Raytheon Aircraft Company

Beechcraft

BONANZA SERIES

V35B	(D-10097, D-10120 and After)
F33A	(CE-748, CE-772 and After)
F33C	(CJ-149 and After)
A36	(E-1111, E-1241 thru E-3635, Except E-3630)
A36TC	(EA-11 thru EA-272, Except EA-242)
B36TC	(EA-242, EA-273 and After)
G36	(E-3630, E-3636 and After)

Maintenance Manual

P/N 36-590001-9
Issued: May 9, 1980

P/N 36-590001-9A28
Revised: August 31, 2005

Published by
RAYTHEON AIRCRAFT COMPANY
P.O. Box 85
Wichita, Kansas 67201
U.S.A.

NOTE

Where Beech Aircraft Corporation is referred to in this publication, it will be taken to read Raytheon Aircraft Company.

Raytheon
Aircraft Company

GAMA
Member of GAMA

General Aviation
Manufacturers Association

RECORD OF REVISIONS

When a revision is inserted, the revision number, the date the revision is inserted into the manual, and the initials of the person(s) inserting the revision should be recorded on this page.

REV NO.	REVISION DATE	INIT	REV NO.	REVISION DATE	INIT	REV NO.	REVISION DATE	INIT
A26	11/18/04	ATP/ JSF						
A27	5/27/05	ATP/PC						
A28	12/9/05	ATP/ JSF						

LIST OF EFFECTIVE REVISIONS

PART NUMBER	DATE	CHAPTERS AFFECTED
36-590001-9A	May 9, 1980	Original
36-590001-9A1	October 10, 1980	Introduction, 5, 6, 11, 24, 25, 30, 34, 36, 73
36-590001-9A2	January 28, 1981	Introduction, 12, 21, 25, 33, 35, 61, 71, 73, 77, 81
36-590001-9A3	March 12, 1981	5, 11, 32, 57
36-590001-9A4	January 20, 1982	Introduction, 6, 12, 21, 23, 24, 25, 27, 28, 34, 39, 57, 61, 81, 91
36-590001-9A5	February 18, 1983	Introduction, 5, 6, 27
36-590001-9A6	October 27, 1983	Introduction, 5, 6, 12, 21, 24, 27, 28, 30, 32, 33, 39, 61, 71, 72, 79, 91
36-590001-9A7	December 21, 1983	71
36-590001-9A8	January 18, 1984	5, 12, 20, 28, 57, 91
36-590001-9A9	September 27, 1984	Introduction, 5, 12, 21, 23, 25, 27, 33, 35, 36, 71, 74, 91
36-590001-9A10	May 31, 1985	Introduction, 27
36-590001-9A11	August 29, 1985	12, 28
36-590001-9A12	August 28, 1987	Introduction, 5, 11, 12, 25, 27, 28, 32, 36, 51, 55, 71, 74
36-590001-9A13	May 30, 1990	Introduction, 7, 32
36-590001-9A14	June 20, 1991	Introduction, 5, 12, 20, 27, 55, 71, 91
36-590001-9A15	December 20, 1991	Introduction, 52
36-590001-9A16	October 16, 1992	5, 9, 11, 12, 21, 25, 27, 28, 51, 55, 56, 91
36-590001-9A17	November 16, 1994	Introduction, 32, 74
36-590001-9A18	August 18, 1995	Introduction, 12, 21, 23, 27, 32, 91
36-590001-9A19	March 29, 1996	5, 27

A28

Basic publications are assigned a part number which appears on the title page with the date of the issue. Subsequent revisions are identified by the addition of a revision code after the part number. A1 after a part number denotes the first revision to the basic publication, A2 the second, etc. Occasionally, it is necessary to completely reissue and reprint a publication for the purpose of obsoleting a previous issue and outstanding revisions thereto. As these replacement reissues are made, the code will also change to the next successive letter of the alphabet at each issue. For example, B for the first reissue, C for the second, etc.

When ordering a handbook, give the basic number, and the reissue code when applicable, if a complete up-to-date publicationis desired. Should only revision pages be required, give the basic number and revision code for the particular set of revision pages you desire.

LIST OF EFFECTIVE REVISIONS (Continued)

PART NUMBER	DATE	CHAPTERS AFFECTED
36-590001-9A20	February 26, 1999	27
36-590001-9A21	December 23, 1999	5, 32, 52
36-590001-9A22	November 10, 2000	20, 25, 57
36-590001-9A23	June 28, 2002	5
36-590001-9A24	September 30, 2003	7, 23, 25, 27, 32, 73
36-590001-9A25	March 31, 2004	Introduction, 20, 34, 36
36-590001-9A26	September 30, 2004	5, 20, 24, 52, 53, 57, 77, 91
36-590001-9A27	March 31, 2005	Introduction, 5, 10, 12, 24, 27, 52, 61, 71
36-590001-9A28	August 31, 2005	Introduction, 91, G36 MM Supplement

RECORD OF TEMPORARY REVISIONS

Temporary Revision No.	Affected Chapter	Inserted		Removed	
		By	Date	By Revision No.	Date

NOTE: Insert this Record of Temporary Revisions after the Log of Temporary Revisions page(s).

Record of Temporary Revisions (Continued)

Temporary Revision No.	Affected Chapter	Inserted		Removed	
		By	Date	By Revision No.	Date

LOG OF TEMPORARY REVISIONS

Revision No.	Revision Date	Subject	Revision Incorporated
27-1	Dec 11/92	Flap Drive Cable Connection	TR 27-2
27-2	Nov 15/93	Flap Drive Cable Connection	A20

NOTE: Insert this Log of Temporary Revisions after the Record of Revisions page. Previous Log of Temporary Revisions may be discarded. Update the Record of Temporary Revisions page(s) as required.

LOG OF TEMPORARY REVISIONS (Continued)

Revision No.	Revision Date	Subject	Revision Incorporated

P/N 36-590001-9, REVISION A28, AUG 31/05

The chapters which have been revised or added are listed below with the Highlights of each change. Remove the affected pages and insert this A28 Revision in accordance with the attached Instruction Page. Enter the revision number and the date inserted on the Record of Revisions page of this manual. The Highlights Page may be retained with the manual for future reference.

HIGHLIGHTS

Chapter/Section	Description
Introduction	Revised to include reference of G36 Maintenance Manual Supplement and associated publications. Revised Chart 1 to reflect addition of Supplement.
91-00-00	Revised Chart 1 to include new consumable materials.

Raytheon Aircraft Company

BONANZA SERIES MAINTENANCE MANUAL
INSTRUCTIONS
for
REVISION 36-590001-9A28

REMOVE PAGE	CHAPTER	INSERT PAGE	CHAPTER	DATED
Title Page		Title Page		August 31, 2005
Logo Page		Logo Page		- - -
"A" Page		"A" Page		A28
"B" Page		"B" Page		A28
"C" Page		"C" Page		A28
All	INTRODUCTION	1 thru 17	INTRODUCTION	Aug 31/05
All	91 - EFF		91 - LOEP	
All	91 - TOC		91 - TOC	
All	91-00-00	1 thru 12	91-00-00	Aug 31/05

After compliance, this Instruction Sheet may be discarded.

LIST OF EFFECTIVE PAGES

CHAPTER	PAGE	DATE
	Title Page	Aug 31/05
	Logo Page	
	"A" Page	A28
	"B" Page	A28
	"C" Page	A28
Introduction	1 thru 17	Aug 31/05

NOTE - The chapter List of Effective Pages is located in the front of each chapter.

INTRODUCTION

NOTE: Neither reissues nor revisions are automatically provided to the holder of this manual. For information on how to obtain reissues or revisions applicable to this manual, refer to the latest revision of the Raytheon Aircraft Company Service Bulletin No. 2001.

Additional publications are listed in the current Publications Price List CD-ROM (P/N 994-32808). For Information on these publications contact the Technical Manual Distributions Center (TMDC) at 1-800-796-2665, fax (316) 676-4824, E-mail TMDC@rac.ray.com or visit our web site at http://pubs.raytheonaircraft.com.

The Bonanza Series Maintenance Manual is prepared in accordance with the GAMA (General Aviation Manufacturers Association) Specification No. 2 format. It also meets the intent of the requirements of the ATA Specification 100 (Air Transport Association of America) with respect to the arrangement and content of the System/ Chapters within the designated chapter-numbering system. This maintenance manual is supplemented by the following publications:

NOTE: It shall be the responsibility of the owner/operator to ensure that the latest revision of publications referenced in this handbook are utilized during operation, servicing, and maintenance of the airplane.

- The Bonanza 36 Series Illustrated Parts Catalog, P/N 36-590001-1
- The Bonanza 35 Series Illustrated Parts Catalog, P/N 35-590102-5
- The Bonanza 33 Series Illustrated Parts Catalog, P/N 33-590010-7
- The Bonanza Wiring Diagram Manual, P/N 35-590102-9
  (covers Models F33A, F33C, V35B, A36 "serials E-2110 and prior, except E-1946 and E-2104", and A36TC & B36TC "serials EA-388 and prior, except EA-320")
- The Bonanza Wiring Diagram Manual, P/N 35-590102-11
  (covers Models A36 "serials E-1946, E-2104, E-2111 thru E-3635, except E-3630" and B36TC "serials EA-320, EA-389 and After")
- The Bonanza Model G36 Electrical Wiring Diagram Manual, P/N 36-590001-13
- The Bonanza Model G36 Avionics Wiring Diagram Manual, P/N 36-590001-15
- The Bonanza 33, 35 and 36 Series Continuing Care Inspection Guide, P/N 98-36711
- The Bonanza Model 33, 35 and 36 Inspection Guide, P/N 98-32227
- The Bonanza Model G36 Maintenance Manual Supplement, P/N 36-590001-11

NOTE: Raytheon Aircraft Company expressly reserves the right to supersede, cancel and/or declare obsolete any parts, part numbers, kits, or publications that may be referenced in this manual without prior notice.

Since a wide variety of avionic components and equipment is available and because avionic manufacturers normally supply parts and servicing manuals with each set/component, the avionic publications are not included in the Publications Price List. The manufacturer of the equipment should be contacted when additional parts or servicing information is required.

WARNING: Use only parts obtained from sources approved by Raytheon Aircraft Company, in connection with the maintenance and repair of Raytheon Aircraft Company airplanes.

Genuine Raytheon Aircraft Company parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in Raytheon Aircraft Company airplane applications. Parts purchased from sources other than those approved by Raytheon Aircraft Company, even though outwardly 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.

Salvaged airplane parts, reworked parts obtained from sources not approved by the Raytheon Aircraft Company or parts, components or structural assemblies, the service history of which 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 techniques. This may render the part, component or structural assembly, even though originally manufactured by the Raytheon Aircraft Company, unsuitable and unsafe for airplane use.

Raytheon Aircraft Company expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of parts not approved by the Raytheon Aircraft Company.

CORRESPONDENCE

If a question should arise concerning the care of your airplane, it is important to include the airplane serial number in any correspondence. The serial number appears on the model designation placard. Refer to Chapter 11-00-00 for placard location.

PUBLICATIONS CHANGE REQUEST (PCR)

If an irregularity or missing information is noted, the user of this manual may access a PCR form at www.raytheonaircraft.com/service_support/publications_change.htm. This form and the information that was entered will be electronically forwarded to Raytheon Aircraft Customer Support. The change request will be researched for any necessary updates to the publication. Assistance is available, at any time, by contacting Raytheon Aircraft Technical Support at 800-429-5372 or 316-676-3140.

ASSIGNMENT OF SUBJECT MATERIAL

The content of this publication is organized into four levels. The four levels are:

GROUP - Identified by different colored divider tabs. These are the primary divisions of the manual that enable broad separation of content. Typical of this division is the separation between Airframe Systems and the Power Plant.

SYSTEM/CHAPTER - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. The systems are arranged more or less alphabetically rather than by precedence or importance. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element **28** of the number 28-00-00 refers to the chapter **FUEL**. Everything concerning the fuel system will be covered in this chapter.

SUBSYSTEM/SECTION - The major systems/chapters of an airplane are broken down into subsystems. These subsystems are identified by the second element of the standard numbering system. The element **40** of the number 28-40-00 concerns itself with the indicating section of the fuel system.

UNIT/SUBJECT - The individual units within a subsystem/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 may or may not be used.

APPLICATION

Any publication conforming to the GAMA or ATA format will use the same basic numbering system. Thus, whether the manual is Bonanza Series Maintenance Manual or a Bonanza Series Wiring Diagram Manual, the person wishing information concerning the indication portion of the fuel system, would refer to the System/Chapter Tab **28 - FUEL**. The Table of Contents in the front of Chapter 28 provides a list of subsystems and sections covered in this chapter. For example, the fuel system chapter with a full index could contain the following:

28	**FUEL**
28-00-00	General
28-10-00	Storage (covers Tanks, cells, necks, caps, instruments, etc.)
28-20-00	Distribution (covers Fuel lines, pumps, valves, controls, etc.)
28-30-00	Dump (If in-flight dumping system is installed, it would appear here.)
28-40-00	Indicating (covers Quantity, temperature, pressure, etc., does not include engine fuel flow or pressure.)

The material within the chapter is arranged in an ascending, numerical sequence. The System/Chapter-Subsystem-Section numbers and the page numbers are located at the lower outside corner of each page. A Subsystem may not be included in a particular system/chapter if it is not applicable to the airplane (e.g. The airplane does not have a cooling or air conditioning system, then subsystem 21-50-00 would not be included in Chapter 21).

TITLE PAGE

A Title page is located at the beginning of the manual and provides the part number, the chapters, and lists all aircraft models pertaining to this manual and their respective serial numbers. Information throughout this manual is applicable to all serial numbers listed on the title page except where specifically stated.

LIST OF EFFECTIVE REVISIONS

The List of Effective Revisions pages follow the Title page of the manual and lists the revisions currently effective for the manual. The page numbers for these pages are alphabetically numbered starting with the upper case "**A**" and are located at the lower outside corner of each page.

RECORD OF REVISIONS PAGE

The Record of Revisions page follows the List of Effective Revisions pages. When a revision is inserted, the revision number, the date the revision is inserted into the manual, and the initials of the person(s) inserting the revision should be recorded on this page.

LOG OF TEMPORARY REVISIONS PAGE

The Log of Temporary Revisions page follows the Record of Revisions page. The Log of Temporary Revisions page provides a history of each temporary revision, including the revision number which incorporated the temporary revision into the manual.

RECORD OF TEMPORARY REVISIONS PAGE

A Record of Temporary Revisions page follows the Record of Revisions page. When a temporary revision is inserted or removed from this manual, the appropriate information should be recorded on this page.

LIST OF EFFECTIVE PAGES

Each chapter has a List of Effective Pages that is found at the begin of the chapter. The List of Effective Pages provides a list the issue or revision date of each page in the chapter.

TEMPORARY REVISIONS

Temporary revisions are issued to provide maintenance information in the interim between revisions. Each temporary revision is issued by the chapter number to which it applies followed by a sequential number in the order of publication (Temporary Revisions 12-1, 12-2, etc.). Temporary revisions are printed on yellow paper and are to be placed in the maintenance manual in accordance with the instructions provided on each page included in the revision. The information in the temporary revision will be included in the next revision of the manual.

REVISED TEXT

Any text that has been revised by the addition of new text or by a change to the existing text, is denoted by a solid, vertical revision bar adjacent to the affected text. For changes to single column text, the revision bar will be located in the outside margin of the page. For changes to two column text, the revision bars will be located in the outside and inside margins depending on which column has the change. Revision bars are not placed in the area between two columns.

Revision bars are only shown on pages that have changes. Not all pages in a revision may have changes and therefore some pages of a revision will not have change bars. Revision bars are only applicable to changes of the specific revision the change(s) were made and subsequent revisions will not show these revision bars. The revision number (e.g. A9) and revision date (e.g. Sep 27/84) are printed at the bottom of the page and indicated when the latest changes were made to that page and what the revision number for the changes are. Revision bars are not used to show punctuation, spelling, capitalization, and/or pagination changes unless the change will affect the technical understanding of the text.

REVISED ILLUSTRATIONS

When an illustration is modified or a new illustration is added, it will be denoted by a solid, vertical revision bar adjacent to the illustration. The revision bar is located in the outside margin of the page.

WARNINGS, CAUTIONS AND NOTES

- **WARNING** - Brings attention to an operating procedure, inspection, repair or maintenance practices, which if not correctly followed, could result in personal injury or loss of life.
- **CAUTION** - Brings attention to an operating procedure, inspection, repair or maintenance condition, which if not strictly observed, could result in damage or destruction of equipment.
- **NOTE** - Brings attention to an operating procedure, inspection, repair or maintenance condition, which is essential to highlight.

SCHEMATIC DIAGRAMS

Schematic diagrams are illustrated with the following conditions:

- Airplane is on the ground.
- All doors are closed and locked.
- Electrical power is not applied to the airplane.

A note will be shown on the schematic diagram if the above conditions are different (e.g. NOTE - Airplane shown with power applied and entrance door open.).

Contacts on connectors that are identified with lower case letters will be shown by an underlined letter or a letter with an asterisk (A*).

SPECIAL CONDITIONS CAUTIONARY NOTICE

Airplanes operated for Air Taxi, or other than normal operation, and airplanes operated in humid tropics, cold and damp climates, etc., may need more frequent inspections for wear, corrosion and/or lack of lubrication. Under these adverse conditions, perform periodic inspections in compliance with this guide at more frequent intervals until the owner or operator can set his own inspection periods based on the contingencies of field experience.

CAUTION: *The recommended periods do not constitute a guarantee the item will reach the period without malfunction as the aforementioned factors cannot be controlled by the manufacturer.*

SYSTEM/CHAPTER INDEX GUIDE

The System/Chapter Index Guide (refer to Chart 1) is prepared in accordance with both ATA Specification No. 100 and GAMA Specification No. 2 for use with this maintenance manual and its applicable illustrated parts catalogs, electrical wiring diagram manuals, avionics wiring diagram manuals, and maintenance manual supplements. The guide provides a list of all system/chapters and subsystems that are applicable to this maintenance manual. The following chapters are not applicable to this maintenance manual: 4, 26, 29, 37, 38, 49, 60, 70, 75, 76, 77, 78, 83 and 95.

Chart 1
System/Chapter Index Guide

SYSTEM/CHAPTER - SUBSYSTEM - SECTION	TITLE
INTRODUCTION	
5	**TIME LIMITS/MAINTENANCE CHECKS**
5-10-00	Overhaul and Replacement Schedule
5-20-00	Scheduled Maintenance Checks
6	**DIMENSIONS AND AREAS**
6-00-00	Dimensions and Areas
7	**LIFTING AND SHORING**
7-00-00	Lifting and Shoring
7-10-00	Lifting
8	**LEVELING AND WEIGHING**
8-00-00	General
8-20-00	Airplane Leveling
9	**TOWING AND TAXIING**
9-00-00	Towing and Taxiing
10	**PARKING AND MOORING**
10-00-00	General
11	**PLACARDS AND MARKINGS**
11-00-00	Required Placards
11-20-00	Exterior Placards and Markings

Chart 1
System/Chapter Index Guide

SYSTEM/CHAPTER - SUBSYSTEM - SECTION	TITLE
12	**SERVICING**
12-00-00	General
12-10-00	Replenishing
12-20-00	Scheduled Servicing
20	**STANDARD PRACTICES - AIRFRAME**
20-00-00	Standard Practices - Airframe
20-01-00	Torque Wrenches
20-02-00	Electrostatic Discharge Sensitivity
20-03-00	Electrical Bonding
20-04-00	Control Cables and Pulleys
20-05-00	Bearings
20-06-00	Tube and Hose Assemblies and Fittings
20-07-00	Locking Devices
20-08-00	Airplane Finish Care
20-09-00	Corrosion
21	**ENVIRONMENTAL SYSTEMS**
21-40-00	Heating and Ventilating System
21-50-00	Cooling
22	**AUTO FLIGHT**
22-14-00	Autopilot

Chart 1
System/Chapter Index Guide

Chart 1
System/Chapter Index Guide

Chart 1
System/Chapter Index Guide

SYSTEM/CHAPTER - SUBSYSTEM - SECTION	TITLE
32	**LANDING GEAR**
32-00-00	General
32-10-00	Main Gear and Doors
32-20-00	Nose Gear and Doors
32-30-00	Extension and Retraction
32-40-00	Wheels and Brakes
32-50-00	Steering
32-60-00	Position and Warning
33	**LIGHTS**
33-20-00	Interior
33-40-00	Exterior
34	**NAVIGATION**
34-10-00	Flight Environment Data/Pitot Static
34-12-00	Flight Environment Data/Pitot Static
34-15-00	Flight Environment Data/Pitot Static
34-20-00	Attitude & Direction
34-25-00	Attitude & Direction
34-31-00	Landing and Taxiing Aids
34-32-00	Landing and Taxiing Aids
34-40-00	Independent Position Determining
34-45-00	Independent Position Determining
34-51-00	Dependent Position Determining
34-52-00	Dependent Position Determining
34-53-00	Dependent Position Determining

Chart 1
System/Chapter Index Guide

SYSTEM/CHAPTER - SUBSYSTEM - SECTION	TITLE
35	**OXYGEN**
35-00-00	General
36	**PNEUMATIC**
36-00-00	General
39	**ELECTRIC/ELECTRONIC PANELS AND MULTIPURPOSE PARTS**
39-00-00	General
39-10-00	Instrument and Control Panels
39-20-00	Electrical and Electronic Equipment Racks
51	**STRUCTURES**
51-00-00	General
52	**DOORS**
52-00-00	General
52-10-00	Cabin Passenger/Crew Door
52-30-00	Cargo Doors
53	**FUSELAGE**
53-10-00	Fuselage
53-30-00	Plates/Skins

Chart 1
System/Chapter Index Guide

SYSTEM/CHAPTER - SUBSYSTEM - SECTION	TITLE
55	**STABILIZERS**
55-00-00	General
55-10-00	Horizontal Stabilizers
55-20-00	Elevator and Ruddervator
55-30-00	Vertical Stabilizer
55-40-00	Rudder
56	**WINDOWS**
56-00-00	General
56-10-00	Flight Compartment
56-20-00	Cabin
57	**WINGS**
57-00-00	Wings
57-30-00	Plates/Skin
57-40-00	Attach Fittings
57-50-00	Balancing Control Surfaces
61	**PROPELLERS**
61-10-00	Propeller
61-20-00	Controlling
71	**POWER PLANT**
71-00-00	General
71-10-00	Cowling

Chart 1
System/Chapter Index Guide

SYSTEM/CHAPTER - SUBSYSTEM - SECTION	TITLE
72	**ENGINE**
72-00-00	General
73	**ENGINE FUEL SYSTEMS**
73-30-00	Fuel Flow Indicating
73-31-00	Indicating
74	**IGNITION**
74-00-00	General
74-20-00	Distribution
77	**ENGINE INDICATING**
77-00-00	General
77-11-00	Power
77-21-00	Temperature
77-22-00	Temperature
77-31-00	Analyzers
77-40-00	Integrated Engine Instrument Systems
79	**OIL**
79-00-00	General
80	**STARTING**
80-10-00	Cranking

Chart 1
System/Chapter Index Guide

SYSTEM/CHAPTER - SUBSYSTEM - SECTION	TITLE
81	**TURBINES**
81-00-00	General
91	**CHARTS**
91-00-00	Charts

SUPPLIER PUBLICATIONS

ENGINE

IO-520 ENGINE

Service Parts Catalog, Form X-30040. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

Maintenance and Overhaul Manual, Form X-30039. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

Operators Handbook, Form X-30041. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

TSIO-520 ENGINE

Overhaul Manual for TSIO-520 Series Aircraft Engines, Form No. X-30042. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

Operators Manual for TSIO-520-U and -UB Engines, Form No. X-30044. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

IO-550 ENGINE

Illustrated Parts Catalog, Form X-30569. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

Overhaul Manual, Form X-30568. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

Continued Airworthiness Maintenance and Operators Manual, Form X-30565. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

TURBOCHARGER

Overhaul Manual and Parts Catalog, Form No. X-30055. Teledyne Continental Motors Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

FUEL INJECTION

Overhaul Manual and Parts Catalog, Form No. X-30052. Teledyne Continental Motors Corporation, Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

PROPELLER

Overhaul Manual and Parts Catalog Manual No. 720415, McCauley Industrial Corporation, Dayton, Ohio.

Hartzell Propeller Owner's Manual, 115H, or Overhaul Manual No. 113B, Hartzell Propeller, Inc., Piqua, Ohio.

Service Manual with overhaul and parts for McCauley 3A32C406-X propellers, Manual No. 761001 or McCauley propeller Operators Manual No. MPC-11, McCauley Accessory Division, Cessna Aircraft Company, 1840 Howell Ave, Dayton, Ohio 45417.

PROPELLER GOVERNOR

McCauley Service Manual No. 78041 for the 35-380088-3 Propeller Governor, 3535 McCauley Drive, Vandalia, Ohio 45377.

Overhaul Manual with Parts List Bulletin No. 33080 for the 35-380088-1 Propeller Governor, Woodward Governor Company, Rockford, Illinois.

MAGNETOS

Overhaul Instructions for Bendix S-1200 Series Magnetos, Form L-609. Scintilia Division, Bendix Aviation Corporation, Sidney, New York.

Service Parts List for Bendix S-1200 Series Magnetos, Form L-608. Scintilia Division, Bendix Aviation Corporation, Sidney, New York.

Installation, Maintenance and Operation Instructions, S6RN-201 and S6RN-205 Magnetos, Form L-526. Scintilia Division, Bendix Aviation Corporation, Sidney, New York.

Overhaul Instructions, S-600 Series Magnetos, Form L-551. Scintilia Division, Bendix Aviation Corporation, Sidney, New York.

Service Parts List, S-600 Series Magnetos, Form L-552-1. Scintilia Division, Bendix Aviation Corporation, Sidney, New York.

4200/6200 Series Aircraft Magnetos Maintenance and Overhaul Instructions, Form No. 1037-A. Slick Electro, Inc., Rockford, Illinois 61101.

F-1100 Master Service Manual, Form L-1363 (rev. B), 4300/6300 Series Slick Magnetos. Unison Industries, 7575 Baymeadows Way, Jacksonville, FL 32256.

STARTING MOTOR

Equipment List, Service Parts and Technical Data OE-A1, Parts and Equipment Section Service Department, Toledo, Ohio 43694.

VOLTAGE REGULATOR

Voltage Regulator - 28 volt (Alternate), P/N B-00-387-1, Lamar Inc., 71 Indel Ave., P.O. Box 251, Rancocas, NJ 08073.

ALTERNATOR

Equipment List, Service Parts and Technical Data OE-A1, Prestolite Service Department, Parts and Equipment Section, Toledo, Ohio 43601.

Service and Overhaul Instructions for Continental P/N 642056A1 or 642051 Alternator, Publication No. X-30531, Teledyne Continental Motors, Aircraft Products Division, Post Office Box 90, Mobile, Alabama 36601.

ELECTRIC PROPELLER DEICER

Installation of Deicer Boots, Report 70-04-700, Maintenance Manual Report 68-04-712B, B.F. Goodrich Engineered Systems Company Division, B F Goodrich Company, Akron, Ohio 44318.

AUTOPILOT

King KFC-200 Installation Manual No. 006-0203-00 for Models F33C, F33A, A36 and A36TC or No. 006-0201-00 for Model V35B, King Radio Corporation, 400 N. Rogers Road, Olathe, Kansas 66061.

Edo-Aire Mitchell Service and Overhaul Manual for Century III P/N 68S54 or Century IV P/N 68S89, P.O. Box 610, Mineral Wells, Texas 76067.

STROBE LIGHT

Overhaul Manual with Illustrated Parts List (60-1750-3 Power Supply), Publication Number: 33-40-58; Grimes Div. of Midland Ross Corp., 515 North Russel Street, Urbana, Ohio 43078.

AIR CONDITIONER COMPRESSOR

Model 508 Compressor, Abacus International, P.O. Box 327, Dallas, Texas 75221.

FLIGHT CONTROLS

ELECTRIC ELEVATOR TRIM TAB

Edo-Aire Mitchell, Automatic Flight Control Systems, AK563 Bulletin No. 686 or AK669 Bulletin No. 798, EDO-AIRE MITCHELL, P.O. Box 610, Mineral Wells, Texas 76067.

BATTERY

Service Manual, Publication Number GSM-1277, Teledyne Battery Products, P.O. Box 431, 840 W. Brockton Ave. Redlands, CA 92373.

Service Manual CB12-9, for Concorde Aircraft Battery, Concorde Battery Corp., 2009 San Bernadino Rd., West Covina, CA 01790.

RADAR

WeatherScout Digital Weather Radar System, System description and Installation Manual, Publication Number: 1B8023100, R.C.A., Avionics Systems, 8500 Balboa Blvd., Van Nuys, CA 91409.

INTEGRATED AVIONICS SYSTEM

Garmin G1000™, Cockpit Reference Guide for the Beechcraft A36/G36, Publication Number: 190-00525-00 01, Garmin International, Inc., 1200 E 151st Street, Olathe, KS 66062 USA.

Garmin G1000™, Configuration Manual, Publication Number: 190-00303-04, Garmin International, Inc., 1200 E 151st Street, Olathe, KS 66062 USA.

Garmin G1000™, Line Maintenance Manual, Publication Number: 190-00352-00, Garmin International, Inc., 1200 E 151st Street, Olathe, KS 66062 USA.

SUPPLEMENTARY PUBLICATIONS

98-35012 Servicing Maintenance Instructions and Illustrated Parts Breakdown for the Main Wheel, Nose Wheel and Brake Assembly.

32-31-24 Maintenance Information and Illustrated Parts Breakdown for EM 27-8 Landing Gear Motor.

CHAPTER

05

TIME LIMITS/ MAINTENANCE CHECKS

CHAPTER 5 - TIME LIMITS/MAINTENANCE CHECKS

TABLE OF CONTENTS

CHAPTER 5 - TIME LIMITS/MAINTENANCE CHECKS

TABLE OF CONTENTS (Continued)

SUBJECT *PAGE*

5-50-00

CHAPTER 5 - TIME LIMITS/MAINTENANCE CHECKS

LIST OF EFFECTIVE PAGES

OVERHAUL AND REPLACEMENT SCHEDULE

The first overhaul or replacement must be performed not later than the recommended period. The condition of the item at the end of the first period can be used as a criterion for determining subsequent periods applicable to the individual airplane or fleet operation, provided the operator has an approved monitoring system.

The time periods for inspections noted in this manual are based on average usage and average environmental conditions.

NOTE: The recommended periods do not constitute a guarantee the item will reach the period without malfunction as the aforementioned factors cannot be controlled by the manufacturer.

SPECIAL CONDITIONS CAUTIONARY NOTICE

WARNING: Prior to performing maintenance on an engine or the Airframe, ALWAYS pull the starter control circuit breakers and the Landing Gear circuit breaker. This will remove power to the starter control as well as the igniter power relay and Landing Gear Control relay.

Airplanes operated for Air Taxi, or other than normal operation, and airplanes operated in humid tropics, or cold and damp climates, etc., may need more frequent inspections for wear, corrosion and/or lack of lubrication. In these areas, periodic inspections should be performed until the operator can set his own inspection periods based on experience.

NOTE: The date noted on the STANDARD AIRWORTHINESS CERTIFICATE, FAA Form No. 8100-2, which is issued with each new airplane, is to be used as the basis for all TBO or replacement components listed in the following schedule.

An engine cycle is defined as the period of time from the initial start to shutdown of the engine. This encompasses start-up, increase to full or partial power (as required during a flight regime) and back to complete engine shutdown. Normal operation results in the number of landings being equivalent to engine cycles.

OVERHAUL AND REPLACEMENT SCHEDULE

ITEM	OVERHAUL OR REPLACE

NOTE: All items not listed are to be overhauled or replaced On condition. On condition items are to be overhauled or replaced if inspection reveals a potentially unsafe or unserviceable condition, if they are worn, inoperative, inaccurate, intermittent and not repairable through normal maintenance. Primarily items that are calender, cycle or hour limited are included in the following list.

LANDING GEAR

Main Gear Assembly	On condition. (Leaking or collapsed struts that cannot be corrected by seal replacement will constitute the On condition requirement. Any pitting, corrosion, cracking, distortion or visible wear noted during the seal replacement will also constitute the requirement for an overhaul.)

OVERHAUL AND REPLACEMENT SCHEDULE (Continued)

ITEM	OVERHAUL OR REPLACE
LANDING GEAR *(Continued)*	
Nose Gear Assembly	On condition. (Leaking or collapsed struts that cannot be corrected by seal replacement will constitute the On condition requirement. Any pitting, corrosion, cracking, distortion or visible wear noted during the seal replacement will also constitute the requirement for an overhaul.)
Nose Gear Retract Rod Rod-Ends (All)	2,000 hours
Actuator	4,000 hours
Retract Motor	2,000 hours
Retract Motor Brushes	500 hours or On condition.
Shimmy Damper	On condition.
Wheels and Tires	On condition.
Brake Assembly	On condition.
Brake Lining	On condition.
Master Cylinder	On condition.
Shuttle Valve Assembly	On condition.
Parking Brake Valve	On condition.
All Hoses	On condition.

POWER PLANT

NOTE: A TBO (time between overhaul) recommendation is in no way to be construed as a warranty or engine life proration basis. The TBO recommendation is based on the projected time for most advantageous initial overhaul. The individual operator's experience may indicate a departure in either direction from the recommended TBO for the particular operation.

ITEM	OVERHAUL OR REPLACE
Cabin Heater Muff	On condition.
Engine	Refer to Teledyne Continental Service Information Letter SIL 98-9A Rev. A, or subsequent, for detailed overhaul period instructions.
Engine Controls	On condition.
Engine Vibration Isolator Mounts	Engine overhaul or On condition.
Exhaust System	On condition.
Starter	Inspect at engine overhaul, overhaul or replace On condition.
Standby Generator	1,500 hours
Standby Generator Brushes	500 hours

OVERHAUL AND REPLACEMENT SCHEDULE (Continued)

ITEM	OVERHAUL OR REPLACE
POWER PLANT (Continued)	
Alternator	On condition.
Oil Cooler	On condition, replace if contaminated.
Propeller (McCauley)	Refer to McCauley Service Bulletin 137B or subsequent.
Propeller (Hartzell)	Refer to the latest revision of Hartzell Service Letter 61 for TBO.
Propeller Controls	On condition.
Propeller Governor (McCauley)	At engine overhaul or On condition but not to exceed 1,800 hours.
Propeller Governor (Woodward)	At engine overhaul or On condition. Refer to the latest revision of Woodward Service Bulletin 33580 or subsequent.
Air Pressure Pump	Airborne Pumps - refer to Airborne Replacement Schedule SI 300-17 or subsequent. See Supplier Data CAUTION at the end of this Chapter.* Aero Accessories Pump, Part Number AA442CW, - Replace at 500 hours time-of-operation. Aero Accessories Pumps, Part Number AA216CW or AA3216CW, - Replace at 1,200 hours time-of-operation.
Standby Air Pressure Pump	Airborne Pumps - refer to Airborne Replacement Schedule SI 300-17 or subsequent except hours are to be pump operation time. See Supplier Data CAUTION at the end of this Chapter.* Aero Accessories Pumps, Part Number AA216CW or AA3216CW, - Replace at 1,200 hours time-of-operation.
All Hoses	Hoses carrying flammable liquids at engine overhaul or every 5 years, whichever occurs first since the last replacement or delivery date of the airplane from the factory; all other hoses On condition.
Engine Air Filter	Clean every 50 hours of operation (10 times max.). Replace every 500 hours or 1 year, whichever occurs first.
Engine Baffle Seals	Replace as necessary or every 10 years of service.
Magneto (Bendix & Teledyne Continental Motors (TCM)	Engine overhaul or every four years, whichever comes first. Refer to TCM Service Bulletin 643.
Slick Magnetos (Unison Industries)	Refer to Slick Aircraft Products Maintenance Manual (P/N L-1363) and Slick Service Bulletin SB2-80C.

OVERHAUL AND REPLACEMENT SCHEDULE (Continued)

ITEM	OVERHAUL OR REPLACE
FLAPS AND FLIGHT CONTROLS	
Aileron Trim and Linkage	On condition.
Flight Controls	On condition.
Elevator Tab Actuator	On condition.
Flap Motor and Gearbox	Replace On condition.
Flap Actuators	2,000 hours
Flap Flexible Shaft	2,000 hours
FUEL SYSTEM	
Fuel Cells	On condition.
Wing Fuel Quantity Transmitters	On condition.
Fuel Cell Drain Valve	On condition.
Fuel System Check Valves	On condition.
Fuel Selector Valve	Replace every 10 years.
Fuel Boost Pump	Overhaul every 10 years.
All Hoses	Hoses carrying flammable liquids at engine overhaul or every 5 years, whichever occurs first since the last replacement or delivery of the airplane from the factory; all other hoses On condition.
Fuel Cell Reservoir Kit (If installed)	Replace foam insert every 10 years.
INSTRUMENTS	
Turn Coordinator	On condition.
Altimeter	Every 24 months per FAA directive (inspect and calibrate).
Directional Gyro	On condition.
Gyro Horizon	On condition.
Gyro Pressure Gage	On condition.
Engine Gage Units	On condition.
Airspeed Indicator	On condition.
Rate-Of-Climb	On condition.
Fuel Flow/Manifold Pressure Indicator	On condition.
Tachometer	On condition.
Clock	On condition.

OVERHAUL AND REPLACEMENT SCHEDULE (Continued)

ITEM	OVERHAUL OR REPLACE
INSTRUMENTS (Continued)	
Flap Position Indicator	On condition.
Free Air Temperature Indicator	On condition.
Pressure System Filter (In-line and Intake)	Refer to Parker-Hannifin Airborne Service Letter 59 or subsequent. See Supplier Data CAUTION at the end of this Chapter.*
Standby Pressure System Filters (In-line and Intake)	Refer to Parker-Hannifin Airborne Service Letter 59 or subsequent except hours are to be pump operation time. See Supplier Data CAUTION at the end of this Chapter.*
Air Pressure Regulator Valve	On condition.
All Hoses	On condition.
Standby Air Pressure System Check Valve	Replace every 10 years.
ELECTRICAL SYSTEM	
Battery Master Relay	On condition.
All Other Relays	On condition.
Voltage Regulator	On condition.
Starter Relay	On condition.
Battery (Emergency Locator Transmitter)	Replace at 50% of useful life (as stated on the battery) or any time transmitter is used more than one cumulative hour.
MISCELLANEOUS	
Hand Fire Extinguisher	Inspect every 12 months, recharge as necessary.
Cabin Heating and Ventilating Ducts	Inspect every 12 months or On condition.
Oxygen Regulator	On condition.
Air Conditioner Filter	On condition.
Air Conditioner Compressor	On condition.
Seat Belts or Shoulder Harnesses	Inspect every 12 months or On condition.
Oxygen Cylinder (Lightweight 3HT Type)	Hydrostatically test every 3 years. Replace every 24 years or 4,380 refills (ICC regulation), whichever occurs first.
Oxygen Cylinder (Standard Weight 3AA Type)	Hydrostatically test every 5 years.

OVERHAUL AND REPLACEMENT SCHEDULE (Continued)

ITEM	OVERHAUL OR REPLACE
WINGS	
Wing-Attach Bolts	Replace 10 years after initial inspection or On condition. Refer to Chapter 57.

CAUTION: *After removing wing attach nuts for any reason, always install new wing attach nuts. Do not reuse existing nuts.*

**Supplier Data on this item may change without notice. Users of this manual should refer to the Parker Hannifin website (www.parker.com/airborne) for the latest information.*

SCHEDULED MAINTENANCE CHECKS - MAINTENANCE PRACTICES

ELECTRIC PROPELLER DEICER (50 HOUR GUIDE)

The various components of the propeller deicer system should be inspected every 50 hours for the appearance of defects. The following inspections may provide means for detecting and correcting such defects before they render the deicer system inoperative:

a. Lock the brakes and operate the engine at near takeoff power. Turn the deicer systems switch ON and observe the ammeter for at least 3 minutes. If the ammeter needle does not indicate amperage (reference ELECTRIC PROPELLER DEICING in Chapter 30-60-00 for proper amperage) for 90 seconds at 90 second intervals, refer to the troubleshooting chart for the probable sources of trouble.

WARNING: Before moving propeller, make certain that ignition switch is OFF and that engine has cooled completely. There is always some danger of a cylinder firing when propeller is moved.

CAUTION: *While following the instructions of Step b., move the propeller back and forth to prevent arcing between the brushes and slip ring.*

b. With the engine shut off, turn the deicer switch ON and feel the deicer boots on the propeller for the proper sequence of heater operation. The presence of local hot spots indicates service damage to the deicer heaters, which should be repaired before more serious damage develops.

c. Remove the spinner and open all access doors pertaining to the wiring and components of the deicer system. Turn the deicer switch ON and station an assistant in the cockpit to observe the system ammeter. Flex all accessible wiring, particularly the lead straps, leads from the slip ring assembly, and the firewall electrical connectors and their wiring. Any movement of the ammeter, other than the cycling flicker that occurs at 90 second intervals, indicates a short or open circuit that must be located and corrected.

d. To extend the life of the lead strap between the hub clamp and clip, reposition the bend in the strap at a point at least 1/2 inch from the existing location of the bend.

e. Check for damaged brush rods or springs and for worn or damaged brushes.

ELECTRIC PROPELLER DEICER (100 HOUR GUIDE)

a. Check for radio noise or radio compass interference by operating the engine at near takeoff power with the radio gear turned on. If, under these conditions, noise or interference occurs when the deicer switch is ON and disappears when the switch is OFF, refer to the troubleshooting chart for the probable source of trouble.

WARNING: Before moving propeller, make certain that ignition switch is OFF and that engine has cooled completely. There is always some danger of a cylinder firing when a propeller is moved.

b. Check all clamps, clips, mountings, electrical connections and connectors for tightness and electrical soundness. Check also for loose, broken or missing safety wire.

c. Closely check the deicer boots for wrinkles, loose or torn areas, particularly around the outboard end and at the point where the strap passes under the hub clamp. Look for abrasion or cuts along the leading edge of the flat or thrust face. If the heater wires are exposed in damaged areas or if the rubber is found to be tacky, swollen or deteriorated (as from contact with oil or solvent fluids), replace the damaged deicer boot.

d. Check that the hub clamps are tight. Inspect for cracks or other damage. Check to see that the cushioning material is not missing or damaged in the area under the hub clamp or on the edge of the spinner dome. Manually operate the propeller from "high pitch" to "low pitch" while checking that the deicer lead straps do not come under tension.

e. Check the slip rings for gouges, roughened surfaces, cracks, burned or discolored areas, and for deposits of oil, grease or dirt. Clean greasy or contaminated slip rings with CRC-2-26 solvent (23, Chart 1, 91-00-00). After such a cleaning, allow a run-in time of 5 hours of engine operation before turning on the deicer system.

f. If uneven wear or wobble is detected, check the alignment of the slip rings to the prop shaft with a dial indicator. While turning the prop to check the slip ring alignment, push in on the prop to eliminate play in the propeller thrust bearing. If the run out over 360° of rotation is over 0.005 inch or if over any 4-inch arc it exceeds 0.002 inch, refer to the paragraph on SLIP RING ALIGNMENT in Chapter 30-60-00.

g. Examine the brush mounting bracket and housing for cracks, deformation, or other indications of damage. Make sure that connections are tight and that the leads are not chafed or binding.

h. Check to see that each brush rides fully on its slip ring over 360° of rotation. If the brush is not properly aligned, add shims under the brush block or elongate the holes in the mounting bracket to raise or lower the brush block to the proper position. If the brushes ride BOTH high and low with respect to the slip rings in 360° of rotation, the slip ring assembly is eccentrically mounted and the spinner bulkhead must be replaced. For the correct angular location of the brushes to the slip ring, refer to the illustrations in Chapter 30-60-00.

i. Check for proper spacing between the brush block and slip rings as indicated in DEICER BRUSH REPLACEMENT, Chapter 30-60-00. If this distance is not within the specified limits, loosen the mounting screws and reposition them in the elongated holes until the block is properly positioned. If necessary, add shims between the thrust bearing plate and mounting bracket until the brush block is properly located.

j. Estimate the contact angle of the brush block in relation to the slip rings. If this angle is not approximately 2°, as indicated in DEICER BRUSH REPLACEMENT, Chapter 30-60-00, loosen the mounting screws and reposition the brush block until the proper angle exists between the brush block and slip rings. The spacing established in Figure 3, Chapter 30-60-00 must also be maintained after the proper contact angle is established.

CAUTION: *While following the instructions of Step k., move the propeller back and forth to prevent arcing between the brushes and slip ring.*

k. With the deicer system operating and a man in the cockpit observing the ammeter, visually inspect and physically flex the wiring from the brush blocks to each component of the deicer system and to the aircraft power supply. Movement of the ammeter needle (other than the cycling that occurs when the timer switches at 90-second intervals) indicate loose or broken wiring in the area under examination at the moment. In such instances, continue to flex the wiring in the area that first indicated trouble while checking the continuity through the individual wires of the affected harness until the source of trouble is located. Use the wiring diagram to trace the circuitry of the deicer system.

TURBOCHARGER (EA-11 AND AFTER)

25 HOURS

a. Visually inspect oil leaks, exhaust system leaks and general condition.

50 HOURS

a. Visually inspect oil leaks, exhaust system leaks and general condition.

100 HOURS

Inspect turbocharger system per the following method:

a. Remove compressor inlet duct assembly. Inspect the compressor wheel for nicks, cracks or broken blades. Turn wheel by hand and feel for excess bearing drag or wheel rubbing against housing. Reinstall air inlet duct.

b. Check the oil inlet and outlet ports in center housing for leaks, and the turbine heat blanket for condition and security.

c. Check for any interference with linkage between the bypass valve (wastegate) and actuator, its general condition and security.

d. Inspect all exhaust system components for worn or damaged areas, loose clamps, cracks and leaks.

e. Inspect lubrication system components for worn or damaged areas, loose clamps and leaks. Special attention should be given to the ducts downstream (pressure side) of the compressor.

f. Inspect the fuel injection nozzle pressure reference manifold, for deteriorated hose, loose connections, leaks or obstructions.

g. All fluid power lines should be checked for leaks and security.

h. The compressor discharge reference line from the throttle air valve to the controller should be opened and inspected for oil leakage from the controller. Any leakage is cause for replacement of the controller.

E33C, F33C SPIN INSPECTION (ACROBATIC CATEGORY)

This inspection is required on all E33C and F33C (CJ-1 and After) airplanes which are being acrobatically spun (even if the spin time is only a small part of total time). This inspection is NOT required if an airplane is performing acrobatic maneuvers other than spins (no spins at all). The regular 100-Hour Inspection (P/N 98-32227G or subsequent), Intermediate 100-Hour Inspection (P/N 98-38999 or subsequent) or Continuing Care Inspection Guide (P/N 98-36711D or subsequent) MUST also be complied with.

E33C, F33C SPIN INSPECTION (ACROBATIC CATEGORY)

FREQUENCY	PART	INSPECTION	CORRECTIVE ACTION	MECH	INSP
1. 50 Hours	Rudder pedal bellcrank support assembly	Check for cracks.	If cracks are found, contact the Technical Support Department of Raytheon Aircraft Company.		
2. 50 Hours	Elevator to Elevator torque fitting casting joint	Check screw holes (4 per elevator) for proper hole diameter.	If hole diameter is more than 0.194 inch, ream hole to 0.208 ± 0.002 inch diameter and install NAS 2903-4 or NAS 6203-4X oversize bolt. If hole diameter exceeds 0.210 inch for oversize bolts, contact the Technical Support Department of Raytheon Aircraft Company. Torque bolt or screw to 30 to 40 in.-lbs.		
		Check hole size in elevator inboard hinge mount hole in center of elevator torque fitting.	If hole diameter is greater than 0.251 inch, replace elevator torque fitting.		
		Check elevator rod end mounting hole in the elevator torque fitting for proper diameter.	If hole diameter is greater than 0.379 inch, ream to 0.436 ± 0.001 inch and install one BS 105740-X-XC-0500 bushing.		
3. 50 Hours	Horizontal and vertical stabilizer attachment bolt holes (stabilizer spars and bulkheads)	Horizontal stabilizer forward spar: Check diameter of 4 outboard bolt holes on each side (2 upper and 2 lower). Horizontal stabilizer rear spar: Check diameter of 2 outboard bolt holes on each side (1 upper and 1 lower). If any of these holes are oversize, check all other horizontal stabilizer holes and vertical stabilizer bolt holes for correct diameter.	If bolt holes are more than 0.253 inch in diameter or elongated, ream the bushings to 0.270 ± 0.002 inch diameter and install NAS 2904-14 oversize bolts. If hole diameter exceeds 0.272 inch for oversize bolts, contact the Technical Support Department of Raytheon Aircraft Company. Torque the nuts to 85 to 100 in.-lbs.		

E33C, F33C SPIN INSPECTION (ACROBATIC CATEGORY) (Continued)

FREQUENCY	PART	INSPECTION	CORRECTIVE ACTION	MECH	INSP
4. 50 Hours		Check torque on all nuts.	Torque the nuts to 85 to 100 inch pounds.		
	Inboard elevator hinge bolts	Check for straightness and wear.	Replace if bent or worn.		
	Elevator push-rods to elevator torque fitting bolt	Check for straightness and wear.	Replace if bent or worn smaller than 0.370 inch diameter.		
5. 50 Hours	Upper and middle rudder hinges	Inspect tor cracks, corrosion and excessive wear.	Replace if any of noted conditions exist.		
	Lower rudder hinge	Inspect tor cracks, corrosion and excessive wear.	Replace if any of noted conditions exist.		
6. 50 Hours	Elevator hinge joint	Check bearing for looseness and bearing bracket for cracks, corrosion and excessive wear.	Replace if noted conditions exist.		
		Check bushing diameters.	If I.D. is over 0.191 inch or O.D. is under 0.310 inch, replace bushings. Replace if noted conditions exist.		
		Check elevator hinge brackets hole diameter.	If greater than 0.200 inch, replace bracket.		
		Check elevator hinge bracket for cracks, corrosion and excessive wear.	Replace if noted conditions exist.		
		Check bolts for wear.	Replace if plating is worn or corroded.		
		Check reassembled joint for looseness.	Install new parts as required.		
7. 50 Hours	Elevator pushrods	Check for straightness, and cracks.	Replace pushrod if bent or cracked.		
		Check rod end bearing for excessive free play.	Replace rod end bearing if excessive free play is noted.		
		Check rod end mounting hole diameter.	If more than 0.378 inch in diameter, replace rod end.		

E33C, F33C SPIN INSPECTION (ACROBATIC CATEGORY) (Continued)

FREQUENCY	PART	INSPECTION	CORRECTIVE ACTION	MECH	INSP
8. 50 Hours	Trim Tab	Check for cracks.	Replace if noted conditions exist.		
		Check free play as indicated in Chapter 27-30-00.	Replace tab bushing and/or trim tab pushrod ends and/or trim tab actuator shaft and/or trim tab hinge if excessive free play is noted.		
9. 50 Hours	Elevator	Check for cracks, especially between outboard hinge and elevator balance horn.	If cracks are found, contact the Technical Support Department of Raytheon Aircraft Company for repair.		
10. 50 Hours	Trim tab pushrod assemblies	Check straightness.	Replace if bent.		
11. 50 Hours	Trim tab actuator	Check output shaft for straightness.	Replace if bent.		
		Check actuator installation for looseness.	Check attach bolts for proper torque.		
12. 50 Hours	Elevator bellcrank	Check pushrod mounting hole for proper diameter.	If more than 0.379 inch, press out existing bushing and press in one BS105740X-XC0968 bushing and drill 0.377 ± 0.002-inch diameter hole through bushing.		
13. 50 Hours	Bolt (elevator pushrod to bellcrank)	Check for straightness and wear.	Replace if bent or worn smaller than 0.370 inch.		
14. 50 Hours	Inboard elevator hinge casting	Check for cracks. Check hinge bearings for looseness.	Replace if noted condition exists.		

100-HOUR OR ANNUAL INSPECTION GUIDE

The owner or operator is responsible for maintaining the airplane in an airworthy condition, including compliance with all applicable Airworthiness Directives as specified in Part 39 of Title 14 Code of Federal Regulations (14 CFR). It is further the responsibility of the owner or operator to ensure that the airplane is inspected in conformity with the requirements covered in 14 CFR Parts 43 and 91. These 14 CFR Parts cover the requirements concerning the Inspection Guide. This Inspection Guide is not intended to be all inclusive, for no such guide can replace the good judgement of a certified airframe and power plant mechanic in the performance of his duties. As the one primarily responsible for the airworthiness of the airplane, the owner or operator should select only qualified personnel to maintain the airplane.

FACTS PROGRAM (MODELS A36 AND B36TC)

Airplanes delivered from the factory after August 1, 2001 will use the Factory Aircraft Comprehensive Tracking System (FACTS) which becomes the factory computerized maintenance tracking and forecasting system for the Model A36/B36TC series airplanes. The FACTS program for the Model A36/B36TC adheres to the guidelines established in this chapter of the maintenance manual. The Raytheon Aircraft approved inspection program contained in this chapter, and within the Raytheon factory computerized maintenance inspection program (FACTS), is specifically for the Model A36/B36TC series airplanes. Any variation to the inspection program must be approved in writing by the FAA Flight Standards District Office (FSDO), or Airworthiness Authority. The FACTS program meets the requirement of both 14 CFR 91 and 14 CFR 135.

SPECIAL CONDITIONS CAUTIONARY NOTICE

The time periods for the inspections noted in this schedule are based on normal usage under average environmental conditions. Airplanes operated in humid tropics, or in cold, damp climates, etc., may need more frequent inspections for wear, corrosion, lubrication, and/or lack of maintenance. Under these adverse conditions, perform periodic inspections in compliance with this guide at more frequent intervals until the owner or operator can set his own inspection periods based on the contingencies of field experience.

NOTE: The required periods do not constitute a guarantee that the item will reach the period without malfunction, as the aforementioned factors cannot be controlled by the manufacturer.

This inspection program, in accordance with 14 CFR Parts 43 and 91, consists of, but is not limited to, inspection items listed in this Inspection Guide, any applicable Airworthiness Directives issued against the airframe or any equipment installed therein and conformity to Type Certificate Data Sheet as applicable.

Material contained in this guide, including the inspection intervals, may be changed at any time by the owner/ operator, with prior notification and approval of the local FAA General Aviation District Office, when warranted by service experience or engineering recommendations. Information contained herein is applicable to all Bonanza series airplanes covered in this maintenance manual except where differences are indicated by serial effectivity.

While the Inspection Guide may be used as an outline, detailed information of the many systems and components in the airplane will be found in the various sections of this maintenance manual and the pertinent supplier publications. It is also recommended that reference be made to the applicable maintenance handbooks, service instructions, Raytheon Aircraft service bulletins, applicable FAA regulations and publications, and supplier bulletins and specifications for torque values, clearances, settings, tolerances, and other requirements. In the final analysis, it is the responsibility of the owner/operator to ensure that the airframe and power plant mechanic inspecting the airplane has access to the previously noted documents as well as to this Inspection Guide.

NOTE: Any time an airplane is repainted or touched up, inspect all placards and decals to assure that they are not covered with paint, are easily readable, and are securely attached. Replace any placards that have been inadvertently defaced or removed.

In addition to the inspections prescribed by this schedule, the altimeter system and all ATC transponders MUST be tested and inspected at 24-month intervals in compliance with the requirements specified in 14 CFR Parts 91.411, and 91.413.

A complete inspection of the airplane must be accomplished within each 12-month period for compliance with the Title 14 Code of Federal Regulations. The time periods for inspections stated in this inspection guide should NEVER be exceeded by more than 10 hours, and then only if the additional time is required to reach a place where the inspection can be satisfactorily accomplished. However, the additional time used must be deducted from the next inspection time. If 10 hours were used to reach the inspection facility, the next inspection would be due in 90 hours for the next 100-hour inspection with no extension allowed.

An airplane must receive a complete (100-hour, annual, or complete continuing care inspection) inspection every 12 months regardless of the hours flown. The inspections completed during a 12-month period can be deleted from the items to be inspected. Rubber goods such as fuel lines are recommended to be changed at five year periods regardless of airplane time.

NOTE: Additional publications are listed in the current Publications Price List CD ROM (P/N 994-32808). For information on these publications contact the Technical Manual Distribution Center (TMDC) at 1-800-796-2665, fax (316) 676-4824, E-mail TMDC@rac.ray.com or visit our web site at http://raytheonaircraft.com.

NOTE: All electrical systems operational inspections are to be made using an external power source capable of delivering and maintaining 28.25 ± 0.25 vdc.

Raytheon Aircraft Company issues service information for the benefit of owners and operators in the form of two classes of Service Bulletins. MANDATORY (Red Border) Service Bulletins are changes, inspections or modifications that could affect safety. The factory considers compliance with these Service Bulletins mandatory. OPTIONAL (No Border) Service Bulletins cover changes, modifications, improvements or inspections which may benefit the owner. Due to the wide range of information covered by the OPTIONAL Service Bulletin, each owner or operator is responsible for conducting a thorough review of each OPTIONAL Service Bulletin to determine if compliance is required based on the applicability of the OPTIONAL Service Bulletin to his particular set of operating conditions. It is the responsibility of the owner or operator to ensure that all Raytheon Aircraft Service Bulletins which are pertinent to his particular operation are complied with.

NOTE: Model E33C and F33C airplanes being spun MUST also have the AEROBATIC INSPECTION at 50 hours.

WARNING: During the performance of this inspection the airplane will be placed on three-point jacks. Ensure the landing gear is down and locked before removing the airplane from the jacks.

100-Hour or Annual Inspection

A. OPERATIONAL INSPECTION	MECH	INSP
1. STARTER - Check for proper operation, unusual noise and dragging. Check starter energized light (if installed) and/or load meter to ensure starter disengagement when starter switch is released.		
2. FUEL FLOW - Check for proper fuel pressure limits and fluctuations. Refer to Chapter 71-00-00 for fuel system setup.		
3. CYLINDER HEAD TEMPERATURE - Check for proper operation, temperature and fluctuations.		
4. ALTERNATOR - Check for proper output and unusual noises.		
5. STANDBY ALTERNATOR/GENERATOR - Check for proper operation in test mode. Perform a functional test as outlined in Chapter 24-31-00 of P/N 36-590001-9 (or subsequent), the Bonanza Series Maintenance Manual. Check wiring for security and condition.		
6. INSTRUMENT AIR SYSTEM - Check for proper operation and output pressure.		
7. STANDBY INSTRUMENT AIR (If installed) - Check for proper operation. Check plumbing and wiring for security and condition. Refer to AFM Supplement 36-590006-23.		
8. PROPELLER OPERATION - Cycle propeller and check for proper rpm drop and smoothness of operation.		
9. PROPELLER DEICER - Check for proper operation and amperage drawn on ammeter.		
10. OIL PRESSURE AND TEMPERATURE - Check for proper pressure, temperature limits and unusual fluctuations.		
11. MAGNETOS - Check the performance of the magneto as outlined under the heading NORMAL PROCEDURES in the appropriate Pilot's Operating Handbook.		
12. POWER CHECK - Refer to NORMAL PROCEDURES in the appropriate Pilot's Operating Handbook.		
13. AMMETER - Check for proper indication and unusual fluctuations.		
14. HEATING AND VENTILATING SYSTEM - Check for proper operation, heat and airflow output. Check controls for freedom of movement.		
15. FIREWALL SHUTOFF VALVE - Check for proper operation and freedom of movement.		
16. IDLE RPM AND MIXTURE SETTINGS - Check for both proper rpm and mixture settings. Check controls for freedom of operation.		
17. IDLE CUT-OFF - Check for proper operation and freedom of movement.		
18. IGNITION SWITCH - Rotate the ignition switch through the OFF position to the extreme limit of switch travel; if the engine stops firing, the switch is normal. If the engine continues to run with the switch held against the OFF stop, it is an indication that one magneto is still "hot" or ungrounded. When the switch is released, it should automatically return to OFF and the engine should stop running. However, any ignition switch exhibiting this abnormal condition should be replaced.		

100-Hour or Annual Inspection (Continued)

A. **OPERATIONAL INSPECTION** *(Continued)*	**MECH**	**INSP**
19. ALL ENGINE CONTROLS - With the engine running, check for proper operational limits, engine response and rigging. Check friction locks for proper operation.		
20. FUEL QUANTITY GAGES - Check for proper operation and unusual fluctuations.		
21. AUXILIARY FUEL PUMP - Check pump for proper operation, unusual noise and fluctuations.		
22. FUEL TANK SELECTOR - Check for proper placarding, proper operation and feel for positive detent.		
23. ALL LIGHTS - Check for condition, attachment, cracked or broken lenses. Check switches, knobs and circuit breakers for looseness and operation.		
24. STALL WARNING SYSTEM - Check for proper operation and heating of the unit.		
25. RADIO OPERATION - Check for proper operation, security of switches and knobs.		
26. FLAPS - Check for noisy operation, full travel and proper indication.		
27. PITOT HEAT - Check for amperage drawn on ammeter and for proper heating of the unit.		
28. FLIGHT INSTRUMENTS - Check for condition and proper operation.		
29. BRAKES - Check for condition and wear, ease of operation and proper release of the parking brake. Check for unusual brake chatter.		
30. EMERGENCY LOCATOR TRANSMITTER - Check for proper operation. Tune radio to 121.5 MHz on VHF or 243 MHz on UHF, then turn ELT switch to ON and monitor for one signal. Turn ELT switch OFF, then place in ARM position. Ensure that the ELT is armed when the airplane is returned to service.		
31. AIR-CONDITIONER - Operate the air conditioner and verify that the retractable condenser moves to the ground extended position when turned on and returns to the retracted position when turned off. Check for proper operation and unusual noise.		
32. OXYGEN SYSTEM - Functionally check the oxygen system for proper operation. Check the oxygen bottle shutoff valve for proper operation.		
33. SWITCHES, CIRCUIT BREAKERS - Check for proper operation.		
34. FLIGHT CONTROLS, TRIM CONTROLS AND TRIM INDICATOR - Check freedom of movement and proper operation through full travel with and without flaps extended. Check electric trim controls for operation.		
B. **POWER PLANT**		
1. NACELLE SKIN - Check for deformation and obvious damage or cracks. Check for loose or missing rivets.		
2. NACELLE STRUCTURE - Check for cracks and deformation. Check for loose or missing rivets and concealed damage.		
3. COWLING - Check for condition, security and adjustment of latches. Open the upper cowling and clean. Inspect for cracks.		
4. COWL FLAPS - Check for travel, deformation and security. Inspect for cracks.		

100-Hour or Annual Inspection (Continued)

B. POWER PLANT *(Continued)*	MECH	INSP
5. SPARK PLUGS - Clean, inspect, regap, test and replace as necessary. Tighten spark plugs to proper torque and check ignition harness condition and for proper attachment.		
6. COMPRESSION - Perform differential compression test.		
7. BATTERY - Inspect for clean, tight connections and add distilled water to maintain a level of 3/8-inch above top of separators. Inspect the vents and overflow tube for obstructions. Check for security and proper attachment. Check for corrosion. Make certain the battery is clean. Water or dirt on battery surface can cause the battery to discharge.		
8. PLUMBING - Inspect plumbing and associated accessories for condition (such as cracks and fraying) and attachment. Check plumbing clearance and secure against possible chafing.		
9. BRAKE FLUID RESERVOIR - Check reservoir for security, open vent, proper fluid level and for leaks.		
10. ENGINE OIL TANK OR SUMP - Check for cracks, leaks, proper fluid level, deformation and security.		
11. CRANKCASE - Check security of crankcase-thru bolts. Inspect the dipstick tabs for security and that the tabs are not bent.		
12. OIL SUMP DRAINS AND SCREENS - Clean screens, check for holes in the screens and for obstructions. Check for metal particles or foreign matter on screens and filters. Check for proper torque after installation.		
13. OIL COOLER - Check oil cooler, lines and fittings for condition, security, chafing and leaks.		
14. PROPELLER AND MOUNTING BOLTS - Check for condition and security. Check the tip of the blades for evidence of lightning strikes. If there is evidence of lightning strikes, consult the propeller manufacturer, the engine manufacturer and Raytheon Aircraft Company. Inspect the blades for cracks, dents, nicks, scratches, erosion, corrosion, security and movement in the hub.		
15. PROPELLER SPINNER - Check for deformation, security and cracks.		
16. PROPELLER HUB - Check for cracks, excessively leaking seals and condition.		
17. ALTERNATOR - Check for condition and attachment. Check wiring for proper attachment and possible chafing. Check for unusual noise.		
18. ALTERNATOR - (Prestolite or Delco Remy only) Remove and disassemble the alternator as necessary to inspect the rotor shaft bearings for condition and replace if necessary. Refer to Service Instructions No. 0546-359 Rev II or subsequent.		
19. STARTER - Check for condition, attachment and chafed or loose wires.		
20. STANDBY GENERATOR/ALTERNATOR - Check for condition, attachment, security of wires and for chafing.		

100-Hour or Annual Inspection (Continued)

B. **POWER PLANT** (Continued)	**MECH**	**INSP**
21. MAGNETOS - Check contact points for proper clearance. Points with deep pits or excessively burned areas must be discarded. Inspect the cam follower felt pad for proper lubrication and clean the compartment with a clean, dry cloth. Check ignition harness for proper connection, security and fraying. Check timing.		
22. MAGNETO PRESSURIZATION FILTER - Check for condition, cleanliness and security.		
23. CYLINDERS AND BAFFLES - Check cylinders and exhaust manifold for obvious leaks, security and cracks, check baffles for cracks and security. Check cylinders for broken cooling fins and loose or missing base nuts.		
24. EXHAUST SYSTEM - Check for deformation, security, cracks, leaks, loose or missing nuts and clamps. Check for thin wall condition which may occur due to normal internal erosion on stacks which have long service time.		
25. FIREWALL - Check for wrinkles, damage or cracks. Check all electrical and control access holes for proper sealing.		
26. HOSE AND DUCTS - Check all fuel, oil and air hose or duct for leakage, cracks, deterioration and damage. Check fittings for security.		
27. ENGINE ACCESSORIES - Check for condition, security and leaks. Check wiring, hoses and tubes for chafing, security and leaks.		
28. ENGINE MOUNTS - Check for cracks, corrosion and security. Inspect rubber cushions, mount bolts and nuts, and grounding straps for condition and security.		
29. CABIN HEATER SYSTEM - Check for cracks, distortion, corrosion, leaks and obstructions per Chapter 21-40-00.		
30. PROPELLER GOVERNOR - Check for leaks and corrosion and control arm for security.		
31. ENGINE CONTROLS - Check controls and associated equipment for condition, attachment, alignment and rigging. Remove cable connection bolts and check for wear each 300 hours.		
32. IGNITION HARNESS - Inspect for fraying and attachment.		
33. ELECTRICAL WIRING AND EQUIPMENT - Inspect electrical wiring and associated equipment and accessories for fraying and attachment.		
34. ALL DRAINS AND PLUGS - Check for condition, security and obstructions. Check for leaks and correct tightness.		
35. PRESSURE PUMP INTAKE FILTER - Refer to Parker-Hannifin Airborne Service Letter 59 or subsequent. Refer to Chapter 5-10-00 for additional information.		
36. AIR-CONDITIONER COMPRESSOR - Check for security and attachment. Check refrigerant level and for oil leaks. Refer to Chapters 12 and 21. Check belt for tension and worn or frayed condition.		
37. INDUCTION AIR FILTER - Check for condition, cleanliness and security.		

100-Hour or Annual Inspection (Continued)

B. **POWER PLANT** *(Continued)*	**MECH**	**INSP**
38. INDUCTION SYSTEM AND ALTERNATE AIR - Check hot and cold flexible air ducts for delamination of the inner lining. Check the alternate air valve for blockage, security, cracks, operation and wear.		
39. FUEL INJECTION CONTROL VALVE - Clean the screen and check for damage. Install screen and check for leaks.		
40. FUEL INJECTION SYSTEM - Inspect all fuel injection components, lines and fittings for evidence of fuel leaks, fraying and cracking.		
41. FUEL RETURN LINE (EA-11 thru EA-439) - Check for chafing against the wastegate seal drain line, particularly in the area approximately six inches from the fire wall bulkhead fitting of the fuel return line.		
42. ELECTRIC PROPELLER DEICER -		
a. Check for service damage to the deicer heaters, brush rods, springs and brushes. Check for attachment and security.		
b. Check the lead strap and all other clamps, connectors and wiring for electrical soundness, security and attachment.		
c. Check the slip rings for roughness, cracks, burned or discolored areas and for deposits of oil, grease or dirt. Check for security and attachment of all components.		
d. Check deicer boots for wrinkles, loose or torn areas.		
43. TURBOCHARGER SYSTEM -		
a. Inspect the system for oil leaks, exhaust system leaks, cracks and attachment.		
b. Inspect the compressor wheel for nicks, cracks or broken blades and freedom of movement.		
c. Inspect the bypass valve (wastegate) for proper operation and inspect all linkage for interference, condition, security and attachment.		
d. Inspect all exhaust system components for worn or damaged areas, loose clamps, cracks and leaks.		
e. Inspect lubrication system components for worn or damaged areas, loose clamps, cracks and leaks.		
f. Inspect the upper deck pressure reference lines and the fuel injection reference manifold for loose connections, leaks and possible chafing.		
g. Check and calibrate the turbine inlet temperature indicator in accordance with Chapter 77-00-00.		
h. Check manifold pressure controller linkage for wear.		
44. ENGINE BAFFLE SEALS - Inspect for security and condition at each 100-hour or annual inspection. Replace as necessary or every 10 years of service.		
45. FILTERS - Inspect pressure system in-line filter for condition, cleanliness and security. Refer to Parker-Hannifin Airborne Service Letter 59 or subsequent. Refer to Chapter 5-10-00 for additional information.		

100-Hour or Annual Inspection (Continued)

B. **POWER PLANT** *(Continued)*	**MECH**	**INSP**
46. PRESSURE PUMP (Airborne) - Inspect as required by Parker - Hannifin Service Letter 43A or subsequent. Refer to Chapter 5-10-00 for additional information. PRESSURE PUMP (Aero Accessories Pumps, Part Number AA216CW or AA3216CW) - Initially inspect at 600 hours time-in-service in accordance with Aero Accessories Service Letter No. 004 and thereafter as directed by the Service Letter. Refer to Chapter 5-10-00 for additional information.		
C. **CABIN AND BAGGAGE COMPARTMENT**		
1. SKIN - Inspect skins for deformation, cracks and loose or missing rivets. If damage is found, check adjacent structure.		
2. STRUCTURE - Check for cracks and deformation. Check for loose or missing rivets and concealed damage.		
3. CABLES, PULLEYS AND TURNBUCKLES - Check the flight control components, cables and pulleys. Replace control system components (pushrods, turnbuckles, end fittings, castings, etc.) that have bulges, splits, bends, or cracks. Check control cables, pulleys, and associated equipment for condition, attachment, alignment, clearance and proper operation. Replace cables that have more than 3 broken strands in any 3-foot length of cable or evidence of corrosion. Check cables for proper tension. **NOTE:** It is important to operate controls through their full range so that the cables move away from pulleys and all portions of the cables are exposed for inspection.		
4. LANDING GEAR GEARBOX AND ACTUATING LINKAGE - Check for leakage, wear, condition and attachment. Check for unusual noise. Remove oil filler plug and check oil level by engaging and turning the emergency hand crank 1/2 turn to determine that oil is being picked up on the worm gear. The oil level should be maintained no more than necessary to cover 1/2 of the diameter of the worm gear. Install oil filler plug.		
5. FLAP MOTOR AND SHAFTS - Check for condition, security and wear at all points. Check drive shaft housing for security and check jam nuts for tightness.		
6. AUXILIARY FUEL PUMP AND FUEL LINES - Check for condition, security and leaks. Check lines for signs of chafing or cracks.		
7. BRAKE MASTER CYLINDER AND PARKING BRAKE VALVE - Check for condition, security and leaks. Check lines for signs of chafing or cracks.		
8. RUDDER PEDALS - Check for freedom of movement. Check cables, push/pull rods, bellcranks, pulleys, turnbuckles and fair leads for proper routing, condition and security. Check rudder pedal fore and aft positions for wear. Check locks and pins to ensure positive lock. **NOTE:** It is important to operate controls through their full range so that the cables move away from pulleys and all portions of the cables are exposed for inspection.		
9. CONTROL COLUMN, TRIM CONTROL AND INDICATOR (Electric and Manual) - Check for freedom of movement. Inspect pulleys, sprockets, bearings, actuators, chains and turnbuckles for condition, security and operation. Check trim indicator for proper indication.		

100-Hour or Annual Inspection (Continued)

C. **CABIN AND BAGGAGE COMPARTMENT** *(Continued)*	**MECH**		**INSP**
10. ENGINE CONTROLS - Check for ease of operation through full travel. Check friction locks for proper operation.			
11. ELECTRICAL WIRING AND EQUIPMENT - Check for condition, security and signs of chafing.			
12. PLUMBING - Check all plumbing and connections for security, leakage and general condition.			
13. WINDOWS AND DOORS - Inspect windows for scratches, crazing and general condition. Inspect doors for security of attachment. Check latching mechanism for proper engagement and ease of operation. Check that rotation of the interior door handle without depressing the handle lock release button does not unlatch the door.			
14. INSTRUMENTS AND INSTRUMENT PANEL - Inspect instrument panel, sub panels, placards and instruments for condition and attachment. Check all knobs for security. Inspect shock mounts and ground straps for cracks and security.			
15. SEATS, SEAT BELTS AND SHOULDER HARNESSES - Inspect cabin seats, seat belts and shoulder harnesses for proper operation, condition and security of attachment. Inspect floorboards for condition and seat attachment. Check for operation of the seat stops.			
16. OXYGEN SYSTEM - Check condition of the oxygen system and check the oxygen masks for cleanliness and stowage.			
17. VENTILATING SYSTEM - Check all fresh air and heat outlet vents for proper movement and operation.			
18. FUEL SELECTOR VALVE - Inspect for leakage, security, freedom of movement, proper detent feel and condition. Clean strainer and check for condition. Check for proper placarding.			
19. EMERGENCY EXIT HATCH - Check emergency release handle and latch assembly for proper operation. Check that the hatch moves out freely. Check the complete latch assembly for condition and all moving parts for proper operation. With the hatch installed, check for proper latching and seal. Safety the emergency exit with 0.020 inch-diameter copper wire after opening.			
20. STATIC SYSTEM - Check and drain water from the static lines.			
21. CABIN AIR BLOWER - Check for condition, mounting security and wear at all points.			
22. FUEL STRAINER - Drain and clean. On fuel cells with foam inserts, check for brown foam material. Refer to Safety Communique No. 67 and Service Bulletin No. 2109.			
23. CONTROL COLUMN (E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After) - Inspect the control column U-joint roll pins and ensure they are not backing out.			
D. **WINGS AND CARRY-THROUGH STRUCTURE**	**MECH**		**INSP**
	LH	**RH**	
1. SKIN - Check for deformation and obvious damage. Check for cracks, loose or missing rivets. If damage is found, check adjacent structure. Check for indications of hard landing or excessive flight loading.			

100-Hour or Annual Inspection (Continued)

D. WINGS AND CARRY-THROUGH STRUCTURE *(Continued)*	MECH		INSP
	LH	RH	
2. STRUCTURE - Check for cracks, deformation and concealed damage. Check for loose or missing rivets. Refer to Chapter 53-10-00 of this Maintenance Manual for inspections for fuselage web cracks at the fuselage/wing spar carry through area.			
3. ACCESS DOORS AND PANELS - Inspect for cracks, proper fit and attachment.			
4. CABLES, PULLEYS AND TURNBUCKLES - Check the flight control components, cables and pulleys. Replace control system components (pushrods, turnbuckles, end fittings, castings, etc.) that have bulges, splits, bends, or cracks. Check control cables, pulleys, and associated equipment for condition, attachment, alignment, clearance and proper operation. Replace cables that have more than 3 broken strands in any 3-foot length of cable or evidence of corrosion. Check cables for proper tension. **NOTE:** It is important to operate controls through their full range so that the cables move away from pulleys and all portions of the cables are exposed for inspection.			
5. AILERONS - Check for condition and security. Check for cracks, loose or missing rivets and freedom of movement. Check hinge bearings and brackets for condition, push/pull rods for security and rod ends for corrosion.			
6. FUEL CELLS, CAPS AND VENTS - Inspect fuel cells, caps and vent lines. Refer to Chapter 28. Refer to Service Instruction Number 0632-280.			
7. PLUMBING - Check for leakage, chafing, condition and security.			
8. ELECTRICAL WIRING AND EQUIPMENT - Inspect for chafing, damage, security and attachment.			
9. FLAP LIMIT SWITCHES - Check for condition, security and freedom of operation.			
10. FLAPS AND ACTUATORS - Check for condition, security, binding or chafing of actuator drive shafts. Check flap skin and structure for cracks, loose or missing rivets. Check roller bearings and tracks for condition. Check stop area for condition and damage.			
11. FLAP POSITION TRANSMITTER - Check for security and operation.			
12. DRAIN HOLES - Check the drain holes in the upper wing attach fittings to ensure that they are open and free of obstruction.			
13. WING SPAR CAP - Inspect the wing spar cap for corrosion. Refer to Chapter 57. See Service Bulletin 2538.			
14. WING BOLTS - Check wing bolts for proper torque at the first 100-hour inspection and at the first 100-hour inspection after each reinstallation of the wing attach bolts. Refer to Chapter 57 of this maintenance manual for wing bolt, nut and fitting inspection criterion and frequency.			
15. RADAR ANTENNA COVER - Check the fiberglass for security, attachment and cracks.			
16. FUEL VENTS AND AIR INLETS, PITOT TUBE AND STALL WARNING VANE - Check for condition and obstruction.			
17. Perform the INSPECTION OF FUEL CELL FLAPPER VALVE procedure. Refer to Chapter 28-10-00.			

100-Hour or Annual Inspection (Continued)

E. **NOSE GEAR**	**MECH**		**INSP**
1. WHEEL AND TIRE - Check wheel for cracks and tire for wear, damage and proper inflation. Check wheel bearings for condition and wear.			
2. LANDING GEAR STRUT - Inspect the shock strut and components for cracks, attachment, proper inflation and evidence of leakage.			
3. ACTUATING LINKAGE - Check for wear at attach points. Check for cracks and security.			
4. GEAR DOORS AND LINKAGE - Check doors for damage and cracks to the structure and skins. Check linkage for wear and cracks at the attach points. Check for condition and security.			
5. NOSE GEAR STEERING LINKAGE - Inspect linkage for tightness, condition and security. Inspect linkage boots for condition.			
6. SHIMMY DAMPER - Check for condition and attachment. Check attach points for cracks. Check fluid level per Chapter 12-20-00.			
7. STRUT FLUID LEVEL - Check and maintain the proper fluid level in the strut as outlined in Chapter 12-20-00.			
8. STRUT AND A-FRAME HINGE BOLTS - Inspect for corrosion and security of attachment.			
9. STATIC CABLE (If installed) - Inspect for condition, proper clearances and attachment.			
10. VISUAL INDICATOR - Check for condition.			
11. NOSE LANDING GEAR DRAG BRACE (P/N 002-820016-31, P/N 002-820018-3, or with Kit 35-4012-1 Installed) - Check that the two drag brace bracket attachment bolts (Item 22, Figure 4, Chapter 32-20-00) are secure. Check drag brace assembly for shear stress, wear and corrosion. At 2,000 hours, remove and inspect the two bracket attachment bolts. Replace all hardware with evidence of shear stress, wear and/or corrosion.			
12. NOSE LANDING GEAR RETRACT ROD ROD-ENDS - Check the retract rod rod-ends for signs of cracking, sheer stress, wear and corrosion.			
F. **MAIN GEAR AND BRAKES**	**MECH**		**INSP**
	LH	**RH**	
1. BRAKES, LINES, LINING AND DISCS - Check for condition, wear and security. Check lines for chafing and signs of leakage or cracks. Check discs for wear or warping. Check brake discs for cracks.			
2. WHEELS AND TIRES - Check wheels for cracks and tires for wear, damage, condition and proper inflation. Check wheel bearings for condition and wear.			
3. ACTUATOR GEARBOX, MOTOR AND SWITCHES - Check for leakage, condition and security.			
4. LANDING GEAR STRUTS - Inspect the shock struts and components for cracks, attachment, corrosion, proper inflation and evidence of leakage.			

100-Hour or Annual Inspection (Continued)

F. **MAIN GEAR AND BRAKES** *(Continued)*	MECH		INSP
	LH	RH	
5. ACTUATING LINKAGE - Check for wear and cracks at attach points. Check for condition and security.			
6. GEAR DOORS AND LINKAGE - Check doors for damage and cracks to the structure and skins. Check linkage for wear and cracks at the attach points. Check for condition and security. Determine that all clevis retaining pins are in place and secured with cotter pins.			
7. STRUT FLUID LEVEL - Check and maintain the proper hydraulic fluid level in the struts as outlined in Chapter 12-20-00.			
8. STRUT AND A-FRAME HINGE BOLTS - Inspect for corrosion and security of attachment.			
G. **MAIN GEAR OPERATION**			
WARNING: Under no circumstances should the landing gear be operated electrically while the hand crank is engaged. In the event of such an operation, a tear down and magnetic inspection should be performed to determine damage to the engagement slot in the worm shaft. ***CAUTION:*** *Since the battery voltage is not sufficient to properly cycle the landing gear for this inspection, use only an external power source capable of delivering and maintaining 28.25 ± 0.25 vdc to the airplane's electrical system throughout the extension and retraction cycles when performing the landing gear retraction inspection. Refer to Chapter 32 for more specific information on the following items.*			
1. DOORS - Check operation, fit and fair. Check for unusual noise.			
2. POSITION LIGHTS - Check for security, adjustment and wiring for breaks, condition of insulation, loose connections and proper indication.			
3. WARNING HORN - Check for proper operation.			
4. UPLOCK CABLE TENSION - Check uplock cable mechanism for condition and security. Check uplock cable for proper tension and for possible fraying.			
5. EMERGENCY EXTENSION - Check system for freedom of operation. Check for unusual noise. With the spar cover installed, check for proper engagement of the emergency extension handle and proper system operation.			
6. DOWNLOCK TENSION - Check for proper deflection force on the main gear knee joints.			
7. UPLOCK ROLLERS - Check condition and clearance of uplock rollers and lubricate as indicated in Chapter 12-20-00. Check for binding.			
8. LIMIT SWITCH RIGGING - Check for security and proper adjustment of the limit switches. Refer to RIGGING THE LANDING GEAR in Chapter 32-30-00 of this maintenance manual for correct landing gear gearbox internal clearance.			
9. SAFETY SWITCH - Check for security, proper rigging and operation.			

100-Hour or Annual Inspection (Continued)

G. MAIN GEAR OPERATION *(Continued)*	MECH		INSP
	LH	RH	
10. GENERAL OPERATION - Place the airplane on jacks and cycle the landing gear while checking to ascertain that the position light switches operate in conjunction with the landing gear position. Check the condition and operation of the complete landing gear system.			
11. DYNAMIC BRAKING ACTION - Verify proper operation of dynamic brake relay.			
12. ASSIST STEP (If Installed) - Inspect the retractable step for cable and safety link condition, proper adjustment and operation. Check fixed link condition, proper adjustment and operation. Check fixed steps for security.			
H. NOSE GEAR OPERATION	**MECH**		**INSP**
WARNING: Under no circumstances should the landing gear be operated electrically while the hand crank is engaged. In the event of such an operation, a tear down and magnetic inspection should be performed to determine damage to the engagement slot in the worm shaft. ***CAUTION:*** *Since the battery voltage is not sufficient to properly cycle the landing gear for this inspection, use only an external power source capable of delivering and maintaining 28.25 ± 0.25 vdc to the airplane's electrical system throughout the extension and retraction cycles when performing the landing gear retraction inspection. Refer to Chapter 32 for more specific information on the following items.*			
1. DOORS - Check operation, fit and fair. Check for unusual noise.			
2. NOSE GEAR UP TENSION - Check the up tension on the nose gear as indicated in RIGGING THE LANDING GEAR in Chapter 32-30-00.			
3. DOWNLOCK TENSION - Check the downlock tension on the nose gear as indicated in RIGGING THE LANDING GEAR in 32-30-00.			
4. GENERAL OPERATION - Place the airplane on jacks and cycle the landing gear while checking to ascertain that the position light switches operate in conjunction with the landing gear position. Check the condition and operation of the complete landing gear system.			
5. VISUAL INDICATOR - Inspect for proper adjustment and operation.			
6. NOSE GEAR STEERING - Check for condition and security.			
I. REAR FUSELAGE AND EMPENNAGE			
1. SKIN - Check for deformation, cracks and obvious damage. Check for loose or missing rivets. If damage is found, check adjacent structure.			
2. INTERNAL FUSELAGE STRUCTURE - Check for cracks and deformation. Check for loose or missing rivets. Check bulkheads, door posts, stringers and doublers for corrosion, cracks and buckles.			
3. STRUCTURE - Inspect the two most aft bulkheads for cracks, distortion, loose rivets or other obvious damage.			

100-Hour or Annual Inspection (Continued)

I. REAR FUSELAGE AND EMPENNAGE *(Continued)*	MECH	INSP
4. CABLES, PULLEYS AND TURNBUCKLES - Check the flight control components, cables and pulleys. Replace control system components (pushrods, turnbuckles, end fittings, castings, etc.) that have bulges, splits, bends, or cracks. Check control cables, pulleys, and associated equipment for condition, attachment, alignment, clearance and proper operation. Replace cables that have more than 3 broken strands in any 3-foot length of cable or evidence of corrosion. Check cables for proper tension. **NOTE:** It is important to operate controls through their full range so that the cables move away from pulleys and all portions of the cables are exposed for inspection.		
5. CONTROL SURFACES - Check for deformation, cracks and security. Check for loose or missing rivets. Check for freedom of movement. Check for security of hinges and bond cables. Check the inboard elevator hinge casting (on the aft bulkhead) for cracks in mounting bolt holes.		
6. TRIM TABS AND ACTUATORS - Check for security and wear. Check free play per Chapter 27-30-00. Check hinges and trim tab actuators for security and wear. Check trim tabs for cracks and control rods for attachment. Lubricate trim tab hinges per Chapter 12-20-00.		
7. STATIC PORTS - Check for obstruction and clean as necessary.		
8. PLUMBING - Check for leakage, cracks, chafing, condition and security.		
9. ELECTRICAL WIRING AND EQUIPMENT - Inspect for chafing, damage, security and attachment.		
10. STATIC LINES - Check condition of static lines and drain.		
11. ANTENNAS - Check for condition and security.		
12. ELEVATOR/RUDDER (Ruddervators) -		
a. Check that the drain holes are open and clean.		
b. Check that the ruddervator trim tab and hinge pin are correctly mated. Refer to ELEVATOR TRIM TAB INSTALLATION, Chapter 27-21-00.		
c. Check for cracks on the trim tab hinge support channel.		
d. Check the stabilizer front and rear spar attach points for cracks and looseness.		
13. RUDDER FORWARD SPAR (CE-748, CE-772 thru CE-1425; CJ-149 thru CJ-179; E-1111, E-1241 thru E-2518; EA-11 thru EA-500 and airplanes that have not installed Kit 33-6001-1 - Refer to Service Bulletin No. 2333 every 500 flight hours or annually.		
14. RUDDER FORWARD SPAR (CE-1426 and After; CJ-180 and After; E-2519 and After; EA-501 and After and airplanes that have installed Kit 33-6001-1 - Open inspection covers adjacent to the upper and center hinges. Inspect ribs, spar, hinges and all rudder components in area of the hinges for attachment security, cracks and general condition using a flashlight and mirror. Install covers.		
J. GENERAL		
1. Airplane cleaned and serviced.		
2. Airplane lubricated, after cleaning, in accordance with Chapter 12-20-00.		

100-Hour or Annual Inspection (Continued)

J. **GENERAL** *(Continued)*	**MECH**	**INSP**
3. Inspect all placards to ensure that they are easily readable and securely attached.		
4. Ensure that all Airworthiness Directives, Raytheon Aircraft Service Bulletins and previously issued Service Instructions are reviewed and complied with as required.		
5. For a complete or annual inspection of the airplane, all items on the airplane that are noted in this guide should be inspected.		

UNSCHEDULED MAINTENANCE CHECKS - MAINTENANCE PRACTICES

This subchapter is assembled in chart form to allow a technician to perform checks for damage after operating the airplane in conditions which could require unscheduled maintenance. Specific conditions, such as lightning strikes, turbulent air penetration or hard landings, etc., are included. Inspection instructions are included for each of the conditions listed.

WARNING: During the performance of these inspections the airplane could be placed on three-point jacks. Ensure the landing gear is down and locked before removing the airplane from the jacks.

UNSCHEDULED MAINTENANCE CHECK

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
OPERATION AFTER SUDDEN STOPPAGE INCIDENTS		
Propeller Governor	The propeller governors should be overhauled or replaced as instructed in the manufacturer's manuals.	After sudden engine stoppage.
WHEN OPERATING IN AREAS OF HIGH DUST CONTENT		
Nose Landing Gear Shock Strut	Clean off and wipe dry exposed polished surfaces.	Routine.
Instrument Air Filters	Replace instrument line supply filters at or before 100 hours under extremely dusty conditions.	As noted.
Alternate Air Door	Ensure door is sealed around all edges and there is adequate spring tension on the door.	Routine.
CAUTION: *To avoid damaging the barometric sensor, disconnect the autopilot sensor line prior to applying reverse air pressure to the pitot and static lines.*		
Pitot and Static Lines	Check for obstructions by applying reverse air pressure (not to exceed 20 psi) to the ends of the pitot and static lines with them disconnected from the instruments.	200 hours or as required.
WHEN OPERATING IN AREAS OF HIGH HUMIDITY		
Floor Structure	Check structure under the floor for corrosion by removing a floor panel and inspection the structure, especially the channel sections.	At a scheduled inspection.
Aft Cabin	Remove aft cabin access covers and inspect for corrosion, especially aft of bulkhead points.	At a scheduled inspection.
Wing	Remove wing and center section access covers and check for corrosion.	At a scheduled inspection.
Empennage	Remove all fuselage access covers and check for corrosion.	At a scheduled inspection.

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
AFTER RECEIPT OF THE AIRPLANE		
Wing	Check torque of the wing attach bolts.	After the first 100 hours and at the first 100 hours after adjustment of the wing.
OPERATING FROM VERY SOFT OR UNUSUAL TERRAIN		
LANDING GEAR		
Tires	Visually check for cuts, wear, deterioration and inflation.	Routine.
Main Landing Gear	Check strut inflation.	
a. Wheels	1. Check for obvious damage.	Routine.
	2. Remove and clean; inspect for abrasions, cracks and chipped rims, bearing for wear, corrosion, fretting and bluing; check seals for distortion, deterioration, and proper fit and security.	Every 100 hours and/or annually.
b. Brake Units	1. Check cylinders and associated lines for damage and leaks.	Routine.
	2. Check for evidence of overheating.	Every 100 hours and/or annually.
	3. Check discs for scoring, distortion, damaged plating and evidence of overheating.	Every 100 hours and/or annually.
c. Shock Absorber	Check surfaces for cleanliness, free from oil or grease deterioration.	Every 100 hours and/or annually.
d. Wheel Wells	Clean foreign material (dirt, etc.) from wheel wells. Inspect supports between main and aft spars in upper wheel well and the lift leg attach bracket at the main spar for deformation, cracks, etc.	As required.
Nose Landing Gear		
a. Wheel	1. Visually check for obvious damage.	Routine.
	2. Remove and clean. Inspect for abrasions, cracks and chipped rims, bearings for wear, corrosion, fretting and bluing; check seals for distortion, deterioration, proper fit and security.	Every 100 hours.
b. Shock Strut	1. Check for obvious damage and leaks. Clean exposed surface of shock strut piston with clean cloth moistened with hydraulic fluid.	Routine.

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
OPERATING FROM VERY SOFT OR UNUSUAL TERRAIN *(Continued)*		
b. Shock Strut (Continued)	2. Check for correct extension.	Every 100 hours.
	3. Thoroughly clean and inspect for leaks, damage and security; service as necessary.	Every 100 hours.
c. Fork Assembly	Check for cleanliness and obvious damage.	Routine.
d. Nose Wheel Steering	Check for obvious damage, associated rods and connections for damage and security; steering and pulleys for wear and security.	Every 100 hours.
e. Actuator Linkage	Check for excessive play, safety and security.	Every 100 hours.
f. Shimmy Damper	Inspect for condition and attachment.	Every 100 hours.
INSPECTION AFTER HARD LANDING		
	Perform the following:	As applicable.
NOTE: This inspection should be carried out after a hard landing and before the airplane is certified as ready for further flight. The inspections are conducted at two levels. The first level consists of determining if any external damage has occurred and looking for evidence of internal structural failure. The second level is concerned with a more detailed inspection of any damaged areas which were indicated in the findings of the first level inspection. If it is determined by the first level inspection that there is no damage to the airplane, it is not necessary to proceed to the second level inspection.		
WARNING: Even though wrinkles in the wing or fuselage skin surface may be slight enough to be considered as negligible, a close inspection of the internal supporting structure may reveal serious damage.		
	FIRST LEVEL INSPECTION	Prior to next flight.
General Appearance	Determine that the airframe components (wings, fuselage and empennage) are in their normal configuration.	
Landing Gear	1. Inspect tires for excessive wear, splits in the tread, bottoming out or folding over the sidewalls.	
	2. Check the wheels (rims) for flat spots or cracked castings.	
	3. Check shock struts and attachment lugs for cracks.	
	4. Inspect hydraulic brake lines for leaks.	
	5. Inspect nose drag legs and gear door retract linkage for damage.	

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER HARD LANDING *(Continued)*		
Landing Gear (Continued)	6. Inspect landing gear lift leg attach bracket at the main spar for deformation, cracks, etc.	
	7. Inspect area around landing gear attach points.	
Nose Structure	1. Inspect external skin surfaces for distortion, loose or missing rivets.	
	2. Check cowling attachment for alignment or damage.	
	3. Inspect engine control cables for smooth operation and check plumbing and wiring for security and attachment.	
	4. Inspect engine support fittings for cracks or structural failure.	
	5. Check tips of propeller for damage.	
	6. Check propeller spinner and backplate for evidence of interference with cowling.	
	7. Inspect wheel well structure for damage or cracks. Check area surrounding the landing gear attachment points.	
Wing Carry-thru Structure	1. Check wing attachment fittings for cracks. Perform a Dye Penetrant inspection.	
	2. Inspect plumbing, wiring and actuator for damage and security of attachment.	
	3. Check keel, front and rear spar on the lower side of fuselage for damage and alignment.	
Wings	1. Inspect external wing surface skin for cracks, abnormal wrinkles and loose or missing rivets.	
	2. Check wing attachment fittings for cracks. Perform a Dye Penetrant inspection.	
	3. Inspect internal structure.	
	4. Inspect plumbing and wiring for security of attachment.	

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER HARD LANDING *(Continued)*		
Fuselage Center Section	1. Inspect external skin surface for cracks, abnormal wrinkles and loose or missing rivets.	
	2. Inspect around cabin windows for structural cracks.	
Fuselage, Aft	1. Check external skin surface the entire length for cracks, abnormal wrinkles and loose or missing rivets.	
	2. Inspect empennage and control surfaces for freedom of movement.	
	SECOND LEVEL INSPECTION	As required.
NOTE: Because shock loading may be transmitted along one structural member to another, carefully inspect the surrounding and supporting structure in any damaged area found in the first level inspection.		
Landing Gear	1. Place airplane on jacks and check shock strut for free up and down movement.	
	2. Remove tires and inspect internally for cuts or broken areas.	
	3. Disassemble and examine wheels (rims) for cracks or distortion.	
	4. Visually inspect axle with 10-power glass. If suspect, dye check or magnaflux.	
	5. Remove and replace or magnaflux the landing gear attach bolts, check bolt holes for cracks or elongation.	
	6. Remove and replace or magnaflux drag link bolts and supports.	
	7. Perform landing gear retraction test.	
Nose Structure	1. If tips of propeller have been damaged, refer to the applicable Engine Maintenance Manual for engine inspection procedure.	
	2. Inspect areas surrounding the engine support fittings.	
	3. Check the internal structure of the wheel well for cracks or damage.	
	4. Test plumbing and wiring for proper operation.	

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER HARD LANDING *(Continued)*		
Nose Structure (Continued)	5. Inspect wheel well structure and surrounding areas for signs of structural failure.	
Wing Carry-thru Structure	1. Dye check wing attachment fittings; examine (magnaflux or replace) attachment bolts and check bolt holes for alignment and correct dimensions.	
	2. Remove floorboards and access plates and inspect the front and rear spar, and keel structure for evidence of deformation or structural failure.	
	3. Test plumbing, wiring, flaps, control cables, pulley mounts, and any other system found in this area for proper operation.	
Wings	1. Dye check wing attachment fittings; examine (magnaflux or replace) attachment bolts and check bolt holes for alignment and correct dimensions.	
	2. Test plumbing and wiring for proper operation.	
Fuselage, Center and Aft Section	1. Examine stringers, frames and sidewalls for deformation structural failure.	
	2. Test plumbing and wiring for proper operation.	
	3. Inspect heating and air-conditioning ducts for damage.	
	4. Examine the control cables and pulley mountings and check for clearance from structure at pass-through locations. Ensure a smooth operation.	
REPAIR OF DAMAGE		
Due to the variety and degree of structural damage which may be involved, the best repair of replacement procedure must be based on the findings of the individual airplane. If the hard landing inspection indicates that serious structural damage has occurred, contact Raytheon Technical Support, Raytheon Aircraft Company, Wichita, KS 67201 for assistance.		
LOG BOOK ENTRY		
Following a hard landing inspection, an entry covering the extent of inspection, the damage and the repair (if applicable) must be noted in the airplane permanent records.		

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER ENCOUNTERING TURBULENT AIR		
	Perform the following:	As applicable.
NOTE: This inspection should be carried out after the airplane has been subjected to high G loading while flying through turbulent air and before the airplane is returned to service. The inspection is conducted on two levels. The first level consists of determining if any external damage has occurred and looking for evidence of internal structural failure. The second level is concerned with a more detailed inspection of damaged areas which were indicated in the findings of the first level inspection. If it is determined by the first inspection that there is no damage to the airplane, it is not necessary to proceed to the second level inspection.		
	FIRST LEVEL INSPECTION	Prior to next flight.
WARNING: Even though wrinkles in the wing or fuselage skin surface may be slight enough to be considered as negligible, a close inspection of the internal supporting structure may reveal serious damage.		
General Appearance	Determine that the airframe components (wings, fuselage and empennage) are in their normal configuration.	
Wing Carry-thru Structure	1. Inspect the external skin surface for cracks, abnormal stress wrinkles and loose or missing rivets.	
	2. Check wing attachment fittings for cracks.	
	3. Inspect plumbing and wiring for damage and security of attachment.	
	4. Check the keel and the front and rear spar on the lower side of the fuselage for damage and alignment.	
Nose Structure	1. Inspect the external skin surfaces for wrinkles and loose or missing rivets.	
	2. Check cowling attachment for alignment or damage.	
	3. Inspect the engine support fittings for cracks or deformation or structural failure.	
	4. Inspect engine control cables for smooth operation and check plumbing and wiring for security and attachment.	
	5. Inspect structure in wheel well for damage or cracks.	

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER ENCOUNTERING TURBULENT AIR *(Continued)*		
Wings	1. Inspect the top and bottom wing surface for cracks, wrinkles and loose or missing rivets.	
	2. Inspect wing attachment fittings for cracks.	
	3. Inspect aileron, aileron tab and flaps for wrinkles or cracks.	
	4. Inspect internal structure and fuel cells through access panels.	
	5. Inspect plumbing and wiring for security of attachment.	
Nose Structure	1. Check external skin surface for cracks, wrinkles and loose or missing rivets.	
	2. Inspect area forward of windshield for evidence of structural deformation or failure.	
Fuselage, Center Section	Inspect external skin surface for cracks, abnormal wrinkles and loose or missing rivets.	
Fuselage, Aft	1. Inspect the entire length of the external skin surface for cracks, stress wrinkles and loose or missing rivets.	
	2. Check the empennage surfaces for damage and free movement.	
	3. Inspect for skin wrinkles at the juncture of the fuselage and empennage.	
	SECOND LEVEL INSPECTION	As required.
NOTE: Because G loading may be transmitted along one structural member to another, carefully inspect the surrounding and supporting structure in any damaged area found in the first level inspection.		
Wing Carry-thru Structure	1. Dye check wing attachment fittings, examine (magnaflux or replace) attachment bolts and check bolt holes for alignment and correct dimension.	
	2. Remove floorboards and access plates and inspect the front and rear spar and keel structure for evidence of deformation or structural failure.	
	3. Operational test plumbing, wiring, flaps, control cables, pulley mounts and any other system found in this area.	

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER ENCOUNTERING TURBULENT AIR *(Continued)*		
Nose Structure	1. Inspect areas surrounding the engine support fittings.	
	2. Inspect internal structure for cracks or damage.	
	3. Operational test plumbing and wiring.	
Wings	1. Dye check wing attachment fittings, examine (magnaflux or replace) attachment bolts.	
	2. If there is evidence of damage to the fuel cells or fuel lines, remove the cells and inspect the fuel cell liners and liner support structure.	
	3. Operational test the plumbing and wiring, flap actuator, aileron and tab control cables and pulley mounting.	
Fuselage Center Section	1. Examine stringers, frames and sidewalls for deformation or structural failure.	
	2. Examine heating and air-conditioning ducts for damage.	
	3. Operational test plumbing and wiring.	
	4. Examine the control cables, pulley mountings and the cable clearance at areas the cables pass through the structure. Ensure a smooth, normal operation.	
Empennage	1. Inspect elevator pushrods, torque tubes and bellcrank for damage.	
	2. Inspect the attachment of the vertical stabilizer spars to the top of the fuselage for evidence of damage.	
	3. Inspect skin surfaces for condition and loose or missing rivets.	
	4. Check structure for cracks, loose rivets and/or concealed damage.	
	5. Check rudder for freedom of movement and attachment.	
	6. Check elevator for freedom of movement and attachment.	

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER ENCOUNTERING TURBULENT AIR *(Continued)*		
Empennage (Continued)	7. Check trim tab actuators for smoothness of operation and attachment. Check the wiring of the electrical trim tab actuator for connection, security of attachment and condition. Check the electrical trim tab actuator for full travel and security of attachment.	
REPAIR OF DAMAGE		
Due to the variety and degree of structural damage which may be involved, the best repair or replacement procedure must be based on the inspection findings of the individual airplane. If the turbulent air inspection indicates that serious structural damage has occurred, contact Raytheon Technical Support, Raytheon Aircraft Company, Wichita, KS 67201, for assistance.		
LOG BOOK ENTRY		
Following a turbulent air inspection, an entry covering the extent of inspection, the damage and the repair (if applicable) must be noted in the permanent records.		
INSPECTION AFTER LIGHTNING STRIKE		
	Perform the following:	Prior to next flight.
CAUTION: *Propellers must be inspected and/or replaced utilizing the data provided in the manufacturers manuals prior to returning the airplane to service following any lightning strikes or other impact damage.*		
Propeller	1. At times the difficulty is not in inspecting the airplane, but in determining if a strike has occurred. Most times, an exit location will indicate possible damage to the components. The entry point is most often the propeller. A darkened area in the propeller tip may be noticeable after a lightning strike. A 3- to 5-power magnifier will show slag at the bottom of a nick in the propeller blade. If a strike is suspected, inspect deep nicks in the blade. Damage after a lightning strike should be corrected utilizing the procedure specified by the manufacturer.	
	2. Blade overhaul must be accomplished by a mechanic certified by propeller manufacturer. Damage beyond the limits specified by the propeller manufacturer may require the blade to be returned to the factory or to a designated repair facility for evaluation.	
Engine	Inspect as instructed in the appropriate Engine Maintenance Manual.	

UNSCHEDULED MAINTENANCE CHECK (Continued)

ITEM	INSPECTION REQUIREMENT	INSPECTION INTERVAL
INSPECTION AFTER LIGHTNING STRIKE *(Continued)*		
Fuselage	1. Carefully inspect the exterior of the airplane. Evidence of a strike will usually appear as a burned hole or as a series of burned holes in metallic surfaces. Plastic parts may be delaminated and/or deformed due to high internal pressures. Normally two or more points will be found, the entry and the exit points. Antennas are frequently an entry point of lightning and should be carefully inspected for evidence of arcing, sooting or pitting.	
	2. From the point of entry, the strike usually spreads aft in a series of small holes or burn marks. After the points of entry and exit are found, the structure between these points should be carefully inspected. Attention should be given to hinges and hinge pins for possible pitting. Cables, pulleys, bearings, bolts and all bonding jumpers in the area should be inspected for possible damage. Antennas, electrical and electronic equipment should be visually checked for damage and functionally checked for operation. If the strike was near the fuel vent, all plumbing should be carefully inspected for damage. Steel components may exhibit magnetism and require degaussing so as not to affect compass systems.	

CHAPTER

06

DIMENSIONS AND AREAS

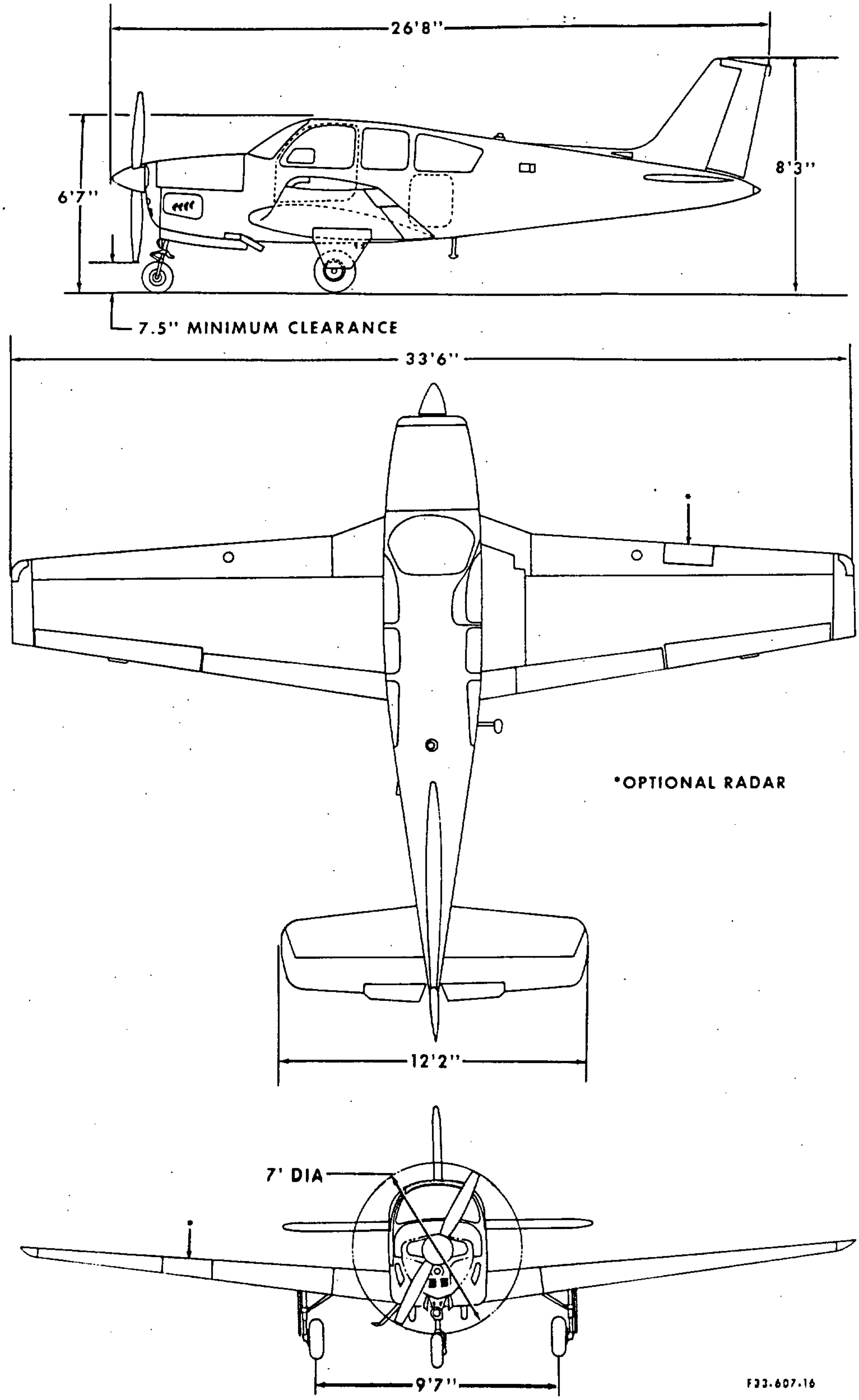
CHAPTER 6

LIST OF PAGE EFFECTIVITY

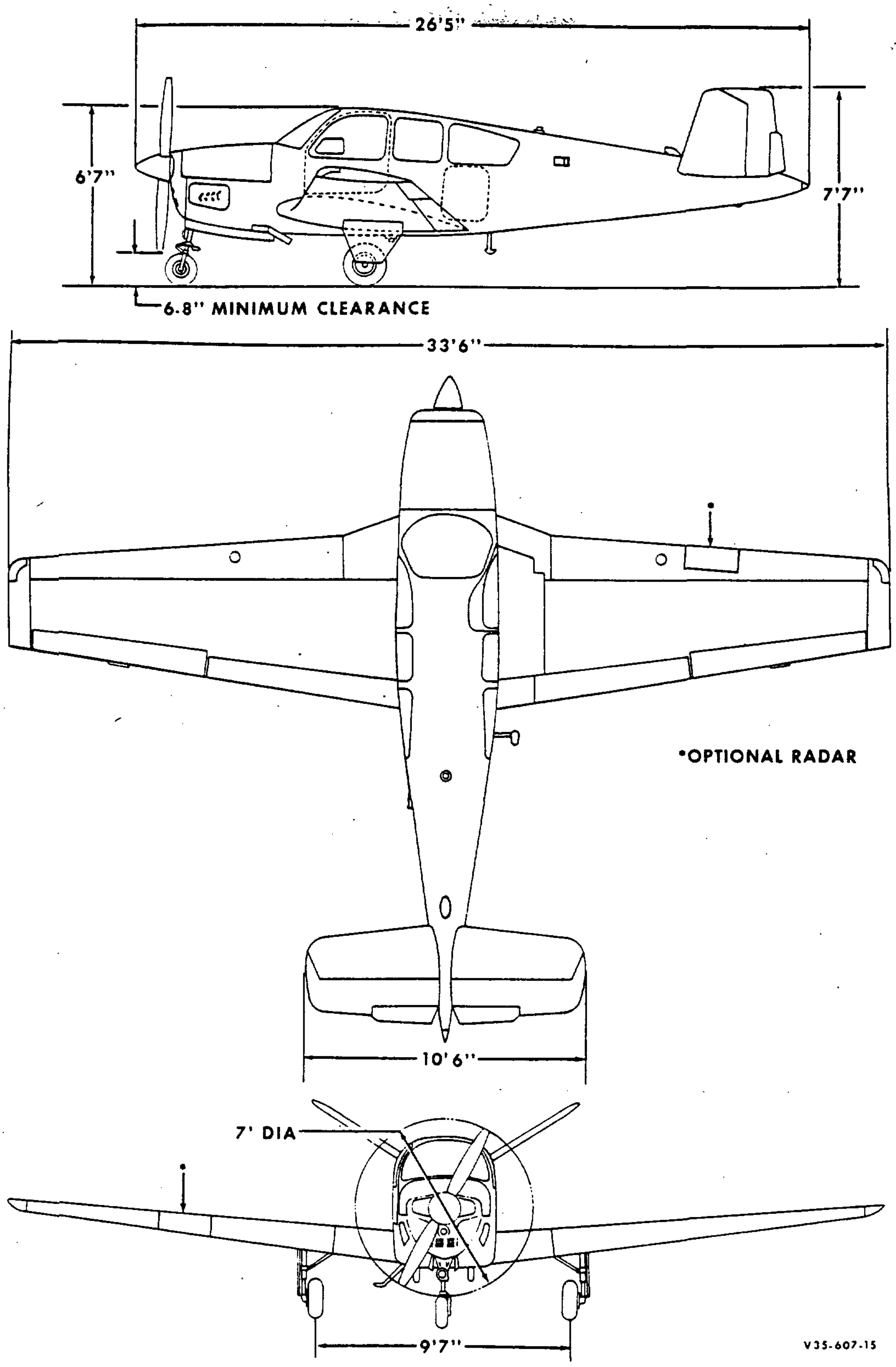
CHAPTER 6 - DIMENSIONS AND AREAS

TABLE OF CONTENTS

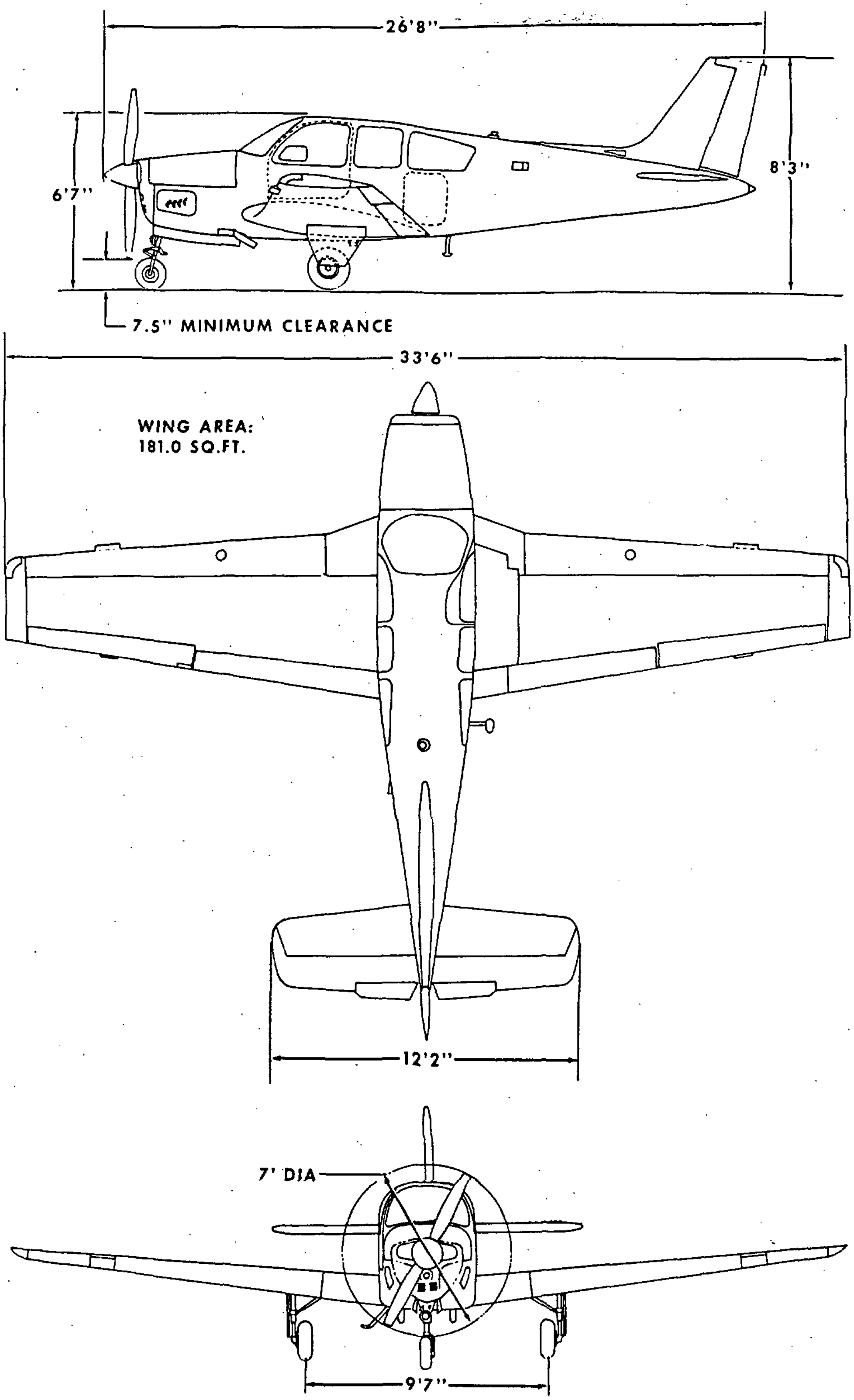
"END"



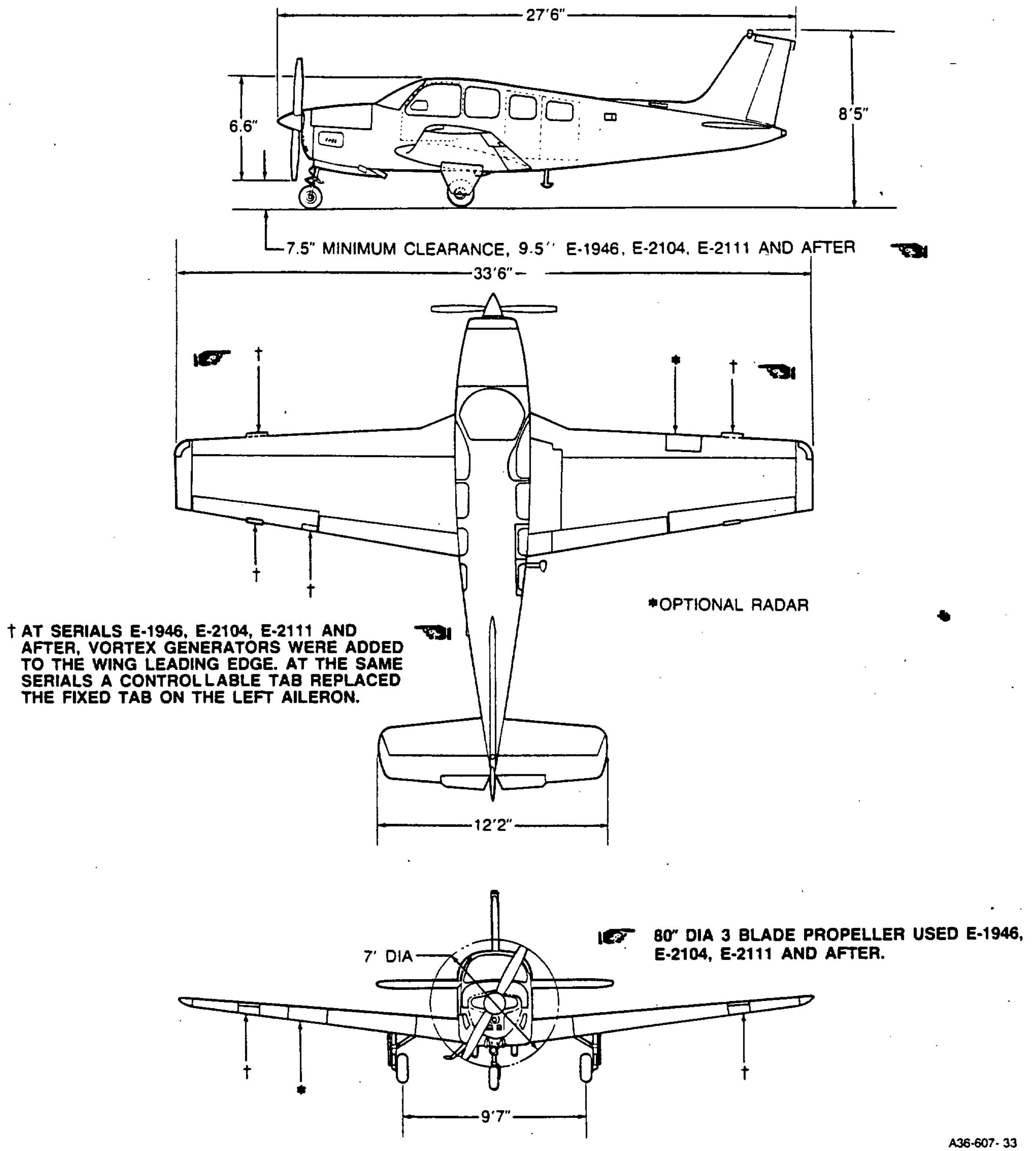
Airplane Dimensions (CE-748, CE-772 and after; CJ-149 thru CJ-155 Without Kit 33-4002-1)
Figure 1



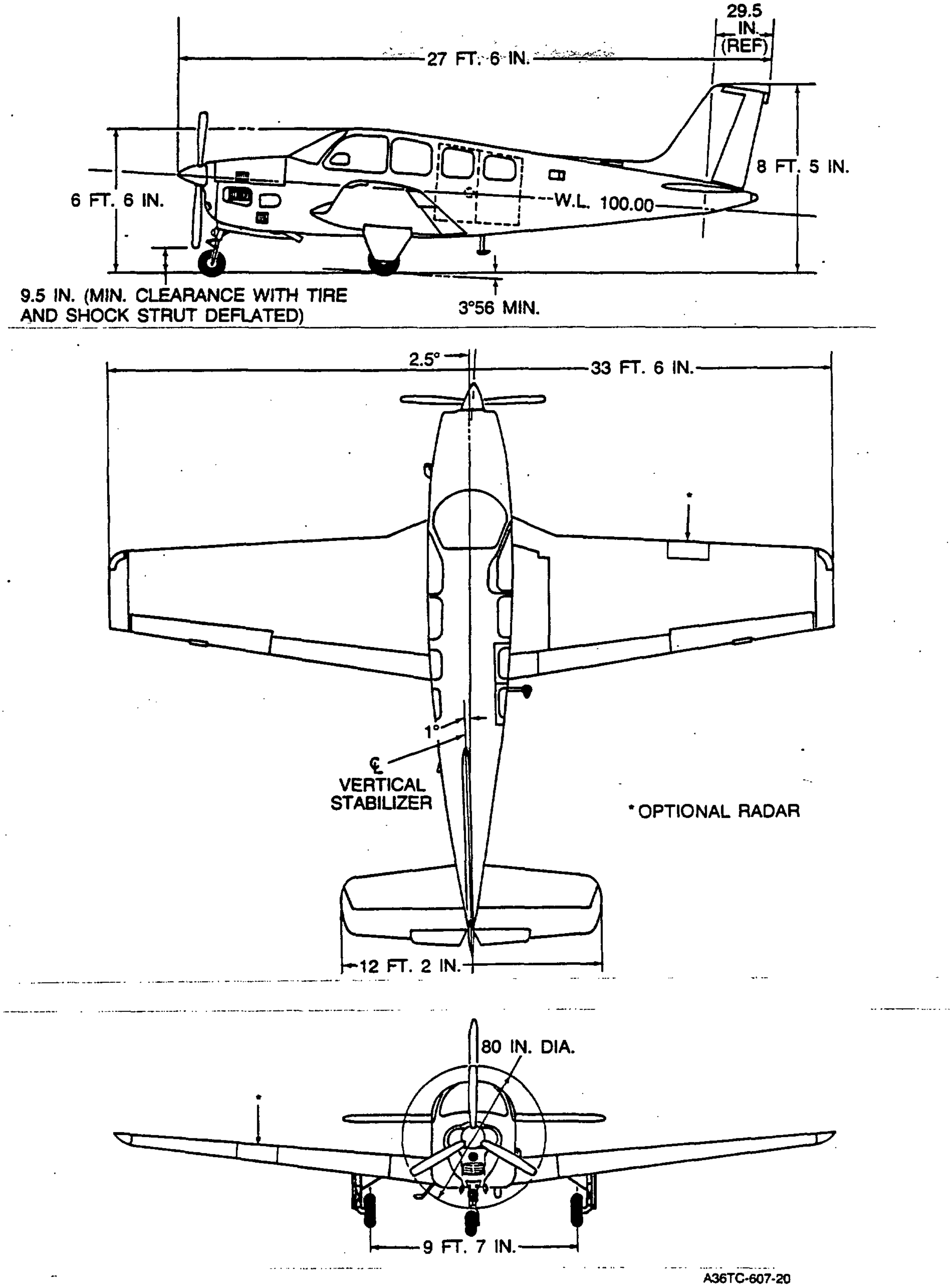
Airplane Dimensions (D-10097, D-10120 and after)
Figure 2



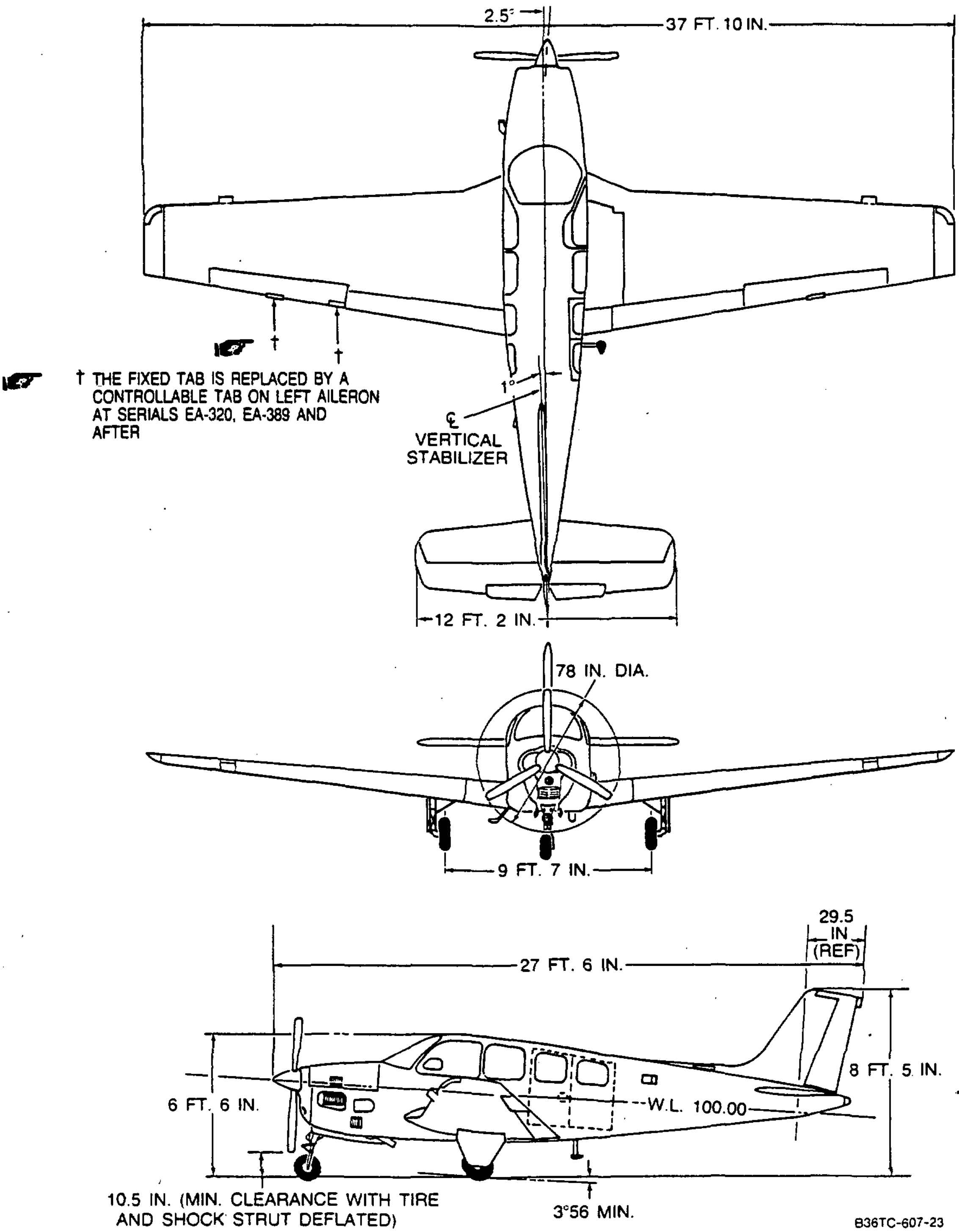
Airplane Dimensions (CJ-156 and after, and CJ-149 thru CJ-155 With Kit 33-4002-1)
Figure 2A



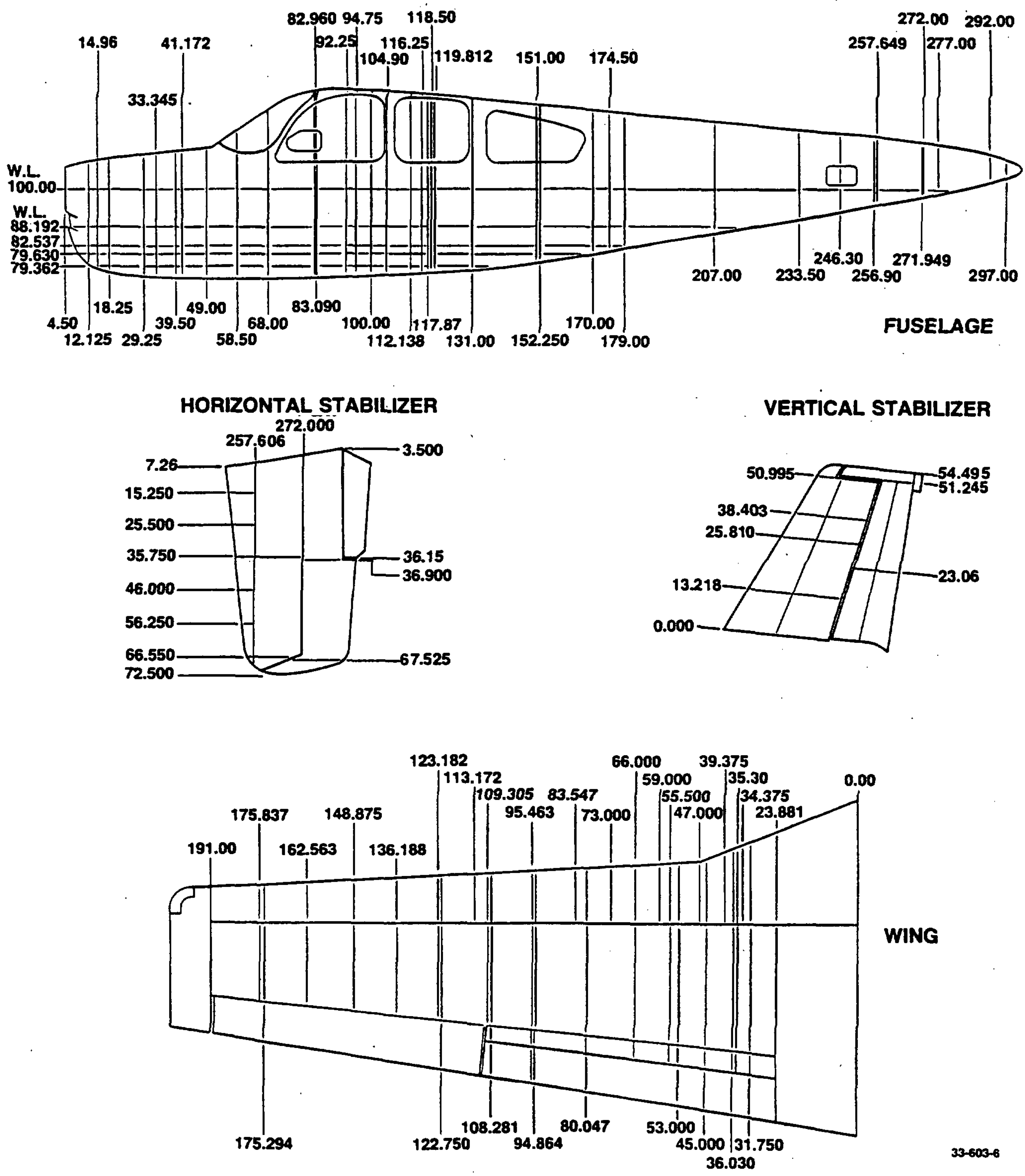
Airplane Dimensions (E-1111, E-1241 and after)
Figure 3



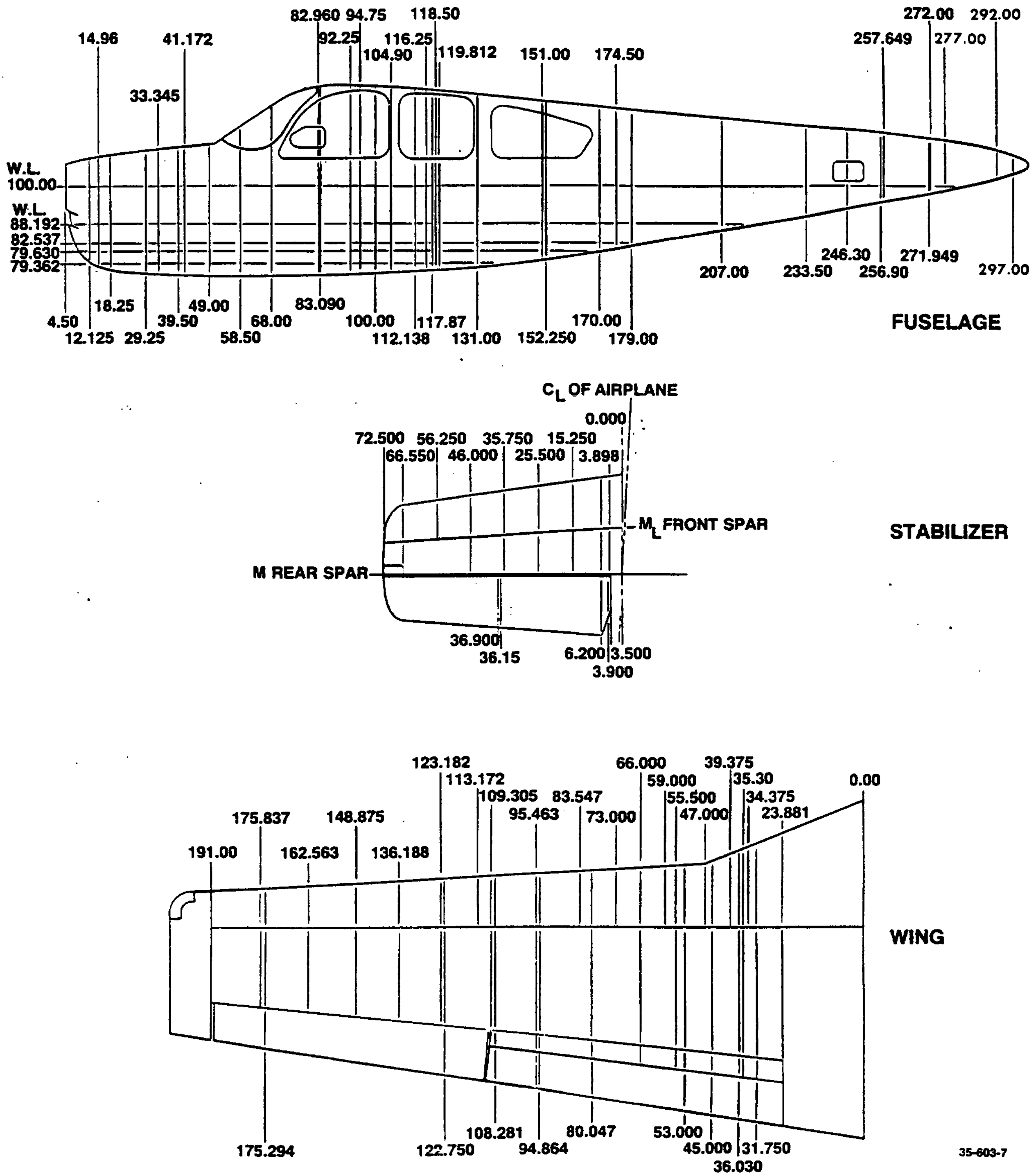
Airplane Dimensions (EA-1 thru EA-272 Except EA-242)
Figure 4



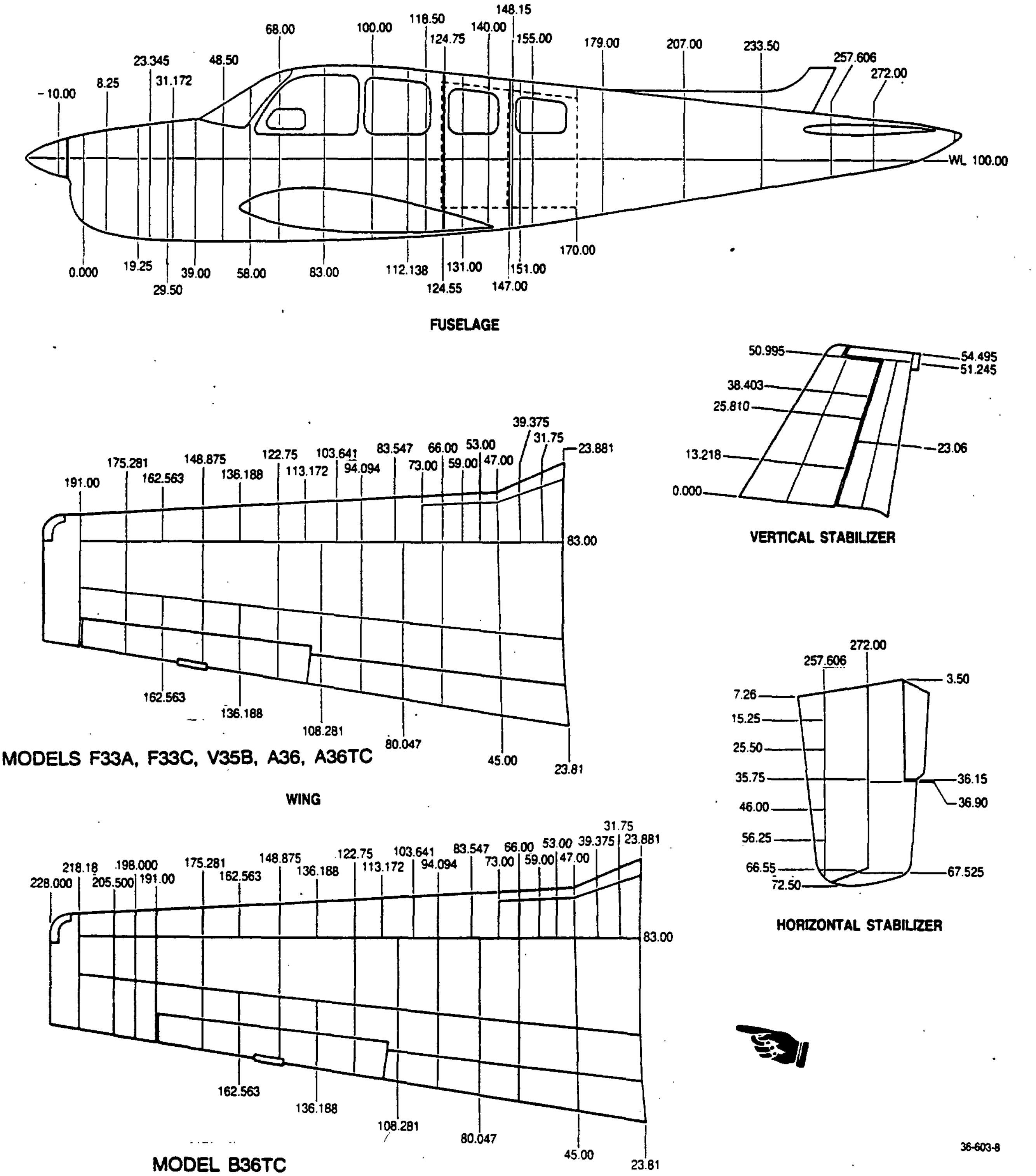
Airplane Dimensions (EA-242, EA-273 and after)
Figure 5



Stations Diagram (CE-748, CE-772 and after; CJ-149 and after)
Figure 6



Stations Diagram (D-10097, D-10120 and after)
Figure 7



Stations Diagram (E-1111, E-1241 and after; EA-1 and after)
Figure 8

"END"

CHAPTER

07

LIFTING AND SHORING

CHAPTER 7 - LIFTING AND SHORING

TABLE OF CONTENTS

SUBJECT *PAGE*

7-00-00

CHAPTER 7 - LIFTING AND SHORING

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
7-LOEP	1	Sep 30/03
7-CONTENTS	1	Sep 30/03
7-00-00	1 thru 4	Sep 30/03

LIFTING AND SHORING - MAINTENANCE PRACTICES

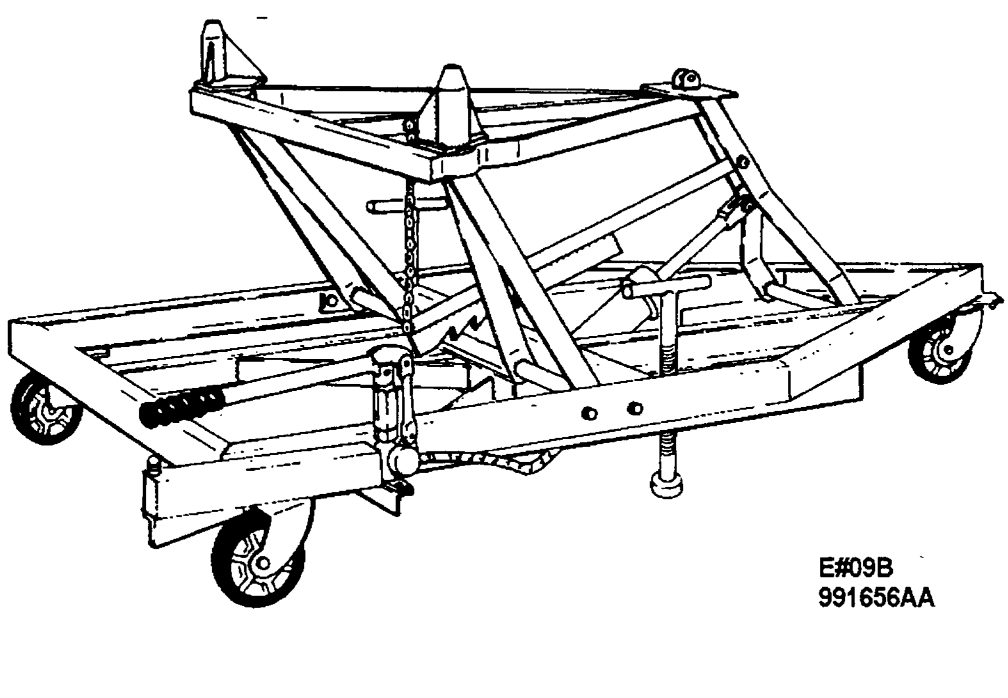
JACKING

WARNING

The landing gear struts do not incorporate internal stops. When the airplane is on jacks, do not attempt to remove the torque knees, the torque knee pins or the bolt connecting the torque knees without first deflating the shock absorber assembly and supporting the gear. The torque knees provide the extension stop for the lower shock absorber assembly. When they are disconnected, the cylinder is free to slide out of the upper assembly.

CAUTION

Jacking the landing gear should only be accomplished within an enclosed building or hangar. Should it become necessary to jack the airplane in the open, no more than one jack point should be utilized at a time. For safety of personnel and the airplane, wind velocity in any direction must be considered prior to jacking the airplane.



Model 300 Service Jack
Figure 1

A three point jack is used to lift the airplane off the ground (Ref. Figure 1). Each jack pad is identified and located on the underside of the fuselage. One jack pad is located on each of the lower wing-to-fuselage attachment fittings along the front spar. The rear jack fitting consists of an eye bolt that is screwed completely into the airplane.

WARNING

Be sure the rear jack point safety is in place and secured to prevent the airplane from nosing over. As an additional precaution against nosing over, attach, but not suspend, a weight of approximately 200 pounds to the aft tie-down lug.

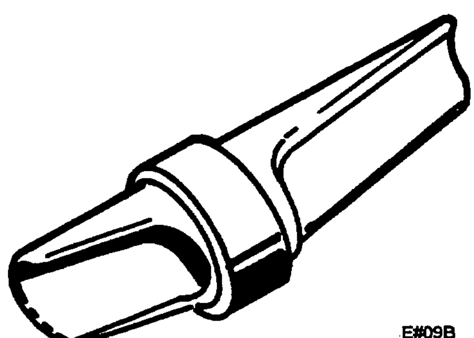
When one wing is to be removed, a stand should be placed under the opposite wing and the tail to counteract the resulting unbalanced condition of the airplane.

MAIN WHEEL JACKING

CAUTION

Do not walk on the wing walk with the airplane on the main wheel jack.

The main wheel jack adapter P/N 35-590006, is supplied as optional equipment (Ref. Figure 2). Before raising the airplane, be sure the shock strut is properly inflated to the correct height. If the strut is not inflated to the recommended height, it will be impossible to insert the jack adapter into the main wheel axle. A scissor type jack is recommended for individual wheel jacking.



E#09B
991657AA

Main Wheel Jack Adapter (P/N 35-590006)
Figure 2

CAUTION

When lowering the airplane, caution should be exercised to prevent the shock strut from becoming compressed and forcing the landing gear door against the jack adapter.

HOISTING

The airplane may be hoisted for maintenance or parts replacement as follows:

a. Install the hoisting sling fitting, P/N 35-590067, at each upper forward wing attach bolt location using bolts of the proper length with 5/8-18UNF threads.

b. Attach the hoisting sling assembly, P/N 35-590064-1, to the hoisting sling fittings (Ref. Figure 3).

c. Install the strap assembly around the propeller blade shanks.

d. Hoist the airplane smoothly.

NOTE

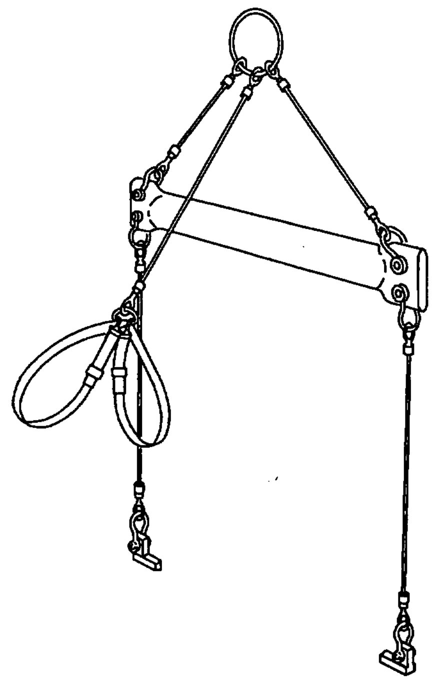
Adjust the strap assembly to keep the airplane in a level or slightly nose down attitude.

e. As an added precaution, a stand may be installed under the tail of the airplane.

CAUTION

A spreader must be used above the cabin to prevent damaging the door moulding and window frame.

If the airplane must be hoisted and the hoisting sling assembly, P/N 35-590064-1, is not available, remove the cabin door, the left front window and the front seats. Attach a sling to the front wing spar in the fuselage and a line to the hoist fitting on the engine.



Hoisting Sling Assembly P/N 35-590064-1
Figure 3

CHAPTER

08

LEVELING AND WEIGHING

CHAPTER 8

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
8-EFFECTIVITY/CONTENTS	1	May 9/80
8-00-00	1	May 9/80

CHAPTER 8 - LEVELING AND WEIGHING

TABLE OF CONTENTS

"END"

GENERAL - MAINTENANCE PRACTICES

LEVELING

To level the airplane longitudinally, attach a cord and plumb bob to the phillips head screw, located beneath the rear window on the left side of the airplane. Inflate or deflate the nose gear shock strut as necessary to pass the cord through the center of a second phillips head screw directly below. Suspending the plumb bob in a can of light engine oil will assist in stabilizing it.

Lateral leveling is accomplished by removing the front seat(s) and placing a bubble level on the spar carry thru structure. Deflate the tire or strut on the high side of the airplane to center the bubble.

"END"

CHAPTER

09

TOWING AND TAXIING

CHAPTER 9-TOWING AND TAXIING

TABLE OF CONTENTS

"END"

CHAPTER 9

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
9-EFFECTIVITY	1	Oct 16/92
9-CONTENTS	1	Oct 16/92
9-00-00	1	Oct 16/92

"END"

TOWING AND TAXIING - MAINTENANCE PRACTICES

TOWING

WARNING

If the engine is warm, and it is necessary to move the propeller to attach the tow bar, stand clear of the area of rotation and move the propeller against the normal direction of rotation. Make certain the magneto switch is off. While the engine is warm, residual fuel in the intake ports and injectors may ignite and cause the engine to kick.

CAUTION

When an airplane is being towed, a qualified person must be in the pilot's seat to operate the brakes in case of an emergency. When the airplane is being moved backward, do not apply the brakes abruptly. Tow the airplane slowly, avoiding sudden stops. Never tow or taxi the airplane with a flat strut. Even brief towing or taxiing with a deflated strut can cause severe damage to the strut.

NOTE

The top of the cabin door should not be used as a handhold while entering or leaving the cabin. Always open the storm window to relieve internal pressure when closing the door. Never leave the cabin door open on the ramp as wind gusts may damage the door.

ONE PERSON TOWING

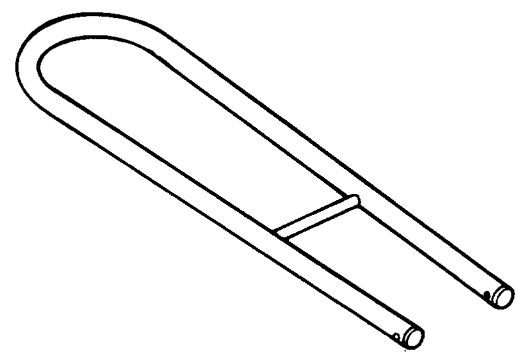
CAUTION

The Hand Tow Bar (Figure 1) must not be used with a tow vehicle.

One person can move the airplane easily on a smooth and level surface with the tow bar (P/N 36-590015) furnished with the airplane. Attach the tow bar to the tow pins on the nose gear lower torque knee and push or pull gently to move the airplane.

CAUTION

After moving the airplane, always remove the tow bar. Never turn the propeller with the tow bar attached to the nose gear as the propeller will hit the tow bar.



Hand Tow Bar
Figure 1

TOWING WITH A TRACTOR OR TUG

To tow the airplane with a tractor or tug, attach the tow bar (P/N 45-590075) to the tow pins on the nose gear lower torque knee. Always observe the turn limits of the nose gear when making turns. Turns geater than these limits can cause extensive damage to the nose gear and shimmy damper. Also, exercise care when removing the tow bar from the nose gear lower torque knee to prevent damage to the lubrication fittings on the torque knee.

NOTE

Do not attempt to tow the airplane backward by the fitting in the tail skid. The tail skid was designed only to protect the tail in the tail-low landing and to provide attachment for the tail tie-down.

TAXIING

The airplane must be taxied with the wing flaps up, and the engine cowl flaps open. Turning may be accomplished by the use of the nose wheel steering mechanism.

"END"

CHAPTER

10

PARKING, MOORING, STORAGE, RTN TO SVC.

CHAPTER 10- PARKING AND MOORING

TABLE OF CONTENTS

SUBJECT *PAGE*

10-00-00

CHAPTER 10 - PARKING AND MOORING

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
10-LOEP	1	Mar 31/05
10-CONTENTS	1 and 2	Mar 31/05
10-00-00	1 thru 6	Mar 31/05

GENERAL- MAINTENANCE PRACTICES

PARKING

The brakes are set for parking by pulling out the parking brake control, then pressing the pilot's brake pedals until firm. Do not attempt to lock the parking brake by applying force to the parking brake handle; it controls a valve only and cannot apply pressure to the brake master cylinders.

CAUTION: *Do not set the parking brake control when the brakes are hot from severe use or during low temperature when an accumulation of moisture may cause the brakes to freeze. An increase in outside air temperature can build up excessive pressure in the system. In addition, the parking brake should be left OFF and wheel chocks installed if the airplane is to be left unattended.*

MOORING

This section is designed to provide guidelines which can be followed when mooring and securing Bonanza series airplanes. Mooring procedures for normal tie-down operations as well as mooring for extended storage and high wind conditions follow:

NORMAL TIE-DOWN

On Bonanza series airplanes, a tie-down lug is installed on each wing, and on the aft fuselage. The tie-downs should be nylon or dacron ropes or chains with sufficient strength to restrain the airplane in high or gusty winds. Manila or hemp ropes should never be used. The tie-downs should allow very little or no movement when tightened, too much slack will allow the airplane to jerk against the tie-downs. When securing the tail section of the airplane, the tie-down should have a slight slack so that the nose of the airplane will not be raised off the ground. In a strong headwind, a tail tie-down that is too tight will increase the angle between the wing and the oncoming air. This creates an additional lifting force, which causes more pressure to be placed on the wing tie-down ropes and anchors. Adequate antislip knots such as bowlines or square knots should be used when securing the lines.

Securing operations should be planned so the airplane is tied down facing the prevailing wind, if the ground attachment permits. Once the airplane has been positioned into the wind, the wheels should be chocked fore and aft. The flight control surfaces must then be secured to prevent banging against the stops. The controls should be secured in position with control locks that are installed in the control column. When mooring, be sure to fasten all doors and windows properly. Pitot-static tubes should be covered.

EXTENDED STORAGE AND HIGH WIND

When mooring the Bonanza, the following method is recommended: Place chocks fore and aft of each main wheel. Position a tail stand under the tail skid, adjusting the height of the stand to slightly compress the nose gear shock strut. Run a line through each wing mooring lug, fastening each end to a ground point, one forward and one aft of the wing. Run a line through the hole in the tail skid and anchor at the sides of the airplane approximately 5 feet from the base of the stand. If a storm is anticipated, two lines may be secured to each main landing gear strut barrel near the V-brace and also a line may be attached around the nose gear strut near the lower torque knee. It is recommended that the airplane be tied down headed into the wind, with the control lock installed.

CONTROL LOCK

A control column lock pin is provided for the control column and the aileron control wheel. The lock pin secures both the aileron control wheel and the elevator control. A cover is provided on the control lock to cover the throttle control, boost pump, and the propeller control. Install the control lock assembly in the following sequence:

a. Rotate the control wheel to the right and move the column forward so the hole in the bracket and the column align to accept the pin.

b. Push the control column lock pin through the hole provided in the control column guide and into the control column.

c. Ensure positive retention of the lock pin by placing the cover assembly over the throttle control, boost pump, and the propeller control.

WARNING: Always completely remove the control lock assembly before engine start, taxiing, and flight.

STORAGE

The storage procedures listed are intended to protect the airplane from deterioration while it is not in use. The primary objectives of these measures are to prevent corrosion and damage from exposure to the elements. Three types of storage are considered:

a. FLYABLE STORAGE- 7 to 30 days.

b. TEMPORARY STORAGE- up to 90 days.

c. INDEFINITE STORAGE.

FLYABLE STORAGE - 7 TO 30 DAYS

a. MOORING- If the airplane cannot be placed in a hangar, install the control lock and tie the airplane down securely at the three points provided. Do not use hemp or manila rope. It is recommended a tail support be used to compress the nose strut and reduce the angle of attack of the wings. Attach a line to the nose gear.

b. ENGINE PREPARATION FOR STORAGE- Engines in airplanes that are flown only occasionally tend to exhibit cylinder wall corrosion much more than engines that are flown frequently.

   1. Check for correct oil level and add oil if necessary to bring level to full mark

   2. Run engine at least five minutes at 1,200 to 1,500 rpm with oil and cylinder head temperatures in the normal operating range.

WARNING: Before rotation of propeller blades, ascertain magneto switch is OFF, throttle in CLOSED position and mixture control is in the IDLE CUT-OFF position. Always stand in the clear while turning propeller.

c. DURING FLYABLE STORAGE- Each seven days during flyable storage, the propeller shall be rotated by hand. After rotating the engine six revolutions, stop the propeller 60 to 120° from the position it was in.

   1. If at the end of 30 days, the airplane will not be removed from storage, the engine should be started and run. The preferred method is to fly the airplane for 30 minutes in order to keep the internal parts of the engine lubricated. Ground running of the engine will not provide proper heating of the oil without possible damage to other engine compartment components due to lack of air flow, and will result in condensation of moisture in the oil supply, increasing the possibility of cylinder/crankshaft rust.

d. FUEL CELLS- Fill to capacity to minimize fuel vapor and protect cell inner liners.

e. FLIGHT CONTROL SURFACES- Lock with internal and external locks.

f. GROUNDING- Static ground airplane securely and effectively.

g. PITOT TUBE- Install cover.

h. WINDSHIELD AND WINDOWS- Close all windows and window vents. It is recommended that covers be installed over windshield and windows.

i. PREPARATION FOR SERVICE- Remove all covers and tape, clean the airplane and give it a thorough inspection, particularly wheel wells, flaps, and control openings.

   1. If the engine has a total time of more than 25 hours and the oil consumption has stabilized, drain the break-in oil after a ground warm-up and install oil per Teledyne Continental Motors Specification MHS-24C.

   2. Preflight the airplane.

TEMPORARY STORAGE - 30 TO 90 DAYS

a. MOORING- See FLYABLE STORAGE.

b. ENGINE PREPARATION FOR STORAGE- Operate engine (Preferably in flight) until oil temperature reaches normal range. Drain oil supply from sump while engine is still warm and replace drain plug.

   1. Fill the sump to the full mark on the dipstick gage with corrosion preventive oil (3, Chart 1, 91-00-00), which will mix with normal oil and provide protection against corrosion.

   2. Remove the top spark plug and atomize spray preservative oil (4, Chart 1, 91-00-00) at room temperature, through the upper spark plug hole of each cylinder with piston in the down position. Rotate crankshaft as each pair of cylinders is sprayed. Stop crankshaft with no piston at top position, and thoroughly respray each cylinder. Reinstall spark plugs.

   3. Apply preservative to engine interior by spraying the above specified oil (approximately two ounces) through the oil filler tube. Seal all engine openings exposed to the atmosphere using suitable plugs, or moisture resistant tape, and attach red streamers at each point. Affix a tag to the propeller in a conspicious place with the following notation; DO NOT TURN PROPELLER, ENGINE PRESERVED. Seal the propeller blade spinner cutouts with tape.

c. FUEL CELLS- Fill to capacity to minimize fuel vapor and protect cell inner liners.

d. FLIGHT CONTROL SURFACES- Lock with internal and external locks.

e. GROUNDING- Static ground airplane securely and effectively.

f. PITOT TUBE- Install cover.

g. WINDSHIELD AND WINDOWS- Close all windows and window vents. It is recommended cover be installed over windshield and windows.

h. BATTERY- Remove and store according to standard practices.

i. PREPARATION FOR SERVICE- Remove all covers, tape, and tags. Clean the airplane and give it a thorough inspection, particularly wheel wells, flaps, and control openings. With bottom spark plugs removed, hand turn propeller several revolutions to clear excess preservative oil, then reinstall plugs. Preflight the airplane and flight test.

INDEFINITE STORAGE

a. MOORING- See FLYABLE STORAGE.

b. ENGINE PREPARATION FOR INDEFINITE STORAGE- Drain the engine oil and service with corrosion preventive oil (3, Chart 1, 91-00-00).

   1. Immediately after servicing with the corrosion preventive oil, fly the airplane for a period of time not to exceed a maximum of 30 minutes.

   2. It is recommended the propeller be removed and the engine removed from the airplane. The propeller shaft should be coated with preservative oil (4, Chart 1, 91-00-00) and wrapped with moisture proof material and tape.

      NOTE: If engine is removed from the airplane, a tail mooring stand must be used.

   3. Remove the top spark plug from each cylinder and spray thoroughly with corrosion preventive oil (3, Chart 1, 91-00-00), at a temperature range of 221 to 250°F.

   4. Install protex plugs in each of the top spark plug holes, making sure that each plug is blue in color when installed. Protect and support the spark plug leads with AN-4060-1 protectors.

   5. Place a bag of desiccant in the exhaust pipes and seal openings with moisture resistant tape.

   6. Seal cold air inlet to the heater muff with moisture resistant tape.

   7. Seal engine breather by inserting a protex plug in the breather hose and clamping in place.

   8. Wrap engine with moisture proof material and tape after desiccant bags have been installed.

   9. Attach a red streamer to each place on the engine where bags of desiccant are placed. Either attach red streamers outside of the sealed area with tape or to the inside of sealed area with safety wire to prevent wicking of moisture into sealed area.

   10. If the propeller has not been removed, affix a tag in a conspicuous place with the following notation: DO NOT TURN PROPELLER- ENGINE PRESERVED.

c. DURING INDEFINITE STORAGE- The cylinder protex plugs shall be inspected weekly. The plugs should be changed as soon as their color indicates unsafe conditions of storage. If the dehydrator plugs have changed color in one-half or more of the cylinders, all desiccant material on the engine should be replaced.

   1. The cylinder bores should be resprayed with corrosion preventive oil every six months or more frequently if bore inspection indicates corrosion has started. Replace all desiccant and protex plugs. Before spraying, the engine shall be inspected for corrosion as follows: Inspect the interior of at least one cylinder on the engine through a spark plug hole. If cylinder shows start of rust, spray cylinder with corrosion preventive oil (3, Chart 1, 91-00-00) and turn prop over five or six times, then respray. Remove the rocker box cover from the engine and inspect the valve mechanism.

d. PROPELLER- Coat blades with preservative oil and wrap with moisture proof material and tape. If propeller has been removed, coat all parts with protective material to exclude dust, and then tape.

e. FUEL CELLS- Drain fuel cells.

   1. Flush, spray, or rub a thin coating of light engine oil on the inner liners of all fuel cells which have contained gasoline.

   2. After 24 hours, remove cells and store according to standard practices. Do not remove or handle fuel cells until 24 hours after oil has been applied.

f. FLIGHT CONTROL SURFACES- Lubricate all flight control surface hinge pins, bearings, bellcranks, chains, control rods and quadrants and coat lightly with corrosion preventive compound (5, Chart 1, 91-00-00).

   1. Lock with internal and external control locks.

g. GROUNDING- Static ground airplane securely and effectively.

h. PITOT TUBE- Apply a thin coating of grease (6, Chart 1, 91-00-00), and install cover.

i. WINDSHIELD AND WINDOWS- Close all windows and window vents and install covers over windshield and windows.

j. LANDING GEAR- Coat the extended portion of the shock struts with light weight oil.

k. TIRES- Install covers. Check air pressure periodically. Inflate as necessary.

l. WING FLAP TRACKS AND ROLLERS- Coat with corrosion preventive compound. Place flaps in retracted position.

m. BATTERY- Remove and store according to standard practices.

n. INSTRUMENT PANEL- Cover with barrier material and secure with tape.

o. SEATS- Install protective covers.

p. LANDING LIGHTS- Cover with barrier material and secure with tape.

q. STALL WARNING UNIT- Remove and store according to standard practices. Tape connections.

r. LOOSE TOOLS AND EQUIPMENT- Remove and store in a dry temperate room.

s. AIRFRAME- Cover static ports and all openings with barrier material and secure with tape to exclude rain, sun, and foreign matter.

PREPARATION FOR SERVICE

a. Remove all covers, tape, and tags from the airplane.

b. Remove all cylinder plugs and all paper, tape, and dehydrating agent used to preserve engine.

c. Drain corrosion preventive oil and reservice with recommended lubricating oil, per Teledyne Continental Motors MHS-24C.

d. Reinstall the propeller if it was removed. Rotate propeller to clear excess preservative oil from the cylinders.

e. Install the spark plugs, battery, and rotate propeller by hand through all compressions of the engine to check for liquid lock. Reinstall cowling and start engine in the normal manner.

f. Give the airplane a thorough cleaning, visual inspection and test fly the airplane.

CHAPTER

11

PLACARDS AND MARKINGS

CHAPTER 11 - PLACARDS

TABLE OF CONTENTS

"END"

CHAPTER 11

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
11-EFFECTIVITY	1	Oct 16/92
11-CONTENTS	1	Oct 16/92
11-00-00	1	Oct 16/92
11-20-00	1	May 9/80
	2	Oct 16/92
	3	Oct 16/92
	4	Oct 16/92
	5	Oct 16/92
	6	Oct 16/92

"END"

REQUIRED PLACARDS - DESCRIPTION AND OPERATION

FAA REQUIRED PLACARDS AND MARKINGS

All required interior placards and markings are listed in the Limitations of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual. Refer to Section II of the applicable Pilot's Operating Handbook for these placards and markings. For the acrobatic Bonanza (CJ-149 and after), also refer to the LOG OF SUPPLEMENTS in the Pilot's Operating Handbook.

CAUTION

Any time an airplane is repainted, inspect all placards to assure that they are not covered with paint, are easily readable, and are securely attached.

MODEL DESIGNATION PLACARD

The model designation placard identifies the airplane by its model number and serial number. Should a question arise concerning the care of this airplane, it is important to include the airplane serial number in any correspondence to Beech Aircraft Corporation. Refer to Chapter 11-20-00 for illustration of the placard. On airplanes D-10097, D-10120 and after; EA-1 thru EA-272 except EA-242; CJ-149 and after; CE-748, CE-772 thru CE-1200; E-1111, E-1241 thru E-2399; and EA-242, EA-273 thru EA-472, the model designation placard is located on the right side of the fuselage adjacent to the inboard end of the flap.

On airplanes CE-1201 and after, E-2400 and after, and EA-473 and after, the model designation placard is located on the right side of the fuselage under the leading edge of the horizontal stabilizer. The placard is mounted .50-inch below the skin lap and 12-inches forward of the tail cone.

"END"

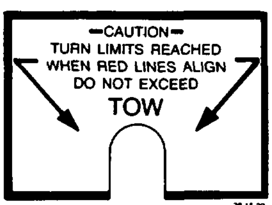
EXTERIOR PLACARDS AND MARKINGS - DESCRIPTION AND OPERATION

Shown in this Chapter are exterior placards and markings, which are essential for good maintenance practices, followed by location/description of each. The placards which follow are shown for location only and may or may not bear identical information to the placards installed on the various individual models. Note the specific information on the placards installed on each model to determine current information for that model.

IMPORTANT
INSTALL DOOR
LINK ROD BOLT
WITH HEAD AFT.

36-15-14

LOCATED ON THE OUTBOARD SIDE OF THE ROOT RIB IN THE WHEEL WELL, VISIBLE ABOVE THE INBOARD DOOR



36-15-22

LOCATED DIRECTLY ABOVE THE NOSE LANDING GEAR TORQUE KNEE

L P
E O
V I
E N
L T

36-15-25

LOCATED ON THE LH SIDE OF THE FUSELAGE AT APPROXIMATELY FS 151.00 (2 PLACES)

JACK ATTACH POINT

LOCATED IN THE CENTER OF THE UNDERSIDE OF THE FUSELAGE AT APPROXIMATELY FS 131.00

JACK PAD

36-15-24

LOCATED AT WING ROOT ON CENTER SECTION SPAR, FORWARD OF THE INBOARD WHEEL WELL DOOR

IMPORTANT
INSTALL UPLOCK
CABLE ATTACH BOLT
WITH HEAD AFT

36-15-26

LOCATED AT APPROXIMATELY WS 60.00 IN EACH WHEEL WELL, DIRECTLY ABOVE THE UPLOCK ASSEMBLY

Beechcraft
OIL AIR STRUT
PART NO. 35-825195
BEECH AIRCRAFT CORPORATION
WICHITA, KANSAS, USA

INSTRUCTIONS
TO CHECK FLUID AND FILL
REMOVE VALVE CAP, DEPRESS VALVE CORE AND ALLOW STRUT TO FULLY COMPRESS. THEN RAISE AND BLOCK STRUT ¼ INCH FROM COMPRESSED POSITION. REMOVE VALVE BODY ASSEMBLY AND FILL WITH HYDRAULIC OIL CONFORMING TO INSTRUCTION MANUAL SPECIFICATIONS. SLOWLY EXTEND STRUT FROM BLOCKED POSITION AND REPLACE VALVE BODY ASSEMBLY. DEPRESS VALVE CORE AND COMPLETELY COMPRESS STRUT TO RELEASE EXCESS AIR AND OIL. WITH AIRPLANE EMPTY EXCEPT FOR FULL FUEL AND OIL KEEP STRUT INFLATED TO 3½ INCHES OF PISTON SHOWING.
WARNING
RELEASE AIR IN STRUT BEFORE DISASSEMBLING

BUILT UNDER ONE OR MORE OF THE FOLLOWING BEECH PATENTS: 2368137, 2412885, OR 2470616; OTHER PATENTS PENDING.

36-15-11

CE-748 THRU CE-979; CJ-143 THRU CJ-155; E-1111, E-1241 THRU E-1969; D-10097, D-10120 THRU D-10396; EA-1 THRU EA-272.
LOCATED ON THE NOSE LANDING GEAR STRUT

Beechcraft
OIL AIR STRUT
PART NO 36-820020
BEECH AIRCRAFT CORPORATION
WICHITA KANSAS USA

INSTRUCTIONS
TO CHECK FLUID AND FILL
REMOVE VALVE CAP. DEPRESS VALVE CORE AND ALLOW STRUT TO FULLY COMPRESS. THEN RAISE AND BLOCK STRUT ¼ INCH FROM COMPRESSED POSITION. REMOVE VALVE BODY ASSEMBLY AND FILL WITH HYDRAULIC OIL CONFORMING TO INSTRUCTION MANUAL SPECIFICATIONS. SLOWLY CYCLE STRUT TO DISPLACE TRAPPED AIR REPEAT UNTIL ADDITIONAL OIL CANNOT BE ADDED WITH STRUT EXTENDED REPLACE VALVE BODY ASSY DEPRESS VALVE CORE AND COMPLETELY COMPRESS STRUT TO RELEASE EXCESS AIR AND OIL

WITH AIRPLANE EMPTY EXCEPT FOR FULL FUEL AND OIL KEEP STRUT INFLATED TO 5 INCHES OF PISTON SHOWING.

WARNING
RELEASE AIR IN STRUT BEFORE DISASSEMBLING

D-10397 AND AFTER; CJ-156 AND AFTER; E-1970 AND AFTER; CE-980 AND AFTER. EA-273 AND AFTER;

LOCATED ON THE NOSE LANDING GEAR STRUT

SEE CHAPTER 12 OR 32 FOR CORRECT EXTENSION

Beechcraft
OIL AIR STRUT
PART NO 35-815247-29
BEECH AIRCRAFT CORPORATION
WICHITA KANSAS USA
INSTRUCTIONS
TO CHECK FLUID AND FILL
REMOVE VALVE CAP DEPRESS VALVE CORE AND ALLOW STRUT TO FULLY COMPRESS THEN RAISE AND BLOCK STRUT ¼ INCH FROM COMPRESSED POSITION REMOVE VALVE BODY ASSEMBLY AND FILL WITH HYDRAULIC OIL CONFORMING TO INSTRUCTION MANUAL SPECIFICATIONS SLOWLY EXTEND STRUT FROM BLOCKED POSITION AND REPLACE VALVE BODY ASSEMBLY DEPRESS VALVE CORE AND COMPLETELY COMPRESS STRUT TO RELEASE EXCESS AIR AND OIL WITH AIRPLANE EMPTY, EXCEPT FOR FULL FUEL AND OIL KEEP STRUT INFLATED TO 3 INCHES OF PISTON SHOWING
WARNING
RELEASE AIR IN STRUT BEFORE DISASSEMBLING

36-15-12

LOCATED ON THE RIGHT MAIN LANDING GEAR STRUT

Beechcraft
OIL AIR STRUT
PART NO 35-815247-27
BEECH AIRCRAFT CORPORATION
WICHITA KANSAS USA
INSTRUCTIONS
TO CHECK FLUID AND FILL
REMOVE VALVE CAP DEPRESS VALVE CORE AND ALLOW STRUT TO FULLY COMPRESS THEN RAISE AND BLOCK STRUT ¼ INCH FROM COMPRESSED POSITION REMOVE VALVE BODY ASSEMBLY AND FILL WITH HYDRAULIC OIL CONFORMING TO INSTRUCTION MANUAL SPECIFICATIONS SLOWLY EXTEND STRUT FROM BLOCKED POSITION AND REPLACE VALVE BODY ASSEMBLY DEPRESS VALVE CORE AND COMPLETELY COMPRESS STRUT TO RELEASE EXCESS AIR AND OIL. WITH AIRPLANE EMPTY, EXCEPT FOR FULL FUEL AND OIL KEEP STRUT INFLATED TO 3 INCHES OF PISTON SHOWING
WARNING
RELEASE AIR IN STRUT BEFORE DISASSEMBLING

36-15-13

LOCATED ON THE LEFT MAIN LANDING GEAR STRUT

C9101542

NOTICE
WING BOLTS ARE LUBRICATED
SEE MAINTENANCE MANUAL
FOR CORRECT TORQUE VALUES

ON AIRPLANES CE-950 AND AFTER, CJ-156 AND AFTER, D-10372 AND AFTER, E-1847 AND AFTER, EA-221 AND AFTER.

LOCATED ON THE LEFT WING NEAR THE FOUR WING ATTACH BOLTS AND ON THE RIGHT WING NEAR THE TWO LOWER ATTACH BOLTS. ALSO LOCATED ON THE RIGHT SIDE OF THE FUSELAGE NEAR THE TWO UPPER WING ATTACH BOLTS.

EMERGENCY LOCATOR TRANSMITTER SWITCH

ARM – OFF – ON

FOR AVIATION EMERGENCY USE ONLY.
UNLICENSED OPERATION UNLAWFUL.
OPERATION IN VIOLATION OF FCC
RULES SUBJECT TO FINE OR LICENSE
REVOCATION.

LOCATED ON THE RIGHT SIDE OF THE FUSELAGE FORWARD AND BELOW THE STABILIZER ON AIRPLANES: EA-1 AND EA-2; CE-748, CE-772 THRU CE-828; E-1111, E-1241 THRU E-1406; D-10097, D-10120 THRU D-10196 AND CJ-149 EXCEPT AIRPLANES WITH KITS 101-3046 OR 101-3127 INSTALLED.

EMERGENCY LOCATOR TRANSMITTER SWITCH

REARM – ARM – XMIT

FOR AVIATION EMERGENCY USE ONLY.
UNLICENSED OPERATION UNLAWFUL.
OPERATION IN VIOLATION OF FCC
RULES SUBJECT TO FINE OR LICENSE
REVOCATION.

LOCATED ON THE RIGHT SIDE OF THE FUSELAGE FORWARD AND BELOW THE STABILIZER ON AIRPLANES: D-10197 THRU D-10346; EA-3 THRU EA-80; E-1407 THRU E-1686; CE-829 THRU CE-905 AND CJ-150 THRU CJ-155 EXCEPT AIRPLANES WITH KITS 101-3046 OR 101-3127 INSTALLED.

EMERGENCY LOCATOR TRANSMITTER SWITCH

XMIT – ARM

FOR AVIATION EMERGENCY USE ONLY.
UNLICENSED OPERATION UNLAWFUL.
OPERATION IN VIOLATION OF FCC
RULES SUBJECT TO FINE OR LICENSE
REVOCATION.

LOCATED ON THE RIGHT SIDE OF THE FUSELAGE FORWARD AND BELOW THE STABILIZER ON AIRPLANES D-10347 AND AFTER; EA-81 THRU EA-411; E-1687 THRU E-2147; CE-906 THRU CE-1032 AND AIRPLANES WITH KIT NO. 101-3046 EXCEPT AIRPLANES WITH KIT NO. 101-3127 INSTALLED.

EMERGENCY LOCATOR TRANSMITTER SWITCH

TEST AUTO XMIT

FOR AVIATION EMERGENCY USE ONLY.
UNLICENSED OPERATION UNLAWFUL.
OPERATION IN VIOLATION OF FCC
RULES SUBJECT TO FINE OR LICENSE
REVOCATION.

LOCATED ON THE RIGHT SIDE OF THE FUSELAGE FORWARD AND BELOW THE STABILIZER ON AIRPLANES: E-2148 THRU E-2423; EA-412 THRU EA-479; CE-1033 THRU CE-1240 AND CJ-156 THRU CJ-179 EXCEPT AIRPLANES WITH KITS 101-3046 OR 101-3127 INSTALLED.

C9200973

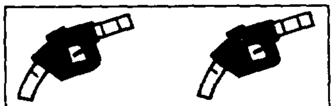
EMERGENCY LOCATOR TRANSMITTER
SWITCH

TEST ARM XMIT

FOR AVIATION EMERGENCY USE ONLY.
UNLICENSED OPERATION UNLAWFUL.
OPERATION IN VIOLATION OF FCC
RULES SUBJECT TO FINE OR LICENSE
REVOCATION.

LOCATED ON THE RIGHT SIDE OF THE FUSELAGE FORWARD AND BELOW THE STABILIZER ON AIRPLANES: CE-1241 THRU CE-1646; E-2424 THRU E-2693 AND EA-480 THRU EA-530 EXCEPT AIRPLANES WITH KIT 101-3127 INSTALLED.

AVGAS ONLY



FOR ALTERNATE FUELS SEE
PILOTS OPERATING HANDBOOK

CAPACITY 40 US GALLONS (37 USABLE)
WITH WINGS LEVEL

CAP. TO TAB BOTTOM 30 GAL (27 USABLE)

CAP. TO TAB SLOT 35 GAL (32 USABLE)

CAUTION

DO NOT INSERT
FUEL NOZZLE
MORE THAN 3"
INTO TANK

80 GALLON FUEL SYSTEM
ON AIRPLANES D-10303 AND AFTER;
EA-33 THRU EA-272 EXCEPT EA-242;
CE-884 AND AFTER;
CJ-156 AND AFTER; AND
E-1594 AND AFTER

EMERGENCY LOCATOR TRANSMITTER
SWITCH

ARMED/
RESET ON

FOR AVIATION EMERGENCY USE ONLY.
UNLICENSED OPERATION UNLAWFUL.
OPERATION IN VIOLATION OF FCC
RULES SUBJECT TO FINE OR LICENSE
REVOCATION.

LOCATED ON THE RIGHT SIDE OF THE FUSELAGE FORWARD AND BELOW THE STABILIZER ON AIRPLANES: CE-1647 AND AFTER; E-2694 AND AFTER; EA-531 AND AFTER AND AIRPLANES WITH KIT 101-3127 INSTALLED.

AVGAS ONLY

FOR ALTERNATE FUELS SEE
PILOTS OPERATING HANDBOOK

DEPRESS FLAPPER
CHECK QUANTITY & SECURE CAP

CAUTION

DO NOT INSERT FUEL NOZZLE
MORE THAN 1½" INTO TANK

PLACE INBOARD OF FILLER CAP

FUEL

54 US GAL CAPACITY

(51 US GAL USABLE)

PLACE DECAL AFT OF FILLER CAP
108 GALLON FUEL SYSTEM
ON AIRPLANES EA-242,
EA-273 AND AFTER

C9200974

FUEL

AVIATION GASOLINE

GRADE 100LL or 100

FOR ALTERNATE FUELS SEE
PILOTS OPERATING MANUAL

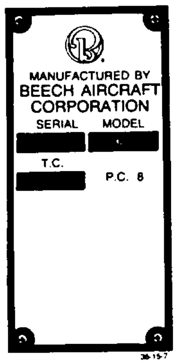
CAPACITY 25 US GALLONS (22 USABLE)

CAUTION

**DO NOT INSERT FUEL NOZZLE
MORE THAN 3" INTO TANK**

50 GALLON FUEL SYSTEM
ON AIRPLANES D-10097; D-10120 THRU D-10302;
EA-1 THRU EA-32;
CE-748, CE-772 THRU CE-883;
CJ-149 THRU CJ-155; AND
E-1111, E-1241 THRU E-1593

C9200975



THE MODEL DESIGNATION PLACARD IS LOCATED ON THE RIGHT SIDE OF THE FUSELAGE ADJACENT TO THE INBOARD END OF THE FLAP ON AIRPLANES D-10097, D-10120 AND AFTER; EA-1 THRU EA-272; CJ-149 AND AFTER; CE-748, CE-772 THRU CE-1200; E-1111, E-1241 THRU E-2399; AND EA-273 THRU EA-472.

THE MODEL DESIGNATION PLACARD IS LOCATED ON THE RIGHT SIDE OF THE FUSELAGE UNDER THE LEADING EDGE OF THE HORIZONTAL STABILIZER ON AIRPLANES CE-1201 AND AFTER, E-2400 AND AFTER, AND EA-473 AND AFTER.

PULL TO
CHECK LATCH

LOCATED NEAR THE FORWARD HANDLE OF EACH COWLING DOOR

CAUTION
MAGNETO IS NOT INTERNALLY GROUNDED. CONSULT OWNERS MANUAL BEFORE DISCONNECTING.

LOCATED ON THE INSIDE OF EACH COWLING DOOR, ON THE AFT SIDE. THIS PLACARD IS VISIBLE WHEN EITHER DOOR IS OPEN

NO STEP

INBOARD END LEFT FLAP, JUST OUTBOARD WALKWAY ON RIGHT FLAP, 4 INCHES OUTBOARD OF FUSELAGE NEAR WING LEADING EDGE.

EXTERNAL
POWER
24 VOLT

LOCATED ON THE RIGHT SIDE OF THE ENGINE COMPARTMENT, JUST BELOW THE COWLING DOOR

USE ONLY MS20392-2C25 OR AN393-25
SHEAR PIN WITH THIS PLUNGER ASSY

LOCATED ON THE NOSE LANDING GEAR RETRACT LINK ROD

STATIC AIR.
KEEP CLEAN

LOCATED ON THE LEFT SIDE OF THE FUSELAGE JUST AFT AND BELOW THE REAR WINDOW

OIL
USE SAE 50 ABOVE 40° F
USE SAE 30 BELOW 40° F

LOCATED ON THE INSIDE OF THE LEFT COWLING DOOR, ON THE FORWARD SIDE. THE PLACARD IS VISIBLE WHEN THE DOOR IS OPEN

FUEL CELL SUMP
DRAIN DAILY

LOCATED ON THE UNDERSIDE OF EACH WING NEAR THE FUSELAGE

FUEL STRAINER
DRAIN DAILY

LOCATED ON THE LEFT SIDE OF THE FUSELAGE JUST BELOW THE LEADING EDGE OF THE WING

NO HANDLE

ON TOP SURFACE NEAR OUTBOARD END OF EACH HORIZONTAL STABILIZER.

C9200972

"END"

CHAPTER

12

SERVICING

CHAPTER 12- SERVICING

TABLE OF CONTENTS

CHAPTER 12- SERVICING
TABLE OF CONTENTS (Continued)

SUBJECT *PAGE*

CHAPTER 12 - SERVICING

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
12-LOEP	1	Mar 31/05
12-CONTENTS	1 and 2	Mar 31/05
12-00-00	1	May 9/80
12-10-00	1 thru 7	Mar 31/05
12-20-00	1	May 9/80
	2	Jun 20/91
	3 thru 5	Aug 28/87
	6 and 6A	Sep 27/84
	7	Oct 7/83
	8	May 9/80
	9, 10, and 10A	Aug 29/85
	11	Oct 7/83
	12 thru 14	May 9/80
	15 thru 18	Oct 7/83
	19 thru 21	Jan 18/84
	22	Aug 29/85

GENERAL - DESCRIPTION AND OPERATION

The information contained within this chapter pertains to the general servicing procedures and maintenance practices used when servicing the various systems of the airplane. Detailed maintenance information pertaining to these systems will be found in the applicable chapters. Overhaul information for components of several systems will be contained within this manual. For electrical wiring diagrams refer to the BONANZA F33A, F33C, V35B & A36 Wiring Diagram Manual, P/N 35-590102-9.

"END"

REPLENISHING - MAINTENANCE PRACTICES

FILLING THE FUEL CELLS

CAUTION: *Any time the fuel system is drained or a fuel cell is empty for any reason, air may enter the system. If the possibility that air has entered the system does exist, start and operate the engine on the ground until all air is removed from the system. Operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the Pilot's Operating Handbook and Airplane Flight Manual before starting and operating the engine.*

Either the 44-gallon-usable (50-gallon-capacity) standard fuel system or the 74-gallon-usable (80-gallon-capacity) optional fuel system is available for all Bonanzas except EA-242, EA-273 and After. At serials EA-242, EA-273 and After, (B36TC) a 102-gallon-usable (108-gallon-capacity) fuel system is standard. The fuel system consists of rubber cells in the leading edge of the wings. A visual measuring tab in each cell (except EA-242, EA-273 and After) is attached to the filler neck of the 44-gallon system. The bottom of the tab indicates 27 gallons of usable fuel and the detent indicates 32 gallons of usable fuel in the tanks. At serials EA-242, EA-273 and After, a float-type sight gage is installed in the fuel system. This gage will indicate a partial load of 25, 30 or 35 gallons of fuel in its respective wing. When the gage is indicating in the black zone, do not use the gage. On all airplanes except CJ-149 and After, each wing contains a baffled main fuel cell which provides an uninterrupted flow of fuel to the engine.

When filling the airplane fuel cells, always observe the following:

a. The airplane is designed for operation on 100/130 grade (green) or 100LL grade (blue) aviation gasoline (1, Chart 1, 91-00-00). If these fuels are not available, 115/145 grade (purple) may be used.

b. Make sure the airplane is statically grounded to the servicing unit.

c. Do not fill fuel cells near open flame or within 100 feet of any open energized electrical equipment capable of producing sparks.

NOTE: Care should be exercised while filling the fuel cell to prevent scratching, denting, or otherwise damaging the surface or leading edge of the wing. Do not allow the fuel nozzle to contact the rubber fuel cell.

DRAINING THE FUEL SYSTEM

The three snap-type drains should be opened daily to purge any condensed water vapor from the system. (EA-242, EA-273 and After have push-type drains which require the preflight drain tool. Refer to Chapter 12-20-00, SPECIAL TOOLS.) Each fuel cell drain is located on the bottom of the wing, just outboard of the root. The system low spot drain at the bottom of the fuel selector valve is accessible through a door inboard of the left wing root.

CAUTION: *After defueling or fuel cell replacement, operate the engine on each fuel tank with the airplane on the ground to ensure that all air has been purged from the fuel cells and the fuel lines to the engine.*

FUEL CELL RESERVOIR (CJ-149 AND AFTER)

A non collapsible, sponge-filled reservoir is incorporated into some of the fuel cells of acrobatic airplanes to provide an uninterrupted supply of fuel to the engine during slow rolls, uncoordinated maneuvers, fast turns, slips, etc. in either the 25-gal. (22-gal. usable) or 40-gal. (37-gal. usable) fuel cells. An extra long tube extends into the sponge area to allow use of the fuel contained in the sponge-filled reservoir.

ENGINE FUEL FILTERS AND SCREENS

Most fuel injection system malfunctions can be attributed to contaminated fuel. Inspecting and cleaning the fuel strainers should be considered to be of the utmost importance as a regular part of preventive maintenance.

Normally the fuel strainers should be inspected and cleaned every 100 hours. However, the strainers should be inspected and cleaned at more frequent intervals in response to severe conditions of service, unknown fuel handling practices, and operation in areas of excessive sand or dust.

OIL SYSTEM

The airplane is equipped with a wet sump oil system with a capacity of 12 quarts of oil. The oil filler cap is accessible through an access door in the left engine cowling.

To drain the engine sump, remove the right hand access plate and unscrew the sump drain plug in the lower right hand side of the engine crankcase. An oil drain trough, furnished with each airplane is used to convey the oil through the bottom of the engine cowl prior to D-10364; CE-922; CJ-156; E-1752 and EA-129. At D-10364 and After; CE-922 and After; CJ-156 and After; E-1752 and After and EA-129 and After, a quick attach, snap-type fuel/oil drain adapter and approximately 18 inches of hose will be used to drain the oil sump. Refer to Chapter 12-20-00, SPECIAL TOOLS.

Under normal operating conditions, the recommended number of operating hours between oil changes is 100 hours. The oil filter should be removed and replaced at each oil change. When operating under adverse weather conditions or continuous high power settings, the oil should be changed more frequently. Before draining the oil, run up the engine until the oil reaches operating temperature to assure complete draining of the oil. Oil grades, (2, Chart 1, 91-00-00) are general recommendations only, and will vary with individual circumstances. Check oil inlet temperature during flight in determining use of the correct grade of oil. Inlet temperatures consistently near the maximum allowable indicates a heavier oil is needed. The new airplane is delivered with corrosion preventative compound (3, Chart 1, 91-00-00) in the engine. This is a corrosion-preventive oil and should be removed at 20 hours of operation, but no later than 25 hours of operation. If the corrosion preventative compound is not removed at the proper time, varnish may form in the engine. Oil conforming to mineral oil may be added to the corrosion preventative compound as necessary. After removing the corrosion preventative compound, refill with mineral oil, which should be used until oil consumption has stabilized (until after engine break-in). After the break-in period, use an ashless dispersant (AD) aviation grade oil in the heaviest weight that will give satisfactory starting. Above 40°F (4.4°C), SAE 50 viscosity should be used; below 40°F (4.4°C), SAE 30 is recommended. Any aviation grade engine oil which meets Continental Motors Corporation Specification MHS-24B is acceptable for use.

CAUTION: *If metal contamination of the oil system is detected and the cause is corrected, the oil cooler should be replaced. In addition, flush out the system through the interconnected oil system plumbing and replace or clean any other accessories that will remain with the engine.*

OIL FILTER REMOVAL

a. Gain access to the engine oil filter by opening the LH engine cowl access door.

b. Remove the engine oil filter safety wire.

c. Loosen the spin-off filter and remove filter.

OIL FILTER INSTALLATION

a. Clean and lubricate the new filter gasket with engine oil.

b. Position the new filter on the engine mounting adapter and tighten the filter to a torque of 18 to 20 ft-lbs. If a torque wrench is not available, tighten the filter with a suitable wrench for three-quarters to one full turn after gasket contact.

c. Safety wire the filter to the engine adapter.

d. Secure the left engine cowl access door.

AIR CONDITIONING SYSTEM

Servicing the air conditioning system consists of periodically checking the refrigerant level, checking compressor oil level, checking the compressor belt tension, and changing the system air filter. Recharge the system as outlined under CHARGING THE AIR CONDITIONING SYSTEM whenever the refrigerant level is low, air has entered the system, or components carrying refrigerant are replaced. Refrigerant leaks may be detected by inspection with a flameless leak detector. When working on a refrigerant air cooling system, observe the following special servicing precautions:

WARNING: A face shield should be worn when performing maintenance on the lines because refrigerant coming in contact with the eyes can cause loss of sight.

Do not smoke when servicing the system with refrigerant because it converts to a highly toxic gas when exposed to an open flame.

a. Due to the air quality control regulations enacted in the United States, R-12 refrigerant cannot be vented into the atmosphere. When performing maintenance on the air-conditioning system where R-12 can escape from the system, evacuate the system with only a recovery or recycle servicing unit that will salvage the refrigerant.

b. The air-conditioning system is a high pressure system. Before disconnecting a refrigerant line, the system must be discharged with a recovery servicing unit. Purge the entire system to a 125-micron level.

DEPRESSURIZING THE AIR CONDITIONING SYSTEM

WARNING: A face shield should be worn when performing maintenance on the lines because refrigerant coming in contact with the eyes can cause loss of sight.

Do not smoke when servicing the system with refrigerant because it converts to a highly toxic gas when exposed to an open flame.

The servicing points for discharging the system are located under the copilot's seat.

a. Connect a service unit that recycles the refrigerant to the service valves and open the low pressure valve.

b. When the pressure is depleted, open the pressure valve and operate the vacuum pump to completely remove the refrigerant from the system.

c. After the system is depressurized, perform the CHECKING COMPRESSOR OIL LEVEL procedures.

PURGING THE AIR CONDITIONING SYSTEM

To purge the system, connect a recycle servicing unit to the low pressure side of the air conditioning system (located under the copilot's seat). Purge the entire system with the vacuum pump operating at the 125-micron level. Refer to the Chapter 21-50-00, AIR CONDITIONING SYSTEM SCHEMACTIC illustration in the Maintenance Practices section.

CHARGING THE AIR CONDITIONING SYSTEM

WARNING: **A face shield should be worn when performing maintenance on the lines because refrigerant coming in contact with the eyes can cause loss of sight.**

Do not smoke when servicing the system with refrigerant because it converts to a highly toxic gas when exposed to an open flame.

The servicing points for charging the system are located under the copilot's seat.

a. For airplane serials prior to CE-1792; E-2945 and EA-579 use refrigerant R-12 (7, Chart 1, 91-00-00). For airplane serials CE-1792 and After; E-2945 and After; and EA-579 and After, use refrigerant R-134a (64, Chart 1, 91-00-00). Other refrigerants, particularly those containing methyl chloride, will cause rapid deterioration of the aluminum compressor components.

b. Connect the recycle/recovery service unit to the air conditioning system service ports located under the copilot's seat. If the system contains a partial charge, evacuate all refrigerant prior to charging.

c. Perform the compressor oil level check procedures provided in this chapter to determine if additional refrigerant oil is required.

CAUTION: *Do not over charge the air conditioning system. A full charge is 2.4 pounds of refrigerant. Failure to comply could result in damage to the air-conditioning system.*

d. Add an initial charge of 1 pound of refrigerant to the air conditioning system and any additional refrigerant oil required.

e. Start the engine in accordance with the applicable Pilot's Operating Handbook and run the air conditioning system.

CAUTION: *Never add liquid refrigerant to the air conditioning system while the compressor is running. Refrigerant added while the compressor is operating must be in vapor form.*

NOTE: Charging the air conditioning system through observation of the sight glass (bubbles disappearing) requires the temperature to be above 75°F (23.9°C). Charging the air conditioning system, through observation of the sight glass, is not recommended at ambient temperatures below 75°F (23.9°C). At temperatures below 75°F (23.9°C) the refrigerant should be measured into the air conditioning system.

f. If the ambient temperature is above 75°F (23.9°C), slowly add vapor refrigerant into the air conditioning system until the sight glass is clear (no bubbles). If the ambient temperature is below 75°F (23.9°C), measure 1.4 pounds of vapor refrigerant into the system making the total charge 2.4 pounds.

CHECKING COMPRESSOR OIL LEVEL

The air conditioner compressor oil level should be checked by a qualified air conditioner service man if the refrigerant charge is lost (evidenced by oil loss). For airplane serials prior to CE-1792; E-2945 and EA-579, the air conditioner system requires 4 to 5 ounces of 500-viscosity oil (8, Chart 1, 91-00-00). For airplane serials CE-1792 and After; E-2945 and After and EA-579 and After, the air conditioner system requires 4 to 5 ounces of Ester Oil (65, Chart 1, 91-00-00).

Check the compressor oil level as follows:

a. Fabricate a dipstick by bending a wire to a 90° angle so that 1 1/2 inches of the wire will insert into the compressor.

b. Paint the dipstick with a flat black paint. Allow sufficient time for the paint to dry.

c. Start the engine in accordance with the applicable Pilot's Operating Handbook and run the air-conditioning system for 15 minutes with the engine running at low rpm to allow oil to accumulate in the compressor. Observe the engine operating limitations as noted in the applicable Pilot's Operating Handbook. Shut down the engine in accordance with the applicable Pilot's Operating Handbook.

d. Relieve the air conditioner system pressure by evacuating the system with a recycle servicing unit.

e. After the system pressure is relieved, remove the oil filler plug.

f. Insert the dipstick through the oil filler port, slowly rotate the clutch shaft until the dipstick will insert to the bottom of the compressor.

g. Withdraw the dipstick; oil should register on the dipstick at 5/8 inch below the filler port. Add oil as necessary to maintain this measurement.

h. Install the oil filler plug with O-ring and secure plug.

NOTE: Make sure that the O-ring is not twisted and that dirt or particles are NOT ON the O-ring seat. The plug should be snug. Do not overtighten the plug.

i. Perform the CHARGING THE AIR CONDITIONING SYSTEM procedures.

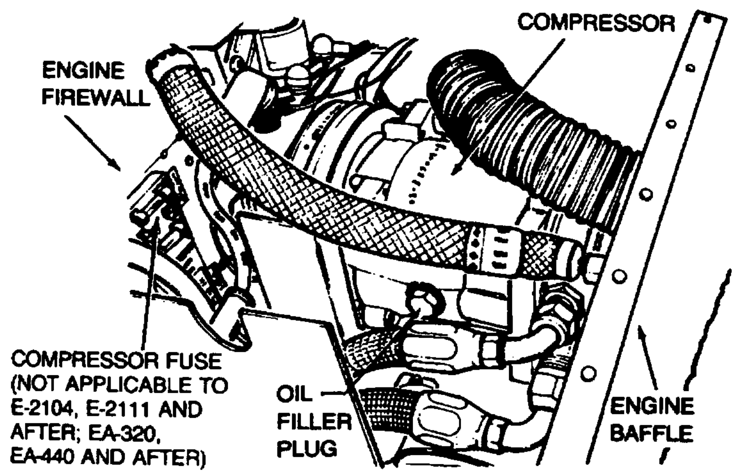
j. Check the area around the filler plug for leaks. If leaks exist, do not overtighten the filler plug. Remove the plug as noted in Step e. and install a new O-ring after depressurizing the system with a recycle servicing unit. Secure the plug and recharge the system as noted in Step h. and Step i..

BRAKE SYSTEM

The hydraulic brakes are self-compensating and require no adjustment. Linings should be checked for small nicks or sharp edges which could damage the brake discs. Worn, dished or distorted brake discs should be replaced. The brake fluid is supplied to the brake system from the reservoir tank located in the engine accessory section and is accessible by raising the right side of the engine cowl. The reservoir should be filled to within 1 1/2 inches of the top and a visible fluid level maintained on the dipstick at all times. Use only hydraulic fluid (9, Chart 1, 91-00-00) in the brake system. Ensure that no dirt or foreign matter is allowed to enter the brake system.

CHARGING THE OXYGEN SYSTEM

In general, the oxygen system on the Bonanzas may be serviced in accordance with FAA AC43.13-1A.



Servicing Compressor
Figure 1

WARNING: **Keep fire and sparks away and never smoke in the proximity of oxygen. Tools, equipment and hands must also be kept clean when servicing the oxygen system, since deposits of oil or other hydrocarbons are highly flammable when exposed to high concentrations of oxygen. Furthermore, the presence of other foreign particles in the oxygen lines may result in leaks that will both exhaust the oxygen supply and present a fire hazard. As an additional safety precaution, use only the antiseize compounds and leak-testing soaps recommended for breathing oxygen systems.**

NOTE: Use only Aviator's Breathing Oxygen (10, Chart 1, 91-00-00) when recharging the oxygen bottle.

The following procedures should be followed prior to, and during the oxygen servicing operation:

a. Ensure that all airplane electrical power is off. Do not operate electrical switches, or connect or disconnect ground power generators during the oxygen charging operation.

b. Make sure that no fueling or other flammable fluid servicing is in process when servicing the oxygen system.

c. Ground the servicing equipment and the system to be serviced before connecting the filler adapter.

WARNING: **Do not use oxygen intended for medical purposes, or such industrial uses as welding. Such oxygen may contain excessive moisture that could freeze up the valves and lines of the oxygen system.**

d. Open the cylinder shutoff valve and slowly fill the system to 1,850 ± 50 psi at 70°F (21.1°C), ambient temperature. This pressure may be increased an additional 3.5 psi for each degree of increase in temperature; similarly, for each degree of drop in temperature, reduce the pressure for the cylinder by 3.5 psi.

e. Close the shutoff valve, disconnect the supply cylinder, and replace the filler valve cap.

OXYGEN SYSTEM SERVICING (ALL AIRPLANES EXCEPT E-1946, E-2104, E-2111 AND AFTER; EA-320, EA-389 AND AFTER)

Observe the guidelines under the heading OXYGEN SYSTEM in this Chapter and service the system as follows:

a. Remove the access opening over the oxygen cylinder shutoff valve and check that the valve is off.

b. Slide the copilot's seat to the rear until the filler valve is clear, then remove the cap from the filler valve and connect the supply cylinder to the filler valve.

c. Open the valve on the airplane oxygen cylinder.

d. Open the valve on the charging cylinder and slowly fill the airplane cylinder.

e. Close the valve on the airplane oxygen cylinder.

f. Close the valve on the charging cylinder.

g. Disconnect the supply cylinder and replace the filler valve cap.

h. Replace the access panel.

i. Slide the copilot's seat forward to its normal position.

OXYGEN SYSTEM SERVICING (E-1946, E-2104, E-2111 AND AFTER; EA-389 THRU EA-439)

Observe the guidelines under the heading OXYGEN SYSTEM in this Chapter and service the system as follows:

a. Check that the oxygen system is turned off. (Check the push-pull knob.)

b. Slide the copilot's seat to the rear until the filler valve is accessible.

c. Remove the filler valve cap and connect the supply cylinder.

d. Open the valve on the supply cylinder and slowly fill the system.

e. Close the valve on the supply cylinder and disconnect the supply cylinder.

f. Install the filler valve cap.

g. Slide the copilot's seat to its normal position.

OXYGEN SYSTEM SERVICING (EA-320, EA-440 AND AFTER)

Observe the guidelines under the heading OXYGEN SYSTEM in this Chapter and service the system as follows:

a. Locate and remove the access panel on the top of the left wing, outboard of WS 66, and aft of the front spar.

b. Remove the cap from the filler opening and connect the supply cylinder to the filler opening.

c. Open the charging cylinder valve and slowly fill the airplane cylinder(s).

d. After filling the airplane cylinder(s), close the supply cylinder shutoff valve, disconnect the supply cylinder, and replace the filler valve cap.

e. Reinstall the access cover.

SCHEDULED SERVICING - MAINTENANCE PRACTICES

TIRES

The nose wheel tire is a 5.00-5 4-ply tire. The main wheel tires are 7.00-6 6-ply tires. Inflate the nose wheel tires to 40 pounds and the main wheel tires to 33 to 40 pounds. Maintaining proper tire inflation will minimize tread wear and aid in preventing tire rupture caused from running over sharp stones and ruts. When inflating tires, visually inspect for cuts, cracks, breaks, and tread wear. The pressure of a serviceable tire that is fully inflated should not drop more than 4 percent over a 24-hour period.

