR NO 1 INOP	BOOST PUMP	FUEL PRESS	LOW BUS VOLTAGE	CABIN ALTITUDE	STALL WARN FAIL
ALTERNATOR NO 2 INOP	GEAR WARN	DOOR AJAR	FLAPS	STARTER ENGAGE	WINDSHIELD HEAT FAIL
PROP DE-ICE FAIL	OXYGEN	—————	ANNUNC INOP	—————	SURFACE DE-ICE

Annunciator Panel
Figure 4

[Effectivity
4636314 thru 4636374,
and 4636299](#)

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[Effectivity](#)
4636375 and up

Annunciator Panel
Figure 5

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CHAPTER

32

LANDING GEAR

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GENERAL

This chapter provides instructions for the overhaul, inspection and adjustment of the various components of the landing gear and brake systems. Also included are adjustments for the electrical limit, safety and warning switches.

1. Description and Operation

This airplane is equipped with a retractable tricycle air-oil strut type landing gear which is hydraulically operated by an electric hydraulic pump. A selector handle or switch on the instrument panel to the left of the control quadrant is used to select gear UP or DOWN positions.

Gear positions are indicated by a display of three green lights (for gear down and locked) located above the gear selector and a red warning light (for gear-in-transit or gear-unsafe conditions) in annunciator panel. There is no separate light to indicate that all gears are fully retracted other than all gear lights being out.

The landing gear swings to the down position and each actuator extends to its locked position, a switch located on each actuator activates to indicate by a green light that the individual gear is safely down and locked. When the gear begins to retract and the hydraulic actuators unlock, the down limit switch actuates to the NC circuit and, in series with the NC circuit of the up limit switch, allows the gear unsafe light to come on. The gear unsafe light will remain on until the gear is up and all up limit switches are actuated to their normally open (NO) circuit.

A gear warning horn will sound when power is decreased to 15 ± 1 In. Hg. manifold pressure unless all three gears are down. This horn will also sound if the flaps are extended beyond approach position if the gears are not down and locked.

The red gear unsafe light also operates simultaneously with the warning horn. Their primary purpose is to give warning when power is reduced below 15 ± 1 In. Hg. manifold pressure and the landing gear has not reached the down and locked position. This circuit is controlled by three (3) paralleling down limit switches connected in series with a throttle switch located in the control quadrant (see 91-32-60 for electrical schematic).

Each landing gear is retracted and extended by a single hydraulic locking cylinder attached to the oleo strut housing. As the gears retract, doors enclose each gear through mechanical linkage. The gears are held in their up position by hydraulic pressure on the cylinder.

A hydraulic system modification and power pak upgrade provides a modification to the hydraulic power pak electrical system which will, under certain conditions, bypass the low pressure switch in the event the switch fails to operate.

The gear system has a free fall secondary extension system which consists of a valve that is controlled from the panel. A down spring is incorporated in the nose gear to overcome air loads resisting gear extension.

The nose gear is steerable through a 60 degree arc by use of the rudder pedals. As the gear retracts, the steering linkage becomes separated from the gear so that rudder pedal action with the gear retracted is not impeded by the nose gear operation. The nose gear rotates 90° to stow in the horizontal position underneath the luggage compartment floor. A steering bungee is also incorporated in the nose wheel steering mechanism.

The main wheels are equipped with dual piston, single-slotted disc hydraulic brakes.

The parking brake is set by depressing both toe brakes and setting a push-pull valve lock on the instrument panel.

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2. Special Tools

These tools are used at the factory and are recommended where rigging, alignment, or installation procedures specify "use a suitable tool." Order them through any Piper Dealer.

Tool (Tool Number)	Piper P/N
Rudder Pedal Neutral Alignment Tool (HF 622724)	762-151
Nose Wheel Centering (i.e. - Neutral) Tool (HF 622722)	762-147
Nose Gear Steering Bellcrank Centering (i.e. - Neutral) Tool (TL 622723)	762-148
Nose Gear Steering Horn / Arm Gap Tool (TL 690672)	N/A
Nose Gear Actuator Alignment Tool (TL 690672)	762-137
Nose Gear Downspring Disassembly/Reassembly Tool (SK VB1152)	762-155
Nose Gear Downspring Remove/Install Tool (SK VB1153) (See also 32-30-00, Figure 3.)	762-157
Control Wheel Neutral Tool (HF 622725)	N/A

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MAIN GEAR AND DOORS

1. Troubleshooting

See Chart 1.

2. Main Gear Oleo

A. Disassembly

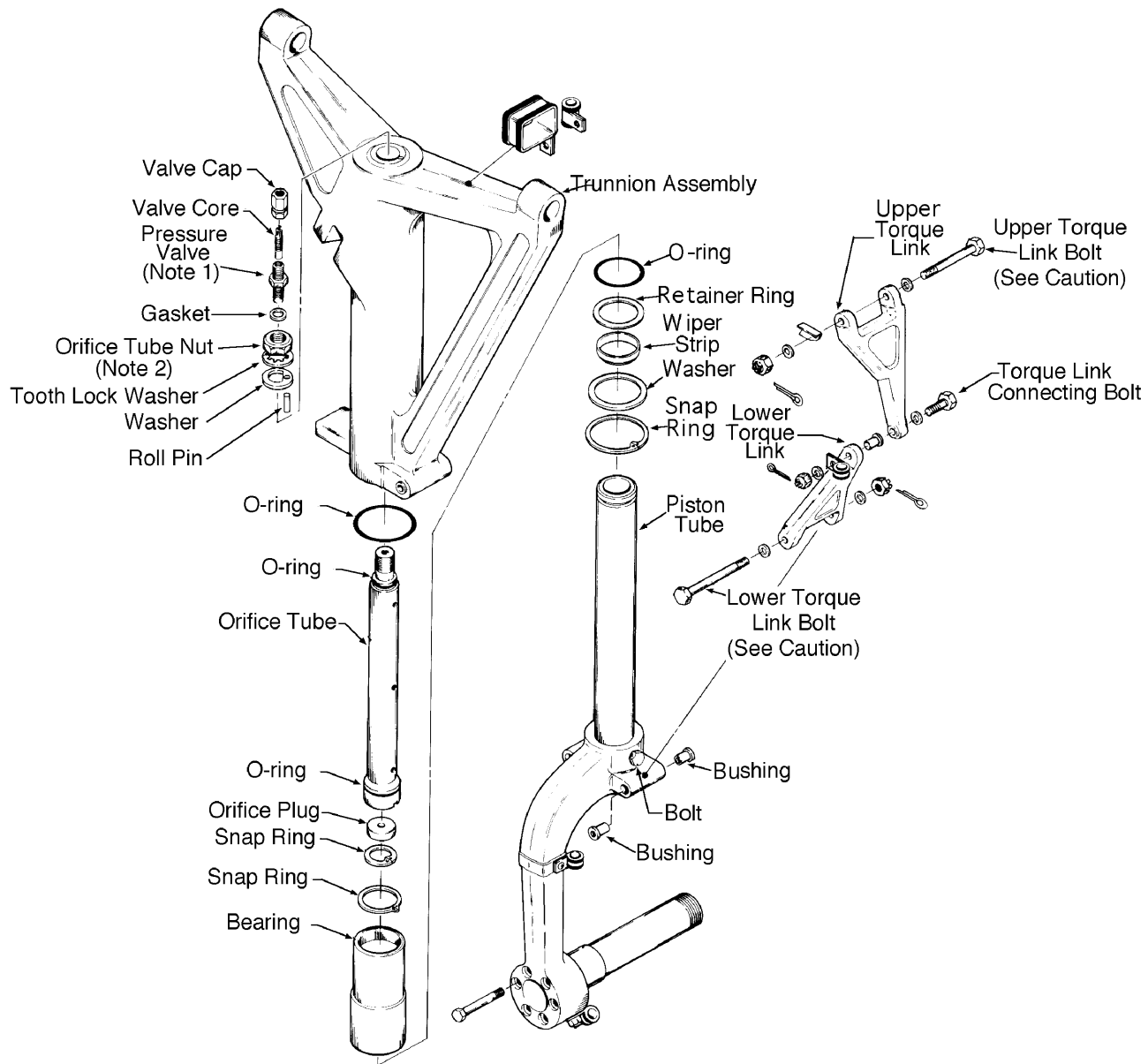
The main gear oleo assembly may be removed from the gear oleo housing and disassembled with the gear removed from or installed in the airplane.

- (1) Place airplane on jacks (refer to 7-10-00).
- (2) Place a drip pan under the main gear to catch spillage.
- (3) Remove air and fluid from the oleo. Depress the air valve core pin to reduce strut pressure. Remove the filler plug. With a thin hose, siphon as much hydraulic fluid from the strut as possible.

**CHART 1
TROUBLESHOOTING MAIN LANDING GEAR**

Trouble	Cause	Remedy
Main landing gear shimmies during fast taxi, takeoff, or landing.	Tire out of balance.	Check balance and replace tire if necessary.
	Worn or loose wheel bearings.	Replace and/or adjust wheel bearings.
	Worn torque link bolts and / or bushings.	Replace bolts and/or bushings.
Excessive or uneven wear on main tires.	Incorrect operating pressure.	Inflate tire to correct pressure.
	Wheel out of alignment (toe in or out).	Check wheel alignment.
	Hydraulic actuator out of adjustment, allowing gear to slant in or out. (There is no adjustment on the extended length - adjust for retracted position only).	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.
Landing gear doors fail to completely close.	Landing gear not retracting completely.	Check adjustment of gear.
	Door retraction mechanism out of adjustment.	Check adjustment.

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CAUTION BE CERTAIN TO INSTALL BOLTS
IN CORRECT DIRECTION TO
PREVENT DAMAGE TO DOOR.

- NOTE:**
1. Apply Parker thread lube #6PB to threads of air valve upon installation.
 2. Torque from 53 to 55 inch-pounds.
 3. Apply Loctite 290 after pressing bushing on torque link.

Main Gear Oleo Strut Assembly
Figure 1

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- (4) Disconnect brake line at the joint located in the wheel well. Disconnect brake line retaining clamp that attaches the brake line to the upper part of the strut housing.
 - (5) To remove the piston tube assembly from the oleo housing, remove the bolt that connects the upper and lower torque link. Note the number and thickness of spacer washer(s) between the two links.
 - (6) Compress the piston tube. Reach up into the lower end of the oleo housing and release the snap ring from the annular slot at the bottom of the oleo housing.
 - (7) Pull the piston tube with its component parts from the cylinder housing.
 - (8) The piston tube components may be removed by removing the retainer ring from the top of the piston tube. Slide the bearing assembly (with its inner O-ring and ring), wiper strip and washer over the top of the piston tube.
 - (9) To remove the piston tube plug, located at the bottom of the piston tube assembly, remove the bolt and insert a rod into the hole in the bottom of the fork and push the plug out of the top of the piston tube.
 - (10) To remove the orifice tube, remove the orifice tube locknut, washer, lock washer and roll pin from the top of the orifice tube (at the top of the trunnion). Slide the orifice tube from the trunnion.
 - (11) The orifice tube plug may be removed by removing the snap ring from the slot at the bottom of the orifice tube.
- B. Assembly
- (1) Determine that all parts are cleaned and inspected.
 - (2) To install the piston tube plug, first lubricate the plug O-ring with hydraulic fluid and install it on the plug. Lubricate the inside wall of the piston tube. Insert the plug into the top of the piston tube and push it down the tube. Align the bolt holes of the fork, tube and plug. Then install the bolt assembly.
 - (3) 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.
 - (4) To assemble components of orifice tube, insert the orifice plate into the bottom of the tube and secure it with the snap ring. Install piston tube ring in slot on outer diameter of lower section of orifice tube.
 - (5) To install the orifice tube in the oleo housing, install upper O-ring on orifice tube and insert the tube up through the housing. With the end of the tube exposed through the top of the housing, install the washer, lock washer, roll pin and locknut. Tighten the locknut only finger tight at this time.
 - (6) Assemble components of piston tube on the tube by installing in order, snap ring, washer, wiper ring, bearing assembly (with outer O-ring and inner O-ring/ring) and retainer ring.
 - (7) Lubricate the wall of the cylinder oleo housing and piston tube. Carefully insert the piston tube assembly into the housing, guiding the orifice tube into the piston tube. Slide the washer and wiper strip into position and secure the assembly with the snap ring in the lower part of the trunnion.
 - (8) Torque the locknut at the top of the orifice tube from 530 to 550 inch-pounds.
 - (9) Insure that the bushings are installed in the torque links. Bolt the links together making sure that there is the same thickness of spacer washers between the links as previously removed (to maintain wheel alignment). Tighten the bolt tight enough to allow no side play in the links but still be free enough to rotate.
 - (10) Connect brake line and bleed brakes.

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- (11) Lubricate gear assembly (refer to Lubrication Chart 3, 12-20-00).
- (12) 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.
- (13) Service the oleo strut with fluid and air (refer to Oleo Struts, 12-10-00).
- (14) Check main gear alignment (refer to Alignment of Main Landing Gear) and gear operation.
- (15) Ascertain that gear is down and locked.
- (16) Remove the airplane from the jacks.

C. Cleaning, Inspection, and Repair

- (1) Clean all parts with a suitable dry type cleaning solvent.
- (2) Inspect landing gear oleo assembly components for the following:
 - (a) Bearings and bushings for excessive wear (refer to Main Gear Tolerance illustration for specifications), corrosion and overall damage.
 - (b) Snap rings for cracks, burrs, etc.
 - (c) Cylinder and orifice tube for corrosion, scratches, nicks and excessive wear.
 - (d) Orifice plate for hole restriction.
 - (e) Fork tube for corrosion, scratches, nicks, dents and misalignment.
 - (f) Air valve for general condition.
- (3) Repair of the oleo is limited to smoothing out minor scratches, nicks or dents and replacement of parts.

3. Main Gear Assembly

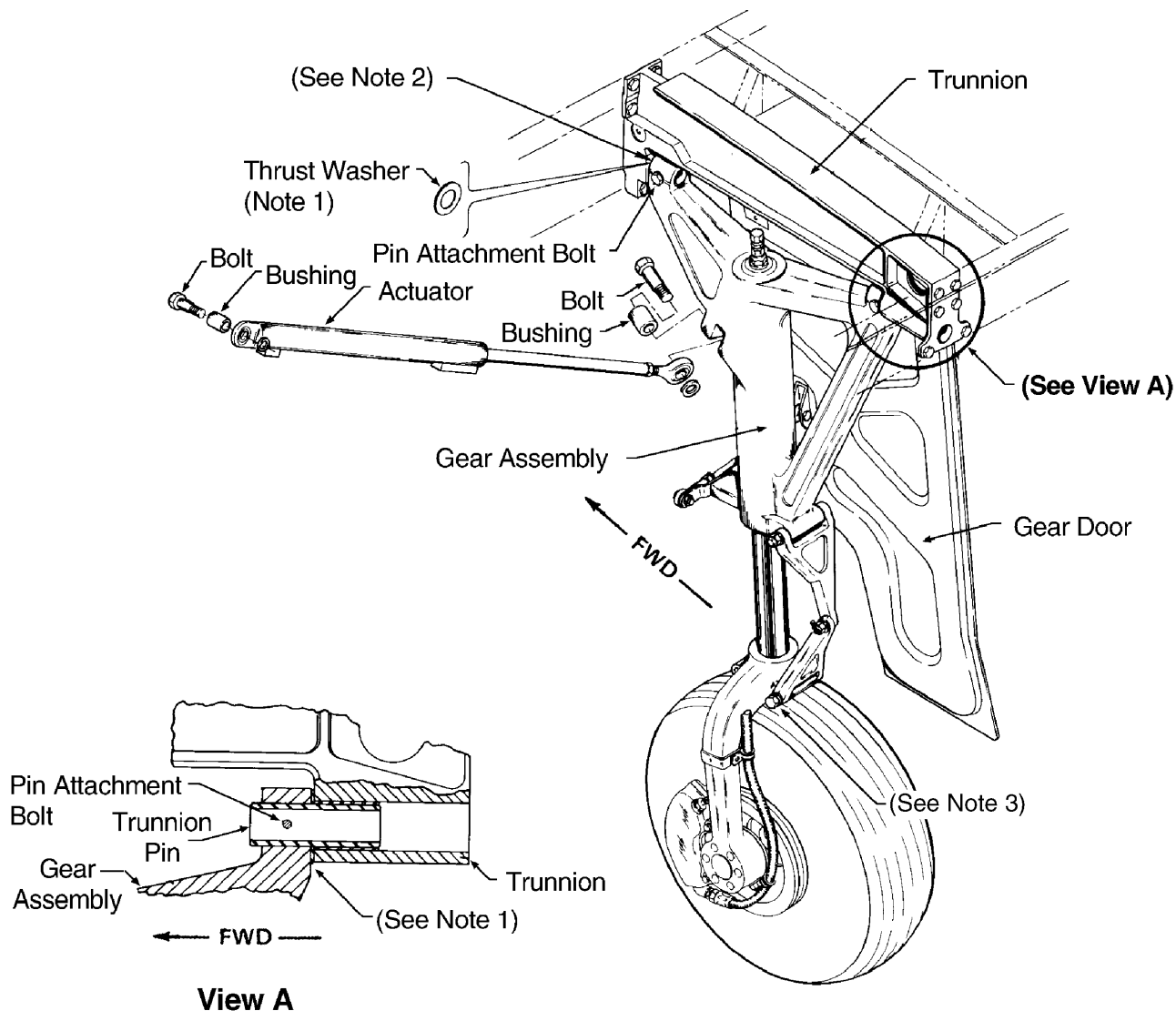
A. Removal

- (1) Place the airplane on jacks.
- (2) Disconnect locking actuator from strut housing.
- (3) Disconnect brake line at its upper end in the wheel well.
- (4) Disconnect gear door actuating rod at the gear housing.
- (5) Remove bolt which retains forward strut housing support to the forward trunnion pin.
- (6) Remove the forward trunnion pin by inserting a hook through the pin and drawing it towards the center of the gear assembly.

NOTE: When withdrawing the pin do not lose the teflon washer and note the amount of shims (if any) between the mating surfaces of the strut housing support and the support fitting.

- (7) Remove the bolt which retains the aft strut housing support to the aft trunnion pin.
- (8) Remove the aft trunnion pin by inserting a hook through the pin and drawing it towards the center of the gear assembly. Do not lose the teflon washer that was installed between the mating surfaces of the strut housing support and the support fitting.
- (9) Allow the gear to slowly drop from the wing.

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- NOTE:**
1. Install special thrust washers with the teflon surface towards the trunnion surfaces.
 2. If required, shim between the forward gear attachment and rear surface of the thrust washer to obtain trunnion end play of .002 to .004 inches.
 3. Add a maximum of one (1) each P/N 85012-133 and 85012-134 washers under head of lower torque link bolt to provide clearance between tail of bolt and main gear door during retraction, as required.

Main Gear Installation
Figure 2

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B. Installation

NOTE: When assembling components of the landing gear, lubricate bearings, bushings and friction surfaces with proper lubricant as described in 12-10-00.

(1) Install gear housing in the wheel well of the wing as follows:

(a) Place the gear up into the wheel well and align the holes in the strut support with the holes in the support fittings.

NOTE: Ensure that one teflon washer is installed between each mating surface of the strut support and the support fittings. The teflon surface of the washer should face away from the centerline of the gear assembly.

NOTE: Install any previously removed shims between the mating surfaces of the forward strut support and the support fittings. There should be 0.002 - 0.004 of trunnion end play.

(b) Rotate the trunnion pin until the hole in the pin aligns with the hole in the strut support.

(c) Insert bolt (bolt head should be inboard) through strut support and trunnion pin. Secure bolt with nut and washers.

(d) Repeat steps (b) and (c) for remaining trunnion pin and strut support.

(2) Attach the gear door actuating rod to the gear housing.

(3) Connect brake line at its upper end in the wheel well.

(4) Connect locking actuator to gear housing.

(5) Ensure that the landing gear is lubricated per Lubrication Chart 3, 12-20-00.

(6) Check the alignment of the wheel per instructions in Alignment, below.

(7) Remove the airplane from the jacks.

C. Cleaning, Inspection, and Repair

(1) Clean all parts in a suitable dry type cleaning solvent.

(2) Inspect the gear components for the following unfavorable conditions:

(a) Bolts, bearings and bushings for excessive wear, corrosion and damage.

(b) Gear housing, torque links and attachment plates for cracks, bends or misalignment.

(3) Check the general condition of each limit switch and its actuator. Check the electrical wiring for fraying, poor connections or conditions that may lead to failures.

(4) 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.

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D. Adjustment

- (1) Place the airplane on jacks.
- (2) Level the airplane laterally and longitudinally (refer to Leveling, 8-20-00).
- (3) Disconnect gear door actuating rod from the strut housing by removing the rod attachment bolt. Secure the door out of the way.
- (4) Disconnect the locking actuator from the strut housing.
- (5) Adjust the locking actuator to a nominal length of 24.08 inches with no load on the wheel. Attach locking actuator to strut housing.
- (6) Using the hydraulic pump, retract landing gear into wing well.

NOTE: This will require approximately 60 psi of pressure on the rod end part of the actuator to unlock the cylinder and allow the cylinder to retract.

- (7) Adjust the locking cylinder rod end so that the fork is lightly contacting the rubber pad when the actuator is fully retracted.
- (8) Inspect for adequate engagement of the rod end into the locking cylinder and tighten the check nut.
- (9) If the down lock limit switch is properly adjusted, retract and extend the gear hydro-electrically to ascertain that the gear operates properly.

E. Alignment (See Chart 2 and Figure 3.)

- (1) Place a straightedge no less than twelve feet long across the front of both main landing gear wheels. Butt the straightedge against the tire at the hub level of the landing gear wheels. Jack the airplane up just high enough to obtain a six and one-half inch dimension between the centerline of the strut piston and the centerline of the center pivot bolt of the gear torque links. Devise a support to hold the straightedge in this position.
- (2) Set a square against the straightedge and check to see if its outstanding leg bears on the front and rear side of the brake disc. (It may be necessary to remove the brake assembly to have clear access to the disc.) If it touches both forward and rear flanges, the landing gear is correctly aligned. The alignment for the main landing gear wheels is $0^{\circ} 15' \pm 5'$.

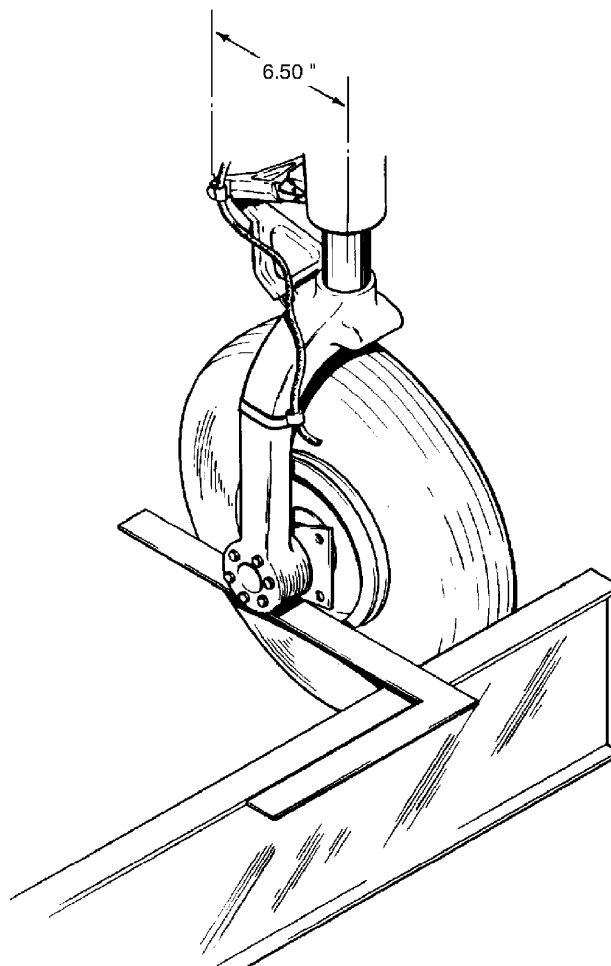
NOTE: A carpenter's square, because of its especially long legs, is recommended for checking main landing gear wheel alignment.

- (3) If the square contacts the rear side of the disc, leaving a gap between it and the front flange, the wheel is toed-out. If a gap appears at the rear flange, the wheel is toed-in.
- (4) To rectify the toe-in and toe-out condition, remove the bolt connecting the upper and lower torque links and remove or add spacer washers to move the wheel in the desired direction. See Chart 2.
- (5) Should a condition exist that all spacer washers have been removed and it is still necessary to move the wheel further in or out, then it will be necessary to turn the torque link assembly over. This will put the link connecting point on the opposite side allowing the use of spacers to go in the same direction.
- (6) Recheck wheel alignment. If the alignment is correct, safety the castellated nut with cotter pin.
- (7) If a new link on the top left main gear 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.
- (8) Check adjustment of landing gear safety switch (squat switch).

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**CHART 2
TOE-IN / TOE-OUT CORRECTION CHART**

TOE-IN TOE-OUT ANGLE	SHIM WASHERS	WASHERS UNDER HEAD	WASHERS UNDER NUT	AN174 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	-14
	AN960-416			
1 ° 04 '	AN960-416 (2)	AN960-416	AN960-416	-14
1 ° 19 '	AN960-416L	AN960-416L	AN960-416	-14
	AN960-416 (2)			
1 ° 35 '	AN960-416 (3)	AN960-416	AN960-416 (2)	-15
2 ° 05 '	AN960-416 (4)	AN960-416	AN960-416	-15
Max. Allow.				
AN960-416L Washers .031 Thick AN960-416 Washers .062 Thick				



Aligning Main Gear
Figure 3

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4. Main Gear Door Assembly

A. Removal

- (1) With the landing gear down, disconnect the door retraction rod from the door by removing the nut, washers and bolt.
- (2) Remove the door from the wing panel by cutting the safety wire on the two hinge pins and driving the pins from the hinges.

B. Installation

- (1) Position the door so that the hinges line up and insert the hinge pins. The pins should be installed with the safety wire holes towards the center line of the door.
- (2) Ensure that the ends of the pins which have the safety wire holes protrude approximately 1/4 inch from the hinges. Safety the pins to the wing with MS20995-C41 safety wire.
- (3) Attach the door retraction rod to the door with the previously removed bolt, washers and nut.

C. Cleaning, Inspection, and Repair

- (1) Clean the door and retraction rod with a suitable cleaning solvent.
- (2) Inspect the door for cracks or damage, loose or damaged hinges and brackets.
- (3) Inspect the door retraction rod and end bearing for damage and corrosion.

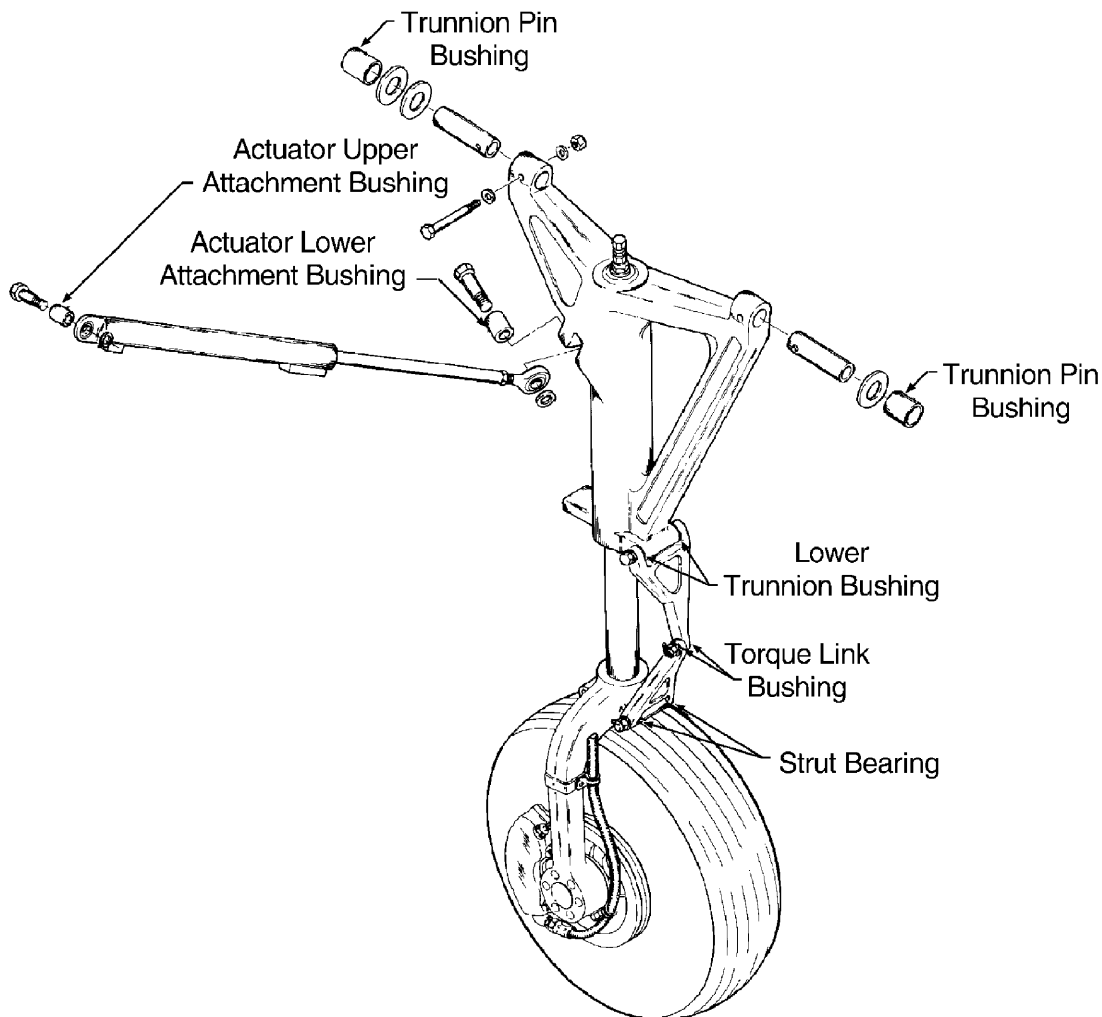
5. Main Gear Tolerances

See Chart 3 and Figure 4.

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**CHART 3
MAIN GEAR TOLERANCES**

Item	Part No.	New Dimension	Service Dimension	Service Tolerance	Notes
Lower Trunnion Bushing	FF411-4	.314 / .315			1 & 3
Strut Bearing	67026-7	.313 / .314			1 & 3
Torque Link Bushing	31796	.3760 / .3745			1
Upper Actuator Attachment Bushing	82695-59	.439 / .437			
Trunnion Pin Bushing	16DU24				
NOTE: 1. Line ream to the "new" dimension after installation of new part. 2. Install bearing with wet zinc chromate on adjacent surfaces of bearing and casting. 3. Press fit.					



Main Gear Tolerances
Figure 4

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NOSE GEAR AND DOORS

1. Troubleshooting

See Chart 1.

CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING NOSE LANDING GEAR

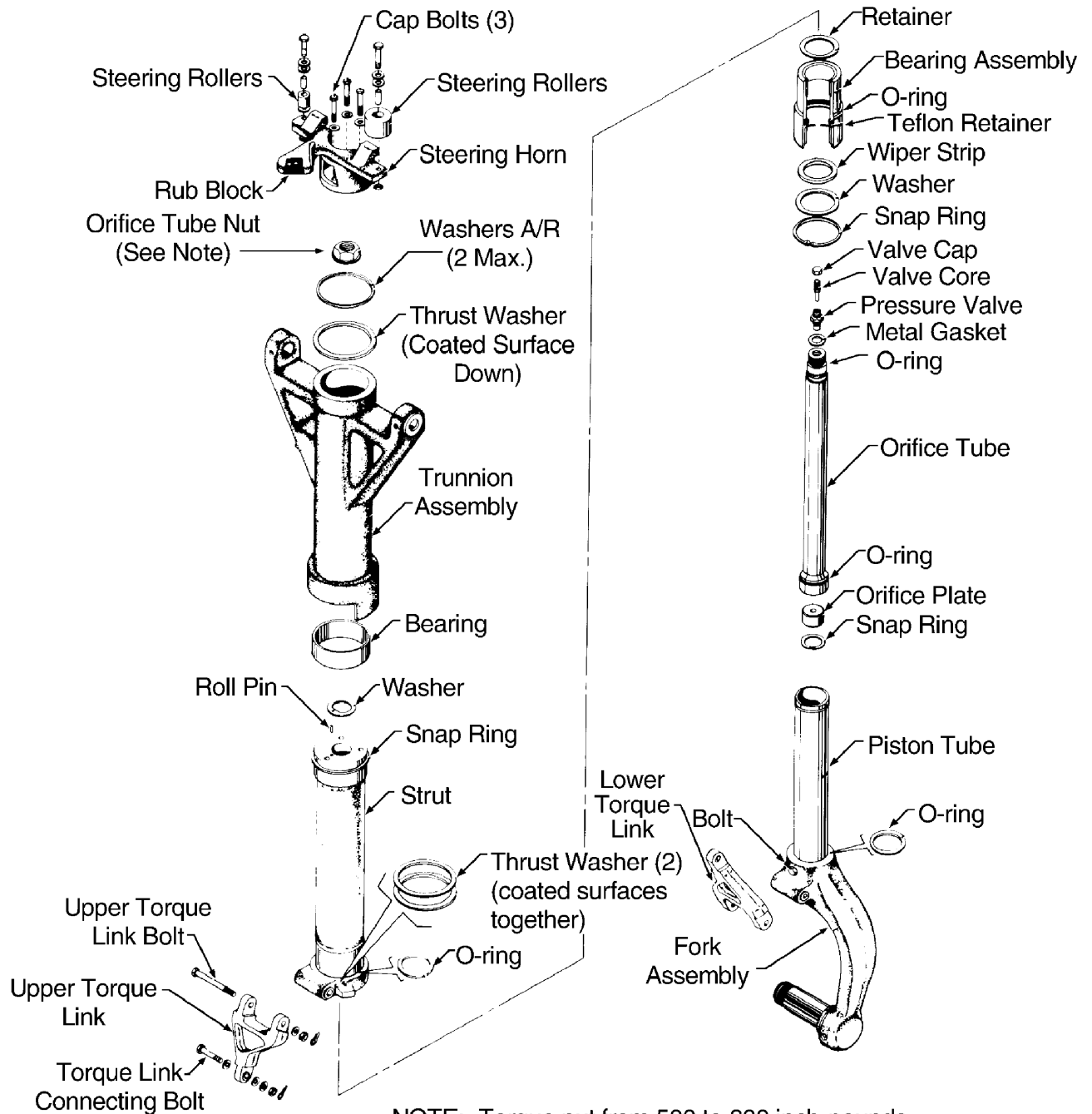
Trouble	Cause	Remedy
Nose landing gear shimmies during fast taxi, takeoff or landing.	Internal wear in bungee.	Replace bungee.
	Bungee loose at mounting.	Replace necessary parts and bolts.
	Tire out of balance.	Check balance and replace tire if necessary.
	Worn or loose wheel bearings.	Replace and/or 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 preceding "trouble" for correction.
Nose gear fails to steer properly.	Oleo cylinder binding in strut housing.	Lubricate strut housing (refer to 12-10-00).
	Cylinder and/or strut housing bushings damaged.	Determine cause and correct.
	One brake dragging.	Determine cause and correct.
	Rollers not engaged. (Metal to metal in Gear Down Position.)	Determine cause and correct.
	Steering bellcrank loose on	Readjust and tighten attachment plate.
	Steering bellcrank bearing and/or bolt worn.	Replace bearing and/or bolt.
	Bungee 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.

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**CHART 1 (Sheet 2 of 2)
TROUBLESHOOTING NOSE GEAR**

Trouble	Cause	Remedy
Nose gear fails to straighten when landing gear retracts.	Centering guide roller sheared.	Replace roller.
	Damaged guide.	Replace guide.
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.
Landing gear doors fail to completely close.	Landing gear not retracting completely.	Check adjustment of gear.
	Door retraction mechanism out of adjustment.	Check adjustment.

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NOTE: Torque nut from 500 to 600 inch-pounds.

Nose Gear Oleo Strut Assembly
Figure 1

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2. Nose Gear Oleo

A. Disassembly

The nose gear oleo assembly may be removed and disassembled from the gear oleo housing with the gear removed from or installed on the airplane.

- (1) Place the airplane on jacks. (refer to Jacking, 7-10-00).
- (2) Place a drip pan under the nose gear to catch spillage.
- (3) Remove air and oil from the oleo strut. Depress the air valve core pin until the strut chamber pressure has diminished, remove the filler plug and, with a small hose, siphon as much hydraulic fluid from the strut as possible.
- (4) To remove the complete strut and fork assembly from the oleo housing:
 - (a) Cut the safety wire on the three cap bolts that retain the steering arm to the strut. Remove the bolts.
 - (b) Remove the snap ring, thrust washer, and washers (if any) at the top of the strut housing.
 - (c) Pull the complete strut and fork assembly from the bottom of the housing.
- (5) To remove the piston tube and fork from the strut:
 - (a) Separate the upper and lower torque links by removing the link connecting bolt assembly. Separate the two links, noting the amount of spacer washers between the two links.
 - (b) Compress the piston tube. Reach up along the tube and release the snap ring from the annular slot at the bottom of the strut.
 - (c) Pull the piston tube with its component parts from the strut.
 - (d) The piston tube components may be removed from the piston tube by removing the retainer from the annular slot at the top of the piston tube.
 - (e) Slide the bearing assembly (with inner O-ring and teflon retainer), wiper ring, washer and snap ring off of the piston tube.
- (6) To remove the orifice tube:
 - (a) Remove the orifice tube retaining nut from the top of the strut assembly.
 - (b) Pull the orifice tube down and out of the strut.
 - (c) The orifice plate is removed from the bottom of the orifice tube by releasing the snap ring that holds the plate in position.
- (7) To remove the piston tube plug with O-ring:
 - (a) Remove the bolt assembly.
 - (b) Insert a rod up through the hole in the body of the fork.
 - (c) Push the plug out through the top of the tube.

B. Assembly

- (1) Ascertain that parts are cleaned and inspected.
- (2) To install the piston tube plug, first lubricate the tube plug and O-ring with hydraulic fluid (MIL-H-5606) and install the O-ring on the plug. Lubricate the inside wall of the tube, insert the plug into the top of the tube and push it to the fork end. Align the bolt holes of the fork, tube and plug and install the bolt assembly.
- (3) 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.

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- (4) To assemble the components of the orifice tube:
 - (a) Insert the orifice plate into the bottom of the tube, with the countersunk side of the hole in the orifice plate exposed.
 - (b) Secure the plate with the snap ring, lubricate and install the two O-rings on the tube (one at each end).
 - (5) Insert the orifice tube up through the bottom of the strut. With the threaded portion of the orifice tube exposed through the top of the strut, install the washer and insert a roll pin through the washer into the strut. Install the orifice tube nut finger tight at this time.
 - (6) The fork and piston tube assembly may be assembled by installing the tube components on the tube. In order, slide onto the tube the snap ring, washer, wiper ring, bearing assembly (with inner O-ring and teflon retainer). Reinstall the retainer in the annular slot in the top of the piston tube.
 - (7) Lubricate the inner wall of the strut with hydraulic fluid. Insert O-ring into bottom of strut. Carefully insert the piston tube assembly into the bottom of the strut, allowing the orifice tube to guide itself into the piston tube. Push the tube all the way up in the cylinder. Position wiper ring and install wiper ring, slide washer up into the strut and secure the assembly by placing the snap ring into the annular slot in the bottom of the strut.
 - (8) At the top of the strut, torque the orifice tube retaining nut as specified in Figure 1.
 - (9) Ascertain that bushings are installed in the upper and lower torque links and then install both links. Lubricate the torque link bolts and tighten them only tight enough to allow no side play in the links, yet still be free enough to rotate.
 - (10) Ensure that the two thrust washers (with their coated surfaces together) are installed in place on the lower portion of the strut immediately above the boss where the upper torque link attaches to the strut.
 - (11) Slide the strut assembly up into the trunnion. Ensure that a thrust washer (with its coated side down) is placed on top of the trunnion. Place the snap ring in its annular slot in the top of the strut.
 - (12) At the top of the oleo strut assembly install the steering arm to the top of the strut with the three cap bolts. Torque the bolts and safety them with 0.032 safety wire.
 - (13) Lubricate the gear assembly (refer to 12-20-00, Chart 4).
 - (14) Compress and extend the strut several times to ascertain that the strut will operate freely. Weight of the gear wheel and fork should allow the strut to extend.
 - (15) Service the oleo strut with fluid and air (refer to 12-10-00, Landing Gear Oleo Struts).
 - (16) Check nose gear for alignment (refer to Nose Gear Assembly - Alignment, below) and gear operation.
- C. Cleaning, Inspection, and Repair
- (1) Clean all parts with a suitable dry type cleaning solvent.
 - (2) Inspect the landing gear oleo assembly components for the following:
 - (a) Bearings and bushings for excess wear, corrosion, scratches and overall damage.
 - (b) Lock rings for cracks, burrs, etc.
 - (c) Cylinder and orifice tube for corrosion, scratches, nicks and excess wear.
 - (d) Bushing assembly for looseness or turning in cylinder.
 - (e) Orifice plate for hole restriction.
 - (f) Fork tube for corrosion, scratches, nicks, dents and misalignment.
 - (g) Air valve for general condition.
 - (3) Repair of the oleo is limited to smoothing out minor scratches, nicks and dents and replacement of parts.

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3. Nose Gear Assembly

A. Removal

- (1) Remove the engine cowling (refer to 71-10-00).
- (2) Place the airplane on jacks (refer to 7-10-00).
- (3) Retract the nose gear slightly to remove it from the down locked position.

WARNING: USE HOSE CLAMPS TO HOLD DOWN SPRING WITHIN THE CONFINES OF SPECIAL TOOL. DO NOT ATTEMPT TO RELEASE DOWN SPRING WITHOUT THE USE OF THE SPECIAL TOOL. THE DOWN SPRING ASSEMBLY IS SPRING LOADED AND WILL FLY APART.

- (4) Use the special tool to hold down spring at proper length for installation. Disconnect the actuator and emergency down spring mechanism from the right-hand side of the trunnion by removing the bolt, spacers and washers.
- (5) The landing gear may then be removed by removing the nuts, washers and bolts that attach the gear trunnion to the attachment points on each side of the engine mount.

B. Installation

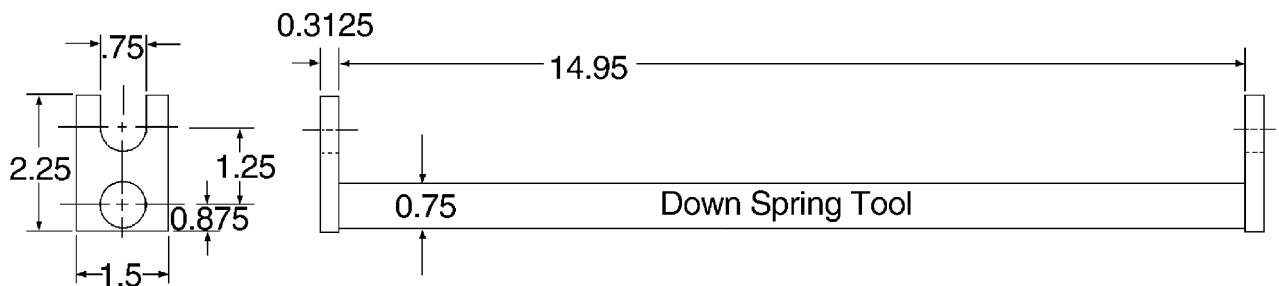
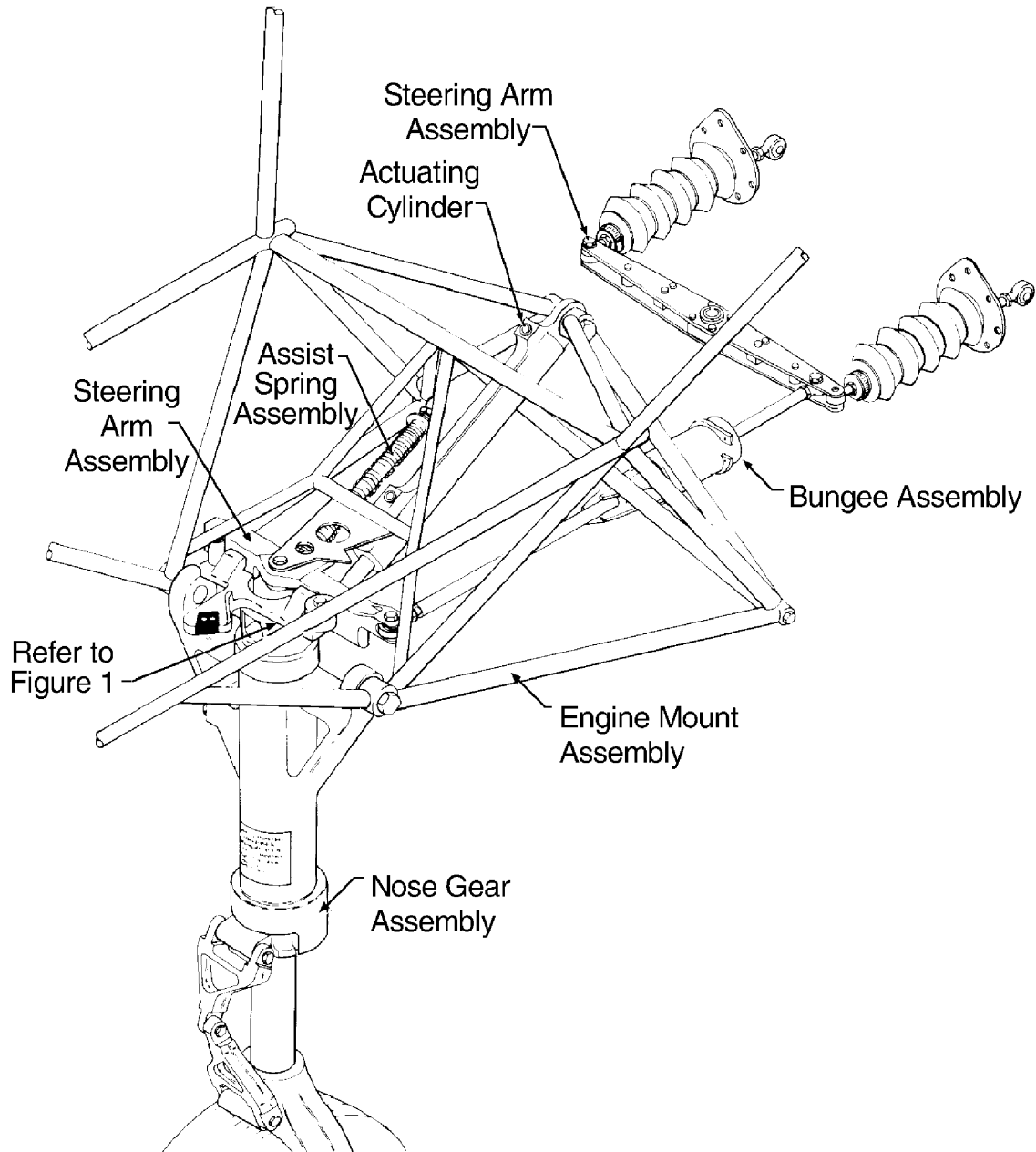
NOTE: When assembling any units of the landing gear, lubricate bearings, bushings, and friction surfaces with the proper lubricant as described in 12-20-00.

- (1) To install the landing gear assembly, position the gear so that the bolt attachment points on the housing align with the attachment points on the engine mount. Install pivot bolts, washers and nuts. Tighten the nuts to a snug fit, still allowing the gear to swing free.
- (2) Connect the actuator and emergency down mechanism to the right-hand side of the trunnion with the previously removed bolt, spacers and washers. Safety the bolt to the trunnion with MS20995-C41 safety wire. Remove the down spring retaining tool.
- (3) Cycle the gear a minimum of three times to ensure proper operation.
- (4) Ascertain that gear is lubricated per 12-20-00, Chart 4.
- (5) Check the adjustment of the gear per Nose Gear Assembly - Adjustment, below.
- (6) Install engine cowling (refer to 71-10-00).
- (7) Retract landing gear and check door operation per Nose Gear Door Adjustments, below.
- (8) Check the alignment of the nose gear per Nose Gear Assembly - Alignment, below.
- (9) Remove the airplane from the jacks (refer to 7-10-00).

C. Cleaning, Inspection, and Repair

- (1) Clean all parts with a suitable dry type cleaning solvent.
- (2) Inspect the gear components for the following unfavorable conditions:
 - (a) Bolts, bearings and bushings for excessive wear, corrosion and damage.
 - (b) Gear housing, torque links and down spring for cracks, bends or misalignment.
- (3) Check the general condition of each limit switch and its actuator. Check wiring for fraying, poor connections or conditions that may lead to failures.
- (4) The bungee requires no service other than routine inspection. In case of damage or malfunction, the bungee should be replaced rather than repaired.
- (5) Repair to the landing gear is limited to reconditioning of parts such as replacing bearings and bushings, smoothing out minor nicks and scratches, repainting of areas where paint has chipped or peeled and replacement of parts.

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Nose Gear Installation
Figure 2

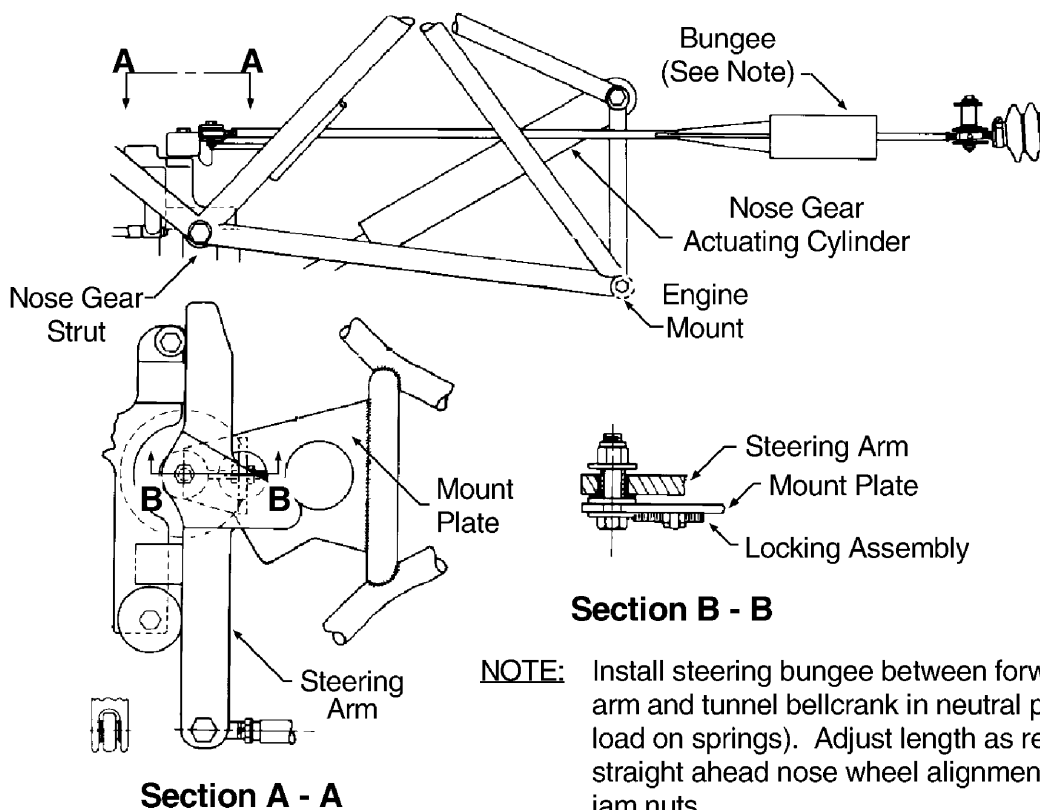
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D. Adjustment

- (1) Remove the engine cowl.
- (2) Place the airplane on jacks (refer to Jacking 7-10-00).
- (3) Place gear in UP position. Gear should retract until it touches gear up stop, located on right hand side of nose gear wheel well opening.
- (4) Adjust gear for retracted position only, as follows:
 - (a) Loosen locknut where actuator rod-end bearing attaches to trunnion.
 - (b) Adjust actuator for full retraction.
 - (c) Tighten locknut.
- (5) Repeat step (4) as needed.
- (6) Place gear in DN position. Extended position is determined by the cylinder locking (refer to Nose Gear Actuator Assembly, 32-30-00).
- (7) Remove airplane from jacks.

E. Alignment

- (1) Place the airplane on a smooth level floor that will accommodate the striking of a chalk line.
- (2) Ascertain that the nose gear is properly adjusted as given in Nose Gear Assembly - Adjustment, above.

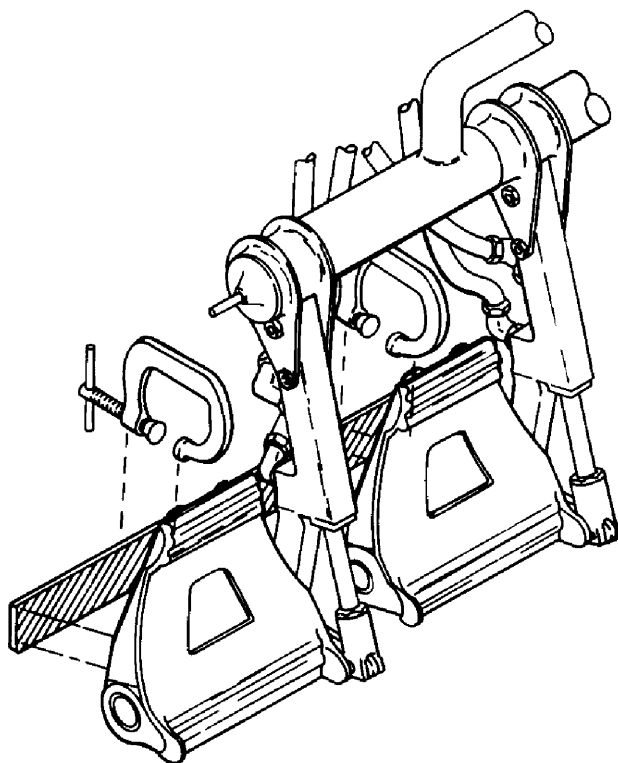


NOTE: Install steering bungee between forward steering arm and tunnel bellcrank in neutral position (no load on springs). Adjust length as required for straight ahead nose wheel alignment and tighten jam nuts.

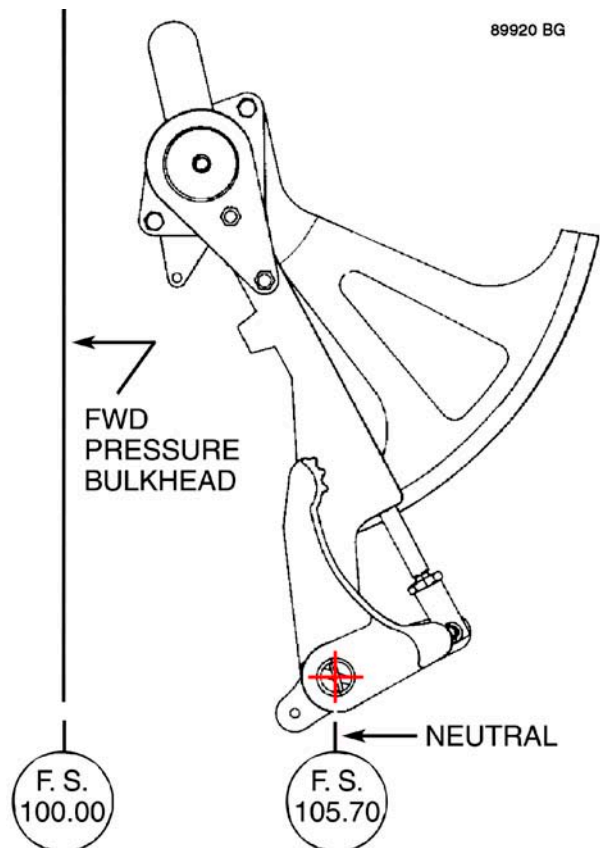
Nose Gear Adjustment
Figure 3

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- (3) With the landing gear in the down locked position, weight proportionally on the nose gear and the nose wheel facing forward, adjust the steering arm - roller clearance as described in 27-20-00, Rudder Controls, Rigging and Adjustment.
- (4) Place the airplane on jacks (refer to 7-10-00).
- (5) Level the airplane laterally and longitudinally (refer to 8-20-00).
- (6) From the center point of the tail skid, extend a plumb bob and mark the contact point on the floor.
- (7) Extend a chalk line from the mark on the floor below the tail skid to a point approximately three feet forward of the nose wheel. Allow the line to pass under the wheel at the centerline of the tire. Snap the chalk line.
- (8) Clamp the rudder pedals to align them in a lateral position. Ascertain that the rudder pedals are in their neutral position (refer to Figures 4 and 5).
- (9) Check to ensure that the steel bellcrank mounted in the nose gear tunnel is perpendicular (crosswise) to the sides of the tunnel (steering pushrods from the bellcrank to the pedals must be equal length).
- (10) Disconnect steering bungee at the forward end.
- (11) To align the nose wheel straight forward, stand in front of the nose gear and align the center rib of the tire with the chalk line, or lay a straightedge along the side of the tire and parallel the straightedge with the chalk line.

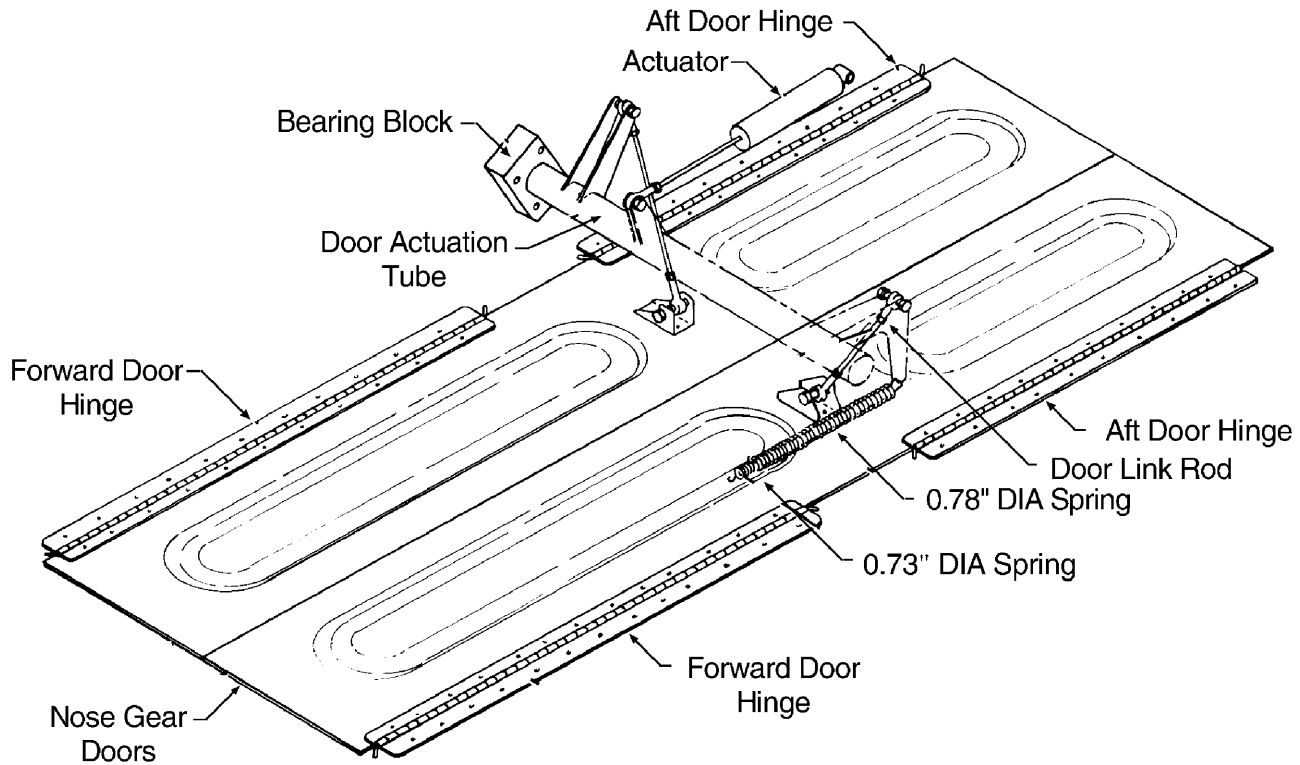


Clamping Rudder Pedals in Neutral Position
Figure 4



Rudder Pedal Neutral
Figure 5

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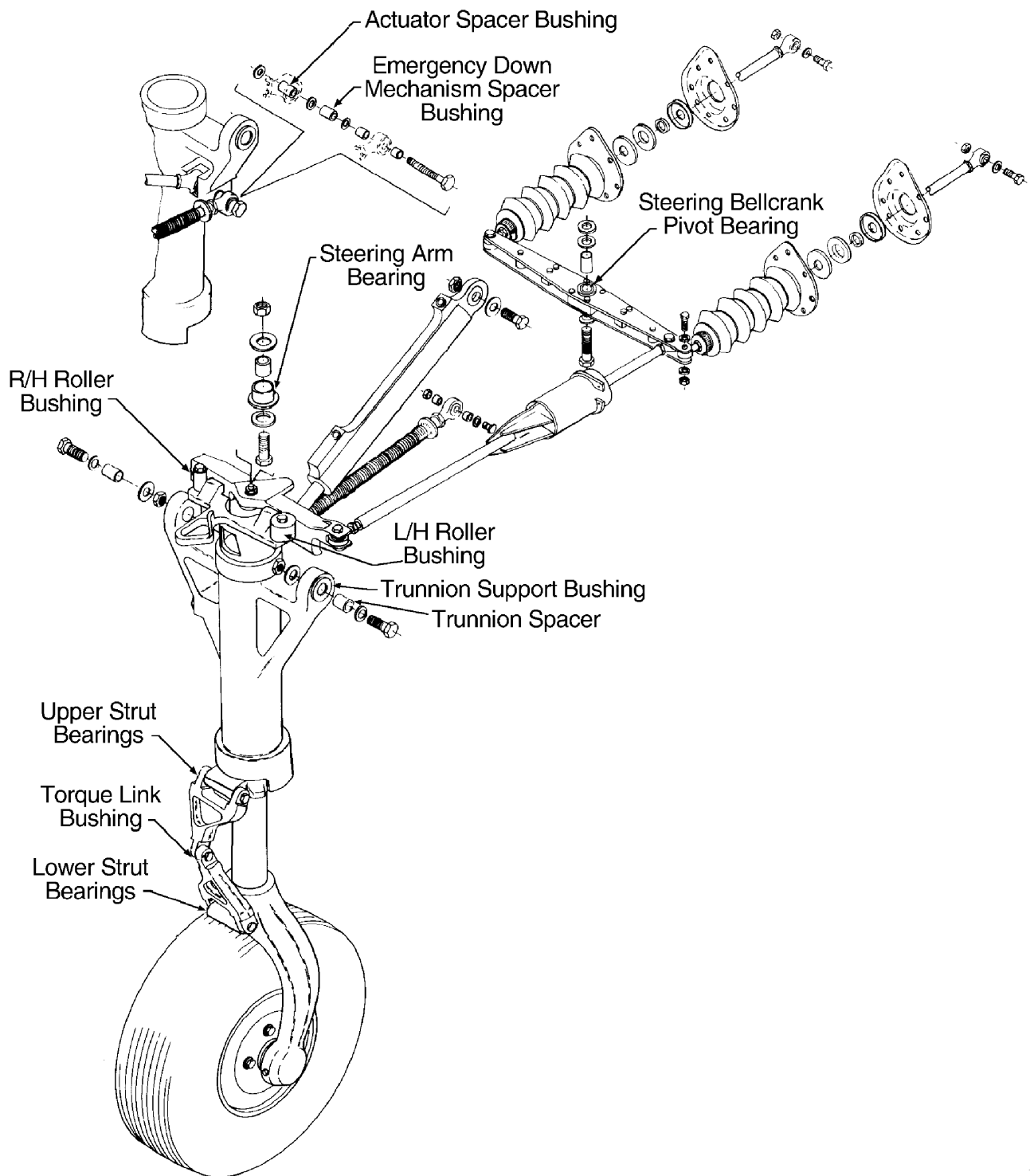


Nose Gear Doors
Figure 6

**CHART 2
NOSE GEAR TOLERANCES**

Item	Part No.	New Dimension	Service Dimension	Service Tolerance	Notes
Upper & Lower Strut Bushings	FF411-2	.313 / .314			1
Torque Link Bushing	FF310-5	.2495 / .2505			1 & 2
Trunnion Support Bushing	83630-5	.753			3
L/H Roller Bushing	86700-47	.312 O.D.			
R/H Roller Bushing	82695-18	.660 O.D.			
Trunnion Spacer	82695-3	.501 / .500			
Steering Arm Bearing	83630-4	.501 / .502			1
Actuator Spacer Bushing	82695-61	.377 / .375			
Emergency Down Mechanism Spacer Bushing	82695-62/-108	.377 / .375			
Steering Bellcrank Pivot Bearing	83630-2	.6245 / .6255			1
NOTE: 1. Line ream to "new" dimension after installation. 2. Install bearing with wet zinc chromate. 3. Shrink fit.					

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Nose Gear Tolerances
Figure 7

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- (12) Adjust the steering bungee length and install with nose wheel straight forward. Check that the rod ends have sufficient thread engagement by ascertaining that a wire will not go through the check hole in the rod. Tighten the jam nuts.
- (13) To check the nose gear steering for its 30° right and left maximum travel, mark the 30° angles on each side of the nose wheel from the centerline and wheel pivot point. Turn the wheel to its maximum travel in both directions to check for allowable travel. Should travel be too much in one direction but not enough in the other direction, check for possible damage to the gear fork or torque links.

4. Nose Gear Door Assembly (See Figure 6.)

A. Removal

- (1) With nose gear extended, disconnect door link by removing nut, bolt and washers.
- (2) To remove doors from cowl, bend one end of both hinge pins straight and pull out both pins.

B. Installation

- (1) Install the gear doors by aligning the hinge halves of the door and the door support assembly and then inserting the two hinge pins. It is recommended that new pins be used. Bend the ends of the pins to secure them in place. Rotate the hinge pin ends so that they point into the wheel well when the doors are closed.
- (2) Attach the door link to the door with the previously removed bolt, nut and washers.

C. Cleaning, Inspection, and Repair

- (1) Clean all parts with a suitable cleaning solvent.
- (2) Inspect doors for damage, loose or damaged hinges and brackets.
- (3) Inspect door retraction link assemblies and arms for damage or wear.
- (4) Check the tension spring (right door) for wear and tension. Reject the spring if the tension does not maintain the doors in the full open position.
- (5) Repairs to the door are limited to replacement of hinges and painting.
- (6) Repairs to the retraction mechanism are limited to replacement of parts, removal of light corrosion and painting.

5. Nose Gear Door Adjustments

- A. Place the airplane on jacks (refer to 7-10-00).
- B. Disconnect both gear door actuating rods.
- C. Retract gear into wheel well.
- D. Adjust rod assemblies so that the door assemblies form a straight line at B.L. 0.000. Adjust the right hand door first by itself, then adjust the left hand door.

6. Nose Gear Tolerances

See Chart 2 and Figure 7.

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EXTENSION AND RETRACTION

1. Troubleshooting

See Chart 1.

CHART 1 (Sheet 1 of 3)
TROUBLESHOOTING LANDING GEAR EXTENSION AND RETRACTION SYSTEMS

Trouble	Cause	Remedy
Landing gear system fails to operate.	Hydraulic pump circuit breaker open.	Reset circuit breaker and determine cause.
	Hydraulic pump circuit wires broken.	Check wiring.
	Safety (squat) switch out of adjustment.	Adjust switch.
	Squat switch inoperative.	Replace switch.
	Pressure switch inoperative.	Check bypass circuitry. Replace switch.
	Hydraulic pump inoperative.	Check ground wire. Repair or replace pump.
	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid to full level and investigate cause.
	Battery low or dead.	Check condition of battery. Recharge or replace.
	Hydraulic fluid leak in system.	Isolate leak and repair.
	Hydraulic pump electric motor inoperative.	Repair / replace motor top plate assembly.
	Hydraulic lines obstructed or leaking.	Check lines.
Landing gear retraction extremely slow.	Hydraulic pump motor.	Check pump motor.
	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid. Check for leaks.
	Internal / external leak in system.	Isolate and repair / replace.
	Restriction in hydraulic lines.	Isolate and check hydraulic lines.

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**CHART 1 (Sheet 2 of 3)
TROUBLESHOOTING LANDING GEAR EXTENSION AND RETRACTION SYSTEMS**

Trouble	Cause	Remedy
Pump stops during gear retraction / extension.	Hydraulic pump circuit breaker opens.	Reset circuit breaker and determine cause for overload.
	Pressure switch out of adjustment.	Check bypass circuitry. Remove and readjust or replace switch.
	Bypass circuitry malfunction or nose gear extension prior to main gear extension.	Check per Landing Gear Retraction System . Functional Test, below.
	Pressure relief valve out of adjustment.	Adjust / replace pressure relief valve.
	Mechanical restriction or obstruction in hydraulic system to allow pressure to build up and shut off pump before gear has extended / retracted.	Place airplane on jacks and run extension check. Isolate and determine cause.
Pump fails to shut off though gear has fully retracted / extended.	Pressure switch inoperative.	Repair / replace switch.
	Pressure switch out of adjustment.	Check bypass circuitry. Adjust switch.
	Pump relay sticking.	Replace relay.
	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid. Check for leaks.
	Pressure relief valve out of adjustment.	Adjust / replace pressure relief valve.
	Internal / external leakage of system.	Check gear actuating cylinders for internal / external leakage. Check for internal damage to hydraulic pump. Check for damaged hydraulic lines.

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**CHART 1 (Sheet 3 of 3)
TROUBLESHOOTING LANDING GEAR EXTENSION AND RETRACTION SYSTEMS**

Trouble	Cause	Remedy
Pump running intermittently after gear has retracted/extended.	Pump leaking.	Isolate and repair.
	Internal leakage of system.	Check free fall valve for internal leakage. Check pressure relief valve. Check gear actuating cylinders for internal leakage.
	External leakage of system.	Check for leak between reservoir and pump. Check gear actuating cylinders for external leakage. Check for broken or damaged hydraulic lines.
Pump running intermittently after gear has retracted.	Hydraulic fluid low in reservoir.	Fill reservoir and check for leaks.
Gear stops part way up, but pump continues to run.	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid.
	Internal leakage of system.	Check gear actuating cylinders for internal leakage. Check free fall valve for internal leakage Check for broken or damaged hydraulic lines.
	Emergency extender pulled.	Reset emergency extender.
All gears fail to free fall.	Free fall function of selector fails to operate.	Check mechanical connections. Inspect valve for damage.
	Gear pivot points dry.	Lube pivot points.

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2. Landing Gear Retraction System Functional Test

(PIR-PPS60033-7, Rev. G/-13, Rev. NEW.)

WARNING: BE SURE AIRPLANE IS ON JACKS BEFORE PROCEEDING WITH THE FOLLOWING TEST.

The following test verifies that the landing gear retraction system is functioning properly.

A. Set up

- (1) Verify that the main and nose gears are properly adjusted (see 32-10-00 and 32-20-00, respectively).
- (2) Place the airplane on jacks per 7-10-00.
- (3) Connect a 28 Vdc regulated power source capable of supplying a minimum of 50 amperes to the aircraft electrical system.

NOTE: With power supplied through the auxiliary power plug the batt-master switch should remain in the "OFF" position. The APU circuit bypasses the batt-master switch to energize the ship power circuits.

NOTE: Before starting test, check for adequate clearance of nose gear lights, sequence valves, actuators, hoses, etc.

NOTE: Never operate the emergency gear release piston with the hydraulic pump circuit breaker "IN".

- (4) During all tests, add clean filtered MIL-H-5606 (Revision "F" or higher) hydraulic fluid to the reservoir as necessary to keep fluid level at the "F" (full) mark on the sight gauge with the gear down.
- (5) Bleed the hydraulic system per 29-10-00, Bleeding Hydraulic System.
- (6) Set the sequence valve.

Adjust the plunger screw outward until the sequence lever depresses the plunger approximately .125 inch when the nose gear is fully retracted, and the nose gear door actuating torque tube rotates. Lock the plunger and screw in place and connect the nose gear door actuation rods. These rods shall be long initially and shortened progressively until the nose gear doors seat firmly, but are not distorted when closed. Cycle the gear as required to insure proper operation.

- (7) Check/adjust switches.
 - (a) Check/adjust squat switch per Landing Gear Safety Switch (Squat Switch) Adjustment, 32-60-00.
 - (b) Check to insure that the gear door closed (gear "UP") switches are wired to the proper panel indicator light (gear warning annunciator).

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B. Procedure

CAUTION: DO NOT PULL THE EMERGENCY GEAR RELEASE KNOB WHILE THE HYDRAULIC PUMP IS OPERATING. ALWAYS PULL THE HYDRAULIC PUMP CIRCUIT BREAKER BEFORE TESTING THE EMERGENCY GEAR RELEASE SYSTEM. FAILURE TO COMPLY WILL DAMAGE THE EMERGENCY GEAR RELEASE VALVE.

CAUTION: DO NOT OVERFILL AND DO NOT ALLOW HYDRAULIC FLUID LEVEL TO DROP BELOW THE "L" (LOW) MARK ON THE SIGHT GAUGE WITH THE GEAR IN THE DOWN POSITION.

NOTE: Perform the following in the sequence given. Any failure of the system to respond as specified indicates a malfunction which must be corrected before proceeding further.

- (1) In S/N's 4636001 thru 4636374: Pull the throttle aft to the closed position.
In S/N's 4636375 and up: Jump G8L20 to G8K20 at the manifold pressure switch connector.
- (2) Place the gear selector switch in the DOWN position.
- (3) Verify that:
 - (a) Three green safe lights are illuminated.
 - (b) Red gear warning light is off.
 - (c) Gear warning horn does not sound.
 - (d) Hydraulic pump does not operate.I. E. - Leave the gear down for at least five (5) minutes. Check that the hydraulic pump motor does not operate. If the pump operates at any time during the five (5) minute period, check for leaks or malfunctioning components in the system.

NOTE: One momentary pump operation is allowable during this five (5) minute period, provided that the gear warning light is out and no repeated pump operations for a subsequent fifteen (15) minute period occur.

- (4) Place the gear selector switch in the UP position.
- (5) Verify that:
 - (1) Three green safe lights are out.
 - (2) Red gear warning light illuminates.
 - (3) The hydraulic pump light illuminates while gear are in transit.
 - (4) Gear warning horn sounds.
 - (5) All gear retract fully and the gear doors close.
 - (6) Hydraulic pump motor stops operating.
- (6) In S/N's 4636001 thru 4636374: Advance the throttle to the mid-travel position.
In S/N's 4636375 and up: Remove jumper between G8L20 to G8K20 at the manifold pressure switch connector.
The warning horn should stop sounding and the gear warning light should go out.
- (7) With the gear fully retracted extend the flaps to the 10° position. The red "GEAR WARN" annunciator and gear warning horn should not operate. At flap extension beyond 10° to the full down position the red "GEAR WARN" annunciator and the gear warning horn should operate simultaneously and continuously.
Operate the flap extension back to the 10° position and the red "GEAR WARN" annunciator will turn off and gear warning horn will stop sounding.

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- (8) Leave the gear up for at least five (5) minutes. Check that the hydraulic pump motor does not operate. If the pump operates at any time during the five (5) minute period, check for leaks or malfunctioning components in the system.

NOTE: One momentary pump operation is allowable during this five (5) minute period, provided that the gear warning light is out and no repeated pump operations for a subsequent fifteen (15) minute period occur.

CAUTION: DO NOT PULL THE EMERGENCY GEAR RELEASE KNOB WHILE THE HYDRAULIC PUMP IS OPERATING. ALWAYS PULL THE HYDRAULIC PUMP CIRCUIT BREAKER BEFORE TESTING THE EMERGENCY GEAR RELEASE SYSTEM. FAILURE TO COMPLY WILL DAMAGE THE EMERGENCY GEAR RELEASE VALVE.

- (9) Pull the "Hydraulic Pump" circuit breaker OUT.
(10) Release the guard and pull the emergency gear release (i.e. - free fall) knob OUT.
(11) Verify that:

- (a) The landing gear falls to the down and locked position.
- (b) Red gear warning light goes out when the gear locks.
- (c) Three green safe lights are illuminated when the gear locks.
- (d) In S/N's 4636314 and up (i.e. - airplanes equipped with Frisby hydraulic pumps only): allow pressure to bleed off before continuing (approximately two (2) minutes).

NOTE: The main gear may not fall completely into the locked position during ground free fall tests. Extend the main gear using a side force at the center line of axle that does not exceed nine (9) pounds. The gear should move easily and then lock in place.

- (12) Place the gear selector switch in the DOWN position.
(13) Push in the emergency gear release (i.e. - free fall) knob and engage the guard.
(14) Push the "Hydraulic Pump" circuit breaker IN.
(15) Check that three green lights stay on.

NOTE: Pump may run momentarily.

- (16) Cycle gear up and down, one time to verify normal operations.
(17) With the landing gear fully extended operate the flaps to full down position and verify the warning horn does not sound.
(18) Place the landing light switch ON.
(19) Place the gear selector switch in the UP position.
(20) Verify that:

- (a) Hydraulic pump motor operates and the gear retracts.
- (b) Three green gear safe lights go out.
- (c) Red gear warning light illuminates, until all the gear are up, and then goes out.
- (d) The gear retracts fully in:
 - 1 In S/N's 4636001 thru 4636313 (i.e. - airplanes equipped with Parker Hannifin hydraulic pumps only) - eight (8) seconds or less.
 - 2 In S/N's 4636314 and up (i.e. - airplanes equipped with Frisby hydraulic pumps only) - nine (9) seconds or less.
- (e) Hydraulic pump motor stops operating after the gear is up.
- (f) Gear warning horn does not sound.
- (g) The landing light shuts off as the gear door closes.

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(21) Gear Down Pressure Switch Bypass Relay Circuit Test:

- (a) In S/N's 4636001 thru 4636313 (i.e. - airplanes equipped with Parker Hannifin hydraulic pumps only):

- 1 Disconnect the gear down pressure switch circuit and conduct the Gear Selector Switch DOWN Check, below.

CAUTION: DO NOT PULL THE EMERGENCY GEAR RELEASE KNOB WHILE THE HYDRAULIC PUMP IS OPERATING. ALWAYS PULL THE HYDRAULIC PUMP CIRCUIT BREAKER BEFORE TESTING THE EMERGENCY GEAR RELEASE SYSTEM. FAILURE TO COMPLY WILL DAMAGE THE EMERGENCY GEAR RELEASE VALVE.

It is acceptable if only the nose gear fully extends down and locked. The main gear may only extend partially. Complete main gear extension by activating the emergency gear release valve and moving the main gear to the down and locked position.

- 2 Reconnect the gear down pressure switch circuit. Disconnect the gear down pressure switch bypass relay circuit and conduct the Gear Selector Switch DOWN Check, below.

- 3 Reconnect the gear down pressure switch bypass relay circuit.

- (b) In S/N's 4636314 and up (i.e. - airplanes equipped with Frisby hydraulic pumps only):

- 1 Disconnect the gear down pressure switch circuit, see Wire A, Figure 1, and conduct the following sequence:

- a Place the gear selector switch in the UP position. The gear should function normally.

- b Place the gear selector switch in the DOWN position. The pump will shut OFF before the gears reach the full down position.

CAUTION: DO NOT PULL THE EMERGENCY GEAR RELEASE KNOB WHILE THE HYDRAULIC PUMP IS OPERATING. ALWAYS PULL THE HYDRAULIC PUMP CIRCUIT BREAKER BEFORE TESTING THE EMERGENCY GEAR RELEASE SYSTEM. FAILURE TO COMPLY WILL DAMAGE THE EMERGENCY GEAR RELEASE VALVE.

It is acceptable if the nose gear fully extends down and locks. The main gears may only extend partially. Complete gear extension by pulling the emergency gear release valve and moving the main gear to the down and locked position.

- c Reconnect the gear down pressure switch circuit, Wire A, Figure 1.

- d Reset the emergency gear release valve.

- 2 Disconnect the gear down pressure switch by-pass relay circuit, see Wire B, Figure 1, and conduct the following sequence:

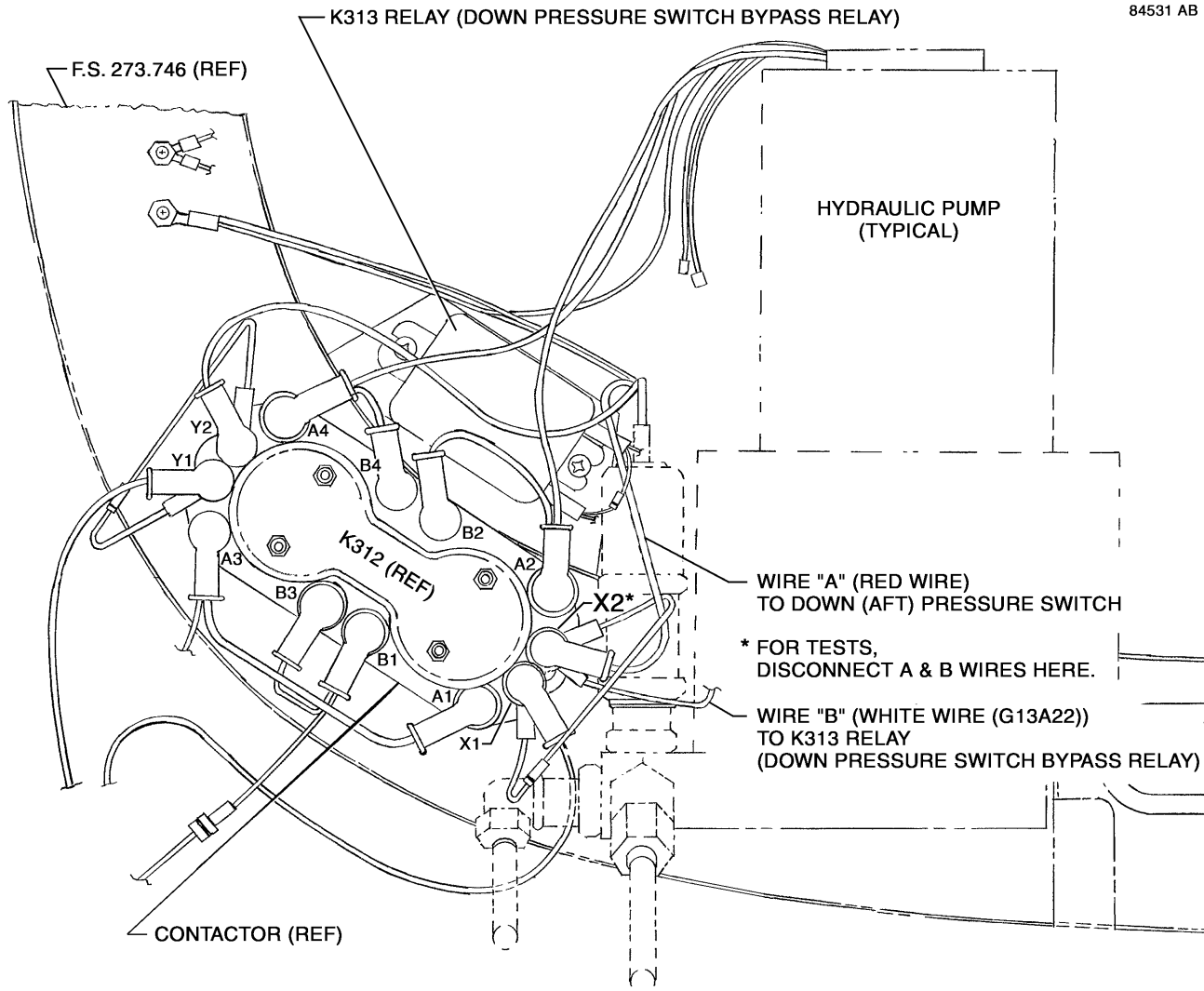
- a Place the gear selector switch in the UP position. The gear should function normally.

- b Place the gear selector switch in the DOWN position. The gear should function normally.

- c Reconnect the gear down pressure switch by-pass relay circuit, Wire B, Figure 1.

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84531 AB



Down Pressure Switch Bypass Relay
Figure 1

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(22) Gear Selector Switch DOWN Check

Place the gear selector switch in the DOWN position and verify that:

- (a) Hydraulic pump motor operates and the gear extends.
- (b) All gear return to the down and locked position. Extending fully in:
 - 1 eight (8) seconds or less, in S/N's 4636001 thru 4636313 (i.e. - airplanes equipped with Parker Hannifin hydraulic pumps only).
 - 2 nine (9) seconds or less, in S/N's 4636314 and up (i.e. - airplanes equipped with Frisby hydraulic pumps only).
- (c) Hydraulic pump motor stops operating after the gear is in down and locked position.

CAUTION: ANY MOMENTARY BLINKING OF THE RED OR GREEN GEAR LIGHTS AFTER THE ACTUATOR IS DOWN AND LOCKED MAY INDICATE AN IMPROPERLY ADJUSTED SWITCH IN A LOCKING CYLINDER.

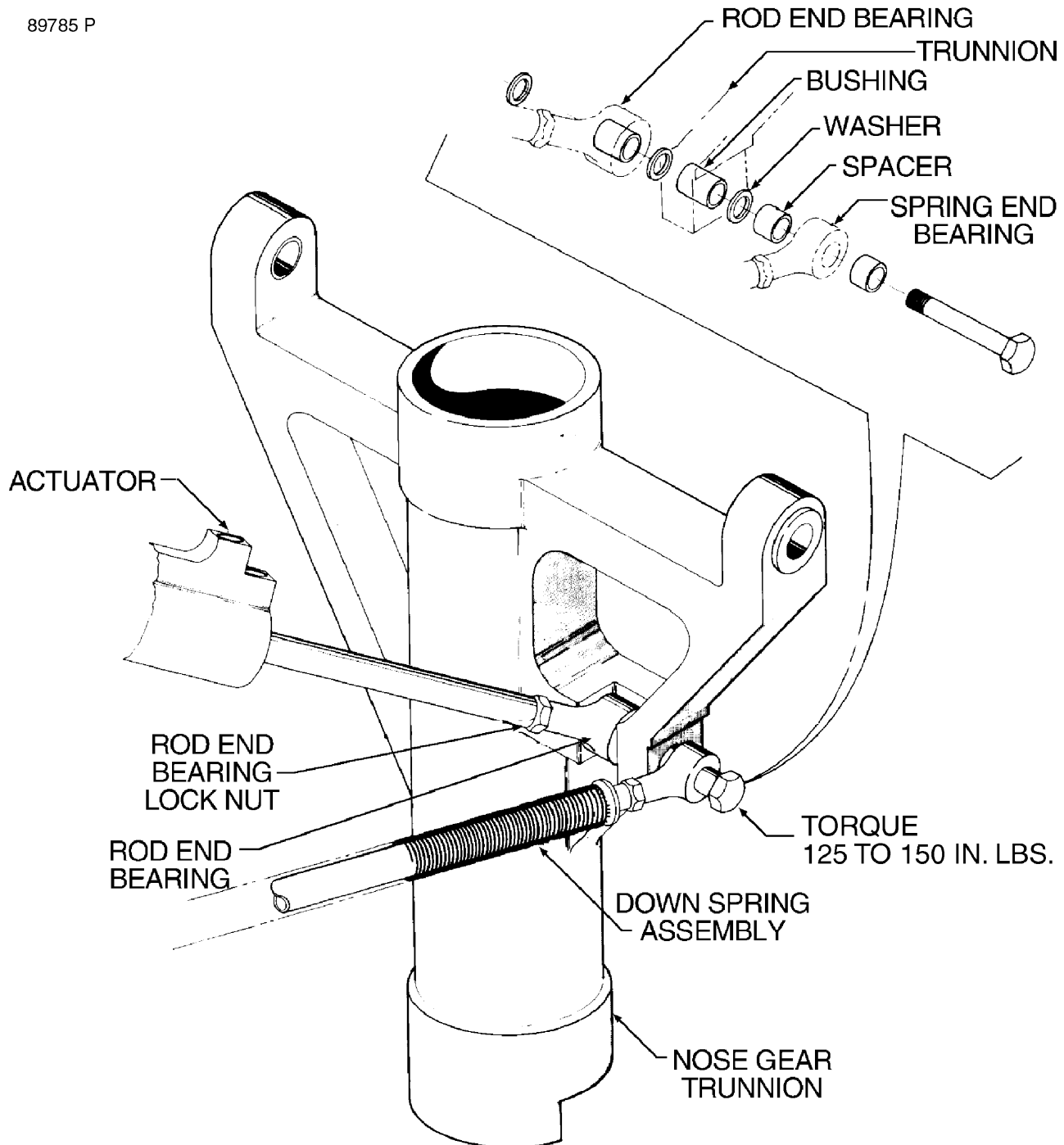
- (d) Red gear warning light is illuminated while gear is in transit.
 - (e) Three green safe lights are illuminated as the gear locks.
 - (f) Gear warning horn does not sound.
 - (g) Landing light illuminates as the gear door opens.
- (23) Turn the landing light switch to the OFF position.
- (24) Disconnect the ground power unit.

WARNING: VERIFY GEAR ARE DOWN AND LOCKED BEFORE REMOVING AIRPLANE FROM JACKS.

- (25) Remove airplane from the jacks per 7-10-00.

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89785 P



Nose Gear Actuator Installation
Figure 2

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3. Nose Gear Actuator Assembly

NOTE: No field repair of landing gear actuators installed in PA-46-350P airplanes is authorized. Actuator overhaul service is available through Piper distributors.

A. Removal (See Figure 2.)

- (1) Place airplane on jacks (refer to 7-10-00).
- (2) Reduce hydraulic pressure as follows:
 - (a) Place the gear control in the UP position.
 - (b) Allow gear to retract approximately halfway and pull Hydraulic Pump circuit breaker.

NOTE: Have an assistant stand by nose gear to catch the gear and prevent it from falling back to a down and locked position. Block the nose gear to hold that position.

- (c) Set the BATT MASTER switch to the OFF position.

CAUTION: DO NOT ATTEMPT TO REMOVE OR DISCONNECT EITHER END OF THE NOSE GEAR DOWNSPRING ASSEMBLY WITHOUT THE USE OF THE SPECIAL TOOL (P/N 762-157) SHOWN IN FIGURE 3. THE DOWNSPRING ASSEMBLY IS HEAVILY LOADED.

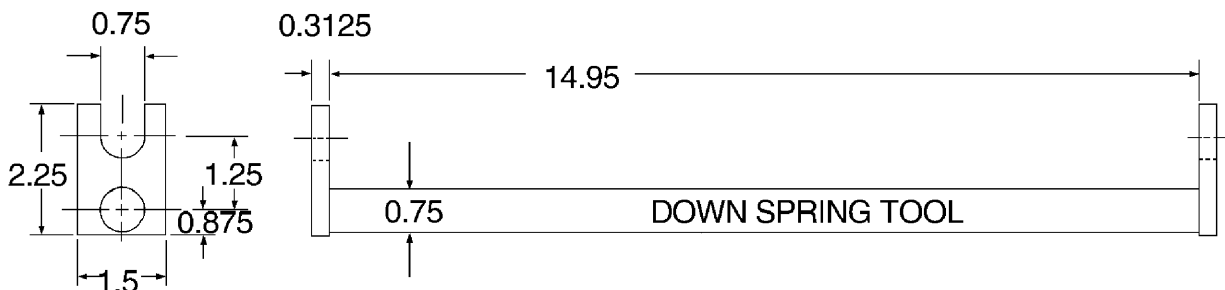
CAUTION: ONCE THE REMOVE/INSTALL TOOL (P/N 762-157) IS IN PLACE, USE HOSE CLAMPS TO SECURE IT TO THE DOWNSPRING ASSEMBLY.

- (3) Position the special remove/install tool (P/N 762-157) (see Figure 3) so that the nose gear downspring is within the two end plates. Secure the special tool to the downspring assembly with hose clamps. Remove bolt holding actuator rod end bearing and downspring assembly to trunnion. Remove washers, spacers, and bushing.

CAUTION: IF COMPLETE DISASSEMBLY OF THE DOWNSPRING MECHANISM IS DESIRED, USE OF THE SPECIAL DISASSEMBLY/REASSEMBLY TOOL (P/N 762-155) IS REQUIRED. THE EMERGENCY DOWNSPRING MECHANISM IS SPRING LOADED AND COULD CAUSE SERIOUS INJURY OR DAMAGE IF THE SPECIAL DISASSEMBLY/REASSEMBLY TOOL (P/N 762-155) IS NOT USED.

- (4) Disconnect electrical leads from downlimit micro-switch.
- (5) Disconnect and quickly cap two hydraulic lines at nose gear actuator.

NOTE: If the hydraulic line elbow on the lower end of the nose gear actuator is to be removed (i.e. - if replacing actuator), it may be necessary to first remove the downlimit micro-switch. If so, remove only the four screws holding the switch plate to the actuator. DO NOT move or adjust the jam nuts and lockwire attaching the micro-switch to the switch plate as that would affect lock engagement verification.



Nose Gear Downspring Remove/Install Tool (P/N 762-157)

Figure 3

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- (6) Move landing gear selector to the DOWN position.
- (7) Manually extend rod so that actuator assembly locks in down, or fully extended, position.
- (8) Measure and record distance from end fitting to center of rod end bearing. This measurement is important for proper installation.

WARNING: IF EITHER THE NOSE GEAR OR ACTUATOR IS DAMAGED OR MISALIGNED, THIS MEASUREMENT MAY NOT BE VALID. IN EITHER CASE, REPLACE DAMAGED COMPONENTS, AS REQUIRED, AND USE MALIBU NOSE GEAR ACTUATOR ALIGNMENT TOOL (P/N 762-137) DURING INSTALLATION.

- (9) Remove rod end bearing from actuator rod. Check that rod end bearing locknut is free of scoring and nicks. Smooth out if necessary.
- (10) Remove actuator from engine mount.

B. Installation (See Figure 2.)

NOTE: If the downlimit micro-switch was previously removed from the actuator, install it and tighten the four screws in a criss-cross pattern, torquing each 13 to 17 in. lbs. Verify lock indication in the extended position and unlock indication in the retracted position with a multi-meter or continuity tester.

- (1) Manually extend rod so that actuator assembly locks in down, or fully extended, position.
- (2) Install rod end bearing in actuator rod. Adjust to same length as recorded during Removal, above. (See WARNING above.)
- (3) Install upper end of actuator to engine mount.

NOTE: Pay close attention to the nose gear actuator / engine mount connecting hardware to ensure the correct locknut is used (i. e. - P/N 404-891, MS 20365-720C). Additionally, check for proper thread engagement between the bolt and nut by ensuring at least one thread of the bolt protrudes through the nut per AC 43.13-1, latest revision. If there are not sufficient threads exposed after the lock nut, replace the bolt with a longer bolt, P/N 401-509 (AN7-15A). Torque to the standard torque value (91-10-00, Chart 6) for a 7/16-20 AN7 bolt/MS 20365 nut.

- (4) Uncap and connect hydraulic lines to actuator.
- (5) Connect electrical leads to downlimit micro-switch.
- (6) Unlock actuator as follows:
 - (a) Set the BATT MASTER switch to the ON position.

NOTE: Have an assistant stand by the actuator to observe the rod position and signal as soon as the rod retracts from the fully extended and locked position.

- (b) Place the gear control in the UP position and when signalled by the assistant, pull the Hydraulic Pump circuit breaker.
 - (c) Set the BATT MASTER switch to the OFF position.
- (7) Install rod end bearing and nose gear down assist spring in trunnion. Torque per Figure 2.
- (8) Check adjustment and alignment of nose gear per 32-20-00.
- (9) Tighten rod end bearing locknut.

NOTE: If unable to rig nose wheel assembly to proper retracted location with two jam nuts installed, remove one jam nut. Maximum thread exposure with single nut is 0.28 inch.

- (10) Purge air from system per Bleeding Hydraulic System, 29-10-00.
- (11) Check that hydraulic pump circuit breaker is on (pressed in), gear control lever is in the DOWN position, and BATT MASTER switch is in the OFF position.

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- (12) Set BATT MASTER switch to the ON position. Cycle landing gear up and down at least three (3) times. Watch that the gear operates smoothly and check that there are no hydraulic leaks.
- (13) Service reservoir as required.
- (14) Remove airplane from jacks (see 7-10-00).

4. Main Gear Actuator Assembly

NOTE: No field repair of landing gear actuators installed in PA-46-350P airplanes is authorized. Actuator overhaul service is available through Piper distributors.

A. Removal

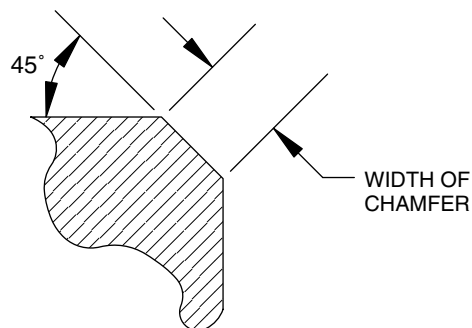
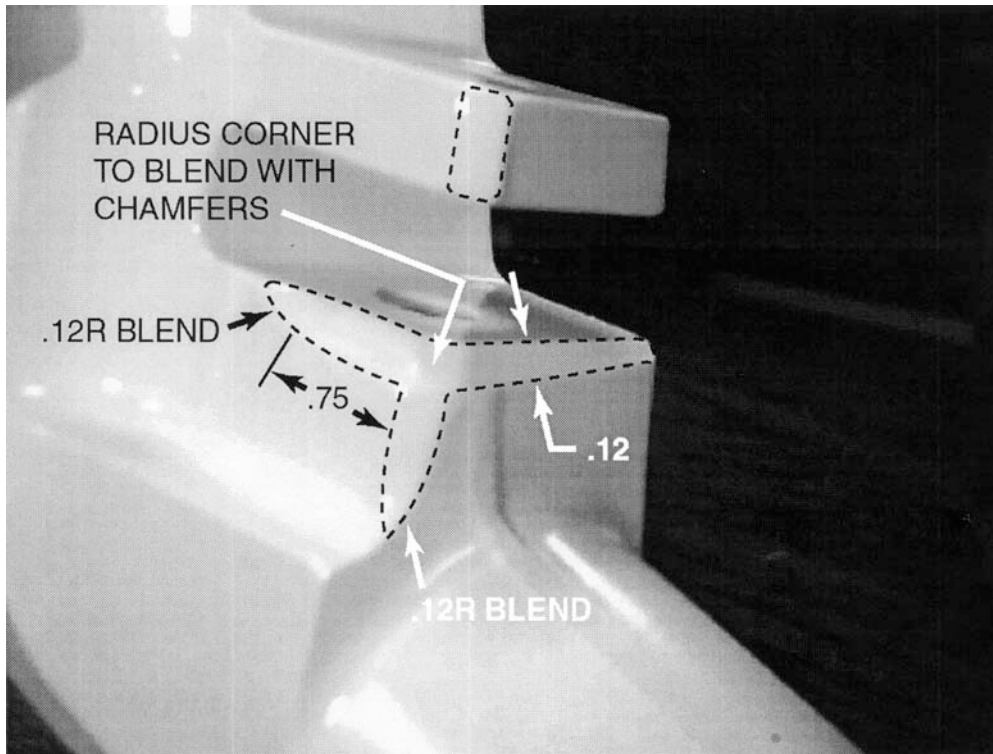
- (1) Place airplane on jacks per 7-10-00.
- (2) Reduce hydraulic pressure as follows:
 - (a) Place gear control in the UP position.
 - (b) Allow gear to retract approximately halfway and pull Hydraulic Pump circuit breaker.
NOTE: Have assistants standing by each main gear to catch the gear and prevent them from falling back to a down and locked position. Block each main gear to hold that position.
- (c) Set BATT MASTER switch to the OFF position.
- (5) Disconnect and quickly cap hydraulic lines at main gear actuator.
- (6) Disconnect actuator from landing gear trunnion by removing washer, bushing, and bolt.
- (7) Disconnect upper end of actuator from its mounting bracket by removing bolt and washer.
- (8) Remove actuator from airplane.
- (9) Remove rod end bearing from actuator rod. Check that rod end bearing lock nut is free of scoring and nicks. Smooth out if necessary.
- (10) Move landing gear selector to the DOWN position.
- (11) Manually extend rod so that actuator assembly locks in down, or fully extended position.

B. Installation

NOTE: In S/N's 4636001 thru 4636195 only, when installing service replacement actuators P/N 89075-015 (RH) or P/N 89075-016 (LH) for the first time, modify the associated original equipment main gear trunnion per Trunnion Modification, below.

- (1) Install rod end bearing on actuator rod.
- (2) Bolt upper end of actuator to its mounting bracket. Torque to 210 -270 in.-lbs. Safety the bolt.
- (3) Position gear in order to bolt rod end bearing to main gear trunnion. Torque to 260 -320 in.-lbs. Safety the bolt.
- (4) Check adjustment of rod end bearing per 32-10-00, Main Gear Assembly, Adjustment.
- (5) Tighten rod end bearing locknut.
- (6) Uncap and connect hydraulic lines.
- (7) Purge system of air per Bleeding Hydraulic System, 29-10-00.
- (8) Check that hydraulic pump circuit breaker is set (pressed in), gear control switch is in the DOWN position and BATT MASTER switch is OFF.
- (9) Remove airplane from jacks (see 7-10-00).

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THE CHAMFER WIDTH IS TYPICALLY .25 INCHES
EXCEPT FOR THE .12 INCH CHAMFER WIDTH
SHOWN IN THE PHOTO.

[Effectivity](#)
4636001 thru 4636195

Chamfer Details
Figure 4

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C. Trunnion Modification (S/N's 4636001 thru 4636195 only.)

The 89075-015 and 89075-016 actuators incorporate a larger rod end bearing than the actuators factory installed in S/N's 4636001 thru 4636195. This larger rod end bearing will not adequately clear the original equipment main gear trunnion. Accordingly, the first time either original equipment main gear actuator is replaced with a -015 or -016 actuator, modify the associated original equipment trunnion as follows:

- (1) Remove main gear actuator per Removal, above.
- (2) Chamfer the edges of the main gear trunnion as specified in Figure 4.
- (3) Re-install the actuator per Installation, above.
- (4) Swing the gear and observe to assess rod end/trunnion clearance. If required, repeat steps (1) - (3), above, adjusting the depth of the chamfer as required to obtain adequate clearance for normal gear function.
- (5) When adequate clearance has been obtained for normal gear function, prime and paint reworked area to match the remaining trunnion finish.
- (6) Make log book entry for completion of this modification.

5. Nose Gear Door Actuator Assembly (See Figure 5.)

NOTE: No field repair of nose gear door actuators installed in PA-46-350P airplanes is authorized. Actuator overhaul service is available through Piper distributors.

A. Removal

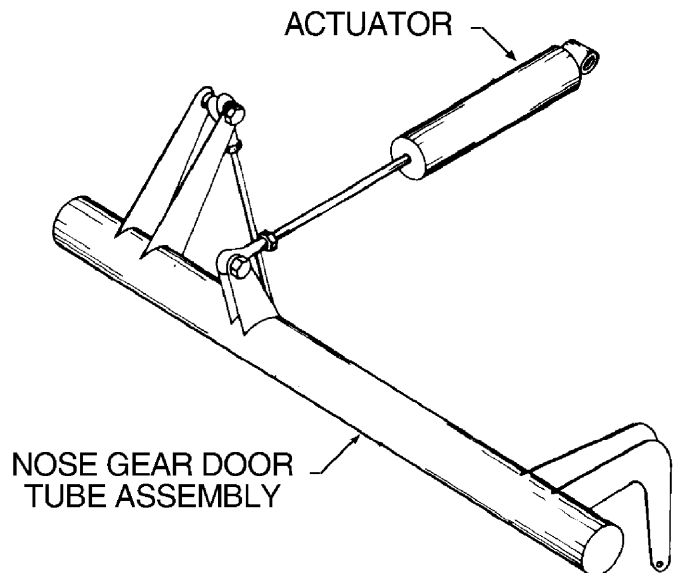
- (1) Place airplane on jacks (refer to 7-10-00).
- (2) Reduce hydraulic pressure as follows:
 - (a) Place gear control in the UP position.
 - (b) Allow gear to retract approximately halfway and pull Hydraulic Pump circuit breaker.

NOTE: Have an assistant stand by nose gear to catch the gear and prevent it from falling back to a down and locked position. Block the nose gear to hold that position.

- (c) Set BATT MASTER switch to the OFF position.
- (3) Disconnect and quickly cap hydraulic line to nose gear door actuator. Tie capped line to airframe.
- (4) Remove bolt, nut, and washers holding rod end to nose gear/tube assy.
- (5) Remove clevis bolt, four washers, nut, and bushing from aft end of actuator.
- (6) Remove actuator from airplane.

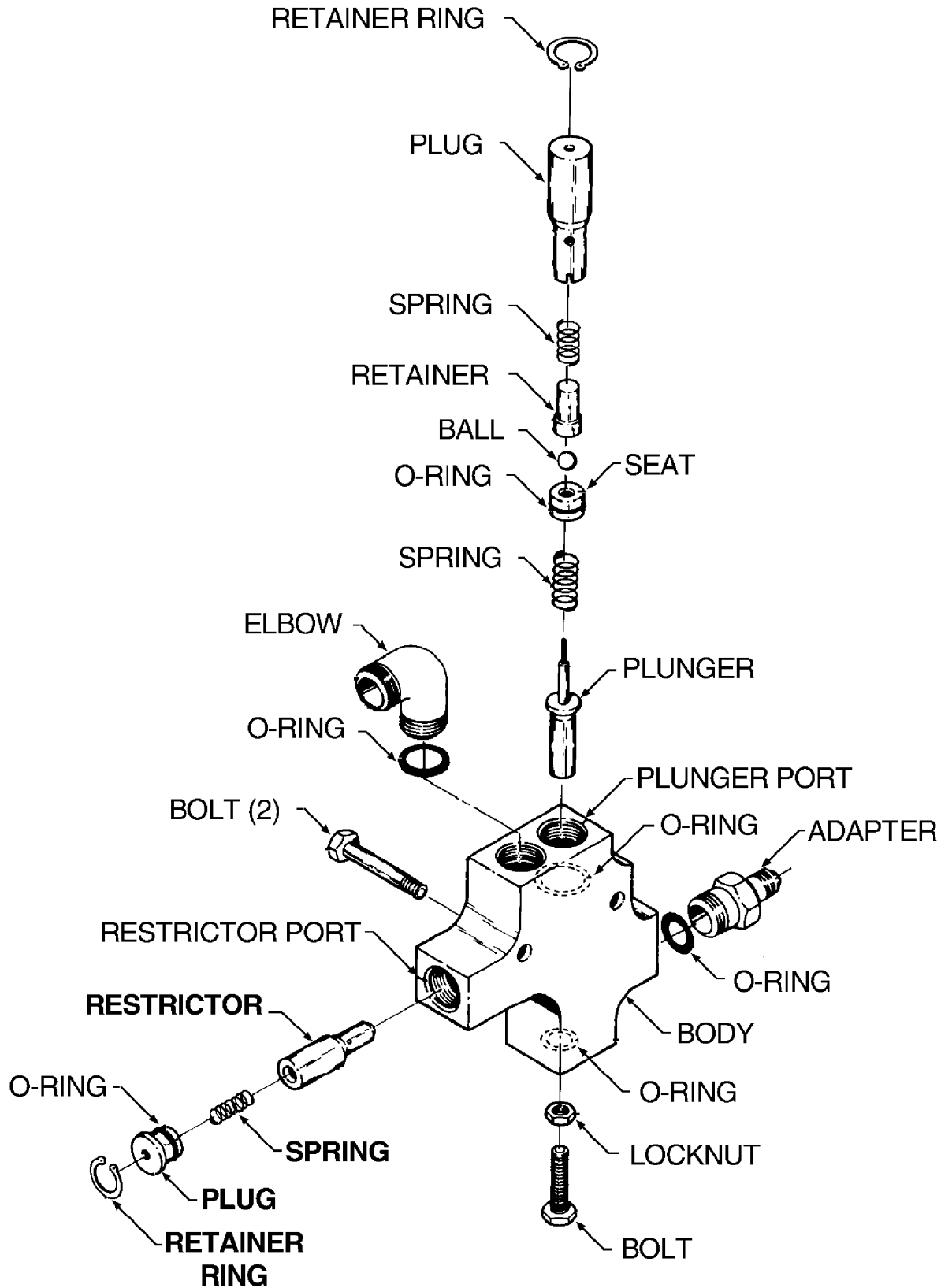
B. Installation

- (1) Position actuator in airplane and secure aft end of actuator with clevis bolt, four washers, nut, and bushing.
- (2) Bolt rod end to nose gear door tube assy with bolt, nut, and two washers.
- (3) Uncap and connect hydraulic line to nose gear door actuator. Purge system of air per Bleeding Hydraulic System, 29-10-00.



Nose Gear Door Actuator Tube Assembly
Figure 5

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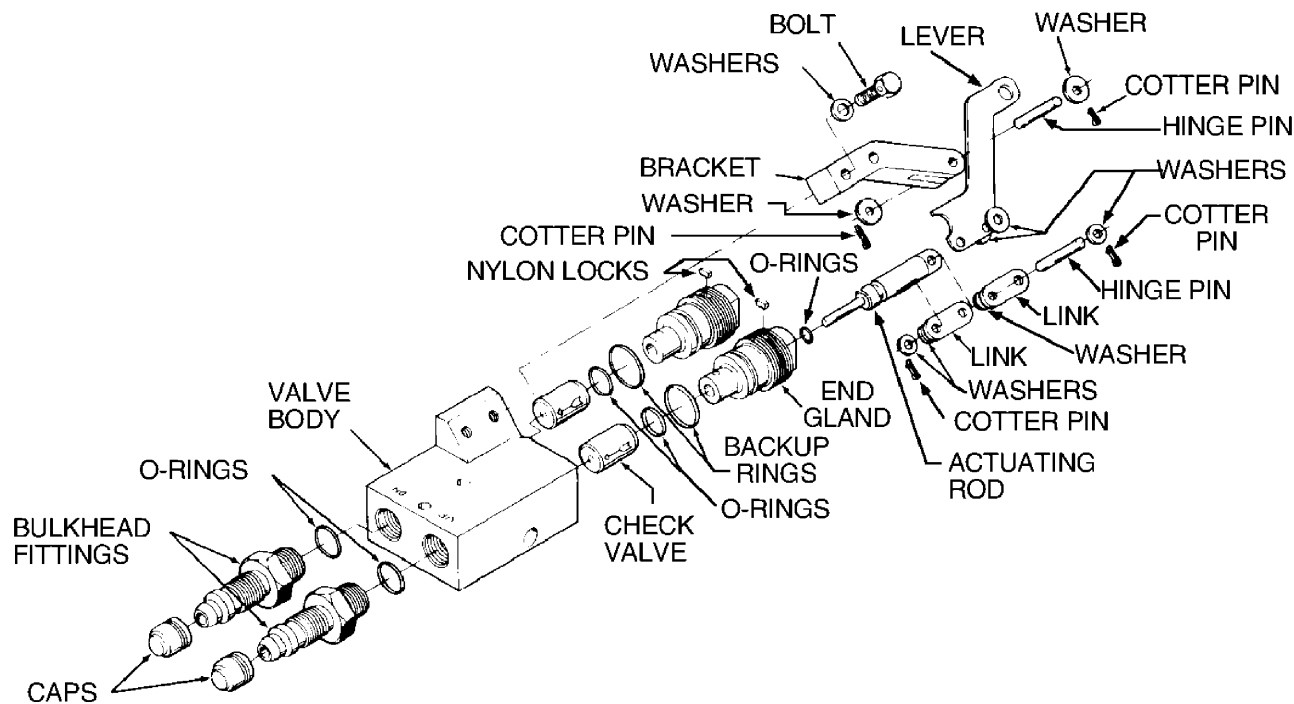


Sequence Valve (Parker Hannifin)
Figure 6

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- (4) Check that hydraulic pump circuit breaker is set (pressed in), gear control switch is in the DOWN position and BATT MASTER switch is OFF.
 - (5) Remove airplane from jacks (see 7-10-00.)
6. Sequence Valve Parts Replacement (Parker Hannifin Only) (See Figure 6.)
- CAUTION:** TAKE CARE NOT TO LOSE ANY SMALL PARTS IN VALVE.
- A. Drain valve by removing two plugs. Remove and discard O-rings.
 - B. Remove retaining ring from restrictor port in valve body.
 - C. Remove plug at restrictor port using three-quarter-inch screw with 4-40 threads.
 - D. Remove and discard O-ring.
 - E. Remove spring and restrictor. Tap valve at restrictor port into palm of hand to aid removal of restrictor.
 - F. Remove retaining ring from plunger port. Remove plug using three-quarter-inch screw with 4-40 threads.
 - G. Remove spring, spring retainer, and ball from plunger port.
 - H. Remove and discard O-ring from plunger port.
 - I. Remove bolt and locknut to remove plunger, seat, and spring. Use a No. 1 Phillips screwdriver to aid in removal of plunger.
 - J. Remove and discard O-ring from seat.
 - K. Remove and discard O-ring from plunger port.
- WARNING:** USE SOLVENT IN WELL VENTILATED AREA. AVOID CONTACT WITH SKIN. KEEP AWAY FROM HEAT OR FLAME.
- L. Clean parts as needed with solvent.
- CAUTION:** DO NOT REUSE O-RINGS. COAT REPLACEMENT O-RING WITH HYDRAULIC FLUID MIL-H-5606.
- M. Lubricate all ports with hydraulic fluid.
 - N. Insert restrictor and spring. Install O-ring onto plug and install plug. Secure with retaining ring.
 - O. Install O-ring, plunger, and spring into valve body. Install O-ring onto seat and install seat.
 - P. Install O-ring, ball, spring retainer, and spring.
 - Q. Insert plug and retaining ring.
 - R. Thread locknut onto bolt and thread bolt into plunger. Torque locknut to 12 - 15 in.-lbs.
 - S. Upon installation, set the sequence valve as described under Landing Gear Retraction System Functional Test, above.

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Emergency Gear Release Valve (Parker Hannifin shown)
Figure 7

7. Emergency Gear Release Valve (See Figure 7.)

NOTE: Emergency gear release valve is located beneath floor boards under copilot's seat.

A. Removal

- (1) Remove copilot's seat, carpet, access panel, and center floorboard.
- (2) Remove and quickly cap hydraulic lines.
- (3) Loosen nuts at bulkhead fittings.
- (4) Disconnect cable.
- (5) Remove valve from aircraft.

B. Installation

- (1) Position valve in airplane. Secure bulkhead fittings with nuts and tighten.
- (2) Connect cable.
- (3) Uncap and connect hydraulic lines.
- (4) Install access panel and floorboard. Secure with screws. Replace carpet and seat.

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C. Parker Hannifin Valves Only:

(1) Disassembly

- (a) Drain valve by removing two caps.
- (b) Remove lockwire, two bolts, and two washers that secure bracket. Remove bracket, lever, and links as one unit.
- (c) Pull actuating rod out of end gland. Remove and discard O-ring from actuating rod.
- (d) Remove end glands from UP and DN ports. Remove and discard O-rings from end glands.
- (e) Remove bulkhead fittings from UP and DN ports. Remove and discard O-rings from bulkhead fittings.
- (f) Remove check valves. Remove and discard O-ring from inside valve body.

(2) Assembly

WARNING: USE SOLVENT IN WELL VENTILATED AREA. AVOID CONTACT WITH SKIN. KEEP AWAY FROM HEAT OR FLAME.

CAUTION: DO NOT REUSE LOCKWIRE, COTTER PINS, OR O-RINGS. COAT REPLACEMENT O-RINGS WITH HYDRAULIC FLUID MIL-H-5606.

- (a) Clean parts as needed with solvent. Wipe dry.
- (b) Lubricate all parts in valve body with hydraulic fluid.
- (c) Install new O-rings onto bulkhead fittings.
- (d) Install bulkhead fittings into UP and DN ports. Torque to 60 - 65 in.-lbs.

CAUTION: CHECK VALVES ARE NOT INTERCHANGEABLE. BEFORE INSERTING VALVES INTO UP AND DN PORTS, CORRECTLY IDENTIFY VALVE BY PRINTED VENDOR NUMBER.

- (e) Insert check valve with rubber seal (2203C-20) into DN port. Arrow on check valve must point toward end gland. Push seal against valve.
- (f) Install O-ring onto end gland assembly.
- (g) Thread end gland assembly into DN port. Torque to 60 - 65 in.-lbs.
- (h) Insert check valve with teflon seal (2203C-3-5) into UP port. Arrow on check valve must point toward end gland. Push seal against valve.
- (i) Install O-ring onto end gland assembly.
- (j) Thread end gland assembly into UP port. Torque to 60 - 65 in.-lbs.
- (k) Attach actuating rod to bracket, lever, and links. lubricate actuating rod with hydraulic fluid.
- (l) Install O-ring onto actuating rod. Insert rod into end gland assembly.
- (m) Slide bracket/lever assembly as far as possible toward check with lever in open position.

NOTE: There should be very little travel.

- (n) Torque bolts to 20 - 25 in.-lbs. Lockwire bolts.

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**GRIDS 4E20 THRU 4E24
INTENTIONALLY BLANK**

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WHEELS AND BRAKES

1. Nose Wheel Assembly (See Figure 1.)

A. Removal and Disassembly

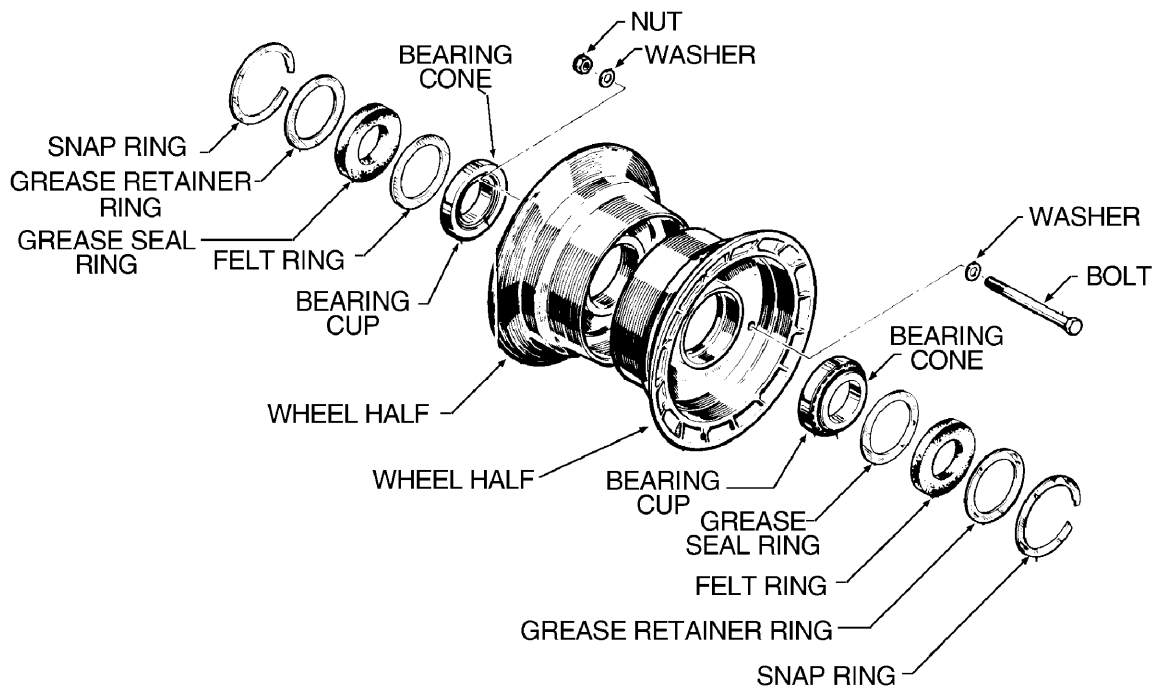
- (1) Jack the airplane enough to raise the nose wheel clear of the ground (refer to Jacking, 7-10-00).
- (2) To remove the nose wheel, first remove the cotter pin and washer that secures the safety clevis pin of the wheel nut. Next remove the clevis pin and wheel nut. Then slide the wheel from the axle.
- (3) The wheel halves may be separated by first deflating the tire. With the tire sufficiently deflated, remove the wheel through bolts. Pull the wheel halves from the tire by removing the wheel half opposite the valve stem first and then removing the other half.
- (4) The wheel bearing assemblies may be removed from each wheel half by first removing the snap rings that secure the grease seal retainers, and then the retainers, grease seals and bearing cones. The bearing cups should be removed by tapping out evenly from the inside.

B. Assembly and Installation

- (1) Ascertain that the bearing cup for each wheel is properly installed. Install the tire with tube on the wheel half with the valve stem hole and then join the two wheel halves. Install the through bolts with the washers and nuts to the valve stem side.

NOTE: Torque the nuts on the Cleveland Wheel Assembly to 90 inch-pounds. Torque the nuts on the McCauley wheel assembly to 140-150 inch-pounds on the McCauley wheel assembly only. A bushing is required to prevent tube movement.

- (2) Lubricate the bearing cones and install the cones, grease seals, felt rings and seal retainer rings. Secure with snap rings.



Nose Wheel Assembly
Figure 1

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- (3) Slide the wheel on the axle. While rotating the wheel, tighten the axle nut from 17 to 25 inch-pounds. Back off the nut to reduce torque to zero. While rotating the wheel, tighten the axle nut from 10 to 15 inch-pounds. Rotate the axle nut to align the nearest slot with the cotter pin hole. Install the cotter pin.

C. Inspection

- (1) Visually check all parts for cracks, distortion, defects and excess wear.
- (2) Check tie bolts for looseness or failure.
- (3) Check internal diameter of felt grease seals. Replace the felt grease seal if surface is hard or gritty.
- (4) Check tire for cuts, internal bruises and deterioration.
- (5) Check bearing cones and cups for wear and pitting. Then lubricate.
- (6) Replace any wheel casting having visible cracks.

2. Main Wheel Assembly (See Figure 2.)

A. Removal and Disassembly

- (1) Place the airplane on jacks (refer to Jacking, 7-10-00).
- (2) To remove the main wheel, remove the cap bolts that join the brake cylinder housing and the lining back plate assemblies. Remove the back plate from between brake disc and wheel.
- (3) Remove the dust cover, the cotter pin and flat head pin that safeties the wheel nut, and the wheel nut. Slide the wheel from the axle.
- (4) The wheel halves may be separated by first deflating the tire. With the tire sufficiently deflated, remove the wheel through bolts. Pull the wheel halves from the tire by removing the inner half from the tire first, and then the outer half.
- (5) The wheel bearing assemblies may be removed from each wheel half by first removing the retainer snap rings that secure the grease seal retainers, and then the retainers, grease seals and bearing cone. The bearing cups should not be removed except for replacement. Refer to Nose and Main Wheel Assembly Repairs, below, for bearing cup replacement instructions.

B. Assembly and Installation

- (1) Ascertain that the bearing cup for each wheel is properly installed. Install the tire with tube and wheel half with the valve stem hole. Ascertain that the index mark is aligned with the index mark on the tire to ensure proper tire, tube and wheel balance. Join the two wheel halves and position the brake disc in the inner wheel half. Install the through bolts with nuts on the valve stem side. Torque the wheel nuts to 150 inch-pounds and inflate the tire.
- (2) Lubricate the bearing cones and install the cones, grease seals and seal retainer rings. Secure retainer with snap ring.
- (3) Slide the wheel on the axle and secure with the retainer nut. While rotating the wheel, tighten the axle nut from 17 to 25 inch-pounds torque. Back off the nut to reduce the torque to zero. While rotating the wheel, tighten the axle nut from 10 to 15 inch-pounds torque. Rotate the axle nut to align the nearest slot with the cotter pin hole. Install the cotter pin.
- (4) Position the brake lining back plates between the wheel and brake disc and the brake cylinder on the torque plate. Insert the spacer blocks between the back plates and cylinder, and install the four bolts to secure the assembly. If the brake was disconnected, reconnect the line and bleed the brakes.

C. Inspection

- (1) Visually check all parts for cracks, distortion, defects and excess wear.
- (2) Check tie bolts for looseness or failure.

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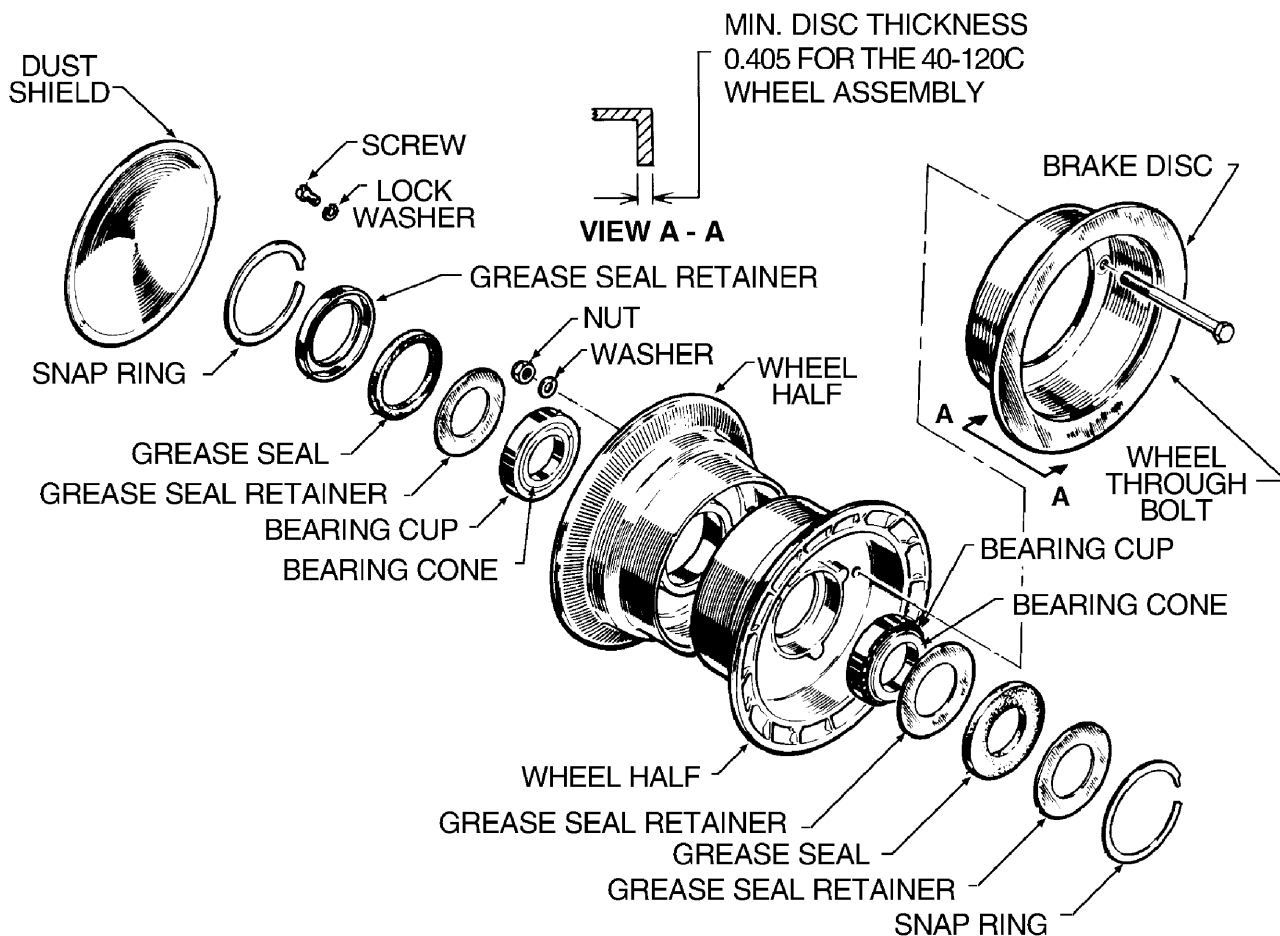
- (3) Check internal diameter of felt grease seals. Replace the felt grease seal if surface is hard or gritty.
 - (4) Check tire for cuts, internal bruises and deterioration.
 - (5) Check bearing cones and cups for wear and pitting. Then lubricate.
 - (6) Replace any wheel casting having visible cracks.
 - (7) Inspect brake disc for cracks, excessive wear or scoring, rust, corrosion and warpage.
 - (8) Remove rust and blend out nicks, using fine 400 grit sandpaper.
 - (9) Replace disc if cracked or when disc is worn below .405 in. (Wheel Brake Assembly - Cleaning, Inspection and Repair, below.)
3. Nose and Main Wheel Assembly Repairs

Repairs are limited to blending out small nicks, scratches, gouges and areas of slight corrosion, plus the replacement of parts which are cracked or badly corroded.

NOTE: Remove corrosion and blend out small nicks, using fine 400 grit sandpaper.

Wheels may also be repainted if the parts have been repaired and thoroughly cleaned. Paint exposed areas with one coat zinc chromate primer and one coat of aluminum lacquer.

NOTE: Never paint working surfaces of the bearing cups.



Main Wheel Assembly
Figure 2

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4. Bearing Cup

A. Removal

- (1) Insert wheel half into boiling water for 15 minutes or place in an oven not exceeding 250° F (121° C) for 15 minutes.
- (2) Remove from source of heat and invert wheel half. If the cup does not drop out, tap the cup evenly from the axle bore with a fiber drift pin or suitable arbor press.

B. Installation

- (1) To replace a new cup, apply one coat of zinc chromate primer to wheel half bearing bore.
- (2) Insert wheel half into boiling water for 15 minutes or place in an oven not exceeding 250° F (121° C) for 15 minutes. Chill new bearing cup in dry ice for a minimum of 15 minutes.
- (3) Remove wheel half from source of heat and bearing cup from dry ice. Install the chilled bearing cup into the bearing bore of the heated wheel half. Tap gently to seat evenly in place, using a fiber drift pin or suitable arbor press.

5. Brake Adjustment and Lining Tolerance

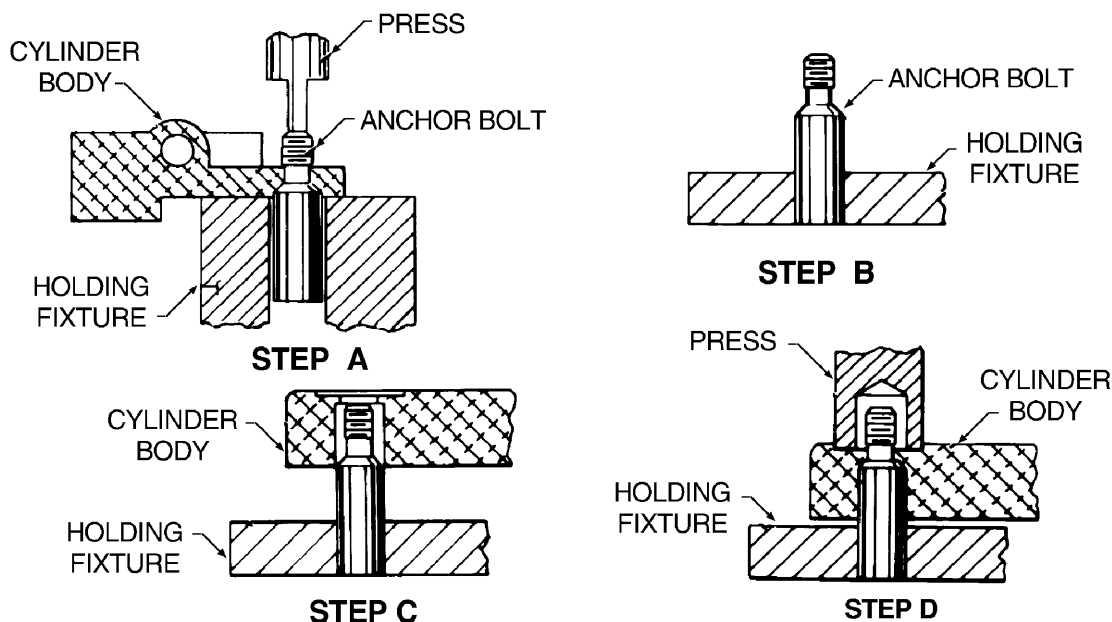
No adjustment of the brake lining clearance is necessary as they are self-adjusting. Inspection of the lining is necessary, and it may be inspected visually while installed on the airplane. The linings are of the riveted type and should be replaced if the thickness of any one segment becomes worn below 0.100 of an inch or unevenly worn.

6. Wheel Brake Assembly (See Figures 3 and 4.)

A. Removal and Disassembly

To remove the brake assembly:

- (1) Disconnect the brake line from the brake cylinder at the tube fitting.
- (2) Remove the cap bolts that join the brake cylinder housing and the lining back plate assembly. Remove the back plate from between the brake disc and wheel.



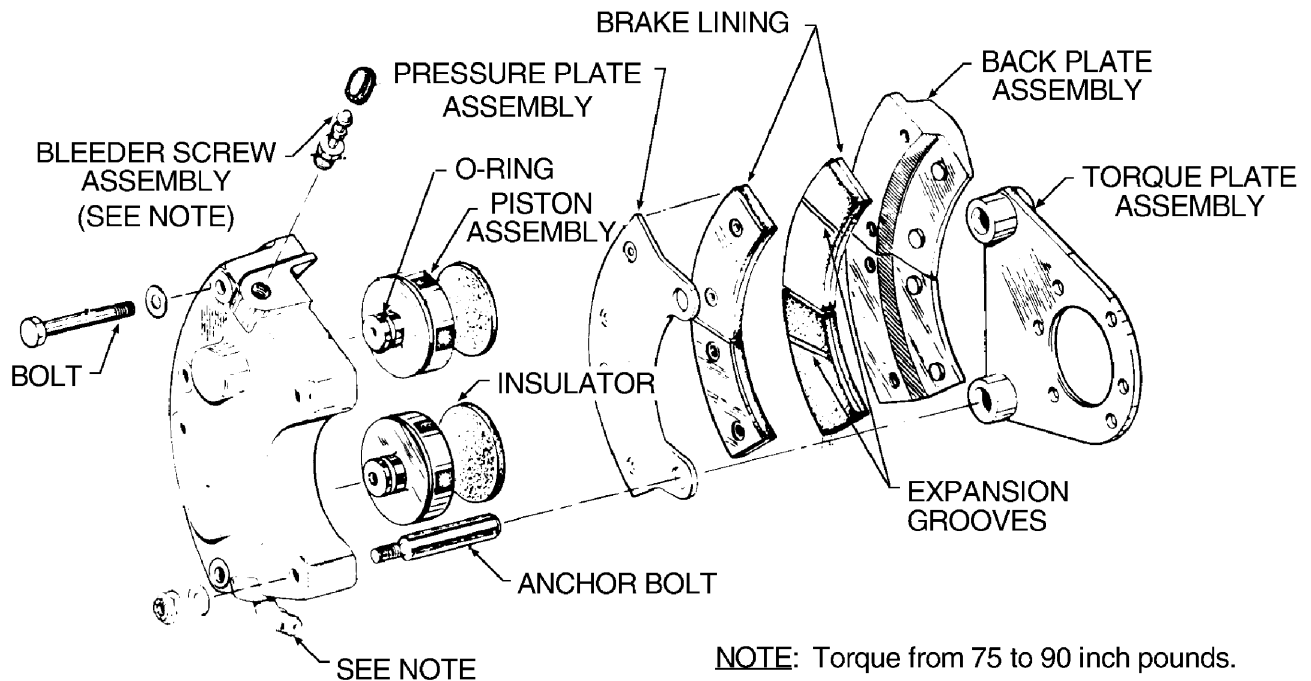
Anchor Bolt, Removal and Installation
Figure 3

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- (3) Slide the brake cylinder housing from the torque plate.
- (4) Remove the pressure plate by sliding it off the anchor bolts of the housing.
- (5) Remove piston(s) by injecting low air pressure in the cylinder fluid inlet and forcing the piston from the housing.
- (6) Check anchor bolt for wear.
 - (a) To remove anchor bolt:
 - 1 Position cylinder assembly on a holding fixture (refer to Figure 3, Step A).
 - 2 Use a suitable arbor press to remove the anchor bolt from the cylinder body.
 - (b) To install anchor bolt:
 - 1 Support anchor bolt in a holding fixture (refer to Figure 3, Step B).
 - 2 Align cylinder body over anchor bolt (refer to Figure 3, Step C).
 - 3 Use a suitable arbor press and apply pressure on the spot face directly over the anchor bolt hole (refer to Figure 3, Step D).

B. Assembly and Installation

- (1) Lubricate the piston O-ring(s) with fluid MIL-H-5606 and install on piston(s). Slide the piston(s) in cylinder housing until flush with surface of housing.
- (2) Slide the lining pressure plate onto the anchor bolts of the housing.
- (3) Slide the cylinder housing assembly on the torque plate of the gear.
- (4) Position the lining back plate between the wheel and brake disc. Install the bolts and torque to 40 inch-pounds to secure the assembly.
- (5) Connect the brake line to the brake cylinder housing.
- (6) Bleed the brake system as described in Bleeding Brakes.



Wheel Brake Assembly
Figure 4

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C. Cleaning, Inspection, and Repair (See Figure 4):

- (1) Clean the assembly with a suitable solvent and dry thoroughly.
- (2) Check the wall of the cylinder housing and piston for scratches, burrs, corrosion, etc, that may damage O-rings.
- (3) Check the general condition of the brake bleeder screw and lines.
- (4) Check the brake disc for wear, grooves, scratches, or pits. The minimum disc thickness of Disc 164-46 used on Wheel Assembly 40-120C is .405. A single groove or isolated grooves up to .030 of an inch deep would not necessitate replacement, but a grooving of the entire surface would reduce lining life and would necessitate replacement of the disc. Should it be necessary to remove the wheel disc, see Main Wheel Assembly - Removal and Disassembly.
- (5) To remove the snap-on type lining used on the brake assemblies may be by prying loose with a screwdriver or a thin flat wedge. Install the snap-on type lining by positioning onto the pins and applying pressure to snap into position.
- (6) If a powdery rust appears on the brake disc, one or two taxi braking applications should wipe the disc clear. Rust allowed to progress beyond this point may require removal of the disc from the wheel assembly to properly clean both faces. Wire brushing followed by sanding with 220 grit sandpaper can restore the braking surfaces for continued use.

NOTE: To inspect the linings, check the expansion groove. If the groove is not showing, replace the lining.

NOTE: Replacement brake linings (metallic) used on the brake assembly should be conditioned by performing three hard braking applications at 45 to 50 mph. Do not allow the brake discs to cool substantially between stops. This will wear off any high spots and at the same time generate sufficient heat to glaze the surface of the metallic linings. Once the linings are glazed, they will provide many hours of maintenance free service.

7. Toe Brake Cylinder Assembly (See Figure 6.)

A. Removal

WARNING: MAKE CERTAIN AIRPLANE IS PARKED ON LEVEL GROUND WITH WHEELS CHOCKED.

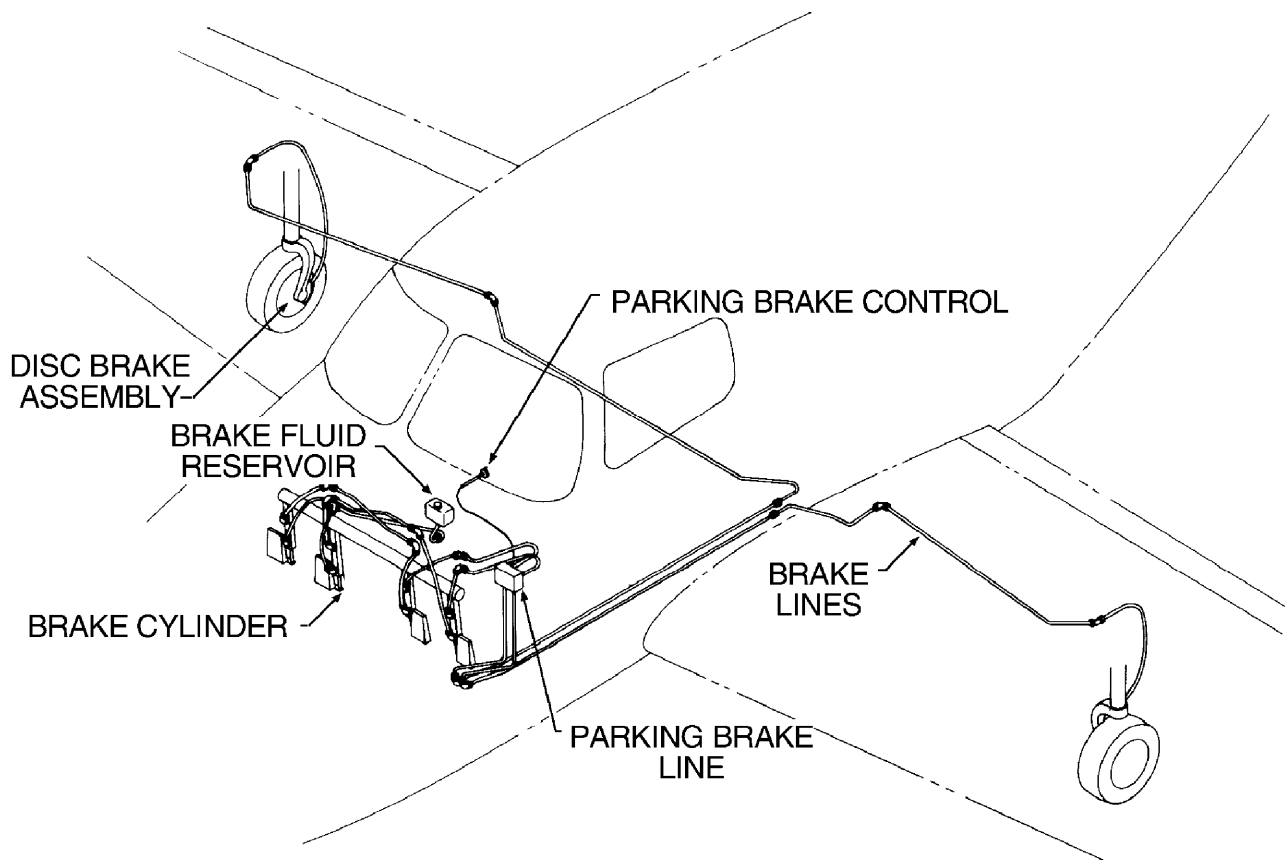
CAUTION: USE PARKER HANNIFIN REPLACEMENT BRAKE CYLINDERS ONLY. GAR-KENYON AND PARKER HANNIFIN BRAKE CYLINDERS ARE NOT INTERCHANGEABLE. PILOT'S LEFT AND RIGHT CYLINDERS MUST BE THE SAME MANUFACTURER. COPILOT'S LEFT AND RIGHT CYLINDERS MUST BE THE SAME MANUFACTURER. SEE PIPER PARTS CATALOG, P/N 761-878.

- (1) Place chocks under main and nose wheels.
- (2) Release parking brake.
- (3) Disconnect and quickly cap upper and lower hydraulic lines from cylinder assembly being removed.
- (4) Disconnect clevis from rudder pedal by removing cotter pin and pin.

NOTE: The rod and ring subassembly may be removed at this time without further disassembly of the toe brake assembly. Refer to Disassembly, Repair, and Installation, below, steps (1) and (2) for rod and ring removal instructions and steps (9) and (10) for installation. (See also the CAUTION above step (9).)

- (5) (Inboard toe brake assemblies only.) Remove nut, bolt, and washer holding nose wheel steering rod assembly to pedal.

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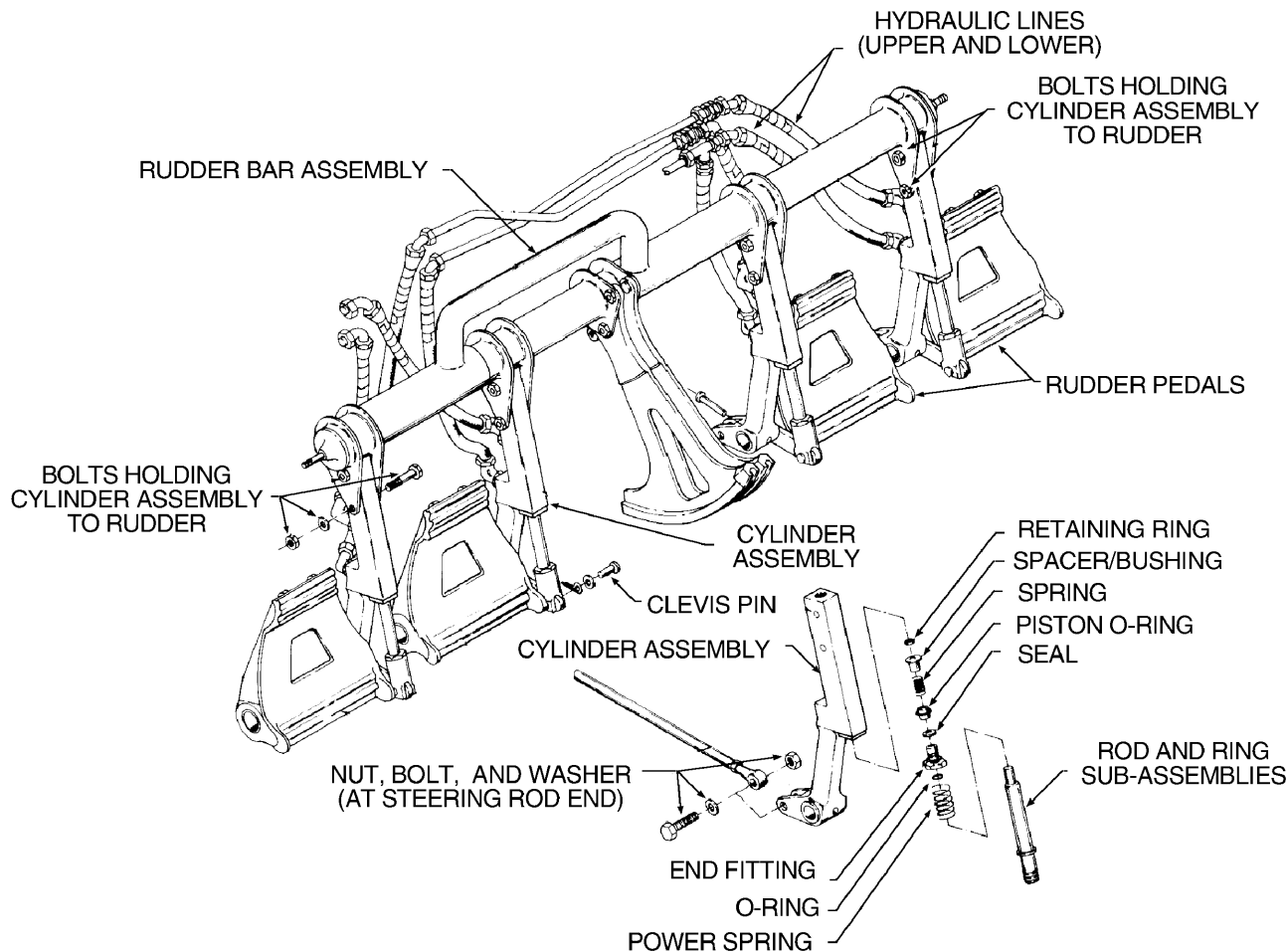
NOTE: Apply Tite Seal 3-T3 to all male pipe threads prior to assembly. Do not allow sealant to enter into system.

Brake System Installation
Figure 5

- (6) Remove the two nuts, bolts, and washers holding cylinder assembly to rudder bar.
- (7) Remove toe brake and cylinder assembly from airplane.
- B. Disassembly, Repair, and Installation
 - (1) Remove end fitting from cylinder housing.
 - (2) Slide entire rod and ring assembly with attached piston out of cylinder housing.

NOTE: Repairs to the rod and ring assembly and piston are limited to polishing small scratches and burrs, and replacement of parts.
 - (3) Clean cylinder bore, rod and ring assembly, and piston with dry-type solvent.
 - (4) To replace any of the component parts shown in the parts catalog, remove retaining ring. All parts will slide off rod and ring assembly.
 - (5) Soak end fitting O-rings (one internal, one external) and piston O-ring in hydraulic fluid. Coat with fluid compatible gel.
 - (6) Install power spring on rod and ring assembly.

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Toe Brake Cylinder Assembly
Figure 6

- (7) Insert rod and ring sub-assembly with spring through end fitting.
- (8) Insert, in order: washer seal, piston, piston spring, and bushing. Snap retaining ring into groove.

CAUTION: PISTON MUST BE INSERTED INTO CYLINDER HOUSING IN SUCH A WAY THAT ONLY PISTON O-RING CONTACTS THE CYLINDER INNER SURFACE. OTHERWISE, THE INNER SURFACE MAY BECOME SCRATCHED.

- (9) Carefully insert piston and rod and ring assembly into cylinder housing.
- (10) Tighten end fitting to a torque of 13-17 inch-lbs.
- (11) Connect cylinder assembly to rudder bar with two nuts, bolts, and washers.
- (12) (Inboard toe brake assemblies only.) Connect pedal to nose wheel steering rod assembly.
- (13) Connect clevis to rudder pedal by inserting pin, washer, and cotter pin.
- (14) Uncap and connect upper and lower hydraulic lines to cylinder assembly.
- (15) Bleed brakes (refer to Bleeding Brakes, 32-40-00).

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- (16) Set parking brakes.
- (17) Remove chocks from wheels before moving airplane.

8. Brake Bleeding Procedure

A. (Gravity)

- (1) On both main landing gear wheel brake assemblies, attach a clear plastic hose to the brake bleeders. Extend the hoses into a container partially filled with hydraulic fluid, MIL-H-5606. The ends of the hoses should be submerged in the fluid. Open both bleeders approximately one and one-half to two turns.
- (2) Fill the brake reservoir on the forward pressure bulkhead with hydraulic fluid, MIL-H-5606.
- (3) Pump the toe brakes very slowly approximately 25 times until fluid is observed passing through the clear plastic hoses at the wheel cylinder.

NOTE: Fluid level in the reservoir must be maintained to prevent air from entering the line.

- (4) Tighten both wheel bleeders.
- (5) Check per Brake System Leak Check.

B. (Pressure)

- (1) Place a small clear plastic hose on the vent tube of the brake reservoir and place a second small clear plastic hose on the bleeder fitting on one main landing gear. Place the open ends of these hoses in a suitable container to collect the fluid overflow. Open the bleeder fitting one or two turns.
- (2) On the other main gear, slide the hose of the pressure unit over the bleeder fitting, then open the fitting one or two turns and pressure fill the brake system with MIL-H-5606 fluid.
- (3) With fluid continually flowing through the brake system, SLOWLY and together actuate the pedals several times.

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 toe brakes remain spongy, it may be necessary to repeat the brake bleeding procedure.

- (4) Close the open bleeder fitting on the gear being bled. Close the open bleeder fitting to which the pressure hose is attached; then close the pressure unit and remove the hoses from the bleeder fittings and from the reservoir vent. Check the brakes for proper pedal pressure. Replace the caps over the bleeder fittings.

NOTE: It may be necessary to remove any trapped air in the top of the wheel brake unit by applying pressure to the system with the toe brakes and slowly opening the bleeder and releasing the hand lever.

- (5) Repeat this procedure, if necessary, on the other gear.
- (6) Drain excess fluid from the reservoir to fluid level line with a syringe.

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C. Brake Bleeding After a Unit Has Been Changed

CAUTION: DO NOT ALLOW PRESSURE TO BLEED OFF BEFORE CLOSING BLEEDERS, FOR THIS WILL ALLOW AIR TO ENTER THE SYSTEM. REPEAT THE PUMPING AND BLEEDING APPROXIMATELY 10 OR MORE TIMES OR UNTIL ALL THE AIR IS RELEASED FROM THE SYSTEM. DURING ALL BLEEDING, FLUID LEVEL OF THE RESERVOIR MUST BE MAINTAINED.

- (1) Actuate the toe brakes until some pressure builds up in the system. At this time crack the attaching B nuts at any of the hose connections of the replaced unit. Most of the brake pedals' spongy feeling should be displaced by this action. Tighten B nut.
- (2) Actuate the toe brake/ master cylinder on the side on which the unit has been replaced. Bleed fluid through the wheel brake assembly by pumping pressure and cracking bleeder until the pressure drops.

9. Brake System Leak Check

- A. Push on the toe brakes for a good firm pressure and lock the parking brake mechanism.
- B. Allow the system to stand for approximately 10 minutes, then, by pushing the toe brakes, they should not be able to be pushed forward further than the original set.
- C. If the toe brakes can be pushed forward and feel spongy, a leak is present at some point in the system.
- D. This leak may appear at any one of the connections throughout the system or internally in the toe brake master cylinder or wheel brake assemblies.

10. Parking Brake Valve

A. Removal

- (1) Disconnect the parking brake cable from the valve actuating arm.
- (2) Disconnect the fluid lines from the valve.
- (3) Remove the screws that attach the valve to its mounting bracket.
- (4) Place a protective material over the line openings to prevent contamination of the system.

B. Installation

- (1) Attach the valve to the bulkhead mounting bracket with screws.
- (2) Connect the fluid lines to the valve.
- (3) Connect the control cable to the valve lever.

C. Disassembly

- (1) Remove the two fittings from the outside of the valve body. A valve spring is held in place by the fittings. Use caution not to loosen these when removing the fittings.
- (2) From the valve body, remove the valve spring and valve.
- (3) To remove the valve cam, remove the nut, washer, bushing and spring. Pull the cam from the valve body.

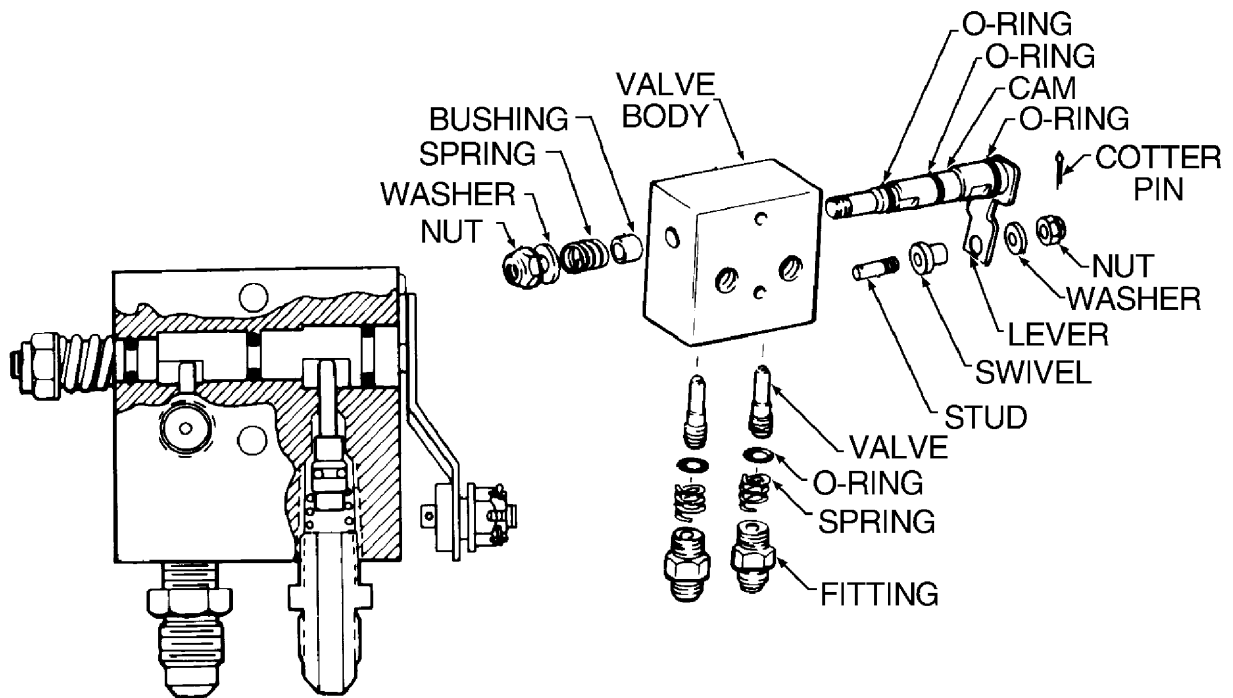
D. Assembly

- (1) Install O-rings on valve cam.
- (2) Lubricate O-rings with fluid (MIL-H-5606), insert cam into valve body and secure with spring, bushings, washer and self-locking nut.
- (3) Install O-ring on the valve, insert valve in hole of out port, install valve spring and secure with outlet fitting.

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E. Cleaning, Inspection, and Repair

- (1) Clean the valve parts with a suitable solvent and dry thoroughly.
- (2) Inspect valve and seat surfaces of valve body for excessive wear and corrosion.
- (3) Inspect the cam assembly for burrs, scratches, excess wear, loose operating lever, etc.
- (4) Check general condition of valves and springs.
- (5) Repair to the valve is largely limited to smoothing burred or scratched surfaces and replacing O-rings.



Parking Brake Valve Assembly (Parker-Hannifin)
Figure 7

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MAINTENANCE MANUAL

STEERING

The nose gear is steered by means of the rudder pedals. Movement of the pedals is transmitted to the steering arm by two steering pushrods, a steering bellcrank and a steering bungee. Bellows are installed on the forward portion of the steering pushrods where they pass through the forward pressure bulkhead.

1. Steering Pushrod

A. Removal

- (1) Disconnect the aft end of the pushrod from the arm on the rudder bar.
- (2) Disconnect the forward end of the pushrod from the steering bellcrank.
- (3) Loosen the forward end of the bellows and slip the pushrod through the bellows. The rod end on the forward end of the bellows will have to be removed to allow the rod to pass through the opening in the bellows.

B. Installation

- (1) Set the length of the steering pushrods to an initial length of 11.90 inches between the centers of the bolt holes in the rod end bearings. Insure that the rod ends are positioned 90° to each other. Loosen the forward jam nut 1/2 turn. Remove the rod end / jam nut without turning the jam nut on the rod end shaft any more.
- (2) Insert the steering rod assembly into the aft end of the bellows. Push the rod through the sleeve in the forward end of the bellows.
- (3) Reinstall the rod end on the end of the pushrod. Then tighten the rod end 1/2 turn.
- (4) Attach the forward end of the steering rod to the steering bellcrank.
- (5) Attach the aft end of the steering rod to the arm on the rudder bar.
- (6) Locate the forward end of the bellows immediately aft of the jam nut on the forward rod end and tighten the hose clamp on the forward end of the bellows.

2. Steering Bellcrank

A. Removal

- (1) Disconnect the forward ends of both steering pushrods from the bellcrank.
- (2) Disconnect the aft end of the bungee from the left side of the bellcrank.
- (3) Cut the safety wire and remove the bolt that secures the steering bellcrank to the outer support plate.
- (4) Remove the bellcrank.

B. Installation

- (1) Ensure that two bushings and spacer are in place in the steering bellcrank.
- (2) Place washer over bolt and slide bolt into steering bellcrank.
- (3) Place washers over bolt. Insert bolt in support plates, insuring that spacer is in place between inner and outer support plate. Torque bolt and safety bolt to clip with MS20995-C41 safety wire.
- (4) Connect the aft end of the steering bungee to the left side of the steering bellcrank.
- (5) Connect the forward ends of both steering pushrods to the bellcrank.

3. Bungee Assembly

A. Removal

- (1) Disconnect forward end of bungee from left-hand side of steering arm.
- (2) Disconnect aft end of bungee from left-hand side of steering bellcrank.
- (3) Remove bungee.

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B. Installation

- (1) Place bungee in position.
- (2) Connect aft end of bungee to left-hand side of steering bellcrank.
- (3) Connect forward end of bungee to steering arm. The thinner washer goes under the bolt head, the thicker washer under the nut.

4. Steering Pushrod Bellows

A. Removal

- (1) Loosen hose clamps on forward end of bellows.
- (2) Disconnect steering pushrod from steering bellcrank. Remove rod end bearing and jamnut from forward end of steering pushrod.
- (3) Slide pushrod aft.
- (4) Remove screws from fire shield. (The fire shield is the plate on the aft side of the pressure bulkhead which helps to secure the large end of the bellows to the aft side of the pressure bulkhead.)
- (5) Slide fire shield, packing ring/housing/spacer assembly and plate aft on steering rod tube.
- (6) Push bellows forward out of cutout in pressure bulkhead.
- (7) Remove bellows from steering rod.

B. Installation

- (1) Place bellows over forward end of steering pushrod.
- (2) Push large end of bellows through cutout in pressure bulkhead.
- (3) Slide plate, packing ring/housing/spacer assembly and fire shield forward on steering rod tube.
- (4) Line up holes in pressure bulkhead, plate and fire shield; install screws, washers and nuts.

NOTE: Install all screws, except the uppermost one, with their shanks pointing aft. The uppermost screw's shank should point forward.

- (5) Install steering pushrod per instructions in this chapter.
- (6) Reconnect steering rod to steering bellcrank.
- (7) Tighten hose clamp on forward end of bellows.

NOTE: With nose landing gear pointing straight ahead, the forward end of the bellows should be approximately even with the forward end of the steering rod tube.

5. Steering Arm

A. Removal

- (1) Disconnect the forward end of the bungee from the left-hand side of the steering arm.
- (2) Remove the nut and washer that secures the steering arm to the mount plate.
- (3) Lift the steering arm off of the bolt.

B. Installation

- (1) Position the steering arm on the bolt, ensuring that a washer is installed above and below the spacer which goes through the bushing in the steering arm. Install and torque nut.
- (2) Attach forward end of bungee to left side of steering arm.
- (3) Adjust the clearance between one roller and the steering arm to 0.005-0.020 inch by moving the jamnuts on the steering arm locking assembly (located beneath the mount plate) forward or aft as required. Measure this clearance on one side with the other roller in contact with the steering arm.

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POSITION AND WARNING

1. Troubleshooting

WARNING: ALWAYS PLACE THE AIRPLANE ON JACKS BEFORE ATTEMPTING ANY TROUBLESHOOTING OF THE LANDING GEAR. SEE 7-10-00.

**CHART 1 (Sheet 1 of 3)
TROUBLESHOOTING LANDING GEAR WARNING SYSTEMS**

Trouble	Cause	Remedy
Red gear unsafe light out while gear is in transit.	Indicator lamp burned out.	Replace lamp.
	Indicator light ground incomplete.	Check ground circuit.
	Indicator light circuit wire broken.	Check wiring.
	Indicator light circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
Red gear unsafe light on though gear has retracted.	One or more up limit switches failed.	Isolate and replace switch.
	Nose gear up limit switch out of adjustment.	Check gear up adjustment and readjust up limit switch.
	Main gear not retracting far enough to actuate switch.	Check gear up adjustment.
Red gear unsafe light on though gear is down and locked.	One or more down limit switches failed.	Isolate and replace switch.
	Nose gear down limit switch out of adjustment.	Readjust down limit switch.
	Main gear down limit switch out of adjustment.	Readjust down limit switch.
<u>NOTE:</u> The out of adjustment or failed switch may be determined by noting which down light is not lit.		
Red gear unsafe light operates on and off after gear has retracted.	Light circuit wire loose.	Check wiring.
	Hydraulic system losing pressure.	Refer to Chapter 29 and Section 32-30-00.
	Gear up switch out of adjustment.	Check gear up adjustment and then switch adjustment.

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**CHART 1 (Sheet 2 of 3)
TROUBLESHOOTING LANDING GEAR WARNING SYSTEMS**

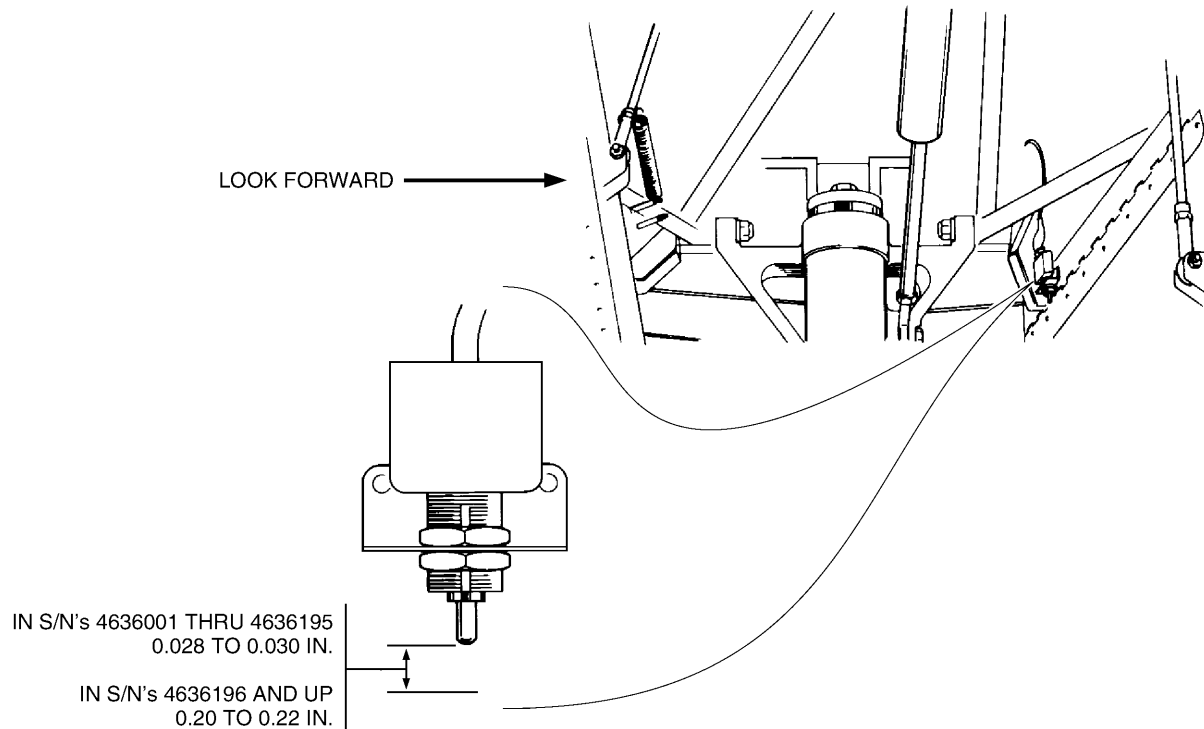
Trouble	Cause	Remedy
Red gear unsafe light out and one green gear down light out though gear is down and locked. NOTE: Ascertain navigation lights are off (daytime).	Lamp burned out.	Replace lamp.
	Gear down limit switch failed.	Replace switch.
	Light circuit wire broken.	Check wiring.
Red gear unsafe light and all green lights out. NOTE: Ascertain navigation lights are off (daytime).	Indicator lights circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Light circuit wire broken.	Check wiring.
Red gear unsafe light and horn fail to operate when power is decreased to approximately 15 IN. HG. MAP and landing gear is retracted.	Landing gear selector 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 at throttle failed .	Replace switch.
	Warning horn and light circuit wire broken.	Check wiring.
Red gear unsafe light and horn fail to stop when throttle is closed and gear has extended. (Gear extended through the use of the emergency gear down.)	Gear selector handle in up position.	Place handle in down position.
Red gear unsafe light and horn fail to operate when selector switch is moved to up position with gear extended and throttle not full forward.	Warning light and horn circuit wire broken.	Check wiring.
Above condition on ground.	Defective safety (squat) switch.	Replace switch.
Hydraulic pump shuts off, but red gear unsafe light remains on.	Gear not fully retracted.	Check gear retraction adjustments.
	Gear not contacting up micro switches.	Check gear up switches.

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**CHART 1 (Sheet 3 of 3)
TROUBLESHOOTING LANDING GEAR WARNING SYSTEMS**

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 instrument panel light control.)	Replace switch.
Green gear down light fails 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.
Green gear down lights blink momentarily before the down lock is engaged on roller.	Micro switch out of adjustment.	Adjust micro switch.

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Nose Gear Up Switch Adjustment
Figure 1

2. Nose Gear

WARNING: ADJUSTMENT OF ALL LIMIT SWITCHES SHOULD BE MADE WITH THE AIRPLANE ON JACKS.

A. Up Limit Switch Adjustment (See Figure 1.)

The nose gear up limit switch is located on the right-hand side of the wheel well opening. The right-hand nose wheel door actuates this switch.

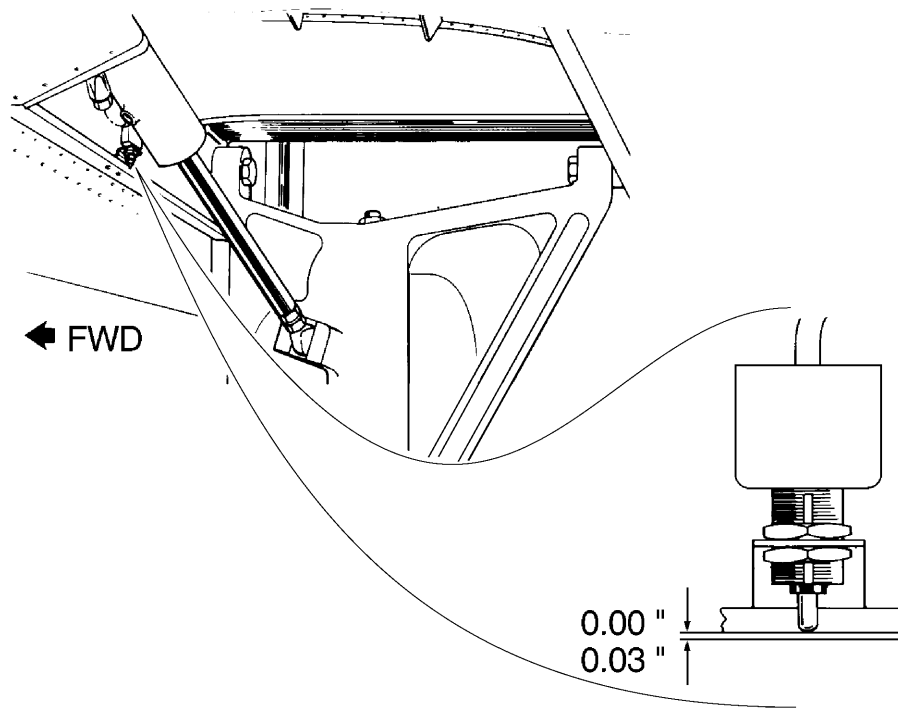
This switch is adjusted by backing off the two nuts on the switch plunger bushing.

B. Down Limit Switch Adjustment

The nose gear down limit switch is mounted on the nose gear locking actuator. The switch is activated when the cylinder is extended and locked.

No adjustment of this switch is allowed.

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Main Gear Up Switch Adjustment
Figure 2

3. Main Gear

WARNING: ADJUSTMENT OF ALL LIMIT SWITCHES SHOULD BE MADE WITH THE AIRPLANE ON JACKS.

A. Up Limit Switch Adjustment (See Figure 2.)

A gear up limit switch is located in the wing wheel well, beneath the locking actuator. There is no adjustment of the switch other than that shown in Figure 2; i.e. - 0.0 to 0.03 inch above the flush line of the lower wing skin.

B. Down Limit Switch Adjustment

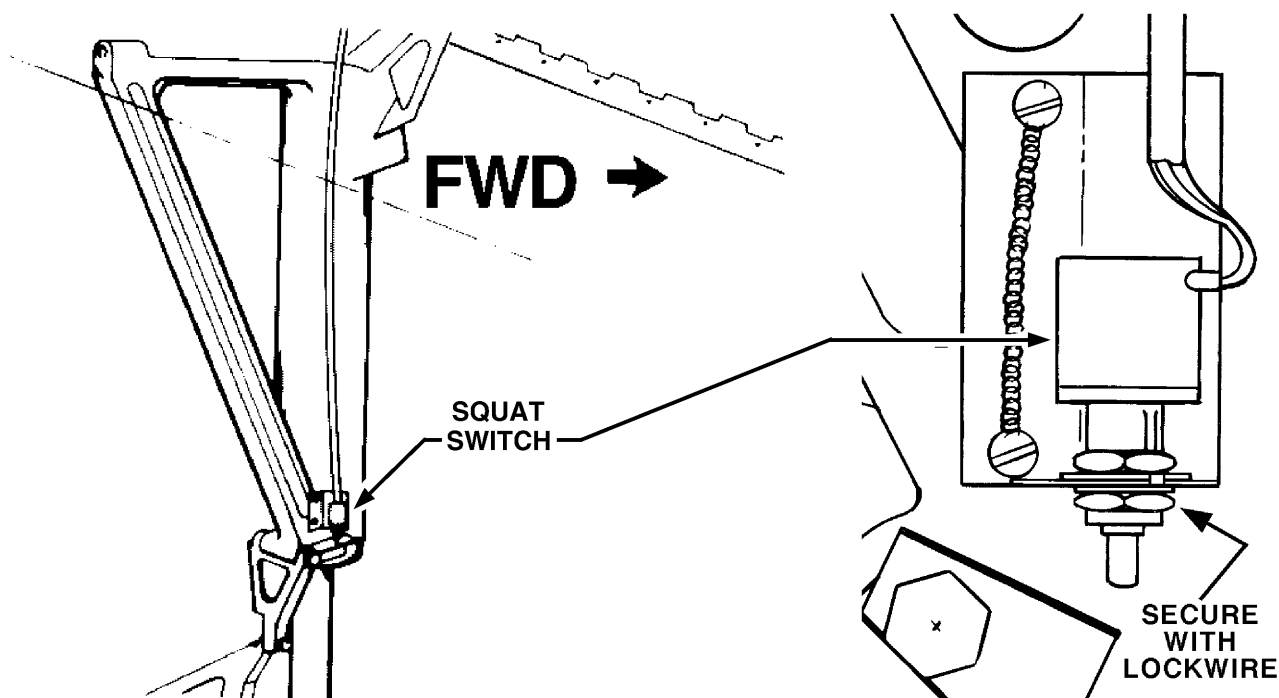
The main gear down limit switches are mounted in each main gear locking actuator. The switch is activated when the cylinder is extended and locked.

No adjustment of these switches is required.

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Adjustment of Squat Switch
Figure 3

4. Landing Gear Safety Switch (Squat Switch) Adjustment (See Figure 3.)

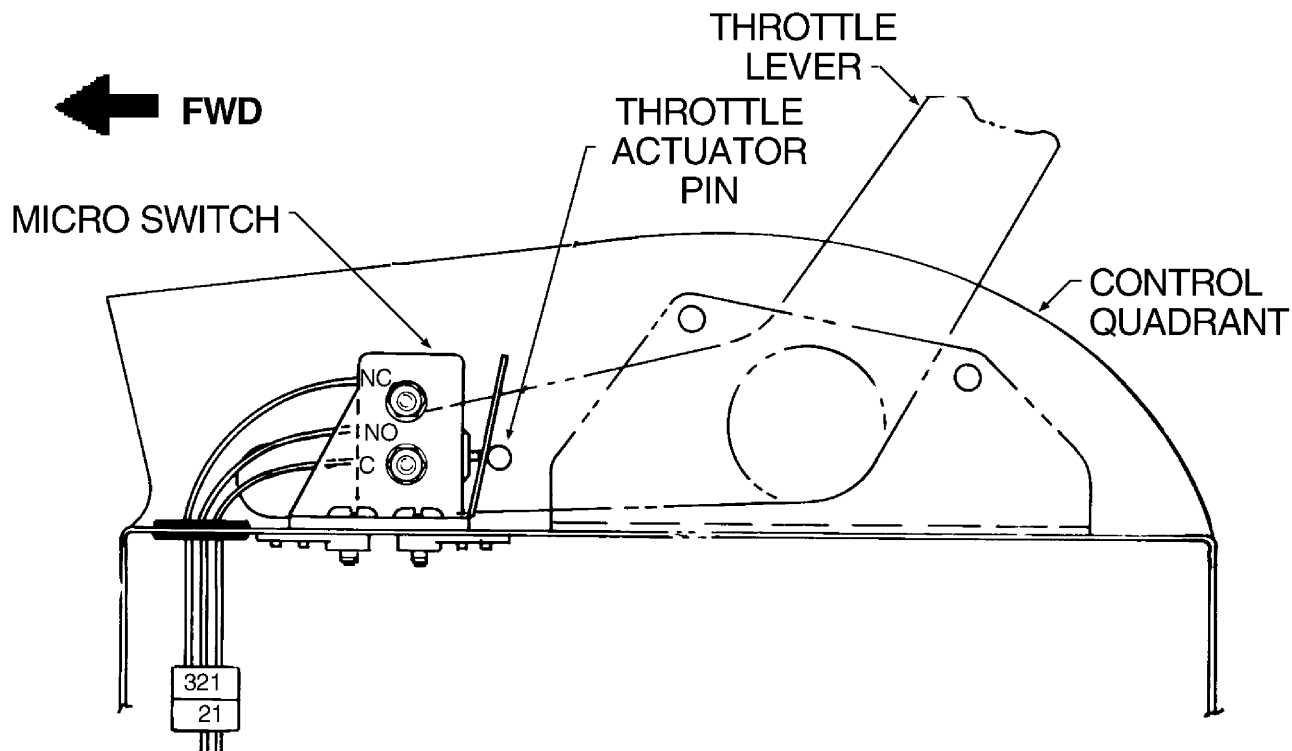
(PIR-PPS60033-7, Rev. G/-13, Rev. NEW.)

WARNING: ADJUSTMENT OF ALL LIMIT SWITCHES SHOULD BE MADE WITH THE AIRPLANE ON JACKS.

The landing gear safety switch is located on the left main gear housing. It is adjusted to provide a closed gear selector "UP" control circuit at a strut extension of 8.00 inches maximum and an open gear "UP" control circuit at a strut extension of 7.70 inches minimum.

- A. Jack the airplane (refer to 7-10-00).
- B. Compress the strut until 7.875 inches is obtained between the top of the gear fork and the bottom of the gear housing. Hold the gear at this measurement.
- C. Adjust the switch so that it actuates at this point. Secure the switch with lockwire.
- D. Extend and then compress the strut to ascertain that the switch will actuate within the last quarter of an inch of oleo extension.

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Landing Gear Up / Power Reduced Warning Switch
Figure 4

[Effectivity](#)

4636001 thru 4636374

5. Landing Gear Up / Power Reduced Warning Switch (See Figure 4.)

A. [S/N's 4636001 thru 4636374](#)

(1) Removal

The landing gear up / power reduced warning switch is located in the engine control quadrant assembly. It is on the left side of the throttle lever.

- Loosen the control quadrant cover and slide it up the engine control levers and out of the way.
- Disconnect the electrical leads to the switch at the plug.
- Remove screws, nuts, and washers that attach the switch to its mounting bracket.

(2) Installation

- Attach the switch to its mounting bracket with screws, nuts, and washers.
- Reconnect the electrical leads at the plug.
- Slide control quadrant cover down the engine control levers and secure it to the top of the console.
- Adjust the switch per the following instructions.

(3) Adjustment

(PIR-FTP2001-8, Rev. E.)

This switch is adjusted by backing off the two nuts on the switch mounting bracket to reposition the switch. Set for horn to sound at 15 ± 1 In. Hg. manifold pressure.

B. [S/N's 4636375 and up](#)

(PIR-FTP2001-8, Rev. E.)

Uses manifold pressure to operate a pressure switch to sound the gear warn horn if power is reduced to or below 15 ± 1 In. Hg with the gear up. No adjustment is required.

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CHAPTER

33

LIGHTS

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FLIGHT COMPARTMENT

All lighting is 24 Vdc except for the circuit breaker panels, which are lit by electroluminescent means and use an inverter to convert 24 Vdc input from the 5 amp INSTR PANEL circuit breaker, to 115 Vac 400 Hz.

Cockpit lighting consists of instrument panel post lights which are controlled by a solid state dimmer control unit. Radio lighting is controlled separately and in any case consists of integral lighting normally provided in radio equipment. Switches are back lighted for positive identification and visibility. An overhead light is located in the cockpit ceiling above each of the two front seats providing map lights and standby panel lighting for each crew member. These standby/ map lights are controlled by an ON-OFF, dimmer rheostat, located on the overhead, between the two lights. The electroluminescent lighting receives its power from the PANEL LIGHTS circuit breaker via the panel lights dimmer switch, taper block TB1 and the electroluminescent panel inverter.

The three dimmer control units are solid state and powered through the 3 amp ANNUN and AVIONICS DIMMING, and the 5 amp INSTR PANEL circuit breakers. The dimmer controls rheostats control the dimmer outputs for post lights, circuit breaker panels, switch, and avionics lighting intensity.

All panel lights, except for integral radio equipment lighting, are controlled from the dimmer control unit and dimming rheostat. Employ conventional troubleshooting methods: panel lights full bright, first replacing offending individual lamps. If not successful measure socket voltage and repair as required. If all lamps are "OUT" check power from bus, through circuit breaker, harness, dimmer control, and dimmer output. Replace or repair as required.

NOTE: Refer to 91-33-10, 91-33-20, and 91-33-40 for schematics on the Lighting systems.

1. Dimmer Control Unit

A. Removal

- (1) The dimmer control units are mounted on the aft right side of the forward pressure bulkhead. Access is gained from beneath the copilot's instrument panel. The rheostat controls are mounted on the lower left side of the pilot's instrument panel just below the main electrical switch panel.
- (2) Disconnect the electric harness connector.
- (3) Remove mounting screws and the dimmer control assembly.

B. Installation

- (1) Position the dimmer control assembly in place and secure with the mounting screws.
- (2) Connect the electrical harness connector to dimmer assembly.
- (3) Cycle lighting to verify function.

2. Post Lights

A. Removal

- (1) Disconnect wire from rear of socket behind panel.
- (2) Unscrew rear contact collar from rear of socket.
- (3) Remove mounting washer and nut from light assembly.
- (4) Pull assembly from panel mounting hole.

B. Installation

- (1) Insert assembly into panel mounting hole.
- (2) Install mounting washer and nut onto light assembly.
- (3) Screw rear contact collar from rear of socket.
- (4) Connect wire to rear of socket behind panel.

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C. Lamp Replacement

- (1) Pull firmly on the post light hood and remove.
- (2) The lamp will be pulled from socket and remain inside hood. Gently pry the lamp base flange from the hood to remove the lamp.
- (3) Push the new lamp into the hood and push the hood back into the socket.

3. Annunciator Panel (See Chart 1 and Figures 1 and 2.)

The annunciator panel, located at the top center of the instrument panel, provides systems visual warning information. A complete functional description is provided in 31-50-00. Complete electrical schematics are provided in 91-31-50.

- A. In S/N's 4636001 thru 4636131, it is not necessary to remove the annunciator panel assembly to replace lamp bulbs. Simply "PUSH-IN" on the function light until it "clicks", and release pressure. The cover assembly will be partially ejected from the lamp base assembly. Pull the cover from the base and rotate to expose the lamp bulb. Replace defective bulb and reverse removal procedure. Depress "Test" function to verify lamp function.
- B. In S/N's 4636132 thru 4636374, pull evenly on the annunciator panel bezel to access the lamp bulbs. An extraction tool and four spare bulbs are located behind the bezel. Use the extraction tool to replace defective bulb and reverse removal procedure. Depress "Test" function to verify lamp function.

NOTE: Test function only tests the bulbs, not the circuit.

- C. In S/N's 4636375 and up, the annunciator panel is an LED unit. In the unlikely event of LED failure, the entire unit must be replaced.

4. Standby Map Light Removal and Installation

- A. Remove the four lens retainer screws and remove the lens.
- B. Remove and replace the bayonet type lamp.
- C. Replace the lens and four mounting screws.

5. Dimming Rheostat

A. Removal

- (1) Remove the overhead access panel between pilot's standby-map light and radio speaker.
- (2) Remove rheostat mounting screws.
- (3) Disconnect and label wiring.
- (4) Remove rheostat.

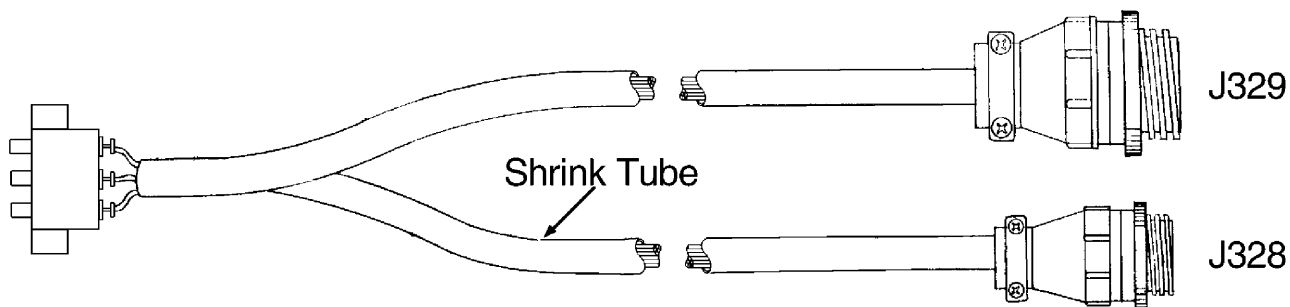
B. Installation

- (1) Connect wiring to rheostat.
- (2) Position rheostat in proper location and install mounting screws.
- (3) Install the overhead access panel.

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**CHART 1
ANNUNCIATOR PANEL LOCATOR / COLOR**

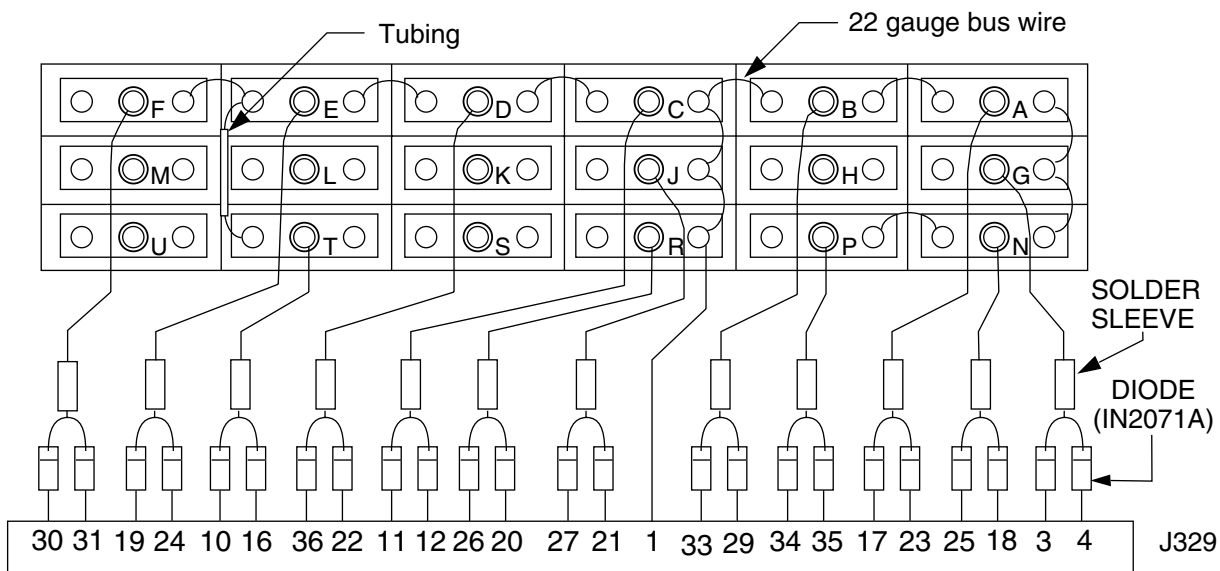
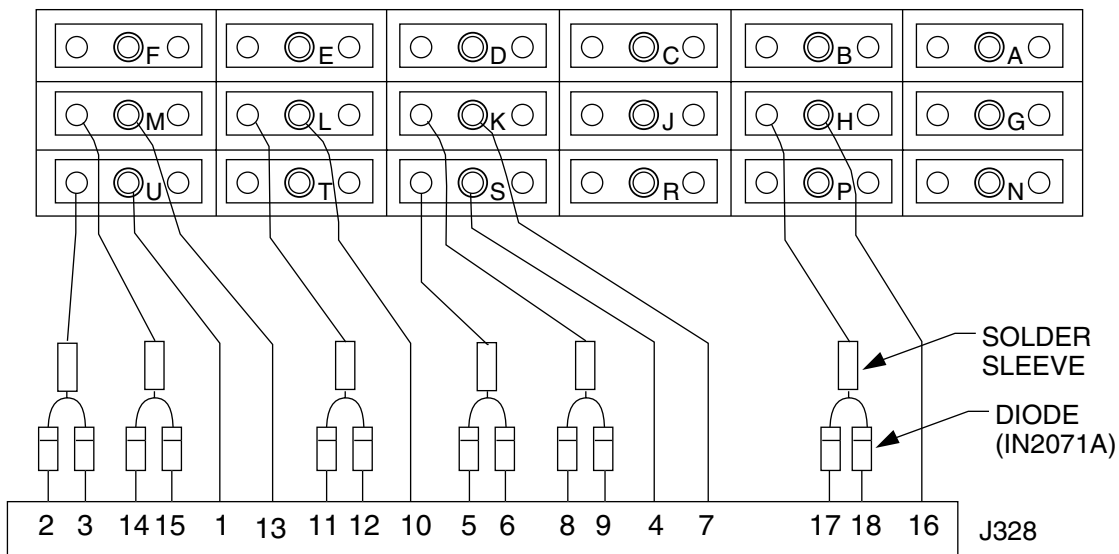
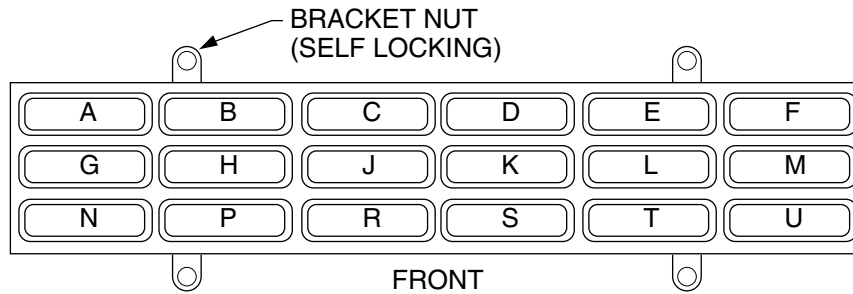
Station Fig. 2	Station Fig. 3	Annunciator	Color	Station Fig. 2	Station Fig. 3	Annunciator	Color
A	G	ALTERNATOR NO. 1 INOP	RED	P	--	-----	GREEN
B	H	BOOST PUMP	RED	R	X	OIL PRESS	AMBER
C	J	FUEL PRESS	RED	S	Y	HYDRAULIC PUMP	AMBER
D	K	LOW BUS VOLTAGE	RED	T	Z	SURFACE DE-ICE	GREEN
E	L	CABIN ALTITUDE	RED	U	AA	ANNUNCIATOR INOP	AMBER
F	M	STALL WARN FAIL	RED	--	W	PITOT HEAT OFF / INOP	AMBER
G	N	ALTERNATOR NO. 2 INOP	RED	--	A	VACUUM NO. 1 INOP	AMBER
H	P	GEAR WARN	RED	--	B	VACUUM NO. 2 INOP	AMBER
J	R	DOOR AJAR	RED	--	C	-----	GREEN
K	S	FLAPS	RED	--	D	-----	GREEN
L	T	STARTER ENGAGE	RED	--	E	-----	GREEN
M	U	WINDSHIELD HEAT FAIL	RED	--	F	FUEL IMBALANCE	AMBER
N	V	OXYGEN	AMBER	--	--	SELECT * DE-ICE	AMBER
				--	--	ICE DETECT * FAIL	AMBER
Fig. 2 = S/N's 4636001 thru 4636020 only. Fig. 3 = S/N's 4636021 thru 4636131 only. * = S/N's 4636132 thru 4636313, less 4636299.							



Annunciator Wiring Harness
Figure 1

[Effectivity](#)
4636001 thru 4636131

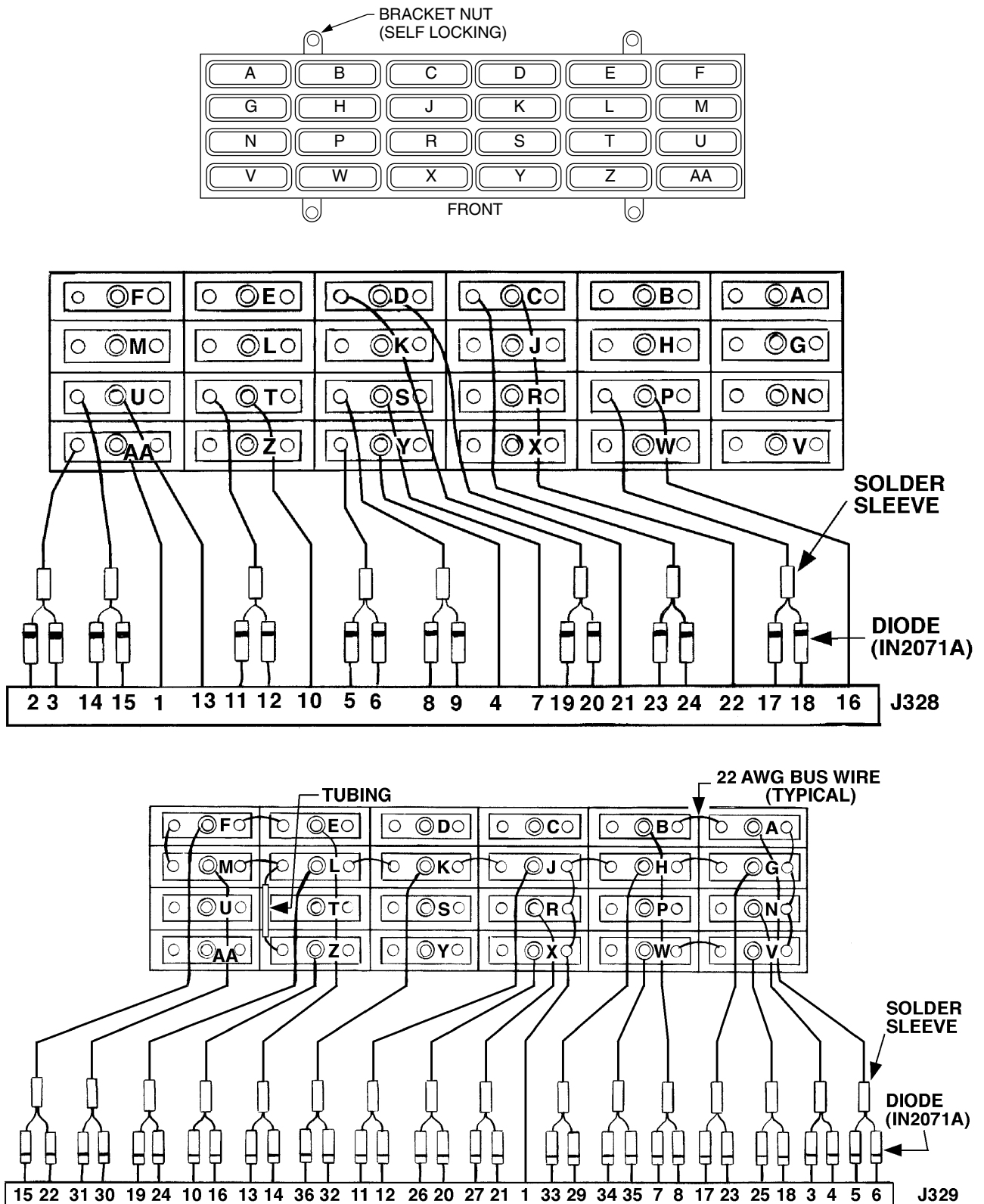
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[Effectivity](#)
4636001 thru 4636020

Annunciator Panel Installation
Figure 2 (Sheet 1 of 3)

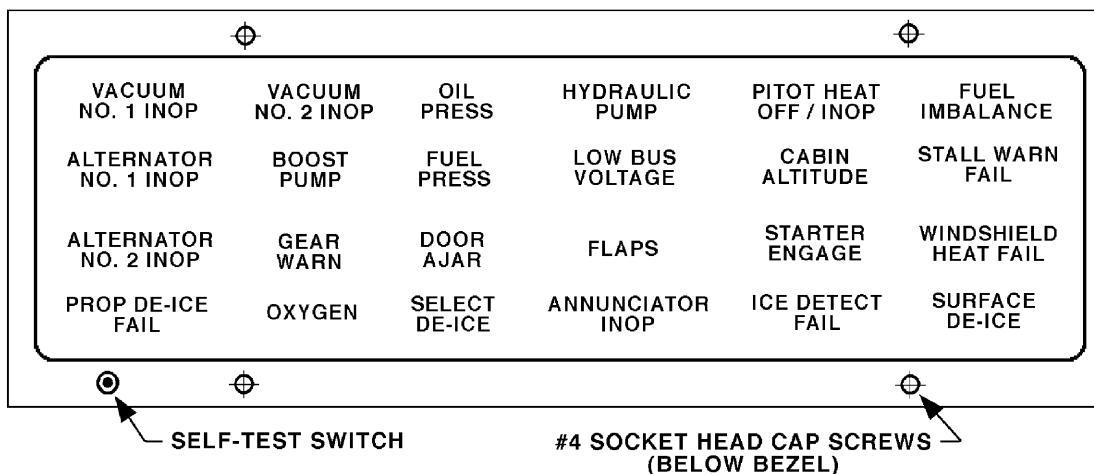
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Annunciator Panel Installation
Figure 2 (Sheet 2 of 3)

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PIN CONNECTIONS

(37 Pin "D" Connector on Annunciator to J329 Connector)

Pin	Connection	Remarks
1	Brightness Control	From aircraft panel lights dimmer
2	Fuel Imbalance Input	Ground
3	Stall Warn Fail Input	Ground
4	Cabin Altitude Input	Ground
5	Pitot Heat OFF / Inop Input	Ground
6	Low Bus Voltage Input	Ground
7	Hydraulic Pump Input	+28VDC
13	Fuel Press Input	Ground
14	Oil Press Input	Ground
15	Vac No. 2 Input	Ground
16	Vac No. 1 Input	Ground
17	Boost Pump Input	Ground
18	Press to Test Output	+28VDC
19	Power Input	+28VDC
20	Starter Engage Input	+28VDC
21	Windshield Heat Fail Input	+28VDC
22	Surface De-ice Input	Ground
23	Ice Detect Fail Input	Ground
24	Flaps Input	+28VDC
25	Annunciator Inop Input	+28VDC
26	Case Ground	
31	Select De-ice Input	Ground
32	Door Ajar Input	Ground
33	Gear Warn Input	+28VDC
34	Oxygen Input	Ground
35	Prop De-ice Fail	Ground
36	Alt No. 2 Inop Input	Ground
37	Alt No. 1 Inop Input	Ground

Pins 8-12 and 27-30 are connected to Case Ground.

[Effectivity](#)

4636132 thru 4636313,
less 4636299

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6. Switch Lamps Removal and Installation

- A. On the exposed arc of the rocker switch find an indentation and pry the rocker portion of switch from the switch assembly, using the indentation for leverage, note rocker position.
- B. Locate and pull the metal tab. Remove lamp from its socket and replace. It is not necessary to rotate lamp when removing or installing it.
- C. After replacing the lamp, place the rocker portion of the switch in the same position as when removed, and press it firmly into place noting an audible "snap" as the plastic locks mate into place. Cycle the switch to confirm rocker is seated.

7. Illuminated Switch Assembly Removal and Installation

CAUTION: ALTHOUGH SMALL SWITCH ASSEMBLIES ARE FAR EASIER TO REMOVE IF WIRING IS FIRST DISCONNECTED, THE LIMITED WORK SPACE BEHIND THE PANEL CAN RESULT IN BURNED WIRE INSULATION. DO NOT ATTEMPT TO UNSOLDER THESE SMALL ELECTRICAL CONNECTIONS BEHIND THE INSTRUMENT PANEL UNDER ANY CONDITIONS. IF NECESSARY CUT THE WIRES AT THE POINT OF CONNECTION. IN ANY CASE IT IS BETTER TO DAMAGE THE SWITCH AT TIME OF REMOVAL AND REPLACE IT, RATHER THAN DAMAGE THE WIRING HARNESS LEADS.

- A. To remove, squeeze metal lock tabs at rear of panel and push switch from the rear sliding assembly from the front of panel.
- B. To install, align the switch from the panel front and push firmly into the panel cutout until the metal lock tabs snap into position against the rear face of the panel. Make sure the electrical connections are completed first.

8. Environmental/De-ice Switch Panel (S/N's 4636132 and up)

The Environmental/De-ice switch panel adjacent to the annunciator, in S/N's 4636132 and up, is a sealed unit lighted with LED's and cannot be repaired in the field. Return failed units to Piper for repair or replacement.

9. Circuit Breaker Panels Electroluminescent Lighting

Illumination by electroluminescence is accomplished by discharging an alternating current through phosphor treated material, such as the circuit breaker decal strips. Should any one decal strip fail to illuminate, the complete strip must be replaced.

Should all decal strips fail to illuminate, the probable fault is with the inverter used to convert 24 Vdc to 115 Vac. The inverter is located on the rib between the pilot's circuit breaker panels, below the panels. Replace the inverter.

The 24 Vdc power to the inverter comes through the INSTR PANEL 5 amp circuit breaker. If the electroluminescence placards and post lights fail to illuminate, check that the INSTR PANEL circuit breaker has not tripped; reset, if necessary. If the INSTR PANEL circuit breaker has not tripped, check the PANEL dimmer control unit.

If the PANEL dimmer control unit is good, check that neither MAIN 60 amp Tie Bus circuit breaker has tripped; reset as necessary.

If none of the above correct the problem, check all related wiring. Refer to Chapter 91 for appropriate electrical schematics.

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10. Post-Installation Set-up

(PIR-PPS-60199-2, Rev.G / PPS-60206, Rev. G.)

The GNS-430/-530 NAV/COM/GPS and the GTX-327/-330 Transponder each have lighting configuration settings which must be adjusted after installation. Whenever a unit is replaced, use the following procedures to configure the lighting in the new unit.

A. GNS-430/-530

With power applied to the avionics rack and the GNS-430/-530 turned off, press and hold the ENT key and turn the unit ON. Release the ENT key when the display activates. After the data base pages, press the ENT key twice (to step through the Data Base Information and Indicator Self Test Pages). The next page displayed is the MAIN ARINC 429 CONFIG page.

While in Configuration Mode, pages can be selected by ensuring the cursor is off and rotating the small (inner) right knob. Do this now and select the MAIN LIGHTING PAGE.

To change data on the displayed Main Lighting Page, press the small (inner) right knob (CRSR) to turn on the cursor. Turn the large (outside) right knob to step through the data fields. Turn the small (inner) right knob to change the data in the field that the cursor is on. Press the ENT key to accept the data that is displayed in the selected field.

Configure a newly installed unit as shown in Chart 2.

NOTE: Initial configuration may be done using aircraft battery or external power. Final performance should be checked with the airplane configured as follows:

Engine - Running	Alternator – ON	Avionics – ON
Instrument Panel Lights – Full Bright	Day/Night Switch – Day	
Navigation Lights – ON	Strobe Lights – ON	Pitot Heat – OFF
Air Conditioning – OFF	Cabin Blower Fan – Low	Vent Blower – OFF

**CHART 2
GNS-430/-530 MAIN LIGHTING CONFIGURATION**

	DISPLAY	KEY
LIGHTING	NO SETTING	NO SETTING
SOURCE	28 VDC	PHOTO
RESP TIME / MIN	4 / 80	4 / 99
SLOPE / OFFSET	50 / 50	50 / 90
PHOTO TRANS %	25	
PHOTO SLP / OFST	35 / 35 (See Note)	

NOTE: Due to tolerances of electrical components, these settings may vary slightly from unit to unit. Adjust ($\pm$ -10%) if needed, to obtain optimum lighting balance between panel units.

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B. GTX-327/-330

With power applied to the avionics rack and the GTX-327/-330 turned off, press and hold the FUNC key and turn the unit ON. This provides access to the configuration pages. The FUNC key sequences forward through the configuration pages. The START/STOP key sequences the configuration pages backward. The CRSR key will highlight selectable fields on each page. When a field is highlighted, the numeric data entry will be performed with the 0-9 keys, and list selections will be performed with the 8 or 9 keys. Press the CRSR key to accept changes. Pressing the FUNC key moves on to the next configuration page without saving the changes. To exit the configuration pages, turn the power off and then on again (without holding the FUNC key).

Configure a newly installed unit as shown in Chart 3.

NOTE: For the GTX-330 only: when the unit is turned on for the first time, or an invalid aircraft address is recognized, the unit will prompt the user to enter a valid aircraft address. See latest revision of Garmin GTX-330 Installation Manual, P/N 190-00207-02.

**CHART 3
GTX-327/-330 LIGHTING CONFIGURATION**

Data Element	Selection
DISPLAY MODE PAGE	
DISPLAY MODE	AUTO
LEVEL	75
DISPLAY BACKLIGHT PAGE	
BKLT	AUTO
LVL	Not Selectable
RSP TIME	4
MIN	8
BKLT SRCE	PHOTO
SLOPE	50
OFFSET	50
KEY LIGHTING PAGE	
KEY	AUTO
LVL	Not Selectable
RSP TIME	4
MIN	5
KEY SRCE	28V
SLOPE	20
OFFSET	30
CONTRAST MODE	AUTO

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PASSENGER COMPARTMENT

All lighting is 24 Vdc.

1. Courtesy / Rear Baggage Area Lighting

A. Description

Cabin courtesy, rear baggage area and forward baggage compartment lighting is powered through an in-line 5 amp fuse from the battery bus. Two switches, an upper and lower, are actuated by the cabin entrance door. One half of the lower switch controls the cabin courtesy lighting, while the other half and the upper portion of the switch provides door ajar warning power to the annunciator panel. The cabin entrance lighting circuit is controlled by a five minute "one-shot" timer to prevent unnecessary battery discharge if the door is left open unattended. The lights are located to ensure the entrance steps are illuminated. The forward baggage compartment light is controlled by a switch in the forward baggage compartment that is activated when the baggage compartment door is opened.

B. Lamp Replacement

- (1) Remove lens mounting screws.
- (2) Pull out bayonet base lamp.
- (3) Install replacement, check, and reinstall lens.

2. Courtesy Lights Timer

A. Removal

- (1) The courtesy lights timer is located on a frame assembly aft of the lower cabin door.
- (2) Disconnect electrical wires.
- (3) Remove mounting screws and timer assembly.

B. Installation

- (1) Position timer assembly in place and secure with mounting screws.
- (2) Connect electrical wires.
- (3) Test for proper operation of timer.

3. Reading Lights and Lamp

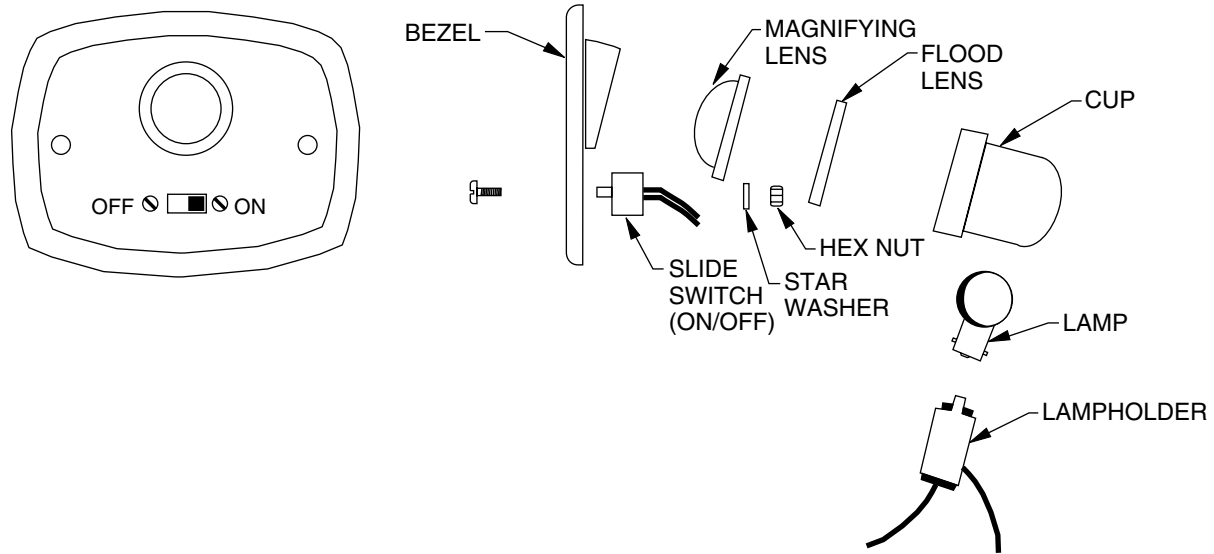
A. Removal

- (1) Remove two faceplate mounting screws and gently pull bezel from ceiling cavity, pulling switch and lamp wires into cabin area until lamp holder is exposed. Be careful magnifying and flood lens do not drop to floor (refer to Figure 1).
- (2) Squeeze lamp holder and withdraw it from cup. Replace bayonet lamp.
- (3) Slide switch can also be replaced in bezel after removal.

B. Installation

- (1) With new lamp installed in lamp holder, squeeze lamp holder mount tabs and insert holder into cup. Make sure lamp holder locks securely in place.
- (2) Place magnifying lens and flood lens in position on bezel, holding it horizontal, and place cup in position on bezel.
- (3) Holding assembly together, insert entire assembly into ceiling cavity.
- (4) Align faceplate mounting holes and reinstall faceplate mounting screws.