NOTE

Oil and other hydrocarbons spilled on tires not only weaken the rubber but may cause it to swell. Avoid spilling oil, fuel or solvents on tires and clean off any accidental spillage as soon as possible.

CAUTION

Beech Aircraft Corporation cannot recommend the use of recapped tires. Recapped tires have a tendency to swell as a result of the increased temperature generated during takeoff. Increased tire size can jeopardize proper function of the landing gear retract system, with the possibility of damage to the landing gear doors and retract mechanism.

EXTERNAL POWER

An external power unit with a negative ground may be used to supply power for ground checks, starting and battery charging. The power unit may be connected directly to the battery or to an optional external power receptacle, located on the lower engine cowling. The receptacle is designed for use with a standard AN type plug.

The optional external power circuit is equipped with a relay and a diode to protect the airplane electrical system against damage from an external power source with reversed polarity.

Observe the following precautions when using an external power source.

a. Before connecting an external power unit, turn OFF all electrical equipment switches, all radio equipment, and the alternator switch. The battery switch in the airplane should be ON.

b. To prevent arcing, make certain no power is being applied by the external power unit when the connection is made.

c. Leave the battery ON during the entire external power operation.

CAUTION

The battery may be damaged if exposed to voltages higher than 30 volts.

BATTERY

A 24-volt, 110 ampere hour Teledyne Battery Products lead-acid battery is provided for operation of the electrical system.

The battery is located on the right side of the engine compartment, just forward of the firewall. The battery is accessible for servicing by raising the right engine cowl door and removing the battery box cover.

The fluid level of the battery should be checked every 25 hours and maintained 3/8 inch above the top of the separators. Add only distilled water to maintain the specific gravity of between 1.275 and 1.295.

NOTE

Do not overfill the battery. When the battery cells are overfilled, water and acid will spill on the lower portions of the engine accessory section and lower fuselage.

For further servicing information, detailed instructions are furnished with each battery from Teledyne Battery Products.

PROPELLER DEICE BOOTS

The surface of the deice boots should be checked for engine oil after servicing the airplane and at the end of each flight. Any oil found on the surface of the boots should be removed. Removal of oil can be accomplished by the use of a neutral soap and water solution. Special care should be used on electric deice boots, while cleaning, to avoid damaging the special conductive surfacing.

NOTE

Because the deicer boots are made of soft flexible stock, care must be exercised against dragging gasoline hoses over them or resting ladders or platforms against the surface of the boots.

SHOCK STRUTS

To check the fluid level and fill the strut, jack the airplane, remove the valve cap and depress the valve core to release the air pressure from the strut.

WARNING

The strut should be deflated before removal of the valve body or excessive pressure may result in personal injury or property damage.

Compress and block the strut 1/4-inch from the fully compressed position. Remove the valve body assembly and fill with MIL-H-5606 hydraulic fluid (9, Chart 1, 91-00-00). After filling the strut, slowly extend the strut from the blocked position and replace the valve body assembly. Completely compress the strut to release excess air and oil, then reinstall the valve core.

CAUTION

Do not inflate the struts with the airplane on jacks since sudden extension or over-inflation of the strut may cause internal damage to the strut.

With the airplane resting on the ground and the fuel cells full, inflate the nose strut with dry air or nitrogen until 3-1/2 inches of piston is exposed. On airplane serials CE-980 and after, CJ-156 and after, D-10,397 and after, E-1,970 and after, and EA-273 and after, inflate the nose gear strut until 5 inches of the strut piston is exposed. Rock the airplane gently to prevent possible binding of the piston in the barrel when inflating.

CAUTION

If a bottle containing compressed air or nitrogen under extremely high pressure is used, care should be taken not to overinflate the strut. A pressure regulator must be used with high pressure bottled air or nitrogen.

Remove all foreign material from the exposed piston area of the shock struts with a cloth moistened with hydraulic fluid.

SHIMMY DAMPER

To check the fluid level in the shimmy damper, insert a wire of approximately 1/16-inch diameter through the hole in the disc at the end of the piston rod until it touches the bottom of the hole in the floating piston. Mark the wire, remove and measure the depth of insertion. Inserting the wire in the hole of the floating piston, rather than letting it rest against the face of the piston, will give a more accurate check.

NOTE

To determine if the wire is inserted in the hole of the floating piston, insert the wire several times, noting each insertion depth. When the wire is correctly inserted, the length will be approximately 1/4-inch greater.

When the shimmy damper is full, the insertion depth is 2-3/16 inches. The empty reading is 3-1/16 inches. If the wire enters the piston rod over 2-3/8 inches, hydraulic fluid should be added. When hydraulic fluid is needed, remove the shimmy damper and add MIL-H-5606 hydraulic fluid (9, Chart 1, 12-20-00) as follows:

a. Secure the shimmy damper in a fixed position with the clevis end down.

b. Remove the cotter pin, washer, and spring, from the piston rod. Remove with care as the spring is compressed.

c. Remove the internal snap ring, scraper ring and the end seal from the aft end of the barrel (opposite the clevis end).

d. Insert a 6-32 threaded rod into the floating piston and remove the piston.

e. Push the piston rod to the clevis end and fill the barrel with MIL-H-5606 hydraulic fluid (9, Chart 1, 91-00-00).

f. Slowly actuate the piston rod, allowing the fluid to flow into the clevis end chamber, then return the piston to the clevis end of the barrel.

g. Refill the displaced fluid and replace the end seal, scraper ring and internal snap ring.

h. Fill the piston rod with fluid.

i. Reinstall the floating piston, spring washer and cotter pin. Spread the cotter pin to allow clearance for the measuring wire.

j. Release the 6-32 rod and remove it from the floating piston.

k. Reinstall the shimmy damper.

PROPELLER BLADE MAINTENANCE

Due to the high stresses to which propeller blades are subjected, their careful maintenance is vitally important, particularly on the leading edge of each blade from the tip inboard to just beyond the 33-inch station. All nicks and scratches must be repaired before the airplane is flown. Nicks and scratches set up concentrations of stress which can exceed the strength of the blade material; the result will be a crack and premature failure of the blade. The method and limits for this type of repair, as outlined in the applicable Propeller Handbook, should be followed carefully.

INDUCTION AIR FILTER

The induction air filter should be cleaned periodically and replaced every 500 hours of service. Clean the filter as described in the manufacturer's instructions on the filter.

SPARK PLUGS

For the proper spark plug and spark plug gap, refer to Continental Service Bulletin No. M77-10. The spark plugs should be installed with no lubrication and torqued to 300 to 360 inch-pounds (25 to 30 foot-pounds).

ROTON LOCKS
(Figure 1)

Usually, Roton locks will not need service. If there is a grinding and binding in the lock as the seat reclines or if the return action becomes jerky, a small amount of grease properly applied as follows should improve the operation.

a. Use only ENCO ANDOK-B grease (12, Chart 1, 91-00-00) on the threads as shown in Figure 1. Too much grease in the wrong place can cause improper operation.

b. Compress the spring guide and counterbalance spring approximately one inch.

c. Remove the retaining ring.

d. Relax pressure on the spring guide and counterbalance spring slowly until the spring is fully extended.

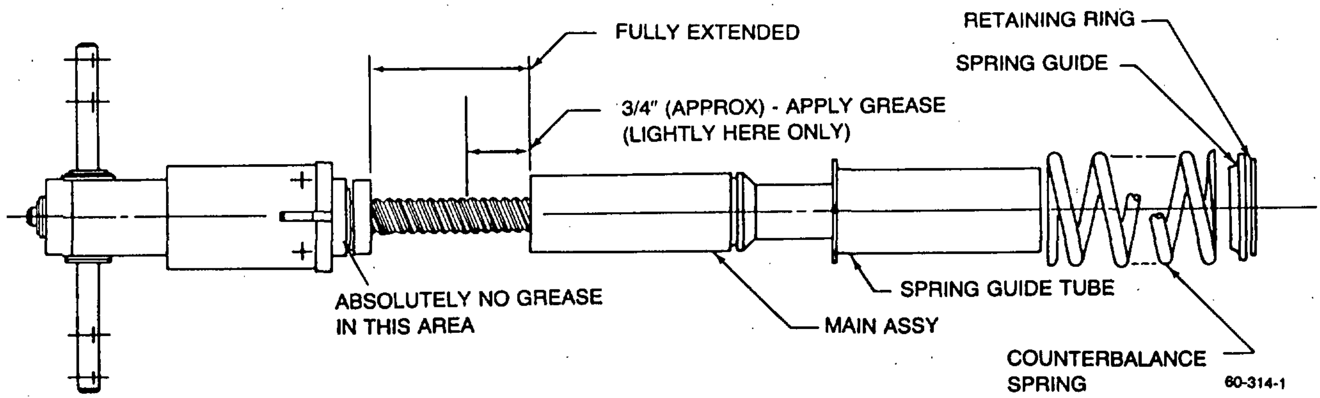
e. Remove the lock from the fixture and remove the spring guide, counterbalance spring and spring guide tube.

f. Apply a small quantity of grease to the completely extended thrust screw (see Figure 1).

g. Reassemble the lock. For service other than lubrication, return the Roton lock to the manufacturer.

CLEANING AND WAXING THE AIRPLANE FINISH

Prior to cleaning the exterior, cover the wheels, making certain the brake discs are covered; attach pitot cover securely; install plugs in or mask off all other openings. Be particularly careful to mask off both static air buttons before washing or waxing.



Roton Lock
Figure 1

The urethane paint finish cleans easily with a sponge and mild detergent solution. Rinse with clear water. A clean white cloth, saturated with either MEK (31, Chart 1, 91-00-00) or toluol (19, Chart 1, 91-00-00) may be used to remove accumulations of oil or grease, and dried insects. Flush the surface with plenty of cool water to remove all traces of soap and dry with a chamois to prevent water marks.

CAUTION

When washing the airplane with mild soap and water, use special care to avoid washing away grease from any lubricated area. After washing with solvent in the wheel well areas, lubricate all lubrication points. Premature wear of lubricated surfaces may result if the above precautions are not taken.

For better protection, a non-abrasive wax may be used on airplanes exposed to corrosive atmospheres with moisture condensation.

Wax application procedures are important and will vary in accordance with the type being used. For best results, follow the wax manufacturers specifications. A build-up of several coats of wax may give the finish a yellowed appearance. The old wax should be removed before a new coat is applied.

Airplanes with aluminum skin surfaces may be polished to a high gloss with any warranted aluminum polish. Soft clean cloths or a chamois should be used to prevent scratching the aluminum when cleaning and polishing.

CLEANING PLASTIC WINDOWS

CAUTION

Do not use an ice scraper to remove ice from windows because this practice may cause scratches to the window surface. To avoid scratches, any cleaning of the windows should be done with care.

A commercial cleaning compound made specifically for acrylic plastic windows may be used. When using a commercial cleaner, follow the instructions on the container. If a commercial cleaner is not available, the following instructions should be followed:

Cleaning of the acrylic plastic windows should never be attempted when dry. The window should first be flushed with water or a mild soap solution, then rubbed lightly with a grit-free cloth, chamois or sponge. Stubborn grease or oil deposits are readily removed with aliphatic naphtha or hexane. Rinse with clear water.

CAUTION

Do not use thinner or aromatic abrasive cleaners to clean the windows; they will damage the surface of the plastic. Aliphatic naphtha and similar solvents are highly flammable, and extreme care must be taken when using them.

CLEANING INTERIOR CABIN TRIM

Proper care and cleaning of the interior cabin trim (Noryl and Kydex plastics) is of primary importance to maintain a desirable appearance. Clean the interior cabin trim with a detergent soap and water, and brush scrub with a soft bristle brush will dislodge most dirt. Wet wipe with clean water and wipe dry. Alcohol may be used to remove foreign material that is alcohol soluble.

CAUTION

The interior cabin trim can be easily contaminated if cleaned with methyl ethyl ketone, naphtha, Mufti, standard solvent, gasoline, lacquer thinner and other types of thinners. Sharp edges or cuts on the edge of the interior cabin trim material may cause it to crack.

ENGINE CLEANING

The engine may be cleaned with Stoddard solvent, or any standard neutral solvent recommended for cleaning engines. The cleaner may be sprayed or brushed on the engine. Compressed air may be used to speed up drying time.

LUBRICATION

Lubrication charts and diagrams within this section contain information that ensure the proper operation and preservation of the airplane. Location, interval, and lubricant required are given. Avoid excessive application of lubricants.

LUBRICATION OF LANDING GEAR UPLOCK ROLLERS

The uplock roller bearings should be lubricated with MIL-G-23827 grease (11, Chart 1, 91-00-00) every 100 hours or any time after cleaning the wheel well the bearings are subjected to degreasing with solvent under pressure. Using a pressure gun, the uplock bearing is lubricated through a grease fitting installed in the uplock bearing bolt.

NOTE

The grease fitting on the drag leg, directly above the uplock roller bearing, does not supply lubrication for the uplock roller bearing.

CHART 1
SERVICING

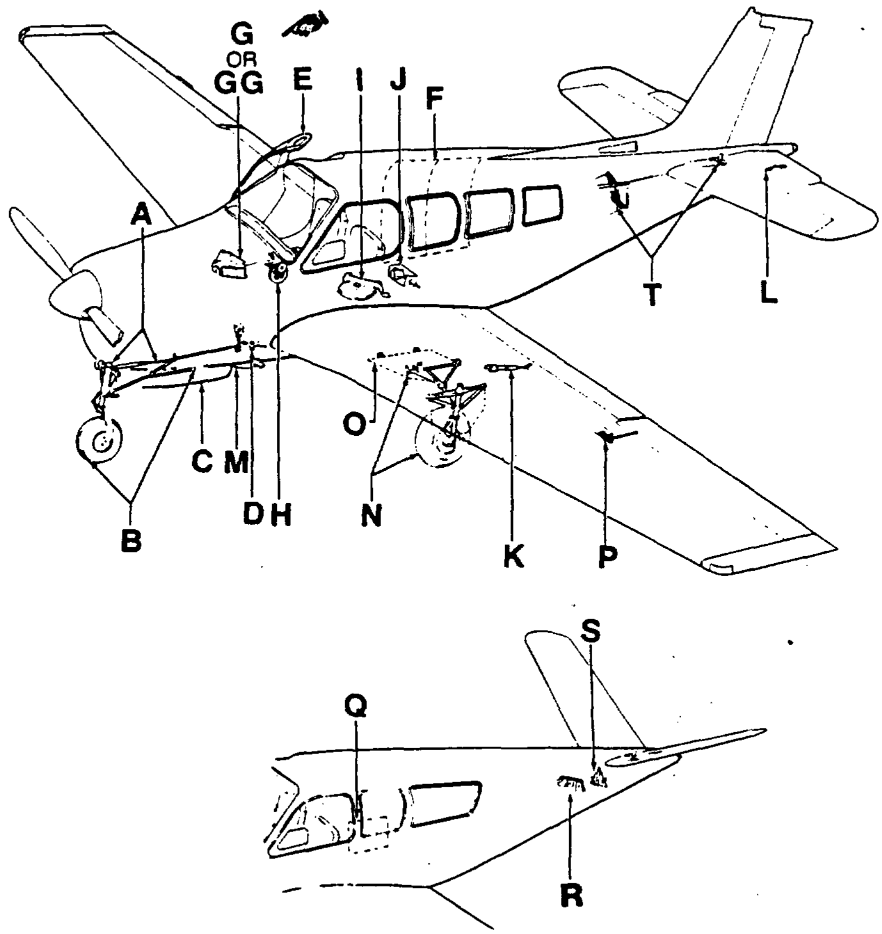
ITEM	*LOCATION*	*SERVICE WITH*	*INTERVAL*
Check			
Engine Oil Level	Access door on upper cowl (1)	See Consumable Materials Chart	Preflight
Battery Water	RH rear side of engine compartment (1)	Distilled Water	25 hrs.
Air Conditioner Compressor Oil Level	See Chapter 21 for location and special instructions	Suniso No. 5GS or Texaco WF 100 500 Viscosity Oil	As required
Air Conditioner Refrigerant	See Chapter 21 for location and special instructions	Refrigerant No. 12	As required
Magneto Pressure-ization Air Filter	Between Magnetos		50 hrs.
Change			
Engine Oil	*Lower rear side of* engine (1)	*See Consumable* Materials Chart	*100 hrs.*
Engine Oil Filter	Left rear side of engine (1)		100 hrs.
Clean			
Induction Air Filter	Fuselage nose section grill (1)	Clean as described on the filter	50 hrs.
Fuel Injection Control Valve Screen	Fuel injection control valve on the lower side of the engine (1)	Clean with solvent and blow dry with air pressure	100 hrs.
Fuel Selector Valve Strainer	Fuel selector valve inboard left wing root (1)	Clean with solvent and blow dry with air pressure	100 hrs.
Pressure Pump Intake Filter	Rear engine baffle (1)	Replace	300 hours or on condition
Drain			
Fuel Sump Drain	Inboard left wing root (1)		Preflight
Fuel Cell Drains	Under both wings (2)		Preflight
Static Drain	Behind the aft upholstery panel (1)	50 hrs.	
Replace			
Induction Air Filter	Fuselage nose section grill (1)		500 hrs. or on condition
Pressure System Inline Filter	Between pressure regulator and instruments (1)		300 hrs. or on condition

CHART 1
SERVICING (CONT'D)

ITEM	*LOCATION*	*SERVICE WITH*	*INTERVAL*
Service			
Brake Fluid Reservoir	Upper forward side of the firewall (1)	MIL-H-5606 hydraulic fluid	As required
Oxygen Cylinder	Under front seats (1) except EA-320 EA-440 and after. EA-320, EA-440 *and after in* left wing (1)	MIL-O-27210 aviator's breathing oxygen	As required
Main and Nose Landing Gear Struts	Top of each strut (3)	MIL-H-5606 hydraulic fluid and dry compressed air	As required or annually
Shimmy Damper	Nose landing gear (1)	MIL-H-5606 hydraulic fluid	As required or annually

( ) Denotes quantity of servicing points.

CHART 2
LUBRICATION SCHEDULE



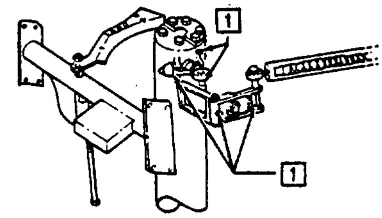
NOTES

1. The following details, (A thru T) constitute a lubrication servicing schedule. Major differences between model types relative to lubrication points are the V-tail configuration, exclusively for the V35B, and the cargo doors provided only on the model A36, A36TC, & B36TC.
2. Environmental conditions and operational application may dictate more frequent servicing.
3. Landing gear components may require lubrication every 25 or 50 hours, depending on operation.
4. MIL-G-81322 grease may be used in place of MIL-G-23827 grease in warm climates; however, in extremely cold climates MIL-G-23827 grease should be used.
5. Care should be taken when using greases MIL-G-81322 and MIL-G-23827, since they contain synthetic lubricants which will discolor painted surfaces, and will soften rubber products.

36-604-121

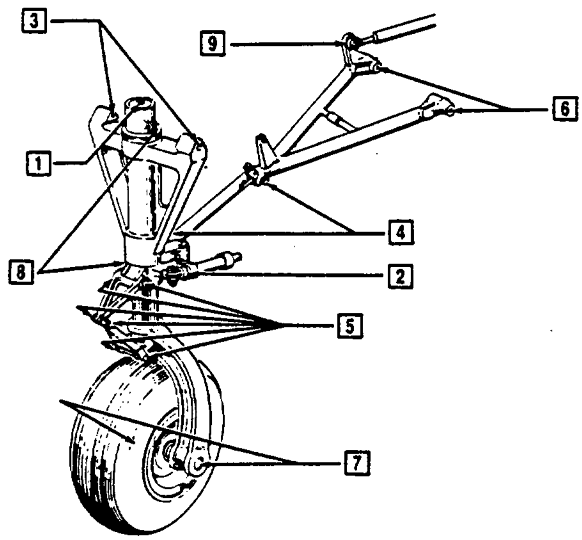
CHART 2 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	NOSE WHEEL WELL			
1	Nose wheel steering	(5)	MIL-G-81322	100 hrs



DETAIL A

35-604-12

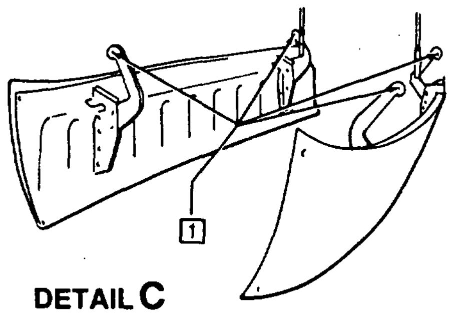


DETAIL B

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	NOSE LANDING GEAR			
1	Nose shock strut	(1)	MIL-H-5606	AR
2	Shimmy damper	(1)	MIL-H-5606	AR
3	Nose gear hinge points	(2)	MIL-G-81322	100 hrs
4	Nose gear linkage	(2)	MIL-G-81322	100 hrs
5	Nose gear torque knees	(6)	MIL-G-81322	100 hrs
6	"A" Frame pivot points	(2)	MIL-G-81322	100 hrs
7	Nose wheel bearings	(2)	Aeroshell 5 Preferred or MIL-G-81322	100 hrs
8	Nose gear swivel	(2)	MIL-G-81322	100 hrs
9	Rod end fitting	(1)	MIL-G-81322	100 hrs

35-604-13

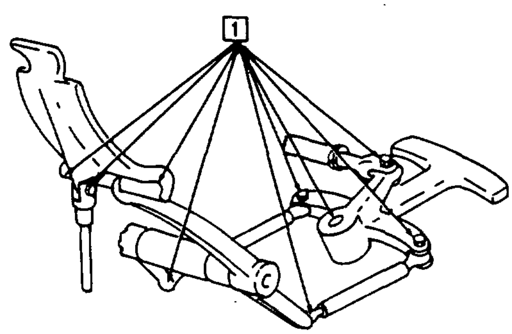
CHART 2 (Cont'd)
LUBRICATION SCHEDULE



DETAIL C

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	NOSE GEAR DOORS			
1	Nose wheel door hinges	(4)	SAE 20 or SAE 10W30	100 hrs

35-604-14



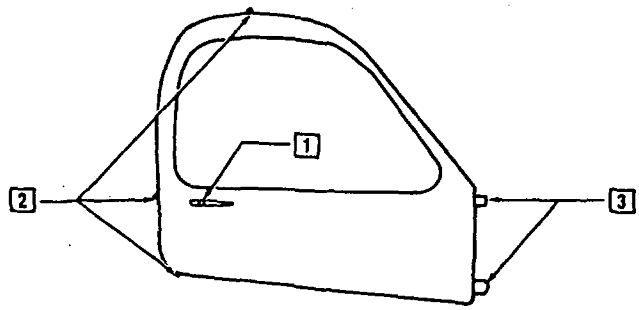
DETAIL D

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	RUDDER PEDALS			
1	Rudder pedal linkage	(18)	SAE 20 or SAE 10W30	100 hrs

35-604-15

CHART 2 (Cont'd)
LUBRICATION SCHEDULE

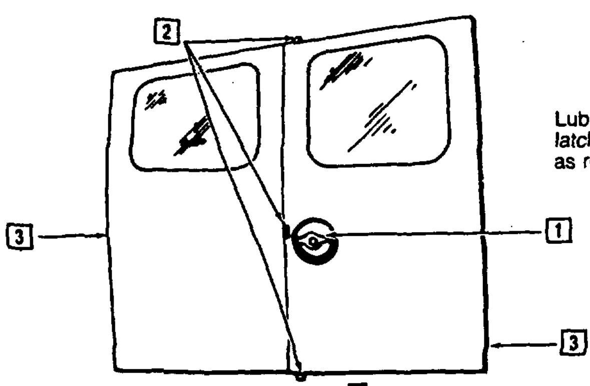
INDEX	LOCATION	POINT( )	LUBRICANT	INTERVAL
	FORWARD CABIN DOOR			
1	Forward cabin door handle	(1)	SAE 20 or SAE 10W30	100 hrs
2	Forward cabin door latch	(3)	SAE 20 or SAE 10W30	100 hrs
3	Forward cabin door hinges	(2)	SAE 20 or SAE 10W30	100 hrs



DETAIL E

35-604-16

Detail F applies only to serials E-1111, E-1241 and after; EA-1 and after.



NOTE
Lubricate all internal moving parts of the latching mechanism with Aeroshell 17, as required.

DETAIL F

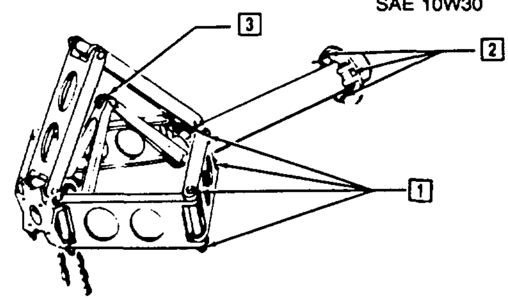
INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	AFT CABIN DOOR			
1	Aft cabin door handle	(1)	SAE 20 or SAE 10W30	100 hrs
2	Aft cabin door latch	(3)	SAE 20 or SAE 10W30	100 hrs
3	*Aft cabin door hinges	(2)	MIL-M-7866	AR

*Mix MIL-M-7866 with naphtha and apply with a brush.

35-604-17

CHART 2 (Cont'd)
LUBRICATION SCHEDULE

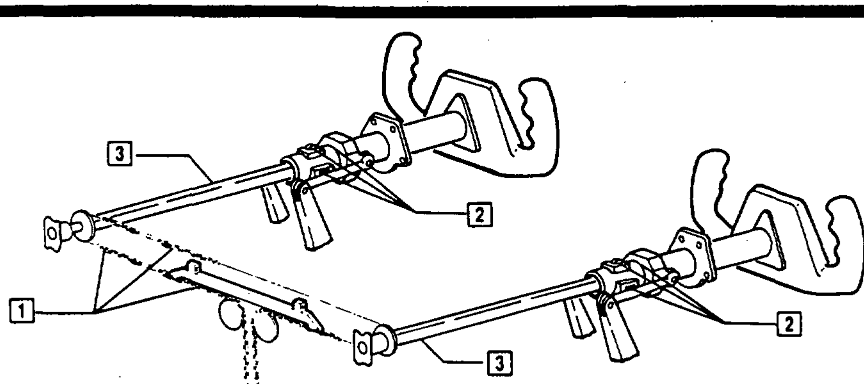
INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	CONTROL COLUMN			
1	Control column linkage	(18)	SAE 20 or SAE 10W30	100 hrs
2	Control column head	(3)	SAE 20 or SAE 10W30	100 hrs
3	Control column torque knees	(6)	SAE 20 or SAE 10W30	100 hrs



PRIOR TO D-10404, CE-1037, E-2111 EXCEPT E-1946 AND E-2104, EA-389 EXCEPT EA-320

DETAIL G

36-604-118



DETAIL GG

E-1946, D-2104, E-2111 AND AFTER, EA-320, EA-389 AND AFTER.

INDEX	LOCATION	POINTS ( )	LUBRICANT	INTERVAL
	CONTROL COLUMN			
1	Control column chains	(4)	SAE20 or 10W30 Oil	100 hrs.
2 **	Ball bearings (without seals)	(10)	MIL-L-7870 Oil	100 hrs.
3 *	Torque Shafts	(2)	MEK Solvent	100 hrs.

* Wipe full length of square shafts with MEK, these surfaces to remain dry and free of oil.

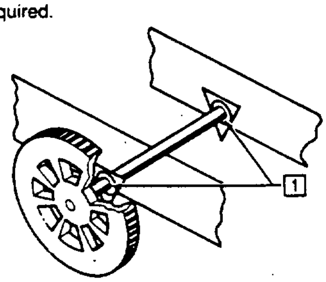
** Remove one of the nonadjustable rollers (27-00-00). If it is a sealed roller with the seals intact, reinstall the roller and make a maintenance record that the rollers are sealed and do not need lubrication. If the rollers are not sealed, or the seals are not intact, they may be replaced with sealed rollers and a maintenance record made that the rollers do not need lubrication. If the adjustable rollers are removed for lubrication or replacement, refer to Chapter 27-00-00 for adjustment.

36-604-117
001

CHART 2 (Cont'd)
LUBRICATION SCHEDULE

NOTE

At series D-10380 and after, CJ-156 and after, CE-960 and after, E-1886 and after, EA-249 and after, sealed bearings were installed and no lubrication is required.



DETAIL H

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	TRIM TAB CONTROL			
1	Elevator trim control	(2)	SAE 20 or SAE 10W30	100 hrs

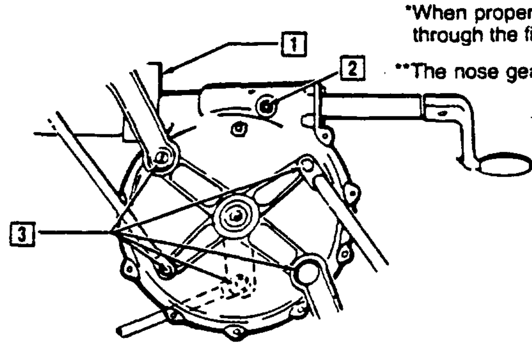
36-604-119

CHART 2 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	LANDING GEAR ACTUATOR			
1	Landing gear motor gear box	(1)	MIL-G-81322	600 hrs
2	*Landing gear actuator gear box	(1)	MIL-L-2105 or Mobil 636	300 hrs
3	**Landing gear system retract arms	(5)	SAE 20 or SAE 10W30	100 hrs

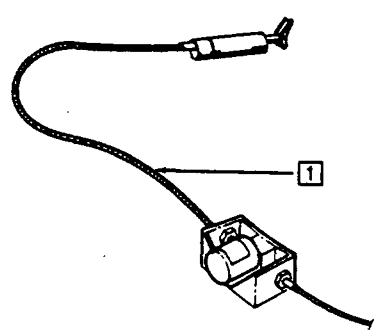
*When properly filled, the oil level on a dip stick inserted through the filler hole will be approximately 1/4 inch.

**The nose gear retract arm is located beneath the gear box.



DETAIL I

35-604-47



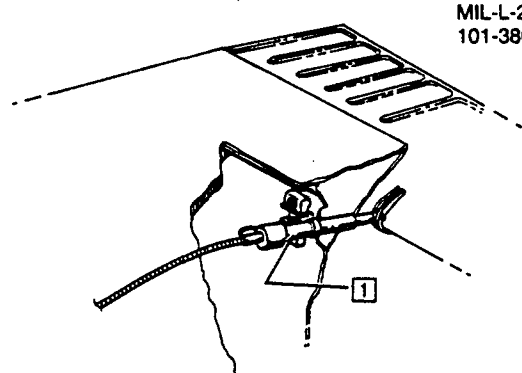
DETAIL J

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	FLAP MOTOR			
1	Flap flexible drive shaft (inside of cable housing)	(1)	MIL-G-23827	900 hrs

35-604-48

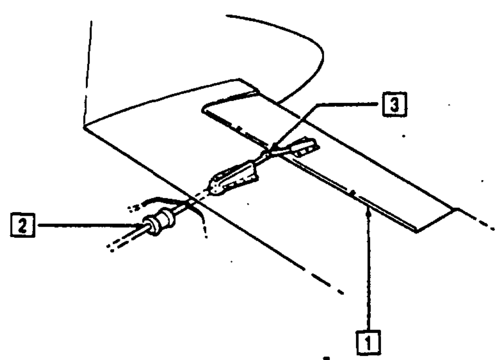
CHART 2 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	FLAP ACTUATOR			
1	Flap actuator	(2)	MIL-L-10324A OR MIL-L-2105C 75W OR 101-380016-1	900 hrs



DETAIL K

35-604-50



DETAIL L

Detail L depicts the Bonanza 33 and 36 Series airplanes. The Bonanza 35 Series does not incorporate Index 2.

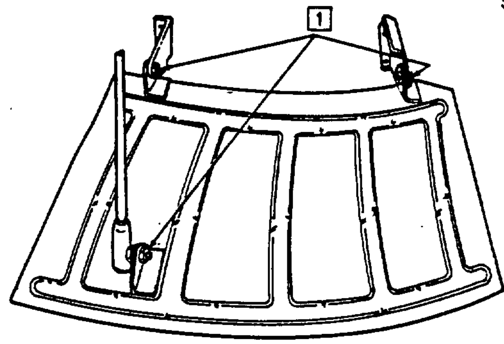
INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	ELEVATOR TRIM			
1	*Elevator trim tab hinge	(2)	MIL-M-7866	100 hrs
2	**Elevator trim tab actuator	(2)	MIL-G-23827	AR
3	†Tab control horn pivot	(†)	SAE 20 or SAE 10W30	AR

*Mix MIL-M-7866 with naphtha and apply with a brush.
**The actuator is not used on the Bonanza 35 series airplanes.
†On the Bonanza 35 series, lubricate both the upper and lower tab control horn pivots (Index 3). On the Bonanza 33 and 36 series airplanes, only the upper tab control horn pivot lubrication is required.

35-604-49

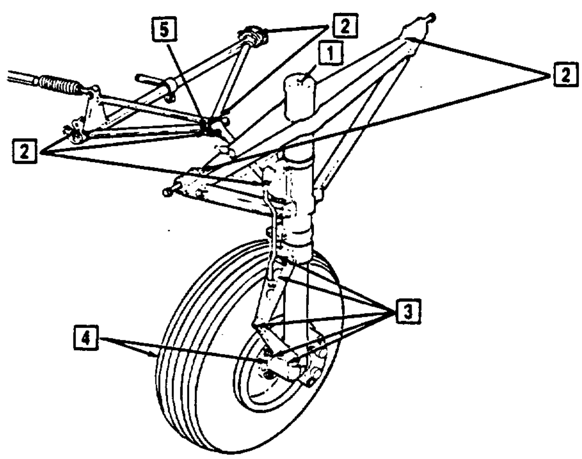
CHART 2 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	COWL FLAPS			
1	Cowl flap hinges	(6)	SAE 20 or SAE 10W30	100 hrs



DETAIL M

35-604-51



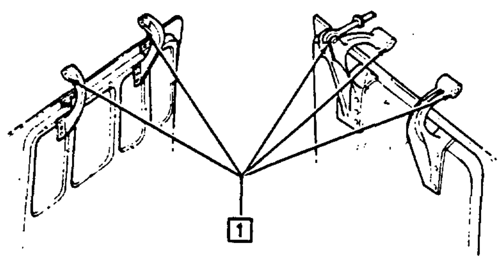
DETAIL N

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	MAIN LANDING GEAR			
1	Main shock struts	(2)	MIL-H-5606	AR
2	Hinge points and retract links	(14)	MIL-G-81322	100 hrs
3	Main gear torque knees	(10)	MIL-G-81322	100 hrs
4	Main wheel bearings	(4)	Aeroshell 5 Preferred or MIL-G-81322	100 hrs
5	Landing gear uplock rollers	(2)	MIL-G-23827 See Lubrication of Landing Gear Uplock Rollers in this chapter.	

35-604-52

CHART 2 (Cont'd)
LUBRICATION SCHEDULE

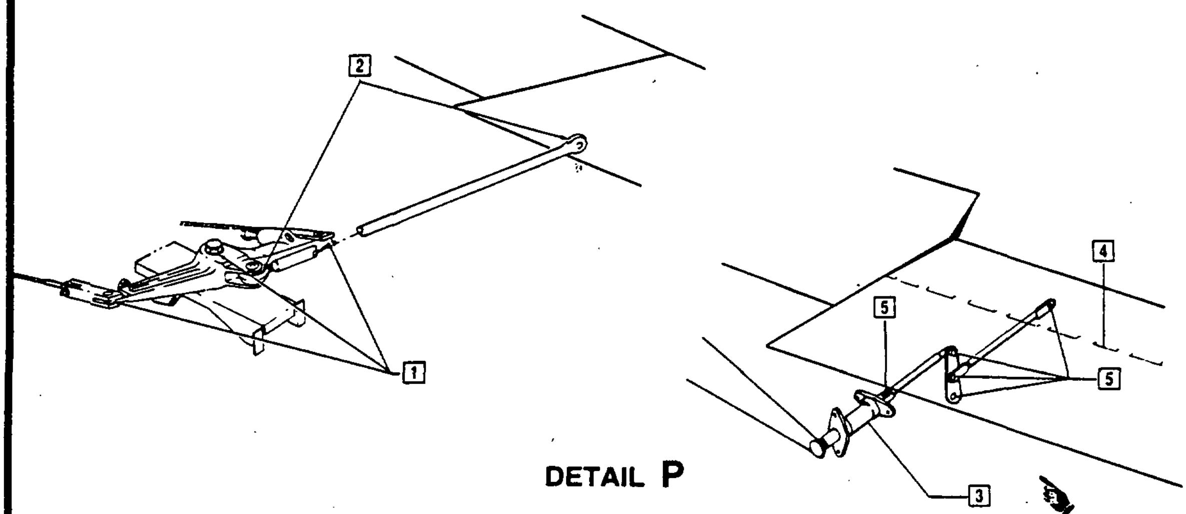
INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	MAIN LANDING GEAR DOORS			
1	Landing gear door hinges	(10)	SAE 20 or SAE 10W30	100 hrs



DETAIL O

35-604-53

CHART 2 (Cont'd)
LUBRICATION SCHEDULE



DETAIL P

*Lubricate the aileron push/pull rod ends (in place) at 100 hr intervals using SAE 20 or 10W30 oil, or remove the aileron push/pull rod assembly and clean & lubricate rod ends using MIL-G-23827 grease. Rotate the rod end eye balls to assure adequate lubrication coverage. Check aileron rigging after reinstallation of the rod end assembly.

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	AILERON			
1	Aileron control linkage	(6)	SAE 20 or SAE 10W30	100 hrs
2	*Aileron push/pull rods ends	(4)	MIL-G-23827 or SAE 20 or SAE 10W30	100 hrs
3 †	Aileron trim tab actuator	(1)	MIL-G-23827	AR
4 †	Aileron trim tab hinge	(1)	VV-L-800 Preferred, LPS-1, CRC 3-36, WD-40	100 hrs
5 †	Aileron trim tab push-pull linkage	(5)	VV-L-800 Preferred, LPS-1, CRC 3-36, WD-40	100 hrs

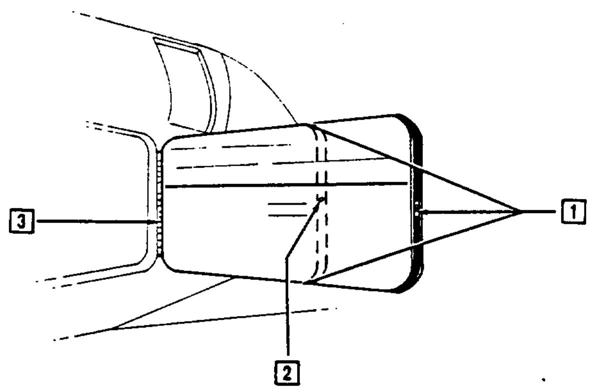
† Effective E-1946, E-2104, E-2111 and after; EA-320, EA-389 and after.

36-604-122

CHART 2 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION BAGGAGE DOOR	POINTS( )	LUBRICANT	INTERVAL
1	Large door latch mechanism	(3)	SAE 20 or SAE 10W30	100 hrs
2	Small door latch mechanism	(1)	SAE 20 or SAE 10W30	100 hrs
3	*Door hinge	(1)	MIL-M-7866	AR

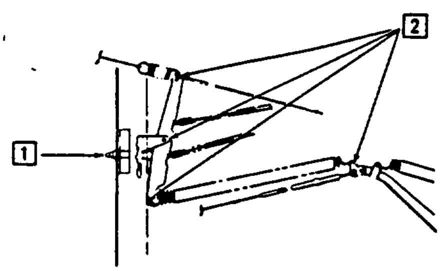
*Mix MIL-M-7866 with naphtha and apply with a brush.



DETAIL Q

Detail Q includes serials CE-748, CE-772 and after; CJ-149 and after; and D-10097, D-10120 and after.

35-604-55



DETAIL R

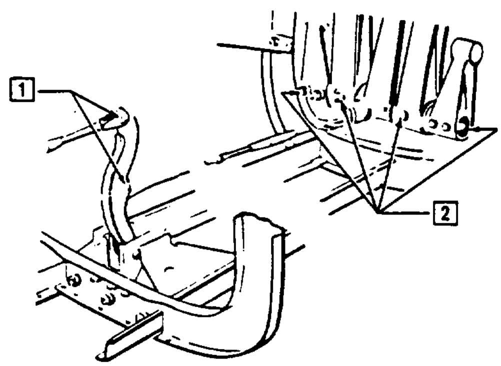
INDEX	LOCATION ELEVATOR TAB	POINTS( )	LUBRICANT	INTERVAL
1	Elevator tab actuator	(1)	MIL-G-81322	100 hrs
2	Elevator tab linkage	(4)	SAE 20 or SAE 10W30	100 hrs

Detail R includes only serials D-10097, D-10120 and after.

35-604-56

CHART 2 (Cont'd)
LUBRICATION SCHEDULE

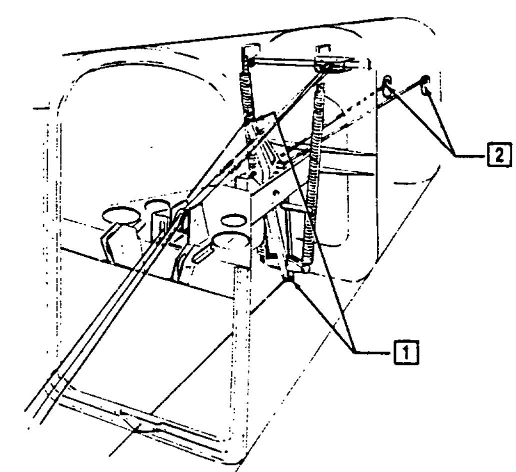
INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	DIFFERENTIAL CONTROL			
1	Elevator cable reduction arm	(2)	SAE 20 or SAE 10W30	100 hrs
2	Differential control assy	(4)	MIL-G-81322	100 hrs



DETAIL S

Detail S includes only Bonanza 35 series airplanes.

35-604-57

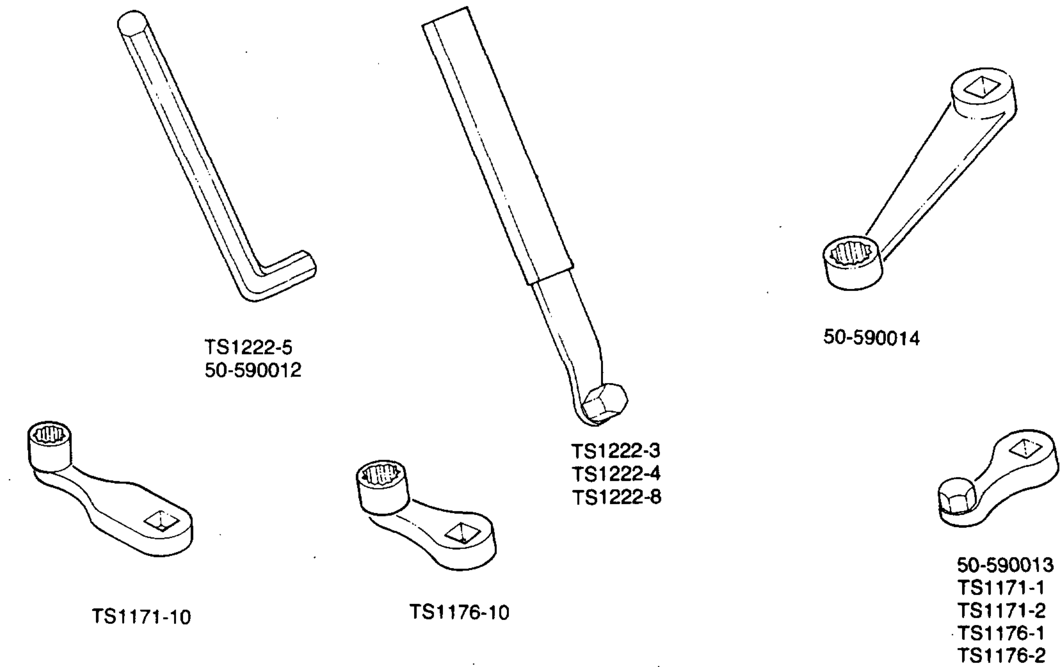


DETAIL T

INDEX	LOCATION	POINTS( )	LUBRICANT	INTERVAL
	ELEVATOR CONTROL			
1	Elevator bell crank	(2)	SAE 20 or SAE 10W30	100 hrs
2	Elevator control push pull	(2)	SAE 20 or SAE 10W30	100 hrs

Detail T includes only serials CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 and after; and EA-1 and after.

35-604-58



UPPER FORWARD WING BOLT WRENCHES:

TS1222-3	(FOR NAS152-37 BOLTS)
TS1222-5	(FOR MS20012-20 AND 131790-1 BOLTS)
50-590012	(FOR MS20012-20 AND 131790-1 BOLTS)
TS1222-4	(FOR MS20012-20 AND 131790-1 BOLTS)
TS1222-8	(FOR MS20012-20 AND 131790-1 BOLTS)

UPPER FORWARD WING NUT TORQUE WRENCH ADAPTERS:

TS1171-2	(PRIOR TO CE-928, CJ-156, D-10353, E-1758 AND EA-150)
TS1176-2	(PRIOR TO CE-928, CJ-156, D-13053, E-1758, AND EA-150)
TS1176-10	(CE-928 AND AFTER, CJ-156 AND AFTER, D-10353 AND AFTER, E-1758 AND AFTER, EA-150 AND AFTER)
TS1171-10	(CE-928 AND AFTER, CJ-156 AND AFTER, D-10353 AND AFTER, E-1758 AND AFTER, EA-150 AND AFTER)

LOWER FORWARD WING BOLT WRENCHES:

TS1222-5	(CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; D-10097, D-10120 AND AFTER; EA-1 THRU EA-272 EXCEPT EA-242)
50-590012	(CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; D-10097, D-10120 AND AFTER; EA-1 THRU EA-272 EXCEPT EA-242)
TS1222-4	(CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; D-10097, D-10120 AND AFTER; EA-1 THRU EA-272 EXCEPT EA-242)
TS1222-8	(CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; D-10097, D-10120 AND AFTER; EA-1 THRU EA-272 EXCEPT EA-242)
TS1222-3	(EA-242, EA-273 AND AFTER)

36-17-15

Special Tools (Sheet 1 of 4)
Figure 2

LOWER FORWARD WING NUT TORQUE WRENCH ADAPTERS:

TS1171-2	(PRIOR TO CE-928, CJ-156, E-1758, D-10353, AND EA-150)
TS1176-2	(PRIOR TO CE-928, CJ-156, E-1758, D-10353, AND EA-150)
TS1176-10	(CE-928 AND AFTER, CJ-156 AND AFTER, E-1758 AND AFTER, D-10353 AND AFTER, EA-150 THRU EA-272 EXCEPT EA-242)
50-590014	(EA-242, EA-273 AND AFTER)

UPPER AFT WING BOLT WRENCHES:

50-590012
TS1222-5
TS1222-4
TS1222-8

UPPER AFT WING NUT TORQUE WRENCH ADAPTERS:

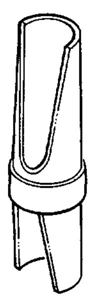
50-590013
TS1171-1
TS1176-1

LOWER AFT WING BOLT WRENCHES:

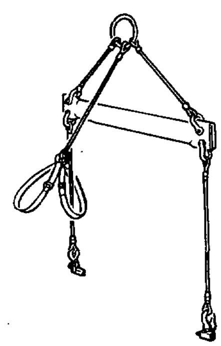
50-590012
TS1222-5
TS1222-4
TS1222-8

LOWER AFT WING NUT TORQUE WRENCHES:

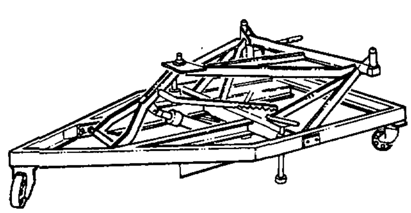
TS1171-1
TS1176-1
50-590013



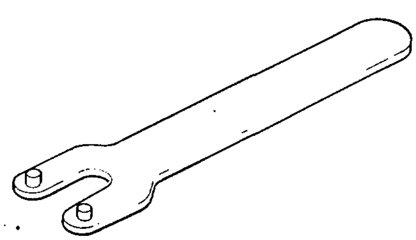
35-590006
MAIN WHEEL JACK ADAPTER



35-590064-1
HOISTING SLING ASSEMBLY



MODEL 300
SERVICE JACK
MAX. CAPACITY 5000 LBS

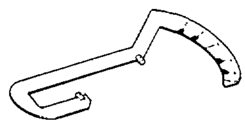


35-590009
THROTTLE RETAINING NUT WRENCH

36-17-22

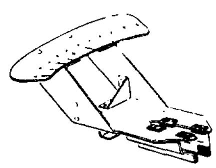
Special Tools (Sheet 2 of 4)
Figure 2

SPECIAL TOOLS

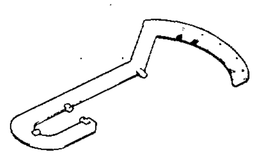


810-5 35660040 LH
810-5 35660040-1 RH
ELEVATOR CHECK FIXTURE
USED ON MODEL SERIALS D-10097, D-10120 AND AFTER

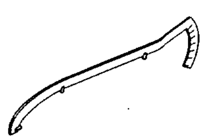
810-3 35660040 LH
810-3 35660040-1 RH
ELEVATOR CHECK FIXTURE
USED ON MODEL SERIALS CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; AND EA-1 AND AFTER



810 35660043-2
TRIM TAB JIG

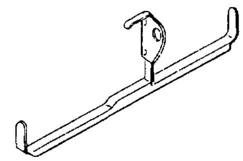


810 33524000
RUDDER CHECK FIXTURE

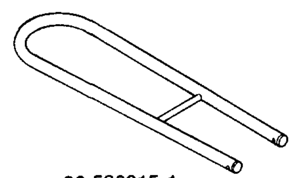


810-1 50590091
AILERON TRAVEL GAGE

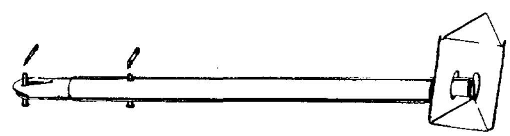
35-590087
DIFFERENTIAL MECHANISM
USED ON THE BONANZA 35 SERIES AIRPLANES ONLY



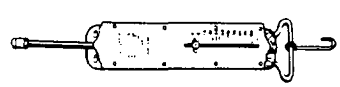
35-590087-9 STOP
USED WITH 35-590087 ASSEMBLY WHEN RIGGING THE MODEL SERIALS D-10097, D-10120 AND AFTER



36-590015-1
TOW BAR



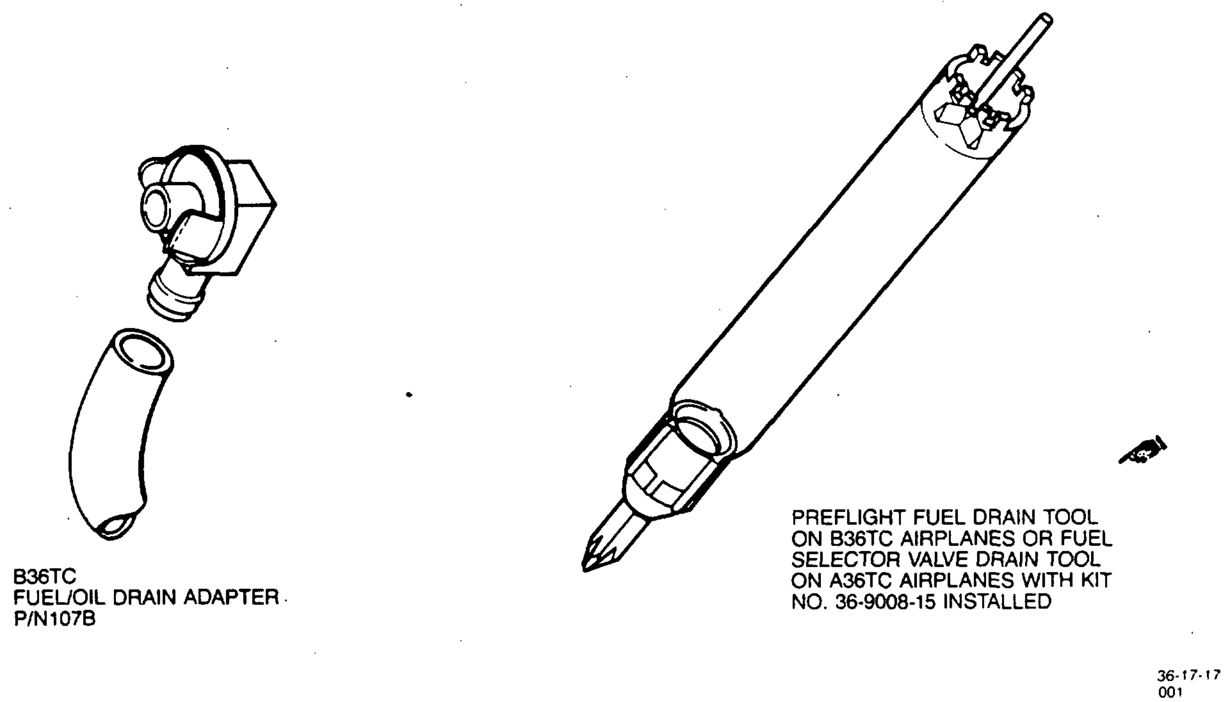
35-590021
TAIL TIE-DOWN SUPPORT ASSEMBLY



45-590074-7
LANDING GEAR TENSION GAGE

36-17-16

Special Tools (Sheet 3 of 4)
Figure 2



Special Tools (Sheet 4 of 4)
Figure 2

"END"

CHAPTER

20

STANDARD PRACTICES (AIRFRAME)

CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

TABLE OF CONTENTS

CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

TABLE OF CONTENTS (Continued)

SUBJECT *PAGE*

CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

TABLE OF CONTENTS (Continued)

SUBJECT *PAGE*

20-07-00

20-08-00

CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

TABLE OF CONTENTS (Continued)

CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
20-LOEP	1	Sep 30/04
20-CONTENTS	1 thru 4	Sep 30/04
20-00-00	1 and 2	Nov 10/00
20-01-00	1 thru 5	Jun 20/91
20-02-00	1 thru 12	Jun 20/91
20-03-00	1 thru 12	Jun 20/91
20-04-00	1 thru 4	Mar 31/04
20-05-00	1 thru 4	Jun 20/91
20-06-00	1 thru 7	Sep 30/04
20-07-00	1 thru 7	Jun 20/91
20-08-00	1 thru 8	Sep 30/04
20-09-00	1 thru 6	Sep 30/04

STANDARD PRACTICES - AIRFRAME

WARNING

Any maintenance requiring the disconnection and reconnection of flight control cables, plumbing, electrical connectors or wiring requires identification of each side of the component being disconnected to facilitate correct reassembly. At or prior to disassembly, components should be color coded, tagged or properly identified in a way that it will be obvious how to correctly reconnect the components. After reconnection of any component, remove all identification tags. Check all associated systems for correct function prior to returning the airplane to service.

This chapter describes the standard maintenance practices used in maintaining the airplane in an airworthy condition. The information in this chapter is applicable during maintenance in several chapters of this maintenance manual. Maintenance procedures in a particular chapter supersede the general information in this chapter.

The information is broken down in several unit/subjects. The following is a list of the information contained in each chapter.

20-01-00 - Nut and Bolt Torque Information

This unit/subject contains the general information for installation of torqued fasteners. It has information on the use of torque adapters and torque charts showing the torque of different types of nuts and bolts.

20-02-00 - Electrostatic Discharge Sensitivity Information

This unit/subject contains the general information for maintenance of components that are subject to electrostatic damage. Information is included for electrostatic free workstations, symbols, packaging requirements, storage and transit requirements, static charge buildup and humidity and dust effects.

20-03-00 - Electrical Bonding Information

This unit/subject contains the general information for installation of electrical wiring grounding, tube grounding and electrical power returns.

20-04-00 - Control Cable and Pulley Information

This unit/subject contains the general information for maintenance and inspection of control cables and pulleys.

20-05-00 - Bearing Information

This unit/subject contains the general information for installation and removal of bearings. The removal is described by the use of the hydraulic and mechanical press method. The installation is described by use of the retaining compound and the staking method.

20-06-00 - Tubing Information

This unit/subject contains the general information for maintenance of hoses, tubing and fittings. Components are not identified, but the information is basic and applies to most applications.

20-07-00 - Fastener Locking Information

This unit/subject contains the general information for the installation of cotter pins, lockwire, tab and cup type key-washers, retaining rings and turnbuckle locking clips.

20-08-00 - Airplane Finish Information

This unit/subject contains the general information for maintenance of the finishes used on the airplane and paint removal and application.

20-09-00 - Corrosion Removal and Control Information

This unit/subject contains the general information for the control, treatment and removal of corrosion.

TORQUE WRENCHES (FIGURES 1 AND 2)

Threads of nuts and bolts to be torqued must be clean and free of all lubricants unless otherwise specified. The loss of normal friction by contamination may result in overtorquing.

NOTE

Torque wrenches should be exercised before they are used.

A measurable torque may be required to initiate the turning of some locknuts. This initial torque must then be added to the desired torque to attain the proper torque setting. For example; a locknut that requires 20 inch-pounds of force to turn freely should be torqued at 20 inch-pounds above the desired torque. If the desired torque is 80 inch-pounds, the torque wrench must indicate 100 inch-pounds to achieve the desired torque. This method compensates for the friction of the locknut or fastener.

When an adapter is used with a torque wrench (Figure 1), compensation must be made for the increased or lost leverage. A new torque requirement must be calculated before the final torquing. To figure the desired torque which will actually give the torque specified, use the following formula:

Basic Torque Formula: $\dfrac{T \times L}{L + \text{or} - E} = Y$

LEGEND:
- T = Actual (Desired) Torque
- Y = Apparent (Indicated) Torque
- L = Effective Lever Length
- E = Effective Length of Extension

EXAMPLE:
- T = 135 inch-lbs.
- Y = Unknown
- L = 10.0 inches
- E = 1.5 inches

Formula for increased effective length:

$$Y = \frac{135 \times 10}{10 + 1.5} = \frac{1350}{11.5} = 117.39$$

Y = 117 inch-lbs.

Formula for decreased effective length:

$$Y = \frac{135 \times 10}{10 - 1.5} = \frac{1350}{8.5} = 158.82$$

Y = 159 inch-lbs.

BT01039

If a torque wrench is not available, an acceptable method of checking the torque is to attach a spring scale (Figure 2) to a conventional flex or "T" handle inserted into an adapter. Force should be applied in a direction perpendicular to an imaginary line extending from the center of the bolt through the spring scale attaching point.

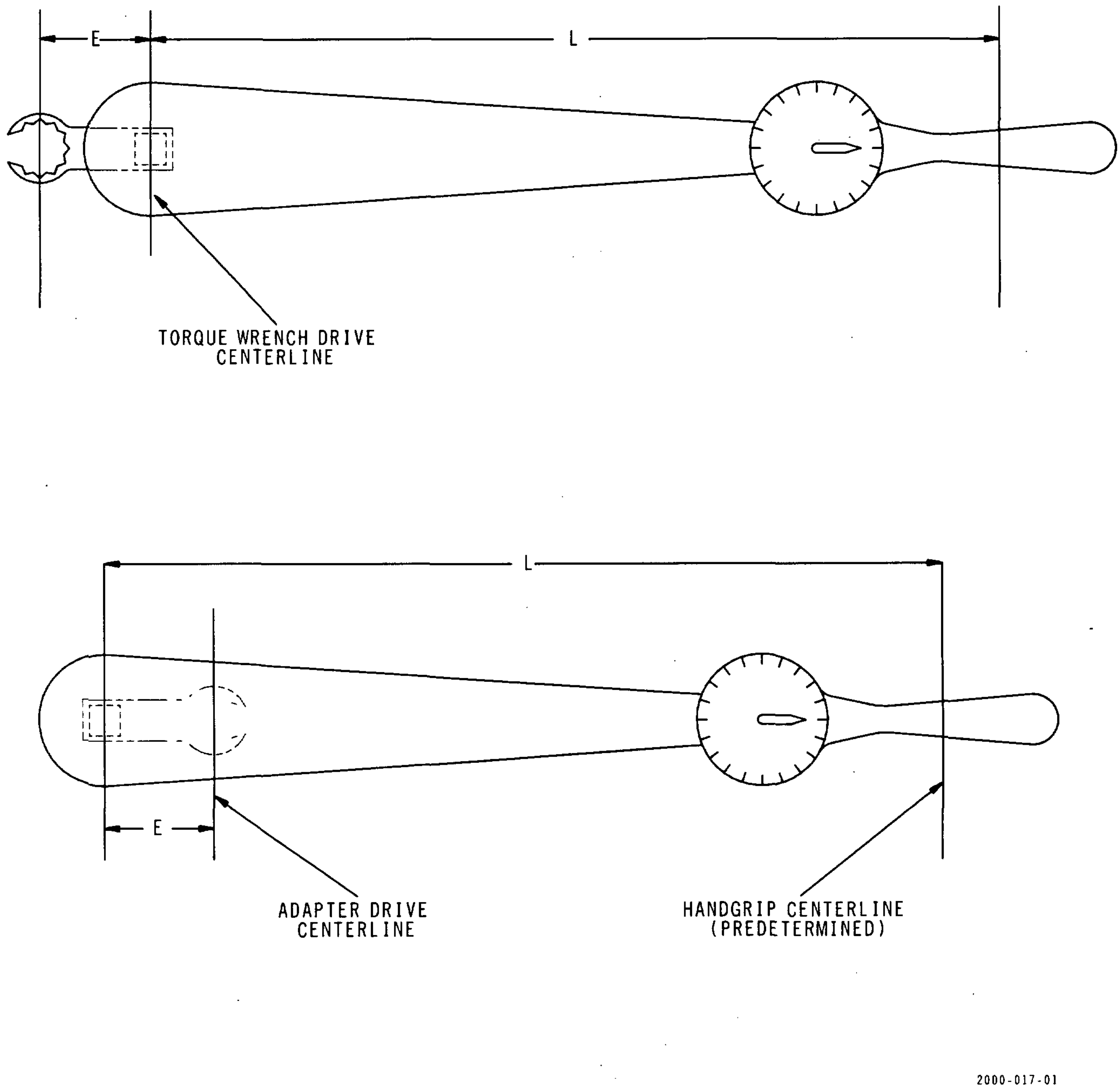
To calculate the force in pounds (scale reading) required to obtain the specified torque, divide the torque in inch-pounds by the distance in inches between the center of the bolt and the scale attaching point. For example, if the specified torque is 200 inch-pounds and the distance is 15 inches, a pull of 13.3 pounds must be applied.

When a torque wrench adapter is used, the length of the adapter must be added to the length of the flex or "T" handle wrench and a value calculated for that particular combination. The following is a typical example in finding a desired value.

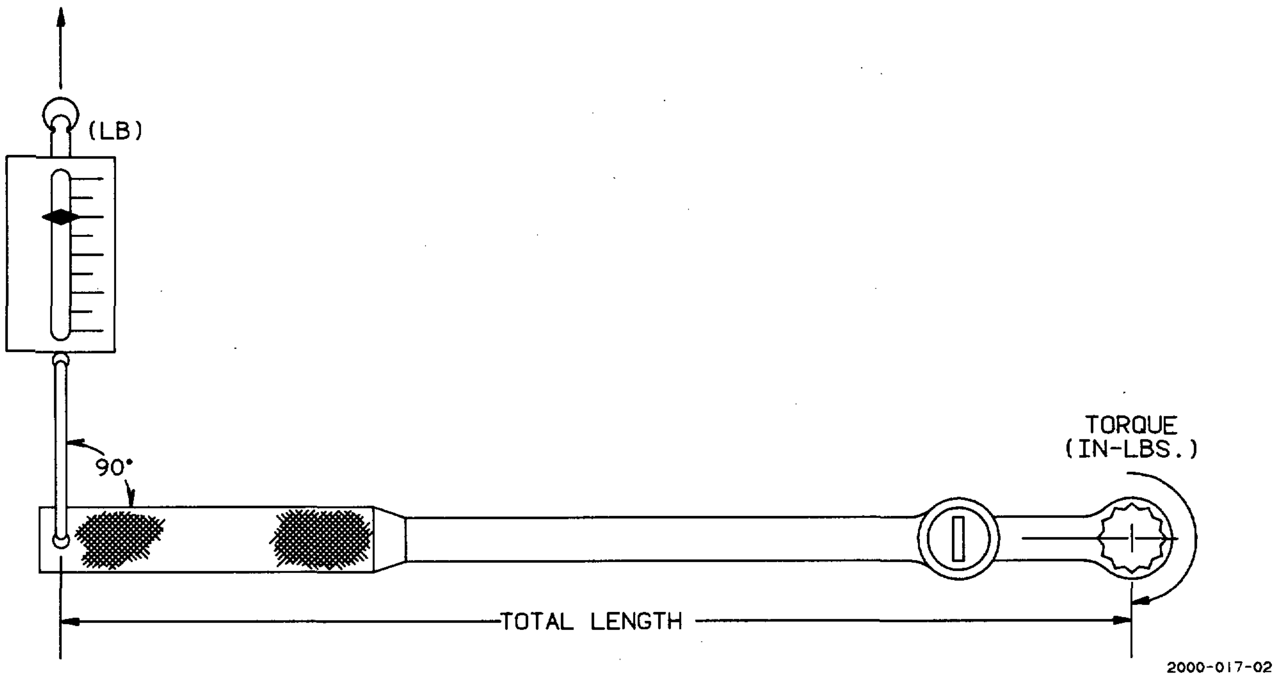
Effective length of flex or "T"
Handle wrench . . . . 12 inches
Length of adapter . . . . .3 inches
Total length . . . . 15 inches
Desired torque on bolt . . . . 2000 inch-lbs.

(2000 inch-lbs.) ÷ (15 inches) = 133.3 lbs.

BT01038



Torque Wrench and Adapter
Figure 1



Computing Torque with a Spring Scale
Figure 2

CHART 1
FINE THREAD SERIES, CLASS 3, CADMIUM PLATED AND NONLUBRICATED (EXCEPT AS NOTED)

	Torque Limits Recommended for Installation (Inch-Pounds)				Maximum Allowable Tightening Torque (Inch-Pounds)			
	Column 1		Column 2		Column 3		Column 4	
Size	MS20365 & AN310 Nuts	MS21042 Dry-Film Lub Nut	MS20364 & AN320 Nuts	MS21245 Dry-Film Lub Nut	MS20365 & AN310 Nuts	MS21042 Dry-Film Lub Nut	MS20364 & AN320 Nuts	MS21245 Dry-Film Lub Nut
5/32-36	12-15	*	7-9	---	20	*	12	---
3/16-32	20-25	15-19	12-15	---	40	30	25	---
1/4-28	50-70	37-47	30-40	---	100	70	60	---
5/16-24	100-140	56-78	60-85	---	225	135	140	---
3/8-24	160-190	72-108	95-110	---	390	200	240	---
7/16-20	450-500	---	270-300	---	840	---	500	---
1/2-20	480-690	---	290-410	210-230	1100	---	660	415
9/16-18	800-1000	---	480-600	310-430	1600	---	960	660
5/8-18	1100-1300	---	660-780	485-605	2400	---	1400	1060
3/4-16	2300-2500	---	1300-1500	1090-1250	5000	---	3000	2500
7/8-14	2500-3000	---	1800-2400	1640-2100	7000	---	4200	3740

*This is a coarse thread (.1640-32) with recommended torque limits of 9-11 inch-pounds and a maximum allowable tightening torque of 14 inch-pounds.

BT03021

CHART 2
TORQUING COARSE THREADED BOLTS LOADED IN SHEAR

Size	Torque Limits REcommended (Inch-Pounds) AN365 & AN310 Nuts	AN364 & AN320 Nuts	Maximum Allowable Torque (Inch-Pounds) AN365 & AN310 Nuts	AN364 & AN320 Nuts
9-32	12-15	7-9	20	12
10-24	20-25	12-15	35	21
1/4-20	40-50	25-30	75	45
5/16-18	80-90	48-55	160	100
3/8-16	160-185	95-110	275	170
7/16	235-255	140-155	475	280
1/2-13	400-480	240-290	880	520
9/16-12	500-700	300-420	1100	650
5/8-11	700-900	420-540	1500	900
3/4-10	1150-1600	700-950	2500	1500
7/8-9	2200-3000	1300-1800	4600	2700
1-8	3700-5000	2200-3000	7600	4500
1 1/8-8	5500-6500	3300-4000	12000	7200
1 1/4-8	6500-8000	4000-5000	46000	1000

The above values apply to Class 3 threads, cadmium plated and nonlubricated.
BT03022

ELECTROSTATIC DISCHARGE SENSITIVITY - DESCRIPTION AND OPERATION

Some types of electronic components are easily damaged by electrostatic discharge (ESD), and require special handling and storage procedures. ESD is a release of stored electrostatic charge which has been generated by actions such as contact, rubbing, or separating of materials. A charge of this type can damage electrical and electronic equipment installed in the airplane. In some instances, the damage may not be immediate, but progressive. Components and items of equipment that can be damaged by electrostatic discharge are considered to be electrostatic discharge sensitive (ESDS). Electronic components that are considered to be electrostatic discharge sensitive include integrated circuits, transistors and diodes, monolithic and hybrid microelectronics, MOS capacitors, thin film resistors, and piezoelectric crystals. Any circuit or piece of equipment containing ESDS components is subject to ESD damage if certain handling precautions are not observed.

Personnel who remove, inspect, test or install instruments and equipment containing ESDS components must be aware of the possibility of ESD damage, and should handle ESDS components in accordance with procedures covered in this chapter. Proper procedures and policies for the handling of ESDS components and equipment should be adhered to for the following reasons:

- Control of ESD damage, from time of component manufacture to time of actual installation, must be verifiable and must be maintained by use of established industry standards.
- Established policy dictates that all personnel follow certain procedures to prevent damage to ESDS components and equipment.
- Interacting areas of responsibility must be aware of their obligation to maintain proper ESD-controlled environments.

Table 1 lists several materials and the associated electrostatic charge polarity and magnitude for each. Materials at the top of the list are capable of producing the greatest amount of positive electrostatic charge, while materials at the bottom of the list are capable of producing a similar negative electrostatic charge. Items of dissimilar polarity provide the greatest potential for electrostatic discharge. Numeric values have not been assigned to the listed materials, as static charge levels are not constant, and will vary with ambient conditions. A greater possibility of ESD exists when the positions of listed items in Table 1 are farther apart. For example, an individual using his/her hands to pick up a PVC pipe has more potential for producing ESD than does an aluminum part contacting a steel part.

Table 2 identifies some typical electrostatic charge levels and the actions that can produce the electrostatic charge.

ELECTROSTATIC DISCHARGE SENSITIVITY CLASSIFICATION

Three levels of sensitivity classification are established for electrostatic discharge sensitivity devices. Classification is used to aid the manufacturer or supplier in providing packaging and handling requirements that protect the ESD sensitive item, device or component through all phases of handling and packaging of the device during its service life. The three classes of ESD sensitivity are as follows:

Class 1 - Sensitivity range is from 0 to 1,999 volts.

Class 2 - Sensitivity range is from 2,000 to 3,999 volts.

Class 3 - Sensitivity range is from 4,000 to 15,999 volts.

ELECTROSTATIC DISCHARGE SENSITIVITY - MAINTENANCE PRACTICES

REMOVAL/INSTALLATION OF ESDS EQUIPMENT

Observe the following procedures when removing or installing ESDS equipment at the airplane:

TABLE 1
MATERIAL POLARITY

MATERIALS	CHARGE (Relative Magnitude and Polarity)
Air	Positive
Human Hands	Positive
Asbestos	Positive
Rabbit Fur	Positive
Glass	Positive
Mica	Positive
Human Hair	Positive
Nylon	Positive
Wool	Positive
Fur	Positive
Lead	Positive
Silk	Positive
Aluminum	Positive
Paper	Positive
Cotton	--Neutral--
Steel	Negative
Wood	Negative
Amber	Negative
Sealing Wax	Negative
Hard Rubber	Negative
Nickel, Copper	Negative
Brass, Silver	Negative
Gold, Platinum	Negative
Sulfur	Negative
Acetate, Rayon	Negative
Polyester	Negative
Celluloid/	Negative
Orlon/	Negative
Saran/	Negative
Polyurethane	Negative
Polyethylene	Negative
Polypropylene	Negative
PVC (Vinyl)	Negative
KEL-F (CTFE)	Negative
SILICON	Negative
TEFLON/	Negative

BT01030

CAUTION

Tools with plastic or insulated handles should not be used around ESDS devices. These tools can carry a static charge which does not readily discharge during the grounding process. Insulated tools should be used only during power-on testing of aircraft systems to prevent electrical shock to maintenance personnel performing the tests.

Some circuit board assemblies may be protected by plastic covers. These covers can store an electrostatic charge. Use a static control work station to neutralize any electrostatic

TABLE 2

TYPICAL ELECTROSTATIC VOLTAGES		
ACTIONS OF PERSONS	MOST COMMON READING (VOLTS)	HIGHEST READING (VOLTS)
* Walking across carpet	12,000	39,000
* Walking across vinyl tile floor	4,000	13,000
* Seated in polyurethane foam chair	1,800	18,000
* Picking up poly bag	1,500	20,000
* Inserting paperwork into vinyl envelopes	800	7,000
Data based on ambient relative humidity = 15% to 36% BT01031		

charge on the covers before touching a printed circuit board. Store the covers a safe distance from the work area.

a. When using test equipment, discharge all test leads to ground prior to connection to the ESDS circuit under test.

b. Use a portable static control work station when removing ESDS circuit boards from card cages and enclosures at the airplane.

c. Place removed ESDS equipment on the work station static dissipative work surface before opening the static shielding container holding the replacement ESDS equipment.

d. Just prior to engaging a cable connector with its mating receptacle, touch the connector shell to the receptacle shell to neutralize any electrostatic charge on the connector or the installer's body.

e. Maintain protective coverings on stored ESDS equipment.

HANDLING OF ESDS COMPONENTS AND EQUIPMENT

All personnel handling ESDS components and equipment should receive instruction in the proper handling of such items. Observe the following handling rules to prevent damage to ESDS components and equipment:

a. Keep ESDS components and equipment inside ESD protective packaging until opened at a static control work station.

b. Before unsealing ESD protective packages, place the packages on the work surface of a static control work station.

c. Do not use pressure air nozzles to remove dust from ESDS printed circuit boards. Rapid movement of air, combined with airborne dust particles, can create an electrostatic charge that will destroy ESDS components.

d. Always wear a grounding wrist strap when opening any ESD protective package.

e. Avoid touching circuit components or connector pins when handling ESDS components or equipment.

f. Never place any ESDS component, before or after assembly, on a nonconductive surface or in a container not specifically designed for storage of ESDS devices.

g. Protect ESDS components and equipment with protective containers, conductive caps, and/or pin-shorting devices.

h. Store and transport ESDS components and equipment in ESD protective containers. Seal all protective containers with an ESD warning label prior to shipment.

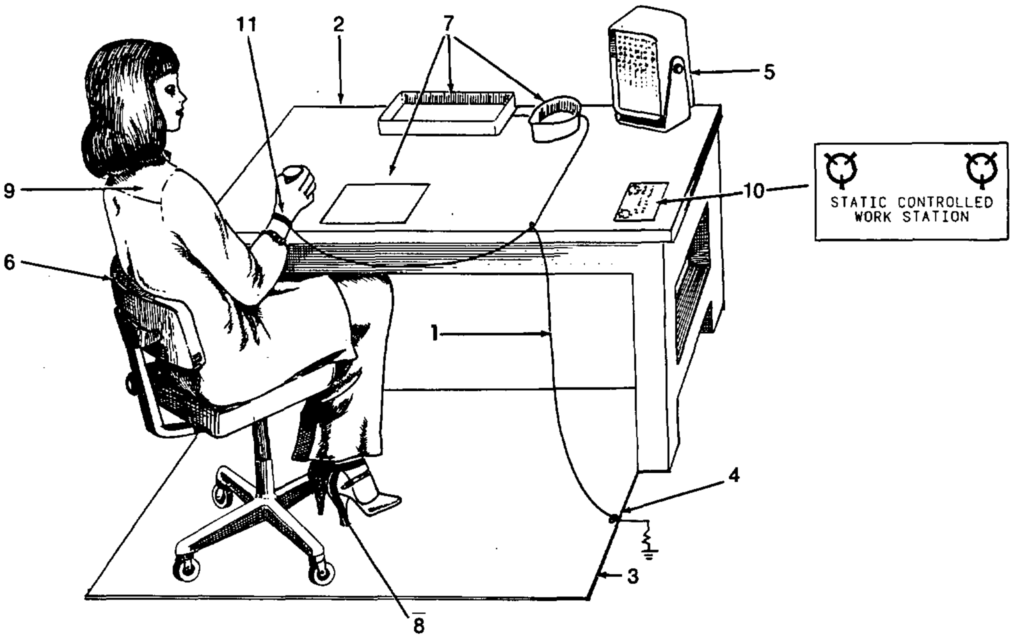
i. Place all loose ESDS components and equipment into ESD protective containers BEFORE removing a grounding wrist strap.

j. Keep the work station free of any material not required to accomplish the assigned task.

k. Follow established ESD protection rules and procedures.

l. Always use a static control work station, either permanent or portable, when removing ESDS components and equipment from protective packaging.

m. Use only grounded, electrically isolated, and temperature controlled soldering irons that have been rated for use with ESDS components and equipment. Use only hand tools that have conductive or static dissipative handles or grips. Test equipment, such as scopes and meters, must be



- * 1. GROUND CORD ASSEMBLY
- * 2. STATIC DISSIPATIVE MAT OR WORK BENCH SURFACE
- 3. STATIC DISSIPATIVE/CONDUCTIVE FLOOR OR MAT
- * 4. GROUND CONNECTION
- * 5. IONIZED AIR BLOWER
- 6. STATIC CONTROLLED CHAIR
- * 7. CONDUCTIVE CONTAINERS AND CONDUCTIVE BAGS
- 8. HEEL GROUNDING STRAP
- 9. ANTISTATIC/CONDUCTIVE CLOTHING OR OUTER GARMENT
- *10. SIGN - ESD CONTROLLED WORK STATION
- *11. SNUG-TO-SKIN PERSONNEL WRIST STRAP TO GROUND

NOTE

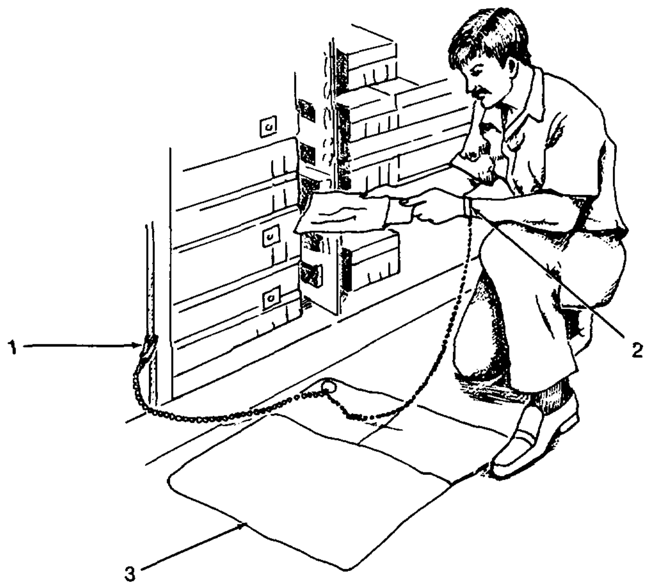
ITEMS MARKED WITH AN (*) ARE REQUIRED FOR A STATIC CONTROLLED WORK STATION. ALL OTHER ITEMS ARE OPTIONAL, BUT PROVIDE ADDED PROTECTION OR ENHANCE WORKER MOBILITY.

NOTE

KEEP STATIC GENERATORS, SUCH AS PLASTIC CUPS, CIGARETTE WRAPPERS, SURPLUS CLOTHING, HANDBAGS, LUNCH CONTAINERS, PLASTIC BAGS, FOAM PACKING, READING MATERIAL, ETC. AWAY FROM STATIC CONTROL WORK STATIONS.

AP014188

Permanent Static Control Work Station
Figure 1



1. ALLIGATOR CLIP TO RELIABLE GROUND CONNECTION
2. SNUG-TO-SKIN PERSONNEL WRIST STRAP
3. STATIC DISSIPATIVE WORK SURFACE

AP014189

Portable Static Control Work Station
Figure 2

rated for use around ESDS components and equipment.

n. Avoid exposing ESDS components and equipment to large electromagnetic or electrostatic fields such as transformers or transmitting antennas.

CONTROLLING STATIC CHARGE BUILDUP

Four basic techniques are employed in ESD control. These are:

a. MINIMIZE THE CHARGE BUILDUP - Minimize electrostatic charge buildup by using conductive or static dissipative flooring and static-dissipative work surfaces. Wear leather shoes, cotton socks, and a grounding ankle strap to dissipate body charge buildup. Wear cotton clothing instead of wool or synthetics. Use an ionized air blower to dissipate charges from nonconductive items.

b. DRAIN OFF THE CHARGE TO GROUND - The human body is a good electrical conductor and for that reason electrostatic charges on the body can be dissipated by skin contact with a grounding device such as a wrist or ankle strap. Always wear a grounding wrist strap when opening ESD containers or handling exposed ESDS components and equipment.

c. NEUTRALIZE THE CHARGE - Nonconductors, such as polystyrene coffee cups, plastic bags, and some clothing develop electrostatic charges that cannot be neutralized by grounding. Ionized air flow will neutralize an electrostatic charge on a nonconductor as long as the ionized air blower puts out both positive and negative ions.

d. MINIMIZE THE EFFECTS OF ELECTROSTATIC FIELDS - The immediate environment surrounding ESDS components and equipment must be free of electrostatic fields or must have suitable static shielding to minimize induced effects from electrostatic fields.

PERMANENT STATIC CONTROL WORKSTATION (FIGURE 1)

A static control work station provides for static-free handling of ESDS components and equipment by diverting, to ground, electrostatic charges on conductive objects.

A permanent static control work station consists of the following items:

CAUTION

Never wear a grounding wrist strap over clothing. The strap must be in contact with the wearer's skin to adequately dissipate any electrostatic charge. Under certain conditions, personnel using a grounding wrist strap may need to use a lotion-type skin moisture enhancer to provide a low-resistance connection between the wrist and the wrist strap.

a. GROUNDING WRIST STRAP - Each person that handles ESDS components and equipment must wear a grounding wrist strap to dissipate bodily electrostatic charges. The wrist strap must fit firm against the skin and release quickly in case of an emergency. The wrist strap incorporates a 1 megohm current-limiting resistor, in series with the ground cord, to protect the wearer from electrical shock hazards.

b. STATIC-DISSIPATIVE WORK SURFACE - Conductive mats on the work bench surface are designed to remove electrostatic charges from conductive items placed on the mat.

c. CONDUCTIVE FLOORING - Conductive flooring is used when additional control of ESD is required. To maintain total control over ESD, use conductive chairs, a grounding heel strap, and conductive shoes. Conductive flooring in ESD control areas must be free of all wax or other nonconductive coatings.

d. HARD GROUND CONNECTION - Grounding of the static control work station is accomplished through one or more copper ground rods driven into moist earth to a depth sufficient to provide a low resistance path from the work station to ground. All work station connections to ground are made through a one megohm resistor to protect work station personnel from electrical shock hazards by limiting current flow to ground.

NOTE

Some building grounds need to be checked to ensure that there is no current looping from other nearby grounds.

Ensure that the source of current is external and not static.

e. IONIZED AIR BLOWER - The ionized air blower provides a constant flow of positive and negative ions over the work station surface to neutralize electrostatic charges on nonconductive materials in the air flow path. The use of an ionized air blower, in combination with a static control work station, provides additional protection for ESDS components and equipment. Since it is not always possible to eliminate all static charge accumulators (styrofoam, plastic, etc.) from a work area, the ionized air blower is used to provide additional protection by flooding the work area with balanced negative/positive ionized air. Static charge accumulators should always be kept away from static-free areas, but inadvertent static is hard to control, especially when developed by such common items as clothing, footwear, combs, and pens. An ionized air blower will help control some of this inadvertent buildup.

f. STATIC DISSIPATIVE SEATING - Chairs used at ESD protected work stations must be conductive, and if padded, must be covered with static dissipative material.

g. CONDUCTIVE CONTAINERS - ESDS devices must be transported in approved containers to prevent ESD damage. These special containers are made of metal or special conductive plastic. Before static-sensitive components and equipment are removed from a static control work station, they must be packaged in containers that provide at least as much protection as that provided by the work station. Conductive boxes, kit trays, and similar types of approved containers provide complete ESD protection to ESDS components and equipment while in transit.

h. GROUNDING HEEL STRAP - A grounding heel strap can provide additional ESD protection. The heel strap makes contact with the wearer's skin at the ankle, and extends to the bottom of footwear to make contact with a conductive mat or conductive flooring. The grounding heel strap can be used in combination with a grounding wrist strap to provide maximum ESD protection.

i. ANTISTATIC/CONDUCTIVE CLOTHING - Many types of clothing generate electrostatic

CAUTION

THIS EQUIPMENT CONTAINS DEVICES SENSITIVE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING, OR INSERTING PARTS OR ASSEMBLIES.

AP014190 C

Equipment Enclosure Cautionary Placards
Figure 3

charges. To remove some of this buildup, work station personnel should wear outer garments that help dissipate electrostatic charges. Cotton ranks among the best fabrics for antistatic protection. Do not wear synthetic or wool fabrics around ESDS devices, as these fabrics retain electrostatic charges.

PORTABLE STATIC CONTROL WORKSTATION (FIGURE 2)

A portable static control work station provides for static-free handling of ESDS components and equipment during maintenance operations at the airplane. The typical portable work station is available as a field service kit that is used to dissipate electrostatic charges before the charges can damage ESDS components and equipment.

A typical portable static control work station consists of the following items:

a. GROUNDING WRIST STRAP - Each person who handles ESDS components and equipment must wear a grounding wrist strap to dissipate bodily electrostatic charges. The wrist strap must fit firm against the skin and should release quickly in case of emergency. The wrist strap incorporates a 1 megohm current-limiting resistor, in series with the ground cord, to protect the wearer from electrical shock hazards.

b. STATIC-DISSIPATIVE WORK SURFACE - A conductive mat is an integral part of the portable work station, and is designed to remove electrostatic charges from conductive items when those items contact the mat.

c. HARD GROUND CONNECTION - Ground the portable work station to the airframe or to a common ground as shown in Figure 2. All portable work station connections to ground are made through 1 megohm current-limiting resistors to protect maintenance personnel from electrical shock hazards.

HUMIDITY AND DUST EFFECTS ON ESDS COMPONENTS AND EQUIPMENT

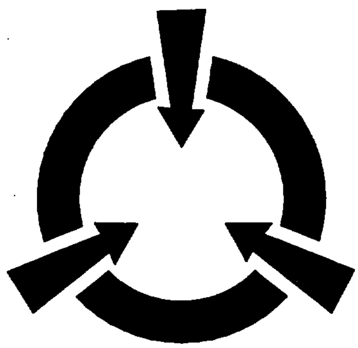
Humidity is a factor in the control of ESD. The lower the humidity, the greater the chance of damage to ESDS components and equipment. Humidity at the work station should be maintained between 30 and 65 percent.

CAUTION

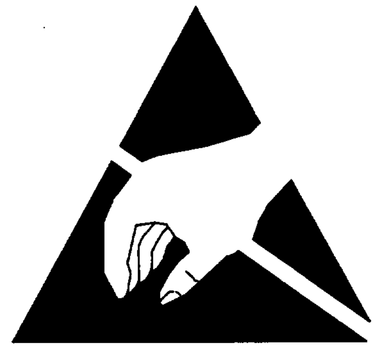
ELECTROSTATIC DISCHARGE
SENSITIVE ELECTRONIC DEVICES.
SPECIAL HANDLING REQUIRED.

AP014191 C

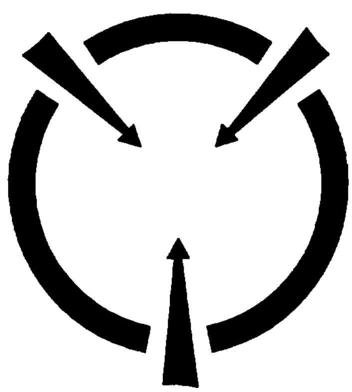
ESDS Drawing Note
Figure 4



MIL-STD-1285 ESD SYMBOL



RS-471 ESD SYMBOL



MIL-STD-129H ESD SYMBOL

AP014193 C

ESDS Symbols
Figure 5

Repair of ESDS circuit boards, including replacement of ESDS components, should be performed in a dust-free environment.

PACKAGING OF ESDS COMPONENTS AND EQUIPMENT

All ESDS components and equipment require special ESD protective packaging. Seal all ESDS packages with an appropriate cautionary label as shown in Figures 3 through 8.

CAUTION

Do not use clips or staples when sealing any ESDS package.

Do not use carbon-filled, conductive bags.

Remove ESDS components and equipment from protective, static-shielded containers ONLY at a static control work station after attaching a grounding wrist strap and verifying that ESD producing items are not on the static dissipative work surface.

ESD protective packaging requirements, unless otherwise defined by specification, shall conform to the following:

- Class 1 - Package in multi-layer conductive type bags consisting of an inner and outer layer of antistatic (surface resistivity of 10^9 to 10^{14} ohms per square inch) or static dissipative (surface resistivity of 10^5 to 10^9 ohms per square inch) material with a middle layer of conductive material (surface resistivity of 10 ohms or less).
- Class 2 - Package in a static dissipative material possessing a surface resistivity of 10^5 to 10^9 ohms per square inch. Materials specified for Class 1 may also be used.
- Class 3 - Package in an antistatic material possessing a surface resistivity of 10^9 to 10^{14} ohms per square inch.

Place all ESDS devices in approved static shielding containers before packing in shipper's normal exterior containers. Use antistatic cushioning or fill materials. Do not use static generating materials, such as polyethylene, styrofoam, or paper.

Antistatic packaging is generally pink or blue in color. The material differs from common plastic in

CAUTION

SENSITIVE ELECTRONIC DEVICES.
SPECIAL HANDLING REQUIRED.
DO NOT OPEN EXCEPT AT AN APPROVED
WORK STATION.

(PREFERRED)

ATTENTION

CONTENTS
STATIC SENSITIVE

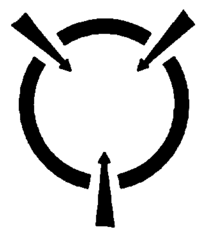
HANDLING
PRECAUTIONS REQUIRED

CONTENTS ______________

(ACCEPTABLE)

AP014192 C

ESD Unit Container Notice
Figure 6



ATTENTION

CONTENTS
STATIC SENSITIVE

HANDLING
PRECAUTIONS REQUIRED

AP014194 C

Protective Container Notice
Figure 7

that an antistatic compound is incorporated into the material during the manufacturing process. This type of packaging DOES NOT provide static shielding, and is generally used to package instruction sheets, data sheets, and other non-ESDS materials prior to introduction into a static-free environment. All non-ESDS items, that are to enter an ESD work station, require repackaging in antistatic materials.

Conductive static shielding packaging differs from antistatic packaging, in that it has the ability to shield devices, contained within, from external static charges. Conductive static shielding packaging is available in the form of bags and rigid containers.

MARKING OF ESDS COMPONENTS AND EQUIPMENT

All ESDS components and equipment should be marked appropriately with an ESDS symbol as shown in Figure 5.

NOTE

ESDS symbols (circle with arrows pointing into the circle from equidistant positions or a hand inside of a triangle with an angling bar across the triangle) are yellow on a black background or black on a yellow background.

Mark unit containers with the ESDS caution label on the outside of the package. Mark exterior containers with an ESD caution label as shown in Figure 8. Apply marks directly to each ESDS printed circuit board, assembly cover, equipment enclosure, or access door that would expose ESDS devices, if removed. Mark appropriately using decal transfer, stencil, silk screen, or any other method meeting permanent legibility requirements.

Display ESDS symbols in a prominent package location to alert all personnel to the presence of ESDS devices and equipment. The ESDS symbol should be at least 1/4" in diameter. ESDS symbols that are attached to circuit boards should contrast with the circuit board base color. Enclosures that contain ESDS circuit boards should be identified by bright orange paint on the outer face of the enclosure.

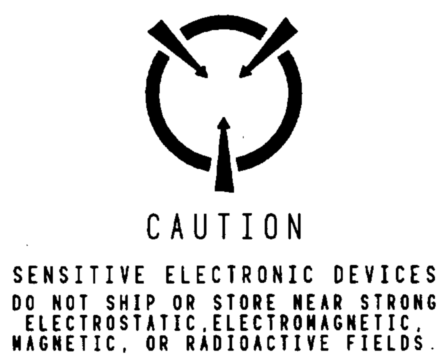
STORAGE AND TRANSIT OF ESDS COMPONENTS AND EQUIPMENT

CAUTION

NEVER use ordinary plastic containers or packing materials when transporting ESDS components or equipment.

When preparing ESDS devices for shipment, ensure all assemblies and equipment have been protected against ESD through appropriate handling at static controlled work stations.

ESDS packages, which have been properly enclosed in protective packages, require proper storage and transfer in conductive static-dissipative, or static-free containers. Shipping information and other instructions, accompanying ESD-protected packages, shall be contained in anti-static materials. ESDS components, that are received in damaged or opened packing containers, are not acceptable, and should be returned for replacement.



AP014195

In-House Storage Container Label
Figure 8

ELECTRICAL BONDING - DESCRIPTION AND OPERATION

The following terms are defined as used in the system description:

- ELECTRICAL BOND: A reliable electrical connection between conductive parts which provides electrical conductivity.
- ELECTRICAL BONDING: Conductive parts are considered electrically bonded when they are mechanically interconnected to maintain a common electrical potential.
- GROUND: A conducting connection, whether intentional or accidental, by which an electrical current or equipment is connected to maintain a common electrical potential.

ELECTRICAL BONDING METHODS

There are two basic types of electrical bonding; direct and indirect. Both are accomplished by using mechanical methods to attach the electrical conductors. Bolts, rivets, conductive laminates, flashing and bonding jumpers are commonly used.

Whether direct or indirect, all electrical bonding must reflect high maintenance standards to maintain the electrical integrity. Many times, an ill-prepared surface may initially provide sufficient grounding properties, but experience a rapid deterioration in conductivity when corrosion from contaminants or moisture appears on the bonding surface. All bonding surfaces should be free of primer or coatings not compatible with electrical conductance. This includes but is not limited to, all protective films such as anodize, grease, oil, paint, lacquer, or other finishes with high resistance properties. Once the electrical bonding surface is cleaned, and the necessary protective coatings applied, the component is installed and a resistance check is performed to verify continuity of the electrical bond.

DIRECT ELECTRICAL BONDING

Direct electrical bonds are frequently used for metal-to-metal joints. Before assembly, the joints are treated with a conductive film that prevents corrosion of the bonding surface. Most direct electrical bonds involve the installation of components on aluminum.

INDIRECT ELECTRICAL BONDING

When direct electrical bonding methods are impractical, indirect bonding methods are used. Indirect electrical bonding is most commonly accomplished by using bonding jumpers to make the desired connection. These flexible metal straps are attached to a prepared metal surface using screws, studs, nuts and washers. The connection is always as short as possible and uses a single jumper. Two bonding jumpers connected in a series is unacceptable, as this can double the resistance between the ground plane and bonded component. Bonding jumpers are also used to electrically connect tubes between joints.

CAUTION

Anytime maintenance is performed on or around these flexible bonding jumpers, the wire should not be bent or damaged as this has a tendency to weaken the jumper and reduce its effectiveness. "Waggling" the bonding jumper to see if the end terminals are tight is unacceptable as this may also induce fatigue on the crimped portion of the bonding jumper.

Indirect electrical bonding is also used to connect the airplane wire harness shielding terminals to a ground. The tubular braiding attaches to the electrical connectors with clamps and shields the airplane wire harness for its entire length.

ELECTRICAL BONDING OF TUBES

All metallic tubes that carry petroleum products or other fluids, including gases, must have a mechanically secure connection to the ground plane for static dissipation. Plumbing sections must be electrically bonded to each other to eliminate a potential electrical charge on the individual segments. Continuity between the plumbing segments is achieved with electrical bonding clamps or jumpers. Electrical bonding clamps, used in some applications, have a wire that contacts the plumbing on either side of the clamp, ensuring continuity across the joint.

ELECTRICAL POWER RETURNS

Electrical power returns should be direct with the shortest possible path from the operating equip-

CHART 1
RECOMMENDED MATERIALS

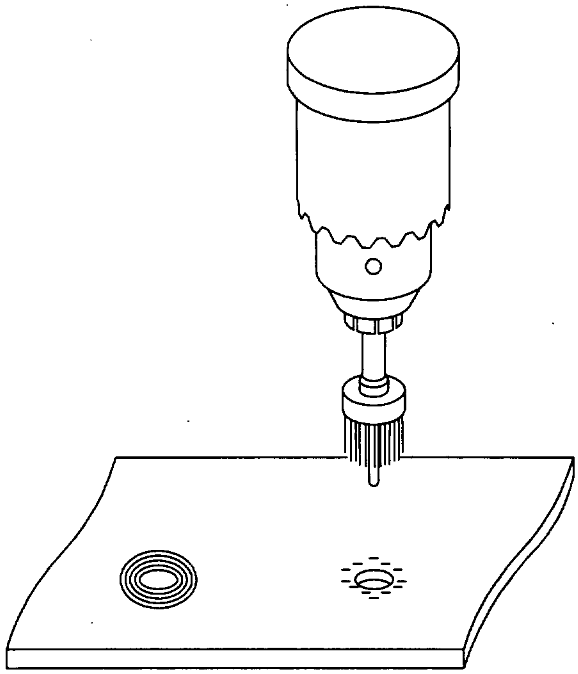
MATERIAL	SPECIFICATION	PRODUCT	VENDOR
1. Cleaner	TT-M-261	Methyl Ethyl Ketone	Obtain locally
2. Coating		Alodine 1200	Amchem Products Inc., Spring Garden St., Ambler, PA 19002
3. Conformal Coating	MIL-I-46058	Conothane CE-1155	Conap Inc., 1405 Buffalo St., Olean, NY 14706
4. Primer	MIL-P-2337	1-1Y-12/1-1H-7	Advanced Coatings & Chemicals, 4343 Temple City Blvd., Temple City, CA 91780
5. Sealant	MIL-S-8802 Type 1	PR1422	Products Research and Chemical Corp., 5426 San Fernando Rd., Glendale, CA 91203
6. Cleaner	0-T-634	1,1,1, Trichlorothane	BF Goodrich, 500 S. Main Street, Akron, OH 44318

BT03019

ment to ground when practical. Current return leads 4 AWG or larger should not be connected directly to the airplane structure, but should be connected to a electrical bonding stud attached to the structure. This method prevents damage should a faulty connection induce high current flow through the connection. A maximum of four wire terminals may be installed on an individual grounding stud. If two or more wires are grounded to an individual stud, each wire must form a mechanically sound connection and meet applicable maximum resistance values. Component case electrical bonding and current return bonding are separate, with the connections made to separate ground studs. As a general rule and precaution, note the power return configuration before removal of a component, and ensure the right configuration is used during installation.

RECOMMENDED MATERIALS

The recommended materials listed in Chart 1 as meeting federal, military or vendor specifications are provided for reference only and are not specifically required by Beech Aircraft Corporation. Any product conforming to the specification may be used subject to availability. The products included in these charts have been tested and approved for aviation usage by Beech Aircraft Corporation, by the vendor or compliance to the applicable specifications. GENERIC OR LOCALLY MANUFACTURED PRODUCTS WHICH CONFORM TO THE REQUIREMENTS OF A SPECIFICATION MAY BE USED EVEN THOUGH NOT INCLUDED IN THE CHART. Only the basic number of each specification is listed. No attempt has been made to update the listing to the latest revision. It is the responsibility of the technician or mechanic to determine the current revision of the applicable specification prior to usage of the product listed. This can be done by contacting the vendor of the product to be used.



2000-610-32

Use of Stainless Steel Wire Brush On Aluminum (With Pilot)
Figure 1

ELECTRICAL BONDING - MAINTENANCE PRACTICES

METAL SURFACE PREPARATION AND ELECTRICAL BONDING

Surface preparation for electrical bonding requires the complete removal of anodic film, grease, oil, paint, lacquer, metal finishes and other resistive coatings from an area slightly larger than the bonding surface. A clean, smooth, properly contoured electrical bonding surface should be obtained, while removing the least amount of metal possible.

NOTE

Do not use emery cloth or iron oxide sandpaper. Use only aluminum oxide or silicon carbide sandpaper.

WARNING

When working in an enclosed area with solvents, cleaners or finishes, provide a means of adequate ventilation to prevent a concentration of harmful vapors. The procedures that follow describe preparation of the various types of metal surfaces for electrical bonding.

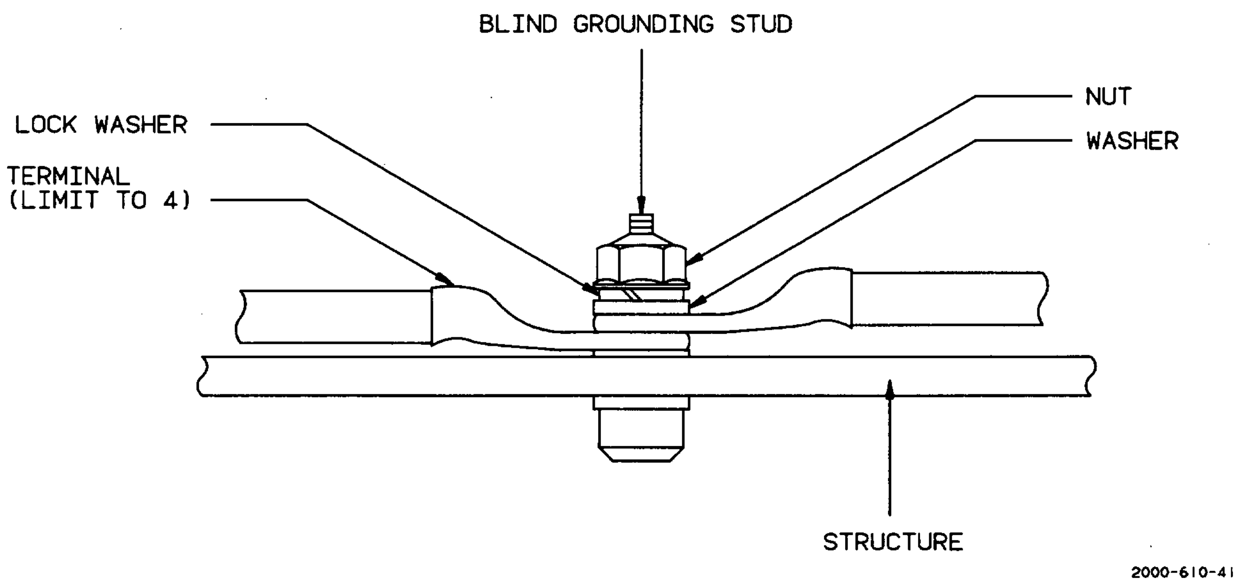
ALUMINUM SURFACES

a. Remove any nonsoluble protective finishes or corrosion from an area slightly larger than the area to be bonded (minimum of .25 inch) by sanding with fine sandpaper.

NOTE

A stainless steel wire brush with a pilot may be used to clean small areas (Figure 1).

b. Clean the bonding surface thoroughly with MEK (1, Chart 1) to remove any oils or contaminants.



Typical Blind Ground Stud
Figure 2

NOTE

Do not touch the bonding surface with bare hands. Body oils or acids may prevent adhesion of the alodine film or cause corrosion.

c. Shake the alodine solution (2, Chart 1) vigorously just prior to application, then apply to the bonding surface with a clean Scotch Brite pad, sponge, brush or cloth.

NOTE

The alodine solution should have an amber color. If the solution is coffee colored, it has been contaminated. Repeat the cleaning procedure if contaminated alodine has been applied to the bonding surface.

d. Keep the treated area wet with alodine for approximately 3 to 5 minutes until a yellow color develops. Should the alodine not change color, it is an indication that the surface was not properly cleaned.

e. After the alodine has changed color, rinse the area with clean, deionized water and gently wipe dry. Touch up any areas where the alodine does not cover the bonding surface. Care must be taken not to damage the alodine coating as it is still soft when bonding.

NOTE

The bonding surfaces must be assembled within one hour of alodine treatment. Once dried, alodine must be softened before it can be effectively used in bonding. If more than an hour has passed, soften the alodine by applying wet alodine to the dried surface.

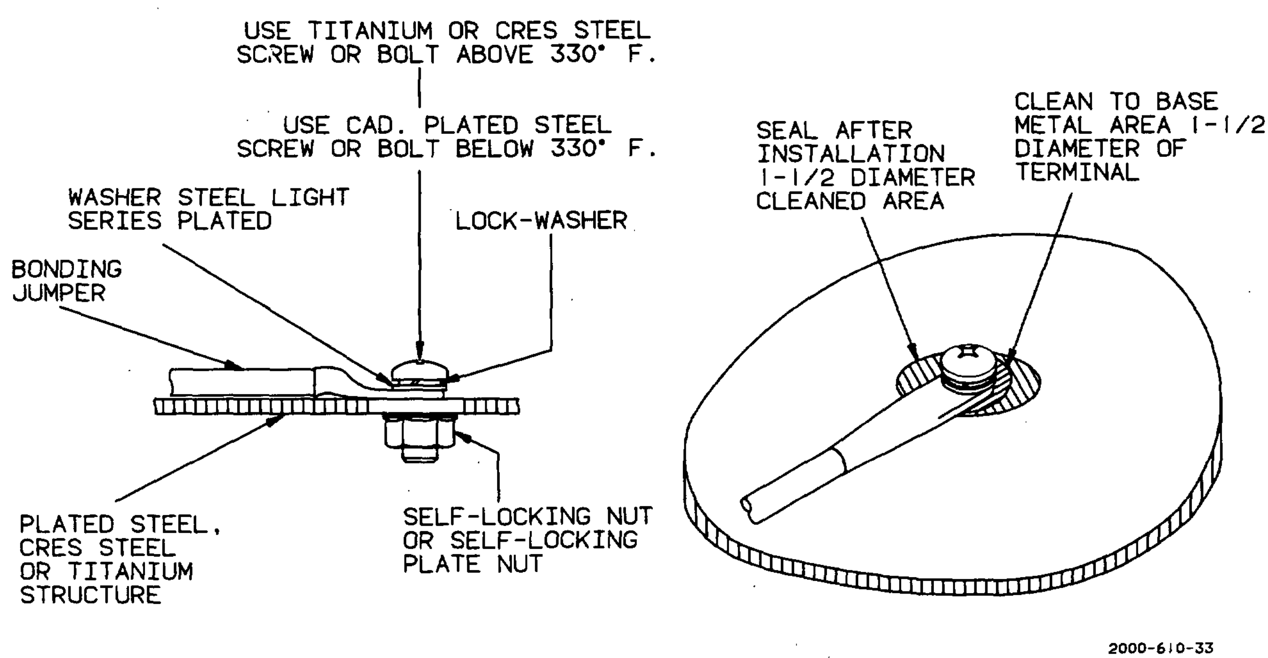
f. Install the component being electrically bonded.

g. Seal around the edges of the electrical bond with conformal coat per MIL-I-46058 (3, Chart 1). If the assembly was originally protected by primer, prime the assembly with primer (4, Chart 1) and reapply the original finish as required.

CHART 1
HARDWARE USED WITH GROUND STUDS

Structure	Screw, bolt Lock-Nut	Plain Nut	Washer A	Washer B	Washer C & D	Lock Washer E MS35338	Lock Washer F MS35338
			Tinned Copper Terminal and Jumper				
Aluminum Alloys	Cad. Plated Steel	Cad. Plated Steel	Alum. Alloy	Alum. Alloy	Cad. Plated Steel	Cad. Plated Steel	Cad. Plated Steel
Steel, Cadmium Plated	Cad. Plated Steel	Cad. Plated Steel	None	None	Cad. Plated Steel	Cad. Plated Steel	Cad. Plated Steel
Steel, CRES (corrosion-resistant)	CRES Steel	CRES Steel	None	None	Cad. Plated Steel	Cad. Plated Steel	CRES Steel

BT03020



CRES Steel or Titanium Electrical Bonding
Figure 3

NOTE

The bond area must be refinished within 24 hours of electrical bonding to preserve the integrity of the bond. If the bond involves a structural component, it must be fillet sealed at the edges or seams with sealant (5, Chart 1) to prevent moisture from entering and deteriorating the electrical bonding surfaces. Refer to Chapter 20-08-00 for information on airplane finishes.

CORROSION-RESISTANT (CRES) STEEL SURFACES

a. Remove all grease and oil from the electrical bonding surface with cleaner (6, Chart 1).

b. Remove all paint or lacquer from the electrical bonding surface with MEK (1, Chart 1).

NOTE

Use care not to remove any zinc or cadmium plating from the steel surfaces.

c. Allow the electrical bonding surfaces time to thoroughly dry.

d. Install the component being electrically bonded.

NOTE

The bond area must be refinished within 24 hours of bonding to preserve the integrity of the bond. If the bond involves a structural component, it must be fillet sealed at the edges or seams with sealer (5, Chart 1) to prevent moisture from entering and deteriorating the electrical bonding surfaces. Refer to Chapter 20-08-00 for information on airplane finishes.

STAINLESS STEEL AND TITANIUM SURFACES

a. Remove all oil and grease from the electrical bonding surface with cleaner solvent (6, Chart 1).

b. Remove all paint or lacquer from the electrical bonding surface with MEK (1, Chart 1).

c. Allow the electrical bonding surface to thoroughly dry.

d. Lightly sand the electrical bonding surface.

e. Use cleaner solvent (6, Chart 1) to clean the electrical bonding surfaces and wipe dry with a clean rag.

f. Install the component being electrically bonded.

g. After a good bond has been verified with the resistance check procedures, it must be fillet sealed at the edges or seams with sealant (5, Chart 1) to prevent moisture from entering and deteriorating the electrical bonding surfaces.

ELECTRICAL BONDING EXAMPLES

TYPICAL BLIND GROUND STUD (FIGURE 2)

Installation of a typical blind ground stud may be accomplished as follows:

NOTE

Use MS35338 lock washers on all bolted electrical bonding/grounding connections. Their function is to ensure a tight connection with plain or self-locking nuts under conditions where thermal expansion of the screw may occur.

a. The sidewalls of the mounting hole must be clean and free of all chemical films, grease and paint (cleaning of the upper and lower surfaces is not required).

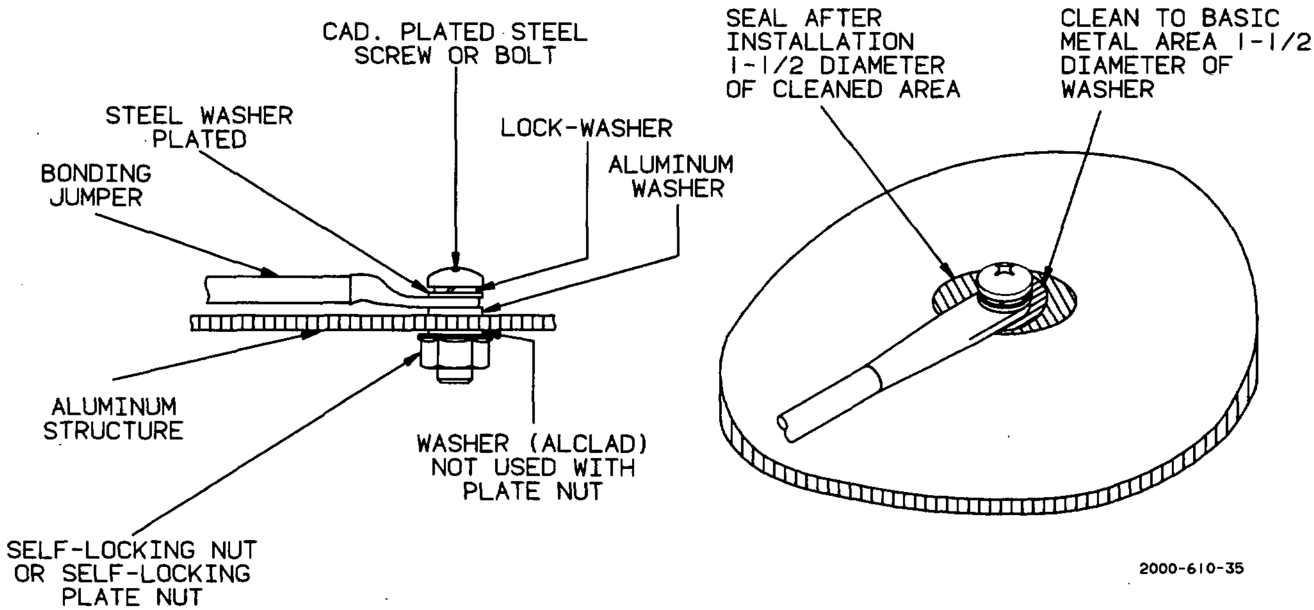
b. Ensure the blind ground stud is of sufficient size to distribute the current it will be subjected to.

CRES STEEL OR TITANIUM ELECTRICAL BONDING (FIGURE 3)

a. Prepare the electrical bonding surfaces as outlined under METAL SURFACE PREPARATION AND ELECTRICAL BONDING in this chapter.

b. Screw size: Use a No. 10 screw where edge distance will permit. A No. 8 or No. 6 screw may be substituted for the No. 10 screw if necessary to meet edge distance requirements. A Titanium or CRES steel screw must be used.

c. Use a 1/4-inch diameter fastener for 100-amp current returns.



Aluminum Electrical Bonding
Figure 4

d. Use a 5/16-inch diameter fastener for 200-amp current returns.

e. Use an MS35206 cad plated or steel screw for applications below 330° F..

f. Use an MS35206 CRES steel or titanium screw for applications above 330° F..

NOTE

Use MS35338 lock washers on all bolted electrical bonding/grounding connections. Their function is to ensure a tight connection with plain or self-locking nuts under conditions where thermal expansion of the screw may occur.

g. Use an MS21042L self-locking nut, or a self-locking nutplate (MS21047L or MS21069L) to retain the screw.

h. No sealing is required where the maximum temperature exceeds 600° F..

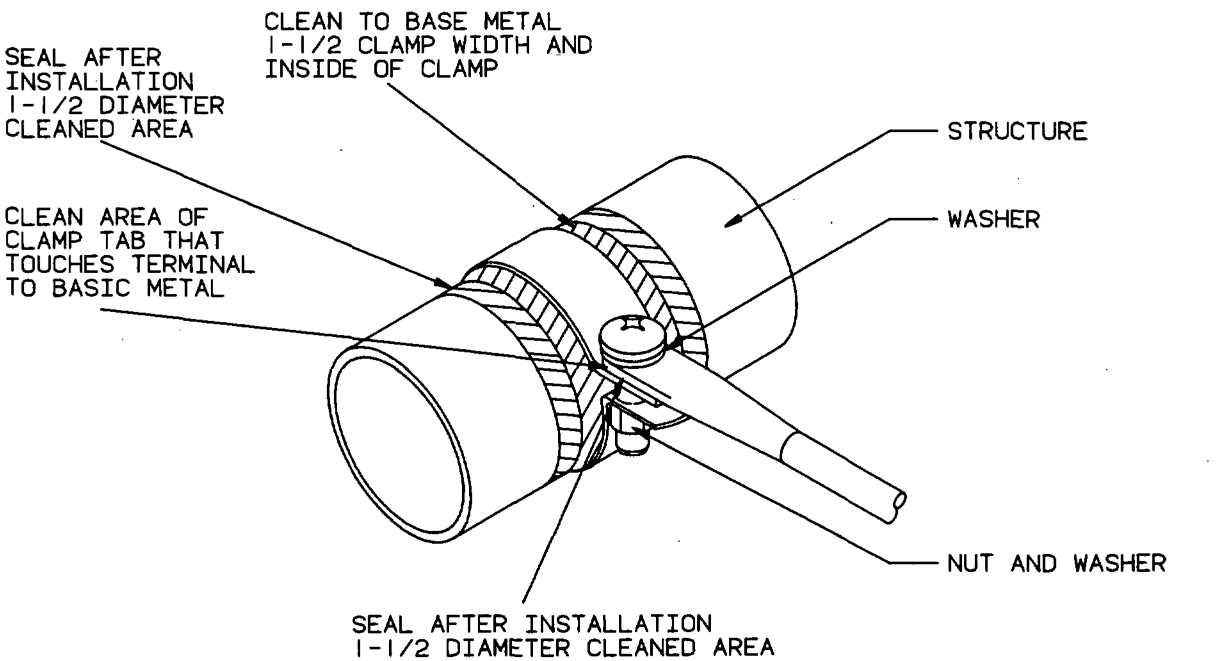
ALUMINUM ELECTRICAL BONDING (FIGURE 4)

a. Prepare the electrical bonding surfaces as outlined under METAL SURFACE PREPARATION AND ELECTRICAL BONDING in this chapter.

b. Screw size: Use a No. 10 screw where edge distance will permit. A No. 8 or No. 6 screw may be substituted for the No. 10 screw if necessary to meet edge distance requirements.

c. Use a 1/4-inch diameter fastener for 100-amp current returns.

d. Use a 5/16-inch diameter fastener for 200-amp current returns.



Tubing Clamp to Bonding Jumper Electrical Bonding
Figure 5

NOTE

Use MS35338 lock washers on all bolted electrical bonding/grounding connections. Their function is to ensure a tight connection with plain or self-locking nuts under conditions where thermal expansion of the screw may occur.

e. Use an MS21042L self-locking nut, or a self-locking nutplate (MS21047L or MS21069L) to retain the screw.

TUBING CLAMP TO BONDING JUMPER ELECTRICAL BONDING (FIGURE 5)

Accomplish electrical bonding of tubing clamps with bonding jumpers as follows:

a. Prepare the electrical bonding surfaces as outlined under METAL SURFACE PREPARATION AND ELECTRICAL BONDING in this chapter.

b. Use an MS35206 cad plated steel screw below 330° F..

c. Use an MS35206 CRES steel screw above 330° F..

d. Use clamps of the same tube material to avoid dissimilar metal contact.

BONDING JUMPER ACROSS TUBING CLAMP ELECTRICAL BONDING (FIGURE 6)

Accomplish electrical bonding of tubing segments with bonding jumpers across clamps as follows:

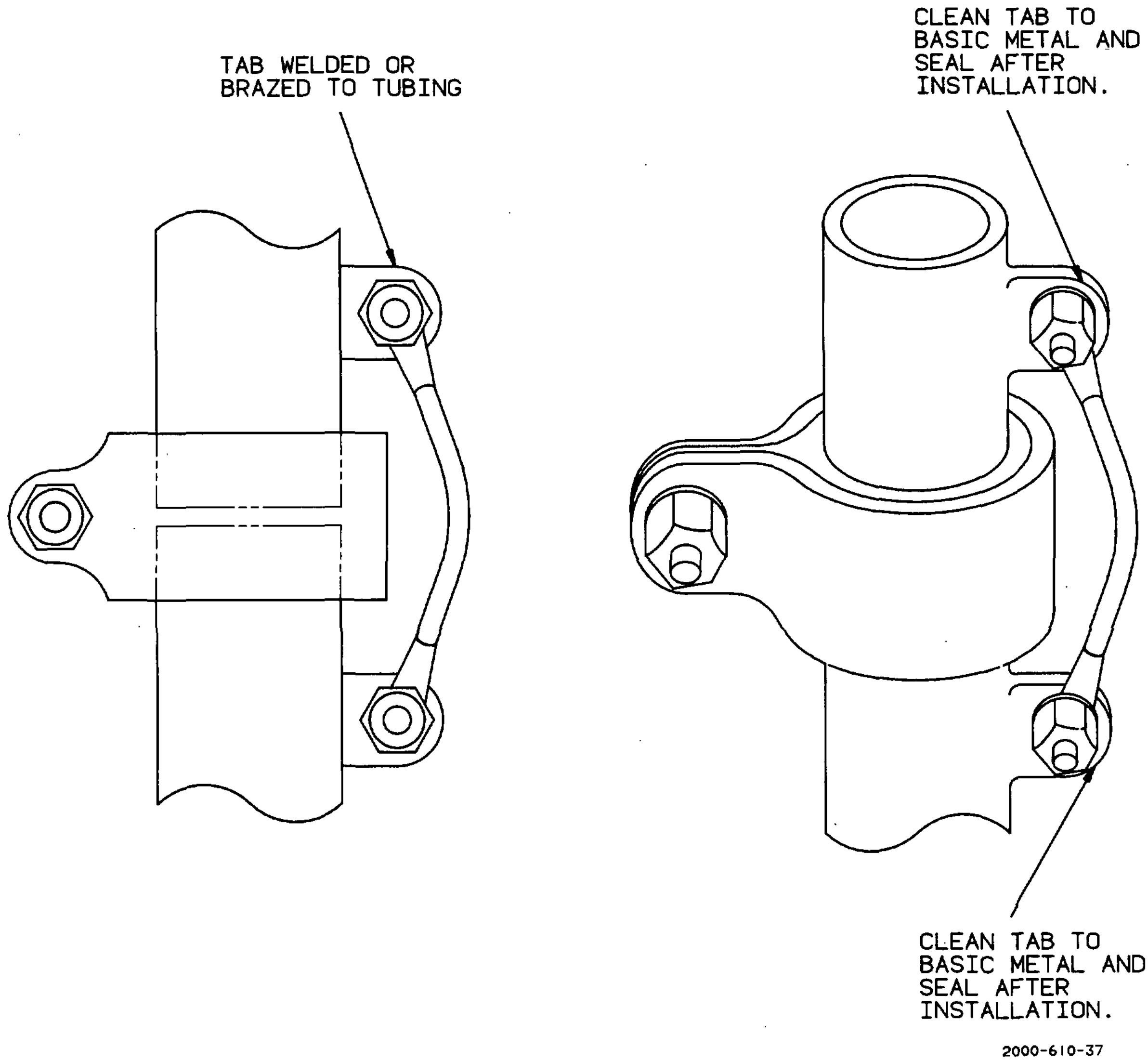
a. Prepare the electrical bonding surfaces as outlined under METAL SURFACE PREPARATION AND ELECTRICAL BONDING in this chapter.

b. Use an MS35206 cad plated steel screw below 330° F..

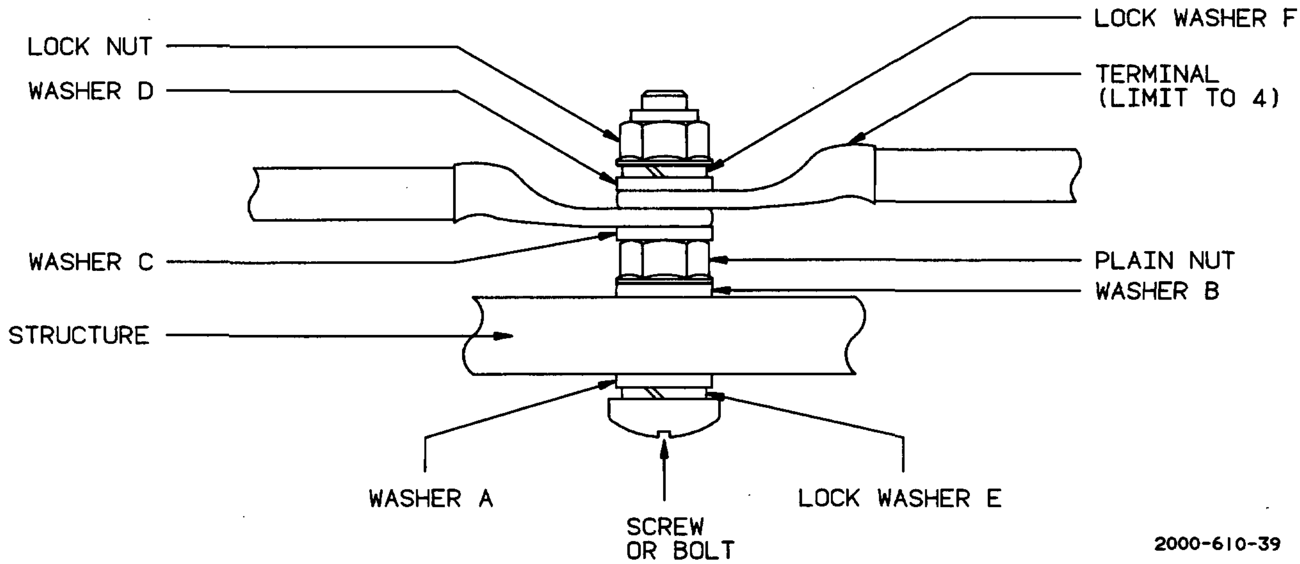
c. Use an MS35206 CRES steel screw above 330° F..

d. Install an AN960 cad plated washer under the screw head and nut.

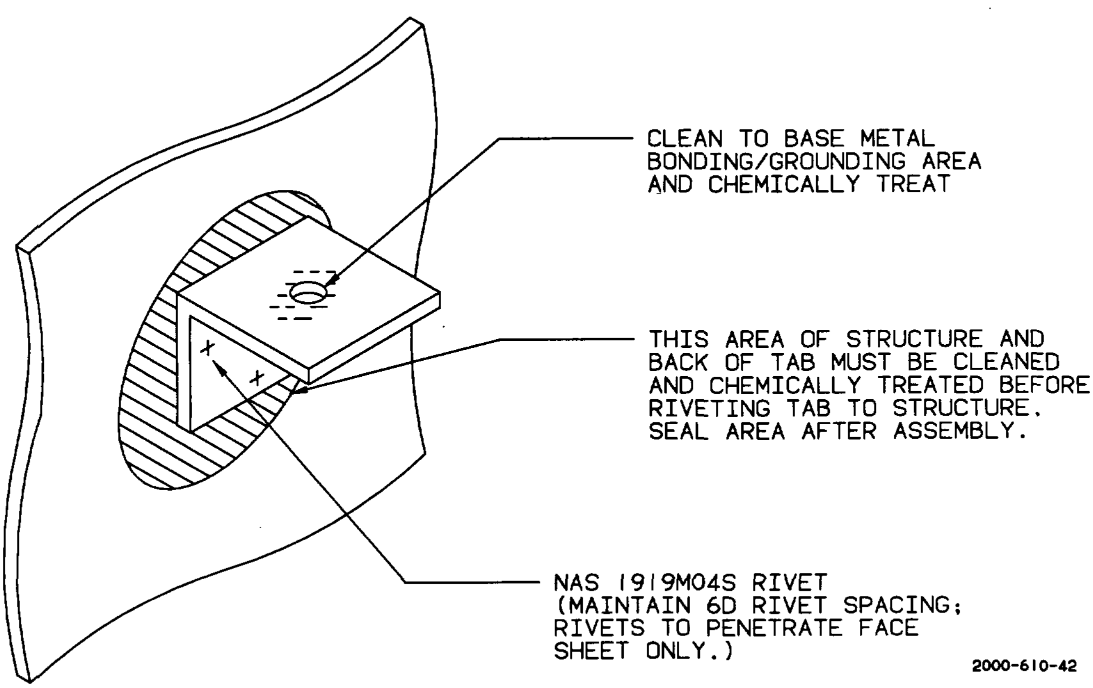
e. Use an MS21042L self-locking cad plated steel nuts.



Bonding Jumper Across Tubing Clamp Electrical Bonding
Figure 6



Typical Ground Stud Electrical Bonding
Figure 7



Electrical Bonding of Ground Tabs
Figure 8

TYPICAL GROUND STUD ELECTRICAL BONDING (FIGURE 7)

Accomplish electrical bonding of ground studs for current returns as follows:

a. Screw size: Use a No. 10 screw where edge distance will permit. A No. 8 or No. 6 screw may be substituted for the No. 10 screw if necessary to meet edge distance requirements.

b. Use a 1/4-inch diameter fastener for 100-amp current returns.

c. Use a 5/16-inch diameter fastener for 200-amp current returns.

NOTE

Use MS35338 lock washers on all bolted electrical bonding/grounding connections. Their function is to ensure a tight connection with plain or self-locking nuts under conditions where thermal expansion of the screw may occur.

d. Refer to Chart 2 for a listing of compatible hardware used with grounding studs.

ELECTRICAL BONDING OF GROUND TABS (FIGURE 8)

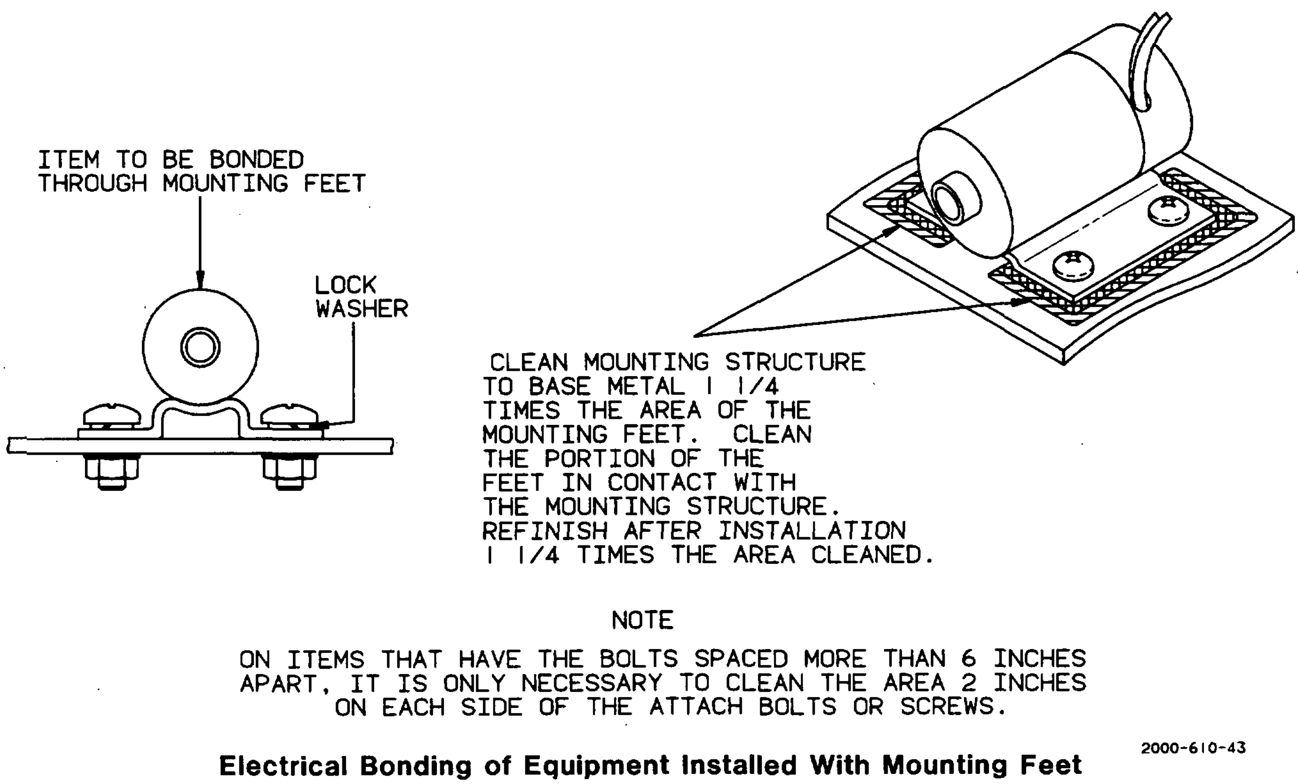
a. Prepare the electrical bonding surfaces as outlined under METAL SURFACE PREPARATION AND ELECTRICAL BONDING in this chapter.

b. Use an NAS1919M04S rivet to attach the ground tab.

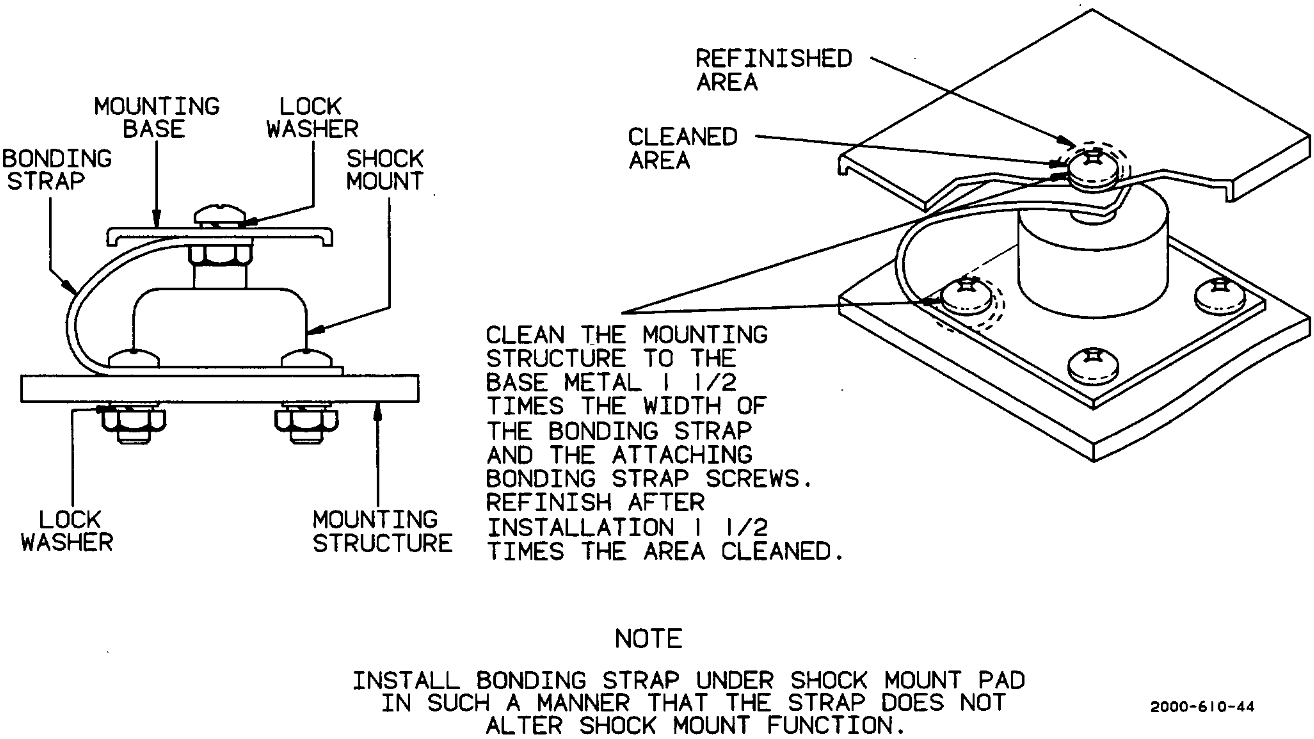
c. Use a minimum of three rivets to attach the ground tab.

NOTE

If it is necessary to remove the tab for any reason, the surface must be recleaned to remove all films.



Electrical Bonding of Equipment Installed With Mounting Feet
Figure 9



Electrical Bonding of Equipment Installed With Shock Mounts
Figure 10

CONTROL CABLES AND PULLEYS - DESCRIPTION AND OPERATION

This airplane uses carbon steel control cables of multiple wire construction with the number of strands varying according to the diameter of the cable. The carbon steel wire is helically twisted into strands and the strands wound about other strands forming the flexible carbon steel cable.

RECOMMENDED MATERIALS

The recommended materials listed in Chart 1 as meeting federal, military or vendor specifications are provided for reference only and are not specifically required by Raytheon Aircraft Company. Any product conforming to the specification may be used subject to availability. The products included in this chart have been tested and approved for aviation usage by Raytheon Aircraft Company, by the vendor or by compliance to the applicable specifications. GENERIC OR LOCALLY MANUFACTURED PRODUCTS WHICH CONFORM TO THE REQUIREMENTS OF A SPECIFICATION MAY BE USED EVEN THOUGH NOT INCLUDED IN THE CHART. Only the basic number of each specification is listed. No attempt has been made to update the listing to the latest revision. It is the responsibility of the technician or mechanic to determine the current revision of the applicable specification prior to usage of the product listed. This can be done by contacting the vendor of the product to be used.

Chart 1
RECOMMENDED MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
1. Lubricant	MIL-G-23827	Supermil Grease A722823	American Oil Co. 165 N. Canal Chicago, IL 60606
		Royco 27A	Royal Lubricants Co. River Road Hanover, NJ 07936
		Aeroshell Grease 7	Shell Oil Co. 1 Shell Plaza P.O. Box 2463 Houston, TX 77001
		BP Aero Grease 31B	BP Trading Limited Moore Lane, Britannic House, London E.C. 2 England
2. Corrosion Preventive Compound	MIL-C-16173	Petrotect Grade 2	Pennsylvania Refining Co. 1686 Lisbon Road Cleveland, OH 44104
		Braycote 130	Bray Oil Co., Los Angeles, CA

CONTROL CABLES AND PULLEYS - MAINTENANCE PRACTICES

CONTROL CABLE SYSTEM INSPECTION

WARNING: When inspecting control cables, always wear gloves to avoid injury from frayed or broken wires.

When a control cable is removed from the airplane, the cable should be dipped in MIL-C-16173 corrosion preventive (2, Chart 1). Excess corrosion preventive may be removed by wiping with a clean cloth.

Inspect the control cable system as follows:

a. Inspect the control cables for incorrect routing, fraying and twisting. Look for interference with adjacent airplane structure, equipment, wiring, plumbing and other control cables.

NOTE: It is important to operate controls through their full range so that cables move away from pulleys and all portions of the cables are exposed for inspection.

b. Monitor control cable movement for freedom, looseness and full travel.

c. Visually inspect all swaged fittings for distortion, cracks or broken wires at the fitting.

d. Turnbuckles should have the proper thread exposure and be correctly safety wired.

e. Locate any control cable broken or corroded wires as follows:

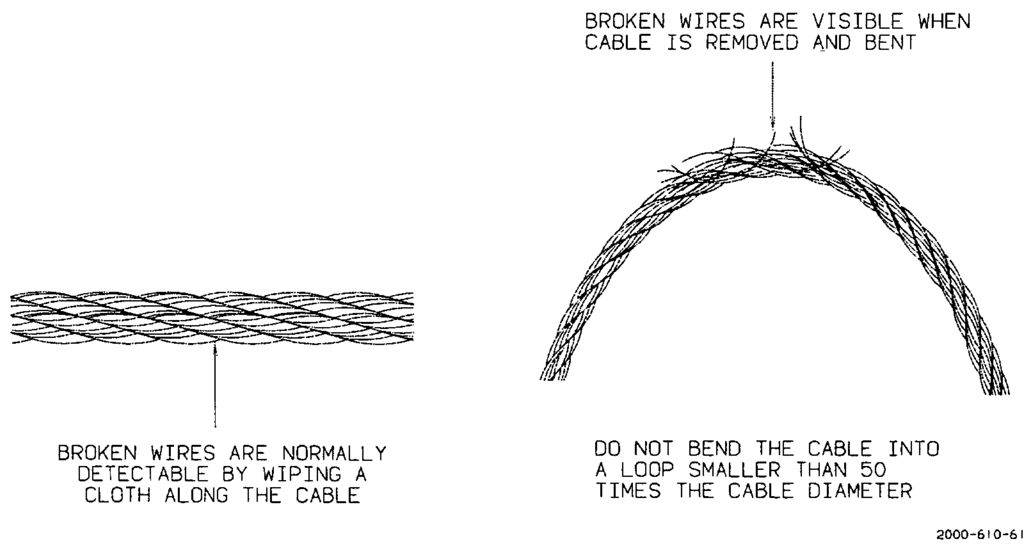
1. Inspect the control cables near fairlead pulleys by passing a cloth along the length of the cable. If a snag is found, closely examine the cable to determine the extent of the damage (Ref. Figure 1).

2. Any suspect cable should be removed and placed in a loop position and checked for additional broken wires (Ref. Figure 1).

NOTE: Individual broken wires are acceptable in primary and secondary control cables at random locations when there are no more than three broken wires on any three foot segment of cable.

The interior of all turnbuckles should be coated or filled with MIL-G-23827 grease (1, Chart 1) for corrosion protection.

3. Inspect the control cables with broken wires for evidence of corrosion. If necessary, remove the control cable, form it into a loop and check the center strand for corrosion. Replace any control cable that shows evidence of corrosion.



Typical Control Cable With Broken Wires
Figure 1

CONTROL CABLE STORAGE

Control cables should be stored straight or in a coil. When stored in coil form, the coil inside diameter should not be less than 150 times the control cable diameter, or bent in a radius of not less than 75 times the control cable diameter. Coils should not be flattened, twisted or folded during storage. Storage requirements should apply until the control cable is installed in its normal position in the airplane. If only a part of the control cable is installed in an assembly, control cable requirements apply to the uninstalled portion of the control cable.

CONTROL CABLE PULLEY INSPECTION

Inspect all control cable pulleys as follows:

NOTE: Control cable pulleys are installed along the control cables where a change of direction is needed.

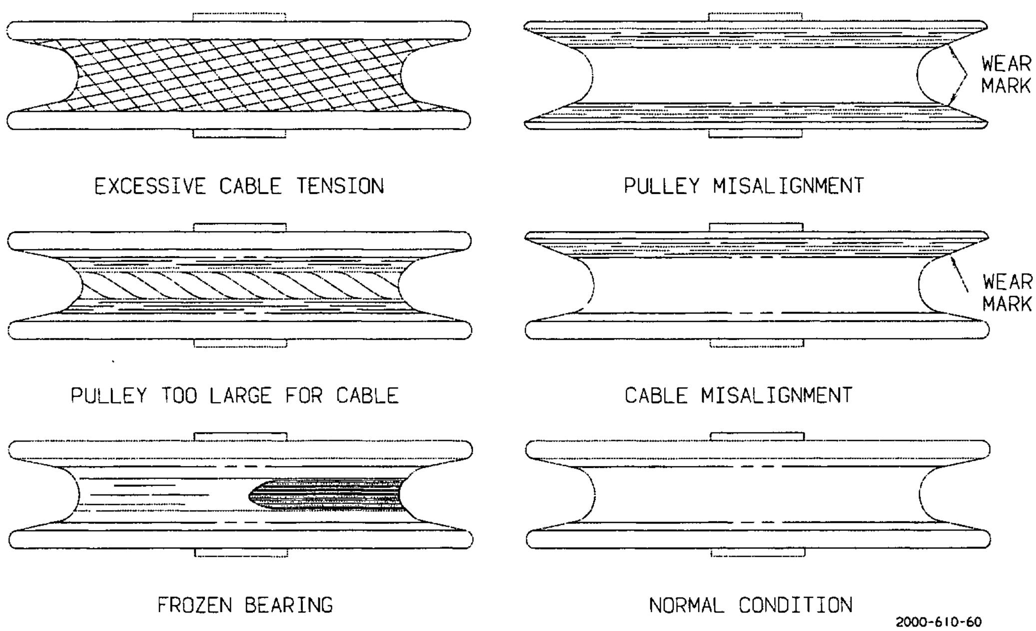
a. Inspect all control cable pulleys for roughness, sharp edges and presence of foreign material embedded in the grooves (Ref. Figure 2).

b. Inspect all control cable pulley bearings for smooth rotation, freedom from flat spots and foreign material.

c. Inspect all control cable pulleys for proper alignment.

d. Inspect the control cable pulley brackets and guards for damage, misalignment and looseness.

e. Control cable pulleys which turn for a short distance must be rotated periodically to provide a new bearing surface for the control cable.



Control Cable Pulley Wear Patterns
Figure 2

BEARINGS - DESCRIPTION AND OPERATION

This chapter contains bearing installation and removal information.

RECOMMENDED MATERIALS

The recommended materials listed in Chart 1 as meeting federal, military or vendor specifications are provided for reference only and are not specifically required by Beech Aircraft Corporation. Any product conforming to the specification may be used subject to availability. The products included in these charts have been tested and approved for aviation usage by Beech Aircraft Corporation, by the vendor or compliance to the applicable specifications. GENERIC OR LOCALLY MANUFACTURED PRODUCTS WHICH CONFORM TO THE REQUIREMENTS OF A SPECIFICATION MAY BE USED EVEN THOUGH NOT INCLUDED IN THE CHART. Only the basic number of each specification is listed. No attempt has been made to update the listing to the latest revision. It is the responsibility of the technician or mechanic to determine the current revision of the applicable specification prior to usage of the product listed. This can be done by contacting the vendor of the product to be used.

BEARINGS - MAINTENANCE PRACTICES

HYDRAULIC PRESS BEARING REMOVAL (FIGURE 1)

a. Remove the bearing housing from the airplane.

b. Place two supports on the hydraulic press table under the bearing housing as shown in Figure 1. The supports should be at least 1/2-inch thicker than the bearing width.

c. Center a bearing removal and installation tool on the bearing outer race. The bearing and installation tool should be approximately 1/8-inch smaller than the outside diameter of the bearing outer race.

CAUTION

The hydraulic press plunger and bearing removal and installation tool should remain in direct alignment with the bearing being removed at all times.

d. Align the bearing and the bearing removal and installation tool with the hydraulic press plunger and apply pressure to force the bearing from the bearing housing.

MECHANICAL PRESS BEARING REMOVAL (FIGURE 1)

a. Remove the bearing housing from the airplane.

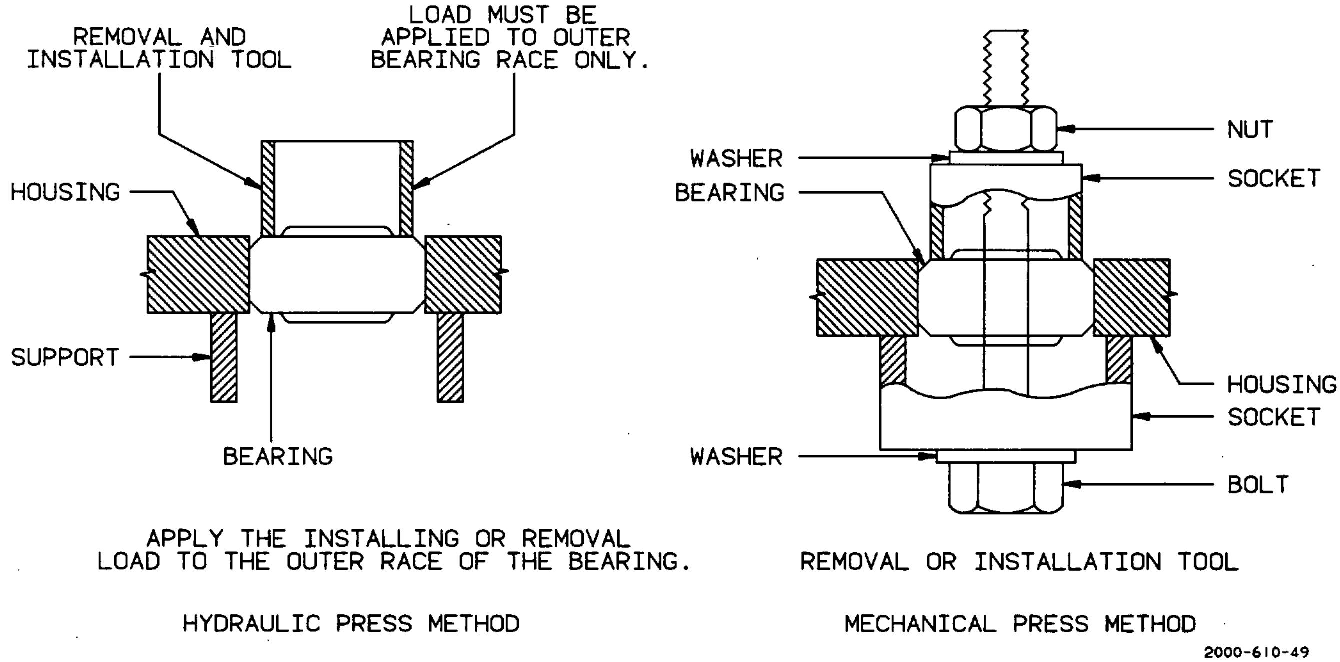
b. On the bearing housing, center a bearing removal socket with an inner diameter larger than the bearing outer race and 1/2-inch deeper than the bearing width.

c. Center a bearing removal socket smaller in diameter than the the bearing outer race.

CHART 1
RECOMMENDED MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
1. Cleaner	TT-M-261	Methyl Ethyl Ketone	Obtain locally
2. Primer		Locquic Primer "T"	Loctite Corp., 705 N. Mountain Rd., Newington, CT 06111
3. Retaining Compound		609	Loctite Corp., 705 N. Mountain Rd., Newington, CT 06111

BT01240



Bearing Removal
Figure 1

d. Install a washer and bolt through one of the sockets, through the center of the bearing, then through the opposite socket as shown in Figure 1.

e. Install a washer and nut on the bolt threads.

f. Tighten the nut on the bolt until the pressure is sufficient to release the bearing from the bearing housing.

BEARING HOUSING INSPECTION

Inspect the bearing housing for any grooves, cracks, warpage or hole elongation. The bearing housing-to-bearing contact surface must be smooth and uniform.

BEARING INSTALLATION USING RETAINING COMPOUND

a. Clean the outer surface of the bearing race with MEK (1, Chart 1) and wipe dry.

CAUTION

When cleaning bearing surfaces, never allow solvent to enter the bearing. Never touch the bearing or bearing housing surfaces with bare hands. Use a clean cloth to cover the bearing to prevent contamination after they have been cleaned.

b. Coat the surfaces where a retaining compound is to be applied with primer (2, Chart 1). This includes the bearing outer surface, bearing housing mating surface and the bearing housing retention flange if applicable.

CAUTION

Ensure that no primer is applied to the bearing oil grooves or lubrication ports.

NOTE

All cadmium, zinc, corrosion-resistant and anodized steel, including plastic items, must be primed to assure proper adhesion of the retaining compound (3, Chart 1).

c. Allow the primer (2, Chart 1) to air dry for at least 30 minutes at room temperature.

NOTE

The retaining compound (3, Chart 1) may be applied before or after bearing installation in the bearing housing.

d. Apply a thin coat of the retaining compound (3, Chart 1) to the bearing and the bearing housing mating surfaces where the primer (2, Chart 1) was applied.

e. Center the bearing on the bearing housing.

f. Using the hydraulic or mechanical pressure method shown in Figure 1, apply pressure to the bearing until it is firmly seated in the bearing housing. Pressure on the bearing must be applied in direct alignment to the bearing housing for the bearing to seat properly.

g. Apply retaining compound (3, Chart 1) to the area between the bearing and the bearing housing.

h. The retaining compound must cure before the bearing is put into service. Curing may be accomplished with one of the following:

1. Allow the bearing and bearing housing to remain at room temperature for 24 hours without any movement of the parts.

2. Heat the bearing and bearing housing to 275° ±10° F. and maintain that temperature for 15 minutes only.

CHART 2
RECOMMENDED STAKES FOR BEARINGS

Bearing O.D.	Number of Stakes
up to .734-inch	4
.735-inch to .984-inch	6
.985-inch to 1.234-inches	8

BT01160

BEARING INSTALLATION BY STAKING (FIGURE 2)

a. Center the bearing on the bearing housing.

b. Using the hydraulic or mechanical pressure method shown in Figure 1, apply pressure to the bearing until it is firmly seated in the bearing housing. Pressure must be applied in direct alignment to the bearing housing for the bearing to seat properly.

c. Place the bearing and bearing housing on two supports, as shown in Figure 2, if both sides of the bearing are to be staked. The inner bearing race must not touch the supports.

d. If the bearing housing was previously staked, the new stakes should be centered between the existing stakes. If a new bearing housing is being used, the stake pattern should be the same as the one on the old bearing housing.

NOTE

When a ring stake is used, combined total length should be 25 percent of the bearing circumference.

e. Pin stakes should be located .030 ±.010-inch from the outer diameter of the bearing on the bearing housing.

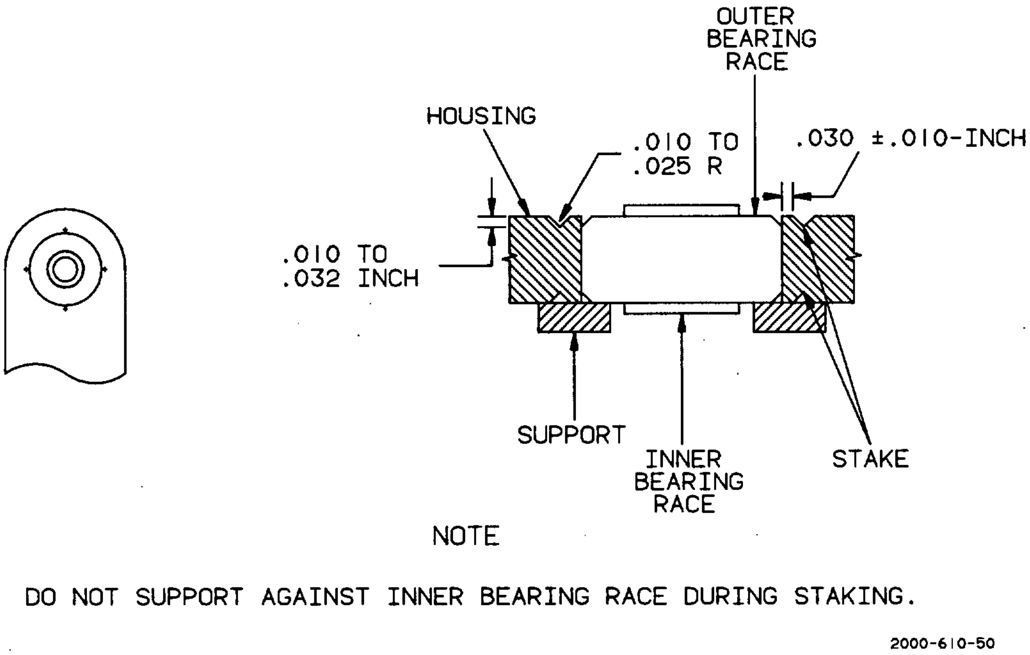
f. Pin stakes should only be .010 to .032-inch deep to retain bearings when the bearing housing is staked on both sides.

g. The number of pin stakes around a bearing housing should be as indicated in Chart 2.

After the bearing has been secured in the housing by staking or by the use of a retaining compound, relubricate with the proper lubrication and reinstall in the airplane.

CAUTION

If the bearing should slip or move in the bearing housing, the bearing must be removed and recleaned. The bearing housing must be recleaned. Examine the bearing for any damage and reinstall in the bearing housing.



Bearing Staking
Figure 2

TUBE AND HOSE ASSEMBLIES AND FITTINGS - DESCRIPTION AND OPERATION

This chapter contains information to remove, maintain and install hose and tube assemblies and fittings. Although all hoses and tubes may not be specifically identified herein, the basic maintenance practices normally apply. Any handling and installation of individual system hoses, tubes and fittings is identified in the appropriate system chapter.

The majority of tube assemblies used in the airplane are aluminum or steel machine formed tubing assemblies.

Hoses are used in areas of the airplane where a flexible line is more suitable for installations and freedom of movement is necessary.

TUBING, HOSE AND FITTINGS - MAINTENANCE PRACTICES

Observe all WARNINGS, CAUTIONS and NOTES throughout this maintenance manual when performing maintenance, repair or servicing on any fluid or pneumatic operated system.

CAUTION: *Verify that systems which operate from fluids or pneumatics under pressure are fully depressurized before opening or disconnecting a tubing or hose.*

The following list of maintenance practices is provided as an aid for handling, removing, installing and repairing tubing and hoses.

a. Cap or plug all disconnected tubing and hose assemblies and fittings immediately to prevent contamination of the system.

b. Visually check for cleanliness, evidence of contamination and obstructions prior to reconnection of tube or hose assemblies.

c. Any hose and tube assemblies that did not have protective covers installed must be cleaned and checked for obstruction prior to installation.

d. When connecting tube assemblies, do not force the tube assembly to the installed position. If a mismatch between the male and female fittings should result, see Figure 1 for the allowable mismatch.

e. Never stretch a hose to make a connection.

f. The hose material must be compatible with the applicable system fluids. Substitution of a hose material that is not compatible with the system fluid will contaminate the system.

REMOVAL OF TUBE AND HOSE ASSEMBLIES

Tube and hose assemblies may be removed as follows:

a. Relieve all system pressure.

b. Disconnect both ends of the hose or tube assembly and immediately cap or plug the tube or hose ends and fittings.

c. Remove all clamps securing the hose or tube assembly.

d. Remove the tube or hose assembly and tag identify both ends to aid in reinstallation.

HOSE ASSEMBLY INSTALLATION

Hose assemblies may be installed as follows:

NOTE: If a new hose assembly is to be installed, the hose assembly must be clean, the correct length, clear of obstructions and material compatible with the system fluid.

a. Observe the maintenance practices outlined under the heading TUBE AND HOSE ASSEMBLIES AND FITTINGS - MAINTENANCE PRACTICES.

b. Connect the B nuts of the hose assembly to the proper fittings.

c. Torque the B nuts to the fittings using the torque specified in Chart 1.

d. After torquing the B nuts, inspect the hose to ensure that the hose is not under tension and that no indication of twisting is present.

e. Inspect the hose for proper length.

f. Inspect the hose for freedom to expand and contract.

g. Inspect the hose for clearance to all structure. If inadequate clearance exists between the hose and structure, protection must be provided for the hose to prevent damage from chafing.

TUBE INSTALLATION

NOTE: If a new tube assembly is to be installed, the tube assembly must be clean, the correct length, clear of obstructions and manufactured of the correct material.

a. Observe the maintenance practices outlined under the heading TUBE AND HOSE ASSEMBLIES AND FITTINGS - MAINTENANCE PRACTICES.

b. Inspect the tube for damage, particularly at tube ends, fittings, and bends. Damaged tube assemblies should be replaced or repaired.

c. Make certain that the fittings are properly installed before connection of the tube assembly.

d. Check alignment and fit of the tube assembly as follows before installation:

1. Place the tube assembly in the proper position and tighten one coupling nut at one end of the tube assembly.

2. The opposite end of the tube must be within two degrees of parallel with the fitting (Ref. Figure 1).

3. The free tubing end must be aligned within 1/32 inch of the fitting per every 10 inches of tube length.

4. The free end of the tube must match the fitting cone lengthwise within 1/32 inch per every 10 inches of tube length.

e. If necessary, apply the proper anti seize compound to fittings.

f. Install the tube assembly on the fittings and tighten the B nuts to the torque values specified (Ref. Chart 1).

FLUID LINE FITTING INSTALLATION

Fluid line fittings may be installed as follows:

a. Lubricate the male threads of the fitting, backup ring and packing sparingly with the system fluid or petrolatum (AN-P-51, Vaseline).

b. Install the nut (AN6289) on the fitting until the nut is clear of the thread relief.

c. Install the teflon backup ring in the counterbore of the nut.

d. Install the packing (O-ring) on the thread relief.

NOTE: The packing must be compatible with the system fluid.

e. Turn the nut down until the packing is pushed firmly against the lower threaded section of the fitting.

f. Install the fitting into the boss with the nut turning with the fitting until the packing contacts the boss.

NOTE: This point can be detected by a sudden increase in torque.

g. Holding the nut with a wrench to prevent it from turning, rotate the fitting in an additional 1 1/2 turns. Position the fitting in the proper direction by turning in no more than one additional turn.

h. Holding the fitting, turn the nut down tightly against the boss. Slight extrusion of the ring around the backup ring is acceptable.

NONPOSITIONING TYPE FITTING INSTALLATION

Nonpositioning type fittings may be installed as follows.

a. Lubricate the packing with the system fluid or petrolatum (AN-P-51, Vaseline).

b. Install the packing in the fitting thread relief.

c. Thread the fitting into the boss until it bottoms tightly on the boss.

d. Tighten the fitting to the specified torque value.

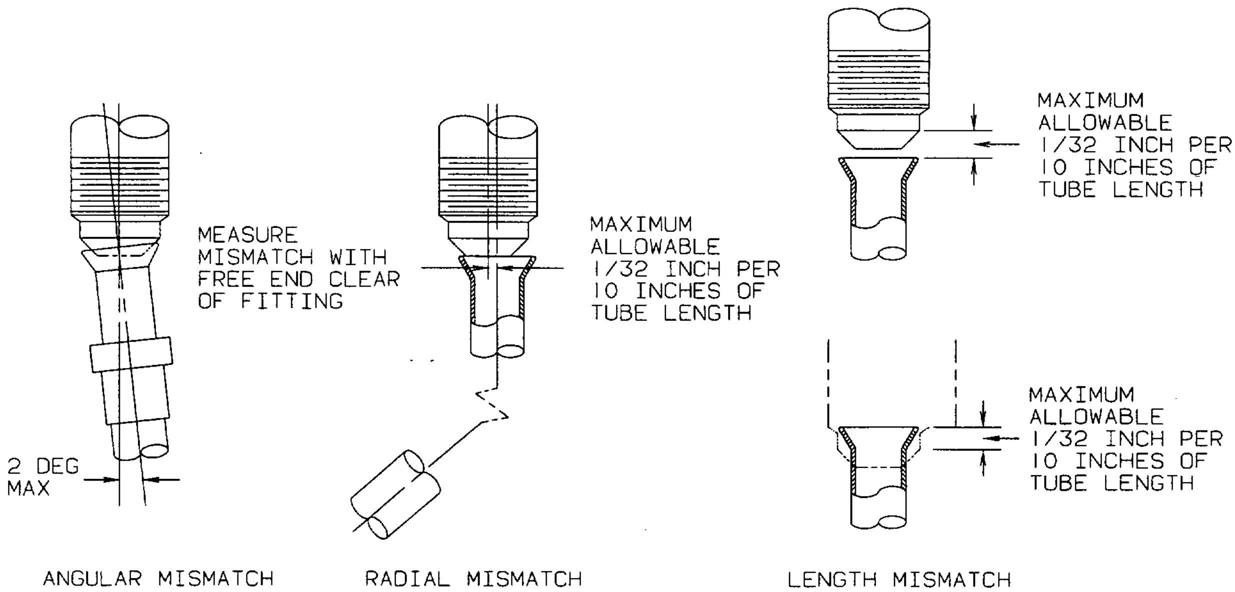
PIPE THREAD FITTING INSTALLATION

Pipe thread fittings may be installed as follows:

a. Apply teflon tape to the threads as follows:

1. Start tape at or close to narrow end of threads.
2. Wrap the tape around the fitting in the direction of the threads. Wrap clockwise for right hand threaded fittings. Wrap counterclockwise for left hand threaded fittings.
3. Apply tension to the tape to conform the tape to the shape of the threads.
4. The tape should overlap the previous wrap of tape up to one-half inch to seal pipe thread fittings up to two inches in diameter.

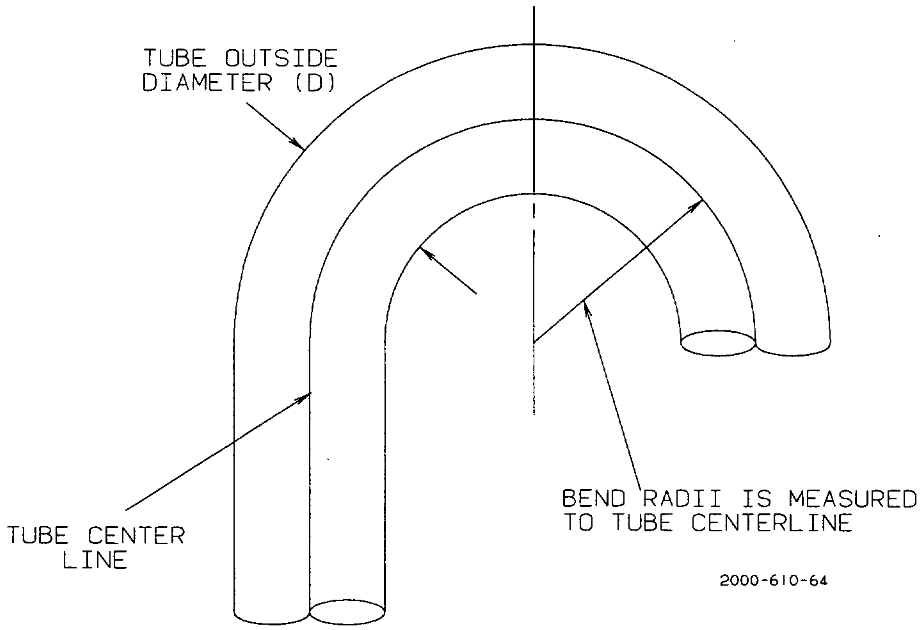
b. Thread the fitting into the boss and tighten until it bottoms tightly on the boss.



Tubing Installation Mismatch
Figure 1

Chart 1
Flared Fitting Torque Chart (In.-lbs)

Hose Size	Tubing O.D. (inches)	Aluminum Tubing Flare		Steel Tubing Flare		Aluminum Tubing Flareless		Steel Tubing Flareless		Oxygen Line Fitting (Aluminum)		Hose End Fitting	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
-3	3/16	---	---	90	100	75	90	90	100	---	---	70	100
-4	1/4	40	65	135	150	80	100	135	150	---	---	70	120
-5	5/16	60	80	180	200	100	130	180	200	100	125	85	180
-6	3/8	75	125	270	300	100	130	270	300	---	---	100	250
-8	1/2	150	250	450	500	200	240	450	500	---	---	210	420
-10	5/8	200	350	700	800	360	400	700	800	---	---	300	480
-12	3/4	300	500	1100	1150	390	430	1100	1150	---	---	500	850
-16	1	500	700	1200	1400	600	900	1200	1400	---	---	700	1150
-20	1 1/4	600	900	1300	1450	600	900	1300	1450	---	---	---	---
-24	1 1/2	600	900	1350	1500	600	900	1350	1500	---	---	---	---



Tube Bending
Figure 2

TUBE DAMAGE LIMITS

NOTE: Nicks and scratches not exceeding the following limitations may be repaired by polishing out the damaged area, using fine grade of emery cloth and oil. Finish polishing with crocus cloth and oil. Flush and clean all grit from line assembly.

a. Replace steel tubes which have nicks or scratches deeper than 10% of tubing wall thickness.

b. Replace any aluminum tube which has nicks or scratches deeper than 20% of the tube wall thickness.

c. Replace any tubes which have dents deeper than 5% of the tube outside diameter.

Chart 2
Tubing Bending Limits

TUBE OUTSIDE DIAMETER (D)		RECOMMENDED BEND RADII				ADDITIONAL BEND RADII	
		3D		4D		6D	
INCH	MILLIMETER	INCH	MILLIMETER	INCH	MILLIMETER	INCH	MILLIMETER
1/8	3.175	0.375	9.525	0.500	12.700	0.750	19.050
3/16	4.762	0.563	14.286	0.750	19.048	1.125	28.572
1/4	6.350	0.750	19.050	1.000	25.400	1.500	38.100
5/16	7.937	0.938	23.811	1.250	31.748	1.875	47.622
3/8	9.525	1.125	28.575	1.500	38.100	2.250	57.150
7/16	11.112	1.312	33.336	1.750	44.448	2.625	66.672
1/2	12.700	1.500	38.100	2.000	50.800	3.000	76.200
5/8	15.875	1.875	47.625	2.500	63.500	3.750	95.250
3/4	19.050	2.250	57.150	3.000	76.200	4.500	114.300
7/8	22.225	2.625	66.675	3.500	88.900	5.250	133.350
1	25.400	3.000	76.200	4.000	101.600	6.000	152.400
1 1/8	28.575	3.375	85.725	4.500	114.300	6.750	171.450
1 1/4	31.750	3.750	95.250	5.000	127.000	7.500	190.500
1 3/8	34.925	4.125	104.775	5.500	139.700	8.250	209.550
1 1/2	38.100	4.500	114.300	6.000	152.400	9.000	228.600
1 5/8	41.275	4.875	123.825	6.500	165.100	9.750	147.650
1 3/4	44.450	5.250	133.350	7.000	177.800	10.500	266.700
1 7/8	47.625	5.625	142.875	7.500	189.500	11.250	285.750
2	50.800	6.000	152.400	8.000	203.200	12.000	304.800
2 1/4	57.150	6.750	171.450	9.000	228.600	13.500	342.900
2 1/2	63.500	7.500	190.500	10.000	254.000	15.000	381.000
3	76.200	9.000	228.600	12.000	304.800	18.000	457.200

LOCKING DEVICES - DESCRIPTION AND OPERATION

Except for specific instructions required to satisfy a certain application, the following procedures are standard methods used to install various locking devices used in conjunction with bolts, screws and nuts.

SELF-LOCKING NUTS

Where self-locking nuts are used, the following procedure applies:

a. For self-locking nuts, note the torque necessary to turn the self-locking nut before the self-locking nut is seated.

b. Add the above torque to the value detailed in the assembly instruction for the application. Use this new value as the total applied torque.

SLOTTED, STEEL LOCKNUTS (PREVAILING TORQUE TYPE)

Effective locking of slotted, steel locknuts on bolts requires the full engagement of all locknut threads. The chamfered section of the locknut ID does not exert force on the bolt. It is not necessary that the bolt be flush with or protrude from the outer face of the locknut.

LOCKWIRE AND COTTER PIN REQUIREMENTS

When tightening a castellated nut for cotter pin installation, alignment of the slot must be obtained without exceeding the maximum torque. If this is not possible, replace the nut. After tightening the nut to the recommended torque, the nut must not be loosened to permit insertion of a cotter pin. If the slot in the nut or lockwire hole in the bolt or screw is not correctly aligned at the minimum torque value given, the nut, screw or bolt should be further tightened to the next alignment position, but the maximum torque value given must not be exceeded. Should alignment still be impossible without exceeding the maximum torque, back off the nut one-half turn and retorque.

Lockwire and cotter pins must never be reused. All lockwire and cotter pins must fit snugly into drilled holes in the bolts and studs for locking purposes. Bushings and plugs must be lockwired to the adjacent boss or casing. Never lockwire bushing to plug. Cotter pins should be installed so that the head fits into the slot of the castellated nut and, unless otherwise specified, one end of the pin should be bent over the stud or bolt and the other end flat against the flat of the nut.

LOCKING DEVICES - MAINTENANCE PRACTICES

LOCKWIRE INSTALLATION PROCEDURES (FIGURES 1 AND 2)

NOTE

Figure 1 illustrates a typical lockwire procedure. Although there are numerous lockwire operations performed on the airplane, practically all are derived from the basic examples shown in Figure 2.

Observe the following guidelines when installing lockwire:

a. New lockwire must be used.

b. Use the same type and diameter of lockwire as that employed during the initial assembly. Except where otherwise specified, the wire used on the airplane power plant is heat and corrosion resistant steel wire of 0.025-inch diameter.

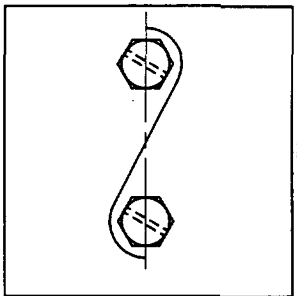
c. Lockwire must be tight after installation to prevent failure due to rubbing or vibration.

d. Lockwire must be installed in a manner that tends to tighten and keep a part locked in place, thus counteracting the natural tendency of the part to loosen.

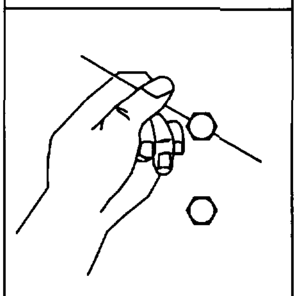
e. Lockwire must never be overstressed. It will break under vibrations if twisted too tightly. The lockwire shall be pulled taut when being twisted, but shall have minimum tension, if any, when secured.

f. Lockwire ends must be bent toward the engine, or structure, to avoid sharp or projecting ends which might present a safety hazard or vibrate in the air stream.

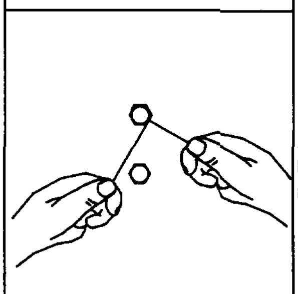
g. Internal wiring must not cross over or obstruct a flow passage when an alternate method can be used.



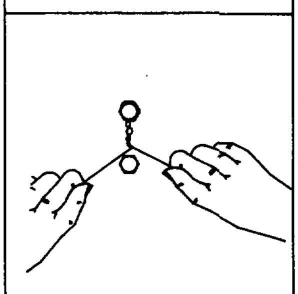
POSITION THE HOLES.



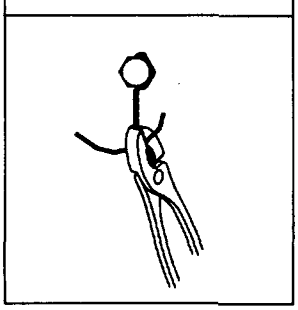
INSERT PROPER GAGE WIRE.



WRAP UPPER END OF WIRE AND BEND IT AROUND THE HEAD OF THE BOLT. THEN UNDER THE OTHER END OF THE WIRE. BE SURE WIRE IS TIGHT AROUND HEAD.

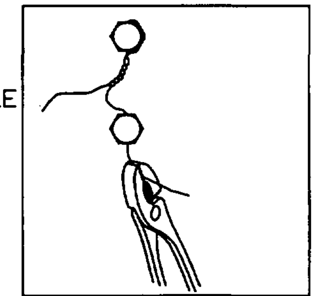


TWIST WIRE UNTIL WIRE IS JUST SHORT OF HOLE IN THE SECOND BOLT.

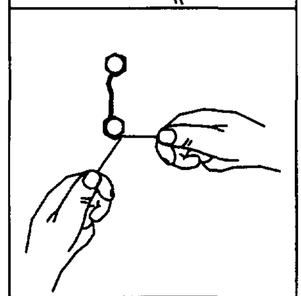


KEEPING WIRE UNDER TENSION, TWIST IN A CLOCKWISE DIRECTION UNTIL THE WIRE IS TIGHT. WHEN TIGHTENED THE WIRE SHALL HAVE APPROXIMATELY 7 TO 10 TWISTS PER INCH.

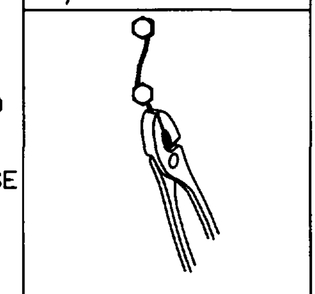
INSERT THE UPPERMOST WIRE, WHICH POINTS TOWARD THE SECOND BOLT, THROUGH THE HOLE WHICH LIES BETWEEN THE NINE AND TWELVE O'CLOCK POSITIONS. GRASP THE END OF THE WIRE WITH A PAIR OF PLIERS AND PULL THE WIRE TIGHT.



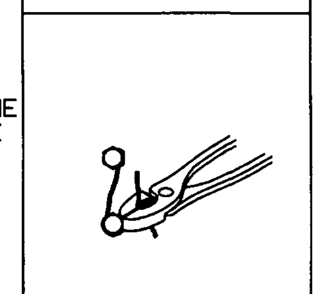
BRING THE FREE END OF THE WIRE AROUND THE BOLT HEAD IN A COUNTER-CLOCKWISE DIRECTION AND UNDER THE END PROTRUDING FROM THE BOLT HOLE. TWIST THE WIRE IN A COUNTER-CLOCKWISE DIRECTION.



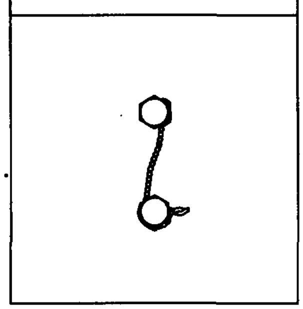
GRASP THE WIRE BEYOND THE TWISTED PORTION AND TWIST THE WIRE ENDS COUNTER-CLOCKWISE UNTIL TIGHT.



DURING THE FINAL TWISTING MOTION OF THE PLIERS, BEND THE WIRE DOWN AND UNDER THE HEAD OF THE BOLT.

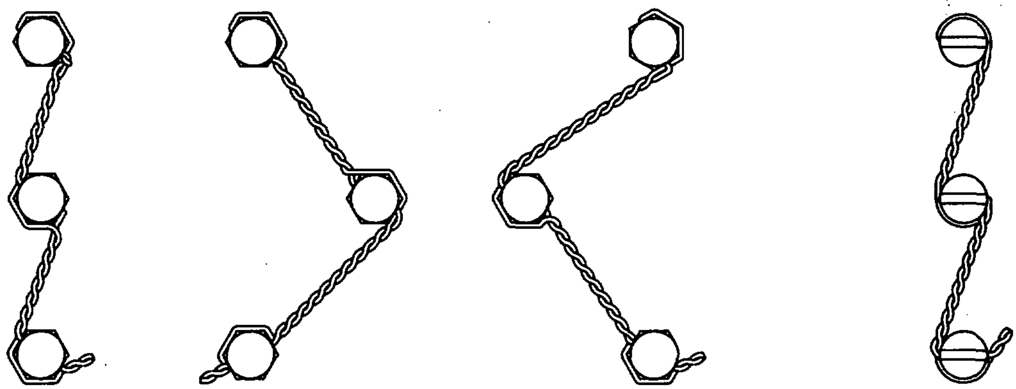


CUT OFF EXCESS WIRE WITH DIAGONAL CUTTERS.



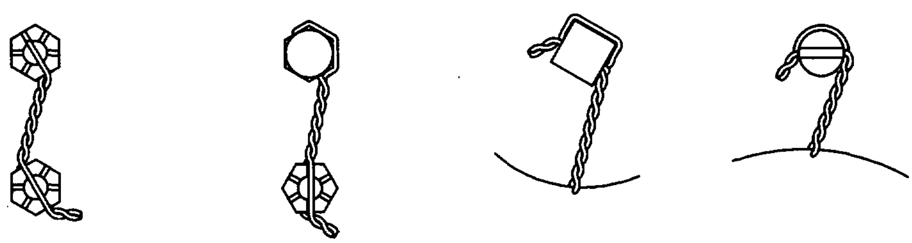
2000-604-18

RH Thread Lockwiring Procedure
Figure 1



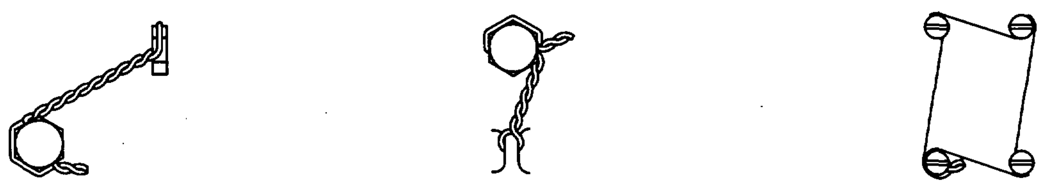
EXAMPLE 1 EXAMPLE 2 EXAMPLE 3 EXAMPLE 4

BOLTS, FILLISTER HEAD SCREWS, SQUARE HEAD PLUGS, AND OTHER SIMILAR PARTS ARE WIRED SO THAT THE LOOSENING TENDENCY OF EITHER PART IS COUNTERACTED BY THE TIGHTENING OF THE OTHER PART. THE DIRECTION OF TWIST FROM THE SECOND TO THE THIRD UNIT IS COUNTER-CLOCKWISE TO KEEP THE LOOP IN POSITION AGAINST THE HEAD OF THE BOLT. THE WIRE ENTERING THE HOLE IN THE THIRD UNIT WILL BE THE LOWER WIRE AND BY MAKING A COUNTER-CLOCKWISE TWIST AFTER IT LEAVES THE HOLE, THE LOOP WILL BE SECURED IN PLACE AROUND THE HEAD OF THAT BOLT.



EXAMPLE 5 EXAMPLE 6 EXAMPLE 7 EXAMPLE 8

METHODS FOR WIRING VARIOUS STANDARD ITEMS. WIRE MAY BE WRAPPED OVER THE UNIT RATHER THAN AROUND IT WHEN WIRING CASTELLATED NUTS OR ON OTHER ITEMS WHEN THERE IS A CLEARANCE PROBLEM.



EXAMPLE 9

THE METHOD FOR WIRING BOLTS IN DIFFERENT PLANES. NOTE THAT WIRE SHOULD ALWAYS BE APPLIED SO THAT TENSION IS IN THE TIGHTENING DIRECTION.

EXAMPLE 10

HOLLOW HEAD PLUGS WIRED WITH THE TAB BENT INSIDE THE HOLE TO AVOID SNAGS AND POSSIBLE INJURY TO PERSONNEL.

EXAMPLE 11

CORRECT APPLICATION OF SINGLE WIRE TO CLOSELY SPACED MULTIPLE GROUP.

2000-604-19

RH Thread Lockwiring Examples
Figure 2

LOCKWIRE HOLE ALIGNMENT

Check the units to be lockwired to make sure that they have been correctly torqued and that the wiring holes are properly positioned in relation to each other. When there are two or more units, it is desirable that the holes in the units be in the same relationship to each other. Never overtorque or loosen units to obtain proper alignment of the holes. It should be possible to align the wiring holes when the units are torqued within the specified limits. However, if it is impossible to obtain a proper alignment of the holes without either over or undertorquing, select another unit which will permit proper alignment within the specified torque limits.

LOCKWIRE TWISTING

To prevent mutilation of the twisted section of the wire when using pliers, grasp the wire at the ends or at a point that will not be twisted. Lockwire must not be nicked, kinked or mutilated. Never twist the wire ends off with the pliers and, when cutting off ends; leave at least three complete twists after the loop, exercising extreme care to prevent the wire ends from falling into areas where they might create a hazard or damage. The strength of lockwire holes is marginal.

COTTER PIN INSTALLATION (FIGURE 3)

Use the following to select and install cotter pins for the desired application:

a. Install new cotter pins.

b. Select cotter pin material in accordance with temperature, atmosphere and service limitations as specified in Chart 1.

c. When nuts are to be secured to a fastener with cotter pins, tighten the fastener to the low side (minimum) of the applicable specified or selected torque range, unless otherwise specified, and if necessary, continue tightening until the nut slot aligns with the fastener hole. Maximum torque must never be exceeded.

d. Castellated nuts installed on fasteners are safetied with cotter pins. The preferred method is with the cotter pin bent parallel to the axis of the fastener. The alternate method, where the cotter pin is mounted perpendicular to the axis of the fastener, may be used when the cotter pin in the preferred method is apt to become a snag.

e. *If 50 percent or more of the cotter pin diameter* is above the nut castellation, a washer should be used under the nut or a shorter fastener should be installed. A maximum of two washers may be permitted under a nut.

f. Use the largest nominal diameter cotter pin listed in MS24665 that the hole and slots will accommodate. No application of a cotter pin to any nut or fastener is permitted if the fastener hole size is less than the required hole and slot size for the cotter pin.

g. Install the cotter pin head firmly in the slot of the nut with the axis of the cotter pin eye at right angles to the fastener shank. Bend the cotter pin prongs so that the cotter pin head and upper prong are firmly seated against the fastener and the lower prong against the nut.

h. In clevis pin or rod end applications, install the cotter pin with the axis of the eye parallel to the shank of the clevis pin or rod end. Bend the prongs around the shank of the clevis pin or rod end as shown in Figure 3.

CHART 1
COTTER PIN INFORMATION

MATERIAL	TEMPERATURE	SERVICE
MS24665 Cotter Pins Carbon Steel	Ambient Temperature up to 460°F	Normal atmosphere cotter pins contacting cadimum plated bolts or nuts.
MS24665 Cotter Pins Corrosion-Resistant Steel	Ambient Temperature up to 800°F	Nonmagnetic requirements cotter pins contacting corrosion-resistant steel bolts or nuts in a corrosive atmosphere.

BT01083

i. Cadmium plated cotter pins should not be used in applications bringing them in contact with fuel, hydraulic fluid or synthetic lubricants.

KEYWASHERS (TAB AND CUP TYPES) INSTALLATION

The terms keywasher, tabwasher and cupwasher are interchangeable.

Observe the following when installing new keywashers, tabwashers and cupwashers:

a. Always use new washers for each assembly.

b. When bending or setting the washer tabs, do not use sharp pointed tools. Use of such tools can lead to subsequent failure of the locking tabs which, upon becoming detached, can cause extensive damage.

RETAINING RINGS (SPIROLOX, ETC.) INSTALLATION

a. Retaining rings must be installed using approved retaining ring pliers.

b. Internal rings must not be compressed beyond the point where ends of the ring meet.

c. External type rings must be expanded only enough to allow installation without becoming bent.

d. After installation, ensure each retaining ring is completely seated in its groove, without looseness or distortion.

TURNBUCKLE LOCK CLIP INSTALLATION (FIGURE 4)

NOTE

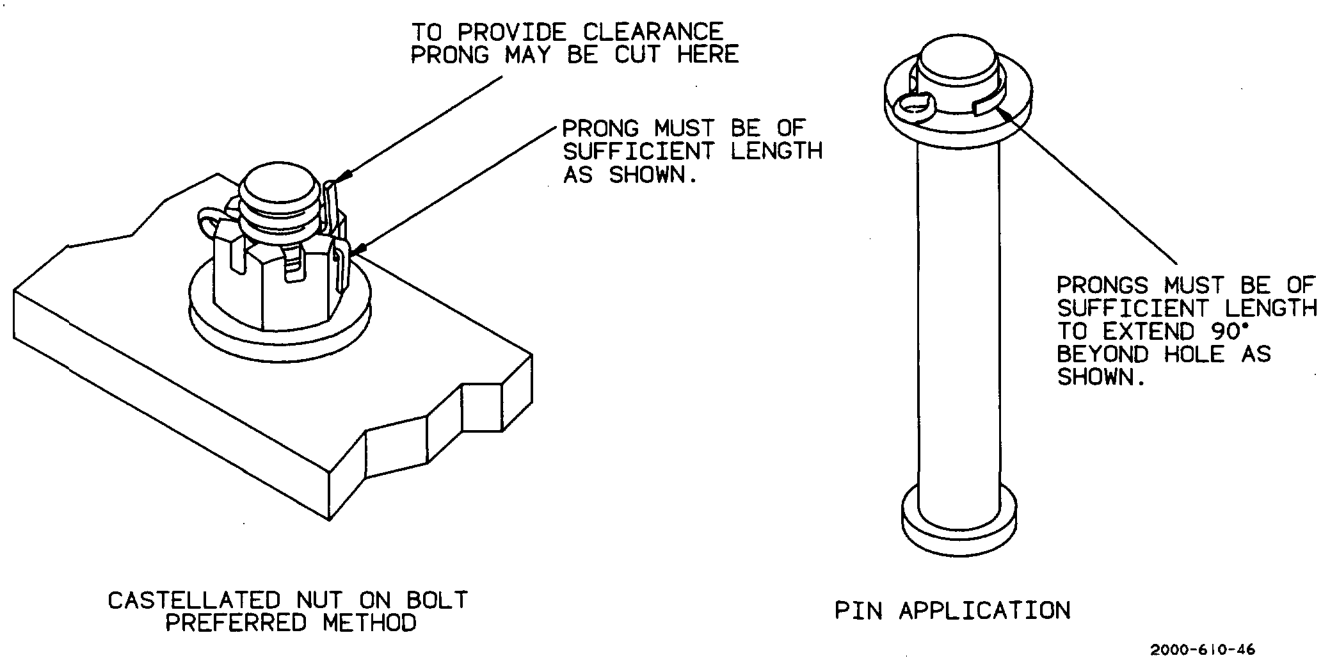
The turnbuckle barrel must be filled with MIL-G-23827 grease before the threaded terminals are screwed into the turnbuckle barrel.

Safety turnbuckles with lock clips as follows:

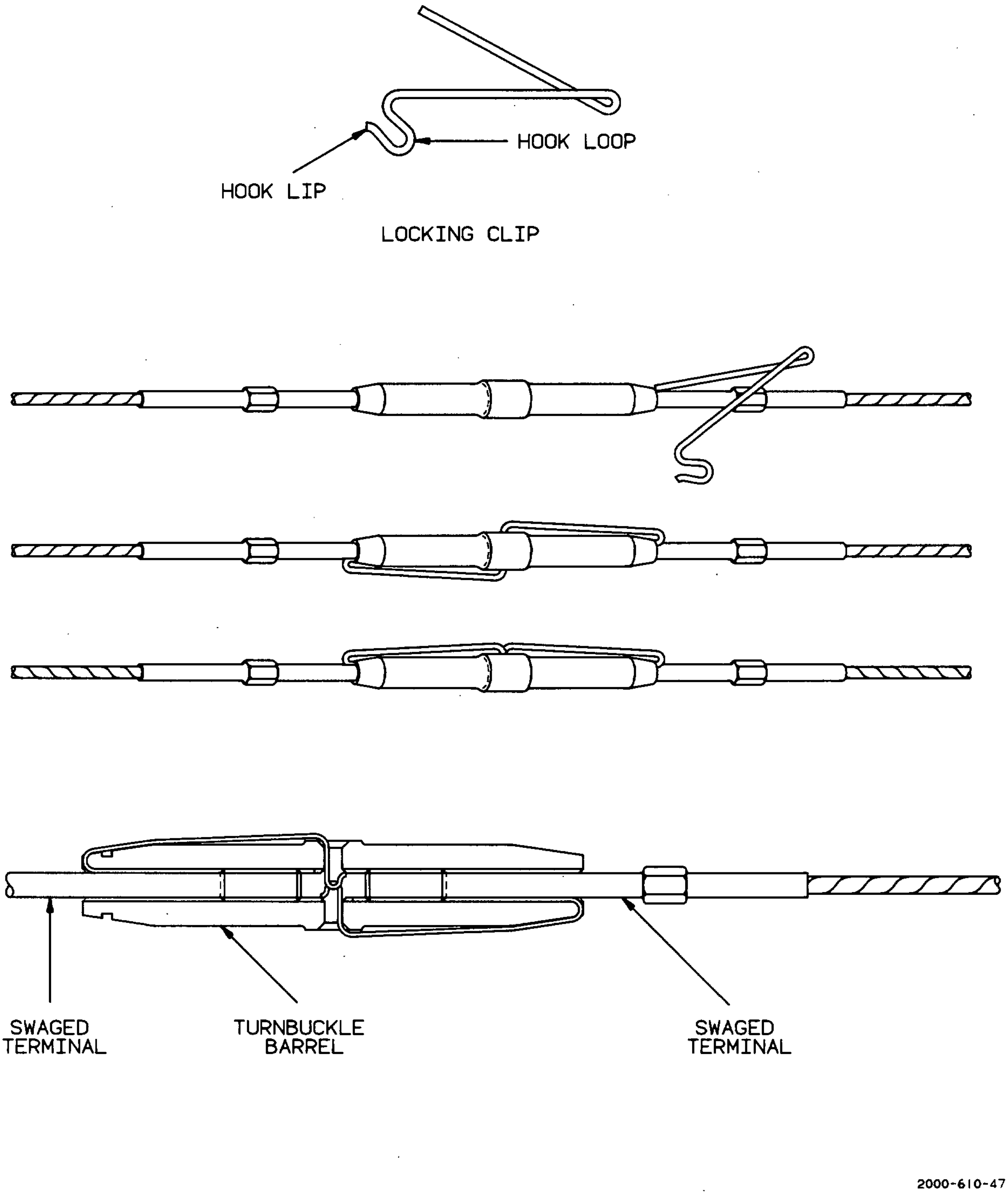
a. New lock clips must be used.

b. Screw both threaded terminals an equal distance into the turnbuckle barrel so that no more than three threads of either terminal is exposed outside the body.

c. If necessary, adjust the terminals until the cable is to the proper tension, adjust the turnbuckle to the locking position (groove on terminals and slot indicator notch on barrel should be aligned) and



Cotter Pin Installation
Figure 3



Turnbuckle Safetying Using Lock Clips
Figure 4

insert the end of the locking clip into the terminal and turnbuckle barrel end until the "U" curved end of the locking clip is over the hole in the center of the turnbuckle barrel.

d. Press the locking clip in the hole in the center of the turnbuckle barrel to its full extent.

e. The curved end of the locking clip will latch in the hole in in the center of the turnbuckle barrel.

f. To check proper seating of the locking clip, attempt to remove the pressed "U" end from the turnbuckle barrel using fingers only. Do not use a tool to check the lock clip installation as the locking clip could be distorted.

g. Repeat the previous steps for installation of the locking clip on the opposite end of the turnbuckle barrel.

h. Both locking clips may be inserted in the same side of the turnbuckle barrel center hole or in opposite sides of the turnbuckle barrel center hole.

AIRPLANE FINISH CARE - DESCRIPTION

The following cleaning, waxing, placarding and painting information provides finish care information needed to maintain the airplane in an approved condition.

NOTE: When interior or exterior paint is required, refer to the airplane log book for the paint part number. This number will identify the type of paint used on the airplane as it was delivered new. On older airplanes which do not have the paint part number listed on the airplane log book, contact Raytheon Technical Support, Raytheon Aircraft Company, Wichita, KS 67201-0085 to determine the paint used on the airplane as it was delivered.

RECOMMENDED MATERIALS

The recommended materials listed in Chart 1 as meeting federal, military or vendor specifications are provided for reference only and are not specifically required by Raytheon Aircraft Company. Any product conforming to the specification may be used subject to availability. The products included in these charts have been tested and approved for aviation usage by Raytheon Aircraft Company, by the vendor or compliance to the applicable specifications. GENERIC OR LOCALLY MANUFACTURED PRODUCTS WHICH CONFORM TO THE REQUIREMENTS OF A SPECIFICATION MAY BE USED EVEN THOUGH NOT INCLUDED IN THE CHART. Only the basic number of each specification is listed. No attempt has been made to update the listing to the latest revision. It is the responsibility of the technician or mechanic to determine the current revision of the applicable specification prior to usage of the product listed. This can be done by contacting the vendor of the product to be used.

Chart 1
Recommended Materials

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
1. Cleaner	ASTM D239	Acetone	Obtain locally.
2. Cleaner		Methyl Propyl Ketone	Obtain locally.
3. Cleaner	TT-N-95, Type II	Naphtha, Aliphatic	Obtain locally.
4. Acid Etching Primer	MIL-C-8514		Obtain locally.
5. Base Primer		EX2016G	Pratt & Lambert Coatings Div., P.O. Box 2153, Wichita, KS 67201
6. Catalyst		T607	Pratt & Lambert Coatings Div., P.O. Box 2153, Wichita, KS 67201
7. Urethane Primer		38-Y-3	U.S. Paint, Lacquer and Chemicals Co., St. Louis, MO
8. Cleaner		Lacquer Thinner	Obtain locally.

Chart 1
Recommended Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
9. Anti-static Coating		528-104 or 528-306	DeSoto Inc., Southwestern Plant, Forrest Ln. and Shiloh Rd., P.O. Box 401268 Garland, TX 75042
10. Elastomeric Polyurethane (white base)		M-213	Lord Chemical Products Group, 2000 W. Grandview Blvd., Erie, PA 16514
11. Curing Solution (elastomeric polyurethane)		M-200	Lord Chemical Products Group, 2000 W. Grandview Blvd., Erie, PA 16514
12. Sealer		EC750	Minnesota Mining and Mfg. Co., St. Paul, MN
13. Oakite No. 6			Oakite Products Inc., Berkeley Hts., N.J. 07922
14. Sanding Surfacer		F900 Primer Surfacer	Andrew Brown Co., 801 E. Lee, Irving, TX
15. Toluol (toluene)	TT-T-548		Obtain locally.
16. Isopropyl Alcohol	TT-I-735		Obtain locally.
17. Alodine 1200S	MIL-C-5541		Amchem Products Inc. Ambler, PA 19002
18. Primer, Epoxy-Polyamide	MIL-P-23377		U.S. Paint, Lacquer and Chemical Co. St. Louis, MO
19. Urethane Paint		6160 Matterhorn White	U.S. Paint, Lacquer and Chemical Co. St. Louis, MO

AIRPLANE FINISH CARE - MAINTENANCE PRACTICES

AIRPLANE FINISH CLEANING

CAUTION: *Since paint films do not obtain a hard finish for a considerable time after drying, airplanes that have been recently painted should not be polished or waxed until the finish has cured for at least 60 days.*

a. Remove dust and dirt from painted surfaces with a cellulose sponge and cool tap water.

b. Remove oil and grease with a cloth dampened with cleaner (3, Chart 1).

CAUTION: *When washing the airplane with mild soap and water, use special care to avoid washing away grease from any lubricated area. After washing the wheel well areas with solvent, lubricate all lubrication points. Premature wear of lubricated surfaces may result if these precautions are not observed.*

c. Remove insects with a cellulose sponge and a mild Ivory or Lux soap and water solution.

CAUTION: *Harsh soaps and detergents will damage the airplane finish.*

d. Carefully rinse the surface to remove ALL soap.

e. Dry the cleaned surface thoroughly with a chamois to prevent water marks.

ENVIRONMENTAL FALLOUT (ACID RAIN)

After the specified curing period of new paint, avoid outside storage when conditions exist where moisture may collect on painted surfaces. Acids which remain in standing water can stain the paint topcoat and cause permanent damage to the finish. Flush off residual moisture with clean tap water and dry the surface. At this time, waxing the surface can provide protection from acid rain damage.

WAXING AIRPLANE FINISHES

A good coat of wax will protect the airplane finish from the sun's rays and protect the surface against oxidation. Any good automotive polish or wax may be used.

PLACARD REPLACEMENT

All placards must be in place and legible. Whenever the airplane has been repainted or touched up after repairs, replace any placard that has been defaced or is missing.

URETHANE PAINTS

NOTE: Any time the paint on the airplane is stripped for repainting, whether the repaint is to be on a localized area of the airplane or on the entire airplane, a thorough inspection for possible hidden corrosion should be conducted.

The need for an extremely hard finish for protection against sandblast during takeoff and landings led to the development of urethane coatings for airplanes. Urethane paint dries to a high gloss and retains color much better than standard finishes. It is unaffected by the chemicals in hydraulic fluids, deicer fluids and fuels and requires less care and maintenance than standard finishes.

NOTE: After any painting repairs, inspect placards to ascertain that none have been covered with paint.

URETHANE PAINT REPAIR PROCEDURES

NOTE: The time normally required for urethane paint to cure must be extended at temperatures below 70°F. The paint will not cure at temperatures below 60°F.

This airplane is finished with pretreatment (wash) primer, urethane primer and a top coat of urethane enamel. The following procedures include cleaning, paint stripping, repaint preparation, priming, applying a urethane topcoat and an alternate method for small repairs not requiring paint stripping. Careful observance of these procedures should result in a smooth, hard, glossy finish with firm adhesion for maximum life.

NOTE: Precut stripe, numeral and letter patterns are available through Modagrafics, 5300 Newport Dr., Rolling Meadows, IL. 60008.

STRIPPING AND CLEANING URETHANE PAINT

CAUTION: *DO NOT USE STRIPPER OF ANY TYPE FOR REMOVING PAINT FROM FIBERGLASS, NYLON OR COMPOSITE SURFACES. Paint must be removed from these surfaces with fine sandpaper, using care not to sand into the material. Never use aluminum foil to mask electrothermal windshields during painting, for most metal brighteners will combine with aluminum to form a hydrogen gas that eats away the stannous oxide used as an antistatic coating on electrothermal windshields. If metal brighteners are used, cover the windshield with paper or pasteboard masking material.*

Because of their resistance to chemicals and solvents, urethane paints and primers require a special paint stripper. If a urethane stripper is not available, a good enamel stripper may be used. Removing the finish with such a substitute will require several applications while working the stripper in with a stiff brush or wooden scraper.

a. Mask around the edge of the skin or skins containing the damaged area. Use a double thickness of heavy paper to prevent accidental splashes of paint stripper from penetrating the masking.

b. Apply urethane stripper as instructed by the manufacturer. Stay approximately 1/8 inch away from the masking tape. This will necessitate a little more cleanup upon finishing, but will prevent damage to the finish on the adjacent skin. The stripper will not attack aluminum during the stripping process and can be neutralized afterwards by rinsing the affected area with water.

CAUTION: *Urethane strippers usually contain acids that irritate or burn the skin. Wear rubber gloves and eye protection when using stripper.*

c. Rinse the area with water and dry.

d. Wash the stripped area carefully with a cleaner (1, 2 or 8, Chart 1). This will prevent tiny particles of loose paint from adhering to the stripped area.

e. Using a nylon scratch pad or aluminum wool dipped in clean water, clean the surface with a cleanser such as Bon Ami, Ajax, Comet cleaner, etc. A good scouring will leave the surface completely clean.

f. Thoroughly rinse with clean water and carefully dry the affected area. If the stripped area includes several joints of skin laps, let the airplane sit until all moisture has dried. This may be accelerated by blowing the skin laps and seams with compressed air. Wet masking should be replaced.

PRETREATMENT (WASH) PRIMER FOR URETHANE PAINT

An acid etching primer (4, Chart 1) should be applied to improve the adhesion of the finishing coats. A base primer (5, Chart 1) and catalyst (6, Chart 1) are used in equal parts as a pretreatment wash primer at the factory.

a. Mix the primer as instructed by the manufacturer.

b. Apply a thin wet coat of primer. It should be permitted to dry for at least an hour, but not over six hours, before the next coat of urethane primer is applied.

URETHANE PRIMER

a. Mix the urethane primer (7, Chart 1) as instructed by the manufacturer.

NOTE: For the best results these directions must be followed carefully, some manufacturers require that the primer be allowed to set for 1/2 hour after the catalyst and base have been mixed while others recommend immediate use after mixing.

b. Apply a coat of urethane primer with a spray gun using 35 to 40 psi of air pressure. A spotted appearance only indicates that the coat is thin.

c. If the initial primer coat is allowed to cure for more than 24 hours before the topcoat is applied, sand the primer slightly to roughen the surface and assure adhesion. Wipe off the sanding dust with a cloth dampened with a cleaner (8, Chart 1), then apply the topcoat.

URETHANE TOPCOATS

a. Mix the paint and catalyst as instructed by the manufacturer.

b. Apply the topcoat with a spray gun at 35 to 45 psi of air pressure. Two coats are normally required to fully conceal the primer and build up the topcoat film necessary for adequate service life and beauty. The urethane finish will normally cure to approximately 85% of its full hardness in 24 hours at temperatures of 80°F or higher.

URETHANE TOUCH-UP REPAIR

a. Mask around the skin containing the damaged area.

b. Remove all loose edges of paint by using a high tack adhesive tape around the edge of the damaged area.

c. Using a coarse sandpaper, fair the edge of the damaged area with the metal.

d. When the edge of the paint begins to fair into a smooth joint, use a fine grade of sandpaper to eliminate the scratches left by the coarse paper. Take care to avoid removing any more metal than is absolutely necessary.

e. Wash the sanded area with a cleaner (2 or 8, Chart 1). Change often to clean wash cloths so that all of the sanding dirt will be picked up.

f. After the area to be touched up has been cleaned until all traces of discoloration are gone, apply a thin coat of pretreatment primer (4, Chart 1) to the damaged area.

NOTE: If a metal conversion coating such as iridite or alodine is used, the wash primer coating can be dispensed with. If the metal has not been treated with a metal conversion coating but no wash primer is available, carefully clean the surface to be touched up and apply urethane primer (7, Chart 1) to the bare metal. This should produce a satisfactory undercoat for the repair area.

g. After the urethane primer has cured for 24 hours, sand the area under repair with medium fine sandpaper. Sand the edge of the repair area until the indentation where the metal and old paint meet is gone. If necessary, apply additional urethane primer until the juncture of old paint with metal is no longer visible.

h. Spray on two urethane topcoats.

PAINTING MAGNESIUM

PAINT REMOVAL FROM MAGNESIUM SURFACES

WARNING: Do not use paint strippers that may cause an immediate corrosive effect on magnesium and/or aluminum surfaces. Acid base and some phenol base strippers are not recommended. Consult the manufacturer for cautions if the stripper is not listed in the consumable materials chart of this manual.

a. Mask areas not being stripped with two or more thicknesses of masking tape and aluminum foil to prevent accidental spillage from penetrating the masking.

b. Apply paint stripper (27, Chart 1, 91-00-00) to the surface being stripped with a brush or non-atomizing gun.

NOTE: Most strippers are neutralized with water; therefore, the surface being stripped must be thoroughly dry before any application of the stripper. Magnesium surfaces are treated at the factory with a brown to amber Dow # 19 primer coat. Any magnesium surfaces not displaying this color should be resprayed with a primer coat before application of paint.

Dow # 19 is used in the field to restore the original anti-corrosion surface treatment that may have been penetrated in service. The chemicals for Dow #19 formula may be purchased from a Raytheon Aircraft Company Authorized Outlet in powder form or may be procured locally and produced as follows:

1. Place approximately 3/4 gallon of distilled water in a plastic container which will measure one gallon of fluid. The water should be at a temperature of between 70 and 90°F.
2. Add 1 1/3 oz. of chromic acid (H_2CrO_4).
3. Add 1 oz. of calcium sulfate ($CaSO_4$) to the water.
4. Add distilled water to make one gallon of solution and stir vigorously for at least 15 minutes.
5. Brush the solution in and around the bare surfaces of the magnesium, keeping the area wet with the solution for one to three minutes to produce a brown film. Do not exceed three minutes.
6. Rinse with cold running water and dry by exposure to hot air blast.
7. Apply a liberal coating of epoxy-based corrosion resistant primer.

WARNING: Stripping should be accomplished in a well ventilated area, since prolonged exposure to high concentrates of vapor may irritate the eyes and lungs.

c. Allow the paint stripper to remain on the airplane for 20 to 30 minutes, then work the remaining paint loose with a bristle brush. The stripper may remain on the airplane for 2 hours but must not be allowed to dry on the surface.

CAUTION: *Never use a wire brush when removing paint from magnesium surfaces for it may cause damage to the surface.*

d. Remove the masking paper and wash the affected area thoroughly with water under high pressure. Remove all remnants of paint with lacquer thinner.

PAINTING MAGNESIUM SURFACES

NOTE: Any time an airplane is repainted, inspect all placards to assure that they are not covered with paint, are easily readable and are securely attached.

a. Prepare the surface to be repainted as indicated under PAINT REMOVAL FROM MAGNESIUM SURFACES. Clean the affected area thoroughly with lacquer thinner or an equivalent solvent.

NOTE: Unprimed areas of magnesium castings are to be coated with MIL-M-3171 corrosion preventative compound (28, Chart 1, 91-00-00) unless these areas will come in contact with oil or grease after assembly. Any holes in the castings which will receive bushings or bearings shall be coated with wet, unreduced zinc chromate primer or corrosion preventative compound at the time of installation.

b. Prime the affected area with corrosion preventative compound and apply the urethane topcoat.

NOTE: Prior to application of the primer base, the magnesium surface should be thoroughly dried. Drying may be accomplished by subjecting the magnesium to an elevated temperature of 130 to 140°F for a minimum of one hour. Allow a minimum of four hours drying time between application of the primer and topcoat.

SPECIAL PROCEDURES

PROPELLER BLADES

Paint the propeller blades as instructed by the propeller manufactures owner's manual.

SURFACES SUSCEPTIBLE TO MUD AND SPRAY

Apply one coat of white epoxy paint to the following areas:

a. Main and nose landing gear wheel wells.

b. Interior surface of landing gear doors.

c. Main and nose landing gear assemblies.

RUBBER SEALS

Apply one coat of a thoroughly dissolved solution of one part Oakite No. 6 (13, Chart 1, 91-00-00) and two parts water to all rubber surfaces that are to come into contact with metal or other rubber surfaces.

ENCLOSED AREAS SUBJECT TO HIGH HUMIDITY

Steel, aluminum or magnesium parts and assemblies which are enclosed and subject to high humidity should be protected against corrosion by coating with either epoxy primer, MIL-C-16173 corrosion preventative compound, light grease or heavy oil (5, Chart 1, 91-00-00).

BATTERY BOX AND LID

Finish the interior of the battery box and lid as follows:

a. Apply two (2) coats of Epoxy-Polyamide Primer per MIL-P-23377 (56, Chart 1, 91-00-00).

b. Apply two (2) coats of Matterhorn White urethane paint No. 6160 (57, Chart 1, 91-00-00).

PAINT FREE AREAS

The following areas shall be kept free from paint:

a. Engine controls.

b. Flight control cables and chains.

c. Exhaust manifolds and exhaust stacks.

d. Firewalls and wrought aluminum surfaces forward of the firewall, with the following exception:

   1. Aluminum parts attached directly to the firewall shall be primed in detail.

e. Aluminum flexible conduit.

f. All tubing except unplated steel, which shall receive two coats of primer on the exterior, on interiors where the color scheme must be maintained, and except as noted, on the interior of the engine compartment.

g. Stall warning vane.

h. Chromium plated portions of the landing gear piston tubes.

i. Rubber and rubberlike surfaces.

j. Electrical wiring, unless otherwise noted as a specific requirement.

k. Glide path antenna (if installed).

l. Pitot mast and static buttons.

m. Cabin door sill and upper latch.

n. Utility door opening threshold (E-1111, E-1241 and After; EA-11 and After).

o. Window moldings, overhead console escutcheon, shoulder harness escutcheon, lower utility door escutcheon, window latch escutcheon, OAT escutcheon, ignition panel escutcheon, circuit breaker panel escutcheon, upper utility door latch escutcheon, wing bolt cover escutcheons, and sidewall air valve escutcheons.

p. All bearing surfaces subject to rotation or sliding, such as elevator trim tab linkage joints.

q. All exterior placards. See Chapter 11 in this manual for placard locations.

CORROSION - DESCRIPTION

Corrosion is the gradual eating away of material by chemical action.

Corrosion may develop at areas where the protective coating has been damaged. When this happens, it is important to restore the protective coating. Corrosion also occurs when dissimilar metals are in contact with any moisture present. High levels of humidity, high levels of environmental impurities (such as salt spray, acid rain, exhaust deposits, or chemical fumes), or high ambient temperatures will increase the rate of corrosion. Some of the more common types of corrosion are surface corrosion, inter granular corrosion, pitting, exfoliation, and electrolytic or galvanic corrosion.

GALVANIC CORROSION

The galvanic series shown below shows which metals are attacked when in contact with a dissimilar metal (Ref. Figure 1). The wider the separation in the series, from the top to the bottom, the faster the rate of corrosion. A partial galvanic series list follows:

Anodic, or corroded end of series

Magnesium alloys

Aluminum alloys 5052, 5056, 5356, 6061, 6063

All other aluminum alloys

Zinc

Cadmium

Lead

Tin

Steel

Copper alloys

Nickel alloys

Titanium

Cathodic, or protected end of series

NOTE: Corrosion is relative. For example: aluminum alloys corrode when in contact with steel; steels corrode when in contact with copper.

TABLE I
GALVANIC COUPLES **

GROUP	METALLURGICAL CATEGORY	EMP (VOLT)	PERMISSIBLE COUPLES*
1	GOLD, SOLID AND PLATED; GOLD-PLATINUM ALLOYS, WROUGHT PLATINUM	+0.15	
2	RHODIUM; GRAPHITE	+0.05	
3	SILVER, SOLID OR PLATED; HIGH SILVER ALLOYS	0	
4	NICKEL, SOLID OR PLATED; MONEL; HIGH NICKEL-COPPER ALLOYS; TITANIUM	-0.15	
5	COPPER, SOLID OR PLATED; LOW BRASSES OR BRONZES; SILVER SOLDER; GERMAN SILVER; HIGH COPPER-NICKEL ALLOYS; NICKEL-CHROME ALLOYS; AUSTENITIC STAINLESS STEELS (301, 302, 304, 309, 316, 321, 347)	-0.20	
6	COMMERCIAL YELLOW BRASSES AND BRONZES	-0.25	
7	HIGH BRASSES AND BRONZES; NAVAL BRASS, MUNTZ METAL	-0.30	
8	18% CHROMIUM TYPE CORROSION RESISTANT STEELS 440-430, 431, 446, 17-7PH, 17-4PH	-0.35	
9	CHROMIUM, PLATED; TIN, PLATED; 12% CHROMIUM TYPE CORROSION-RESISTANT STEEL, 410, 416, 420	-0.45	
10	TIN-PLATE, TERNEPLATE; TIN-LEAD SOLDERS	-0.50	
11	LEAD, SOLID OR PLATED, HIGH LEAD ALLOYS	-0.55	
12	ALUMINUM, WROUGHT ALLOYS OF THE DURALUMIN TYPE, 2014, 2024, 2017	-0.60	
13	IRON, WROUGHT, GRAY, OR MALLEABLE; PLAIN CARBON AND LOW ALLOY STEELS; ARMCO IRON	-0.70	
14	ALUMINUM, WROUGHT ALLOYS OTHER THAN DURALUMIN; TYPE 6061, 7075, 5052, 5056, 1100, 3003. CAST ALLOYS OF THE SILICON TYPE 355, 356.	-0.75	
15	ALUMINUM, CAST ALLOYS OTHER THAN SILICON TYPE; CADMIUM, PLATED AND CHROMATED	-0.80	
16	HOT-DIP-ZINC PLATE; GALVANIZED STEEL	-1.05	
17	ZINC WROUGHT; ZINC-BASE DIE CAST ALLOYS; ZINC-PLATED	-1.10	
18	MAGNESIUM AND MAGNESIUM-BASE ALLOYS CAST OR WROUGHT	-1.60	

* MEMBERS OF GROUPS CONNECTED BY LINES ARE CONSIDERED AS PERMISSIBLE COUPLES; HOWEVER, THIS SHOULD NOT BE CONSTRUED AS BEING DEVOID OF GALVANIC ACTION. PERMISSIBLE COUPLES REPRESENT A LOW GALVANIC EFFECT.
○ INDICATES THE MOST CATHODIC MEMBER OF THE SERIES.
● AN ANODIC MEMBER, AND THE ARROWS INDICATE THE ANODIC DIRECTION.
REFER TO TABLE II, MIL-STD-186, FOR GROUP AMPLIFICATION OF GALVANIC COUPLES.

**TAKEN FROM MIL-STD-1250(MI), 31 MARCH 1967

2000-610-45

Galvanic Couples List
Figure 1

RECOMMENDED MATERIALS

The recommended materials listed in Chart 1 as meeting federal, military or vendor specifications are provided for reference only and are not specifically required by Raytheon Aircraft Company. Any product conforming to the specification may be used subject to availability. The products included in these charts have been tested and approved for aviation usage by Raytheon Aircraft Company, by the vendor or compliance to the applicable specifications. GENERIC OR LOCALLY MANUFACTURED PRODUCTS WHICH CONFORM TO THE REQUIREMENTS OF A SPECIFICATION MAY BE USED EVEN THOUGH NOT INCLUDED IN THE CHART. Only the basic number of each specification is listed. No attempt has been made to update the listing to the latest revision. It is the responsibility of the technician or mechanic to determine the current revision of the applicable specification prior to usage of the product listed. This can be done by contacting the vendor of the product to be used.

Chart 1
Recommended Materials

MATERIAL	SPECIFICATION	PRODUCTS	VENDOR
1. Coating	MIL-C-5541	Alodine 1200	Amchem Products Inc., Spring Garden St., Ambler, PA 19002 Amchem Products Inc., St. Joseph, MO
2. Primer	MIL-P-23377	Epoxy Primer	Ameron Industrial, Coatings Div., P.O. Box 2153, Wichita, KS 67201
3. Rust Remover	MIL-M-10578		

CORROSION - MAINTENANCE PRACTICES

CORROSION CONTROL

Corrosion damage requires inspection to determine the depth of penetration and the cross-sectional area change. The damaged area must be thoroughly cleaned. If deterioration has significantly reduced the structural strength of a part (e.g., a reduction of thickness more than 5%), the component must be repaired or replaced. Upon completion of the clean-up or repair, all elements must be treated and refinished as applicable. In all instances, good preventive maintenance and regular cleaning will be the most effective corrosion control.

The following solvents may be used to remove grease, oil, stains and other surface contaminants on most materials.

Product	**Specification**
Trichloroethylene	O-T-634
Perchloroethylene	O-T-236
Toluene	TT-T-548
Xylene	TT-X-916
Methyl Propyl Ketone	n/a
Dry cleaning solvent	P-D-680 Type III
Kerosene	VV-K-211

Vapor degreasing of parts may be used when the proper equipment is available.

WARNING: Do not use chlorides on titanium. Do not use exotic solvents on composites. Do not use any solvents in areas close to the oxygen system.

CORROSION PROTECTION

All common metals are subject to corrosion in varying degrees. Aircraft parts are protected against corrosion by several methods. Most aircraft aluminum alloy sheet have a thin cladding layer of pure aluminum (ALCLAD) applied at the mill. Other aluminum alloy parts may be protected with an anodic coating system or a chromate treatment. Many steel parts are protected by cadmium plating. Most parts have protective primer.

ALUMINUM CORROSION REMOVAL

Corrosion may be removed mechanically or chemically.

In mechanical removal, it is essential that the abrasive materials on the tool leave no residue or particles that could cause future corrosion. An abrasive previously used on ferrous metals will contain minute particles which will imbed in aluminum alloys and start a new cycle of corrosion. A steel wire brush used on aluminum alloys will leave tiny particles sufficient to initiate corrosion of the aluminum.

On aluminum alloy parts, corrosion is best removed with aluminum oxide abrasive paper or aluminum wool.

On clad aluminum alloys, use a chemical alkaline cleaner. Mix and store alkaline solutions in plastic, stainless steel, or glass containers. Mask off all dissimilar metals as well as all cracks and sheet laps. Apply cleaner with a soft brush. Rinse thoroughly with clean water and dry with compressed air.

WARNING: Always wear rubber gloves and protective clothing when working with acids. A face mask may be necessary, depending upon ventilation in the area. If acid accidentally contacts skin or eyes, immediately flush with fresh water and seek medical advice.

REMOVAL OF CORROSION FROM ALUMINUM SURFACES

a. Strip all paint from the surface as directed under STRIPPING AND CLEANING URETHANE PAINT in Chapter 20-08-00.

b. Mechanically remove corrosion by sanding or rubbing as necessary.

c. Inspect the surface carefully to ensure that sufficient material remains to satisfy structural requirements.

d. Clean the corrosion removed area with a chemical alkaline cleaner.

e. Treat all aluminum surfaces with MIL-C-5541 (1, Chart 1).

   1. Rinse the treated area in COLD running water and dry in an oven or by exposure to hot air blast.

   NOTE: If cold running water is not available, rinsing may be eliminated and the area dried as stated above.

   2. Brush 2 coats (a minimum of 30 minutes apart) of epoxy primer (2, Chart 1) on and around the reworked area. Assure adequate penetration of primer into the treated area.

ALUMINUM CORROSION TREATMENT

After corrosion removal and surface cleaning, metals should be given protective treatment and painted. Alodine treatment of aluminum alloys forms a protective coating which resists corrosion and provides a good surface for adhesion of the paint primer.

Alodine 1200, 1200S, 1201 (1, Chart 1), or equivalent, when mixed 2 ounces per gallon of water, will be an acceptable treatment material. Mix only in rubber, plastic or stainless steel containers. Alodine 1200 series products contain fluorides that should not be mixed in glass containers. Coat the area with the Alodine solution and allow the coating to dwell for approximately five minutes. After the dwell time has elapsed, wash the area with water and blow dry (do not wipe dry). Paint the coated area with epoxy polyamide primer (2, Chart 1) and allow to dry.

WARNING: Brushes and cloths should not be left in the Alodine solution. They should be washed immediately after use. If such items are left to dry in the open air, they could create a fire hazard.

CAUTION: *Keep the Alodine solution confined to the affected area. Mask or seal all cracks and crevices, all steel parts, and any mechanical components. Wash all brushes and cloths immediately after use to prevent inadvertent contact with the acid solution and to eliminate a possible fire hazard from any such materials that dry without being washed.*

MAGNESIUM CORROSION REMOVAL

a. Strip all paint from the surface as directed under PAINT REMOVAL FROM MAGNESIUM SURFACES.

b. Mechanically remove corrosion by sanding or rubbing as necessary. If sanding, use aluminum sandpaper. Start with 240 grit and finish with 400 grit.

c. Inspect the surface carefully to ensure that sufficient material remains to satisfy structural requirements.

d. Clean the corrosion removed area with Methyl Propyl Ketone (MPK) or naphtha.

e. Apply corrosion treatment to the unprotected magnesium.

MAGNESIUM CORROSION TREATMENT

Any bare magnesium component which will be returned to service should be lightly sanded to remove any oxide coatings and coated with Dow # 19 formula.

The chemicals for Dow #19 formula may be purchased from a Raytheon Aircraft Company Authorized Outlet in powder form or may be procured locally and produced as follows:

a. Place approximately 3/4 gallon of distilled water in a plastic container which will measure one gallon of fluid. The water should be at a temperature of between 70 and 90°F.

b. Add 1 1/3 oz. of chromic acid (H_2CrO_4).

c. Add 1 oz. of calcium sulfate ($CaSO_4$) to the water.

d. Add distilled water to make one gallon of solution and stir vigorously for at least 15 minutes.

e. Brush the solution in and around the bare surfaces of the magnesium, keeping the area wet with the solution for one to three minutes to produce a brown film. Do not exceed three minutes.

f. Rinse with cold running water and dry by exposure to hot air blast.

g. Apply a liberal coating of epoxy based corrosion resistant primer.

STEEL CORROSION REMOVAL

Remove corrosion from steel parts by mechanical means. Use a steel wire brush, a steel scraper, steel wool, or 400 grit abrasive paper.

If acid cleaning must be used, it is essential that all plated areas, operating mechanisms, braided lines, or material laps which could trap the acid be adequately masked. Mix one part of metal conditioner and rust remover (3, Chart 1) with one part of clean water in a stainless steel, plastic or glass container. Apply solution to the corroded area using an acid resistant brush. Allow to stand one minute, then thoroughly rinse with hot water and wipe dry.

WARNING: Always wear rubber gloves and protective clothing when working with rust removal. A face mask may be necessary, depending upon ventilation in the area. If acid accidentally contacts the skin or eyes, immediately flush with fresh water and seek medical advice.

In most cases, steel that has been cleaned shall be treated with a minimum of one coat of epoxy primer (2, Chart 1) to protect against future corrosion.

CHAPTER

21

AIR CONDITIONING

CHAPTER 21 - ENVIRONMENTAL SYSTEMS

TABLE OF CONTENTS

SUBJECT *PAGE*

21-40-00

21-50-00

CHAPTER 21 - ENVIRONMENTAL SYSTEMS

TABLE OF CONTENTS (Continued)

CHAPTER 21 - ENVIRONMENTAL SYSTEMS

LIST OF PAGE EFFECTIVITY

CHAPTER-SECTION-SUBJECT	*PAGE*	*DATE*
21-Effectivity	1	Aug 18/95
21-Contents		
	1	Aug 18/95
	2	Aug 18/95
21-40-00		
	1	Oct 16192
	2	Oct 16/92
	3	Oct 16/92
	4	Oct 16/92
	5	Oct 16/92
	6	Oct 16/92
	7	Oct 16/92
	8	Oct 16/92
	9	Oct 16/92
	10	Oct 16/92
21-50-00		
	1	Aug 18/95
	2	Aug 18/95
	3	Aug 18/95
	4	Aug 18/95
	5	Aug 18/95
	6	Aug 18/95
	7	Aug 18/95
	8	Aug 18/95
	9	Aug 18/95
	10	Aug 18/95
	11	Aug 18/95
	12	Aug 18/95

HEATING AND VENTILATING SYSTEM - DESCRIPTION AND OPERATION (Figures 1,2,3,4 and 5)

CABIN HEATING

A heat exchanger connected to the right exhaust stack provides for heated air to five outlets in the forward and aft areas of the cabin. The two forward outlets are located above and forward of each set of rudder pedals. The two aft outlets are installed behind the right front seat and the right rear seat. The fifth outlet provides heated air for windshield defrosting.

In flight, ram air enters through the heater air intake and passes through the heater, then into a mixer valve on the forward side of the firewall. The heater air intake on Models F33A, F33C, V35B and A36 is from the right side of the nose. Models A36TC and B36TC have an airscoop on the left side of the engine compartment that furnishes air to the heater. In the mixer valve, the heated air is combined with a controlled quantity of unheated ram air picked up at the fresh air intake. The fresh air intake on Models F33A, F33C, V35B and A36 is in the engine rear baffle. The fresh air intake on Models A36TC and B36TC is from the right side of the nose. Air of the desired temperature is then ducted from the mixer valve to the outlets in the cabin. When the forward cabin control is in the cold position, unheated air circulates through the cabin.

HEATER AND DEFROSTER OPERATION

The heater controls are located on the lower left pilot's subpanel. To obtain heated air to the cabin outlets, pull the CABIN HEAT control. The control regulates the amount of cold air that is mixed with the air from the heater. When the control is pulled fully out, the cold air is directed overboard and only heated air enters the cabin. The forward vents, located on the firewall forward of the rudder pedals, deliver heated air to the forward cabin when the CABIN HEAT control is pulled out. To provide heated air to the aft seat outlets, pull out the AFT CABIN HEAT control. For maximum heat, the control is pulled fully out. To obtain heated air for defrosting the windshield, pull the DEFROST control out. It may be necessary to vary or close the AFT CABIN HEAT control to obtain maximum air flow for defrosting. To close off all air from the heater system, pull the red FIREWALL AIR control located to the extreme left of the pilot's lower subpanel.

CABIN VENTILATION

In moderate temperatures, ventilation air can be obtained from the same outlets used for heating by pushing the CABIN HEAT control full forward. However, in extremely high temperatures, it may be desirable to pull the red FIREWALL AIR control and use only the fresh air ventilation described in the following paragraphs.

PILOT'S FRESH AIR VENTILATION

A duct in each wing root is connected directly to an adjustable outlet in the upholstery panel forward of each front seat. Airflow from each outlet is controlled by a center knob. The direction of airflow is controlled by rotating the louvered cover with the small knob on the rim.

OVERHEAD FRESH AIR VENTILATION

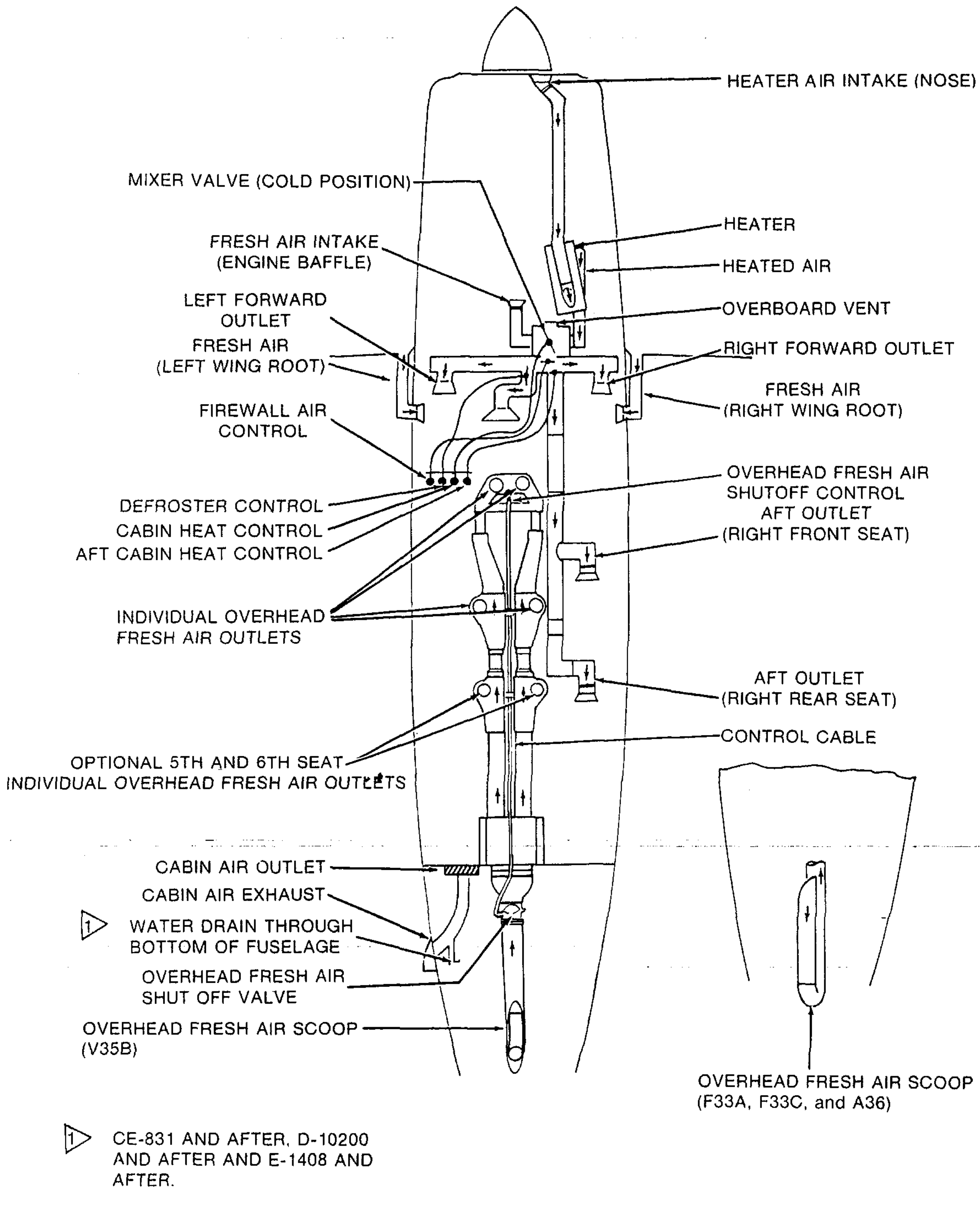
Fresh ram air from the air intake on the upper side of the aft fuselage is ducted to individual outlets above each seat, including the optional 5th seat on Models F33A and V35B and the optional 5th and 6th seats on Models A36, A36TC and B36TC. Each outlet can be positioned to direct the flow of air as desired. The volume of incoming air can be regulated by rotating the outlet. A shutoff valve is installed in the fresh air duct aft of the cabin compartment panel. The valve is operated by turning a knob on the overhead panel.

CABIN AIR EXHAUST

Since the cabin is sealed, an air exhaust is required to provide for circulation of cabin ventilation air. A cabin air outlet is installed in the cabin aft upholstery panel and is connected to an exhaust vent installed in the left side of the fuselage.

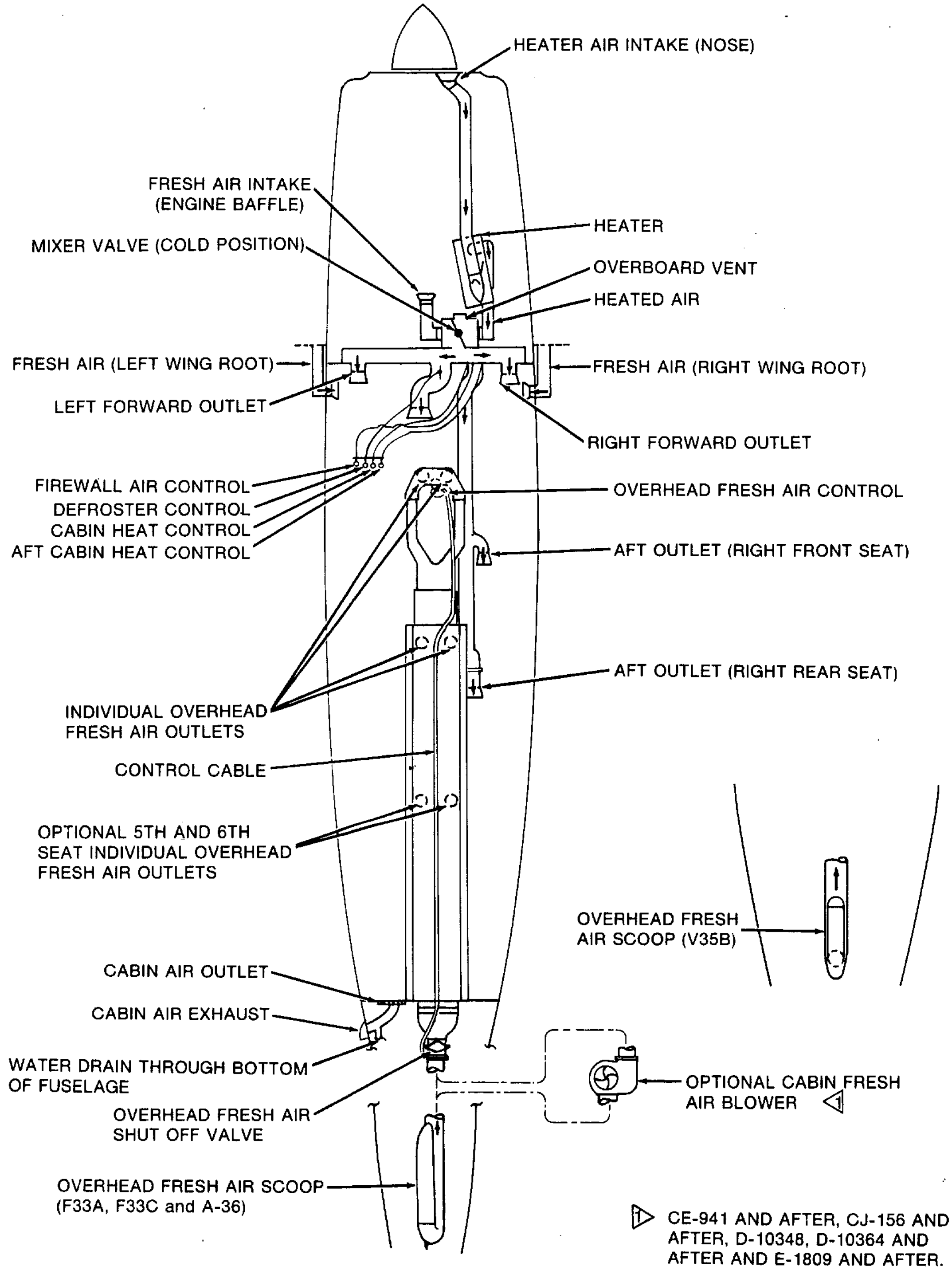
FRESH AIR BLOWER

An optional fresh air blower may be installed on airplanes CE-941 and after, CJ-156 and after, D-10348, D-10364 and after, E-1809 and after and EA-192 and after. The fresh air blower utilizes the same ducts and air outlets as the overhead fresh air system. The blower is located aft of the baggage compartment wall at the aft end of the overhead fresh air plenum. The blower's circuit breaker/switch is located on the console near the fuel mixture lever on early airplanes. On airplanes CE-990 and after, CJ-156 and after, D-10390 and after, E-1954, E-1988 and after and EA-243, EA-273 and after, the circuit breaker/switch is located in the center of the subpanel.

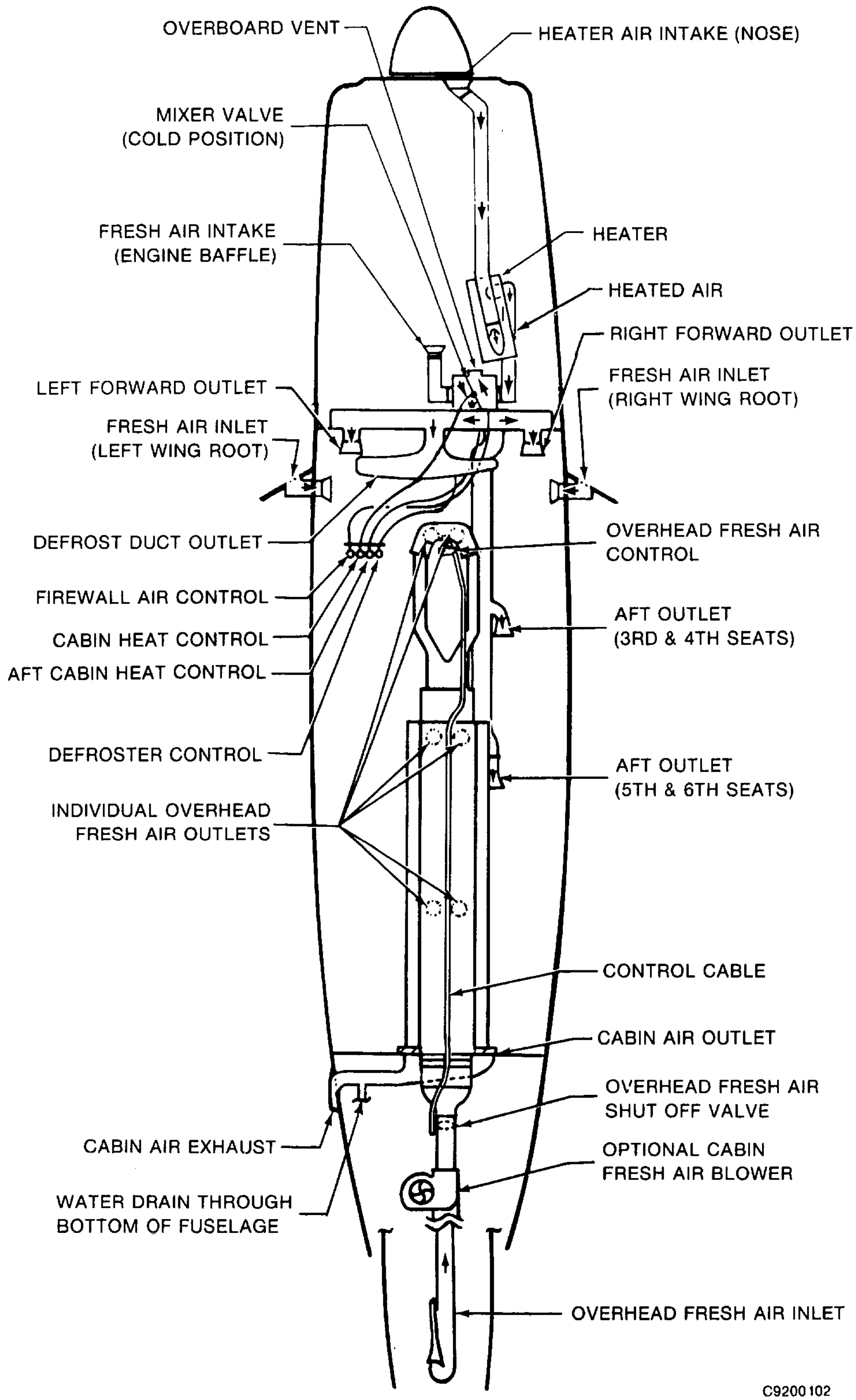


C9200100

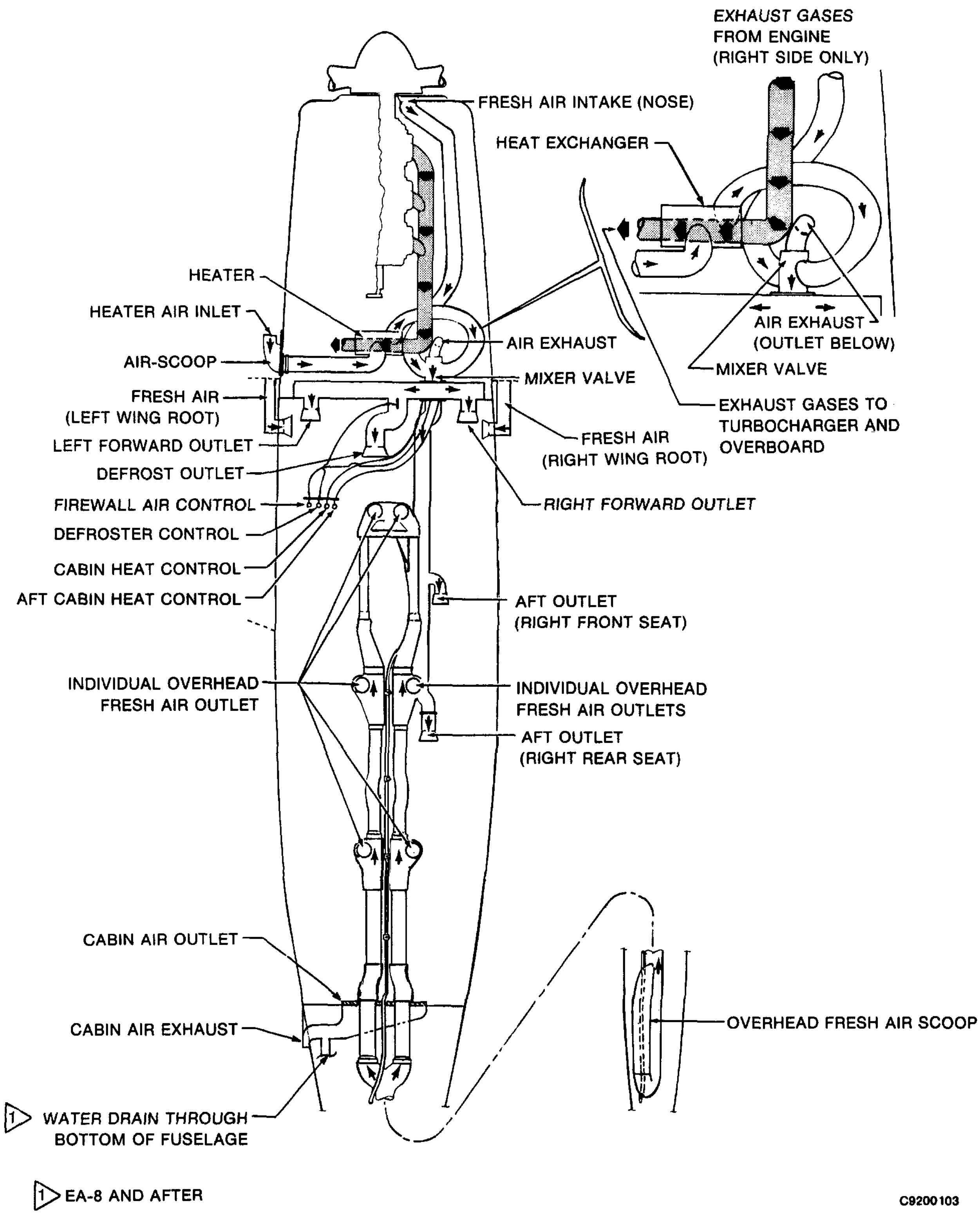
Heating and Ventilating System
(CE-748, CE-772 thru CE-918, CE-920 thru CE-922, CE-924, CE-926 and CE-928; CJ-149 thru CJ-155; D-10097, D-10120 thru D-10347; and E-1111, E-1241 thru E-1421, E-1423 thru E-1550, E-1552 thru E-1568, E-1570 thru E-1580 and E-1582 thru E-1593)
Figure 1



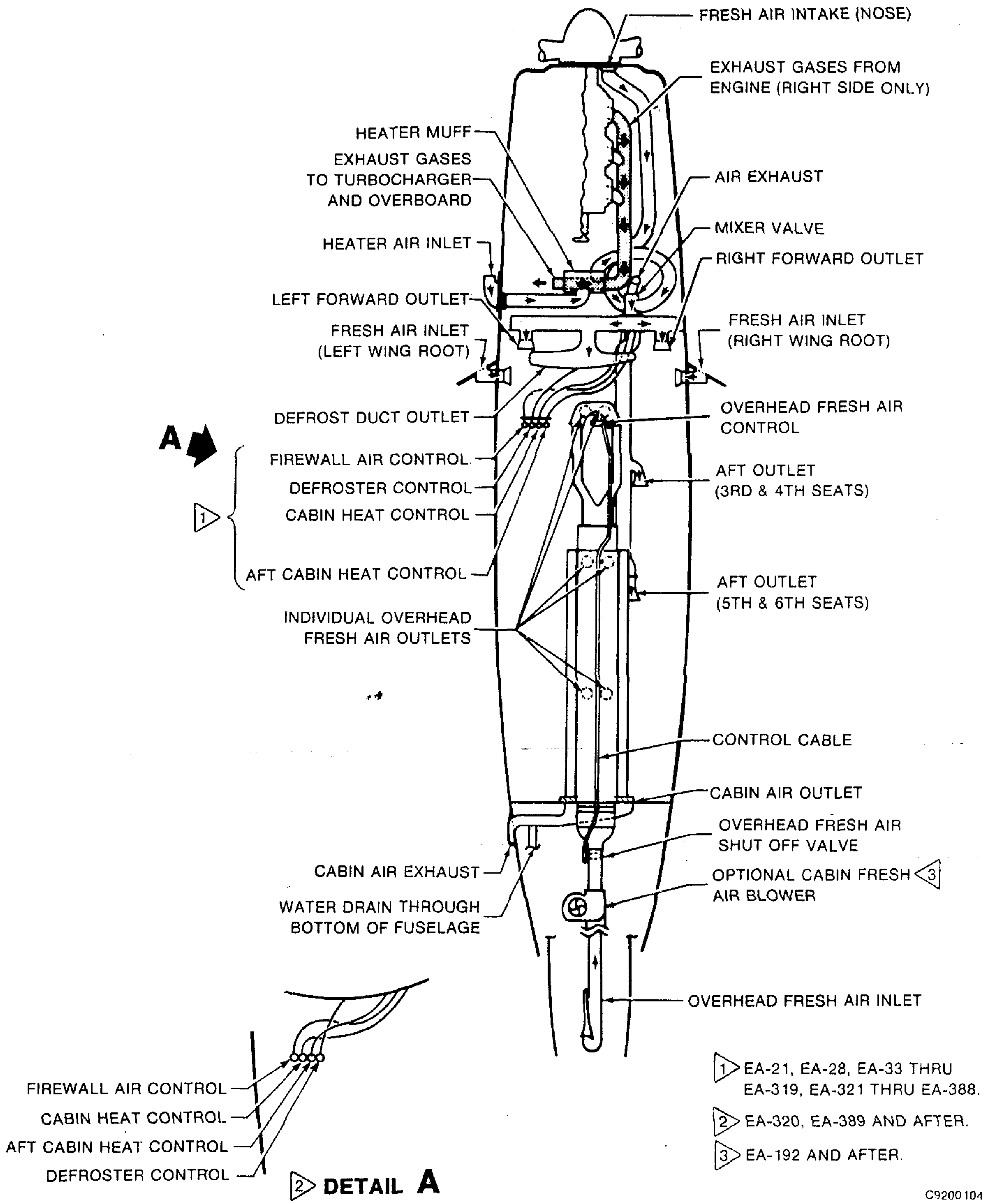
Heating and Ventilating System (CE-919, CE-923, CE-925, CE-927, E-929 and after; CJ-156 and after; D-10348, D-10353 and after; and E-1422, E-1551, E-1569, E-1581, E-1594 thru E-1945, E-1947 thru E-2103, and E-2105 thru E-2110)
Figure 2



Heating and Ventilating
(E-1946, E-2104 and E-2111 and after)
Figure 3



**Heating and Ventilating
(EA-1 thru EA-20, EA-22 thru
EA-27 and EA-29 through EA-32)
Figure 4**



Heating and Ventilating
(EA-21, EA-28, EA-33 and after)
Figure 5

HEATING AND VENTILATING - MAINTENANCE PRACTICES

INSPECTION OF HEATING AND VENTILATING SYSTEM

Inspect the air intake ducts leading to the heater; check all clamps and connections for tightness and the duct for holes and cracks. Check the duct for internal restrictions and/or collapsing. Check the screen at the intake duct; remove and clean as necessary.

Inspect the heater control box for full stop-to-stop travel and proper sealing of the valve. Inspect the condition of the air ducts leading to the windshield defroster and cabin heat outlets. Seal or tape openings around wires, tubes, or cables passing through the firewall.

Inspect around the removable web on the lower half of the cabin rear bulkhead for leaks. Openings, stringer cutouts, or cracks must be kept sealed with sealing compound (17, Chart 1, 91-00-00) between the bulkhead and the skin by removing the upper upholstery panel of the bulkhead. Also plug the leveling lug holes in the baggage doorframe to prevent entry of cold air.

100-HOUR INSPECTION OF HEATING AND VENTILATING SYSTEM

Check for corrosion, cracks or worn areas in ducts, loose clamps, loose or missing fasteners or obstructions. Check for proper operation, travel and sealing of valves.

100-HOUR INSPECTION OF THE EXHAUST SYSTEM

Check per POWER PLANT - EXHAUST SYSTEM in Chapter 5-20-00.

HEATER REMOVAL (F33A, F33C, V35B AND A36)

a. Remove the heater access panel from the right side.

b. Remove both heat ducts from the heater.

c. Disconnect the heater from the exhaust system and remove it from the airplane.

d. Remove the screws from the heater shroud and slide the shroud off the heater.

HEATER INSTALLATION (F33A, F33C, V35B AND A36)

a. Install the heater shroud and retaining screws.

b. Install the heater in the airplane.

c. Connect the engine exhaust system to the heater.

d. Connect the heater ducts to the heater.

e. Install the heater access panel.

HEATER REMOVAL (A36TC AND B36TC)

a. Remove the heater access panel from the right side.

b. Remove the heater ducting.

c. Remove four bolts on the right side of the heater which attach it to the exhaust system.

d. Loosen the clamp on the left side of the heater.

e. Remove the heater through the access hole.

f. Remove the heater shroud from the heater.

g. Pressure test the heater as indicated in HEATER PRESSURE TESTING in this Chapter.

HEATER INSTALLATION (A36TC AND B36TC)

a. Install the heater shroud on the heater.

b. Install the heater through the access hole.

c. Tighten the clamp on the left side of the heater.

d. Install the four bolts on the right side of the heater which attach it to the exhaust system. Tighten to 100 to 110 inch-pounds.

e. Install the ducts to the heater.

f. Install the heater access panel.

HEATER PRESSURE TESTING

The heater should be inspected for cracks and leaks which could introduce carbon monoxide into the heating system.

On all Bonanzas except the turbocharged models (EA-1 and after), perform a visual inspection each 100 hours and pressure test each 500 hours. On the turbocharged models (EA-1 and after), visually inspect and pressure test each 100 hours. The pressure test can be accomplished as follows:

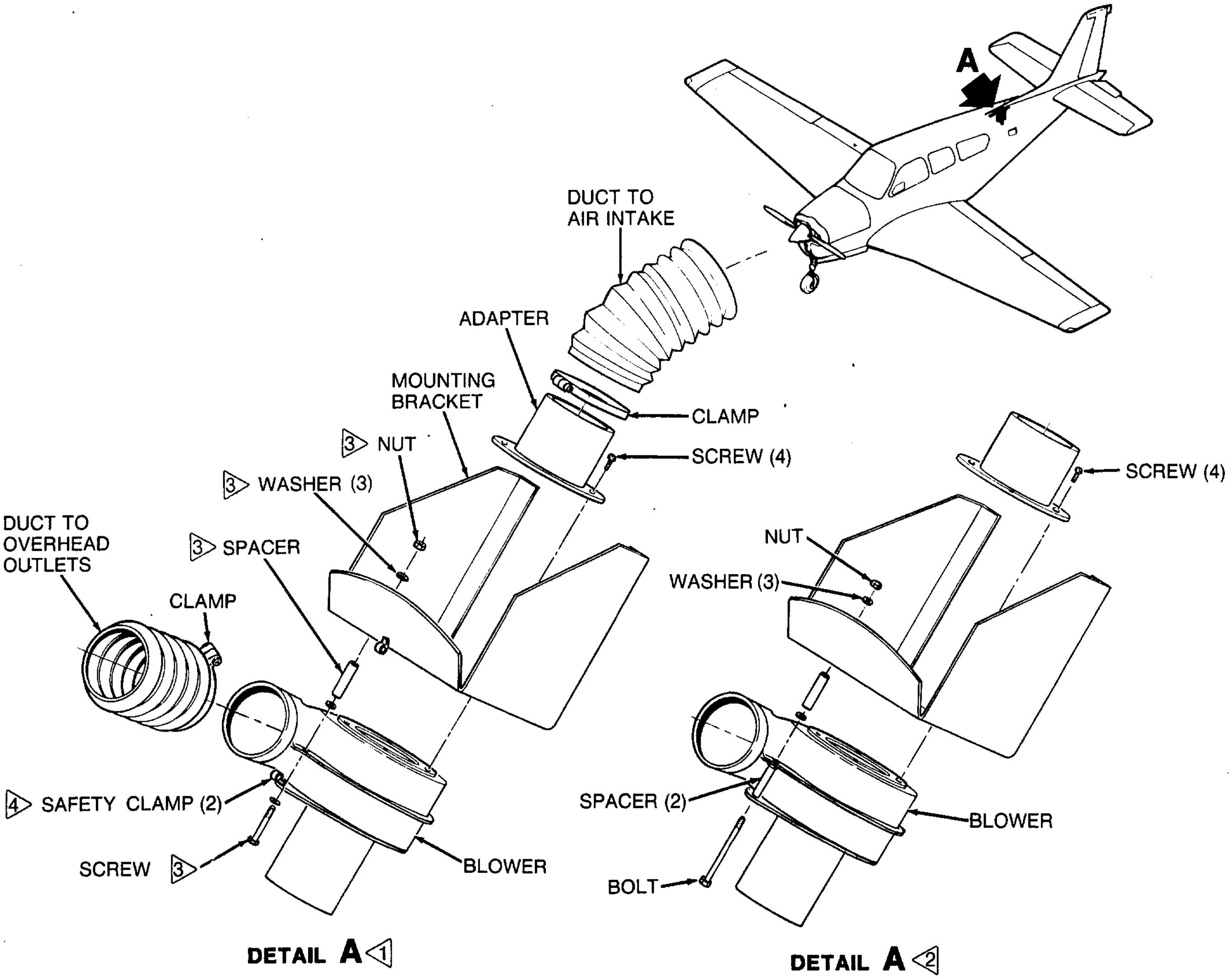
a. Remove the heater as indicated in HEATER REMOVAL.

b. Inspect the heater visually and pressure test for leaks. On F33A, F33C, V35B and A36 airplanes, pressurize the heater to 25 psig. On A36TC and B36TC, pressurize the heater to 5 psig. Pressurize the heater with air or nitrogen and either immerse in water or "paint" with a soap solution. If any leaks are apparent, replace the heater. This test is also recommended for the heater at every engine change.

NOTE

The heat transfer studs along with the internal baffle and/or cone must be in place for a correct supply of heat. Any warpage is cause for replacement.

c. If the inspection indicates a good heater, reinstall the heater as indicated in HEATER INSTALLATION.



1 CE-941 THRU CE-1555; CJ-156 THRU CJ-179; D-10348, D-10364 THRU D-10403; E-1809 THRU E-2592; EA-192 THRU EA-514.

2 CE-1556 AND AFTER, E-2593 AND AFTER, EA-515 AND AFTER.

3 CE-1457 THRU CE-1555, E-2532 THRU E-2592, EA-505 THRU EA-514.

4 SAFETY CLAMPS AND SAFETY WIRE INSTALLED PER SERVICE BULLETIN NO. 2380.

C9200124

Fresh Air Blower Installation
Figure 6

FRESH AIR BLOWER REMOVAL (Figure 6)

a. Remove the fifth and sixth seats when installed.

b. Remove the cabin rear upholstery panel.

c. Disconnect the electrical connector.

d. Remove the clamps securing the ducts to the fan inlet and outlet.

e. Remove the safety wire from airplanes that comply with Service Bulletin No. 2380.

f. Remove the screw (or bolt/bolts) through the blower flange and mounting bracket. Observe spacer and washer installation so they can be installed in the original locations.

g. Remove four screws through the adapter, mounting bracket and the blower housing. Remove the blower from the airplane.

FRESH AIR BLOWER INSTALLATION (Figure 6)

a. Place the blower in position and install four screws attaching the adapter and blower to the mounting bracket.

b. Connect the air ducts with clamps.

c. Install the screw, or bolt(s), and spacer(s) through the blower flange and brackets.

d. Blowers that have the safety clamps must be safety wired. Use a minimum of three strands of .041-inch safety wire looped through the safety clamps. The safety wire should be installed with a slight tension and each strand should have equal tension.

e. Connect the electrical connector.

f. Install the rear upholstery panel.

g. Install the fifth and sixth seats if used.

"END"

CONTINUED

COOLING - DESCRIPTION AND OPERATION (Effectivity: Optional)

The optional air-conditioning system is a recirculating 12,000-BTU cooling system. The air-conditioner is wired through the right landing gear uplock position switch, the left landing gear safety switch, and the normally closed full throttle switch. With the air-conditioner operating on the ground, the control circuit is wired through the left landing gear safety switch, which fully opens the condenser air scoop door located under the airplane. With the gear extended and the throttle fully opened, action of the full throttle switch will remove power from the compressor clutch coil, and drive the condenser air scoop door closed. When the airplane is airborne and the landing gear is retracted, power is transmitted from the normally open contacts of the full throttle switch (actuated closed when the throttle is fully open), through the right landing gear uplock-position switch (actuated closed when the gear is up and locked) to the condenser air scoop door actuator. Power is then conducted through the normally open contacts of the door flight-position-limit switch located at the end of the door (actuated closed when the door is closed), causing the actuator to open the door to the flight position. When the door flight-position-limit switch is actuated, the power is then directed to the compressor clutch coil.

A light, independent of the air-conditioner circuit, is actuated by the condenser air scoop door, through the left landing gear uplock-position switch's normally closed contacts (closed with the landing gear extended), which will indicate a door-open condition while the gear is extended.

The high-pressure-sensing switch monitors the pressure of the refrigerant from the compressor to the expansion valve. The normally closed high pressure switch will actuate, causing an open circuit to the compressor clutch coil when the pressure in the line reaches 390 ± 10 psi, (340 ± 10 psi on serials E-2121 and after; EA-320, EA-440 and after; CE-1030 and after) which disables the compressor. The high pressure switch automatically resets to the normally closed position when the refrigerant falls to a safe pressure. There is also a high-pressure-poppet relief valve, located on the forward side of the firewall, which will relieve the system if the pressure reaches 450 psi, and will reseal again at 360 psi.

The low pressure switch, normally open (actuated closed when the system is charged with refrigerant) senses system pressure. When the pressure in the refrigerant line drops to a pressure low enough to indicate refrigerant and/or oil loss (below 7 psi), the switch will open and prevent further operation of the compressor. When the refrigerant system is properly charged (approximately 7 psi or more), the switch will be activated closed allowing the compressor clutch coil to be activated so the air-conditioner may operate. The purpose of the switch is to prevent damage to the compressor should oil and/or refrigerant loss occur.

The condenser air scoop door under the airplane automatically opens when the air-conditioner is turned on. On the ground, the door opens to approximately 3 inches. In flight, the door opens to approximately 3/4 + l/2 - inch. The air scoop door-actuator-limit switches are preset; however if adjustment becomes necessary, refer to CONDENSER CONTROL RIGGING in this chapter.

The belt-driven compressor, which is coupled with a magnetic clutch, compresses the refrigerant to a high pressure, high temperature gas. This gas passes through the condenser where cooling air removes heat from the gas, condensing it to a liquid state. The liquid then passes through the expansion valve where it is metered into the evaporator at a rate of 55 psi, (30 psi on serials E-2104, E-2111 and after; EA-320, EA-440 and after;and CE-1037 and after) which allows most of the liquid to return to a gas. The heat required for evaporation is absorbed from cabin air passing over the evaporator coils. After passing through the evaporator, the refrigerant returns to the compressor at a reduced pressure.

A time delay relay has been added to the compressor circuit at serials E-2104, E-2111 and after; EA-320, EA-440 and after; CE-1037 and after. The time delay relay prevents the compressor from being energized while a high head pressure exists, which would cause unnecessary stress on the belt and other components. The time delay relay is located on the forward side of the front spar carry-through on the right side of the airplane.

(Effectivity: All Serials except E-2104, E-2111 and after and except EA-320, EA-389 and after)

The optional air-conditioning system is controlled by a switch on the powerplant control panel and by both high- and low-pressure-sensing switches. The switch which controls the system is located on the powerplant control panel (console) and is placarded AIR

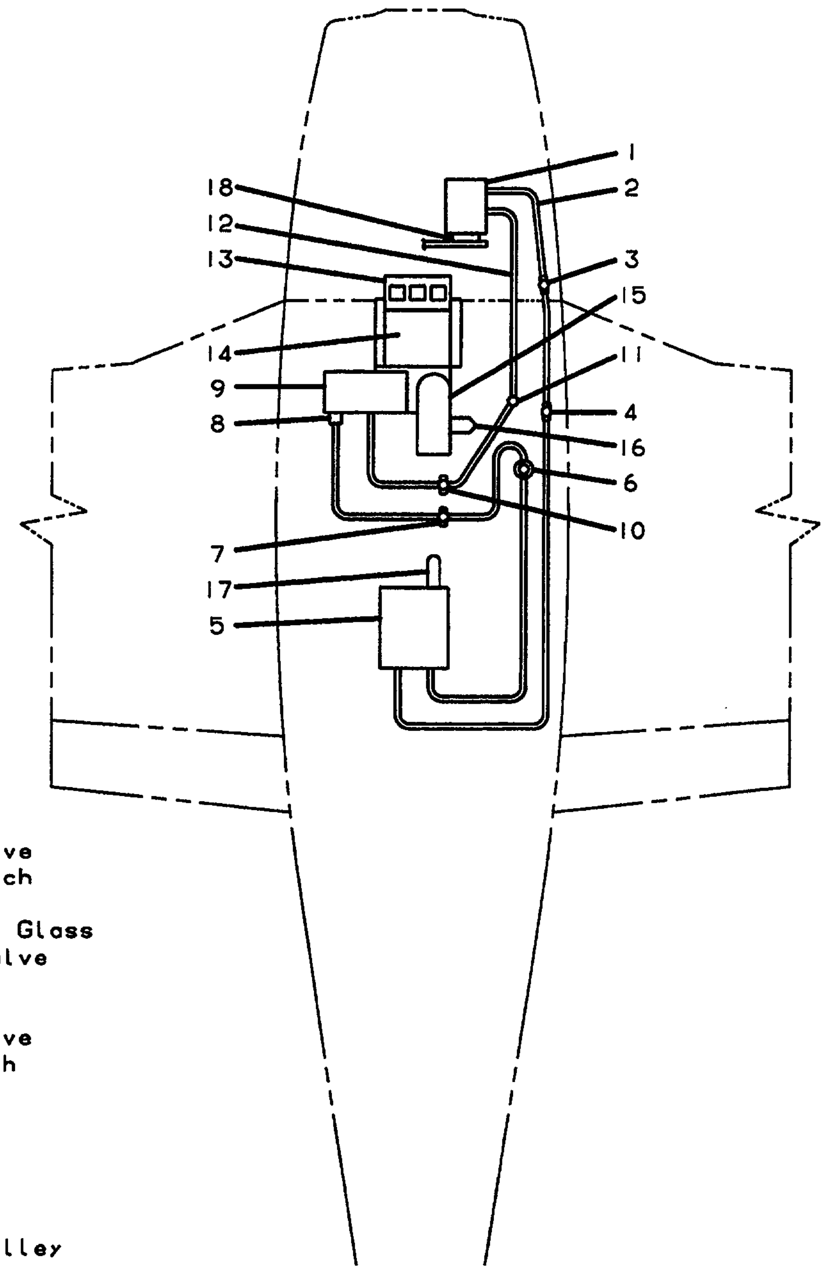
COND OFF HI LO. The system circuit breaker, located on the right hand subpanel, is placarded A/C CIR BKR.

The entire system is protected by a 15-amp circuit breaker. The compressor and condenser air scoop door are protected by two separate 5-amp fuses. The fuses are located on the forward side of the firewall in front of the copilot. This allows the evaporator fan to be operated after the compressor has been removed from the system by a blown fuse.

(Effectivity: Serials E-2104, E-2111 and after, EA-320, EA-389 and after)

The optional air-conditioning system is a recirculating cooling system. The two switches which control the system are located to the left of the pilots control column and are placarded A/C OFF and BLOWER HI LO and OFF. The two circuit breakers which protect the system are located in the left sidewall circuit breaker panel. One circuit breaker (5 amps) protects the compressor wiring, while the other (15 amps) protects the blower wiring.

If the air-conditioner switch is in the A/C position, the air-conditioner will come on with the blower at low speed, even if the blower switch is off; however, moving the blower switch from OFF or LO to HI will result in blower speed increasing to its maximum. With the air-conditioner switch off, the blower will operate at either high or low speed according to the switch position.



1. Compressor
2. High Pressure Line
3. High Pressure Relief Valve
4. High Pressure Sense Switch
5. Condenser
6. Receiver-Dryer and Sight Glass
7. High Pressure Service Valve
8. Expansion Valve
9. Evaporator
10. Low Pressure Service Valve
11. Low Pressure Limit Switch
12. Low Pressure Line
13. Louvers-Air Duct
14. Air Duct
15. Fan
16. Fan Moter
17. Condenser Actuator
18. Compressor Clutch and Pulley

C95EA21B0022 C

Air-Conditioner System
Figure 1

CHART 1
TROUBLESHOOTING
AIR-CONDITIONING SYSTEM (Effectivity: Optional)

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
1. Insufficient cooling.	a. Blower not functioning.	a. Repair.
	b. Obstructed or disconnected air duct.	b. Remove obstruction or repair.
	c. Compressor clutch or belt slipping.	c. Repair or adjust.
	d. Evaporator filter clogged.	d. Replace.
	e. Refrigerant level low.	e. Leak-test and recharge.
	f. Expansion valve malfunction.	f. Replace.
2. No cooling.	a. Blown fuse, loose connection.	a. Check connections, fuse, continuity.
	b. Blower not functioning.	b. Repair.
	c. Leak in system.	c. Leak-test and recharge.
	d. Compressor valves inoperative.	d. Repair or replace.
3. Excessive vibration of unit.	a. Overcharged.	a. Correct refrigerant charge.
	b. Air in system.	b. Purge and recharge system.
	c. Mount or compressor bolts loose.	c. Tighten.
	d. Drive pulley loose.	d. Tighten.
4. Noisy unit.	a. Compressor oil level low.	a. Add oil.
	b. Defective belt.	b. Replace.
	c. Low refrigerant level.	c. Add refrigerant.
	d. Fan hitting shroud.	d. Align and tighten shroud.
	e. Defective compressor.	e. Replace.
5. Hissing in evaporator module.	a. Low charge.	a. Add refrigerant.
6. Chatter or knock in evaporator module.	a. Defective expansion valve.	a. Replace.
7. Belt slipping.	a. Loose.	a. Adjust.
	b. Overcharged.	b. Correct refrigerant level.
	c. Air in system.	c. Evacuate and recharge.
8.Excessive belt wear.	a. Pulleys not in line.	a. Align pulleys.
	b. Belt too tight.	b. Adjust or replace.
	c. Pulley groove wrong size.	c. Replace.
	d. Belt width wrong.	d. Replace.
9. Broken belt.	a. Check all causes listed.	a. Replace or correct.

COOLING - MAINTENANCE PRACTICES (Effectivity: Optional)

MAINTENANCE OF AIR-CONDITIONER

Servicing the air-conditioning system consists of periodically checking the refrigerant level, checking compressor oil level and changing the system air filter. Recharge the system whenever the refrigerant level is low, air has entered the system or components carrying refrigerant are replaced. Refrigerant leaks may be detected by inspection with a flameless leak detector.

PRECAUTIONARY SERVICE MEASURES

a. Due to the air quality control regulations enacted in the United States, R-12 refrigerant cannot be vented into the atmosphere. When performing maintenance on the air-conditioning system where R-12 can escape from the system, evacuate the system with only a recovery or recycle servicing unit that will salvage the refrigerant.

b. The air-conditioning system is a high pressure system. Before disconnecting a refrigerant line, the system must be discharged with a recovery servicing unit. Purge the entire system to a 125-micron level.

WARNING

A face shield should be worn when performing maintenance on the lines because refrigerant coming in contact with the eyes can cause loss of sight.

Do not smoke when servicing the system with refrigerant because it converts to a highly toxic gas when exposed to an open flame.

c. Before any service is attempted which requires opening of refrigeration plumbing or units, the person doing the work should be throughly familiar with instructions on servicing the system. They should follow very carefully these instructions when performing the task that will maintain this system in a proper functioning order.

d. The major reasons for these measures are for safety and to prevent dirt and moisture from entering the system. Dirt contaminants may cause leaky valves or wear in the compressor. Moisture may not only freeze into ice at the expansion valve, but can also cause the formation of hydrochloric or hydrofluoric acids in the system. The air-conditioning system must be purged if contaminated with foreign material or moisture.

e. All precautions should be taken to prevent damage to fittings or connections. Even minute damage to a connection could cause it to leak. Any fittings getting grease or dirt on them should be wiped clean with a cloth dampened with alcohol. Do not use chlorinated solvents such as trichloroethylene for a cleaning agent, for they are contaminants. If dirt, grease or moisture gets inside lines and cannot be removed, the line will have to be replaced.

f. For airplane serials prior to CE-1792, E-2945 and EA-579, use a small amount of clean 500 viscosity refrigeration oil (8, Chart 1, 91-00-00) on all tube joints and dip the o-ring in this oil before assembling the joint.

g. For airplane serials CE-1792 and after, E-2945 and after, and EA-579 and after, use a small amount of Ester Oil (65, Chart 1, 91-00-00) on all tube joints and dip the o-ring in this oil before assembling the joint. This will help in making a leak-proof joint.

CAUTION

Insufficiently torqued tubing connections can result in loose joints while excessively torqued connections can cause deformed joint parts. Either condition can result in refrigerant leakage.

h. When connecting aluminum fittings in the refrigerant system, torque all 5/8-inch fittings to 18 - 21 foot-pounds and all 1/2-inch fittings to 11 - 13 foot-pounds.

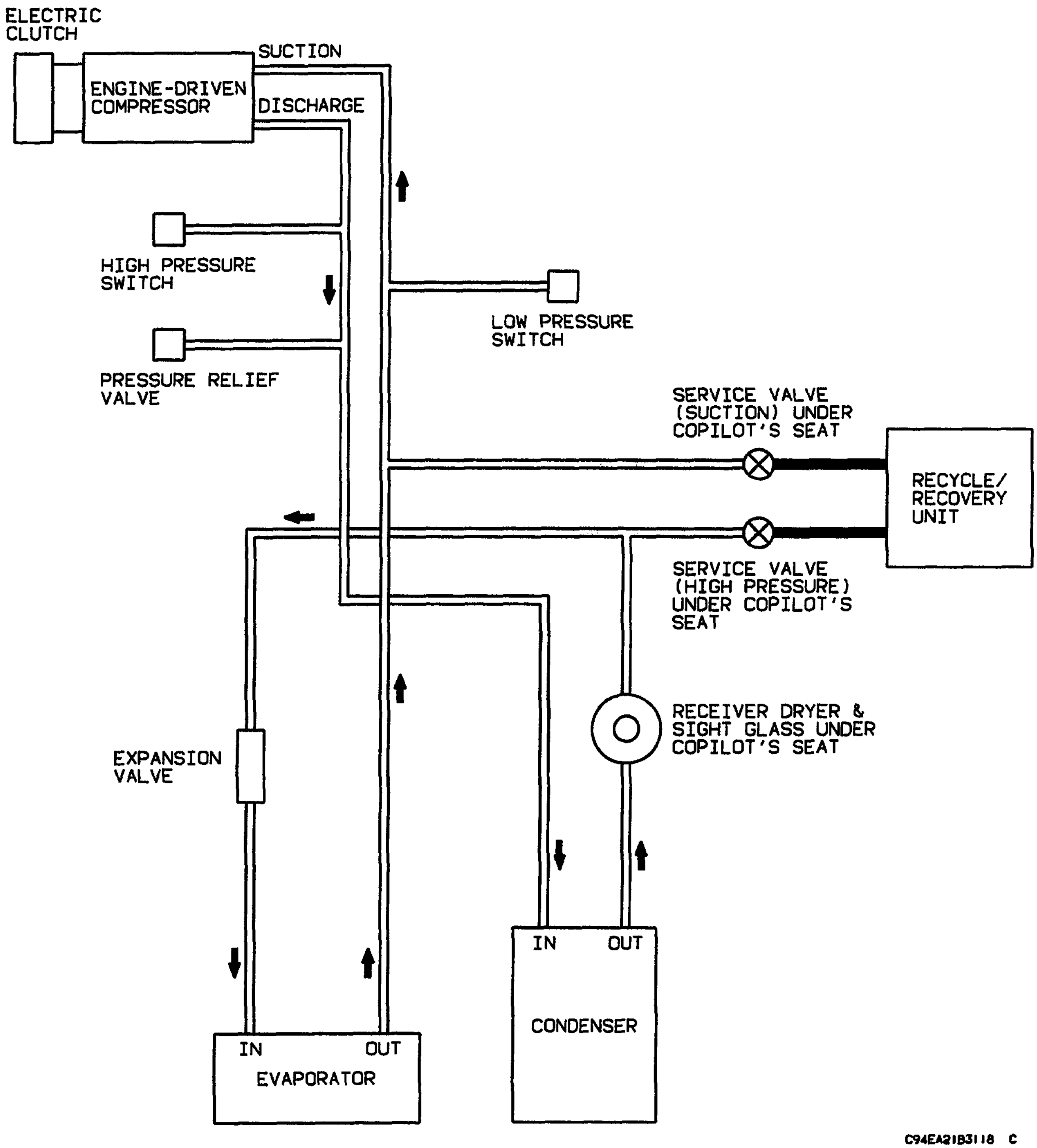
NOTE

The receiver-dryer is the last assembly to be connected. This is necessary to reduce and/or eliminate the entry of moisture into the lines.

For charging the air-conditioner or checking the oil, refer to Chapter 12-10-00.

AIR-CONDITIONING FUNCTIONAL TEST

With the engine running at 1,000 rpm and the system on, observe the sight glass. If refrigerant appears milky or bubbles appear, charge the system as noted



Air-Conditioning System Schematic
Figure 2

under the heading CHARGING THE AIR-CONDITIONING SYSTEM in Chapter 12-10-00. Check the system for leaks using a flameless leak detector.

SYSTEM LEAK DETECTION

A reduction of system cooling ability or the presence of bubbles in the refrigerant, may indicate a partial loss of refrigerant. Check for bubbles in the sight glass on the receiver-dryer located under the copilot's seat. The sight glass should be checked during operation at maximum available ambient and cabin temperatures. Streams of bubbles past the glass and/or milky appearance in the glass indicate an inadequate quantity of refrigerant. If a loss of refrigerant is suspected, an inspection of the system plumbing should be carried out to locate the source of the leak. Large leaks may be located by the appearance of oily spots where oil has been carried out by escaping refrigerant. Smaller leaks, which are much more difficult to locate, may be detected by detergent bubbles, or an electronic detector.

COMPRESSOR BELT REMOVAL (Figure 4)

a. Open the engine cowling to gain access to the compressor belt.

b. Loosen the jamnut on the adjusting bolt.

c. Loosen the self-locking nut on the idler arm.

d. Use the adjusting bolt to remove tension from the compressor belt.

e. Remove the compressor belt.

COMPRESSOR BELT INSTALLATION (Figure 4)

a. Install the compressor belt over the compressor pulley, idler pulley, and drive pulley.

b. Use the adjusting bolt on the idler pulley bracket to increase belt tension as indicated in COMPRESSOR BELT TENSION ADJUSTMENT in this chapter.

c. Torque the self-locking nut on the idler arm to 300 to 350 inch pounds.

d. Torque the jam nut on the adjusting bolt to 275 to 325 inch pounds.

e. Close the engine cowling.

COMPRESSOR BELT TENSION ADJUSTMENT

New belts should be installed with a static tension of 65 to 80 pounds. After 5 hours of operating time, the belt should be retensioned to 50 to 65 pounds and maintained at this tension. To check the compressor belt tension, use a Burrough's Model BT-33-73F-50 belt tension gage or equivalent. Position the belt tension gage as shown in Figure 3. If a belt tension gage is not available, a properly tensioned new belt will require 4.1 to 5.0 pounds force for a midspan deflection of 0.14 inch. After 5 hours operating time, the belt should be retensioned. After 5 hours, a properly tensioned belt will require a force of 3.3 to 4.1 pounds for a midspan deflection of 0.14 inch. The belt should be maintained at this tension. See Figure 4 for belt tension by midspan deflection.

COMPRESSOR MOUNTING TORQUES

Mounting Bracket to Engine

Bolts .... 220 to 260 in. lbs.

Nut ....275 to 325 in.lbs.

Compressor to Bracket

Nut on Bolt ....275 to 325 in. lbs.

Idler Pulley Bolt ....800 to 850 in. lbs.

Drive Pulley Nut ....700 to 800 in lbs.

Adjusting Bolt Jamnut ....275 to 325 in. lbs.

Idler Arm Self-Locking Nut..........300 to 350 in. lbs.

COMPRESSOR BELT PULLEY ALIGNMENT

If it is determined that the compressor belt pulleys are out of alignment, they may be adjusted as follows:

NOTE

An alignment gage is available (Burrough's No. 8082 for 0.38 pulleys and No. 8082A for 0.50 pulleys) to check belt alignment.

a. Open the engine cowling.

b. Remove the belt as indicated in COMPRESSOR BELT REMOVAL.

c. Determine if the idler pulley or drive pulley is out of alignment.

d. Remove the appropriate pulley and add or remove shims as required per Figure 5.

e. Reinstall the pulley and torque as indicated in Figure 5.

f. If the drive pulley was removed, install the cotter pin.

NOTE

If the cotter pin holes do not align within the prescribed torque range, a new nut may be installed or one AN960-C916L washer may be used under the nut.

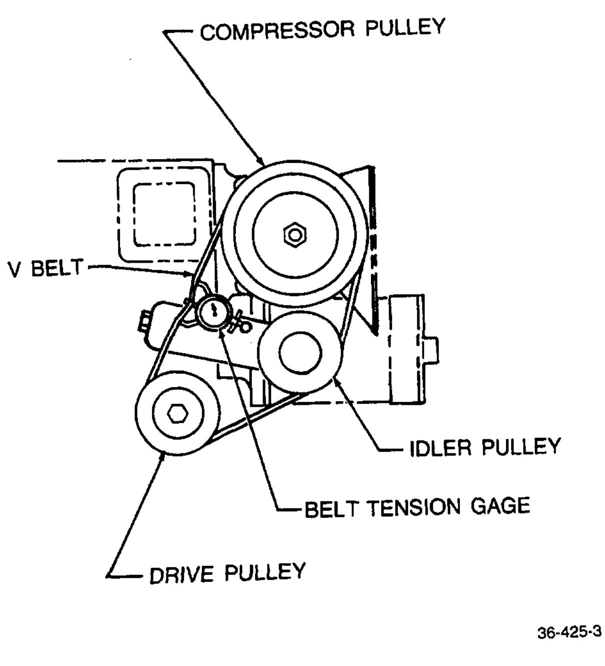
CONDENSER REMOVAL

The condenser is located beneath the airplane aft of the main spar carry-through.

a. Remove the beacon light.
b. Remove the fairing aft of the condenser.
c. Disconnect the hoses at the condenser.
d. Remove actuator bolts.
e. Remove the attach bolts.
f. Remove the condenser.

CONDENSER INSTALLATION

a. *Place the condenser in position.*
b. Secure condenser with attaching bolts.
c. Install the actuator bolt.



Belt Tension Measurement
Figure 3

d. Connect the hoses to the condenser.
e. Install the fairing.
f. Install the beacon light.

CONDENSER CONTROL RIGGING :

The condenser is located on the bottom side of the airplane fuselage approximately even with the 3rd and 4th seats. With the airplane on the ground and the air-conditioner turned on, the condenser will be fully open. Any tine the air-conditioner is turned off or the engine is at full throttle with the air-conditioner turned on, the condenser will be fully closed. With the air-conditioner turned on the condenser will be open to the flight position any time the airplane is in normal flight.

The condenser is controlled by the electrical circuitry that controls the air-scoop actuator. Check the condenser for proper operation. If the condenser fails to operate, check for an open circuit between the *PRESS AIR COOL switch and control actuator.*

CONDENSER UPLIMIT AND DOWNLIMIT RIGGING

For complete condenser rigging, full up travel of the condenser should first be checked.

a. With the condenser actuator motor attached to the condenser, and the condenser in the upper limit of travel, the forward edge of the condenser fairing should be approximately flush with the lower skin.

b. If the fairing is not flush, operate the condenser motor to lower the condenser.

c. With the condenser lowered, disconnect the bolt that attaches the actuator to the condenser and screw the actuator eye bolt in to raise, or out to lower, the condenser.

d. Reconnect the condenser attach bolt, operate the motor, and recheck for flush uptravel of the condenser.

e. When the proper uptravel of the condenser is attained, the fully down travel (full extension), is automatically set through the action of the internal limit switch of the actuator and need not be adjusted. In the fully extended position, the forward edge of the condenser fairing is approximately 3 inches beneath the fuselage skin.

CONDENSER FLIGHT-EXTENSION LIMIT RIGGING

Both the flight-extension limit and the condenser-*extended warning-light switches are located on a* bracket near the aft end on the right side of the condenser assembly. To rig both of the switches, proceed as follows:

a. Remove the 12 screws and washers from the fairing which covers the switches and pressure hoses aft of the condenser.

b. Remove the fairing.

c. Disconnect each of the two pressure hoses located on each side of the condenser assembly.

d. Connect a voltmeter to the flight-extension-limit switch (outboard switch), by attaching one lead to the top screw on the switch and one lead to the bottom screw. Do not make connection with the center screw.

e. Adjust the bolt on the end of the condenser to actuate the switch when the forward edge of the condenser is lowered 1.25 inches perpendicular to the fuselage skin at the airplane centerline.

f. Connect the voltmeter as indicated in step c to the condenser-extended warning-light switch (inboard switch). Adjust the switch actuating bolt on the condenser to actuate the switch when the forward edge of the condenser is lowered 1.5 inches perpendicular to the fuselage skin at the airplane centerline.

NOTE

Using a voltmeter to adjust the above switches is not necessary if the click of switches upon actuation is audible.

g. Connect and tighten the pressure hoses, place the aft condenser fairing in position and install the 12 washers and screws.

h. Purge and charge the air-conditioning system as indicated in CHARGING THE AIR-CONDITIONING SYSTEM in Chapter 12.

COMPRESSOR REMOVAL

NOTE

Due to the air quality control regulations enacted in the United States, R-12 refrigerant cannot be vented into the atmosphere. When performing maintenance on the air-conditioning system where R-12 can escape from the system, evacuate the system only with a recovery or recycle servicing unit that will salvage the refrigerant.

WARNING

The air-conditioning system is a high pressure system. Before disconnecting a refrigerant line, the system must be discharged with a recovery servicing unit. Purge the entire system to a 125-micron level.

A face shield should be worn when performing maintenance on the lines because refrigerant coming in contact with the eyes can cause loss of sight.

Do not smoke when servicing the system with refrigerant because it converts to a highly toxic gas when exposed to an open flame.

a. Open the right engine cowling.

b. Remove electrical leads from compressor clutch terminals.

c. Disconnect refrigerant lines at the compressor. Cap refrigerant lines and compressor fittings.

d. Remove the compressor belt as noted in COMPRESSOR BELT REMOVAL in this chapter.

e. Remove the compressor mounting bolts and nuts and remove compressor.

INSTALLATION AND ALIGNMENT OF COMPRESSOR

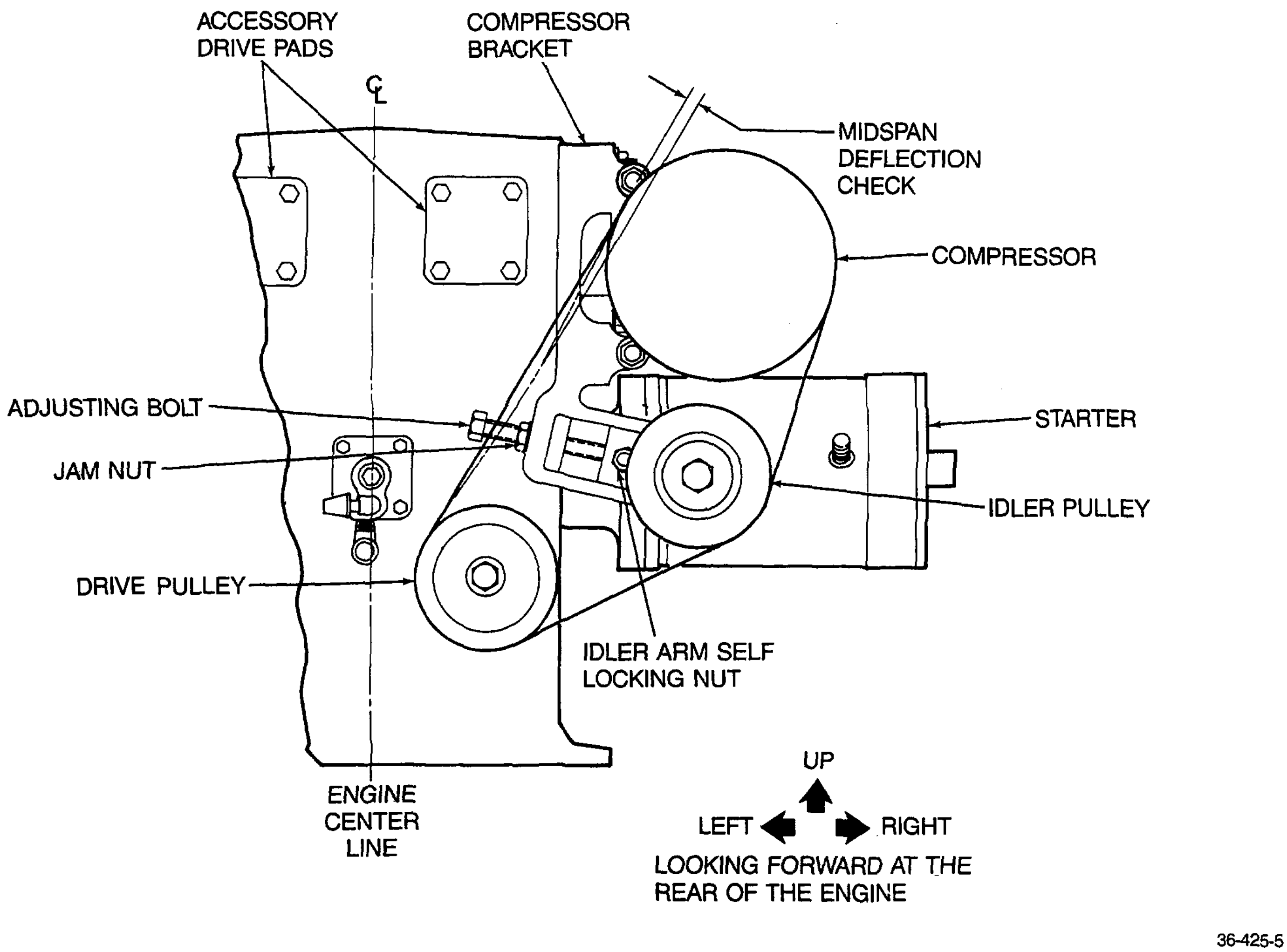
a. The starter drive pulley nut is torqued to 700 - 800 inch-pounds. If the cotter pin holes will not align, change the nut and/or use a washer under the nut. Do not overtorque the drive pulley nut. Install the cotter pin.

NOTE

The use of AN960-C916L washer, or equivalent, as required for cotter pin alignment, is permissible.

b. Remove the spacer from the bolt through the case. Inspect the o-ring for damage and replace if necessary.

c. Install the compressor bracket assembly and align the idler pulley with the drive pulley. The idler should be tightened snug within track. Install the existing nut and washer on the through bolt, then install the two



Belt Tension By Midspan Deflection
Figure 4

.375-inch-diameter, 2-inch-long bolts with their washers, and tighten all 3 bolts finger-tight. Beginning with the through bolt, tighten the bolts to 220-260 inch-pounds in sequence counterclockwise.

d. Install the compressor utilizing the bolts, washers, and self-locking nuts that are supplied with the bracket equipment kit. Torque the nuts 275 - 325 inch-pounds.

e. Loosen the jam nut on the adjusting bolt and self-locking nut on the idler arm. Install the V-belt. Adjust the idler outward by rotating the adjusting bolt inward to obtain the proper belt tension. Adjust the V-belt to the tension outlined in COMPRESSOR BELT TENSION ADJUSTMENT in this chapter.

f. Torque the jam nut 275 to 325 inch-pounds, and self-locking nut 300 to 350 inch-pounds.

g. Remove caps from lines and compressor and install lines to the fittings on the compressor.

h. Install the electrical leads to the magnetic clutch.

i. Service the system with oil as specified in CHECKING COMPRESSOR OIL LEVEL in Chapter 12-10-00.

j. Charge the system with refrigerant as specified in CHARGING THE AIR-CONDITIONING SYSTEM in Chapter 12-10-00.

k. Close the engine cowling.

VENTILATION BLOWER REMOVAL

a. Remove the pilot's and copilot's seats per Chapter 25.

b. Remove the spar cover.

c. Disconnect the electrical leads from the motor.

d. Remove the bolts which attach the blower to the evaporator and remove the blower.

VENTILATION BLOWER INSTALLATION

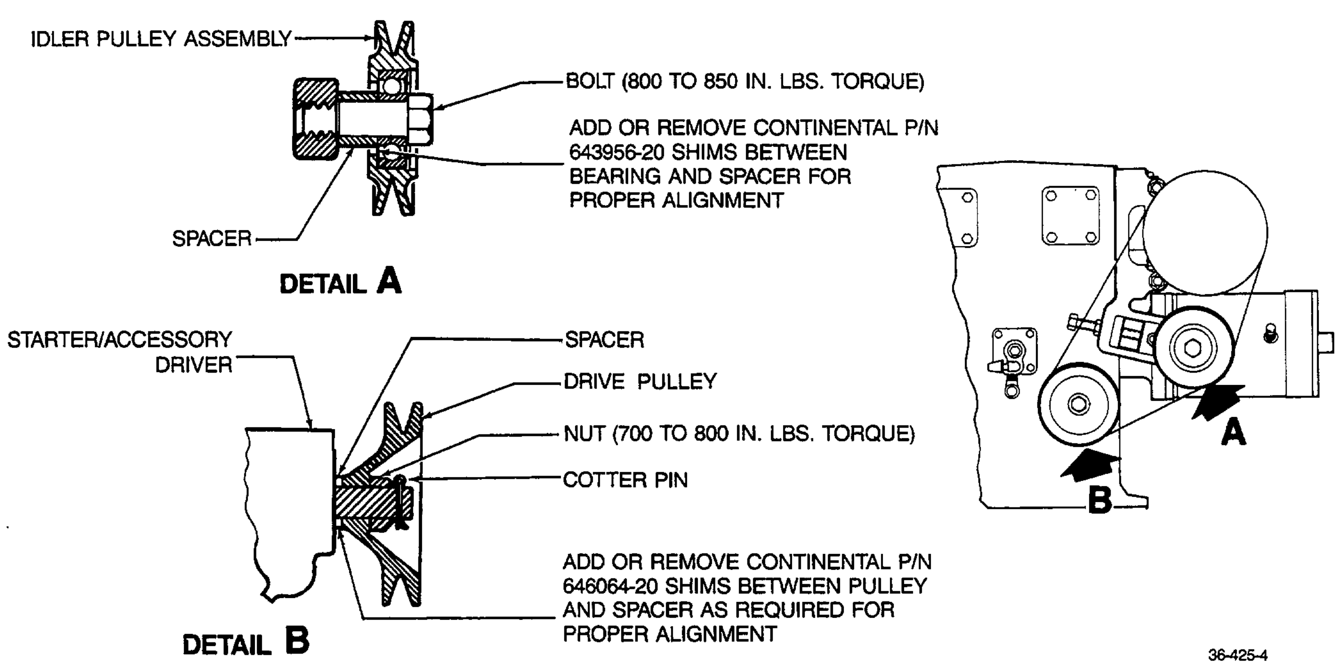
a. Position the blower on the evaporator.

b. Install the bolts attaching the blower to the evaporator.

c. Connect the electrical leads to the motor.

d. Install the spar cover.

e. Install the seats per Chapter 25.



Belt Pulley Alignment
Figure 5

EVAPORATOR REMOVAL

a. Depressurize the air-conditioning system with a recycle servicing unit as specified in DEPRESSURIZING THE AIR-CONDITIONING SYSTEM in Chapter 12.

b. Remove the pilot's and copilot's seats per Chapter 25.

c. Remove the filter cover and filter.

d. Remove the cover from over the ducts.

e. Disconnect the drain tubes and remove the tape between the evaporator and duct.

f. Remove the spar cover.

g. Remove the ducts.

h. Disconnect the electrical leads from the motor.

i. Disconnect the refrigerant lines and cap the open ports.

j. Remove the bolts attaching the evaporator to the floorboard. Remove the evaporator from the airplane.

EVAPORATOR INSTALLATION

a. Position the evaporator in the airplane and install the bolts attaching it to the floorboard.

b. Connect the refrigerant lines.

c. Connect the electrical leads to the motor.

d. Install the ducts and tape with duct tape (29, Chart 1, 91-00-00) to the evaporator and connect the drain tubes.

e. Charge the system with refrigerant as specified in CHARGING THE AIR-CONDITIONER SYSTEM in Chapter 12-10-00.

f. Install the spar cover.

g. Install the filter and filter cover.

h. Install the cover over the ducts.

i. Install the seats per Chapter 25.

EVAPORATOR FILTER REPLACEMENT

The evaporator filter should be replaced if clogged, dirty or defective. Remove the screws in the spar cover located on the underside of the airplane on the copilot's side to gain access to the filter.

CHAPTER 23

COMMUNICATIONS

CHAPTER 23 - COMMUNICATIONS

TABLE OF CONTENTS

CHAPTER 23 - COMMUNICATIONS

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
23-LOEP	1	Sep 30/03
23-CONTENTS	1	Sep 30/03
23-10-00	1	Sep 27/84
23-60-00	1 and 2	Sep 30/03

GROUND COMMUNICATION SYSTEM - DESCRIPTION AND OPERATION

GROUND COMMUNICATION (E-2104, E-2111 and after; EA-320, EA-389 and after)

The airplane may be equipped with an optional ground communication system. This system allows radio communication while all other electrical equipment is turned off. The switch for this system is a push-on, push-off switch located near the top of the instrument panel to the right of center. The system's two 5-amp circuit breakers are located below the battery box. On airplane serials CE-1037 and after, this optional equipment is available on the model F33A; however, there are no standard locations for the equipment.

"END"

STATIC DISCHARGING - DESCRIPTION AND OPERATION

A static electrical charge may build up in the surface of the airplane while it is in flight. This electrical charge, if retained, can cause interference in radio and avionics equipment operation. Therefore, static wicks are installed on the trailing edges of the flight surfaces to aid in the dissipation of the electrical charge.

STATIC DISCHARGING - MAINTENANCE PRACTICES

On serials prior to D-10383; CJ-156; CE-978; E-1932, and EA-273, the static wicks are installed with one on each elevator, one on each aileron and one on the rudder. These five (four on model 35) static wicks are removed and installed in the same manner. On serials D-10383; CJ-156; CE-978; E-1932; EA-273 and After, the static wicks are installed with one (three on the B36TC) on each wing tip, two (none on the B36TC) on each aileron, three on each elevator and three on the rudder. These fifteen (twelve on the V35B) static wicks are removed and installed in the same manner. The base of the later static wicks is riveted to the flight surface and need not be removed in normal service.

STATIC WICK REMOVAL (PRIOR TO D-10383; CJ-156; CE-978; E-1932; EA-273)

a. Remove the two screws and lock washers securing the wick to the surface.

b. Remove the wick from the surface.

STATIC WICK INSTALLATION (PRIOR TO D-10383; CJ-156; CE-978; E-1932; EA-273)

Clean around the static wick area by:

a. Removing all grease, oil, paints, metal finishes or other high resistance properties with Minnesota 3M No. 600 grit sandpaper, or equivalent. The mating surfaces must be smooth and contoured so that the maximum surface area is in actual contact. Alodine treatment for aluminum or Dow treatment of magnesium is a suitable corrosion preventative to use between the static wick base and the airplane surface.

NOTE

Dissimilar materials are not to be used in intimate contact unless suitably protected against electrolytic corrosion. Whenever it is necessary that any combination of such metals be assembled, an interposing material compatible to each should be used.

b. Install the wick, using the two screws and lock washers.

NOTE

Check the continuity between the static wick base and the surface to which it is attached. There should be a resistance of 2.5 milliohms or less.

c. Refinish the surface area around the wick attachment point.

STATIC WICK REMOVAL (D-10383; CJ-156; CE-978; E-1932; EA-273 AND AFTER)

a. Unscrew the static wick from the base.

b. Remove the static wick and the lock washer.

STATIC WICK INSTALLATION (D-10383; CJ-156; CE-978; E-1932; EA-273 AND AFTER)

The threads must be clean and free from grease, oil and paint.

a. Install the static wick and lock washer.

b. Torque the static wick to 4.7 in.-lbs.

STATIC WICK INSPECTION

Static wicks are inspected to ensure correct discharge capabilities. Use a megohmeter with a minimum test voltage of 500 volts to measure the resistance of the static wicks.

NOTE

All static wicks on the airplane must be the same type and manufacturer.

Use the following procedure to check the static wicks.

CAUTION

Refer to the megohmeter manufacturers operating data to correctly use the megohmeter and prevent electric shock.

a. Connect a test lead from the megohmeter to the tip of the static wick.

b. Connect the other test lead of the megohmeter to the base of the static wick.

c. Set the switch on the megohmeter to ON and read the meter:

   1. If static wicks part number 35-5010-3 are installed, the meter reading must be 470 kilohms ± 20%.

   2. For other static wicks the reading must be between 1 and 100 megohms.

d. Replace static wicks that are outside the ranges given in Step c. above.

e. Set the switch on the megohmeter to OFF and disconnect the test leads from the static wick.

CHAPTER

24

ELECTRICAL POWER

CHAPTER 24 - ELECTRICAL POWER

TABLE OF CONTENTS

SUBJECT — *PAGE*

CHAPTER 24 - ELECTRICAL POWER

TABLE OF CONTENTS (Continued)

CHAPTER 24 - ELECTRICAL POWER

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
24-LOEP	1	Mar 31/05
24-CONTENTS	1 and 2	Mar 31/05
24-30-00	1 thru 9	Mar 31/05
24-31-00	1 and 2	Sep 30/04
24-31-01	1 thru 3	Sep 30/04
24-40-00	1	Sep 30/04
24-50-00	1 thru 5	Sep 30/04

DC GENERATION - DESCRIPTION AND OPERATION

ELECTRICAL SYSTEM

The airplane electrical system includes a 28-volt, 50-amp (prior to CJ-156; CE-929; D-10354 EA-159; E-1766) or 60-amp (CJ-156 and After; CE-929 and After; D-10354 and After; EA-159 and After; E-1766 and After) alternator. A 100-amp alternator is optional. The alternator and one 11.0-ampere-hour lead acid battery supply all the dc power to the airplane. The battery supplies power for the airplane starter system and electrical system when the engine is not operating. The alternator provides the dc voltage to the electrical system during engine operation.

The alternator output is controlled by a combined transistorized voltage regulator/overvoltage relay. Current to excite the alternator field is normally derived from the airplane bus through a 10 amp switch/circuit breaker and the voltage regulator/overvoltage relay. The self excited alternator is designed to have a small amount of residual magnetism. In the event the battery is discharged to the extent that it will not excite the alternator field, the residual magnetism is strong enough to excite the alternator field if all the load is removed from the airplane electrical system until the bus is brought up to proper voltage. When attempting to excite the alternator and develop output without battery power, turn off all electrical load and operate the engine at near cruise speed. In the event the alternator is not producing electrical power, the alternator sensor will illuminate an annunciator light.

Electrical system repair methods used must be made in accordance with the Federal Aviation Agency's Aircraft Inspection and Repair manual AC 43.13-1A and/or the Aircraft Alterations manual AC 43.13-2. Any components replaced and any wire, cable, or terminals used in the maintenance of the electrical system must be of airplane quality. Any solderless terminals or splices used must be applied with tooling specified by the vendor.

DC GENERATION - TROUBLESHOOTING

Troubleshooting procedures in this section apply to a 50-amp (prior to CJ-156; CE-929; D-10354; EA-159; E-1766), 60-amp (CJ-156 and After; CE-929 and After; D-10354 and After; EA-159 and After; E-1766 and After) or optional 100-amp alternator and may be accomplished without special test equipment. All supporting systems or equipment must be operating. All circuit breakers, switches, etc. must be in the position required for proper operation before troubleshooting begins.

The following troubleshooting charts are general in nature. Refer to the appropriate subchapter for further information.

Chart 1
Troubleshooting Alternator System

TROUBLE	PROBABLE CAUSE	REMARKS
1. No ammeter indication.	a. Loose connection.	a. Check connections throughout system.
	b. No alternator output.	b. Check alternator output.
	c. Defective voltage regulator.	c. Replace regulator.
	d. Overvoltage relay tripped.	d. Check regulator/overvoltage relay for proper output.
	e. Defective ammeter.	e. Replace ammeter.
2. No alternator output.	a. Circuit breaker tripped.	a. Reset.
	b. Open circuit.	b. Check continuity of circuit.
	c. Defective control switch.	c. Replace switch.
	d. Brushes worn out.	d. Replace brushes.
	e. Dirty slip rings.	e. With alternator running, clean slip rings with No. 400 or finer sandpaper. Use air jet to remove grit.
	f. Brushes not contacting slip rings.	f. Clean brushes and holders with a clean, lint-free, dry cloth. Replace weak springs.
	g. Open or shorted circuit in rotor.	g. Test resistance of rotor. Replace if defective.
	h. Open or shorted circuit in stator.	h. Test resistance of stator. Replace if defective.
	i. Defective voltage regulator.	i. Replace regulator.
3. Alternator output low.	a. Defective rectifier diode.	a. Replace diode.

Chart 2
Troubleshooting Battery System

TROUBLE	PROBABLE CAUSE	REMARKS
1. No power indicated with battery master switch ON.	a. Battery discharged or defective.	a. Test.
	b. Open circuit between battery and master switch.	b. Check continuity.
	c. Master switch defective.	c. Check switch for operation. Replace if necessary.
	d. Defective relay.	d. Check relay for operation. Replace if necessary.
2. Power on with master switch in OFF position.	a. Master switch defective.	a. Check switch for operation. Replace if necessary.
	b. Relay contacts stuck.	b. Replace relay.
3. Complete failure to operate.	a. Loose or broken lead.	a. Secure lead.
	b. Loose or disengaged terminals in battery.	b. Secure terminals.
	c. Battery not charged.	c. Charge battery.
4. Excessive spewage (crystalline deposits on outside of battery).	a. Excessive charge rate.	a. Clean the battery and adjust the electrolyte level.
	b. Excessive ambient temperature during charge.	b. Clean the battery and adjust the electrolyte level.

Chart 3
Troubleshooting Voltage Regulator System

TROUBLE	PROBABLE CAUSE	REMARKS
1. No Output.	a. Output voltage adjustment set too low.	a. Readjust output voltage.
	b. Field circuit fuse open.	b. Replace fuse.
	c. Overvoltage protection circuit tripped.	c. Reset overvoltage protection circuit.
	d. Defective voltage regulator.	d. Replace regulator.
2. Output is normal when engine is started but ceases after a short time.	a. Overvoltage circuit set too low.	a. Readjust overvoltage circuit.
	b. Output voltage set too high.	b. Readjust output voltages.

Chart 3
Troubleshooting Voltage Regulator System (Continued)

TROUBLE	PROBABLE CAUSE	REMARKS
3. Overvoltage circuit inoperative at any voltage.	a. External pin connections not properly made.	a. Check external pin connections.
	b. Defective voltage regulator.	b. Replace regulator.
4. Continuous high output.	a. Output voltage adjustment set too high.	a. Readjust output voltage.
	b. Defective voltage regulator.	b. Replace regulator.
5. Indicator lamp fails to light.	a. Lamp burned out.	a. Replace lamp.
	b. Relay contacts dirty.	b. Clean relay contacts.
	c. Bad ground connection at indicator lamp.	c. Check ground connection.

DC GENERATION - MAINTENANCE PRACTICES

ALTERNATOR REMOVAL

CAUTION: *The output terminal of the alternator is connected directly to the battery. Make sure the battery switch is OFF before removing the wires at the alternator or serious damage to the wiring harness and alternator may result from accidental grounding of the output stud.*

a. Access to the alternator is gained through the right cowl door and through the forward opening of the cowl.

b. Disconnect the electrical wiring harness from the alternator.

c. Remove the four attaching bolts. Remove the alternator.

ALTERNATOR INSTALLATION

CAUTION: *Do not force the alternator into position or damage to the alternator or drive gears could result. Care must be taken to assure that the alternator pilot enters the crankcase bore squarely, and the alternator is resting flat on the engine pad.*

d. Install a new gasket on the alternator flange.

e. Position the alternator on the mounting pad.

f. Install the attaching nuts and washers bringing to a snug condition. Torque the nuts to 150 to 180 in-lb in diagonally opposite pairs.

CAUTION: *Never turn the battery switch ON until all wiring harness connections have been made and properly tightened or serious damage to the wiring harness and alternator may result from accidental grounding.*

g. Connect the electrical wiring to the alternator.

h. Start the engine and check for oil seepage and proper operation.

NOTE: If a new alternator is to be installed, refer to DRIVE GEAR AND COUPLING INSTALLATION ON NEW ALTERNATORS to change the drive gear and coupling to the new alternator.

DRIVE GEAR AND COUPLING INSTALLATION ON NEW ALTERNATORS

The new alternator may be received with or without a new drive gear and coupling. The drive gear and coupling from the old alternator may need to be installed on the new alternator. The drive and coupling may be changed by following the procedures as follows:

a. Remove the shipping spacer and washer (if installed) from the replacement alternator.

b. Install the woodruff key (if not already installed), coupling assembly and thrust washer. Ensure the bearing surface (copper color) of the thrust washer is installed toward the alternator.

c. Install the nut and tighten to a torque of 400 in-lb. If the slots of the castellated nut do not align with the cotter pin hole in the shaft, the nut should be tightened further, but not to exceed 500 in-lb. Do not back off the nut to align holes.

d. Install an MS24665-302 cotter pin carefully to ensure clearance when the alternator is installed in the engine.

NOTE: Do not clamp the alternator body or mounting flange in a vise. The cotter pin must be installed and then trimmed. The portion bent toward the alternator housing must NOT touch the thrust washer when bent over the nut. The portion bent away from the alternator housing must NOT reach beyond the threads on the end of the shaft.

VOLTAGE REGULATOR REMOVAL

a. Ensure that the battery switch is OFF, the battery is disconnected, and the external power source is disconnected.

b. Locate the voltage regulator installed on the right aft side of the firewall in the flight compartment.

c. Tag and remove all wires from the voltage regulator.

d. Remove the voltage regulator attaching screws and remove the voltage regulator.

VOLTAGE REGULATOR INSTALLATION

a. Ensure that the battery switch is OFF, the battery is disconnected, and the external power source is disconnected.

b. Place the voltage regulator in position and secure with attaching screws.

c. Install electrical wires on the voltage regulator and remove tags.

d. Connect the battery.

e. Operate the engine and confirm the voltage regulator setting under various loads.

VOLTAGE REGULATOR ADJUSTMENTS

CAUTION: *Observe engine operating limitations.*

NOTE: The voltage regulator is set and sealed at the factory. Breaking the seal prior to the warranty limitations voids the warranty. Should it become necessary to adjust the voltage regulator, adjustments may be made in the following manner.

a. Bring the voltage regulator and the alternator up to operating temperature (preferably by flying), by operating the engine at 1,800 rpm with approximately 50% load for a minimum of 15 minutes.

b. Connect a precision voltmeter to the circuit breaker bus.

c. Operate the engine at cruise rpm (2,500 rpm) with the alternator ON, and the electrical load reduced to a minimum.

d. Check the bus voltage. If it is not 28.50 ± 0.25 vdc, adjustment should be made as indicated in the following Step.

e. Remove the plastic plug labeled REG from the corner of the regulator and adjust the regulator by turning the potentiometer clockwise to increase the voltage and counterclockwise to decrease the voltage. Make any adjustments in small increments and allow 2 or 3 minutes operation time for the system to stabilize between adjustments.

f. For final check and adjustment, the engine should be operated at cruise rpm (2,500 rpm) with the alternator ON and carrying approximately 50% load.

BATTERY MAINTENANCE PROGRAM

The battery is accessible for servicing by raising the right engine cowl and removing the battery box cover. A systematic battery maintenance program should be established as follows:

a. A log in the services performed on the battery should be maintained.

b. The battery should be removed from the airplane and serviced after 100 flight hours or 30 days, whichever occurs first. If the ambient temperatures are above 90°F or the time between engine starts averages less than 30 minutes, the time between servicing may be reduced.

c. The fluid level of the battery should be checked every 25 hours and when fully charged, should barely touch or be slightly short of the eyelet at the bottom of the vent well. If the fluid level is low, add distilled water to fill. Recheck the battery after charging for a proper specific gravity.

NOTE: Do not overfill the battery. When the battery cells are overfilled, water and acid will spill on the lower portions of the engine accessory section and lower fuselage. Neutralize the acid spillage immediately with a water solution of sodium bicarbonate (baking soda).

Do not allow the fluid level to drop below the top of the plates.

During periods when the ambient temperature is below 32°F, the battery should be maintained in a fully charged state to prevent freezing. When distilled water is added, the battery should be charged sufficiently to thoroughly mix the water with the electrolyte as a precaution against freezing.

CAUTION: *Excessive spewage may result if the cell vents are not kept clean and open.*

d. For peak performance, the battery must be kept clean and dry. If foreign materials are present in sufficient quantities, the resultant deposits may form conductive paths that permit a rapid self discharge of the battery. To prevent the collection of such deposits, the battery should be cleaned after each 100 hours of service or every 30 days, whichever occurs first.

e. The log of battery service performed should be evaluated to determine the need to service the battery at the above recommended intervals or to extend the intervals if justified. Accurate water consumption data is a valid barometer to use for adjustment of the servicing intervals. For further servicing, information instructions are furnished with each battery.

BATTERY REMOVAL

a. Place the battery switch in the OFF position and ensure that the external power unit is disconnected.

b. Locate the battery in the engine compartment on the upper right hand side of the firewall.

CAUTION: *Always remove the ground cable terminal first and install it last to prevent accidental short circuits.*

c. Remove the negative battery cable from the battery.

d. Disconnect the positive cable from the battery and position it so it will not interfere with the removal of the battery.

e. Remove the battery box from the firewall.

f. Remove the battery from the airplane.

BATTERY INSTALLATION

a. Place the battery switch in the OFF position and ensure that the external ground power unit is disconnected.

b. Position the battery in the battery box.

c. Install the battery box at the firewall.

CAUTION: *If the positive battery terminal is not marked (+), POS, or painted red and the negative battery terminal is not marked (-), NEG, or painted black, use a voltmeter to determine the battery polarity before connecting the battery in the airplane. Reverse polarity will destroy the diodes and other electronic components in the electrical system.*

d. Coat the battery terminals and cable terminal with a light coat of petroleum jelly.

e. Position the positive cable on the battery and secure.

f. Position the negative cable on the battery and secure.

g. Remove any excess petroleum jelly from the terminals.

h. Position the battery box lid on the battery box and secure.

i. Secure the aft fuselage access panel.

BATTERY CLEANING

a. Remove the battery. Refer to BATTERY REMOVAL procedure.

CAUTION: *Never use a wire brush or brush with a metal construction for this purpose as short circuiting or other damage may result.*

b. Ensure that the battery cell filler caps are in place and tight. Brush dirt off with a stiff bristle brush.

CAUTION: *Entrance of ammonia or soda solution into a battery cell will neutralize the cell electrolyte. Never use solvents to clean the battery, for these may damage the battery case.*

c. Scrub the battery with a solution of ammonia or bicarbonate of soda (one part of soda to a gallon of water). This will neutralize any electrolyte sprayed or spilled out.

d. Rinse the battery with clear water, then sponge off the excess water. Allow the battery to air-dry.

e. Wash the battery filler caps with clean hot water and no soap, then examine the vent holes in the battery filler caps to make sure they are clear.

f. Inspect the battery for cracks, holes, or burn spots. Replace if necessary.

g. Make sure that all battery hardware is clean and in good mechanical condition.

NOTE: If additional cleaning of the battery terminals and cable terminal is required, use a battery terminal cleaning tool and brighten up the terminals to ensure a good electrical connections.

BATTERY BOX CLEANING

The battery box is vented overboard to dispose of electrolyte and hydrogen gas fumes discharged during normal charging operation. To ensure the disposal of these fumes, the vent hose connections at the battery box should be checked frequently for obstructions. The battery box should be washed out thoroughly and dried each time the battery is removed and cleaned.

BATTERY SERVICING

The battery should be maintained in a fully charged state at all times and the electrolyte level checked at regular intervals. A clean fully charged battery will provide peak performance. Never add anything but distilled water when adjusting the electrolyte level of the battery. If electrolyte is added each time the level in the battery is low, a high concentration of electrolyte may cause dissolution of the plates. Under high temperature conditions, this may be indicated by the presence of black particles in the electrolyte of the affected cells.

NOTE: Do not over fill the battery. Only lead-acid equipment should be used when servicing lead-acid type batteries.

STANDBY GENERATOR - DESCRIPTION AND OPERATION (PRIOR TO E-3306; PRIOR TO EA-652)

An optional standby generator system is provided to power essential equipment in the event of loss of electrical power on the main system.

The optional standby generator system is an independent electrical system incorporated into the main system in such a manner as to furnish power only to essential engine instruments, fuel quantity, certain lights, turn coordinator and navigation and communication system. A diode in the circuit from the battery to the standby generator system prevents the generator from furnishing any power to the battery, but allows the battery (if serviceable) to supply power to the essential equipment in the event of inadequate output or failure of the standby generator.

NOTE: For airplanes with 12 vdc battery, the circuits from the battery to the standby generator system and the battery to the stall warning system are always alive, even though the battery switch may be in the OFF position.

The optional standby generator system should only be used when there is a loss of electrical power on the main electrical system. As soon as loss of electrical power is evident, turn the alternator and battery switches OFF (this is to prevent possible damage to the main system if a short exists therein, and to save battery power for lowering the flaps and gear if the problem is determined to be only a faulty alternator). After turning the switches OFF, turn the standby generator on. This optional generator is mounted aft of the right magneto aft of the engine baffle and is cooled by air that is picked up from the engine baffle.

The switch and voltmeter are located on the right side of the instrument panel prior to E-2111 (except E-1946 and E-2104), and EA-389 (except EA-320). At the noted serials the switch is moved to the left subpanel and the standard voltmeter near the pedestal is used. The switch is placarded OFF-ON-GEN/RESET. The voltage regulator/overvoltage relay is mounted aft of the firewall and controls the generator output.

The standby generator is self-exciting and requires no external electrical power for it to function, although it does require 2,925 to 4,050 rpm (engine rpm is 1,950 to 2,700) to function properly. At a minimum engine speed of 1,950 rpm, the generator will produce a continuous 6.5 amps at 28 volts or for intermittent (1 minute on 2 minutes off) operation 11 amps at 24 volts.

The standby generator system is controlled and protected by a voltage regulator/overvoltage relay. The regulator will control the voltage at 28.50 ± 0.50 volts. The overvoltage relay will remove the standby generator from the circuit should the voltage reach 32.0 ± 0.5 volts. The overvoltage relay is not sensitive to small voltage spikes (at 33 volts it will not trip for 50 milliseconds). Should a transient voltage spike cause the overvoltage relay to trip removing the generator from the system, it may be reset in flight by moving the switch momentarily to the GEN/RESET position.

STANDBY GENERATOR - MAINTENANCE PRACTICES

STANDBY GENERATOR FUNCTIONAL TEST

a. Turn the generator switch OFF.

b. Turn the battery switch OFF.

c. Turn the standby generator switch ON (do not contact the GEN/RESET position).

d. The volt meter should register approximately 24 volts.

e. Place the switch momentarily in the GEN/RESET position.

f. The volt meter should register approximately 28 volts, with the engine operating at 1,950 rpm.

STANDBY ALTERNATOR - DESCRIPTION AND OPERATION (E-3306 AND AFTER; EA-652 AND AFTER)

The standby alternator is mounted on the aft side of the engine, behind the right magneto, aft of the engine baffle.

The standby alternator system is an independent electrical source that is connected to the main busing system and will supply power to any components in the airplane up to it's load limitation of 20 amps.

When the STBY ALT switch is set to ON, the standby alternator will be regulated to approximately 26.0 volts with overvoltage trip off set at 32 volts. The standby alternator will then automatically power the airplane bus in the event the primary alternator fails and/or the airplane bus voltage drops below 26 volts. System activation is controlled by the standby alternator voltage regulator which monitors the airplane bus voltage. The automatic switching from the primary alternator to the standby alternator is indicated by the illumination of the amber STBY ALT ON annunciator. The primary alternator switch should be placed to the OFF position when the standby alternator is operating. If the existing electrical load is small, such as may occur during the preflight check, automatic switching of the standby alternator may be delayed until the bus voltage drops below 26 volts. Increasing the load, such as turning on the taxi or landing lights, will facilitate the lowering of the bus voltage allowing the standby alternator to power the battery bus more quickly. The standby alternator is not self exciting and requires that the battery master switch be left in the ON position.

In normal operation, the standby alternator switch is turned on at the same time as the primary alternator switch. The standby alternator switch should remain in the ON position for the duration of the flight.
If the LOW BUS VOLT annunciator illuminates during the operation of the standby alternator, engine speed may be too slow for the alternator load or the load may exceed 20 amps. Annunciator illumination is a function of engine speed, load on the standby alternator and ambient conditions within the standby alternator. Maintaining an engine speed of 2,300 rpm or more and a standby alternator load of 20 amps or less, will keep the annunciator extinguished.

The standby alternator load may be monitored by placing the loadmeter switch to STANDBY from PRIMARY. On airplanes equipped with a 100 amp primary alternator, the maximum output of 20 amps will be indicated as 100% on the loadmeter. On airplanes equipped with a 60 amp primary alternator, the output of the standby alternator may be read in amps directly from the loadmeter, i.e. a 20 amp output will indicate 20 on the loadmeter.

Output voltage of the standby alternator will be indicated on the BUS VOLTS meter and will indicate approximately 26.0 volts with the engine at 2,300 rpm or above. If voltage drops below 25 volts, the electrical load should be checked and reduced if above the 20 amp limit. The standby alternator is capable of outputs greater than 20 amps for up to 5 minutes. Extended operation above 20 amps may cause immediate or premature alternator failure and depletion of the battery reserve.

On early versions of the voltage regulator used in the standby alternator system, the STBY ALT ON annunciator light will flash (light may go solid if left flashing for a period of time) if the STBY ALT switch is not selected ON with power on the bus of the airplane. This is an indication to the pilot that the standby alternator is not activated. The STBY ALT ON light should illuminate whenever the airplane bus voltage is 26 volts or below and the standby alternator switch is ON.
On later versions of the voltage regulator, if the standby alternator switch is OFF the STBY ALT ON light is extinguished.
With the standby alternator switch ON, the standby alternator light will be illuminated whenever the airplane bus voltage is 26 volts or below and extinguished anytime the bus voltage is above 26 vdc.
During standby alternator operation, if the electrical load is over 20 amps, the STBY ALT ON annunciator light will flash. After reducing the electrical load to less than 20 amps the annunciator light will be on steady.
Procedures for proper operation of the standby alternator system can be found in the supplement section of the Pilots Operating Hand Book.

STANDBY ALTERNATOR - MAINTENANCE PRACTICES

STANDBY ALTERNATOR FUNCTION TEST

a. Set the throttle to 2,300 rpm.

b. Set primary alternator switch to OFF.

   1. The STBY ALT ON annunciator will illuminate.

   2. The loadmeter reads no load.

NOTE: Depending upon the battery bus voltage, the electrical load may need to be increased (such as turning on the landing and/or taxi lights) to activate the standby alternator.

c. Set the loadmeter switch to STANDBY.

d. Check the loadmeter reading (greater than 0, less than 100% or 20 amps).

e. Check the voltmeter reading (26.0 volts).

f. Set the throttle between 1,000 and 1,200 rpm (LOW BUS VOLT annunciator light should illuminate).

g. Set the standby alternator switch to:

   1. OFF - the STBY ALT ON annunciator light will extinguish.

   2. ON - the STBY ALT ON annunciator light will illuminate.

h. Set primary alternator switch to ON.

   1. STBY ALT ON annunciator light will extinguish.

   2. LOW BUS VOLT annunciator light will extinguish.

i. Set the loadmeter switch to PRIMARY.

j. Verify a normal indication for the primary alternator load.

STANDBY ALTERNATOR REMOVAL

a. Gain access to the alternator through the right cowl door.

b. Disconnect the electrical wiring harness from the alternator.

c. Remove the four attaching bolts. Remove the alternator.

STANDBY ALTERNATOR INSTALLATION

a. Install a new gasket on the alternator flange.

CAUTION: *Do not force the alternator into position or damage to the alternator or drive gears could result. Care must be taken to assure that the alternator pilot enters the accessory case bore squarely, and the alternator is resting flat on the engine pad.*

b. Position the alternator on the mounting pad.

c. Install the attaching nuts and washers to a snug condition.

d. Torque the nuts to 90 to 110 in.-lb in diagonally opposite pairs.

e. Connect the electrical wiring to the alternator.

f. Start the engine and check for oil seepage and proper operation.

EXTERNAL POWER - MAINTENANCE PRACTICES (CE-1024 AND AFTER; CJ-156 AND AFTER; E-2111 AND AFTER; EA-339 AND AFTER) (CE-748, CE-772 THRU CE-1023; CJ-149 THRU CJ-154; D-10097, D-10120 AND AFTER; E-1111, E-1241 THRU E-2110; EA-11 THRU EA-338; AIRPLANES MODIFIED BY FACTORY WORK ORDER OR AIRPLANES WITH KIT 33-3008 INSTALLED)

The airplane electrical system is protected against damage from reverse polarity by a relay and diodes in the external power circuit. The external power receptacle is located on the right side of the fuselage and just aft of the engine. The receptacle is designed for a standard AN type plug. To supply power for ground checks and for ground power unit assisted engine starts, a ground power unit capable of supplying a continuous load of 300 amperes at 24 to 30 volts is required. Use of an inadequate ground power unit can cause a voltage drop below the drop-out voltage of the starter relay, resulting in relay chatter and welded contacts. By the same token, a maximum continuous load in excess if 350 amperes will damage the external power relay and power cables of the airplane.

Observe the following precautions when using an external power source:

a. Use only an auxiliary power source that is negatively grounded. If the polarity of the power source is unknown, determine the polarity with a voltmeter before connecting the unit to the airplane.

b. Before connecting the external power unit, turn OFF all radio equipment and alternator switches, but leave the battery master switch on to protect transistorized equipment against transient voltage spikes.

CAUTION: *When the battery switch is turned off for extended ground power operation, place an external battery in parallel with the output of the external power unit before operating any transistorized avionic equipment.*

c. If the ground power unit does not have a standard AN plug, check the polarity of the plug. The positive lead from the ground power unit must connect to the center post, the negative lead must connect to the front post and a positive voltage of 24 to 28 vdc must be applied to the small polarizing pin of the airplane's external power receptacle. The power output of the external power receptacle must be capable of maintaining 28.5 ± 0.25 vdc and should be checked periodically with a voltmeter of known accuracy.

ELECTRICAL LOAD DISTRIBUTION - MAINTENANCE PRACTICES

ELECTRICAL UTILIZATION CHART

The following specifies the electrical load for each piece of equipment, either standard or optional, available on the airplane. Based on this information, the total electrical load for the airplane may be determined.

The electrical loads have been divided into 4 categories as follows:

1. Continuous Load (Standard Equipment). Refer to Chart 1
2. Continuous Load (Optional Equipment). Refer to Chart 2.
3. Intermittent Load (Standard Equipment). Refer to Chart 3.
4. Intermittent Load (Optional Equipment). Refer to Chart 4.

Intermittent loads are defined as those items which will be operated for two minutes or less. Intermittent items should not be figured into the total figure since the short duration of their usage will not significantly alter the standard load.

Under no condition shall the total continuous electrical load be more than 80% of the total alternator capacity. Total continuous load consists of loads listed continuous and the avionics receiving loads. Transient loads are intermittent loads.

NOTE: The loads listed as continuous loads are for equipment which will be operated for periods of 15 minutes or longer; however, the intermittent loads and avionics transmitting loads should be considered for determining possible overloading during shorter periods of time, i.e., takeoff and landing.

Chart 1
Continuous Load (Standard Equipment)

EQUIPMENT	NUMBER PER AIRPLANE	EACH AMPS	TOTAL AMPS
Flap Indicator System	1	0.06	0.06
Fuel Indicator System	2	0.02	0.04
Inverter, Electroluminescent	1	0.50	0.50
Instruments, Engine	1	0.32	0.32
Clock, Panel	1	0.01	0.01
Clock, Digital	1	0.20	0.20
Potentiometer, Light Dim	4	0.03	0.12
Relay, Annunciator Dim	1	0.04	0.04
Relay, Battery Master	1	0.50	0.50
Sensor, Alternator Out	1	0.04	0.04
Turn Coordinator	1	0.40	0.40
Voltage Regulator	1	3.33	3.33
Flight Hour Meter	1	0.01	0.01
Power Supply, Strobe	1	5.00	5.00
Heater, Pitot	1	4.60	4.60
LIGHTING			
3rd & 4th Passenger Reading	2	0.30	0.60
5th & 6th Seat Reading	2	0.30	0.60
Cabin Light	2	0.17	0.34
Map	2	0.30	0.60
Instrument, Wedge Light (Single)	14	0.024	0.67
Compass	1	0.04	0.04
Elevator Tab	1	0.04	0.04
Flap Position	1	0.04	0.04
Fuel Select	2	0.04	0.08
Glareshield Flood	12	0.17	2.04
OAT	1	0.04	0.04

Chart 1
Continuous Load (Standard Equipment) (Continued)

LIGHTING (Continued)	NUMBER PER AIRPLANE	EACH AMPS	TOTAL AMPS
Tail Position	1	1.02	1.02
Rotating Beacon, Lower	1	3.22	3.22
Rotating Beacon, Upper	1	3.22	3.22
Tail Nav/Strobe	1	1.02	1.02
Wing Tip Nav/Light	2	0.93	1.86

Chart 2
Continuous Load (Optional Equipment)

EQUIPMENT	NUMBER PER AIRPLANE	EACH AMPS	TOTAL AMPS
Air Conditioning			
Compressor Clutch	1	1.70	1.70
Evaporator Blower	1	13.50	13.50
Electrothermal Prop Anti-ice			
(2 Blade)	1	10.00	10.00
(3 Blade)	1	15.00	15.00
Ammeter	1	0.01	0.01
Timer	1	0.10	0.10
LIGHTING			
Clock, Control Wheel 8-day	1	0.04	0.04
Instrument, Post Light (Single)	26	0.04	1.04
Instrument, Post Light (Dual)	37	0.04	1.48
Instrument, Wedge Light (Dual)	16	0.024	0.77

Chart 3
Intermittent Load (Standard Equipment)

EQUIPMENT	NUMBER PER AIRPLANE	EACH AMPS	TOTAL AMPS
Cigarette Lighter	1	6.00	6.00
Flap Motor	1	11.00	11.00
Elevator Trim			
Actuator	1	0.85	0.85
Resistor, Shunt	1	0.37	0.37
Flasher, Gear Warning	1	0.04	0.04
Horn, Gear Warning	1	0.20	0.20
Horn, Stall Warning	1	0.20	0.20
Landing Gear Motor	1	40.00	40.00**
Relay, Ldg Gear Latch	1	0.08	0.08
Pump, Auxiliary Fuel	1	3.00	3.00*
Pump, Auxiliary Fuel	1	3.00	3.00***
Pump, Auxiliary Fuel	1	4.00	4.00****
Relay, Dynamic Brake	1	1.25	1.25
Relay, Starter	1	3.30	3.30
Starter, Engine	1	100.00	100.00
Starter Vibrator	1	2.00	2.00****
LIGHTING			
Alternator Out	1	0.04	0.04
Courtesy Light	2	0.17	0.34
Door Ajar	2	0.024	0.048
Landing Gear Indicator	3	0.04	0.12
Landing Light	1	8.93	8.93
Taxi Light	1	8.93	8.93

NOTES: * Used only on models A36, V35B, F33A and F33C.

** Peak current after initial start-up load.

*** Used only on Model F33C.

**** Used only on Models A36TC and B36TC.

Chart 4
Intermittent Load (Optional Equipment)

EQUIPMENT	NUMBER PER AIRPLANE	EACH AMPS	TOTAL AMPS
Air Conditioning			
Actuator, Condenser Door	1	0.77	0.77
LIGHTING			
Condenser Door Open	2	0.024	0.048

CHAPTER

25

EQUIPMENT/ FURNISHINGS

CHAPTER 25 - EQUIPMENT/FURNISHINGS

TABLE OF CONTENTS

CHAPTER 25 - EQUIPMENT/FURNISHINGS

TABLE OF CONTENTS (Continued)

SUBJECT *PAGE*

CHAPTER 25 - EQUIPMENT/FURNISHINGS

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
25-LOEP	1	Sep 30/03
25-CONTENTS	1 and 2	Sep 30/03
25-00-00	1 thru 7	Sep 30/03
25-60-00	1 thru 13	Oct 16/92

FLIGHT AND PASSENGER COMPARTMENTS - DESCRIPTION AND OPERATION

FLIGHT COMPARTMENT AND PASSENGER COMPARTMENT SEATING

On all serials except CJ-149 and After, the pilot and copilot seat backs fold forward to facilitate passengers entering and leaving the airplane. Airplane serials CJ-149 and After have locking seat backs on the pilot and copilot seats which can be folded forward by rotating the seat back release lever, located on the lower inboard side of each seat. An additional lever located behind copilot's seat on the upper right corner is also used to fold the copilots seat forward for access to the passenger seats.

The passenger seat backs can be folded forward by rotating the seat back release lever located on the lower inboard side of each seat. All passenger seats have locking backs.

To adjust the pilot, copilot, and passenger seats forward or aft, an adjustment lever, located beneath the front of the seats, must be pulled up. The seat can then be slid to the desired position.

A seat back adjustment lever, located on the lower inboard side of the pilot, copilot, passenger, and on the fifth and sixth seats (A36 Series), enables the seat back to be adjusted to several positions. It is controlled by a mechanical, three position cam lock. An optional seat installation is available whereby the adjustment of the copilot and passenger seat backs are controlled by a Roton lock lever located on the forward inboard side of the seat bottom.

Airplane serials E-2104, E-2111 and After, and EA-389 and After are equipped with vertically adjusting seats in the flight compartment (copilot's seat is optional). The seat is raised and lowered by gas springs mounted underneath the seat. The seat is adjustable through a range of 1.3 inches for improved visibility and crew comfort. The raising and lowering action is initiated by pulling up on a release lever located on the front RH side of the seat. When the release lever is raised, two ratchet type camlocks are disengaged from sector gears attached to the gas springs mounted on each side underneath the seat, allowing the gas spring piston rods to extend or retract to raise or lower the seat. To raise the seat the pilot's weight must be shifted forward. To lower the seat the weight must be shifted to the rear to overcome the gas spring tension.

FLIGHT AND PASSENGER COMPARTMENTS - MAINTENANCE PRACTICES

PILOT AND COPILOT SEAT REMOVAL

a. Remove the seat stops at the aft end of the mounting tracks.

b. Pull up on the fore and aft adjustment lever located beneath the front of each seat, and slide the seat off the mounting tracks.

PILOT AND COPILOT SEAT INSTALLATION

NOTE

If shims were installed in the seat support, they should be reinstalled in the same location from which they were removed to achieve proper seat locking engagement with the seat track.

a. Align the seat guide with the seat track. If shims were installed in the front seat guide, they should be reinstalled in the same location as that from which they were removed.

b. Pull up on the fore and aft adjustment lever and slide the seat onto the seat track. Release the adjustment lever and ensure that the seat is securely in place.

c. If the lock pin does not align with the holes in the center seat track, it will be necessary to reposition the guides with shims. Use shims as needed to center the locking pin with the holes in the seat track.

NOTE

Shims (three inches long x 0.3 inch wide) may be fabricated from 0.016 6061-T6 Sheet aluminum. The shims are placed inside the seat guide and formed around the guide (Ref. Figure 2).

d. Pull up on the fore and aft adjustment lever and slide the seat through the full travel of seat adjustment. Ensure that the locking pin has positive engagement in all holes of the seat track.

e. Install the seat stops at the aft end of the seat track.

NOTE

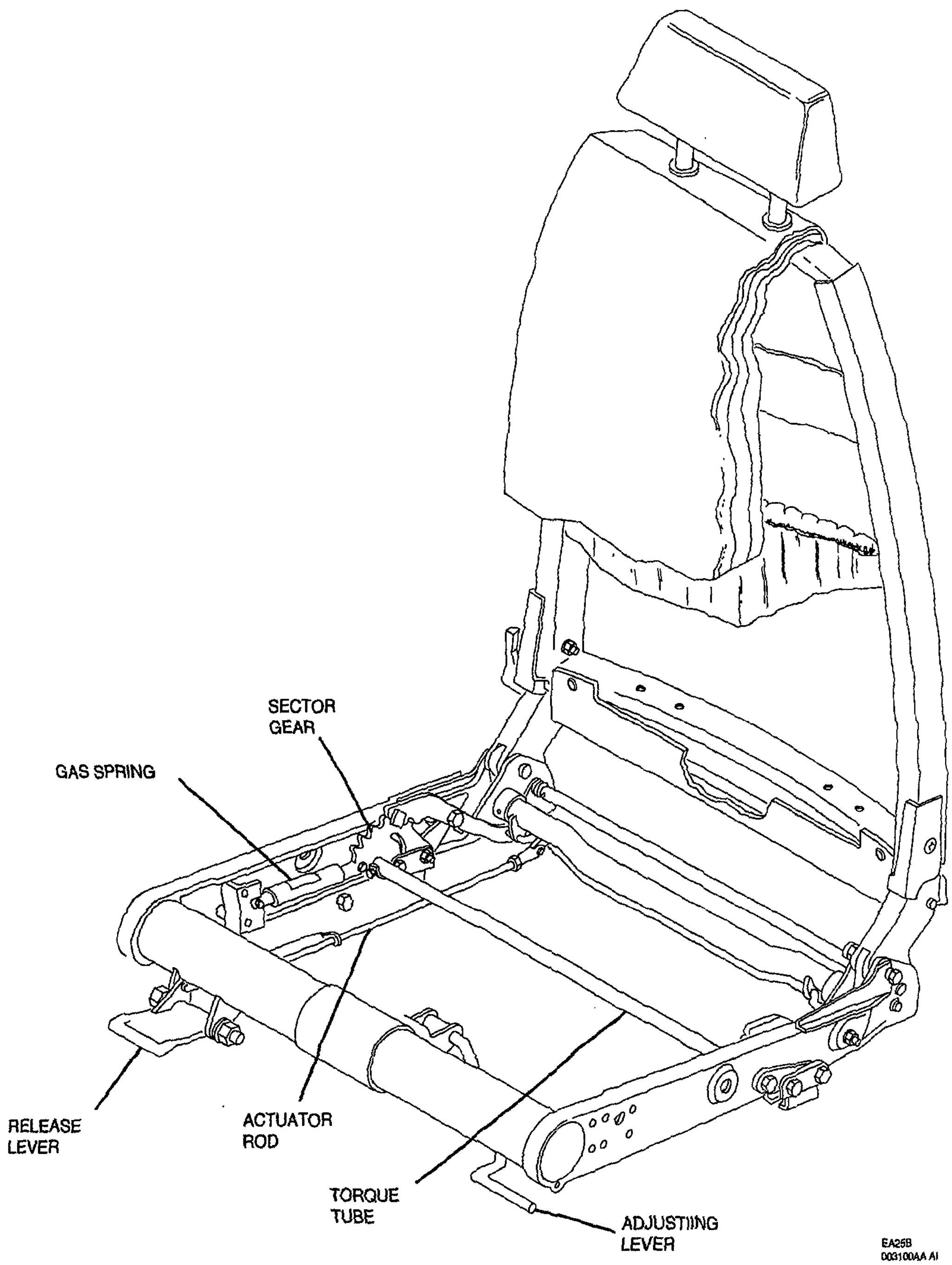
When airplane serials CJ-149 and After are used for aerobatics and parachutes are worn, the headrests for the pilot and copilot seats must be removed and the seat back cushions rotated over the seat backs and reattached to the bottom of the seat backs. The headrest can then be reinstalled.

PASSENGER SEAT REMOVAL

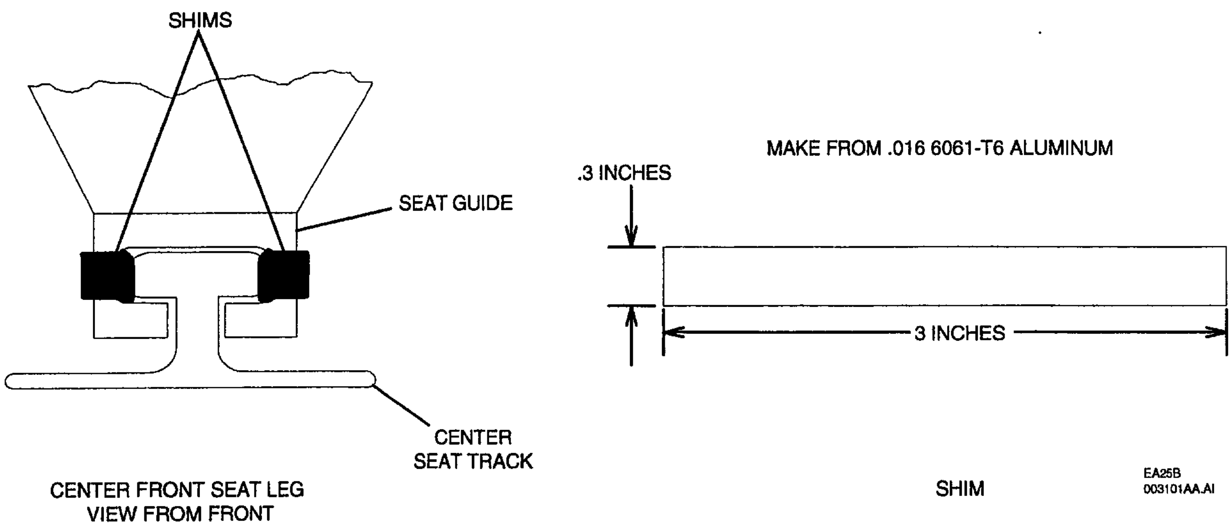
a. When airplane serials CJ-149 and After are being operated in the aerobatics category, the passenger seats may need to be removed in order to meet the center of gravity requirements.

b. Remove the seat stops at the aft end of the seat tracks.

c. Pull up on the fore and aft adjustment lever, located beneath the front of each seat, and slide the seat off the mounting track.



Vertically Adjusting Seat
Figure 1



Seat Track Shims
Figure 2

PASSENGER SEAT INSTALLATION

a. Align the seat guides with the slots in the mounting tracks.

b. Pull up on the fore and aft adjustment lever and slide the seat onto the mounting tracks. Release the lever and ensure that the seat is securely in place.

c. Reinstall the seat stops at the aft end of the mounting tracks.

FIFTH SEAT REMOVAL (CE-748, CE-772 AND AFTER; D-10097, D-10120 AND AFTER)

a. Remove the two bolts at the lower aft portion of the seat bottom.

b. Remove the seat by removing the extrusion at the forward top side of the hat shelf. Reinstall the extrusion on the hat shelf.

FIFTH SEAT INSTALLATION (CE-748, CE-772 AND AFTER; D-10097, D-10120 AND AFTER)

a. Remove the extrusion from the hat shelf.

b. Install the extrusion along with the seat back retaining strap on the hat shelf.

c. Install the seat bottom, seat belts, and the two securing bolts.

FIFTH SEAT STOWAGE (CE-748, CE-772 AND AFTER; D-10097, D-10120 AND AFTER)

a. Pull forward on the lower portion of the seat back until the seat back is in a horizontal position. Lift up on the forward side on the seat bottom, rotate the seat bottom to a vertical position, and position the seat bottom legs parallel with the seat bottom.

b. Lower the seat back into a vertical position and snap the retaining strap into position.

FIFTH AND SIXTH SEAT REMOVAL (E-1111, E-1241 AND AFTER; EA-1 AND AFTER)

a. Fold the bottom of the seat up to a vertical position and fold the seat support in the retract position.

b. Remove the seat attach pins.

FIFTH AND SIXTH SEAT INSTALLATION (E-1111, E-1241 AND AFTER; EA-1 AND AFTER)

a. Position the seats.

b. Install the seat attach pins.

c. Fold the seat bottom and seat support down and snap the support into the floor base.

FIFTH AND SIXTH SEAT STOWAGE (E-1111, E-1241 AND AFTER; EA-1 AND AFTER)

The fifth and sixth seats may be folded either in a horizontal or vertical position to provide additional cargo space. This may be accomplished as follows:

VERTICAL POSITION

a. Fold the seat bottom up to a vertical position.

b. Fold the seat support into the retract position.

c. Position the seat against the rear bulkhead in a vertical position.

HORIZONTAL POSITION

a. Fold the seat support into retract position and position the seat bottom on the floorboard.

b. Fold the seat back forward and position on top of the seat bottom.

NOTE

A club seating arrangement is available (A36, A36TC and B36TC series only) that enables the third and fourth passenger seats to be turned facing aft. On A36 serials prior to E-1371, when this arrangement is used, the fifth and sixth seats must be moved four (4) inches aft to maintain proper weight and balance. If the seats are returned to a standard seating arrangement (facing forward), the fifth and sixth seats MUST be moved back to their original position. Holes are located in the floorboard under the carpeting to facilitate installation of the side mounting brackets and the seat support base. It is recommended that both the third and fourth passenger seats face the same direction at all times.

HEADLINER REMOVAL (CE-919, CE-923, CE-925, CE-927, CE-929 AND AFTER; CJ-156 AND AFTER; D-10348, D-10353 AND AFTER; E-1422, E-1551, E-1569, E-1594 AND AFTER; EA-21, EA-28, EA-33 AND AFTER)

a. Perform the FIFTH SEAT REMOVAL and the FIFTH AND SIXTH SEAT REMOVAL procedures.

b. Remove the aft bulkhead closure.

c. Working through the aft bulkhead, remove the tape from around the air ducts that connects the air duct to the headliner duct.

d. Remove the screws which hold the overhead console in place.

e. Disconnect the wires to the light and remove the console.

f. Remove the window moldings.

g. Remove the door trim.

h. Perform the GLARESHIELD REMOVAL procedure in Chapter 39-10-00.

i. Remove the windshield trim.

j. Remove the garment hanger.

k. Gently pull on the headliner to disconnect the fabric hook and loop fasteners. These hook and loop fasteners are located wherever the airplane frame and headliner come together.

l. Separate the forward air ducts from the air duct in the headliner. A spatula or similar tool may be used to work between the ducts to work the sealer loose.

m. Disconnect the electrical wiring to the headliner lights. (This connector is located near the center of the headliner toward the front, or aft of the pilot's side window.)

n. Remove the headliner through the door.

HEADLINER INSTALLATION (CE-919, CE-923, CE-925, CE-927, CE-929 AND AFTER; CJ-156 AND AFTER; D-10348, D-10353 AND AFTER; E-1422, E-1551, E-1569, E-1594 AND AFTER; EA-21, EA-28, EA-33 AND AFTER)

a. Place the headliner in the airplane.

b. Connect the electrical wiring to the headliner lights.

c. Connect the forward ventilation ducts. Seal ducts with adhesive (54, Chart 1, 91-00-00).

d. Engage the hook and loop fasteners to hold headliner in place.

e. Install the garment hanger.

f. Install the windshield trim.

g. Perform the GLARESHIELD INSTALLATION procedure in Chapter 39-10-00.

h. Install the door moldings.

i. Install the window molding.

j. Connect the wires to the console light and install the console.

k. Connect the duct aft of the rear bulkhead closure. Tape the joint with two-inch wide tape (55, Chart 1, 91-00-00).

l. Install the bulkhead closure.

m. Perform the FIFTH SEAT INSTALLATION and the FIFTH AND SIXTH SEAT INSTALLATION procedures.

FORWARD CARRY-THROUGH SPAR COVER REMOVAL

a. *Perform the PILOT AND COPILOT SEAT REMOVAL procedures.*

b. Remove emergency landing gear crank cover from spar cover.

c. On aft side of spar cover, pull back carpet and remove screws from spar cover.

d. On forward side of spar cover, pull back carpet and remove screws from spar cover.

e. Remove RH access cover.

f. From inside of RH access cover, loosen clamp and remove air duct from plenum and grill assembly.

g. Lift spar cover and remove from forward spar.

FORWARD CARRY-THROUGH SPAR COVER INSTALLATION

CAUTION

Improper installation of the forward carry-through spar cover may interfere with the landing gear emergency hand crank operation. Ensure the landing gear hand crank will engage and rotate without interference with the spar cover.

a. Center spar cover on the forward spar.

b. From inside of RH access cover, install air duct on plenum and grill assembly and tighten clamp.

c. Install RH access cover assembly.

d. On forward side of spar cover, install screws to secure forward end of spar cover and install carpet.

e. On aft side of spar cover, install screws to secure aft end of spar cover and install carpet.

f. Check the emergency landing gear hand crank to ensure handle will engage and rotate without interference with the forward carry-through spar cover.

g. Install emergency landing gear crank cover to spar cover.

h. Perform the PILOT AND COPILOT SEAT INSTALLATION procedures.

EMERGENCY - DESCRIPTION AND OPERATION

EMERGENCY LOCATOR TRANSMITTER

The airplane is equipped with an automatically actuated emergency locator transmitter (ELT) to assist in the tracking and recovery of the airplane and crew in the event of a crash or emergency landing. The ELT system consists of a battery-powered emergency locator transmitter (ELT), an antenna and a switch accessible through a spring-loaded door in the right side of the fuselage adjacent to the ELT. The output frequencies of the ELT are 121.5 and 243.0 MHz, simultaneously. Range is approximately line of sight. The ELT is mounted near the right side of the fuselage, at approximate F. S. 230.00.

The antenna for the ELT is mounted on top of the fuselage at F.S. 195 on airplanes D-10097, D-10120 and after; E-1111, E-1241 thru E-2147; CE-748, CE-772 thru CE-1032; EA-1 thru EA-411 and CJ-149 thru CJ-155. The antenna is mounted under the dorsal fin just forward of the vertical stabilizer on airplanes CJ-156 and after, CE-1033 and after and EA-412 and after.

COMMUNICATIONS COMPONENTS CORPORATION ELT TR70-17 AND TR70-13
(Figure 1)

There are two Communication Component Corporation ELTs being used. The TR70-17 ELT is installed on airplanes D-10097, D-10120 thru D-10196; E-1111, E-1241 thru E-1406; EA-1 and EA-2; CE-748, CE-772 thru CE-828 and CJ-149. The TR70-13 ELT is installed on airplanes D-10197 thru D-10346, E-1407 thru E-1686, EA-3 thru EA-80, CE-829 thru CE-905 and CJ-150 thru CJ-155. Both, the TR70-17 and TR70-13, can be replaced with the Narco ELT 10 by Kit No. 101-3046-1 or the Artex ELT 110-4 by Kit No. 101-3127-1.

The TR70-17 ELT is mounted in the airplane so the control switch is accessible through a small door in the right side of the fuselage. The placarded switch positions are ARM-OFF-ON. The OFF position prevents operation of the ELT. The ON position is momentary and is used to test the operation of the ELT. The ARM position arms an impact switch which will actuate the ELT automatically upon impact of the airplane.

The TR70-13 has a control switch which is not accessible from outside the airplane. It is placarded OFF-ON-ARM. The OFF position prevents operation of the ELT. The ON position can be used for manual operation of the ELT. The ARM position arms an impact switch which will actuate the ELT automatically upon impact of the airplane. The TR70-13 also has a remote switch which is accessible through a small door in the right side of the fuselage. The placarded switch positions are REARM-ARM-XMIT. The XMIT position is momentary and is used to test the operation of the ELT. The ARM position is used to arm the impact switch for automatic actuation upon impact of the airplane. The REARM position is used to reset the impact switch after testing the ELT.

NARCO ELT 10
(Figure 2)

The Narco ELT 10 is installed with a two-position remote switch (XMIT-ARM) on airplanes D-10347 and after, EA-81 thru EA-411, E-1687 thru E-2147 and CE-906 thru CE-1032. The remote switch is placed in the XMIT position to test the ELT or in the ARM position for automatic operation upon impact of the airplane.

The Narco ELT 10 is installed with a three-position remote switch (TEST-ARM-XMIT) on airplanes E-2424 thru E-2693, EA-480 thru EA-530 and CE-1241 thru CE-1646. The TEST and XMIT position are used for testing the ELT. The ARM position is used for automatic operation upon impact of the airplane.

The Narco ELT 10 has a control switch decaled ON-OFF-ARM. The ELT can be removed from the airplane and used as a portable unit. In this event, the ELT control switch would be placed in the ON position to transmit continuously. The OFF position on the ELT prevents operation of the unit and the ARM position is used to arm the impact switch for automatic actuation upon impact of the airplane.

The Narco ELT 10 can be replaced with the Artex ELT 110-4 by Kit No. 101-3127-1.

DORNE AND MARGOLIN ELT
(Figure 3)

The Dorne and Margolin ELT is installed on airplanes CE-1033 thru CE-1240, CJ-156 and after, E-2148 thru E-2423 and EA-412 thru EA-479.

An AUTO-OFF-ON control switch located on the ELT controls the operation of the unit. When the switch is on the ON position, the ELT will transmit for testing or manual operation. The AUTO position arms an impact switch which will actuate the ELT automatically upon impact of the airplane. The OFF position prevents operation of the ELT. A remote TEST-AUTO-XMIT switch is used for testing and manual actuation of the ELT. The TEST position is a momentary switch which will cause the ELT to transmit. The XMIT position turns the unit on for manual operation and the AUTO position arms the unit to operate when the impact switch is actuated upon impact of the airplane.

The Dorne and Margolin ELT can be replaced with the Artex ELT 110-4 by Kit No. 101-3127-1.

ARTEX ELT 110-4
(Figure 4)

The Artex ELT 110-4 is installed on airplanes CE-1647 and after, E-2694 and after and EA-531 and after.

An ON-OFF control switch on the ELT controls the operation of the unit. When the switch is in the ON position, the ELT will transmit for testing or manual operation. Place the switch in the OFF position to discontinue the transmission. An internal impact switch will actuate the ELT automatically upon impact of the airplane. The remote ARMED/RESET-ON switch is used to arm the ELT or to manually actuate the ELT. When placed in the ON position, the ELT will transmit. The ARMED/RESET position arms the ELT to operate automatically upon impact of the airplane. To reset the ELT, cycle the control switch on the ELT to the ON position, then to the OFF position, and cycle the remote switch to the ON position, then to the ARMED/RESET position.

EMERGENCY - MAINTENANCE PRACTICES

EMERGENCY LOCATOR TRANSMITTER MAINTENANCE

Maintenance on the ELT is normally limited to replacing the battery. The following is a list of the various conditions which warrant battery replacement:

a. Visual inspection shows signs of leakage, corrosion or unsecured leads.

b. Elapsed replacement date noted on the battery case (this date represents 50% of the useful life of the battery).

NOTE

The useful life of the battery is the length of time which the battery may be stored without losing its ability to continuously operate the ELT for 48 hours.

c. After any emergency use.

d. After one cumulative hour of use.

e. After operation of unknown duration.

f. If the transmitter is stored in an area where the temperature is normally above 100°F (38°C), the battery life will be shortened.

CAUTION

Avoid storing the batteries at temperatures in excess of 130°F (55°C).

Information on battery life and replacement is included in the data furnished with each ELT, and is usually placarded on the battery.

NOTE

Replacement batteries should be obtained only from ELT and aircraft manufacturers or other acceptable suppliers, since the condition and useful life of over-the-counter batteries, such as those sold for flashlights, portable radios, etc., are usually unknown.

CAUTION

The ELT switch should not be turned ON unless the ELT is connected to its associated antenna or a 50-ohm dummy load.

COMMUNICATIONS COMPONENTS CORPORATION BATTERY REPLACEMENT

NOTE

Kit No. 101-3127-1 (Artex ELT 110-4) or Kit No. 101-3046-1 (Narco ELT 10) may be installed on these airplanes. Refer to the appropriate procedure when one of these kits is installed on your airplane.

a. Remove the cabin aft upholstery panel to gain access to the aft fuselage.

b. Place the ARM-OFF-ON switch on the ELT in the OFF position.

c. Disconnect the antenna cable. On the TR70-13 ELT, disconnect the remote switch wiring.

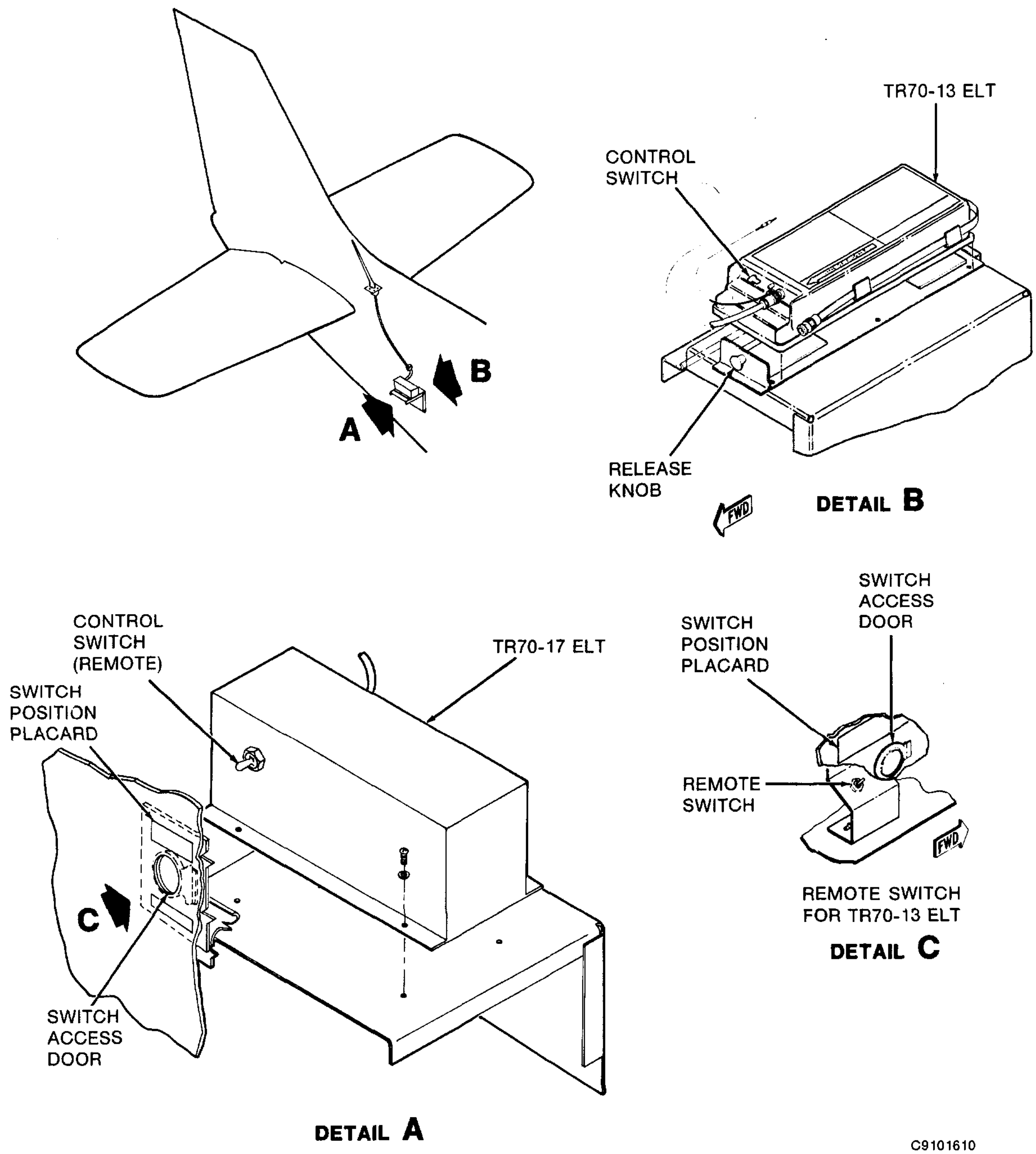
d. On the TR70-17 ELT, remove four screws attaching the ELT to the mounting bracket. On the TR70-13 ELT, rotate the release knob on the base to release the ELT. Remove the ELT from the airplane.

e. Remove the screws which hold the mounting base on the transmitter and remove the base.

f. Remove the old battery and disconnect the electrical connector. Discard the old battery.

WARNING

DO NOT discard the battery in a fire.



Communications Components Corporation Installation
Figure 1

g. Inspect for, and properly treat, any corrosion that may be indicated in the area where the battery was installed.

h. Connect a fresh battery and install it in the compartment.

i. Replace the base and screws.

j. Install the transmitter in the airplane and attach the antenna cable. On the TR70-13 ELT, connect the remote switch wiring.

k. The new replacement date should be marked on the ELT in a visible area. This will aid in future inspections of the ELT. This date is 50% of the useful life of the battery as defined by the battery manufacturer.

l. Test the ELT as instructed in TESTING THE EMERGENCY LOCATOR TRANSMITTER.

m. Install the cabin aft upholstery panel.

NARCO BATTERY REPLACEMENT (Figure 2)

NOTE

Kit No. 101-3127-1 (Artex ELT 110-4) may be installed on these airplanes. Refer to the Artex ELT 110-4 procedure when this kit is installed on your airplane.

a. Remove the cabin aft upholstery panel to gain access to the aft fuselage.

b. Place the ARM-OFF-ON control switch on the ELT in the OFF position.

c. Disconnect the antenna cable from the ELT. Disconnect the remote switch wiring from the terminals on the ELT.

d. Unlatch the mounting strap and remove the ELT from the airplane.

e. Extend the portable antenna.

CAUTION

To avoid damage to the antenna or the plastic tab on the upper end, care must be exercised in extending the portable antenna and handling the control head.

f. Remove the four screws attaching the control head to the battery casing and slide the control head and battery case apart. The battery connection leads are approximately 3-inches long.

NOTE

Do not remove the sealant on the inside lip of the battery pack or a watertight seal will not be made when the ELT unit is reassembled.

g. Disconnect the battery by unsnapping the battery terminals from the bottom of the transmitter PC board. Discard the old battery.

WARNING

DO NOT discard the battery in a fire.

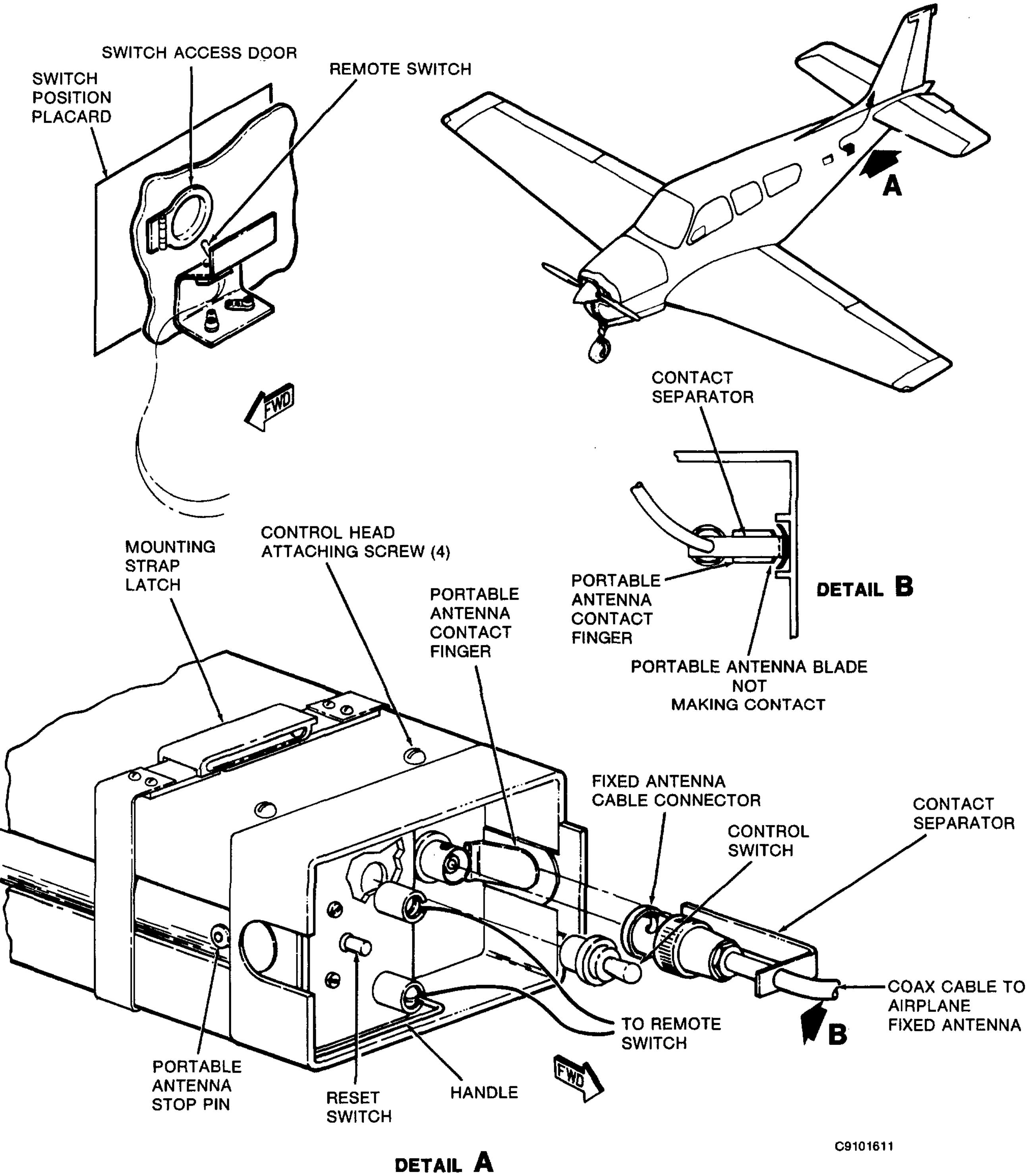
h. Inspect for and properly treat any corrosion that may be indicated in the area where the battery was installed.

i. Connect the terminals of the new battery to the bottom of the transmitter PC board.

j. Using a spatula, apply a bead of sealant (supplied with each battery pack) around the area of the control head which is joined with the battery case when reassembled.

NOTE

This sealant provides a watertight seal when the unit is assembled.



Narco ELT 10 Installation
Figure 2

k. Insert the control head section into the battery case, being careful not to pinch the wires and install the four attaching screws. Wipe any excess sealant from the outside of the unit.

NOTE

If the four screw holes do not line up, rotate the battery case 180° and reinsert.

l. Stow the portable antenna.

CAUTION

Exercise extreme care in order to avoid damage to the antenna or the plastic tab on the upper end.

m. Install the transmitter in the airplane and secure the mounting strap.

n. Connect the fixed antenna cable to the ELT. Ensure that the contact (plastic) separator is inserted between the portable antenna contact and the portable antenna as shown in Figure 2.

NOTE

With the contact separator not in place, a very weak signal may be transmitted, which is strong enough for a functional test, but too weak for emergency use.

o. Connect the remote switch wiring to the terminals on the ELT.

p. Press the RESET button and place the ARM-OFF-ON switch on the ELT in the ARM position.

q. The new replacement date should be marked on the ELT in a visible area. This will aid in future inspections of the ELT. This date is 50% of the useful life of the battery as defined by the battery manufacturer.

r. Test the ELT as instructed in TESTING THE EMERGENCY LOCATOR TRANSMITTER in this chapter.

s. Install the cabin aft upholstery panel.

DORNE AND MARGOLIN BATTERY REPLACEMENT (Figure 3)

NOTE

Kit No. 101-3127-1 (Artex ELT 110-4) or Kit No. 101-3046-1 (Narco ELT 10) may be installed on these airplanes. Refer to the appropriate procedure when one of these kits is installed on your airplane.

a. Remove the cabin aft upholstery panel to gain access to the aft fuselage.

b. Make certain the ELT is turned off.

c. Disconnect the antenna cable.

d. Disconnect the remote switch.

e. Remove the screws holding the ELT in place.

f. Remove the ELT from the airplane.

g. Remove the screws from the bottom of the ELT and remove the bottom.

h. Disconnect the battery and discard it.

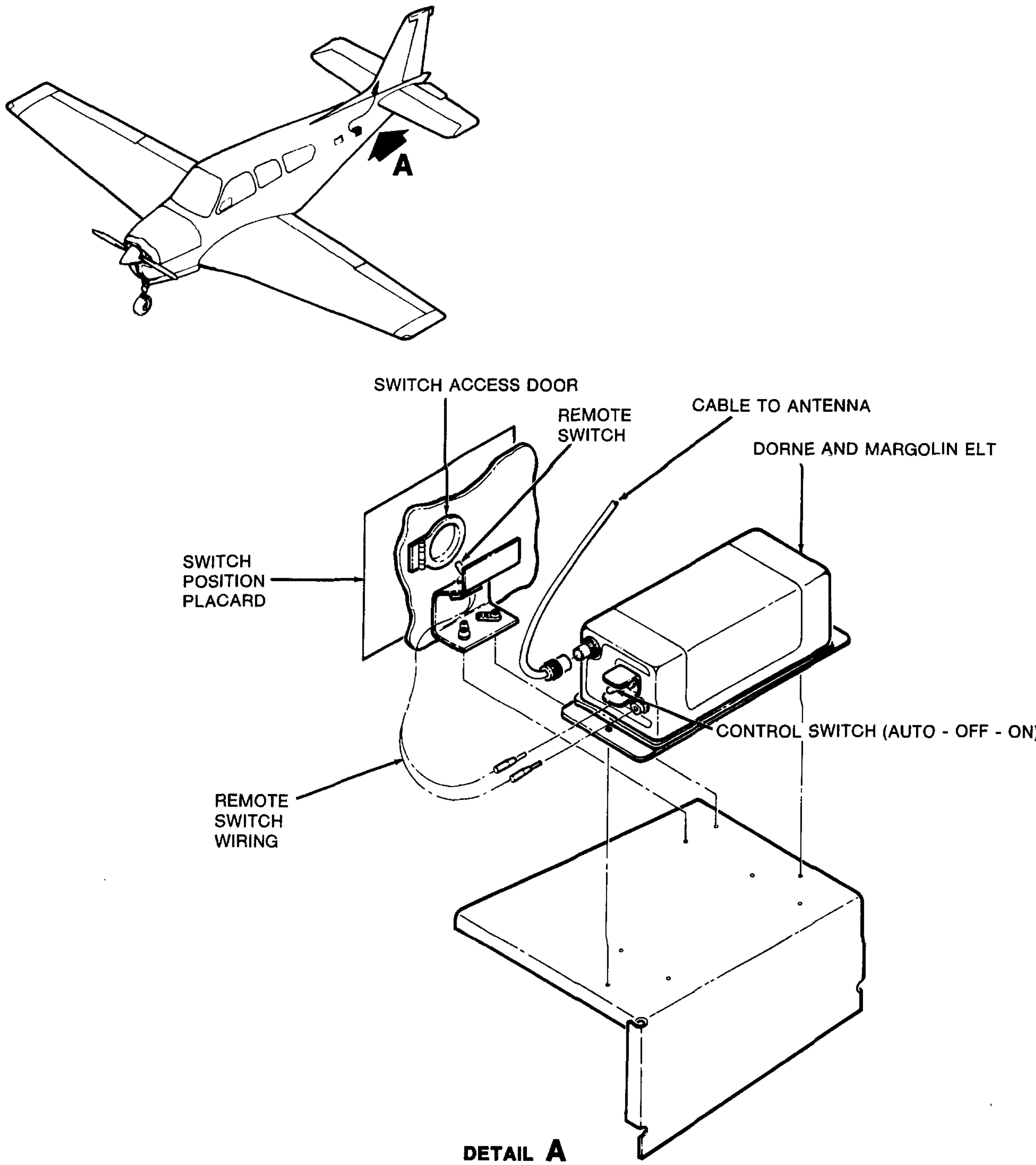
WARNING

DO NOT discard the battery in a fire.

i. Inspect for and properly treat any corrosion that may be indicated in the area where the battery was replaced.

j. Connect the new battery.

k. The new replacement date should be marked on the ELT in a visible area. This will aid in future inspections of the ELT. This date is 50% of the useful life of the battery as defined by the battery manufacturer.



Dorne And Margolin ELT Installation
Figure 3

l. Install the bottom of the ELT and the screws.

m. Install the ELT in the airplane and install the screws which hold it in place.

n. Test the ELT as instructed in TESTING THE EMERGENCY LOCATOR TRANSMITTER in this chapter.

o. Install the cabin aft upholstery panel.

ARTEX ELT 110-4 BATTERY PACK REPLACEMENT (Figure 4)

NOTE

This procedure must be used for airplanes that have Kit No. 101-3127-1 installed on them.

a. Remove the cabin aft upholstery panel to gain access to the aft fuselage.

b. Place the control switch (12) on the ELT in the OFF position.

c. Loosen the two thumb screws (1) securing the mounting frame cap (2) to the mounting frame base (5).

d. Disconnect the antenna cable (4) from the ELT.

e. Disconnect the remote switch harness (3) from the ELT (11).

f. Remove the ELT (11) from the mounting frame base (5).

g. Disconnect the battery pack connector (10) from the ELT.

h. Remove the screws (8) securing the battery pack to the ELT (11).

WARNING

Do not discard battery pack in a fire.

NOTE

Replacement battery packs should be obtained only from ELT and airplane manufacturers or from other acceptable suppliers, since the condition and useful life of over-the-counter batteries, such as those sold for flashlights, portable radios, etc., are usually unknown.

i. Inspect for and properly treat any corrosion that may be indicated in the area where the battery was installed.

j. A new battery pack replacement date must be marked on the outside of the transmitter. The date is 50% of the useful life of the battery pack as defined by the battery pack manufacturer.

k. Connect the battery pack electrical connector (10).

l. Secure the battery pack to the ELT with the screws (8). Make certain that all gaskets are properly aligned and in good condition.

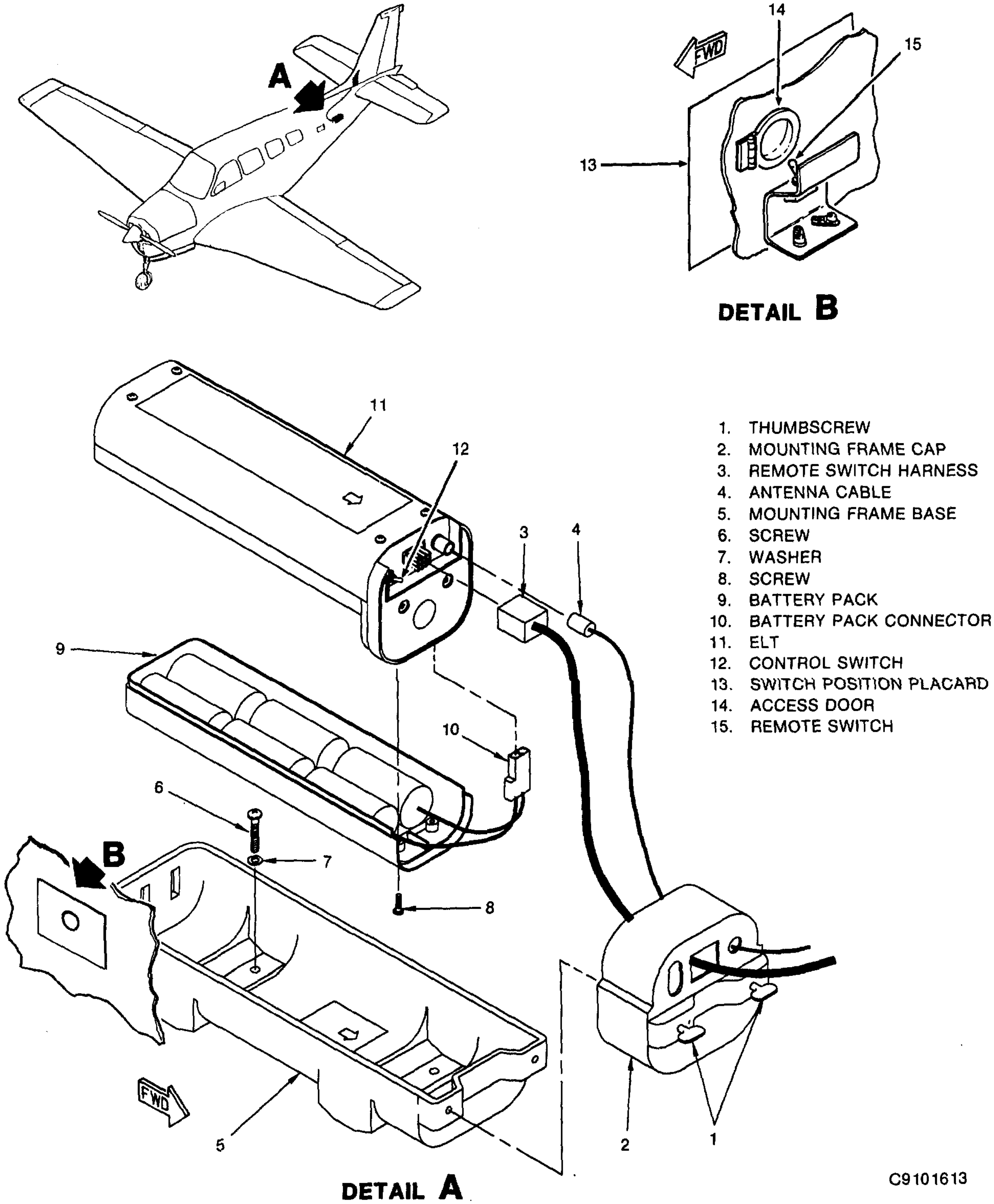
m. Insert the antenna cable (4) through the mounting frame cap (2) and connect to the ELT (11).

n. Insert the remote switch harness (3) through the mounting frame cap (2) and connect to the ELT (11).

o. Install the ELT (11) in the mounting frame base (5). Position the ELT in the mounting frame base so that the arrow on the top of the ELT is pointed in the direction of flight.

p. Install the mounting frame cap (2) onto the mounting frame base (5) and secure with the thumb screws (1).

q. Place the control switch (12) on the ELT in the OFF position.



Artex Elt 110-4 Installation
Figure 4

r. Test the ELT as instructed in TESTING THE EMERGENCY TRANSMITTER in this chapter.

s. Install the cabin aft upholstery panel.

TESTING THE EMERGENCY LOCATOR TRANSMITTER

Any time maintenance is performed on the ELT, the following operational test must be performed. The FAA/DOT allows free space transmission tests from the airplane anytime within five minutes after each hour. The test time is generally three sweeps of the warble tone, or approximately a one-second test. The control tower should be notified that a test is about to be performed.

Improper testing of the ELT could trigger false alerts and create frequency jamming of real emergency transmissions. Be certain that all procedures are closely followed and that monitoring of frequencies occurs to ensure the ELT switches are placed in the proper positions after testing is complete. If the test is performed with the ELT removed from the airplane, Federal Communications Commission regulations require the testing be done in a screened or shielded test room, or in a test enclosure that will hold the self-contained ELT and an antenna.

CAUTION

The ELT switch must not be placed in the ON position unless the ELT is connected to its associated antenna or a 50-ohm dummy load.

NOTE

Tests should not be longer than three audio sweeps. One audio sweep may be defined as amplitude modulating the carrier with an audio frequency sweeping downward over a range of not less than 700 Hz, within the range 1600 to 300 Hz, and a sweep repetition rate between two and four Hz. Tests should be conducted only in the first five minutes of any hour. If the operational tests must be made at a time not included within the first five minutes after the hour, the tests should be coordinated with the nearest FAA tower or flight service station.

Operational testing of installed ELTs must be accomplished by the following appropriate procedure:

TESTING THE COMMUNICATIONS COMPONENTS CORPORATION ELT TR70-13 AND TR70-17 (Figure 1)

a. Turn on the airplane's COMM-1 and tune it to 121.5 MHz.

b. Turn the COMM-1 audio switch to the SPEAKER position and place the volume control in the center of its range.

NOTE

Monitor a frequency on COMM 1 to be certain the radio is operating.

c. Place the TR70-17 ELT switch to ON or the TR70-13 remote switch to XMIT for approximately one second and monitor the ELT signal.

NOTE

A distinctive downward sweeping tone should have been heard from the monitoring receiver during the test. If the tone was heard, the ELT is functioning properly. If there was no audible tone (assuming that the VHF transceiver is operating properly), the battery is probably disconnected, outdated or discharged.

d. After the test, place the TR70-17 ELT switch to the OFF position or the TR70-13 ELT remote switch to the REARM position. The audio signal should disappear completely.

e. Place the ELT switch in the ARM position. There should be no audible signal present.

f. If the ELT continues to operate, check that the remote switch is in the ARM position.

g. On the TR70-17 ELT, place the control switch to ON, then place it firmly in the ARM position. On the TR70-13 ELT, gain access to the ELT control switch and place it in the OFF position. The audio signal should stop. Reset the TR70-13 ELT to the ARM position.

TESTING THE NARCO ELT 10 (Figure 2)

a. Turn on the airplane's COMM-1 and tune it to 121.5 MHz.

b. Turn the COMM-1 audio switch to the SPEAKER position and place the volume control in the center of its range.

NOTE

Monitor a frequency on COMM 1 to be certain the radio is operating.

c. Place the remote ELT (TEST-AUTO-XMIT, XMIT-ARM) switch to XMIT for approximately one second and monitor the ELT signal.

NOTE

A distinctive downward sweeping tone should have been heard from the monitoring receiver during the test. If the tone was heard, the ELT is functioning properly. If there was no audible tone (assuming that the VHF transceiver is operating properly), the battery is probably disconnected, outdated or discharged.

d. After the test, place the remote TEST-AUTO-XMIT switch to the AUTO position or the XMIT-ARM switch to the ARM position. The audio signal should disappear completely.

e. If the ELT continues to operate, check that the remote XMIT- ARM switch is in the ARM position or the TEST-AUTO-XMIT switch is in the AUTO position.

f. If the ELT continues to send a signal, gain access to the ELT and firmly press the reset switch on the front of the ELT and listen to ensure that the audio signal disappears from the COMM 1. The ELT's control switch must be in the ARM position when completing the test procedure.

TESTING THE DORNE AND MARGOLIN ELT (Figure 3)

a. Turn on the airplane's COMM 1 and tune it to 121.5 MHz.

b. Turn the COMM-1 audio switch to the SPEAKER position and place the volume control in the center of its range.

NOTE

Monitor a frequency on COMM 1 to be certain the radio is operating.

c. Place the remote TEST-AUTO-XMIT switch in the TEST position and hold the switch for approximately one second.

NOTE

A distinctive downward sweeping tone should have been heard from the monitoring receiver during the test. If the tone was heard, the ELT is functioning properly. If there was no audible tone (assuming that the VHF transceiver is operating properly), the battery is probably disconnected, outdated or discharged.

d. After the test, place the remote TEST-AUTO-XMIT switch in the AUTO position.

e. Monitor the emergency channel to ensure the ELT has discontinued operation.

f. If the ELT continues to operate, be certain the remote switch is in the AUTO position. Gain access to the ELT and check that the control switch is in the AUTO position also.

g. If the ELT still continues to send a signal, cycle the control switch on the ELT to the ON position and then to the AUTO position to reset the ELT impact switch.

TESTING THE ARTEX ELT 110-4 (Figure 4)

a. Turn on the airplane's COMM 1 and tune it to 121.5 MHz.

b. Turn the COMM-1 audio switch to the SPEAKER position and place the volume control in the center of its range.

NOTE

Monitor a frequency on COMM 1 to be certain the radio is operating.

c. Place the remote ARMED/RESET-ON switch in the ON position for approximately one second.

NOTE

A distinctive downward sweeping tone should have been heard from the monitoring receiver during the test. If the tone was heard, the ELT is functioning properly. If there was no audible tone (assuming that the VHF transceiver is operating properly), the battery is probably disconnected, outdated or discharged.

d. After the test, place the remote ARMED/RESET-ON switch in the ARMED/RESET position.

e. Monitor the emergency channel to ensure that the ELT has discontinued operation.

f. If the ELT continues to operate, be certain the remote switch is in the ARMED/RESET position. Gain access to the ELT and check that the control switch is in the OFF position also.

g. If the ELT still continues to send a signal, cycle the control switch on the ELT to the ON and then OFF position and the remote switch to the ON and then ARMED/RESET position to reset the ELT impact switch.

"END"

CHAPTER 27

FLIGHT CONTROLS

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS (Continued)

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS

SUBJECT *PAGE*

27-30-00

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS (Continued)

CHAPTER 27 - FLIGHT CONTROLS

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE	CH-SE-SU	PAGE	DATE
27-LOEP	1	Mar 31/05	27-30-00	1 thru 6C	Aug 18/95
				7	Jun 20/91
27-CONTENTS	1 thru 4	Mar 31/05		8 and 9	May 31/85
27-00-00	1 and 2	Sep 30/03		10	Oct 7/83
				11	May 31/85
27-10-00	1 thru 11	Mar 31/05		12 thru 12B	Jun 20/91
27-11-00	1 thru 18	Sep 30/03		13	Oct 7/83
27-20-00	1 thru 6	Feb 26/99	27-31-00	1	May 9/80
27-21-00	1	Mar 29/96	27-50-00	1 thru 13	Sep 30/03
	2	Aug 18/95	27-70-00	1	May 9/80
	3 thru 15	Mar 29/96			

FLIGHT CONTROLS - DESCRIPTION AND OPERATION

CONTROL SURFACES

All Model F33A, F33C, V35B and A36TC airplanes and earlier Model A36 and B36TC airplanes are equipped with either a single throw-over or dual T control column. At serials E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After, dual control columns were installed as standard equipment. The flight controls are cable operated conventional surfaces which require no power assistance for normal control by the pilot or copilot. The flaps and optional electric elevator trim are electrically driven.

All primary flight control surfaces are manually controlled through cable bell crank systems. Each system incorporates surface travel stops and linkage adjustments. The ailerons, elevators and rudder may be secured with control locks (gust locks) in the flight compartment. When these locks are installed, the elevator is at approximately 11° down and the control wheel is approximately 12° to the right. The rudder pedals are interconnected by a linkage below the flight compartment floor. The rudder pedals are adjustable to two positions by pressing the spring-loaded lever on the side of the pedal. If brakes are not installed on the copilot's pedals, this same lever may be used to place the copilot's pedals against the floor.

One flap installed on each wing is operated by an electric motor-driven gearbox on the rear side of the front spar at the centerline of the airplane. The gearbox drives two flexible drive shafts, each connected to an acme thread type jackscrew at each flap. The flaps are controlled by a lever in the subpanel, and their position indicated by an instrument to the left of the control column. The lever (switch) must be pulled out of a detent to change positions. On airplane serials CJ-149; CE-748, CE-772 thru CE-815; D-10097, D-10120 thru D-10178; E-1111, E-1241 thru E-1370, the flaps may be stopped at any desired position by moving the flap switch to the OFF position when the flaps are at the desired position. The switch is placarded UP, OFF and DOWN. The markings on this position indicator will be 10°, 20° and DN.

NOTE

On serials E-1946, E-2104, E-2111 and After, the approach position is 12°.

On airplane serials CJ-150 and After; CE-816 and After; D-10179 and After; E-1371 thru E-2110 except E-1946 and E-2104; EA-1 and After, the flaps have three positions: UP (0°), APPROACH (15°) and DOWN (30°). The switch is placarded UP, APPROACH and DOWN. There is no way to stop the flaps in other positions without using the circuit breaker. The flap position transmitter (if installed) is located near the left flap actuator.

On airplane serials E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After, the position of the flaps is indicated by three lights, located near the flap control handle, in the subpanel. The lights will indicate down, approach and in-transit positions. All lights are out when the flaps are up.

Trim tabs are installed on each elevator. The tabs are manually controlled by the pilot through drum-cable systems using jackscrew actuators. Tab position indicators are provided on the tab controls.

The optional electric elevator trim tab is operated by a control switch on the outboard handle of the pilot's control wheel. A down spring and bob weight are incorporated into the elevator control system for improved stability.

On earlier serials, aileron trimming was performed by bendable tabs on each aileron and a spring tension trimmer in the control column. The bendable tabs were adjustable only on the ground. The spring tension trimmer was adjustable in flight.

The spring tension trimmer and left bendable tab were replaced by an inflight adjustable trim tab at serials E-2111 and After, except E-1946 and E-2104, and on serials EA-320, EA-389 and After. This system is a cable control system with a jackscrew actuator and a trim wheel in the pedestal.

Positive stops on the primary flight control surfaces limit their travel, and traveling stops secured to the cables limit trim tab movement. Because the cables are connected at turnbuckles, each cable has one left hand and one right hand threaded cable end. Proper routing of the cables as shown in the applicable sub-chapter will aid against crossing the cables, and causing improper movement after the cables have been removed and reinstalled.

Refer to the applicable rigging procedures for details regarding chain and cable tension, control wheel movement and force, and down spring force and system friction.

EFFECT OF TEMPERATURE UPON CABLE TENSION

Graphs specifying the correct maximum and minimum cable tension permissible for the various controls appear on the individual control system illustrations. The graphs provide rigging limits at temperatures varying from 0° to 110° F. The horizontal scale on the graphs designates the temperature in degrees Fahrenheit at which the control cables may be rigged, and the vertical scale designates the correct tension in pounds for each temperature reading.

TAPER PINS

Refer to the applicable rigging procedures for details regarding chain and cable tension, control wheel movement and force, and system friction. Any time the control column has been removed and disassembled, the following precautions should be observed:

CAUTION

The taper pin may crack the torque tube if driven excessively.

a. When taper pins are to be installed, use a light weight rawhide or nylon mallet to set the pin. The small end of the tapered shank should be flush with, or extend no more than 0.06 inch over the surface.

WARNING

On airplane serials E-1946, E-2104, E-2111 and After; EA-320, E-389 and After, observe the color on all parts when replacing or reinstalling control cables, bellcranks and/or other control system components. DO NOT connect coded parts of one color to coded parts of different color.

AILERON AND TAB - MAINTENANCE PRACTICES (D-10097, D-10120 AND AFTER; CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 THRU E-2110, EXCEPT E-1946 AND E-2104; EA-11 THRU EA-388, EXCEPT EA-320)

SINGLE THROW-OVER CONTROL COLUMN

CONTROL COLUMN ARM REMOVAL

a. Remove the four screws that secure the retainer collar assembly to the control column housing (Ref. Figure 1).

b. Disconnect any electrical wiring.

c. Remove the aileron trimmer. Perform the AILERON CONTROL TRIMMER REMOVAL procedure.

d. Pull the T handle located on the forward side of the control arm.

e. Rotate the control column arm to the nearly vertical position and slide the control column arm off the housing.

CONTROL COLUMN ARM INSTALLATION

a. Position the control column arm vertical (Ref. Figure 1). Make sure that the slot in the lower sprocket is approximately parallel to the sides of the arm and that the turnbuckles between the long and short chains are opposite each other near the access opening.

b. The ailerons MUST be in the neutral position.

c. Pull the T handle located on the forward side of the control arm.

d. Slide the control column arm on the control column housing.

e. Connect all electrical wiring.

f. Install the retainer collar and attach it with the four screws.

g. Install the aileron trimmer. Perform the AILERON CONTROL TRIMMER INSTALLATION procedure.

h. Check the control column for full movement and the control surfaces for proper direction of movement.

RIGGING THE CONTROL ARM CHAIN

a. Position the control arm, control wheel and sprockets (Ref. Figure 1). The long and short chains must be centered on the sprockets within one link. The turnbuckles must be near the access opening. The slot in the lower sprocket should be approximately parallel to the sides of the arm.

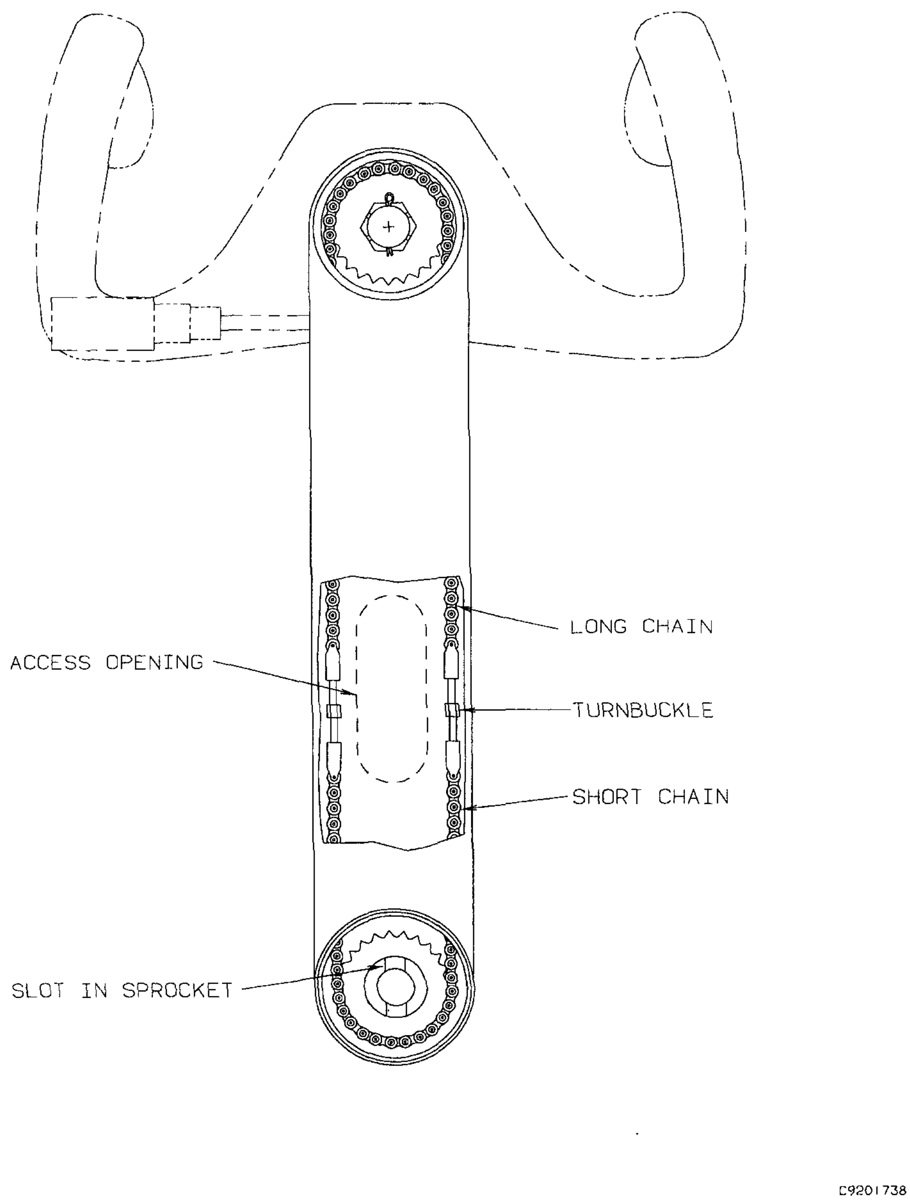
b. Remove the safety wire from the turnbuckles and loosen or tighten the chain as necessary.

NOTE: Tighten the chain until friction or binding is felt on the control wheel, then loosen the chain just enough to remove the binding or friction from the control wheel.

c. Check the control wheel and control surfaces for proper operation and freedom of movement.

d. After the adjustments are complete, check that the location of the control wheel, sprockets and turnbuckles are as shown (Ref. Figure 1).

e. Safety wire the turnbuckles.



Single Throw-Over Control Column
Figure 1

DUAL CONTROL ARM

DUAL CONTROL ARM REMOVAL

a. Remove the four screws that secure the retainer collar assembly to the control column housing (Ref. Figure 2).

NOTE: Some installations may have a T handle on the right forward side of the control arm. Pull the T handle and omit the following step.

b. Remove the screw and washer retaining the pin assembly on the right forward side of hub of the control arm.

c. Disconnect all electrical wiring.

d. Slide the control arm off the installation.

DUAL CONTROL ARM INSTALLATION

a. Position the control arm as shown (Ref. Figure 2).

b. Make sure the slot in the center sprocket is approximately vertical and the turnbuckles between the long chains and the short chains are opposite each other near the access openings.

c. The ailerons MUST be positioned at neutral.

NOTE: Some installations may have a T handle on the right forward side of the control arm. Pull the T handle.

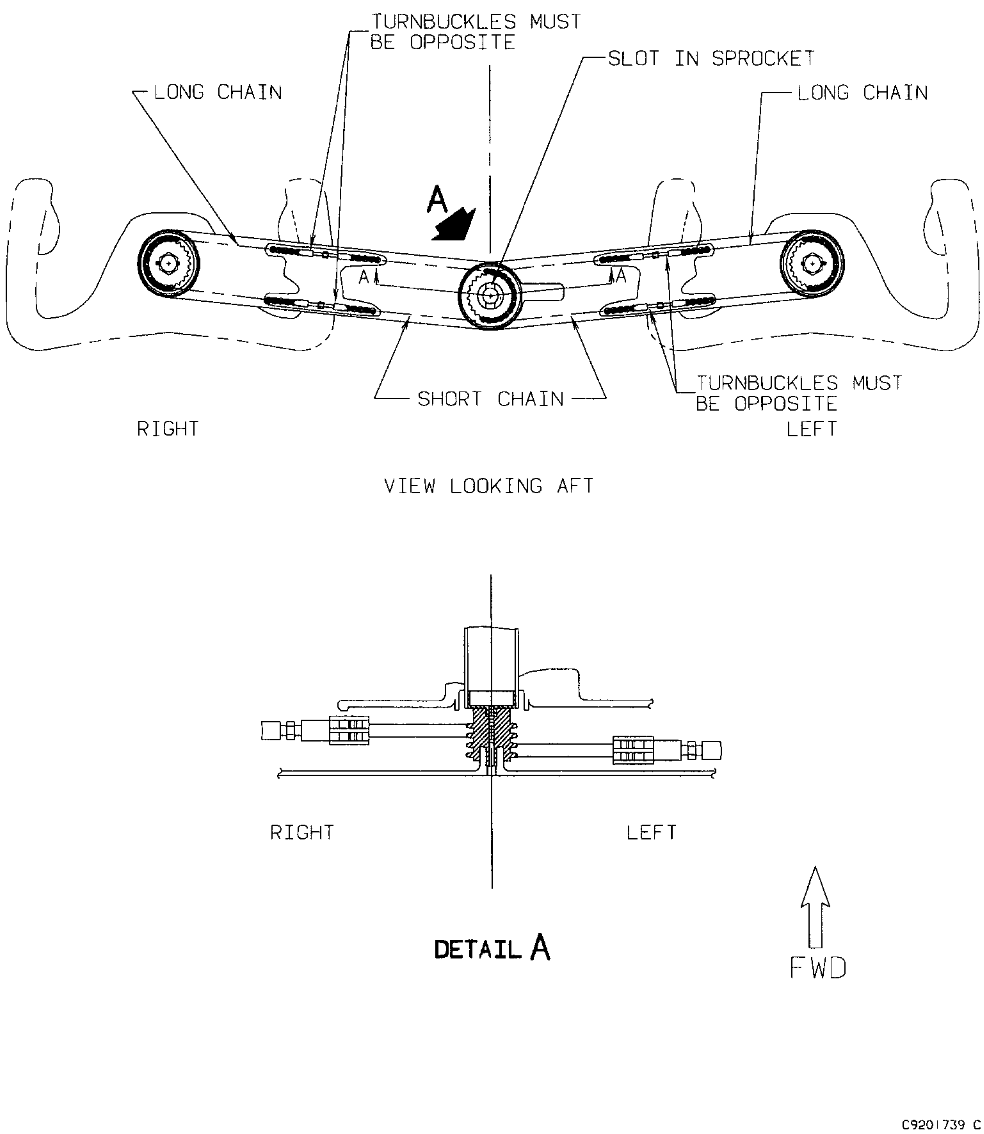
d. Slide the control column arm on the control column housing.

NOTE: On installations with a T handle, omit the next step.

e. Install the pin assembly on the right side of the control arm hub.

f. Install the retainer collar and attach it with the four screws.

g. Check for full control movement and for proper direction of movement.



Dual Control With Single Control Column
Figure 2

RIGGING THE DUAL CONTROL ARM CHAIN

a. Position the control arm, control wheel and sprocket as shown (Ref. Figure 2).

b. Center the long and short chains on their sprockets within one link.

c. The slot in the center sprocket must be approximately vertical as shown.

d. Remove the safety wire from the turnbuckles.

e. Adjust the chains as necessary.

NOTE: The chains are properly adjusted by tightening the chains until binding is noticed on the control wheel; then loosen the chains just enough to remove the binding or friction from the control wheel.

f. After the adjustments are complete, check that the location of the control arm, control wheels, sprockets and turnbuckles are as shown.

g. Safety wire the turnbuckles.

h. Check the controls for freedom of movement and the control surfaces for proper direction of movement.

AILERON REMOVAL

a. Support the aileron and remove the two attaching screws from the top and bottom of each hinge bracket.

b. Pull the aileron straight away from the wing to avoid damage to the attaching areas.

c. Remove the screws attaching the bonding cable to the aileron.

AILERON INSTALLATION

a. Attach the bonding cable to the aileron.

b. Place the aileron in position on the hinge brackets. The hinge brackets must be in the correct place between the aileron skin and the reinforcing structure.

c. Install the upper and lower hinge bracket screws.

d. Pull on the aileron in a direction straight away from the wing to make sure that the hinge brackets are positioned correctly. If there is any movement of the aileron, recheck the position of all hinge brackets.

RIGGING THE AILERON CONTROL SYSTEM

NOTE: Raytheon Aircraft Company recommends the use of the aileron travel gage. Refer to Chapter 12-20-00, SPECIAL TOOLS. The front of the travel gage should be located over the leading edge skin splice with the aft portion over the number 8 wing rib (just outboard of the inboard aileron hinge).

a. Aileron and flap surfaces must align with the upper and lower surfaces of the wing within 1/16 inch.

b. Adjust the aileron downstops in the wing until the bellcrank just clears the gusset on the wing rib. Set the aileron upstop in the wing so that the aileron bellcrank just misses the aileron pushrod (Ref. Figure 3).

c. Adjust the link connecting the aileron to the bellcrank to allow full travel of the aileron surface between the upstop and downstop.

NOTE: The aileron is in neutral when the aileron trailing edge aligns with the trailing edge of the wing, and its inboard end is parallel with the outboard end of the flap.

d. Adjust the cables from the wing to the control column cables. The turnbuckles are in the wheel wells.

e. Secure the control column wheel in neutral by securing a bar across the top of the control wheel and leveling the control wheel with a bubble level. (With the control locks installed, the control wheel is rotated 12° to the right). Adjust the tension as shown on the aileron temperature cable tension graph (Ref. Figure 3).

NOTE: The control wheel must be level in relation to the airplane. If the airplane is not level, make a corresponding change to the position of the control wheel using a spirit level protractor.

Take the cable reading in the wheel well where the control column cables attach to the wing cables.

f. Rotate the control wheel to ascertain by feel that the wing bellcranks reach their stops before the control column reaches its stops.

g. If there is less travel of the control wheel in one direction than in the other direction, loosen one turnbuckle on the lower cable and tighten the opposite lower cable turnbuckle, depending on which way the travel is off. Maintain the correct cable tension.

h. Secure the control wheel in neutral after the correct travel of the wheel is obtained. Adjust the link connecting the aileron to the wing bellcrank to obtain the aileron in neutral. Neutral position of the aileron is determined by aligning the inboard end of the aileron with the outboard end of the flap with the flap in the up position.

i. Set the bellcrank stops to give a deflection of 20 ± 2° up and/or down (Ref. Figure 3).

NOTE: The aileron bellcrank stops should make contact 1/16 inch before the control column stops are reached.

j. Be sure each aileron bellcrank contacts its upstop at the same time as the bellcrank in the opposite wing contacts its downstop.

k. Check the control stop (secondary stop) in the control column for 1/16 inch clearance in each direction. If the clearance is not correct, recheck the entire aileron control system for correct chain and cable rigging.

NOTE: The control stop clearance provides a slight movement of the control wheel (a cushion) after the travel stops and the aileron bellcranks make contact.

l. Recheck cable tension and safety wire the turnbuckles.

m. Tighten all jam nuts.

WARNING: Check the ailerons for correct direction of movement. When the control wheel is moved to the left, the left aileron must move up and the right aileron must move down. When the control wheel is moved to the right, the right aileron must move up and the left aileron must move down.

Check to make sure that cabin floorboards, floorboard insulation and other interior parts do not contact the control cables.

AILERON CONTROL TRIMMER (SINGLE CONTROL COLUMN AIRPLANES)

The aileron control system is equipped with an aileron control trimmer which functions by applying tension on the aileron control cables to level the wings as needed. The holding pressure exerted by the aileron control trimmer can be easily overridden at the discretion of the pilot. The trimmer does not change the system rigging but should be removed before checking the cable tension.

TRIMMER REMOVAL

a. Unscrew the two body halves by holding the clutch body housing (outer half) and turning the clutch body nut (inner half) counterclockwise (Ref. Figure 4).

b. Separate the two body halves by pulling out on the clutch body housing.

TRIMMER INSTALLATION

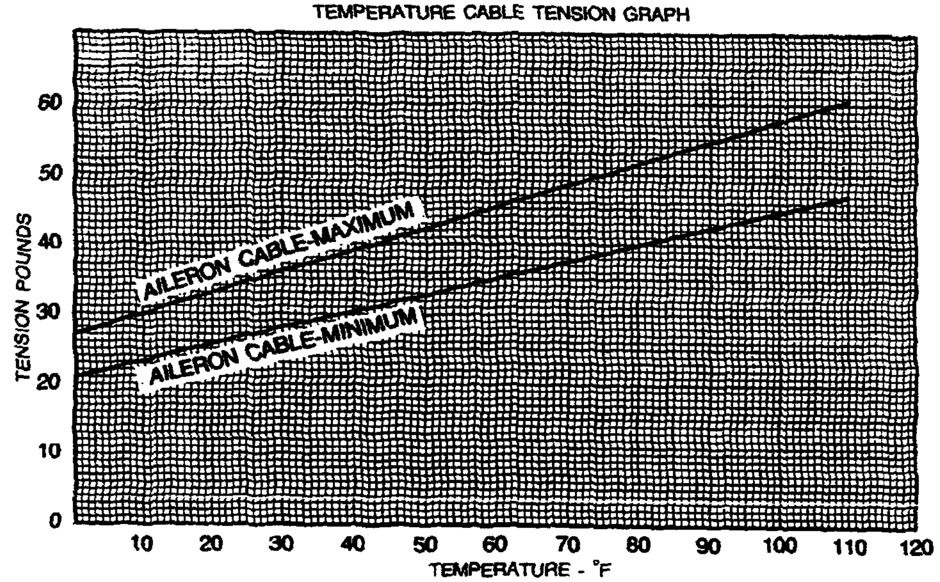
a. Carefully insert the shaft through the felt seal into the hub bearing, being careful not to shear the felt seal.

b. Screw the two halves of the unit together by holding the clutch body and turning the clutch body nut. Hand tightening the two halves should be sufficient.