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Reading and Courtesy Light
Figure 1

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CARGO AND SERVICE COMPARTMENTS

All lighting is 24 Vdc.

Forward Baggage Compartment Lamp Replacement

The forward baggage compartment door actuates the door ajar switch controlling the annunciator panel door ajar indicator. The baggage light contains its own integral switch.

- A. Remove lens.
- B. Replace bayonet lamp.
- C. Replace lens and check operation.

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EXTERIOR

External lighting consists of anti-collision strobes, landing, taxi-pulse, position, and wing inspection lights. All lighting is 24 Vdc, except for the anti-collision strobe lighting, which is powered through a power supply, which converts 24 Vdc, received from the aircraft bus power, to a very high voltage required to flash the lights. Refer to 91-33-40 for electrical schematic details of these lighting systems.

1. Strobe Lights

A. Description (See Figure 1 and 91-33-40.)

Each wing tip strobe tube is powered by its individual power supply. Both power supplies receive power from the main bus through the 5 amp STROBE LIGHTS circuit breaker, and are controlled by the strobe light switch. If both strobe lights exhibit a fault, first verify that the STROBE LIGHTS circuit breaker has not opened (reset, if necessary), and then integrity of the strobe light switch (replace, if required). If either strobe is operating correctly, the strobe switch considered good. Check wiring from the strobe light switch to each strobe power supply to verify system wiring integrity.

The strobe light assembly functions as a capacitor high voltage discharge system. An audible tone of 1 to 1.5 K Hertz is emitted during the charge cycle of the strobe power supply in a normally functioning unit. However, the audible tone does not necessarily mean the power supply firing circuit is good. A voltage of approximately 450 volts is developed on the capacitor, after which the audible tone ceases. The capacitor is paralleled across the Xenon flash tube which holds off the voltage until the tube is triggered by a separate pulse generated by a solid state timing circuit.

After the trigger pulse causes ionization of the Xenon gas in the envelope, an intense light is given off for a brief moment as the capacitor discharges. Following discharge across the tube, the oscillator again chops up the dc aircraft current into alternating current, and again develops a higher voltage through transformer action. After full voltage is again impressed on the capacitor the cycle repeats itself occurring at about 50 flashes per minute.

Since each wing tip strobe is powered by its own power supply, and if both power supplies are emitting audible tones, simply switch power supplies from each wing tip. If the trouble is one of the power supplies, replace it. If the faulty strobe still malfunctions replace that strobe tube. Refer to Replacement of Position / Strobe Lamps and to Replacement of Strobe Power Supplies.

B. General Service Information

- (1) Never reverse power supply input connections for even an instant. Reverse polarity will permanently damage the circuitry. Even though damage may not be immediately apparent, the power supply will fail in use.
- (2) Wait five minutes for high voltage bleed down to occur, before handling a strobe power supply to avoid electrical shock.
- (3) Never allow connection between pins 1 and 2 of the flash tube connector, since this will discharge the capacitor and destroy the trigger circuit in the power supply.

NOTE: All of the following conditions, except item (6), are considered to require replacement.

- (4) A Xenon flash tube can be photo-sensitive. Some may flash normally when exposed to light, but may become difficult to fire in darkness.
- (5) Xenon flash tubes become more difficult to fire with age, or when exposed to very high temperatures.
- (6) A tube with most of the service life left in it, should fire on a reduced voltage of 22 volts.
- (7) A tube with little service life left in it, will fire with an engine running, but refuse to fire on battery voltage.

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- (8) Under hot and cold cycling during normal operation, "egg-shelling" of the glass envelope can occur, or leaks may develop in the glass seal.
- (9) Xenon strobe tubes can sometimes go into "self-ionization" continuously glowing a light blue, thus rendering the system inoperative.

C. Position / Strobe Lamps Replacement

- (1) Remove the screws securing the plexiglass cover to the wing tip structure, and separate the cover from the wing tip.
- (2) Remove lens retainer screws, retainer, and lens, exposing the light bracket assembly (refer to Figure 1).
- (3) The position lamps can now be replaced.

NOTE: If strobe (Xenon) lamp is to be replaced, proceed to step (5). If not complete step (4).

- (4) Install lens, retainer, and cover in reverse of the preceding steps.
- (5) Each strobe lamp is powered by its own power supply which is attached to a wing access panel located on the lower wing surface just inboard of each wing tip.

CAUTION: WHEN DISCONNECTING STROBE POWER SUPPLY, ALLOW FIVE MINUTES OF BLEED DOWN TIME BEFORE HANDLING A CHARGED UNIT.

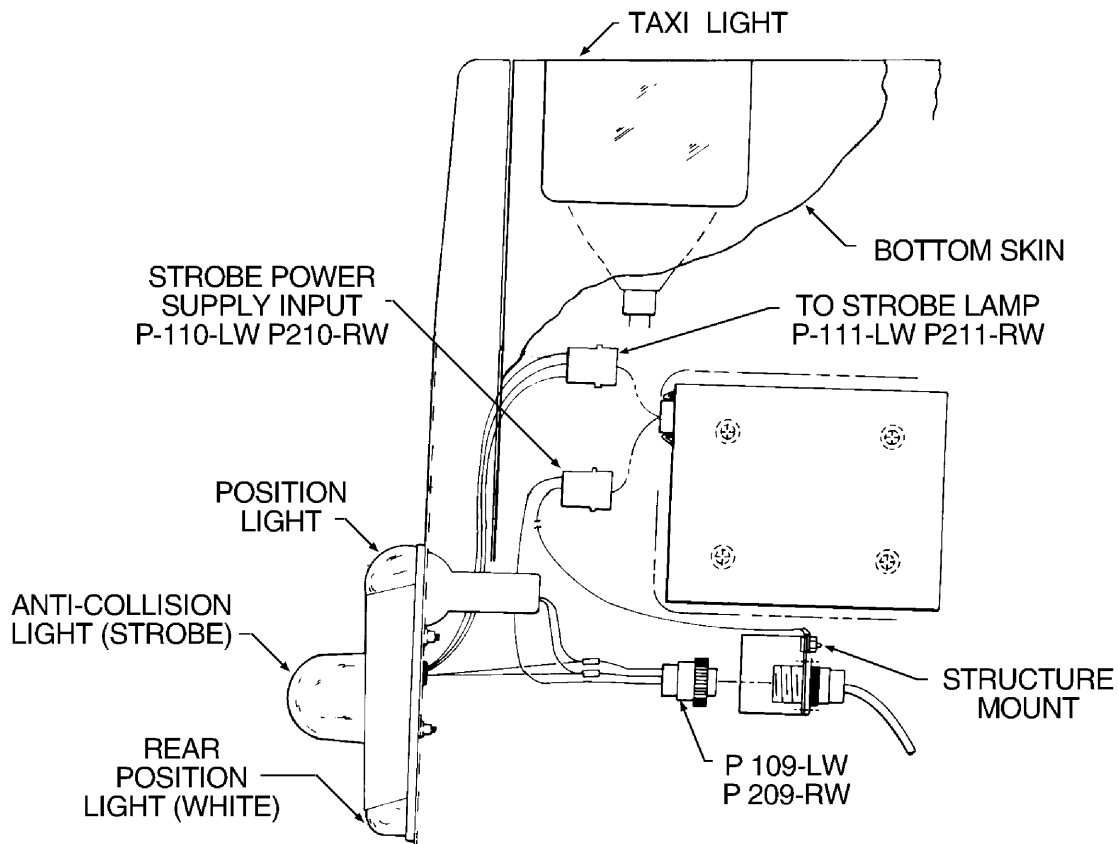
- (6) Remove the 12 screws securing wing access panel to the underside of the wing. Drop access panel from the wing exposing the attached strobe power supply.
- (7) Remove four attachment screws and eight AN960-10 washers; separate power supply from access panel. Set wing access panel aside to protect paint etc.
- (8) Unplug both power supply connectors, (P110 and P111 left wing / P210 and P211 right wing) and remove power supply from wing.
- (9) Reach into wing and unscrew (P109 left wing / P209 right wing) releasing this connector (refer to Figure 1).
- (10) Remove light bracket assembly mounting screws from wing tip and gently pull entire light assembly free of wing tip, feeding wiring through wing tip opening until plug (P101/P2111) three wire connector is pulled outside of wing.

NOTE: If sufficient wire length is not available to continue with the following steps, the remaining ground wire will have to be disconnected at the plug bracket assembly ground lug (Figure 1).

- (11) Cut the disconnected three wire connector, P111 or P211, at the base of the strobe light bracket assembly and discard cut wires and connector end.
- (12) Remove and destroy Xenon strobe lamp.
- (13) Route new wires attached to replacement strobe lamp through hole in bracket assembly and install new Xenon tube in bracket assembly.
- (14) Referring to 91-33-40 schematic of anti-collision strobe lighting insert new wiring terminals into the replacement connector plug supplied with the new strobe lamp. Wire according to schematic.
- (15) Gently feed cable assembly back into wing and align light bracket assembly in place. Do not mount assembly.

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- (16) If ground wire was disconnected from plug bracket ground lug, connect this wire.
 - (17) Reconnect (P109 or P209) to plug bracket mate.
 - (18) Connect new three wire connector P-111 or P-211 and the original P-111 or P-210 connectors to power supply.
 - (19) Install power supply to access panel with the eight AN960-10 washers and four attachment screws.
 - (20) Install wing access panel with power supply attached and wires facing outboard, to the wing surface with appropriate mounting screws previously removed.
 - (21) Install the light bracket assembly, lens, lens retainer and plexiglass cover.
- D. Strobe Power Supplies Replacement
- (1) Each wing tip strobe light is powered by its individual power supply which is attached to a wing access panel located on the lower wing surface just inboard of the wing tip. Refer to Figure 2.
 - (2) Remove wing access panel.
 - (3) Unplug power supply connectors P-111 and P-110 on left wing and P-211 and P-210 on right wing.
 - (4) Remove four screws and eight AN960-10 washers attaching power supply to wing access panel and separate from power supply.
 - (5) Reverse procedures for installation of strobe power supply.

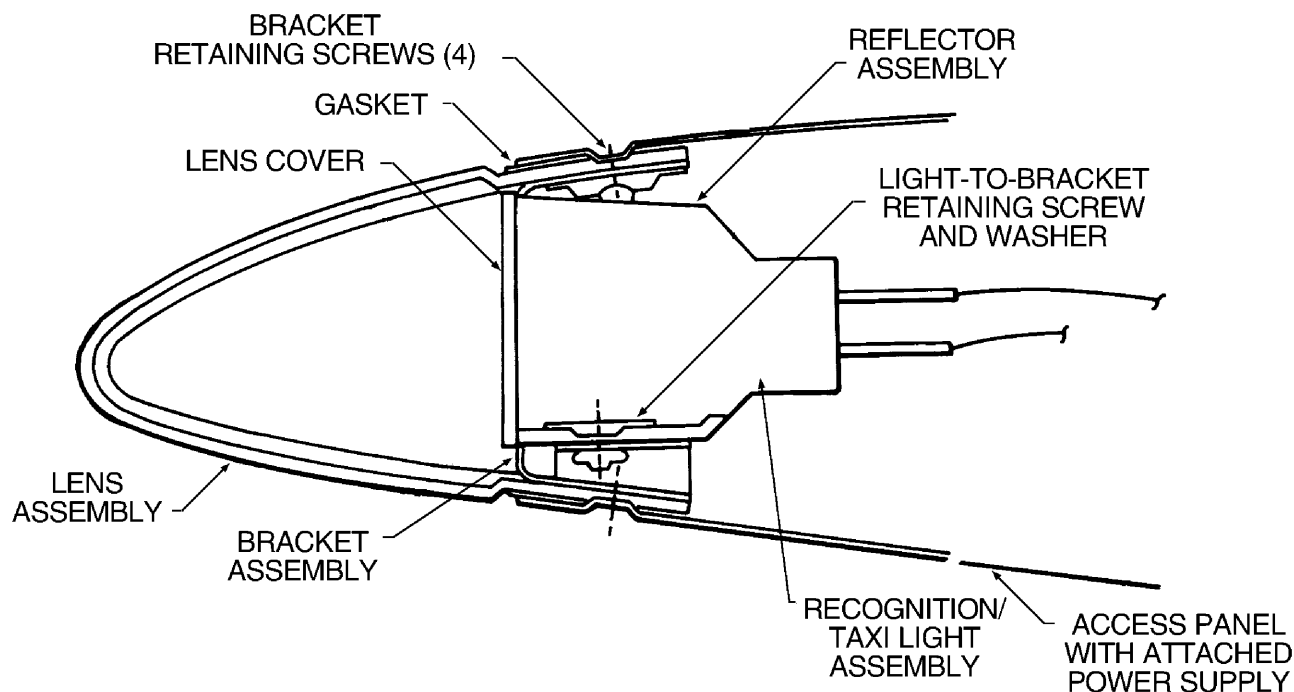


Position, Strobe, and Taxi Light Installation
Figure 1

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2. Taxi Light Replacement

- A. A 50 watt taxi light is located within the leading edge of each wing inboard of the tip.
- B. If the strobes have just been in operation, wait five minutes for high voltage bleed down to occur before removing wing access panel located on the lower surface of the wing just inboard of the wing tip by removing the 12 screw securing to the wing. The strobe power supply is attached to this wing access panel with 4 screws and eight AN960-10 washers.
- C. Remove access panel and unplug strobe power supply connectors, so access panel with power supply still attached can be set aside. This will prevent weight of power supply from pulling on electrical harness (refer to Figure 1).
- D. Disconnect taxi light, and electrical connectors from rear of light.
- E. Remove four bracket retaining screws from the assembly. These screws are removed from the external surface of the wing; 2 on the bottom and 2 on top.
- F. Slide the light bracket assembly aft and down and out through access opening.
- G. To remove lens, squeeze lens gently and slide forward, out of edge of wing structure, ensuring the gasket does not slide off and into the wing.
- H. To remove lamp from light assembly, snap lens cover off of the reflector and replace the lamp.
- I. Installation is reverse of preceding steps.



Recognition / Taxi Light
Figure 2

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3. Landing Light Replacement

A 250 watt landing light is attached to the nose gear strut by a support bracket and brace. It functions independently of the taxi lights.

- A. Remove the four lens attachment screws and pull the bezel from the fixture being careful not to damage the seal. Remove seal and bezel.
- B. The lamp will be free to separate from the support bracket. Pull the lamp forward and unscrew the electrical connections from the lamp.
- C. Replace the lamp making sure the electrical connections are secured with the electrical connection screws previously removed, and push the lamp into the lamp support bracket.
- D. Reinstall the seal and bezel with the four attachment screws.

4. Wing Inspection Light

The wing inspection light is located on the left hand side of the fuselage at F.S. 129.60. The light is used to help the pilot inspect the wing for any ice formation on its leading edge.

A. Removal

- (1) Remove pilot's side panel.
- (2) Remove the three (3) MS24693-S26 screws and one (1) MS24693-S28 (located externally) securing the light assembly to the doubler.
- (3) Push the light assembly inward.
- (4) Disconnect the wiring harness from the light. Refer to item 4B, above.
- (5) Remove the light assembly.

B. Installation

- (1) Clean any remaining sealant from the light assembly, shim and inboard side of doubler.
- (2) Apply GE RTV 1508 sealant to both sides of the shim.

NOTE: The thicker end of the shim should face aft.

- (3) Install the shim and light assembly. Secure with the screws. Make sure
- (4) Install the electrical connector. Refer to item 4D, above.
- (5) Check operation of light.
- (6) Install pilot's side panel.

C. Changing Light Bulb

- (1) Gain access to wing inspection light bulb by removing pilot's side panel.
- (2) Locate ice light. Release the two spring clips (at approximately the 9:30 and 7:30 clock positions) and remove bulb from socket.
- (3) Insert a new bulb into socket. (Refer to Parts Catalog for part number.)
- (4) Insert socket into lamp assembly. Make sure spring clips engage.
- (5) Check light operation. Install pilot's side panel.

5. Pulse Lights

In S/N's 4636132 and up, the two position "OFF-Taxi" switch is replaced with a three position "Taxi-OFF-Pulse" rocker switch. When switched to "Pulse", a flasher unit (mounted under the pilot's feet at FS 108.00) is engaged and the taxi lights illuminate alternately at about 55 pulses per minute.

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CHAPTER

34

NAVIGATION

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GENERAL

1. 1995 thru 2005 (S/N's 4636001 thru 4636374.)

A. Standard

Traditional 3.25 inch flight instruments are installed as standard equipment. These instruments are face mounted, see 39-10-00 for removal and installation.

B. Optional (S/N's 4636333 thru 4636374; and 4636299 only.)

The Meggitt Avionics next Generation Integrated Cockpit (MAGIC) Electronic Flight Information System (EFIS) is available as an option on the pilot's side only. When installed, it's the primary flight and navigation instrumentation. The MAGIC EFIS consists of three primary components:

- A. Primary Flight Display (PFD) [i.e. - Electronic Attitude Director Indicator (EADI)],
- B. Navigation Display (NAV) [i.e. - Electronic Horizontal Situation Indicator (EHSI)], and
- C. Air Data & Attitude Heading Reference System (ADAHRS) [i.e. - Attitude Heading Reference System (AHRS)].

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.)

Line maintenance of this system is limited to basic troubleshooting and that is addressed in 34-20-00.

2. 2006 and up (S/N's 4636375 and up.)

The Avidyne FlightMax Entegra Electronic Flight Information System (EFIS) is installed as standard equipment.

This system uses three large 10.4-inch diagonal, high-resolution, sunlight-readable full color displays (PFD and MFD), to provide standard flight instrumentation including attitude direction indicator (EADI), horizontal situation indicator (EHSI), altitude, airspeed, vertical speed, moving map, weather, terrain and traffic data, as well as all engine instrumentation. Standard primary flight instruments (i.e. - airspeed, electric attitude indicator, and altimeter) provide redundancy. (See 34-20-00, Figure 2.)

The EFIS installation consists of the following components: pilot and co-pilot Primary Flight Display s (PFD's); a single Multifunction Display (MFD); Data Acquisition Unit (DAU), and associated sensors; and two Magnetometer/OAT Sensor Assemblies.

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

Line maintenance of this system is limited to basic troubleshooting and that is addressed in 34-20-00.

See 77-40-00 for additional info on the Data Acquisition Unit (DAU).

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FLIGHT ENVIRONMENT DATA

The instrument air system consists of pitot air and static air sources. The system supplies both pitot and static air pressure for the airspeed indicator, and static pressure for the altimeter, vertical speed indicator, and the triple indicator (cabin pressure differential, vertical speed, and altitude). When installed, pitot and static air pressure is also provided for either the Meggitt EFIS or Avidyne Entegra EFIS Air Data and Attitude Heading Reference System (ADAHRS).

1. Pitot and Static Systems

A. Description and Operation

The pitot air system consists of pitot mast (located on the underside of the left wing, Avidyne installations include pitot mast locations on the underside of both the left and right wing) with its related plumbing. Impact air pressure entering the pitot tube is transmitted from the pitot inlet, through hose and tubing, routed through the wing to the airspeed indicator(s), located on the instrument panel; and, if installed, to the ADAHRS unit located on the aft equipment shelf (Meggitt) or in each PFD (Avidyne). A partially or completely blocked pitot head will give erratic, erroneous, or zero reading on the instruments.

The static air source consists of two static ports, one on each side of the fuselage at F.S. 266.66. The static air system is connected to the airspeed indicator(s), altimeter(s), vertical speed indicator and the triple indicator (cabin pressure differential, vertical speed, and altitude), located on the instrument panel; and, if installed, to the ADAHRS unit located on the aft equipment shelf (Meggitt) or in each PFD (Avidyne); by means of hose and tubing routed through the fuselage. In the event the primary static source becomes blocked, the system incorporates an external alternate static port located on the bottom of the fuselage at approximately F.S. 247.0. A shutoff valve, located below the instrument panel to the left of the pilot, opens or closes the alternate static port as required. A placard giving instructions for use of alternate static pressure, is located on the instrument panel or pilot's window frame.

WARNING: DO NOT ATTEMPT TO DRAIN STATIC SYSTEM DURING PRESSURIZED FLIGHT.

If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks or moisture. A partially or completely blocked pitot head will give erratic, erroneous, or zero reading on the instruments. Pitot and static lines can be drained through the drain valve located on the left lower side of the fuselage interior.

The holes in the sensors for pitot and static pressure must be fully open and free from blockage. Blocked sensor holes will give erratic or zero readings on the instruments.

The heated pitot head(s) is(are) standard equipment. The pitot heat switch is located on the right overhead switch panel. Static source pads have been demonstrated to be non-icing; however, in the event that icing does occur, selecting the alternate static source will alleviate the problem.

B. Troubleshooting

See Chart 1. With the optional Meggitt EFIS installation, see also, Appendix 1 (grid 4K19).

C. Test

(PIR-PPS 60035, Rev. M / FTP201-8, Rev. E.)

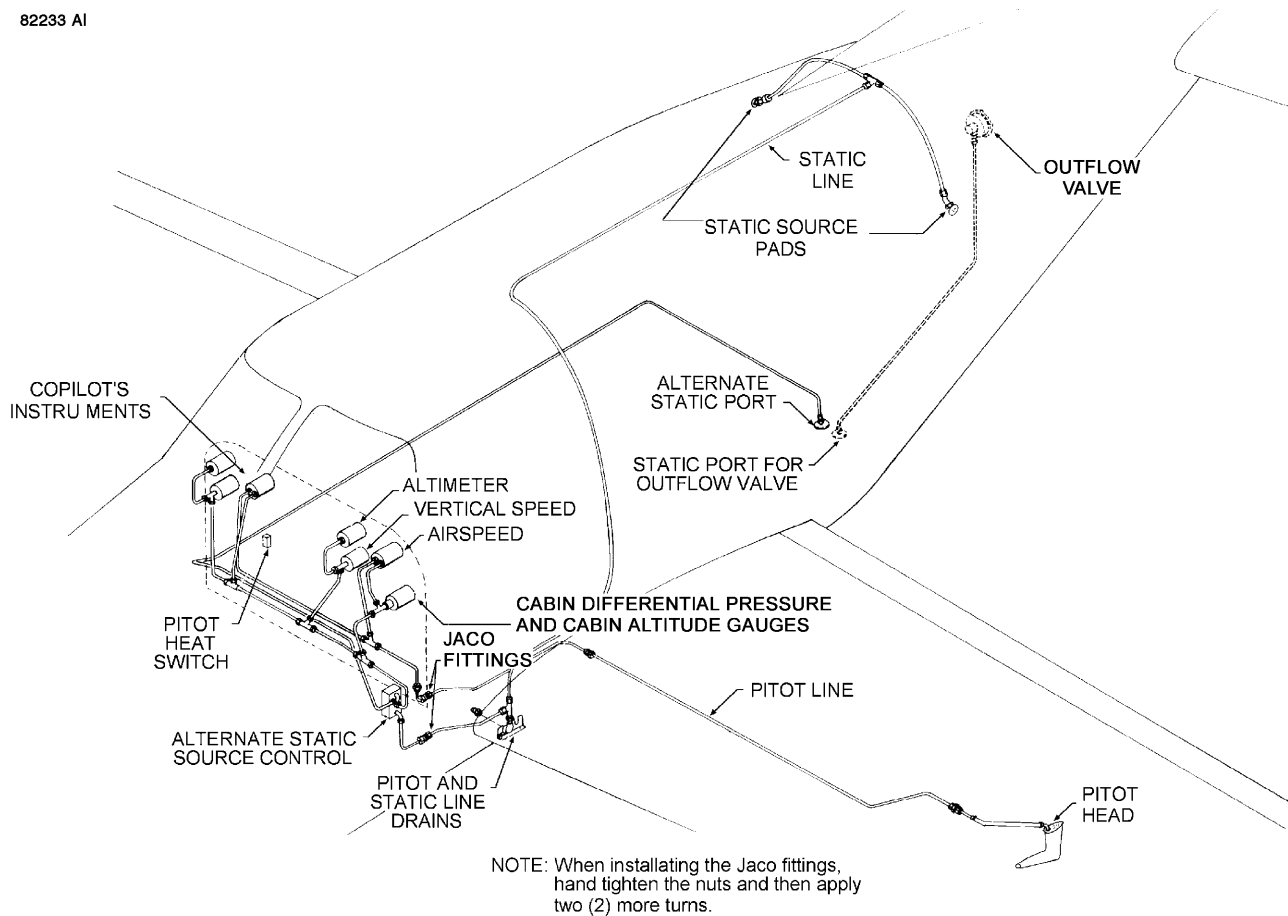
This test requires a pitot/static test fixture (i.e. - Aerosonic Air Data Test Set - Model 90000-0168, Barfield P/N 101-00164, or equivalent) and calibrated air source (i.e. - airspeed simulator) and should be performed at any time an instrument, fitting, line, pitot head, or static button is disconnected. The test should be performed prior to the next flight.

NOTE: Ensure the lines and fittings are free of any entrapped moisture or restrictions.

- (1) Attach the test fixture to the pitot head. Align the holes in the fixture with the holes in the head.
- (2) Attach the airspeed simulator hose to the pitot (pressure) port of the fixture.

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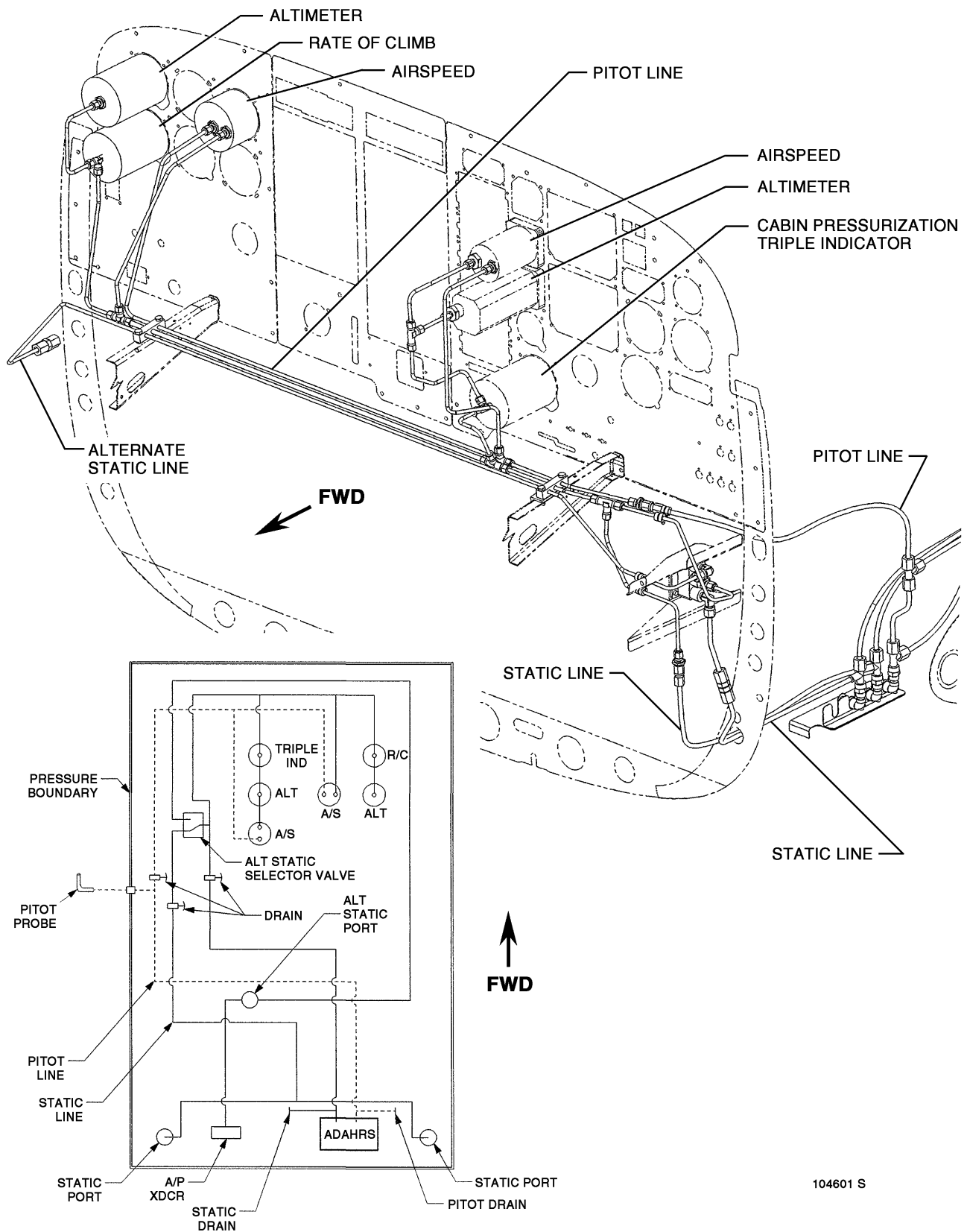
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[Effectivity](#)
4636001 thru 4636374

Pitot-Static System Installation
Figure 1 (Sheet 1 of 3)

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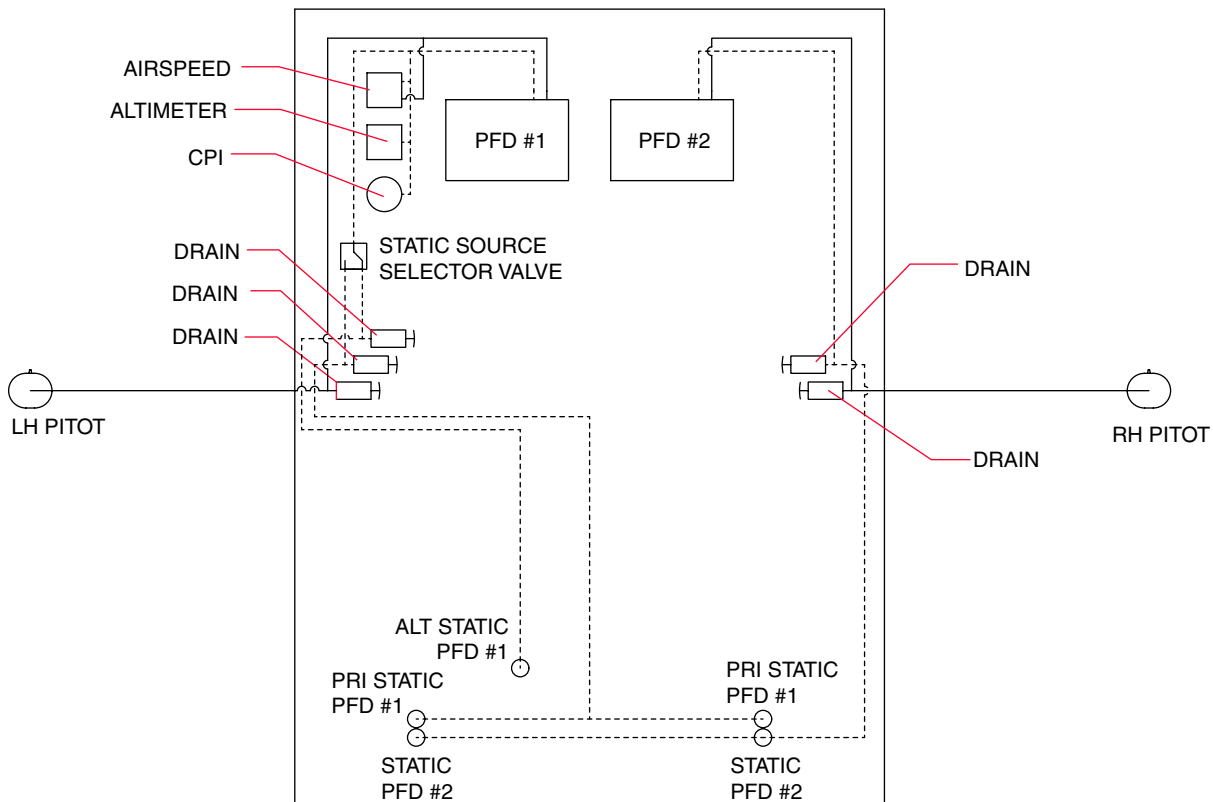
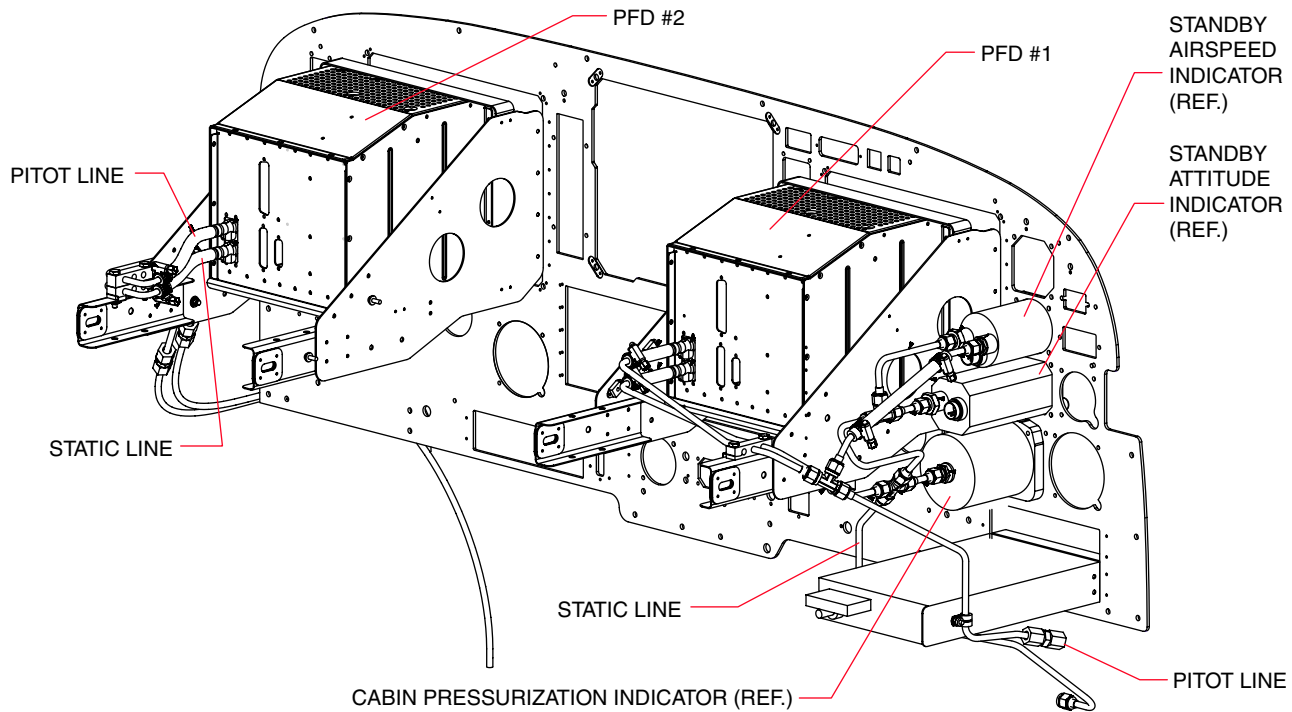


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Pitot-Static System Installation
Figure 1 (Sheet 2 of 3)

Effectivity
with Meggitt EFIS Option

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Pitot-Static System Installation
Figure 1 (Sheet 3 of 3)

[Effectivity](#)
4636375 and up

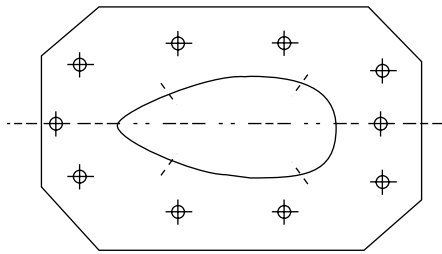
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**CHART 1
TROUBLESHOOTING PITOT AND STATIC SYSTEMS**

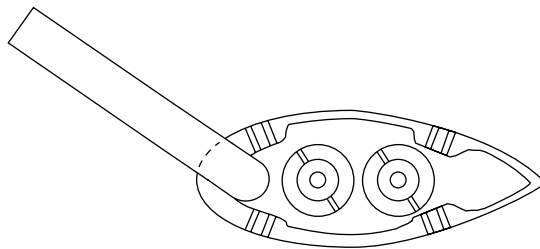
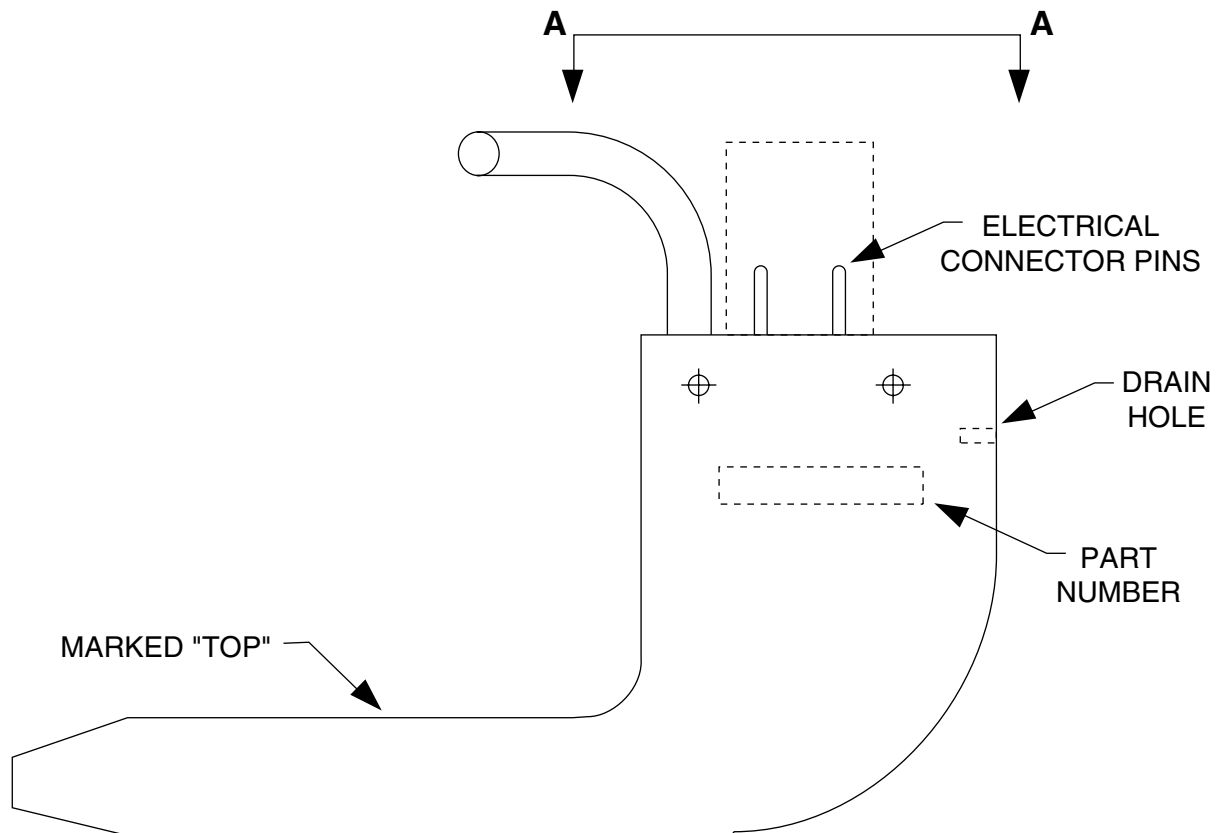
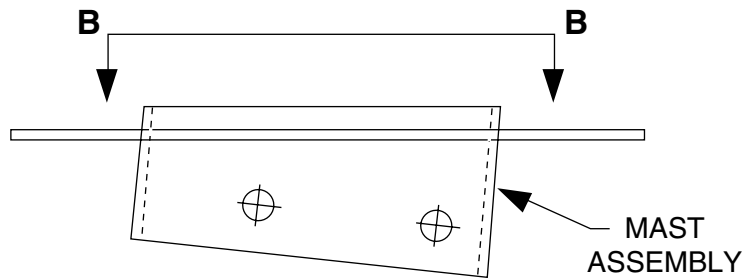
Trouble	Cause	Remedy
Heating element inoperative.	Defective switch.	Replace the switch.
	Grounded or open circuit.	Check for continuity and repair.
	Defective heating element in pitot head.	Replace the pitot-static mast.
Circuit breaker keeps tripping.	Grounded wire.	Check for continuity and repair.
Instruments inoperative or erratic in operation.	Lines clogged.	Disconnect lines at instruments and blow out with low pressure air.
	Line leaks.	Check lines for loose connections at all connection points.
NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With optional Meggitt EFIS installation, see Appendix 1 (grid 4K19).		

- (3) When equipped with the optional Meggitt EFIS, turn ON the PFD (i.e. - EADI).
- (4) When equipped with the Avidyne Entegra, turn ON both PFD's.
- (5) Operate the simulator to obtain a reading of 75 knots on the airplane airspeed indicator(s).
- (6) Check that the airspeed indicator needles follow in the same direction as the simulator airspeed indicator needle.
- (7) Raise airspeed to 198 knots and wait 15 seconds to allow the airplane airspeed indicators to stabilize.
- (8) Observe the simulator and airplane airspeed indicators for 15 seconds. If a leak is present, the indicator needles will move toward zero.
- (9) If a leak is present, check the fixture installation, hose connections, and pitot system lines and fittings. Repair the leak when found, then repeat steps (1) - (8), above.
- (10) In S/N's 4636001 thru 4636374 with standard instrumentation, operate the simulator to indicate 140 knots on the airspeed indicators. Verify that the airspeed indicators show within three (3) knots of the simulator indication.
- (11) When equipped with the optional Meggitt EFIS:
 - (a) Operate the simulator to indicate 140 knots on the PFD. Verify that the airspeed indicators show within three (3) knots of the simulator indication on the PFD.
 - (b) Operate the simulator until the overspeed aural alarm first sounds. Verify that the simulator indicates an airspeed of 198 to 204 knots.
 - (c) Increase the simulator airspeed indication to 210 knots.
 - (d) Decrease the simulator airspeed indication until the overspeed aural alarm first stops. Verify that the simulator indicates an airspeed of less than 198 knots.
 - (e) Turn OFF the PFD (i.e. - EADI).

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VIEW B - B



VIEW A - A

"L" Shaped Pitot Tube Installation
Figure 2

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- (12) **When equipped with the Avidyne Entegra EFIS:**
 - (a) Turn OFF the copilot's PFD.
 - (b) Operate the simulator to indicate 140 knots on the pilot's PFD. Verify that the pilot's PFD indicates within three (3) knots of the simulator indication.
 - (c) Turn OFF the pilot's PFD and turn ON the copilot's PFD.
 - (d) Repeat step (b) for the copilot's PFD and for the standby airspeed indicator.
 - (e) Turn ON the pilot's PFD and turn OFF the copilot's PFD.
 - (f) Operate the simulator until the overspeed aural alarm first sounds. Verify that the simulator indicates an airspeed of 198 to 204 knots.
 - (g) Increase the simulator airspeed indication to 210 knots.
 - (h) Decrease the simulator airspeed indication until the overspeed aural alarm first stops. Verify that the simulator indicates an airspeed of less than 198 knots.
 - (i) Turn OFF the pilot's PFD and turn ON the copilot's PFD.
 - (i) Repeat steps (f) - (h).
- (13) Remove the test fixture from the pitot head.
- (14) Attach static test fixture to the static port and pitot test port of the aircraft. Tape over the other static button.
- (15) **When equipped with the optional Meggitt EFIS**, turn ON the PFD (i.e. - EADI).
- (16) **When equipped with the Avidyne Entegra**, turn ON the Pilot's PFD.
- (17) Set the aircraft altimeter needles to read zero altitude. Operate the static simulator to cause the aircraft altimeter needles to read 1,000 feet altitude. Momentarily open the alternate static port. There should be a decrease in altimeter indication. If no change occurs the system is blocked and must be repaired prior to further testing.
- (18) Increase altitude to 1,050 feet.
- (19) Check that the aircraft altimeter shows an increase.
- (20) Observe the aircraft altimeter. Loss of indicated altitude shall not exceed 100 feet in one minute.
- (21) Increase altitude to 12,700 feet.
- (22) Check that the aircraft altimeter shows an increase.
- (23) Observe the aircraft altimeter. Loss of indicated altitude shall not exceed 254 feet in one minute.
- (24) If a leak exceeds the tolerances in step (18) or (21), check the fixture installation, plumbing and fittings. Repair the leak when found and repeat the static system checks above.
- (25) **When equipped with the optional Meggitt EFIS**, turn OFF the PFD (i.e. - EADI).
- (26) **When equipped with the Avidyne Entegra**, turn OFF the Pilot's PFD and turn ON the copilot's PFD. Repeat steps (17) thru (24) for copilot's PFD.
- (27) Remove the test fixture and tape from the static button.

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2. Pitot Head (See Figure 2.)

In S/N's 4636001 thru 4636374, the pitot head is located on the underside of the left wing.

In S/N's 4636375 and up, a pitot head is located on the underside of each wing.

A. Removal

- (1) Remove the four screws which secure the pitot tube to the mast assembly.
- (2) Carefully pull the pitot tube from the mast assembly.
- (3) Remove the hose from the elbow on top of the pitot tube.
- (4) Disconnect the electrical leads at the connector.

B. Installation

- (1) Reconnect the electrical leads to the heating elements.
- (2) Install the pitot tube into the mast assembly.
- (3) Secure the pitot tube to the mast assembly with the four screws.
- (4) Reconnect the electrical leads to the gauge.

C. Heaters Test

- (1) Remove the pitot head from mast assembly and the wing.
- (2) With one of the test leads connected to one of the terminals of the head, ground the other lead to the metal body of the head assembly. There should be no continuity.
- (3) Reinstall the pitot head into the mast assembly and the wing.

3. Vertical Speed Indicator

NOTE: With the Avidyne Entegra EFIS installed, this function is performed by the PFD's.

The Vertical Speed 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 a rate of ascent or descent of the airplane in feet per minute. But due to the lag of the instrument, the aircraft will be climbing or descending before the instrument starts to read and the instrument will continue to read after the aircraft has assumed level flight. This lag should not be considered a malfunction when operating in turbulent (rough) air.

NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With optional Meggitt EFIS installation, see Appendix 1 (grid 4K19).

A. Troubleshooting

See Chart 2.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

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**CHART 2
TROUBLESHOOTING VERTICAL SPEED INDICATOR**

Trouble	Cause	Remedy
Pointer does not set on zero.	Aging of diaphragm.	Reset pointer to zero by means of setting screw. Tap instrument while resetting.
Pointer fails to respond.	Obstruction in static line.	Disconnect all instruments connected to the static line. Clear line.
	Pitot head frozen over.	Apply pitot heat.
	Water in static line.	Check individual instruments for obstruction in lines.
	Obstruction in pitot head.	Clean lines and head.
Pointer oscillates when not operating in turbulent air.	Leak 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.
Vertical Speed indicates when aircraft is banked.	Water in static line.	Disconnect static lines and blow out lines from cockpit out to static ports.
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 broken or leaking.	Replace instrument.

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4. Altimeter

The altimeter uses pressure differential to indicate altitude in feet. When the barometric pressure scale on the instrument is set to the current altimeter setting, the altimeter will indicate 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 thousands of feet and the short pointer in tens of thousands of feet. A window in the lower center of the dial face contains a "barber pole" design to show when the airplane is below 10,000 feet. As the airplane climbs, the barber pole design progressively disappears until, when at or above 10,000 feet, the window is blank. The barometric pressure window, located on the right side of the indicator dial, is set by the knob located on the lower left corner of the instrument. The altimeter consists of a sealed aneroid (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 aneroid expands, causing the pointers to move through the mechanical linkage.

NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With optional Meggitt EFIS installation, see Appendix 1 (grid 4K19).

A. Troubleshooting

See Chart 3.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

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**CHART 3
TROUBLESHOOTING ALTIMETER**

Trouble	Cause	Remedy
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Defective mechanism.	Replace instrument.
High or low reading.	Improper venting.	Eliminate leak in static pressure system and check alignment of airspeed tube.
Setting knob is hard to turn.	Wrong lubrication or lack of lubrication.	Replace instrument.
Inner reference marker fails to move when setting knob is rotated .	Out of engagement.	Replace instrument.
Setting knob set screw loose or missing.	Not tight when altimeter was reset.	Tighten instrument screw, if loose. Replace instrument, if screw is missing.
Cracked or loose cover glass.	Case gasket hardened.	Replace instrument.
Dull or discolored markings.	Age.	
Barometric scale and reference markers out of synchronism.	Slippage of mating parts.	Replace instrument.
Barometric scale and reference markers out of synchronism with pointers.	Drift in mechanism.	Refer to the latest revision of 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 static ports.
Altimeter changes reading as aircraft is banked.	Water in static line.	Remove static lines from all instruments, and blow line clear from cockpit to static ports.
Altimeter requires resetting frequently.	Temperature compensator inoperative.	Change instrument.

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5. Airspeed Indicator

The airspeed indicator provides a means of indicating the speed of the airplane passing through the air. The airspeed indication is the differential pressure reading between pitot air to pressure and static air pressure. This instrument has the diaphragm vented to the pitot air source, and the case is vented to the static air system. As the airplane increases speed, the pitot air pressure increases, causing the diaphragm to expand. A mechanical linkage picks up this motion and moves the instrument pointer to the indicated speed. The instrument dial is calibrated in knots, and also has the necessary operating range markings for safe operation of the airplane.

NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With optional Meggitt EFIS installation, see Appendix 1 (grid 4K19).

A. Troubleshooting

See Chart 4.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 4
TROUBLESHOOTING AIRSPEED TUBES AND INDICATOR**

Trouble	Cause	Remedy
Pointers on instruments stick or do not indicate properly.	Leak in instrument case or in pitot lines.	Check for leak and seal.
Pointer of instrument oscillates.	Defective mechanism.	Replace instrument.
Instrument reads high.	Pointer not on zero.	Replace instrument.
	Leaking static system.	Find leak and correct.
Instrument reads low.	Pointer not on zero.	Replace instrument.
	Leaking static system.	Find leak and correct.
	Pitot head not aligned correctly.	Realign pitot head.
Airspeed changes as aircraft is banked.	Water in pitot line.	Remove lines from static instruments and blow out lines from cockpit to pitot head.

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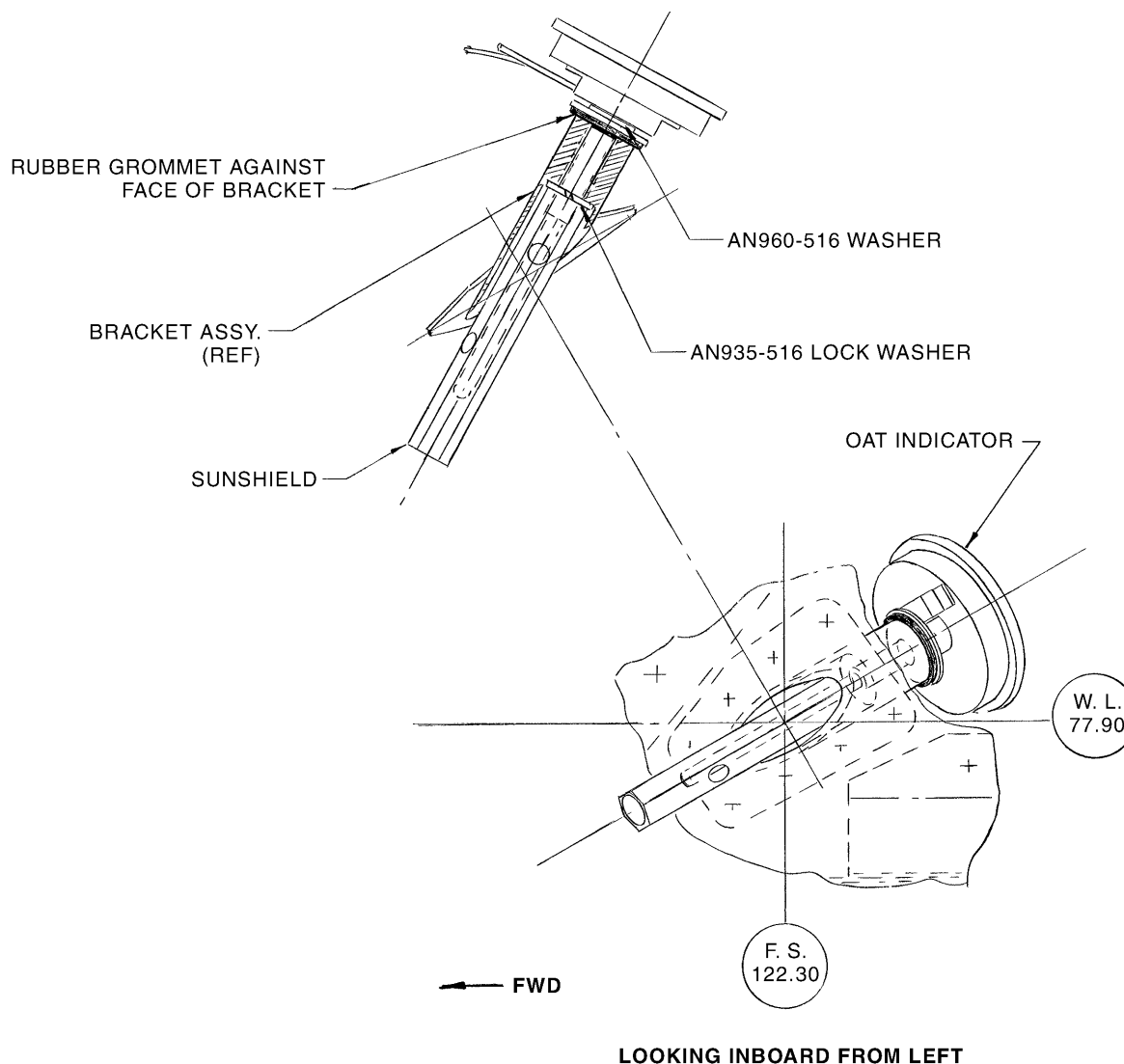
6. Outside Air Temperature (OAT)

A. S/N's 4636001 thru 4636020

The OAT indicator is located just forward of the pilot's side window at F.S. 122.30 (see Figure 3). The probe of the direct reading gauge screws into a bracket and protrudes through the airplane's skin.

(1) Removal

- (a) Disconnect the electrical leads from the gauge.
- (b) Turn the gauge counterclockwise to screw it out of the sunshield. It may be necessary to have an assistant hold the sunshield to prevent it from turning with the gauge.
- (c) Remove the gauge, washers, and rubber grommet from inside the airplane.
- (d) Remove the sunshield and lock washer from outside the airplane.



Outside Air Temperature Indicator
Figure 3

Effectivity
4636001 thru 4636020

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(2) Installation

- (a) Place the two washers and rubber grommet over the stem of the gauge.
- (b) Slide the gauge into its support bracket in the airplane.
- (c) Slide the lock washer and sunshield over the stem of the gauge (from the outside).
- (d) Screw the gauge clockwise into the sunshield.
- (e) Reconnect the electrical leads to the gauge.

B. [S/N's 4636021 thru 4636374](#)

A remote OAT probe is located on the underside of the right wing:

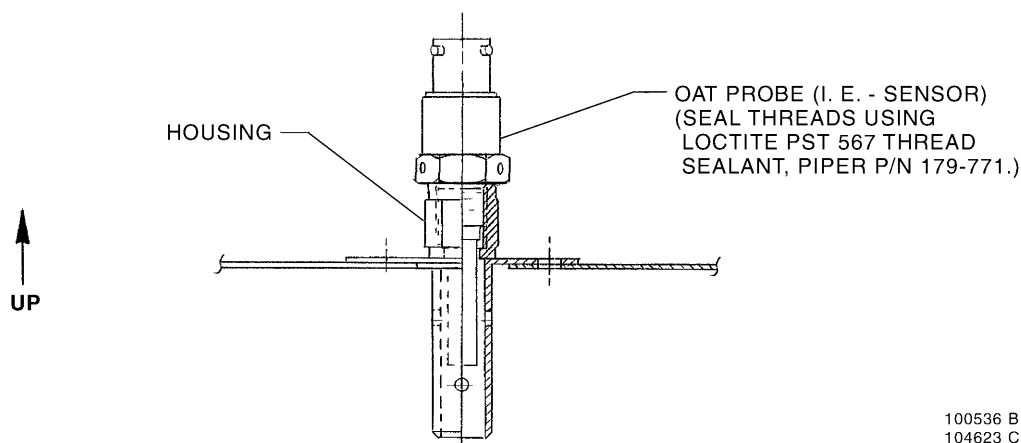
- mounted to a cover plate at W.S. 86.50 in [S/N's 4636021 thru 4636369](#); and,
- mounted in the wing skin at W.S. 244.3 in [S/N's 4636370 thru 4636374](#).

OAT measurement is accomplished by an OAT sensor and the Transicoil Electronic Module Instrument System (EMIS). See 77-40-00 for more information.

C. [S/N's 4636375 and up](#)

A remote OAT probe is located on the underside of the right wing at W.S. 244.3.

The Data Acquisition Unit (DAU) collects the OAT sensor data and sends it to the Primary Flight Displays (PFD's) and the Multifunction Display (MFD).



100536 B
104623 C

[Effectivity](#)
[4636021 and up](#)

OAT Probe Installation
Figure 4

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ATTITUDE & DIRECTION

1. Attitude Indicator

The Attitude Indicator is essentially an air driven gyroscope rotating in a horizontal plane and is operated on the principal of rigidity in space. Due to the gyroscopic inertia, the spin axis continues to point in the near vertical direction, providing a constant visual reference to the attitude of the airplane relative to pitch and roll axis. A bar across the face of the indicator represents the horizon, and aligning the miniature airplane to the horizon bar simulates the alignment of the airplane to the actual horizon. Any deviation simulates the deviation of the airplane from the true horizon. The Attitude Indicator is marked for different degrees of bank.

A. Troubleshooting

See Chart 1.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 1
TROUBLESHOOTING ATTITUDE INDICATOR**

Trouble	Cause	Remedy
Bar fails to respond.	Insufficient vacuum.	Check pump and tubing.
	Vacuum System Filter dirty.	Clean or replace filter.
Bar does not settle.	Insufficient vacuum.	Check line and pump.
	Adjust valve.	
	Incorrect instrument.	Check part number.
Bar oscillates or shimmies continuously.	Defective instrument.	Replace.
	Instrument loose in panel.	Tighten mounting screws.
	Vacuum too high.	Adjust valve.
	Defective mechanism.	Replace instrument.
Instrument does not indicate level flight.	Instrument not level in panel.	Loosen screws and level instrument.
	Aircraft out of trim.	Trim aircraft.
Bar high after 180° turn.	Normal, if it does not exceed 1/16th inch.	Self correcting.
Instrument tumbles in flight.	Low vacuum.	Reset regulator.
	Dirty Vacuum System filter.	Clean or replace filter.
	Line to filter restricted.	Replace line.
	Plug missing or loose in instrument.	Replace or tighten plug.

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2. Standby Attitude Indicator

In S/N's 4636375 & up, an electric standby attitude indicator is installed to the left of the pilot's Primary Flight Display (PFD).

Other than removing and replacing the unit itself (see 39-10-00), the only line replaceable part is the emergency power battery which is located in the aft section of the radar pod.

A. Troubleshooting

See Chart 2.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 2
TROUBLESHOOTING STANDBY ATTITUDE INDICATOR**

Trouble	Cause	Remedy
Bar fails to respond.	No power.	Check power.
	Faulty instrument.	Check/replace instrument.
Bar does not settle.	Incorrect instrument.	Check part number.
	Defective instrument.	Replace.
Bar oscillates or shimmies continuously.	Instrument loose in panel.	Tighten mounting screws.
	Defective mechanism.	Replace instrument.
Instrument does not indicate level flight.	Instrument not level in panel.	Loosen screws and level instrument.
	Aircraft out of trim.	Trim aircraft.
Bar high after 180° turn.	Normal, if it does not exceed 1/16th inch.	Self correcting.

C. Emergency Power Supply

A 24Vdc battery operated power supply (i.e. - B.F. Goodrich PS-834A) is installed in the aft radar pod compartment to provide emergency power for the standby attitude indicator. The unit is connected to the main electrical bus and its sealed lead-acid cells are automatically charged and recharged by its built-in charging system.

(1) System Test.

The power supply may be tested locally using its integral test switch and light, or, remotely, using the annunciator (i.e. - STBY ATT IND TEST) and instrument panel mounted remote switch (i.e. - Standby Gyro Test Switch).

In either case, place the switch in TEST position for a minimum of five (5) seconds. The test light must remain illuminated the entire time. The built-in-test function checks for operation of the up-converter with an internal load applied. During the built-in-test, the input power is automatically switched off and then the voltage of the battery pack is compared to a

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temperature compensated reference. If the battery capacity is greater than 50% and the built-in-test monitors are valid, a green "TEST" LED on the connector end of the unit and the remote test lamp will remain on as long as the unit is in test mode.

While in the remote activated built-in-test mode, the 28 Vdc output will maintain 0.24 ± 0.1 Amp at 24 ± 0.2 Vdc for 4.0 ± 1.0 seconds. Six seconds after remote activation, the 28 Vdc output will time-out and drop to $24 - 0.1, + 0.5$ Vdc and less than 0.1 Amp.

If the test light fails to illuminate as required during the test, one or more of the following conditions may exist:

- 1 the power supply batteries are less than 50% charged;
- 2 the test lamp is burned out; or,
- 3 the power supply unit is defective.

To determine which condition(s) exist(s), first check the test lamp and then proceed to the Capacity Test, below.

(2) Capacity Test.

Each twelve months, verify the B.F. Goodrich PS-834A Emergency Power Supply battery capacity as follows:

(a) Required Equipment

Power Supply - variable, 0-32 Vdc @ 6.0 amps continuous output.

Voltmeter - Fluke 8050A or equivalent

Load Resistors - 100.0 ohm $\pm 2\%$, 10.0 W (28.0 V load)

- 13.0 ohm (or equivalent) $\pm 2\%$, 5.0 W (5.0 V load)

(b) Procedure

- 1 Disconnect and remove power supply from radar pod.
- 2 Ground J1 pin E or F.

NOTE: Connect directly to the pin(s) or via a test harness equipped with a MS3106F20-27S (or equivalent) connector.

- 3 Apply 28.0 ± 0.5 Vdc to J1 pin A for two (2) hours.
- 4 After two (2) hours, remove 28 Vdc input.
- 5 Apply 100.0 ohm $\pm 2\%$, 10.0 W, load resistor to J1 pin C.
- 6 Apply 13.0 ohm $\pm 2\%$, 5.0 W, load resistor to J1 pin H.

NOTE: The 13 ohm resistor can consist of two five (5) watt resistors whose series ohm value is equal to 13 ohms.

- 7 Ground J1 pin I to turn unit ON.
- 8 Using the voltmeter:
 - a Monitor the output voltage from J1 pin C for a minimum of 45 minutes. Voltage must be 24.0 ± 1.0 Vdc for at least 45 minutes after the load is applied.
 - b Check the output voltage from J1 pin H. Verify 5.0 ± 0.3 Vdc.
- 9 If the unit meets the standards in step 8, proceed to step 10. If the unit fails the standards in step 8, replace it.
- 10 Disconnect all loads (i.e. - J1 pin C and J1 pin H) and the ground from J1 pin I.
- 11 Repeat step 3. When the unit is fully charged, disconnect it from the test set-up and reinstall it.

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3. Horizontal Situation Indicator (HSI) or Electronic Horizontal Situation Indicator (EHSI)

The HSI or EHSI, which combines pictorial VOR/ILS Localizer indications with an electrical heading indicator, is the pilot's primary heading indicator. The gyro is not in the instrument proper, but is located on the accessory shelf in the tail section of the airplane. The gyro is slaved to the earth's magnetic field through a flux detector (i.e. - flux gate compass) installed in the leading edge of the vertical stabilizer. Should the slaving mechanism become inoperative, the heading gyro can be deslaved through a switch on slave controlled unit mounted on the extreme upper left section of the pilot's instrument panel. Once deslaved, the heading gyro becomes free running, making it susceptible to gyroscopic precession. The compass control unit includes a spring loaded to OFF switch marked as CW (clockwise) or CCW (counterclockwise), used to electrically drive the remote gyro to correct the heading indication for any precession. The system is protected through the 3 amp COMPASS circuit breaker located on the copilot's C/B panel

A. Troubleshooting

See Chart 3.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 3
TROUBLESHOOTING ELECTRIC HEADING INDICATOR**

Trouble	Cause	Remedy
Heading card "frozen" regardless if gyro is slaved or deslaved.	3 amp COMPASS circuit breaker open.	Reset breaker, if open.
	Faulty remote gyro unit.	Replace gyro unit.
	Break in wiring between remote gyro and instrument.	Check and repair broken wire(s).
	Faulty Indicator (Instrument).	Replace Indicator.
Heading card "frozen" or erratic when slaved, but works satisfactorily when deslaved.	Bad flux detector.	Replace flux detector.
	Faulty remote gyro unit.	Replace gyro unit.
Compass card erratic whether slaved or deslaved.	Faulty remote gyro unit.	Replace gyro unit.
	Faulty Indicator (Instrument).	Replace Indicator.
When deslaved, compass card will not respond to CW or CCW commands.	Faulty compass control unit.	Replace compass control control unit.
	Faulty remote gyro unit.	Replace gyro unit.

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4. Air Driven Heading Indicator (i.e. - Directional Gyro)

The air driven heading indicator is offered as an option for the copilots navigation instrument package. The air driven heading indicator is a flight instrument incorporating an air driven gyro stabilized in the vertical plane. The gyro is rotated at high speed by lowering the pressure in the air tight case and simultaneously allowing atmospheric air pressure to enter the instrument against the gyro buckets. Due to gyroscopic inertia, the spin axis continues to point in the same direction, even though the aircraft yaws to the right or left. This relative motion between the gyro and the instrument case is shown on the instrument dial, which is equipped with a 360° compass card. The card, when set to agree with the airplane's magnetic compass, provides a positive indication free from acceleration/deceleration and turning errors. However, the heading indicator has no sense of direction, and must be set to the magnetic compass. Since the magnetic compass is subject to errors due to magnetic fields, electric instruments, etc, the directional gyro is only accurate for the heading it has been set for. If the gyro is set on 270°, for instance, and the aircraft is turned to some other heading, there can be a large error between the gyro and the magnetic compass due to the error in compass compensation. This will appear as gyro precession. The gyro should frequently be checked precession. Due to internal friction, span axis error, air turbulence and airflow, the gyro should be set at least every 15 minutes for accurate operation, whether it has drifted or not.

A. Troubleshooting

See Chart 4.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 4
TROUBLESHOOTING AIR DRIVEN HEADING INDICATOR**

Trouble	Cause	Remedy
Excess drift in either direction.	Setting error.	Review Directional Gyro (4).
	Defective instrument.	Replace instrument.
	High or low vacuum. If vacuum is not correct, check for the following:	
	1. Relief valve improperly adjusted.	1. Adjust.
	2. Incorrect gauge reading.	2. Replace gauge.
Dial spins during turn.	3. Pump failure.	3. Repair or replace.
	4. Vacuum line kinked or leaking.	4. Check and repair. Check for collapsed inner wall of hose.
	Limits (55° bank) of gimbal exceeded.	Recage gyro in level flight.
Dial spins continuously.	Defective mechanism.	Replace.

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5. EFIS

A. Meggitt Electronic Flight Information System (EFIS) - (Optional in S/N's 4636349 thru 4636374.)

(1) Electronic Attitude Director Indicator (EADI) [i.e. - Meggitt MAGIC EFIS Primary Flight Display (PFD)]

The Primary Flight Display (PFD) is a microprocessor-based color, liquid crystal (LCD) display system. Information displayed includes Airspeed, Altitude, Attitude, Vertical Speed, Heading and Instrument Landing System data. The information is conveyed via predefined display formats. In addition, the PFD includes built-in test, performance and health monitoring functions and display brightness control. The PFD provides Gillam Code Altitude Output for the transponder (Mode C altitude).

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Descriptions of the operator controls and basic operating modes and screens are in the appropriate Pilot's Operating Handbook Supplement.

(a) Troubleshooting

See Chart 5. See also Appendix 1 (grid 4K19).

(b) Basic Functional Test

CAUTION: IF, DURING THE FOLLOWING TEST, ANY COMPONENT DOES NOT PRODUCE THE EXPECTED RESULTS, THAT COMPONENT MUST NOT BE USED IN FLIGHT UNTIL THE PROBLEM IS CORRECTED.

- 1** Before applying power, verify proper voltage inputs and ground connections as well as all system interfaces.
- 2** Start the PFD in Test Mode by pressing and holding the Baro Pushbutton while applying power until the Initialization page is shown. Verify that the Initialization page displays 'MIRAGE PRIMARY FLIGHT DISPLAY' at the top of the screen and is replaced by the Configuration Data page after approximately five (5) seconds.
- 3** Verify that the Configuration Data page Configuration Discrete Parity Status and Power On Self Test results both show results of Pass. If the result is FAIL, further diagnostic effort is required to determine if the failed indication is the result of improper installation, a faulty PFD, or both.
- 4** Verify that the Configuration Data page displays the correct installation location (primary or secondary).
- 5** Remove power from the PFD to terminate Test Mode. Re-apply power to the PFD and start the display in Mission Operational Mode.
- 6** Verify that the PFD displays the Initialization page for approximately five (5) seconds prior to displaying the PFD Screen Format. If power has not been applied to the ADAHRS then the PFD screen format will be replaced by failure indications.
- 7** Apply power to the Air Data Attitude Heading Reference System (ADAHRS) (i.e. - AHRS).
- 8** Verify that the PFD Screen Format is displayed (if the ADAHRS is performing initialization then the ADAHRS Initialization screen will replace the attitude sphere). If any of the failure indications are displayed refer to Chart 5.

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- 9 Verify that the ADAHRS has completed initialization by observing that the attitude sphere replaces the ADAHRS Initialization screen. If the ADAHRS has not completed initialization within 180 seconds after application of power to the ADAHRS refer to Chart 5.
 - 10 Apply power to the Navigation Display (ND) (i.e. - EHSI).
 - 11 If installed, apply power to the Radar Altimeter. Perform a functional test on the Radar Altimeter system and verify that the PFD Rad Alt Indication and Decision Height Annunciation are displayed correctly.
 - 12 Apply power to the VOR radio. Perform a functional test on the VOR Radio system and verify that the PFD Localizer/Glideslope and Backcourse/Localizer Sensing Indications are displayed correctly.
 - 13 Apply power to the Marker Beacon system. Perform a functional test on the Marker Beacon system and verify that the PFD Marker Beacon indications are displayed correctly.
 - 14 Apply power to the Autopilot system. Place the Autopilot Master Switch in the Flight Director position and verify that the flight director bars are displayed correctly.
 - 15 Press the Baro pushbutton and verify that the barometric correction displays 'STD'. Rotate the Baro Rotary Control clockwise and verify that the barometric correction increases. Rotate the Baro Rotary Control counter-clockwise and verify that the barometric correction decreases.
 - 16 On the overhead switch panel, decrease the Panel LCD's dimmer switch and verify that the PFD brightness decreases.
 - 17 On the overhead switch panel, increase the Panel LCD's dimmer switch and verify that the PFD brightness increases.
 - 18 Press the EADI Display Down switch. Verify that the PFD screen blanks and that the PFD screen format is displayed on the Navigation Display (ND) (i.e. - EHSI) .
 - 19 Press the EADI Display Down switch again. Verify that the PFD screen format is displayed on the PFD and that the PFD screen format is removed from the ND.
- (c) Removal and Installation
See 39-10-00.

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**CHART 5 (Sheet 1 of 3)
TROUBLESHOOTING EADI (i.e. - PFD)**

Trouble	Cause	Remedy
No display visible at power up.	+28 VDC power missing.	Check wiring & bus voltage.
	+28 VDC Return missing.	Check wiring.
	Failed PFD.	Replace PFD.
	EADI Display Down mode selected.	Check EADI Display Down switch.
Test mode visible at power up.	Stuck Baro pushbutton.	Check Baro pushbutton.
	PFD failed self test.	Replace PFD.
Display brightness does not change when PFD brightness control operated.	28 VDC lighting bus not connected or not functional.	Check wiring and 28 VDC lighting bus.
	Brightness control not functional.	Check Brightness control.
	Failed PFD.	Replace PFD.
Barometric correction does not change when BARO Rotary control is rotated.	PFD in test mode.	Ensure PFD in mission operational mode.
	Failed PFD.	Replace PFD.
Barometric correction does not change to standard setting when Baro pushbutton is pressed.	PFD in test mode.	Ensure PFD in mission operational mode.
	Failed PFD.	Replace PFD.
Unable to enter test mode when Baro pushbutton is pressed.	Airspeed equal to or greater than 40 knots detected.	Ensure airspeed is less than 40 knots.
	Unit not powered off before Baro Pushbutton is pressed.	Ensure unit is powered off before Baro Pushbutton is pressed.
	Baro Pushbutton pressed and held for insufficient time.	Ensure Baro Pushbutton is pressed and held until initialization page displays.
	Failed PFD.	Replace PFD.
Test page does not change when Baro Rotary Control is rotated.	PFD in mission operational mode.	Ensure PFD in test mode.
	Failed PFD.	Replace PFD.
Power on self test status on Configuration Data page is indicated as FAIL.	Failed PFD.	Replace PFD.
Configuration discrete parity status on Configuration Data page is indicated as FAIL.	Parity input (Configuration Discrete 7) not wired correctly.	Check configuration discrete setting.
	Failed PFD.	Check wiring. Replace PFD.

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**CHART 5 (Sheet 2 of 3)
TROUBLESHOOTING EADI (i.e. - PFD)**

Trouble	Cause	Remedy
Installation location on Configuration Data page incorrect.	Configuration discretes 0 and 1 not wired correctly. Failed PFD.	Check configuration discrete setting. Check wiring. Replace PFD.
ADAHRS initialization screen is not removed from the display after 3 minutes have elapsed since ADAHRS power on.	ADAHRS not completing initialization.	Perform ADAHRS test.
Rad Alt indication and/or decision height annunciation are not displayed correctly.	Failed Radar Altimeter. Failed PFD.	Perform Rad Alt test. Replace PFD.
Localiser/Glideslope and/or Backcourse/Localiser sensing indications not displayed correctly.	Failed VOR radio. Failed PFD.	Perform VOR radio test. Replace PFD.
Marker beacon indications not displayed correctly.	Failed marker beacon system. Failed PFD.	Perform marker beacon system test. Replace PFD.
Flight director bars not displayed correctly.	Failed Autopilot system. FD/AP switch not functional/wired correctly. Failed PFD.	Perform Autopilot system test. Check FD/AP switch and wiring. Replace PFD.
Full Field Red, Green, Blue, Black, and White pages are not displayed correctly.	Failed PFD.	Replace PFD.
ND Interface Data page shows valid data is not being transmitted.	Failed PFD.	Replace PFD.
ND Interface Data page shows valid data is not being received.	RS422 Receive A and B lines are not connected or are wired incorrectly. Failed ND.	Check wiring. Replace ND.
ADAHRS Interface Data pages show valid data is not being received.	ARINC IN A and B lines are not connected or are wired incorrectly. Failed ADAHRS. Failed PFD.	Check wiring. Replace ADAHRS. Replace PFD.

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**CHART 5 (Sheet 3 of 3)
TROUBLESHOOTING EADI (i.e. - PFD)**

Trouble	Cause	Remedy
Selecting the EADI Display Down switch to EADI Display Down does not remove the PFD display.	EADI Display Down switch not functional/wired correctly. Failed PFD.	Check EADI Display Down switch and wiring. Replace PFD.
PFD screen format not displayed on the PFD when the EADI Display Down switch selected to normal.	EADI Display Down switch not functional/wired correctly. Failed PFD.	Check EADI Display Down switch and wiring. Replace PFD.

- (2) Electronic Horizontal Situation Indicator (EHSI) [i.e. - Meggitt MAGIC EFIS Navigation Display (ND)]
The Navigation Display (ND) is, like the Meggitt Primary Flight Display (PFD), a microprocessor-based color, liquid crystal (LCD) display system. Information displayed includes Navigation Data, Autopilot Data, Radio Tuning, Airspeed, Altitude, Attitude, Vertical Speed, Heading and Instrument Landing System data. The information is displayed via a series of predefined display formats (HSI, ARC, MAP). In addition, the ND includes built-in test, performance and health monitoring functions and display brightness control.

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.)

Descriptions of the operator controls and basic operating modes and screens are in the appropriate Pilot's Operating Handbook Supplement.

(a) Troubleshooting

See Chart 6. See also Appendix 1 (grid 4K19).

(b) Basic Functional Test

The following test procedure should be performed with the aircraft in a suitable position to receive valid VOR/ILS/GPS/DME signals. If this is not possible, then use the appropriate test sets to simulate the signals as required.

CAUTION: IF, DURING THE FOLLOWING TEST, ANY COMPONENT DOES NOT PRODUCE THE EXPECTED RESULTS, THAT COMPONENT MUST NOT BE USED IN FLIGHT UNTIL THE PROBLEM IS CORRECTED.

- 1 Before applying power, verify proper voltage inputs and ground connections as well as all system interfaces.
- 2 Start the ND in Test Mode by pressing and holding the MNU Pushbutton while applying power until the Initialization page is shown. Verify that the Initialization page displays 'MERIDIAN NAVIGATION DISPLAY' at the top of the screen and is replaced by the Configuration Data page after approximately five (5) seconds.
- 3 Verify that the Configuration Data page Configuration Discrete Parity Status and Power On Self Test results both show results of Pass. If the result is FAIL, further diagnostic effort is required to determine if the failed indication is the result of a fault in the wiring, a faulty ND, or both.

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**CHART 6 (Sheet 1 of 3)
TROUBLESHOOTING EHSI (i.e. - ND)**

Trouble	Cause	Remedy
No display visible at power up.	+28 VDC power missing.	Check wiring & bus voltage.
	+28 VDC Return missing.	Check wiring.
	Failed ND.	Replace ND.
Display powers-up in EADI Display Down mode.	EADI Display Down mode selected.	Check EADI Display Down switch.
	Failed ND.	Replace ND.
Test mode visible at power up	Stuck MNU button	Check MNU button
	ND failed self test	Replace ND
Display brightness does not change when Panel LCD's dimmer switch operated	28 VDC lighting bus not connected or not functional	Check wiring and 28 VDC lighting bus
	Panel LCD's dimmer module not functional	Check/replace module
	Panel LCD's dimmer switch not functional	Check/replace switch.
	Failed ND	Replace ND
Menu does not appear when MNU button is pressed	Stuck MNU button	Check MNU button
	Failed ND	Replace ND
Menu cursor does not change when ↑ and/or ↓ buttons are pressed	Stuck ↑ and/or ↓ buttons	Check ↑ and ↓ buttons
	Failed ND	Replace ND
Unable to select menu options when SEL button is pressed	Stuck SEL button	Check SEL button
	Failed ND	Replace ND
Unable to enter Test mode when MNU button is pressed	Airspeed equal to or greater than 40 knots detected	Ensure airspeed is less than 40 knots
	Unit not powered off before MNU button is pressed	Ensure unit is powered off before MNU button is pressed
	MNU button pressed and held for insufficient time	Ensure MNU button is pressed and held until initialization page displays
	Failed ND	Replace ND
Test menu does not change when the ↑ and/or ↓ buttons are pressed	ND in mission operational mode	Ensure ND in test mode
	Stuck ↑ and/or ↓ buttons	Check ↑ and/or ↓ buttons
	Failed ND	Replace ND
Unable to select Test pages when the SEL button is pressed	Stuck SEL button	Check SEL button
	Failed ND	Replace ND

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**CHART 6 (Sheet 2 of 3)
TROUBLESHOOTING EHSI (i.e. - ND)**

Trouble	Cause	Remedy
Barometric setting does not change in EADI Display Down mode when the ↑ and/or ↓ buttons are pressed	Stuck ↑ and/or ↓ buttons	Check ↑ and ↓ buttons
	Failed ND	Replace ND
Selected CRS does not change when CSR knob rotated	Stuck CRS knob	Check CRS knob
	Failed ND	Replace ND
Selected HDG does not change when HDG knob rotated	Stuck HDG knob	Check HDG knob
	Failed ND	Replace ND
Selected CRS does not align with present heading when CSR knob pushed	Stuck CRS knob	Check CRS knob
	Failed ND	Replace ND
Selected HDG does not align with present heading when HDG knob pushed	Stuck HDG knob	Check HDG knob
	Failed ND	Replace ND
Failure flags present on display	Equipment supplying relevant data to ND failed	Check status of equipment supplying data to ND
	Failed ND	Check data on relevant ND test page
Power on self test status on Configuration Data page is indicated as FAIL	Failed ND	Replace ND
Configuration discrete parity status on Configuration Data page is indicated as FAIL	Parity input (Configuration Discrete 7) not wired correctly	Check configuration discrete setting
	Failed ND	Check wiring Replace ND
Installation location on Configuration Data page incorrect	Configuration discretes 0 and 1 not wired correctly	Check configuration discrete setting
	Failed ND	Check wiring Replace ND
PFD Interface Data Page shows valid data is not being received/transmitted	RS422 Receive and/or Transmit lines are not connected or wired correctly	Check wiring
	Failed ND	Replace ND
	Failed PFD	Replace PFD
ADAHRS Interface Data pages show valid data is not being received	ARINC IN A and B Bus 1 lines are not connected or are wired incorrectly	Check wiring
	Failed ADAHRS	Replace ADAHRS
	Failed ND	Replace ND

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**CHART 6 (Sheet 3 of 3)
TROUBLESHOOTING EHSI (i.e. - ND)**

Trouble	Cause	Remedy
NAV Interface Data Page shows valid data is not being Received	ARINC In A and B Bus 2 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
	Failed Nav radio	Replace Nav radio
GPS Interface Data Pages show valid data is not being Received	ARINC In A and B Bus 4A and/or 4B lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
	Failed GPS Receiver	Replace GPS Receiver
Cross Side Input Interface Data Page shows valid data is not being Received	ARINC In A and B Bus 3 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
	Failed cross-side ND	Test cross-side ND
Cross Side Output Interface Data Page shows valid data is not being Transmitted	ARINC Out A and B Bus 2 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
NAV/GPS Output Interface Data Page shows valid data is not being transmitted	ARINC Out A and B Bus 1 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
Analog Interface Data Page shows valid data is not being Received or Transmitted	Failed ND	Replace ND
	Failed Autopilot Input	Perform Autopilot Test
	Failed DME Input	Perform DME Test
	Failed Audio Panel Input	Perform Audio Panel Test
	Failed Rad Alt Input	Perform Rad Alt Test
	Failed ADF Input	Perform ADF Test
Discrete Interface Data Page shows valid data is not being Received or Transmitted	Failed Autopilot outputs	Check ND inputs
	Failed ND	Replace ND
	Failed Autopilot Input	Perform Autopilot Test
	Failed DME Input	Perform DME Test
	Failed Rad Alt Input	Perform Rad Alt Test
	Failed Autopilot output	Check Nav inputs

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**CHART 7
NAVIGATION DISPLAY (ND) DEFAULT SETTINGS**

Screen Format	HSI
Element	Setting
CDI	VOR1
RMI1	OFF
RMI2	OFF
RANGE	2.5NM
GPS SEL	GPS1
APOINTS	Disabled
NAVAIDS	Disabled
WPTS	Disabled
NDB	Disabled
Selected Heading	Last Known Setting
Selected Course / Desired Track	Last Known Setting
Barometric Setting	Last Known Setting

**CHART 8
NAVIGATION DISPLAY (ND) COLOR CODING**

Display Parameter		
Color	Mission Operational Mode	EADI Display Down Mode
White	A/C Symbol, Scales, Range Rings, Digital Readouts, RMI1 Pointer and Annunciation	Scales, Digital Readouts
Grey	N/A	Scale Tapes
A/C Symbol	N/A	Aircraft Symbol, Lubber Line
Amber	Failures and Annunciation's	Stall Warning, Failures and Annunciation's
Red	N/A	Airframe Limits
Sky	N/A	Sky
Ground	N/A	Ground and Radar Altimeter ground reference
Green	N/A	Baro Correction
Magenta	Deviation Bar, Sel HDG/CRS Bugs, CDI Pointer and Annunciation	Flight Director Command Bars and Deviation Pointers
Cyan	RMI2 Pointer and Annunciation	N/A

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- 4 Verify that the Configuration Data page displays the correct installation location (primary or secondary).
- 5 Remove power from the ND to terminate Test Mode. Re-apply power to the ND and start the display in Mission Operational Mode.
- 6 Verify that the ND displays the Initialization page for approximately five (5) seconds prior to displaying the HSI Screen Format. If power has not been applied to the ADAHRS then the HSI screen format will display the heading failure indication.
- 7 Apply power to the Air Data Attitude Heading Reference System (ADAHRS) (i.e. - AHRS).
- 8 Apply power to the Primary Flight Display (PFD) (i.e. - EADI).
- 9 Verify that the HSI Screen Format is displayed and the installation specific defaults as shown in Chart 6 apply. If any of the failure flags are displayed refer to Chart 6.
- 10 Enable the Mission Operational Mode/Rev Mode menu by pressing the bezel mounted 'MNU' button. Verify that the menu is displayed correctly.
- 11 Ensure that the Nav Radios are selected off. Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting RMI1 to display VOR1 and RMI2 to display VOR2. Verify that the RMI1 and RMI2 second level menus are displayed correctly and the RMI1 and RMI2 source annunciations match the selections.
- 12 Verify that the RMI1, RMI2 and CDI source annunciations are amber in color. Verify that the associated frequency annunciations are replaced with amber dashes. Verify that both RMI pointers and the CDI pointer are removed from the display.
- 13 Apply power to the Nav radios. Select valid VOR frequencies on the Nav Radios and verify that the RMI1, RMI2 and CDI source and frequency annunciations are displayed in the correct colors (see Chart 8). Verify that the ND displayed frequencies match the Nav radio frequencies (i.e. RMI1 frequency matches Nav Radio 1 and RMI2 frequency matches Nav Radio 2. The CDI frequency should match the currently selected CDI source frequency). Verify that both RMI pointers and the CDI pointer are displayed correctly.
- 14 Select valid ILS frequencies on the Nav Radios and verify that the RMI1, RMI2 and CDI source annunciations display VOR1, VOR2 and ILS1/ILS2 (dependent on current selected CDI source) respectively in the correct colors (see Chart 8). Verify that the ND displayed frequencies match the Nav radio frequencies (i.e. RMI1 frequency matches Nav Radio 1 and RMI2 frequency matches Nav Radio 2. The CDI frequency should match the currently selected CDI source frequency). Verify that both RMI pointers are removed and the CDI pointer is displayed correctly.
- 15 Apply power to the GPS Receivers. Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting RMI1 and RMI2 to display GPS and CDI (verify that the CDI second level menu is displayed correctly) to display GPS (GPS1 or GPS2 will be available dependent on GPS source selection). Verify that the RMI1, RMI2 and CDI source annunciations reflect the selections.
- 16 Refer to the GPS Installation Manual and display the self test page on the on-side GPS. Verify that the applicable ND parameters display the correct self test values as listed in the GPS Installation Manual during the display of the self test page.
- 17 Verify that the GPS source annunciation displays the currently selected GPS source in white. Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting the GPS source to the off-side GPS. Verify that the GPS second level menu is displayed correctly. Verify that the GPS source annunciation displays the currently selected GPS source in white.

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- 18 Refer to the GPS Installation Manual and display the self test page on the off-side GPS. Verify that the applicable ND parameters display the correct self test values as listed in the GPS Installation Manual during the display of the self test page.
- 19 Press the EADI Display Down switch to select EADI Display Down mode and verify that the ND displays the PFD (i.e. - EADI) screen format. Verify that the PFD screen blanks.
- 20 If installed, apply power to the Radar Altimeter. Perform a functional test on the Rad Alt system and verify that the ND Rad Alt Indication and Decision Height Annunciation are displayed correctly.
- 21 Perform a functional test on the VOR Radio system and verify that the ND Localizer / Glideslope and Backcourse / Localizer Sensing indications are displayed correctly.
- 22 Apply power to the Marker Beacon system. Perform a functional test on the Marker Beacon system and verify that the ND Marker Beacon indications are displayed correctly.
- 23 Apply power to the Autopilot system. Place the Autopilot Master Switch in the Flight Director position and verify that the flight director bars are displayed correctly.
- 24 Press the bezel mounted “↑” button once and verify that the barometric correction increases by 0.01inHg/1hPa. Press and hold the bezel mounted “↑” button and verify that the barometric correction continuously increases in increments of 0.01inHg/1hPa until the button is released or the maximum barometric correction is reached.
- 25 Press the bezel mounted “↓” button once and verify that the barometric correction decreases by 0.01inHg/1hPa. Press and hold the bezel mounted “↓” button and verify that the barometric correction continuously decreases in increments of 0.01inHg/1hPa until the button is released or the minimum barometric correction is reached.
- 26 Press the EADI Display Down switch to shift back to normal mode and verify that the HSI screen format is displayed on the ND. Verify that the PFD screen format displays on the PFD.
- 27 Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting the Arc screen format. Verify that the Arc screen format is displayed correctly.
- 28 Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting the Map screen format. Verify that the Map screen format is displayed correctly.
- 29 Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting the HSI screen format. Rotate the CRS Rotary Control clockwise and verify that the selected CRS pointer rotates clockwise around the compass card and the selected course digital readout increases and mirrors the pointer heading. Rotate the CRS Rotary Control anti-clockwise and verify that the selected CRS pointer rotates anti-clockwise around the compass card and the selected course digital readout decreases and mirrors the pointer heading. Push the CRS Pushbutton and verify that the selected course pointer and digital readout align to the current aircraft heading.
- 30 Rotate the HDG Rotary Control clockwise and verify that the selected HDG bug rotates clockwise around the compass card and the selected heading digital readout increases and mirrors the bug heading. Rotate the HDG Rotary Control anti-clockwise and verify that the selected HDG bug rotates anti-clockwise around the compass card and the selected heading digital readout decreases and mirrors the bug heading. Push the HDG Pushbutton and verify that the selected heading bug and digital readout align to the current aircraft heading.

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31 On the overhead switch panel, decrease the Panel LCD's dimmer switch and verify that the ND brightness decreases.

32 On the overhead switch panel, increase the Panel LCD's dimmer switch and verify that the ND brightness increases.

(c) Removal and Installation

See 39-10-00.

(3) Air Data & Attitude Heading Reference System (ADAHRS) [i.e. - Attitude Heading Reference System (AHRS)].

The ADAHRS unit is located on the aft equipment shelf behind the cabin rear closeout panel.

NOTE: When installing the ADAHRS unit; first, level the airplane per 8-20-00; and then, use NAS1149FN816P washers as required to level the ADAHRS unit.

(a) Magnetic Heading Compensation / Calibration

Perform the Magnetic Heading Compensation/Calibration procedure in Magnetic Heading Systems, below, whenever the ADAHRS unit is installed or replaced.

(b) Ground Test Procedure

This test procedure (included as Appendix 1 - grid 4K19) verifies the integrity and accuracy of the air data and pitot-static systems and shows that these systems comply with the applicable airworthiness regulations. Perform this procedure:

- 1 each 24-months,
- 2 to proof test the static system in accordance with FAR 23.1325 each time any connections in static system are opened for maintenance, or
- 3 following installation or maintenance on the ADAHRS unit, the primary flight display (PFD), or the transponder Mode C interface.

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B. Avidyne Entegra Electronic Flight Information System (EFIS) (S/N's 4636375 and up.)

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

The Avidyne FlightMax Entegra Electronic Flight Information System (EFIS) is installed as standard equipment. See 28-40-00 and 34-10-00 for more info.

(1) Description (See Figure 1.)

This system uses two large 10.4-inch diagonal, high-resolution, sunlight-readable full color displays (PFD and MFD), to provide primary flight and engine information as well as a wide variety of other data. Standard primary flight instruments (i.e. - airspeed, electric attitude indicator, and altimeter) provide redundancy.

The EFIS installation consists of the following components: Primary Flight Display (PFD), Multifunction Display (MFD), Data Acquisition Unit (DAU), and associated sensors, and Magnetometer/OAT Sensor Assembly.

(2) Maintenance

The Instructions for Continued Airworthiness (ICA) published by Avidyne provide the necessary information for maintaining this system as installed in Piper airplanes, except as noted below.

(a) Primary Flight Display (PFD)

(PIR-PPS60227, Rev. NEW.)

Use 700-00006-0XX PFD & 700-00011-000 Mag/OAT ICA, Avidyne Document No. AVPFD-174, latest revision, with the following exceptions:

- 1 In para 6, Troubleshooting Information, in the chart where it says "OAT (Optional)," cross out "optional." The OAT is standard in the Piper installation.
- 2 In para 7.2 and Figure 7, where the standard Avidyne installation describes alignment pins and retaining clips on the sides of the PFD, the Piper installation uses a single alignment pin on the top of the PFD engaging a slot in the upper rear cross bracket.
- 3 In para 7.5.2.2, in the "Main RS232 Configuration Page" table, for CHNL 3 under GNS-430 No 2, both Input and Output should read "Crossfill" instead of "Off."
- 4 In para 7.5.4.3, below the heading "Autopilot Unit - STEC Autopilots," insert the following:
"If the PFD is replaced, the IRU calibration and Magnetometer calibration must be completed before continuing with the following steps."
- 5 Replace para 7.5.5.1, Barometric Unit Setting, with the following:
 - a Press LSK L1, labeled "Trim Ann", as required until "Show" is displayed.
 - b Press LSK L2, labeled "A/P Annun", as required until "Show" is displayed.
 - c Press LSK L3, labeled "V-Speeds", as required until "Show" is displayed.
 - d Press LSK R1, labeled "Baro Unit", as required until "inHg", or "mb" if foreign, is displayed.
 - e Press LSK R2, labeled "Horiz Marks", as required until "Show" is displayed.
 - f Press LSK R3, labeled "ARS", as required until "Delta" is displayed.

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(b) Multifunction Display (MFD)

(PIR-PPS60226, Rev. NEW.)

Use 700-00004-0XX-() Multifunction Display ICA, Avidyne Document No. AVMFD-167, with the following exceptions:

- 1 In para 2, items 7 and 8 are standard in the Piper installation.
- 2 In para 7.3.1, Maintenance Mode Access, replace 3 and 4 with the following:
 - a At the prompt "Press any bezel key to continue", press any Line Select Key (LSK). This places the screen at the exceedance page. Press OK to acknowledge exceedances and to continue to the Initial Usable Fuel Page. Depress the "Fuel Done" LSK R4.
 - b Rotate the right outer concentric knob clockwise until the AUX page is displayed.
- 3 Replace 7.3.2.1, GAMA 429 Graphics Setup (EX5000 only) with the following:
 - a From the maintenance page, depress the LSK L1 to access the GPS setup page.
 - b Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration; configure the GPS Setup page for the following conditions:

Receiver 1:	GAMA 429 FORMAT
Port:	ARINC 429 RX 1
Speed:	LOW
Receiver 2:	GAMA 429 FORMAT
Port:	ARINC 429 RX 2
Speed:	Low
 - c Press SAVE button.
- 4 Replace 7.3.4, Lightning Sensor Interface and Setup, with the following:
 - a From the maintenance page, depress LSK (L3) to access the Lightning Set-up page.
 - b Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration. Configure the Lightning Setup page for the following conditions:

Sensor:	WX-500
Operating Mode:	Weather
Port:	RS232 3 – (Lightning Default)
Stabilization type:	Use Map Heading / Track
Enable lightning ahead:	box CHECKED
Antenna on top:	box NOT CHECKED
 - c Press SAVE button.
- 5 Replace 7.3.10, Engine Sensor, with the following:
 - a From the maintenance page, depress LSK (L4) to access the Engine Set-up page.
 - b Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration. Configure the Engine Setup page for the following conditions:

Aircraft Model:	PA-46-350P (Mirage)
Serial Port:	RS232 4
 - c When setting up a MFD for the first time only the following set up box appears. "Select ACFT Model and Port (s)" Press "Resync".

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- 6 Replace 7.6.3.1, TAWS Setup, with the following:
- a From the maintenance page, depress LSK (L5) to access the TAWS Set-up page.
 - b Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration. Configure the TAWS Setup page for the following conditions:

Sensor: Honeywell EGPWS
ARINC 429 Port: ARINC 429 TX 2
ARINC 453 Port: ARINC 453 2 – (TAWS Default)
Altitude
Annunciation on: box CHECKED
 - c Press SAVE button.
- 7 Replace 7.3.8, Map Heading, with the following:
- a From the maintenance page, depress LSK (R1) to access the MAP Heading page.
 - b Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration; configure the Map Heading page for the following conditions:

Map Heading: FMS/GPS
 - c Press SAVE button.
- 8 Replace 7.3.11.1, Auxiliary Data; 7.3.12, Datalink; 7.3.12.1, Narrowcast Datalink Setup; and 7.3.12.2, Broadcast Datalink Setup with the following:
- a From the maintenance page, depress LSK (R2) to access the AIRCRAFT Set-up page.
 - b Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration. Configure the Aircraft Setup page for the following conditions:

Narrowcast: Quake SC
Port: RS232 6 (Data link Default)
Broadcast: XM Radio
Port: RS232 1
Aux Data: Entegra PFD
Port: ARINC 429 RX 4
Dimming Bus
Voltage: Shows Current Voltage with aircraft Day/Night switch in "Night"

Brightest Dimming
Voltage: 24.0 Volts
Darkest Dimming
Voltage: 5.0 Volts
 - c Press SAVE button.

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- 9 Replace 7.3.7, Radar Sensor; and 7.3.12.7, Radar Setup, with the following:

Setup

If configuring a replacement MFD, start with step (a). In all other cases start with step (f).

- a From the maintenance page, depress LSK (R3) to access the RADAR Set-up page.
- b Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration.
- c From the RADAR Set-up Page select the following:
 - Sensor: AlliedSignal ART-2000 ARINC 429
 - Port: ARINC 429 Tx 1 ARINC 453
 - Port: ARINC 453 1
- d Press SAVE. (After pressing SAVE, MFD goes to maintenance Setup Page)
- e From the Maintenance Setup Page, press Restart System.
- f Re-enter Maintenance Setup Page, depress LSK R3 to access the RADAR Steup Page.
- g Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration. Configure the Radar Setup page for the following conditions:

Radar Sensor: AlliedSignal ART-2000

Park Position: Centered

Beam Width: 7.0 °

Beam Height: 7.0 °

All boxes CHECKED, except "Disable Stabilization" is NOT CHECKED.

Press SAVE. (After pressing save, MFD goes to Maintenance Setup Page)

Calibration

The R/T Configuration Module must be configured using the Allied Signal KPA 900 Configuration Module Programmer Kit (Part Number 050-03311-0002) in conjunction with a personal computer. See the configuration module user data for detailed setup instructions. Follow the instructions for the programmer.

Perform radar R/T calibration as follows: Reference AlliedSignal (Bendix/King) 2000 Radar Sensor installation manual.

Antenna Clearance Check

- a From the Maintenance Set Up Page Select RADAR.
- b Set the radar park position to Full Up. Enter SAVE.
- c Restart the MFD. (SYSTEM) (R5)
- d From the Radar Page, set the Radar Function to SBY. (L3)
- e Set the Radar Mode to GND. (R1) Set KNOB to gain (L5)
- f Reduce the gain until the gain indicator shows the minimum setting.

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- g Set the Antenna Tilt to full Up (U 15.0)
- h Set Range to 240 NM.
- i From the Aux Page, enter Maintenance Mode, as described in Section 6.3, "Using the Maintenance Mode Page" on page 25.
- j Press "Radar Setup".
- k Press "Calibration" to display the RT CALIBRATION DATA page. Upon display of the RT CALIBRATION DATA page with the system in calibration mode, all fault fields will flash briefly. This verifies that the system is in calibration mode.
- l Starting at -30 , slowly adjust the gain control downward until the antenna clearance scan begins. This should take place at a gain value no lower than -26. The antenna will move to each of the extreme positions to determine that there is no interference with antenna movement and all scan motors are working properly.

Calibrate Radar Pitch and Roll.

- a Use the right outer knob to set ROLL TRIM to 0 degrees.
- b Calibrate AHRS ARINC 429 Pitch Offset.

Level aircraft.

Adjust the GAIN buttons for a GAIN POT /2 setting to 11- or 12-.

Set the PITCH ANGLE field to 0.0 +/- 1.0 degrees.

To increment the value of the PITCH ANGLE, use the left inner knob to change the TILT SETTING to between 5 and UP. When the TILT SETTING is set to between 5 and 10 UP, the value of the PITCH ANGLE field will slowly increase.

To decrement the value of the PITCH ANGLE, use the left inner knob to change the TILT SETTING to between 5 and 10 DOWN. When the TILT SETTING is set to between 5 and 10 DOWN, the value of the PITCH ANGLE field will slowly decrease.

When the desired setting is reached, quickly adjust the TILT SETTING to above 10 UP to lock in the setting.

- c Calibrate AHRS ARINC 429 Roll Offset.

Verify that the aircraft is level.

Adjust the GAIN buttons for a GAIN POT setting to 7- or 9-.

Set the ROLL ANGLE field to 0.0 +/- 1.0 degrees.

To increment the value of the ROLL ANGLE, use the left inner knob to change the TILT SETTING to between 5 and 10 UP. When the TILT SETTING is set to between 5 and 10 UP, the value of the PITCH ANGLE field will slowly increase.

To decrement the value of the ROLL ANGLE, use the left inner knob to change the TILT SETTING to between 5 and 10 DOWN. When the TILT SETTING is set to between 5 and 10 DOWN, the value of the ROLL ANGLE field will slowly decrease.

When the desired setting is reached, quickly adjust the TILT SETTING to above 10 UP to lock in the setting.

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d Save Configuration:

Adjust the GAIN controls for a GAIN POT /2 setting to 4- or 5-.

The FAULTS field will display GYRO.

Set the TILT SETTING to 15.0 DOWN. The fault fields will flash indicating that your settings are being saved. If the save procedure is successful the GYRO fault will disappear and the azimuth count will cycle through its entire number range.

NOTE: Transmitter FAULTS with the Radar OFF.

If the GYRO fault remains, set the TILT to 0 and repeat the previous step.

Enter EXIT.

After the Calibration is completed then enter SAVE.

Return to the RADAR Setup Page and change Park Position to Centered and SAVE.

10 See Chart 9 for Port Information.

(c) Data Acquisition Unit (DAU)

The DAU is mounted underneath the instrument panel on the right aft side of the forward pressure bulkhead (F.S. 100.00) (see Figure 1). Maintenance is on condition.

Use 200-00041-000 DAU ICA, Avidyne Document No. AVSIU-011, with the following exceptions:

- 1** In para 6, in "Table 2 - DAU Pinout," pins J1-2 and J1-21 have "No Connection" in the Piper installation.
- 2** In para 6, in "Table 4 - DAU Sensor Compatibility," parameter "VAC" is not used in the Piper installation.

Configuration/calibration procedures are in 28-40-00.

(d) Magnetometer/OAT Sensor Assembly

See information under Primary Flight Display, above. Removal, installation, and calibration instructions are provided under "Magnetic Heading Systems - S/N's 4636375 and up," below.

(3) Component Locator

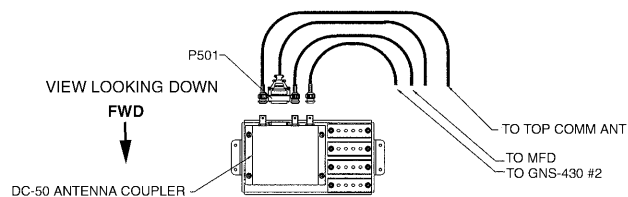
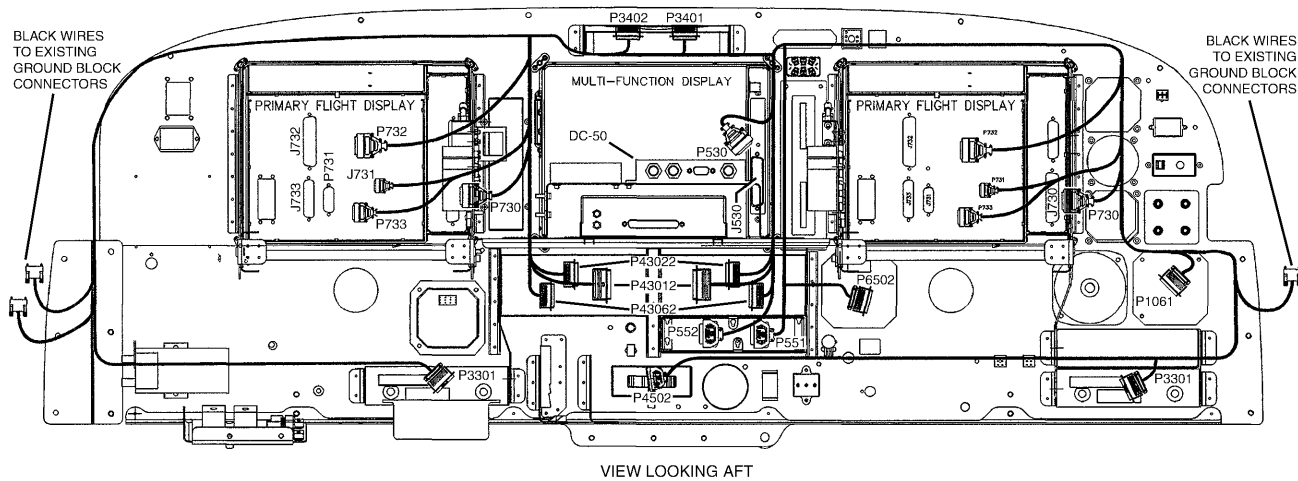
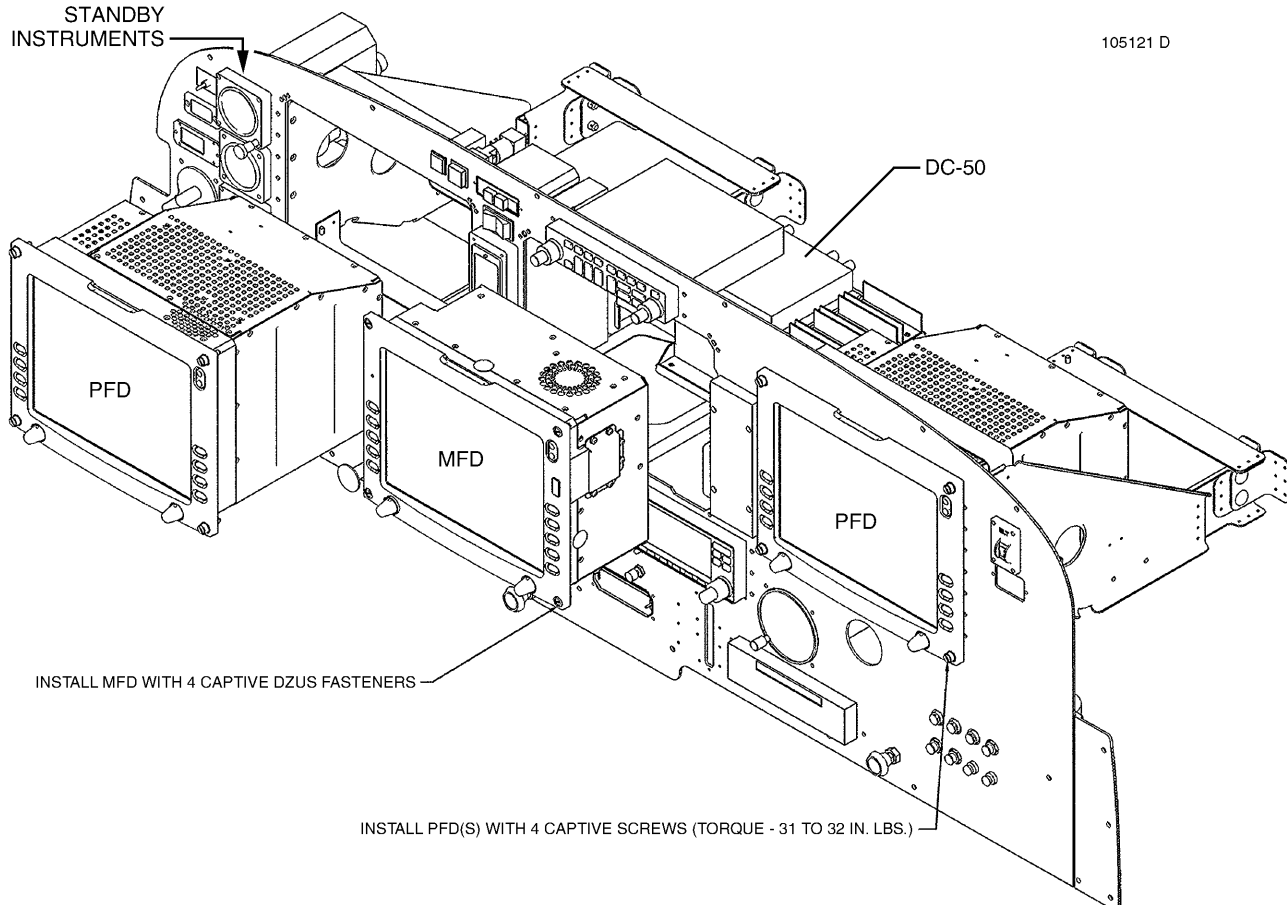
See Figures 1 and 5.

**CHART 9
PORT INFORMATION PAGE**

Port	Used By	Port	Used By
RS232 1	Broadcast	ARINC 429 TX1	Radar
RS232 2	-----	ARINC 429 TX2	TAWS
RS232 3	Lightening	ARINC 429 TX3	-----
RS232 4	Engine	ARINC 429 TX4	-----
RS232 5	Datalink	ARINC 453-1	Radar
RS232 6	Datalink	ARINC 453-2	TAWS
ARINC 429 RX1	GPS A		
ARINC 429 RX2	GPS B		
ARINC 429 RX3	Traffic		
ARINC 429 RX4	PFD Link		

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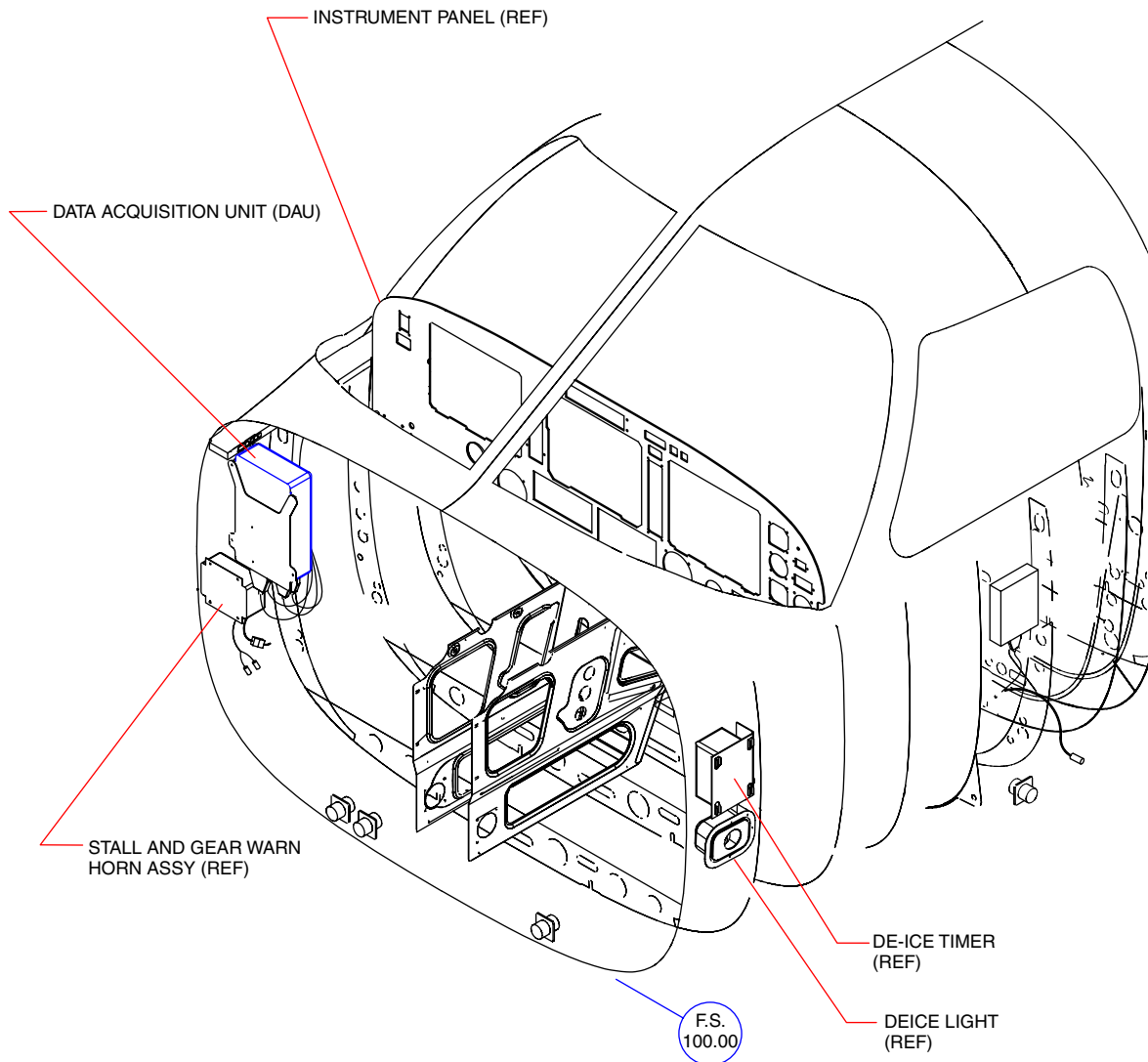
105121 D



[Effectivity](#)
4636375 and up

Avidyne EFIS Component Locator
Figure 1 (Sheet 1 of 2)

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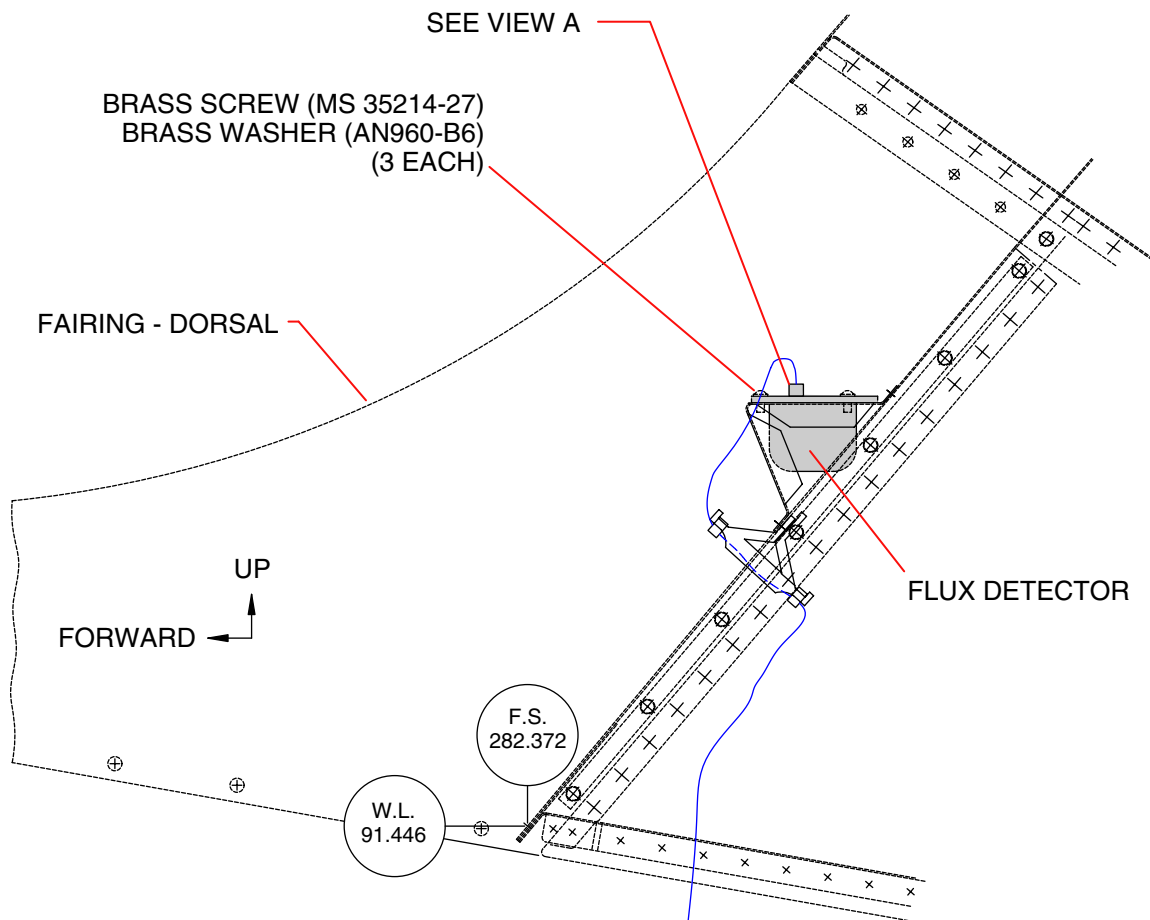


Avidyne EFIS Component Locator
Figure 1 (Sheet 2 of 2)

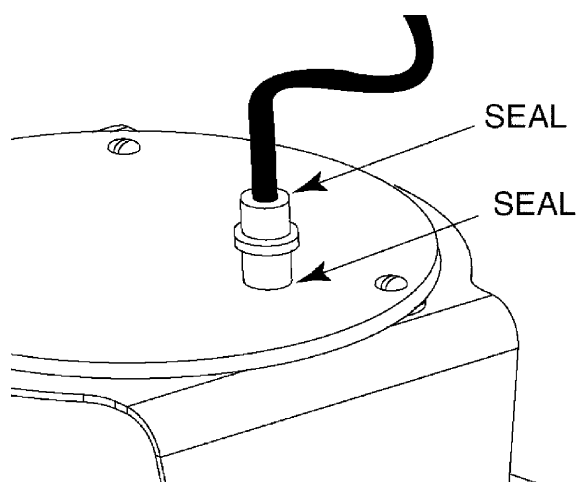
[Effectivity](#)
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VIEW LOOKING INBOARD (LEFT HAND SIDE)



VIEW A

Flux Detector Installation
Figure 2

Effectivity
4636160, and
4636248 thru 4636374

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6. Magnetic Heading Systems - S/N's 4636160, and 4636248 thru 4636374

NOTE: The slaving magnetic compass installed in S/N's 4636001 thru 4636247, less 4636160, were installed as part of the Bendix/King Autopilot/Flight Director installations in those airplanes and are serviced and adjusted per Bendix/King literature. See 22-10-00.

A. Flux Detector (See Figure 2.)

A flux detector installed in the leading edge of the vertical fin is used to provide heading data to the HSI/EHSI and, if installed, the ADAHRS.

(1) Removal

CAUTION: PERFORM MAGNETIC HEADING COMPENSATION / CALIBRATION, BELOW, WHENEVER THE FLUX DETECTOR IS CHANGED.

- (a) Remove the dorsal fairing to expose the flux detector.
- (b) Disconnect the wiring harness(es) from the top of the flux detector to be removed.
- (c) Unscrew and remove the three brass screws and washers and remove the flux detector.

(2) Installation

CAUTION: THE FLUX DETECTOR IS SECURED TO THE MOUNTING BRACKET WITH BRASS SCREWS. ENSURE ONLY BRASS SCREWS ARE USED WHEN REINSTALLING.

- (a) Place the flux detector into position on its mounting bracket and secure with brass screws and washers (3 ea.)
- (b) Connect wiring harness to the connector on top of the flux detector.
- (c) Seal the connector backshell and base (see Figure 2, View A) with DOW Corning 4 Electrical Insulating Compound.
- (d) Reinstall the dorsal fairing.

NOTE: Ensure correct hardware is used when reinstalling vertical fin dorsal fairing over flux detector.

B. Magnetic Heading Compensation / Calibration

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

(1) Standard Installation

(PIR-PPS60191, Rev. New.)

Accuracy of the entire heading system is dependent on the location of the flux detector and proper calibration. Accuracies of plus or minus one degree are possible when care is taken during installation and calibration. To obtain such results:

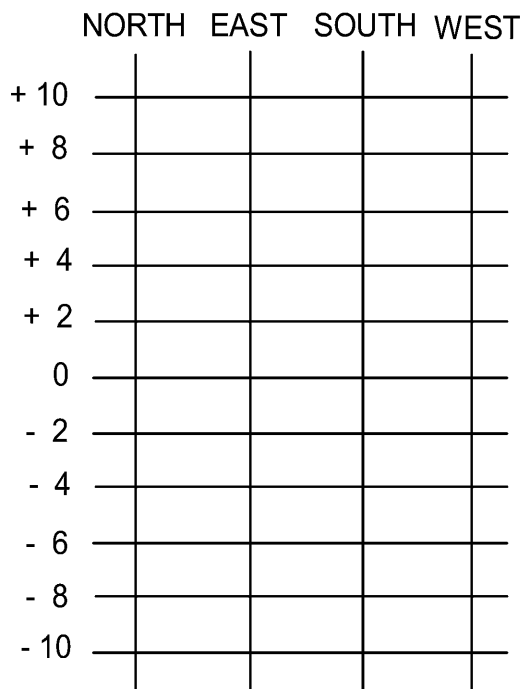
- The flux detector must be positioned so that it points in the direction of aircraft flight; and,
- The north-south and east-west correctors must be adjusted to compensate for extraneous magnetic fields near the location of the flux detector.

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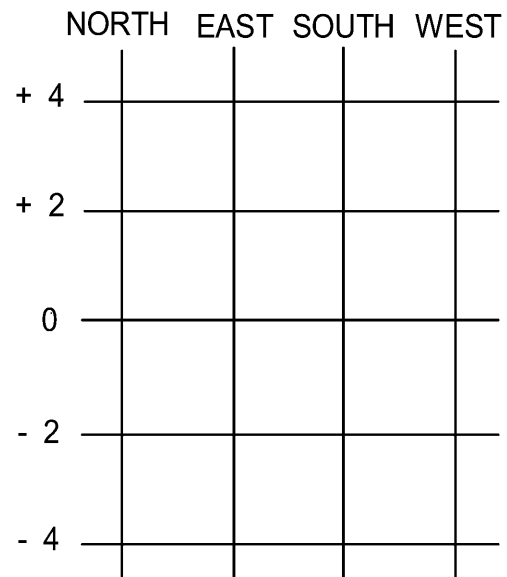
**CHART 10
DEVIATION CHART**

Approx. Magnetic Heading	Actual Magnetic Heading	Heading Card Reading	Deviation
North			
East			
South			
West			

INITIAL DEVIATION GRAPH



FINAL DEVIATION GRAPH



ST-180 Deviation Graphs
Figure 3

[Effectivity](#)
4636160, and
4636248 thru 4636374

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(a) Required Equipment

Instrument Flight Research Corp. RF signal generator NAV-40IL or equivalent. Characteristics of the signal generator include: Frequency ranges 108 to 118 MHz, 117 to 136 MHz, 328 to 336 MHz; $\pm 1/-0.01\%$ accuracy, output level continuously adjustable from 1 μ V to 0.1V into a 50 ohm load; 50 ohm output impedance; and internal adjustable or stepped VOR, LOC, and GS modulation. The RF signal generator should be portable and convenient for use while sitting in the aircraft cockpit.

(b) Procedure

- 1 Apply power to the Model ST-180 HSI System. Allow at least three (3) minutes for the gyro to erect and synchronize.
- 2 Prior to actual alignment of the flux sensor, turn the aircraft to both north and east headings. Apply power to electrical equipment such as navigation and beacon lights and verify that the compass system is not affected.
- 3 Align the aircraft to an approximate magnetic north heading. On Chart 10, record the actual magnetic heading and the HSI heading card reading.
- 4 Determine and record on Chart 10 the deviation between the actual magnetic heading and the heading card heading. If the heading card reads high, the deviation is a plus.
- 5 Repeat steps (3) and (4) for east, south, and west headings. Record actual magnetic headings, heading card readings, and deviations on Chart 10.
- 6 Plot deviations on the initial deviation graph in Figure 3.
- 7 Realign the aircraft to north. Adjust the north-south corrector on the Slaving Panel, for one half of the difference between the north and south deviations. Record the new deviation for north and south on the initial deviation graph in Figure 3.
- 8 Realign the aircraft to east. Adjust the east-west corrector on the Slaving Panel, for one half the difference between the east and west deviations. Record the new deviation for east and west on the initial deviation graph in Figure 3.
- 9 If the pattern is not centered around zero, rotate the flux sensor clockwise to correct for minus deviations or counterclockwise for plus deviations. Plot final deviations on the final deviation graph in Figure 3.
- 10 The deviations should now center around the zero reference line of the graph. If the error exceeds the specified system error limits (± 3 degrees), repeat the complete procedure.

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(2) Optional Meggitt EFIS Installation

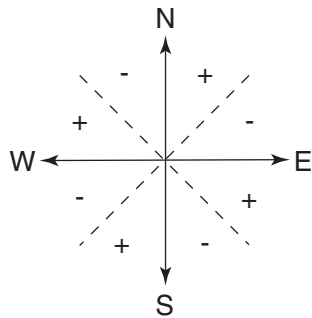
(PIR-PPS 60189-1, Rev. New.)

The Air Data & Attitude Heading Reference System (ADAHRS) unit mounted on the aft equipment shelf provides the other components of the Meggitt Magic EFIS system with magnetic heading data derived from the flux detector installed in the leading edge of the vertical fin. The ADAHRS unit should be swung (checked for changes in deviation) whenever the ADAHRS unit, flux detector, or either cabin recirculation blower is changed, and at least once a year.

Use the following procedure to compensate and calibrate the magnetic heading indication portion of the Meggitt Magic EFIS installation:

(a) Setup

- 1 Level the airplane within ± 1 degree laterally and longitudinally at the top surface of the seat rails.



Calculating Heading Error
Figure 4

- 2 Configure the airplane as follows:

External Power Applied to Aircraft	Avionics - ON
Instrument Panel Lights - Full Bright	LCD Displays - Full Bright
Day/Night Switch - Day	Navigation Lights - ON
Strobe Lights - ON	Pitot Heat - OFF
Windshield Heat - OFF	Air conditioning - OFF
Cabin Blower Fan - Low	Vent Blower - OFF

(b) Adahrs Unit Alignment Procedure

- 1 Place the EHSI in the "TEST MODE" by applying power with the "MNU" button held in the depressed position until the initialization page is displayed.
- 2 Select ADAHRS test page 2 from the EHSI menu selections.
- 3 Allow the ADAHRS to complete the initialization period and display an attitude sphere on the EADI.
- 4 Verify that the pitch and roll errors, as displayed on the EHSI test page, are less than ± 0.5 degrees in either axis.
- 5 If required for ADAHRS leveling, install shims under the ADAHRS mounting feet and re-secure the unit to the mounting structure.
- 6 Repeat the alignment procedure until the minimum acceptable criteria is met.

(c) Compass System Calibration Procedure

- 1 Flux Detector Indexing

CAUTION: THE TEST CABLE P/N 101453-002 IS REQUIRED EQUIPMENT. NO OTHER TEST CABLE IS AUTHORIZED. SEE PIPER SERVICE LETTER 1085.

- a Install the ADAHRS test cable and verify that the ADAHRS test cable calibration switch is in the "NORMAL" (open) position.
- b Place the EHSI in the "TEST MODE" by applying power with the "MNU" button held in the depressed position until the initialization page is displayed.
- c Select the ADAHRS interface test page 2 from the Navigation Display (ND) menu selection. The ADAHRS must be in the "INITIALIZATION" mode for the indexing procedure.

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- d Place the ADAHRS test cable calibration switch in the "CAL" (closed) position. Insure that the heading system flag comes into view on the EADI, replacing the heading scale tape and the digital readout.

NOTE: If no calibration has ever been entered into the ADAHRS memory, a heading flag will be in view at the time of the unit initial power-up.

- e Position the aircraft on the NORTH heading of the compass rose and record the indicated "MAGHDG" as displayed on the ND. Record the heading indication in Chart 11. (This is the raw data output from the flux detector). Repeat this step for EAST, SOUTH, and WEST headings.
- f After recording the raw heading information, calculate and record the index heading errors in Chart 11. Refer to Figure 4 to calculate the errors. The following logic applies to calculating heading errors:

For N, if indication is +, then error is +
For N, if indication is -, then error is -
For E, if indication is more than 90, then error is +
For E, if indication is less than 90, then error is -
For S, if indication is - and less than 180, (i.e. -179) then error is +
For S, if indication is + and less than 180, (i.e. +179) then error is -
For W, if indication is - and less than 90, (i.e. -89) then error is +
For W, if indication is - and greater than 90, (i.e. -91) then error is -

Enter the errors for the four cardinal headings in Chart 11. Add the errors and enter the sum in the "TOTAL ERROR" block in Chart 11. Divide the Total Error by 4 and enter the result in the "INDEX ERROR" block in Chart 11. This result is the "Index Error" of the flux detector.

- g If the index error is greater than one (1) degree, loosen the flux detector and adjust out the index error by rotating the flux detector.
- h Repeat steps (e) through (g) until the index error is less than one (1) degree.

NOTE: Upon completion of the flux detector indexing procedure, apply torque stripe to each of the flux detector mounting screws.

- i This completes flux detector indexing, proceed to Heading System Calibration / Compensation, below.

2 Heading System Calibration / Compensation

- a Heading system calibration / compensation should be performed upon completion of flux detector indexing, above, and using the same aircraft configuration specified in setup, above.
- b Place the Navigation Display (ND) in the "NORMAL" or mission operational mode (normal power-up).

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**CHART 11
INDEXING DATA**

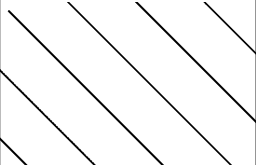
Aircraft S/N:		Registration No.:
ND Error ($\pm$)	ND Heading	Compass Rose
		N
		E
		S
		W
	Total Error (N+E+S+W)	
	Index Error (Total Error $\div$ 4)	

**CHART 12
HEADING SYSTEM CALIBRATION**

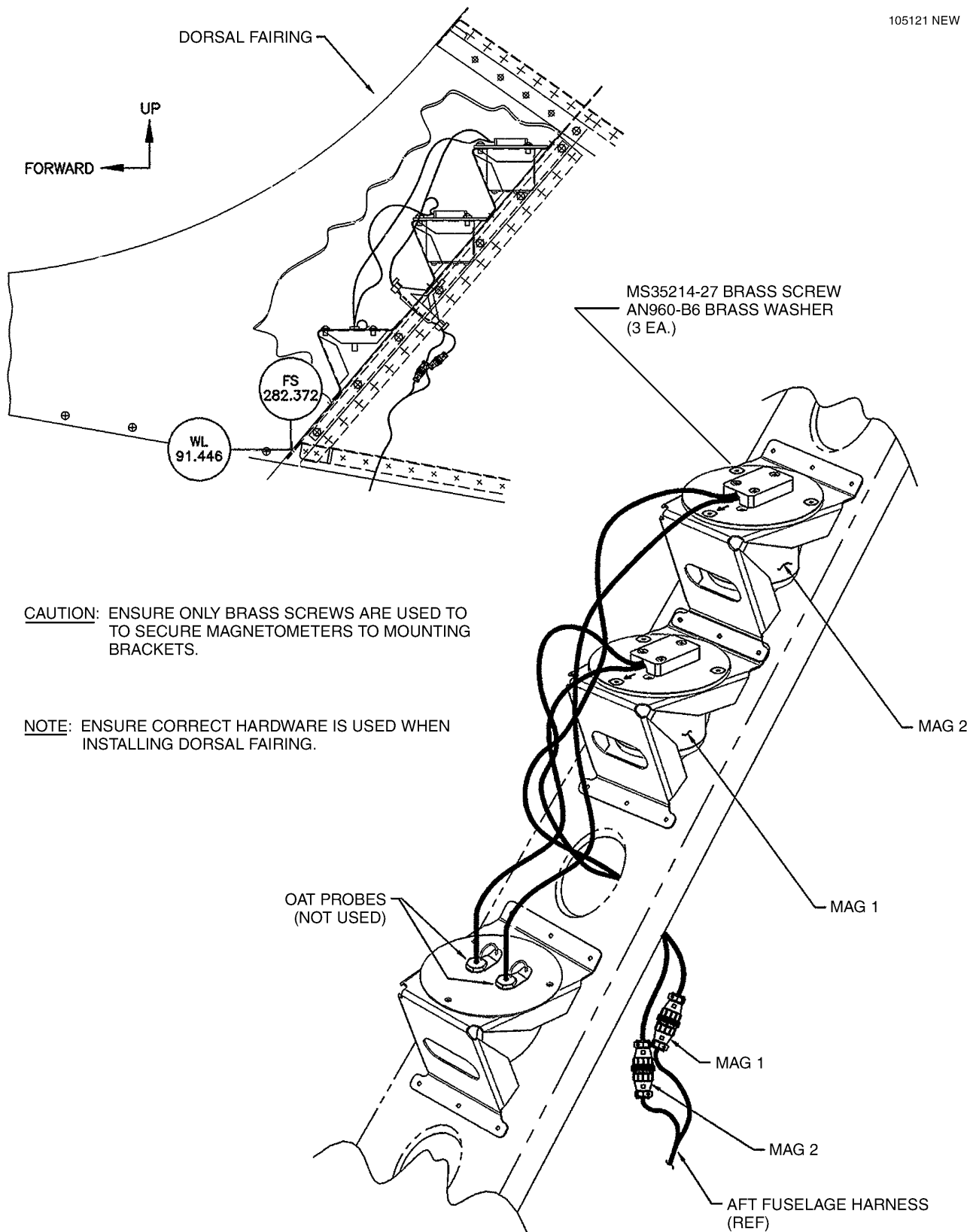
ND Heading	Compass Rose
	N
	30
	60
	E
	120
	150
	S
	210
	240
	W
	300
	330

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- c With the ADAHRS test cable installed, and the calibration switch in the "CALIBRATE" (closed) position, slowly taxi the aircraft in two (2) complete 360-degree turns. The direction of the turn does not matter; however, a minimum time of one (1) minute for each 360-degree turn (two (2) minutes minimum for the full 720 degrees) is required for the calibration process. The slow turn rate permits more data point samples for constructing the compensation curve. Make sure that the turns are continued until the heading flag is replaced by a normal heading indication.
- d Upon completing the two turns, the magnetic heading will automatically be displayed on both the EADI and EHSI. Place the ADAHRS test cable calibration switch in the "NORMAL" (open) position. Allow the compass system to stabilize for one (1) minute.
- e With the ADAHRS test cable calibration switch in the NORMAL (open) position, perform a complete heading system "swing". A settling time of two (2) minutes must be used at each heading to ensure heading stabilization. After two (2) minutes of settling, record the indicated heading against the known compass rose heading for all twelve compass rose points in Chart 12. The heading system error should not exceed ± 2 degrees on any compass point.

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105121 NEW



Magnetometer/OAT Sensor Assemblies
Figure 5

[Effectivity
4636375 and up](#)

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7. Magnetic Heading Systems - S/N's 4636375 and up

Two Magnetometer / OAT Sensor Assemblies (Mag/OAT) feed magnetic heading information to the Primary Flight Displays (PFD's) and the Multifunction Display (MFD). The Mag/OAT's are mounted under the dorsal fairing atop the aft fuselage at F.S. 282.372. See Figure 5.

NOTE: The OAT sensors in the Mag/OAT assemblies are not used. See Outside Air Temperature in 34-10-00.

A. Magnetometer/OAT (MAG/OAT) Assemblies

(1) Removal

- (a) Remove the dorsal fairing to expose the magnetometers.
- (b) Disconnect the wiring harness(es) from the aft fuselage harness.
- (c) Unscrew the three screws securing the OAT probe mounting plate to the mounting bracket.
- (d) Remove the OAT probe mounting plate and unscrew and remove the OAT probe nut(s) from the bottom of the mounting plate and remove the OAT probe(s).
- (e) Unscrew and remove the three brass screws and washers securing the magnetometer to its mounting bracket and remove the magnetometer(s).

(2) Installation

CAUTION: THE MAGNETOMETERS ARE SECURED TO THE MOUNTING BRACKET WITH BRASS SCREWS. ENSURE ONLY BRASS SCREWS ARE USED WHEN REINSTALLING.

- (a) Place the magnetometer(s) into position on its mounting bracket, with the arrow on the magnetometer pointing forward, and secure with brass screws and washers (3 ea).
- (b) Place the OAT probe(s) into position on its mounting plate and secure with nut(s) from bottom.
- (c) Place OAT probe mounting plate into position on mounting bracket and secure with brass screws and washers (3 ea.)
- (d) Connect wiring harness(es) to the aft fuselage harness.
- (e) Reinstall the dorsal fairing.

NOTE: Ensure correct hardware is used when reinstalling vertical fin dorsal fairing over flux detector.

B. Calibration

(PIR-PPS60227, Rev. NEW.)

Calibration can be accomplished using either of the following two methods.

NOTE: LSK L1 "Perform IRU Mx" and LSK L3 "Perform ADU Cal" are to be performed by Avidyne Service Technicians only. These functions are for bench test only.

(1) Bore sight reference compass (2 technicians)

NOTE: A hand-held bore sight reference compass is required for this procedure.

- (a) Apply external power to the aircraft to allow the PFD's to align while conserving the battery for the remaining calibration procedure.
- (b) Allow 3 minutes for the PFD's to align, until the ADAHRS countdown timer expires and the Gyro Warm-up box is removed from view Aircraft in "level flight attitude."

NOTE: The PFD countdown timer might automatically restart its count before the countdown expires. This is a normal operation and does not indicate a problem with the PFD.

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- (c) Allow an additional 10 minutes in the aligned state to ensure complete stability.
- (d) Place Battery Master Switch "ON".
- (e) Remove external power from the aircraft.
- (f) Position the aircraft in an area located away from metal structures and magnetic interference such as that caused by underground power lines, etc.
- (g) Using the bore sight compass, align the aircraft to a heading of $360^{\circ} \pm 1^{\circ}$.
- (h) Enter the System Setup mode on the pilot and copilot PFD's.
- (i) Press the "Perform Mag Cal" Line Select Key (L2).
- (j) Follow the directions on the "Magnetometer Calibration Page" and press the "Calibrate Heading" button and wait until "Done" is displayed.
- (k) Align the aircraft to each of the remaining 11 consecutive 30° headings using steps (g) through (j) and press the "Calibrate Heading" LSK (R4) at each of these alignment points after satisfactory alignment is achieved.
- (l) At the final alignment point (330°), remain stationary until "Done" is displayed. This could take up to one minute as data from the 12 calibration points is loaded onto the PFD's.
- (m) When complete, the following message appears:

MAG CAL COMPLETE - YOU MUST CYCLE POWER ON THE PFD IN ORDER FOR THE MAGNETOMETER CALIBRATION TO TAKE EFFECT.

- (n) Cycle power by pulling the following circuit breakers.
 - 1 Main bus: Pilot PFD and Copilot PFD
 - 2 Non Essential Bus: PFD/MFD Power Converter
 - 3 Avionics 1 Bus: Pilot PFD
 - 4 Avionics 2 Bus: Copilot PFD

NOTE: Wait 20 seconds before applying power.

- (o) Verify the calibration by aligning the aircraft with consecutive 90° headings, starting with 360° . Use the same alignment procedure as before and view the digital heading display on the pilot and copilot PFD's at each of these headings.

(2) Magnetometer Calibration Using Compass and Engine Run

- (a) Perform normal engine start and turn on Avionics Master if needed for taxi communications.
- (b) Remain stationary and allow the pilot and copilot PFD's to align for approximately 3 minutes until the ADAHRS countdown timer expires and the Gyro Warm-up box is removed from the PFD screen.

NOTE: The PFD countdown timer might automatically restart its count before the countdown expires. This is a normal operation and does not indicate a problem with the PFD.

- (c) Allow an additional 10 minutes in the aligned state to ensure complete stability.
- (d) Taxi to the compass rose with a technician to act as a spotter to aid in the alignment.
- (e) Enter the System Setup mode on the pilot and copilot PFD's.
- (f) Press the "Perform Mag Cal" Line Select Key (L2).
- (g) Align the aircraft with magnetic north on the compass rose with the assistant to within $\pm 1^{\circ}$.
- (h) Follow the directions on the "Magnetometer Calibration Page" and press the "Calibrate Heading" button and wait until "Done" is displayed.

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- (i) Align the aircraft to each of the remaining 11 consecutive 30° headings using steps (g) through (h) and press the “Calibrate Heading” LSK (R4) at each of these alignment points after satisfactory alignment is achieved.
- (j) At the final alignment point (330°), remain stationary until “Done” is displayed. This could take up to one minute as data from the 12 calibration points is loaded onto the PFD’s.
- (k) When complete, the following message appears:
MAG CAL COMPLETE - YOU MUST CYCLE POWER ON THE PFD IN ORDER FOR THE MAGNETOMETER CALIBRATION TO TAKE EFFECT.
- (l) Cycle power by pulling the following circuit breakers.
 - 1 Main bus: Pilot PFD and Copilot PFD
 - 2 Non Essential Bus: PFD/MFD Power Converter
 - 3 Avionics 1 Bus: Pilot PFD
 - 4 Avionics 2 Bus: Copilot PFD

NOTE: Wait 20 seconds before applying power.
- (m) Verify the calibration by aligning the aircraft with consecutive 90° headings, starting with 360°. Use the same alignment procedure as before and view the digital heading display on the pilot and copilot PFD’s at each of these headings.

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**CHART 13
TROUBLESHOOTING MAGNETIC COMPASS**

Trouble	Cause	Remedy
Excessive card error.	Compass not properly compensated.	Compensate instrument.
	External magnetic interference.	Locate magnetic interference and eliminate if possible.
Excessive card oscillation.	Insufficient liquid.	Replace instrument.
Card sluggish.	Weak card magnet.	Replace instrument.
	Excessive pivot friction or broken jewel.	Replace instrument.
Liquid leakage.	Loose bezel screws.	Replace instrument.
	Broken cover glass.	Replace instrument.
	Defective sealing gaskets.	Replace instrument.
Discolored markings.	Age.	Replace instrument.
Defective light.	Burned out lamp or broken circuit.	Check and replace lamp. Check continuity of wiring.
Card sticks.	Altitude compensating diaphragm collapsed.	Replace instrument.
Card does not move when compensating screws are turned.	The gears that turn compensating magnets are stripped.	Replace instrument.
Compass swings erratically. when radio transmitter is keyed.	Normal.	

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8. Magnetic Compass

The magnetic compass is a self-contained instrument. This instrument has an individual light which is connected to the instrument lighting circuit. The compass correction card is located in the card holder mounted on the instrument. The compass should be swung (checked for changes in deviation) whenever instruments or radios are changed, and at least once a year.

A. Troubleshooting

See Chart 13.

B. Adjustment

Before attempting to compensate compass, every effort should be made to place the aircraft in simulated flight conditions; check to see that the doors are closed, flaps in retracted position, engine running, throttle set at cruise position and aircraft in level flight attitude. Aircraft master switch, alternator switch, and all radio switches should be in the ON position. All other cockpit controlled electrical switches should be in the OFF position.

- (1) 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.
- (2) Head aircraft on a magnetic North heading. Adjust N-S adjustment screw until compass reads

**CHART 14
TROUBLESHOOTING TURN COORDINATOR**

Trouble	Cause	Remedy
Instrument fails to respond when power is being applied to instrument.	Foreign matter lodged in instrument.	Replace instrument.
Incorrect sensitivity.	Out of calibration.	Replace instrument.
Incorrect turn rate.	Out of calibration.	Replace instrument.
Ball sticky.	Flat spot on ball.	Replace instrument.
Ball not in center when aircraft is correctly trimmed in wings level flight.	Instrument not level in panel.	Level instrument.
Instrument will not run.	No power to instrument.	Check appropriate circuit breaker on pilot's circuit breaker panel. Check circuit and repair.
	Instrument malfunction.	Replace instrument.

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INDEPENDENT POSITION DETERMINING

Color Weather Radar

Maintenance instructions included in the manual are limited to description, removal, replacement, and self-test. Work exceeding this scope should be conducted by a qualified avionics repair facility in accordance with the component manufacturer's maintenance instructions.

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.)

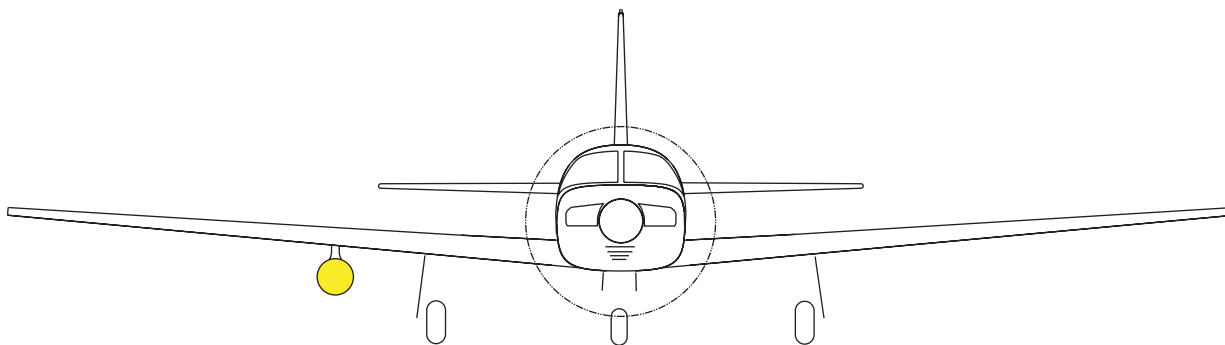
AlliedSignal's Bendix/King RDR 2000 Vertical Profile Radar system is installed as standard equipment. It consists of the IN-182A radar display indicator in the center of the instrument panel and the ART 2000 antenna transceiver, AA2010H antenna array, and CM 2000 configuration module mounted in a teardrop shaped pod hung from the right wing at the joint between the outboard and center wing sections. (See Figure 1.)

NOTE: In S/N's 4636375 and up, the IN-182A display is replaced by the Avidyne Entegra MFD. See 34-20-00, Avidyne Entegra EFIS, Maintenance, Multifunction Display (MFD), for setup and calibration.

The antenna transceiver and antenna array are assembled as a single unit and are mounted to the forward side of the bulkhead inside the radar pod. The configuration module is separately mounted to the pod bulkhead.

The antenna transceiver and array assembly are covered by a removable radome secured to the circumference of the pod bulkhead with screws.

A door in the right rear of the pod provides access to the void aft of the bulkhead, which can be used for miscellaneous lightweight storage, such as the ground protection equipment.



Color Weather Radar Pod
Figure 1

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WARNING: AIRBORNE WEATHER RADAR SHOULD BE OPERATED ON THE GROUND ONLY BY QUALIFIED PERSONNEL.

WARNING: THIS INSTRUMENT GENERATES MICROWAVE RADIATION.

-- DO NOT ALLOW PERSONNEL TO STAND NEAR OR CROSS IN FRONT OF A TRANSMITTING RADAR ANTENNA.

-- DO NOT ALLOW PERSONNEL TO LOOK INTO A WAVEGUIDE, OR INTO THE OPEN END OF A COAXIAL CONNECTOR OR LINE CONNECTOR TO A RADAR TRANSMITTER OUTPUT.

WARNING: DO NOT OPERATE RADAR WHILE AIRCRAFT IS IN A HANGAR OR OTHER ENCLOSURE UNLESS THE RADAR TRANSMITTER IS NOT OPERATING OR THE ENERGY IS DIRECTED TOWARD AN ABSORPTION SHIELD WHICH DISSIPATES THE RADIO FREQUENCY (RF) ENERGY.

A. Removal

- (1) Remove screws (13) and remove the radome.
- (2) Disconnect ground wires, antenna transceiver connector, and configuration module connector.
- (3) Remove screws (4) and remove the antenna transceiver / array assembly.
- (4) Remove screws (2) and remove the configuration module.

B. Installation

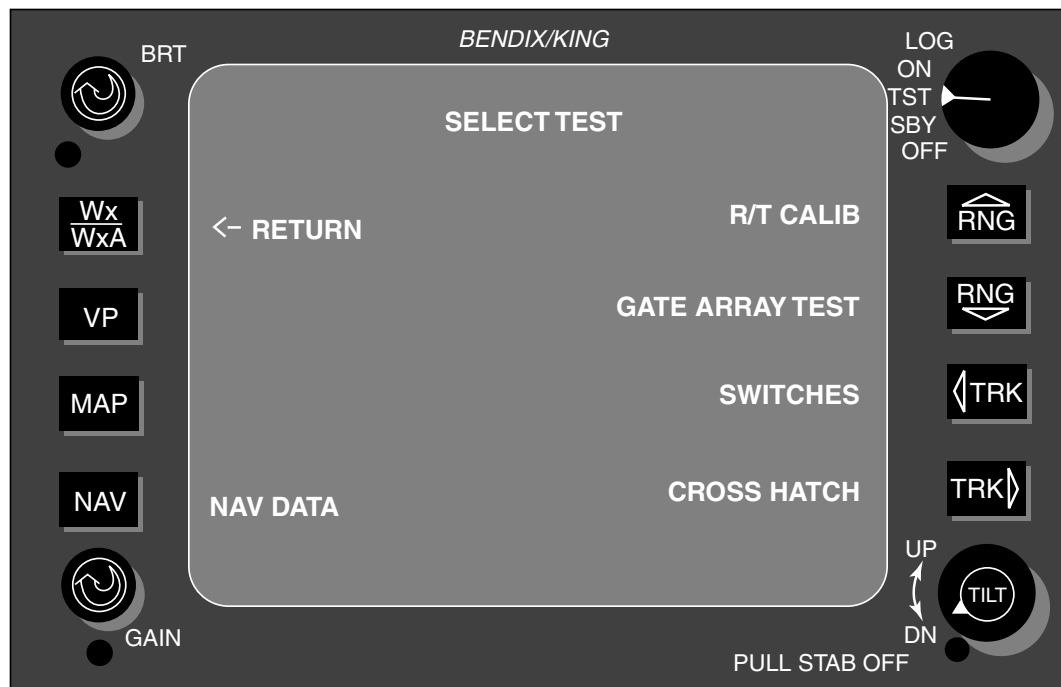
- (1) Position the configuration module and secure with screws (2).
- (2) Position the antenna transceiver / array assembly and secure with screws (4).
- (3) Connect ground wires, antenna transceiver connector, and configuration module connector.
- (4) Position the radome and secure with screws (13).

C. Self-test (S/N's 4636001 thru 4636374 only.)

The following displays basic system fault information and tests antenna clearance. Use the GAIN, TILT, and function knobs and the RNG and mode buttons on the IN-182A indicator.

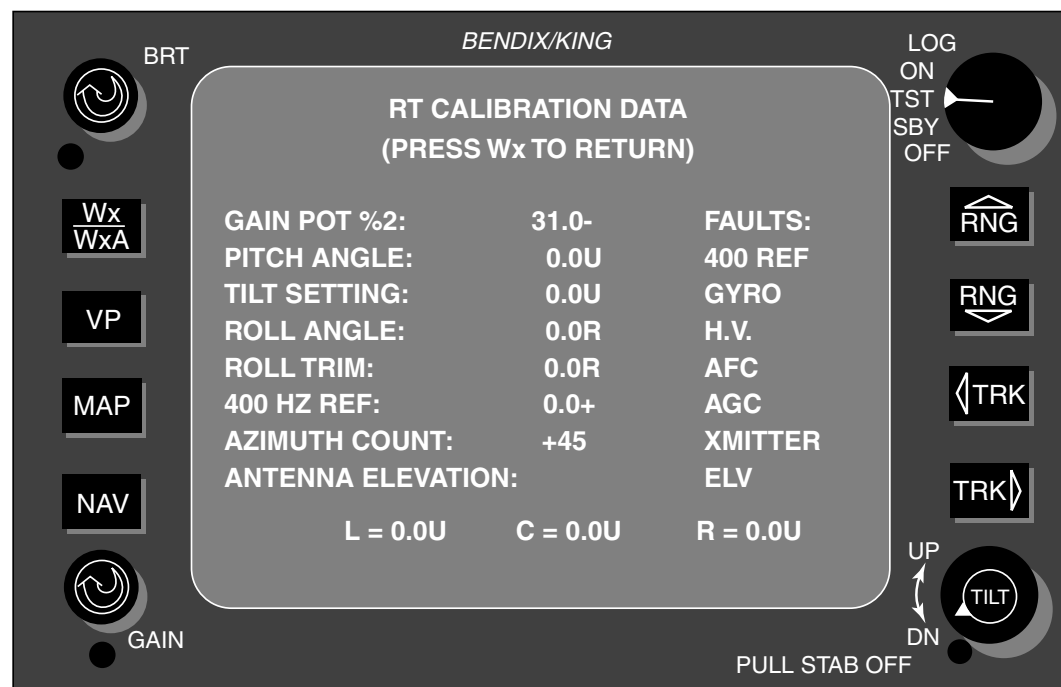
- (1) Set the radar function knob to TST.
- (2) Turn GAIN knob to minimum.
- (3) Set antenna TILT to full up and select a range (RNG) of 240 NM.
- (4) At the same time, depress the Wx/WxA and VP mode buttons to display the maintenance menu. (See Figure 2.)
- (5) Press the range up (RNG ^) to display the RT CALIBRATION DATA page. (See Figure 3.)
- (6) As the RT CALIBRATION DATA page comes up, all fault fields will flash briefly. When the display stabilizes, the only fault field displayed should be XMITTER. If any other fault fields are displayed, further investigation is required.
- (7) To initiate the antenna clearance test, rotate the GAIN knob to obtain a GAIN POT %2 value of -26.5 to -28. The antenna will then move to each of its extreme positions to verify that there are no physical interference and to ensure that all scan motors are working properly.

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IN-182A Maintenance Menu
Figure 2

[Effectivity](#)
4636001 thru 4636374



IN-182A RT Calibration Data Display
Figure 3

[Effectivity](#)
4636001 thru 4636374

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DEPENDENT POSITION DETERMINING

1. COM/NAV/GPS

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. S/N's 4636299, and 4636314 thru 4636374.

Dual Garmin GNS-530 COM/NAV/GPS systems are installed as standard equipment. Each installation consists of the GNS-530 transceiver/display unit, associated wiring, and antennas.

Maintenance of the GNS-530 is "on condition" only and, with the exception of swapping complete units, should be performed only by a qualified avionics shop in accordance with the GARMIN Series 500 Maintenance Manual (Garmin P/N - 190-00181-05).

Information provided in this manual is intended solely to aid the removal and installation of the GNS-530 transceiver/display units, their associated wiring and antennas.

(1) Removal and Installation

See 39-10-00.

(2) Post-Installation Lighting Set-up

See 33-10-00, Post-Installation Lighting Set-up.

B. S/N's 4636375 and up.

Dual Garmin GNS-430 COM/NAV/GPS systems are installed as standard equipment. Each installation consists of the GNS-430 transceiver/display unit, associated wiring, and antennas.

Maintenance of the GNS-430 is "on condition" only and, with the exception of swapping complete units, should be performed only by a qualified avionics shop in accordance with the GARMIN Series 400 Maintenance Manual (Garmin P/N - 190-00140-05).

Information provided in this manual is intended solely to aid the removal and installation of the GNS-430 transceiver/display units, their associated wiring and antennas.

(1) Removal and Installation

See 39-10-00.

(2) Post-Installation Lighting Set-up

See 33-10-00, Post-Installation Lighting Set-up.

C. Post Installation Setup Procedure

(1) Aircraft Preparation and Configuration

Setup and prelliminary checks may be made using the aircraft battery or external power supplied by an external power cart. Final checks (OBS/CDI or HSI accuracy) should be made with the engine running and the aircraft configured in Chart 1.

(2) Configuration Setup Procedure

Access the Configuration Mode of the unit by depressing and holding the ENT key while applying power to the unit. Release the ENT key when the display activates. After the data base pages, press the ENT key twice to display the MAIN ARINC 429 CONFIG page. Pages may be selected by ensuring the cursor is off and rotating the inner concentric knob on the right side of the unit.

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**CHART 1
FINAL CHECK CONFIGURATION**

Engine running, alternators	On	Avionics	On
Instrument Panel Lights	Full Bright	Day/Night Switch	Day
Navigation Lights	On	Strobe Lights	On
Pitot Heat	Off	Air Conditioning	Off
Cabin Blower Fan	Low	Vent Blower	Off

To change data on the displayed Configuration Page, the cursor must be selected. Press the inner concentric knob on the right side of the unit to activate the cursor. Rotating the outer concentric knob on the right side of the unit changes the selected data field. Rotating the inner concentric knob changes the data within the selected field. To accept entry of the desired selection, press the ENT key.

- (a) Configure the MAIN ARINC 429 Page on both GNS #1 and #2 as follows:

	SPEED	DATA
IN 1	HIGH	OFF, or TRAFFIC ADVISORY (if Skywatch is installed)
IN 2	HIGH	OFF
OUT	HIGH	GAMA 429 GRAPHICS W/INT
SDI	LNAV 1 (GNS Unit #1) LNAV 2 (GNS Unit #2)	

- (b) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the MAIN RS232 CONFIG page. Configure both the GNS #1 and #2 as follows:

	INPUT	OUTPUT
CHNL 1	OFF	AVIATION NO ALT
CHNL 2	OFF	OFF
CHNL 3	CROSSFILL	CROSSFILL
CHNL 4	OFF or WX500	OFF or WX500 (if Stormscope is installed)
CHNL 5	OFF	OFF
CHNL 6	OFF	OFF
FUEL TYPE		AV Gas

- (c) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the MAIN LIGHTING page. Change only the "SOURCE" setting to display an output of "PHOTO" and key of "28V DC".
- (d) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the MAIN CDI/OBS CONFIG page. Setup is only required for selected course calibration

Adjust the OBS or HSI course needle to indicate a selected course of 150 degrees. The SELECTED COURSE field on the GNS unit should indicate very close to 150 degrees. Select the "Calibrate to 150?" field and press ENT. Verify the OBS (or HSI course) operation by checking that the course displayed on the GNS unit is within 2° of the selected course. Verify the accuracy at cardinal headings around the OBS card.

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- (e) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the COM SETUP page. Change only the "SPACING" setting to display "Select 25.0 KHz"
- (f) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the VOR/LOC/GS/CDI page. Change only the "DME CHNL MODE" setting to display "Parallel 2x5".

2. Transponder

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. S/N's 4636299, and 4636314 thru 4636348.

A Garmin GTX-327 Transponder is installed as standard equipment. Maintenance of the GTX-327 is "on condition" only and, with the exception of swapping complete units, should be performed only by a qualified avionics shop in accordance with the GARMIN GTX-327 Maintenance Manual (Garmin P/N - 190-00187-05).

Information provided in this manual is intended solely to aid the removal and installation of the GTX-327 transceiver/display unit, its associated wiring and antenna.

- (1) Removal and Installation
See 39-10-00.
- (2) Post-Installation Lighting Set-up
See 33-10-00, Post-Installation Lighting Set-up.

B. S/N's 4636349 and up.

A Garmin GTX-330 Transponder is installed as standard equipment. Maintenance of the GTX-330 is "on condition" only and, with the exception of swapping complete units, should be performed only by a qualified avionics shop in accordance with the GARMIN GTX-330 Maintenance Manual (Garmin P/N - 190-00207-02).

Information provided in this manual is intended solely to aid the removal and installation of the GTX-330 transceiver/display unit, its associated wiring and antenna.

- (1) Removal and Installation
See 39-10-00.
- (2) Post-Installation Lighting Set-up
See 33-10-00, Post-Installation Lighting Set-up.

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C. Post Installation Setup Procedure

Access the Configuration Mode of the unit by depressing and holding the FUNC key while applying power to the unit. Release the FUNC key when the display activates. The FUNC key sequences forward through the configuration pages. The START/STOP key reverses through the pages, stopping at the Menu page. The CRSR key highlights selectable fields on each page. When a field is highlighted, the 0-9 keys enter numeric data and the 8 or 9 keys move through list selections. Press the CRSR key to accept changes. When a field is highlighted, pressing the FUNC key moves to the next configuration page without saving the changes. To exit the configuration pages, turn the power off and then turn the unit on again without holding the FUNC key for normal operation.

NOTE: When the unit is turned on for the first time, or an invalid address is recognized, the unit will prompt the user to enter a valid aircraft address. See Mode S Address paragraph, below.

(1) Configuration Menu

The JUMP TO menu page provides the capability to select a configuration mode starting page without having to step through all of the pages. Press the CRSR key and sequence through to the desired section with the 8 and 9 keys. Jump to the selection by pressing the CRSR key again with the desired selection highlighted. The FUNC key steps to the next configuration page, after which the START/STOP key reverses until stopping at the JUMP TO menu page. Following is a list of selections and their descriptions

SELECTION	DESCRIPTION
DIAGNOSTICS	Jumps to Gray Code Input Page
DISPLAY/AUDIO	Jumps to Audio Volume Page
I/O CONFIG	Jumps to ARINC INPUT #1 Page
ACFT CONFIG	Jumps to Operation Configuration #1 Page

(2) Refer to Charts 2-8 for required settings on the configuration pages.

**CHART 2
VOICE AND VOLUME**

Function	Selection	Description
VOLUME	MAX	
VOICE	MALE	
MESSAGE (0-5)		Selected Audio Tones and Messages 0= Toggle a continuous tone on and off 1= Attention Tone, precedes voice messages to attract the pilot's attention. 2= "Leaving Altitude", when altitude monitor is active and the altitude deviation is exceeded. 3= "Traffic", when a TIS traffic alert is received. 4= "Time Expired", when the countdown expires. 5= "Traffic Not Available", when TIS service is not available or out of range of an operating TIS MODE S site. 6-9 are not used.
ALTITUDE MONITOR	OFF	When Altitude Pre-Select is installed.
	TONE	When Altitude Pre-Select is not installed.
PAGE CHANGE	ENABLE	
COUNTDOWN TIMER	TONE	

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**CHART 3
DISPLAY MODE AND KEY LIGHTING**

DISPLAY MODE	AUTO
LEVEL	75
BKLT	AUTO
LVL	Not Selectable
RSP TIME	4
MIN	8
BKLT SRCE	PHOTO
SLOPE	50
OFFSET	50
KEY	AUTO
LVL	Not Selectable
RSP TIME	4
MIN	5
KEY SRCE	28V
SLOPE	20
OFFSET	30
CONTRAST MODE	

**CHART 4
ARINC 429 CONFIGURATION PAGE - STANDARD INSTALLATION (S/N's 4636001 THRU 4636374)**

#1 GTX 330			#2 GTX 330	
429 INPUT	SPEED	DATA	SPEED	DATA
CHANNEL 1	HIGH	GPS/FMS	HIGH	GPS/FMS
CHANNEL 2	LOW	OFF	LOW	OFF
CHANNEL 3	LOW	OFF	LOW	OFF
CHANNEL 4		OFF		OFF
429 OUTPUT		DATA		DATA
CHANNEL 1		OFF		OFF
CHANNEL 2		GARMIN W/TIS GARMIN W/IHAS		GARMIN W/TIS GARMIN W/IHAS

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CHART 5
ARINC 429 CONFIGURATION PAGE - MEGITT EFIS OPTION (S/N's 4636349 THRU 4636374)

#1 GTX 330			#2 GTX 330	
429 INPUT	SPEED	DATA	SPEED	DATA
CHANNEL 1	HIGH	GPS/FMS	HIGH	GPS/FMS
CHANNEL 2	HIGH	ADC W/ALT	HIGH	ADC W/ALT
CHANNEL 3	LOW	OFF	LOW	OFF
CHANNEL 4		OFF		OFF
429 OUTPUT		DATA		DATA
CHANNEL 1		OFF		OFF
CHANNEL 2		GARMIN W/TIS GARMIN W/IHAS		GARMIN W/TIS GARMIN W/IHAS

CHART 6
ARINC 429 CONFIGURATION PAGE - AVIDYNE ENTEGRA (S/N's 4636375 AND UP)

#1 GTX 330			#2 GTX 330	
429 INPUT	SPEED	DATA	SPEED	DATA
CHANNEL 1	LOW	GPS/FMS	LOW	GPS/FMS
CHANNEL 2	HIGH	ADC W/ALT	HIGH	ADC W/ALT
CHANNEL 3	LOW	OFF	LOW	OFF
CHANNEL 4		OFF		OFF
429 OUTPUT		DATA		DATA
CHANNEL 1		OFF		OFF
CHANNEL 2		"OFF" W/IHAS "GARMIN W/TIS" W/O IHAS		"OFF" W/IHAS "GARMIN W/TIS" W/O IHAS

CHART 7
RS-232 INPUT AND OUTPUT

RS-232 CONFIG	GTX	
232 INPUT	INPUT	OUTPUT
CHANNEL 1	OFF	OFF
CHANNEL 2	OFF	OFF

CHART 8
OPERATION CONFIGURATION

VS RATE	500
FORMAT	FEET
VFR ID	1200
ALTITUDE ALERT DEVIATION	200
SQUAT SWITCH	"YES"
"SENSE"	"LOW"
DELAY TIME	24
AUTO FLIGHT TIMER	MANUAL

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- (3) On the TEMPERATURE Page, select “NO” for SENSOR INSTALLED.
- (4) MODE S Address (ICAO Aircraft Address Code) and FLIGHT ID Entry Page

When the unit is turned on for the first time, or an invalid address is recognized, the unit will prompt the user to enter a valid aircraft address.

NOTE: U.S. registered aircraft ICAO Aircraft Address Code (ADDRESS HEX) is the “N number” and is displayed as such on the ATC-601. On Non-U.S. registered aircraft, verify only that the hexadecimal code displayed on ATC-601 matches the “ADDRESS HEX” code programmed on the GTX-330.

(a) U.S. Registered Aircraft

- 1 To highlight the “U.S. Tail #” address field, press the CRSR key one time.
- 2 Enter the registration number using the number keys. Press the CRSR key to select the numeric entry field. Press a key repeatedly to scroll through the digit/alpha characters for that entry field.
- 3 Repeat step 2 until the complete number is entered.
- 4 When finished, press the CRSR key to accept the number entry.
- 5 For entering the Flight ID number, press the CRSR key one time.
- 6 Repeat steps 2 and 3.
- 7 When finished, press the CRSR key to accept the number entry.

**CHART 9
Hexadecimal Conversion**

Binary	Hexadecimal	Decimal	Binary	Hexadecimal	Decimal
/0000	0	0	/1000	8	8
/0001	1	1	/1001	9	9
/0010	2	2	/1010	A	10
/0011	3	3	/1011	B	11
/0100	4	4	/1100	C	12
/0101	5	5	/1101	D	13
/0110	6	6	/1110	E	14
/0111	7	7	/1111	F	15

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(b) Non-US Registered Aircraft

- 1 For entering Non-U.S. Aircraft Registration, press the CRSR key one time, then 8 or 9 to select ADDRESS HEX.
- 2 Non-U.S. Aircraft Registry normally supplies a 24 bit binary code, known as the ICAO Aircraft Code for the Mode S address in lieu of directly entering the N# for U.S. registered aircraft.
- 3 The GTX 330 only accepts a hexadecimal format for the Non-U.S. Registered Aircraft, so the 24 bit binary code must be converted to a hexadecimal format.
- 4 Convert the 24 bit binary code to hexadecimal as follows:
 - a 24 bit binary code: 11100100011111101101101
 - b Separate for hex conversion: 1110/0100/0111/1110/1110/1101
 - c Apply the hexadecimal values found in Chart 9.

E	4	7	E	E	D
1110/	0100/	0111/	1110/	1110/	1101
- 5 Enter the hexadecimal address using the number keys. Press the CRSR key to select the numeric entry field. Press a key repeatedly to scroll through the digit/alpha characters for that entry field.
- 6 Repeat step 5 until the complete number is entered.
- 7 for FLIGHT ID select "CONFIG ENTRY" and enter the Hex code or select "POWER UP ENTRY".

8 When finished, press the CRSR key to accept the number entry.

- (5) On the "MODE S Aircraft Type" Page, select "<15.5k Lb" for AC TYPE, and "<=300 kt" for MAX AIRSPEED.
- (6) When entries are complete, cycle unit power and check for entries.

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APPENDIX

1

GROUND TEST PROCEDURE

MEGGITT MAGIC AIR DATA & HEADING REFERENCE SYSTEM (ADAHRS) AND PITOT-STATIC SYSTEM

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APPENDIX 1

LIST OF EFFECTIVE PAGES

<u>CHAPTER SECTION</u>	<u>PAGE</u>	<u>DATE</u>	<u>CHAPTER SECTION</u>	<u>PAGE</u>	<u>DATE</u>
APP1 - List of	1	Feb 7/06			
Effective Pages	2	Feb 7/06			
APP1	1	Feb 7/06			
	2	Feb 7/06			
	3	Feb 7/06			
	4	Feb 7/06			
	5	Feb 7/06			
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1. Reference Regulations and Guidance

Title 14 of the Code of Federal Regulations (14 CFR), Part 43 Appendix E, 23.1301(d), 23.1323(a)(c), 23.1325(b), 91.411, Advisory Circular AC 43-6B, and Advisory Circular AC 43.13-1B CHG 1 (or later) Chapter 12, Section 4.

2. Reference Documents

- Applicable Airplane Flight Manual (AFM)
- Applicable Airplane Maintenance Manual
- Applicable Meggitt Avionics/S-TEC MAGIC Pilot's Operating Handbook (POH)
- Meggitt Avionics/S-TEC Airspeed Configuration Data document (if applicable) for the airplane under test.

3. System Description

Each Meggitt MAGIC Electronic Flight Instrument System (EFIS) consists of the following components related to the Air Data and Pitot-Static systems:

- Primary Flight Display (PFD) with primary altimeter
- Navigation Display (ND) with reversionary altimeter
- Air Data/Attitude and Heading Reference System (ADAHRS)
- Standby Altimeter
- Standby Airspeed Indicator
- ATC Transponder (if installed)

Refer to the appropriate installation drawings or Instructions for Continued Airworthiness (ICA) document to determine the specific part numbers and locations of these components.

4. General

Purpose. This test procedure verifies the integrity and accuracy of the air data and pitot-static systems on the aircraft under test and shows that these systems comply with applicable airworthiness regulations. No bench testing or field repairs are included in this procedure. Any unsatisfactory findings should be repaired in accordance with other acceptable means.

Use this on-aircraft ground test procedure (GTP) to inspect and test each Meggitt Avionics/S-TEC MAGIC Air Data and Pitot-Static system, under the following conditions:

- In accordance with 24-month static system test; or
- To proof test static systems following any opening and closing of the pitot-static plumbing, except for the use of system drain and alternate static pressure valves (§ 23.1325(b)(2); or
- Following installation or maintenance on Air Data/Attitude and Heading Reference System (ADAHRS), Primary Flight Display (PFD), or Transponder Mode C interface.

5. Effectivity

This GTP is effective to aircraft with Meggitt Avionics/S-TEC MAGIC EFIS and pneumatic standby instruments.

6. Prior to testing

Conduct this GTP after the following has been accomplished:

- Continuity testing of new or altered electrical wiring
- Power and ground testing of new or altered electrical wiring
- Electrical bonding testing of new equipment
- Installation of equipment

9. Precautions

This section contains precautions that should be taken during tests to avoid damage to the sensitive instruments.

Damage can occur to instruments that are connected to both the static system and pitot system when only the static system is evacuated. The maximum design differential pressure of these instruments may be exceeded. This GTP requires that both the pitot and static ports be connected to the pitot-static tester.

Safeguards should be taken to prevent accidental disconnection of the test equipment plumbing from the aircraft or the test equipment while the static system is evacuated. The resultant sudden pressure change may damage both the test instruments and the aircraft instruments. The aircraft static system should be returned to ambient pressures before disconnecting static test equipment from the system

If static ports are blocked for the purpose of testing, use a long piece of brightly colored tape (red or orange) forming a streamer or similar method of warning be attached to the blockage device.

Damage may occur to other aircraft instruments if the altitude rate is changed faster than the limit of instruments.

10. Calibration of equipment

Conformity aircraft. Unless otherwise specified, test instruments used to calibrate or verify calibration in a certification project should be calibrated by an approved instrument repair inspector prior to FAA testing. Test instruments should be calibrated within 3 months of FAA testing. Reference AC 21-40, Section 8-4(h).

Follow-on installations and maintenance. In accordance with § 145.47 (b), the repair station shall ensure that all inspection and test equipment is tested at regular intervals to ensure correct calibration to a standard derived from the National Bureau of Standards or to a standard provided by the equipment manufacturer.

- Required test equipment, technical data, and rated personnel are available to perform a static system check as required by § 91.411(a)(2).
- Calibrated pitot-static tester and transponder ramp tester is available to determine the pressure altitude transmitted by the transponder in accordance with § 91.217(b).
- Completion of appropriate EFIS Post-Installation GTP.

NOTE

This Pitot-Static GTP is to be accomplished after MAGIC EFIS Post-Installation GTP and after leveling of the ADAHRS, which may require that the pitot-static lines to be temporarily disconnected.

7. After testing

Ensure that an appropriately rated person returns the aircraft to service following the alteration or maintenance in accordance with § 43.9.

8. Standard atmospheric ambient conditions and tolerances

Unless otherwise specified, testing shall be performed during the following standard atmospheric ambient conditions:

- Temperature: $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$
Record temperature if outside of range: _____

Avoid calibrating air data systems at extreme temperatures.

4. Barometer (pressurized aircraft only). A calibrated barometer may be used to determine the "station pressure" at the field where the aircraft will be tested. Station pressure will be used to calculate the MAX DIFF test altitude, which is the test altitude where the pitot-static system will be tested for leaks. *(Do not use altimeter setting barometric pressure for the MAX DIFF calculation.)*

CAUTION

Remove all tape and thoroughly clean ports to remove any adhesive resins after testing.

11. Ground Equipment

Use the following ground equipment for this GTP.

1. Ground Power Unit (GPU). Conduct this test procedure using a GPU that will provide sufficient regulated electrical power to the aircraft.
2. Pitot-Static tester. Use a calibrated pitot-static tester to simulate airspeed and altitudes on the aircraft. It is recommended to use a tester with a remote electronic control panel to facilitate the verification of the instruments in the aircraft.
3. ATC Transponder Ramp Tester. Use a calibrated ATC Transponder ramp tester to interrogate and verify proper Mode C (altitude) altitude reporting.

12. Ground Equipment ID

Record in Table I below the specific ground equipment used during this GTP:

Table I — Test Equipment

TEST EQUIPMENT	MANUFACTURER	MODEL	S/N	CAL DATE	CAL DUE
Ground Power Unit (GPU)					
Pitot-Static Tester					
ATC Transponder Tester					
Barometer					

13. Local information

Field elevation. Record the field elevation (H_a) where the aircraft is being tested, as a reference.

Field Elevation (H_a) feet

14. Proof Test Parameters (Pressurized Aircraft Only)

MAX DIFF test altitude (computation). For pressurized aircraft only, determine the equivalent altitude of the maximum cabin pressure differential (MAX DIFF test altitude).

This is the test point at which the proof test will be accomplished. The test altitude will vary depending on the current station barometer and the cabin pressurization limit of the aircraft under test. The following steps are provided to compute the MAX DIFF test altitude:

Step 1 (Station Pressure): Obtain the current local barometric pressure (station pressure) within 25 miles. (*Note that the station barometer is the true barometric pressure, unlike altimeters settings, which are "reduced" to sea level pressure*):

Station Barometer (Inches of Mercury) In Hg

Step 2 (Barometer Conversion): Convert the station barometric pressure to PSI, by dividing the barometric pressure by 2.036:

Station Barometer (Pounds per Square Inch) PSI

Step 3: (Cabin Pressurization Limit). Obtain the approved maximum cabin differential pressure for the aircraft under test, which is usually found in the AFM Limitations:

Maximum Cabin Differential Pressure 5.5 PSI

Step 4 (MAX DIFF test pressure). Subtract Step 3 from Step 2 to determine the MAX DIFF test pressure:

MAX DIFF test pressure PSI

Step 5 (MAX DIFF test altitude). Use Table IX at the end of this document to approximate the test pressure of Step 4 to an equivalent altitude, by selecting the next lower number in the PSI column and recording its corresponding altitude below:

Equivalent Altitude of Maximum Cabin Pressure Differential (MAX DIFF test altitude) feet

EXAMPLE:

Step 1. Local station pressure: 25.39 Inches of Mercury

Step 2. PSI = $\frac{25.39}{2.036}$ = 12.47 PSI

Step 3: Cabin pressurization limit: 5.3 PSI

Step 4: 12.47 – 5.3 = 7.17 PSI

Step 5: 7.17 PSI $\approx$ 19000 feet

The MAX DIFF test altitude of 19000 feet was estimated by rounding 7.17 PSI to the next lower value of 7.0412, as shown in Table IX at the end of this document.

MAX DIFF test altitude (alternate method). An alternate method to determine MAX DIFF test altitude on aircraft with an approved maximum differential cabin pressure indicator is to use the redline mark on this indicator. By this method, use the pitot-static tester to increase the altitude of the static system until the cabin differential pressure indicator reaches redline. Record the corresponding altitude as the MAX DIFF test altitude.

MAX DIFF tolerance. Calculate the MAX DIFF tolerance of 2% of MAX DIFF test altitude. Multiply MAX DIFF test altitude by **0.02** to obtain the tolerance. Insert this value into Table IV also.

MAX DIFF Tolerance = (0.02) x (MAX DIFF): ± feet

15. Airspeed and Altitude Limits

Record the airspeed and altitude design limits of the aircraft under test, as specified in the appropriate Airplane Flight Manual (AFM) or Type Certificate Data Sheet (TCDS). Use these figures to determine the limits of testing. Do not exceed the airspeed limit by more than 10 knots or the altitude limit by more than 2500 feet.

Airspeed limit. Record the maximum operating airspeed of the aircraft under test. Also make a note of the maximum airspeed in the margin of Table VIII for the Indicated Airspeed Test.

Maximum Operating Airspeed: * knots

Altitude limits. Record the maximum operating altitude of the aircraft under test. Also make a note of the maximum altitude in the margin of Table V for the Scale Error Test and Table VII for the Friction Test.

Maximum Operating Altitude: ** feet

* 188 KIAS - PA-46-500TP
198 KIAS - PA-46-350P

** 30,000 FT - PA-46-500TP
25,000 FT - PA-46-350P

16. Hysteresis Test

Dive (hysteresis) test points. Calculate required hysteresis test points from the maximum operating altitude.

50% test point. Multiply the maximum operating altitude by **0.5**. From this value, select the closest test point from the altitudes listed in Table V as the 50% test point:

50 % test point: feet

40% test point. Multiply the maximum operating altitude by **0.4**. From this value, select the closest test point from the altitudes listed in Table V as the 40% test point:

40 % test point: feet

Record the 50% and 40% test points in the "*Calculated Test Point Altitude*" column of Table VI.

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
1.	Before Applying Electrical Power				
2.	GROUND SAFETY INSPECTION Conduct a ground safety inspection in accordance with the appropriate Airplane Maintenance Manual prior to applying electrical power to the aircraft under test.	Check that master switches are OFF. Pull circuit breakers for engine start and fire control OUT.			
3.	Remove pitot-static covers (if installed)	Check that pitot-static ports are clear.			
4.	Inspection				
5.	<i>The following inspections are in compliance with § 23.1325(b)(1) and § 43 Appendix E(a).</i>				
6.	<u>Note:</u> Whenever blockage of the static lines is suspected, they should be purged before the static pressure system test is performed. Purging may keep objects from entering the test equipment and instruments. Since purging applies positive pressure to lines, the following precautions should be taken: (1) Disconnect all instruments, sensors, and ADAHRS from the pitot-static lines. (2) Secure a cloth bag over the end of the lines to catch any debris. (3) Clean drains after purging as they can act as a sump for foreign material.				
7.	Inspect and operate the pitot-static drains.	Verify drains operate normally and that positive drainage of moisture is provided in all pitot-static lines.			
8.	Inspect installation of the pitot-static lines.	Verify that chafing of the tubing and excessive distortion or restriction at bends in the tubing is avoided.			

Ground Test Procedure (Sheet 6 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
9.	Inspect the ports, tubing, accessories, and instruments connected to the static system to identify any parts that might be defective (e.g., broken "B" nuts, cracked flare sleeves, deteriorated flexible tubing, bad valves, etc.).	Verify that the materials used are durable, suitable for the purpose intended, and protected against corrosion.			
10.	Inspect static ports.	Verify static ports are free of debris and corrosion.			
		Verify that no alterations or deformations of the airframe surface have been made in the areas near the static ports.			
11.	Inspect alternate static ports.	Verify alternate static port is free of debris or corrosion.			
12.	Inspect pitot probes.	Verify inlet is free of debris or damage.			
		Verify that the pitot probe does not have any corrosion within ½-inch of probe tip.			
		Ensure that no alterations or deformations of the airframe surface have been made in the areas near the pitot probes.			
13.	Inspect transponder antennas. <i>Note: Oil, exhaust, and dirt buildup on a transponder antenna may attenuate and shift frequency out of tolerance.</i>	Verify transponder antennas are clean and not damaged.			
14.	Set up ground equipment				
15.	Set up Transponder ramp tester with the test antenna near the transponder antenna.				
16.	Connect Ground Power Unit to aircraft.				

Ground Test Procedure (Sheet 7 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
17.	Apply electrical power to aircraft				
18.	Activate ground power in accordance with the Airplane Maintenance Manual procedures and turn on electrical buses.				
19.	Turn on cabin lights to verify electrical power is applied to the aircraft.				
20.	Turn on EFIS power. <i>Check that PFD is not in reversionary mode.</i>	Verify normal PFD screen after PFD initialization screen. Verify ADAHRS initializes after normal countdown.			
21.	Turn on static port heat (if installed).	Verify either increased ammeter current or that static port becomes hot to the touch.			
22.	Turn off static port heat (if installed).	Verify either reduced ammeter current or that static port returns to ambient.			
23.	Turn on pitot heat.	Verify either increased ammeter current or that pitot probe becomes hot to the touch.			
24.	Turn off pitot heat.	Verify either reduced ammeter current or that pitot probe returns to ambient.			

Ground Test Procedure (Sheet 8 of 24)
Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
25.	Alternate Static (if installed) Test at Field Elevation				
26.	Purpose. This test will verify that the altimeters do not change more than 50 feet between normal and alternate static sources at field elevation, in compliance with § 23.1325(b)(3). → A functional flight check of the alternate static selector is recommended.				
27.	Press BARO knob on PFD 1 and 2.	Verify PFD indicates STD.			
28.	Set BARO on standby altimeter to 29.92 .	Verify dial rotates normally.			
29.	Inspect the alternate static source selector.	Verify alternate static selector is clearly marked and can be switched freely between normal and alternate sources.			
30.	Switch alternate static to NORMAL .	Record results in the NORMAL row in Table II below.			
31.	Switch alternate static to ALTERNATE .	Record results in the Alternate row in Table II below.			
32.	Return alternate static to NORMAL .	Compute the difference between normal and alternate in Table II below. Verify that the altitude does not differ by more than 50 feet, IAW § 23.1325(b)(3).			

Table II — Alternate Static Test

Alternate Static Switch	Pilot's Altimeter (feet)	Copilot's Altimeter (feet)	Standby Altimeter (feet)	Tolerance (feet)	Pass/Fail
Normal					
Alternate					
Difference				±50	

Meggitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pilot-Static System
Ground Test Procedure (Sheet 9 of 24)

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
33.	Barometric Scale Error Test				
34.	Purpose. This test verifies the accuracy of the barometric scale on each altimeter, in compliance with § 43 Appendix E, Table IV.				
35.	Set the BARO knob on each altimeter to standard pressure 29.92 in order to determine the pressure altitude (Pa) at field elevation.	Record the pressure altitude (Pa) in the first row of Table III below. Use this altitude as the reference point.			
36.	Adjust the BARO knob on each altimeter to the specified settings, record the new indicated altitudes, and compute the difference between the indicated altitudes from pressure altitude.	Verify that the change in altitude on each altimeter is within ± 25 feet of the expected change from pressure altitude at field elevation.			

Table III — Pressure-Altitude Difference

BARO Setting	Expected Change from Pressure Altitude (Pa)	Tolerance	PFD 1 Altimeter (feet)		PFD 2 Altimeter (feet)		Standby Altimeter (feet)		Pass/Fail
			Indication	Altitude change from Pa	Indication	Altitude change from Pa	Indication	Altitude change from Pa	
29.92	Pressure Altitude (PA)								
29.50	-392	±25 ft							
29.00	-863	±25 ft							
28.50	-1,340	±25 ft							
28.10	-1,727	±25 ft							
30.50	+531	±25 ft							
30.90	+893	±25 ft							
30.99	+974	±25 ft							

37.	Press BARO knob on PFD 1 and 2.	Verify PFD indicates STD.			
38.	Reset BARO on standby altimeter to 29.92 .				

Ground Test Procedure (Sheet 10 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
39.	Pitot-Static Tester Set Up <i>Test Points. Connect the pitot-static test equipment directly to the pitot-static ports on the aircraft, if practicable. Otherwise, connect to a static system drain or tee connection and seal off the static ports. If the test equipment is connected to the static system at any point other than the static port, it should be made at a point where the connection may be readily inspected for system integrity after the system is returned to its normal configuration.</i> <i>Seals. Block unconnected ports with brightly colored tape long enough to have a streamer.</i> Note: Remove all static port seals after completion of this test procedure.				
40.	<i>Separation. If the aircraft under test has more than one pitot-static system, test each system separately to ensure their independence and that the leak rate for each is within tolerance.</i> <i>Vibration. Unless otherwise specified, each test may be conducted with vibration applied to pneumatic standby instruments.</i> Note: When applying vibration, lightly tapping the standby instrument face with a finger should suffice. DO NOT install a shaker or vibrator on the instrument panel. Caution: Secure pitot-static test connections carefully. Avoid circumstances that would result in a test line disconnecting unintentionally while test pressure is being applied.				

Ground Test Procedure (Sheet 11 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
41.	Proof Test Purpose. This test will verify the integrity of the pitot-static system(s), including the lines and components, in compliance with § 23.1325(b)(2) and § 91.411(a)(2). Procedures are included for both pressurized and non-pressurized aircraft, with the allowable tolerance of each type shown. Use one or the other as appropriate for the aircraft under test. Method. Each pitot-static system shall be tested separately to verify that it can hold the test pressure for 1 minute without support from the vacuum pump in the tester. The pitot and static ports of each system shall be connected to the pitot-static tester to verify both lines.				
42.	Note: On aircraft with multiple pitot systems using a single static system, connect all pitot systems to the pitot-static tester to avoid damage to instruments. Caution: Monitor all air data instruments during testing to ensure that none are operated beyond limitations. <i>All instruments in the aircraft under test shall be connected to their normal lines to assure that no leaks occur within the instruments or their connections.</i> <i>The primary altimeter in the aircraft under test or that in the pitot-static tester may be used as a vacuum gauge for the proof test.</i> <i>Use Table IV to record readings, calculations, and pass/fail results.</i>				

Ground Test Procedure (Sheet 12 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
43.	<u>Unpressurized Airplanes.</u> With the pitot-static tester connected to each pitot-static system separately, simulate a test altitude of 1,000 feet above field elevation at 0 knots airspeed. Upon reaching the test altitude, record the indicated altitude displayed on the specified altimeter as the <i>Initial Altitude</i> in Table IV. After 1 minute without additional vacuum being applied to the aircraft, record the second altitude from the same altimeter.	Compute the <i>Altitude Loss</i> in Table IV by subtracting the <i>Initial Altitude</i> from the <i>Altitude After 1 Minute</i>. Verify that the <i>Altitude Loss</i> is less than the unpressurized proof test tolerance of ± 100 feet.			
44.	<u>Pressurized Airplanes.</u> With the pitot-static tester connected to each system separately, simulate MAX DIFF test altitude, as computed in Section 14: ► _____ feet Upon reaching the MAX DIFF altitude, record the indicated altitude displayed on the specified altimeter as the <i>Initial Altitude</i> in Table IV. After 1 minute without additional vacuum being applied to the aircraft, record the second altitude from the same altimeter.	Compute the <i>Altitude Loss</i> in Table IV by subtracting the <i>Initial Altitude</i> from the <i>Altitude After 1 Minute</i>. Verify that the <i>Altitude Loss</i> is less than the Pressurized MAX DIFF Tolerance (2% of MAX DIFF altitude).			
45.	Return pitot-static tester to atmospheric conditions on conclusion of proof test.				

Table IV — Proof Test

Parameter	Pilot's Altimeter (feet)	Copilot's Altimeter (feet)	Standby Altimeter (feet)	Unpressurized Proof Test Tolerance(feet)	Pressurized MAX DIFF Tolerance(feet)	Pass/Fail
1 st reading → <i>Initial Altitude</i>						
2 nd reading → <i>Altitude After 1 Minute</i>						
Calculate → $1^{st} - 2^{nd} = \text{Altitude Loss}$				± 100	► $\pm$	

Ground Test Procedure (Sheet 13 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
46.	Scale Error and Altitude Reporting Test				
47.	Purpose. This test will verify the accuracy of the altimeters and altitude-reporting devices during a 4000--6000 FPM climb between test points, in compliance with Part 43 Appendix E, Table I and § 91.217(b). Method. Each static system may be tested separately or together. The pitot and static ports of each system shall be connected to the pitot-static tester. Caution: Monitor all air data instruments during testing to ensure that none are operated beyond limitations. <i>All instruments in the aircraft under test shall be connected to their normal lines.</i> <i>Each altimeter in the aircraft under test will be compared to the altitude of the tester at test point altitudes, as specified in Table V.</i> <i>Use Table V to record readings, calculations, and pass/fail results.</i>				
48.	Set pitot-static tester altimeter to 29.92 and airspeed to 0.				
49.	Press the BARO knob on PFD 1 and 2 for STD (29.92) setting.				
50.	Set the BARO on standby altimeter to 29.92.				
51.	Set up the transponder ramp tester to interrogate the transponder(s) on the aircraft.				
52.	Turn on transponder 1 in Mode 3/A with altitude (Mode C) off.	Verify on the ramp tester that the transponder is NOT transmitting altitude information.			
53.	Turn on altitude (Mode C) on transponder 1.	Verify proper altitude pulse train or decoded altitude on the ramp tester.			

Ground Test Procedure (Sheet 14 of 24)
Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
54.	Turn on transponder 2 (if installed) in Mode 3/A with altitude (Mode C) off.	Verify on the ramp tester that the transponder is NOT transmitting altitude information.			
55.	Turn on altitude (Mode C) on transponder 2 (if installed).	Verify proper altitude pulse train or decoded altitude on the ramp tester.			
56.	Continue to interrogate each transponder with the ramp tester through the remainder of the scale test, up to the maximum altitude.	Record the altitude reporting of each transponder at each test point in Table V and verify that the reported altitude is within MODE C tolerance of ± 125 feet.			
57.	<i>Use the pitot-static tester to apply suction to the static system in accordance with the test points listed in Table V up to the maximum operating altitude of ► ^{**} feet for the aircraft. NOTE: Do not exceed the maximum altitude of the aircraft by more than 2500 feet.</i>				
58.	Adjust the pitot-static test set vertical speed to climb at 4000–6000 FPM between test points. Stop when the tester reaches each test point and record the indicated altitude on each altimeter.	Verify that the indicated altitude on each altimeter is within the SCALE tolerance specified in Table V.			
59.	Turn off transponder(s) after reaching maximum altitude.				
60.	Turn off transponder ramp tester after reaching maximum altitude.				
61.	End of Scale Error and Altitude Reporting Test. <i>Begin the hysteresis (dive) test from the maximum altitude within 15 minutes of reaching the maximum altitude.</i>				

** 30,000 FT - PA-46-500TP
25,000 FT - PA-46-350P

Ground Test Procedure (Sheet 15 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table V — Scale Error and Altitude Reporting Test (Climb at 4000–6000 FPM)

TEST POINTS Test Set Altitude	Pilot PFD Altimeter	Copilot PFD Altimeter (if installed)	Standby Altimeter (if installed)	SCALE Tolerance ±(feet)	Transponder1 Mode C Altitude (if installed)	Transponder2 Mode C Altitude (if installed)	MODE C Tolerance ±(feet)	Pass/Fail
-1,000				±20			±125	
0				±20			±125	
500				±20			±125	
1,000				±20			±125	
1,500				±25			±125	
2,000				±30			±125	
3,000				±30			±125	
4,000				±35			±125	
6,000				±40			±125	
8,000				±60			±125	
10,000				±80			±125	
12,000				±90			±125	
14,000				±100			±125	
16,000				±110			±125	
18,000				±120			±125	
20,000				±130			±125	
22,000				±140			±125	
25,000				±155			±125	
30,000				±180			±125	
35,000				±205			±125	
40,000				±230			±125	
45,000				±255			±125	
50,000				±280			±125	

Ground Test Procedure (Sheet 16 of 24)
Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
62.	Hysteresis (Dive) and After Affect Test				
63.	Purpose. This test will verify the accuracy of the altimeters after a simulated dive from maximum altitude, to 50% of maximum, to 40%, to Atmospheric Pressure, in compliance with § 43 Appendix E, Table II. !! Begin dive test at maximum altitude within 15 minutes of reaching maximum altitude. Use Table VI to record readings, calculations, and pass/fail results.				
64.	Descend to 50% test point. Adjust test set to descend to the 50% test point at greater than or equal to 6000 FPM until within 3000 feet. Approach at 3000 FPM. Hold at test point for 5 minutes before taking a reading.	Verify indicated altitude is within ± 75 feet of the value recorded in Table V at the same altitude after holding at the 50% test point for 5 minutes.			
65.	Descend to 40% test point. Adjust test set to descend to the 40% test point at greater than or equal to 6000 FPM until within 3000 feet. Approach at 3000 FPM. Hold at test point for 1 minute before taking a reading.	Verify indicated altitude is within ± 75 feet of the value recorded in Table V at the same altitude after holding at the 40% test point for 5 minutes.			
66.	Descend to test point. Adjust test set to descend to Atmospheric Pressure at greater than or equal to 6000 FPM until within 3000 feet. Approach at 3000 FPM and hold.	Within 5 minutes of reaching Atmospheric Pressure, verify indicated altitude is within ± 30 feet of the pitot-static test set.			

Table VI — Hysteresis Test (dive from MAX ALT at greater than or equal to 6000 FPM)

TEST POINT	Calculated Test Point Altitude (from Section 16)	Pilot PFD Altimeter	Copilot PFD Altimeter (if installed)	Standby Altimeter (if installed)	Tolerance ($\pm$ feet) from the value recorded in Table V	Pass/Fail
50% test point	▶				± 75 after 5 min	
40% test point	▶				± 75 after 1 min	
Atmospheric Pressure	▶				± 30 within 5 min	

Ground Test Procedure (Sheet 17 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
67.	Friction Test (750 FPM Climb)				
68.	Purpose. This test will verify the accuracy of the altimeters during a 750 FPM climb, in compliance with § 43 Appendix E, Table III. Method. Each static system shall be tested separately. Both the pitot and static ports of each system shall be connected to the pitot-static tester. All instruments in the aircraft under test shall be connected to their normal lines. Each altimeter in the aircraft under test will be compared to the altitude of the tester at test point altitudes, as specified in Table VII. Use Table VII to record all readings, calculations, and pass/fail results.				
69.	Set pitot-static tester altimeter to 29.92 and airspeed to 0.				
70.	Press the BARO knob on PFD 1 and 2 for STD (29.92) setting.				
71.	Set the BARO on standby altimeter to 29.92.				
72.	Use the pitot-static tester to apply suction to the static system in accordance with the test points listed in Table VII up to the maximum operating altitude of ► _____ feet for the aircraft. NOTE: Do not exceed the maximum altitude of the aircraft by more than 2500 feet.				
73.	Adjust the pitot-static test set vertical speed to climb at 750 FPM between test points. Stop when the tester reaches each test point and record the indicated altitude on each altimeter.	Verify that the indicated altitude on each altimeter is within the FRICTION tolerance specified in Table VII.			
74.	End of Friction Test Adjust pitot-static tester to descend to atmospheric conditions.				

Ground Test Procedure (Sheet 18 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table VII — Friction Test (Climb at 750 FPM)

TEST POINTS Test Set Altitude	Pilot PFD Altimeter	Copilot PFD Altimeter (if installed)	Standby Altimeter (if installed)	FRICTION Tolerance ±(feet)				Pass/Fail
1,000				±70				
2,000				±70				
3,000				±70				
6,000				±70				
10,000				±80				
16,000				±90				
20,000				±100				
25,000				±120				
30,000				±140				
35,000				±160				
40,000				±180				
50,000				±250				

Ground Test Procedure (Sheet 19 of 24)
Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
75.	Airspeed Test				
76.	Purpose. This test will verify the accuracy of the airspeed indicators at pressure altitude, in compliance with § 23.1323(a). Method. Each pitot-static system may be tested separately or together. The pitot and static ports of each system shall be connected to the pitot-static tester. All instruments in the aircraft under test shall be connected to their normal lines. Each airspeed indicator in the aircraft under test will be compared to the airspeed Indicator of the tester at various test point speeds, as specified in Table VIII. Use Table VIII to record readings, calculations, and pass/fail results.				
77.	Set pitot-static tester altimeter to 29.92.				
78.	Press the BARO knob on PFD 1 and 2 for STD (29.92) setting.				
79.	Set the BARO on standby altimeter to 29.92.				
80.	Use the pitot-static tester to apply pressure to the pitot system in accordance with the test points listed in Table VIII up to the maximum operating speed of ► _____ knots for the aircraft. NOTE: Do not exceed the maximum airspeed of the aircraft by more than 10 knots.				
81.	Adjust the pitot-static test set to attain the speeds specified in Table VIII. Stop when the tester reaches each test point and record the indicated airspeed.	Verify that the indicated airspeed on each indicator is within the tolerance specified in Table VIII.			
82.		Verify redline displayed at the maximum airspeed per AFM at ► _____ kts			
83.		Verify overspeed alerter (if installed) activates within ±2 knots of redline.			
84.	Decrease pitot-static tester to atmospheric conditions.				

Ground Test Procedure (Sheet 20 of 24)
Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table VIII — Indicated Airspeed (at field elevation)

Test Set Indicated Airspeed	Pilot PFD Indicated Airspeed	Copilot PFD Indicated Airspeed	Standby Airspeed Indicator	Tolerance $\pm$ KIAS	Pass	Fail
40				± 5		
50				± 5		
60				± 5		
70				± 5		
80				± 5		
90				± 5		
100				± 5		
110				± 5		
120				± 5		
130				± 5		
140				± 5		
150				± 5		
160				± 5		
170				± 5		
180				± 6		
190				± 6		
200				± 6		
210				± 6		
220				± 7		
230				± 7		
240				± 7		
250				± 7		
260				± 8		

Ground Test Procedure (Sheet 21 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
85.	Shut Down				
86.	Select EFIS off.				
87.	Shut down electrical power.				
88.	Select cabin lights off.				
89.	Disconnect Ground Power Unit from aircraft.				
90.	Disconnect pitot-static tester from aircraft.				

Note:
Remove any seals or adhesive from pitot-static
ports upon completion of this test procedure.

Ground Test Procedure (Sheet 22 of 24)
Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table IX — Pressure-to-Altitude Conversion Chart

Altitude (ft)	Pressure (PSI)	Altitude (ft)	Pressure (PSI)	Altitude (ft)	Pressure (PSI)	Altitude (ft)	Pressure (PSI)
-1000	15.2348	17500	7.4915	36000	3.2966	54500	1.3549
-500	14.9634	18000	7.3389	36500	3.2183	55000	1.3227
0	14.6959	18500	7.1888	37000	3.1419	55500	1.2913
500	14.4323	19000	7.0412	37500	3.0673	56000	1.2606
1000	14.1726	19500	6.8961	38000	2.9945	56500	1.2307
1500	13.9166	20000	6.7534	38500	2.9234	57000	1.2015
2000	13.6644	20500	6.6131	39000	2.854	57500	1.173
2500	13.4159	21000	6.4752	39500	2.7862	58000	1.1451
3000	13.1711	21500	6.3397	40000	2.72	58500	1.1179
3500	12.9299	22000	6.2064	40500	2.6554	59000	1.0914
4000	12.6923	22500	6.0754	41000	2.5924	59500	1.0655
4500	12.4583	23000	5.9466	41500	2.5308	60000	1.0402
5000	12.2277	23500	5.8201	42000	2.4707	Refer to Table IV GEOPOTENTIAL ALTITUDE, ENGLISH UNITS, contained in the document titled "U.S. Standard Atmosphere, 1976 (Stock No. 003-017-00323-0)	
5500	12.0007	24000	5.6958	42500	2.4121		
6000	11.777	24500	5.5736	43000	2.3548		
6500	11.5567	25000	5.4536	43500	2.2989		
7000	11.3398	25500	5.3356	44000	2.2443		
7500	11.1262	26000	5.2197	44500	2.191		
8000	10.9159	26500	5.1059	45000	2.139		
8500	10.7088	27000	4.9941	45500	2.0882		
9000	10.5049	27500	4.8843	46000	2.0386		
9500	10.3041	28000	4.7764	46500	1.9902		
10000	10.1065	28500	4.6705	47000	1.9429		
10500	9.9119	29000	4.5665	47500	1.8968		
11000	9.7204	29500	4.4644	48000	1.8518		
11500	9.5319	30000	4.3641	48500	1.8078		
12000	9.3464	30500	4.2657	49000	1.7649		
12500	9.1638	31000	4.1691	49500	1.723		
13000	8.9841	31500	4.0742	50000	1.682		
13500	8.8072	32000	3.9811	50500	1.6421		
14000	8.6332	32500	3.8898	51000	1.6031		
14500	8.462	33000	3.8001	51500	1.565		
15000	8.2935	33500	3.7121	52000	1.5279		
15500	8.1278	34000	3.6258	52500	1.4916		
16000	7.9648	34500	3.5411	53000	1.4562		
16500	7.8044	35000	3.458	53500	1.4216		
17000	7.6466	35500	3.3765	54000	1.3878		

Refer to Table IV GEOPOTENTIAL ALTITUDE, ENGLISH UNITS, contained in the document titled "U.S. Standard Atmosphere, 1976 (Stock No. 003-017-00323-0)

Ground Test Procedure (Sheet 23 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

17. Ground Test Witness

I certify that I have performed or witnessed this Ground Test Procedure on the following aircraft:

TEST LOCATION			
TYPE AIRCRAFT	SERIAL No.	REGISTRATION No.	MODE S ADDRESS (if applicable).
WITNESS NAME	SIGNATURE		DATE

Comments:

Meggitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System
Ground Test Procedure (Sheet 24 of 24)

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AIRPLANE MAINTENANCE MANUAL

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PA-46-350P



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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
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PR980101	January 1, 1998	1, 2, 3, 4, 5, and 6
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PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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

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INTRODUCTION

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

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3. Effectivity

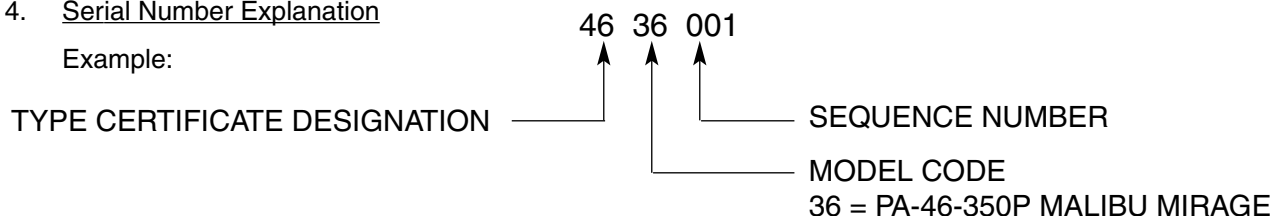
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or) S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

**(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP,
AND ALL HYDRAULIC COMPONENTS:**

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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	00	General	
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51		STRUCTURES	5F1
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CHAPTER 35 - OXYGEN

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CREW

Fixed Oxygen Generator System

The oxygen generator system will deliver constant flow upon demand for approximately 15 minutes (i. e. - long enough for the airplane to be flown to an altitude of 10,000 feet or less).

The pilot's and copilot's oxygen generators are located in a tray under the copilot's seat. A drawer containing two masks opens inboard. The basic system is the same as that installed for the passengers. See 35-20-00 for detailed information on removal, installation, and inspection.

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PASSENGER

1. Description

The chemical oxygen generator system used in this airplane is a single-use system, which will deliver constant flow upon demand for approximately 15 minutes (i.e. - long enough for the airplane to be flown to an altitude of 10,000 feet or less) after ignition.

Passenger oxygen is installed in the cabin under the passenger seat directly behind the copilot's seat, and contains four masks and two oxygen generators.

The generators are activated individually by removing a mask from the storage drawer and pulling the lanyard attached to the mask. This action pulls the firing pin allowing the hammer to strike the percussion cap and ignites the generator. Once activated, the oxygen will continue to flow until the particular generator is expended. An indicator light is located in the annunciator panel and illuminates whenever any one of the generators has been activated.

2. Fixed Oxygen Generator System (See Figures 1 and 2.)

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.)

Take care when handling the oxygen generators. Even though they are not under high pressure, they do generate very high temperatures. Inadvertant ignition due to careless handling is to be avoided. The generators have a percussion cap igniter on one end which must be protected with a plastic cover when the generator(s) are removed from the mounting tray/drawer. Do not remove this plastic protective cover until the generator is installed/reinstalled in the mounting tray/drawer and the system is rearmed.

NOTE: Installed generators are normally removed only when expended, damaged, or at the end of their twelve (12) year service life (as indicated by the date of manufacture on the individual unit dataplate).

A. 100 Hour Inspection

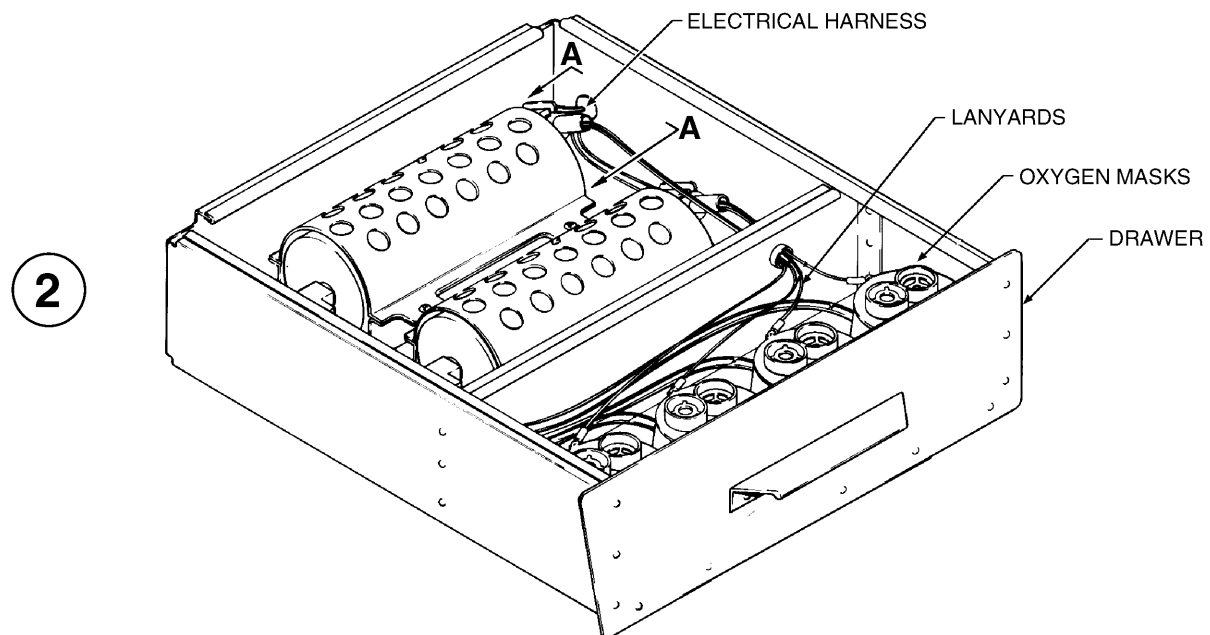
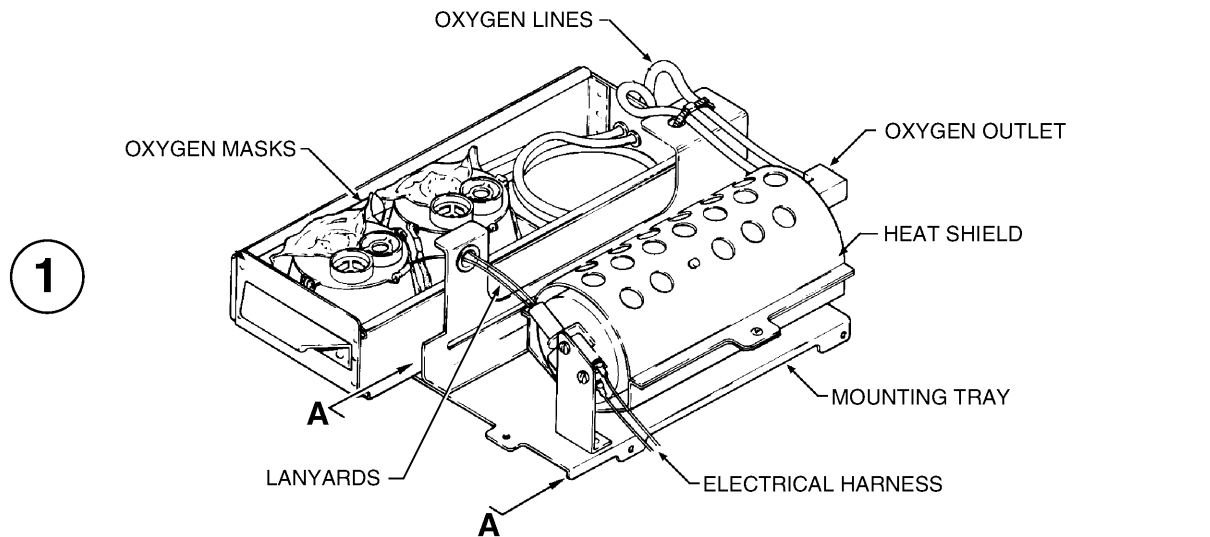
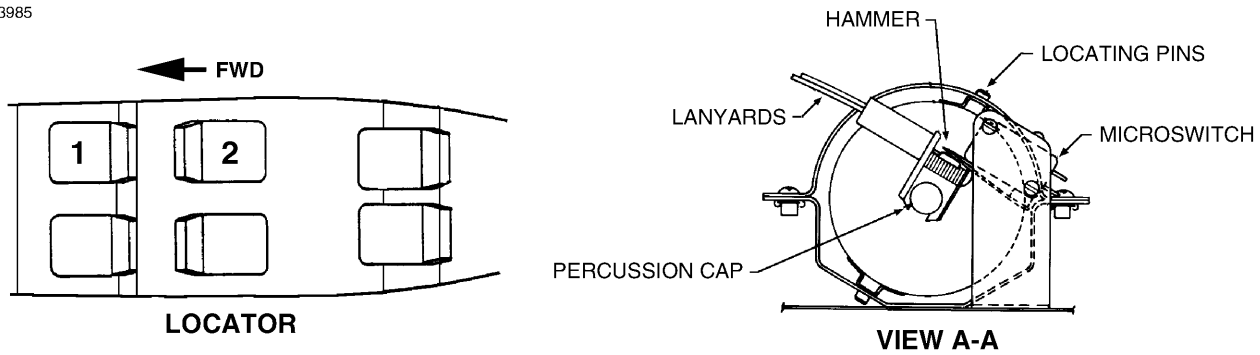
- (1) Turn master switch ON. Inspect the annunciator panel display to ensure "Oxygen" warning light remains OFF. If warning light is ON, check first for an expended generator. If no generator is expended, check that the hammer has properly captured the microswitch at each generator location.
- (2) Inspect each firing pin and hammer. If firing pin has been pulled and hammer is in contact with percussion cap, consider the generator to be expended and replace.
- (3) Inspect each percussion cap:
 - (a) Verify that the plastic protective cover has been removed from each percussion cap. If not, remove plastic protective cover.
 - (b) If the normally smooth surface of the percussion cap exhibits any evidence of indentation, replace the generator.
- (4) Check each generator for security within its mounting points.
- (5) Check each generator for any obvious physical damage (i.e. - punctures, dents, deep scratches, etc.). If damage present, replace generator.