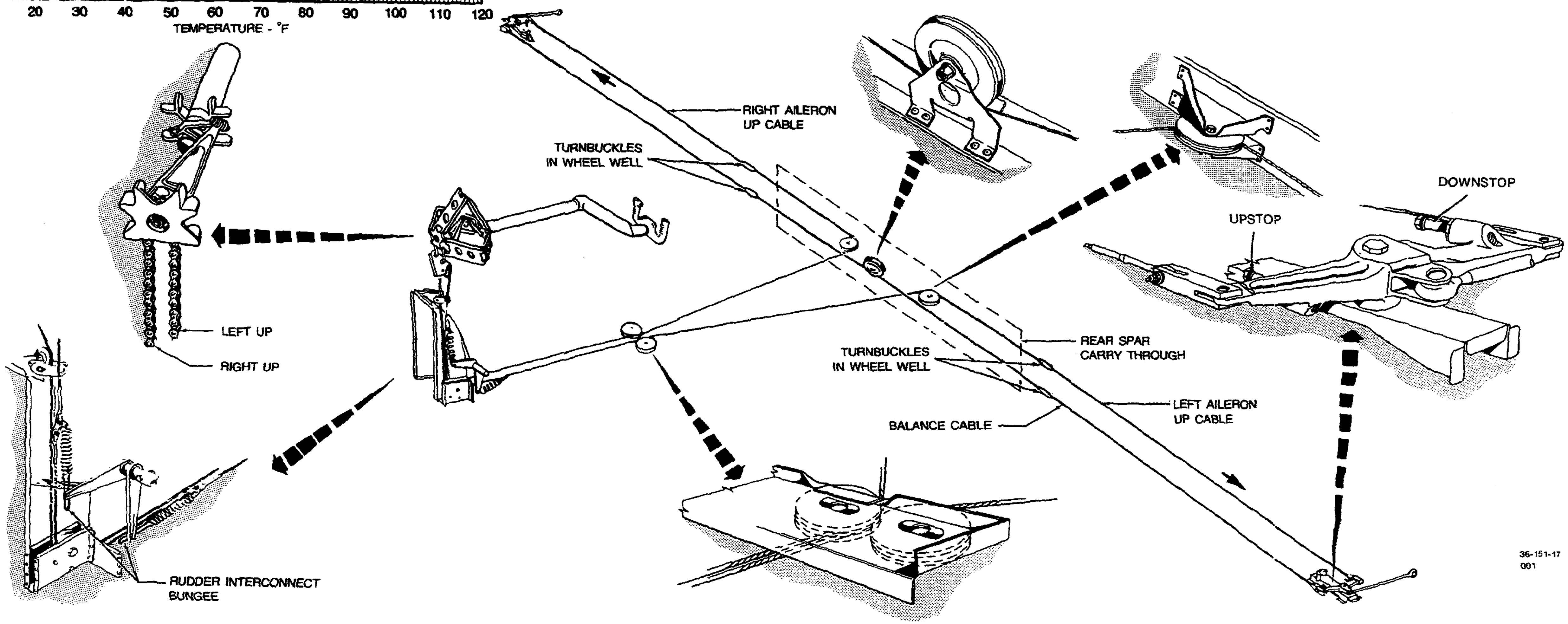
c. Check that the tangs of the drive shaft engage properly with the sprocket as the unit is being tightened by hand. Also note that the position indicator on the face of the unit is right side up as the shaft engages with the sprocket (Ref. Figure 4).

This Page Intentionally Left Blank

TEMPERATURE CABLE TENSION GRAPH



CABLES	CABLE TENSION	SURFACE TRAVEL
AILERON	40 LBS ±5 LBS AT 59°F *BUNGEE SPRINGS* CONNECTED	20° $^{+2}_{-2}$ UP 20° $^{+2}_{-2}$ *DOWN*

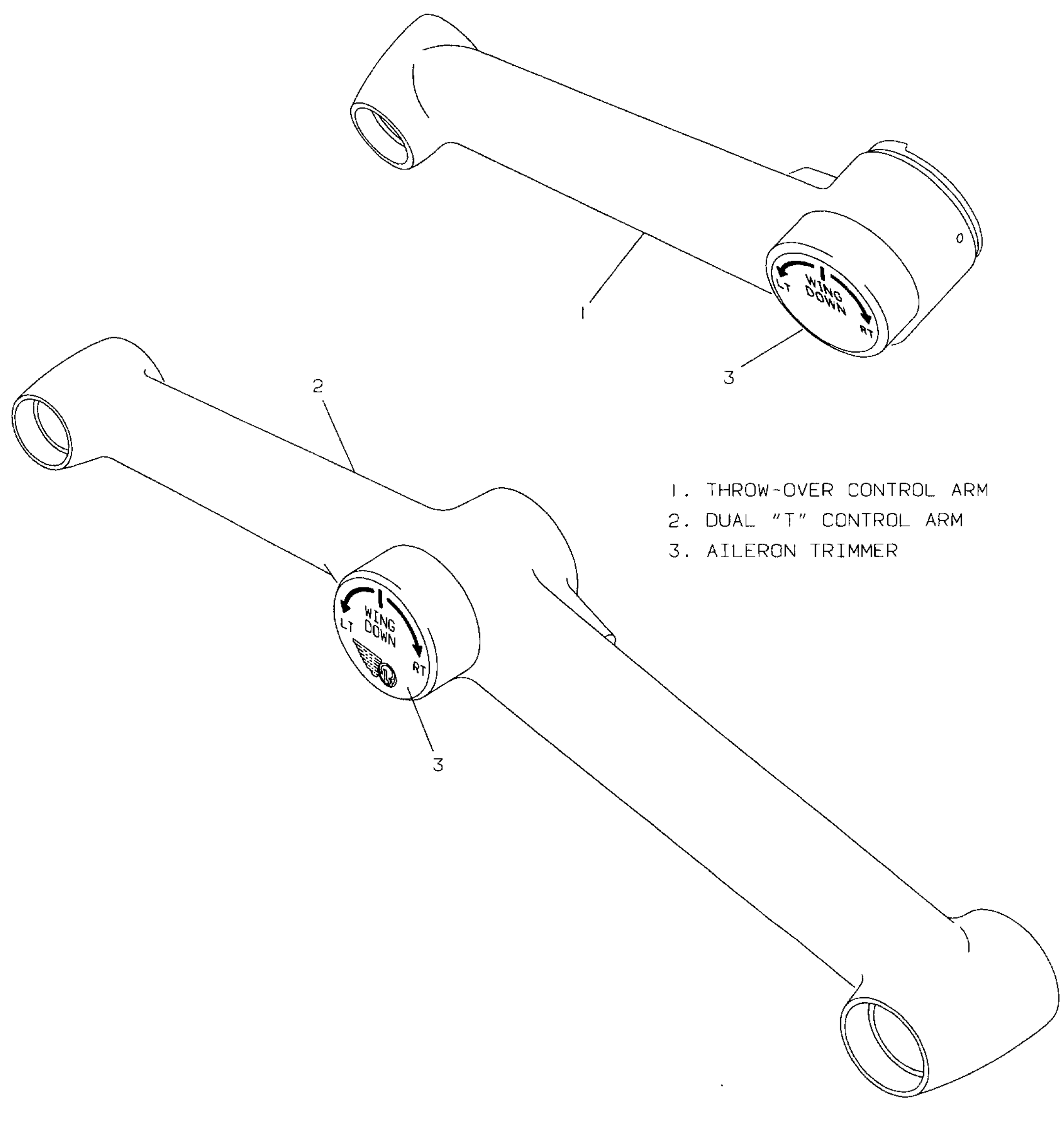


Rigging the Aileron Control System
Figure 3

This Page Intentionally Left Blank

AILERON TABS

The ailerons are equipped with sheet metal tabs which may be adjusted while the airplane is on the ground. The tabs are adjusted by bending them in opposite directions to each other. Bend the tabs only a small amount each time and check the setting by flight test.



Aileron Trimmer (Single Control Column)
Figure 4

AILERON AND TAB - MAINTENANCE PRACTICES (E-1946, E-2104, E-2111 AND AFTER; EA-320, EA-389 AND AFTER)

WARNING

Make certain that insulation, tie wraps, etc. do not interfere with control components such as cables, chains, etc.

DUAL CONTROL COLUMN

WARNING

On airplane serials E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After, observe the color coding on all parts when replacing or installing control cables, bellcranks and/or other control system components. DO NOT connect parts of one color to coded parts of a different color.

CONTROL COLUMN CHAIN REMOVAL

a. Paint one tooth of each control column's sprocket and its corresponding chain link to ensure proper alignment of the control wheels at installation (Ref. Figure 1).

b. Loosen the turnbuckles of the control column chain and the aileron turnbuckles in the wheel well.

c. Remove the safety wire from the four bolts (two on each end), and remove the six bolts from the channel between the control columns.

d. Remove the channel from the airplane.

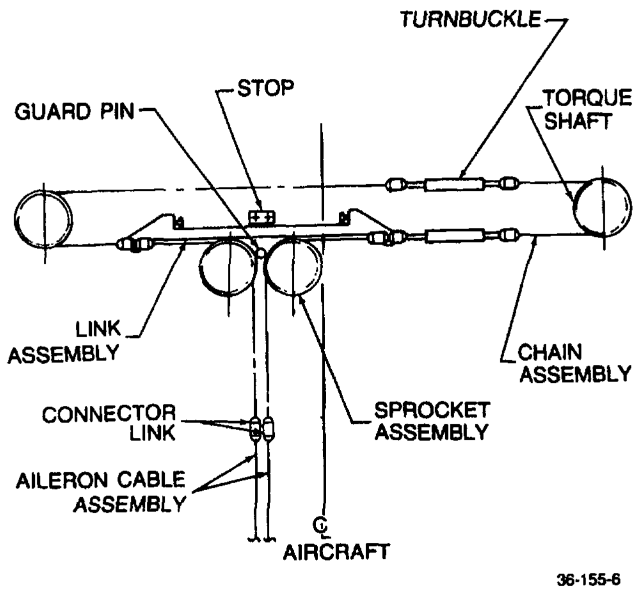
e. Disconnect the turnbuckles from the chain of the control column.

f. Remove the four connector links from the stop link assembly, then remove the stop link assembly.

NOTE

It may be necessary to remove the stop block before removing the stop link assembly.

g. Slide the sprocket support assembly aft over the joint then remove the chains from the control columns.



Dual Control Column Chain Adjustment
Figure 1

CONTROL COLUMN CHAIN INSTALLATION

a. Install the chains over the control column sprockets (Ref. Figure 1).

b. Install the stop link assembly. The outboard holes are used with the control column chain.

c. Install the aileron cable chains. The inboard holes of the stop link assembly are used with the aileron cable chains.

NOTE

Make certain the connector links are properly installed.

d. Install the stop block if removed.

e. Connect the turnbuckles (do not tighten).

f. Slide the sprocket support assemblies forward and install the six bolts to the channel between the control columns. Safety wire the four bolts.

g. Tighten the control column chains. Refer to the CONTROL COLUMN CHAIN RIGGING procedures.

WARNING

Check the ailerons for proper motion. When the control column is turned to the right, the left aileron should move down and the right aileron move up.

CONTROL COLUMN CHAIN RIGGING

Rigging of the control column chain may be accomplished by the following:

a. Rig neutral on the control wheels by placing a straightedge across the top of the control wheels. One of the grips may be ± 0.06 inch off the straightedge (Ref. Figure 1).

b. Ensure that the ends of the control column chain around the right sprocket are within one link of equidistance from the centerline of the sprocket.

c. If the stop link assembly is not centered within ± 0.02 inch with respect to its stop, adjust the turnbuckles to center the link.

d. Place a vertical load of two pounds on the top chain near the airplane centerline. The chain should deflect 0.25 ± 0.06 inches. Adjust the turnbuckles as necessary to obtain this deflection.

e. After rigging the control column chain, refer to RIGGING THE AILERON CONTROL SYSTEM and make certain the ailerons are properly rigged.

CONTROL COLUMN ROLLER ADJUSTMENT

FORWARD OUTER TUBE ROLLERS (ROLL ON THE INNER SQUARE SHAFT)

There are four rollers on the forward end of each control column which transmit torque to the square inner shaft. Two of the rollers of each control column are installed with eccentric bolts which allow for adjustment of roller clearance. These two bolts may be identified by their 10-32 threads. Refer to Figure 2 and adjust the rollers as follows:

a. Wipe the shafts clean and dry.

b. Hold one of the nonadjustable rollers firmly against the shaft.

c. The roller on the opposite side of the shaft should turn freely while having no more than 0.002 inch clearance.

d. If the conditions of Step c. are not met, loosen the nut on the roller which has the bolt with 10-32 threads.

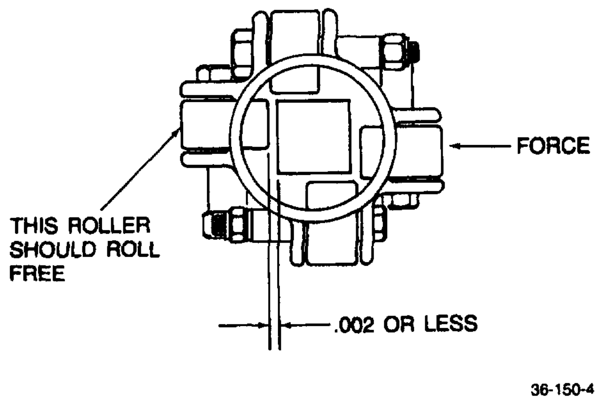
e. Turn the bolt until the conditions of Step c. are complied with.

f. Tighten the nut, then recheck the roller clearance in accordance with Steps b. and c..

g. Check the other pair of rollers as indicated in Steps b. and c..

h. If the adjustment is needed, follow Steps d., e. and f. for the second set of rollers.

Repeat this procedure for the other control column.



Forward Control Column Rollers
Figure 2

CONTROL COLUMN SUPPORT ROLLER ADJUSTMENT (ATTACHED TO THE INSTRUMENT SUBPANEL)

The top two rollers (22) of each control column support are installed with eccentric bolts which may be used for adjustment as follows (Ref. Figure 3):

Pull the control column fore and aft until the position of least clearance between the control column and support rollers is located. Keep the control column in this position while checking and/or adjusting the clearance. Each control column will probably have its own position of least clearance.

a. Hold the control column firmly against the two top rollers.

b. The clearance between the control column tube and the lower roller should be 0.005 ± 0.002 inch.

c. If the correct clearance is not indicated, loosen the nuts on the two top rollers.

d. Rotate the bolts to obtain the proper clearance.

e. Tighten the nuts.

f. Recheck for proper clearance (Step b.).

g. Repeat for the other control column.

AILERON REMOVAL

a. Lower the flaps and disconnect the push-pull rod to the aileron tab.

b. Support the aileron and remove the two attaching screws from the top and bottom of each hinge bracket.

c. Pull the aileron straight away from the wing to avoid damage to the attaching areas.

d. Remove the screws attaching the bonding cables to the aileron.

AILERON INSTALLATION

a. Attach the bonding cables to the aileron.

b. Place the aileron in position on the hinge brackets. Be sure the hinge bracket is in the proper place between the aileron skin and the reinforcing structure.

c. Install the upper and lower hinge bracket screws.

d. Pull on the aileron in a direction straight away from the wing to assure that the hinge brackets are properly positioned. If any movement of the aileron is noted, recheck the position of all hinge brackets.

e. Lower the flap and connect the aileron tab push-pull rod and install the cotter pin.

AILERON CONTROL CABLE REMOVAL

a. Remove the pilot's and copilot's seat, and the floorboards in the pilot's compartment.

b. Remove the forward passenger seats and the floorboards between the main and rear spars.

c. Remove the access plates as necessary to gain access to the aileron cables and pulley brackets on the lower trailing edge of the wings.

d. Remove all necessary cable retaining pins from the cable pulley brackets.

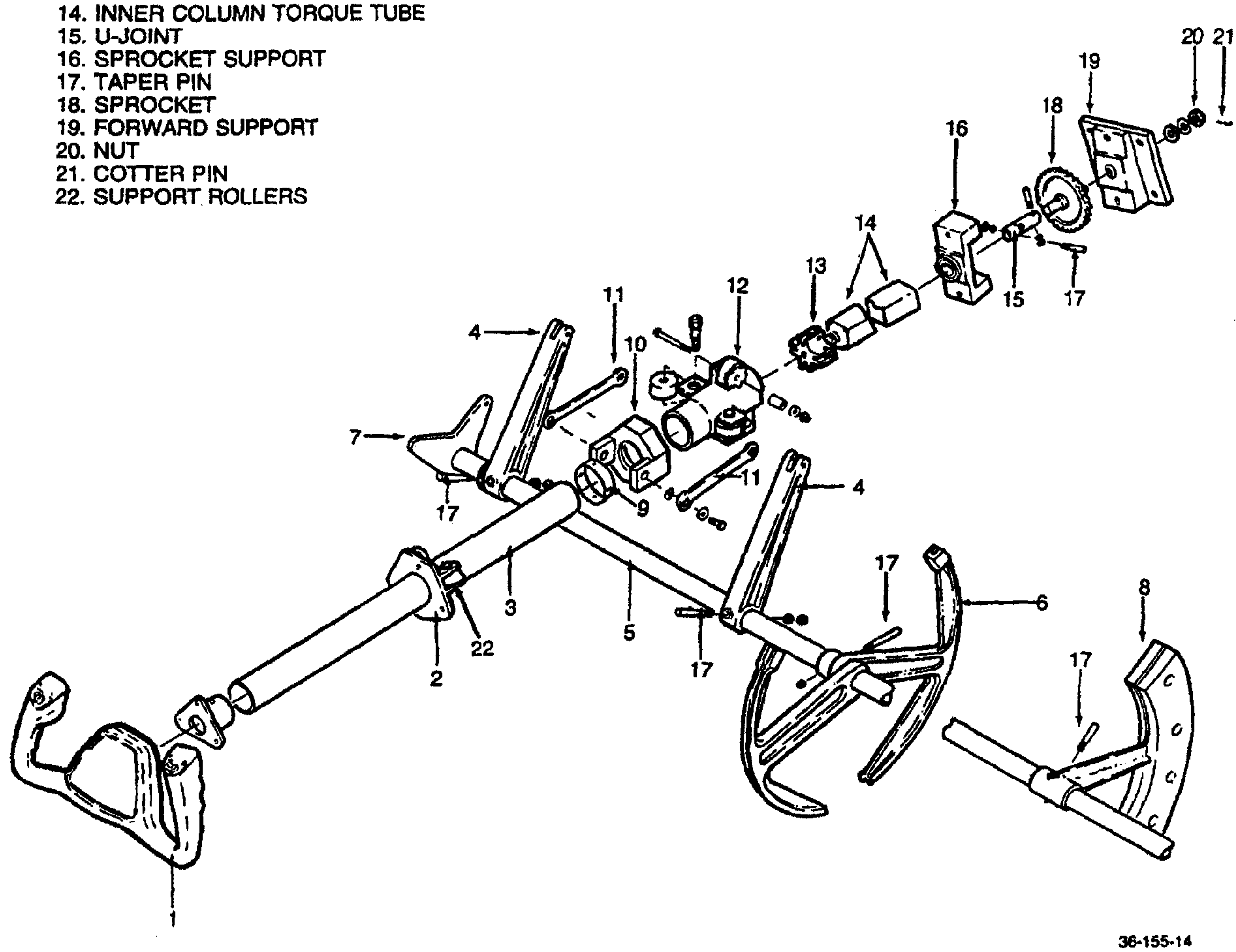
e. Disconnect the forward aileron cables from the chain and cable assembly at the connector link below the control column. Install lead lines to both aileron cables (Ref. Figure 4).

f. Disconnect the forward aileron cables and the forward outboard wing cable at the turnbuckles in each wing. Connect a lead line to one end of the cable and remove the cable.

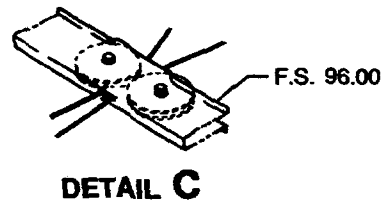
g. Disconnect the balance cable at the turnbuckle in each wing. Connect a lead line to one end of the cable and remove the cable.

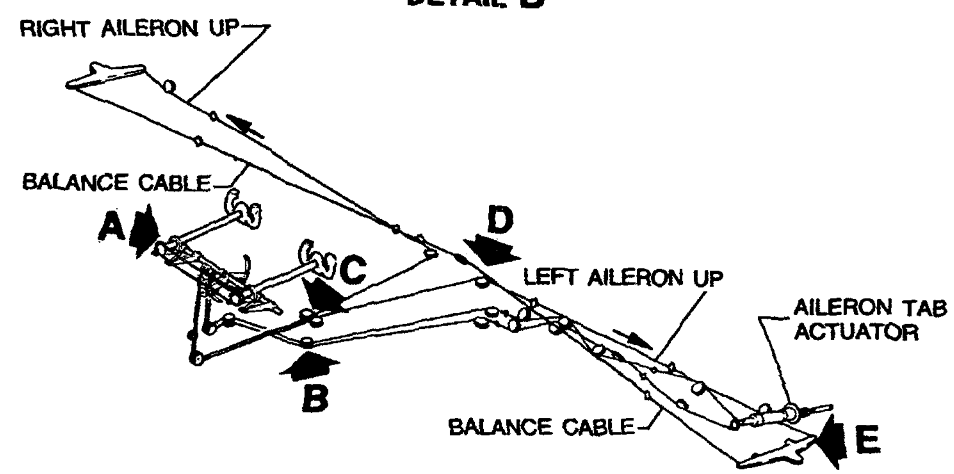
h. Disconnect the forward outboard and the aft outboard cables at the bellcrank in each wing. Identify and remove the cables.

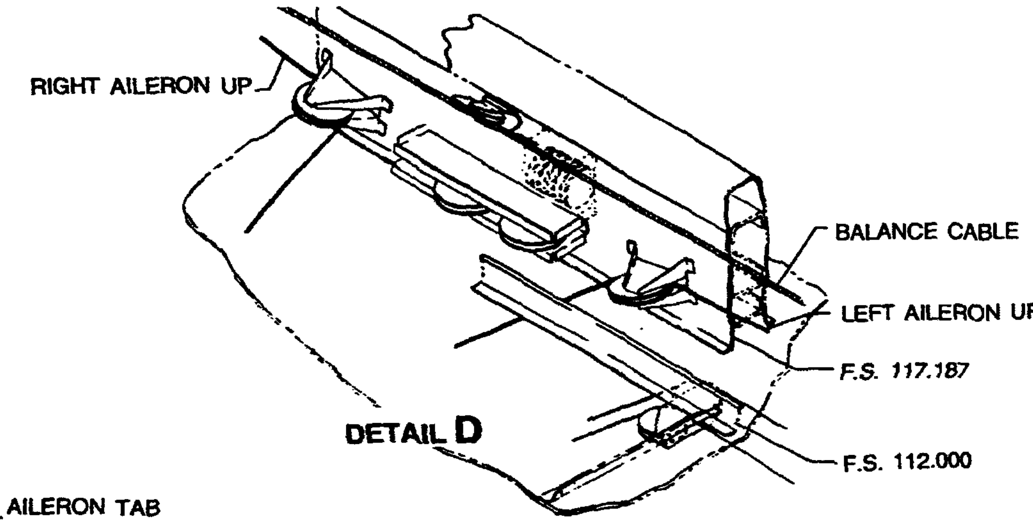
1. WHEEL
2. COLLAR ASSEMBLY
3. COLUMN TORQUE TUBE
4. ELEVATOR TORQUE ARM
5. ELEVATOR TORQUE TUBE
6. ELEVATOR BELLCRANK
7. ELEVATOR TORQUE TUBE SUPPORT
8. BOB WEIGHT ASSEMBLY
9. COLLAR
10. COLLAR ASSEMBLY
11. ELEVATOR PUSHROD
12. CONNECTOR
13. INNER COLUMN GUIDE
14. INNER COLUMN TORQUE TUBE
15. U-JOINT
16. SPROCKET SUPPORT
17. TAPER PIN
18. SPROCKET
19. FORWARD SUPPORT
20. NUT
21. COTTER PIN
22. SUPPORT ROLLERS

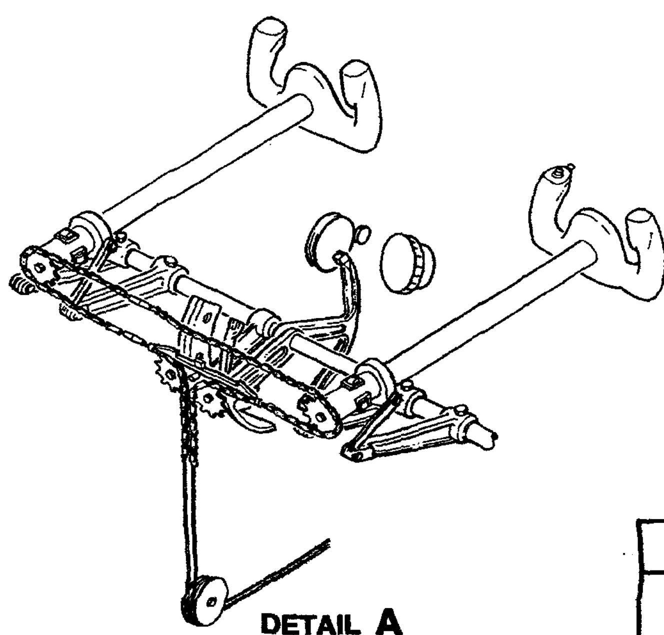


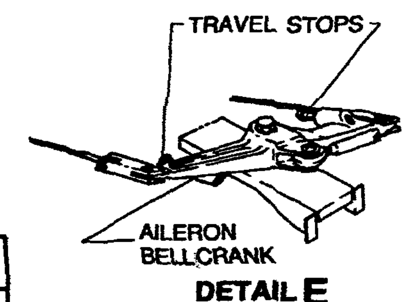
Control Column
Figure 3

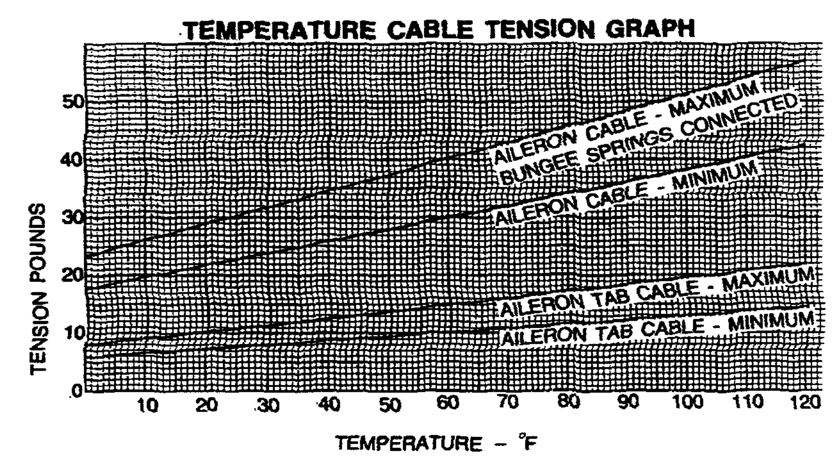












CABLE	CABLE TENSION	SURFACE TRAVEL
AILERON	35 ± 5 LBS AT 59°F BUNGEE SPRINGS CONNECTED	20° ± 2° UP 20° ± 2° DOWN
AILERON TAB	10 LBS +5 LBS −0 LBS AT 59°F	9°+ 0 − 1° UP 9°+ 0 − 1° DOWN

F.S. = APPROXIMATE FUSELAGE STATION

36-151-18

Aileron System
(E-1946, E-2104, E-2111 and After;
EA-320, EA-389 and After)
Figure 4

This Page Intentionally Left Blank

AILERON CONTROL CABLE INSTALLATION

a. Connect the forward outboard and the aft outboard cables to the bellcrank in each wing. Route the cables inboard and disconnect the lead lines (Ref. Figure 4).

b. Route the balance cable through one wing, the fuselage, then through the opposite wing. Disconnect the lead line and connect the balance cable and the aft outboard cables to the turnbuckles in each wing.

c. Route one end of the aileron cables outboard in each wing, and the other end forward to the control column. Connect the cables to the turnbuckles at the forward outboard cable in each wing.

d. Connect the chain and cable assembly to both aileron cables at the connector link below the control column.

e. Install all retaining pins in the pulley brackets.

f. Rig the aileron control system.

g. Install the access plates on the lower trailing edge of the wings.

h. Install the floorboards and the forward passenger seats.

i. Install the floorboards and the pilot's and copilot's seats.

WARNING

Make certain that insulation, tie wraps, etc. do not interfere with control components such as cables, chains, etc.

Check for correct direction of movement by moving the control wheel. When the control wheel is moved to the left, the left aileron should move up and the right aileron move down. When the control wheel is turned to the right, the right aileron should move up and the left aileron down.

Check to make sure that cabin floorboards, floorboard insulation and other interior parts do not contact the control cables.

RIGGING THE AILERON CONTROL SYSTEM

NOTE

Raytheon Aircraft Company recommends the use of the aileron travel gage. Refer to SPECIAL TOOLS in Chapter 12-20-00. The front of the travel gage should be located over the leading edge skin splice with the aft portion over the number 8 wing rib (just outboard of the inboard aileron hinge). Alternate rigging with TE-100TB Universal Travel Board and KS6005 Digital Protractor is acceptable.

a. Aileron and tab surfaces must align with the upper and lower surfaces of the wing within 1/16 inch.

b. Place the aft arm of both aileron bellcranks parallel to the adjacent wing rib. If the aileron is not in neutral, loosen the locknuts on both ends of the push-pull tube and adjust the push-pull tube until the aileron is in neutral.

c. Tighten the locknuts.

d. Rig neutral on the control wheels by placing a straightedge across the top of the two control wheels. One grip may be ± 0.06 inch off of the straightedge.

e. Assure that the ends of the chain around the right control column are within one link of equidistance from the centerline of the sprocket.

f. If the link stop assembly is not centered with respect to its stop, adjust the turnbuckles to center the link.

g. Place a vertical load of two pounds on the top chain near the airplane centerline. The chain should deflect 0.25 ± 0.06 inch. Adjust the turnbuckles as necessary to obtain this deflection.

h. Connect the bungee springs.

i. With a straight rig pin installed between the pilot's rudder pedals and with a simulated (10 lbs.) cable tension, adjust the turnbuckle above the forward aileron bungee spring until both bungee springs are extended equally ± 0.06 inch.

j. Adjust the turnbuckles in the wheel wells to bring the ailerons to neutral (0°).

k. Remove the straightedge from the control wheels.

l. Adjust the aileron bellcrank stops (primary stops) for a deflection of 20 ± 2° up, and 20 ± 2° down from neutral.

m. Tighten the locknuts on the bellcrank stop bolts.

n. Rig the aileron cables to the tension indicated in Figure 4. Use the turnbuckles in the wheel wells.

o. Be sure each bellcrank contacts its upstop at the same time the bellcrank in the opposite wing contacts its downstop.

p. Set the secondary stop bolts (the stop link at the forward end of the control column) to maintain 0.06 to 0.12 inch clearance from the stop with the ailerons at full travel (both right and left).

q. With a straight rig pin installed between the pilot's rudder pedals, the control wheels should center within 5° of neutral. If necessary, readjust the vertical turnbuckle above the forward bungee spring and the aft turnbuckle in the wheel well as required to center the control wheels.

r. Recheck cable tension and safety the turnbuckles. Make certain all locknuts are tight.

s. With the ailerons fully rigged (bungee springs disconnected), the torque required to move either control wheel 10° right or left of neutral shall not exceed 15 inch-pounds.

t. Connect the bungee springs.

WARNING

Check for correct direction of movement by moving the control wheel. When the control wheel is moved to the left, the left aileron should move up and the right aileron move down. When the control wheel is turned to the right, the right aileron should move up and the left aileron down.

u. Remove all rigging pins.

AILERON TAB

A trim tab has been installed in the left aileron which is controllable from inside the airplane while in flight. The aileron tab is controlled through normal cable and chain linkage to a control wheel located in the pedestal with the indicator.

AILERON TRIM TAB CABLE REMOVAL

a. Remove the pilot's seat and the left floorboard.

b. Remove the lower forward upholstery panel on the left side of the pedestal.

c. Remove the forward left passenger seat and the floorboard.

d. Remove necessary access plates to gain access to the trim tab cables, actuator, and cable pulley brackets.

e. Remove the cable retaining pins at the pulley brackets.

f. Disconnect the tab cables at the turnbuckles in the left wing. Identify and connect lead lines on the cable ends.

g. Remove the cable stops at WS 43.375.

h. Remove the outboard cable from the actuator sprocket. Remove the cable through the actuator access opening.

i. Remove chain master link at the sprocket on the pedestal. Remove cable through the actuator access opening.

AILERON TRIM TAB CABLE INSTALLATION

a. Position the chain of the forward tab cable around the pedestal sprocket and install the chain master link.

b. Route the cable ends aft in the fuselage and outboard into the left wing and disconnect the lead lines.

c. Position the chain of the outboard cable around the actuator sprocket and route the cable ends inboard.

d. Install the cable stops at WS 43.375 and connect the cables at the turnbuckles in the wing.

e. Install the cable retaining pins in the pulley brackets.

f. Rig the aileron trim tab control system, refer to AILERON TRIM TAB RIGGING procedure.

g. Install all access plates in the left wing.

h. Install the floorboard and the left forward passenger seat.

i. Install the floorboard and the pilot's seat.

j. Install the upholstery panel on the left side of the pedestal.

WARNING

Make certain that insulation, tie wraps, etc. do not interfere with control components such as cables, chains, etc.

The aileron tab should stay in the same plane with respect to the aileron when the aileron is moved. When the tab control wheel is turned to indicate left wing up, the aileron tab should move up. If the aileron and aileron tab do not move in the proper direction, recheck rigging.

AILERON TRIM TAB RIGGING

NOTE

Place the aileron in neutral.

a. Place the aileron trim tab control in neutral position.

b. Place the aileron in neutral position and connect the trim tab to the tab actuator.

c. By turning the sprocket on the actuator, adjust the trim tab to both extremes of travel; measure both settings and return the tab to the midpoint of the two extremes of travel. This will place the actuator in the neutral position.

d. If the trim tab is not in the neutral position upon completion of Step c., adjust the pushrod to place the tab in neutral position.

e. Center the chain on the sprocket and tighten the cable.

f. Set the aileron tab stop (at WS 43.375) to obtain a surface deflection of 9° + 0° - 1° up and down. Torque the stops to 40 to 60 inch pounds.

g. Rig cable tension and adjust travel (Ref. Figure 4).

h. Check trim tab travel, safety all turnbuckles and stops.

WARNING

After rigging the aileron and aileron tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. The aileron tab should stay in the same plane with respect to the aileron when the aileron is moved. When the tab control wheel is turned to indicate left wing up, the aileron tab should move up. If the aileron and aileron tab do not move in the proper direction, recheck the rigging.

AILERON TRIM TAB ACTUATOR REMOVAL

a. Remove the access plates at the actuator.

b. Disconnect the outboard cable at the turnbuckles in the wing.

c. Remove the outboard cable from the actuator sprocket.

d. Disconnect the actuator from the trim tab linkage.

e. Remove the bolts attaching the actuator to the wing structure. Remove the actuator.

AILERON TRIM TAB ACTUATOR INSTALLATION

a. Position the actuator against the wing structure and install the attaching bolts.

b. Connect the actuator to the tab linkage.

c. Install the outboard cable on the actuator sprocket.

d. Connect the cables at the turnbuckles in the wing.

e. Rig the aileron trim tab control system.

f. Install the access plates at the actuator.

AILERON TRIM TAB ACTUATOR DISASSEMBLY

a. Remove the pins from the nut assembly (5) and sprocket (1) and remove the sprocket from the actuator assembly (Ref. Figure 5).

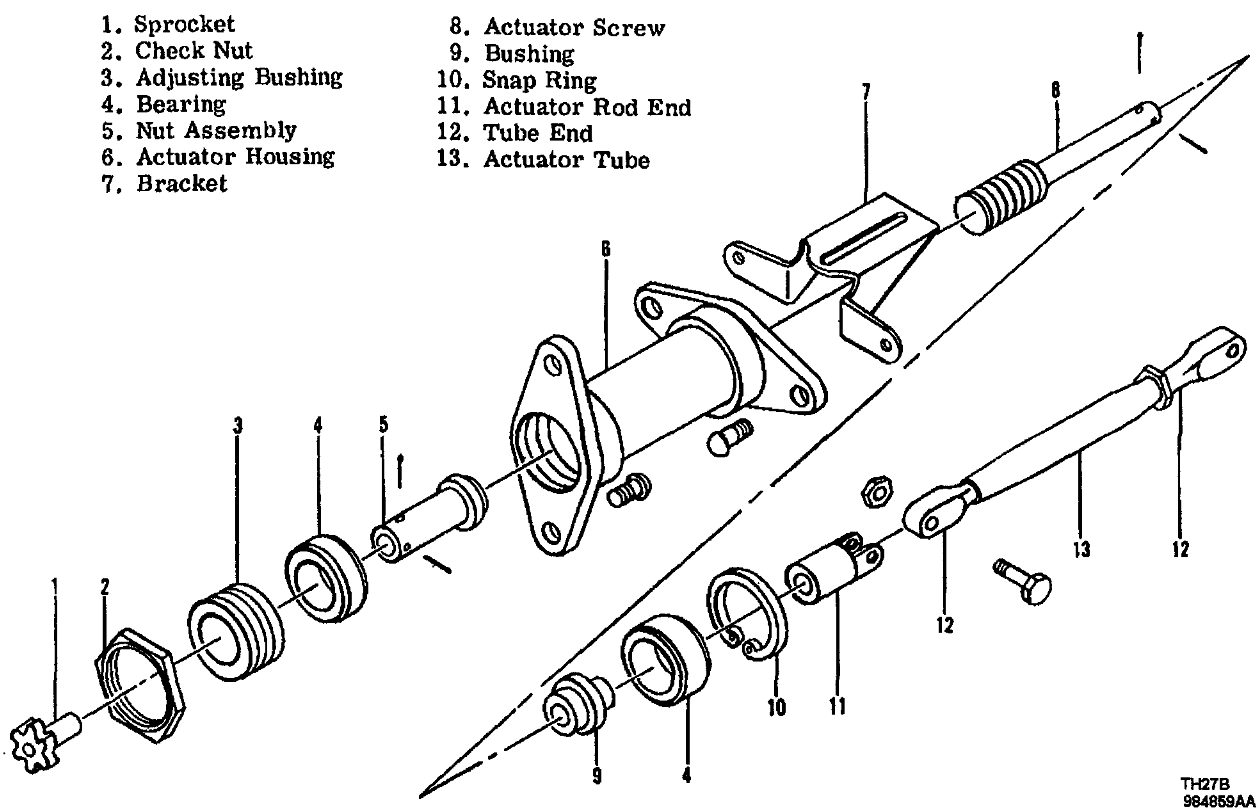
b. Remove the snap ring (10) from the actuator housing (6), and pull the nut assembly (5) out of the housing.

c. Remove the actuator screw (8) from the nut assembly (5).

d. Remove the pins from the actuator screw (8) and the actuator rod end (11) and remove the actuator rod end from the actuator screw. The bearing (4) and the bushing (9) can now be removed from the actuator screw.

e. Remove the check nut (2), and screw out the adjusting bushing (3) with a spanner wrench.

f. Remove the bearing (4) from the nut assembly (5).



Aileron Trim Tab Actuator
Figure 5

AILERON TRIM TAB ACTUATOR ASSEMBLY

NOTE

During assembly lubricate all moving parts with grease (11, Chart 1, 91-00-00).

a. Install the bearing (4) on the nut assembly (5).

b. Install the other bearing (4) and bushing (9) on the actuator screw (8).

c. Install the actuator screw (8) in the nut assembly (5).

d. Push the nut assembly (5) into the actuator housing (6), and install the snap ring (10) in the actuator housing (6).

e. Use a spanner wrench to install the adjusting bushing (3) into the actuator housing (6) until the end play between the screw housing and nut assembly (5) is less than 0.025 inch. If the end play cannot be reduced to within limits, replace the actuator.

f. Install the check nut (2) on the adjusting bushing (3).

g. Install the actuator rod end (11) on the actuator screw (8).

h. Align the holes in the actuator screw (8) with those of the actuator rod end (11) and install the two pins.

i. Install the sprocket (1) on the actuator assembly.

j. Align the holes in the sprocket (1) with those in the nut assembly (5) and install the two pins.

CHECKING AILERON TRIM TAB FREE PLAY

Visually inspect the aileron trim tab for damage, security of hinge attach points, and for tightness of the actuating system. Inconsistencies must be corrected before checking the free play of the tab.

A check fixture (P/N 45-135030-9/810) or equivalent, a dial indicator, and a push-pull scale for applying accurate loading to the tab are required for making the inspection for tab free play (Ref. Figure 6).

a. Securely lock the control surfaces to prevent movement of the ailerons. Set the aileron trim tab in neutral.

b. Use shot bags to hold the dial indicator check fixture so that the point of the dial indicator is 2.0 inches aft of the tab hinge line and on the outboard edge of the aileron tab.

c. Apply a small piece of masking tape (for paint protection) 4.0 inches aft of the tab hinge line and along the centerline of the tab actuator. This is the point of pressure against the tab by the push-pull scale.

d. Apply another piece of masking tape in the corresponding location on the bottom surface of the tab.

e. Set the dial indicator at zero. Do not reset the dial indicator during the checking procedure.

f. With the push-pull scale on the masking tape, apply a 3.0 pound downward load. Record the dial reading as A.

g. Release half of the load to obtain a 1.5 pound downward load. Record the dial reading as B.

h. On the masking tape on the bottom surface, apply a 3.0 pound upward load. Record the dial reading as C.

i. Release half of the load to obtain a 1.5 pound upward load. Record the reading as D.

j. Enter the recorded readings on a copy of Chart 1 and proceed as follows:

   1. Subtract A from 2B and record as X.
   2. Multiply B by 2 and record as 2B.
   3. Multiply D by 2 and record as 2D.
   4. Subtract C from 2D and record as Y.

NOTE

X and Y can be negative numbers.

5. Add X and Y and record as E.

k. (E = 0.094 INCH MAXIMUM)

l. If the free play is over the maximum specified in Chart 1, inspect all components of the tab actuator system to determine the cause. All worn parts must be replaced.

AILERON TRIM TAB FREE PLAY INSPECTION

This check should be performed at least once a year to ensure that the trim tab free play falls within the prescribed limits.

A check fixture (P/N 45-135030-9/810) or equivalent, a dial indicator, and a push-pull scale for applying accurate loading to the tab are required for making the inspection for free play of the tab (Ref. Figure 6).

a. Securely lock the control surfaces to prevent movement of the ailerons. Set the aileron tab in the neutral position.

b. Using shot bags, affix the dial indicator check fixture so that the dial indicator point is 2.00 inches aft of the tab hinge line and on the outboard edge of the aileron tab.

c. Apply a small piece of masking tape (for paint protection) 4.00 inches aft of the tab hinge line and along the centerline of the tab actuator. This will be the point of pressure against the tab by the push-pull scale.

d. Apply another piece of masking tape in the corresponding position on the bottom surface of the tab for the same purpose.

e. Zero the dial indicator at no load initially. Do not reset during the checking procedure.

f. With the push-pull scale at the point of masking tape, apply a full 3-pound downward load. Record the dial reading as A.

g. Release half the load until a 1.5 pound downward load is obtained. Record the dial reading as B.

h. Apply a full 3 pound upward load at the masking tape on the bottom surface. Record the dial reading as C.

i. Release half the load until a 1.5 pound upward load is obtained. Record the dial reading as D.

j. Enter the recorded values on a copy of Chart 1 and proceed as follows:

1. Multiply B by 2 and record as 2B.
2. Subtract A from 2B and record as X.
3. Multiply D by 2 and record as 2D.
4. Subtract C from 2D and record as Y.

NOTE

The results of X and Y can be negative numbers.

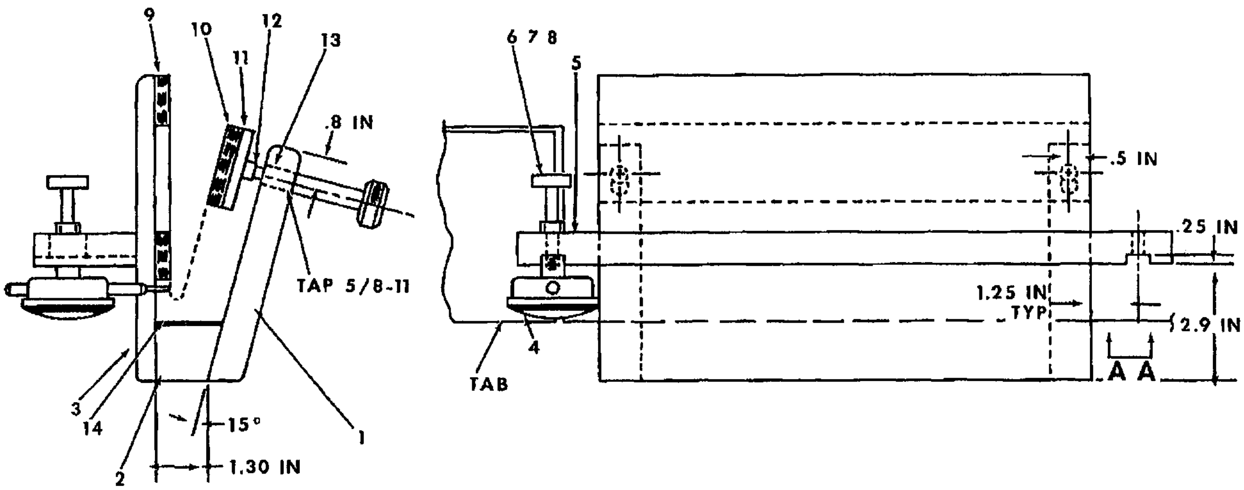
5. Add X and Y and record as E.

k. If the free play exceeds 0.094 inch, inspect all components of the tab actuator system to determine the cause. All worn parts should be replaced.

CHART 1
AILERON TAB FREE PLAY LIMITS

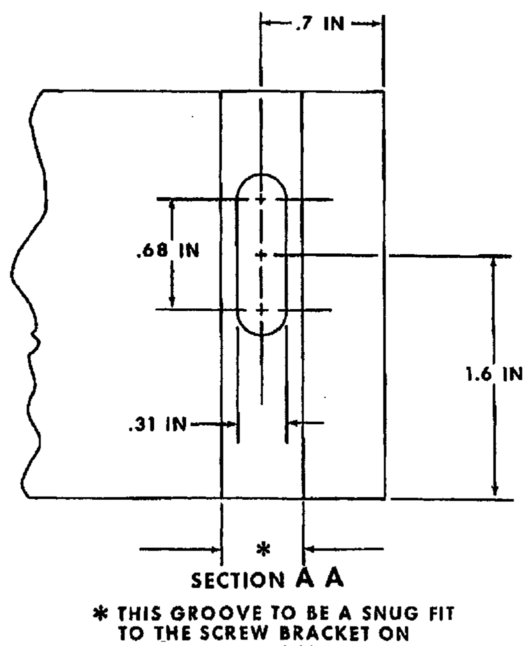
1.5 POUND READING	3 POUND READING	
B__________		
2B__________	-A__________	=X__________
D__________		
2D__________	-C__________	=Y__________
X__________	+Y__________	=E__________

(E=0.094-inch maximum)



ITEM NO.	QUANT.	DESCRIPTION
1	2	3/4 x 1 x 6 aluminum or equiv.
2	2	1 x 1 3/8 x 1 3/4 aluminum or equiv.
3	1	1/2 x 7 1/2 x 10 aluminum or equiv.
4	1	C81Q Indicator**
5	1	3/4 x 2 1/2 x 14 aluminum or equiv.
6	1	1/4 Dia. x 2 corrosion res. stl.
7	1	1/4 Dia. x 1 corrosion res. stl.
8	1	1/4-28 nut
9	1	3/8 x 5 x 10 rubber
10	1	3/8 x 2 x 10 rubber
11	1	1/4 x 2 x 10 corrosion res. stl.
12	2	1/2 x 13 x 3 VLIER Torque screw
13	2	KN813 Keensert or tap 1/2 - 13
14	2	1/8 x 1 x 3/4 rubber

**P/N of Federal Products Corp., Providence, R. I.



Fabricating Clamp for Tab Deflection
Figure 6

RUDDER AND TAB - MAINTENANCE PRACTICES

RUDDER (F33A, F33C, A36, A36TC, AND B36TC)

WARNING

On airplane serials CE-1566 and after; E-1946, E-2104, E-2111 and after; EA-320, EA-389 and after, observe the color coding on all parts when replacing or installing control cables, bellcranks and /or other control system components. DO NOT connect parts of one color to coded parts of a different color.

RUDDER REMOVAL

a. Detach the tail cone, disconnect the tail navigation light wire and remove the tail cone.

b. Remove the tail section access doors on the left hand side of the aft fuselage.

c. Remove the four attach bolts from the rudder bellcrank.

d. Disconnect the rudder hinges and rudder bonding cable.

e. Remove the rudder.

RUDDER INSTALLATION

a. Place the rudder in position.

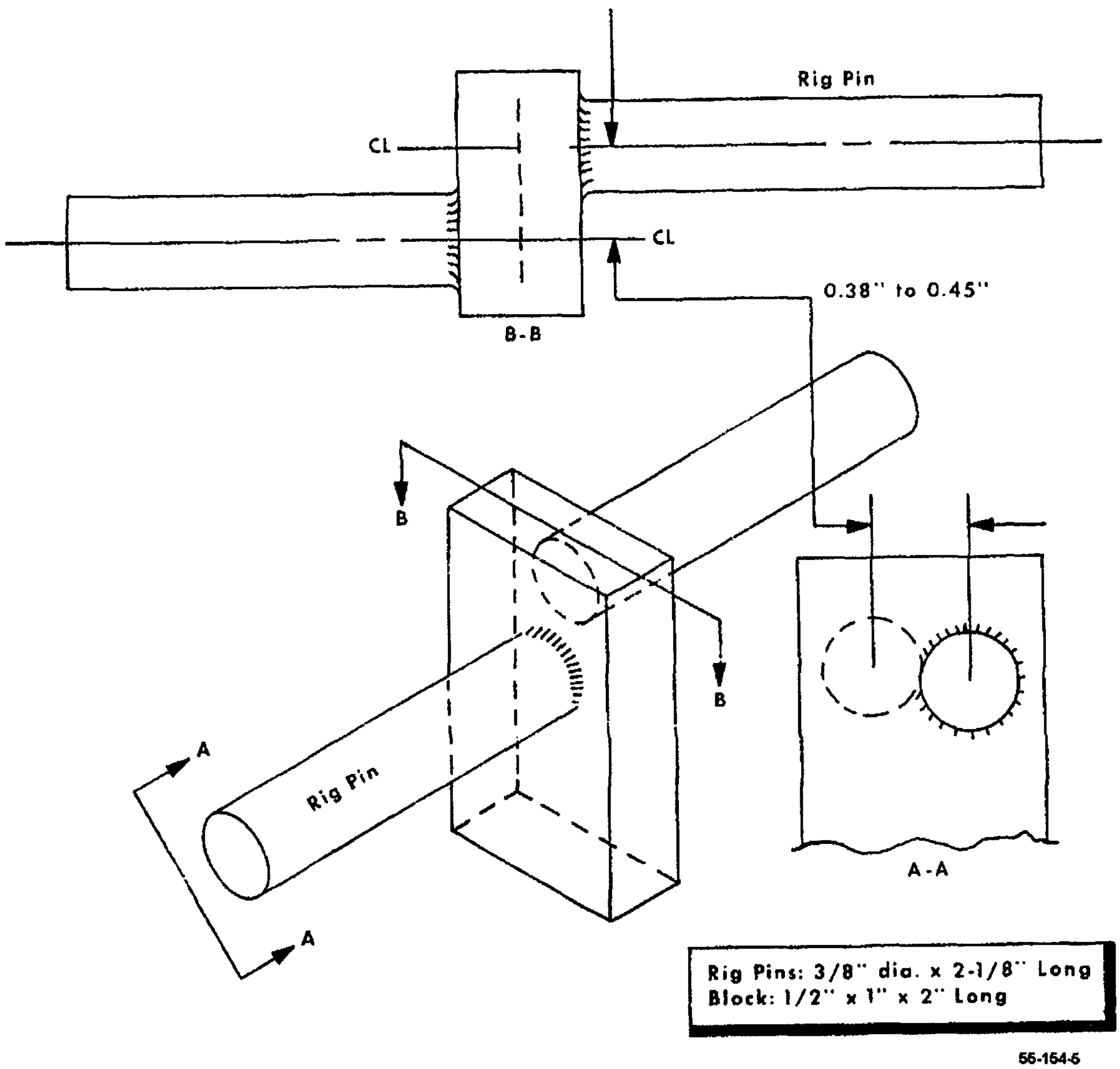
b. Connect the rudder hinges and bonding cable.

c. Install the rudder bellcrank attach bolts (torque to 50 to 70 inch-pounds).

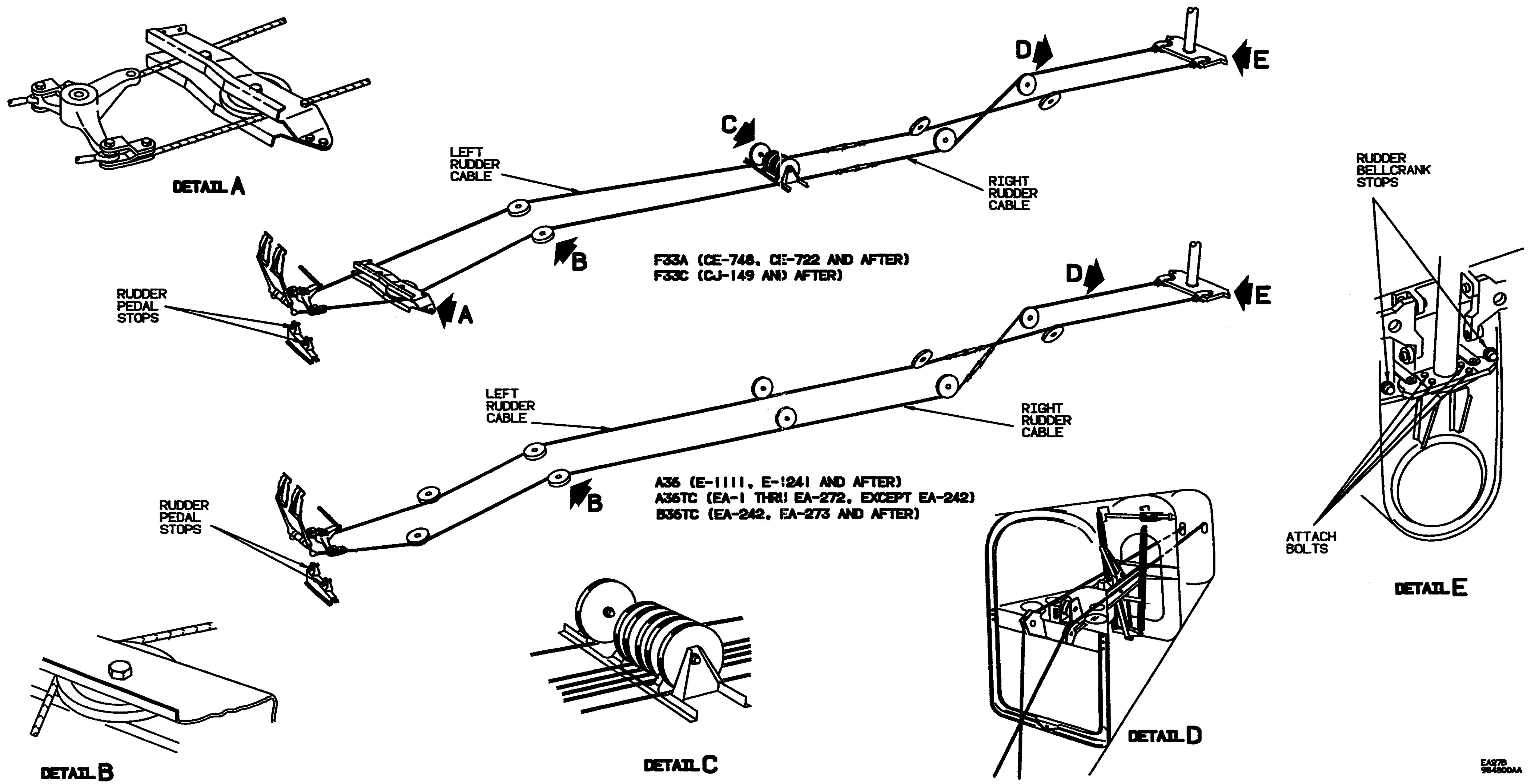
d. Install the access doors.

e. Connect the navigation light wires.

f. Install the tail cone.



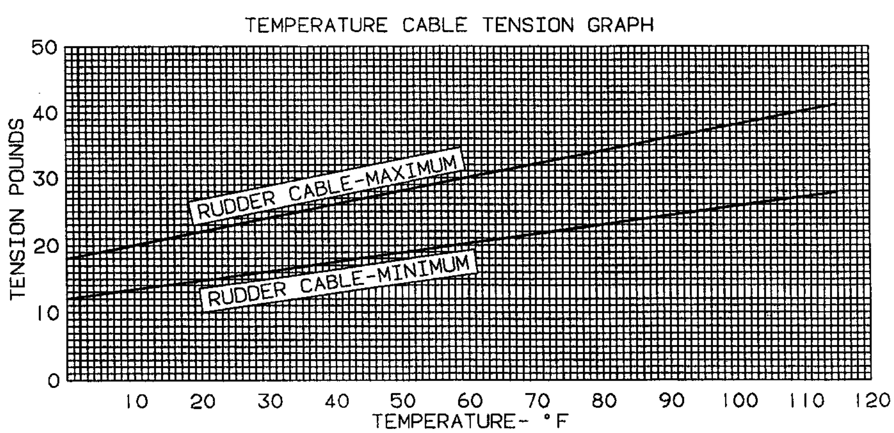
Rudder Pedal Rig Tool
Figure 1



Rudder System
Figure 2

THIS PAGE INTENTIONALLY LEFT BLANK

CABLES	CABLE TENSION	SURFACE TRAVEL	
RUDDER	25 LBS ± 5 LBS AT 59° F	25 ± 1 LEFT AND RIGHT	ALL F33A AND A36TC, F33C PRIOR TO CJ-156 WITHOUT KIT 33-4002-1, A36 PRIOR TO E-2111 EXCEPT E-1946 AND E-2104
		20 +0 -1 LEFT AND RIGHT	B36TC
		25 ±1 LEFT 20 +0 -1 RIGHT	F33C, CJ-156 AND AFTER, AND EARLIER F33C'S WITH KIT 33-4002-1
		23 +0 -1 LEFT AND RIGHT OF NEUTRAL	E-1946, E-2104 AND E-2111 AND AFTER



EA27B
98480IAA

Rudder Cable Tension and Surface Travel Data
Figure 3

RIGGING THE RUDDER CONTROL SYSTEM
FIGURES 2 AND 3

NOTE

To facilitate rigging of the rudder pedals a rigging tool may be fabricated from a steel block 1/2 inch X 1 inch X 2 inches; and two 3/8-inch- x 2-1/8-inch-long pins. The rig pins are located parallel and forward of the block, one on each side, and welded. The rig pins should be spaced as noted in Figure 1.

a. Place the rudder pedals in the aft position.

b. Install a rig tool in the holes provided in the pilot's rudder pedals.

c. With the bellcrank in the neutral position, rig the cables to the tension shown on the temperature cable tension graph in Figure 3, then remove the rig pin.

NOTE

Installation of the rig pin in the pilot's rudder pedals will bring the copilot's pedals to the same adjustment as the pilot's pedals.

The right hand rudder pedals are rigged 0.38 - 0.45 inch forward of the neutral position.

d. Adjust the rudder travel at the rudder bellcrank stops as indicated in Figure 2.

e. Adjust the rudder pedal travel at the rudder pedal stops so that contact with the rudder bellcrank stops occurs immediately prior to contact with the rudder pedal stops.

f. Make sure that the rudder movement corresponds to the movement of the rudder pedals.

RUDDERVATOR AND TAB - MAINTENANCE PRACTICES

RUDDER (V35B)

RUDDER RIGGING PROCEDURE (Figure 1)

NOTE

All rudder rigging should be accomplished with a travel board installed. A bubble protractor should not be used for any rudder rigging procedure.

The rudder system and elevator system are separate systems forward of the empennage. The control surfaces for both the rudder and elevator are the same parts. The rudder and elevator control surfaces will be referred to as ruddervator.

a. Adjust the stops on the aft fuselage bulkhead to permit a maximum combined ruddervator travel as shown on the overall travel tables. Refer to Figure 1.

b. With the adjusting link at the rudder quadrant, located just aft of the rudder pedals, lengthen or shorten as necessary to align the copilot's pedals with the pilot's pedals. When aligning the pedals, be sure both sets of pedals are in the same position.

c. Straighten the nose wheel and position the rudder pedals in neutral position with an aligning (rig) tool in the pedals. Refer to Figure 1, 27-20-00.

NOTE

The left rudder pedal is rigged .38 to .45 inch aft of the neutral position. To facilitate rigging of the rudder pedals to these dimensions, a rigging tool may be fabricated from a steel block 1/2 x 1 x 2 inches, and two 3/8 x 2-1/8-inch-long rig pins. See Figure 1, 27-20-00. The rig pins are located parallel and forward on the block, one on each side, and welded. Rig pins are spaced per Figure 1, 27-20-00.

d. Position the control column in the neutral position with 4-1/2 inches (4-3/4 inches on D-10359 and after) between the collar on the instrument panel and split collar on the control column. This can be accomplished by cutting a block 4-1/2 (or 4-3/4 for D-10359 and after) inches long and taping it to the control column.

e. Install the differential mechanism jig assembly (refer to Figure 1, Detail E) to position the differential mechanism in the neutral position. The jig assembly will position the differential mechanism of the right tail control arm aft of the differential mechanism for the left tail control arm with the elevator and rudder systems in neutral.

NOTE

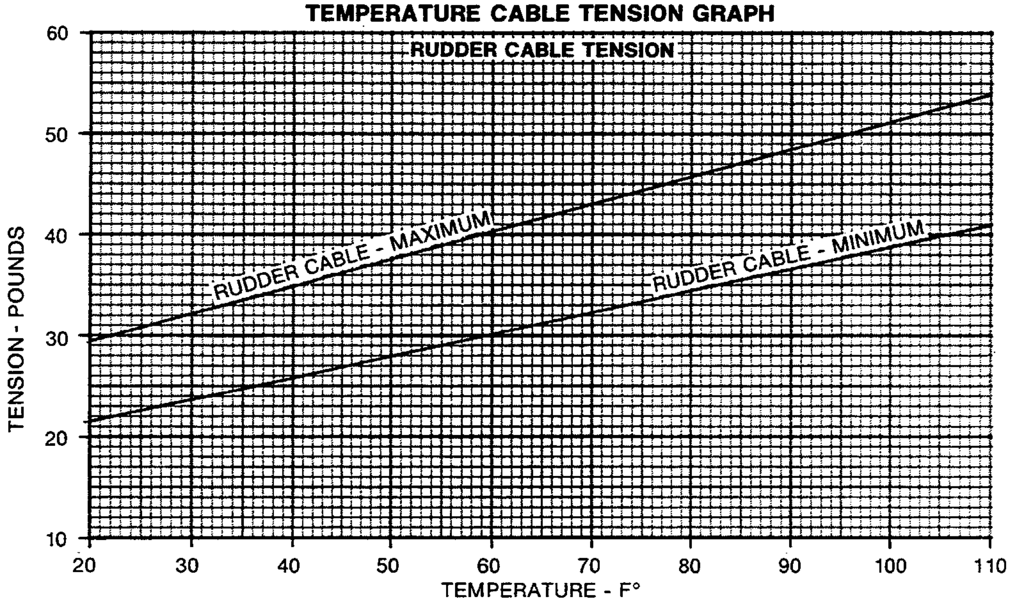
The 35-590087 differential mechanism jig assembly is to be used with the 35-590087-9 stop installed.

With the rudder, elevator and tab systems correctly adjusted and in neutral, the differential mechanism tail control (rudder) arms are lightly contacting the aft side of the 35-590087 differential mechanism jig assembly and the outboard ends (legs) of the jig assembly are lightly contacting the forward side of the fuselage station 256.9 bulkhead. The nut on the differential mechanism elevator control (center) arm is to be positioned inside the hole in the jig assembly.

The elevator and rudder system are in neutral when the differential mechanism jig assembly, the rudder rig tool and the control column block are installed with the ruddervators in the 0° position with the cable tensions set to the temperature cable tension graph. The trim tab system is in neutral when the cockpit indicator is at 0°, the cable tensions are set to the temperature cable tension graph and the tabs are at 0° or symmetrically split. The tabs are at 0° when their trailing edges align with the trailing edges of the ruddervators.

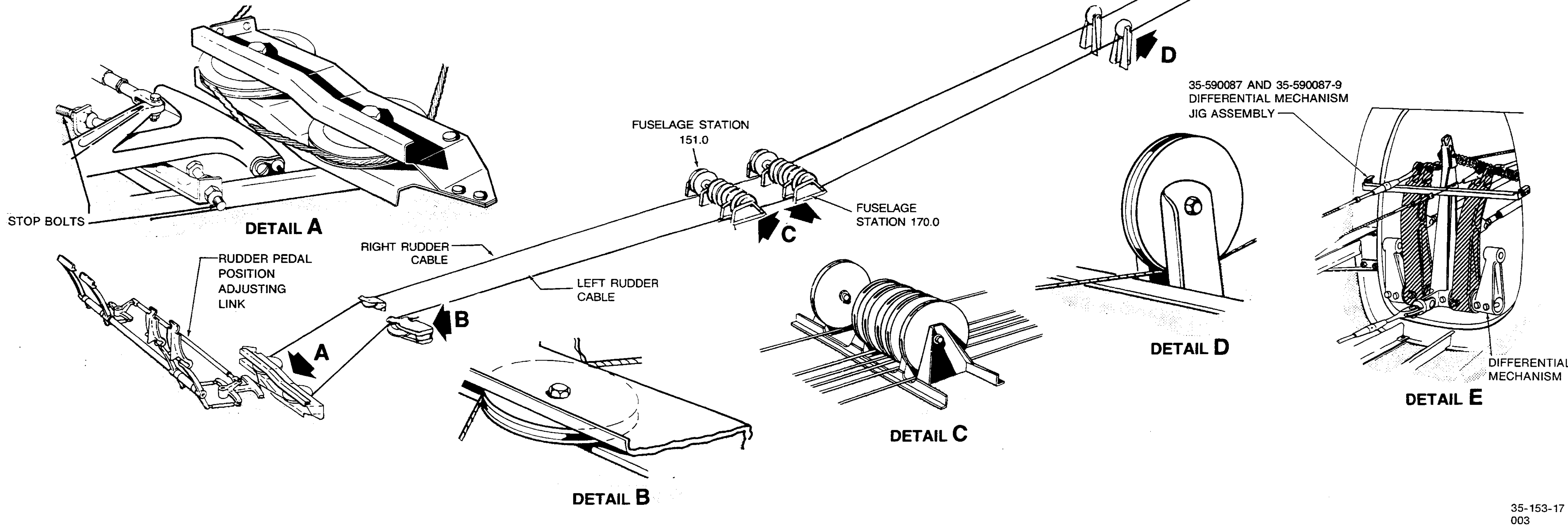
f. Adjust the short, lower elevator cable to a total length of 23.62 ±.06 inches as measured from the center of its attachment points at the reduction bellcrank and the differential mechanism. Refer to Figure 5. No threads on the turnbuckle should be visible outside of the barrel after adjustment. Safety the turnbuckle. No further adjustment of this cable is required.

g. Adjust the main rudder cable tensions to the tension shown on the temperature cable tension graph. Refer to Figure 1. (The cables can be adjusted simultaneously with the rudder balance cable.) The balance cable is adjusted by adding or removing washers



RUDDER TRAVEL		OVER-ALL TRAVEL (COMBINE RUDDER AND ELEVATOR)	
LEFT	RIGHT	LEFT	RIGHT
23° ± 1° UP 26° ± 1° DOWN	26° ± 1° UP 23° ± 1° DOWN	44° ± 2° UP 37° ± 2° DOWN	35° ± 2° UP 40° ± 2° DOWN

RUDDER PEDAL SETTINGS	
R.H. PEDAL	L.H. PEDAL
NEUTRAL POSITION	.38 TO .45 INCHES AFT OF NEUTRAL POSITION



Rudder System (V35B)
Figure 1

behind swivel bolt on the balance cable pulley bracket. The differential mechanism, control column and rudder pedals are still to be in their neutral positions after cable tensions are adjusted.

h. Set the ruddervators in the neutral position (0°) by adjusting the length of the control push-pull rods. Make sure the rod ends remain screwed the required length into the push-pull tubes. They should extend past the inspection hole, i.e. a wire should not pass through the inspection hole.

i. Remove the differential mechanism jig assembly and remove the rudder pedal rig tool. Leave the control column 4-1/2- (or 4-3/4- for D-10359 and after) inch-long block in place to prevent elevator system influence on rudder rigging.

j. Set the rudder travel by adjusting the stop bolts (refer to Figure 1, Detail A) just aft of the pilot's rudder pedals. Refer to Figure 1 for the applicable table of travels and the appropriate ruddervator travel values. Steps b through h should result in the ruddervator travel being correct or nearly correct. Make any final minor adjustments by lengthening or shortening the control push-pull tubes. Make sure the rod ends remain screwed the required length into the push-pull tubes. They should extend past the inspection hole, i.e. a wire should not pass through the inspection hole.

k. When ruddervator travels are correct, tighten the rod end jamnuts, the rudder stop jamnuts, safety the turnbuckles, safety the nut on the swivel bolt on the pulley bracket of the balance cable and recheck travel. Remove the elevator column 4-1/2- (or 4-3/4- for D-10359 and after) inch-long block.

l. Changing rudder rigging may change elevator rigging. Check elevator rigging after changing rudder rigging.

WARNING

Check the ruddervator for the correct direction of movement by working the rudder pedals. When the left rudder pedal is depressed, the left ruddervator should move down and the right ruddervator should move up. When the right rudder pedal is depressed, the left ruddervator should move up, and the right ruddervator should move down.

RUDDERVATOR REMOVAL (Figure 2)

NOTE

The rudder system and elevator system are separate systems forward of the empennage. The control surfaces for both the rudder and elevator are the same parts. The rudder and elevator control surfaces will be referred to as ruddervator.

Before disassembly check the ruddervator for movement perpendicular to the hinge line. If any movement exists, find the cause of the looseness. If any hinge bolt, bearing or bushing shows signs of wear, they must be replaced.

a. Remove the screws holding the tail cone in position.

b. Remove the tail cone and disconnect the navigation light wire.

c. Remove the aft fuselage side and bottom panels.

d. Remove the 5/16-inch bolt from the push-pull tube.

e. Working inside the open left side inspection hole, release the tab cable tension, then fasten the ruddervator tab cables so that no slack in the cables will be transmitted beyond the affected tab.

NOTE

Identify the cables so that they may be reinstalled in the proper location.

f. Disconnect the elevator tab cables at the tab.

g. Remove the guide block located on the tab cable at the front of the ruddervator.

h. Remove the cotter pins from the hinge bolts.

i. Remove the nuts from the three hinge bolts.

NOTE

Support the ruddervator so that it will not fall or twist when the hinge bolts are removed.

Note the position of the washers in each hinge assembly. Tag each hinge assembly as to the location of the washers. Refer to Figure 2.

j. Remove the bolts from the hinges.

k. Remove the two bonding jumpers which are attached near the hinges.

l. Remove the ruddervator.

RUDDERVATOR INSTALLATION (Figure 2)

WARNING

Airframe vibration may be caused by worn elevator hinges, misthreaded trim tab hinges, loose stabilizer attachment or any improper installation which will allow free play.

NOTE

The elevator/rudder control surfaces will be refered to as ruddervator.

a. Support the ruddervator in its proper position. Make sure the hinge bushings are installed in the hinge halves on the stabilizer.

NOTE

Any hinge bolt, bearing or bushing showing signs of wear must be replaced. The maximum wear for the inboard bearing is .001-inch radial and .025-inch axial.

b. Install the bonding jumpers at the center and outboard hinges (two 105090D032-1D washers go between the screw head and skin).

c. Using the notes made during removal (refer to Figure 2), install the proper washers and bolts in the hinges as follows:

NOTE

Install the bolts with the nuts toward the fuselage.

1. The inboard hinge requires two AN960-416L and one AN960-416 washers. Install one AN960-416L washer under the bolt head and one between the torque fitting and the ruddervator inboard hinge support. One AN960-416 washer should be installed under the nut.

2. Torque the nut to 30 to 40 inch-pounds, It may be tightened up to 70 inch-pounds to align the cotter pin holes.

d. Install the nuts on the center and outboard hinge bolts.

NOTE

The center and outboard hinge bolt each require two AN960-10 washers under the nut.

If the bolt grip length, is too long one additional washer may be added under the nut.

e. Torque the nuts to 20 to 25 inch-pounds; they may be tightened up to 40 inch-pounds to align the cotter pin holes.

f. Install the cotter pins in the hinge bolts.

g. Install the guide block for the tab cable at the front of the ruddervator.

h. Connect the tab cables to their respective tab horn.

NOTE

The bolt connecting the cable to the tab horn should be tight enough to prevent rattle, but loose enough to swivel. If the bolt is too tight, the tab control system will bind.

i. Remove the fasteners which were installed to prevent cable slack from being transmitted to the rest of the tab system.

j. Install the 5/16-inch push-pull tube bolt.

k. Install the aft fuselage inspection panels.

l. Connect the tail light wire and install the tail cone.

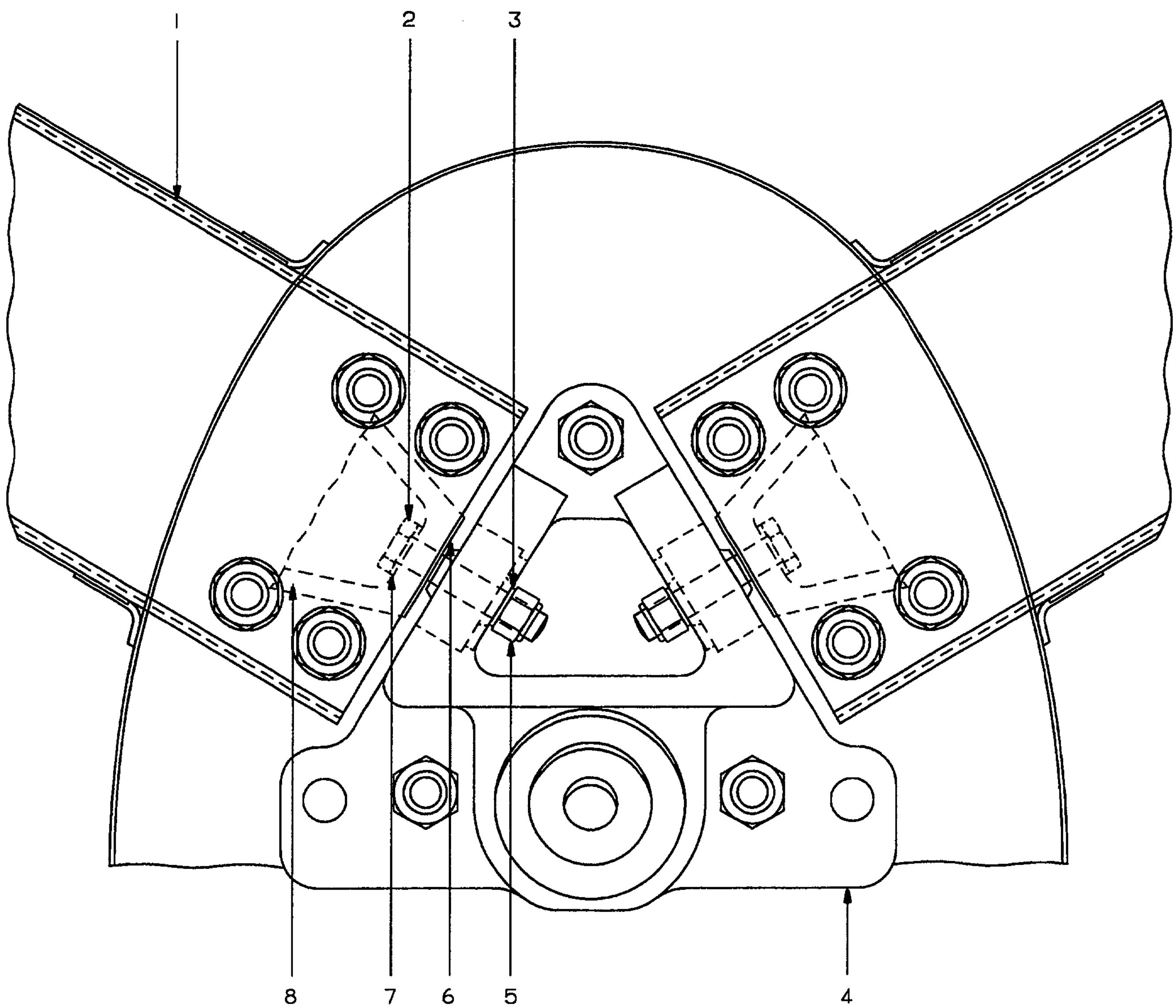
NOTE

Check for proper ruddervator and trim tab travel after installation is complete. When the control column is pulled back, the correct ruddervator movement is up. When the elevator trim tab control is moved toward the nose-up position, the trim tab should move DOWN. When the elevator trim tab control is moved toward the nose-down position, the trim tab should move UP.

ELEVATOR TRIM TAB REMOVAL (Figure 3)

a. Remove the screws from the tail cone.

1 STABILIZER
2 BOLT
3 WASHER
4 ELEVATOR (RUDDERVATOR) INBOARD HINGE SUPPORT
5 NUT
6 WASHER
7 WASHER
8 TORQUE FITTING



Ruddervator Installation
Figure 2

b. Disconnect the electrical wires and remove the tail cone.

c. Remove the cotter pin from the control cables clevises and trim tab.

d. Remove the nuts, washers and bolts from the control cable clevises.

e. Support the trim tab so that it will not fall or twist when the hinge pin is removed.

f. Remove the safety wire from the trim tab hinge pin.

g. Unclip the hinge pin.

h. Pull the hinge pin out and remove the elevator trim tab.

ELEVATOR TRIM TAB INSTALLATION (Figure 3)

a. Support the elevator trim tab in position on the ruddervator.

b. Install the trim tab hinge pin. Refer to Figure 3.

c. Clip the hinge pin in position and safety wire.

d. Connect the control cable clevises to the trim tab with the bolts, washers and nuts.

NOTE

The clevises should be tight enough that they will not rattle but loose enough so that they will swivel. If the clevises are too tight, binding may occur.

e. Install the cotter pins in the clevis bolts.

f. Connect the electrical wires and install the tail cone.

NOTE

Check that the trim tab moves in the correct direction as indicated by movement of the controls.

ELEVATOR AND TAB (V35B)

NOTE

The rudder system and elevator system are separate systems forward of the empennage. The control surfaces for both the rudder and elevator are the same parts. The rudder and elevator control surfaces will be referred to as ruddervator.

ELEVATOR RIGGING PROCEDURE

NOTE

All elevator rigging must be accomplished with a travel board installed. A bubble protractor should not be used for any elevator rigging procedure.

a. Adjust the stops on the aft fuselage bulkhead to permit maximum combined elevator/rudder (ruddervator) travel as shown in the table of travels under OVERALL TRAVEL in Figure 4.

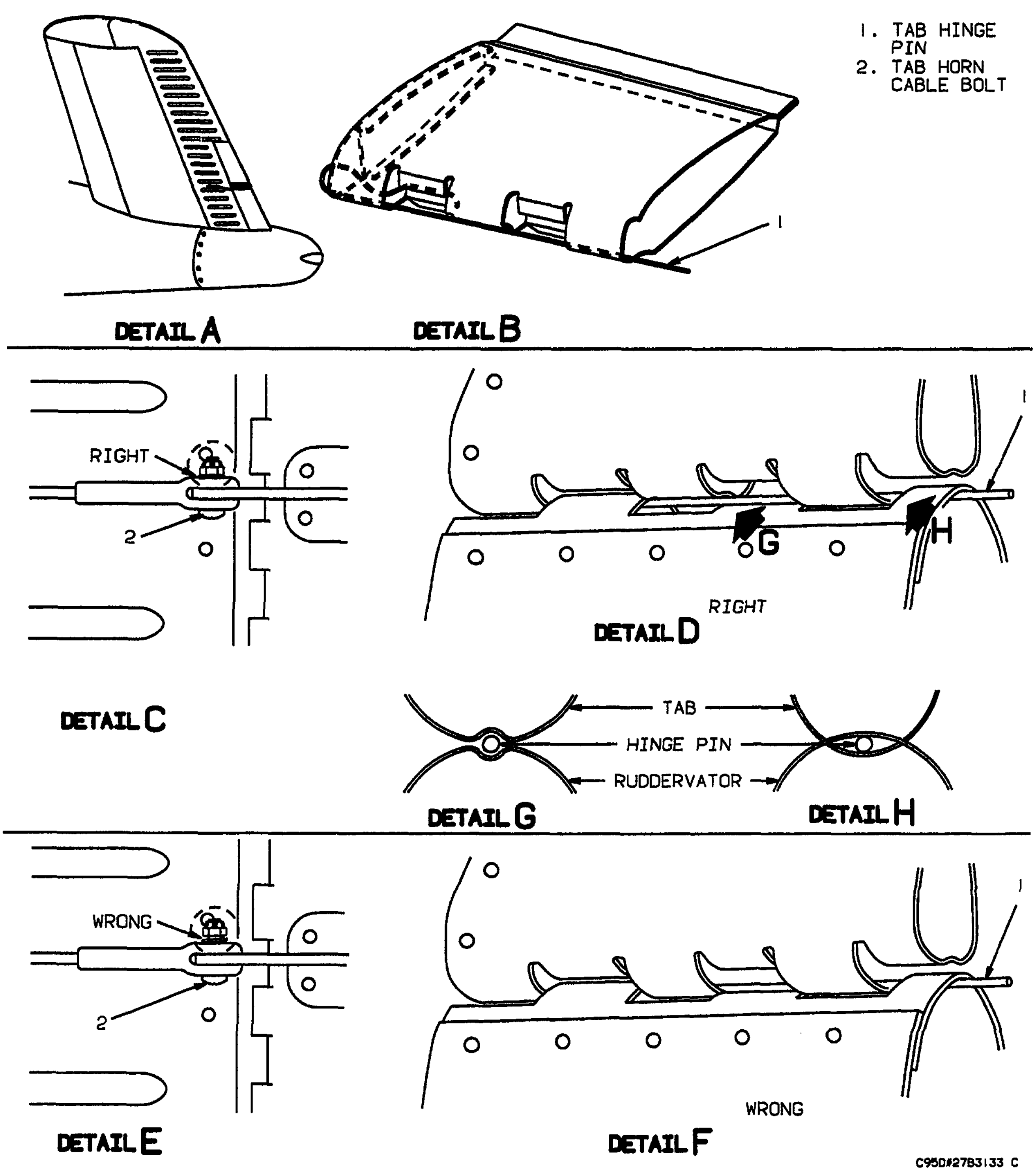
b. Position the control column in the neutral position with 4-1/2 inches (4-3/4 inches on D-10359 and after) between the collar on the instrument panel and the split collar on the control column. This can be accomplished by cutting a block 4-1/2- (or 4-3/4- for D-10359 and after) inches long as applicable and taping it to the control column.

c. Straighten the nose wheel and adjust the pilot's rudder pedals (fore and aft) to the same position. Install the rudder pedal rig tool in the pilot's rudder pedals to place them in the neutral position and to prevent rudder system influence on elevator rigging. The left rudder pedal is aft of the right rudder pedal with the system in neutral. Use an offset rig tool as shown in Figure 1, Chapter 27-20-00.

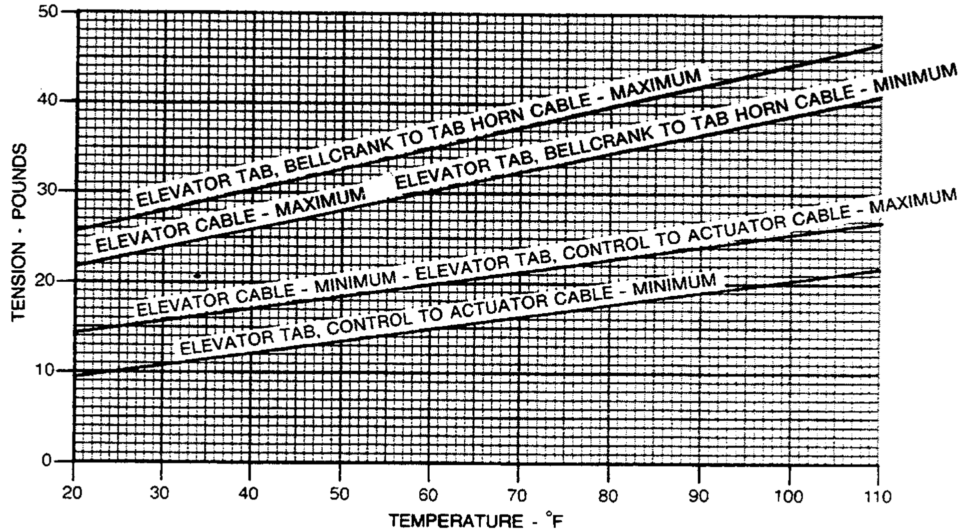
d. Install the differential mechanism jig assembly to position the differential mechanism in the neutral position. This is accomplished with the 35-590087 differential mechanism jig assembly with the 35-590087-9 stop (refer to Figure 1, Detail E) installed. This will position the right tail control arm of the differential mechanism aft of the left tail control arm with the elevator system and rudder system in neutral.

e. Adjust the short, lower elevator cable to a total length of 23.62 ±.06 inches as measured from the center of its attachment points at the reduction bellcrank and the differential mechanism. Refer to Figure 5. No threads on turnbuckle ends should be visible outside of the barrel after adjustment. Safety the turnbuckle. No further adjustment of this cable is required.

f. Adjust the upper and lower (forward of the reduction bellcrank) elevator cable turnbuckles simultaneously until cable tensions are as shown on the temperature cable tension graph in Figure 4. The differential mechanism, the control column and rudder pedals are still to be in their neutral positions after cable tensions are adjusted.

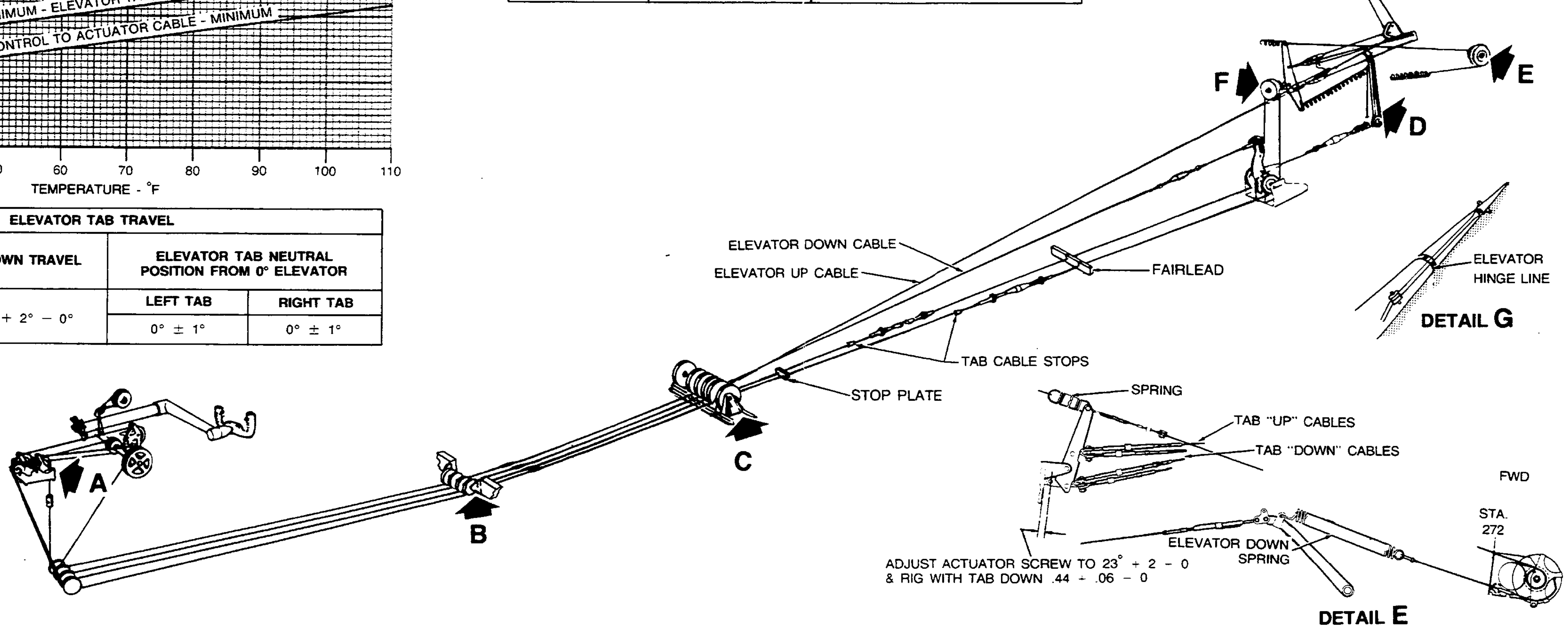


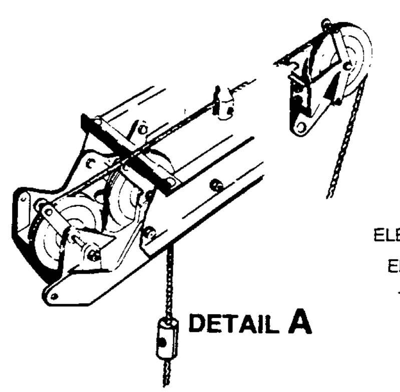
Elevator Trim Tab Installation
Figure 3

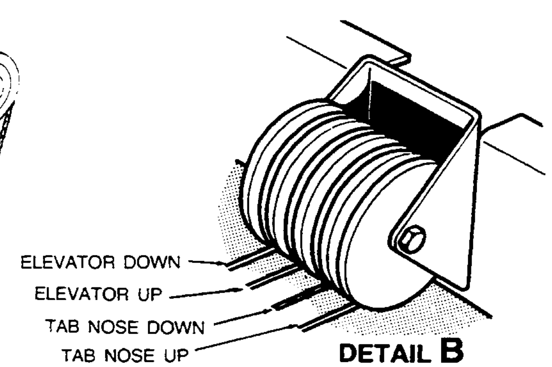


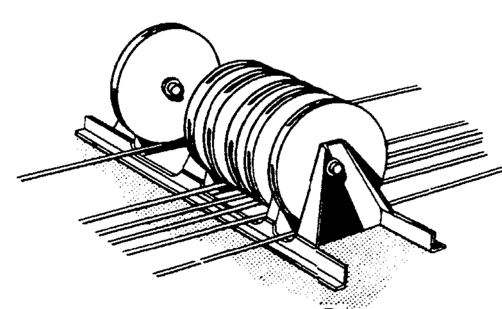
ELEVATOR TAB TRAVEL			
UP TRAVEL	DOWN TRAVEL	ELEVATOR TAB NEUTRAL POSITION FROM 0° ELEVATOR	
		LEFT TAB	RIGHT TAB
5½° +½° −1°	23° + 2° − 0°	0° ± 1°	0° ± 1°

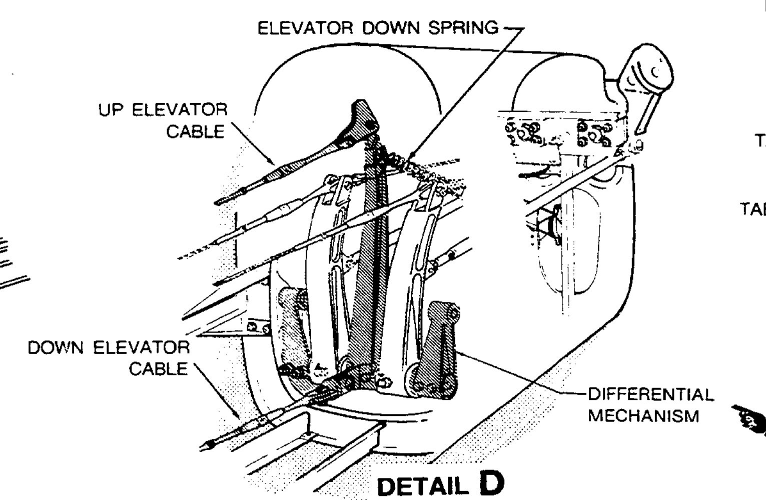
ELEVATOR TRAVEL		
UP TRAVEL	DOWN TRAVEL	OVERALL TRAVEL (COMBINED ELEVATOR AND RUDDER)
22½° + 0° / −1°	19° +2° / −1°	(L.H.) 44° ± 2° UP 37° ± 2° DOWN (R.H.) 35° ± 2° UP 40° ± 2° DOWN

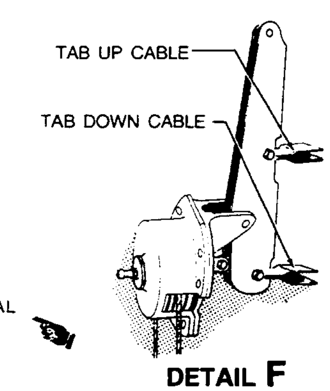












35-152-38
001

Elevator System (V35B)
Figure 4

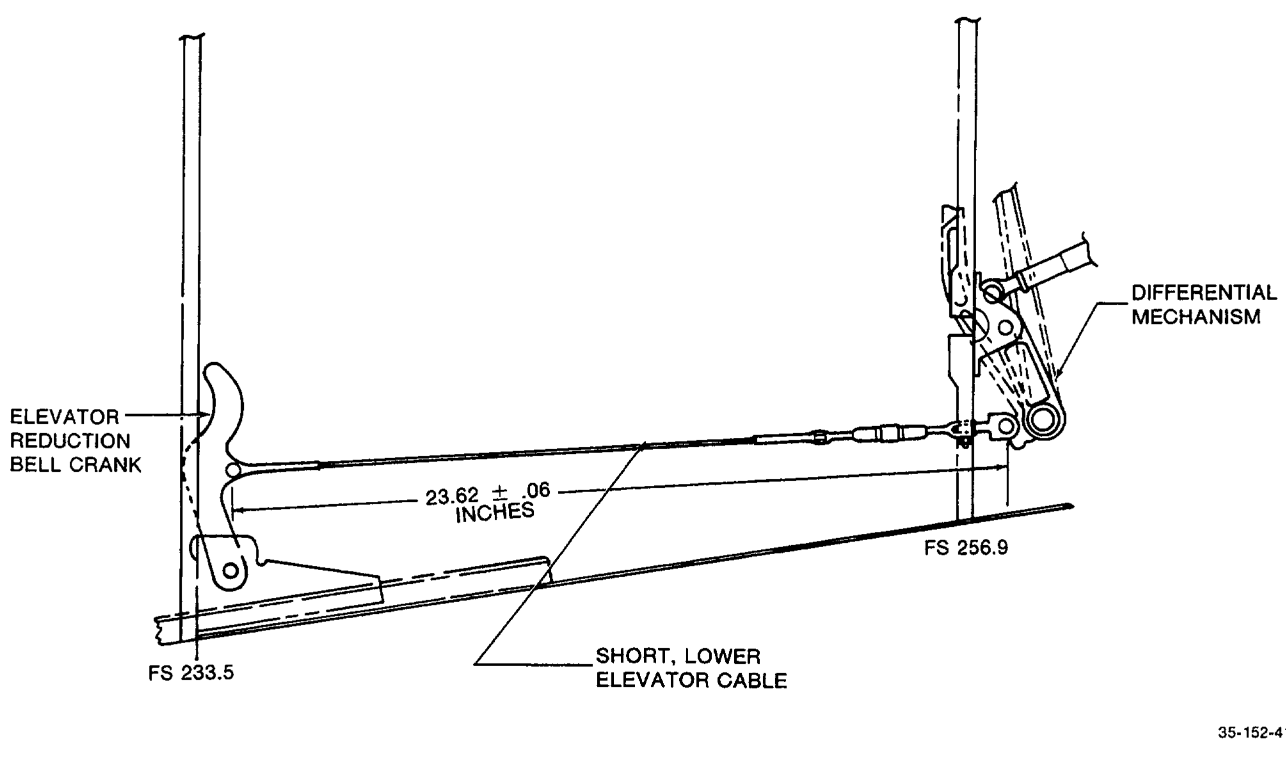
NOTE

With the rudder, elevator and tab cable systems correctly adjusted and in neutral, the differential mechanism is in its neutral position when its tail control (rudder arms) are lightly contacting the aft side of the 35-390087 differential mechanism jig assembly (with -9 stop installed) and the outboard ends (legs) of the jig assembly are lightly contacting the forward side of the fuselage station 256.9 bulkhead. The nut on the differential mechanism elevator (center) control arm is to be positioned inside the hole in the jig assembly.

The elevator and rudder system is in neutral when the differential mechanism jig assembly, the rudder rig tool and the control column block are installed with the ruddervators in the 0° position and the cable tensions set to the temperature cable tension graph. Refer to Figure 4. The trim tab system is in neutral when the cockpit indicator is at 0°, the cable tensions are set to the temperature cable tension graph and the tabs are at 0° or symmetrically split to correct for yaw. The tabs are at 0° when their trailing edges align with the trailing edges of the ruddervators.

g. Set the ruddervators in the neutral position (0°) by adjusting the control push-pull tube lengths. Make sure the rod ends remain screwed the required length into the push-pull tubes. They should extend past the inspection hole, i.e. a wire should not pass through the inspection hole.

h. Remove the differential mechanism jig assemblies and remove the 4-1/2-inch-long block (4-3/4-inch-long on D-10359 and after) on the control column. Recheck (reset if necessary) the elevator cable tensions. The elevator trim system may be repositioned to minimize the downspring/bob weight effect on the elevator arm and elevator cable tensions. After the downspring effect is minimized, the up-and-down cable tension average must fall within the maximum and minimum



Elevator Short Lower Cable Adjustment
Figure 5

values designated by the temperature cable tension graph. Refer to Figure 4.

i. Check the elevators for correct up-and-down travel limits: 22-1/2 degrees +0 -1 degree up and 19 +2 -1 degrees down. The stops are nonadjustable stops forward of the instrument panel and underneath the control column. Steps b through h should result in the ruddervator travel being correct or close to correct. Make any final minor adjustments by lengthening or shortening the ruddervator push-pull tubes, but make sure the rod ends remain screwed the required length into the push-pull tubes. They should extend past the inspection hole, i.e. a wire should not pass through the inspection hole.

j. Adjust the elevator downspring cable turnbuckle with the ruddervators 9° up and the tabs 20° down (nose up) to remove all slack from this cable system; then check the force on the elevator control column. With the trim tabs set at neutral (0°), a force of 19 ±3 pounds applied on the control column is required to move the ruddervators through neutral. If necessary, adjust the elevator downspring cable turnbuckle to obtain the value.

k. When the elevator travels and forces are correct, tighten the rod-end jam nuts, safety the turnbuckles and recheck the travels. Remove the rudder rig tool.

l. Changing elevator rigging may change rudder rigging. Check rudder rigging after changing elevator rigging.

WARNING

Check for correct direction of ruddervator travel by moving the control column. When the control column is pushed forward, the correct ruddervator movement is down. When the control column is pulled back, the correct ruddervator movement is up. When the elevator trim tab control is moved toward the nose-up position, the trim tab should move DOWN. When the elevator trim tab control is moved toward the nose-down position, the trim tab should move UP.

INSPECTION OF ELEVATOR TABS

NOTE

The trim tabs have an upper contoured surface.

a. Check the up and down travel of the elevator tabs. The travel should be 5-1/2° +1/2° -1° up and 23° +2° -0° down.

b. Check the main and the aft tab cables for proper tension as shown on the temperature cable tension graph. Refer to Figure 4. The same number of terminal threads should be visible on each end of the turnbuckle barrels (a maximum of three threads may be visible).

ELECTRIC ELEVATOR TRIM (OPTIONAL)

For the Model F33A, E33C and V35B electric trim system, see Chapter 27-30-00.

ELEVATOR TAB RIGGING

NOTE

The use of a bubble protractor is not adequate to set the ruddervator travels. A travel board must be used for this. However, with the ruddervator set at neutral, a tab travel board or a bubble protractor may be used to set elevator tab travel.

Elevator tabs should be rigged with the travel board or bubble protractor perpendicular to the chord plane of the stabilizer or tab respectively.

a. Install a 4-1/2-inch-long block (or 4-3/4-inch-long on D-10359 and after) on the control column and install the rudder pedal rig tool (Figure 1, 27-20-00) to maintain the ruddervators in neutral. Rotate the elevator tab wheel in the cabin so the indicator dial is set on zero.

NOTE

Both elevator trim tabs should be at neutral (tab trailing edge aligned with ruddervator trailing edge; see the procedure for RIGGING ELEVATOR TRIM TABS TO CORRECT FOR YAW). Trim tab actuator stops on the cables should be moved away from the stops in the fuselage.

b. Rotate the elevator trim tab control wheel to full nose up on the indicator (tabs down). Check the tab actuator at F.S. 233.5. for a distance of .38 to .50 inch between the face of the actuator and the centerline of the bolt in the clevis end of the actuator screw as shown in Figure 6.

c. Adjust the length of the actuator screw by disconnecting the bellcrank at the actuator bolt and turning the screw to the dimension shown in Figure 6. Reconnect the bellcrank to the tab actuator.

d. Adjust the four trim tab cables aft of the bellcrank to obtain 23° +2° -0° tab down position, and establish the initial trim tab cable tension per the temperature cable tension graph on figure 4. Loosen the tab cable stop if necessary. The same number of terminal threads should be visible on each end of the turnbuckle barrel (a maximum of 3 threads).

e. Move the tab control wheel to fully nose down on the indicator (tabs up). The trim tab up-position should be 5-1/2° +1/2° -1° without altering the tab cable adjustment. Loosen the tab cable stop, if necessary, to obtain these dimensions.

The preceding procedure has established the capability of the elevator tab actuator to move through its maximum available range and has correctly oriented the tab indicator, the tab actuator and trim tabs to one another.

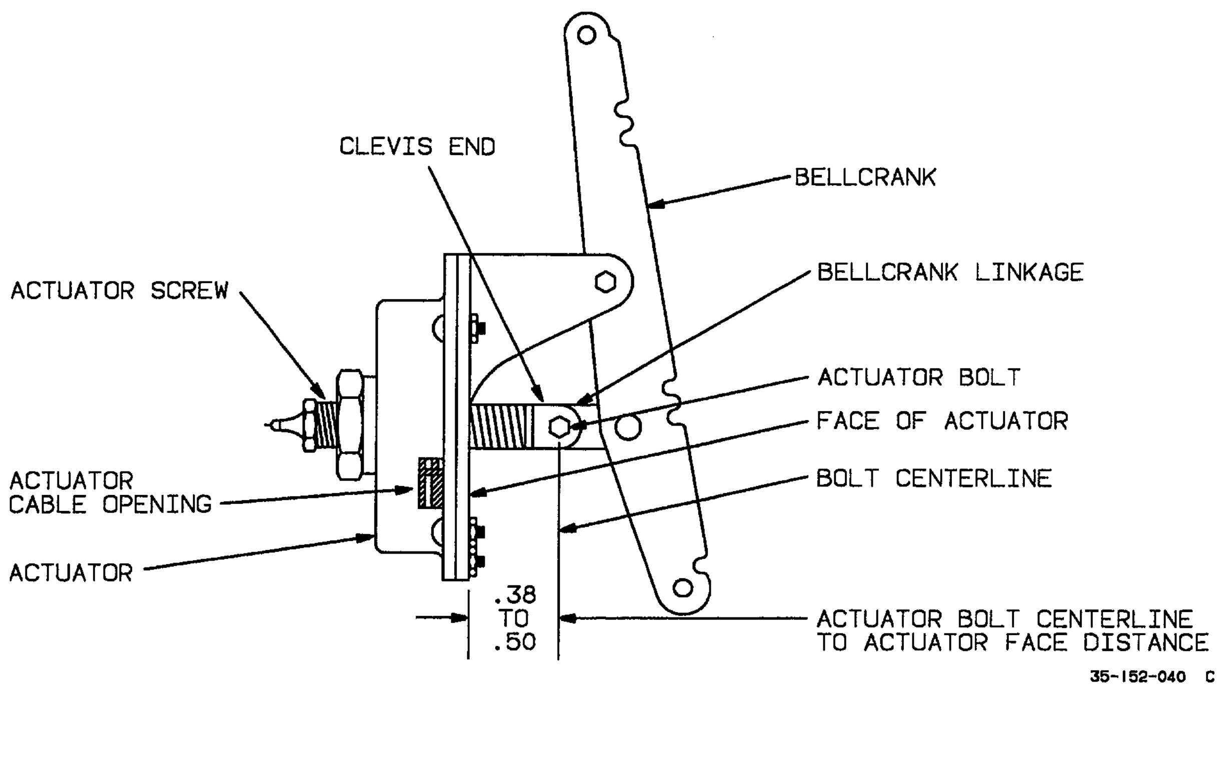
f. Move the tab system to neutral (0°) position. Check and readjust cable tension per the temperature cable tension graph in Figure 4 if necessary.

g. Move the tab control wheel toward nose-down and establish trim tab up-travel per the chart on Figure 4. Move the trim tab cable adjustable upstop against the fixed stop in the fuselage.

h. Check the clevis bolts which attach the tab cables to the tab horn. The clevis bolts should be free of corrosion and dirt and be loose enough to allow free movement of the horn without binding the tab cables.

i. Move the trim tab wheel toward nose-up and establish the trim tab down-travel per the chart on Figure 4, and move the trim tab cable adjustable down stop against the fixed stop in the fuselage. Move the tab control wheel to neutral (0°) on the indicator. The trailing edge of the trim tabs should align with the trailing edge of the ruddervators.

j. Reinspect and safety all turnbuckles, nuts, bolts and cable stops affected during this procedure. The tab cable stops are to be tightened to 20 +5 -0 inch-pounds of torque and safetied.



Trim Tab Actuator and Bellcrank (V35B)
Figure 6

WARNING

After rigging the ruddervator and elevator trim tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the control column is moved forward, the ruddervators should move DOWN. When the control column is moved aft, the ruddervators should move UP. When the elevator trim tab control is moved toward the nose up position, the trim tab should move DOWN. When the elevator trim tab control is moved toward the nose down position, the trim tab should move UP.

k. Close all inspection panels and test fly the airplane.

l. If yawing occurs in level flight, with the ailerons in neutral, adjust the tabs per the instructions under RIGGING ELEVATOR TRIM TABS TO CORRECT FOR YAW.

RIGGING ELEVATOR TRIM TABS TO CORRECT FOR YAW

The elevator tabs can be rigged to function as a rudder tab by making minor adjustments up and down from neutral position.

FOR RIGHT YAW (NOSE OF AIRPLANE TENDS TO MOVE TO RIGHT WITH WINGS LEVEL)

a. Adjust the right elevator tab down approximately 1° by lengthening the upper right trim tab cable and shortening the lower right trim tab cable.

b. Adjust the left elevator tab up approximately 1° by shortening the upper left trim tab cable and lengthening the lower left cable.

c. Set cable tensions to the graph specifications on Figure 4.

d. Safety the two turnbuckles, close inspection panels and test fly the airplane.

FOR LEFT YAW (NOSE OF AIRPLANE TENDS TO MOVE LEFT WITH WINGS LEVEL)

a. Adjust the right elevator tab up approximately 1° by lengthening the lower right tab cable and shortening the upper right tab cable.

b. Adjust the left elevator tab down approximately 1° by lengthening the upper left cable and shortening the lower left cable.

c. Set cable tension to the graph specifications on Figure 4.

d. Safety the two turnbuckles, close inspection panels and test fly the airplane.

NOTE

In the event the above procedure results in overcorrecting, partial readjustment to reduce the rudder effect can be accomplished on one tab only. The maximum allowable amount of split between trim tabs is 6°. The average degree of tab travel at fully up or down cannot exceed the limit of travel.

ELEVATOR TAB INDICATOR CABLE REPLACEMENT (Figure 7)

a. Place the proper tension on the trim cables in neutral position. Both turnbuckles aft of Fuselage Station 185 should be approximately even.

b. To install the dial indicator cable, thread the cable through the hole in the head of the cotter pin and out through the holes in the indicator drum.

c. With the dial at 0 degrees, slip the cable so that both ends of the cable are of equal length.

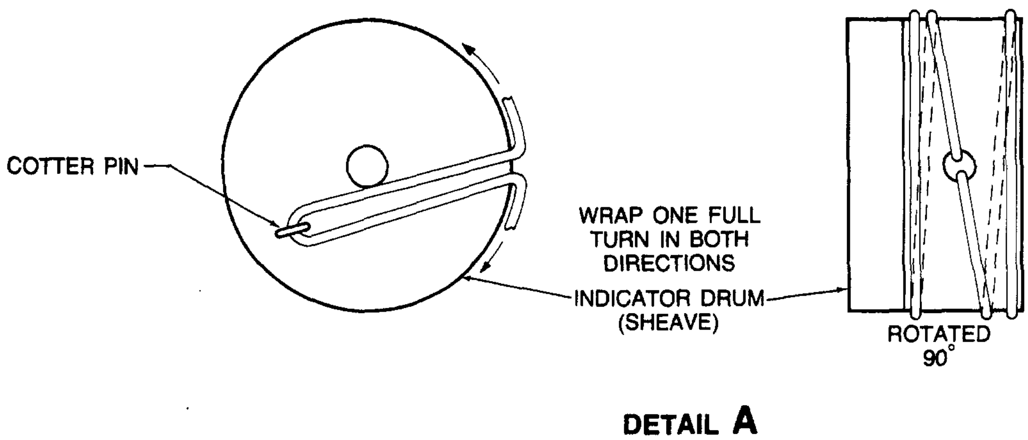
d. Wrap the cable around the drum one full turn in each direction. The end that wraps to the right will be wrapped clockwise around the drum, and the end that wraps to the left will be wrapped counterclockwise, as viewed from the left side.

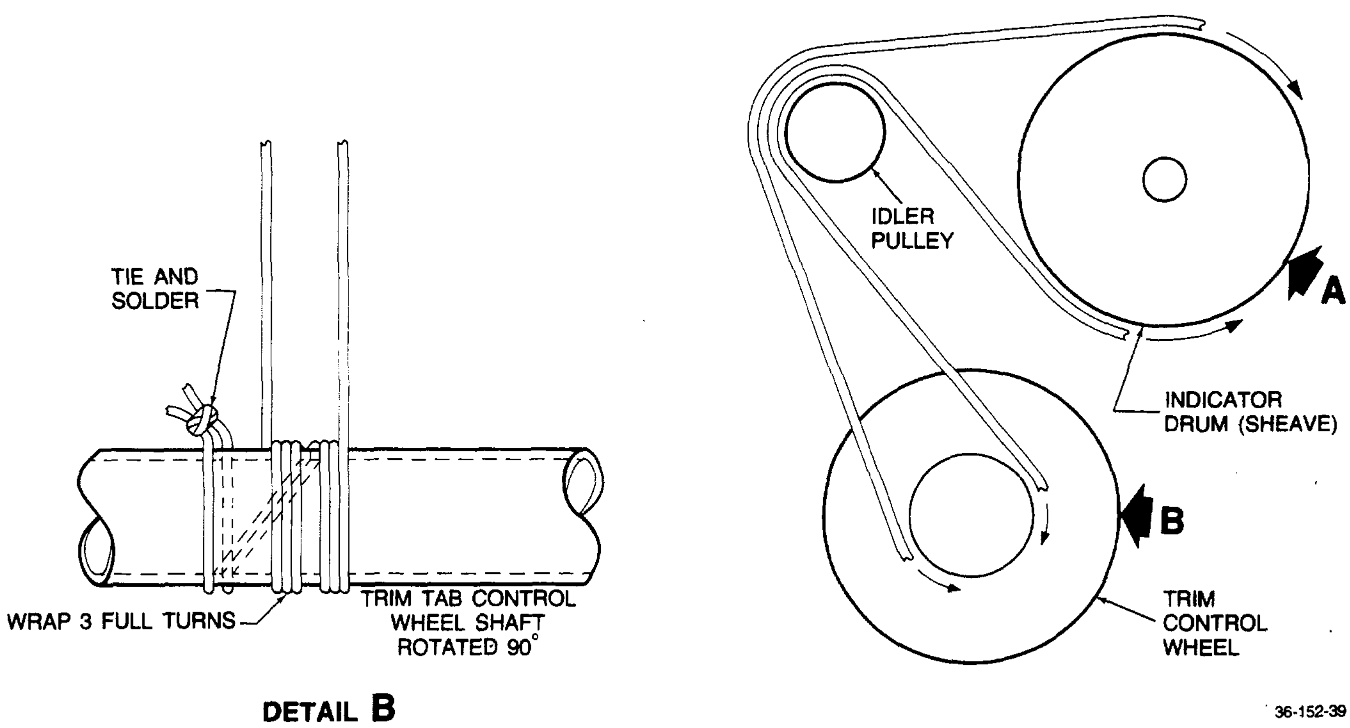
e. Route the cable over the appropriate idler pulley down to the shaft of the tab control wheel.

f. With the dial still in 0 degrees position, take the cable coming off the top of the elevator tab dial sheave and bring it down to the forward side of the tab wheel shaft to the left of the small hole.

g. Wrap the cable (counterclockwise) around the shaft toward the hole three turns. Insert the cable through the hole. Wrap the surplus cable around the shaft.

h. With the dial set at 0 degrees, take the cable coming off the bottom of the trim tab dial sheave and bring it down to the aft side of the tab wheel shaft, to the





Elevator Trim Tab Indicator Cable Replacement
Figure 7

right of the hole in the shaft, and wrap the cable (clockwise as viewed from the left end of the shaft) three turns toward the hole in the shaft.

i. Insert the cable through the hole in the shaft and wrap it around the shaft.

j. Twist the cables together and solder them. Use only rosin core solder.

k. Check the tab dial to see that it will roll from one stop to the other.

l. Set the tab dial at 0 degrees. Place tension on the tab cables in the tail section to hold the tabs in line with ruddervators.

NOTE

With the ruddervators set in the neutral position, the left elevator tab should be set at 2° ±1° above neutral ruddervator position. The right elevator tab should be set at 0° ±1° ruddervator position.

m. Safety the turnbuckles and set the stops on the fuselage cables to maintain proper travel in accordance with the travel table in Figure 4.

WARNING

After rigging the elevator and elevator trim tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator trim tab control wheel is moved toward the NOSE DOWN position, the elevator trim tab should move UP.

INSPECTION OF TAB HINGES

Improper cable tensions, either above or below the recommended limits, will cause excessive wear on the tab hinges. If excessive wear is noted on the ruddervator half of the hinge, it should be replaced.

The bolt securing the cable to the elevator tab horn should swivel in the horn at all times, if the bolt binds, it will cause cracks to develop in the tab horn. The bolt should be just tight enough to prevent rattle, but not tight enough to cause binding in the horn.

TRIM TAB ACTUATOR REMOVAL (V35B)

a. Using the trim tab control in the flight compartment, move the trim control to the fully nose-up position as noted on the elevator trim tab indicator.

b. Remove the access panel on the left side of the fuselage, just forward of the ruddervator.

c. Install identification tags to the cables and disconnect the cables which are routed aft to the elevator trim tabs.

d. Install identification tags to the cables on each side of the first turnbuckle and disconnect the actuator cables routed forward to the flight compartment. Secure the cables so they do not come off of the forward pulleys. Secure the cables to the actuator so the actuator screw position can be maintained.

CAUTION

Do not damage, kink or put bends in the cables.

e. Identify the cables on the actuator being removed so that the cables on the replacement actuator are reconnected correctly.

f. Remove the three bolts securing the actuator to the bracket and remove the actuator and attached bellcrank from the airplane.

NOTE

It may be necessary to remove the two tab cable pulleys located directly below the actuator, in order to provide clearance for the cable ends on the actuator cables through the pulley bracket.

TRIM TAB ACTUATOR INSTALLATION (V35B)

a. Position the actuator assembly in the bracket and install the three attaching bolts.

b. Using the cable at the forward side of the actuator drum, be certain the cable is at the end of its actuator drum travel.

c. Rotate the actuator drum upward until the pin securing the cable to the drum is no longer visible through the actuator cable opening.

NOTE

If the bellcrank-to-actuator screw linkage is disconnected, install the actuator bolt, washers, nut and cotter pin to attach the bellcrank to the actuator.

d. With the actuator bolt connecting the bellcrank to actuator screw linkage installed, position the trim tab actuator screw by rotating the actuator drum to obtain the actuator bolt-centerline-to-actuator-face distance of .38 to .50 as shown in Figure 6.

e. Connect the actuator cables to the cables routed aft from the flight compartment.

f. If the two tab cable pulleys, located directly below the actuators, were removed to provide clearance for the ends of the actuator cable, install the two pulleys at this time.

CAUTION

Do not damage, kink or put bends in the cables.

g. Connect the bellcrank cables routed aft to the elevator trim tabs.

h. The elevator trim tab indicator on the pilot's instrument panel should indicate the fully nose-up position in degrees as noted in Figure 4.

CAUTION

Be certain that all cables are hooked up correctly. Operate the elevator system through the full travel to ensure complete and proper degrees of travel of the trim tabs. Check for proper direction of travel. For a nose-up condition on the airplane, the trim tab should move down. For a full nose-down condition, the trim tab should move up.

i. Install the access panel on the left side of the fuselage, just forward of the ruddervator.

ELEVATOR AND TAB - MAINTENANCE PRACTICES (F33A, F33C, A36, A36TC AND B36TC)

WARNING

On airplane serials CE-1566 and after; E-1946, E-2104, E-2111 and after; EA-320, EA-389 and after, observe the color coding on all parts when replacing or installing control cables, bellcranks, and/or other control system components. DO NOT connect parts of one color to coded parts of a different color.

On the preceding airplane serials and earlier airplanes in compliance with Service Bulletin No. 2399, the elevator tab actuators are color-coded. The actuators may have colored stripes or may be of a solid color. The left actuator will be coded with a blue color. The right actuator will be coded with black or red.

ELEVATOR REMOVAL

a. Detach the tail cone, disconnect the tail navigation light and remove the tail cone.

b. Remove the tail section access doors on the left-hand side of the aft fuselage.

c. Disconnect the elevator push-pull tubes from the torque tube fittings of the elevator.

d. Disconnect the actuator rod at the actuator for the elevator trim tab.

e. Remove the hinge bolts.

f. Disconnect the elevator bonding cable and remove the elevator.

ELEVATOR INSTALLATION

a. Connect the elevator bonding cable and position the elevator on the stabilizer, install the hinge bolts and nuts then tighten and safety.

b. Connect the rod to the trim tab actuator on the elevator.

c. Install the attaching nut at the inboard point for the elevator and torque to 50-70 inch-pounds.

d. Connect the push-pull tubes at the torque tube fitting for the elevator.

e. Connect the tail light wires and install the tail cone.

f. Install the access doors.

RIGGING THE ELEVATOR CONTROL SYSTEM (CE-748, CE-772 AND AFTER, CJ-149 AND AFTER, PRIOR TO E-2111 EXCEPT E-1946 AND E-2104, AND PRIOR TO EA-389 EXCEPT EA-320)

a. Set the downstop bolt so the aft side of the bellcrank just touches a straightedge held vertically against the back of the bulkhead (or is .62 ± .05 inch forward of the straightedge on F33A).

b. Adjust the elevator push-pull rod for a downward deflection of 15° ±1° on F33A, 20° ±1° on A36, or 25° ± 1° on B36TC.

c. Adjust the elevator upstop bolt for a deflection of 23°± 1° up (25° ±1° on F33A).

d. Disconnect the elevator downspring.

e. Rig neutral elevators on the control column by positioning the control column so the gust lock hole is 2.00 ± 0.03 inches aft of the hole in the control column support.

f. With the column fastened at neutral adjust the turnbuckles to obtain neutral elevators with a cable tension as indicated in Sheet 2 of Figure 1.

g. Connect the elevator downsprings.

h. With the elevators fully rigged on A36, A36TC, B36TC only, the control column should have a 1/16- to 1/8-inch cushion when in the full forward position.

i. Employing a hand-held force gage on the control wheel, adjust the elevator downsprings as follows:

1. A36, A36TC and B36TC:

a) 23 maximum pounds of breakout force at 20° DOWN elevator.

b) 25 to 26 pounds of force through NEUTRAL elevator.

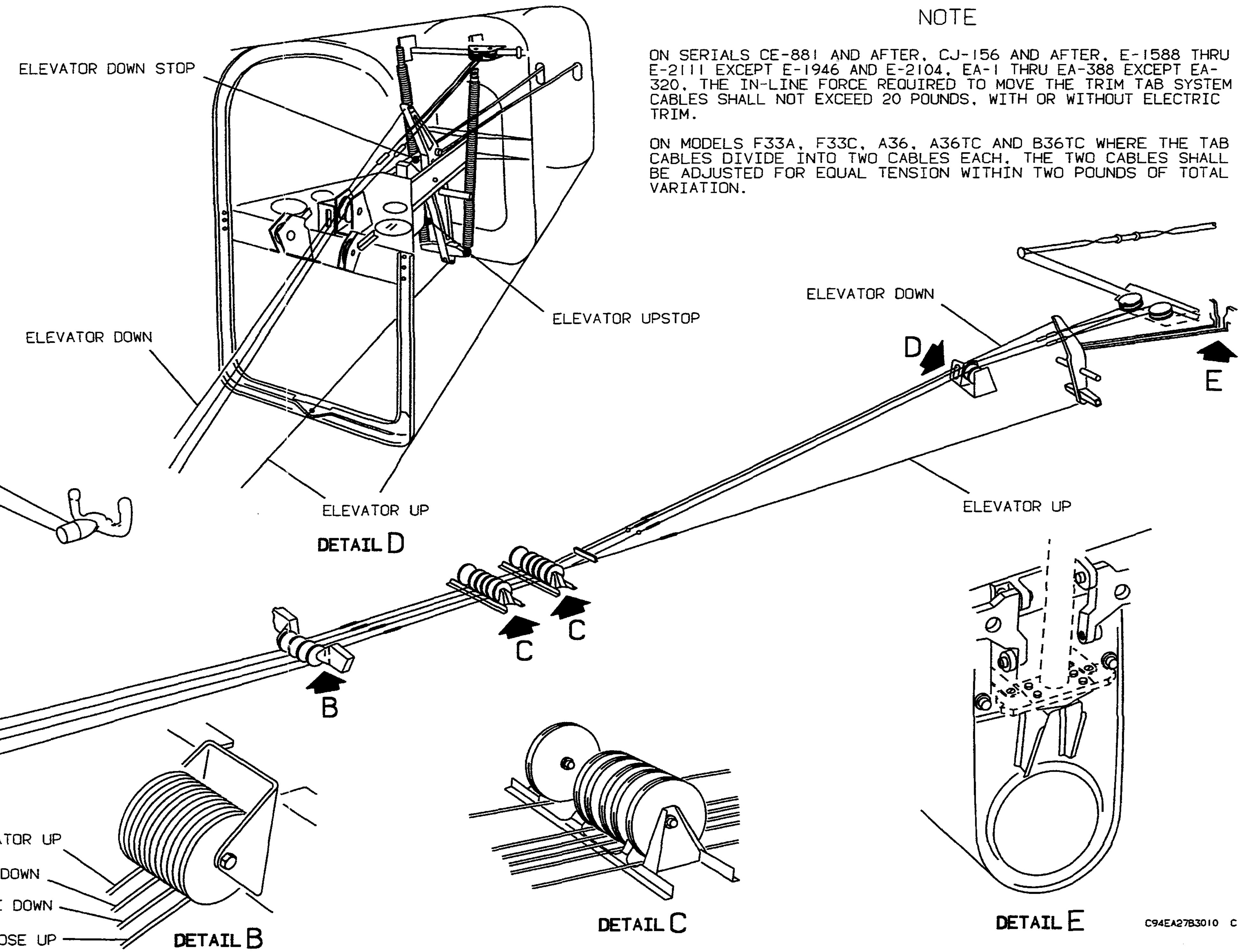
c) 23 to 24 pounds of force as 23° UP elevator is reached.

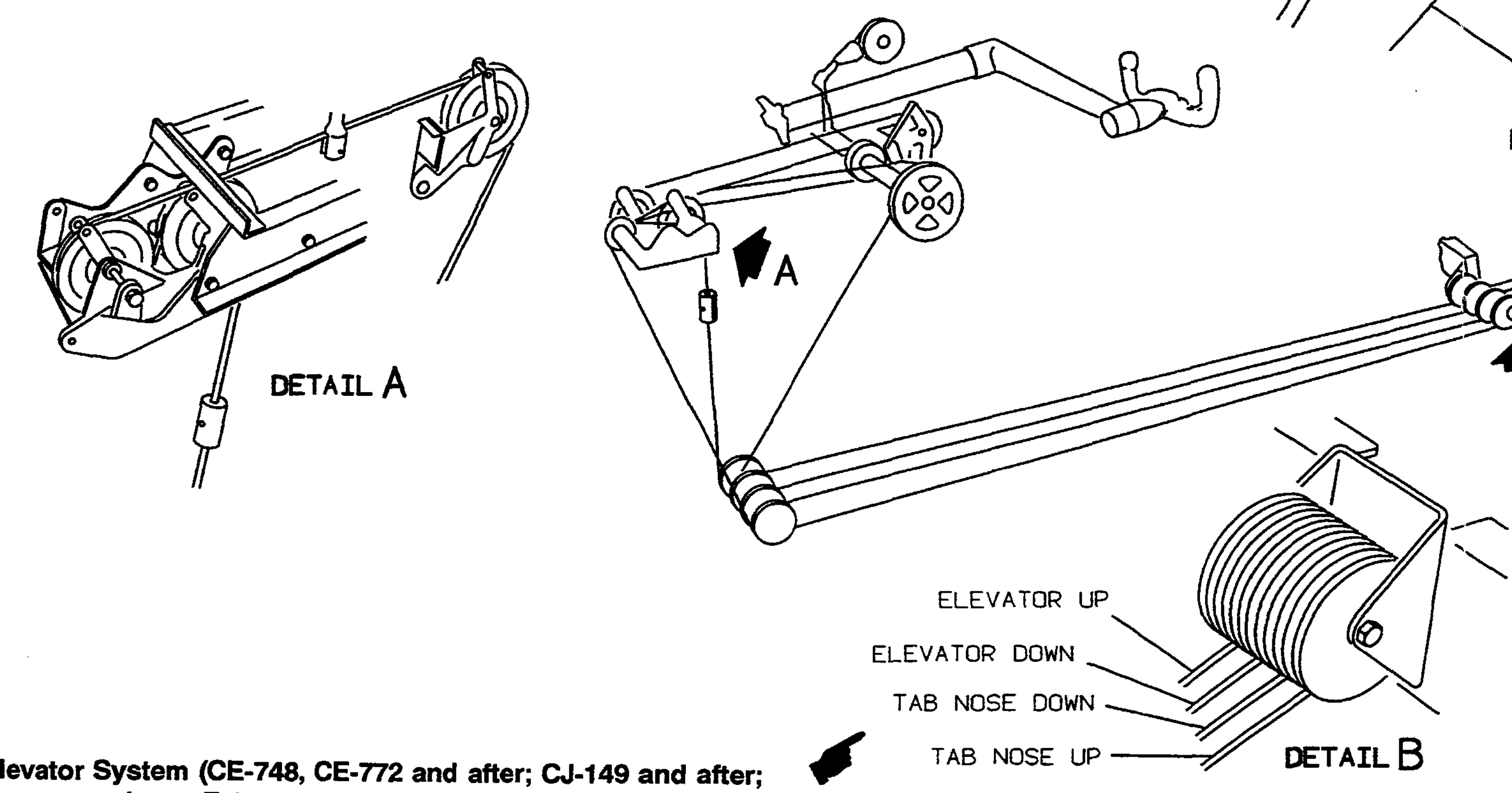
CABLES	CABLE TENSION	SURFACE TRAVEL	MODEL
ELEVATOR	22 ± 5 LBS. TOP CABLE (DOWN ELEVATOR) AT 59°F 23 ± 5 LBS. LOWER CABLE (UP ELEVATOR)	25° ± 1° UP 15° ± 1° DOWN	F33A F33C
	24 ± 5 LBS. TOP CABLE (DOWN ELEVATOR) AT 59°F 26 ± 5 LBS. LOWER CABLE (UP ELEVATOR)	23° ± 1° UP 20° ± 1° DOWN	A36 A36TC
	25 ± 5 LBS. TOP CABLE (DOWN ELEVATOR) AT 59°F 15 ± 5 LBS. LOWER CABLE (UP ELEVATOR)	23° ± 1° UP 25° ± 1° DOWN	B36TC
ELEVATOR TABS	15 LBS. + 5 LBS. - 0 LBS. AT 59°F	10° ± 1° UP 27° ± 1° DOWN	F33A A36 A36TC B36TC
	15 + 5 LBS. - 0 LBS. AT 59°F	10° ± 1° UP 21° ± 1° DOWN	F33C

NOTE

ON SERIALS CE-881 AND AFTER, CJ-156 AND AFTER, E-1588 THRU E-2111 EXCEPT E-1946 AND E-2104, EA-1 THRU EA-388 EXCEPT EA-320, THE IN-LINE FORCE REQUIRED TO MOVE THE TRIM TAB SYSTEM CABLES SHALL NOT EXCEED 20 POUNDS, WITH OR WITHOUT ELECTRIC TRIM.

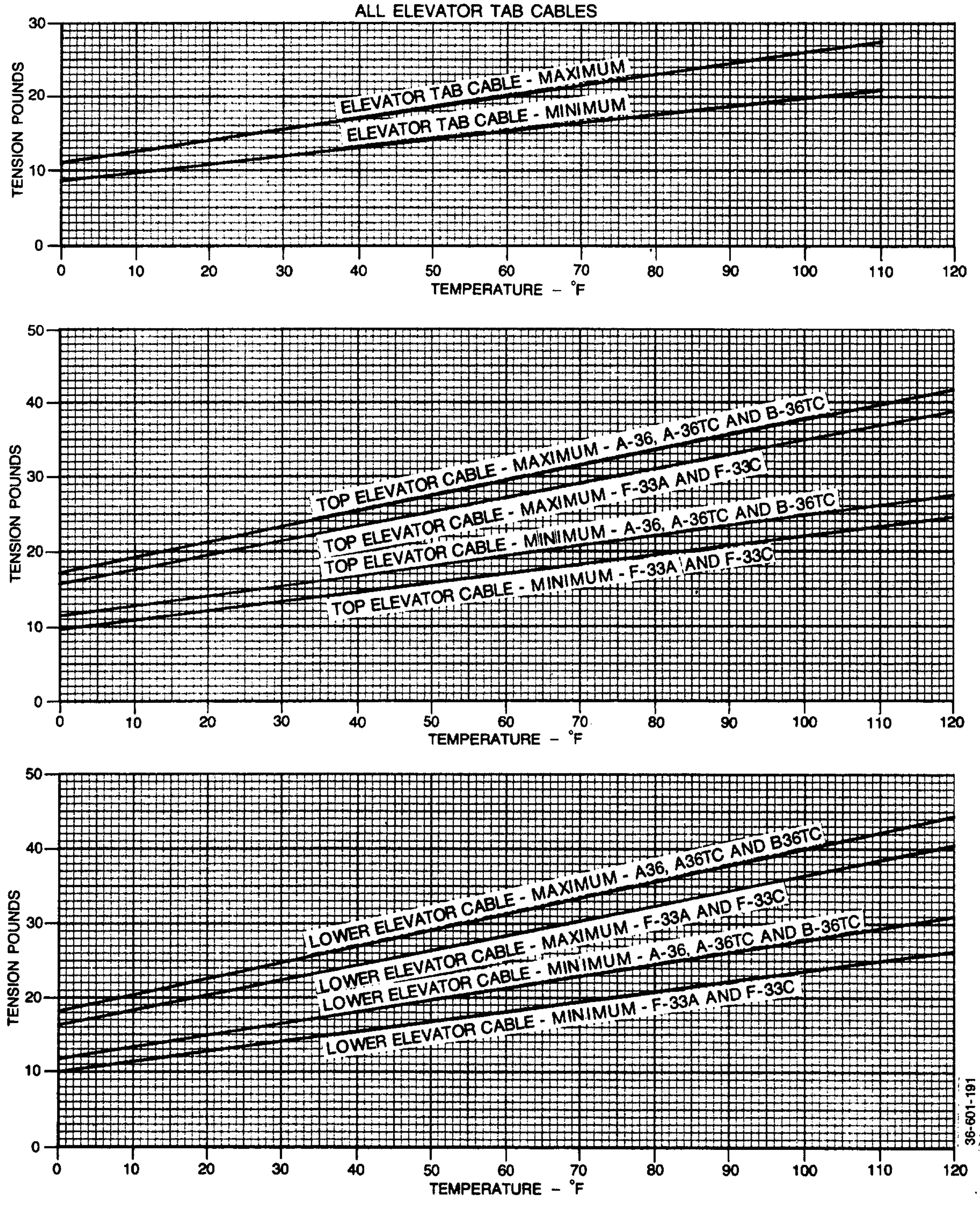
ON MODELS F33A, F33C, A36, A36TC AND B36TC WHERE THE TAB CABLES DIVIDE INTO TWO CABLES EACH, THE TWO CABLES SHALL BE ADJUSTED FOR EQUAL TENSION WITHIN TWO POUNDS OF TOTAL VARIATION.



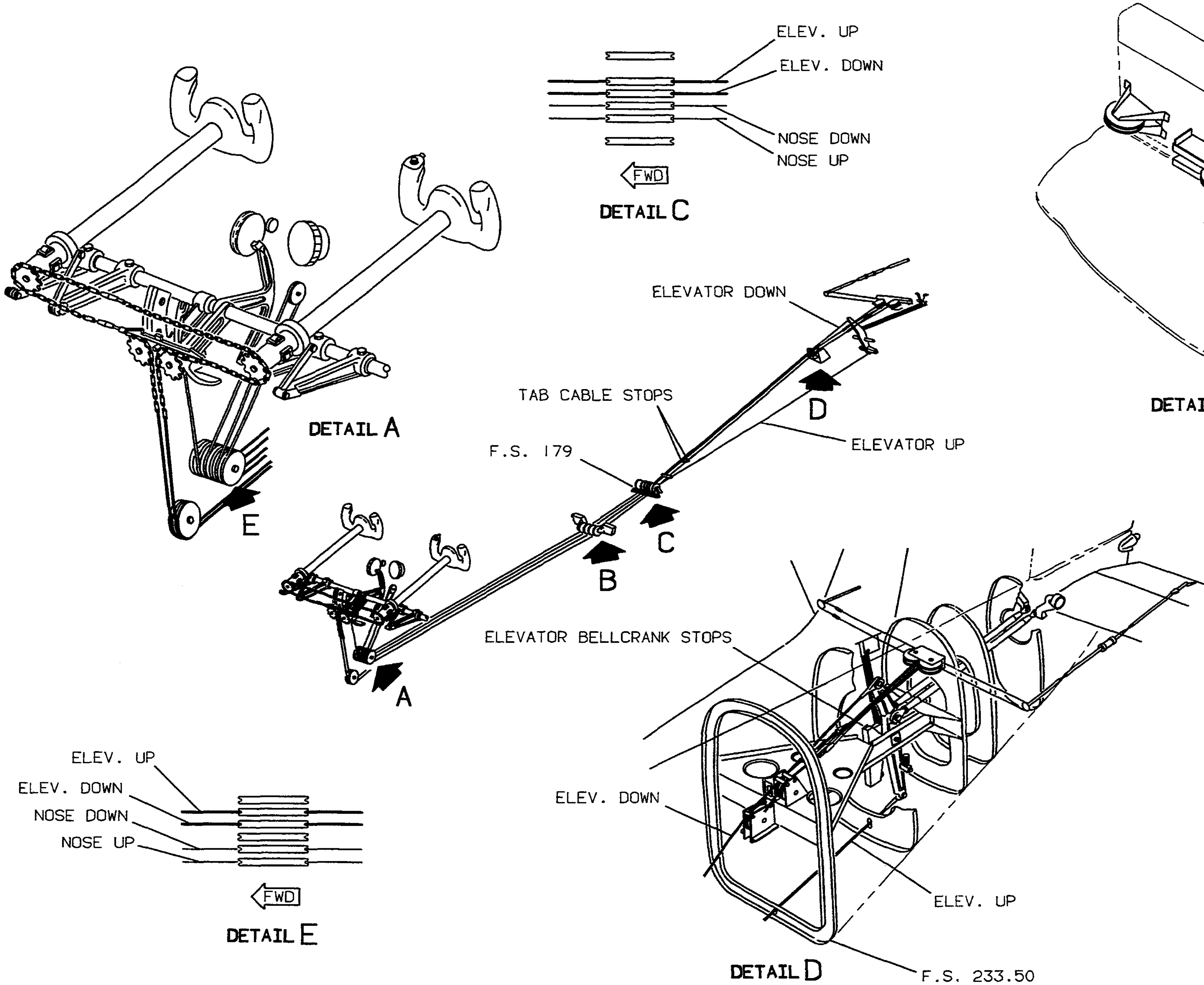


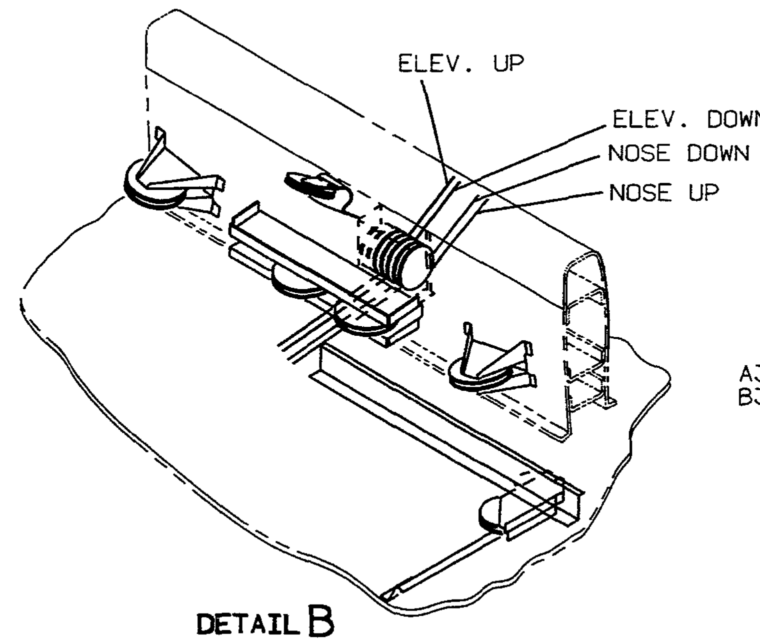
Elevator System (CE-748, CE-772 and after; CJ-149 and after; prior to E-2111, except E-1946 and E-2104; prior to EA-389, except EA-320)
(Sheet 1 of 2)
Figure 1

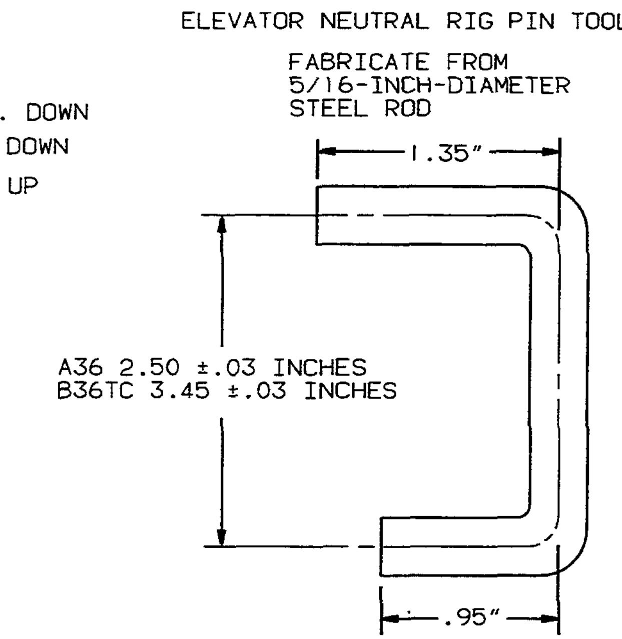
TEMPERATURE CABLE TENSION GRAPH



**Elevator System (CE-748, CE-772 and after; CJ-149 and after;
prior to E-2111, except E-1946 and E-2104;
prior to EA-389, except EA-320)
(Sheet 2 of 2)
Figure 1**







CABLES	CABLE TENSION	SURFACE TRAVEL	MODEL
ELEVATOR *	24 ± 5 LBS. TOP CABLE (DOWN ELEVATOR) AT 59° F 26 ± 5 LBS. LOWER CABLE (UP ELEVATOR)	25° + 1° -0 UP 20° ± 1° DOWN	A36
	24 ± 5 LBS. TOP CABLE (DOWN ELEVATOR) AT 59° F 26 ± 5 LBS. LOWER CABLE (UP ELEVATOR)	23° ± 1° UP 25° ± 1° DOWN	B36TC
ELEVATOR TABS	15 LBS + 5 LBS. - 0 LBS. AT 59° F	25° ± 1° DOWN RH 27° ± 1° DOWN LH 10° ± 1° UP RH 8° ± 1° UP LH	A36 B36TC

ON SERIALS E-1946, E-2104, E-2111 AND AFTER; EA-320, EA-389 AND AFTER, THE IN-LINE FORCE REQUIRED TO MOVE THE TRIM TAB SYSTEM CABLES SHALL NOT EXCEED 16 POUNDS, WITH OR WITHOUT ELECTRIC TRIM.

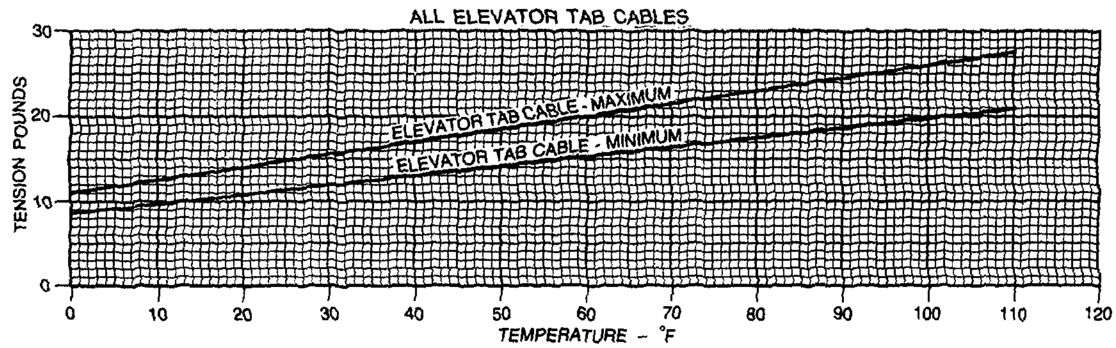
ON MODELS A36, AND B36TC WHERE THE TAB CABLES DIVIDE INTO TWO CABLES EACH, THE TWO CABLES SHALL BE ADJUSTED FOR EQUAL TENSION WITHIN 2 ± .5 POUNDS.

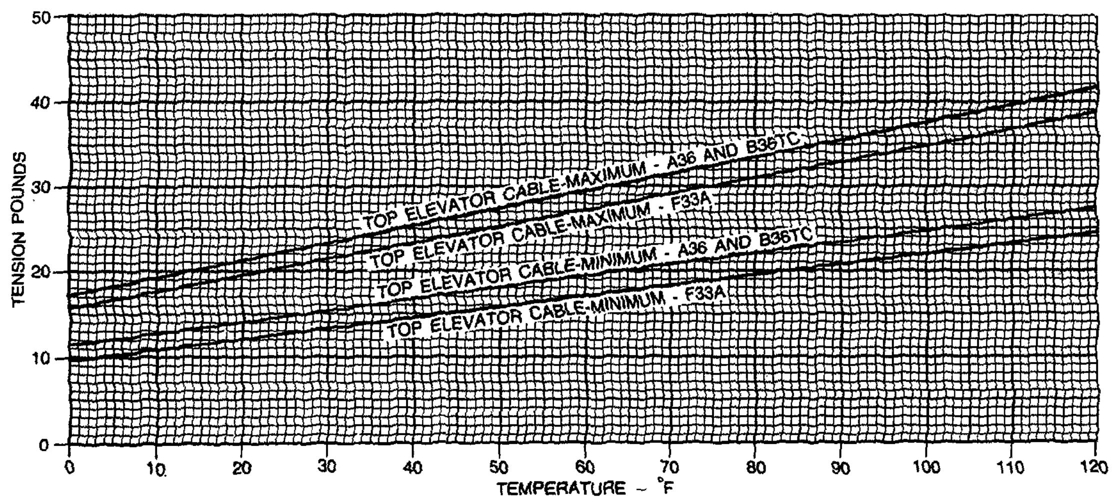
* THE TENSIONMETER READINGS SHALL BE TAKEN ON THE TOP AND BOTTOM CABLES WITH THE ELEVATOR IN THE NEUTRAL POSITION, AGAINST THE STOPS AND THE DOWN-SPRINGS DISCONNECTED.

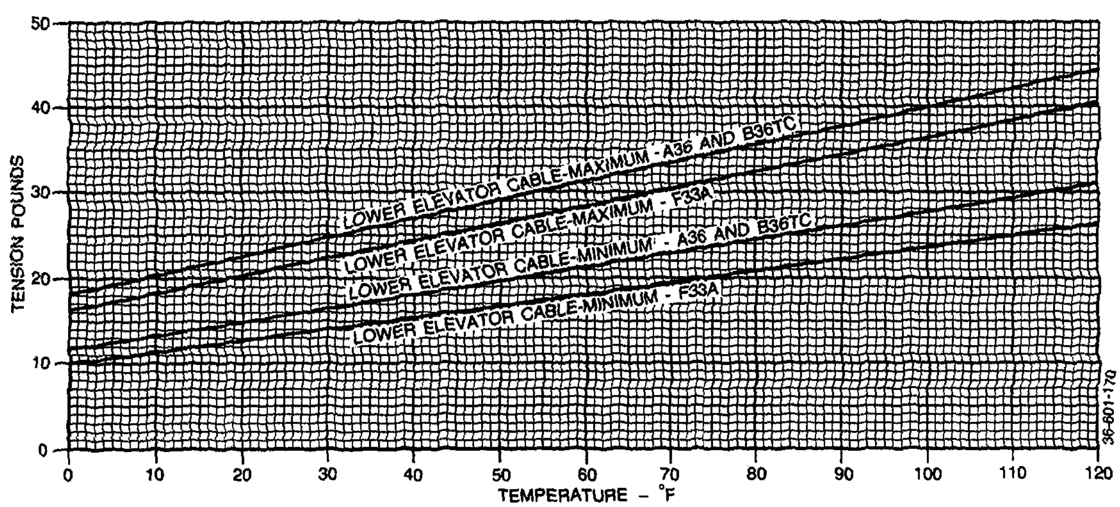
C94EA27B3009 C

Elevator System (E-1946, E-2104, E-2111 and after; EA-320, EA-389 and after)
(Sheet 1 of 2)
Figure 1A

TEMPERATURE CABLE TENSION GRAPH







Elevator System (E-1946, E-2104, E-2111 and after; EA-320, EA-389 and after)
(Sheet *2* of *2*)
Figure 1

2. F33A and F33C:

a) 17 to 18 pounds of force through NEUTRAL elevator.

b) 15 to 16 pounds of force as 25° fully UP elevator is reached.

j. The gage reading at NEUTRAL elevator and 23° (A36, A36TC, and B36TC) or 25° (F33A, F33C) UP elevator (.06 inch off fully upstop) must be taken while the control wheel is in motion.

k. Adjust each spring by transferring the upper end to a spring-attaching hole providing increased or decreased tension, as applicable. The elevator system should have sufficient freedom to allow free return of the elevator from fully UP to fully DOWN.

NOTE

After rigging the elevator and elevator trim tab control system, check for correct movement of the control surfaces with respect to the movement of the controls.

RIGGING THE ELEVATOR CONTROL SYSTEM (E-1946, E-2104, E-2111 AND AFTER, EA-320, EA-389 AND AFTER)

a. Set the downstop bolt so that the center of the hole in the bellcrank is .38 inch ± .05 inch forward of a straightedge held against the back of the bulkhead at F.S. 257.606.

b. Adjust the elevator push-pull rod for an elevator deflection of 20° ±1° down (on B36TC 25° ±1°).

c. Adjust the elevator upstop bolt for a deflection of 25° +1° -0° on A36 and 23° ±1° up on B36TC.

d. Disconnect the elevator downsprings.

e. Rig neutral elevators on the control column by positioning the pilot's control column so the gust lock hole is 2.50 ±.03 (on B36TC 3.45 ±.03) inches aft of the hole in the control column support and install rig tool (Sheet 1 of Figure 1A).

NOTE

The short end of the tool is inserted into the control column support and the long end is inserted into the control column. The weight of the control column will hold the tool in place.

f. Adjust the turnbuckles to obtain neutral elevators with a cable tension as indicated in Sheet 2 of Figure 1A.

g. Remove the rig tool.

h. Connect the elevator downsprings.

i. With the elevators fully rigged (including autopilot and electric trim if installed), the force required to pull the control wheel aft through neutral must be 25 to 29 pounds. The force required to return the wheel through neutral shall be 20 to 24 pounds. The difference (friction of the system) between the two readings shall never exceed 9 pounds (7 pounds is desired) nor be less than 4 pounds.

j. Maintain a minimum clearance of .06 inch between the control wheel adapter and the inner control column guide assembly (both the pilot's and copilot's) at fully down elevator on the A36 and B36TC.

NOTE

After rigging the elevator and trim tab system, check for correct movement of the control surfaces with respect to the movement of the controls. When the trim tab control wheel is moved toward the NOSE DOWN position, the trim tab should move UP.

ELEVATOR TAB INDICATOR CABLE REPLACEMENT (CE-748, CE-772 AND AFTER, CJ-149 AND AFTER, PRIOR TO E-2111 EXCEPT E-1946, AND E-2104, PRIOR TO EA-389 EXCEPT EA-320)

a. Place the proper tension on the trim cables in neutral position.

b. To install the dial indicator cable, thread the cable through the hole in the head of the cotter pin and out through the holes in the indicator drum.

c. With the dial at 0 degrees, slip the cable so that both ends of the cable are equal length.

d. Wrap the cable around the drum one full turn in each direction. The end that wraps to the right will be wrapped clockwise around the drum, and the end that wraps to the left will be wrapped counterclockwise, as viewed from the left side.

e. Route the cable over the appropriate idler pulley down to the shaft of the tab control wheel.

f. With the dial still in 0 degrees position, take the cable coming off the top of the elevator tab dial sheave and bring it down to the forward side of the tab wheel shaft to the left of the small hole.

g. Wrap the cable (counterclockwise) around the shaft toward the hole three turns. Insert the cable through the hole. Wrap the surplus cable around the shaft.

h. With the dial set at 0 degrees, take the cable coming off the bottom of the trim tab dial sheave and bring it down to the aft side of the tab wheel shaft to the right of the hole in the shaft, and wrap the cable (clockwise as viewed from the left end of the shaft) three turns toward the hole in the shaft.

i. Insert the cable through the hole in the shaft and wrap it around the shaft.

j. Twist the cables together and solder them. Use only rosin core solder.

k. Check the tab dial to see that it will roll from one stop to the other.

l. Set the tab dial at 0 degrees. Place tension on the tab cables in the tail section to hold the tabs in line with the elevators.

NOTE

With the elevators set in the neutral position, the left elevator tab should be set at 2° ±1° above neutral elevator position. The right elevator tab should be set at 0° ±1° elevator position.

m. Safety the turnbuckles and set the stops on the fuselage cables to maintain proper travel in accordance with the travel table.

NOTE

After rigging the elevator and elevator trim tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator trim tab control wheel is moved toward the NOSE DOWN position, the elevator trim tab should move UP.

ELEVATOR TRIM TAB FORWARD CABLE REPLACEMENT (E-1946, E-2104, E-2111 AND AFTER, EA-320, EA-389 AND AFTER)

a. Remove the fifth and sixth seats (if installed) as shown in FIFTH AND SIXTH SEAT REMOVAL in Chapter 25-00-00.

b. Remove the screws from the baggage area floor and remove the floor.

c. Remove the upholstery panel from the back of the baggage area.

d. After identifying and tagging the cables for reinstallation, disconnect the forward trim tab cables at the turnbuckles in the aft fuselage.

e. Tie nylon strings to each of the cable ends. Use a small knot.

f. Remove the access panel (actuator door) which is located under the pulleys below the pedestal.

g. Remove the panel on the left side of the pedestal.

h. Remove the autopilot panel (if installed) below the engine and propeller controls.

NOTE

Station a man in the aft fuselage to keep a small amount of tension on the strings as they are pulled through the fuselage.

i. Place the elevator tab control in neutral and mark the neutral position on the sprocket and chain.

j. Count the number of chain links on each side of the mark and note the number for later reference.

k. Pull the cables and strings from the fuselage out through the pedestal.

NOTE

Note which color (blue and black) goes over the top, forward side of the sprocket.

l. Tie the new cable to the strings.

NOTE

The shorter (color coded blue) cable goes over the top forward side of the sprocket.

m. Pull the strings and cables back through the fuselage.

NOTE

Make sure that the trim tab cables do not interfere with the engine and propeller controls located adjacent to them.

n. Check the pulleys below the pedestal to determine that the cables are properly installed.

o. Make certain that the correct number of chain links are on each side of the mark on the sprocket.

p. Connect the turnbuckles in the aft fuselage.

q. Tension the cables per Sheet 2 of Figure 1A.

r. Check for proper elevator tab travel.

s. Set the tab travel as indicated in Sheet 1 of Figure 1A.

t. Install the aft upholstery panel.

u. Install the baggage floor panel.

v. Install the back seats. See FIFTH AND SIXTH SEAT INSTALLATION in Chapter 25-00-00.

w. Install the access panel (actuator door) below the pedestal.

x. Install the access panel(s) on the pedestal. 2rb.

WARNING

Make certain that insulation, tie wraps, etc. do not interfere with control components such as cables, chains, etc.

After rigging the elevator and elevator tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator tab control is moved toward the "NOSE DOWN" position, the tab should move up.

RIGGING THE ELEVATOR TRIM TAB

a. Place the elevator tab indicator in the neutral position.

b. Rig the cables to the tension shown on the elevator temperature cable tension graph in Sheet 2 of Figure 1 or 1A, as applicable.

c. Place the elevator in neutral position and adjust the trim tab pushrod to bring the tab into the neutral position.

NOTE

To improve elevator centering, the LH and RH trim tabs are rigged to a different setting in the neutral position on serials E-1946, E-2104, E-2111 and after, EA-320 and EA-389 and after. Rig these airplanes per steps 1 through 4.

1. Rig neutral tab surfaces with LH down 1° ± .5° and RH up 1° ± .5° with indicator at 0°.

2. The normal total difference between the tab surfaces is to be 2°± .5° for all positions.

3. Set the cable stops to provide 8° ±1° up on LH tab and 10° ±1° up on RH tab, and 27° ±1° down on LH tab and 25° ±1° down on RH tab as indicated in Sheet 1 of Figure 1A.

4. The cockpit indicator is to read 9° ±2° up and 26° ±2° down.

d. Adjust the stops on the cables to allow surface travel as shown in Sheet 1 of Figure 1 except on airplanes with the serials listed in the preceding note.

e. Torque the stop bolts to 40 to 60 inch-pounds.

NOTE

After rigging the elevator and elevator tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator tab control is moved toward the "NOSE DOWN" position, the tab should move up.

ELEVATOR TRIM TAB ACTUATOR

ELEVATOR TRIM TAB ACTUATOR DISASSEMBLY (F33A, B36TC, A36TC AND A36, EXCEPT E-1111, F33C PRIOR TO CJ-156 EXCEPT THOSE AIRPLANES WITH KIT 33-4002-1 INSTALLED) (Figure 2)

a. Remove the snap ring (6) from the actuator housing and pull the nut assembly (10) out of the housing.

b. Remove the actuator screw (9) from the nut assembly.

CAUTION

Do not damage the rod end when drilling out rivets.

c. Remove nut (2), washer (3) and shoulder pin (5) then drill out rivet (1). Remove actuator rod end (4) from the screw. The bearing (7) and the bushing (8) can now be removed from the screw.

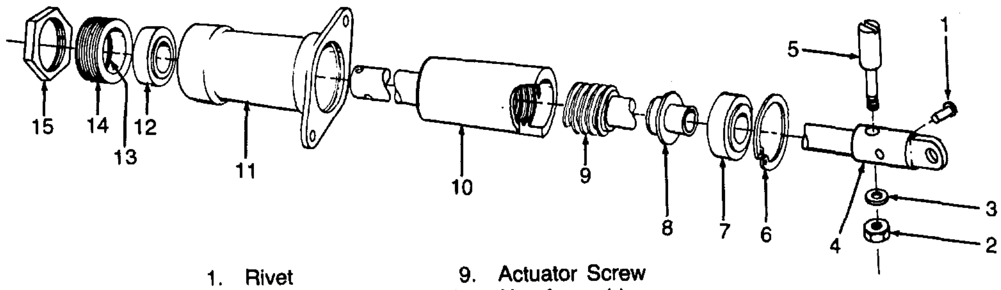
d. Remove check nut (15) and screw out the end adjusting bushing (14) with appropriate spanner wrench.

e. Remove the O-ring (13).

f. Remove the bearing (12) from the housing (11).

ELEVATOR TRIM TAB ACTUATOR ASSEMBLY (F33A, B36TC, A36TC AND A36, EXCEPT E-1111, F33C PRIOR TO CJ-156, EXCEPT THOSE AIRPLANES WITH KIT 33-4002-1 INSTALLED (Figure 2)

Clean all parts in PD680 solvent (16, Chart 1, 91-00-00) and inspect for cracks, corrosion, and distortion. Replace bushings and any parts showing evidence of deterioration. Lubricate all parts with MIL-G-23827 grease (11, Chart 1, 91-00-00) prior to assembly.



1. Rivet
2. Nut
3. Washer
4. Actuator Rod End
5. Shoulder Pin
6. Snap Ring
7. Bearing
8. Bushing
9. Actuator Screw
10. Nut Assembly
11. Housing
12. Bearing
13. O-Ring
14. Adjusting Bushing
15. Check Nut

Elevator Tab Actuator
Figure 2

a. Install bearing (12) into housing (11).

b. Install O-ring (13) into adjusting bushing (14).

c. Install adjusting bushing (14) and check nut (15). (Do not tighten.)

d. Install bushing (8), bearing (7) and snap ring (6) on actuator screw (9).

e. Install actuator rod end (4) on actuator screw (9) and secure with rivet (1) and shoulder pin (5), washer (3) and nut (2).

NOTE

Lubricate all parts except O-ring with MIL-G-23827 grease (11, Chart 1, 91-00-00) prior to assembly. Lubricate the O-ring with MIL-S-8660 (50, Chart 1, 91-00-00).

f. Install screw (9) into nut (10).

WARNING

The trim tab actuator that will be installed on the left hand horizonal stabilizer shall have threads on its actuator screw (9) that will rotate clockwise when screwed into the nut assembly (10). The trim tab actuator that will be installed on the right hand horizontal stabilizer shall have threads on the actuator screw (9) that rotate counter-clockwise when screwed into the nut assembly (10).

g. Install nut assembly (10) into housing (11); secure with snap ring (6).

h. Screw adjusting bushing (14) into housing (11) until the end play has been removed from the nut assembly, and tighten the check nut (15). An end play of 0.003 inch is permissible.

ELEVATOR TRIM TAB ACTUATOR DISASSEMBLY (E-1111 ONLY) (Figure 3)

a. Remove the retainer ring (2) from the housing (5) and pull the nut assembly (6) out of the housing.

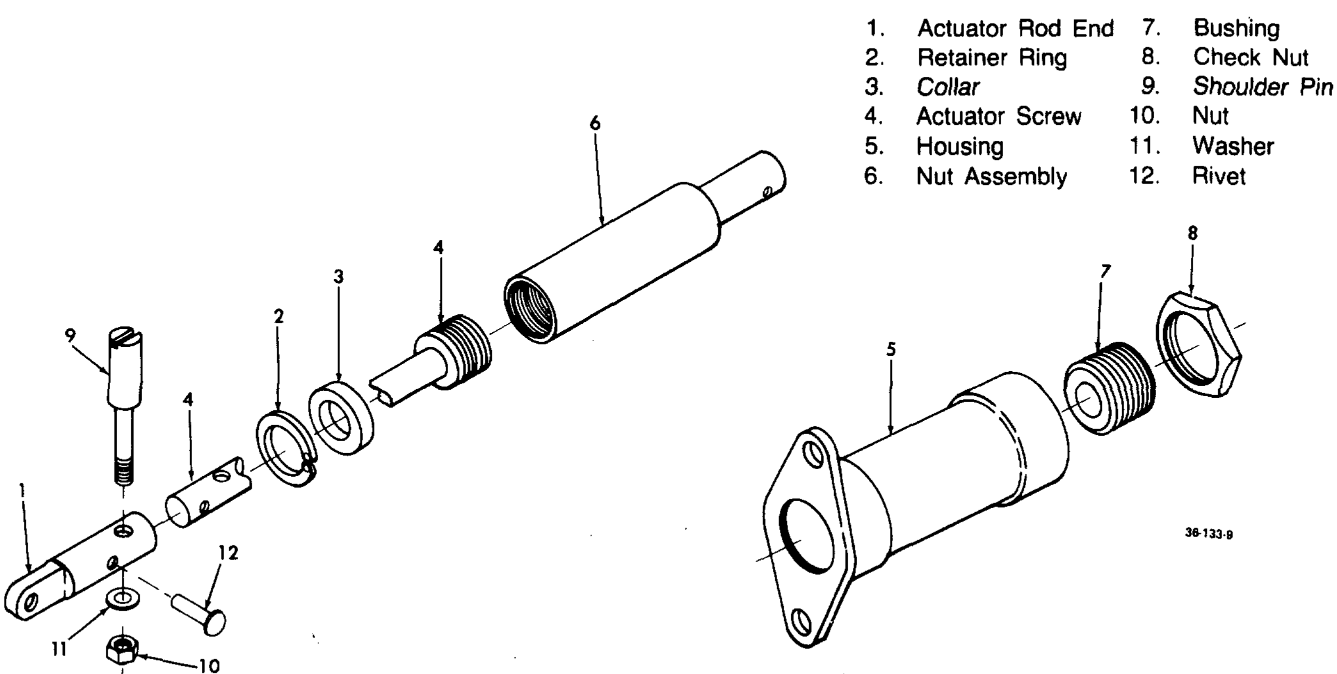
b. Remove the actuator screw (4) from the nut assembly (6).

c. Drill out rivet (12).

d. Remove nut (10), washer (11) and shoulder pin (9). The collar (3) can now be removed.

e. Remove check nut (8) and screw out bushing (7) with the appropriate spanner wrench.

Clean all parts with solvent (16, Chart 1, 91-00-00) and replace parts that are cracked, corroded and distorted. Lubricate all parts with lubricating grease (11, Chart 1, 91-00-00) prior to assembly.



Elevator Tab Actuator (E-1111 Only)
Figure 3

ELEVATOR TRIM TAB ACTUATOR ASSEMBLY (E-1111 only) (Figure 3)

a. Place collar (3) and retainer ring (2) on actuator screw (4).
b. Install actuator rod end (1) on actuator screw (4) being careful to align the holes.
c. Install shoulder pin (9) washer (11) and nut (10).
d. Install rivet (12), P/N MS20613-3C10.

NOTE

Lubricate all parts with lubricating grease (11, Chart 1, 91-00-00) prior to assembly.

e. Install actuator screw (4) into nut assembly (6).

WARNING

The trim tab actuator that will be installed on the left hand horizontal stabilizer shall have threads on its actuator screw (4) that will rotate clockwise when screwed into the nut assembly (6). The trim tab actuator that will be installed on the right hand horizontal stabilizer shall have threads on the actuator screw (4) that rotate counterclockwise when screwed into the nut assembly (6).

f. Install nut assembly (6) into housing (5) and secure with retainer ring (2).

g. Install bushing (7) and secure with check nut (8).

NOTE

When assembling the actuator, screw the threaded bushing (7) into the assembly (5) until end play of the nut assembly (6) has been removed, then lock in place by tightening the check nut (8). The nut assembly (6) must be free to rotate and provide smooth operation through its full travel with a maximum end play of 0.0015 inch.

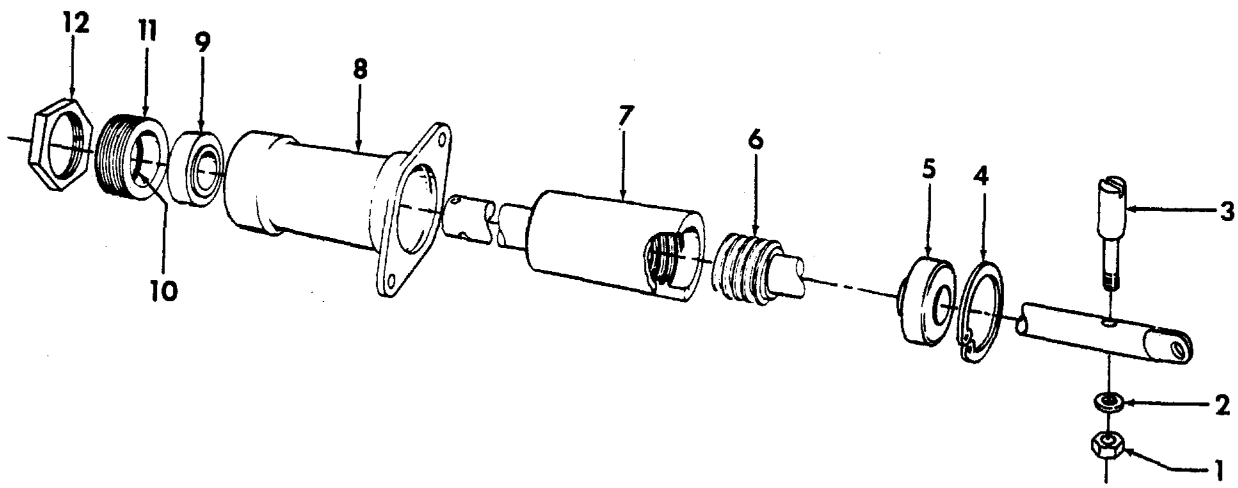
ELEVATOR TRIM TAB ACTUATOR DISASSEMBLY Model F33C (CJ-156 and after, and earlier airplanes incorporating Kit 33-4002-1) (Figure 3A)

a. Remove the snap ring (4) from the actuator housing and pull the nut assembly (7) out of the housing.
b. Remove the actuator screw (6) from the nut assembly.

CAUTION

Do not damage rod end when drilling out rivet.

c. Remove nut (1), washer (2) and shoulder pin (3). The bushing (5) can now be removed from the screw.



1. Nut
2. Washer
3. Shoulder Pin
4. Snap Ring
5. Bushing
6. Actuator Screw
7. Nut Assembly
8. Housing
9. Bearing
10. O-Ring
11. Adjusting Bushing
12. Check Nut

F33C-164-6

Elevator Tab Actuator
Figure 3A

d. Remove check nut (12) and screw out the end adjusting bushing (11) with appropriate spanner wrench.

e. Remove O-ring (10).

f. Remove the bearing (9) from housing (8).

Clean all parts in PD680 solvent (16, Chart 1, 91-00-00) and inspect for cracks, corrosion, and distortion. Replace bushings and any parts showing evidence of deterioration. Lubricate all parts with MIL-G-23827 grease (11, Chart 1, 91-00-00) prior to assembly.

ELEVATOR TRIM TAB ACTUATOR ASSEMBLY
Model F33C (CJ-156 and after, and earlier airplanes incorporating Kit 33-4002-1) (Figure 3A).

Clean all parts in PD680 solvent (16, Chart 1, 91-00-00) and inspect for cracks, corrosion, and distortion. Replace bushings and any parts showing evidence of deterioration. Lubricate all parts with MIL-G-23827 grease (11, Chart 1, 91-00-00) prior to assembly.

a. Install bearing (9) into housing (8).

b. Install O-ring (10) into adjusting bushing (11).

c. Install adjusting bushing (11) and check nut (12). (Do not tighten.)

d. Install bearing (5) and snap ring (4) on actuator screw (6).

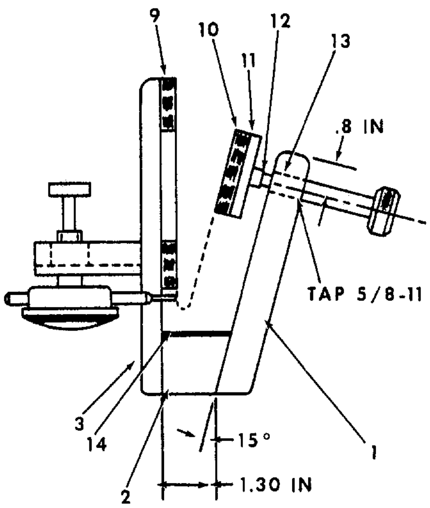
e. Install shoulder pin (3), washer (2) and nut (1) on actuator screw (6).

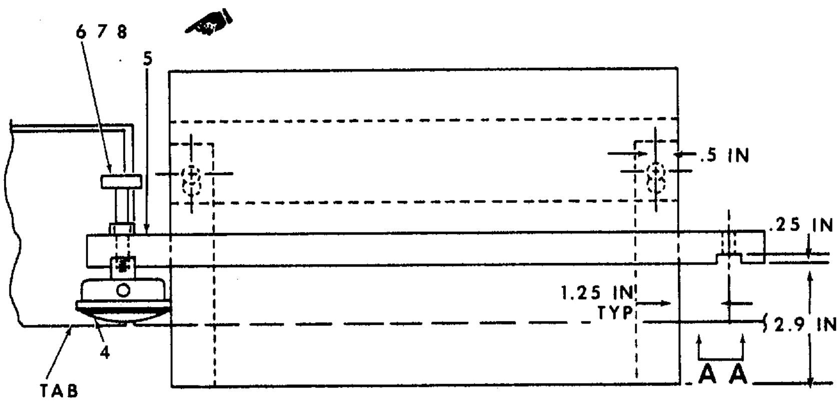
f. Install screw (6) into nut (7).

WARNING

The trim tab actuator that will be installed on the left hand horizontal stabilizer shall have threads on its actuator screw (6) that will rotate clockwise when screwed into the nut assembly (7). The trim tab actuator that will be installed on the right hand horizontal stabilizer shall have threads on the actuator screw (6) that rotate counterclockwise when screwed into the nut assembly (7).

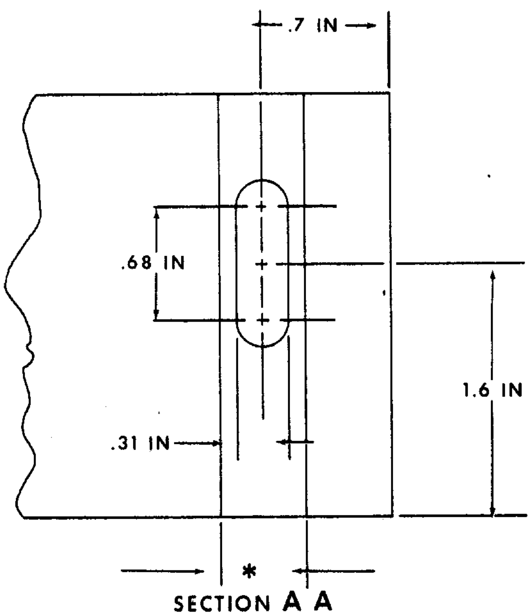
g. Install nut assembly (7) into housing (8), secure with snap ring (4).





ITEM NO.	QUANT.	DESCRIPTION
1	2	3/4 x 1 x 6 aluminum or equiv.
2	2	1 x 1 3/8 x 1 3/4 aluminum or equiv.
3	1	1/2 x 7 1/2 x 10 aluminum or equiv.
4	1	C81Q Indicator**
5	1	3/4 x 2 1/2 x 14 aluminum or equiv.
6	1	1/4 Dia. x 2 corrosion res. stl.
7	1	1/4 Dia. x 1 corrosion res. stl.
8	1	1/4-28 nut
9	1	3/8 x 5 x 10 rubber
10	1	3/8 x 2 x 10 rubber
11	1	1/4 x 2 x 10 corrosion res. stl.
12	2	1/2 x 13 x 3 VLIER Torque screw
13	2	KN813 Keensert or tap 1/2 - 13
14	2	1/8 x 1 x 3/4 rubber

**P/N of Federal Products Corp., Providence, R. I.



* THIS GROOVE TO BE A SNUG FIT TO THE SCREW BRACKET ON THE DIAL INDICATOR

100-135-8

Fabricating Clamp for Tab Deflection
Figure 4

NOTE

Lubricate all parts except O-ring with MIL-G-23827 grease prior to assembly. Lubricate the O-ring with MIL-S-8660 (50, Chart 1, 91-00-00).

h. Screw adjusting bushing (11) into housing (8) until the end play has been removed from the nut assembly, and tighten the check nut (12). An end play of 0.003 inch is permissible.

CHECKING ELEVATOR TAB FREE PLAY (CE-748, CE-772 and after; E-1111, E-1241 and after; CJ-149 and after)

Visually inspect the elevator tabs for any damage, security of hinge attach points, and for tightness of the actuating systems. Inconsistencies should be corrected prior to checking the free play of the tabs.

A check fixture (P/N 810 45-135030-9) or equivalent, a dial indicator, and a push-pull scale for applying accurate loading to the tabs are required for making the inspection for free play of the tabs.

a. Lock the control surface to prevent movement of the elevators. Set the elevator tabs in the neutral position.

b. Using shot bags and tape, affix the dial indicator check fixture so that the dial indicator point is positioned on the outboard edge of the elevator tab at a point 3.30 inches aft of the hinge line as measured along the top of the tab.

c. Apply a small piece of masking tape to the upper surface (for paint protection) 4.50 inches aft of the tab hinge line and along the centerline of the tab actuator. This will be the point of pressure against the tab by the push-pull scale.

d. Apply another piece of masking tape in the corresponding position on the bottom surface of the tab for the same purpose.

e. Zero the dial indicator at no load initially. Do not reset during the checking procedure.

f. With the push-pull scale at the point of the masking tape, apply 3-pound downward load. Record the dial reading as "A".

g. Release half the load until a 1.5-pound downward load is obtained. Record the dial reading as "B".

h. Apply a full 3-pound upward load at the masking tape on the bottom surface. Record the dial reading as "C".

i. Release half the load until a 1.5-pound upward load is obtained. Record the dial reading as "D".

j. Enter the recorded values on a copy of CHART 1 and proceed as follows:

1. Multiply "B" by 2 and record as "2B".
2. Subtract "A" from "2B" and record as "X".
3. Multiply "D" by 2 and record as "2D".
4. Subtract "C" from "2D" and record as "Y".
5. Add "X" and "Y" and record as "E".

CHART 1
ELEVATOR TAB FREE PLAY LIMITS

1.5-POUND READING	3-POUND READING		
B ________			
2B ________	−A ________	=X ______	
D ________			
2D ________	−C ________	=Y ______	
X ________	+Y ________	=E ______	

(E = 0.050 inch maximum)

NOTE

The results of "X" and "Y" can be negative numbers.

k. Repeat steps "b" through "j" on the opposite elevator tab.

ELEVATOR TRIM TAB ACTUATOR REMOVAL (F33A, F33C, A36, A36TC AND B36TC)

a. Remove the access panel near the trailing edge of the horizontal stabilizer to gain access to the elevator trim tab actuator.

b. Detach the tail cone, disconnect the tail navigation light wire and remove the tail cone.

c. Remove the access panel on the left hand side of the fuselage just forward of the horizontal stabilizer.

d. Remove the access panel near the leading edge of the horizontal stabilizer to gain access to the elevator trim tab actuator sprocket.

e. Remove the elevator as outlined in Chapter 27-30-00 under the heading ELEVATOR REMOVAL.

f. Disconnect the elevator trim tab cables at the turnbuckles in the aft fuselage. Secure the forward elevator trim tab cables to prevent them from unwinding at the universal.

CAUTION

Do not damage the cables. Use a material such as phenolic to protect the cables.

g. Remove the chain and cable assembly from the elevator trim tab actuator sprocket.

h. Remove the hardware attaching the elevator trim tab actuator to the horizontal stabilizer. Remove the actuator from the airplane.

ELEVATOR TRIM TAB ACTUATOR INSTALLATION (F33A, F33C, A36, A36TC AND B36TC)

WARNING

The elevator trim tab actuators must not be interchanged between the right and left horizontal stabilizers when they are reinstalled after removal. Reversing the actuators reverses the direction, and plane nose-up trim would actually result in an inadvertent nose-down trim condition that could result in an uncontrollable airplane attitude. Refer to ELEVATOR TRIM TAB ACTUATOR COLOR CODING to reduce the probability of unintentionally switching the actuators upon installation.

a. Position the elevator trim tab actuator in the horizontal stabilizer and install the attaching hardware.

b. Position the chain and cable assembly on the actuator sprocket so that the ends of the chain are equidistant within ±.20 inch at the sprocket centerline.

c. Install the elevator as outlined under the heading INSTALLATION OF THE ELEVATOR.

d. Connect the elevator trim tab cables to the turnbuckles in the aft fuselage.

e. Remove material used to protect the cables.

f. Rig the elevator trim tab control system as outlined under the heading RIGGING THE ELEVATOR TRIM TAB.

NOTE

After rigging the elevator and elevator trim tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator trim tab control wheel is moved toward the NOSE DOWN position, the elevator trim tab should move UP.

g. Install the access panel located near the leading edge of the horizontal stabilizer.

h. Install the access panel located near the trailing edge of the horizontal stabilizer.

i. Install the access panel on the left hand side of the fuselage just forward of the horizontal stabilizer.

j. Connect the tail navigation light wire and install the tail cone.

ELEVATOR TRIM TAB ACTUATOR COLOR CODING (F33A, F33C, A36, A36TC AND B36TC)

On airplanes serials CE-1566 and after, CJ-180 and after, E-2111 and after, and EA-389 and after, elevator trim tab actuators have been color coded LH blue and RH black. Actuators may be inspected for proper installation by removing the actuator inspection hole cover and visually inspecting that the appropriate color coded actuator is installed (LH blue and RH black).

On earlier airplanes, elevator trim tab actuators were not color coded. Color coding of the elevator trim tab actuators can be accomplished with the actuators installed or before installation. This will reduce the probability of unintentionally switching the actuators. Use BEECHCRAFT Mandatory Service Bulletin No. 2399 for painting instructions on how to color code elevator trim tab actuators.

WARNING

Do not install a blue-coded actuator on a black-coded stabilizer or a black-coded actuator on a blue-coded stabilizer.

ELECTRIC ELEVATOR TRIM (OPTIONAL)

The optional electric trim system offered on the Bonanza airplanes allows the pilot to correct the elevator trim without removing his hands from the control wheel. The switch requires 2 actions before it will actuate the system: first depressed (enable switch), then moved forward (down-trim) or rearward (up-trim). On the control wheel left hand grip is a quick-interrupt switch (placarded TRIM INTER) which opens the circuit to the servo and stops the action of the electric trim system. The PITCH TRIM OFF-ON switch is located in the lower left corner of the floating instrument panel and the circuit breaker (placarded TRIM) is located in the electroluminescent circuit breaker panel below the instrument panel.

MODEL A36, A36TC, AND B36TC

ELECTRIC ELEVATOR TRIM TAB SERVO REMOVAL

a. Gain access to the servo by removing the fifth and (if installed) sixth seat (refer to Chapter 25 under FIFTH AND SIXTH SEAT REMOVAL AND INSTALLATION) and the partition between the baggage compartment and aft section of the airplane.

b. Unsafety the turnbuckle on the left trim cable and loosen the cable.

c. Remove the cable (make a note and diagram of the cable routing for reinstallation) from the pulleys and capstan.

d. Remove the 4 bolts, nuts, and 8 washers which secure the servo to the brackets in the airplane.

e. Remove the servo (note on which side of the brackets the servo is mounted) from the airplane.

ELECTRIC ELEVATOR TRIM TAB SERVO INSTALLATION

a. Place the servo in position and install the 4 bolts, 8 washers, and 4 nuts (make certain the servo is installed in the same position from which it was removed).

b. Install the cables on the servo. The left (outboard) trim cable should be routed forward around the outside groove of the capstan and back to the aft pulley, then forward to the other pulley; wrap around the forward pulley and aft around the inside groove of the capstan and forward to the turnbuckle.

c. Install the right (inboard) elevator trim cable to the pulley as indicated in step "b".

d. Adjust the capstan cable guard to within 1/32 inch of the capstan and secure with the attaching screws. Tighten the attaching bolts of the 2 idler pulleys.

e. Adjust the cable tension per RIGGING THE ELEVATOR CONTROL SYSTEM and Figure 1.

f. Operate the elevator trim system through its complete range of of travel to check for any binding or restrictions.

ELECTRIC ELEVATOR TRIM GROUND CHECKS (AIRPLANES WITHOUT AUTOPILOT)

a. After inspection of the electric trim installation for loose wires, obstructions safetied cables, etc., turn "ON" airplane master switch.

b. Turn ON the trim master switch and engage the "TRIM" system circuit breaker.

c. Simultaneously press the enable switch and move pilot's control wheel switch forward. Note that the trim wheel moves toward "DOWN" trim position.

d. With pilot's control wheel switch still engaged, grasp the manual trim wheel and check for manual override capability; the clutch will slip.

e. Simultaneously press the enable switch and move pilot's control wheel switch rearward. Note that the trim wheel moves toward the "UP" trim position.

f. With pilot's control wheel switch still engaged, grasp the trim wheel and check for manual override capability; the clutch will slip.

g. Press the enable switch only; trim system must not run.

h. Move the trim switch fore and aft only; trim system must not run.

i. The control wheel mounting includes an electric trim-interrupt switch. This switch has the primary purpose of stopping all trim action by interrupting both the trim A + and ground. The interrupt switch is a momentary type pushbutton, which may be checked as follows:

1. With the trim system still turned on, actuate the trim switch to drive the trim system. While system is being driven, push the interrupt switch and note that the trim system stops running while the switch is depressed.

2. If the trim system operates while the interrupt switch is depressed, the trouble should be located and corrected before flying the airplane.

j. If the circuit breaker trips or the trim runs without both the enable switch and the direction switch actuated, pull the trim circuit breaker, turn the trim master switch OFF and leave disconnected until the trouble is located. If the trim runs with the circuit breaker out, do not fly the airplane.

k. After the electric trim system check-out, the airplane manual trim system should be free of excessive friction and should function normally.

MODEL F33A, F33C AND V35B

ELECTRIC TRIM TAB ACTUATOR REMOVAL

a. Remove the access door on the fuselage just below the leading edge of the L.H. stablizer.

b. Disconnect the actuator wire harness at the disconnect splices.

c. Disconnect the actuator cable at the turnbuckle. Tape the cable to the actuator to prevent unwinding of the cable.

d. Remove the three bolts securing the actuator to the bracket. The actuator may now be removed from the airplane.

ELECTRIC TRIM TAB ACTUATOR INSTALLATION

a. Place the actuator in its mounting location.

b. Install the bolts securing the actuator in place.

c. Connect the cables at the turnbuckles

d. Connect the wire harness.

NEW TAB CABLE INSTALLATION

Note the position of the old cable in relation to the cable drum and forward end cable fittings. Install the new cable in the same positions

MAGNETIC CLUTCH REMOVAL (Figure 5)

a. Remove the lid from the clutch housing.

b. Loosen the set screw in the clutch rotor and armature hubs.

c. Remove the motor from the clutch housing.

d. Slide the cable drum and shaft assembly from the clutch housing.

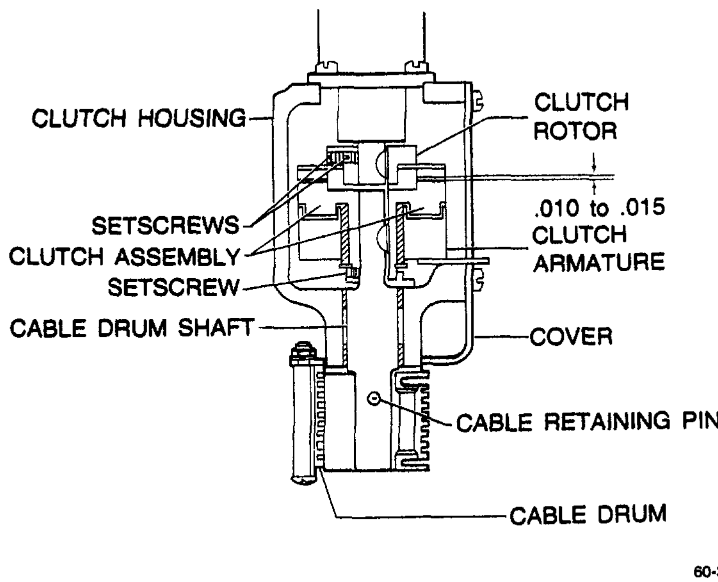
e. Remove the clutch from the clutch housing.

MAGNETIC CLUTCH INSTALLATION (Figure 5)

a. Install the clutch in the clutch housing.

b. Slide the cable drum and shaft assembly into the clutch housing.

c. Tighten the clutch armature set screws until there is no visible end play in the cable drum shaft. Slide the clutch rotor on the motor shaft to obtain .010 to .015 inch clearance between the friction surfaces of the clutch before tightening the set screws. Stake both set screws.



Electric Trim Tab Actuator
Figure 5

CAUTION

With no visible end play in the cable drum shaft, the clutch faces must not make contact while the clutch is de-energized or damage to the clutch will result.

ELECTRIC TRIM TAB ACTUATOR BRUSH REPLACEMENT SCHEDULE

Replace the brushes at intervals of 2000 flight hours.

MAGNETIC CLUTCH TORQUE TEST

The following check should be performed any time the magnetic clutch is replaced.

a. Using a 28 vdc power source, connect the red lead of the magnetic clutch to ground and the white lead to the power source. Using a torque wrench, check that the clutch holds with 30 inch-pounds of torque applied at the actuator shaft.

b. If the static torque of the clutch is less than 30 inch-pounds, burn the clutch as follows:

1. Find a metal plate of sufficient thickness for rigidity and large enough to fit in a vise with the actuator assembly attached. Anchor the plate in a vise and drill 3 holes in the plate to match the actuator mounting holes. Bolt the actuator to the plate.

2. Locate a blade type screwdriver or similar tool that will fit the shaft on which the cable drum is mounted.

3. Remove the handle from the screwdriver or fabricate a similar tool so that a low speed (approximately 450 rpm) ½ inch drill motor may be attached to the screwdriver or similar tool.

4. Secure the screwdriver in the ½ inch drill motor.

5. Remove the access plate from the clutch housing and blow the housing and clutch clean with clean dry air.

6. Using a regulated power source set at 14 to 16 vdc, connect the red electrical lead of the clutch to ground and the white lead to the power source with alligator clips.

7. With the screwdriver in the slot in the drum shaft turn the drill motor on and run for 15 seconds. Turn the drill off and unclip the leads to the clutch.

8. Let the clutch cool for approximately one minute before reattaching the lead for another 15 second interval. Repeat the foregoing sequence until the clutch will hold with 30 inch-pounds of torque as indicated in step "a", then blow the clutch and housing clean with clean dry compressed air. Install the access plate on the clutch housing.

CAUTION

Exceeding the 15 second burn-in periods may overheat and damage the magnetic clutch.

"END"

STALL WARNING/SAFE FLIGHT SYSTEM - DESCRIPTION AND OPERATION

STALL WARNING SYSTEM

The stall warning system is designed to give the pilot advance warning of an impending stall. The stall warning switch is located on the bottom leading edge of the left wing. Air moving over the vane of the switch will cause the switch to open or close depending on the air velocity. The opening or closing of the stall warning switch indicates the lift capabilities of the wing and subsequently indicates to the pilot the approaching of a stall condition.

STALL WARNING - MAINTENANCE PRACTICES

STALL WARNING SYSTEM

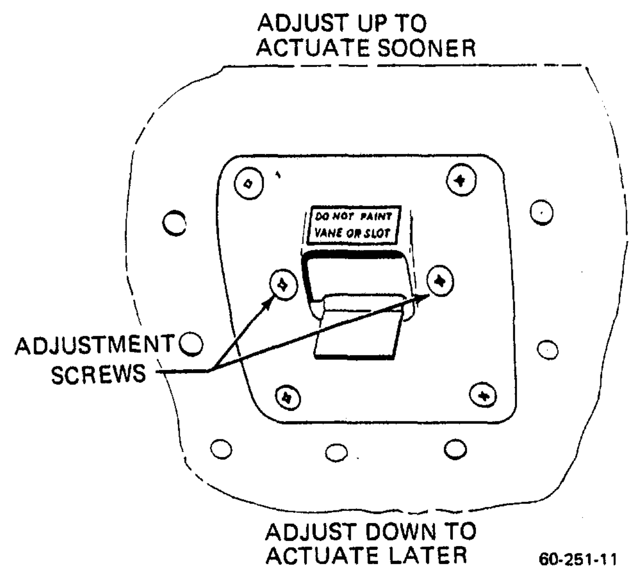
ADJUSTMENTS
(Figure 1)

The stall warning switch is carefully adjusted when the airplane is test flown at the factory. Should it require readjusting, proceed as follows: Locate the switch installation on the under surface of the left wing and loosen the two Phillips-head screws, one on either side of the vane. If the stall warning has been coming on too early, move the vane back and down. If the stall warning has been coming on too late, move the vane up and forward. Moving the vane, with the Phillips-head screws loosened, moves the entire unit up or down inside the wing causing the switch to be closed earlier or later. Retighten the screws after making each adjustment. NEVER TRY TO ADJUST THE SWITCH BY BENDING THE VANE.

NOTE

If a new switch (lift detector) is being installed it should be positioned (with vane full down) so that the upper surface of the vane is in alignment with the index line on the cover plate. The airplane should then be flown and the switch adjusted as indicated in the following procedure.

As a rule of thumb, moving the vane 1/4 inch will change the time the stall warning actuates by about 5 mph of indicated airspeed. The only way to test the accuracy of the setting is to fly the airplane into a stall, noting the speed at which the warning horn comes on and the speed at which the full stall occurs.



Stall Vane Adjustment
Figure 1

The stall should be made with the flaps and gear up and power off. Prior to stalling decelerate no faster than one mph per second. It may be necessary to make several alternate adjustments and test flights before the desired setting can be reached. The stall warning should actuate, ideally, at 7 to 9 mph ahead of the complete stall. The switch setting should be checked and adjusted as necessary whenever a wing or wing leading edge is replaced or extensively repaired, or if a new switch is installed. The switch should require no adjustment in normal service.

"END"

FLAPS - DESCRIPTION AND OPERATION

The flaps are hinged in specially designed tracks. When extended, the flap moves rearward as it pivots downward. This gives a large, effective wing area, which produces additional lift and drag.

One flap is installed on each wing. The flaps are operated by an electric-motor-driven gearbox on the aft side of the front spar at the centerline of the airplane. The gearbox drives two flexible drive shafts, each connected to an acme-thread-type jackscrew at each flap. The flaps are controlled by a lever in the subpanel, and the flap position is indicated by an instrument to the left of the control column. The lever (switch) must be pulled out of a detent to change positions. On airplane serials E-1111, E-1241, thru E-1370; CJ-149; CE-748, CE-772 thru CE-815; D-10097, and D-10120 thru D-10178, the flaps may be stopped at any position by moving the flap switch to OFF when the flaps reach the desired position. The switch is placarded UP, OFF, and DOWN. The markings on the position indicator will be UP, 10°, 20°, and DN. On airplane serials CJ-150 and After; CE-816 and After; D-10179 and After; E-1371 thru E-2110 except E-1946 and E-2104; EA-1 thru EA-388 except EA-320, the indicator is marked UP, 15°, and DN. Serials E-1946, E-2104 and E-2111 and After; EA-320, EA-389 and After have lights to indicate flap position. These lights are marked to indicate the down, in-transit, and approach positions of the flaps. All lights are out when the flaps are up. The flaps can be stopped only on the up, approach, or down position as indicated by the flap switch.

The flap position transmitter (if installed) is located near the left flap actuator. Power to operate the indicator lights of later serials is controlled by the flap relay and limit switches.

NOTE

After an emergency extension at speeds above the normal extension speeds, inspect the flaps for damage or distortion before the next flight.

FLAPS - MAINTENANCE PRACTICES

FLAP REMOVAL

a. Remove the bolt from the flap actuating arm.

b. Remove the bonding cable from the flap tracks.

c. Remove the bolts from the flap track brackets and remove the flaps.

FLAP INSTALLATION

a. Hold the flap in position and install the rollers and the bolts in the flap track bracket.

NOTE

Install the flap track rollers (four rollers per flap and two rollers per track) in the flap track brackets with the flanges of the rollers in one track facing the flanges of the rollers in other track.

b. Connect the bonding cable and install the bolt in the flap actuating arm.

FLAP TRACK WEAR LIMITS

The allowable track wear on the bearing surface is 0.032 inch resulting in a maximum dimension of 0.785 inch in the track slot. The allowable wear into the track side surface is 0.050 inch. Track wear within the preceding limitations may be dressed smooth with light emery cloth to prevent roller binding. Lubricant mixed with solvent (49 and 26, Chart 1, 91-00-00) may be brushed on the flap tracks during servicing of the airplane.

FLAP LIMIT SWITCH ADJUSTMENT

NOTE

Battery voltage is not sufficient to properly cycle the flaps during rigging. An auxiliary power supply capable of maintaining 28.25 ± 0.25 volts should be used. If an external power receptacle is not available on the airplane, jumper cables may be used between the battery and the power supply. Be sure of the polarity before making the connection.

CAUTION

Excessive operation of the flap motor without proper cooling may cause damage to the motor. Allow a short cooling time after each extension and retraction cycle.

The flap limit switches are mounted on a bracket and installed on the outboard side of the inboard flap track in the left wing panel. The limit switches control the travel of the flaps by breaking the circuit to the flap motor at the extreme limits of travel. They are accessible by lowering the flaps.

TWO-POSITION FLAPS
(CE-748, CE-772 THRU CE-815; CJ-149; D-10097, D-10120 THRU D-10178; E-1111, E-1241 THRU E-1370)

There are two limit switches for this system, one for the uplimit position, and one for the downlimit position. To adjust the flaps to neutral position, loosen the screws of the switch assembly so that the assembly can pivot on the forward elongated hole. Adjust the switch as necessary to stop the flaps in neutral position. Actuate the flap switch to the down position and measure the degrees of travel (proper degree of travel is 30° + 0° - 2°). Adjustment of the down position of the flaps is made on the downlimit switch.

THREE-POSITION FLAPS
(CE-816 AND AFTER; CJ-150 AND AFTER; D-10179 AND AFTER; E-1371 AND AFTER; EA-1 AND AFTER)

The limit switches, one for up, two for the approach position and one for the down travel, control the travel of the flaps by breaking the circuit to the flap motor at the extreme limits of selected travel. The switches are accessible by lowering the flaps.

The flap travel is adjusted by moving the limit switches. The left flap is rigged first, then the right flap is synchronized with it. Rig as follows:

NOTE

Rig the flaps under a simulated flight load to reduce overtravel to a minimum after the limit switches have been actuated.

When the flaps are in the 0° position, a clearance of 1/16 inch + 1/16 inch - 1/32 inch must exist between the flap roller and the forward edge of the flap track slot.

a. Adjust the uplimit switch so the flaps will stop at the 0° position.

NOTE

At serials E-1946, E-2104, E-2111 and After, the flap switch approach position is 12°. Adjust the 11° limit (outboard) switch until the flaps are positioned at 11° to 11.5° after the flaps have been actuated from fully up position to the approach position. Adjust the 13° limit switch (inboard) switch until the flaps are at the 13° to 12.5° position after the flaps have been actuated from fully down to the approach position.

b. Adjust the 14° limit switch (inboard) in its mounting slot until the flap is positioned at 14° to 14.5° after the flap has been actuated from fully up to the takeoff position (15° range). Adjust the 16° limit switch (outboard) in its mounting slot until the flap is positioned at 16° to 15.5° after the flap has been actuated from fully down to the takeoff position (15° range).

c. Adjust the downlimit switch in its mounting slot until it actuates at 28° to 30° of flap travel.

d. Remove the bolt attaching the right actuator to the right flap.

e. Turn the jackscrew on the right actuator in or out to align the right flap with the left flap.

f. Install the bolt connecting the actuator to the flap.

CAUTION

If the flaps are removed for any reason the main power switch should be in the OFF position.

NOTE

After the flap is completely rigged, adjust the rubber bumper (flap down) installed on the flap and aileron dividing rib. Turn the adjusting screw in or out, as required, to take out play or stop vibration when the flap is in the up position. A distinct change in the sound of the flap motor near the completion of the flap-up travel may indicate an excessive outward adjustment of the bumper.

g. Operate the flaps through full travel to ensure that the flaps contact the limit switches before they contact the rubber bumper.

FLAP SETTING

CE-748, CE-772 THROUGH CE-815; CJ-149
D-10097, D-10120 THROUGH D-10178;
E-1111, E-1241 THROUGH E-1370

FULL UP = 0°
FULL DOWN = 30° + 0° - 2°

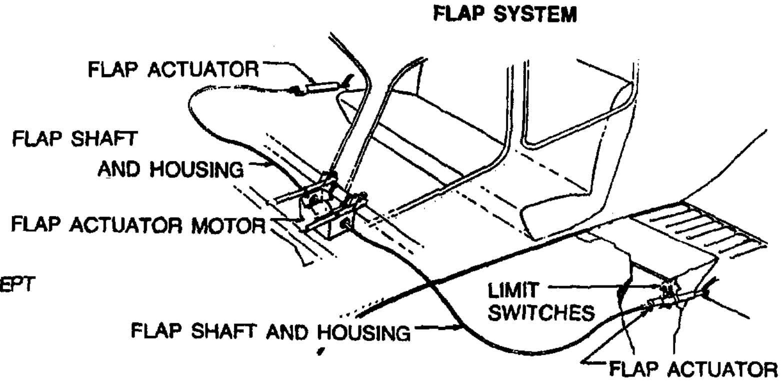
CE-816 AND AFTER, CJ-150 AND AFTER
D-10179 AND AFTER, E-1371 THRU E-2110 EXCEPT
E-1946 AND E-2104, EA-1 AND AFTER

FULL UP = 0°
APPROACH = 15°
FULL DOWN = 30° + 0° – 2°

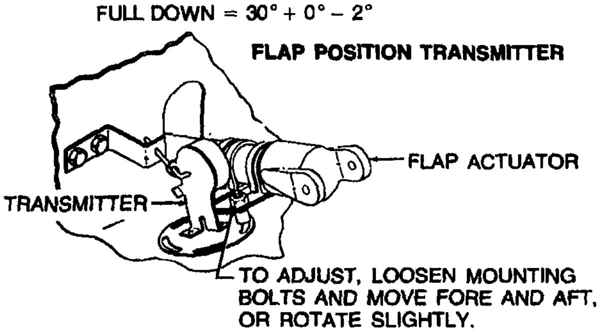
E-1946, E-2104, E-2111 AND AFTER

FULL UP = 0°
APPROACH = 12°
FULL DOWN = 30° + 0° – 2°

FLAP SYSTEM



FLAP POSITION TRANSMITTER



FLAP POSITION INDICATOR

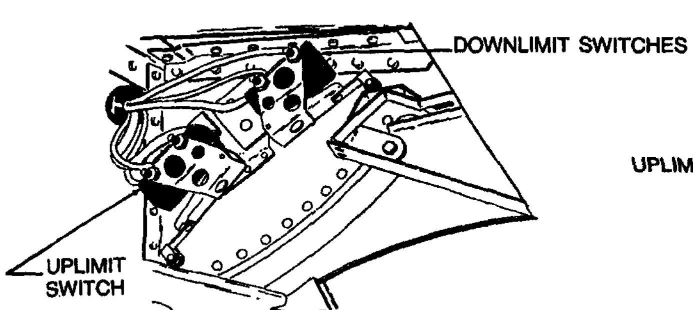
INDICATOR

CE-748, CE-772 THROUGH
CE-815; CJ-149, D-10097,
D-10120 THROUGH D-10178
E-1111, E-1241 THROUGH E-1370

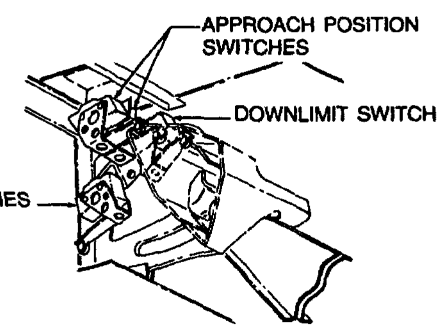
INDICATOR

CE-816 AND AFTER
CJ-150 AND AFTER
D-10179 AND AFTER
E-1371 THRU E-2110 EXCEPT
E-1946 AND E-2104 *
EA-1 THRU EA-388 EXCEPT
EA-320 *

* WHICH HAVE LIGHTS TO INDICATE POSITION



CE-748, CE-772 THROUGH CE-815, CJ-149;
D-10097, D-10120 THROUGH D-10178;
E-1111, E-1241 THROUGH E-1370



CE-816 AND AFTER
CJ-150 AND AFTER
D-10179 AND AFTER
E-1371 AND AFTER
EA-1 AND AFTER

FLAP LIMIT SWITCHES

33-161-15

Flap System
Figure 1

FLAP POSITION INDICATOR AND ADJUSTMENT

The flap position indicator gage is installed in the instrument panel. An adjustable flap position indicator transmitter is installed on the flap actuator in the left wing just forward of the rear spar to coordinate gage reading with flap travel.

a. Adjust the flap travel limit switches to provide the correct up and down travel of the flaps. Refer to FLAP LIMIT SWITCH ADJUSTMENT procedure.

b. Run the flaps down and check the pilot's compartment flap position indicator for 100% flaps. If down flaps are not indicated, loosen the transmitter attachment bolts and adjust transmitter fore and aft or rotate slightly until the reading is correct, then tighten the transmitter attaching bolts.

c. Run the flaps up and check the indicator for up flaps reading.

FLAP MOTOR REMOVAL

CAUTION

If the flap motor fails or if major overhaul is required for it to operate properly, the flap motor should be replaced. No attempt should be made to overhaul the motor in the field.

a. Remove the front seat assemblies.

b. Remove the spar cover.

c. Detach the clamp supporting the electrical wiring from the right-hand flap-shaft housing.

d. Disconnect the motor electrical wiring at the quick disconnect.

e. Loosen the two set screws on each cable retainer.

f. Rotate the cable retainers 90°.

g. Loosen the nuts on the inboard side of the mounting supports.

h. Pull the flexible drive shafts from the flap motor shafts and retainers.

i. Remove the flap motor attaching bolts and remove the flap motor.

CONNECTING FLEXIBLE FLAP DRIVE SHAFT TO FLAP MOTOR SHAFT

Connect the LH and RH flexible flap drive shafts to the flap drive motor shaft as follows, refer to Figure 2 for component locations:

a. Install the outboard nut and washer as far as they will go onto the threaded portion of the flap shaft housing.

b. Start set screws (2) into retainer. Insert the retainer through the flap shaft mounting support and onto the motor shaft as far as it will go.

c. Align retainer keyway with key slot in flap motor drive shaft and tighten one set screw temporarily.

d. While inserting the flap shaft through the mounting support, install the inboard washer and nut.

e. Install the flap shaft through the retainer and into the motor drive shaft until the keyway is just past the key slot in the retainer.

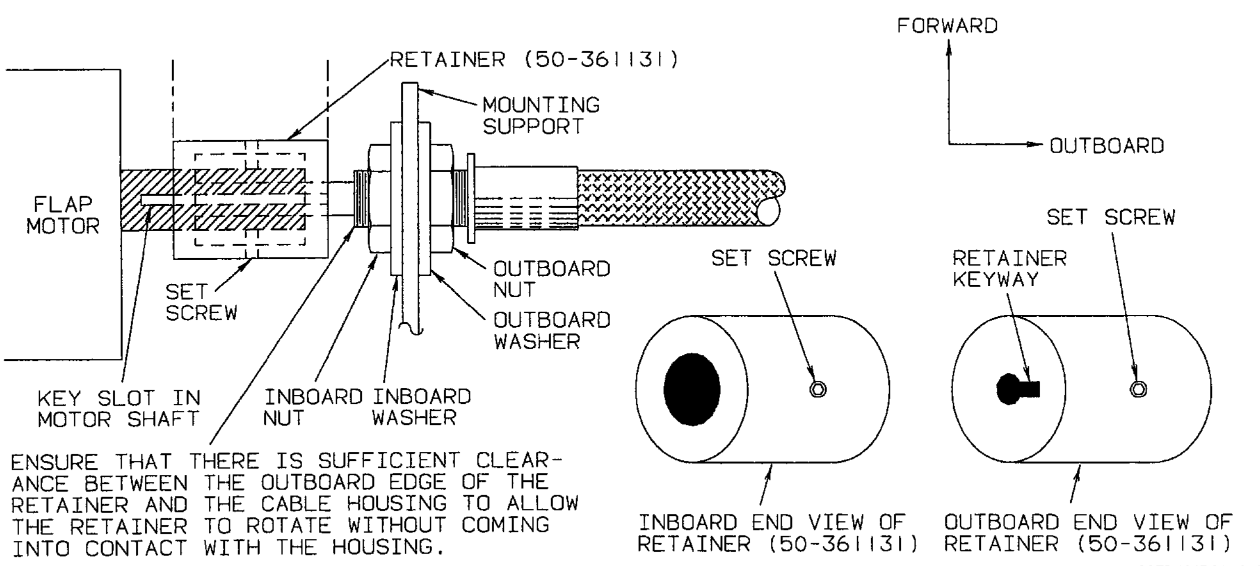
f. Loosen the set screw that was tightened in Step c..

g. Ensure that the retainer is still installed on the motor shaft as far as it will go and rotate retainer 90°.

h. Keep inboard pressure on the retainer and tighten both retainer set screws.

i. Secure the flap drive shaft to the mounting support by tightening the two nuts. Tighten inboard nut to ensure that there is sufficient clearance between the outboard edge of the retainer and the cable housing to allow the retainer to rotate without coming into contact with the cable housing. In threaded part of cable housing is not long enough to install the two nuts and washer, use a die to add 5/8-24 UNEF threads until 0.88 inch thread length is attained.

j. Tighten outboard nut against the mounting support.



Flap Cable Retainer
Figure 2

FLAP MOTOR INSTALLATION

CAUTION

Should the flap motor fail or should major overhaul be required for the flap motor to operate properly, it should be replaced. No attempt should be made to overhaul the motor in the field.

a. Place the flap motor in position and secure with the flap motor attach bolts.

b. Connect the flap motor electrical wiring at the quick disconnect.

c. Install flexible flap drive shafts into the flap motor shafts, refer to CONNECTING FLEXIBLE FLAP DRIVE SHAFT TO FLAP MOTOR SHAFT procedure.

d. Attach the clamp that supports the electrical wiring from the right flap shaft housing.

e. Run the flaps through full travel, up and down, to check flap rigging.

f. Install the spar cover.

g. Install the front seat assemblies.

FLAP SHAFT REMOVAL

a. Place the airplane on jacks and use the circuit breaker to retract the landing gear until the inboard doors are open.

b. Remove the front seat assemblies.

c. Remove the spar cover.

d. Loosen the two set screws on each cable retainer.

e. Rotate the cable retainer 90°.

f. Remove the nut on the inboard side of the mounting support.

g. Pull the flexible drive shaft from the flap motor shaft and retainer.

h. Disconnect all clamps securing the shaft housing to the wing structure.

i. Remove the dust cover in the rear section of the wheel well.

j. Disconnect the flap actuator from the wing flap and the wing spar section.

k. Pull the actuator and flexible shaft housing out of the wing.

FLAP SHAFT INSTALLATION

a. Pull the flexible shaft and housing through the wing and attach the actuator to the wing flap and wing spar section.

b. Set the flaps in the up position.

c. Push the flexible shaft into the flap motor shaft and retainer.

d. Rotate the retainer 90°.

e. While holding the retainer onto the motor shaft as far as possible, tighten the two set screws in each retainer.

f. Tighten the nut on the inboard side of the mounting support.

g. Install the clamps securing the shaft housing to the wing structure.

h. Install the dust cover in the rear section of the wheel well.

i. Run the flaps through full travel, up and down, to check flap rigging.

j. Lower the landing gear and remove the airplane from the jacks.

k. Install the spar cover.

l. Install the front seat assemblies.

FLAP ACTUATOR REMOVAL

a. Place the airplane on jacks and retract the landing gear until the inboard door is open (use the circuit breaker).

b. Remove the dust cover in the rear section of the wheel well to gain access to the actuator.

c. Lower the flaps and disconnect the actuator from the flap.

NOTE

To retain the original rigging of the flaps, mark the extension of the flap actuator before it is removed so that it may be installed in the same position.

d. Remove the flap position transmitter from the flap actuator.

e. Remove the snap ring and disconnect the flexible drive housing.

f. Remove the pivot bolts from the flap actuator mounting bracket and remove the flap actuator.

FLAP ACTUATOR INSTALLATION

a. Place the flap actuator in position and secure it to the flap actuator mounting bracket with the pivot bolts.

b. Connect the flexible drive housing and install the snap ring.

c. Install the flap position transmitter to the flap actuator.

NOTE

The flap position transmitter is on the left-hand flap actuator only.

d. Connect the flap actuator to the flaps in the extended position marked during removal.

e. Install the dust cover in the rear section of the wheel well.

f. Check the flap rigging.

g. Lower the landing gear and remove the airplane from the jacks.

FLAP INNER FLEX SHAFT REMOVAL

a. Place the airplane on jacks and retract the landing gear (using the circuit breaker) until the inboard door is open.

b. Remove the front seat assemblies.

c. Remove the spar cover.

d. Loosen the two set screws on the cable retainer (Ref. Figure 2).

e. Rotate the cable retainer 90°.

f. Remove the dust cover in the rear of the wheel well to gain access to the actuator.

g. Remove the two bolts holding the forward end of the actuator in place.

NOTE

The first clamp which secures the flex drive to the wing may have to be removed to allow more flexibility to the flex drive.

The position transmitter on the left flap may need to be removed.

h. Remove the snap ring holding the flex drive to the actuator

NOTE

Do not lose the spacers located under the flange of the flex drive.

i. To facilitate installation, note how far the shaft protrudes past the flange of the housing.

j. Pull the flex inner shaft from the housing.

FLAP INNER FLEX SHAFT INSTALLATION

a. Lubricate the inner flex shaft with grease (11, Chart 1, 91-00-00).

b. Install the inner flex shaft into its housing (Ref. Figure 2).

c. Rotate the inner flex shaft until the key on the inner end of the shaft slides into place. (When this is accomplished, the measurement noted in FLAP INNER SHAFT REMOVAL procedure Step i. should again be noted at this time.)

d. Push the flap shaft into the flap motor shaft and retainer.

e. Rotate the retainer 90°.

f. While holding the retainer onto the motor shafts as far as possible, tighten the two set screws in the retainer.

NOTE

Be certain the spacers are in place in the actuator.

g. Install the flap shaft into the actuator and install the snap ring.

NOTE

A screwdriver may be used to make small adjustments to the screw of the actuator if the slot in the actuator does not align with the key of the flex shaft.

h. Secure the actuator in place with the two bolts, washers, and nuts.

NOTE

The position transmitter will have to be installed on the left flap if it was removed. Install the clamp on the shaft if it was removed.

i. Install the dust cover.

j. Lower the landing gear and remove the airplane from the jacks.

k. Cycle the flaps to determine that they are properly rigged.

NOTE

For correct adjustment and rigging of the flap position transmitter refer to the FLAP POSITION INDICATOR AND ADJUSTMENT procedure.

FLAP ACTUATOR DISASSEMBLY

a. Remove the snap ring (2) to disconnect the flexible shaft (1) from the actuator (Ref. Figure 3).

b. Tap on the piston plug (11) to drive out the seal (17), spacers (3) and bearings (4).

c. Slide the piston (6) out of the housing (8).

d. Check that the end play between the piston (6) and the actuator screw (5) does not exceed 0.012 inch under 25 to 50 pounds of force in both compression and tension at any of the following positions:

   1. With the actuator screw full in and backed out 1 turn.

   2. With the actuator screw 1/2 extended.

   3. With the actuator screw fully extended and backed in 1 turn.

e. If the 0.012 inch tolerance is exceeded, replace the piston and plug with a new one. If the tolerance is still unacceptable replace the screw. Check the end play of the new piston and screw per the preceding step.

NOTE

Mark the piston and screw so that the same threads will be in contact when the piston and screw are assembled.

f. Remove the O-ring (12) from the housing (8).

g. Remove the actuator screw (5) from the piston (6).

NOTE

The following step should be accomplished only if the piston (6) or piston plug (11) is to be replaced due to damage or wear.

h. Drill out the pin (14) and take the piston plug (11) out of the piston (6).

FLAP ACTUATOR ASSEMBLY

NOTE

A replacement plug (11) may be supplied without the hole for the pin (14).

A replacement piston (6) may be supplied with an under sized hole for the pin (14), on one side of the piston only.

a. If necessary drill a 0.185 to 0.189 inch diameter hole through the piston (6) and piston plug (11) for the pin (14). Countersink the hole on both sides of the piston 100° to 0.250 inch.

b. Clean all parts with solvent (16, Chart 1, 91-00-00) and inspect for cracks, corrosion, distortion and excessive wear. Refer to Chart 1 for tolerances and wear limits.

c. Replace the O-ring (12) and seal (17).

d. Coat the piston plug (11) and pin (14) with adhesive (68, Chart 1, 91-00-00) before assembly.

e. Peen the pin (14) and file it flush with the piston (6).

f. Pack the bearings (4) with lubricating grease (50, Chart 1, 91-00-00) before inserting the piston (6) in the housing (8).

g. Pour lubricating oil (51, Chart 1, 91-00-00) into the housing (8) until it is about two inches from being full.

h. Slide a bearing (4) on the screw (5).

NOTE

When the screw and piston are assembled, be sure the same threads are in contact as when they were disassembled. Check the piston and screw assembly end play per Step d. of FLAP ACTUATOR DISASSEMBLY procedure.

i. Start the screw (5) in the piston (6) and slide the piston into the housing (8).

j. Install the remaining bearing (4) and seal (17). Seat these parts in the housing (8) with approximately 100 lbs. pressure, or use a suitable drift and mallet if a press is not available.

k. Install the spacers (3), shaft (1) and snap ring (2).

l. Tap the piston plug (11) with a rawhide mallet to seat the parts against the snap ring (2).

m. Check that the end play between the piston (6) and housing (8) is between 0.002 inch and 0.010 inch.

NOTE

The total end play between the piston (6) and actuator screw (5) plus the end play between the housing (8) and piston (6) shall not exceed 0.022 inch. Subtract the piston-to-screw end play (determined in Step d. of FLAP ACTUATOR DISASSEMBLY procedure) from the total to get the piston-to-housing end play.

If the piston-to-housing end play is not within tolerance, the spacers (3) may be removed or installed to correct the end play.

Spacers (3) are made up of 3 different spacers (35-251230-2, 35-251230-4 and 35-251230). A maximum of one 35-251230-2, five 35-251230-4 and seven 35-251230 spacers may be used to make up spacers (3).

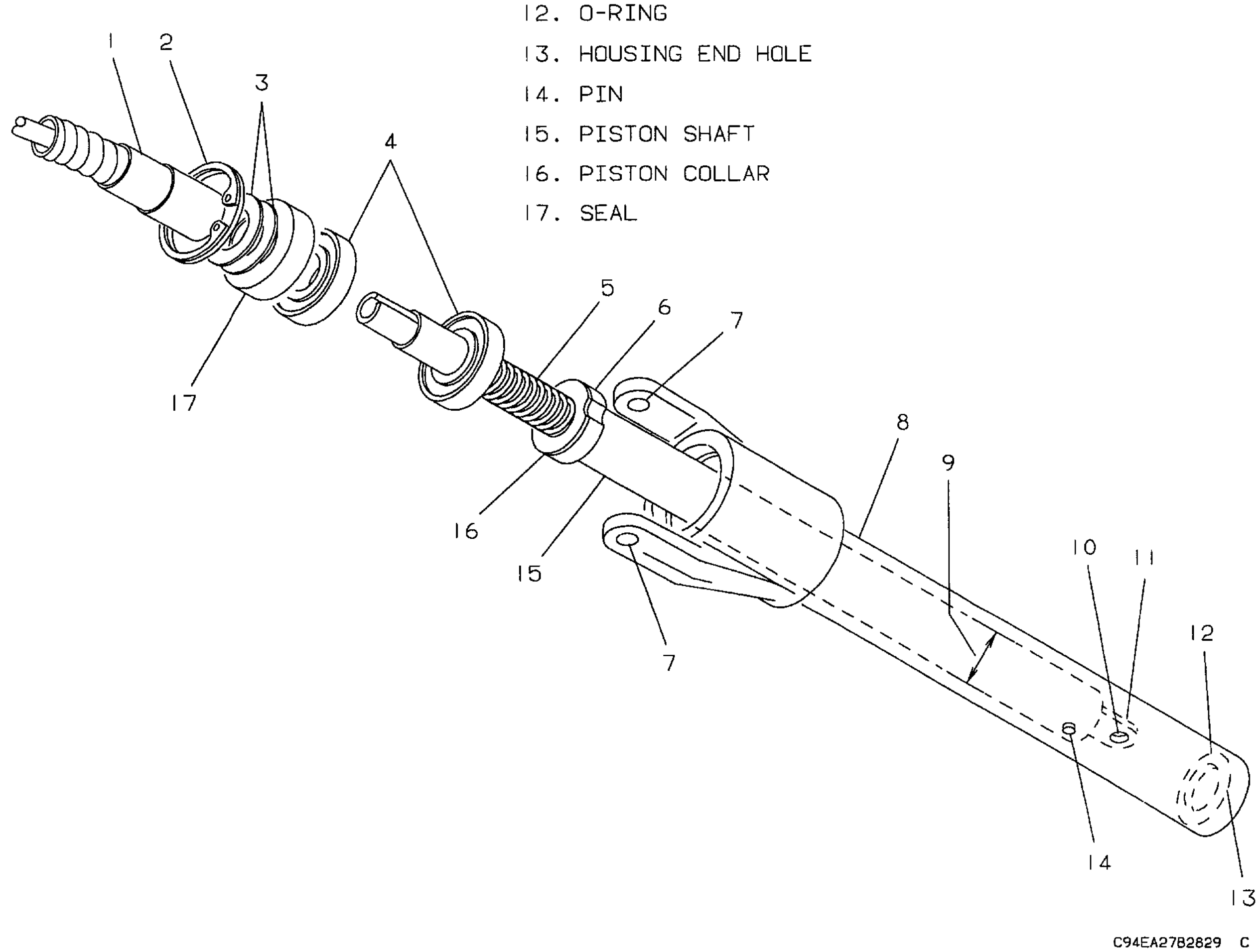
n. Run the actuator in and out several times to assure proper operation in its full travel. Excess lubricant will be forced out of the vent hole the first time the actuator is run all the way up.

o. Install the actuator with the vent hole up.

CHART 1
FLAP ACTUATOR MANUFACTURING TOLERANCES AND WEAR LIMITS

ITEM (Refer to Figure 3 for Item No.)	**MANUFACTURED AND/OR ACCEPTABLE DIMENSIONS**	**ALLOWABLE WEAR LIMITS**
Piston (6)		
Pivot Bolt Holes (7)	Inside Diameter 0.3432 to 0.3442	0.3452
Housing (8)		
Inside Barrel Dimension (9)	Inside Diameter 0.875 to 0.878	0.879
Piston Plug Hole (10)	Inside Diameter 0.3120 to 0.3130	0.314
Piston Plug (11)		
Housing End Hole (13)	Inside Diameter 0.688 to 0.690	0.694
Piston Shaft (15)	Outside Diameter 0.685 to 0.687	0.684
Piston Collar (16)	Outside Diameter 0.861 to 0.864	0.859

1. FLEXIBLE SHAFT
2. SNAP RING
3. SPACERS
4. BEARINGS
5. ACTUATOR SCREW
6. PISTON
7. HOUSING PIVOT BOLT HOLES
8. HOUSING
9. HOUSING BARREL INSIDE DIMENSION
10. PISTON PLUG HOLE (CONNECTS FLAP TO ACTUATOR)
11. PISTON PLUG
12. O-RING
13. HOUSING END HOLE
14. PIN
15. PISTON SHAFT
16. PISTON COLLAR
17. SEAL



Flap Actuator
Figure 3

GUST LOCK AND DAMPER

CONTROL LOCK

A control column lock pin is provided for the control column and the aileron control wheel. The lock pin secures both the aileron control wheel and the elevator control. A cover is provided on the control lock to cover the throttle control, boost pump, and the propeller control. Install the control lock assembly in the following sequence:

a. Rotate the control wheel to the right and move the column forward so the hole in the bracket and the column align to accept the pin.

b. Push the control column lock pin through the hole provided in the control column guide and into the control column.

c. Ensure positive retention of the lock pin by placing the cover assembly over the throttle control, boost pump, and the propeller control.

WARNING

Always completely remove the control lock assembly before engine start, taxiing, and flight.

"END"

CHAPTER

28

FUEL

CHAPTER 28 - FUEL

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

"END"

CHAPTER 28

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
28-EFFECTIVITY	1	Oct 16/92
28-CONTENTS	1	Oct 16/92
	2	Oct 16/92
28-00-00	1	Aug 29/85
	2	Aug 29/85
	3	Aug 29/85
	4	Aug 28/87
	5	Aug 28/87
28-10-00	1	Aug 28/87
	2	Aug 28/87
	2A	Aug 28/87
	3	Jan 20/82
	4	Jan 20/82
	5	Jan 20/82
	6	Jan 20/82
	7	Jan 20/82
	8	Jan 20/82
	9	Jan 20/82
28-20-00	1	Oct 16/92
	2	Oct 16/92
	3	Oct 16/92
	4	Oct 16/92
	5	Oct 16/92
28-40-00	1	Aug 28/87
	2	Aug 28/87

"END"

GENERAL - DESCRIPTION AND OPERATION

FUEL SYSTEM
(Figure 1)

The standard fuel system on CE-748, CE-772 thru CE-883; CJ-149 thru CJ-155; D-10097, D-10120 thru D-10302; E-1111, E-1241 thru E-1593; and EA-1 thru EA-32 consists of a 25 gallon (22 gallons usable) fuel cell located in each wing leading edge, which provides the airplane with a total fuel capacity of 50 gallons (44 gallons usable) of fuel. The standard fuel system on CE-884 and after; CJ-156 and after; D-10303 and after; E-1594 and after, and EA-33 thru EA-272 except EA-242 consists of a 40 gallon (37 gallons usable) fuel cell in each wing leading edge which provides the airplane with an 80 gallon (74 gallons usable) fuel capacity. On EA-242 and EA-273 and after, the fuel system consists of a 40 gallon and a 14 gallon cell in each wing. This provides the airplane with 108 gallons (102 gallons usable) of fuel.

The cells are filled through an independent flush type filler cap located on each wing. On all airplanes except CJ-149 and after, each wing contains a baffled fuel cell to deliver an uninterrupted flow of fuel to the engine. The fuel selector handle, located forward and to the left of the pilot's seat, is placarded OFF-LH TANK-RH TANK for fuel management. Float operated sensors located in each wing tank system measure fuel quantity. A visual measuring tab in each cell is attached to the filler neck of the 80 gallon system. The bottom of the tab indicates 27 gallons of usable fuel in each tank and the detent on the tab indicates 32 gallons of usable fuel in each tank.

At EA-242 and EA-273 and after, a sight gage is installed (inboard of wing station 113.172) to aid in taking on a partial load of fuel. This gage will indicate a partial load of 25, 30, or 35 gallons in its respective wing. When the gage is indicating in the black zone, do not use the gage.

AUXILIARY OR FUEL BOOST PUMP
(CE-748, CE-772 and after; D-10097, D-10120 and after; E-1111, E-1241 thru E-2110 except E-1946 and E-2104)

The single speed auxiliary fuel pump is mounted in front of the forward spar carry-through on the left side of the airplane. The auxiliary fuel pump provides pressure for starting and emergency operation in case the engine-driven pump fails. Immediately after starting, the auxiliary fuel pump can be used to purge the system of vapor caused by an extremely high ambient temperature or a start with the engine hot. The auxiliary fuel pump is controlled by a switch located on the fuel control panel and placarded AUX FUEL PUMP OPERATION, ON OFF.

AUXILIARY OR FUEL BOOST PUMP
(CJ-149 and after)

The fuel boost pump system utilizes 2 separate boost pumps (a high pressure and a low pressure pump) mounted in front of the forward spar carry-through. The switch which controls these pumps is located on the fuel control panel and is placarded HIGH BOOST, OFF, and ACROBATIC BOOST. The high boost pump may be used if the engine driven pump fails, if starting the engine during high ambient temperatures or if the engine is hot. The switch must be in the acrobatic boost position during acrobatic maneuvers. Both pumps are for intermittent use only. The boost pump pressures should be as indicated in Chart 1.

Chart 1
Fuel Boost Pump Pressures

High Boost	23.0 psi. at No Flow	16.0 psi. at 42 gph.
Acrobatic Boost	11.5 psi. at No Flow	7.0 psi. at 55 gph.

The by-pass cracking pressure of each pump is 3.0 in. of water with a maximum by-pass pressure drop of 0.35 psi. at 40 gph.

AUXILIARY OR FUEL BOOST PUMP
(EA-1 thru EA-272 Except EA-242)

NOTE

On airplanes equipped with kit no. 36-9008-IS the EMERGENCY FUEL PUMP switch is removed and the placard covered with black paint. The high boost fuel boost relay under the pilots floorboard is removed and the manifold pressure switch in the manifold pressure gage line has the electrical connector unplugged and the exposed terminals covered with electrical tape. The vent plumbing outboard of the fuel cell has not been changed but the fuel supply system is essentially that of a B36TC (EA-242, EA-273 and after). The fuel selector valve drain requires the use of the same type tool (see special tools) as the B36TC. Refer to the B36TC (EA-242, EA-273 and after) for the description and operation.

NOTE

The auxiliary Fuel Pump Switch is placarded OFF-LOW-AUTO on Serials EA-1 thru EA-53. The auxiliary Fuel Pump Switch on Serials EA-54 and after, and airplanes prior to EA-54 complying with

BEECHCRAFT Service Instructions No. 1093 is placarded OFF-LOW-HI/LOW.

The two speed auxiliary fuel pump is located in front of the forward spar carry-through on the left side of the airplane. The pump is controlled by three switches located in the cabin. One of the switches is located on the fuel control panel and placarded AUX FUEL PUMP, OFF, LOW, AUTO or HI/LOW. In the AUTO or HI/LOW position the pump is operating at all times. At low power settings it operates at low boost, and at higher power settings (27 to 30 in. Hg manifold pressure) it operates at high boost. The mode at which the boost pump operates in the AUTO or HI/LOW position is determined by a switch actuated by manifold pressure. Another switch is located in the subpanel just to the left of the fuel control panel and placarded EMERGENCY FUEL PUMP, OFF ON. This switch will override the other switches and actuate the high pressure side of the pump for emergency operation, such as with a failed engine driven fuel pump. The third switch is located forward of the instrument panel and plumbed into the manifold pressure gage line. This switch is actuated by manifold pressure, and closes between 29 to 30 in. Hg on increasing pressure (to actuate the high pressure side of the pump), and opens between 27 to 30 in. Hg on decreasing pressure (to return the pump to low pressure operation). This switch actuates the high pressure side of the pump, but only functions if the switch on the fuel control panel is in the AUTO or HI/LOW position.

AUXILIARY OR FUEL BOOST PUMP (E-1946, E-2104, E-2111 and after; EA-242, EA-273 and after)

The two speed auxiliary fuel pump is mounted in front of the forward spar carry-through on the left side of the airplane. The auxiliary fuel pump provides pressure for starting and emergency operation in case the engine-driven pump fails. Immediately after starting, the auxiliary fuel pump can be used to purge the system of vapor caused by an extremely high ambient temperature or a start with the engine hot. The auxiliary fuel pump is controlled by a switch located on the subpanel and placarded AUX FUEL PUMP HI LO OFF.

FUEL SYSTEM DRAINS

The fuel system prior to EA-273, except EA-242, is equipped with one snap-type drain in each wing. At serial EA-242 and EA-273 and after, there are two drains in each wing. One drain with its tool is to be used in a preflight check for contaminants in the fuel; the other drain with its Adapter, P/N 107B, is for draining the fuel system.

Each fuel cell drain is located on the lower surface of the wing, forward of the main spar, just outboard of the root. The system low spot drain at the bottom of the fuel selector valve is accessible through a door inboard of the left wing root.

GENERAL - MAINTENANCE PRACTICES

FUEL HANDLING PRACTICES

When filling the airplane fuel tanks, always observe the following:

a. Service the airplane fuel tanks with Grade 100LL (Blue) aviation gasoline, or Grade 100/130 (Green) aviation gasoline (1, Chart 1, 91-00-00). If these fuels are not available, Grade 115/145 (Purple) aviation gasoline (1, Chart 1, 91-00-00) may be used.

b. Be certain the airplane is statically grounded to the servicing unit.

c. Do not fill fuel cells near open flame or within 100 feet of any open energized electrical equipment capable of producing sparks.

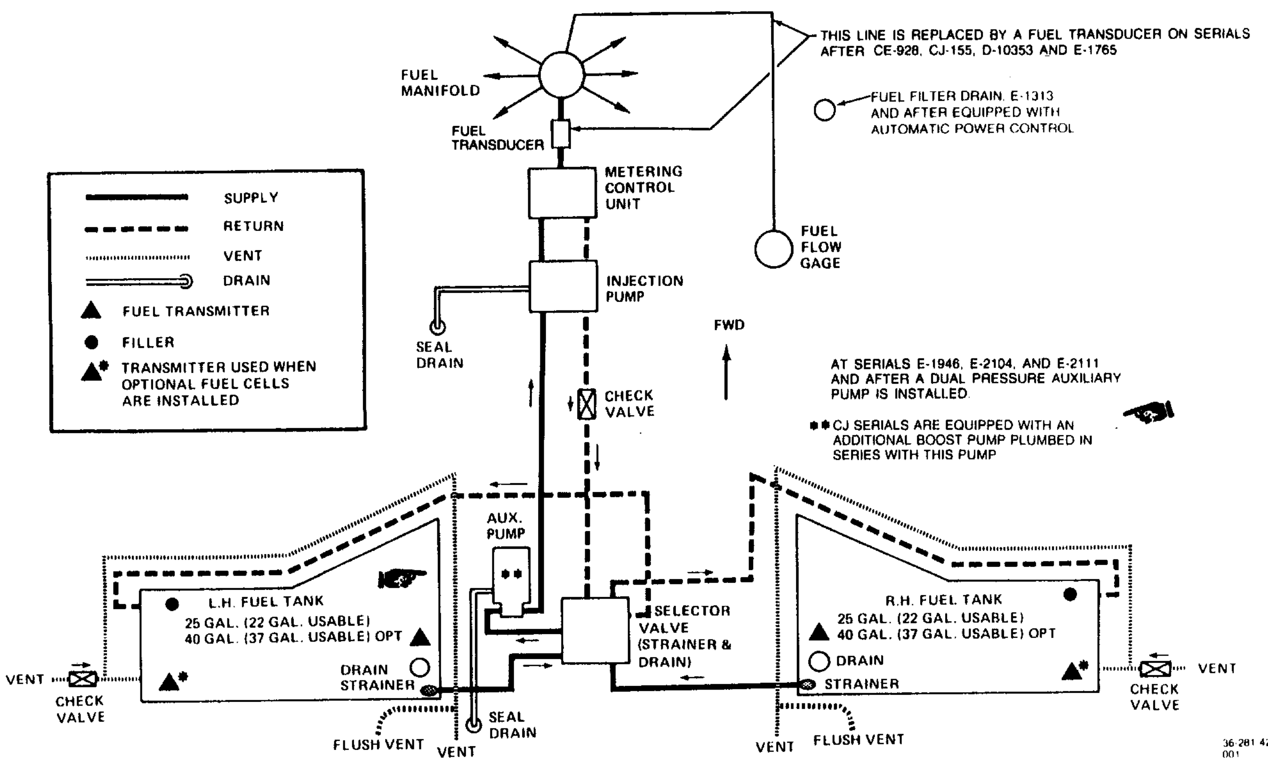
NOTE

Care should be exercised while filling the fuel cell to prevent scratching, denting, or otherwise damaging the surface or leading edge of the wings. Do not allow the fuel nozzle to come in contact with the rubber fuel cell.

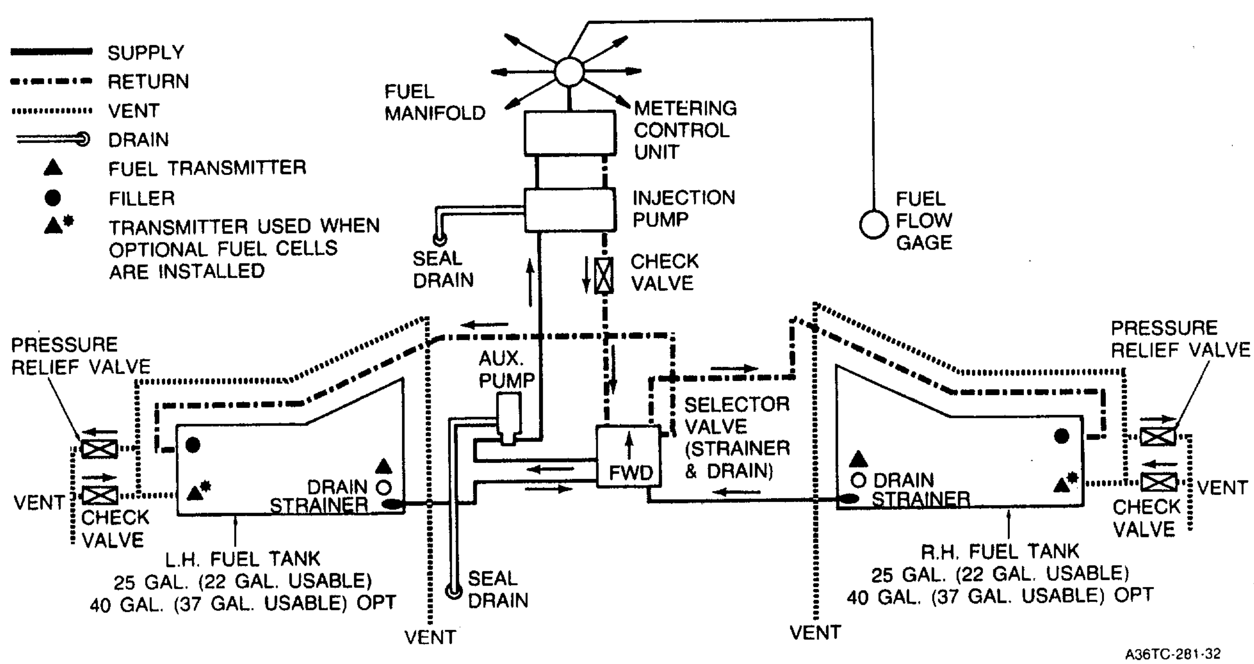
CLEANING FUEL STRAINERS

Most fuel injection system malfunctions can be attributed to contaminated fuel. Inspecting and cleaning the fuel strainers should be considered to be of the utmost importance as a regular part of preventive maintenance.

Normally the fuel strainers should be inspected and cleaned every 100 hours. However, the strainers should be inspected and cleaned at more frequent intervals depending on service conditions, fuel handling equipment and when operating in localities where there is an excessive amount of

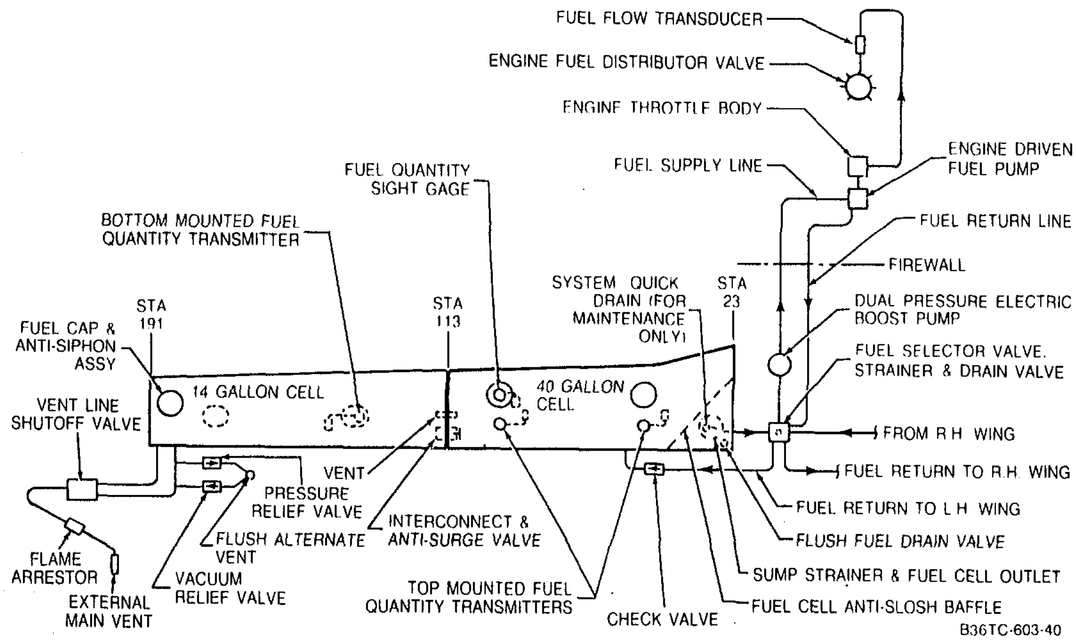


(CE-748, CE-772 and after; CJ-149 and after; D-10097, D-10120 and after; E-1111, E-1241 and after)



(EA-1 thru EA-272 Except EA-242)

Fuel System
Figure 1



Fuel System (EA-242, EA-273 and after)
Figure 2

sand or dust. It is recommended that the fuel strainer, located in the fuel selector valve, be inspected and cleaned at intervals of 50 hours of operation and under no condition should the period be extended over 100 hours. The finger strainers in the fuel cell outlets should be removed and cleaned whenever solid materials are found in the cells, or if the airplane has been in storage for an extended period of time.

CAUTION

The strainer of the non-baffled cell with reservoir and the baffled cell are not interchangeable. Ensure that the correct fuel strainers are reinstalled in the proper cells after cleaning and inspection.

AIRPLANE DEFUELING (PRIOR TO EA-273 EXCEPT EA-242)

WARNING

Do not defuel near an open flame or within 100 feet of any energized electrical equipment capable of producing sparks.

To ensure that all fuel is removed from the system and to expedite the defueling operation, the fuel should be drained through the boost pump. The following steps must be accomplished before energizing the pump:

a. Apply external power to the airplane electrical system.

b. Place the fuel selector valve in the ON position and the mixture lever in IDLE CUT-OFF.

c. Remove the filler caps to vent the system.

d. Disconnect the fuel line at the firewall and attach a drain hose. Provide a suitable container for the fuel.

e. Energize the boost pump.

f. When the fuel is no longer pumped from the airplane, open the sump drains to complete the defueling operation.

CAUTION

After defueling or fuel cell replacement, operate the engine on each fuel tank with the airplane on the ground to ensure that all air has been purged from the fuel cells and the fuel lines to the engine upon refueling.

AIRPLANE DEFUELING (EA-242, EA-273 AND AFTER)

WARNING

Do not defuel near an open flame or within 100 feet of any energized electrical equipment capable of producing sparks.

a. Provide a suitable container for the fuel.

b. Remove the access cover under the drain valve located under the wing near the fuselage.

c. Remove the filler caps to vent the system.

d. Insert the drain adapter (supplied as loose tool) into the drain valve.

e. After draining the fuel, remove the drain adapter and install the access cover.

CAUTION

After defueling or fuel cell replacement, operate the engine on each fuel tank with the airplane on the ground to ensure that all air has been purged from the fuel cells and the fuel lines to the engine upon refueling.

"END"

STORAGE - MAINTENANCE PRACTICES

CAUTION

Any time the fuel system is drained or a fuel cell replaced, air may enter the system. If the possibility that air has entered the system does exist, start and operate the engine on the ground until all air is removed from the system. Operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the Pilot's Operating Manual before starting and operating the engine.

FUEL CELL REMOVAL (PRIOR TO EA-273 EXCEPT EA-242)

a. Drain and purge the fuel cells.

b. Remove the outboard fuel cell access plate and fuel quantity sensor. (The outboard fuel quantity sensor is installed only in the optional 80 gallon fuel system).

c. Remove the inboard access cover and fuel quantity sensor.

d. Disconnect all fuel and vent plumbing.

e. Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

CAUTION

Tape the edge of the access hole to prevent damage to the fuel cell.

FUEL CELL INSTALLATION (PRIOR TO EA-273 EXCEPT EA-242)

CAUTION

Care should be taken when replacing fuel cells to ensure that the correct type fuel cell is used as a replacement. All Bonanza Series Airplanes except CJ-149 and after use baffled fuel cells. CJ-149 and after incorporate a fuel cell with a collapsible fuel cell reservoir in place of a baffled fuel cell. To avoid damage to the fuel cells, the fuel cell cavities MUST be clean of any debris before installing a replacement cell.

a. Return the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION

Before closing the zipper, inspect the fuel cell for any foreign material. If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

The molded nipple fittings used on the fuel cell are lightweight fittings developed for ease of installation in certain locations in the airplane. To get the best service from this type fitting, it is necessary to exercise certain procedures at the time of installation. The specific precautions other than the general care in handling are as follows:

1. Insert the flow tube into the fitting until 3/8 inch or more of the tube extends through the fitting.

2. Locate the hose clamp on the fabric-reinforced area of the nipple; it should clear the end of the fitting by 1/4 inch.

3. Torque hose clamps as indicated in Chart 1 in this chapter. They should be drawn up in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.

4. Use no sealing paste or gasket compounds.

5. Apply a thin film of Simonize wax to metal flow tubes as a lubricant. No other lubricant should be used.

Chart 1
Fuel Cell Nipple Clamp Torques

Inside diameter (in inches) of nipple. Outside diameter (in inches) of tube.	Inch-pounds of torque for fuel nipple clamps.
.25 thru .62	12 to 16
.75 and 1.00	15 to 20
1.00	25 to 30
1.50	30 to 35
3.00	35 to 40

CAUTION

If replacement Goodyear fuel cells have clear/yellow nipples, torque the fuel cell nipple clamps to 25 ±5 inch-pounds.

RESERVOIR INSTALLATION (CJ-149 AND AFTER)
(Figure 1)

Install the reservoir after the fuel cell is in the wing and before the access plate is installed. Installation may be accomplished as follows:

a. Tape the reservoir flapper valve shut before installing the reservoir.

b. Compress the reservoir (squeeze by hand) into a small circumference and pass it through the fuel access ring into the fuel cell.

c. Release the reservoir allowing it to assume its original shape.

d. Insert the connector assembly into the reservoir while tilting both the reservoir and connector assembly upward.

CAUTION

Care should be exercised to avoid cross threading the connector into the reservoir. Also avoid bending or distorting the fuel strainer which is attached to the end of the connector, for it may become entangled in the foam inside the reservoir.

e. Tighten the nipple clamp.

f. Connect the fuel line to the connector assembly.

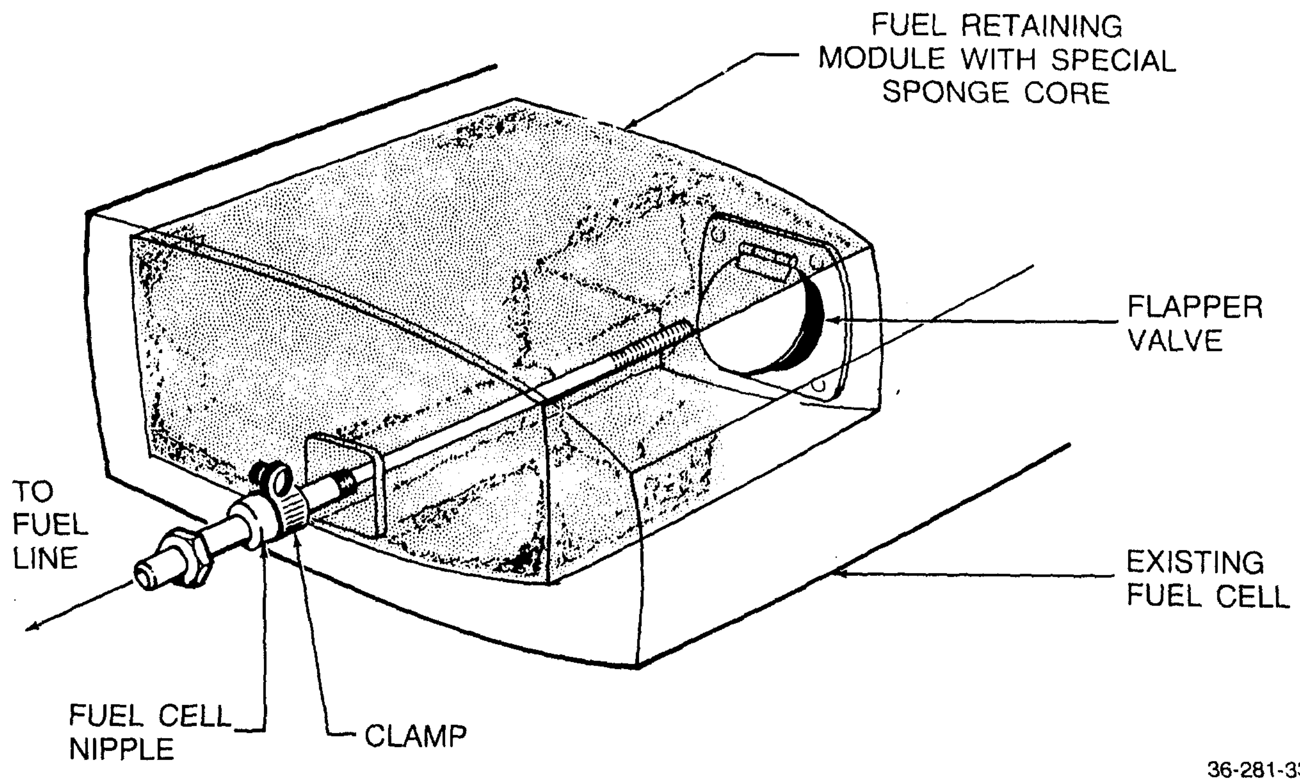
g. Remove the tape from the flapper valve and check the valve for free play and good sealing.

h. Check to make sure the reservoir is positioned properly on the bottom of the fuel cell.

i. Close all access openings used for installing the reservoir.

CAUTION

The parts of the non-baffled fuel cells and the baffled fuel cells are not to be interchanged. When installing a new fuel cell, use only those items pertaining to that particular cell being installed. The strainer for the non-baffled cell with reservoir, for example, is considerably longer that the one for baffled cell and may damage the cell if installed in the baffled cell.



Non-Collapsible Fuel Cell Reservoir (CJ-149 and after)
Figure 1

FUEL CELL REMOVAL (40 GALLON) (EA-242, EA-273 and after)

a. Drain and purge the fuel cells.

b. Remove the outboard fuel cell access cover, fuel quantity sensor, and fuel sight gage and mounting plate.

c. Remove the inboard access cover and fuel quantity sensor.

d. Remove the access cover under the fuel sump.

e. Remove the safety wire and bolts holding the sump in place.

f. Lower the sump assembly and disconnect the hose from the fuel outlet. Remove the sump and hose assembly.

g. Remove the clamp from the drain valve nipple.

h. Remove the drain valve.

i. Remove the pilot's and copilot's seats as outlined in PILOT AND COPILOT SEAT REMOVAL (Chapter 25-10-00).

j. Remove the royalite cover over the main spar.

k. Disconnect the fuel line from the fuel cell fitting.

l. Remove the two bolts holding the fuel cell to the wing root rib.

m. Remove the cotter pin from the flapper valve and interconnect tube at the outboard end of the fuel cell.

n. Loosen the bolt to the flapper valve clamp, and remove the flapper valve.

o. Remove the clamps from the two interconnect tubes.

p. Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

CAUTION

Tape the edge of the access hole to pevent damage to the fuel cell.

FUEL CELL INSTALLATION (40 GALLON) (EA-242, EA-273 and after)

CAUTION

Care should be taken when replacing fuel cells to ensure that the correct type fuel cell is used as a replacement. To avoid damage to the fuel cells, the fuel cell cavities MUST be clean of any debris before installing a replacement cell.

a. Install the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION

Before closing the zipper inspect the fuel cell for any foreign material. If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

b. Close zipper in fuel cell dam.

CAUTION

The access cover and fuel quantity sensor may have to be removed from the 14 gallon fuel cell so the small interconnect nipple may be held inplace during installation of the 40 gallon cell. A light film of petrolatum tech (VV-P-236) (42, Chart 1, 91-00-00) may be used as a lubricant on the nipples and under the clamps.

c. Install the fuel cell nipples on the interconnect tubes. Torque the nipple clamps per Chart 1 in this chapter.

CAUTION

The molded nipple fittings used on the fuel cell are lightweight fittings developed for ease of installation in certain locations in the airplane. To get the best service from this type fitting, it is necessary to exercise certain procedures at the time of installation. The specific precautions other than the general care in handling are as follows:

1. Insert the flow tube into the fitting until 3/8 inch or more of the tube extends through the fitting.
2. Locate the hose clamp on the fabric-reinforced area of the nipple; it should clear the end of the fitting by 1/4 inch.
3. Torque hose clamps as indicated in Chart 1 in this chapter. The hose clamps should be tightened in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.
4. Use no sealing paste or gasket compounds.

d. Install the flapper valve.

1. Install the cotter pin through the interconnect tube and flapper valve clamp.
2. Tighten the flapper valve clamp.

CAUTION

Use new gaskets.

NOTE

On Uniroyal cells remove two screws to allow installation of the bolts which secure the fuel cell to the wing root rib.

e. Install the two bolts which secure the fuel cell to the wing root rib. Torque to 20 to 30 in.-lbs. and lockwire.
f. Install the drain valve in the fuel cell nipple (make certain the hat section support is in place).
g. Install the nipple clamp. Torque per Chart 1 in this Section.
h. Connect the sump assembly hose to the fuel outlet. Torque per Chart 2 (91-00-00).
i. Install the sump. Torque the bolts to 45 to 55 in.-lbs. and safety wire the bolts and drain valve assembly.
j. Install the fuel quantity transmitters (2 in the 40 gallon fuel cell and 1 in the 14 gallon cell if removed). Torque the transmitters to 20 to 30 inch-pounds and the transmitter mounting plate to 45 to 55 in.-lbs.
k. Connect the electrical wire to the transmitter.
l. Install the fuel cell cover plates and fuel sight gage mounting plate. Torque to 45 to 55 in.-lbs.
m. Install the access covers.
n. Connect the fuel line to the fuel outlet. Torque per Chart 2 (91-00-00).
o. Install the royalite cover over the main spar.
p. Install the pilot's and copilot's seats as outlined in PILOT AND COPILOT SEAT INSTALLATION in Chapter 25-10-00.

FUEL CELL REMOVAL (14 Gallon)

a. Drain and purge the fuel cells.
b. Remove the access cover under the wing tip.
c. Disconnect the vent plumbing from the fuel cell.
d. Remove the filler cap, adapter assembly, and anti-siphon assembly.
e. Remove the two access covers under the 14 gallon fuel cell.
f. Remove the two cover assemblies from the fuel cell.
g. Remove the nipple clamps from the interconnect tubes, and remove the nipples from the tubes.
h. Unsnap the fuel cell and remove it through the outboard fuel cell access hole.

CAUTION

Tape the edge of the access hole to prevent damage to the fuel cell.

FUEL CELL INSTALLATION (14 Gallon)

CAUTION

Care should be taken to avoid damage to the fuel cells, the fuel cell cavities MUST be clean of any debris before installing a replacement cell.

a. Return the fuel cell through the outboard fuel cell access hole and snap it into place.

CAUTION

If the cell is not thoroughly clean, it should be cleaned with a lint-free cloth moistened in water, alcohol or kerosene. No other solvent should be used to clean the fuel cell.

b. Install the cell nipples on the interconnect tubes, and tighten the nipple clamps per Chart 1 in this chapter.

CAUTION

The molded nipple fittings used on the fuel cell are lightweight fittings developed for ease of installation in certain locations in the airplane. To get the best service from this type fitting, it is necessary to exercise certain procedures at the time of installation. The specific precautions other than the general care in handling are as follows:

1. Insert the interconnect tube into the fitting until 3/8 inch or more of the tube extends through the fitting.
2. Locate the hose clamp on the fabric-reinforced area of the nipple; it should clear the

end of the fitting by 1/4 inch.

3. Torque hose clamps as indicated in Chart 1 in this chapter. This should be drawn up in one operation; if retightening is necessary, release the clamp completely and wait at least 15 minutes before retightening.
4. Use no sealing paste or gasket compounds.
5. A light film of petrolatum tech (VV-P-236) (42, Chart 1, 91-00-00) may be used as a lubricant under the clamps and nipples.

c. Connect the vent plumbing in the wing tip. Torque the clamps per Chart 1 in this chapter.

NOTE

Use all new gaskets.

d. Install the anti-siphon assembly. Torque the bolts to 45 to 55 in.-lbs. and lockwire.

e. Install the adapter assembly. Use Permatex No. 2 between the skin and adapter.

f. Install the fuel cap.

g. Install the two cover assemblies, the one with the fuel quantity transmitter is the inboard one. Torque to 45 to 55 in.-lbs. and lockwire.

h. Connect the electrical wire to the transmitter.

i. Install the three access covers.

INSPECTION OF FUEL CELL FLAPPER VALVE

On airplanes that are equipped with baffled fuel cells, the flapper valves (metal or phenolic) should be inspected periodically (Beech Aircraft recommends that the inspection be accomplished at each 100 hr. inspection) for freedom of operation and proper seating.

The inspection may be accomplished as follows:

a. Drain all fuel from the airplane.
b. Remove the rectangular access plate located just outboard of the fuselage on the upper skin of each wing leading edge.
c. Cut the safety wire and remove the attaching bolts from the fuel cell access plate.

NOTE

Clean the area around the access plate before removing the plate.

d. Remove the fuel cell access plate and open the zipper in the baffle.
e. Locate the flapper valve in the lower outboard section of the baffle and determine if the flapper valve is metal or phenolic.
f. *If the flapper valve is metal, it should be inspected* and repaired, if necessary, as follows:

1. Move the flapper element of the valve through its full travel. There should be no binding and the element should seat securely against the valve plate.
2. If the flapper element binds and/or does not seat properly, the flapper element arm could be bent. The arm can be straightened by placing a screwdriver between the arm and the element and pressing the element toward the closed position.
3. If after straightening the arm, the flapper element still binds and/or does not seat properly, the flapper element should be removed and replaced with a new flapper element assembly. The flapper element assembly may be replaced by removing the two attaching bolts from the upper part of the flapper valve. The same attaching parts should be used to install the new flapper element assembly. The new flapper element assembly should be inspected after installation to determine that the assembly did not receive damage during installation that could cause it to bind and/or not seat properly.

g. If the flapper valve is phenolic, it should be inspected and reworked, if necessary, as follows:

1. Move the flapper valve element through its full travel. There should be no binding and the element should seat securely against the valve plate.
2. If the flapper element binds and/or does not seat properly, the upper rear side of the flapper element may be binding against the valve plate.
3. The flapper valve element may be relieved from binding by filing a small radius on the upper rear side of the element.

NOTE

A shop towel saturated with light oil may be placed directly below the flapper valve to absorb the phenolic dust during rework.

4. After determining that the flapper valve is functioning properly, thoroughly wipe the area in the vicinity of the flapper valve with an oil saturated shop towel.

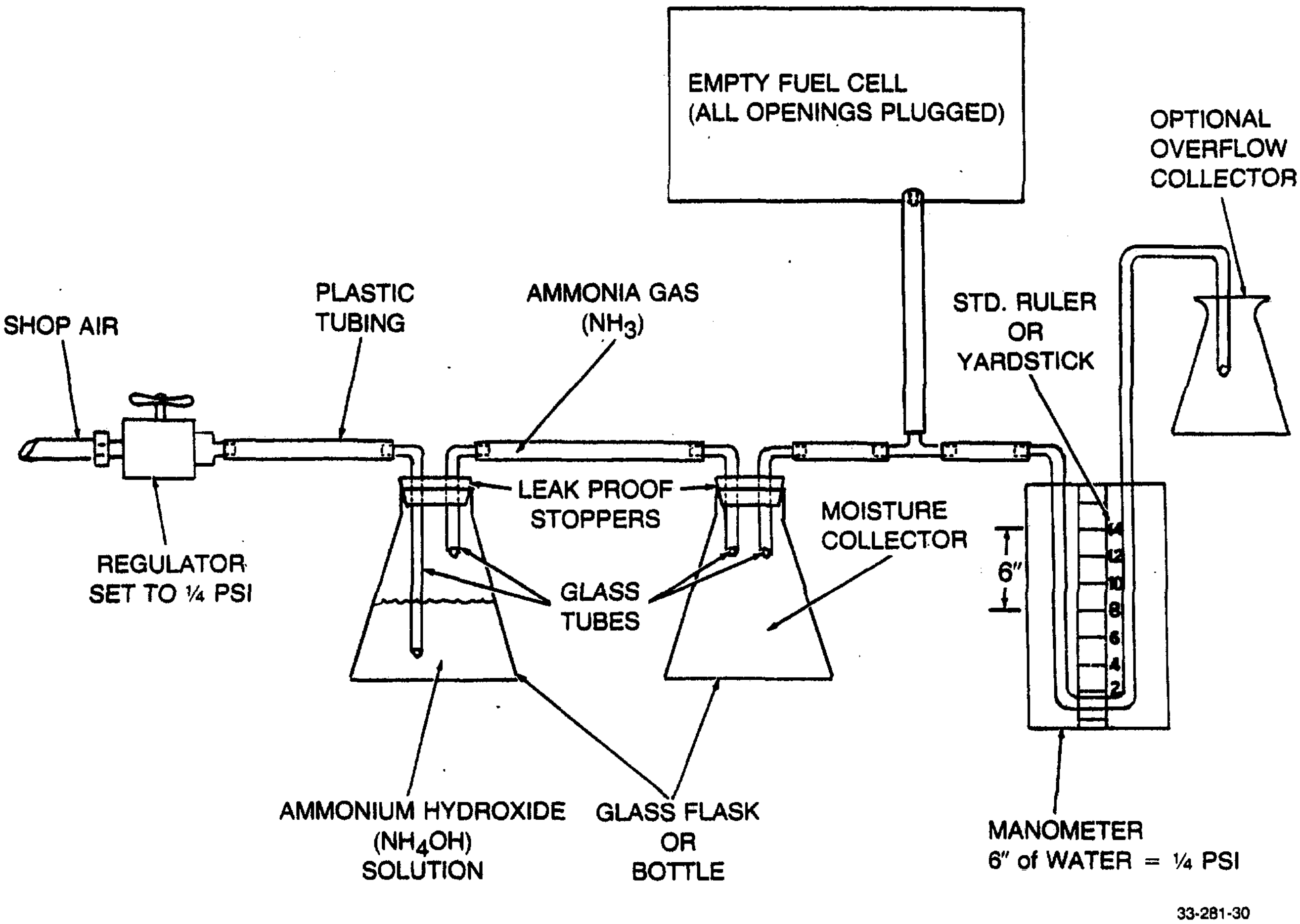
h. *Clean the gasket contact area on the fuel cell and* fuel cell access plate.
i. Close the zipper in the baffle.
j. Install a new gasket and secure the fuel cell access plate in place.
k. Tighten the fuel cell access plate attaching bolts to a torque of 45 to 50 inch-pounds and safety wire.
l. Reinstall the rectangular access plate on the wing *leading edge skin.*

FUEL CELL LEAKAGE TEST
(Figure 2)

Rubber bladder type fuel cells may be bench tested for leakage by sealing off all openings and inflating the empty cell to 1/4 psi with a mixture of shop air and ammonia gas, then checking for visible indications of leakage on a cloth saturated with phenolphthalein solution. To set up and conduct the leakage test, proceed as follows:

a. The following equipment is required and should be hooked up as indicated in the schematic in Figure 2.

1. Closure plates for the fuel cell openings. Such plates may be fabricated of aluminum sheet cut to a size sufficient to cover the cell openings. Drill holes in the closure plate to match the hole pattern around the opening in the fuel cell.
2. Rubber stoppers to plug the fitting openings in the fuel cell. One of the stoppers should have a hole for insertion of the plastic tubing used to connect the fuel cell into the test setup.
3. A manometer for measuring 6 inches of water differential. The manometer can be fabricated from



Setup for Leakage Test
Figure 2

glass or clear plastic tubing; frame and scale similar to the illustration shown.

4. A regulator that can be set to provide 1/4 psi (6 inches of water) from a supply of shop air.

5. Two flasks (or bottles) approximately one liter (or quart) in capacity. A third container may be hooked into the test setup to provide an optional overflow collector if desired. The two containers should be provided with rubber stoppers that have holes for the insertion of 1/4-inch tubes (glass or metal) as shown in the schematic in Figure 2.

6. Plastic tubing of a size to provide a leak-free fit over the tubes and of a length sufficient to interconnect the test components as shown in Figure 2.

7. Make up a solution of phenolphthalein as follows: Add 1/3 ounce phenolphthalein crystals to 1/2 gallon ethyl alcohol, mix, then add 1/2 gallon water.

8. Make up an ammonia solution by adding 100 cc (3 fluid ounces) of concentrated ammonium hydroxide (NH_4OH) per gallon of water.

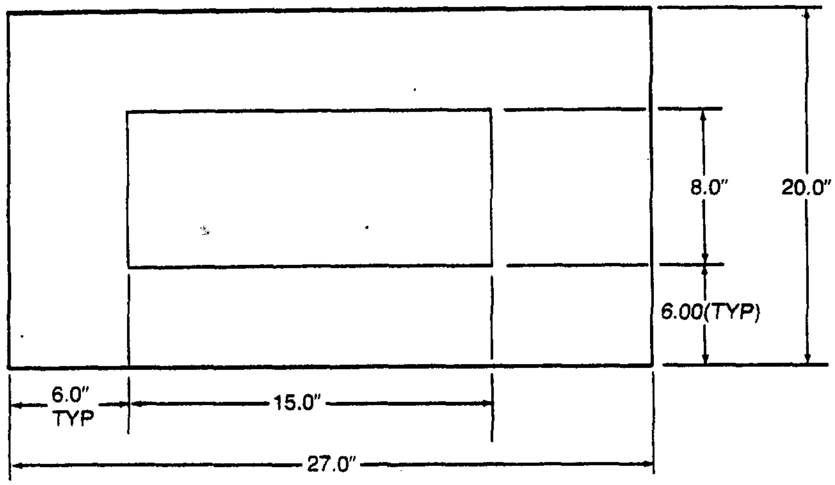
9. The Pressure Test Baffle Restrainer (Figure 3) is made of 3/4 inch thick plywood. Sand all edges to remove sharp corners and/or splinters that may damage the fuel cell.

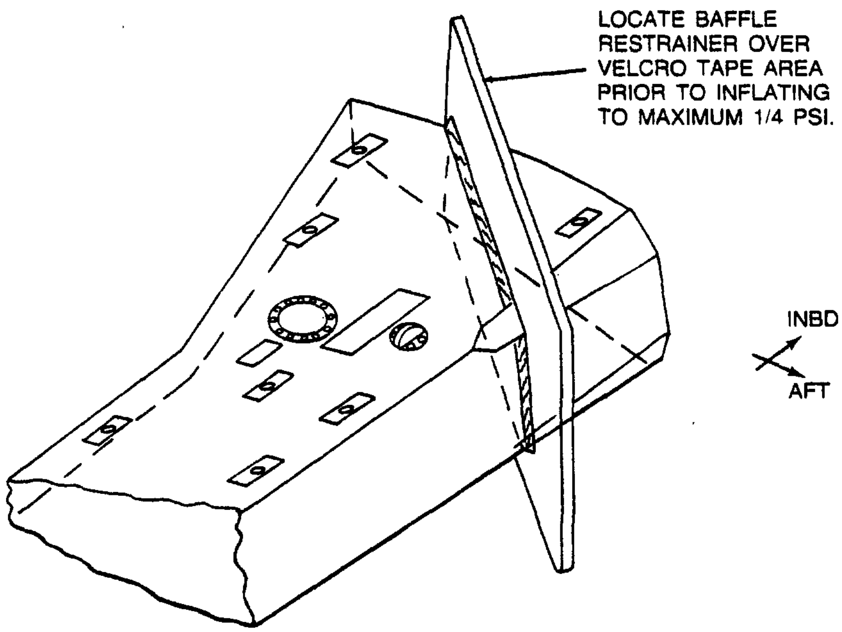
b. Place the fuel cell and test equipment on a clean work bench.

CAUTION

Make sure the work area is clean of metal shavings or other debris that could damage the fuel cell.

c. Install the closure plates over the fuel cell openings and torque the retaining screws as specified in this chapter of this manual for the openings, then insert the rubber stoppers into the open fittings.





Pressure Test Baffle Restrainer
Figure 3

36-281-34

d. The flask (or bottle) containing the ammonium hydroxide solution should be 1/3 to 1/2 full as shown in the illustration.

e. Connect a shop air supply to the regulator and interconnect the regulator, beakers, fuel cell, and manometer as indicated in Figure 2.

f. Place the baffle restrainer over the velcro tape area prior to inflation as indicated in Figure 3.

WARNING

Inflation of the fuel cell without the baffle restrainer can result in irrepairable damage to the baffle.

g. Inflate the fuel cell to 1/4 psi with a mixture of shop air and ammonium gas. A 6-inch difference in the two water levels of the manometer will indicate that the fuel cell is inflated to 1/4 psi. It is not necessary to restrain the cell other than to keep it from rolling off the bench. The filling of the cell will be rather slow at the 1/4 psi, but should not be rushed as overpressure of the cell could result.

h. Saturate a large, clean cloth with phenolphthalein. (Immerse it in a container and squeeze out excess liquid.)

CAUTION

Wear rubber gloves to protect against skin irritation when handling the cloth. As a further protection against possible penetration of the phenolphthalein solution through the gloves, wash your hands thoroughly after finishing the test.

i. Lay the cloth over the various portions of the fuel cell until the entire exterior of the cell has been covered. With each application of the cloth, watch for the formation of a reddish pink stain on the cloth to indicate the presence of a leak. Encircle the area on the fuel cell beneath such stains with a chalk mark to pinpoint the locations of leaks.

NOTE

Continued use of the testing cloth will require repeated saturations with phenolphthalein since rapid evaporation of the alcohol from the cloth progressively reduces the sensitivity of the test unless the solution in the cloth is frequently renewed.

NOTE

Refer to BEECHCRAFT Service Instruction No. 0632-280, Rev. I or subsequent and Goodyear Aerospace Corporation Fuel Tank Repair Manual AP368 for further information on inspection of fuel cells for leakage.

FUEL CELL PRESERVATION

GOODYEAR

Goodyear fuel cells (Construction No. BTC-39, BTC-54A and BTC-67) installed in the airplane do not require preservation when the cell is to be empty for an indefinite period of time. The fuel cell should not be open to the atmosphere except for the normal vent lines in the airplane. The cell is assumed wet from a previous filling.

UNIROYAL

Uniroyal fuel cells must be filled every 10 days or the walls coated with a thin coat of light engine oil if they are to be preserved for periods of up to one year. Uniroyal fuel cells that are to be stored for periods of one year or longer should be coated with a thin coat of light engine oil and then removed from the airplane as outlined under FUEL CELL REMOVAL in this chapter. After the fuel cell is removed from the airplane, it should be wrapped in plastic, placed in a box, and stored in a cool dry area.

NOTE

The fuel cell should not be removed or handled until 24 hours after the oil has been applied.

FUEL CELL REPAIR

GOODYEAR FUEL CELLS

For repairs of Goodyear fuel cells, refer to Goodyear Fuel Cell Repair Manual AP368, Vithane Fuel Cells.

UNIROYAL FUEL CELLS

For repairs of Uniroyal fuel cells, refer to Uniroyal Handbook "Recommended Handling and Storage Procedures for *Bladder Type and Oil Cells" P/N FC 1473-73.*

"END"

DISTRIBUTION- MAINTENANCE PRACTICES

CAUTION

Any time the fuel system plumbing is opened, air may enter the system. This condition may cause rough engine operation or loss of power. If the possibility that air has entered the system does exist, start and operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the Pilot's Operating Handbook and Airplane Flight Manual before starting and operating the engine.

AUXILIARY FUEL PUMP REMOVAL (CE-748, CE-772 AND AFTER, CJ-149 AND AFTER, D-10097, D-10120 AND AFTER)

a. Drain and purge the fuel system.

b. Remove the pilot and copilot seats as outlined in PILOT AND COPILOT SEAT REMOVAL (25-10-00).

c. Remove the royalite cover over the main spar.

d. Remove the fuel selector handle and unscrew the postlight covers from the royalite truss cover, then remove the truss cover.

e. Disconnect the fuel plumbing from the fuel selector valve.

f. Remove the bolts securing the fuel selector valve to the mounting bracket and remove the fuel selector valve.

g. Disconnect the fuel plumbing from the auxiliary fuel pump.

h. Remove the four bolts securing the auxiliary fuel pump to the mounting bracket and remove the auxiliary fuel pump.

AUXILIARY FUEL PUMP INSTALLATION (CE-748, CE-772 AND AFTER, CJ-149 AND AFTER, D-10097, D-10120 AND AFTER)

a. Secure the auxiliary fuel pump and mounting bracket to the airplane with the attach bolts.

b. Reconnect the fuel plumbing to the auxiliary fuel pump.

c. Secure the fuel selector valve to the mounting bracket with the four attach bolts.

d. Reconnect the fuel plumbing to the fuel selector valve.

e. Replace the royalite truss cover.

f. Replace the fuel selector handle and the post light covers.

g. Replace the royalite cover over the main spar.

h. Reinstall the pilot and copilot seats as outlined in PILOT AND COPILOT SEAT INSTALLATION (25-10-00).

AUXILIARY FUEL PUMP REMOVAL (E-1111, E-1241 AND AFTER, EA-1 AND AFTER)

a. Drain and purge the fuel system.

b. Remove the pilot and copilot seats as outlined in PILOT AND COPILOT SEAT REMOVAL (25-10-00).

c. Remove the royalite cover over the main spar.

d. Disconnect the fuel plumbing from the auxiliary fuel pump.

e. Remove the four bolts securing the auxiliary fuel pump to the mounting bracket and remove the auxiliary fuel pump. The pump is located in front of the spar carry-through on the pilot's side.

AUXILIARY FUEL PUMP INSTALLATION (E-1111, E-1241 AND AFTER, EA-1 AND AFTER)

a. Secure the auxiliary fuel pump and bracket to the airplane with the four attach bolts.

b. Reconnect the fuel plumbing to the auxiliary fuel pump.

c. Replace the royalite cover over the main spar.

d. Install the pilot and copilot seats as outlined in PILOT AND COPILOT SEAT INSTALLATION (25-10-00).

FUEL SELECTOR VALVE REMOVAL

a. Drain and purge the fuel system.

b. Remove the pilot and copilot seats as outlined in PILOT AND COPILOT SEAT REMOVAL (25-10-00).

c. Remove the royalite cover over the main spar.

d. Remove the fuel selector handle and unscrew the post light covers from the royalite truss cover, then remove the truss cover.

e. Disconnect the fuel plumbing from the selector valve.

f. Remove the bolts securing the selector valve to the mounting bracket and remove the selector valve.

FUEL SELECTOR VALVE INSTALLATION

a. Lubricate the fuel line threads with VV-P-236 petrolatum (42, Chart 1, 91-00-00) before installation.

b. Secure the selector valve to the mounting bracket with the attach bolts.

c. Connect the fuel plumbing to the fuel selector valve.

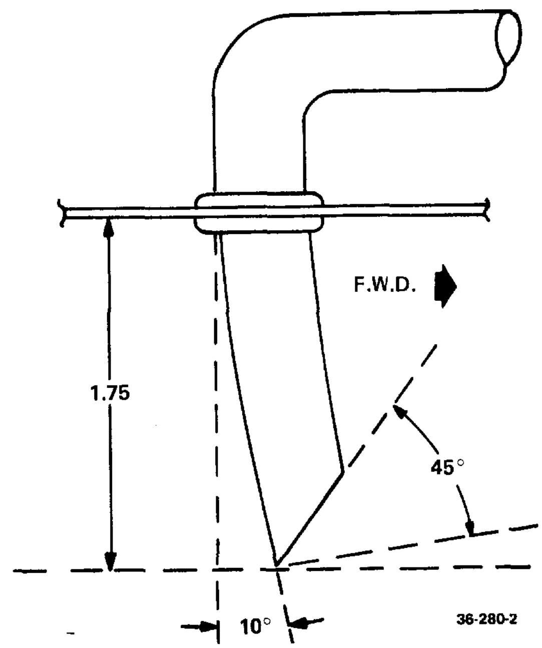
d. Replace the royalite truss cover around the fuel selector valve.

e. Replace the handle on the fuel selector valve and screw the post light covers back on the royalite truss cover.

f. Replace the royalite cover over the main spar.

g. Install the seats as outlined in PILOT AND COPILOT SEAT INSTALLATION (25-10-00).

h. Test the fuel selector valve to ensure that it functions properly in all positions and that the detents correspond to the placard markings.



Fuel Vent
Figure 1

FUEL STRAINER REMOVAL (SELECTOR VALVE) (Figure 2)

Access to the fuel selector valve fuel strainer may be made by opening the access door located under the airplane below the front edge of the pilot's side window.

a. Remove the safety wire around the two screws mounted on the bottom of the fuel selector valve, then remove the screws.

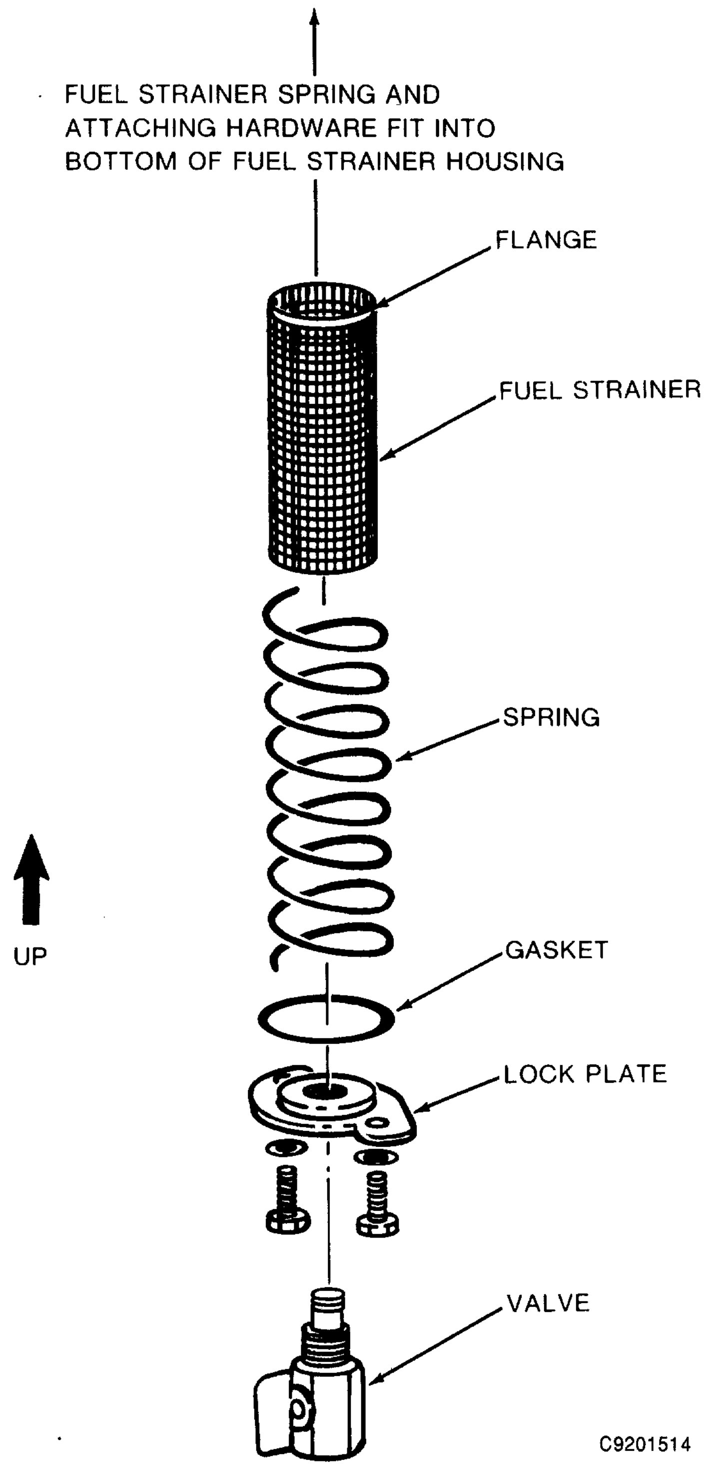
b. Remove the bottom of the selector valve and pull the fuel strainer screen from the fuel selector valve.

FUEL STRAINER INSTALLATION (SELECTOR VALVE) (Figure 2)

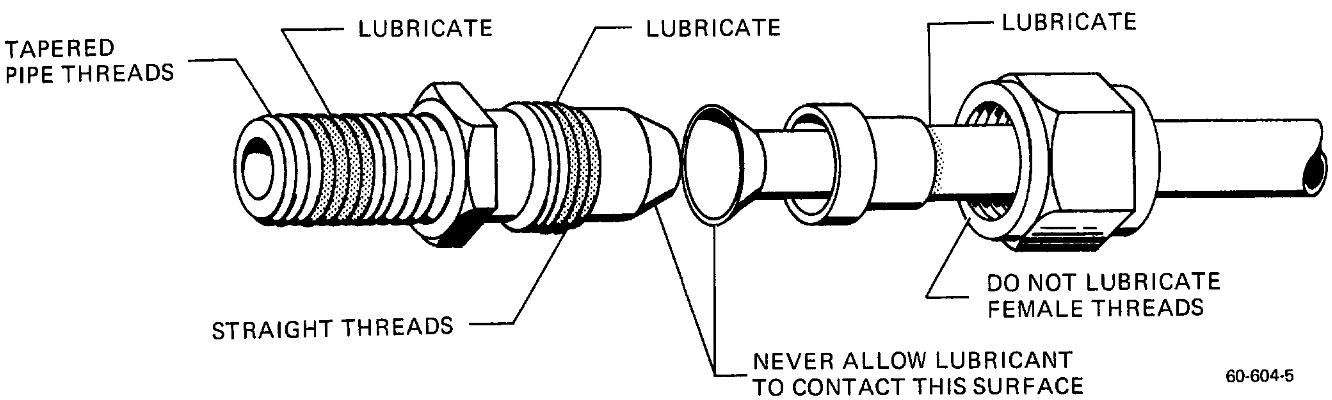
a. Install the screen in the bottom of the selector valve with the flange up.

b. Replace the bottom of the fuel selector valve and secure with the two attach screws.

c. Safety wire the screws.



Fuel Strainer
Figure 2



Lubrication of Flared Fittings
Figure 3

FUEL STRAINER REMOVAL (WING FUEL CELLS)

a. Drain and purge the fuel system.

b. Remove the finger strainer access cover located between the lower portion of the wing and fuselage.

c. Disconnect the fuel line from the connector assembly.

d. Loosen the fuel cell nipple clamp; disconnect the finger strainer and slide the fuel finger strainer from the fuel cell.

FUEL STRAINER INSTALLATION (WING FUEL CELLS)

a. Install the connector assembly in the fuel cell and tighten the nipple clamp.

b. Connect the fuel line to the connector assembly.

c. Install the access cover on the airplane.

INSPECTION OF FUEL CELL VENT LINES AND FUEL FILLER CAPS (Figure 1)

The following procedure is recommended for inspection of fuel tank vent lines and filler caps:

a. Remove the access plate for each wing fuel cell from the lower wing surface.

b. Disconnect the fuel cell vent line from the fuel cell.

c. Apply air pressure to the fuel cell end of the vent line.

d. Alternately plug each vent opening to assure that air is passing through all branches of the vent system for the cell. Continue to blow air through each branch until any obstructions have been removed.

e. Remove the siphon break check valve and blow air through the siphon break line from the check valve end, then reinstall the valve.

f. Reconnect the fuel cell vent line to the fuel cell.

g. Reinstall the access plate below each fuel cell.

h. Visually check each fuel cell filler cap for looseness or deterioration of the seal which could cause leakage. If seals are deteriorated or damaged in any way, they should be replaced.

i. Check the extended vent to ascertain that the vent extends a minimum of 1.75 inches below the lower wing skin surface. The vent tube should be scarfed at a 45° angle on the forward side and should be canted forward 10° from perpendicular to the skin.

NOTE

Any configuration of the vent other than as noted in step "i" may create a negative vent pressure. A negative vent pressure will pull the air, or air and fuel from the fuel tank.

FLARED FITTINGS
(Figure 3)

When installing flared fittings and hoses, make sure the threads are lubricated properly (see Figure 2) with VV-P-236 petrolatum (42, Chart 1, 91-00-00). When previously installed fittings are removed, they should be wiped clean and relubricated before they are reinstalled. Torque all fittings in accordance with the FLARE FITTING TORQUE CHART (Chart 2, 91-00-00).

"END"

INDICATING - MAINTENANCE PRACTICES

CAUTION

Any time the fuel system is drained air may enter the system. If the possibility that air has entered the system does exist, start and operate the engine on the ground until all air is removed from the system. Operate the engine for several minutes on each tank until proper engine operation is assured. Refer to the Pilot's Operating Handbook and Airplane Flight Manual before starting and operating the engine.

FUEL QUANTITY SENSORS - (80 GALLON SYSTEM)

Fuel quantity is measured by float type sensor units located in each wing tank system. Electrical signals are transmitted from the sensors to the individual indicators, which indicate fuel remaining in the tank. Resistance between the stud and case of each fuel sensor must be 0 to 0.5 ohms in the empty position and 43 ±2 ohms in the full position for the outboard fuel sensor and 0 to 0.5 ohms in the empty position and 76 ±2 ohms in the full position for the inboard fuel sensor.

FUEL QUANTITY SENSORS - (108 GALLON SYSTEM)

Fuel quantity is measured by float type sensor units located in each wing tank system. Electrical signals are transmitted from the sensors to the individual indicators, which indicate fuel remaining in the tank. Resistance between the stud and case of each fuel sensor must be 0 to 0.5 ohms in the empty position and 43 ±2 ohms in the full position for the outboard fuel sensor and 0 to 0.5 ohms in the empty position and 76 ±2 ohms in the full position for the inboard fuel sensor of the 40 gallon fuel cell. The resistance between the stud and case of the fuel sensor in the 14 gallon fuel cell is 0 to 5 ohms in the empty position and 19 ±2 ohms in the full position. The total resistance will be 3 ±3 ohms empty and 140 ±6 ohms full.

FUEL QUANTITY INDICATORS (80 GALLON SYSTEM)

Position the airplane in a level flight attitude with the tanks filled as indicated in Chart 1. Measure the input voltage at the indicator terminals. Each reading should be within ±2 millivolts of the value shown in Chart 1, except that the empty reading should be within ±1 millivolt of the chart value.

CHART 1

Fuel Quantity	E	1/4	1/2	3/4	F
Millivolts	6	36	60	86	103

FUEL QUANTITY SENSOR REMOVAL

a. Turn off electrical power.

b. Drain and purge the fuel system.

c. Remove the access panel at the sensor which is to be removed.

d. Disconnect sensor wiring.

e. Cut safety wire and remove the transmitter support screws.

NOTE

Clean the area around the sensor before removing the sensor.

f. Remove the sensor and gasket from the fuel cell.

FUEL QUANTITY SENSOR INSTALLATION

a. Inspect the fuel cell for wrinkles or other obstructions that might impede sensor float travel.

b. Set the new gasket and sensor in position and ensure that the float is unrestricted through its full travel from stop to stop. The float arm may be bent, if necessary, to provide clearance.

c. Install the sensor support screws, torque to 25 inch-pounds, and safety.

d. Connect sensor wiring. Turn the power on and check fuel gage for empty reading.

NOTE

If the gage does not read empty, reinspect the sensors to ensure the float arm is on the down stop and the float clears the bottom of the fuel cell. Check all wiring for faulty connections.

e. Fill the tanks and check the fuel gages for full readings.

NOTE

See Service Instructions No. 0925, Rev. I or subsequent for more information on replacement of fuel quantity sensors.

FUEL QUANTITY INDICATOR CALIBRATION

a. Remove the glareshield over the instrument panel.

b. Locate the two printed circuit boards located on the back of the instrument panel just to the left of center.

c. Locate the calibration screw in the back of each printed circuit board.

d. Calibrate the fuel quantity indicator as follows:

1. Ensure that the fuel tank that corresponds to the fuel quantity being calibrated is full.

2. Turn the calibration screw in back of the corresponding printed circuit board until the needle on the fuel quantity indicator points to the "F" (full) mark.

e. Reinstall the glareshield.

"END"

CHAPTER

30

ICE AND RAIN PROTECTION

CHAPTER 30 - ICE & RAIN PROTECTION

TABLE OF CONTENTS

"END"

CHAPTER 30

LIST OF PAGE EFFECTIVITY

"END"

GENERAL - DESCRIPTION AND OPERATION

The airplane is equipped with a variety of ice and rain protection systems that can be utilized during operation under inclement weather conditions. Air from the cabin heating system prevents the windshield from fogging. The propellers are protected against icing by optional electrothermal boots on each blade that, when activated, automatically cycle to aid in dispersing the formation of ice. The pitot mast contains a heating element connected to the airplane electrical system for protecting the pitot opening from becoming clogged with ice.

An optional weather radar system is available for the Bonanza series airplanes starting at serials CD-878 and after, D-10264 and after, E-1534, E-1537 and after, and EA-11 and after. The indicator is located in the radio section of the instrument panel and the antenna is located in the outboard leading edge of the right wing. (See 34-40-00.)

"END"

PROPELLERS - DESCRIPTION AND OPERATION

ELECTRIC PROPELLER DEICING

The electric propeller deicer system includes an on-off switch (on the LH instrument subpanel), an ammeter, a timer, a brush assembly, slip rings, and an electrically heated boot for each propeller blade. When the on-off switch is turned ON, the ammeter (near the center of the instrument panel) registers the amount of current (2-bladed, 8-12 amps; 3-bladed, 14-18 amps) passing through the system. If the current rises beyond the switch limit, an integral circuit breaker will cut off the power to the timer. The current flows from the timer (forward of instrument panel) to the brush assembly (mounted in front of the engine case) and is conducted by the brush assembly to the slip rings installed on the spinner backing plate. At serials D-10404 and after, CE-1024 and after, E-2069 and after, and EA-378 and after, the slip rings became part of an assembly attached between the engine hub and the propeller. The slip rings distribute current to the deicer boots on the propeller blades. Heat from the boots reduces the grip of the ice, which is then removed by the centrifugal effect of propeller rotation and by the blast of the airstream. The timer cycles power to the heating element on each blade. It takes 3 minutes for the timer to complete a cycle of 90 seconds on, 90 seconds off. Whenever the system is turned on, the ammeter in the instrument panel or subpanel and registers the proper amerage, or zero amperage, depending on the phase the timer is in.

PROPELLER - TROUBLESHOOTING DEICER SYSTEM

The ammeter of the deicer system can be used to indicate the general nature of most electrical problems. Consequently, it is recommended that, to determine which circuits are involved, troubleshooting be preceded by the ammeter test outlined in step "a." of the 50-hour inspection (Chapter 5), and the HEAT TEST described in this chapter. A reading of two-thirds the normal amount of current (or one-half on two-bladed props) is an indication that one of the circuits is open between the slip ring assembly and deicer heater. If the ammeter registers excess current, the power lead is shorted to ground. It is possible that the excess current has welded the timer contacts in one phase. Under these circumstances, the timer will either feed current to the welded contacts continuously, or not cycle. If the former is true, the heat test will show heating throughout the two phases. Unless the grounded power lead is located and corrected, any new timer that is installed may suffer the same internal damage during the first use of the system. In general, for most effective use of the troubleshooting chart, all of the "indication" entries should be read to locate that which matches conditions of the particular system being checked. The numbered "probable cause" and "remarks" then indicate the proper sequence of checks. It should be noted, however, that such numbers are assigned with respect to the approximate usefulness of the check rather than to the most likely sequence of occurance.

TROUBLESHOOTING PROPELLER DEICER SYSTEM

INDICATION	*PROBABLE CAUSE*	*REMARKS*
1. Ammeter shows zero current. (Both phases of the 3 minute cycle.)	a. Switch circuit breaker tripped.	a. Locate and correct short before resetting circuit breaker by turning switch OFF, then ON.
	b. Switch faulty.	b. If no voltage at switch output with voltage at switch input, replace the switch. If voltage is OK at switch output, go to step d.
	c. No power from airplane.	c. If no voltage into switch, locate and correct open circuit.
	d. Ammeter faulty. (If some or all Deicers heat with ammeter at zero, replace ammeter.)	d. Test for voltage up to and out of ammeter. If low or zero output but proper input, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
	e. Open circuit between ammeter and timer.	e. Disconnect harness at timer and check voltage pin B (of harness) to ground. If none, locate and correct open circuit.
	f. Open in wiring between timer and firewall connector.	f. Refer to the paragraph on heat test to find Deicers not heating and test for voltage on that pin of firewall connector. If zero over 3 minutes, locate and fix open in wiring from timer to firewall.
	g. Open between firewall and Deicer lead straps.	g. If voltage OK to firewall plug, try voltage at junction of Deicer lead and slip ring lead. If no voltage, find and correct open in wiring to brush block, open within brush block, or no contact brush to slip ring.
	h. No ground circuit.	h. If voltage at Deicer leads, locate and fix open from Deicer to ground.
2. Ammeter shows normal current part of cycle, low current rest of cycle.	a. Open in Deicer or slip ring assembly.	a. Disconnect Deicer straps to check heater resistance. If resistance is within specified limits, locate and fix open in slip ring leads. If not, replace Deicer with open circuit.
	b. High resistance in circuit with low current.	b. If not in contact of brush to slip ring (including ground brush), trace wiring to Deicer and to timer to fix partially broken wire, loose or corroded connection.

TROUBLESHOOTING PROPELLER DEICER SYSTEM (Continued)

INDICATION	*PROBABLE CAUSE*	*REMARKS*
3. Ammeter shows low current.	a. Airplane voltage low.	a. Check bus voltage.
	b. Ammeter faulty.	b. Refer to step "1-d."
	c. High resistance up to timer.	c. Check for partially broken wire, loose or corroded connection in wiring from airplane supply to timer input.
4. Ammeter shows excess current.	a. Ammeter faulty.	a. Refer to step "1-d."
	b. Ground between ammeter and timer.	b. Disconnect harness at timer and, with ohmmeter, check from pin B (of harness) to ground. If ground is indicated, locate and correct.
	c. Ground between brush block and timer.	c. Disconnect leads at brush block and check from power leads to ground with ohmmeter. If ground is indicated, locate and correct.
	d. Ground between brush block and Deicers. (Excluding ground brush circuit.)	d. If no short exists at brush-slip ring contact, check for ground from slip ring lead to prop while flexing slip ring and Deicer leads. If a ground is indicated, locate and correct.
	e. Timer faulty.	e. Test timer as indicated in paragraph on timer check.
5. Ammeter does not "flick" each 90 seconds.	a. Timer ground open.	a. Disconnect harness at timer and check with ohmmeter from pin G (of harness) to ground. If no circuit, refer to Bonanza Wiring Diagram Manual P/N 35-590012-9.
	b. Timer contacts are welded (caused by short circuit in system.)	b. Test timer as in paragraph on timer check. If timer does not cycle with voltage at pin B, replace timer but be sure short causing original failure has been located and corrected.
6. Ammeter flicks between 90 second phase periods.	a. Loose connection between airplane power supply and timer input.	a. If trouble occurs over entire cycle, trace wiring from power source to timer input to locate and tighten loose connection.
	b. Loose or poor connection timer to Deicers.	b. Check for rough or dirty slip rings causing brush to "skip." If not this, trace circuits to locate and fix loose or poor connection.
	c. Timer cycles erratically.	c. Test timer as indicated in paragraph on timer check.
	d. Electrical wiring breakdown.	d. Replace the faulty deicer boot.

TROUBLESHOOTING PROPELLER DEICER SYSTEM (Continued)

INDICATION	*PROBABLE CAUSE*	*REMARKS*
7. Radio noise or interference with Deicers on.	a. Brushes "arcing."	a. Check brush alignment as in step "h" of 100-hour inspection (Chapter 5). Look for rough or dirty slip rings. If this is the cause, clean, machine or replace slip ring assembly. Check for slip ring alignment.
	b. Loose connection.	b. Refer to step "g". of 100-hour inspection (Chapter 5).
	c. Switch faulty.	c. Try jumper wire across switch. If radio noise disappears, replace the switch.
	d. Wiring located within less than 8 inches of radio equipment wiring.	d. Replace at least 8 inches from input wiring to radio equipment.
8. Rapid brush wear or frequent breakage.	a. Brush block out of alignment.	a. Check brush alignment as in step "h." of 100-hour inspection (Chapter 5).
	b. Slip ring wobbles.	b. Check slip ring alignment with dial indicator.
	c. Rough slip ring surfaces.	c. Replace or machine.
	d. Dirty slip rings.	d. Clean the slip rings.
	e. Brushes arcing.	e. See "8a".

PROPELLERS - MAINTENANCE PRACTICES

PROPELLER DEICER BOOT REMOVAL

a. Remove the propeller spinner.

b. Disconnect the deicer boot leads from the spinner bulkhead and slip ring.

c. Remove the clip securing the lead strap to the spinner bulkhead and the clamp securing it to the propeller hub.

CAUTION

Place the blade so the solvent will run away from the hub. The solvent may damage the propeller seals.

NOTE

If the lead strap is retained by a strap rather than by a clamp, remove the boot lead strap retaining strap as follows:
1. Using methyl ethyl ketone of toluol (31 or 19, Chart 1, 91-00-00) to soften the adhesive of the strap, loosen one corner of the strap sufficiently to grasp it with pliers or similar tool.
2. Apply a slow steady pull to the strap while using the solvent to soften the adhesive.

d. If applicable remove the boot lead strap retaining strap. Using methyl ethyl ketone or toluol (31 or 19, Chart 1, 91-00-00) to soften the adhesive of the strap, loosen one corner of the strap sufficiently to grasp it with pliers or similar tool.

CAUTION

Unless the boot being removed is to be scrapped, cushion the jaws of any pulling tool to prevent damaging the boot surface.

e. Apply a slow, steady pull to the strap while using the solvent to soften the adhesive.

f. Using methyl ethyl ketone or toluol (31 or 19, Chart 1, 91-00-00) to soften the adhesion line between the boot and the blade, loosen one corner of the boot sufficiently to grasp it with vise grip pliers or a similar tool.

g. Apply a slow, steady pull on the boot to pull it off the propeller surface while continuing to use the solvent to soften the adhesive.

h. Remove the remaining adhesive from the boot and propeller blade with toluol or methyl ethyl ketone (19 or 31, Chart 1, 91-00-00).

PROPELLER DEICER BOOT INSTALLATION

NOTE

If a new propeller is installed, the drying time of the 1300L adhesive (52, Chart 1, 91-00-00) must be extended per B. F. Goodrich Service Bulletin No. E-75-51.

a. On B.F. Goodrich installations position the deicer boot on the propeller blade so that its center line at the inboard end is adjacent to the split in the propeller blade clamp and 1 inch outboard of the clamp, and the center line at the outboard end falls on the blade leading edge. Be sure the lead strap is in the proper position to be clamped to the blade retaining clamp.

NOTE

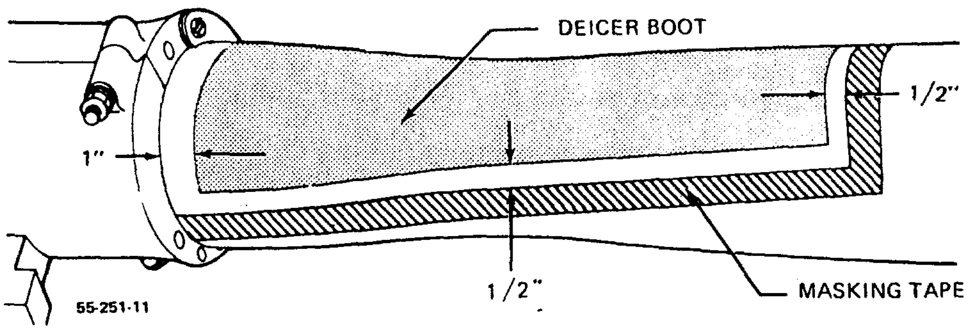
On McCauley installations place the center line of the deicer boot on the leading edge of the propeller. For other McCauley installation dimensions refer to Figure 1A.

b. Mask off an area approximately 1/2 inch from the outer end and each side of the boot. (See Figure 1).

NOTE

On installations using rubber lead straps mask off an area approximately 1/2 inch from the area which will be occupied by the lead strap retainer strap (around the blade shank).

c. Remove the deicer boot and clean the blade in the masked area from the retaining clamp outboard. Clean the area thoroughly with methyl ethyl ketone or toluol, (31 or 19, Chart 1, 91-00-00). For final cleaning, wipe the solvent off quickly with a clean, dry, lint-free cloth to avoid leaving a film.



Deicer Boot Installation
Figure 1

CAUTION

If the blade is painted with laquer remove all paint within the masked off area. If the blade is painted with polyurethane, lightly sand within the masked off area, using 400 grit sand paper.

CAUTION

The metal and rubber parts must be thoroughly clean to assure maximum adhesion.

d. Moisten a clean cloth with methyl ethyl ketone or toluol (31 or 19, Chart 1, 91-00-00) and clean the unglazed surface of the deicer boot and both sides of the rubber retainer strap if applicable, changing the cloth frequently to avoid contamination of the clean area.

e. Thoroughly mix EC-1403 cement (EC 1300L cement may also be used) and apply one even brush coat to the propeller blade and to the unglazed back side of the boot. Allow the cement to dry for at least one hour at 40°F or above when the relative humidity is less than 75%, or two hours if the humidity is between 75% and 90%. Do not apply the cement if the relative humidity is higher than 90% or the temperature is below 50°F.

f. After allowing sufficient drying time, apply a second brush coat of cement to the propeller and to the unglazed surface of the deicer boot. Apply cement to the lead strap as necessary to cement the strap to the propeller, up to the hub. Allow the cement to dry.

NOTE

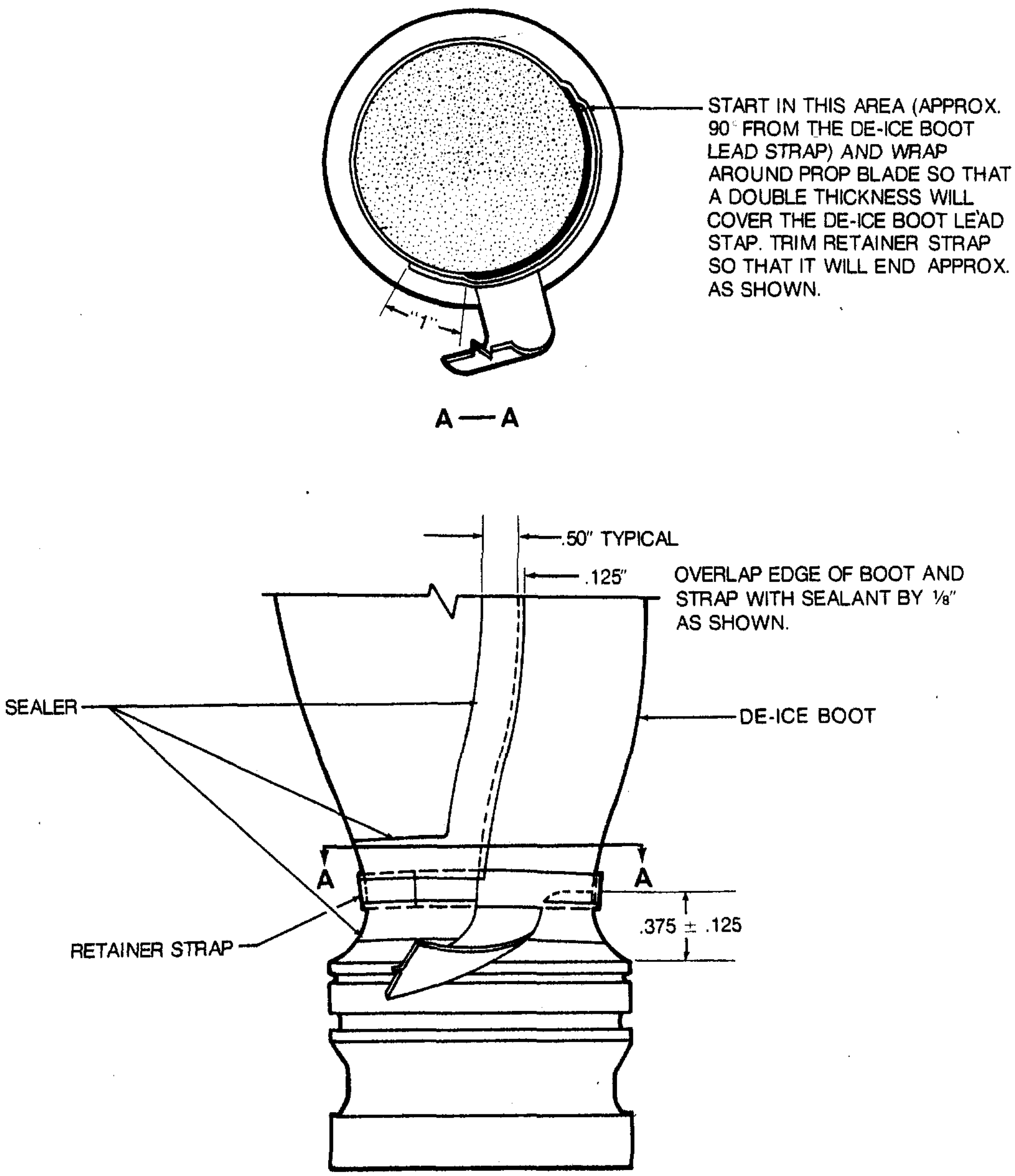
When solvent is used to soften cement, methyl ethyl ketone (MEK) provides approximately 10 seconds time for de-icer application, while Toluol will provide approximately 40 seconds working time.

g. Position the deicer boot on the propeller, starting 1 inch from the blade retaining clamp, making sure the lead strap is in position to clamp to the blade retaining clamp. Moisten the cement lightly with methyl ethyl ketone or toluol (31 or 19, Chart 1, 91-00-00) and tack the boot center line to the blade leading edge. If the center line of the boot deviates from the blade leading edge, pull up with a quick motion and replace properly. Roll firmly along the center line with a rubber roller (see Figure 2).

CAUTION

Never use a metal or wooden roller for this purpose, for they would damage the heating elements in the deicer boot.

h. Gradually tilting the roller, work the boot carefully over each side of the blade contour. Avoid trapping air pockets under the boot (see Figure 3).



Boot Deicer Installation (McCauley)
Figure 1A

i. Roll outwardly from the center line to the edges of the boot (see Figure 4). If excess material at the edges tends to form puckers, work them out smoothly and carefully with the fingers.

j. Roll the tapered edges of the boot with a narrow steel stitcher roller.

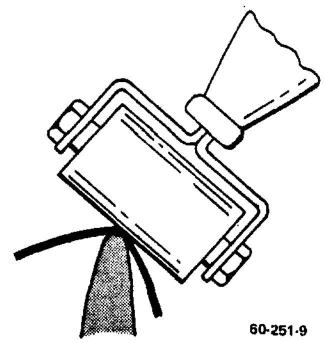
k. Clean the blade with a clean cloth moistened with toluol or methyl ethyl ketone (19 or 31, Chart 1, 91-00-00). Be careful not to let solvent run into the edge of the boot.

l. Apply one even brush coat of sealer around the edges of the boot, allowing 1/16 to 1/8 inch overlap on the boot but extending to the masking tape. Use BFG 82-076-1 and -2 on B.F. Goodrich installations and Sunbrite 78-U-1003 enamel and U-1001-C catalyst on McCauley installations. Remove the masking tape after applying the cement to obtain a neat border.

m. Install the clamp securing the lead strap to the propeller blade retaining clamps.

NOTE

The rubber retainer strap should wrap around the blade shank over the inboard 1/4 inch of the deice boot on B.F. Goodrich or 1/2 inch on McCauley installations.

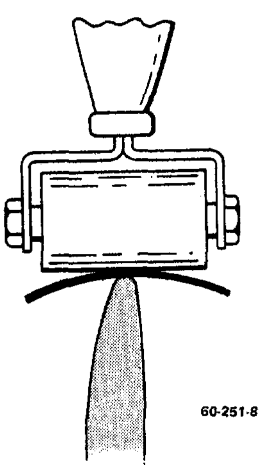


Side Rolling
Figure 3

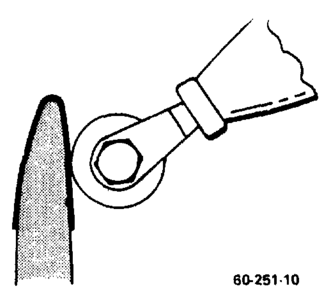
n. Connect the lead terminals and install the clip on the spinner bulkhead. There must be no slack between the terminal and the clip to assure enough slack between the clip and the clamp on the blade to allow full propeller travel.

CAUTION

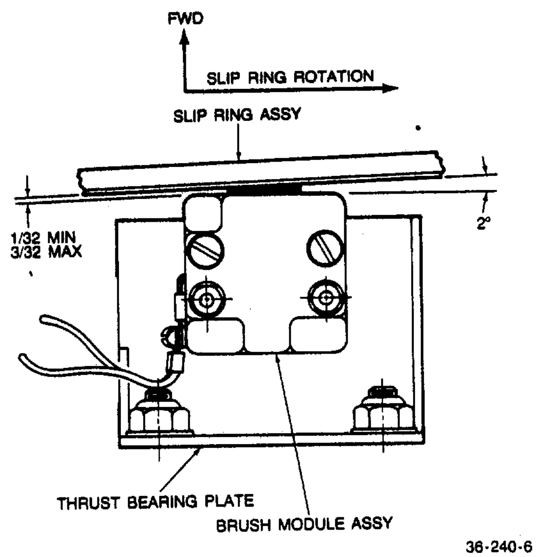
After deicer boot installation allow at least 12 hours for the 1300L or EC-1403 cement to dry before starting the engine, and 12 hours more *before energizing the deicers.*



Center Rolling
Figure 2



Edge Rolling
Figure 4



Propeller Deicer Brush Module (B. F. Goodrich)
Figure 5

BRUSH MODULE REPLACEMENT (B.F. Goodrich)

The modular brush assembly is made up of two modules, each consisting of a plastic housing with an integral brush and spring. These modular units are stacked with a spacer held together by screws to produce the modular brush assembly.

When a brush wears to where only 3/8 inch of brush material remains, the module containing the brush should be replaced. When 1/4 inch of brush remains, the brush module MUST be replaced.

NOTE

> During measurement only 1/16 inch of brush should protrude from the brush module, this being the normal protrusion when the brush is installed on the airplane.

Brush wear is determined by inserting a pin into a hole in the back of the brush module. On all modules having brushes with rods, the brush module should be replaced when the pin can be inserted 15/64 inch and MUST be replaced when the pin can be inserted 19/64 inch. On the rodless brushes, the module should be replaced when the pin can be inserted 1-5/64 inches and MUST be replaced when the pin can be inserted 1 9/64 inches. To replace the brushes, proceed as follows:

a. Disconnect the wire harness terminals at the terminal screws of the modular units that make up the brush block assembly.

b. Remove the screws, nuts, and washers securing the modular brush assembly to it's mounting bracket.

c. Remove the assembly retaining screws and separate the modules and spacer.

d. Replace each module with another of the same part number. The part number is etched into the surface of the plastic housing.

e. Restack the modules and spacers as necessary. If there is interference between adjacent ring terminals, reposition one module with the terminal on the opposite side of the brush module assembly.

f. Install the assembly screws so that the screwhead fits in the recess in the spacer, place the flat washer between the star washer and modular housing and install the retaining nut. Make sure the assembly is square before tightening the assembly screws in place.

g. Place the modular brush assembly on the mounting bracket and insert the mounting screws through both the block and bracket. One washer fits under the head of the screw and one under the retaining nut.

h. Before installing the retainer nuts, make sure that the brushes are aligned with the slip rings such that the entire brush face contacts the copper ring. If the brushes do not align with the slip rings throughout the entire 360 degrees of slip ring rotation, install shims (P/N 1E1157) between the brush module spacer and the mounting bracket until the brushes are properly aligned with the approximate center of the slip ring.

i. Install the retaining washers and nuts, making certain that 1/16 ± 1/32 inch is maintained between the brush modules and the slip ring surface. To prevent damage to the brushes, the modular brush assembly should be angled so that the brushes contact the slip rings at an angle of approximately two degrees from perpendicular, as measured toward the direction of slip ring rotation as shown in Figure 5.

j. Reconnect the "B", and "C" terminals of the airplane system wire harness to the same designated terminals of the modular brush assembly. Ensure that the adjacent ring terminals are not touching.

DEICER TIMER CHECK

Experience in the field has indicated that often the timer is considered defective when the source of the trouble lies elsewhere. For this reason, the following test should be performed before the timer is removed as defective:

a. With the wiring harness disconnected at the timer, and the deicer switch in the ON position, check the voltage from pin B of the harness plug to ground. If no voltage is present, the timer is NOT at fault; however, if system voltage is present at pin B, check the circuit from harness plug pin G to ground with an ohmmeter. If no circuit is indicated, the fault is in the ground lead rather than in the timer. If ground connection is open, the timer step switch will not change position.

b. After the ground and power circuits have been checked, connect a jumper wire from pin B of the timer receptacle to terminal B of the connector plug and from pin G of the timer receptacle to ground. With the deicing system switch ON, check the voltage to ground from pin B of the timer. The voltmeter should indicate bus voltage. Next, check the DC voltage to ground from pin C or pin D on serials D-10404 and after, CE-1024 and after, E-2069 and after, and EA-378 and after; it should indicate bus voltage for 90 seconds, zero volts for 90 seconds, bus voltage 90 seconds, etc.

HEAT TEST

Before this test can be performed, the jumper wire installed for the timer test must be removed so that the connector plug can be replaced in the timer receptacle. Two men are required to perform this test: one in the cockpit to monitor the ammeter; the other outside by the prop to check the deicer boots. The man in the cockpit turns the deicer system ON while the man outside feels the deicer boots to see if they are heating properly. The man in the cabin observes the ammeter for the proper readings (2-bladed: 8-12 amps, 3-bladed: 14-80 amps) throughout the timing sequence. The ammeter needle should deflect every 90 seconds in response to the switching action of the timer. Each time this occurs, the man in the cockpit must notify the man inspecting the propeller deicer boots so that the latter can check the proper heating sequence of the propeller deicer boots (the entire boot will either heat or cool, depending on the timer sequence). If any irregularities are detected, a continuity check should be performed on the wiring from the timer to the brush module holder and the propeller deicer terminal connections.

CAUTION

While following the instructions of the "HEAT TEST" section, move the propeller back and forth to prevent arcing between the brushes and slip ring.

WARNING

Before moving the propeller, make certain that the ignition switch is off and that the engine has cooled completely. There is always some danger of a cylinder firing when the propeller is moved.

BRUSH MODULE RESISTANCE CHECK (B.F. Goodrich)

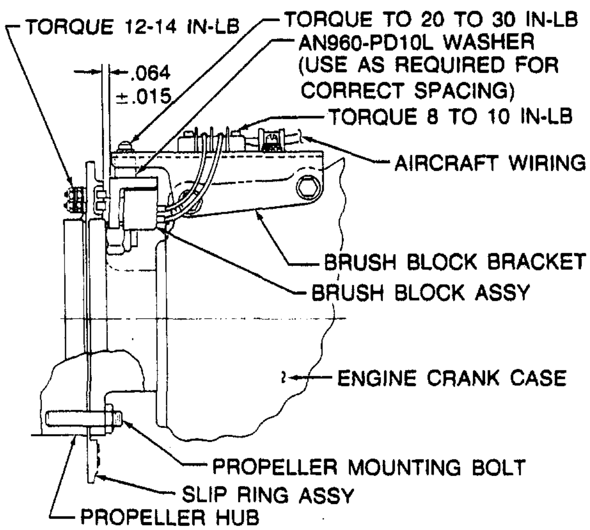
To check for a short circuit, or high resistance in the brush module, measure the resistance from the face of the brush to its terminal studs or receptacle pin with a low range ohmmeter. If this resistance measures over 0.013 ohm, locate and repair the cause of excessive resistance. If the resistance measures zero, locate and correct the open circuit or replace the module. Check the resistance between the terminal studs or receptacle pins. This resistance should not be less than 0.5 meg-ohm.

SLIP RING ALIGNMENT (B.F. Goodrich)

The slip rings are properly aligned when they run in a true plane relative to the brush module. This condition may be checked by attaching a dial indicator gage to the front of the engine crankshaft housing in such a manner that a reading of the slip ring wobble may be obtained. To avoid error in readings, rotate the slip rings slowly while pushing in on the propeller to take the play out of the thrust bearings. If the total run-out over 360 degrees of rotation exceeds 0.005 inch, or 0.002 inch for any 4-inch arc, the slip rings should be aligned as follows:

a. Approximately a 0.012 inch adjustment may be made to correct the slip ring wobble by varying the torque on the attachment bolts. Using the dial indicator to follow the points of maximum deviation, adjust the slip ring assembly to the prescribed run-out limits by varying the torque of the mounting bolts as required within a range of 40 to 100 inch-pounds.

b. If more than 0.012 inch of adjustment is required for alignment, the slip ring assembly may be shimmed to within the prescribed limits for true running by the addition of AN960C416L washers on the mounting bolts between the slip ring assembly and the spinner bulkhead. If necessary, fabricate thinner shims to the AN960 size. Again the torque may be varied as in step "a".



Propeller Deicer Brush Module (McCauley)
Figure 6

NOTE

The above adjustments may affect the clearance between the brush module and slip rings; consequently, after slip ring alignment, a check should be made to ascertain that a distance of from 1/32 to 3/32 inch is maintained between the brush module and slip ring surface (see Figure 5).

SLIP RING MACHINING (B.F. Goodrich)

Slip rings which have roughened or damaged surfaces, but which are structurally sound, can be machined and restored to serviceability. Remove the slip ring assembly from the airplane and mount it in a lathe. Position it concentrically in the lathe, with not over 0.002 inch wobble or run-out over 360 degrees rotation. Take light cuts for a smooth finish and cut no deeper than required to remove surface damage. The contact surfaces of the slip rings must be parallel within 0.005 inch, and flat within 0.005 inch overall. Deviation from flat is not to exceed 0.002 inch over a 4 inch arc. If necessary, undercut the insulation between the slip rings to a depth of 0.020 to 0.030 inch below the contact surface of the slip rings. In this operation, width of the slip ring MUST NOT be reduced more than 0.005 inch. Contact surfaces of the slip rings must have a finish of 29-35 microinches. Deburr the slip ring edges and reinstall in the airplane and align.

NOTE

If, in machining, the solder or braze connection on the underside of the slip ring is exposed, replacement of the slip ring assembly will be necessary.

BRUSH WEAR LIMITS (McCauley)
(Figure 7)

The brushes may be checked for wear by one of the following methods.

ON THE AIRPLANE

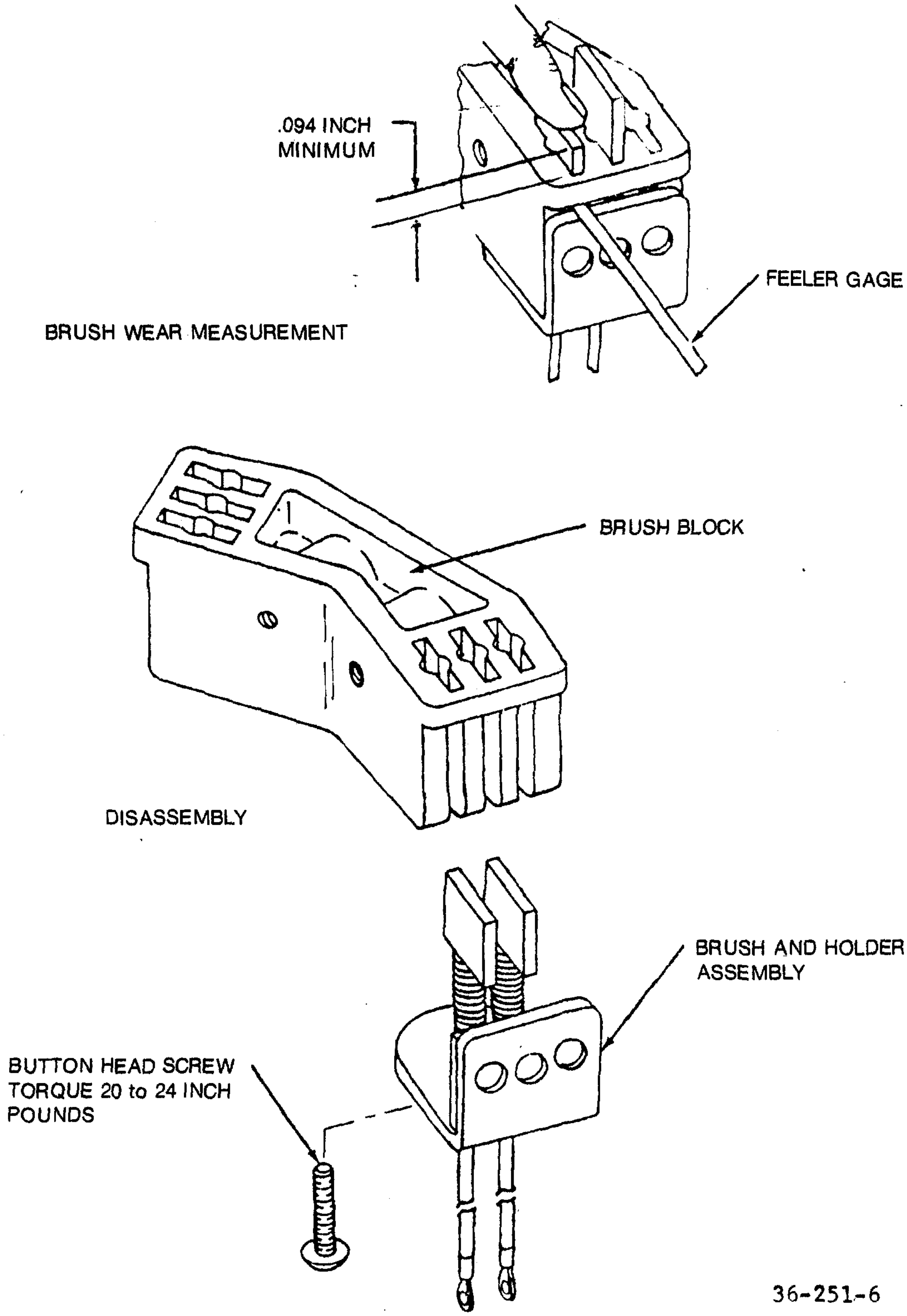
a. Insert a thin stiff feeler gage into the slot on the side of the brush block.
b. If it goes past the back of the brushes the brushes need replaced.

REMOVED FROM THE AIRPLANE

a. Insert a thin stiff feeler gage into the slot on the side of the brush block past the back of the brushes.
b. Gently push the brushes into the brush block.
c. If any brush has .094 inch brush or less remaining outside the brush block, that brush assembly needs replaced.

BRUSH REPLACEMENT (McCauley)
(Figure 7)

a. Remove the brush block from the engine as indicated in BRUSH BLOCK REMOVAL.
b. Remove the two screws in the back of the brush block.
c. Pull the brush holder and brushes from the brush block. Discard the brush holder and brushes.
d. Replace the brushes and brush holder by first sliding the brushes into the slots of the brush block, then sliding the brush holder into place.
e. Install the two screws which hold the holders in place. Torque the screws to 20 to 24 inch-pounds.
f. Push the brushes back into the brush block to ensure that they spring back freely.
g. If the brushes bind, loosen the screws and reposition the brush holders so the brushes ride freely in the slots. Torque the screws to 20 to 24 inch-pounds.
h. Install the brush block as indicated in BRUSH BLOCK INSTALLATION.



Brush Block Assembly (McCauley)
Figure 7

BRUSH BLOCK REMOVAL (McCauley)

a. Disconnect the lead wires from the terminal strip.
b. Disconnect the brush block mounting screws and remove the brush block from the engine.

BRUSH BLOCK INSTALLATION (McCauley) (Figure 8)

a. Install the brush block on the engine with the two screws, but do not tighten the screws.
b. Add or remove shims (see Figure 6) to the brush block mounting screws until each entire brush is in contact with it's slip ring throughout 360° of rotation.
c. Position the brush block on the mounting bracket so that the distance between the brush block and the face of the slip rings is .064 ± .015 inch.
d. Tighten the screws.

SLIP RING (McCauley)

On these slip rings the mounting bolts can not be retorqued or shims added to correct wobble or nonconcentric rotation. Wear or slight wobble may be removed by machining.

NOTE

Friction from the brushes will cause a concave wear pattern on the slip rings. This does not necessitate replacement or machining unless rapid brush wear is encountered. When a new brush assembly is installed on slip rings with normal wear, the brushes will rapidly seat without degradation of operation or service life.

SLIP RING ALIGNMENT (McCauley)

If a chattering or screeching noise is heard coming from the brush block/slip ring area, the probable cause is improper brush block-to-slip ring alignment. A chattering or screeching detected while turning the propeller (in the normal direction of rotation) by hand should be corrected immediately. If the chattering or screeching is heard above idling engine noise; the problem is severe. Repositioning the brush block as indicated in Figure 7 should correct the problem.

SLIP RING OR BRUSH BLOCK CLEANING (McCauley)

The slip rings and brush block may be cleaned with a clean cloth dampened with methyl ethyl ketone.

SLIP RING MACHINING (McCauley)

Structurally sound slip rings with damaged surfaces may be machined to restore serviceability.

a. Clean the slip ring assembly with methyl ethyl ketone before machining.
b. Check the assembly mounting surface flatness. It must be flat within .005 inch overall.
c. Locate the assembly concentrically in a lathe so that there is no more than .002 inch wobble or run-out over 360° of rotation. The assembly should be fixed in the lathe in the same manner as it was attached to the propeller assembly. This will ensure that run-out held while machining the assembly will be transferred when it is mounted on the propeller.
d. Take a light cut for a smooth finish (25 to 20 micro-inches).

NOTE

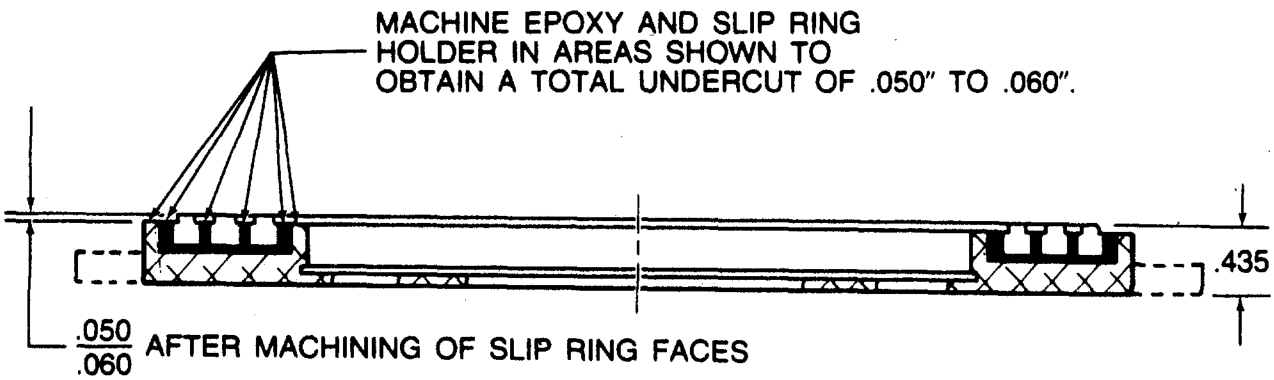
The spindle speed should be 500 rpm or greater. If machine vibration is noticed, it must be corrected. Machine vibration which is not corrected will result in a chattered finish. Feed rate is to be .002 inch or less with a final pass of .005 inch to .010 inch.

e. Ensure that the face surface of the slip rings are parallel and flat within .008 overall.
f. The slip ring holder face and the insulation around and between the slip rings must be undercut to .050 inch to .060 inch (Figure 8).

CAUTION

When undercutting the insulation between the slip rings, do not cut the inside diameters or the outside diameters of the slip rings more than .003 inch past the original diameters.

g. Deburr the slip ring edges.
h. Polish the ring faces with crocus cloth to obtain a finish of 16 to 22 microinches.
i. Check the electrical resistance between each ring and the holder and between each ring. The resistance should be a minimum of 50K ohms.



CAUTION

WHEN UNDERCUTTING INSULATION BETWEEN RINGS, DO NOT CUT INSIDE AND OUTSIDE DIAMETERS OF SLIP RINGS MORE THAN .003" PAST THE ORIGINAL UNDERCUT DIAMETERS.

36-251-7

Slip Ring Machining (McCauley)
Figure 8

"END"

CHAPTER

32

LANDING GEAR

CHAPTER 32 - LANDING GEAR

TABLE OF CONTENTS

CHAPTER 32 - LANDING GEAR

TABLE OF CONTENTS (Continued)

CHAPTER 32 - LANDING GEAR

TABLE OF CONTENTS

SUBJECT *PAGE*

CHAPTER 32 - LANDING GEAR
TABLE OF CONTENTS (Continued)

SUBJECT *PAGE*

32-60-00

CHAPTER 32 - LANDING GEAR

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE	CH-SE-SU	PAGE	DATE
32-LOEP	1	Sep 30/03	32-20-00	1 thru 22	Sep 30/03
32-CONTENTS	1 thru 4	Sep 30/03	32-30-00	1 thru 16	Dec 23/99
32-00-00	1 thru 3	Nov 16/94	32-40-00	1 thru 13	Nov 16/94
32-10-00	1 thru 13	Sep 30/03	32-50-00	1	Nov 16/94
			32-60-00	1 thru 10	Sep 30/03

GENERAL-DESCRIPTION AND OPERATION

LANDING GEAR SYSTEM

The landing gears are operated through adjustable linkage connected to an actuator assembly mounted beneath the front seats. The actuator assembly is driven by an electric motor controlled by the landing gear position switch mounted on the right or left subpanel and limit switches mounted adjacent to the actuator assembly. The landing gear motor, limit switches and actuator assembly are accessible by removing the front seats.

The landing gear may be electrically retracted and extended and may also be lowered manually in an emergency. The landing gear circuit consists of the landing gear position switch, limit switches, safety switches, and motor circuit breaker. The push button for resetting the landing gear motor circuit breaker is located in the right subpanel.

When the landing gear switch is placed in the UP position, the circuit is completed to two safety switches, one located on the left main gear, the other located on the right main gear. If the safety switches have been actuated to complete the circuit to the up-winding of the landing gear motor, as would be the case if the airplane were airborne or supported on jacks, the landing gear motor will run until the landing gear is fully retracted and the uplimit switch is actuated, breaking the circuit to the landing gear motor. When the landing gear position switch is placed in the DOWN position, the circuit is completed to the down-windings of the landing gear motor, and the motor will operate until the landing gear has been fully extended and the downlimit switch actuated, breaking the circuit to the landing gear motor. To prevent overtravel of the gear, the dynamic brake relay simultaneously breaks the power to the motor and makes a complete circuit through the armature and the opposite field winding. The motor then acts as a generator and the resulting electrical load on the armature stops the gear almost instantly.

CAUTION

Do not change the position of the control switch to reverse the direction of the landing gear while the gear is in transit as this could cause damage to the retract mechanism.

In an emergency, the landing gear may be used to create additional drag. Should disorientation occur under instrument conditions, the lowering of the landing gear will reduce the tendency for excessive speed buildup. This procedure would also be appropriate for a noninstrument-rated rated pilot who unavoidably encounters instrument conditions or in other emergencies such as severe turbulence.

Should the landing gear be used at speeds higher than the maximum extension speed, a special inspection of the gear doors is required, with repair as necessary.

CAUTION

Never tow or taxi with a flat strut. Even brief towing or taxiing with a deflated strut can cause severe damage.

OPTIONAL LANDING GEAR SAFETY SYSTEM

The optional landing gear safety system functions through the action of a solenoid in the landing gear position switch in conjunction with a three-position safety system switch, a relay and diode, two pressure switches mounted on the inboard side of the left main wheel well, and a microswitch adjacent to the existing throttle position warning switch in the engine compartment.

Each pressure switch is connected into the pitot and static system. The pressure switch in the gear-up circuit is actuated by the pressure differential that exists between the pitot and static air system and will close with increasing pressure at approximately 90 mph IAS.

When an air speed of 90 mph IAS has been attained with the landing gear position switch in the UP position, the pressure switch in the gear-up circuit closes and actuates a relay mounted on the right-hand instrument panel support, thus completing the circuit and retracting the landing gear. A diode locks the relay in the closed position until the retraction cycle is completed. For the preceding to occur, the microswitch in the engine compartment must also be in the open position. This microswitch is actuated by the throttle control when the throttle is advanced sufficiently for the manifold pressure gage to register approximately 18 inches Hg. Conversely, if the throttle is retarded beyond the position corresponding to approximately

18 inches of Hg in manifold pressure, the microswitch will close. If the air speed has dropped below 120 mph IAS at the same time the microswitch closes, the resultant pressure differential between the pitot and static system will actuate the pressure switch in the gear-down circuit. When both the microswitch and the pressure switch close, the current flow through the solenoid will cause the landing gear position switch to drop into the DOWN position, thus completing the gear-down circuit.

If the landing gear position switch is placed in the UP position while the landing gear safety system is in the ON position, the landing gear will retract only when the following conditions are mutually fulfilled:

- The airplane must have attained an air speed of at least 90 mph IAS.
- The throttle setting must have been advanced sufficiently to produce a manifold pressure of approximately 18 inches Hg.

NOTE

The throttle switch is set at the factory to close when an approximate manifold pressure of 18 inches Hg is produced at about 3000 feet of altitude.

By the same token, the landing gear will automatically extend under the following conditions:

- The airspeed must have dropped below 120 mph IAS.
- The throttle setting must have been retarded enough for manifold pressure to have dropped below approximately 18 inches Hg.

The safety system switch is a three-position switch with normally ON or OFF positions. The switch also contains a momentary or test position for checking that the system is functioning properly. When released from the test position, the switch returns to the ON position.

TROUBLESHOOTING LANDING GEAR ELECTRICAL SYSTEM

INDICATION	PROBABLE CAUSE	REMARKS
1. Motor fails to shut off when gear is retracted.	a. Uplimit switch is out of adjustment	a. Readjust switch.
	b. Defective switch.	b. Replace switch.
2. Landing gear fails to retract.	a. Safety switch not closing.	a. Replace switch.
	b. Uplimit switch open.	b. Replace limit switch.
3. Motor fails to shut off when gear extended.	a. Downlimit switch does not open.	a. Readjust limit switch.
	b. Defective Downlimit switch.	b. Replace switch.
4. Landing gear actuator is hitting internal stops.	a. Limit switch out of adjustment.	a. Readjust limit switch.
-	b. Limit switch is inoperative.	b. Replace switch.
	c. Dynamic brake is not working.	c. Check for inoperative dynamic brake relay or high resistence in relay circuit.
5. Warning horn inoperative or malfunctioning.	a. Open or grounded circuit.	a. Check continuity.
	b. Throttle switches inoperative.	b. Check and adjust as necessary.
6. Landing gear fails to extend.	a. Tripped circuit breaker.	a. Reset circuit breaker.
	b.Downlimit switches open.	b. Check downlimit switch. The downlimit switch should be closed with the gear retracted.
	c. Open circuit	c. Run a continuity check on the downlimit switch.
	d. Landing gear motor inoperative.	d. Check brushes, overhaul or replace motor.
7. Landing gear will not retract or extend.	a. Bad electrical connection.	a. Run a continuity check from circuit breaker to switch.

TROUBLESHOOTING
LANDING GEAR ELECTRICAL SYSTEM *(Continued)*

INDICATION	PROBABLE CAUSE	REMARKS
	b. Landing gear motor not grounded.	b. Check motor ground.
	c. Defective control circuit.	c. Check items 1 through 3.
	d. Landing gear motor inoperative.	d. Check brushes overhaul or replace.

MAIN GEAR AND DOORS - MAINTENANCE PRACTICES

MAIN LANDING GEAR SERVICING

Perform the SHOCK STRUTS procedure in Chapter 12-20-00.

LUBRICATION

Lubricate the main wheel bearings and grease fittings. Refer to Chart 2, LUBRICATION SCHEDULE, in Chapter 12-20-00.

MAIN LANDING GEAR REMOVAL

When removing the landing gear, take care to preserve the original adjustments at the rod-end fittings to facilitate reassembly.

a. With the airplane on jacks, retract the landing gear until the inboard door is in the fully open position.

b. Disconnect the outboard landing gear door from the landing gear strut.

c. Disconnect the inboard landing gear door actuating rod at the forward door hinge.

d. Unsnap the canvas cover and disconnect the uplock assembly from the strut.

e. Open the brake cylinder bleed ports and pump all fluid from the system.

f. Disconnect the hydraulic lines where the flexible hose couples to the tubing on the landing gear.

g. Disconnect the safety switch wire.

h. Remove the bolt attaching the lift leg to the strut.

i. Remove the access door in the lower surface of the wing leading edge for access to the forward hinge bolt retaining nut and remove the nut. The rear strut brace hinge bolt is accessible by lowering the flap.

j. Remove the brace hinge bolts and associated hardware which attach the main gear to the front and rear spars.

k. Lower the main gear assembly from the airplane, being careful not to bend the skin at the edge of the wheel well.

MAIN LANDING GEAR INSTALLATION

a. Carefully position the main landing gear assembly in place against the front and rear spars.

b. Align the hinge bolt holes and install the bushings, bolts, washers and nuts. Torque each nut to 250 to 690 in.-lbs. Install new cotter pins.

NOTE

Install 100951-S-016-XF or 100951-S-032-XF washers as required between the landing gear and the front and rear spars to maintain a maximum total clearance of 0.016 inch. The placement of these washers at the front or rear may help align the lift leg.

c. Install the access door in the lower wing leading edge.

d. Install the bolt attaching the lift leg to the strut.

NOTE

Overtightening the nut on the bolt that connects the lift leg to the shock strut can bind the strut or distort the strut attaching point. Torque the nut to 25 to 75 in.-lbs.

e. Connect the landing gear safety switch wire.

f. Connect the brake hydraulic line.

g. Connect the uplock assembly to the strut and snap the canvas cover in place.

CAUTION

The uplock cable attach bolt must be installed with the head of the bolt pointing aft. This is to avoid interference between the bolt and the stringer in the main gear wheel well as the landing gear is retracted.

h. Connect the inboard landing gear door actuating rod to the forward door hinge.

i. Install the outboard landing gear door to the landing gear strut.

j. Bleed the brake.

CAUTION

Excessive operation of the landing gear motor without proper cooling may cause damage to the landing gear motor. Allow a short cooling time after each extension and retraction cycle.

k. Operate the landing gear and check for proper rigging of the uplock and doors.

MAIN LANDING GEAR OVERHAUL

NOTE

Refer to the OVERHAUL AND REPLACEMENT SCHEDULE in Chapter 5-10-00 for time limits and maintenance checks of the main landing gear.

Experience in the field indicates the points of greatest wear on the main landing gear are the upper and lower bearings in the cylinder assembly. The wear caused on the bearings during takeoff, landing and taxiing tend to result in an oversized condition. The oversized condition of the upper bearing in the cylinder assembly will result in leakage of hydraulic fluid through the upper bearing and O-ring. This will eventually cause fluid to seep down through the felt pad and out the lower bearing.

When replacement of the scraper ring and all O-rings in the cylinder assembly fails to stop leaks, the oversized condition of the bearings is probable. In such instances the landing gear should be overhauled. The following information will aid in determining the extent of landing gear wear and whether it is possible to overhaul or necessary to replace critical landing gear components.

MAIN LANDING GEAR DISASSEMBLY

WARNING

Do not begin any disassembly of the main landing gear until all air pressure has been released.

a. Place the landing gear in a vertical position to prevent hydraulic fluid from spilling.

b. Release the air pressure from the cylinder assembly (9) by depressing the valve core (2) (Ref. Figure 1).

c. To prevent damage, remove all hydraulic plumbing, safety switch components, and clamps.

d. Perform the MAIN WHEEL AND BRAKE ASSEMBLY REMOVAL procedure in Chapter 32-40-00.

e. Remove the retaining ring (5) and retract the lower shock assembly (35) to push the orifice tube (6) out of the cylinder assembly (9).

f. Invert the landing gear and drain the hydraulic fluid.

g. Remove the air valve assembly (3), O-ring (4), piston ring (8) and O-ring (7) from the orifice tube (6).

WARNING

Do not disconnect the torque knees (23 and 34) without first deflating the cylinder assembly (9). The torque knees provide the extension stop for the lower shock assembly, and when disconnected, the shock assembly is free to slide out of the cylinder assembly (9).

h. Remove the nut, washers, and bolt (32) connecting the upper torque knee (23) to the lower torque knee (34).

i. Remove the upper and lower torque knees (23 and 34) by removing the upper and lower torque knee pins (21 and 31), retaining pins and cotter pins.

j. Slide the lower shock assembly (35) out of the cylinder assembly (9).

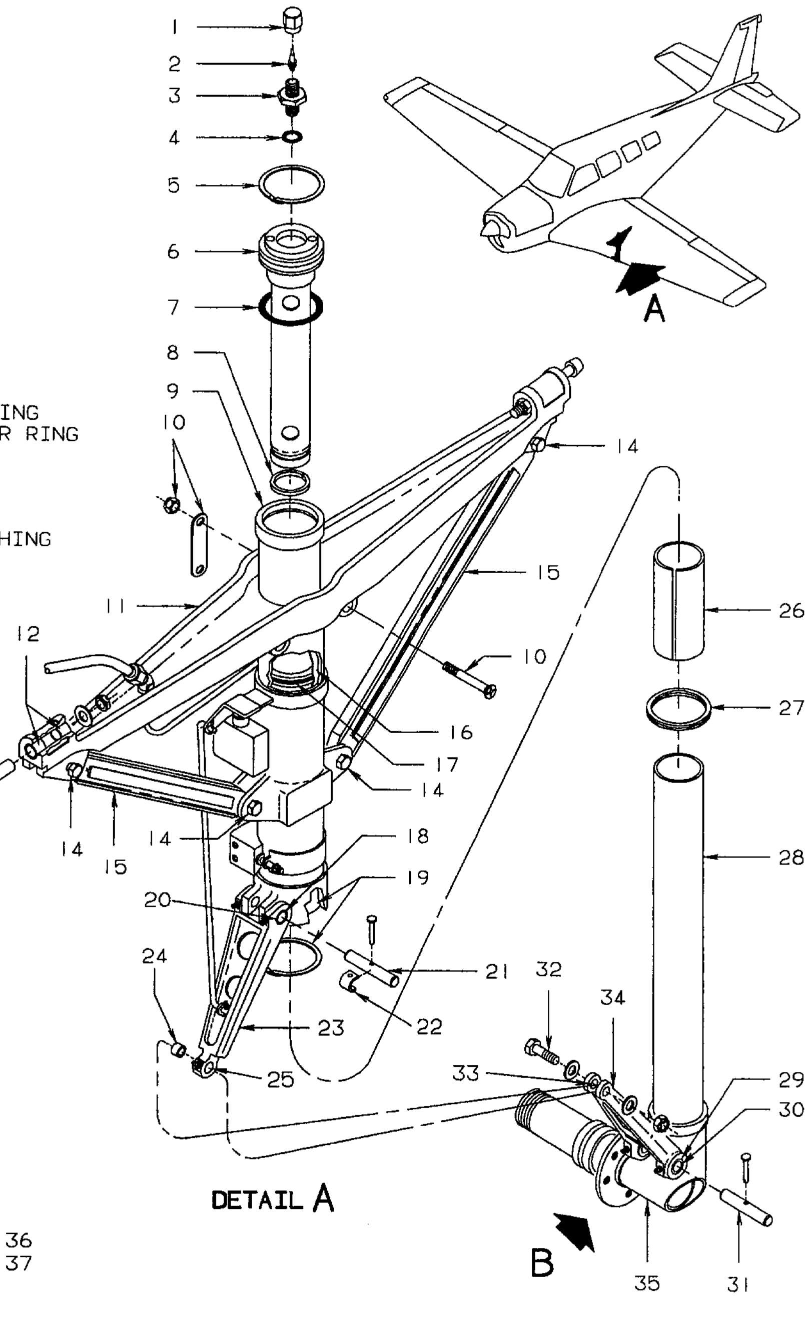
CAUTION

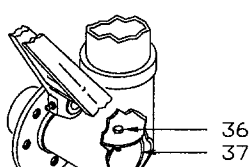
The scraper seal (27) may become sharp during normal operation of the gear; care should be exercised to avoid possible injury when removing the scraper seal.

k. Remove the scraper seal (27), felt pad (26), O-ring and retainer rings (17). The O-ring is located between two retainers within the cylinder assembly (9). Removal of the O-ring may be simplified by using a hook, manufactured from music wire (Ref. Figure 2).

l. Disconnect the columns (15) and brace (11) from the cylinder assembly (9) and from each other. Remove bushings (12) from the brace (11).

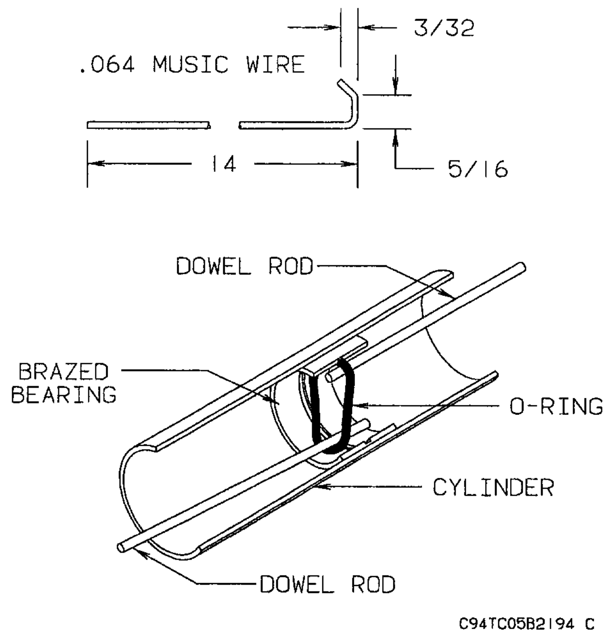
1. AIR VALVE CAP
2. VALVE CORE
3. AIR VALVE ASSEMBLY
4. O-RING
5. RETAINER RING
6. ORIFICE TUBE
7. O-RING
8. PISTON RING
9. CYLINDER ASSEMBLY
10. BOLT, CONNECTOR, NUT
11. BRACE
12. BUSHINGS
13. BUSHING
14. MAIN LANDING GEAR BRACE BOLT
15. COLUMN
16. UPPER BEARING
17. O-RING, RETAINER RINGS
18. UPPER TORQUE KNEE BUSHING
19. LOWER BEARING, RETAINER RING
20. UPPER TORQUE KNEE BORE
21. UPPER TORQUE KNEE PIN
22. STOP
23. UPPER TORQUE KNEE
24. CENTER TORQUE KNEE BUSHING
25. UPPER TORQUE KNEE BORE
26. FELT PAD
27. RETAINER RING/ SCRAPER SEAL
28. PISTON (CHROME PORTION)
29. LOWER TORQUE KNEE BUSHING
30. LOWER TORQUE KNEE BORE
31. LOWER TORQUE KNEE PIN
32. BOLT, WASHERS, NUT,
33. LOWER TORQUE KNEE BORE
34. LOWER TORQUE KNEE
35. LOWER SHOCK ASSEMBLY
36. BRAZED RETAINING BOLT
37. AXLE





DETAIL B

Main Landing Gear Assembly
Figure 1



O-Ring Removal and Installation
Figure 2

MAIN GEAR CLEANING, REPLACEMENT PARTS AND REPAIRS

CLEANING

a. Clean all parts with solvent (16, Chart 1, 91-00-00). Remove all excess solvent and wipe dry after cleaning.

b. Immerse all internal parts in clean hydraulic fluid (9, Chart 1, 91-00-00) prior to assembly.

REPLACEMENT PARTS

a. Inspect all parts and assemblies for damage or excessive wear. The following conditions are cause for rejection:

- Wear which is greater than the allowable wear tolerances. (Ref. Chart 1).
- Damage which cannot be corrected or repaired.
- Screws that are severely damaged or have stripped, severely worn or scored threads.
- Parts that are cracked, chipped or broken.
- Parts that have corrosion or other defects that cannot be repaired.

b. Replace the following parts when main landing gear is overhauled (Ref. Figure 1):

- Cotter pins

- DU Bushings (12)
- Bushing (13)
- Felt Pad (26)
- Piston Ring (8)
- O-Rings (4, 7, 17)
- Retainer Rings (5, 17, 19)
- Safety Wire
- Scraper Seal (27)

c. Replace the following parts on condition when main landing gear is overhauled:

- Bearings (16, 19)
- Bushings (18, 24, 29)
- Grease Fittings
- Grommets
- Huck Bolt and Collar (Replace if removed from the upper bearing (16).)
- Hydraulic Hoses
- Hydraulic Tubing
- Safety Switch Components
- Valve Core (2)
- Wiring

REPAIRS

a. Visually inspect castings for cracks and pitting; and finished surfaces for scoring, pitting, nicks, cracks, distortion and wear. Refer to Chart 1 for tolerances to aid in determining the extent of wear. Replace all defective and excessively worn parts.

b. If fluid leaks have been observed on top of the air valve assembly (3), check the small O-ring (4) of the valve; then look for defects in the valve (Ref. Figure 1).

c. If the leak is from the junction of the orifice tube assembly (6) with the cylinder assembly (9) walls, check the O-ring (7) in the orifice tube (6).

d. All parts or assemblies may be repaired if the following conditions exist:

- Slight scoring of shafts may be corrected by lapping carefully with a flat oil stone.

NOTE

Do not exceed 10% of the component material thickness when removing nicks, burrs and scratches.

- Smooth minor nicks, burrs and scratches.
- Those parts that are scratched or have worn plating may be stripped and replated with the same type of plating as that removed or be replaced with new parts.
- Minor thread damage, chase to clean or smooth.

NOTE

Corrosion damage requires inspection to determine the depth of penetration and the cross-sectional area change. The damaged area must be thoroughly cleaned and the corrosion must be removed. Refer to CORROSION - MAINTENANCE PRACTICES in Chapter 20-09-00. The deterioration caused by corrosion or removal of corrosion must not reduce the material thickness of any component by more than 10%. Refer to Chart 1 for MAIN LANDING GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES on components. For additional information contact the Technical Support Department of Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.

- Remove corrosion if applicable, and apply corrosion prevention materials as necessary per MIL-C-5541 or cadmium plate per Fed QQ-P-416, Type II.
- Bushings that check within allowable wear tolerances may be reused.
- When evidence of damage exists to steel parts, magnetic particle inspect per MIL-STD-1949.

NOTE

Do not remove paint or primer from the area to be fluorescent or dye penetrant inspected per MIL-STD-6866. If the finish absorbs the penetrant so that bleed out prevents satisfactory inspection or if a new finish has not cured for at least 30 days, contact the Technical Support Department of Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.

- When evidence of damage exists to metal parts other than steel, fluorescent penetrant inspect per MIL-STD-6866, Type I.
- Replace damaged or unserviceable parts with new or serviceable parts.

MAIN LANDING GEAR ASSEMBLY

NOTE

Prior to assembly, immerse all internal parts (except felt pad (26)) in hydraulic fluid (9, Chart 1, 91-00-00).

a. Install the O-ring and retainer rings (17) in the upper bearing (16) of the cylinder assembly (9). Two dowel rods may be used to work O-ring and retainers into position (Ref. Figure 1).

b. Soak the felt pad (26) in SAE 10W30 oil and install in the cylinder (9) between the upper and lower bearings (16 and 19).

c. Slide the scraper seal (27) over the piston (28) and insert the lower shock assembly (35) into the cylinder (9). Work the scraper seal (27) into the lower end of the cylinder assembly (9) until seated.

d. Install upper torque knee (23) to the cylinder assembly (9) and lower torque knee (34) to the lower shock assembly (35) using torque knee pins (21 and 31), retaining pins and cotter pins. Install stop (22) to the upper torque knee pin (21). Insert the center torque knee bushing (24) and connect the torque knees (23 and 34) using bolt, washers, nut (32).

e. Lubricate bearings at grease fittings with grease (46, Chart 1, 91-00-00).

f. Install new bushings (12) into brace (11). Install brace (11) onto the cylinder assembly (9) with bolt, connector and nut (10). Install forward and aft columns (15) to the brace (11) and cylinder assembly (9) using main landing gear brace bolts (14).

g. Raise and block lower shock assembly (35) 1/4 inch from the fully compressed position and fill cylinder assembly with hydraulic fluid (9, Chart 1, 91-00-00) until the top of piston (28) is covered (approximately 2 pints of hydraulic fluid).

h. Install O-ring (4), valve core (2) and valve assembly (3) into orifice tube (6). Assemble the O-ring (7) and piston ring (8) to orifice tube and install into cylinder assembly (9). Slowly extend lower shock assembly (35) allowing the suction to pull orifice tube down into the cylinder assembly (9), then install retainer ring (5).

WARNING

As with all operations involving equipment under high pressure, exercise caution when performing the leak test; avoid the areas directly above and below the strut.

i. Inflate the cylinder assembly (9) to approximately 100 psi using dry air or nitrogen. Coat the top of the orifice tube (6) and air valve assembly (3) with soap suds and check for air leaks.

j. Release the air pressure; clean the soapsuds off the top of the orifice tube (6) and air valve assembly (3) with fresh water and wipe dry.

k. Install air valve cap (1) to air valve assembly.

l. Install all hydraulic plumbing, safety switch components and clamps.

m. Perform the MAIN WHEEL AND BRAKE ASSEMBLY INSTALLATION procedure in Chapter 32-40-00.

n. Perform the MAIN LANDING GEAR INSTALLATION procedure.

o. Perform the SHOCK STRUTS procedure in Chapter 12-20-00.

CHART 1
MAIN LANDING GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
			NOTE: Listed below are the tolerances used to determine the extent of wear in the main landing gear components. Where pertinent, the permissible wear limits are given for those components. All inside-diameter (I.D.) and outside-diameter (O.D.) dimensions are given in inches (Ref. Figure 1).
Lower Shock Assembly (35)			Visually inspect piston (28), axle (37) and brazed retaining bolt (36) wear, damage and corrosion. Any sign of scratches and worn areas which can not be repaired is cause for rejection. Conduct a magnetic-particle inspection per MIL-STD-1949. Any sign of cracking is cause for rejection.
Piston (28)			
- Chrome Portion	1.602 1.593	1.8635 1.8600	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
Axle (37)		1.498 1.497	Visually inspect for wear, damage and corrosion. Strip and cadmium plate axle as necessary, per Fed QQ-P-416, Type II, Class 2, on scratched or worn areas.
Upper and Lower Torque Knees (23 and 34)			Visually inspect for wear, damage and corrosion. Conduct a magnetic particle inspection per MIL-STD-1949. Any sign of cracks, scratches or worn areas which can not be repaired is cause for rejection. Remove all bushings and inspect bores for corrosion. Replace bushings as needed and cadmium plate per FED QQ-P-416, Type II, Class 2.
- Torque Knee Bore (20 and 30)	0.6255 0.6245	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Bushings (18 and 29)	0.5015 0.4995	---	Visually inspect for wear, damage and corrosion. If bushings exceed wear tolerances, replace with new bushings. Alignment ream new bushings to specified wear tolerances. Drill out lubricator holes through bushings and install lubricators.

CHART 1
MAIN LANDING GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
- Knee Pins (21 and 31)	---	0.4990 0.4980	Visually inspect for wear, damage and corrosion. Any sign of scratches or worn areas which can not be repaired is cause for rejection. If no visible wear is evident, conduct magnetic particle inspection per MIL-STD-1949. Any sign of cracks is cause for rejection. Replace if wear tolerances are exceeded.
Torque Knee Center Hinge Joint			
- Bore (Upper) (25)	0.4440 0.4370	---	Inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Bushing (24)	0.3150 0.3120	0.4360 0.4330	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Bore (Lower) (33)	0.3195 0.3125	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
Orifice Assembly (6)	---	1.560 1.557	Visually inspect for wear, damage and corrosion. Any sign of scratches or worn areas which can not be repaired is cause for rejection. Check the orifice O.D. does not exceed wear tolerances. Check that orifice hole does not exceed 0.192 inch. Cadmium plate as necessary except for ring groove in orifice head, per Fed QQ-P-416, Type I, Class 2.
Cylinder Assembly (9)			Visually inspect for wear, damage and corrosion. Any sign of cracks, scratches or worn areas which can not be repaired is cause for rejection. If no visible wear is evident, conduct fluorescent or dye penetrant inspection per MIL-STD-6866. Corrosion proof per MIL-C-5541 and paint touch up as required.

CHART 1
MAIN LANDING GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Internal Bearings			
- Upper (16)	1.8695 1.8650	---	Visually inspect for wear, damage and corrosion. Replace bearing if wear tolerances are exceeded. If replacement is required, remove the bearing from the cylinder assembly (9) and measure the O.D.. Select from the O.D. dimensions below to determine the correct replacement bearing. 2.3225/2.3215 inches, (P/N 35-815246-13, Standard Bearing) 2.3345/2.3335 inches, (P/N 35-815246-23, Oversize Bearing) 2.3425/2.3415 inches, (P/N 35-815246-25, Oversize Bearing) If the O.D. dimensions of the bearing is greater than the replacement dimensions above, replace the cylinder assembly (9). If additional information is required contact the Technical Support Department of the Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.
- Lower (19)	1.8695 1.8650	---	Visually inspect for wear, damage and corrosion. Replace bearing if wear tolerances are exceeded. If replacement is required, remove the bearing from the cylinder assembly (9) and measure the O.D.. Select from the O.D. dimensions below to determine the correct replacement bearing. 2.0035/2.0025 inches, (P/N 35-815246-9, Standard Bearing) 2.0185/2.0170 inches, (P/N 35-815246-27, Oversize Bearing) If the O.D. dimensions of the bearing is greater than the replacement dimensions above, replace the cylinder assembly (9). If additional information is required contact the Technical Support Department of Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.

CHART 1
MAIN LANDING GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
			If replacement of bearing is required, coat bore with primer (67, Chart 1, 91-00-00) and install new bearing using an adhesive (66, Chart 1, 91-00-00).
Upper Torque Knee Attachment Hole	0.5010 0.4995	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
Instruction Placards			Do not remove from cylinder assembly except for inspection purposes or replacement.
Brace Assembly (11)			Visually inspect for wear, damage and corrosion. Conduct a fluorescent or dye penetrant inspection per MIL-STD-6866. Any sign of cracks, scratches or worn areas which can not be repaired is cause for rejection.
Hinge Bushings			
- Outer Hinge (12)	---	---	Replace bearings when main landing gear is overhauled.
- Inner Hinge (13)	0.6240 0.6230	---	Replace bearings when main landing gear is overhauled.
Brace Bores			
- Forward Bolt (14) Bore	0.4395 0.4370	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Center Bolt (10) Bore	0.2520 0.2495	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Aft Bolt (14) Bore	0.4395 0.4370	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
Forward and Aft Columns (15)			
Upper and Lower Attachment			
- Forward bores (14)	0.4395 0.4370	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Aft bores (14)	0.4395 0.4370	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.

CHART 1
MAIN LANDING GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Safety Switch Components			Ensure there is electrical continuity when switch is activated. Replace wiring and components on condition.

NOSE GEAR AND DOORS - MAINTENANCE PRACTICES

NOSE GEAR SHOCK STRUT

Perform the SHOCK STRUTS procedure in Chapter 12-20-00.

LUBRICATION

Lubricate the nose wheel bearings and grease. Refer to Chart 2, LUBRICATION SCHEDULE in Chapter 12-20-00.

NOSE GEAR REMOVAL

When removing the nose gear, take care to retain the original adjustment at the rod end fittings to facilitate reassembly.

a. Jack the airplane and partially retract the landing gear to relieve the load on the retract rod compression springs.

b. Disconnect the drag leg at its fitting on the nose gear brace assembly.

c. Disconnect the steering mechanism at the nose gear.

d. Disconnect the landing light wiring.

e. Remove the cotter pins, nuts, washers, bolts, and bushings which connect the nose gear upper brace to the wheel well structure.

f. Lower the nose gear assembly from the nose wheel well.

NOSE GEAR INSTALLATION

a. Carefully position the nose gear assembly against the nose wheel well structure.

NOTE

Use 100951S016YP washers (maximum of two per side) to obtain total end play of 0 to 0.015 inch between the nose gear assembly and supports.

b. Align bolt holes and install bushings, bolts, washers, and nuts. Torque the nuts to 150 to 200 in.-lbs. Install new cotter pins.

c. Connect the landing light wire.

d. Connect the drag leg of the nose gear brace assembly.

e. Connect the steering mechanism to the nose gear.

CAUTION

Excessive operation of the landing gear motor without proper cooling may cause damage to the landing gear motor. Allow a short cooling time after each extension and retraction cycle.

f. Operate the landing gear and check for proper rigging and nose gear adjustment. (Cycle the landing gear a minimum of six complete cycles.)

NOSE GEAR OVERHAUL

NOTE

Refer to the OVERHAUL AND REPLACEMENT SCHEDULE in Chapter 5-10-00 for time limits and maintenance checks of the nose gear.

Experience in the field indicates the points of greatest wear on the nose gear are the upper and lower bearings in the barrel assembly. The forces exerted on the bearings during takeoff and landing tend to result in an oversized condition. The oversized condition of the upper bearing in the barrel assembly will result in leakage of hydraulic fluid through the upper bearing and O-ring. This will eventually cause fluid to seep down through the felt pad and out the lower bearing.

When replacement of the scraper ring and all O-rings in the landing gear fails to stop leaks, the oversized condition of the bearings is probable. In such instances the landing gear should be overhauled. The following information will aid in determining the extent of landing gear wear and whether it is possible to overhaul or necessary to replace critical landing gear components.

NOSE GEAR DISASSEMBLY

WARNING

Do not begin any disassembly of the nose landing gear until all air pressure has been released.

a. Place the strut in a near vertical position to prevent the hydraulic fluid from spilling when the air valve assembly (1) is removed (Ref. Figures 1 and 2).

b. Depress the valve core to deflate the strut and remove the air valve assembly (1).

c. Perform the NOSE WHEEL REMOVAL procedure in Chapter 32-40-00.

d. Remove the snap ring (4) retaining the orifice tube (6).

e. Retract the piston and fork assembly (48) to push the orifice tube (6) out of the barrel (23).

f. Remove the orifice tube (6). Remove the O-ring (5) and piston ring (7).

g. Invert the nose gear and drain out the hydraulic fluid.

WARNING

Do not disconnect the torque knees (37 and 46) without first deflating the nose gear. The torque knees provide the extension stop for the piston and fork assembly (48). When disconnected, the piston and fork assembly (48) is free to slide out of the barrel assembly (23).

h. Remove the cotter pin (40), nut (41), washers (39 and 44), bushing (45), and bolt (43).

i. Remove the cotter pin (36), and pins (25 and 34) to disconnect the upper torque knee (37).

j. Remove the cotter pin (50), pins (42 and 47), and washers (49 and 51) to disconnect the lower torque knee (46).

k. Slide the piston and fork assembly (48) out of the barrel (23). Remove the collar (2) and shim (3).

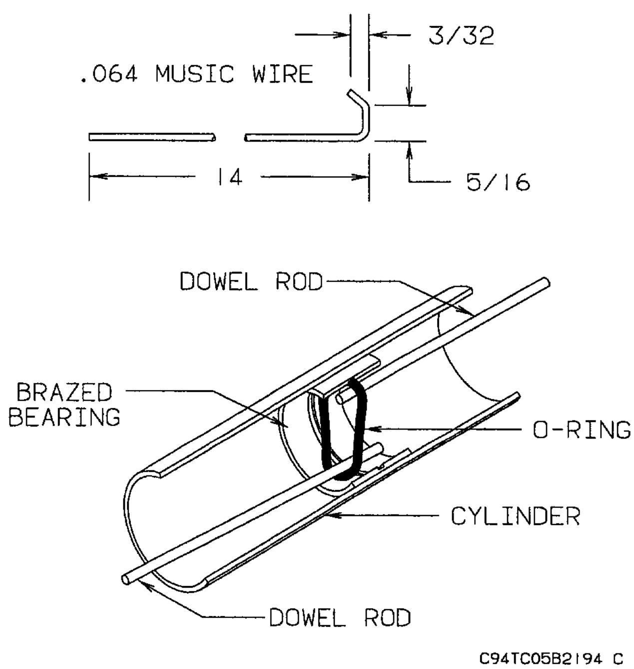
l. Remove the lower snap ring (33), scraper (31), and adapter (32).

m. Remove the O-ring (38) and remove the felt pad (24) from inside the barrel (23). Removal of the O-ring may be simplified by using a hook manufactured from music wire (Ref. Figure 1).

n. Remove the nut (16), washers (17 and 19), bushing (18), and bolt (21) attaching the shimmy damper (20) to the brace (15).

o. Remove the nut (30), washers (27 and 29), bushing (28), and bolt (26) to disconnect the shimmy damper (20) from the barrel (23).

p. Pull the barrel (23) out of the brace (15).



O-Ring Removal and Installation
Figure 1

NOSE GEAR CLEANING, REPLACEMENT PARTS AND REPAIRS

CLEANING

a. Clean all parts with solvent (16, Chart 1, 91-00-00). Remove all excess solvent and wipe dry after cleaning.

b. Immerse all internal parts in clean hydraulic fluid (9, Chart 1, 91-00-00) prior to assembly.

REPLACEMENT PARTS

a. Inspect all parts and assemblies for damage or excessive wear. The following conditions are cause for rejection:

- Wear which is greater than the allowable wear tolerances (Ref. Chart 1).
- Damage which cannot be corrected or repaired.
- Screws that are severely damaged or have stripped, severely worn or scored threads.
- Parts that are cracked, chipped or broken.
- Parts that have corrosion or other defects that cannot be repaired.

b. Replace the following parts when nose gear is overhauled:

- Adapter (32)
- Bushing (12)
- Cotter Pins
- Felt Pad (24)
- Piston Ring (7)
- O-Rings (5, 38)
- Safety Wire
- Scraper (31)
- Snap Rings (4, 33)
- Bearings (8, 22)

c. Replace the following parts on condition when nose gear is overhauled:

- Bushings (18, 28, 35, 45)
- Grease Fittings
- Placards
- Valve Core (1)

REPAIRS

a. Visually inspect castings for cracks and pitting; and finished surfaces for scoring, pitting, nicks, cracks, distortion and wear. Chart 1 lists wear tolerances to aid in determining the extent of wear. Replace all defective and excessively worn parts.

b. If fluid leaks have been observed on top of the air valve assembly (1), check the small O-ring of the valve; then look for defects in the valve (Ref. Figure 2).

c. If the leak is from the junction of the orifice tube assembly (6) and the barrel (23), check the O-ring (5) on the orifice tube (6).

d. All parts or assemblies may be repaired if the following conditions exist:

- Slight scoring of shafts may be corrected by lapping carefully with a flat oil stone.

NOTE

Do not exceed 10% of the component material thickness when removing nicks, burrs and scratches.

- Those parts that are scratched or have worn plating may be stripped and replated with the same type of plating as that removed or be replaced with new parts.
- Smooth minor nicks, burrs, and scratches.
- Minor thread damage, chase to clean or smooth.

NOTE

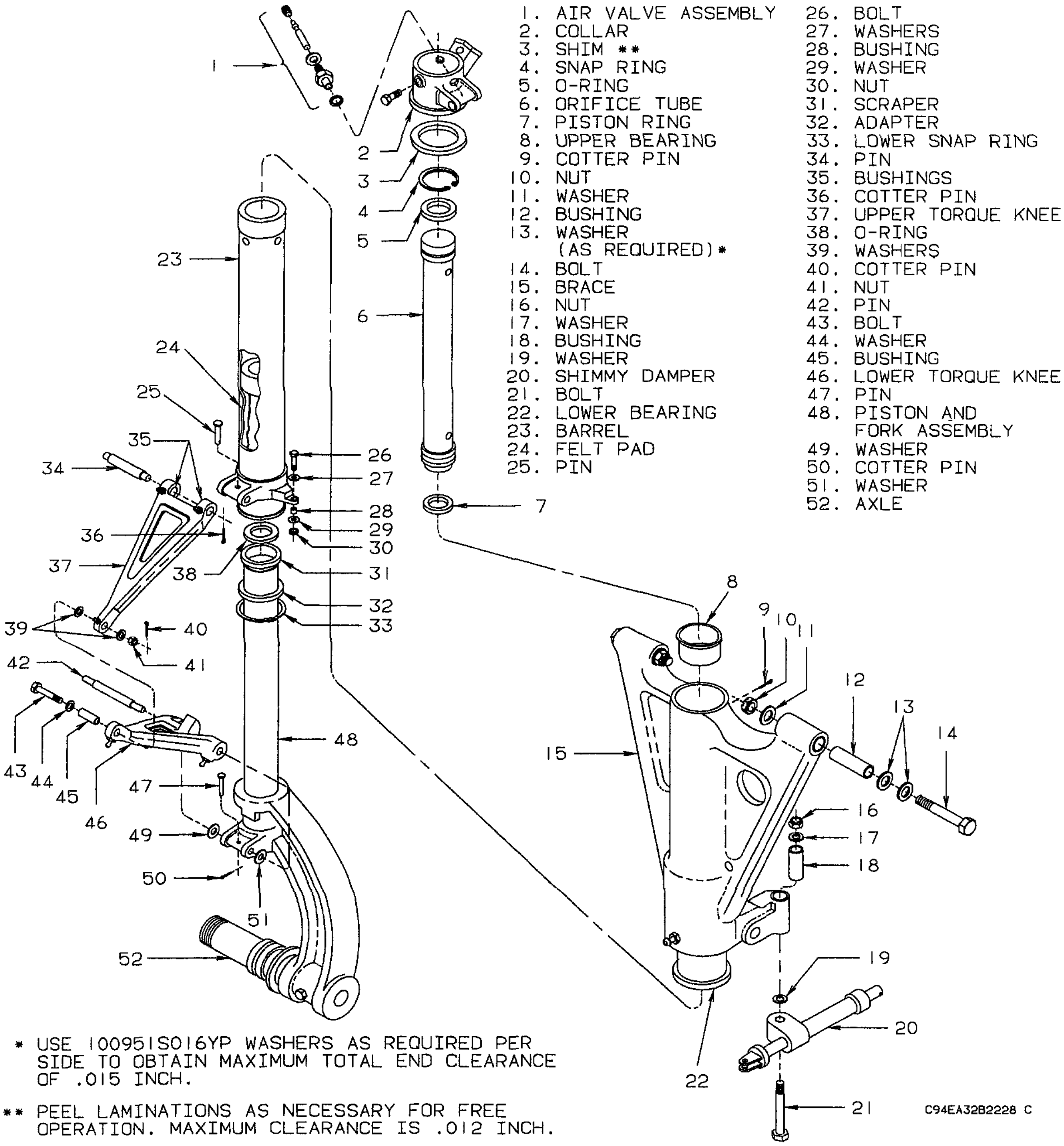
Corrosion damage requires inspection to determine the depth of penetration and the cross-sectional area change. The damaged area must be thoroughly cleaned and the corrosion must be removed. Refer to CORROSION - MAINTENANCE PRACTICES in Chapter 20-09-00. The deterioration caused by corrosion or removal of corrosion must not reduce the material thickness of any component by more than 10%. Refer to Chart 1 for NOSE GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES on components. For additional information contact the Technical Support Department of Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.

- Remove corrosion if applicable and apply corrosion prevention materials as necessary per MIL-C-5541 or cadmium plate per Fed QQ-P-416, Type II.
- Bushings that check within allowable wear tolerances may be reused.
- When evidence of damage exists to steel parts, magnetic particle inspect per MIL-STD-1949.

NOTE

Do not remove paint or primer from the area to be fluorescent or dye penetrant inspected per MIL-STD-6866. If the finish absorbs the penetrant so that bleed out prevents satisfactory inspection or if a new finish has not cured for at least 30 days, contact the Technical Support Department of Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.

- When evidence of damage exists to metal parts other than steel, fluorescent penetrant inspect per MIL-STD-6866, Type I.
- Replace damaged or unserviceable parts with new or serviceable parts.



Nose Gear Assembly
Figure 2

CHART 1
NOSE GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES

NOTE

Listed below are the tolerances used to determine the extent of wear in the nose gear components. Where pertinent, the permissible wear limits are given for those components. All inside-diameter (I.D.) and outside-diameter (O.D.) dimensions are given in inches (Ref. Figure 2).

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Collar (2)	0.3150 0.3120	---	Visually inspect for wear, damage and corrosion. Any scratches or worn areas which can not be repaired is cause for rejection. Conduct magnetic particle inspection per MIL-STD-1949. Any crack is cause for rejection. Replace if wear tolerances are exceeded. Cadmium plate as necessary per Fed QQ-P-416, Type II, Class 2.
Torque Knee Assembly (37 and 46)			Visually inspect for wear, damage and corrosion. Any scratches or worn areas which can not be repaired is cause for rejection. Remove all bushing and inspect bores for corrosion. Corrosion proof as necessary per MIL-C-5541. Any crack is cause for rejection. Replace bushing as needed.
Upper Torque Knee (37)			
- Bore	0.4380 0.4370	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Bushing (35)	0.3775 0.3745	---	Visually inspect for wear, damage and corrosion. If bushings exceed 0.3775 inches I.D., replace with new bushings. Alignment ream new bushings to specified wear tolerances. Drill out lubricator holes through bushings and install lubricators.
- Knee Pin (34)	---	0.3735 0.3725	Visually inspect for wear, damage and corrosion. Any scratches or worn areas which can not be repaired is cause for rejection. If no visible wear is evident, conduct a magnetic particle inspection per MIL-STD-1949. Any crack is cause for rejection. Replace if wear tolerances are exceeded.

CHART 1
NOSE GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Torque Knee Center Hinge Joint			
- Bore (Upper)	0.3150 0.3120	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Bushing (45)	0.2505 0.2495	0.311 0.310	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Bore (Lower)	0.3150 0.3120	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
Lower Torque Knee (46)			
- Bore	0.3775 0.3745	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
- Knee Pin (42)	---	0.374 0.373	Visually inspect for wear, damage and corrosion. Any scratches or worn areas which can not be repaired is cause for rejection. If no visible wear is evident, conduct a magnetic particle inspection per MIL-STD-1949. Any crack is cause for rejection. Replace if wear tolerances are exceeded.
Orifice Assembly (6) **P/N 35-825195** (CE-748, CE-772 thru CE-979; CJ-149 thru CJ-155; D-10097, D-10120 thru D-10396; E-1111, E-1241 thru E-1969; EA-1 thru EA-272)	---	1.449 1.436	Visually inspect for wear, damage and corrosion. Any sign of scratches or worn areas which can not be repaired is cause for rejection. Conduct a magnetic-particle inspection per MIL-STD-1949. Any sign of cracking is cause for rejection. Check the orifice O.D. does not exceed wear tolerances. Check that orifice hole does not exceed 0.185/0.180 inches. Cadmium plate as necessary per Fed QQ-P-416, Type I, Class 2. NOTE: If the orifice assembly P/N 35-825195 exceeds wear tolerances, use Orifice Assembly P/N 36-820021 as a replacement spare.

CHART 1
NOSE GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Orifice Assembly (6) **P/N 36-820021** (CE-980 and After; CJ-156 and After; D-10397 and After; E-1970 and After; EA-273 and After)	---	1.449 1.436	Visually inspect for wear, damage and corrosion. Any sign of scratches or worn areas which can not be repaired is cause for rejection. Conduct a magnetic-particle inspection per MIL-STD-1949. Any sign of cracking is cause for rejection. Check the orifice O.D. does not exceed wear tolerances. Check that orifice hole does not exceed 0.142/0.140 inches. Cadmium plate as necessary per Fed QQ-P-416, Type I, Class 2.
Barrel Assembly (23)			Visually inspect for wear, damage and corrosion. Any sign of scratches or worn areas which can not be repaired is cause for rejection. Conduct a magnetic-particle inspection per MIL-STD-1949. Any sign of cracking is cause for rejection.
Bearings			
- Upper	1.755 1.751	---	Visually inspect for wear, damage and corrosion. Replace barrel assembly if wear tolerances are exceeded.
- Lower	1.755 1.751	---	Visually inspect for wear, damage and corrosion. Replace barrel assembly if wear tolerances are exceeded.
Upper Torque Knee Attachment Hole	0.3755 0.3745	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
Piston and Fork Assembly (48)			
Chrome Portion (top)	1.490 1.482	---	Visually inspect for wear, damage and corrosion. Any sign of scratches and worn areas which can not be repaired is cause for rejection. Conduct a magnetic-particle inspection per MIL-STD-1949. Any sign of cracking is cause for rejection. Replace if wear tolerances are exceeded.

CHART 1
NOSE GEAR WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Axle	---	1.249 1.248	Visually inspect for wear, damage and corrosion. Any sign of scratches and worn areas which can not be repaired is cause for rejection. Conduct a magnetic-particle inspection per MIL-STD-1949. Any sign of cracking is cause for rejection. Strip and cadmium plate axle as necessary, per Fed QQ-P-416, Type II, Class 2 on scratched or worn areas.
Brace Assembly (15)			Visually inspect for wear, damage and corrosion. Any scratches or worn areas which can not be repaired is cause for rejection. Remove all bearings and inspect for corrosion. Conduct fluorescent or dye penetrant inspection per MIL-STD-6866. Any crack is cause for rejection. Coat interior of brace and hinge bearing holes with corrosion preventative compound per MIL-C-16173, Grade 1 or 2. Replace all bearings when nose gear is overhauled.
Hinge Bushings (12)	0.4692 0.4682	---	Replace bearings when nose gear is overhauled. Alignment ream new bearings to specified wear tolerances. Drill out lubricator holes through bearings and install lubricators.
Internal Bearings			
- Upper and Lower (8 and 22)	2.252 2.250	---	Replace bearings when nose gear is overhauled. Alignment ream new bearings to specified wear tolerances. Drill out lubricator holes through bearings and install lubricators.
Instruction Placards			Do not remove from brace assembly except for inspection purposes or replacement.

NOSE GEAR ASSEMBLY

NOTE

Prior to assembly, immerse all internal parts (except felt pad (24)) in hydraulic fluid (9, Chart 1, 91-00-00).

a. Install new O-ring (38) into the upper bearing of the barrel (23). Two dowel rods may be used to work O-ring into position (Ref. Figure 1).

b. Saturate felt pad (24) with SAE 10W30 oil before installation. Install felt pad (24) in the barrel (23) (Ref. Figure 2).

c. Install new scraper (31), adapter (32) and secure with snap ring (33).

d. Install barrel (23) into the brace (15).

e. Install shim (3) as necessary.

NOTE

Add or remove lamination from shim (3) as necessary for free operation. Maximum clearance is 0.012 between collar (2) and brace (15).

f. Install collar (2) to brace (15) and tighten two bolts securing collar. Rotate collar to ensure freedom of movement after tightening bolts. Adjust shim (3) as necessary to allow collar to rotate freely. Secure bolts with safety wire.

g. Install air valve assembly (1) excluding valve core.

h. Install upper torque knee (37) with the pins (25 and 34), and cotter pin (36).

NOTE

Install the washers (17 and 19) above or below the bushing (18) on the brace (15) to align the shimmy damper (20) with the lug on the barrel (23)

i. Position shimmy damper (20) and install the bushing (18), bolt (21), washers (17 and 19) and nut (16).

j. Install the bushing (28), bolt (26), washers (27 and 29) and nut (30) to connect the shimmy damper (20).

k. Slide the piston and fork assembly (48) into the barrel (23).

l. Connect the lower torque knee (46) with the pins (42 and 47), washers (49 and 51) and cotter pin (50).

m. Install the bushing (45), bolt (43), washers (39 and 44), nut (41) and cotter pin (40), to connect the upper and lower torque knees (37 and 46).

n. Install new O-ring (5) and piston ring (7) to orifice tube (6). Push orifice tube (6) down into the barrel (23) and secure by attaching snap ring (4) to the top of collar (2).

o. Lubricate bearings at grease fittings with grease (46, Chart 1, 91-00-00).

p. With the strut in the vertical position and approximately 1/4 inch from fully compressed, fill through the air valve assembly (1) with approximately 500/550 cc of hydraulic fluid (9, Chart 1, 91-00-00).

q. Fully extend and recompress the piston and fork assembly (48) three times or until no additional fluid can be added. Add additional fluid as required with the strut in the compressed position.

r. With the piston and fork assembly (48) compressed, install the valve core into air valve assembly (1).

WARNING

As with all operations involving equipment under high pressure, exercise caution when performing the leak test; avoid the areas directly above and below the strut.

s. To leak test, inflate the nose gear to approximately 90 psi using dry air or nitrogen. Coat the top of the collar (2) and air valve assembly (1) with soapsuds and test for air leaks.

t. Release the air pressure by depressing the valve core in the air valve assembly (1). Clean the soapsuds from the top of the collar (2) and air valve assembly (1) with fresh water.

u. Install the air valve cap to the air valve assembly (1).

a. Perform the NOSE WHEEL INSTALLATION procedure in Chapter 32-40-00.

a. Perform the NOSE GEAR INSTALLATION procedure in 32-20-00.

a. Perform the SHOCK STRUTS procedure in Chapter 12-20-00.

NOSE GEAR SHIMMY DAMPER SERVICING

Perform the SHIMMY DAMPER procedure in Chapter 12-20-00.

NOSE GEAR SHIMMY DAMPER REMOVAL

a. Remove the nut (16), washers (17 and 19), bushing (18), and bolt (21) which attach the shimmy damper (20) to the brace (15) (Ref. Figure 2).

b. Remove the nut (30), washers (27 and 29), bushing (28), bolt (26) and remove the shimmy damper (20) from the barrel (23).

NOSE GEAR SHIMMY DAMPER INSTALLATION

a. Install the bushing (28), washers (27 and 29), nut (30) and bolt (26) attaching the shimmy damper (20) to the barrel (23).

b. Install the bushing (18), washers (17 and 19), nut (16) and bolt (21) attaching the shimmy damper (20) to the nose gear brace (15). For alignment purposes, attach a 100951-X031-YN washer (19) between the damper and the lug on the brace, and a 100951-X031-YM washer (17) under the nut.

c. Swivel the nose wheel to check the turning radius of the strut and for freedom of movement without binding or rough spots. Adjust the nose gear steering travel adjustment bolts to stop shimmy damper piston 1/32 inch to 1/4 inch from maximum travel in both directions.

NOSE GEAR SHIMMY DAMPER OVERHAUL

NOTE

Refer to the OVERHAUL AND REPLACEMENT SCHEDULE in Chapter 5-10-00 for time limits and maintenance checks of the nose gear shimmy damper.

NOSE GEAR SHIMMY DAMPER DISASSEMBLY

a. Remove cotter pin (1), washer (8) and compression spring (9) by holding the washer (8) down with a small rod or screw driver so that the parts will not spring out when the cotter pin (1) is removed (Ref. Figure 3).

b. Remove the floating piston (10) by engaging it with a long 6-32 screw or threaded rod. Remove O-ring (11) from the floating piston (10).

c. Remove the snap ring (2) and piston scraper (3). Force the barrel end (5) out of the barrel (6) by working the piston rod (12) back and forth. Remove O-rings (4) from the barrel end (5).

d. Remove all remaining hydraulic fluid by inverting shimmy damper and pumping the piston rod (12).

e. Remove the snap ring (23) and slide the piston rod (12) with the remaining parts out of the barrel (6).

f. Insert a long 6-32 screw or threaded rod into the hole at the clevis (24) end of the piston rod (12) and engage the forward floating piston (17). Pull floating piston (17) toward clevis (24) so that the piston retaining pin (15) can be driven-out.

g. Remove the piston retaining pin (15) and push the floating piston (17) out the open end of the piston rod (12) and remove O-ring (16).

h. Remove the remaining compression spring (18) and slide the damper piston (14) off the piston rod (12). Remove O-rings (13) from the damper piston (14).

i. Remove remaining barrel end (19) and piston scraper (22) from the piston rod (12). Remove O-rings (20) and (21) from the barrel end (19).

NOSE GEAR SHIMMY DAMPER CLEANING, REPLACEMENT PARTS AND REPAIRS

CLEANING

Clean all parts with cleaning solvent (16, Chart 1, 91-00-00). Rinse and dry thoroughly after cleaning.

CAUTION

For replacement, use O-rings approved for use with mineral base hydraulic fluid.

Lubricate all internal parts with hydraulic fluid (9, Chart 1, 91-00-00) prior to assembly.

REPLACEMENT PARTS

a. Inspect all parts and assemblies for damage or excessive wear (Ref. Figure 3). The following conditions are cause for rejection:

- Wear which is greater than the allowable wear tolerances. Refer to Chart 2, NOSE GEAR SHIMMY DAMPER WEAR TOLERANCES AND INSPECTION PROCEDURES.
- Damage which cannot be corrected or repaired.
- Parts that are cracked, chipped or broken.
- Parts that have corrosion or other defects that cannot be repaired.

b. Replace the following parts when nose gear shimmy damper is overhauled:

- Cotter Pin (1)
- Retaining Pin (15)
- O-Rings (4, 11, 13, 16, 20, 21)
- Safety Wire
- Snap Ring (2)
- Springs (9, 18)
- Piston Scrapers (3, 22)
- Washer (8)

REPAIRS

a. Visually inspect casting for cracks and pitting; and finished surfaces for scoring, pitting, nicks, cracks, distortion and wear. Refer to Chart 2 for tolerances to aid in determining the extent of wear. Replace all defective and excessively worn parts.

b. All parts or assemblies may be repaired if any of the following problems exist:

- Slight scoring of shafts may be corrected by lapping carefully with a flat oil stone.

NOTE

Do not exceed 10% of the component material thickness when removing nicks, burrs and scratches.

- Smooth minor nicks, burrs, and scratches.
- Those parts that are scratched or have worn plating may be stripped and replated with the same type of plating as that removed or be replaced with new parts.
- Minor thread damage, chase to clean or smooth.

NOTE

Corrosion damage requires inspection to determine the depth of penetration and the cross-sectional area change. The damaged area must be thoroughly cleaned and the corrosion must be removed. The deterioration caused by corrosion or removal of corrosion must not reduce the material thickness of any component by more than 10%. Refer to Chart 2 for NOSE GEAR SHIMMY DAMPER WEAR TOLERANCES AND INSPECTION PROCEDURES on components. For additional information contact the Technical Support Department of Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.

- Remove corrosion if applicable, and apply corrosion prevention materials as necessary per MIL-C-5541 or cadmium plate per Fed QQ-P-416, Type II.
- Bushings that check within allowable wear tolerances may be reused.

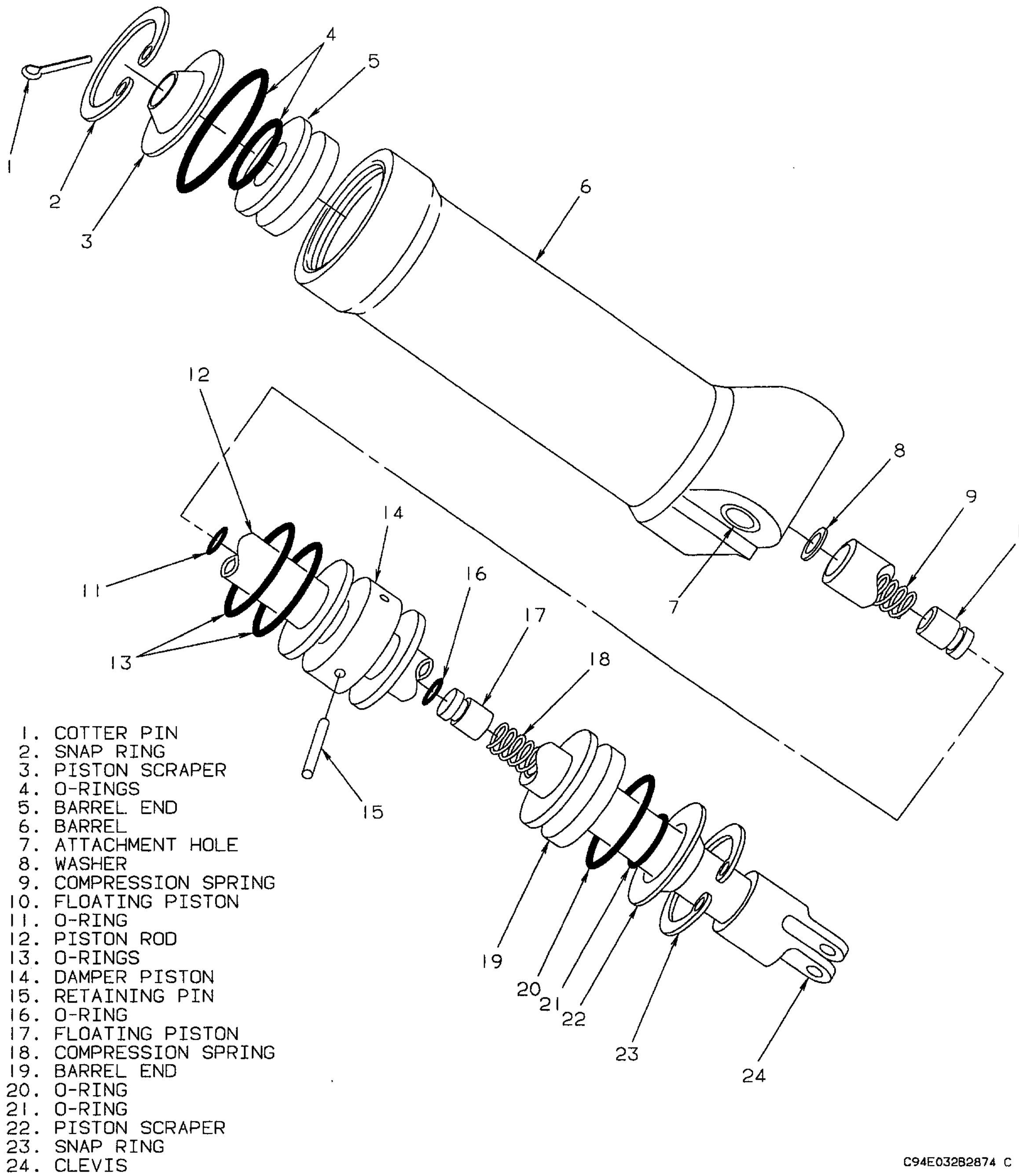
- When evidence of damage exists to steel parts, magnetic particle inspect per MIL-STD-1949.

NOTE

Do not remove paint or primer from the area to be fluorescent or dye penetrant inspected per MIL-STD-6866. If the finish absorbs the penetrant so that bleed out prevents satisfactory inspection or if a new finish has not cured for at least 30 days, contact the Technical Support Department of Raytheon Aircraft Company, P.O. Box 85, Wichita, KS 67201.

- When evidence of damage exists to metal parts other than steel, fluorescent penetrant inspect per MIL-STD-6866, Type I.

- Replace damaged or unserviceable parts with new or serviceable parts.



1. COTTER PIN
2. SNAP RING
3. PISTON SCRAPER
4. O-RINGS
5. BARREL END
6. BARREL
7. ATTACHMENT HOLE
8. WASHER
9. COMPRESSION SPRING
10. FLOATING PISTON
11. O-RING
12. PISTON ROD
13. O-RINGS
14. DAMPER PISTON
15. RETAINING PIN
16. O-RING
17. FLOATING PISTON
18. COMPRESSION SPRING
19. BARREL END
20. O-RING
21. O-RING
22. PISTON SCRAPER
23. SNAP RING
24. CLEVIS

Shimmy Damper
Figure 3

NOSE GEAR SHIMMY DAMPER ASSEMBLY

a. Replace the O-rings (20 and 21) on the barrel end (19). Slide the piston scraper (22) and barrel end onto piston rod (12) (Ref. Figure 3).

b. Replace the O-ring (16) on the floating piston (17) and insert the compression spring (18) and the floating piston into the piston rod (12). With a long 6-32 screw or threaded rod, engage the floating piston (17) by pulling it toward the clevis (24) so that the retaining pin (15) can be inserted. Install the damper piston (14) on the piston rod (12) and insert the retaining pin (15). Replace the O-rings (13) on the damper piston (14).

c. Insert the piston rod (12) and components into the barrel (6) and place the snap ring (23) into position.

d. Place the barrel (6) in a vise with the open end up and fill the barrel (6) and piston rod (12) with hydraulic fluid (9, Chart 1, 91-00-00). Work the piston rod (12) up and down until bubbles stop appearing in the fluid, then refill the barrel (6) and the piston rod (12). To eliminate the possibility of an air pocket under the barrel end (5), ensure that the barrel (6) is completely full of hydraulic fluid. Any excess fluid will be forced into the piston rod (12) as the barrel end (5) is inserted.

e. Replace the O-rings (4) on the barrel end (5). Insert the barrel end (5) and piston scraper (3) into the barrel (6) and secure with snap ring (2).

f. Fill the piston rod (12) with hydraulic fluid (9, Chart 1, 91-00-00). Engage the floating piston (17) with a 6-32 long screw and pull towards the clevis (24). At the same time, insert and push the floating piston (10) down into the piston rod (12). This will cause hydraulic fluid to be sucked into the piston rod (12) and preventing the entry of air.

g. Install compression spring (9), washer (8) and secure with cotter pin (1). Release the 6-32 rod from the piston (17) and remove from the assembly.

h. Check the fluid level in the shimmy damper by spreading the cotter pin (1) and inserting a 1/16-inch-diameter wire into the piston rod (12). Measure the distance to the top of the floating piston (10). If the distance to the piston rod (10) exceeds 2 3/16 inches, remove the floating piston (10) and add more fluid to the piston rod (12).

i. Install shimmy damper on nose gear of the airplane. Perform the NOSE GEAR SHIMMY DAMPER INSTALLATION procedure.

j. Service the shimmy damper. Perform the SHIMMY DAMPER procedure in Chapter 12-20-00.

CHART 2
NOSE GEAR SHIMMY DAMPER WEAR TOLERANCES AND INSPECTION PROCEDURES

NOTE

Listed below are the tolerances used to determine the extent of wear in the nose gear shimmy damper components. Where pertinent, the permissible wear limits are given for those components. All inside-diameter (I.D.) and outside-diameter (O.D.) dimensions are given in inches (Ref. Figure 3).

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Barrel (6)	0.865 0.860	---	Visually inspect for wear, damage and corrosion. Any sign of scratches or worn areas which can not be repaired is cause for rejection. If localized damage exists, conduct a fluorescent or dye penetrant inspection per MIL-STD-6866. Any sign of cracking is cause for rejection. Replace if wear tolerances are exceeded.
Attachment Hole (7)	0.3765 0.3745	---	Visually inspect for wear, damage and corrosion. Replace if wear tolerances are exceeded.
Damper Piston (14)	---	0.857 0.850	Visually inspect for wear, damage and corrosion. Replace if there is any noticeable ridges or grooves at O-ring seats. Replace if wear tolerances are exceeded.
Floating Pistons (10 and 17)	---	0.240 0.232	Visually inspect for wear, damage and corrosion. Replace if there is any noticeable ridges or grooves at O-ring seat. Replace if wear tolerances are exceeded.
Piston Rod (12)	0.253 0.246	0.3745 0.3725	Visually inspect for straightness, cracks, scratches, corrosion or worn areas. Any signs of wear which can not be repaired is cause for rejection. Replace if wear tolerances are exceeded.
Clevis (24)			Visually inspect for wear, damage and corrosion. Cadmium plate as necessary per Fed QQ-P-416, Type II, Class 2.
- Bore	0.196 0.190	---	Visually inspect for any sign of wear. Replace if wear tolerances are exceeded.
- Slot	0.198 0.193	---	Visually inspect for any sign of wear. Replace if wear tolerances are exceeded.

CHART 2
NOSE GEAR SHIMMY DAMPER WEAR TOLERANCES AND INSPECTION PROCEDURES (CONTINUED)

ITEM	I.D.	O.D.	WEAR TOLERANCES AND INSPECTION PROCEDURES
Barrel Ends (5 and 19)			Visually inspect for wear, damage and corrosion. Corrosion proof with coating (53, Chart 1, 91-00-00) as required.
Hole Diameter	0.379 0.376	---	Visually inspect for wear or damage. Replace if wear tolerances are exceeded.

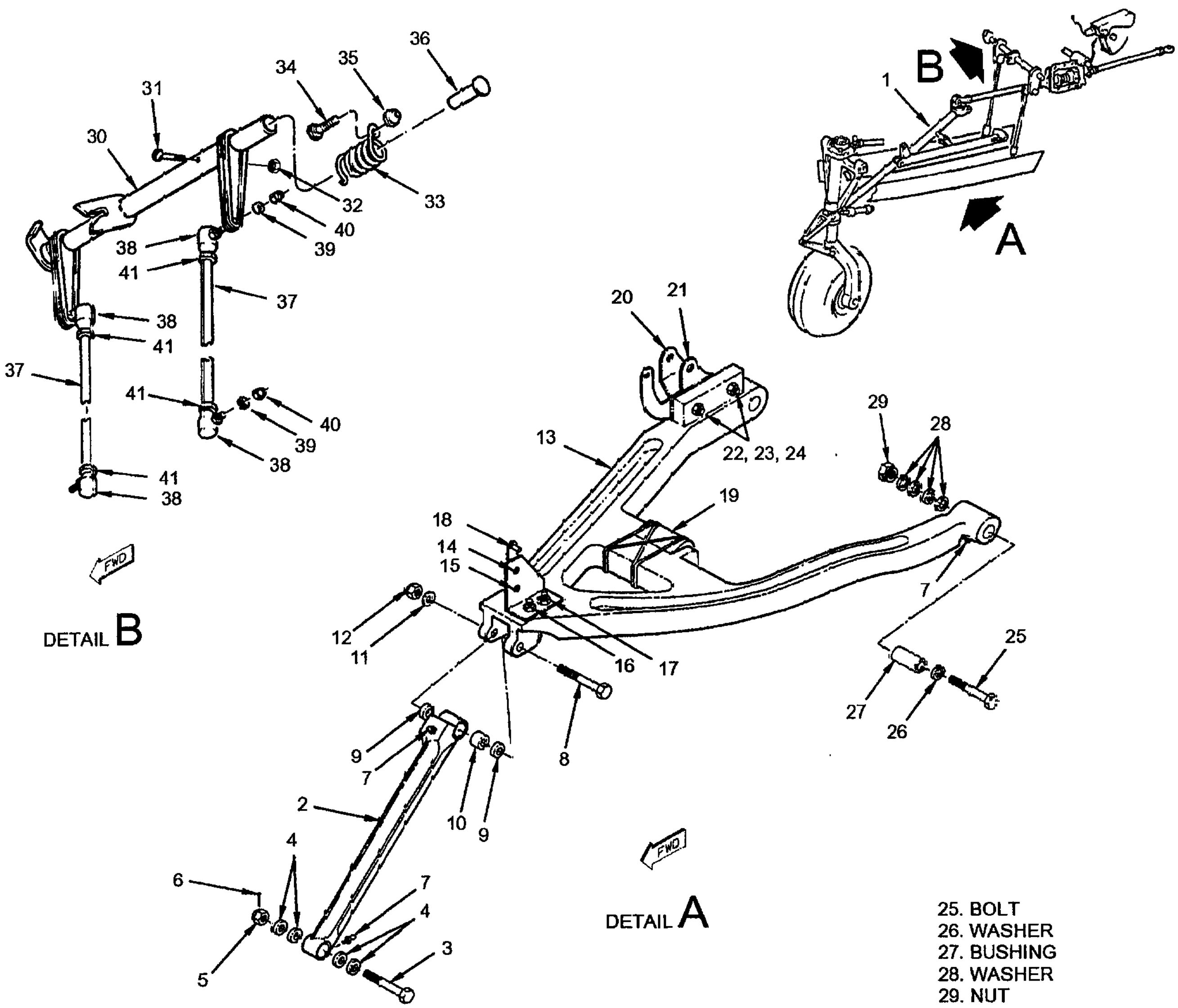
NOSE GEAR RETRACT MECHANISM SERVICING

NOSE GEAR RETRACT BRACE ASSEMBLY CHECK (E-1103 AND AFTER; E-1 THRU E-1102 WITH KIT 35-4012-1 INSTALLED)

a. Check outboard arm (20), inboard arm (21), attachment bolts (22), washers (23) and nuts (24) for security (Ref. Figure 4).

b. Check the retract rod rod-ends (58) and (88) for indications of cracking and the mechanism assembly for shear stress, wear and/or corrosion. Refer to SCHEDULED MAINTENANCE CHECKS - MAINTENANCE PRACTICES in Chapter 5-20-00.

c. Tighten any loose hardware and replace all hardware that show signs of shear stress, wear, corrosion and/or cracking. Clean area of any corrosion before installing hardware.