CAUTION: DO NOT PULL ON THE LANYARD. THE GENERATOR MAY IGNITE IF THE LANYARD IS PULLED.

- (6) Check lanyard cords for fraying and security at both ends.

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Oxygen System Installation
Figure 1

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- (7) Check oxygen lines for security of connections to mask and generator outlet fitting. Verify that each mask lanyard and oxygen line are connected to the same generator.
- (8) Check the manufacturer's data plate on each oxygen generator for date of manufacture. If date is twelve (12) years or older, replace generator.

B. Removal

WARNING: WHEN ACTIVATED, THE EXTERIOR SURFACE OF THE GENERATOR WILL REACH VERY HIGH TEMPERATURES (UP TO 500° F) UNTIL DEPLETION. IF REMOVING AN UNEXPENDED GENERATOR, TAKE CARE TO AVOID INADVERTANT ACTIVATION.

- (1) Disconnect the wiring harness and remove the mounting tray/drawer from the aircraft.
- (2) Remove the screws (3) securing the heat shield over the generator.
- (3) Disconnect the oxygen lines from the generator outlet fitting.
- (4) Untie the lanyards from the masks. Retain the sleeves installed over the knots for reuse.
- (5) If generator has not been expended, place a plastic protective cover over the percussion cap and coil and secure the lanyard to ensure the firing pin is not pulled during removal and handling.
- (6) Remove generator from mounting tray/drawer.

C. Installation

NOTE: New generators are delivered from the factory with the lanyards and firing pin installed and the hammer armed. A plastic protective cover protects the percussion cap from being ignited if the firing pin is inadvertently pulled during handling.

If the firing pin has been pulled during handling, verify that the generator has not been expended and then rearm the generator by pulling the hammer back and inserting the firing pin attached to the end of the lanyard in front of the hammer. Ensure the firing pin covers at least 2/3 of the hammer.

- (1) Place a new generator into position in the mounting tray/drawer, ensuring proper indexing of locator pins to the mounting brackets - i. e. - two down, one up.
- (2) Ensure that the hammer is in contact with the micro switch.
- (3) Connect the oxygen lines to the generator outlet fitting.
- (4) Place the heat shield over the generator. Verify insertion of the indexing pin in the heat shield and secure with screws (3).

CAUTION: ENSURE THAT THE LANYARD AND TUBE FROM EACH MASK ARE CONNECTED TO THE SAME GENERATOR.

- (5) Trim lanyard lengths to 30 inches $\pm$ 1. Using a square knot, tie lanyards to the appropriate masks and cover knots with sleeves.



New Generator Fresh from the Box
Figure 2

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- (6) Coil up each mask and related oxygen line and lanyard and install in the storage compartment of the mounting tray/drawer.

CAUTION: FAILURE TO REMOVE THE PLASTIC PROTECTIVE COVER FROM THE PERCUSSION CAP WILL PREVENT THE GENERATOR FROM IGNITING WHEN THE LANYARD IS PULLED.

- (7) Remove the plastic protective cover (see Figure 2) from the percussion cap on the newly installed generator.
- (8) Install mounting tray/drawer in aircraft.
- (9) Connect the wiring harness, turn ON the master switch, and verify the annunciator panel warning light remains out. If not recheck that the hammer has properly captured the microswitch.

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CHAPTER

37

VACUUM

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GENERAL

1. Description

The vacuum system consists of 2 continuously operating engine-driven dry air pumps; 1 rotating clockwise and 1 rotating counterclockwise. Either pump can independently support the system. Also included are two regulators, an air inlet filter, and a manifold that connects the autopilot, pilot's attitude indicator, cabin pressure controller, vacuum solenoid valve, and optional copilot instruments.

In S/N's 4636001 thru 4636020 only, a vacuum gauge incorporating two red flow buttons is mounted on the pilot's instrument panel. When both pumps are operating satisfactorily, neither flow button is visible. The left flow button will protrude should the clockwise rotating pump fail. The right flow button will protrude should the counterclockwise rotating pump fail. The total vacuum pressure, which is displayed on the vacuum gauge, is normally regulated between 4.8 and 5.2 inches of mercury (in. Hg).

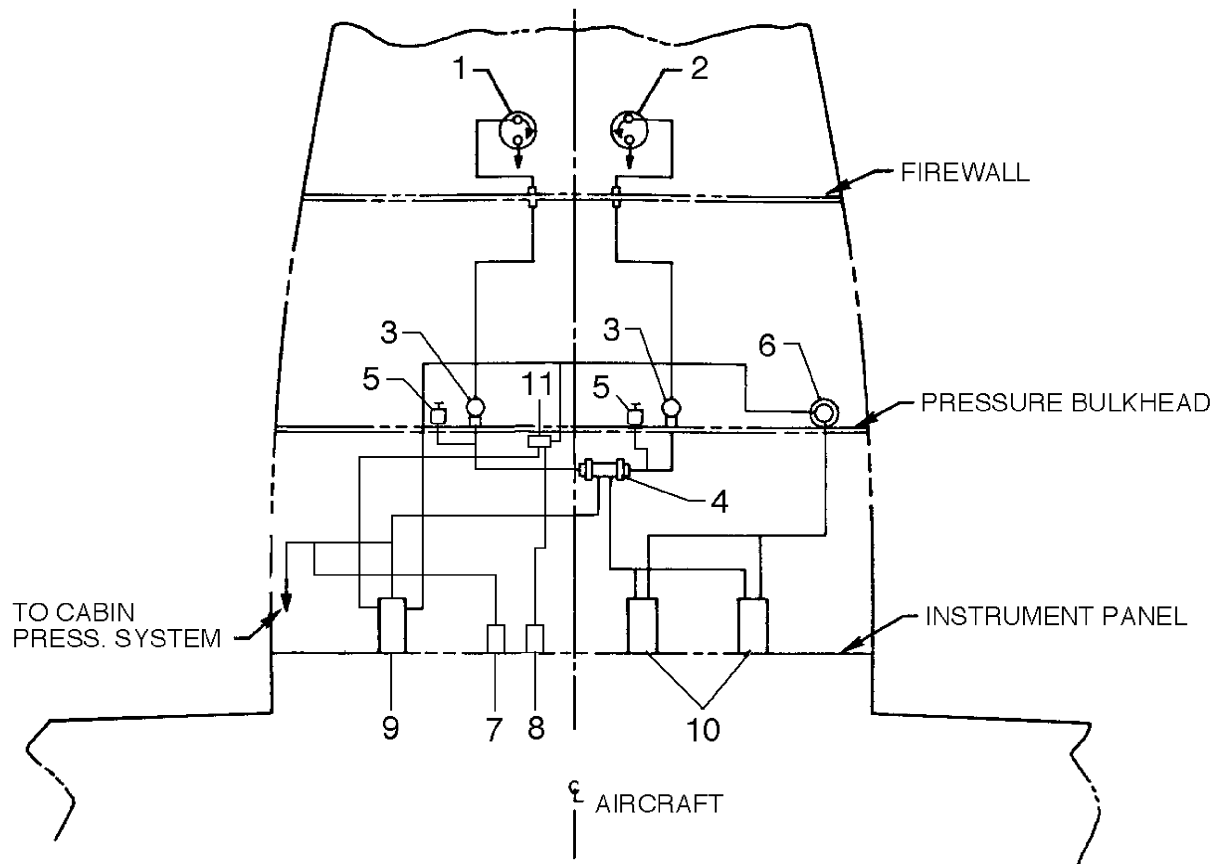
In S/N's 4636021 and up, the vacuum gauge has been incorporated into the Transicoil Electronic Module Instrument System (see 77-40-00). A transducer mounted on the rear of the forward pressure bulkhead provides input to the Vacuum Pressure Indicator (VAC) which is colocated with the Cylinder Head Temperature (CHT) indicator. The VAC indicator provides an analog display in the 3.0 - 6.0 in. HG range. Normal operating pressures are between 4.5 - 5.2 in. hg. or 4.8 - 5.2 in. hg, depending on the gauge installed in the particular aircraft. Vacuum pressure may also be displayed digitally on the Quad Digital Indicator/Enhanced Digital Indicator by pressing the function switch next to the analog display.

If aircraft is equipped with a pneumatic deicing system, refer also to 30-10-00.

2. Troubleshooting

See Chart 1.

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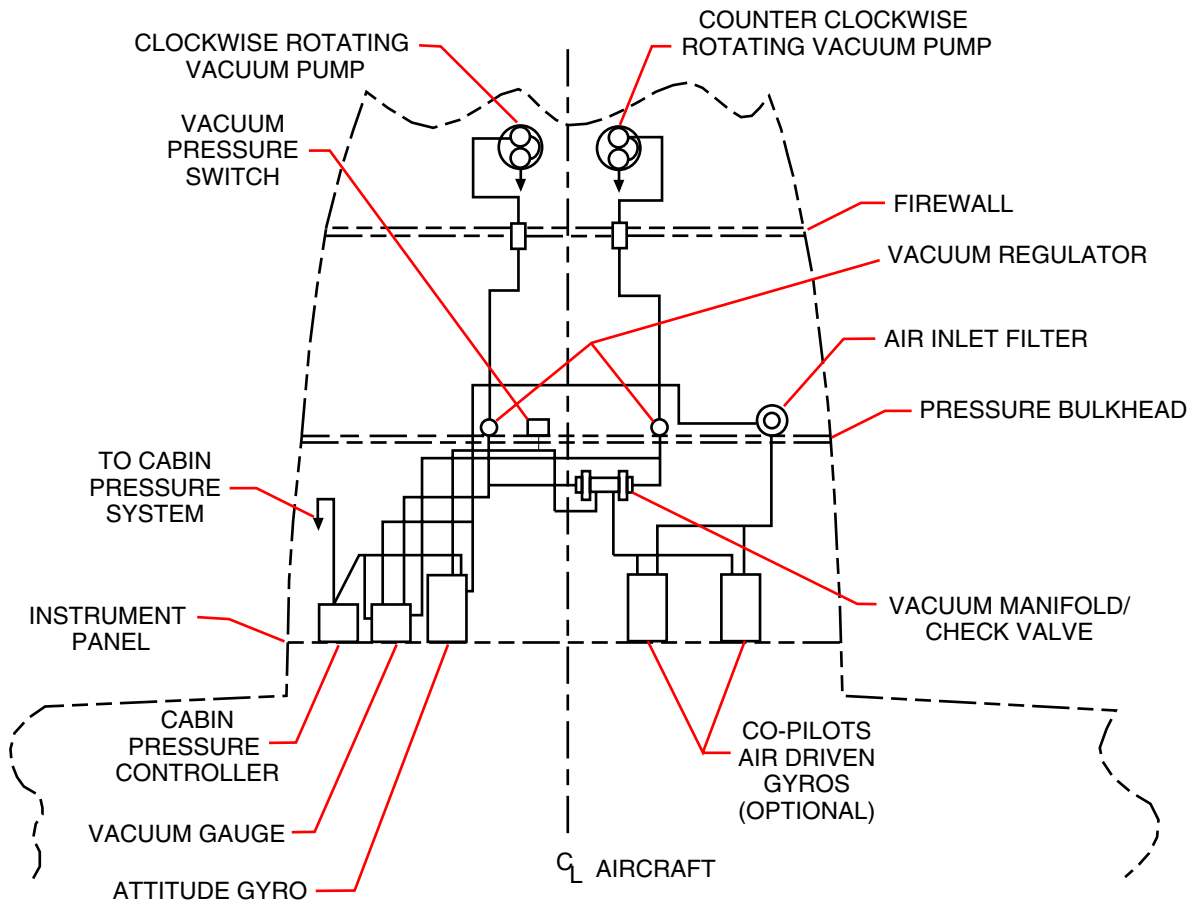


1. CLOCKWISE ROTATING VACUUM PUMP
2. COUNTERCLOCKWISE ROTATING VACUUM PUMP
3. VACUUM REGULATOR
4. VACUUM MANIFOLD/CHECK VALVE
5. VACUUM PRESSURE SWITCH
6. INLINE FILTER
7. CABIN PRESSURE CONTROLLER
8. VACUUM GAUGE (Located in EMIS stack)
9. PILOT'S ATTITUDE GYRO
10. COPILOT'S AIR DRIVEN GYROS (OPTIONAL)
11. VACUUM TRANSDUCER

Effectivity
4636001 thru 4636020

Vacuum System
Figure 1 (Sheet 1 of 3)

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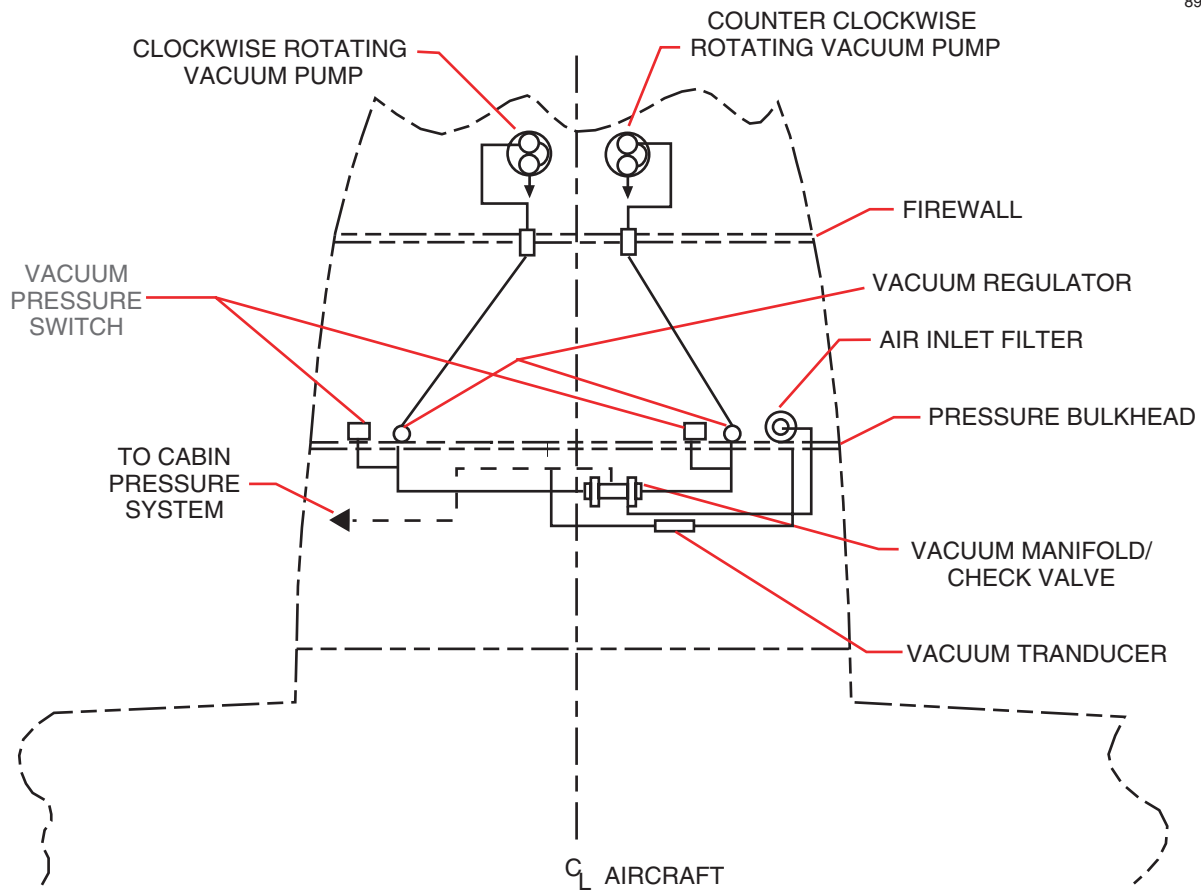


Vacuum System
Figure 1 (Sheet 2 of 3)

[Effectivity](#)
4636021 thru 4636374

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[Effectivity](#)
4636375 and up

Vacuum System
Figure 1 (Sheet 3 of 3)

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CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING VACUUM SYSTEM
(for S/N's 4636021 thru 4636374, see also Chart 1 in 77-40-00)

Trouble	Cause	Remedy
Attitude gyro(s) not receiving sufficient vacuum for proper operation. Low reading on vacuum gauge.	Filter clogged or dirty.	Clean or replace filter.
	Line from gyro to filter restricted.	Check line.
No vacuum gauge indication, but gyro instrument(s) operating satisfactorily.	Faulty gauge.	Replace gauge.
Low vacuum system pressure indicated by low reading on vacuum gauge.	Filter dirty.	Clean or replace filter.
	Vacuum regulator valve incorrectly adjusted.	Adjust regulator valve in accordance with Adjustments in this section.
	Line from gyros to filter restricted.	Repair or replace line.
	Line between pumps and manifold, or between gyros and manifold leaking.	Check all lines and fittings.
In S/N's 4636001 thru 4636020 only:		
Vacuum gauge reading 4.8 to 5.2 in. Hg, but left red button on gauge protruding	Clockwise rotating vacuum pump inoperative.	Replace lower vacuum pump.
or		
Vacuum gauge reading 4.8 to 5.2 in. Hg, but right red button on gauge protruding.	Counterclockwise rotating vacuum pump inoperative.	Replace upper vacuum pump.
Zero vacuum gauge reading.	Both pumps faulty.	Replace pumps.
Both red buttons protruding.	Faulty vacuum pressure switch.	Replace switch.
Normal pressure indication, but sluggish operation of instruments.	Faulty instrument.	Replace instrument.
High system pressure.	Vacuum regulator incorrectly adjusted.	Adjust regulator.
	Vacuum regulator sticking or dirty screen.	Clean and check operation of regulator.

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CHART 1 (Sheet 2 of 2)
TROUBLESHOOTING VACUUM SYSTEM
(for S/N's 4636021 thru 4636374, see also Chart 1 in 77-40-00)

Trouble	Cause	Remedy
Regulator cannot be adjusted to produce correct pressure.	Lines leaking.	Check lines and fittings.
	Vacuum pump(s) malfunctioning.	Replace pump(s).
Vacuum correct on ground, but will not maintain pressure at altitude.	Vacuum pump(s) malfunctioning.	Replace pump(s).
	Regulator sticky.	Clean regulator.
Vacuum correct, but pilot reports pressure erratic or shows complete loss in flight.	Regulator sticky.	Clean regulator.
	Oil in pump due to leaky engine seal or cleaning fluid blown into pump while cleaning engine.	Replace pump.
Pressure can only be maintained at full throttle on ground.	Leak in system.	Repair or replace lines.
	Worn pump.	Replace pump.
	Stuck regulator.	Clean or replace regulator.
Gauge indication follows engine rpm.	Foreign matter on regulator(s) seat.	Raise regulator(s) diaphragm with thin, blunt tool (tongue depressor). Remove the contaminant. Reset regulator. If no foreign matter is present on the regulator seat, test regulator function.

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DISTRIBUTION

The following information is intended to acquaint field service personnel with a means to diagnose vacuum system service symptoms on those components which are serviced by removal and replacement. These items include hoses, clamps, gyro filters, vacuum regulating valves, and vacuum gauges.

1. Hoses and Clamps

- A. These items should be examined periodically and inspected carefully whenever maintenance activities cause hose disconnections to be made at the pumps, manifold, regulators, tube assemblies, gyros and/or vacuum gauge.
- B. Ends of hoses should be examined for rubber separation and slivers of rubber on inside diameter of hoses. These slivers can and do become detached. If this happens, the vacuum pump(s) will suck in the loose particles and eventually ingest them. This can cause pump failure.
- C. Replace old, hard, cracked or brittle hose. Sections of the inner layers may separate, causing pump failure.
- D. Ensure hoses are clear and clean by blowing them out with shop air. Remove from aircraft as required.

CAUTION: DO NOT WIGGLE HOSE FROM SIDE TO SIDE DURING INSTALLATION. WIGGLING COULD CAUSE PARTICLES TO BE CUT FROM INNER WALL OF HOSE WHICH WOULD DAMAGE THE PUMP.

- E. Where hose clearance is tight, making it difficult to reinstall it onto a fitting or barb, spray the fitting or barb with silicone. Let dry, then install hose by pushing it straight on.

CAUTION: WHEN REPLACING ANY OF THE THREADED FITTINGS, DO NOT USE PIPE DOPE, THREADLUBE, OR TAPE. PIPE DOPE / TAPE PARTICLES INGESTED BY THE VACUUM PUMP COULD CAUSE THE PUMP TO FAIL. USE ONLY SILICONE SPRAY, LETTING IT DRY BEFORE ASSEMBLY.

- F. Hose clamps and fittings should be replaced when broken, damaged or corroded.

2. Gyro Filter

- A. Gyro filters must be serviced on a scheduled basis, not to exceed 100 hours, or sooner as condition indicates.
- B. The system installation employs a large central filter and differential vacuum gauge that continuously monitors the filter condition while indicating vacuum readings.

NOTE: A decline in panel gauge reading indicates the filter is becoming clogged. Filters should be replaced when gauge reading declines; DO NOT adjust regulator(s).

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3. Vacuum Pump(s)

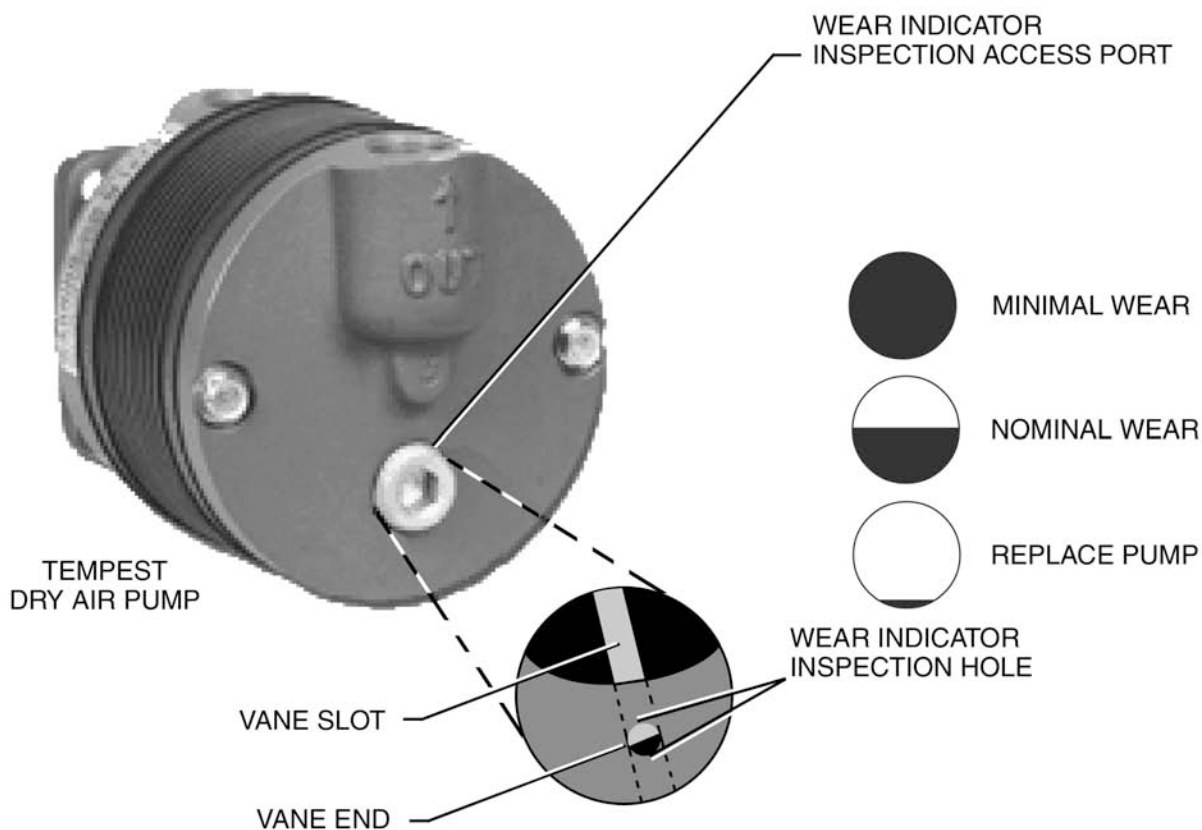
Two (2) engine-driven dry-air pumps are mounted on the accessory section at the rear of the engine. Each vacuum pump is a rotary vane, positive displacement type. These units consist of an aluminum housing, a carbon rotor and carbon vanes. They are driven by means of a coupling mated to an engine-driven gear assembly.

A. Inspection (See Figure 1.)

NOTE: Aero Accessories (Tempest) Dry Air (Vacuum) Pumps are factory installed in S/N's 4636339 & up, and as service replacements. The following inspection applies only to those pumps.

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 1.

- (1) As the vanes wear, they slide outboard in the vane slots in the rotor.
- (2) When the portion of the vane that can be observed in the inspection hole covers approximately $\frac{1}{8}$ TH of the inspection hole, replace the pump.



Vacuum Pump Vane Wear Inspection
Figure 1

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B. Removal

- (1) Remove engine cowling. (Refer to Chapter 71.)
- (2) Loosen hose clamp and remove hose from pump fittings.
- (3) Remove four retaining nuts, lock washers and plain washers used to secure pump to engine; then remove pump.

C. Installation

NOTE: Change the vacuum system filter when installing a new pump.

- (1) If required, install fittings on pump per Replacing Pump Fittings, below.

CAUTION: ONLY PUMP MOUNTING GASKET AUTHORIZED AND APPROVED FOR USE ON AIRBORNE VACUUM PUMP IS AIRBORNE GASKET B3-1-2, PIPER PART NUMBER 751-859. USE OF ANY OTHER GASKET MAY RESULT IN OIL SEEPAGE OR LEAKAGE AT MOUNTING SURFACE.

- (2) Place pump gasket in its proper place and align spline on pump drive with spline on engine drive assembly.
- (3) Secure pump to engine with four plain washers, lock washers and retaining nuts. Torque nuts 50 to 70 inch-pounds.
- (4) Connect hoses to pump and secure with hose clamps.
- (5) Reinstall engine cowling.

D. Replacing Pump Fittings

CAUTION: WHEN REPLACING ANY OF THE THREADED FITTINGS, DO NOT USE PIPE DOPE, THREADLUBE, OR TAPE. PIPE DOPE / TAPE PARTICLES INGESTED BY THE VACUUM PUMP COULD CAUSE THE PUMP TO FAIL. USE ONLY SILICONE SPRAY, LETTING IT DRY BEFORE ASSEMBLY.

- (1) Before installing any fittings on pump, check for any external damage. A pump that has been damaged or dropped should not be installed.

CAUTION: DO NOT APPLY VISE PRESSURE TO OUTSIDE DIAMETER OR OVERALL LENGTH OF PUMP.

- (2) When a vise is used to hold pump while installing fittings, suitable caution must be exercised to avoid pump damage. Square mounting flange must be held between soft wood blocks and only at right angles to vise jaws. Use only enough vise pressure to hold pump firmly.
- (3) The ports of AIRBORNE pumps have been treated with a dry film lubricant and AIRBORNE fittings are cadmium plated thus eliminating any need for thread lubricants. If thread lubricant is required, use only a silicone spray. Apply sparingly to external threads of fittings only and let dry before assembly.

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4. Vacuum Regulator(s)

Two (2) vacuum regulators are incorporated in the system to control vacuum pressure to gyro instruments. The regulators are located above the overhead trim panel in the forward baggage compartment.

A. Removal

- (1) Remove inlet hose from aft side of valve.
- (2) Remove outlet hose from forward side of valve.
- (3) Remove nut that secures valve to firewall.
- (4) Pull valve rearward out of firewall.

B. Installation

- (1) Insert valve into hole in rear of firewall.
- (2) Secure valve to firewall with nut.
- (3) Attach inlet hose to forward fitting of valve.
- (4) Attach outlet hose to aft fitting of valve.

C. Service Tips

- (1) The vacuum regulating valve seldom needs replacement. Symptoms that suggest replacement are:
 - (a) Chatter as indicated by rapid fluctuation of the vacuum gauge needle or an audible sound.
 - (b) Non-repeatability of the vacuum gauge reading when the panel gauge is not suspect or has been checked against a known test gauge (cruise rpm only).
- (2) All modes of regulator malfunction tend to increase the vacuum power applied to the gyros. Thus, although excess vacuum is applied, a loss of vacuum does not occur.
- (3) The gyros themselves act as a limiting device to keep the vacuum power applied from exceeding safe levels.

NOTE: If the panel gauge has been checked and found "OK" and the vacuum gauge reading does not repeat within the normal operating range as marked on the gauge, then the regulating valve should be changed. Observe the usual precautions for maintaining system cleanliness to avoid premature pump service.

D. Adjustment

NOTE: Do not reset the regulator until the filter and lines have been checked

- (1) Disconnect inlet line going to one of the vacuum regulator valves.
- (2) Wrap or cap the end of line with a clean, porous cloth to prevent foreign matter and debris from entering the system.

NOTE: Do not attempt to adjust these valves with the engine in operation without a qualified pilot or other responsible person at the controls of the airplane.

- (3) Start the engine, allow it to warm up and run the engine at magneto check rpm.
- (4) While running the engine at magneto check rpm, the suction gauge (or vacuum pressure indicator) should indicate within the normal operating range as marked on the gauge. If the reading is not in this range, shut down the engine and adjust the valve. (Turn the valve adjustment screw clockwise to increase pressure and counterclockwise to decrease pressure.)
- (5) Start the engine and repeat the check.
- (6) After the system has been properly adjusted, bend the locking tabs on the valve down over the adjustment screw.

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- (7) Uncap the line that goes to the vacuum regulator valve and connect it to the valve.
- (8) Disconnect line going to the other vacuum regulator valve.
- (9) Wrap or cap the end of line with a clean, porous cloth to prevent foreign matter and debris from entering the system.
- (10) Repeat Steps (3) through (7).

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INDICATING

Vacuum (Suction) Gauge (S/N's 4636001 thru 4636020 only.)

NOTE: S/N's 4636021 and up incorporate Integrated Engine Instrumentation Systems. Refer to Section 77-40-00 for more information.

The vacuum (suction) gauge is mounted on the left-hand side of the instrument panel. This gauge is calibrated in inches of mercury, and indicates the amount of vacuum created by the engine-driven vacuum pumps. The total vacuum pressure, which is displayed on the vacuum gauge, is normally regulated between 4.8 and 5.2 inches of mercury (in. Hg).

The vacuum gauge also incorporates two red flow buttons. When both pumps are operating satisfactorily, neither flow button is visible. The left flow button will protrude should the clockwise (lower) rotating pump fail. The right flow button will protrude should the counterclockwise (upper) rotating pump fail.

If the system filter becomes clogged or, as the lines become obstructed, the gauge will show a decrease in pressure. Do not reset the regulator until the filter and lines have been checked. Should the vacuum pressure from any one pump fall below the minimum pressure required, its red button will protrude from the instrument face.

Service Tips

- (1) The suction gauge seldom requires service and usually is replaced when malfunctions occur.

NOTE: Suction gauge failure in a properly operating vacuum system does not impair safety of flight.

NOTE: Two different models of vacuum gauge may be installed in PA-46-350P airplanes. One is marked with a normal operating range of 4.8 to 5.2 in. hg. and the other is marked with a normal operating range of 4.5 to 5.2 in. hg. The vacuum system in a particular airplane should be adjusted to operate in the pressure range indicated on the gauge installed in that aircraft.

- (2) If the suction 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 supplied to the gauge, its pointer should rest against the internal stop in the 9 o'clock position. Any displacement from this position suggests need for replacement.
 - (b) A slight overshoot during engine start-up, not to exceed half an inch of Hg. (1/2 in. of mercury, is normal and is not cause, to replace gauge)
 - (c) The gauge should read in the normal operating range as marked on the vacuum gauge with engine operating at normal cruise rpm.
 - (d) At 1,200 rpm, the vacuum gauge reading should be more than four inches of mercury.

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CHAPTER

39

ELECTRICAL / ELECTRONIC PANELS

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CHAPTER 39

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CHAPTER 39 - ELECTRICAL / ELECTRONIC PANELS

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INSTRUMENT AND CONTROL PANELS

1. General

A. Face-Mounted Instruments

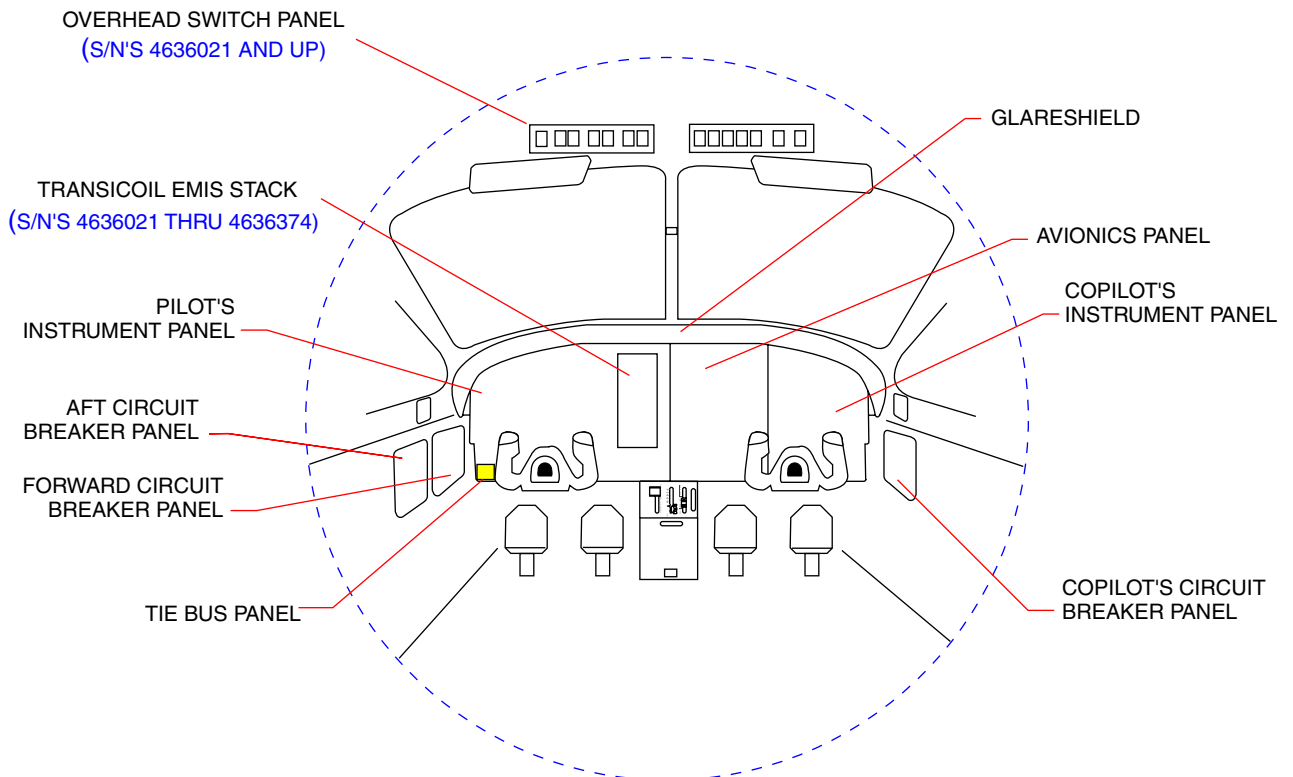
Most instruments are face-mounted and secured to the instrument panel by screws from the front of the panel. Most instruments are removed out the back of the panel, but a few are removed through the front of the panel. Take special care when any operation pertaining to the instruments is performed.

(1) Removal

- (a) Disconnect the plumbing and / or electrical connectors from the back of the instrument. Where two or more lines connect to an instrument, identify and tag each line to facilitate installation. Attach a dust cap to each fitting.

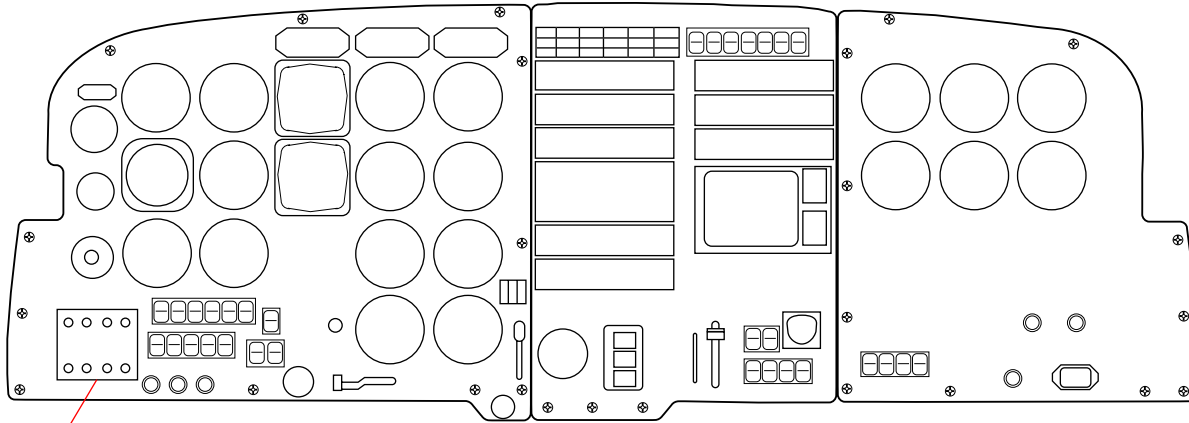
NOTE: For those instruments which remove through the front of the panel, disconnecting and tagging plumbing and / or electrical connectors can be done after the instrument retaining screws are removed and the instrument is slid gently forward to expose the connections at the rear.

- (b) Remove the screws that secure the instrument in the panel cutout.
- (c) Remove the instrument from the panel.



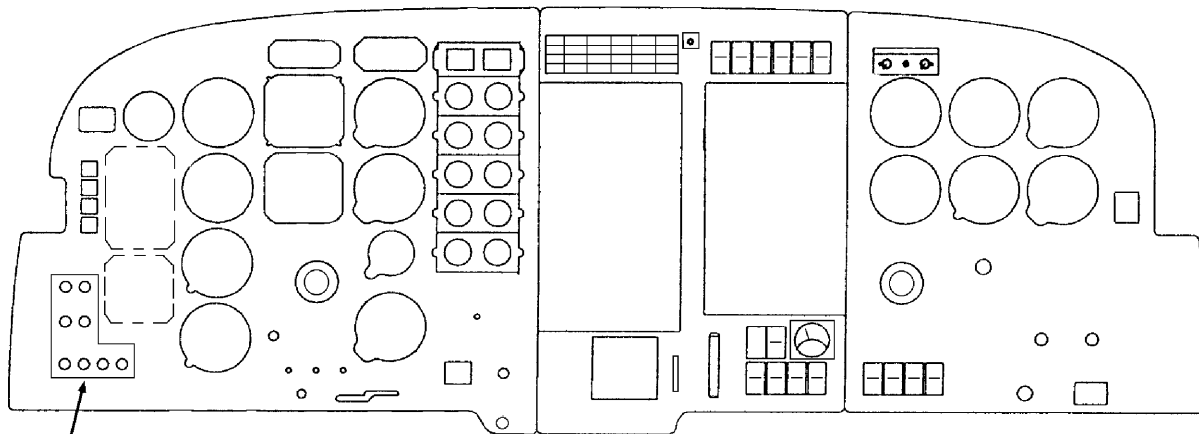
Flight Deck View
Figure 1

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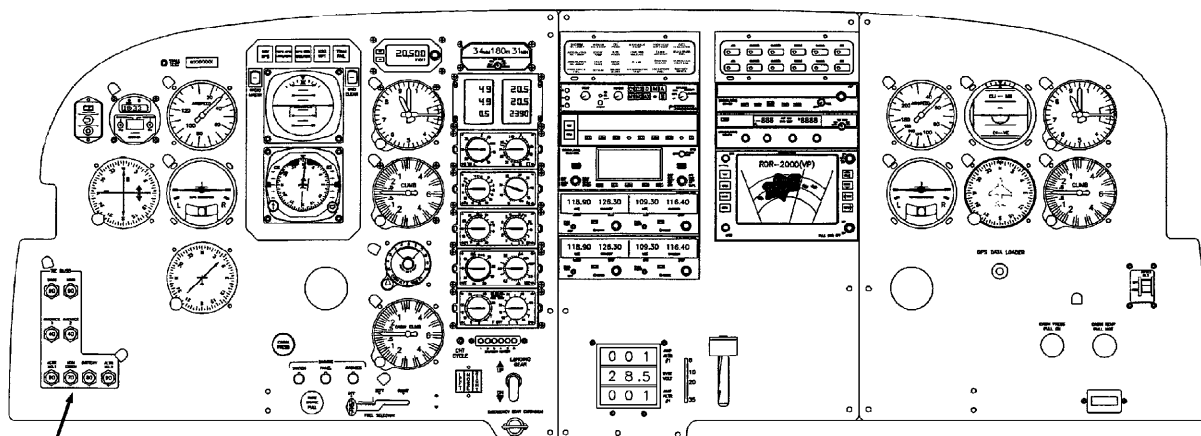
TIE BUS
CIRCUIT BREAKER PANEL

(S/N's 4636001 THRU 4636020 ONLY)



TIE BUS
CIRCUIT BREAKER PANEL

(S/N'S 4636021 THRU 4636131 ONLY)



TIE BUS
CIRCUIT BREAKER PANEL

(S/N'S 4636132 THRU 4636374 - STANDARD)

Instrument Panel Installations (Typical)
Figure 2

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(2) Installation

- (a) Place the instrument in its proper panel cutout and secure with screws.

NOTE: For those instruments which install through the front of the panel, connecting plumbing and / or electrical connectors can be done from the front of the panel before the instrument retaining screws are installed. After the connections are secure, slide the instrument into place and install the retaining screws.

- (b) Connect the plumbing and/or electrical connectors to back of instrument.
(c) Check instrument operation.

B. Rack-Mounted Avionics

Most avionics are rack-mounted front-removable units generally secured to the instrument panel tray/rack by a single jackscrew located in the center of their faceplate.

(1) Removal

- (a) Insert an appropriate size (generally 3/32 inch) allen wrench into the jackscrew access hole in the faceplate.
(b) Unscrew the jackscrew in a counterclockwise direction.
(c) Slide the avionics unit aft and out of the instrument panel tray/rack.

(2) Installation

NOTE: Inspect the front of the panel-mounted avionics tray/rack to verify it is not significantly inset from the panel. If so, correct the tray/rack installation before proceeding.

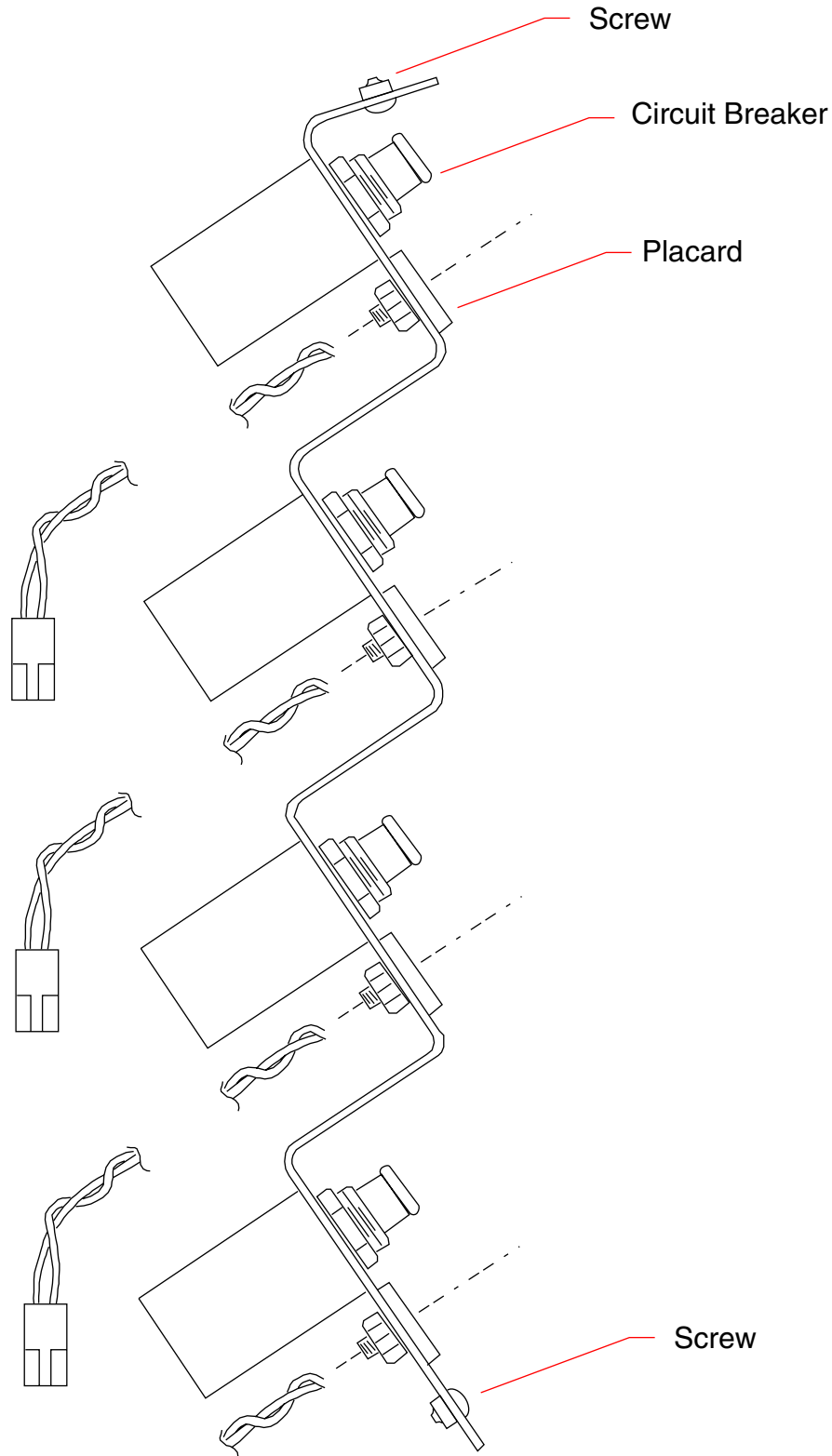
NOTE: The high insertion forces required to seat a unit with "high density" connectors tend to limit the effectiveness of the first seating attempt. Accordingly, the following procedure requires sequential applications of force, and subsequent tightening of the jackscrew, to ensure all connectors seat properly.

- (a) Slide the avionics unit into the instrument panel rack and forward applying a moderate insertion force.
(b) Insert an appropriate size (generally 3/32 inch) allen wrench into the jackscrew access hole in the faceplate and tighten to remove any slack, but do not try to "pull" unit into place with the jackscrew.
(c) Apply additional insertion force to front of unit.
(d) Tighten jackscrew again.
(e) Apply additional insertion force to front of unit.
(f) Finish tightening jackscrew.
(g) Ensure that bezel is "tight" against panel.

2. Circuit Breaker Panels (See Figure 3.)

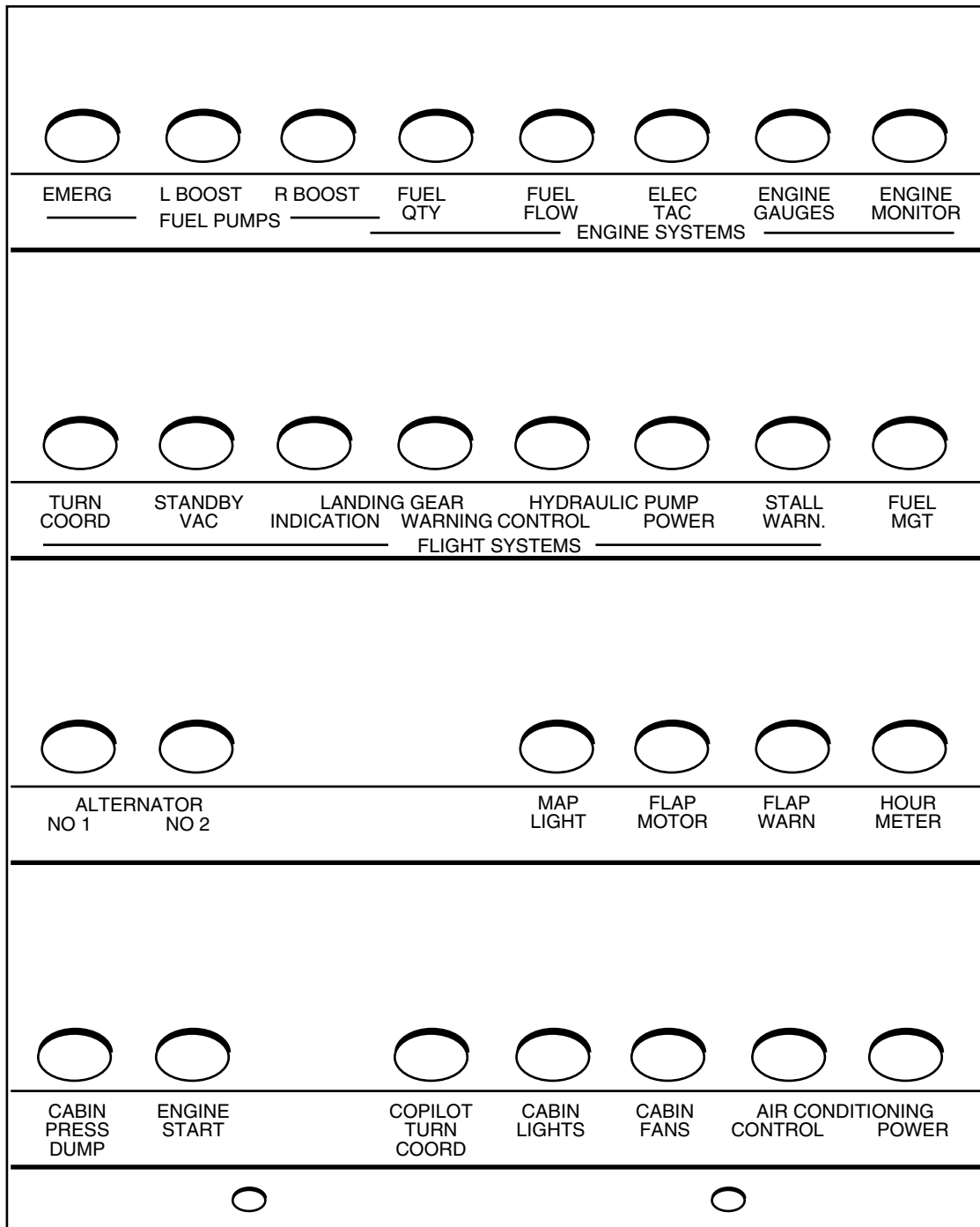
Circuit breakers are installed on both the pilot's and copilot's side. Should a circuit breaker be replaced or added, exercise extreme caution ensuring the breakers are in proper mechanical alignment, any insulators that are called out are installed correctly, and all electrical wiring and connections meet aviation standards. Do not deviate from the parts manual requirements when replacing circuit breakers.

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Profile View
Circuit Breaker Panel
Figure 3 (Sheet 1 of 2)

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Front View
(Typical Pilot's Fwd Panel Shown)

Circuit Breaker Panel
Figure 3 (Sheet 2 of 2)

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3. Switch Panels

NOTE: This airplane uses lighted switches which snap in from the front of the instrument panel and overhead switch panels.

In S/N's 4636001 thru 4636020, switches are of the rocker type and are mounted in the instrument panel.

In S/N's 4636021 thru 4636131, switches are of the rocker type and are mounted in the instrument panel and in overhead switch panels.

In S/N's 4636132 and up, most switches are of the rocker type and are mounted in the instrument panel and in overhead switch panels. The Environmental / Deice switch panel (see Figure 4), however, is a sealed unit.

A. Rocker-type Electrical Switches

(1) Removal

- (a) Gain access to the switch from behind the instrument panel or overhead switch panel. If switch is in an overhead switch panel, gain access by removing four screws which attach the panel to the cockpit overhead panel.
- (b) Squeeze retainer blades on top and bottom of the switch together and push switch from the panel.
- (c) Make note of the placement of wires on the switch to facilitate installation.
- (d) Disconnect wires from the switch. Remove switch.

(2) Installation

- (a) Connect wires to switch.
- (b) Push switch into the panel. Squeeze retainer blades on top and bottom of the switch together, if required.
- (c) If switch is in an overhead switch panel, reinstall overhead switch panel with four screws.

B. Environmental / Deice Switch Panel (S/N's 4636132 and up)

The Environmental / Deice Switch Panel in these airplanes is a front-mounted sealed unit which can not be repaired in the field.

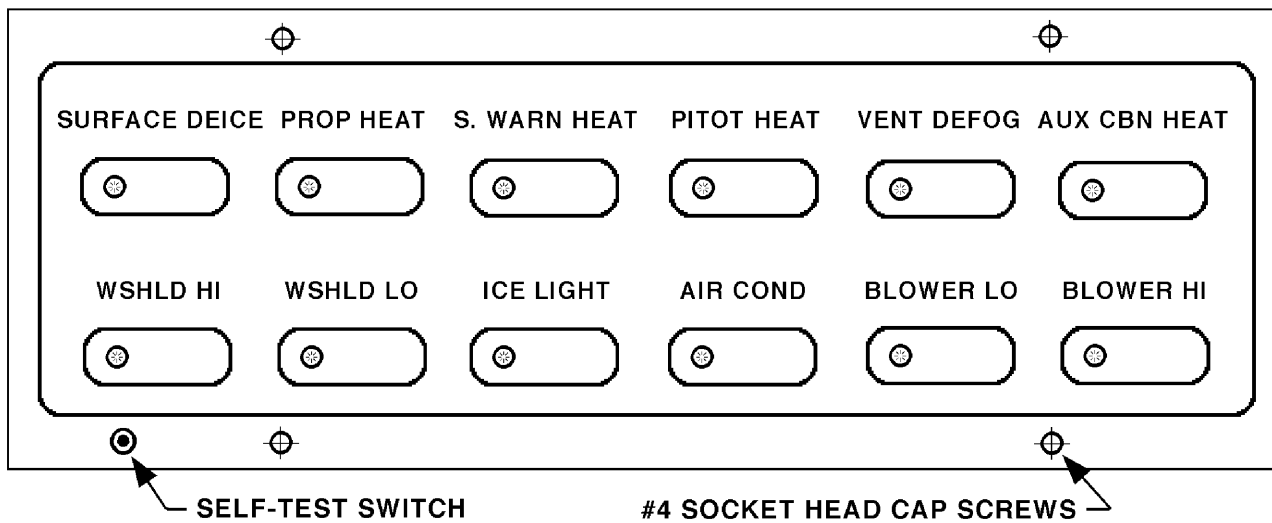
(1) Removal

- (a) Unscrewing the four (4) #4 socket head cap screws and remove.
- (b) Pull the unit out of the instrument panel enough to access the connectors attaching the unit to the wiring harness.
- (c) Note arrangement of the connectors for re-installation. Disconnect the wiring harness and remove the unit.

(2) Installation

- (a) Connect the wiring harness and position the unit in the instrument panel.
- (b) Secure with the four (4) #4 socket head cap screws.

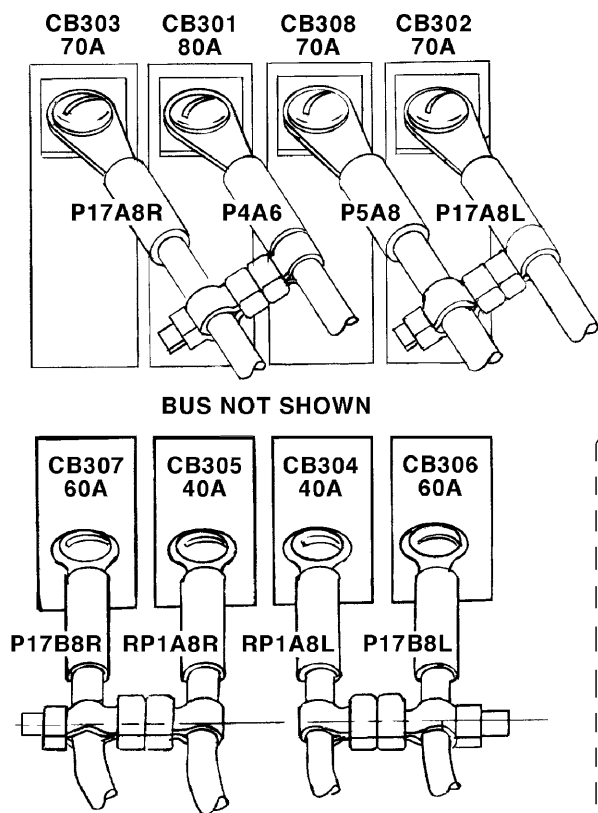
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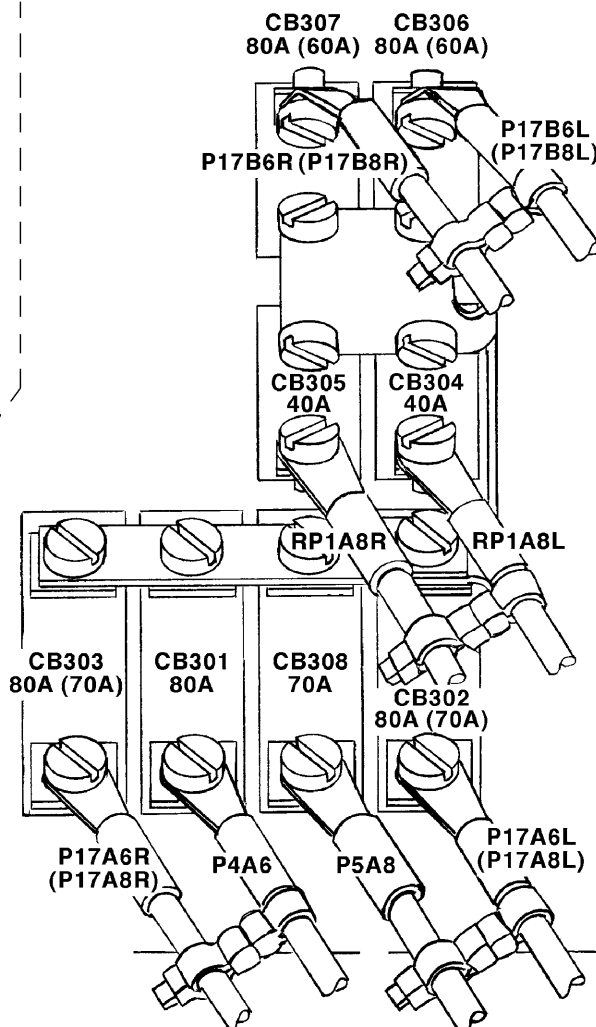
[Effectivity](#)
4636132 thru 4636374

Environmental / Deice Switch Panel
Figure 4

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S/N'S 4636001 THRU 4636020 ONLY



S/N'S 4636021 AND UP
(Callouts in parentheses are effective for
S/N's 4636021 thru 4636131 only.)

NOTE: In all airplanes, the fuselage harness fuses F306 and F307 are connected to any of the eight (8) screws on the Tie Bus.

Tie Bus Panel Connections
Figure 5

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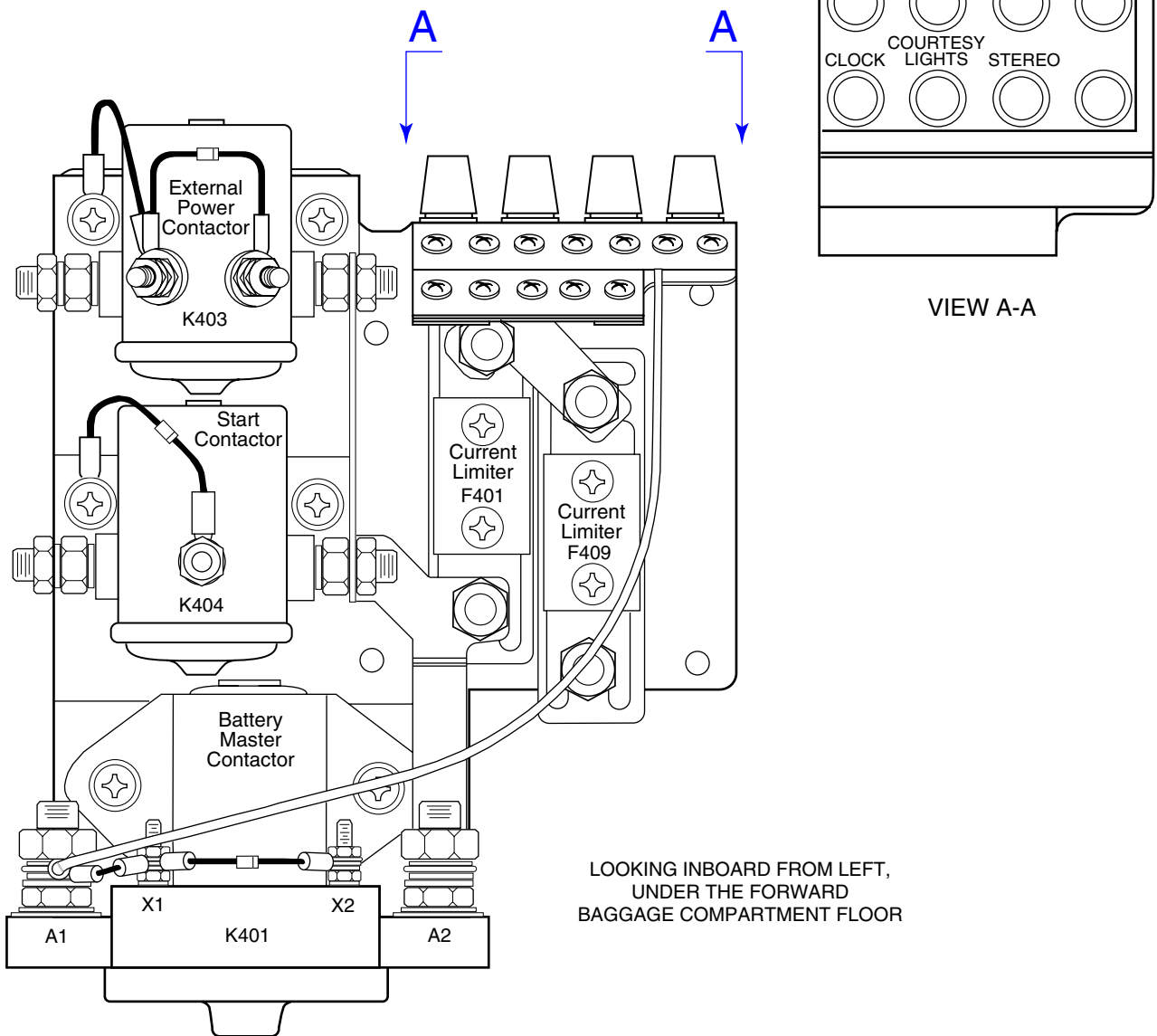
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ACCESSORY COMPARTMENTS

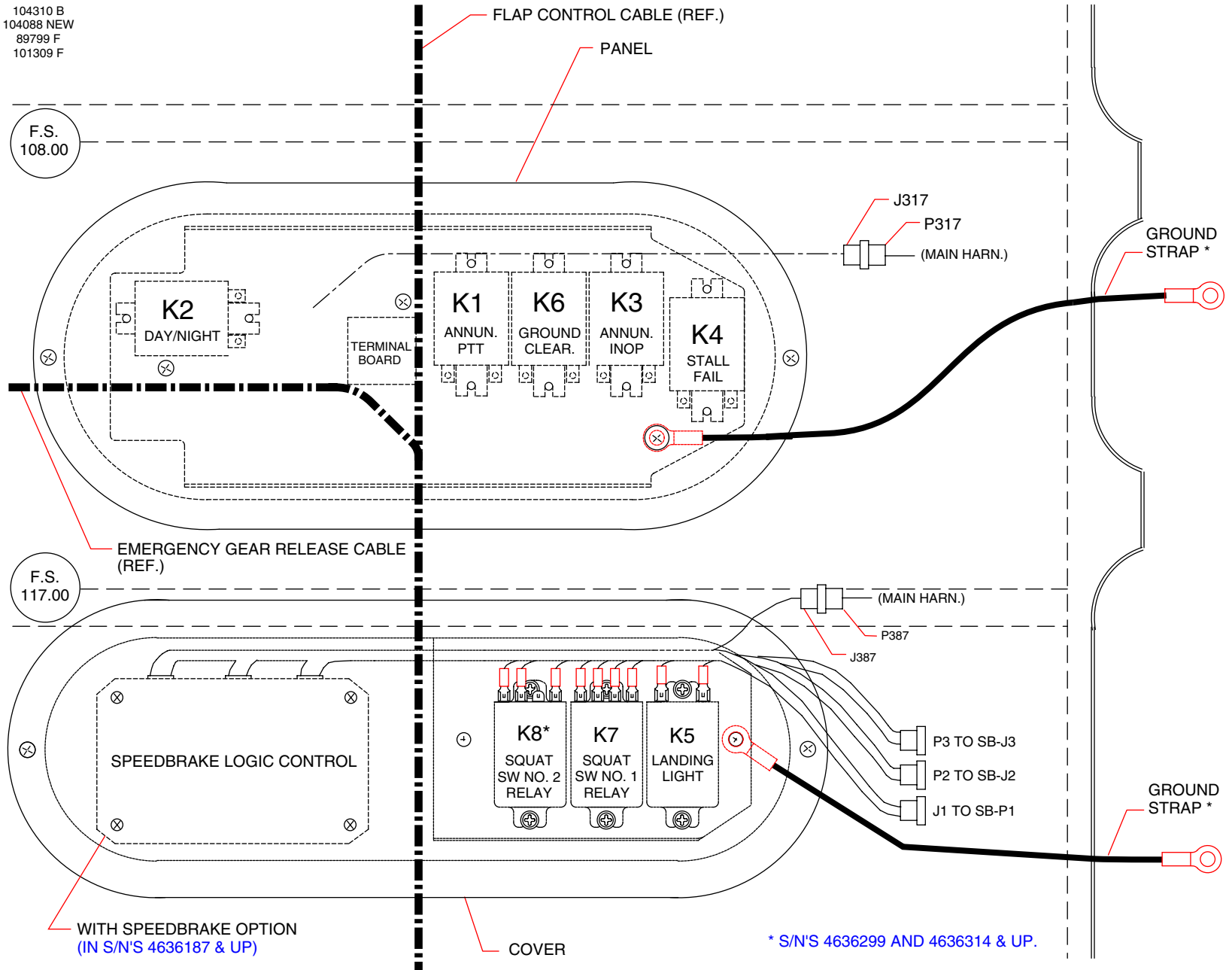
Electrical Shelf and Panels

The electrical panel is installed vertically under the floor of the forward baggage compartment, located outside the forward pressure bulkhead. This panel should be unplugged from the aircraft harness for service due to the tight quarters involved, and to prevent unnecessary tugging on the electrical cable pressure seal where it passes through the pressure bulkhead.

89802 AA
104410 E

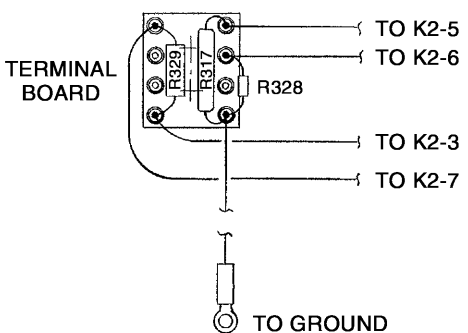
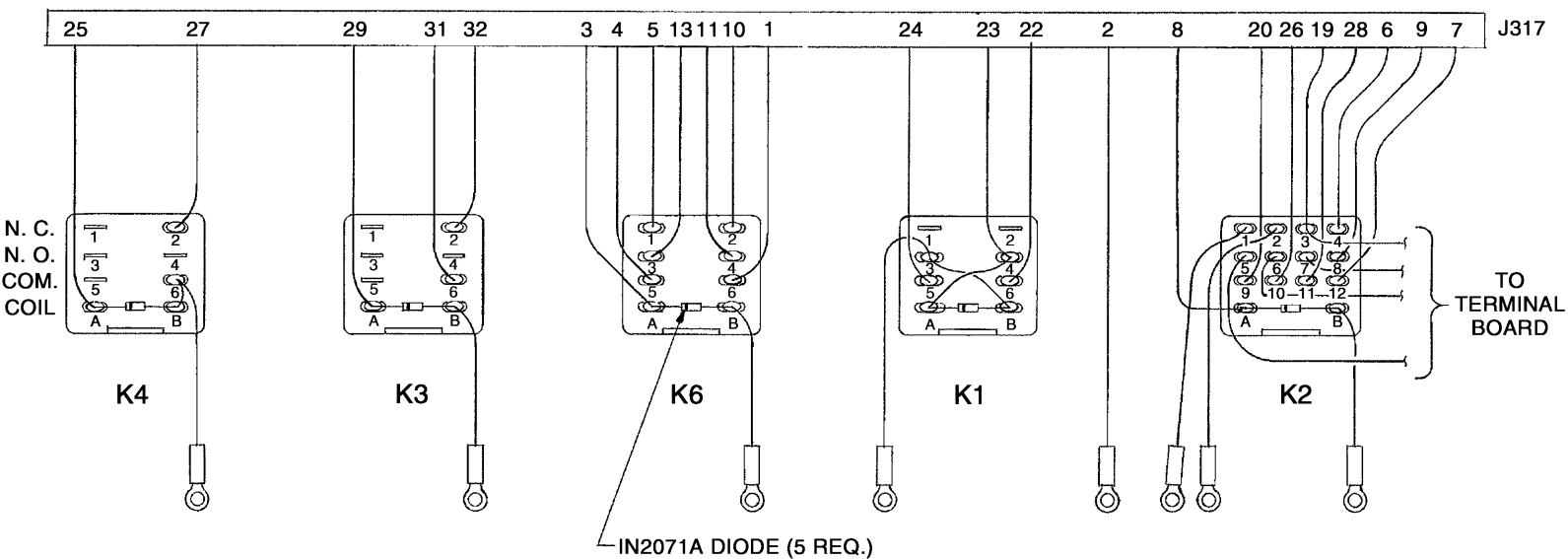


Electrical Shelf (Typical)
Figure 1



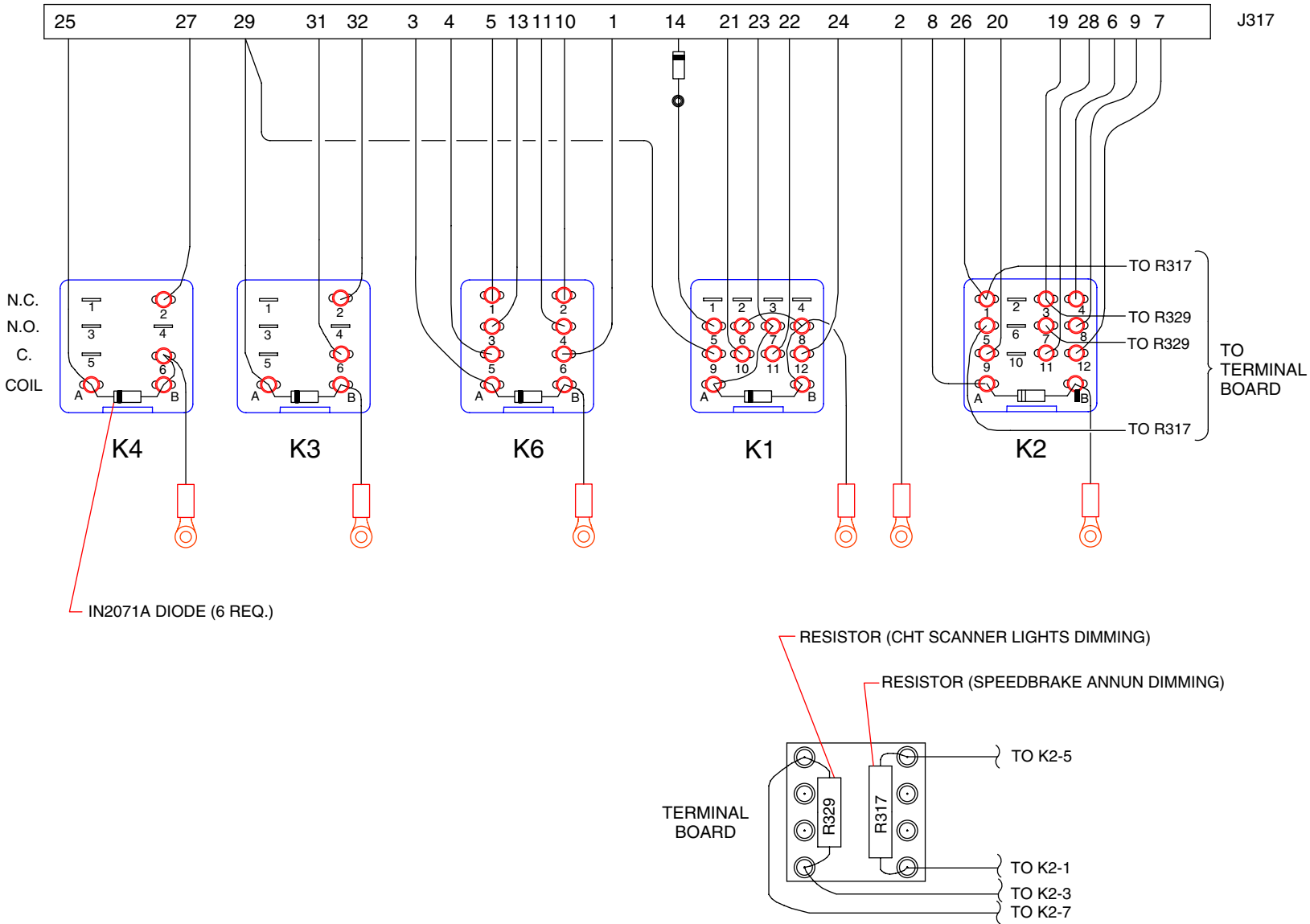
K1 thru K8 Relay Installation - Co-Pilot's Side
Figure 2 (Sheet 1 of 8)

89896 E



K1 thru K8 Relay Installation - Co-Pilot's Side
Figure 2 (Sheet 2 of 8)

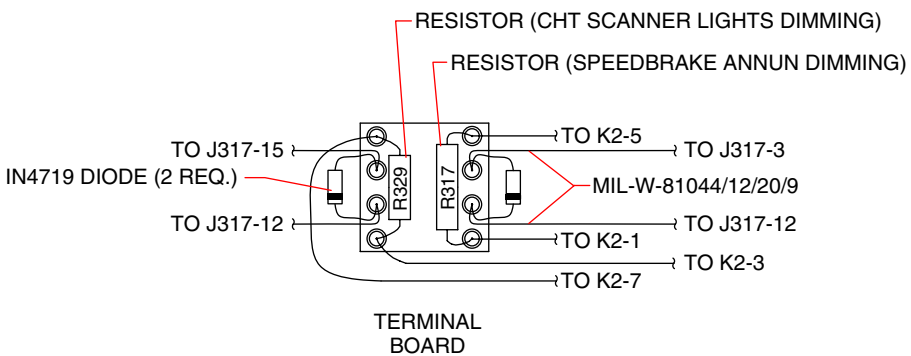
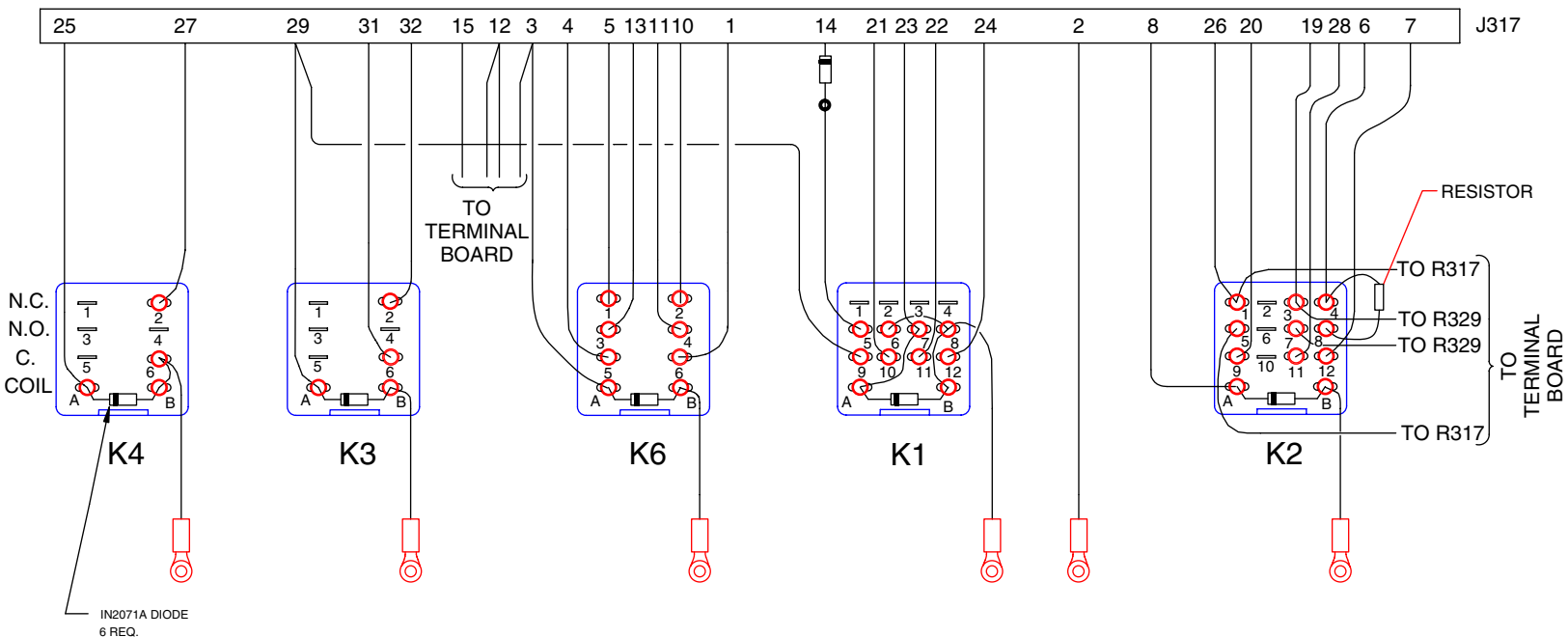
Effectivity
4636001 thru 4636186



Effectivity
4636187 thru 4636247

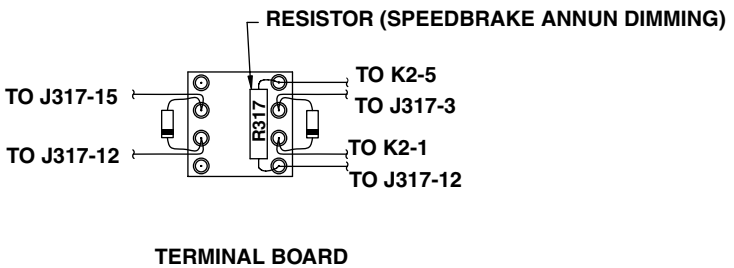
K1 thru K8 Relay Installation - Co-Pilot's Side
Figure 2 (Sheet 3 of 8)

101305 E



K1 thru K8 Relay Installation - Co-Pilot's Side
Figure 2 (Sheet 4 of 8)

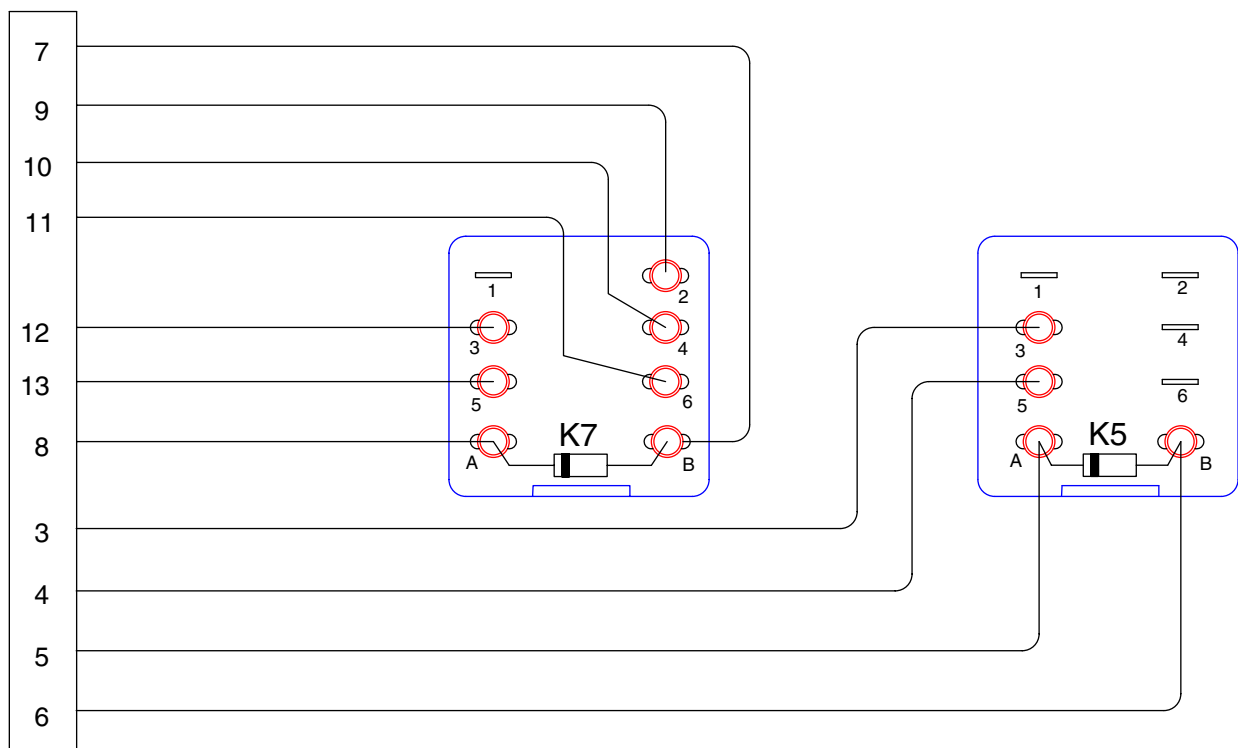
Effectivity
4636248 thru 4636374



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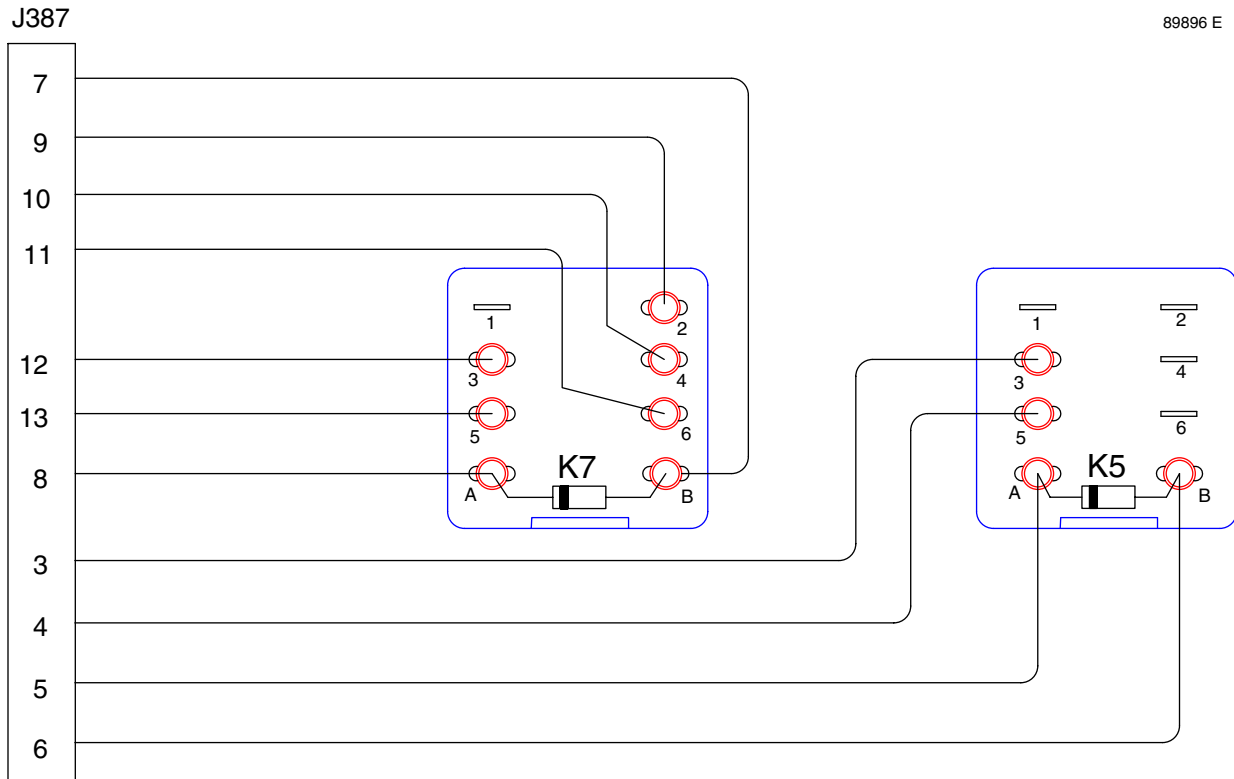
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K1 thru K8 Relay Installation - Co-Pilot's Side
Figure 2 (Sheet 6 of 8)

[Effectivity](#)
4636001 thru 4636131

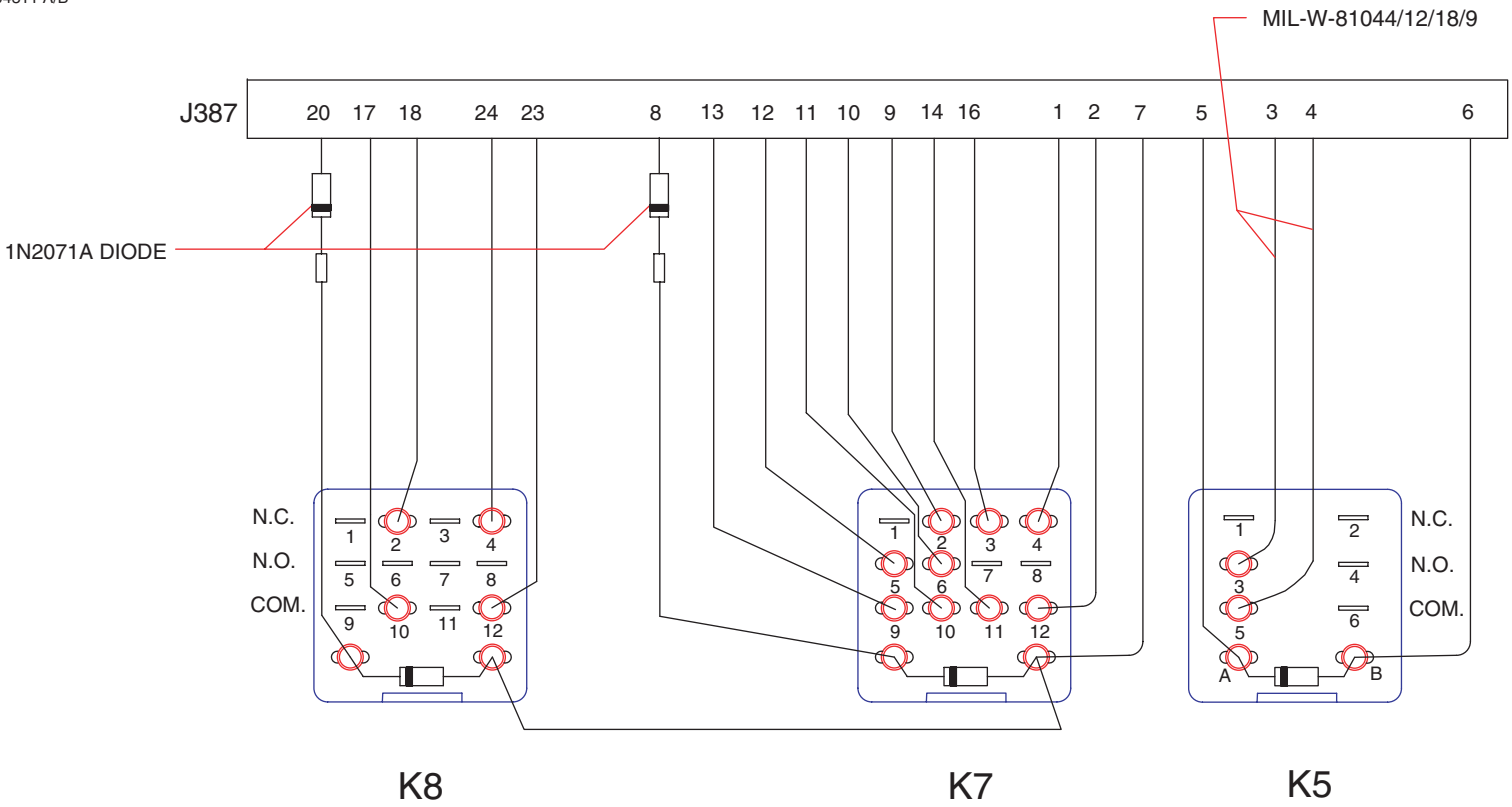
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[Effectivity](#)
4636132 thru 4636313

K1 thru K8 Relay Installation - Co-Pilot's Side
Figure 2 (Sheet 7 of 8)

NOTES

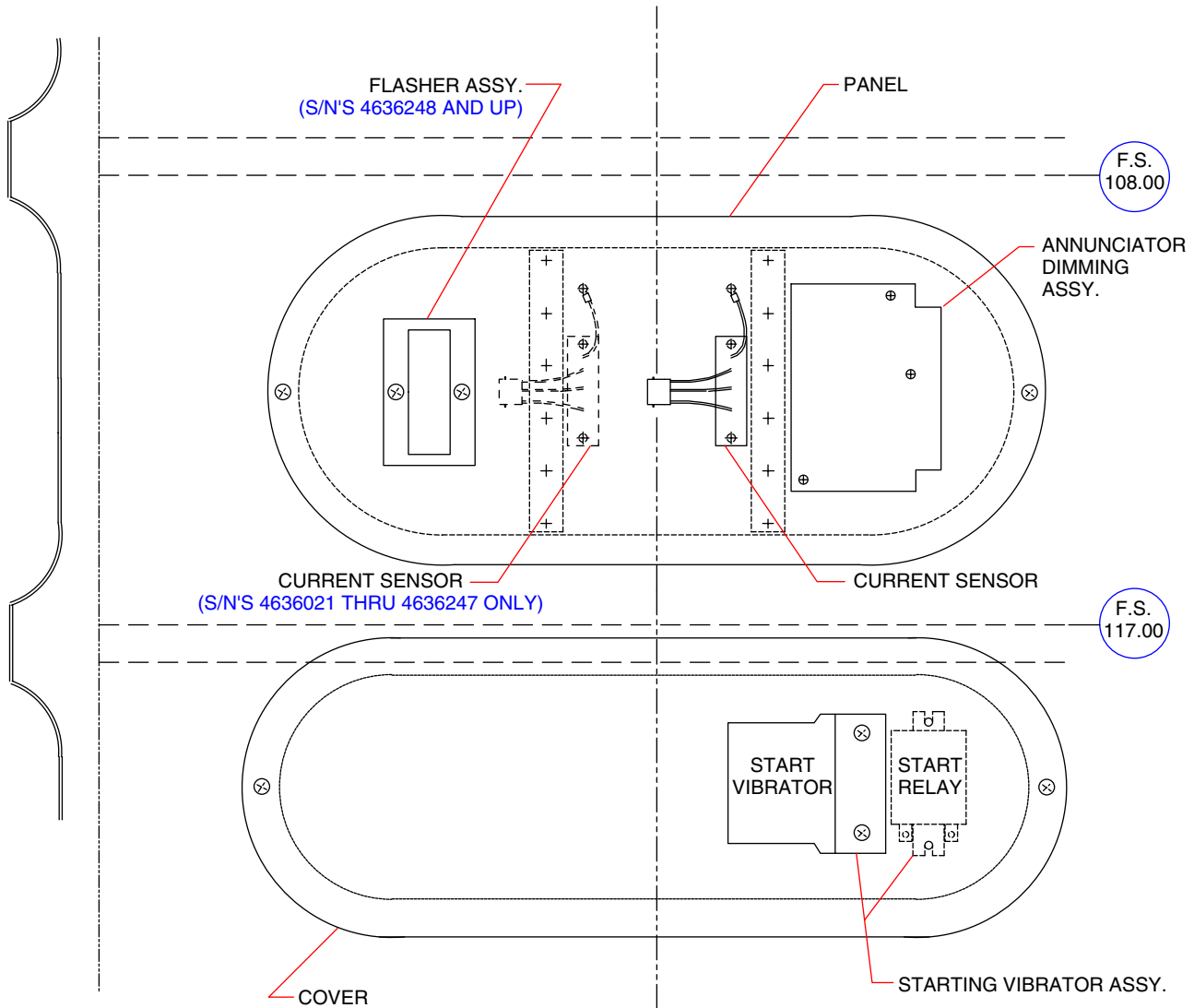


K1 thru K8 Relay Installation - Co-Pilot's Side
Figure 2 (Sheet 8 of 8)

Effectivity
4636299, 4636314 and up

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104310 B
104088 NEW
89799 F



Effectivity
4636021 and up

Relay Installation - Pilot's Side
Figure 3

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**GRIDS 5E16 THRU 5E24
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CHAPTER

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STRUCTURES

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CHAPTER 51 - STRUCTURES

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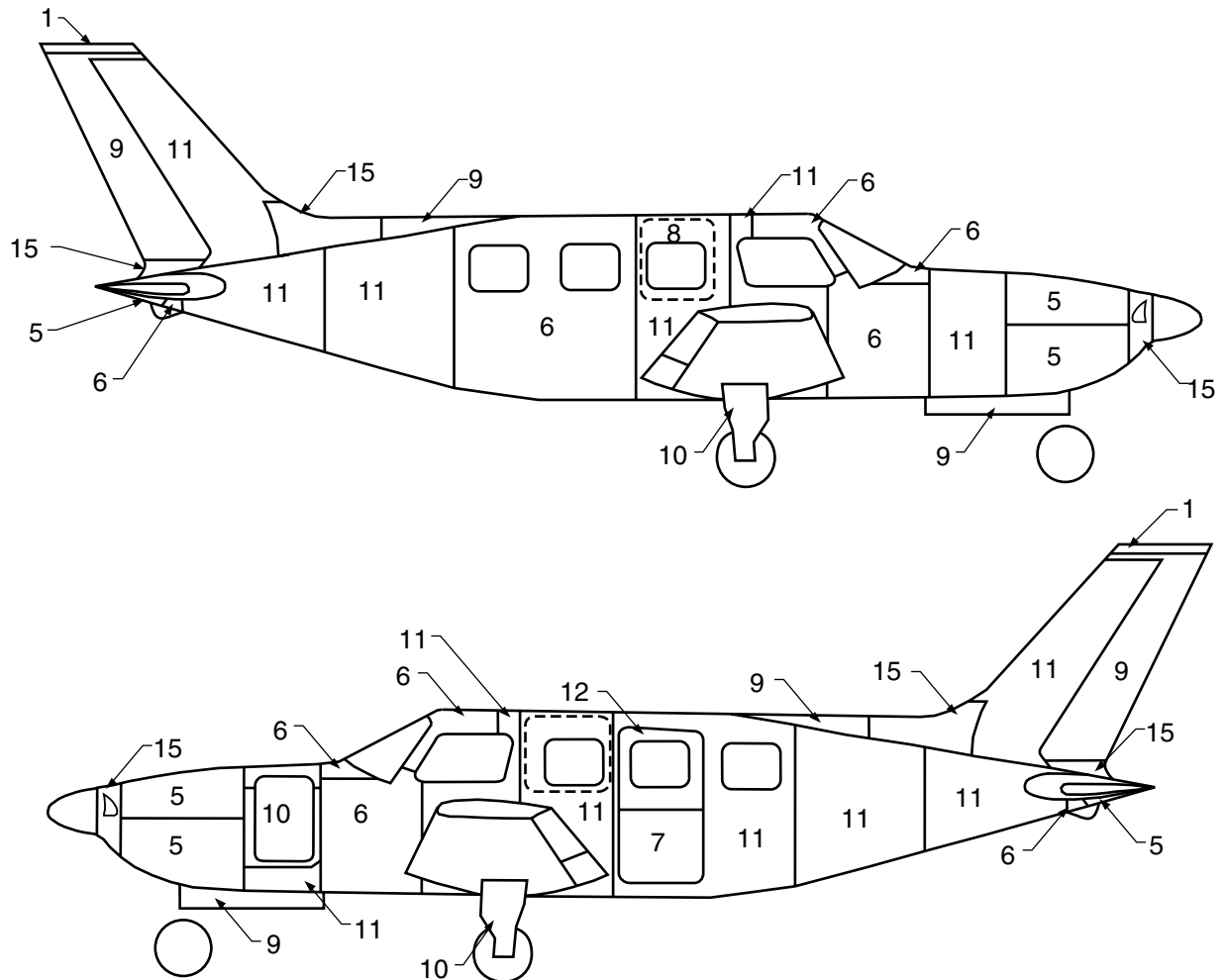
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GENERAL

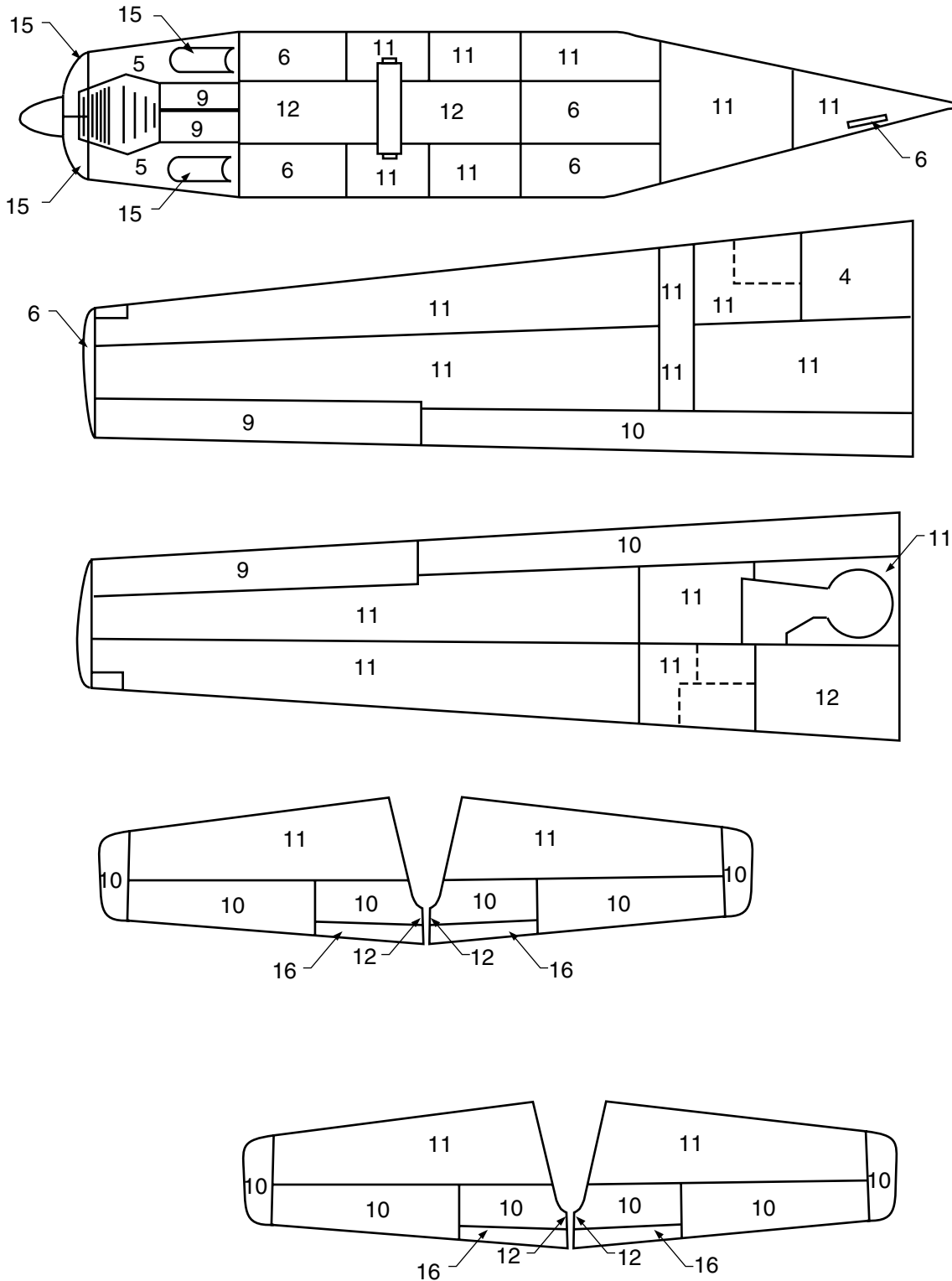


NUMBER	MATERIAL	THICKNESS
1	2024-O	.020
2	2024-O	.025
3	2024-O	.032
4	2024-O	.040
5	2024-O*	.025
6	2024-O*	.032
7	2024-O*	.040
8	2024-O*	.063
9	2024-T3	.020
10	2024-T3	.025
11	2024-T3	.032
12	2024-T3	.040
13	2024-T3*	.040
14	5052-H34	.025
15	FIBERGLASS	
16	2024-T3	.016

* HEAT TREAT TO T42

Skin Material Specifications
Figure 1 (Sheet 1 of 2)

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Skin Material Specifications
Figure 1 (Sheet 2 of 2)

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INVESTIGATION, CLEANUP AND AERODYNAMIC SMOOTHNESS

Corrosion Control

Corrosion is the deterioration of metal by chemical or electrochemical attack. Water which is allowed to remain on the aircraft and industrial pollution are the major causes of corrosion in aircraft. The two general types of corrosion are:

- Direct chemical attack (i.e. spilled battery acid).
- Electrochemical attack which requires a medium (usually water).

The latter is the most common and is responsible for most forms of aircraft corrosion.

Since corrosion is a constant threat, the only effective method to control it is a routine of regular inspection, cleaning, and surface refinishing.

A. Forms of Corrosion (See Chart 1.)

The following are the most common forms of corrosion:

- (1) Surface Corrosion appears as a general roughening or pitting on the surface usually accompanied by a powdery deposit of corrosion products. It may spread under the surface and not be recognized until the paint or plating is lifted off the surface in small blisters.
- (2) Dissimilar Metal Corrosion may occur when two dissimilar metals are contacting each other. This type may be serious because it usually takes place out of sight. The only way to find it before structural failure is by disassembly and inspection. Insulating is necessary between two contacting dissimilar surfaces (2 to 3 coats of zinc chromate on each surface; plus, if one of the surfaces is magnesium, a 0.003 inch thick piece of vinyl tape).
- (3) Intergranular Corrosion is difficult to detect in its early stages. When severe, it causes the surface of the metal to exfoliate (flake or lift).
- (4) Stress Corrosion is the result of sustained tensile stresses and corrosive environment. It usually occurs in assemblies such as aluminum alloy bellcranks with pressed in bushings; landing gear shock struts with pipe thread grease fittings, clevis pin joints and shrink fit parts.
- (5) Fretting Corrosion takes place when two parts rub together, constantly exposing fresh active metal to the corrosive effects of the atmosphere.
- (6) Filiform Corrosion is the appearance of numerous meandering thread like filaments of corrosion on the surface of various types of metal.

B. Conditions Affecting Corrosion

Some conditions which affect the occurrence of corrosion are:

- (1) Heat and humidity increase corrosion.
- (2) Different (i.e. - dissimilar) metals and their relative sizes affect resistance or susceptibility to corrosion.
- (3) Frequent contributing factors to corrosion:
 - (a) Soil and atmosphere dust.
 - (b) Oil, grease, and exhaust residues.
 - (c) Salt water and salt moisture condensation.
 - (d) Spilled battery acids and caustic cleaning solution.
 - (e) Welding, brazing, and soldering flux residue.

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**CHART 1
TYPES OF METAL CORROSION**

Type of Material	Type of Corrosion	Remedy (2)
Steel.	Rust ⁽¹⁾ .	Complete removal of corrosion by mechanical means.
Aluminum.	White to grey powdery material.	Mechanical polishing or brushing with material softer than aluminum.
Magnesium (highly susceptible to corrosion).	White powdery snow-like mounds and white spots.	Mechanical polishing or brushing for a smooth finish.
Cadmium (plating).	White to brown to black mottling of surface (plating is still protecting until iron appears).	Mechanical removal of corrosion is limited to metal surfaces from which cadmium has been depleted.
Chromium (plating).	May pit in chloride environment.	Polishing and buffing.
— NOTES — (1) Red rust generally shows on bolts, nuts, and other aircraft hardware. Rust in these areas is generally not dangerous, however, it shows a need for maintenance and the possibility of corrosive attack in more critical areas. Any surface corrosion on highly stressed steel parts is potentially dangerous. A careful removal of corrosion using mild abrasives (rouge or fine grit aluminum oxide paper) is necessary. Do not overheat metal when removing corrosion. (2) For abrasion, do not use dissimilar material (for example steel wool on aluminum). Remove only material required to clean affected area.		

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- (4) A clean aircraft will resist corrosion better than a dirty one. Cleaning frequency depends on several factors, including geographical location, type of operation, etc. Remove soil as soon as possible, especially when in a high temperature area.
- (5) After cleaning, verify that no cleaning solution remains in any holes, crevices, or joints as it may lead to increased corrosion. All exposed areas (landing gear, flap tracks, control surface, hinge parts, etc) must be lubricated after cleaning.

C. Inspection

CAUTION: INSPECTION FOR CORROSION MUST BE PERFORMED BY PERSONS FAMILIAR WITH CORROSIVE PROBLEMS AND REMEDIES.

NOTE: Some areas of the airplane have been treated with a corrosion inhibiting compound which requires re-treatment at five (5) year intervals. See Each Five (5) Years, Per Calendar Year, 5-30-00.

Check for corrosion at every inspection. In trouble areas, inspection frequency must be increased. In addition to routine inspections:

- (1) Aircraft operating around a marine environment must be given special inspections on a weekly basis. See Per Specific Operation / Operating Environment, 5-30-00.
- (2) Aircraft operating in semi-acid conditions must be inspected monthly. Semi-acid conditions are likely to occur in industrialized areas where sulphur-bearing particles in dust, smoke, and smog will attack painted surfaces. See Per Specific Operation / Operating Environment, 5-30-00.
- (3) Inspection for corrosion must be performed by personnel familiar with corrosive problems and remedies.
 - (a) Daily and preflight inspection must include engine frontal areas, all intake vents, engine compartments, gaps, seams, and faying surfaces in exterior skins, wheel and wheel well areas, battery compartment, fuel cell, all other drains, and any bilge areas not requiring extensive removal of inspection access covers.
 - (b) Detailed inspection must include above referenced areas along with areas requiring removal of inspection plates and panels to thoroughly inspect internal cavities of aircraft.
- (4) Paint tends to hide corrosion in its initial stages. The results of corrosion can sometimes be seen as blisters, flakes, chips, and other irregularities in paint.

D. Corrosion Removal and Control

CAUTION: THE DEPTH OF MATERIAL REMOVED MUST NOT EXCEED SAFE LIMITS.

CAUTION: REMOVAL OF SEVERE CORROSION MAY BE CONSIDERED A MAJOR REPAIR. ANY REPAIR OF THIS TYPE MUST BE APPROVED BY THE FAA BEFORE THE AIRPLANE CAN BE RETURNED TO SERVICE.

Corrosion cannot be prevented or eliminated on aircraft; it can only be reduced to an acceptable level by proper control methods.

All corrosion products must be removed prior to refinishing. If not removed, corrosion will begin again, even though affected area is refinished.

- (1) Before beginning any rework:
 - (a) Position airplane in a wash rack or provide some type of washing apparatus for rapid rinsing of all surfaces.
 - (b) Connect static ground line to airplane.
 - (c) Remove airplane battery if required.

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- (d) Protect pitot-static ports, engine openings, airscoops, louvers, wheels, tires, and other portions of airplane from moisture and chemical brightening agents.
- (e) Protect surfaces next to rework areas from chemical paint strippers, corrosion removal agents, and surface treatment materials.
- (2) Evaluate corrosion damage to determine type and extent of repairs required. Proceed as follows:
 - (a) Light Corrosion: discoloration or pitting. Remove by light hand sanding or a small amount of chemical treatment.
 - (b) Moderate Corrosion: similar to light corrosion except there is blistering or evidence of scaling and flaking. Remove by extensive hand or mechanical sanding.
 - (c) Severe Corrosion: similar to moderate corrosion with severe blistering, exfoliation, scaling, or flaking. Remove by extensive mechanical sanding or grinding.

E. Corrosion Prone Areas

Certain areas are more prone to corrosion than others. The following list is a general guide to areas where corrosion is frequently found.

- (1) Areas around steel fasteners are susceptible to corrosion. The paint on these areas cracks which allows moisture to seep in and corrode the underlying metal. Each time the fastener is removed, it should be coated with zinc chromate (or equivalent) before reinstallation. The paint should be wet when the fastener is installed.
- (2) Fluids tend to seep into faying surfaces, seams and joints due to capillary action. The effect of this type of intrusion is usually detectable by irregularities in the skin's surface.
- (3) Spot welded assemblies are particularly prone to corrosion. The only means to prevent this type of corrosion is by keeping potential moisture entry points in the spot weld filled with a sealant or preservative compound. On an aluminum spot welded assembly, a chromate conversion coating before paint is applied will help prevent corrosion.
- (4) Areas exposed to exhaust gases may have their finish damaged by deposits. These deposits may result in an aggressive attack on the metal by corrosion. Heat from the exhaust may also blister or otherwise damage the paint. Gaps, seams, hinges and fairings are some places where exhaust gas deposits may be trapped and not reached by normal cleaning methods.
- (5) The wheel well and landing gear are the most exposed parts of the aircraft. Due to the complexity of its shape, assemblies and fittings, maintaining a protective coverage is difficult. The especially troublesome areas are:
 - (a) Magnesium wheels: around bolt heads, lugs and wheel well areas:
 - (b) Exposed rigid tubing, B-nuts, ferrules, under clamps and tubing identification tape:
 - (c) Exposed position indicator switches and other electrical equipment:
 - (d) Crevices between stiffeners, ribs and lower skin surfaces.
- (6) Flaps, flight control slots and equipment installed in these areas may corrode unnoticed unless a careful surveillance is maintained.
- (7) Engine frontal areas, air inlet ducts and the leading edge of wings, because they are constantly exposed to abrasion by dirt, dust, gravel and rain, should be checked frequently for the beginning of corrosion.
- (8) Hinges (piano hinges especially) are extremely vulnerable to corrosion. Their protective coatings wear away and they naturally trap dirt, salt and moisture.
- (9) Control cables may have bare spots in their preservative coating which will lead to corrosion. Cables having external corrosion must be checked for internal corrosion. If internal corrosion is present, replace the cable. If only external corrosion is present, remove corrosion with wire brush and recoat cable with preservative.

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- (10) Check and clean drain holes regularly.
- (11) Battery compartment and vent openings are especially prone to corrosion due to spilled electrolyte. Fumes from overheated battery electrolyte will spread to adjacent areas and cause rapid corrosion of unprotected surfaces. Frequent cleaning and neutralization of deposits will minimize corrosion in this area.
- (12) Magnesium parts are prone to corrosion. Special attention must be given to their surface treatment, proper insulation (due to dissimilar metal corrosion), and paint coatings.
- (13) Electrical components and connectors must be checked. Inspection frequency is based on operational environment and past trouble.
- (14) Skin joints and lap-overs are two areas that can trap and hold moisture. Corrosion in these areas may go unnoticed unless particular attention is paid to them during inspection.
- (15) Hoses, having an internal wire braid, which are located in a position where they are frequently water soaked, need a protective treatment.
- (16) Drilled holes and trimmed ends of sandwich panels must be protected. Use an inhibitor solution or sealant application. Any gaps or cavities which allow dirt or moisture to enter must be filled with sealant.

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REPAIRS

Structural repair methods used must be in accordance with regulations set forth in FAA Advisory Circular 43.13-1, latest revision. To assist in making repairs and/or replacements, Figure 1, 51-00-00, identifies type and thickness of various skin material used.

WARNING: NO ACCESS HOLES ARE PERMITTED IN ANY CONTROL SURFACE. USE OF PATCH PLATES FOR REPAIRS OF ALL MOVABLE TAIL SURFACES IS PROHIBITED. USE OF ANY FILLER MATERIAL NORMALLY USED FOR REPAIR OF MINOR DENTS AND/OR MATERIALS USED FOR FILLING INSIDE OF SURFACES IS ALSO PROHIBITED ON ALL MOVABLE TAIL SURFACES.

Never make a skin replacement or patch plate from material other than type of original skin, or of a different thickness than original skin. Repair must be as strong as original skin. However, flexibility must be retained so surrounding areas will not receive extra stress.

1. Fiberglass Repairs

The repair procedure in this section will describe the methods for the repair of fiberglass reinforced structures. This section 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. Also covered are Fracture and Patch Repairs such as puncture, breaks and holes that have penetrated through the structure and damaged the fiberglass cloth. A repair kit, Piper P/N 766-222, that contains the necessary material for such repairs, is available through Piper Distributors.

NOTE: Very carefully follow resin and catalyst mixing instructions furnished with repair kit.

A. Touch-up and Surface Repairs

- (1) Remove wax, oil and dirt from around the damaged area with acetone. Methylethylketone or equivalent and remove paint to gel coat.
- (2) The damaged area may be scraped with a fine blade knife or a power drill with a burr attachment to roughen the bottom and sides of the damaged area. Feather the edge surrounding the scratch or cavity. Do not undercut the edge. (If the scratch or cavity is shallow and penetrates only the surface coat, continue to step (8))
- (3) Pour a small amount of resin into a jar lid or on a piece of cardboard, just enough to fill the area being worked on. Mix an equal amount of milled fiberglass with the resin, using a putty knife or stick. Add catalyst, according to kit instruction, to the resin and mix thoroughly. A hypodermic needle may be used to inject gel into small cavities not requiring fiberglass millings mixed with the gel.
- (4) Work the mixture of resin, fibers and catalyst into the damaged area, using the sharp point of a putty knife or stick to press it into the bottom of the hole and to puncture any air bubbles which may be present. Fill the scratch or hole above the surrounding undamaged area about .062 of an inch.
- (5) Lay a piece of cellophane or waxed paper over the repair to cut off air and start the cure of gel mixture.
- (6) Allow the gel to cure 10 to 15 minutes until it feels rubbery to the touch. Remove the cellophane and trim flush with the surface, using a sharp razor blade or knife. Replace the cellophane and allow to cure completely for 30 minutes to an hour. The patch will shrink slightly below the structure surface as it cures. (If wax paper is used, make sure the wax is removed from surface.)
- (7) Rough up the bottom and edges of the hole with the electric burr attachment or rough sandpaper. Feather hole into surrounding gel coat, do not undercut.

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- (8) Pour out a small amount of resin, add catalyst and mix thoroughly, using a cutting motion rather than stirring. Use no fibers.
- (9) Using the tip of a putty knife or fingertips, fill the hole to about .062 of an inch above the surrounding surface with the gel coat mixture.
- (10) Lay a piece of cellophane over the patch to start the curing process. Repeat step (6), trimming patch when partially cured.
- (11) After trimming the patch, immediately place another small amount of gel coat on one edge of the patch and cover with cellophane. Then, using a squeegee or the back of a razor blade, level with area surrounding the patch; leave the cellophane on patch for one to two hours or overnight, for complete cure.
- (12) 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.

B. Fracture and Patch Repairs

- (1) Remove wax, oil and dirt from around the damaged area with acetone, methylethylketone or equivalent.
- (2) Using a key hole saw, electric saber saw, or sharp knife cut away ragged edges. Cut back to sound material.
- (3) Remove paint three inches back from around damaged area.
- (4) Working inside the structure, bevel the edges to approximately a 30 degree angle and rough-sand the hole and the area around it, using 80 grit dry paper. Feather back for about two inches all around the hole. This roughens the surface for strong bond with patch.
- (5) Cover a piece of cardboard or metal with cellophane. Tape it to the outside of the structure, covering the hole completely. The cellophane should face toward the inside of the structure. If the repair is on a sharp contour or shaped area, a sheet of aluminum formed to a similar contour may be placed over the area. The aluminum should also be covered with cellophane.
- (6) Prepare a patch of fiberglass mat and cloth to cover an area two inches larger than the hole.
- (7) Mix a small amount of resin and catalyst; enough to be used for one step at a time, according to kit instructions.
- (8) Thoroughly wet mat and cloth with catalyzed resin. Daub resin on mat first, and then on cloth. Mat should be applied against structures surface with cloth on top. Both pieces may be wet out on cellophane and applied as a sandwich. Enough fiberglass cloth and mat reinforcements should be used to at least replace the amount of reinforcements removed in order to maintain the original strength. If damage occurred as a stress crack, an extra layer or two of cloth may be used to strengthen area.
- (9) Lay patch over hole on inside of structure, cover with cellophane, and squeegee from center to edges to remove all air bubbles and assure adhesion around edge of hole. Air bubbles will show white in the patch and they should all be worked out to the edge. Remove excess resin before it gels on the part. Allow patch to cure completely.
- (10) Remove cardboard or aluminum sheet from outside of hole and rough-sand the patch and edge of hole. Feather edge of hole about two inches into undamaged area.
- (11) Mask area around hole with tape and paper to protect surface. Cut a piece of fiberglass mat about one inch larger than the hole and one or more pieces of fiberglass cloth two inches larger than the hole. Brush catalyzed resin over hole, lay mat over hole and wet out with catalyzed resin. Use a daubing action with brush. Then apply additional layer or layers of fiberglass cloth to build up patch to the surface of structure. Wet out each layer thoroughly with resin.
- (12) With a squeegee or broad knife, work out all air bubbles in the patch. Work from center to edge pressing patch firmly against the structure. Allow patch to cure for 15 to 20 minutes.

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- (13) As soon as the patch begins to set up, but while still rubbery, take a sharp knife and cut away extra cloth and mat. Cut 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.
- (14) Using dry 80 grit sandpaper on a power sander or sanding block, smooth patch and blend with surrounding surface. Should air pockets appear while sanding, puncture and fill with catalyzed resin. A hypodermic needle may be used to fill cavities. Let cure and resand.
- (15) Mix catalyzed resin and work into patch with fingers. Smooth carefully and work into any crevices.
- (16) Cover with cellophane and squeegee smooth. Allow to cure completely before removing cellophane. Let cure and resand.
- (17) Brush or spray a coat of catalyzed resin to seal patch. Sand patch, finish by priming, again sanding and applying color coat.

NOTE: Brush and hands may be cleaned in solvents such as acetone or methylethylketone. If solvents are not available, a strong solution of detergent and water may be used.

2. Thermoplastic Repairs

The following procedure will assist in making field repairs to items made of thermoplastic which are used throughout the airplane. Chart 1 lists materials needed to perform these repairs along with suggested suppliers. Common safety precautions should be observed when handling some of the materials and tools used while making these repairs. Refer to Vendor Information, Chapter 91, for supplier addresses.

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 V M & P Naphtha will generally ensure a good bond between epoxy compounds and thermoplastic.

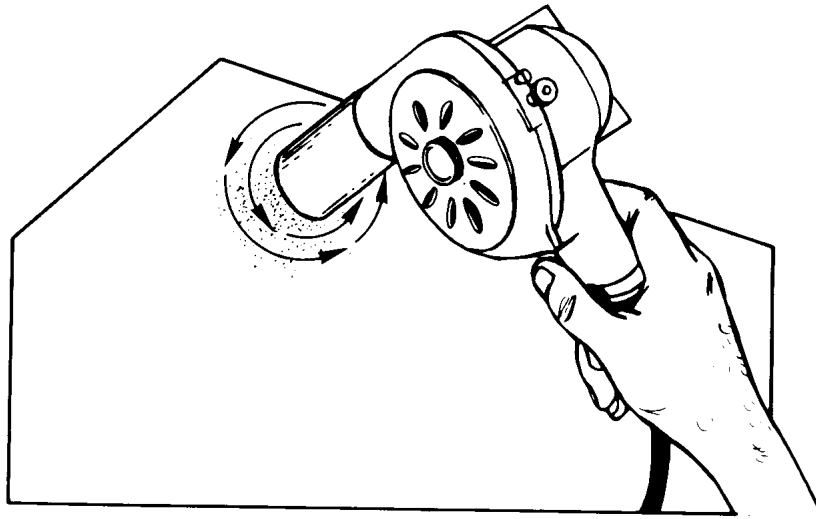
B. Surface Scratches, Abrasion or Ground-in-Dirt (See Figure 1.)

- (1) Shallow scratches and abraded surfaces are usually repaired by following directions on containers of conventional automotive buffing and rubbing compounds.
- (2) If large dirt particles are embedded in thermoplastic parts they can be removed with a hot air gun capable of supplying heat in 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.

C. Deep Scratches, Shallow Nicks and Small Holes - Less than 1 inch in diameter (See Figure 2.)

- (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, or thin walled parts or for patching holes greater than 1/4 inch in diameter.
- (4) For larger damages, an epoxy patching compound is recommended. This type material is a two part, fast curing, easy sanding commercially available compound.
- (5) Adhesion can be increased by roughing the bonding surface with sandpaper and by utilizing as much surface area for the bond as possible.

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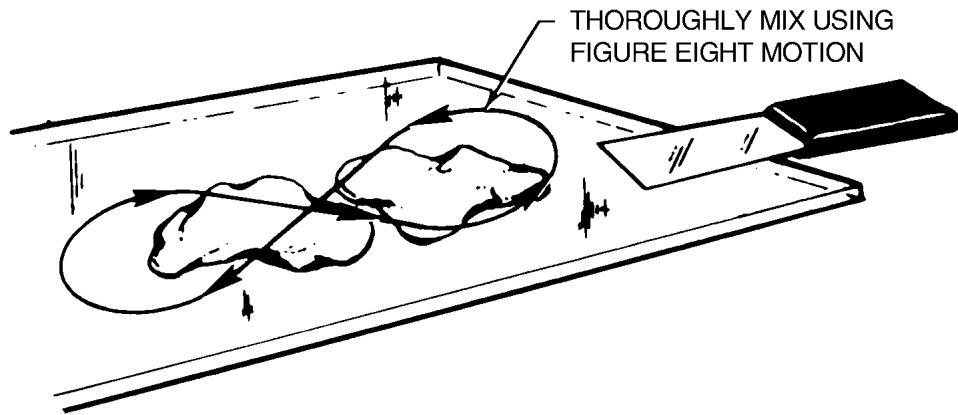


Surface Scratches - Abrasions or Ground in Dirt
Figure 1

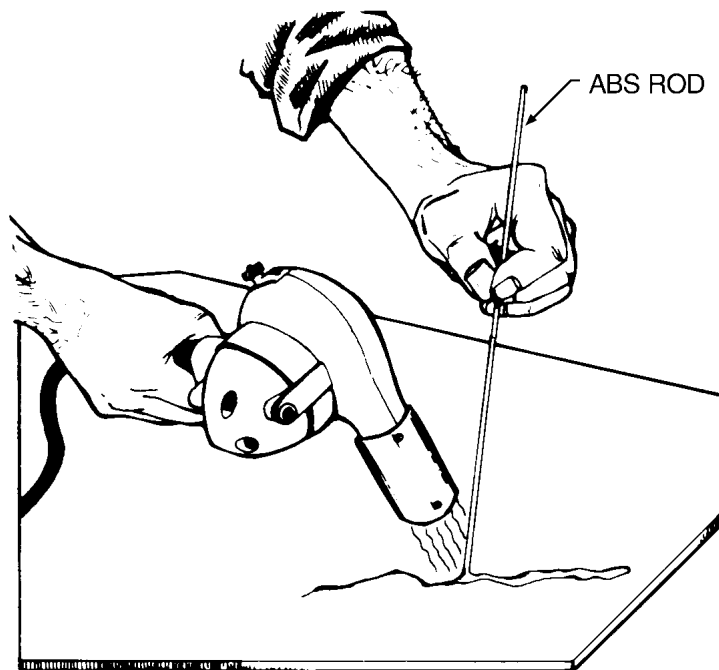


Deep Scratches, Shallow Nicks and Small Holes
Figure 2

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Mixing of Epoxy Patching Compound
Figure 3



Welding Repair Method
Figure 4

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**CHART 1
LIST OF MATERIALS (THERMOPLASTIC REPAIRS)**

Items	Descriptions	Suppliers
Buffing and Rubbing Compounds	Automotive Type - DuPont #7	DuPont Company
	Ram Chemical #69 x 1	Ram Chemicals
	Mirror Glaze #1	Mirror Bright Polish Co., Inc.
Cleaners	Fantastic Spray	Obtain From Local Suppliers
	Perchlorethylene	
	V M & P Naphtha (Lighter Fluid)	
ABS-Solvent Cements	Solarite #11 Series	Solar Compounds Corp.
Solvents	Methylethylketone	Obtain From Local Suppliers
	Methylene Chloride	
	Acetone	
Epoxy Patching Compound	Solarite #400	Solar Compounds Corp.
Hot Melt Adhesives	Stick Form 1/2 in. dia.	Sears Roebuck & Co. or
Polyamids and Hot Melt Gun	3 in. long	Most Hardware Stores
Hot Air Gun	Temp. Range 300° to 400° F	Local Suppliers

- (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 V M & P Naphtha prior to applying the compound (see Figure 3).
- (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.
- (9) For repairs in areas involving small holes, indentations or cracks in the material where high stress is apparent or where thin walled sections are used, the welding method is suggested.
- (10) This welding method requires a hot air gun and ABS rods. To weld, the gun should be held to direct the flow of hot air into the fusion (repair) zone, heating the damaged area and rod simultaneously. The gun should be moved continuously in a fanning motion to prevent discoloration of the material. Pressure must be maintained on the rod to insure good adhesion (see Figure 4).
- (11) After the repair is completed, sanding is allowed to obtain a surface finish of acceptable appearance.

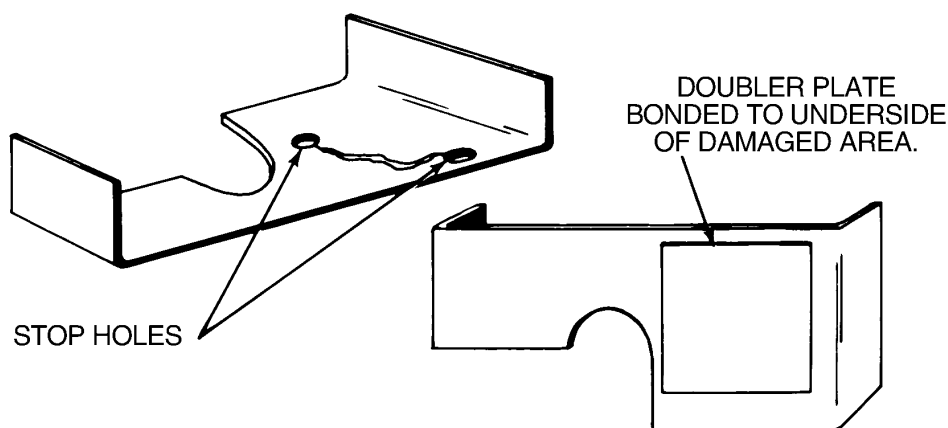
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D. Cracks (See Figure 5.)

- (1) Before repairing a crack in the thermoplastic part, first determine what caused the crack and alleviate that condition to prevent it from 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 it should be hot air welded, whichever is preferred.
- (5) After the repair has cured, it may be sanded to match the surrounding finish.

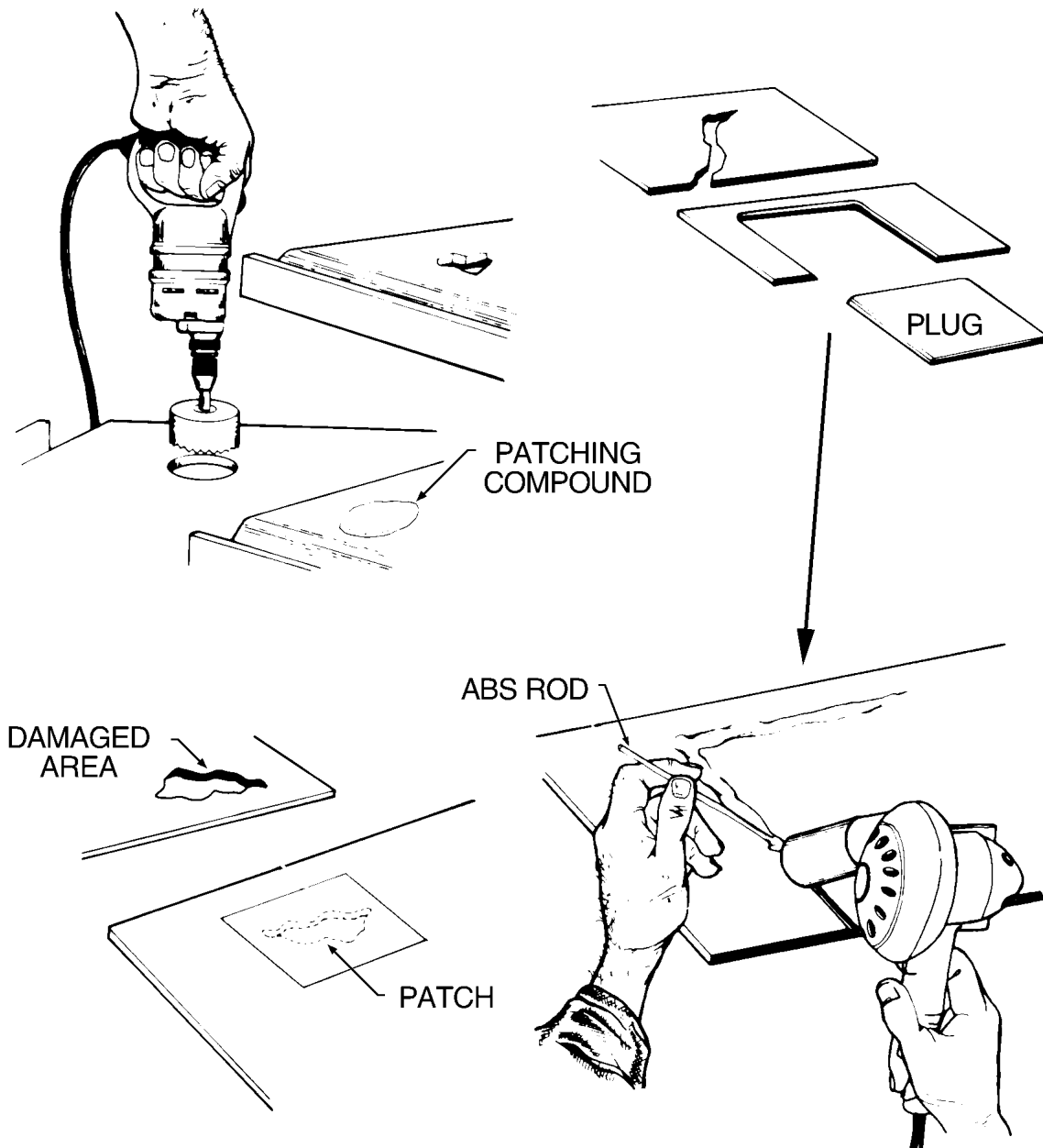
E. Repairing Major Damage - Larger than 1 inch in diameter (See Figure 6.)

- (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 ensure 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 overfill 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 thickness at a time. This will allow the compound to cure and ensure a good solid buildup of successive layers as required.



Repairing of Cracks
Figure 5

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Various Repairs
Figure 6

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F. Stress Lines (See Figure 7.)

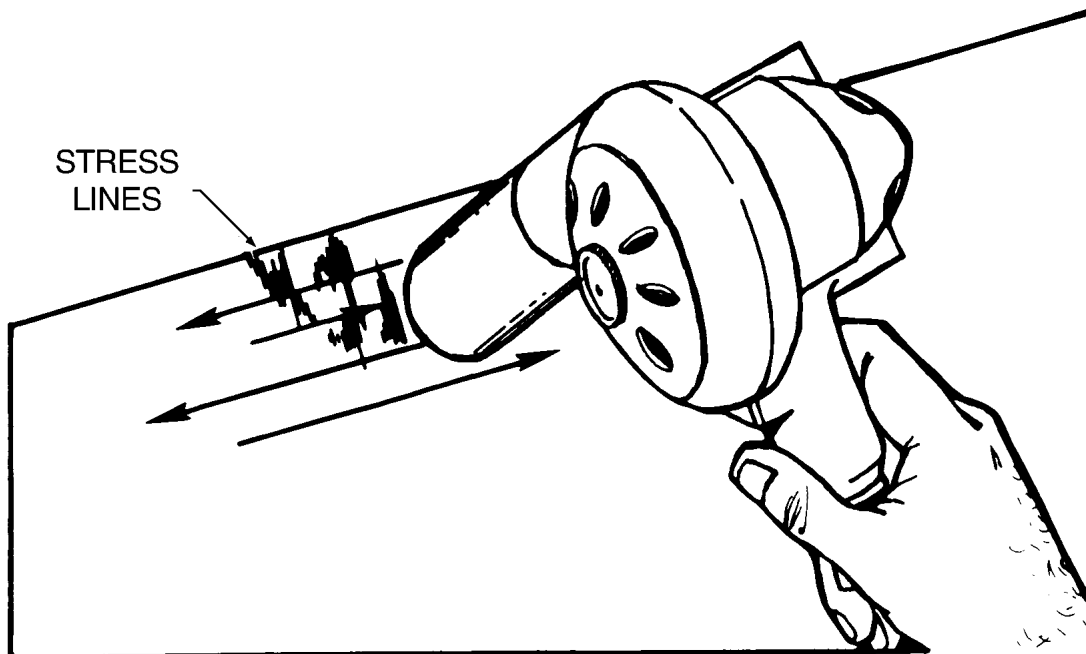
- (1) Stress lines produce a whitened appearance in a localized area and generally emanate from the severe bending or impacting of the material (see Figure 8).
- (2) To restore the material to its original condition and color, use a hot air gun or similar heating device and carefully apply heat to the 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.

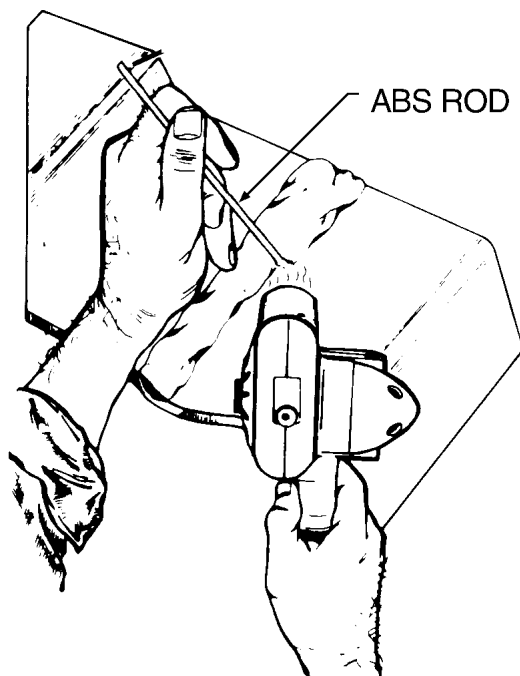
NOTE: It is extremely important that solvent formulations be considered when selecting a paint, because not all lacquers or enamels can be used satisfactorily on thermoplastic. Some solvents used in the paints can significantly affect and degrade the plastic properties.

- (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 coating may crack, thus creating a weak area.



Repair of Stress Lines
Figure 7

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Repair of Impacted Damage
Figure 8

3. Pressure Sensitive Safety Walk Installation

Each of the steps on the lower cabin door have an 11.75 in. x 7.50 in. piece of pressure sensitive safety walk installed on them.

A. Surface Preparation

- (1) Allow newly painted surfaces to dry a minimum of 2 hours prior to applying the safety walk.
- (2) If the paint becomes contaminated, remove the contamination with clean dry rags or paper wipers moistened with MIL-S-18718 Safety Solvent.
- (3) Prior to applying the safety walk, wipe the applicable surface with a clean dry cloth, ensuring that no moisture remains on the surface.

B. Application Procedure

- (1) Do not apply when surface temperature is below 50°.
- (2) Peel back the full width of the protective liner leading edge approximately two inches.
- (3) Adhere this edge of the safety walk to the inboard edge of the step.
- (4) Remove the remaining protective lines as the safety walk is being adhered to the step.
- (5) Roll firmly with a long handled cylindrical brush in both lengthwise directions.

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4. Metal / Wire Stitching Repair (See Figure 9.)

(PIR-PPS20024, Rev. A.)

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

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

Alternate (Rivet) Method of Joining.

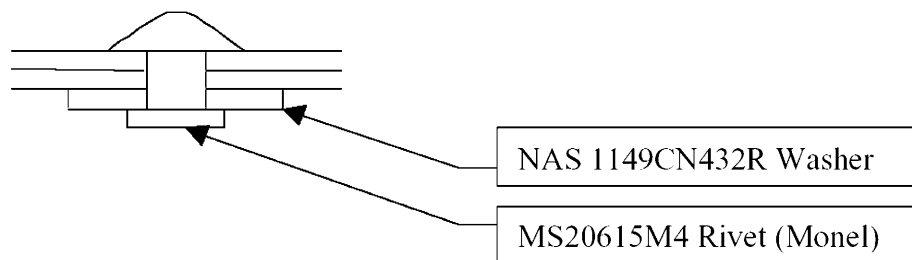
- (1) Substitute two rivets in lieu of each staple where stitching was previously used or is specified. Maintain a minimum of .75 inch spacing between rivets.
- (2) When materials being joined include Stainless Steel, Galvanized Steel or Steel, use:
 - (a) MS20615M4 Rivet (Monel) and NAS1149CN432R Washer (See Figure 9.)
 - (b) Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.
- (3) When materials being joined include only aluminum and nonmetallic materials use:
 - (a) MS20470A4 Rivet and NAS1149DN432H Washer (See Figure 9.)
 - (b) Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.

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

MS20615M4 Rivet (Monel)
NAS1149CN432R Washer

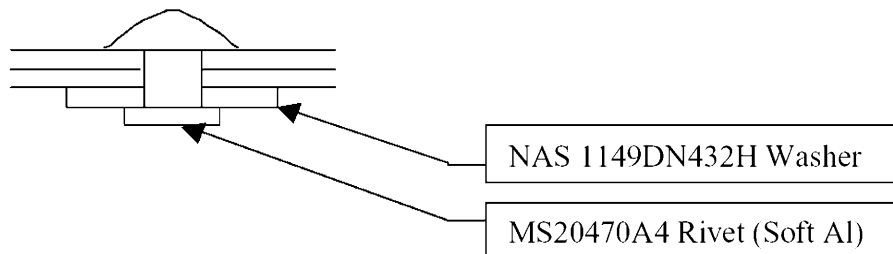
Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.



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

MS20470A4 Rivet
NAS1149DN432H Washer

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



Metal / Wire Stitching Repair
Figure 9

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ELECTRICAL BONDING

1. General (See also 23-60-00.)

(PIR-PPS55006, Rev. T.)

All electrical and electronic equipment and specified components shall be installed in such a manner as to provide a continuous low resistance path (bonds) from the equipment enclosure/component to the airplane structure. Bonds must be installed to ensure that the structure and equipment are electrically stable and free from the hazards of lightning, static discharge, electrical shock, etc.

- A. All parts shall be bonded with as short a lead as possible.
- B. All bonding surfaces shall be cleaned prior to the installation of the bonded joint.
- C. All nuts used in bonding shall be of the self-locking type. (Do Not use fiber-locking type).
- D. All electrical bonding shall be accomplished without affecting the structural integrity of the airframe.

2. 100 Hour Inspection

(PIR-AC 43.13-1, Rev. B.)

Each 100 hours, visually inspect shield and shield terminations of each electrical harness for integrity, condition, and security. If electrical arcing is evident, check for intermittent contact between conducting surfaces. Arcing can be prevented by bonding or insulation, as appropriate.

Inspect the components listed in Chart 1 as follows:

- A. Bond connections shall be secure and free from corrosion.
- B. Bonding jumpers installed so as not to interfere in any way with the operation of moveable components of the aircraft.
- C. No self-tapping screws used for bonding purposes.
- D. Exposed conducting frames or parts of electrical or electronic equipment should have a low resistance bond of less than 2.5 milliohms to structure. If the equipment design includes a ground terminal or pin, which is internally connected to such exposed parts, a ground wire connection to such terminal will satisfy this requirement.
- E. Parts shall be bonded directly to the primary structure rather than to other bonded parts.
- F. Where aluminum or copper is bonded to dissimilar metallic structures, ensure installed hardware (typically washers) is as called out in the parts catalog to minimize electrolytic corrosion and ensure the hardware should corrode first.

3. On Condition Inspection

Whenever any electrically bonded component (see Chart 1) is removed and reinstalled, or visual inspection reveals the electrical bonding to be suspect, measure resistance between component and aircraft structure.

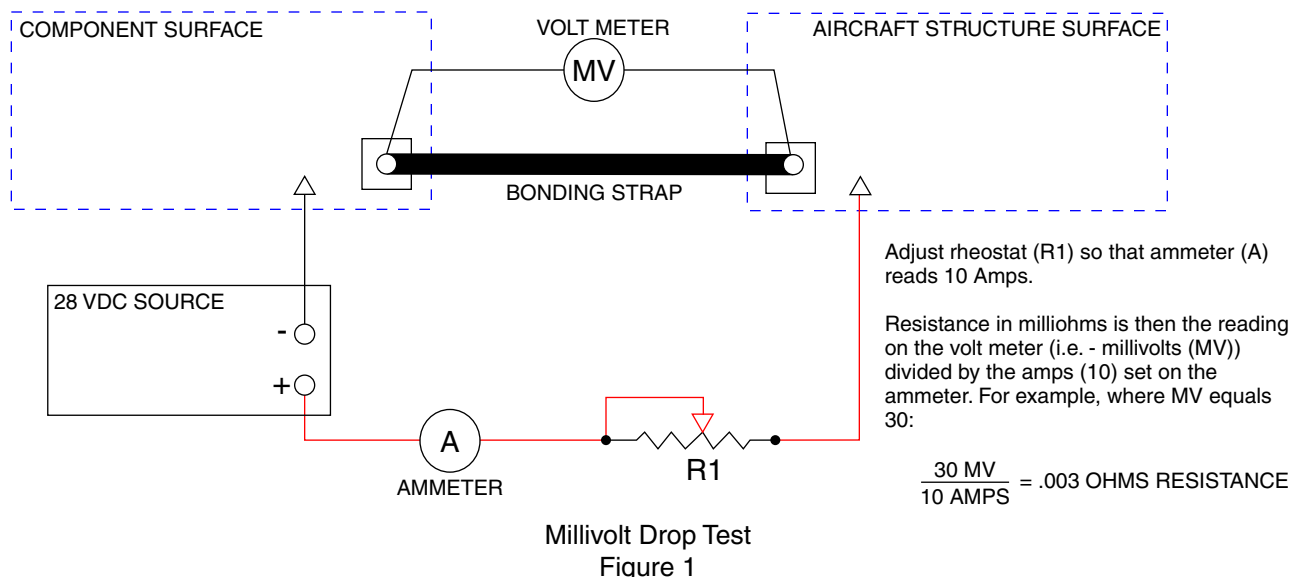
To ensure proper operation and suppression of radio interference from hazards, electrical bonding of equipment must not exceed the maximum allowable resistance values specified in Chart 1.

- A. Measurements should be performed after the grounding and bonding mechanical connections are complete to determine if the measured resistance values meet the basic requirements.
- B. A high quality test instrument (an AN/USM-21A or equivalent) will accurately measure the very low resistance values specified.
- C. Another method of measurement is the millivolt drop test as shown in Figure 1.

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**CHART 1
ELECTRICAL BONDING RESISTANCE INDEX**

Component	Maximum Allowable Resistance Value in Ohms
Engine Mount(s)	.003
Generator(s)	.010
Ailerons	.003
Elevator / Stabliator	.003
Rudder	.003
Alternator(s)	.010
Trim Tab(s)	
Conventional Hinge	.003
Piano Hinge	.010
Instrument Panel Inserts	.010
Exterior Lights Mounted on Non-Conductive Material	.003
Avionics 'Black Boxes'	.003
NOTE: Harnesses should be installed and connected for this check, internal chassis wiring through the connector to ground is permissible for this grounding.	
Battery Ground Point	.010
Static wick mounting plates (TCO Model B-4) P/N 452-094	1.00
NOTE: Where jumper wires or cables are used to accomplish a proper bond, resistance between the jumper terminal and the component or structure shall not exceed .001 ohms. The controlling points for measuring resistance will be within the limits of the cleaned area to be bonded and within 1/4 inch of the exterior limits of the bonding jumper terminal or material called for in the bill of materials of the drawing. Resistance to ground will be measured from wire terminal to structure for electrical / electronic equipment not internally grounded and from mounting flange to structure for equipment that is internally grounded.	



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CHAPTER

52

DOORS

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PASSENGER / CREW

1. Description

This airplane is provided with a cabin door on the left side of the fuselage between the passenger seats. The cabin door is in two sections, the upper door having a window and the lower door having two boarding steps that assume their proper position when the door is lowered. Signal flags are incorporated in each of the cabin door's locking pins to show the pin's position.

The emergency exit is on the right-hand side of the fuselage at the center seat. See 52-20-00.

NOTE: See 51-70-00 for instructions on installing the pressure sensitive safety walk strips on the lower cabin door steps.

2. Cabin Door

A. Upper Half

(1) Removal

- (a) Rotate the handle to the unlocked position and open the door.
- (b) Open the lower door.
- (c) Disengage the door holder assembly from the door.
- (d) Hold the door partly open and relieve the weight of the door from the hinge pin to facilitate hinge pin removal.
- (e) Remove the hinge pin and lift off the door.

(2) Installation

- (a) Align the door hinge with the fuselage hinge and insert the hinge pin.
- (b) Attach the door holder assembly to the door.

B. Lower Half

(1) Removal

- (a) Open both upper and lower doors to full open position.
- (b) Remove the screw, washers and nut which secures the cable assembly to the lower door.
- (c) Relieve the weight of the door from the hinge and remove the hinge pin.
- (d) Lift the door off of the lower hinge.

(2) Installation

- (a) Align the door hinge with the fuselage hinge and insert the hinge pin.
- (b) Attach the cable assembly to the door with the previously removed screw, washers and nut.

3. Door Support

A. Upper Door Half

The upper door half is held open by a hydraulic door support located at its upper left-hand corner. The unit is designed to provide 65 to 80 pounds of pressure when fully extended.

(1) Removal

- (a) Open the upper door. Relieve door weight on the door support.
- (b) Support the door and remove the retaining nuts and washers from both ends of the door support.
- (c) Remove the door support.

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(2) Installation

- (a) Position the door support on the door and fuselage.
- (b) Secure the door support to the door and to the door frame with the previously removed nuts and washers.

B. Lower Door Half

When open, the lower door half is supported by a cable assembly attached to lugs on the door's frame.

(1) Removal

- (a) Open the lower door.
- (b) Support the lower door and remove the cable retaining screws, washers, and nuts from the door lug and door frame lug.
- (c) Remove the cable assembly.

(2) Installation

- (a) Attach the eye end of the cable to the door frame lug.
- (b) Attach the yoke end of the cable to the door lug.

4. Door Latching Mechanism

A. Description

The upper door locking mechanism consists of an external and internal handle which actuate two locking pins in the lower corners of the door and two locking hooks which protrude out of the lower edge of the door. When the handle is rotated to the open position, the guide pins and latch hooks are disengaged and withdrawn into the door.

An auxiliary lock is installed in the upper door under the interior handle to prevent inadvertent opening of the door. When opening the door from inside the airplane, the auxiliary lock handle must be pulled inboard to allow the door handle to rotate.

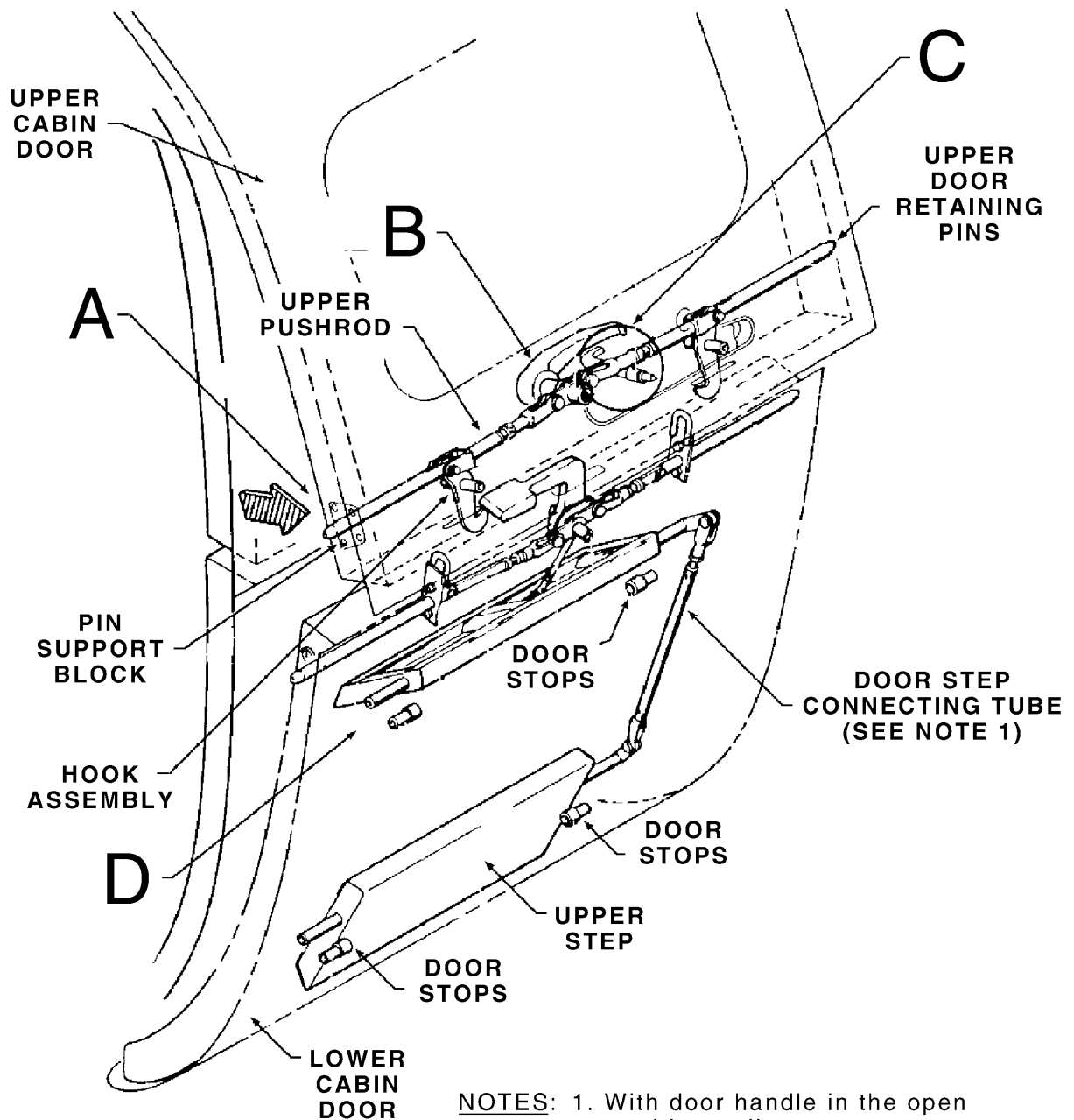
The lower door locking mechanism is similar to the upper mechanism except that it has no latch hooks and only one handle. Lifting the latch handle up withdraws the two pins into the door.

B. Upper Door (See Figure 1.)

(1) Removal

- (a) To remove the door handle bellcrank:
 - 1 Remove the pin which retains the interior door handle to the bellcrank assembly. Remove the handle.
 - 2 Remove the bellcrank support from the interior of the door by removing the rivets from the bellcrank support.
 - 3 Remove the pins which attach the bellcrank to the pushrods.
 - 4 Remove the bellcrank retaining screw from the bellcrank.
 - 5 Pull the bellcrank assembly from the door.
- (b) To remove the pushrod assemblies and the door retaining pins:
 - 1 Remove the pin which connects the pushrod assembly to the bellcrank assembly.
 - 2 Disconnect the pins and washer which secures the pushrod assembly to the door retaining pins.
 - 3 Slide the pushrod and door retaining pin out of the door.
 - 4 Repeat Steps 1, 2, and 3 for the remaining side.

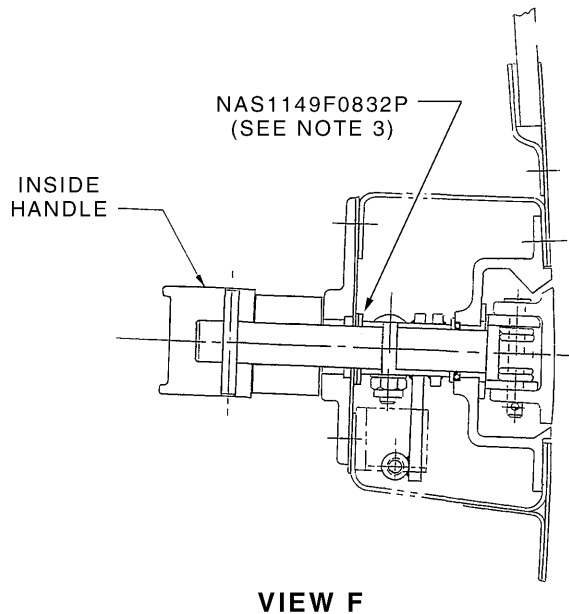
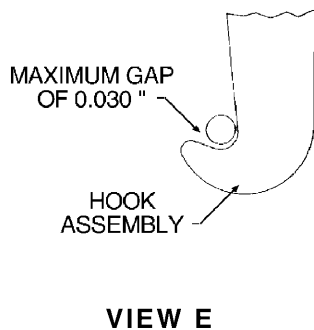
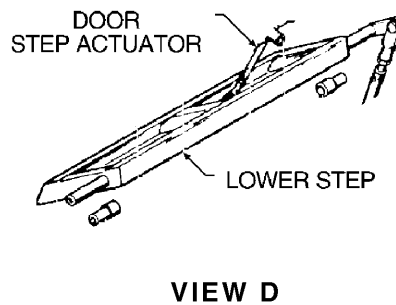
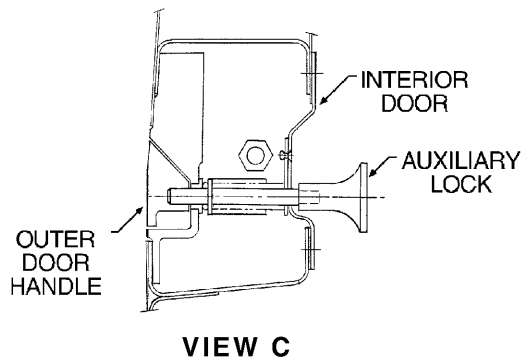
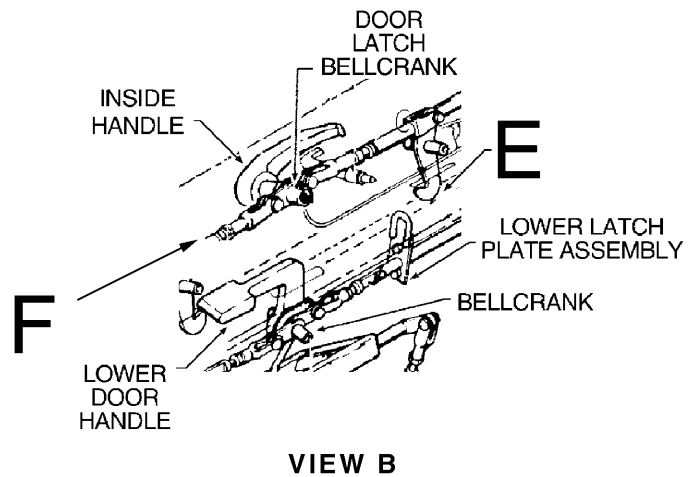
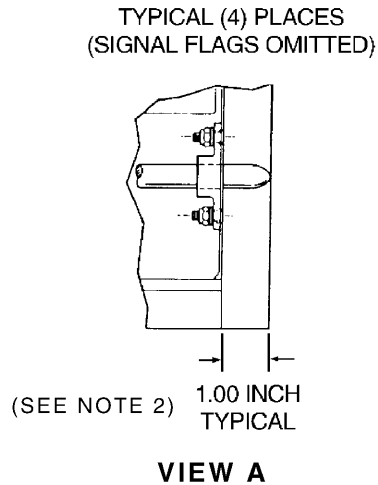
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- NOTES:**
1. With door handle in the open position, adjust steps to open up against stops.
 2. Adjust upper and lower pushrods so that door retaining pins protrude 1.00 inch from door frame. (View A)
 3. Install washers as required up to four (4) maximum to fill gap and minimize end play on shaft. Ensure free rotation of shaft and proper operation of latch mechanism.

Door Locking Mechanism
Figure 1 (Sheet 1 of 2)

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Door Locking Mechanism
Figure 1 (Sheet 2 of 2)

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(2) Installation

(a) To install the door handle bellcrank:

- 1 Position the bellcrank assembly in the door. Ensure that a washer is at each end of the bellcrank.
- 2 Secure the bellcrank assembly with the screw, nut and washer.
- 3 Attach the pushrod clevises to the bellcrank with the pins and washer.
- 4 Rivet the interior bellcrank support to the door.
- 5 Attach the door handle to the bellcrank assembly with the pin.

(b) To install the door retaining pins and pushrod assemblies:

- 1 Slide the door retaining pin into position.
- 2 Place the pushrod assembly into position (the threaded section should point towards the door handle).
- 3 Align the holes in the pushrod clevis, door retaining pin and latch hook. Secure with the pins and washer.
- 4 Attach the remaining pushrod clevis end to the door handle bellcrank with the pins and washers.

NOTE: The door retaining pins should protrude out of the door 1.00 inch with the door handle in the closed position. Make adjustments at the pushrod assembly as required.

(3) Adjustment

- (a) Shut and latch both doors.
- (b) Check gap of hook and latch plate.
- (c) Hook may be filed .053" max. (maintaining the same ramp contour) to provide engagement with plate on lower door assembly. A gap of up to 0.030" maximum between hook and latch plate (with hook fully engaged and without cabin pressure) is acceptable.

C. Lower Door (See Figure 1.)

(1) Removal

(a) To remove the door handle bellcrank:

- 1 Disconnect the pushrod clevises from the bellcrank by removing the pins and washer.
- 2 Remove the bellcrank retaining bolt.
- 3 Remove the rivets which retain the interior bellcrank support to the door channel.
- 4 Remove the screws and nuts which retain the handle to the bellcrank.
- 5 Remove the bellcrank.

(b) To remove the pushrod assemblies and the door retaining pins:

- 1 Disconnect the pushrod clevis from the handle bellcrank by removing the pins and washer.
- 2 Disconnect the pushrod clevis from the door retaining pin by removing the pins and washer.
- 3 Slide the retaining pin out of the door and remove the pushrod assembly.

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(2) Installation

(a) To install the door handle bellcrank:

- 1 Position the bellcrank in door.
- 2 Attach the lever to the bellcrank with the screws, washers and nuts.
- 3 Ensure that washers are positioned at each end of the bellcrank. Insert the bolt through the interior bellcrank support.
- 4 Rivet the support in place and tighten the bolt.

(b) To install the pushrod assemblies and the door retaining pins:

- 1 Position the pushrod assembly in the door. The threaded portion of the pushrod should point towards the bellcrank assembly.
- 2 Secure the pushrod with the pins and washer.
- 3 Slide the door retaining pin into the door.
- 4 Attach the door retaining pin to the pushrod with the pins and washer.

NOTE: The door retaining pins should protrude from the edge of the door approximately 1.00 inch. Make adjustments to the pushrod assembly as required. After installation mechanism must rotate and operate easily through full cycle without friction and binding.

5. Door Seal (See Figure 2.)

NOTE: In S/N's 4636001 thru 4636313 only, if door seal has been damaged by upper door latch pins being extended while the door is moved towards the closed position, install Piper Kit No. 767-387 to preclude reoccurrence.

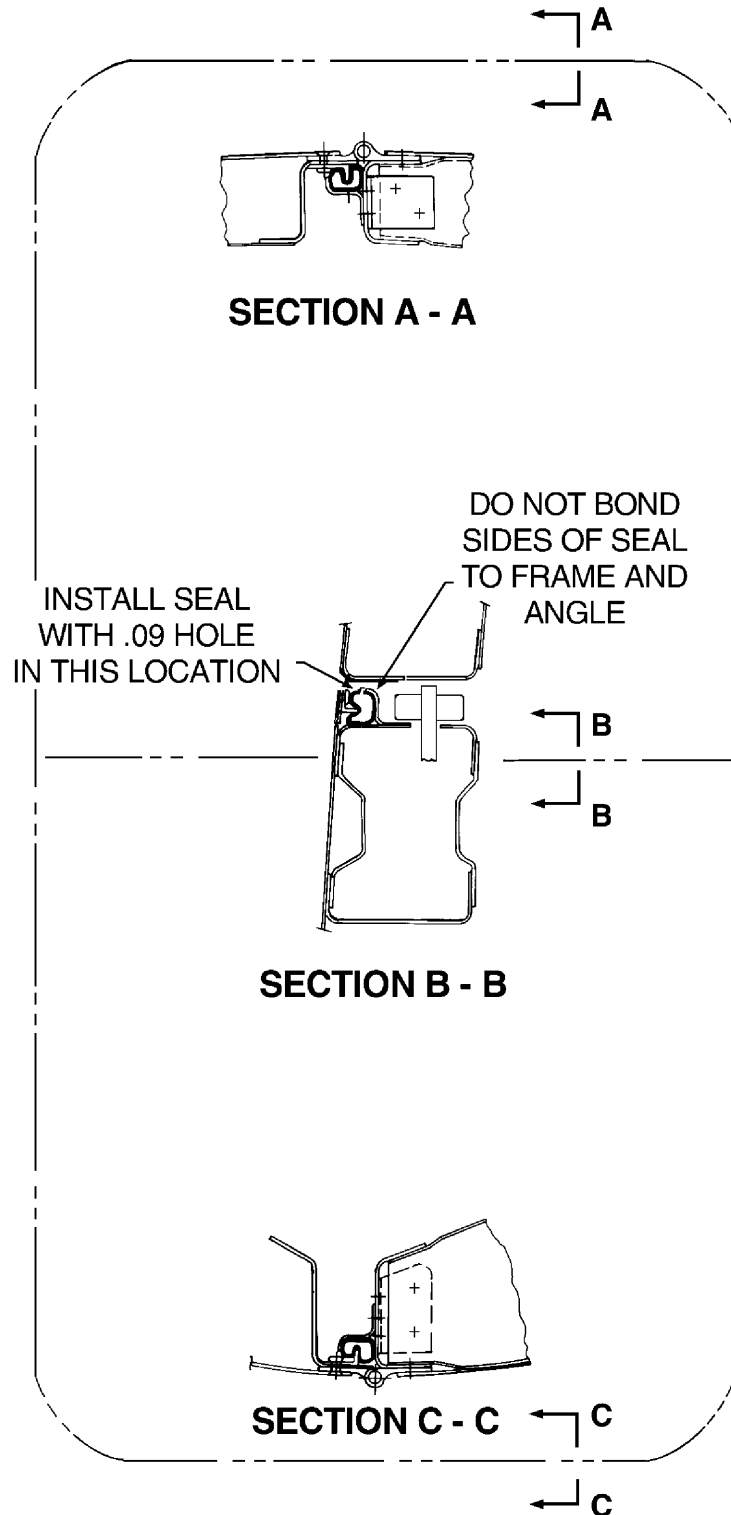
A. Removal

To remove the door seal, pull the cemented surfaces free of the retainer and/or door edge, applying MEK as needed to help loosen the bond.

B. Installation

- (1) Remove any traces of the previous seal and cement.
- (2) Thoroughly clean the areas to be cemented with MEK.
- (3) Bond the seal to the door and/or angle per Figure 2.

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NOTE: Bond seal to angle with GE RTV 157 after cleaning surface with MEK to remove dirt, oil, and/or grease.

Door Seal Installation
Figure 2

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EMERGENCY EXIT

1. Emergency Exit Door

The airplane's emergency exit door is located on the right-hand side of the airplane at the center seat.

A. Removal

To remove the emergency exit door, pull down on the release at the top of the door, bring the top of the door slightly down and lift the entire door towards the center of the aircraft.

B. Installation

To install the door, insert the lower lip of the door on the outboard side of the two stops and push the door outwards until the handle snaps into place on the catch assembly.

2. Seal

A. Removal

Remove the seal by pulling it away from the skin.

B. Installation

- (1) Prepare the surface by removing any remaining trace of the old seal or old cement with a clean rag moistened with MEK.
- (2) Apply a small bead of FAS BOND 10 adhesive or equivalent on the outside radius of the door seal flange and cement the seal in place.

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CARGO

Baggage Compartment Door

The forward baggage compartment is accessed via a separate door located on the left-hand side of the fuselage between the forward pressure bulkhead and the firewall.

A. Removal

- (1) Unlock and unlatch the door.
- (2) Disconnect the door support from the door.
- (3) Lift the door slightly and support it while removing the hinge pin.

B. Installation

- (1) Align the door hinge with the hinge on the fuselage and install the pin. It is recommended that a new pin be used.
- (2) Reconnect the door support to the door.
- (3) Lubricate the pin and close the door.

C. Seal Installation

- (1) Remove any traces of the old seal.
- (2) Clean the surface to be bonded with methylethylketone (MEK) to remove any dirt, oil, and grease.
- (3) Bond the door seal to the retainer with General Electric RTV 157.

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MONITORING AND OPERATION

1. Cabin Door Ajar Warning

A. Description

The cabin door ajar warning system consists of two switches mounted in the W.L. 76.15 and W.L. 71.47 longerons. These switches are activated by the two forward door locking pins pushing on two switch actuating pins. A DOOR AJAR light is provided in the annunciator panel.

B. Troubleshooting

See Chart 1.

**CHART 1
TROUBLESHOOTING CABIN DOOR AJAR WARNING SYSTEM**

Trouble	Cause	Remedy
Cabin door unsafe light will not go out.	Latching relay sticking in the open position.	Lubricate the mechanical parts (sparingly).
	Switch or switches in door frame out of adjustment.	Adjust.
	Short to ground.	Check wiring and repair.
Cabin door unsafe light will not come on.	Circuit breaker open.	Reset circuit breaker.
	Broken wire or loose connection.	Check wiring and repair.

C. Switches

(1) Removal

- (a) Gain access to the switches. They are located approximately four (4) inches in front of each of the forward door locking pins.
- (b) Disconnect the two electrical leads (per switch).
- (c) Loosen the jam nut on the switch and turn the switch body out of the pin support tube assembly.

(2) Installation

- (a) Turn the switch body into the pin support tube assembly. Do not tighten the jam nut at this time.
- (b) Adjust the switches per the following paragraph.
- (c) Reconnect the two electrical leads (per switch).

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(3) Adjustment

- (a) Ensure that the door retaining pins protrude out the side of the door 1.00 inch when the latch mechanism is in the closed position. (See View A, Figure 1, 52-10-00.)
- (b) Close the door and turn the latch mechanism to its locked position.
- (c) Turn the switch body into the pin support tube assembly until the switch activates.
- (d) Tighten the switch jam nut.
- (e) Connect the two leads to the switch.
- (f) Repeat Steps (a) thru (e) for the other switch.

(4) Checks

Periodically check the action of the cabin door switches as follows:

- (a) Insert a small blunt object into the pin support tube receptacle.
- (b) Push on the switch actuating pin until an audible click is heard. Release the pin, noting another audible click.
- (c) Replace any switch in which the click action and mechanical function is doubtful.
- (d) Ensure that the DOOR AJAR light in the annunciator panel comes on when the switch is activated.

2. Baggage Compartment Door Ajar Warning

The baggage door ajar switch is located behind the baggage door latch in the longeron at W.L. 55.46. A DOOR AJAR light is provided in the annunciator panel.

A. Adjustment

Adjust the switch by loosening one of the two locking nuts on the switch body and turning the switch in or out until a slight lifting of the baggage door latch activates the switch.

B. Checks

Periodically check the action of the baggage door switch as follows:

- (1) Slightly lift the baggage door latch, listening for audible clicks when the switch activates and deactivates.
- (2) Ensure that the DOOR AJAR light in the annunciator panel comes on when the switch is activated.

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STABILIZERS

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CHAPTER 55 - STABILIZERS

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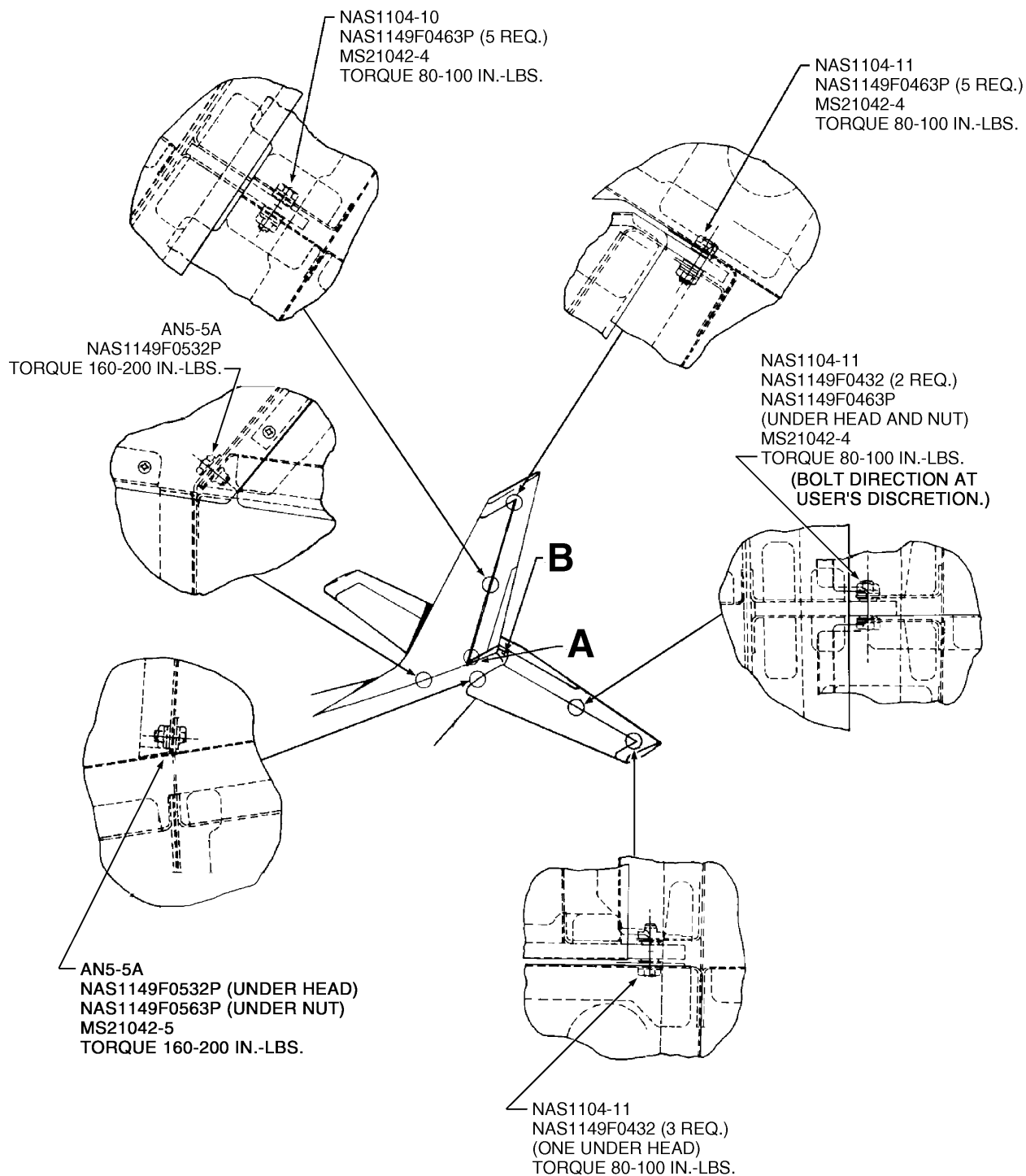
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GENERAL

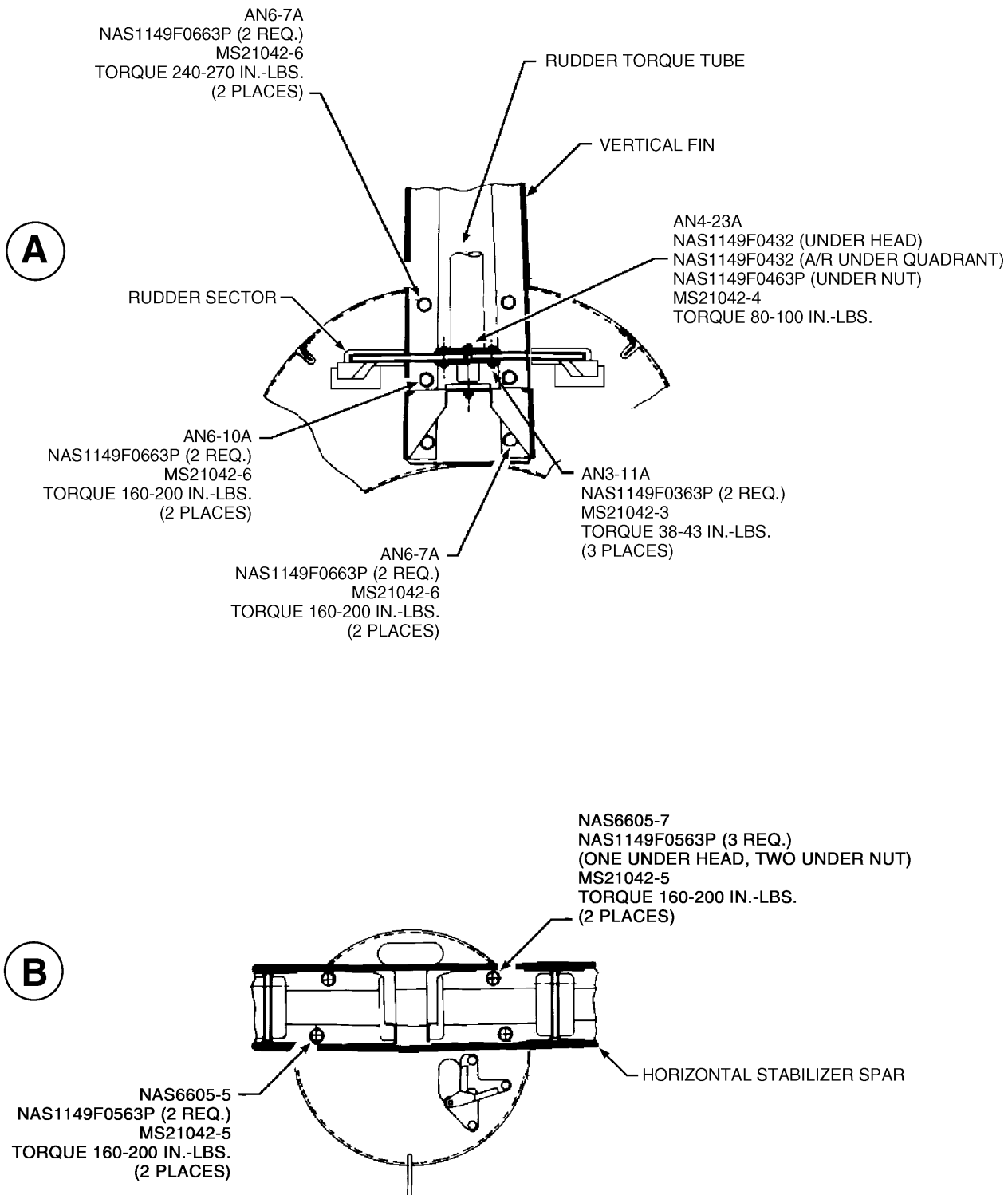
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NOTE: A & B ON SHEET 2.

Empennage Installation
Figure 1 (Sheet 1 of 2)

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Empennage Installation
Figure 1 (Sheet 2 of 2)

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HORIZONTAL STABILIZER

1. Horizontal Stabilizer (Refer to Figure 1, 55-00-00)

A. Removal

- (1) Remove the elevator (refer to 55-20-00).
- (2) Remove the nut, bolt and washer that attaches the stabilizer forward support to the bulkhead (each side).
- (3) Support the stabilizer and remove the nuts, bolts and washers that attach the stabilizer spar to the bulkhead. Remove the stabilizer.

B. Installation

- (1) Position the horizontal stabilizer on the tail section.
- (2) Attach the horizontal stabilizer spar to the bulkhead. Torque the four nuts as specified in Figure 1, 55-00-00.
- (3) Attach the two horizontal stabilizer forward supports to the bulkhead. The bolts should be installed with their heads pointing aft. Torque the bolts as specified in Figure 1, 55-00-00.
- (4) Install the elevator (refer to 55-20-00).
- (5) Check elevator trim and elevator operation (refer to 27-30-00).

2. Attach Fittings Corrosion Control

Each five years, inspect the attach fittings shown in Figures 1 and 2 for corrosion and condition. Repair/replace as required. When inspection and repair/replacement is completed, reapply Dinitrol AV 8 (P/N 89500-800) Corrosion Inhibiting Compound.

NOTE: For all fittings, inspection of the exposed portion is sufficient unless obvious or extensive corrosion is apparent.

NOTE: Any part exhibiting flaking of the metal due to rust must be replaced.

NOTE: If aluminum skin or structure is corroded (beyond a light surface oxidation), the area must be repaired or replaced.

NOTE: On any part being replaced, dip rivets in zinc chromate or equivalent primer and install wet.

A. When inspection and repair or replacement are completed, allow sufficient time for primer to dry, and apply Dinitrol AV 8 to:

- (1) Forward horizontal stabilizer attach points. Inside and outside fuselage. See Figure 2 to add an access hole.
- (2) Aft horizontal stabilizer attach points.
- (3) Entire surface of tail cone interior.

CAUTION: READ PRECAUTIONS ON CONTAINER LABEL AND WEAR A CHARCOAL FILTER MASK WHEN APPLYING DINITROL AV 8.

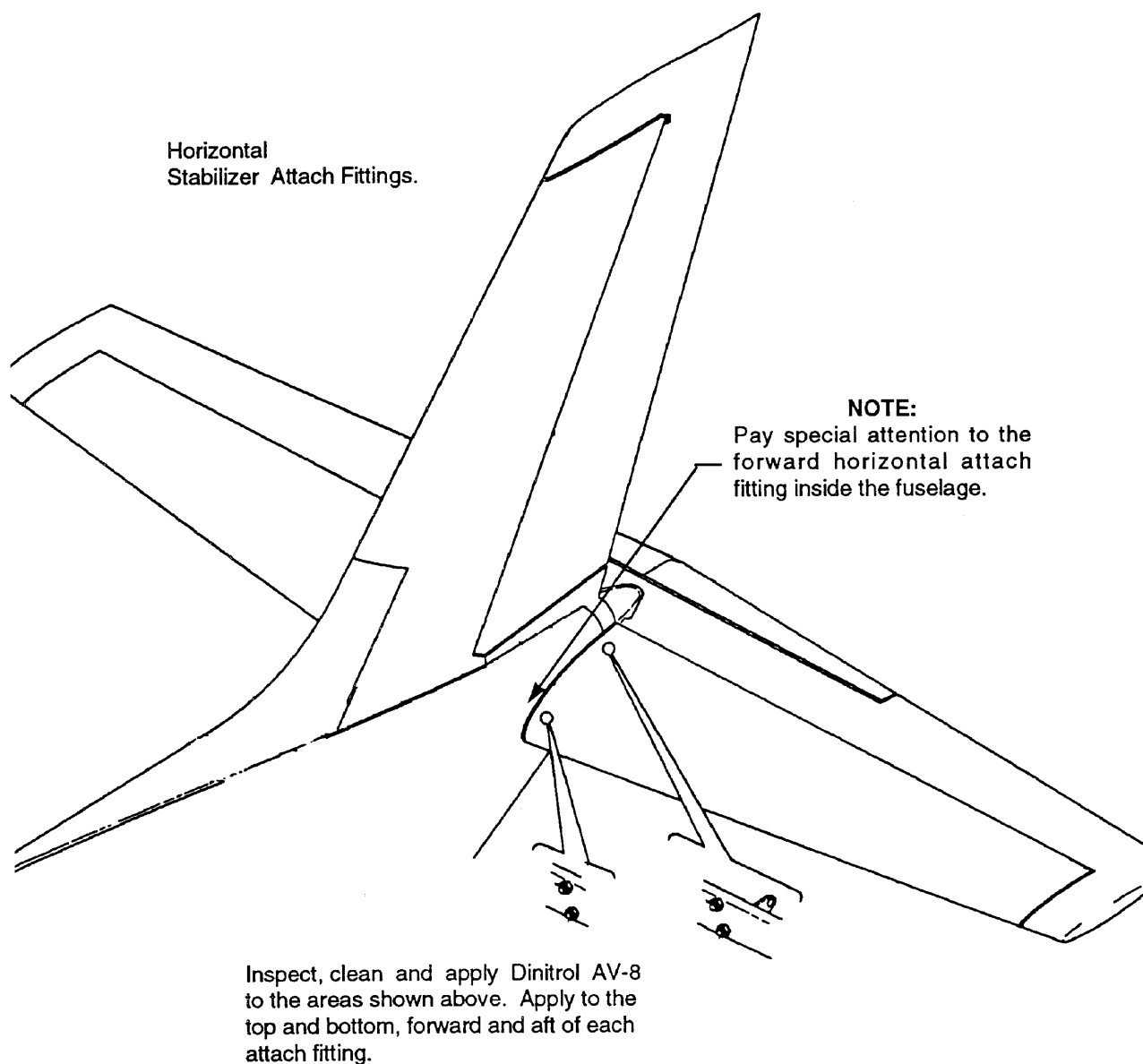
B. Apply Dinitrol by spraying or brush. Use an air or airless spray gun if available. A hand aspirator bottle may be used if a sufficient fan spray pattern can be developed. Product should not be thinned.

C. Cover safety and outflow valves, air conditioning condenser, and other components on the pressure bulkhead. Cover autopilot servos, electrical connectors, and cable pulleys.

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WARNING: DO NOT GET DINITROL INTO AUTOPILOT SERVOS OR CLUTCHES.

- D. Spray directly into faying surfaces and mating points.
- E. Ensure entire attach fitting is treated. Spray inside where the fitting is attached to the structure.
- F. Apply to approximately .8 mils in thickness. Avoid puddling and running. Allow to dry 1 to 1 1/2 hours before airplane use. Full drying takes 6 to 8 hours.

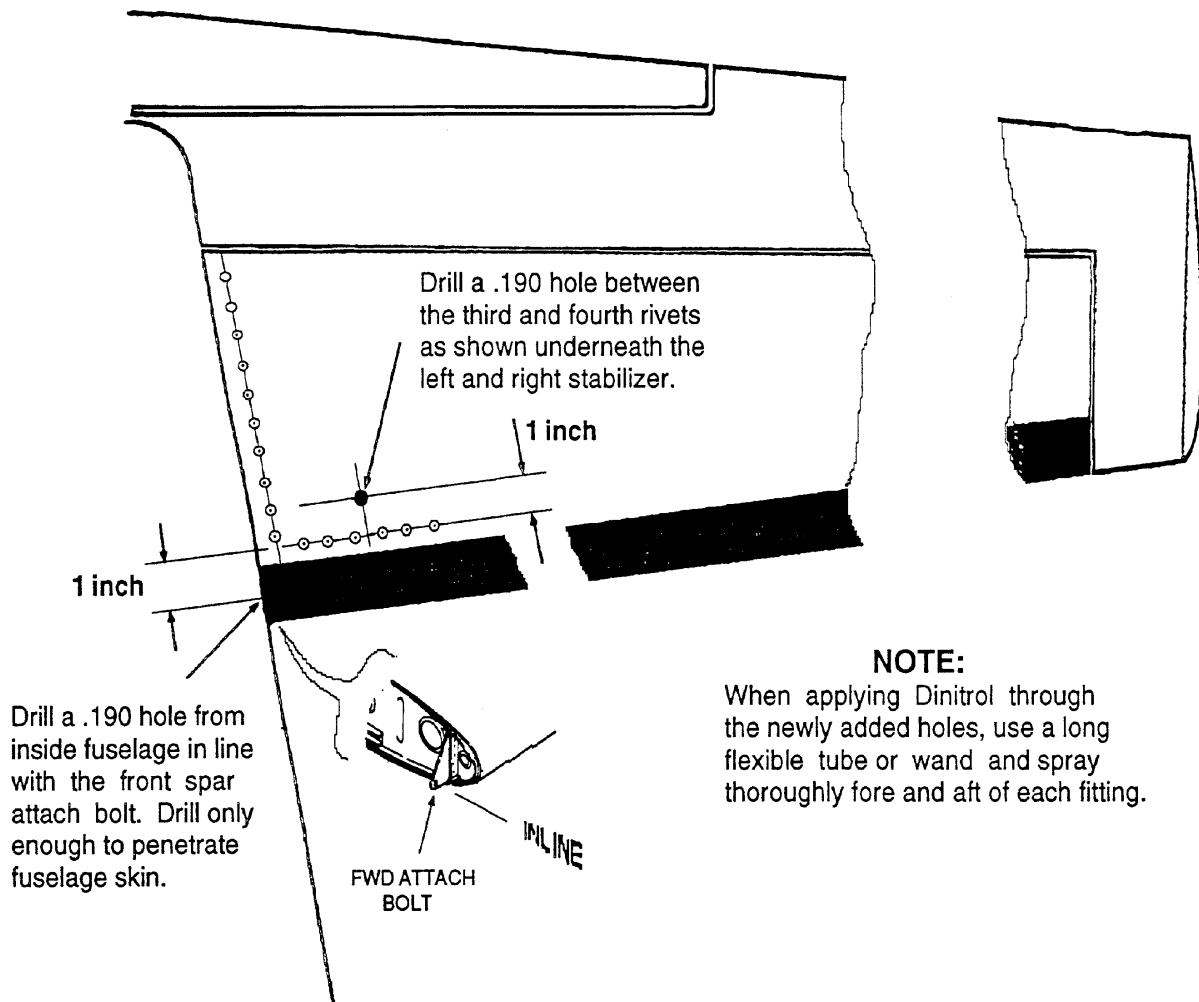


Horizontal Stabilizer Attach Fittings
Figure 1

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VIEW OF TAIL SURFACE
LOOKING UP FROM BOTTOM

Hole location to allow
application of Dinitrol
to attach fittings



Horizontal Stabilizer Forward Attach Fitting Access
Figure 2

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ELEVATOR

1. Elevator (See Figure 1, 55-00-00.)

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

A. Removal

- (a) Disconnect the elevator trim actuating rods at the clevis on the actuator.
- (b) Disconnect the elevator actuating arm at the elevator actuating plate.
- (c) Support the elevator and remove the attaching bolts.
- (d) Remove the elevator from the airplane.

B. Installation

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

- (a) Position the elevator in place on the horizontal stabilizer.
- (b) Attach the elevator to the horizontal stabilizer. Torque the nuts as specified in Figure 1, 55-00-00.
- (c) Connect the elevator actuating arm to the elevator actuating plate.
- (d) Connect the elevator trim actuating rods to the actuator clevis.
- (e) Check elevator trim and elevator operation (refer to 27-30-00).

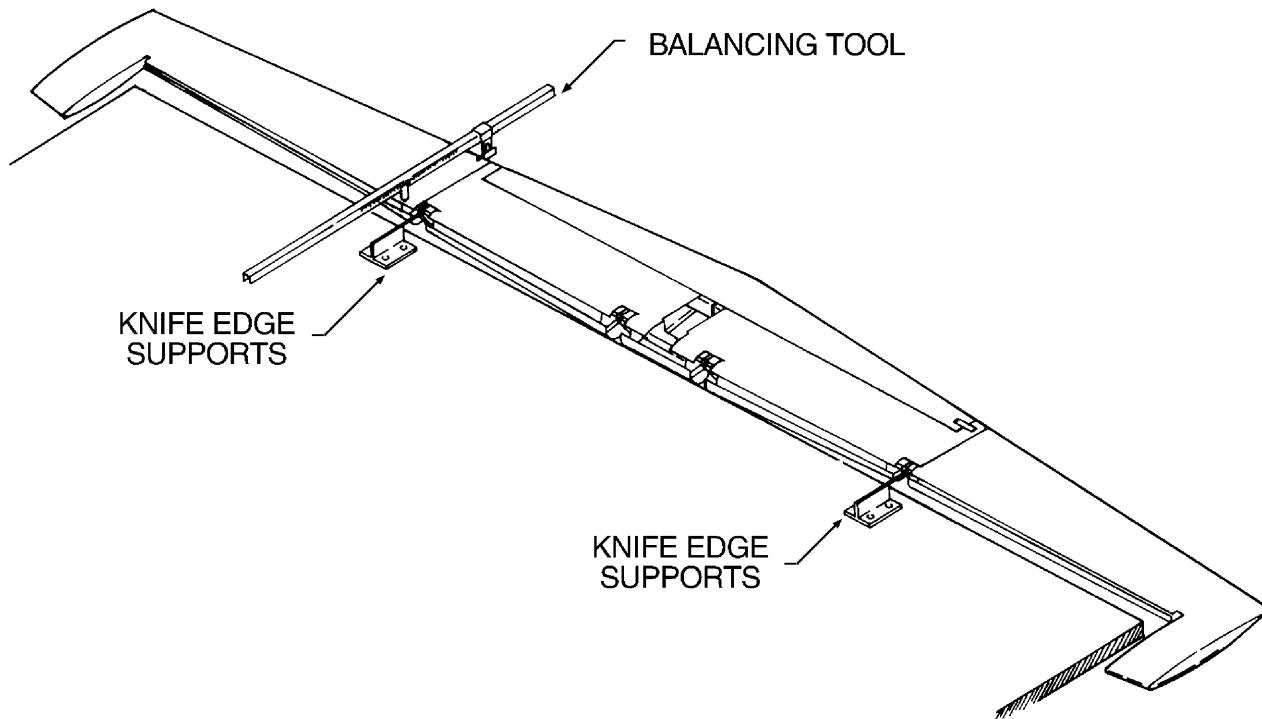
C. Balancing (See Figure 1.)

To balance the elevator, the assembly must be complete including the trim tab (without the tab pushrods), elevator tips and all attaching screws. Before balancing, tape the trim tab in its neutral position with a small piece of tape. Ensure that there are no drafts in the balancing room. Place the complete assembly on the knife edge supports of a balancer with the beam perpendicular to the hinge centerline. Do not place the tool on the trim tab. Calibrate the tool per Balancing Equipment, below. Read the scale when the bubble level has been centered by adjustment of the movable weight and determine the static balance limit (see Chart 1). There are no adjustment provisions on the elevator.

**CHART 1
ELEVATOR STATIC BALANCE LIMITS**

Leading Edge Heavy (Inch-Pounds)	Trailing Edge Heavy (Inch-Pounds)
—	-25 to -50
NOTE: Elevator is balanced with tab installed but without the tab pushrods.	

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Balancing Elevator
Figure 1

D. Balancing Equipment

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 2. Other tool configurations may be used if accuracy is maintained and recalibration capability is provided.

To use this tool:

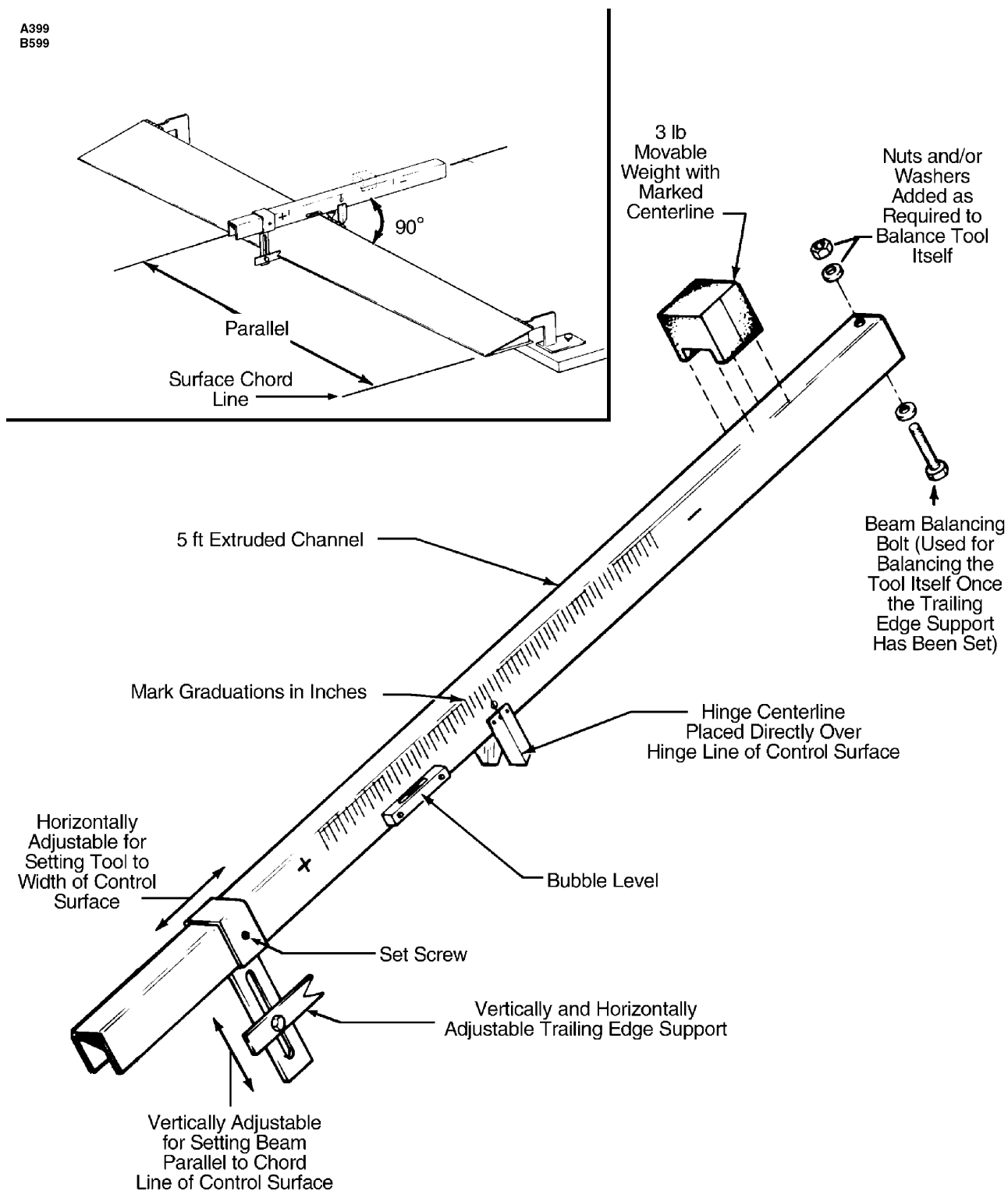
- (1) Insure that the control surface is in its final Flight configuration, static wicks, trim tabs, trim tab push pull rod and control surface tip (as applicable) should be installed. The surface should be painted and trim/servo tabs should be in the neutral position.

NOTE: Because paint is a considerable balance factor, it is recommended that existing paint be removed prior to repainting a control surface.

- (2) Place hinge bolts through control surfaces and place control surface on a holding fixture.
- (3) Calibrate the tool.
 - (a) Avoiding rivets, place the balancing tool on the control surface with the tool's hinge centerline directly over the hinge line of the control surface.
 - (b) Adjust the movable trailing edge support to fit the width of the control surface. Tighten the set screw on the trailing edge support.
 - (c) Adjust the trailing edge support vertically until the beam is parallel with the control surface chord line.
 - (d) Remove the tool from the control surface and balance the tool itself by adding or removing nuts or washers from the beam balancing bolt. When balancing the tool, the movable weight must be at the bar's hinge centerline.

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A399
B599



Control Surfaces Balancing Tool
Figure 2

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- (4) After balancing the tool, reattach it to the control surface per Figures 1 and 2. Keep the beam positioned 90° from the control surface hinge line.
- (5) Determine balance of control surface by sliding movable weight along the balance beam.
- (6) Read the scale when the bubble level has been centered. Multiply by three to determine 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.)

2. Elevator Trim Tab Push Rods Attach Brackets

If the elevator trim tab push rods attach brackets are removed and replaced or reinstalled, ensure that a coat of wet zinc chromate primer is applied between the tab skin and the brackets to eliminate surface corrosion.

3. Elevator Trim Tab Rods Corrosion Control

Each five years, remove the elevator trim tab rods from the airplane and inspect as shown in Figure 3 for corrosion and condition. Repair/replace as required. When inspection and repair/replacement is completed, reapply Dinitrol AV 8 (P/N 89500-800) Corrosion Inhibiting Compound.

NOTE: For all fittings, inspection of the exposed portion is sufficient unless obvious or extensive corrosion is apparent.

NOTE: Any part exhibiting flaking of the metal due to rust must be replaced. The elevator trim tab actuator push rods must be replaced if rust is evident extending from inside the tubes.

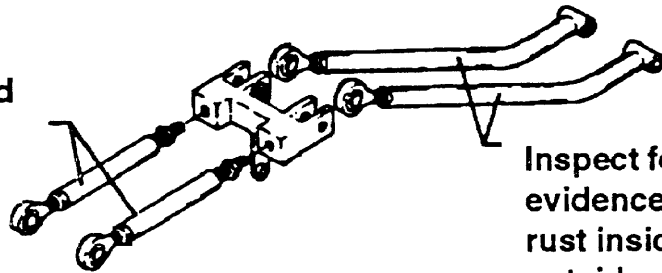
- A. When inspection and repair or replacement are completed, apply Dinitrol AV 8 to elevator trim tab actuator push rod tubes.

CAUTION: READ PRECAUTIONS ON CONTAINER LABEL AND WEAR A CHARCOAL FILTER MASK WHEN APPLYING DINITROL AV 8.

- B. Apply Dinitrol by spraying or brush. Use an air or airless spray gun if available. A hand aspirator bottle may be used if a sufficient fan spray pattern can be developed. Product should not be thinned.
- C. Spray directly into mating points. Pour inside the lower (curved) elevator trim tab actuator push rod tubes until full and drain.
- D. Apply to approximately .8 mils in thickness. Avoid puddling and running. Allow to dry (6 to 8 hours) before reinstalling elevator trim tab rods.

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Inspect for
evidence of
rust inside and
outside.



Inspect for
evidence of
rust inside and
outside.

NOTE:

Inspect, clean and apply Dinitrol AV-8.
Apply inside and outside the tubes shown
above. Replace tubes that show evidence
of rust extending through the tube at any
point.

Elevator Trim Tab Rods
Figure 3

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VERTICAL STABILIZER

1. Vertical Fin (See Figure 1, 55-00-00.)

A. Removal

- (1) Remove the aft fuselage access panel.
- (2) Remove the dorsal fairing.
- (3) Remove the rudder per instructions in this chapter.
- (4) Remove the forward vertical fin attaching bolt.
- (5) Support the fin and remove the aft vertical fin attaching nuts, bolts and washers. Remove the fin from the airplane.

B. Installation

- (1) Position the vertical fin on the airplane.
- (2) Attach the aft vertical fin spar to the fuselage spar with the bolts, nuts and washers. Torque from 160 to 200 in. lbs.
- (3) Attach the forward vertical fin spar to the fuselage spar. Torque the bolt as specified in Figure 1, 55-00-00.
- (4) Attach the rudder to the vertical fin per instructions in this chapter.
- (5) Check the rigging of the rudder (refer to 27-20-00).
- (6) Install the dorsal fairing (seal fairing to skin and fairing recess angle using Bostik Chem-Calk Urethane No. 915 - remove excess sealant) and the aft fuselage access panel.

2. Attach Fitting Corrosion Control

Each five years, inspect the attach fittings shown in Figure 1 for corrosion and condition. Repair/replace as required. When inspection and repair/replacement is completed, reapply Dinitrol AV 8 (P/N 89500-800) Corrosion Inhibiting Compound.

NOTE: For all fittings, inspection of the exposed portion is sufficient unless obvious or extensive corrosion is apparent.

NOTE: Any part exhibiting flaking of the metal due to rust must be replaced.

NOTE: If aluminum skin or structure is corroded (beyond a light surface oxidation), the area must be repaired or replaced.

NOTE: On any part being replaced, dip rivets in zinc chromate or equivalent primer and install wet.

- A. When inspection and repair or replacement are completed, allow sufficient time for primer to dry, and apply Dinitrol AV 8 to forward vertical fin attach point.

CAUTION: READ PRECAUTIONS ON CONTAINER LABEL AND WEAR A CHARCOAL FILTER MASK WHEN APPLYING DINITROL AV 8.

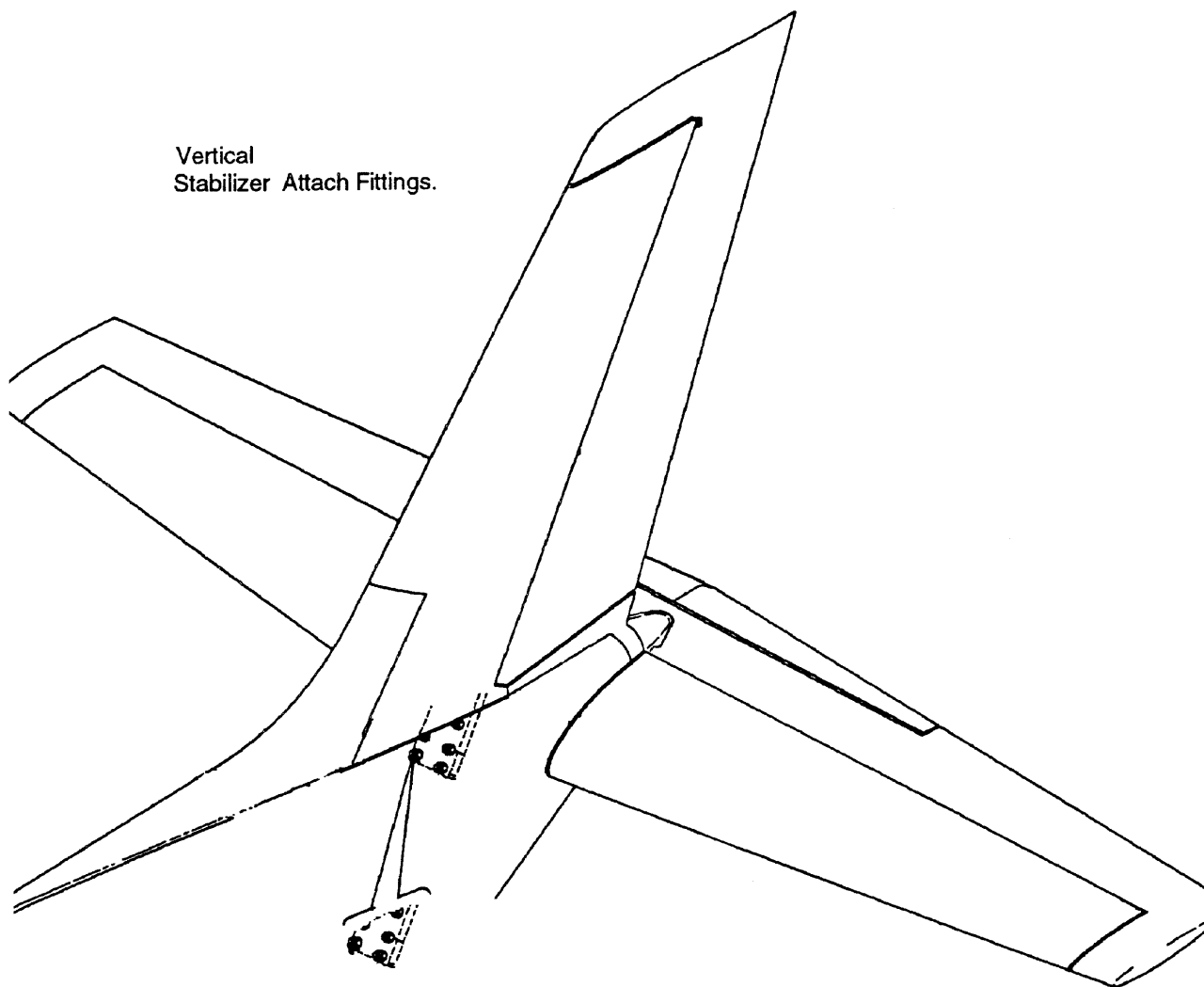
- B. Apply Dinitrol by spraying or brush. Use an air or airless spray gun if available. A hand aspirator bottle may be used if a sufficient fan spray pattern can be developed. Product should not be thinned.
- C. Cover safety and outflow valves, air conditioning condenser, and other components on the pressure bulkhead. Cover autopilot servos, electrical connectors, and cable pulleys.

WARNING: DO NOT GET DINITROL INTO AUTOPILOT SERVOS OR CLUTCHES.

- D. Spray directly into faying surfaces and mating points.

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- E. Ensure entire attach fitting is treated. Spray inside where the fitting is attached to the structure.
- F. Apply to approximately .8 mils in thickness. Avoid puddling and running. Allow to dry 1 to 1 1/2 hours before airplane use. Full drying takes 6 to 8 hours.



Inspect, clean and apply Dinitrol AV-8 to the areas shown above. Apply to the top and bottom, forward and aft of each attach fitting.

Vertical Stabilizer Attach Fittings
Figure 1

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RUDDER

Rudder (See Figure 1, 55-00-00.)

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

A. Removal

- (1) Remove the aft fuselage access panel.
- (2) Remove the rudder cables from the rudder sector, or loosen them if not removing the sector.
- (3) Disconnect the sector from the rudder torque tube by removing 3 bolts, nuts and washers.
- (4) Remove the sector retaining nut, bolt and washers, if sector is to be removed.
- (5) Support the rudder and remove the two sets of rudder hinge retaining bolts, nuts and washers. Remove the rudder from the airplane.

B. Installation

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

- (1) Position the rudder on the airplane.
- (2) Install the two sets of rudder hinge bolts. Torque the nut as specified in Figure 1, 55-00-00.
- (3) If previously removed, install the sector retaining bolt, nut and washers. Torque the nut as specified in Figure 1, 55-00-00.
- (4) Attach the rudder sector to the rudder torque tube. Torque the three (3) nuts as specified in Figure 1, 55-00-00.
- (5) Attach the rudder cables to the sector (if the cables were previously removed).
- (6) Set tension on cables per 27-20-00.
- (7) Check rigging and operation of rudder control system per 27-20-00.
- (8) Install the aft fuselage access panel.