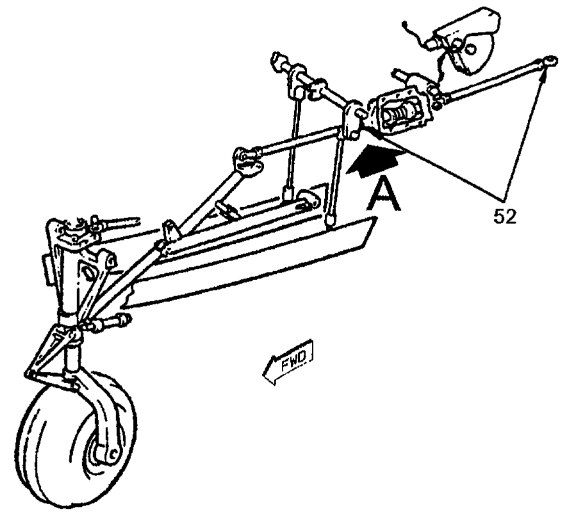


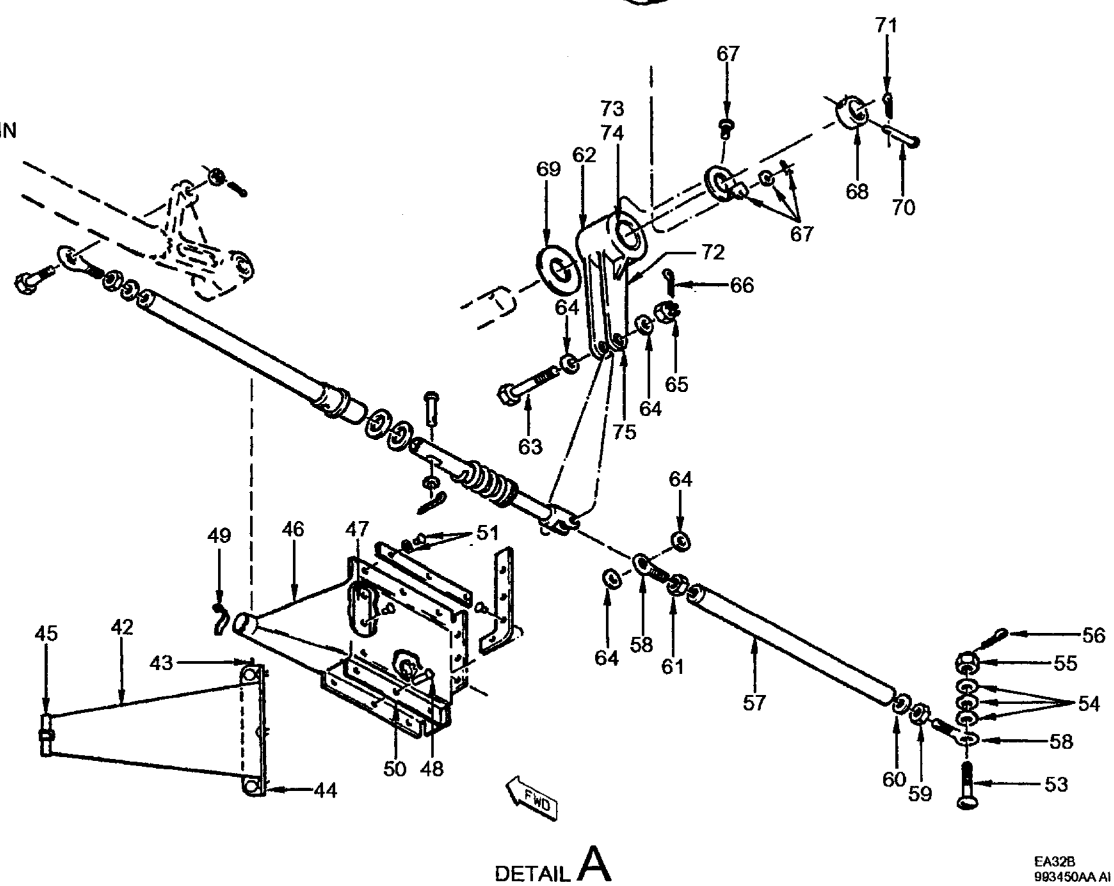
1. RETRACT BRACE ASSEMBLY
2. RETRACT DRAG LEG ASSEMBLY
3. BOLT
4. WASHER
5. NUT
6. COTTER PIN
7. LUBE FITTING AND BUSHING
8. BOLT
9. BUSHING
10. BUSHING
11. WASHER
12. NUT
13. AFT DRAG BRACE ASSEMBLY
14. DOOR ACTUATOR BRACKET AND PIN SUPPORT
15. SCREW, WASHER, NUT
16. BOLT, WASHER, NUT
17. BOLT, WASHER, NUT
18. DOOR ACTUATOR PIN ASSEMBLY
19. BUMPER
20. OUTBOARD ARM
21. INBOARD ART
22. DRAG BRACE ATTACHMENT BOLT
23. WASHER
24. NUT
25. BOLT
26. WASHER
27. BUSHING
28. WASHER
29. NUT
30. DOOR ACTUATOR SHAFT ASSEMBLY
31. SCREW
32. NUT
33. SPRING
34. SCREW
35. NUT
36. ROD END
37. DOOR ACTUATOR ROD ASSEMBLY
38. BALL JOINTS
39. WASHER
40. NUT
41. NUT

EA32B
993449AA AI

Nose Gear Retract Mechanism
(E-1103 and After; E-1 thru E-1102 With Kit 35-4012-1 Installed)
Figure 4 (Sheet 1 of 3)

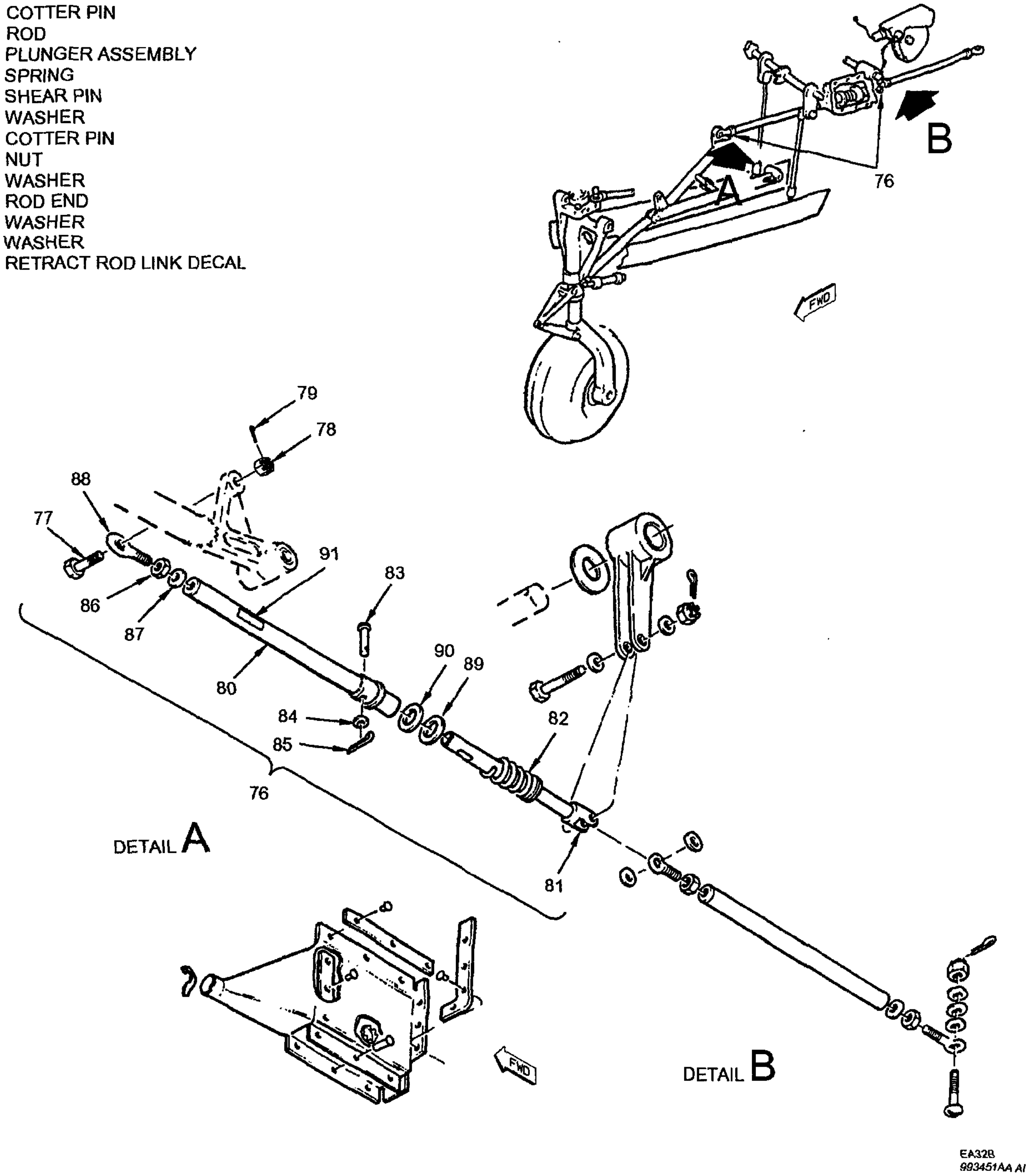
42. RETRACT ROD BOOT ASSEMBLY
43. BOOT RETAINING RING
44. STUD
45. CABLE TIE
46. RETRACT ROD BOOT
47. STRIP
48. STUD
49. CABLE TIE
50. COVER
51. SCREW AND WASHER
52. RETRACT AFT ROD ASSEMBLY
53. BOLT
54. WASHER
55. NUT
56. COTTER PIN
57. TUBE
58. ROD END
59. NUT
60. WASHER
61. NUT
62. RETRACT IDLER ARM ASSEMBLY
63. BOLT
64. WASHER
65. NUT
66. COTTER PIN
67. BRACKET
68. COLLAR
69. WASHER
70. FLATHEAD PIN
71. COTTER PIN
72. IDLER ARM
73. BUSHING
74. BEARING
75. BUSHING





Nose Gear Retract Mechanism
(E-1103 and After; E-1 thru E-1102 With Kit 35-4012-1 Installed)
Figure 4 (Sheet 2 of 3)

76. RETRACT FORWARD LINK ROD ASSEMBLY
77. BOLT
78. NUT
79. COTTER PIN
80. ROD
81. PLUNGER ASSEMBLY
82. SPRING
83. SHEAR PIN
84. WASHER
85. COTTER PIN
86. NUT
87. WASHER
88. ROD END
89. WASHER
90. WASHER
91. RETRACT ROD LINK DECAL



Nose Gear Retract Mechanism
(E1103 and After; E-1 thru E-1102 With Kit 35-4012-1 Installed)
Figure 4 (Sheet 3 of 3)

EXTENSION AND RETRACTION - MAINTENANCE PRACTICES

LUBRICATION

Lubricate the landing gear and retract system as detailed in the Lubrication Chart in Chapter 12-20-00. Note LUBRICATION OF LANDING GEAR UPLOCK ROLLERS in Chapter 12-20-00.

MANUAL LANDING GEAR EXTENSION SYSTEM

In the event of landing gear malfunction in flight, the gear may be manually extended by a hand crank located behind the front spar between the pilot's and copilot's seats.

WARNING

If the gear has been extended manually for emergency reasons, the airplane must be put on jacks and inspected before the gear controls are returned to their normal position.

CAUTION

Do not attempt to retract the landing gear using the hand crank. The manual extension system is designed to lower the landing gear only. Refer to the appropriate Pilot's Operating Handbook for emergency operating instructions.

The landing gear should not be operated electrically with the hand crank engaged. In the event of such operation, a teardown and magnetic inspection should be performed to check for damage to the engagement slot in the worm shaft of the landing gear actuator.

LANDING GEAR ACTUATOR ASSEMBLY REMOVAL

a. Remove the cabin front seats.

b. Remove the access cover on top and directly behind the front carry-through structure.

c. Disconnect the main landing gear retract rods at the actuator.

d. Remove the flap motor attaching bolts and disconnect the landing gear door attaching rods at the actuator.

e. Remove the four screws securing the landing gear limit switch assembly on the left-hand side of the actuator and move the switch assembly aside to permit removal of the actuator.

f. Disconnect the electrical wiring to the landing gear motor. Identify the wires for ease of reinstallation.

CAUTION

Do not remove the shaft from the sector gear of the actuator. If the shaft is removed, teardown of the actuator is necessary for reinstallation of the shaft.

NOTE

For ease of reinstallation, note the index marks on the arm and actuator.

g. Remove the landing gear actuator access door on the bottom of the fuselage, and remove the nose gear actuator arm and linkage from the actuator.

h. Remove the four actuator attaching nuts and remove the actuator.

LANDING GEAR ACTUATOR ASSEMBLY INSTALLATION

a. Position the actuator and install the four attaching bolts.

b. Connect the nose landing gear rod and linkage to the actuator. Make certain that the index mark on the arm coincides with the index mark on the actuator shaft.

c. Install the landing gear actuator access door on the bottom of the fuselage.

d. Connect the landing gear motor electrical wiring.

e. Attach the landing gear limit switch assembly to its bracket.

f. Connect the landing gear door attaching rods at the actuator. Attach the flap motor attaching bolts.

g. Connect the main gear retract rods at the actuator.

h. Install cotter pins and safety wire.

CAUTION

Excessive operation of the landing gear motor without proper cooling may cause damage to the landing gear motor. Allow a 2-minute-cooling time after each extension and retraction cycle.

i. Check rigging of landing gear system. When cycling the gear, listen for unusual noises at the motor and actuator. Cycle the gear a minimum of six times.

j. Install the access covers on top and directly behind the front carry-through structure.

k. Install the cabin front seats.

LANDING GEAR MOTOR REMOVAL

a. Remove the right front seat.

b. Remove the access plate over the motor and disconnect the electrical wiring. Identify the wires for ease of reinstallation.

c. Remove the three landing gear motor attaching bolts and remove the landing gear motor.

LANDING GEAR MOTOR INSTALLATION

a. Position the landing gear motor on the actuator and install the attaching bolts. Safety wire the attaching bolts.

b. Connect the landing gear motor electrical wiring and install the access plate over the motor.

c. Install the right hand seat.

DYNAMIC BRAKE RELAY CHECK

The landing gear is operated by a split-field, series-wound motor located on the forward side of the main spar carry-through. One field is used to drive the motor in each direction. To prevent overtravel of the gear, a dynamic brake relay is incorporated into the landing gear circuit and acts as a brake on the motor. When either the up or downlimit switches activate, the relay simultaneously breaks the power circuit to the motor and makes a complete circuit through the armature and the unused field windings, turning the motor onto a generator. The resulting electrical load applied to the armature stops the gear almost instantly.

To check the dynamic brake relay for proper operation, it is necessary to remove the spar cover to gain access to the actuator and limit switches.

Actuate the landing gear with the landing gear handle (either up or down). When the actuator reaches midtravel position, actuate the appropriate limit switch in the direction the actuator is traveling. The landing gear motor should stop immediately without any noticeable coast.

LANDING GEAR DYNAMIC BRAKE RELAY REMOVAL

a. Remove the right front seat.

b. Remove the access plate which covers both the landing gear motor and the dynamic brake relay.

c. The dynamic brake relay is located slightly outboard and below the landing gear motor. Identify and disconnect the wiring to the dynamic brake relay.

d. Remove the two screws which secure the dynamic brake relay assembly to its attaching bracket.

e. Remove the dynamic brake relay.

LANDING GEAR DYNAMIC BRAKE RELAY INSTALLATION

a. Position the dynamic brake relay on its attaching bracket and install the two attaching screws.

b. Connect the wiring which was disconnected during removal.

c. Install the access cover which covers the landing gear motor and the dynamic brake relay.

d. Install the right front seat.

MAIN LANDING GEAR RETRACT ROD REMOVAL FIGURE 1

a. Remove the pilot's and the right front seat.

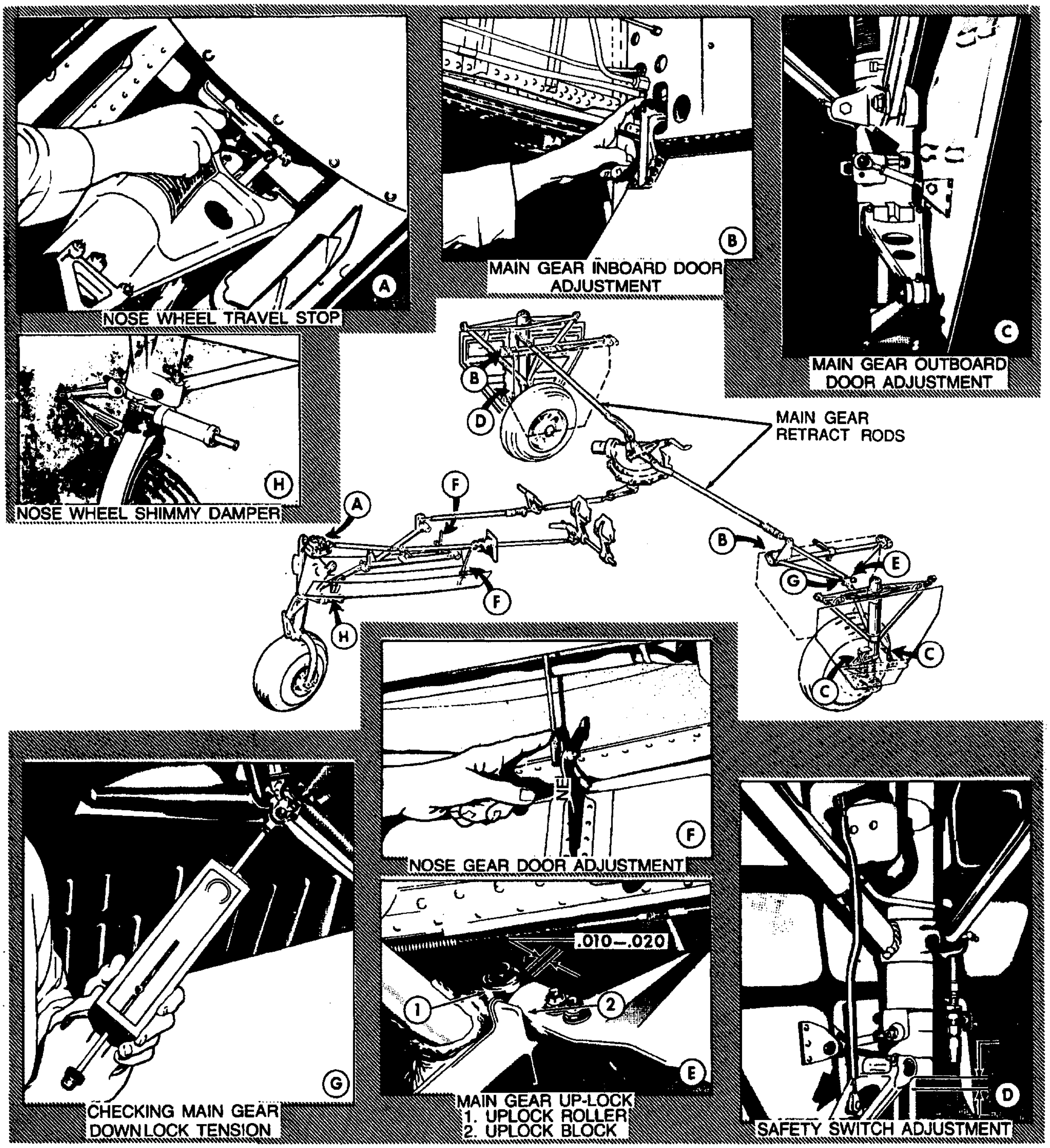
b. Remove the access covers directly aft of the front carry-through spar.

c. With the airplane on jacks, partially retract the landing gear until the inboard door is fully open.

d. Remove the attaching bolts and disconnect the retract rod from the landing gear actuator retract arm.

e. Remove the attaching bolt and disconnect the retract rod from the main landing gear V-brace.

f. Remove the retract rod through the wheel well.



Landing Gear System
Figure 1

MAIN LANDING GEAR RETRACT ROD INSTALLATION FIGURE 1

a. Position the landing gear retract rod in the main landing gear V-brace located in the wheel well.

b. Install the attaching bolt in the main landing gear V-brace and the main landing gear retract rod.

c. Position the main landing gear retract rod in the main landing gear actuator retract arm and install the attaching bolts.

d. Install the access covers immediately aft of the front carry-through spar.

e. Install the pilot's and the right front seat.

RIGGING THE LANDING GEAR

Read the entire landing gear rigging procedure before any attempt to rig the landing gear system. Physically locate each item while reading through the rigging instructions. When any part of the landing gear system requires rigging, it is recommended that ALL of the rigging steps be accomplished in the order shown.

CAUTION

Do not change the position of the control switch to reverse the direction of the landing gear while the landing gear is in transit, as this could cause damage to the landing gear retract mechanism.

After the airplane is placed on jacks, but before beginning to rig the landing gear, start the retraction cycle enough to break the downlock tension. Apply a sharp load by hand against the nose landing gear strut. Approximately a half to one inch of movement under this load by the main landing gear wheels is a good indication that the landing gear actuator needs to be overhauled and/or adjusted.

CAUTION

Battery voltage is not sufficient to properly cycle the landing gear during the rigging procedure. A 28.25 ± 0.25 volt power supply should be utilized for the landing gear during rigging. If an external power supply is not available on the airplane, jumper cables may be used between the battery and the power supply. Be sure of the polarity before connecting the power supply to the battery.

Excessive operation of the landing gear motor without proper cooling may cause damage to the landing gear motor. Allow a 2-minute-cooling time after each extension and retraction cycle.

Whenever the landing gear mechanism or doors are removed or disconnected, retract the landing gear and check the rigging. The following procedure for rigging the landing gear was written on the assumption that the entire landing gear is out of rig.

WARNING

To prevent possible injury, the emergency landing gear actuator hand crank must always be disengaged when operating the landing gear electrically.

CAUTION

Overtightening the nut on the bolt connecting the drag leg to the shock strut can bind the strut or distort the strut attaching points. Torque the nut to 25 to 75 inch-pounds.

a. Place the airplane on jacks as instructed in Chapter 7-00-00.

b. Lengthen the main and nose landing gear retract rods sufficiently to prevent excessive tension on the nose gear retract rods and to eliminate the danger of the V-brace on the main landing gears damaging the skin when the landing gear is retracted. Damage to vital parts may result if abnormal loads are applied to the landing gear retract system. By lengthening the main and nose gear retract rods, such danger is removed.

c. Insert the landing gear retract arm/retract rod attach bolt pointing aft.

d. Disconnect the uplock cables at the brackets, leaving the springs attached. If the springs are disconnected, the uplock arm may damage the wing skin upon retraction of the gear. Place the uplock block in the lower position.

e. Lengthen the nose landing gear retract rod.

f. Disconnect the nose landing gear door linkage at the attaching point on the nose landing gear door. Unscrew the nose landing gear door links from the upper ball joint.

g. Remove the bolts attaching the main landing gear outboard door links at the main strut. Remove the actuator rod to the inboard main landing gear door by unscrewing from the inboard rod ends and removing the bolt in the door bracket.

h. Screw the stop bolts into the main gear V-brace assembly until approximately four or five threads are showing.

CAUTION

When running the landing gear electrically before the switches are reset, or for the first time after resetting the switches, run the landing gear with extreme care to make sure the switches open the electrical circuits before the sector gear hits the internal stops in the gearbox. The sector gear should not be touching the stop when the motor stops. Serious damage may result if the internal stops are hit by the sector gear. When checking the dynamic brake system, actuate one of the limit switches and the motor should stop immediately.

On airplanes with a 5-amp push-pull landing gear control circuit breaker, use this circuit breaker to "bump" the landing gear. On earlier airplanes without the 5-amp push-pull circuit breaker, manually operate the limit switches and use the 30-amp landing gear motor circuit breaker to "bump" the landing gear. When using the 30-amp circuit breaker, use extreme care because the dynamic brake is inoperative.

i. Run the gear about two thirds up, then stop and "bump" the landing gear the remaining distance to either the limit switch setting or to the internal stop by intermittent operation of the LDG GEAR circuit breaker. With the actuator in the retracted position, check that the hand crank will rotate 1/8 to 1/4 turn (5/8 to 3/4 turn on new, or white actuators) before reaching the internal stop of the actuator.

NOTE

A new actuator may be installed on earlier airplanes as a spare. The new actuator may be identified by white epoxy paint on the upper actuator arm, and the upper and lower actuator housing. When the new actuator is installed as a spare on earlier airplanes, the actuator should be adjusted by using the 5/8 to 3/4 hand crank turns remaining after the motor has stopped. If this clearance is not obtained, adjust the uplimit switch. To adjust the uplimit switch, lower the landing gear 5/8 to 3/4 turns of the emergency hand crank, and adjust the switch by turning the screw in the actuator in or out to increase or decrease travel so that it just breaks the circuit.

j. Extend the landing gear and check the hand crank. There should be 1/8 to 1/4 turn (or 5/8 to 3/4 turn on the new (or white) actuators) between the extended position and the internal stop. The downlimit switch adjustment is accomplished by bending the switch actuator arm tab so that it just breaks the circuit. On newer actuators, there is an adjustment screw for use when adjusting the downlimit switch.

NOTE

On airplane serials CE-959 and after, CJ-156 and after, D-10380 and after, E-1879 and after, and EA-247 and after, the landing gear will retract slightly slower than on previous serials because the motor used runs slower in the retract cycle.

Allow 2 minutes of cooling time between each extend and retract cycle

k. Extend and retract the landing gear two or three times to assure that the switches are correctly set and the dynamic brake is operating correctly. Check the hand crank each time to ensure proper adjustment.

NOTE

It may be necessary to make a closer setting of the limit switches, but there should never be less than 1/8 of a turn (5/8 of a turn with the new (or white) actuators) on the hand crank in either the extended or retracted position.

l. Adjust the main landing gear retract rod (either right or left) to maintain a minimum of 1/16-inch clearance between the joint (knee) of the V-brace and the lift leg and the top wing skin with the landing gear fully retracted. The main landing gear should retract only far enough to clear the inboard door while maintaining the minimum clearance of 1/16-inch. To decrease the clearance between the knee and the top wing skin, shorten the retract rod; to increase clearance, lengthen the retract rod.

m. When the proper setting is obtained, leave the landing gear in the retracted position and screw the upper stop bolt down against the main strut. To assure a firm seating, insert a 0.003-inch feeler gage under the bolt head and adjust the bolt until a firm, steady effort is required to pull the feeler gage from under the bolt head. With the feeler gage removed, screw the bolt down an additional 3/4 turn. Tighten the locknut securely.

NOTE

Refer to service instructions No. 0448-211, Rev, 1, entitled Landing Gear - Main Gear Retract Mechanism - Installation of Uplock Roller Lubricating Bolt Assembly.

n. Check the uplock roller for free movement and a maximum clearance of 0.010 to 0.020 inch between the roller and the uplock block. If this clearance is not correct, the uplock block must be adjusted. To adjust, loosen the block retaining bolts and adjust the clearance between the roller and the uplock block. The uplock bracket and the block are serrated and the serrations must be interlocked.

o. Extend the landing gear and attach the uplock cable to the bracket.

CAUTION

The attach bolt on the uplock cable must be installed with the head of the bolt pointing aft. The bolt must be installed in this position to avoid interference between the bolt and the stringer in the wheel well when the landing gear is fully retracted.

p. Retract the landing gear intermittently as in step i and observe the locking action of the uplock bracket. Starting to lock too soon is an indication that the uplock cable is too tight. The cable should be adjusted for a tension of 52.5 + 10 - 0 pounds in the up position. The tension is adjusted at the outboard end of the cable. If sufficient adjustment is not obtainable at the cable eye, additional adjustment may also be made at No. 3 wing rib by moving the cable housing inboard or outboard.

q. Extend the landing gear and check the force required to deflect the main landing gear knee joint. With the landing gear in the down position, it should take 45 to 60 pounds of force to deflect the knee joint. To increase tension, add 100951S063XP washers under the inboard end of the spring as required. Maintain a total minimum gap of 0.06 inch between the spring coils. (The total gap is the sum of all the gaps between the coils.)

NOTE

If unable to obtain adequate spring tension, check for worn spherical bearing in the retract linkage. Wear in the spherical bearing has the effect of shortening the entire linkage, causing the rod end spring to compress and stack, leaving nothing for spring adjustments. New bushings will shorten the linkage, again permitting adjustment of the spring.

r. A minimum of 55 pounds of deflection force is required at the union of the V-brace and the drag leg assembly on the nose gear with the landing gear in the fully down position. To obtain the required force, adjust as follows:

1. Lower the landing gear to just short of the fully down position with no tension on the V-brace and with the wheels clearing the floor.

2. A maximum of three 100951DD064XM washers may be added to the end of the spring on the forward retract rod.

3. If the additional washers did not provide the required minimum deflection force, the rod end on the forward retract rod may be adjusted (shortened or lengthened) to obtain the required deflection force.

4. After the adjustment, check that the retract spring does not stack at any point during full travel of the nose gear.

CAUTION

Do not adjust the rod end bearing out more than a maximum of 0.25 inch as measured between the nut and the end of the threads on the rod end bearing.

s. With the nose landing gear in the fully retracted position and the landing gear doors disconnected, a force of 30 to 35 pounds applied downward at the center line of the tow pin shall be required to move the strut off the bumper. If this force is not obtained, adjust the rod ends on the aft nose gear retract rod. With the nose wheel in the fully retracted position and both doors fully rigged, a minimum force of 20 pounds, applied as noted above, shall be required to move the strut 0.12 inch (at the tow pin) measured along the line of force application.

t. Unscrew the attaching link of the main landing gear on the outboard door to ensure that the door is not damaged when retracted. Connect outboard door linkage and retract landing gear slowly, checking to ensure that clearance is maintained between the door and the landing gear. After checking to see that the door is not too tight, run the landing gear down and adjust the linkage as required; continue this procedure until a snug, firm fit is obtained when the door is completely closed.

u. Connect the main landing gear inboard door linkage, retract the landing gear slowly and check for clearance between the door linkage and the root rib. Run the landing gear to the 3/4 extended position and adjust to maintain 1/4 inch of maximum clearance between the tire and the inboard door with slack removed from the door linkage. Continue this procedure until the door closes tightly in both the up and down positions. Adjust doors by varying the length of the push-pull linkage rods. Disconnect the rods at the clevis fittings to make this adjustment.

CAUTION

Install the pushrod attaching bolt for the main landing gear door in the door linkage bracket with the head to the aft. If installed wrong, the bolt may catch on the fuselage skin and root rib of the wing, causing damage to the landing gear retract mechanism or preventing the landing gear from retracting.

v. Connect the nose landing gear door linkage and rig the nose door. Check closely to see that the right hand aft hinge clears the tire. Adjust the nose landing gear doors by varying the length of the push-pull linkage rods in the nose wheel well. With the landing gear retracted, the doors should have a slight tension on them from the actuator rods to keep the doors from vibrating.

w. Check the landing gear safety switch for the proper adjustment on the right and left main landing gear. Measure 3/4 inch down on the piston from the bottom of the shock strut cylinder and mark the piston with a piece of tape (Figure 1, Detail D). Raise the wheel with a small jack, compressing the shock strut, until the tape is even with the lower edge of the cylinder. Adjust the switch actuating arm at the clevis so the switch is actuated as the tape touches the end of the cylinder. Remove the small jack from the wheel. Pull Landing Gear Motor circuit breaker. Disconnect the left safety switch operating arm at the torque link and position to simulate an "on ground" position. Select "Gear Up", check for audible warning. Select "Gear Down". Connect the safety switch operating arm. Repeat the process with the right landing gear safety switch. On airplane serials CJ-180 and after, CE-1301, CE-1307 and after, E-2458, E-2468 and after and EA-488 and after, check the landing gear retract-prevent switch for proper operation per Chapter 32-60-00.

x. Check the landing gear position lights. The lights are mounted on the sub panel. Three green lights, one for each gear, are illuminated whenever the landing gears are down and locked. The red light illuminates any time one or all of the landing gears are in transit or in any intermediate position. All of the lights will be out when the gears are up and locked.

y. Recheck the light switch adjustment.

z. On airplane serials CE-1301, CE-1307 and after, CJ-180 and after, E-2458, E-2468 and after, EA-488 and after, check the throttle retract-prevent switch for proper operation as instructed in Chapter 32-60-00.

aa. Safety all bolts, tighten all lock nuts and remove the airplane from the jacks.

RETRACT ACTUATOR DISASSEMBLY
FIGURE 2

a. Cut the safety wire and remove the bolts (34) and washers attaching the retract motor (1) to the upper actuator housing (35). Remove the spur and pinion gear (2) from the landing gear motor.

b. Remove the snap ring (3), the worm drive gear (4) and the woodruff key (39) from the worm gear shaft (19).

c. Remove the cotter pin, nut, washers, support plate (37), snap ring (5) and the actuator retract arm (6) from the actuator drive shaft (7). Push the shaft out of the actuator assembly in the direction of the arrows.

d. Remove the snap ring (27) and the actuator retract arm (28) from the actuator drive shaft (7).

e. Remove the cotter pin, nut, washers and bolt (9). Cut the safety wire and remove the screws (8) and washers attaching the lower actuator housing (36) to the upper actuator housing (35).

f. Index mark both housings. Carefully separate both housings and remove the actuator worm sector (10), the sector gear stop assembly (32) and the spacer (33).

g. Remove the seal (25) and the bearings (26) from the upper and lower actuator housings (35 and 36).

h. Cut the safety wire and remove the screws (15) and washers attaching the hand crankshaft housing (16) to the upper actuator housing (35).

i. Using a spanner wrench, remove the retainer nut (17) and remove the worm gear shaft (19) in the direction of the arrows.

j. Remove the cotter pin and loosen the locknut (21) enough to enable the bearing (20) to slide down the worm gear shaft (19) and remove the split bushing (18).

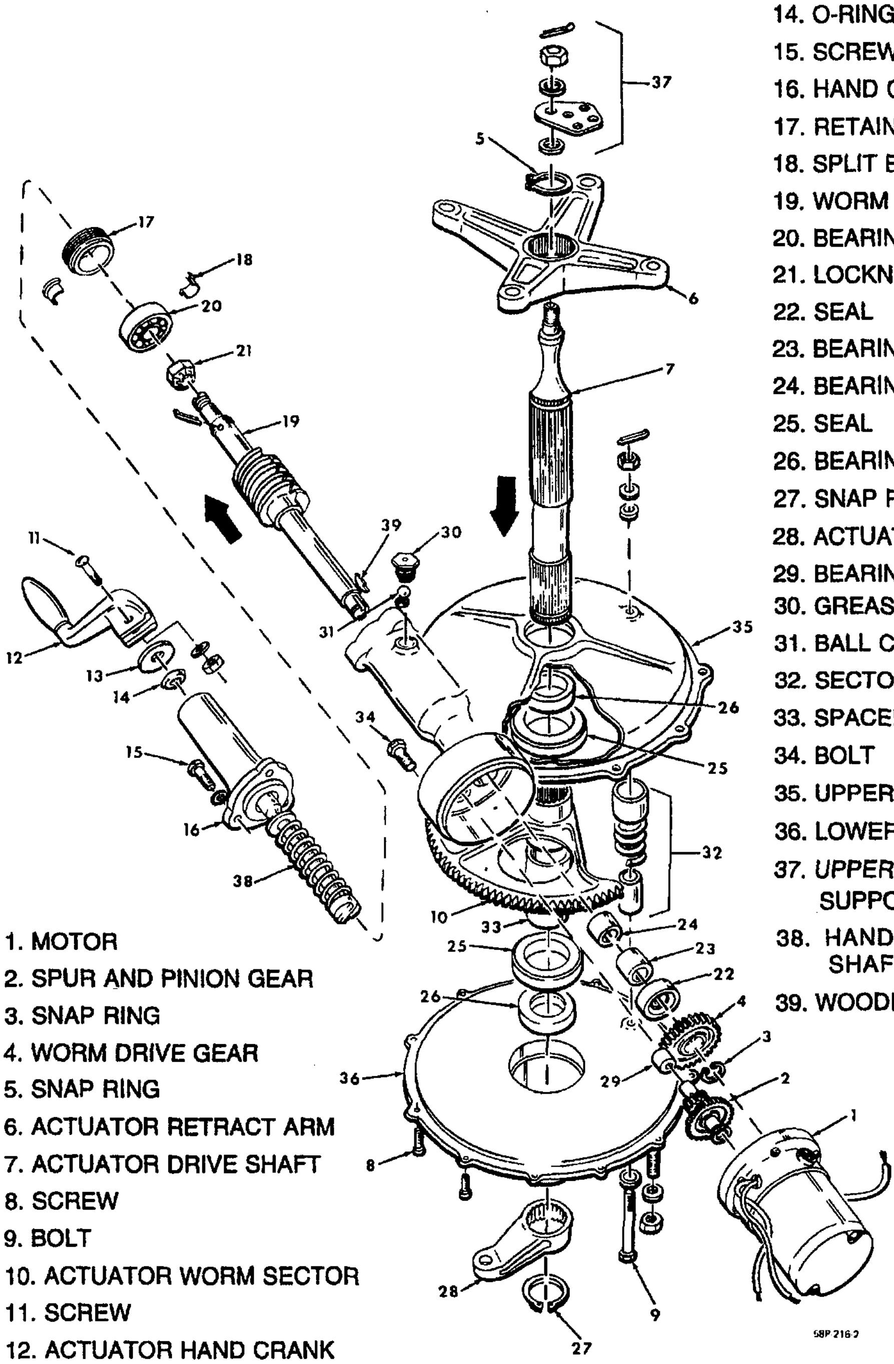
k. Remove the bearing (20) and the locknut (21) from the worm gear shaft (19).

l. Remove the seal (22) and the bearings (23 and 24) from the upper housing (35).

m. Remove the bearing (29) and the grease fill plug (30), with the ball check (31), from the upper actuator housing (35).

n. Remove the screw (11), washer and the nut attaching the actuator hand crank (12) to the engaging shaft (38) for the hand crank.

o. Remove the spacer (13) and the O-ring seal (14) from the hand crank engaging shaft (38) and remove the shaft from the hand crank shaft housing (16).



1. MOTOR
2. SPUR AND PINION GEAR
3. SNAP RING
4. WORM DRIVE GEAR
5. SNAP RING
6. ACTUATOR RETRACT ARM
7. ACTUATOR DRIVE SHAFT
8. SCREW
9. BOLT
10. ACTUATOR WORM SECTOR
11. SCREW
12. ACTUATOR HAND CRANK
13. SPACER
14. O-RING SEAL
15. SCREW
16. HAND CRANKSHAFT HOUSING
17. RETAINER NUT
18. SPLIT BUSHING
19. WORM GEAR SHAFT
20. BEARING
21. LOCKNUT
22. SEAL
23. BEARING
24. BEARING
25. SEAL
26. BEARING
27. SNAP RING
28. ACTUATOR RETRACT ARM
29. BEARING
30. GREASE FITTING PLUG
31. BALL CHECK
32. SECTOR GEAR STOP ASSEMBLY
33. SPACER
34. BOLT
35. UPPER ACTUATOR HOUSING
36. LOWER ACTUATOR HOUSING
37. *UPPER LANDING GEAR* SUPPORT PLATE
38. HAND CRANK ENGAGING SHAFT AND SPRING
39. WOODRUF KEY

Landing Gear Actuator Assembly
Figure 2

RETRACT ACTUATOR CLEANING AND PARTS REPLACEMENT

Clean all parts with PD680 solvent (16, Chart 1, 91-00-00). Check all bearings and bushings for cracks and excessive wear. Check all gears for cracks, chips, missing teeth, nicks and wear. Check the housing for cracks, wear and damage. Replace all worn or damaged parts and seals during assembly.

RETRACT ACTUATOR ASSEMBLY FIGURE 2

a. Fully thread the locknut (21) on the worm gear shaft (19) and slip the bearing (20) on the shaft with the shield side of the bearing toward the slotted end of the worm gear shaft. Install the split bushing (18) on the shaft and tighten the locknut (21) against the bearing (20) and install a new coffer pin.

NOTE

Cut the ends of the coffer pin so that 0.12 to 0.19 inch will protrude beyond the locknut (21). Bend the cotter pin ends tightly across the nut.

b. Install the bearings (23 and 24) and the seal (22) into the upper actuator housing (35).

c. Install the bearing (29) in the upper actuator housing (35).

d. Slide the worm gear shaft (19) into the upper actuator housing (35) in the opposite direction of the arrows.

CAUTION

Do not damage the seal (22) while installing the worm gear shaft (19).

e. Lubricate the threads of the retainer nut (17) with a light coating of thread lube (43, Chart 1, 91-00-00) and install in the upper actuator housing (35) with a spanner wrench. Stake the nut in three places.

f. Place the hand crank engagement shaft and spring (38) in the hand crank shaft housing(16) and install the O-ring seal (14).

g. Position the hand crank housing (16) in the mounted position. Maintain a clearance of 0.001 to 0.015 inch between the hand crank engaging shaft (38) and the worm gear shaft (19) with the worm gear fully seated in its thrust bearing in the direction of the arrows. Coat the mating surfaces of the hand crank housing (16) and the upper actuator housing (35) with sealer (44, Chart 1, 91-00-00) and secure with screws (15) and safety wire.

NOTE

To maintain the specified clearance, the actuator hand crank (12) may be faced off and/or additional spacer (13) may be added or removed.

h. Position the actuator hand crank (12) and the spacer (13) on the hand crank engaging shaft (38) and secure with the screw (11), washer and nut.

i. Install the bearings (26) and the seals (25) in the upper and lower actuator housings (35 and 36).

NOTE

Coat the outside diameters of the seals (25) with sealing compound (45, Chart 1, 91-00-00).

j. Align the double tooth of the spline of the actuator retract arm (28) with the space on the spline on the actuator drive shaft (7). Install the arm on the shaft with the snap ring (27).

NOTE

If the landing gear retract actuator is to be installed in the airplane, the retract actuator arm (28) and the snap ring (27) should be sacked and tied until after the installation of the landing gear actuator in the airplane.

k. Slide the actuator drive shaft (7) into the lower actuator housing (36) in the direction opposite to the arrows. Install the spacer (33).

l. Align the space of the spline on the actuator drive shaft (7) with the double center tooth of the spline of the actuator worm sector (10). Install the actuator worm sector (10) on the shaft.

m. Coat the mating surfaces, and the machined surfaces where the bolt (9) is installed, on the upper and lower actuator housings (35 and 36) with sealer (44, Chart 1, 91-00-00).

n. Insert bolt (9) through the lower actuator housing (36) and position the sector gear stop assembly (32) over the bolt.

o. Align the index marks made during the disassembly, and position the upper actuator housing (35) over the lower actuator housing (36). Install washers and screws (8) and safety wire.

p. Install the washer and nut on the bolt (9) and tighten. Secure the nut with a new cotter pin.

q. Align the space of the spline of the actuator drive shaft (7) with the double tooth of the spline on the actuator retract arm (6). Install the arm on the shaft with the snap ring (5). Install washers, upper landing gear support plate (37), nut and a new cotter pin.

r. Install the woodruff key (39) in the keyway of the worm gear shaft (19).

s. Install the worm drive gear (4) on the worm gear shaft (19) with the snap ring (3). Install the spur and pinion gear (2) in the upper actuator housing (35), making sure the teeth engage those of the worm drive gear (4).

t. Lubricate that portion of the upper actuator housing (35) containing the spur and pinion gear (2) and the worm drive gear (4) with approximately one ounce of MIL-G-81322 grease (46, Chart 1, 91-00-00). Fill to within + 0 - 0.10 inch of the housing center line.

u. Install the retract motor on the upper actuator housing (35) with bolts (34) and washers, and safety wire.

v. Lubricate the actuator assembly, through the grease fill port, with one half pint of grease (47, Chart 1, 91-00-00). When properly filled, the oil level on a dip stick inserted through the filler port will be approximately 1/4 inch.

w. Install the ball check (31) and the grease fill plug (30) in the upper actuator housing (35).

LANDING GEAR RETRACT ACTUATOR FUNCTIONAL TEST

To ensure proper operation and break-in of the actuator, the following functional test procedure must be complied with prior to installation of a newly overhauled actuator in the airplane.

Operate the landing gear retract actuator for five retract and extend cycles with the actuator mechanically loaded to an equivalent of 20 amps in both directions. The motor terminal voltage shall be maintained at 28 ± 0.03 volts.

The stop distance of the dynamic brake, as measured in revolutions of the hand crank, must not vary from the total maximum-to-minimum stop distance by more than 1/16 of a revolution.

The noise output shall not deviate excessively from the average of other accepted actuators in respect to amplitude and frequency.

After the functional test procedures have been performed, place a functional test stamp approximately 1.5 inches inboard of center line of the lubrication fill hole.

LANDING GEAR SAFETY SYSTEM MAINTENANCE AND ADJUSTMENT

No maintenance is required for the landing gear safety system, other than replacing defective units or checking the electrical wiring for condition, security of attachment, and tightness of electrical connections. The switches are preset and adjustment will not normally be required; however, should the system fail to function properly, the following checks and adjustments may be accomplished.

CHECK OF LANDING GEAR SAFETY SYSTEM WITH SAFETY SWITCH IN TEST POSITION

a. Place the throttle in the closed or retarded position.

b. Place the battery master switch ON. The landing gear circuit breaker may be either IN or OUT.

c. Place the landing gear safety system switch in the momentary fully up (test) position. Noise or movement of the solenoid in the landing gear position switch indicates that the automatic landing gear extension part of the system is functioning properly. The on-off switch returns normally to the ON position unless the pilot intentionally places the switch in the OFF position.

LANDING GEAR SAFETY SYSTEM MICROSWITCH ADJUSTMENT
FIGURE 3

The microswitch cannot be accurately adjusted on the ground. Before the safety system microswitch is adjusted, it must be ascertained that the throttle warning horn switch is properly adjusted. See ENGINE-COMPARTMENT-LOCATED LANDING GEAR WARNING SWITCH ADJUSTMENT or PEDESTAL-LOCATED LANDING GEAR WARNING SWITCH ADJUSTMENT in this chapter for proper setting of the throttle warning horn switch. The safety system microswitch may then be adjusted as follows:

a. With the airplane in flight, mark the throttle control at the control panel when the manifold pressure gage registers approximately 18 inches of Hg.

b. With the airplane on the ground, move the throttle until the mark on the control is aligned with the control panel just as it was when the mark was made while the airplane was in flight.

c. Adjust the microswitch until the cam clicks the switch closed with the throttle in the position indicated in the preceding step.

LANDING GEAR SAFETY SYSTEM PRESSURE SWITCH ADJUSTMENT

The pressure switches are preset and will not normally require adjustment. Because of the built-in tolerance of these switches, they should not be tampered with unless radically out of adjustment, that is unless the switch in question fails to actuate at an airspeed within 2 mph above or below the setting recommended for it. Even then the system plumbing and electrical wiring should be checked to ascertain that the source of trouble is not something other than improper adjustment of the pressure switches.

a. Place the airplane on jacks.

b. With the master switch ON, the landing gear circuit breaker ON, and the landing gear warning circuit breaker OFF, advance the throttle to its maximum position.

c. Place the landing gear safety position switch in the ON position.

d. Place the landing gear position switch in the UP position.

e. Clamp a section of soft rubber hose over the pitot head inlet, making certain that the connection is airtight.

f. Crimp the end of the tubing and roll it up until the airspeed indicator registers 90 mph. The landing gear will start retracting immediately if the pressure switch is properly adjusted.

CAUTION

To avoid rupturing the diaphragm of the airspeed indicator, the rubber tubing must be rolled slowly.

g. If the landing gear failed to retract in the preceding step, turn the master switch OFF and adjust the pressure switch (upper switch of the two installed in the left main wheel well) as follows:

1. Secure the rolled up tubing so that it will hold the airspeed indicator reading at 90 mph.

2. Connect a continuity tester across the contacts of the pressure switch, then turn the adjustment screw until the switch closes at the 90 mph reading on the airspeed indicator.

h. Turn the master switch on and roll up the rubber tubing until the airspeed indicator registers 130 mph, then secure the tubing so that the airspeed indicator will hold that reading.

i. Retard the throttle.

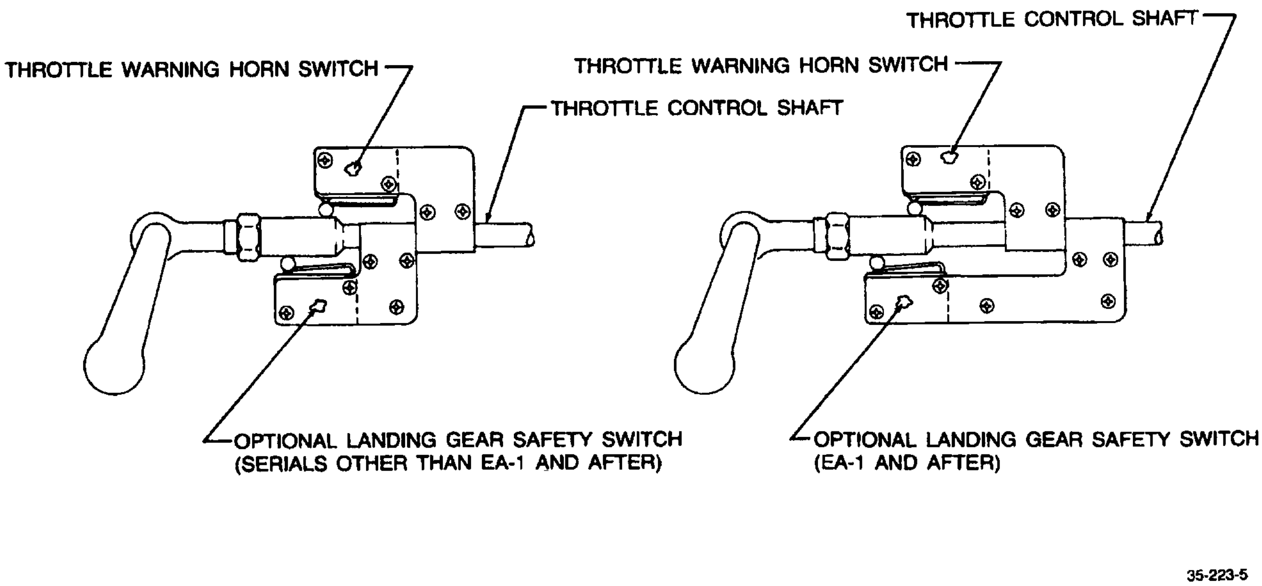
j. Slowly bleed off pressure until the airspeed indicator registers 120 mph. The landing gear will extend immediately if the pressure switch is properly adjusted.

k. Should the landing gear fail to extend, turn the master switch OFF and adjust the pressure switch (lower switch of the two in the left main wheel well) as follows:

1. Secure the rolled up tubing so that it will hold the airspeed indicator reading at 120 mph.

2. Connect a continuity tester across the contacts of the pressure switch, then turn the adjustment screw until the pressure switch closes at the 120 mph reading on the airspeed indicator.

l. Turn the master switch ON and check the landing gear safety system through the complete cycle of operation.



Landing Gear Safety System and Throttle Warning Horn Microswitch
Figure 3

WHEELS AND BRAKES - DESCRIPTION AND OPERATION

MAIN WHEEL ASSEMBLIES

The airplanes are equipped with two Cleveland 6:00 X 6 main wheel assemblies.

Each wheel consists of an inner and outer magnesium wheel half held together with bolts, washers, and nuts.

The cup bearings for the inner halves and cone bearings for the outer wheel halves, as well as seals, are installed in the hub area of the wheels. The brake disc assemblies are bolted to the inner wheel half. A snap ring is used on each side of the complete wheel assembly to retain the bearings and seals.

NOSE WHEEL ASSEMBLY

The airplane is equipped with a Cleveland 5:00 x 5 nose wheel assembly.

The nose wheel consist of an inner and outer magnesium wheel half held together with bolts, washers, and nuts.

Each side of the nose wheel assembly has an inner cone and outer cup bearing assembly, outside of which is a felt grease seal with a ring grease seal on each side of the felt seal. A snap ring is used on each side of the complete wheel assembly to retain the bearings and seals.

TIRES

The main wheel tires on the airplane are 7:00 X 6 tube-type tires. An inflation pressure of 33 to 40 psi should be maintained on these tires.

The nose wheel tire on the airplane is a 5:00 X 5 tube-type tire. An inflation pressure of 40 psi should be maintained on the tire.

BRAKE ASSEMBLY (Figure 1)

A Cleveland brake assembly is installed on each main wheel. The brake assemblies are designed for use with MIL-H-5606 hydraulic fluid (9, Chart 1, 91-00-00).

Each Cleveland brake assembly contains a piston housing with two pistons. The brake assembly contains a pressure plate, a lining, and a backing plate with a brake lining. The brake assembly torque plate is attached to the flange of the wheel axle. Braking action occurs when hydraulic pressure to the two pistons in the piston housing forces the two brake linings against the rotating brake assemblies. The pistons are sealed against leakage with O-rings.

SHUTTLE VALVE

On airplanes with dual brake systems, the earlier airplanes (prior to CE-839, CJ-150, D-10209, E-1432 and EA-3) use a shuttle valve in the hydraulic plumbing of each brake. The shuttle valve prevents the pressure from flowing from one master cylinder through the opposite master cylinder of the same brake. At serials CE-839 and after, CJ-150 and after, D-10209 and after, E-1432 and after, and EA-3 and after, the dual brakes are plumbed in series without a shuttle valve. The parking brakes may be set with either the pilot's or copilot's brake pedals on the new system.

BRAKE WEAR AND WEAR LIMITS

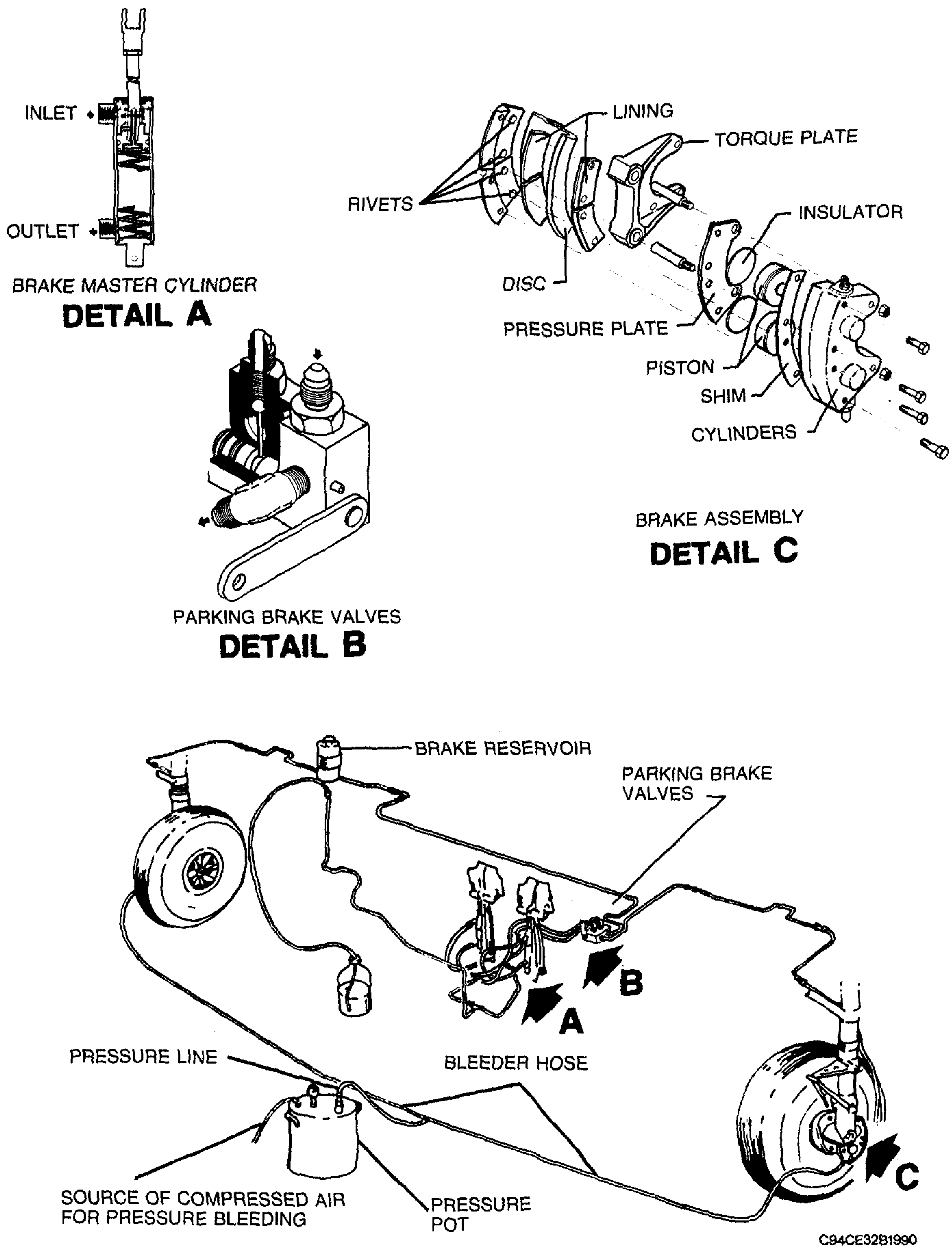
The brake lining MUST be replaced before the metal backplate is exposed through the abrasive surface. This can be checked visually without disassembling the brake. The minimum allowable thickness for the abrasive surface is 3/32 inch above the rivet. The brake disc should be replaced when its thickness measures .450 inch.

In service, the brakes disc will assume a light straw color as the result of heat. These changes in color are normal and need not be a cause for concern. A glazed appearance of the brake linings also is normal; the glaze actually improves the effectiveness of the brakes.

HYDRAULIC BRAKE SYSTEM

Fill the fluid reservoir, located on the forward side of the firewall, to within 1-1/2 inches of the top and maintain a visible fluid level on the dip stick at all times by adding MIL-H-5606 hydraulic fluid (9, Chart 1, 91-00-00) as necessary.

The hydraulic brake system is operated by depressing the pilot's rudder pedals to compress the piston rods of the attached master cylinders. The hydraulic pressure resulting from the movement of the master cylinder pistons is transmitted through flexible hoses and fixed aluminum tubing to the brake disc assemblies mounted on each main landing gear. This pressure forces the brake pistons to press against the linings and the disc of the brake assembly. Upon release of pressure against the piston, the brakes disc will have a tendency to drag against the stationary liners.



Brake System
Figure 1

TROUBLESHOOTING
BRAKE SYSTEM

INDICATION	PROBABLE CAUSE	REMARKS
1. Solid pedal no brakes	a. Brake linings worn beyond allowable limits	a. Replace linings.
2. Spongy brake.	a. Air in system.	a. Bleed brake system.
3. Unable to hold pressure.	a. Leak in brake system.	a. Visually check entire brake system for leaks.
	b. Defective master cylinder.	b. Check master cylinder seals replace if required.
4. Parking brake will not hold.	a. Air in system.	a. Bleed brake system.
	b. Defective parking brake valve.	b. Replace valve.
5. Brakes grab	a. Stones or foreign matter locking brake disc.	a. Clean brake disc and linings.
	b. Warped or bent disc.	b. Replace disc.

A parking brake valve is installed under the floorboards, forward of the pilot's seat. After the pilot's pedals have been depressed to build pressure in the hydraulic lines, the parking brake is closed by pulling out the parking brake handle. This closes the valve and retains the pressure in the brake lines. The parking brake is released when the parking brake handle is pushed in. The optional dual brake system provides the hydraulic breaking action from the copilot's position as well as the pilot's position.

WHEELS AND BRAKES - MAINTENANCE PRACTICES

WHEEL AND TIRE MAINTENANCE

Smooth wheel abrasions, nicks and burrs with a fine file and retouch with zinc chromate primer and aluminum lacquer to prevent corrosion. Replace any damaged wheel parts. Replace tires showing breaks, blisters or excessive wear.

Tires in service grow slightly due to shock loads during landings. Normally, this growth is balanced by tread wear so there is no increase in tire diameter.

Beech Aircraft Corporation cannot recommend the use of recapped tires. The tires may pass the retraction test when first installed; however, recapped tires have a tendency to swell after use and may cause malfunctions of the retract system or damage the landing gear doors.

NOTE

While Beech Aircraft Corporation cannot recommend the use of recapped tires, tires retreaded by an FAA approved repair station with a specialized service-limited rating per TSO-C62c may be used.

MAIN WHEEL AND BRAKE ASSEMBLY REMOVAL

a. Place the airplane on jacks.

b. Remove the four bolts which attach the brake backplate and inner linings to the cylinders, then remove the backplate assembly.

c. Disconnect the brake hydraulic line, and remove the cylinder assembly by sliding the two guide pins out of the torque plate.

NOTE

Removal of the wheel only does not necessitate disconnection of the line.

d. Remove the cotter pin, wheel retaining nut, washer and spacer. Slide the wheel and inner spacer off the axle.

e. The brake disc assembly can be removed by removing the six bolts which join the wheel halves.

NOTE

The brake linings and cylinder assembly can be removed without removing the wheel by utilizing steps a, b, and c.

MAIN WHEEL INSPECTION AND CLEANING

WARNING

Because dry cleaning solutions are toxic and volatile, use in a well-ventilated area, avoid contact with skin or clothing and do not inhale the vapors.

a. Degrease all parts and dry thoroughly. A soft bristled brush may be used to remove hardened grease, dust, and dirt.

CAUTION

Do not spin the bearings with compressed air as this will cause damage.

b. Visually inspect bearing cups and cones for nicks, scratches, water stains, galling, heat discoloration, roller wear, cage damage, and cracks or distortion. Replace if damaged or worn.

c. Inspect the wheel bearing grease for contamination and solidification at each periodic maintenance inspection.

d. Inspect wheel halves for cracks, corrosion and other damage. Cracked and badly corroded castings should be replaced. Small nicks, scratches or pits can be blended out using fine (400-grit) sandpaper.

e. Inspect snap rings and grease seals for deterioration and wear; replace if damaged or deformed. Lightly saturate the felt seals with 10W30 oil (remove excess by pressing lightly). Coat the sides and outer diameter with same type of grease as that used on the bearing.

f. Inspect bearing cups for looseness, scratches, pitting, corrosion, or evidence of overheating. Coat the bearing cups with bearing grease. Repack with either Aero Shell No. 5 or other greases per MIL-G-81322 (46, Chart 1, 91-00-00).

CAUTION

Aero Shell No. 5 grease is not compatible with other greases covered by MIL-G-81322. Use only Aero Shell No. 5 or one of the other greases; do not mix.

g. Inspect the brake disc assembly for cracks, excessive wear, or scoring, rust and corrosion. Remove rust and blend out small nicks with a fine emery cloth. The brake disc should be replaced when its thickness measures .450 inch.

h. Inspect the wheel bolts for cracks, corrosion or other damage. Replace any cracked bolts.

BRAKE ASSEMBLY INSPECTION AND CLEANING

a. Clean O-rings in clean hydraulic fluid (9, Chart 1, 91-00-00) or denatured alcohol. If O-rings are damaged or excessively worn they should be replaced.

CAUTION

Gasoline and dry cleaning fluids are unsuitable as cleaning agents because they will damage O-rings.

b. Clean dirty and greasy surfaces with denatured alcohol.

c. Inspect entire brake assembly for cracking, nicks, corrosion, damaged threads, etc. Check cylinder walls for scoring or excessive wear.

d. Carefully inspect pistons for nicks or burrs which might damage the O-rings. Remove nicks and burrs with fine crocus cloth, then thoroughly clean.

e. Inspect all brake linings for cracks. Linings should be replaced if they are worn 3/32 inch above the rivets.

MAIN WHEEL AND BRAKE ASSEMBLY INSTALLATION

a. Clean and repack wheel bearings as indicated in MAIN WHEEL INSPECTION AND CLEANING in this chapter. Replace any damaged grease seals, and be sure the grease seal retaining rings and snap rings are in place before reinstalling the wheel.

b. Install inner spacer, wheel, outer spacer, washer, retaining nut and cotter pin.

NOTE

At least one 100951X100VY or 100951X050VY washer shall be installed between the outer spacer and wheel retaining nut to permit free rotation of the wheel

c. Install the brake cylinder assembly by inserting the two guide pins into the torque plate.

NOTE

If the torque plate has been removed, it should be reinstalled so that the guide pin holes are positioned aft and centered above and below the horizontal centerline of the axle. The torque plate nuts are to be torqued to 100 to 140 inch-pounds.

d. Torque the axle nut as follows:

1. Check for burrs or rough threads on the axle and retaining nut. Apply bearing grease to the axle threads and the bearing surface of the nut.
2. While rotating the wheel, tighten the axle retaining nut to 180 to 240 inch-pounds to ensure that the bearings are properly seated.
3. Back off the axle retaining nut to zero torque.
4. Retighten the nut with fingers to remove end play in the bearings.
5. Torque the axle retaining nut to the next keying position and install the cotter pin.

e. Bleed the brake system if necessary.

NOSE WHEEL REMOVAL

a. Jack the nose wheel.

b. Remove the cotter pin, nut, and bushing which retain the nose wheel assembly on the axle.

c. Remove the nose wheel assembly by sliding it off the axle.

NOSE WHEEL INSPECTION AND CLEANING

WARNING

Dry cleaning solutions are toxic and volatile. Use in a well ventilated area. Avoid contact with skin or clothing. Do not inhale the vapors.

a. Degrease all parts and dry thoroughly. a soft bristle brush may be used to remove hardened grease, dust, and dirt.

CAUTION

Do not spin the bearings with compressed air. This will cause damage.

b. Visually inspect bearing cups and cones for nicks, scratches, water staining, galling, heat discoloration, roller wear, cage damage, and cracks or distortion. Replace if damaged or worn.

c. Inspect the wheel bearing grease for contamination and solidification at each periodic maintenance inspection.

d. Inspect wheel halves for cracks, corrosion, and other damage. Cracked or badly corroded castings should be replaced. Small nicks, scratches, or pits can be blended out using fine (400-grit) sandpaper.

e. Inspect the snap rings and grease seals for deterioration and wear; replace if damaged or deformed. Lightly saturate felt seals with 10W30 oil (remove excess by pressing lightly). Coat the sides and outer diameter with the same type grease as that used on the bearings.

f. Inspect the bearing cups and cones for looseness, scratches, pitting, corrosion, or evidence of overheating. Coat the cups and cones with bearing grease. Repack with either Aero Shell No. 5 grease or other greases per MIL-G-81322 (46, Chart 1, 91-00-00).

CAUTION

Aero Shell No. 5 grease is not compatible with other greases covered with MIL-G-81322. Use only Aero Shell No. 5 or one of the other greases; do not mix.

g. Inspect the wheel bolts for cracks, corrosion or other damage. Replace any cracked bolts.

NOSE WHEEL INSTALLATION

a. Clean and repack wheel bearings as indicated in *NOSE WHEEL INSPECTION AND CLEANING in this* chapter. Replace any damaged grease seals, and be sure the grease seal retaining rings and snap rings are in place before reinstalling the wheel.

NOTE

A bushing is permanently installed on the inboard end of the axle. No other hardware is required between the wheel and the inboard end of the axle.

b. Install the wheel, outer spacer, retaining nut and cotter pin.

c. *Torque the axle nut as follows:*

1. Check for burrs or rough threads on the axle and retaining nut. Apply bearing grease to the axle threads and bearing surface of the nut.

2. While rotating the wheel, tighten the axle retaining nut to 150 - 200 inch-pounds to insure that the bearings are properly seated.

3. Back off the axle retaining nut to zero torque.

4. While rotating the wheel, retorque the axle retaining nut to 30 inch-pounds and check for alignment of the locking holes.

5. If not at a locking position, continue tightening the axle nut to the first locking locking position and install the cotter pin.

RELINING THE BRAKES

CAUTION

Do not have the parking brake engaged while removing the brakes.

a. Remove the four bolts that attach the backplate assembly to the cylinder assembly.

NOTE

The hydraulic brake line does not have to be disconnected to remove the brake linings.

b. Remove the backplate assemblies from the inboard side of the brake disc and seperate the pressure plate assembly from the cylinder assembly.

c. Place the backplate assembly on a table with the lining facing down and punch or drill out the rivets that attach the linings to the backplate.

d. The linings on the pressure plate may be removed by using the same procedure as used on the backplate.

e. Place the new linings on the backplate and install the rivets. Set the rivets with the punch until the lining is firmly against the backplate.

f. The rivets on the pressure plate may be set by using the same procedure as used on the backplate.

BRAKE MASTER CYLINDER REMOVAL

a. Close the parking brake valve by pulling the parking brake handle.

b. Unsnap the floor mat and remove the floorboard section below the brake pedals.

c. Disconnect the two brake hydraulic lines at each master cylinder and mark the lines to assure correct reinstallation.

d. Remove the master cylinder attaching bolts and nuts and remove the master cylinder.

BRAKE MASTER CYLINDER INSTALLATION

a. Place the cylinder in position beneath the brake pedal and install the attaching bolts and nuts.

b. Connect the two hydraulic lines to the cylinder. The inlet port is the upper port.

c. Replenish the hydraulic fluid and bleed the brake system.

d. Install the floorboard and floor mat.

BRAKE MASTER CYLINDER LINKAGE ADJUSTMENT

The proper linkage adjustment will adjust the brake pedals to a straight upright position. This is considered the best adjustment since it will prevent the pedals from hitting the firewall in their extreme forward position. Linkage adjustment is obtained by removing the clevis from the rudder pedal and turning the clevis on or off the piston rod as required. After both pistons are adjusted to the same length, tighten the jam nuts.

BRAKE MASTER CYLINDER DISASSEMBLY (Figure 2)

a. Remove the snap ring (1) and pull the assembled piston out of the brake cylinder (2).

b. Remove the clevis (3) from the piston (14) and the check nut (4); this will free the washer (5), piston guide bushing (6), retainer O-ring (7) and the rear seat washer (8) from the piston (14).

c. Remove the cotter pin (9) from the collar (10) and pull the collar from the piston.

d. Remove the cotter pin (11) from the plunger end of piston to free the flow lock piston (12). The return spring (13) will fall free of the cylinder with the piston removed.

BRAKE MASTER CYLINDER CLEANING AND PARTS REPLACEMENT

Clean all parts with PD680 Solvent (16, Chart 1, 91-00-00). Check all parts for cracks, corrosion, distortion and wear. Replace all washers and seals at reassembly. Lubricate all parts with MIL-H-5606 hydraulic fluid (9, Chart 1, 91-00-00) prior to assembly. Reassemble the cylinder.

BRAKE MASTER CYLINDER ASSEMBLY (Figure 2)

a. Place the return spring (13) in the brake cylinder.

b. Slide the flow lock piston (12), into the plunger end of the piston (14) and install the cotter pin (11) through the piston and the flow lock piston.

c. Place the collar (10) on the piston and place the cotter pin (9) through the collar and piston.

d. Install the rear seat washer (8), retainer O-ring (7), piston guide bushing (6), and washer (5), on the piston (14). Install the check nut (4) and clevis (3) on the piston.

e. Slide the assembled piston into the brake cylinder (2). Install the snap ring (1).

PARKING BRAKE VALVE REMOVAL

a. Bleed the brake system of all hydraulic fluid.

b. Remove the floorboards forward of the pilot's and copilot's seats.

c. Disconnect he parking brake cable from the parking brake valve by loosening the set screw and pulling the cable free of the cable attach fitting.

d. Disconnect and cap the hydraulic lines from the parking brake valve. Identify hydraulic lines for ease of installation.

e. Remove the attach bolts, and remove the valve.

PARKING BRAKE VALVE INSTALLATION

a. Place the parking brake valve in position under the floorboards, forward of the pilot's and copilot's seats. Install the attach bolts.

b. Connect the hydraulic lines to the same ports from which they were removed.

c. Connect the parking brake cable. Adjust the parking brake as covered in PARKING BRAKE ADJUSTMENT in this chapter.

d. Bleed the brake system.

e. Install the floorboards forward of the pilot's and copilot's seats.

PARKING BRAKE ADJUSTMENT

a. Place the parking brake control in the OFF (valve OPEN) position.

b. Remove the floorboards forward of the pilots seats.

c. Loosen the set screw in the cable attach fitting and adjust the cable housing through the mounting block to obtain 1-1/2 inch of travel between the cable housing and the attach fitting. The 1-1/2 inch clearance should be made with the parking brake valve lever in the OPEN position.

d. Tighten the mounting block, insert the cable in the cable attach fitting, tighten and safety wire the set screw in the attach fitting.

e. Test the parking brake adjustment by pulling the parking brake handle out and operating the brake pedals.

f. If the brake pedals are not solid, place the parking brake control in the OFF position and recheck the rigging.

g. Inspect the parking brake valve for hydraulic fluid loss.

PARKING BRAKE VALVE DISASSEMBLY (Figure 3)

a. Disconnect and remove each of the two side-by-side fittings (13) from the valve body. Remove the O-ring (7), spring (1), steel ball (6), O-ring (8), seal (2), and pin (3) from each of the two orifices from which the fittings were removed.

b. Disconnect and remove the retaining ring (10) from the end of the cam lever assembly (4).

c. Remove the cam lever assembly (4) by grasping the lever and rotating the cam lever assembly counterclockwise while pulling outward to prevent scoring of the cam lever assembly surface.

PARKING BRAKE CLEANING AND PARTS REPLACEMENT

Clean all parts with PD680 Solvent (16, Chart 1, 91-00-00). Check all parts for cracks, corrosion, distortion and wear. Replace all washers and seals at reassembly. Lubricate all parts with hydraulic fluid (9, Chart 1, 91-00-00) prior to assembly. Reassemble the parking brake valve.

PARKING BRAKE VALVE ASSEMBLY

a. Install the cam lever (4) with the new O-rings (9) by grasping the lever and rotating clockwise while pushing inward to prevent scoring of the cam lever assembly surface

b. Connect the retaining ring (10), to the end of the cam lever assembly (4).

c. Install the pin (3), seal (2), O-ring (8), steel ball (6), and spring (1) in each of the two side-by-side fitting orifices on the valve body. Install an O-ring (7), on each fitting (13), and install the fittings.

BLEEDING THE BRAKE SYSTEM

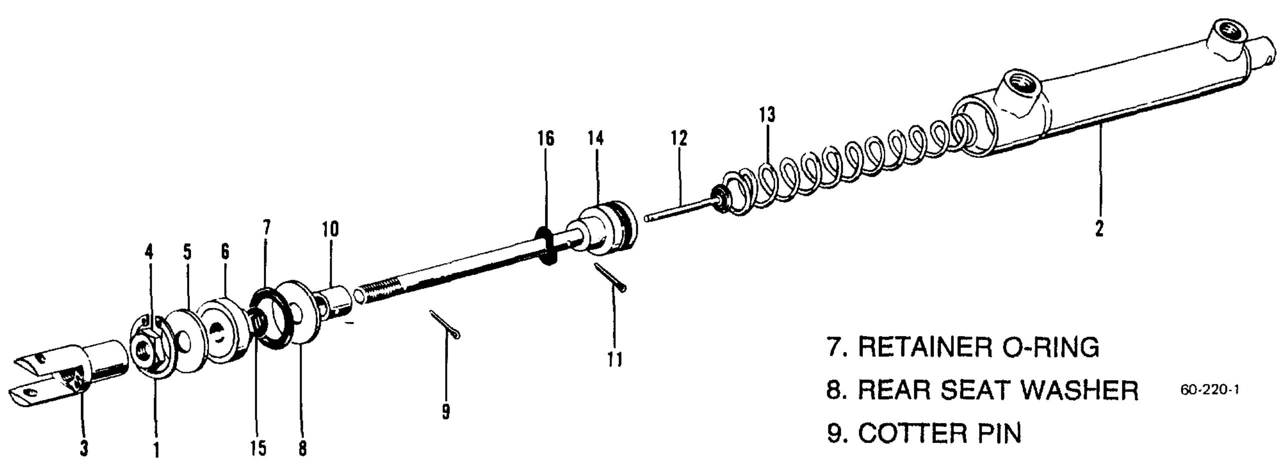
WARNING

Whenever the brakes are to be released, make sure the airplane is on level ground and the wheels are chocked.

Brake system bleeding will be required whenever the system is opened at any point between the master cylinder and the wheel brake assembly, whenever the brakes become spongy in service, or whenever the parking brakes will no longer hold. In the latter instance, the system must be further checked for leakage.

Use only MIL-H-5606 hydraulic fluid (9, Chart 1, 91-00-00) in the brake system, and ensure that no dirt or foreign matter is allowed to get into the brake system. Dirt under seals results in leaks or clogging of the compensating ports in the master cylinders resulting in brake locking. Beech Aircraft recommends the use of a pressure pot for bleeding the brakes. If the pressure pot bleeding method is not available, electric bleeding is recommended. Use the gravity method only if the other two methods are not available. If the gravity method is used, pressure bleed the brakes at the earliest possible time. Using any method, the parking brake control and toe brake pedals must both be fully released to open the compensating ports in the master cylinders.

If the brakes feel soft or "spongy" after the bleeding operation, air is trapped in the brake cylinders. Remove the brake assembly and lay it on its side. Add brake fluid as needed through the bleed port and tap the brake lightly with a rubber hammer to dislodge any air bubbles. When air bubbles no longer appear at the port, install the brake and repeat the bleeding procedure.



1. SNAP RING
2. CYLINDER
3. CLEVIS
4. CHECK NUT
5. WASHER
6. PISTON GUIDE BUSHING
7. RETAINER O-RING
8. REAR SEAT WASHER
9. COTTER PIN
10. COLLAR
11. COTTER PIN
12. FLOW LOCK PISTON
13. RETURN SPRING
14. PISTON
15. O-RING
16. VALVE SPRING

Brake Master Cylinder
Figure 2

GRAVITY BLEEDING

WARNING

Whenever the brakes are to be released, make sure the airplane is on level ground and the wheels are chocked.

This method of bleeding is done from the master cylinder down to the brake assembly. The brake fluid reservoir must be kept full during the bleeding operation. Since the pilot's and copilot's master cylinders are plumbed in series (except on EA-1 and EA-2), the entire system is bled by operating the pilot's brake pedals in the following manner:

NOTE

Make provision for catching the drained hydraulic fluid.

a. Open the bleeder port of the brake assembly on one landing gear.

b. Depress the pilot's corresponding brake pedal slowly and smoothly to eliminate air trapped in the system.

c. Hold the pedal in the depressed position and close the bleeder port at the brake assembly.

d. Release the brake pedal.

e. Repeat steps a through d until no more bubbles appear in the drained fluid.

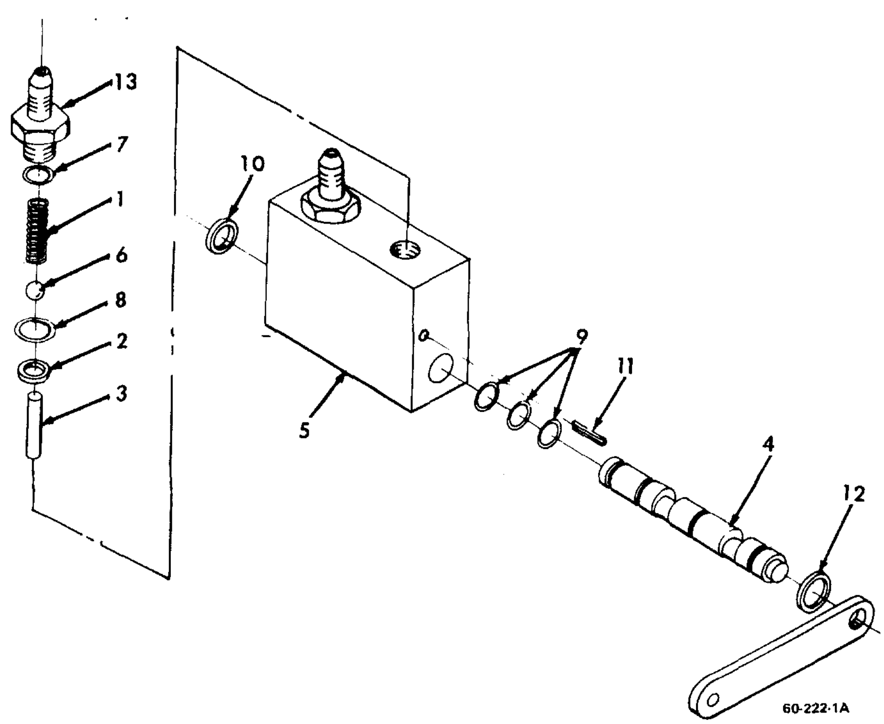
f. Open the bleeder port of the brake assembly on the other landing gear and repeat steps b through e.

NOTE

On serials prior to CE-839, CJ-150, D-10209, E-1432 and EA-3, the copilot's master cylinder will have to be bled separately. Repeat steps a through f for the copilot's brakes.

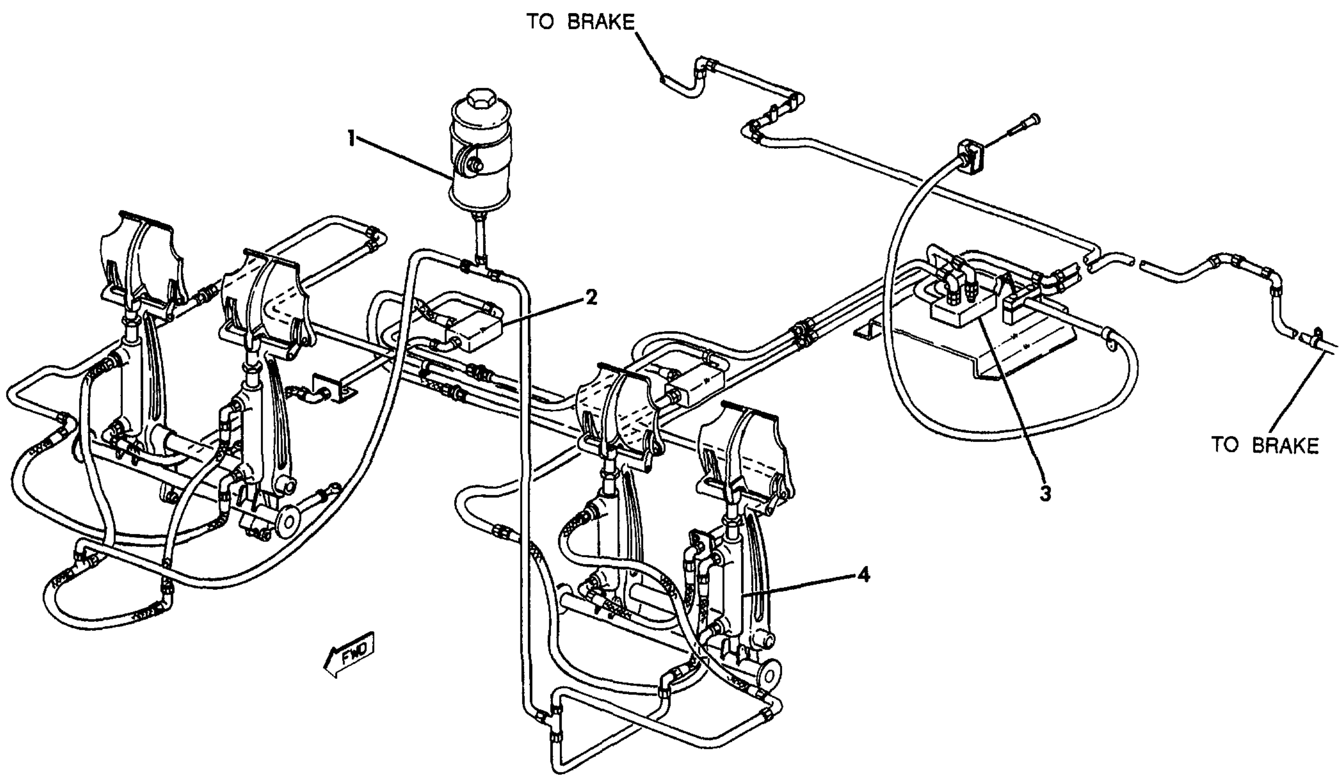
g. Tighten the bleeder ports of the brake assemblies.

h. Check the brake reservoir fluid level and add hydraulic fluid MIL-H-5606 (9, Chart 1, 91-00-00) as required to obtain a full reading.



1. Spring
2. Seal
3. Pin
4. Cam Lever Assembly
5. Valve Body
6. Steel Ball
7. O-Ring
8. O-Ring
9. O-Ring
10. Retaining Ring
11. Roll Pin
12. Washer
13. Fitting

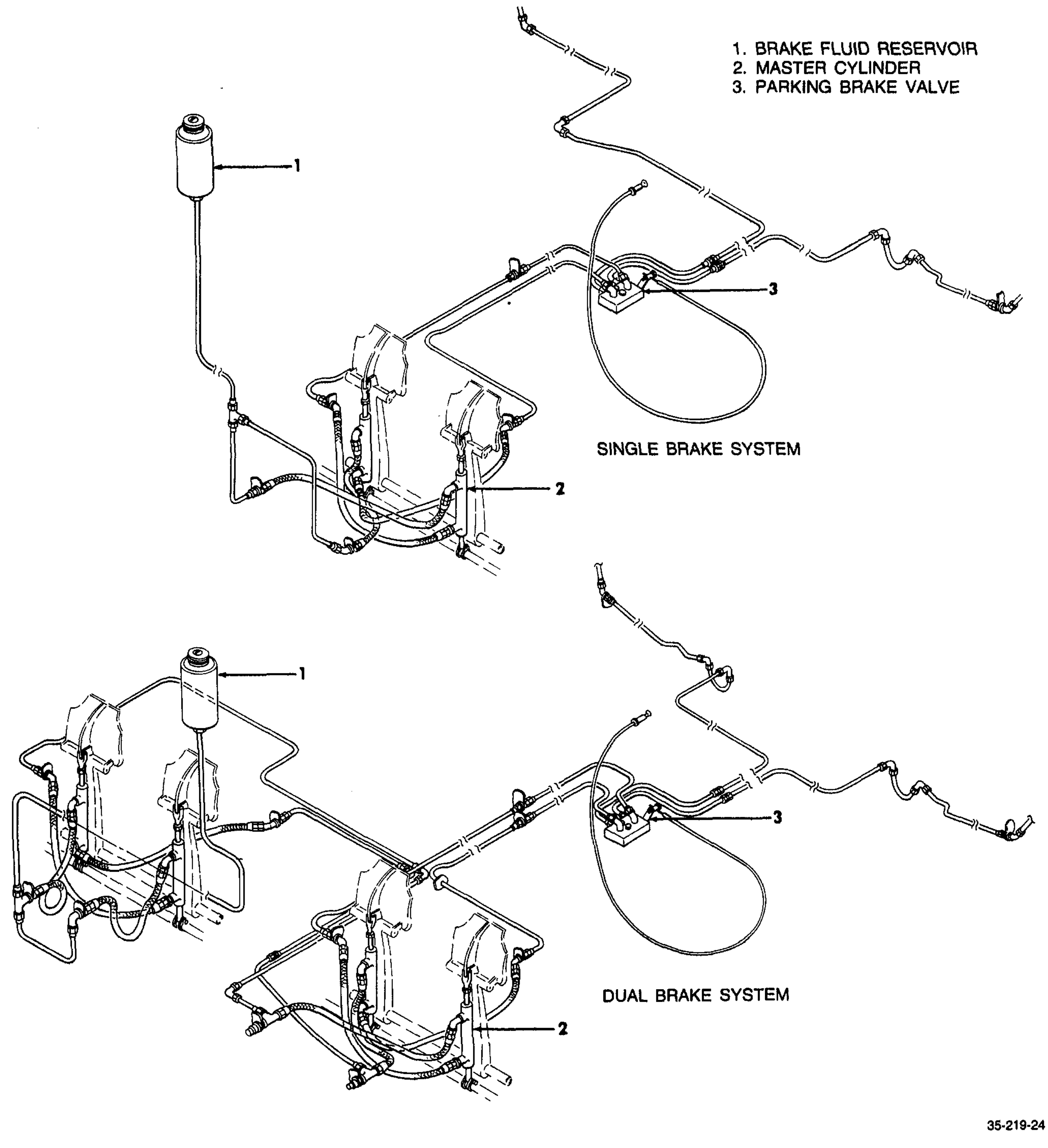
Parking Brake Valve
Figure 3



1. RESERVOIR
2. SHUTTLE VALVE
3. PARKING BRAKE VALVE
4. MASTER CYLINDER

C93EA32B0011

Brake System Plumbing with Shuttle Valves
Figure 4



Brake System Plumbing without Shuttle Valves
Figure 5

i. Check the brakes for proper operation. When the brake pedals are depressed, there must be no spongy feeling and the pedal pressure equal on both brakes.

PRESSURE POT BLEEDING (Figure 1)

WARNING

Whenever the brakes are to be released, make sure the airplane is on level ground and the wheels are chocked.

Pressure bleeding is the most efficient method of bleeding the brakes. This procedure involves attaching a pressure pot to the brake assembly bleeder port and back bleeding the system to the fluid reservoir.

a. Remove the cap from the brake fluid reservoir.

b. Remove the brake fluid from the reservoir.

c. Disconnect the fluid supply line from the reservoir, and attach a hose to the supply line.

d. Place the end of the hose in a clean container to collect the brake fluid overflow.

e. Open the bleeder port of each brake assembly.

f. Install a bleeder hose (shown in Figure 1) onto each brake bleeder port.

g. Connect the bleeder hose assemblies (shown in Figure 1) to the pressure lines of the pressure pot.

NOTE

On serials prior to CE-839, CJ-150, D-10209, E-1432 and EA-3 (airplanes with shuttle valves in the brake system) depress the pilot's brake pedals to actuate the shuttle valve to bleed the pilot's brakes, then proceed through step j. After the pilot's brakes are bled, depress the copilot's brake pedals to actuate the shuttle valve to bleed the copilot's brakes and follow steps g through j.

h. Apply a constant pressure of not more than 30 pounds to the pressure pot. Open the pressure pot control valve.

i. Bleed the system until the draining fluid is free of bubbles.

j. Close the pressure pot valve.

k. Remove the bleeder hose from each landing gear.

l. Close the bleeder port of each brake assembly.

m. Connect the fluid reservoir supply line to the reservoir.

n. Check the hydraulic fluid reservoir and add MIL-H-5606 hydraulic fluid (9, Chart 1 91-00-00) as required to obtain a full reading.

o. Install the cap on the reservoir.

p. Check the operation of the brakes. There must be no soft or spongy feeling at the brake pedals and the pedal pressure must be equal on both brakes.

ELECTRIC BLEEDING

The hookup for electric bleeding is nearly the same as pressure pot bleeding except the pressure pot bleeder is replaced with an electric bleeder (refer to Figure 1).

WARNING

Whenever the brakes are to be released, make sure the airplane is on level ground and the wheels are chocked.

a. Remove the cap from the brake fluid reservoir.

b. Remove the brake fluid from the reservoir.

c. Disconnect the fluid supply line from the reservoir, and attach the electric bleeder fluid return line to the supply line.

d. Open the bleeder port of each brake assembly.

e. Connect the infusion line on the electric bleeder to each brake bleeder port (Figure 1).

NOTE

On serials prior to CE-839, CJ-150, D-10209, E-1432 and EA-3 (airplanes with shuttle valves in the brake system) depress the pilot's brake pedals to actuate the shuttle valve to bleed the pilot's brakes, then proceed through step h. After the pilot's brakes are bled, depress the copilot's brake pedals to actuate the shuttle valve to bleed the copilot's brakes and follow steps f through i.

f. Activate the bleeder and set the relief valve to approximately 15 pounds; this may be ascertained by observing the pressure gage prior to opening the electric bleeder control valve.

g. Open the electric bleeder control valve and observe the returning fluid through the in-line sight glass.

NOTE

Pumping the pilot's and copilot's pedals during the bleeding process may help to dislodge any air bubbles trapped in the master cylinders.

h. When the returning fluid shows no further evidence of air bubbles, close the electric bleeder control valve.

i. Disconnect the fluid infusion line from the bleeder port. Close the bleeder port valves.

j. Disconnect the fluid return line from the brake fluid reservoir supply line.

k. Connect the fluid reservoir supply line to the reservoir.

l. Check the brake fluid level and add MIL-H-5606 hydraulic fluid (9. Chart 1, 91-00-00) as required to obtain a full reading

m. Install the cap on the reservoir.

n. Check the operation of the brakes. When the brake pedals are depressed there should be no spongy feeling and the pedal pressure should be equal on both brakes.

STEERING - MAINTENANCE PRACTICES

The nose wheel should be parallel to the fore and aft centerline of the airplane with the rudder pedals in the neutral position. Loosen the nose gear steering actuator arm at the aft end and screw the end fitting either in or out to make the adjustment.

NOSE WHEEL TRAVEL STOP ADJUSTMENT

The travel stop must be adjusted so that the nose wheel travel is stopped when the shimmy damper is 1/32 to 1/4 inch from its maximum travel.

If adjustment is required, the following procedure is recommended:

a. Loosen the locknuts on the adjustment bolts so that they clear the stops on the nose wheel straightener.

b. Turn the nose wheel to the extreme left turn position: the adjustment bolts must be clear of the stops with the nose wheel in this position.

c. Place tape around the aft end of the shimmy damper piston rod at a point 1/32 to 1/4 inch from the scraper ring.

d. Turn the locknuts on the adjustment bolts so that the nose wheel is turned and the tape on the piston rod just contacts the scraper ring. Tighten the locknuts securely.

e. Repeat preceding steps b, c and d, except turn the nose wheel to the extreme right, and place the tape on the forward end of the piston rod.

POSITION AND WARNING - MAINTENANCE PRACTICES

LANDING GEAR POSITION LIGHT ADJUSTMENT

The landing gear position lights are mounted on the right subpanel on early serial number airplanes. On airplane serials E-1946, E-2104, E-2111 and After; EA-320, and EA-389 and After, the landing gear position lights were moved to the left side of the pilot's subpanel. Three green lights, one for each gear, are illuminated whenever the landing gear is down and locked. The red light illuminates any time any portion of the landing gear is in transit or at any intermediate position. All of the lights will be extinguished when the landing gear is up and locked.

The landing gear position lights on the instrument panel are operated by the up-indicator switches and down-indicator switches on each gear.

Before making the following adjustments, place the airplane on jacks as instructed in Chapter 7-00-00, LIFTING AND SHORING - MAINTENANCE PRACTICES.

MAIN GEAR

With the landing gear down and locked, adjust the downswitch, located on the forward side of the main gear V-brace, so that the overtravel of the switch plunger is 0.05 in. after the switch is actuated to the ON position. With the landing gear in fully up position, adjust the up-switch, located inboard of the forward side of the main landing gear V-brace, so that the overtravel of the switch plunger is 0.05 in. after the switch is actuated to the ON position.

NOSE GEAR

With the landing gear down and locked, adjust the down-switch, located on the right hand side of the wheel well, so that the overtravel of the switch plunger is 0.05 in. after the switch is actuated to the ON position. With the landing gear in the fully up position, adjust the upswitch, located on the right-hand side of the wheel well, so that the overtravel of the switch plunger is 0.05 in. after the switch is actuated to the ON position. Check the instrument panel to be sure the indicator lights correspond to the landing gear position.

Recheck the switch adjustment and remove the airplane from the jacks.

ENGINE-COMPARTMENT-LOCATED LANDING GEAR WARNING SWITCH ADJUSTMENT (CE-748, CE-772 THRU CE-1300, CE-1302 THRU CE-1306; CJ-149 THRU CJ-179; D-10097, D-10120 AND AFTER; E-1111, E-1241 THRU E-2110, EXCEPT E-1946 AND E-2104; EA-1 THRU EA-388, EXCEPT EA-320)

NOTE

The following steps must be made by pulling the throttle control back. Incorrect settings may occur if the throttle control is pushed forward to check the switch adjustment.

If the altitude referenced in the following step cannot be obtained, use Table 1 for alternate altitude settings.

a. With the airplane in flight at 100 to 110 knots with 3,000 ± 100 ft of pressure altitude (5,000 ± 100 ft pressure altitude with the propeller at 2,400 rpm on EA serials) and the landing gear retracted, retard the throttle to obtain 12 ± 1 in. of Hg in manifold pressure (15 ± 1 in. of Hg on EA serials). The landing-gear-up warning horn should sound at this manifold pressure, but not before.

b. If the horn did not sound under the conditions established in Step a., measure and note the distance from the throttle to the subpanel.

c. Land the airplane and shut down the engine.

d. Set the throttle at the position noted in Step b..

e. Open the engine cowling and locate the gear warning (throttle) switch. Refer to the Chapter 32-30-00 LANDING GEAR SAFETY SYSTEM AND THROTTLE WARNING HORN MICROSWITCH illustration in the Landing Gear Safety System Maintenance and Adjustment section.

f. Loosen the upper switch bracket and slide the bracket until the gear warning switch closes as indicated by a clicking sound.

g. Anchor the switch bracket at this position.

h. Repeat Step a. to check the warning horn adjustment. If the adjustment is incorrect, repeat Steps a. thru g..

i. Working with the throttle control, check that the switch actuator roller rides up smoothly on the throttle control actuator and operates without catching or hanging on the tapered end. Readjust if the switch roller hangs up or does not operate smoothly during the throttle control movement from idle to full power travel. Ensure full throttle travel and ease of movement.

j. Close the engine cowling.

ENGINE-COMPARTMENT-LOCATED LANDING GEAR WARNING SWITCH ADJUSTMENT (CE-1301, CE-1307 AND AFTER; CJ-180 AND AFTER)

NOTE

The landing gear retract-prevent switch may be checked and/or adjusted at the same time the landing gear warning switch is being adjusted because of the similarity of the adjustment. Accomplish the instructions under the ENGINE-COMPARTMENT-LOCATED RETRACT-PREVENT SWITCH ADJUSTMENT heading.

a. Gain access to the throttle linkage in the engine compartment.

b. Inspect the landing gear warning switch for proper installation (Ref. Figure 1). The switch plunger is NOT to be under the dimple in the switch actuator arm.

c. Push the throttle to the fully forward position.

d. Inspect the switch plunger and switch actuator arm. The switch plunger should be touching the switch actuator arm. If the switch plunger and the switch actuator arm are not touching, mark the position of the upper switch bracket on the throttle control housing. Remove the switch actuator assembly from the upper switch bracket and bend the switch actuator arm so that, when installed, the switch actuator arm will be touching the switch plunger.

e. If removed, return the upper switch bracket to the position noted in Step d..

NOTE

The following checks must be made by pulling the throttle control back. Incorrect settings may occur if the throttle control is pushed forward to check the switch adjustment.

If the altitude referenced in the following step cannot be obtained, use Table 1 for alternate altitude settings.

TABLE 1
ALTITUDE COMPENSATION

PRESSURE ALTITUDE	GEAR WARNING FOR EA SERIALS	GEAR WARNINGS FOR E, CE, CJ SERIALS
1,000 ft	19 in. Hg	14 in. Hg
2,000 ft	18 in. Hg	13 in. Hg
3,000 ft	17 in. Hg	12 in. Hg
4,000 ft	16 in. Hg	11 in. Hg
5,000 ft	15 in. Hg	10 in. Hg
6,000 ft	14 in. Hg	9 in. Hg
7,000 ft	13 in. Hg	8 in. Hg
8,000 ft	12.5 in. Hg	7.5 in. Hg
9,000 ft	11.5 in. Hg	6.5 in. Hg
10,000 ft	11 in. Hg	6 in. Hg

f. With the airplane flying at 100 to 110 knots with 3,000 ft pressure altitude and the landing gear retracted, retard the throttle to obtain a manifold pressure of 12 ± 1 in. of Hg. The landing-gear-up warning horn should sound and the annunciator light should flash at and below this manifold pressure, but not above it.

g. If the switch adjustment is wrong, retard the throttle to obtain 12 ± 1 in. of Hg manifold pressure.

h. Measure and note the distance from the subpanel to the throttle control.

NOTE

The landing-gear-up warning horn will sound and the GEAR UP warning annunciator light will flash at full flaps with the landing gear in the up position.

i. Land the airplane and shut down the engine.

j. Position the throttle control at the measurement noted in Step h..

k. Open the engine cowling and locate the warning switch (Ref. Figure 1).

l. Loosen the upper switch bracket and slide the bracket until the switch closes as indicated by a clicking sound.

m. Tighten the upper switch bracket at this position.

n. Working with the throttle control, check that the switch actuator roller rides up smoothly on the throttle control actuator and operates without catching or hanging up on the tapered end. Readjust if the switch roller hangs up or does not operate smoothly during the throttle control movement from idle to full power. Ensure full throttle travel and ease of movement.

o. Close the engine cowling.

p. Repeat the flight check of the switch setting at the airspeed and altitude of the first check. The landing gear warning horn should sound and the gear warning annunciator light on the instrument panel should flash at settings below the manifold pressure being used to adjust the switch. If necessary, readjust the switch as previously instructed.

PEDESTAL-LOCATED LANDING GEAR WARNING SWITCH ADJUSTMENT (E-1946, E-2104, E-2111 AND AFTER; EA-320, EA-389 AND AFTER)

NOTE

The landing gear warning switch may be checked and/or adjusted at the same time as the landing gear retract-prevent switch because of the similarity of the adjustment. Perform the PEDESTAL-LOCATED LANDING GEAR RETRACT-PREVENT SWITCH ADJUSTMENT procedures.

The following checks must be made by pulling the throttle control back. Incorrect settings may occur if the throttle control is pushed forward to check the switch adjustment.

If the altitude referenced in the following steps cannot be obtained, refer to TABLE 1, ALTITUDE COMPENSATION.

a. With the airplane flying at 100 to 110 knots with 3,000 ft pressure altitude (5,000 ± 100 ft pressure altitude with the propeller at 2,400 rpm on serials EA-320, EA-389 and After) and the landing gear retracted, retard the throttle to obtain 12 ± 1 in. of Hg manifold pressure (15 ± 1 in. of Hg on serials EA-320, EA-389 and After). The landing gear up warning horn should sound (the gear warning annunciator light should flash also on serials E-2458, E-2468 and After and EA-488 and After) at and below this manifold pressure. Mark this throttle position on the pedestal.

b. On serials E-2761 and After, advance the throttle to above 13 in. Hg (above 16 in. Hg on serials EA-320, EA-389 and After). Lower the flaps to fully down and the warning horn should sound and GEAR UP annunciator light should flash.

c. After landing the airplane and shutting down the engine, set the throttle at the position marked on the pedestal in Step a..

d. Remove the pedestal side covers.

e. Loosen the retaining nuts on the cam located on the end of the actuator rod arm for the landing gear warning switch (Ref. Figure 2).

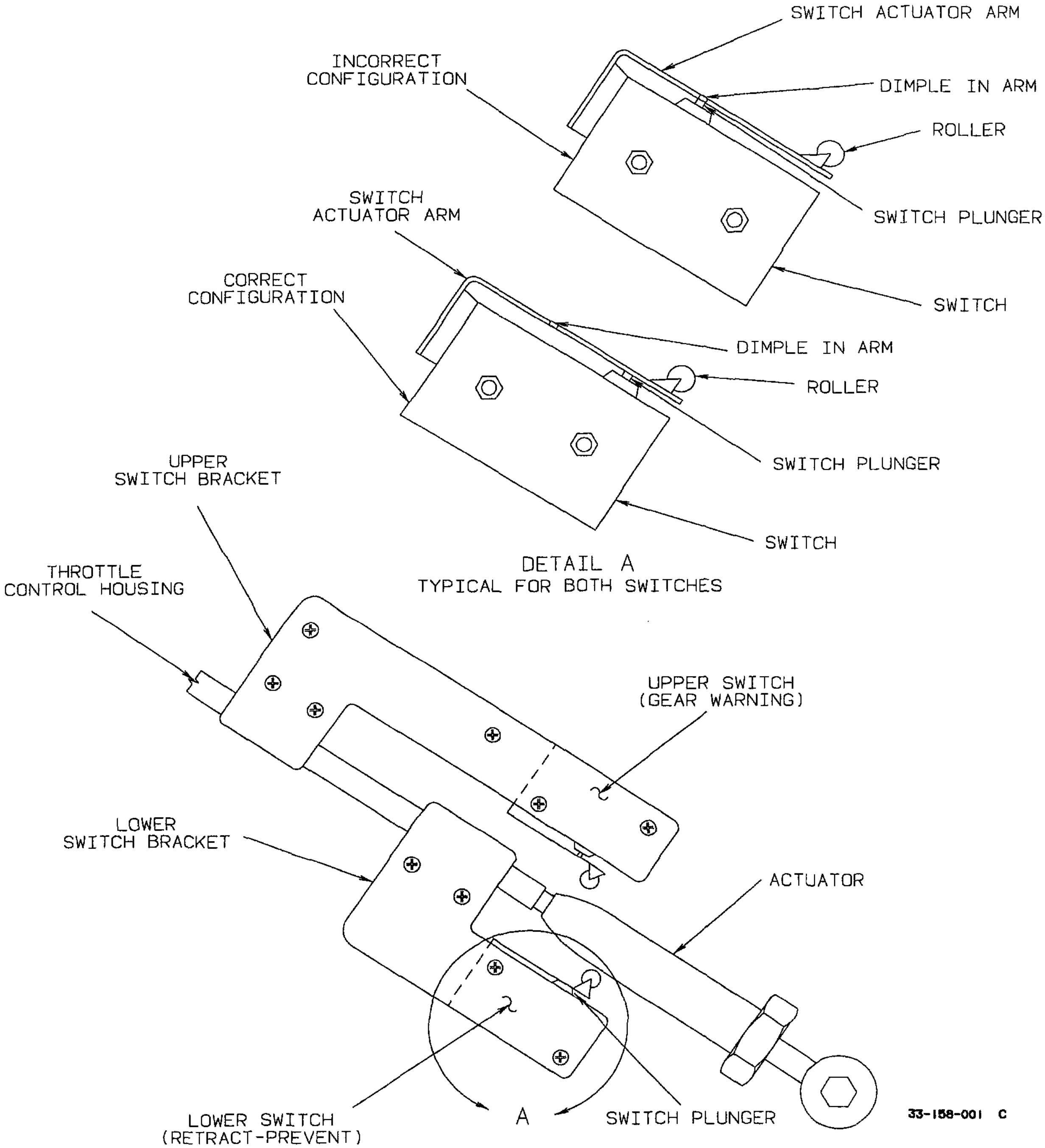
f. Adjust the cam so that the switch closes, indicated by a click, with the throttle control at the top position noted in Step a..

g. Retighten the cam retaining nuts.

h. Ensure full throttle control travel and ease of movement.

i. Reinstall the pedestal side covers.

j. Repeat the check of the switch setting at the airspeed and altitude stated in Step a.. If necessary, readjust the switch as previously instructed.



Engine-Compartment-Located Landing Gear Warning Switches
Figure 1

ENGINE-COMPARTMENT-LOCATED LANDING GEAR RETRACT-PREVENT SWITCH ADJUSTMENT (CE-1301, CE-1307 AND AFTER; CJ-180 AND AFTER)

NOTE

The landing gear warning switch may be checked and/or adjusted at the same time the landing gear retract-prevent switch is being adjusted because of the similarity of the adjustment. Accomplish the instructions under the ENGINE-COMPARTMENT-LOCATED LANDING GEAR WARNING SWITCH ADJUSTMENT heading.

a. Gain access to the throttle linkage in the engine compartment.

b. Inspect the switch for proper installation (Ref. Figure 1). The switch plunger is NOT to be under the dimple in the switch actuator arm.

c. Push the throttle to the full forward position.

d. Inspect the switch plunger and switch actuator arm. The switch plunger should be touching the switch actuator arm. If the switch plunger and the switch actuator arm are not touching, mark the position of the lower switch bracket on the throttle control housing. Remove the switch actuator assembly from the lower switch bracket and bend the switch actuator arm so that, when installed, the switch actuator arm will be touching the switch plunger.

e. If removed, return the upper switch bracket to the position noted in Step d..

NOTE

The following checks must be made by pulling the throttle control back. Incorrect settings may occur if the throttle control is pushed forward to check the switch adjustment.

If the altitude referenced in the following step cannot be obtained, refer to TABLE 2, ALTITUDE COMPENSATION.

f. With the airplane flying at 100 to 110 knots with 3,000 ± 100 feet of pressure altitude and the landing gear extended, the landing gear must not retract at any manifold pressure below 17 ± 1 in. of Hg. It is acceptable to initially check this by advancing the throttle from a manifold pressure below 17 in. of Hg with the landing gear down and the cockpit landing gear position switch in the up position.

g. If the retract-prevent switch adjustment is wrong, retard the throttle control to obtain 17 ± 1 in. of Hg manifold pressure.

h. Measure and note the distance from the subpanel to the throttle control.

NOTE

There is a latching relay in the circuit which allows the landing gear to fully retract once retraction starts. Retarding the throttle should not stop the landing gear in midtravel.

i. Land the airplane and shut down the engine.

j. Open the engine cowling and locate the switch (Ref. Figure 1).

k. Place the throttle at the distance from the subpanel measured in Step h..

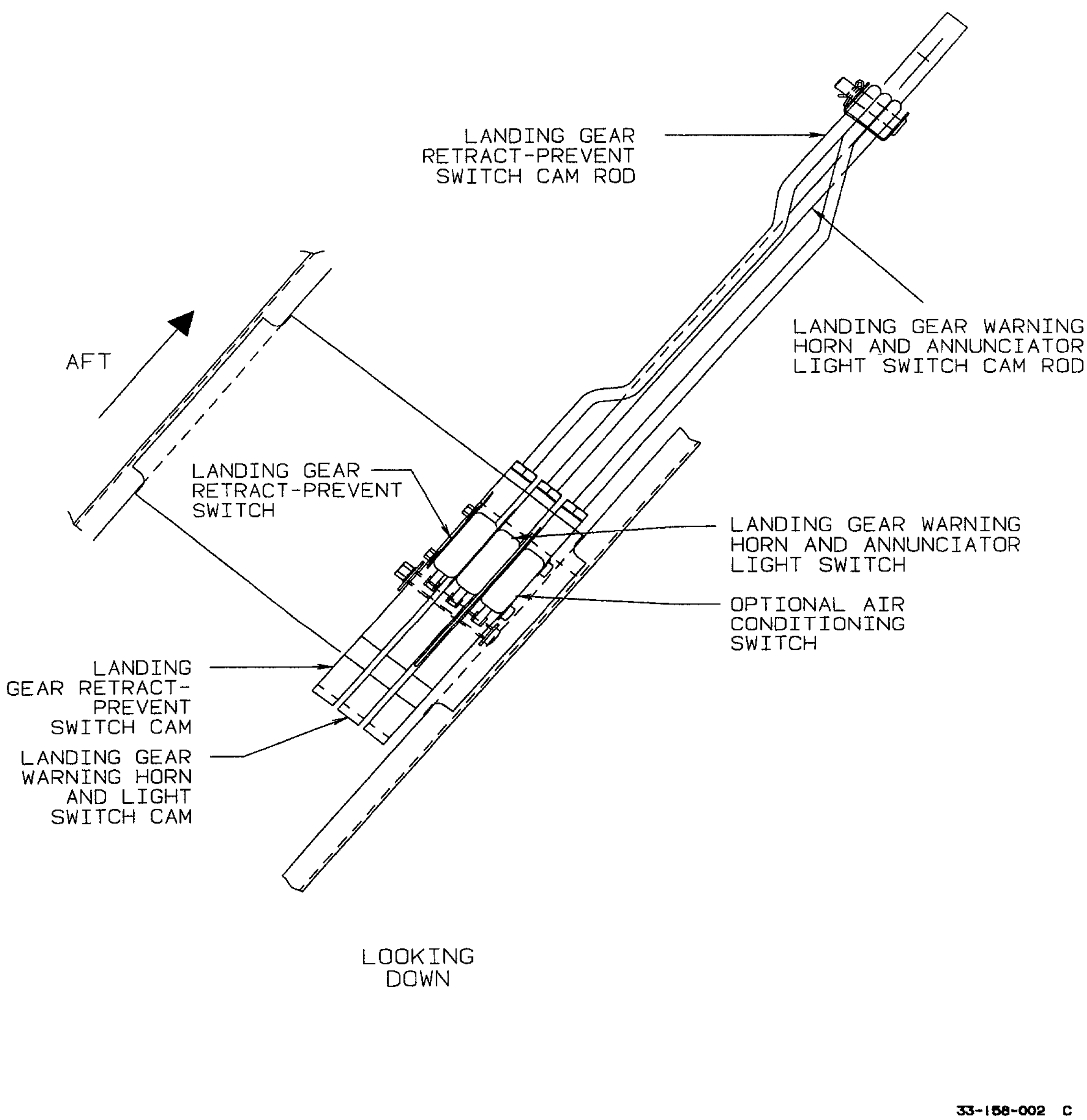
l. Loosen the lower switch bracket and slide the bracket until the switch closes as indicated by a clicking sound.

m. Tighten the lower switch bracket at this position.

n. Working with the throttle control, check that the actuator roller for the retract-prevents switch rides up smoothly on the throttle control actuator and operates without catching or hanging up on the tapered end (Ref. Figure 1). Readjust if the switch roller hangs up or does not operate smoothly during the throttle control travel from idle to full power. Ensure full throttle travel and ease of movement.

o. Close the engine cowling.

p. Repeat the flight check of the retract-prevent switch setting at the airspeed and altitude stated in Step f.. If necessary, readjust the switch as previously instructed.



Pedestal-Located Landing Gear Warning Switches
Figure 2

TABLE 2
ALTITUDE COMPENSATION

PRESSURE ALTITUDE	GEAR RETRACT FOR E, CE, CJ, EA SERIALS
1,000 ft	19 in. Hg
2,000 ft	18 in. Hg
3,000 ft	17 in. Hg
4,000 ft	16 in. Hg
5,000 ft	15 in. Hg
6,000 ft	14 in. Hg
7,000 ft	13 in. Hg
8,000 ft	12.5 in. Hg
9,000 ft	11.5 in. Hg
10,000 ft	11 in. Hg

PEDESTAL-LOCATED LANDING GEAR RETRACT-PREVENT SWITCH ADJUSTMENT (E-2458, E-2468 AND AFTER; EA-320, EA-389 AND AFTER)

NOTE

The landing gear warning switch may be checked and/or adjusted at the same time as the landing gear retract-prevent switch because of the similarity of the adjustment. Perform the PEDESTAL-LOCATED LANDING GEAR WARNING SWITCH ADJUSTMENT procedures.

NOTE

The following checks must be made by pulling the throttle control back. Incorrect settings may occur if the throttle control is pushed forward to check the switch adjustment.

If the altitude referenced in the following steps cannot be obtained, refer to TABLE 2, ALTITUDE COMPENSATION.

a. With the airplane flying at 100 to 110 knots with 3,000 ± 100 ft of pressure altitude (5,000 ± 100 ft pressure altitude with propeller at 2,400 rpm on serials EA-320, EA-389 and After) and the landing gear extended, the landing gear must not retract at or below a manifold pressure of 16 in. Hg. It is acceptable to initially check this by advancing the throttle from a manifold pressure below 16 ± 1 in. Hg with the landing gear down and the landing gear position switch in the cockpit in the gear-up position.

b. Mark the position of the throttle control on the pedestal with the throttle retarded to the appropriate manifold pressure.

NOTE

There is a latching relay in the circuit which allows the landing gear to fully retract once retraction starts. Retarding the throttle should not stop the landing gear in midtravel.

c. Land the airplane and shut down the engine.

d. Place the throttle control at the mark made on the pedestal in Step b..

e. Remove the pedestal side covers.

f. Loosen the retaining nuts on the cam located on the end of the actuator rod for the gear retract-prevent switch (Ref. Figure 2).

g. Adjust the cam so that the switch closes, indicated by a click, with the throttle control at the position noted in Step b..

h. Retighten the cam retaining nuts.

i. Ensure full throttle travel and ease of movement.

j. Reinstall the pedestal side covers.

k. Repeat the flight check of the switch setting at the airspeed and altitude stated in Step a.. If necessary, readjust the switch as previously instructed.

CHAPTER

33

LIGHTS

TABLE OF CONTENTS

CHAPTER 33 - LIGHTS

TABLE OF CONTENTS (Cont'd)

"END"

CHAPTER 33

LIST OF PAGE EFFECTIVITY

"END"

INTERIOR - MAINTENANCE PRACTICES

INSTRUMENT POST LIGHT BULB REMOVAL

Individual post lights, located adjacent to the instruments on the instrument panel may have bulbs removed as follows:

a. Pull the light shield from the post light assembly.
b. Remove the bulb from the post light assembly.

INSTRUMENT POST LIGHT BULB INSTALLATION

a. Install the bulb in the post light assembly.
b. Insert the shield to the instrument post light assembly.

INSTRUMENT WEDGE LIGHT TRAY REMOVAL

Internal lighting of the instruments provides additional illumination across each instrument. A light tray mounted on the top side of the bezel of each instrument holds two bulbs wired in parallel. If the light bulbs are damaged or burn out the light tray with bulbs must be replaced.

a. Remove the screws that secure the instrument panel in place and tilt the instrument panel aft to gain access to the instruments.

NOTE

Instruments located at the lower edge of the panel may be removed if necessary, to gain access to the light tray at the top of the instruments.

b. Remove the screws that attach the light tray to the instrument bezel.

INSTRUMENT WEDGE LIGHT TRAY INSTALLATION

a. Install the new light tray and secure in place with the attach screws.

ELECTROLUMINESCENT PANEL REMOVAL

Three electroluminescent panels provide lighting for the instrument subpanel. The electroluminescent lamp is an integral part of the finished panel and cannot be replaced separately. If the acrylic face panel or the printed circuit board becomes damaged, the whole unit must be replaced.

a. Remove the attaching screws located on each side of the face panel.
b. Disconnect the wiring running from the printed circuit board at the splice.
c. Pull the assembly from the subpanel.

ELECTROLUMINESCENT PANEL INSTALLATION

a. Reconnect the wiring at the splice.
b. Place the panel assembly in place in the subpanel and secure it with the attaching screws.

WARNING AND POSITION LIGHT BULB REMOVAL (LANDING GEAR, ALTERNATOR, BAGGAGE DOOR)

a. Remove the light shield.
b. Remove the bulb.

WARNING AND POSITION LIGHT BULB INSTALLATION (LANDING GEAR, ALTERNATOR, BAGGAGE DOOR)

a. Replace the bulb in the light assembly.
b. Install the light shield on the light assembly.

GLARESHIELD FLOODLIGHT BULB REMOVAL

a. Locate the defective bulb.
b. Remove the glareshield attach screws and push up on the glareshield to gain access to the bulb.
c. Remove the bulb.

GLARESHIELD FLOODLIGHT BULB INSTALLATION

a. Replace the bulb in the light assembly.
b. Install the glareshield and secure with the attach screws.

PASSENGER READING LIGHT BULB REMOVAL

a. Remove the aluminum light cover.
b. Remove the bulb.

PASSENGER READING LIGHT BULB INSTALLATION

a. Replace the bulb in the light assembly.
b. Install the aluminum light cover on the light assembly.

COMPASS LIGHT BULB REMOVAL

a. Flip the bulb shield over to one side.
b. Bulb will pop out.

COMPASS LIGHT BULB INSTALLATION

a. Replace the bulb in the light assembly.
b. Flip the bulb shield back over the bulb.

TRIM TAB LIGHT BULB REMOVAL

a. Pull the light assembly away from the back of the instrument panel.
b. Remove the bulb.

TRIM TAB LIGHT BULB INSTALLATION

a. Replace the bulb in the light assembly.
b. Install the light assembly into the instrument panel.

COURTESY LIGHT BULB REMOVAL

a. Remove the screws attaching the upper door moulding to the door.
b. Bend door moulding over to gain access to the bulb.
c. Remove the bulb from the light assembly.

COURTESY LIGHT BULB INSTALLATION

a. Replace the bulb in the light assembly.
b. Secure the moulding to the door with the attach screws.

MAP LIGHT BULB REMOVAL

a. Remove the screws securing the center plate to the control wheel.
b. Pull out center plate and remove the bulb from the light assembly.

MAP LIGHT BULB INSTALLATION

a. Replace the bulb in the light assembly.
b. Reinstall the center plate in the control wheel and secure with the attaching screws.

CABIN OVERHEAD LIGHT BULB REMOVAL (Prior to CE-933, CJ-156, D-10357, E-1783, EA-171)

a. Remove the overhead panel assembly to gain access to the bulb. (Fresh air vents and vent knob must be removed also.)
b. Remove the bulb from the light assembly.

CABIN OVERHEAD LIGHT BULB INSTALLATION (Prior to CE-933, CJ-156, D-10357, E-1783, EA-171)

a. Replace the bulb in the light assembly.
b. Reinstall the overhead panel assembly.
c. Reinstall the fresh air vents and vent knob.

CABIN OVERHEAD LIGHT BULB REMOVAL (CE-933 and after, CJ-156 and after, D-10357 and after, E-1783 and after, EA-171 and after)

a. Squeeze the lens sufficiently to release the catches and pull the lens away from the light assembly.
b. Remove the inoperative light bulb.

CABIN OVERHEAD LIGHT BULB INSTALLATION (CE-933 and after, CJ-156 and after, D-10357 and after, E-1783 and after, EA-171 and after)

a. Install a new light bulb.
b. Install the lens into the light assembly.

"END"

EXTERIOR - DESCRIPTION AND OPERATION

STROBE LIGHTS

Flashing strobe lights are mounted on each wing tip and are available on the tail cone. The system is activated by a circuit breaker switch mounted on the instrument subpanel. The strobe lights are powered by a power supply unit located in the baggage compartment. A transistorized circuit in the power supply unit steps up the voltage of the airplane electrical system to the level (approximately 400 volts) required to operate the strobe lights. The stepped-up-voltage is stored in a capacitor until released to the strobe lights. The current from the power supply unit is conducted to the flashtube of the strobe light by a specially shielded power cable. A charge of high voltage electricity is momentarily released to a coil in the flashtube assembly. The coil further steps up the charge to a point where it ionizes the xenon gas in the flashtube. The high voltage stored in the capacitor then surges through the gas to produce the brilliant burst of light energy that characterizes the strobe light. When the capacitor voltage drops sufficiently, the lamp will go out while the capacitor begins recharging for the next cycle.

STEP LIGHT - OPTIONAL

On serials E-2104, E-2111, and after; and EA-320, EA-389 and after, a step light may be mounted in the fuselage just forward of the step and aft of the right wing trailing edge. The switch is mounted in the top of the forward door frame. In some installations, the aft door ajar switch will activate the step light as well as perform its annunciator function. The timer is located on the forward side of the forward spar carry through, and the five amp fuse is located on the right side forward of the firewall.

This system is wired directly to the battery through a five amp fuse and will operate any time the doors are opened. The courtesy lights are a part of the same system and operate simultaneously with the step light. Once the step light has been activated the timer will turn the light off in approximately 15 minutes.

TROUBLESHOOTING
EXTERIOR LIGHTS

STROBE LIGHTS

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Lights inoperative.	a. Circuit breaker tripped.	a. Check for short circuit. Reset circuit breaker.
	b. Loose connection.	b. Check and tighten electrical connections.
	c. Battery defective.	c. Replace battery or use external power.
	d. Power supply inoperative.	d. Replace.
2. One bulb does not light.	a. Bulb burned out.	a. Replace bulb.
	b. Fixture not grounded.	b. Check for good bonding between fixture and structure. Tighten mounting screws.
	c. Loose connection.	c. Check all connections in circuit.
	d. Defective fixture or switch.	d. Replace fixture or switch.

TAIL LIGHT, TAIL NAV/STROBE LIGHT, LANDING LIGHT, AND TAXI LIGHT

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Lamp fails to light.	a. Circuit breaker switch tripped.	a. Check for short circuit. Reset circuit breaker.
	b. Circuit breaker switch defective.	b. Check continuity through switch. Replace if necessary.
	c. Lamp burned out.	c. Replace lamp.
	d. Loose connection or defective wiring.	d. Tighten connections and check wire circuit continuity. Replace or repair wire if necessary.

EXTERIOR - MAINTENANCE PRACTICES

LIGHTS

POWER SUPPLY UNIT REMOVAL

CE-748, CE-772 and after; CJ-149 and after; D-10097, D-10120 and after; E-1111, E-1241 to E-1370

WARNING

High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 10 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies and before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.

a. Remove the floorboard on the RH side of the baggage compartment.
b. Disconnect the electrical wiring to the power supply.
c. Remove the screws, washers, and nuts anchoring the module to the support structure.
d. Remove the power supply from the airplane.

E-1371 and after; EA-1 and after

WARNING

Observe the warning precautions given in the removal instructions for the earlier serializations.

a. Locate the access cover in the floorboard, aft of fuselage station 170, on the right side of the airplane, in the baggage compartment.
b. Remove the 4 screws and washers from the cover and remove the cover.
c. Disconnect the electrical wiring from the power supply.
d. Remove the screws which hold the power supply in place and remove the power supply.

POWER SUPPLY UNIT INSTALLATION

CE-748, CE-772 and after; CJ-149 and after; D-10097, D-10120 and after; E-1111, E-1241 to E-1370

CAUTION

An incorrect hook-up of the wires in either the power input or between the strobe light assemblies and the power supply will cause a reversal of polarity that results in serious component damage and failure. Care must be taken to ensure that the red wire is connected to positive (+) power and the black wire is connected to ground. Make sure that the connectors are properly assembled and that white/red, white/black, and white/yellow wires are connected properly. The shields for the wing and tail light cables should be grounded to the airplane structure at the power supply. Refer to the *WIRING DIAGRAM MANUAL P/N* 35-590102-9 to ensure a correct hook-up of the components in the strobe light system.

a. Position the power supply unit in the airplane and secure with the screws, washers, and nuts.
b. Connect the electrical wiring to the power supply.
c. Install the floorboard on the RH side of the baggage compartment.

E-1371 and after; EA-1 and after

a. Place the power supply in its proper location and install the screws which hold it in place.
b. Connect the electrical wiring to the power supply adhering to the caution indicated for the above earlier serializations.
c. Place the access cover in place and install the screws and washers.
d. Reinstall the carpet.

WING STROBE LIGHT REMOVAL

WARNING

High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 10 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies and before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.

a. Remove the transparent shield covering the wing tip lights.

b. Detach the strobe light assembly from the wing by removing the allen head screws. Remove the nuts securing the mounting bracket to the strobe light assembly.

c. Disconnect the electrical wiring.

d. Remove the screws securing the end plate assemblies to the light assembly. Remove the end plate assemblies.

e. Remove the clear filter cover from the strobe light housing assembly.

NOTE

Place a clean cloth around the flashtube to keep fingers from coming in contact with the glass.

f. Carefully remove the flashtube from the contact assemblies.

WING STROBE LIGHT INSTALLATION

CAUTION

Observe the caution procedure stated in POWER SUPPLY UNIT INSTALLATION in this chapter.

a. Replace the flashtube if necessary.

NOTE

Place a clean cloth around the flashtube to keep fingers from coming in contact with the glass.

b. Reinstall the clear filter cover in the strobe light housing.

c. Install the end plate assemblies and mounting bracket on the strobe light housing and secure with the screws and nuts.

d. Reconnect the wiring and secure the strobe light assembly to the airplane with the allen head screws.

e. Reattach the transparent shield to the wing tip.

WING NAVIGATION LIGHT REMOVAL

a. Remove the attaching screws from the transparent shield and remove from the wing tip.

b. Remove the screw from the navigation light bulb retainer and remove the retainer.

c. Rotate the bulb counterclockwise to remove.

WING NAVIGATION LIGHT INSTALLATION

a. Replace the bulb.

b. Install the retainer on the navigation light bulb and secure with the screw.

c. Install the transparent shield and secure with screws.

NOTE

Before installing the transparent shield on the wing, apply Presstite 176 sealer around the shield to ensure moisture cannot enter the light compartment.

TAIL STROBE/NAV LIGHT REMOVAL

WARNING

High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 10 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies and before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.

a. Remove the tail cone and light shield to gain access to the strobe light assembly.

b. Disconnect the strobe/nav light assembly from the airplane electrical system.

c. Rotate the nav bulb counterclockwise and remove the bulb if it needs to be replaced.

d. If the flashtube assembly needs replacement, remove the screws on the backside of the light assembly and remove the light assembly from the tail cone.

TAIL STROBE/NAV LIGHT INSTALLATION

a. Replace the flashtube assembly and secure to the tail cone with the screws in the backside of the light assembly.

b. Replace the bulb if necessary.

c. Reconnect the strobe/nav light assembly to the airplane electrical system.
d. Reinstall the light shield over the strobe/nav light assembly.
e. Reinstall the tail cone on the airplane.

TAIL NAVIGATION LIGHT REMOVAL

a. Remove the outer light shield to gain access to the bulb.
b. Remove the inner bulb shield from the bulb.
c. Rotate the bulb counterclockwise to remove.

TAIL NAVIGATION LIGHT INSTALLATION

a. Replace the bulb in the holder.
b. Place the inner bulb shield over the bulb.
c. Reinstall the outer light shield on the tail cone.

TAXI LIGHT REMOVAL

a. Remove the screws from the light retaining ring.
b. Remove the screws on the back of the light to disconnect the wiring.

TAXI LIGHT INSTALLATION

a. Replace the light and place the retaining ring around the light. Secure the retaining ring with screws. Properly index the light bulb.
b. Reconnect the wiring to light and secure with screws.

LANDING LIGHT REMOVAL

a. Remove the outer retaining screws to detach the light from the lower portion of the nose bug.
b. Remove the screws from the back of the light assembly and pull off the retaining ring.
c. Disconnect the wiring from the light assembly by removing the screws.
d. Remove the seal from between the light and the retaining ring.

NOTE

The beam adjustment screws should not be moved in either direction during removal or installation of the landing light. This will ensure that no further adjustment of the light will be needed.

LANDING LIGHT INSTALLATION

a. Replace the light and install the seal back around the light.
b. Install the retaining ring around the light and secure with screws.
c. Reconnect the wiring to the back of the light and secure with screws.
d. Install the light assembly on the lower portion of the nose bug and secure with screws.

UPPER ROTATING BEACON REMOVAL

a. Remove the screw from the lens retaining clamp. Remove the lens.
b. Remove the bulb by rotating counterclockwise.

UPPER ROTATING BEACON INSTALLATION

a. Replace the bulb in the holder.
b. Install the lens on the plane making sure that the black "mask" is facing forward.
c. Secure the lens clamp with the screw.

LOWER ROTATING BEACON REMOVAL
(Prior to E-2050, CE-1014, D-10404, and EA-324 except EA-320)

a. Remove the screw from the lens retaining clamp. Remove the lens.
b. Remove the bulb by rotating counterclockwise.

LOWER ROTATING BEACON INSTALLATION
(Prior to E-2050, CE-1014, D-10404, EA-324 except EA-320)

a. Replace the bulb in the holder.
b. Install the lens on the plane.
c. Secure the lens clamp with the screw.

LOWER ROTATING BEACON BULB REMOVAL
(E-2050 and after; EA-320, EA-324 and after; CE-1014 and after; D-10404 and after)

a. Remove the screw from the lens.
b. Remove the lens.
c. Remove the bulb.

LOWER ROTATING BEACON BULB INSTALLATION
(E-2050 and after; EA-320, EA-324 and after; CE-1014 and after; D-10404 and after)

a. Install the bulb.
b. Install the lens and secure with the screw.

STEP LIGHT BULB REPLACEMENT

a. Locate the small upholstery side panel over the step light.
b. Remove the screws which hold the upholstery panel in place and remove the panel.
c. Pull the light assembly from its mounting bracket.
d. Remove the light bulb.

STEP LIGHT BULB INSTALLATION

a. Install a new bulb (1495 G E) in the light socket.
b. Install the light assembly in its mounting bracket.
c. Place the upholstery panel in place and install the screws.

CHART 1
LIGHT BULB REPLACEMENT

(D-10097, D-10120 and after; CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 through E-2110 except E-1946 and E-2104; EA-1 through EA-388 except EA-320)

LOCATION	*BULB REPLACEMENT*
Alternator Out Light	327
Cabin Overhead Light	1864
Clock Light	267
Compass Light	327
Condenser Door Open Light	327
Courtesy Light	1864
Door Ajar Light	327
Elevator Trim Tab Light	1819
Flight Compartment Floodlights	313
Fuel Select Light	327
Instrument Post Lights	327
Instrument Wedge Lights	267
Landing Gear Intransit Lights	327
Landing Gear Uplock Light	327
Landing Light	4596
Light Tray Assembly	267
Map Light	1495
Navigation Light (Tail)	A7512-24
OAT Light	327
Reading Light	303
Rotating Beacon (Lower) (Prior to E-2050, CE-1014, D-1404 and EA-324 except EA-320)	D7080A5-24
Rotating Beacon (Lower) (E-2050 thru E-210 except E-1946 and E-2104; EA-324 thru EA-388; CE-1014 and after)	WRM1939
Rotating Beacon (Upper)	D7080A1-24
Subpanel Post Lights	327
Strobe Light (Tail)	30-0815-1
Strobe Light (Wing)	30-1467-1
Tail Light	1683

(E-1946, E-2104, E-2111 and after; EA-320, EA-389 and after)

LOCATION	*BULB REPLACEMENT*
Alternator Out Light	327
Cabin Overhead Light	303
Cabin Reading	303
Clock Light	327
Compass Light	327
Condenser Door Open Light	327
Courtesy Light	1864
Door Ajar Light	1864
Elevator Trim Tab Light	1819
Flap Indicator	327
Flight Compartment Floodlights	313
Fuel Select Light	327
Glareshield	313AM
Instrument Post Lights	327
Instrument Wedge Lights	58-380022-13 Light Tray
Landing Gear Transit Light	327
Landing Gear Downlock Lights	327
Landing Light	4596
Map Light	1495
Navigation Light (Tail)	A508
Navigation (Wing)	A7512-24
OAT Light	327
Oxygen Post Light	334
Pedestal Post Lights	334
Reading Light	303
Rotating Beacon (Lower)	A707-9B-24
Rotating Beacon (Upper)	WRM1939
Rotating Beacon (Tail)	WRM1939
Step Light	1495
Strobe Light (Tail)	A506
Strobe Light (Wing)	30-1467-1
Tail Light	1683
Taxi Light	4313

"END"

CHAPTER 34

NAVIGATION

CHAPTER 34 - NAVIGATION & PITOT/STATIC

TABLE OF CONTENTS

SUBJECT *PAGE*

34-10-00

34-40-00

CHAPTER 34 - NAVIGATION & PITOT/STATIC

LIST OF EFFECTIVE PAGES

FLIGHT ENVIRONMENTAL DATA/PITOT STATIC - DESCRIPTION AND OPERATION

PITOT SYSTEM

The pitot system provides a source of impact air for operation of the airspeed indicator. The pitot mast is located under the leading edge of the left wing outboard of WS 122.75 on serials D-10097, D-10120 and After; CE-748, CE-772 and After; CJ-1149 and After; E-1111, E-1241 thru E-1370. At serials E-1371 and After; EA-11 and After the pitot mast is located outboard of WS 191.0. The pitot head is provided with an electric heating element which is turned on and off with a switch on the instrument panel. The switch should be on when flying in visible moisture. It is not advisable to operate the pitot heating element on the ground except for testing or for short intervals of time to remove ice and snow (Ref. Figures 1 and 2).

NORMAL STATIC AIR SYSTEM

The normal static system provides a source of static air to the flight instruments through a flush static fitting on each side of the airplane aft fuselage. On airplanes D-10097, D-10120 and After; CE-748, CE-772 and After; CJ-1149 and After; E-1111, E-1241 thru E-1370, aft of the rear closure bulkhead (rear seat panel) is a drain line, located at the low point of the static system. On E-1371 and After; EA-11 and After the drain is located under the airplane below the front edge of the pilot's side window (aft of FS 58). The drain may be accessed through the fuel strainer access door. They are provided to drain moisture accumulations from the system. The drain plug should be removed and the moisture drained from the plastic line every 100 hours and/or after exposure to visible moisture or sand and dust, either in the air or on the ground.

EMERGENCY STATIC AIR SYSTEM

An optional emergency static source may be installed to provide air for instrument operation, should the static ports become clogged. The emergency static control valve is located on the left side panel below the instrument subpanel at approximately FS 65. The static air control valve is a two-position valve with both OFF NORMAL and an ON EMERGENCY position. The valve handle is red in color and operation instructions are on a placard near the valve. For further information regarding the emergency static air source system, refer to the respective pilots operating handbook.

FLIGHT ENVIRONMENTAL DATA/PITOT STATIC - TROUBLESHOOTING

PITOT AND STATIC PRESSURE SYSTEM

Chart 1
Troubleshooting Pitot And Static Pressure System

INDICATION	PROBABLE CAUSE	REMARKS
1. Heating element inoperative.	a. Defective switch.	a. Replace switch.
	b. Grounded or open circuit.	b. Check continuity. Repair and replace as necessary.
	c. Defective heating element in pitot head.	c. Replace heating element.
2. Circuit breaker keeps tripping.	a. Grounded wire.	a. Remove ground from positive lead.
3. Instruments inoperative or erratic in operation.	a. Lines clogged.	a. Open drain valve, allow lines to drain. Disconnect the lines at the instrument panel and blow out lines with low air pressure.
	b. Lines leak.	b. Check lines for loose connection points and tighten.
	c. Leak in instruments.	c. Check instrument case.

FLIGHT ENVIRONMENTAL DATA/PITOT STATIC - MAINTENANCE PRACTICES

PITOT SYSTEM PRESSURE TEST

A functional test of the pitot system can be made by using an observer in the cabin to watch the airspeed indicator while air pressure is built up artificially by using a section of soft rubber tubing as follows:

a. Clamp the rubber tubing over the pitot head inlet, making certain that the connection is airtight.

CAUTION: *To avoid rupturing the diaphragm of the airspeed indicator, roll up the rubber tubing slowly.*

b. Crimp the end of the tubing and slowly roll it up until the airspeed indicator registers approximately 100 knots.

c. Secure the rolled up tubing so that it will hold the airspeed reading.

d. If there is no decline in the reading after several minutes, there is no leak in the pitot system.

e. If a decline in the reading of the airspeed indicator is observed, check the pitot system plumbing for leaky hoses and loose connections.

CAUTION: *Release the air pressure slowly by unrolling the rubber tubing; a sudden release of the air pressure may damage the airspeed indicator.*

INSPECTING PITOT SYSTEM HOSES

Before the pitot system is checked for leaks, the hose sections should be visually inspected for signs of deterioration. There are two sections of hose in the pitot system: one hose at the pitot mast, accessible by removing the inspection door adjacent to the mast, and the other hose behind the floating instrument panel which connects the pitot line to the airspeed indicator, accessible through the access door in the left side of the firewall. Hoses that are cracked or hardened should be replaced with rubber hose (14, Chart 1, 91-00-00). Anytime a hose is replaced, repeat the PITOT SYSTEM PRESSURE CHECK.

STATIC SYSTEM CHECKS

Proper functioning of the static air system is vital to safety of flight, particularly on instrument flight. Correct maintenance of the system should be performed as required.

The amount of attention required by the static system will depend largely on operating conditions. Extremes of humidity or precipitation, or of dry, dusty conditions, should be signals for increased emphasis on static systems check, since both are favorable to accumulations of foreign matter in the ports and lines.

CLEANING STATIC AIR SYSTEM

CAUTION: *Never blow air through the line toward the instrument panel; to do so will seriously damage the instruments. When blowing back through the line from the instrument panel, make sure that no air is blown into the instruments.*

NOTE: Wax or polish applied to the air buttons can cause wrong instrument readings. The static air buttons should be cleaned periodically with a cleaning solvent to insure that no film exists on the static air buttons.

Blow LOW pressure air through the lines from the disconnected lines at the airspeed indicator, altimeter and vertical speed indicator to the static ports. Cover each static port separately when blowing to insure that each line is clear. Instrument error or possible damage could result if even one port is clogged with dirt or foreign matter.

TESTING THE STATIC SYSTEM FOR LEAKS

The static system, altimeter instrument, and all ATC transponders must be tested and inspected at twenty four month intervals in compliance with the requirements specified in FAR Parts 91.170 and 91.177 under Title 14 of the Code of Federal Regulations.

CAUTION: *To avoid damaging the airspeed indicator, the indicator should be removed from the system and the lines capped or an equal pressure should be applied to the pitot side of the indicator while leak testing the system.*

Check the hoses connecting the static air line to the instrument plumbing and the tygon tubing which forms the static air line drain. Hoses which are cracked, particularly at the bends or connection points, or which have become hard, should be replaced with rubber hose (14, Chart 1, 91-00-00).

OUTSIDE AIR TEMPERATURE GAGE

The outside air temperature gage is mounted in the left side panel beneath the storm window. The pointer registers on a dial calibrated in degrees over a range of -70 to +150°F (-50 to +60°C).

REMOVAL OF THE OUTSIDE AIR TEMPERATURE GAGE

CAUTION: *Tape the gage to the molding or have an assistant hold the gage to prevent it from falling.*

a. Remove the sunshield, boss and washers from the stem.

b. When removing the gage, use care to avoid damaging the stem.

INSPECTION OF THE OUTSIDE AIR TEMPERATURE GAGE

Inspect the sunshield for dents, plugged openings and any misalignment that would allow contact with the stem. Inspect the nut and stem base for stripped or damaged threads. Inspect rubber washers for peeling, cracking and resiliency. Inspect the index markings on the gage for legibility. Inspect the pointer for chipped or peeling paint. Replace defective parts.

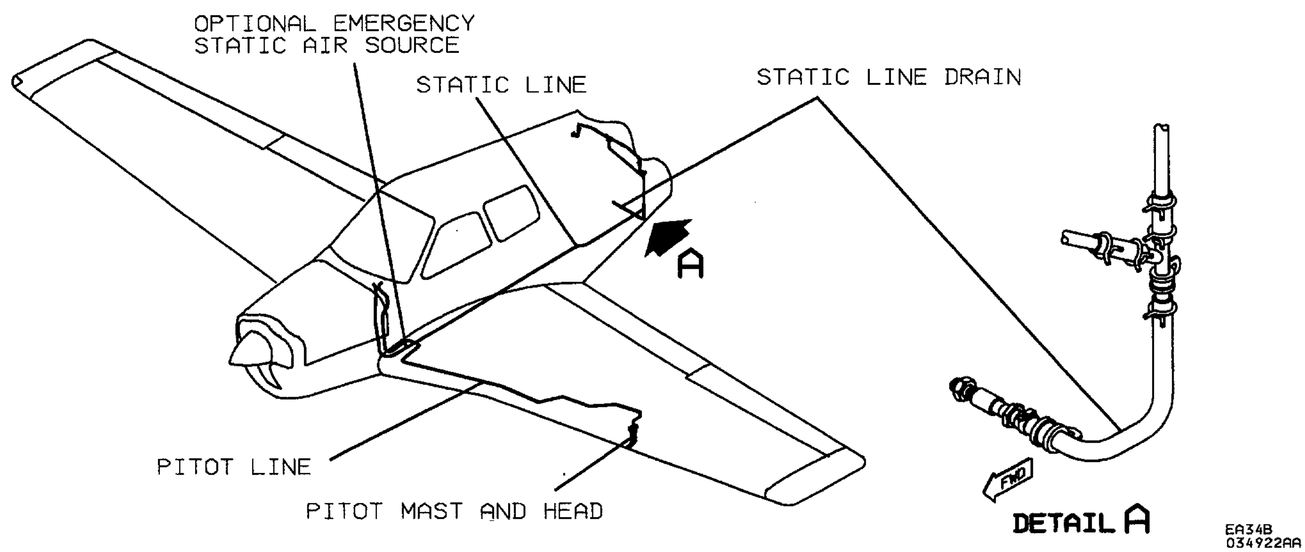
INSTALLATION OF THE OUTSIDE AIR TEMPERATURE GAGE

a. Install the mounting washer, boss and gage into the left side panel molding.

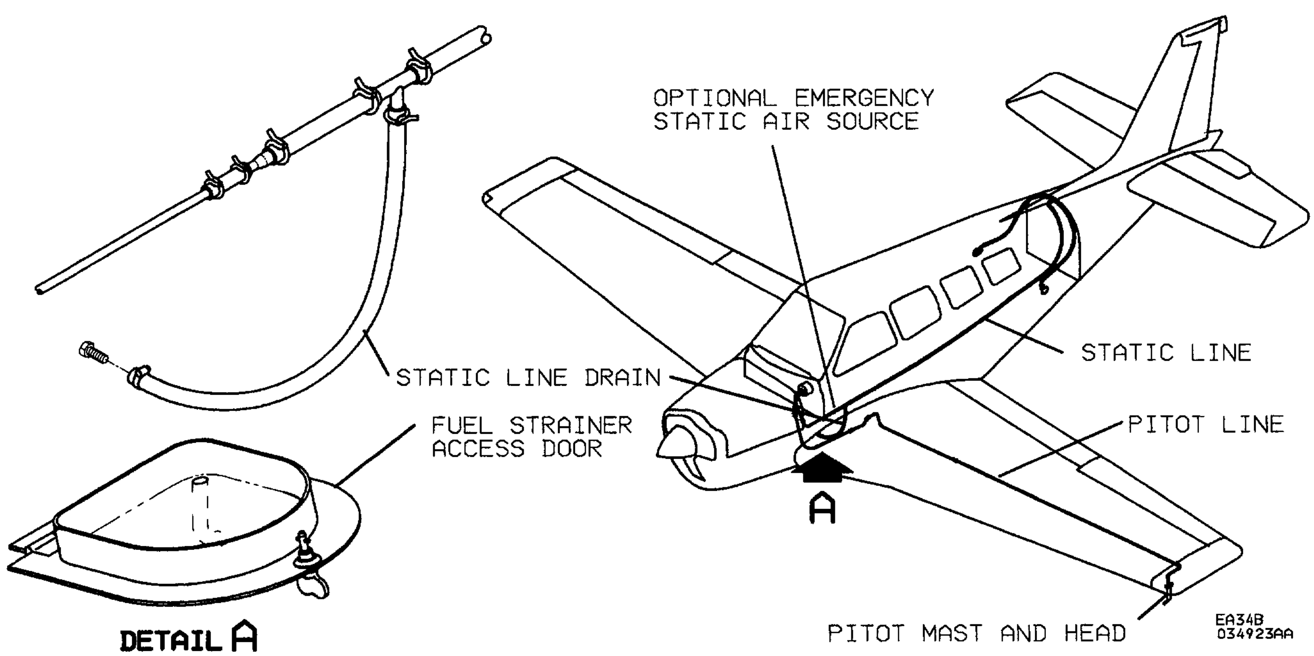
CAUTION: *Tape the gage to the molding or have an assistant hold the gage to prevent it form falling.*

b. Install the outer washers and boss.

c. Install the sunshield.



Pitot and Static System
(D-10097, D-10120 and After; CE-748, CE-772 and After; CJ-1149 and After; E-1111, E-1241 thru E-1370)
Figure 1



Pitot and Static System
(E-1371 and After; EA-11 and After)
Figure 2

INDEPENDENT POSITION DETERMINING - DESCRIPTION AND OPERATION

WEATHER RADAR

The weather scout 1 consists primarily of two items: the indicator in the radio section of the instrument panel, and the antenna in the outboard section of the right wing. There is also supporting equipment, such as a larger capacity engine driven air pump, electrical wiring, plumbing, etc. When the radar unit is turned on, there is a 30 to 40 second warm-up period with the word WAIT displayed on the screen. After WAIT disappears from the screen, there is a delay of approximately four minutes before the radar will function. (It is required that ventilation air be pumped through the antenna bay for approximately 4.5 minutes before the antenna will energize.)

WARNING

When the radar is on, personnel should not be within three feet of the radar antenna. This includes the complete 180° arc in front of the antenna. The eyes, reproductive and other vital organs of the body are particularly vunerable to radiation damage.

The time delay of 4.5 minutes starts upon completion of two actions: (1) the radar is turned on, (2) there is air pressure equal to approximately two inches of water in the air supply line to the antenna. (The sense switch is located in the air line near the antenna.) This air flow purges the antenna bay of all fuel fumes before the antenna comes on. The special fiberglass covering of the radar antenna is manufactured of three layers of 181 Volan, Epon 828 resin, Furane 951 hardener, Flex-T flexolizer. Any area of the fiberglass through which the radar will either transmit or receive should NOT be repaired.

INDEPENDENT POSITION DETERMINING - MAINTENANCE PRACTICES

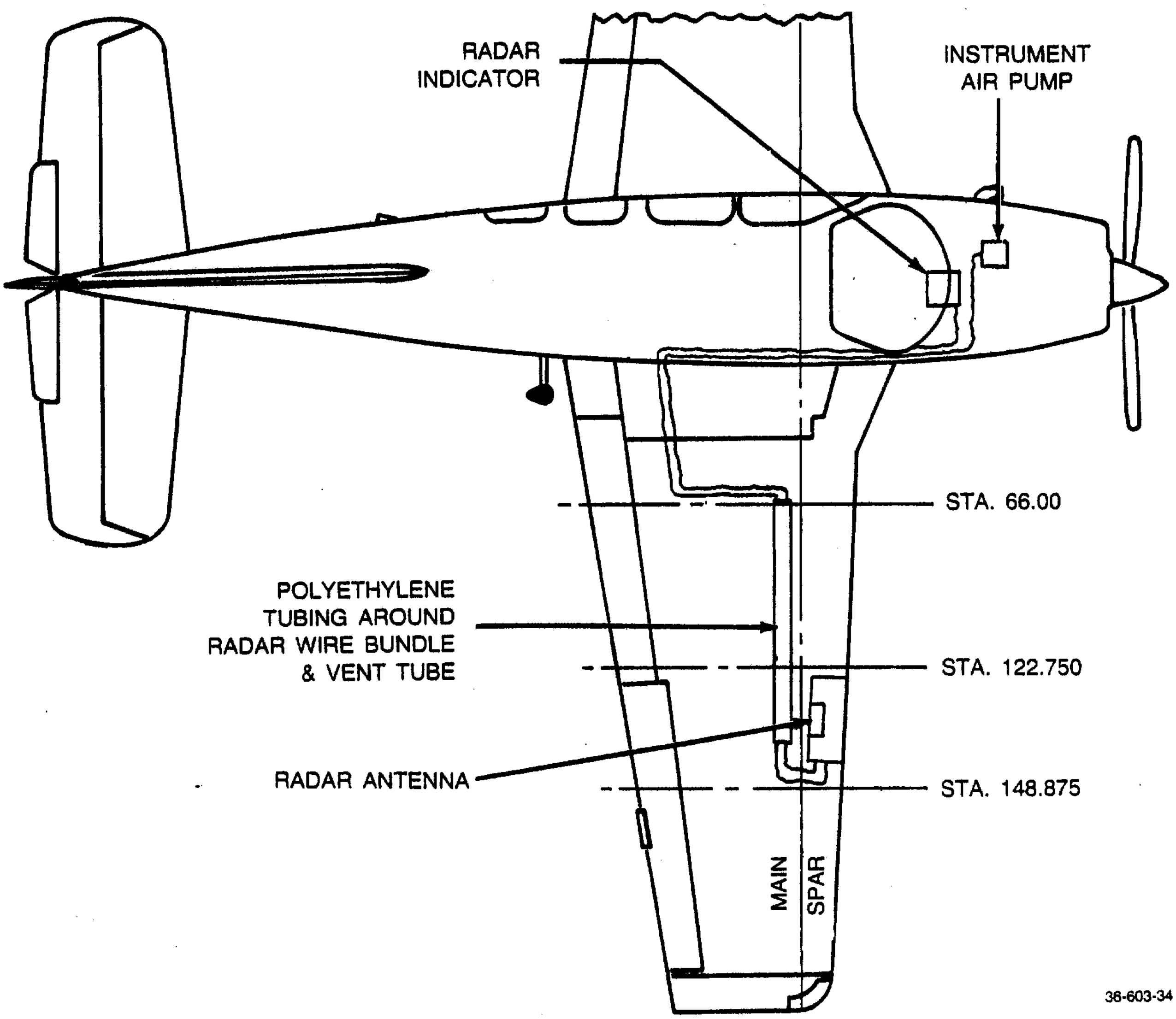
WEATHER RADAR

RADAR ANTENNA REMOVAL

a. Locate the antenna in the outboard leading edge of the right wing.
b. Remove the fiberglass antenna cover from the wing leading edge.
c. Remove the four bolts (2 on each end) from the antenna.
d. Pull the inboard end of the antenna forward until the connectors on the outboard end are accessible.
e. Disconnect the electrical connector, then disconnect the air line connector.
f. Remove the antenna.

RADAR ANTENNA INSTALLATION

a. Place the antenna in the wing.
b. Connect the airline connector, then connect the electrical connector.
c. Place the antenna in its mounting location and install the four bolts which secure it in place.
d. Install the fiberglass cover on the wing.



Radar Schematic
Figure 1

"END"

CHAPTER

35

OXYGEN

CHAPTER 35 - OXYGEN

TABLE OF CONTENTS

"END"

CHAPTER 35

LIST OF PAGE EFFECTIVITY

"END"

GENERAL - DESCRIPTION AND OPERATION

The optional oxygen system in the Bonanza series airplanes (except EA-320, EA-440 and after) has an oxygen cylinder attached to the floor in front of the spar carry through. The filler valve is attached to the spar cover below the copilots seat. The oxygen console to the left of the pilot contains the pilot's outlet and the pressure gage. On some airplanes (prior to E-2111, except E-1946, E-2104; and prior to EA-389 except EA-320), the oxygen console also contains a shutoff valve and the pressure regulator mounted on the back of the console. This system also has a shutoff valve mounted on the oxygen cylinder. On serials E-1946, E-2104, E-2111 and after; and EA-320, EA-389 and after, there is one cable operated shutoff valve mounted on the oxygen cylinder. The push-pull knob for this shutoff valve is in the subpanel below the pilot's control column. On serials EA-320, EA-440 and after the oxygen filler valve, cylinder(s), shutoff valve(s), and regulator(s) are mounted in the wing(s) outboard of wing station 66.

The oxygen system in the Bonanza Series airplanes may be equipped with oxygen outlets for either 3, 4, or 5 passengers and the pilot. On earlier airplanes the oxygen outlets are all in the sidewalls of the airplane. On serials CE-919, CE-923, CE-925, CE-927, CE-929 and after; CJ-156 and after; D-10348, D-10353 and after; E-1422, E-1551, E-1569, E-1581, E-1594 and after; EA-21, EA-28, EA-33 and after, the oxygen outlets for the pilot and copilot are in the sidewall, while the other outlets are in the headliner near the center of the airplane. The oxygen masks for the pilot (except on E-1946, E-2104, E-2111, and after; EA-320, EA-389, and after) and the copilot are stowed in a box under their seats. At serials E-1946, E-2104, E-2111, and after; EA-320, EA-289, and after, the mask for the pilot may be stowed in a place he considers convenient. The third and fourth seat oxygen masks are stowed in a box attached either to the front or rear of the rear spar, depending upon the seating arrangement. The oxygen masks for the fifth and sixth seats are stowed in a box attached to the bottom of their seats.

Starting with serials EA-320 and EA-440 and after, the B36TC oxygen system (Figure 3) has wing mounted oxygen cylinders. The 98-cubic foot system has one 49-cubic foot cylinder mounted in each wing. The 49-cubic foot system has one 49-cubic foot cylinder mounted in the left wing only. Mounted on the end of each cylinder is the altitude compensating regulator, overboard dump, and the shut-off valve. The cylinders are mounted in the wing aft of the main spar outboard of wing station 66. The filler valve and a pressure gage are mounted in the top of the wing outboard of wing station 66 and aft of the main spar. There is an overboard dump system on each cylinder which will automatically dump the oxygen any time the cylinder pressure reaches between 2500 and 2775 psi. There is an indicator (placarded OXY, H.P. Relief) under each wing which will rupture any time the dump system is activated.

The shut-off valves(valve) are(is) controlled by a push-pull knob (Figure 4) in the pilots subpanel. The oxygen pressure gage and pilots outlet are located in the pilots left side panel while the copilots outlet is located in the right side panel. The five passenger outlets are located in the headliner near the center of the airplane. The oxygen masks for the pilot (except on EA-320, EA-389, and after) and copilot are stowed in a box under their seats. At serials EA-320, EA-389 and after, the mask for the pilot may be stowed in a place he considers convenient. The third and fourth seat oxygen masks are stowed in a box attached either to the front or rear of the rear spar, depending on the seating arrangement. The oxygen masks for the fifth and sixth seats are stowed in a box attached to the bottom of their seats. Access to the filler valve and pressure gage is gained by removing the access panel located on top of the left wing aft of the main spar outboard of Wing Station 66. The access panel is held in place by six Dzus fasteners.

A 49.8-cubic foot oxygen cylinder is the normal optional system on all Bonanza's except EA-320, EA-440 and after. At serial E-1241 and after, and EA-2 through EA-388, a 76.5-cubic foot optional cylinder is offered. At serials EA-320, EA-440 and after, either a 49-cubic foot or 98-cubic foot system is offered. The cylinder should be filled to a pressure of 1850 ± 50 psi at a temperature of 70 degrees F. This pressure may be increased 3.5 psi. for each degree of temperature increase, or lowered 3.5 psi. for each degree of temperature decrease. The pressure gage is connected directly to the oxygen cylinder and indicates the supply (psi.) of oxygen available. The altitude compensated pressure regulator limits system operation to above 8,000 feet, where its sensing element meets increases in altitude with increased oxygen flow. When the system is not in use, shut off the control valve to prevent oxygen loss. For system servicing refer to Chapter 12.

WARNING

Keep fires, cigarettes and sparks away when outlets are in use. Open and close all oxygen valves slowly. Make sure the oxygen shut-off valve is in the closed position. Inspect the filler connection for cleanliness before attaching it to the filler valve. Keep tools, hands and components clean, as fire or explosion may occur when pure oxygen comes in contact with organic material such as grease or oil.

GENERAL - MAINTENANCE PRACTICES

CAUTION

All persons handling and servicing oxygen systems should review proper precautions to be observed during servicing. FAA Advisory Circular 43.13-1A contains the necessary information.

OXYGEN LOW PRESSURE TEST PROCEDURE (D-10097, D-10120 and after; CE-748, CE-772 and after; E-1111, E-1241 through E-2110 except E-1946 and E-2104; EA-1 through EA-388 except EA-320)

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Oil and grease will ignite upon contact with oxygen under pressure.

a. Turn the valve on the oxygen cylinder to the full off position.

b. Disconnect the oxygen cylinder from the regulator at the regulator and cap the open lines.

c. Plug a 0 to 100 psi. pressure gage into any outlet except the pilot's outlet.

d. Pressurize the system 50 to 55 psi. and allow the system to stabilize for 2 minutes.

e. During the following 15 minutes the pressure drop should not exceed 5.0 psi.

f. If the pressure test is satisfactory, reconnect the high pressure lines disconnected in step "b".

g. Pressure test the connections made in step "f" using cylinder pressure (1500 psi. or higher), and leak test compound, (13, Chart 1, 91-00-00).

h. After the test, wipe the area clean and dry.

OXYGEN HIGH PRESSURE TEST PROCEDURE (D-10097, D-10120 and after; CE-748, CE-772 and after; E-1111, E-1241 through E-2110 except E-1946 and E-2104; EA-1 through EA-388 except EA-320)

a. Check to make certain the system is charged to 1500 psi. or higher.

b. Make sure the shut-off valve on the oxygen console is turned off.

c. Turn off the oxygen supply at the oxygen cylinder.

d. Observe the pressure gage on the oxygen console; there should be a pressure drop of no more than 400 psi. in 5 minutes.

e. If the test was satisfactory, turn on the oxygen supply at the oxygen cylinder. If a leak was detected, check the suspected areas with leak test compound, (13, Chart 1, 91-00-00) and repeat steps "c" through "e".

f. After the test, wipe the area clean and dry.

OXYGEN LOW PRESSURE TEST PROCEDURE (E-1946, E-2104, E-2111, and after; EA-320, EA-389, and after)

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

a. Turn the oxygen to the full off position (use the push-pull knob).

b. Disconnect the oxygen low pressure lines from the regulator(s) and cap the open lines.

c. Plug a 0 to 100 psi. pressure gage into any outlet.

d. Pressurize the system to 50 to 55 psi and allow the system to stabilize for 2 minutes.

e. During the next 15 minutes the pressure drop should not exceed 5.0 psi.

f. If the pressure test is satisfactory, reconnect the lines disconnected in step "b".

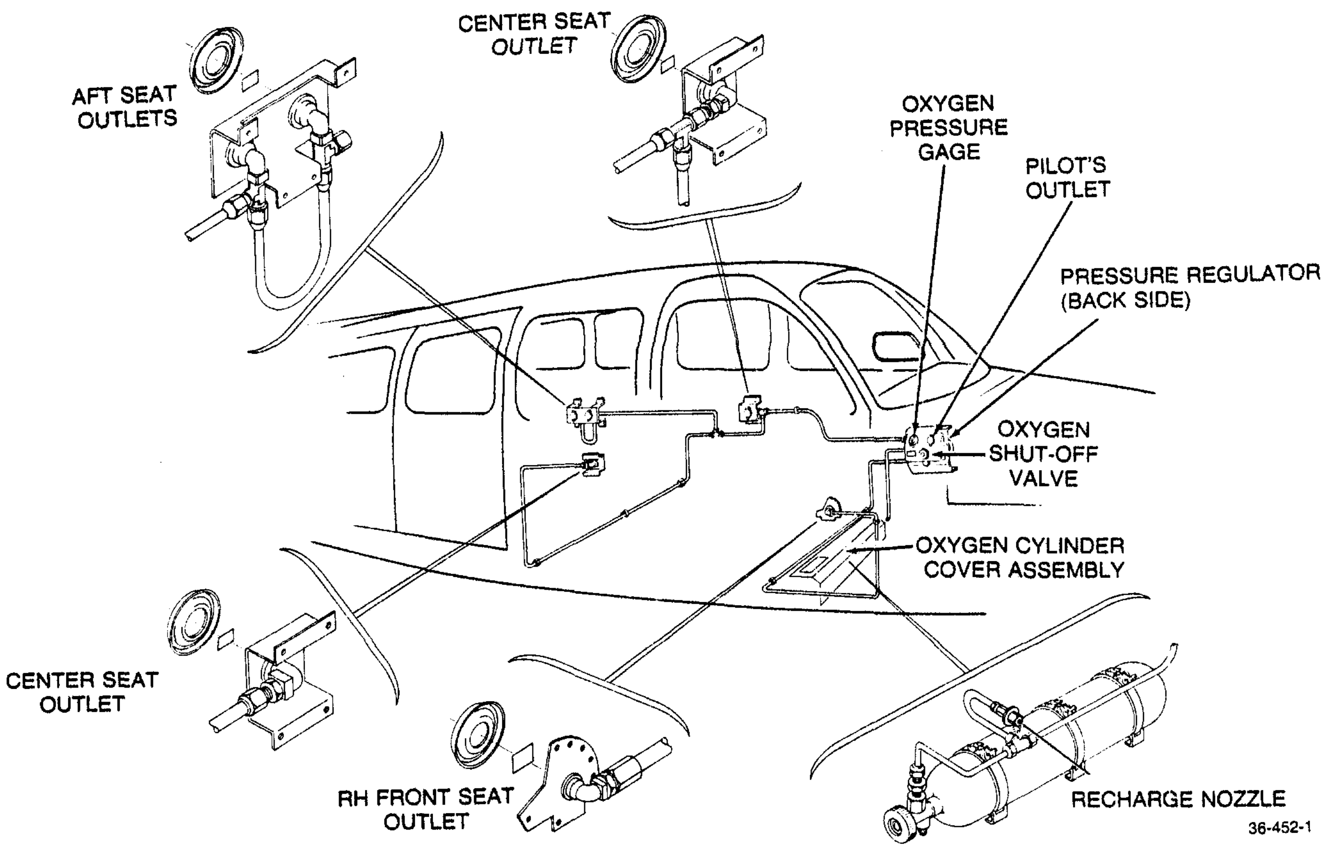
g. Pressure test the connections made in step "f" using cylinder pressure (1500 psi. or higher in the cylinder), and leak test compound, (13, Chart 1, 91-00-00).

h. After the test, wipe the area clean and dry.

OXYGEN HIGH PRESSURE TEST PROCEDURE (E-1946, E-2104, E-2111, and after; EA-320, EA-389, and after)

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.



Oxygen System (Prior to CE-929 except CE-919, CE-923, CE-925, CE-927; prior to CJ-156; prior to D-10353 except D-10348; prior to E-1594 except E-1422, E-1551, E-1569 and E-1581; prior to EA-33 except EA-21 and EA-28)
Figure 1

a. Check to make certain the system is charged to 1500 psi. or higher.

b. Make sure the shut-off valve(s) is(are) off (check the push-pull knob).

c. Observe one of the pressure gages, there should be no pressure drop in 30 minutes.

d. If the leak test is not satisfactory, use leak test compound (13, Chart 1, 91-00-00) on the system connections until the leak is located.

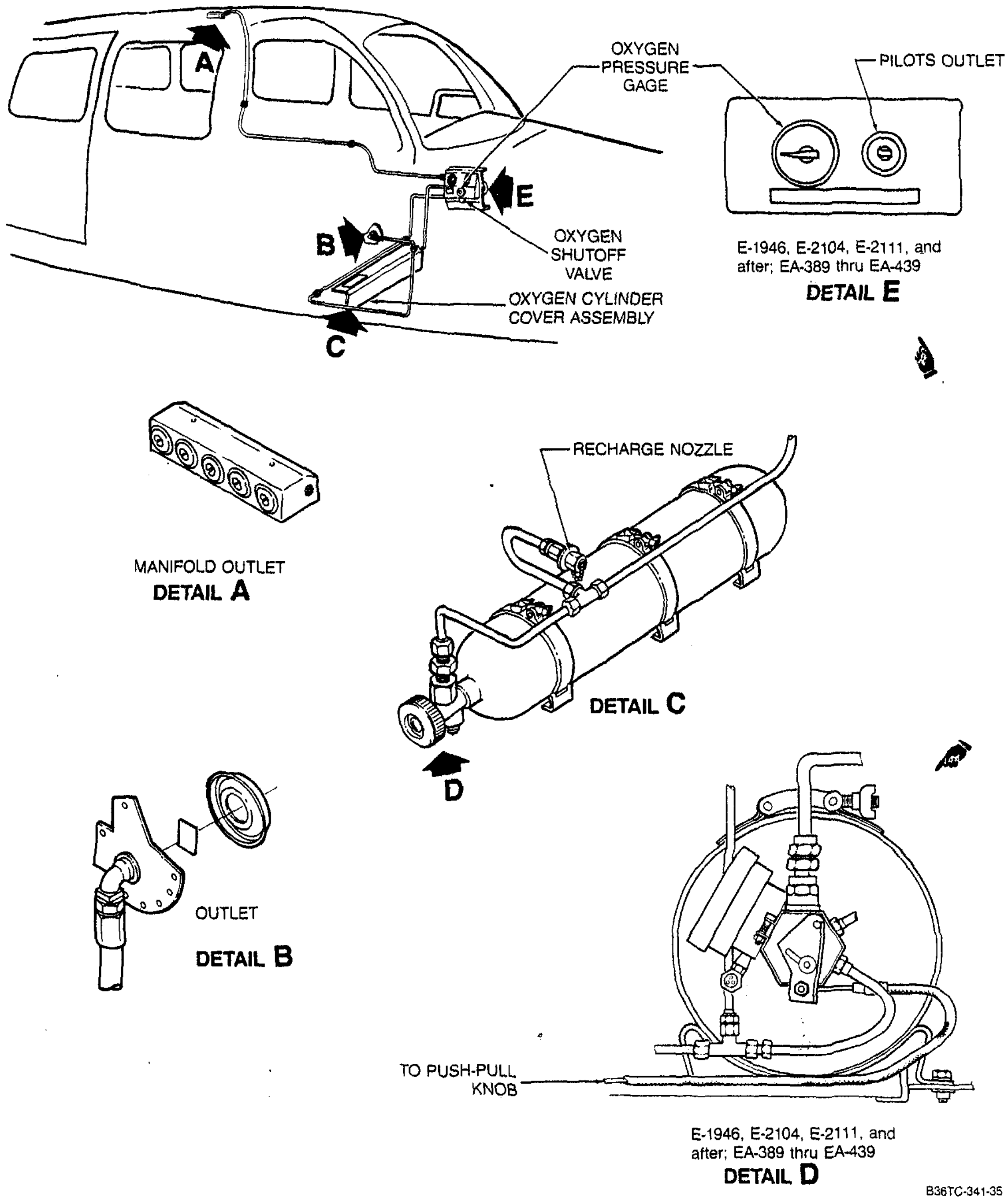
e. Make the necessary repairs and repeat step "c".

f. Wipe the tested areas clean and dry.

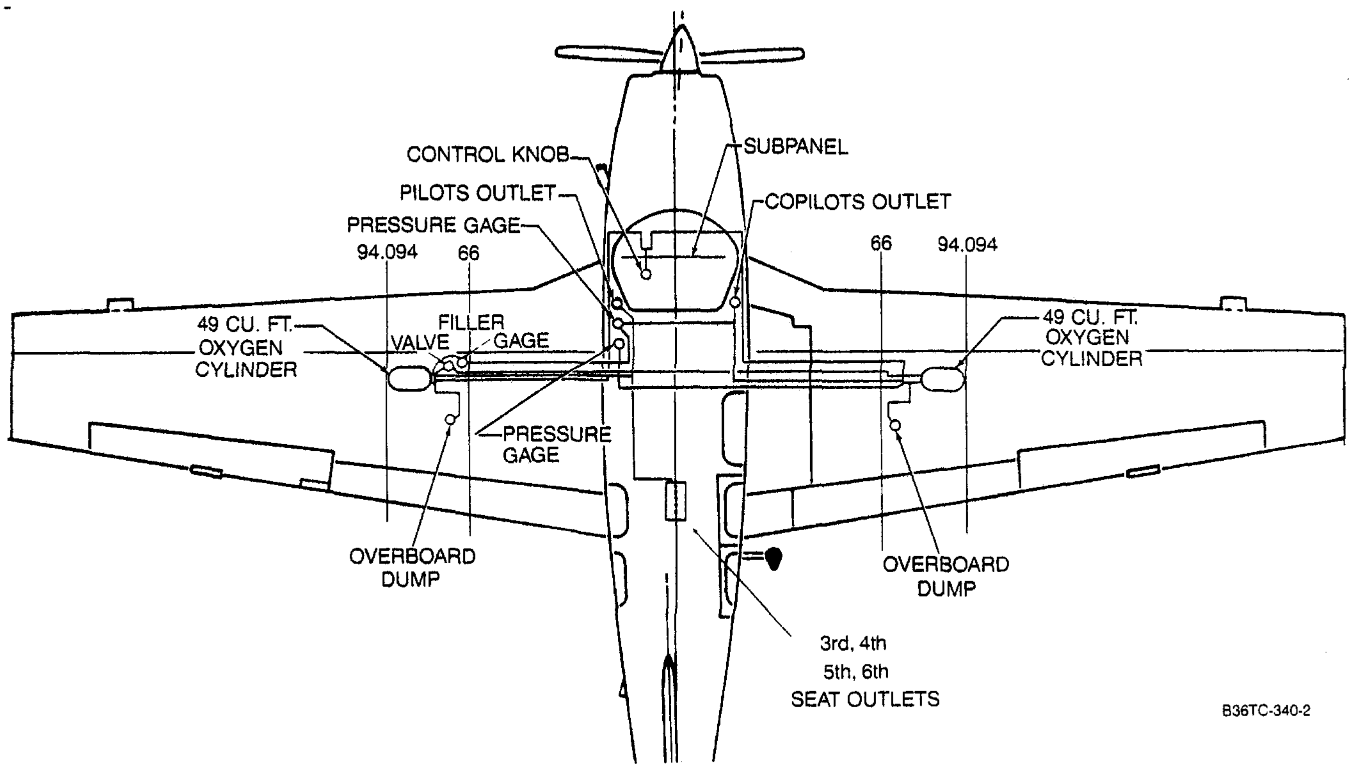
OXYGEN SYSTEM PURGING

WARNING

Do not use oxygen intended for medical purposes, or such industrial uses as welding. Such oxygen may contain excessive moisture that could freeze up the valves and lines of the oxygen system. When filling the oxygen system, use only MIL-O-27210 Aviator's Breathing Oxygen (10, Chart 1, 91-00-00).



Oxygen System (CE-919, CE-923, CE-925, CE-927, CE-929 and after; CJ-156 and after; D-10348, D-10353 and after; E-1422, E-1551, E-1569, E-1581, E-1594 and after; EA-21, EA-28, EA-33 through EA-439 except EA-320)
Figure 2



Oxygen System
(EA-320, EA-440 and after)
Figure 3

Offensive odors may be removed from the oxygen system by purging. *The system should also be purged any time the* lines are left open and subject to contamination. Purging is accomplished by connecting a recharging cart into the system and permitting oxygen to flow through the lines and outlets until any offensive odors have been carried away. The following steps outline the procedures recommended for purging the oxygen system.

WARNING

Avoid making sparks and keep all burning cigarettes or fire away from the vicinity of the airplane when the outlets are in use. Inspect the filler connection for cleanliness before attaching it to the filler valve. Make sure that your hands, tools, and clothing are clean, particularly from grease and oil stains, for these contaminants *will ignite upon contact with oxygen.*

a. Connect a line from a recharging cart to the oxygen filler valve.
b. Slowly open the oxygen supply.
c. Slowly open the valve which allows oxygen to flow through the mask outlets
d. Plug in an oxygen mask at each outlet in the cabin and cockpit.
e. Open all doors and windows.
f. Set the cart pressure regulator to deliver 50 psi to the system.
g. Allow system to purge for one hour and check for the presence of odor. If the odor is still present, continue purging for one additional hour. If the odor is still present after the second hour of purging, replace the supply cylinder.

OXYGEN CYLINDER REMOVAL (D-10097, D-10120 and after; CE-748, CE-772 and after; E-1111, E-1241 through E-2110 except E-1946 and E-2104; EA-1 through EA-388 except EA-320)

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

a. Slowly close the oxygen supply cylinder valve.
b. Remove the pilot's and copilot's seat. (See PILOT AND COPILOT SEAT REMOVAL in Chapter 25-00-00.)
c. Remove the spar cover.
d. Disconnect the line from the supply cylinder.
e. Cap the open line immediately with a clean metal fitting.
f. Loosen the bracket clamp wing nuts.
g. Unhook the cylinder clamps and remove the cylinder from the brackets.

OXYGEN CYLINDER INSTALLATION (D-10097, D-10120 and after; CE-748, CE-772 and after; E-1111, E-1241 through E-2110 except E-1946 and E-2104; EA-1 through EA-388 except EA-320)

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

a. Place the new cylinder in the brackets and close the cylinder clamps.
b. Tighten the bracket clamp wing nuts.
c. Carefully inspect the fittings on both the cylinder and the line for cleanliness and the presence of foreign matter, which may contaminate the oxygen until it is unfit for breathing.
d. Connect the line fitting to the cylinder fitting.
e. Slowly open the supply cylinder valve.
f. Test the connections for leaks with Oxygen System Leak-Test Compound, (13, Chart 1, 91-00-00).
g. Install the spar cover.
h. Install the seats. (See PILOT AND COPILOT SEAT INSTALLATION in Chapter 25-00-00.)

OXYGEN CYLINDER REMOVAL (E-1946, E-2104, E-2111 and after; EA-389 through EA-439)

a. Make certain the system is turned off.
b. Remove the pilot's and copilot's seat. (See PILOT AND COPILOT SEAT REMOVAL in Chapter 25-00-00.)
c. Remove the spar cover.
d. Disconnect the control cable from the oxygen valve.

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

CAUTION

Care must be exercised to prevent accidentally turning the oxygen on. Some oxygen will be lost when the lines are disconnected, especially the high pressure line.

e. Disconnect the lines from the oxygen cylinder and cap or plug the openings.
f. Loosen the wing nuts on the cylinder clamps and disconnect the clamps.
g. Remove the oxygen cylinder.

OXYGEN CYLINDER INSTALLATION (E-1946, E-2104, E-2111 and after; EA-389 through EA-439)

a. Place the cylinder in the proper position in the airplane.
b. Connect the cylinder clamps and tighten the wing nuts.
c. Remove the plugs or caps and install the oxygen lines.

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

CAUTION

Care must be exercised to prevent accidentally turning the oxygen on. Some oxygen will be lost when the lines are connected, especially the high pressure line.

d. Connect the control cable to the oxygen valve.

e. Check for leaks as indicated in OXYGEN LOW PRESSURE TEST PROCEDURE (E-1946, E-2104, E-2111 and after; EA-320, EA-389, and after) and in OXYGEN HIGH PRESSURE TEST PROCEDURE (E-1946, E-2104, E-2111, and after; EA-320, EA-389 and after).

f. Install the spar cover.

g. Install the pilot's and copilot's seats. (See PILOT AND COPILOT SEAT INSTALLATION in Chapter 25-00-00.)

OXYGEN CYLINDER REMOVAL (EA-320, EA-440 and after)

a. Turn the oxygen off.

b. Locate the oyxgen cylinder access panel located under the wing aft of the main spar and outboard of Wing Station 66.

c. Remove the screws from the access panel and remove the panel.

d. Disconnect the control cable from the oxygen cylinder valve.

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

CAUTION

Care must be exercised to prevent accidentally turning the oxygen on. Some oxygen will be lost when the lines are disconnected, especially the high pressure line.

e. Disconnect the lines from the oxygen regulator and cap or plug the openings.

f. Loosen the wing nuts on the cylinder clamps.

g. Position a suitable cradle under the oxygen cylinder and disconnect the clamps.

OXYGEN CYLINDER INSTALLATION (EA-320, EA-440 and after)

a. Position the oxygen cylinder in position in the wing and connect the clamps.

b. Check to be certain the cylinder is in the proper position and tighten the clamp wing nuts. Safety wire the nuts.

c. Remove the caps or plugs from the connection points and install the oxygen lines.

CAUTION

If there is oxygen in the cylinder, there will be some oxygen lost when the high pressure lines are connected, particularly the pressure gage line.

WARNING

Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Hands, clothing and tools should be clean. Oil and grease will ignite upon contact with pure oxygen under pressure.

d. Connect the control cable to the oxygen cylinder valve.

e. Check for leaks as indicated in OXYGEN LOW PRESSURE TEST PROCEDURE (EA-320, EA-440 and after) and OXYGEN HIGH PRESSURE TEST PROCEDURE (EA-320, EA-440 and after).

f. If the pressure tests are satisfactory, install the access cover under the wing.

OXYGEN CONTROL CABLE ADJUSTMENT (E-1946, E-2104, E-2111, and after; EA-389 through EA-439)

a. Remove the pilot's and copilot's seats. (See PILOT AND COPILOT SEAT REMOVAL in Chapter 25-00-00.)

b. Remove the spar carry through cover.

c. Adjust the control cable by repositioning the cable, cable housing or both.

d. Install the spar carry through cover.

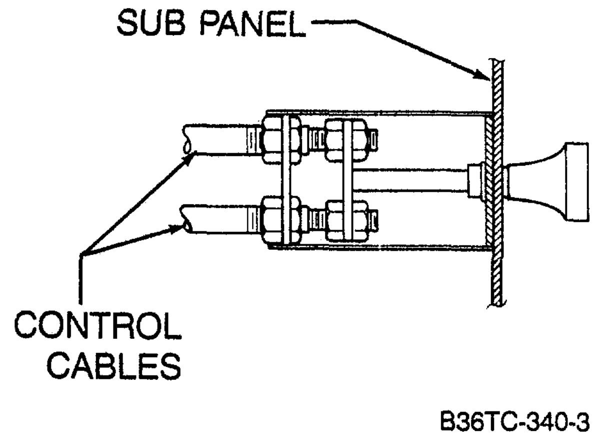
e. Install the pilot's and copilot's seats. (See PILOT AND COPILOT SEAT INSTALLATION in Chapter 25-00-00.)

OXYGEN CONTROL CABLE ADJUSTMENT (EA-320, EA-440 and after)

The control cable(s) may be adjusted either in the wing(s) at the valve(s) or at the push-pull knob (Figure 4) just forward of the instrument subpanel. Coarse adjustments may be made at the valve(s) by repositioning the cable, cable housing, or both. The valve(s) is located on the cylinder above an access panel outboard of Wing Station 66 and aft of the main spar. Finer adjustment of the system cables may be made at the push-pull knob (Figure 4) just forward of the instrument subpanel. On the two cylinder system both valves should turn off or on simultaneously.

OXYGEN CYLINDER RETESTING

Oxygen cylinders used in the airplanes are the light weight type, stamped "3 HT" on a plate on the side of each cylinder. Each oxygen cylinder must be hydrostatically tested every three years and the test date stamped on the cylinder. The cylinder has a service life of 24 years and/or 4,380 pressurizations, whichever occurs first. When the service life of the cylinder is complete, the cylinder must be discarded.



Oxygen Shut-Off Control
Figure 4

"END"

CHAPTER

36

PNEUMATIC

CHAPTER 36 - PNEUMATIC

TABLE OF CONTENTS

SUBJECT *PAGE*

36-00-00

CHAPTER 36 - PNEUMATIC

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
36-LOEP	1	Mar 31/04
36-CONTENTS	1	Mar 31/04
36-00-00	1 thru 11	Mar 31/04

PNEUMATIC - DESCRIPTION AND OPERATION

INSTRUMENT AIR SYSTEM

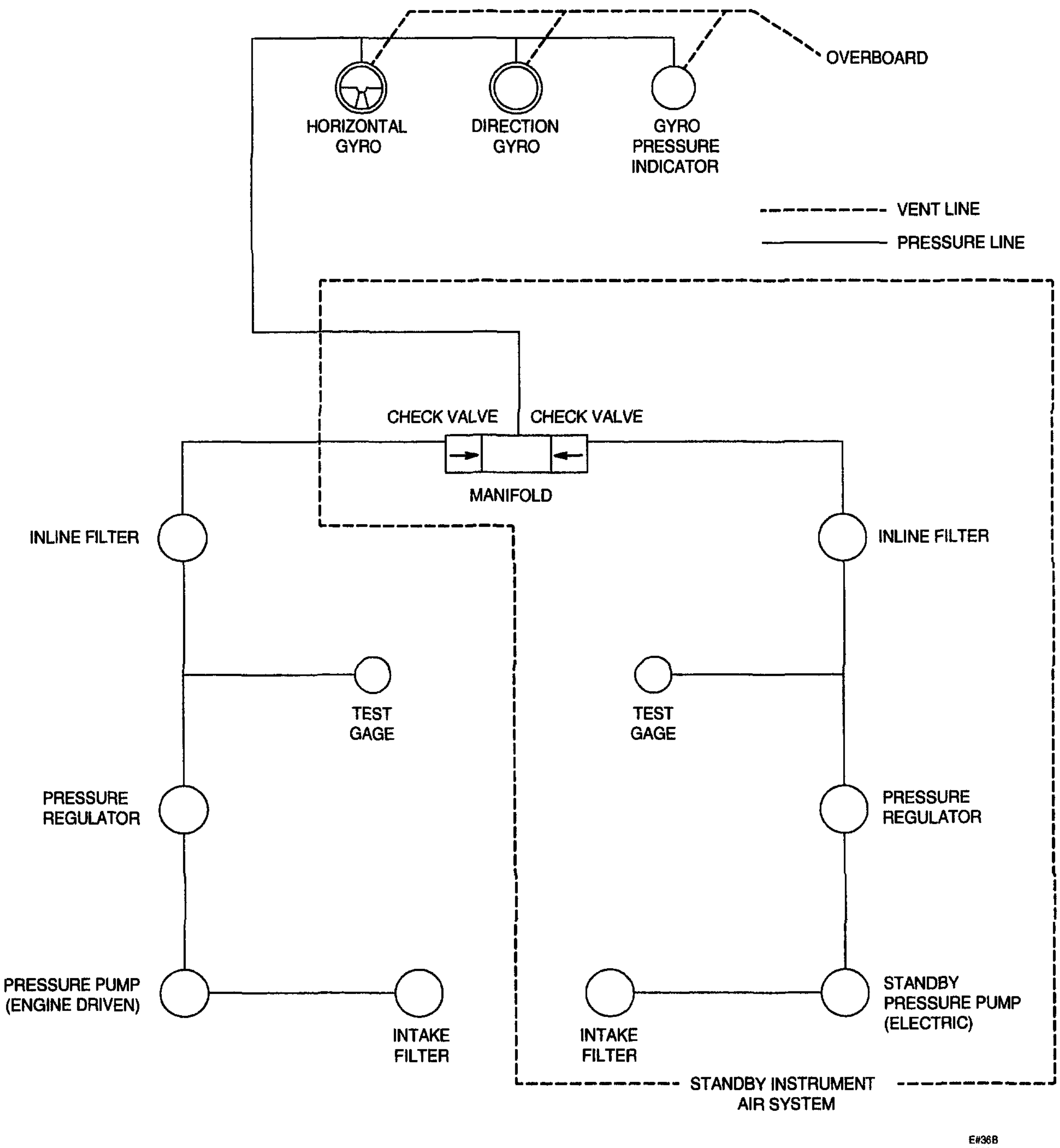
The instrument air pressure system provides air for operation of the directional gyro and horizon gyro. Air is drawn through an inlet air filter mounted on the rear engine baffle by the dry air pump. The air is then routed through the air pressure regulator and inline filter to the gyros. The regulator, which is located near the inline filter on the rear engine baffle, should be adjusted to a pressure of 5.0 in. Hg. as indicated on the cockpit gage (Ref. Figure 1).

Instrument air pressure is monitored by the instrument air gage located in the upper right side of the instrument panel. (At serials E-1946, E-2104, E-2111 and After; EA-320, EA-389 and After, the pressure gage is in the left side of the instrument panel.)

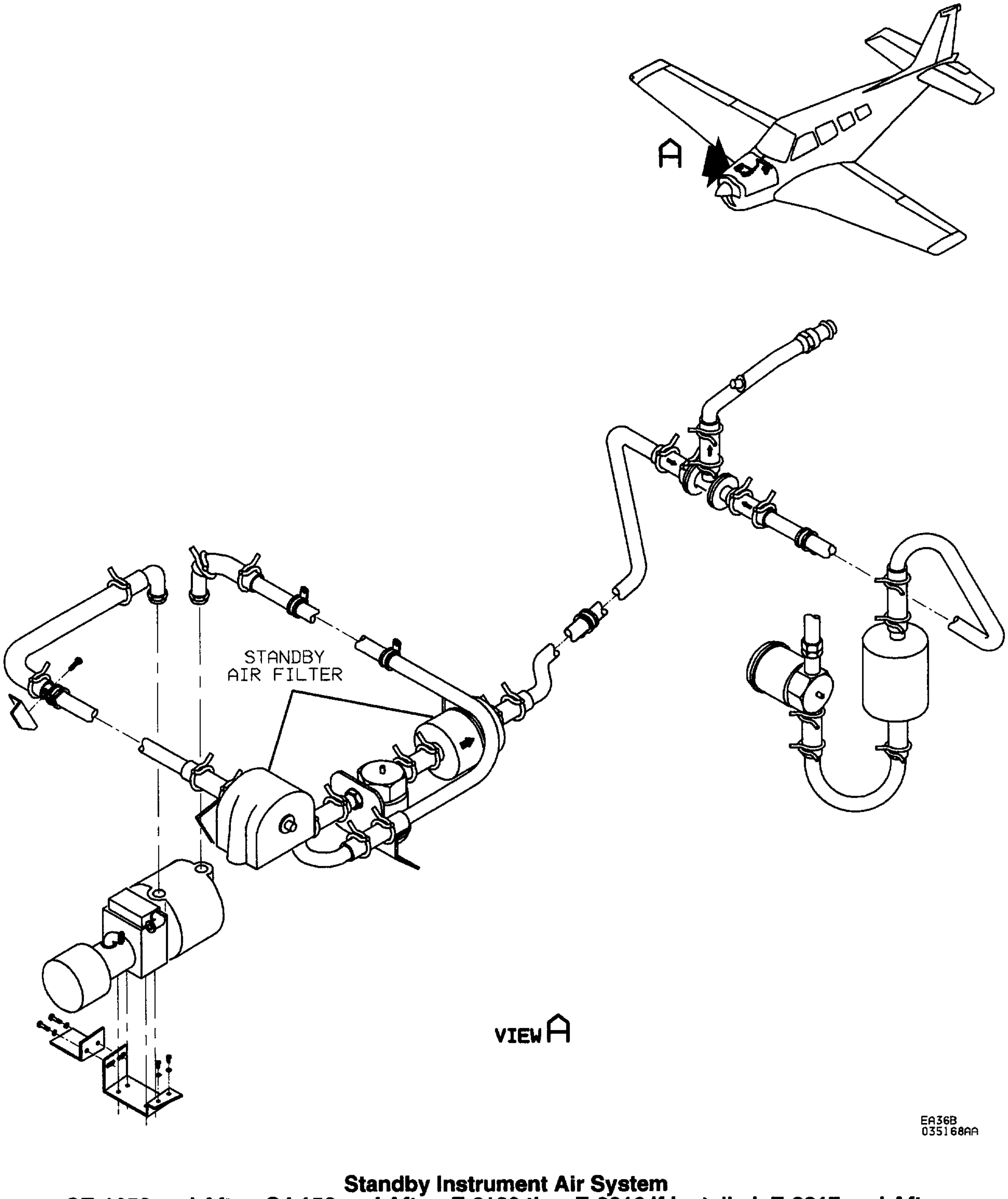
STANDBY INSTRUMENT AIR SYSTEM (CE-1056 AND AFTER; CJ-156 AND AFTER; E-2180 THRU E-2216 IF INSTALLED, E-2217 AND AFTER; EA-422 THRU EA-442 IF INSTALLED, EA-443 AND AFTER; AND AIRPLANES WITH KIT NO. 36-5009 OR 36-5011 INSTALLED)

CAUTION: *Never use an air pump which has been dropped or mishandled.*

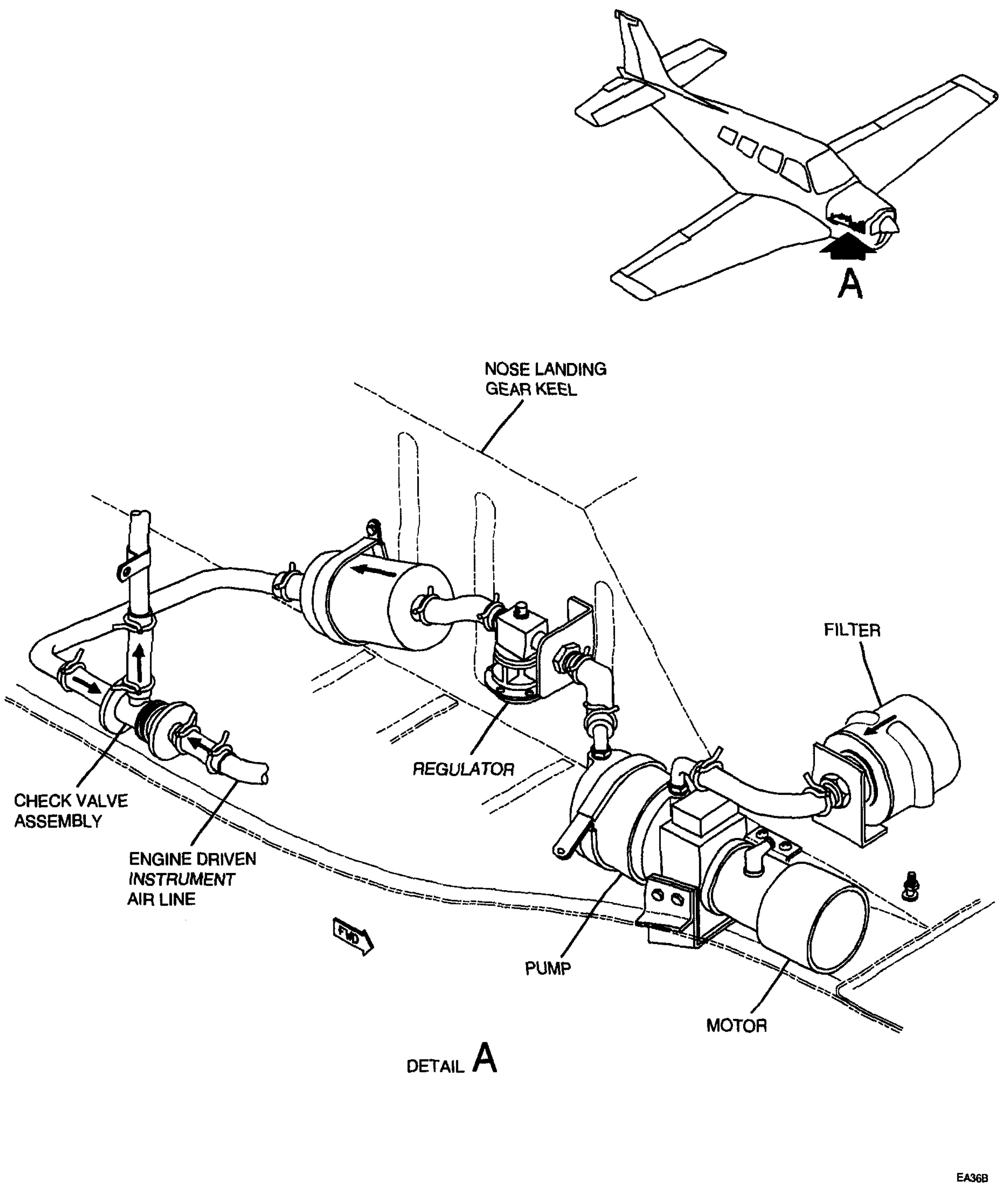
A standby instrument air pressure system is provided to supply instrument air in the event the primary instrument air pressure system fails. The system incorporates a pressure pump which is driven by an electric motor, a pump intake filter which is mounted on the underside of the engine, an inline filter and a pressure regulator. The standby system is controlled by an ON/OFF toggle switch, placarded STANDBY GYRO P, located on the LH subpanel. When the system is activated, a solenoid valve, mounted in the pressure supply line just aft of the firewall fitting, automatically isolates all air driven instruments except the directional gyro and the horizon gyro. The standby air pressure system is plumbed into the primary system ducting by use of a manifold with check valves to prevent backflow.



Pressure System Schematic
Figure 1



Standby Instrument Air System
CE-1056 and After; CJ-156 and After; E-2180 thru E-2216 If Installed, E-2217 and After, and Airplanes With Kit No. 36-5009 Installed
Figure 2 (Sheet 1 of 2)



Standby Instrument Air System
EA-422 thru EA-442 if Installed, EA-443 and After, and Airplanes With Kit No. 36-5011 Installed
Figure 2 (Sheet 2 of 2)

PNEUMATIC - TROUBLESHOOTING

TROUBLESHOOTING INSTRUMENT AIR SYSTEM

Chart 1
Troubleshooting Instrument Air System

INDICATION	PROBABLE CAUSE	REMARKS
1. Zero indication on instrument gage.	a. Hole in gyro plumbing, line plugged, filter plugged or plumbing disconnected.	a. Inspect plumbing, replace or connect lines or replace filter as necessary.
	b. Defective instrument pressure gage.	b. Replace gage.
	c. Defective gyro horizon or direction gyro.	c. Inspect instrument and replace as necessary.
	d. Defective pump.	d. Replace pump.
	e. Defective regulator.	e. Replace regulator.

Note: Troubleshooting procedures for the primary and standby air pressure systems are the same.

PNEUMATIC - MAINTENANCE PRACTICES

SERVICING

Impurities and foreign matter are removed from the air by two pressure system filters. The intake filter is located on the top of the engine, ahead of the pressure pump. This filter should be replaced annually or every 300 to 500 hours of service time depending upon operating conditions. The filter element must not be subjected to solvents and must be replaced if this occurs. Always reinstall the filter cover with the opening facing down. The inline filter is located between the pressure regulator and the instruments. The frequency of replacing this air filter will depend upon service conditions; however, they should be checked approximately every 100 hours of operation and replaced every 300 hours of operation, or sooner if conditions warrant.

The intake filter for the standby instrument air system is located on the underside of the engine attached to the keel structure. The inline filter is mounted in the RH engine compartment between the pressure regulator and the instruments, at FS 28.25 to 30.75. The intake filter should be replaced every 500 hours or on condition and the inline filter should be replaced every 300 hours or on condition.

When operating in localities where there is a great amount of dust or sand in the air, the filters should be replaced at more frequent intervals. Under extremely dusty conditions, it may be necessary to inspect the filters daily. A clogged filter reduces air flow and slows up the rotor, causing improper gyro indication due to a loss of gyroscopic inertia.

LOW INSTRUMENT AIR PRESSURE

If the pressure pump has failed or operation of the instruments indicates a fluctuation of the system pressure or a decrease in system pressure, check for excessive pressure, a partial restriction in the lines, a filter partially obstructed, or pressure loss resulting from loose connections. These conditions may be checked by:

NOTE: Use a dry, low pressure air source (10 psi maximum) for this test. If air flow resistance in the filter removed from the airplane exceeds that of the new filter by more than 1.0 psi, replace the filter.

a. Removing the inline filter from the system and checking it for obstructions by comparing the resistance to flow with a new filter.

b. Check all connections for tightness.

c. Check the lines for bends, kinks and excessive carbon.

With the discrepancy repaired, or whenever any components are replaced in the pressure system, adjust the pressure, refer to PRESSURE REGULATOR ADJUSTMENT procedure.

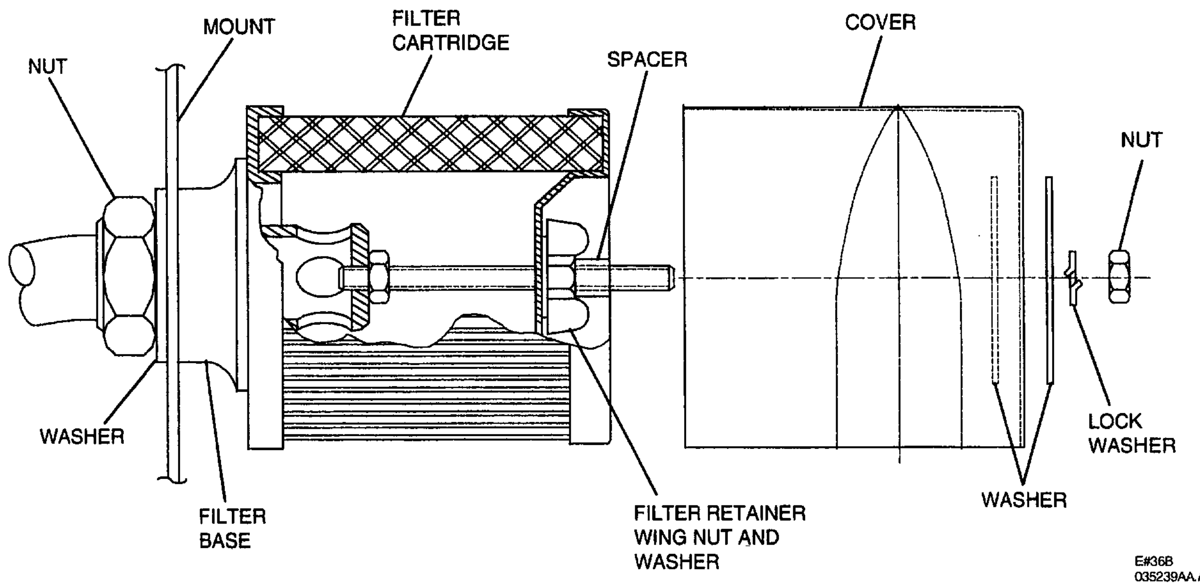
AIR FILTER REMOVAL (INTAKE)

a. Gain access to the filter by opening the left engine cowling (Ref. Figure 3).

b. Remove the nut, washers, and cover from the filter.

c. Remove the spacer and nut which secures the filter.

d. Remove the filter.



Intake Air Filter
Figure 3

AIR FILTER INSTALLATION (INTAKE)

a. Install the filter and secure with the nut (Ref. Figure 3).

b. Install the spacer and cover. The cover should be installed with the cover opening facing down.

c. Secure the cover with the washers and nut.

d. Close the engine cowling.

STANDBY AIR FILTER REMOVAL (INTAKE)

a. Gain access to the filter by opening the RH engine cowling (Ref. Figure 3).

NOTE: The standby system intake filter is mounted on the underside of the engine attached to the keel structure.

b. Remove the nut, washers, and cover from the filter.

c. Remove the spacer and nut which secures the filter.

d. Remove the filter.

STANDBY AIR FILTER INSTALLATION (INTAKE)

a. Install the filter and secure with the nut (Ref. Figure 3).

b. Install the spacer and cover. The cover should be installed with the cover opening facing down.

c. Secure the cover with the washers and nut.

d. Close the engine cowling.

AIR FILTER REMOVAL (INLINE)

a. Open the engine cowling and locate the filter attached to the bracket below the engine baffle.

b. Remove the inlet and outlet hoses from the filter.

c. Remove the nut and washer which hold the filter in place.

d. Remove the filter.

AIR FILTER INSTALLATION (INLINE)

a. Place the filter in position and secure with washer and nut.

b. Install the inlet and outlet hoses.

c. Close the engine cowling.

STANDBY AIR FILTER REMOVAL (INLINE)

a. Open the LH engine cowling and locate the filter attached to the bracket below the engine baffle.

b. Remove the inlet and outlet hoses from the filter.

c. Remove the nut and washer which hold the filter in place.

d. Remove the filter.

STANDBY AIR FILTER INSTALLATION (INLINE)

a. Place the filter in position and secure with washer and nut.

b. Install the inlet and outlet hoses.

c. Close the engine cowling.

PRESSURE REGULATOR REMOVAL

a. Open the engine cowling and locate the pressure regulator.

b. Remove the inlet and outlet hoses.

c. Remove the nut and washer which secure the regulator in position.

d. Remove the regulator.

PRESSURE REGULATOR INSTALLATION

a. Place the regulator in position.

b. Install the nut and washer.

c. Install the inlet and outlet hoses.

d. Close the engine cowling.

STANDBY PRESSURE REGULATOR REMOVAL

a. Open the LH engine cowling and locate the pressure regulator.

b. Remove the inlet and outlet hoses.

c. Remove the nut and washer which secure the regulator in position.

d. Remove the regulator.

STANDBY PRESSURE REGULATOR INSTALLATION

a. Place the regulator in position.

b. Install the nut and washer.

c. Install the inlet and outlet hoses.

d. Close the engine cowling.

STANDBY PRESSURE REGULATOR ADJUSTMENT (CE-1056 AND AFTER; CJ-156 AND AFTER; E-2180 AND AFTER; EA-422 AND AFTER; AND AIRPLANES WITH KIT 36-5009 OR 36-5011 INSTALLED)

NOTE: This procedure is performed with the engine NOT running and the primary instrument air system turned off.

a. Gain access to the regulator by opening the engine cowling.

b. Install a test gage (0-10 psi) in the outlet side of the pressure regulator.

NOTE: During this procedure, battery voltage must be maintained at 28.5 ±0.3 volts. It is recommended that an auxiliary power supply, regulated to 28.5 ±0.25 vdc, be used.

c. With the engine NOT running, and the primary instrument air system OFF, turn ON the standby air pump circuit breaker switch in the LH subpanel.

d. Adjust the pressure regulator to provide 5.0 +0.1/ -0.2 in. Hg as indicated on the instrument air pressure gage mounted in the instrument panel.

NOTE: Rotate the adjusting screw clockwise to increase the pressure and counterclockwise to decrease the pressure.

CAUTION: *At no time should the gage installed in the outlet side of the pressure regulator indicate more than 5.0 psi. If this is not enough air pressure for satisfactory instrument operation, the system has a leak, blockage or restriction which must be repaired immediately.*

e. Turn the standby air pump circuit breaker switch on the LH subpanel to OFF.

f. Remove the test gage from the airplane.

g. Close the engine cowling.

NOTE: When this procedure is completed, adjust the primary instrument air system, refer to PRESSURE REGULATOR ADJUSTMENT procedure.

PRESSURE REGULATOR ADJUSTMENT

NOTE: When performing this procedure on airplanes with the standby air pressure system installed, ensure that the standby air pressure system is turned OFF.

a. Gain access to the pressure regulator by opening the engine cowling.

b. Install a test gage (0-10 psi) at the outlet side of the pressure regulator.

c. Adjust the pressure regulator to 5.0 +0.1/ -0.2 in. Hg as indicated on the instrument air pressure gage mounted in the instrument panel with the engine operating at 2,300 rpm. Rotate the adjusting screw on the pressure regulator clockwise to increase the pressure and counterclockwise to decrease the pressure.

CAUTION: *At no time should the gage installed in the outlet side of the pressure regulator indicate more than 5.0 psi. If this is not enough air pressure for satisfactory instrument operation, the system has a leak, blockage or restriction which must be repaired immediately.*

d. Check the instrument air pressure gage in the instrument panel. With the engine operating at 800 rpm, the pressure should remain in the green arc.

e. Remove the test gage from the airplane.

f. Close the engine cowling.

CHAPTER

39

CHAPTER 39 - ELECTRIC PANELS PARTS & INSTRUMENTS

TABLE OF CONTENTS

"END"

CHAPTER 39

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
39-EFFECTIVITY	1	Oct 7/83
39-CONTENTS	1	May 9/80
39-00-00	1	May 9/80
39-10-00	1	May 9/80
	2	Oct 7/83
	3	Oct 7/83
39-20-00	1	May 9/80
	2	May 9/80
	3	May 9/80
	4	May 9/80
	5	Jan 20/82
	6	May 9/80
	7	May 9/80
	8	May 9/80
	9	May 9/80
	10	May 9/80
	11	May 9/80
	12	Jan 20/82

"END"

GENERAL - DESCRIPTION AND OPERATION

The instrument panel on the airplane is divided into seven general groupings: (1) A floating panel, located on the upper left corner of the instrument panel, which contains those instruments necessary to sustain flight. (2) The center stationary panel which contains instruments that indicate the various monitoring systems of the engine. (3) The avionics and radio rack, located to the right of the engine instrument panel, which contains various optional avionics and radio receiving equipment. (4) The stationary right panel which contains indicators, switching, and the glove box. (5) The upper left subpanel, located below the left floating panel and above the left subpanel contains autopilot control switching, OMNI indicators, and the flap position indicator. (6) The lower left subpanel contains the heater and air controls for cabin temperature, ignition switch, circuit breaker switches, light controls, flap control, and fuel pump controls. (7) The lower right subpanel contains the landing gear control and indicating lights, and the standard and optional circuit breakers.

"END"

INSTRUMENT AND CONTROL PANELS - MAINTENANCE PRACTICES

WARNING

To avoid personal injury, shut off all electrical power, both battery and external, before removing or installing any electrical components.

GLARESHIELD REMOVAL

a. Remove the attach screws at each end of the glareshield.
b. Lift the glareshield gently to detach it from the velcro hook and pile which secures it at its top side.
c. Disconnect the electrical quick disconnects for both the compass and the glareshield lights.
d. Disconnect the defroster heat duct.
e. Remove the glareshield.

GLARESHIELD INSTALLATION

a. Place the glareshield in position and connect the defroster heat duct.
b. Connect the electrical quick disconnects for both the compass and the glareshield lights.
c. Install the attach screws at each end of the glareshield.
d. Press downward on the top side of the glareshield to secure the velcro hook and pile.

REMOVAL OF ENGINE AND FLIGHT INSTRUMENTS

a. Remove the glareshield.
b. Disconnect the plumbing and/or electrical connections from the flight instruments.
c. Disconnect and remove any post lights.
d. Remove the mounting screws securing the instrument to the panel section.
e. Remove the instrument.

INSTALLATION OF ENGINE AND FLIGHT INSTRUMENTS

a. Place the instrument in the proper position in the panel.
b. Secure the instrument to the panel with the attaching screws.

CAUTION

If any screws are replaced upon reinstallation of any instrument, be sure they are the same length as the original screws.

c. Connect the post lights as necessary.
d. Connect the plumbing and/or electrical connections to the flight instruments.
e. Install the glareshield.

REMOVAL OF THE ENGINE INSTRUMENT CLUSTER PANEL

a. Remove the glareshield.
b. Disconnect the harness connector on the back of the engine instrument cluster.
c. Remove the screws securing the instrument cluster to the instrument panel. Support the cluster assembly while removing the screws to prevent dropping it.
d. Remove the cluster from the panel.

INSTALLATION OF THE ENGINE INSTRUMENT CLUSTER PANEL

a. Place the engine instrument cluster panel in the proper position in the instrument panel.
b. Secure the instrument cluster to the instrument panel with the screws.

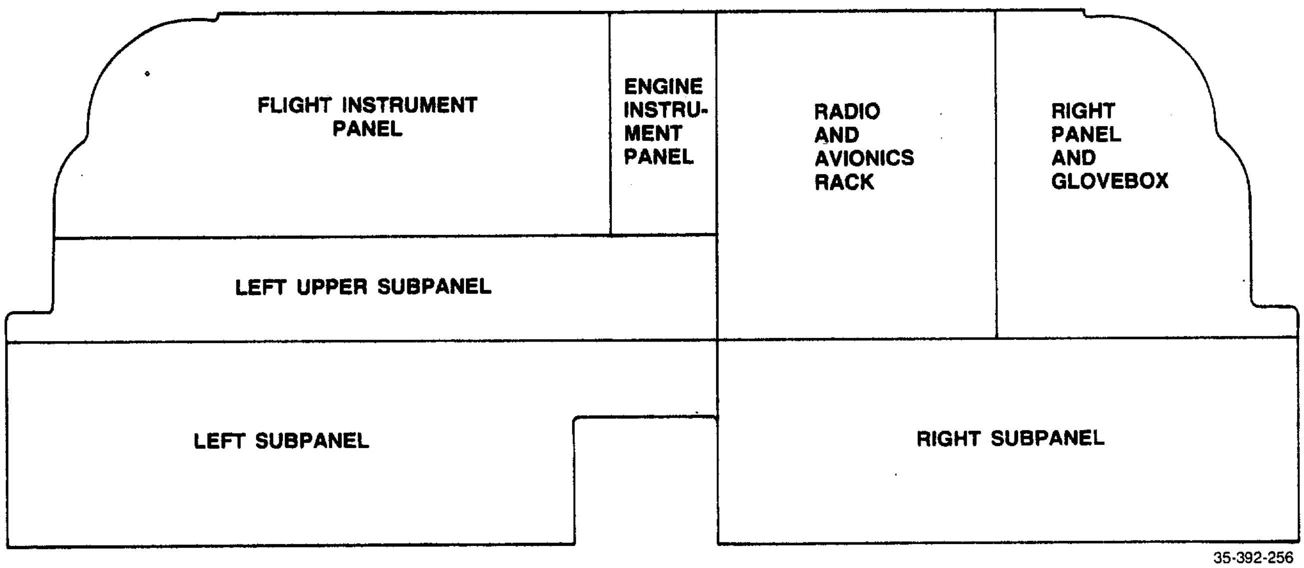
CAUTION

If replacement of the screws is required, use screws of the same length as the original screws to avoid internal damage to the instrument cluster.

c. Connect the engine harness connector to the back of the instrument cluster.
d. Install the glareshield.

REMOVAL OF RADIO/AVIONICS EQUIPMENT

a. Locate the component you wish to remove from the radio/avionics rack.
b. Loosen the Allen screw which secures the piece of gear in the rack.
c. Slide the required piece of gear from the shelf on the radio/avionics rack.



Instrument and Control Panel (except serials E-1946, E-2104, E-2111 and after and EA-320, EA-389 and after)
Figure 1

INSTALLATION OF RADIO/AVIONICS EQUIPMENT

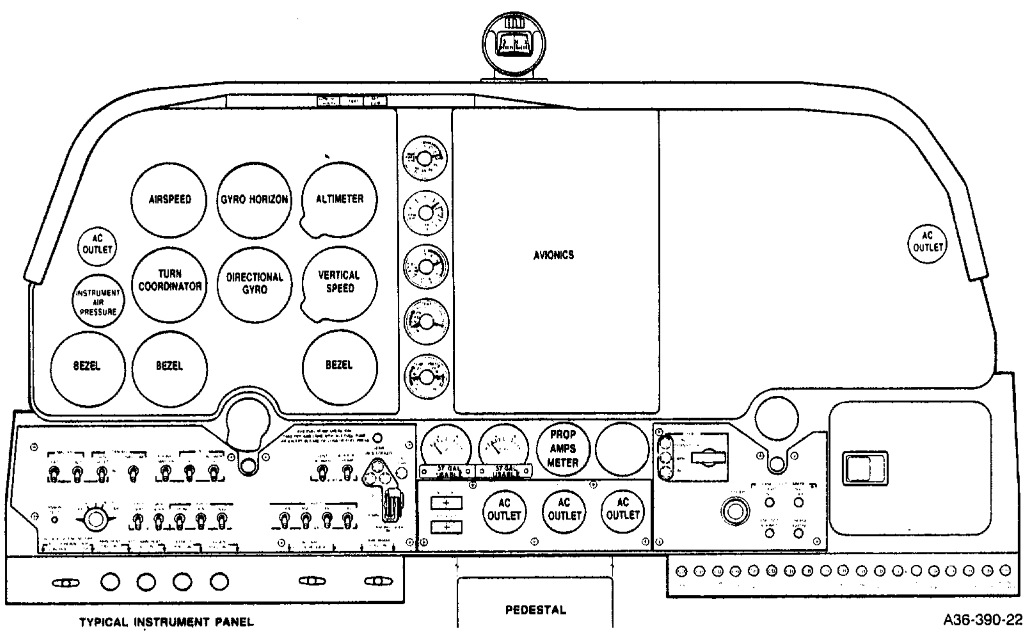
a. Slide the radio/avionics component you wish to install on its proper shelf.

b. Make sure the component is seated all the way back in the shelf to make its electrical connection.

c. Tighten the Allen screw which retains the component in the shelf.

RIGHT AND LEFT SUBPANEL

Access to the individually mounted circuit breakers is obtained from the underside of the instrument panel. Before starting any removal or installation procedures, ensure that the battery switch is in the OFF position, the battery is disconnected, and that the external ground power unit is disconnected. When removing any of the components for maintenance purposes, tag and identify any wires removed to facilitate reinstallation of the components.



**Instrument and Control Panel
(Serials E-1946, E-2104, 2111 and after
and EA-320, EA-389 and after)
Figure 2**

"END"

ELECTRICAL AND ELECTRONIC EQUIPMENT RACKS - MAINTENANCE PRACTICES

The circuit diagrams and the accompanying equipment lists in the Wiring Diagram Manual identify each electrical component with a reference designator. Further, the equipment list identifies the area in which the component is installed by a zone number. The airplane zoning diagram, which is repeated in Figure 1, shows the various zones of the airplane. The lists of components, and the illustrations showing their installation on the following pages, identify these components by the reference designator, shown in parenthesis ( ), assigned each component in the Wiring Diagram Manual, (P/N 35-590102-9).

COMPONENT LOCATION ZONES

( ) Indicates Right Side

100 BELOW FLOOR

140	Firewall to Main Spar
150	Main Spar to Rear Spar
160	Aft of Rear Spar

200 FORWARD FUSELAGE

221 (222)	Firewall (Attached to or Accessible from Forward Side)
231 (232)	Firewall to Instrument Panel
240	Instrument Panel and Subpanel
251 (252)	Cabin (Floor Line to Headliner)
253	Cabin Headliner Area
270	Main Spar Carry-Through Structure
280	Rear Spar Carry-Through Structure

300 AFT FUSELAGE AND EMPENNAGE

310	Aft Fuselage
320	Dorsal Fin (Aircraft with Conventional Tail)
330	Vertical Stabilizer (Aircraft with Conventional Tail)
340	Rudder (Aircraft with Conventional Tail)
351 (352)	Horizontal Stabilizer

300 AFT FUSELAGE AND EMPENNAGE (Cont'd)

361 (362)	Elevator
370	Tail Cone

410 ENGINE COMPARTMENT

500 (600) WING AND CONTROL SURFACES

531 (631)	Wing, Inboard Leading Edge
532 (632)	Wing, Inboard-Aft of Main Spar
533 (633)	Flap
541 (641)	Wing, Outboard-Leading Edge
542 (642)	Wing, Outboard-Aft of Main Spar
543 (643)	Aileron
550 (650)	Wing Tip

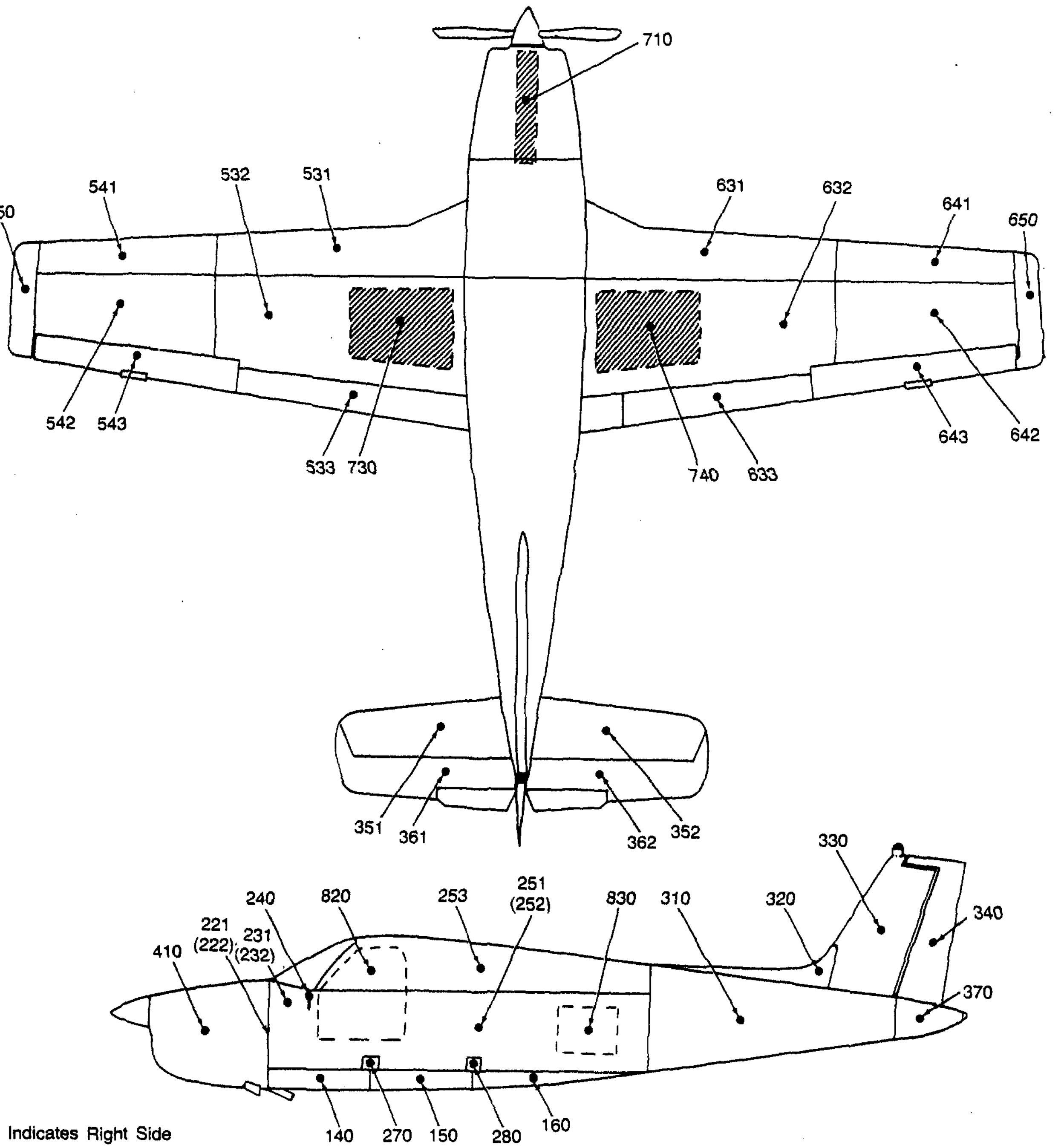
700 GEAR DOORS AND WHEEL WELLS

710	Nose Landing Gear
730 (740)	Main Landing Gear

800 DOORS

820	Cabin Entry Door
830	Baggage or Cargo Door

Airplane Zoning Diagram
Figure 1 (Sheet 1 of 2)



( ) Indicates Right Side

35-607-22

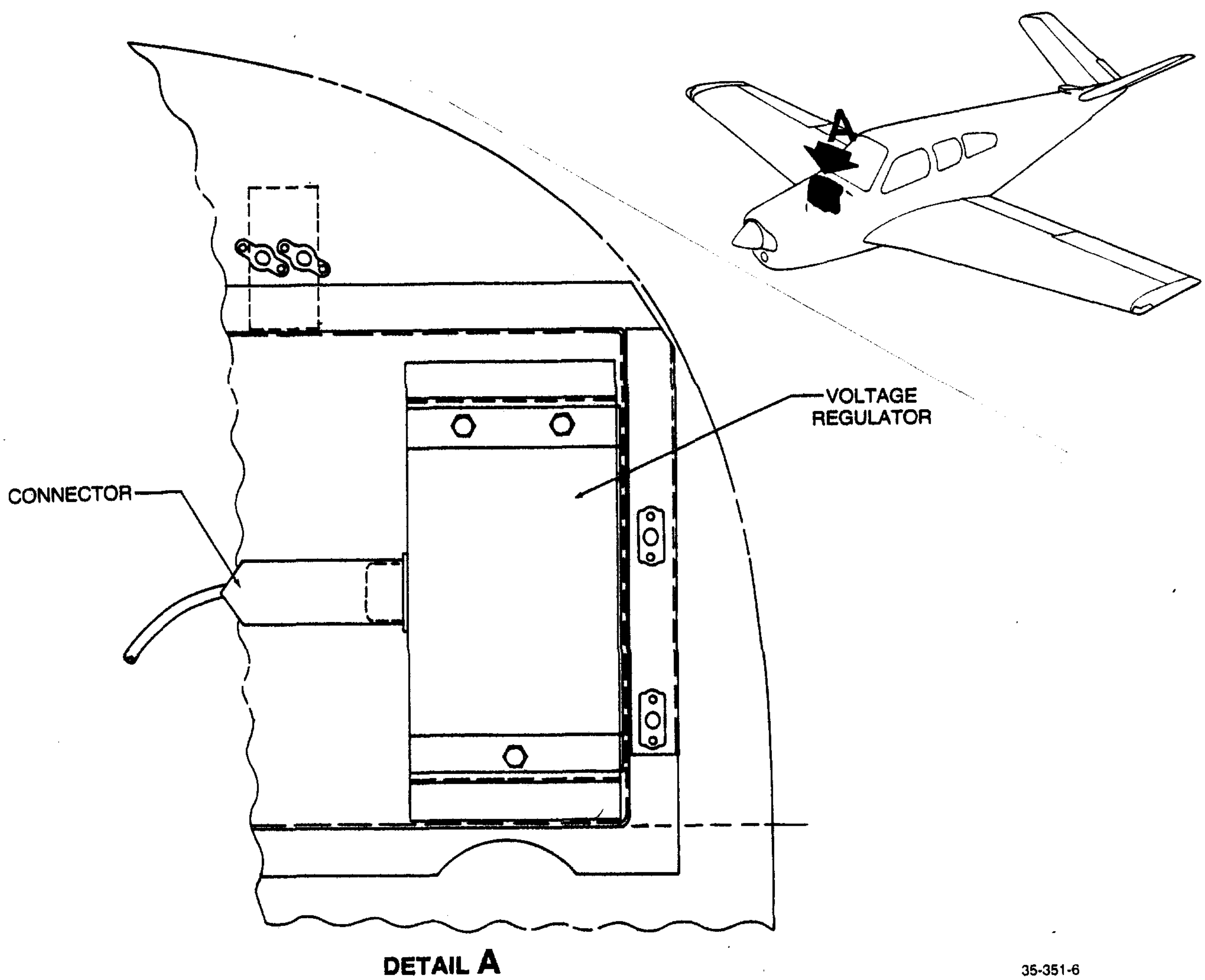
Airplane Zoning Diagram
Figure 1 (Sheet 2 of 2)

AREA BETWEEN THE FIREWALL AND INSTRUMENT PANEL - AIRPLANE ZONES 231 AND 232 (Figure 2)

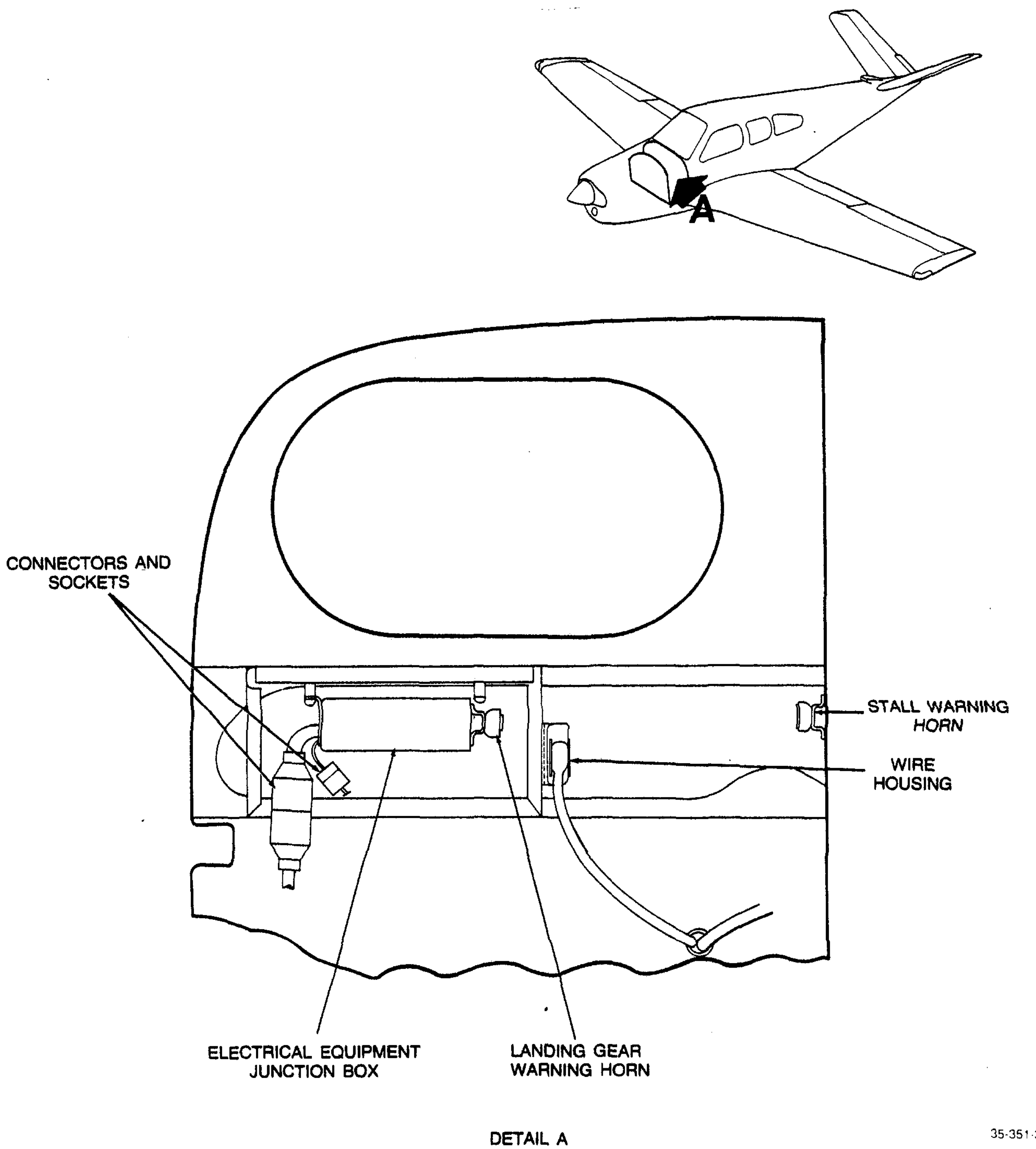
The electrical components located between the firewall and instrument panel (zones 231 and 232) are individually mounted with screws or bolts. Prior to performing any maintenance on these components, ensure that the battery switch is OFF, the battery is disconnected, and that the external power source (if installed) is disconnected. When removing these components for maintenance purposes, tag and identify any wires removed to facilitate the reinstallation of the components.

For maintenance coverage of the voltage regulator, refer to Chapter 24 of the Maintenance Manual. The electrical equipment junction box contains the flap position PC board, the annunciator dimming PC board, relays, diodes, and an externally mounted flasher. The following components are located in airplane zones 231 and 232:

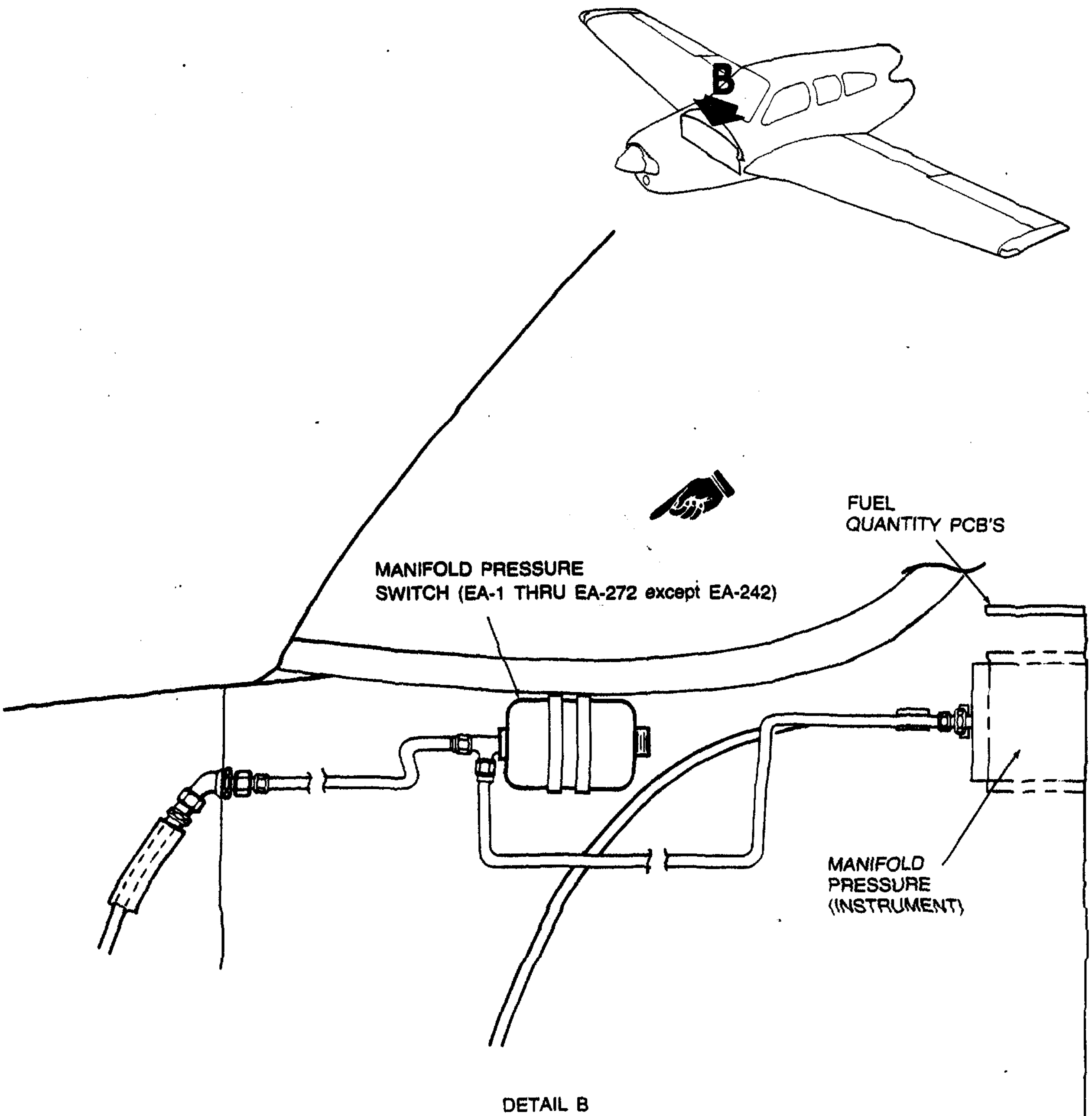
Electrical Equipment Junction Box (231) (A19)
Landing Gear Warning Horn (231) (LS11)
Stall Warning Horn (231) (LS12)
Voltage Regulator (232) (VR11)
Manifold Pressure Switch (231) (S54)
LH Fuel Quantity PCB (231) (A13)
RH Fuel Quantity PCB (231) (A14)



Right Area Between Firewall and Instrument Panel - Zone 232
Figure 2 (Sheet 1 of 3)



Left Area Between Firewall and Instrument Panel - Zone 231
Figure 2 (Sheet 2 of 3)



Left Center Area Between Firewall and Instrument Panel - Zone 231
Figure 2 (Sheet 3 of 3)

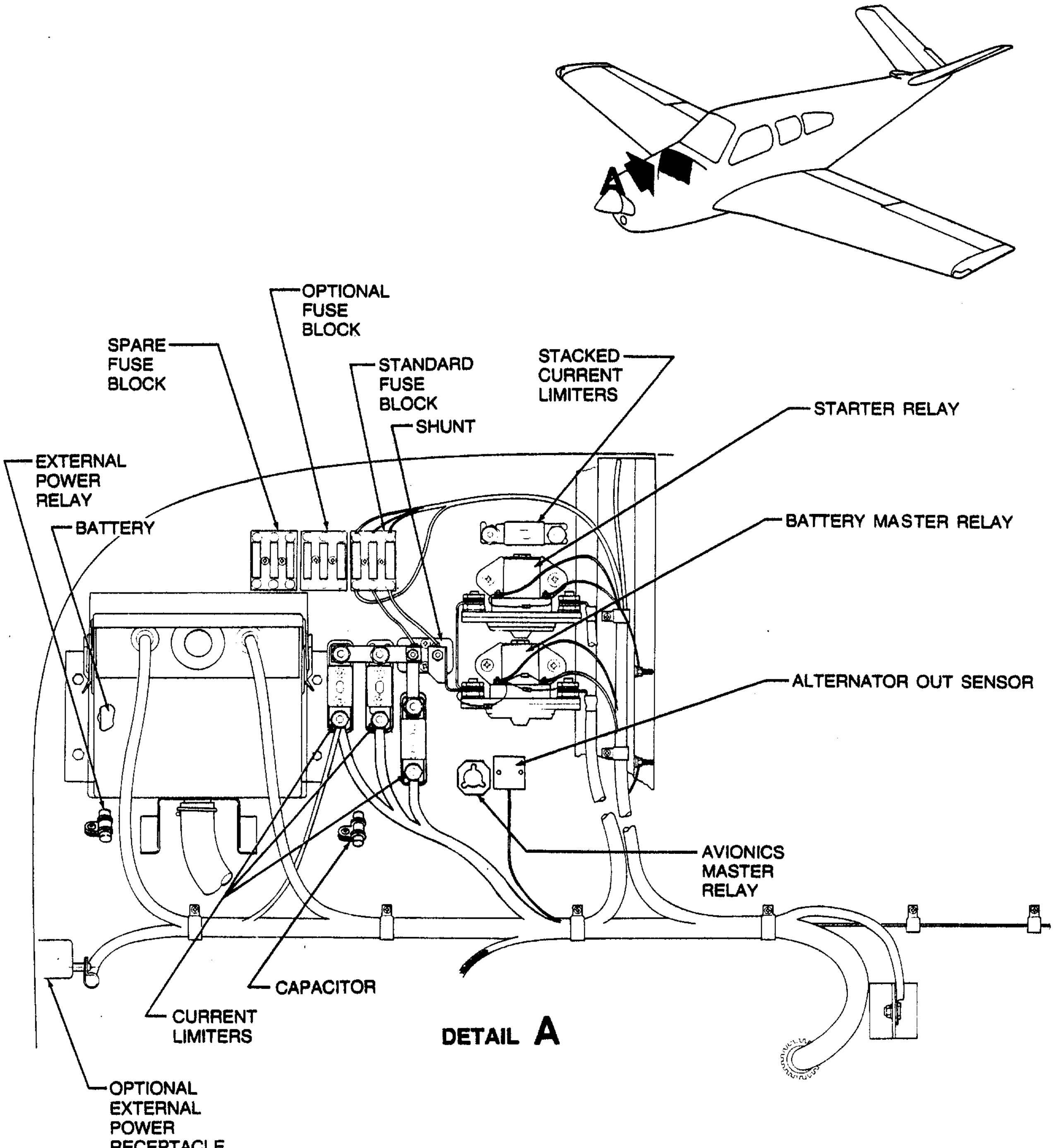
AREA WHICH INCLUDES THE FORWARD, RIGHT SIDE OF THE FIREWALL, THE ENGINE COMPARTMENT, AND THE NOSE LANDING GEAR WELL - AIRPLANE ZONES 222/410/710 (Figure 3)

The electrical components located in the above areas and zones are mounted with nuts, bolts, screws, or clamps. Prior to performing any maintenance on these components, ensure that the battery switch is OFF, the battery is disconnected, and that the external power source (if installed) is disconnected. When removing these components for maintenance purposes, tag and identify any wires removed to facilitate the reinstallation of the components.

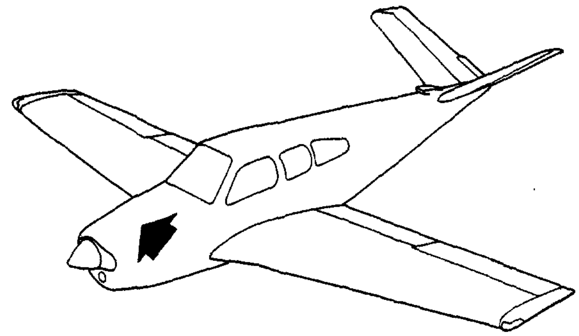
The nose landing gear uplock and downlock switches are located in the nose wheel well, and are mounted on the right, outboard side of the wheel well keel. These switches work in conjunction with the indicator lights on the right subpanel to indicate nose landing gear position.

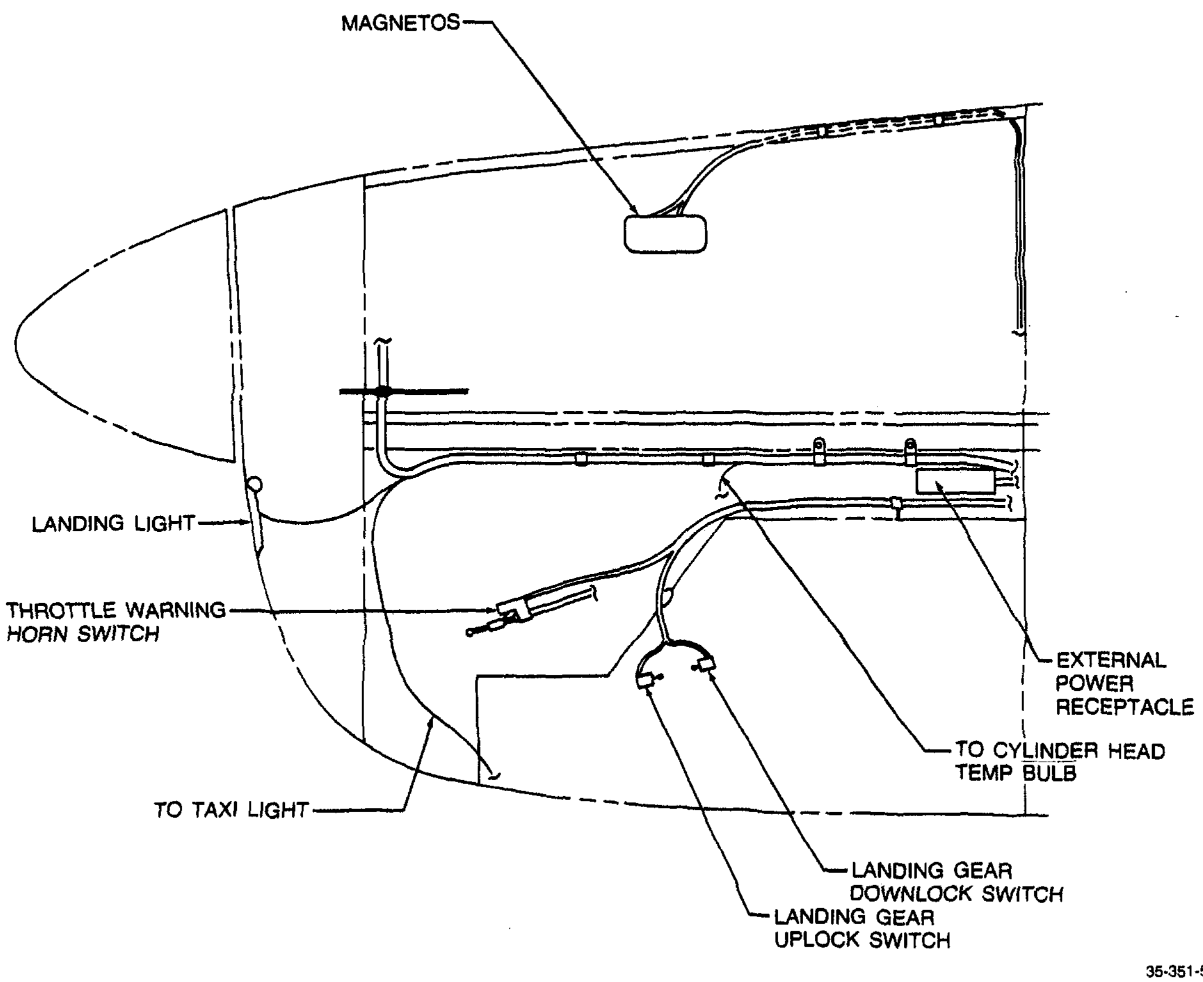
For maintenance coverage of the battery, refer to Chapter 12 of the Maintenance Manual. The throttle warning horn switch (S41) and the optional landing gear safety switch (S34) are located on the throttle control shaft and are located in zone 410. Adjustment and pictorial coverage of these switches is found in Chapter 32 of the Maintenance Manual. All major engine electrical components i.e., alternator, starter, etc., will be shown in the IO-520 or TSIO-520 Series Aircraft Engines Overhaul Manual, FORM X-30039A or X-30042. The following components are located in airplane zones 222 and 410:

Fuse blocks, both Standard and
Optional (222) (F15, F16, XF15)
Battery (222) (BT10)
Shunt (222 (R34)
Current Limiters (222) (F1, F2, XF1, XF2)
Capacitor Filter (222) (C11)
Optional External Power Relay (222) (K12)
Optional External Power Receptacle (410) (J32)
Starter Relay (222) (K14)
Battery Master Relay (222) (K15)
Alternator Out Sensor (222) (A16)
Throttle Warning Horn Switch (410)
(S41) - Chapter 32
Optional Landing Gear Safety Switch
(410) (S34) - Chapter 32
Avionics Master Relay (222)
Switch, Nose Landing Gear Uplock (710) (S62)
Switch, Nose Landing Gear Downlock (710) (S63)



Forward, Right Side of Firewall and Engine Compartment - Zones 222/410
Figure 3 (Sheet 1 of 2)





Engine Compartment and Nose Landing Gear Well - Zones 410/710
Figure 3 (Sheet 2 of 2)

AREA BENEATH THE FLOOR FROM THE FIREWALL TO THE MAIN SPAR AND FROM THE MAIN SPAR TO THE REAR SPAR - AIRPLANE ZONES 140 AND 150 (Figure 4)

The electrical components located from the firewall to the main spar, and from the main spar to the rear spar are mounted with nuts, bolts, screws, and clamps. Prior to performing any maintenance on these components, ensure that the battery switch is OFF, the battery is disconnected, and that the external power source (if installed) is disconnected. When removing these components for maintenance purposes, tag and identify any wires removed to facilitate the reinstallation of the components.

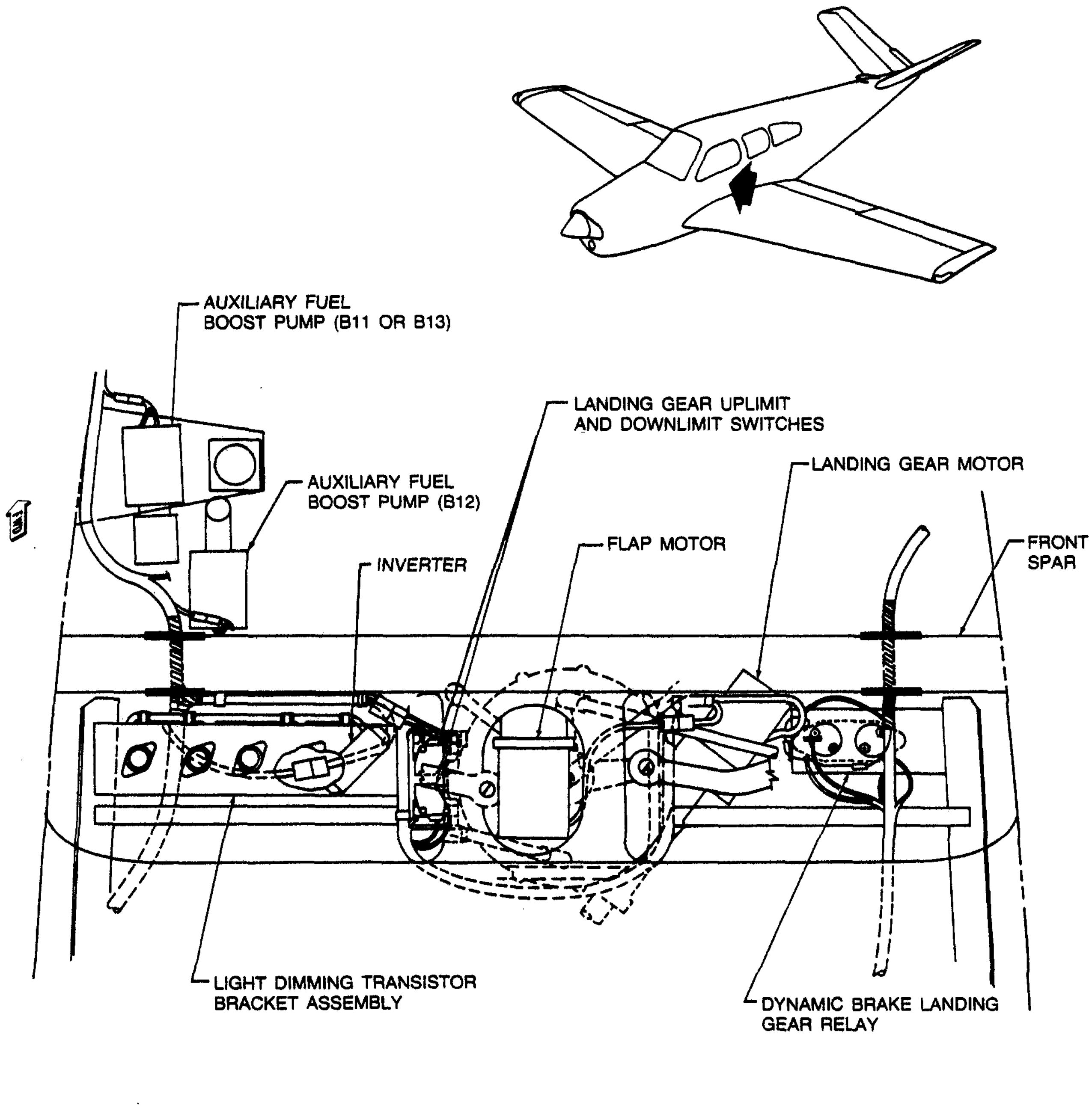
CAUTION

Make sure the grommets are installed in the area of the main spar through which the wire harness passes, so chafing of the harness will not occur.

The auxiliary fuel pumps are located forward of the main spar; all other components in this figure are located aft of the main spar. There are three different auxiliary fuel pumps used in the Bonanza Series airplanes: On serials CE-748, CE-772 and after; D-10097, D-10120 and after; E-1111, E-1241 and after, a reference designator (B11) is used for high boost pump. On serials CJ-149 and after, two auxiliary boost pumps are used: Reference designator (B11) for high boost and reference designator (B12) for low boost. On serials EA-1 and after, a single pump with both high and low speeds is used. The pump used on EA-1 and after is reference designator (B13).

The flight dimming transistor bracket assembly contains four dimming transistors and is located in zone 150 (left side). For adjustment of the landing gear uplimit and downlimit switches, refer to Chapter 32 of the Maintenance Manual. The following components are located in airplane zones 140 and 150:

- Auxiliary Fuel Boost Pump (140) (B11, B12, or B13) See above.
- Light Dimming Transistor Bracket Assembly (150) (A21)
  - Glareshield Light Dimming Transistor (150) (Q1)
  - Subpanel Light Dimming Transistor (150) (Q2)
  - Eng Inst and Avionics Console Light Dimming Transistor (150) (Q3)
  - Flight Instrument Light Dimming Transistor (150) (Q4)
- Inverter (150) (MG1)
- Flap Motor (150) (B22)
- Landing Gear Motor (150) (B21)
- Dynamic Brake Landing Gear Relay (150) (K17)
- Landing Gear Uplimit Switch (150) (S39)
- Landing Gear Downlimit Switch (150) (S40)



Area Beneath the Floor From the Firewall to the Rear Spar - Zones 140/150
Figure 4

AREA WHICH INCLUDES THE WINGS AND MAIN LANDING GEARS - AIRPLANE ZONES 531 THRU 650, AND ZONES 730 AND 740 (Figure 5)

The electrical components located within the wings and main landing gear wheel wells are mounted with nuts, bolts, screws, clamps, and rivets. Prior to performing any maintenance on the components, ensure that the battery switch is OFF, the battery is disconnected, and that the external power source (if installed) is disconnected. When removing the components for maintenance purposes, tag and identify any wires removed to facilitate the reinstallation of the components.

Each wing contains two fuel level transmitters which provide fuel quantity information to their respective fuel quantity indicator on the engine instrument panel. The inboard fuel quantity transmitter for each wing is located at approximately WS 43.00, and the outboard transmitter is located at approximately WS 97.00.

The heated pitot tube is mounted on the left outboard wing rib at approximately WS 125.00. The pitot tube heat element wires are routed with the tube air line. When the pitot tube is removed for maintenance purposes, be sure to cap the end of the air line to prevent entry of foreign material. Remove the cap upon reinstallation of the tube.

The stall warning switch is located on the left outboard wing leading edge at approximately WS 140.00. Adjustment coverage of the stall warning system is located in Chapter 27 of the Maintenance Manual. The stall warning switch is removable by screws located around the perimeter of the mounting bracket.

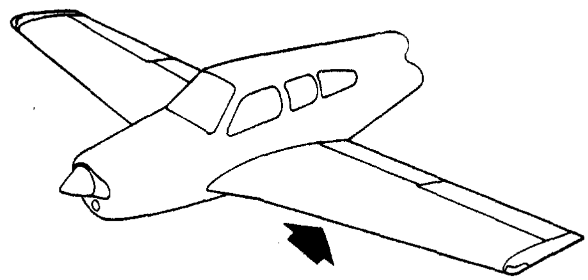
The landing gear uplock and downlock switches, a pair for each main landing gear, are located in the wheel well on the aft side of the front wing spar at WS 45.00 for the gear up switch, and at WS 52.00 for the gear down switch. These switches work in conjunction with the indicator lights on the right subpanel to indicate landing gear position.

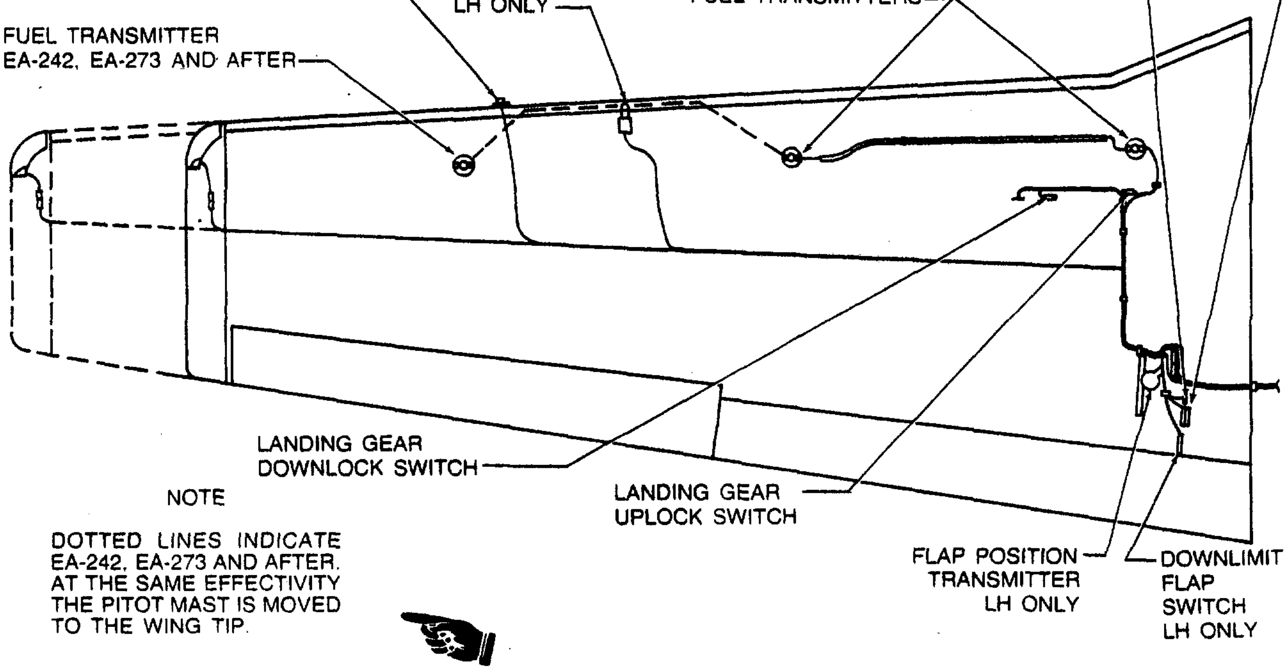
The electrical flap position transmitter and the flap limit switches are located within the left wing. The flap position indicator is mounted at the left flap actuator at approximately WS 40.00. It is accessible through the landing gear wheel well forward of the wing rear spar. The flap limit switches are accessible forward of the left flap and may be serviced with the flaps lowered. The flap switches are located at approximately WS 33.00. For flap limit switch adjustment refer to Chapter 27 of the Maintenance Manual. At airplane serials D-10179 and after, CJ-150 and after, CE-816 and after, E-1371 and after, and EA-1 and after the airplanes are equipped with 14 degree and 16 degree approach flap limit switches in addition to the uplimit and downlimit flap switches of prior airplane serials.

A landing gear safety switch (squat switch) is located on the strut of each main landing gear. The safety switches are provided to prevent inadvertent retraction of the landing gear on the ground. The switches open the control circuit when the struts are compressed. The landing gear safety switches also serve to control the position of the retractable air conditioner condenser. When the airplane is on the ground and the air conditioner is turned on, the condenser extends to the ground extension position.

The following electrical components are located in the area which includes the wings and main landing gear. This area includes airplane zones 531 thru 650, and zones 730 and 740:

Stall Warning Switch (531) (S43)
Heated Pitot Tube (531) (HR23)
Transmitter, LH Inboard Fuel (531) (R20)
Transmitter, LH Outboard Fuel (531) (R21)
Transmitter, RH Inboard Fuel (631) (R22)
Transmitter, RH Outboard Fuel (631) (R23)
Switch, LH Landing Gear Uplock (730) (S60)
Switch, LH Landing Gear Downlock (730) (S61)
Switch, RH Landing Gear Uplock (740) (S64)
Switch, RH Landing Gear Downlock (740) (S65)
Flap Position Transmitter (730) (MT2)
Switch, Flap Uplimit (533) (S50)
Switch, Flap Downlimit (533) (S51)
Switch, 14 Degree Flap Limit (533) (S76)
Switch, 16 Degree Flap Limit (533) (S47)
Switch, RH Landing Gear Safety (740) (S36)
Switch, LH Landing Gear Safety (730) (S37)





Area Which Includes the Wings and Main Landing Gear (Left Wing Shown) Zones 531 thru 650 and Zones 730 and 740
Figure 5

"END"

CHAPTER

51

STANDARD PRACTICES-STRUCTURES

CHAPTER 51 - STRUCTURES

TABLE OF CONTENTS

"END"

CHAPTER 51

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
51-EFFECTIVITY	1	Oct 16/92
51-CONTENTS	1	Aug 28/87
51-00-00	1	Oct 16/92
	2	Oct 16/92

"END"

GENERAL - DESCRIPTION AND OPERATION

The airplane is all metal with a semimonocoque type construction. Stresses are carried by both the skin and stiffener members of the fuselage, wings, and empennage. The airplane has primarily a riveted structure. Field repairs to skins and stiffener members may be accomplished with standard materials and hand tools. The basic structure of the airplane is the fuselage, which is constructed of bulkheads strengthened with longerons, stringers, and skin panels.

The wing sections are attached to the fuselage carry-through structure by front main and rear spars. The leading edge and rear panel (box section) of each wing are attached to the main spar by continuous piano-type hinges. The wing tip is attached to the last outboard wing rib. The horizontal and vertical stabilizers are each constructed around two channel-section spars and are covered with a skin stiffened by internal beads. Each is attached to the fuselage at the front and rear spars. The elevators and rudder both have a main spar and ribs.

PRIMARY STRUCTURAL COMPONENTS

The following primary structural components are essential to the proper function of the airplane. Damage, occurring to any of the components, would seriously endanger the safety of the airplane and/or the passengers.

a. Control systems

b. Engine mounts

c. Fittings

d. Skins of the fuselage, wings, tail surfaces and control surfaces

e. Wing, tail surface, and control surface spars

f. Landing gears and support structure

g. Auxiliary members used to strengthen or support other members carrying direct loads

h. Seats and seat structure.

Structural Integrity of V35B and V35B-TC airplanes is improved by installation of Kit No. 35-4016-7 S. The kit will provide additional support to the leading edge of the stabilizers, and can be installed without removal of the stabilizer.

SECONDARY STRUCTURAL COMPONENTS

In the event of damage, the following secondary structural components would require immediate attention, but would not necessarily endanger the safety of the airplane and/or the passengers.

a. Wing tips

b. Fairings

c. Nonstructural doors and covers

d. Furnishings and upholstery (excluding seating)

STRUCTURES - MAINTENANCE PRACTICES

STRUCTURAL REPAIR

In general, structural repair methods used on the airplane may be in accordance with AC 43.13-1A AIRCRAFT INSPECTION AND REPAIR MANUAL and AC 43.13-2 AIRCRAFT ALTERATIONS MANUAL. Never make a skin replacement or patch from a material thinner than the original skin. Patches should be of the next thicker material. The following considerations are recommended in addition to AC 43.13-1 and AC 43.13-2 for repair of the airplane.

a. All lap joints, including patches, must have at least two staggered rows of rivets.

b. All repair material must be free of any defects such as nicks, scratches, etc., which can cause stress rises.

c. Never dimple a structural member by driving the rivet head into the part.

d. Do not countersink deeper than 75% of the material thickness.

REPAIR OF FIBERGLASS COMPONENTS

a. Large holes and cracks require that the damaged area be cut out and trimmed just beyond the area of damage. If the parts are painted, remove the paint and sand that portion of the part extending at least 2 inches beyond the cutout.

b. Prepare 3 patches of laminated glass cloth, such as Trevano, Uniglas, or their equivalent. Cut the first patch to the dimensions of the sanded area, the second patch 1/2-inch smaller than the first, and the third patch 1/2-inch smaller than the second.

c. Prepare the MIL-R-7575 resin (24, Chart 1, 91-00-00) for the patch in accordance with the manufacturer's instructions. Make sure that your hands are free of oil, grease, and dirt when handling the resin.

d. Apply an even coat of resin to the sanded area. Impregnate all three laminated glass cloth patches by laying the patches on clean waxed paper and working the resin through the fabric with a 2-inch brush.

e. Place the large patch over the cutout area, working out all bubbles and wrinkles. If the patch starts to sag, place a support behind the repair area. Coat the support with automobile wax or waxed paper to prevent the resin from adhering to the support. Work out all air bubbles and wrinkles while installing the second patch over the first. Install the third patch over the second in the same manner.

f. Brush the repaired area with an even coat of resin. After the patches have cured for 24 hours at temperatures between 23°C (75°F) and 66°C (150°F), blend the patch into the contour of the part with fine sandpaper. Paint the repair to match the rest of the part.

"END"

CHAPTER

52

DOORS

CHAPTER 52 - DOORS

TABLE OF CONTENTS

SUBJECT *PAGE*

CHAPTER 52 - DOORS

LIST OF EFFECTIVE PAGES

GENERAL - DESCRIPTION AND OPERATION

CABIN DOOR

The airplane is provided with a cabin door which furnishes access to the flight compartment. The door is located on the right side of the fuselage between FS 58.00 and FS 100.00 on the Model A36 series airplanes, and between FS 68.00 and FS 104.90 on the Model 33 and 35 series airplanes. Each door is hinged on the forward side of the door at two points, and a door stop is located on the bottom edge of each door.

The cabin door is provided with an aft outside and forward inside door handle. The outside handle contains the cabin door lock and tumbler assembly. The door contains three latches: a hook latch on the upper edge of the door, a sliding bolt latch on the aft side of the door, and a pin type latch on the lower edge of the door. A cable assembly connects the movement of the upper latch, and a bell crank assembly controls the movement of both the aft and lower pin latches. An optional courtesy light is installed in the door above the window. The wiring for the courtesy light exits the door above the upper door hinge.

CABIN DOOR QUICK RELEASE MECHANISM (CJ-149 and after only)

The cabin door can be instantaneously jettisoned by a quick release mechanism in the event of an emergency. The quick release mechanism actuates the door latches through a lever and cam arrangement. To prevent accidental activation of the mechanism the red handle that actuates the release is secured to the escutcheon on the door by an aluminum catch and a single strand of safety wire. The wire breaks and the aluminum catch straightens out to release the handle when the latter is pulled. The cam on the lever to which the handle is attached then rotates to actuate the link that unlatches the upper and lower door latches. Simultaneously, an actuator on each end of the quick release lever rotates and, through interconnecting links, withdraws the retainers that lock the upper and lower hinges in place around the hinge pins. This completely releases the door from the fuselage.

UTILITY DOORS (E-1111, E-1241 and after; EA-1 and after)

The A36 series airplanes are provided with two utility doors which furnish access to the cabin area. The doors are located on the right side of the fuselage between FS 124.55 and FS 170.00. Each utility door contains a window, with the forward door being hinged on the forward side and the aft door being hinged on the aft side. Each utility door has a folding door stop located at the bottom edge of each door.

The forward utility door contains an outside D-ring latch handle with a lock and tumbler assembly and an inside latch handle. The forward door contains three latches: two pin-type latches, one on the top and one on the bottom edges of the door, and a bayonet latch which makes contact with the striker plate on the aft door. The movement of the three latches is controlled by a bell crank assembly. The aft utility door contains a lever type handle on the front edge, inside of the door. The door contains two hook type latches which each engage a striker plate lip at the top and bottom of the door sill. The movement of the two latches is controlled by a bell crank assembly.

BAGGAGE DOORS (CE-748, CE-772 and after; CJ-149 and after; D-10097, D-10120 and after)

Bonanza airplanes other than the A36 series are provided with an optional (small or large) baggage door for cargo storage. The doors are located on the right side of the fuselage. The small door is located between FS 131.00 and FS 151.00, and the large door is located between FS 131.00 and FS 170.00. Either door is hinged on the forward side. The small baggage door has a stop rod on the forward inboard side of the door near the door hinge, and the large door has a scissors type door stop connecting the top of the door sill to the top of the baggage door.

The small baggage door contains a combination latch and lock mechanism located on the aft side of the door. The latch makes contact with a striker plate on the door sill. This is the only latching device on the small baggage door. The large baggage door contains an outside and inside D-ring latch handle. A lock assembly is provided and is located beside the handle. The large baggage door contains three pin type latches located on the aft edge and the top and bottom edges of the door. The movement of the three latches is controlled by a bell crank assembly.

"END"

CABIN PASSENGER/CREW DOOR - MAINTENANCE PRACTICES

CABIN DOOR REMOVAL (E-1111, E-1241 AND AFTER; EA-11 AND AFTER; CE-748, CE-772 AND AFTER; D-10097, D-10120 AND AFTER)

a. Remove the inboard door handle.

b. Remove the window upper molding trim.

c. Remove the armrest, upholstery panel and the ash tray.

d. If the optional courtesy light is installed, disconnect the wire splice which is located behind the right side of the instrument panel.

e. With the door open, insert a screwdriver between the door stop and the bottom of the door (Ref. Figure 1). Slowly close the door while applying a downward pressure on the door stop until the stop is released from the door.

f. Remove the two phillips screws from each hinge cover.

g. Remove the remaining screws which secure the door frame to the hinges.

NOTE: At the upper hinge, four screws are located aft of the hinge cover; on the lower hinge, three screws are aft of the hinge cover.

h. Carefully remove the door by pulling the door directly away from the hinges.

NOTE: Shims have been installed between the hinges and the door to obtain a proper fit. The shims should be retained and the same number of shims installed, where removed, under each hinge when the door is reinstalled. Door assembly may be adjusted up or down and forward or aft by sliding door on hinges. Adjust inboard or outboard by changing shims to inboard or outboard side of hinges. Do not omit hinges.

CABIN DOOR INSTALLATION (E-1111, E-1241 AND AFTER; EA-11 AND AFTER; CE-748, CE-772 AND AFTER; D-10097, D-10120 AND AFTER)

a. If the door is new, place the door in position and mark the door hinge tab and perimeter of the door frame where any excess material needs to be removed. Remove the excess material to obtain the best fit prior to installing the seal.

b. On a new door, install new door seals around the inside edge of the door frame. Check the old door for reference to a new door seal location.

c. Place the door in position, making sure the upper and lower door hinge shims are in place. The same number of shims should be used on installation of the door as when the door was removed. The shims serve to keep the door flush to the fuselage.

d. Attach the four phillips screws aft of the upper door hinge which secure the door frame to the hinge. Attach the three phillips screws aft of the lower door hinge.

e. Attach the upper and lower hinge cover plates; each is attached with two phillips screws.

f. Install the door stop in the channel located on the bottom edge of the door.

NOTE: The upper door hook latch bracket, located in the door sill above the door, should be preset flush with the door sill.

g. If the door contains the optional courtesy light installation, feed the wire from the courtesy light to the location behind the right side of the instrument panel by routing the wire above the door hinge to behind the panel. Splice the courtesy light wire to its connecting wire.

h. Install the upholstery panel, ashtray, and armrest.

i. Install the window upper molding trim.

j. Install the inboard door handle.

k. If adjustments to the installed door are required, refer to CABIN DOOR ADJUSTMENT.

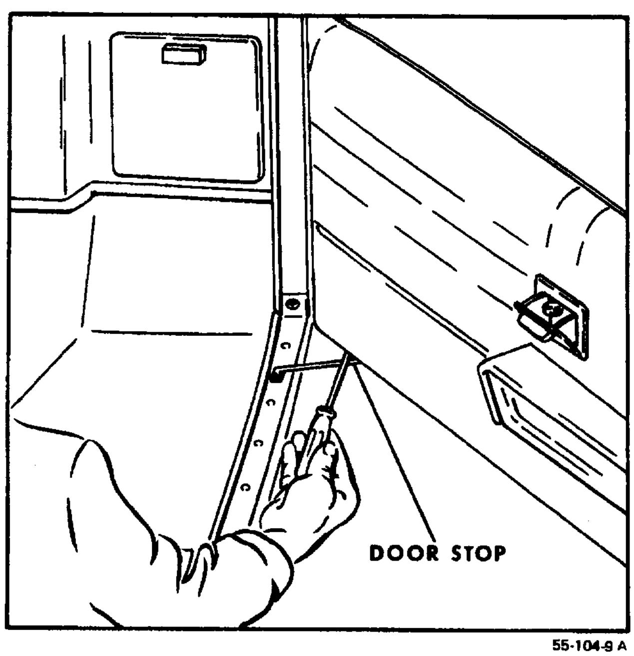
CABIN DOOR REMOVAL (CJ-149 AND AFTER ONLY)

CAUTION: *Support the door to avoid damaging the wing when the quick release frees the door.*

To remove the door, cut safety wire securing the quick release handle (red) in place and straighten out the aluminum catch. Pull the handle that disengages the hinge pin retainers and remove the door.

CABIN DOOR INSTALLATION (CJ-149 AND AFTER ONLY)

To install the door, position the door so that the hinge pins slide into the hinge slots, then push in the quick release handle (red) until the retainers engage the holes in the hinge to lock the hinges in place around the hinge pins. Bend the aluminum catch back in place over the handle and secure the handle to the catch with one wrap of 0.020 in. (0.051 cm) diameter copper wire per QQ-W-343 Type S.



Cabin Door Stop
Figure 1

CABIN DOOR ADJUSTMENT

If any of the following conditions exist, check and adjust the cabin door latching mechanism:

- The door is difficult to close.
- There is excessive wind noise around the door.
- The door is not airtight or watertight.
- The door is opening in flight.
- The door has recently been removed or repaired.

a. Ensure that the door's internal latch mechanism is not binding and/or preventing proper door closing as follows:

   1. With the door in the open position, operate the latching mechanism several times to ensure that the internal mechanism is operating smoothly and properly.

   2. With the door still in the open position, rotate the inside door handle counterclockwise as far as possible. Mark the inside handle escutcheon plate at the edge of the blade protruding from the inner forward end of the handle.

   3. Place the latch in the open position and then close and latch the door. Check to see that the handle rotates to the position that was marked in the previous step. If the handle does not line up with the mark, open the door and remove the door upholstery. Inspect the latching mechanism to determine the reason for the interference and make the necessary adjustments.

   NOTE: The areas of possible interference are where the lower pin, the upper latch hook, and the aft latch bolt engage in the door frame.

b. The latches may require adjustment to ensure positive door locking as follows:

   1. UPPER LATCH - There are three points that should be inspected and/or adjusted on the upper latch.

      a) Check to ensure that the upper latch mechanism is over center when the door is latched. This can be accomplished by using a small inspection mirror to see that the upper operating link is against the adjustment screw and the forward edge of the upper operating link is forward of the forward edge of the lower operating link. If the latch mechanism is not over center when the door is latched, adjust the over center stop screw (Ref. Figure 2, Sheet 1).

      b) Check to ensure that the upper latch hook pin is positioned so that it is almost touching the aft portion of the hook without riding on the hook. If the upper hook does not properly engage the pin, move the pin forward or aft (it has four positions) to obtain proper adjustment.

      c) Check for proper adjustment of the door upper latch bracket in the door sill above the door. If the door does not fit properly in the frame (inboard/outboard) when closed and latched, leaving a noticeable gap between the door and the frame, the upper latch bracket needs to be adjusted **in** to create more tension on the door. This can be accomplished by adjusting the forward tension screw.

   2. LOWER LATCH - The lower aft latch pin should be adjusted in the latched (closed) position so that the shoulder (straight sided) portion of the pin has extended through both the striker plate and the door opening frame to a minimum of 0.05 in. (0.13 cm) above the tapered area of the pin. The latch pin must engage a

minimum of 0.33 in. (0.84 cm) below the lower surface of the door opening frame (Ref. Figure 2, Sheet 2). Adjust the latching pin as follows, so that it just clears the striker plate when the latch is in the unlatched (open) position, and does not interfere with door opening.

NOTE: The amount of the latching pin protruding from the door with the latch mechanism open will depend on the gap between the bottom of the door and the door frame in the fuselage.

a) Remove the safety wire in the turnbuckle.

b) Turn the barrel to extend or retract the pin as necessary.

NOTE: It may be necessary to shorten the pin guide by grinding a maximum of 0.2 in. (0.51 cm) off the top of the pin guide in order to obtain enough travel to make this adjustment.

c) For E-2711, E-2728 and After; EA-537 and After, and prior airplanes with Kit 36-4007-1 installed, perform the following steps, proceed to Step d. for all other airplanes.

1) Adjust turnbuckle so the latching pin will extend a minimum of 0.85 in. (2.16 cm) through door pan when the latching mechanism is in the over center (latched) position. The latching pin may extend up to 0.18 in. (0.46 cm) out of the door pan when the latch mechanism is in the unlatched position (Ref. Figure 3).

2) With the door latched. Point C (center of the clevis pin) is to be 0.03 in. (0.08 cm) to 0.15 in. (0.38 cm) forward of a line (over center) between points A and B.

3) Install a screw in the upper hole or in the hole below this one in the lower arm of the bellcrank. The extension may be rotated or turned over as required to obtain the over center dimension as noted in Step 2. The extension will provide up to 13 different positions using different hole combinations.

4) Tighten the screws in lower arm of bellcrank that are holding the extension.

d) Safety the turnbuckle.

3. AFT LATCH BOLT - Check to ensure that the aft latch bolt provides a pre-catch and protrudes into the socket on the aft door frame as far as possible without bottoming out. If adjustment is required, proceed as follows (Ref. Figure 2, Sheet 3):

a) Disconnect the operating tube at the inside door handle.

b) Disconnect the lower aft latch pin mechanism from the operating tube.

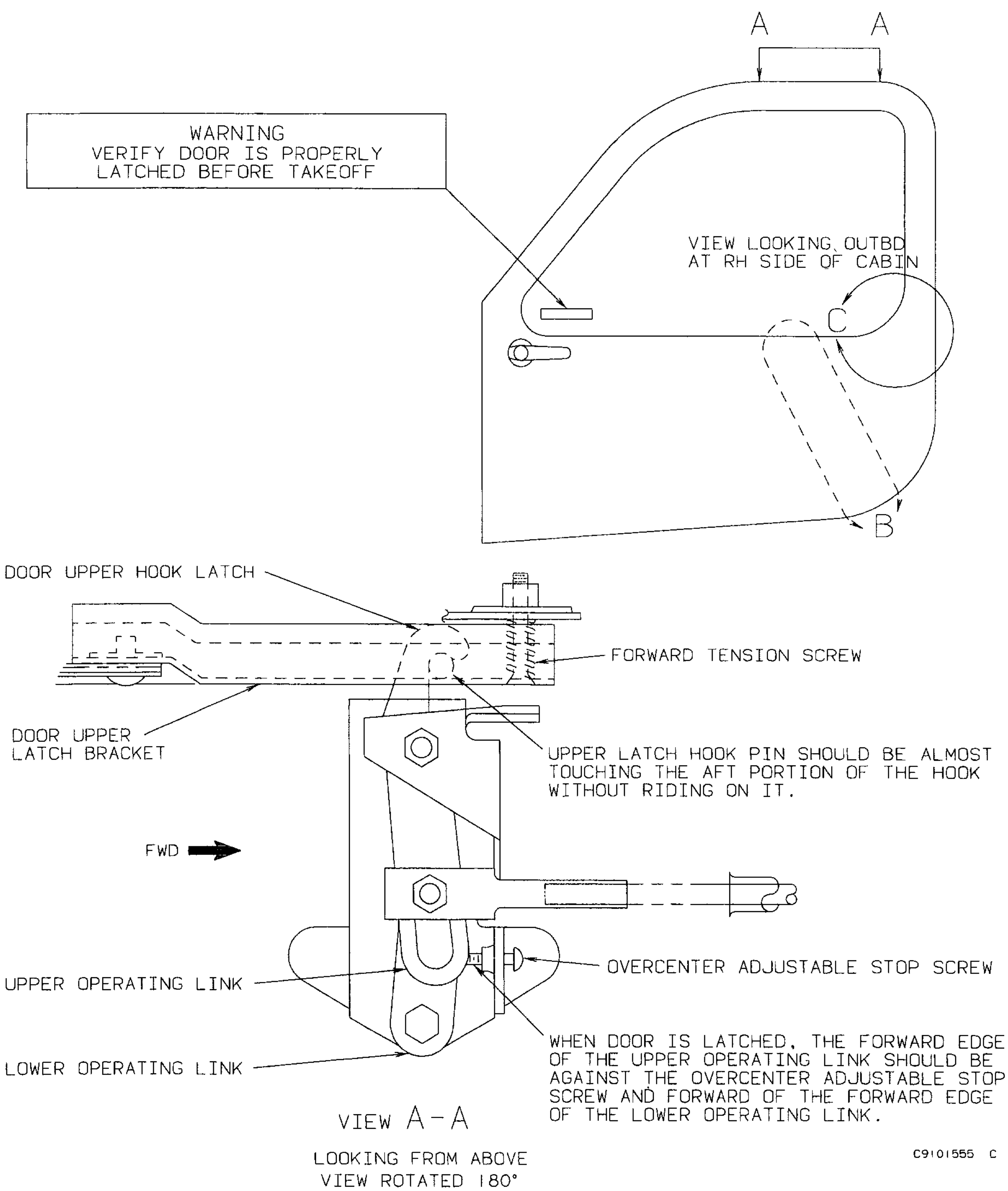
c) Rotate the tube to allow the bolt to protrude the proper distance.

NOTE: When this is done, the outside handle may protrude up to 0.25 in. (0.64 cm) into the air stream, which is acceptable.

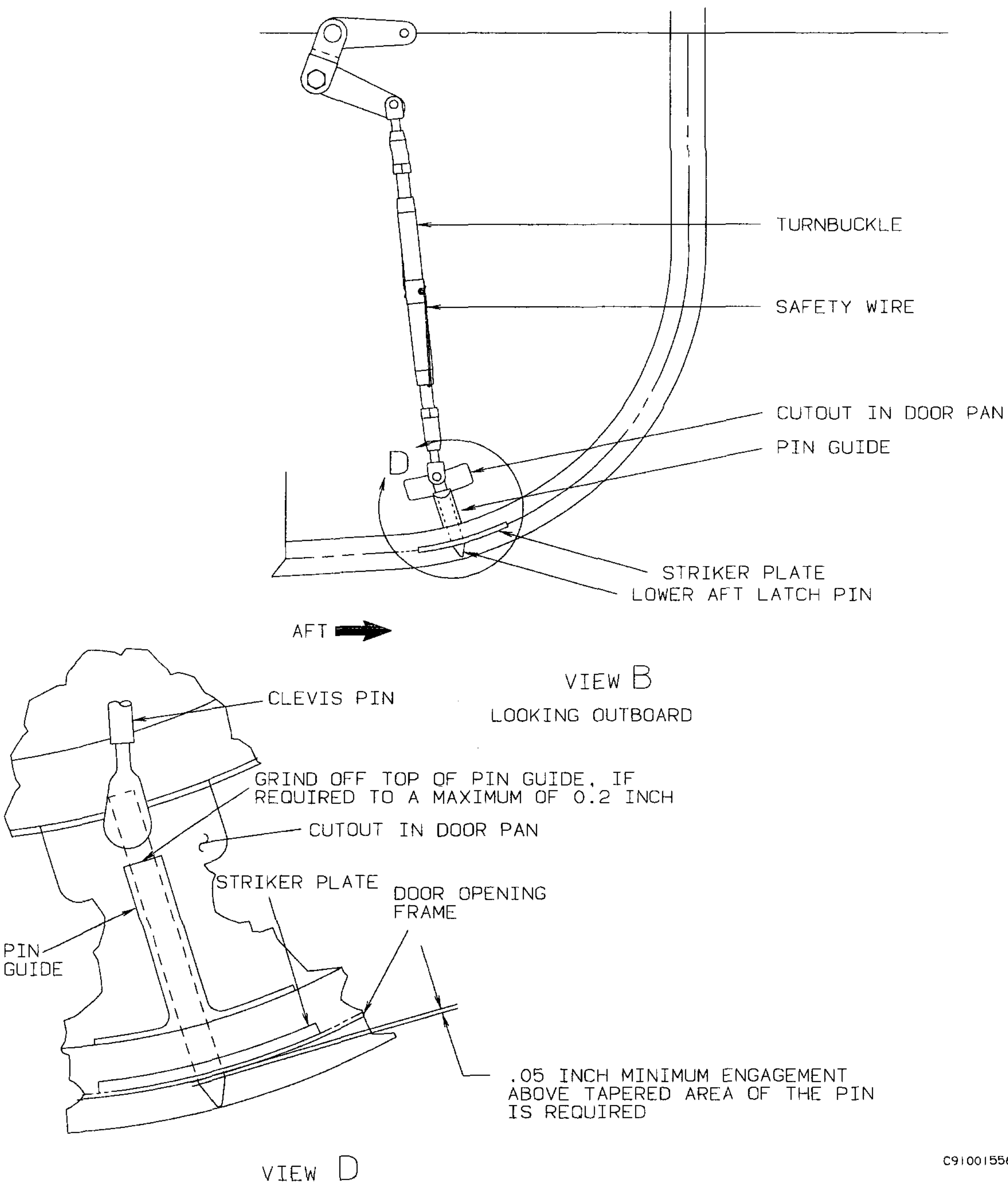
d) Connect the lower aft latch pin mechanism to the operating tube. Connect the operating tube to the inside door handle.

NOTE: The aft latch bolt can be adjusted inboard or outboard by loosening the four retaining screws on the aft side of the door and moving the bolt inboard or outboard as necessary, and then tightening the four screws.

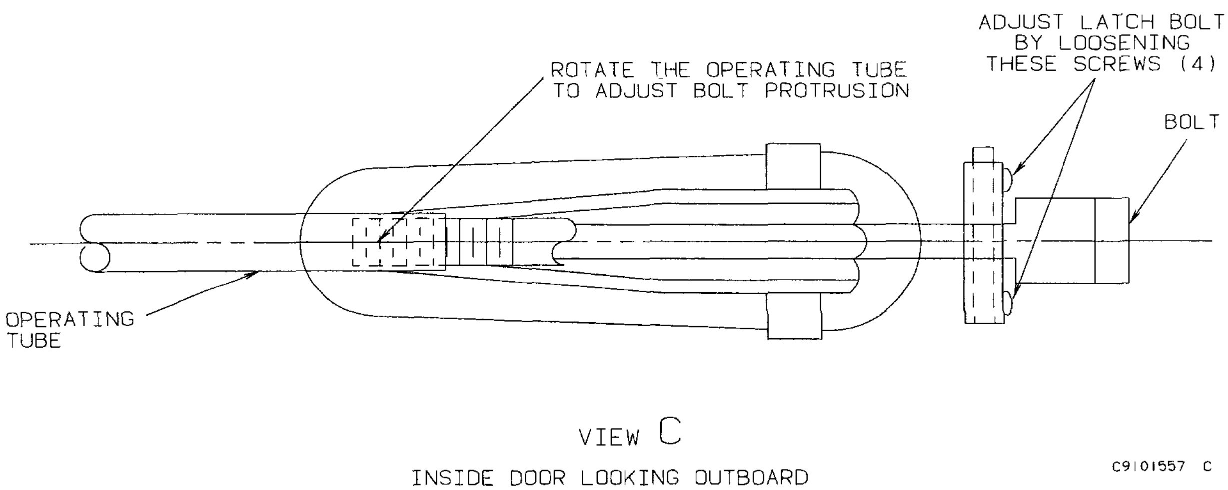
c. Install any upholstery and/or equipment that was removed.



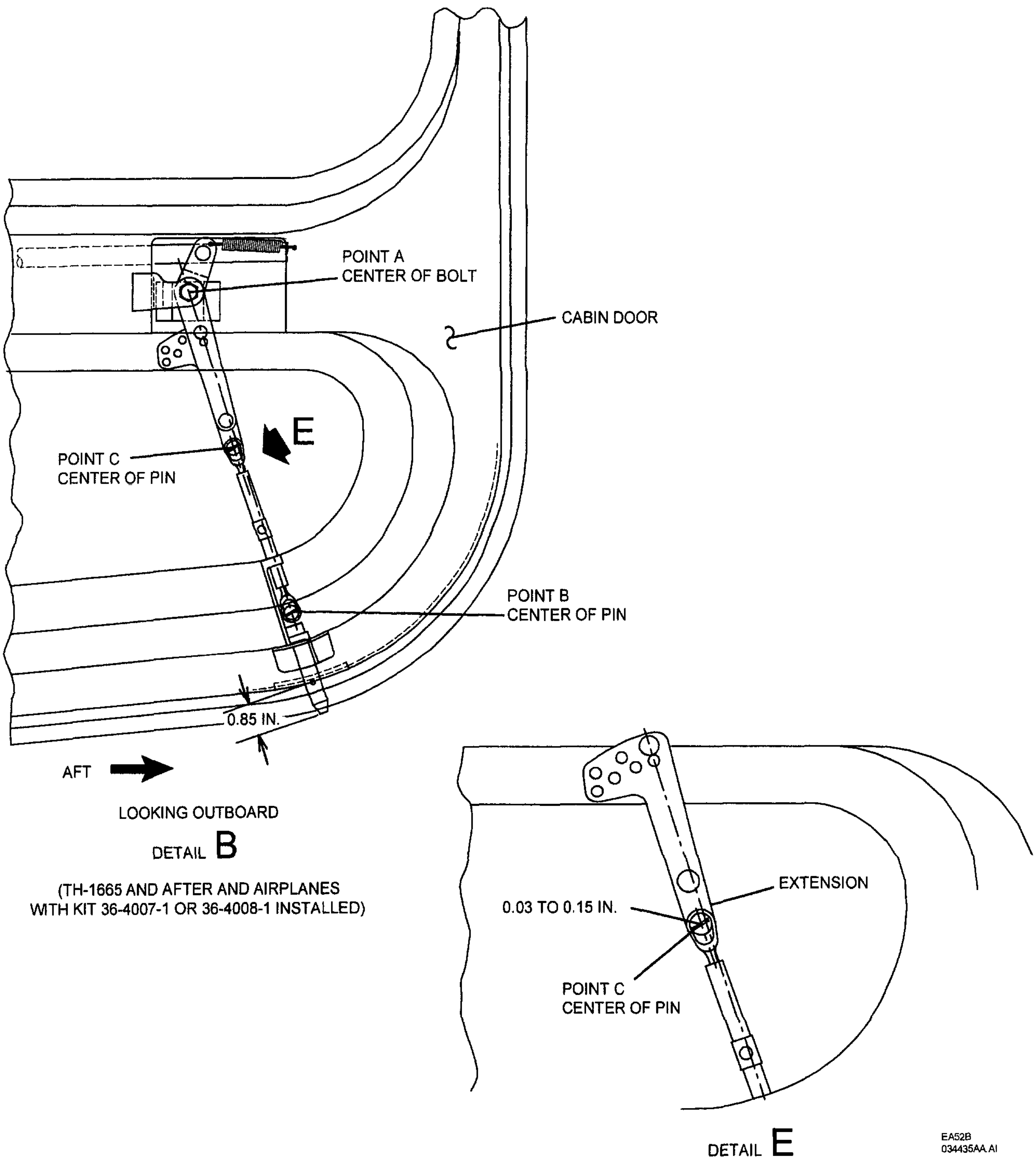
Cabin Door Latch Points
Figure 2 (Sheet 1 of 3)



Cabin Door Latch Points
Figure 2 (Sheet 2 of 3)



Cabin Door Latch Points
Figure 2 (Sheet 3 of 3)



Cabin Door Lower Linkage Adjustment
(E-2711, E-2728 and After; EA-537 and After, and prior Airplanes with Kit 36-4007-1 Installed)
Figure 3

INSTALLING CABIN DOOR LOCK AND FITTING TUMBLER TO KEY

When a lock on the baggage compartment door, cabin door or ignition is broken or worn, it is not necessary to install a full set of replacement locks with a new key. A new tumbler can be readily converted (one time), for use with an old key. To fit a new tumbler to a key proceed as follows:

a. Insert the key to be used into the new lock.

b. With key in the unlocked position, examine the top of the lock barrel where the slots for the tumbler are located.

c. Note that one or more tumblers are protruding through the slot.

d. With a fine file, remove the raised portion of each of these tumblers. The key will now operate the new lock.

To install a new lock in the cabin door, proceed as follows:

e. Loosen the upholstery panel on the cabin door to gain access to the handle mechanism through the cutout in the channel under the latch assembly.

f. Remove the lower aft screw from the external door handle fairing directly under the lock mechanismand remove the pin from the handle through the cutout in the door channel.

NOTE: Both the extreme aft screw and the lower aft screw of the outside latch housing serve as retainers. The extreme aft screw secures the door handle spring in position, and the lower aft screw retains the sliding bolt latch pin in position.

g. Remove the aft screw from the external door handle fairing. This will free the handle spring and allow the handle to be disengaged from the actuating assembly.

h. After fitting the new lock to the key, install the lock barrelin the unlocked positioninto the handle.

i. Bevel the edges of the square hole in the locking cam (beveled edge must face out)and place the cam on the end of the lock barrel. The locking lug on the cam must be in line with the handle.

j. Cover a steel plate with cloth to prevent marring the latch handle and peen the end of the lock barrel until the locking cam is firmly riveted in place.

k. Install the handle in the door.

REMOVING AND INSTALLING THE CABIN DOOR TELEFLEX CABLE

a. Remove the inside door handle and the machine screws on the upper door facing.

b. Remove the door upholstery panels.

c. Remove the bolt securing the teleflex cable to the upper door latch.

d. Remove the bolt securing the lower end of the cable to the lower actuating arm.

NOTE: Attach a length of safety wire to the lower end of the cable before removing it from the door and leave the wire in the cable track as a means of positioning the new cable.

e. Grasp the upper end of the cable with vise grip pliers and pull it out through the upper latch opening. Remove the safety wire from the cable.

NOTE: Braze or silver solder two AN340-832 nuts to two new AN742-4 clamps.

f. Prior to installing the upper clevis, place one of the newly prepared clamps between the shoulders on the lower end of the cable housing and attach the safety wire remaining in the door to the upper end of the cable housing.

g. Pull the housing into position by gripping it with vise grip pliers below the shoulder at the lower end. Pull on the safety wire attached to the upper end while tapping on the vise grip pliers to drive the housing through the door channel.

h. Align the lower clamp with the hole in the door facing and secure it with a machine screw, then install the upper clamp in place on the housing and secure it in the same manner.

i. Install the upper clevis and attach the cables to the upper and lower latch connections.

j. Adjust cable tension by varying the cable length at either latch connection.

INTERIOR CABIN DOOR HANDLE

INTERIOR CABIN DOOR HANDLE REMOVAL AND INSTALLATION

NOTE: It may be necessary to place the interior cabin door handle in the unlatched position to access both screws that secure the door handle.

a. Remove the two screws that secure the interior door handle base plate.

b. Slide the interior door handle from the shaft, maintaining the same orientation of the door handle with respect to the shaft (Ref. Figure 4).

c. Rotate the door handle 90° clockwise, maintaining the base plate in the same position.

NOTE: Interior door handle configuration of some airplanes may differ from that shown in Figure 4. Initial setup is important to confirm proper movement and operation of the latching points.

d. Remove the necessary hardware and adjust clevis as required to position the inside door shaft assembly to approximately 30° below horizontal when in locked position.

e. Attach clevis to inside door shaft assembly with removed hardware.

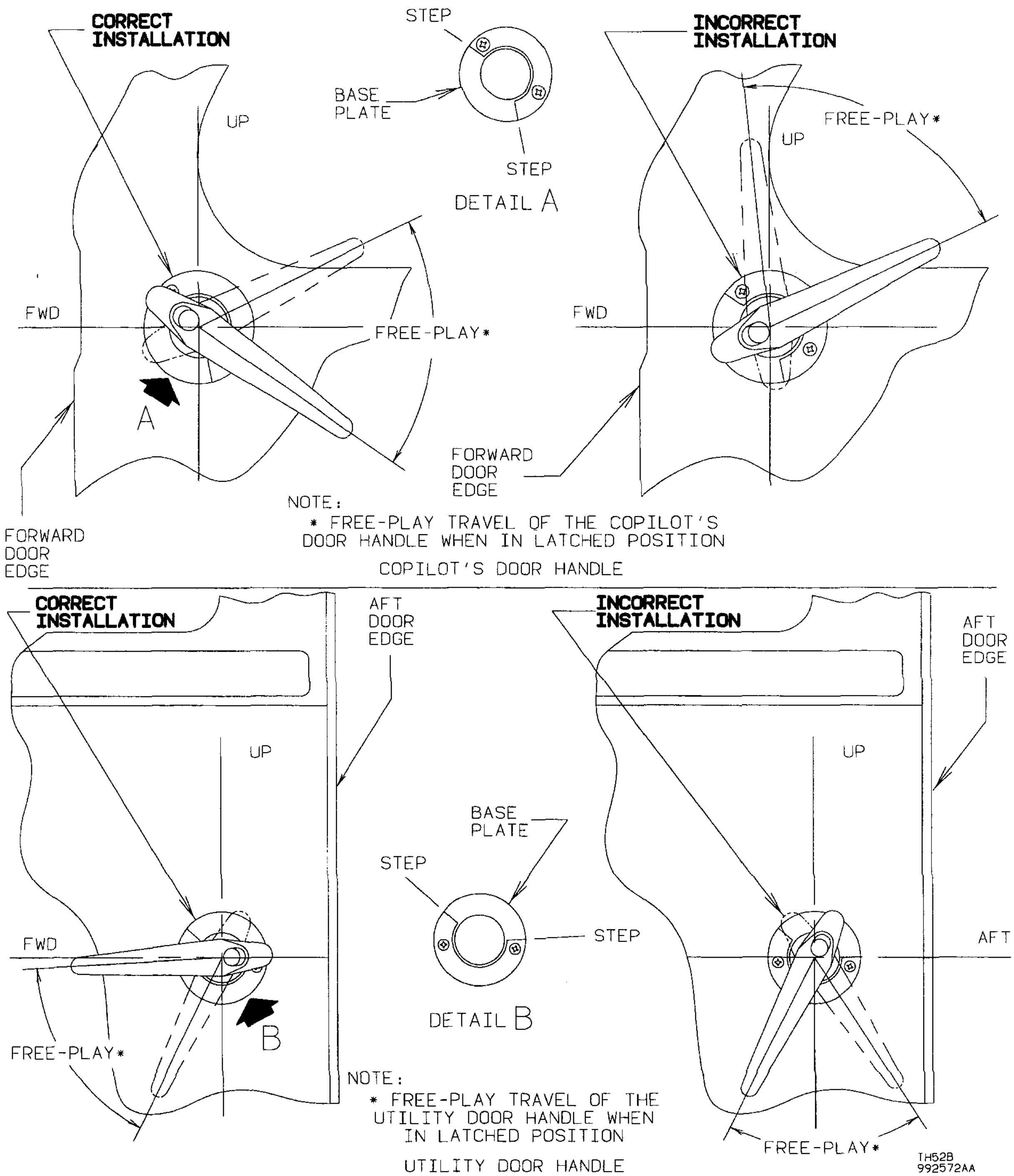
f. Slide the interior door handle over the shaft and secureusing the screws removed in Step a..

g. Latch the door by rotating the interior door handle counterclockwise.

CAUTION: *Rotation of the interior door handle without depressing the handle lock release button should not result in unlatching of the door.*

h. Rotate the interior door handle clockwise without depressing the handle lock release button. If the door remains latched, proceed to Step g.. If the door becomes unlatched, repeat Steps a. thru e..

i. With the door latched, depress the handle lock release button while rotating the door handle clockwise. The door should unlatch.



Interior Crew Door Handle and Interior Utility Door Handle Installation and Orientation
Figure 4

CARGO DOORS - MAINTENANCE PRACTICES

UTILITY DOOR REMOVAL (E-1111, E-1241 AND AFTER; EA-1 AND AFTER)

a. With the doors open, remove the screws that attach the scissors door stop to the door sill.

b. Support the doors and remove the hinge pins by pulling straight up.

UTILITY DOOR INSTALLATION (E-1111, E-1241 AND AFTER; EA-1 AND AFTER)

a. Support the doors and install the hinge pins.

b. Install the screws that attach the scissors door stop to the door sill.

UTILITY DOOR ADJUSTMENT

If the utility door does not close properly or permits air leaks while completely closed, several adjustments may be made to assure proper sealing of the door. After determining the origin of the air leakage as to whether it is from around the forward half of the utility door or the aft half of the door, make the following adjustments as necessary:

ADJUSTMENT OF THE AFT HALF OF THE UTILITY DOOR

a. Adjustments of the aft door may be performed by removing the upholstery paneling and shortening or lengthening the door latch connecting tube assembly.

NOTE

By shortening the connecting tube assemblies, the door will be pulled tighter against the door seal.

b. To adjust the length of the connecting tube assembly, remove the cotter key, washers and pin. Turn the pin eye "in" to shorten the tube assembly and turn the pin eye "out" to lengthen the tube assembly.

c. After the desired length has been set, install the pin, washers and cotter key.

d. Replace the upholstery paneling.

ADJUSTMENT OF THE FORWARD HALF OF THE UTILITY DOOR

a. If air leakage is found around the forward half of the door, the necessary adjustments may be made at the aft door latch striker plates, located slightly above and below the upper and lower door sill of the aft door.

b. For a tighter fit, loosen the screws on the upper and lower striker plates on the aft door and move them inboard. By moving the plates inboard, the aft door will adjust inboard thus pulling inward the forward door when it is latched.

UTILITY DOOR LATCH PIN ADJUSTMENT

If the forward door does not open freely, the door latch pins may not be retracting enough. This may be corrected by the following adjustments:

a. Remove the upholstery paneling.

b. Remove the cotter keys, pins and washers.

c. Loosen the pin eye jam nut and turn the pin eye "in" to shorten the tube assemblies; turn the pin eye "out" to lengthen the tube assemblies.

d. After the desired length has been set, tighten the pin eye jam nut. Install the pins, washers and cotter keys.

e. Replace the upholstery paneling.

INTERIOR UTILITY DOOR HANDLE REMOVAL AND INSTALLATION

Refer to Section 52-10-00, INTERIOR CABIN DOOR HANDLE for the removal, installation and checkout instructions for the interior utility door handle.

LARGE BAGGAGE DOOR REMOVAL (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER)

a. On the large type door, unlatch the door and remove the scissors type door stop at the top of the door.

b. Remove the door hinge pin.

LARGE BAGGAGE DOOR INSTALLATION (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER)

a. Install the door hinge pin.

b. Install the scissors type door stop at the top of the door.

SMALL BAGGAGE DOOR REMOVAL (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER)

a. On the small door, unlatch the door and remove the door hinge pin while carefully holding the door in position.

b. Disconnect the door stop rod from the door at the door.

SMALL BAGGAGE DOOR INSTALLATION (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER)

a. Connect the stop rod to the door.

b. While carefully holding the door in position, install the hinge pin.

BAGGAGE DOOR ADJUSTMENT (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER)

If the large baggage door does not open freely, the door latch pins may not be retracting enough. This may be corrected by the following adjustments:

a. Remove the upholstery paneling.

b. Remove the cotter keys, pins, and washers.

c. Loosen the pin eye jam nut and turn the pin eye "in" to shorten the tube assemblies; turn the pin eye "out" to lengthen the tube assemblies.

d. After the desired length has been set, tighten the pin eye jam nut. Install the pins, washers and cotter keys.

e. Replace the upholstery paneling.

If additional inward tension for a tighter fit of the door is required, adjust inward the three striker plates on the door sill (large door), or inward on the single latch mechanism contact plate on the door sill (small door).

CHAPTER

53

FUSELAGE

CHAPTER 53 - FUSELAGE

TABLE OF CONTENTS

CHAPTER 53 - FUSELAGE

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
53-LOEP	1	Sep 30/04
53-CONTENTS	1	Sep 30/04
53-10-00	1 thru 5	Sep 30/04
53-30-00	1 thru 9	May 9/80

FUSELAGE - MAINTENANCE PRACTICES

WING FORWARD SPAR CARRY-THROUGH STRUCTURE INSPECTION WITHOUT REPAIR KIT

This procedure provides inspection and repair information relating to the forward wing spar structure at the forward and aft frames.

NOTE: The areas identified in Figure 1 should be inspected for cracking at the intervals specified for non repaired structures by Chart 1 using the following inspection procedure:

a. Remove the carry-through cover to obtain access to the forward spar carry-through structure. Refer to the FORWARD CARRY-THROUGH SPAR COVER REMOVAL procedure in 25-00-00.

b. Thoroughly clean the forward and aft frames (webs) of the forward spar carry-through structure in the areas shown in Figure 1 with solvent (26, Chart 1, 91-00-00).

c. Perform a visual inspection of the cleaned areas for evidence of cracks.

d. Perform a fluorescent or dye penetrant inspection of the cleaned area per MIL-STD-6866 and inspect for evidence of cracks.

e. If cracks are discovered, determine the crack size and method of repair as outlined in the WING FORWARD SPAR CARRY-THROUGH STRUCTURE REPAIR/INSPECTION procedure.

f. If no cracks are noted, install the carry-through cover. Refer to the FORWARD CARRY-THROUGH SPAR COVER INSTALLATION procedure in 25-00-00.

WING FORWARD SPAR CARRY-THROUGH STRUCTURE INSPECTION WITH REPAIR KIT

NOTE: The areas identified in Figure 1 should be inspected for cracking at the intervals specified for repaired structures by Chart 2 using the following inspection procedure:

a. Remove the carry-through cover to obtain access to the forward spar carry-through structure. Refer to the FORWARD CARRY-THROUGH SPAR COVER REMOVAL procedure in 25-00-00.

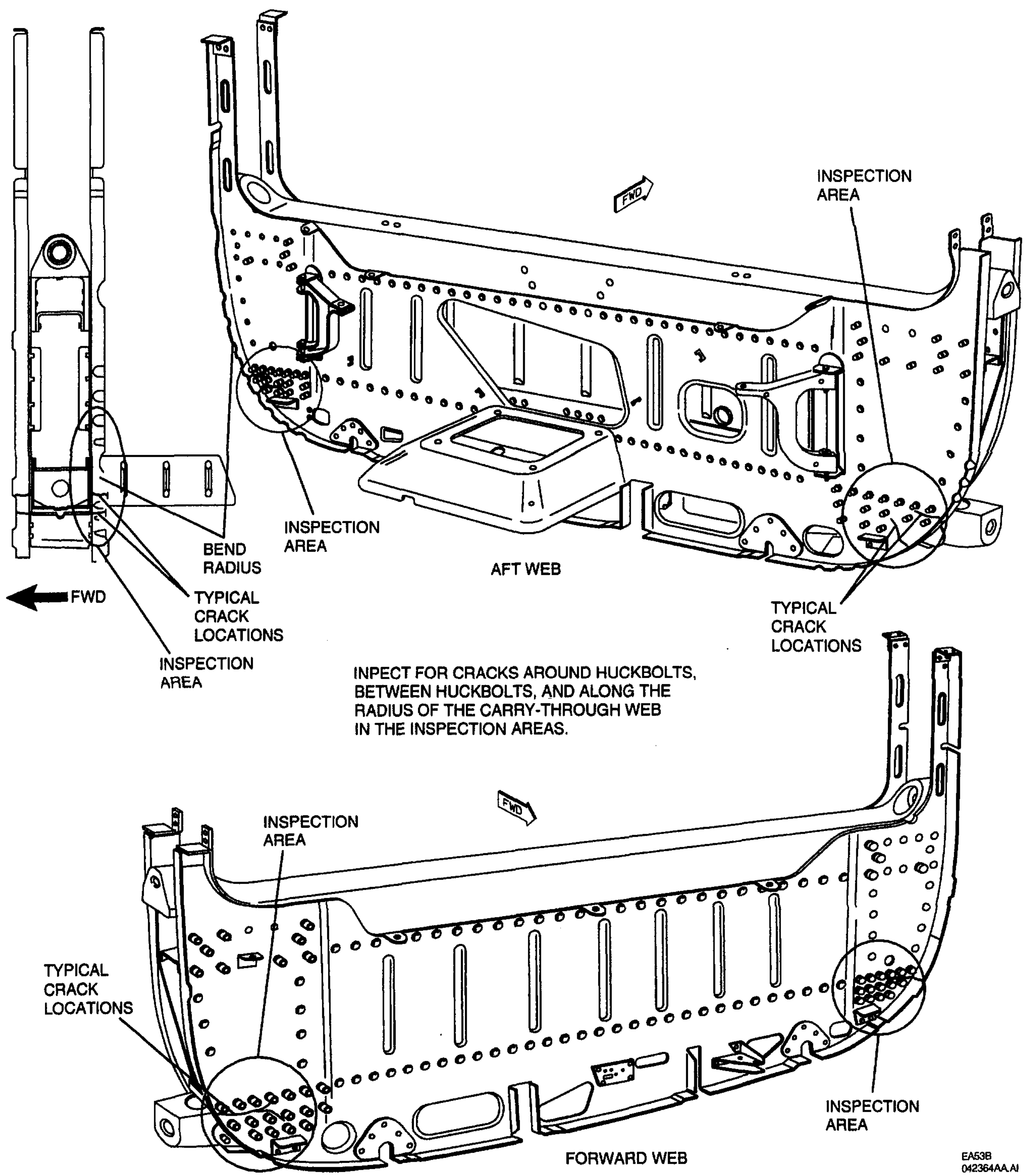
b. Thoroughly clean the forward and aft frames (webs and reinforcing doubler) of the forward spar carry-through structure in the areas shown in Figure 1 with solvent (26, Chart 1, 91-00-00).

c. Perform a visual inspection of the cleaned areas for evidence of cracks.

d. Perform a fluorescent or dye penetrant inspection of the cleaned area per MIL-STD-6866 and inspect for evidence of cracks.

e. If cracks are discovered in the doubler or the existing web face, the crack has progressed beyond the doubler profile; contact the Technical Support Department at Raytheon Aircraft Company for further instructions.

f. If no cracks are noted, install the carry-through cover. Refer to the FORWARD CARRY-THROUGH SPAR COVER INSTALLATION procedure in 25-00-00.



Wing Forward Spar Carry-Through Structure Inspection
Figure 1

WING FORWARD SPAR CARRY-THROUGH STRUCTURE REPAIR/INSPECTION

NOTE: The extent of repair/inspection is limited to cracking in the radius of the web flange and cracks in the web face around the fasteners in the lower forward spar cap.

BEND RADIUS CRACK

The following procedure should be performed to repair/inspect cracks in the bend radius (Ref. Figure 1):

CAUTION: *Caution must be used during the stop drilling operation. Do not drill into the spar cap, skin or any other structure. A thin stainless steel sheet may be used to prevent damaging adjacent structure.*

a. A crack exceeding 4.0 inches in length must be repaired PRIOR TO FURTHER FLIGHT per the applicable kit listed in Chart 3.

b. A crack up to 4.0 inches in length must be stop drilled with a #30 drill bit at the crack ends. The area must be repaired per the applicable kit listed in Chart 3 within the next 100 flight hours, 12 months or the next scheduled inspection, whichever occurs first.

WEB FACE CRACK

The following procedure should be performed to repair/inspect cracks in the web face around the huck-bolt fasteners (Ref. Figure 1):

CAUTION: *Do not stop drill, due to the possibility of damaging structure behind web face.*

a. A crack passing through two fasteners and extending beyond for more than 0.5 inch on either end shall be repaired PRIOR TO FURTHER FLIGHT per the applicable kit listed in Chart 3.

b. Any other crack shall be repaired per the applicable kit listed in Chart 3 within the next 25 flight hours, 12 months or the next scheduled inspection, whichever occurs first.

COMBINATION BEND RADIUS AND WEB FACE CRACKS

a. If cracks are found in both the forward and aft frames on the same side of the airplane, in either the web face and/or the bend radius, and any of the cracks are more than 1.0 inch long, a repair shall be made PRIOR TO FURTHER FLIGHT.

b. If cracks are found in both the forward and aft frames on the same side of the airplane, in either the web face and/or the bend radius, and all of the cracks are less than 1.0 inch long, a repair shall be made per the applicable kit listed in Chart 3 within the next 25 flight hours, 12 months or the next scheduled inspection, whichever occurs first.

c. If a fuselage skin crack is discovered around the opening for the lower forward carry-through fitting, an external skin doubler may be required. Contact the Technical Support Department at Raytheon Aircraft Company for further instructions.

d. Install the carry-through cover. Refer to the FORWARD CARRY-THROUGH SPAR COVER INSTALLATION procedure in 25-00-00.

Chart 1
Inspection Program For Non Repaired Structures

AIRCRAFT SERIAL NO.	INITIAL INSPECTION	FREQUENCY OF INSPECTION
Model F33A (CE-748, CE-772 thru CE-1192)	1,500 HOURS	500 HOURS
Model F33C (CJ-149 thru CJ-179)	1,500 HOURS	500 HOURS
Model V35B (D-10097, D-10120 thru D-10403)	1,500 HOURS	500 HOURS
Model A36 (E-1111, E-1241 thru E-2397)	1,500 HOURS	500 HOURS
Model A36TC (EA-11 thru EA-272, except EA-242) **Model B36TC** (EA-242, EA-273 thru EA-471)	1,500 HOURS	500 HOURS
Model F33A (CE-1193 and After)	3,000 HOURS	1,000 HOURS
Model A36 (E-2398 and After)	3,000 HOURS	1,000 HOURS
Model B36TC (EA-472 and After)	3,000 HOURS	1,000 HOURS

Chart 2
Inspection Program For Repaired Structure

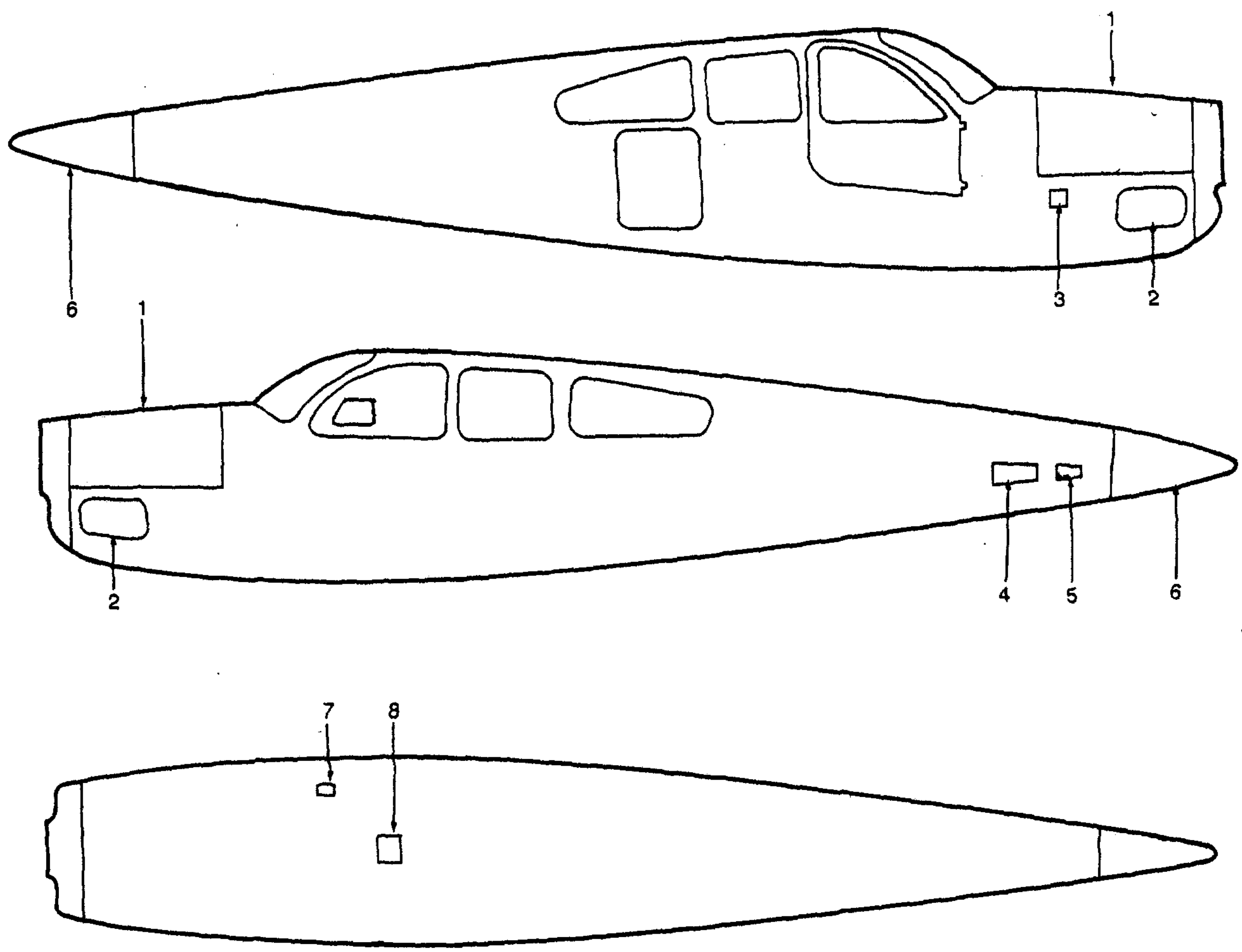
AIRCRAFT SERIAL NO.	AFTER DOUBLER INSTALLATION	FREQUENCY OF INSPECTION
Model F33A (CE-748, CE-772 thru CE-1192)	1,500 HOURS	500 HOURS
Model F33C (CJ-149 thru CJ-179)	1,500 HOURS	500 HOURS
Model V35B (D-10097, D-10120 thru D-10403)	1,500 HOURS	500 HOURS
Model A36 (E-1111, E-1241 thru E-2397)	1,500 HOURS	500 HOURS
Model A36TC (EA-11 thru EA-272, except EA-242) **Model B36TC** (EA-242, EA-273 thru EA-471)	1,500 HOURS	500 HOURS
Model F33A (CE-1193 and After)	3,000 HOURS	1,500 HOURS
Model A36 (E-2398 and After)	3,000 HOURS	1,500 HOURS
Model B36TC (EA-472 and After)	3,000 HOURS	1,500 HOURS

Chart 3
Forward Spar Carry-Through Structure Repair Kits

AIRCRAFT SERIAL NO.	PART NUMBER	KIT DESCRIPTION	QUANTITY PER AIRCRAFT
Model F33A (CE-748, CE-772 and After) **Model F33C** (CJ-149 thru CJ-179) **Model V35B** (D-10097, D-10120 thru D-10403) **Model A36** (E-1111, E-1241 and After) **Model A36TC** (EA-11 thru EA-241, EA-243 thru EA-272)	36-4004-5	FORWARD SPAR CARRY-THROUGH STRUCTURE REINFORCEMENT (FORWARD FRAME)	1 REQUIRED
Model F33A (CE-748, CE-772 and After) **Model F33C** (CJ-149 thru CJ-179) **Model V35B** (D-10097, D-10120 thru D-10403) **Model A36** (E-1111, E-1241 and After) **Model A36TC** (EA-11 thru EA-241, EA-243 thru EA-272)	36-4004-7	FORWARD SPAR CARRY-THROUGH STRUCTURE REINFORCEMENT (AFT FRAME)	1 REQUIRED
Model B36TC (EA-242, EA-273 and After)	36-4004-9	FORWARD SPAR CARRY-THROUGH STRUCTURE REINFORCEMENT (FORWARD FRAME)	1 REQUIRED
Model B36TC (EA-242, EA-273 and After)	36-4004-11	FORWARD SPAR CARRY-THROUGH STRUCTURE REINFORCEMENT (AFT FRAME)	1 REQUIRED

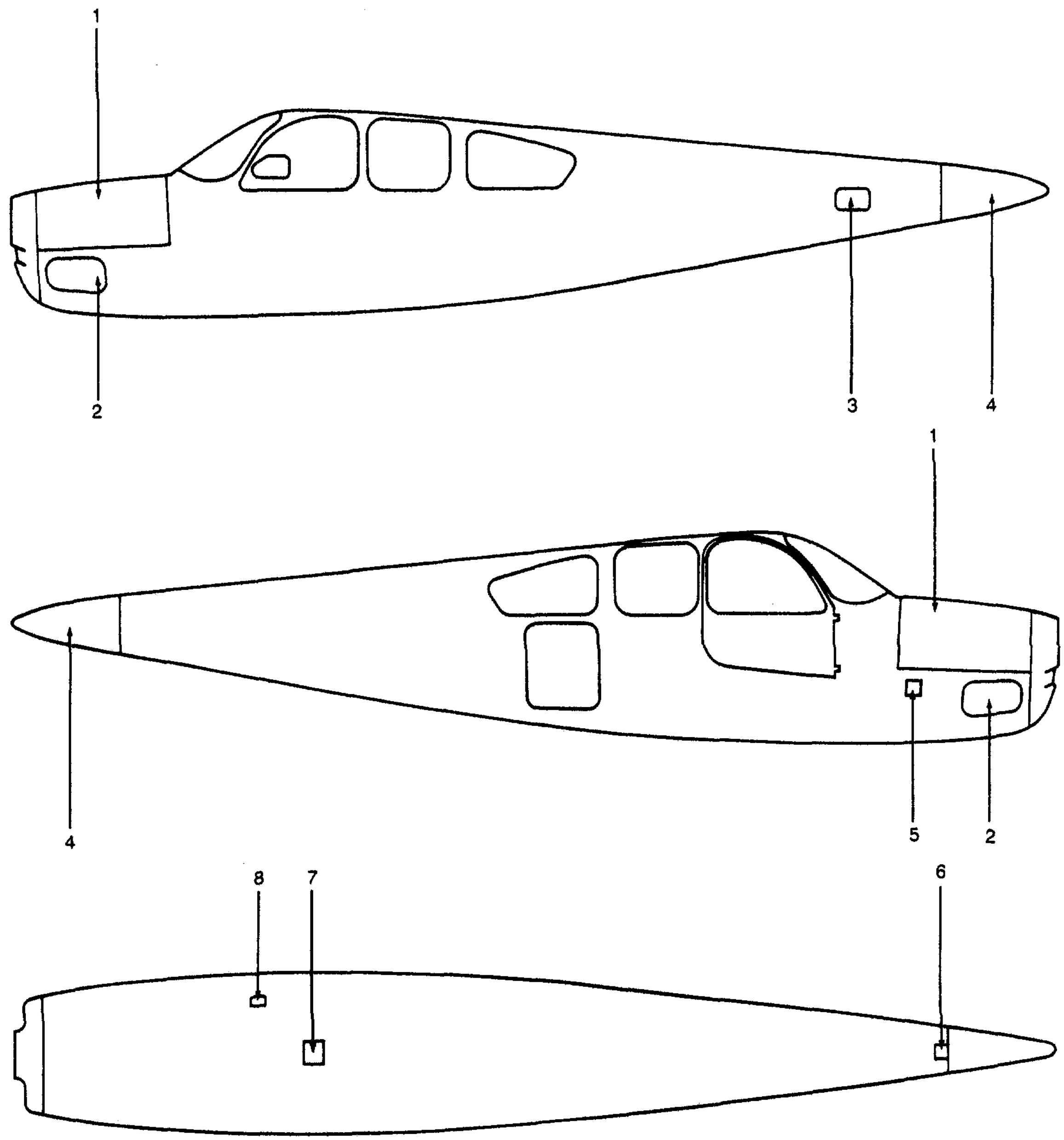
PLATES/SKIN - MAINTENANCE PRACTICES

FUSELAGE ACCESS OPENINGS



1. Engine Cowl
2. Access Plates for Engine
3. External Power Receptacle
4. Empennage Utility Access
5. Empennage Utility Access
6. Empennage Control Linkage
7. Fuel Strainer
8. Landing Gear Actuator

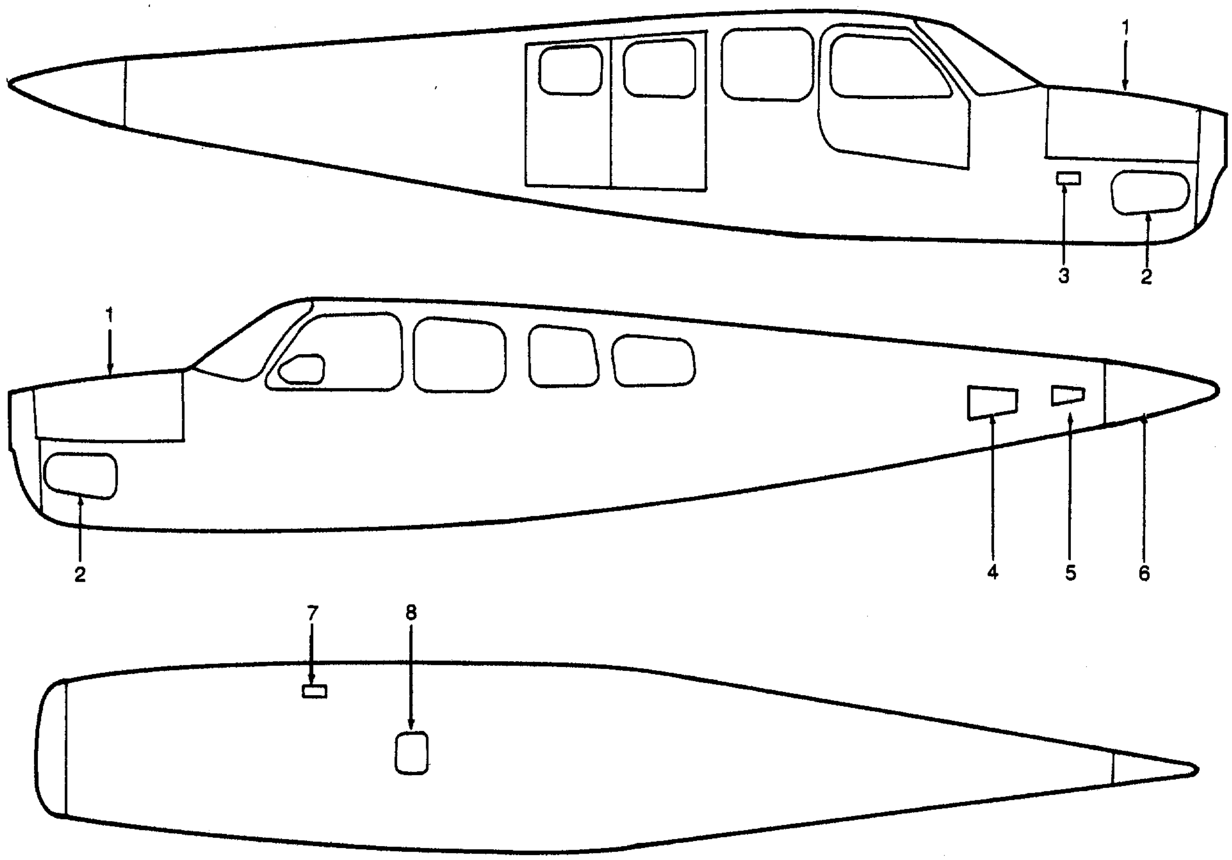
Fuselage Access Openings (CE-748, CE-772 and after; CJ-149 and after)
Figure 1



1. Engine Cowl
2. Access Plates for Engine
3. Differential Mechanism (LH)
4. Empennage Control Linkage
5. External Power Receptacle
6. Differential Mechanism (Lower)
7. Landing Gear Actuator
8. Fuel Strainer

36-13-16

Fuselage Access Openings (D-10097, D-10120 and after)
Figure 2



1. Engine Cowl
2. Access Plates for Engine
3. External Power Receptacle
4. Empennage Utility Access
5. Empennage Utility Access
6. Empennage Control Linkage
7. Fuel Strainer
8. Landing Gear Actuator

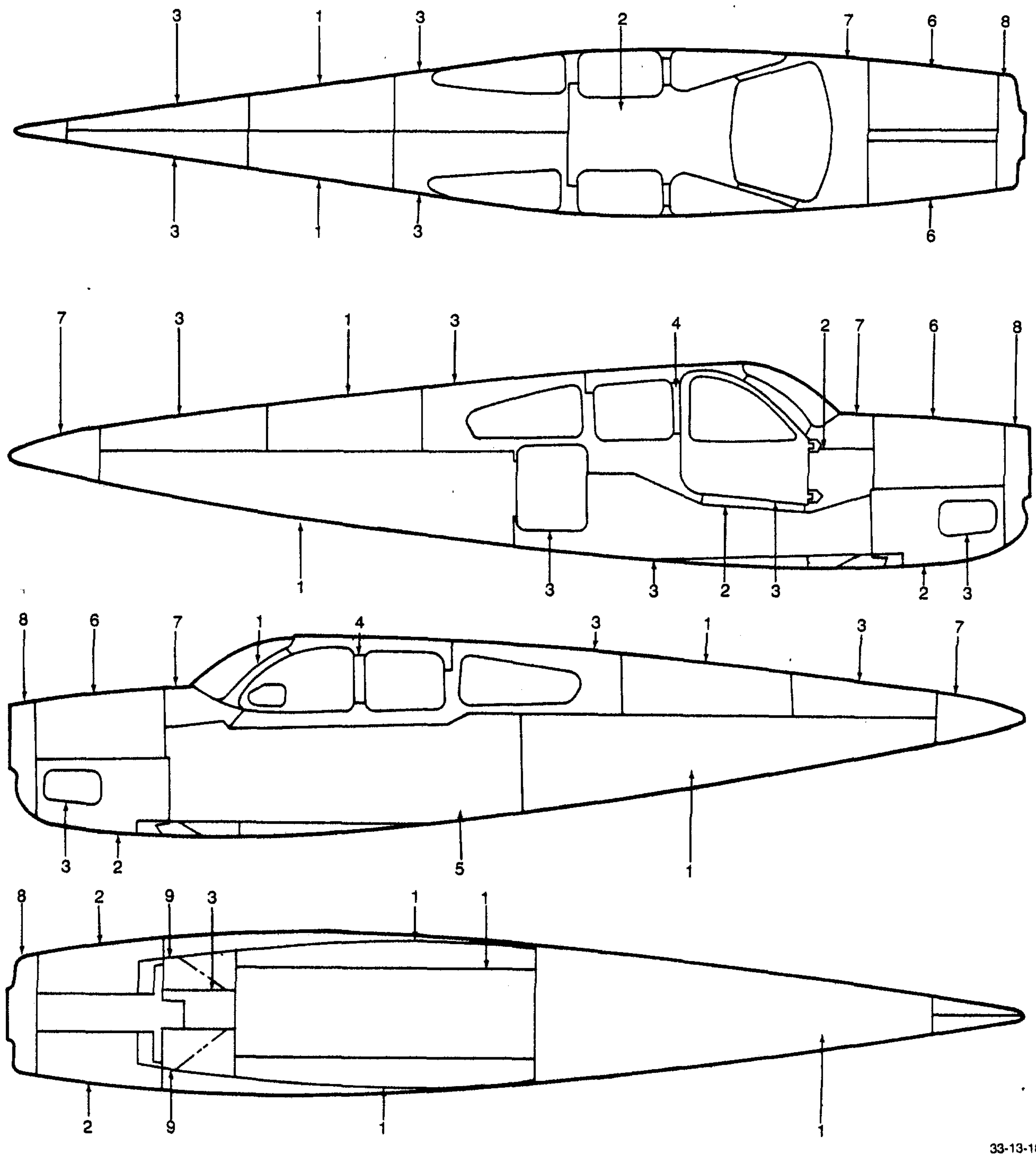
36-13-17

Fuselage Access Openings (E-1111, E-1241 and after; EA-1 and after)
Figure 3

FUSELAGE SKIN THICKNESS

NUMBER	*MATERIAL*	*THICNESS IN INCHES*
1.	2024-T3	.020
2.	2024-T3	.025
3.	2024-T3	.032
4.	2024-T42	.020
5.	2024-T42	.032
6.	6061-T6	.020
7.	6061-T6	.025
8.	6061-T6	.040
9.	COMP 301 CRES	.016

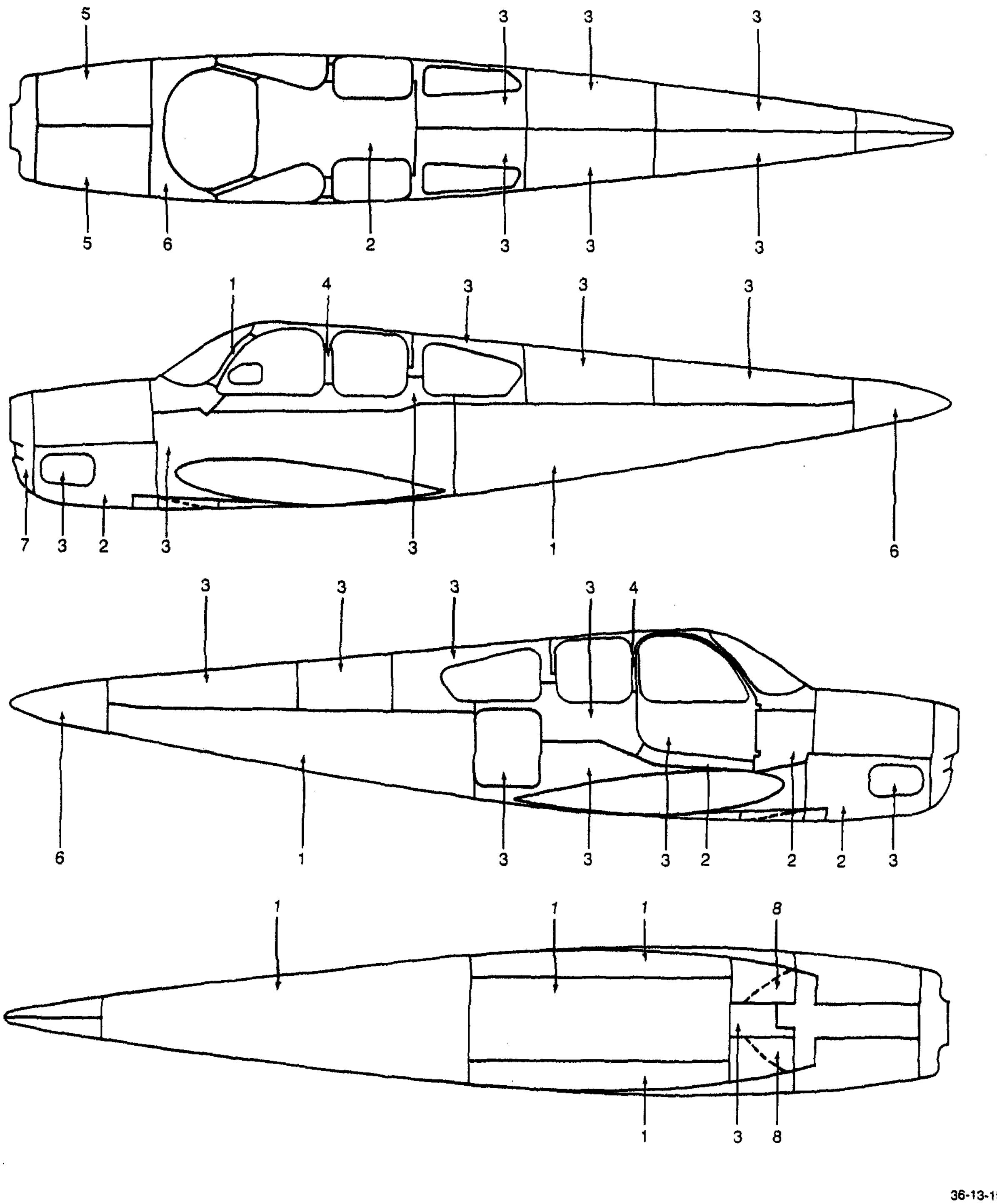
Fuselage Skin Thickness (CE-748, CE-772 and after; CJ-149 and after)
Figure 4 (Sheet 1 of 2)



Fuselage Skin Thickness (CE-748, CE-772 and after; CJ-149 and after)
Figure 4 (Sheet 2 of 2)

NUMBER	*MATERIAL*	*THICKNESS IN INCHES*
1.	2024-T3	.020
2.	2024-T3	.025
3.	2024-T3	.032
4.	2024-T42	.020
5.	6061-T6	.020
6.	6061-T6	.025
7.	6061-T6	.040
8.	COMP 301 CRES	.016

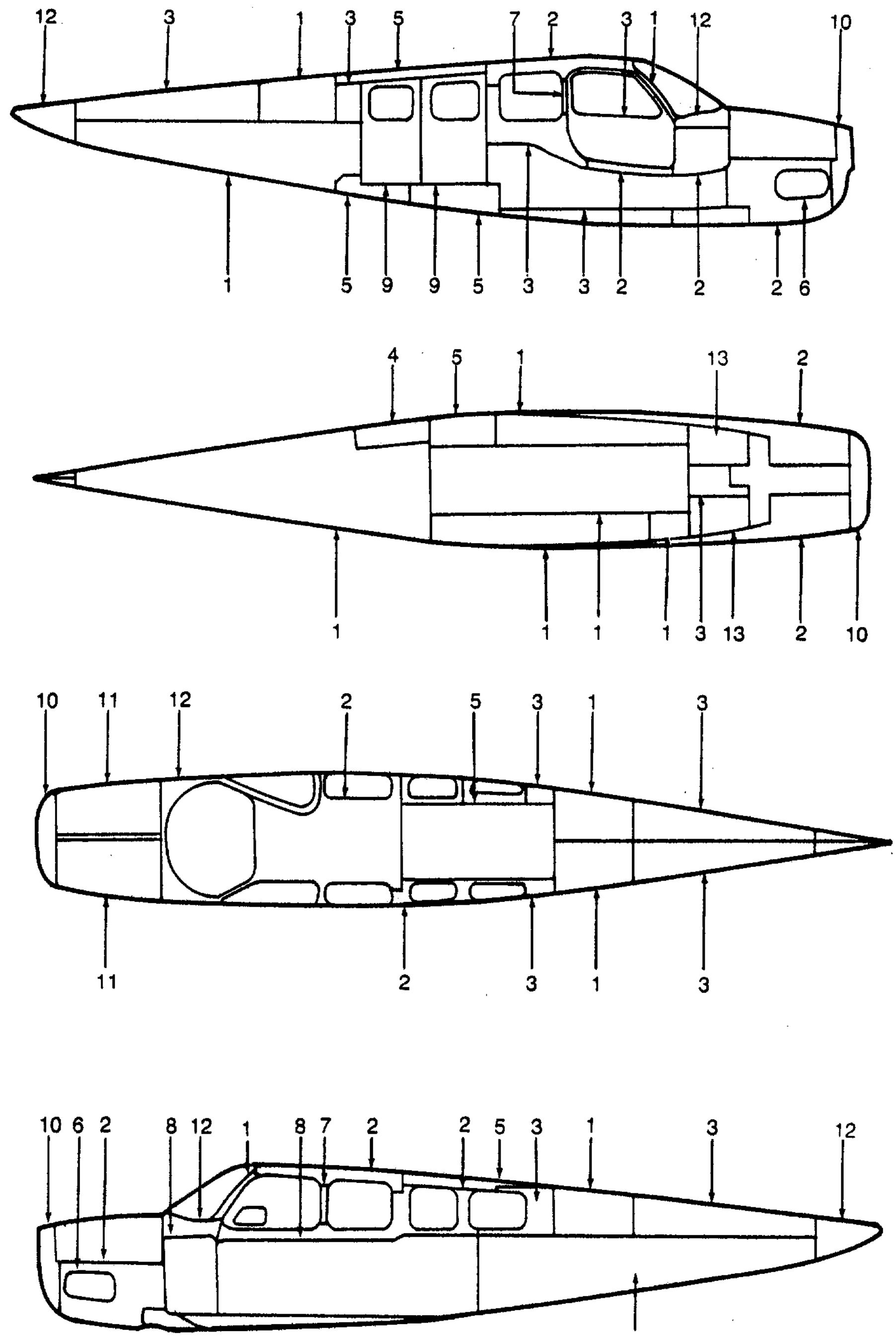
Fuselage Skin Thickness (D-10097, D-10120 and after)
Figure 5 (Sheet 1 of 2)



Fuselage Skin Thickness (D-10097, D-10120 and after)
Figure 5 (Sheet 2 of 2)

NUMBER	*MATERIAL*	*THICKNESS IN INCHES*
1.	2024-T3	.020
2.	2024-T3	.025
3.	2024-T3	.032
4.	2024-T3	.040
5.	2024-T3	.063
6.	2024-T4	.032
7.	2024-T42	.020
8.	2024-T42	.032
9.	6061-T4	.025
10.	6061-T4	.040
11.	6061-T6	.020
12.	6061-T6	.025
13.	COMP 301 CRES	.016

Fuselage Skin Thickness (E-1111, E-1241 and after; EA-1 and after)
Figure 6 (Sheet 1 of 2)



Fuselage Skin Thickness (E-1111, E-1241 and after; EA-1 and after)
Figure 6 (Sheet 2 of 2)

"END"

CHAPTER

55

STABILIZERS

CHAPTER 55 - STABILIZERS

TABLE OF CONTENTS

SUBJECT *CHAPTER* *PAGE*

TABLE OF CONTENTS (Cont'd)

"END"

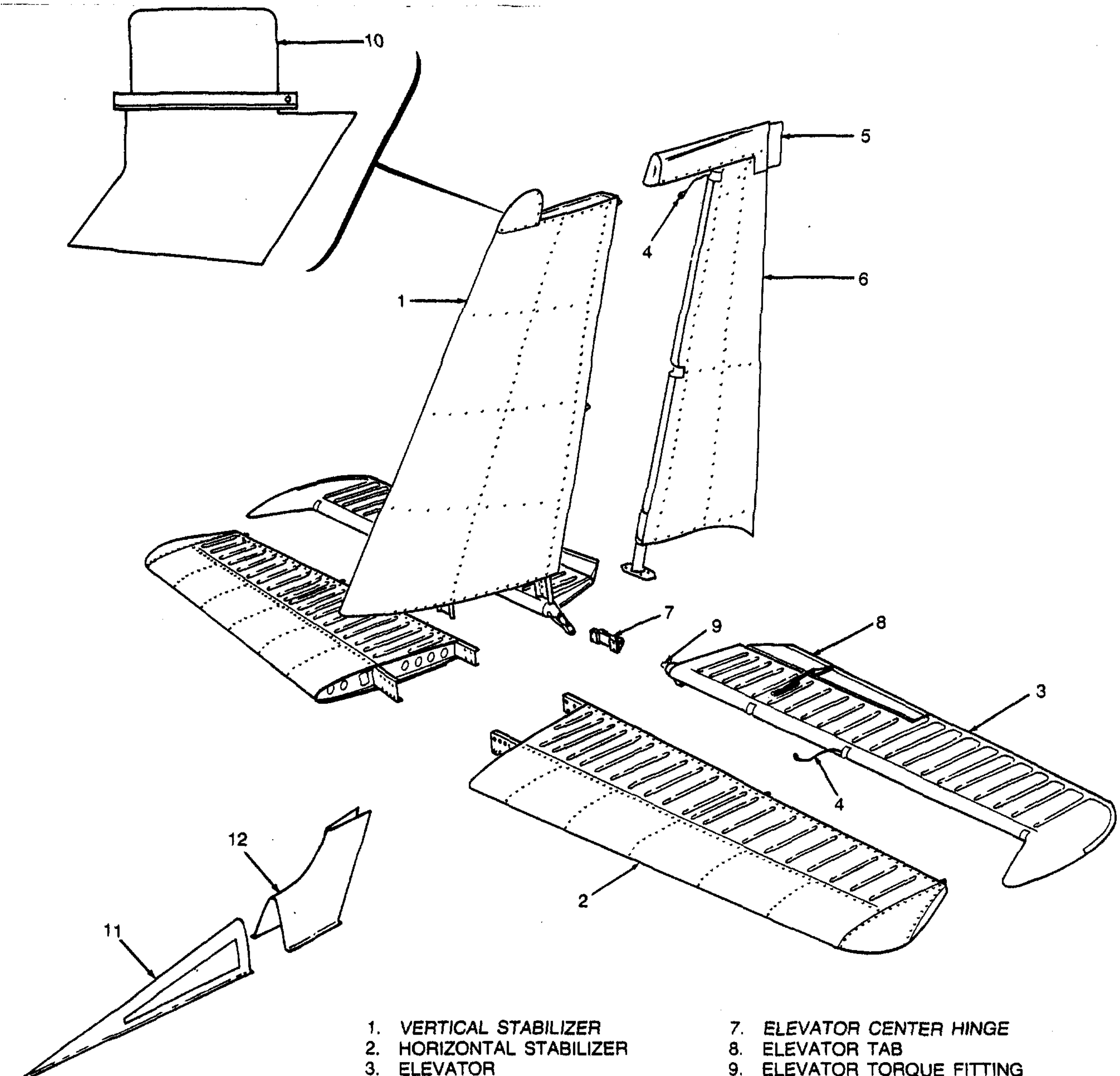
CHAPTER 55

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
55-EFFECTIVITY	1	Oct 16/92
55-CONTENTS	1	Oct 16/92
	2	Oct 16/92
55-00-00	1	May 9/80
	2	May 9/80
	3	May 9/80
	4	May 9/80
	5	May 9/80
55-10-00	1	Oct 16/92
	2	Oct 16/92
55-20-00	1	Oct 16/92
	2	May 9/80
	3	Oct 16/92
	4	Oct 16/92
	5	Oct 16/92
	6	Oct 16/92
55-30-00	1	May 9/80
55-40-00	1	May 9/80
	2	May 9/80
	3	May 9/80

"END"

GENERAL - MAINTENANCE PRACTICES

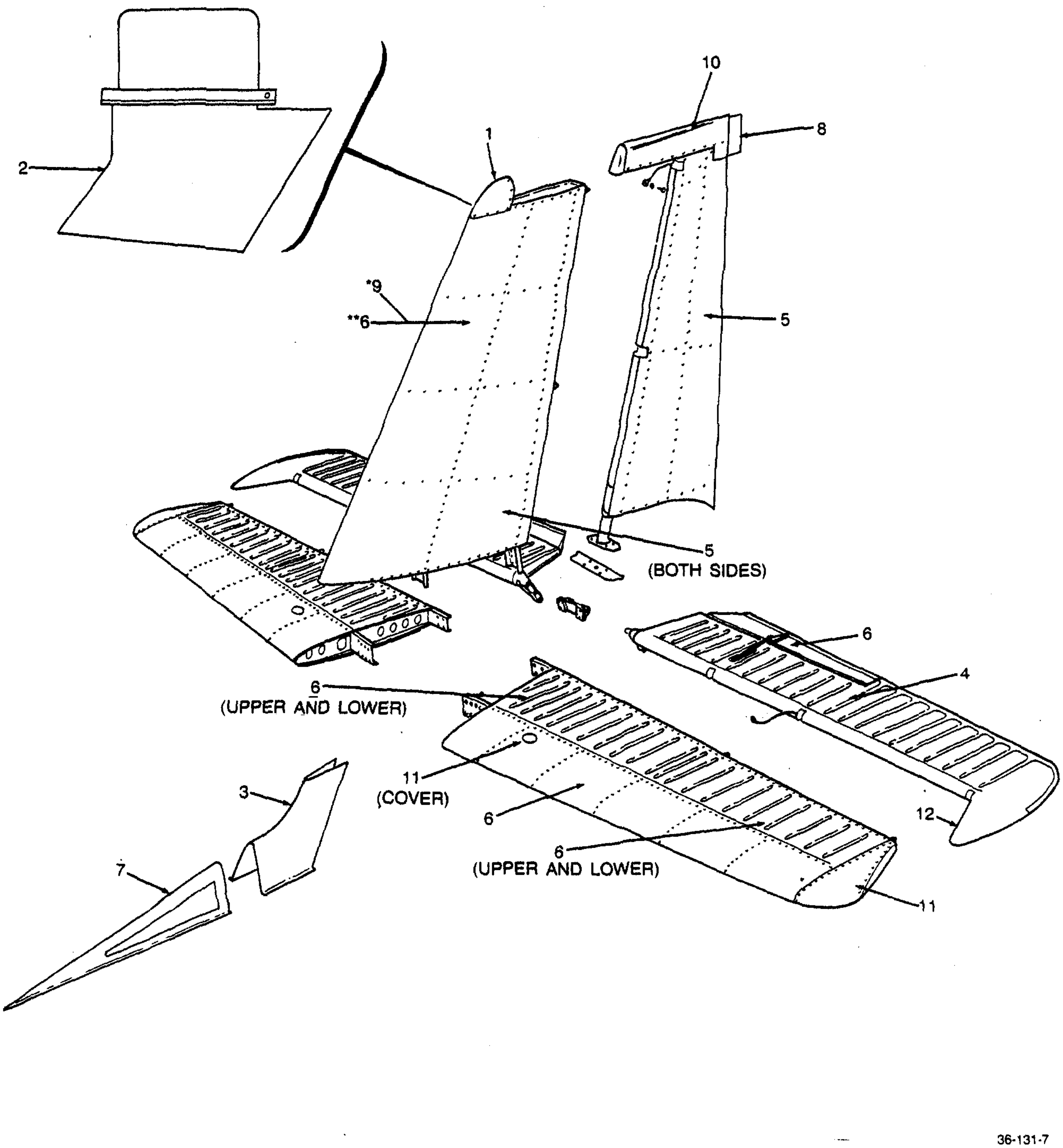


1. *VERTICAL STABILIZER*
2. HORIZONTAL STABILIZER
3. ELEVATOR
4. BONDING JUMPER
5. RUDDER TAB
6. RUDDER
7. *ELEVATOR CENTER HINGE*
8. ELEVATOR TAB
9. ELEVATOR TORQUE FITTING
*10. ROTATING BEACON
11. DORSAL FIN FAIRING
12. DORSAL FIN SADDLE

*THIS ROTATING BEACON IS OPTIONAL ON E-1111, E-1241 AND AFTER; EA-1 AND AFTER.

36-131-8

Empennage (CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 and after; EA-1 and after)
Figure 1



Empennage Skin Thickness (CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 and after; EA-1 and after)
Figure 2 (Sheet 1 of 2)

EMPENNAGE SKIN THICKNESS

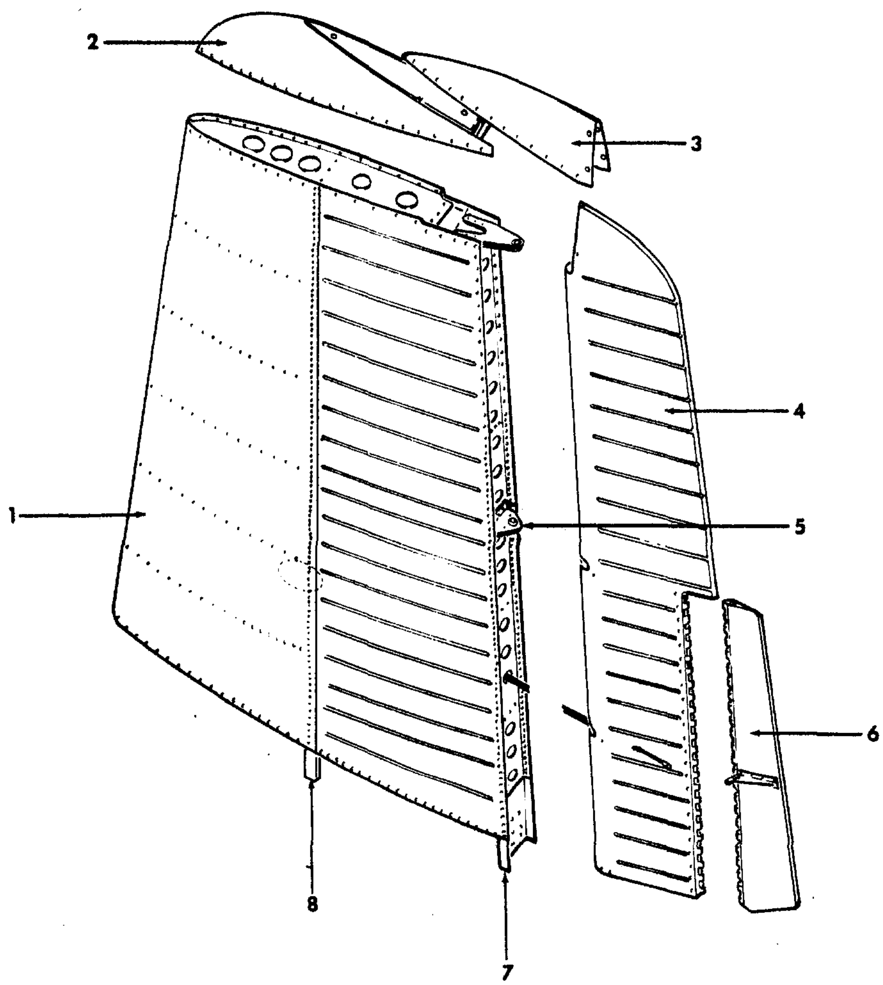
NUMBER	*MATERIAL*	*THICKNESS IN INCHES*
1.	Royalite	3/32 inch
2.	181 Glass Cloth and Polyester Resin	
3.	Acrylic P.V.C. Alloy Sheet	.090
4.	Magnesium Alloy - Condition H	.020
5.	2024-T	.020
6.	2024-T3	.020
7.	6061-T4	.020
8.	2024-T	.032
9.	2024-T3	.032
10.	2024-T	.040
11.	6061-T6	.040
12.	6061-T6	.050

NOTE

Skin thickness for the left side of the empennage are the same as the right side.

*This skin used only on CJ-149 and after.
**This skin used only on CE-748, CE-772 and after; E-1111, E-1241 and after; EA-1 and after.

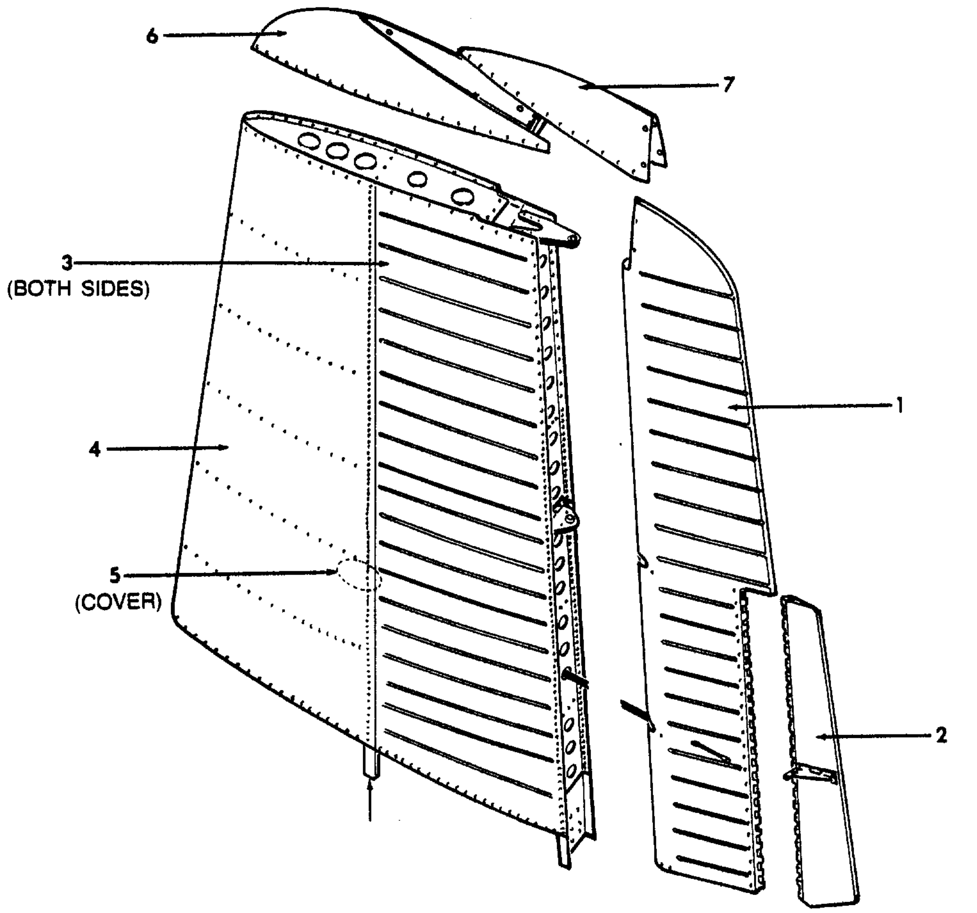
Empennage Skin Thickness (CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 and after; EA-1 and after)
Figure 2 (Sheet 2 of 2)



1. Stabilizer
2. Stabilizer Tip
3. Ruddervator Horn
4. Ruddervator
5. Stabilizer Hinge
6. Ruddervator Tab
7. Stabilizer Rear Spar
8. Stabilizer Front Spar

36-131-6

Empennage (D-10097, D-10120 and after)
Figure 3



EMPENNAGE SKIN THICKNESS

NUMBER	MATERIAL	THICKNESS IN INCHES
1.	MAGNESIUM ALLOY - COND H	.020
2.	2024-T3	.020
3.	2024-T4	.020
4.	2024-T3	.025
5.	2024-T3	.040
6.	6061-T6	.040
7.	6061-T6	.050

Empennage Skin Thickness (D-10097, D-10120 and after)
Figure 4

"END"

HORIZONTAL STABILIZERS - MAINTENANCE PRACTICES

HORIZONTAL STABILIZER REMOVAL (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; EA-1 AND AFTER)

a. Remove the applicable elevator. Refer to ELEVATOR REMOVAL in Chapter 27-30-00.

b. Remove the access panels located on the left side at the rear of the fuselage.

c. Disconnect the elevator tab cables, accessible through the left side fuselage access openings.

d. Remove the elevator rear spar attaching bolts and the elevator center hinge bracket on the rear spar.

e. Disconnect the trim tab pushrods.

f. While supporting the stabilizer, remove the attach bolts at the front spar.

g. Remove the stabilizer.

HORIZONTAL STABILIZER INSTALLATION (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; EA-1 AND AFTER)

a. Place the stabilizer in position and install the rear spar attaching bolts.

NOTE

When installing the horizontal stabilizer, the nuts for the rear spar attaching bolts must the placed on the forward side of the spar to avoid contact with the elevator center hinge assembly.

b. Install the forward stabilizer spar attaching bolts. Place one MS20002C4 washer under the head of each bolt and two AN960-416 washers under each nut. Torque the nuts on the bolts to 85-100 inch-pounds.

c. Install four aft stabilizer spar attaching bolts through the inboard holes in each spar with the bolt heads on the aft side of the spar. Place one MS20002C4 washer under the head of each bolt and one AN960-416 washer under each nut. Torque the nuts to 85-100 inch-pounds.

d. Install the inboard elevator hinge bracket on the aft side of the aft spar with four bolts with heads on the aft side of the hinge bracket. Place one MS20002C4 washer under the head of each bolt and two AN960-416 washers under each nut. Torque the nuts to 85-100 inch-pounds.

e. Connect the trim tab pushrods to the stabilizer.

f. Connect the elevator tab cables, accessible through the left side fuselage access openings.

g. Install the access panels.

h. Install the applicable elevator. Refer to INSTALLATION OF ELEVATOR in Chapter 27-30-00.

STABILIZER REMOVAL (D-10097, D-10120 AND AFTER)

NOTE

If not already installed, kits are available to provide additional support to the stabilizer leading edge on V-tail Bonanzas. Refer to Chapter 51-00-00.

a. Remove the applicable elevator. Refer to ELEVATOR REMOVAL in Chapter 27-21-00.

b. Remove the access panels located on the left side, at the rear of the fuselage.

c. Disconnect the elevator tab cables, accessible through the left side fuselage access openings.

d. Remove the attach bolts at the front spar.

e. While supporting the stabilizer, remove the stabilizer attach bolts at the rear spar.

f. Remove the stabilizer.

STABILIZER INSTALLATION (D-10097, D-10120 AND AFTER)

a. Place the stabilizer in position and install the rear stabilizer attaching bolts.

b. Install the forward stabilizer spar attaching bolts.

c. Torque the front spar attaching nuts to 200-225 inch pounds and the rear spar attaching bolts to 85-100 inch pounds.

d. Connect the elevator tab cables, accessible through the left side fuselage access openings.

e. Install the access panels.

f. Install the applicable elevator. Refer to ELEVATOR INSTALLATION in Chapter 27-21-00.

"END"

ELEVATOR AND RUDDERVATOR - MAINTENANCE PRACTICES

BALANCING THE ELEVATOR (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; EA-1 AND AFTER)
(Figure 1)

When the elevator control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. AFTER ANY REPAINTING OR REPAIR, THE FINISHED SURFACE SHOULD BE CHECK BALANCED TO ENSURE THAT ITS STATIC MOMENT ABOUT THE HINGE LINE IS WITHIN THE MANUFACTURER'S PRESCRIBED LIMITS. The complete painted elevator assembly, including the control arm and the tab control rod should not be tail-heavy over a maximum moment of 7.8 inch-pounds. The static moment is the total unbalanced weight of the elevator control surface multiplied by the perpendicular distance from its hinge centerline to the center of gravity, when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced elevator control surface is 0.0 lb. A tail-heavy surface exhibits static underbalance. A nose-heavy surface exhibits static overbalance.

CHECKING BALANCE

The elevator balance must be checked in a draft-free area with the elevator completely assembled in flying condidtion. ALL PAINTING, INCLUDING STRIPES AND TOUCH-UP, MUST BE COMPLETED. The tab, tab pushrod, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

a. **Actual Force Measurement** - Measurement of the force applied by the elevator surface on a single support at a known distance from the centerline of the hinge.

b. **Counterbalancing** - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the elevator assembly.

CHECK BALANCE BY FORCE MEASUREMENT

The equipment required to perform the check balance by force measurement is as follows:

a. A stand with knife-edge supports as illustrated in Figure 1. The knife edges should be in the same horizontal plane.

b. A certified beam balance calibrated in units of .01 lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2.0 lbs. minimum.

c. A support spindle similar to the illustration and leveling blocks, as required (blocks + spindle = tare).

d. A straightedge, ruler and spirit level.

Balancing Procedure Force Measurement Method

Locate the chord line by placing a straightedge at the inboard end of the elevator so that one end is aligned with the center of the torque tube and the other end is centered on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straightedge. Fit correct size bolts in the outboard and center hinge brackets and mount the elevator on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a leveled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle. Measure the perpendicular distance from the hinge centerline to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance.

Calculate the static underbalance moment "M" from the formula:

M = D(R-T) inch-pounds where,

D = Perpendicular distance from the hinge centerline to the spindle point (inches).

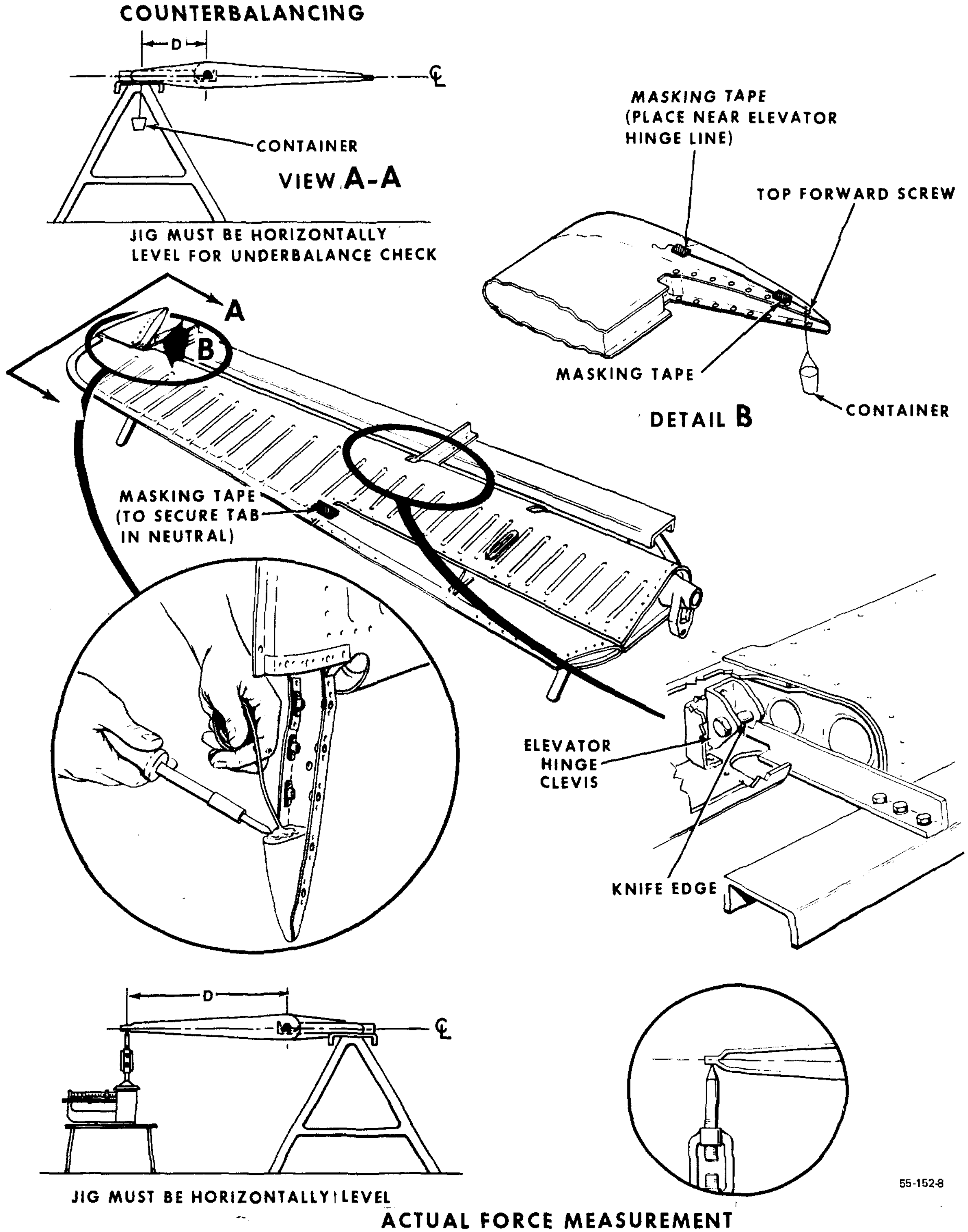
R = Reaction (pounds)read from the beam balance.

T = Tare, i.e. spindle plus leveling blocks or shims on the scale platform (pounds).

The following is an example:

D is 13.5 inches, R is 1.49 lb. and T = 1.00 lb.

M = 13.5 (1.49 - 1.00); M = 6.6 inch-pounds.



Balancing the Elevator, Ruddervator
Figure 1

M is within the range which is satisfactory.

If M is not within the prescribed range, refer to step i under BALANCING PROCEDURE COUNTERBALANCING METHOD.

CHECK BALANCE BY COUNTERBALANCING

The equipment required to perform check balancing by counterbalancing is as follows:

a. A stand with knife-edge supports as illustrated in Figure 1. The knife edges must be in the same horizontal plane.

b. A paper cup or similar lightweight container.

c. Approximately 2 pounds of lead shot.

d. A certified beam balance weighing device calibrated in units of .01 pound or less.

e. A straightedge, ruler, and a spirit level.

Balancing Procedure Counterbalancing Method

a. Locate the chord line by placing a straightedge at the inboard end of the elevator assembly so that one end is on the hinge centerline and the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straightedge.

b. Secure the trim tab in its neutral position with a small piece of masking tape.

c. Fit the correct size bolts in the hinge clevises and mount the elevator on the knife-edge supports. Ascertain that the elevator is free to rotate about the hinge line.

d. To determine if weight should be added or removed, use a short length of small diameter string secured to the surface with a small piece of masking tape and a paper cup hanging vertically as illustrated in Figure 1. Slightly loosen the forward top screw on the elevator leading edge tip. Suspend the paper cup on the inboard side of the tip and wrap the string around the screw. Secure the string to the surface with a small piece of masking tape aft of the top forward screw and near the hinge centerline as shown in Figure 1. The cup must be free to hange vertically.

CAUTION

Be certain the forward top screw on the elevator leading edge tip is secured after the elevator has been balanced.

e. Add small quantities of lead shot to the cup until the elevator balances with the chord level. Check this by holding the spirit level aligned with the marked chord line.

f. The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.

g. Remove the cup, contents, and string, then weigh them.

NOTE

Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

h. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".

2. The over or underbalance moment is designated by "M".

3. $M = W \times D$.

4. The following is a typical example of a balancing calculation:

Assume the elevator is underbalanced (tail-heavy) and the paper cup was suspended from the horn. If the elevator balances with the chord line level at "W = 0.60 pound" and "D = 12.6 inches", then:

$M = 0.60 \times 12.6$

M = 7.6 inch-pounds. In this instance, "M" is within the required static balance range and is therefore acceptable.

i. The complete painted elevator assembly, including the control arm and the tab control rod, must not be tail-heavy over a maximum moment of 7.8 inch-pounds. If the static balance does not comply, remove the elevator horn cover and add or remove solder to bring the elevator balance within required limits.

NOTE

Coat the weight with a corrosion preventive material such as zinc chromate primer (20, Chart 1, 91-00-00) to insulate the dissimilar metals. Replace the elevator horn cover and recheck the balance.

BALANCING THE RUDDERVATOR (D-10097, D-10120 AND AFTER) (Figure 1)

When the ruddervator control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. AFTER ANY REPAINTING OR REPAIR, THE FINISHED SURFACE SHOULD BE CHECK BALANCED TO ENSURE THAT ITS STATIC MOMENT ABOUT THE HINGE LINE IS WITHIN THE MANUFACTURER'S PRESCRIBED LIMITS. The complete painted rudddervator assembly, including the control arm and the tab control cable attach bolt, nut and washer for both sides of the tab, must not be tail-heavy over a maximum moment of 14.4 to 17.4 inch-pounds. The static moment is the total underbalance weight ot the ruddervator control surface multiplied by the perpendicular distance from its hinge centerline to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced ruddervator control surface is 0.0 lb. A tail-heavy surface exhibits static underbalance. A nose-heavy surface exhibits static overbalance.

CHECKING BALANCE

The balance must be checked in a draft free area with the ruddervator completely assembled in a flying condition. ALL PAINTING, INCLUDING STRIPES AND TOUCH-UP, MUST BE COMPLETED. The tab, tab control cable attach bolt, nut and washer for both sides of the tab, static wicks and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

a. **Actual Force Measurement** - Measurement of the force applied by the ruddervator surface on a single support at a known distance from the centerline of the hinge.

b. **Counterbalancing** - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the ruddervator assembly.

CHECKING BALANCE BY FORCE MEASUREMENT

The equipment required to perform the check balance by force measurement is as follows:

a. A stand with knife-edge supports as illustrated in Figure 1. The knife edges should be in the same horizontal plane.

b. A certified beam balance calibrated in units of .01 lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2.0 lbs. minimum.

c. A support spindle similar to the illustration and leveling blocks, as required (blocks + spindle = tare).

d. A straightedge, ruler and spirit level.

Balancing Procedure Force Measurement Method

Locate the chord line by placing a straightedge at the inboard end of the ruddervator so that one end is aligned with the center of the torque tube and the other end is centered on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straightedge. Fit correct size bolts in the outboard and center hinge brackets and mount the ruddervator on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a leveled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle. Measure the perpendicular distance from the hinge centerline to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance.

Calculate the static underbalance moment "M" from the formula:

M = D(R-T) inch-pounds where,

D = Perpendicular distance from the hinge centerline to the spindle point (inches).

R = Reaction (pounds)read from the beam balance.

T = Tare, i.e. spindle plus leveling blocks or shims on the scale platform (pounds).

The following is an example:

D is 13.5 inches, R is 2.26 lb. and T = 1.00 lb.

M = 13.5 (2.26 - 1.00); M = 17.0 inch-pounds.

M is within the range which is satisfactory.

If M is not within the prescribed range, refer to step i under BALANCING PROCEDURE COUNTERBALANCING METHOD.

CHECK BALANCE BY COUNTERBALANCING

The equipment required to perform check balancing by counterbalancing is as follows:

a. A stand with knife-edge supports as illustrated in Figure 1. The knife edges must be in the same horizontal plane.

b. A paper cup or similar lightweight container.

c. Approximately 3.5 pounds of lead shot.

d. A certified beam balance weighing device calibrated in units of .01 pound or less.

e. A straightedge, ruler, and a spirit level.

Balancing Procedure Counterbalancing Method

a. Locate the chord line by placing a straightedge at the lower closure rib of the ruddervator so that one end is aligned with the centerline of the torque tube and the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straightedge.

b. Secure the trim tab in its neutral position with a small piece of masking tape.

c. Fit the correct size bolts in the hinge clevises and mount the ruddervator on the knife-edge supports. Ascertain that the ruddervator is free to rotate about the hinge line.

d. To determine if weight should be added or removed, if the balance is tail-down:

On the ruddervator leading edge tip, slightly loosen the forward top screw. Suspend a paper cup on the inboard side of the tip and wrap the string around the screw. Secure the string to the surface with a small piece of masking tape aft of the forward top screw and near the hinge centerline as shown in Figure 1. The cup must be free to hang vertically.

CAUTION

Be certain the forward top screw on the ruddervator leading edge tip is secured after the ruddervator has been balanced.

e. Add small quantities of lead shot to the cup until the ruddervator balances with the chord line level. Check this by holding a spirit level aligned with the marked chord line.

f. The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.

g. Remove the cup, contents, and string, then weigh them.

NOTE

Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

h. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".

2. The over or underbalance moment is designated by "M".

3. M = W x D.

4. The following is a typical example to a balancing calculation:

Assume the ruddervator was underbalance (tail-heavy) and the paper cup was suspended from the leading edge. If the ruddervator balances with the chord line level as "W = 2.83 pounds" and "D = 6.0 inches", then:

M = 2.83 x 6.0

M = 17.0 inch-pounds. The product of "W x D". In this instance, "M" is within the required static balance range and is therefore acceptable.

i. The complete painted ruddervator assembly, including the control arm and the tab control cable attach bolt, nut and washer for both sides of the tab, should not be tail-heavy over a maximum of 14.4 to 17.4 inch-pounds. If the static balance does not comply, remove the ruddervator horn cover and add or remove solder to bring the ruddervator balance within the required limits.

NOTE

Coat the weight with a corrosion preventive material such as zinc chromate primer (20, Chart 1, 91-00-00) to insulate the dissimilar metals. Replace the ruddervator horn cover and recheck the balance.

"END"

VERTICAL STABILIZER - MAINTENANCE PRACTICES

VERTICAL STABILIZER REMOVAL (CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 and after; EA-1 and after)

a. Remove the elevators, horizontal stabilizers, and the rudder. Refer to the applicable chapters for removal instructions.
b. Remove the stabilizer saddle and fairings.
c. Disconnect the rotating beacon wires (if applicable).
d. Support the stabilizer and remove the bolts at the front and rear spars.
e. Pull the stabilizer straight up to remove it from the fuselage.

VERTICAL STABILIZER INSTALLATION (CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 and after; EA-1 and after)

a. Carefully place the vertical stabilizer in position and install the bolts in the front and rear spars.
b. Torque all AN4 vertical stabilizer attaching bolts to 50-70 inch-pounds.
c. Connect the rotating beacon wires (if applicable).
d. Install the stabilizer saddle and fairings.
e. Install the elevators, horizontal stabilizers, and rudder. Refer to the applicable chapters for installation procedures.

"END"

RUDDER - MAINTENANCE PRACTICES

BALANCING THE RUDDER (CE-748, CE-772 and after; CJ-149 and after; E-1111, E-1241 and after; EA-1 and after) (Figure 1)

When the rudder surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. After any repainting or repair, the finished surface must be check balanced to ensure that its static moment about the hinge line is within the manufacturers prescribed limits. The complete painted rudder assembly, including the control arm should not be tail-heavy over a maximum of 8.4 inch-pounds. The static moment of the rudder is determined by multiplying the unbalanced weight of the rudder assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced rudder assembly is 0.0 inch-pounds. Tail heaviness indicates static underbalance while nose heaviness indicates static overbalance.

CHECKING BALANCE

The rudder balance must be checked in a draft free area with the rudder completely assembled in flying condition. All painting, including stripes and touch-up, must be completed. The tab, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

a. Actual Force Measurement - Measurement of the force applied by the rudder surface on a single support at a known distance from the center line of the hinge.

b. Counterbalancing - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the rudder assembly.

CHECK BALANCE BY FORCE MEASUREMENT

The equipment required to perform the check balance by force measurement is as follows:

a. A stand with knife edge supports as illustrated in Figure 1. The knife edges should be in the same horizontal plane.

b. A certified beam balance calibrated in units of .01 lb. or less. The balance should have a flat weighing platform and its capacity should equal tare plus 2.0 lbs. minimum.

c. A support spindle similar to the illustration and levelling blocks as required. (Blocks + spindle = tare).

d. A straight edge, rule and spirit level.

BALANCING PROCEDURE FORCE MEASUREMENT METHOD

Locate the chord line by placing a straight edge at the inboard end of the rudder so that one end is aligned with the center of the torque tube and the other end is centered on the trailing edge. Mark the chord line by grease pencil or other means on the rib. Remove the straight edge. Fit correct size bolts in the outboard and center hinge brackets and mount the rudder on the knife edges. Ensure that it is free to rotate about the hinge line. Support the trailing edge behind the center hinge point with a spindle resting on a levelled beam balance platform as illustrated. The spindle must be vertical throughout the balancing procedure. Hold a spirit level against the marked chord line and level it by extending or contracting the spindle, or by using blocks and shims under the spindle. Measure the perpendicular distance from the hinge center line to the point supported by the spindle. Ensure that the spirit level and rule are removed from the surface and read the reaction on the beam balance. Calculate the static underbalance moment "M" from the formula:

M = D(R-T) inch-pounds where,
D = Perpendicular distance from the hinge center line to the spindle point (inches).
R = Reaction (Pounds) read from the beam balance.
T = Tare, i.e. spindle plus levelling blocks or shims on the scale platform (Pounds).

The following is an example:

D is 13.8 inches, R = 1.49 lb. and T is 1.00 lb.
M = 13.8 (1.49 - 1.00); M = 6.8 inch-pounds.
M is within the range which is satisfactory.
If M is not within the prescribed range, refer to step h, under BALANCING PROCEDURE COUNTERBALANCING METHOD.

CHECK BALANCE BY COUNTERBALANCING

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING BY COUNTERBALANCING

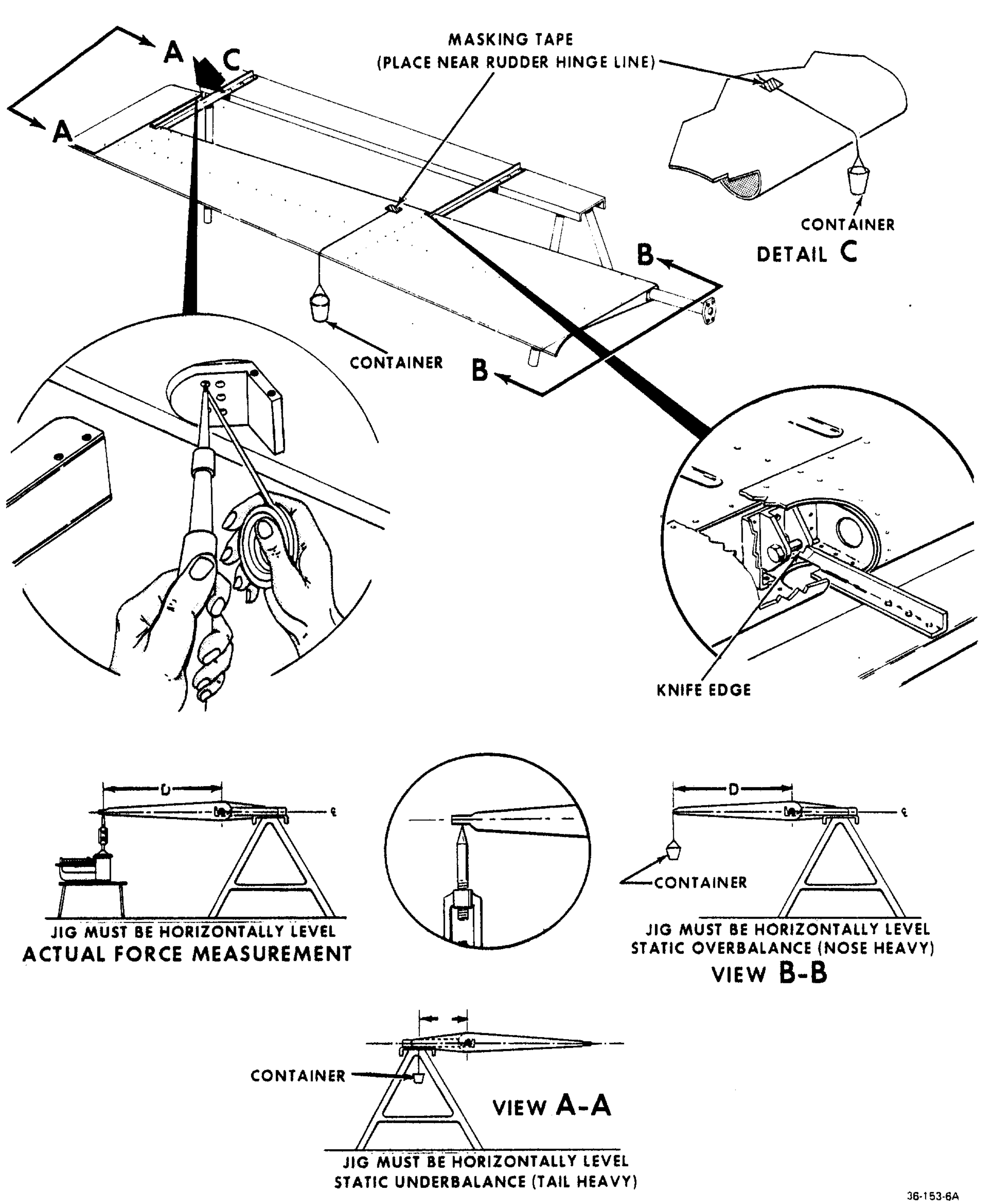
a. A stand with knife edge supports as illustrated in Figure 1. The knife edges must be in the same horizontal plane.

b. A paper cup or similar light weight container.

c. Approximately 2 pounds of lead shot.

d. A certified beam balance weighing device calibrated in units of .01 pound or less.

e. A straight edge, ruler, and spirit level.



Balancing the Rudder
Figure 1

BALANCING PROCEDURE COUNTERBALANCING METHOD

a. Locate the chord line by placing a straight edge at the lower closure rib of the rudder so that one end is aligned with the center of the torque tube while the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.

b. Fit the correct size bolts in the hinge brackets and mount the rudder on the knife edge supports. Ascertain that the rudder is free to rotate about the hinge line.

c. To determine if weight should be added or removed, suspend a paper cup from a point near the center of the rudder trailing edge if the balance is nose-down or near the center of the horn leading edge if the balance is tail-down. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in Figure 1. The cup must be free to hang vertically.

d. Add small quantities of lead shot to the cup until the rudder balances with the chord line level. Check this by holding a spirit level aligned with the marked chord line.

e. The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.

f. Remove the cup, contents, and string, then weigh them.

NOTE

Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

g. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".
2. The over or underbalance moment is designated by "M".
3. M = W x D
4. The following is a typical example of a balancing calculation: Assume the rudder was slightly underbalance (tail-heavy) and the paper cup was suspended from the horn leading edge. If the rudder balances with the chord line level at "W = .65 pound" and "D = 12.5 inches", then . . .

M = .65 x 12.5

M = 8.1 inch-pounds. In this instance, "M" is within the required static balance range and is therefore acceptable.

h. The complete painted rudder assembly, including the control arm must not be tail-heavy over a maximum of 8.4 inch-pounds. If the static balance does not comply, remove the weight in the rudder horn and add or remove solder to bring the rudder balance within required limits.

NOTE

Coat the weight with a corrosion preventative material such as zinc chromate primer to insulate the dissimilar metals. Replace the weight in the rudder horn and recheck the rudder balance.

"END"

CHAPTER

56

WINDOWS

CHAPTER 56 - WINDOWS

TABLE OF CONTENTS

"END"

CHAPTER 56

LIST OF PAGE EFFECTIVITY

"END"

GENERAL - DESCRIPTION AND OPERATION

The windshield and windows for the Bonanza Series airplanes are made of cast acrylic plexiglass.

The flight compartment of each airplane is equipped with a windshield, cabin door window, and a left cabin window with an enclosed storm window. The cabin area of the airplane contains an openable window on each side, just aft of the flight compartment. The cabin are of the Model A36 airplanes contains two windows on each side, behind the openable windows; a window in each of two utility doors, and matching windows on the left side. The cabin area of the Model 33 and 35 series airplanes contains an aft window on each side of the airplane, just behind the openable windows.

GENERAL - MAINTENANCE PRACTICES

CLEANING PLASTIC WINDOWS

CAUTION

Do not use an ice scraper to remove ice from windows because this practice may cause scratches to the window surface. To avoid scratches, any cleaning of the windows should be done with care.

Plastic windows should be kept clean and waxed at all times. To prevent scratches and crazing, wash the windows carefully with plenty of soap and running water.

CAUTION

When washing the windows, do not use water from a bucket or pail. Sand, dirt particles or other debris may collect in the standing water and cause scratches in the plastic.

Use the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used only for the purpose of carrying water to the surface of the window. After washing, rinse the window thoroughly with running water and dry it with a clean, moist chamois. Do not rub the plastic window with a dry cloth because this will cause an electrostatic charge which attracts dust.

Remove oil and grease with a cloth moistened with kerosene (58, Chart 1, 91-00-00), aliphatic naphtha (26, Chart 1, 91-00-00) or hexane (59, Chart 1, 91-00-00), then rinse the window with clear water.

CAUTION

Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, fire extinguisher or anti-ice fluid, lacquer thinner, or glass cleaner with a base of these materials, for such materials will soften the plastic and may cause crazing. Aliphatic naphtha and similar solvents are highly flammable and extreme care must be exercised when using these chemicals.

If it is desirable to use a commercial cleaner to clean the plastic windows, use only cleaners that are approved by Beech Aircraft Corporation. There are several cleaners available commercially that state that they are approved for use on acrylic surfaces. However, it has been discovered that some of these cleaners cause acrylic plastic to craze. Therefore, only the following products are approved as cleaners for acrylic plastic windows: Federal Specification PP-560, Part No. 403D; Parko Anti-Static Plastic Polish; and McGuiar's MGH-10 (60, Chart 1, 91-00-00). Follow the directions on the container.

After washing plastic windows with soap and water, apply a good grade of commercial wax (61, Chart 1, 91-00-00). The wax will fill in minor scratches and help prevent further scratches. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft flannel cloth. Never use a power buffer, as the heat generated by the buffing pad may soften the plastic.

If the windows were cleaned with one of the three commercial cleaners mentioned previously, it will not be necessary to apply wax. Each of these cleaners contains wax, as well as cleaning agents.

"END"

FLIGHT COMPARTMENT - MAINTENANCE PRACTICES

WINDSHIELD REMOVAL
(Figure 1)

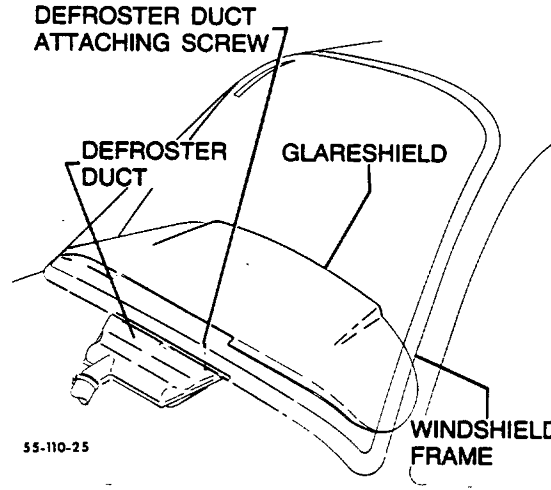
a. Remove the glareshield. Refer to GLARESHIELD REMOVAL, Chapter 39-10-00.
b. Remove the attaching screws from the defroster duct and move the duct to clear the lower row of rivets on the windshield.
c. Mark the position of the three glareshield supports attached to the inside of the windshield frame.
d. Mark the location and remove the headliner trim strips and lower the headliner to permit the windshield to be removed.
e. Remove any necessary molding that covers the window frame to facilitate windshield removal.
f. Remove the rivets from around the windshield.
g. Remove the windshield.

NOTE

Due to the windshield being sealed, considerable effort may be required to release the windshield from the canopy section.

WINDSHIELD INSTALLATION

a. Remove any sealer around the canopy with toluol. Touch-up any scratches or bare metal with zinc chromate primer.
b. Place the windshield in position and mark the area where material must be removed from the windshield to obtain a proper fit. The windshield frame edge should not bind in the radius of the fuselage framework.
c. Remove the windshield and trim off excess material as determined in step "b".
d. Place the windshield in position and cleco in place using the pilot holes provided.
e. Back drill the windshield frame using the existing holes in the canopy section as a guide.
f. Remove the windshield, burr all holes and apply Presstite 576 sealer (17, Chart 1, 91-00-00) to the windshield frame where it makes contact with the canopy section.
g. Place the windshield in position and cleco in place.
h. Using rivets, secure the windshield to the canopy section making sure the glareshield supports are installed in the same position as they were removed.
i. Clean off the excess Presstite 576 sealer from the outside of the window frame.
j. Place a narrow bead of EC1814 sealer (18, Chart 1, 91-00-00) to the outside window frame where the frame meets the canopy section. Remove excess sealer.



Windshield
Figure 1

k. Install the headliner trim strips and secure the headliner in position.
l. Install any windshield molding removed for windshield removal.
m. Install the glareshield. Refer to GLARESHIELD INSTALLATION, 39-10-00.

FORWARD LEFT WINDOW REMOVAL

a. Remove the upholstery panels as required to gain access to the window frame.
b. Remove the trim strip from around the inside of the window.
c. Remove the rivets from around the window.
d. Remove the window.

FORWARD LEFT WINDOW INSTALLATION

a. Clean the sealer from the canopy section where the old window was removed using toluol (19, Chart 1, 91-00-00). Touch up any scratches or bare metal with zinc chromate primer (20, Chart 1, 91-00-00).
b. Place the window in position and mark the area where material must be removed from the window frame to obtain a proper fit.
c. Remove the window and trim off the excess material as determined in step "b".
d. Place the window in position and cleco in place using the pilot holes provided.
e. Back drill the window frame using the existing holes in the canopy section as a guide.
f. Remove the window, burr all holes, and apply

Presstite 576 sealer (17, Chart 1, 91-00-00) to an area approximately 1/2 inch wide on the canopy section where the old sealer was removed.

g. Place the window in position and cleco in place.

h. Using rivets, secure the window to the canopy section making sure the trim strip clips are reinstalled in the same position as removed.

i. Install the upholstery panels.

j. Install the tirm strip.

k. Clean off the excess Presstite 576 sealer from the outside of the window frame.

l. Place a narrow bead of EC1814 sealer (18, Chart 1, 91-00-00) to the outside window frame where the frame meets the canopy section. Remove excess sealer.

STORM WINDOW REMOVAL

a. Open the latch mechanism at the top of the storm window.

b. Remove the two internally threaded hinge pins at the bottom of the storm window.

STORM WINDOW INSTALLATION

a. Install the two internally threaded hinge pins at the bottom of the storm window.

b. Close the latch mechanism at the top of the storm window.

CABIN DOOR WINDOW REMOVAL

a. Remove the inboard door handle, ash tray and arm rest.

b. Remove the center upholstery panel.

c. Remove the trim strip around the inside of the window.

d. To facilitate reinstallation, mark the location of the trim strip clips.

e. Remove the rivets around the window retainer.

f. Remove the window.

CABIN DOOR WINDOW INSTALLATION

a. Clean the sealer from the door where the old window was removed, using toluol (19, Chart 1, 91-00-00). Touch up any scratches or bare metal with zinc chromate primer (20, Chart 1, 91-00-00).

b. Apply Proseal 890 sealer (21, Chart 1, 91-00-00) to an area approximately 1/2 inch wide on the door where the old sealer was removed.

c. Place the new window in position.

d. Place the retainer in position, over the window, and cleco the retainer to the cabin door.

e. Secure the window retainer to the door skin with rivets.

NOTE

When riveting the window in place, install the trim strip clips in the same locations as marked in step "d" of the window removal procedure.

f. Install the trim strip.

g. Clean and paint as necessary.

h. Reinstall the center, upholstery panel.

i. Reinstall the inboard door handle, ash tray and arm rest.

"END"

CABIN - MAINTENANCE PRACTICES

OPENABLE WINDOW REMOVAL

a. Remove the emergency release pin.
b. Remove the hinge pin.

OPENABLE WINDOW INSTALLATION

a. Install the hinge pin.
b. Install the emergency release pin.

UTILITY DOORS WINDOW REMOVAL (E-1111, E-1241 and after; EA-1 and after)

a. Remove the window molding trim.
b. Remove the rivets from the window retaining strips.

NOTE

When removing the rivets from the retainers on the forward window, remove the latch link rod so that all the rivets are accessible.

c. Remove the window.

UTILITY DOORS WINDOW INSTALLATION (E-1111, E-1241 and after; EA-1 and after)

a. Clean the old sealer from the door where the window was removed, using toluol, (19, Chart 1, 91-00-00). Touch up any scratches or bare metal with zinc chromate primer (20, Chart 1, 91-00-00).
b. If new retaining strips are required, dimple the rivet holes in the retaining strips with a 5/16 inch dimpler.
c. Place the window in position and cleco the retaining strips in place.
d. Tape the entire outside surface of the window, then trim the excess tape away from the area that overlaps the door frame. This procedure locates the area that the new sealer is to be applied.
e. Remove the retaining strips and window. Apply PR1221B1/2 sealer (22, Chart 1, 91-00-00) to the area of the window located in step "d".
f. Place the window in position and rivet the retaining strips in place.

NOTE

Connect the latch link rod if the forward window is being replaced.

g. Clean excess sealer from the outside of the window edge and install the interior window molding.

WINDOWS AFT OF OPENABLE WINDOWS REMOVAL

a. Remove the upholstery panels as required to gain access to the window frame.
b. Remove the trim strip from around the inside of the window.
c. Remove the rivets (Model A36 series airplanes), or screws from the window retaining strips.
d. Remove the window.

WINDOWS AFT OF OPENABLE WINDOWS INSTALLATION

a. Clean the sealer from the cabin section where the old window was removed using toluol (19, Chart 1, 91-00-00). Touch up any scratches or bare metal with zinc chromate primer (20, Chart 1, 91-00-00).
b. Apply Presstite 576 sealer (17, Chart 1, 91-00-00) to an area approximately 1/2 inch wide on the cabin section where the old sealer was removed.
c. Place the window in position and install the window retaining strips to the cabin section with screws. On the Model A36 series airplanes only, the retaining strips are secured with screws on the top retainer and rivets on the side and bottom retainers.
d. Clean excess sealer from the outside of the window edge and install the trim strips to the inside of the window.
e. Install the upholstery panels.

"END"

CHAPTER

57

WINGS

CHAPTER 57 - WINGS

TABLE OF CONTENTS

CHAPTER 57 - WINGS

LIST OF EFFECTIVE PAGES

WINGS - DESCRIPTION AND OPERATION

The all metal wing group consists of the front and rear spars, leading edge, wing tips, flaps, ailerons, and fuel tanks. The wing tips, flaps, and ailerons are readily removable. The forward wing attaching point is located at FS 83.00 while the rear wing attaching point is located at FS 118.00 on all Model 33, 35 and 36 series airplanes. An optional remote compass is located in the left wing tip on all serials except CJ-149 and After.

WINGS - MAINTENANCE PRACTICES

WING TIP REMOVAL

a. Remove the screws attaching the wing tip to the wing.

b. Disconnect the electrical leads to the navigation light.

c. Disconnect the remote compass at the left wing tip (if installed).

WING TIP INSTALLATION

a. Connect the remote compass at the left wing tip (if installed).

b. Connect the electrical leads to the navigation light.

c. Place the wing tip in position and secure it to the wing with screws.

WING REMOVAL

a. Drain and purge the fuel cells.

b. Remove the front seats.

c. Remove the rear seat panel.

d. Remove the wing mounting bolt access plates from the top and bottom of the wing.

e. Place the airplane on jacks and raise the airplane until the wheels are clear of the ground. Refer to Chapter 7-00-00 for jacking instructions. A three point jack should be used because of the unbalanced condition of the airplane after the wing is removed.

f. Disconnect and cap hydraulic lines at the wing root.

g. Operate the landing gear switch until the inboard landing gear doors are fully open.

h. Disconnect the inboard door actuator rod from the control horn.

i. Disconnect the landing gear uplock cable at the inboard connection in the wheel well.

j. Disconnect the landing gear actuator rod from the V-brace in the wheel well.

k. Disconnect and cap the fuel lines between the wing root rib and the fuselage.

l. Disconnect and cap the pitot line at the left wing root in the wheel well.

m. Disconnect and label electrical wiring in the wheel well.

n. Disconnect and identify the aileron cables at the turnbuckles located inside the cabin, forward of the rear spar below the floorboards.

o. Disconnect the flap drive shaft from the motor.

p. Cradle the wing.

q. Place a wing stand under the wing not being removed and place a stand under the tail.

r. Outline the position of the wing on the fuselage as a guide for reinstallation.

CAUTION: *There should be no bolt binding during removal. Should binding occur, adjust the wing position until the bolt disengages freely. Do not screw or drive a bolt in or out of the fittings.*

s. Remove the mounting nuts, bolts and washers from the wing.

WARNING: A bushing is installed in the lower front spar attach fitting. This bushing should not be removed when the wing is removed, and must be in place when the wing is reinstalled.

NOTE: Discard the mounting nuts. Install new mounting nuts when installing the wing.

Discard the special soft aluminum washer used on the wing upper mounting bolts. Install new aluminum washers when installing the wing.

t. Disconnect the cold air flex duct at the wing leading edge.

u. Remove the wing by pulling it straight away from the fuselage.

REMOVAL OF LEADING EDGE AND MAIN SPAR

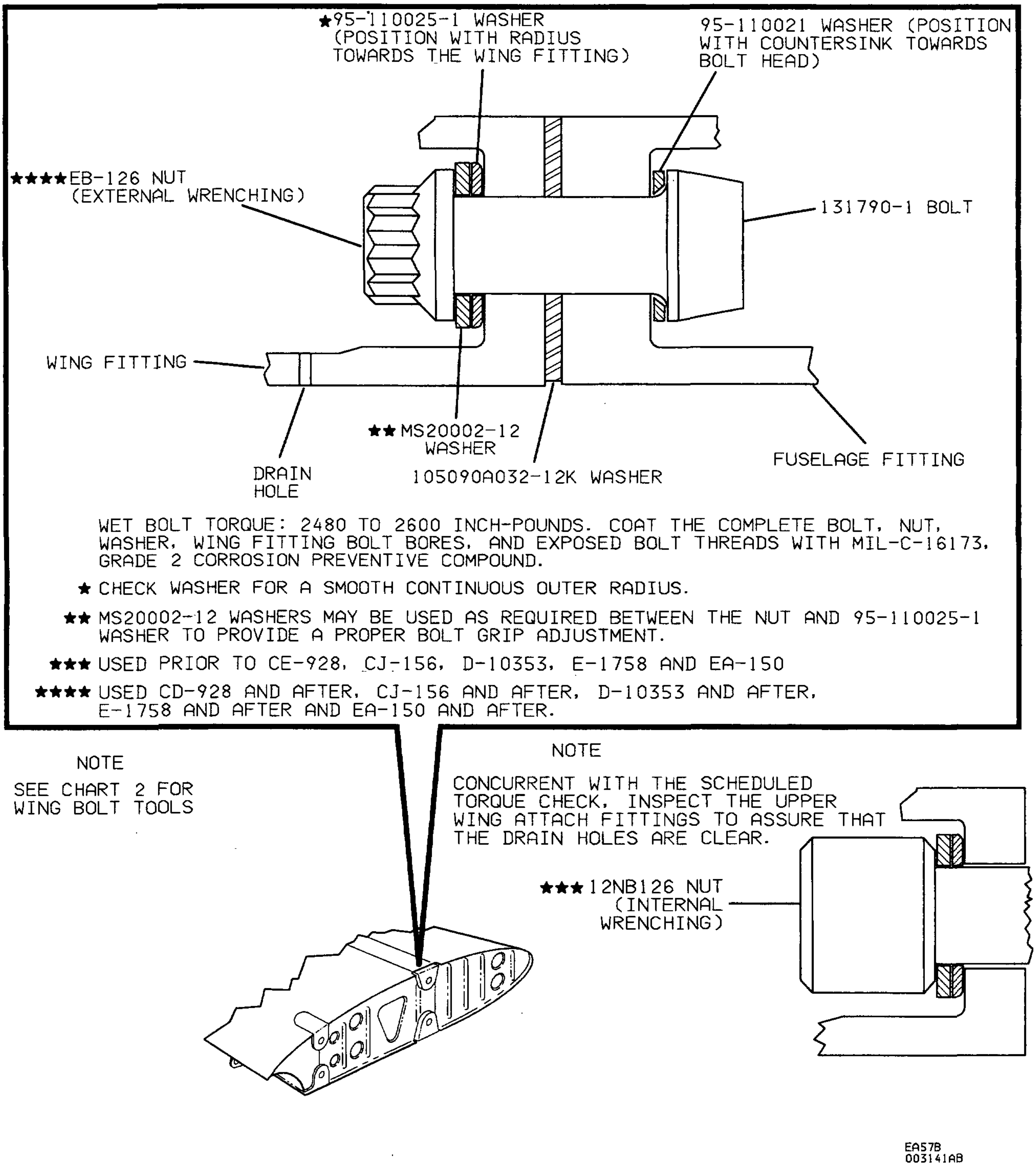
The wing must be removed from the airplane before the leading edge or main spar can be removed. Remove the attaching screws at the wing tip and wing butts. Access to the screws at the main spar root is through the wheel well. Pull the hinge pins which attach the leading edge, disconnect the landing gear and remove the main spar.

NOTE: Support the landing gear to avoid damaging the aft spar gear connection or remove the gear at both connections.

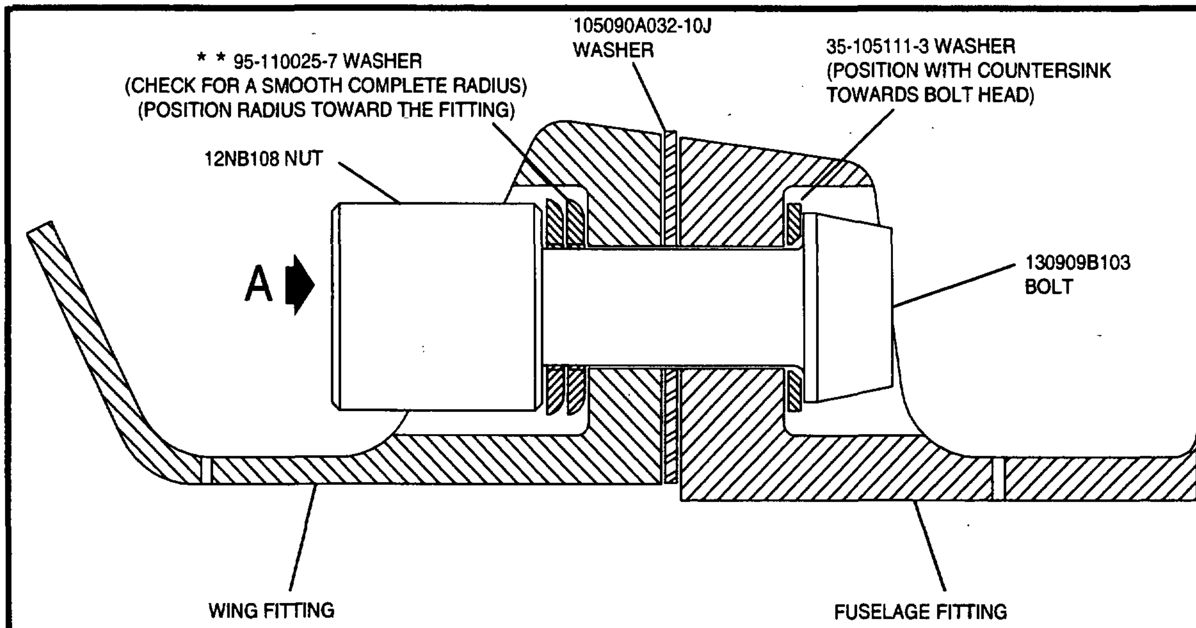
INSTALLATION OF LEADING EDGE AND MAIN SPAR

The hinge pins are to be driven with a rivet gun by supporting the hinge pin in telescoping tube, repair Kit 35-588 S. Make sure the hinge halves are free of metal burrs and mated before attempting to drive the hinge pin. Grind the end of the pin to a point before starting it in the hinge. A second rivet gun or mallet may be used to tap along the upper or lower edge of the main spar to help the pin through the hinge. Use a wooden block as a pad to prevent damage to the spar.

CAUTION: *Do not attempt to spin the hinge pin in with a drill motor. Heat and expansion may cause the wire to seize or break.*



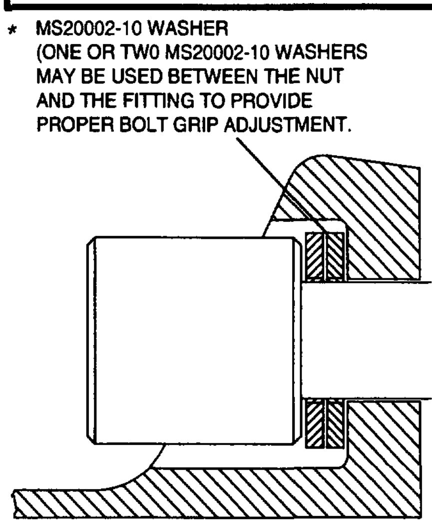
Upper Forward Wing Bolt Installation
Figure 1



WET BOLT TORQUE: 1,180 TO 1,300 INCH-POUNDS. COAT THE COMPLETE BOLT, NUT, WASHERS, WING FITTING BOLT BORES, AND EXPOSED BOLT THREADS WITH MIL-C-16173, GRADE 2 CORROSION PREVENTIVE COMPOUND.

* USED PRIOR TO CE-935; CJ-156; D-10359; E-1791; EA-177.

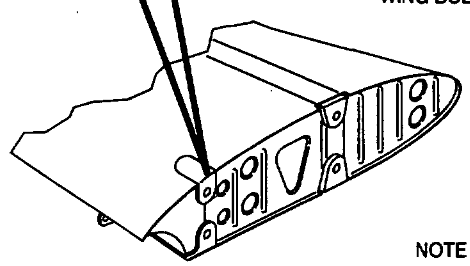
* * USED CE-935 AND AFTER; CJ-156 AND AFTER; D-10359 AND AFTER; E-1791 AND AFTER; EA-177 AND AFTER.



DETAIL A

NOTE

SEE CHART 2 FOR WING BOLT TOOLS

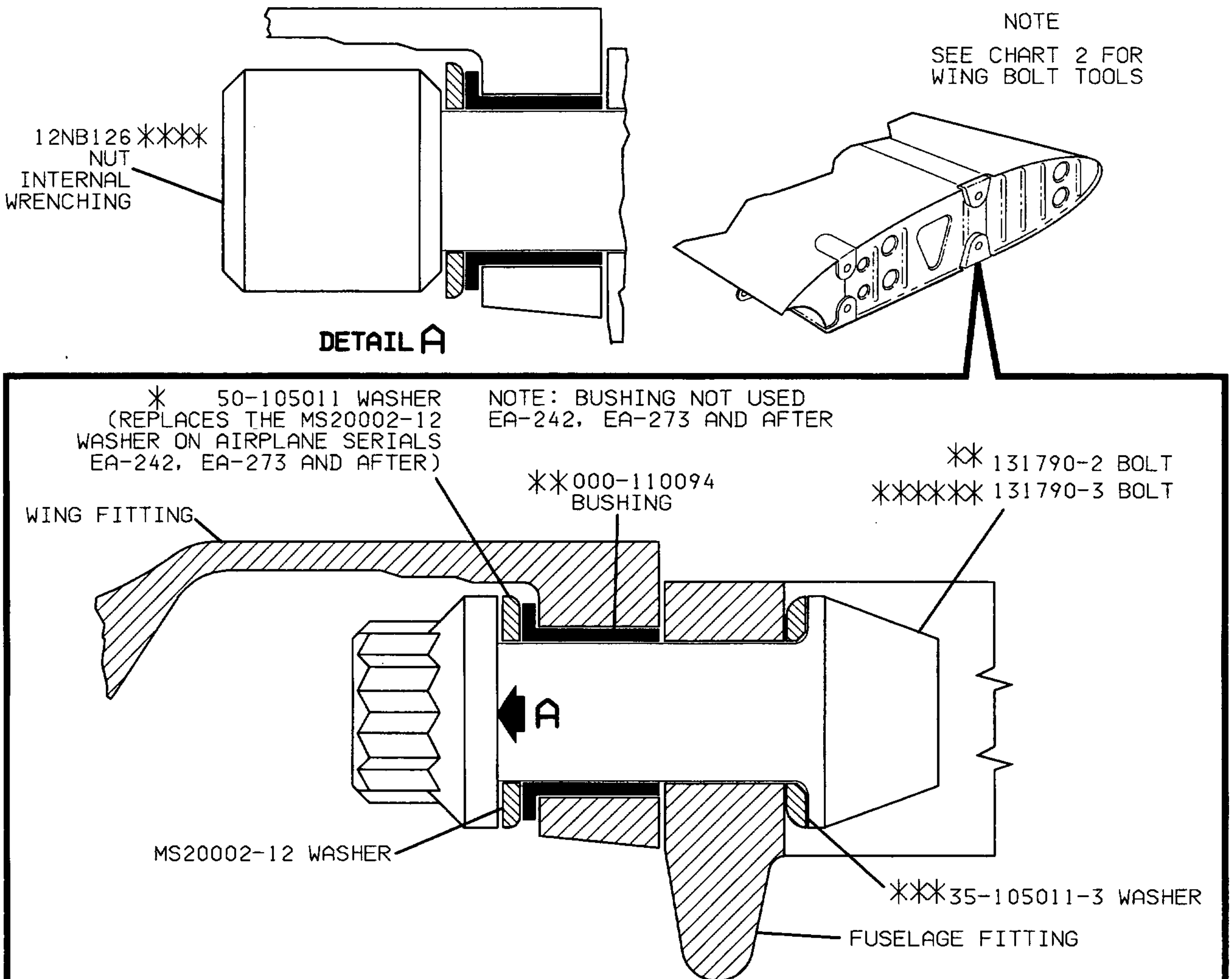


NOTE

CONCURRENT WITH THE SCHEDULED TORQUE CHECK, INSPECT THE UPPER WING ATTACH FITTINGS TO ENSURE THAT THE DRAIN HOLES ARE UNOBSTRUCTED.

EA57B
031760AA.AI

Upper Aft Wing Bolt Installation
Figure 2



WET BOLT TORQUE: 2,480 TO 2,600 INCH-POUNDS (ALL SERIALS EXCEPT EA-242, EA-273 AND AFTER), 2,880 TO 3,000 INCH-POUNDS (EA-242, EA-273 AND AFTER). COAT THE COMPLETE BOLT, NUT, WASHER, WING FITTING BOLT BORES, AND EXPOSED THREADS WITH MIL-C-16173, GRADE 2 CORROSION PREVENTIVE COMPOUND.

✱ CHECK WASHER FOR A SMOOTH CONTINUOUS OUTER RADIUS AND POSITION WITH RADIUS TOWARD BOLT HEAD.

✱✱ USED CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; E-1111, E-1241 AND AFTER; D-10097, D-10120 AND AFTER; EA-1 THRU EA-272 EXCEPT EA-242.