C. Balancing (See Figure 1.)

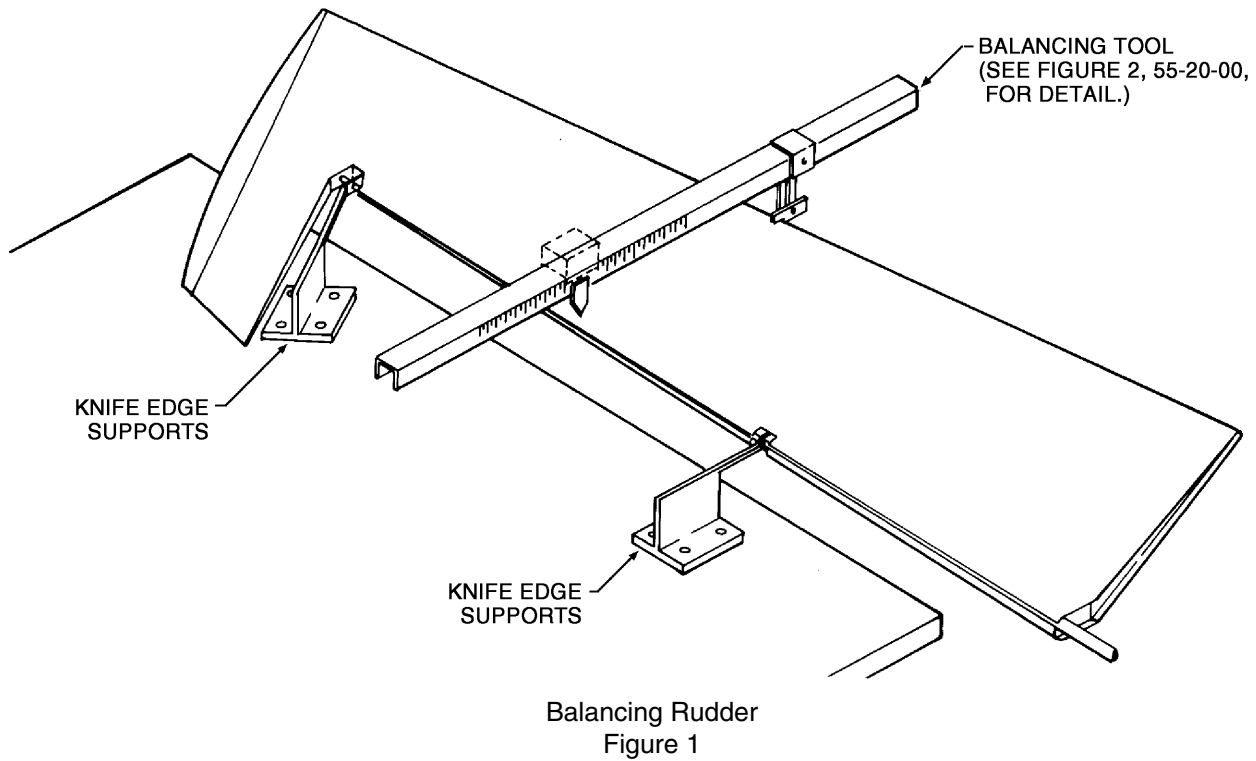
To balance the rudder, the assembly must be complete. Place the complete assembly horizontally on the knife edge support of a balancer. Ensure that there are no drafts in the balancing room. Place the tool on the rudder with the beam perpendicular to the hinge centerline. Calibrate the tool per Balancing Equipment, 55-20-00. 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 Chart 1, proceed as follows:

- (1) Nose Heavy: This condition is highly improbable: recheck calculations and measurements.
- (2) Nose Light: In this case, the rudder is too heavy because of painting or repairs; it will be necessary to strip the paint and repaint the rudder. If the rudder is too heavy as a result of repairs, the repair must be removed and the damaged parts replaced.

**CHART 1
RUDDER STATIC BALANCE LIMITS**

Leading Edge Heavy (Inch-Pounds)	Trailing Edge Heavy (Inch-Pounds)
0	-32.0

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CHAPTER

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WINDOWS

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GENERAL

The airplane is equipped with a two piece windshield and eight cabin windows (one is in the door and one is the emergency exit window).

The pilot's windshield is made of two-ply laminated glass and is heated. The co-pilot's windshield and windows are made of clear stretched acrylic. They are installed with sealant and fasteners as necessary to retain them and prevent water or air leaks.

1. Limitations

- A. If this airplane must be flown with a cracked or crazed window or windshield it must not be flown in a pressurized condition.
- B. Pressurized flights with discoloration or haze should be avoided but, if absolutely necessary while awaiting replacement, flights may be made if careful inspection for crazing is implemented before each flight.

2. Definitions

The following apply to all cockpit and cabin windows and windshields.

Critical	The viewing area of the windshields used for taxiing, takeoff, climb, cruise, and landing.
Semi-Critical	The viewing area used for general flight vision.
Non-Critical	Viewing areas not normally used for flight operations.
Distortion	Lines in windows or windshields that cause waviness in objects when looking through the window or windshield.
Crack	Critical narrow break, fissure, or separation extending through the entire thickness of the transparent material.
Craze	Fissure on the surface of the transparent material that does not penetrate the full thickness of the material.
Crazing	Mesh of fine hairline cracks that do not penetrate the full thickness of the material, located on the surface or within the structure of the transparent material.
Star Craze	A condition where several fissures radiate from a central point.
Wedge	A condition in a piece of optical glass having a progressive variation in thickness or absorption from one side to the other.
Scratch	An abrasion on the surface of the material caused by contact with rough abrasives or sharp objects.
Hairline Scratch	Visible scratch undetectable when passing a fingernail over the scratch. Considered non-critical other than being an appearance defect.
Light Scratch	A scratch measuring less than 0.010 inch (0.254 mm) deep. Can be detected when passing a fingernail over the scratch. Considered non-critical except for appearance.
Heavy Scratch	A scratch measuring more than 0.010 inch (0.254 mm) deep. Can be detected when passing a fingernail over the scratch. This type of scratch may be accompanied by chipping along the edge. Considered critical when occurring to inner glass ply. Considered semi-critical when occurring to outer glass ply within certain limitations (see inspection criteria). Considered non-critical within certain limitations (see inspection criteria) when occurring to acrylic surfaces.
Chip	A chip is considered a small scratch.

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Peel Chip	Peel chips, also known as adhesion chips or cold chips, occur on the laminated surface of a glass ply when the vinyl interlayer pulls a chip of glass out of the glass ply.
Haze	A foggy appearance located on the surface of the transparent material.
Blemish	Speck, air bubble, or other minor imperfection imbedded in the transparent material.
Mark-Off	An almost nonexistent shallow depression on the surface possessing practically no depth. Discernible only due to a noticeable rim or roughened surface caused by mold surface defects transferred to the surface during the forming operation.
Delamination	Visible evidence of a physical break of the bond between the plastic interlayer and either glass ply. Delamination may be caused by laminating stresses, preload on installation, or excessive heat. Cloudy or milky appearance in the delamination indicates moisture or solvent penetration.

3. Inspection and Repair

CAUTION: DAMAGE LIMITS AND REPAIRS STATED HEREIN MUST BE APPLIED CONSERVATIVELY. REWORK OF MULTIPLE CHIPS OR SCRATCHES SHOULD NOT BE ATTEMPTED IN ANY CASE WHERE, WHEN FINISHED, A LINEAR PATTERN WILL HAVE BEEN CREATED.

A. Heated Glass Windshield (Pilot's Side) Inspection

CAUTION: PRESSURIZED FLIGHT PROHIBITED WITH CRACKED OR CRAZED WINDSHIELD.

The pilot's windshield is a two-ply laminated glass containing a heating element.

- (1) Critical Area Inspection. The area of the laminated glass windshield used for taxiing, takeoff, climb, cruise, and landing.
 - (a) Cracks can occur in either the inner, outer, or both glass plies. Cracking in either ply is critical and cause for immediate replacement.
 - (b) Blemishes.
 - 1 Blemishes in windshields form in the vinyl plastic interlayer bonding the two glass plies together.
 - 2 Blemishes in the critical or semi-critical portion of the windshield are not acceptable unless 0.062 inch (1.575 mm) or smaller in circumference, including distorted area.
 - 3 No more than two blemishes, at least 12 inches (30.48 cm) apart are acceptable in the windshield.
 - 4 No more than two blemishes within a two inch (5.08 cm) area along the upper portion of the windshield are acceptable.
 - (c) Haze or foggy appearance on the glass is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.
 - (d) Scratches.
 - 1 Scratches in the outboard surface of the outer glass ply no longer than 0.062 inch (1.575 mm) and no deeper than 0.020 inch (0.508 mm) are allowable.
 - 2 Scratches in the inboard surface of the inner glass ply with a depth less than or equal to 0.002 inch (0.05 mm) are allowable.
 - 3 Scratches which obstruct vision required for safe operation of the aircraft or exceed the above limits are cause for immediate windshield replacement.

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- (e) Delamination.
Delamination is primarily a vision issue. Cloudy or milky appearance in the critical area (i.e. - obstructing vision required for safe operation of the aircraft) is cause for immediate replacement.
- (f) Peel Chips.
 - 1 Delaminated areas characterized by irregular or jagged boundaries indicate uneven separation of the vinyl and glass. This condition may cause the vinyl to pull chips from the inner glass ply, resulting in failure of the glass ply. Conduct periodic inspections to determine if the damage is progressive or if chipping of the inner glass ply is present.
 - 2 Replace windshield if any of the following conditions are noted:
 - a Evidence of chipping of inner glass ply.
 - b Area of vision required for safe operation is affected.
 - c Windshield heat system inoperative.
- (g) Mark-Off of such low intensity that vision quality is not impaired and that is not visible when looking through the windshield is acceptable.
- (h) Distortion. Slight horizontal distortion is acceptable, if: there are no more than two lines; they do not occupy more than 25 percent of the windshield area, and; they are separated by a minimum of six inches (15.24 cm).
- (2) Semi-Critical Area Inspection. The perimeter area of the heated glass windshield used for general flight vision.
 - (a) Blemishes.
 - 1 Blemishes in windshields form in the vinyl plastic interlayer bonding the two glass plies together.
 - 2 Blemishes in the critical or semi-critical portion of the windshield are not acceptable unless 0.062 inch (1.575 mm) or smaller in circumference, including distorted area.
 - 3 No more than two blemishes, at least 12 inches (30.48 cm) apart are acceptable in the windshield.
 - 4 No more than two blemishes within a two inch (5.08 cm) area along the upper portion of the windshield are acceptable.
 - (b) Haze or foggy appearance on the glass is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.
 - (c) Scratches.
 - 1 Scratches in the outboard surface of the outer glass ply no longer than 0.062 inch (1.575 mm) and no deeper than 0.020 inch (0.508 mm) are allowable.
 - 2 Scratches in the inboard surface of the inner glass ply with a depth less than or equal to 0.002 inch (0.05 mm) are allowable.
 - 3 Scratches which obstruct vision required for safe operation of the aircraft or exceed the above limits are cause for immediate windshield replacement.
 - (d) Delamination.
Delamination is primarily a vision issue.
 - 1 Delamination is allowable up to two inches along the perimeter of the daylight opening of the windshield. In the corners, up to four inches is allowable.
 - 2 Windshields exhibiting delamination must be monitored as the condition is usually progressive.

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- 3 Replace windshield if any of the following condition are noted:
 - a Delamination exceeds allowable limits.
 - b Area of vision required for safe operation is affected.
 - c Windshield heat system inoperative.
 - (e) Peel Chips.
 - 1 Delaminated areas characterized by irregular or jagged boundaries indicate uneven separation of the vinyl and glass. This condition may cause the vinyl to pull chips from the inner glass ply, resulting in failure of the glass ply. Conduct periodic inspections to determine if the damage is progressive or if chipping of the inner glass ply is present.
 - 2 Replace windshield if any of the following condition are noted:
 - a Evidence of chipping of inner glass ply.
 - b Area of vision required for safe operation is affected.
 - c Windshield heat system inoperative.
 - (f) Mark-Off of such low intensity that vision quality is not impaired and that is not visible when looking through the windshield is acceptable.
 - (g) Distortion.
 - 1 A moderate amount of distortion is acceptable along the lower portion of the windshield if no more than 1.5 inches (3.81 cm) above the windshield retainer strip.
 - 2 Distortion may not be so severe that it restricts vision or diverts runway lines or section lines more than 45°.
 - 3 Slight horizontal distortion is acceptable, if: there are no more than two lines; they do not occupy more than 25 percent of the windshield area, and; they are separated by a minimum of six inches (15.24 cm).
- B. Acrylic Windshield (Co-Pilot's Side) Inspection

CAUTION: PRESSURIZED FLIGHT PROHIBITED WITH CRACKED OR CRAZED WINDSHIELD.

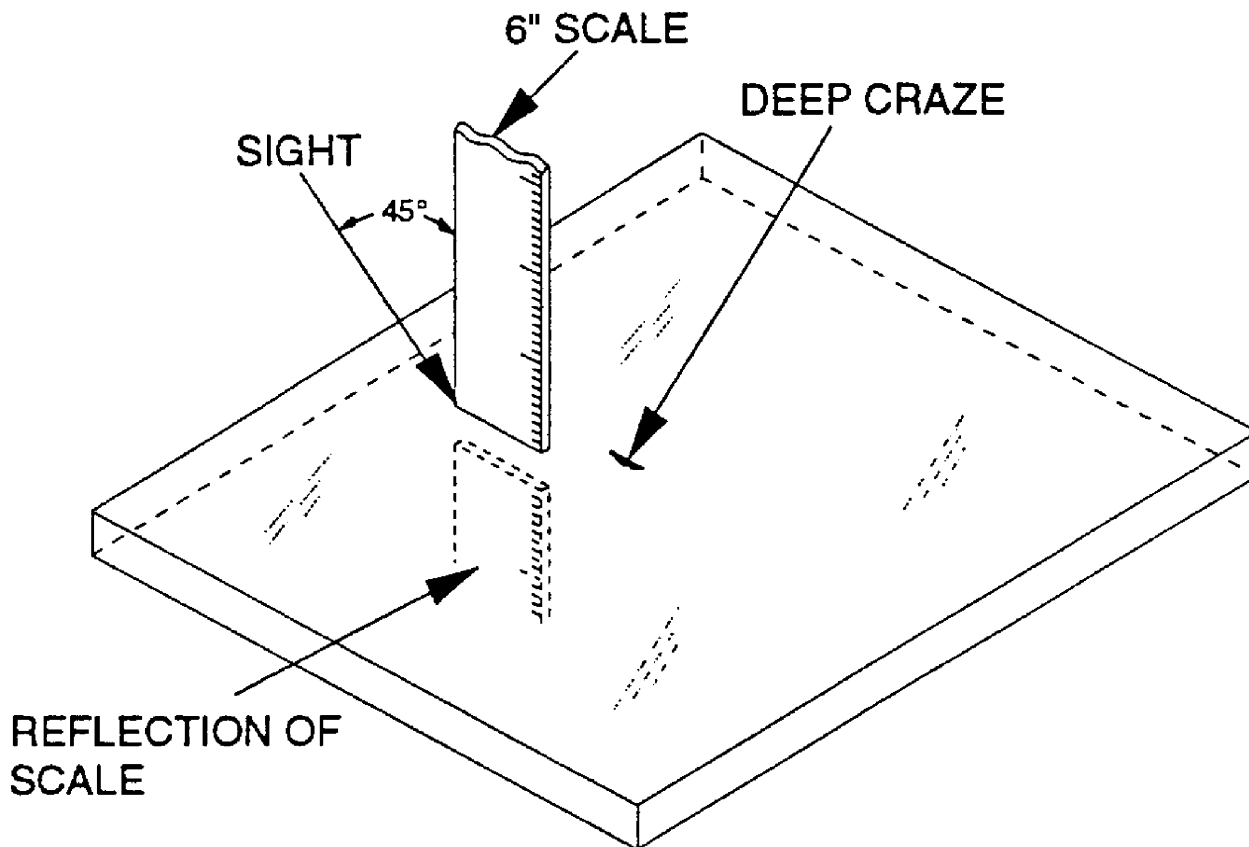
The co-pilot's windshield is formed from 0.312 inch thick acrylic.

- (1) Critical Area Inspection. The area of the acrylic windshield used for taxiing, takeoff, climb, cruise, and landing.
 - (a) Cracking in the windshield is critical and cause for immediate replacement. Inspect per Crack Inspection - Acrylic Windows and Windshields, below.
 - (b) Crazing.
 - 1 Crazing in the windshield is critical.
 - 2 Determine depth of craze using a calibrated depth gauge or scale (see Figure 1).
 - 3 A craze of 0.062 inch (1.575 mm) depth is cause for immediate replacement. A craze of 0.031 inch (0.787 mm) depth is cause for replacement at the earliest opportunity.
 - 4 Crazing in any portion of the windshield requires replacement.
 - (c) Haze or foggy appearance is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.

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- (d) Scratches.
 - 1 Limits:
 - 1.5 inch (38.1 mm) long
 - 0.031 inch (0.787 mm) deep
 - 0.2 inch (5.080 mm) wide
 - 0.25 in² (1.613 cm²) total area
 - 2 No more than two allowed per 10 in² (64.516 cm²) of area (i.e. - an area approximately 3.16 inch by 3.16 inch).
 - 3 Scratches exceeding these limits are cause for immediate windshield replacement / rework (see Window / Windshield Repair / Rework, below).
 - (e) Mark-Off of such low intensity that vision quality is not impaired and that is not visible when looking through the windshield is acceptable.
 - (f) Distortion. Slight horizontal distortion is acceptable, if: there are no more than two lines; they do not occupy more than 25 percent of the windshield area, and; they are separated by a minimum of six inches (15.24 cm).
- (2) Semi-Critical Area Inspection. The perimeter area of the acrylic windshield used for general flight vision.
- (a) Crazing.
 - 1 Crazing in the windshield is critical.
 - 2 Determine depth of craze using a calibrated depth gauge or scale (see Figure 1).
 - 3 A craze 0.031 inch (0.787 mm) deep is cause for replacement at the earliest opportunity.
 - 4 Crazing in any portion of the windshield requires replacement.
 - (b) Haze or foggy appearance is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.
 - (c) Scratches.
 - 1 Scratches in acrylic windshields may be reworked per Window / Windshield Repair / Rework, below, if:
 - a They are less than 0.030 inch (0.762 mm) deep.
 - b Windshield is a minimum of 0.279 inch (7.087 mm) thick after rework.
 - c No vision distortions in critical and semi-critical areas as a result of rework.
 - 2 Replace acrylic windshields with scratches that cannot be reworked in accordance with these standards.
 - (d) Mark-Off of such low intensity that vision quality is not impaired and that is not visible when looking through the windshield is acceptable.
 - (e) Distortion.
 - 1 A moderate amount of distortion is acceptable along the lower portion of the windshield if no more than 1.5 inches (3.81 cm) above the windshield retractor strip.
 - 2 Distortion may not be so severe that it restricts vision or diverts runway lines or section lines more than 45°.
 - 3 Slight horizontal distortion is acceptable, if: there are no more than two lines; they do not occupy more than 25 percent of the windshield area, and; they are separated by a minimum of six inches (15.24 cm).

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Determining Depth of Craze
Figure 1

C. Acrylic Window (Cockpit) Inspection

CAUTION: PRESSURIZED FLIGHT PROHIBITED WITH CRACKED OR CRAZED WINDOW.

- (1) The cockpit windows are formed from 0.250 inch thick acrylic.
- (2) Semi-Critical Area Inspection. The areas of cockpit acrylic windows used for general flight vision.
 - (a) Cracks.

Inspect for cracks per Crack Inspection - Acrylic Windows and Windshields, below.
 - (b) Crazing.
 - 1 Crazing in the windows is critical.
 - 2 Determine depth of craze using a calibrated depth gauge or scale (see Figure 1).
 - 3 A craze 0.050 inch (1.270 mm) deep is cause for immediate replacement. A craze 0.025 inch (0.635 mm) deep is cause for replacement at the earliest opportunity.
 - 4 Crazing in any portion of a window requires replacement.
 - (c) Haze or foggy appearance is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.

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- (d) Scratches.
 - 1 Limits:
 - 1.5 inch (38.1 mm) long
 - 0.025 inch (0.635 mm) deep
 - 0.2 inch (5.080 mm) wide
 - 0.25 in² (1.613 cm²) total area
 - 2 No more than two allowed per 10 in² (64.516 cm²) of area (i.e. - an area approximately 3.16 inch by 3.16 inch).
 - 3 Scratches exceeding these limits are cause for immediate windshield replacement / rework (see Window / Windshield Repair / Rework, below).
 - 4 Scratches in acrylic cockpit windows may be reworked per Window / Windshield Repair / Rework, below, if:
 - a They are less than 0.025 inch (0.635 mm) deep.
 - b Window is a minimum of 0.225 inch (5.715 mm) thick after rework.
 - c No vision distortions in critical and semi-critical areas as a result of rework.
 - 5 Replace acrylic windows with scratches that cannot be reworked in accordance with these standards.
- (e) Mark-Off of such low intensity that vision quality is not impaired and that is not visible when looking through the windshield is acceptable.
- (f) Distortion.
 - 1 A moderate amount of distortion is acceptable along the lower portion of the windshield if no more than 1.5 inches (3.81 cm) above the windshield retractor strip.
 - 2 Distortion may not be so severe that it restricts vision or diverts runway lines or section lines more than 45°.
 - 3 Slight horizontal distortion is acceptable, if: there are no more than two lines; they do not occupy more than 25 percent of the windshield area, and; they are separated by a minimum of six inches (15.24 cm).

D. Acrylic Window (Cabin) Inspection

CAUTION: PRESSURIZED FLIGHT PROHIBITED WITH CRACKED OR CRAZED WINDOW.

- (1) The cabin windows are formed from 0.210 inch thick acrylic.
- (2) Non-Critical Area Inspection. Any portion of a window not used for flight vision.
 - (a) Cracks.

Inspect for cracks per Crack Inspection - Acrylic Windows and Windshields, below.
 - (b) Crazing.
 - 1 Crazing in the windows is critical.
 - 2 Determine depth of craze using a calibrated depth gauge or scale (see Figure 1).
 - 3 A craze of 0.043 inch (1.092 mm) depth is cause for immediate replacement. A craze 0.021 inch (0.533 mm) deep is cause for replacement at the earliest opportunity.
 - 4 Crazing in any portion of a window requires replacement.
 - (c) Haze or foggy appearance on the glass is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.
 - (d) Mark-Off in moderate amounts is acceptable provided that visibility is not impaired.

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(e) Distortion.

- 1 Distortion along the sides of the window within 0.5 inches (12.70 mm) or less of the retainer is acceptable.
- 2 Distortion along the upper portion of the window is acceptable if distortion does not extend downward more than 2.00 inches (50.8 mm) from the top and does not impair vision.
- 3 Distortion of the main body of the side window is acceptable providing the distorted area does not exceed 25 percent of the window area.

E. Crack Inspection - Acrylic Windows and Windshields

CAUTION: PRESSURIZED FLIGHT PROHIBITED WITH CRACKED OR CRAZED WINDOW/WINDSHIELD.

- (1) Perform this inspection annually or each 1,000 hours, whichever occurs first.

NOTE: This inspection should also be performed after repainting when any chemical stripping agent was used. Use the prism method described in step (3), below, to inspect the entire circumference of the window for stripper damage/etching; especially in areas concealed by window frames, retainers, plates, or collars.

- (2) Inspect window panes as follows:

- (a) Inspect sealant for signs of wear, deterioration, and positive contact with mounting surfaces.
- (b) Inspect window frames, retainers, plates, and collars for cracks, loose rivets or screws, corrosion, and structural defects.

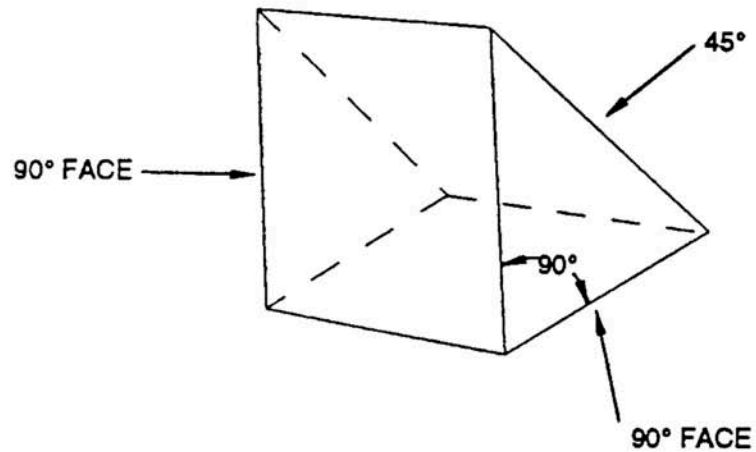
- (3) Inspect bolt holes in windows and co-pilot's windshield as follows, using Window Inspection Kit - P/N 766-294. (A 45° acrylic prism and glycerin may be used if kit not available.)

- (a) Clean area to be inspected with soap and water to ensure surface is free of oil, dirt, and wax.
- (b) Determine which immersion oil to use: Type A in cold weather; Type B in hot weather.
- (c) Apply a small amount of oil to the surface of window adjacent to bolt hole. On initial application, use a small amount of oil applied directly to one 90° face of inspection prism in contact with glass or acrylic (see Figure 2).
- (d) Press oiled face of prism to glass or acrylic. Slide prism around until a constant film of oil extends across prism face and window surface.
- (e) Look into 90° face of prism (see Figure 2). The image of an unfractured fastener hole will appear as a frosty cylinder.
- (f) If hole is countersunk, cylinder will appear to have a cone setting on one end as seen in Figure 2.
- (g) The image of a cracked hole will appear as a frosty or reflective projection extending from the hole (see detail A-A, Figure 3).
- (h) The image of a crack from one hole to another will appear as a frosty or reflective irregular surface (see detail B-B, Figure 3).

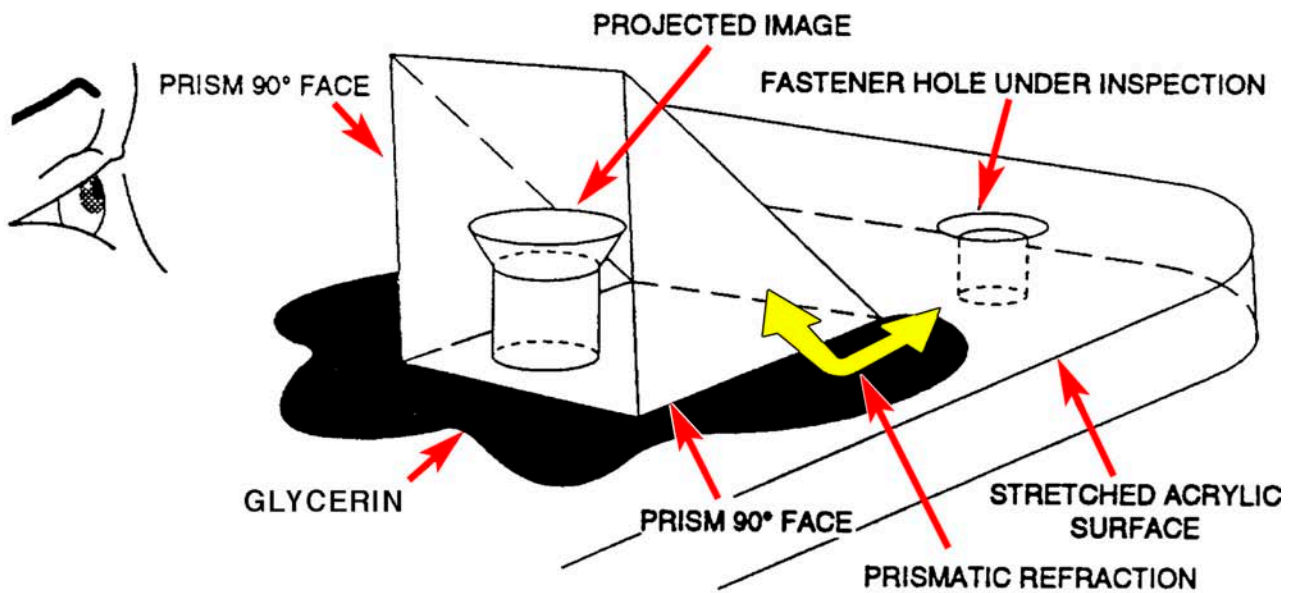
- (4) Crack Limitation.

- (a) The maximum acceptable length of a crack from any single screw hole is 0.300 inch (7.62mm).
- (b) The maximum combined length of multiple cracks into the space between two adjacent bolt holes is 0.300 inch (7.62mm) (see Figure 3).

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A. PRISM FACES



B. PRISM INSPECTION

Visual Inspection
Figure 2

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- (c) If a crack less than 0.300 inch (7.62mm) is left unrepaired, reinspect the window each additional 25 hours of aircraft operation.
 - (d) A maximum of three bolt holes with cracks less than 0.299 inch (7.59mm) long are acceptable in any one window pane before that window pane must be replaced.
 - (e) Replace window pane if a single crack or combination of adjacent facing cracks exceed 0.300 inch (7.62mm) in length.
- (5) Chips, Scratches, and Crazing Limitations.

CAUTION: DAMAGE LIMITS AND REPAIRS STATED HEREIN MUST BE APPLIED CONSERVATIVELY. REWORK OF MULTIPLE CHIPS OR SCRATCHES SHOULD NOT BE ATTEMPTED IN ANY CASE WHERE, WHEN FINISHED, A LINEAR PATTERN WILL HAVE BEEN CREATED.

- (a) Scratches in acrylic windows and the co-pilot's windshield may be reworked (see Window / Windshield Repair / Rework, below) as follows:
 - 1 Co-pilot's windshield - scratch is less than 0.030 inch (0.762 mm) deep and windshield is a minimum of 0.279 inch (7.087 mm) thick after rework.
 - 2 Cockpit side windows - scratch is less than 0.025 inch (0.635 mm) deep and window is a minimum of 0.225 inch (5.715 mm) thick after rework.
 - 3 Cabin side windows - scratch is less than 0.021 inch (0.533 mm) deep and window is a minimum of 0.189 inch (4.800 mm) thick after rework.
 - 4 No vision distortions in critical and semi-critical areas as a result of rework.
- (b) Replace acrylic windows with scratches that cannot be reworked in accordance with these standards.

- F. Window / Windshield Repair / Rework Procedure (Acrylic Windows / Co-Pilot's Windshield Only). The following methods should be used for repairs:

CAUTION: ANY ACRYLIC WINDOW WHICH MAY HAVE BEEN DAMAGED BY PAINT THINNER, PAINT REMOVER OR OTHER SOFTENING AGENT MUST BE REPLACED. NO REPAIR IS PERMITTED FOR THIS TYPE OF DAMAGE.

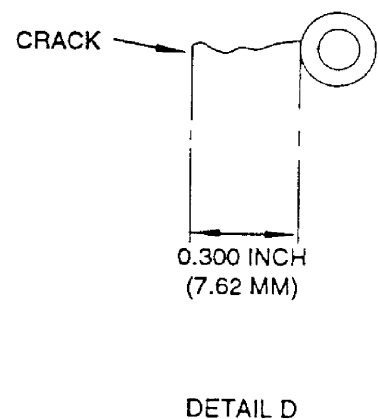
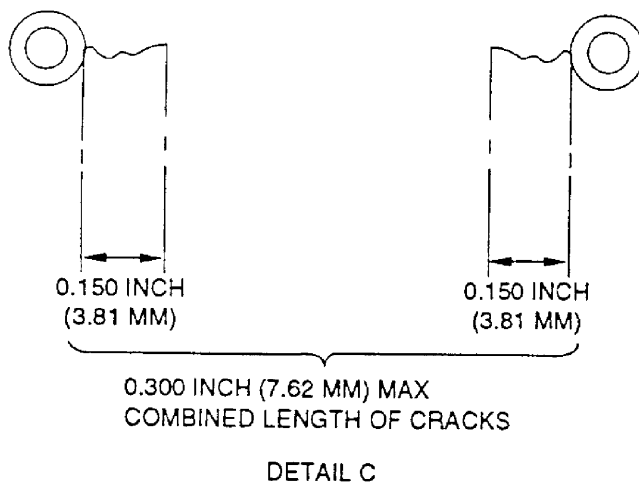
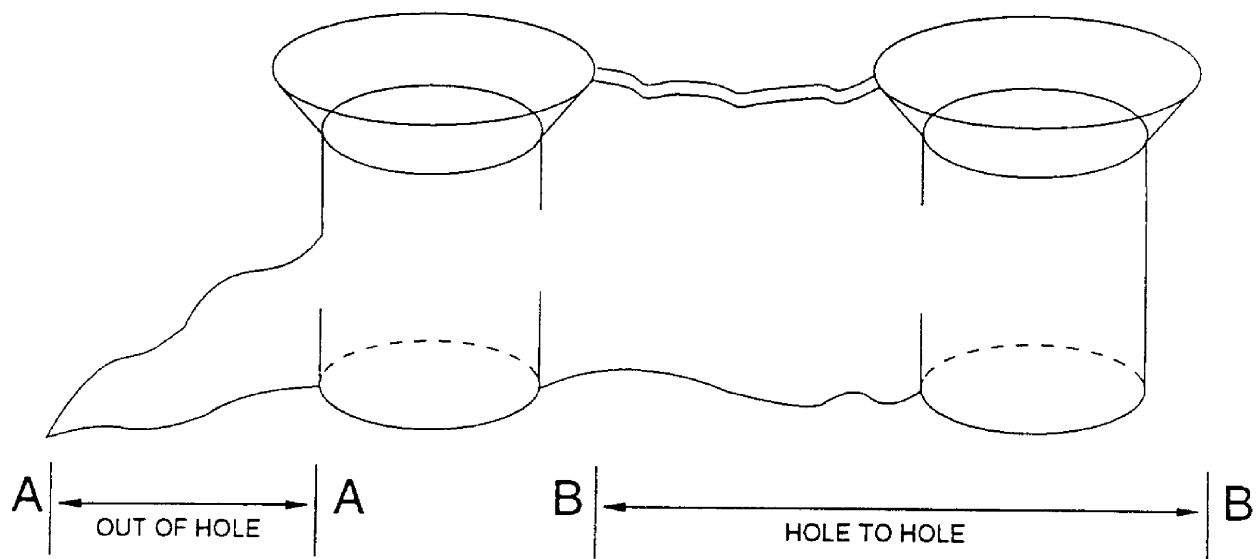
CAUTION: DAMAGE LIMITS AND REPAIRS STATED HEREIN MUST BE APPLIED CONSERVATIVELY. REWORK OF MULTIPLE CHIPS OR SCRATCHES SHOULD NOT BE ATTEMPTED IN ANY CASE WHERE, WHEN FINISHED, A LINEAR PATTERN WILL HAVE BEEN CREATED.

Rework the damaged area to the depth of the damage, approximately twice the length and three times the width, removing all sharp edges.

- (1) Areas with small scratches:
 - (a) Clean the window, using generous amounts of water and a mild detergent.
 - (b) Polish the window with an approved compound and soft cloth.
 - (c) Clean and wax the polished area.
- (2) Areas with large scratches, gouges, and nicks: Areas with damages exceeding .003 of an inch depth or those with less than .003 of an inch in depth, having sharp edges which cause hanging of fingernail should be locally rounded out or buffed.
 - (a) Clean the window using generous amounts of water and a mild detergent.
 - (b) Use a scratch removal kit, such as the type supplied by Micro-Surface Finishing Products Inc., P.O. Box 456, Wilton, Iowa, to remove the defective area, blend and buff.
 - (c) Using 400A wet or dry abrasive paper wrapped around a smooth rubber block and generous amounts of water, lightly sand over and around the defected area in a circular motion, extending in a diameter equal to two or three times the defected area.

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- (d) Continue sanding until the initial defect is no longer apparent. Thoroughly flush the area with water.
- (e) Using 600A wet or dry abrasive paper, repeat step (c). Continue sanding only until the hairline scratches caused by the coarse sanding are no longer apparent. Sand a larger area than that covered by the original sanding operation. Thoroughly wash the area.
- (f) Finish the repair using instructions given in paragraph (1), above.



Crack Limitations
Figure 3

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FLIGHT COMPARTMENT

1. Windshield

A. Removal

- (1) If removing the pilot's windshield (i.e. - heated), disconnect the battery and remove external power connections, if any.
- (2) Remove all screws which attach the windshield to the retainer and the retainer to the fuselage.
- (3) If removing heated windshield, disconnect black ground wire from tooling hole near instrument panel support clip.
- (4) Remove the retainer.
- (5) Remove the windshield.

B. Installation

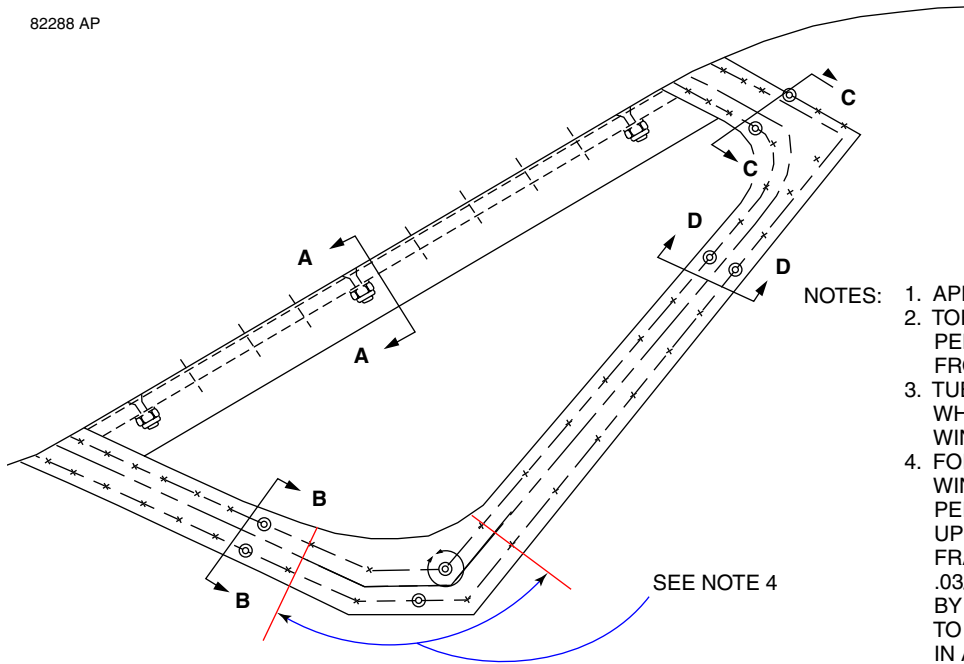
- (1) If the old retainer is being reused, remove all traces of the old sealant from its inside surface.
- (2) Remove all traces of the old sealant from the shims, windshield mounting angles and retainer mating surfaces.
- (3) All corners must be broken and all edges smooth and free of tool marks.
- (4) Check fit the windshield to the fuselage to ensure that it will fit the contour of the fuselage. If replacing the co-pilot's windshield (i.e. - acrylic), trim excess material as required.
- (5) If using a new retainer:
 - (a) Check fit and trim to fit as required. The areas most likely to require trimming are the lower left outboard side and along the bottom edge near the center post.
 - (b) Using the old retainer as a template, drill .191 inch screw holes. Countersink the screw holes .380 in. dia. x 100 degrees.

NOTE: For the pilot's heated glass windshield, apply a parting agent (Polyvinyl Alcohol, P/N 915-936, or equivalent) to the faying surface of the retainer and do not install silicone rubber tubes in the screw holes as described in step (6), below.

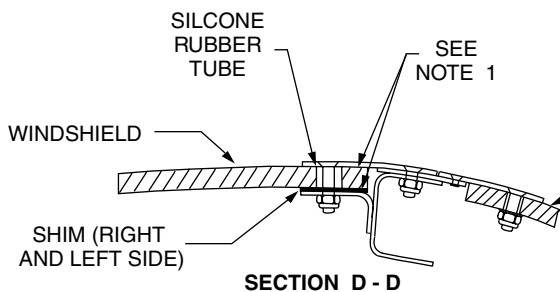
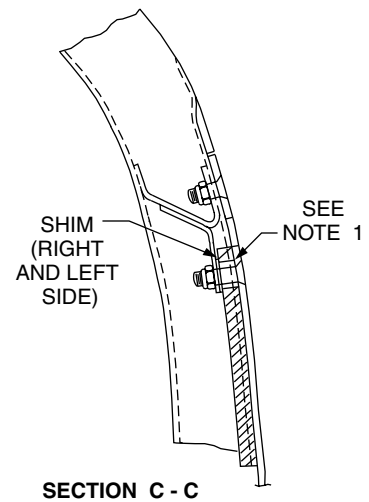
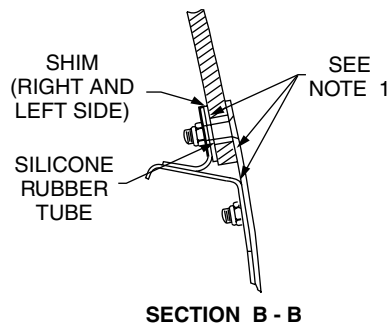
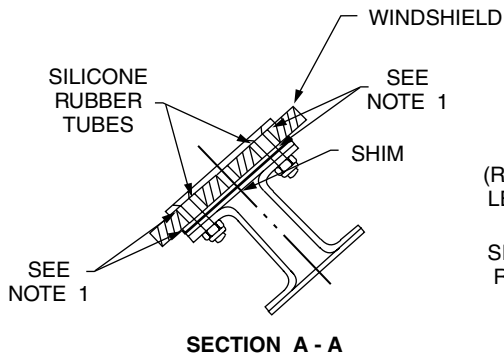
- (6) Apply sealant per Figure 1 and install windshield insuring that a silicone rubber tube is installed in each tooling hole in the windshield. Torque any fasteners which penetrate the windshield as specified in Figure 1.
- (7) If installing glass heated windshield, connect black ground wire to tooling hole near instrument panel support clip with a MS35206-215 screw, AN960-4 washer, MS35338-41 lock washer, and a MS21044N04 nut.
- (8) Install the retainer.
- (9) Conduct the Pressurization System Test, 21-30-00.
- (10) Reconnect the battery and, if desired, external power.
- (11) Conduct the Heated Windshield Test, 30-40-00.
- (12) Prime and paint as desired.
- (13) Make a proper logbook entry documenting this installation.

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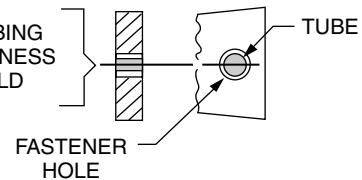
- NOTES:
1. APPLY SEALANT HERE.
 2. TORQUE ALL FASTENERS WHICH PENETRATE THE WINDSHIELD FROM 19 TO 22 INCH POUNDS.
 3. TUBING NOT REQUIRED WHEN GLASS HEATED WINDSHIELD IS INSTALLED.
 4. FOR PILOT'S HEATED GLASS WINDSHIELD ONLY, IT IS PERMISSABLE TO REMOVE UP TO .10 INCH OF FIBERGLASS FRAME EDGE TO ACHIEVE .03/.06 INCH EDGE CLEARANCE BY SANDING PERPENDICULAR TO EDGE WITH (MAX) 220 GRIT, IN AREA SHOWN ONLY. REFINISH SANDED EDGE WITH FLAT BLACK ENAMEL PAINT.



PILOTS WINDOW (REF)

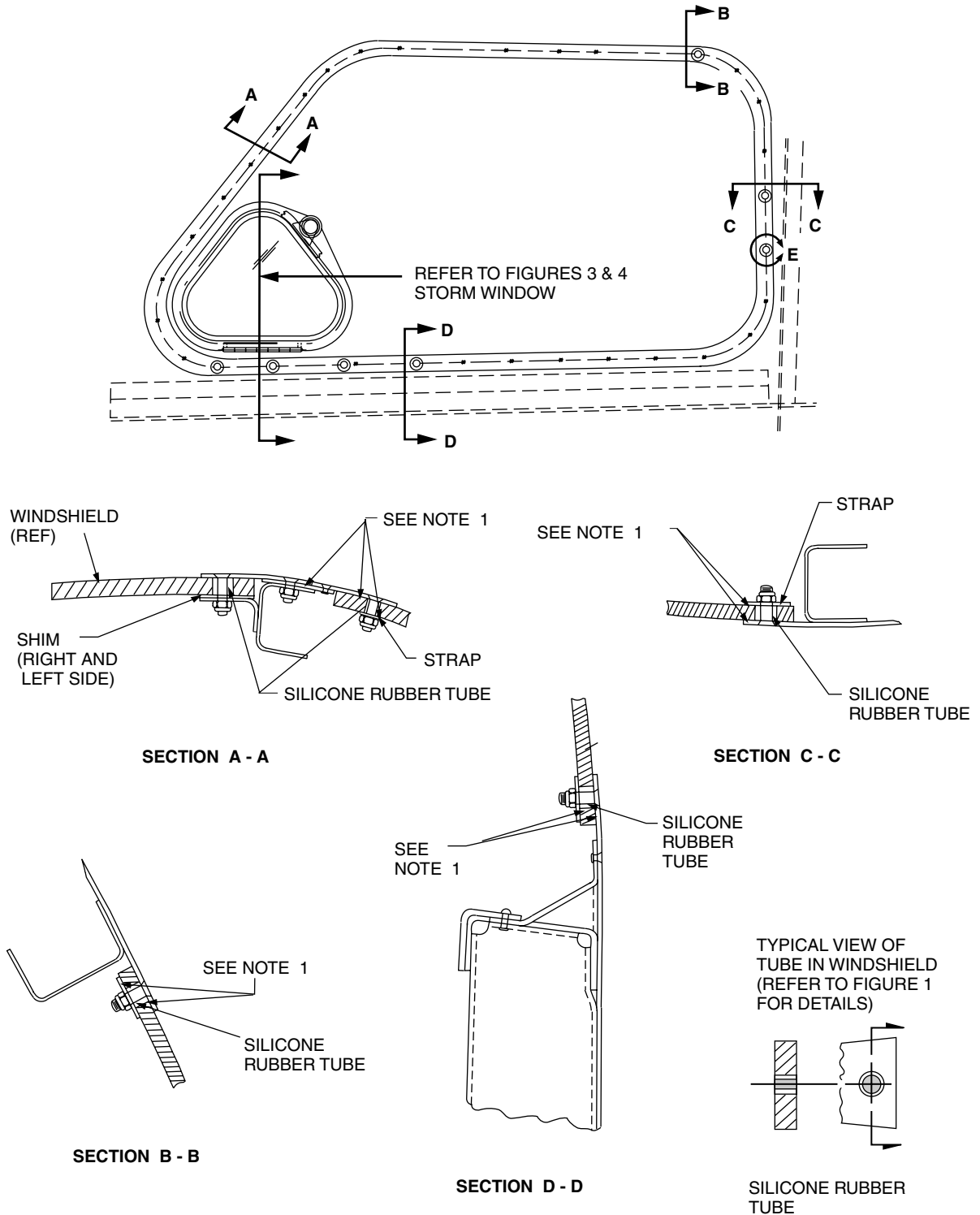
LENGTH OF TUBING TO EQUAL THICKNESS OF WINDSHIELD

TYPICAL VIEW OF SILICONE RUBBER TUBE IN WINDSHIELD (SEE NOTE 3)



Windshield Installation
Figure 1

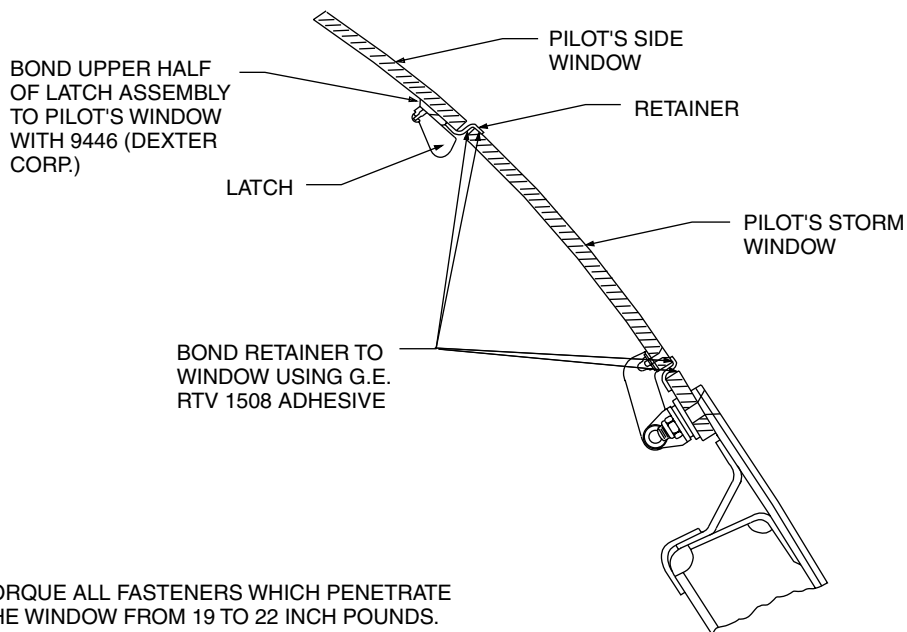
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- NOTES: 1. APPLY SEALANT HERE. SEE 91-10-00, CHART 10, SEALANT, WINDOWS AND WINDSHIELDS.
2. ALL FASTENERS WHICH PENETRATE THE WINDOW SHALL BE TORQUED TO 19 - 22 INCH POUNDS.

Pilot's / Copilot's Window Installation
Figure 2

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Storm Window
Figure 3

[Effectivity](#)
[4636001 thru 4636076 only](#)

2. Pilot's / Copilot's Window

A. Removal

- (1) Remove the screws, nuts, washers and strap that retain the window to the fuselage.
- (2) Remove the window.

B. Installation

- (1) Remove all traces of old sealant from the outboard side of the strap and the inboard side of the fuselage window frame.
- (2) All corners must be broken and all edges smooth and free of tool marks.
- (3) Check fit the window to the fuselage window frame to ensure that it will fit. Trim excess material as required.
- (4) Apply sealant to the inboard side of the fuselage window frame.
- (5) Position the window in its frame, apply sealant to the outboard side of the strap. Secure the window to the frame and strap with the previously removed nuts, bolts and washers. Torque any fasteners which penetrate the window as specified in Figure 2.

3. Storm Window ([S/N's 4636001 thru 4636076 only](#)) (See Figure 3.)

A. Removal

- (1) Rotate the latch to open the storm window.
- (2) Remove the nuts, washers, bolts and screws that attach the storm window hinge to the pilot's window.
- (3) Remove the pilot's window.

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B. Installation

NOTE: If installing a service replacement storm window, order Kit No. 767-335.

- (1) Position the storm window in the hole in the pilot's window.
- (2) Torque the fasteners that attach the storm window hinge to the window as specified in Figure 3.
- (3) Rotate the latch to lock the storm window.

NOTE: The storm window retainer is bonded to the storm window with General Electric RTV1508 adhesive or equivalent (i.e. - G.E. RTV 108, DOW RTV 732, etc.). The latch assembly upper half is bonded to the pilot's window with Dexter Hysol 9446.

4. Storm Window (S/N's 4636077 and up) (See Figure 4.)

A. Replacing the storm window in an existing pilot's side window.

- (1) Removal
 - (a) Push button on latch and pull latch to open the storm window.
 - (b) Remove hinge pin.
 - (c) Remove storm window.
- (2) Installation
 - (a) Align storm window hinge half with hinge half on the pilot's window.
 - (b) Install hinge pin.
 - (c) Push latch onto latch pin to close the storm window.

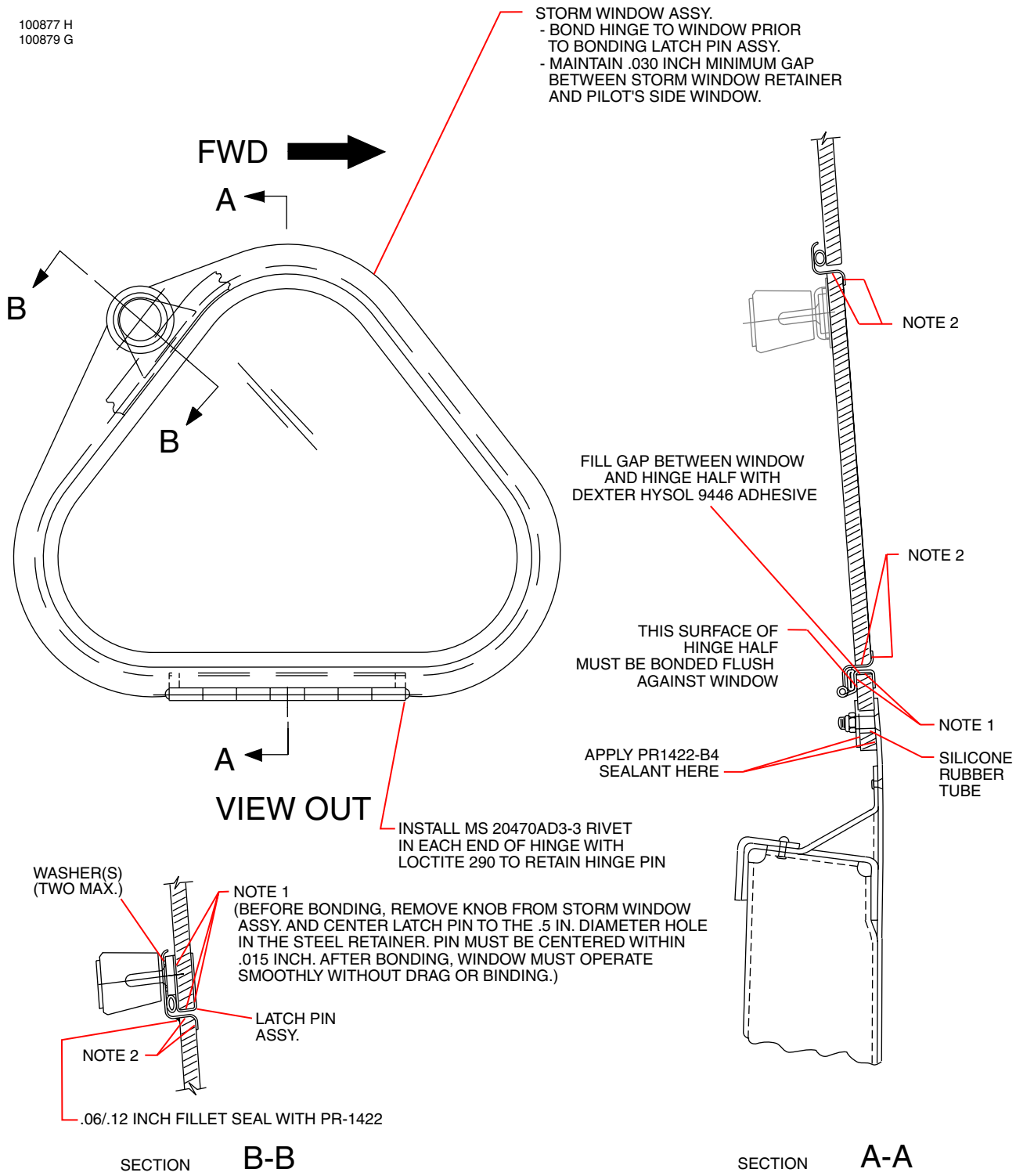
B. Installing a storm window in a new pilot's side window.

- (1) Position the hinge in the notch at the base of the storm window cut-out. With the storm window in a closed position, center the storm window in the cut-out and mark the pilot's window to indicate the outer edges of the hinge.
- (2) Bond the hinge half to the pilot's side window with Dexter Hysol 9446 (see A-A, Figure 4). Take care to ensure the inside edge of the hinge half is bonded flush to the pilot's window. Also, ensure that a .030 inch gap is left between the bottom edge of the cut-out and the inside of the hinge half and that the gap is filled with adhesive.
- (3) When the hinge to window bond is cured, slide the latch pin assembly over the rear upper edge of the storm window cut-out and push the storm window to a closed and latched position. Mark the position of the latch pin assembly on the pilot's side window.
- (4) Bond the latch pin assembly to the pilot's side window with Dexter Hysol 9446 (see B-B, Figure 4). Ensure that the latch pin assembly is aligned to the markings previously made on the pilot's side window.

NOTE: The storm window retainer is bonded to the storm window with PRC PR-1422 Sealant. The latch pin assembly and hinge are bonded to the pilot's window with Dexter Hysol 9446.

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100877 H
100879 G



NOTES: 1. BOND WITH DEXTER HYSOL 9446.
2. BOND WITH PR-1422.

[Effectivity](#)
4636077 and up

Storm Window
Figure 4

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CABIN

Passenger Windows

A. Removal

- (1) Drill out the rivets which fasten the window retainer to the fuselage skin.
- (2) Push the window and retainer inward until it is free of the fuselage skin.
- (3) Remove the retainer from the window.
- (4) Save the old window for a template if a new window is to be installed.

B. Installation

- (1) Remove all traces of old sealant from the retainer, inboard edge of the window opening, and old window.
- (2) All corners must be broken and all edges smooth and free of tool marks.
- (3) If a new window is being installed, ensure that it is the same dimensions as the old window.
- (4) Apply PRC 1422-B4 sealant to the outboard surface of the window where it mates with the inboard edge of the window opening. Also apply sealant to the outboard surface of the retainer where it mates with the inboard edge of the window opening and where it mates with the inboard edge of the window.
- (5) Line up the rivet holes and rivet the retainer to the skin and to the window.

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DOOR

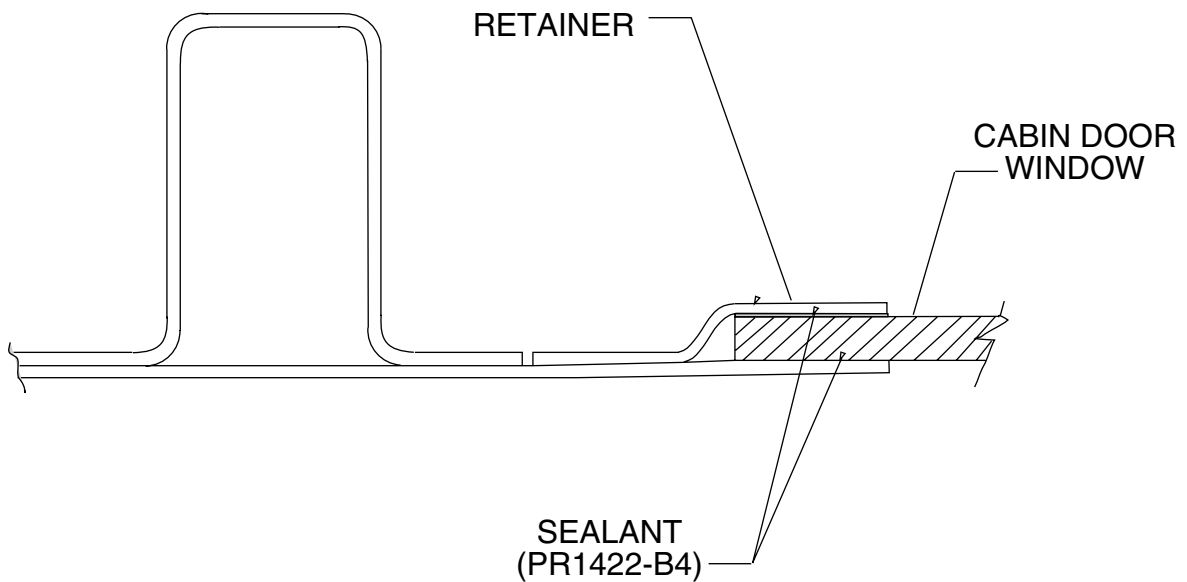
Door Window

A. Removal

- (1) Drill out the rivets which fasten the window retainer to the inner frame of the door.
- (2) Remove the retainer.
- (3) Remove the door window.

B. Installation

- (1) Remove all remaining traces of a sealant from the inner surface of the door window frame and outboard-facing side of the retainer.
- (2) Fit-check the new window before applying sealant.
- (3) Apply PRC1422-B4 sealant to the inner surface of the frame and outboard-facing side of the retainer. Rivet the retainer to the frame.



Section View of Cabin Door Window
Figure 1

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CHAPTER

57

WINGS

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CHAPTER 57

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CHAPTER 57 - WINGS

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ATTACH FITTINGS

1. General (See Figure 1.)

This chapter contains removal and installation procedures for the wing and related components.

The wing is comprised of three separate sections. The center section is comprised of the inboard portion of each wing joined by a continuous main spar. The outboard edges of each inboard portion of the wing are fitted with an outer panel splice. The outboard panel has a mating splice plate and an integral fuel tank from its center splice to an area 18 inches from the wing tip.

NOTE: Replacement wing sections built for service are direct replacement parts for current production aircraft only (S/N's 4636196 and up). Aircraft with serial numbers 4636001 thru 4636195 must order Service Hardware Kits as listed below to enable installation of a new replacement wing or section(s):

To Install a New

Order Hardware Kit No.

Left Outboard Wing Section

766-662

Right Outboard Wing Section

766-663

Center (Inboard) Wing Section

766-665

Complete Wing

766-675

Refer to the latest revision of the PA-46-350P Illustrated Parts Catalog for further details.

2. Outboard Wing

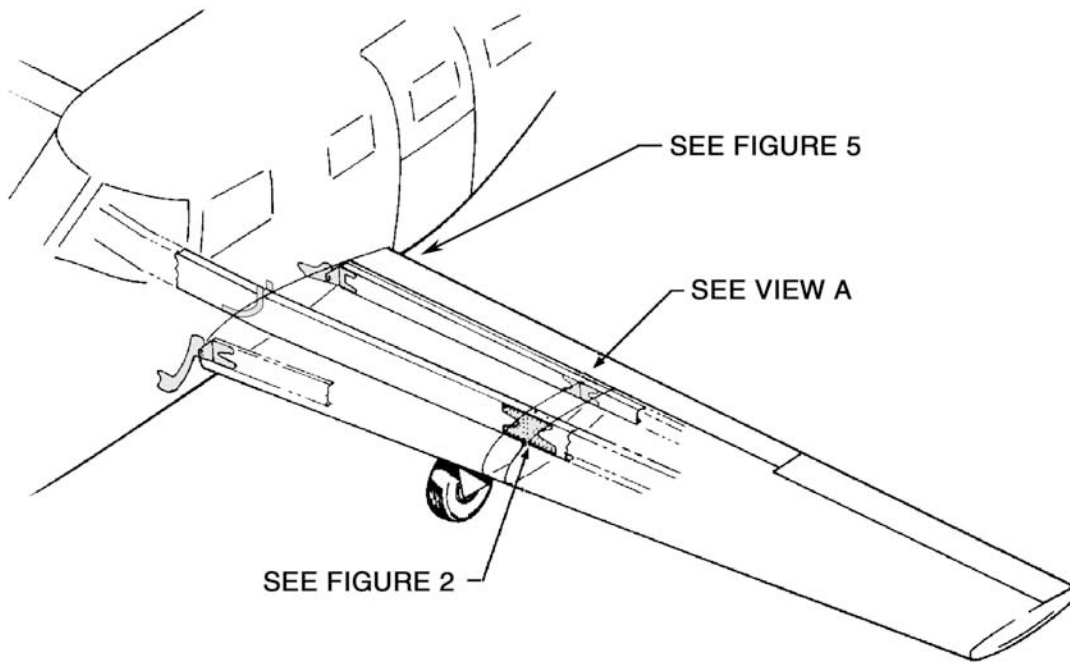
A. Removal (See Figures 1 and 2.)

- (1) Drain the fuel from both wings (refer to Draining Fuel System, 12-10-00).
- (2) Remove the aileron per 57-50-00. If replacing the wing section, remove the aileron sector.
- (3) Remove the flap per 57-50-00.
- (4) Carefully remove the wing splice skin (W.S. 107.56 - W.S. 115.25) that covers the inboard / outboard wing splice. This old skin may be used as a template for the new skin.
- (5) Remove the screws from the fuel access panels.

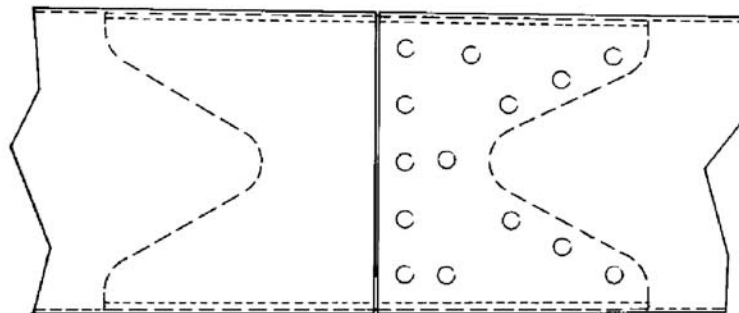
NOTE: The fuel access panels are installed with low adhesive sealant and will not come off without some method of separating them from the wing.

- (6) Using a fabricated laminated fiberglass wedge, carefully remove the fuel panels so they may be reused.
- (7) Disconnect the fuel lines by removing clamps and cutting the flexible connections.
- (8) Disconnect the fuel quantity sender lead. If replacing the wing section, remove fuel quantity sender per 28-40-00.
- (9) Disconnect the taxi/recognition and navigation/strobe light leads. If replacing the wing section, remove the taxi/recognition and navigation/strobe lights per 33-40-00.
- (10) Support the outboard wing. Drill out rivets and remove the Hi-Lok pins and collars from the splice plate.
- (11) Carefully remove the outboard wing, being certain that all electrical leads, fuel and vent lines, and control cables are disconnected.

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← INBOARD

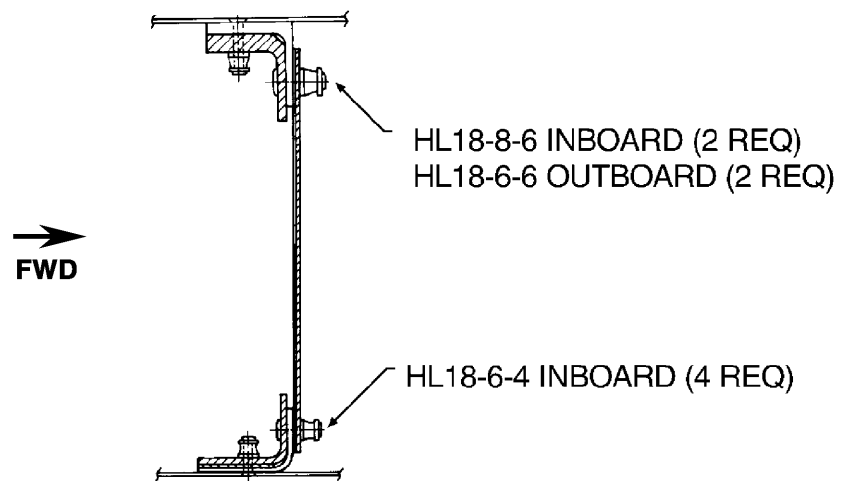
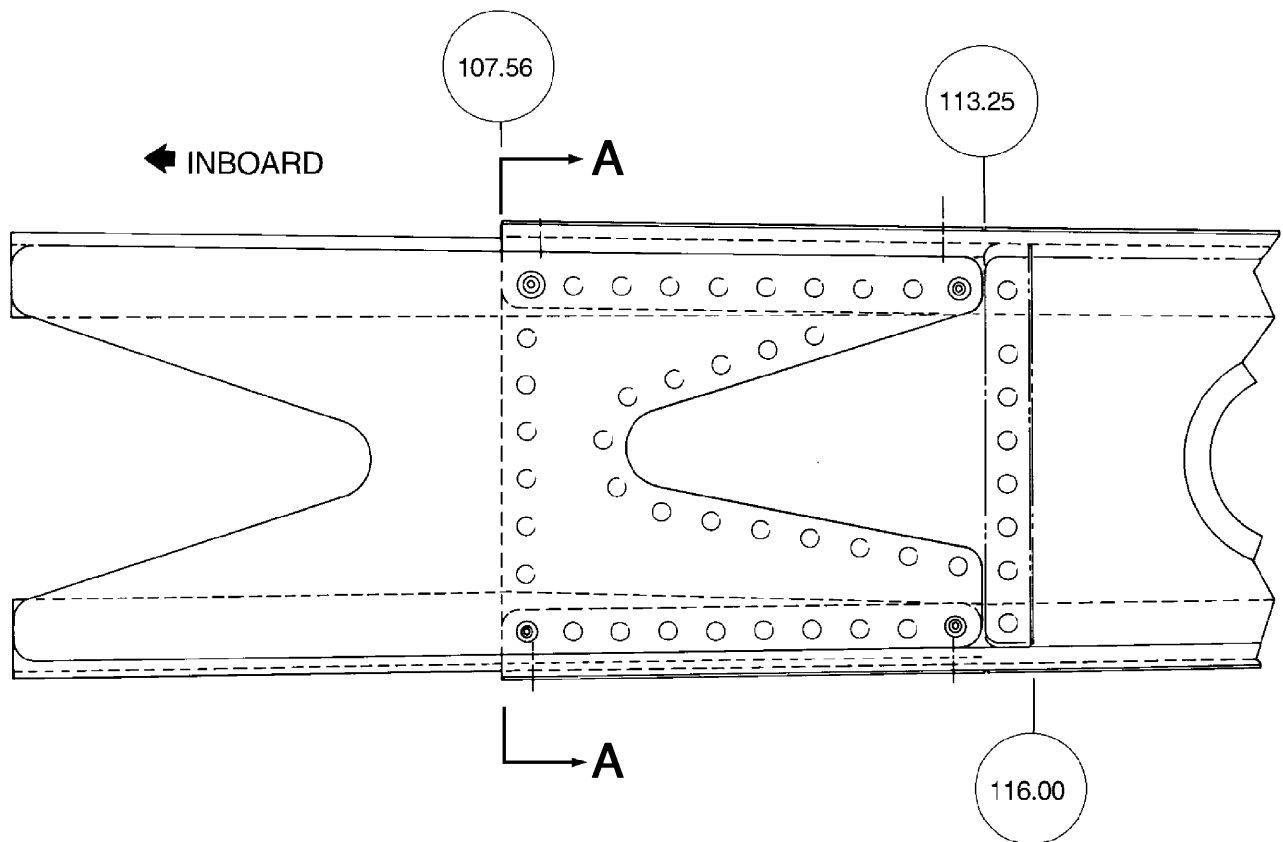


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VIEW A
(LOOKING AFT)

Wing Installation
Figure 1

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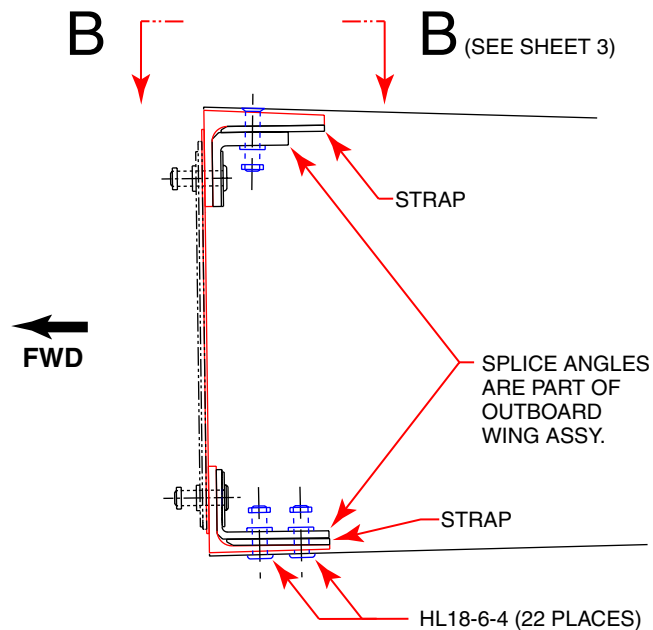
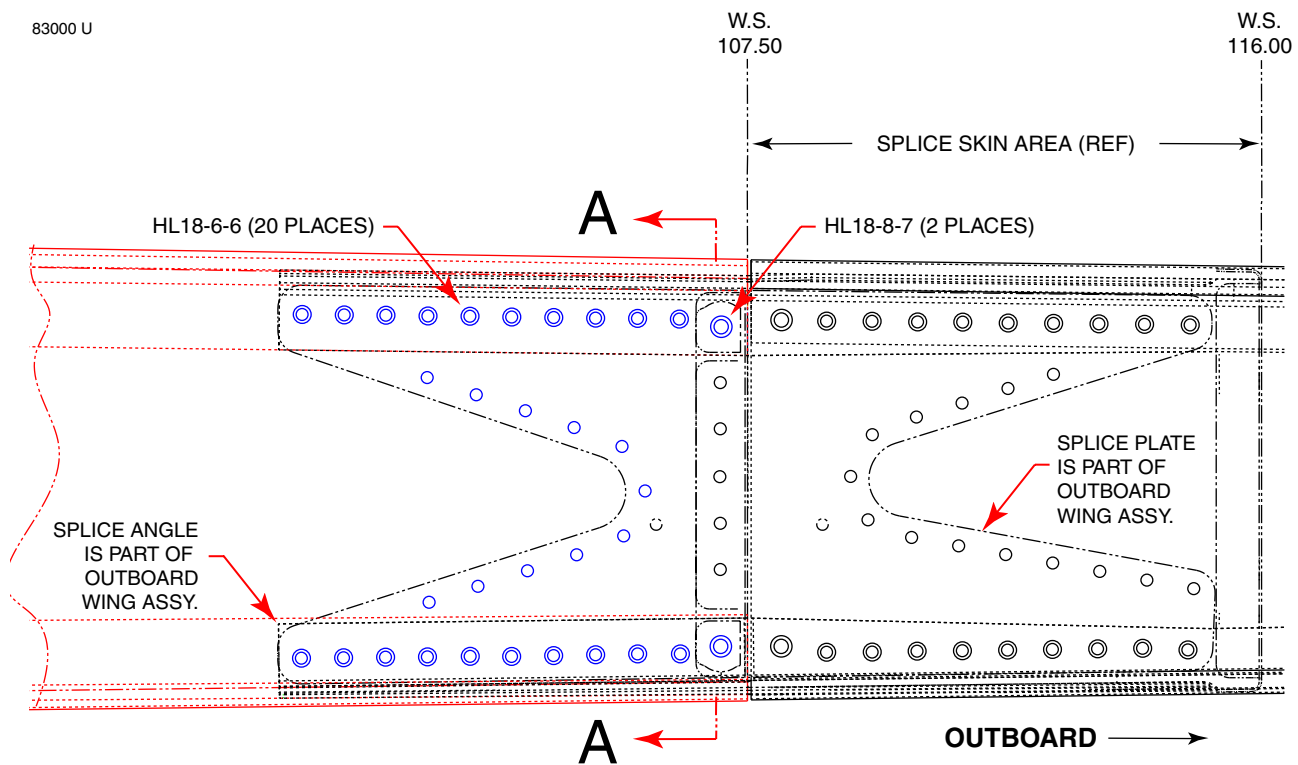
SECTION A - A
(LOOKING OUTBOARD)

Outboard Wing Installation
Figure 2 (Sheet 1 of 3)

[Effectivity](#)
4636001 thru 4636195

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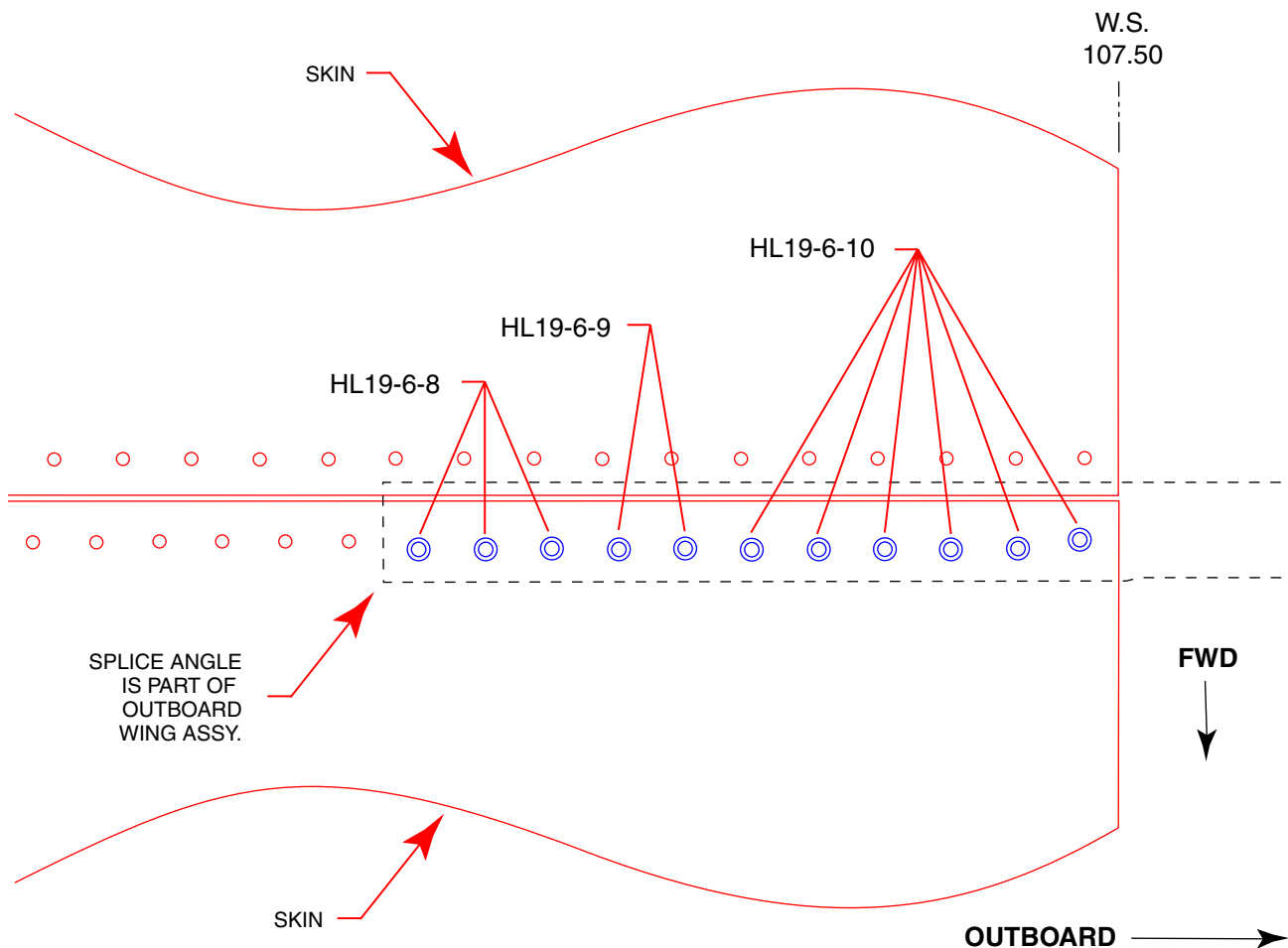
SECTION A - A
(LOOKING INBOARD)

Outboard Wing Installation
Figure 2 (Sheet 2 of 3)

[Effectivity](#)
4636196 & up

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SECTION B - B
(ROTATED 90°)
(LOOKING DOWN)

Outboard Wing Installation
Figure 2 (Sheet 3 of 3)

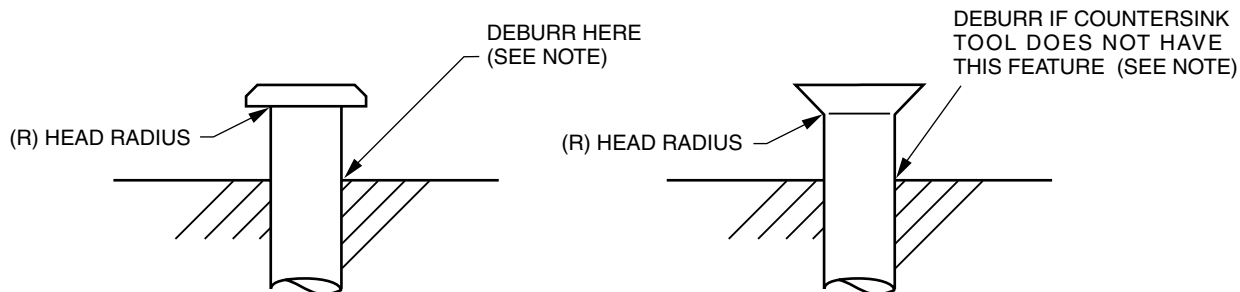
[Effectivity](#)
4636196 & up

B. Installation

NOTE: When installing a "replacement" wing or wing section, perform Stall Warning Flight Test Procedure, 27-30-00, upon completion of wing installation.

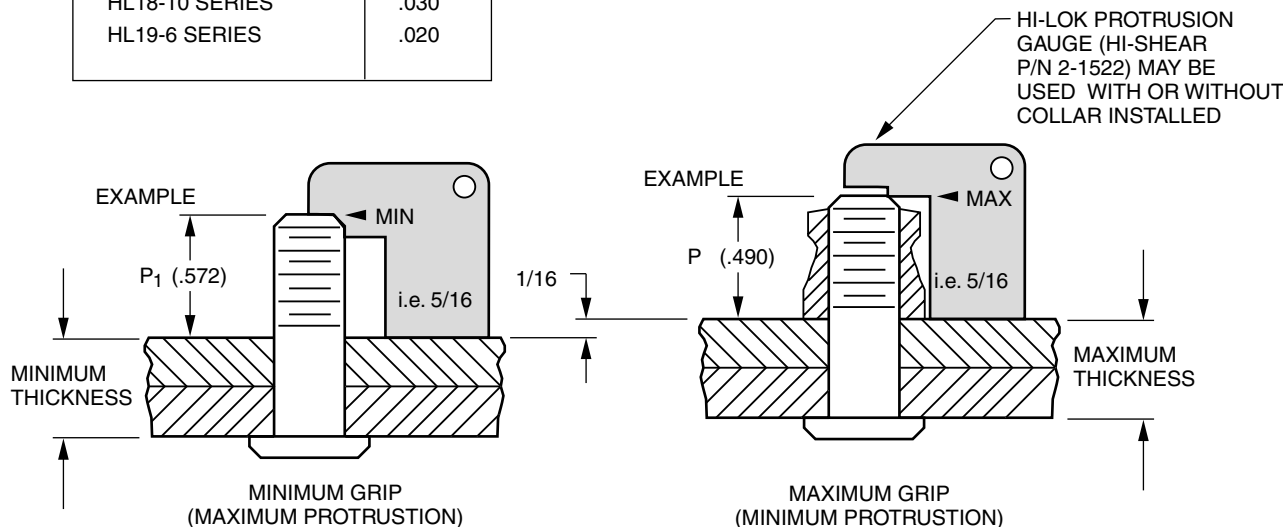
- (1) Carefully position the outboard wing in alignment with the splice plates on the inboard wing main and rear spars.
- (2) Using a string of suitable length extended from the inboard wing leading edge next to the fuselage out to the outboard wing tip to help maintain true alignment of the wing sections. Also, extend a string from the wing tip to the stabilizer, marking its length and checking this with the opposite wing and stabilizer, using the same reference points on both wings and stabilizers.
- (3) While maintaining proper alignment of the wing, install the Hi-Lok pins and rivets into the spars and splice plates per Figure 3. Refer to the PA-46-350P Illustrated Parts Catalog, P/N 761-878, for correct rivet part numbers and locations.

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NOTE: The HI-LOK pin has a slight radius under its head. After drilling, deburr the edge of the hole. This permits the head to fully seat in the hole. See the list in this figure for head radius dimensions. For example, the 3/16 protruding head (HL 18-6 series) has a .015/.025 radius while the 3/16 flush head (HL 19-6 series) has a .025/.030 radius.

TYPE OF HI-LOK PIN	(R)
HL18-5 SERIES	.025
HL18-6 SERIES	.015
HL18-8 SERIES	
HL18-10 SERIES	.030
HL19-6 SERIES	.020



EXAMPLE

HL18-10-10

MAXIMUM GRIP LENGTH OF PIN IN 1/16ths
(10/16" OR 5/8" GRIP LENGTH FOR THIS EXAMPLE)

STANDARD HI-LOK PIN FIRST DASH NUMBER	NOMINAL DIAMETER	MINIMUM PROTRUSION P	MAXIMUM PROTRUSION P ₁
-5	5/32	.302	.384
-6	3/16	.315	.397
-8	1/4	.385	.467
-10	5/16	.490	.572

HI-LOK Fasteners Installation
Figure 3

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- (4) Connect the leads from the taxi/recognition and navigation/strobe lights. If installing a replacement wing section, install the taxi/recognition and navigation/strobe lights first per 33-40-00.
- (5) Connect the fuel and vent lines, using new flexible connections.
- (6) Connect the fuel quantity sender leads. If installing a replacement wing section, install the fuel quantity sender first per 28-40-00.

NOTE: When installing the fuel area access panels with the sender units mounted, strict attention should be paid to avoid having the sender unit wires from becoming wrapped around the sender unit arm and immobilizing the sender when it is finally installed.

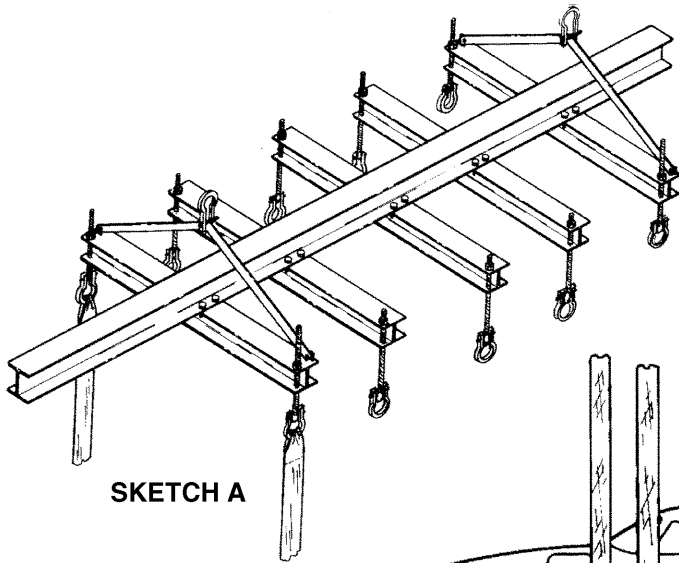
- (7) Install the wing splice skin at W.S. 107.56 - 115.25.
- (8) Install the flap and aileron per 57-50-00. If installing a replacement wing section, install the aileron drive sector on the aft spar first. Torque sector mounting bolt per Figure 4, 27-10-00.
- (9) Check fuel system for leaks and flow (see 28-10-00).
- (10) Check operation of the taxi/recognition lights and navigation/strobe lights.
- (11) Fill the fuel system per Filling Fuel Cells, 12-10-00.
- (12) Make appropriate logbook entry.

3. HI-LOK Removal and Installation

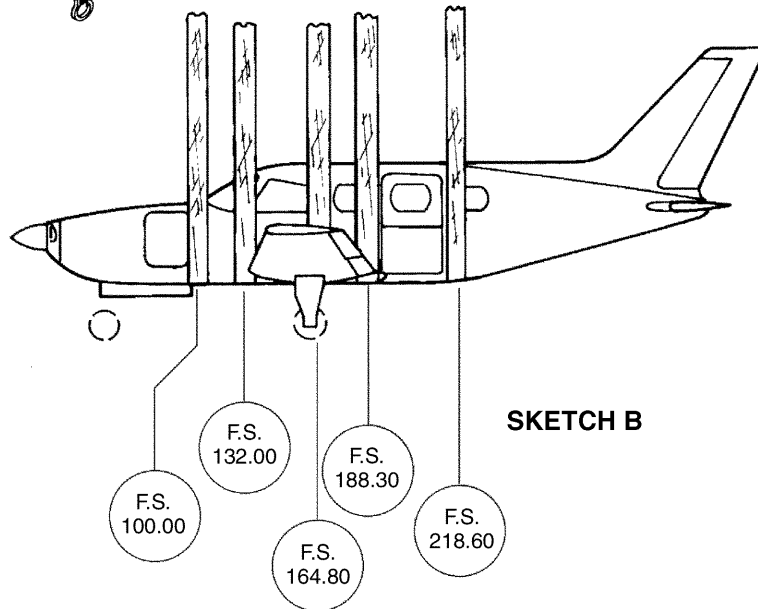
NOTE: Refer to Hi Shear Catalogs for further information and a complete list of power and hand tools to aid in removal and installation of the Hi-Lok fasteners.

- A. Hi-Lok pins and collars are used at various points in the wing installation. Refer to the Piper Parts Catalog, P/N 761-878, for locations and proper pin and collar part numbers.
- B. To remove the Hi-Lok pin and collar:
 - (1) Grasp the collar with pliers.
 - (2) Insert an Allen hex wrench in the hex in the end of the pin.
 - (3) Turn the collar with pliers.
 - (4) Remove the collar and pin.
 - (5) If not damaged during removal, the Hi-Lok pin can be reused.
- C. To install the Hi-Lok pin and collar:
 - (1) Insert the Hi-Lok pin in the hole (after hole has been deburred if new).
 - (2) Manually turn the Hi-Lok collar onto the pin.
 - (3) If using Hi-Lok power tools, insert the hex wrench tip of the power driver into the pin's hex recess, and the socket over the collar hex. Press the power driver against the collar and operate the power driver until the collar's wrenching device has been torque off.
 - (4) If using shop tools, insert an Allen wrench into the pin's hex recess and turn the collar hex with an open end wrench until the collar's wrenching device has been turned off.
 - (5) Check the protrusion of the threaded end for the limits given in Figure 3. Hi-Lok Protrusion Gauges (P/N 2-1522) offer a convenient method to check the pin protrusion limits.

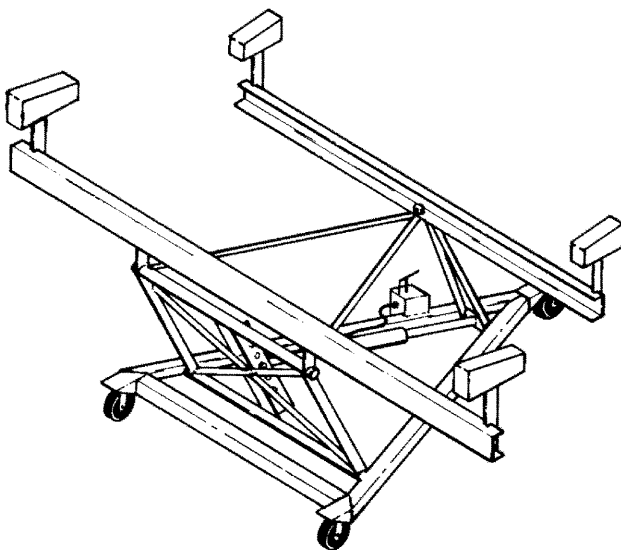
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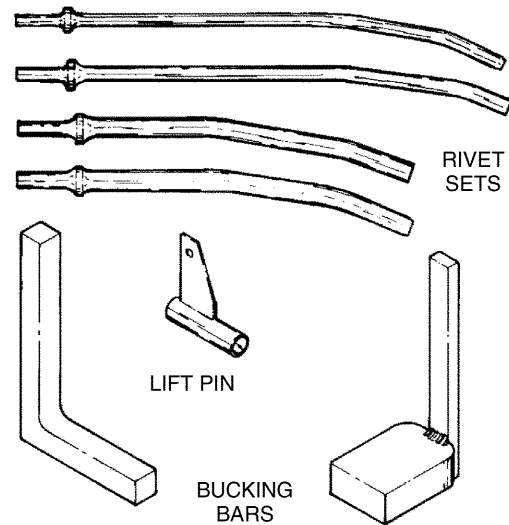
SKETCH A



SKETCH B



SKETCH C



SKETCH D

Special Equipment for Wing Removal and Installation
Figure 4

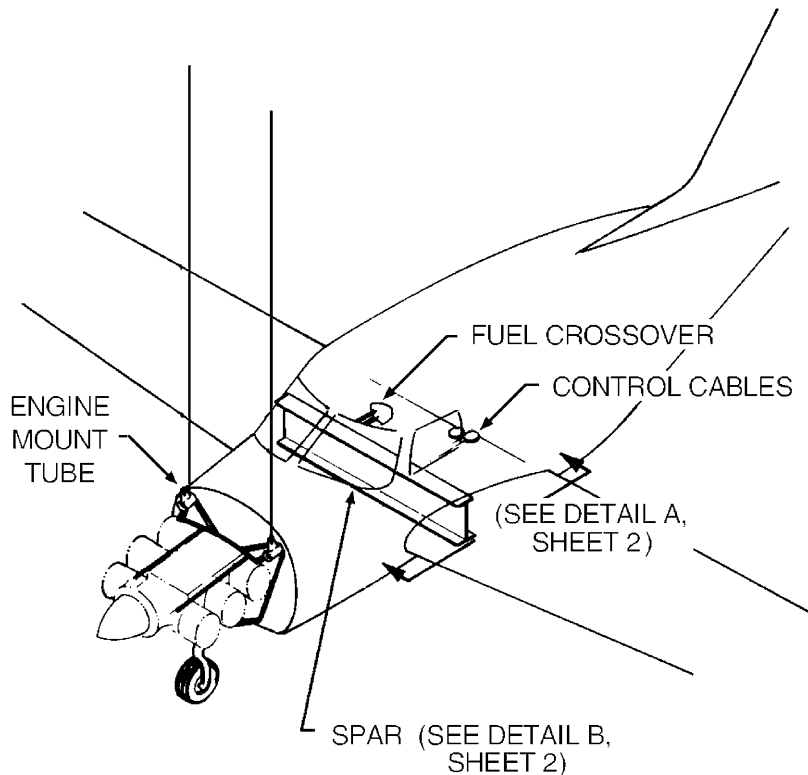
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4. Inboard Wing

A. General

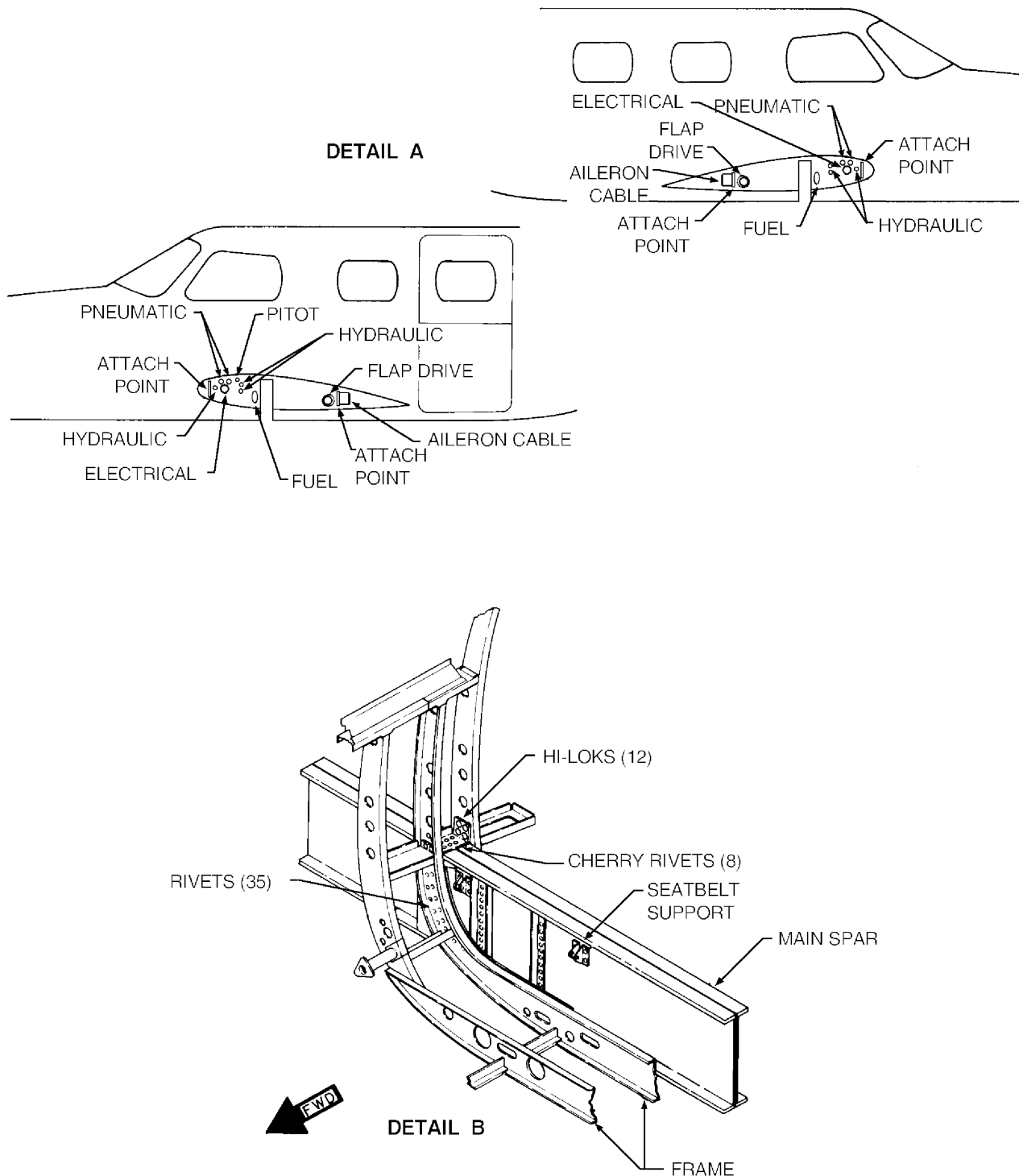
If it is necessary to replace the entire wing structure, you will need special equipment. Allow time for setting up as follows:

- (1) Determine whether wing will be lowered or fuselage raised to remove wing. Equipment will vary accordingly.
- (2) Fabricate the following special equipment prior to starting the procedure (see Figure 4).
 - (a) Cradle to support fuselage: Create slings from industrial nylon lifting strap, six (6) inches wide. Lifting capability needed only if raising fuselage away from wing.
 - (b) Dolly to cradle wing: A single jack may be specially adapted for this procedure in order to lower wing away from fuselage.
 - (c) Hoist assembly: To be attached to ceiling, with sufficient weight-bearing capacity. Position clamps so that straps will cradle fuselage at bulkheads (see Figure 4) for best support.
 - (d) Lifting pins (left and right) and cable: Suitable to attach to engine mount for additional steadying.
 - (e) Tools for removing rivets and cutting sealant: May be standard or fabricated.



Removal and Installation of Inboard Wing
Figure 5 (Sheet 1 of 2)

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Removal and Installation of Inboard Wing
Figure 5 (Sheet 2 of 2)

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B. Removal

- (1) Remove all fuel from the wing.
- (2) Prepare hoist and fuselage supports.
- (3) Set up dolly under wing.

NOTE: Perform steps (4) thru (6) inside airplane.

- (4) Remove interior furnishings as follows:
 - (a) Forward and center seats, left and right.
 - (b) Cabinets, left and right.
 - (c) Floor carpet.
 - (d) Forward side panels below window line, left and right.
- (5) Remove floor panels from forward cockpit area to entrance door (F.S. 117.00 to F.S. 89.60).
- (6) Remove lines and cables as follows:
 - (a) Remove relief tube, located under center left floorboard.
 - (b) Derig aileron, rudder, and stabilator cables. Remove from below spar.

NOTE: Do not disconnect hydraulic lines at this time.

- (c) Remove fuel crossover valve cover and close-out, located on right side. Remove fuel crossover lines across front of spar. Remove fuel line (tear drop) crossover cover on left side.
 - (d) Remove fuel crossover valve.

NOTE: Perform steps (7) and (8) outside airplane.

- (7) Remove wing to fuselage fairings, left and right wing roots. Remove bottom fuselage skin panels at wing spar, left, center, and right. Remove tee channels and angles below spar.
- (8) Disconnect/remove lines as follows (Figure 5, Detail A):
 - (a) Disconnect flap drive. Remove rods, left and right (see Figure 2, 20-00-00).
 - (b) Pull aileron cables through wing root and secure cables (refer to 27-00-00).
 - (c) Clear fuel lines from wing root area.
 - (d) Disconnect electrical cannon plugs, left and right.

NOTE: Perform step (9) with one man inside airplane at wing spar and one outside assisting. Use special tools to remove rivets and Hi-Loks.

- (9) Remove rivets and hardware (see Figure 5, Detail B).
 - (a) Remove pilot seat belt supports, each side of forward spar
 - (b) Remove six forward and six aft Hi-Loks, each side above spar.
 - (c) Remove five rivets thru fuselage skin and angle each side above spar.
 - (d) Remove sealant between fuselage, frame, and angle each side above spar.
 - (e) Remove floor board clips attached to aft spar.

NOTE: It may be necessary to cut sealant several times to get complete separation. Sealant after 28 days has 260 psi adhesion.

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- (10) Break sealant loose forward and aft of spar each side.
- (a) Use a sharp putty knife and cut away excess sealant top and bottom of spar.
 - (b) Use piano wire between spar and frame pulling from inside and outside thru seals like a saw. The wire will cut the sealant but not the aluminum. Drip PSS solvent on piano wire as you cut and this will help separation.

NOTE: Perform the following steps to support the fuselage for wing removal. Use fabricated hoist, cradle, and lifting pin.

- (11) Attach straps, as shown in Figure 4, at indicated fuselage stations.

CAUTION: PROTECT AIRPLANE FINISH BY PLACING CLOTH OR PADDING UNDER STRAPS.

- (12) Anchor fabricated lifting pins to engine mount tubes to secure nose and prevent fuselage from rotating (see Figure 4).

WARNING: DO NOT ENTER AIRPLANE BEFORE ATTACHING LIFTING PINS TO KEEP FUSELAGE FROM ROTATING IN SLINGS.

- (13) Suspend fuselage with hoist. Attach cable to lifting pins.

NOTE: Dolly should already be in place under wing.

NOTE: Perform step (14) both inside and outside airplane.

- (14) Retract landing gear and remove hydraulic lines as follows:

- (a) Using hydraulic pressure, release gear down locks.
- (b) Retract and tie back main landing gear.
- (c) Drain off hydraulic pressure.
- (d) Remove hydraulic lines from wing root and below spar (Figure 5).

NOTE: The following final steps may require additional manpower.

- (15) Remove forward and aft wing attach bolts, each side. If sealant is completely free, wing will be ready to remove.

WARNING: MAKE CERTAIN THAT FUSELAGE LIFTING DEVICE AND LIFTING STRAPS ARE STRONG AND POSITIONED PROPERLY. SPAR FITS TIGHTLY IN CANTED SPAR BOX IN FUSELAGE. EVEN AFTER SEALANT HAS BEEN CUT, A HEAVY AMOUNT OF LIFTING PRESSURE (TO BREAK SEALANT GRIP) MAY BE REQUIRED. TAKE EXTREME CARE NOT TO DAMAGE FUSELAGE AND WING.

- (16) Additional pressure will be necessary to separate wing from fuselage. Proceed as follows:

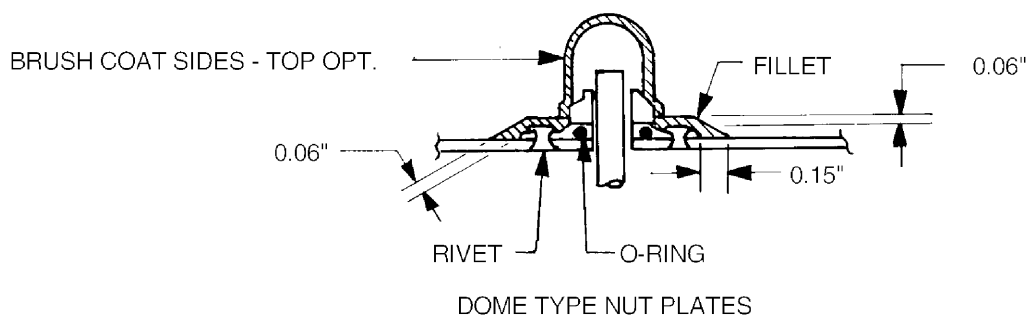
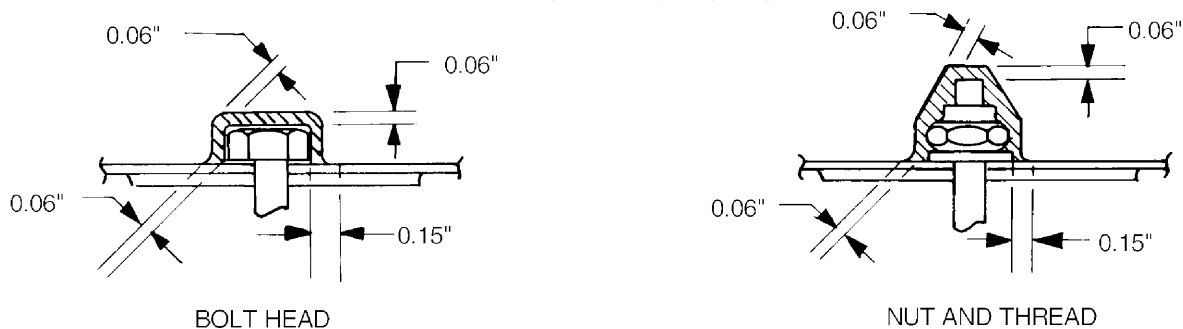
- (a) Have one man on each wing tip to steady the airplane and apply downward pressure.
- (b) Observe spar area inside airplane.
- (c) Strike spar with dead blow mallet until wing is completely released.

- (17) With wing resting on dolly, lift fuselage to clear spar or lower wing.

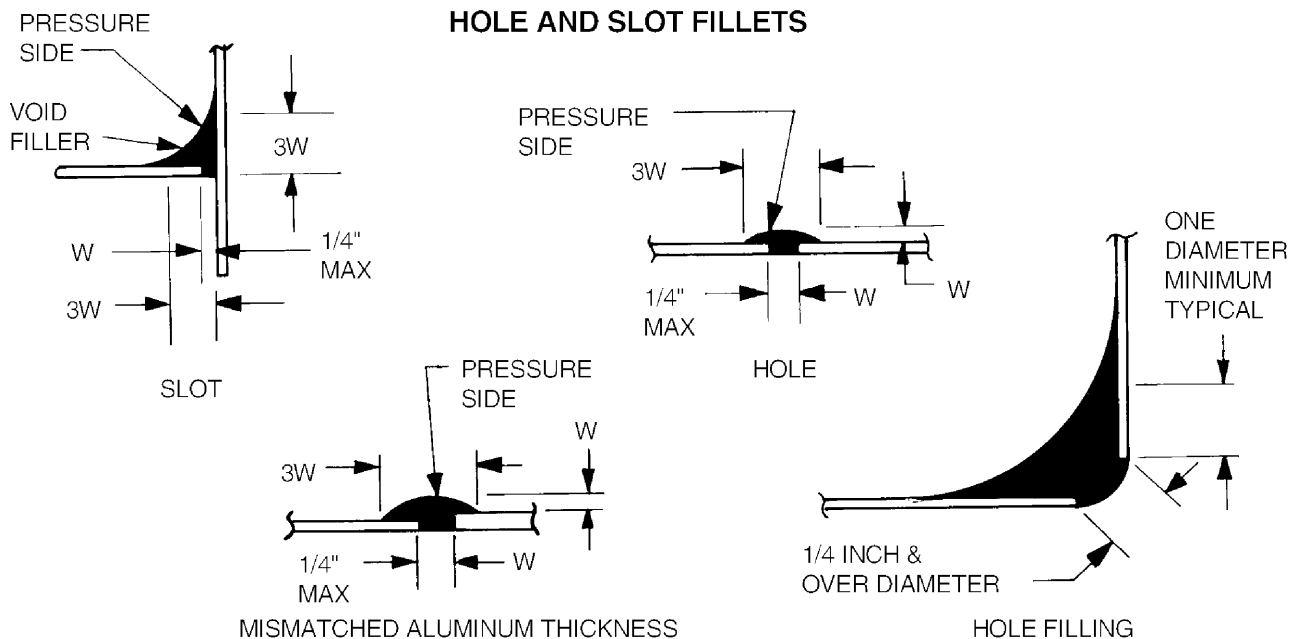
- (18) Remove wing.

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FILLET SEALING BOLTS



HOLE AND SLOT FILLETS



NOTE: Minimum fillet dimensions are shown. Fillet size shall be kept as near minimum as possible.

Hole and Slot Fillets
Figure 6

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C. Installation

WARNING: FUSELAGE MUST BE CRADLED.

NOTE: When installing a "replacement" wing or wing section, perform Stall Warning Flight Test Procedure, 27-30-00, upon completion of wing installation.

- (1) Clean surfaces and all parts to be installed using PSS or other suitable solvent. Pay special attention to frame area inside airplane where sealant was broken or rivets removed. Remove all old sealant residue. Remove all corrosion inhibiting surface paint. This will ensure good sealant grip.
- (2) Place new wing on dolly and position under fuselage.
- (3) Raise wing or lower fuselage over wing.
- (4) Secure forward and aft wing attach bolts, each side.
- (5) Align spar with frames. Drill holes. Align angles with top of spar and with frames each side. Mark holes thru angles in top of spar each side.

CAUTION: KEEP SURFACES FREE OF METAL SPLINTERS.

- (6) Remove wing attach bolts and separate fuselage from wing. Move wing away from fuselage to work on each independently.
- (7) Drill wing spar top each side for angles that attach to fuselage and frame.
- (8) Use a vacuum or air hose to clean away all metal splinters in both wing spar and fuselage.
- (9) Apply sealant to top spar and angles each side. Use R4 sealant.
- (10) Attach angles to top spar each side with cherry rivets. (Two #6/11, two #6/9, two #6/10 and two #6/11).

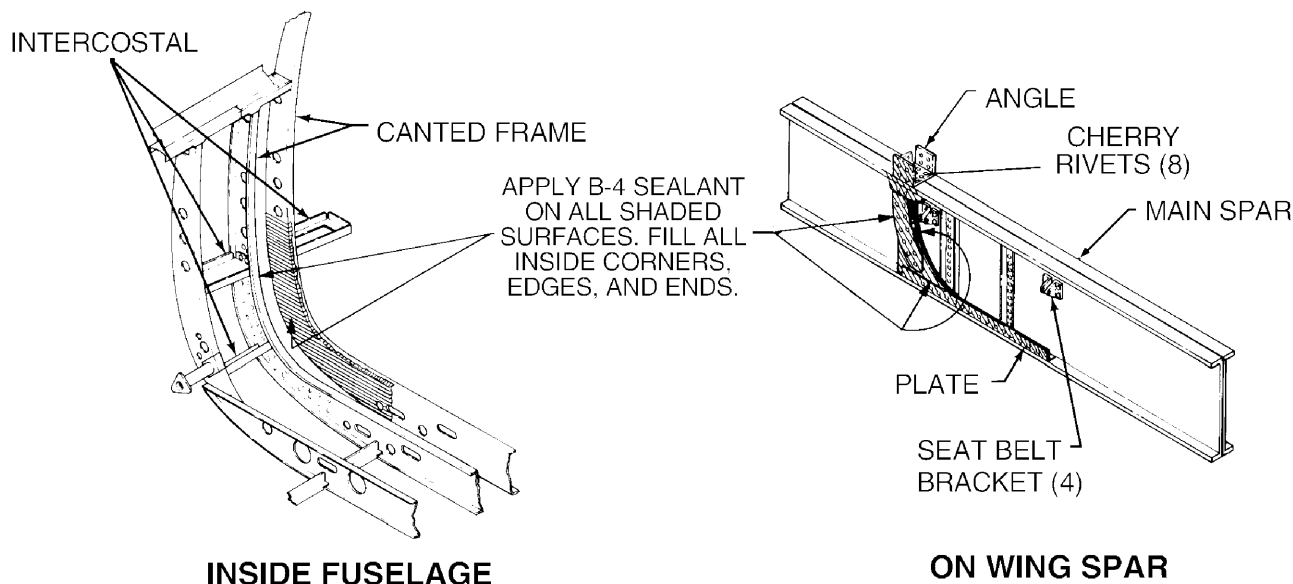
CAUTION: PROPER SEALING IS CRITICAL TO MAINTAIN PRESSURIZATION OF COCKPIT. BE GENEROUS WITH SEALANT PARTICULARLY IN CORNERS WITH WIDE GAPS. USE B4 SEALANT.

- (11) Apply sealant to wing spar aft, forward, left and right plates and angles as shown in Figures 6 and 7.
- (12) Apply sealant to canted frames as shown in Figure 7.
- (13) Position wing under fuselage for installation.
- (14) Lower fuselage onto wing spar. Some sealant will squeeze out.
- (15) Secure wing with wing attach bolts. Install forward bolts, then aft Hi-Loks with nuts forward.
- (16) Tighten forward nuts to a torque of 550 inch - pounds and tighten aft nuts (Hi-Loks) till they shear off.

NOTE: Two people are needed to buck and shoot rivets.

- (17) Clean off excess sealant with PSS solvent.
- (18) Rivet canted frames to left and right aft spar. (Ten #6/9, ten #5/8, and ten #5/7.)
- (19) Rivet floorboard clips to aft spar.
- (20) Rivet canted frame at left forward spar. (Ten #6/9, ten #5/8, six #5/7 and four #5/8 thru floorboard clip.)
- (21) Rivet canted frame to spar at right forward spar. (Ten #6/9, seven #5/8, three #5/9 thru lower intercostal, six #5/7, and four #5/8 thru floorboard clip.)
- (22) Install five (5) rivets in angle on top of spar each side thru fuselage skin from outside fuselage.

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Application of Sealant
Figure 7

- (23) Install four (4) Hi-Lok bolts thru each intercostal, frame, angle and two (2) thru frame and wing spar, just under intercostal. All four locations are left, right, fwd and aft of top wing spar. See Figures 5 and 7.
- (24) Install four (4) angles that form two (2) tee's in bottom of fuselage. Tap with a plastic mallet thru aft channels in the frame under wing spar until they clear the fwd frame under spar. Then using small vise grips attach to angles and tap thru fwd frame channels an equal amount.
- (25) Inside fuselage align angles evenly with Kleco fasteners to existing holes one on each side of stringer.
- (26) Below fuselage place short tee angles between floor angles and rivet together with four (4) rivets on top. Then go inside and rivet both ends to bottom stringer.
- (27) Ensure there are no metal splinters or chips between skins prior to installing close outs.
- (28) Apply sealant to all skins and close out skins on bottom of aircraft. See Figure 6. Apply sealant 1/4 inch each side of rivets.
- (29) Install close outs in place with Kleco fasteners and insert rivets from bottom.
- (30) Inspect rivets.
- (31) Install fwd pilot's seat belt brackets with bolts.
- (32) Install cat grommets on all passage holes in bottom spar.
- (33) Inside fuselage at spar all newly installed rivets and Hi-Loks must be brush sealed with A-4 sealant.
- (34) Make adjustments as follows:
 - (a) Control cables (refer to Aileron Control - Rigging and Adjustment, 27-10-00).
 - (b) Fuel crossover lines and valve (refer to 28-20-00).

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(c) Hydraulic lines (refer to Hydraulic System Testing and Bleeding Hydraulic System, 29-10-00).

- 1 Put pressure on system.
- 2 Allow gear to extend.
- 3 Test and bleed system.
- 4 Perform gear cycle test (refer to Landing Gear Retraction System Functional Test, 32-30-00).
- 5 Be sure that all three landing gear are down and locked.

(35) Remove support straps.

(36) Remove dolly.

(37) Install wing to fuselage fairings and bottom skin panels.

(38) Install interior furnishings.

(39) Reinstall lines and cables as follows: (Figure 5, Detail A)

NOTE: Reinstall electrical, fuel and hydraulic lines first. Then, reinstall control cables.

(a) Outside airplane.

- 1 Install hydraulic lines in wing root and below spar.
- 2 Connect electrical cannon plugs, left and right.
- 3 Install fuel lines in wing root area.
- 4 Pull aileron cables through wing root and secure cables (refer to 27-00-00).
- 5 Connect flap drive. Reinstall rods, left and right (see Figure 2, 20-00-00).

(b) Inside airplane.

- 1 Reinstall fuel crossover valve.
- 2 Reinstall fuel crossover lines across front of spar.
- 3 Reinstall fuel line (tear drop) crossover cover on left side.
- 4 Reinstall fuel crossover valve cover and close-out, located on right side.
- 5 Reconnect aileron, rudder, and stabilator cables. Rig per Chapter 27.
- 6 Reinstall relief tube, located under center left floorboard.

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5. Attach Fittings Corrosion Control

Each five years, inspect the attach fittings shown in Figure 8 for corrosion and condition. Repair/replace as required. When inspection and repair/replacement is completed, reapply Dinitrol AV 8 (P/N 89500-800) Corrosion Inhibiting Compound.

NOTE: For all fittings, inspection of the exposed portion is sufficient unless obvious or extensive corrosion is apparent.

NOTE: Any part exhibiting flaking of the metal due to rust must be replaced.

NOTE: If aluminum skin or structure is corroded (beyond a light surface oxidation), the area must be repaired or replaced.

NOTE: On any part being replaced, dip rivets in zinc chromate or equivalent primer and install wet.

A. When inspection and repair or replacement are completed, allow sufficient time for primer to dry, and apply Dinitrol AV 8 to:

- (1) Forward wing spar attach fittings.
- (2) Aft wing spar attach fittings.

NOTE: Includes wing and fuselage fittings.

CAUTION: READ PRECAUTIONS ON CONTAINER LABEL AND WEAR A CHARCOAL FILTER MASK WHEN APPLYING DINITROL AV 8.

B. Apply Dinitrol by spraying or brush. Use an air or airless spray gun if available. A hand aspirator bottle may be used if a sufficient fan spray pattern can be developed. Product should not be thinned.

C. Cover autopilot servos, electrical connectors, and cable pulleys.

WARNING: DO NOT GET DINITROL INTO AUTOPILOT SERVOS OR CLUTCHES.

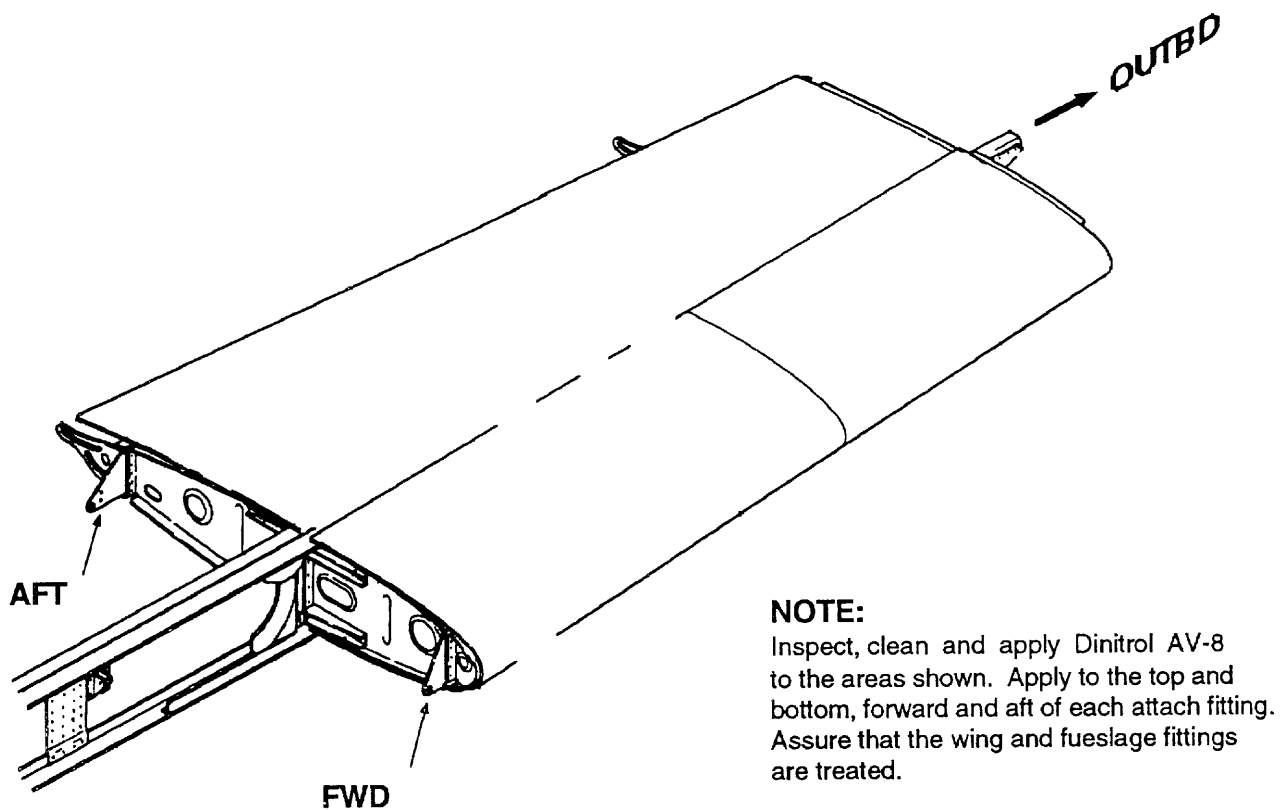
D. Spray directly into faying surfaces and mating points.

E. Ensure entire attach fitting is treated. Spray inside where the fitting is attached to the structure.

F. Apply to approximately .8 mils in thickness. Avoid puddling and running. Allow to dry 1 to 1 1/2 hours before airplane use. Full drying takes 6 to 8 hours.

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Fwd and aft wing to fuselage
attach fittings.



Wing Attach Fittings Corrosion Control
Figure 8

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FLIGHT SURFACES

1. Aileron (See Figure 1.)

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

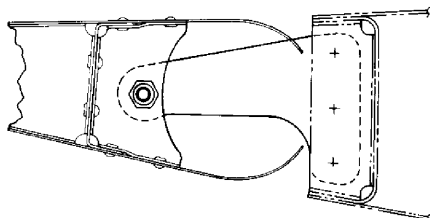
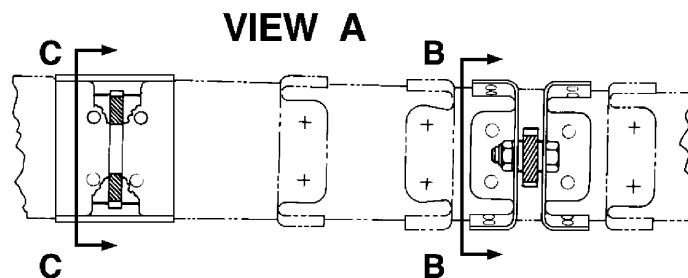
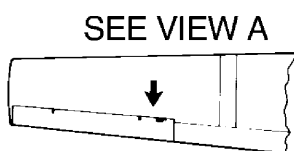
A. Removal

- (1) Remove the nut and bolt which secures the aileron drive sector to the yoke in the aileron.
- (2) Support the aileron and remove the two aileron hinge bolts.
- (3) Remove the aileron.

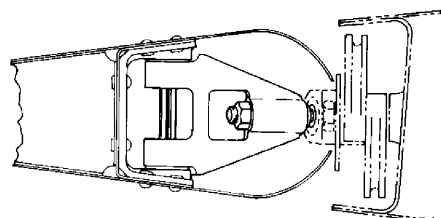
B. Installation

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

- (1) Position the aileron on the trailing edge of the wing.
- (2) Install the attaching nuts, bolts and washers.
- (3) Attach the aileron drive sector to the yoke in the aileron with the previously removed nut, bolt and washers.
- (4) Actuate the aileron controls to insure freedom of movement.



SECTION B - B



SECTION C - C

Aileron Installation
Figure 1

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C. Balancing (See Figure 2.)

To balance the aileron, the assembly must be complete, including the trim tab and all attaching screws. Before balancing, bend the trim tab into its neutral position. Place the aileron assembly on the knife edge supports in a draft free room with the beam perpendicular to the hinge centerline. Do not place the tool on the trim tab. Calibrate the tool as described in Balancing Equipment, below. Read the scale when the bubble level has been centered by adjustment of the movable weight and determine the static balance limit (see Chart 1).

There is no adjustment provision for the ailerons.

2. Balancing Equipment

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 3. Other tool configurations may be used if accuracy is maintained and recalibration capability is provided.

To use this tool:

- 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 2 and 3. Keep the beam positioned 90° from the control surface hinge line.

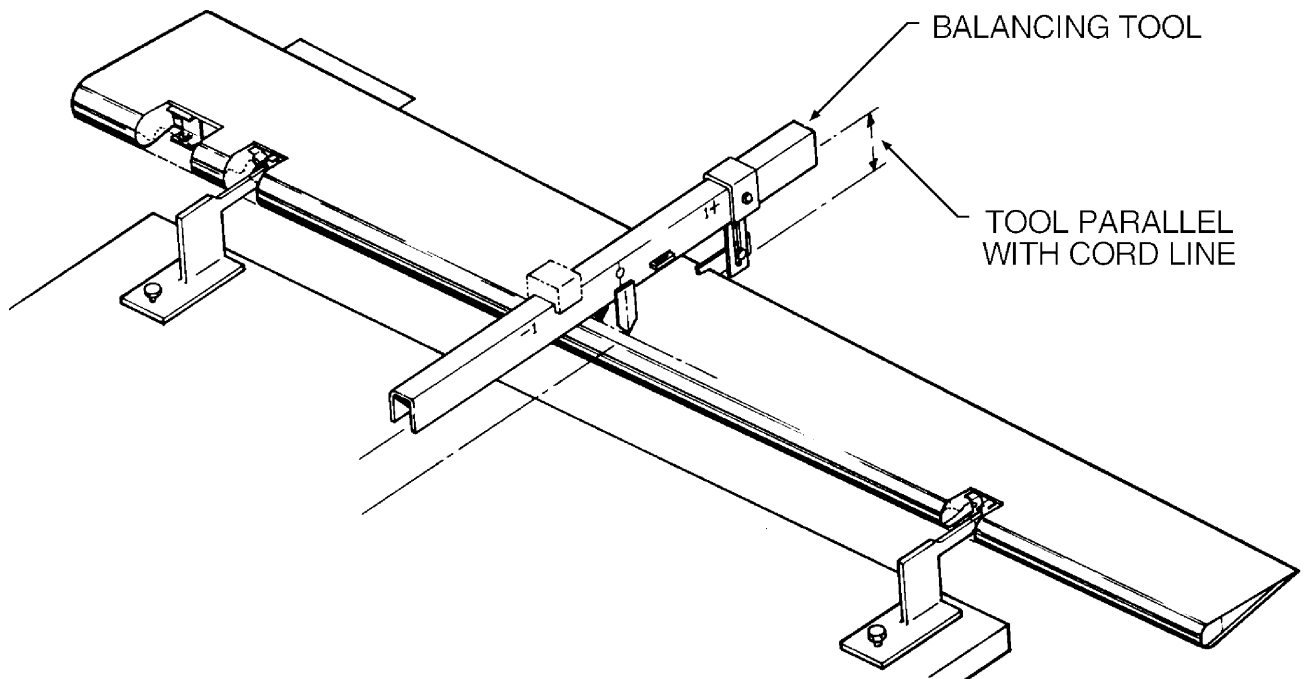
- E. Determine balance of control surface by sliding movable weight along the balance beam.

- 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 (3) pounds, every inch it is moved from the center of the beam equals three (3) inch-lbs of force.)

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CHART 1
AILERON BALANCE LIMITS

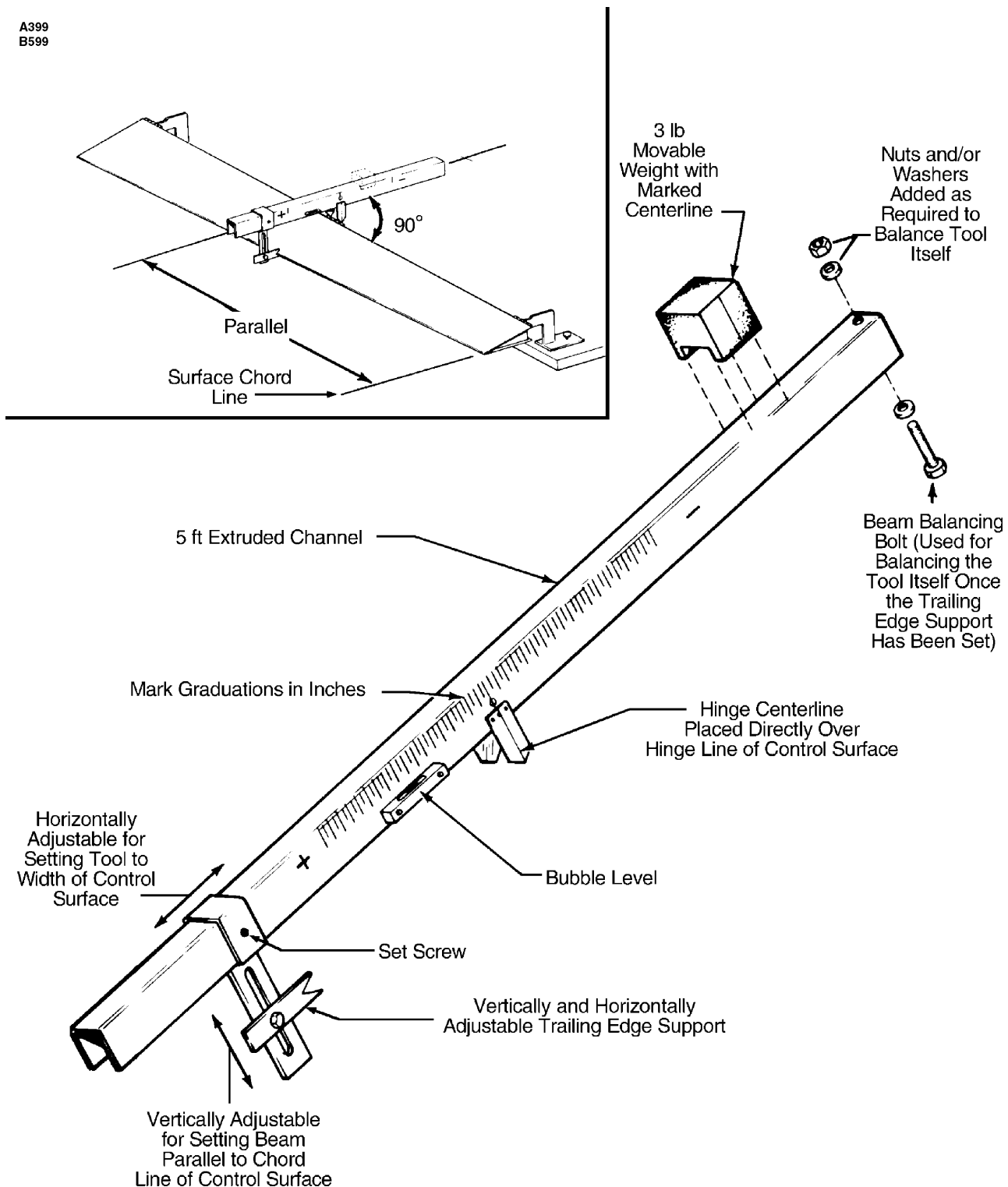
Leading Edge Heavy (Inch-Pounds)	Trailing Edge Heavy (Inch-Pounds)
0	-5.2



Balancing Aileron
Figure 2

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A399
B599



Control Surfaces Balancing Tool
Figure 3

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3. Wing Flaps (See Figure 4.)

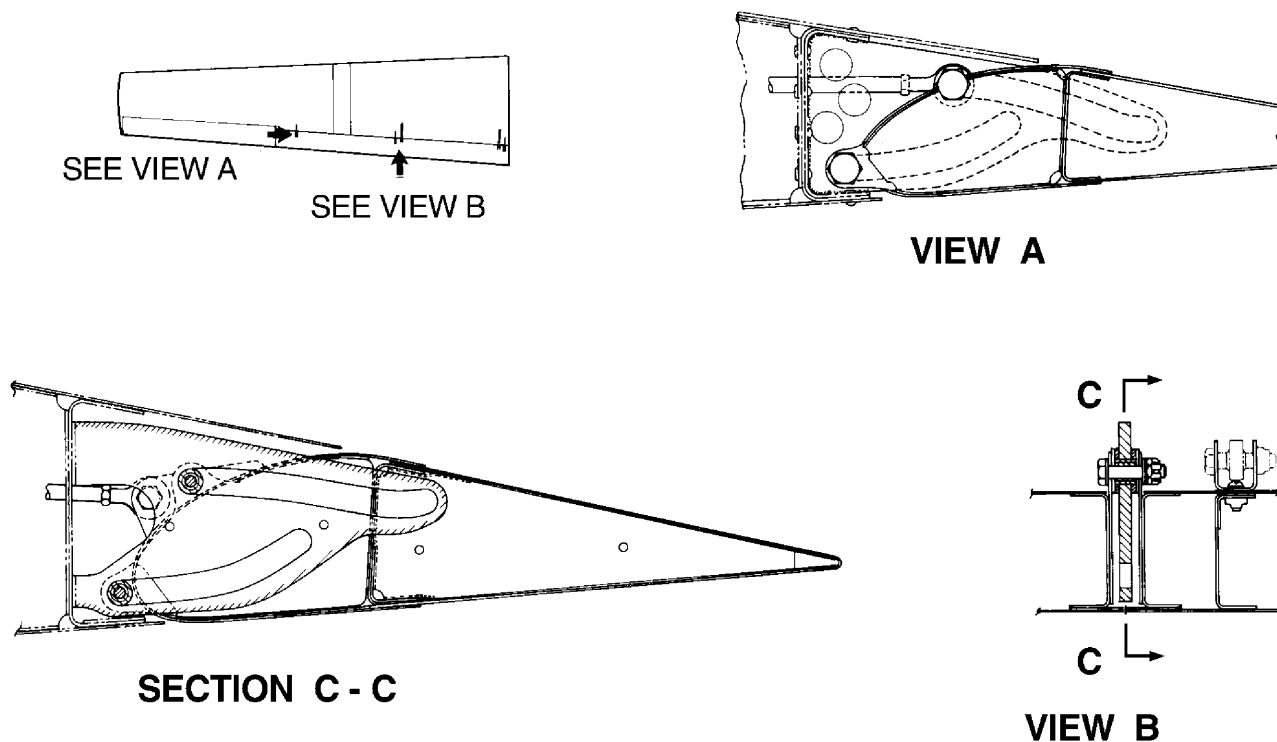
CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

A. Removal

- (1) Extend the flap and disconnect the flap drive push rods (2 places each flap).
- (2) Support the flap and remove the flap hinge bolts, nuts and washers.
- (3) Pull the flap straight back off the wing.

B. Installation

- (1) Position the flap on the trailing edge of the wing.
- (2) Insure that spacers are in place in the flap tracks.
- (3) Insert bolts, washers and nuts. Torque the nuts from 38 - 43 inch pounds and safety with cotter pins. Install the teflon faced washers on the center tracks so that the teflon side faces the flap track.
- (4) Connect the two flap drive push rods to the aileron.
- (5) Cycle the flaps several times to make sure that they are operating freely (refer to Flap Rigging and Adjustment, 27-50-00).



Wing Flap Installation
Figure 4

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**GRIDS 5L10 THRU 5L24
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AIRPLANE MAINTENANCE MANUAL

CARD 6 OF 8

PA-46-350P



(S/N's 4636001 AND UP)

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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	June 19, 1996	All
PR980101	January 1, 1998	1, 2, 3, 4, 5, and 6
CR981223	December 23, 1998	1, 2, 3, 4, 5, and 6
PR000201	February 1, 2000	1, 2, 3, 4, 5, and 6
PR010515	May 15, 2001	1
CR050730	July 30, 2005	1, 2, 3, 4, 5, 6, 7 and 8
PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

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3. Effectivity

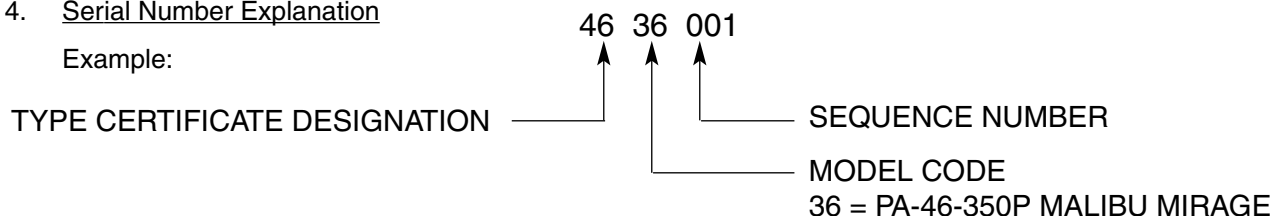
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or) S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

**(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP,
AND ALL HYDRAULIC COMPONENTS:**

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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(23) PROPELLER AND 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

Propeller
Overhaul Instructions: Manual No. 113

Composite Blade
Maintenance: Manual No. 135

Propeller Owner's
Manual: Manual No. 115

Aluminum Blade
Inspection, Repair,
and Overhaul Instructions: Manual No. 133

(24) RADAR (WEATHER), RDR - 2000:

Vendor Address:	Honeywell (Bendix/King) (See Autoflight, above)

Maintenance Manual:	Bendix/King ART 2000 P/N 006-05332-0001

(25) RADIO COOLING BLOWER:

Vendor Address:	Globe Motors 2275 Stanley Ave. Dayton, Ohio 45404 http://www.globe-motors.com/home.html	PH: (937) 228-3171 FAX: (937) 229-8531

(26) STARTER:

Vendor Address:	Electro Systems, Inc. (See Alternator, above)

(27) TURBOCHARGER:

Vendor Address:	Turbocharging Systems Worldwide HQ Building #10, Ste. 200 23326 Hawthorne Blvd. Torrance, CA 90505 http://www.alliedsignal.com/turbos/products/index.html	PH: (310) 791-9101 FAX: (310) 534-5941

(28) VACUUM PUMP:

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

(29) VACUUM REGULATORS:

Vendor Address:	Parker Hannifin Corp. (see "Fuel Boost Pump," above)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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	30	Special Inspections	
	50	Unscheduled Maintenance Checks	
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7		LIFTING AND SHORING	1F1
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11		REQUIRED PLACARDS	1G19
	20	Exterior Placards and Markings	
	30	Interior Placards and Markings	
12		SERVICING	1I3
	00	General	
	10	Replenishing	
	20	Scheduled Servicing	

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20		STANDARD PRACTICES - AIRFRAME	1J19
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21		ENVIRONMENTAL SYSTEMS	2C1
	00	General	
	20	Distribution	
	30	Pressurization Control	
	40	Heating	
	50	Cooling	
	60	Temperature Control	
22		AUTOFLIGHT	2F11
	10	Autopilot	
23		COMMUNICATIONS	2G19
	00	General	
	50	Audio Integrating	
	60	Static Discharging	
24		ELECTRICAL POWER	2H11
	00	General	
	30	DC Generation	
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25		EQUIPMENT/FURNISHINGS	2I23
	10	Flight Compartment	
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26		FIRE PROTECTION	2K3
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27		FLIGHT CONTROLS	3C1
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	10	Aileron and Tab	
	20	Rudder and Tab	
	30	Elevator and Tab	
	50	Flaps	
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	10	Storage	
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	20	Accessory Compartments	
51		STRUCTURES	5F1
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	10	Investigation, Cleanup, and Aerodynamic Smoothness	
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GENERAL

Description

The PA-46-350P, Malibu Mirage, is equipped with a Hartzell two-bladed all-metal constant-speed propeller as standard equipment. In S/N's 4636132 and up, a Hartzell three-bladed Kevlar-composite constant-speed propeller is available as an option. Both blade models have an 80 inch diameter.

In all installations, the propeller is controlled by an engine mounted Hartzell V-5-2 governor which supplies oil through the propeller shaft. Oil pressure increases the blade pitch (reduces rpm) and blade centrifugal forces reduces the blade pitch (increase rpm).

When propeller heat is installed, a B.F. Goodrich single-element system is used as described in section 30-60-00.

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

PROPELLER ASSEMBLY

1. Propeller

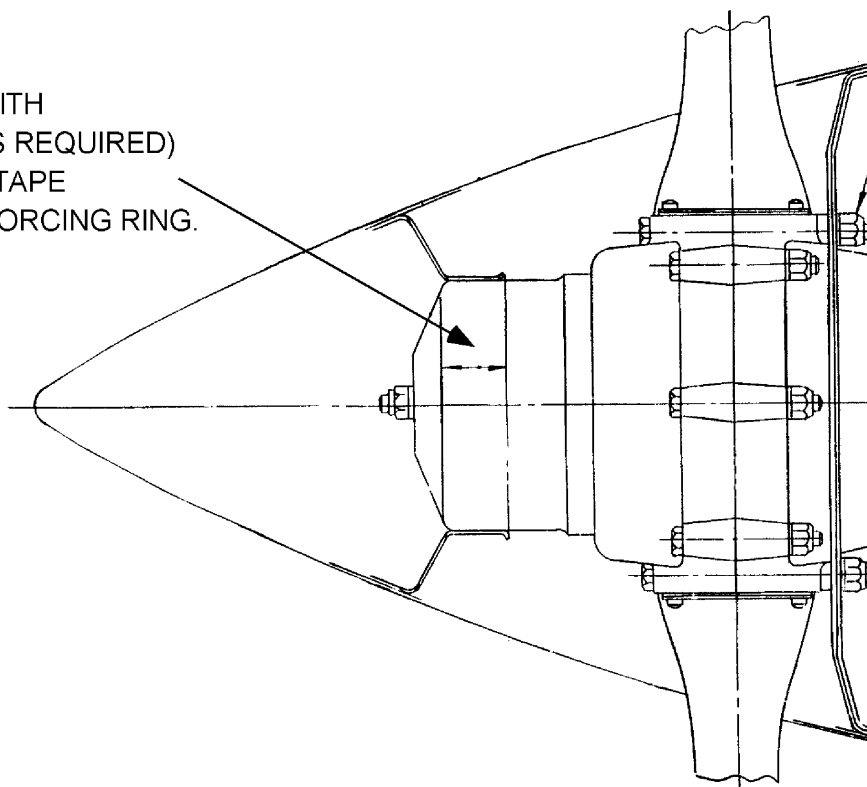
A. Removal

- (1) Ensure master and magneto switches are off.
- (2) Move fuel selector to off position.
- (3) Place mixture control in idle cut-off.
- (4) Note position of each component to facilitate reinstallation.
- (5) Remove the screws from around the spinner assembly and remove the spinner.
- (6) Place a drip pan under the propeller to catch oil spillage.
- (7) Remove the six propeller mounting bolts and remove propeller.

B. Installation

- (1) Ensure master and magneto switches are off.
- (2) Move fuel selector to off position.
- (3) Place mixture control in idle cut-off.
- (4) 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 must be inserted in the starter ring gear hole, likewise identified with an "O" mark.

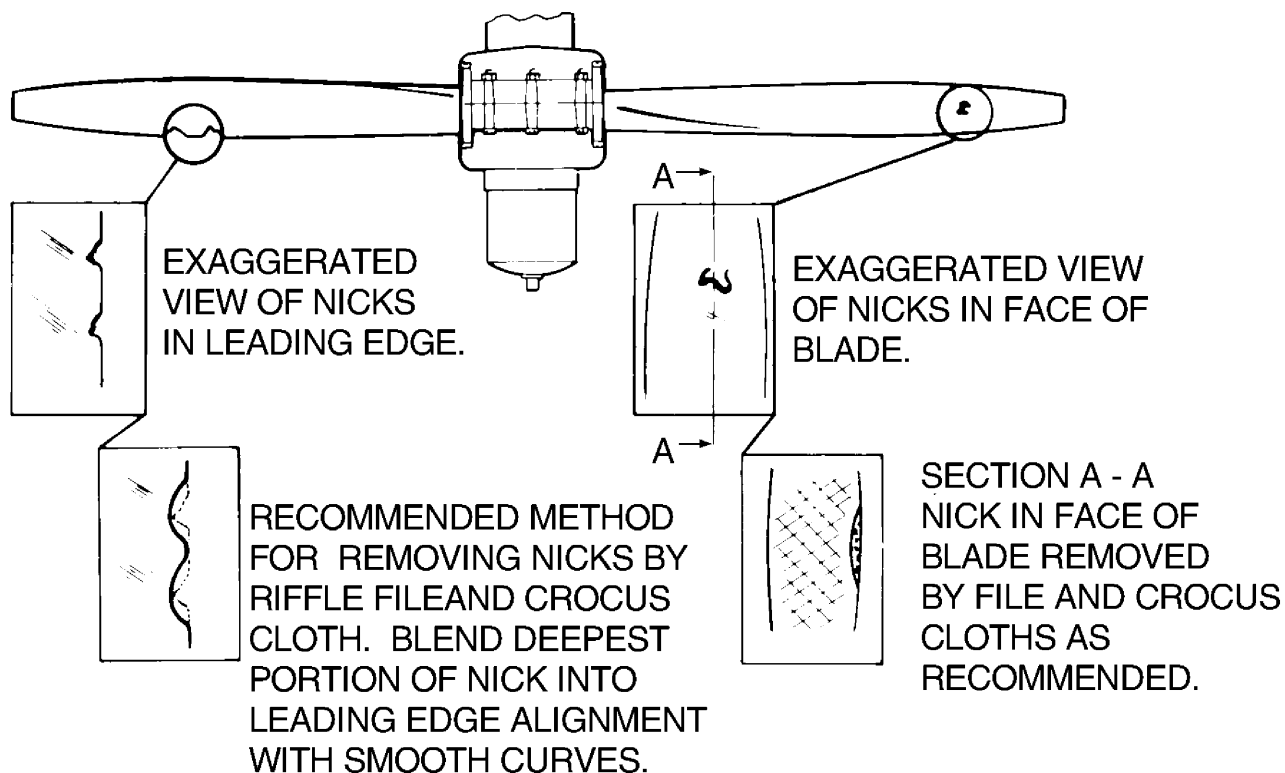
WRAP HUB CYLINDER WITH
UP TO FOUR LAYERS (AS REQUIRED)
OF P/N 289-788 TEFLON TAPE
FOR SNUG FIT OF REINFORCING RING.



Spinner Installation
Figure 1

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- (5) Wipe crankshaft and propeller pilot to ensure that no chips or foreign matter enter the propeller mechanism.
- (6) 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.
- (7) Install propeller with blades aligned with mounting bolt hole marked "O".
- (8) If not installed already, install rear spinner bulkhead using four (4) or six (6) hub clamping bolts, two and three blade installations, respectively. Torque 20 to 24 FT.-LBS.
- (9) Slide propeller carefully over pilot, taking care that O-ring is not damaged.
- (10) Install the six propeller mounting bolts and torque 60 to 70 FT.-LBS.
- (11) Check propeller blade track.
- (12) Safety the propeller mounting bolts with safety wire.
- (13) Grease propeller per Lubrication Chart in 12-20-00.
- (14) Wrap hub cylinder as required with 289-788 Teflon tape. Refer to Figure 1.
- (15) Install spinner.



Typical Nicks and Removal Method for All-Metal Blades
Figure 2

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C. Blade Track

Blade track is the ability of one blade tip to follow the other, while rotating, in almost the same plane. Excessive difference in blade track - more than 0.0625 inch - may be an indication of bent blades or improper propeller installation. Check the blade track as follows:

- (1) With the engine shut down and blades vertical, secure a smooth board to the airplane just under the tip of the lower blade. Move the tip fore and aft through its full blade-shake travel, making small marks with a pencil at each position. Then center the tip between these marks and scribe a line on the board for the full width of the tip.
- (2) Carefully rotate the propeller by hand to bring the opposite blade down. Center the tip and scribe a pencil line as before and check that the lines are not separated more than 0.0625 inch.
- (3) Propellers having excess blade track should be removed and inspected for bent blades, or for parts of sheared O-rings, or foreign particles, which have lodged between the hub and crankshaft mounting faces. Bent blades will require repair and overhaul of assembly.

D. Cleaning, Inspection, and Repair

- (1) Check for oil and grease leaks.
- (2) Clean the spinner, propeller hub interior, exterior, and blades with a non-corrosive solvent.
- (3) Inspect the hub parts for cracks.
- (4) Steel hub parts should not be permitted to rust. Use aluminum paint to touch up if necessary, or replating during overhaul.
- (5) Check all visible parts for wear and safety.
- (6) Check the blades to determine whether they turn freely on the hub pivot 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, remove the pitch change mechanism so that each blade can be checked individually. If the blades are tight, the propeller should be disassembled.

2. Propeller Blade Inspection and Repair

A. All-Metal Blades

- (1) Inspect the blades for damage or cracks. Nicks in the leading edges of the blades should be filed out and all edges rounded, to prevent formation of cracks. Use fine emery cloth for finishing.
- (2) Refer to Figure 2 for all-metal propeller blade care.

B. Kevlar-Composite Blades

CAUTION: SEE LATEST REVISION HARTZELL MANUAL NO. 135, MAINTENANCE MANUAL FOR COMPOSITE PROPELLER BLADES, FOR SPECIFIC DAMAGE LIMITS AND APPROVED REPAIR PROCEDURES. THE FOLLOWING INFORMATION IS ADVISORY ONLY.

- (1) Description.

The composite blade is composed of a metal blade shank retention section into which is molded a low-density foam core that supports built-up layers of composite laminate. An erosion shield of electroformed nickel is adhesively bonded to the blade leading edge to protect it from impact damage. A finish covering of polyurethane paint protects the entire blade from erosion and ultraviolet damage.

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(2) Inspection.

Inspect entire blade for nicks, gouges, looseness of material, erosion, cracks and debonds, and lightning strikes. Each 500 hours coin tap the erosion shield. Each 1000 hours coin tap the entire blade surface. Defects or damage discovered during inspection must be evaluated in accordance with the following criteria to determine: if repairs are required prior to further flight; and, if so, whether or not repairs may be conducted locally or must be performed by a qualified propeller shop.

Coin-Tap Test:

- (a) Composite blades can be inspected for delaminations and debonds by tapping the blade, or cuff (if applicable), with a "metal washer."
- (b) Use a washer-shaped metal tapper, approximately 2.5 inches O.D. x 1.25 inches I.D. x 0.25 inch thick, and weighing no less than 3 oz. Tap the surface. If an audible change is apparent, sounding hollow or dead, a debond or delamination is likely.

NOTE: Blades which incorporate a "cuff" will have a different tone when coin-tapped in the cuff area. To avoid confusing sounds, the cuff area and the transition area between cuff and blade should be coin-tapped separately from the blade area.

- (c) Mapping of the area being inspected is recommended. Coin-tap within an imaginary grid or matrix consisting of 2 inch squares during scheduled aircraft inspections. During blade overhaul, a more thorough inspection is required by using a smaller, 0.5 inch, grid.
- (d) The metal erosion shield is more likely to have problems than the blade, therefore a more thorough coin-tapping of the erosion shield is desirable. Also, slight deformations in the erosion shield may be noticed by careful visual and manual (touch) inspection. Such deformations may be the result of a debond and should be given a careful coin-tap inspection.
- (e) If a suspected delamination or debond is discovered, a localized, thorough coin-tap inspection is required to define the precise area of delamination or debond.
- (f) Outline any suspect areas with a grease pencil to determine approximate size of damage. If repairable, proceed per Hartzell Manual No. 135, latest revision.

(3) Definitions.

Airworthy Damage	Damage that does not affect the safety or flight characteristics of the propeller blade. Although a blade may continue in service with airworthy damage, this type of damage should be repaired at the earliest practical time to prevent further damage to the blade.
Unairworthy Damage	Damage that exceeds the maximum limits of airworthy damage. Unairworthy damage can affect the safety or flight characteristics of the propeller blade. This type of damage must be repaired at prior to the next flight. Exceptions may be possible, but require written authorization from Hartzell.
Minor Repair	Correction of damage that may be safely performed in the field by a certified aircraft mechanic (preferably one who has completed Hartzell composite blade training).
Major Repair	Correction of damage that cannot be performed by elementary operations. Major repairs must be performed by a Hartzell Propeller Inc. approved repair station. Exceptions may be possible, but require written authorization from Hartzell.

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(4) Airworthy Damage Limits.

CAUTION: SEE LATEST REVISION HARTZELL MANUAL NO. 135, MAINTENANCE MANUAL FOR COMPOSITE PROPELLER BLADES, FOR SPECIFIC DAMAGE LIMITS.

(5) Minor Repairs.

CAUTION: SEE LATEST REVISION HARTZELL MANUAL NO. 135, MAINTENANCE MANUAL FOR COMPOSITE PROPELLER BLADES, FOR SPECIFIC DAMAGE LIMITS AND APPROVED REPAIR PROCEDURES. THE FOLLOWING INFORMATION IS ADVISORY ONLY.

Procedures for the following minor repairs are provided in latest revision Hartzell Manual No. 135 - Maintenance Manual for Composite Propeller Blades.

- (a) Nickel Erosion Shield.
 - Debond extending to trailing edge or crack.
 - Gouge.
 - Missing area of trail side or inboard end.
- (b) Blade Cuff.
 - Cracks at the root end of cuff.
 - Nick or scratch.
 - Cracks.
 - Delamination.
- (c) Kevlar Blade.
 - Gouges or loss of material.
 - Crushed trailing edge.
 - Split trailing edge.
 - Frayed trailing edge.
- (d) Lightning Strike.

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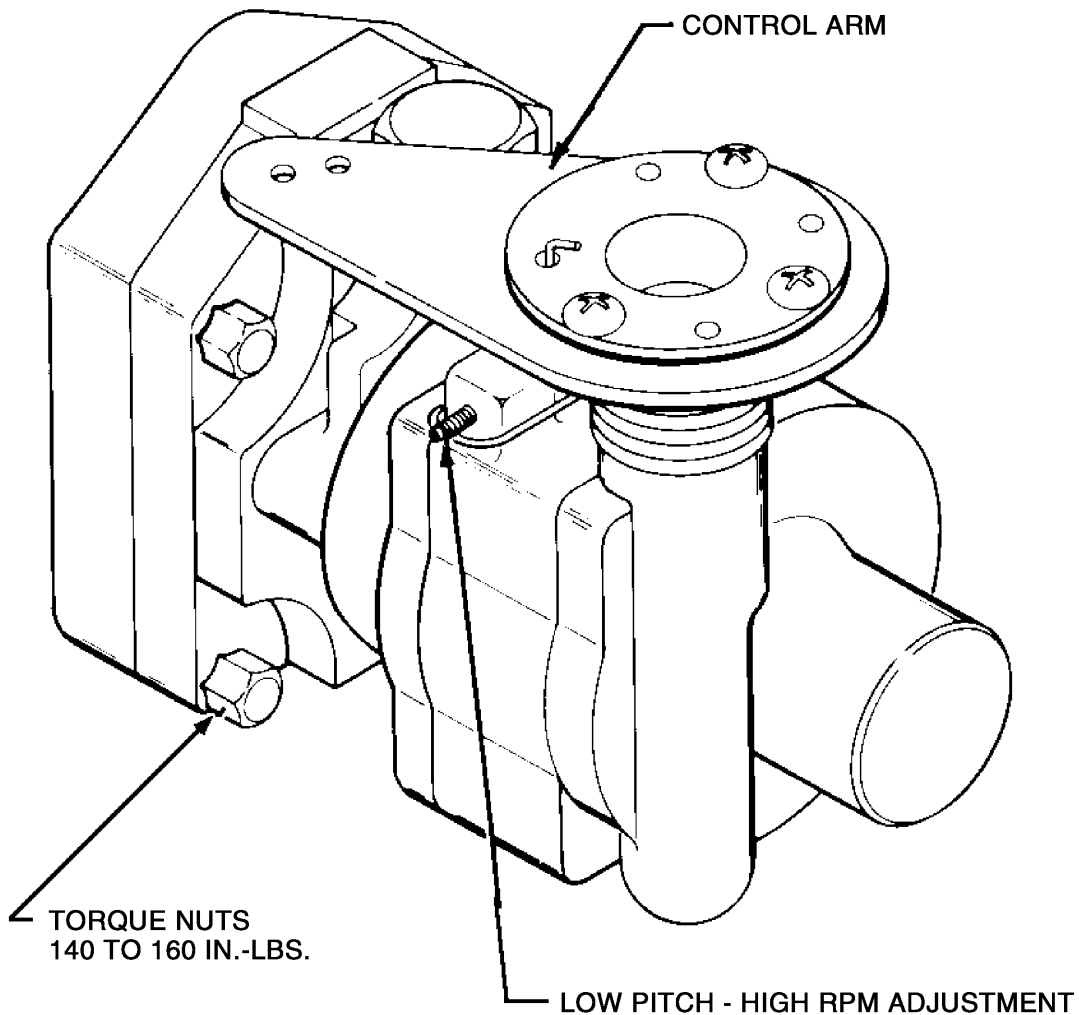
CONTROLLING

1. Propeller Governor

A. Removal

The propeller governor is mounted on the upper forward portion of the crankcase. Remove the governor as follows:

- (1) Remove the upper cowl and left side of the nose cowl to gain access to the governor.
- (2) Disconnect the governor control cable end from the governor control arm.
- (3) Remove the governor mounting nuts and withdraw the governor, with control bracket, from the mounting pad. Cover the mounting pad to prevent foreign material from entering the engine.



Propeller Governor
Figure 1

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B. Installation

- (1) Clean the mounting pad and the governor drive shaft thoroughly.
- (2) Coat the mounting gasket with Dow Corning release agent or equivalent.
- (3) Lubricate the drive shaft with engine oil and install the governor, with control mounting bracket, on the mounting pad.
- (4) Tighten the mounting bolts evenly and tighten to a final torque as shown in Figure 1.
- (5) Connect the control cable to the control arm. Check to be sure the attachment bolt and hardware are installed properly and do not contact the governor body while moving the control arm through its full travel.

C. Rigging and Adjustment

- (1) Start the engine; park the airplane 90° to the wind direction and warm in a normal manner until the oil temperature reaches 180°F.
- (2) To check the high rpm, low pitch setting, move the propeller control all the way forward. At this position the governor speed control arm should be against the high rpm fine adjusting screw. With the throttle full forward, observe engine rpm, which should stabilize between 2,475 and 2,500 rpm. A takeoff must be conducted during which the engine rpm should reach 2,500 rpm and remain steady.
- (3) If the engine rpm does not read 2,500 rpm in flight, the high rpm setting must be adjusted as follows:
 - (a) Land and shut down the engine.
 - (b) Adjust the governor by means of the fine adjustment screw for 2,500 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.
 - (c) Repeat step (b), above, as required to obtain proper rpm setting.
 - (d) After setting the proper high rpm adjustment, run the self-locking nut on the fine adjustment screw against the base projection to lock.
- (4) With the high rpm adjustment complete, the control system should be adjusted so that the governor control arm will contact the high rpm stop when the cockpit control knob is 0.032 to 0.047 of an inch from its full stop forward. Reconnect the cable end and tighten the jamnut. (Upper cowl must be removed to accomplish this adjustment.)
- (5) It is usually only necessary to adjust the high rpm (low pitch) setting of the governor control system, as the action automatically takes care of the positive low rpm (high pitch) setting.

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CHAPTER

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STANDARD PRACTICES - ENGINE

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GENERAL

Procedures

Use the following procedures whenever applicable:

- A. To facilitate and ensure proper installation, tag and/or mark all parts and hardware as to their location before they are removed or disassembled.
- B. When removing any tubes or engine parts, look for indications of scoring, burning or other undesirable conditions. Tag any unserviceable parts or units for investigation and possible repair.
- C. Take extreme care to prevent foreign matter (lockwire, nuts, washers, dirt, etc.) from entering the engine whether it is on or off the aircraft. Make use of protective caps, plugs, and covers to ensure openings are not exposed.

CAUTION: DUST CAPS USED TO PROTECT OPEN LINES SHOULD ALWAYS BE INSTALLED OVER THE TUBE ENDS AND NOT IN THE TUBE ENDS. FLOW THROUGH THE LINES MAY BE BLOCKED OFF IF LINES ARE INADVERTENTLY INSTALLED WITH THE DUST CAPS IN THE TUBE ENDS

- D. If anything is dropped into the engine, work should be stopped immediately and the item removed even if considerable time and labor is required.
- E. Ensure all parts are thoroughly clean before assembling, especially during engine build-up.
- F. Never reuse any lockwire, lock washers, tablocks, tab washers, or cotter pins.
- G. All lockwire and cotter pins must fit snugly in holes drilled in specific hardware. On castellated nuts, the cotter pin head must fit into a recess of the nut with the other end bent such that one leg is back over the stud and the other is down flat against the nut. Use only corrosion resistant steel for cotter pins or lockwire.
- H. When replacing gaskets, packings, or rubber parts, use the same type or composition as that of the gasket that was removed.
- I. Make sure replacement nonmetallic parts show no sign of storage deterioration.
- J. Use only a mallet of plastic or rawhide when installation of a part requires such force.

CAUTION: ENSURE THAT ANTI-SEIZE COMPOUNDS ARE APPLIED IN THIN EVEN COATS AND THAT EXCESS COMPOUND IS COMPLETELY REMOVED TO AVOID CONTAMINATION OF ADJACENT PARTS.

- K. Loose fitting spline drives external to the engine which have no means of lubrication should be lubricated with an anti-seize lubricant such as molybdenum disulfide.

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CHAPTER

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POWER PLANT

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GENERAL

1. Description

The PA-46-350P, Malibu Mirage, is powered by a Textron Lycoming TIO-540-AE2A series six cylinder, direct drive, wet sump, horizontally opposed, fuel injected, dual turbocharged, air cooled engine with a compression ratio of 7.3:1, rated at 350 hp at 2,500 rpm and designed to operate on 100 or 100LL (minimum) octane aviation grade fuel.

The engine cowling is cantilevered from the firewall with secondary supports from the nose gear door frame. The engine cowling consists of an upper and dual lower sections which are fabricated from sheet metal with bonded stiffeners. The metal nose cowl is split through the vertical propeller centerline to permit complete cowl removal without removing the propeller.

The induction system consists of a dry type air filter, an alternate air door, a Bendix servo regulator continuous flow type RSA-10ED1 fuel injector and an AN type fuel supply pump as an integral part of the fuel injector system. Dual AiResearch turbochargers are mounted as an integral part of the engine which incorporate bleed air sources for cabin pressurization. Automatic waste gate control of the turbochargers provides constant air pressure at the fuel injector inlet from sea level to critical altitude.

This engine is equipped with dual pressurized Slick type 6360 and 6363 magnetos. One magneto has a retard breaker providing fixed retard, long duration boosted spark for starting. A source of dc power and a starting vibrator are required to complete the installation. The spark advance is 20° BTC.

In addition to the aforementioned components, each engine is equipped with dual alternators, geared starter, and dual pneumatic vacuum pumps. Engine mounts are steel tubing construction attached at the firewall and incorporate vibration absorbing dynafocal mounts. From the exhaust stacks, gases are directed to individual turbocharger exhaust plenums, through or around the turbo turbine, as required, and overboard at bottom rear of the engine cowling on each side.

The lubrication system is of the pressure wet sump type. The oil pump, which is located in the accessory housing, draws oil through a drilled passage leading from the oil suction screen located in the sump. The oil from the pump then enters a drilled passage in the accessory housing which feeds the oil to a threaded connection on the rear face of the accessory housing, where a flexible line leads the oil to the external oil cooler. Pressure oil from the oil cooler travels thru tubing to a remote pressure oil filter and then is returned thru tubing to a threaded connection on the accessory housing and into the engine. In the event that cold oil or an obstruction should restrict the oil flow through the cooler, an oil cooler bypass valve is provided to pass the oil directly from the oil pump to the oil pressure filter.

The oil filter element, located on the engine mount frame, provides a means of filtering from the oil any solid particles that may have passed through the suction screen in the sump. After being filtered, the oil is fed through a drilled passage to the oil pressure relief valve, located in the upper left side of the accessory housing at the rear of the engine. This relief valve regulates the engine oil pressure by allowing excessive oil to return to the sump, while the balance of the pressure oil is fed to the main oil gallery in the right half of the crankcase. Residual oil is returned by gravity to the sump, where after passing through a screen it is again circulated through the engine.

2. Troubleshooting

See Chart 1.

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**CHART 1 (Sheet 1 of 6)
TROUBLESHOOTING ENGINE**

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.
	Over priming.	Leave ignition OFF and mixture control in idle cut-off, open throttle and unload engine by cranking for a few seconds. Turn ignition switch on and proceed to start in a normal manner.
	Incorrect throttle setting.	Open throttle to one fourth of its range.
	Defective spark plugs.	Clean and adjust or replace spark plugs.
	Defective ignition wire.	Check with electric tester and replace any 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.
	Water in fuel injector.	Drain fuel injector or fuel lines.
	Internal failure.	Check oil screens for metal particles. If found, complete overhaul of engine may be indicated.
Engine is hard starting.	Low voltage or defective vibrator.	Measure voltage between vibrator terminal marked IN and the ground terminal while operating starter. There must be at least 13 volts.

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**CHART 1 (Sheet 2 of 6)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Engine is hard starting. (continued)	Inoperative or defective vibrator.	If voltage is adequate, listen for buzzing of vibrator during starting. If no buzzing is heard, either the vibrator is defective or the circuit from the Output terminal on the vibrator to the retard contact assembly is open. Check both Switch and Retard circuits. Also check for good electrical ground.
	Retard contact assembly in magneto not operating electrically. Engine may kick back during cranking due to advance timing of ignition.	Retard points may not be closing due to wrong adjustment, or may not be electrically connected in circuit due to a poor connection. Inspect retard points to see if they close. Check for proper contact at the Switch and Retard leads at magneto and at the vibrator. Check wiring.
	Vibrator-magneto combination not putting out electrically.	Turn engine in proper direction of rotation until retard points just open No. 1 cylinder position. Remove input connection from starter to prevent engine turning and, while holding No. 1 plug lead 0.19 of an inch from ground, energize vibrator by activating the starter switch. Plug lead should throw a 0.19 of an inch spark. If spark is weak or missing, try new vibrator. If this does not correct trouble, check magneto for improper internal timing or improperly meshed distribution gears.
	Magneto improperly timed to engine.	Check magneto to engine timing.

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**CHART 1 (Sheet 3 of 6)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Engine is hard starting. (continued)	Advance contact assembly out of adjustment (internal timing off).	Check magneto timing.
	Retard points opening too late.	Check timing of retard points.
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 adjustment.	Adjust throttle stop to obtain correct idle.
	Uneven cylinder compression.	Check condition of piston rings and valve seats.
	Faulty ignition system.	Check entire ignition system.
	Insufficient fuel pressure.	Adjust fuel pressure.
	Leak in air bleed nozzle balance line.	Check connection and replace if necessary.
	Plugged fuel injector nozzle.	Clean or replace nozzle.
Low power and uneven running.	Flow divider fitting plugged.	Clean fitting.
	Mixture too rich as 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. Readjustment of fuel injector by authorized personnel is indicated.
	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.

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**CHART 1 (Sheet 4 of 6)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Low power and uneven running. (continued)	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.
	Fuel injector nozzles clogged.	Clean or replace nozzle.
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.
	Plugged fuel injector nozzle.	Clean or replace nozzle.
	Propeller out of rig.	Adjust propeller.
	Faulty ignition.	Tighten all connections. Check system with tester. Check ignition timing.
Rough engine.	Cracked engine mount.	Repair or replace mount.
	Defective mounting bushings.	Install new mounting bushings.
	Uneven compression.	Check compression.
	Defective spark plugs.	Try new spark plugs.
	Defective plug leads.	Check plug leads for continuity and break down. Check distributor block for moisture and carbon tracking. Check contact springs in distributor block. Check magneto contact assemblies for burning or dirt (Main and Retard). Check distributor timing.

CHART 1 (Sheet 5 of 6)

TROUBLESHOOTING ENGINE

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**CHART 1 (Sheet 6 of 6)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Excessive oil consumption.	Low grade of oil.	Fill sump with oil conforming to specifications.
	Failing or failed bearings.	Check sump for metal particles.
	Piston rings worn.	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 until oil consumption stabilizes.
High fuel flow indicated on fuel gauge.	Plugged fuel injector nozzle.	Clean or replace nozzle.

3. Engine

A. Removal

WARNING: PLACE A TAIL STAND UNDER THE TAIL OF THE AIRPLANE BEFORE REMOVING THE ENGINE.

NOTE: All hoses, lines, and wires should be tagged (identified) to facilitate installation. Open fuel, oil, and vacuum lines and fittings should be covered to prevent contamination.

- (1) Turn off all electrical switches in the cockpit and then disconnect the battery ground wire at the battery.
- (2) Move the fuel selector lever in the cockpit to OFF.
- (3) Remove the engine cowl.
- (4) Remove the propeller (refer to 61-10-00).
- (5) Discharge the air conditioning system and disconnect the air conditioning compressor lines (refer to 21-50-00).
- (6) Disconnect the starter positive and ground leads at the starter. Remove the lead attachment clamps.
- (7) Disconnect the propeller governor control cable at the governor. Remove the cable attachment clamps.
- (8) Disconnect the heated air hose from the heat muff.
- (9) Disconnect the throttle and mixture cables at the injector.
- (10) Remove the turbocharger air inlet ducts from both turbochargers.

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- (11) Disconnect the fuel pump supply line.
- (12) Disconnect both engine oil lines.
- (13) Disconnect the magneto P leads at the magnetos.
- (14) Disconnect the engine vent tubes at the engine.
- (15) Disconnect the engine oil temperature lead at the aft end of the engine.
- (16) Disconnect the tachometer leads at the engine magneto sensors.
- (17) Untie the ignition harness, hoses and lines at the aft end of the engine.
- (18) Disconnect the vacuum pump lines at the pumps and remove the fittings from the pumps.
- (19) Disconnect oil pressure line at the engine.
- (20) Disconnect the manifold pressure line from the engine on the right side intake manifold.
- (21) Disconnect the alternator leads and the cable attachment clamps.
- (22) Attach a one-half ton (minimum) hoist to the hoisting straps and relieve the tension from the engine mounts.
- (23) Check the engine for any attachments remaining to obstruct its removal.
- (24) Drain the engine oil, if desired, and then close drain.
- (25) Remove the four engine mount assemblies and swing the engine free, being careful not to damage any attaching parts.
- (26) Place the engine on a suitable stand.

B. Installation

NOTE: Prior to installing the engine, install all items that were removed from the engine after the engine was removed from the aircraft. Remove any protective caps and identification tags as each item is installed.

- (1) Attach a one-half ton (minimum) hoist to the engine and swing the engine into alignment with its attaching points.

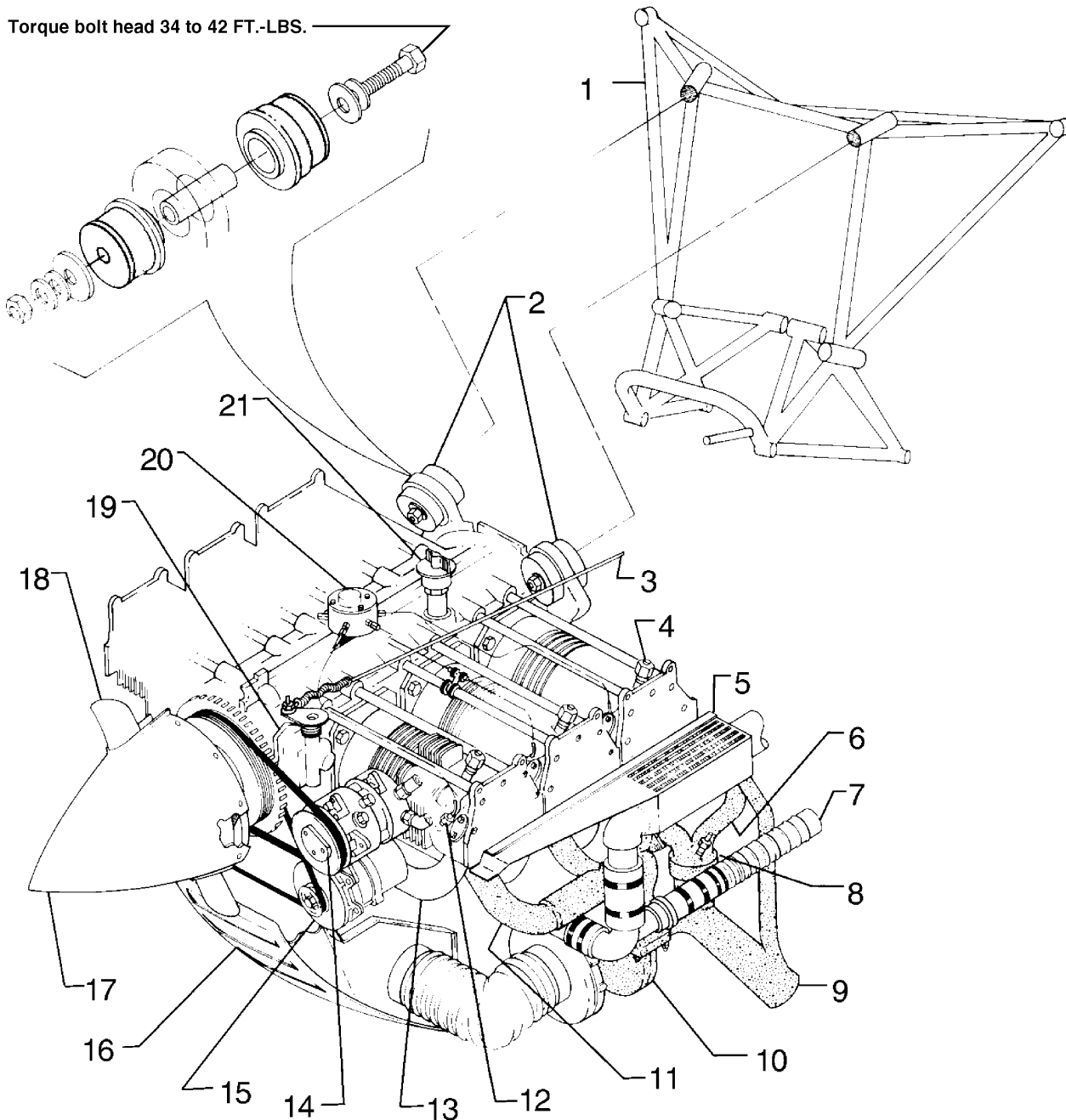
NOTE: Refer to Figure 1 for the arrangement of the shock mount assemblies. The top shock mounts are assembled so the silver shocks are aft and the gold shocks are forward. The bottom shock mounts are installed opposite of the top shock mounts.

- (2) Insert an engine mount bolt with washer against head into bottom motor mounts. Then insert heat shields, aft shock mount, and then spacer onto bolt.
- (3) Lower engine against aft shock mount and add forward shock mount over bolt and spacer onto engine mount bracket.
- (4) Place large wide washer then small washer over bolt, add nut and start only a few threads.
- (5) Insert an engine mount bolt with washer against head into top motor mounts. Then insert aft shock mount and then spacer onto bolt.
- (6) Raise engine against aft shock mount and add forward shock mount over bolt and spacer onto engine mount bracket.
- (7) Place large wide washer then two small washers over bolt, add nut and start only a few threads.
- (8) Tighten engine shock mounts (4) to torque specified in Figure 1.
- (9) Tighten engine mount assembly bolts (5) to 240-270 inch pounds (torque bolt head).
- (10) Connect alternator leads and secure the leads with the cable clamps.
- (11) Connect the manifold pressure line to the right bottom side of the engine.

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- (12) Connect the oil pressure line.
- (13) Install the fittings in the vacuum pumps (refer to 37-10-00) and attach the lines to the pumps.
- (14) Connect the tachometer leads at the engine magneto sensors.
- (15) Connect the engine oil temperature lead to the aft end of the engine.
- (16) Connect engine vent tube to the engine.
- (17) Connect the magneto p-leads to the magnetos.
- (18) Connect oil filter lines to the oil cooler and engine.
- (19) Connect the fuel pump supply line to the fuel pump.
- (20) Attach the turbocharger air inlet ducts to the turbochargers.
- (21) Connect the throttle and mixture cables to the injector.
- (22) Connect the heated air hose to the heat muff.
- (23) Connect the propeller governor control cable to the governor. Secure the control cable with the clamps.
- (24) Connect the starter positive and ground leads to the starter. Secure the leads with the clamps.
- (25) Connect the air conditioning compressor lines, if the air conditioning is installed.
- (26) Ensure that any other lines, hoses or electrical leads that were disconnected during removal of the engine are now reconnected.
- (27) Reinstall the propeller (refer to 61-10-00).
- (28) Reinstall the engine cowling.
- (29) Add the proper grade and amount of engine oil (refer to 12-10-00).
- (30) Turn on the fuel valve, open the throttle full and turn on the electric fuel pump. Check the fuel lines for leaks.
- (31) Service the air conditioning system.
- (32) Refer to 81-20-00 for information on pre-lubricating the turbochargers.
- (33) Perform an engine operational check. Inspect for any leaks and make final adjustments to engine controls as required.

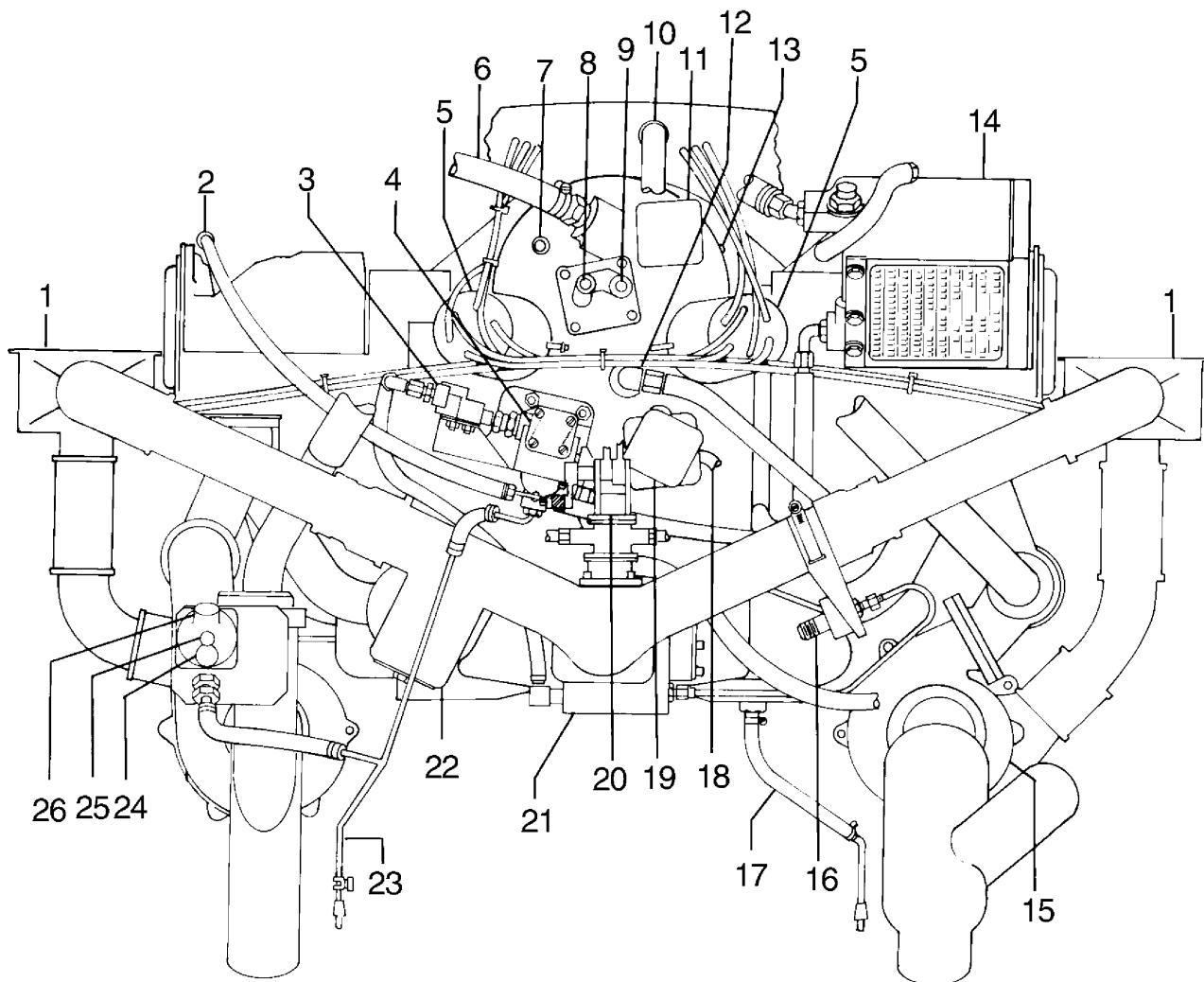
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1. ENGINE MOUNT ASSEMBLY	12. FUEL / AIR INJECTION NOZZLE
2. ENGINE SHOCK MOUNTS (2 UPPER, 2 LOWER)	13. INTAKE MANIFOLD
3. CONTROL CABLE TO PROPELLER GOVERNOR	14. AIR CONDITIONING COMPRESSOR
4. SPARK PLUG	15. ALTERNATOR
5. INTERCOOLER	16. AIR BOX
6. EXHAUST MANIFOLD PRESSURE CROSSOVER	17. SPINNER
7. BLEED AIR PICKUP FOR PRESSURIZATION	18. PROPELLER
8. WASTEGATE	19. PROPELLER GOVERNOR
9. EXHAUST PIPE	20. FUEL FLOW DIVIDER
10. TURBOCHARGER	21. OIL DIPSTICK AND FILLER NECK
11. EXHAUST MANIFOLD	

Engine Installation
Figure 1 (Sheet 1 of 2)

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1. INTERCOOLER	14. OIL COOLER
2. DECK PRESSURE FOR FUEL PUMP & NOZZLES	15. TURBOCHARGER
3. "AN" FUEL PUMP	16. FUEL PRESSURE SWITCH
4. FUEL FLOW TRANSDUCER	17. FUEL DRAIN
5. MAGNETO CONTROLLER	18. OIL RETURN FROM VARIABLE PRESSURE
6. OIL BREATHER TUBE TO OIL SEPARATOR	19. VACUUM PUMP PAD #2
7. OIL RETURN FROM FILTER	20. VARIABLE PRESSURE CONTROLLER
8. OIL PRESSURE TO LEFT TURBOCHARGER	21. FUEL INJECTOR SERVO
9. THERMOCOUPLE PORT	22. ABSOLUTE PRESSURE CONTROLLER
10. FUEL LINE FROM FUEL INJECTOR SERVO TO FUEL FLOW DIVIDER DRAIN	23. FUEL PUMP RELIEF AND WASTEGATE
11. VACUUM PUMP PAD #1	24. OIL PRESSURE TO VARIABLE PRESSURE
12. OIL TO COOLER CONTROLLER	25. WASTEGATE CONTROLLER
13. TO OIL PRESSURE GAUGE	26. ENGINE OIL TO WASTEGATE CONTROLLER

Engine Installation
Figure 1 (Sheet 2 of 2)

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COWLING

Engine Cowling (See Figure 1.)

A. Removal

(1) Upper

- (a) Release the fasteners that attach the upper cowl to the nose cowl and lower cowls.
- (b) Release the fasteners that attach the upper cowl to the fire wall flange.
- (c) Remove the upper cowl.

(2) Lower

NOTE: Support lower cowl before removing any attaching hardware.

- (a) Release clamp attaching heater muff hose to the NACA inlet on right cowl.
- (b) Release clamp attaching hose from NACA inlet on right cowl to air modulator box.
- (c) Remove screws that attach the lower cowl to the nose cowl
- (d) Remove the screws that attach the lower inboard edges of the lower cowls to the induction air panel assembly.
- (e) Release the fasteners that attach the upper cowl to the fire wall flange.
- (f) Remove lower cowl.

(3) Nose Bowl

- (a) Remove the screws that attach the lower inboard edges of the nose cowl to the induction air panel assembly.
- (b) Remove the five upper and two lower screws attaching the right half of the nose cowl to the left half.
- (c) Remove nose bowl cowl.

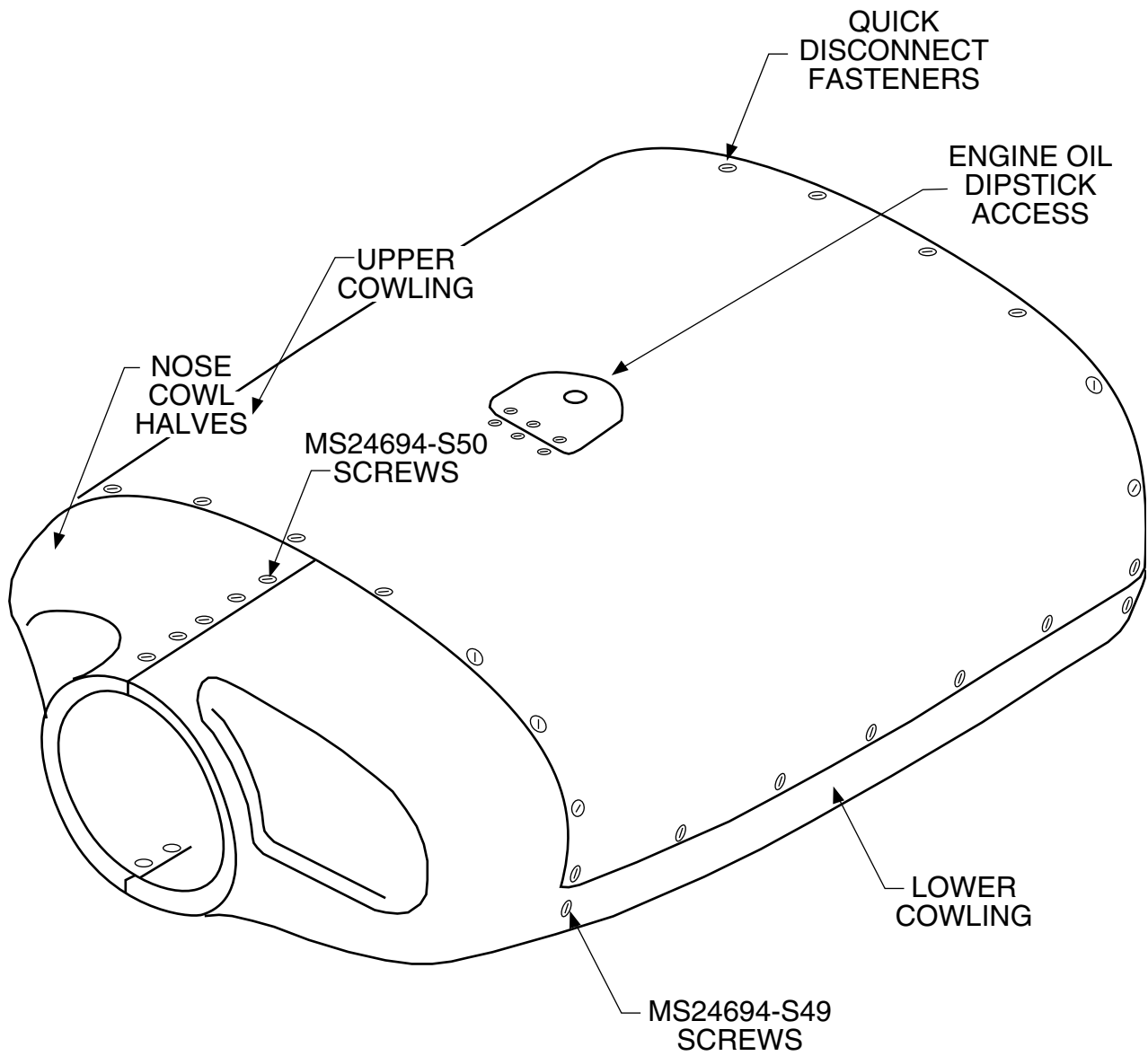
B. Installation

- (1) Place the nose cowl halves around the propeller drive shaft and secure them to each other and to the induction air panel assembly with MS24695-S50 screws.
- (2) Position both halves of the lower cowling in place and secure them to the nose cowl and firewall flange with the MS24694-49 screws.
- (3) Install screws attaching induction air panel assembly to the lower inboard edges of the lower cowls
- (4) Install the screws that attach the lower inboard edges of the nose cowl to the induction air panel assembly.
- (5) Attach hose from NACA inlet on right cowl to air modulator box. Tighten clamp.
- (6) Attach heater muff hose to the NACA inlet on right cowl. Tighten hose clamp.
- (7) Place the upper cowl in place and secure it to the nose cowl, lower cowlings and firewall flange.

C. Cleaning, Inspection and Repair

- (1) Clean the cowling with a suitable solvent and then wipe dry with a clean cloth.
- (2) Inspect the cowling for dents, cracks, loose rivets, damaged or missing fasteners, and damaged areas.
- (3) Repair all defects to prevent further damage.

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Engine Cowling
Figure 1

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MOUNTS

1. Engine Mount

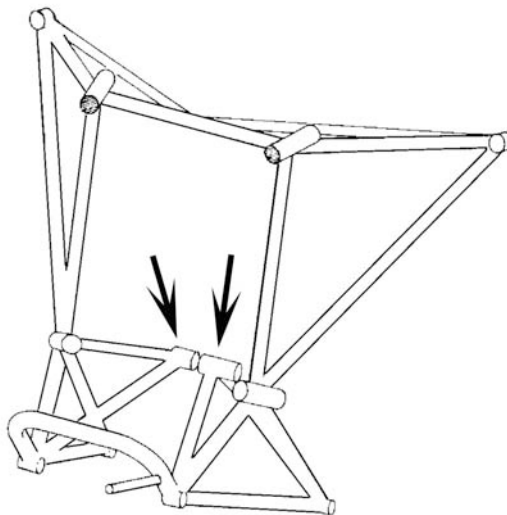
A. Inspection

(1) 100 Hour

In serial numbers 4636001 through 4636319 with the original factory-installed engine mount, each 100 hours time-in-service:

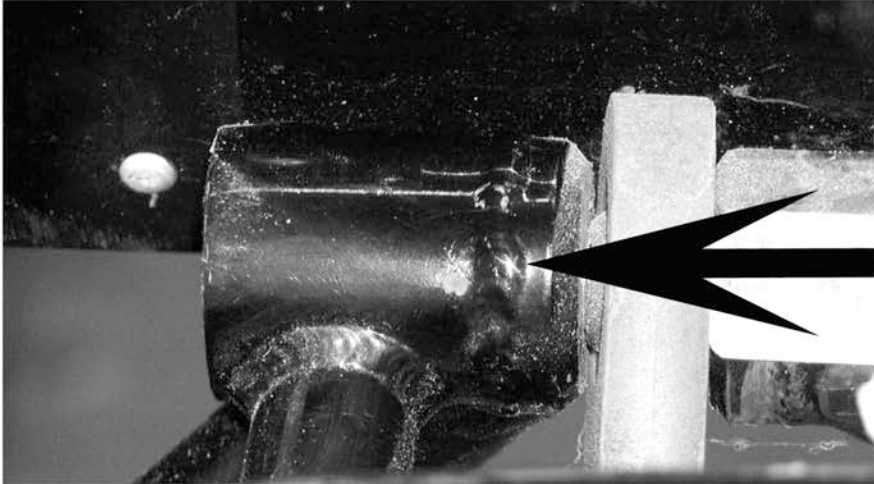
NOTE: Installation of a current production engine mount (see Figure 1, Sheet 2) will relieve the requirement for this repetitive inspection.

- (a) Clean the nose gear actuator attach feet (see Figure 1).
- (b) Remove protective coating (paint or Dinitrol AV8) from the actuator attach feet.
- (c) Inspect the welded area of the nose gear actuator attach feet (see Figure 1, Sheet 2) for cracks:
 - 1 First inspect visually. If no cracks are detected using that method; then,
 - 2 Perform a 'liquid penetrant inspection' per latest revision of AC 43.13-1.
- (d) If cracking is detected in either of the actuator attach feet, the entire engine mount assembly must be replaced before further flight.
- (e) If no cracks are found, the engine mount can continue in service until the next 100 hour inspection.
- (f) Clean the actuator attach feet and apply Dinitrol AV8 (P/N 89500-800) to the area where the protective coating was previously removed.
- (g) Make an appropriate logbook entry documenting this inspection.

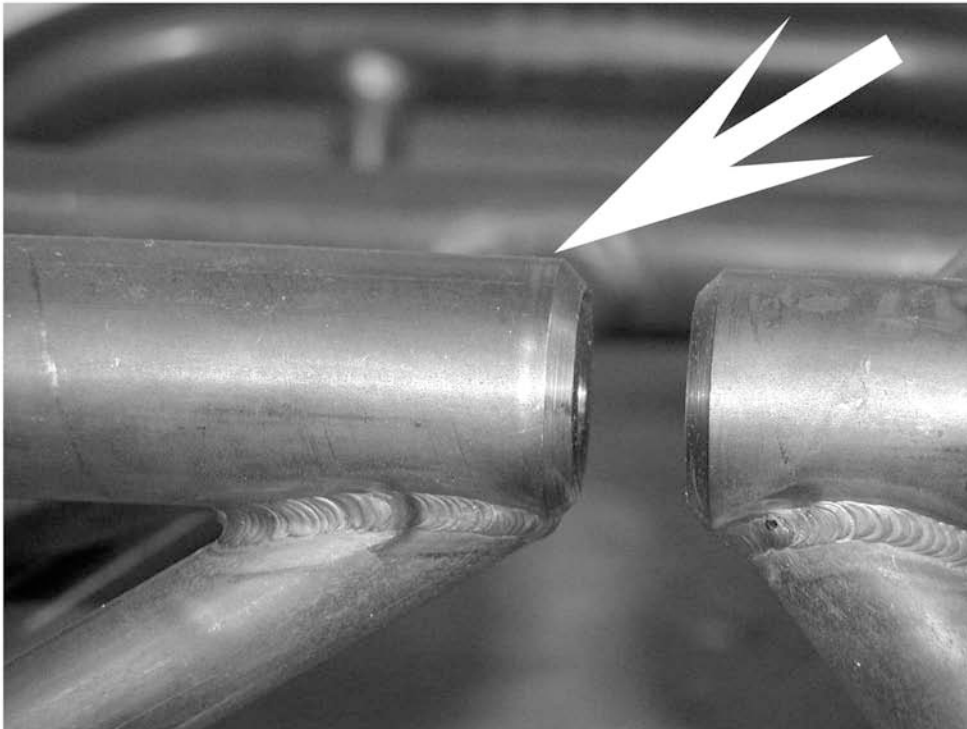


100 Hour Engine Mount Inspection
Figure 1 (Sheet 1 of 2)

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OLD STYLE ATTACH FEET - INSPECT WELD FOR CRACKS



NEW STYLE ATTACH FEET - NO WELD

100 Hour Engine Mount Inspection
Figure 1 (Sheet 2 of 2)

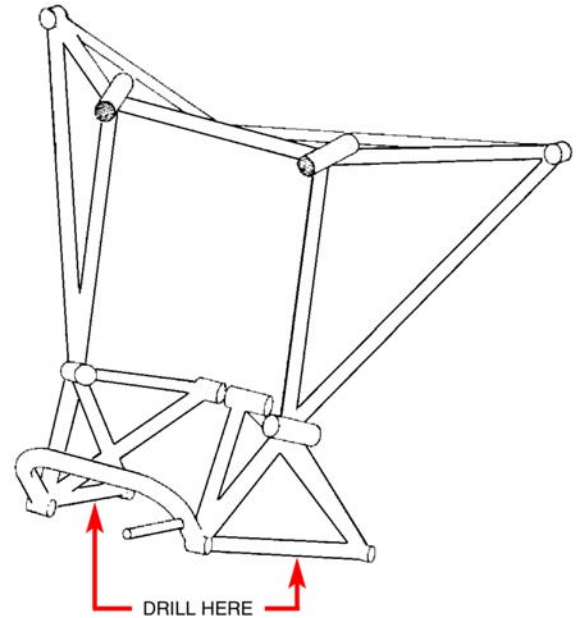
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(2) Corrosion Inspection, Immersion in Water

The following guidance is general in nature and should be applied or varied to fit the individual situation based on water level during immersion, length of time immersed, length of time since exposure, etc. Proceed as follows:

(a) Inspection

- 1 Level the aircraft per 8-20-00.
- 2 In the two lower tubes as indicated in Figure 2; drill a 3/16 inch hole in each tube, at the approximate mid-point.
- 3 Visually inspect the interior surface of each tube through the 3/16 inch hole for evidence of internal corrosion.
- 4 Should evidence of corrosion be detected in step (3), above, replace the engine mount. If no corrosion is detected, proceed with corrosion prevention, paragraph B, below.



Engine Mount Corrosion Inspection Points
Figure 2

(b) Corrosion Prevention

If no evidence of corrosion is detected in step (3), above, proceed as follows:

- 1 Place a drip pan below the inspection holes in each engine mount tube.
- 2 Insert a plastic tube thru each inspection hole and feed it up to the high point of the engine mount tube.
- 3 Using a syringe inserted into the end of the plastic tube, pump linseed oil into the upper end of the engine mount tube while rotating the syringe / plastic tube assembly to assure maximum coverage. Continue pumping until the lower end of the engine mount tube is filled with linseed oil to the level of the inspection hole.
- 4 Now, draw the plastic tube out of the upper end of the engine mount tube and reinsert it in the opposite direction, feeding it to the lower end of the engine mount tube.
- 5 Suck excess linseed oil out of the engine mount tube with the syringe / plastic tube assembly.
- 6 When linseed oil can no longer be picked up by the syringe / plastic tube assembly, remove it and allow the engine mount tube to drain into drip pans for approximately two hours.
- 7 Purge excess oil from tubes by applying air pressure to each 3/16 inch inspection hole, one at a time.
- 8 Insure that roughly the same amount of linseed oil that was pumped in is retrieved in the drip pans.
- 9 Apply a liberal coating of an approved fuel tank sealant (see Chart 3, 91-10-00) to each inspection hole and seal the hole with an appropriate blind rivet. After installing the rivet, apply a liberal coating of the approved fuel tank sealant over the head of the rivet.

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B. Installation

CAUTION: WHEN INSTALLING A REPLACEMENT ENGINE MOUNT ASSEMBLY, ENSURE IT CONFORMS TO THE LATEST DESIGN AS SHOWN IN FIGURE 1, SHEET 2.

Pay close attention to the nose gear actuator / engine mount connecting hardware to ensure the correct locknut is used (i. e. - P/N 404-891, MS 20365-720C). Additionally, check for proper thread engagement between the bolt and nut by ensuring at least one thread of the bolt protrudes through the nut per AC 43.13-1, latest revision. If sufficient threads are not exposed after the lock nut, replace the bolt with a longer bolt, P/N 401-509 (AN7-15A). Torque to the standard torque value (91-10-00, Chart 6) for a 7/16-20 AN7 bolt/MS 20365 nut.

2. Engine Shock Mounts Replacement

The engine shock mounts may be replaced with the engine installed as well as removed from the airplane. Refer to Figure 1, 71-00-00, for the arrangement of the shock mount assemblies. The top shocks are assembled so the silver colored shocks are aft and the gold colored shocks are forward. The lower shock mounts are installed opposite of the top shock mounts. The procedure described in this paragraph is with the engine installed.

- A. Remove the engine cowlings.
- B. Attach a one-half ton (minimum) hoist to the engine hoisting hooks and relieve tension from the shock mounts.
- C. Loosen the upper shock mount attachment nuts.
- D. Remove the lower mount attachment nuts, washers, forward shock mounts and spacers.
- E. Remove the lower attachment bolts just far enough to allow the aft shock mounts to be removed. The bushing in each lower mount must be removed with the bolt.

CAUTION: CARE SHOULD BE TAKEN NOT TO INTRODUCE ADVERSE STRESSES ON THE CONTROL CABLES, ELECTRICAL CABLES, HOSES AND OTHER ITEMS ATTACHED TO THE ENGINE, WHILE HOISTING THE ENGINE.

- F. Raise the nose of the engine enough to remove the lower aft shock mounts and replace with new ones.
- G. Lower the engine, slide the attachment bolts with bushings into place and install the spacers, forward shock mounts, washers and nuts. Start nuts only a few threads.
- H. Rotate the heat shields on the lower mounts to provide the greatest protection against exhaust heat.
- I. Remove the upper mount attachment bolts, nuts, washers, forward shock mounts and spacers.
- J. Lower the engine enough to replace the upper aft shock mounts. Raise the engine into position.
- K. Install the spacers, forward shock mounts, mounting bolts, washers and nuts.
- L. Tighten engine shock mounts (4) to torque specified in Figure 1, 71-00-00.

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DRAINS

Cylinder Head Drain

The cylinder head drain valve is located on the bottom forward right hand air intake plenum. The drain valve is connected to the cylinder head drain lines which come from both banks of cylinders. A drain tube goes from the drain valve through the lower cowling.

The drain valve is closed by manifold pressure when the engine is running. When the engine is shut down, the lack of manifold pressure allows the drain valve to open, thus draining any excess fuel from the cylinder heads.

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CHAPTER

73

ENGINE FUEL & CONTROL

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CHAPTER 73

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CHAPTER 73 - ENGINE FUEL AND CONTROL

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DISTRIBUTION

1. Fuel Injection System

A. 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 PA-46-350P is powered by a Textron Lycoming (TIO-540-AE2A) engine and is fuel injected to achieve even fuel distribution to all cylinders for a smooth and efficient running engine.

A vaned, positive displacement, engine driven fuel pump supplies fuel under pressure to the fuel injector servo metering unit. This metering unit determines the proper amount of fuel to be sent to the flow divider where the fuel flow is distributed equally among the six injector nozzles.

To atomize the fuel in the injector nozzles prior to entering the cylinder, turbocharged compressed air pressure (deck pressure) is picked up just prior to the throttle valve injector metering unit and distributed evenly to each injector nozzle where it atomizes the fuel prior to entering the cylinders. The nozzles continuously spray and atomize the metered fuel into the intake valve port of the engine cylinder heads in proportion to induction airflow.

B. Maintenance

- (1) Little attention is required between scheduled injector overhauls. Check the following items during periodic inspection of the engine:
 - (a) Check tightness and lock of all nuts and screws which fasten the injector to the engine.
 - (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 rods and levers for tightness and lock.
 - (d) Remove and clean the injector fuel inlet strainer at the first 25 hour inspection and each 50 hour inspection thereafter. Damaged strainer O-rings should be replaced.
- (2) Tests prove that gasoline, which becomes stale due to prolonged storage, absorbs oxygen rapidly. This stale oxidized gasoline acquires a very distinctive odor similar to varnish, causes rapid deterioration of synthetic rubber parts, and forms a gummy deposit on internal metal parts. This condition does not occur during normal operation of the injector where fresh fuel is being constantly circulated.

C. Lubrication

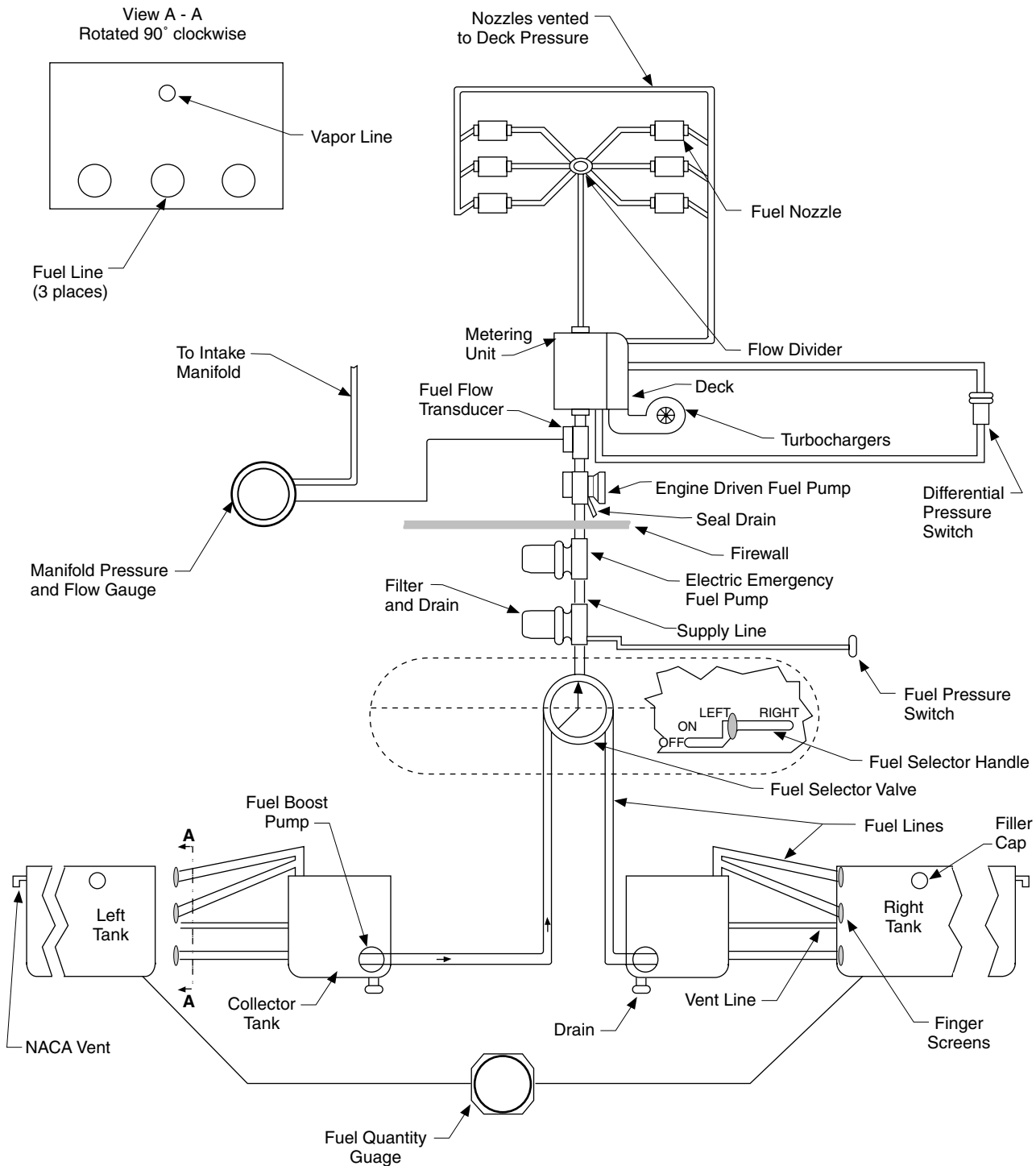
- (1) The clevis pins used in connection with the throttle and manual mixture control levers should be checked for freedom of movement and lubricated, if necessary. There is no need for lubrication of the injector in the field between scheduled overhauls.
- (2) Place a drop of engine grade oil on the end of the throttle shaft in such a manner that it can work into the throttle shaft bushings.

2. Fuel Injector

A. Removal

- (1) Remove the lower cowl panel.
- (2) Disconnect the throttle and mixture control cables at the injector. Disconnect the control rod that comes from the absolute pressure controller.
- (3) Disconnect the fuel inlet, flow, pressure and discharge lines at the injector.

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Fuel System Fluid Diagram
Figure 1

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- (4) Remove the bolts securing the injector to the air box and induction duct.
- (5) Remove the fuel injector.

B. Installation

- (1) Attach the injector to the air box and induction duct.
- (2) Connect the fuel inlet, flow, pressure and discharger lines to the injector.
- (3) Connect the throttle and mixture control cables to the injector. Attach the control rod that comes from the absolute pressure controller to the fuel injector. Rig controls.
- (4) Pressure check for leaks.
- (5) Adjust idle speed and mixture.
- (6) Replace cowling.

C. Storage Preparation

CAUTION: BECAUSE FLUID CAN EASILY ENTER THE AIR SECTION OF THE INJECTOR THROUGH THE IMPACT TUBES OR THE ANNULAR GROOVE AROUND THE VENTURI, INSTALL A PROTECTIVE PLATE ON THE SCOOP MOUNTING FLANGE WHEN PERFORMING ROUTINE MAINTENANCE ON THE ENGINE, SUCH AS WASHING DOWN THE ENGINE AND AIR SCOOP, SERVICING THE AIR FILTER (SURPLUS OIL ON THE ELEMENT), OR WHEN INJECTING PRESERVATIVE INTO THE ENGINE PRIOR TO STORING OR SHIPPING.

Any unit taken out of service, or units being returned for overhaul, must be flushed with preserving oil (Specification MIL-O-6081, Grade 1010), using the following procedure:

CAUTION: DO NOT EXCEED 15 PSI AIR PRESSURE AS INTERNAL DAMAGE TO THE INJECTOR MAY RESULT.

- (1) Remove plugs and drain all fuel from the injector. If available, apply 10 - 15 psi air pressure to the fuel inlet until all fuel is discharged from the injector.
- (2) Replace plugs and apply flushing oil filtered through a 10 micron filter at 13 - 15 psi to the injector fuel inlet until oil is discharged from the outlet.
- (3) Replace fuel inlet shipping plug.
- (4) After filling with preservative oil, the injector should be protected from dust and dirt and given such protection against moisture as climactic conditions at the point of storage require. In most cases, storing the unit in a dry area will be sufficient.
- (5) If the unit is to be stored near or shipped over salt water, the following precautions should be observed:
 - (a) Spray the exterior of the injector with an approved preservative oil.
 - (b) Pack in a dustproof container. Wrap the container with moisture and vapor-proof material and seal. Pack the wrapped unit in a suitable shipping case. Pack a one-half pound bag of silica gel crystals in the dustproof container with injector. The bag must not touch the injector.

3. Fuel Air Bleed Nozzle

A. Removal

The nozzles must be carefully removed as they or the cylinders may be damaged.

- (1) Remove the lower engine cowl.
- (2) Disconnect the fuel line from the nozzle.
- (3) Remove the spring retainer and spring from the nozzle stem.

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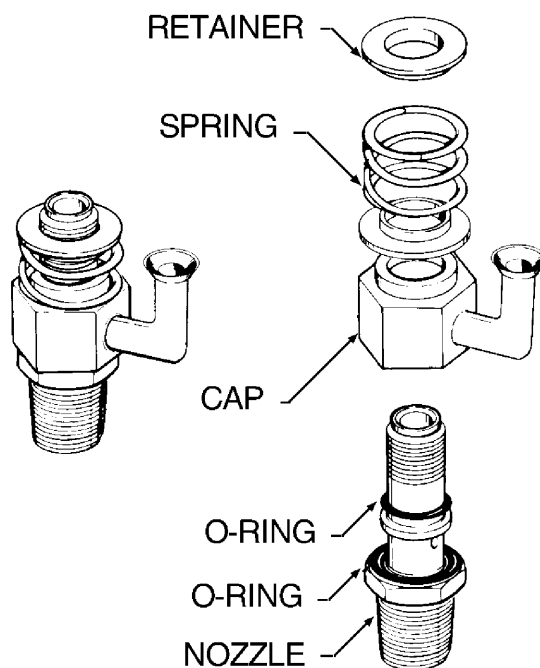
- (4) Disconnect the nozzle shroud from the vent hose and remove it from the nozzle.
- (5) Carefully remove the nozzle, using the correct size deep socket.

B. Installation

- (1) Install the nozzles and torque to 60 inch - pounds.
- (2) Ascertain that the O-rings are properly installed on the nozzle stem and install the nozzle shroud (refer to Figure 2).
- (3) Connect the vent to the nozzle shroud.
- (4) Install the spring and spring retainer on the nozzle stem.
- (5) Connect the fuel line to the nozzle and clamp the fuel lines as described in latest revision of Lycoming Service Bulletin No. 335.
- (6) Install the engine cowl.

C. Cleaning and Inspection

- (1) Clean the nozzle with acetone or equivalent and blow out all foreign particles. Do not use wire or other hard objects to clean orifices. (Refer to the latest revision of Lycoming Service Instruction No. 1275)
- (2) Inspect and replace nozzle O-rings if found to be cracked, brittle or distorted.
- (3) A test procedure for air bleed nozzles is described in latest revision of Lycoming Service Instruction No. 1275.



Fuel Air Bleed Nozzle
Figure 2

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INDICATING

NOTE: Serial numbers 4636021 and up incorporate Integrated Engine Instrumentation Systems. See Section 77-40-00 for more information.

1. Fuel Flow Gauge

The fuel flow gauge is mounted to the right of center in the upper section of the instrument panel, and is electrically operated by the flow transducer.

A. Troubleshooting

See Chart 1.

B. Removal

- (1) Gain access to the instrument form behind the instrument panel. Disconnect the electrical connection from the instrument.
- (2) Remove the post light(s) by turning off nut.
- (3) Remove the screws securing the instrument to the panel.
- (4) Remove the instrument from the panel.

C. Installation

- (1) Place the instrument in its proper panel cutout and secure with screws.
- (2) Install the post light(s) and secure. Do not overtighten the nut.
- (3) Connect the electrical connector to the gauge.

2. Fuel Pressure Low Warning Light

Illumination of the FUEL PRESS annunciator light indicates impending fuel starvation due to insufficient fuel pressure to the engine. See also 31-50-00 and 91-31-50.

3. Fuel Pump

A. Adjustment

To adjust the fuel pump output pressure:

- (1) Loosen the jamnut on the adjustment screw to allow free movement.
- (2) Adjust the pump pressure by turning screw in or out.
- (3) Tighten fuel pump jamnut and perform operation check.

**CHART 1
TROUBLESHOOTING FUEL FLOW GAUGE**

Trouble	Cause	Remedy
Pointer oscillates.	Air in fuel line.	Purge line.

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B. Pressure Operational Check

WARNING: MAKE SURE ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF THE PROPELLER ROTATIONAL AREA DURING ENGINE START AND RUN UP.

CAUTION: SHOULD EXCESSIVE FUEL PRESSURE OCCUR, IMMEDIATELY SHUT DOWN ENGINE AND ADJUST FUEL PUMP.

- (1) Pull the submerged boost pump circuit breaker.
- (2) Run engine to maximum power and observe fuel pressure gauge for 38 ± 2 psi.

4. Fuel Flow Transducer

The fuel flow transducer is located on the engine accessory case just below the left magneto.

A. Removal

- (1) Disconnect electrical leads going to transducer.
- (2) Disconnect B-nut on transducer fuel outlet line.
- (3) Remove the nuts, washers, and bolts securing transducer to mounting bracket.
- (4) Remove transducer mounting bracket from engine.
- (5) Disconnect transducer from fuel pump.

B. Installation

- (1) Coat all pipe threads with PST 563 sealant. Do not coat the orifice in the parts.
- (2) Position transducer in place. Connect fuel IN port to fuel pump.
- (3) Install transducer mounting bracket to engine.
- (4) Attach transducer to mounting bracket with two each AN4-12A bolts, AN960-416 washers, and MS21042-4 nuts.
- (5) Install AN816-6 adapter into transducer OUT port and connect B nut.
- (6) Connect electrical leads to transducer.

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IGNITION

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CHAPTER 74 - IGNITION

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ELECTRICAL POWER SUPPLY

1. Ignition System

A. Description

Ignition of the fuel charge in each cylinder is accomplished by two spark plugs independently excited by one of two Slick magnetos. Each magneto separately generates, times and distributes high tension (voltage) through leads to each cylinder. Both magnetos are pressurized by turbo compressor bleed air taken from the induction duct downstream from the right intercooler through an in-line filter to improve magneto efficiency at altitude.

The magnetos are controlled by two switches on the pilot's instrument panel. With the switch OFF, the magneto is grounded and will not produce spark. The right magneto fires the lower left and upper right spark plugs. The left magneto fires the lower right and upper left spark plugs.

The right magneto is standard and the left magneto is a retard breaker type with a fixed retard and long duration boosted spark for starting. A dc power source and a remote starting vibrator are required for operation. The magnetos incorporate an integral feed-through capacitor. The retarded magneto must have the right or standard magneto grounded during the starting cycle.

B. Replacement Magnetos

NOTE: Check the magneto dataplate to verify the specific model number and series of the magneto being worked on.

C. Overhaul

Overhaul is required as conditions indicate, but in no case may Slick 6300 series magnetos time-in-service exceed the TBO for the engine. Magnetos must also be overhauled after a lightning strike or following a sudden engine stoppage.

NOTE: An alternative to overhaul is complete magneto replacement with a new Slick magneto. New Slick magnetos incorporate all the latest design features and may be a cost effective alternative to overhaul.

Information provided in this section is intended to support magneto removal, cleaning, inspection, replacement and timing. For magneto overhaul procedures, see Slick's F-1100 Master Service Manual, available from:

Slick Aircraft Products
Unison Industries
Attn: Subscription Dept.
530 Blackhawk Park Avenue
Rockford, IL 61104

PH: 815-965-4700

D. Troubleshooting

See Chart 1.

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**CHART 1
TROUBLESHOOTING IGNITION SYSTEM**

Trouble	Cause	Remedy
Failure of engine to start.	Defective spark plugs.	Clean and adjust or replace spark plugs.
	Defective ignition wire.	Check with electric tester and replace any defective wires.
	Improper operation of magneto.	Check timing of magnetos.
	Improper switch wiring for left magneto starting.	Reverse magneto switch wires.
	Frozen spark plug electrodes.	Replace spark plugs or dry out removed plugs.
	Shorted ignition switch or loose ground.	Check and replace or repair.
	Defective vibrator.	Replace vibrator.
Failure of engine to idle properly.	Faulty ignition system.	Check entire ignition system.
	Improper spark plug setting for altitude.	Check spark plug gap.
Low power and uneven running engine.	Defective spark plugs.	Clean or replace sparkplug.
	Magneto not working properly.	Check timing of magneto.
	Defective ignition wire.	Check wire with electric tester. Replace defective wire.
	Defective spark plug terminal connections.	Replace connectors or spark plug wire.
	Improper ignition timing.	Check magnetos for timing and synchronization.
Failure of engine to develop full power.	Faulty ignition.	Tighten all connections. Check system. Check ignition timing.
Rough running engine.	Lead deposit on spark plug.	Clean or replace plugs.

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2. Magnetos (See Figure 3.)

A. 100 Hour Inspection

Every 100 hours or at annual inspection, whichever comes first, perform the following checks.

WARNING: BE SURE IGNITION SWITCH IS IN THE "OFF" POSITION AND THE CONDENSER P-LEAD IS GROUNDED.

(1) Adjust timing to engine.

- (a) Turn the engine crankshaft in the normal direction of rotation until the No. 1 cylinder is in the full-advance firing position.

- 1 Cover spark plug hole of number one cylinder with thumb. Rotate crankshaft until pressure is felt on thumb.
- 2 Remove plug in front of number six cylinder. Rotate crankshaft slowly to observe timing mark on alternator drive gear. When the mark on the gear is centered in the viewing hole, number one piston is at 20° BTC.

NOTE: Verify correct engine timing for the airplane being worked on by checking the engine dataplate.

- (b) Scribe a reference mark on the magneto mounting flange and engine accessory case.
- (c) Loosen the magneto mounting bolts, and connect a standard timing light between engine ground and the magneto condenser terminal.

WARNING: DO NOT ROTATE PROPELLER WHEN IGNITION SWITCH IS IN THE "ON" POSITION. THE MAGNETOS WILL FIRE THE SPARK PLUGS IF THE PROPELLER IS ROTATED - FATAL INJURY IS POSSIBLE.

- (d) Turn ignition switch ON.
- (e) Rotate the magneto, in its mounting, in the direction of normal operating rotation until the timing light indicates the contact breaker points are open.
- (f) Slowly rotate the magneto opposite normal rotation of the magneto on the engine mounting until the timing light (or audible signal) goes out.
- (g) Measure the distance from the reference mark previously scribed on the accessory case and the corresponding reference mark on the magneto. If this measurement is more than 1/8 inch, remove the magneto per Removal, below, and inspect/adjust the contact breaker points as described in 500 Hour Inspection and Cleaning; and, Assembly - Time the magneto internally; respectively, below. A 1/8 inch change corresponds to an approximate 5° change in internal magneto timing.
- (h) Secure the magneto in this position, alternately tightening the magneto mounting clamps - first to 8 ft-lbs. and finally to 17 ft-lbs. of torque.
- (i) Turn ignition switch OFF.
- (2) Inspect harness. See Section 74-20-00.
- (3) Inspect P-lead attachment. The P-lead connects the magneto primary circuit to the ignition switch. If the P-lead is disconnected, the magneto will be "HOT" and will fire the spark plug if the propeller is rotated. Verify that the P-lead is attached to the condenser stud. Torque to 13 to 15 in-lbs.
- (4) Inspect switch wire (left magneto only). This retard breaker lead connects the retard contact points to the ignition vibrator. If disconnected, the starting circuit will be inoperative. Torque to 13 to 15 in-lbs.
- (5) Inspect turbo filter. Look for yellow or red color, condensation, water, or foreign matter in the filter element. If the filter is contaminated: replace filter; inspect and repair pressurization system; and remove and inspect magnetos.

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- (6) Inspect and clean inlet nozzle. Yellow or white particles or any oily film indicates moisture contamination and possible lack of pressurization. Inspect and repair pressurization system.
- (7) Inspect and clean orifice vent. Maximum orifice diameter is .025 inch.

B. Removal

CAUTION: ASCERTAIN THAT THE PRIMARY CIRCUIT OF THE ENGINE IS GROUNDED BEFORE WORKING ON THE ENGINE.

Before removing the magnetos, make sure the magneto switches are OFF.

WARNING: THE MAGNETO IS NOT INTERNALLY GROUNDED, WHEN THE GROUND LEAD IS DISCONNECTED THE MAGNETO IS HOT. REMOVING THE HARNESS ASSEMBLY FIRST AND INSTALLING THEM LAST, MINIMIZES THE DANGER OF STARTING THE ENGINE ACCIDENTALLY WHEN THE GROUND LEAD IS REMOVED FROM THE MAGNETO.

- (1) Turn the engine crankshaft in the normal direction of rotation until the No. 1 cylinder is in the full-advance firing position.
- (2) Remove the harness cap from the magneto. Before doing this, place an index mark on the harness cap and distributor housing to ensure proper alignment upon reassembly.
- (3) Disconnect the P-lead and pressurization tube from magneto. Disconnect the retard breaker lead to the starting circuit from the left magneto.
- (4) Remove the nuts, washers and clamps, and remove the magnetos from the engine.
- (5) Cover the magneto accessory opening with suitable material to prevent internal engine contamination.

C. 500 Hour Inspection and Cleaning

Each 500 hours, remove magneto per Removal, above, and disassemble magneto, as necessary, per Disassembly, below. Inspect and clean magneto as follows:

- (1) Inspect ball bearing assembly by rotating rotor shaft. Shaft should rotate freely without binding or sticking, but should not appear loose. If not, replace bearings.
- (2) Inspect rotor for damage or worn keyway. Check rotor surfaces for wear.
 - (a) Inspect oil seal location on shaft.
 - (b) Assemble bearings and rotor per Assembly, steps (1) & (2), below.
- (3) Inspect coil for visible radial cracks. Replace coil if cracks evident. Inspect coil for primary and secondary circuit resistance and continuity, as follows: primary coil - .50 to 1.2 ohms; secondary coil - 13,000 to 20,500 ohms. Replace, if required.
- (4) Inspect primary contact points for signs of pitting and discoloration. If points are not discolored and have a white, frosty surface around the edges, points are functioning properly and can be reused. If points are blue (indicating excessive arcing) or pitted, they should be discarded. Replace primary contact point assembly, condenser and cam.

NOTE: For left magneto only (i.e. - retard breaker magneto), the primary contact points are secured by a BLACK anodized screw.

- (5) For left magneto only, inspect retard breaker contact points for signs of pitting and discoloration. If points are not discolored and have a white, frosty surface around the edges, points are functioning properly and can be reused. If points are blue (indicating excessive arcing) or pitted, they should be discarded. Replace retard breaker contact point assembly and cam.

NOTE: The retard breaker contact points are secured by a SILVER screw.

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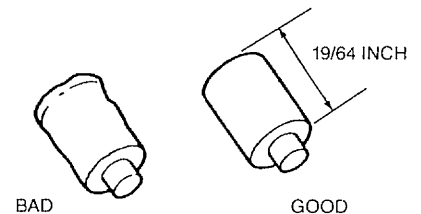
- (6) Clean and inspect condenser.
- (a) If the external surfaces of the condenser are dirty, clean with light soapy water. Rinse thoroughly with clear water and pat dry before reinstalling into the magneto housing.
 - (b) Using a magnifying lens, examine the glass bead end seals of the capacitor for broken glass or for glass separation from the retaining steel rings. Replace, if required.
 - (c) Inspect the condenser for signs of corrosion. Replace, if required.
 - (d) Inspect the condenser P-lead stud for twisting or "pulled" condition. Replace, if required.
 - (e) Test the electrical properties of the condenser using appropriate calibrated test equipment. Test for capacitance value with condenser charged to 400 volts DC. Service limit: .35 microfarad + 10 percent. Test for resistance, measured between condenser lead wire and condenser shell. Resistance should be greater than 10 megohms.

NOTE: No field repairs of any type to the condenser are approved.

- (f) Install condenser per Assembly, step (10), below.
- (7) Clean and Inspect Distributor Block.

CAUTION: DO NOT PUT CLEANER IN EITHER BRONZE OILITE BUSHING. THESE BUSHINGS ARE IMPREGNATED AT THE FACTORY AND CLEANER WILL DRAW THE LUBRICANT OUT OF THE BUSHING.

- (a) Disassemble and clean the distributor block bearing bar. Use standard non-filming non-conductive cleaner. Clean distributor gear with soapy water and rinse with clean water.
 - (b) Clean all surfaces free of dirt, oil, carbon dust and other contaminants using a cotton swab or "Q-Tip".
 - (c) Inspect the distributor block for cracks or other physical damage. Replace, as required.
 - (d) Inspect the brass electrode posts for signs of physical wear. Replace block assembly, as required, but note that during normal operation, the post will experience an electrical-metal transfer with the distributor gear electrode.
 - (e) Inspect oilite bushing for gumming oil. The bushing should be free of contamination and the gear should turn freely in the distributor block with no appreciable drag. If the bushing is gummed, wipe the bushing with MEK and lubricate with one drop of Exxon Teresstic 100 or Slick P/N M-3306. No other oils should be placed in these bushings.
 - (f) Ensure the distributor block surfaces are free of all oil and carbon dust prior to reassembly.
 - (g) Inspect distributor gear teeth for wear and general integrity. Replace block assembly as required.
 - (h) Inspect the electrode finger for looseness. The electrode should be held securely to the shaft when tested with light finger pressure. If loose, replace block and gear.
 - (i) Clean the end of the electrode to remove electrical deposits.
 - (j) Inspect bearing bar for cracks or other physical damage. Replace as required.
 - (k) Ensure the bearing bar is free of all and carbon dust prior to reassembly.
- (8) Inspect the carbon brush. Overall length must be greater than 19/64 (.297) inch and the outside diameter must be uniform (see Figure 1). Replace as required.
- (9) Inspect the loading spring. Overall free standing length should be greater than 19/32 (.594) inch. Springs that appear worn, that have flat spots or are too short must be replaced.



Carbon Brush Assembly
Figure 1

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- (10) Inspect and clean inlet nozzle. Yellow or white particles or any oily film indicates moisture contamination and possible lack of pressurization. Inspect and repair pressurization system.
- (11) Inspect and clean orifice vent. Maximum orifice diameter is .025 inch.
- (12) Inspect frame gasket for wear. Replace as required. Use only Slick replacement gaskets as gasket contains a metal mesh to insure proper ground between magneto frame and housing. Inspect screw gaskets for wear. Replace as required.
- (13) Inspect harness cap O-ring for wear. Replace as required.

D. Disassembly (See Figures 2 and 3.)

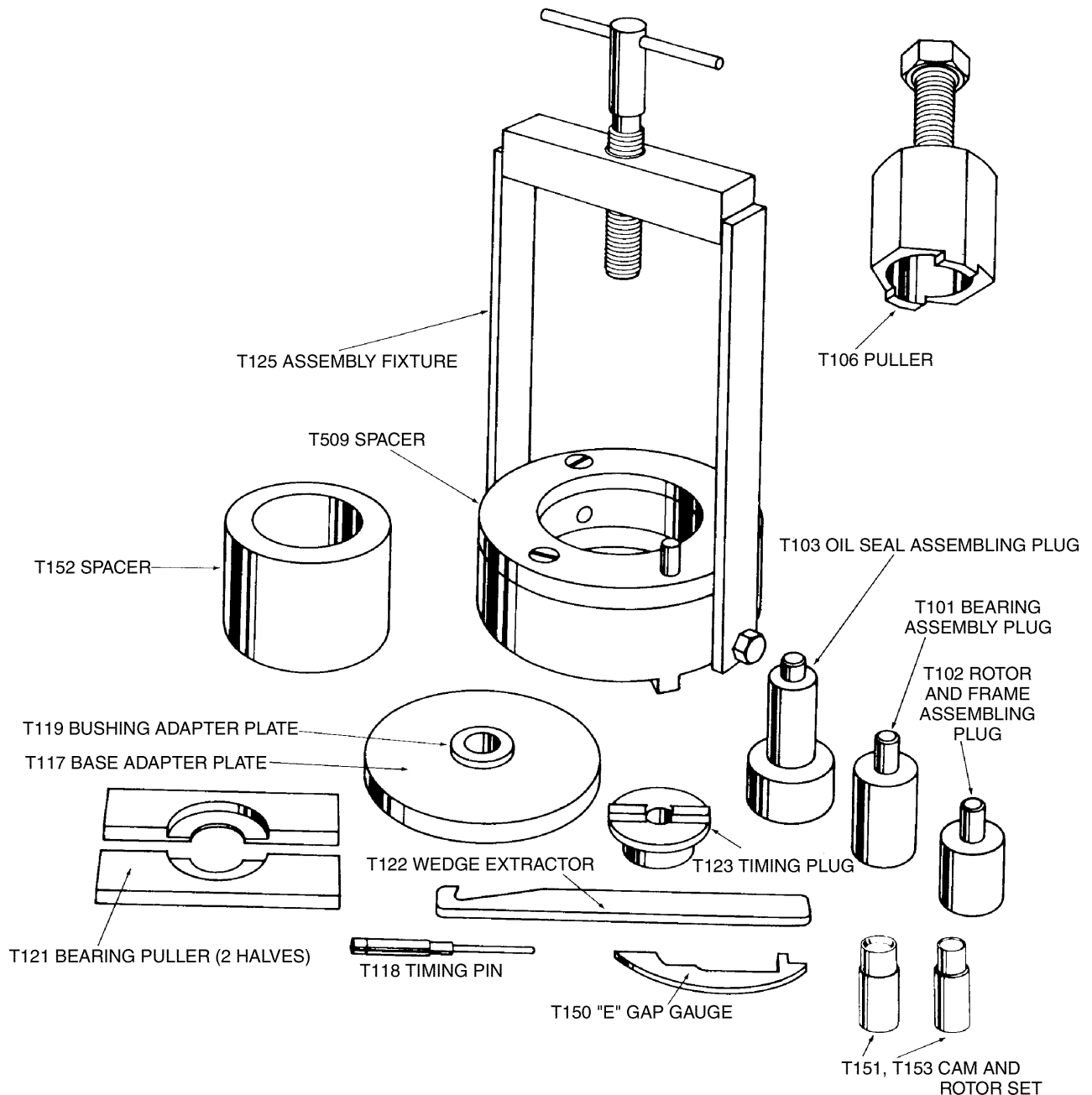
NOTE: Use of the Slick T - 100 Assembly and Timing Kit (Figure 2) is strongly recommended. The tools contained in this kit will greatly facilitate magneto disassembly/assembly and help prevent damage to parts.

- (1) Remove Woodruff key by prying key from rotor shaft using pliers.
- (2) Remove distributor housing assembly.
 - (a) Remove three long screws and single short screw from distributor housing.
 - (b) Separate distributor housing from magneto frame.
 - (c) Disconnect condenser lead from contact breaker assembly.
 - (d) Left magneto only - disconnect retard breaker switch lead from contact breaker assembly.
- (3) Remove the distributor block assembly by removing two screws and remove distributor bearing bar, distributor gear and distributor block from the housing.
- (4) Remove condenser.
 - (a) When removing the condenser from the distributor housing, carefully rotate the condenser wire counterclockwise in the same direction as the condenser to eliminate twisting the condenser lead.
 - (b) For left magneto only, remove the screw that secures the retard contact breaker switch wire to the distributor housing.
- (5) Remove rotor gear by prying it out of the end of the rotor assembly using two flat-blade screwdrivers.
- (6) Remove contact breaker assembly - Direct Drive Magnetos (i.e. - right magneto only).
 - (a) Disconnect coil lead wire from contact breaker assembly.
 - (b) Remove screws and washers from breaker assembly.
 - (c) Remove contact breaker assembly from bearing cap.
 - (d) Remove cam by prying straight up with a screwdriver blade.
- (7) Remove contact breaker assembly - left magneto only (i.e. - retard breaker magneto).

NOTE: In a retard breaker magneto, the primary contact points are secured by a BLACK anodized screw. The retard breaker contact points are secured by a SILVER screw.

- (a) Disconnect coil lead wire from primary contact breaker assembly.
- (b) Remove cam by prying straight up with a screwdriver blade.
- (c) Remove screws and washers from primary contact breaker assembly.
- (d) Remove primary contact breaker assembly.

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Slick T - 100 Assembly and Timing Tool Kit
Figure 2

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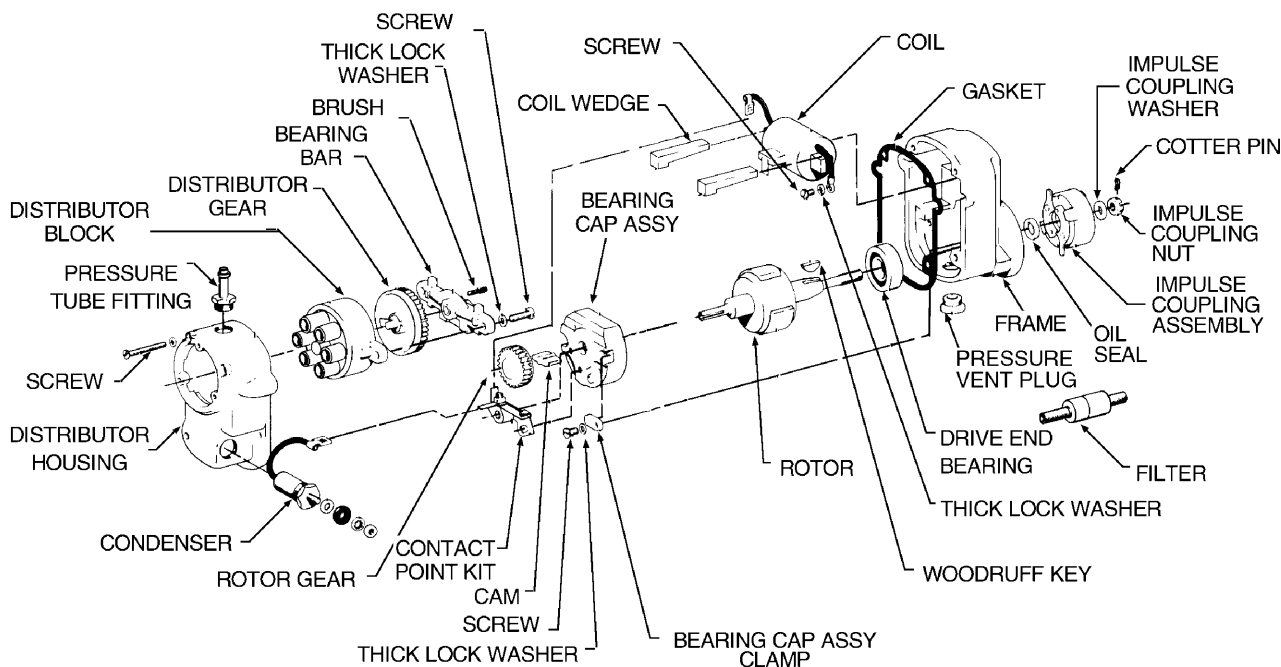
- (e) Remove screws and washers from retard breaker contact breaker assembly. Remove retard breaker contact breaker assembly and spacer.
- (f) Remove retard breaker contact breaker assembly and spacer.
- (8) Remove rotor assembly.
 - (a) Remove two screws and two bearing plate clamps.
 - (b) Press against the drive end of the rotor shaft and withdraw the rotor and bearing cap assembly from the drive frame.
- (9) Remove bearings from shaft and discard.

CAUTION: DO NOT DISASSEMBLE BEARING CAP ASSEMBLY SLICK PART NUMBER M-3485. THIS ASSEMBLY HOLDS A DOUBLE-SHIELDED BEARING CAPTIVE IN THE BEARING CAP AND IS PRE-LUBRICATED AT THE FACTORY WITH SPECIAL GREASE THAT TOLERATES THE OZONE RICH ENVIRONMENT WITHIN THE MAGNETO.

- (a) Place rotor on T-152 spacer with drive end down. Using T-125 assembly fixture, press rotor shaft, removing bearing cap assembly.
- (b) Reverse rotor shaft and insert T-121 bearing puller (both halves) between the drive end bearing and the rotor magnet head.
- (c) Place rotor and T-121 on T-152 spacer.

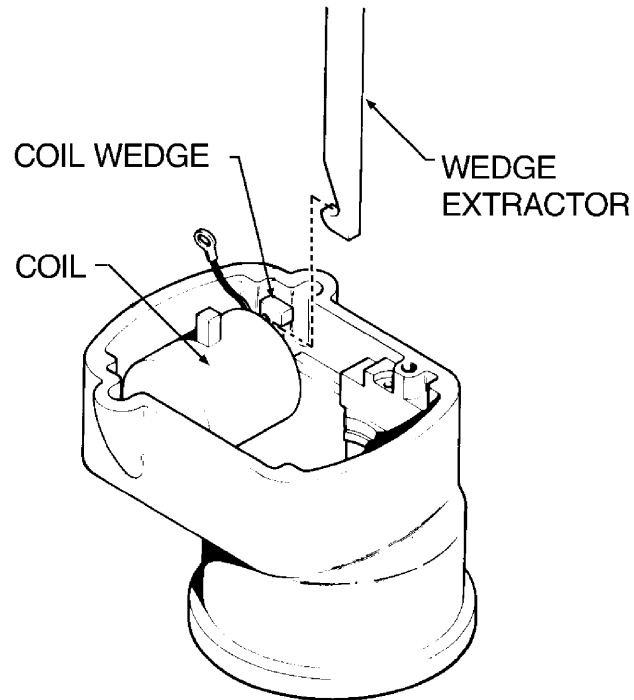
CAUTION: DO NOT ALLOW ROTOR TO COME INTO CONTACT WITH METAL CHIPS OR FILINGS. ROTOR IS MAGNETIZED.

- (d) Press rotor shaft and remove drive end bearing.



Exploded View of Magneto
Figure 3

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Removing Coil Wedges
Figure 4

- (10) Remove coil.
 - (a) Remove coil primary ground screw.
 - (b) Using coil wedge extractor T-122, remove coil wedges and lift out coil (see Figure 4).
- (11) Remove air vent/pressure vent plug from magneto.
- (12) Remove oil seal from magneto.

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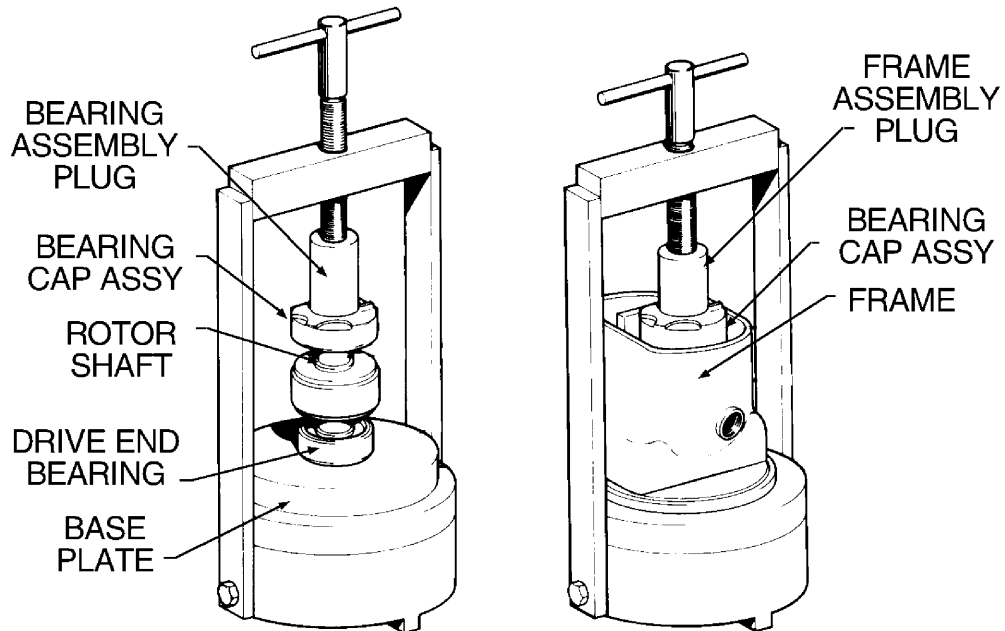
E. Assembly

NOTE: The following parts **MUST BE REPLACED** at engine overhaul (refer to Slick Service Bulletin No. SB-2-80C). Condenser, drive end bearing, bearing cap assembly, impulse coupling, coil, rotor gear, oil seal, contact point kit and distributor block and gear assembly. Refer to Slick Part List for part numbers. At each 500 hour inspection replace parts that are worn or damaged.

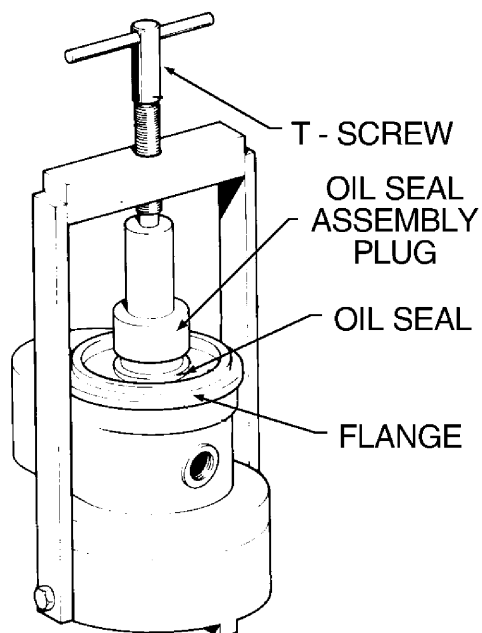
- (1) Assemble new bearings onto shaft (see Figure 5).
 - (a) Insert the base plate (T-117) and adapter plate bushing (T-119) into T-125 assembly fixture.
 - (b) Place one drive-end bearing and one bearing cap assembly onto the rotor shaft.
 - (c) Insert the rotor shaft into the adapter plate bushing (threaded end down).
 - (d) Place the bearing assembly plug (T-101) onto the exposed end of the rotor shaft.
 - (e) Turn T-handle screw to seat the bearings against the bearing shoulders on the rotor shaft.
 - (f) Remove the rotor shaft, adapter bushing, adapter plate and bearing assembly plug from T-125 assembly fixture.
- (2) Install rotor shaft assembly (see Figure 5).
 - (a) Place magneto frame in T-125 assembly fixture (flange down).
 - (b) Position rotor shaft assembly in the magneto frame.
 - (c) Insert rotor and frame assembly plug (T-102) into the T-handle.
 - (d) Turn T-handle until the bearing cap bottoms in the frame. Place cap over end of rotorshaft first.
 - (e) Place T-151 cam and rotor set onto the end of the rotor shaft and turn T-handle until the shaft bottoms in magneto frame.
 - (f) Install bearing clamps and the hold-down screws.
 - (g) Torque screws to 20-24 in-lbs.
- (3) Install oil seal (see Figure 6).
 - (a) Lubricate oil seal with engine oil.
 - (b) Reverse the magneto on the T-125 assembly fixture so the flange is facing up.
 - (c) Insert the oil seal over the rotor shaft.
 - (d) Press the oil seal flush into the frame using the oil seal assembly plug (T-103) and the T-handle screw.
- (4) Install Woodruff key by pressing woodruff key into the key slot of the rotor shaft.
- (5) Install coil.
 - (a) Place the frame on the T-125 assembly fixture. Insert the coil into the frame, being sure that it is back against the stops. Insert coil wedges between the bridge and the frame.
 - (b) Drive the two wedges tight, using a hammer and flat punch. Attach the ground wire coil (either black or white - depending on coil type) to the frame with a screw. Torque to 20 in-lbs.

CAUTION: IF THE HIGH TENSION LEAD PROTRUDES ABOVE THE MAGNETO FRAME, IT CAN MAKE DIRECT CONTACT WITH THE DISTRIBUTOR GEAR AND CAUSE THE MAGNETO TO MALFUNCTION.
 - (c) Position the coil high tension lead flush to 1/32 (.031) inch below the parting surface of the magneto frame.

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Bearing Installation with T - 125 Assembly Fixture
Figure 5



Oil Seal Installation with T - 125 Assembly Fixture
Figure 6

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- (6) Install primary contact points - Both magnetos.

CAUTION: RETARD BREAKER MAGNETOS USE DIFFERENT LENGTH SCREWS TO SECURE THE CONTACT BREAKER ASSEMBLIES. USE OF INCORRECT MOUNTING SCREWS WILL DAMAGE UPPER MAGNETO BEARING AND CAUSE POSSIBLE MAGNETO FAILURE.

Attach contact point assembly on the bearing cap using appropriate screw.

NOTE: In left magnetos only (i.e. - retard breaker magnetos), the primary points are secured with a black anodized screw.

- (7) For left magneto only - Install retard breaker contact point assembly.

NOTE: Install primary point assembly before installing retard point assembly.

- (a) Place spacer on bearing cap and attach retard contact points assembly using silver screw and plain washer.
- (b) Do not tighten screws until magneto is timed.

- (8) Install rotor cam.

- (a) Install cam using a light hammer and T-151 cam and rotor set.
- (b) Drive the cam until it bottoms in the rotor cam slot.

- (9) Time the magneto internally

- (a) Set primary points - All magnetos.

NOTE: In left magneto only (i.e. - retard breaker magnetos), the primary points must be set first. The retard (i.e. - secondary) points are set in reference to the primary points and, accordingly, the primary points must be set correctly or the retard contact settings will not be accurate.

- 1 Place the magneto on the T-125 assembly fixture, flange down, with the T-509 timing base adapter removed.
- 2 Install the T-123 timing plug on the rotor shaft before placing the magneto on the T-125 assembly fixture.
- 3 Looking directly down on the magneto, align the magneto so that the coil is oriented in the 12 o'clock position.
- 4 Insert T-150 "E" Gap Gauge between the pole laminations in the rotor shaft and the pole laminations in the frame. Read the magneto dataplate for magneto rotation.
 - a For old style rotor (i.e. - no slots on the magnet head), insert flat end of T-150 "E" Gap Gauge. Insert the "E" Gap Gauge against the right lamination for right-hand rotation magnetos and against the left laminations for left-hand rotation magneto.
 - b For new style rotors (with slots on magnet head), insert notched end of T-150 "E" Gap Gauge. Locate the appropriate "L" or "R" timing slot on the rotor magnet head and insert the notched end of the "E" gap gauge. Use the "L" slot for left-hand rotation magnetos and the "R" slot for right-hand rotation magnetos.
- 5 Rotate the magneto frame on the T-125 assembly fixture until the T- 150 "E" Gap Gauge rests against the pole lamination in the magneto frame. Rotate the magneto frame clockwise for left-hand rotation magnetos and counterclockwise for right-hand rotation magnetos. The magneto rotor shaft is now in "E" Gap position.
- 6 Using a timing light, adjust the contact points to be just opening when the frame is against the T-150 gauge. This will provide a point gap opening of .008-.012 inches.

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- 7 For right magneto only: Secure the points in this position by tightening the screws. Torque adjusting screw to 18-20 in-lbs. Torque the pivot screw to 15-18 in-lbs.
 - 8 For left magneto only: Secure primary points by tightening the adjusting screw. Torque to 15-18 in-lbs. Proceed to Set secondary points - left magneto only, below.
 - 9 Apply cam grease sparingly to each lobe of the cam.
 - 10 Attach coil lead wire to the vertical bronze male terminal of the primary point assembly.
- (b) Set secondary points - left magneto only

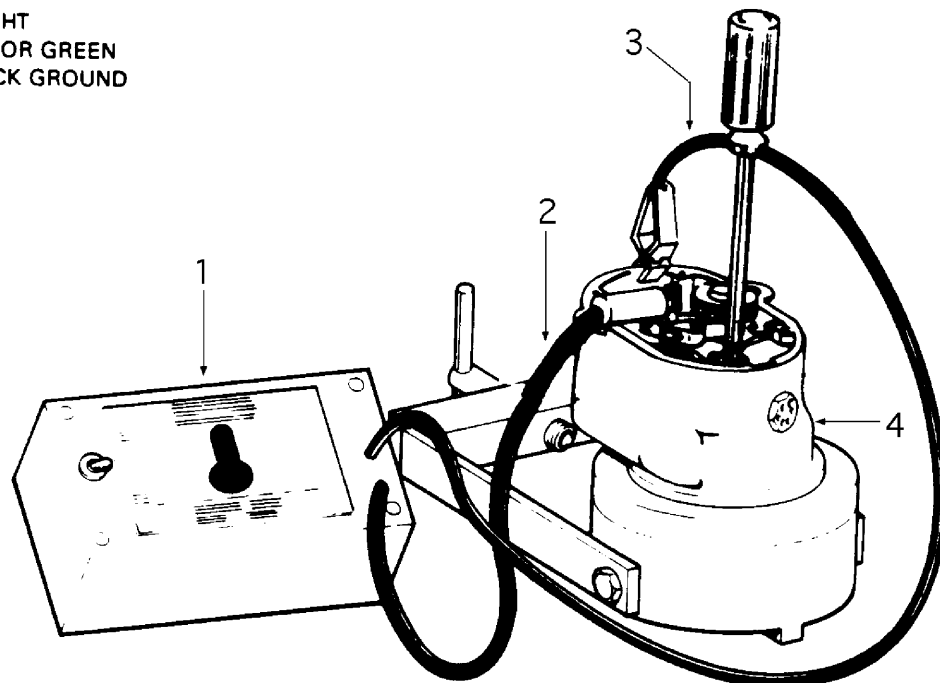
NOTE: In left magneto only (i.e. - retard breaker magnetos), the primary points must be set first. The retard (i.e. - secondary) points are set in reference to the primary points and, accordingly, the primary points must be set correctly or the retard contact settings will not be accurate.

- 1 Set primary points according to instructions, above. Do not remove T-150 "E" Gap Gauge and do not remove magneto frame from T-125 assembly fixture.

NOTE: Retard points are set in reference to primary point settings. The lag angle on the magneto dataplate is the retard breaker's retard angle measured in degrees. Use the following procedure to set the retard points the required number of degrees from the primary points.

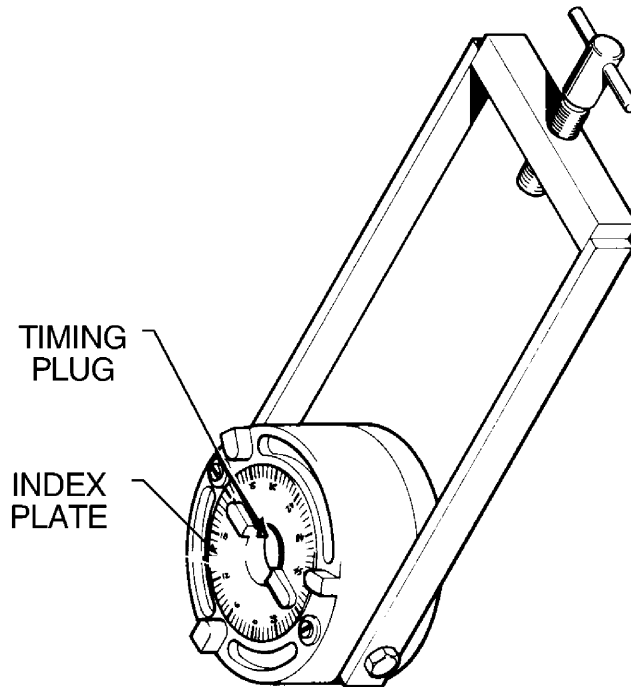
- 2 Holding magneto securely in base (in "E" gap position), tip magneto and T-125 assembly fixture and loosen timing disk retaining screws. Timing disk should rotate freely.

1. TIMING LIGHT
2. WIRE, RED OR GREEN
3. WIRE, BLACK GROUND
4. VENT



Magneto Internal Timing
Figure 7

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Index Plate and Timing Plug
Figure 8

- 3 Ensure that the T-150 "E" gap gauge is still positioned against the correct lamination. Rotate magneto frame until it contacts the pin in the T-125 assembly fixture. Rotate the magneto frame clockwise for left-hand rotation magnetos, counterclockwise for right-hand rotation magnetos.
- 4 Hold magneto securely in base and tip magneto and T-125 assembly fixture. Tighten one timing disk retaining screw to hold the timing disk in place. Remove magneto from T-125 assembly fixture.
- 5 Turn T-125 assembly fixture over so that timing disk is facing you. Loosen timing disk retaining screw. Scribe a mark on the timing disk corresponding to the index mark on the T-125 base. This represents a point-of-reference for primary point "E" gap. (See Figure 8.)

NOTE: The actual number at the timing disk index mark is not critical. This index mark will be used as a point of reference for setting the retard points a specified number of degrees from the primary points.

- 6 Note the lag angle and direction of rotation from the magneto dataplate.
- 7 The ticks on the timing disk each represent 5°. To set the timing disk in the proper position, rotate the timing disk counterclockwise for left-hand rotation magnetos and clockwise for right-hand rotation magnetos. Rotate the disk the appropriate number of ticks for the lag angle noted on the magneto dataplate.

EXAMPLE:

Lag angle as noted from dataplate: 25°
Rotation as noted from dataplate: L

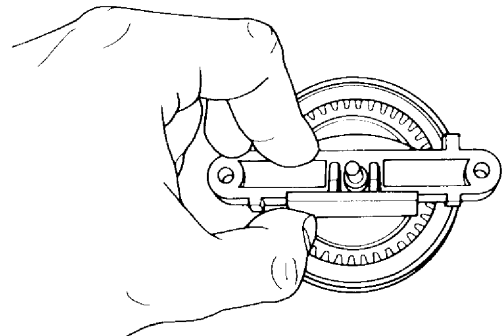
To set timing disk, turn the timing disk 5 ticks ($5 \times 5^\circ = 25^\circ$) counterclockwise using scribed mark as reference point.

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- 8 Tighten timing disk retaining screws. Reverse T-125 assembly fixture and place magneto in it, flange down (use T-123 timing plug). Remove T-150 "E" Gap Gauge from magneto.
- 9 Rotate magneto against the direction of normal rotation (clockwise for left-hand rotation magnetos and counterclockwise for right-hand rotation magnetos) until the magneto bumps against the pin in the T-125 assembly fixture. The magneto rotor shaft is now retarded from E-gap position the number of degrees indicated on the magneto dataplate.
- 10 Using a timing light, adjust the retard contact points to where they are just opening. Tighten the adjusting screws to secure the retard points in this position. Torque adjusting screws to 18-20 in-lbs.
- 11 Apply cam grease sparingly to each lobe of the cam.
- 12 Attach coil lead wire to the male terminal of the primary point assembly.
- 13 Install retard contact breaker lead by inserting ignition switch screw through eyelet end of retard breaker lead wire and then through magneto housing. Secure screw using nut and lockwasher.

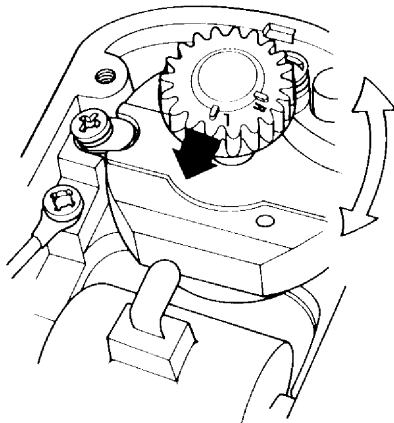
CAUTION: RETARD BREAKER LEAD WIRE MUST BE CHanneled SECURELY UNDER CONDENSER. FAILURE TO DO SO MAY CAUSE THE LEAD WIRE TO INTERFERE WITH ROTOR GEAR MOVEMENT OR POINT OPERATION.

- (10) Assemble the condenser into the distributor housing, being sure to rotate the condenser wire the same rotation as the condenser is tightened in the housing. For left magneto only, ensure retard breaker contact lead is channeled underneath condenser.
- (11) Distributor gear assembly.
 - (a) Install carbon brush into spring.
 - 1 Insert small end of carbon brush tapered end of spring.
 - 2 Turn carbon brush clockwise until shoulder of carbon brush seats spring.
 - (b) Install carbon brush assembly into distributor gear.
 - 1 Insert the open end of the spring into open end of the distributor gear shaft.
 - 2 Gently press the carbon brush and spring assembly into the shaft until the spring seats on the bottom of the shaft. The top of the carbon brush should protrude from the top of the shaft approximately 1/4 inch.
- (12) Install distributor block.
 - (a) Assemble the distributor gear in the distributor block with the L&R facing you.
 - (b) Assemble the bearing bar to the distributor block as shown in Figure 9.
- (13) Connect condenser wire.
 - (a) Connect condenser wire to the remaining terminal of the contact assembly.
 - (b) Attach the terminal with the lead pointing left.
- (14) Connect retard terminal wire to retard contact points.
- (15) Install rotor gear onto shaft.



Bearing Bar Assembly
Figure 9

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Rotor Gear Alignment
Figure 10

- (16) Align the "L" or "R" (depending on the rotation of the magneto—look at dataplate) on the rotor gear so that it points up, toward the high tension lead of the coil. Secure rotor shaft to prevent rotation during assembly. Alignment of rotor gear is critical. (See Figure 10.)
- (17) Align the "L" or "R" hole in the distributor gear with the "L" or "R" in the distributor block. Use "L" for left-hand rotation and "R" for right-hand rotation magnetos.

CAUTION: DO NOT ROTATE MAGNETO ROTOR SHAFT WITH THE T-118 TIMING PIN INSERTED IN THE DISTRIBUTOR BLOCK. IF ROTOR SHAFT IS ROTATED WITH TIMING PIN INSERTED, THE MAGNETO MUST BE DISASSEMBLED AND INSPECTED FOR DISTRIBUTOR BLOCK AND GEAR DAMAGE.

- (18) Lock the distributor gear in place with the T- 118 timing pin through the appropriate hole in the block and gear. Then:
 - (a) Place distributor block spacers on magneto frame.
 - (b) Place distributor block on magneto frame. The distributor gear and rotor gear are properly meshed when the index mark on the rotor gear aligns with the index mark on the distributor block.
 - (c) Secure distributor block to frame with screws provided.
- (19) Install the distributor housing gasket.
- (20) Insert the top boss of the distributor housing into its mating pilot on the magneto frame.

CAUTION: MAKE SURE THE CARBON BRUSH IS CONTAINED WITHIN THE DISTRIBUTOR SHAFT DURING ASSEMBLY. IF THE CARBON BRUSH CATCHES ON THE SIDE OF THE DISTRIBUTOR SHAFT, THE COIL STRAP WILL BE BENT INTO THE WRONG POSITION DURING ASSEMBLY.

- (21) Gently rotate the distributor housing onto the magneto frame.
- (22) Secure the housing with three long screws and one short screw. Torque all four to 24 in-lbs.
- (23) Remove T-118 timing pin.

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F. Testing

Complete Magneto Reassembly, above. Verify that the T-118 Timing Pin has been removed.

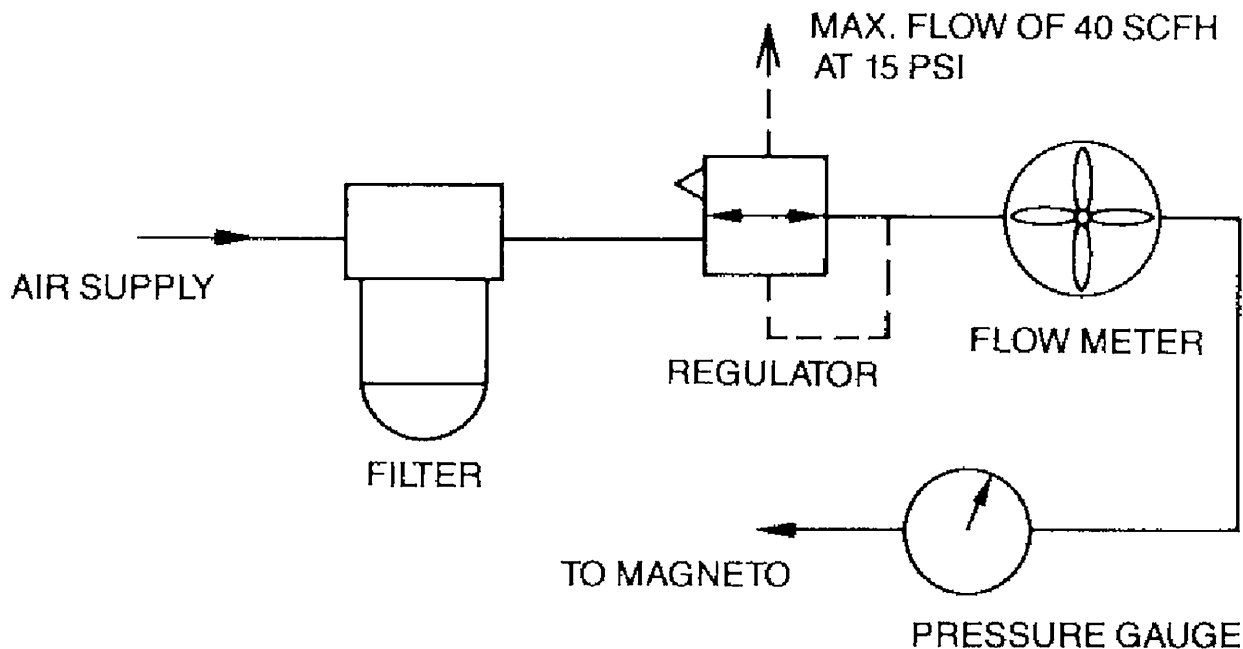
- (1) Mount the magneto on a suitable test stand in the same relative position as installed on the engine.

CAUTION: DO NOT OPERATE THE MAGNETO UNLESS THE IGNITION HARNESS IS INSTALLED AND THE OUTPUT LEADS ARE CONNECTED TO THE 5MM GAP.

- (2) Install a Slick High-Temperature Ignition Harness on the magneto and connect each output lead to a 5mm spark gap.
- (3) Coming-in Speed
 - (a) Determine the lowest speed at which the magneto can be turned and still spark all 5mm gaps without missing.
 - (b) The test gap must fire consistently at 200 RPM on both magnetos.

- (4) Pressure Testing

After magneto reassembly, install a pressurized harness cap and apply 15 psi filtered air to the inlet nozzle of the magneto (see Figure 11). Air flow at 15 psi is not to exceed 40 standard cubic feet per hour (SCFH). If flow is excessive, reposition gaskets and retorque housing and harness cap screws. Screws should be torqued to 21-25 in-lbs. for 6300 series magnetos. Testing should be conducted with magneto at room temperature.



Magneto Pressure Test Set-up
Figure 11

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G. Installation

WARNING: BE SURE SWITCH IS IN OFF POSITION AND THE P LEAD IS GROUNDED.

When installing new or adjusting breaker points and before timing the magneto to the engine, it is important that the internal timing of the magneto be correct. To find number one tower, the following instructions should be performed:

NOTE: No need to spark out these magnetos.

- (1) Insert the T - 118 timing pin in the L or R hole in the distributor block (depending on rotation of the magneto).
- (2) Turn rotor opposite the rotation of the magneto until the pin engages the gear.
- (3) If the pin is binding and will not go in the hole in the gear, you have hit the pointer on the gear. Pull the pin out, enough to continue opposite rotation until the pointer has passed, re-insert pin.
- (4) When the pin sticks through the hole in the gear about 1/4 inch, you are now ready to fire number one cylinder.
- (5) Turn the engine crankshaft in the normal direction of rotation until the No. 1 cylinder is in the full-advance firing position.
 - (a) Cover spark plug hole of number one cylinder with thumb. Rotate crankshaft until pressure is felt on thumb.
 - (b) Remove plug in front of number six cylinder. Rotate crankshaft slowly to observe timing mark on alternator drive gear. When the mark on the gear is centered in the viewing hole, number one piston is at 20° BTC.

NOTE: Verify correct engine timing for the airplane being worked on by checking the engine dataplate.

- (6) Place a new gasket on magneto flange. Install magneto carefully so drive coupling lugs mate with slots of drive bushings. Install holding washers, lockwashers, and nuts.

NOTE: Do not tighten completely. Allow for turning magneto for final timing.

- (7) After the magneto is installed on engine, remove the timing pin. The magneto is now ready to be timed to the engine.
- (8) Complete magneto to engine timing procedure listed under 100 Hour Inspection, above.

WARNING: THE MAGNETO IS NOT INTERNALLY GROUNDED, WHEN THE GROUND LEAD IS DISCONNECTED THE MAGNETO IS HOT. REMOVING THE HARNESS ASSEMBLY FIRST AND INSTALLING IT LAST, MINIMIZES THE DANGER OF STARTING THE ENGINE ACCIDENTALLY WHEN THE GROUND LEAD IS REMOVED FROM THE MAGNETO.

- (9) Replace the harness cap onto the magneto. Align the index marks made on the harness cap and distributor housing when removed.
- (10) Connect the P-lead and pressurization tube to magneto. Connect the retard breaker lead to the starting circuit to the left magneto.

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DISTRIBUTION

1. Harness

A. Inspection

- (1) 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 damage 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.
- (2) 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.
- (3) For electrical test of harness assembly, use a high voltage, direct current tester such as the 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.
- (4) 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.

B. Removal

- (1) Disconnect the clamps that secures the wires to the engine and accessories.
- (2) Loosen the coupling nuts at the spark plugs and remove the insulators from the spark plug barrel well. Use caution when withdrawing the insulator not to damage the insulator spring.
- (3) Place a guard over the harness insulators.
- (4) Remove the harness assembly terminal plate from the magneto.
- (5) Remove the harness from the airplane.

C. Installation

Before installing harness on magneto, check mating surfaces for cleanliness.

- (1) Place the harness terminal plate on the magneto and tighten nuts around the plate alternately to seat cover squarely on magneto.

NOTE: The right magneto fires the lower left and upper right spark plugs. The left magneto fires the lower right and upper left spark plugs.

- (2) Route ignition wires to their respective cylinders per markings on wire insulation.
- (3) Clamp the harness assembly in position and install the magneto terminal plate.
- (4) Connect the leads to the spark plugs.

D. Disassembly

- (1) To remove spring from a damaged lead, turn the spring counterclockwise while pulling gently. This will remove the spring and the M-1498 Electrode Screw from the end of the coiled conductor.
- (2) To separate the spring and the screw, hold the electrode screw with a pair of pliers and turn the spring clockwise until it is through the threaded portion.

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- (3) Remove the insulator sleeve from the end of the wire.
- (4) To remove a lead from the M-1568 Harness Cap, use diagonals or cutting pliers and cut the lead off close to the housing. A drift or punch can be used to tap the ferrule loose from the housing.

NOTE: Further service on the Slick harness wires require the use of Slick M-1495 Service Tool Kit, obtained from:

Slick Aircraft Products PH: 815-965-4700
Unison Industries
530 Blackhawk Park Avenue
Rockford, IL 61104

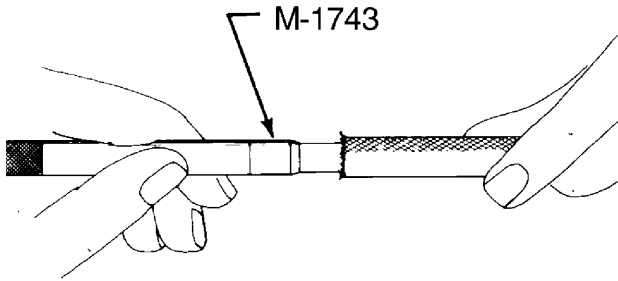
E. Assembly

- (1) Cut a piece of harness wire to the length required. Do not stretch the wire when measuring it.
- (2) On the magneto end, make a final mark 0.75 inch from the end of the wire. A 0.937 inch mark should be made from the spark plug end of the wire.
- (3) Flare out shielding, then without allowing any of the shielding to fold under, insert Slick M-1743 Stripping Tool under the braided shielding (refer to Figure 1).
- (4) Make sure the stripping tool is inserted past the cutting mark, then cut the shielding with a sharp knife using a rolling motion and remove the shielding and stripping tool. Take care not to cut the silicone insulation (refer to Figure 2).
- (5) Cut exposed insulation 0.062 inch back from end and roll the insulation clockwise to remove it. Do not pull the insulation off the wire. Trim the end of the coiled conductor to make a clear hole for inserting the stud (refer to Figure 3).
- (6) Using M-1742 Pin Vise, insert M-1741 Drill (72 drill), drill out the silicone rubber from inside of coiled conductor approximately 0.375 inch deep (refer to Figure 4).
- (7) On spark plug end of wire install M-1462 Nut followed by M-1459 Female Taper Hex Ferrule (refer to Figure 5).
- (8) After installation of nut and ferrule, bend and rotate the silicone insulation as illustrated in Figure 6 to flare out the shielding so a drive ferrule can be inserted. Take care not to cut the silicone insulation with the sharp braiding while the wire is being rotated (refer to Figure 6).
- (9) On spark plug end of wire install M-1458 Male Tapered Drive Ferrule over silicone insulation and under shielding to within 0.062 inch from flange of ferrule. Make certain that shielding is away from ferrule flange then slide Ferrule M-1459 over the M-1458 Drive Ferrule until tight (refer to Figure 7).

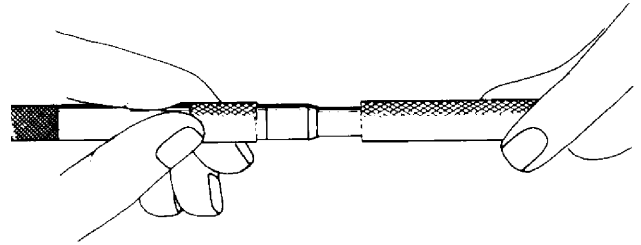
NOTE: Do not reuse the M-1458 Drive Ferrule.

- (10) For spark plug end, mount M-1747 Drive Plate in a bench vise. Set the hex ferrule in the slot of the drive plate. Drive the M-1458 Drive Ferrule flush against the hex ferrule using the M-1744 Drive Tool (refer to Figure 8).
- (11) For magneto end of wire, insert wire through approximate hole in the M-1568 Harness Cap so the shielding is through the hole as shown in Figure 9.
- (12) Install an M-1458 Male Tapered Drive Ferrule over insulation and under shielding as in Step (9), then drive the ferrule into the M-1568 Harness Cap using the M-1744 Drive Tool, similar to Step (10) (refer to Figure 10).
- (13) Clamp the threaded end of the M-1498 Electrode Screw in the M-1742 Pin Vise. Insert the tapered pin of the electrode screw into the center of the coiled conductor by turning the pin vise counterclockwise and pushing at the same time until the screw is flush with the insulation. This is done at both ends of the wire assembly (refer to Figure 11).

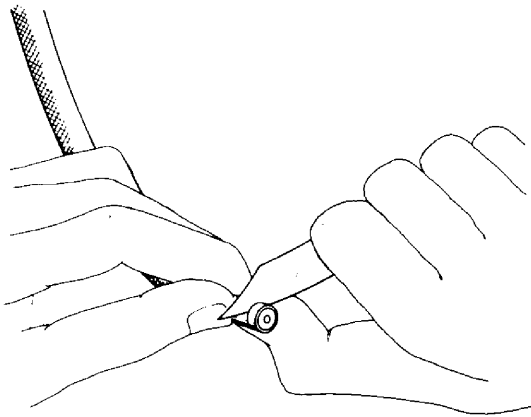
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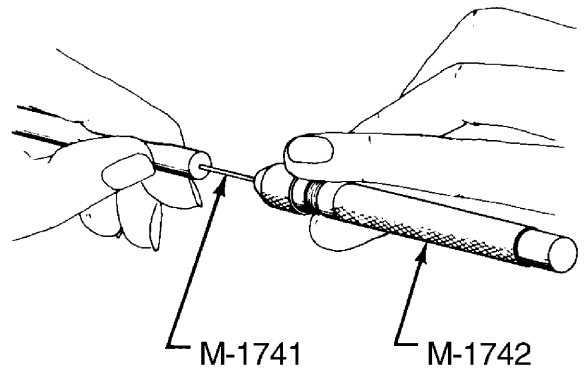
Stripping Tool
Figure 1



Inserting Stripping Tool
Figure 2

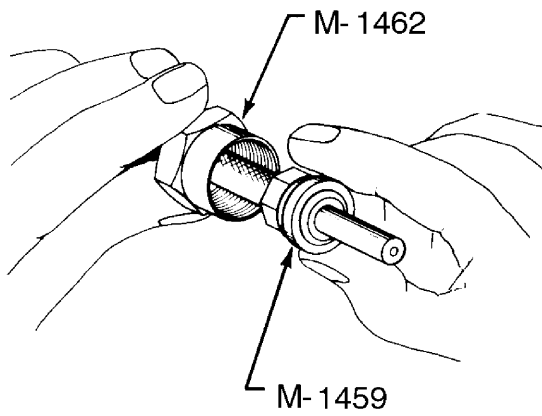


Cutting Insulation
Figure 3

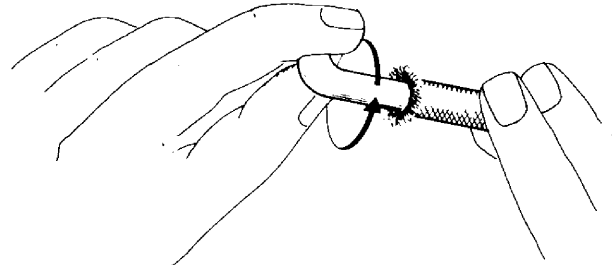


Removing Silicone Rubber from Wire
Figure 4

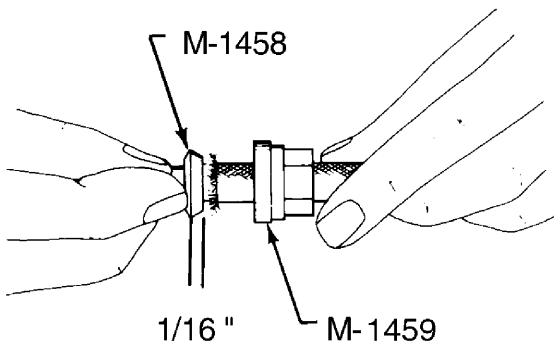
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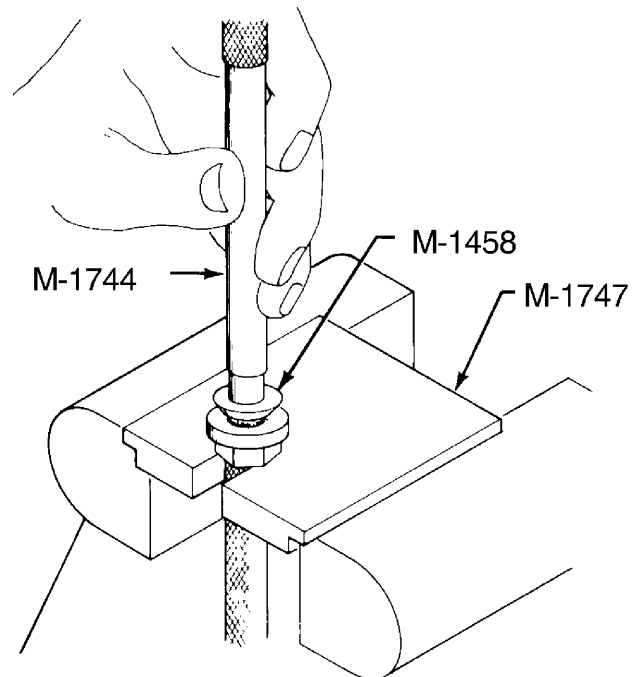
Installation of Plug Endnut
Figure 5



Flaring Out the Shielding
Figure 6

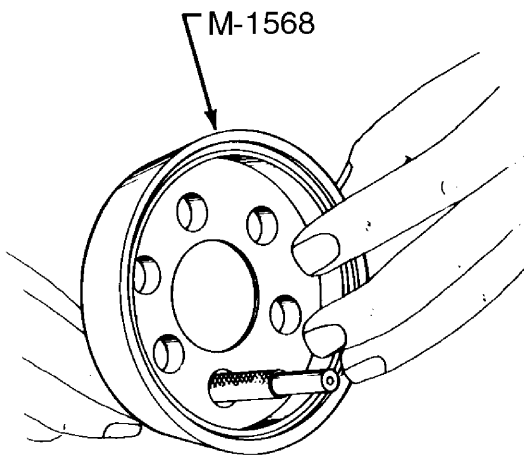


Installation of Ferrule
Figure 7

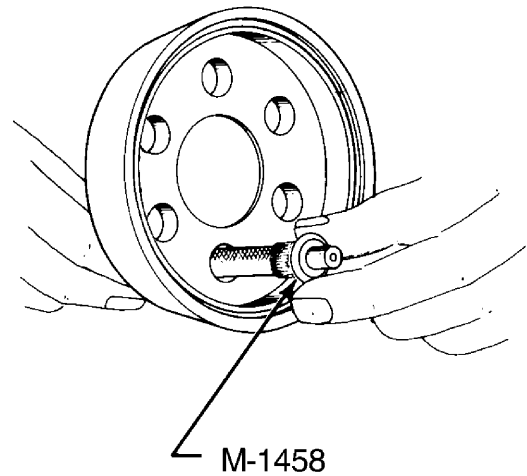


Driving Tool
Figure 8

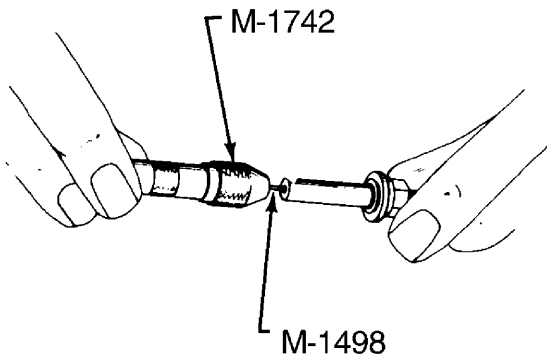
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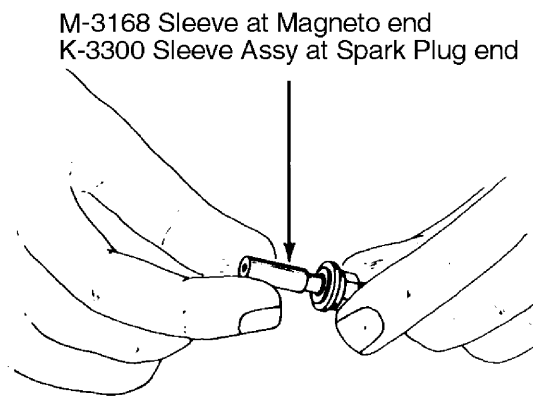
Installation in Housing
Figure 9



Securing Wire in Housing
Figure 10



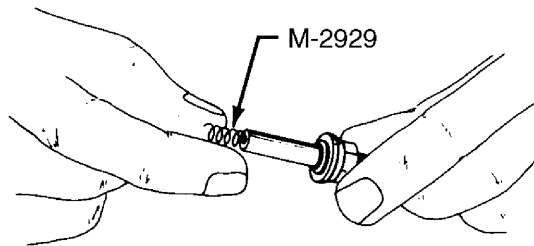
Installation of Electrical Screw
Figure 11



Installation of Insulator Screw
Figure 12

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- (14) On the magneto end of the wire, place M-3168 Insulator Sleeve over the silicone insulation. On the spark plug end of the wire, use K-3300 Insulator Sleeve Assy (refer to Figure 12).
- (15) Turn M-1455 Spring clockwise on the electrode screw three full turns until the end is flush with the first large coil of the spring. This applies to both ends of the wire (refer to Figure 13).



Installation of Spring
Figure 13

2. Spark Plugs

A. Removal

- (1) Loosen the coupling nut on the harness lead and remove the terminal insulator from the spark plug barrel well. A crows foot adapter is needed to remove the lower spark plugs and special spark plug wrench P/N 8160 for upper plug blocked by the intercoolers (see Note).

NOTE: The special spark plug wrench P/N 8160 can be obtained from:

Borroughs Tool and Equipment Corp.
2429 North Burdick St.
Kalamazoo, MI 49007-1897

NOTE: When withdrawing the ignition cable lead connection from the plug, care must be taken to pull the lead straight out and in line with the 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.

NOTE: Do not use a torque wrench to remove spark plugs.

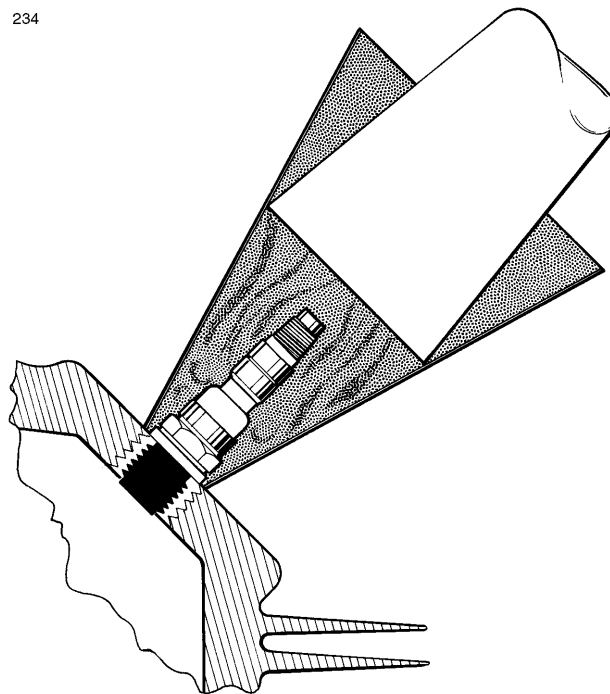
- (2) Remove the spark plug from the engine. In the course of engine operation, carbon and other combustion products will be deposited on the end of the spark plug and will penetrate the lower threads to some degree. As a result, greater torque is frequently required for removing a plug than for installing it. 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, if sufficiently severe, could produce a failure in this location.
- (3) As soon as they are removed, place spark plugs in a tray that will identify their position in the engine.

NOTE: Spark plugs should not be used if they have been dropped.

- (4) Removal of seized spark plugs in the cylinder may be accomplished by application of carbon dioxide by a conical metal funnel adapter with a hole at the apex just large enough to accommodate the funnel of a CO₂ bottle (refer to Figure 14). When a seized spark plug cannot be removed by normal means, the funnel adapter is placed over and around the spark plug. Place the funnel of the CO₂ bottle inside the funnel adapter and release the carbon dioxide to chill and contract the spark plug. Break the spark plug loose with a wrench. A warm cylinder head at the time the carbon dioxide is applied will aid in the removal of an excessively seized plug.
- (5) Do not allow foreign objects to enter the spark plug hole.

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Removing Frozen Spark Plug
Figure 14

B. Installation

Before installing spark plugs, ascertain that the threads within the cylinder are clean and not damaged.

CAUTION: MAKE CERTAIN THAT 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.

- (1) Apply anti-seize compound sparingly on the threads and install the gasket and spark plugs. Torque the plugs to 420 inch-pounds.
- (2) Carefully insert the terminal insulator in the spark plug and tighten the coupling unit.

C. Inspection and Cleaning

- (1) Visually inspect each spark plug for the following non-repairable defects:
 - (a) Severely damaged shell or shield threads nicked up, stripped or cross-threaded.
 - (b) Badly battered or rounded shell hexagons.
 - (c) Out-of-round or damaged shielding barrel.
 - (d) Chipped, cracked or broken ceramic insulator portions.
 - (e) Badly eroded electrodes worn to approximately 50° of original size.
- (2) Clean the spark plug as required, removing carbon and foreign deposits.
- (3) Set the electrode at 0.016 to 0.021 inches. (See Lycoming Service Instruction No. 1042.)
- (4) Test the spark plug, both electrically and for resistance.

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CHAPTER

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ENGINE CONTROLS

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POWER CONTROL

1. Engine Setup Procedures

WARNING: BEWARE PROPELLER BLAST AND ROTATING PROPELLER BLADES DURING ENGINE OPERATION. EXERCISE CAUTION TO AVOID DAMAGE TO PERSONNEL AND EQUIPMENT.

CAUTION: BEFORE ATTEMPTING FULL POWER CHECKS, BE SURE THAT THE BRAKES ARE PROPERLY MAINTAINED AND SET, AND THAT THE GROUND CONDITIONS WILL NOT PERMIT THE WHEELS TO SLIP DURING FULL POWER CHECK.

2. Idle Speed and Mixture Adjustment

CAUTION: IT IS EXTREMELY IMPORTANT THAT THE ENGINE BE THOROUGHLY WARMED UP. HOWEVER, EXCESSIVE ENGINE TEMPERATURES MUST BE AVOIDED.

NOTE: Allow for the effect of weather conditions and field altitude when making idling adjustment.

- A. Start and warm up the engine until the oil temperature reaches 170°F to 190°F.
- B. Check magnetos. If the magneto drop is normal, proceed with idle adjustment.
- C. Set throttle stop screw so that the engine idles at 700 rpm. If the rpm changes appreciably after making idle mixture adjustment during the following steps, readjust the idle speed to the desired rpm.
- D. When the idling speed has stabilized, move the cockpit mixture control, with a smooth steady pull, toward the Idle Cut-Off 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 drops to a point of engine cut out. An increase of more than 50 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 step (D) indicates that the idle mixture is too rich or too lean, turn the idle mixture adjustment in the direction required for correction and check this new position by repeating step (D).
- F. Make additional adjustments as necessary until a mixture check step (D) results in a momentary pick up of approximately 50 rpm. Each time the adjustment is changed the engine should be run up to 2,000 rpm to clear the engine before proceeding with the rpm check.
- G. Make final adjustment of the idle speed adjustment to obtain an idle speed of 700 ± 25 rpm with closed throttle and air conditioner off.
- H. 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.

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3. Variable Pressure Controller

A. Controller / Throttle Rigging

With the controller lever against the stop in full boost position, adjust the linkage rod to maintain 0.015 / 0.020 inch clearance between the fuel injector throttle lever and the full throttle stop.

See also Textron Lycoming Service Instruction No. 1431, Supplement 2.

B. Adjustment for Manifold Pressure

- (1) Warm up the engine until the oil temperature is 170°F to 190°F.
- (2) Ensure mixture control is full rich and propeller control is at full rpm (2,500 rpm).
- (3) Slowly advance the throttle lever to full throttle or 42.0 in. Hg. manifold pressure.
- (4) If the throttle reaches full forward prior to the manifold pressure reaching 42.0 in. Hg., INCREASE manifold pressure by turning the controller adjustment bolt counterclockwise.

NOTE: A general relationship between the number of turns on the controller adjustment and manifold pressure is one turn per 1.0 inch of manifold pressure.

- (5) If the manifold pressure reaches 42.0 inches prior to the throttle reaching full forward position, DECREASE manifold pressure by turning the controller adjustment bolt clockwise.
- (6) Repeat steps (3), (4), and (5) as required to establish 42.0 in. Hg. manifold pressure at full throttle. Tighten adjustment bolt jam nut.

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ENGINE INDICATING

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POWER

NOTE: In S/N's 4636375 and up, engine data is collected by the Data Acquisition Unit (DAU) and is displayed on the Multi-Function Display (MFD) and Primary Flight Display (PFD). See Electronic Flight Information System, 34-20-00; 77-40-00, and 91-77-40 for more information.

Manifold Pressure Gauge

NOTE: Serial numbers 4636021 thru 4636374 incorporate the Transicoil Electronic Module Instrument System (EMIS). See 77-40-00.

A. Description

The manifold pressure gauge is a vapor proof, absolute pressure type instrument. Pressure from the intake manifold of the engine is transmitted to the instrument through a line. A pointer indicates the manifold pressure available at the engine in inches of mercury. A manual drain is provided in the line. The drain line leads from a tee on the back of the manifold air pressure gauge to the drain which is mounted forward of the elevator trim wheel on the left hand side.

B. Troubleshooting

See Chart 1.

**CHART 1
TROUBLESHOOTING MANIFOLD PRESSURE GAUGE**

Trouble	Cause	Remedy
Excessive error at existing barometric pressure.	Pointer shifted.	Replace instruments.
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.	Replacement instrument.
Incorrect reading.	Moisture or oil in line.	Disconnect lines and blow out.

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2. Tachometer Indicator

NOTE: S/N's 4636021 and up incorporate Integrated Engine Instrumentation Systems. See 77-40-00.

A. Description

The tachometer is electrically connected to the engine magnetos. The tachometer 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. A calibration check on the tachometer is performed every 100 hours. The correct tolerance at 2,500 rpm is (-) 25 rpm (+) 0 rpm.

B. Troubleshooting

See Chart 2.

**CHART 2
TROUBLESHOOTING TACHOMETER INDICATOR**

Trouble	Cause	Remedy
No reading on indicator, either permanent or intermittent.	Inoperative instrument.	Replace instrument.
	Loose cable connections.	Tighten cable.
Pointer oscillates excessively.	Inoperative instrument.	Replace instrument.
	Excessive friction in instrument.	Replace instrument.
Indicator changes in climb.	Excessive cleanup in speed cup.	Replace instrument.
Pointer goes all the way to stop, more noticeable in cold weather.	Excessive lubricant in instruments.	Replace instrument.
Pointer jumps at idle.	Speed cup hitting rotating magnet.	Replace instrument.
Tachometer cable breaks.	Cable bent too sharply.	Reroute cable.

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TEMPERATURE

NOTE: In S/N's 4636375 and up, engine data is collected by the Data Acquisition Unit (DAU) and is displayed on the Multi-Function Display (MFD) and Primary Flight Display (PFD). See Electronic Flight Information System, 34-20-00; 77-40-00, and 91-77-40 for more information.

1. Turbine Inlet Temperature (T.I.T.) Gauge

NOTE: Serial numbers 4636021 thru 4636374 incorporate the Transicoil Electronic Module Instrument System (EMIS). See 77-40-00.

A. Description

This instrument is used to monitor the temperature of the exhaust gases as they leave the cylinders (but before they enter the turbocharger turbine).

Although the gauge is adjustable, if it is found defective after checking with the troubleshooting chart, it should be replaced. Replace any faulty leads to the gauge. Because the resistance of the leads is critical for the proper operation of the gauge, use the same type and length of wire as the original when replacing leads.

B. Troubleshooting

See Chart 1.

C. Gauge and Probe Cleaning and Inspection

CAUTION: DO NOT CONNECT OHMMETER ACROSS METER. IT WILL BURN OUT THE MOVEMENT OF THE METER.

Unless mechanical damage is evident (broken glass, bent or broken pointer, or broken case) the following checks should be performed before removing the instrument:

- (1) Remove the engine cowlings as necessary to expose the exhaust transition.
- (2) Loosen the nut which secures the probe to the waste gate transition assembly. Remove the probe.
- (3) Check for a broken weld (at tip end) or a burnt off end. The measured resistance of probe should be 0.73 ± 0.01 ohms. Clean the connections with steel wool.
- (4) Disconnect the lead wires at the instrument and measure the resistance. Resistance with the lead wires connected to probe should be 8 ohms. Clean connections with steel wool.

**CHART 1
TROUBLESHOOTING TURBINE INLET TEMPERATURE (T.I.T.) GAUGE**

Trouble	Cause	Remedy
Gauge inoperative.	Defective gauge, probe or wiring.	Check probe and lead wires for chafing, breaks or shorting between wires and/or metal structure.
	Adjusting potentiometer turned off scale.	Reset potentiometer.
Fluctuating reading.	Loose, frayed or broken electrical leads or faulty connections.	Clean and tighten connections. Repair or replace defective wire.

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- (5) Make sure that the adjustment screw, located at 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. With the leads connected to instrument, heat probe using an Alcor testing unit. The meter should read up to the fourth graduation of approximately 1,500° F. If meter still does not read, replace it.

D. Gauge

(1) Removal

- (a) Disconnect wires from the gauge at the instrument panel.
- (b) Remove four screws which secure the gauge to the instrument panel and remove the gauge.
- (c) Remove wires from the wire harness going to the gauge.

(2) Installation

- (a) Route the thermocouple wires along with the existing wire harness to the instrument panel.
- (b) Install the gauge into the instrument panel and secure it with four screws.
- (c) Connect the thermocouple wires to the rear of the gauge.

F. Probe Replacement (See Figure 1.)

NOTE: The normal service life (limit) for the T.I.T. probe is two hundred-fifty hours time in service.

NOTE: If the probe time is unknown, initial replacement should occur within the next one hundred hours time in service. If system inaccuracy is suspected, the probe should be replaced immediately.

- (1) Remove the engine cowling as required to expose the exhaust transition.
- (2) Remove the existing T.I.T. probe mounted in a boss welded to the upper portion of the exhaust transition.
- (3) Install a new T.I.T. probe into the hole in the waste gate transition assembly and tighten.
- (4) Run the aircraft and operationally check for a proper T.I.T. reading.
- (5) Re-install the engine cowling.

G. System Calibration and Test

This procedure is applicable to the Lewis T.I.T. Indicators, either the standard analog P/N 471-008 or the optional digital P/N 548-811, and is required each time a T.I.T. Indicator is replaced or if system error is suspected. It should be noted that T.I.T. probe replacement must occur at cylinder changes, engine overhauls or should other T.I.T. system maladies become apparent.

EQUIPMENT REQUIRED: A variable D.C. millivolt power supply and a digital volt-ohm meter. If a millivolt power supply is not available the following items will be required. One 5K Potentiometer JS1N056S502UA (Allen-Bradley part number 481-239) or equivalent. One 27K OHM Resistor $\pm$ 10% 1/2 Watt. (See Figures 2 & 3.)

- (1) Place the aircraft in an enclosed hanger where the temperature may be stabilized between 50 - 90° F. (Please take note that the successful completion of this calibration procedure is dependent upon stabilizing the aircraft temperature prior to starting calibration.)
- (2) Disconnect the leads of the existing T.I.T. probe which is mounted in a boss welded to the exhaust transition. (See Figure 1.)

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CAUTION: TO AVOID ERRONEOUS INDICATIONS, DO NOT USE ANY ADDITIONAL WIRING BETWEEN THE MILLIVOLT POWER SUPPLY AND THE T.I.T. WIRING HARNESS EXCEPT AS SHOWN IN FIGURE 2.

- (3) Connect a stable millivolt power supply directly to the T.I.T. wiring harness. It should be noted that the yellow harness wire is "positive."

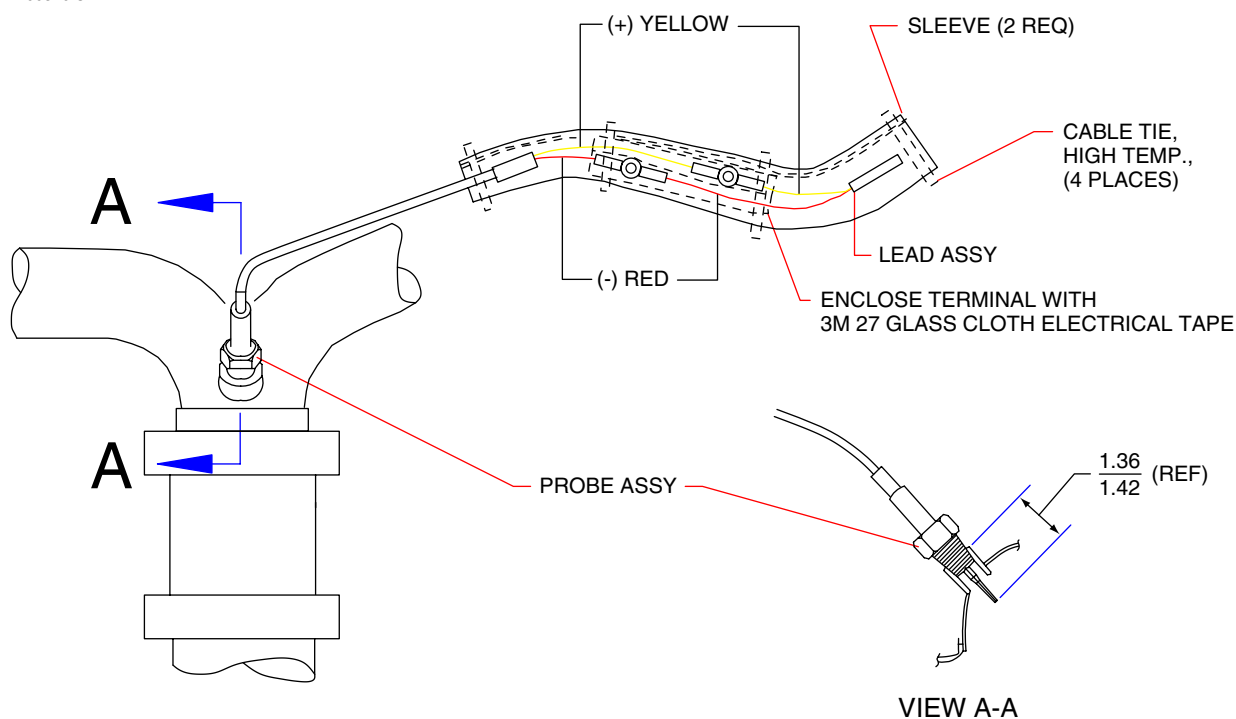
NOTE: If a millivolt power supply is not available, it is permissible to construct the circuit shown in Figure 2 and connect this circuit to the aircraft battery as shown in Figure 3.

- (4) Once this calibration configuration is established, allow the aircraft to remain in the hanger for at least 3 hours for the system temperature to stabilize.

CAUTION: DO NOT TOUCH THE CONTACTS ON THE BACK OF THE T.I.T. INDICATOR WITH YOUR HANDS. IF CONTACT IS MADE, ALLOW THE SYSTEM TO STABILIZE FOR AT LEAST ONE HOUR BEFORE MAKING THE ADJUSTMENT TO THE INDICATOR.

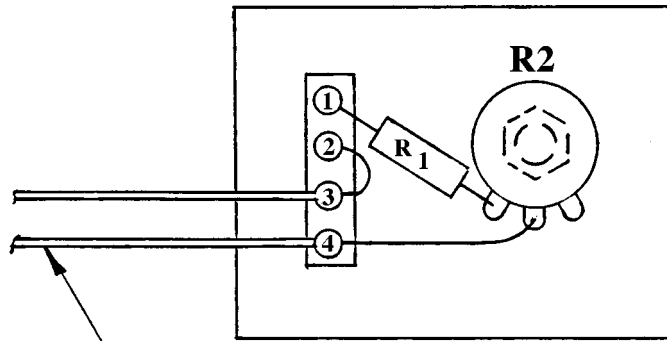
- (5) Gain access to the back of the T.I.T. indicator. (Remove the glareshield if necessary.)
(6) Adjust the variable D.C. millivolt power supply so the input voltage to the T.I.T. harness is $37.1 \pm .1$ m.v. It should be noted that this value does not correspond to the standard Alumel-Chromel Tables for "K"- Type thermocouples due to the electrical load of the harness and indicator.

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T.I.T. Probe Installation
Figure 1

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6.0" (Length)
AN20 WIRE
Locally Manufactured Milli-volt Power Supply
Figure 2

- (7) For the standard analog indicator, vary the adjustment screw on the backplate of the indicator until indicator pointer is at the lower edge of the red radial (1750° F.). For the optional analog/digital indicator, verify that the pointer is at the lower edge of the red radial (1750° F.) - if not, replace indicator.
- (8) Re-install the glareshield.

2. Combustion Analyzer Gauge (S/N's 4636001 thru 4636020 only.)

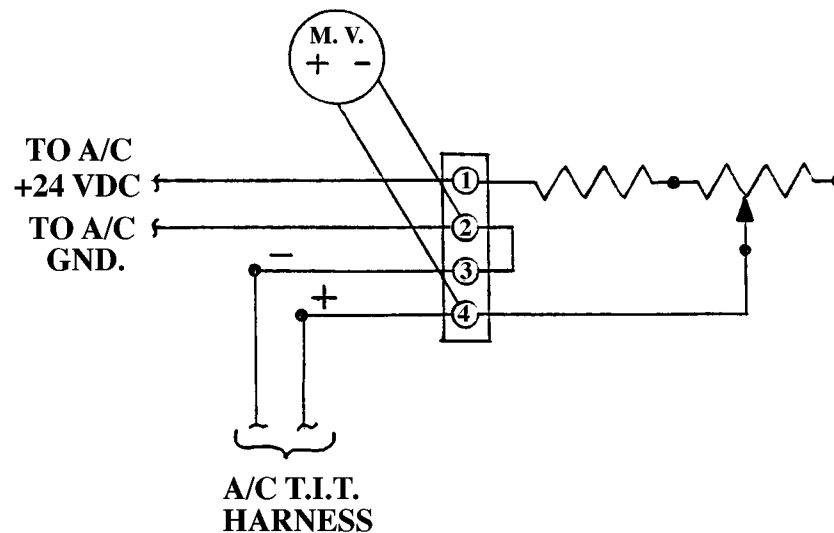
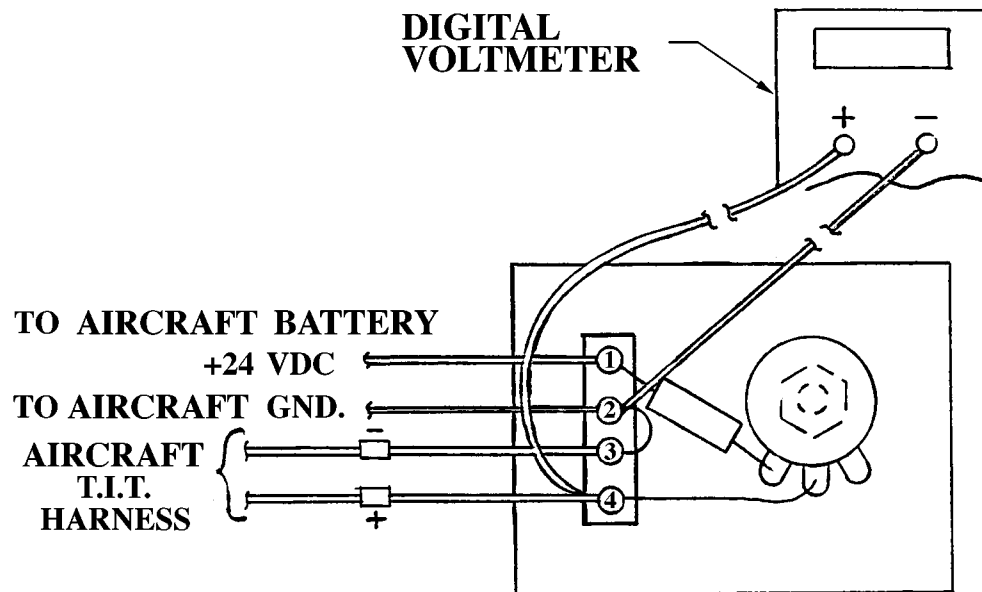
A. Description

In S/N's 4636001 thru 4636020 only, a multi-channel combustion analyzer is optional. When installed, it is located on the instrument panel. The combustion analyzer measures the cylinder head temperature in each cylinder head. The combustion analyzer is an electrical instrument and is wired through the instruments circuit breaker.

B. Troubleshooting

See Chart 2.

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TIT System Calibration Set-up
Figure 3

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**CHART 2
TROUBLESHOOTING COMBUSTION ANALYZER GAUGE**
(S/N's 4636001 thru 4636020 only)

Trouble	Cause	Remedy
75° - 100° rise for one cylinder.	Spark plug not firing due to fouling, faulty plug, lead, or distributor in magneto.	Check spark plug. Clean or replace if necessary. Check lead. Replace if necessary. Check magnetos. Repair if necessary.
75° - 100° rise for ALL cylinders.	One magneto not operating.	Repair faulty magneto.
Increase or decrease, especially after ignition system maintenance.	Improper timing - Increase in EGT means retarded ignition. Decrease means advanced ignition.	Check magneto timing.
Loss of peak EGT.	Poor ignition or vapor in fuel injection system.	Check magnetos. Repair if necessary. Purge fuel injection system if necessary.
Decrease in EGT for ALL cylinders.	Decrease in total airflow carburetor ice or induction ice.	Check alternate air system.
Decrease in EGT for one cylinder.	Intake valve not opening fully - faulty valve lifter. Scored cylinder or broken ring to cause low compression (EGT may increase due to plug fouling from oil consumption).	Check valve lift. Check spark plugs. Clean or replace if necessary. Check compression.
Slow rise in EGT.	Burned exhaust valve.	Check compression.
Decrease in peak and flat.	Detonation - usually the result of 80 octane fuel in 100 octane engine.	Check to make sure proper octane fuel is used.
Sudden off scale rise for any cylinder.	Preignition	During takeoff - Abort if possible. Go to full rich. Check fuel injector flow for proper operation.
Any EGT decrease.	If none of the above causes is evident, suspect a low reading probe or faulty connection.	Check calibration with ALCOR System Tester.
Any increase in EGT.	TROUBLE - because any malfunction of probe, lead, or meter will cause a decrease.	Check probe & leads with ALCOR System Tester. Replace any found to be faulty.

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3. Cylinder Head Temperature (CHT) Scanner

The following information describes the Cylinder Head Temperature Scanner used in the Malibu Mirage. This scanner, when connected to the cylinder head temperature gauge and six resistive temperature probes, scans the six probes, determines the hottest cylinder, connects that probe to the gauge and outputs a signal that can be used to indicate which cylinder is the hottest.

A. Description

(1) Electrical

The Cylinder Head Temperature Scanner gives a discrete output to indicate which cylinder out of six is the hottest. The scanner, momentarily disconnects the CHT gauge and connects all of the probes to measuring circuits that measure the resistance of each probe. The scanner then makes appropriate determinations based upon those measurements, reconnects the gauge to a selected probe, and outputs a discrete output.

An external cycle switch may be used to manually select which cylinder head temperature probe is connected to the gauge. Momentarily grounding the proper pin will step the scanner to Cylinder No. 1. Cylinder No. 1 will be displayed on the gauge for approximately 8 seconds (the "heartbeat" period). Upon the next heartbeat the gauge will again display the hottest cylinder. Again momentarily connecting this pin to ground before the heartbeat will step the scanner to Cylinder No. 2. Now Cylinder No. 2 will be displayed on the gauge for the heartbeat period. Upon the next heartbeat the gauge will again display the hottest cylinder. Continuing to momentarily connect this pin to ground before the heartbeat will step the scanner to the next cylinder in rotation (3, 4, 5, 6, etc.). By maintaining a ground on this pin, any particular cylinder being displayed will continue to be displayed until the ground is removed and the heartbeat cycle occurs. Heartbeat will not occur so long as this pin is grounded.

Six discrete lamps are used to display the hottest cylinder (1 through 6), and are mounted adjacent to the external cycle switch.

An alarm output is also generated when any cylinder is over the preset limit for a "Hot" cylinder. This alarm output is interfaced with the Exceedance Audio Alert Horn. When the external cycle control is in use, the alarm will maintain the last condition displayed when in the automatic mode, regardless of the current condition during the manual external cycling.

(2) Physical

The Cylinder Head Temperature Scanner is a single unit with an integral heat sink and requires no forced cooling. The internal circuits are arranged on two printed circuit boards mounted parallel to the each other. All connections between boards are made by means of two part connectors.

B. Troubleshooting

In the event of a detectable scanner failure, the scanner will automatically connect the gauge to the probe for cylinder number 3.

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4. Cylinder Head Temperature Indicator Calibration Check (S/N's 4636021 thru 4636374.)

All equipment necessary for the proper operation of the CHT, including the CHT/VAC Dual Analog Module Indicator, the cylinder head temperature scanner, and all six CHT probes with proper harnesses, must be installed in the aircraft and be operational prior to the test, adjustment, and validation described below.

A. Testing

- (1) Remove CHT probe from #1 cylinder.
- (2) Disconnect harness from probe for #1 cylinder.
- (3) Connect test box (see Figure 4, construct locally if required) to the two leads removed from probe for #1 cylinder.
- (4) Turn switch on test box to 100° F and turn on aircraft power. The CHT indicator should read 100° F $\pm$ 10° F. Record displayed value.

NOTE: Engine temperature must be less than 100° F. If temperature is higher than 100° F, press CHT scanner cycle switch repeatedly until lamp for #1 cylinder on instrument panel is illuminated. Hold switch in until temperature is displayed on Quad Digital Indicator (QDI) / Enhanced Digital Indicator (EDI) (see 77-40-00).

- (5) Turn switch on test box to 450° F. The CHT indicator should read 450° F $\pm$ 10° F. Record displayed value.

NOTE: CHT scanner must be operating during these tests.

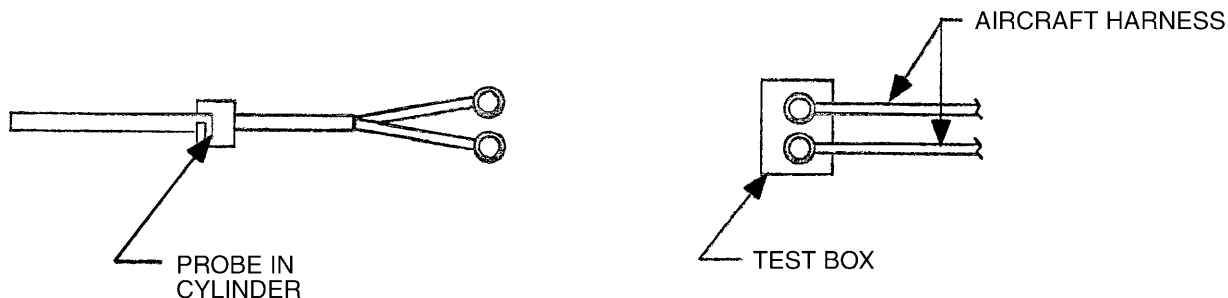
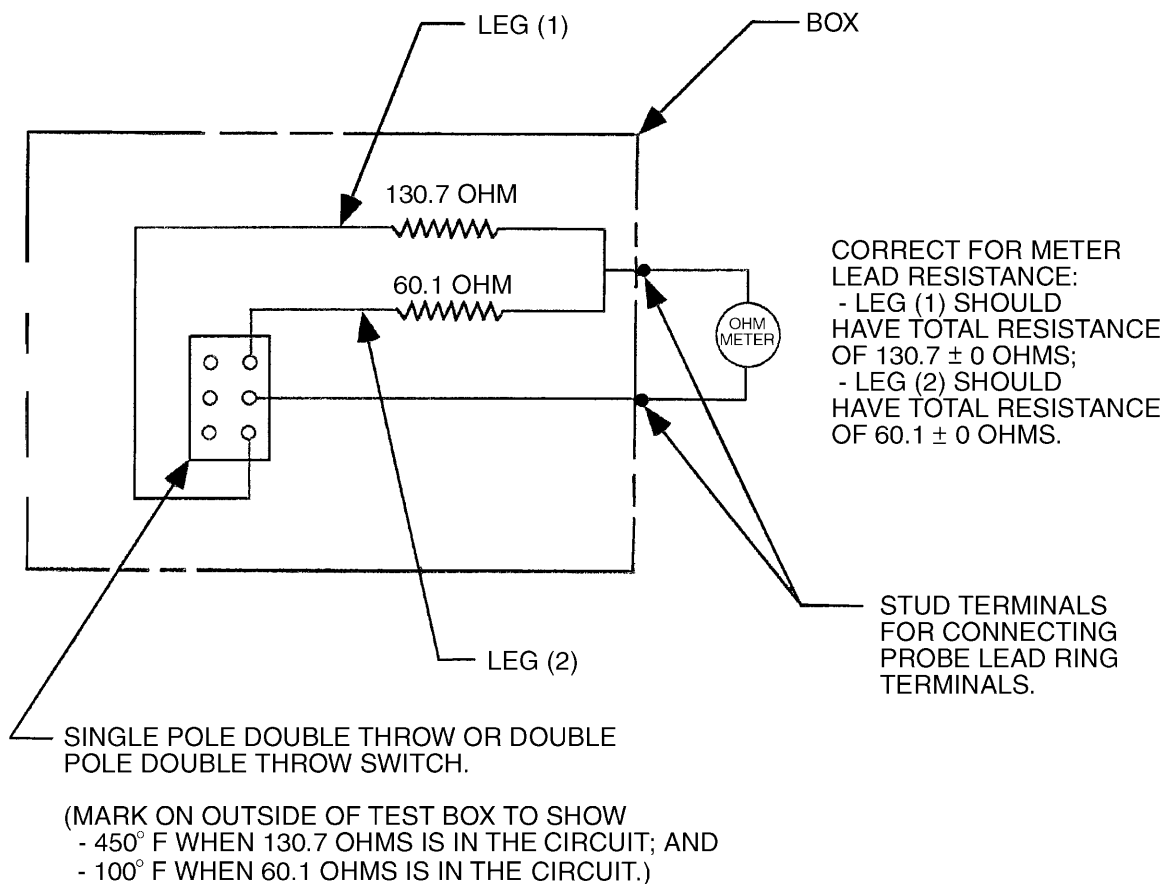
- (6) If the CHT indicator meets the specified limits, go to Securing the System, below. If the CHT indicator does not meet the specified limits, proceed to Adjustment or Validation, below, depending on aircraft serial number.

B. Adjustment (P/N 599-588 only - original equipment in S/N's 4636021 thru 4636131 only.)

NOTE: P/N's 602-299 or 602-247, installed as original equipment in S/N's 4636132 thru 4636374 are backward compatible and may be encountered in S/N's 4636021 thru 4636131 as service spares. They can be identified by the lack of potentiometers and are not adjustable. If encountered, validate per paragraph C, below.

- (1) With test box connected per Testing steps (1) - (3), above, select 100° F on test box. Remove CHT/VAC dual analog module indicator from the instrument panel far enough to remove foil sticker from the side of the CHT indicator. Adjust (z) zero potentiometer so that the QDI displays 100° F.
- (2) Select 450° F on test box. Adjust (s) span potentiometer so that the QDI displays 450° F.
- (3) Return test box switch to 100° F setting and check that CHT indicator reads 100° F $\pm$ 10° F. If it does not, readjust the (z) zero potentiometer.
- (4) Set switch on test box to 450° F setting and check that CHT indicator reads 450° F $\pm$ 10° F. If it does not, readjust the (s) span potentiometer.
- (5) Repeat steps (3) and (4) until no adjustment is required to repeat 100° F and 450° F readings when the test box is set to the corresponding switch position.

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CHT Test Box Construction and Lead Connection
Figure 4

Effectivity
4636021 and up

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- C. Validation (P/N's 602-299 or 602-247 - original equipment in [S/N's 4636132 thru 4636374.](#))
- (1) Pull circuit breaker for engine monitor (i.e. - scanner) and repeat test in Testing, above, except test #3 cylinder in lieu of #1.
 - (2) If CHT indicator fails to meet the specified limits on #3 cylinder also, replace CHT/VAC dual analog module indicator.
 - (3) If CHT indicator meets the specified limits on #3 cylinder, troubleshoot CHT probe and harness on #1 cylinder and repeat test in Testing, above.
- D. Securing the System
- (1) Replace foil sticker over trim potentiometers, if removed.
 - (2) Reinstall CHT/VAC dual analog module indicator in instrument panel, if removed.
 - (3) Disconnect and remove test box.
 - (4) Reconnect harness to probe(s) and reinstall probe(s) in correct cylinder(s).

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INTEGRATED ENGINE INSTRUMENT SYSTEMS

1. Transicoil Electronic Module Instrument System (EMIS) (S/N's 4636021 thru 4636374.)

The Transicoil Electronic Module Instrument System (EMIS) is a precision measurement and display system containing both analog and digital displays of engine related parameters (See Figure 2). The EMIS is comprised of two parts:

- Dual Analog Module Indicators, and
- Quad Digital Indicator (QDI) (S/N's 4636021 thru 4636131), or
Enhanced Digital Indicator (EDI) (S/N's 4636132 thru 4636374) display.

Both Dual Analog Module Indicators and the QDI/EDI are face-mounted instruments and may be removed and installed per 39-10-00.

A. Dual Analog Module Indicator (See Figure 1 and Chart 2.)

The Dual Analog Module Indicator is a precision micro-processor based instrument for displaying engine parameters. Each module consists of two completely independent analog indicators. Each indicator displays its respective engine parameter reading on the analog dial as well as transmits digital data to the QDI/EDI via the data bus. A rear connector is provided for system interface and analog sensor inputs. Alarm outputs are provided where applicable.

(1) Features

Each Dual Analog Module Indicator features the following (See Figure 1):

- (a) Two parallax free dials, each featuring "Return to Zero" pointers which hold just below "0", or the lowest graduation, when power is removed.
- (b) Four status indicator LEDs, two green and two red, with the exception of the Dual Fuel Quantity Module which has green and yellow.
- (c) Two front-accessible buttons which provide a simple user interface.

(2) Performance

(a) Stand Alone

1 Power Up Characteristics

When power is first applied, a stand alone Dual Analog Module will simply drive its pointers towards the correct reading after a short power up delay (less than 0.5 sec).

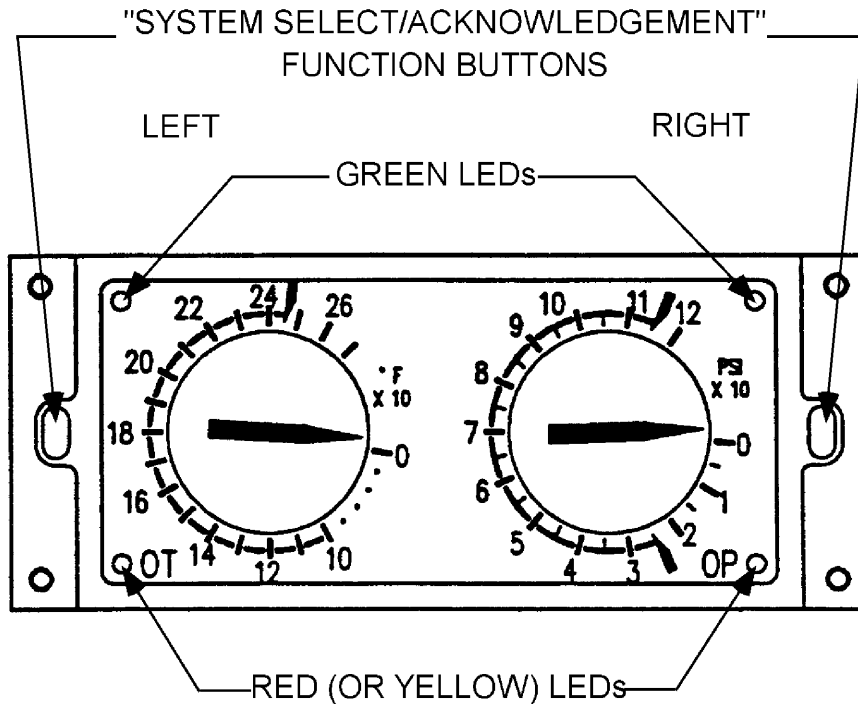
2 Exceedance Characteristics

The traditional "Red Line", if present, corresponds to a preset limit for that parameter. If the reading exceeds the preset customer specified limit (that may differ from the Red Radial) for more than a specified time delay, the red or yellow LED corresponding to that indicator will illuminate, and the external audible alarm output will turn on.

3 Pressing the switch next to the analog indicator in exceedance will mute the external audible alarm.

NOTE: Additional features, if any, shall be found on the respective analog drawings.

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NOTE: Engine OT/OP Dual Analog Indicator is used as an example for this figure. The above dial presentation is for reference only and will vary from one system type to another. Controls and LEDs apply to all analog indicators in the stack. Pointers are shown in power off condition.

Dual Analog Module Indicator (Typical)
Figure 1

(b) System

The Dual Analog Module can be operated as part of a system when a Quad Digital Indicator (QDI)/Enhanced Digital Indicator (EDI) is connected to the data bus.

1 Power Up Characteristics

When power is applied to the system, a seven (7) second power-up self-test is initiated by the QDI/EDI as communication is established between it and the dual analog indicator. The following test functions will occur:

- a** Both pointers will drive to the 9 o'clock position.
- b** All indicator LEDs illuminate.
- c** External audible alarm(s) sound for the last two (2) seconds of self-test.

2 Normal Digital Display Characteristics

Press the select button adjacent to the analog indicator that is to be displayed digitally on the QDI/EDI. When the indicator is being displayed digitally, its green LED will illuminate, indicating that it has been selected.

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3 Exceedance Characteristics

The "Red Line" (if present) on the dial face corresponds to a preset limit for that parameter. If the reading exceeds the preset customer specified limit (that may differ from the Red Radial for more than a specified time delay, the red or yellow LED corresponding to that indicator will illuminate and the external audible alarm will sound. The QDI/EDI will automatically select the exceeding indicator to be displayed digitally. This will turn on the green LED for that indicator. The audible alarm will remain on until the reading moves to the normal range, or the select switch next to the parameter in exceedance is pressed. This will mute the external alarm. The red or yellow LED will remain on until the reading returns to the normal range. Once the parameter in exceedance is acknowledged, the exceeding indicator will return to its normal display operation.

4 Retrieval of Exceedances Characteristics

The QDI/EDI stores data concerning an exceedance event which can be retrieved at any time. While the QDI/EDI is displaying this data, both LEDs will flash on the analog indicator corresponding to that data.

5 Self-Test Characteristics

a Power Up - See Power Up Characteristics, above.

b Manual - With power applied to the system, press the adjacent select button of the indicator to be tested for two seconds. The indicator's pointer will drive to 9 o'clock and both LEDs will illuminate. Continue to press button (approx. 5 seconds more) until the external alarm sounds. The audible alarm will remain activated until the select button is released. During this test the digital display will continue to display the actual indicator value.

(3) Troubleshooting
See Chart 1.

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**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING DUAL ANALOG MODULE INDICATORS**

Trouble	Cause	Remedy
During system self test, analog pointer(s) does not drive to 9 o'clock position but red and green LEDs turn on.	Stuck pointer or faulty drive circuit.	Return module to factory.
During system self test, analog module does not respond.	Loss of power to module.	Check module circuit breaker. Check module connector. Check aircraft wire harness. Return module to factory.
	Loss of communication data bus.	Check module connector. Check aircraft wire harness. Return module to factory.
Analog pointer always drives to the lowest or highest graduation point.	Open or shorted sensor lines.	Check sensor connections.
	Faulty sensor.	Change sensor.
Oil pressure analog instrument goes into exceedance when RPM instrument is below 1400 RPM.	Faulty connection between RPM module connector pin 5 and VAC module connector pin 4.	Check aircraft wire harness.
	Faulty internal circuit in either RPM or OP module(s).	Return RPM and OP instrument modules to the factory.
VAC analog instrument goes into exceedance when RPM is below zero.	Faulty connection between RPM module connector pin 5 and VAC module connector pin 4.	Check aircraft wire harness.
	Faulty internal circuit in either RPM or VAC module(s).	Return RPM and VAC instrument modules to the factory.
Analog instrument cannot be selected by QDI/EDI.	Loss of power to the instrument.	Check module circuit breaker. Check module connector.
	Loss of communication data bus.	Check module connector. Check aircraft wire harness. Reset QDI/EDI. Return module to factory.
	Faulty select switch.	Return module to factory.

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CHART 1 (Sheet 2 of 2)
TROUBLESHOOTING DUAL ANALOG MODULE INDICATORS

Trouble	Cause	Remedy
Audio alarm does not function during exceedance.	Loss of connection to alarm.	Check connection from instrument to alarm.
	Faulty alarm.	Change alarm.
	Faulty internal alarm circuit in module.	Return module to factory.
Non-uniform lighting.	Faulty light bulb.	Return module to factory.
Pointer does not return to zero with power-off.	Sticky pointer or faulty return to zero mechanism.	Return module to factory.

C. Quad Digital Indicator (QDI) / Enhanced Digital Indicator (EDI) Module

The Quad Digital Indicator (QDI) / Enhanced Digital Indicator (EDI) is a precision microprocessor based instrument which contains two Dichroic Liquid Crystal Displays (LCDs) with two lines (QDI), or three lines (EDI), each for display, and an annunciator in the lower left corner of each LCD. The LCDs are backlit for use in low ambient light conditions, and contain heaters for low temperature operation. The QDI and EDI are capable of displaying four or six engine parameters at one time, respectively. The QDI lower half is dedicated to engine manifold pressure and RPM while the upper half will digitally display a selected analog indicator reading. The EDI top line is dedicated to engine manifold pressure and RPM, the middle displays selected analog indicators, and the lower displays OAT and % PWR.

Electrical interface is provided by a single 25 pin male "D" subminiature connector. The QDI/EDI contains EMI and RFI protection.

An independent signal conditioning circuit is provided for Outside Air Temperature (OAT).

(1) Functions include:

- (a) Automatically posts exceedance warnings.
- (b) Stores analog indicator exceedance data for future maintenance review.
- (c) Digitally enhances any selected analog indicator in the EMIS system stack.
- (d) Performs and posts "Real Time" fuel management calculations.
- (e) Automatically posts fuel imbalance using an external panel annunciator.

(2) Front Display and Pushbutton Controls (See Figure 3.)

The QDI/EDI contains two LCDs, one in each window, with two or three lines, respectively, for numerical display. The display is capable of posting four or six parameters at one time. In addition, there are four or six front-accessible buttons to select and/or control the following display modes:

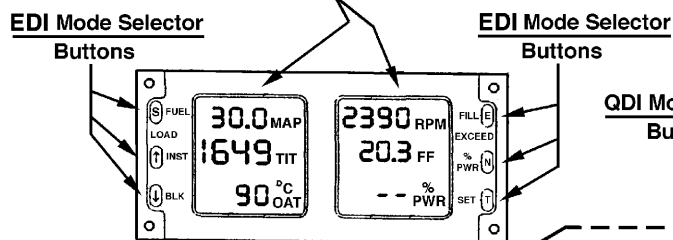
- (a) Display Blanking
- (b) Fuel Management
- (c) Outside Air Temperature
- (d) Manual Fuel Load Entry
- (e) Maximum Fuel Load Entry
- (f) Exceedance Review
- (g) Percent Power (EDI only - [S/N's 46360132 thru 4636374](#))

A summary of these pushbutton functions for the QDI only are listed in Figure 3 for easy reference. These controls are explained within this section.

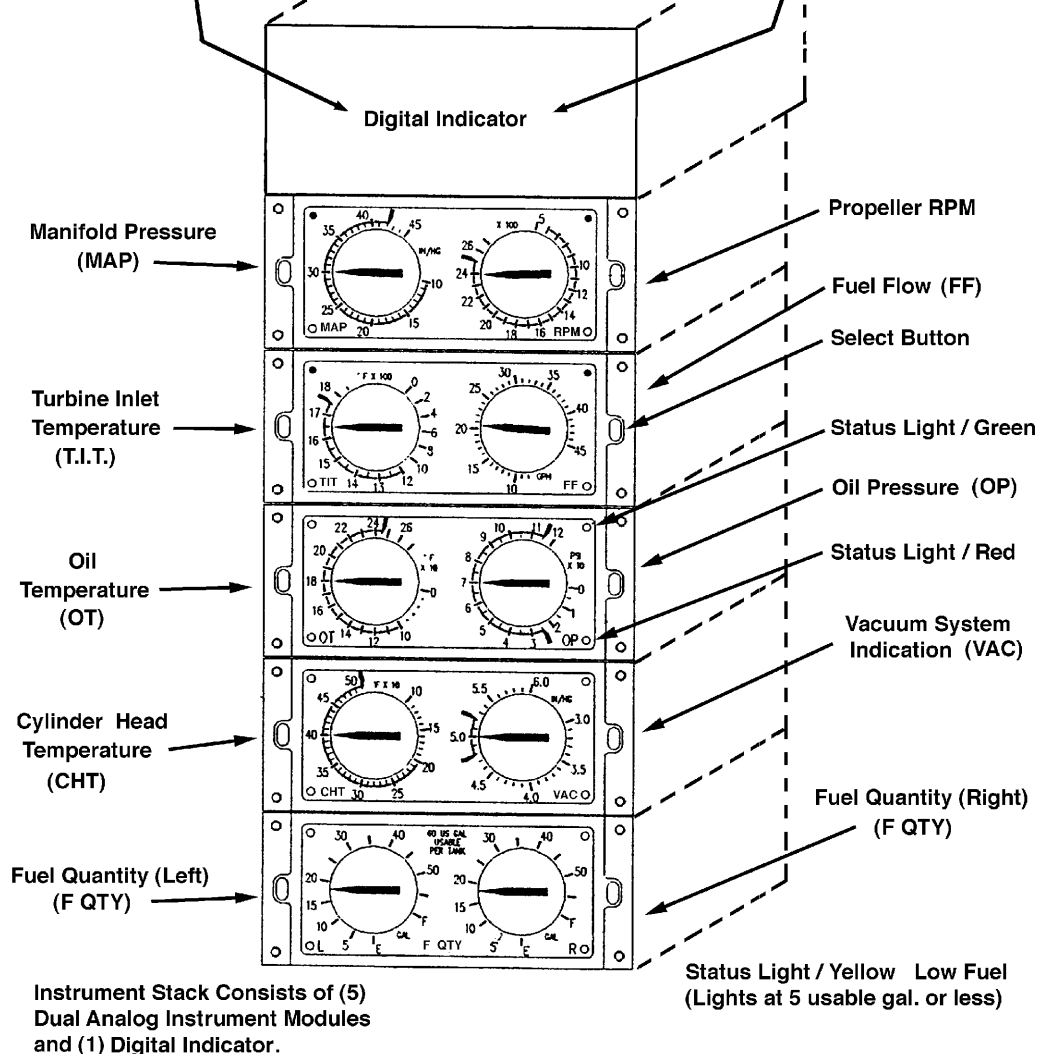
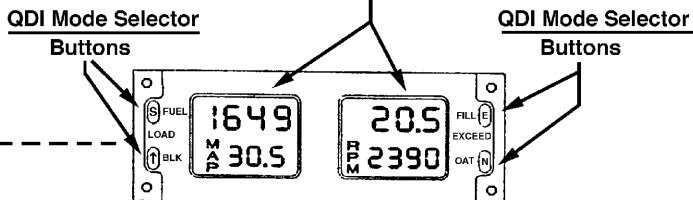
(3) Remote Switch Controls, External Alarm, External Interface Overview

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Enhanced Digital Indicator Display
(S/N's 4636132 and Up)



Quad Digital Indicator Display
(S/N's 4636021 Thru 4636131 Only)



Transicoil Electronic Module Instrument System (EMIS)
Figure 2

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- 1 When an analog indicator is in exceedance, its red or yellow LED will illuminate and remain on until the unit is no longer in exceedance.
 - 2 The external audible alarm will sound and the LCD display will flash until the operator acknowledges each exceedance by pressing the switch adjacent to the exceeding instrument.
- (b) During the entirety of the exceedance (up to 10 minutes or 599.9 seconds), the QDI/EDI will record the peak value of the exceedance, the average value of the exceedance, and the time duration of the exceedance. This data is stored in non-volatile memory for future recall.
- (c) If more than one exceedance occurs at the same time, all will be recorded in the non-volatile memory with only the last exceedance being displayed. The operator must acknowledge each exceedance to mute the external audible alarm. Acknowledgment of each exceedance can be random.

(12) Exceedance Review Mode

- (a) The QDI/EDI contains non-volatile memory for future examination of recorded exceedances. The memory size is sufficient to record a total of 238 exceedance events. Each event contains the Peak, Average and Time duration of exceedance. The exceedance history is presented in reverse chronological order for each indicator during review, with the most recent exceedance event listed first.

CAUTION: WHEN THE MEMORY ALLOCATED FOR EXCEEDANCE RECORDING IS FULL, NO NEW EXCEEDANCES WILL BE RECORDED. IT WILL BE NECESSARY FOR THE OPERATOR TO HAVE A QUALIFIED MECHANIC PERIODICALLY RESET THIS MEMORY. THIS MEMORY CAN BE RESET BY USE OF THE REMOTE SECURITY RESET SWITCH. REFER TO PARAGRAPHS C(1), ABOVE, AND M, BELOW.

- (b) To enter the exceedance review mode, depress both right hand buttons (with the word "EXCEED" between them) on the front of the QDI/EDI. The operator can exit this mode at any time by selecting any analog indicator.

(c) Display Messages

- 1 The QDI/EDI will post four possible messages during the exceedance review operation.
 - a "E Clr" (See Figure 9, View A)
This message indicates that no exceedances were found in the exceedance memory.
 - b "END ind" (See Figure 9, View B)
This message indicates that all of the exceedance events for the indicator under examination have been displayed.
 - c "END ALL" (See Figure 9, View C) This message indicates that all of the exceedance events for all indicators have been displayed.
 - d "END ind" and "E FUL" (See Figure 9, View D)
These messages indicate that all of the exceedance events for the indicator under examination have been displayed and exceedance memory is full.

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The rear connector provides access to interface:

- (a) A remote (normally open) switch to reset the exceedance memory.
- (b) An outside air temperature sensor interface.
- (c) An open collector output, capable of sinking 2.3 watts max. resistive load, is provided as an output for a fuel imbalance indicator and/or alarm.

(4) Power Up Characteristics

When power is first applied to the EMIS system stack, the following events take place:

- (a) First, an automatic system self test is initiated by the QDI/EDI.
 - 1 All analog pointers will be driven clockwise to the 9 o'clock position for approximately seven (7) seconds.
 - 2 All analog indicator LEDs will illuminate.
 - 3 All external alarms will be activated for about 2 seconds at the end of the self test cycle.
 - 4 All active segments of the displays will be energized.
- (b) After the self-test is complete, the QDI/EDI steps into its normal digital enhancement mode (see paragraph E.). If the entire EMIS stack is connected, the QDI/EDI will automatically select and display the "MAP", "RPM", "TIT" and "FF" indicators. The EDI will also display the "OAT" and, as long as the aircraft is on the ground, a nulled % PWR.

NOTE: Any exceedances that have previously been recorded must be called up manually by the operator.

- (c) Upon reaching the 9 o'clock self-test pointer position, any analog indicator(s) can be taken out of self-test by depressing and then releasing the select switch associated with the analog indicator(s) you wish to see. The selected indicator(s) will display current sensor readings. The rest of the system stack will complete the self-test cycle.

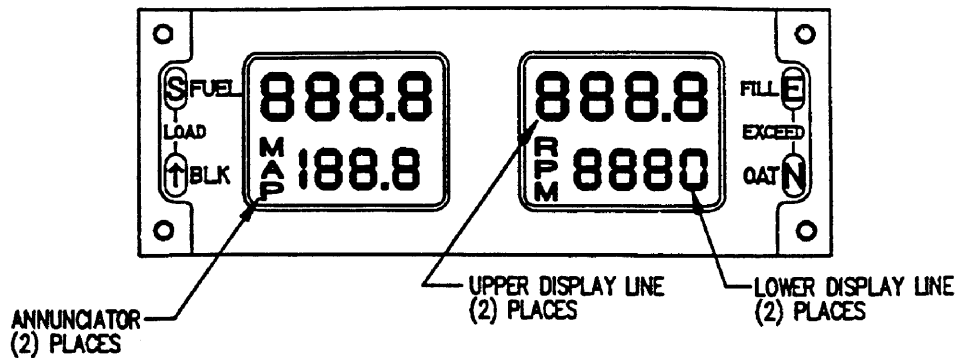
(5) Normal Digital Enhancement Mode, Analog Indicator

In normal operation mode, the QDI/EDI posts a digital enhancement of the selected analog indicators. When the QDI/EDI is in this mode, four or six parameters are posted simultaneously. In the QDI, two of them are posted in the upper half of the LCDs. The lower half of the display is dedicated to the MAP and RPM analog indicators. (See Figure 4.) In the EDI, two of them are posted in the middle of the LCDs, the top line of the display is reserved for the MAP and RPM analog indicators, and the bottom line displays OAT and % PWR.

To post the corresponding digital reading for an analog indicator, momentarily press the button adjacent to that analog indicator. The selected analog indicator will have its GREEN LED illuminated. The left analog readings will be posted in the upper or middle left LCD and the right analog reading will be posted in the upper or middle right LCD.

NOTE: At power-up the TIT and FF are the default indicators automatically selected for the digital enhancement mode.

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NORMAL FLIGHT PUSH BUTTON FUNCTIONS

BUTTON	DISPLAY FUNCTION	FIGURE	SECTION
BLK	BLANK ENTIRE DISPLAY		6.0
FUEL	FUEL MANAGEMENT MODE <u>PRESS BUTTON</u> <u>DISPLAYED INFORMATION</u> once FUEL REMAINING IN GALLONS again FLIGHT TIME REMAINING IN HOURS again FUEL CONSUMED IN GALLONS again RECYCLES DATA	3A 4A 5	7.0
OAT	OUTSIDE AIR TEMPERATURE IN °C	6	9.0

SECONDARY PUSH BUTTON FUNCTIONS SUMMARY

DEPRESS BOTH LEFT BUTTONS "S" AND "↑" TO ENTER FUEL LOAD ENTRY MODE (SECTION 8.0)

BUTTON	DISPLAY FUNCTION
S MOMENTARY	SELECTS DIGIT TO BE CHANGED AND SELECTED DIGIT WILL START TO FLASH
↑	INCREMENTS VALUE OF SELECTED DIGIT
E MOMENTARY	AUTO MAX FUEL LOAD 120 GALS AND EXITS TO NORMAL FUEL MANAGEMENT MODE
S PUSH/HOLD (APPROX 2 SEC)	LOADS ENTERED FUEL QTY INTO MEMORY AND EXITS TO FUEL MANAGEMENT MODE

NOTE:
1) FUEL LOAD MEMORY IS NON-VOLATILE.
2) RE-ENTRY WILL POST PRESENT FUEL QUANTITY

DEPRESS BOTH RIGHT BUTTONS TO ENTER EXCEEDANCE REVIEW MODE (SECTION 12.0)

BUTTON	DISPLAY FUNCTION	FIGURES
E	<u>PRESS BUTTON</u> <u>DISPLAYED INFORMATION</u> once LAST EXCEEDANCE PEAK VALUE OF FIRST EXCEEDING INDICATOR IN MEMORY again DURATION OF LAST EXCEEDANCE AND AVERAGE VALUE OF EXCEEDANCE FOR ABOVE SELECTED INDICATOR again RECYCLES DATA IF ONLY ONE EXCEEDANCE FOUND IN MEMORY FOR THE SELECTED INDICATOR IN REVIEW - OR - DISPLAYS PREVIOUS PEAK VALUES, AVERAGE VALUES & DURATION IN REVERSE CHRONOLOGICAL ORDER OF SELECTED INDICATOR TO "End ind" PROMPT, THEN REPEATS LIST FROM BEGINNING.	8 10 7B
↑	QUICK ADVANCE THROUGH EXCEEDANCE PEAK VALUES IN REVERSE CHRONOLOGICAL ORDER OF SELECTED INDICATOR PRESENTLY UNDER REVIEW.	
N	SELECTS "NEXT" INDICATOR FOR REVIEW	

"E Clr" MESSAGE = NO EXCEEDANCES IN MEMORY
"End ALL" MESSAGE = ALL EXCEEDANCE EVENTS WERE POSTED

(all display segments as shown are energized during self test)

Quad Digital Indicator Overview
Figure 3

Effectivity
4636021 thru 4636131

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(6) Display Blanking

The LCD can be blanked at the operator's discretion. To select this operation, press the "BLK" button. To exit this mode, select any analog indicator from the EMIS system stack or select any other QDI/EDI function.

NOTE: Since the pushbutton designated for blanking the display has secondary functions during exceedance review and fuel management mode, the display blanking function is disabled during these modes of operation.

If an exceedance occurs, the blank mode will end and the exceedance will automatically be posted.

(7) Fuel Management Mode

- (a) QDI (S/N's 4636021 thru 4636131 only). The QDI is linked to the fuel flow indicator in the system stack through the data bus. Having this information available allows the QDI to perform "Real Time" fuel management calculations. Fuel remaining, flight time remaining, and fuel consumed can be selected on the display.

To enter the fuel management (posting) mode, momentarily press the "FUEL" button.

- 1 See Fuel Load Entry Mode, below, for the fuel load entry procedure.
- 2 If a fuel value had previously been entered into the fuel computer, the fuel remaining will be displayed in gallons. (See Figure 5A).
- 3 To view the flight time remaining, momentarily press the "FUEL" button a second time. (See Figure 7A).

NOTE: In the event no fuel flow is detected, the flight time remaining will be displayed as "----". (See Figure 7B). When the calculated flight time remaining has expired, "0.0" will be displayed. (See Figure 7C).

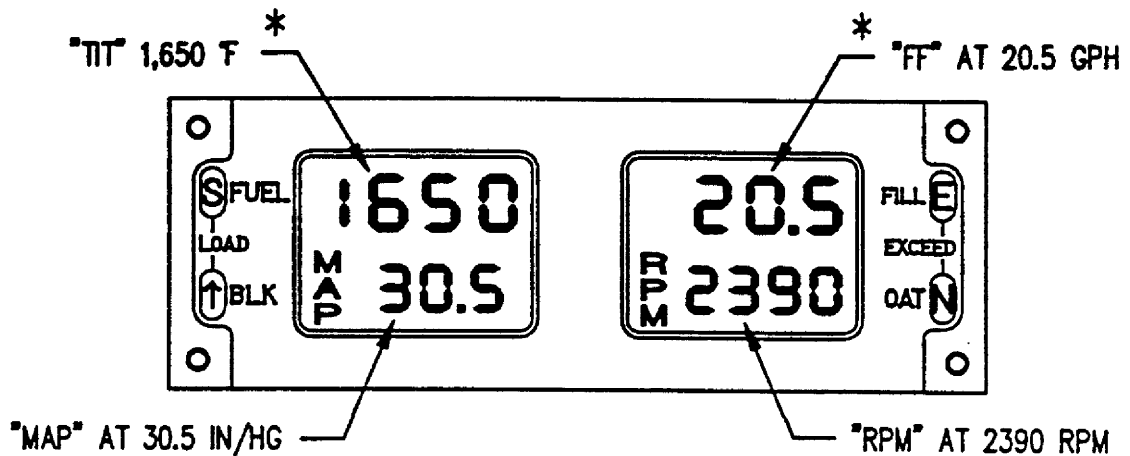
- 4 To view the fuel consumed, momentarily press the "FUEL" button a third time. The fuel consumed will be displayed in gallons (See Figure 8A). As long as fuel flow is detected, the fuel computer will continue to update the fuel used.
- 5 Continuing to press the "FUEL" button repeatedly will simply cycle through the three fuel management displays.
- 6 To exit the fuel management mode, return to the normal digital enhancement mode and select any analog indicator in the EMIS system stack or any other function of the QDI.

NOTE: The memory allocated for the fuel management mode is non-volatile.

- (b) EDI (S/N's 4636132 thru 4636374). The EDI is linked to the fuel flow indicator in the system stack through the data bus. Having this information available allows the EDI to perform "Real Time" fuel management calculations. Fuel remaining, flight time remaining, and fuel consumed can be selected on the display.

- 1 To enter the fuel management (posting) mode (see Figure 8B), momentarily press the "FUEL" button. If a fuel value had previously been entered into the fuel computer, the Fuel Remaining (REM) will be displayed in gallons, as well as: Endurance (ENDUR), Nautical Miles Per Gallon (NMPG), Total Fuel Used (USE), Gallons To Destination (GAL TO DEST) and Gallons At Destination (GAL AT DEST).
- 2 To exit the fuel management mode and return to the normal digital enhancement mode push the "INST" button.

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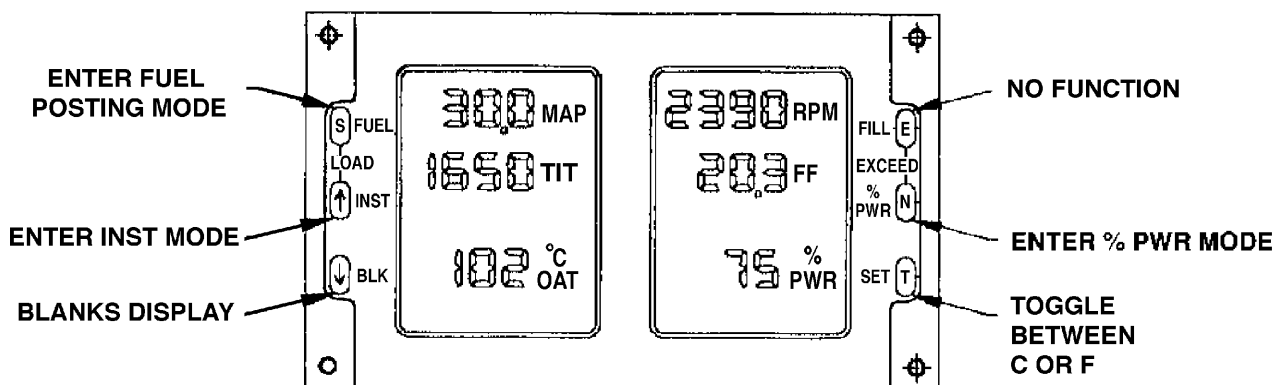


(Lower display lines are dedicated to "MAP" and "RPM" when in Digital Enhancement Mode (i.e. - Normal Display))

* Corresponds to the analog reading of the selected Dual Analog Module Indicator in the EMIS System stack.
In this example, the "TIT" and "FF" indicators have been selected and are being displayed digitally.

QUAD DIGITAL INDICATOR

(S/N'S 4636021 THRU 4636131 ONLY)



ENHANCED DIGITAL INDICATOR

(S/N'S 4636132 AND UP)

Digital Enhancement Mode (i.e. - Normal Display)

Figure 4

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

H. Fuel Load Entry Mode

(1) QDI (S/N's 4636021 thru 4636131 only).

(a) To select fuel load entry mode, press "S" and "UP ARROW" buttons simultaneously.

- 1 The LCD will display "FUEL 000" or present fuel remaining with the most significant digit found flashing along with a flashing "Pro"gramming prompt in the lower left. (See Figure 5B).
- 2 Pressing the "UP ARROW" button will increment the flashing digit. Pressing the "S"elect button will advance to the next digit. The digits will increment up to nine or the capacity of the aircraft fuel tanks (120 gallons). To enter this fuel load into memory, depress and hold the "S"elect button for approximately 2 seconds. The QDI will automatically enter the normal fuel management mode which will be evident by the absence of the flashing "Pro"gramming prompt and flashing selected digit.

NOTE: The Manual Fuel Load Entry can be re-entered at any time. In this mode, the QDI will post the last fuel remaining (will not update). Depressing and holding the "S"elect button for approximately 2 seconds will:

- Update fuel load data, if new data is manually entered.
- Will display updated fuel remaining if no change is made.

(b) Max Fuel Load

While in the fuel entry mode, press and release the "E" button with "FILL" adjacent to it. The LCD will display "FUEL 120" and return to the fuel management mode. (See Figure 5C).

(2) EDI (S/N's 4636132 and up).

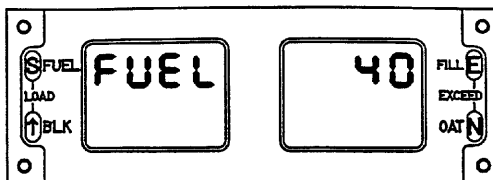
(a) Prior to engine start, a new fuel loading can be entered into the EDI by selecting the fuel posting mode. Press the "S" button on the left side of the display. Once in the fuel posting mode, enter the fuel loading mode by simultaneously pressing the "S" and "Up Arrow" buttons (Figure 5D and 5E). The digital display will show "000" or present fuel remaining with the left most digit flashing. Pressing the "UP ARROW" button will increment the flashing digit up while the "DOWN ARROW" will increment the flashing digit down. Pressing "T" button will toggle between flashing parameter digits. This sequence is repeated until the new fuel loading is displayed in the EDI window. To enter this fuel load into memory, depress the "S" button on the left side of the display. At this point the CDI will return to the fuel posting mode automatically.

NOTE: During fuel loading entry sequence, the three digits must display 120 gallons or less at all times to permit fuel load entry into the EDI.

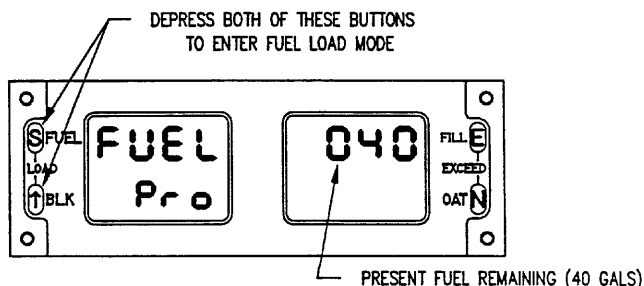
(b) Max Fuel Load

If the fuel tanks are filled to max capacity (120 gallons usable), the pre-set full fuel valve can be entered by depressing the "E" button while in the fuel entry mode (Figure 5E).

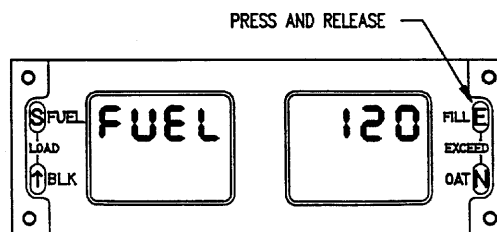
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



VIEW A
FUEL DISPLAY SHOWING 40 GALLONS FUEL REMAINING
(FUEL MANAGEMENT MODE)

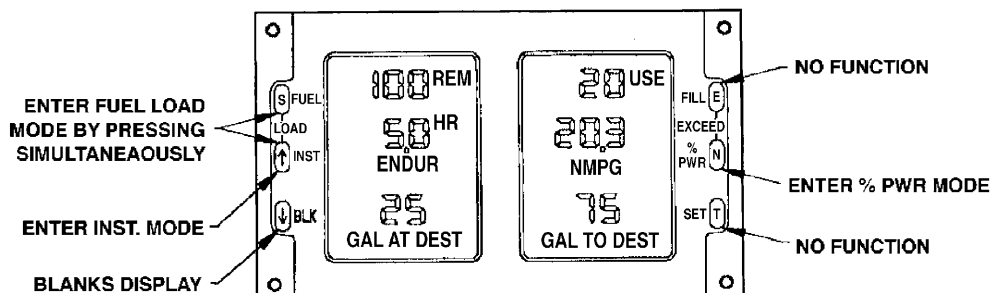


VIEW B
FUEL LOAD ENTRY DISPLAY,
WITH THE "Pro"GRAMMING ANNUNCIATOR
AND SELECTED DIGIT FLASHING

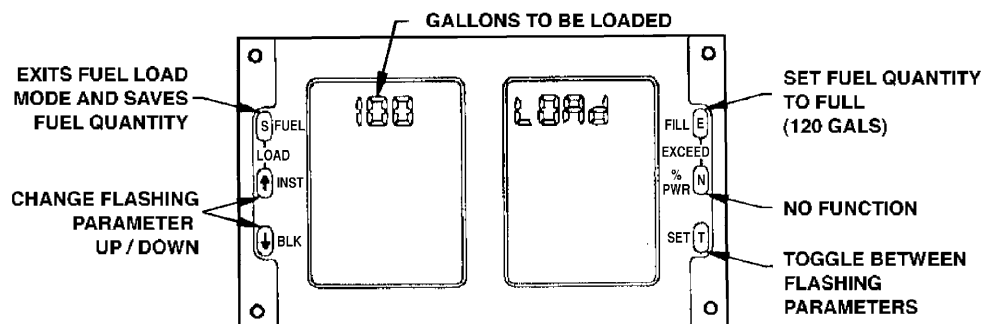


VIEW C
FUEL LOAD DISPLAY
SHOWING MAXIMUM LOAD

**QUAD DIGITAL INDICATOR (QDI)
(S/N'S 4636021 THRU 4636131 ONLY)**



VIEW D
FUEL MANAGEMENT (POSTING) MODE



VIEW E
FUEL LOAD MODE

**ENHANCED DIGITAL INDICATOR (EDI)
(S/N'S 4636132 AND UP)**

Fuel Modes
Figure 5

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
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(9) Outside Air Temperature "OAT"

(a) QDI (S/N's 4636021 thru 4636131 only).

- 1 The "OAT" reading will be posted on the LCD when this function is manually selected.
- 2 To post the "OAT" reading, press the "N" button with the "OAT" adjacent to it. The "OAT" reading is displayed in degrees C. (See Figure 6.)
- 3 To exit from this mode, select any analog indicator from the EMIS system stack, or any other function button of the QDI.

NOTE: Since the pushbutton designated for the "OAT" display has a secondary function during exceedance review mode, the "OAT" display mode is disabled during that mode of operation.

(b) EDI (S/N's 4636132 thru 4636374).

- 1 "OAT" is the default display in the left LCD when in the INST mode. (See Figure 4.)
- 2 When in INST mode, the "OAT" display can be cycled from "° F" to "° C" by pressing the SET button.

(10) Fuel Imbalance Alarm

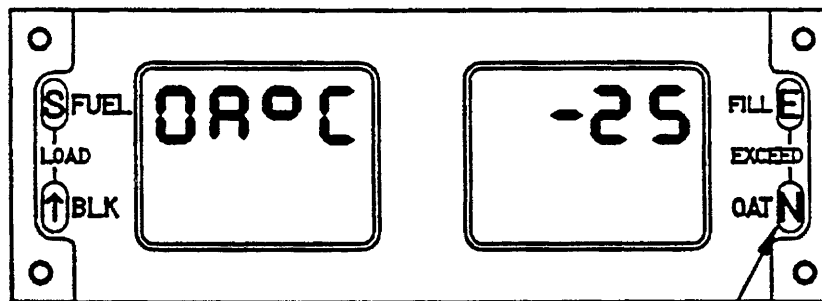
If a fuel imbalance greater than 10 gallons is sensed between the left and right fuel tanks, the alarm output (for an external annunciator) will be activated after 60 seconds. As soon as the imbalance is corrected, the alarm will deactivate.

(11) Automatic Exceedance Warning Mode

- (a) The exceedance warning mode has the highest priority. When an exceedance is detected, the QDI/EDI will automatically select that indicator and display the readings on the LCD. The peak exceedance value of the indicator will flash in the display.

NOTE: The QDI/EDI will automatically select and display exceedances in the order they are detected. Low exceedance recording and the alarm outputs of the VAC and OP analog indicators will be suppressed until the engine reaches a speed of 1400 RPM.

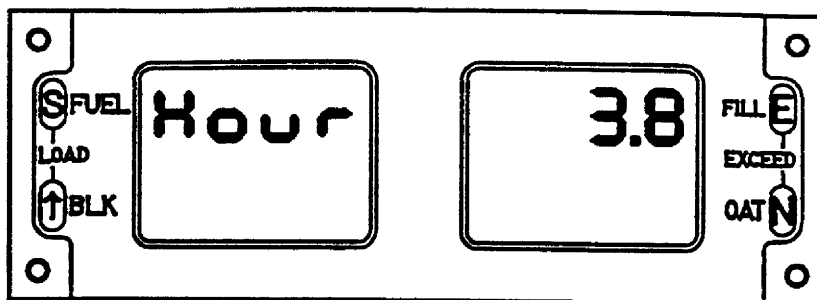
THIS EXAMPLE ILLUSTRATES AN "OAT" READING OF -25°C.



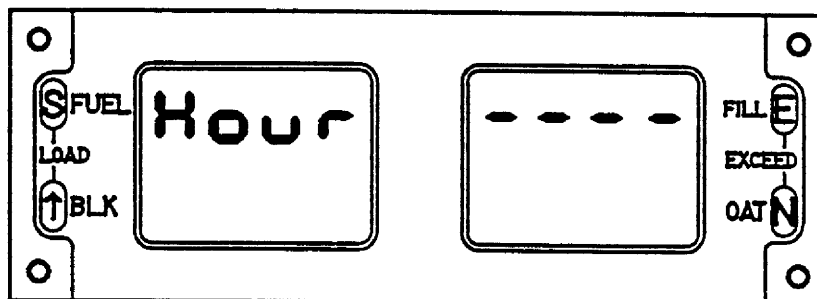
OAT Display - QDI
Figure 6

[Effectivity](#)
4636021 thru 4636131

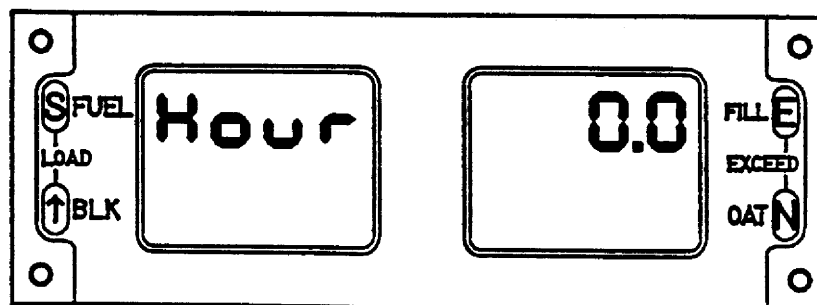
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



VIEW A
FLIGHT TIME REMAINING DISPLAY
SHOWING 3.8 HOURS REMAINING
(FUEL FLOW SENSED)



VIEW B
FLIGHT TIME REMAINING DISPLAY
WITH NO FUEL FLOW SENSED

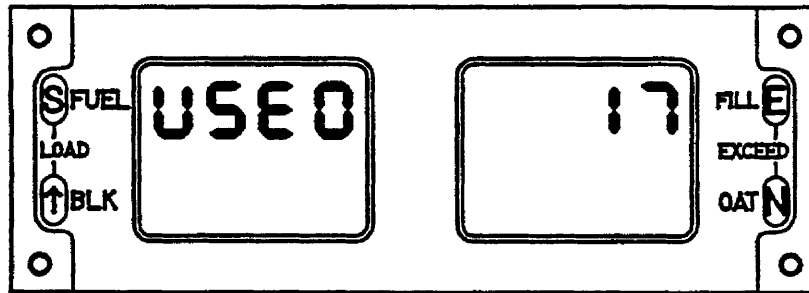


VIEW C
FLIGHT TIME REMAINING DISPLAY
SHOWING FLIGHT TIME EXPIRED

Flight Time Remaining - QDI
Figure 7

[Effectivity](#)
4636021 thru 4636131

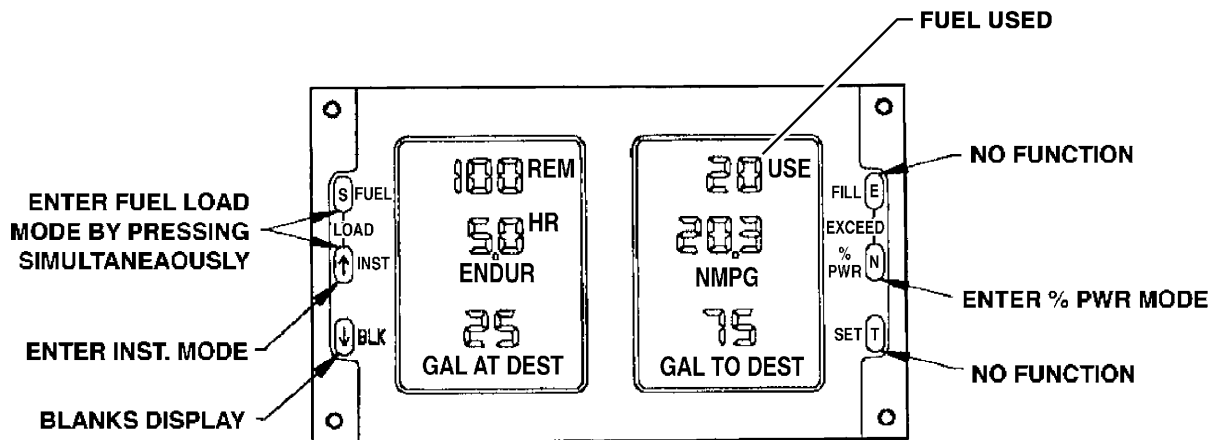
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



VIEW A
FUEL CONSUMED DISPLAY
SHOWING 17 GALLONS OF FUEL USED

NOTE: The fuel flow indicator must be connected to the data bus for input to the fuel computer.

QUAD DIGITAL INDICATOR (QDI)
(S/N'S 4636021 THRU 4636131 ONLY)



VIEW B
FUEL MANAGEMENT (POSTING) MODE
SHOWING 20 GALLONS OF FUEL USED

ENHANCED DIGITAL INDICATOR (EDI)
(S/N'S 4636132 AND UP)

Fuel Used
Figure 8

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

K. Automatic Exceedance Warning Mode

- (1) The exceedance warning mode has the highest priority. When an exceedance is detected, the QDI/EDI will automatically select that indicator and display the readings on the LCD. The peak exceedance value of the indicator will flash in the display.

NOTE: The QDI/EDI will automatically select and display exceedances in the order they are detected. Low exceedance recording and the alarm outputs of the VAC and OP analog indicators will be suppressed until the engine reaches a speed of 1400 RPM.

- (a) When an analog indicator is in exceedance, its red or yellow LED will illuminate and remain on until the unit is no longer in exceedance.
 - (b) The external audible alarm will sound and the LCD display will flash until the operator acknowledges each exceedance by pressing the switch adjacent to the exceeding instrument.
- (2) During the entirety of the exceedance (up to 10 minutes or 599.9 seconds), the QDI/EDI will record the peak value of the exceedance, the average value of the exceedance, and the time duration of the exceedance. This data is stored in non-volatile memory for future recall.
- (3) If more than one exceedance occurs at the same time, all will be recorded in the nonvolatile memory with only the last exceedance being displayed. The operator must acknowledge each exceedance to mute the external audible alarm. Acknowledgment of each exceedance can be random.

L. Exceedance Review Mode

- (1) The QDI/EDI contains non-volatile memory for future examination of recorded exceedances. The memory size is sufficient to record a total of 238 exceedance events. Each event contains the Peak, Average and Time duration of exceedance. The exceedance history is presented in reverse chronological order for each indicator during review, with the most recent exceedance event listed first.

CAUTION: WHEN THE MEMORY ALLOCATED FOR EXCEEDANCE RECORDING IS FULL, NO NEW EXCEEDANCES WILL BE RECORDED. IT WILL BE NECESSARY FOR THE OPERATOR TO HAVE A QUALIFIED MECHANIC PERIODICALLY RESET THIS MEMORY. THIS MEMORY CAN BE RESET BY USE OF THE REMOTE SECURITY RESET SWITCH. REFER TO PARAGRAPHS C(1), ABOVE, AND M, BELOW.

- (2) To enter the exceedance review mode, depress both right hand buttons (with the word "EXCEED" between them) on the front of the QDI/EDI. The operator can exit this mode at any time by selecting any analog indicator.
- (3) Display Messages
 - (a) The QDI/EDI will post four possible messages during the exceedance review operation.
 - 1 "E Clr" (See Figure 9, View A)
This message indicates that no exceedances were found in the exceedance memory.
 - 2 "END ind" (See Figure 9, View B)
This message indicates that all of the exceedance events for the indicator under examination have been displayed.
 - 3 "END ALL" (See Figure 9, View C) This message indicates that all of the exceedance events for all indicators have been displayed.
 - 4 "END ind" and "E FUL" (See Figure 9, View D)
These messages indicate that all of the exceedance events for the indicator under examination have been displayed and exceedance memory is full.

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PA-46-350P, MALIBU MIRAGE
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(4) Pushbutton Functions

(a) QDI (S/N's 4636021 thru 4636131 only).

1 The "E"xceedance Button

This button will cause the QDI to display all the exceedance events for the indicator under examination. Each time this button is pressed, the displayed data will change from the "Exceedance Peak" to the "Average and Duration of Exceedance" for each event in memory until the "END ind" message is displayed. Continuing to press the button will repeat the list.

2 The "UP ARROW" Button

This button will display only the "Exceedance Peaks". The "END ind" message is posted to signify that all peak events have been displayed. Continuing to press this button will repeat the list.

3 The "N"ext Button

This button allows the operator to manually select another indicator to be reviewed. This option is convenient when only the last exceedance peaks for all of the exceeding indicators in memory are required to be reviewed. The "END ALL" message will be posted when all the indicators have been displayed. Continuing to press this button will repeat the list.

(b) EDI (S/N's 4636132 and up).

1 The push button functions used to review the limitation exceedance events in the exceedance review mode "PEAK DISPLAY" (See Figure 10) are

a Down Arrow - This button will cause the EDI display to post all the exceedance events for the indicator under examination. Each time the down arrow button is pressed, the posted data will change to the next peak exceedance for the same indicator.

b "N" (Next) - This button allows the operator to manually select another indicator to be reviewed. The "END ALL" message will be posted when all the indicators have been posted. Further depressions will repeat the list.

c "E" (Exceedance) - This button allows the operator to enter the exceedance review mode average display.

2 The push button functions used to review the limitation exceedance events in the exceedance review mode "Average Display" are: (See Figure 11.)

a "E" (Exceedance) - This button will cause the EDI display to post all the average exceedance events for the indicator under examination. Each time "E" is pressed, the posted data will change to the next average exceedance for the same indicator.

b "N" (Next) - This button allows the operator to manually select another indicator to be reviewed. The "END ALL" message will be posted when all the indicators have been posted. Further depressions will repeat the list.

c Up Arrow - This button allows the operator to enter the instrument mode display.

(5) Upon entry into the exceedance review mode, two possible presentations will be displayed based on the status of the QDI/EDI's exceedance memory.

(a) No Exceedance Data Found In Memory

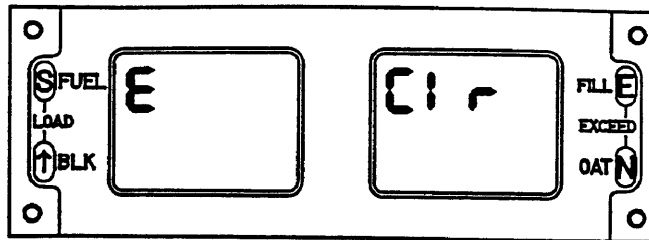
In the event no exceedance data is found, an "E Clr" prompt will be displayed. (See Figure 9, View A). At this point, the operator can exit the exceedance review mode.

(b) Exceedance Data Found In Memory

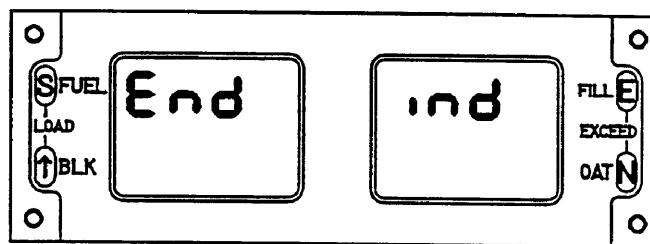
When exceedance data is found in memory, the QDI/EDI will display the peak exceedance data for the first indicator found in memory.

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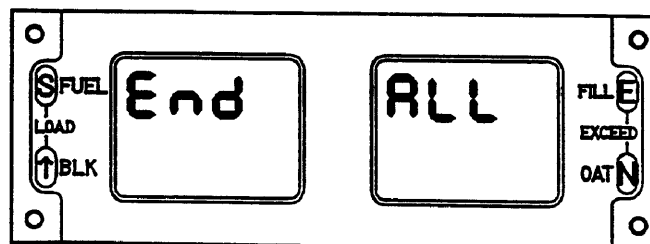
NOTE: QDI shown, EDI similar.



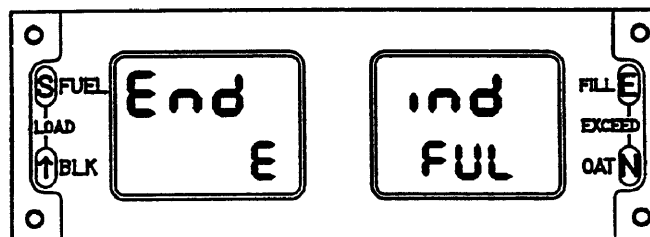
VIEW A
EXCEEDANCES CLEAR MESSAGE



VIEW B
END INDICATOR MESSAGE



VIEW C
END ALL MESSAGE

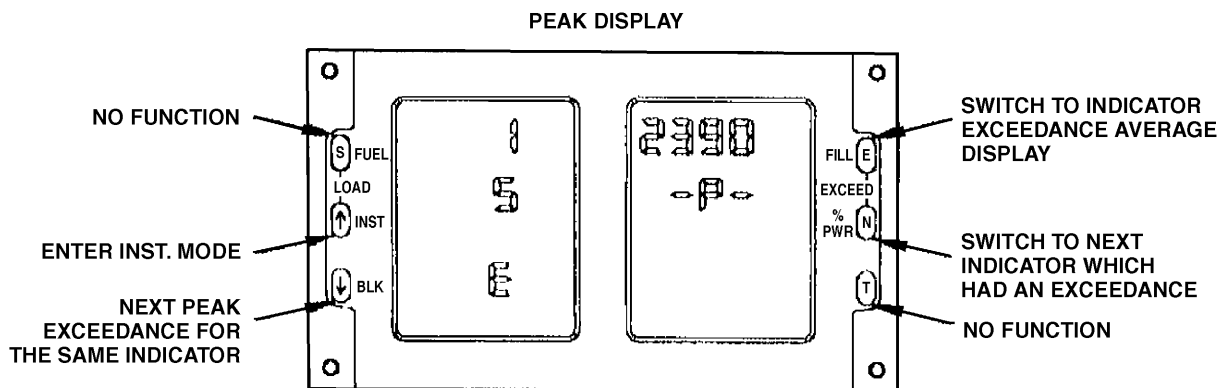


VIEW D
END INDICATOR AND
EXCEEDANCES FULL MESSAGES

Exceedance Review
Figure 9

**THE NEW PIPER AIRCRAFT, INC.
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- (e) Upon entry into the exceedance review mode, two possible presentations will be displayed based on the status of the QDI/EDI's exceedance memory.
- 1 No Exceedance Data Found In Memory
In the event no exceedance data is found, an "E Clr" prompt will be displayed. (See Figure 9, View A). At this point, the operator can exit the exceedance review mode.
 - 2 Exceedance Data Found In Memory
When exceedance data is found in memory, the QDI/EDI will display the peak exceedance data for the first indicator found in memory.
- (e) Peak Exceedance Display
- 1 The peak exceedance display format for an analog indicator is illustrated in Figure 10. An analog indicator with an exceedance displayed is identified by both the red or yellow and green LEDs flashing. The operation of the analog indicator is not affected during exceedance review.
 - 2 The peak value of the exceedance will be displayed digitally above the analog indicator under review.
 - 3 The opposite display window will contain an "E" and two numbers. The top number represents the exceedance event being reviewed for that indicator. The lower number represents the number of exceedance events that are in memory for that indicator.
- (f) Exceedance Average and Time Display
- One side of the display will post the average exceedance value in memory, above the prompt "-A-". The other side of the display will post the exceedance time in seconds above the prompt "SEC". (See Figure 11.)



Peak Exceedance Display
Figure 10

[Effectivity](#)
4636132 thru 4636374

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(13) Remote Exceedance Memory Reset Control

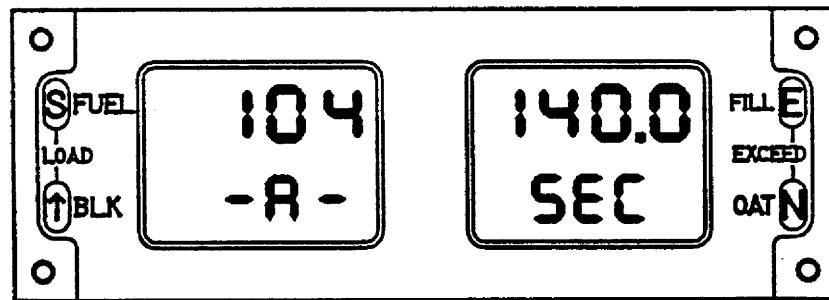
WARNING: ALL EXCEEDANCE HISTORY DATA WILL BE LOST DURING THIS RESET OPERATION, AND CANNOT BE RETRIEVED.

The QDI/EDI is configured to accept a remote exceedance memory reset control (See Remote Switch Controls, External Alarm, External Interface Overview; above). Upon receipt of the control signal, the QDI/EDI will reset (clear) its NVRAM exceedance memory. This control can be initiated at any time.

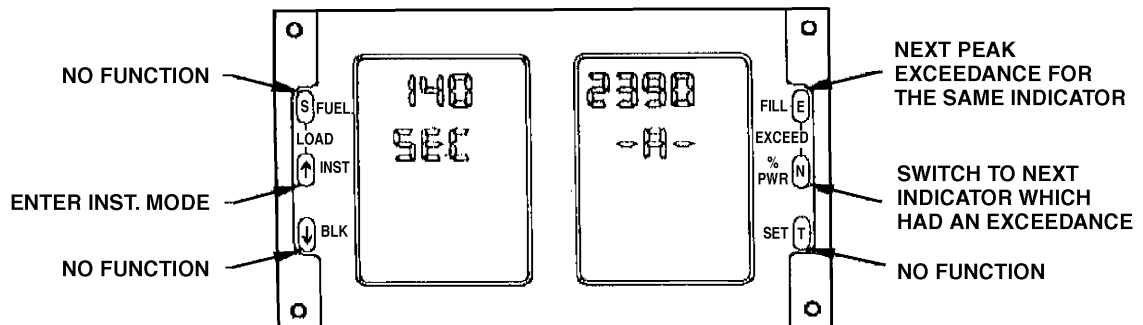
(14) Servicing

The Quad Digital Indicator/Enhanced Digital Indicator cannot be serviced in the field. Should any of the preceding checks indicate a failure, return the unit to the factory for service.

AVERAGE EXCEEDANCE VALUE AND EXCEEDANCE TIME IN SECONDS MESSAGES



QUAD DIGITAL INDICATOR (QDI)
(S/N'S 4636021 THRU 4636131 ONLY)

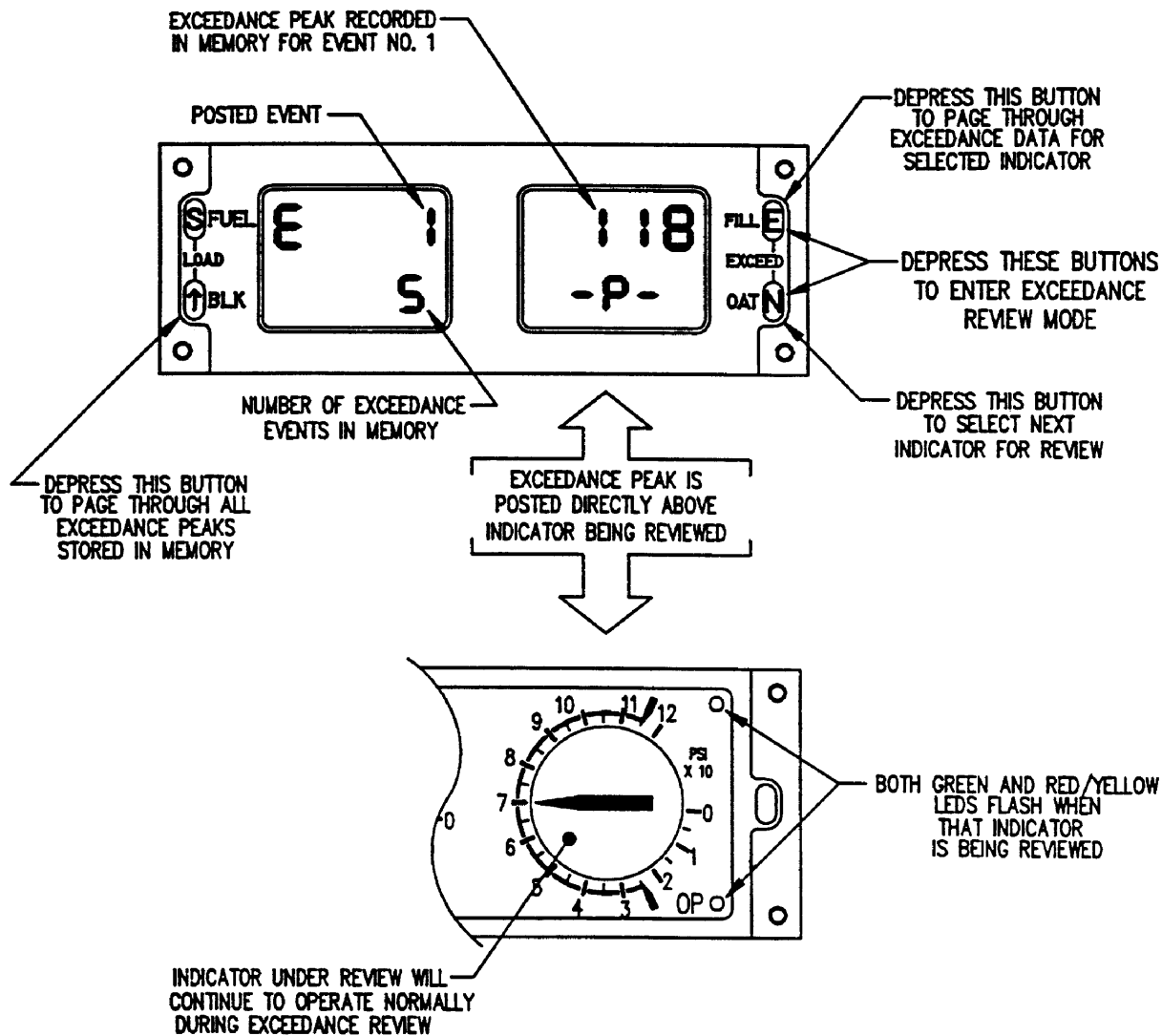


ENHANCED DIGITAL INDICATOR (EDI)
(S/N'S 4636132 AND UP)

Exceedance Average and Time Display
Figure 11

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

QDI SHOWN, EDI SIMILAR



EXAMPLE OF ANALOG INDICATOR EXCEEDANCE REVIEW MESSAGE

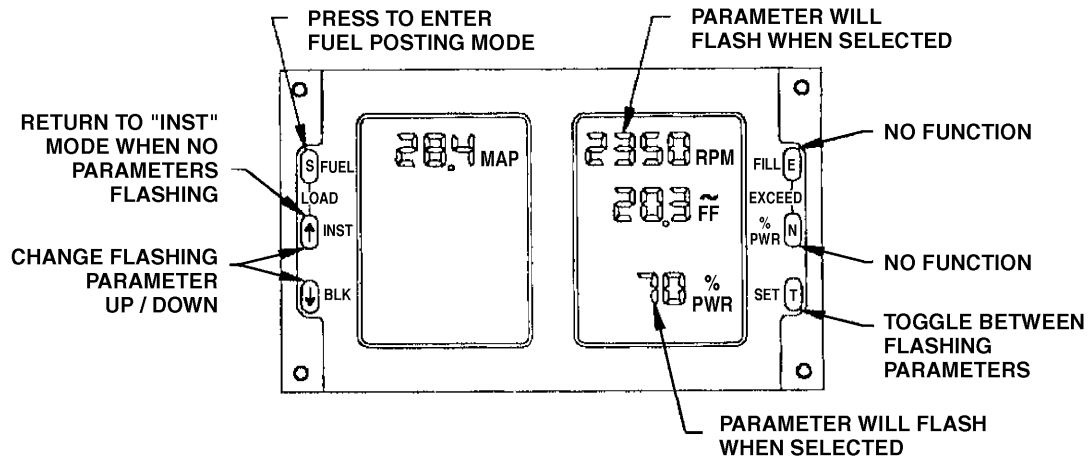
THE ABOVE EXAMPLE INDICATES:

- 1) THE PRESENT INDICATOR IN REVIEW IS THE "OP" INDICATOR
- 2) THE PEAK EXCEEDANCE EVENT POSTED, " 118 PSI ", WAS THE LAST RECORDED
- 3) THERE ARE 5 EXCEEDANCE EVENTS IN MEMORY FOR THIS INDICATOR

NOTE: THE ANALOG PRESENTATION IS FOR REFERENCE ONLY.
DIAL CONFIGURATION IS SUBJECT TO CHANGE.

Exceedance Review - Analog Indicator
Figure 12

**THE NEW PIPER AIRCRAFT, INC.
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Percent Power Mode
Figure 13

[Effectivity](#)
4636132 thru 4636374

(15) Percent Power (EDI only - [S/N's 4636132 thru 4636374](#))

- (a) Another feature of the EDI is the percent power mode (Figure 2B). To enter this mode momentarily depress the percent power (% PWR) button (middle button on the right side of the EDI). This will bring up the percent power page with the following parameters listed. Manifold Pressure (MAP), RPM, Approximate Fuel Flow (~FF) and Percent Power (% PWR). A desired percent power setting can be chosen by first depressing the set button on the lower right side of the EDI. Depressing this button toggles between the percent power and RPM parameters, causing the active parameter to flash. Once the percent power parameter is active the power can be cycled up or down by depressing the appropriate up and down arrow keys on the left side of the display. The % power range is that which can be selected is from 45% to 80% in 5% increments.
- (b) As % power is changed, a suggested approximate value for manifold pressure and fuel flow will be displayed. If a different RPM is desired, the select button can be depressed to toggle the active parameter to the RPM display, and the up/down arrow buttons can be used to vary the RPM in 100 RPM increments. This variation in RPM changes expected values of MAP and Fuel Flow accordingly. Once the desired % PWR and RPM combination are chosen pressing of the instrument button (INST) will return to the instrument display mode.

D. Calibration

Transicoil Electronic Module Instrument System (EMIS) components (i.e. - QDI/EDI and Dual Analog Module Indicators) can be calibrated against the criteria in Chart 3, except for Fuel Quantity and Cylinder Head Temperature (CHT).

Fuel Quantity calibration specifications and procedures are in Section 28-40-00.

CHT indicator calibration specifications and procedures are in Section 77-20-00.

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CHART 3
Electronic Module Instrument System (EMIS) CALIBRATION

INDICATOR TYPE	SENSOR FULL SCALE OUTPUT (UNLESS NOTED)	CALIBRATION POINTS EACH INDICATOR SHALL MEET THE CRITERIA SPECIFIED BELOW WITH ITS APPLICABLE SENDER UNIT					
OAT	84.23 TO 121.32 OHMS (- 40 TO 55 °C)	TEST POINT °C	- 40	-20	0	20	55
		MAXIMUM OHMS	85.07	93.00	100.84	108.63	122.16
		MINIMUM OHMS	83.47	91.32	99.16	106.95	120.48
MAP ¹	1.786 TO 4.536 VDC (10 TO 45 IN HG)	TEST POINT IN HG(ABS)	10	20	30	42	45
		MAXIMUM VDC	1.814	2.599	3.385	4.328	4.564
		MINIMUM VDC	1.759	2.544	3.330	4.273	4.509
RPM ²	12.50 HZ TO 67.50 HZ (500 TO 2700 RPM)	TEST POINT RPM	500	1400	2000	2500	2700
		MAXIMUM HZ	13.05	35.55	50.55	63.05	68.05
		MINIMUM HZ	11.95	34.45	49.45	61.95	66.95
TIT	0 TO 1850 °F - 0.692 mV TO 41.657 mV	TEST POINT °F	200	1200	1600	1750	1800
		MAXIMUM °F	218.5	1218.5	1618.5	1768.5	1818.5
		MINIMUM °F	181.5	1181.5	1581.5	1731.5	1781.5
FUEL FLOW	53.831 TO 302.8 HZ (8 TO 45 GPH)	TEST POINT GPH	8	15	25	35	45
		MAXIMUM HZ	56.321	103.423	170.712	238.001	305.290
		MINIMUM HZ	51.341	98.443	165.732	233.021	300.310
CHT ³	60.09 TO 143.80 OHMS (NON-LINEAR)	SEE SECTION 77-20-00					
CHT ⁴	417.87 mV TO 1.00 V (NON-LINEAR)	SEE SECTION 77-20-00					
OIL TEMPERATURE	84.50 TO 143.45 OHMS (NON-LINEAR)	TEST POINT °F	0	140	180	245	270
		MAXIMUM OHMS	85.00	112.88	121.92	137.71	144.15
		MINIMUM OHMS	84.01	111.70	120.66	136.35	142.75
OIL PRESSURE	1.0 TO 4.2 VDC (0 TO 120 PSI)	TEST POINT PSI	0	25	70	115	120
		MAXIMUM VDC	1.032	1.699	2.899	4.099	4.232
		MINIMUM VDC	0.968	1.635	2.835	4.035	4.168
VAC ^{5, 6}	3.0 TO 5.0 VDC (3.0 TO 6.0 IN HG)	TEST POINT IN HG	3.0	4.8	5.0	5.2	6.0
		MAXIMUM VDC	3.020	4.220	4.353	4.487	5.020
		MINIMUM VDC	2.980	4.180	4.313	4.447	4.980
VAC ^{5, 7}		TEST POINT IN HG	3.0	4.5	5.0	5.2	6.0
		MAXIMUM VDC	3.020	4.020	4.353	4.487	5.020
		MINIMUM VDC	2.980	3.980	4.313	4.447	4.980
FUEL QUANTITY		SEE SECTION 28-40-00					
		(PIR-PS50183 L.)					

Calibrate with 28Vdc at room temperature.

- When the MAP indicator receives a signal from 41.1 IN HG to 42.9 IN HG, the digital indicator will snap to 42 IN HG. The analog MAP indicator will continue to display the actual IN HG. When calibrating MAP indicator, shorting pins 23 and 25 on the QDI/EDI will result in a digital increment of 0.1 IN HG, allowing a more accurate set point.
- When the RPM indicator receives a signal from 2460 RPM to 2540 RPM, the digital indicator will snap to 2500 RPM. The analog RPM indicator will continue to display the actual RPM.
- P/N 599-588.
- P/N's 602-229 or 602-247.
- When the vacuum indicator receives a signal below 3.0 IN HG, the digital indicator will snap to 0 IN HG.
- P/N's 599-588 or 602-229.
- P/N 602-247.

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2. Avidyne FlightMax Entegra EFIS

In S/N's 4636375 and up, engine instrumentation is integrated into the Primary Flight Display (PFD) and Multi-Function Display (MFD). The Data Acquisition Unit (DAU) collects and processes the raw sensor input and provides a refined data stream to the PFD and MFD which actually display the data.

See 28-40-00 and 91-77-40 for more information.

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.)

Line maintenance of this system is limited to basic troubleshooting and that is addressed in vendor publications referenced in 34-20-00.

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OIL

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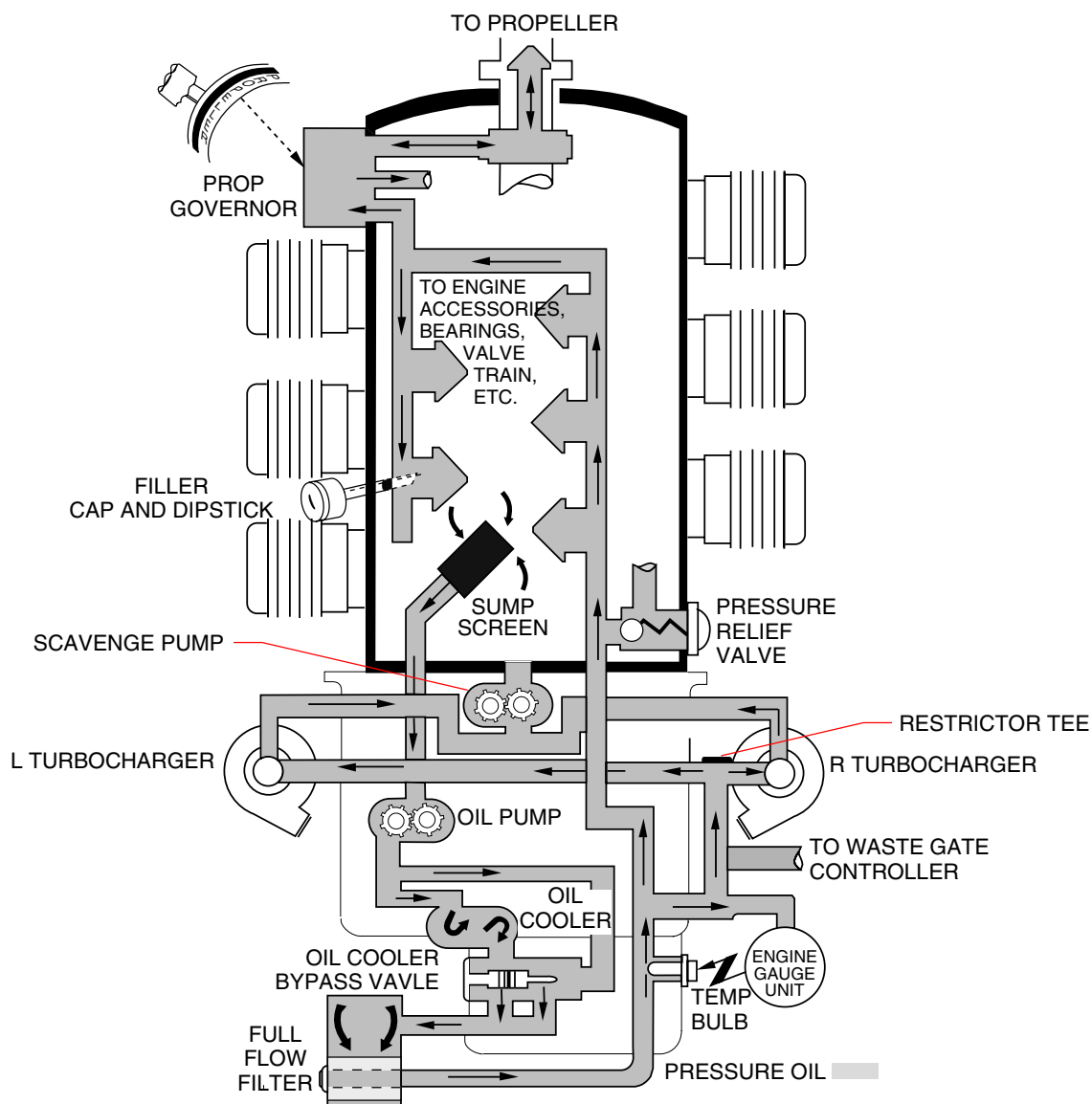
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DISTRIBUTION

Oil System

Oil is drawn from the sump through a suction tube to the intake side of the engine driven, gear type, oil pump. Outlet oil is directed to a full flow replaceable element oil filter. A bypass valve is incorporated in the filter. The oil pump has an oil pressure relief valve in the housing. A second gear driven pump located below the starter, scavenges oil from the turbochargers.

Engine oil is cooled by ram air passing through the oil cooler on the rear of the engine. Oil is distributed throughout the engine providing lubrication, cooling and oil supply to the propeller governor. Oil temperature and pressure information is available from the combination gauge on the bottom right of the pilot's instrument panel. Engine crankcase gases are discharged to an air/ oil separator behind the oil cooler and are then vented out the left exhaust stack.



Engine Oil System Fluid Diagram
Figure 1

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INDICATING

NOTE: In S/N's 4636375 and up, oil temperature and pressure data is collected by the Data Acquisition Unit (DAU) and is displayed on the Multi-Function Display (MFD and Primary Flight Display (PFD). See Electronic Flight System, 34-20-00, and 91-77-40 for more information.

1. Engine Oil Pressure Gauge

A. Description

NOTE: Serial numbers 4636021 thru 4636374 incorporate the Transicoil Electronic Module Instrument System (EMIS). See 77-40-00 for more information.

The oil pressure gauge is mounted next to the landing gear lever on the instrument panel. This gauge will indicate the amount of oil pressure available at the pressurized engine oil passage.

B. Troubleshooting

See Chart 1.

**CHART 1
TROUBLESHOOTING ENGINE OIL PRESSURE GAUGE**

Trouble	Cause	Remedy
Excessive error at zero.	Pointer loose on shaft.	Replace instrument.
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.

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2. Engine Oil Temperature Gauge

A. Description

NOTE: S/N's 4636021 thru 4636374 incorporate the Transicoil Electronic Module Instrument System (EMIS). See 77-40-00 for more information.

The oil temperature indicator is mounted next to the landing gear lever on the instrument panel. This instrument will provide a temperature indication of the engine oil in degrees Fahrenheit. The instrument has a temperature bulb (heat sensitive probe) located between the magnetos.

B. Troubleshooting

See Chart 2.

**CHART 2
TROUBLESHOOTING ENGINE OIL TEMPERATURE GAUGE**

Trouble	Cause	Remedy
Instrument fails to show any reading.	Broken or damaged bulb. Wiring open.	Check engine unit and wiring to instrument.
Excessive scale error.	Improper calibration adjustment.	Repair or replace.
Pointer fails to move as engine is warmed up.	Broken or damaged bulb or open wiring.	Check engine unit and wiring.
Dull or discolored marking.	Age	Replace instrument.

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STARTING

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CRANKING

1. Starter System

A. Description

This chapter provides general maintenance information on the Malibu starter motor, Prestolite/Electrosystems Model MHB-4016. For overhaul and repair procedures contact the Kelly Aerospace (see vendor contact information under Supplementary Publications in the Introduction).

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 also flows through the brushes and commutator, and finally through the armature to ground. The result is a high cranking torque, for a limited period of time, with a high current flow at a minimum loss of voltage.

The drive end gear of the armature mates with the reduction gear which drives the Bendix shaft. The Bendix drive is held in position on the shaft by a spirol pin. As the armature turns the reduction gear, the Bendix drive pinion meshes with the starter drive gear by inertia and action of the spirol grooves within the Bendix unit. A detent pin engages in a notch in the screw threads which prevents demeshing if the engine fails to start. When the engine does start and reaches a predetermined speed, centrifugal action forces the detent pin to release and allows the pinion to demesh from the starter drive gear.

B. Troubleshooting

See Chart 1.

2. Starter Motor

A. Removal

- (1) Disconnect the ground (negative) cable from the battery to ensure shorting of cabling does not occur.
- (2) Disconnect starter cable from starter terminal post.
- (3) Remove mounting bolts and lift off starter motor.

B. Installation

NOTE: In S/N's 4636001 thru 4636326, if installing a current production Lycoming 31B22474 Starter, order Piper Kit No. 767-337.

- (1) Clean all traces of rust, corrosion, or dirt from all mounting surfaces and mounting hardware. All ground points or straps must be clean and tight.
- (2) Place starting motor in position with no stresses or binding forces being present and install mounting bolts. Torque bolts to 200 to 220 inch-pounds.
- (3) Reinstall starter cable to starter terminal post.
- (4) Reconnect ground cable to negative post of battery.
- (5) Perform cranking tests.

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**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING STARTER SYSTEM**

Trouble	Cause	Remedy
Motor fails to operate.	Low battery charge.	Check and recharge if necessary.
	Defective or improper wiring or loose connections.	Refer to wiring diagram and check all wiring.
	Defective starter solenoid or control switch.	Replace faulty unit.
	Binding, worn, or improperly seated brush, or brushes with excessive side play.	Brushes should be a free fit in the brush boxes without excessive side play. Binding brushes and brush boxes should be wiped clean with a gasoline (undoped) moistened cloth. A new brush should be run in until at least 50% seated; however, if facilities are not available for running in brushes, then the brush should be properly seated by inserting a strip of No. 0000 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.
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.

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**CHART 1 (Sheet 2 of 2)
TROUBLESHOOTING STARTER SYSTEM**

Trouble	Cause	Remedy
Motor fails to operate. (continued)	Dirty commutator.	If commutator is rough or dirty, smooth and polish with No. 000 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 and then replace with new part.
Motor operates at proper speed but fails to crank check, engine.	Faulty Bendix drive.	Remove Bendix drive assembly. Clean and reinstall.
Low motor and cranking speed.	Worn, rough, or improperly lubricated motor or starter.	Disassemble, clean, inspect and relubricate, replacing ball bearings, if worn.
	Same electrical causes listed under "Motor fails to operate."	Same remedies listed for these troubles.
Excessive arcing of motor brushes.	Binding, worn, or improperly seated brush or brushes, with excessive side play.	See information above dealing with this trouble.
	Dirty, rough, pitted or scored commutator.	Clean as outlined above.
	Grounded or open field circuit.	Test and replace defective parts.
Excessive wear and arcing of motor brushes.	Rough or scored commutator.	Remove and turn commutator down on a lathe.
	Armature assembly not concentric.	Reface commutator.

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3. Cranking Tests

The starting circuit should be inspected at regular intervals. The frequency should be determined by the type of starting conditions and the amount of starter usage under which the airplane has been operated. In any case, it is recommended that the following tests be completed at least twice a year.

- A. Check the battery with a hydrometer to make sure it is fully charged and filled to the proper level. A load test should be made on the battery to verify proper condition before proceeding.
- B. Check all starter circuit wiring, making sure all connections, including battery terminals, are clean and tight and that all insulation is sound and complete.
- C. A voltage loss test should be made to locate any high-resistance connections that would impair starting motor electrical efficiency. Using a low-reading voltmeter scale while cranking engine (or at approximately 100 amperes current flow) measure for the following limits:
 - (1) Voltage loss from the insulated (positive) battery post to the starter motor terminal = 0.3 volt maximum.
 - (2) Voltage loss from the battery negative (ground) terminal to the starter motor frame = 0.1 volt maximum.
- D. If voltage loss exceeds the above limits, measure the voltage drops across all connections to discover the faulty connection. When within the maximum limits proceed to next step.
- E. The starter motor should be operated for several seconds with the ignition OFF. The starter motor engagement should be prompt and the motor should turn freely at a uniform speed without binding or producing unusual sounds.
- F. Re-engage the starter two or three times, listening for prompt engagement, without the clashing of gears, and to determine that the pinion disengages properly when the starter switch is released.

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TURBINES

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TURBO-SUPERCHARGER

1. **Turbocharger System**

A. **Description**

This chapter contains information on the removal, installation and adjustment of the various components of the turbocharging and exhaust system.

The Lycoming TIO-540-AE2A engine is equipped with dual AiResearch (Garret) turbochargers, one on each side of the engine. Each turbocharger extracts exhaust energy from its respective bank of cylinders to pressurize the induction air.

Air is taken from the induction inlet louvers into the induction air box. Here it is filtered and divided for distribution to the left and right turbocharger compressors. The compressed air then flows through an aftercooler where its air temperature is reduced. Downstream from the aftercoolers, the air flows join at the Y junction of the intake tubes, then passes through the throttle butterfly valve and is divided to individual intake pipes to each cylinder.

Metered fuel is injected into the cylinder head upstream of the intake valve. After combustion in the cylinder, exhaust gases flow into the exhaust manifold, to the turbocharger turbines where exhaust energy is extracted to drive the turbines which, in turn, drives or turns the compressor.

B. **Troubleshooting**

See Chart 1.

2. **Turbocharger Pre - Lubrication**

Following engine oil and filter changes, and following any prolonged period of non-operation, pre - lubricate the turbochargers as follows:

- A. Temporarily disconnect the engine oil supply lines from the turbocharger oil inlet ports and the engine air duct from the compressor housing inlets.
- B. Fill the turbocharger oil inlet ports with clean engine oil and manually turn the compressor wheels several revolutions to coat all journal and bearing surfaces with oil. Reconnect the air ducts.
- C. Place suitable containers under the disconnected engine oil supply lines to avoid spilling oil on the engine.
- D. Crank the engine, without allowing it to start.
- E. When a steady flow of oil is obtained from the supply lines to show that air has been purged from the system, stop cranking. Reconnect the oil supply lines.

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**CHART 1 (Sheet 1 of 3)
TROUBLESHOOTING TURBOCHARGER SYSTEM**

Trouble	Cause	Remedy
Excessive noise or vibration.	Improper bearing lubrication.	Supply required oil pressure. Clean or replace oil line; clean oil strainer. If trouble persists, overhaul turbocharger.
	Leak in engine intake or exhaust manifold.	Tighten loose connections or replace manifold gaskets as necessary.
	Dirty impeller blades.	Disassemble and clean.
Engine will not deliver rated power.	Clogged manifold system.	Clean all ducting.
	Foreign material lodged in compressor impeller or turbine.	Disassemble and clean.
	Excessive dirt build-up in compressor.	Thoroughly clean compressor assembly. Service air cleaner and check for leakage.
	Leak in engine intake or exhaust.	Tighten loose connections or replace manifold gaskets as necessary.
	Rotating assembly bearing seizure.	Overhaul turbocharger.
	Restriction in return lines from actuator to exhaust bypass controller.	Remove and clean lines.
	Exhaust bypass controller is in need of adjustment.	Have exhaust bypass controller adjusted.
	Oil pressure too low.	Tighten fittings. Replace lines, or hoses, increase oil pressure to desired pressure.
	Inlet orifice to actuator clogged.	Remove inlet line at actuator and clean orifice.
	Exhaust bypass controller malfunction.	Replace unit.
	Exhaust bypass butterfly not closing.	Low pressure. Clogged orifice in inlet to actuator. Butterfly shaft binding. Check bearings.

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**CHART 1 (Sheet 2 of 3)
TROUBLESHOOTING TURBOCHARGER SYSTEM**

Trouble	Cause	Remedy
Engine will not deliver rated power. (continued)	Turbocharger impeller binding, frozen or fouling housing.	Check bearings. Replace turbocharger.
	Piston seal in actuator leaking. Usually accompanied by oil leakage at drain line.	Remove and replace actuator or disassemble and replace packing.
Critical altitude lower than specified. Engine surges or smokes.	Controller not getting enough oil pressure to close the exhaust bypass.	Check pump outlet pressure, oil filters, external lines for leaks or obstructions.
	Chips under metering valve in controller holding it open.	Replace controller.
	Metering jet in actuator plugged.	Remove actuator and clean jet.
	Actuator piston seal failed and leaking excessively.	If there is oil leakage at actuator drain, clean cylinder and replace piston seal.
	Exhaust bypass valve sticking.	Clean and free action.
	Air in oil lines or actuator.	Bleed system.
	Controller metering valve stem seal leaking oil into manifold.	Replace controller.
	Clogged breather.	Check breather for restrictions to air flow.
	NOTE: Smoke would be normal if engine has idled for a prolonged period.	
High deck pressure. (Compressor Discharge Pressure)	Controller metering valve not opening, aneroid bellows leaking.	Replace controller assembly or replace aneroid bellows.
	Exhaust bypass sticking closed.	Shut off valve in return line not working. Butterfly shaft binding. Check bearings.
		Replace exhaust bypass valve or correct linkage binding.
	Controller return line restricted.	Clean or replace line.

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**CHART 1 (Sheet 3 of 3)
TROUBLESHOOTING TURBOCHARGER SYSTEM**

Trouble	Cause	Remedy
High deck pressure. (Compressor Discharge Pressure)	Oil pressure too high.	Check pressure 75 to 85 psi (80 psi desired) at exhaust bypass actuator inlet. If pressure on outlet side of actuator is too high, have exhaust bypass controller adjusted.
	Exhaust bypass valve actuator piston locked in full closed position. (Usually accompanied by oil leakage at actuator drain line.)	Remove and disassemble actuator, check condition of piston and packing or replace actuator assembly.
	Exhaust bypass controller malfunction.	Replace controller.

NOTE: Exhaust bypass normally closed in idle and low power conditions. Should open when actuator inlet line is disconnected.

- F. If the turbochargers are installed on a new or overhauled engine, with the initial run-in period not completed, proceed as follows:

CAUTION: BECAUSE CLEANING OF THE EXTRA SCREENS IS NOT PROVIDED FOR IN PERIODIC MAINTENANCE PROCEDURES FOR THE ENGINE, THE SCREENS MUST NOT BE LEFT IN PLACE AFTER THE INITIAL RUN-IN PERIOD. OPERATION OF THE TURBOCHARGERS WITH CLOGGED SCREENS WILL CAUSE TURBOCHARGER FAILURE DUE TO LACK OF LUBRICATION.

CAUTION: MAKE ENTRY IN AIRPLANE LOGBOOK TO ENSURE THAT SCREENS ARE REMOVED AFTER THE INITIAL ENGINE RUN-IN PERIOD HAS BEEN COMPLETED.

CAUTION: TAG LINES WITH A SUITABLE TAG TO REMIND MECHANIC THAT THE TEMPORARY SCREENS HAVE BEEN INSTALLED IN THE LINES.

- (1) TEMPORARILY install a screen of 100 mesh or finer in the oil supply line to each turbocharger to trap metal particles from the engine during the initial run-in.

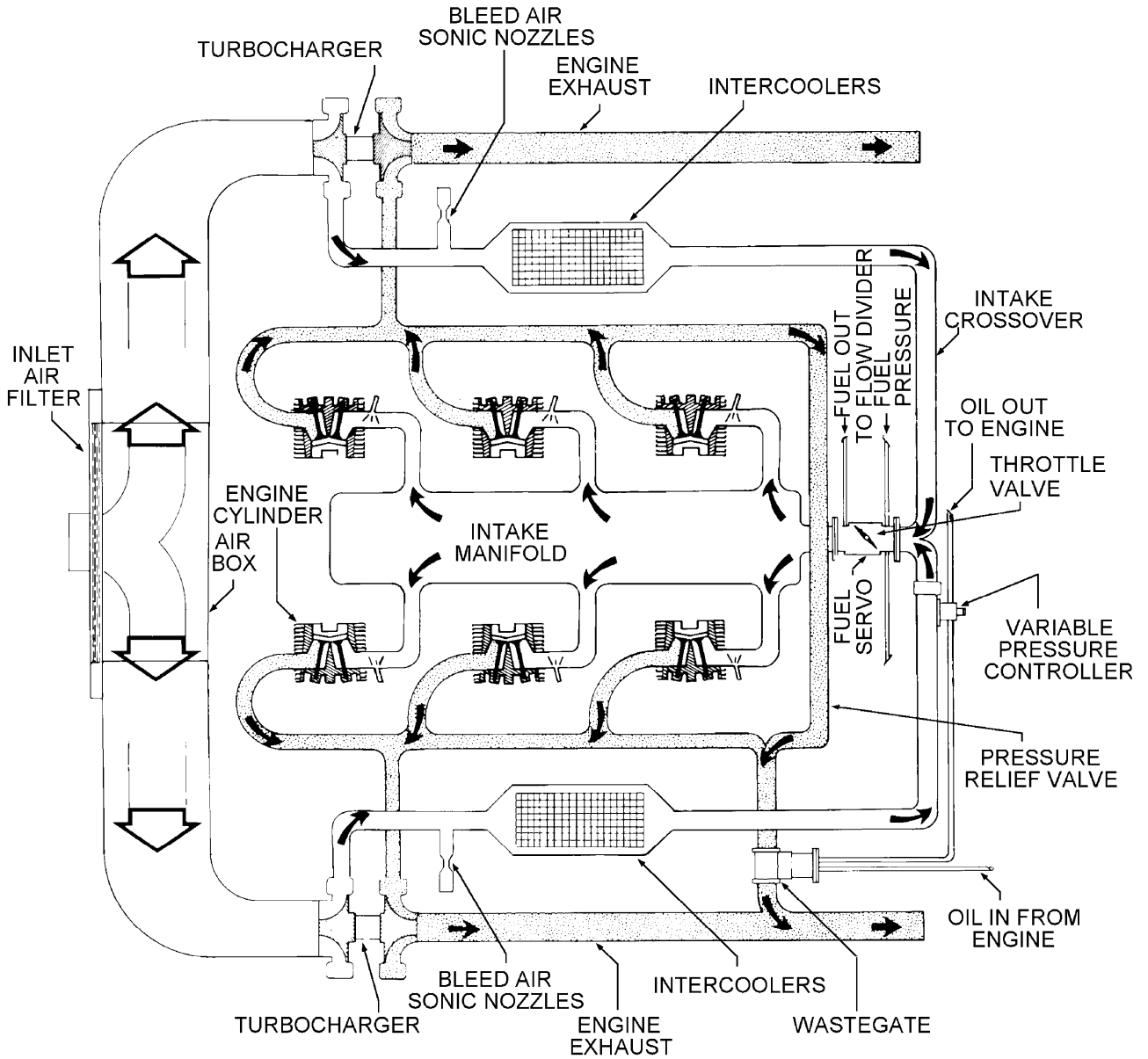
WARNING: OPERATION OF THE TURBOCHARGER WITHOUT ALL NORMALLY INSTALLED INLET DUCTS AND FILTERS CONNECTED WILL RESULT IN INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT FROM FOREIGN OBJECTS ENTERING THE TURBOCHARGER.

CAUTION: OPERATION OF THE ENGINE AT ANY SPEED FASTER THAN IDLE IMMEDIATELY AFTER START-UP CAN RESULT IN OIL LAG FAILURE OF TURBOCHARGER BEARINGS, ESPECIALLY IN COLD WEATHER OR AFTER A PROLONGED NON-OPERATIVE PERIOD.

- (2) Remove the extra screens from the oil supply lines after the initial run - in period.

- G. Verify that all air and exhaust inlet ducts and filters are properly installed.

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Turbocharger System Diagram

Figure 1

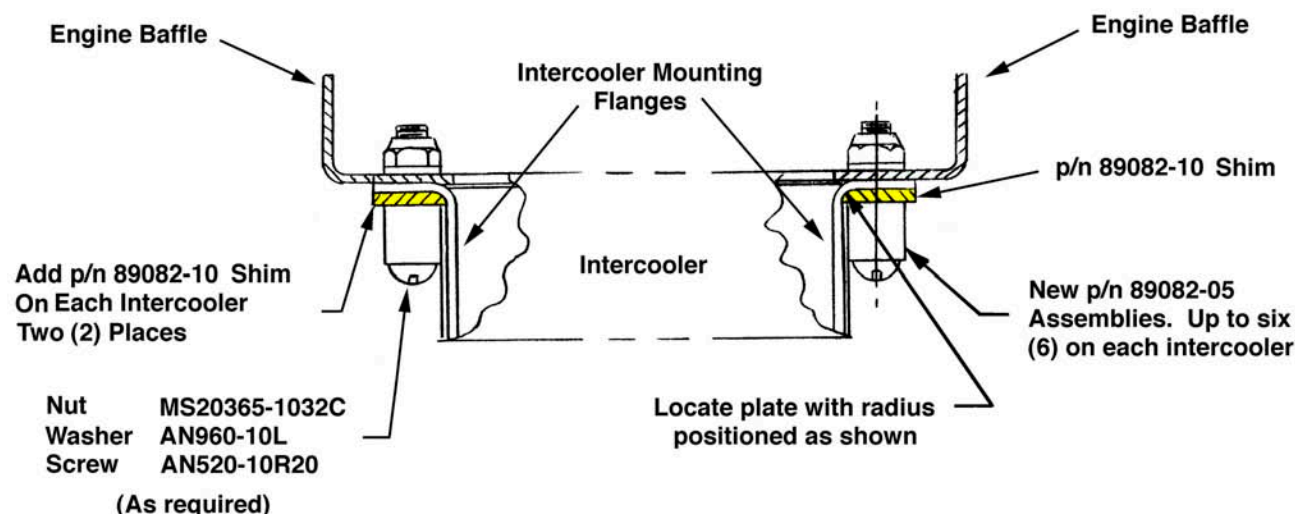
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- H. Start engine and operate for 3 - 4 minutes at idle to allow engine oil pressure and flow to stabilize.
- I. Check all oil connections for leakage, and tighten or repair as needed.

3. Inspections

A. Turbocharger and Exhaust System - Visual Inspection

- (1) With the engine shut down, inspect all components of the air induction system for loose connections, cuts, cracks, punctures, corrosion or other evidence of deterioration. If evidence is found of any condition that could permit air leakage between the air cleaner and the turbocharger compressor, proceed as follows:
 - (1) Disconnect the air duct from the compressor air inlet and inspect the edges of the compressor wheel blades for damage. Also examine the wheel for excessive dirt buildup and oiliness which would indicate seal leakage, and check for evidence of wheel rub on the compressor housing.
 - (2) Replace damaged air ducting components.
 - (3) Reconnect the air ducting to the compressor air inlet and tighten attaching parts securely.
- (2) Check the air duct connections between the compressor and the engine intake manifold and between the intake manifold and engine. Tighten any loose connections.
- (3) Verify the engine air cleaner has been properly serviced (see Induction Air Filter, 12-10-00).
- (4) Inspect the exhaust system for leakage, especially at the exhaust manifold connection to the turbocharger turbine inlet and at the engine exhaust manifold gasket.
- (5) Disconnect the exhaust ducting from the turbine outlet and examine the turbine wheel blades for damage. Look for oil in the turbine wheel housing (indicative of seal leakage), and check for evidence of wheel rub on the housing.
- (6) Check for oil leakage at the connections to the turbocharger oil inlet and drain ports. Tighten connections or replace gaskets, fittings, etc. as required.
- (7) On left-hand tail pipe, disconnect the engine crankcase breather tube and remove the lower tube assembly from the tail pipe at the slip joint. Remove any contaminate buildup accumulated. Accumulation may be very hard and may require scraping or sanding to remove. Insure balance of breather is free of any restrictions to air flow.



[Effectivity](#)
4636001 thru 4636194 only

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B. Intercooler Attachment Clips Inspection/Replacement (S/N's 4636001 thru 4636194 only.)

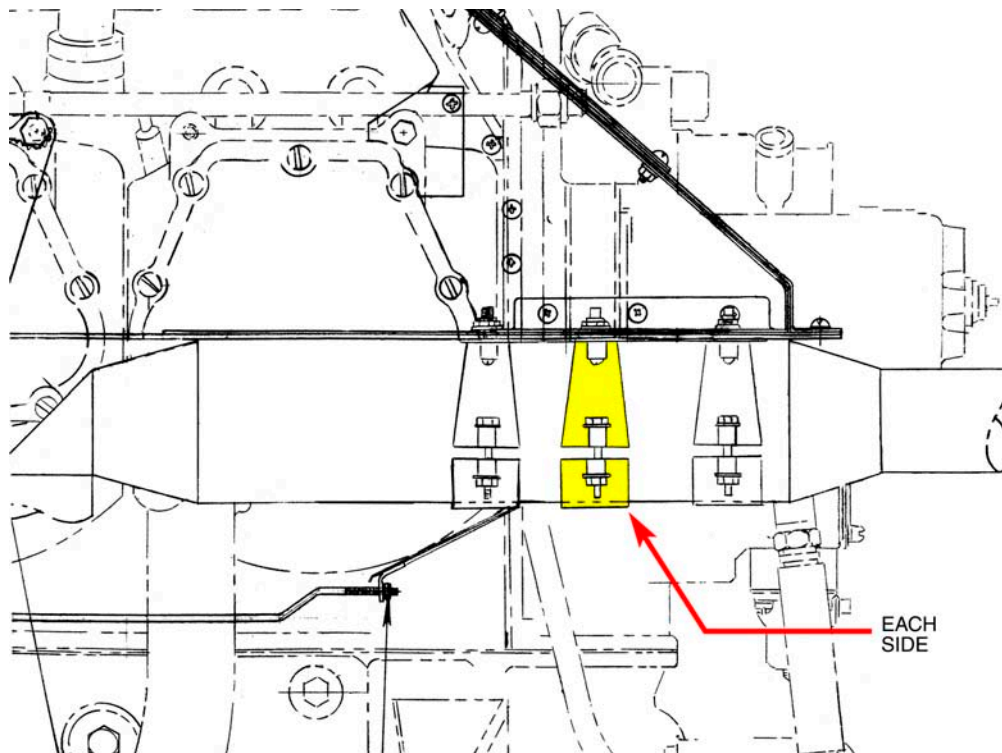
The factory installed clips which hold the intercoolers to the engine baffles in these aircraft may occasionally fracture. An improved intercooler clip (P/N 89082-005) is available and should be installed as required to provide longer service life. Additionally, flange support shims (P/N 89082-010) should be installed on both intercoolers and two more intercooler clips should be added to the left intercooler (See latest revision Piper Service Letter No. 1018).

To coincide with any event inspection or at owner/operator discretion:

- (1) Remove the engine cowling.
- (2) Remove and inspect the left and right intercooler clips for evidence of cracks or damage.
- (3) Replace any damaged intercooler clips, as required, with the improved P/N 89082-005 clips.
- (4) Install four flange support shims (P/N 89082-010), one under each intercooler flange as shown in Figure 2. Ensure that the radius side of the shim faces the intercooler flange.
- (5) Install intercooler clips and tighten screws to standard torque.

NOTE: When installing the clips, tightening the screws will tend to twist the clip leaving gaps. Ensure that the flat side of the intercooler hold down clip lays flat against the intercooler wall with no gap visible on either side of the clip.

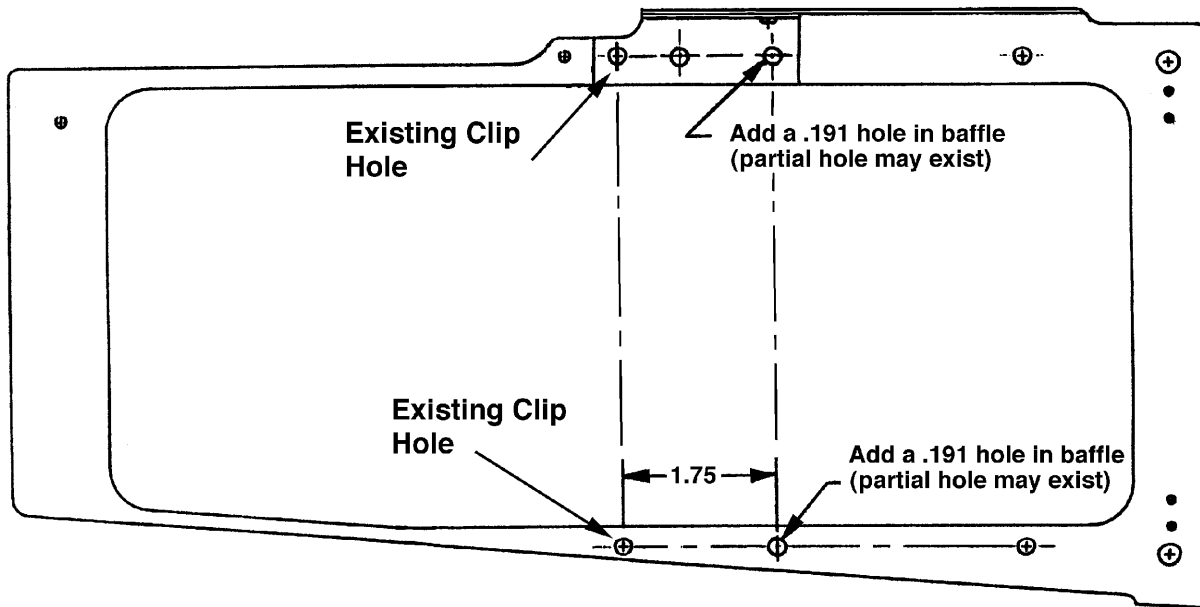
- (6) On the left (pilot's side) intercooler, install two new clips (P/N 89082-005) in between the existing clips as shown in Figure 3. Locate the existing holes in the engine baffle (see Figure 4) and drill a .191 inch hole through the intercooler flange at those locations.
- (7) Re-install the engine cowling and make an appropriate logbook entry.



Adding Intercooler Clips to Left Engine Baffle
Figure 3

[Effectivity](#)
4636001 thru 4636194 only

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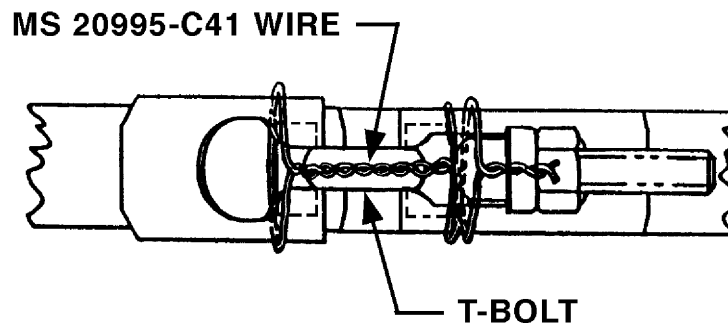


Left Engine Baffle Hole Locations
Figure 4

[Effectivity](#)
4636001 thru 4636194 only

C. V-Band Coupling 100 Hour Inspection (See Figure 5.)

Each 100 hours, inspect lockwiring on V-band couplings for condition and security. If lockwiring is found broken, inspect T-bolt for stretching, cracking, or any other damage. Replace coupling as required.



Lockwiring V-Band Couplings
Figure 5

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**GRIDS 6K18 THRU 6L24
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AIRPLANE MAINTENANCE MANUAL

CARD 7 OF 8

PA-46-350P



(S/N's 4636001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

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Technical Publications

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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	June 19, 1996	All
PR980101	January 1, 1998	1, 2, 3, 4, 5, and 6
CR981223	December 23, 1998	1, 2, 3, 4, 5, and 6
PR000201	February 1, 2000	1, 2, 3, 4, 5, and 6
PR010515	May 15, 2001	1
CR050730	July 30, 2005	1, 2, 3, 4, 5, 6, 7 and 8
PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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

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	8	Jul 30/05			

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

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3. Effectivity

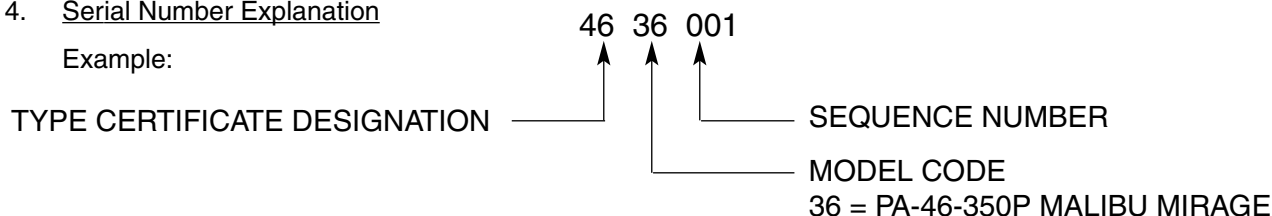
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

**(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP,
AND ALL HYDRAULIC COMPONENTS:**

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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(23) PROPELLER AND 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

Propeller
Overhaul Instructions: Manual No. 113

Composite Blade
Maintenance: Manual No. 135

Propeller Owner's
Manual: Manual No. 115

Aluminum Blade
Inspection, Repair,
and Overhaul Instructions: Manual No. 133

(24) RADAR (WEATHER), RDR - 2000:

Vendor Address:	Honeywell (Bendix/King) (See Autoflight, above)

Maintenance Manual:	Bendix/King ART 2000 P/N 006-05332-0001

(25) RADIO COOLING BLOWER:

Vendor Address:	Globe Motors 2275 Stanley Ave. Dayton, Ohio 45404 http://www.globe-motors.com/home.html	PH: (937) 228-3171 FAX: (937) 229-8531

(26) STARTER:

Vendor Address:	Electro Systems, Inc. (See Alternator, above)

(27) TURBOCHARGER:

Vendor Address:	Turbocharging Systems Worldwide HQ Building #10, Ste. 200 23326 Hawthorne Blvd. Torrance, CA 90505 http://www.alliedsignal.com/turbos/products/index.html	PH: (310) 791-9101 FAX: (310) 534-5941

(28) VACUUM PUMP:

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

(29) VACUUM REGULATORS:

Vendor Address:	Parker Hannifin Corp. (see "Fuel Boost Pump," above)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

<u>CHAPTER</u>	<u>SECTION</u>	<u>TITLE</u>	<u>GRID NO.</u>
4		AIRWORTHINESS LIMITATIONS	1C1
	00	General	
5		TIME LIMITS/MAINTENANCE CHECKS	1C9
	00	General	
	10	Time Limits	
	20	Scheduled Maintenance Checks	
	30	Special Inspections	
	50	Unscheduled Maintenance Checks	
6		DIMENSIONS AND AREAS	1E11
	00	General	
7		LIFTING AND SHORING	1F1
	10	Jacking	
8		LEVELING AND WEIGHING	1F9
	10	Weighing and Balancing	
	20	Leveling	
9		TOWING AND TAXIING	1F21
	00	General	
	10	Towing	
	20	Taxiing	
10		PARKING AND MOORING	1G9
	10	Parking	
	20	Mooring	
11		REQUIRED PLACARDS	1G19
	20	Exterior Placards and Markings	
	30	Interior Placards and Markings	
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<u>CHAPTER</u>	<u>SECTION</u>	<u>TITLE</u>	<u>GRID NO.</u>
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	00	General	
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3150	7H21	Deice	
3260	7I19	Detection	7G22
3310	7I23	Pitot and Lift Detector	7H1
3320	7J23	Propeller	7H11
3340	7K7	Surface	7G17
3420	8C8	Windshield	7H7
3510	8C12	Digital Voice Recorder Clock	7F10
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7330	8C18	Electroluminescent Panel Lighting	7J3
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7710	8D2	Engine Start	8C21
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7740	8D12	Exceedance Audio Alert	7I15
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CHARTS

1. Torque Requirements

CAUTION: DO NOT OVERTORQUE FITTINGS.

NOTE: When installing flared fittings, verify that male threads are properly lubricated. Use torque fittings values in Chart 1.

The torque values given in Chart 2 are derived from oil-free cadmium-plated threads and are recommended for all airframe installation procedures where torquing is required, unless otherwise noted in sections where other values are stipulated. Engine torque values are found in the latest revision of Lycoming SSP-1776, and propeller torque values are found in 61-10-00. Chart 1 lists the torque values for flared fittings of various sizes and material.

- A. Calibrate the torque wrench periodically to assure accuracy, and recheck frequently.
- B. Unless otherwise specified, torque all nuts to the applicable torque in Chart 2. If the nut (or bolt) is listed but not its mating fastener, use the lower torque in Chart 2 for the listed nut (or bolt).

NOTE: If normal operation requires movement between any of the components being clamped together, tighten the nut (or bolt) enough to insure intended operation of the assembly.
- C. Bolt and nut threads should be clean and dry unless otherwise specified. If the threads are to be lubricated, reduce the recommended nut torque given in Chart 2 (plus the friction drag torque) by 50%.
- D. For thread sizes 8 through 7/16, add the friction drag torque (in Chart 2) for all self-locking fasteners. For non-self locking fasteners, assume the friction drag torque to be zero.

**CHART 1
FLARE FITTING TORQUE VALUES**

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

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- E. For other bolt sizes, determine the friction drag torque by attaching a scale type torque wrench to the nut and determining the torque required to turn the nut on the bolt. (Before the nut makes contact with the bearing surface.) Add the friction drag torque to the specified torque to get the final torque.

NOTE: If the bolt is stationary and the nut is torqued, use the lower side of the torque range. If the nut is stationary and the bolt is torqued use the higher side of the torque range.

- F. When torquing castellated nuts, begin with minimum torque plus friction drag torque, but do not exceed maximum torque plus friction drag torque when aligning cotter key hole with the castellations in the nut. If they do not align change washers and retorquer.

NOTE: When using castellated nuts on movable joints, do not torque as described above. Tighten nuts only enough to remove looseness in the joint and install the cotter pin.

- G. Unless otherwise specified, when parts are used on Lycoming engines, using Piper furnished or existing Lycoming threaded fasteners, use the torque specified in Lycoming Service Table of Limits SSP-1776 latest revision.

- H. After the final torque, apply slippage mark to the nut or bolt or screw head as applicable.

NOTE: For more details on torquing, refer to FAA AC 43.13-1, latest revision.

2. Conversion Tables

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

Chart 3, Torque Conversion

Chart 4, Decimal Conversions

Chart 5, Temperature Conversion

Chart 6, Weights and Measures Conversion

Chart 7, Metric Conversion

Chart 8, Drill Sizes

3. Hose Specifications

See Chart 9.

4. Consumable Materials

See Chart 10.

5. Vendor Contact Information

See Chart 11.

6. Electrical Wire Coding

See Chart 12.

7. Electrical Symbols

See Chart 13.

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CHART 2 (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 to 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 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 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
CHART A							
BOLT SIZE		FRICTION DRAG TORQUE (IN. -LB.)					
		Coarse	Fine				
8		15	--				
10		18	18				
1/4		30	15				
5/16		60	60				
3/8		80	80				
7/16		100	100				

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CHART 2 (Sheet 2 of 2)
RECOMMENDED NUT TORQUES

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

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**CHART 3
TORQUE CONVERSION**

INCH POUNDS (IN.-LBS.) TO CENTIMETER KILOGRAMS (CMKG.)

CENTIMETER KILOGRAMS (CMKG.) TO INCH POUNDS (IN.-LBS.)

FOOT POUNDS (FT.-LBS.) TO METER KILOGRAMS (MKG.)

METER KILOGRAMS (MKG.) TO FOOT-POUNDS (FT.-LBS.)

IN.-LBS.	CMKG.	FT.-LBS.	MKG.	FT.-LBS.	MKG.	MKG.	FT.-LBS.
5	5.76	2.5	.346	115	15.900	1	7.23
10	11.52	5	.691	120	16.591	2	14.46
15	17.28	7.5	1.037	125	17.282	3	21.69
20	23.04	10	1.383	130	17.974	4	28.98
25	28.80	12.5	1.728	135	18.665	5	36.16
30	34.56	15	2.074	140	19.356	6	43.39
35	40.32	17.5	2.419	145	10.047	7	50.63
40	46.08	20	2.765	150	20.739	8	57.86
45	51.84	22.5	3.111	155	21.430	9	65.09
50	57.60	25	3.456	160	22.121	10	72.32
55	63.36	27.5	3.802	165	22.813	11	79.56
60	69.12	30	4.148	170	23.504	12	86.79
65	74.88	32.5	4.493	175	24.195	13	94.02
70	80.64	35	4.839	180	24.887	14	101.26
75	86.40	37.5	5.185	185	25.578	15	108.49
80	92.16	40	5.530	190	26.269	16	115.72
85	97.92	42.5	5.876	195	26.960	17	122.95
90	103.68	45	6.222	200	27.652	18	130.19
95	109.44	47.5	6.567	205	28.343	19	137.42
100	115.20	50	6.913	210	29.034	20	144.65
105	120.96	52.5	7.258	215	29.726	21	151.89
110	126.72	55	7.604	220	30.417	22	159.12
115	132.48	57.5	7.950	225	31.108		
120	138.24	60	8.295	230	31.800		
		62.5	8.641	235	32.491		
		65	8.987	240	33.182		
		67.5	9.332	245	33.873		
		70	9.678	250	34.565		
		72.5	10.024	255	35.256		
		75	10.369	260	35.947		
		77.5	10.715	265	36.639		
		80	11.060	270	37.330		
		82.5	11.406	275	38.021		
		85	11.752	280	38.713		
		87.5	12.097	285	39.404		
		90	12.443	290	40.095		
		92.5	12.789	295	40.786		
		95	13.134	300	41.478		
		97.5	13.480				
		100	13.826				
		105	14.517				
		110	15.208				
CMKG.	IN.-LBS.						
50	43.4						
100	86.8						
150	130.2						
200	173.6						
250	217.0						
300	260.4						
350	303.8						
400	347.2						
450	390.6						
500	434.0						
550	477.4						
600	520.8						
650	564.2						
700	607.6						

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**CHART 4
DECIMAL CONVERSIONS**

4ths	8ths	16ths	32nds	64ths	TO 3 PLACES	TO 2 PLACES	M.M. EQUIV
1/4	1/8	1/16	1/32	1/64	.016	.02	.397
					.031	.03	.794
			3/64		.047	.05	1.191
					.062	.06	1.587
		3/32	5/64		.078	.08	1.984
					.094	.09	2.381
			7/64		.109	.11	2.778
					.125	.12	3.175
	3/8	3/16	9/64		.141	.14	3.572
					.156	.16	3.969
			11/64		.172	.17	4.366
					.188	.19	4.762
		7/32	13/64		.203	.20	5.159
					.219	.22	5.556
			15/64		.234	.23	5.953
					.250	.25	6.350
	1/2	1/2	17/64		.266	.27	6.747
					.281	.28	7.144
			19/64		.297	.30	7.540
					.312	.31	7.937
		5/16	21/64		.328	.33	8.334
					.344	.34	8.731
			23/64		.359	.36	9.128
					.375	.38	9.525
	3/4	3/4	25/64		.391	.39	9.922
					.406	.41	10.319
			27/64		.422	.42	10.716
					.438	.44	11.112
		7/16	29/64		.453	.45	11.509
					.469	.47	11.906
			31/64		.484	.48	12.303
					.500	.50	12.700

4ths	8ths	16ths	32nds	64ths	TO 3 PLACES	TO 2 PLACES	M.M. EQUIV
3/4	5/8	9/16	17/32	33/64	.516	.52	13.097
					.531	.53	13.494
			35/64		.547	.55	13.891
					.562	.56	14.288
		19/32	37/64		.578	.58	14.684
					.594	.59	15.081
			39/64		.609	.61	15.478
					.625	.62	15.875
	7/8	11/16	41/64		.641	.64	16.272
					.656	.66	16.669
			43/64		.672	.67	17.065
					.688	.69	17.462
		23/32	45/64		.703	.70	17.859
					.719	.72	18.256
			47/64		.734	.73	18.653
					.750	.75	19.050
	15/16	15/16	49/64		.766	.77	19.447
					.781	.78	19.844
			51/64		.797	.80	20.241
					.812	.81	20.637
		7/8	53/64		.828	.83	21.034
					.844	.84	21.431
			55/64		.859	.86	21.828
					.875	.88	22.225
	1	1	57/64		.891	.89	22.622
					.906	.91	23.019
			59/64		.922	.92	23.416
					.938	.94	23.812
		31/32	61/64		.953	.95	24.209
					.969	.97	24.606
			63/64		.984	.98	25.003
					1.000	1.00	25.400

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**CHART 5
TEMPERATURE CONVERSION**

CENTIGRADE - FAHRENHEIT

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

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

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**CHART 6
WEIGHTS AND MEASURES CONVERSION**

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

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CHART 7
METRIC CONVERSION

Example: Convert 1.5 inches to millimeters.

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

INCHES TO MILLIMETER										
INCHES	0.0000	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009
	MILLIMETER									
0.000		0.0025	0.0050	0.0076	0.0101	0.0127	0.0152	0.0177	0.0203	0.0228
0.001	0.0254	0.0279	0.0304	0.0330	0.0355	0.0381	0.0406	0.0431	0.0457	0.0482
0.002	0.0508	0.0533	0.0558	0.0584	0.0609	0.0635	0.0660	0.0685	0.0711	0.0736
0.003	0.0762	0.0812	0.0838	0.0863	0.0889	0.0914	0.0939	0.0965	0.0990	0.1016
0.004	0.1016	0.1041	0.1066	0.1092	0.1117	0.1143	0.1168	0.1193	0.1219	0.1244
0.005	0.1270	0.1295	0.1320	0.1346	0.1371	0.1397	0.1422	0.1447	0.1473	0.1498
0.006	0.1524	0.1549	0.1574	0.1600	0.1625	0.1651	0.1676	0.1701	0.1727	0.1752
0.007	0.1778	0.1803	0.1828	0.1854	0.1879	0.1905	0.1930	0.1955	0.1981	0.2006
0.008	0.2032	0.2057	0.2082	0.2108	0.2133	0.2159	0.2184	0.2209	0.2235	0.2260
0.009	0.2286	0.2311	0.2336	0.2362	0.2387	0.2413	0.2438	0.2463	0.2489	0.2514
INCHES	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
	MILLIMETER									
0.00		0.025	0.050	0.076	0.101	0.127	0.152	0.177	0.203	0.228
0.01	0.254	0.279	0.304	0.330	0.355	0.381	0.406	0.431	0.457	0.482
0.02	0.508	0.533	0.558	0.584	0.609	0.635	0.660	0.685	0.711	0.736
0.03	0.762	0.787	0.812	0.838	0.863	0.889	0.914	0.939	0.965	0.990
0.04	1.016	1.041	1.066	1.092	1.117	1.143	1.168	1.193	1.219	1.244
0.05	1.270	1.295	1.320	1.346	1.371	1.397	1.422	1.447	1.473	1.498
0.06	1.524	1.549	1.574	1.600	1.625	1.651	1.676	1.701	1.727	1.752
0.07	1.778	1.803	1.828	1.854	1.879	1.905	1.930	1.955	1.981	2.006
0.08	2.032	2.057	2.082	2.108	2.133	2.159	2.184	2.209	2.235	2.260
0.09	2.286	2.311	2.336	2.362	2.387	2.413	2.438	2.463	2.489	2.514
INCHES	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	MILLIMETER									
0.0		0.254	0.508	0.762	1.016	1.270	1.524	1.778	2.032	2.286
0.1	2.540	2.794	3.048	3.302	3.556	3.810	4.064	4.318	4.572	4.826
0.2	5.080	5.334	5.588	5.842	6.096	6.350	6.604	6.858	7.112	7.366
0.3	7.620	7.874	8.128	8.382	8.636	8.890	9.144	9.398	9.652	9.906
0.4	10.160	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
0.5	12.700	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
0.6	15.240	15.494	15.748	16.002	16.256	16.510	16.764	17.018	17.272	17.526
0.7	17.780	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
0.8	20.320	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.352	22.606
0.9	22.860	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146
INCHES	0.00	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	MILLIMETER									
0.0		2.54	5.08	7.62	10.16	12.70	15.24	17.78	20.32	22.86
1.0	25.40	27.94	30.48	33.02	35.56	38.10	40.64	43.18	45.72	48.26
2.0	50.80	53.34	55.88	58.42	60.96	63.50	66.04	68.58	71.12	73.66
3.0	76.20	78.74	81.28	83.82	86.36	88.90	91.44	93.98	96.52	99.06
4.0	101.60	104.14	106.68	109.22	111.76	114.30	116.84	119.38	121.92	124.46
5.0	127.00	129.54	132.08	134.62	137.16	139.70	142.24	144.78	147.32	149.86
6.0	152.40	154.94	157.48	160.02	162.56	165.10	167.64	170.18	172.72	175.26
7.0	177.80	180.34	182.88	185.42	187.96	190.50	193.04	195.58	198.12	200.66
8.0	203.20	205.74	208.28	210.82	213.36	215.90	218.44	220.98	223.52	226.06
9.0	228.60	231.14	233.68	236.22	238.76	241.30	243.84	246.38	248.92	251.46

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CHART 8
DRILL SIZES

Decimal/Millimeter Equivalents of Drill Sizes From 1/2" to No. 80											
Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.
1/2	0.500	12.7000	G	0.261	6.6294	5/32	0.1562	3.9687	51	0.067	1.7018
31/64	0.4843	12.3031	F	0.257	6.5278	23	0.154	3.9116	52	0.0635	1.6129
15/32	0.4687	11.9062	E-1/4	0.250	6.3500	24	0.152	3.8608	1/16	0.0625	1.5875
29/64	0.4531	11.5094	D	0.246	6.2484	25	0.1495	3.7973	53	0.0595	1.5113
7/16	0.4375	11.1125	C	0.242	6.1468	26	0.147	3.7338	54	0.055	1.397
27/64	0.4218	10.7156	B	0.238	6.0452	27	0.144	3.6576	55	0.052	1.3208
Z	0.413	10.4902	15/64	0.2343	5.9531	9/64	0.1406	3.5719	3/64	0.0468	1.1906
13/32	0.4062	10.3187	A	0.234	5.9436	28	0.1405	3.5687	56	0.0465	1.1811
Y	0.404	10.2616	1	0.228	5.7912	29	0.136	3.4544	57	0.043	1.0922
X	0.397	10.0838	2	0.221	5.6134	30	0.01285	3.2639	58	0.042	1.0668
25/64	0.3906	9.9212	7/32	0.2187	5.5562	1/8	0.125	3.1750	59	0.041	1.0414
W	0.386	9.8044	3	0.213	5.4102	31	0.120	3.048	60	0.040	1.016
V	0.377	9.5758	4	0.209	5.3086	32	0.116	2.9464	61	0.039	0.9906
3/8	0.375	9.5250	5	0.2055	5.2197	33	0.113	2.8702	62	0.038	0.9652
U	0.368	9.3472	6	0.204	5.1816	34	0.111	2.8194	63	0.037	0.9398
23/64	0.3593	9.1262	13/64	0.2031	5.1594	35	0.110	2.794	64	0.036	0.9144
T	0.358	9.1281	7	0.201	5.1054	7/64	0.1093	2.7781	65	0.035	0.899
S	0.346	8.7884	8	0.199	5.0546	36	0.1065	2.7051	66	0.033	0.8382
11/32	0.3437	8.7300	9	0.196	4.9784	37	0.104	2.6416	1/32	0.0312	0.7937
R	0.339	8.6106	10	0.1935	4.9149	38	0.1015	2.5781	67	0.032	0.8128
Q	0.332	8.4328	11	0.191	4.8514	39	0.0995	2.5273	68	0.031	0.7874
21/64	0.3281	8.3337	12	0.189	4.8006	40	0.098	2.4892	69	0.029	0.7366
P	0.323	8.2042	3/16	0.1875	4.7625	41	0.096	2.4384	70	0.028	0.7112
O	0.316	8.0264	13	0.185	4.699	3/32	0.0937	2.3812	71	0.026	0.6604
5/16	0.3125	7.9375	14	0.182	4.6228	42	0.0935	2.3749	72	0.025	0.635
N	0.302	7.6708	15	0.180	4.572	43	0.089	2.2606	73	0.024	0.0696
19/64	0.2968	7.5387	16	0.177	4.4958	44	0.086	2.1844	74	0.0229	0.58166
M	0.295	7.4930	17	0.173	4.3942	45	0.082	2.0828	75	0.021	0.5334
L	0.290	7.3660	11/64	0.1718	4.3656	46	0.081	2.0574	76	0.020	0.508
9/32	0.2812	7.1425	18	0.1695	4.3053	47	0.0785	1.9939	77	0.018	0.4572
K	0.281	7.1374	19	0.166	4.2164	5/64	0.0781	1.9844	1/64	0.0156	0.3969
J	0.277	7.0358	20	0.161	4.0894	48	0.076	1.9304	78	0.016	0.4064
I	0.272	6.9088	21	0.159	4.0386	49	0.073	1.8542	79	0.0145	0.3683
H	0.266	6.7564	22	0.157	3.9878	50	0.070	1.778	80	0.0135	0.3429
17/64	0.2656	6.7462									

DRILL SIZES AVAILABLE

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

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**CHART 9
HOSE SPECIFICATIONS**

SINGLE WIRE BRAID FABRIC COVERED

MIL PART NO.	TUBE SIZE O.D.	HOSE SIZE I.D.	HOSE SIZE O.D.	RECOMMENDED OPER. PRESS	MIN BURST PRESS	MAX PROOF PRESS	MIN BEND RADIUS
MIL-H-8794- 3-L	3/16	1/8	.45	3,000	12,000	6,000	3.00
MIL-H-8794- 4-L	1/16	3/16	.52	3,000	12,000	6,000	3.00
MIL-H-8794- 5-L	5/16	1/4	.58	3,000	10,000	5,000	3.38
MIL-H-8794- 6-L	3/8	5/16	.67	2,000	9,000	4,500	4.00
MIL-H-8794- 8-L	1/2	13/32	.77	2,000	8,000	4,000	4.63
MIL-H-8794-10-L	5/8	1/2	.92	1,750	7,000	3,500	5.50
MIL-H-8794-12-L	3/4	5/8	1.08	1,500	6,000	3,000	6.50
MIL-H-8794-16-L	1	7/8	1.23	800	3,200	1,600	7.38
MIL-H-8794-20-L	1 1/4	1 1/8	1.50	600	2,500	1,250	9.00
MIL-H-8794-24-L	1 1/2	1 3/8	1.75	500	2,000	1,000	11.00
MIL-H-8794-32-L	2	1 13/16	2.22	300	1,400	700	13.25
MIL-H-8794-40-L	2 1/2	2 3/8	2.88	200	1,000	300	24.00
MIL-H-8794-48-L	3	3	3.56	200	800	300	33.00

Construction: Seamless synthetic rubber inner tube reinforced with one fiber braid, one braid of high tensile steel wire and covered with an oil resistant rubber impregnated fiber braid.

Identification: Hose is identified by specification number, size number, quarter year and year, hose manufacturer's identification.

Uses: Hose is approved for use in aircraft hydraulic, pneumatic, coolant, fuel and oil systems.

Operating Temperatures:

Sizes -3 thru -12: Minus 65°F. to plus 250°F.

Sizes -16 thru -48: Minus 40°F to plus 275°F.

NOTE: Maximum temperatures and pressures should not be used simultaneously.

MULTIPLE WIRE BRAID RUBBER COVERED

MIL PART NO.	TUBE SIZE O.D.	HOSE SIZE I.D.	HOSE SIZE O.D.	RECOMMENDED OPER. PRESS	MIN BURST PRESS	MAX PROOF PRESS	MIN BEND RADIUS
MIL-H-8788- 4-L	1/4	7/32	.63	3,000	16,000	8,000	3.00
MIL-H-8788- 5-L	5/16	9/32	.70	3,000	14,000	7,000	3.38
MIL-H-8788- 6-L	3/8	11/32	.77	3,000	14,000	7,000	5.00
MIL-H-8788- 8-L	1/2	7/16	.86	3,000	14,000	7,000	5.75
MIL-H-8788-10-L	5/8	9/16	1.03	3,000	12,000	6,000	6.50
MIL-H-8788-12-L	3/4	11/16	1.22	3,000	12,000	6,000	7.75
MIL-H-8788-16-L	1.00	7/8	1.50	3,000	10,000	5,000	9.63

Hose Construction: Seamless synthetic rubber inner tube reinforced with one fabric braid, two or more steel wire braids, and covered with a synthetic rubber cover (for gas applications, request perforated cover).

Identification: Hose is identified by specification number, size number, quarter year and year, hose manufacturer's identification.

Uses: High pressure hydraulic, pneumatic, coolant, fuel and oil.

Operating Temperature:

Minus 65°F to plus 200°F.

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**CHART 10 (Sheet 1 of 7)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
ABS-Solvent/ Cements		Solarite, #11 Series	Solar Compounds Corp.
Adhesive		EC 801 EC 807 EC 1357 Scotch Grip 210 (Rubber Adhesive)	Minnesota Mining and Manufacturing Adhesive Coating and Sealers Division
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
Cleaners		Fantastic Spray Perchlorethylene VM&P Naphtha (Lighter Fluid)	Local Supplier
Deicer Boot Surface Coatings		Agemaster	B.F. Goodrich
Dry Lubricant	MIL-L-60326	MS-122-6075	Local Supplier
Epoxy Patching Compound		Solarite #400	Solar Compounds Corp.
Gasket Cement		Permatex No. 2	Permatex Company, Inc.
Grease, Actuator		2196-74-1	Dukes Astronautics Co.

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**CHART 10 (Sheet 2 of 7)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, Aircraft Instrumentation, Gear and Actuator Screw (Temp. Range - (100°F to +250°F))	MIL-G-23827A (See Note at end.)	Supermil Grease No. A72832	Amoco
		Royco 27A	Royal Lubricants Co.
		Shell 6249 Grease	Shell Oil Company
		RR-28	Socony Mobil Oil Co.
		Castrolase A1	Burmah-Castrol LTD.
		Low-Temp. Grease E.P.	Texaco Incorp.
		5114 E.P. Grease AV55	Standard Oil of Calif.
		Aeroshell Grease 7 Braycote 627S	Shell Oil Company
		Mobil Grease 27 B.P. Aero Grease 31B	Mobil Oil Corporation 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 Royco 78	Shell Oil Corporation Royal Lubricants Company
		L-1212	Sinclair Refining Co.
		1916 Uni-Temp Grease	California Texas Oil Corporation
Grease Ball and Roller Bearing	MIL-G-18709	Regal ASB-2 Formula TG-10293	Texaco Incorporated
		Andok B Code 1-20481, Darina Grease 1 XSG-6213 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	Exxon Company, U.S.A. Shell Oil Company

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**CHART 10 (Sheet 3 of 7)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, General Purpose Wide Temperature	MIL-G-81322	Marfax All Purpose	Texaco Incorporated
		Aeroshell No. 6	Shell Oil Company
		Mobil Grease 77 or Mobilux EP2	Mobil Oil Corporation
		Shell Alvania EP2	Shell Oil Company
		Royco 22	Royal Lubricants Company
		Mobil Grease 28	Mobil Oil Corporation
		Aeroshell No. 22	Shell Oil Company
Grease, High Temperature	MIL-G-3545	High Temp. Grease, Marfak All Purpose	Texaco Incorporated
		Shellaire Grease HT Alvania E.P. Grease 2	Shell Oil Company
		Aeroshell Grease 5	
		Grease 77, Mobilux E.P. 2	Mobil Oil Corporation
		Royco 45A	Royal Lubricants Co.
		L-1231	Sinclair Refining Company
Grease, Aircraft General Purpose	MIL-G-7711	Regal AFB2 Regal Starfak Premium	Texaco Incorporated
		PED 3040	Standard Oil of Calif.
		Aeroshell Grease 6	Shell Oil Company
		Royco II	Royal Lubricants Co.
Grease, Lubricating, Molybdenum Disulfide, Low and High Temperature	MIL-G-21164	Aeroshell Grease No. 17	Shell Oil Company
		Royco 64C	Royal Lubricants Co.
		Castrol MSA (c)	Burmah Castrol LTD.
Grease, Lubricating, Plug Valve, Gasoline and Oil Resistant	MIL-G-6032	Royco 32	Royal Lubricant Co.
		Castrol 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

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**CHART 10 (Sheet 4 of 7)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, Waterproof, High and Low Temperature		Aero Lubriplate	Fiske Brothers Refining Company
"Hot Melt" Adhesive Polyamids and "Hot Melt" Gun.	Stick Form 1/2 in. diameter, 3 in. long		Sears, Roebuck and Company or most hardware stores.
Hydraulic Fluid	MIL-H-5606	Brayco 756D	Bray Oil Company
		TL-5874	Texaco Incorporated
		PED 3565	Standard Oil Company of California
		Aircraft Hydraulic Oil AA	Texaco Incorporated
		RPM Aviation Oil No. 2 Code PED 2585 PED 3337	Standard Oil Company of California
		3126 Hydraulic Oil (Univis 40)	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
Isocryl Tape	(PMS-C1012-2)		Schnee Moorehead Chemicals, Incorporated
Kevlar		Kevlar	Kevlar Special Products
Leak Detector Solution for Oxygen Systems	MIL-L-25567	ALPHA 73 Oxygen Leak Detector Type 1	U.S. Gulf Corporation
		Leak Tec #16-OX	American Gas and Chemical Co. LTD.
Loctite	MIL-S-22473 Grade AA	Loctite 290	Loctite Corporation
	MIL-S-22473 Grade H and HV	Loctite 222	
Methylethylketone	Fed. Spec. TT-M-261		Local Supplier

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**CHART 10 (Sheet 5 of 7)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Molybdenum Disulfide	MIL-M-7866	Molykote-Type G (Paste) Molykote - Type 2 (Powder)	Dow Corning Corp.
Oil, Air Conditioner, R12		Frigidaire #525 Suniso #5 Texaco Capilla "E"	Virginia Chemical Sun Oil Company of Pennsylvania Texaco Incorporated
Oil, Air Conditioner, HFC-134a	Piper P/N 923-384	PAG-21941	
Oil Lubricating, General Purpose, Low Temperature	MIL-L-7870	Caltex Low Temp. Oil Sinclair Aircraft Orbit Lube 1692 Low Temp Oil Aviation Instrument Oil Royco 363	Caltex Oil Products Company Sinclair Refining Company Texaco Incorporated Standard Oil Company of California Royal Lubricants Co.
Rain Repellent	FSCM 50150	Repcon	Unelco Corporation
Safety Walk Pressure Sensitive		Flexfred 300	Wooster Products, Incorporated
Sealant	MIL-S-11031B	PRC 5000 PRC 383	Products Research Company
Sealant, Fuel Tank Sealing		*RS-36b, Stripper (thin) *RS-24b, Stripper (thick) *PR 1422 A-2 Sealant (Brushing Consistency) *PR 1422 B-2 Sealant (Trowling Consistency) *PR 1431G, Faying Surface Seal, Type 1 * PR 1321-B 1/2, Access Panel Sealant * PR 1560 MK, Primer (Anti-Bacteriological Coating)	CEE BEE Chemical Co. Products Research Company Products Research Company

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**CHART 10 (Sheet 6 of 7)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Sealant, Fuel Tank Sealing(continued)		* BJO-0930, Phenolic Balloons * ERL-2795, Epoxy Resin * 22LA-0340 Polyamid Hardener * Thiokol MC-236	Union Carbide Plastics Division
	Class A-2		
		* NOTE: Use of Equivalent Sealant Approved.	
Sealant, Fuselage Structure	Class A-1/2, A-2, B-2 B-4, B-6, B-8	EC 1239 EC 612 (Leak Marker or Weather Stripping, etc) G.E.-SS-4004 (Primer) RTV-88 with RTV-9811	H.S. Bancroft Corp. Minnesota Mining and Manufacturing Industrial Specialties Division General Electric Silicone Products Department
Sealant, Windshield & Windows	AMS 3333 Type II, Class B-2	EC-801/1063 (Piper P/N 279-047) PR 1425 (Piper P/N 279-019) CS3247 (Piper P/N 279-227)	3M Company Products Research Company Chem Seal
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 G-624	Dow Corning General Electric Co. Silicone Products Department
Solvents		Methylethyl Ketone Methylene Chloride Acetone Y2900	Local Suppliers Union Carbide; Plastic Division

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**CHART 10 (Sheet 7 of 7)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Solvents (continued)	Fed. Spec. PD 680 Type I - Stoddard Solvent		Local Supplier
	Type II - High Temperature		Local Supplier
Propeller Slip Ring Cleaning Solvent		CRC-2-26	Corrosion Reaction Consultants, Inc.
Toluol	TT-M-261		Local Supplier
Trichlorethylene	MIL-T-7003	Perm-A-Clor	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. Permcel Division
Thread Sealant for High Pressure Oxygen System	MIL-T-27730	Permcel 412	Johnson & Johnson, Inc. Permcel Division
Vinyl Foam	1 in. x 1/8 in.	530 Series, Type I	Norton Tape Division
Vinyl, Foam Tape	1/8 in. x 1 in.	501 Series, Type II	Norton Tape Division
Vinyl, Black Plastic	2 in. x 9 mil. and/or 1 1/2 in. x 9 mil.		
Corrosion Retardant Compounds	MIL-C-16173 D	LPS-3 Heavy Duty Rust Inhibitor (Piper P/N 197-508)	Holt Lloyd Corp.
		Metal Parts Protector Protector Flex (Piper P/N 197-509)	Chemi-Cap. Chemical Packaging Corp.
NOTE: Take precautions when using MIL-G-23827 and engine oil. These lubricants contain chemicals harmful to painted surfaces.			

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**CHART 11 (Sheet 1 of 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 Chemical Co.
9520 E. CEE BEE Drive
Box 400
Downey, CA 92041

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

Corrosion Reaction
Consultants, Inc.
Limekin Pike
Dresher, PA 19025

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

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.
Permaceel 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

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

**CHART 11 (Sheet 1 of 2)
VENDOR CONTACT INFORMATION**

M

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

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

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

Morton Inc.
7341 Anaconda Ave
Garden Grove, CA 92641
724-373-2837
Fax 724-373-1913

N

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

P

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

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

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

R

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

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

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

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

S

Schnee Moorhead Chemicals, Inc.

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

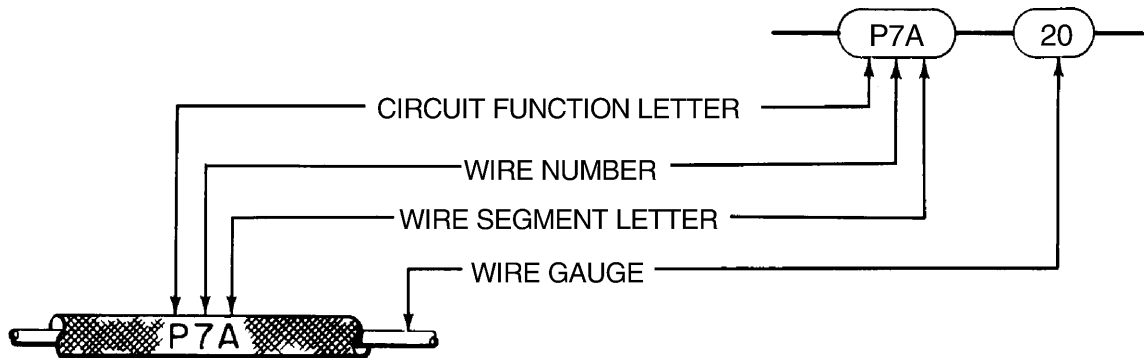
Virginia Chemical
3340 W. Norfolk Rd.
Portsmouth, VA 23703
703-484-5000

W

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

**THE NEW PIPER AIRCRAFT, INC.
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**CHART 12
ELECTRICAL WIRE CODING**



CIRCUIT FUNCTION LETTER	CIRCUITS
A	AUTOPILOT
C	CONTROL SURFACE
E	ENGINE INSTRUMENT
F	FLIGHT INSTRUMENT
G	LANDING GEAR
H	HEATER - VENTILATING & DEICING
L	LIGHTING
P	POWER
Q	FUEL & OIL
RP	RADIO POWER
RZ	RADIO AUDIO
J	IGNITION
W	WARNING
K	STARTER

**THE NEW PIPER AIRCRAFT, INC.
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**CHART 13 (Sheet 1 of 2)
ELECTRICAL SYMBOLS**

AIRCRAFT LOCATION SYMBOLS			ADJUSTABILITY		BATTERIES		BUS	
FS FUSELAGE STATION WL WATER LINE BL BUTT LINE			GENERAL		GENERAL MULTICELL			
CABLES AND CONDUCTORS								
GROUPING OF LEADS TWISTED PAIR TWISTED TRIPLE			SHIELDED SINGLE CONDUCTOR COAXIAL CABLE SHIELDED TWO CONDUCTOR W / GROUND SHIELDED TWISTED PAIR					
CAPACITOR		CIRCUIT BREAKERS				CONNECTORS		CURRENT LIMITER
GENERAL		CB BASIC PUSH BREAKER PUSH-PULL BREAKER SWITCH BREAKER				RECEPTACLE PLUG MATED PLUG & RECEPTACLE		
DIODES				FUSE		GROUNDS		
GENERAL ZENER, UNIDIRECTIONAL ZENER, BIDIRECTIONAL				OR		GROUND OR CIRCUIT RETURN GROUND TO CHASSIS (WITH TERMINAL)		
HORN		HEATED ELEMENT		SQUIB ELECTRIC IGNITER		LAMPS		
						INDICATOR LIGHT (* LETTER DENOTES COLOR - ASTERISK IS NOT PART OF SYMBOL) INCANDESCENT LAMP FLUORESCENT LAMP		
MOTOR		METER		POLARITY		POTENTIOMETER		
		* LETTER DENOTES THE TYPE OF METER i.e. A = AMMETER		POSITIVE NEGATIVE				
RELAY COIL		RESISTOR		RHEOSTAT		SPLICE		TERMINAL BOARD
		OR				PERMANENT DISCONNECT		
TRANSDUCER		TRANSFORMERS				TRANSISTORS		
		GENERAL SINGLE PHASE (3) WINDING W/CORE NON SATURATING				PNP TYPE NPN TYPE		
THERMAL ELEMENT (TRANSDUCER)						COILS		
GENERAL						GENERAL ADJUSTABLE		

**THE NEW PIPER AIRCRAFT, INC.
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**CHART 13 (Sheet 2 of 2)
ELECTRICAL SYMBOLS**

CONTACT SWITCH ASSEMBLIES BASIC			PUSH BUTTON			MOMENTARY OR SPRING RETURN		
CLOSED CONTACT	OPEN CONTACT	TRANSFER	(MAKE) CIRCUIT CLOSING	(BREAK) CIRCUIT OPENING	TWO CIRCUIT			
NON-LOCKING			MOMENTARY OR SPRING RETURN			LOCKING AND NON-LOCKING		
(MAKE) CIRCUIT CLOSING	(MAKE OR BREAK) CIRCUIT CLOSING OR OPENING	(BREAK) CIRCUIT OPENING	TWO CIRCUIT	TRANSFER	THREE POSITION ONE POLE	THREE POSITION TWO POLE		
PRESSURE OR VACUUM ACTUATED SWITCH			TEMPERATURE ACTUATED					
					NOTE: "t" symbol equals operating temperature of the device.			
CLOSES ON RISING PRESSURE	OPENS ON RISING PRESSURE		CLOSES ON RISING TEMPERATURE	OPENS ON RISING TEMPERATURE				
LIMIT SWITCH, DIRECTLY ACTUATED - SPRING RETURN			THERMAL SWITCHES					
NORMALLY OPEN	NORMALLY OPEN HELD CLOSED	NORMALLY CLOSED	NORMALLY CLOSED HELD OPEN	NORMALLY OPEN CLOSES ON RISING TEMPERATURE	NORMALLY CLOSED OPENS ON RISING TEMPERATURE	NORMALLY OPEN INTERNAL HEATER SHOWN		
SELECTOR OR MULTI - POSITION SWITCH			EXAMPLE ON-ON-ON SWITCH ACUTATION					
ANY NUMBER OF TRANSMISSION PATHS MAY BE SHOWN						TOGGLE IN THE DOWN POSITION	TOGGLE IN THE UP POSITION	
EXAMPLE OF RELAY			SWITCHES WITH TIME/DELAY FEATURE			ROTARY SWITCH		
			OPEN TIME-DELAY CLOSING	CLOSED TIME-DELAY OPENING	OPEN TIME-DELAY OPENING	CLOSED TIME-DELAY CLOSING	NOTE: Viewed from end opposite control knob.	
			ARROW INDICATES DIRECTION OF SWITCH OPERATION IN WHICH CONTACT ACTION IS DELAYED					

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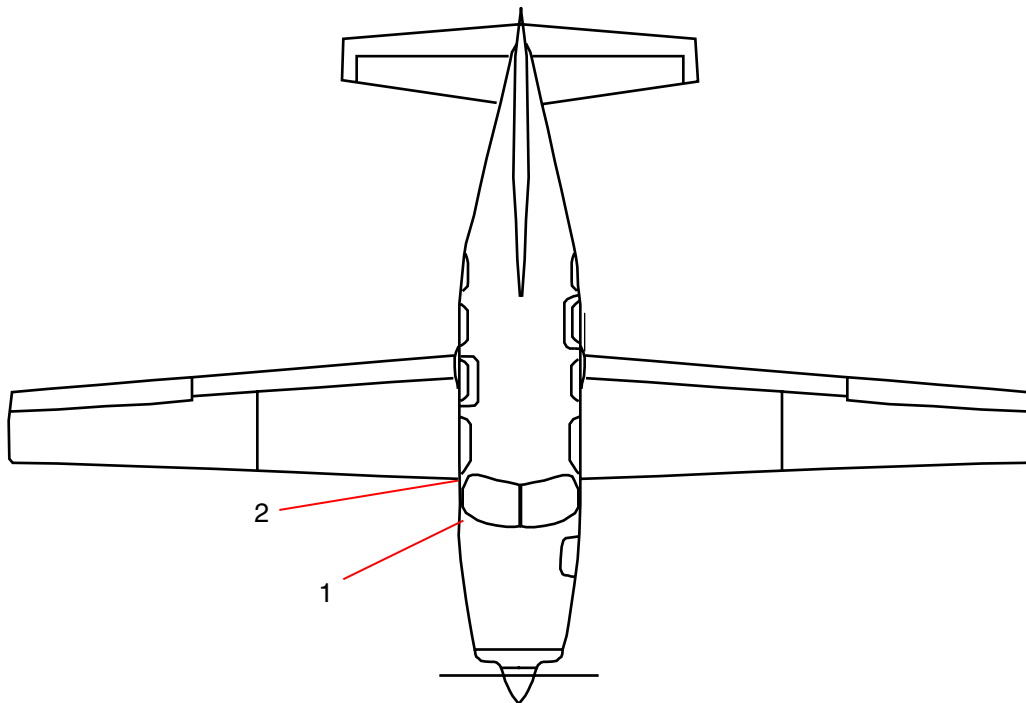
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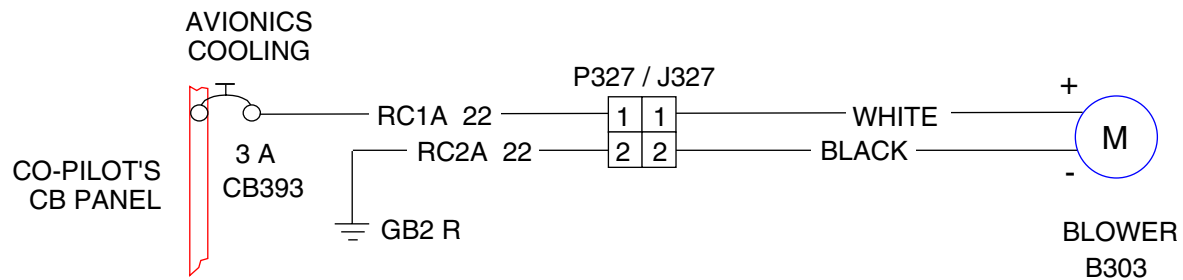
**THE NEW PIPER AIRCRAFT, INC.
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Item #	Designation	Description
1	B303	Blower
2	CB393	Circuit Breaker (3 Amp)



Avionics Cooling
Figure 1 (Sheet 1 of 4)

THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL

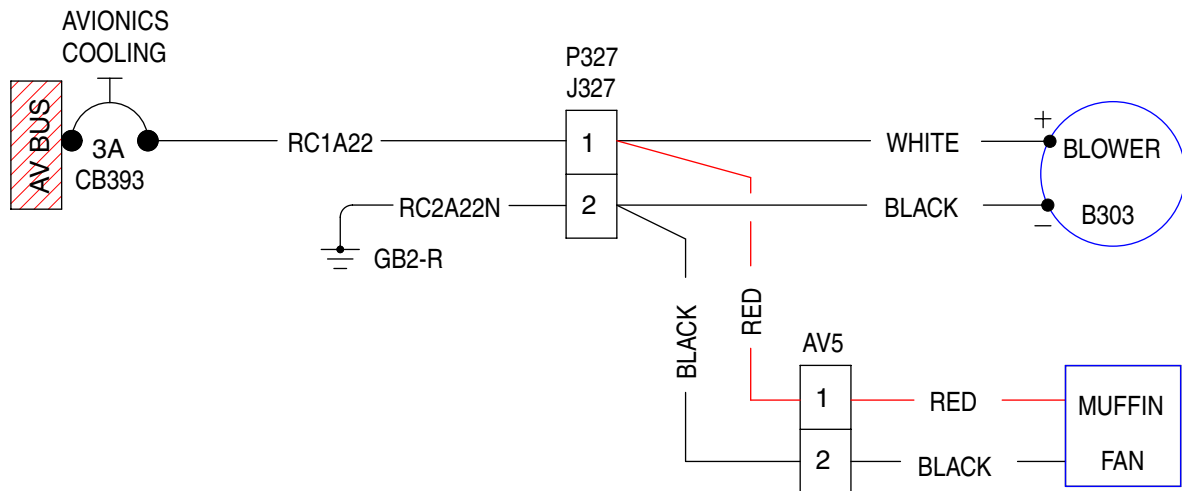


89801 AH 37.0
85508 L
101238 E
101301 C
104051 C

[Effectivity](#)
4636001 thru 4636313,
less 4636299

Avionics Cooling
Figure 1 (Sheet 2 of 4)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

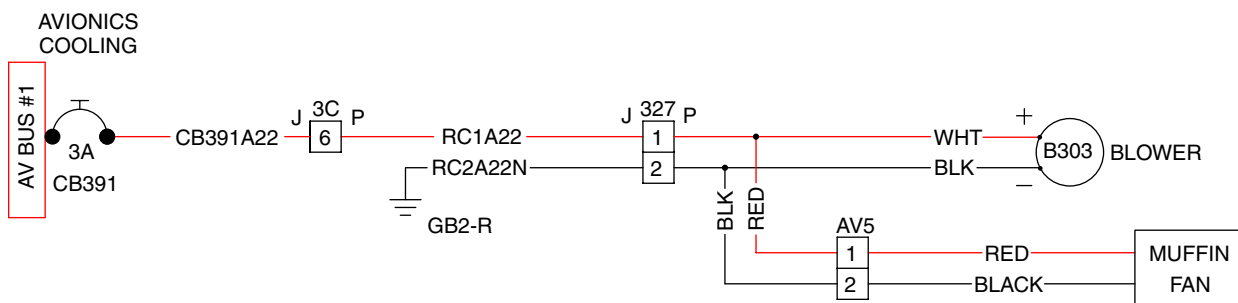


104301 H/S 37.0

Avionics Cooling
Figure 1 (Sheet 3 of 4)

Effectivity
4636299 and
4636314 thru 4636374

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MAINTENANCE MANUAL



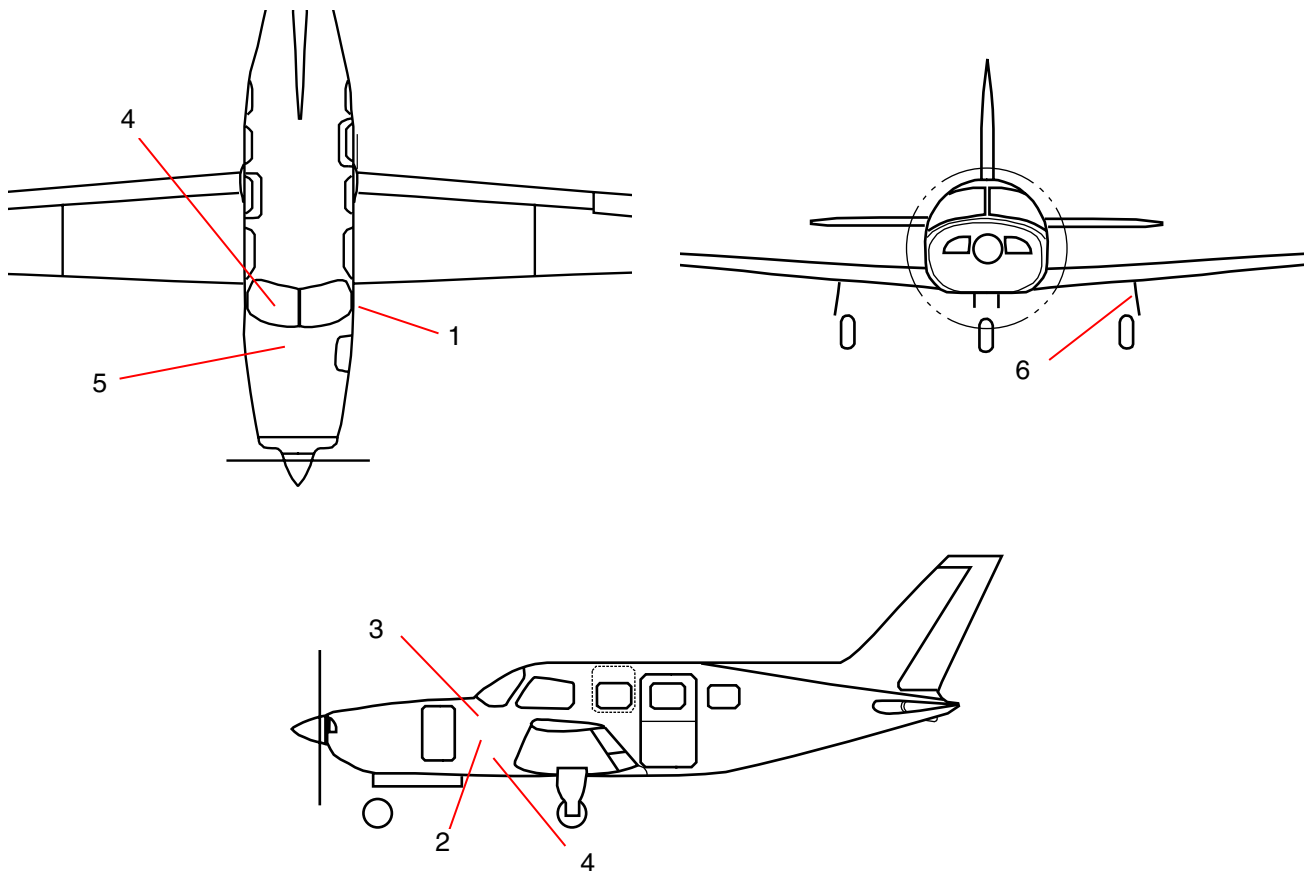
105115 NEW 17.0

[Effectivity](#)
4636375 and up

Avionics Cooling
Figure 1 (Sheet 4 of 4)

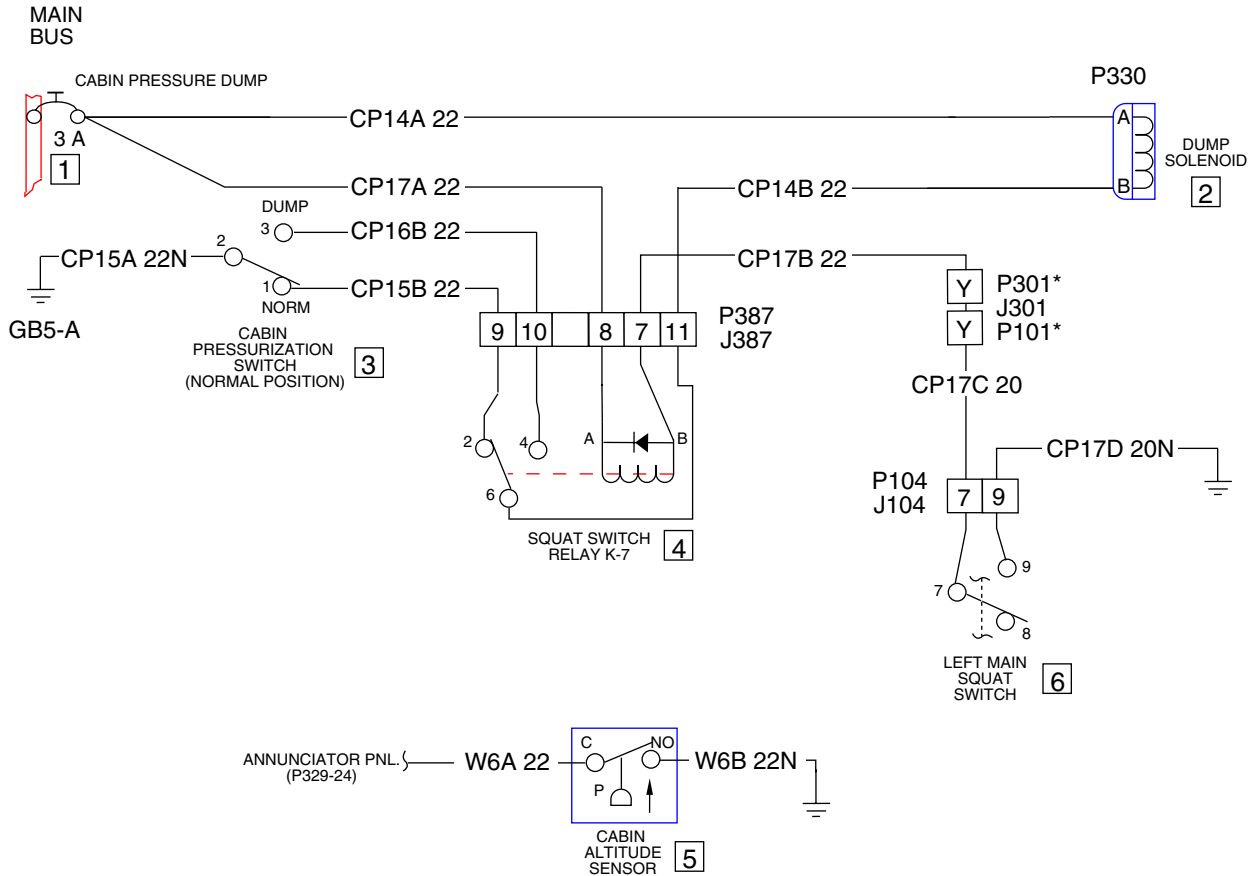
**THE NEW PIPER AIRCRAFT, INC.
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Item #	Designation	Description
1	CB333	3 Amp Circuit Breaker
2	A312	Cabin Pressurization Dump Solenoid
3	S310	Cabin Pressurization Dump Switch
4	K7	Squat Switch Relay
5	A314	Cabin Pressure Sensor
6	S103	Squat Switch Assembly



Cabin Pressurization
Figure 1 (Sheet 1 of 4)

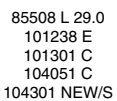
**THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL**



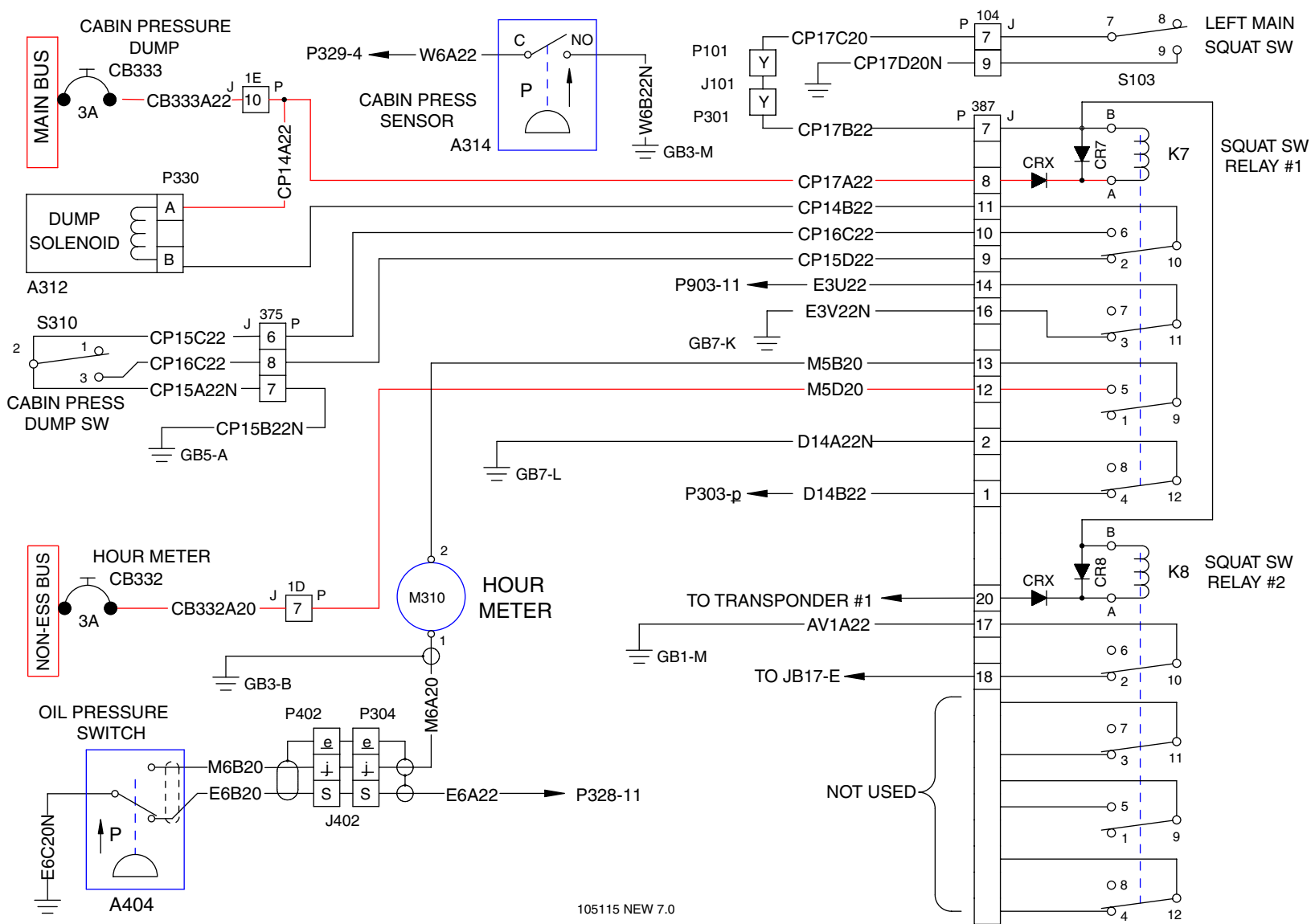
89801 AH 29.0

[Effectivity](#)
4636001 thru 4636020

Cabin Pressurization
Figure 1 (Sheet 2 of 4)



Effectivity
4636021 thru 4636374

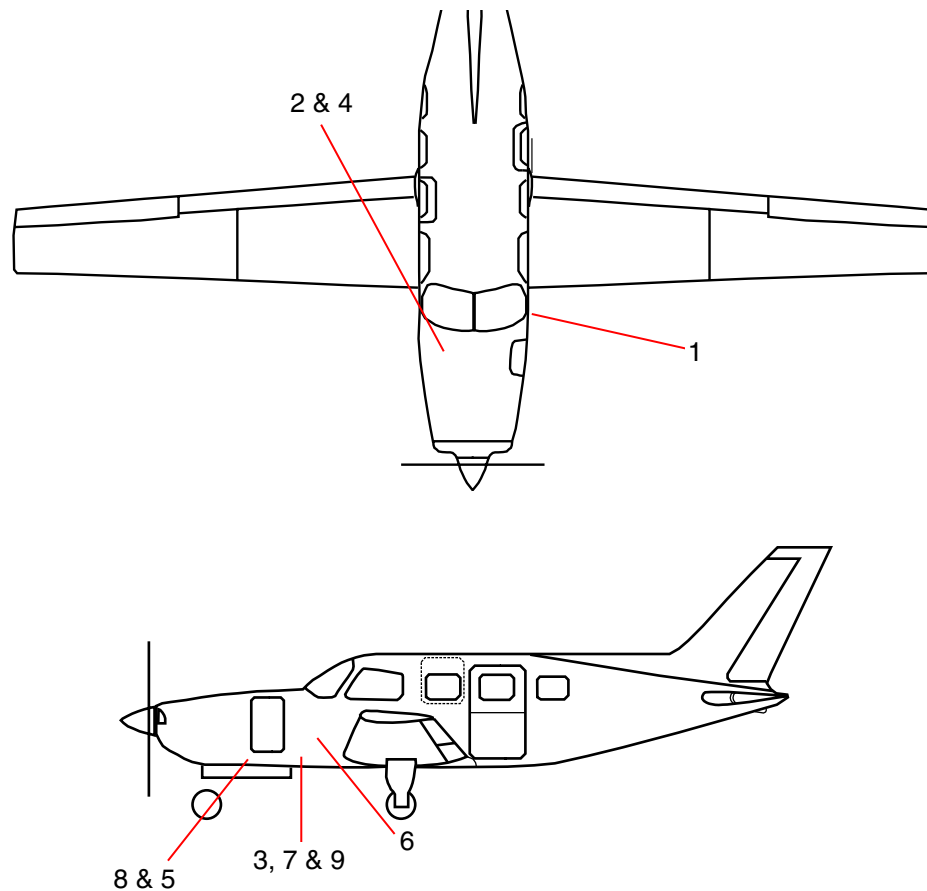


Effectivity
4636375 and up

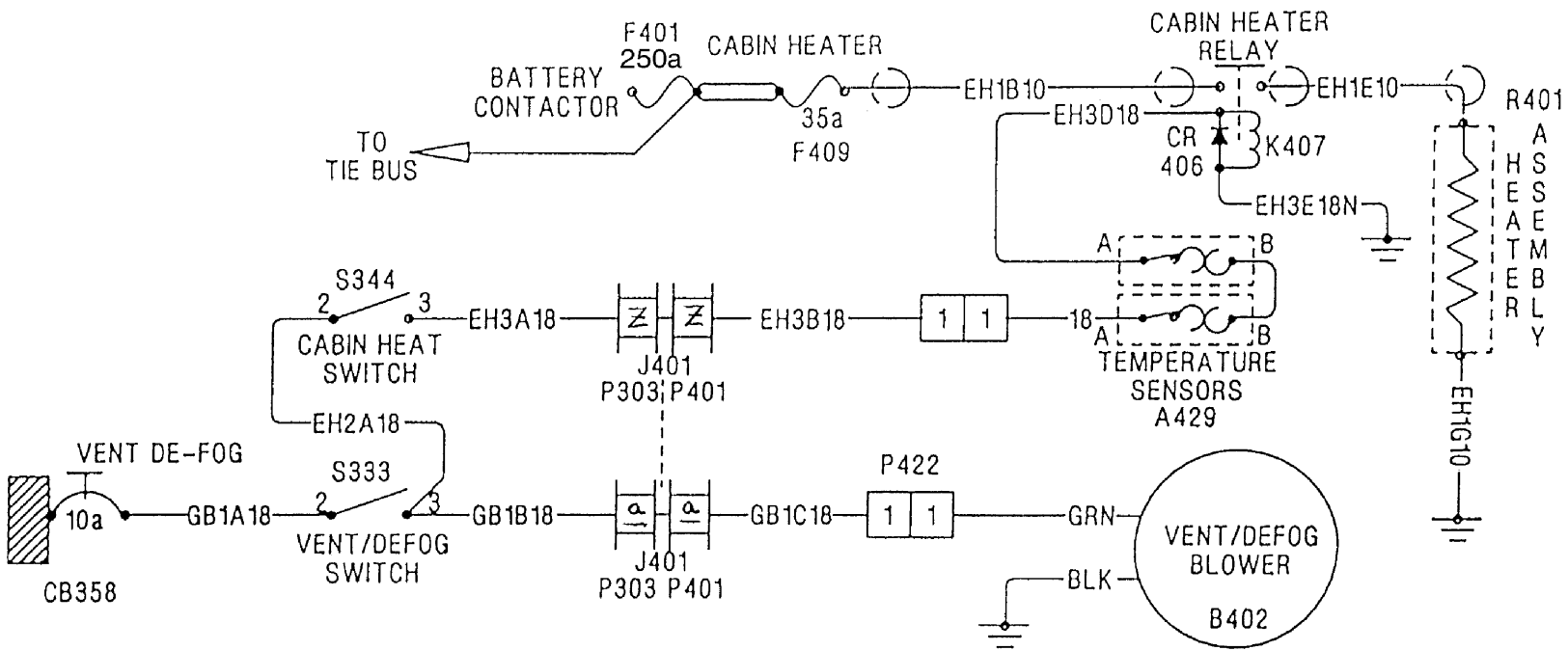
Cabin Pressurization
Figure 1 (Sheet 4 of 4)

THE NEW PIPER AIRCRAFT, INC.
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Item #	Designation	Description
1	CB358	10 Amp Circuit Breaker
2	S333	Vent/Defog Switch
3	B402	Vent/Defog Blower
4	S344	Cabin Heat Switch
5	F401	100 Amp Current Limiter
6	K407	Cabin Heater Relay
7	A429	Temperature Sensors
8	F409	35 Amp Current Limiter
9	R401	Heater Assembly



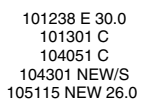
Vent Defogger and Cabin Heater
Figure 1 (Sheet 1 of 3)



89801 AH 30.0
85508 L

Effectivity
4636001 thru 4636131

Vent Defogger and Cabin Heater
Figure 1 (Sheet 2 of 3)



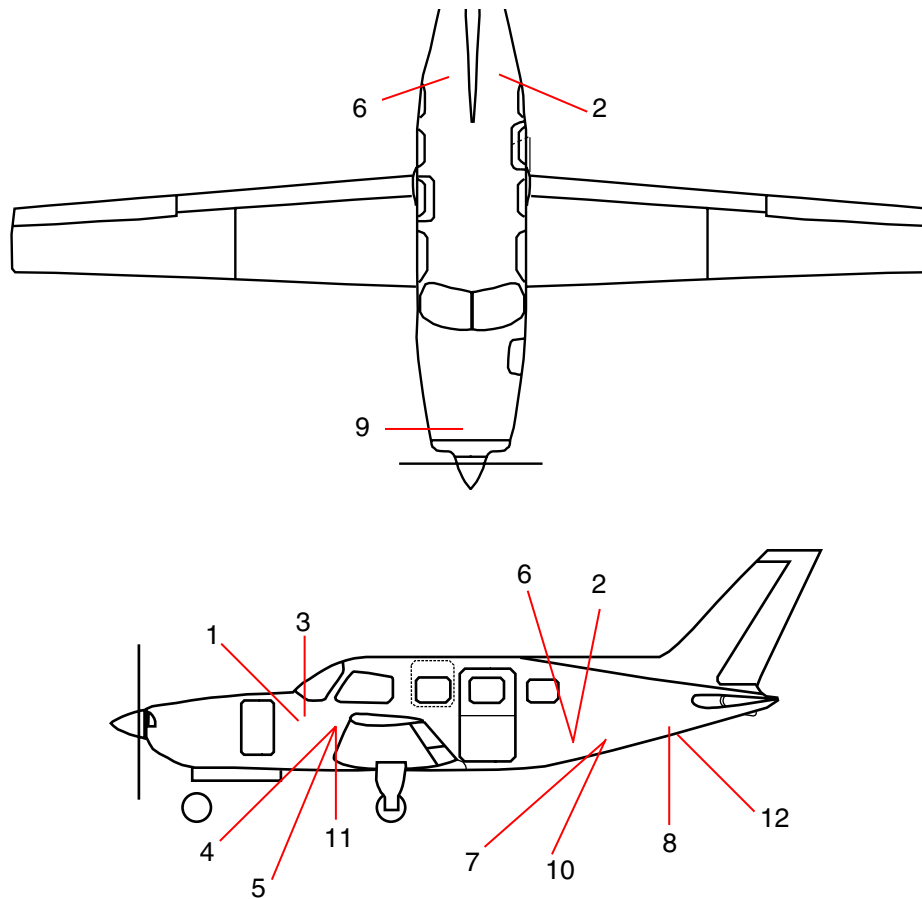
Effectivity
4636132 and up

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MAINTENANCE MANUAL**

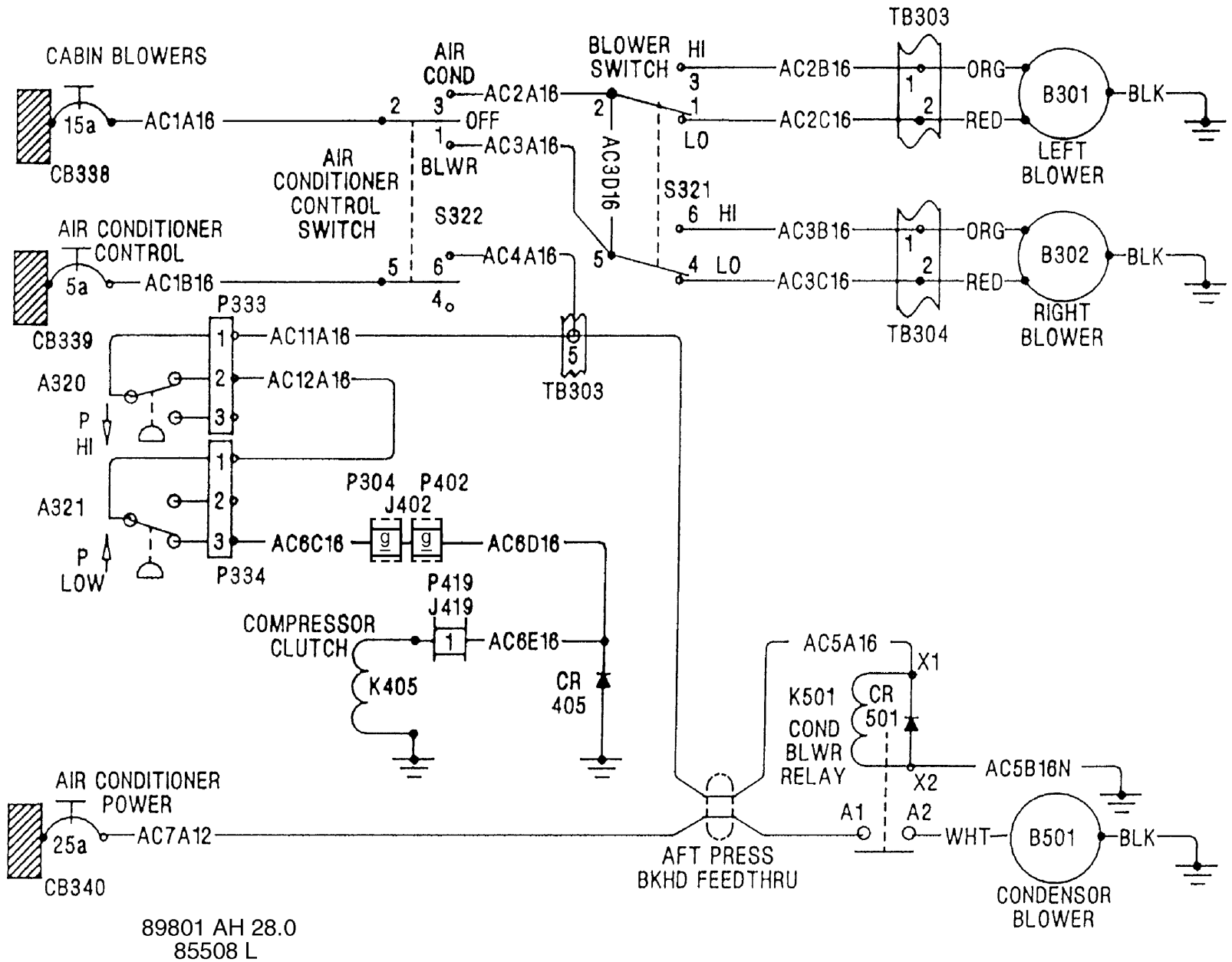
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Item #	Designation	Description
1	S321	Recirculation Blower Switch
2	B301	Left Blower Fan Motor
3	S322	Air Conditioner Switch
4	CB338	15 Amp Circuit Breaker
5	CB339	5 Amp Circuit Breaker
6	B302	Right Blower Fan Motor
7	A320	High Pressure Switch
8	K501	Condenser Blower Relay
9	K405	Compressor Clutch Assembly
10	A321	Low Pressure Switch
11	CB340	25 Amp Circuit Breaker
12	B501	Condenser Blower Motor Assembly
13	CR405	Diode
14	CR501	Diode



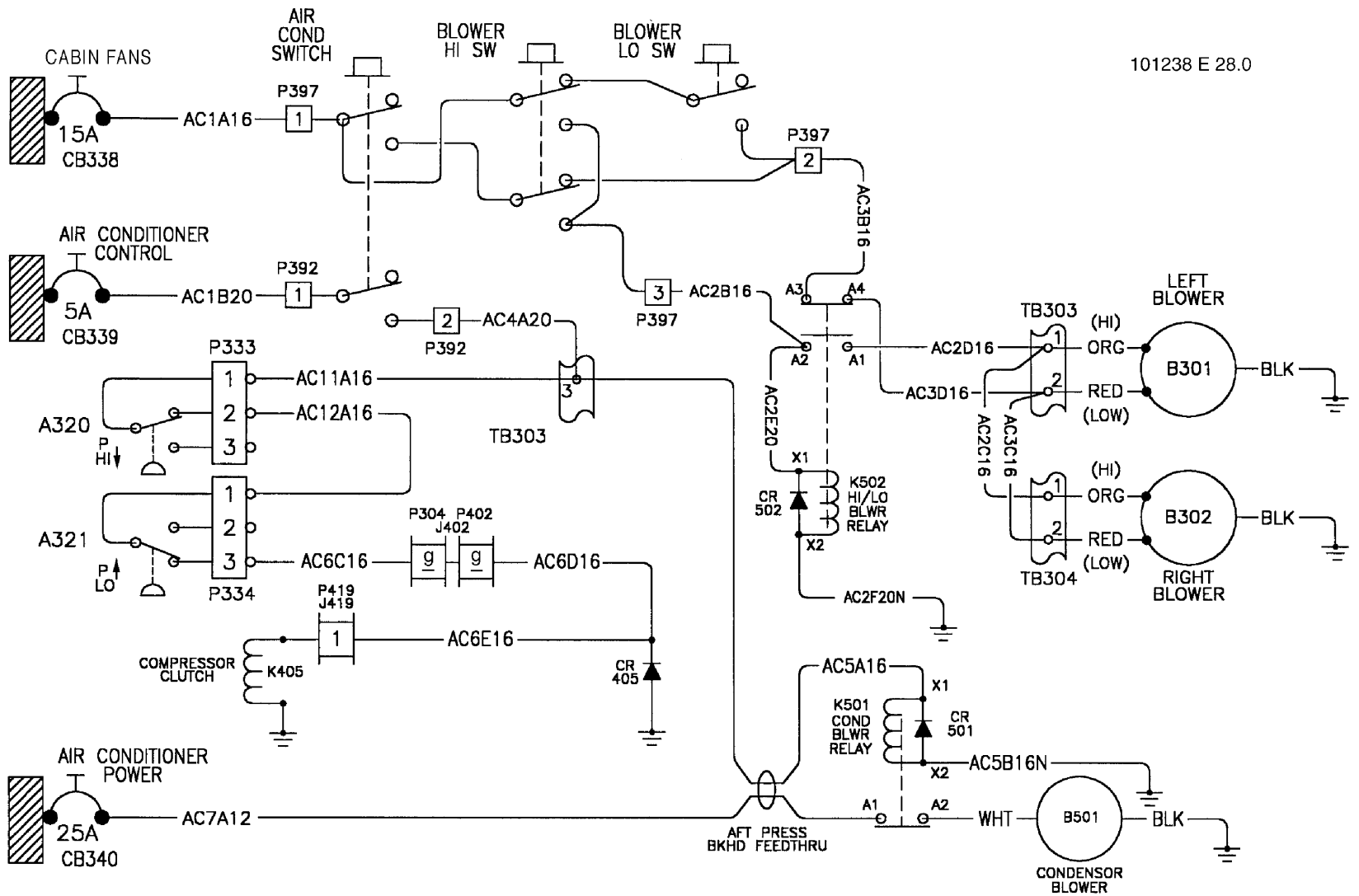
Vent Blowers and Air Conditioning
Figure 1 (Sheet 1 of 5)



89801 AH 28.0
85508 L

Effectivity
4636001 thru 4636131
Vent Blowers and Air Conditioning
Figure 1 (Sheet 2 of 5)

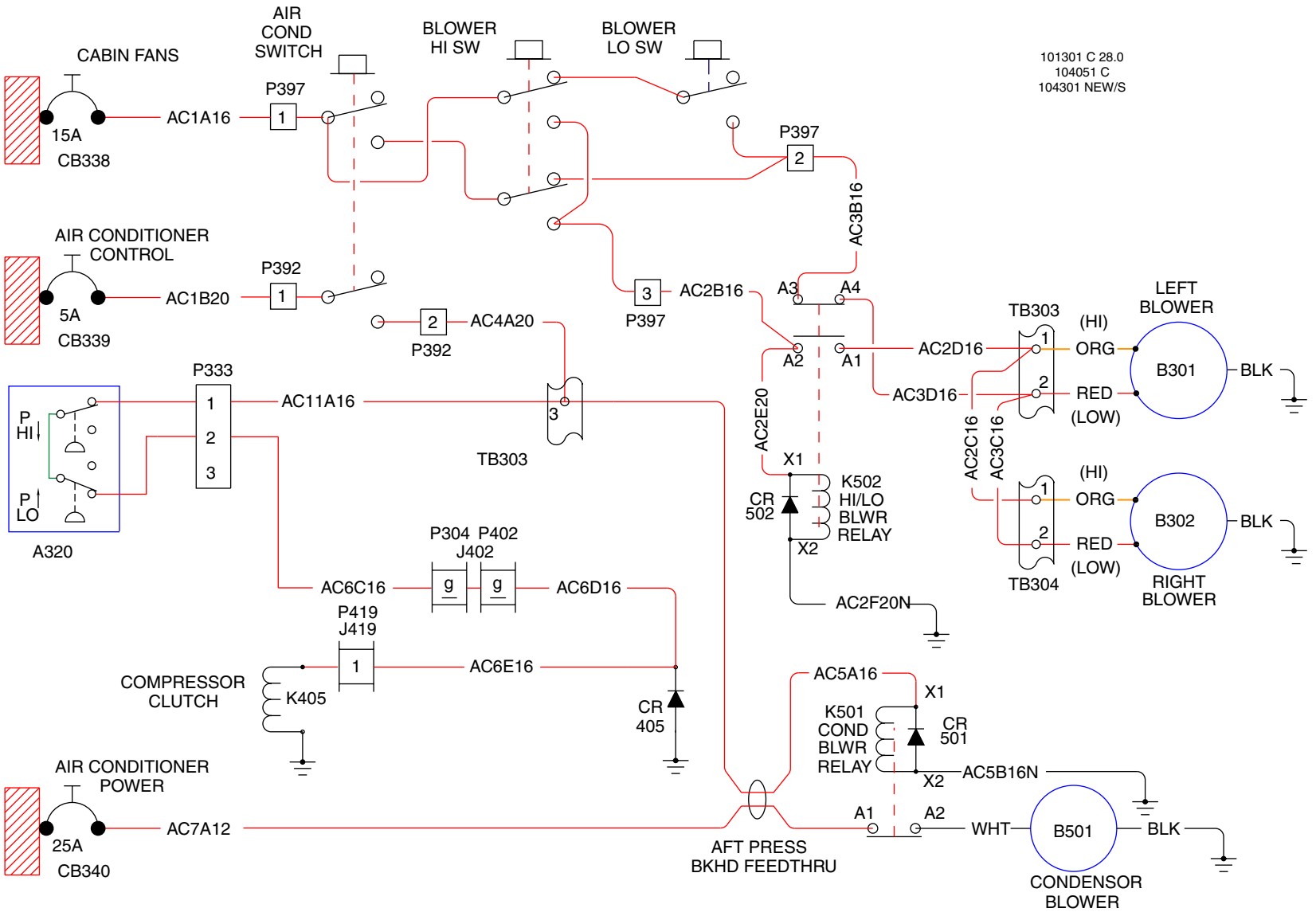
101238 E 28.0



Vent Blowers and Air Conditioning
Figure 1 (Sheet 3 of 5)

Effectivity
4636132 thru 4636186

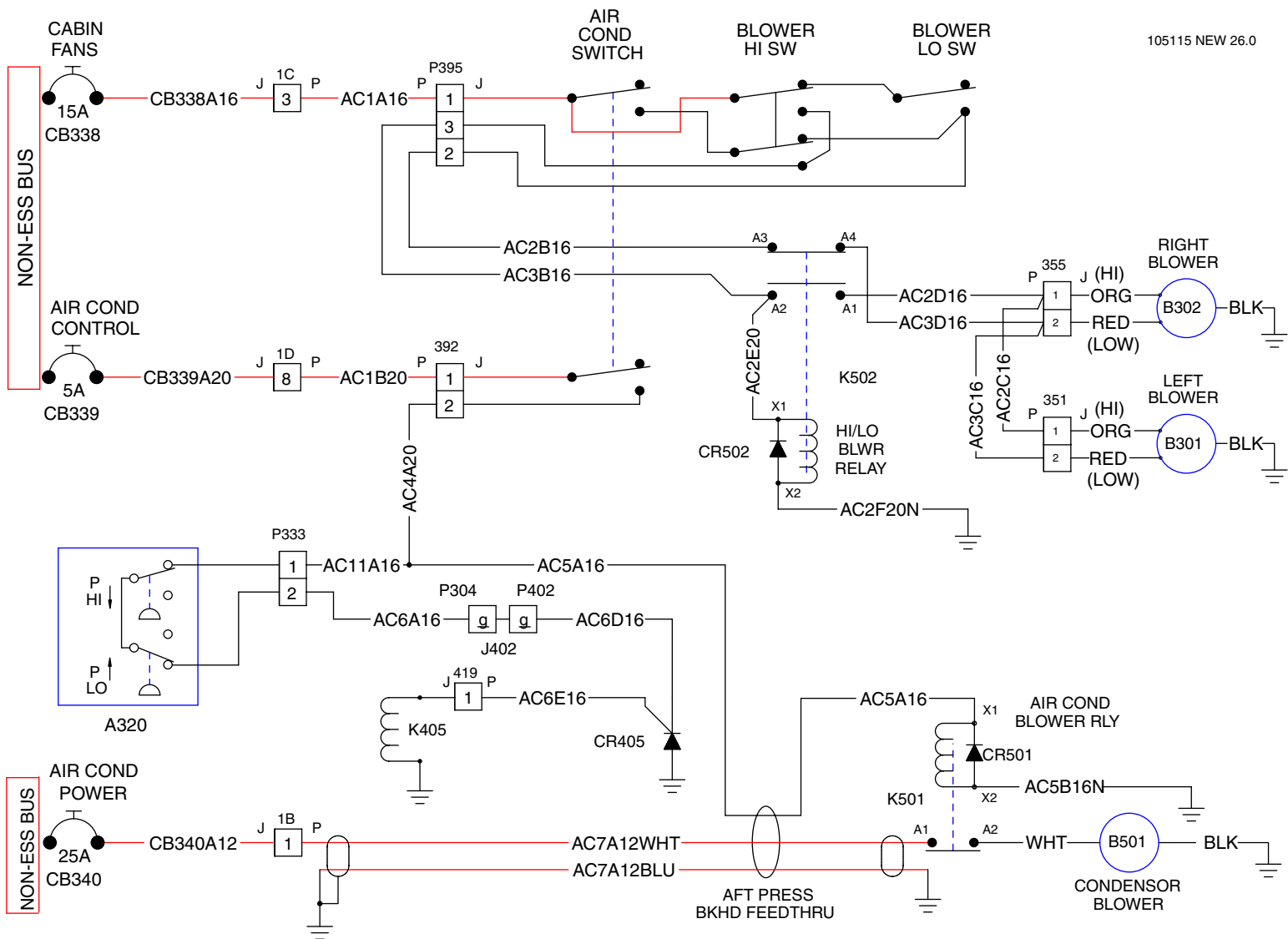
101301 C 28.0
104051 C
104301 NEW/S



Effectivity
4636187 thru 4636374

Vent Blowers and Air Conditioning
Figure 1 (Sheet 4 of 5)

105115 NEW 26.0



Vent Blowers and Air Conditioning
Figure 1 (Sheet 5 of 5)

Effectivity
4636375 and up

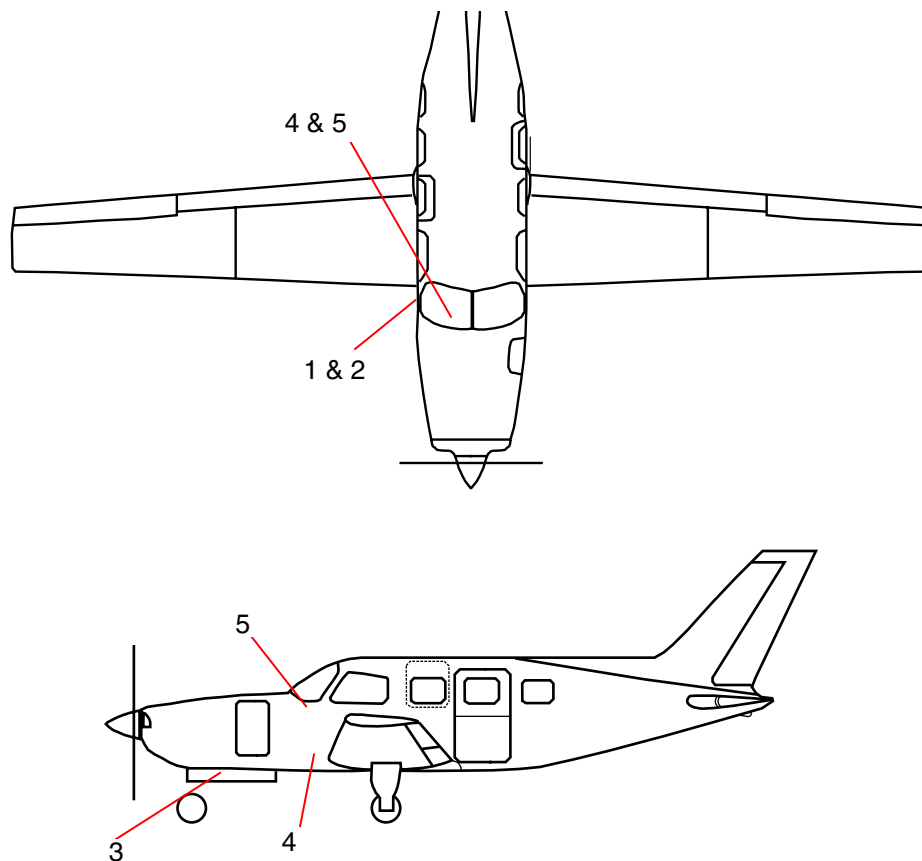
**THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL**

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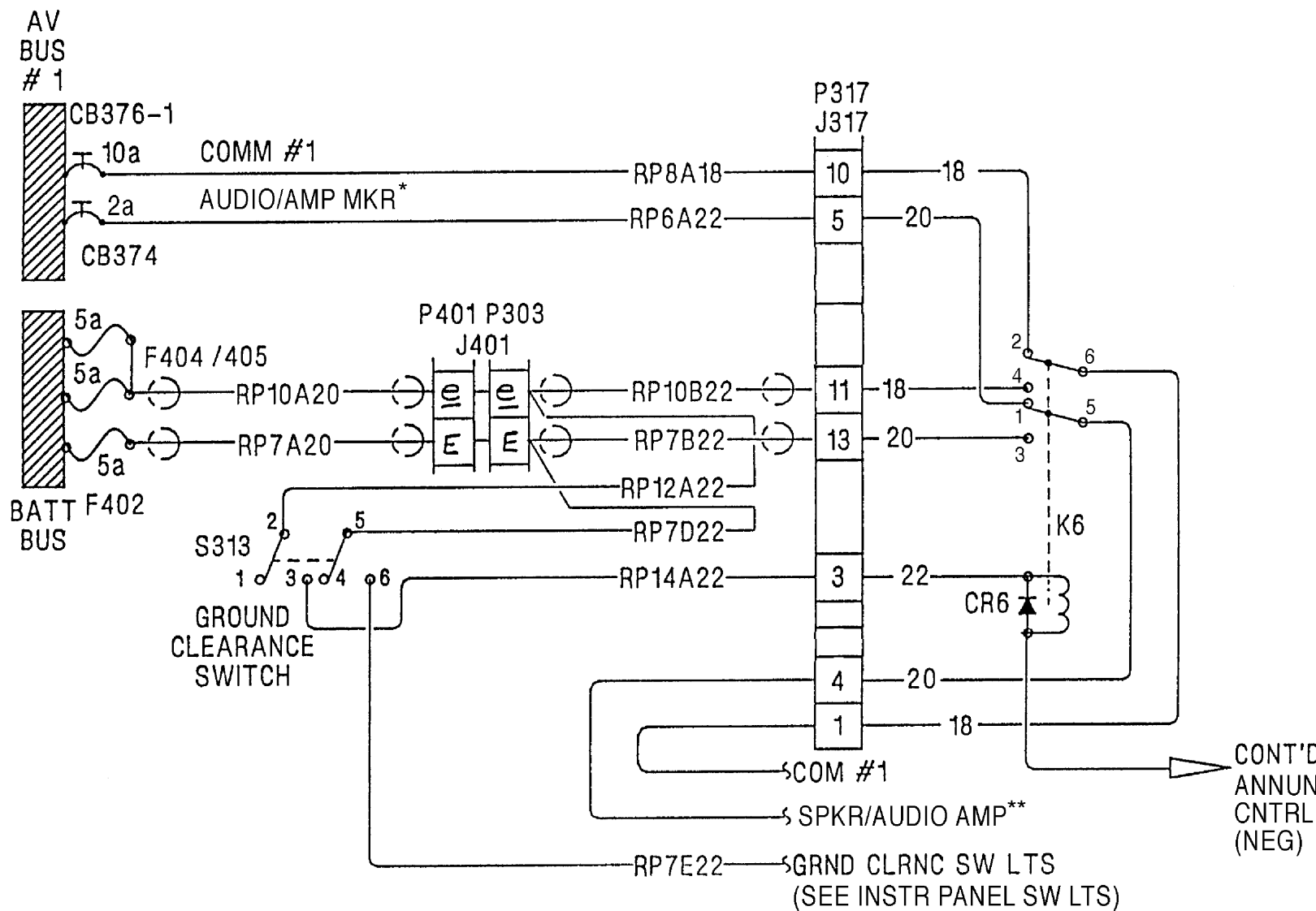
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Item #	Designation	Description
1	CB376-1	10 Amp Circuit Breaker
2	CB374	2 Amp Circuit Breaker*
3	F402	5 Amp Fuse
	F404	5 Amp Fuse
	F405	5 Amp Fuse
4	K6	Ground Clearance Relay
5	S313	Ground Clearance Switch
		Ground Clearance Switch Cap
	CR6	Diode

* 3 Amp Circuit Breaker ([4636001](#) thru [4636020](#) only)

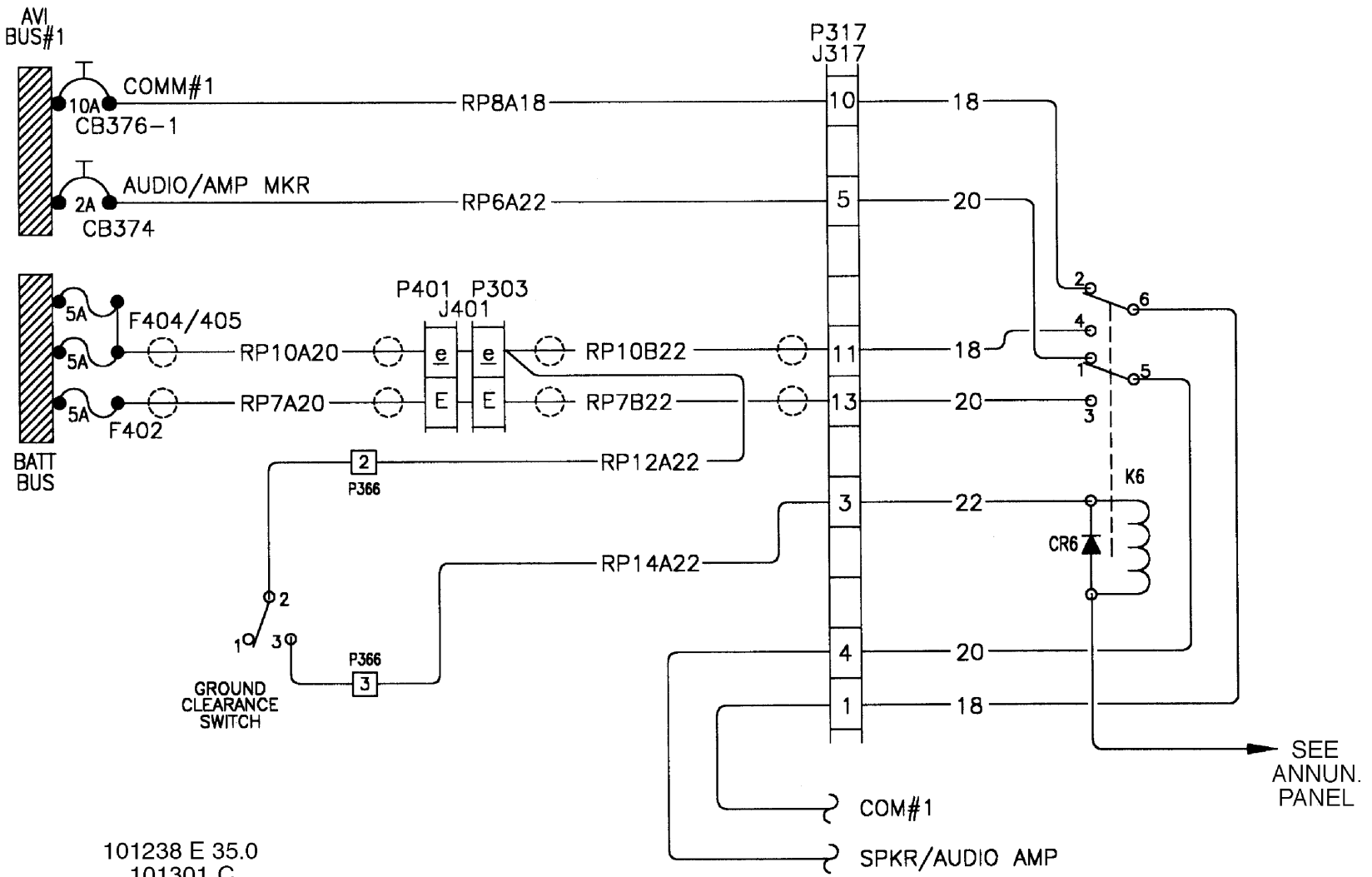


Ground Clearance
Figure 1 (Sheet 1 of 5)



89801 AH 35.0
85508 L

* SPKR AMP (4636001 THRU 4636020 ONLY)
** KMA24, SPKR AMP (4636001 THRU 4636020 ONLY)



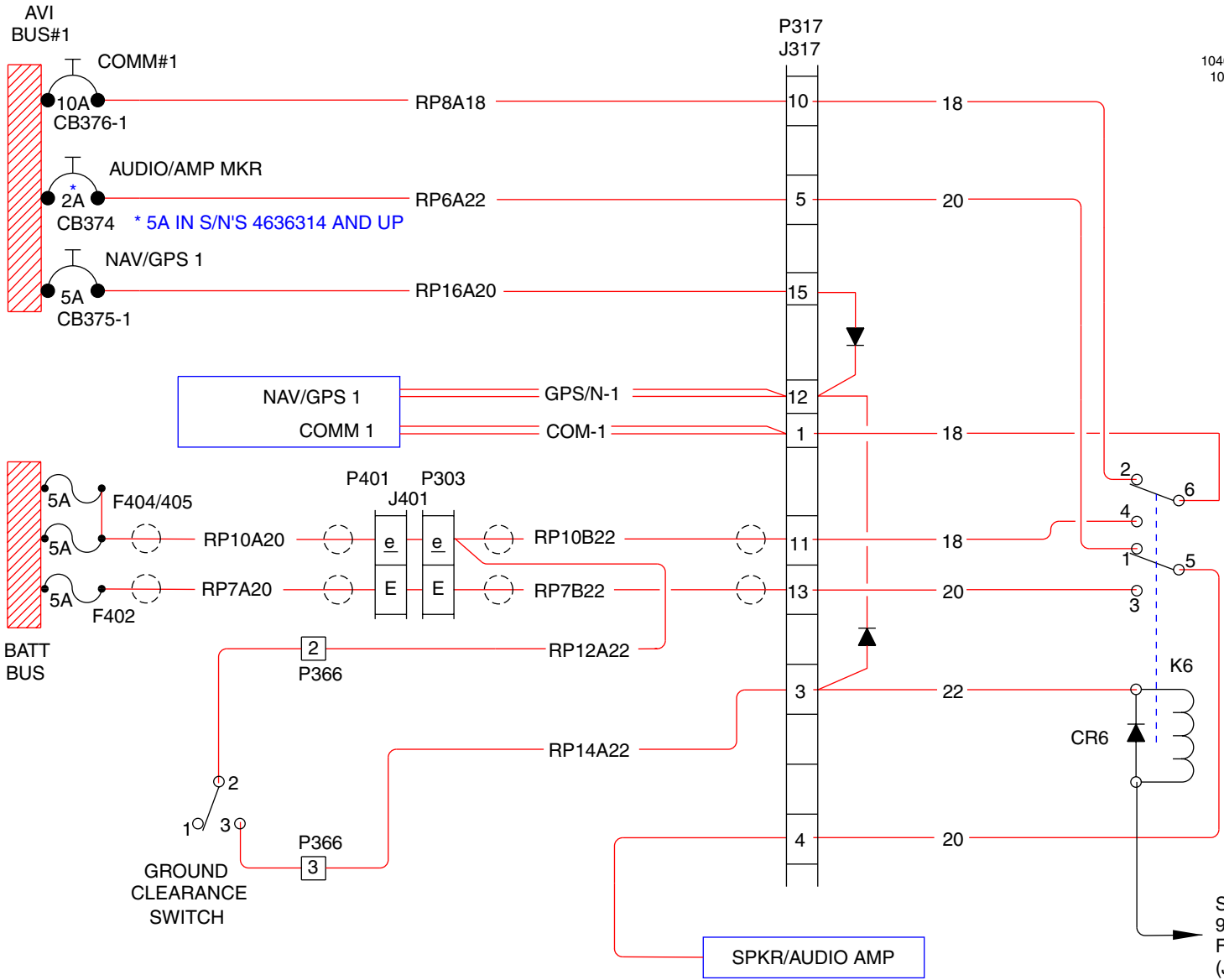
Ground Clearance
Figure 1 (Sheet 3 of 5)

101238 E 35.0
101301 C

Effectivity
4636132 thru 4636247

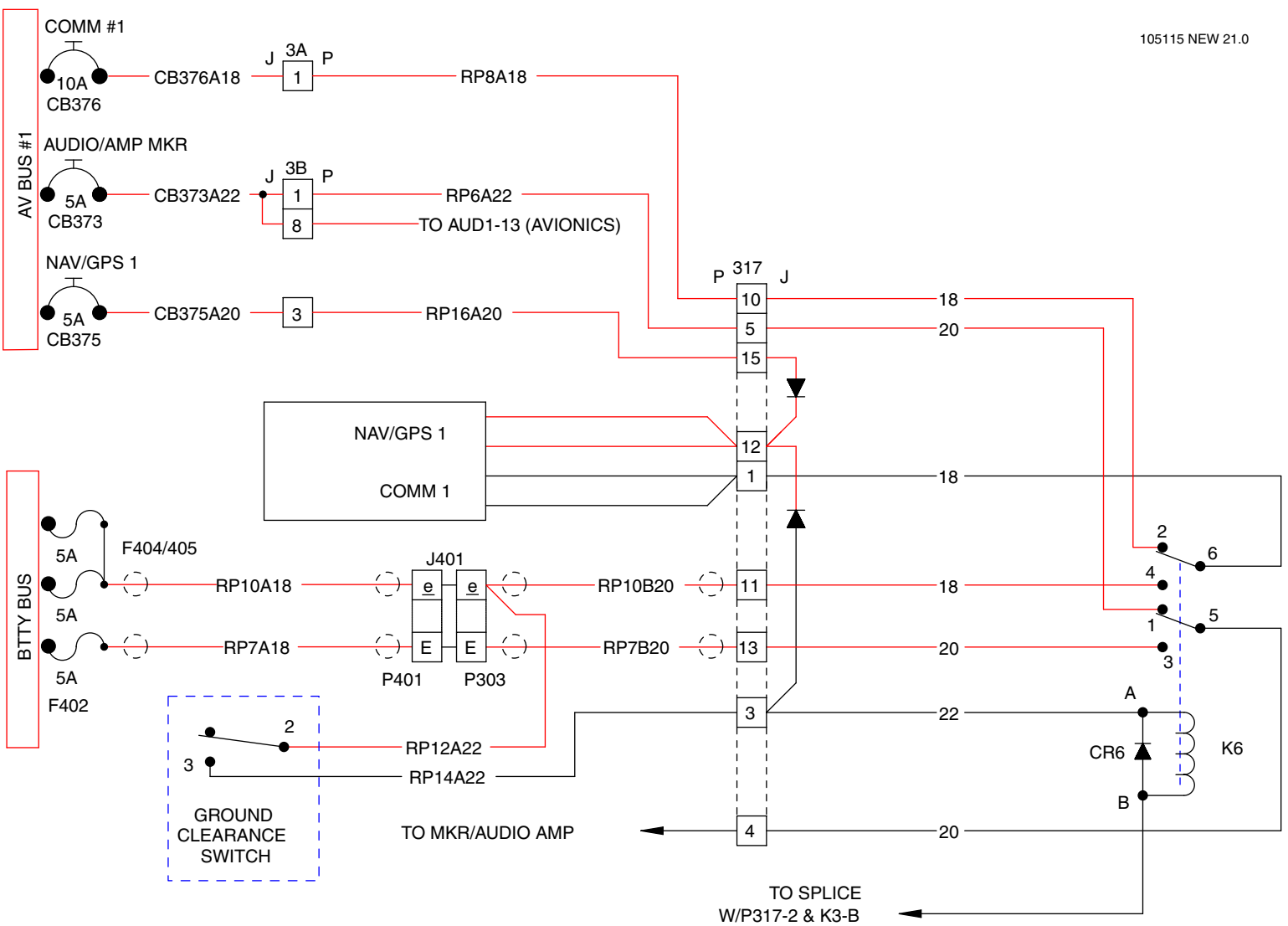
104051 C 35.0
104301 B/S

SEE
91-31-50,
FIGURE 1
(J317-2)



Ground Clearance
Figure 1 (Sheet 4 of 5)

Effectivity
4636248 thru 4636374



Ground Clearance
Figure 1 (Sheet 5 of 5)

Effectivity
4636375 and up

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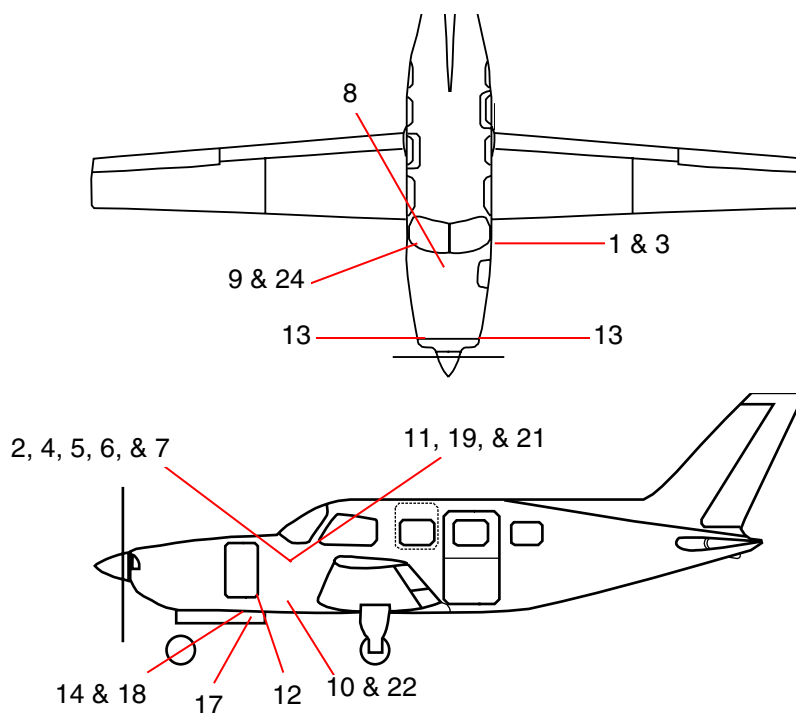
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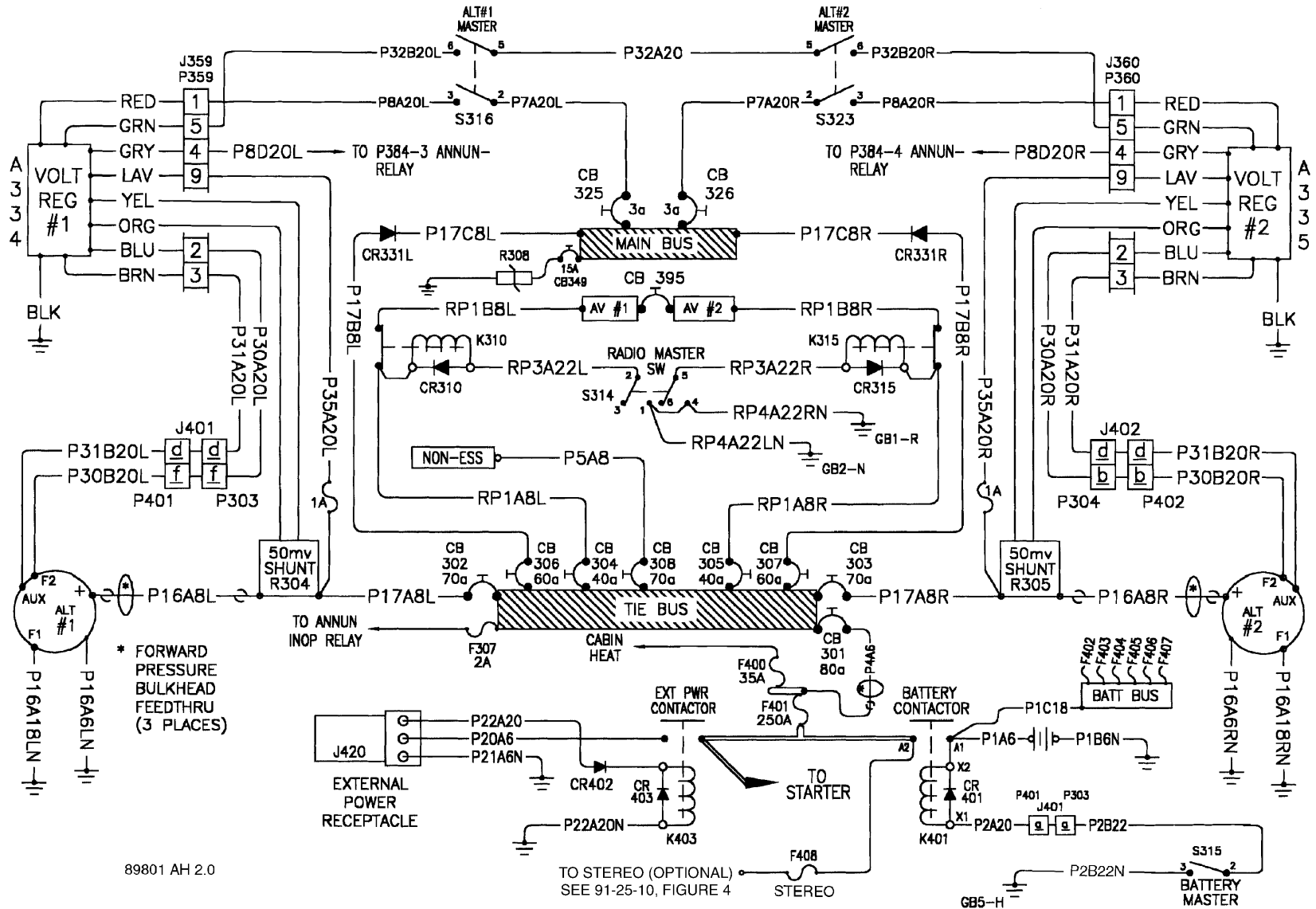
Item #	Designation	Description
1	CB325, CB326	Circuit Breaker (3 Amp or 5 Amp)
2	CB306, CB307	Circuit Breaker (60 Amp or 80 Amp)
3	CB349	Circuit Breaker (15 Amp)
4	CB302, CB303, CB308	Circuit Breaker (70 Amp or 80 Amp)
5	CB301	Circuit Breaker (80 Amp)
6	F408	Fuse (5 Amp)
7	CB304, CB305	Circuit Breaker (40 Amp)
8	S314	Radio Master Switch
9	K310, K315	Radio Master Contactor
10	A334, A335	Voltage Regulator
11		Day Night Switch
12	J420	External Power Receptacle
13		Alternator (1)
14	K403	External Power Contactor
15		(2)
16		(2)
17		Battery
18	K401	Battery Contactor
19	S315	Battery Switch
20		(2)
21	S316, S323	Alternator Switch
22	R304, R305	Shunt
23		(2)
24	CB395	Avionics Bus Tie Circuit Breaker (25 Amp)

(1) Alternators supplied by Textron Lycoming

(2) See Power Monitor and Meters



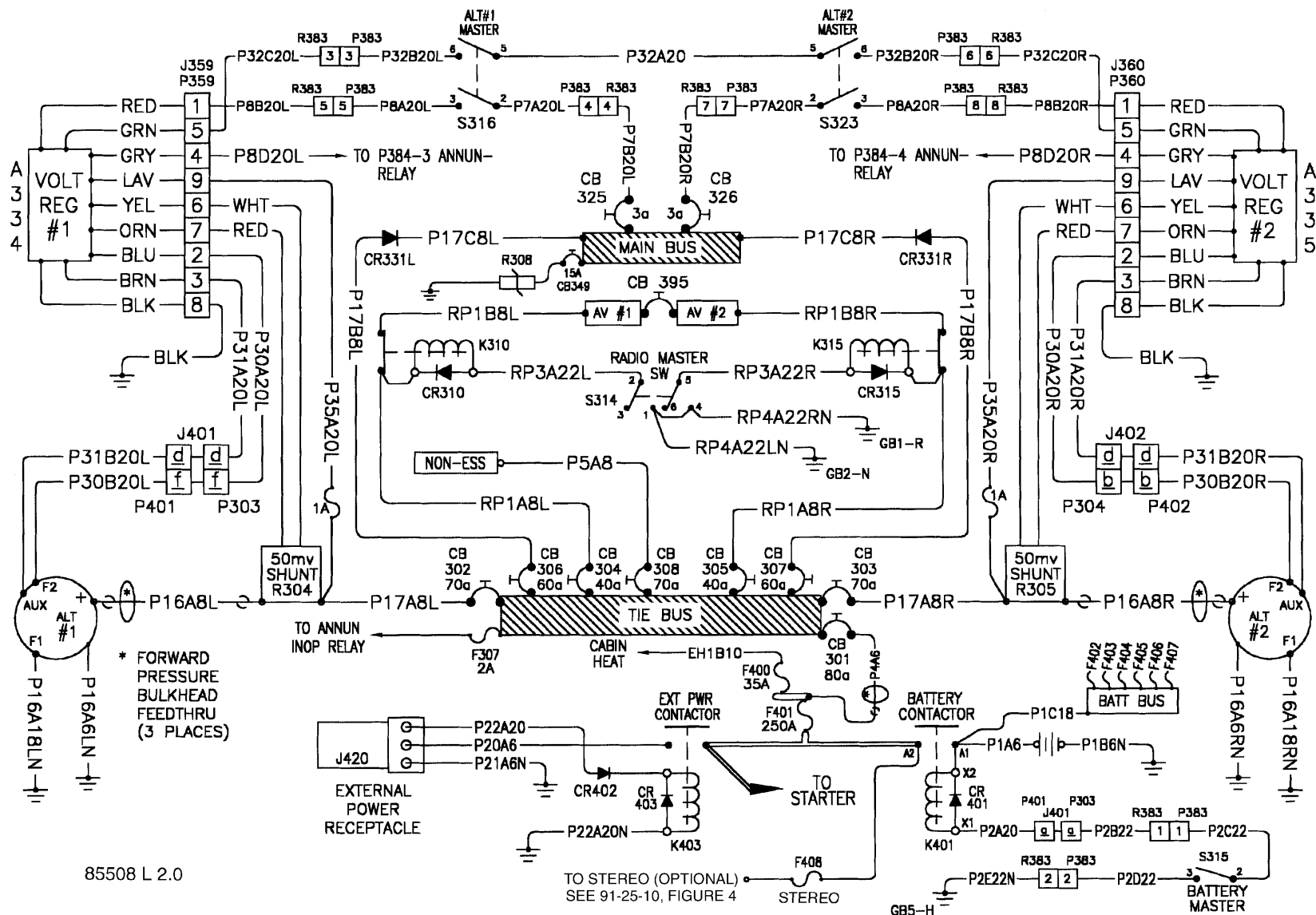
Power Distribution and Control
Figure 1 (Sheet 1 of 7)



SHOWN AFTER COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1017

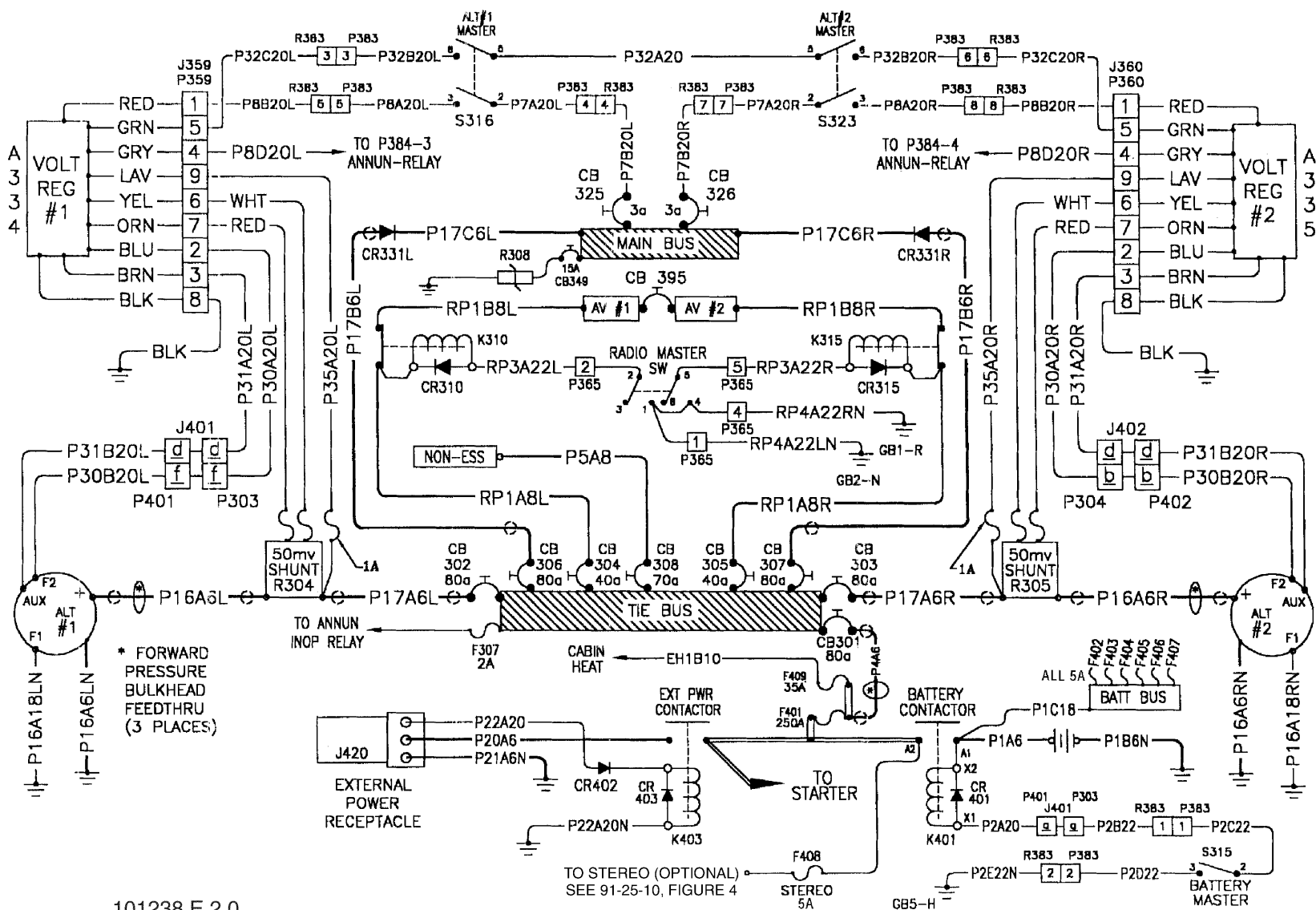
Effectivity
4636001 thru 4636020
Power Distribution and Control
Figure 1 (Sheet 2 of 7)

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MAINTENANCE MANUAL**



SHOWN AFTER COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1017

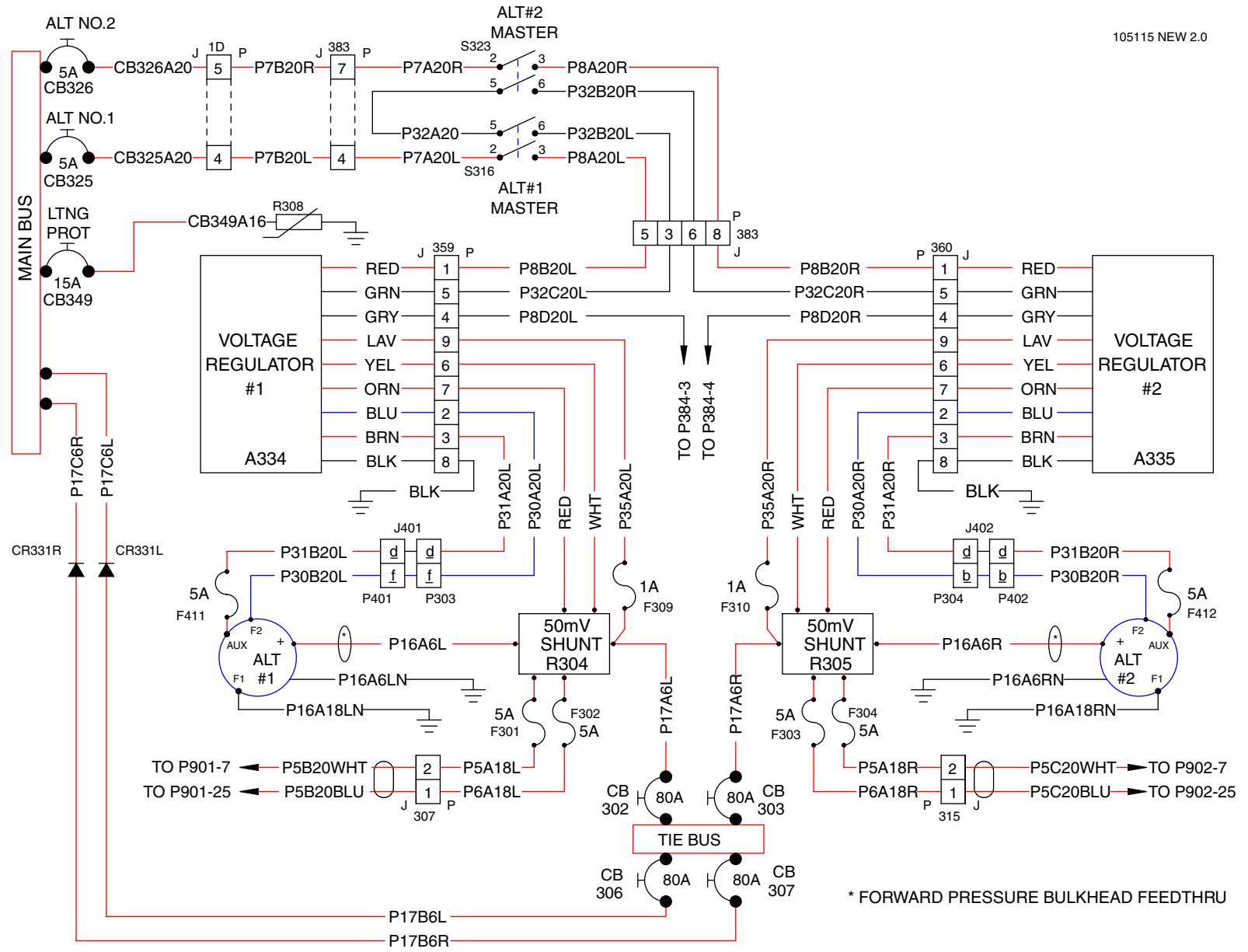
Power Distribution and Control
Figure 1 (Sheet 4 of 7)



101238 E 2.0

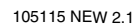


105115 NEW 2.0



* FORWARD PRESSURE BULKHEAD FEEDTHRU

Effectivity
4636375 and up
Power Distribution and Control
Figure 1 (Sheet 6 of 7)



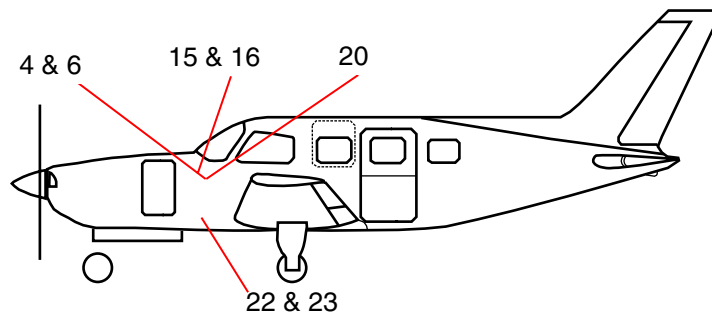
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Item #	Designation	Part Number	Description
1 - 3*			
4	CB302, CB303		Circuit Breaker (70 Amp or 80 Amp)
5*			
6	F408		Fuse (5 Amp)
7 - 14*			
15	M311, M312		Ammeters
16	M301		Volt Meter
17 - 19*			
20	K323		Day/Night (Bright Dim) Relay
21*			
22	R304, R305		Shunt
23	F301 - F304		Fuse (5 Amp)

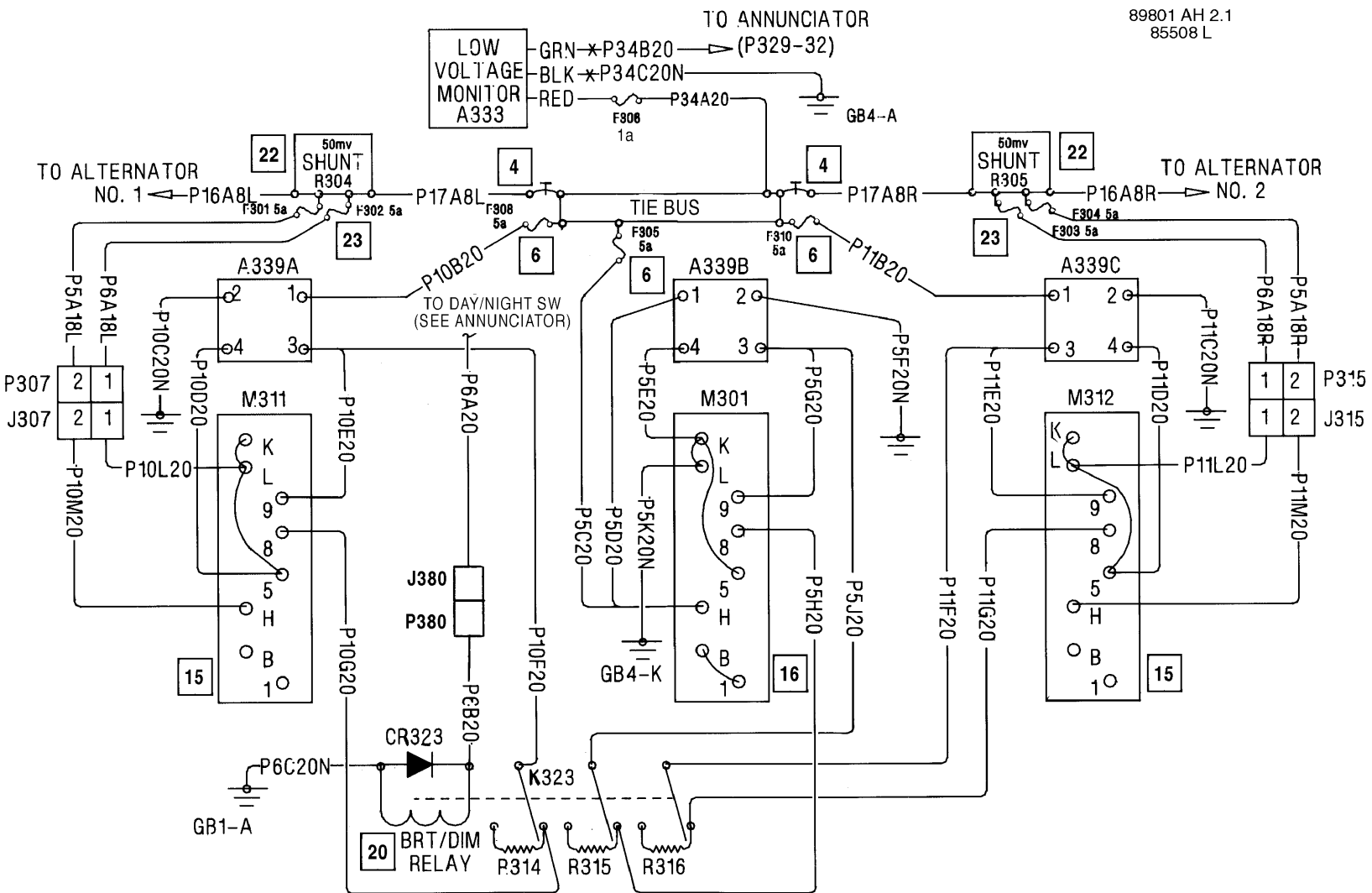
* See Power Distribution and Control



Power Monitor and Meters
Figure 2 (Sheet 1 of 4)

[Effectivity](#)
4636001 thru 4636131

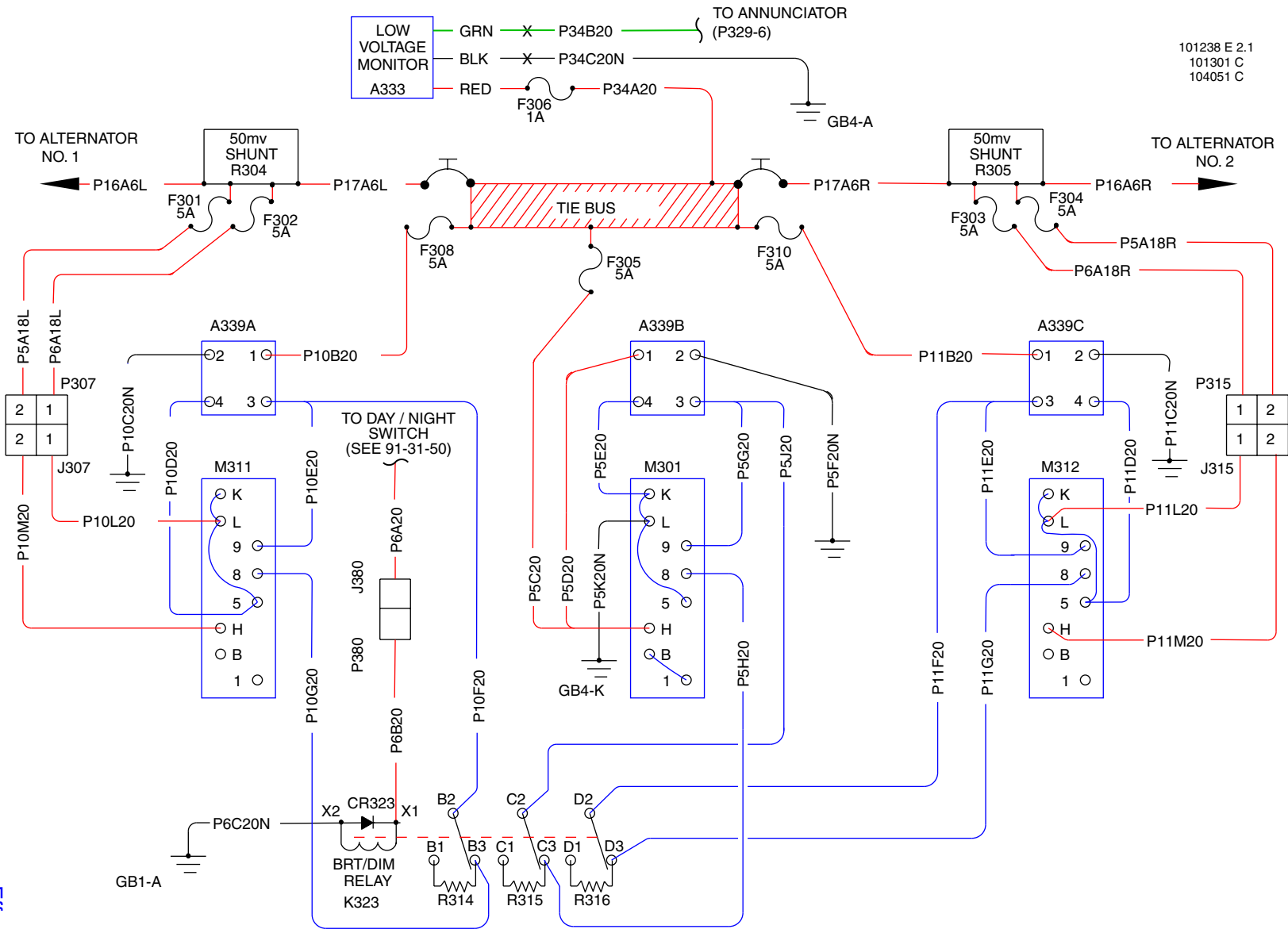
89801 AH 2.1
85508 L



Effectivity
4636001 thru 4636131

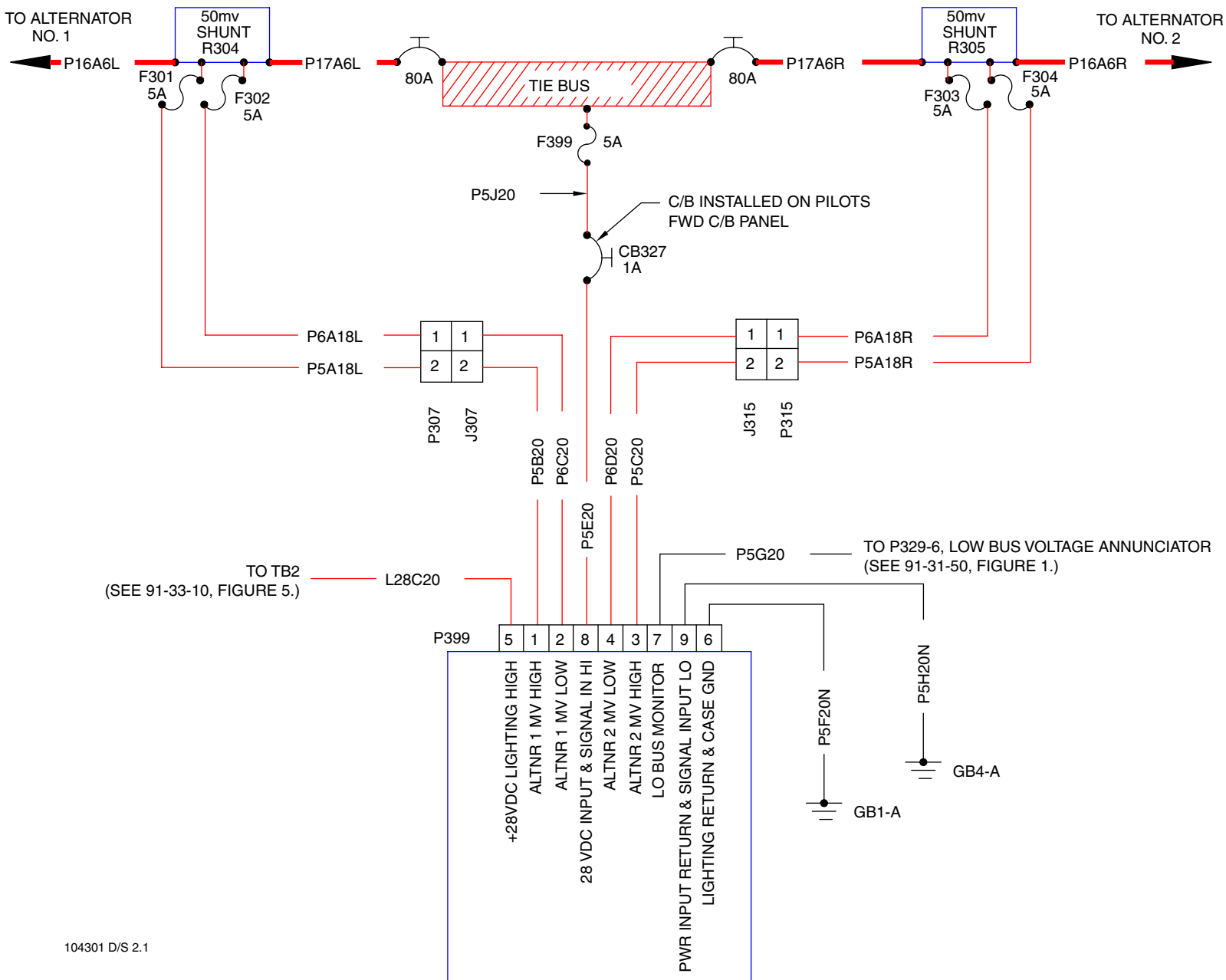
Power Monitor and Meters
Figure 2 (Sheet 2 of 4)

101238 E 2.1
101301 C
104051 C



Power Monitor and Meters
Figure 2 (Sheet 3 of 4)

Effectivity
4636001 thru 4636313,
less 4636299



104301 D/S 2.1

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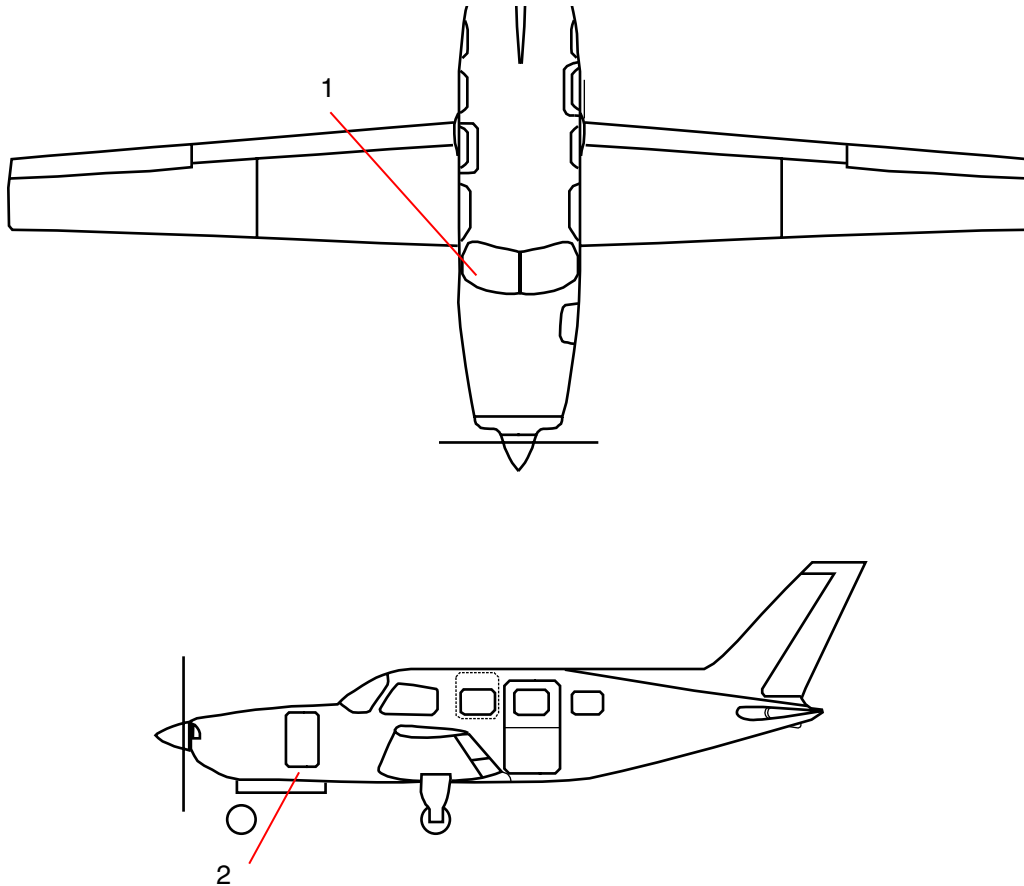
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	R307	Cigar Lighter (1) or
2	R307 F403	Power Point (2) 5 Amp Fuse

(1) - 4636001 thru 46360247 only

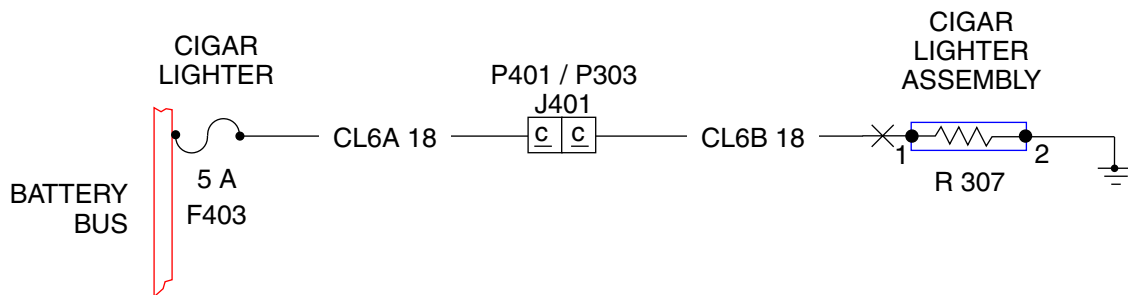
(2) - 4636248 and up



[Effectivity](#)
4636001 and up

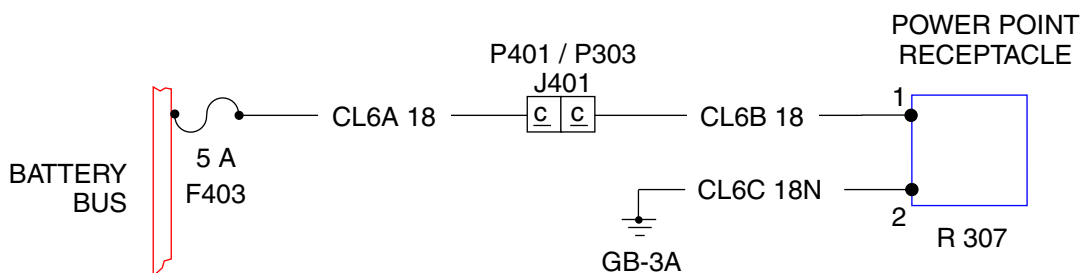
Cigar Lighter / Power Point
Figure 1 (Sheet 1 of 2)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



89801 AH 41.0
85508 L
101238 E 46.0
101301 C

S/N'S 4636001 THRU 4636247 ONLY



104051 C 46.0
104301 NEW/S

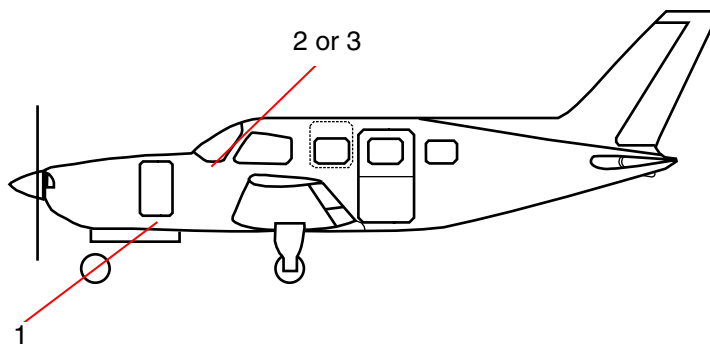
S/N'S 4636248 AND UP

Cigar Lighter / Power Point
Figure 1 (Sheet 2 of 2)

Effectivity
4636001 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	F406	5 Amp Fuse
2	LC-2	Digital Quartz Clock
3	LC-6	Digital Quartz Clock

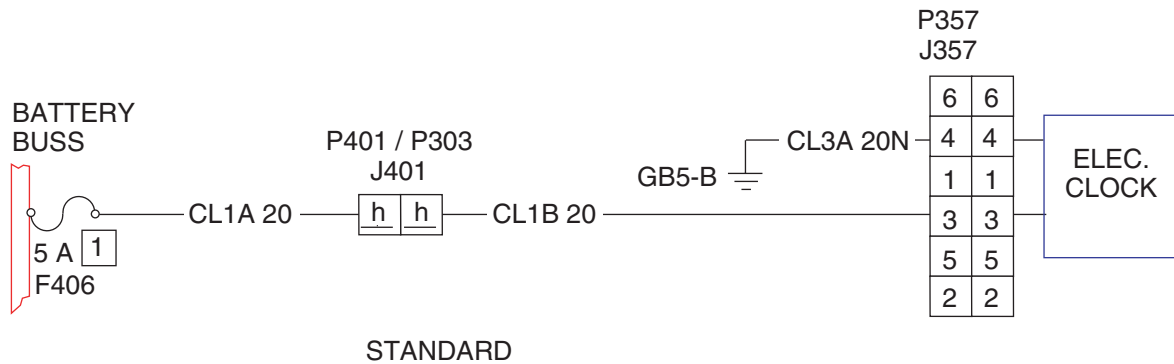


[Effectivity](#)
4636001 thru 4636020

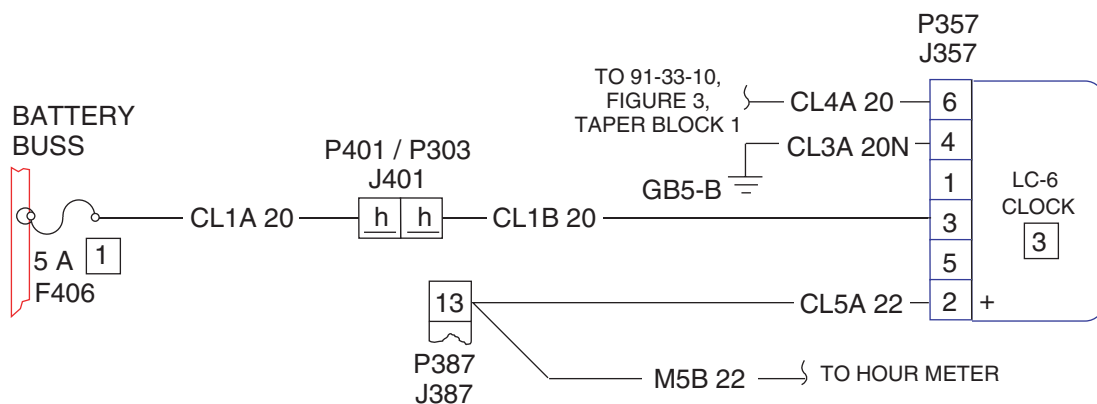
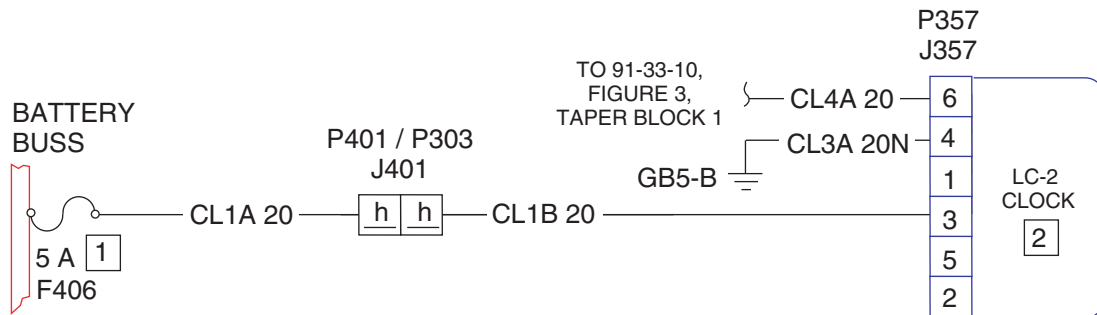
Electric and Digital Clocks
Figure 2 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

89801 AH 39.0/39.1



DIGITAL CLOCK (OPTIONAL)

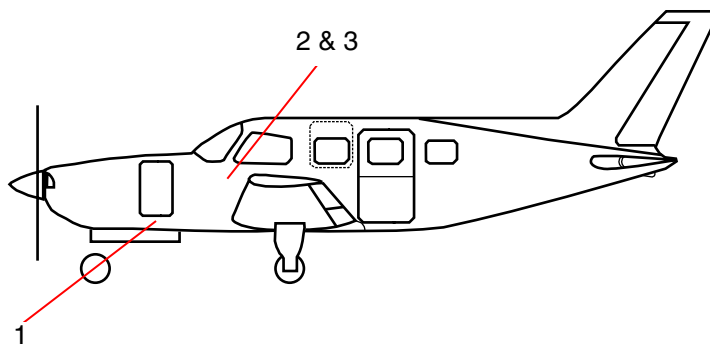


Electric and Digital Clocks
Figure 2 (Sheet 2 of 2)

[Effectivity](#)
4636001 thru 4636020

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	F406	Fuse (5 Amp)
2	CB394	Circuit Breaker (1.5 Amp)
3		Digital Quartz Clock

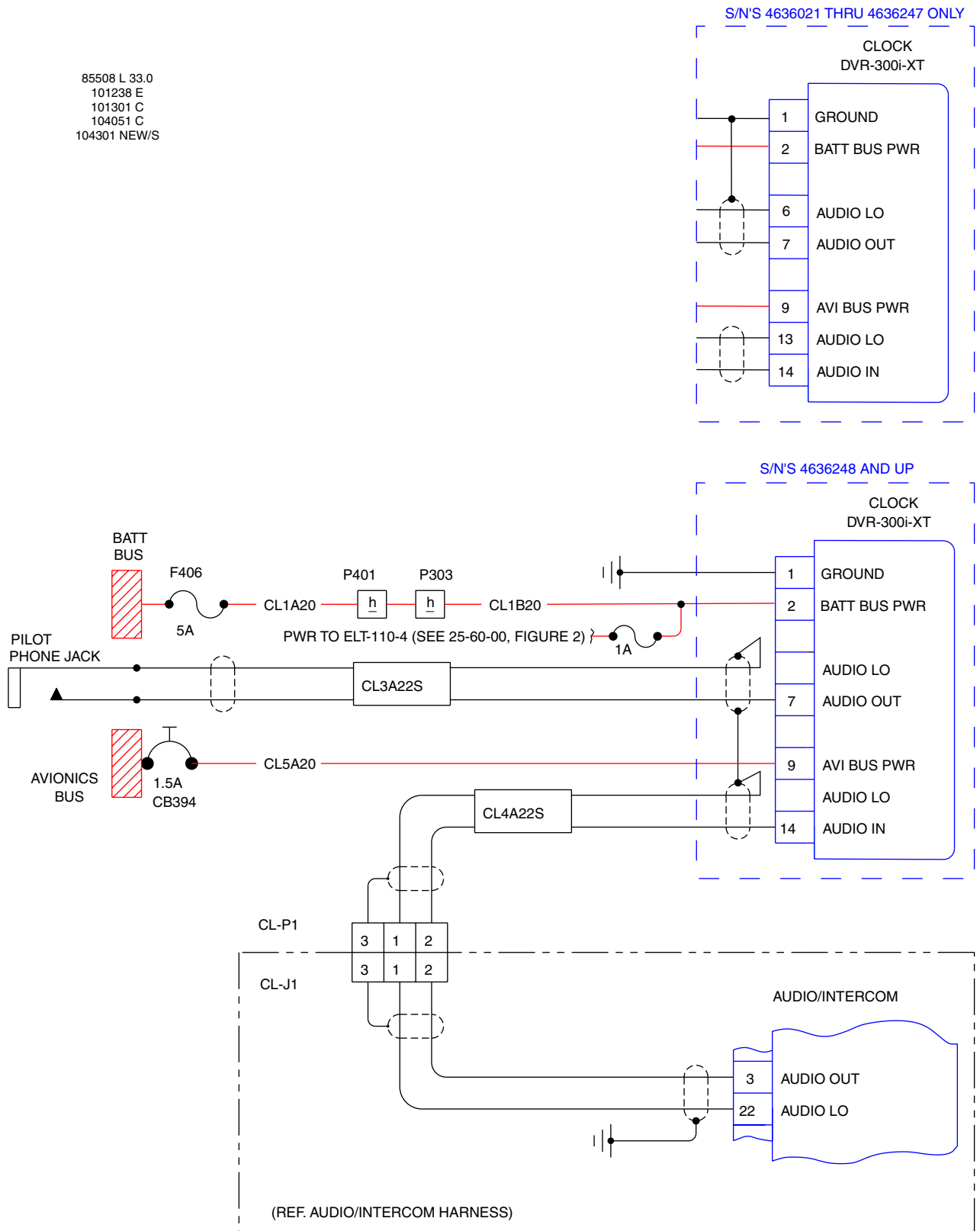


[Effectivity](#)
4636021 and up

Digital Voice Recorder Clock
Figure 3 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

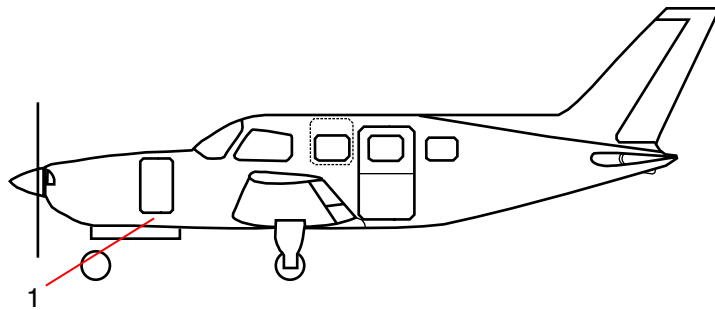
85508 L 33.0
101238 E
101301 C
104051 C
104301 NEW/S



[Effectivity](#)
4636021 and up

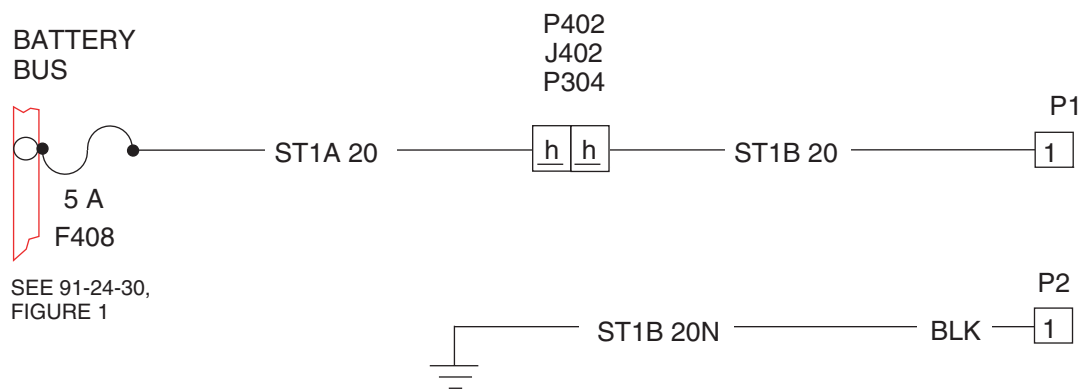
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	F408	5 Amp Fuse



Stereo (Optional)
Figure 4 (Sheet 1 of 4)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



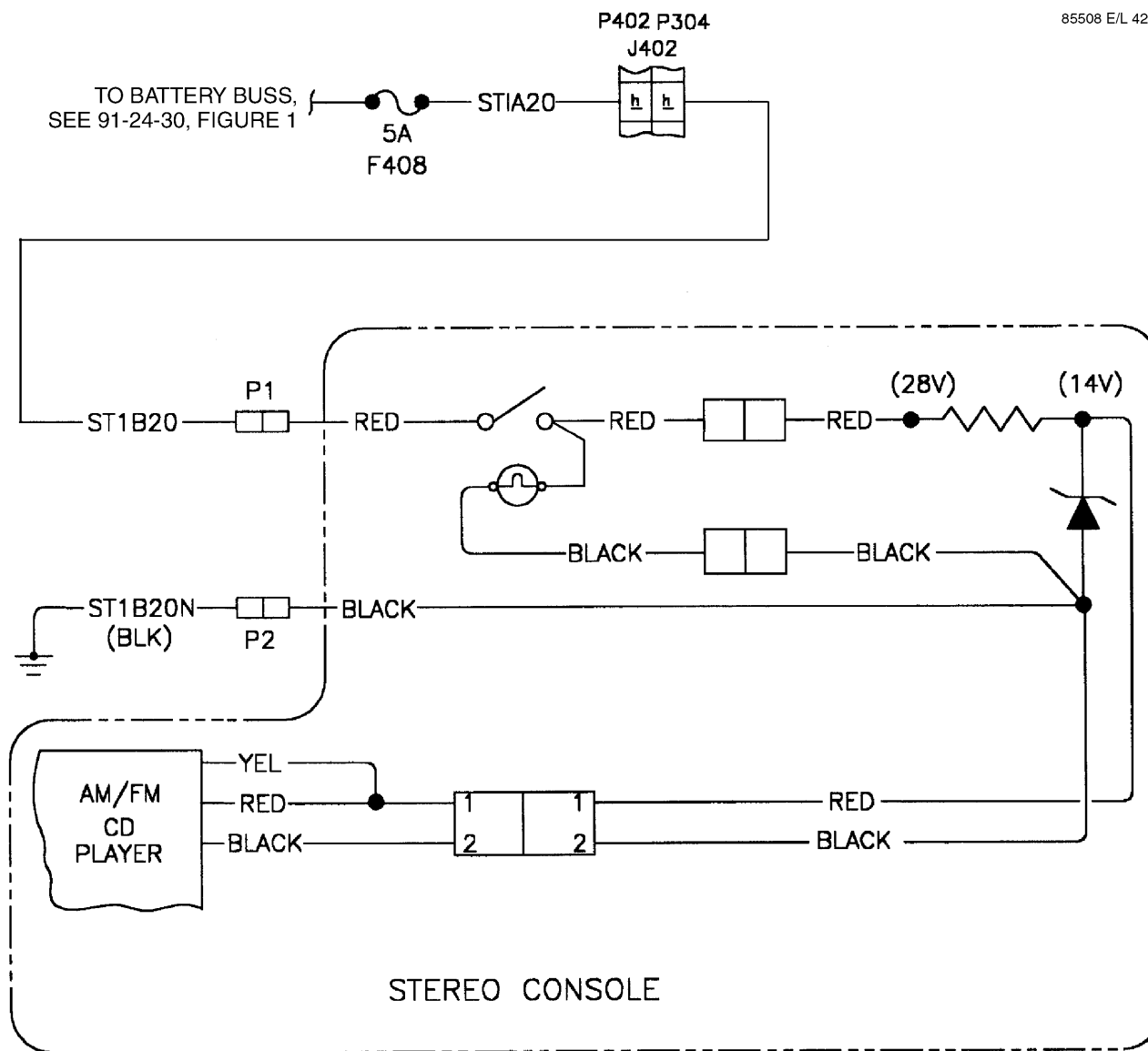
89801 AH 42.0

Stereo (Optional)
Figure 4 (Sheet 2 of 4)

[Effectivity](#)
[4636001 thru 4636020](#)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

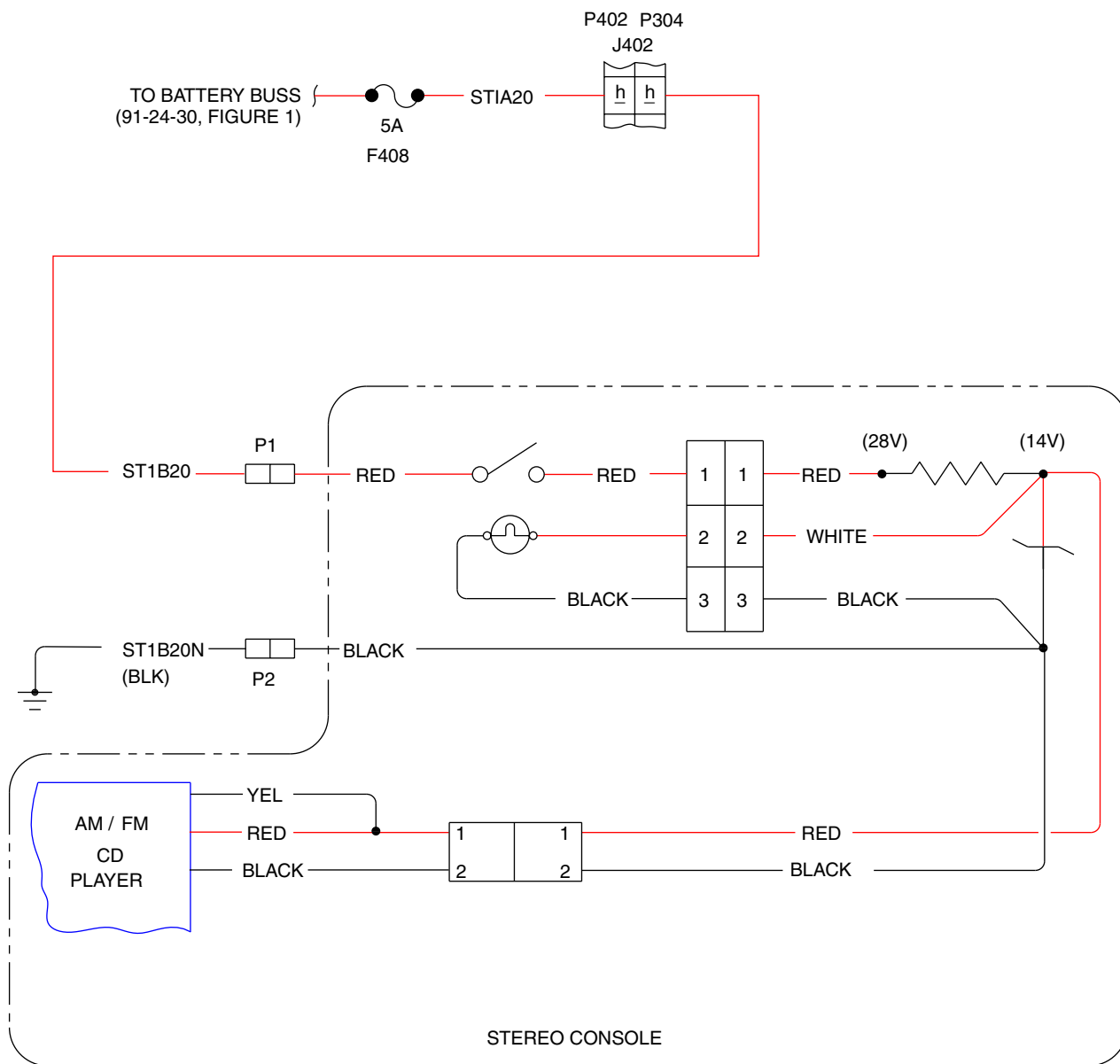
85508 E/L 42.0



Effectivity
4636021 thru 4636076

Stereo (Optional)
Figure 4 (Sheet 3 of 4)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



85508 L
101238 E 42.0
101301 C
104051 C
104301 NEW/S 41.0
105115 NEW 31.0

Stereo (Optional)
Figure 4 (Sheet 4 of 4)

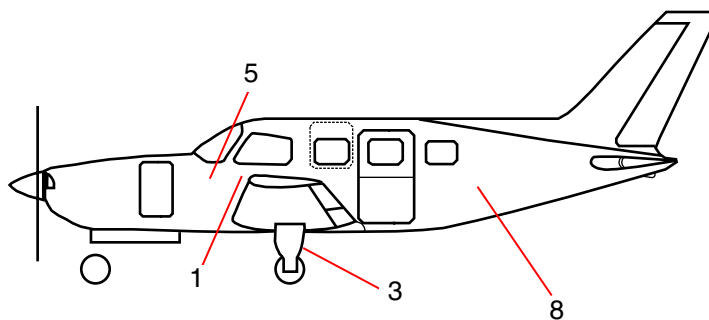
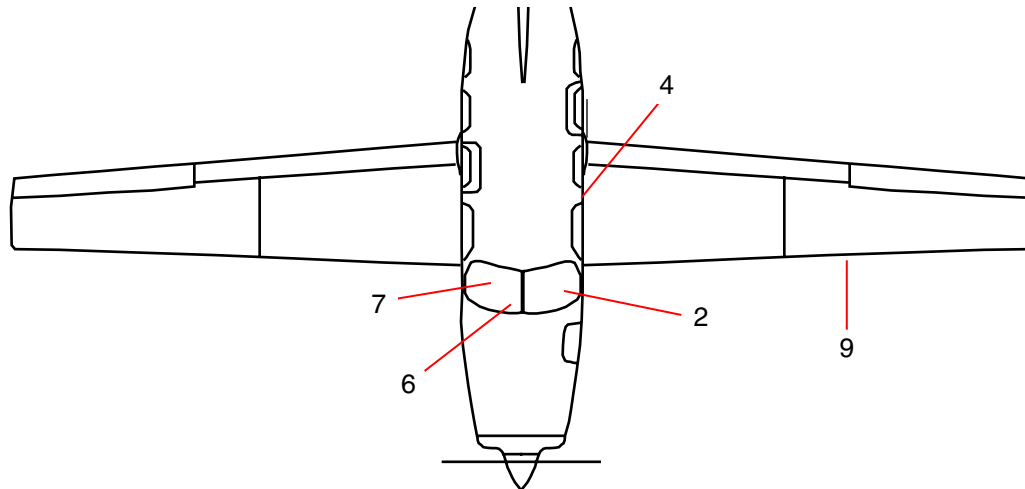
[Effectivity](#)
4636077 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

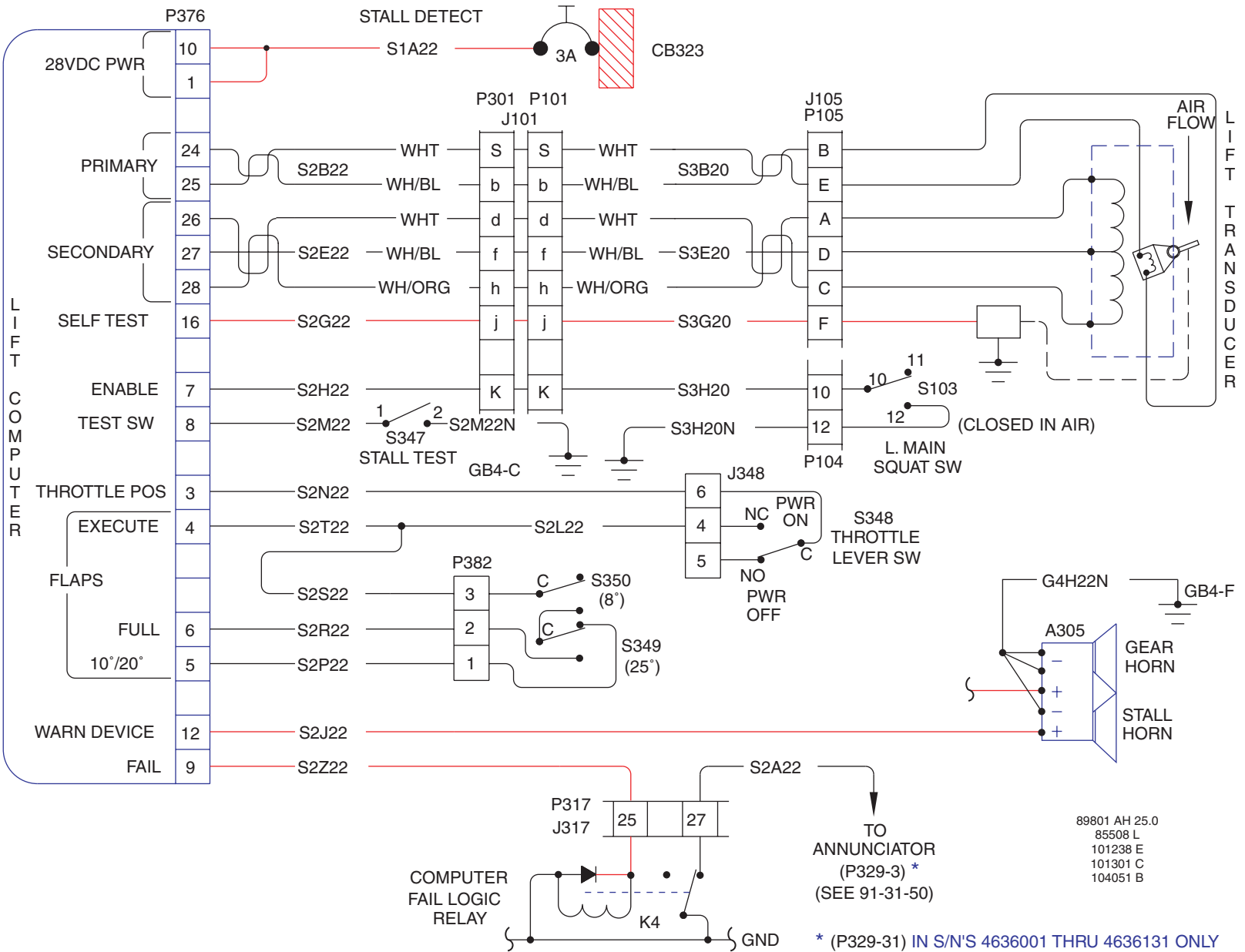
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	CB323	3 Amp Circuit Breaker
2	S347	Stall Test Switch
3	S103	Squat Switch Assembly
4	S349, S350	Actuator Switch (2 each)
5	S348	Throttle Lever Switch Assembly
6	A305	Horn - Dual Warn Unit
7	K4	Relay Assembly
8		Lift Computer
9		Lift Transducer



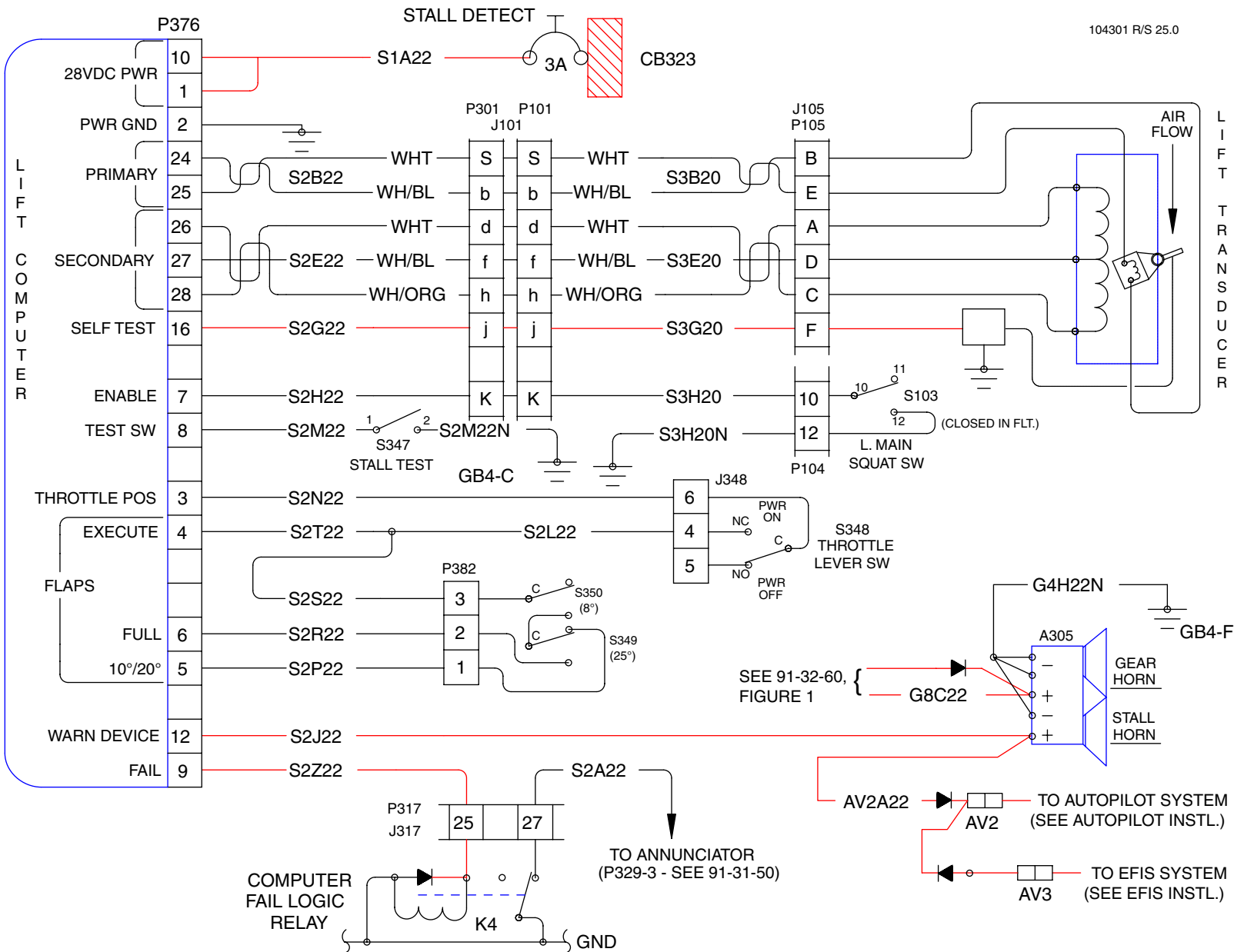
Stall Detection and Warning
Figure 1 (Sheet 1 of 4)



Effectivity
4636001 thru 4636131,
less 4636299

Stall Detection and Warning
Figure 1 (Sheet 2 of 4)

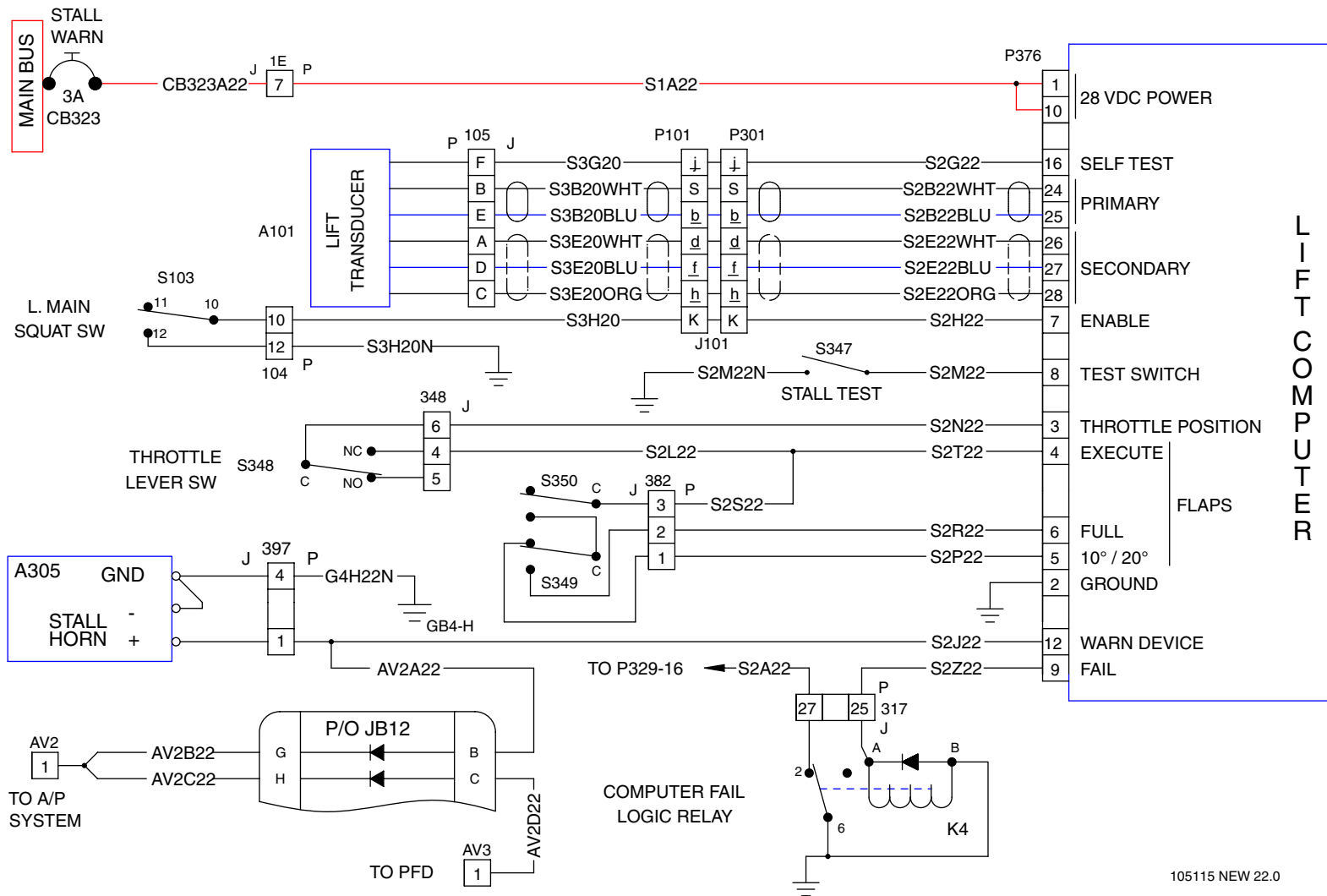
104301 R/S 25.0



Stall Detection and Warning
Figure 1 (Sheet 3 of 4)

Effectivity
4636299 and
4636314 thru 4636374

LIFT COMPUTER



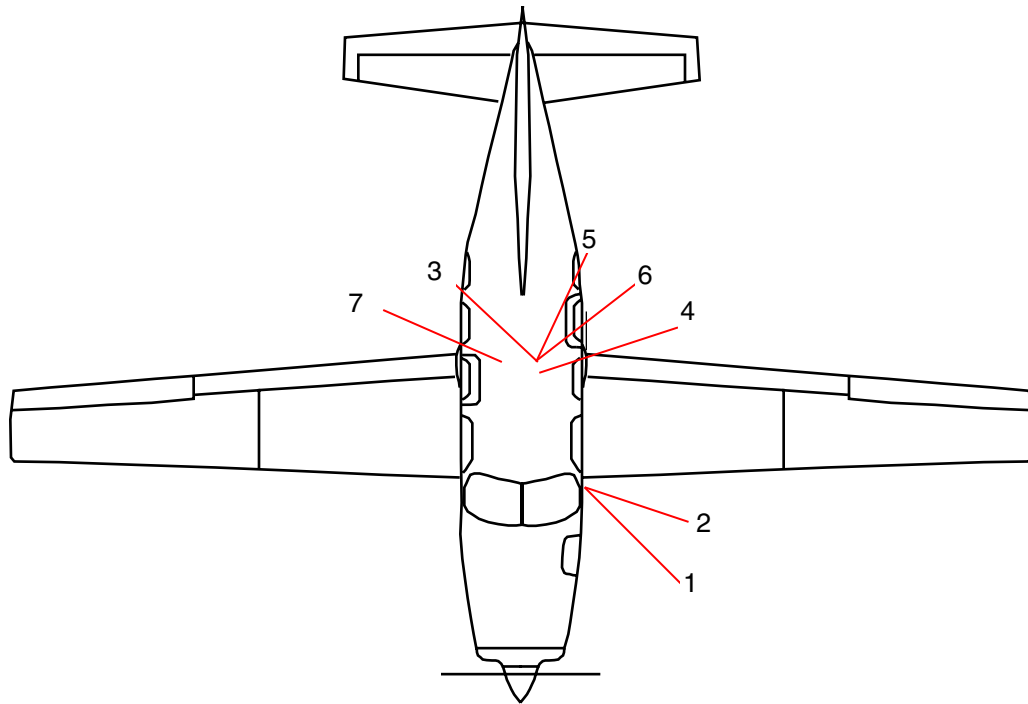
105115 NEW 22.0

Effectivity
4636375 and up

Stall Detection and Warning
Figure 1 (Sheet 4 of 4)

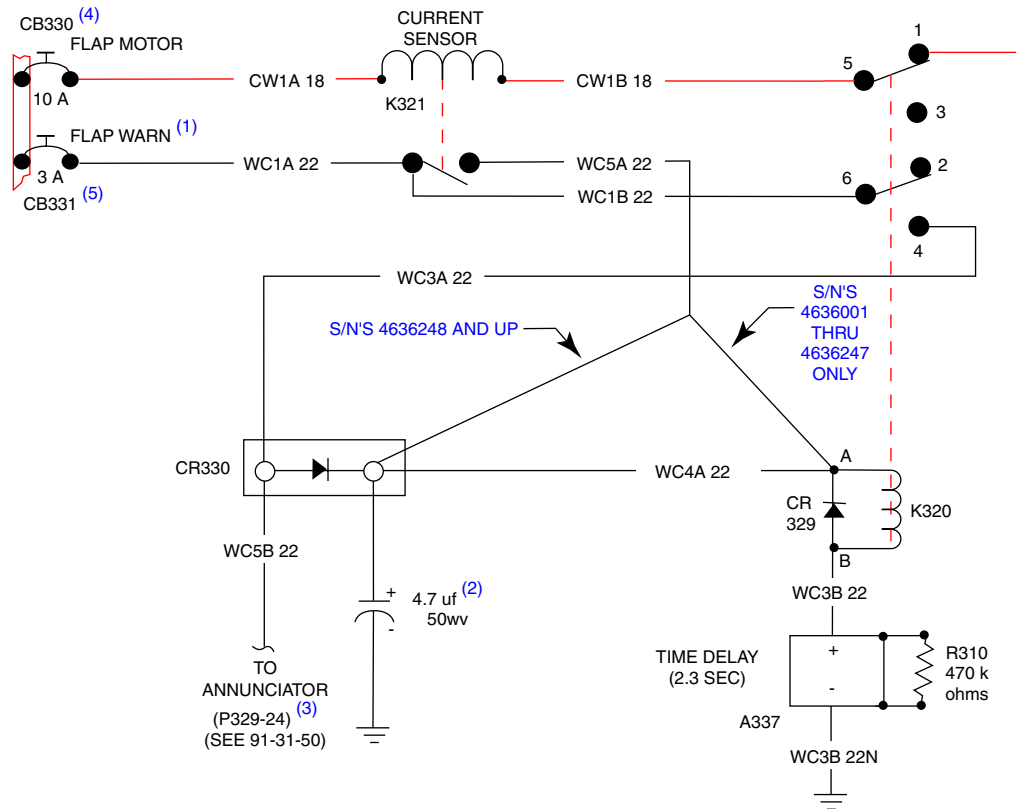
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	CB330	Circuit Breaker (10 Amp)
2	CB331	Circuit Breaker (3 Amp)
3	K321	Current Sensor
4	MT302	Actuator Motor Assembly
5	K320	Relay
6	A337	Time Delay Module
7	S340, S341	Flap Control Switch
	CR330	Diode Assembly
	R310	Resistor Assembly
		Capacitor Assembly

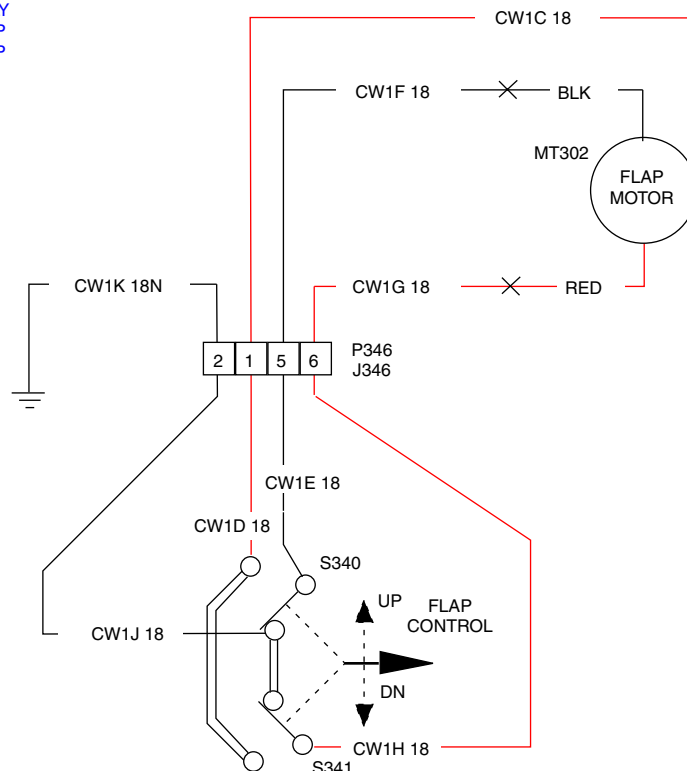


Electric Flaps
Figure 1 (Sheet 1 of 3)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



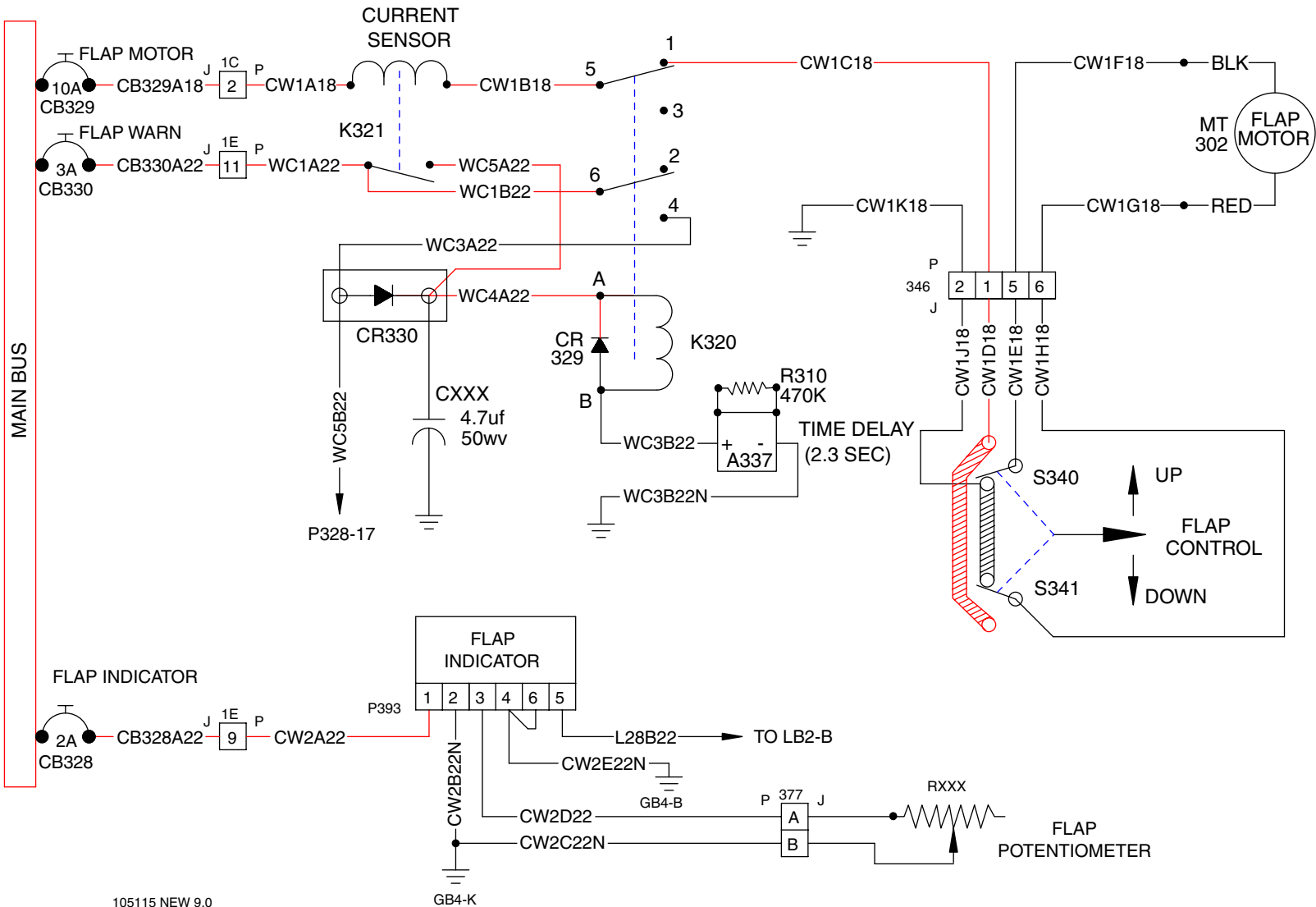
- (1) - "FLAP ANNUN." IN S/N'S 4636001 THRU 4636131 ONLY
- (2) - 5.0 uf IN S/N'S 4636001 THRU 4636020 ONLY
- (3) - (P328-9) IN S/N'S 4636001 THRU 4636131 ONLY
- (4) - CB330 IN S/N'S 4636299 AND 4636314 AND UP
- (5) - CB331 IN S/N'S 4636299 AND 4636314 AND UP



89801 AH 11.0
85508 L
101238 E
101301 C
104051 C
104301 NEW/S

Effectivity
4636001 thru 4636374

Electric Flaps
Figure 1 (Sheet 2 of 3)



Electric Flaps
Figure 1 (Sheet 3 of 3)

Effectivity
4636375 and up

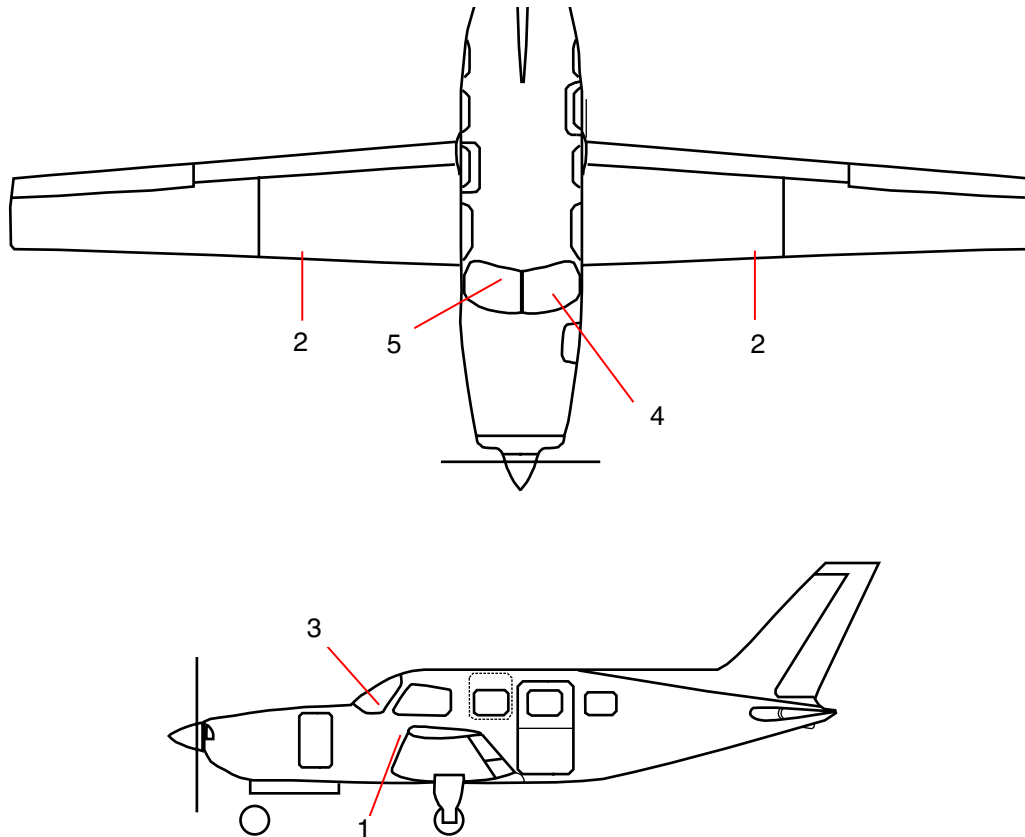
105115 NEW 9.0

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

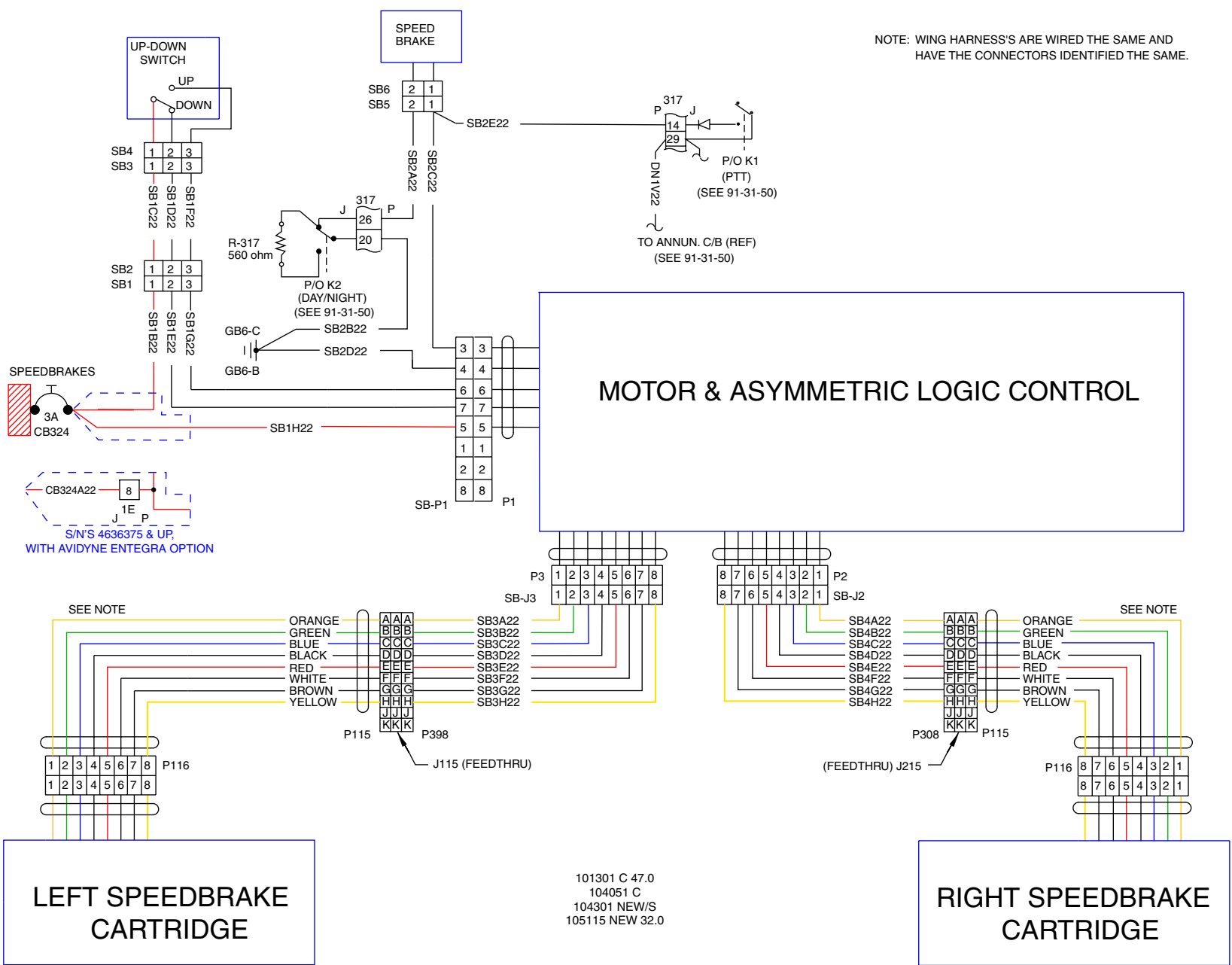
Item #	Designation	Description
1	CB324	Circuit Breaker (3 Amp)
2		SpeedBrake Cartridge(s)
3		Up/Down Switch (on yoke)
4		Annunciator Light
5		Asymmetric Logic Switching Unit



SpeedBrakes
Figure 1 (Sheet 1 of 2)

[Effectivity
4636187 and up](#)

NOTE: WING HARNESS'S ARE WIRED THE SAME AND HAVE THE CONNECTORS IDENTIFIED THE SAME.



101301 C 47.0
104051 C
104301 NEW/S
105115 NEW 32.0

Effectivity
4636187 and up
Speed Brakes
Figure 1 (Sheet 2 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

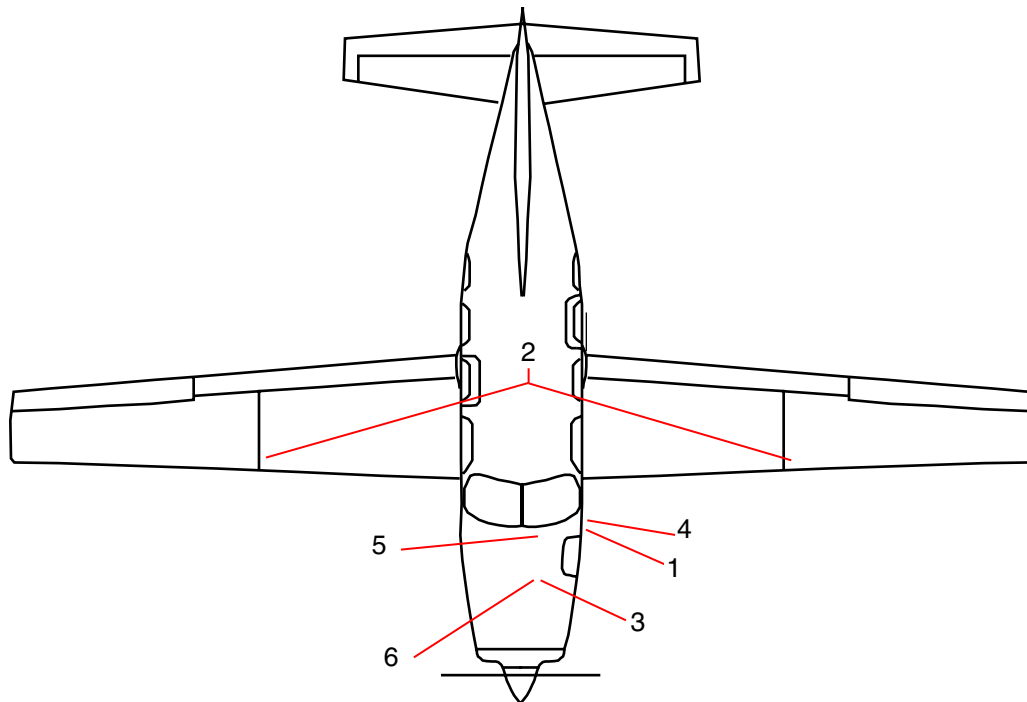
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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

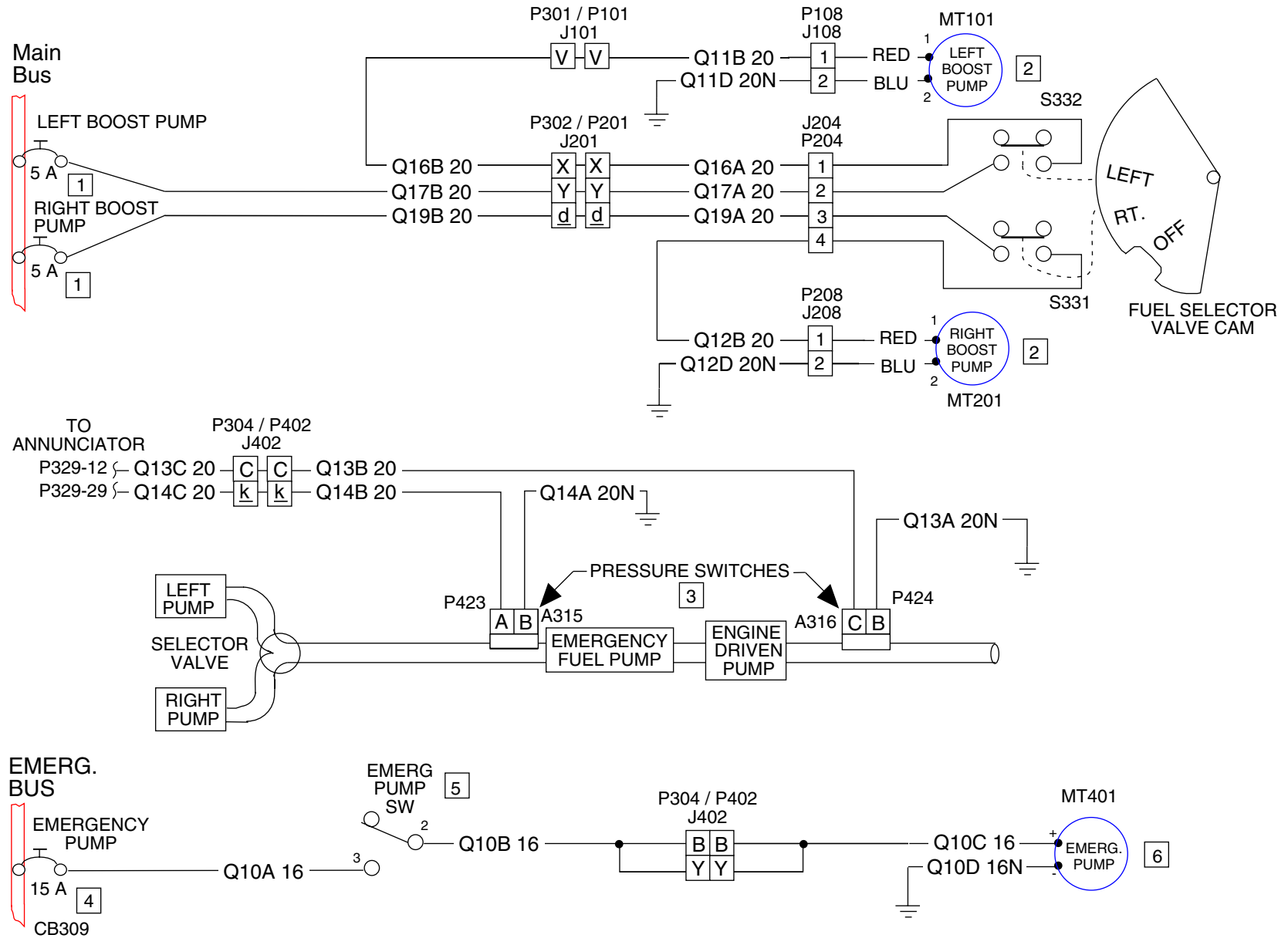
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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

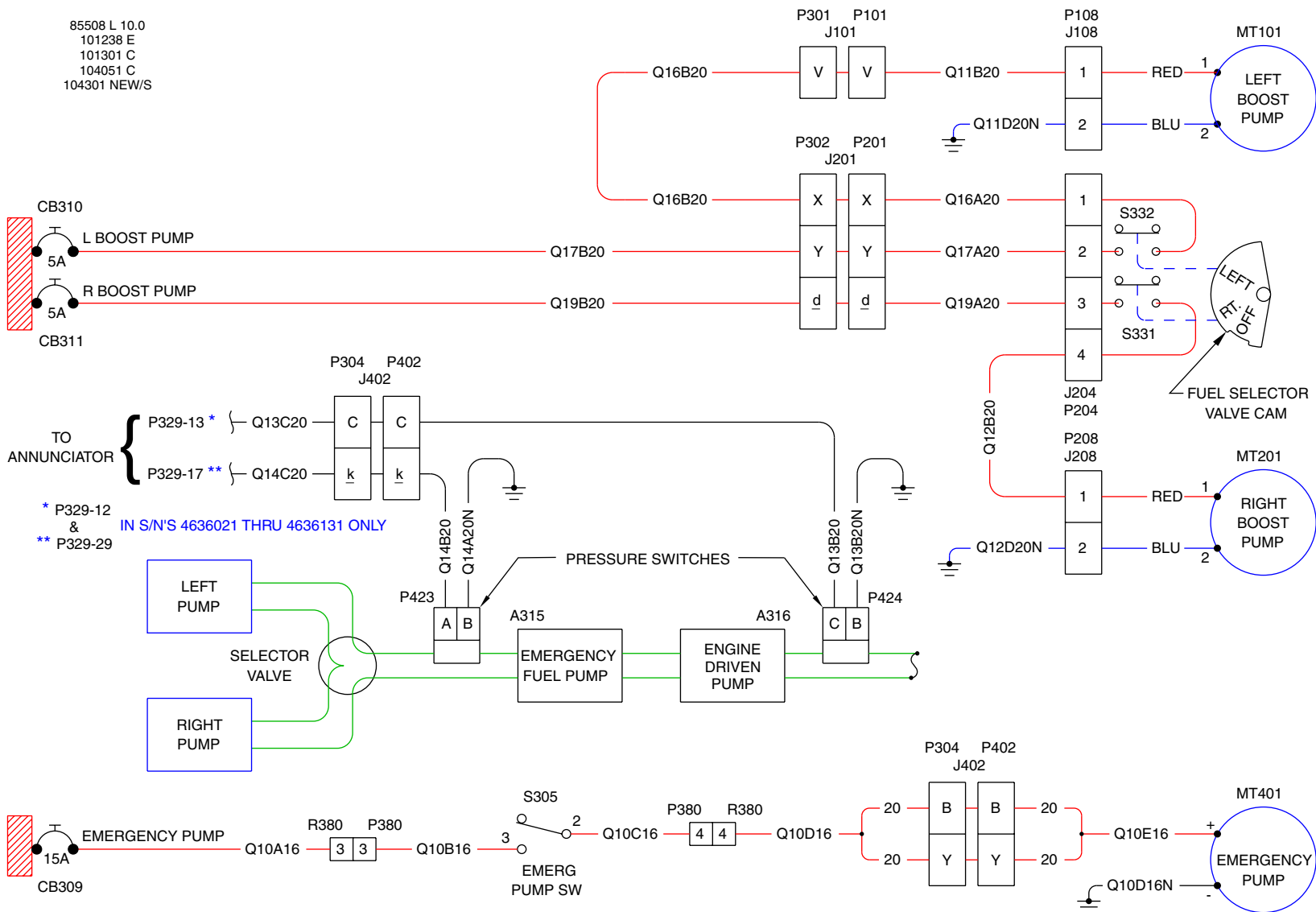
Item #	Designation	Description
1	CB310, CB311	Circuit Breaker (5 Amp)
2	MT101, MT201	Fuel Pump
3	A315, A316	Fuel Pressure Switch
4	CB309	Circuit Breaker (15 Amp)
5	S305	Emergency Fuel Pump Switch
6	MT401	Emergency Fuel Pump



Fuel Pumps
Figure 1 (Sheet 1 of 4)

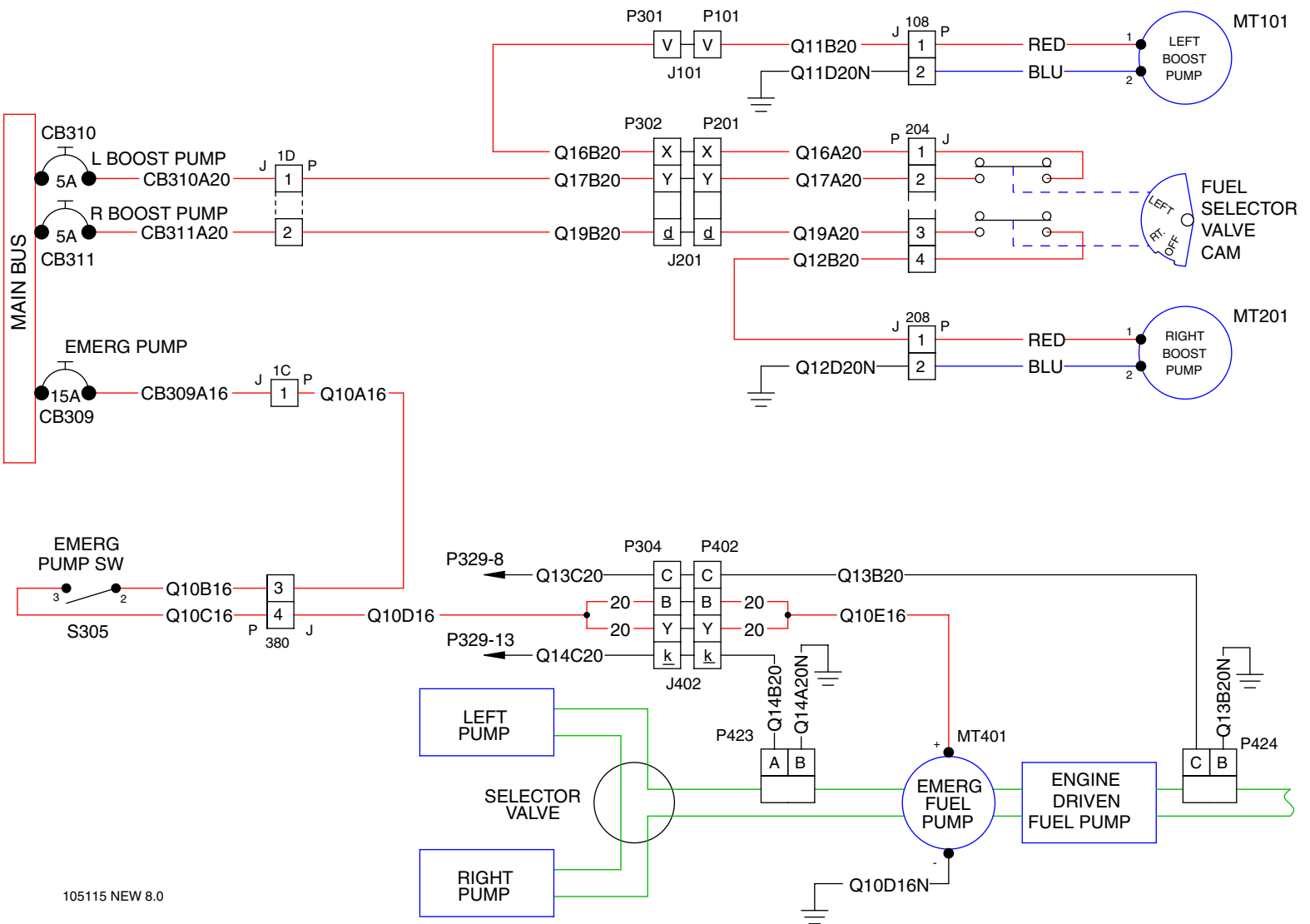


Effectivity 4636001 thru 4636020
Fuel Pumps
Figure 1 (Sheet 2 of 4)



Fuel Pumps
Figure 1 (Sheet 3 of 4)

Effectivity
4636021 thru 4636374



105115 NEW 8.0

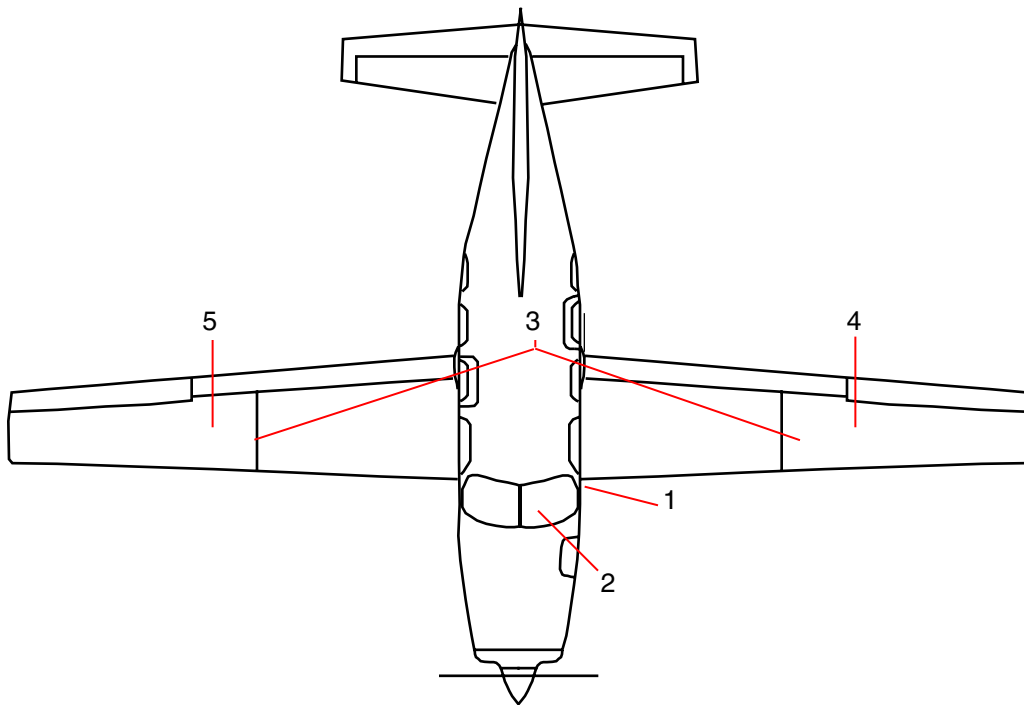
Effectivity
4636375 and up
Fuel Pumps
Figure 1 (Sheet 4 of 4)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB312 *	Circuit Breaker (3 Amp)
	or	
	CB372	Circuit Breaker (3 Amp)
2	M305	Dual Fuel Indicator
3		Inboard Fuel Quantity Senders
4		Outboard Fuel Quantity Sender, Left
5		Outboard Fuel Quantity Sender, Right

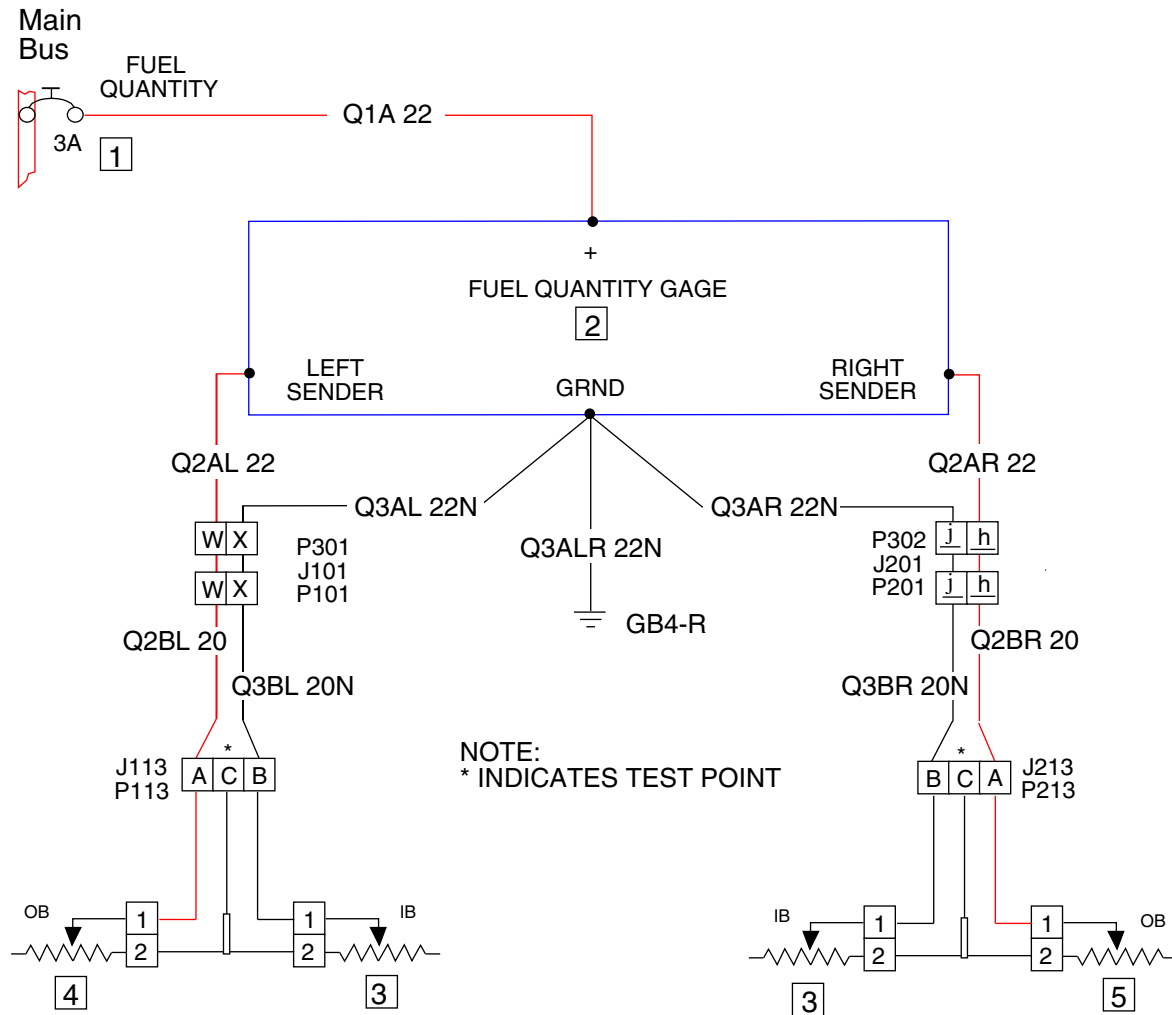
* S/N's 4636001 thru 4636020 only

In S/N's 4636375 and up, see 91-77-40, Figure 7, Sheet 3.



Fuel Quantity Indicator
Figure 1 (Sheet 1 of 3)

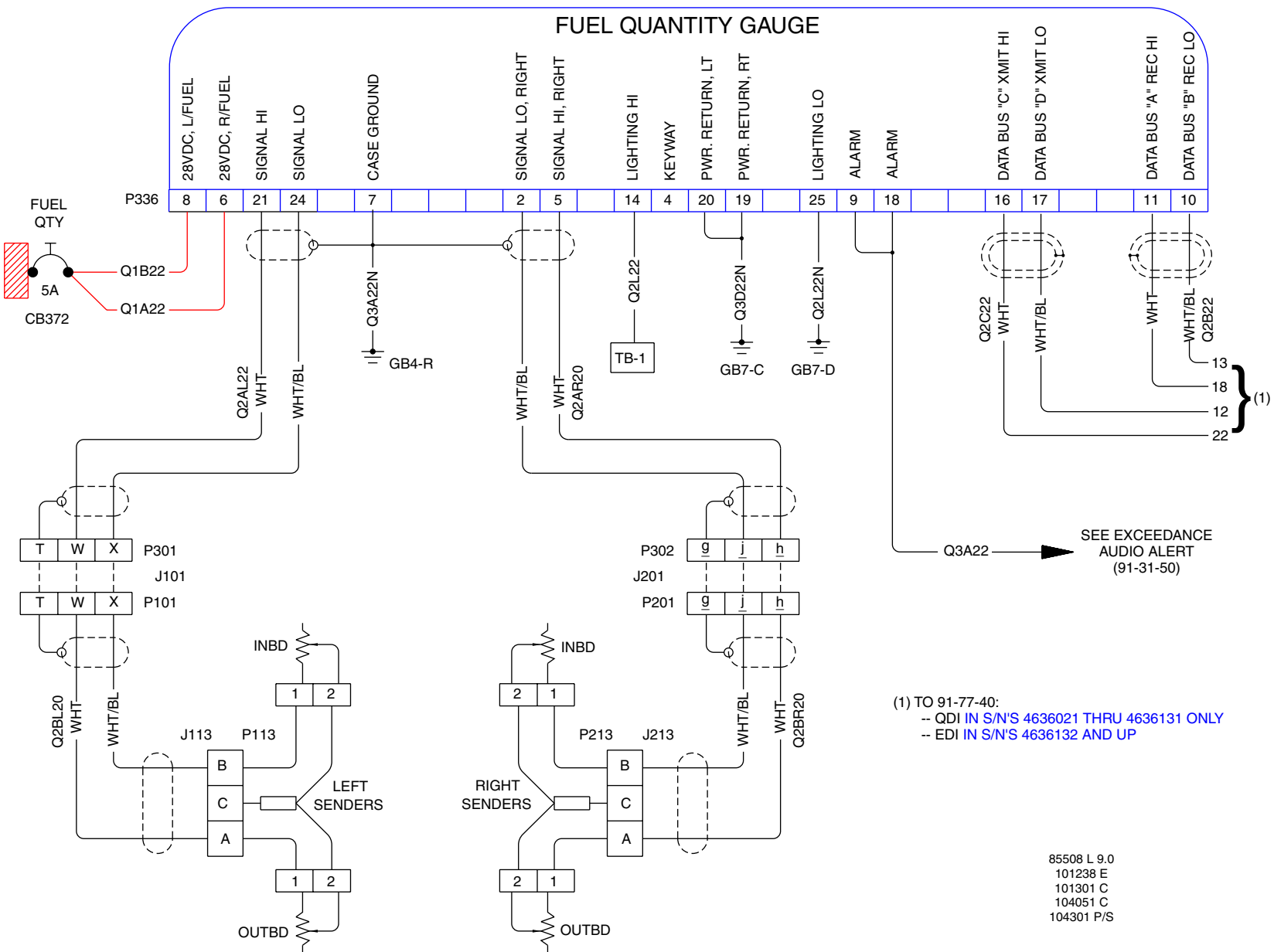
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



89801 AH 9.0

[Effectivity](#)
4636001 thru 4636020

Fuel Quantity Indicator
Figure 1 (Sheet 2 of 3)



Fuel Quantity Indicator
Figure 1 (Sheet 3 of 3)

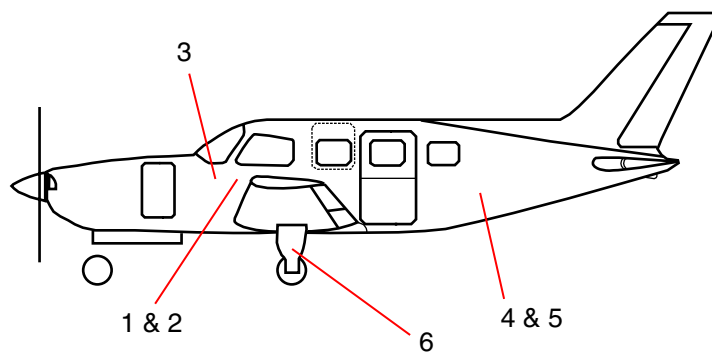
Effectivity
4636021 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

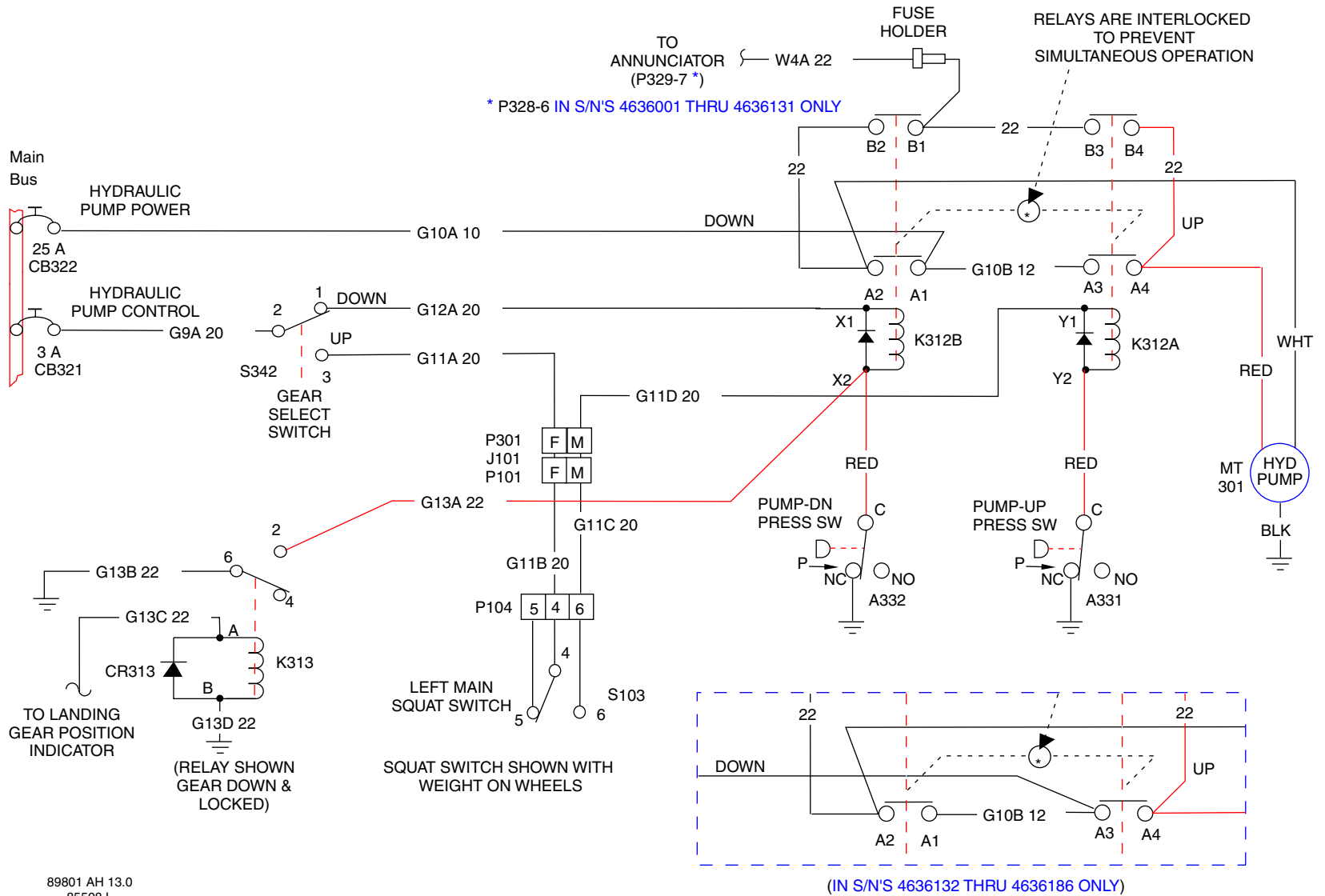
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	CB322	Circuit Breaker (25 Amp)
2	CB321	Circuit Breaker (3 Amp)
3	S342	Gear Selector Switch
4	A332, A331	Pressure Switch Assembly
5	MT301	Hydraulic Pump
6	S103	Squat Switch Assembly

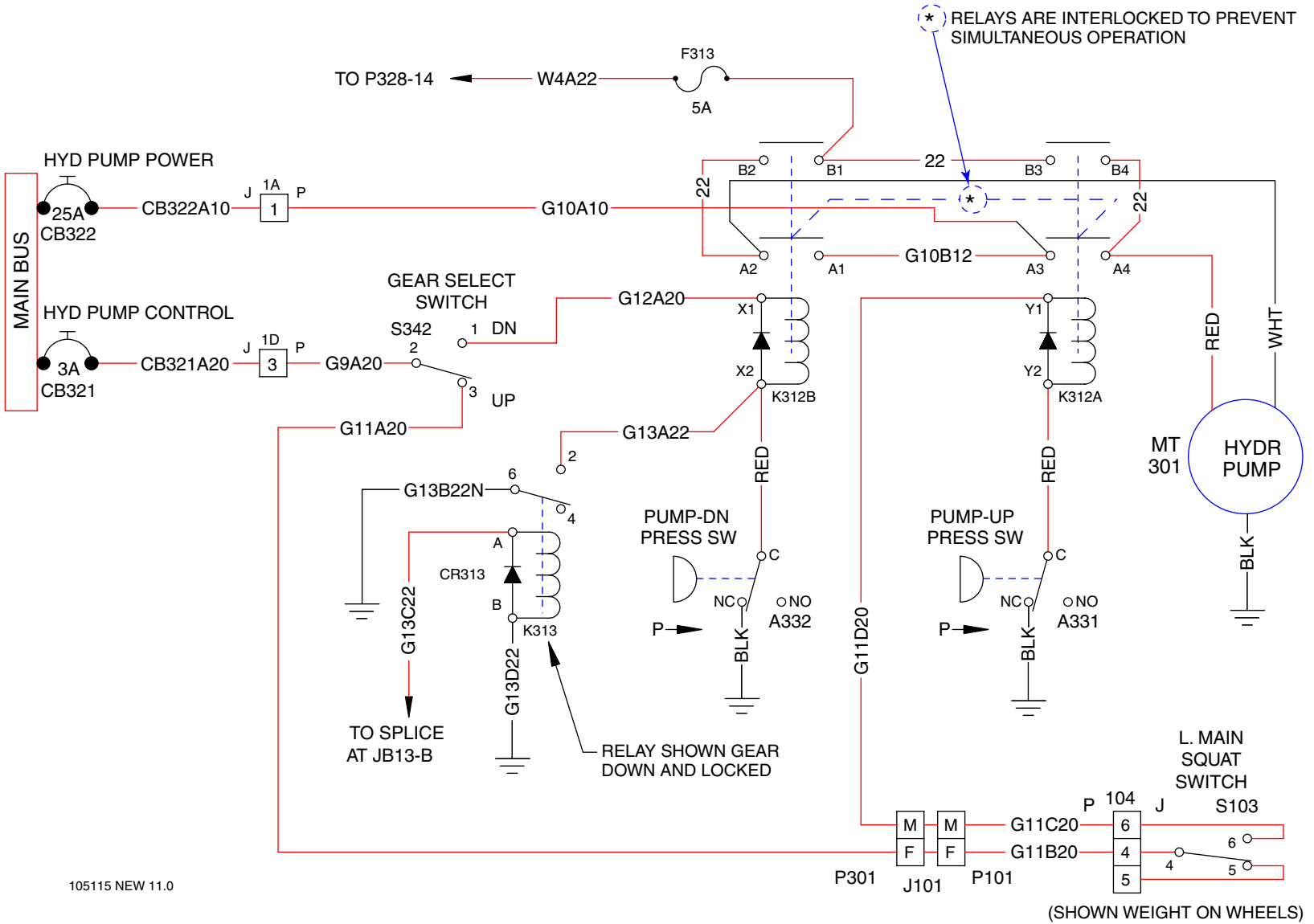


Hydraulic Pump
Figure 1 (Sheet 1 of 3)



89801 AH 13.0
85508 L
101238 E
101301 C
104051 C
104301 NEW/S

Effectivity
4636001 thru 4636374
Hydraulic Pump
Figure 1 (Sheet 2 of 3)



105115 NEW 11.0

Hydraulic Pump
Figure 1 (Sheet 3 of 3)

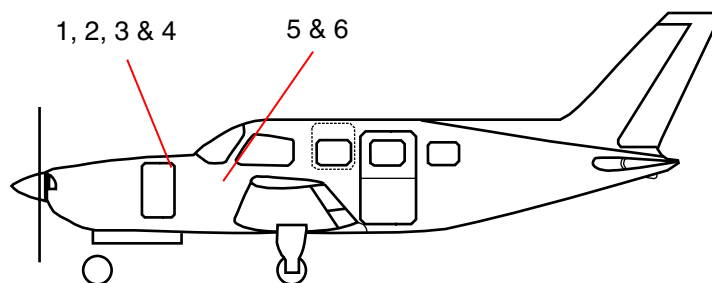
Effectivity
4636375 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

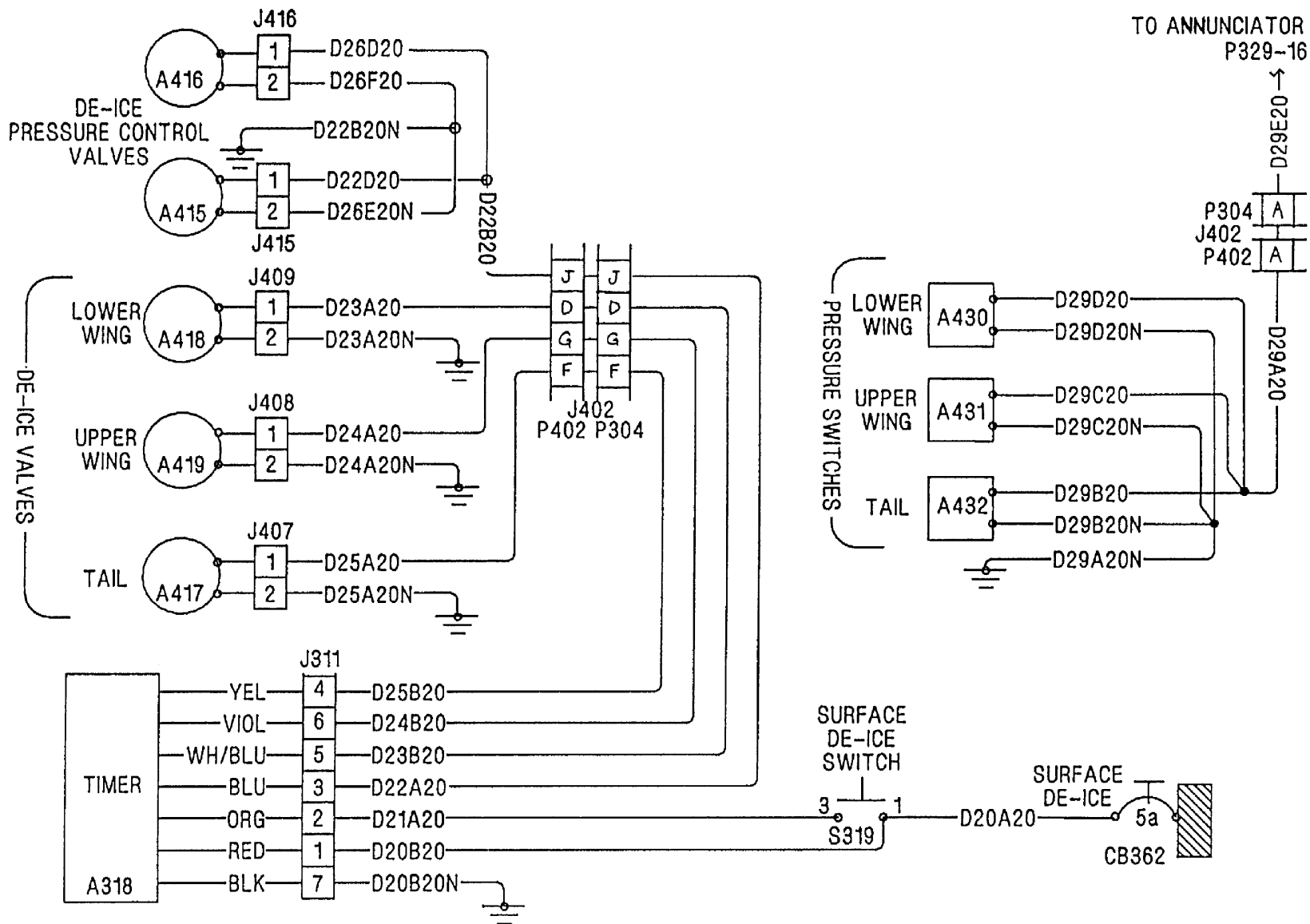
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	A318	Timer Assembly
2	A415, A416	Pressure Control Valve
3	A417, A418, A419	De-Ice Valve
4	A430, A431, A432	Pressure Switch
5	CB362	Circuit Breaker (5 Amp)
6	S319	Switch



Surface Deice (Optional)
Figure 1 (Sheet 1 of 4)

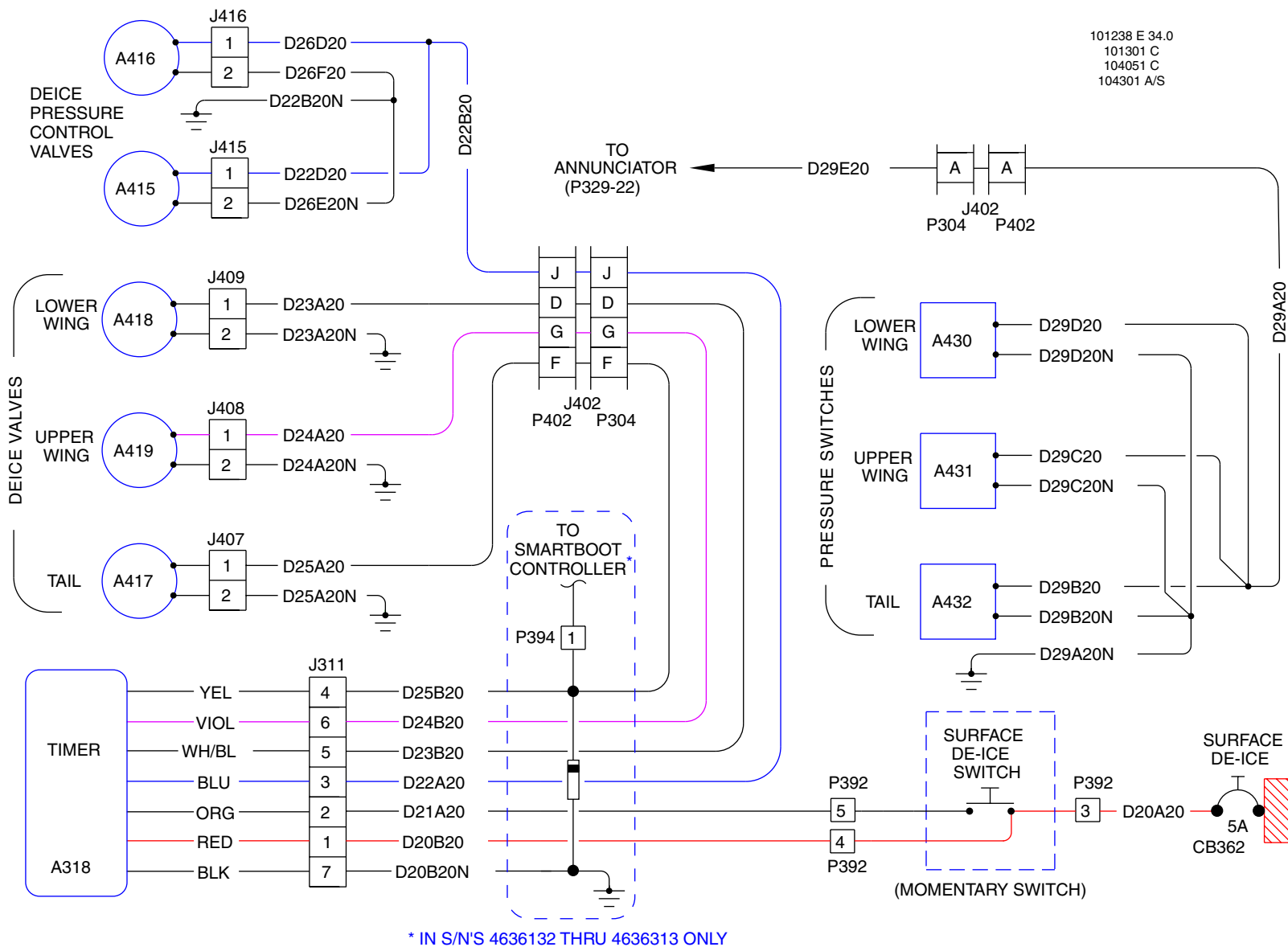


89801 AH 34.0
85508 L

Effectivity
4636001 thru 4636131

Surface Deice (Optional)
Figure 1 (Sheet 2 of 4)

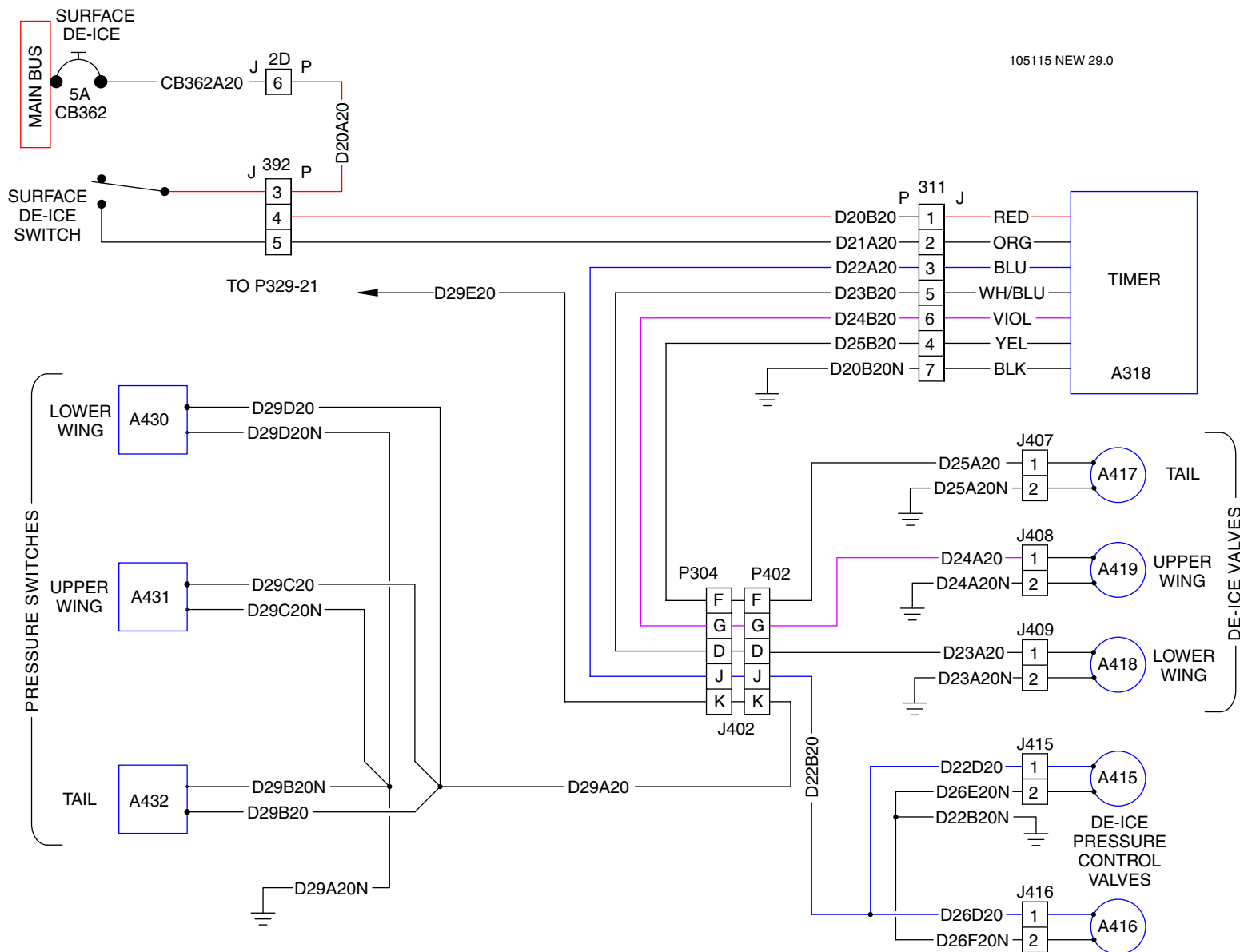
101238 E 34.0
101301 C
104051 C
104301 A/S



Surface Deice (Optional)
Figure 1 (Sheet 3 of 4)

Effectivity
4636132 thru 4636374

105115 NEW 29.0



Effectivity
4636375 and up

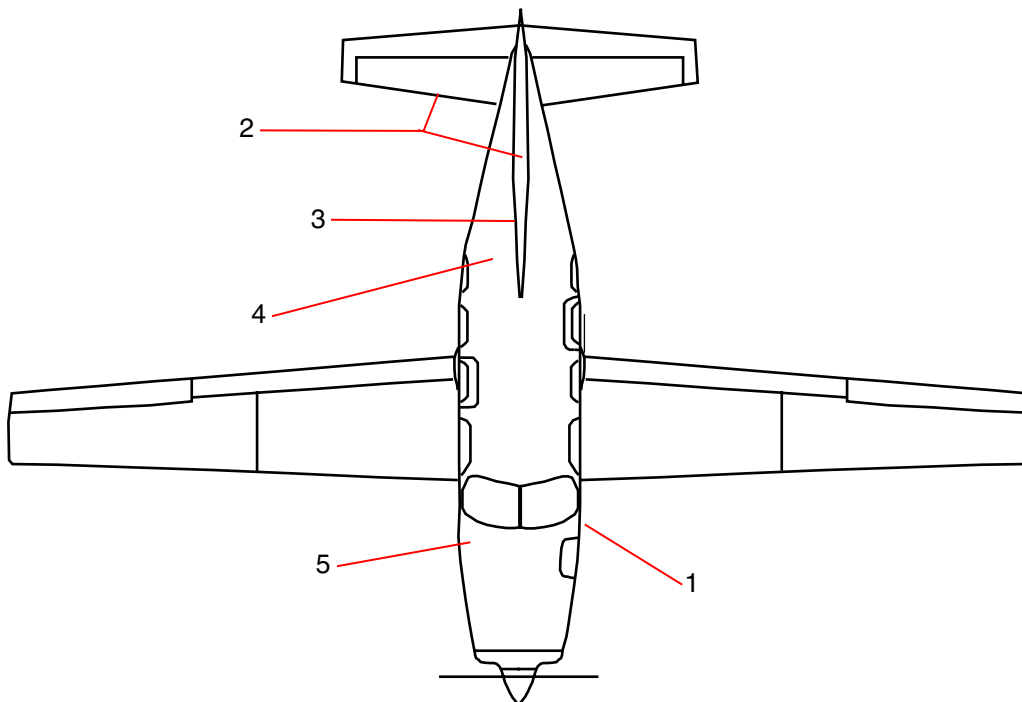
Surface Deice (Optional)
Figure 1 (Sheet 4 of 4)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

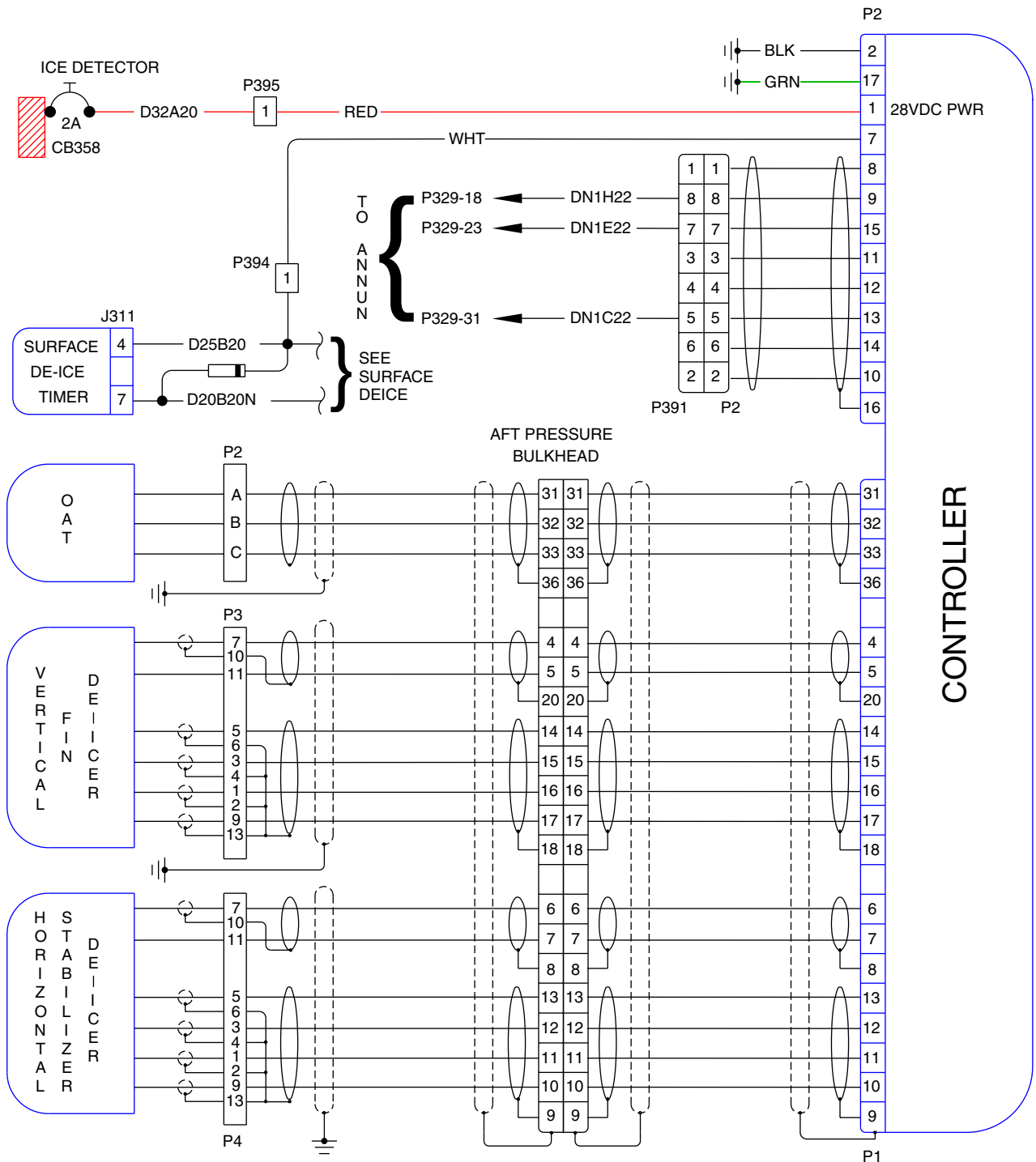
Item #	Designation	Description
1	CB358	Circuit Breaker (2 Amp)
2		De-icers with Integral Detectors
3		OAT Sensor
4		Controller
5	A318	Surface De-ice Timer



[Effectivity](#)
4636132 thru 4636313

Ice Detection System (SMARTboots™) (Optional)
Figure 2 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



101238 E 39.0
101301 C
104051 C

Ice Detection System (SMARTboots™) (Optional)
Figure 2 (Sheet 2 of 2)

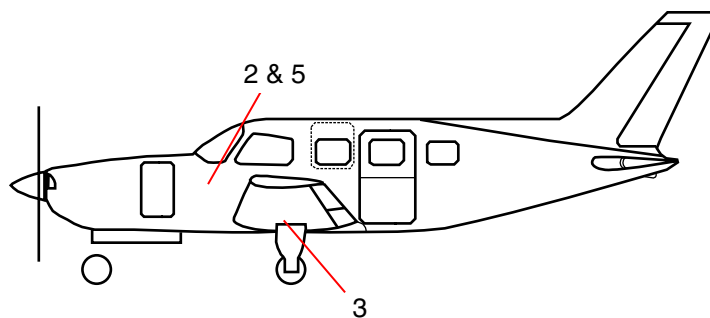
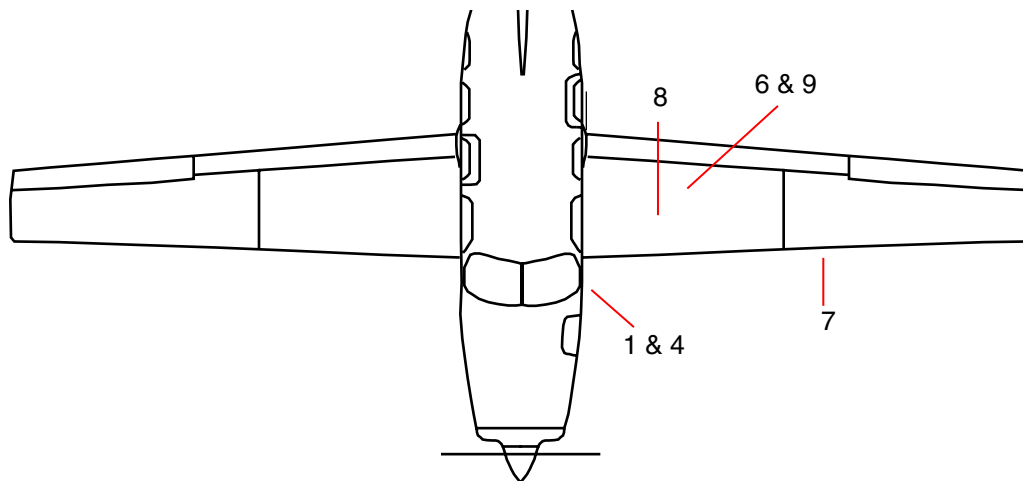
[Effectivity](#)
4636132 thru 4636313

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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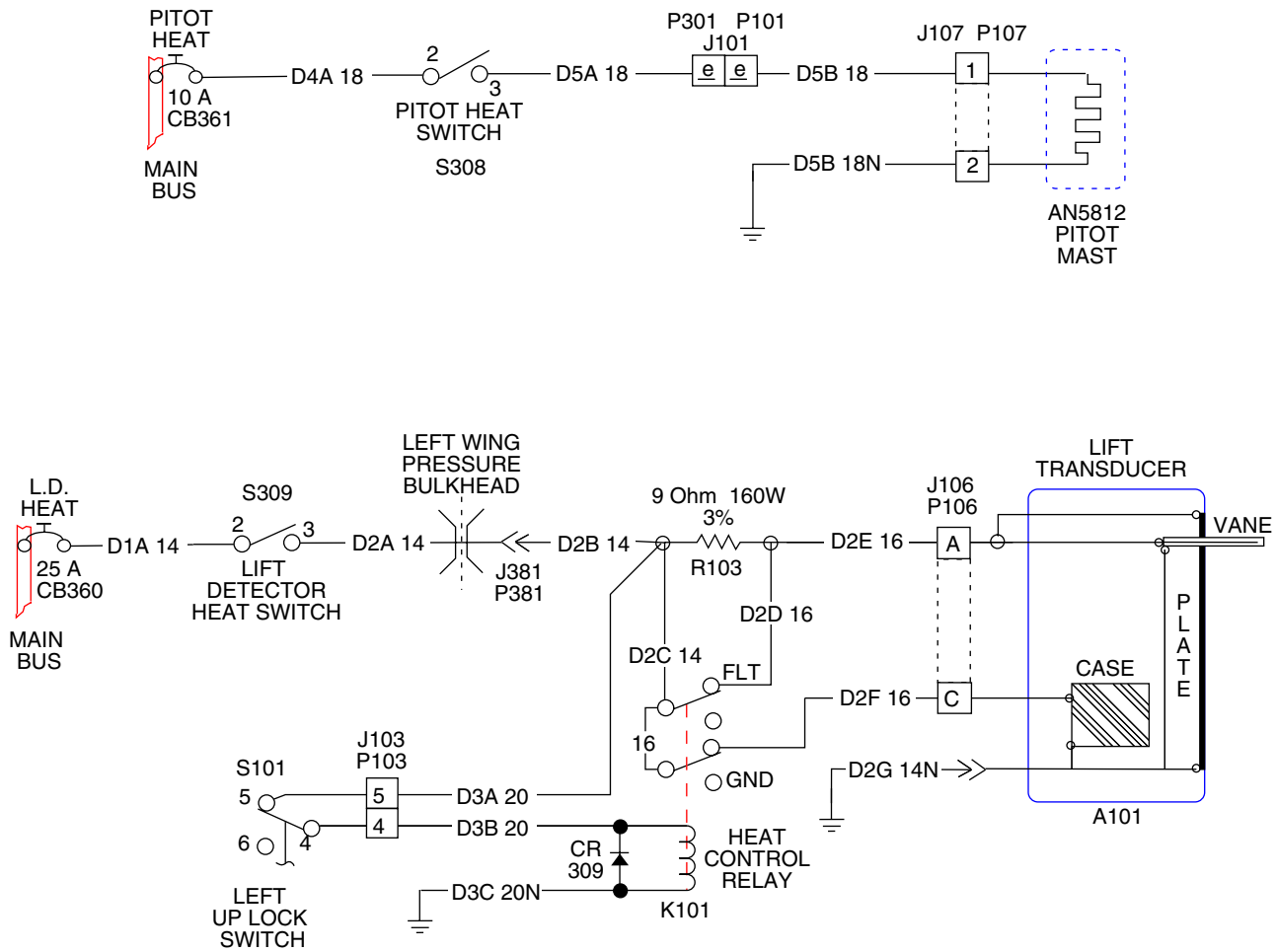
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB361	Circuit Breaker (10 Amp) - Pitot Heat
2	S308	Pitot Heat Switch
3	AN5812	Pitot Head Assembly - Heated (Left and Right Wings with Avidyne Entegra Option)
4	CB360	Circuit Breaker (25 Amp) - Stall Warn
5	S309	Stall Warn Heat Switch
6	R103	Resistor - Heated Stall Warn
7	A101	Lift Transducer
8	S101	Switch Assembly - Main Gear Uplock - Left
9	K101	Relay Assembly - Heated Stall Warning



Pitot and Lift Detector Heat
Figure 1 (Sheet 1 of 5)

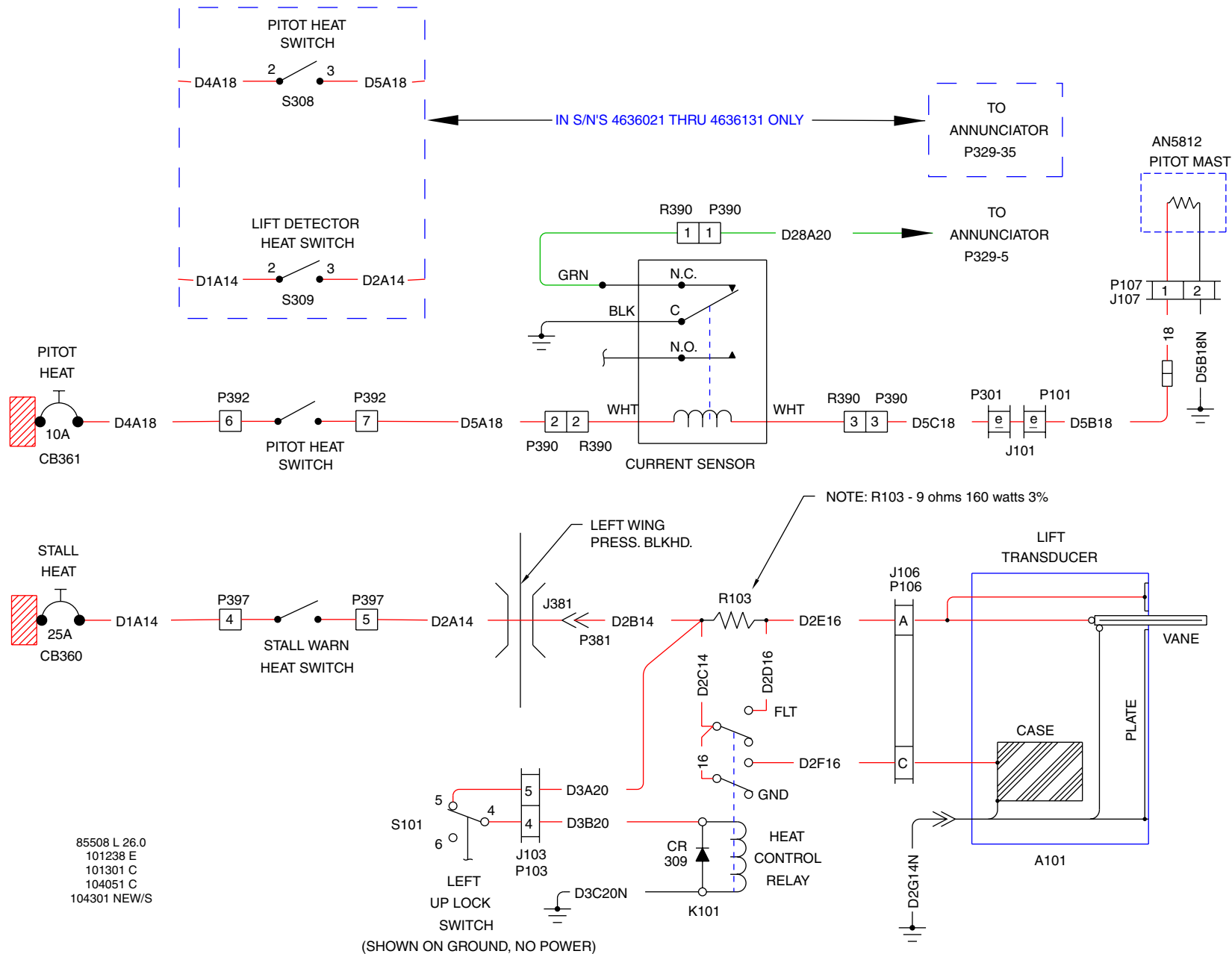
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



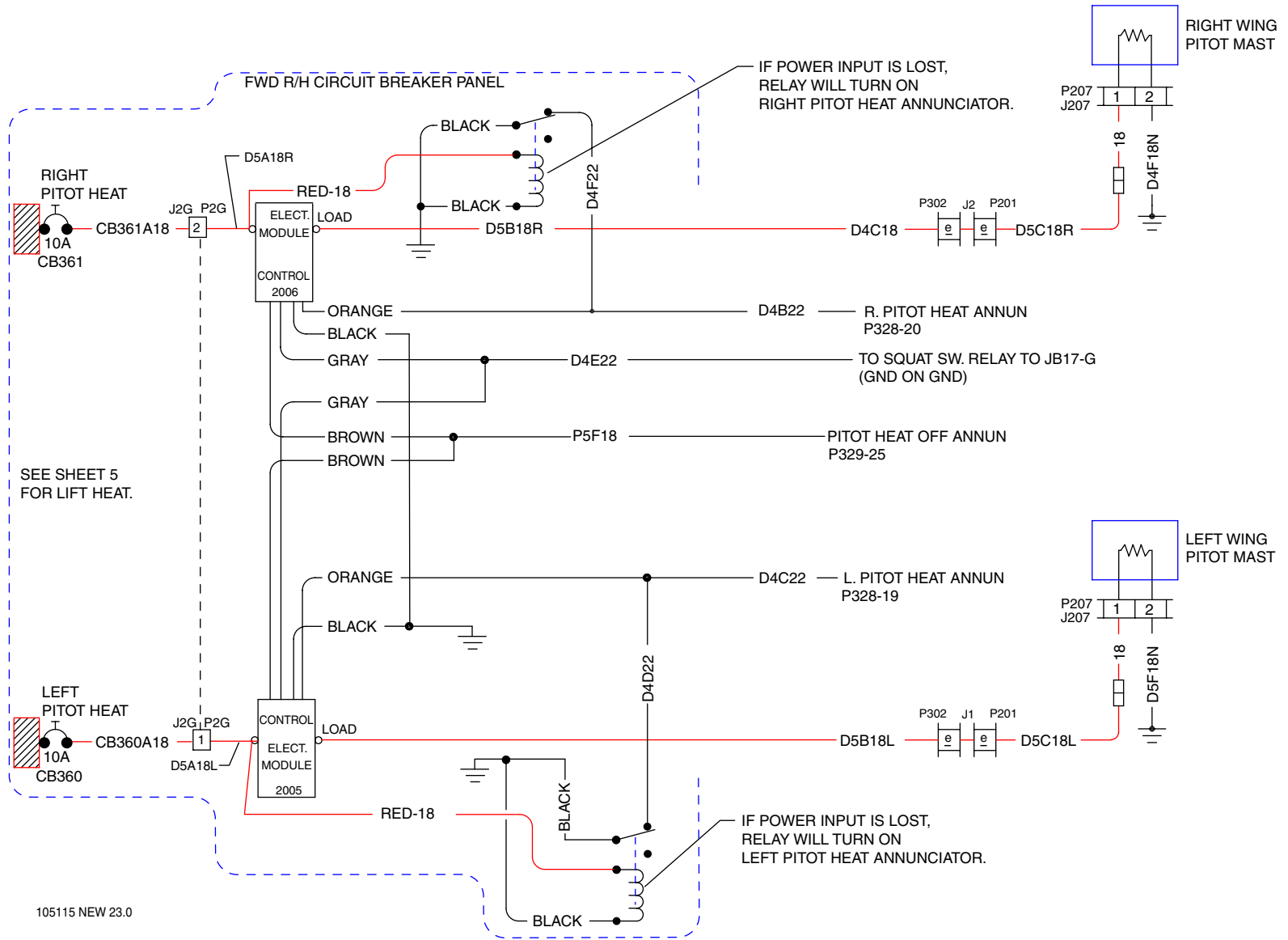
89801 AH 26.0

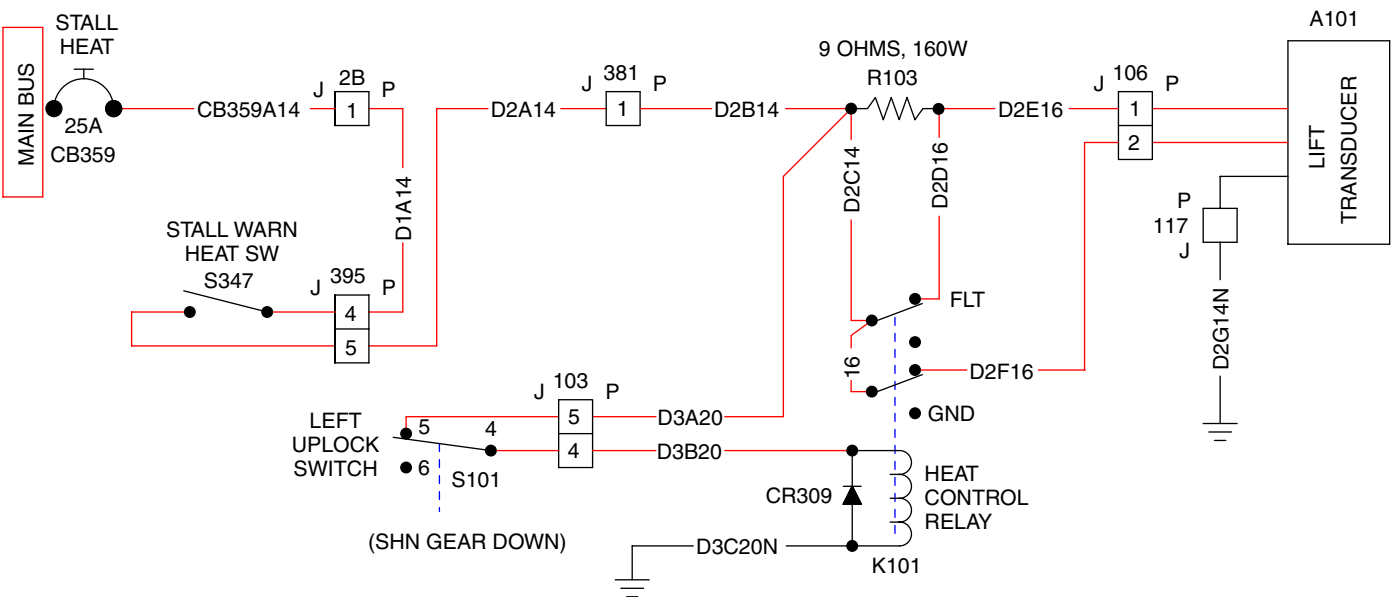
[Effectivity](#)
4636001 thru 4636020

Pitot and Lift Detector Heat
Figure 1 (Sheet 2 of 5)



NOTE: PITOT HEAT WILL CYCLE AT A 30 SECOND RATE WHEN AIRCRAFT IS ON THE GROUND WITH SWITCH ON.
PITOT HEAT WILL BE ON CONSTANTLY IN THE AIR WHEN SWITCH IS ON.





SEE SHEET 4 FOR PITOT HEAT.

Pitot and Lift Detector Heat
Figure 1 (Sheet 5 of 5)

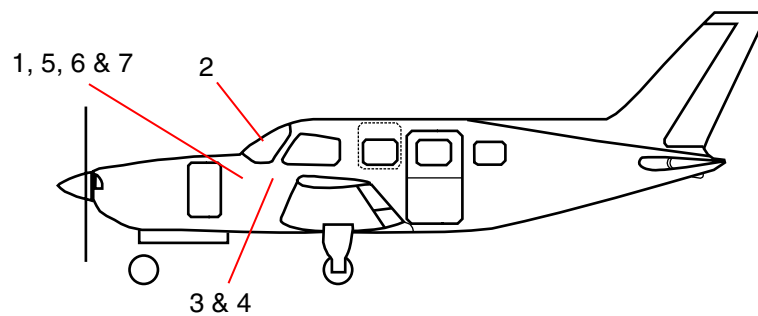
Effectivity
4636375 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

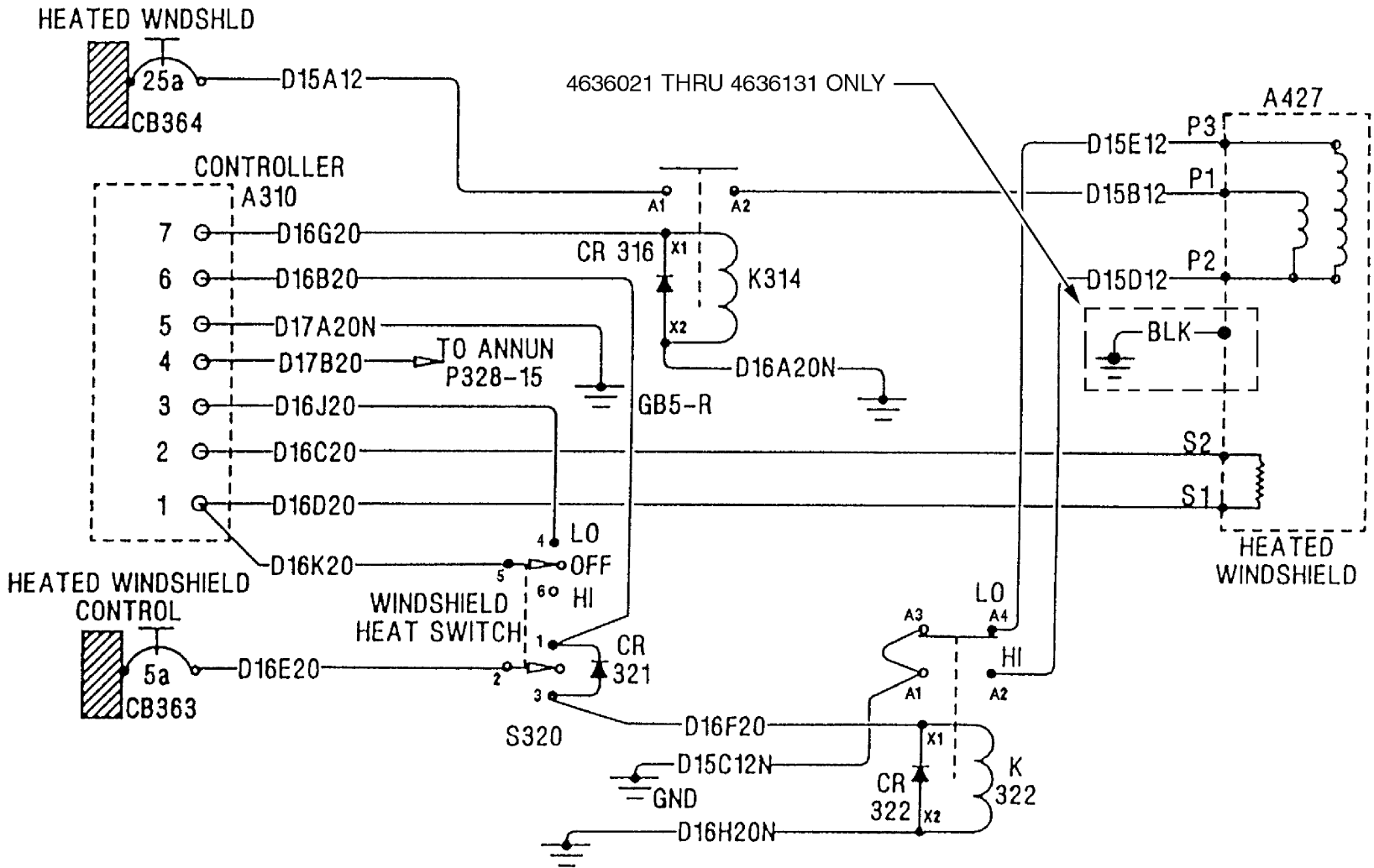
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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	A310	Controller
2	A427	Heated Windshield
3	CB363	Circuit Breaker (5 Amp)
4	CB364	Circuit Breaker (25 Amp)
5	K314	Controller Relay
6	K322	Heat Relay
7	S320	Heat Switch



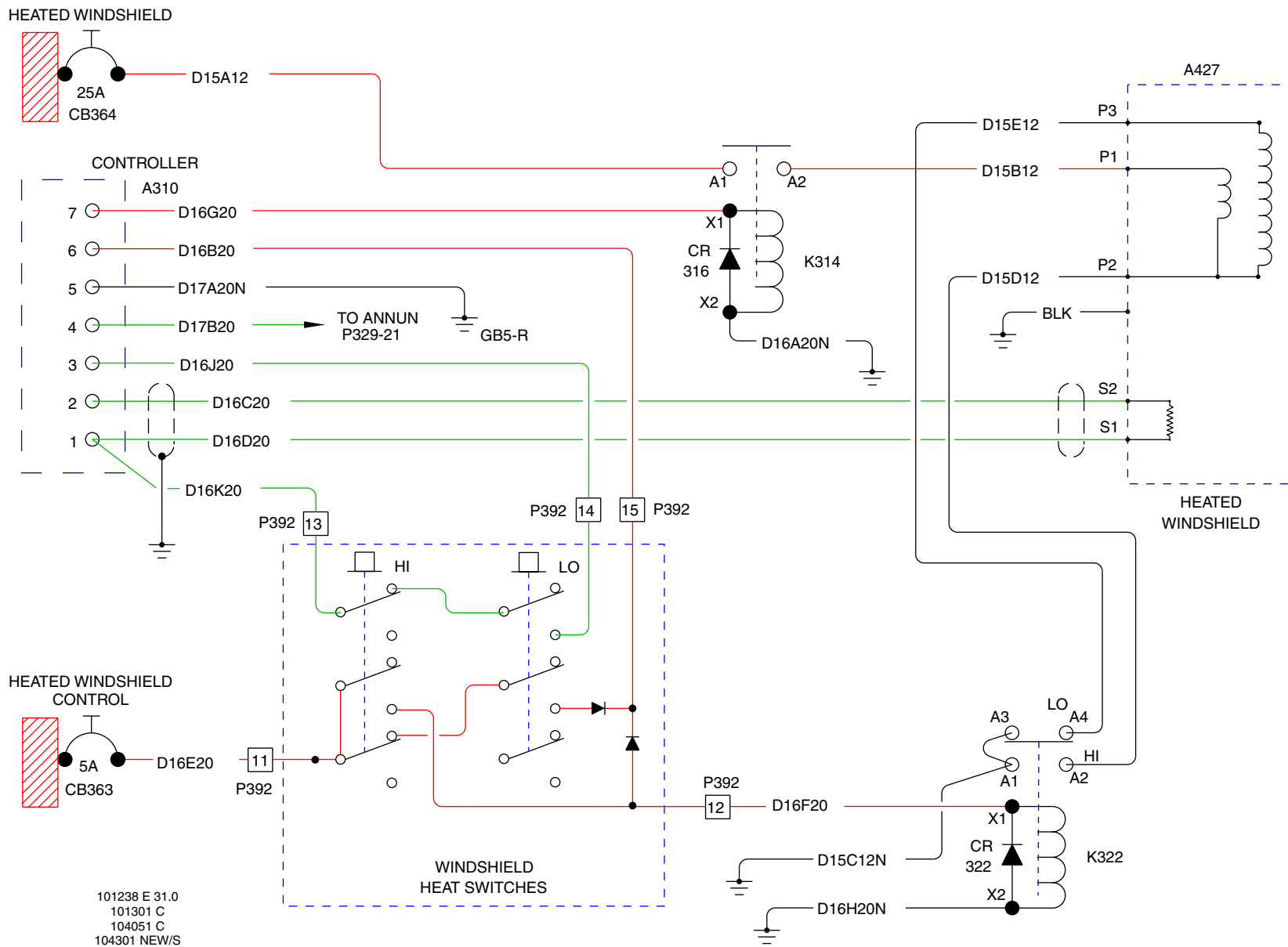
Heated Windshield (Optional)
Figure 1 (Sheet 1 of 4)



89801 AH 31.0
85508 L

Effectivity
4636001 thru 4636131

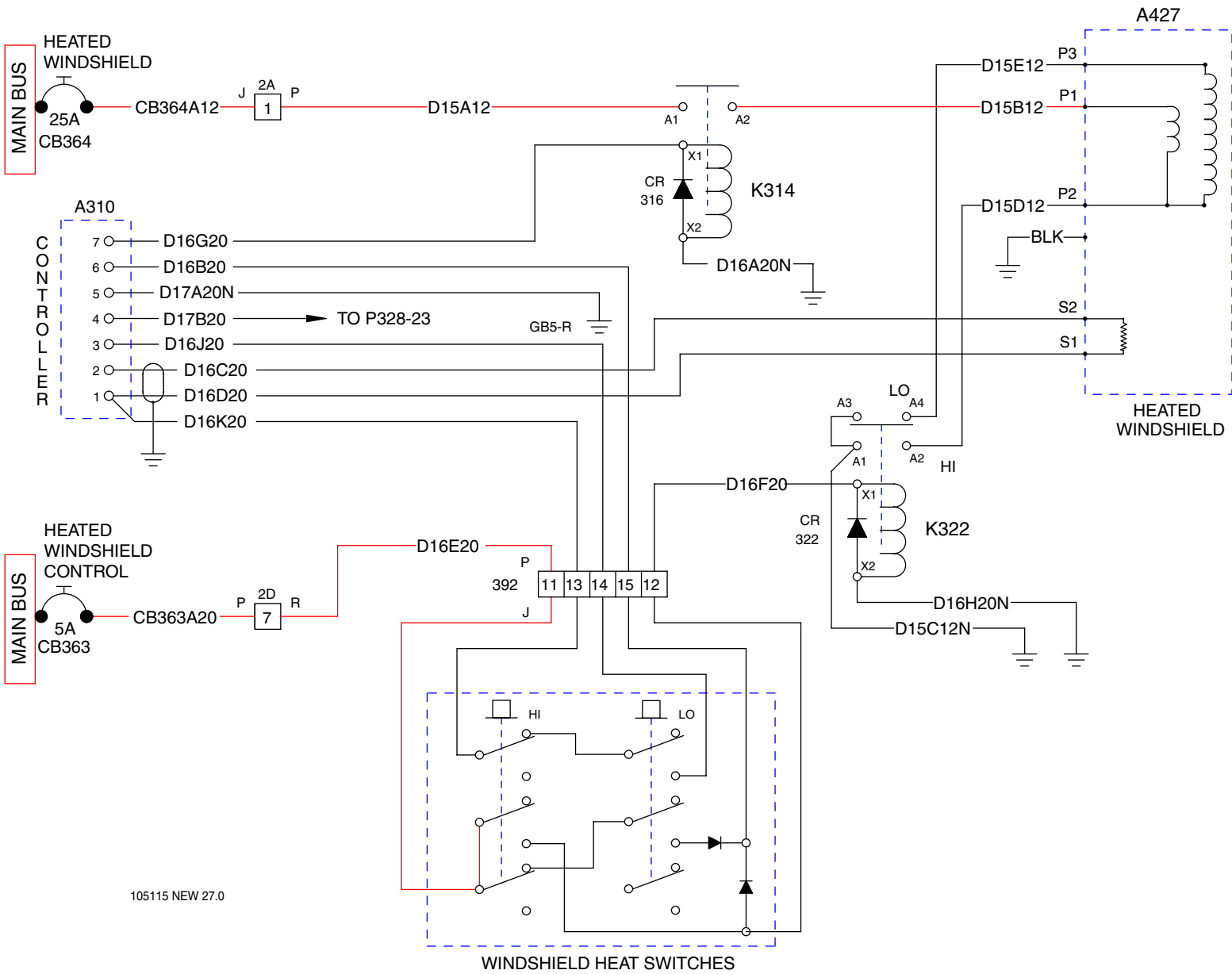
Heated Windshield (Optional)
Figure 1 (Sheet 2 of 4)



Heated Windshield (Optional)
Figure 1 (Sheet 3 of 4)

101238 E 31.0
101301 C
104051 C
104301 NEW/S

Effectivity
4636132 thru 4636374



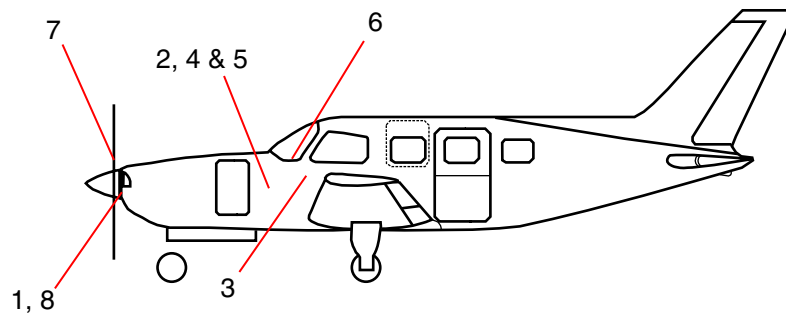
105115 NEW 27.0

Effectivity
4636375 and up

Heated Windshield (Optional)
Figure 1 (Sheet 4 of 4)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

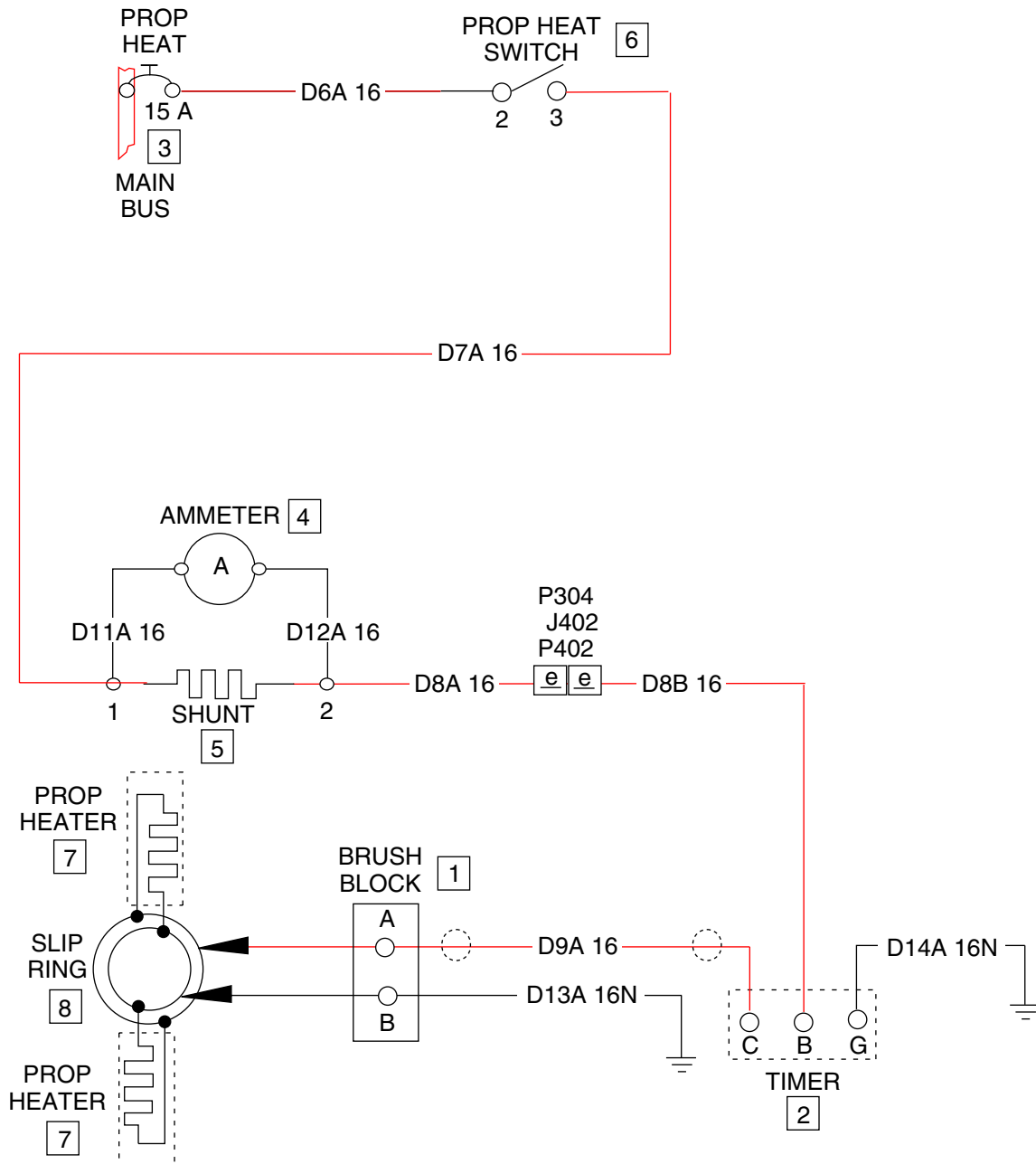
Item #	Designation	Description
1	A411	Brush Block
2	A428	Timer
3	CB359	Circuit Breaker (15 Amp)
4	M303	Ammeter
5	R306	Shunt
6	S318	Switch
7		Prop Heater
8		Slip Ring



Propeller Heat (Optional)
Figure 1 (Sheet 1 of 5)

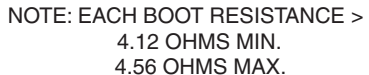
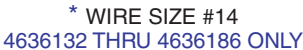
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

89801 AH 32.0
85508 L

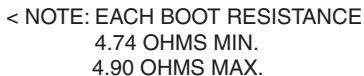


[Effectivity](#)
4636001 thru 4636131

Propeller Heat (Optional)
Figure 1 (Sheet 2 of 5)

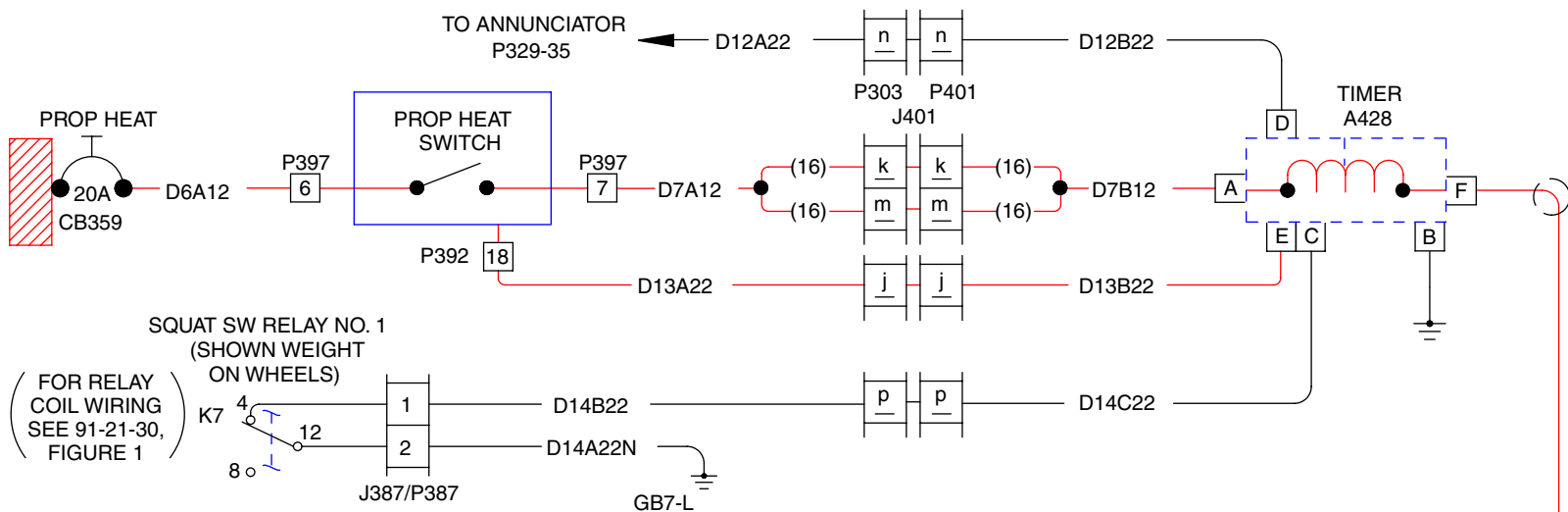


(3 BLADE)

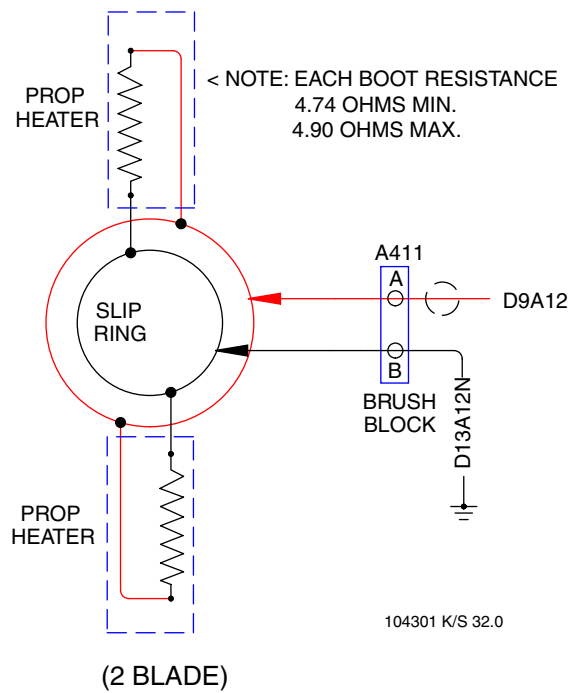
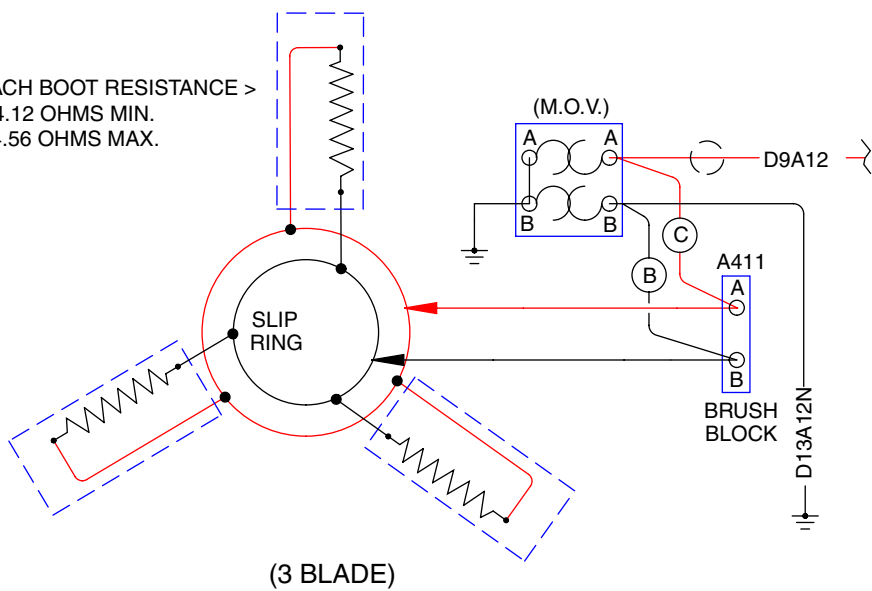


(2 BLADE)

Effectivity
4636132 thru 4636313,
less 4636299



NOTE: EACH BOOT RESISTANCE >
4.12 OHMS MIN.
4.56 OHMS MAX.

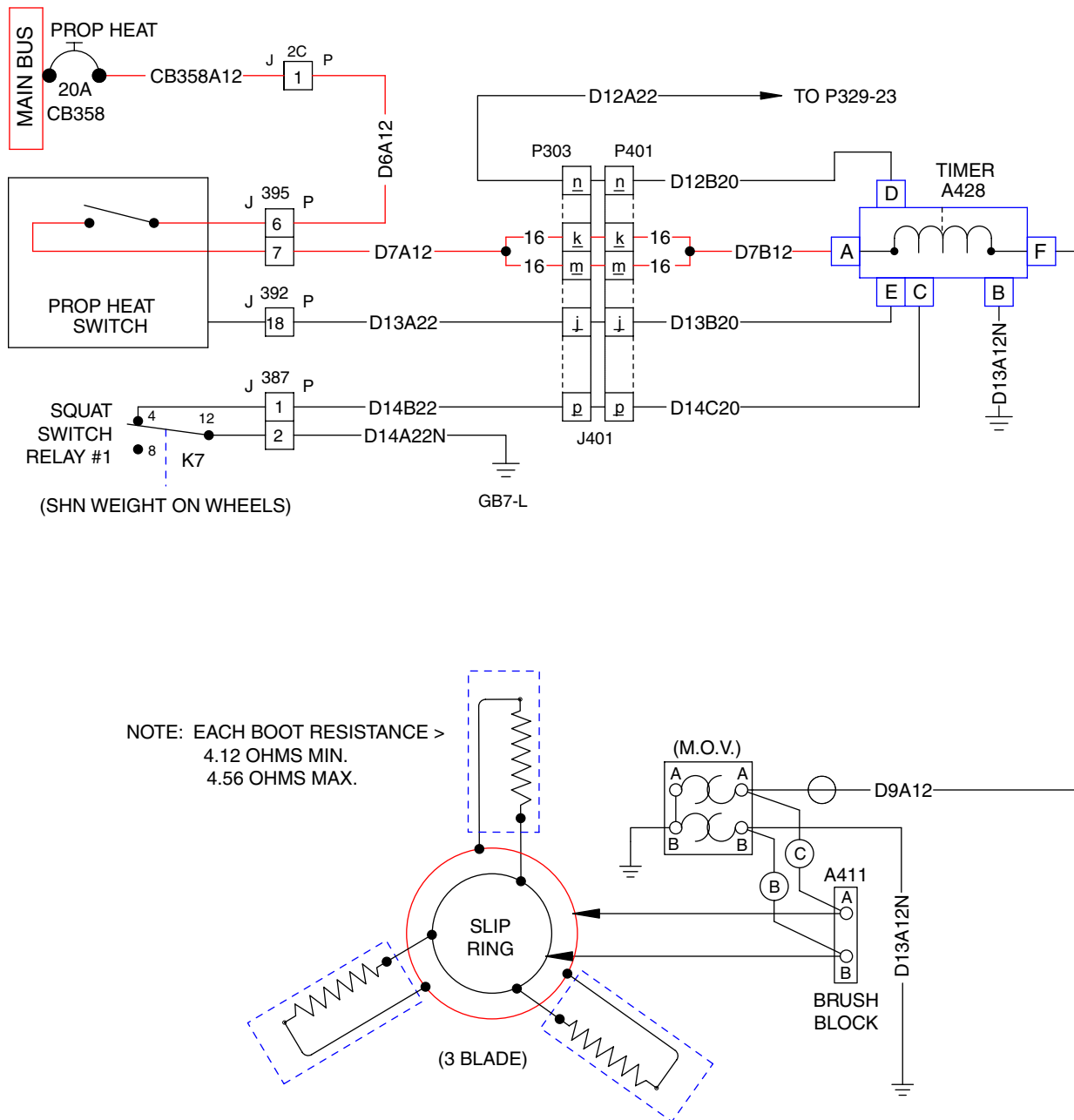


Effectivity

4636299 and
4636314 thru 4636374

Propeller Heat (Optional)
Figure 1 (Sheet 4 of 5)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



105115 NEW 28.0

Propeller Heat (Optional)
Figure 1 (Sheet 5 of 5)

[Effectivity](#)
4636375 and up

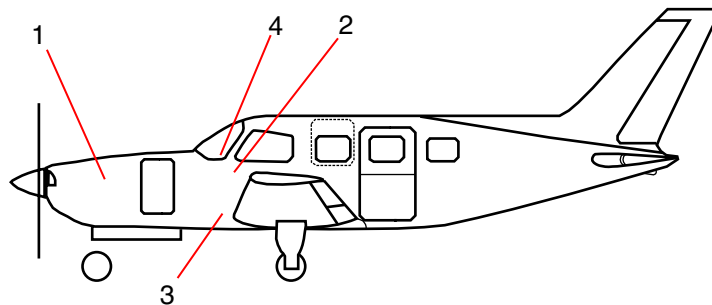
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

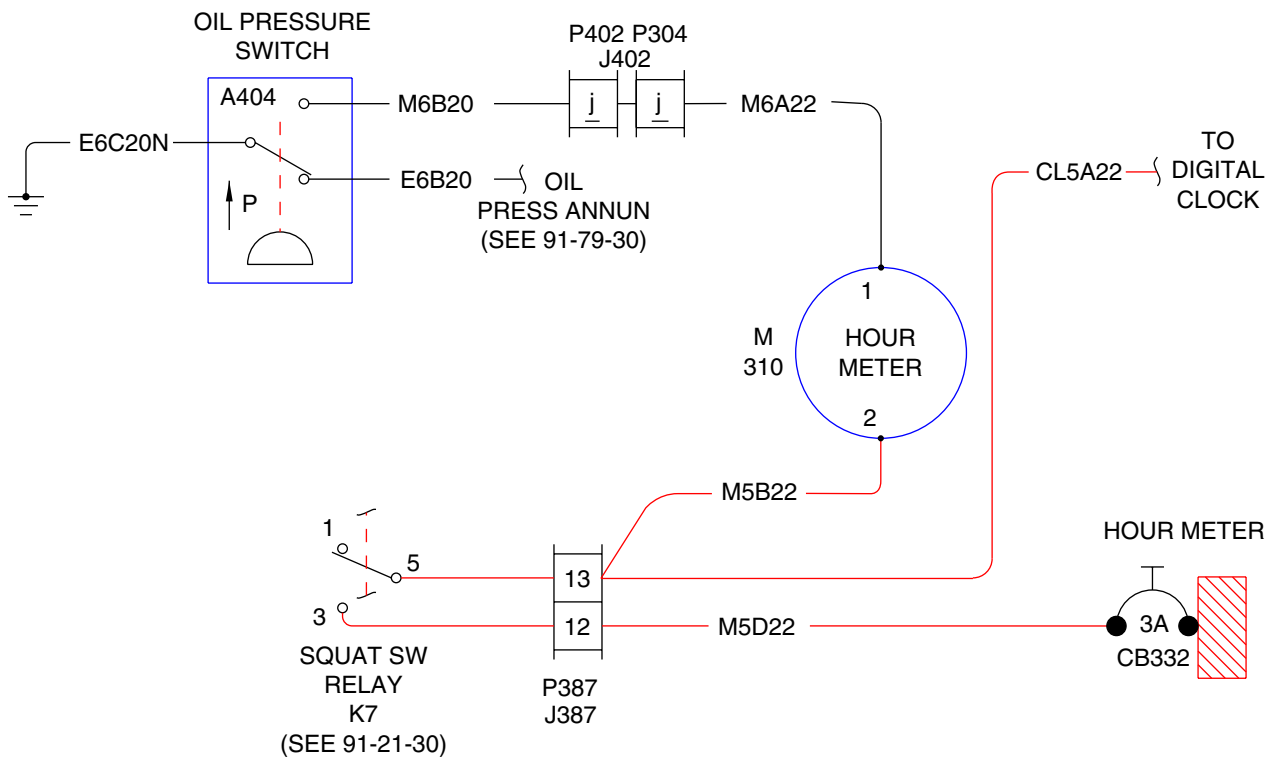
Item #	Designation	Description
1	A404	Oil Pressure Switch
2	CB332	Circuit Breaker (3 Amp)
3	K7	Squat Switch Relay
4	M310	Flight Hour Meter

In S/N'S 4636375 and up, see 91-21-30, Figure 1, Sheet 4.



Flight Hour Meter
Figure 1 (Sheet 1 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

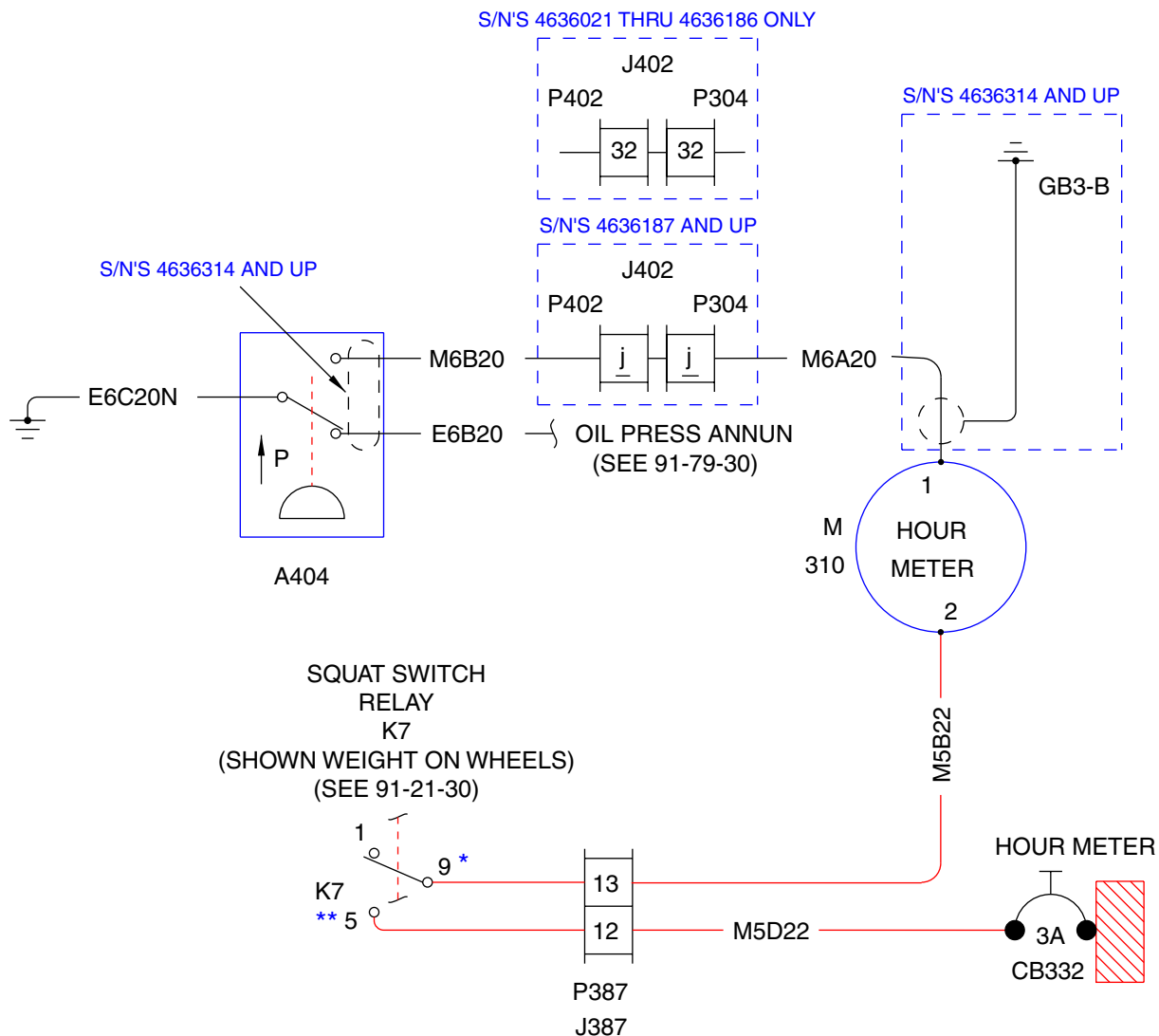


89801 AF/AH 8.0

[Effectivity](#)
4636001 thru 4636020

Flight Hour Meter
Figure 1 (Sheet 2 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



* 5 IN S/N'S 4636021 THRU 4636131 ONLY

** 3 IN S/N'S 4636021 THRU 4636131 ONLY

85508 L 8.0
101238 E
101301 C
104051 C
104301 L/S

IN S/N'S 4636375 AND UP, SEE 91-21-30, FIGURE 1, SHEET 4.

Flight Hour Meter
Figure 1 (Sheet 3 of 3)

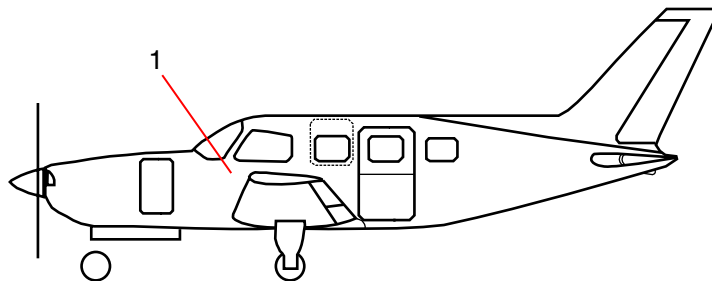
Effectivity
4636021 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB355	Circuit Breaker (3 Amp)



Annunciator Panel
Figure 1 (Sheet 1 of 16)

[Effectivity](#)
4636001 thru 4636020

80801 AH 14.2

* FOR CONTINUATION
SEE NEXT PAGE

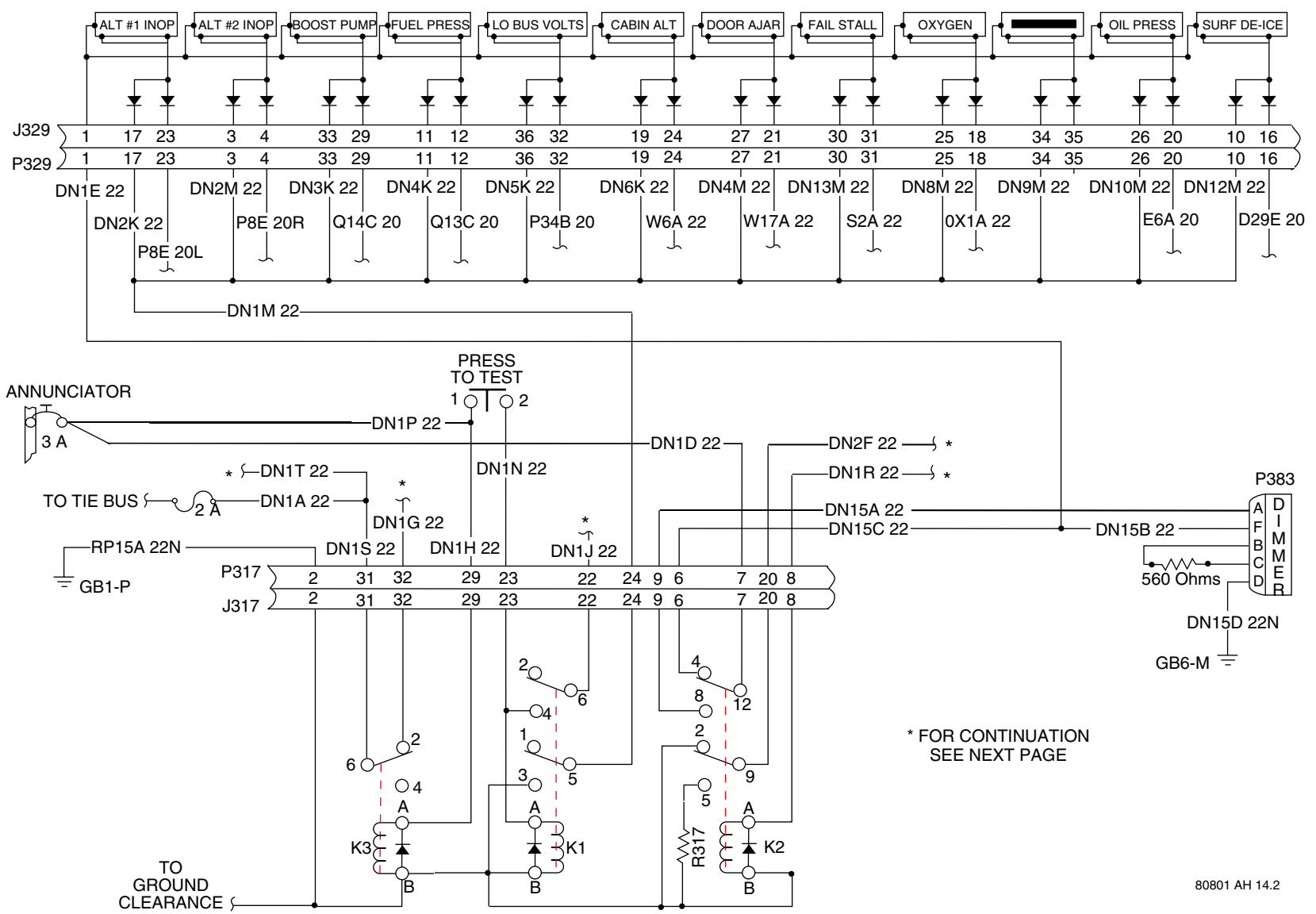
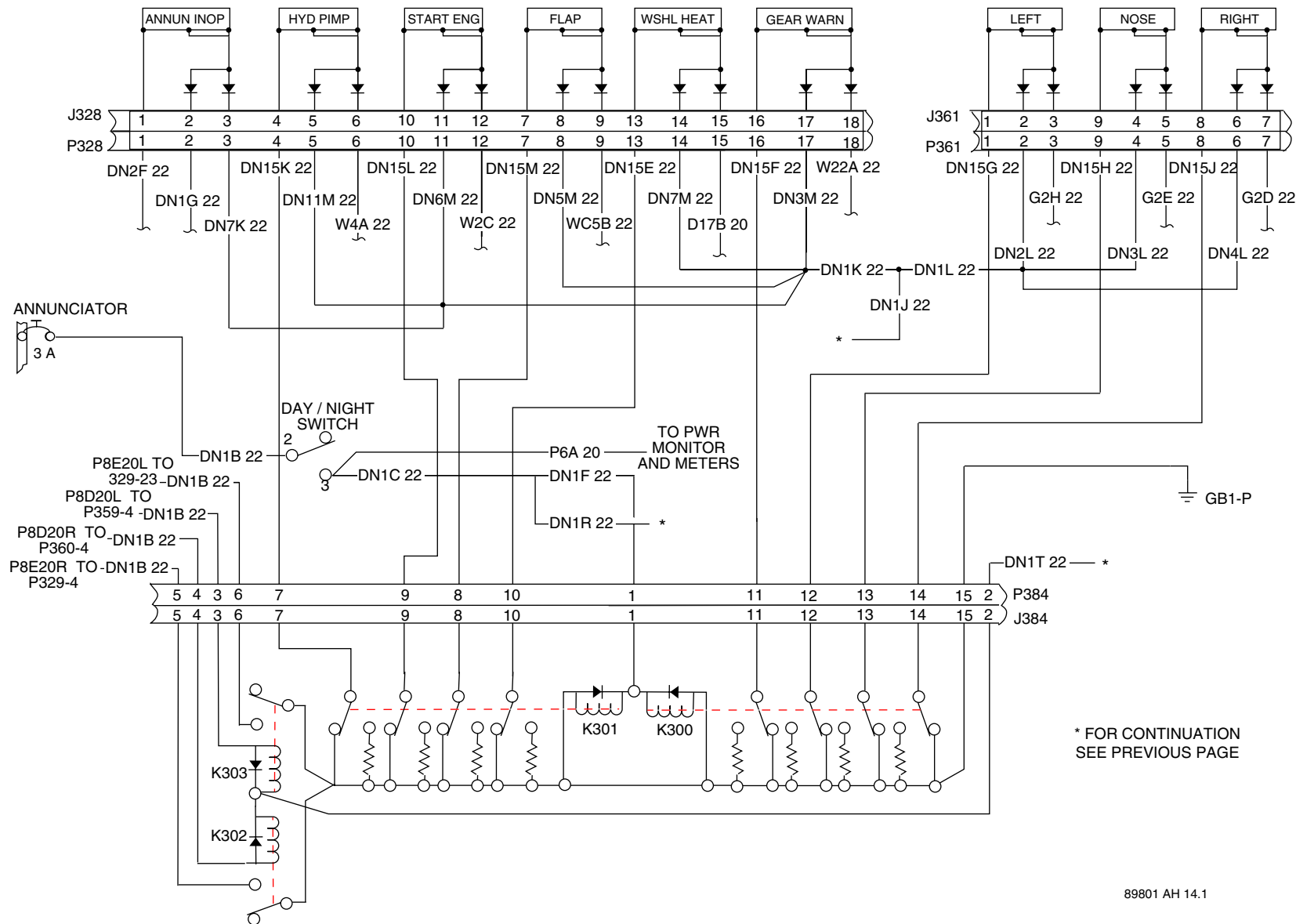


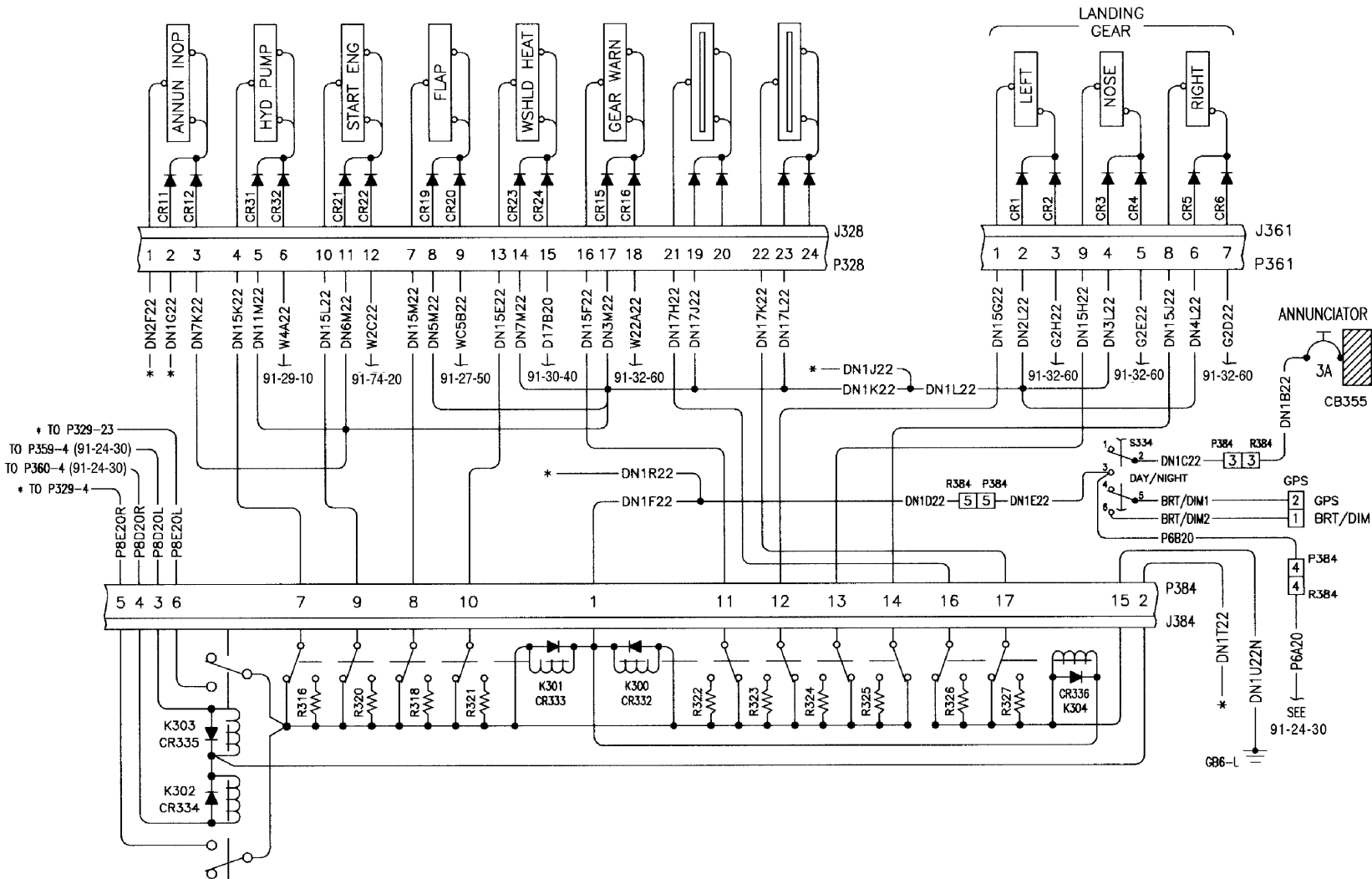
Figure 1 (Sheet 2 of 16)



89801 AH 14.1

Annunciator Panel
Figure 1 (Sheet 3 of 16)

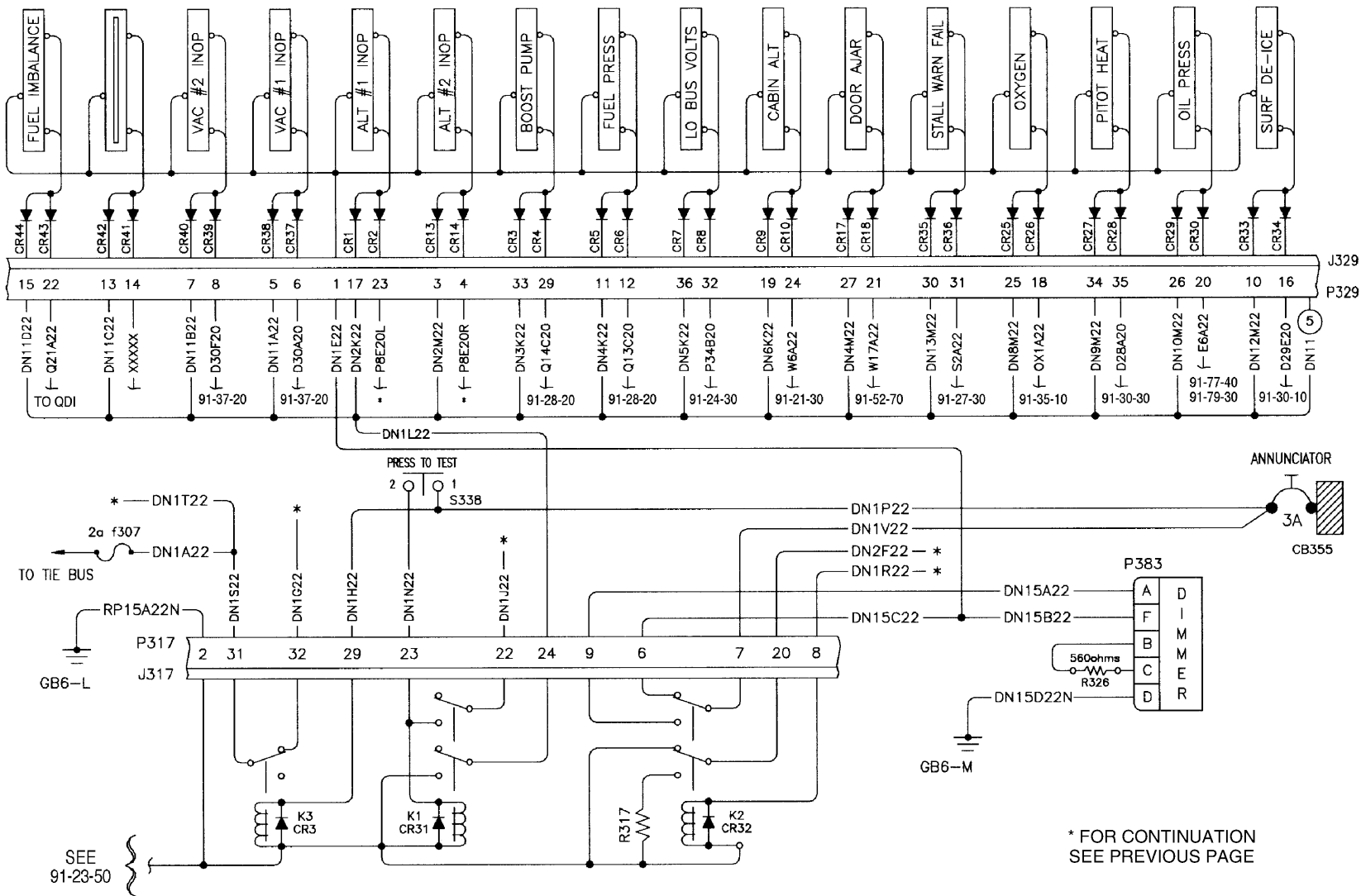
Effectivity
4636001 thru 4636020



* FOR CONTINUATION
SEE NEXT PAGE

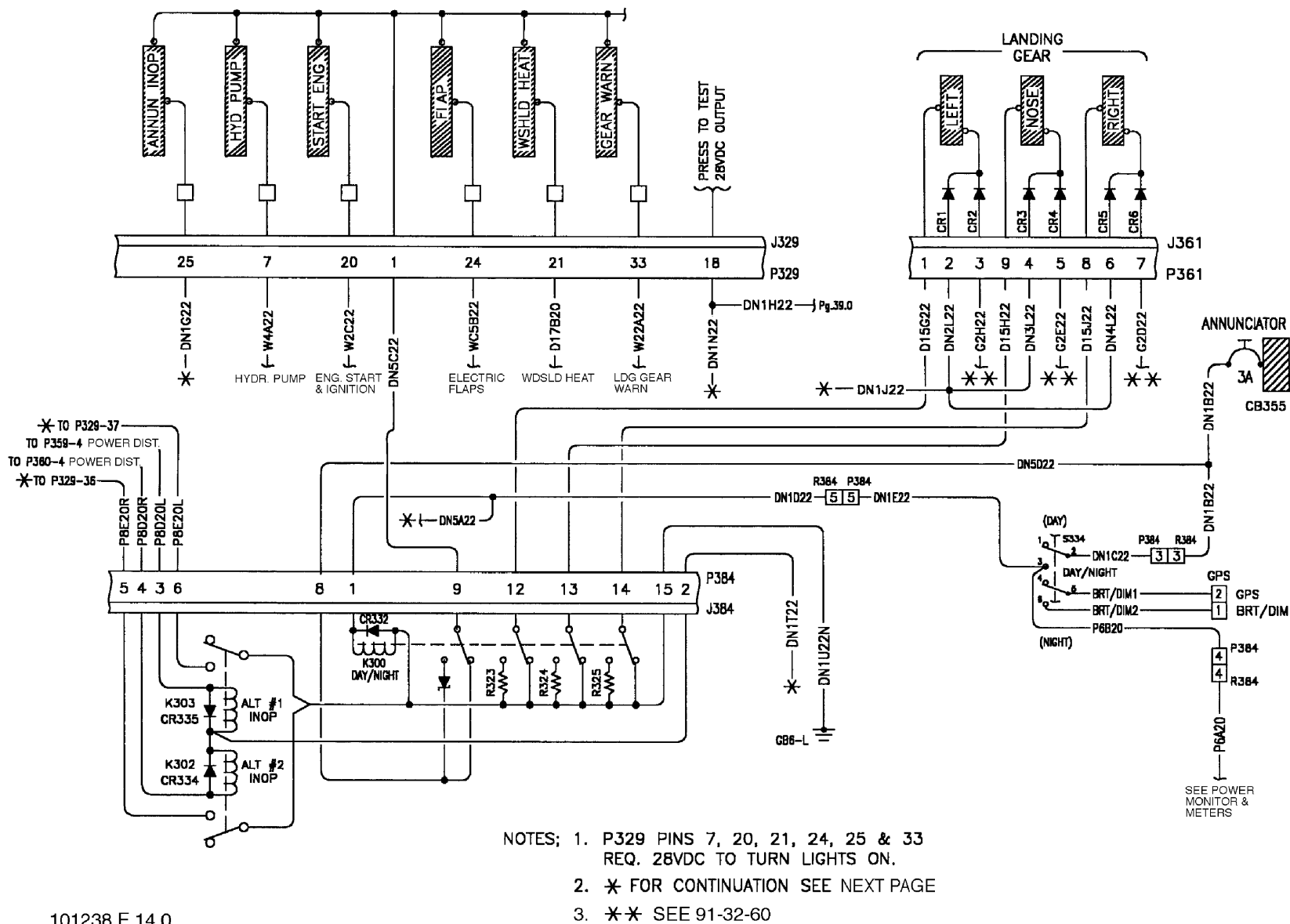
85508 L 14.0

Effectivity
4636021 thru 4636131
Annunciator Panel
Figure 1 (Sheet 4 of 16)



* FOR CONTINUATION
SEE PREVIOUS PAGE

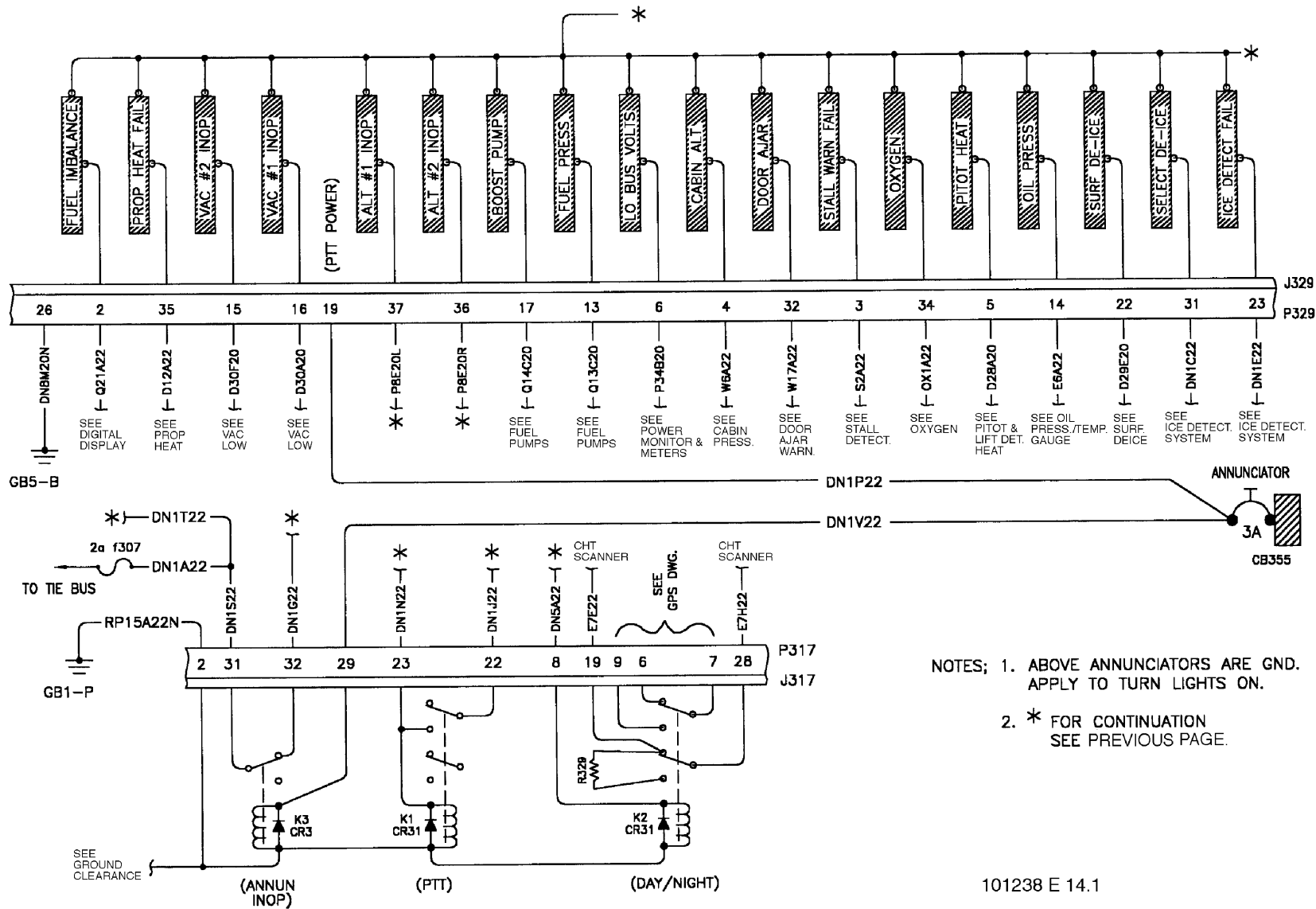
85508 L 14.1



101238 E 14.0

Annunciator Panel
Figure 1 (Sheet 6 of 16)

Effectivity
4636132 thru 4636186

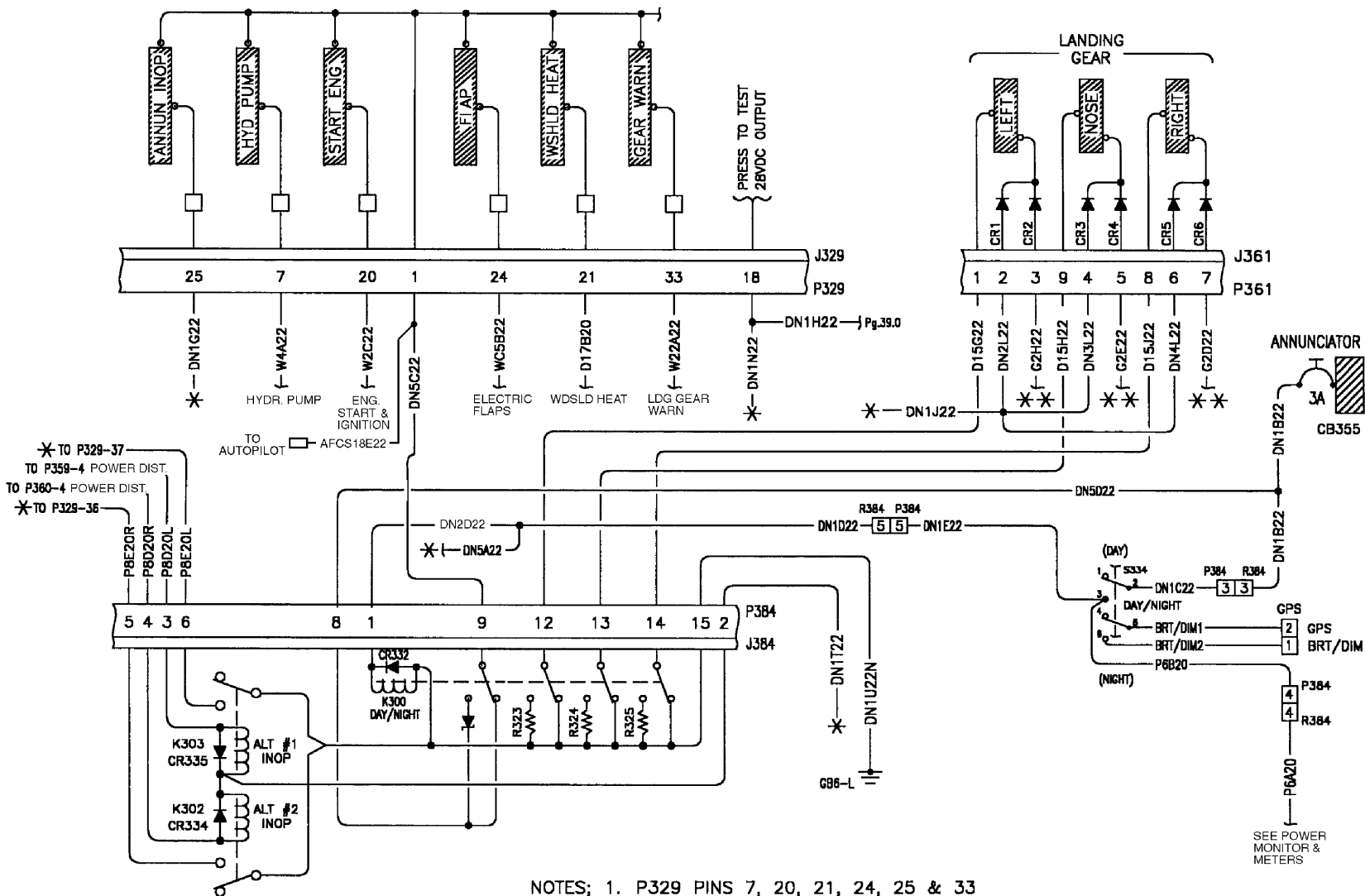


- NOTES; 1. ABOVE ANNUNCIATORS ARE GND. APPLY TO TURN LIGHTS ON.
2. * FOR CONTINUATION SEE PREVIOUS PAGE.

101238 E 14.1

Annunciator Panel
Figure 1 (Sheet 7 of 16)

Effectivity
4636132 thru 4636186

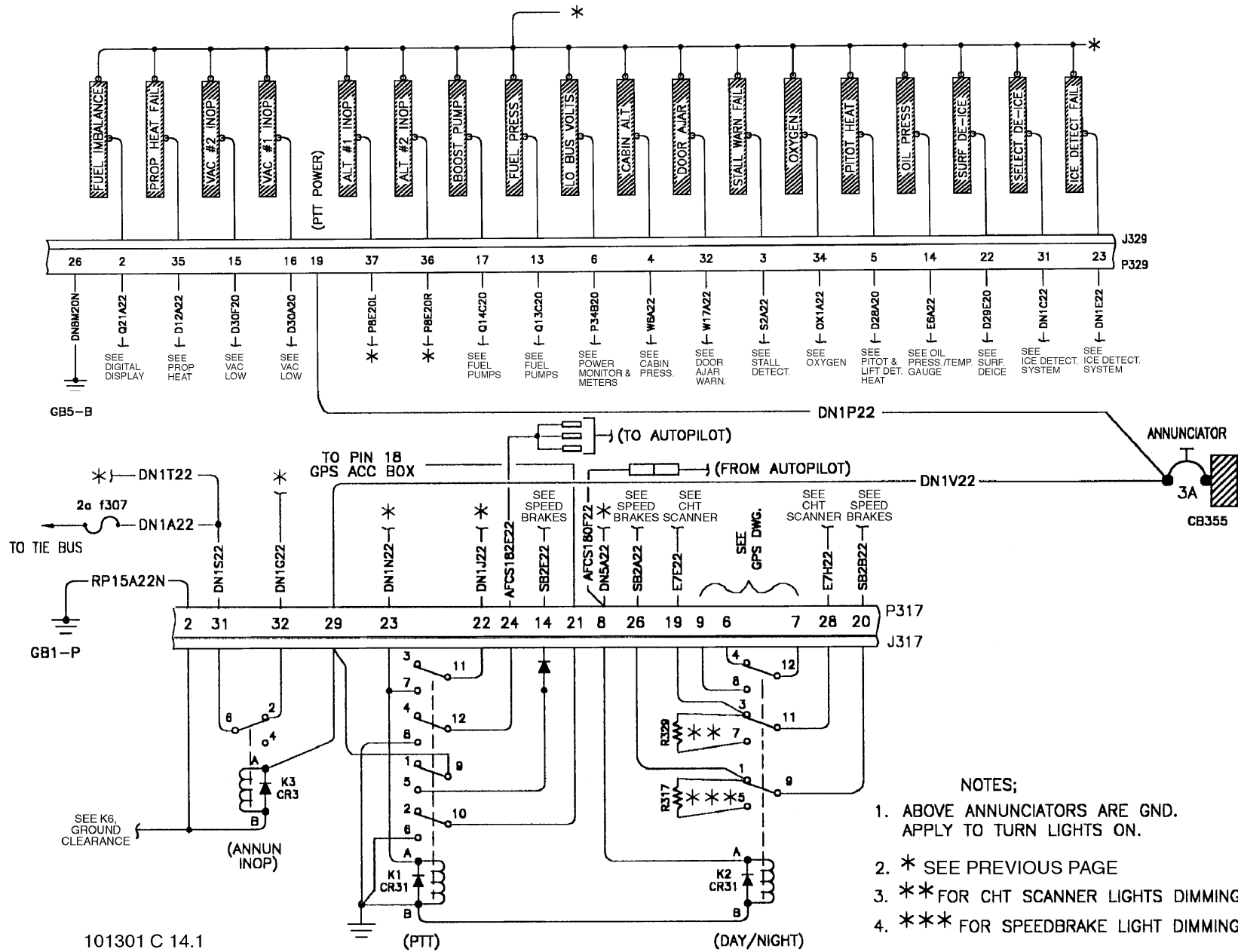


NOTES; 1. P329 PINS 7, 20, 21, 24, 25 & 33
REQ. 28VDC TO TURN LIGHTS ON.
2. * FOR CONTINUATION SEE NEXT PAGE
3. ** SEE 91-32-60

101301 C 14.0

Annunciator Panel
Figure 1 (Sheet 8 of 16)

Effectivity
4636187 thru 4636247

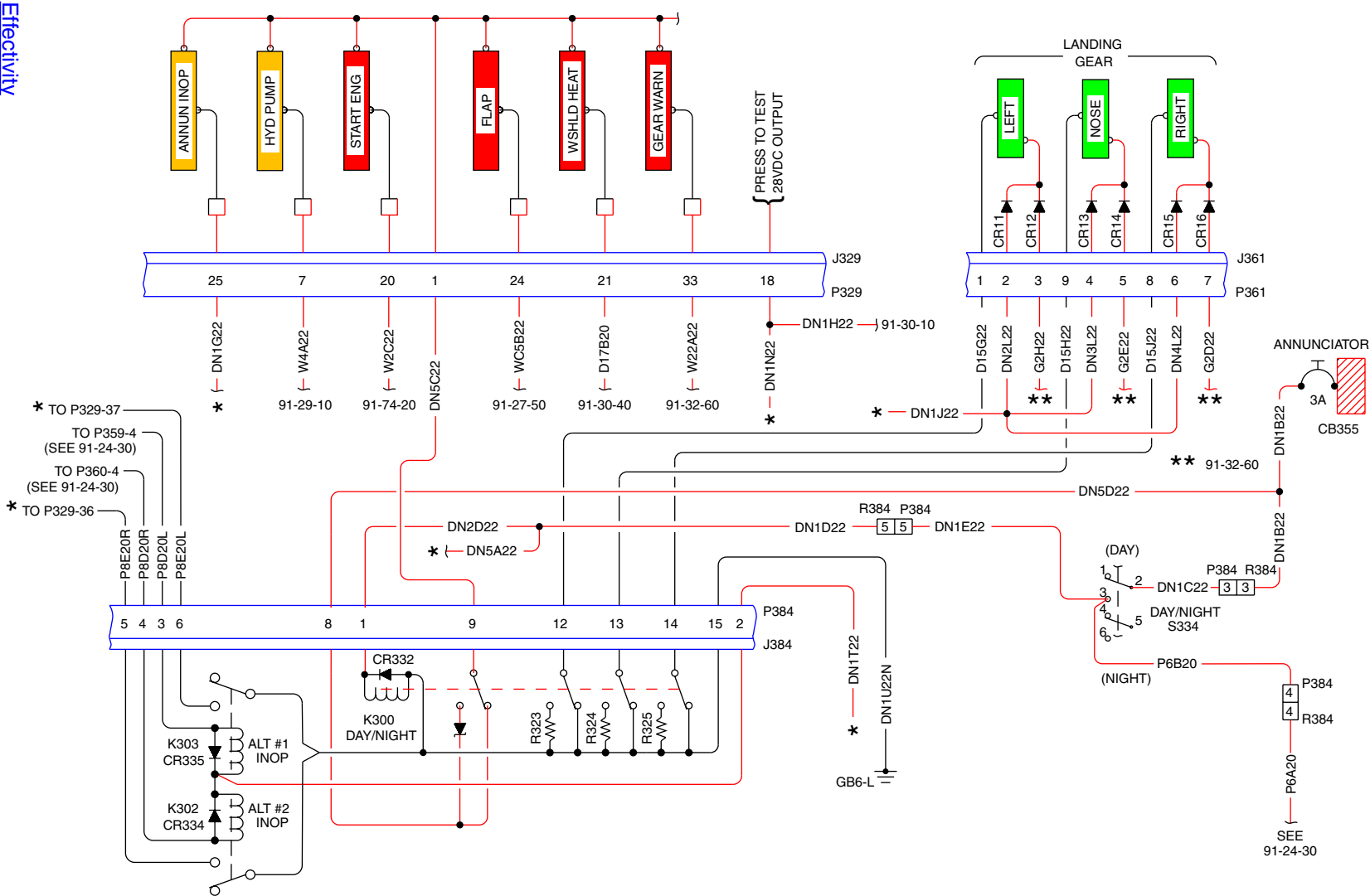


Effectivity

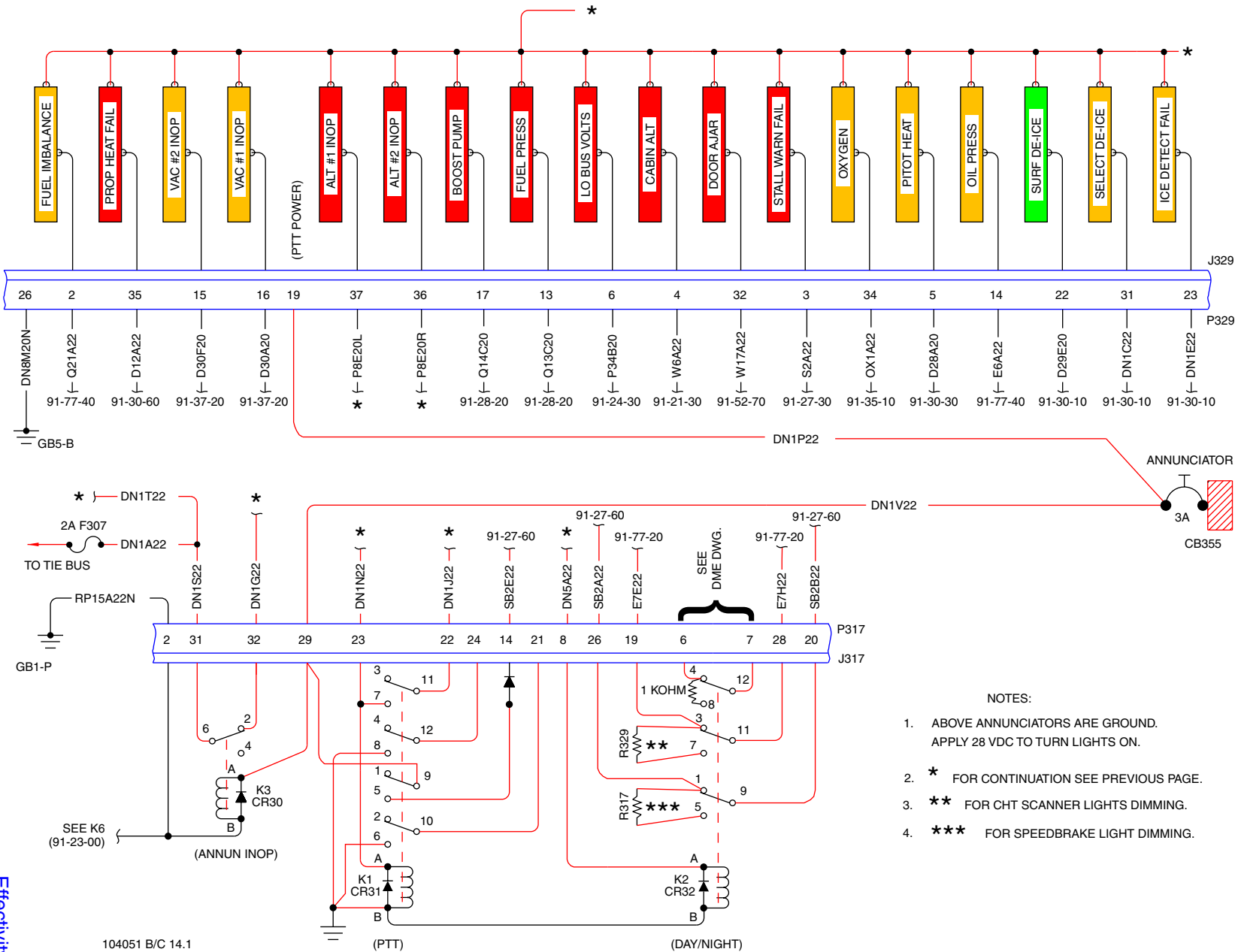
4636248 thru 4636313,
less 4636299

Annunciator Panel

Figure 1 (Sheet 10 of 16)



- NOTES:
1. P329 PINS 7, 20, 21, 24, 25 & 33
REQUIRES 28VDC TO TURN LIGHTS ON.
 2. * FOR CONTINUATION SEE NEXT PAGE.

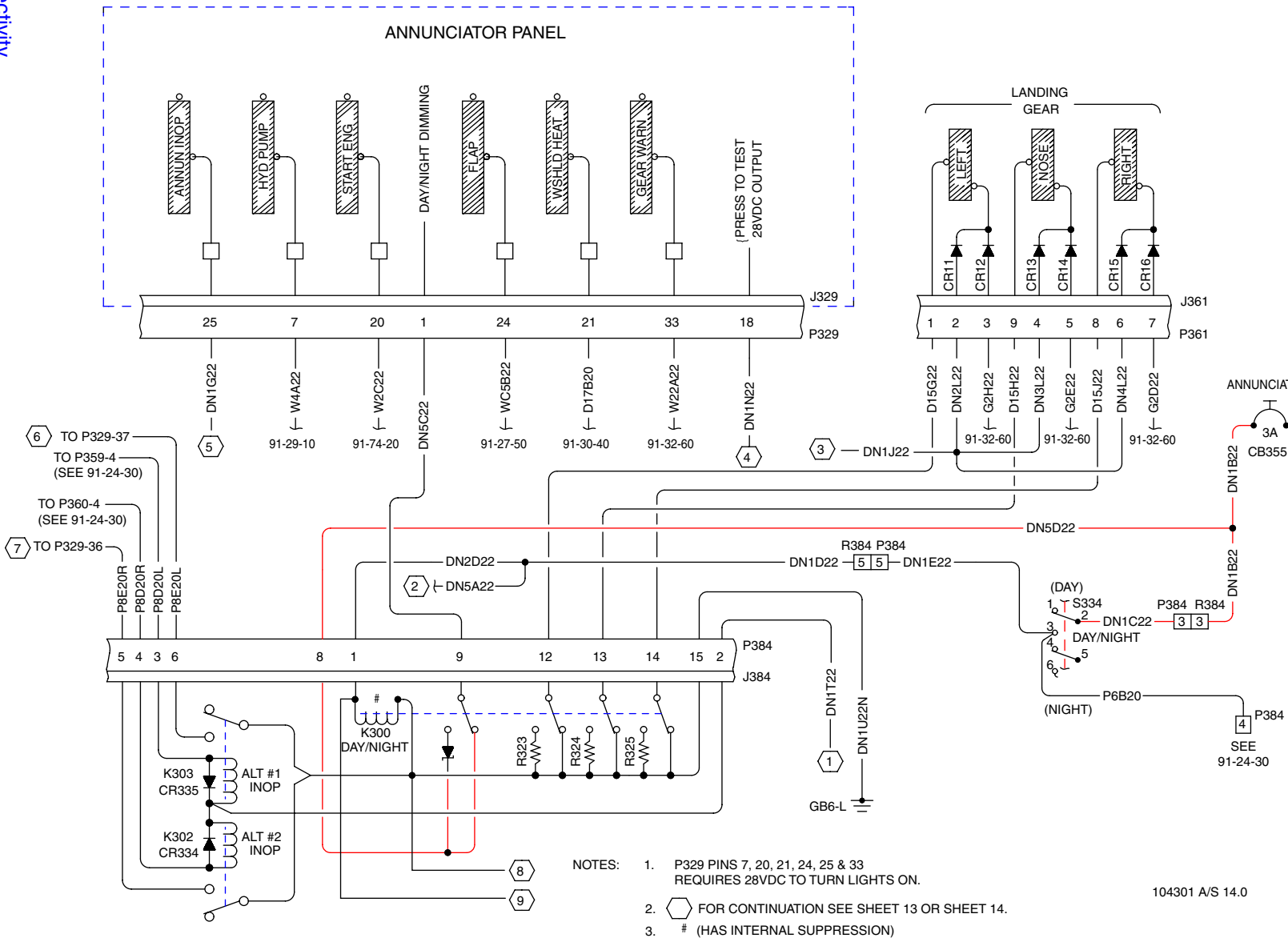


Annunciator Panel
Figure 1 (Sheet 11 of 16)

Effectivity
4636248 thru 4636313,
less 4636299

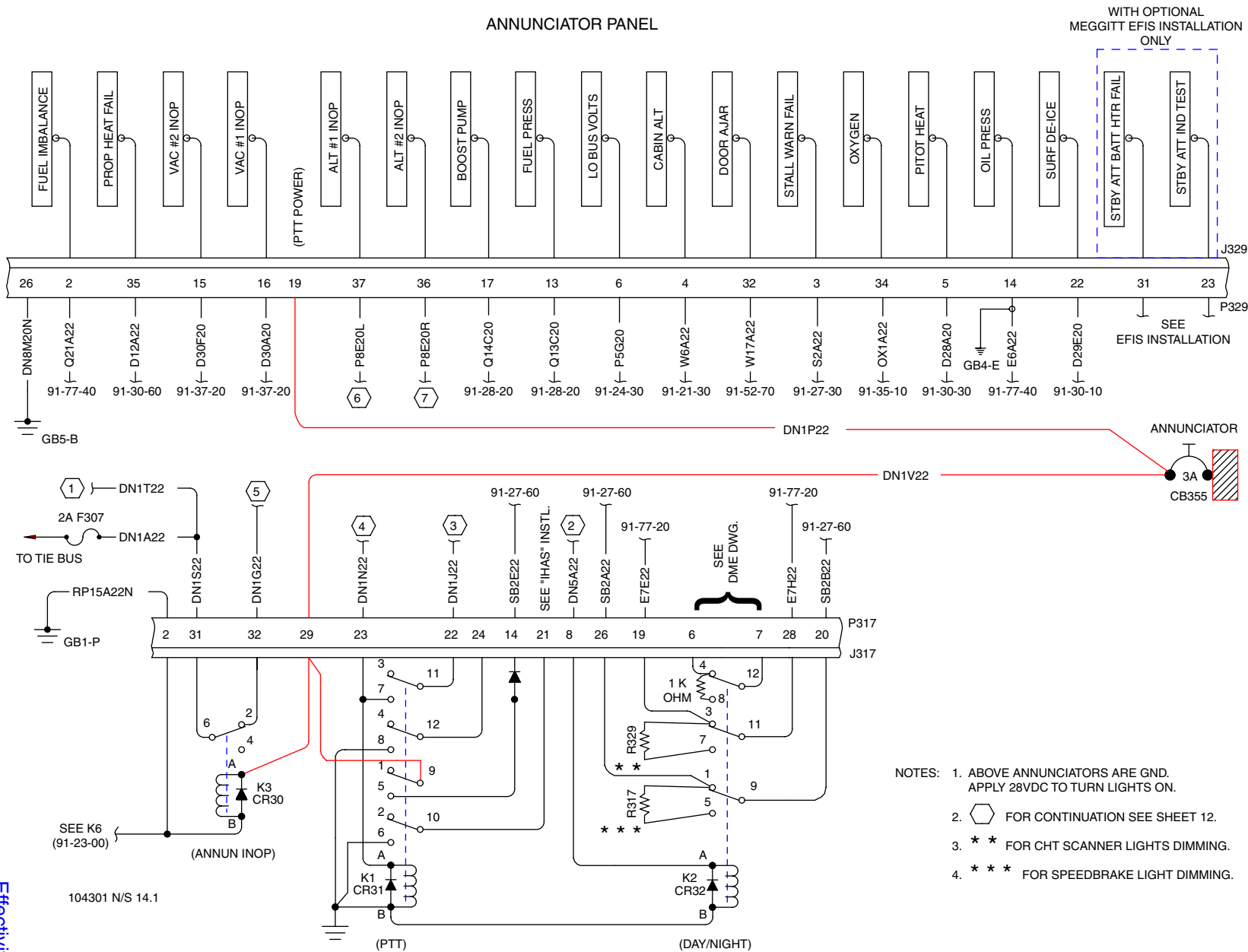
104051 B/C 14.1

104301 A/S 14.0



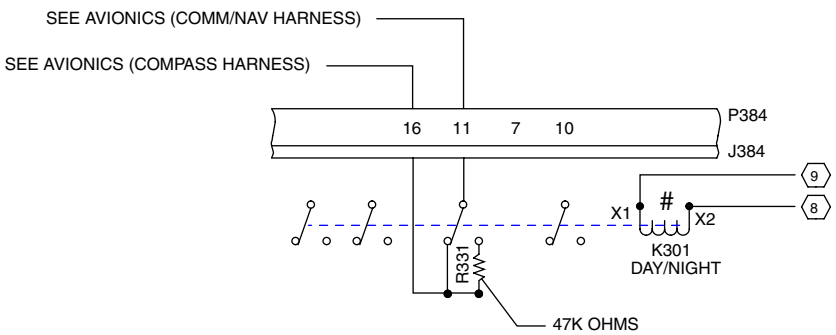
Annunciator Panel
Figure 1 (Sheet 12 of 16)

Effectivity
4636299 and
4636314 thru 4636374



Annunciator Panel
Figure 1 (Sheet 13 of 16)

Effectivity
4636299 and
4636314 thru 4636374



- NOTES: 1.  FOR CONTINUATION SEE SHEET 12.
2. # (HAS INTERNAL SUPPRESSION)

104301 E/S 14.2

Effectivity
4636299 and
4636314 4636374

Annunciator Panel
Figure 1 (Sheet 14 of 16)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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Annunciator Panel

Effectivity
4636375 and up

Figure 1 (Sheet 15 of 16)

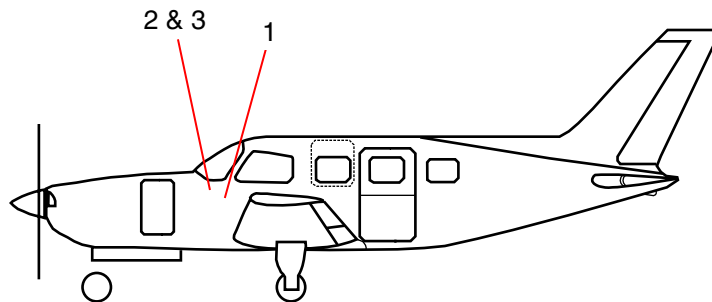


**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

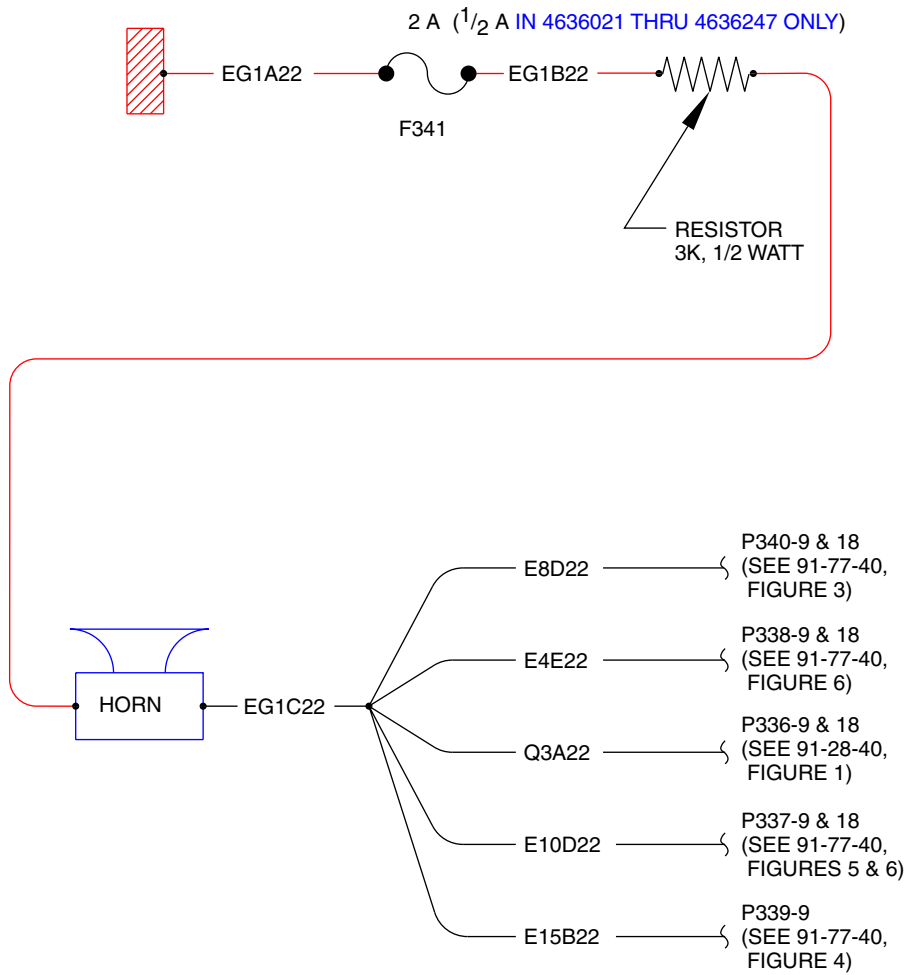
Item #	Designation	Description
1	F341	Fuse (2 Amp) (5 Amp with Avidyne Entegra Option) (½ Amp in S/N's 4636021 thru 4636247 only)
2		Resistor
3		Horn



Exceedance Audio Alert
Figure 2 (Sheet 1 of 3)

[Effectivity](#)
[4636021 and up](#)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



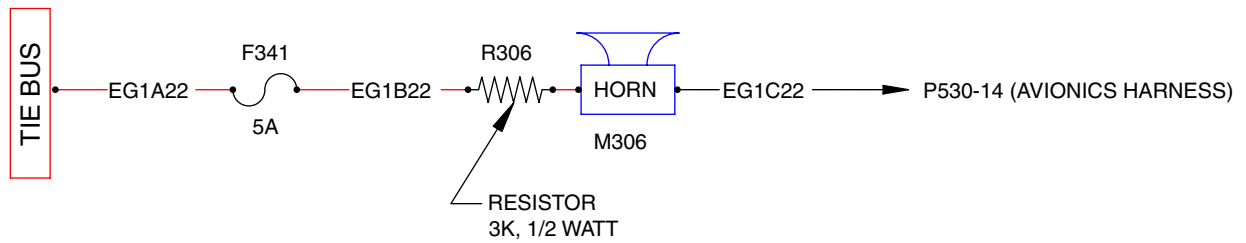
85508 L 5.0
101238 E
101301 C
104051 C
104301 NEW/S

[Effectivity](#)
4636021 thru 4636374

Exceedance Audio Alert
Figure 2 (Sheet 2 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

105115 NEW 13.0



Exceedance Audio Alert
Figure 2 (Sheet 3 of 3)

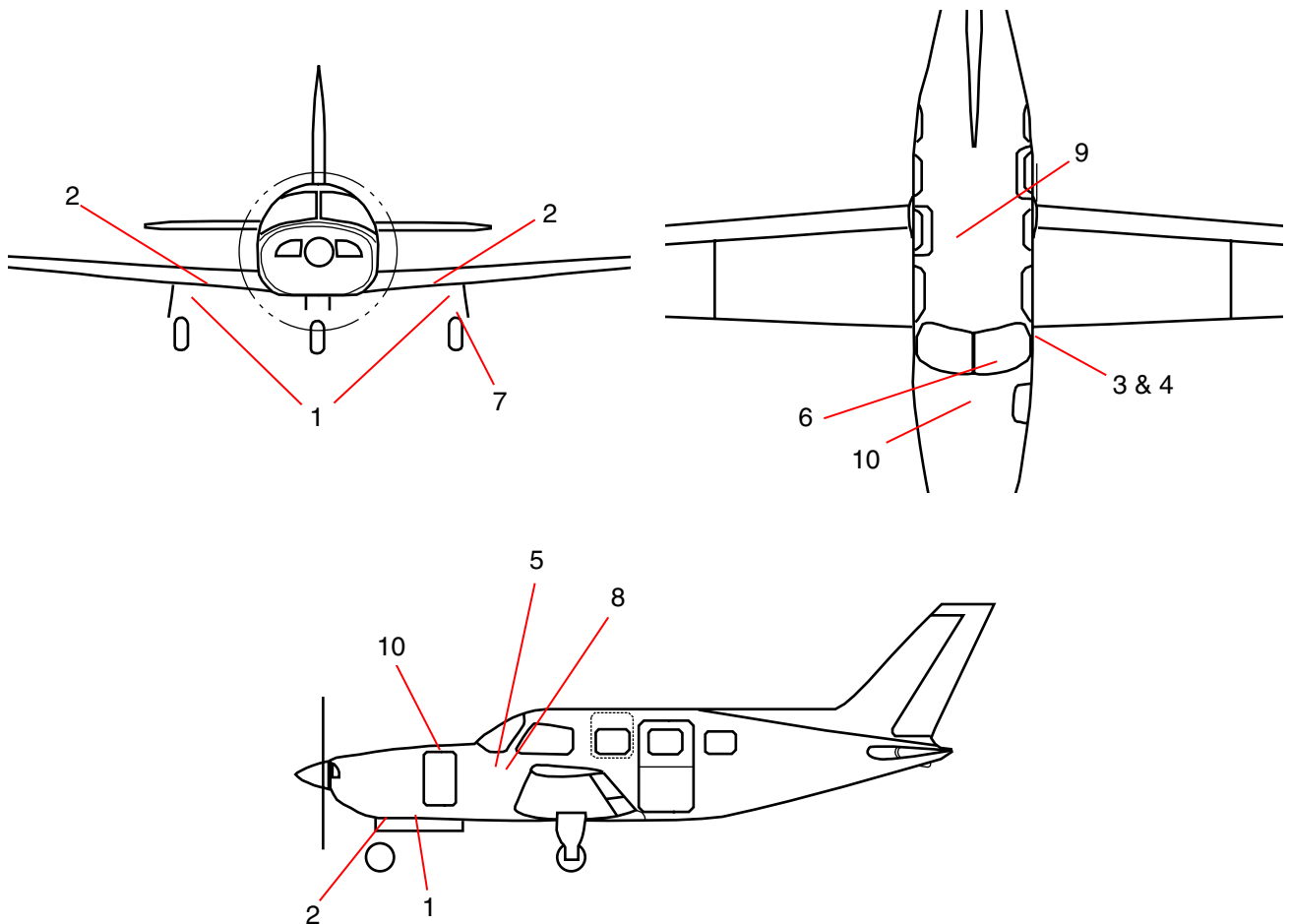
[Effectivity](#)
4636375 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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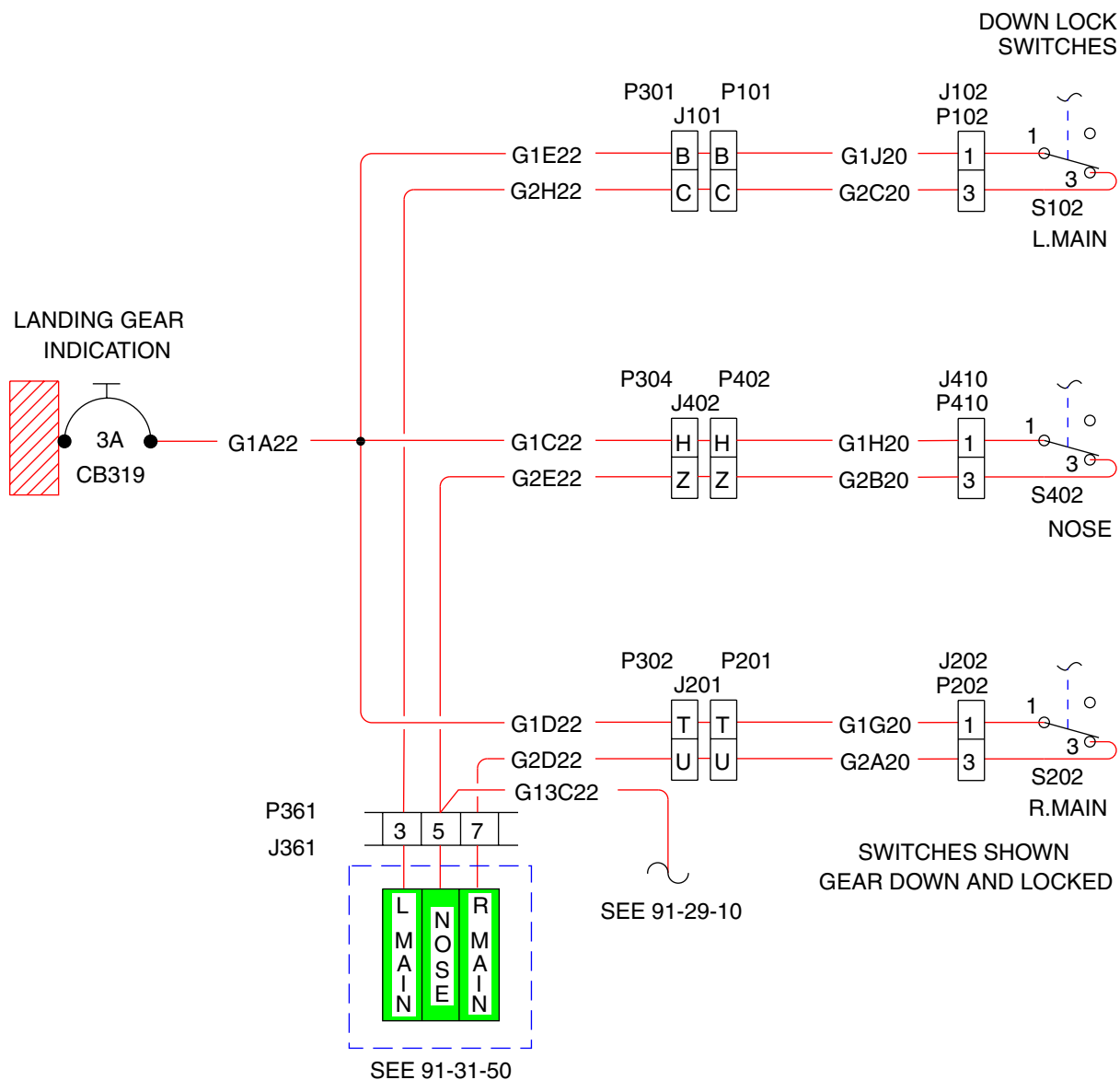
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	S102, S202, S402	Left, Right Main and Nose Gear Down Lock Switch Assembly
2	S101, S201, S401	Left, Right Main and Nose Gear Up Lock Switch Assembly
3	CB319	Circuit Breaker (3 Amp)
4	CB320	Circuit Breaker (3 Amp)
5	S342	Gear Selector Switch
6	A305	Dual Warning Horn
7	S103	Squat Switch Assembly
8	S325	Throttle Switch Assembly (S/N's 4636001 thru 4636374 only)
9	S330	Flap Switch
10	S405	MAP Switch (S/N's 4636375 and up)



Landing Gear Position and Warning
Figure 1 (Sheet 1 of 4)

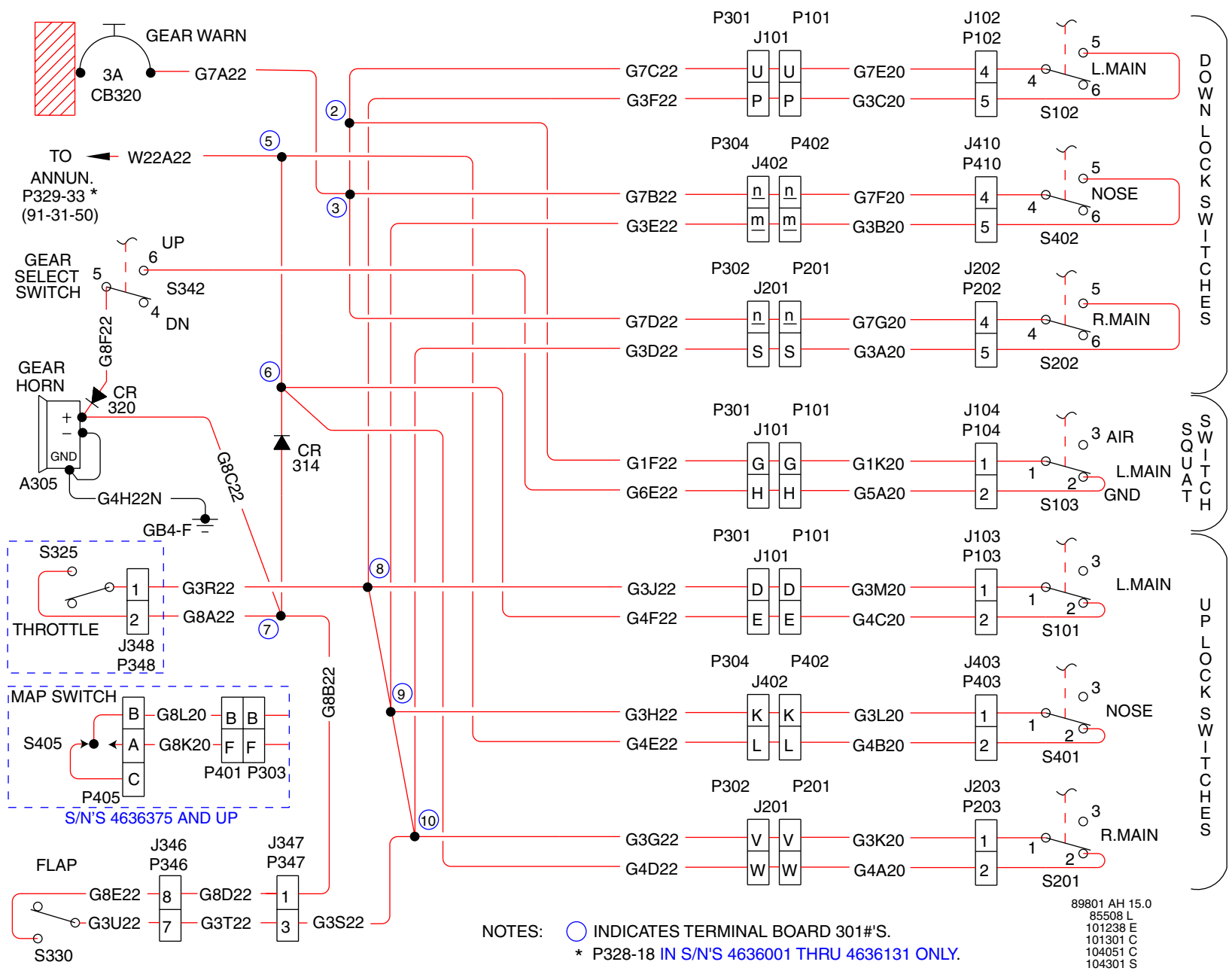
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



89801 AH 12.0
85508 L
101238 E
101301 C
104051 C
104301 NEW/S

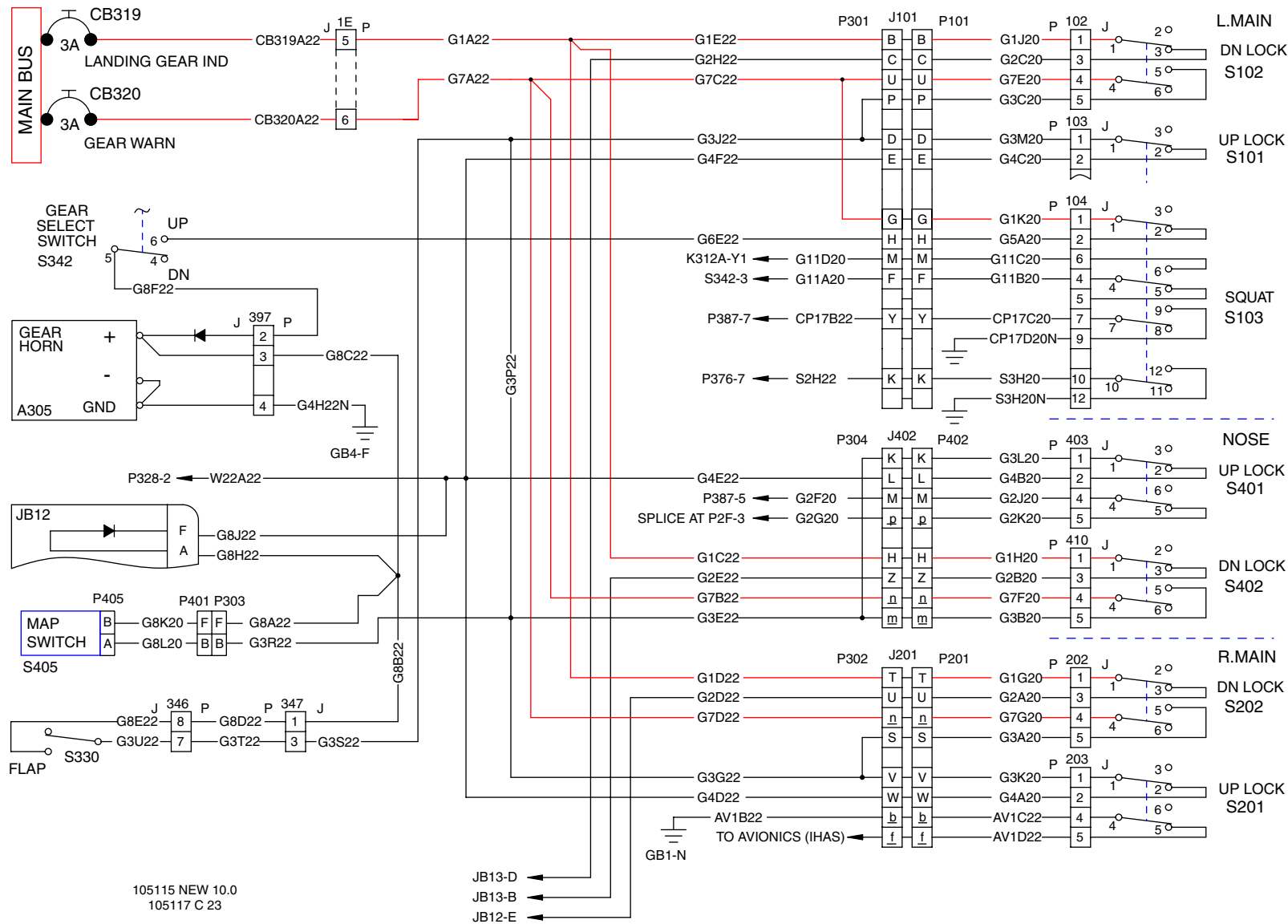
[Effectivity](#)
4636001 thru 4636374

Landing Gear Position and Warning
Figure 1 (Sheet 2 of 4)



Landing Gear Position and Warning
Figure 1 (Sheet 3 of 4)

Effectivity
4636001 thru 4636374

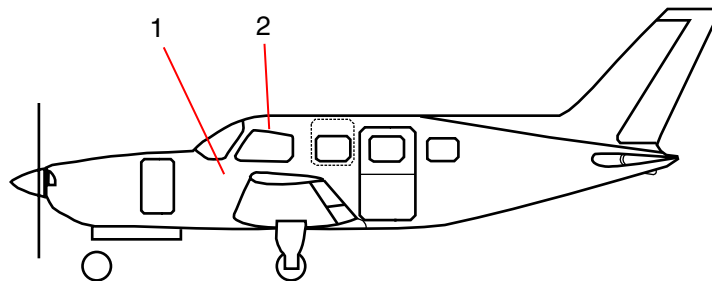


Effectivity
4636375 and up

Landing Gear Position and Warning
Figure 1 (Sheet 4 of 4)

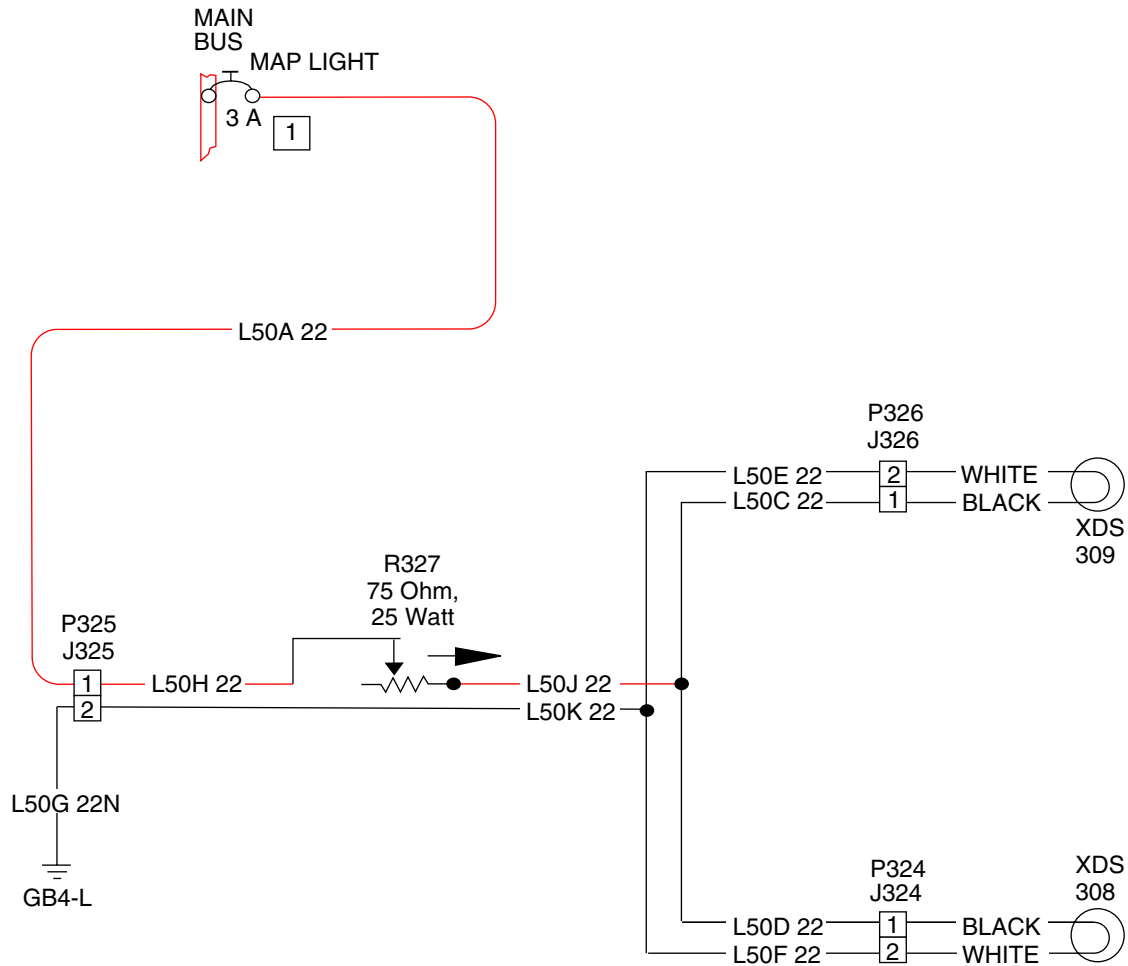
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	CB329 (CB331 in S/N's 4636314 and up)	Circuit Breaker (3 Amp)
2	XDS308, XDS309	Map Light



Map Lights
Figure 1 (Sheet 1 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

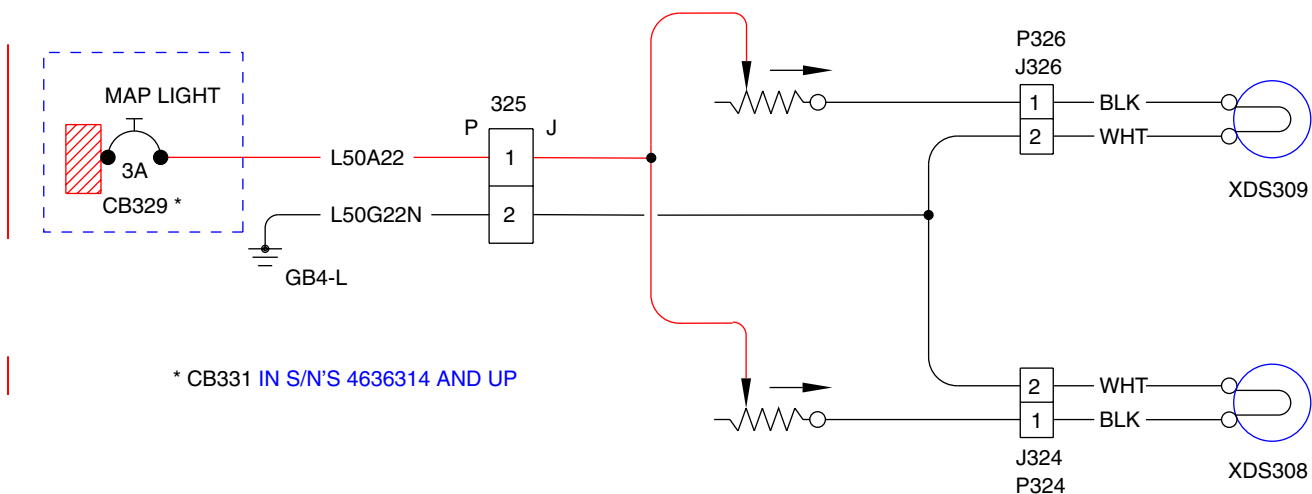
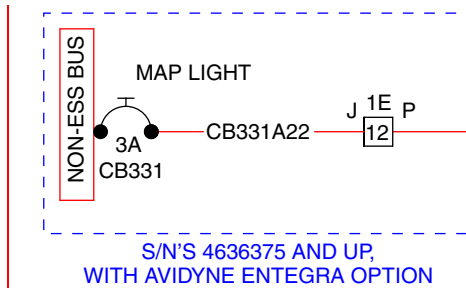


89801 AH 23.0

[Effectivity](#)
4636001 thru 4636020

Map Lights
Figure 1 (Sheet 2 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



85508 L 23.0
101238 E
101301 C
104051 C
104301 NEW/S
105115 NEW 18.0

Map Lights
Figure 1 (Sheet 3 of 3)

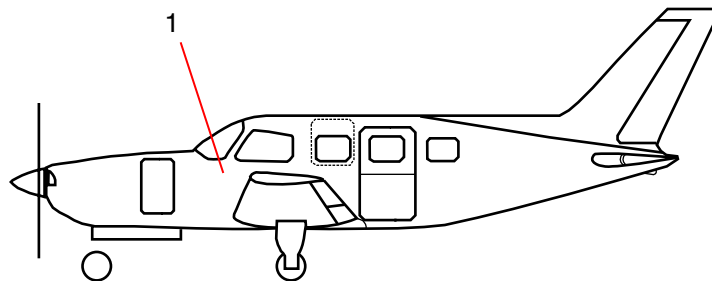
Effectivity
4636021 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

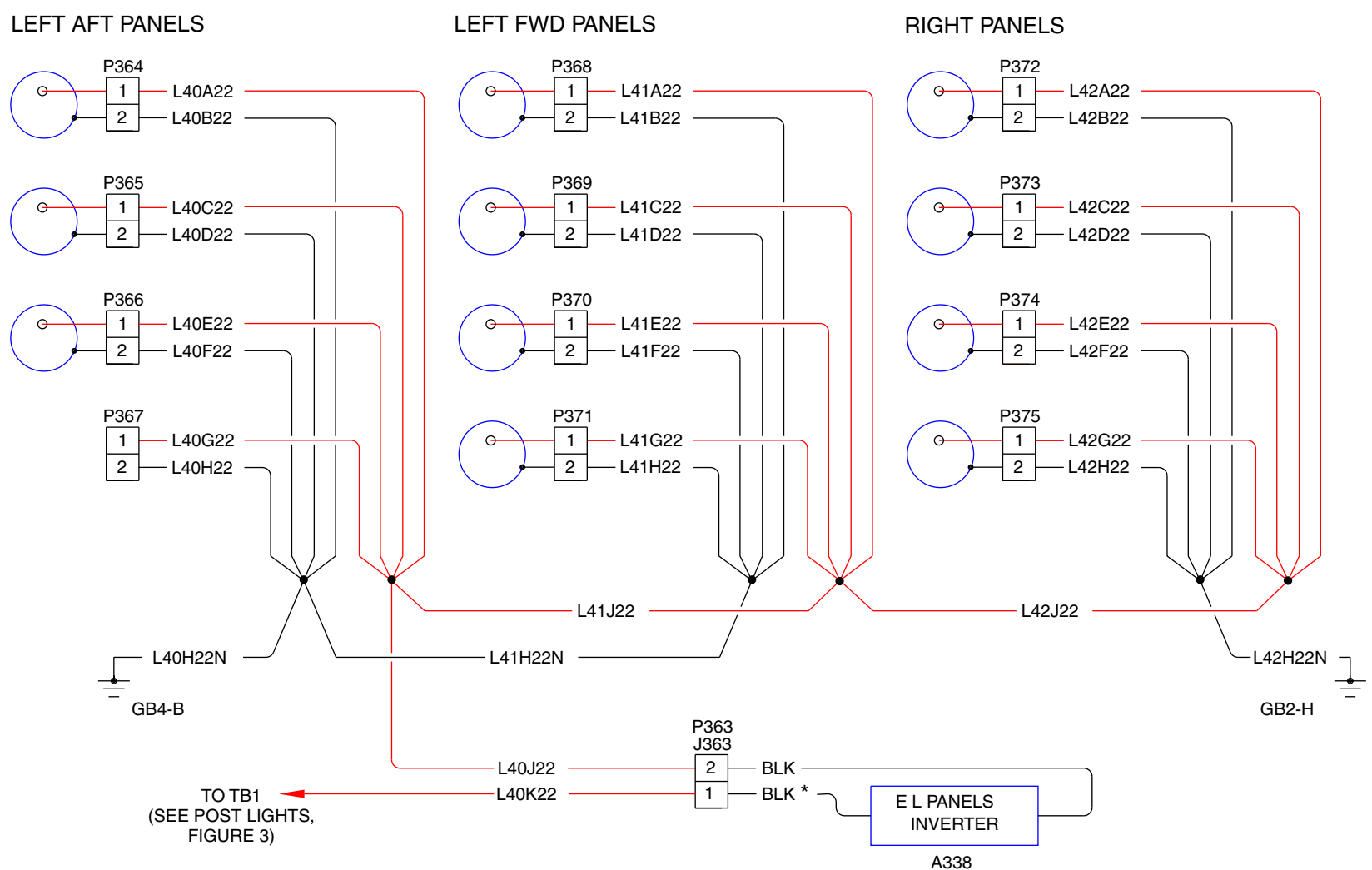
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	A338	Inverter



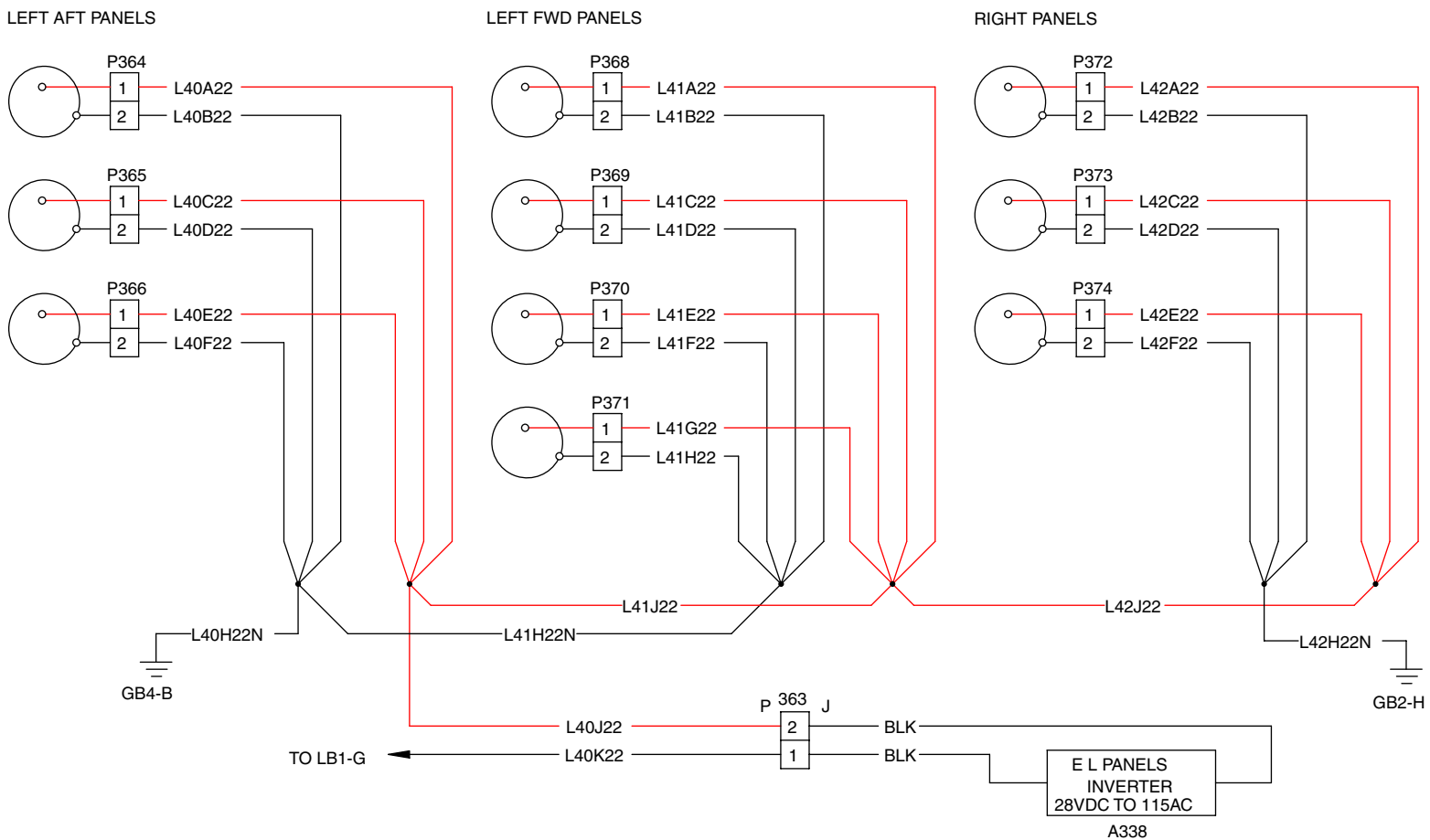
Electroluminescent Panel Lighting (C/B Panels)
Figure 2 (Sheet 1 of 3)



* RED IN S/N'S 4636001 THRU 4636131 ONLY.

- 89801 AH 44.0
- 85508 L
- 101238 E 43.0
- 101301 C
- 104051 C
- 104301 NEW/S

Effectivity
4636001 thru 4636374
Electroluminescent Panel Lighting (C/B Panels)
Figure 2 (Sheet 2 of 3)



105115 NEW 14.2

Electroluminescent Panel Lighting (C/B Panels)
Figure 2 (Sheet 3 of 3)

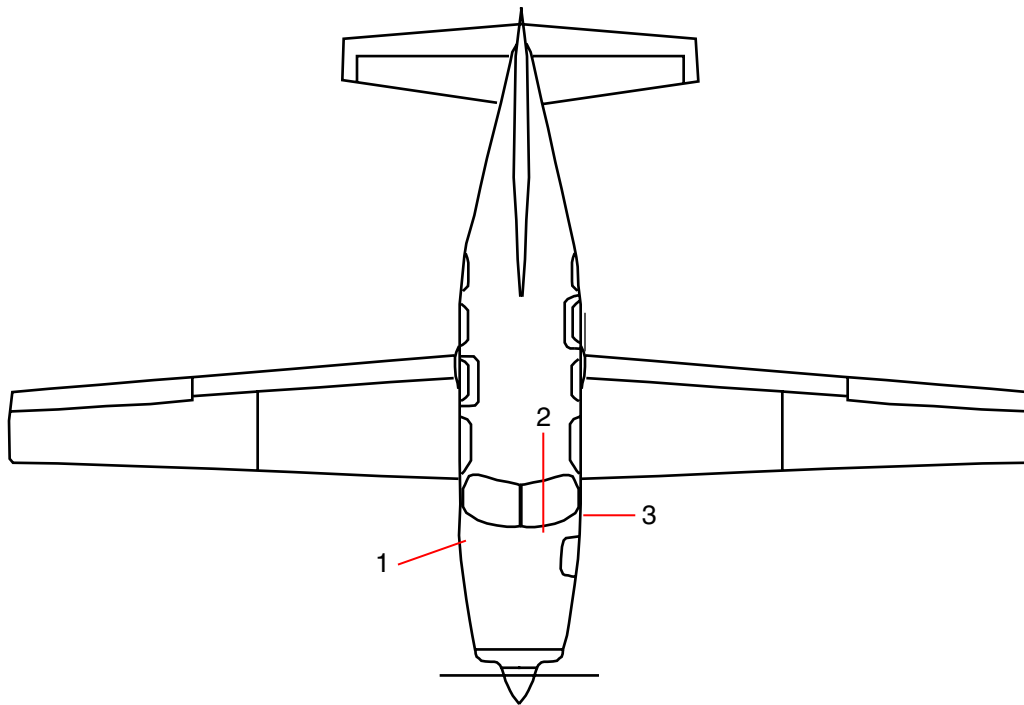
Effectivity
4636375 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

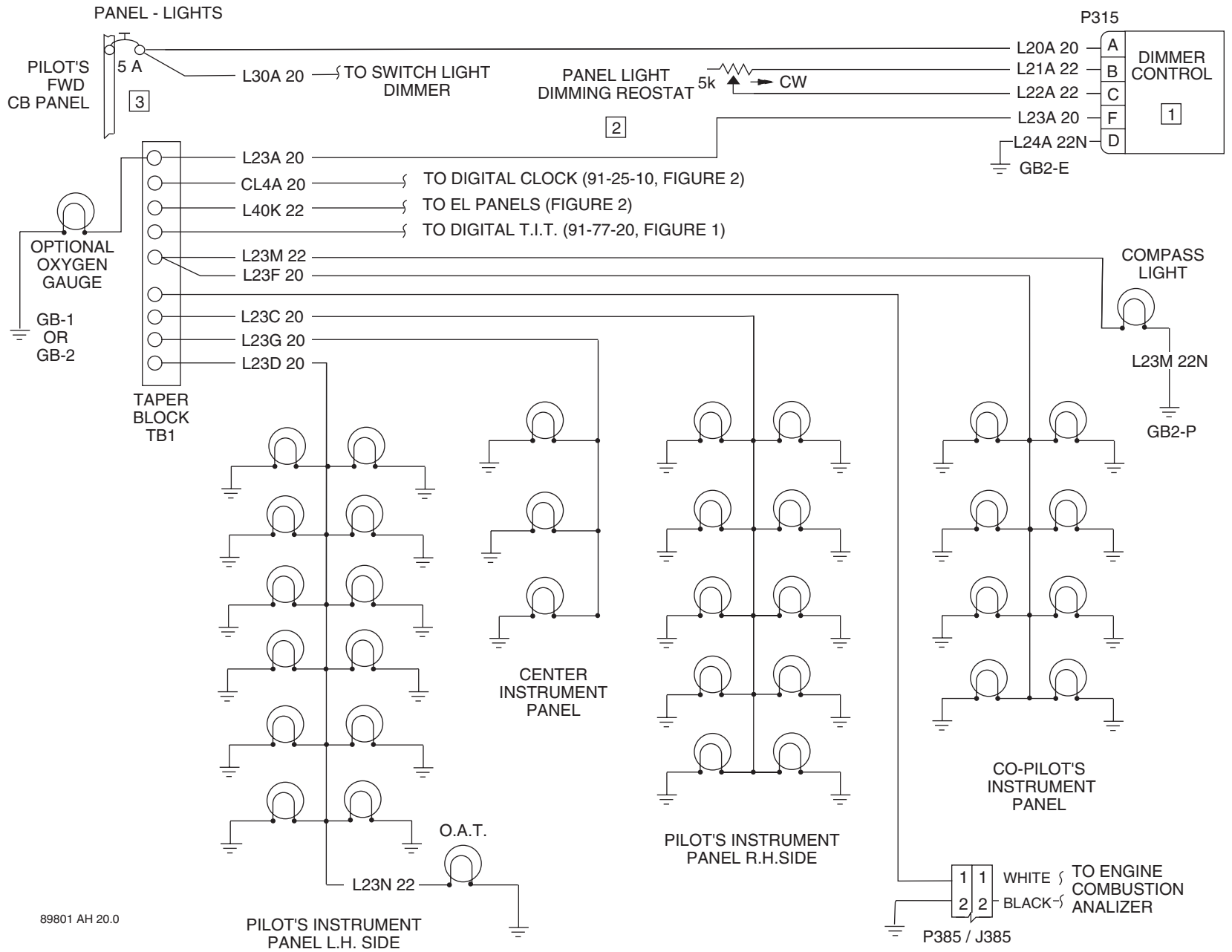
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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	A302	Dimmer Control
2	R301	Panel Light Dimmer Rheostat
3	CB354	Circuit Breaker (5 Amp) Post Light Assembly



Post Lights
Figure 3 (Sheet 1 of 4)



89801 AH 20.0

Effectivity 4636001 thru 4636020

Post Lights

Figure 3 (Sheet 2 of 4)

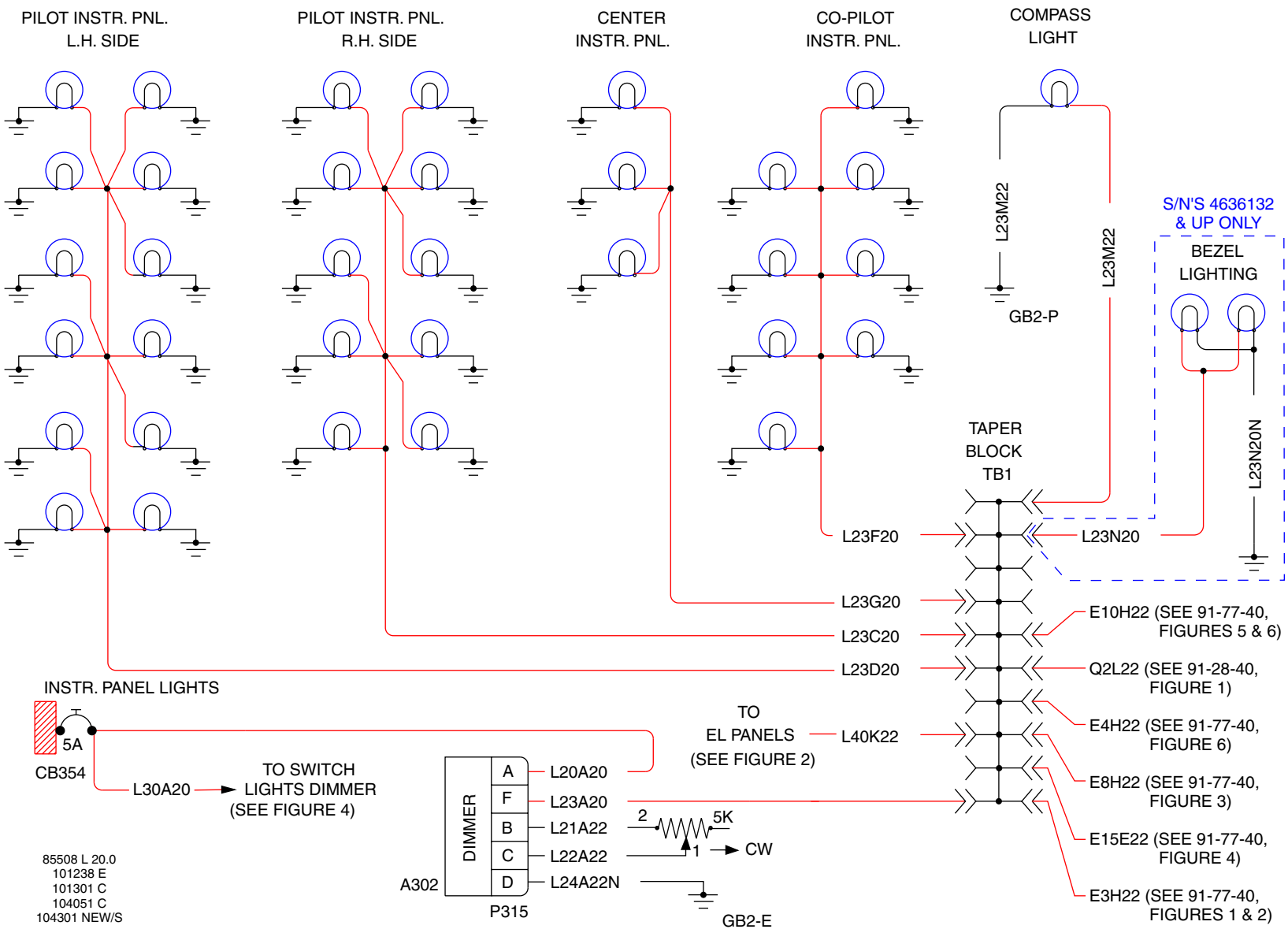
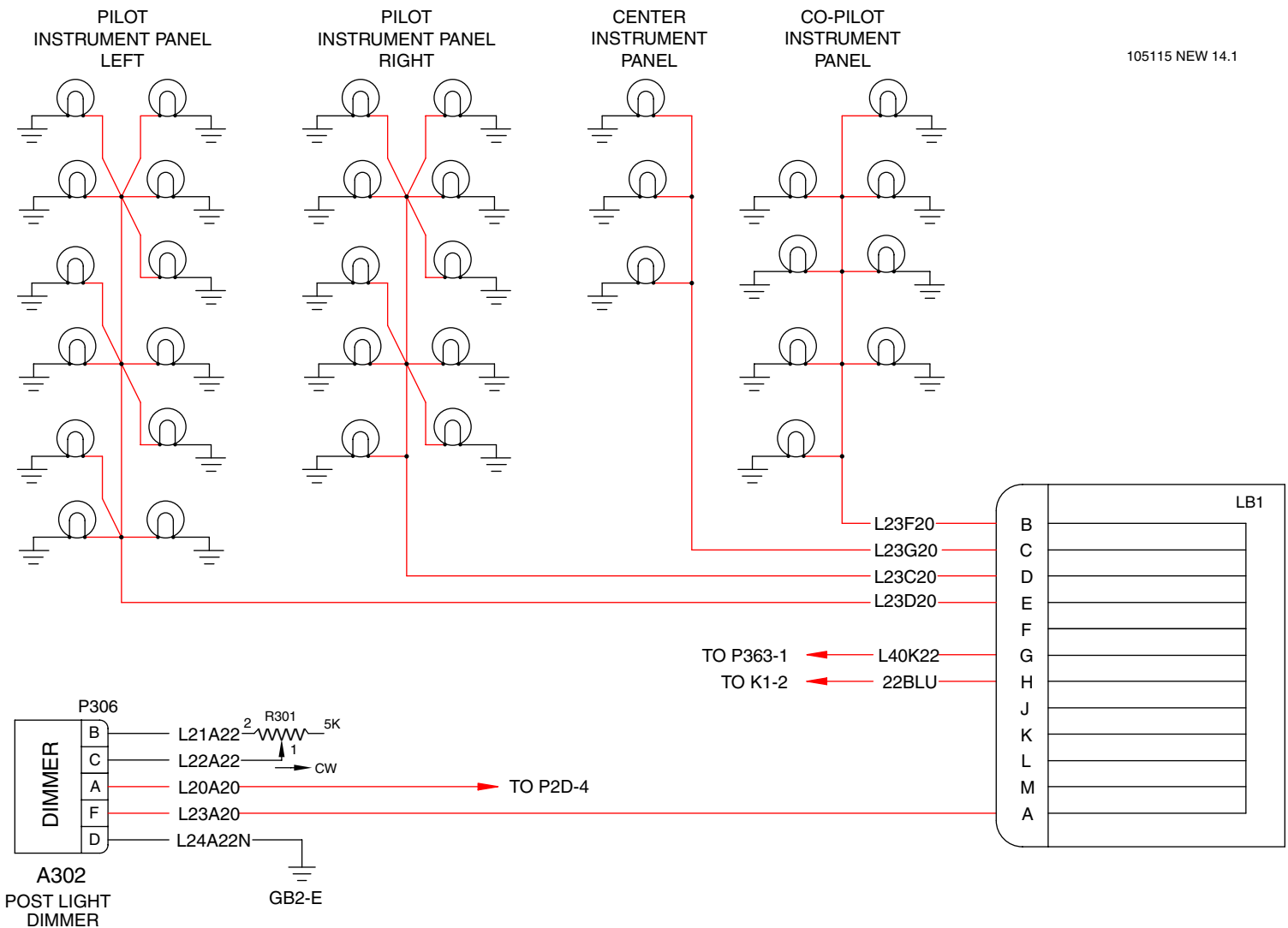


Figure 3 (Sheet 3 of 4)

105115 NEW 14.1

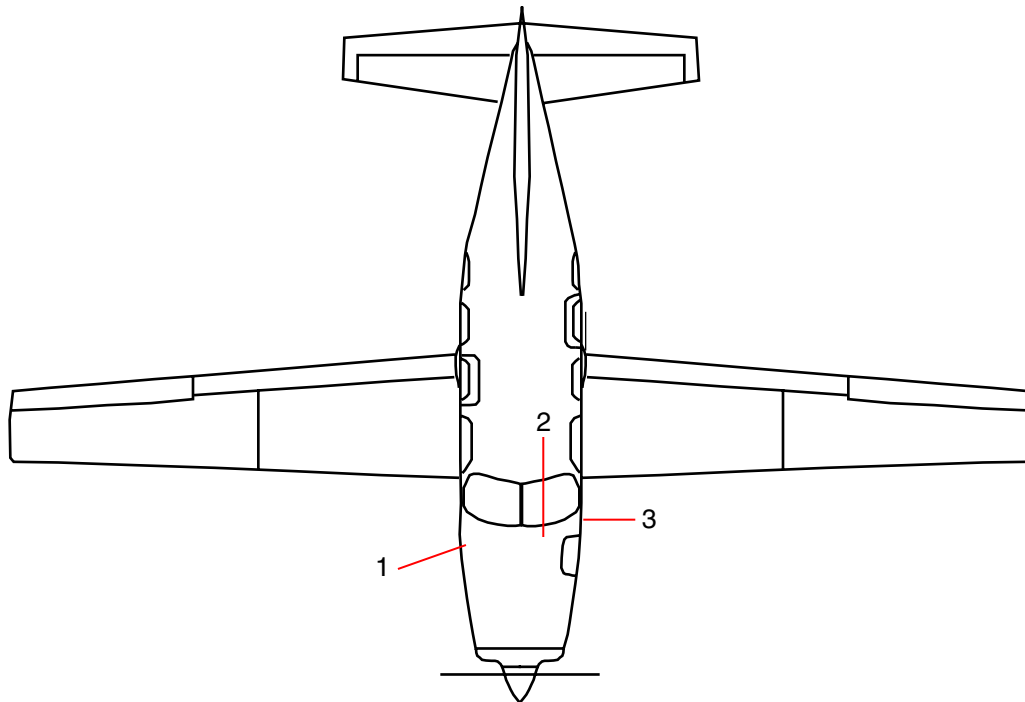


Effectivity
4636375 and up

Post Lights
Figure 3 (Sheet 4 of 4)

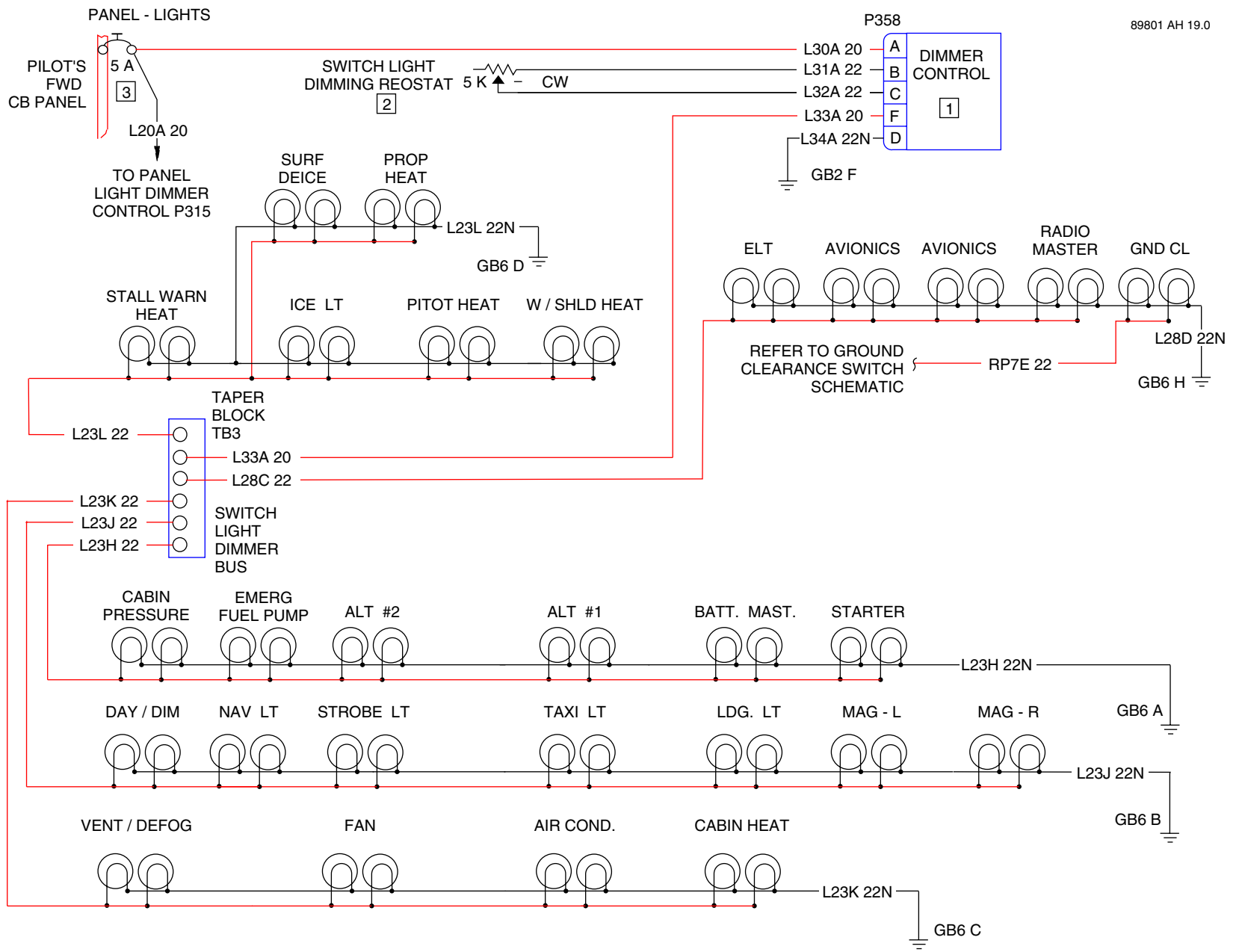
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	A329	Dimmer Control
2	R309	Panel Light Dimmer Rheostat
3	CB354	Circuit Breaker (5 Amp)

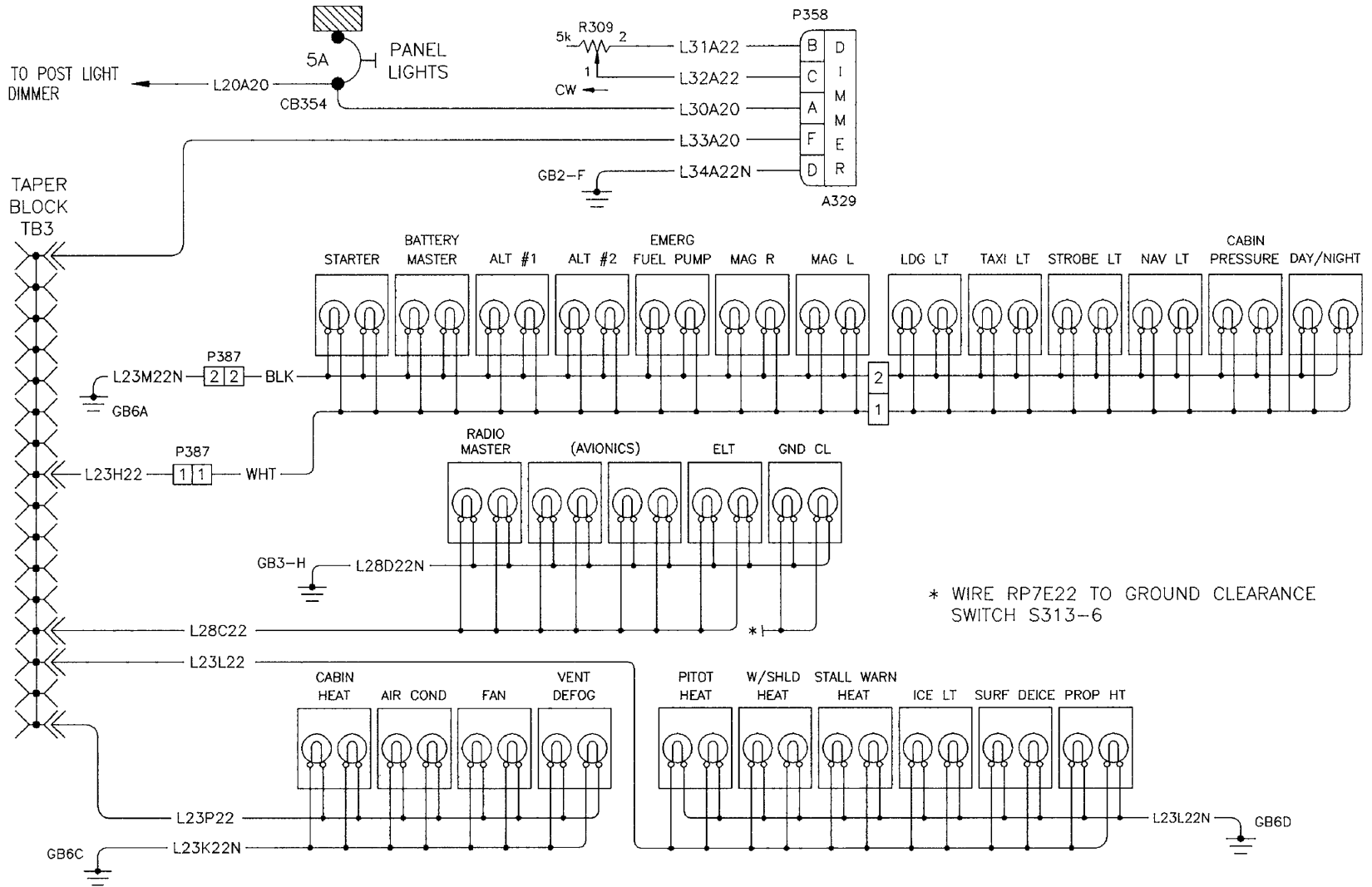


Instrument Panel Switch Lights
Figure 4 (Sheet 1 of 7)

89801 AH 19.0



Instrument Panel Switch Lights
Figure 4 (Sheet 2 of 7)

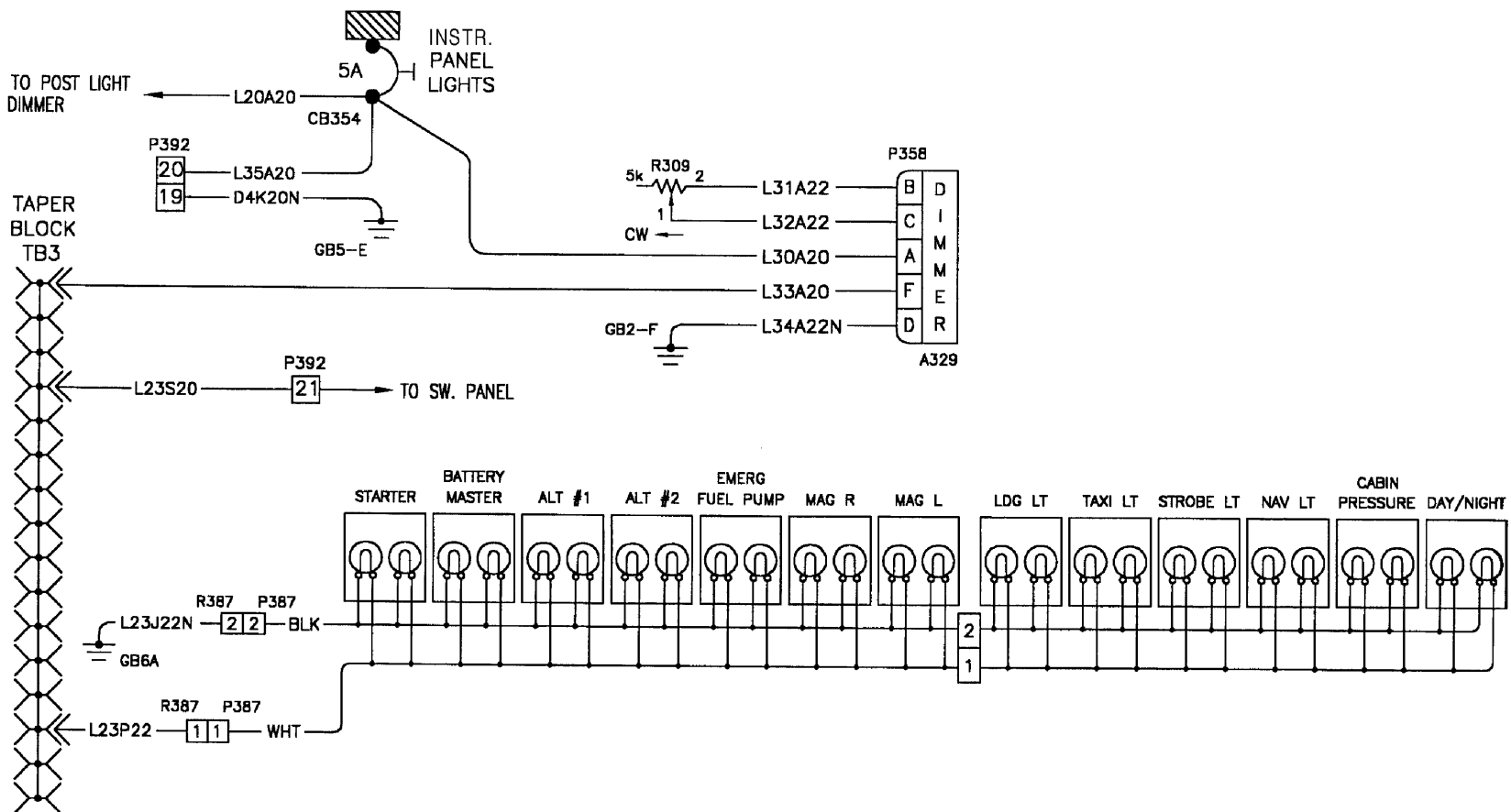


85508 L 19.0

Instrument Panel Switch Lights
Figure 4 (Sheet 3 of 7)

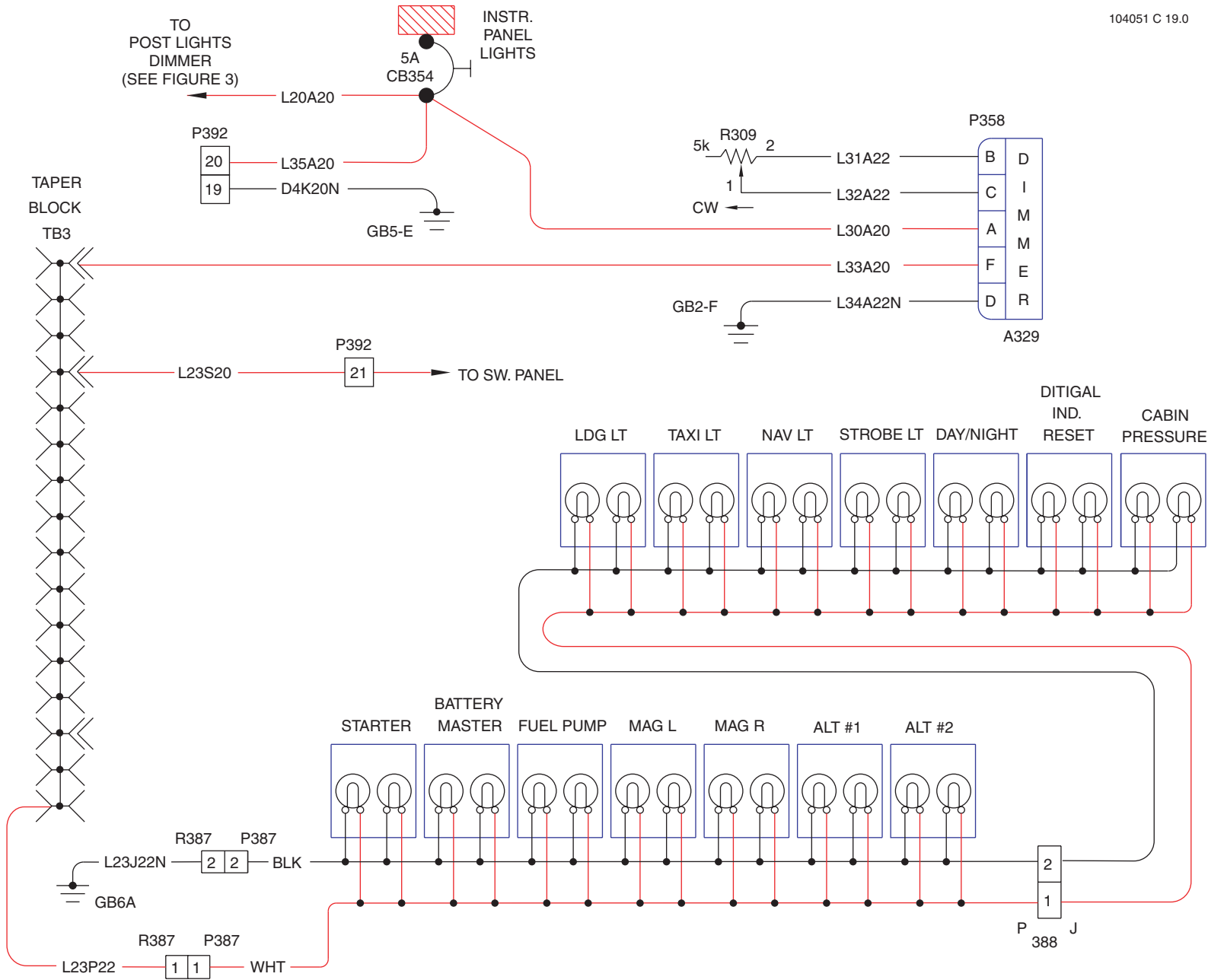
Effectivity
4636021 thru 4636131

Instrument Panel Switch Lights
Figure 4 (Sheet 4 of 7)



101238 E 19.0
101301 C

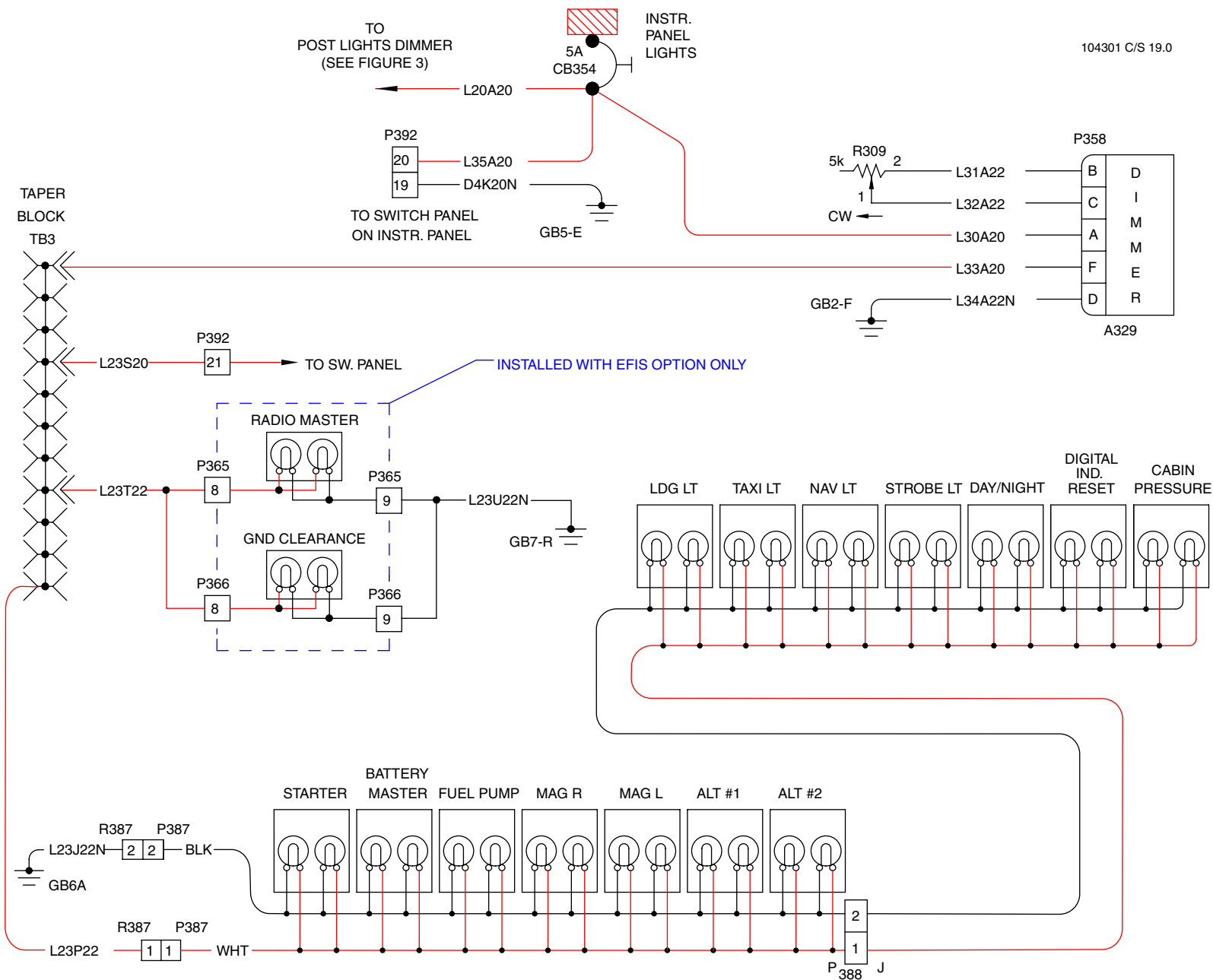
104051 C 19.0

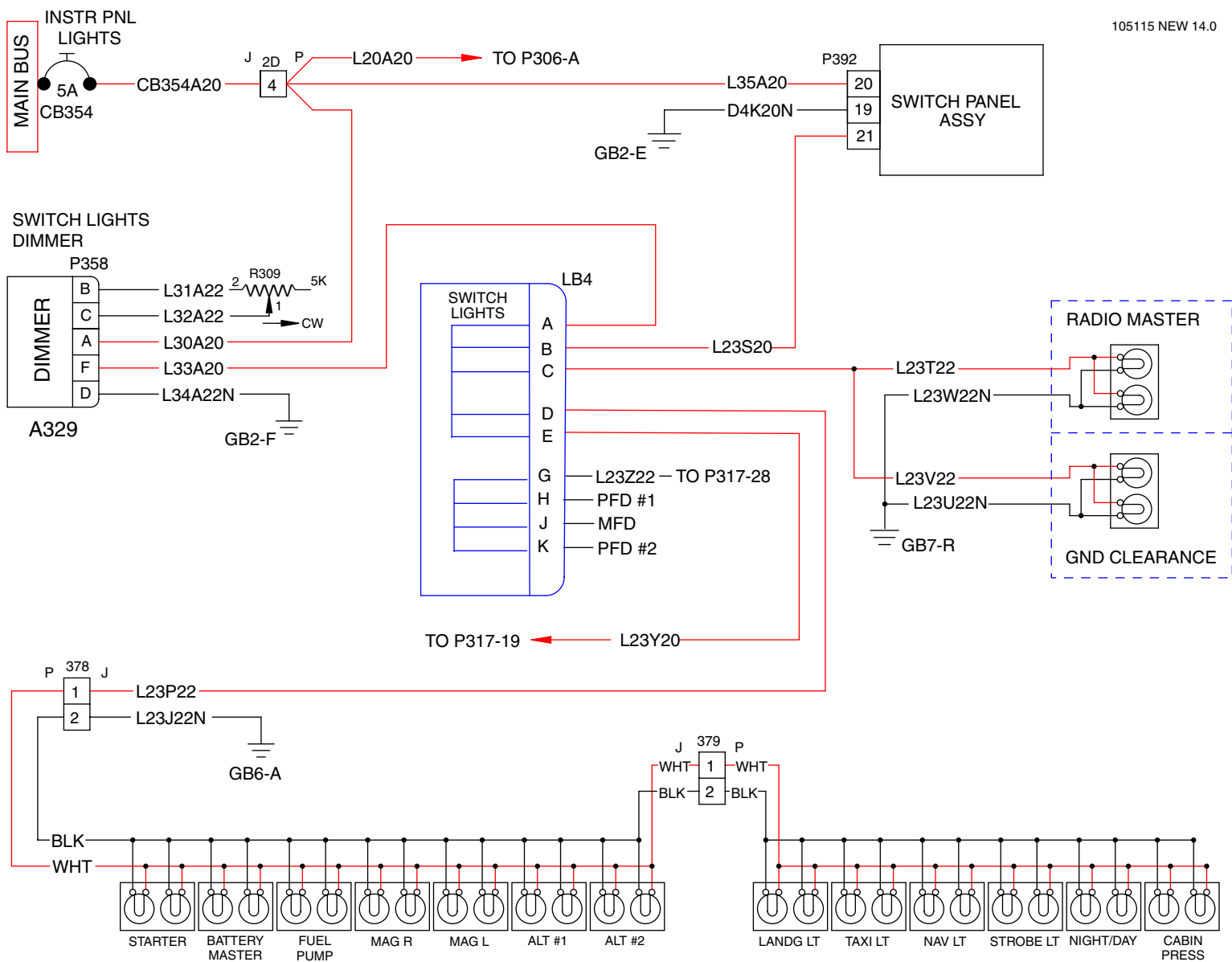


Instrument Panel Switch Lights
Figure 4 (Sheet 5 of 7)

Effectivity
4636248 thru 4636313,
less 4636299

104301 C/S 19.0





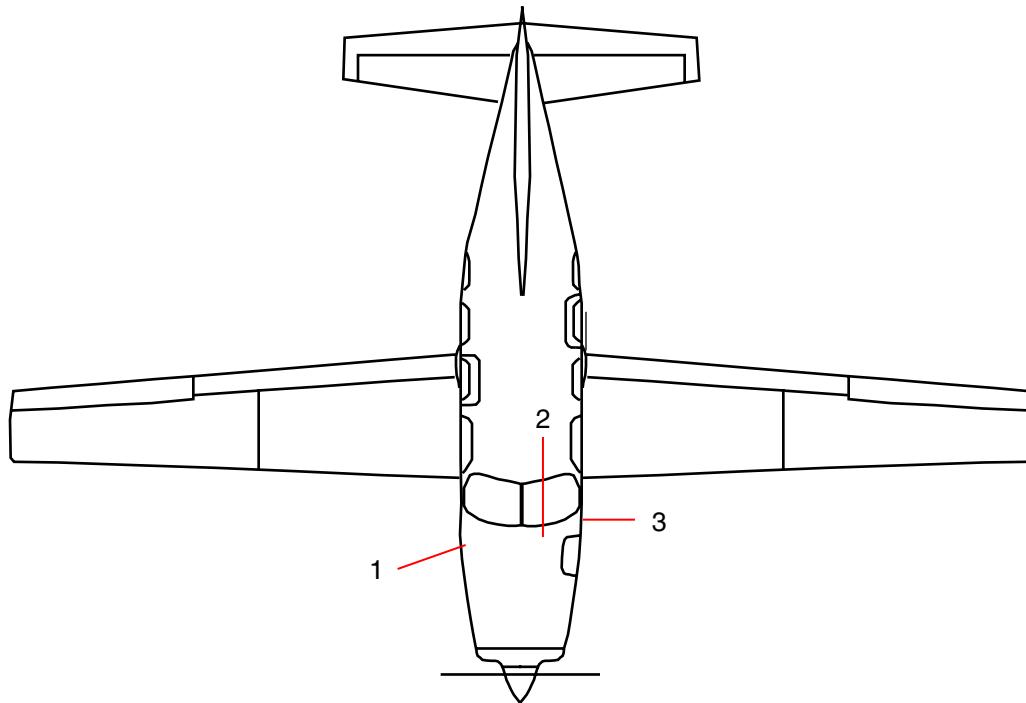
Instrument Panel Switch Lights
Figure 4 (Sheet 7 of 7)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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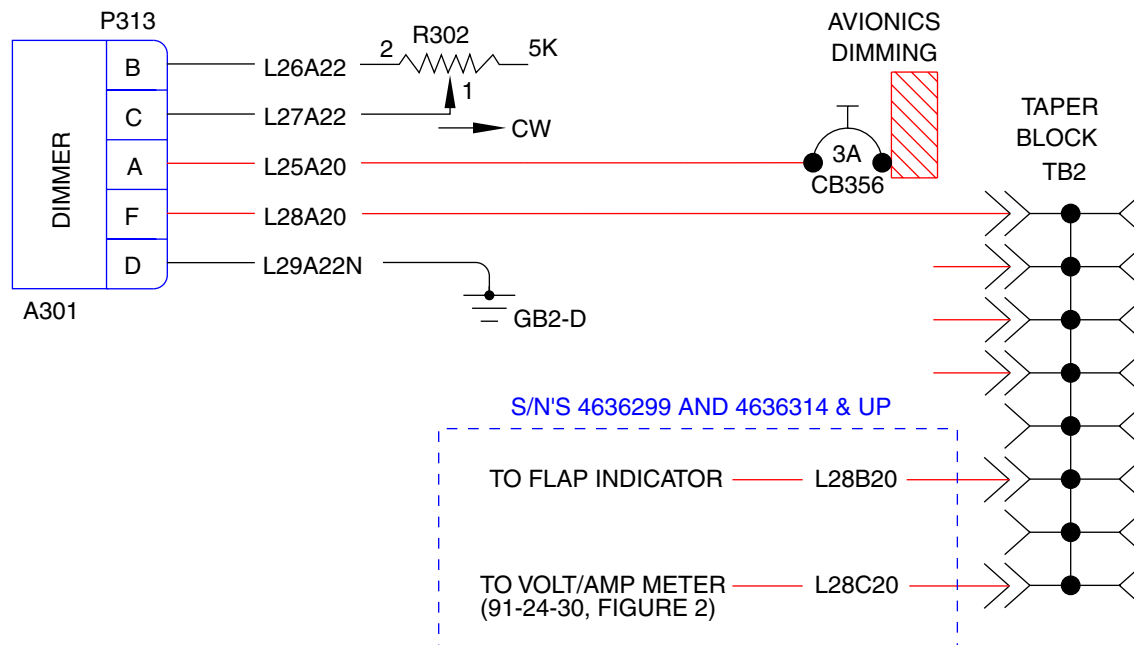
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	A301	Dimmer Control
2	R302	Panel Light Dimmer Rheostat
3	CB356	Circuit Breaker (3 Amp)



Avionics Lighting
Figure 5 (Sheet 1 of 3)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

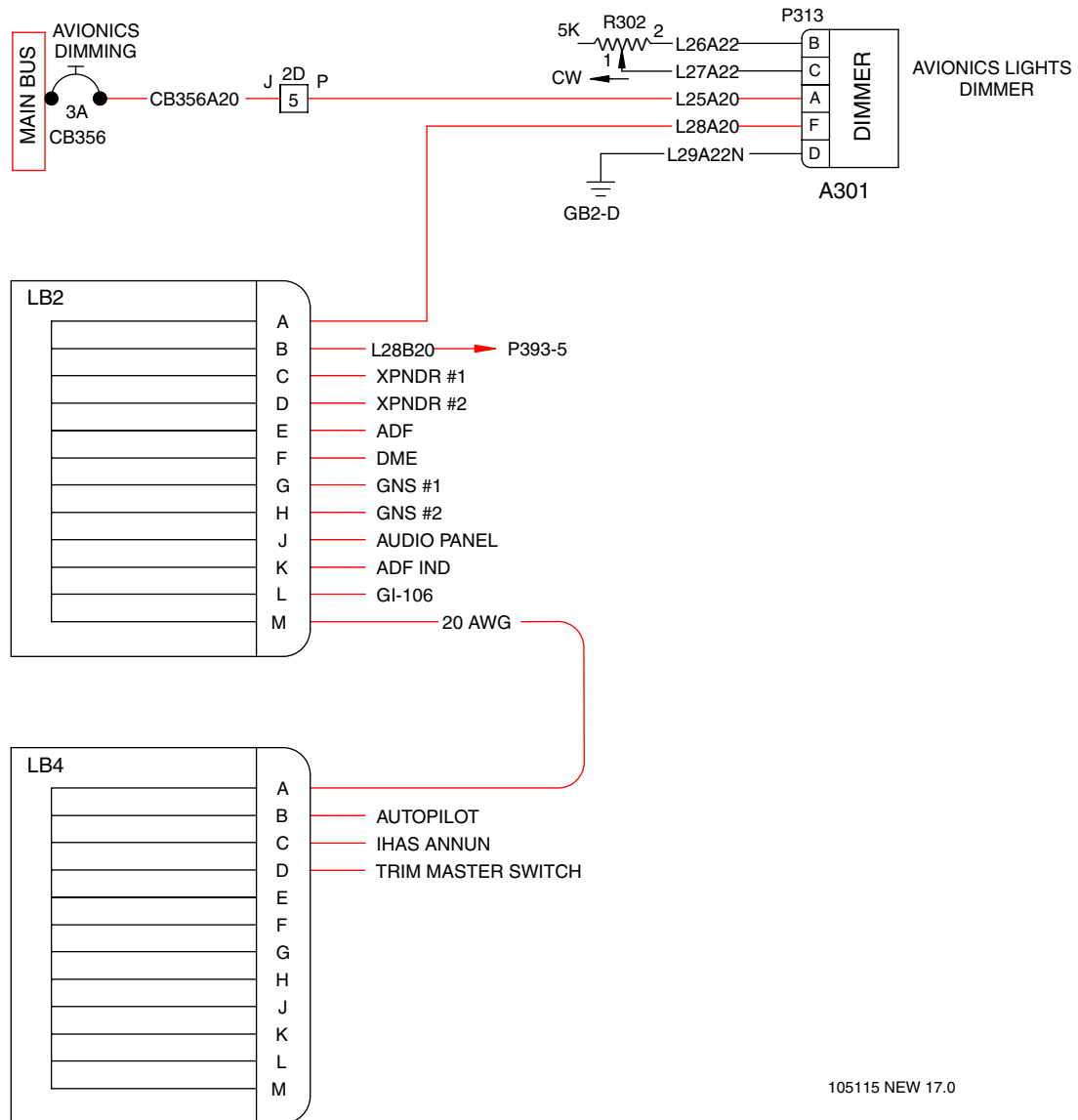


89801 AH 36.0
85508 L
101238 E
101301 C
104051 C
104301 NEW/S

Effectivity
4636001 thru 4636374

Avionics Lighting
Figure 5 (Sheet 2 of 3)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



105115 NEW 17.0

Avionics Lighting
Figure 5 (Sheet 3 of 3)

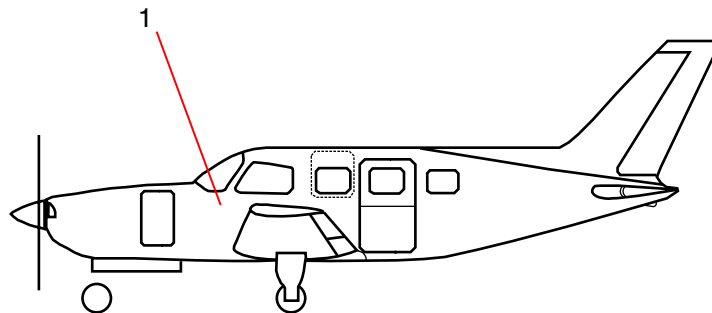
[Effectivity](#)
4636375 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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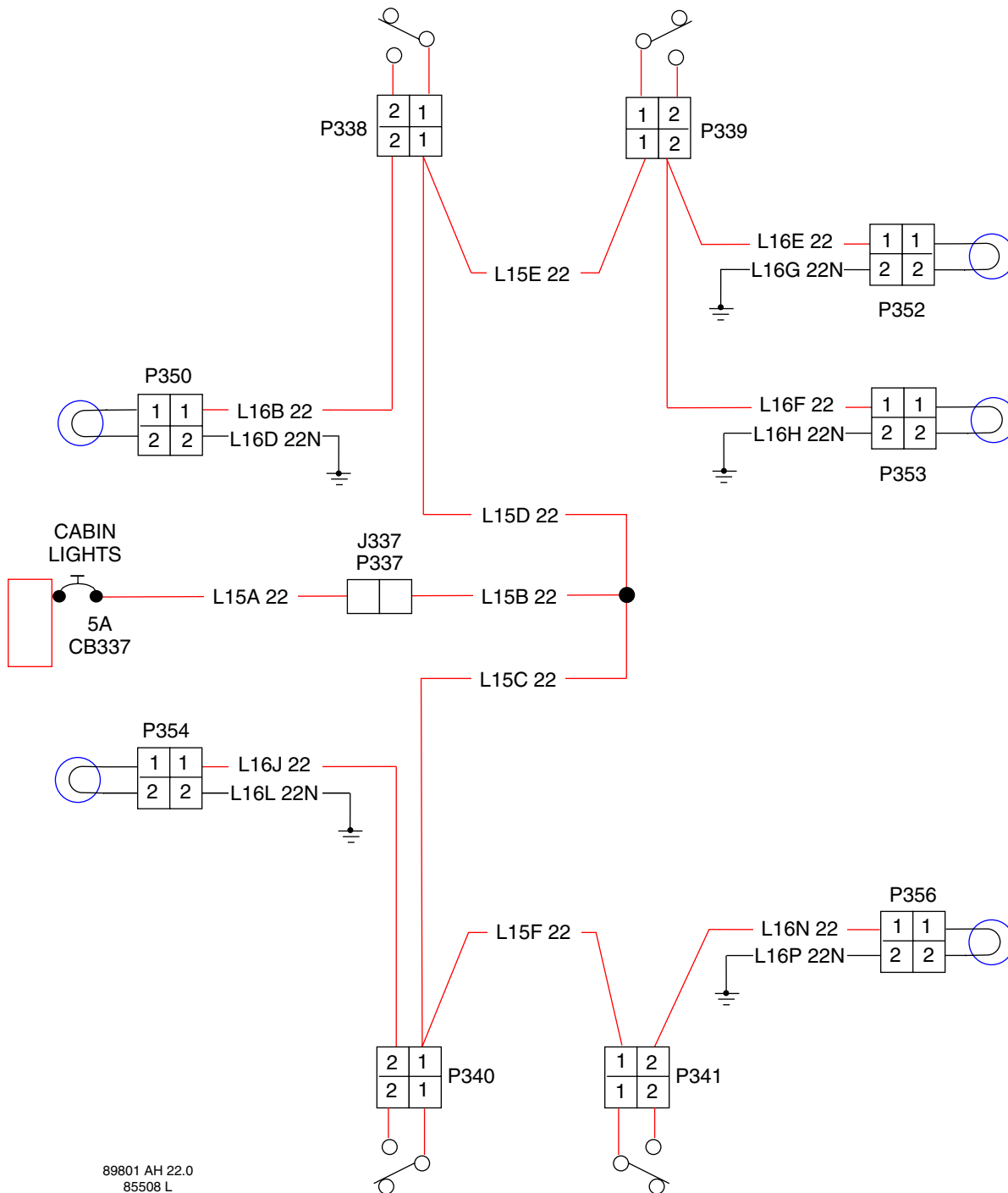
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB337	Circuit Breaker (5 Amp)



Cabin Lights
Figure 1 (Sheet 1 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

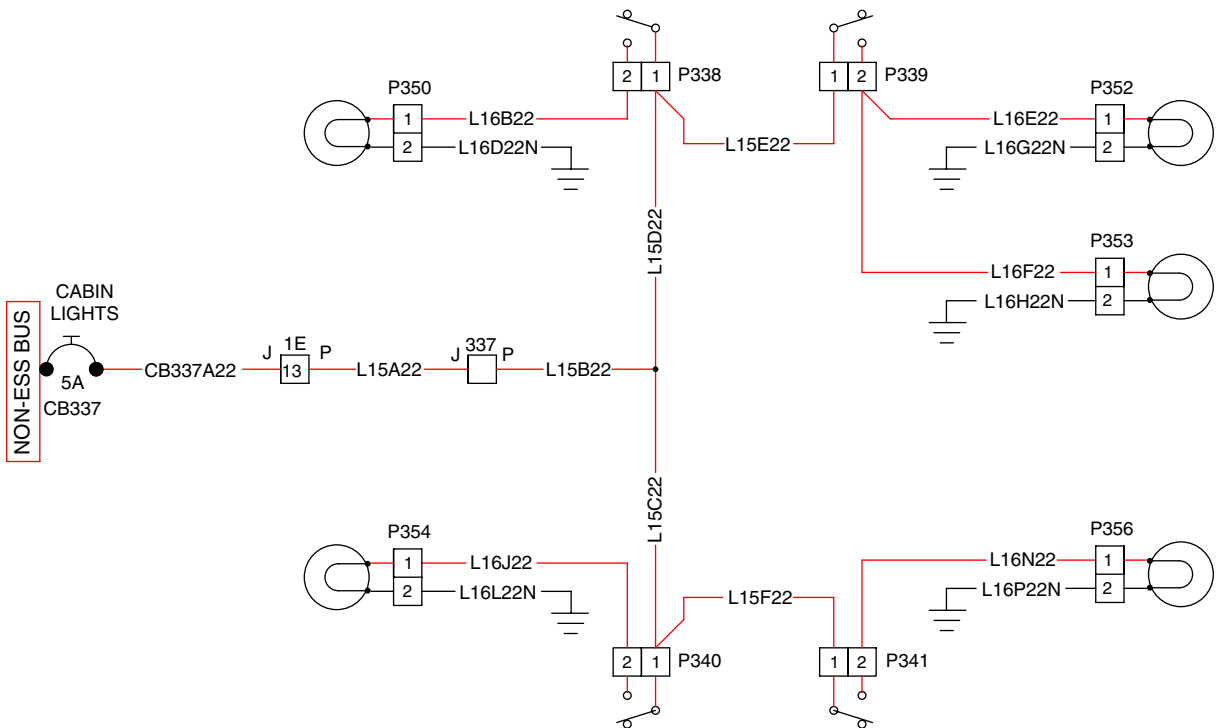


89801 AH 22.0
85508 L
101238 E
101301 C
104051 C
104301 NEW/S

[Effectivity](#)
4636001 thru 4636374

Cabin Lights
Figure 1 (Sheet 2 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



105115 NEW 16.0

Cabin Lights
Figure 1 (Sheet 3 of 3)

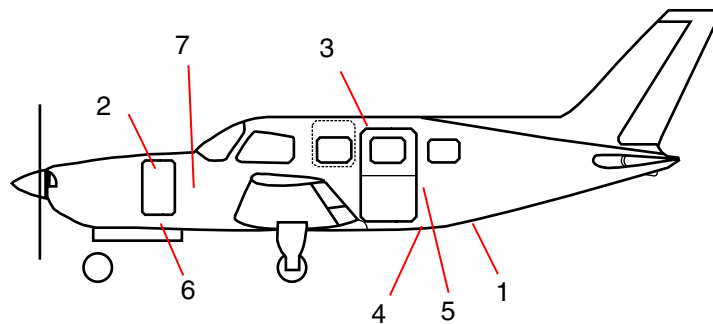
[Effectivity](#)
4636375 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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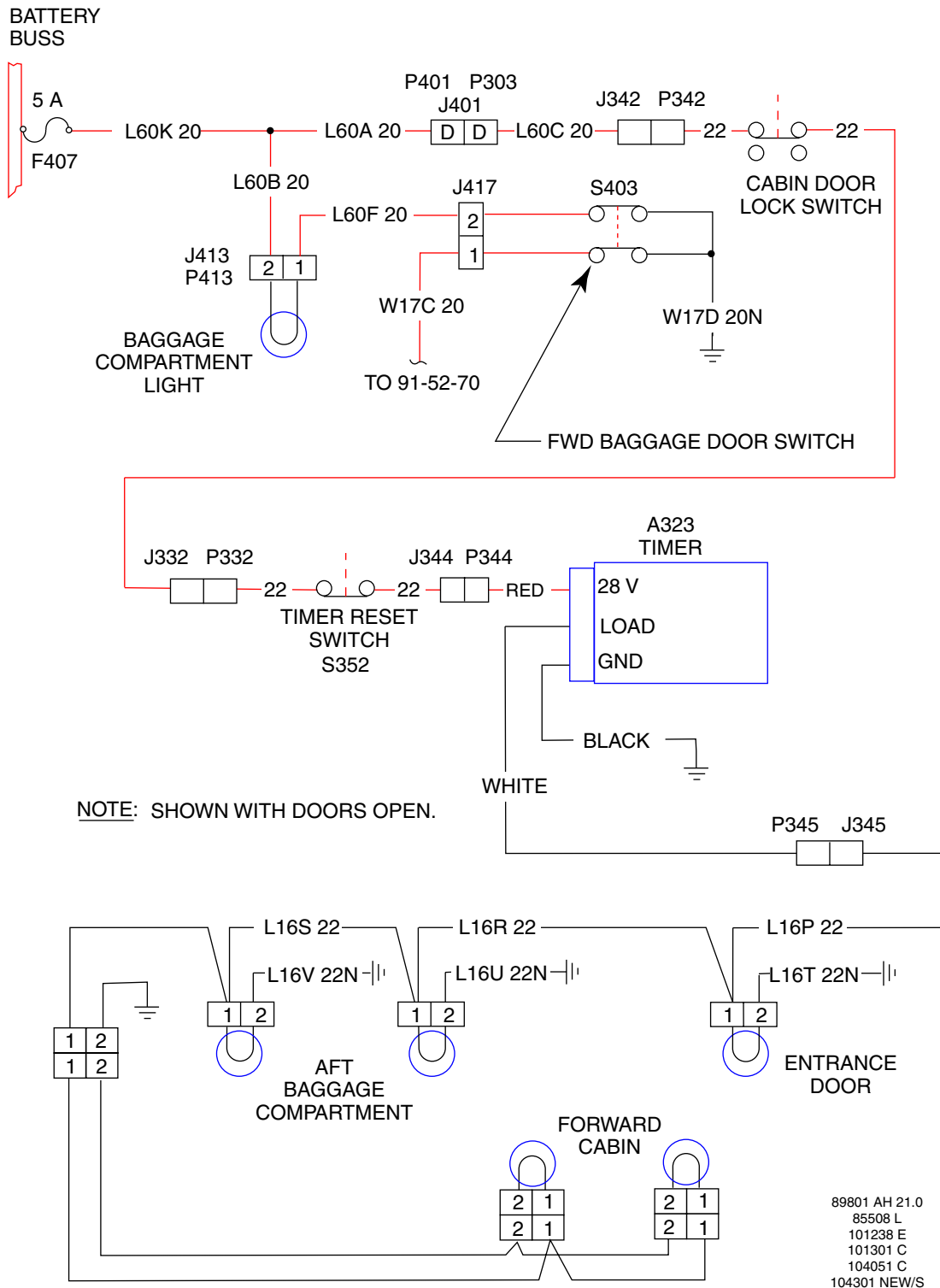
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	A323	Timer
2		Baggage Compartment Light Assembly
3		Courtesy Light Assembly
4	S352	Timer Reset Switch
5		Cabin Door Lock Switch
6	S403	Baggage Door Switch
7	F407	Fuse (5A)



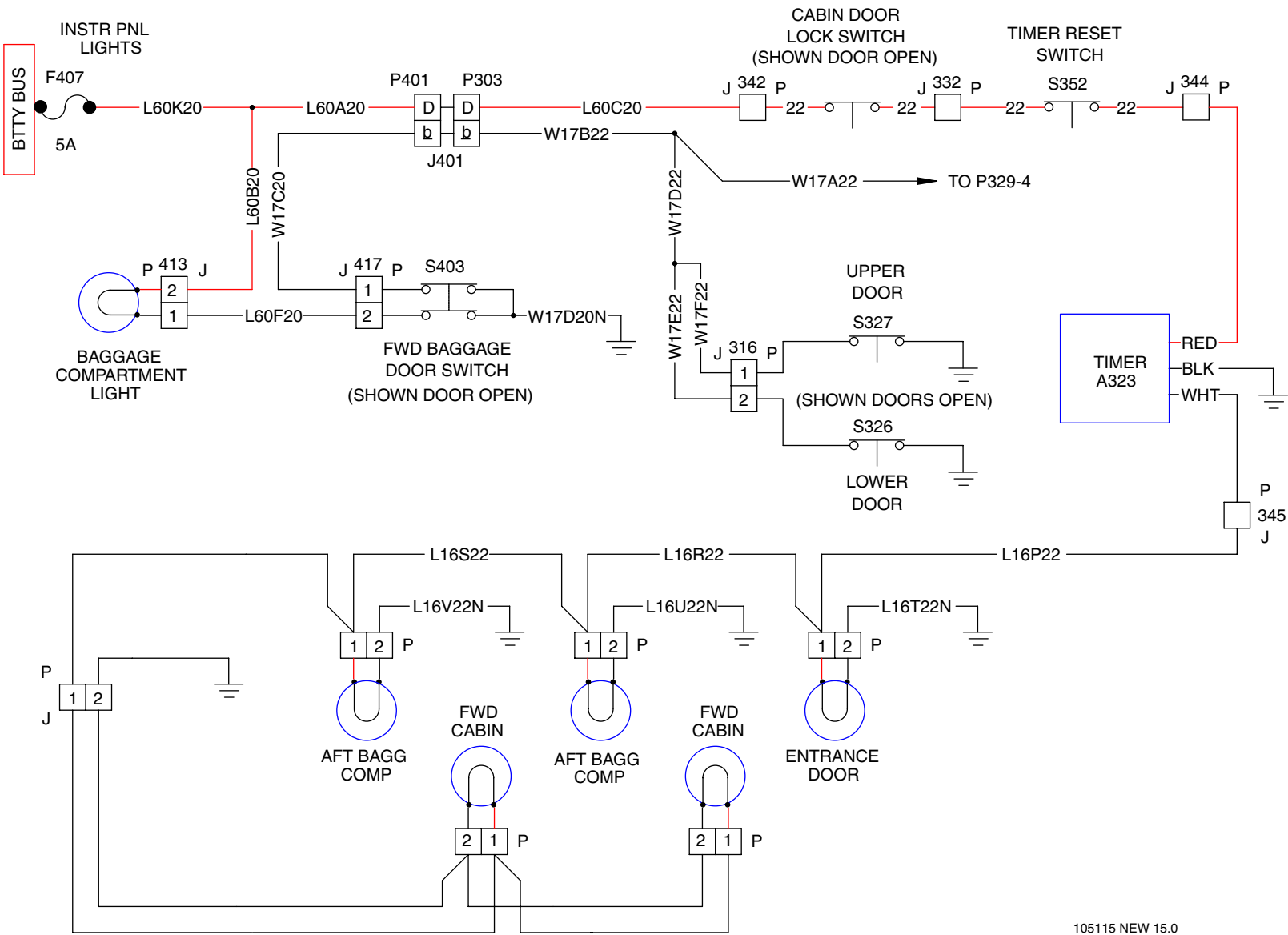
Courtesy Lights (Baggage Compartments, Door, & Cabin)
Figure 2 (Sheet 1 of 3)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



[Effectivity](#)
4636001 thru 4636374

Courtesy Lights (Baggage Compartments, Door, & Cabin)
Figure 2 (Sheet 2 of 3)



105115 NEW 15.0

Courtesy Lights (Baggage Compartments, Door, & Cabin)
Figure 2 (Sheet 3 of 3)

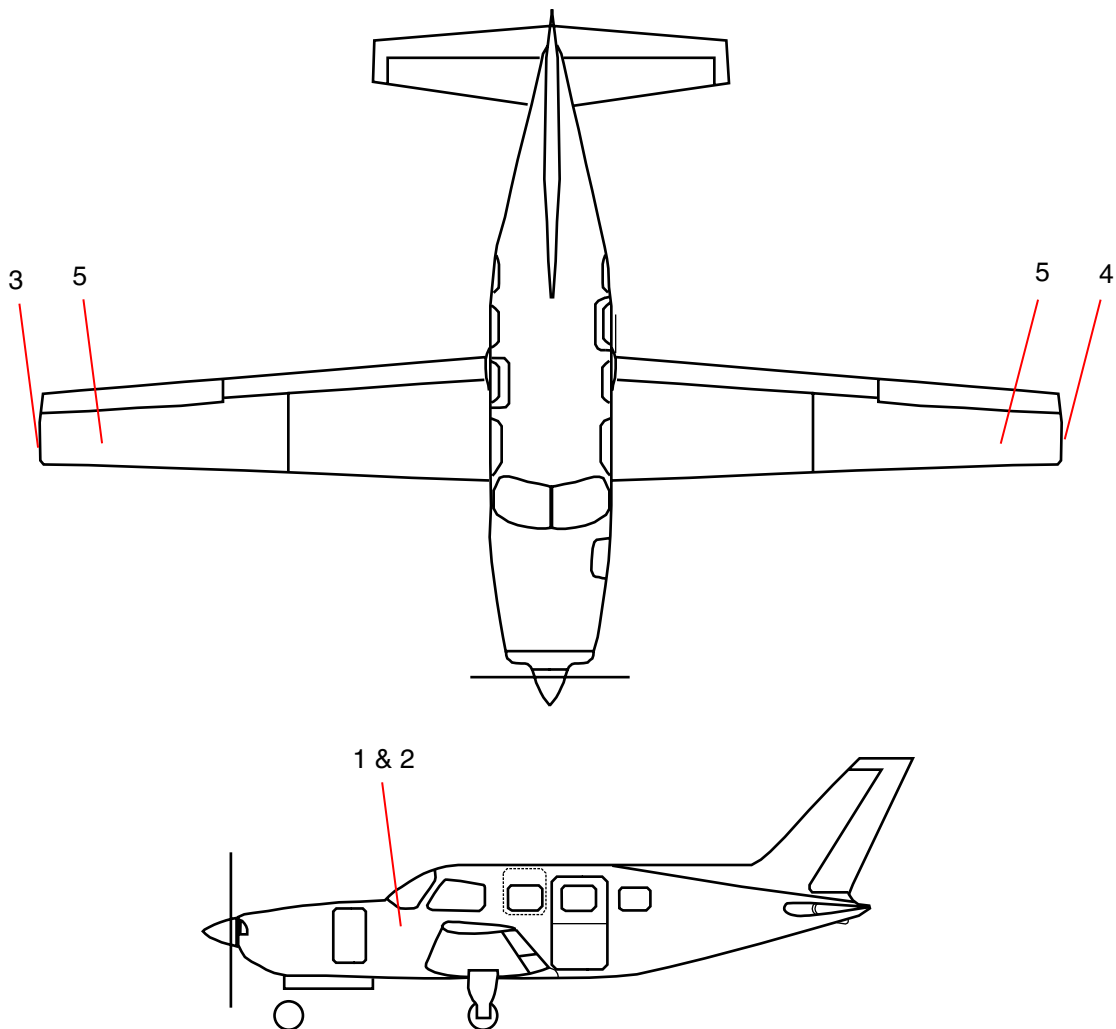
Effectivity
4636375 and up

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

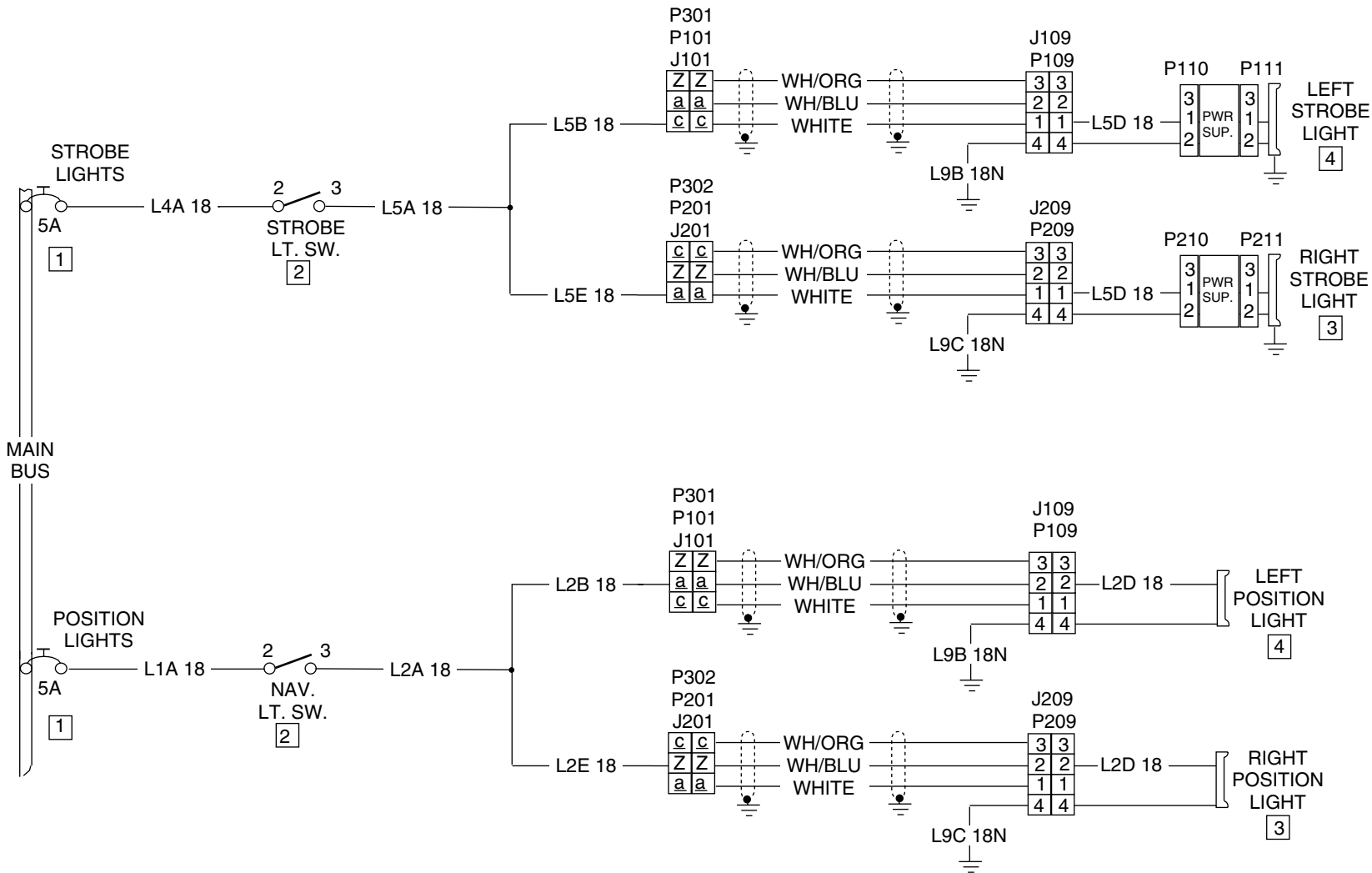
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	CB344, CB345	Circuit Breaker (5 Amp)
2	S303, S304	Nav & Strobe Lights Switch
3	XDS 202, XDS 203	Nav & Strobe Light, Right
4	XDS 102, XDS 103	Nav & Strobe Light, Left
5	A103, A201	Strobe Light Power Supply



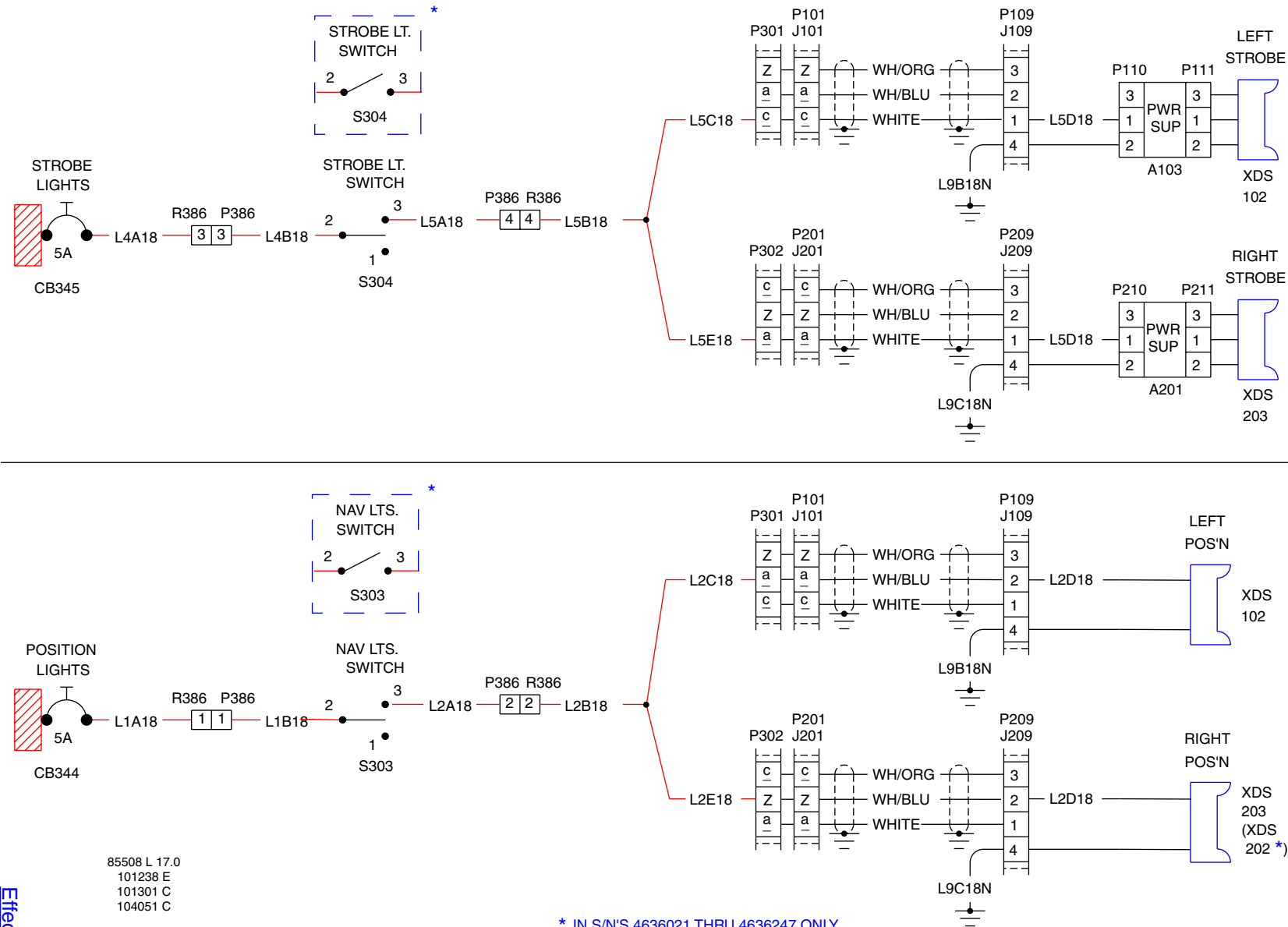
Position and Strobe Lights
Figure 1 (Sheet 1 of 6)



89801 AH 17.0

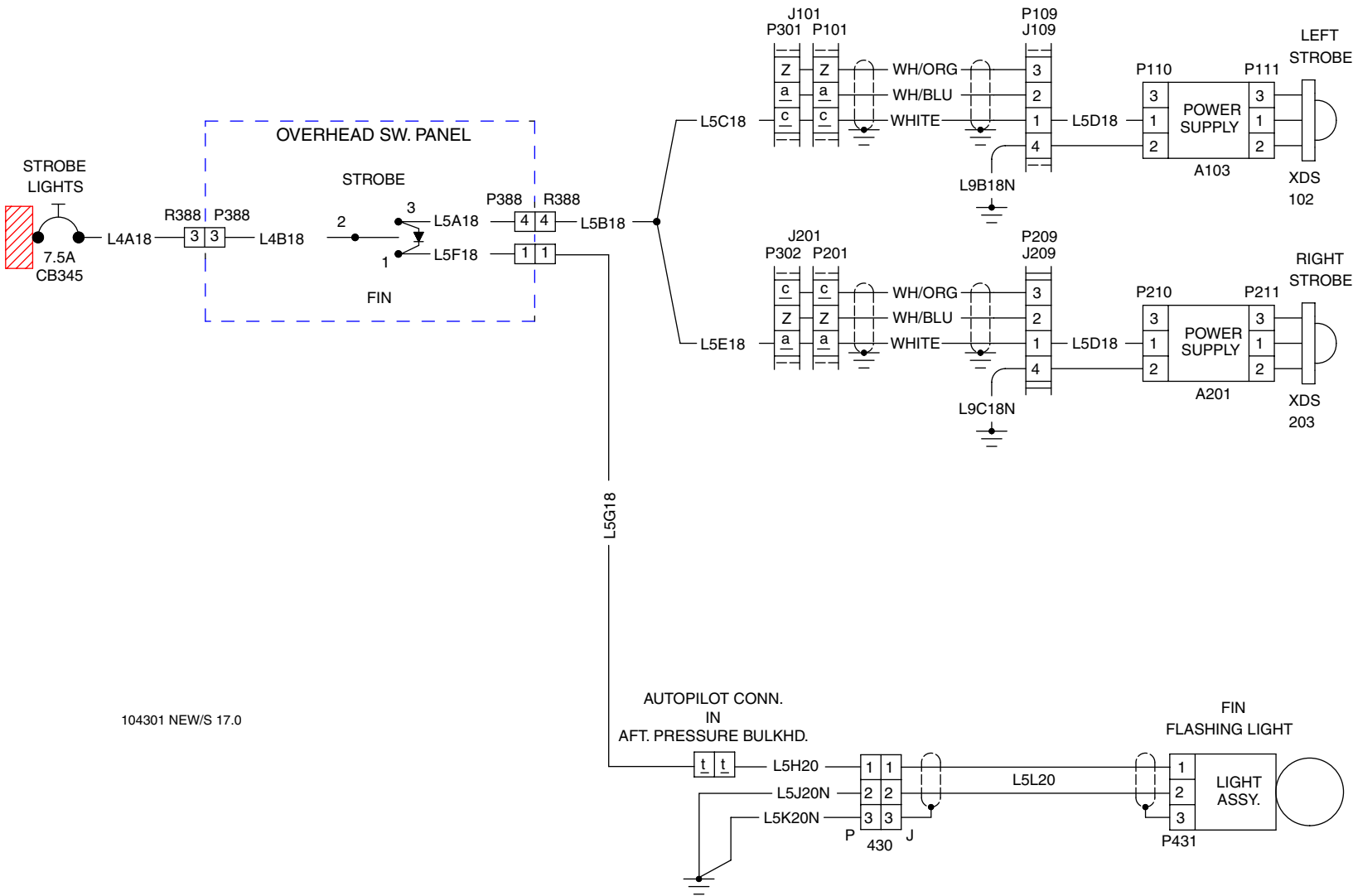
Effectivity
4636001 thru 4636020

Position and Strobe Lights
Figure 1 (Sheet 2 of 6)



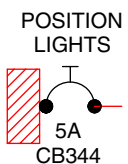
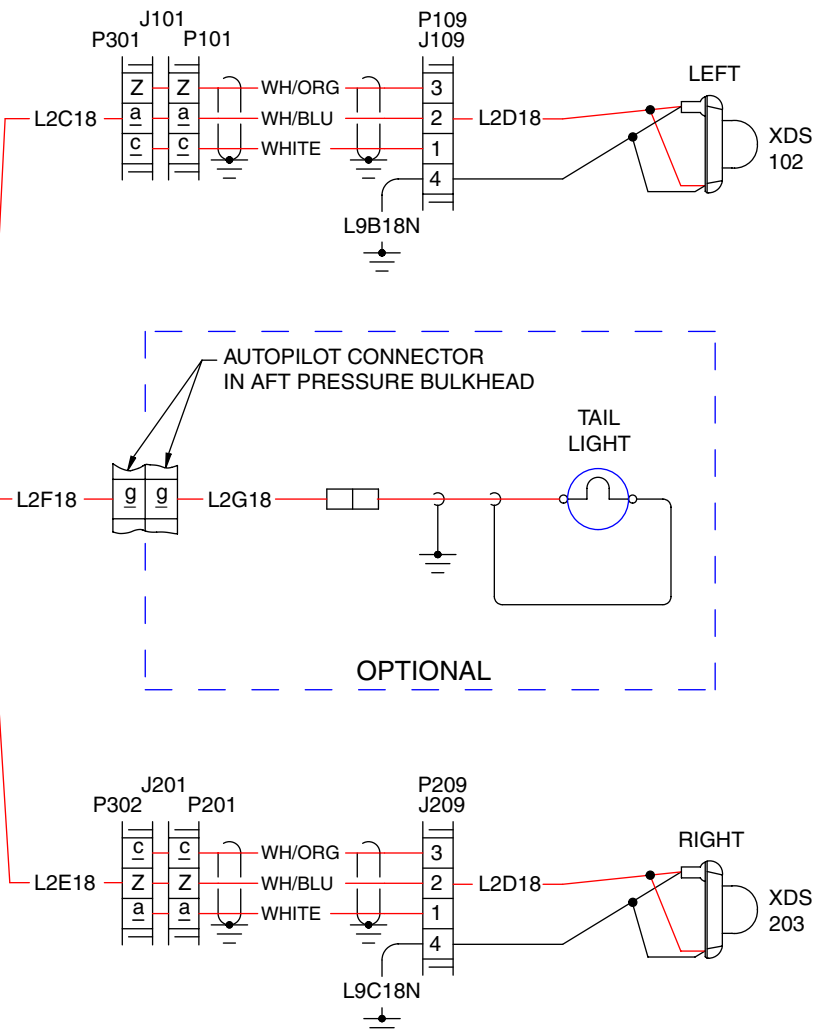
* IN S/N'S 4636021 THRU 4636247 ONLY

Position and Strobe Lights
Figure 1 (Sheet 3 of 6)



104301 NEWS 17.0

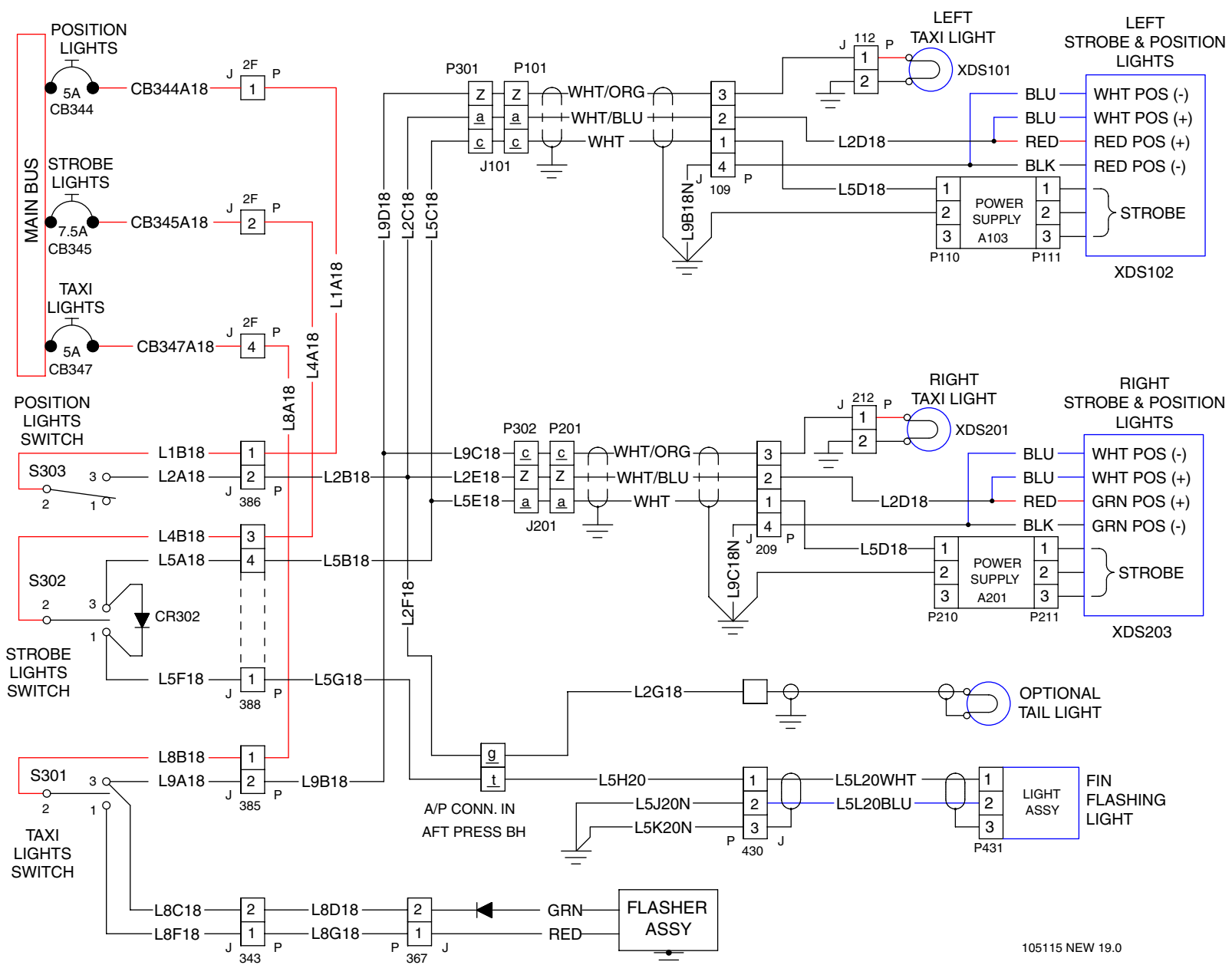
Effectivity
4636299 and
4636314 thru 4636374
Position and Strobe Lights
Figure 1 (Sheet 4 of 6)



Position and Strobe Lights
Figure 1 (Sheet 5 of 6)

104301 NEW/S 17.1

Effectivity
4636299 and
4636314 thru 4636374



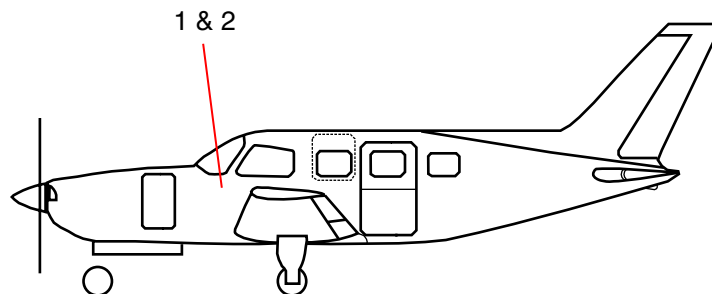
105115 NEW 19.0

Effectivity
4636375 and up
Position and Strobe Lights
Figure 1 (Sheet 6 of 6)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
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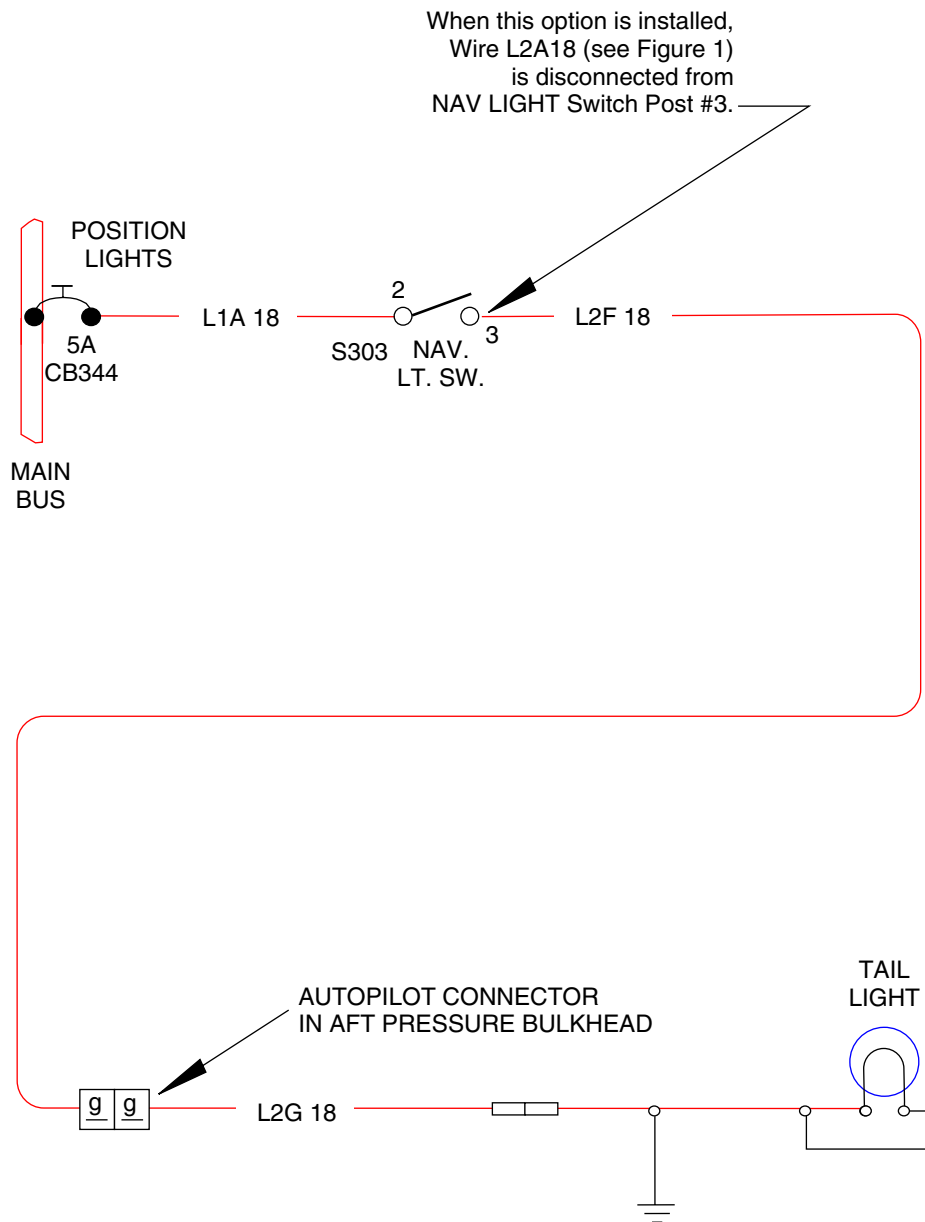
Item #	Designation	Description
1	CB344	Circuit Breaker (5 Amp)
2	S303	Nav Lights Switch

In S/N's 4636299 and 4636314 & up, see Figure 1, Sheets 5 and 6.



Tail Light (Optional)
Figure 2 (Sheet 1 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

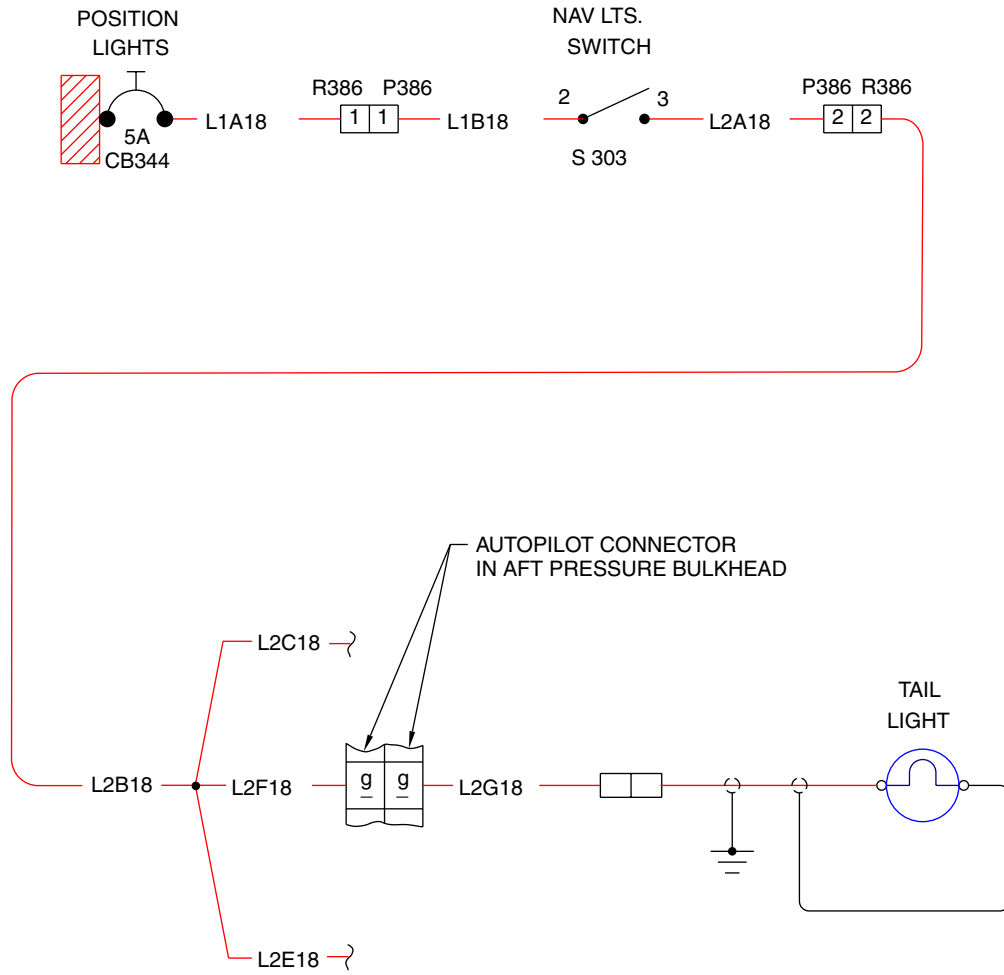


89801 AH 17.1

[Effectivity](#)
4636001 thru 4636020

Tail Light (Optional)
Figure 2 (Sheet 2 of 3)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



85508 L 17.1
101238 E
101301 C
104051 C

Tail Light (Optional)
Figure 2 (Sheet 3 of 3)

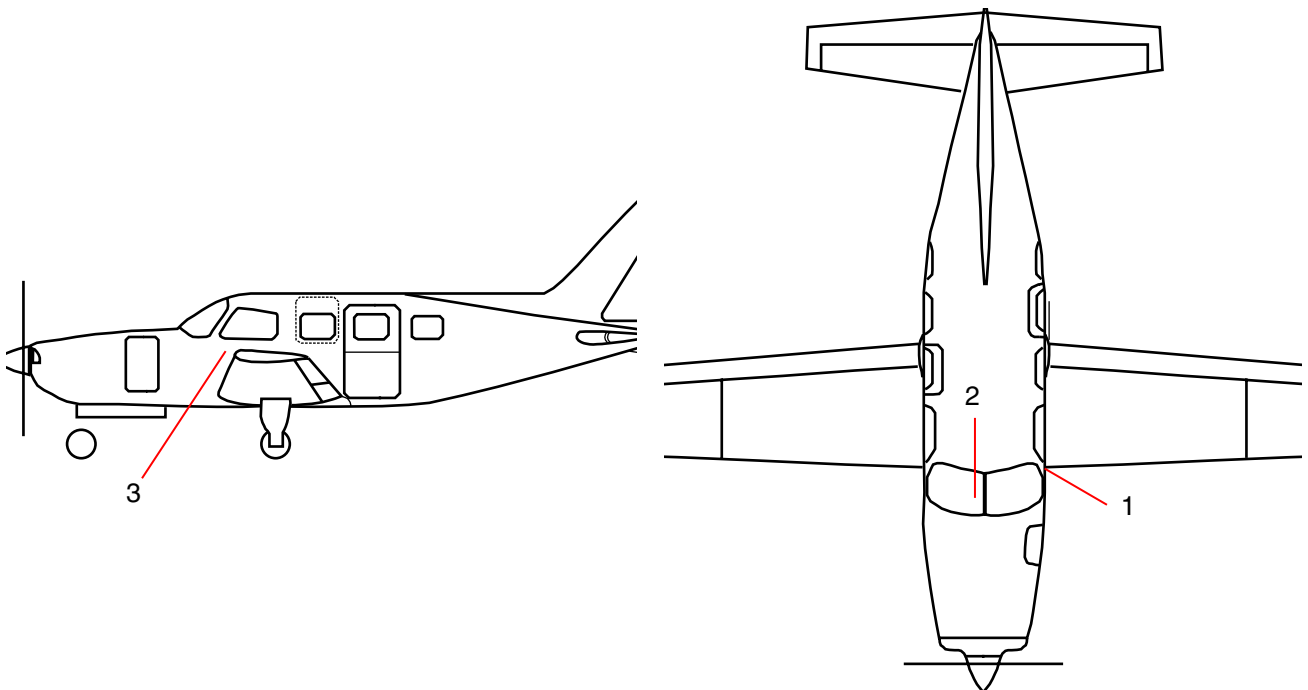
Effectivity
4636021 thru 4636313,
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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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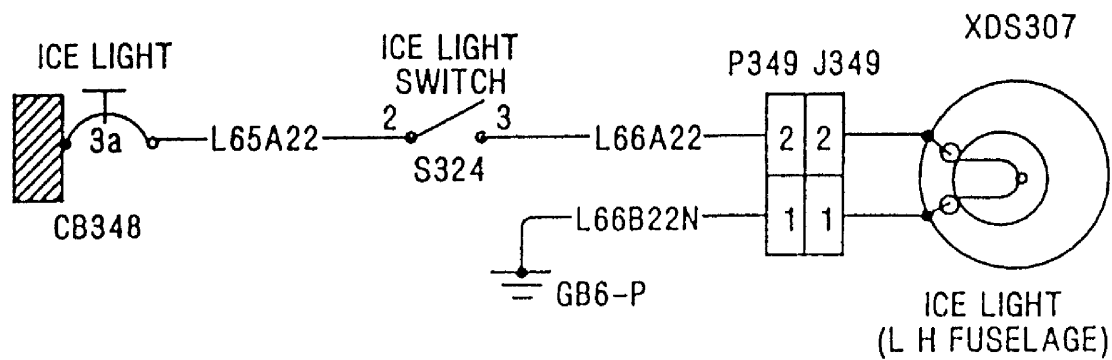
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
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Item #	Designation	Description
1	XDS307	Ice Light
2	S324	Ice Light Switch
3	CB348	Circuit Breaker (3 Amp)



Wing Inspection (Ice) Light (Optional)
Figure 3 (Sheet 1 of 3)

THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL

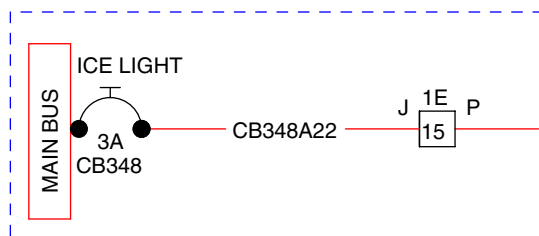


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85508 L

[Effectivity](#)
4636001 thru 4636131

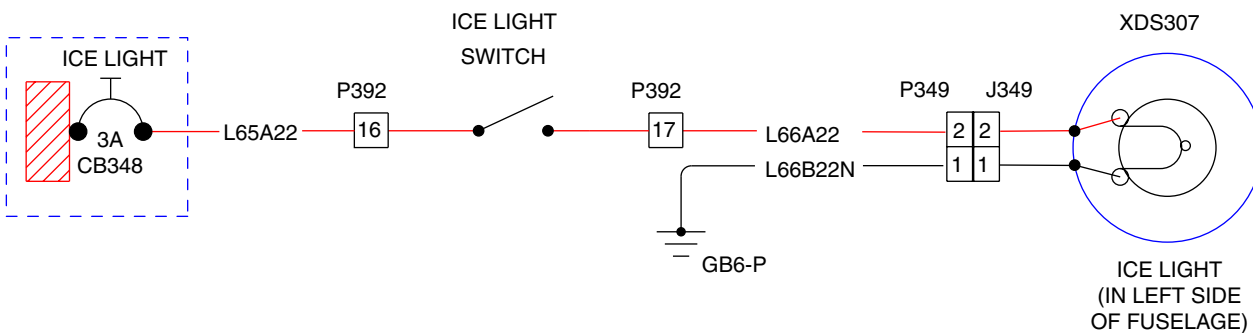
Wing Inspection (Ice) Light (Optional)
Figure 3 (Sheet 2 of 3)

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S/N'S 4636375 AND UP, WITH AVIDYNE ENTEGRA OPTION

105115 NEW 18.0



101238 E 24.0
101301 C
104051 C
104301 NEW/S

Wing Inspection (Ice) Light (Optional)
Figure 3 (Sheet 3 of 3)

[Effectivity](#)
4636132 and up

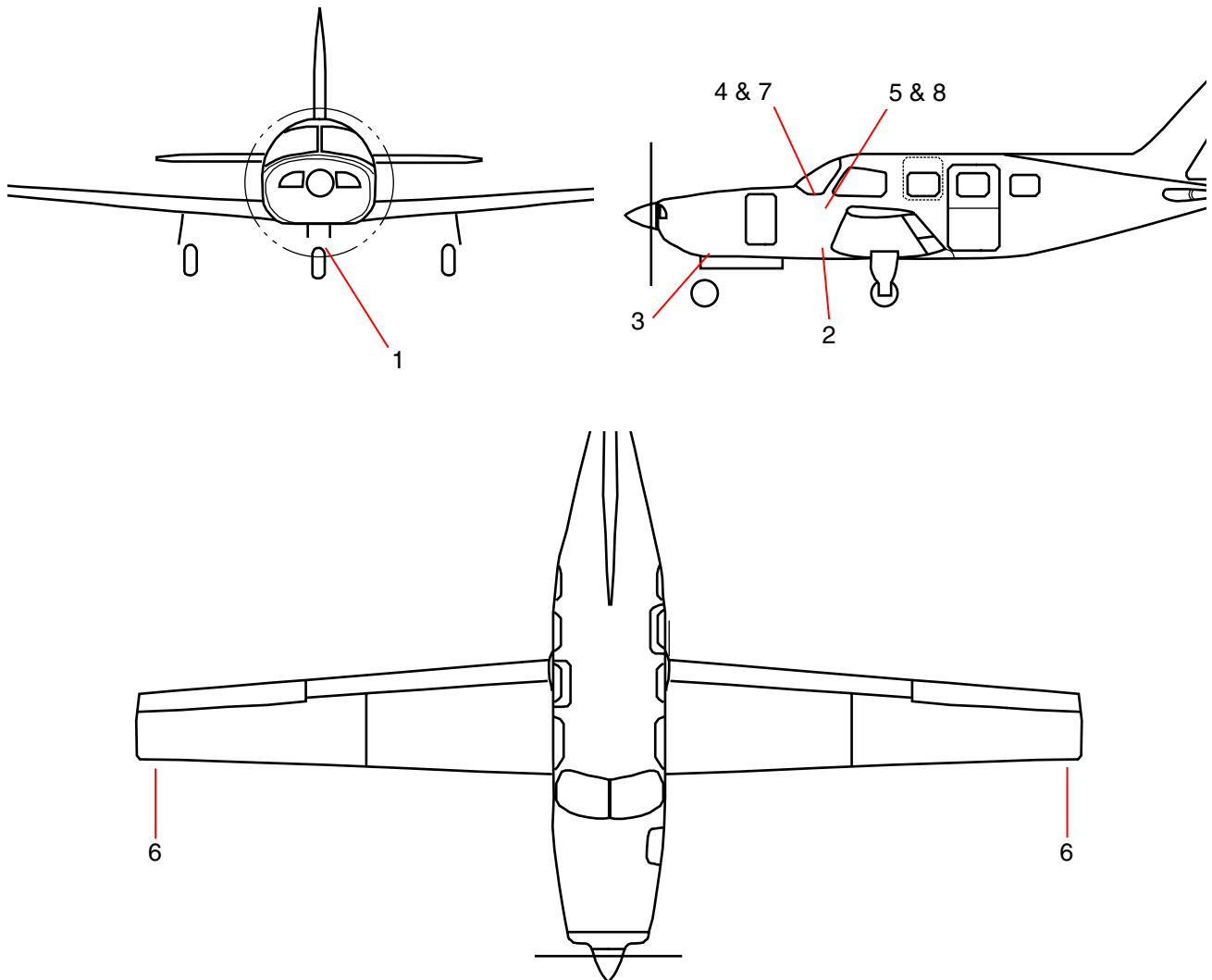
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
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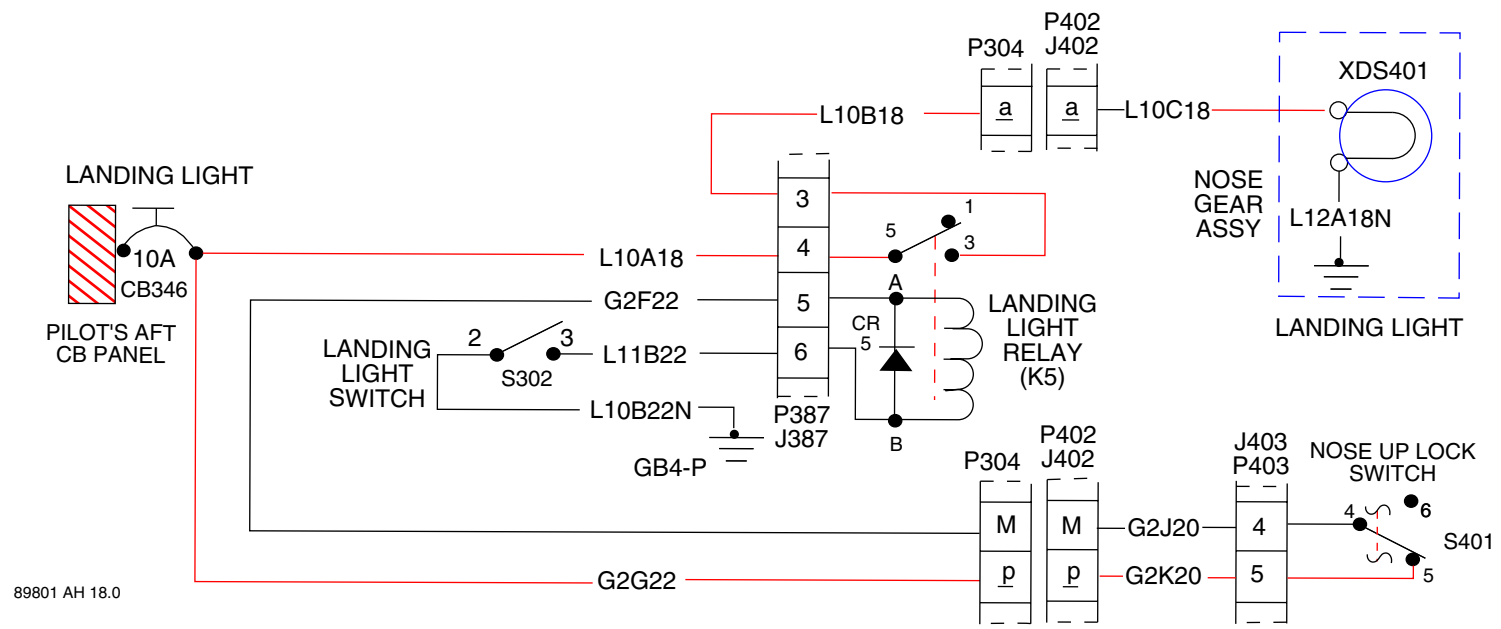
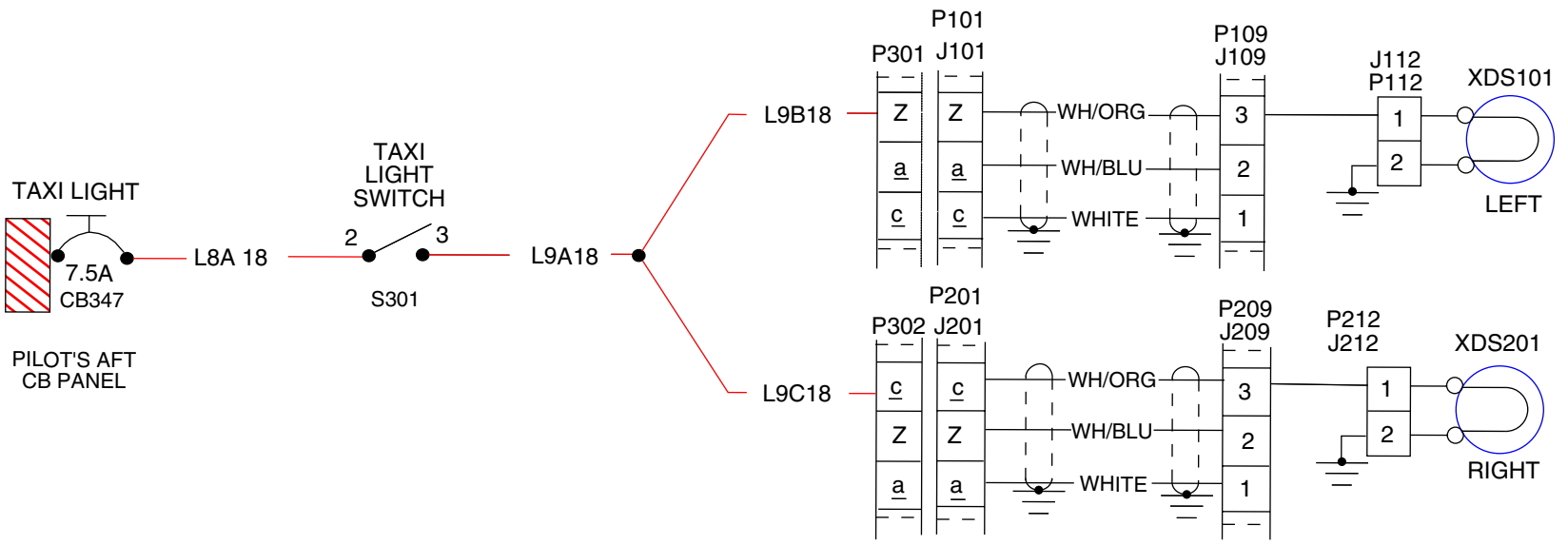
**THE NEW PIPER AIRCRAFT, INC.
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Item #	Designation	Description
1	XDS401	Landing Light
2	K5	Landing Light Relay
3	S401	Nose Gear Up Lock Switch
4	S302	Landing Light Switch
5	CB346	Circuit Breaker (10 Amp.)
6	XDS101, XDS201	Taxi Lights
7	S301	Taxi Lights Switch
8	CB 347	Circuit Breaker (7.5 Amp.)

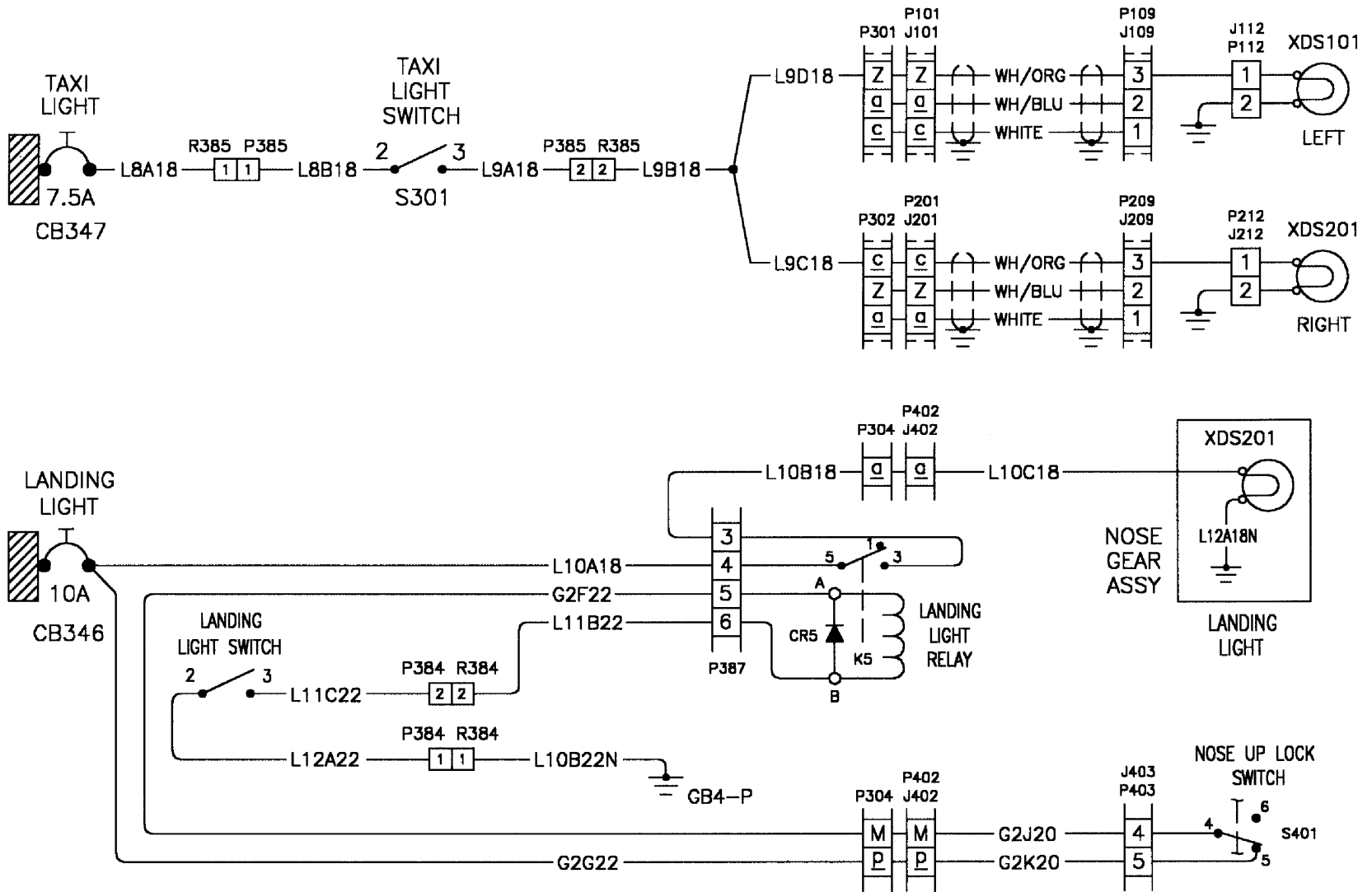
In S/N's 4636375 and up, see Figure 1, Sheet 6 for Taxi Lights.



Landing and Taxi Lights
Figure 4 (Sheet 1 of 5)



Effectivity
4636001 thru 4636020
Landing and Taxi Lights
Figure 4 (Sheet 2 of 5)

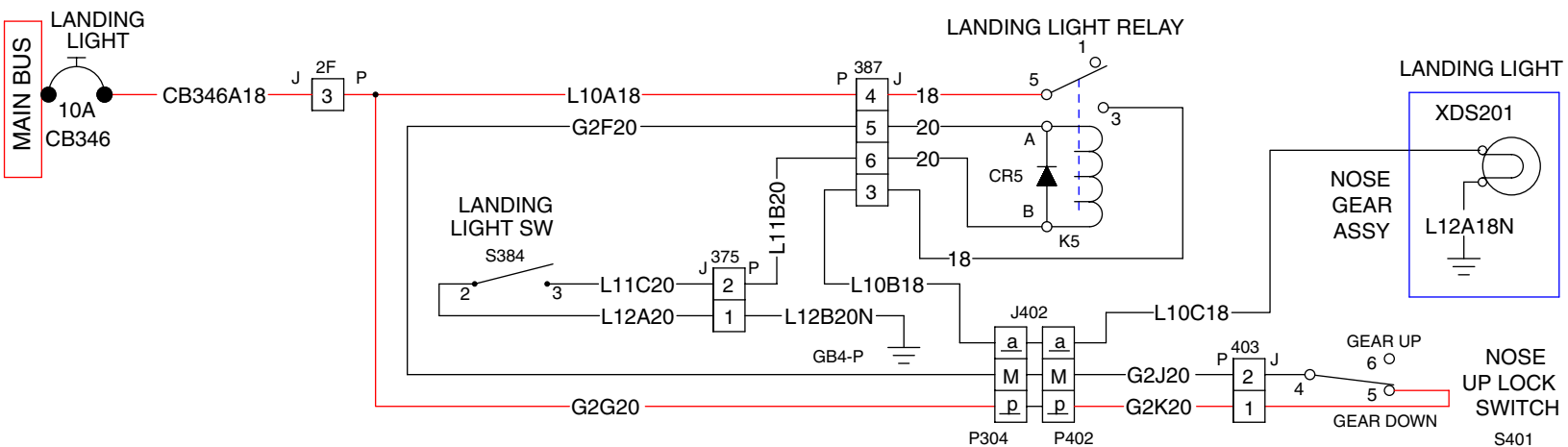


85508 L 18.0

Landing and Taxi Lights
Figure 4 (Sheet 3 of 5)

Effectivity
4636021 thru 4636131

101238 E 18.0
101301 C
104051 C
104301 G/S



105115 NEW 18.0

SEE FIGURE 1, SHEET 6, FOR TAXI LIGHTS.

Landing and Taxi Lights
Figure 4 (Sheet 5 of 5)

Effectivity
4636375 and up

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PA-46-350P, MALIBU MIRAGE
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**GRIDS 7L2 THRU 7L24
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AIRPLANE MAINTENANCE MANUAL

CARD 8 OF 8

PA-46-350P



(S/N's 4636001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

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**THE NEW PIPER AIRCRAFT, INC.
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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual, P/N 761-876, issued July 12, 1995 and reissued May 30, 2005 are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	June 19, 1996	All
PR980101	January 1, 1998	1, 2, 3, 4, 5, and 6
CR981223	December 23, 1998	1, 2, 3, 4, 5, and 6
PR000201	February 1, 2000	1, 2, 3, 4, 5, and 6
PR010515	May 15, 2001	1
CR050730	July 30, 2005	1, 2, 3, 4, 5, 6, 7 and 8
PR060207*	February 7, 2006	1, 2, 3, 4, 5, 6, 7 and 8

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-876**

Revisions appear in all Aerofiche Cards. Accordingly, discard your entire existing Aerofiche Card Set and replace it with this one dated 02/07/06.

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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Effective Pages	2	Jul 30/05			
Intro-Table of Contents	1	Jul 30/05			
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	7	Feb 7/06			
	8	Jul 30/05			

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INTRODUCTION

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE ICA PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-46-350P Malibu Mirage Maintenance Manual constitutes the Instructions for Continued Airworthiness as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

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

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

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

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

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

**THE NEW PIPER AIRCRAFT, INC.
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3. Effectivity

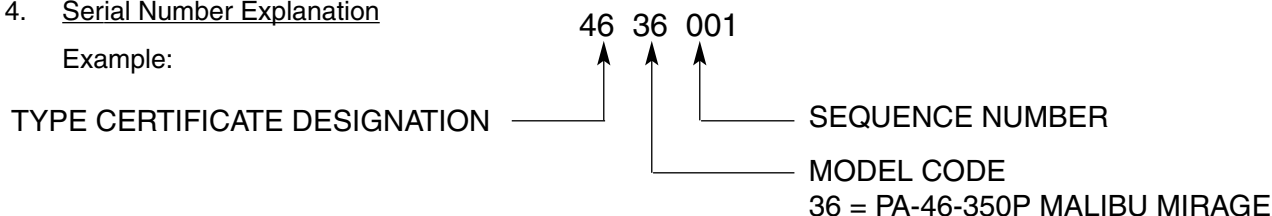
This maintenance manual is effective for PA-46-350P Malibu Mirage airplane serial numbers 4636001 and up. This encompasses the following model years:

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

<u>Model Year</u>	<u>Serial Numbers</u>
1995	4636001 thru 4636020
1996	4636021 thru 4636076
1997	4636077 thru 4636131
1998	4636132 thru 4636186
1999	4636187 thru 4636247
2000	4636248 thru 4636313
2002	4636299, 4636314 thru 4636338
2003	4636339 thru 4636348
2004	4636349 thru 4636363
2005	4636364 thru 4636374
2006	4636375 and up

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

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

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element “28” of the number 28-40-01 refers to the chapter “Fuel”. Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element “40” of the number 28-40-01 concerns itself with the indicating section of the fuel system.
- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element “01” of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 12, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

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6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system explained above forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1).

7. Aerofiche Effectivity

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

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

First number is the Aerofiche card number.

Letter is the horizontal row reference per card

Second number is the vertical column reference per card.

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

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

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

8. Identifying Revised Material

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

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

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index. Likewise, all change bars are removed when a publication is completely revised (i.e. - reissued).

9. Indexing

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

10. List of Effective Pages

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

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.

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12. Accident/Incident Reporting

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

13. Supplementary Publications

The following is a list of publications providing servicing, overhaul and parts information on various components on the PA-46-350P airplane, which you should use to supplement this manual.

A. Piper Publications:

- (1) Parts Catalog - P/N 761-878
- (2) Progressive Inspection Manual (50 hour) - P/N 767-013
- (3) Periodic Inspection Report Form - P/N 767-011

B. Vendor Publications:

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

(1) AIR CONDITIONING COMPRESSOR:

Vendor Address:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, Texas 75098 http://www.sanden.com/	PH: (972) 442-8400 FAX: (972) 442-8700

(2) AIR CONDITIONING EVAPORATORS AND BLOWERS:

Vendor Address:	Enviro Systems, Inc. P.O. Box 1404 Seminole, Oklahoma 74868	PH: (405) 382-0731

(3) 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

(4) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or) S-TEC Corporation One S-TEC Way Mineral Wells, TX 76067 PH: (940) 325-9406 http://www.s-tec.com

(5) BATTERY:

Vendor Address:	Gill/Teledyne 840 W. Brockton Ave. Redland, California 92374 http://www.gillbatteries.com/index.htm	PH: (800) 456-0070

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(6) BRAKES:

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>

(7) DEICE SYSTEM (PNEUMATIC):

Vendor Address: De-Icing and Specialty Systems PH: (330) 374-3040
Goodrich Corporation FAX: (330) 374-2290
1555 Corporate Woods Parkway
Uniontown, Ohio 44685-8799

Technical Assistance: PH: (800) 334-2377
(330) 374-3743
FAX: (330) 374-2290
Email: dssd.support@goodrich.com
<http://www.deicingsystems.goodrich.com/>

Black Standard
Pneumatic De-Icer
Installation,
Maintenance and
Repair Manual: ATA 30-10-31
SmartBoot System: ATA 30-10-65

(8) ELECTRONIC FLIGHT INFORMATION SYSTEM (EFIS):

Vendor Address: Meggitt Avionics, Inc. PH: - (603) 669-0940
10 Ammon Drive FAX: - (603) 669-0931
Manchester, NH 03103-7406
<http://www.meggittavi.com/>

or,

Vendor Address: Avidyne Corporation PH: - (800) 284-3963
55 Old Bedford Road
Lincoln, MA 01773
<http://www.avidyne.com/index.htm>

(9) EMERGENCY LOCATOR TRANSMITTER:

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

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(10) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, Pennsylvania 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:	TIO-540-AE2A - P/N PC-315-7	
Operator's Manual:	TIO-540-AE2A Engines - P/N 60297-27	

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.

(11) 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

(12) FORCE APPLICATOR KIT:

Vendor Address:	Safe Flight Instrument Corp. 20 New King Street White Plains, New York 10602	PH: (914) 946-9500

(13) FUEL BOOST PUMP:

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

(14) GROUND BLOWER (OPTIONAL):

Vendor Address:	Electro-Mech Inc. 2600 S. Custer Wichita, Kansas

**(15) GEAR LOCKING ACTUATORS, NOSE, GEAR DOOR ACTUATOR, HYDRAULIC PUMP,
AND ALL HYDRAULIC COMPONENTS:**

Vendor Address:	Parker Hannifin Corp. (See Brakes, above)

or,

Frisby Aerospace 4520 Hampton Rd. Clemmons, NC 27012 http://frisbyaerospace.com/	PH: (336) 766-9036 FAX: (336) 766-9040

(16) HI-LOK FASTENERS AND TOOLS:

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

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(17) MAGNETOS:

Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/index4.html	PH: (904) 739-4000 FAX: (904) 739-4006
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

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

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

(19) NAVIGATION/STROBE LIGHTS STANDBY/MAP LIGHTS:

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

(20) OXYGEN SYSTEM:

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

(21) PRESSURIZATION VALVES; SAFETY AND OUTFLOW VALVE & CONTROLLER VALVE:

Vendor Address:	AlliedSignal Aerospace Aerospace Equipment Systems 2525 W. 190th Street Torrance, CA 90504 http://www.alliedsignal-aerospace.com/aerospace/	PH: (310) 323-9500 FAX: (310) 512-2221

(22) PROPELLOR DEICE

Vendor Address:	See DEICE SYSTEM (PNEUMATIC)

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(23) PROPELLER AND 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

Propeller
Overhaul Instructions: Manual No. 113

Composite Blade
Maintenance: Manual No. 135

Propeller Owner's
Manual: Manual No. 115

Aluminum Blade
Inspection, Repair,
and Overhaul Instructions: Manual No. 133

(24) RADAR (WEATHER), RDR - 2000:

Vendor Address:	Honeywell (Bendix/King) (See Autoflight, above)

Maintenance Manual:	Bendix/King ART 2000 P/N 006-05332-0001

(25) RADIO COOLING BLOWER:

Vendor Address:	Globe Motors 2275 Stanley Ave. Dayton, Ohio 45404 http://www.globe-motors.com/home.html	PH: (937) 228-3171 FAX: (937) 229-8531

(26) STARTER:

Vendor Address:	Electro Systems, Inc. (See Alternator, above)

(27) TURBOCHARGER:

Vendor Address:	Turbocharging Systems Worldwide HQ Building #10, Ste. 200 23326 Hawthorne Blvd. Torrance, CA 90505 http://www.alliedsignal.com/turbos/products/index.html	PH: (310) 791-9101 FAX: (310) 534-5941

(28) VACUUM PUMP:

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

(29) VACUUM REGULATORS:

Vendor Address:	Parker Hannifin Corp. (see "Fuel Boost Pump," above)

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13. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 36, 38, 49, 53, 54, 60, 72, 75, 78, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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6		DIMENSIONS AND AREAS	1E11
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	30	DC Generation	
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	10	Aileron and Tab	
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	50	Flaps	
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	10	Airfoil	
	30	Pitot and Static	
	40	Windows, Windshields and Doors	
	60	Propellers/Rotors	
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51		STRUCTURES	5F1
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Landing Gear Position and Warning	7I19		
Landing Light	7K21		
MAP Indicator	8D17, 8E9		
Map Lights	7I23		
OAT	8E9		
Oil Pressure Indicator	8E5, 8E9, 8E14		
Oil Temperature Indicator	8E5, 8E9, 8E14		
Oxygen System	8C12		
Position Lights	7K7		
Post Lights	7J7		
Power Distribution and Control	7E15		
Power Monitor and Meters	7E23		
Power Point	7F6		
Quad Digital Indicator (QDI)	8D12		
RPM Indicator	8D2, 8D17		
SMARTboots	7G22		
SpeedBrakes	7G1		
Stall Detection and Warning	7F17		
Standby Instruments	8C10		
Stereo	7F12		
Strobe Lights	7K7		
Tachometer	8D2, 8D17, 8E9		
Tail Light (Optional)	7K10, 7K13		
Taxi Lights	7K21		
TIT Indicator	8D4, 8D21, 8E9		
Turn Coordinator(s)	8C8		
Vacuum Indicator	8E1, 8E9		

NOTE: Card 7 grid numbers, above, may be erroneous if Card 7 has been updated subsequent to this revision of Card 8. See Chapter 91 Table of Contents on Card 7.

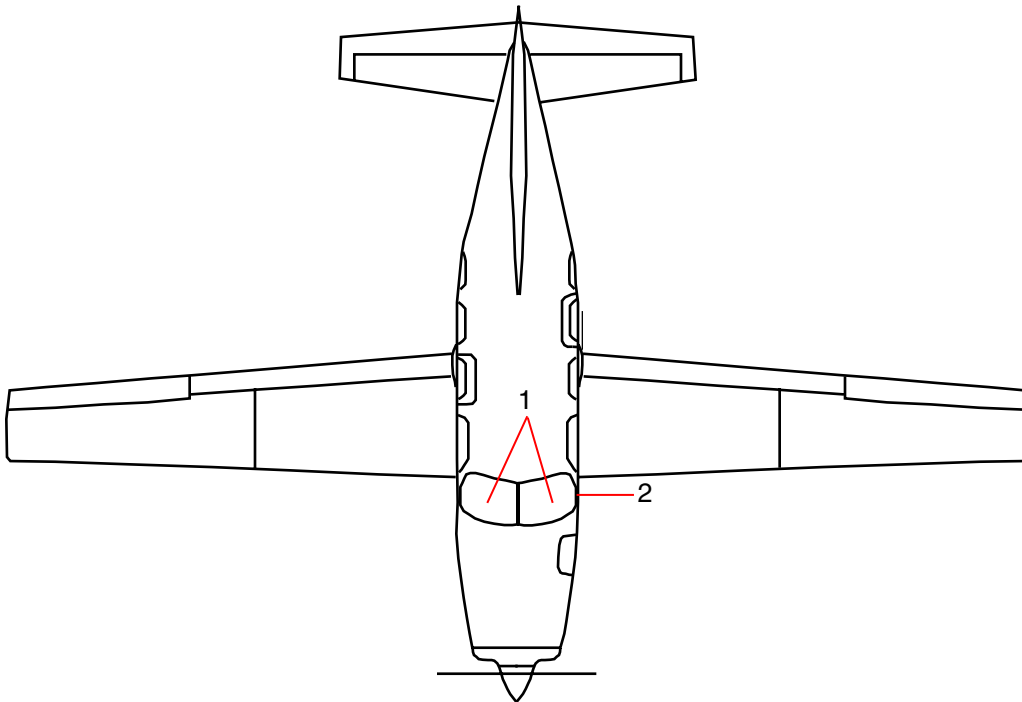
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

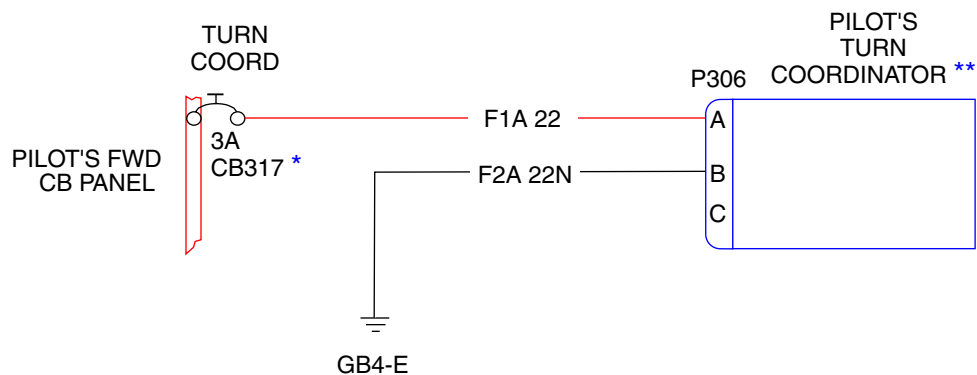
Item #	Designation	Description
1		Pilot's Turn Coordinator (Standard) Copilot's Turn Coordinator (Optional)
2	CB318*, CB336	Circuit Breaker (3 Amp)

* CB317 in 4636001 thru 4636131 only



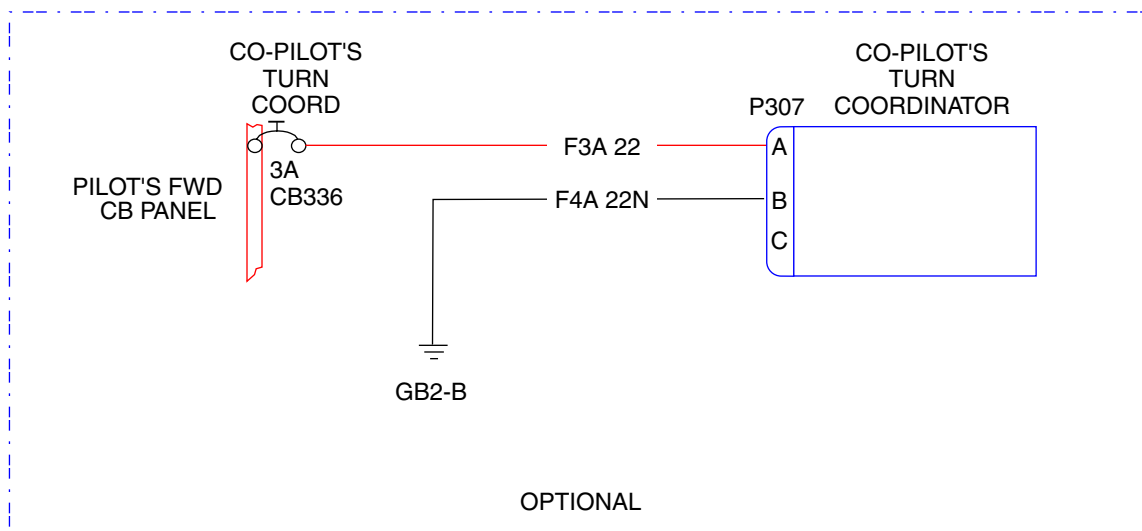
Turn Coordinator(s)
Figure 1 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



* CB318 IN S/N'S 4636001 THRU 4636131 ONLY.

** IN S/N' 4636248 AND UP, SEE AUTOPILOT C.I.P. FOR PILOT'S TURN COORDINATOR WIRING.

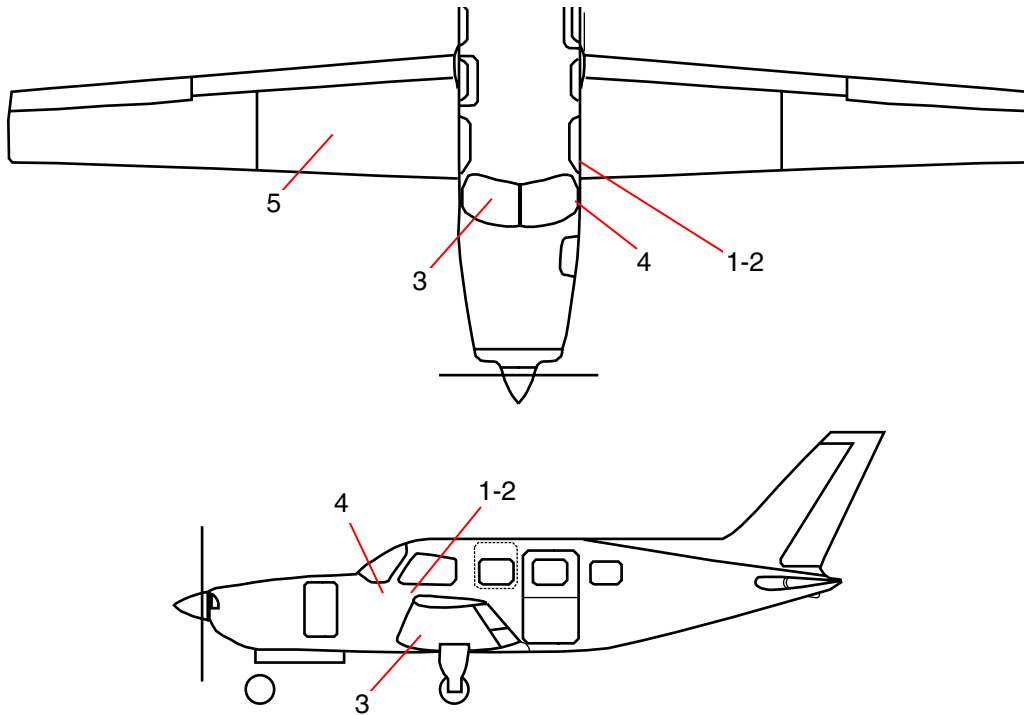


89801 AH 38.0
85508 L
101238 E
101301 C
104051 C
104301 NEW/S

Turn Coordinator(s)
Figure 1 (Sheet 2 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB341	Circuit Breaker (3 Amp)
2	CB342	Circuit Breaker (7.5 Amp)
3	K-1	Lighting Relay
4	S356	Standby Gyro Switch
5	PS-834A	Power Supply



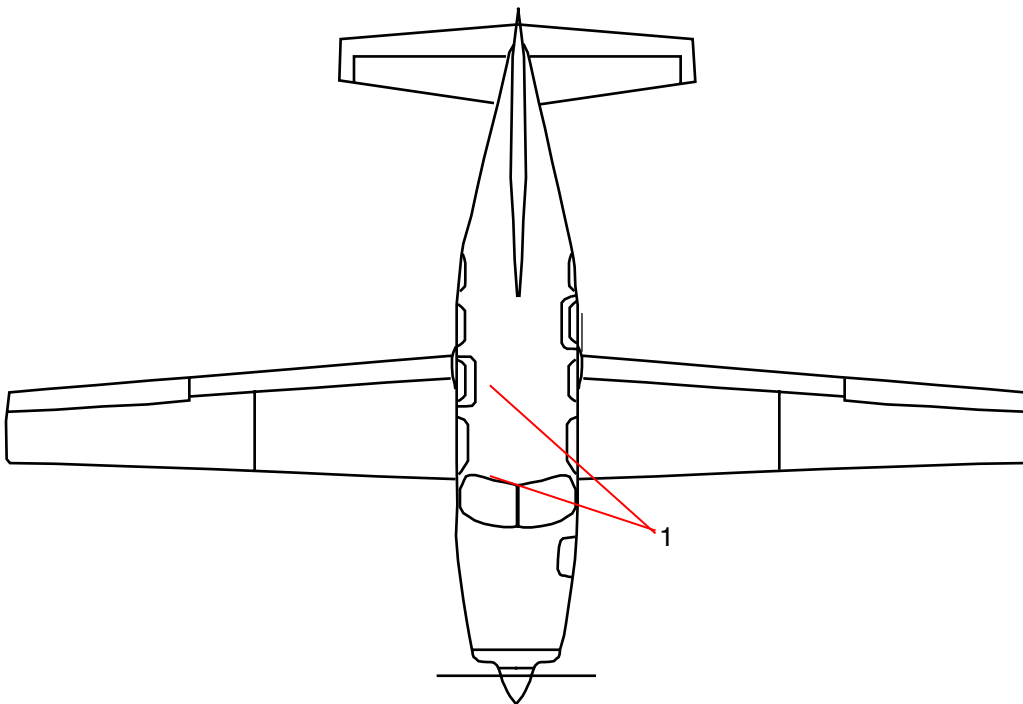
[Effectivity](#)
4636375 and up

Standby Instruments
Figure 2 (Sheet 1 of 2)



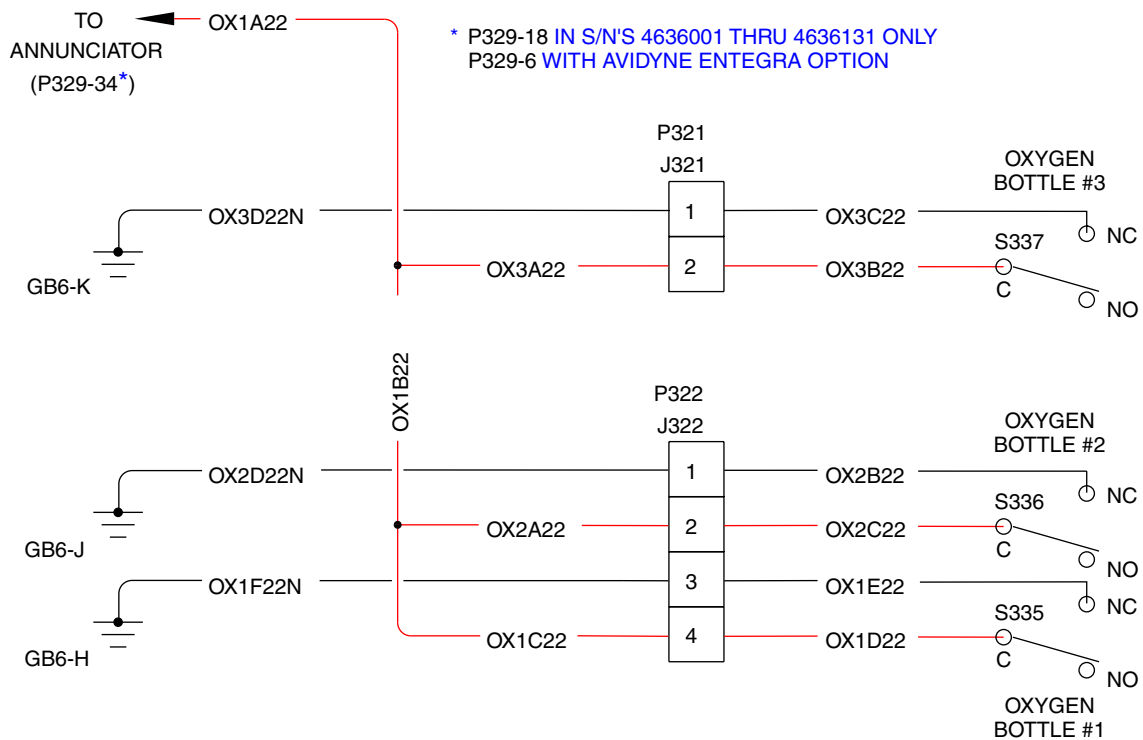
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	S335, S336, S337	Switch (3 each)



Oxygen System (Optional)
Figure 1 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



SWITCHES SHOWN IN ARMED POSITION

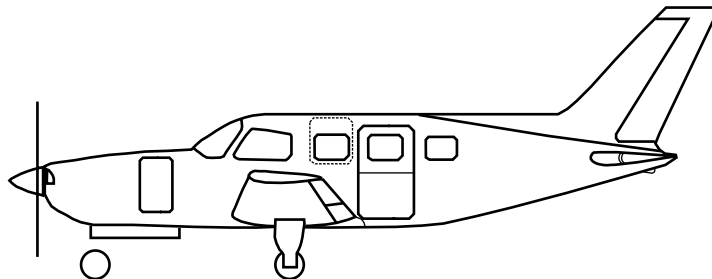
89801 AH 40.0
85508 L
101238 E
101301 C
104051 C
104301 NEW/S
105115 NEW 30.0

Oxygen System (Optional)
Figure 1 (Sheet 2 of 2)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

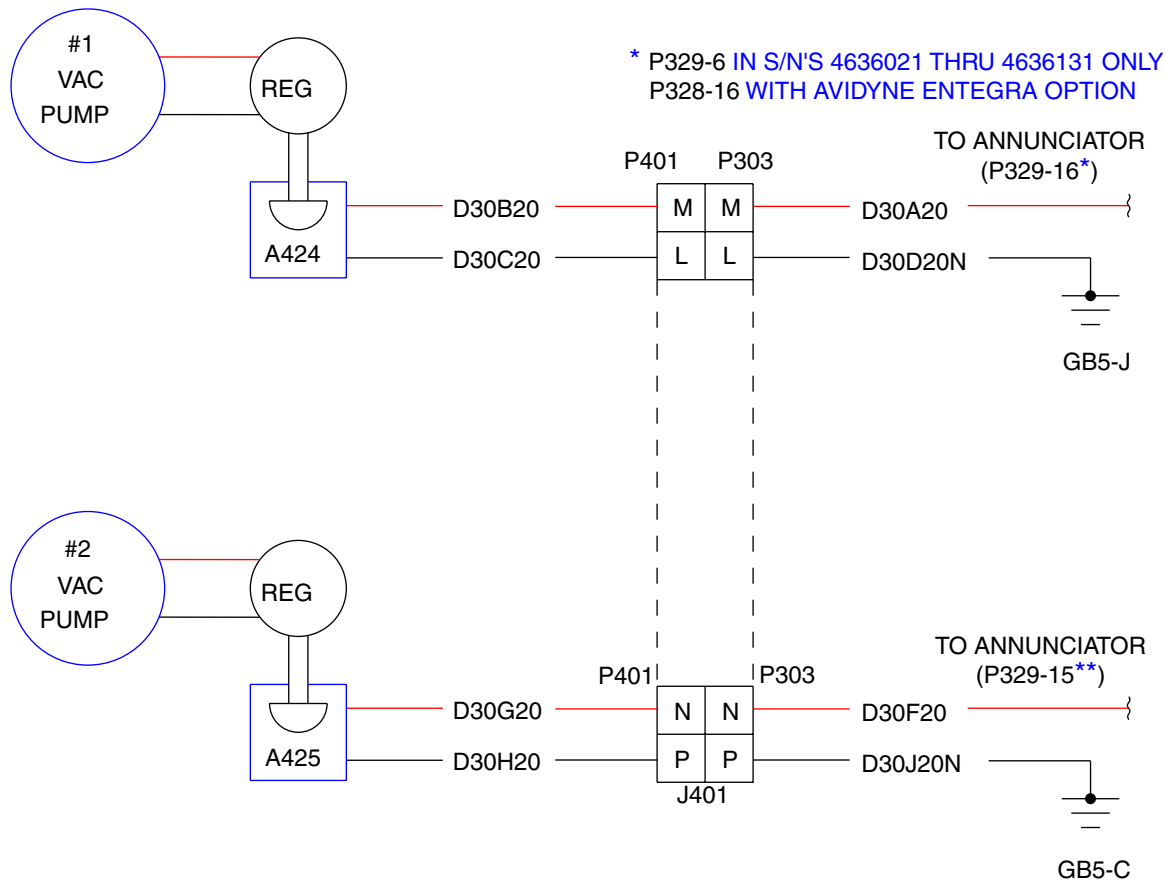
Item #	Designation	Description

Information Pending - See Parts Catalog



Vacuum Low Indicator
Figure 1 (Sheet 1 of 2)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



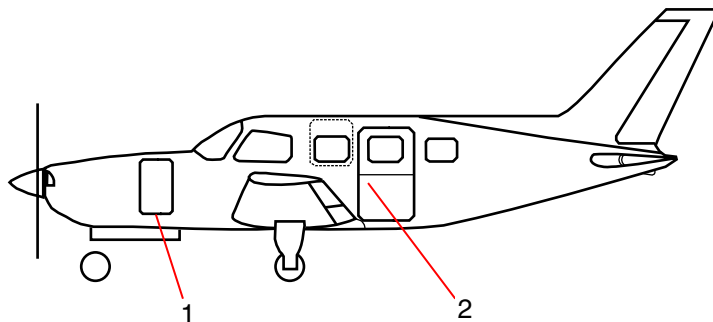
85508 L 27.0
101238 E
101301 C
104051 C
104301 NEW/S
105115 NEW 24.0

Vacuum Low Indicator
Figure 1 (Sheet 2 of 2)

Effectivity
4636021 and up

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	S403	Nose Baggage Door Switch
2	S326, S327	Door Ajar Switch (Lower & Upper)



Door Ajar Warning
Figure 1 (Sheet 1 of 2)

TO
ANNUNCIATOR
(P329-32*)

W17A22

W17D22

W17E22

W17F22

J316
P316

1

2

S326

LOWER
DOOR
AJAR
SWITCH

S327

UPPER
DOOR
AJAR
SWITCH

W17D20N

NOSE
BAGGAGE
DOOR
SWITCH

S403

(SWITCHES SHOWN
NORMALLY CLOSED,
WITH DOORS OPEN)

P401
J401

P303

W17C20

W17B22

L60F20

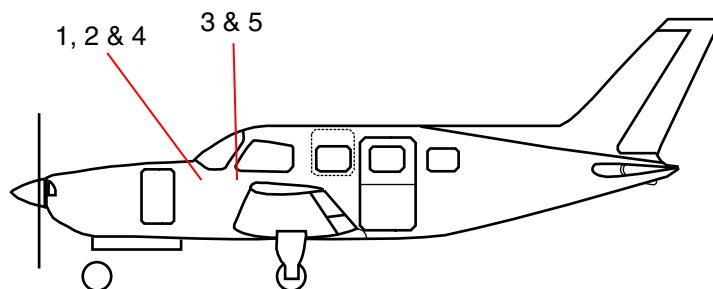
TO BAGGAGE
LIGHT
(SEE COURTESY LIGHTS)

S/N'S 4636132 THRU 4636374

* P329-21 IN S/N'S 4636001 THRU 4636131 ONLY
** P329-4 IN S/N'S 4636375 AND UP
*** 2 IN S/N'S 4636375 AND UP
*** 1 IN S/N'S 4636375 AND UP

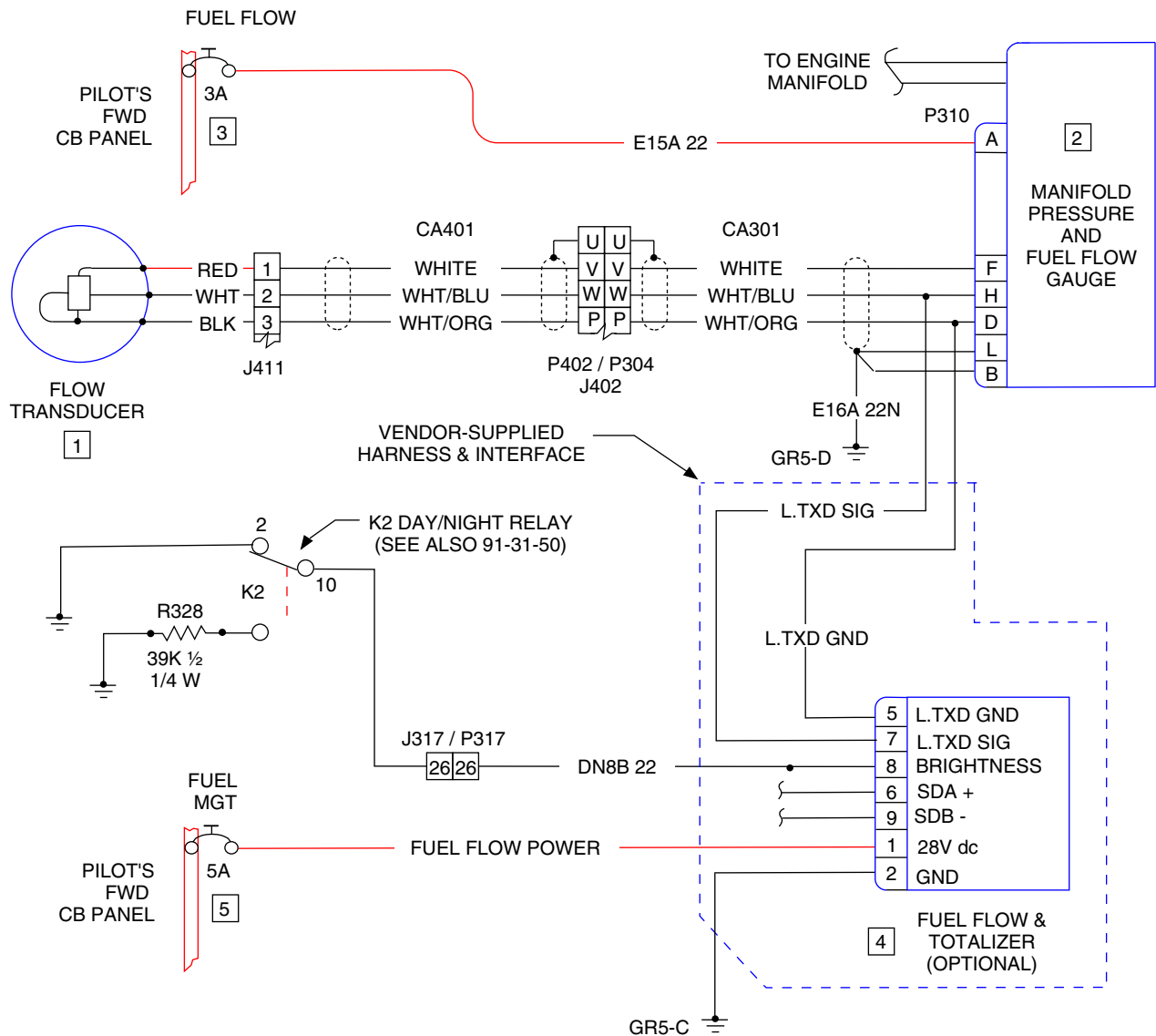
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	A413	Flow Transducer
2	M308	Manifold Pressure and Fuel Flow Gauge
3	CB313	Circuit Breaker (3 Amp)
4	M306	Fuel Flow & Totalizer
5	CB324	Circuit Breaker (5 Amp)



Fuel Flow Gauge(s)
Figure 1 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



89801 AH 6.0

Fuel Flow Gauge(s)
Figure 1 (Sheet 2 of 2)

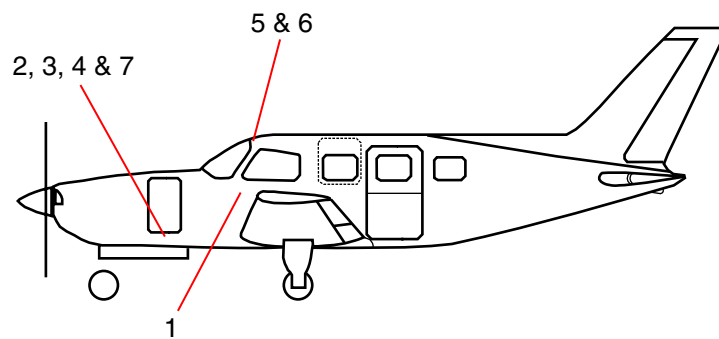
[Effectivity](#)
4636001 thru 4636020

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

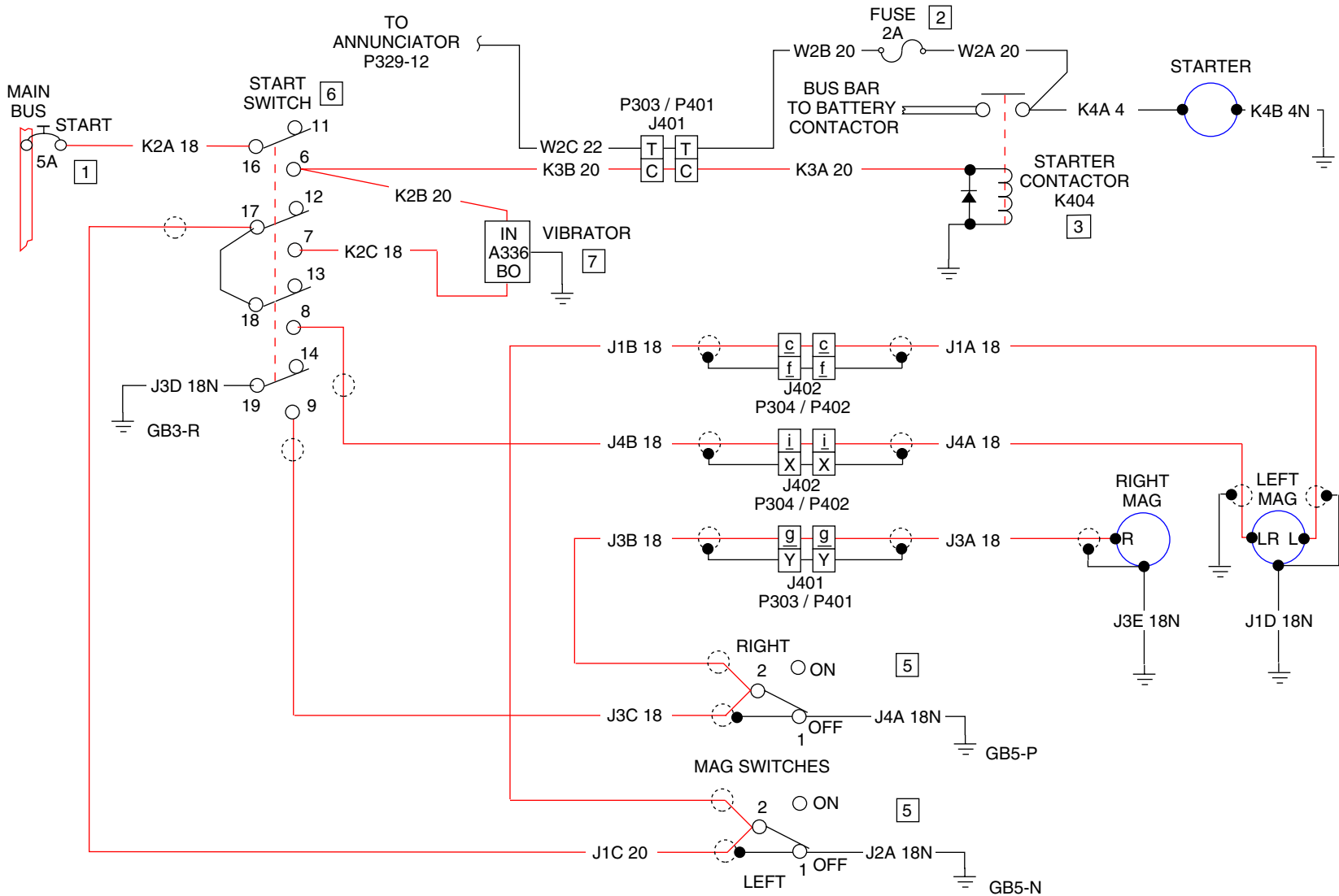
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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	CB334	Circuit Breaker (5 Amp)
2	F410	Fuse (2 Amp)
3	K404	Starter Contactor
4		Start Relay
5	S311 (L), S312 (R)	Magneto Switch
6		Start Switch
7	A336	Vibrator

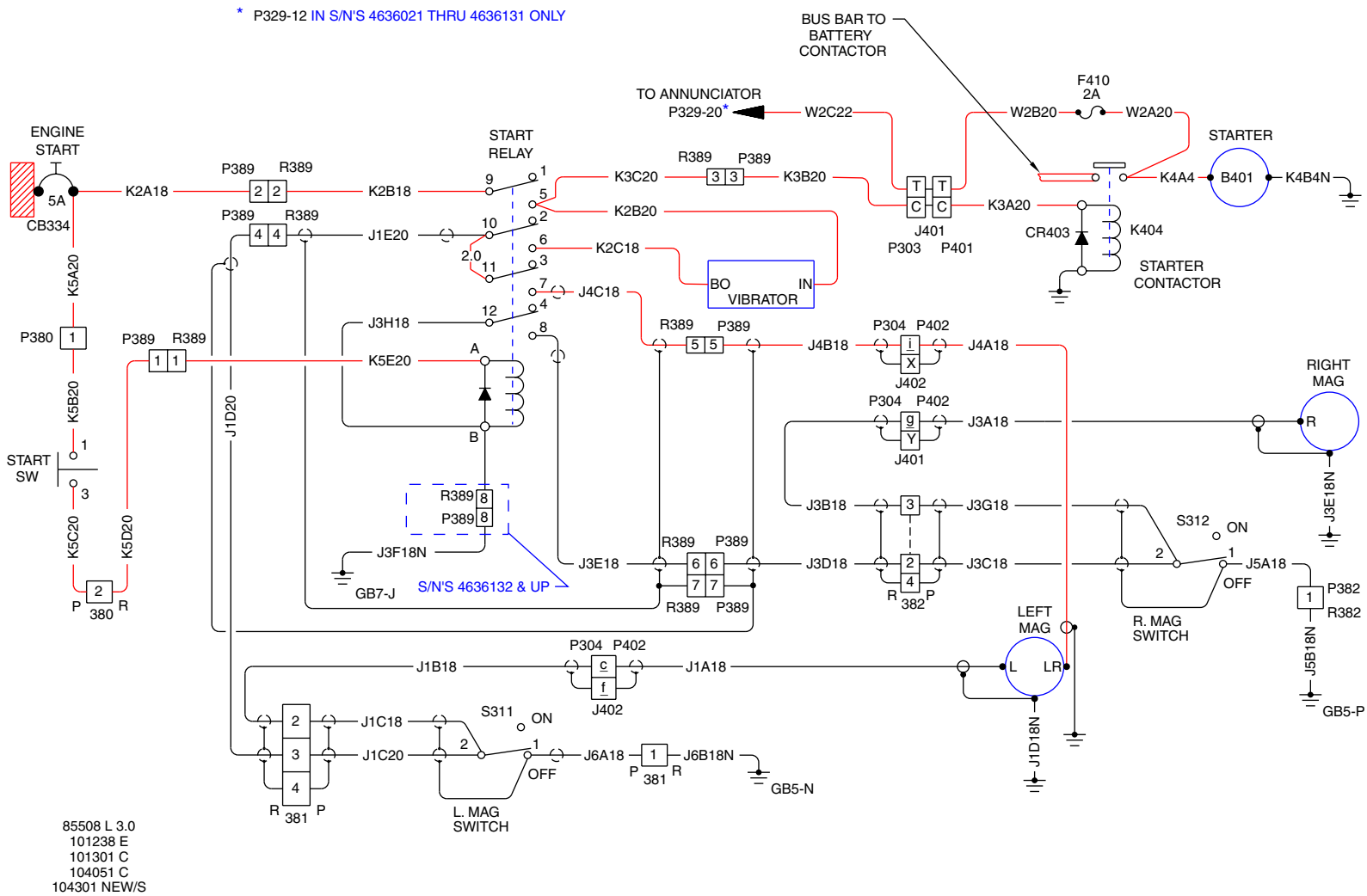


Engine Start and Ignition
Figure 1 (Sheet 1 of 4)



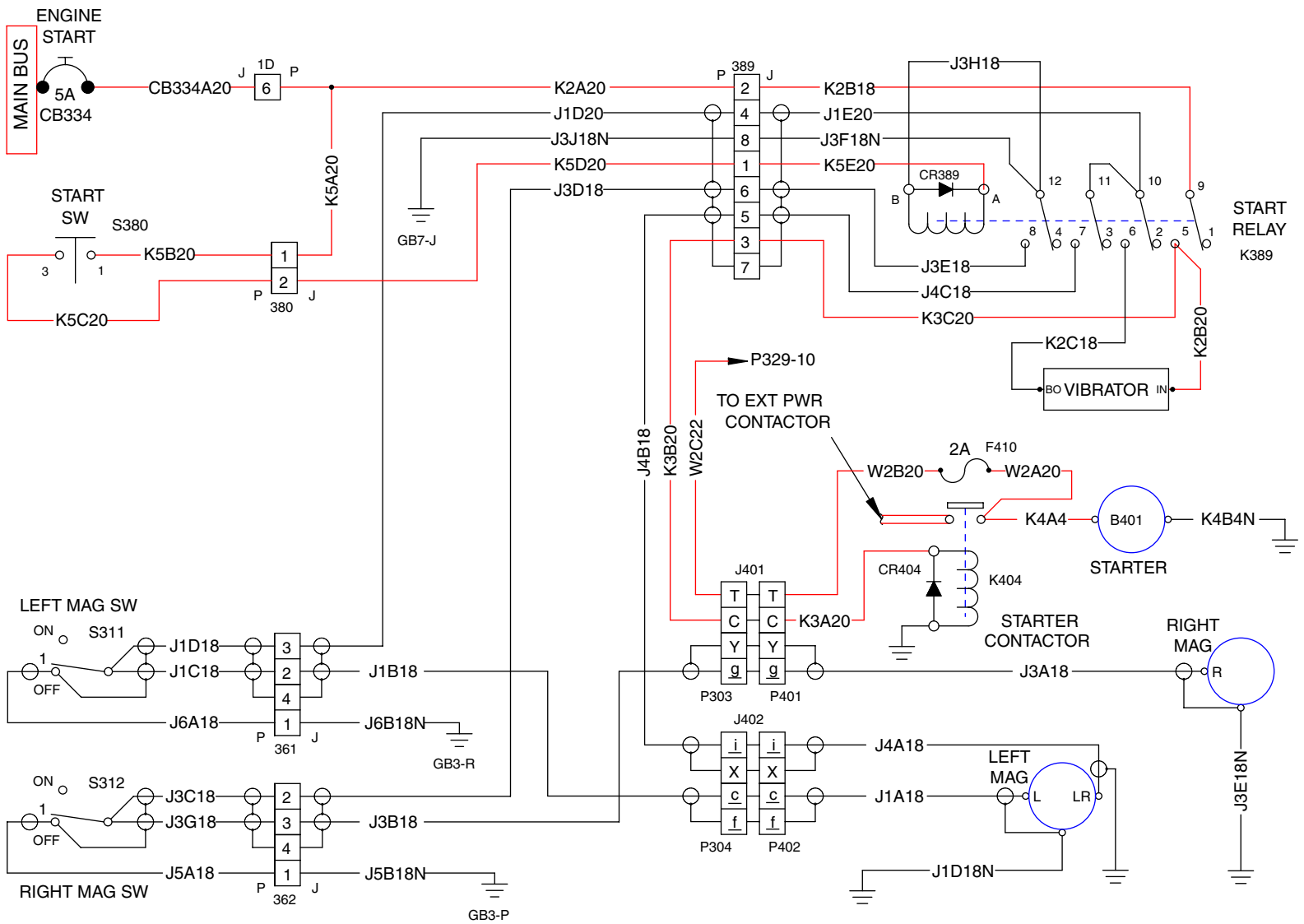
89801 AH 3.0

Effectivity
4636001 thru 4636020
Engine Start and Ignition
Figure 1 (Sheet 2 of 4)



Engine Start and Ignition
Figure 1 (Sheet 3 of 4)

Effectivity
4636021 thru 4636374



105115 NEW 3.0

Effectivity
4636375 and up

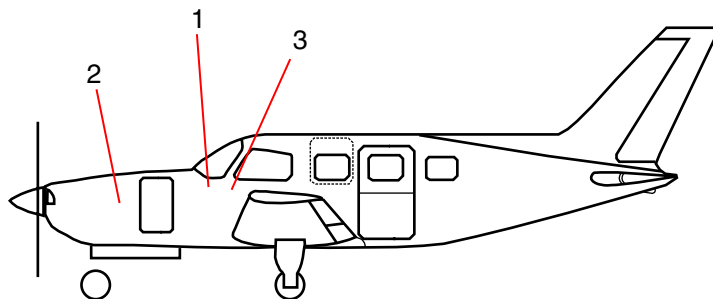
Engine Start and Ignition
Figure 1 (Sheet 4 of 4)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

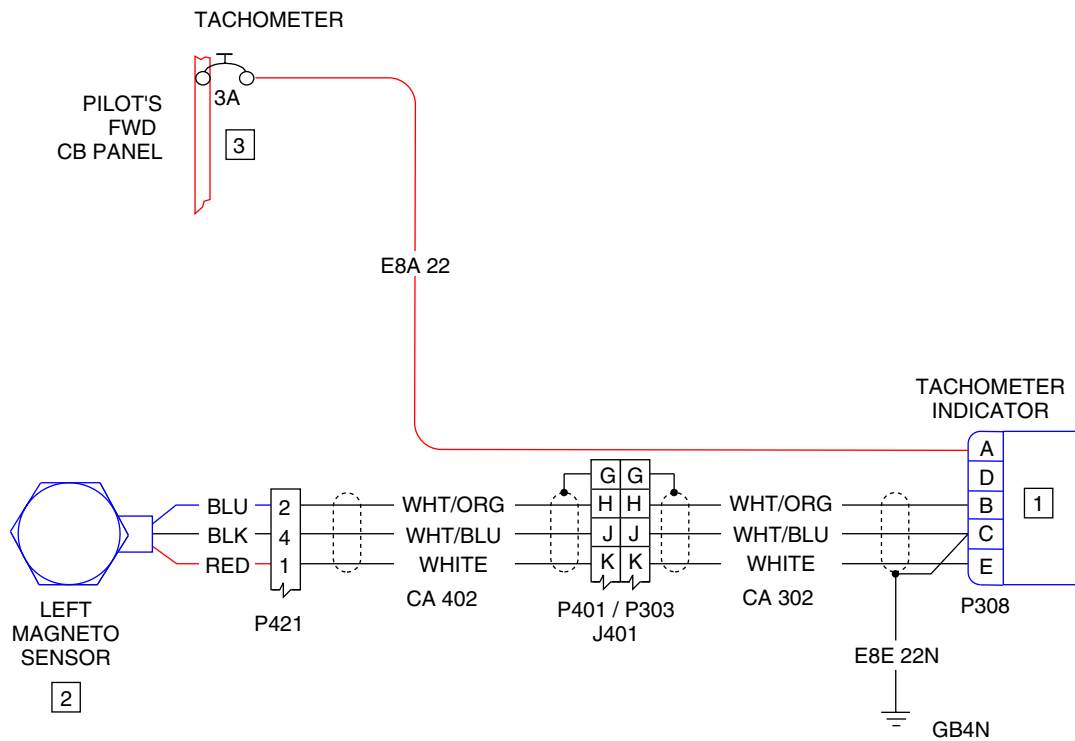
Item #	Designation	Description
1	M304	Tachometer Indicator
2		Magneto Sensor
3	CB314	Circuit Breaker (3 Amp)



[Effectivity](#)
4636001 thru 4636020

RPM Indicator (Tachometer)
Figure 1 (Sheet 1 of 2)

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL



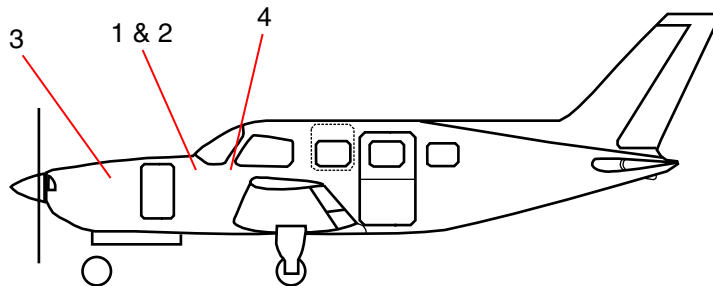
89801 AH 5.0

RPM Indicator (Tachometer)
Figure 1 (Sheet 2 of 2)

[Effectivity](#)
4636001 thru 4636020

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

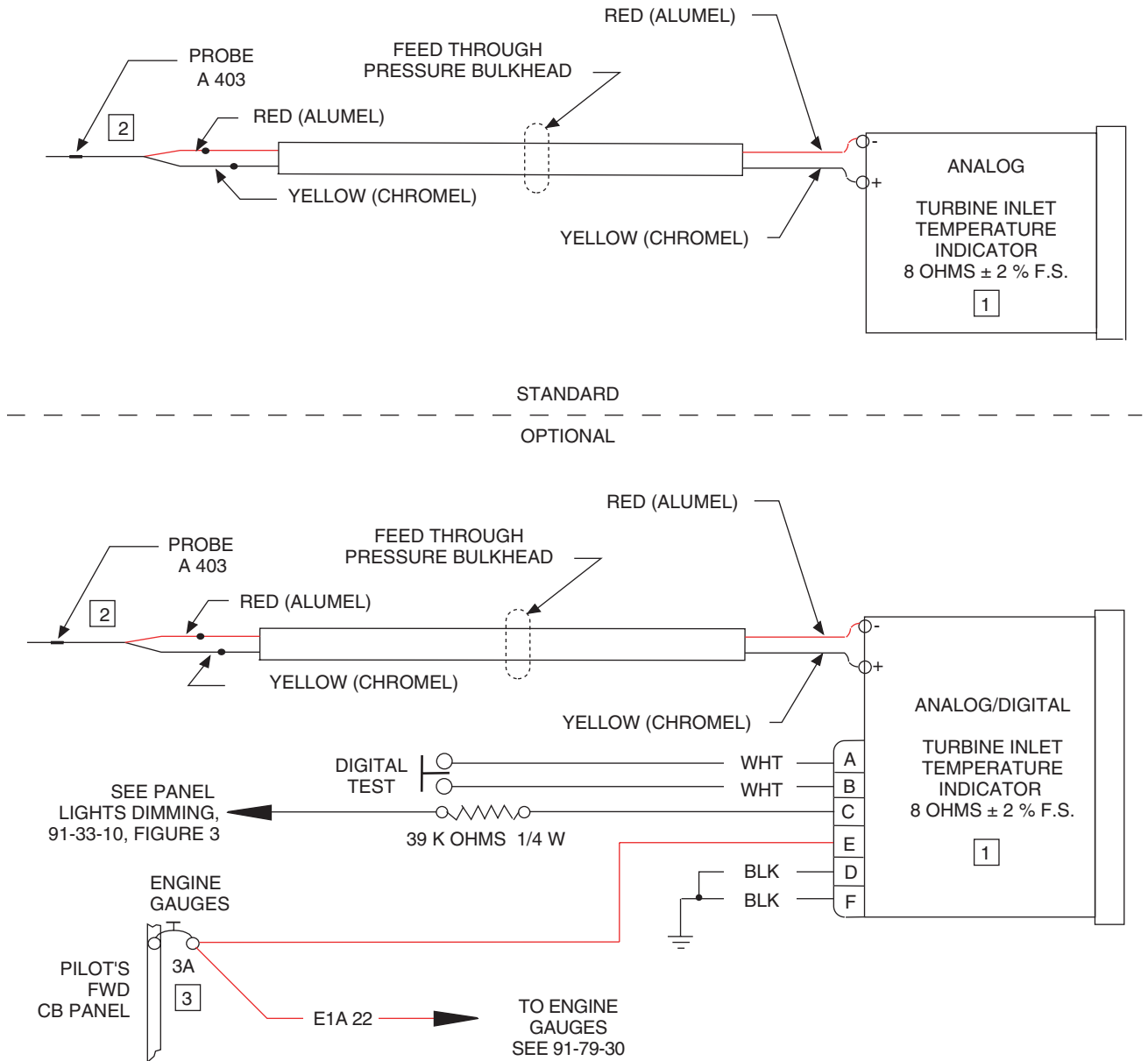
Item #	Designation	Description
1	M307	Turbine Inlet Temperature Indicator
2	A403	Turbine Inlet Temperature Probe
3	CB315	Circuit Breaker (3 Amp)



[Effectivity](#)
4636001 thru 4636020

Turbine Inlet Temperature (TIT) Indicator
Figure 1 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



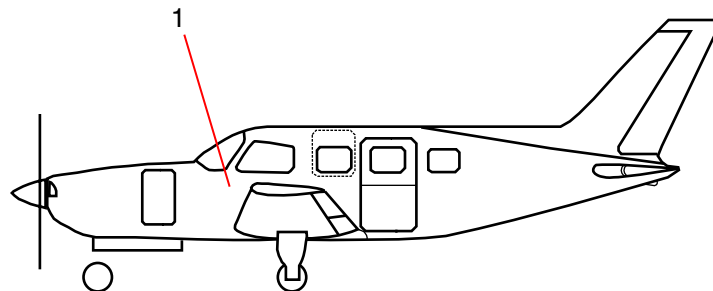
89801 AH 7.0

Turbine Inlet Temperature (TIT) Indicator
Figure 1 (Sheet 2 of 2)

[Effectivity](#)
4636001 thru 4636020

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

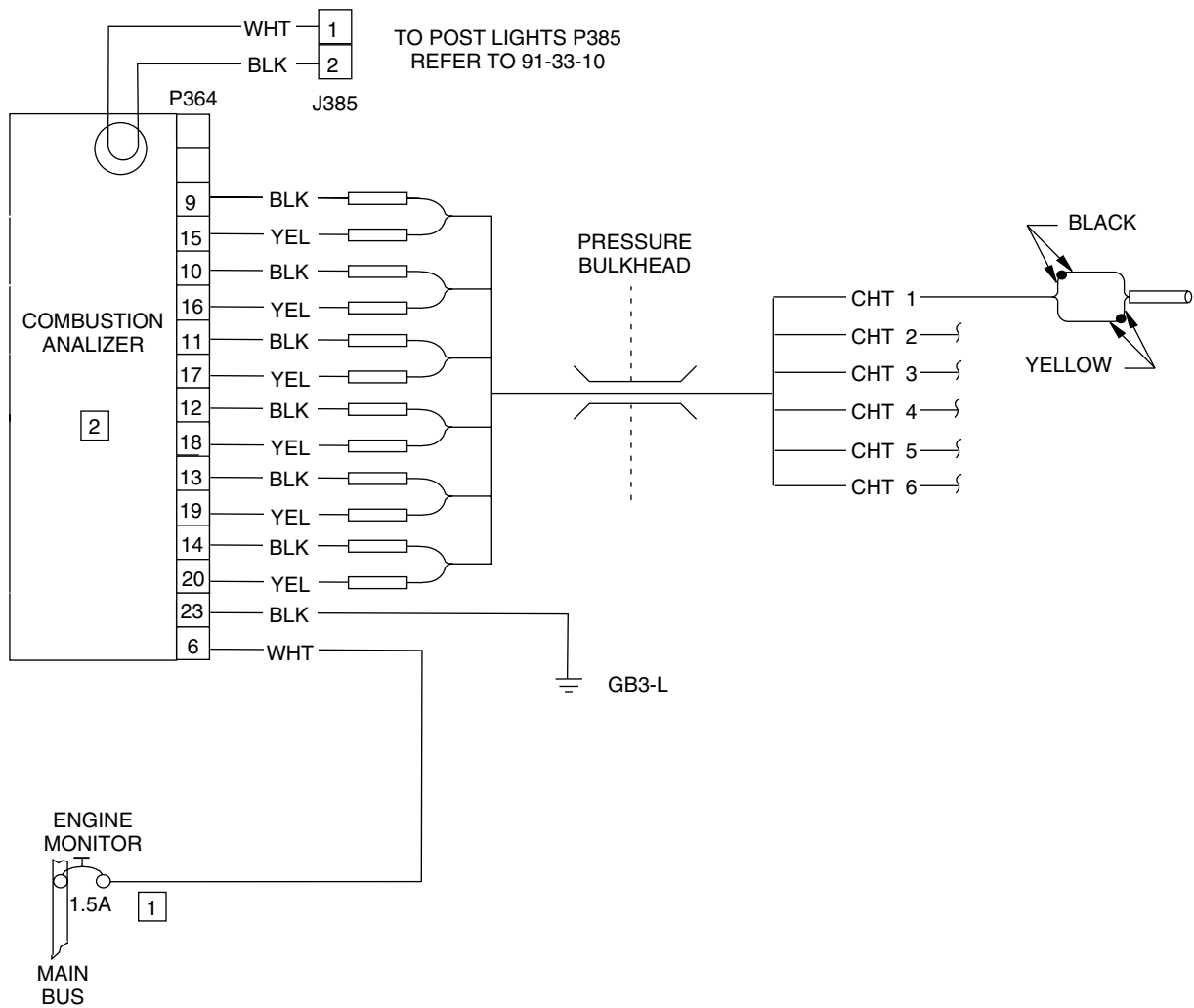
Item #	Designation	Description
1	CB316	Circuit Breaker (1.5 Amp)
2	M309	Combustion Analyzer



[Effectivity](#)
4636001 thru 4636020

Combustion Analyzer (Optional)
Figure 2 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**



89801 AH 43.0

Combustion Analyzer (Optional)
Figure 2 (Sheet 2 of 2)

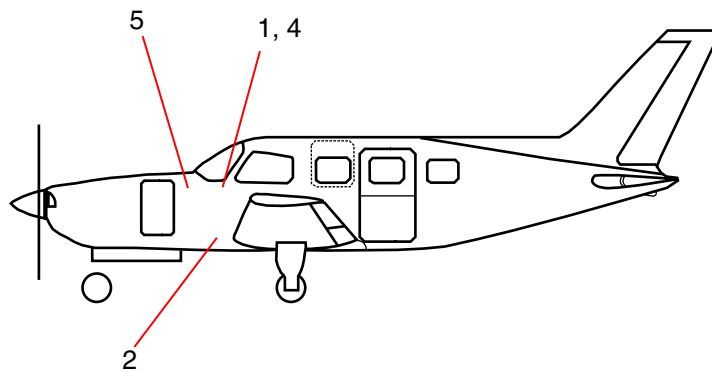
[Effectivity](#)
[4636001 thru 4636020](#)

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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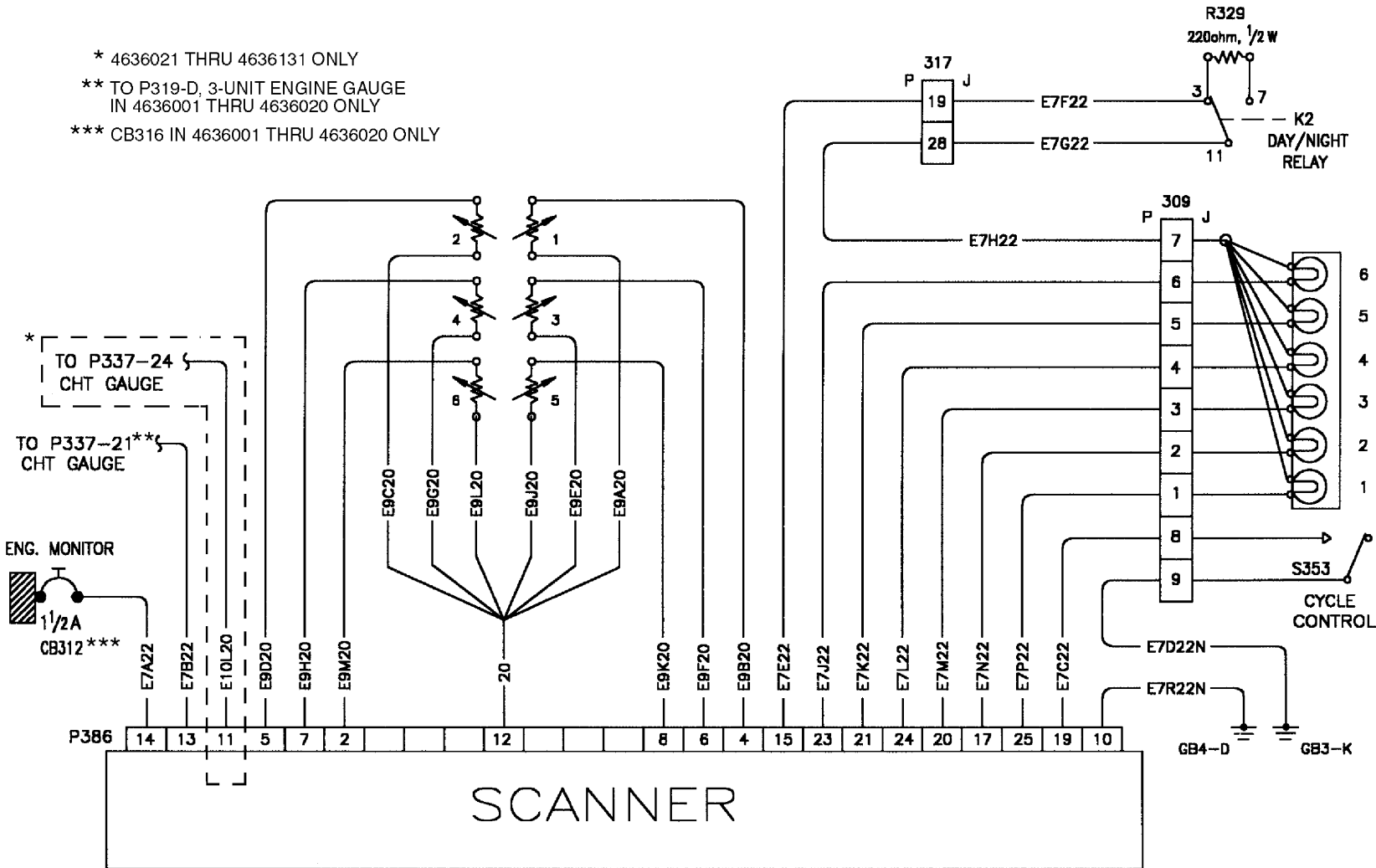
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB312	Circuit Breaker (1.5 Amp)
2	K2	Day/Night Relay
3	R329	Resistor
4	S353	Cycle Control Switch
5		Scanner



CHT Scanner
Figure 3 (Sheet 1 of 3)

[Effectivity](#)
4636001 thru 4636374

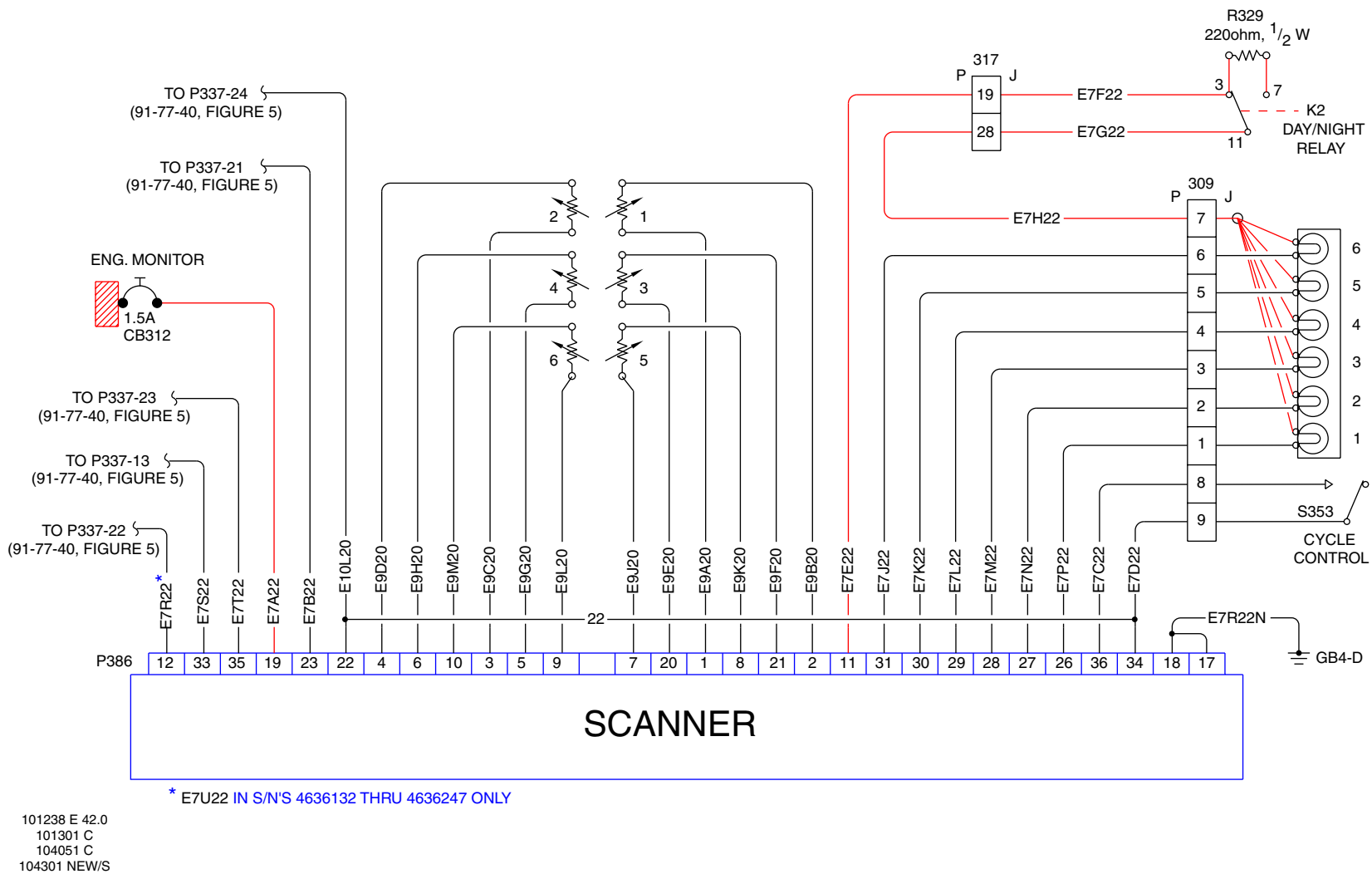


89801 AH 43.1
85508 L 43.0

Effectivity
4636001 thru 4636131

- * 4636021 THRU 4636131 ONLY
- ** TO P319-D, 3-UNIT ENGINE GAUGE
IN 4636001 THRU 4636020 ONLY
- *** CB316 IN 4636001 THRU 4636020 ONLY

CHT Scanner
Figure 3 (Sheet 2 of 3)



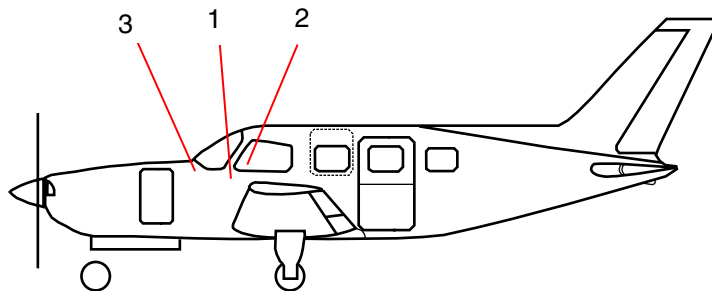
101238 E 42.0
101301 C
104051 C
104301 NEW/S

CHT Scanner
Figure 3 (Sheet 3 of 3)

Effectivity
4636132 thru 4636374

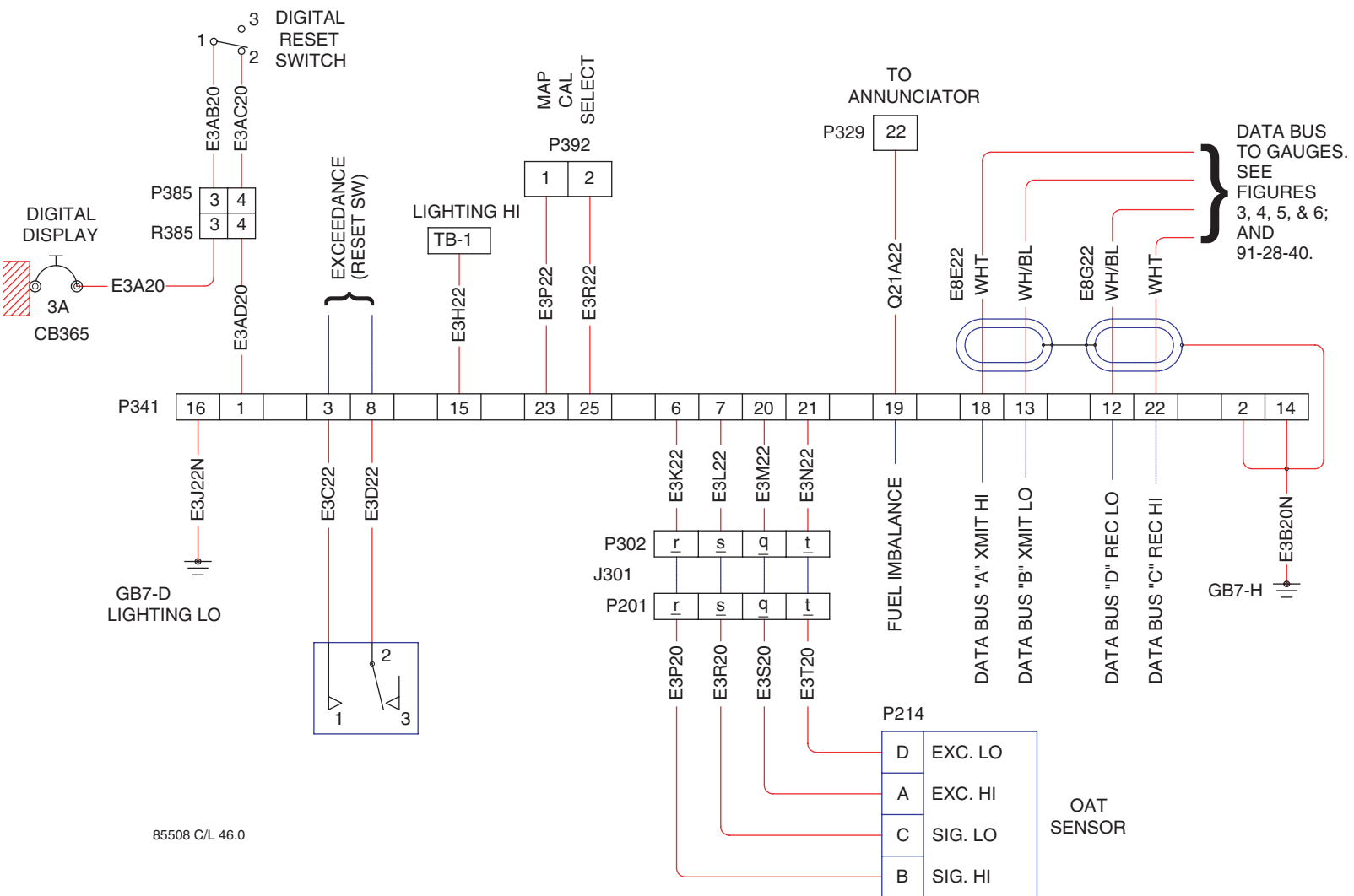
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB365	Circuit Breaker (3 Amp)
2		OAT Sensor
3		Quad Digital Indicator



[Effectivity](#)
4636021 thru 4636131

Quad Digital Indicator (QDI)
Figure 1 (Sheet 1 of 2)



85508 C/L 46.0

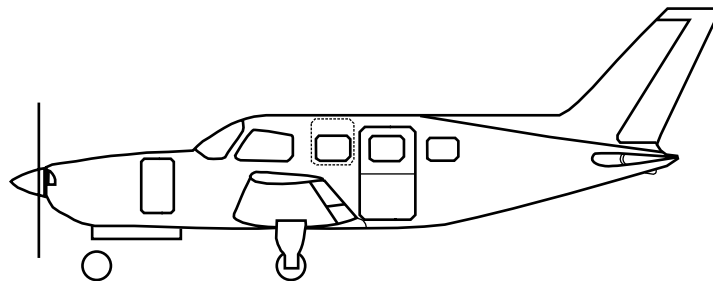
Quad Digital Indicator (QDI)
Figure 1 (Sheet 2 of 2)

Effectivity
4636021 thru 4636131

THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

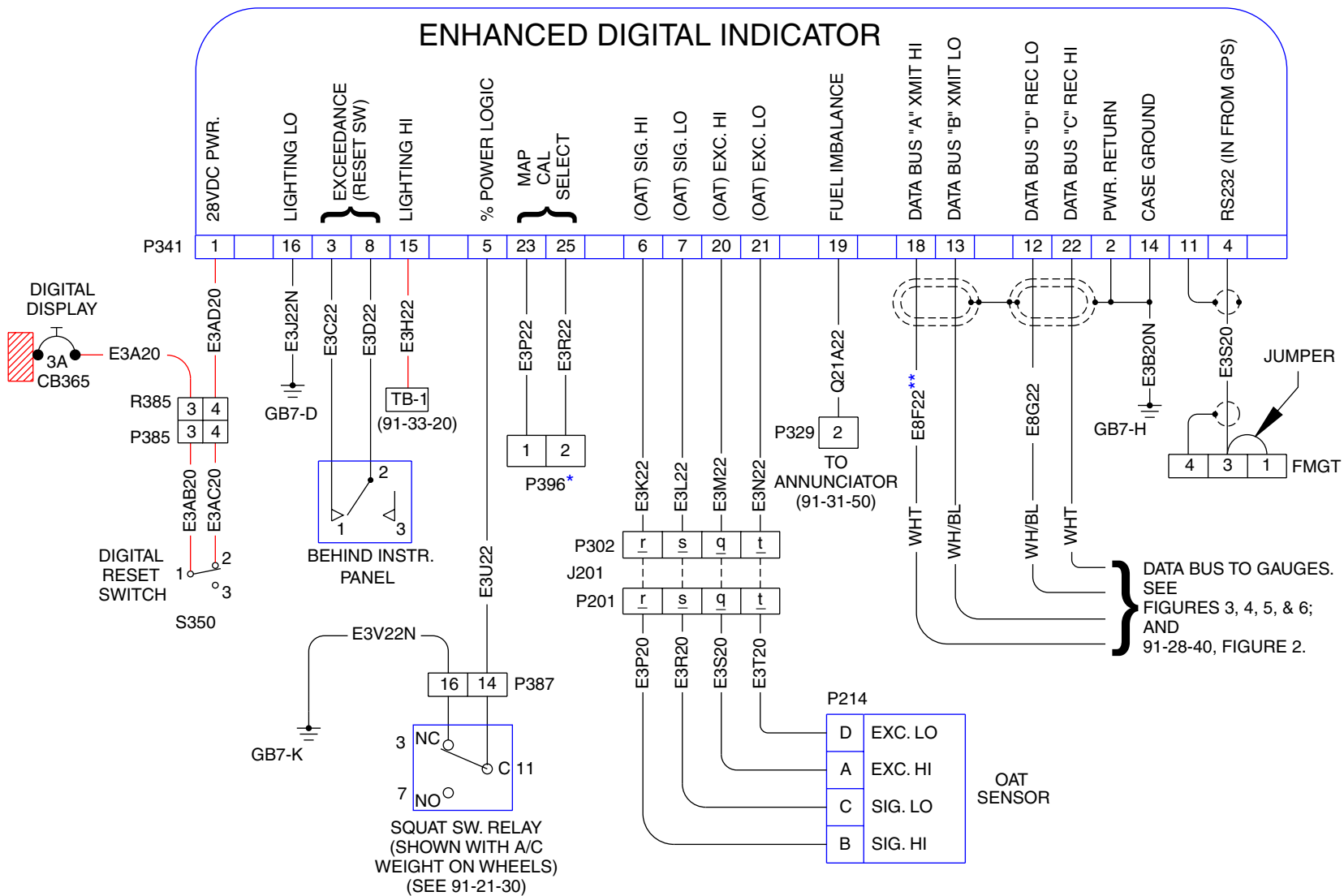
Item #	Designation	Description

Information Pending - See Parts Catalog



[Effectivity](#)
4636132 thru 4636374

Enhanced Digital Indicator (EDI)
Figure 2 (Sheet 1 of 2)



101238 E 45.0
101301 C
104051 C
104301 NEW/S

* P392 IN S/N'S 4636132 AND 4636186 ONLY
** E8E22 IN S/N'S 4636132 AND 4636186 ONLY

Enhanced Digital Indicator (EDI)
Figure 2 (Sheet 2 of 2)

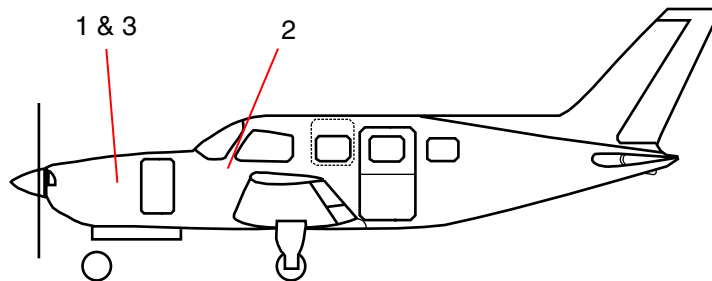
Effectivity
4636132 thru 4636374

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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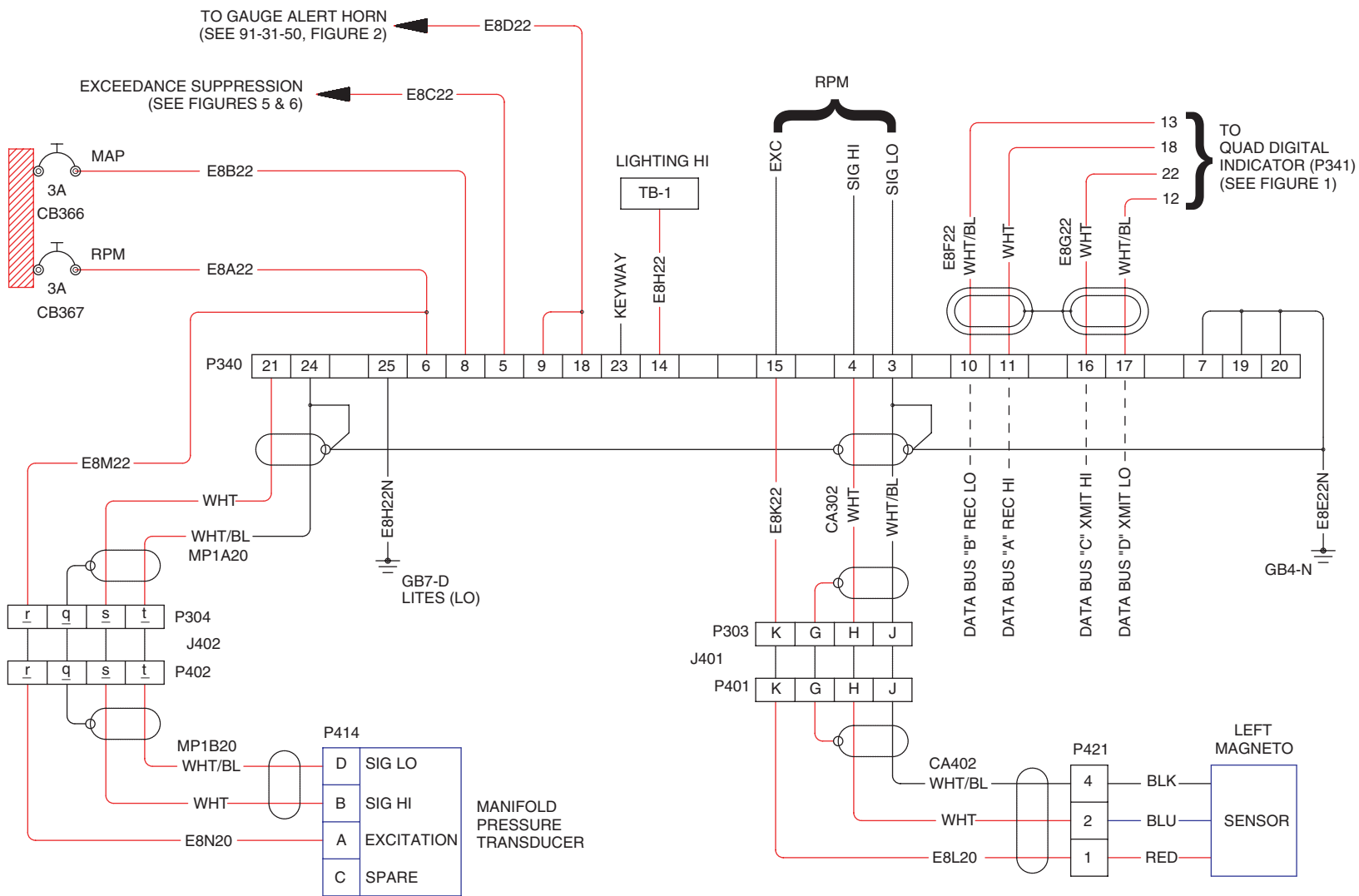
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB366, CB367	Magneto Sensor
2		Circuit Breaker (3 Amp)
3		Transducer



MAP / RPM Indicator (Tachometer)
Figure 3 (Sheet 1 of 3)

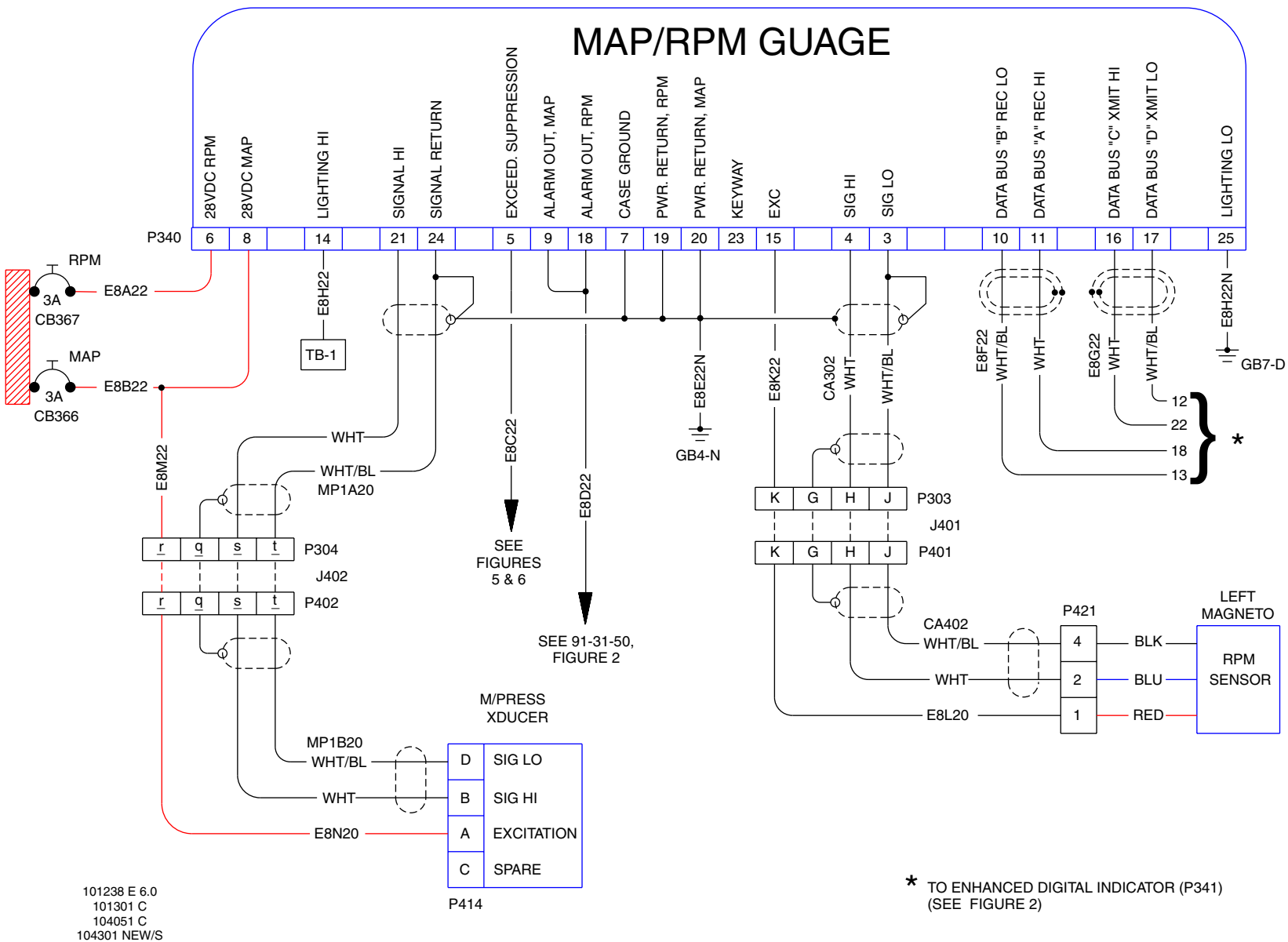
[Effectivity](#)
4636021 thru 4636374



85508 C/L 6.0

Effectivity
4636021 thru 4636131

MAP / RPM Indicator (Tachometer)
Figure 3 (Sheet 2 of 3)



MAP / RPM Indicator (Tachometer)
Figure 3 (Sheet 3 of 3)

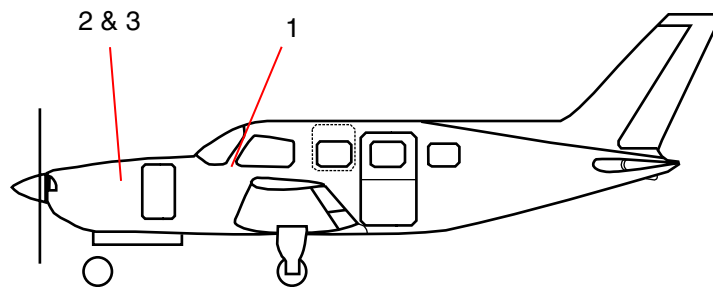
Effectivity
4636132 thru 4636374

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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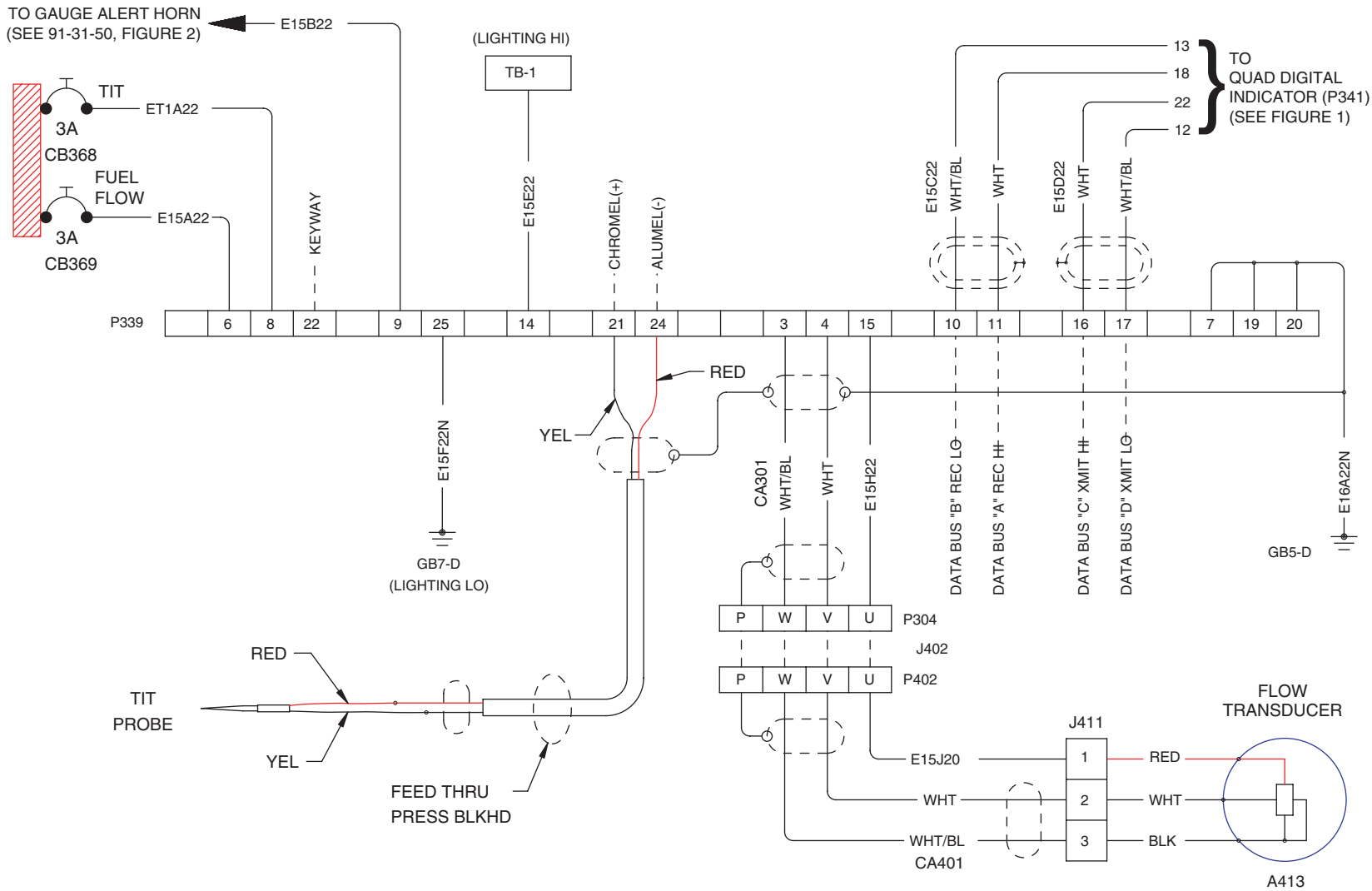
**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

Item #	Designation	Description
1	CB368, CB369	Circuit Breaker (3 Amp)
2	A413	Flow Transducer
3		TIT Probe



TIT and Fuel Flow Indicator
Figure 4 (Sheet 1 of 3)

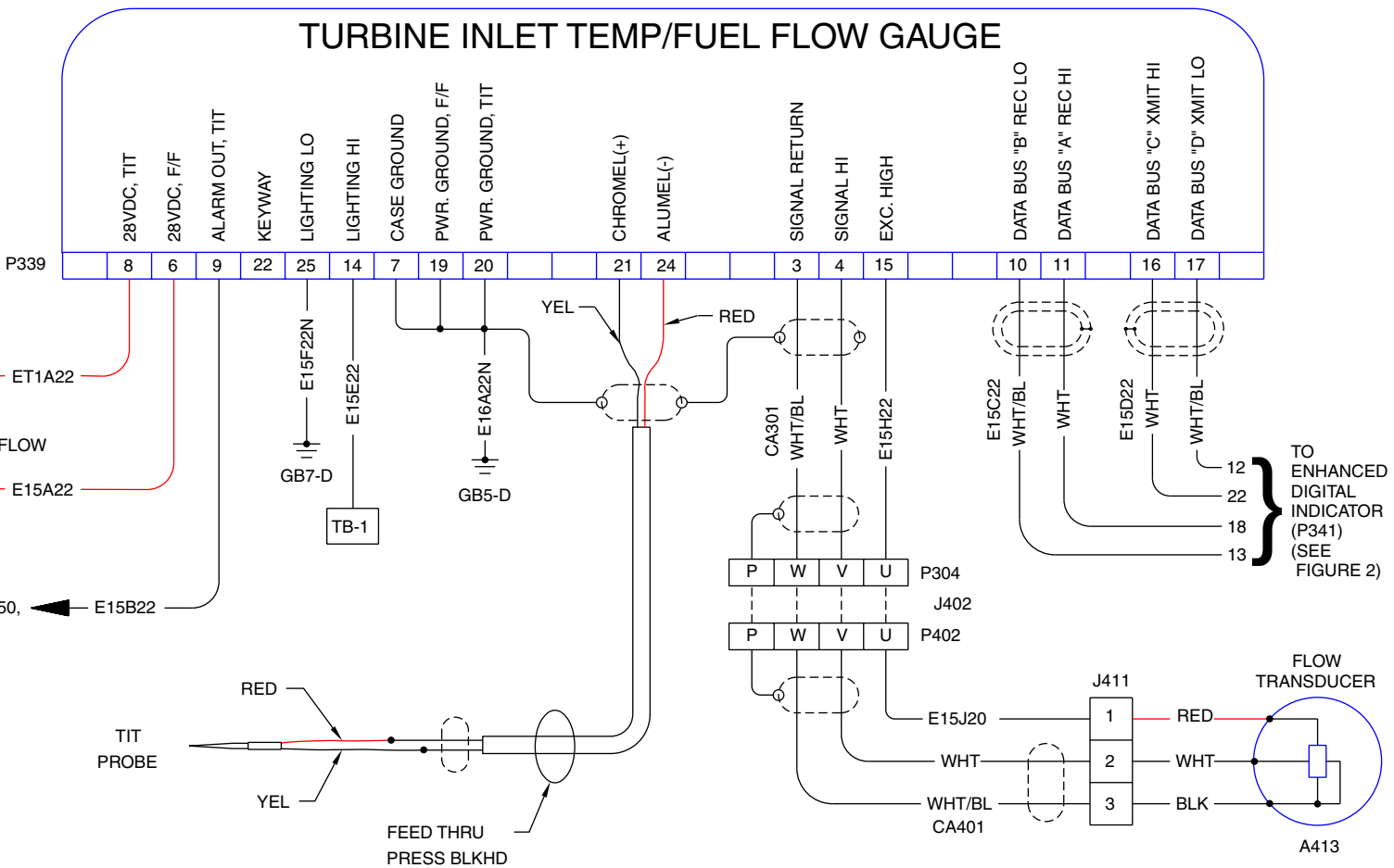
[Effectivity](#)
4636021 thru 4636374



85508 C/L 7.0

Effectivity
4636021 thru 4636131

TIT and Fuel Flow Indicator
Figure 4 (Sheet 2 of 3)



101238 E 7.0
101301 C
104051 C
104301 NEW/S

TIT and Fuel Flow Indicator
Figure 4 (Sheet 3 of 3)

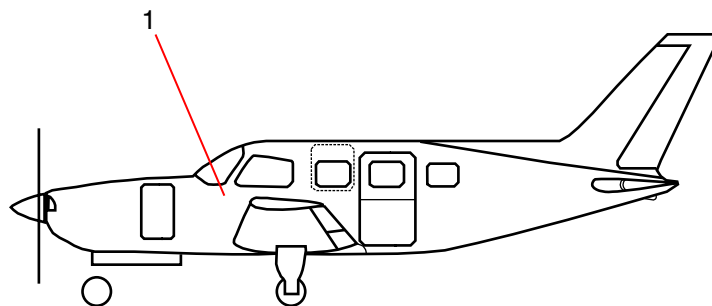
Effectivity
4636132 thru 4636374

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PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

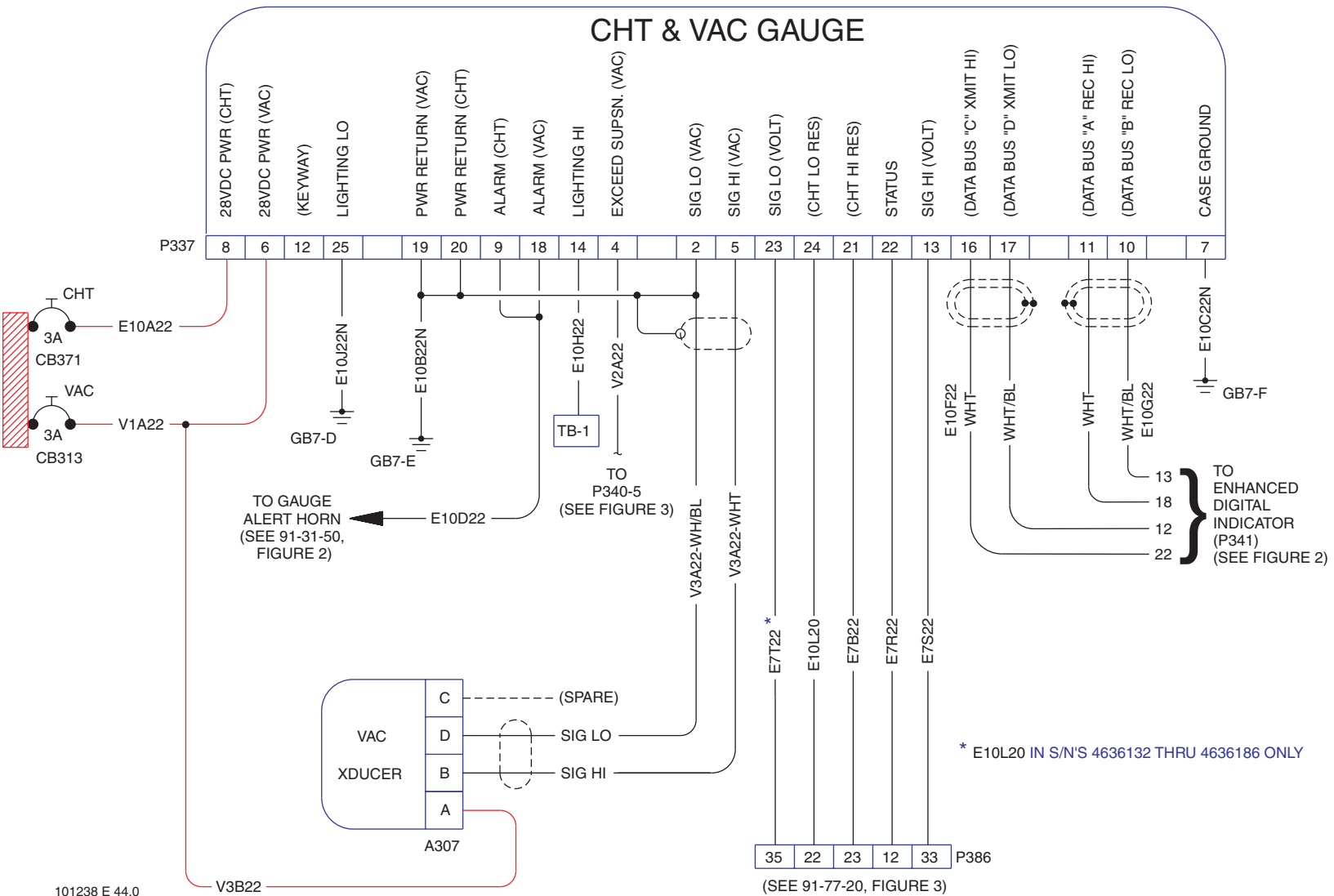
Item #	Designation	Description
1	CB313, CB371	Circuit Breaker (3 Amp)



CHT and Vacuum Indicator
Figure 5 (Sheet 1 of 3)

[Effectivity](#)
4636021 thru 4636374





CHT and Vacuum Indicator
Figure 5 (Sheet 3 of 3)

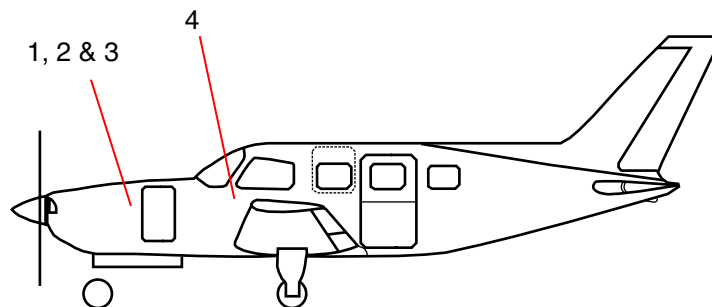
Effectivity
4636132 thru 4636374

**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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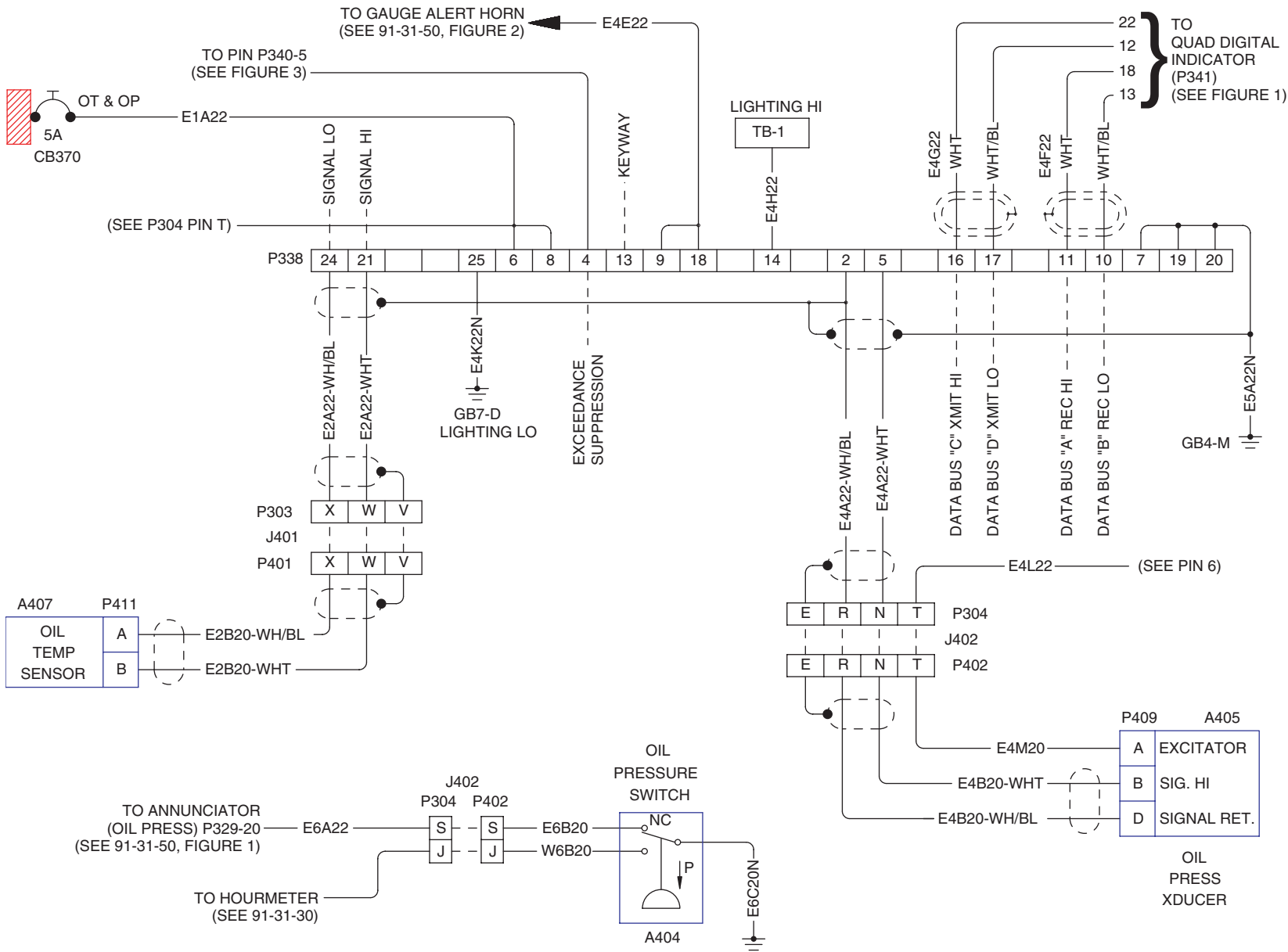
THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL

Item #	Designation	Description
1	A404	Oil Pressure Switch
2	A405	Oil Pressure Transducer
3	A407	Oil Temperature Sensor
4	CB370	Circuit Breaker (3 Amp)



Oil Pressure and Temperature Indicator
Figure 6 (Sheet 1 of 3)

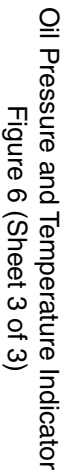
[Effectivity](#)
4636021 thru 4636374



85508 C/L 4.0

Effectivity
4636021 thru 4636131

Oil Pressure and Temperature Indicator
Figure 6 (Sheet 2 of 3)

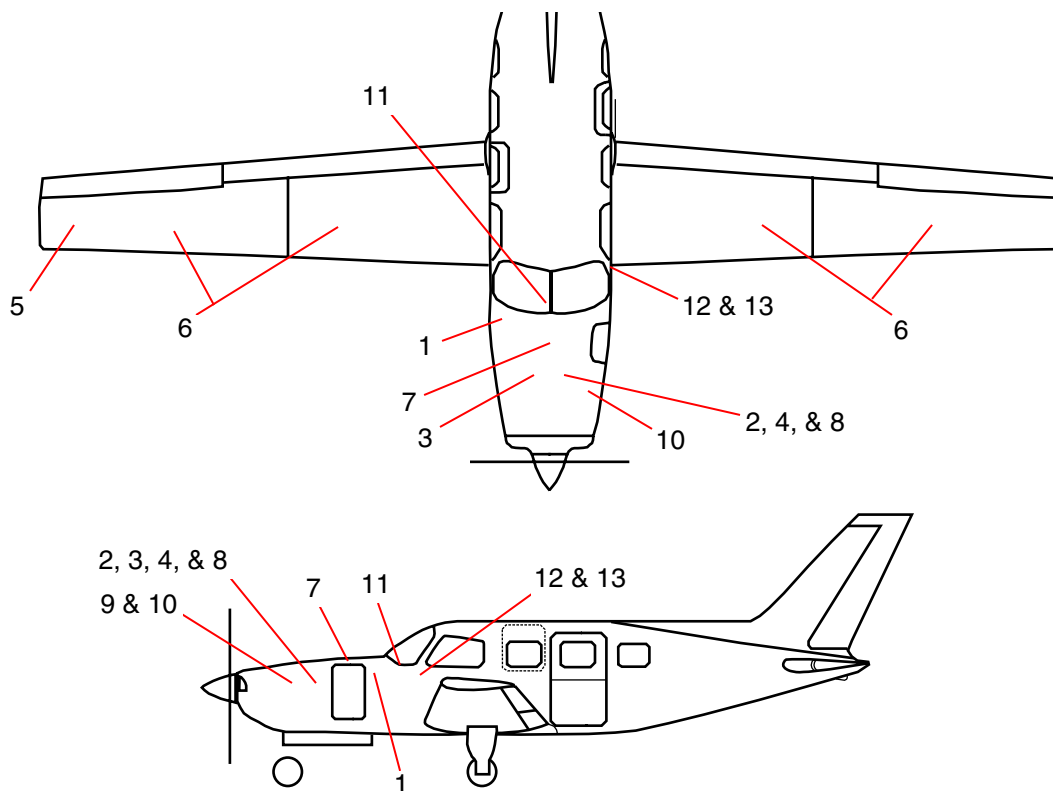


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PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

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**THE NEW PIPER AIRCRAFT, INC.
PA-46-350P, MALIBU MIRAGE
MAINTENANCE MANUAL**

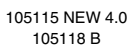
Item #	Designation	Description
1		Data Acquisition Unit (DAU)
2		RPM Sensor (on Left Magneto)
3	A405	Oil Pressure Transducer
4	A407	Oil Temp Sensor
5		OAT Sensor
6		Fuel Senders (Left & Right; Inboard & Outboard)
7		MAP Transducer
8	A413	Fuel Flow Transducer
9	A441 thru A446	CHT Sensors
10		TIT Sensor
11	A307	Vacuum Transducer
12	CB343, CB353	Circuit Breaker (2 Amp)
13	CB313	Circuit Breaker (3 Amp)



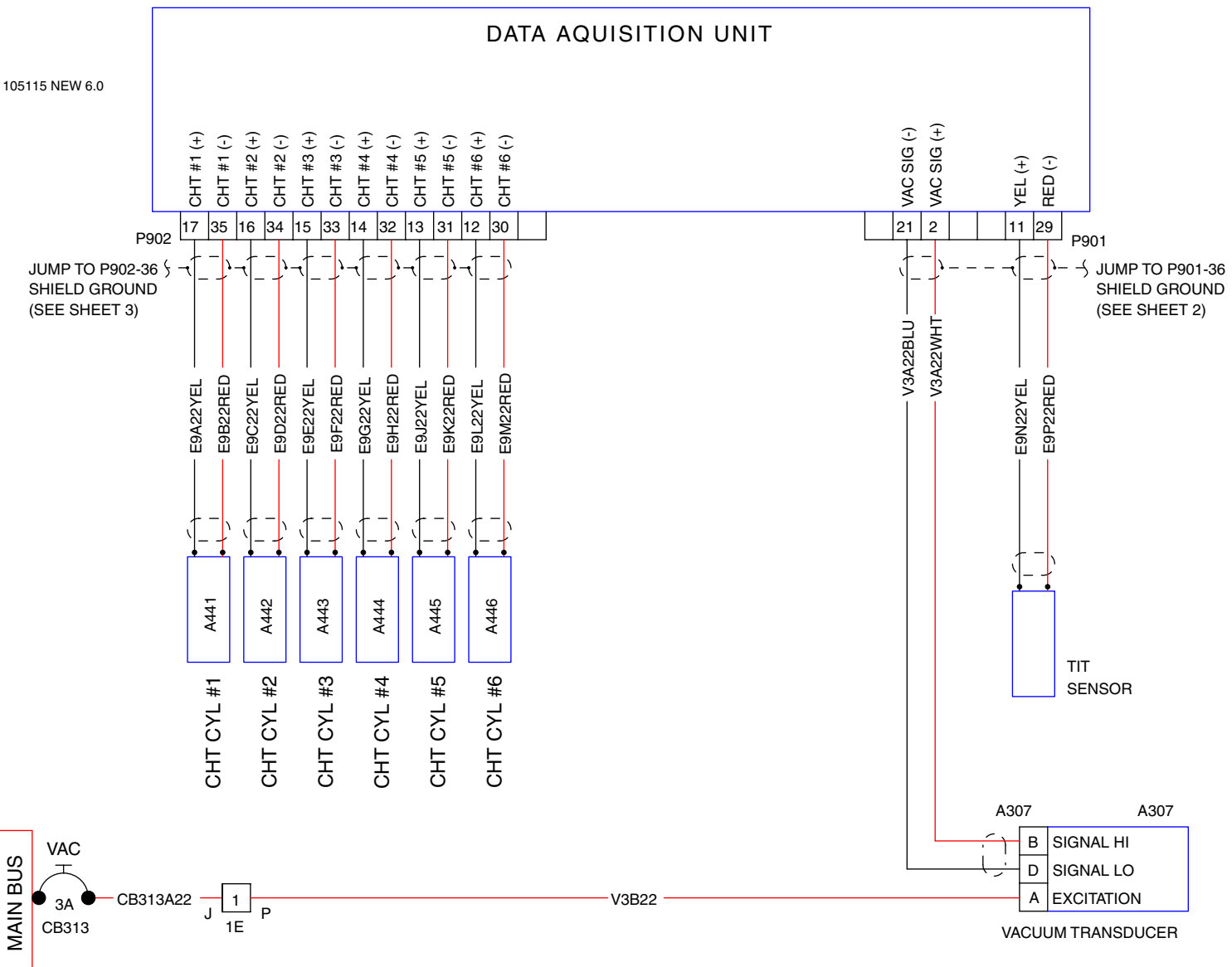
Data Acquisition Unit (DAU)
Figure 7 (Sheet 1 of 4)

[Effectivity](#)
4636375 and up

Data Acquisition Unit (DAU)
Figure 7 (Sheet 2 of 4)







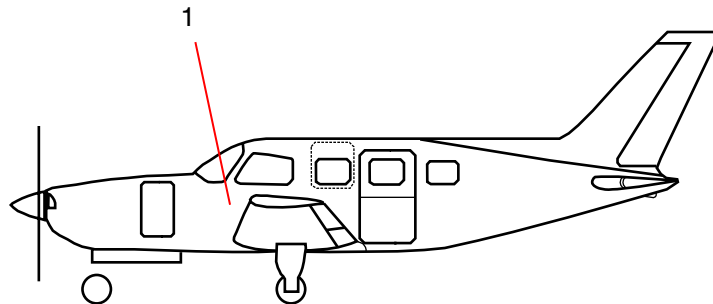
Effectivity
4636375 and up
Data Acquisition Unit (DAU)
Figure 7 (Sheet 4 of 4)

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PA-46-350P, MALIBU MIRAGE
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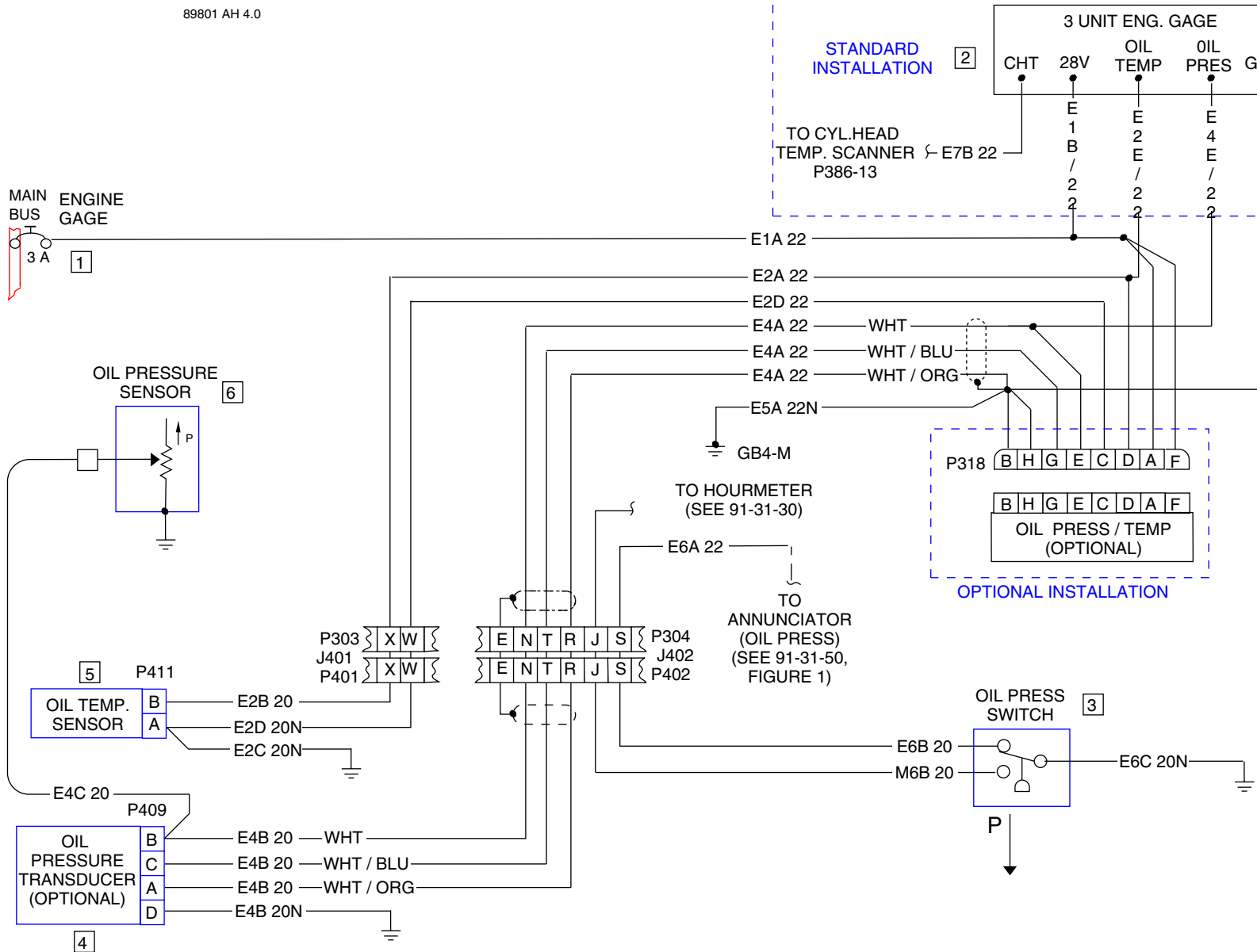
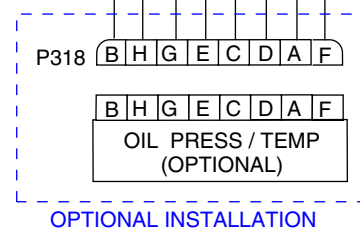
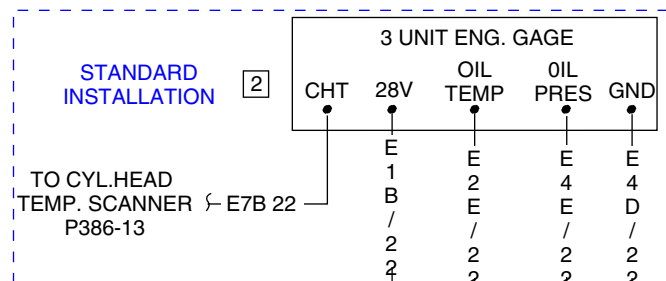
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Item #	Designation	Description
1	CB315	Circuit Breaker (3 Amp)
2	M30	3-Unit Engine Gauge
3	A404	Oil Pressure Switch
4	A405	Oil Pressure Transducer
5	A407	Oil Temperature Sensor
6		Oil Pressure Sensor



[Effectivity](#)
4636001 thru 4636020

Oil Pressure and Temperature Indicators
Figure 1 (Sheet 1 of 2)



Oil Pressure and Temperature Indicators
Figure 1 (Sheet 2 of 2)

Effectivity
4636001 thru 4636020

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**GRIDS 8E16 THRU 8L24
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