✱✱✱ WASHER NOT USED UNDER BOLT HEAD EA-242, EA-273 AND AFTER.

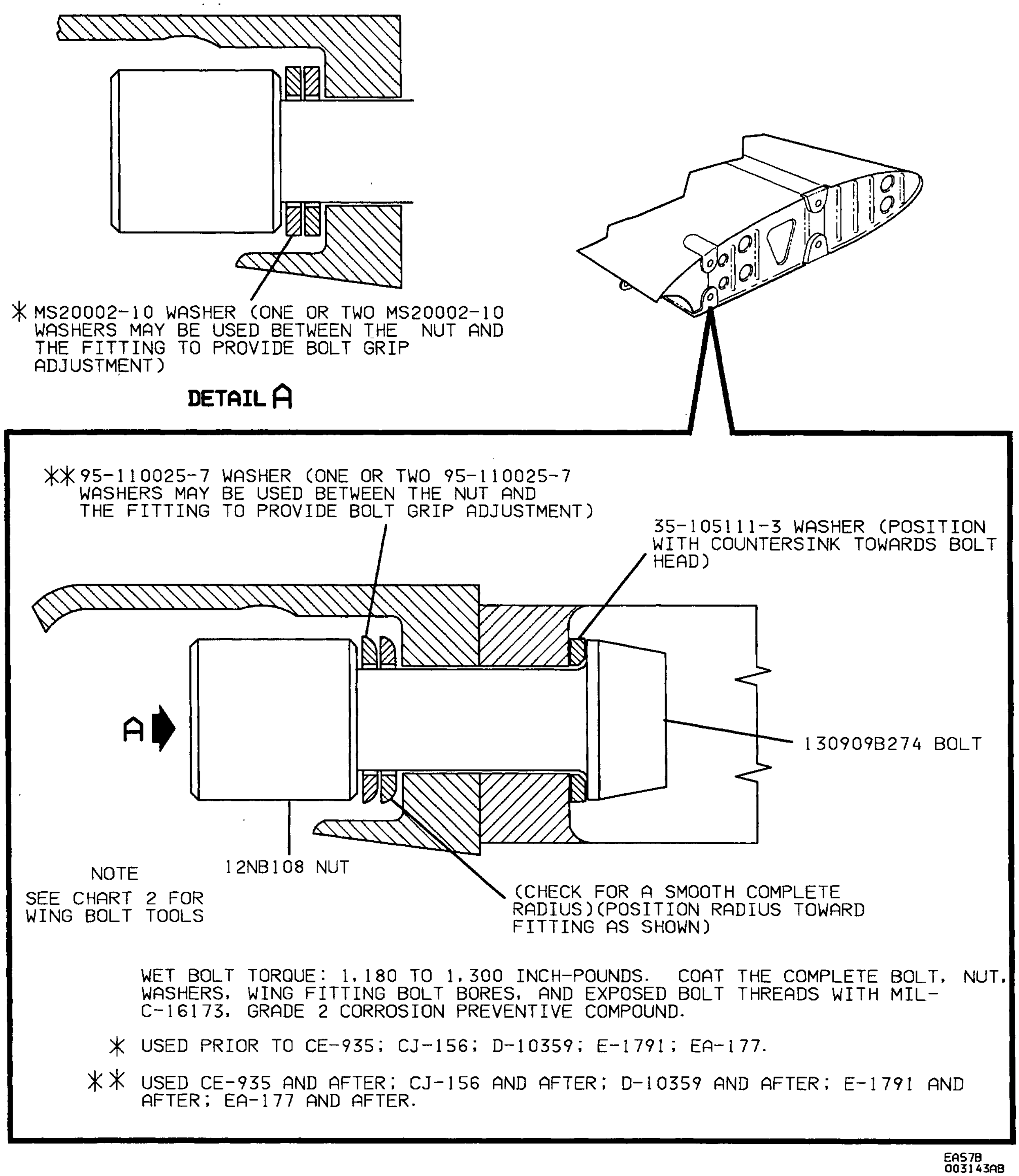
✱✱✱✱ USED PRIOR TO D-10353; CE-928; CJ-156; E-1758; EA-150.

✱✱✱✱✱ USED D-10353 AND AFTER; CE-928 AND AFTER; CJ-156 AND AFTER; E-1758 AND AFTER; EA-150 THRU EA-272, EXCEPT EA-242.

✱✱✱✱✱✱ USED EA-242, EA-273 AND AFTER.

EA57B
00314 2AB

Lower Forward Wing Bolt Installation
Figure 3



Lower Aft Wing Bolt Installation
Figure 4

WING INSTALLATION

NOTE: When replacing wing bolts make sure that the replacement bolts have been properly inspected using the magnetic particle process. Bolts must be magnetically inspected before installation as wing bolts. Bolts may be acquired through Raytheon Aircraft Parts Inventory and Distribution (RAPID). The individual placing the order must stipulate the need to have the bolts inspected before shipment.

a. Using a nonmetallic brush and solvent (26 or 31, Chart 1, 91-00-00), clean all wing attach fittings and hardware (bolts, washers and nuts). Inspect the wing attach fittings, bolts, washers, and nuts as instructed under WING BOLT AND FITTING INSPECTION.

WARNING: Wing bolts that have reached their life limit (10 years after the initial inspection) must not be reused. The mounting nuts must be replaced at each inspection interval.

b. Coat the fitting bolt bores and bearing faces, bolts, washers and nuts with corrosion preventive compound (5, Chart 1, 91-00-00).

WARNING: The bushing installed in the lower forward spar attach fitting must be in place prior to installation of the wing attach bolts.

c. Move the wing into position, align the wing fittings with the carry-through fittings, and insert the bolts.

CAUTION: *Each bolt must be inserted by hand without binding. If a bolt cannot be easily inserted, reposition the wing until the bolt moves freely through fittings. Do not drive or screw bolt into the fittings. Bolts and nuts must be oriented as shown in applicable illustration for each location (Figure 1, 2, 3, and 4).*

d. Start the nuts on the upper forward and aft bolts. Rotate the wing trailing edge until the wing is aligned with the outline on the fuselage. After alignment is established, verify that the lower forward bolt is not binding in the bolt bore. If bolt binding is encountered, adjust the wing position until the bolt moves freely.

e. Tighten the upper forward and aft nuts.

CAUTION: *When torquing wing nuts, assure that the wrenches do not bottom out on wing attach fittings. Such an occurrence could cause false torque readings and damage to fittings. After torquing the upper forward wing attach nut, remove the holding force from the wing cradle and torque the remaining three nuts.*

f. Torque the nuts in the following order: upper forward, upper aft, lower forward, and lower aft. When a torque wrench adapter is used, the length of the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Chapter 20-00-00.

CAUTION: *Before the lower aft nut is torqued, a slight gap may be evident between the fittings. This gap should not exceed 0.060 in width. No gap should remain after the nut is torqued. Torque the wing attach bolts at the nut end, do not rotate the bolt in the bolt bore.*

g. Coat the bolt threads that protrude through the nut with corrosion preventive compound (5, Chart 1, 91-00-00).

h. Connect the cold air duct at the wing leading edge.

i. Connect the flap drive shaft to the flap motor.

j. Connect the aileron cables at the turnbuckles.

k. Connect the electrical wiring in the wheel well.

l. Connect the pitot line in the wheel well (LH only).

m. Connect the fuel lines.

n. Connect the landing gear actuator rod.

o. Connect the landing gear uplock cable.

p. Connect the inboard door actuator rod.

q. Connect the hydraulic brake lines and bleed the brakes.

r. At the first scheduled inspection after the wing has been installed, check the attaching bolts for proper torque. Check the drain ports to assure that they are unobstructed.

ADJUSTING THE WINGS

After the wing has been installed or repaired, flight tests may show the wing to be chronically heavy or light. This condition may be corrected by rotating the wing to lower the trailing edge of a heavy wing or raise the trailing edge of a light wing or by a combination of adjusting both wings. The aluminum washers between the upper wing fittings must be replaced each time the position of the wing is changed. If both wings have been removed, install the right wing with the trailing edge at the highest point of the adjustment travel and the left wing 1/16 inch down from the highest point of travel. The total adjustment on each wing is approximately 1/8 inch. The following steps should be implemented when adjusting the wings:

a. Using a grease pencil, outline the position of the wing on the fuselage.

b. Place the airplane on a three point jack and raise until the wheels are clear. Refer to Chapter 7-00-00 for jacking instructions. Place a suitable cradle under the wing being adjusted and a wing stand under the opposite wing. A tail stand will also be required to assure stability.

c. Loosen the nuts on the lower wing attach bolts and remove the bolts and nuts from the upper wing attach fittings. Coat the bearing faces and bolt bores of the fittings, the complete bolt, washers, and nut with corrosion preventive compound (5, Chart 1, 91-00-00). Install new soft aluminum washers between the upper wing attach fittings. Install the bolts, washers, and nuts into the fittings. Raise or lower the trailing edge as required and torque the wing attach nuts in the following order: upper forward, upper aft, lower forward, and lower aft. There should be no gap between the fittings after the last nut is torqued. Torque each nut to the wet torque value shown in the appropriate illustration (Figure 1, 2, 3, and 4). Coat the exposed threads that protrude through the nuts with corrosion preventive compound (5, Chart 1, 91-00-00).

NOTE: After torquing the upper forward wing attach nut, remove the holding force from the wing cradle prior to torquing the remaining three nuts.

d. Remove the wing and tail stands, remove the airplane from the jack, and test fly the airplane.

e. At the first scheduled inspection after the wing has been adjusted, check for correct wing bolt torque. Check the drain ports in the upper wing attach fittings to assure that they are unobstructed.

WING BOLT AND FITTING INSPECTION

NOTE: Read the entire section before removing any wing bolts.

WARNING: The wing bolts installed in the Bonanza series airplanes five years old or older must be removed and inspected. If the bolts prove to be free of all damage, they may be reinstalled for an additional five year period. At the end of this period the bolts must again be removed and inspected. Ten years after the initial inspection, all wing bolts must be replaced with new hardware. The mounting nuts must be replaced at each inspection interval. Render unserviceable all components removed in compliance with this warning. See Chart 1 for the inspection and replacement cycle of the wing bolts.

a. Before removing any wing bolt, draw an outline of the wing position on the fuselage with a grease pencil. If wing bolt binding is encountered and the wing must be shifted, the outline will be helpful in returning the wing to its original position.

WARNING: Use only the components specified in the applicable illustrations. DO NOT INSTALL THE BLACK P/N H-20 NUTS, these nuts have been dry film lubricated with molybdenum disulfide. When MIL-C-16173 Grade II corrosion preventive compound is added to these nuts, the additional lubrication may cause improper preload in the bolt when it is torqued.

CAUTION: *There should be no wing bolt binding during removal or installation of bolts. Do not screw or drive a bolt in or out of the fittings. If wing bolt binding is encountered, place the airplane on a three point jack and raise until the wheels are clear (see Chapter 7-00-00 for jacking instructions). Place a wing stand under each wing and a tail stand under the aft fuselage. Defuel the wing, loosen the remaining three bolts and rotate the wing until the binding bolt moves freely through the fittings. Replace the soft aluminum washers between the upper wing attach fittings and torque the bolts as instructed under WING INSTALLATION. If bolt binding is not encountered and the wing has not shifted, replacement of soft aluminum washers between the upper wing attach fittings is not required.*

NOTE: Raytheon Aircraft Company supplies wing attach hardware that has been given an additional magnetic particle inspection since manufacture. These components may be identified by the green dye on the head of the bolt and on some portion of the nut.

b. Starting at the lower wing attach point on each side, remove, inspect and torque one bolt at a time until the complete set of eight bolts and nuts have been inspected.

c. Using a nonmetallic brush, thoroughly clean the bolt, washers and with solvent (26 or 31, Chart 1, 91-00-00).

CAUTION: *Assure that the 95-110025-1 (Ref. Figure 1), the 50-105011 (Ref. Figure 3), and the 95-110025-7 (Ref. Figures 2 and 4) washers have a complete radius with no sharp edges that could damage the wing fittings.*

d. If the bolts do not exceed the life limit shown in Chart 1, visually inspect each bolt with a 10-power or stronger magnifying glass; inspect for corrosion, cracks, and mechanical damage. The cadmium plating may display areas that appear rubbed, discolored, or polished. These areas are usually the result of prevailing installation procedures and are of no significance. A bolt should not be rejected because of cadmium plating deterioration; however, any component that is cracked, corroded or has mechanical damage must be replaced.

e. Using the magnetic particle inspection process described in this chapter, check each bolt for circumferential crack indications. If the bolts prove to be free of all damage (corrosion, cracks, and mechanical damage), they may be reused after demagnetization and cleaning.

f. Clean the spar fitting bolt bores with naphtha or methyl propyl ketone (26 or 31, Chart 1, 91-00-00). Do not strip the epoxy paint from this area. Inspect the surface condition of each fitting; focus special attention on the washer seat and bolt bore area. If scoring, corrosion pitting or washer impressions are discovered in this area, contact Raytheon Aircraft Technical Support. If the fitting is satisfactory, coat the bolt bore and bearing faces of the fitting with Alodine 1200, 1200S or 1201 (53, Chart 1, 91-00-00). Allow the coating to remain on the surface for approximately five minutes. When the time has elapsed, wash the coated areas with water and blow dry (do not wipe dry). Paint the treated areas with zinc chromate primer (20, Chart 1, 91-00-00) and allow to dry.

g. Coat the bearing faces and bolt bores of the fittings, the complete bolt, washers, and nut with corrosion preventive compound (5, Chart 1, 91-00-00).

h. Install the bolt, washers, and nut into the fitting.

CAUTION: *Ensure that the wing bolt wrenches do not bottom out on the fittings when torquing the nut. This could result in damage to the wing fittings and erroneous torque readings.*

i. Torque the nut to the wet torque value shown in the appropriate illustration (Ref. Figures 1, 2, 3, and 4). When a torque wrench adapter is used, the length of the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Chapter 20-00-00.

j. Coat the exposed threads that protrude through the nut with corrosion preventive compound (5, Chart 1, 91-00-00).

k. Check that the decal shown in Figure 5 is affixed to the appropriate locations on the airplane. When the corrosion preventive compound has been applied to the wing bolts, affix the decal to the following locations:

   1. On the side of the fuselage immediately above the RH forward and aft wing bolt covers.
   2. On the wing immediately forward of the LH forward and aft wing bolt covers.
   3. On the wing immediately forward of the lower forward wing bolt covers on both sides.
   4. On the wing immediately aft of the lower aft wing bolt covers on both sides.

l. Check the drain ports in the upper wing attach fittings to ensure that they are unobstructed and free to drain.

m. At the first scheduled inspection after the wing bolts have been inspected or replaced, check for proper bolt torque.

Chart 1
Wing Bolt And Nut Inspection And Replacement Cycle

NEW AIRPLANE	5 years initial inspection	5 years second inspection	5 years first replacement interval	5 years repeat inspection and replacement cycle
	initial inspection **(airplanes 5 years old or older)**	5 years second inspection	5 years first replacement interval	5 years repeat inspection and replacement cycle

NOTE: At each inspection interval, the nuts must be replaced.
At each replacement interval, all wing attach hardware (bolts, washers, and nuts) must be replaced.

Chart 2
Wing Bolt Wrenches And Torque Adapters

POSITION	BOLT PART NUMBER	WRENCH PART NUMBER	NUT PART NUMBER	NUT TORQUE ADAPTER
UPPER FORWARD	131790-1	TS1222-3, TS1222-5, 50-590012, TS1222-4, TS1222-8	12NB-126 (Prior to CE-928; CJ-156; D-10353; E-1758 and EA-150) EB-126 (CE-928 and After; CJ-156 and After; D-10353 and After; E-1758 and After; EA-150 and After)	TS1171-2, TS1176-2 TS1176-10, TS1171-10
LOWER FORWARD	131790-2 (CE-748; CE-722 and After; CJ-149 and After; E-1111, E-1241 and After; D-10097; D-10120 and After; EA-11 thru EA-272, except EA-242) 131790-3 (EA-242, EA-273 and After)	TS1222-5, 50-590012, TS1222-4, TS1222-8 TS1222-3	12NB-126 (Prior to CE-928; CJ-156; D-10353, E-1758 and EA-150) EB-126 (CE-928 and After; CJ-156 and After, D-10353 and After; E-1758 and After; EA-150 thru EA-272, except EA-242) EB-144 or ZEB1845-144 (EA-242, EA-273 and After)	TS1171-2, TS1176-2 TS1176-10, TS1171-10 50-590014
UPPER AFT	130909B103	50-590012, TS1222-5, TS1222-4, TS1222-8	12NB-108	50-590013, TS1171-1, TS1176-1
LOWER AFT	130909B274	50-590012, TS1222-5, TS1222-4, TS1222-8	12NB-108	50-590013, TS1171-1, TS1176-1

NOTICE

WING BOLTS ARE LUBRICATED
SEE MAINTENANCE MANUAL
FOR CORRECT TORQUE VALUES

WHEN THE CORROSION PREVENTIVE COMPOUND HAS BEEN APPLIED TO THE WING BOLTS, AFFIX THE ABOVE DECAL TO THE FOLLOWING LOCATIONS:

1. ON THE SIDE OF THE FUSELAGE IMMEDIATELY ABOVE THE RH FORWARD AND AFT WING BOLT COVERS.
2. ON THE WING IMMEDIATELY FORWARD OF THE LH FORWARD AND AFT WING BOLT COVERS.
3. ON THE WING IMMEDIATELY FORWARD OF THE LOWER FORWARD WING BOLT COVERS ON BOTH SIDES.
4. ON THE WING IMMEDIATELY AFT OF THE LOWER AFT WING BOLT COVERS ON BOTH SIDES.

THIIB
992996AA

Lubrication Bolt Identification Placard
Figure 5

MAGNETIC-PARTICLE INSPECTION

Magnetic-Particle Inspection is a method for locating surface and subsurface discontinuities in ferromagnetic materials (i.e. materials capable of being magnetized); consequently, nonferromagnetic materials (such as aluminum alloys, magnesium alloys, copper alloys, lead, titanium alloys, pickle base alloys and many stainless steel alloys) cannot be inspected by this method. Magnetic-Particle Inspection is based upon the principle that any discontinuities lying in a direction generally transverse to the direction of the magnetic field of the part magnetized for the test will cause a leakage field to be formed at and above the surface of the part. The presence of the leakage field denoting the discontinuity is detected by the use of finely divided ferromagnetic particles over the surface of the part. Some of the particles are magnetically gathered and held by the leakage field to form an outline indicating the location, size, shape and extent of the discontinuity. In general, magnetic particle inspection utilizes a variety of types of equipment for magnetization as well as several methods for application of ferromagnetic particles to the test part. Additionally, the ferromagnetic particles are available in a selection of colors (including fluorescent) and particle shapes. Magnetic particle inspections required by this manual can best be accomplished utilizing the wet continuous method on the standard wet horizontal type equipment with either visible or fluorescent magnetic particles suspended in a petroleum base vehicle (normally kerosene). Since magnetic particle indications are best obtained when the discontinuity lies in a direction transverse to the magnetic field, the following procedures are recommended for optimum detection of discontinuities in bolts.

WARNING: Improper operation of the particle inspection, because of faulty equipment or untrained operators, can jeopardize the airworthiness of parts being tested. Minute electrical arc burns caused during inspection by improper operation of the test equipment can result in eventual failure of the part.

Bolts: Inspection of a bolt is accomplished by longitudinal magnetization in a multiturn low-fill factor coil (i.e. the inner diameter of the coil greatly exceeds the bolt diameter). For proper magnetization the bolt is positioned close to the coil inside wall with the bolt length perpendicular to the winding direction. The magnetic particle suspension is flowed on the bolt and the appropriate current is applied to achieve adequate field strength. Using the described procedure, laboratory testing has indicated that the ampere turn values listed in Chart 3 provide for optimum detection of discontinuities perpendicular to the bolt axis.

After magnetic particle inspection, the parts must be carefully demagnetized and cleaned of the ferromagnetic particles. Examine parts for any possible evidence of electric arc burn that may have occurred during the inspection.

Chart 3
Magnetic-Particle Inspection
(Steel Bolts)

BOLT DIAMETER	TOTAL BOLT LENGTH INCLUDING HEAD TO NEAREST 1/4 INCH	AMPERE TURNS *
5/8 INCH	2 1/2 INCH	7,900
5/8 INCH	2 3/4 INCH	7,100
5/8 INCH	3 INCH	6,600
3/4 INCH	3 INCH	7,900
3/4 INCH	3 1/4 INCH	7,400
3/4 INCH	3 1/2 INCH	6,700
3/4 INCH	3 3/4 INCH	6,300
7/8 INCH	3 1/2 INCH	7,900
7/8 INCH	3 3/4 INCH	7,400
7/8 INCH	4 INCH	6,900
7/8 INCH	5 INCH	5,500
1 INCH	5 INCH	6,300

* Amperage requirement is the ampere turns value divided by the number of turns on the coil. For example: A 1-inch diameter x 5-inch long bolt tested on a 5-turn coil would require 6,300 ÷ 5, or 1,260 amps.

Chart 4
Magnetic-Particle Inspection
(Steel Nuts)

NUT SIZE	CENTRAL CONDUCTOR SIZE	AMPERAGE
5/8 INCH	1/2 INCH	500 AMPS
3/4 INCH	5/8 INCH	600 AMPS
7/8 INCH	3/4 INCH	700 AMPS
1 INCH	7/8 INCH	800 AMPS

OUTBOARD WING MAIN SPAR CAP INSPECTION

The outboard wing main spar cap must be inspected annually for corrosion.

WARNING: All areas of the spar cap from the wing attach fitting to the outboard end of the spar cap must be inspected.

NOTE: Special emphasis should be placed on airplanes that have been operated or stored for extended periods (5 years or longer) where geographical locations or atmospheric conditions are highly conducive to corrosion.

Inspection of the upper and lower spar cap should be accomplished in the following manner:

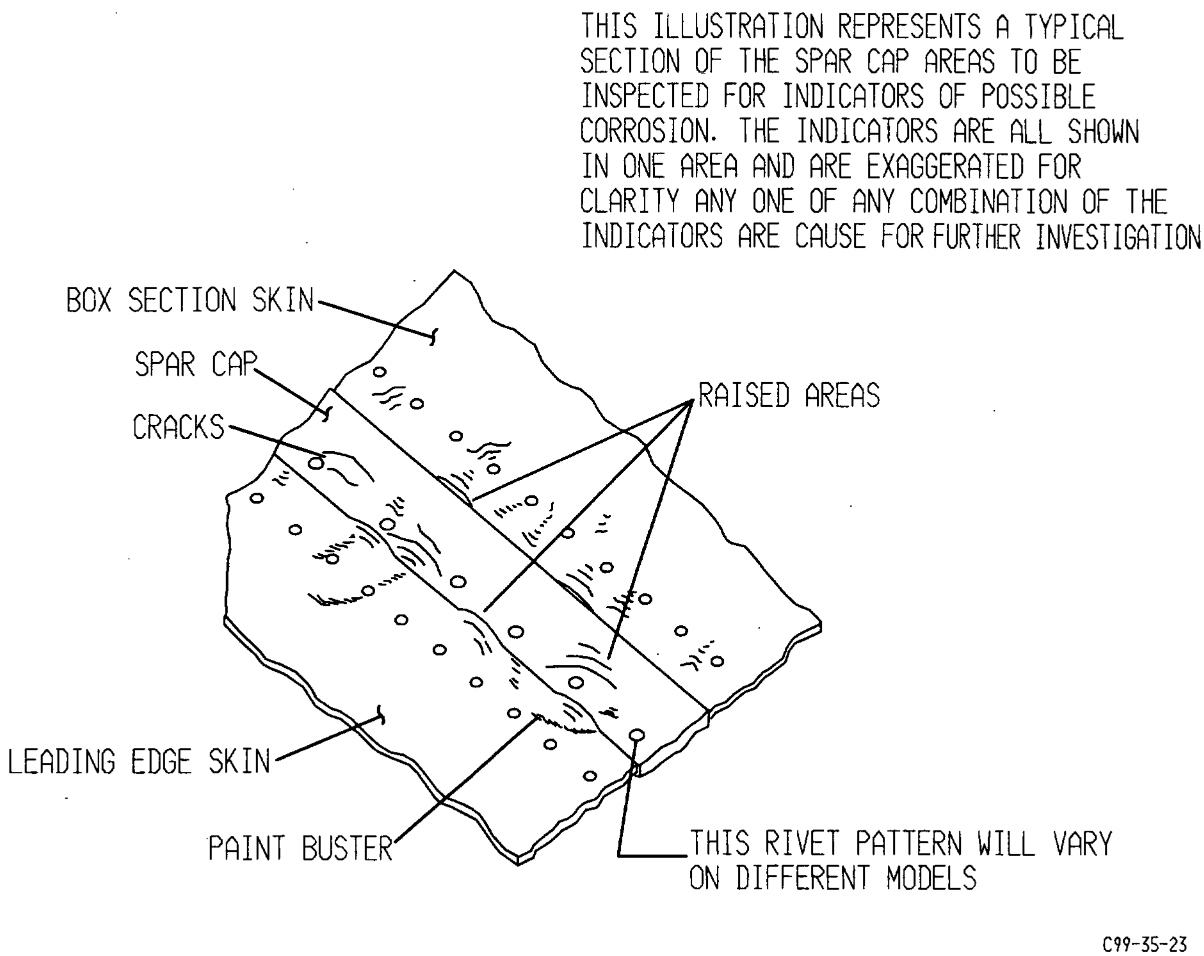
a. Examine the forward and aft sides of the spar cap where it meets the skin. If a whitish, salt-like, nonmetallic substance is noted in these areas, a thorough inspection should be performed to determine if corrosion has occurred. Wax or paint trapped between the edge of the skin and the exposed section of the spar cap should not be misinterpreted as corrosion.

b. Wash all exposed areas of the upper and lower spar cap.

c. Visually inspect all exposed areas of the upper and lower spar caps for irregularities, such as paint blisters, raised or uneven areas, and cracks. The exposed areas of the spar cap are extruded flat and irregularities could be an indication of corrosion. Investigate all irregularities to determine if any damage has occurred (Ref. Figure 6).

NOTE: Uneven or raised areas on the spar caps may be detected by sliding the fingers over the surface, by moving a straight edge over the surface or by sighting down the length of the par cap surface.

If unusual conditions are encountered that cannot be resolved locally, contact Raytheon Aircraft Technical Support for evaluation and determination of corrective action that may be required.



Visual Spar Cap Inspection
Figure 6

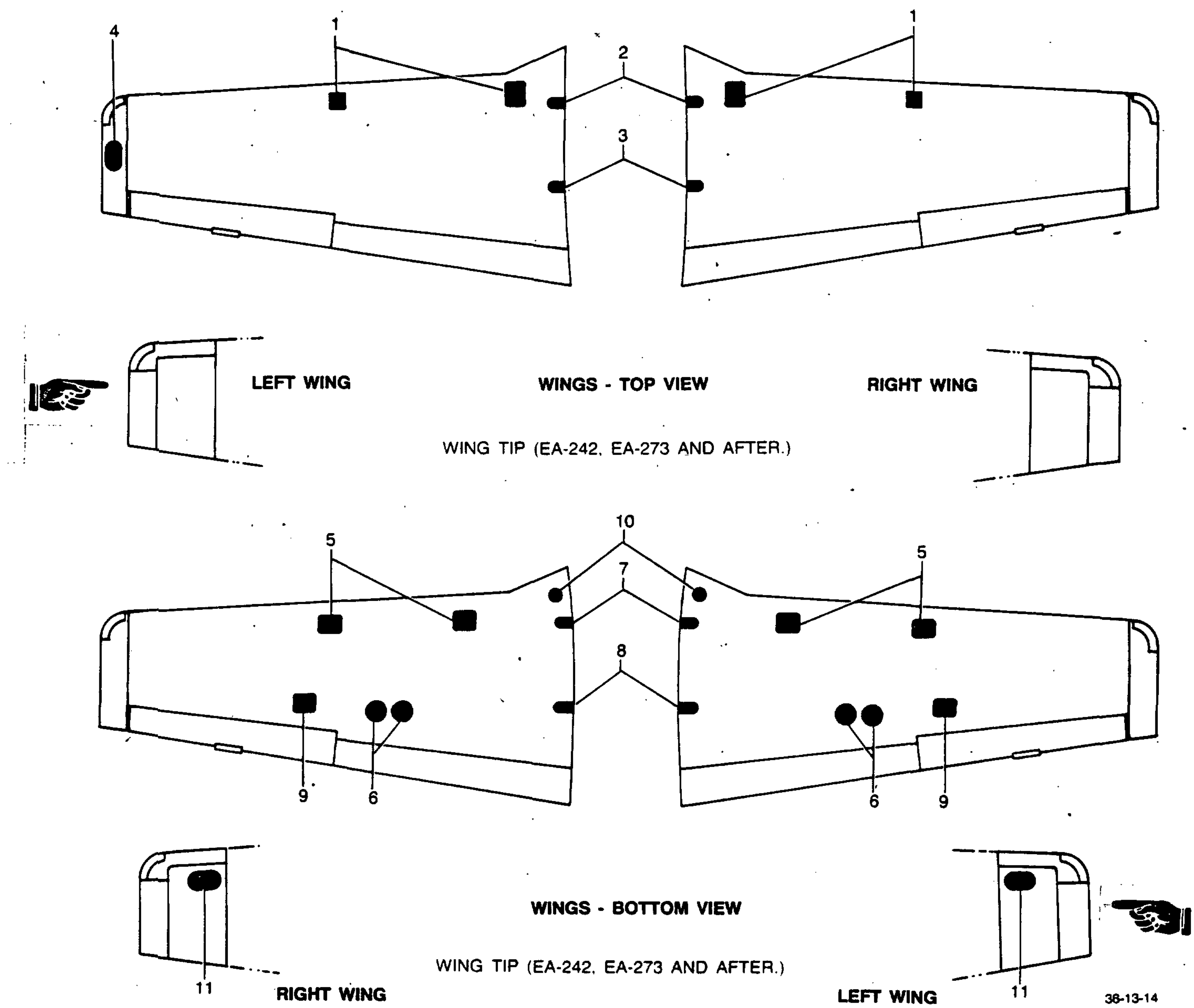
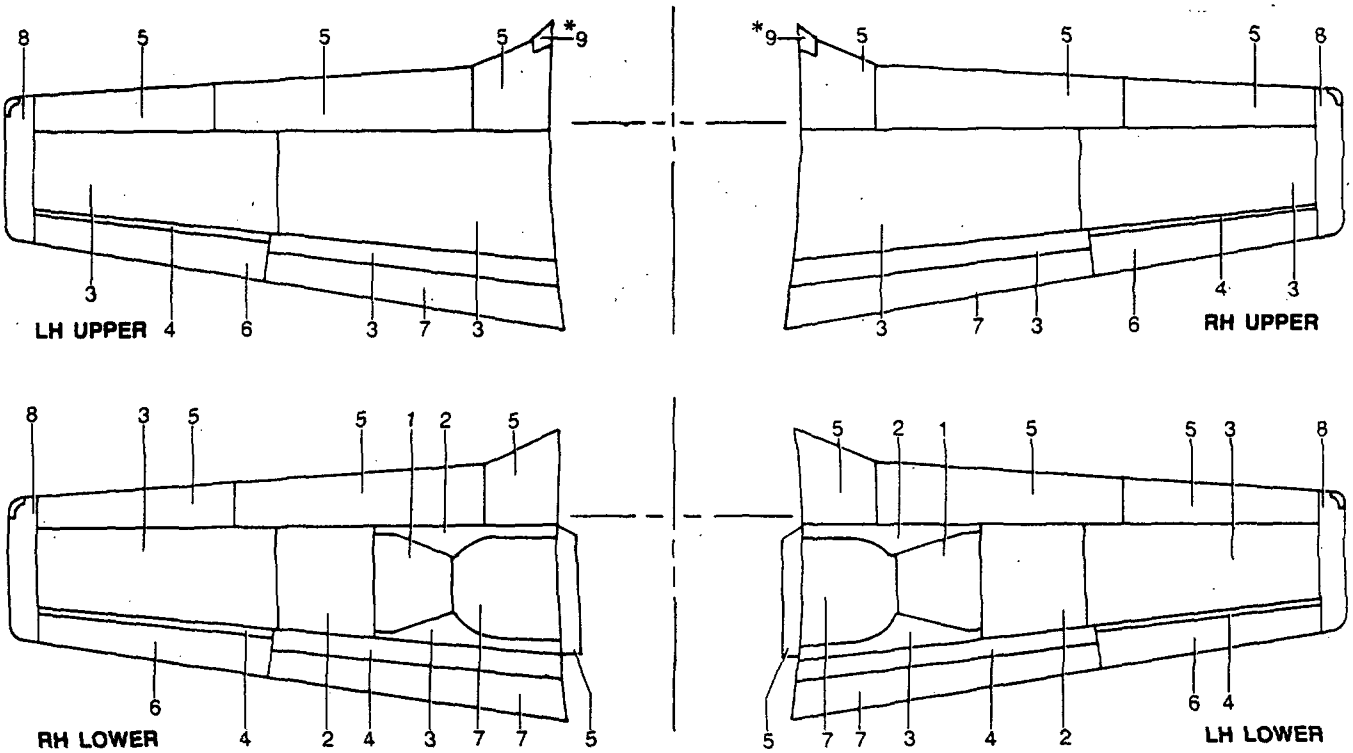


PLATE SKIN - MAINTENANCE PRACTICES

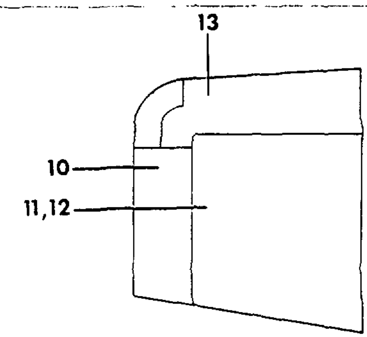
WING ACCESS OPENINGS

1. Upper fuel cell and transmiiter access
2. Upper forward wing attach bolt
3. Upper aft wing attach bolt
4. Optional remote compass (Except CJ-149 and after)
5. Lower fuel cell access
6. Flap actuator access
7. Lower forward wing attach bolt
8. Lower aft wing attach bolt
9. Aileron bell crank access
10. Fuel drain (EA-242, EA-273 and after)
11. Fuel vent float valve, flame arrestor, vent and vacuum refill valve (EA-242, EA-273 and after)

Wing Access Openings
Figure 1



*FILLET USED ONLY ON SERIALS D-10097, D-10120 AND AFTER



NUMBER	MATERIAL	THICKNESS IN INCHES
1	2024-T	.016
2	2024-T3	.016
3	2024-T3	.020
4	2024-T3	.025
5	2024-T3	.032
6	6061-T6	.016
7	6061-T6	.020
8	6061-T6	.032
9	6061-0	.032

WING TIP EA-242, EA-273 AND AFTER

NUMBER	MATERIAL	THICKNESS IN INCHES
10 †	6061-0	.032
11 UPPER	2024-T3	.025
12 LOWER	2024-T3	.020
13	2024-T3	.020

† HEAT TREAT TO T6 CONDITION

35-12-10

*Fillets used only on serials D-10097, D-10120 and after.

Wing Skin Thickness
Figure 2

"END"

ATTACH FITTINGS - MAINTENANCE PRACTICES

The major fittings in each wing are the supporting structures adjacent to the attachment points for the flap actuator, flap tracks and flap, aileron hinge brackets and hinges, main landing gear support brace and landing gear doors. Minor fittings include brackets to support cable pulleys, bell cranks, and similar components. If the landing gear hinge bolt fittings are cracked or if the spar is warped or buckled, replacement is necessary.

"END"

BALANCING CONTROL SURFACES - MAINTENANCE PRACTICES

BALANCING THE AILERON

When the aileron control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge.

NOTE: After any repainting or repair, the finished surface must be check balanced to ensure that its static moment about the hinge line is within the prescribed limits.

The painted aileron assembly must be nose-heavy by 0.2 to 1.5 in.-lbs. The static moment of the aileron is determined by multiplying the unbalanced weight of the aileron assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced control surface is 0.0 in.-lbs. A tail-heavy surface exhibits static underbalance. A nose-heavy surface exhibits static overbalance.

CHECKING BALANCE

The aileron balance must be checked in a draft-free area with the aileron completely assembled in flying condition.

NOTE: All painting, including stripes and touch-up, must be completed.

The tab, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, they can be categorized under the following two headings:

a. Counterbalancing - The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the aileron assembly.

b. Actual Force Measurement - Measurement of the force applied by the aileron surface on a single support at a known distance from the center line of the hinge.

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING

a. A stand with knife edge supports as illustrated in Figure 1. The knife edges must be in the same horizontal plane.

b. A paper cup or similar light weight container.

c. Approximately 1 lb of lead shot.

d. A certified beam balance weighing device calibrated in units of 0.01 lb or less.

e. A straight edge, ruler, and spirit level.

BALANCING PROCEDURE

COUNTERBALANCING METHOD

a. Locate the chord line by placing a straight edge at the inboard end of the aileron assembly so that one end is on the trailing edge and the other end is centered on the leading edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.

b. Fit the correct size bolts in the hinge brackets and mount the aileron on the knife edge supports. Ascertain that the aileron is free to rotate about the hinge line.

c. To determine if weight should be added or removed, suspend a paper cup from a point near the center of the aileron trailing edge. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in Figure 1. The cup must be free to hang vertically.

d. Add small quantities of lead shot to the cup until the aileron balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.

e. The distance D must be perpendicular to the hinge line. Measure D from the hinge line to the suspension point of the cup.

NOTE: Since any weighing error is magnified by the distance D, weighing is most important and must be done carefully on scales that are certified for accuracy.

f. Remove the cup, contents, and string, then weigh them.

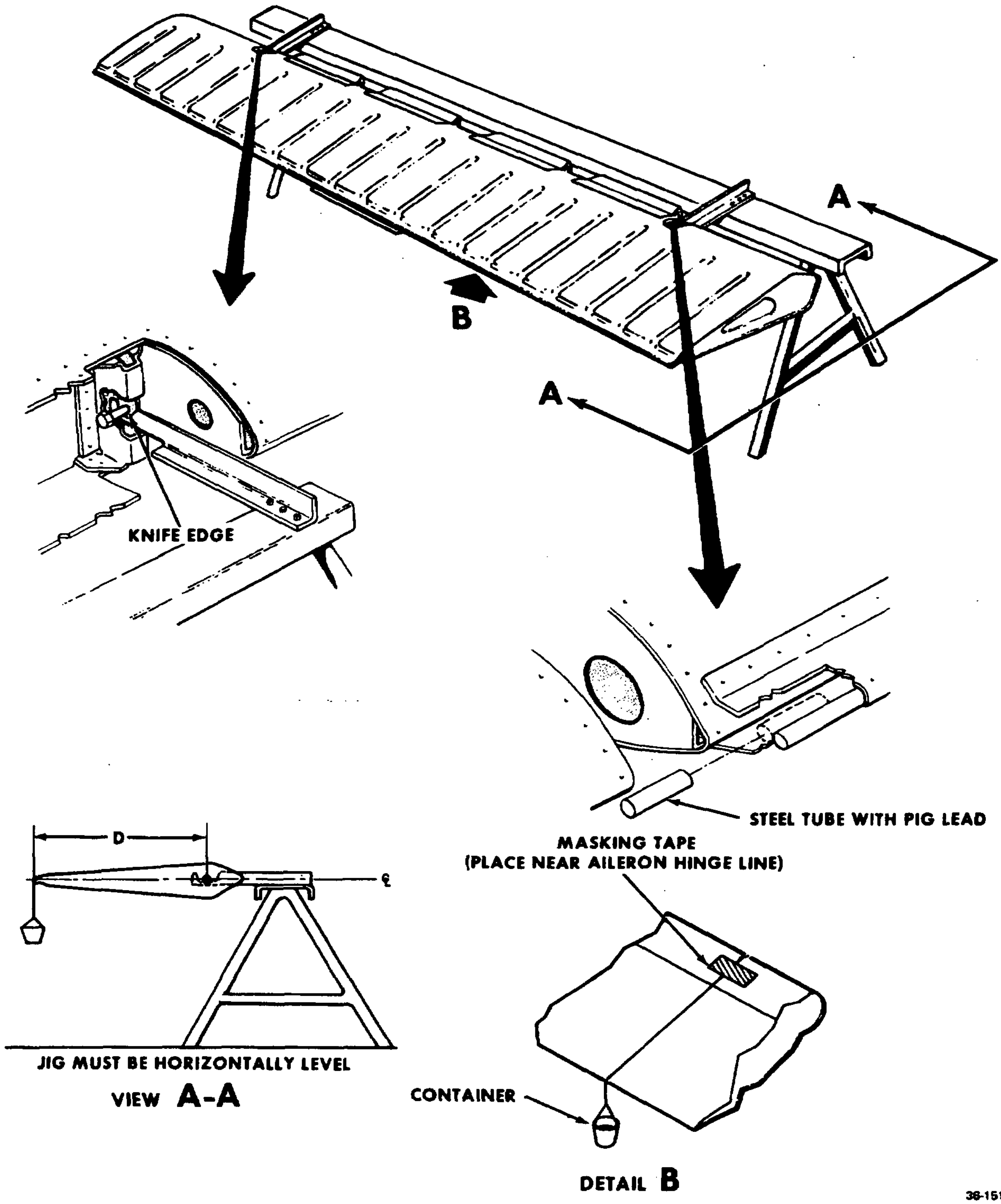
g. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by W.
2. The over or underbalance moment is designated by M.
3. M = W x D
4. The following is a typical example of a balancing calculation: Assume the aileron is overbalance (nose-heavy) and the paper cup was suspended from the trailing edge. Assume that the aileron balances with the chord line level at W = 0.150 lb and D = 10.0 in., then...

   M = 0.150 x 10.0
   M = 1.50 in.-lbs. The product of W x D. In this instance, M is within the required static balance range and is therefore acceptable.

CAUTION: *When a lead rod is added to obtain correct balance, it must be installed securely with rivets. A loosely installed rod will vibrate and may cause an undesirable vibration of the surface.*

h. The center of gravity of the aileron is forward of the hinge center line causing the surface to be nose-heavy. Proper aileron balance is obtained by adding or removing lead rod at the leading edge of the aileron. The rod is 15/32 in. diameter and is installed in brackets attached to the leading edge of the aileron. When adding additional lead rod the maximum total of the length of the rod to be added is not to exceed 5 in. over the entire length of the aileron and would be installed at the center brackets.



Balancing the Aileron
Figure 1

CHAPTER

61

PROPELLERS/ PROPULSORS

CHAPTER 61- PROPELLER

TABLE OF CONTENTS

SUBJECT *PAGE*

61-10-00

61-20-00

CHAPTER 61 - PROPELLERS

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
61-LOEP	1	Mar 31/05
61-CONTENTS	1	Mar 31/05
61-10-00	1 thru 5	Mar 31/05
61-20-00	1	May 9/80

PROPELLER - DESCRIPTION AND OPERATION

PROPELLERS

The Bonanza airplanes are equipped with a two-blade or three-blade McCauley propeller or a three-blade Hartzell propeller as indicated in Chart 1.

Chart 1
Propellers

McCauley	Hartzell
CE-748, CE-772 thru CE-912, CE-917, CE-919, CE-978 and After.	CE-913 thru CE-916, CE-918, CE-920 thru CE-977.
D-10097, D-10120 thru D-10349, D-10383 and After.	D-10350 thru D-10382.
E-111, E-1241 thru E-1715, E-1932 thru E-3220.	E-1716 thru E-1931, E-3221 and After.
EA-11 thru EA-105, EA-107, EA-108, EA-110, EA-118, EA-242, EA-273 thru EA-631.	EA-106, EA-109, EA-111 thru EA-117, EA-119 thru EA-241, EA-243 thru EA-272, EA-632 and After.

These units are single-acting propellers in which the centrifugal twisting moment of the rotating blades is opposed by hydraulic pressure in the cylinder (and spring force in the McCauley propellers) to obtain the correct pitch for the engine load. Governor (engine driven) controls the amount and pressure of oil passing through the propeller shaft to the power piston in the propeller hub. An increase in engine power output causes oil to enter the piston, thus increasing propeller pitch. A decrease in engine power output results in oil leaving the piston, thus decreasing pitch.

PROPELLER - MAINTENANCE PRACTICES

PROPELLER REMOVAL

WARNING: To avoid possible injury, ensure that the ignition switch is in the OFF position before working on the propeller.

a. Remove the six propeller attach nuts from the studs attaching the propeller to the engine crankshaft flange.

NOTE: When propeller deice is installed, it is necessary to tape the brushes in place before the propeller is removed.

b. Place a drain trough under the attaching point of the propeller to the crankshaft, to prevent oil draining into the engine cowl.

c. Remove the propeller from the engine crankshaft flange.

d. Use clean shop rags to plug the center of the engine crankshaft and the propeller hub.

PROPELLER INSTALLATION

a. Lubricate the O-ring that is installed in the circular groove of the propeller hub with engine oil (2, Chart 1, 91-00-00) before installating the propeller.

b. Two blade propeller: Place the No. 1 propeller blade directly over the T/C mark on the crankshaft flange. Three blade propeller: (F33A, A36 and Optional for B36TC). Install propeller on engine flange. Refer to Figure 1 for indexing of propeller to engine crankshaft flange.

NOTE: Due to the close tolerance fit of the prop hub bore to the pilot on the crankshaft, the hub must be placed square on the engine shaft and seated evenly to the crankshaft flange.

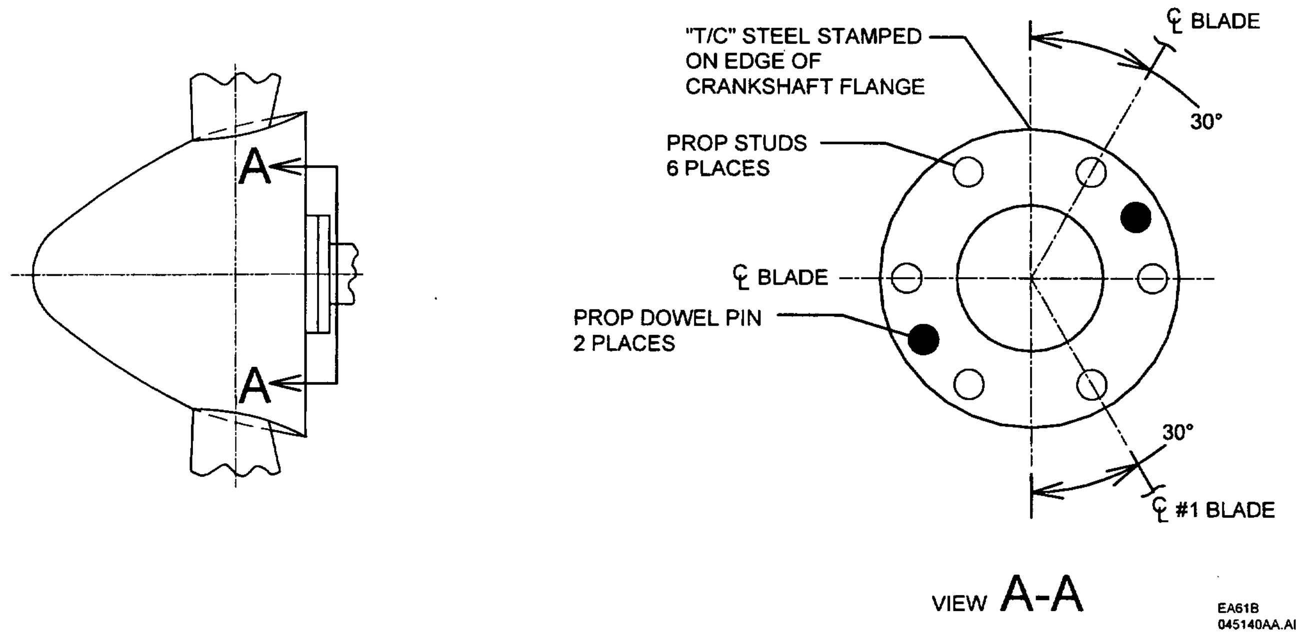
c. On McCauley propellers liberally apply grease, A-1637-16 (PN of McCauley), or grease (70, Chart 1, 91-00-00) only to threads of studs and face of nuts.

d. Snug the six propeller attach nuts down evenly in a diagonal pattern. Torque the attach nuts in a diagonal pattern to 45-50 foot-pounds for McCauley propellers, and 70 to 80 foot-pounds on Hartzell propellers.

e. On McCauley propellers wipe off excessive grease after torquing.

f. It may be necessary to check the alignment of the deicer brushes to the slip ring as noted in Chapter 30-60-00.

g. Check the prop blade track after installation.



Indexing Propeller
Figure 1

PROPELLER ADJUSTMENT

For adjustments, service, overhaul and maintenance procedures, refer to the applicable FAA Approved Propeller Manual and or Approved Propeller Overhaul Shop Manual. All pitch measurements are made at the 30 inch station. For McCauley propeller adjustments refer to Chart 2. For Hartzell propeller adjustments refer to Chart 3.

Chart 2
McCauley Propeller Adjustment

Hub/Blade Part Number	Low Pitch	High Pitch
TWO-BLADE PROPELLERS		
Hub: 2A36C23 Blade: 84B-0	13.3° ± 0.2°	29.7° ± 0.5°
THREE-BLADE PROPELLERS		
Hub: 3A32C406 X Blade: X 82NDB-2	13.3° ± 0.3°	29.0° ± 0.5°
Hub: 3A32C76 Blade: 82NB-2	13.3° ± 0.2°	29.0° ± 0.5°
Hub: 3A32C76-U Blade: 82NB-2	15.0° ± 0.2°	34.5° ± 0.1°
Hub: 3A32C406 X Blade: X 82NDB-4	15.8° ± 0.3°	34.9° ± 0.5°
Hub: 3A32C409-X Blade: 82NDB-2	13.7° ± 0.3°	28.8° ± 0.5°

Chart 3
Hartzell Propeller Adjustment

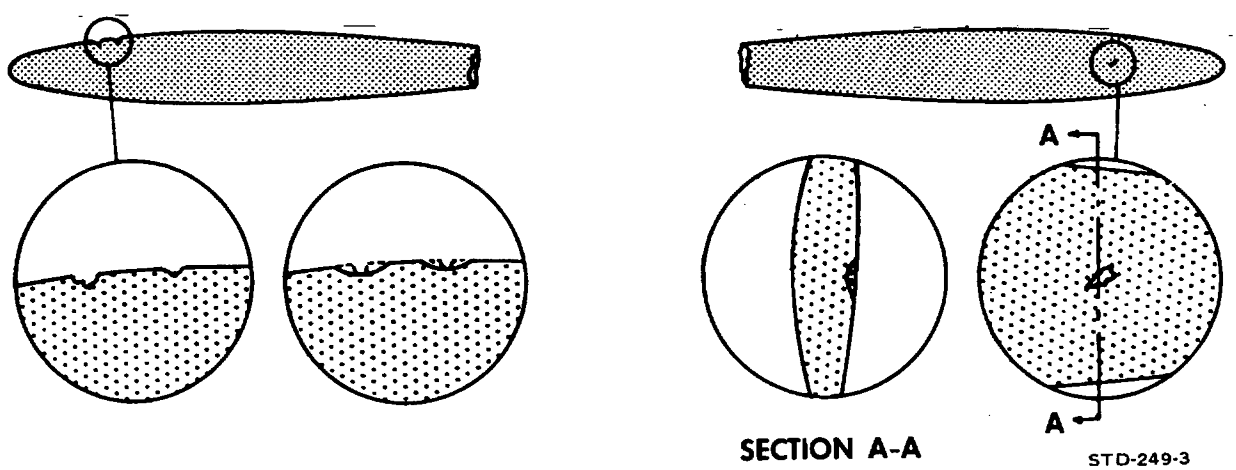
Hub/Blade Part Number	Low Pitch	High Pitch
THREE-BLADE PROPELLERS		
Hub: PHC-C3YF-1RF (Used on IO-520-BB) Blade: F8468A-6R	12.0° ± 0.2°	33.0° ± 1.0°
Hub: PHC-C3YF-1RF (Used on TSIO-520-UB & IO-550-B) Blade: F8468A-6R	13.0° ± 0.2°	36.0° ± 1.0°
Hub: PHC-C3YF-1RF Blade: F8468A-8R	13.0° ± 0.2°	36.0° ± 1.0°

MINOR PROPELLER REPAIR

Minor nicks, dents, and gouges may be dressed out by qualified personnel only. Blend any nicks or gouges into the leading edge with smooth curves and generous radii (Ref. Figure 2). Re-anodize reworked area by the chromic acid process only.

If shortening of the propeller is necessary for repair, care should be taken that the blades are not shortened to a length less than the minimum amount specified. When shortening a propeller to repair the tip(s) all of the blades must be shortened an equal amount and the tips have identical shapes.

The specified diameters for McCauley two-blade and three-blade propellers are provided in Chart 4. The specified diameters for Hartzell three-blade propellers are provided in Chart 5.



Minor Propeller Blade Repair
Figure 2

Chart 4
McCauley Propellers Diameter Specifications

Hub/Blade Part Number	Maximum Inches	Minimum Inches
TWO-BLADE PROPELLERS		
Hub: 2A36C23 Blade: 84B-0	84	82
THREE-BLADE PROPELLERS		
Hub: 3A32C406 X Blade: 82NDB-2	80	78 1/2
Hub: 3A32C76 Blade: 82NB-2	80	78 1/2
Hub: 3A32C76U Blade: 82NB-2	80	78 1/2
Hub: 3A32C406 X Blade: 82NDB-4	78	77
Hub: D3A32C409 X Blade: 82NDB-2	80	79

Chart 5
Hartzell Propellers Diameter Specifications

Hub/Blade Part Number	Maximum Inches	Minimum Inches
THREE-BLADE PROPELLERS		
Hub: PHC-C3YF-1RF Blade: F8468A-6R	80	78
Hub: PHC-C3YF-1RF Blade: F8468A-8R	78	77

CONTROLLING - MAINTENANCE PRACTICES

PROPELLER GOVERNOR REMOVAL

a. Open the engine cowling.
b. Disconnect the control rod end at the governor control lever.

NOTE

Care should be taken not to loosen the jam nut on the control rod end which could alter the setting of the control rod.

c. Remove the four mounting nuts and pull the governor from the engine.
d. Cover the governor base and engine pad to protect them.

PROPELLER GOVERNOR INSTALLATION

a. Remove the cover from the governor base and wipe the base clean.
b. Install a new governor mounting gasket on the governor, ensuring that the protruding gasket screen is facing into the body of the governor.
c. Remove the cover from the engine pad and wipe the pad clean.
d. Reinstall the governor on the engine pad and secure with the four mounting nuts. Torque the nuts to 180 to 220 inch-pounds.
e. Reconnect the control rod to the governor lever.
f. Close the engine cowling.

PROPELLER GOVERNOR ADJUSTMENT

The propeller governor can be adjusted for a high rpm setting. The high rpm adjustment must be checked while the airplane is in flight. For instructions on adjustment of the low rpm setting, refer to IDLE SPEED AND MIXTURE ADJUSTMENT, Chapter 71-00-00.

HIGH RPM ADJUSTMENT

The high rpm adjustment must be checked while the airplane is in flight. Observe the take-off rpm to see if it exceeds the redline figure. If excessive rpm is observed, adjust the high rpm screw inward to reduce the rpm. The propeller governor adjustment screw is located on the governor, facing outward from the engine. One complete revolution of the screw reduces the propeller rpm by approximately 25-30 revolutions.

"END"

CHAPTER

71

POWERPLANT

CHAPTER 71 - POWER PLANT

TABLE OF CONTENTS

CHAPTER 71 - POWER PLANT

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
71-LOEP	1	Mar 31/05
71-CONTENTS	1 and 2	Mar 31/05
71-00-00	1 thru 27	Mar 31/05
71-10-00	1	May 9/80

GENERAL - DESCRIPTION AND OPERATION

IO-520-BA, IO-520-BB ENGINE (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER; E-1111, E-1241 THRU E-2110, EXCEPT E-1946 AND E-2104)

The above Bonanza serial airplanes are equipped with IO-520-BA Continental engines until the following serials, at which time they are equipped with IO-520-BB engines: CE-816 and After; CJ-149 and After; D-10179 and After, and E-1371 thru E-2110, except E-1946 and E-2104. The IO-520-BB engine differs from the previous engines in that it has an improved crankshaft and other changes related to the improved crankshaft. The engine is a fuel injected, direct-drive, air-cooled, horizontally opposed, 6cylinder, 520 cubic-inch displacement, 285horsepower engine. The engine crankshaft rotates in the clockwise direction. Recommended fuel for the engine is Aviation Gasoline 100LL (blue), or 100/130 (green) minimum grade. The oil capacity for the engine is 12.0 quarts of oil conforming to Continental Motors Bulletin MHS-24B. For overhaul of the engine, refer to Continental IO-520 Series Aircraft Engines Overhaul Manual, FORM X-30039A.

IO-550-B ENGINE (E-1946, E-2104, E-2111 AND AFTER)

At the above noted airplane serials, the A36 Bonanza airplanes were equipped with IO-550-B Continental engines. These are fuel injected, direct-drive, air-cooled, horizontally opposed, 6 cylinder, 550 cubic-inch displacement 300 horsepower engines.

On certain airplanes, as designated by Factory Work Order, a Quiet Bonanza is made. A red line of 2,550 rpm is established for the tachometer and the throttle system is set to produce 2,550 rpm. A propeller governor set to 2,550 rpm along with a propeller that matches the governor and the engine is installed.

The engine crankshaft rotates in the clockwise direction. Recommended fuel for the engine is Aviation Gasoline 100LL (blue), or 100/130 (green) minimum grade. The oil capacity for the engine is 12.0 quarts of oil conforming to Continental Motors Bulletin MHS-24B. For overhaul of the engine, refer to Continental IO-550 Series Aircraft Engines Overhaul Manual, FORM X-30568.

TSIO-520-UB ENGINE (EA-11 AND AFTER)

The Turbocharged Bonanza A36TC and B36TC airplanes are equipped with turbocharged Continental engines. EA-11 and After are equipped with TSIO-520-UB engines. These engines are rated at 300 horsepower at 2,700 rpm. The turbocharger provides a means by which the engine can maintain takeoff power from sea level through a critical altitude of 20,500 feet with a maximum operating altitude of 25,000 feet.

The turbocharger is located beneath and to the left rear of the engine and is driven by exhaust gases. The turbocharger is lubricated by engine oil and is dependent upon the engine oil pump for its lubrication. For this reason the engine should be allowed to run at idle for a short period of time (4 to 5 minutes) before it is shut down. This idle time will allow the turbocharger to slow down and cool before its oil supply is shut off. The turbocharger can obtain maximum continuous speeds of 96,000 rpm (in an overspeed condition it must not exceed 115,000 rpm) and run for 1 to 2 minutes after the engine has been shut down. This 1 to 2 minutes of turbocharger operation occurs without oil pressure because the engine oil pump is not running. Therefore it is important that the turbocharger be allowed to slow down before the engine is shut down.

The engine is designed to operate with a maximum manifold pressure of 36 in. Hg, and is protected from overboost by an automatic pressure relief valve. This valve is located downstream from the turbocharger and will relieve pressure if the system reaches an overboost condition of 39.5 in. Hg.

For specific information regarding the turbocharger system, refer to Chapter 81-00-00.

ENGINE AIR INDUCTION SYSTEM

Engine induction air is available from two sources, primary and alternate air. The primary air source is supplied through an intake duct, located on the forward cowling below the propeller. The primary air passes through an air filter and then into the induction system.

NOTE: If, after cleaning, the surfaces of the air filter show metallic wires through the remaining flocking material, the filter is no longer effective and should be replaced.

If the primary source of ram air is obstructed, the induction system low pressure opens an Alternate Air Source door and permits the required volume of air flow for normal engine performance. The alternate air door is located just aft of the air filter and on the left side of the intake duct.

GENERAL - TROUBLESHOOTING

Chart 1
Troubleshooting the Engine

INDICATION	PROBABLE CAUSE	REMARKS
1. Engine will not start.	a. No fuel gage pressure - No fuel to engine.	a. Check fuel control for proper position, auxiliary pump ON and operating, fuel selector valve open. Fuel filter open, and fuel in tank.
	b. Have gage pressure - engine flooded.	b. Turn off auxiliary pump and ignition switch, set throttle to FULL OPEN and fuel control to IDLE CUT-OFF, and crank engine to clear cylinders of excess fuel. Repeat starting procedures.
	c. Have gage pressure - No fuel to engine.	c. Check for bent or loose fuel lines. Loosen one line at fuel nozzle. If no fuel shows replace fuel manifold valve.
2. Engine starts but fails to keep running.	a. Inadequate fuel to fuel manifold valve.	a. Set fuel control in FULL RICH position, turn auxiliary pump ON check to be sure feed lines and filters are not restricted. Clean or replace defective components.
	b. Defective ignition system.	b. Check accessible ignition cables and connections. Tighten loose connections. Replace defective spark plugs.
3. Engine runs rough at idle.	a. Improper idle mixture adjustment.	a. Readjust idle setting. Tighten adjustment nut to richen mixture and back off adjustment nut to lean mixture.
	b. Fouled spark plugs.	b. Remove and clean plugs, adjust gaps. Replace defective plugs.
4. Engine has poor acceleration.	a. Idle mixture too lean.	a. Readjust idle mixture as described in 3a.
	b. Incorrect fuel-air mixture, worn control linkage, or restricted air cleaner.	b. Tighten loose connections, replace worn elements of linkage. Service air cleaner.
	c. Defective ignition system.	c. Check accessible cables and connections. Replace defective plugs.

Chart 1
Troubleshooting the Engine (Continued)

INDICATION	PROBABLE CAUSE	REMARKS
5. Engine runs rough at speeds above idle.	a. Improper fuel-air mixture.	a. Check manifold connections for leaks. Tighten loose connections. Check fuel control and linkage for setting and adjustment. Check fuel filters and screens for dirt. Check for proper pump pressure, and replace pump if defective.
	b. Restricted fuel nozzle.	b. Remove and clean all nozzles.
	c. Ignition system and spark plugs defective.	c. Clean and regap spark plugs. Check ignition cables for defects. Replace defective components.
6. Engine lacks power, reduction in maximum manifold pressure or critical altitude.	a. Incorrectly adjusted throttle control, sticky linkage or dirty air cleaner.	a. Check movement of linkage by moving control from idle to full throttle. Make proper adjustments and replace worn components. Service air cleaner.
	b. Defective ignition system.	b. Inspect spark plugs for fouled electrodes, heavy carbon deposits, erosion of electrodes, improperly adjusted electrode gaps, and cracked porcelains. Test plugs for regular firing under pressure. Replace damaged or misfiring plugs. Spark plug gap to be 0.015 to 0.019 inch.
	c. Loose or damaged intake manifolding.	c. Inspect entire manifold system for possible leakage at connections. Replace damaged components, tighten all connections and clamps.
	d. Fuel nozzles defective.	d. Check for restricted nozzles and lines and clean or replace as necessary.
7. Low fuel pressure.	a. Restricted flow to fuel metering valve.	a. Check mixture control for full travel. Check for restrictions in fuel filters and lines, adjust control and clean filters. Replace damaged parts.
	b. Fuel control lever.	b. Check operation of throttle control and for possible contact with cooling shroud. Adjust as required to obtain correct operation.
	c. Incorrect fuel injector pump adjustment and operation.	c. Check and adjust using appropriate equipment. Replace defective pumps.
	d. Defective fuel injector pump relief valve.	d. Replace pump.

Chart 1
Troubleshooting the Engine (Continued)

INDICATION	PROBABLE CAUSE	REMARKS
8. High fuel pressure.	a. Restricted flow beyond fuel control assembly.	a. Check for restricted fuel nozzles or fuel manifold valve. Clean or replace nozzles. Replace defective fuel manifold valve.
	b. Defective relief valve operation in fuel injector.	b. Replace fuel injector pump.
	c. Restricted re-circulation *passage in fuel injector pump.*	c. Replace pump.
9. Fluctuating fuel pressure.	a. Vapor in fuel system, excess fuel temperature.	a. Normally operating the auxiliary pump will clear system. Operate auxiliary pump and purge system.
	b. Fuel gage line leak or air in gage line.	b. Drain gage line and tighten connections.
	c. Restriction in vapor separator vent.	c. Check for restriction in ejector jet of vapor separator cover. Clean jet with *solvent (only). Do Not Use Wire As Probe.* Replace defective parts.
10. Low oil pressure on engine gage or high oil temperature.	a. Insufficient oil in oil sump, oil dilution or using improper grade oil for prevailing ambient temperature.	a. Add oil, or change oil to proper viscosity.
	b. Defective vernatherm valve.	b. Check for defective vernatherm valve. Replace valve if defective.
	c. *Oil cooler restriction.*	c. *Clean oil cooler.*
	d. Leaking, damaged, or loose oil line connection. Restricted screen or filter.	d. Check for restricted lines and loose connections and for partially plugged oil filter. Clean parts, tighten connections and replace defective parts.
	e. Low oil pressure.	e. Readjust oil pressure if necessary.
	f. Relief valve stuck open.	f. Remove, clean, and reinstall.
11. Poor engine idle cut-off.	a. Engine getting fuel.	a. Check fuel control for being in full IDLE CUT-OFF position. Check auxiliary pump for being OFF. Check for leaking fuel manifold valve. Replace defective components.

GENERAL - MAINTENANCE PRACTICES

ENGINE REMOVAL (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D10097, D-10120 AND AFTER; E-1111, E-1241 AND AFTER)

CAUTION: *Care should be taken when removing and installing the engine that no dirt or foreign objects, be allowed to enter the induction system. Be careful not to damage duct work when removing and installing the engine.*

a. Check that the ignition switch is in the OFF position.

WARNING: To be safe, treat all magnetos as hot. To ground the magneto, disconnect the ignition switch lead wire at the capacitor and ground the capacitor pole. If this is impractical, remove the ignition harness on the magneto or disconnect the spark plug leads.

b. Remove the engine cowling. Refer to Chapter 71-10-00.

c. Drain the engine oil sump.

d. Remove the propeller. Refer to Chapter 61-10-00.

e. Disconnect and identify the ducts, engine controls, plumbing and wiring harness. Cap all open lines and fittings.

f. Place a support under the tail of the airplane.

g. Place the engine hoist in position and attach to the lifting eyes on the engine.

h. Hoist the engine sufficiently to remove the tension from the shock mount bolts.

i. Remove the shock mount bolts.

NOTE: It is recommended that the shock mounts be replaced at each engine change. Replace the mounts as a complete set. All the shock mounts on a particular engine should be of the same manufacturer.

j. Position the engine slightly nose down and hoist slowly, making certain that the engine crankshaft flange clears the nose cowl.

CAUTION: *As the engine is hoisted away from the cowl, check to make sure that all wires, hoses and lines have been disconnected.*

ENGINE INSTALLATION (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D10097, D-10120 AND AFTER; E-1111, E-1241 AND AFTER)

a. Observe the WARNINGS, CAUTIONS, and NOTES as noted in ENGINE REMOVAL.

b. Position the engine hoist and attach the hoisting sling to the engine.

c. Move the hoist into position in front of the airplane. Position the engine slightly nose down and lower slowly, making certain the engine crankshaft flange clears the nose cowl.

d. Align the shock mount bolt holes and install the shock mounts and bonding strap. Torque the four engine mount bolts 300 to 350 in-lbs.

e. Disconnect the hoisting sling and move the hoist clear of the airplane.

f. Uncap all lines and fittings and connect the ducts, engine controls, plumbing and wiring harness.

g. Adjust all engine controls.

h. Install the propeller. Refer to PROPELLER INSTALLATION procedure in Chapter 61-10-00.

i. Install the engine cowling.

j. Perform an engine run-up as described in this chapter.

k. Complete the final adjustments.

NOTE: If a new or newly overhauled engine has been installed, the engine must be depreserved and serviced.

ENGINE REMOVAL (EA-11 AND AFTER)

CAUTION: *The magnetos should be considered hot when the ground lead is disconnected. To avoid accidental starting of the engine, ground the magneto by connecting a wire to the magneto switch lead and then to the engine case, or disconnect the spark plug leads.*

a. Remove the cowling as described in COWLING REMOVAL in this chapter.

b. Remove the upper portion of the nose bug by removing the screws and hinge pins.

c. Remove the propeller. Refer to PROPELLER REMOVAL procedure in Chapter 61-10-00.

d. Disconnect the heater induction tubing at the mixer valve.

e. Remove the air induction tubing between the air box and the turbocharger inlet.

f. Disconnect the exhaust stack from the turbocharger.

g. Disconnect the engine controls, plumbing, and wiring harness. Tag and label all items for reinstallation. Be sure to cap all open tubing.

h. Place a support under the tail of the airplane.

i. Place the engine hoist in position and attach to the lifting eyes on the engine.

j. Hoist the engine sufficiently to remove the tension from the shock mount bolts.

k. Remove the two front and the right rear shock mount bolts. Remove the six bolts attaching the left rear engine mount to the wheel well.

l. Carefully hoist the engine from the airplane.

CAUTION: *As the engine is hoisted away from the airplane, check to make certain that all wires, hoses and lines have been disconnected.*

ENGINE INSTALLATION (EA-11 AND AFTER)

a. Install the left rear engine mount to the engine and torque to 300 to 350 in-lbs.

b. Carefully lower the engine into the airplane.

c. Install the remaining three shock mount bolts and torque to 300 to 350 in-lbs. Install the six bolts securing the left rear mount to the wheel well. Torque these bolts to 100 to 105 in-lbs.

d. Remove the hoist from the engine.

e. Install the wiring harness, plumbing, and engine controls.

f. Connect the exhaust to the turbocharger.

g. Install the induction tubing between the air box and turbocharger.

h. Connect the heater tubing at the mixer valve.

i. Install the propeller. Refer to PROPELLER INSTALLATION procedure in Chapter 61-10-00.

j. Install the upper portion of the nose bug.

k. Install the cowling. Refer to COWLING INSTALLATION procedure.

ENGINE BUILD-UP

Engine build-up consists of the removal of accessories and equipment from the old engine and installing them on the new engine. Refer to the Continental Aircraft Engine Manuals for the proper torque values.

NOTE: Tag or identify all hoses, washers, nuts, electrical connectors, and note harness clamp locations for reinstallation on the new engine. Cap all open hoses and engine ports to prevent contamination.

AIR PRESSURE PUMP REMOVAL

NOTE: All plumbing from the intake filter to the pump and on the outlet side of the pressure pump must be thoroughly cleaned, and all the filters replaced when the pressure pump is installed or replaced.

a. Access to the air pressure pump is gained through the left hand cowl door.

b. Disconnect the necessary plumbing from the pump.

c. Remove the four attaching nuts and washers and pull the pump straight out.

AIR PRESSURE PUMP INSTALLATION

***CAUTION:** Never use an air pump which has been dropped or mishandled.*

a. Install a new gasket on the mounting pad flange.

***CAUTION:** Never jam or force the pump onto the engine mounting pad.*

b. Position the pump on the mounting pad and install the attaching nuts and washers.

c. Reinstall the plumbing.

d. Start the engine and check for leakage at the mounting flange, and check for proper operation and pressure readings.

ENGINE DRIVEN FUEL PUMP REMOVAL

a. Access to the engine-driven fuel pump is gained through the left upper cowling.

b. The fuel pump is located at the rear, in the center of the engine.

c. Disconnect the fuel plumbing and drain the fuel from the pump.

d. Remove the fuel pump cooling shroud from the pump.

e. Remove the pump retaining nuts and remove the pump.

CAUTION: *Make sure the fuel pump drive is removed with the pump.*

ENGINE DRIVEN FUEL PUMP INSTALLATION

a. Install the fuel pump with a new gasket and tighten the two retaining nuts.

b. Install the fuel pump cooling shroud.

c. Connect and tighten the fuel pump plumbing.

CAUTION: *Make sure the fuel pump drive is installed with the pump.*

GROUND RUNNING AND WARM-UP

NOTE: The engine should be pre-oiled prior to starting, with spark plugs removed to relieve the starter load. To pre-oil, connect the auxiliary power unit and crank with the starter, (not to exceed 45 seconds) until slight oil pressure is detected on the gage. Reinstall the spark plugs.

The engine cowl flaps should be open during all ground operation.

CAUTION: *After starting the engine, an oil pressure indication of 10 psi should be noted within 30 seconds in warm weather and 60 seconds in cold weather. If no pressure is noted within the specified time, stop the engine and investigate the cause. Normal oil pressure at maximum rpm should be 30-60 psi and 10 psi at idle.*

a. Head the airplane into the wind.

b. Start engine and maintain the engine speed at approximately 900 to 1,000 rpm for at least one minute in warm weather, and as required during cold weather to prevent cavitation in the pressure oil pump, and to assure adequate lubrication.

c. Advance the throttle to a setting of 1,200 rpm or slightly above and cycle the propeller two or three times to ensure lubrication of the oil transfer collar assembly and propeller governor. Use 1,200 rpm for the rest of the warm-up procedure.

d. Operate the engine on the ground with the propeller blade set at the minimum angle (high rpm) setting.

e. Maintain the cylinder head temperature between 200 to 460°F (93 to 238°C). Never allow the cylinder head temperature to exceed 460°F (238°C).

f. Extended periods of idling at low rpm may result in fouled spark plugs.

g. The mixture control should remain in the FULL RICH position unless leaning is required during the checkout.

IDLE SPEED AND MIXTURE ADJUSTMENT (CE-748, CE-772, AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER; E-1111, E-1241 THRU E-2110, EXCEPT E-1946 AND E-2104)

NOTE: Fuel flow values and procedures are referenced in Teledyne Continental Motors SID 97-3 and subsequent revisions.

a. Start and run the engine according to the warm up procedures in this chapter. Place mixture control in full rich.

b. Proceed to check the magnetos. Refer to MAGNETO DROP-OFF CHECK in Chapter 74-00-00. Maximum drop off differential should not exceed 50 rpm. If the differential is within limitations, proceed with the idle adjustment.

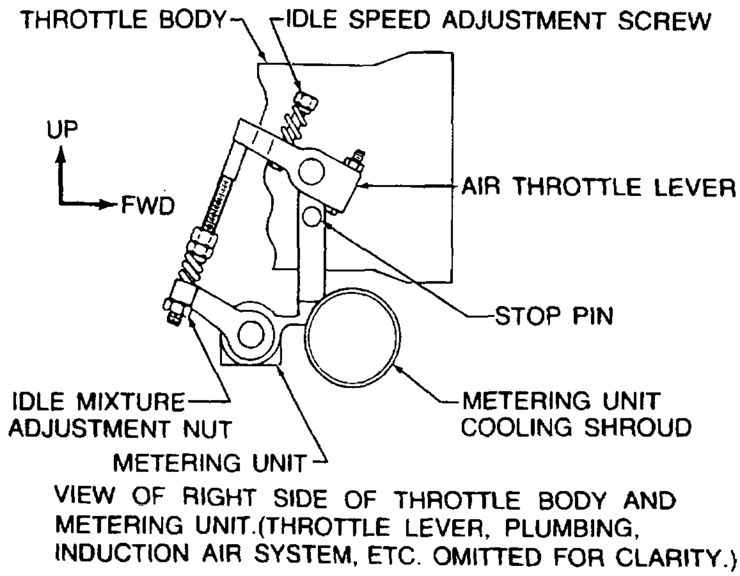
c. Slowly retard the throttle lever to the idle position. The engine tachometer should indicate 600 rpm (normal idle setting). To adjust, turn the idle speed adjusting screw at the throttle lever stop until the desired rpm is reached (Ref. Figure 1).

d. Set the pump pressure at idle rpm (Ref. Chart 2), using the relief valve adjustment screw on the aft centerline of the engine fuel pump (Ref. Figure 2). Turn the screw clockwise to increase pressure and counterclockwise to decrease pressure.

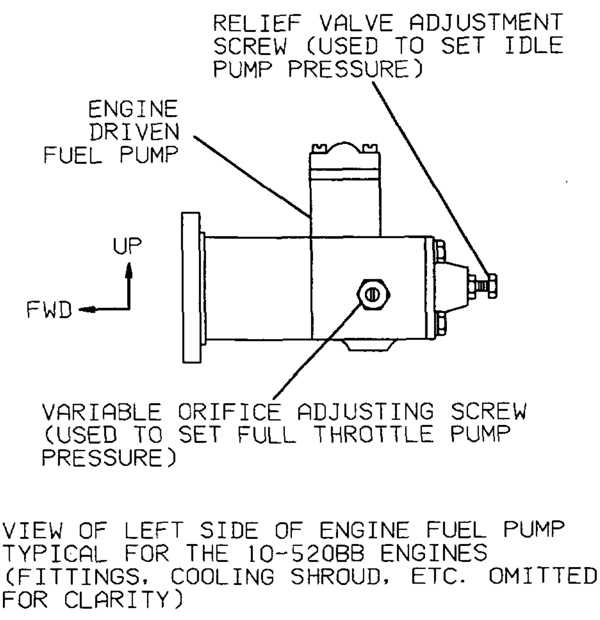
e. When the idle setting has been stabilized, move the cockpit mixture control lever with a smooth steady pull into the IDLE CUT-OFF position. Observe the rpm during the leaning out process. Adjust the idle mixture to obtain approximately 25/50 rpm gain in the idle speed as the mixture control is slowly moved toward the IDLE CUT-OFF. (If the mixture is set too lean, the idle speed will drop under the same conditions.) The idle mixture adjustment is the locknut at the metering valve end of the linkage between the metering valve and air throttle levers. Tightening the nut to shorten the linkage provides a richer mixture. A leaner mixture is obtained by backing off the nut to lengthen the linkage.

f. After each idle mixture adjustment change, clear the engine by running it up to 2,000 rpm before making a mixture check.

g. If the idle setting does not remain stable, check the idle linkage; any looseness in this linkage will cause erratic idling. In all cases, allowance should be for this effect of weather conditions upon idling adjustments.



RH Side of Throttle Body and Metering Unit
Figure 1



LH Side of IO-520-BB Engine Driven Fuel Pump
Figure 2

FULL THROTTLE ADJUSTMENT (CE-748, CE-772 AND AFTER; CJ-149 AND AFTER; D-10097, D-10120 AND AFTER; E-1111, E-1241 THRU E-2110, EXCEPT E-1946 AND E-2104)

NOTE: Fuel flow values and procedures are referenced in Teledyne Continental Motors SID 97-3 and subsequent revisions.

a. Complete the IDLE SPEED AND MIXTURE ADJUSTMENT before proceeding with this procedure.

b. With the mixture control at full rich, advance the throttle to full rated engine (2,700) rpm to check the fuel flow.

NOTE: Fuel flow values may be monitored by the fuel flow gage in the airplane or a pressure gage attached to the manifold valve.

c. (IO-520-BB) To obtain the specified values of nozzle pressure or fuel flow at full throttle and rated rpm, turn the variable orifice adjusting screw (located on the side of the pump) clockwise to increase pressure and counterclockwise to decrease pressure (Ref. Figure 2 and Chart 2).

NOTE: If the rated rpm cannot be achieved at full throttle during static run-up, adjust nozzle pressure or fuel flow slightly below limits, making certain specified values are achieved when rated rpm is achieved during takeoff roll.

IDLE SPEED AND MIXTURE ADJUSTMENT (E-1946, E-2104, E-2111 AND AFTER) (IO-550-B ENGINE)

NOTE: Fuel flow values and procedures are referenced in Teledyne Continental Motors SID 97-3 and subsequent revisions.

a. Install a pressure gage in the fuel line between the engine driven fuel pump and the metering unit. The gage will be used to monitor fuel pump idle pressure (also called unmetered pressure).

NOTE: The pressure gage should be vented to the atmosphere.

b. Start and run the engine until normal operating temperatures are attained. Refer to Pilot's Operating Handbook. Move the mixture control to full rich. The idle speed should be 625 to 650 rpm. If the engine is not idling within the specified range, change the idle-speed adjustment screw as required to obtain the proper idle speed (Ref. Figure 1). Turn the idle speed adjustment screw clockwise to increase rpm and counterclockwise to decrease rpm.

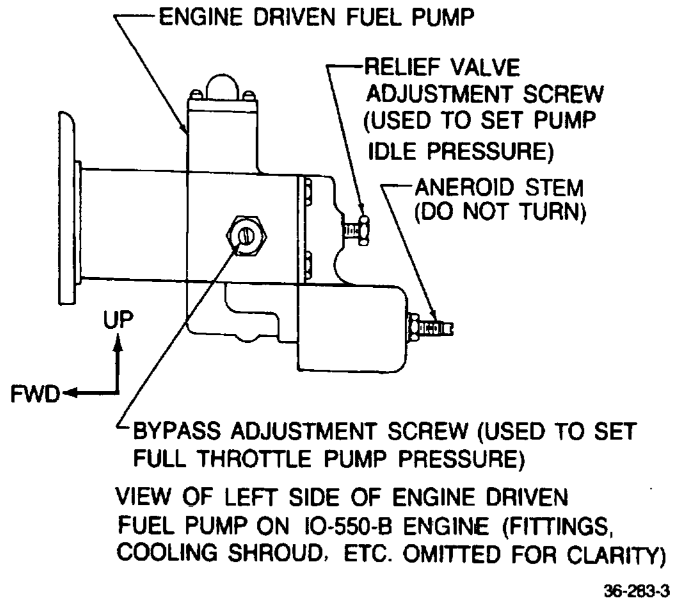
c. The engine-driven fuel pump pressure should read 9.00 to 11.00 psig (Ref. Chart 2). If adjustment is required to achieve proper fuel pump pressure, turn the relief valve adjustment screw clockwise to increase pressure and counterclockwise to decrease pressure (Ref. Figure 3).

d. Maintain the specified idle rpm and the fuel pump pressure. Adjust the idle mixture to attain a momentary gain of 25 to 50 rpm when the mixture control is moved toward the idle cutoff position. If the mixture is too lean, the rpm will drop. If it is too rich, the gain will be greater than 50 rpm. If an idle mixture adjustment is required, turn the idle mixture nut as necessary (tighten the nut to enrich the mixture or loosen the nut to lean the mixture) to obtain the correct idle mixture (Ref. Figure 1).

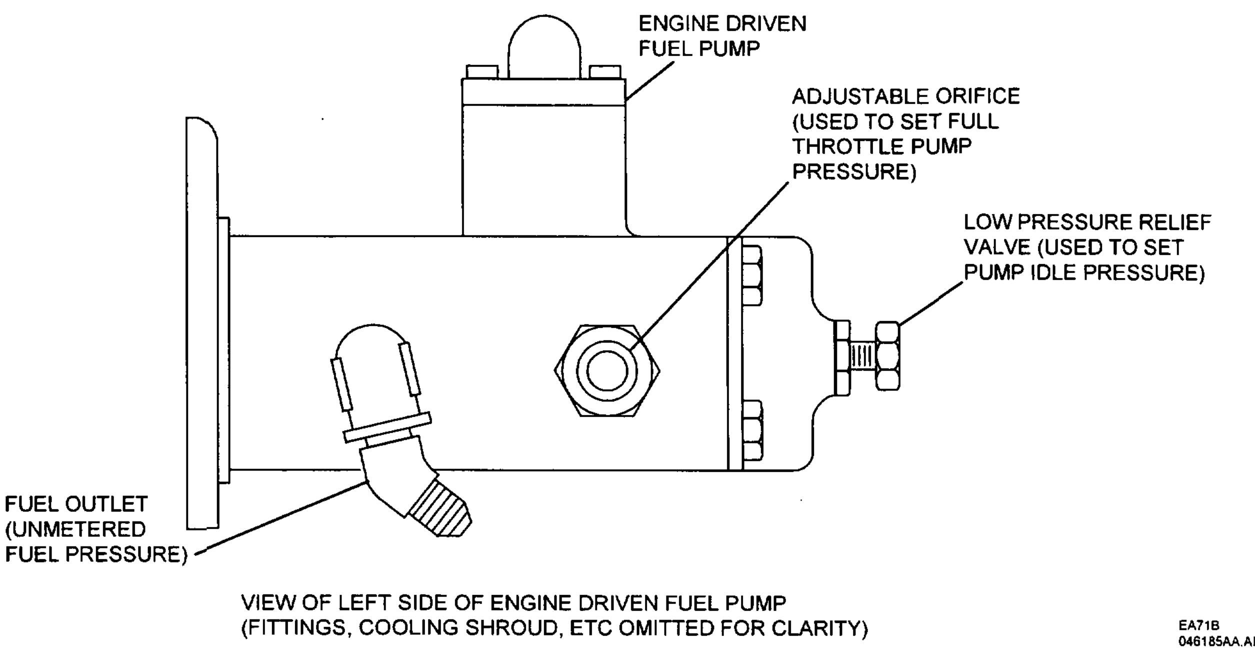
NOTE: After each idle mixture adjustment, clear the engine by running up to approximately 2,000 rpm before making the next mixture check.

Chart 2
Fuel Flow Chart *

Engine		Propeller (RPM)	Unmetered or Pump Pressure (psi)	Metered or Nozzle pressure (psi)	Fuel Flow (Lbs/Hr)	Fuel Flow (Gal/Hr)
All top end values are shown for rated RPM and manifold pressure.						
IO-520-B, BA or BB	CE-748, CE-772 and After; CJ-149 and After; D-10097, D-10120 and After; E-1111, E-1241 thru E-2110, except E-1946 and E-2104	600	9 - 11	2.3 - 3.0	-	-
		2,700	28 - 31	14.9 - 17.2	136 - 146	23.2 - 24.9
IO-550-B	(E-1946, E-2104 and E-2111 thru E-3099 without Quiet option)	625 - 650	9 - 11	-	-	-
		2,700	-	Ref. Figure 4	-	-
	(E-1946, E-2104 and E-2111 thru E-3099 with Quiet Option)	625 - 650	9 - 11	-	-	-
		2550	-	Ref. Figure 4	-	-
	(E-3100 and After without Quiet Option)	600 - 700	9 - 11	3.9 - 4.5	-	-
		2,700	29.2 - 36.2	16.5 - 18.4	146 - 156	24.9 - 26.6
	(E-3100 and After with Quiet Option)	600 - 700	9 - 11	3.9 - 4.5	-	-
		2,550	25.2 - 32.2	15.4 - 17.2	136 - 146	23.2 - 24.9
* These values taken from Teledyne Continental Motors SID 97-3.						



IO-550-B Engine Driven Fuel Pump
(E-1946, E-2104 and E-2111 thru E-3099)
Figure 3 (Sheet 1 of 2)



IO-550-B Engine Driven Fuel Pump
(E-3100 and After)
Figure 3 (Sheet 2 of 2)

FULL THROTTLE ADJUSTMENT (E-1946, E-2104, E-2111 AND AFTER) (IO-550-B ENGINE)

NOTE: Fuel flow values and procedures are referenced in Teledyne Continental Motors SID 97-3 and subsequent revisions.

a. Install a pressure gage in the line between the engine fuel flow transducer and the manifold valve to read metered fuel pressure.

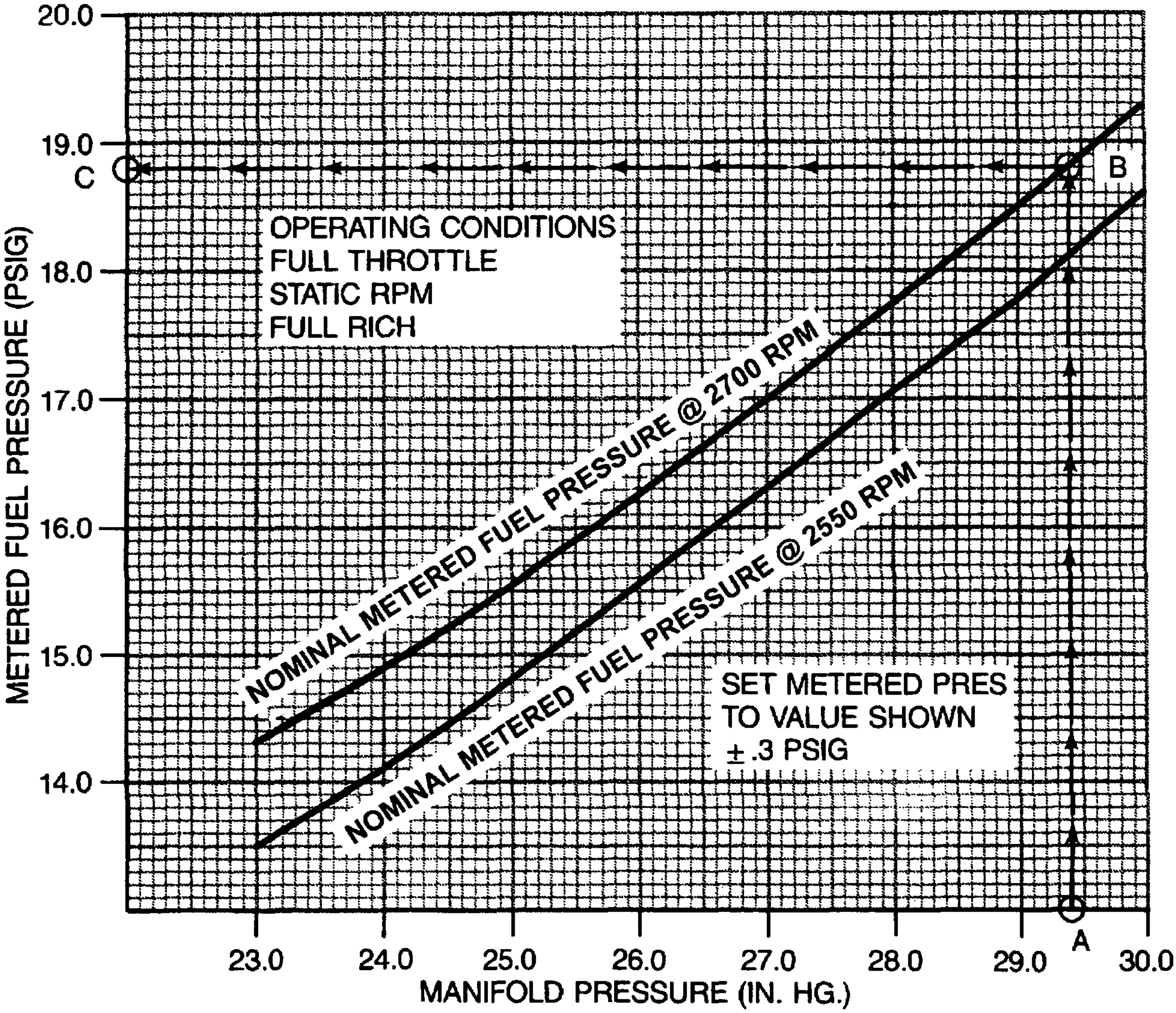
NOTE: The pressure gage should be vented to the atmosphere and mounted at approximately the same level as the manifold valve.

b. Run the engine until normal engine operating temperatures are attained.

c. With the mixture control in the full rich position, advance the throttle control to full throttle and maximum static engine rpm (2,550 for Quiet Bonanza installation) (Ref. Chart 2). Check the metered fuel pressure versus engine manifold pressure.

d. Refer to Figure 4 for determination of correct metered engine fuel pressure. If a fuel pressure adjustment is required, turn the engine-driven fuel pump bypass adjustment screw as necessary (clockwise to increase pressure or counterclockwise to decrease pressure) to obtain a correct pressure reading (Ref. Figure 3).

NOTE: This fuel pump adjustment procedure is NOT a complete procedure, but a starting point. For the complete procedure FUEL FLOW CALIBRATION AND CORRECTION (E-1946, E-2104, E-2111 AND AFTER) MUST also be completed.



LOCATE MANIFOLD PRESSURE ATTAINED DURING FULL THROTTLE STATIC RPM RUN-UP (POINT A).

AT THE POINT WHERE THE MANIFOLD PRESSURE LINE INTERSECTS THE NOMINAL METERED PRESSURE LINE (POINT B), READ METERED FUEL PRESSURE IN PSIG (POINT C).

THE POINTS A, B, AND C WHICH ARE SHOWN ARE AN EXAMPLE. THE ACTUAL POINTS A, B, AND C WILL VARY WITH ALTITUDE AND FROM AIRPLANE TO AIRPLANE.

EA71B
034177AA

Full Throttle Fuel Pressure Chart for the IO-550-B Engine
Figure 4

FUEL FLOW SYSTEM CALIBRATION AND CORRECTION (E-1946, E-2104, E-2111 AND AFTER)

NOTE: Fuel flow values and procedures are referenced in Teledyne Continental Motors SID 97-3 and subsequent revisions.

A fuel flow system calibration and correction should be obtained from the following procedure.

a. Install a Fisher Porter Flow Rator Model 10A4555S, a product of Durkin Equipment Co., 1445 Swift Avenue North, Kansas City, MO 64116 or equivalent flow meter, at a point between the fuel flow transducer and the engine fuel distributor valve. (The Fisher Porter Flow Rator must be installed in a straight vertical position in order to provide the most accurate reading.) Return the fuel from the flow rator back to the airplane fuel system through the wing filler port.

NOTE: Use an external power supply capable of providing 28.25 ± 0.25 volts for the source of electrical power.

b. Turn the airplane AUX FUEL PUMP to HI.

NOTE: The throttle and mixture levers must be in the full forward position. Use the adjustable valve to adjust the fuel flow as necessary (Ref. Figure 5).

c. Adjust the flow rator (using the adjustable valve) to the test readings in Chart 3 and record the airplane fuel flow (gph) from the fuel flow indicator on a copy of Chart 3.

d. Once an error in the airplane fuel flow hardware has been determined, determine the system correction as in the following example:

EXAMPLE:
At the 80 pph flow rate with the fuel temperature at 40°F (4°C), an airplane fuel flow indicator reads 13.0 gph. Using a fuel density of 5.9, Chart 3 shows the indicator should be reading 13.5 gph. Therefore, the instrument error is 0.5 gph low. When the airplane indicator is reading 13.0 gph, add 0.5 gph for system correction.

NOTE: This fuel flow indicator check, should be made at all six flow rates as the system error may vary as the flow rate changes.

The FULL THROTTLE ADJUSTMENT (E-1946, E-2104, E-2111 and After) procedure MUST be completed before proceeding.

e. Remove the installed flow rator and restore airplane including a leak check of the disturbed fuel lines.

WARNING: Comply with standard FAA regulations for oxygen usage when performing this test.

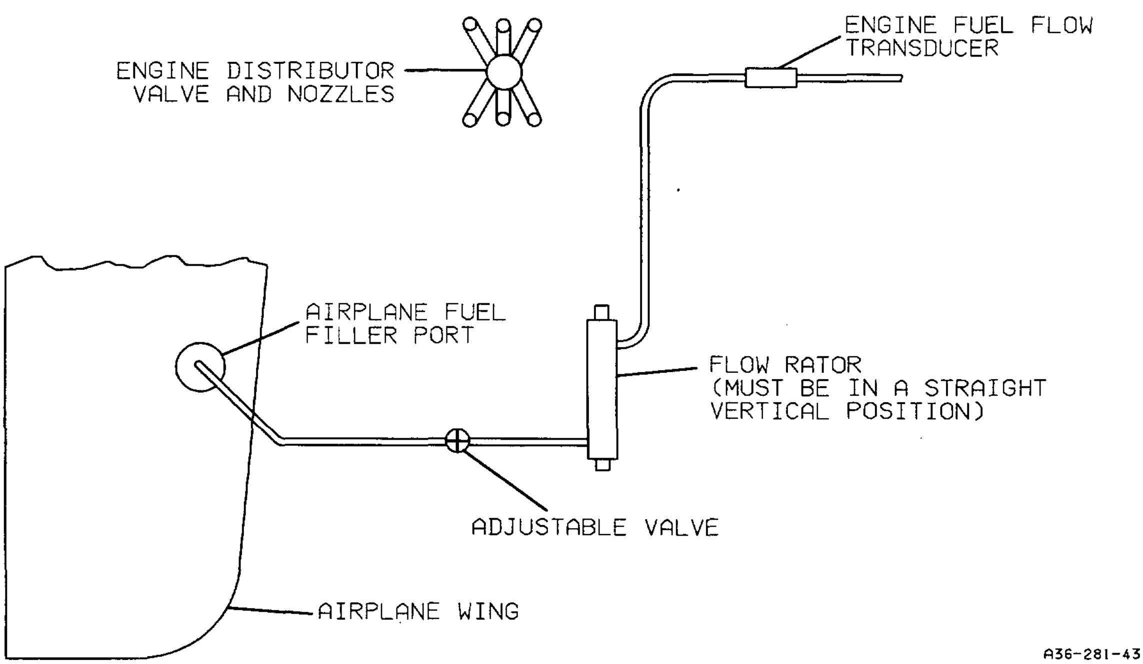
f. Flight check for proper engine fuel schedule. Establish a climb at 110 kias (knots indicated air speed)

- Throttle .... Full Forward
- Prop .... 2,700 rpm (2,550 rpm for Quiet Bonanza installation)
- Mixture .... Full Rich
- Boost Pump .... Off

g. Record the fuel flow at all pressure altitudes (altimeter set at 29.92 in. Hg) shown in Chart 4.

h. While in flight at 8,000 feet, set power to 20.5 in. manifold pressure, prop to 2,300 rpm, and mixture control to full rich. The EGT margin should be 68°F (20°C) rich of peak or greater. Next lean mixture from peak to engine roughness. The margin should be 68°F (20°C) lean of peak or greater.

i. If the corrected fuel flow does not fall within the required fuel flow limits (refer to Chart 4) or if the rich of peak margin is not obtained, readjust the metered engine fuel pressure. Refer to FULL THROTTLE ADJUSTMENT (E-2104, E-2111 and After), Step d.. Turn the engine-driven fuel pump bypass adjustment screw as necessary, clockwise to increase pressure (fuel flow) or counterclockwise to decrease pressure (fuel flow) (Ref. Figure 3). One psi is approximately equal to one gph.



Fuel Flow Calibration
Figure 5

Chart 3
Fuel Flow Testing

TEMPERATURE WHEN FUEL FLOW IS CHECKED (FUEL TEMPERATURE)__________ DEGREES F.

Flow Rator Setting in Pounds per Hour (pph)	Flow Of Fuel In Gallons per Hour (gph) Based on Density (Temperature) lbs/gal				Record Airplane Fuel Flow From Indicator (gph)	Correction to Airplane Fuel Flow System
Density	6.0	5.9	5.8	5.7		
Flow 60 pph	gph 10.0	gph 10.2	gph 10.3	gph 10.5		
Flow 80 pph	gph 13.3	gph 13.5	gph 13.8	gph 14.0	(13.0 gph in example)	(+0.5 gph in example)
Flow 90 pph	gph 15.0	gph 15.3	gph 15.5	gph 15.8		
Flow 110 pph	gph 18.3	gph 18.6	gph 19.0	gph 19.3		
Flow 120 pph	gph 20.0	gph 20.3	gph 20.7	gph 21.0		
Flow 140 pph	gph 23.3	gph 23.7	gph 24.1	gph 24.5		
Density Of Fuel Based On Temperature	20°F............6.0 lbs/gal 40°F............5.9 lbs/gal				70°F...............5.8 lbs/gal 100°F................5.7 lbs/gal	

Chart 4
Fuel Flow Limits

Pressure Altitude (Set Altimeter At 29.92 In. Hg)	Observed Fuel Flow In Flight	System Correction From Chart 3	Corrected Fuel Flow	* Required Fuel Flow (gph) IO-550-B Max. 2700 rpm	* Required Fuel Flow (gph) ** IO-550-B Max. 2550 rpm
Sea Level				23.8 to 27.4	22.6 to 25.8
2,000				22.1 to 25.2	21.0 to 24.1
4,000				20.5 to 23.8	19.3 to 22.3
6,000				18.8 to 22.3	17.6 to 20.8
8,000				17.2 to 21.0	16.0 to 19.2
10,000				15.5 to 19.7	14.3 to 17.8
12,000				13.8 to 18.2	12.6 to 16.6
14,000				12.3 to 17.0	11.1 to 15.1
16,000				10.8 to15.8	9.6 to 14.0
* Based on 6.00 lb/gal density (Av Gas @ 37°F).					
**Quiet Bonanza installation.					

FUEL SYSTEM ADJUSTMENT (EA-11 AND AFTER)

NOTE: Fuel Flow values and procedures are referenced in Teledyne Continental Motors SID 97-3 and subsequent revisions.

The engine fuel system senses turbocharger deck pressure and any change in deck pressure or manifold pressure will be accompanied by a change in fuel flow. During an overboost condition with cold oil where manifold pressure may increase 1 to 2 in. Hg over redline, a corresponding enrichment in fuel flow will be observed. This is a normal characteristic of the fuel system and is desirable to maintain mixture strength. The correct procedure is to retard the throttle to 36.0 in. Hg which will provide a corresponding decrease in fuel flow.

The fuel system on the Continental TSIO-520-U or TSIO-520-UB engines may be adjusted as follows:

a. Install a calibrated fuel pressure gage in the fuel line between the fuel pump and metering unit to monitor pump outlet pressures. This gage must be vented to atmosphere.

b. Start and run engine to bring cylinder head temperatures up to approximately 250°F (121°C).

c. Using throttle lever, set engine idle speed at approximately 600 rpm.

d. Set pump pressure at idle rpm to 5.3 to 6.5 psi using the relief adjustment screw (4) on the centerline of the fuel pump (Ref. Figure 6). Turn screw CW to increase pressure, and CCW to decrease pressure.

NOTE: After each mixture adjustment change, clear the engine by running it up to 2,000 rpm before making a mixture check.

e. Maintain the idle rpm and idle pump pressure specified above (reset as required); adjust the idle mixture screw (1) on the metering unit to obtain the desirable fuel-air ratio which will result in 25 to 50 rpm rise when the engine is leaned to best power setting with the mixture control. Turn the adjustment screw CW to lean the mixture and CCW to richen.

WARNING: To preclude the possibility of an engine compartment fire, airplanes EA-11 thru EA-146 must have a fuel drain hose connected over the mixture control screw housing boss. Route the fuel drain hose to the right hand cowling flap opening with sufficient clearance to prevent rubbing or chafing. Insure maximum clearance between the hose and the turbocharger/exhaust system.

Airplanes EA-147 and After have a small tray or shield assembly beneath the throttle body and fuel metering assembly (Ref. Figures 7 and 8). Check that the hose (approximately 2 in. long) is attached over the mixture control screw housing boss and drains into the shield assembly. Insure that a fuel drain hose(s) is attached to the shield assembly and routed to the right hand cowl flap opening with sufficient clearance to prevent rubbing or chafing. Insure maximum clearance between the hose(s) and the turbocharger/exhaust system.

NOTE: Cylinder head temperature must be 200 to 250°F (93 to 121°C) each time rpm rise is checked. Otherwise the results will be inconsistent.

f. Advance throttle to full (rated) power setting to check pump pressure and fuel flow. With approximately 2,700 rpm, full throttle and 36.0 in Hg manifold pressure, set fuel flow at 33.2 to 34.9 gallons per hour (195 to 205 lbs/hr). The full power fuel flow setting is made by using the variable orifice adjusting screw (3) located on the aft end of the fuel pump aneroid housing. Turn screw CW to decrease fuel flow and CCW to increase (jam nut must be loosened before turning screw and retightened carefully after each adjustment). Pump pressure should be 33 to 37 psi. Pump pressure values at full power are given for reference only to evaluate the functioning of other components in the fuel system.

g. After completion of item f., recheck items c., d. and e. Readjust as required.

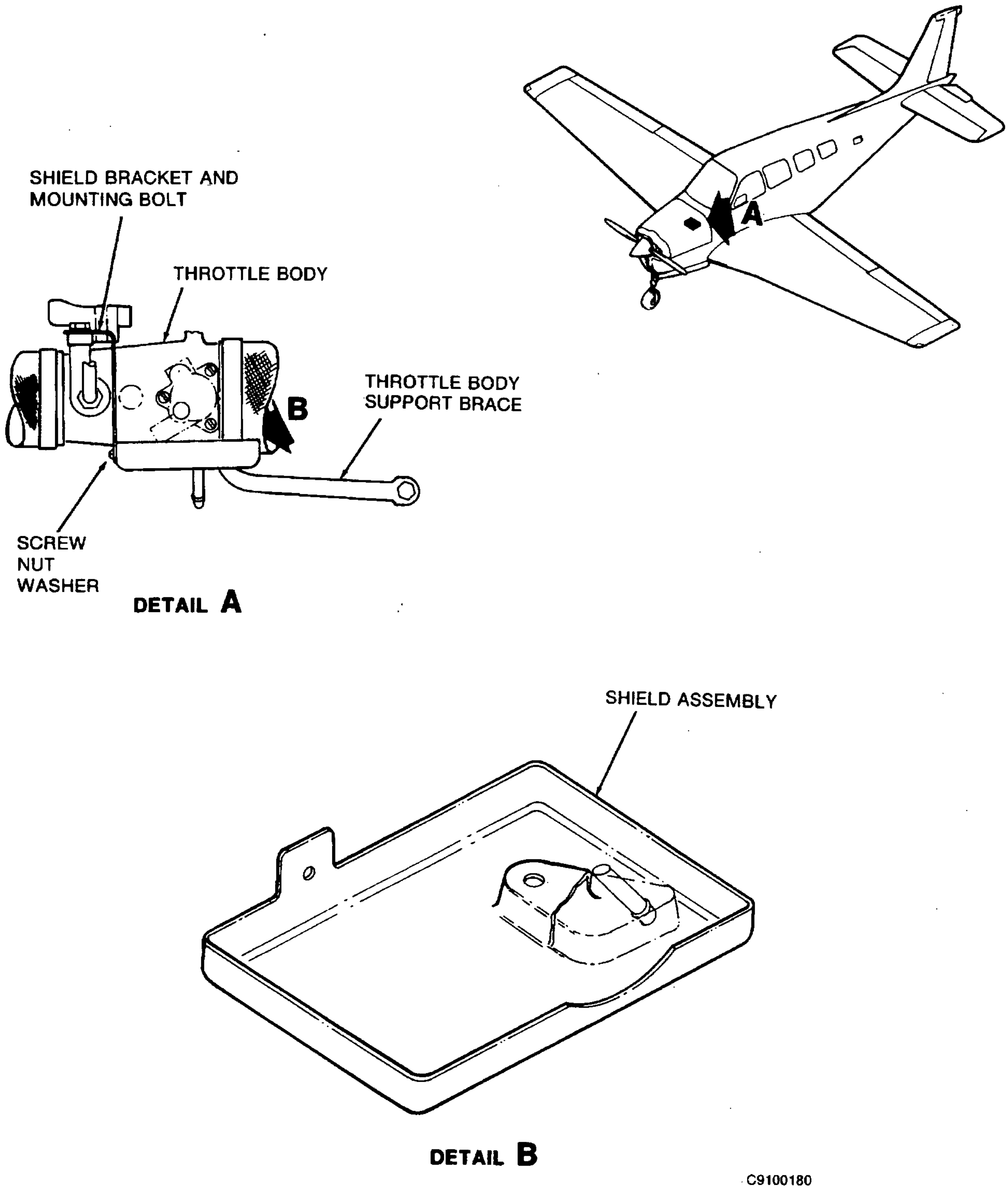
h. When fuel system is accurately adjusted, set engine idle speed to approximately 600 rpm with the idle speed adjustment screw, CW to increase, CCW to decrease (Ref. Figure 9).

i. When setting up full throttle fuel flow on a hot day (above 60°F, 15.5°C) the system should be set toward the lower flow limit. On a cold day (below 60°F, 15.5°C) the system should be set toward the higher flow limit.

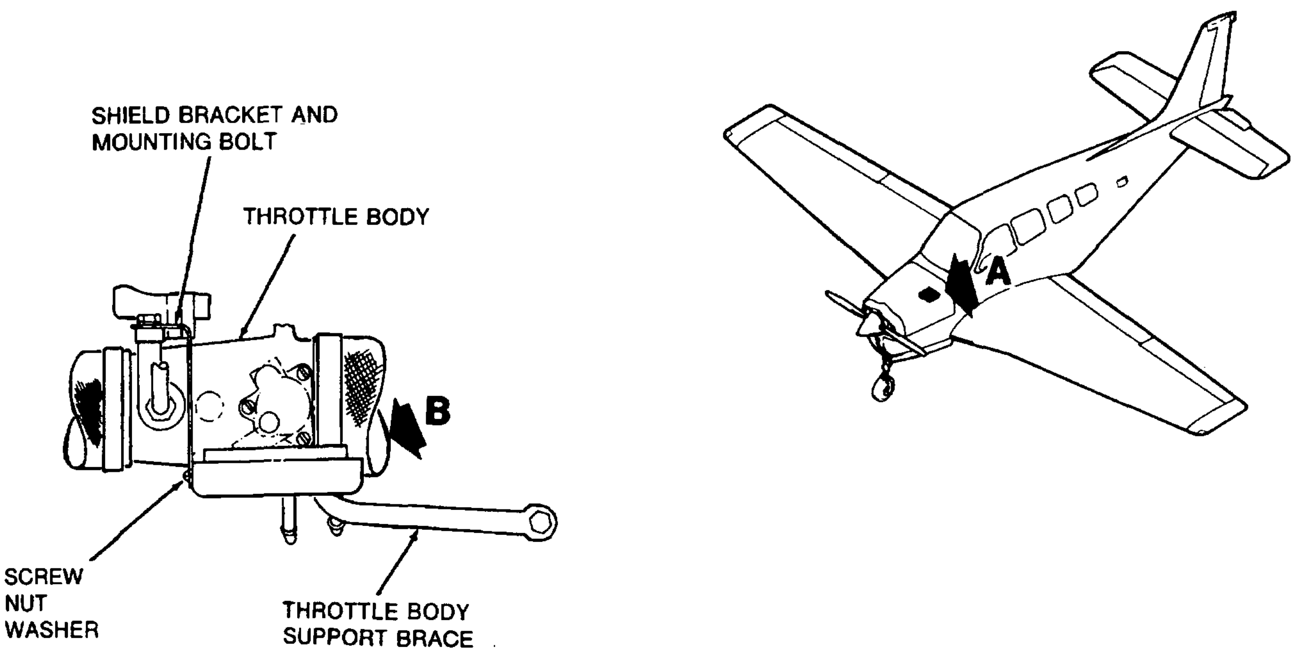
It is important that manifold pressure and fuel flow be within the prescribed limitations simultaneously during a maximum power run-up. Incorrect manifold pressure settings will cause erroneous fuel flow readings. It is also important to note the propeller speed when setting the fuel flow. If the fuel system is adjusted to the prescribed limits with 2,650 rpm during ground static run-up, an enrichment will occur when 2,700 rpm is obtained with forward aircraft speed.

j. Fly the airplane at high power settings for 10 to 15 minutes or more., then land and check the fuel flow at maximum power settings before shutting down the engine. Readjust the fuel flow to (195 to 205 pounds per hour) 33.2 to 33.9 gallons per hour with the variable orifice adjusting screw (3) as required.

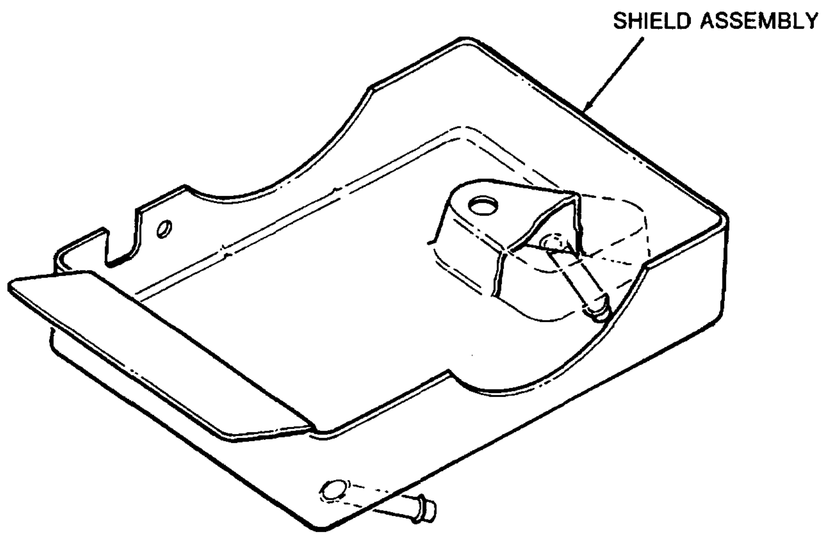
NOTE: It has been observed that fuel flow may increase up to 2 gallons per hour above the redline as the airplane approaches critical altitude. This is a normal characteristic of the Continental engine fuel system as long as the fuel flow does not exceed 36.5 gallons per hour. The correct procedure is to adjust the mixture to 34.0 gallons per hour. If the fuel flow does exceed 36.5 gallons per hour, the engine-driven fuel pump pressure should be readjusted.



Throttle Body Shield Assembly
(EA-147 thru EA-241)
Figure 6



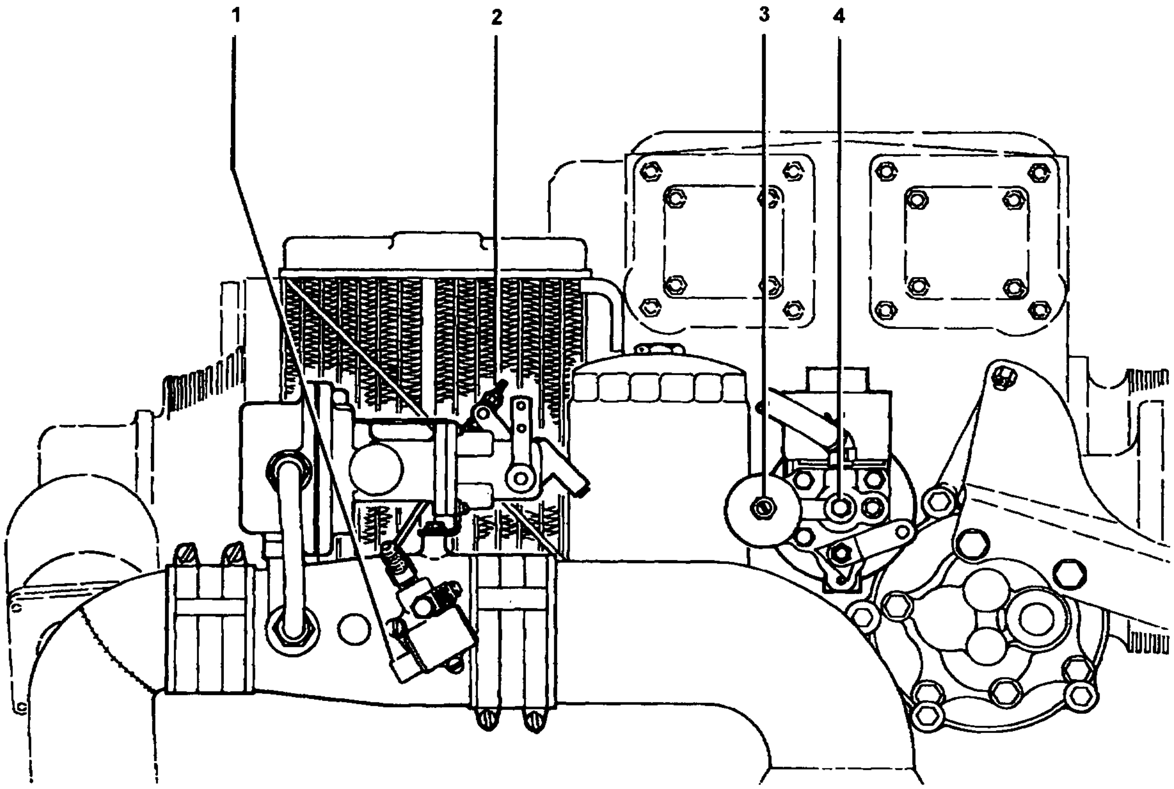
DETAIL A



DETAIL B

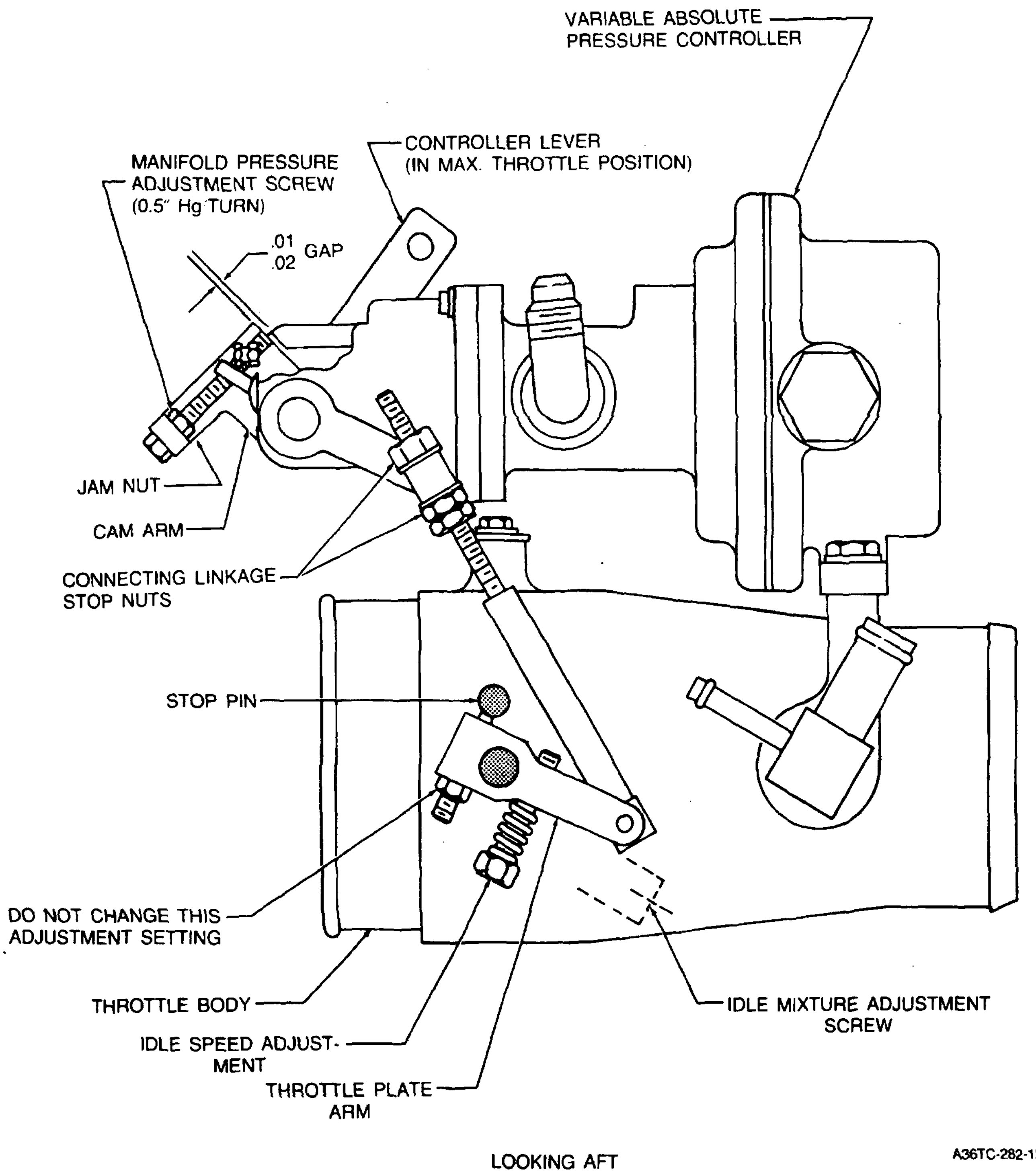
C9100179

Throttle Body Shield Assembly
(EA-242 and After)
Figure 7



INDEX
1. IDLE SPEED
2. IDLE MIXTURE
3. FULL POWER FUEL PUMP PRESSURE
4. IDLE FUEL PUMP PRESSURE

Fuel Adjustment
(EA-11 and After)
Figure 8



Throttle Body and Variable Absolute Pressure Controller
Figure 9

MANIFOLD PRESSURE ADJUSTMENT

The waste gate is controlled by engine oil pressure which is regulated by the variable absolute pressure controller. For this reason manifold pressure is quite sensitive to oil pressure and temperature as well as ambient temperatures. It has been determined that the manifold pressure will vary: (1) 0.2 in. Hg per 10°F (-12°C) change in oil temperature, (2) 0.3 in. Hg per 10 psig in oil pressure and (3) 0.05 in. Hg per 10°F (-12°C) change in ambient temperature. The best time to make adjustments is shortly after the airplane has been flown under the conditions described in Step c., the manifold pressure should be 36 in. Hg.

a. Locate the absolute variable pressure controller mounted the top of the throttle body in the left side of the engine accessory compartment.

b. Check the controller-to-throttle linkage for proper adjustment as follows:

   1. Position the controller lever to allow full travel. Ensure that the throttle push-pull cable will allow full travel.

   2. With the controller lever in the position shown and the throttle plate arm against the stop pin, adjust the connecting linkage stop nuts to a position allowing 0.01 and 0.02 inch gap between the cam arm and the controller maximum stop (Ref. Figure 9). On a new engine this adjustment should already be made by Continental Motors.

c. Start and run the engine to bring the engine oil temperature up to 160 to 180°F (71 to 82°C). Adjust the oil pressure to 40 to 50 psig (45 psig preferred) at 2,600 to 2,700 rpm.

d. After engine warm-up, advance the throttle (without turning the vernier control cable knob) to it's maximum position of 2,600 to 2,700 propeller rpm and full rich mixture. Check and (if required) adjust the manifold pressure adjustment screw on the absolute variable controller. Loosen the jam nut and rotate the adjustment screw counterclockwise to increase, or clockwise to decrease manifold pressure, then retighten the jam nut.

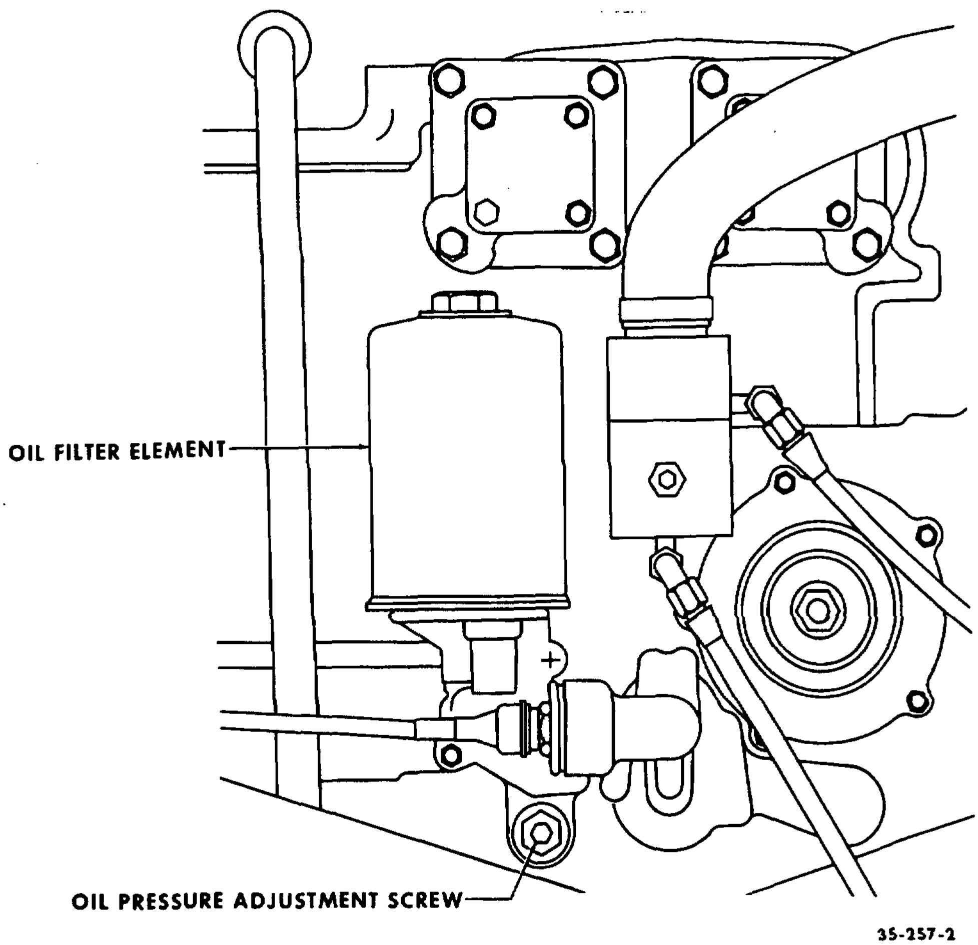
CAUTION: *Do not exceed 36 in. Hg manifold pressure.*

NOTE: If the manifold pressure is adjusted with engine oil temperature at 100°F (38°C) rather than the 160 to 180°F (71 to 82°C) recommended, a decrease in manifold pressure will occur when the oil temperature increases to the normal operating range. Under these conditions, a decrease in manifold pressure of 1 to 2 in. of Hg below the rated 36 in. Hg will occur along the corresponding decreases in fuel flow. If, on the other hand, the manifold pressure is adjusted with engine oil temperature at 230°F (110°C), a corresponding increase in manifold pressure above 36.0 in. Hg will occur on the next flight if the oil temperature is then much lower. A corresponding enrichment in full rich fuel flow above the value obtained at 36.0 in Hg will also occur since the full rich schedule is a function of both deck pressure and rpm. These characteristics must be taken into consideration when manifold pressure adjustments are made. It is important that manifold pressure and fuel flow be within the prescribed limitations simultaneously during a maximum power run up. Incorrect manifold pressure settings will cause erroneous fuel flow readings.

e. Fly the airplane 10 to 15 minutes or more at the high power settings, land and check the manifold pressure at maximum power settings before shutting off the engine. Readjust to 36.0 in. Hg as required.

OIL PRESSURE ADJUSTMENT

The oil pressure adjustment screw is located approximately 3 inches below the oil filter housing (Ref. Figure 10). To adjust, turn the adjusting screw clockwise to increase or counterclockwise to decrease the oil pressure. The oil pressure should be between 30 and 60 psi at maximum operating rpm and temperature, 50 psi at cruise rpm and 10 psi minimum at idle rpm.



Oil Pressure Adjustment
Figure 10

COWLING - MAINTENANCE PRACTICES

COWLING REMOVAL

a. Check to be sure that the engine magneto switch is in the OFF position.

b. Disconnect the necessary electrical wiring from the engine cowling.

c. Remove the bolts, spacers, and nuts at each end of the center cowling angle, and carefully remove the cowling.

COWLING INSTALLATION

a. Check to be sure that the engine magneto switch is in the OFF position.

b. Carefully place the cowling in position.

c. Secure the cowling at each end of the center cowling angle with bolts, spacers, and nuts.

d. Connect any necessary electrical wiring to the cowling.

e. Check to be sure the upper cowling will latch securely to the lower cowling when fully latched; if not, proceed with COWLING LATCH RIGGING.

COWLING LATCH RIGGING

The latch assembly on each side of the cowling consists of an outside master latch; two link rods, and two auxiliary latches located on the inside of the lower cowl; and two brackets, each containing a hook pin, on the inside of the upper cowling. Actuating the outside latch moves each link rod to operate its respective latch. The fore and aft inside latches each incorporate a set of jaws which are open only when the outside latch is placed in the fully unlatched position. The jaws remain closed in both the latched and the pre-latched positions. To rig the latches, proceed as follows:

a. Loosen the fore and aft inside Hartwell latches on their brackets and position the latches so that when the upper cowl door is lowered, the hook pin falls directly over the center of the latch. Secure the latch making sure the latch is vertically straight.

b. Open the outside latch and HOLD the latch in the fully unlatched position. The link rods should hold both sets of auxiliary latch jaws fully open in this position; if not, loosen the connecting points of the two link rods and position the rods to fully open each jaw with the outside latch held fully open. Tighten the connecting points of the two link rods.

c. Hold the latch fully open and lower the top cowl until the latch jaws are between the shoulder of the hook pins and the lip directly above the point. Release the latch to the pre-latched position.

d. Secure the hook pins in this position with the jam nuts.

e. Fully latch the cowling. There should be slight tension on the latch as it is moved from the pre-latched to the fully latched position, thus snugging down the upper cowl. The pull down tension should not be enough to bow the two link rods.

f. Final adjustment on the latch mechanism is accomplished by raising or lowering the hook pins as required to secure the cowling with the above tension.

g. Secure the hook pins in the proper position with the jam nuts, and safety wire the jam nuts together.

CAUTION

When latching the cowling, always be sure the latch jaws fully engage the shoulder of the hook pins. After latching the cowling always pull "up" on the forward and aft cowl door handles to check for security.

COWL FLAP RIGGING

a. Attach the flap control rod end to the flap.

b. Position the control arm, attached to the wheel well cover, up and forward so that the flap control rod parallels the control arm. Connect the rod to the control arm.

c. Adjust the control rod linkage so that the door pulls in snug against the opening.

NOTE

When adjusting the rod end linkage, insure proper rod end engagement by observing threads in the sight hole of the control end.

d. Set the push-pull control in the pilot's compartment to the closed position.

e. Rig the push-pull control arm assembly, at the wheel well cover (right hand side), in the forward position so that the control rod will center over the arm hinge. .00 to .06 inch overcenter is needed to prevent the cowl flaps from creeping open in flight. An amount greater than this maximum may cause the control to override center and lock.

f. Attach the control rod ball joint link to the arm assembly and pull the control to the full open position. The flap should open approximately 4 inches measured at the aft inboard end of the flap to the face of the exhaust stack flame shield.

"END"

CHAPTER

72

ENGINES

CHAPTER 72

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
72 - EFFECTIVITY/CONTENTS	1	Oct 7/83

CHAPTER 72 - ENGINE

TABLE OF CONTENTS

NOTE

For detailed information on the above subjects, refer to the Continental IO-520 Series Aircraft Engines Overhaul Manual, FORM X-30039A or TSIO-520 Series Aircraft Engines Overhaul Manual, FORM X-30042 or IO-550-B Series Aircraft Engine Overhaul Manual, FORM X-30568.

CAUTION

It is imperative that when replacement of engine components and accessories becomes necessary, all part numbers be verified to ensure that the proper part has been obtained for replacement. Incorrect part replacement may result in extensive damage to the engine.

"END"

CHAPTER

73

ENGINE FUEL AND CONTROL

CHAPTER 73 - ENGINE FUEL SYSTEMS

TABLE OF CONTENTS

SUBJECT *PAGE*

73-30-00

CHAPTER 73 - ENGINE FUEL AND CONTROL

LIST OF EFFECTIVE PAGES

FUEL FLOW INDICATING - DESCRIPTION AND OPERATION

FUEL FLOW INDICATOR

On the fuel flow systems prior to CE-929; CJ-156; D-10354; E-1766, and EA-159, the indicator in the instrument panel is teed into the fuel supply line down stream from the throttle servo. In this system the indicator converts fuel pressure to readout in fuel flow of gallons per hour.

On serials CE-929 and After; CJ-156 and After; D-10354 and After; E-1766 and After; EA-159 and After, the fuel flow system does not rely on fuel pressure to indicate fuel flow (Ref. Figure 1). In this system fuel flowing through a transducer modulates an electric signal which is directed to the fuel flow indicator in the instrument panel. The fuel flow indicator gives a readout in gallons per hour. The major components of the system are the transducer and the indicator. Engine fuel flows through the transducer then to the engine fuel distributor valve. The transducer is attached to the top of the engine crankcase, near the forward end on the center line of the engine. The indicator has dual pointers, one for fuel flow and one for manifold pressure. The circuit breaker for the fuel flow system is located in the subpanel in front of the copilot.

FUEL FLOW INDICATING - MAINTENANCE PRACTICES (CE-929 AND AFTER; CJ-156 AND AFTER; D-10354 AND AFTER; E-1766 AND AFTER; EA-159 AND AFTER)

TRANSDUCER REMOVAL

a. Remove electrical power.

b. Open the engine cowl.

c. Disconnect the electrical connector (4) (Ref Figure 2).

d. Disconnect and cap the two fuel lines (8, 3) and cap the openings on the transducer to prevent contamination.

e. Loosen clamps (6) and slide out transducer (5).

TRANSDUCER INSTALLATION

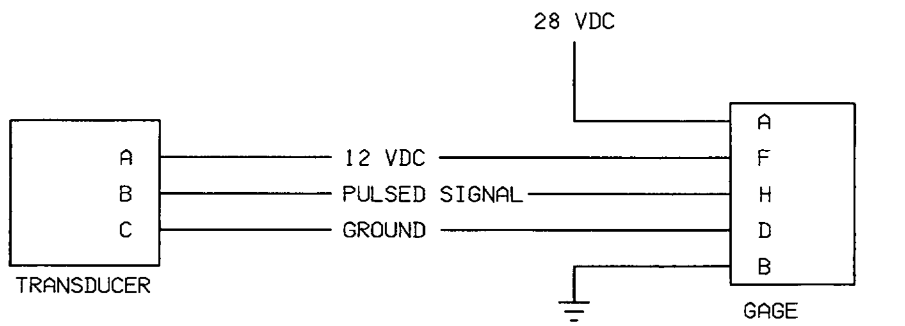
a. Slide the transducer in place and tighten the clamps (6) (Ref. Figure 2).

b. Uncap and connect the two fuel lines (8, 3) to transducer (5).

c. Connect the electrical connector (4).

d. Close the engine cowl.

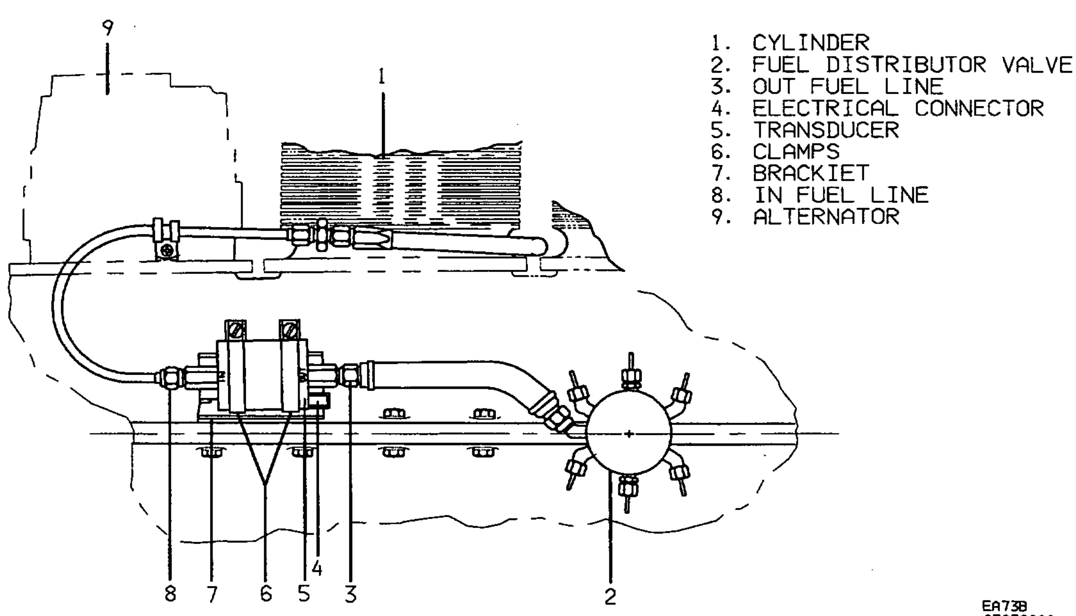
e. Restore electrical power.



PIN - A ON THE GAGE RECEIVES 28 VOLTS D.C. AIRCRAFT VOLTAGE.
PIN - A ON THE TRANSDUCER RECEIVES 12 VOLTS D.C. FROM THE GAGE.
PIN - B ON THE TRANSDUCER SENDS A PULSED SIGNAL BACK TO THE GAGE DEPENDING UPON THE FUEL FLOW SENSED BY THE TRANSDUCER.
PIN - C ON THE TRANSUCER IS THE GROUND CONNECTION TO THE GAGE PIN D.

EA73B
031761AA

Fuel Flow Indicator System
Figure 1



Transducer Removal/Installation
Figure 2

CHAPTER

74

IGNITION

CHAPTER 74 - IGNITION

TABLE OF CONTENTS

"END"

CHAPTER 74 - IGNITION

LIST OF PAGE EFFECTIVITY

GENERAL - DESCRIPTION AND OPERATION

CE-748, CE-772 and after; CJ-149 and after; D-10097, D-10120 and after; E-1111, E-1241 and after

The engine is equipped with two Bendix S6RN-1225 magnetos. Each magneto incorporates an impulse coupler. At starter cranking speeds the impulse coupler automatically retards the spark for starting purposes. Centrifugal force disengages the impulse coupling prior to reaching engine idle speed. The impulse coupler then acts as a straight drive and the magnetos fire at the normal firing position of the engine.

EA-1 through EA-439

The engine is equipped with a Bendix S6RN-1201 magneto (left side), and a Bendix S6RN-1205 magneto on the right side. This system incorporates a starter vibrator. The left magneto has two sets of points: the retard set of points is used for starting and the main set of points is used when the engine is running.

When the starter is engaged the right magneto is grounded and the left magneto (using the retarded set of points) is supplied with pulsating current from the starter vibrator, which received its current from the starter solenoid. The starter vibrator is located on the left aft side of the firewall.

EA-440 and after

The engine is equipped with two Slick 6220, impulse coupled, pressurized magnetos. Pressurizing the magnetos will prevent internal arcing which may occur in unpressurized magnetos while flying at high altitudes. The air to pressurize the magnetos is taken from the throttle body, and should be at or near sea level pressure at all times. After the pressurizing air leaves the throttle body, it passes through a filter on the way to the magnetos. This filter should be checked every 50 hours and replaced as required. If the filter is white it may be continued in service, but if it is red or contaminated the filter should be replaced.

IGNITION AND STARTER SWITCH

The combination ignition and starter switch has five positions:

OFF –	The magnetos are inoperative.
R –	The right magneto is firing its plugs; the left magneto is not firing plugs.
L –	The left magneto is firing its plugs; the right magneto is not firing plugs.
BOTH –	Both the magnetos are firing their plugs.
START –	On S6RN-1225 and Slick magnetos, the starter circuit is completed and the starter is operating. The impulse coupling is engaged to retard the spark for starting. On S6RN-1201 and S6RN-1205 magnetos, the starter solenoid is operating and the vibrator is energized causing current to flow thru the retard breaker on the left magneto while the right magneto is grounded.

TROUBLESHOOTING
IGNITION SYSTEM

INDICATION	*PROBABLE CAUSE*	*REMARKS*
1. Engine fails to start.	a. Spark plugs loose, wet, fouled, or defective.	a. Clean or replace defective spark plugs.
	b. Magneto primary ground wire short circuited.	b. Check primary ground wire between magneto and switch.
	c. Dirty, burned or pitted magneto breaker points.	c. Clean points or replace if badly burned or pitted.
	d. Moisture or oil in magneto distributor.	d. Clean magneto distributor.
	e. Internal trouble with magnetos.	e. Turn engine over and check spark jump. Replace magneto if there is no spark or if spark is weak.

TROUBLESHOOTING
IGNITION SYSTEM (Cont'd)

INDICATION	PROBABLE CAUSE	REMARKS
2. Hard starting.	a. Magneto improperly timed to engine.	a. Time magneto to engine.
	b. Magneto breaker points are not set properly.	b. Set points.
	c. Impulse coupling inoperative or late.	c. Remove access cover and check impulse coupling action.
3. Rough running engine.	a. Spark plugs loose or fouled.	a. Clean and regap spark plugs.
	b. Spark plugs, leads, or connectors oily, dirty or cracked.	b. Clean leads and connectors and replace damaged connectors.
	c. Defective ignition harness.	c. Make continuity and high voltage tests on harness. Replace harness or leads if necessary.
	d. Magnetos incorrectly timed.	d. Time magnetos to engine.
	e. Dirty or burned breaker points.	e. Clean or replace if badly burned.
4. Low power.	a. Burned or defective ignition harness.	a. Check continuity of harness and replace if necessary.
	b. Magnetos incorrectly timed.	b. Time magnetos to engine.
	c. Internal trouble with magnetos.	c. Turn engine over and check spark. Replace magneto if there is weak or no spark.

GENERAL - MAINTENANCE PRACTICES

MAGNETO DROP-OFF CHECK

The drop-off check is accomplished by switching the magneto switch from BOTH to either the RIGHT or LEFT position and noting any loss or variance in rpm.

a. Thoroughly warm-up the engine and set the propeller control in low pitch. Place the mixture control in FULL RICH.

b. Set the throttle to produce 1700 rpm.

c. Note the amount of rpm differential between the LEFT and RIGHT magnetos as the magneto switch is turned from BOTH to LEFT, back to BOTH, and then turned to the RIGHT position. The difference between the two magnetos operated individually should not exceed 50 rpm. Normal magneto drop-off on either magneto should be within 50 rpm of each other. If the magneto drop-off is excessive on either magneto (150 rpm), an inspection to determine the cause should be accomplished. Common causes are incorrectly timed magnetos, or incorrect fuel/air ratio.

NOTE

Due to the design changes in today's higher performance engines, the comparison of single magneto operation versus both magnetos is no longer a sound criteria for evaluation of magneto performance. Therefore, all magneto checks should be performed on a comparative basis between right and left magneto performance. In addition, absence of magneto drop-off should be caused for suspicion that the timing has been bumped up in advance of the specified setting.

CAUTION

To avoid fouling the spark plugs, operation on one magneto should not exceed 5 seconds.

MAGNETO POINT GAP AND TIMING

It is assumed that the magnetos have been properly internally timed and points adjusted per the applicable Bendix or Slick vendor publication. To adjust the magneto points other than that specified in the applicable vendor publication manual will alter the magneto "E gap" and cause a weak spark. This internal timing and point adjustment should not be made on the airplane. For inspection purposes the point gap may be checked when the cam follower is resting on the high point of the cam lobe. The magneto point gap should be as follows:

MAGNETO	POINT GAP IN INCHES
Bendix S6RN-1201 and S6RN-1205	
main breaker	0.016 ± 0.003
retard breaker (S6RN-1201 only)	0.016 ± 0.006
Bendix S6RN-1225	0.016 ± 0.003
Slick 6220	0.009 ± 0.001

On the magnetos the internal timing and point adjustment should be made at the time of assembly or overhaul (Bendix Timing Kit No. 11-8150-1 is available for internal timing of the magneto. Slick T100 Assembly and Timing Kit is available for Slick magnetos.)

NOTE

For adjustment of contact opening and internal timing of Bendix magnetos, refer to Bendix, for applicable manuals. Magneto contact assemblies should be checked after the first 25 and 50 hours operation and each 50 hours thereafter.

PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE

On Bendix magnetos turn the magneto drive in the direction opposite to normal rotation (this keeps the impulse couplers from engaging) (nonimpulse coupled magnetos may also be rotated opposite to normal rotation) until the respective timing mark (viewed through the inspection hole) on the distributor gear is aligned with the divided casting line of the magneto housing. Now the magneto is ready to install on the engine and to fire number 1 cylinder.

Slick magnetos may be prepared for installation on the engine as follows:

a. Insert the T-118 timing pin (or a 6 penny nail) in the R hole in the distributor block.
b. Turn the magneto drive in the direction opposite to normal rotation until the pin inserts through the hole in the gear (approximately ¼ inch).

NOTE

If the pin is binding, but will not insert into the hole in the gear, it has hit the pointer on the gear. Pull the pin out until the pointer has passed, reinstall the pin and continue rotation until the pin inserts in the hole in the gear.

c. The magneto is now ready to install on the engine and supply ignition spark to number one cylinder.
d. As soon as the magneto is installed on the engine the timing pin MUST be removed.

NOTE

If the magneto drive is rotated with the timing pin installed the magneto will be damaged.

MAGNETO PRESSURIZATION AIR FILTER

The magneto pressurization air filter is located on the top of the engine between the magnetos. This filter may be continued in service as long as it appears white and is not contaminated. The filter should be checked every 50 hours and replaced as necessary.

REMOVAL OF THE MAGNETOS

a. Remove the four screws retaining the high tension outlet and remove the outlet from the magneto.

CAUTION

Current production magnetos do not have the automatic grounding devices featured on earlier Scintilla magnetos. To be safe, treat all magnetos as hot whenever the ground lead (switch terminal) is disconnected. To ground the magneto, connect a wire to the switch lead of the magneto and ground the wire to the case.

a. Remove the grounding wire from the magneto.

b. Remove the two magneto retaining nuts and washers and pull the magneto away from the accessory case.

INSTALLATION AND TIMING OF MAGNETOS

a. Remove the lower spark plug from each cylinder.

b. Cover the lower spark plug hole of No. 1 cylinder with the thumb and turn the crankshaft until pressure is felt on the thumb.

c. Remove the plug in front of No. 6 cylinder an observe the timing marks on the alternator drive gear as the crankshaft is rotated. There are 2 marks; 1 at the 20° BTC position, and 1 at the 24° BTC position. When a position halfway between these marks is centered in the viewing hole, No. 1 cylinder is at the 22° BTC position of the compression stroke.

NOTE

Prepare the magneto for installation on the engine as described in PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE.

d. Hold the magneto in the position it will occupy when installed, and check alignment of the gear coupling slot and impulse coupling lugs. If not aligned, pull the gear out of mesh, but not out of the oil seal, and turn to correct alignment. Push the gear back into mesh.

e. Place a new gasket on the magneto flange and install the magneto carefully so drive coupling lugs mate with the slots of the drive coupling. Install holding washers, lockwashers and nuts, but tighten only enough to permit turning the magneto for final timing, without looseness.

f. Connect the timing light lead to the switch terminal (ground terminal) of each magneto. Both timing lights should be on. Tap the right magneto down until the light goes out. Secure the magnetos.

g. Turn the crankshaft a few degrees counterclockwise and bring it back again until the timing marks are aligned. At this point, both timing lights should go out at the same instant that the position halfway between the timing marks on the alternator drive gear appears in the center of the crankcase inspection hole.

h. If the timing lights do not go out at the same time, loosen the magneto that is late or early and repeat the process outlined in steps "e" and "f" above.

TIMING THE MAGNETOS TO THE ENGINE

a. Remove the top spark plug from each cylinder.

b. Remove the plug in front of No. 6 cylinder and observe the timing marks on the alternator drive gear as the crankshaft is rotated. There are 2 marks; 1 at the 20° BTC position, and 1 at the 24° BTC position. When a position halfway between these marks is centered in the viewing hole, No.1 cylinder is at the 22° BTC position of the compression stroke.

c. Rotate the crankshaft in the direction of normal rotation to bring No. 1 cylinder up on its compression stroke. If the engine is equipped with impulse coupled magnetos, continue slowly rotating the engine until the impulse couplings snap.

d. Connect a timing light to the switch terminal (ground terminal) of the right magneto and rotate the crankshaft in the direction opposite to normal rotation to a position past the timing marks on the alternator drive gear (approximately 26°).

e. Turn the crankshaft in the normal direction of rotation until the light goes out. If 22° BTC is indicated by the timing marks on the alternator drive gear, the magneto is correctly timed.

f. Repeat steps "d" and "e" for the left magneto.

g. If the magnetos are not correctly timed, proceed as follows:

1. Install the timing light on the magneto which is not properly timed.

2. Set No. 1 cylinder at 22° BTC as indicated in steps "c" through "e".

3. Loosen the magneto mounting nuts.

4. Rotate the magneto until the light just goes out.

5. Tighten the magneto mounting nuts.

INSTALLATION AND TIMING OF MAGNETOS (WITH A TIMING DISC AND POINTER)

Even though the Continental engines have factory installed timing marks, a positive top dead center (TDC) locator and timing disc similar to that provided with the "Universal Engine Timing Indicator" may be used to time the magneto to the engine or to check the accuracy of the engine timing marks. The engine should be timed to fire at 22° +0° -2° before top center (BTC).

WARNING

The magneto is grounded through the ignition switch, therefore, any time the switch (primary) wire is disconnected from the magneto, the magneto is in a switch ON or HOT condition. Before turning the propeller by hand, disconnect all spark plug leads to prevent accidental firing of the engine.

CAUTION

Current production magnetos do not have internal, automatic grounding devices. To be safe, treat all magnetos as hot whenever the ground lead is disconnected. To ground the magneto, connect a wire to the switch lead at the filter capacitor and ground the wire to the engine case.

a. To locate the compression stroke of number one cylinder, remove the lower spark plugs from each cylinder except number one cylinder. Remove the top plug from number one cylinder.

b. Place thumb of one hand over the number one cylinder spark plug hole and rotate the crankshaft in the direction of normal rotation until the compression stroke is indicated by positive pressure inside the cylinder lifting the thumb off the spark plug hole.

c. After locating the compression stroke of number 1 cylinder, locate the advanced firing position of number 1 cylinder by the use of a timing disc and pointer or the factory installed timing marks on the engine.

NOTE

On IO-520, TSIO-520 and IO-550 series engines the timing marks are located on the alternator drive gear. Remove the plug in front of number 6 cylinder to observe the TDC and advance timing marks.

In all cases, it must be definitely determined that the number one cylinder is at the correct firing position on the compression stroke, after the crankshaft is turned in its normal direction of rotation.

d. If a universal timing disc and pointer is to be used, install the TDC locator in the top spark plug hole of number 1 cylinder.

e. Slowly rotate the engine in the normal direction of rotation until the piston lightly touches the locator.

f. Install the timing disc on the propeller spinner and rotate the timing disc until 0° (TC) is located under the pointer.

g. Rotate the engine in the opposite direction to normal rotation until number 1 piston lightly touches the locator.

h. Note the reading on the timing disc. Now rotate the disc toward 0° (TC) until 1/2 the reading noted is shown.

i. Remove the TDC locator from the spark plug hole.

j. Rotate the engine in the normal direction of rotation to the compression stroke of number 1 cylinder and until the pointer arrives at the number of degrees noted last in step "h" (1/2 the first noted reading in step "h").

k. Rotate the timing disc until the pointer is positioned at 0° (TC).

l. Rotate the engine opposite the normal direction of rotation to approximately 5° beyond the specified timing for the engine being timed.

m. Rotate the engine in the normal direction to the specified before top center (BTC) firing position (this is to remove gear backlash). Further movement of the engine should not be necessary until the magnetos are installed.

NOTE

Without turning the magneto coupling, hold the magneto in the position it will occupy when installed on the engine and check alignment of engine drive coupling slot and magneto impulse coupling lugs. If not aligned, pull engine gear out of mesh (but not out of the oil seal) and turn to alignment. Push gear back into mesh.

NOTE

The magnetos were prepared for installation, to fire number 1 cylinder, in PREPARING THE MAGNETO FOR INSTALLATION ON THE ENGINE in this chapter.

n. Place new gaskets on magneto flanges and install the magnetos carefully so drive coupling lugs mate with slots of engine drive coupling. Install holding washers, lockwashers and nuts, but tighten only enough to permit turning the magnetos for final timing, without looseness.

o. Install timing lights on the magnetos.

p. With the engine still positioned to fire number 1 cylinder at the specified BTC rotate the right magneto in the direction necessary to cause the points to just break open as indicated by the timing light.

q. Secure the right magneto.

r. Repeat steps "p" and "o" on the left magneto.

s. Recheck the magneto setting to confirm the + 0° − 2° has not been exceeded.

t. Turn the engine crankshaft a few degrees in the opposite direction to normal rotation and bring it back again until the advance timing mark is under the pointer on timing disc. At this point both timing lights should indicate, at the same time, that the magneto points opened.

u. If the timing lights do not respond at the same time, loosen the magneto that is either early or late and repeat the process outlined in step "p".

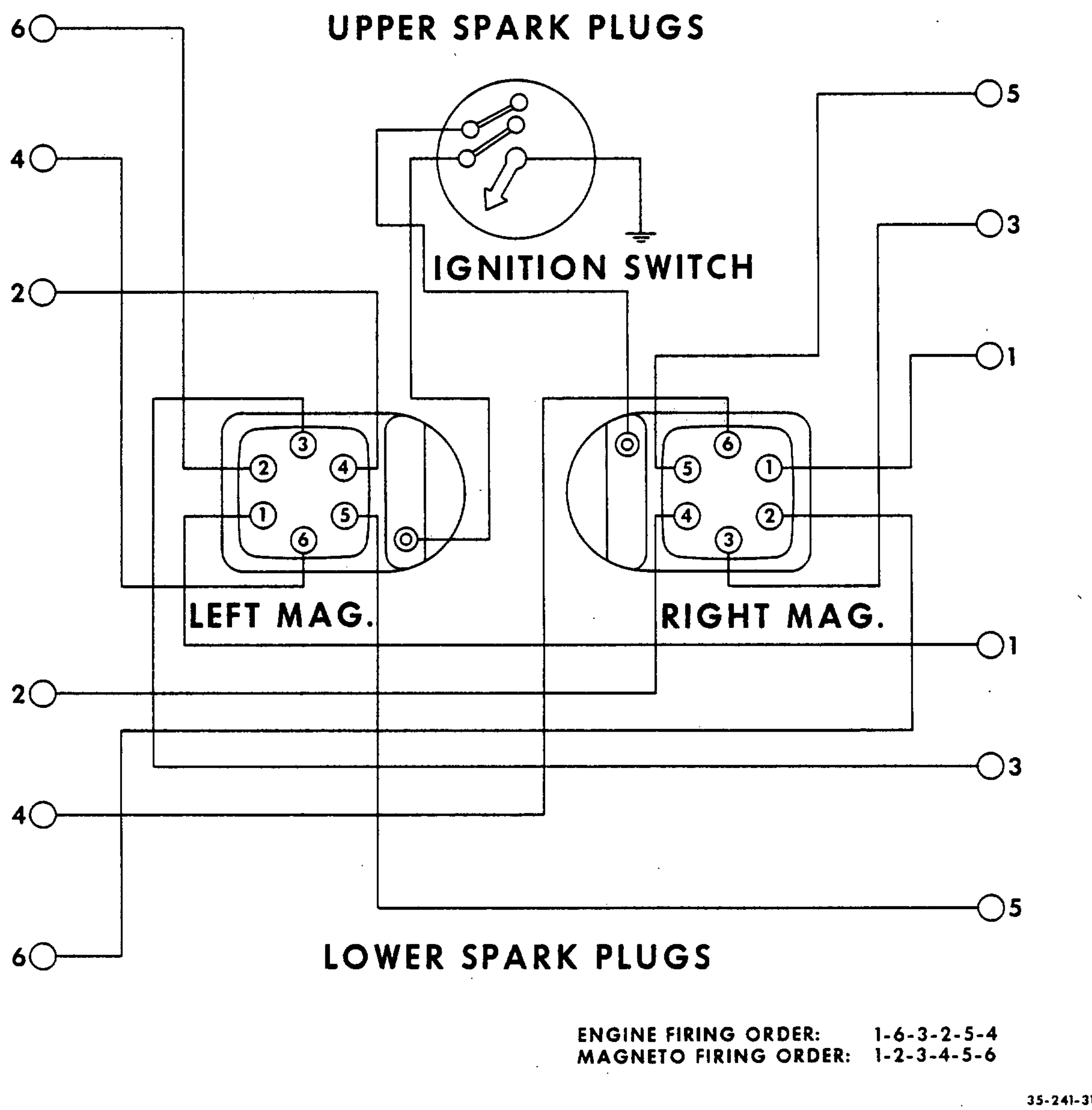
v. Remove the timing lights and reinstall the electrical leads to the magnetos.

"END"

DISTRIBUTION - MAINTENANCE PRACTICES (Figure 1)

Conventional dual ignition is provided by two magnetos. In this ignition system the left magneto fires the 1-3-5 lower and 2-4-6 top spark plugs, while the right magneto fires the 1-3-5 top and 2-4-6 lower spark plugs.

In the event that an ignition harness or an individual lead is to be replaced, consult the Magneto Wire Routing Diagram, Figure 1, to be sure that the harness is correctly installed. Mark the locations of clamps and clips to be certain that replacement is accomplished properly. For the engine firing order and magneto firing order, refer to Figure 1.



Engine Magneto Wire Routing Diagram
Figure 1

"END"

CHAPTER

77

ENGINE INDICATING

CHAPTER 77 - ENGINE INDICATING

TABLE OF CONTENTS

CHAPTER 77 - ENGINE INDICATING

LIST OF EFFECTIVE PAGES

CH-SE-SU	PAGE	DATE
77-LOEP	1	Sep 30/04
77-CONTENTS	1	Sep 30/04
77-00-00	1 and 2	Sep 30/04

GENERAL - MAINTENANCE PRACTICES (EA-11 AND AFTER)

TIT INDICATOR CALIBRATION

TIT calibration is manditory because the engine or turbocharger may be damaged by operating at excessive temperatures (operation at above a TIT of 1,650°F (900°C) is limited to 60 seconds).

CAUTION: *Damage to the turbocharger turbine blades, excessive turbine coking and excessive oil consumption may be caused by turbine inlet temperatures above 1,650°F (900°C).*

To prevent a turbine inlet over-temperature condition due to an inaccurate TIT indicator reading, the indicator should be checked every 100 hours and calibrated if required.

The following procedure may be used to check and calibrate the TIT indicator:

a. Remove the TIT probe from the turbocharger intake manifold. (Do not disconnect the wires from the probe.)

   1. On airplanes EA-320, EA-389 and After, install a ground jumper between the probe body and the engine or airframe.

b. Using the AlCal test equipment, heat the probe to 1,650°F (900°C).

c. If the TIT indicator reads 1,650°F (900°C) the indicator is properly calibrated. If the TIT indicator reading is not 1,650°F (900°C) the calibration screw must be adjusted (Ref. Figure 1 and 2).

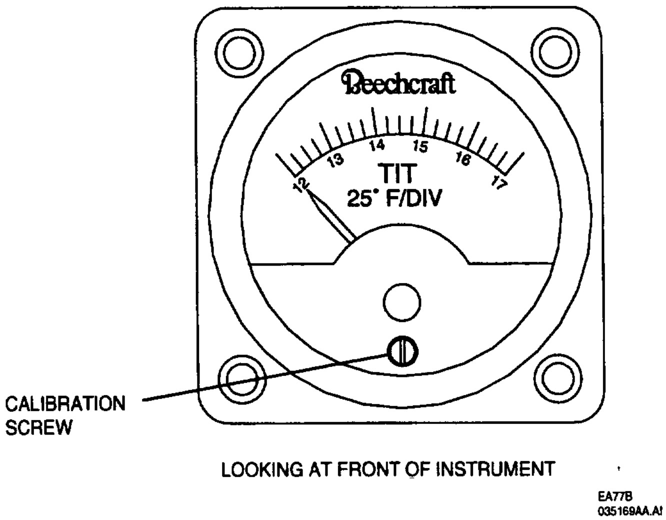
   1. On airplanes EA-11 thru EA-388, except EA-320, the calibration screw is located on the face of the TIT instrument.

   2. On airplanes EA-320, EA-389 and After, the calibration screw is located on the back of the CHT/TIT instrument.

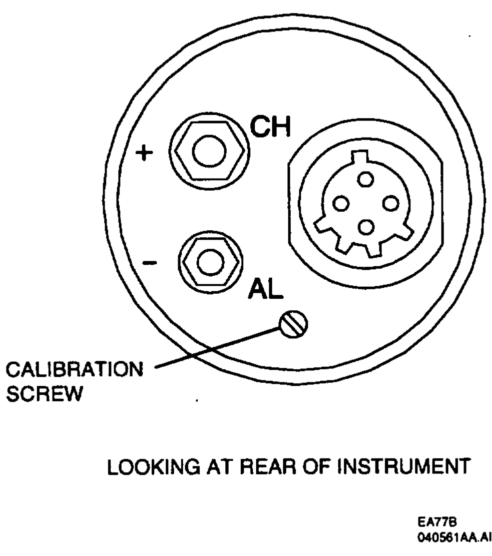
d. If the seal was broken on the calibration screw (front mounted), reseal by applying a small amount of torque seal to the calibration screw.

e. Remove ground jumper installed in Step a. 1..

f. Reinstall the probe in the turbocharger intake manifold.



TIT Indicator
(EA-11 thru EA-388, except EA-320)
Figure 1



TIT Indicator
(EA-320, EA-389 and After)
Figure 2

CHAPTER

79

OIL

CHAPTER 79

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
79-EFFECTIVITY/CONTENTS	1	Oct 7/83
77-00-00	1	Oct 7/83
	2	Oct 7/83

CHAPTER 79 - OIL

TABLE OF CONTENTS

"END"

GENERAL - DESCRIPTION AND OPERATION

The engine oil system is a full-pressure, wet sump type and has a 12-quart capacity. The oil system consists of an oil radiator and automatic thermostat bypass control, oil temperature indicator, oil pressure indicator, oil pressure relief valve, oil drain in the engine sump and an oil pump which is an integral part of the engine. The oil system operating temperatures are controlled by the automatic thermostat bypass control. The bypass control will limit oil flow through the cooler when operating temperatures are below normal and will permit the oil to bypass the cooler, should it become clogged.

GENERAL - MAINTENANCE PRACTICES

OIL SYSTEM

Servicing the engine oil system primarily involves maintaining the oil at the proper level and changing the oil and filter at the recommended intervals. Under normal operating conditions, the recommended number of operating hours between oil changes is 100 hours. When operating under adverse weather conditions, the oil should be changed more frequently. The engines should be warmed up to operating temperature to assure complete draining of the oil. The engine oil drain plug is secured with lock wire. To remove and install the engine oil filter, refer to OIL FILTER REMOVAL and OIL FILTER INSTALLATION in Chapter 12-10-00. When changing the oil and filter, always check for metal contamination in the used oil.

CAUTION

If metal contamination of the oil system is detected and the cause is corrected, the oil cooler should be replaced. In addition, flush out the system through the interconnected oil system plumbing and replace or clean any other accessories that will remain with the engine.

NOTE

Metal contamination that warrants oil cooler replacement would also warrant engine investigation.

HIGH OIL TEMPERATURE

Oil temperature is controlled by a spring loaded Vernatherm oil cooler control valve. Refer to the Engine Overhaul Manual for Vernatherm oil cooler control valve specifications. This valve will operate properly if the oil has not become contaminated with dirt or other foreign particles. If indications are that the valve is not operating properly remove the valve and clean it in solvent (16, Chart 1, 91-00-00). Also inspect the valve seat for damage. No repairs can be made to this valve and readjustments are not recommended since special testing equipment is required. The travel of the valve can be checked by immersing the valve assembly in heated water. The minimum amount of travel should be 0.090 inch as the temperature is raised from 120°F to 170°F. Replace defective valves.

OIL COOLER REMOVAL

a. Access to the oil cooler may be gained through the left cowl door.
b. Disconnect the oil temperature wire and the oil pressure line.
c. Remove the nine bolts and washers securing the baffling to the oil cooler.
d. Remove the five attaching nuts and washers, (two at the top of the oil cooler, and three at the oil cooler inlet). Remove the oil cooler.

OIL COOLER INSTALLATION

a. Install a new gasket at the oil cooler inlet.
b. Install the attaching nuts and washers.
c. Install the oil temperature wire and the oil pressure line.
d. Start the engine and check for leakage and proper operation and temperatures.

BREAK-IN ENGINE OIL

The new airplane is delivered with Rustband oil (MIL-C-6529, Type II) in the engine. This is a corrosion preventive oil and should be removed at 20 hours of operation, but no later than 25 hours of operation. If the Rustband oil is not removed at the proper time, varnish may form in the engine. Oil conforming to MIL-L-6082 may be added to the Rustband oil as necessary. After removing the Rustband oil, refill with MIL-L-6082 mineral oil which should be used until oil consumption has stabilized. After oil consumption has stabilized an ashless dispersant oil, complying with Continental Motors' Specification MHS-24B and MIL-L-22851, must be used. For several suitable engine oils, both break-in and after break-in, see the Consumable Materials Chart, Item 2, in Chapter 91-00-00.

NOTE

It is recommended to use a 75% power setting during the break-in period. Avoid over cooling caused by long power-off and/or rapid descents.

RECOMMENDED OIL GRADES FOR ENGINES

AMBIENT AIR TEMPERATURE	RECOMMENDED VISCOSITY
Above 40°F	SAE-50
Below 40°F	SAE-30 or 10W30
All temperatures	15W50 20W50

"END"

CHAPTER

80

STARTING

CHAPTER 80

LIST OF PAGE EFFECTIVITY

CHAPTER 80 - STARTING

TABLE OF CONTENTS

"END"

CRANKING - DESCRIPTION AND OPERATION

The Bonanza Series airplanes are each equipped with a 24-volt starter which engages with the engine accessory drive gear. The starter is located on the right aft side of the engine.

When the ignition switch is placed in the START position, current is supplied by the battery bus to energize the starter relay, providing high current to the starter through the relay.

TROUBLESHOOTING STARTER SYSTEM

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Starter inoperative.	a. Circuit breaker tripped.	a. Reset circuit breaker.
	b. Starter switch inoperative.	b. Check cockpit lights; if not operative, check switches and battery solenoid.
	c. Defective starter relay.	c. Check continuity of starter system.
	d. Low battery.	d. Test battery; if low, replace or start with external power.
	e. Open circuit.	e. Check continuity of circuit.
	f. Defective starting motor.	f. Check brushes, springs, condition, and commutator. Replace if necessary.

CRANKING - MAINTENANCE PRACTICES

STARTER REMOVAL

a. Access to the starter may be gained through the right hand cowl door.
b. Disconnect the electrical wiring from the starter.
c. Remove the two "palnuts", hex nuts and washers from the mounting studs, and remove the starter.

STARTER INSTALLATION

a. Install a new O-ring on the flange of the starter.
b. Position the starter on the mounting pad.
c. Install the attaching nuts and torque the nuts to 150-180 inch-pounds.
d. Secure the attaching nuts with "palnuts".
e. Connect the electrical wiring to the starter.

NOTE

Prior to attaching the starter to the engine, clean any rust, corrosion or dirt from the mounting surfaces of the starting motor and the engine. Also check all ground strap connections to make sure they are clean and tight.

f. Start the engine to check for oil seepage at the mounting flange and check for proper operation.

STARTER OVERHAUL

Refer to applicable Vendor Publications for complete tests and maintenance procedures.

STARTER LUBRICATION

No lubrication is required on the starting motor except at the time of overhaul. Soak new bearings in SAE 20 oil (2, Chart 1, 91-00-00) before installation. Saturate the felt oiling pad in the commutator end head with SAE 20 oil. Allow excess oil to drain out before installing end head on motor. Put a light film of Lubriplate #777 (15, Chart 1, 91-00-00) on the armature shaft before assembling the motor.

CAUTION

Do not clean the starter in any degreasing tank or grease dissolving solvents. Avoid excessive lubrication.

STARTER BRUSHES

The starter brushes should slide freely in the holder and make full contact on the commutator. The brushes should be replaced when they have worn to 1/4 inch or less. Proper brush spring tension with new brushes installed is 32-40 ounces. This tension is measured with a scale hooked under the brush spring near the brush and the reading taken just as the spring leaves the brush.

"END"

CHAPTER

81

TURBINES

CHAPTER 81 - TURBINES

TABLE OF CONTENTS

"END"

CHAPTER 81

LIST OF PAGE EFFECTIVITY

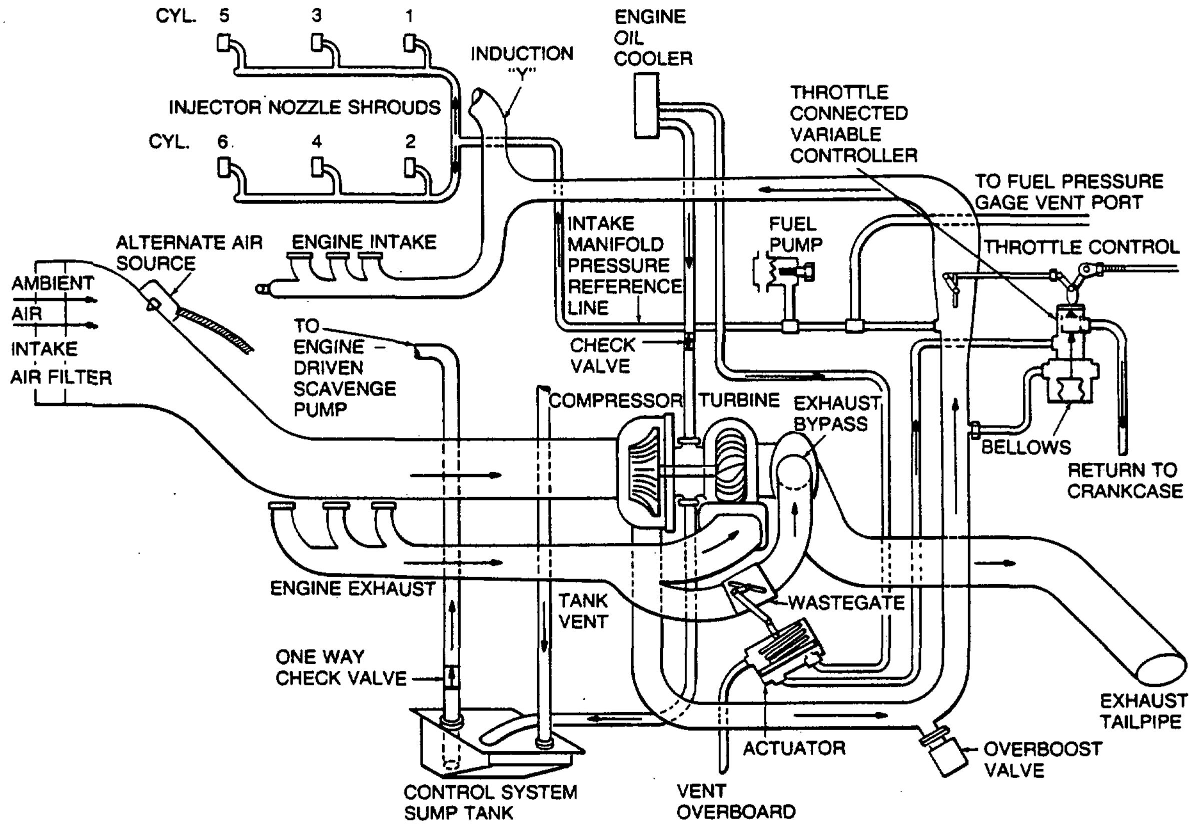
"END"

GENERAL - DESCRIPTION AND OPERATION

TURBOCHARGER SYSTEM (EA-1 and after)

The turbocharger is fully automatic, requiring no additional controls in the cockpit, and is designed to increase the power output and efficiency of the engine by supplying compressed air to the engine intake manifold. The power to drive the turbocharger is drawn from the exhaust gases passing through the turbine housing and over the turbine wheel to spin the shaft which is connected to the compressor. Ambient, filtered air is then drawn in through the air inlet duct to the compressor where it is compressed and delivered to the throttle. As the engine power output increases, the flow of exhaust gases increases resulting in a proportionate increase in speed of the rotating assembly and turbocharger output. The turbocharger system (see Figure 1) consists of an exhaust driven turbine and centrifugal compressor mounted on a common shaft. The center section of the unit contains the bearings and lubrication passages and supports the turbine and compressor housing. Lubrication to the center section is supplied by regulated engine oil pressure at the oil cooler providing a constant oil flow over the bearings. The oil then drains by gravity into the sump tank located at the lowest point in the system and is returned by scavenge pump to the engine sump. Exhaust headers, crossover pipe, turbine inlet plenum, wastegate, exhaust by-pass duct, and tail pipe make up the exhaust system.

Automatic control of the system is supplied by three principal components; the variable absolute pressure controller, the wastegate actuator and engine oil pressure. Engine oil is supplied to the inlet port of the actuator which is permanently restricted by a capillary tube. The actuator is a hydraulic cylinder with oil pressure acting against spring tension. The piston inside the cylinder with an actuating rod attached, is heavily spring loaded in the up, or retracted position. As the oil pressure increases within the chamber an expander-type seal on the piston seals the upper oil chamber from the lower chamber, forcing the piston down, against spring tension, extending the actuator rod which moves the attached wastegate butterfly toward the closed position. A decrease in oil pressure allows spring tension to return the piston, retracting the actuating rod, and returning the wastegate butterfly to the open position. Oil from the outlet oil port of the actuator is not restricted at the actuator but is pressure controlled by the variable absolute pressure controller which contains an aneroid bellows sensitive to pressure changes in the induction manifold. As the pressure it senses decreases, it expands, extending a metering pin which reduces the flow of oil through the body of the unit and increases the pressure across the actuator diaphragm forcing the piston down and moving the wastegate toward the closed position. The lower chamber of the controller equipped with an adjustable cam is linked to the throttle valve and is designed so that the controller setting is varied proportionally to the amount of power the pilot selects with the throttle by moving the metering pin seat. The compressor output is automatically controlled at a constant pressure by the variable absolute pressure controller providing the engine fuel pump and injector nozzles with the required flow and pressure at altitudes they are referenced to. The fuel flow gage diaphragm is also referenced to this pressure to prevent an erroneous reading.



Turbocharger Schematic
Figure 1

TROUBLESHOOTING TURBOCHARGER SYSTEM

INDICATION		*PROBABLE CAUSE*		*REMARKS*
1. Turbocharger inoperative.	a.	Turbocharger rotor jammed.	a.	Replace.
	b.	Controller malfunctioning.	b.	Replace.
	c.	Wastegate linkage not functioning.	c.	Adjust or replace.
	d.	Metering jet in actuator inlet blocked.	d.	Backflush with PD680 solvent (16, Chart 1, 91-00-00), 50 psi.
	e.	Turbocharger inlet blocked.	e.	Remove obstruction.
	f.	Controller pressure sensing line blocked.	f.	Remove obstruction.
2. Engine has low critical altitude.	a.	Controller out of calibration.	a.	Replace.

TROUBLESHOOTING TURBOCHARGER SYSTEM

INDICATION	PROBABLE CAUSE	REMARKS
2. Engine has low critical altitude. (Continued)	b. Controller malfunctioning.	b. Replace.
	c. Wastegate out of rig.	c. Adjust.
	d. Leak in exhaust system.	d. Eliminate any leaks.
	e. Metering jet in actuator inlet blocked.	e. Backflush with PD680 solvent, 50 psi.
	f. Controller pressure sensing line blocked.	f. Remove obstruction.
	g. Compressor discharge duct loose or leaking.	g. Eliminate any leaks.
3. Manifold pressure surges at altitude.	a. Controller malfunctioning.	a. Replace.
	b. Metering jet in actuator inlet blocked.	b. Backflush with PD680 solvent, 50 psi.
	c. Controller pressure sensing line blocked.	c. Remove obstruction.
	d. Compressor discharge duct loose or leaking.	d. Eliminate any leaks.
	e. Leak in exhaust system.	e. Eliminate any leaks.
4. Engine smokes at idle.	a. Turbocharger jammed.	a. Replace.
	b. Seal ruptured in controller.	b. Replace.
	c. Turbocharger bearing seals leaking.	c. Replace.
5. Oil leaking from actuator drain.	a. Actuator piston seal ruptured.	a. Replace.
6. High manifold pressure at take-off.	a. Controller out of calibration.	a. Replace.
	b. Controller malfunctioning.	b. Replace.
	c. Controller pressure sensing line broken.	c. Replace.
	d. Wastegate linkage not functioning.	d. Adjust or replace.

TROUBLESHOOTING TURBOCHARGER SYSTEM

INDICATION		*PROBABLE CAUSE*		*REMARKS*
6. High manifold pressure at take-off. (Continued)	e.	Controller pressure sensing line blocked.	e.	Remove obstruction.
7. Low manifold pressure at take-off.	a.	Controller out of calibration.	a.	Replace.
	b.	Controller malfunctioning.	b.	Replace.
	c.	Controller pressure sensing line blocked.	c.	Remove obstruction.
	d.	Compressor discharge duct loose or leaking.	d.	Eliminate any leaks.
	e.	Metering jet in actuator inlet blocked.	e.	Backflush with PD680 solvent, 50 psi.
	f.	Leak in exhaust system.	f.	Eliminate any leaks.
8. High fuel pressure at altitude.	a.	Leak in pressure reference line at fuel pressure line.	a.	Eliminate any leaks.
	b.	Pressure reference line blocked.	b.	Remove obstruction.
9. Low fuel pressure at altitude.	a.	Leak in pressure reference line at fuel pump.	a.	Eliminate any leaks.
	b.	Pressure reference line blocked.	b.	Remove obstruction.
	c.	Auxiliary fuel pumps not on or inoperative.	c.	Repair or replace.
10. Turbocharger overspeeding.	a.	Controller malfunctioning.	a.	Replace.
	b.	Wastegate out of rig.	b.	Adjust.
	c.	Compressor discharge duct loose or leaking.	c.	Eliminate any leaks.
11. Excessive noise or vibration.	a.	Improper bearing lubrication.	a.	Clean or replace oil line; clean oil strainer, and supply oil pressure. If trouble still persists, overhaul turbocharger.
	b.	Leaking engine intake or exhaust manifold.	b.	Tighten connections or replace manifold gaskets as necessary.
12. Engine will not deliver rated power.	a.	Clogged manifold system.	a.	Clear all ducting.

TROUBLESHOOTING TURBOCHARGER SYSTEM

INDICATION	*PROBABLE CAUSE*	*REMARKS*
12. Engine will not deliver rated power. (Continued)	b. Foreign material lodged in compressor turbine or impeller.	b. Disassemble and clean.
	c. Excessive dirt build-up in compressor.	c. Throughly clean compressor. Service air cleaner and check for leakage.
	d. Leak in engine intake or exhaust manifold.	d. Tighten connections or replace manifold gaskets as necessary.
	e. Rotating assembly bearing seizure.	e. Overhaul turbocharger.

GENERAL - MAINTENANCE PRACTICES

MANIFOLD PRESSURE ADJUSTMENT

The wastegate is controlled by engine oil pressure, which is regulated by the variable absolute pressure controller. For this reason manifold pressure is quite sensitive to oil pressure and temperature as well as ambient temperatures. It has been determined that the manifold pressure will vary: (1) 0.2 in. Hg. per 10°F change in oil temperature, (2) 0.3 in. Hg per 10 psig in oil pressure and (3) 0.05 in. Hg per 10°F change in ambient temperature. The best time to make adjustments is shortly after the airplane has been flown. Under the conditions described in step "c", the manifold pressure should be 36 in. of Hg.

a. Locate the absolute variable pressure controller mounted on the top of the throttle body in the left side of the engine accessory compartment.

b. Check the controller-to-throttle linkage for proper adjustment as follows:

1. Position the controller lever to allow full travel. Ensure that the throttle push-pull cable will allow full travel.

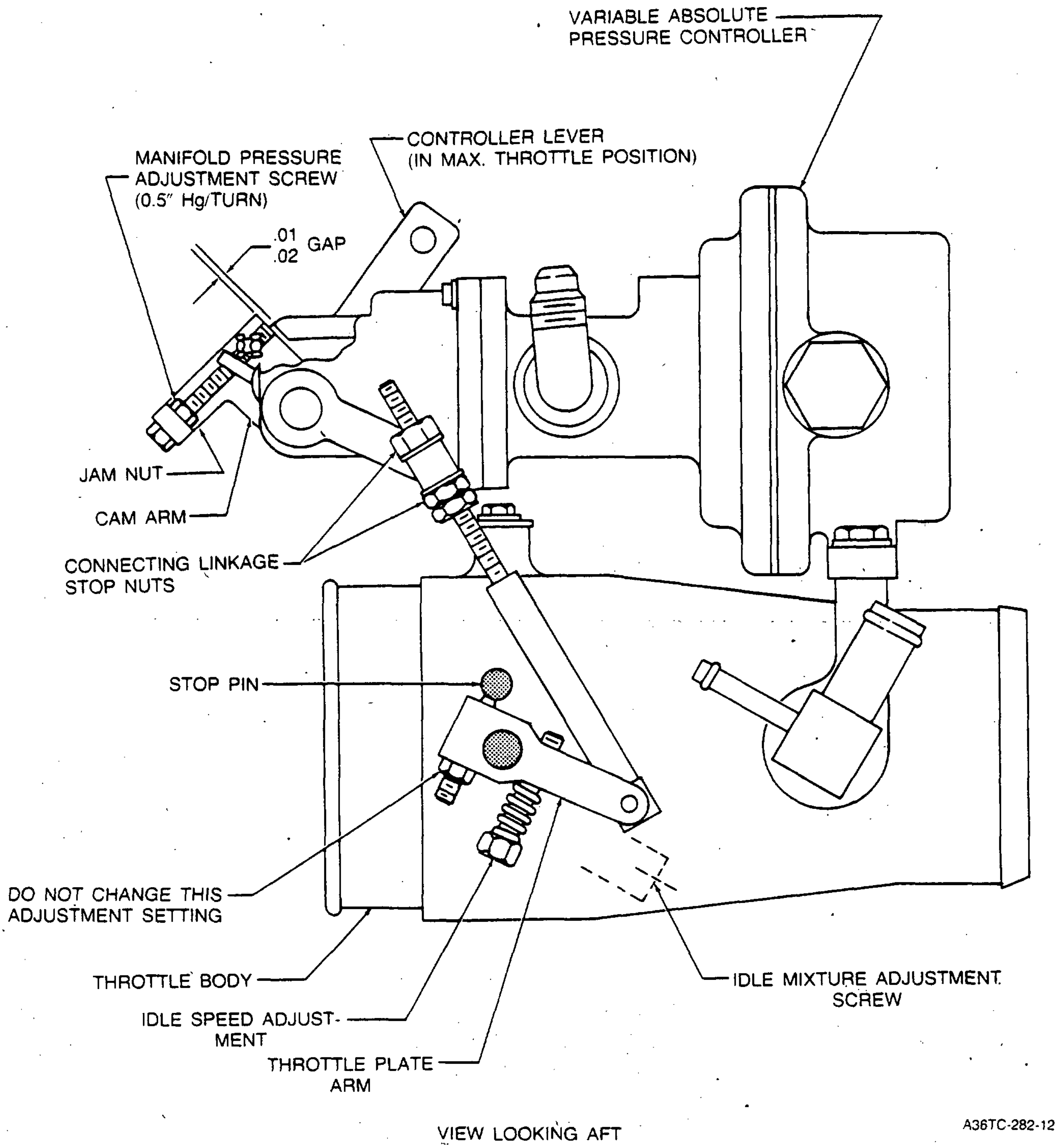
2. With the controller lever in the position shown in Figure 2 and the throttle plate arm against the stop pin, adjust the connecting linkage stop nuts to a position allowing 0.01 to 0.02 inch gap between the cam arm and the controller maximum stop (see Figure 2). On a new engine this adjustment should already be made by Continental Motors.

c. Start and run the engine to bring the engine oil temperature up to (160° to 180°F) 71° to 82°C. Adjust the oil pressure to 40 to 50 psig (45 psig preferred) at 2600 to 2700 rpm.

d. After engine warm-up, advance the throttle to its maximum position of 2600 - 2700 propeller rpm and full rich mixture. Check and (if required) adjust the manifold pressure adjustment screw on the absolute variable pressure controller. Loosen the jam nut and rotate the adjustment screw counterclockwise to increase, or clockwise to decrease manifold pressure, then retighten the jam nut.

NOTE

If the manifold pressure is adjusted with engine oil temperature at (100°F) 38°C rather than the 71° to 82°C (160° to 180°F) recommended, a decrease in manifold pressure will occur when the oil temperature increases to the normal operating range. Under these conditions, a decrease in manifold pressure of 1 to 2 in. of Hg below the rated 36 in. of Hg will occur along with a corresponding decrease in fuel flow. If, on the other hand, the manifold pressure is adjusted with engine oil temperature at (230°F) 110°C, a corresponding increase in manifold pressure above 36.0 in. Hg will occur on the next flight if the oil temperature is then much lower. A corresponding enrichment in full rich fuel flow above the value obtained at 36.0 in. Hg will also occur since the full rich schedule is a function of both deck pressure and RPM. These characteristics must be taken into consideration when manifold pressure adjustments are made. It is important that manifold pressure and fuel flow be within the prescribed limitations simultaneously during a maximum power run-up. Incorrect manifold pressure settings will cause erroneous fuel flow readings.



Throttle Body and Variable Absolute Pressure Controller
Figure 2

protective barrier on the seal surfaces. Although these deposits do restrict, and even stops shaft rotation, they are not harmful to subsequent turbocharger operation once they are removed sufficiently to give free shaft movement.

When this condition is noted, remove the exhaust discharge stack and apply WD-40 penetrating oil or Mouse Milk (40, Chart 1, 91-00-00), liberally to the area behind the wheel around the turbine shaft seal. After a few minutes, attempt to turn the shaft. A light tap on the shaft end with a soft mallet will often assist in freeing the shaft. Once the shaft is free, the engine can be started and a power check made to confirm turbocharger output either on the ground or in flight.

TURBOCHARGER REMOVAL

a. Open the engine cowl on the left side of the airplane.
b. Remove the two louvered access openings on the left side of the engine compartment.
c. Remove the heater ram air inlet duct.
d. Remove the induction tube with the relief valve, by removing the clamps and lifting the tube away from the engine.
e. Disconnect the red and yellow TIT wires.
f. Remove the heat shield from over the turbocharger.
g. Loosen the flex ducts on the turbocharger air inlet duct, and remove the air inlet duct.
h. Remove the tail pipe by removing the clamp and bolt.
i. Remove the oil lines from the turbocharger. Install dust covers.
j. Remove the inlet to heater exhaust system.
k. Remove the turbo inlet assembly above the turbocharger.
l. Remove the bolts that secure the turbocharger to the mounting bracket.
m. Remove the turbocharger through the forward access opening.

TURBOCHARGER INSTALLATION

a. Install the turbocharger through the forward access opening on the left side of the airplane.
b. Install the bolts which secure the turbocharger to the mounting bracket.
c. Install the gaskets and the turbo inlet assembly on the turbocharger.
d. Install the inlet to the heater exhaust system.
e. Remove the dust covers from the oil lines and oil ports. Install the oil lines.
f. Install the tail pipe. Tighten the V-band coupling to 40 inch-pounds. Tap the periphery of the band to distribute tension, then torque to 40 inch-pounds.
g. Install the turbocharger air inlet duct and tighten the flex duct clamps.
h. Install the heat shield over the turbocharger.
i. Connect the red and yellow TIT wires.
j. Install the induction tube which contains the relief valve. Install and tighten the clamps.
k. Install the heater ram air inlet duct.
l. Install the two louvered access openings on the left side of the engine compartment.
m. Close the cowling on the engine compartment.

TURBOCHARGER CONTROLLER REMOVAL

a. Remove the linkage to the throttle.
b. Remove the linkage to the butterfly.
c. Remove the manifold pressure reference line.
d. Remove the oil lines. Install dust covers.
e. Remove the safety wire on the two larger mounting bolts.
f. Remove the three mounting bolts.
g. Remove the turbocharger controller.

TURBOCHARGER CONTROLLER INSTALLATION

a. Place the turbocharger controller in its mounting location.
b. Install the mounting bolts.
c. Safety wire the two appropriate bolts.
d. Remove the dust covers from the oil lines and install the oil lines.
e. Install the manifold pressure reference line.
f. Install the linkage to the throttle butterfly.
g. Install the linkage to the throttle.

"END"

CAUTION

Do not exceed 36 In. Hg manifold pressure longer than 10 seconds during ground run checks.

e. Fly the airplane 10 - 15 minutes or more at high power settings, then land and check the manifold pressure at maximum power setting before shutting off the engine. Readjust to 36.0 in. Hg as required.

TURBOCHARGER LEAK TEST PROCEDURE

The turbocharger system may be checked for leaks in the induction, exhaust and air reference sections of the system as outlined in the following procedure.

a. Plug the exhaust stack with a large rubber stopper.

b. Remove the tube between the induction filter and the compressor inlet. Plug the inlet with a large rubber stopper.

c. Plug the manifold drain hose extending out the right side of the cowl opening.

d. Remove one spark plug from any cylinder and rotate the propeller until the intake valve for the cylinder is in the open position. Proceed with the test as described below. When the intake valve test is complete, rotate the propeller until the exhaust valve for the cylinder is in the open position and again test the system as described below.

e. Install a regulator valve to a shop air supply line. Apply approximately 5 psi air pressure to the turbocharger system through the spark plug port of the cylinder described in step "d".

f. The following areas of the system should be tested for leaks by applying a soap solution.

1. The hose clamps on the induction manifold of the engine.
2. The clamp at the compressor discharge outlet.
3. The clamps on the compressor discharge elbow at the throttle inlet.
4. The clamps at the throttle outlet to the riser manifold.
5. All fittings in the compressor discharge pressure reference lines to the fuel nozzles and fuel pressure gage.
6. The exhaust flanges at the cylinder exhaust ports. (With the exhaust valve in the open position.)
7. The wastegate flanges. (With the exhaust valve in the open position.)

NOTE

The wastegate flanges must be aligned correctly and care taken on assembly to prevent damage to the thin metal gaskets.

8. The turbo inlet gasket and flange bolts.
9. The clamp holding the exhaust tail.pipe to the turbo outlet.
10. The slip joint between the exhaust elbow and the turbo inlet.

NOTE

The slip joint must be a good fit. However, it will not be a leak tight joint.

11. Rigging of the wastegate in the completely closed position.

NOTE

Rigging of the wastegate is checked by removing the wastegate assembly from the exhaust bypass, plugging the oil outlet line and applying an air pressure of 40 to 50 psi to the oil inlet line of the wastegate actuator. Observe the valve movement. Adjust the linkage between the actuator and the valve to obtain a tolerance of .005 to .025 inch between the wastegate butterfly and bore.

After completing the preceding steps, remove all plugs and reassemble the induction system.

FREEING TURBOCHARGER SHAFT

Rust deposits may form in the area of the turbocharger turbine shaft piston ring seal as a result of water vapor accumulation if the airplane is subjected to short intervals of engine operation. This condition occurs only when the unit is new and combustion deposits have not formed a

CHAPTER

91

CHARTS

CHAPTER 91 - CHARTS

TABLE OF CONTENTS

SUBJECT *PAGE*

91-00-00

CHAPTER 91 - CHARTS

LIST OF EFFECTIVE PAGES

CHARTS

CONSUMABLE MATERIALS

The recommended materials listed in Chart 1 as meeting federal, military or supplier specifications are provided for reference only and are not specifically prescribed by Raytheon Aircraft Company. The products included in these charts have been tested and approved for aviation usage by Raytheon Aircraft Company, by the supplier, or by compliance with the applicable specifications. Generic or locally manufactured products which conform to the requirements of the specification listed may be used even though not included in the charts. Only the basic number of each specification is listed. No attempt has been made to update the listing to the latest revision. It is the responsibility of the technician or mechanic to determine the current revision of the applicable specification prior to usage of the product listed. This can be done by contacting the supplier of the product to be used.

Chart 1
Consumable Materials

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
1. Fuel, Engine	100LL (blue), or 100 (green)		
CAUTION: *Do not mix oils of different brands or oils of different types produced by the same manufacturer.*			
2. Engine Oils (BREAK-IN) (First 20 to 30 hours of a new or remanufactured engine)	SAE J 1966 Any approved aircraft engine oil graded at 1100 (SAE 50) or 1065 (SAE 30) Multiviscosity oil not recommended	Exxon Aviation Oil 100	Exxon Mobil L and S 3225 Gallows Rd. Fairfax, VA 22037
		Castrolaero 113 (Grade 1065)	Castrol Oil Canada Ltd., P.O. Box 3, New Toronto Postal Station, Toronto, Ontario
		Castrol Aviator S	Air BP Lubricants Div. of BP Prod. N.A. Parsippany, NJ 07054
		Aeroshell Oil 100 Aeroshell Oil 65	Shell Oil Company, 50 West 50th St., New York, NY 10020
CAUTION: *Do not mix oils of different brands or oils of different types produced by the same manufacturer.*			
(AFTER BREAK-IN)	TCM MHS-24B SAE J 1899 Any approved aircraft engine oil graded at SAE 30, SAE 50, or Multiviscosity	Phillips 66 Aviation Oil, Type A; X/C Aviation Multiviscosity Oil SAE 20W50: X/C Aviation Multiviscosity Oil SAE 25W60	Phillips Petroleum Co., Bartlesville, OK 74003

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
2. Engine Oils (AFTER BREAK-IN) (Continued)	TCM MHS-24B SAE J 1899	Aeroshell Oil W Aeroshell Oil W SAE 15W50	Shell Oil Company, 50 West 50th St., New York, NY 10020
		Conoco Aero S	Continental Oil Company, Ponca City, OK
		Texaco Aircraft Engine Oil-Premium AD	Texaco, Inc., 135 E. 42nd Street, New York, NY 10017
		Castrolaero, AD Oil	Castro Oil Canada Ltd., P.O. Box 3, New Toronto Postal Station, Toronto, Ontario
		Pennzoil Aircraft Engine Oil	Pennzoil Company, Drake Building, Oil City, PA 16301
		Sinclair Avoil	Sinclair Refining Co., 500 Fifth Ave., New York, NY 10020
		Exxon Aviation Oil EE Exxon Elite	Exxon Mobil L and S 3225 Gallows Rd. Fairfax, VA 22037
		BP Aero Oil	BP Oil Corporation, BP (North American) Ltd., 620 Fifth Avenue, New York, NY 10020
		Quaker State AD Aviation Oil	Quaker State Oil & Refining Corporation, Oil City, PA 16301
		Delta-Avoil Oil	Delta Petroleum Co., Inc., P.O. Box 10397, Jefferson, LA 70181
		Union Aircraft Engine Oil HD	Union Oil Company of California
		Gulfpride Aviation AD	Gulf Oil Corp., 439 7th Ave., P.O. Box 1166, Pittsburg, PA 15230

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
3. Corrosion Preventive Compound (Engine Oil)	MIL-C-6529 Type II	Anti-Corrode No. 205	Cities Service Oil Co., 60 Wall Tower, New York, NY
		Rust Foil No. 652-2	Franklin Oil Corp., Bedford, OH 44146
		Kendex No. 7038	Kendall Refining Co., 1177 Kendall Ave., Bradford, PA 16701
4. Preservative Oil	MIL-P-46002, Grade I	Nucle Oil 105	Daubert Chemical Co., 4700 S. Central Ave., Chicago, IL 60638
		Protect VA	Penreco 106 S. Main St. Butler, PA 16001
		Ferro-Gard 1009-G	Ranco Laboratories Inc., 3617 Brownsville Road, Pittsburgh, PA
5. Corrosion Preventive Compound, Solvent Cutback, Cold-Application	MIL-C-16173, Grade II	Braycote 137	Bray Oil Co., 1925 Marianna St., Los Angeles, CA 90032
		Petrotech 1-4	Penreco P.O. Box 671, Butler, PA 16001
		Valvoline TECTYL 890	Ashland Oil Co., 1409 Winchester Ave., Ashland, KY 41101
		Turco 5351	Turco Products, Inc., Division of Purex Corp., Inc., 26400 South Main, Wilmington, CA 90746
6. Grease, Automotive	MIL-G-10924	Shell A and A Grease	Shell Oil Co., One Shell Plaza P.O. Box 2463 Houston, TX 77001
		Cato Code 5210	Cato Oil & Grease Co., Inc., P.O. Box 26868, Oklahoma City, OK 73126

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
6. Grease, Automotive (Continued)		SA8263242	Southwest Petro Chem Inc., 1400 S. Harrison, Olathe, KS 66061
		Sunoco C-352-EP	Sun Oil Company, P.O. Box 426, Marcus Hook, PA 19061
7. Refrigerant, Air Conditioner (Charging)	R-12	Racon 12	Racon Inc., 6040 S. Ridge Road, Wichita, KS 67215
		Genetron 12	Allied Chemicals Corp., P.O. Box 4000R, Morristown, NJ 07960
		Freon 12	DuPont E I De Nemours and Company, Inc., Organic Chemicals Dept., 1007 Market Street, Wilmington, DE 19898
8. 500 Viscosity Oil, (R-12 Air Conditioner Compressor)		Suniso 5GS	Virginia Chemicals Inc., 3340 W. Norfolk Road Portsmouth, VA 27303
		Texaco WF100	Texaco, Inc., 135 E. 42nd Street, New York, NY 10017
9. Hydraulic Fluid	MIL-H-5606	Brayco 756D	Bray Oil Co., 1925 Marianna St., Los Angeles, CA 90032
		PED 3565	Standard Oil of California, 225 Bush Street, San Francisco, CA 94104
10. Aviator's Breathing Oxygen	MIL-O-27210		Obtain Locally.
11. Lubricating Grease (Aircraft and Instruments, Low & High Temperature)	MIL-PRF-23827 Type I (Do not use MIL-PRF-23827 Type II grease)	Mobilgrease 27 Royco 27	Exxon Mobil Corp., 3225 Gallows Rd., Fairfax, VA 22037-0001 Anderol, Inc., 215 Merry Lane, East Hanover, NJ 07936

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
11. Lubricating Grease (Continued)		AeroShell 33	Shell Oil Co., One Shell Plaza P.O. Box 2463 Houston, TX 77001
12. Refer to Item No. 11.			
13. Oxygen System Leak Testing Compound	MIL-L-25567		Obtain Locally.
14. Rubber Hose	MIL-H-5593		Obtain Locally.
15. Grease		Lubriplate 777	Fiske Brothers Refining Co. 129 Lockwood, Newark, NJ 07105
16. Solvent or White Spirits	PD680 Type III or British Stoddard Solvents	Stoddard Solvents (Mineral Spirits)	Obtain Locally.
17. Sealer		Presstite 576	Presstite-Keystone Engineering Co., 3900 Choteau Ave., St. Louis, MO 63110
18. Sealer		EC 1814	Minnesota Mining & Manufacturing Co., 3M Center St. Paul, MN 55101
19. Toluol (Toluene)	TT-T-548		Obtain Locally.
20. Zinc Chromate Primer	MIL-P-8585		Obtain Locally.
21. Sealer		PR-1440	Courtaulds Aerospace Inc., 5454 San Fernando Rd., Glendale, CA 91209
22. Sealer		PRI221B1/2	PRC Products Research & Chemical Corp., Burbank, CA
23. Solvent		CRC-2-26	Corrosion Reaction Consultants Inc., Philadelphia, PA
24. Resin	MIL-R-7575	Laminac 4116	American Cyanamid Co., S. Cherry St., Wallingford, CT 06492

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
25. Wash Primer		EX2016G	Ameron Industrial Coatings Division, P.O. Box 2153 Wichita, KS 67201
26. Naphtha	TT-N-95		Obtain Locally.
27. Paint Stripper		Turco 4260	Turco Products Inc., 26400 S. Main Los Angeles, CA 90646
28. Deleted			
29. Tape		No. 27 Tape	Minnesota Mining & Manufacturing Co., 3M Center St. Paul, MN 55101
30. Tape, Anti-Seize, Tetrafluoroethylene with dispenser (1-inch)	MIL-T-27730		Johnson & Johnson Inc., Permacel Division, U.S. Highway 1, New Brunswick, NJ 08901
31. Methyl Propyl Ketone			Obtain Locally.
32. Black Rubber Cement		EC678	Minnesota Mining & Manufacturing Co., 3M Center St. Paul, MN 55101
33. Acid etching primer	MIL-C-8514		Obtain Locally.
34. Refer to Item No. 25.			
35. Thinning Catalyst		T6070 Catalyst	Ameron Industrial Coatings Division, P.O. Box 2153 Wichita, KS 67201
36. Primer Base		6165 Base	U.S. Paint Lacquer & Chemical Co., 1501 No. Belmont, Wichita, KS 67208
37. Catalyst		AA-92-C-4A Catalyst	U.S. Paint Lacquer & Chemical Co., 1501 No. Belmont, Wichita, KS 67208

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
38. Urethane Primer			U.S. Paint Lacquer & Chemical Co., 1501 No. Belmont, Wichita, KS 67208
39. Sealer		Presstite 176	Presstite-Keystone Engineering Co., 3900 Choteau Ave., St. Louis, MO 63110
40. Penetrating Oil		Mouse Milk	Worldwide Aircraft Filters Corp., 1685 Abram Ct., San Leandro, CA 94577
41. Anti-seize Compound	MIL-A-907D	Anti-seize Compound C5A	Fel-Pro Inc., 7450 McCormick, Skokie, IL 60076
42. Anti-seize Compound, Graphite Petrolatum	VV-P-236		Armite Laboratories, 1845-49 Randolph St., Los Angeles, CA 90001
43. Thread Lubricant		Threadlube	Parker Appliance Co., Cleveland, OH
44. Sealer		Silastic 140	Dow Corning, S. Saginaw Road, Midland, MI 48641
45. Sealing Compound		R-134-B Perfect Seal	Ford Motor Co., Dearborn, MI
46. Grease, Aircraft General Purpose Wide Temperature Range	MIL-G-81322	Mobilgrease 28	Exxon Mobil L and S 3225 Gallows Rd. Fairfax, VA 22037
47. Refer to Item No. 73.			
48. Lubricating grease (Wheel Bearing)		Aeroshell 5	Shell Oil Co., One Shell Plaza P.O. Box 2463 Houston, TX 77001
49. Lubricant Molybdenum Disulfide Powder	MIL-M-7866	Molyikote Z	Wilco Co., 4425 Bandini Blvd. Los Angeles, CA 90023
			Moly-Paul Products Ltd., Noble Road, London, England

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
50. Silicone Compound	MIL-S-8660	DC-4	Dow Corning Corp., S. Saginaw Road, Midland, MI 48640
		Y-2136	Union Carbide 333 Woodward Ave. P.O. Box 44, Tonawanda, NY 14150
		XS 4005	General Electric Silicon Products Dept. Mechanicville Rd. Waterford, NY 12188
51. Lubricating Oil (Gear)	MIL-PRF-2105 Grade 75W	101-380016-1	Raytheon Aircraft Service Centers
		Mobil Lube SHC 75W-90	Exxon Mobil Corp., 3225 Gallows Rd. Fairfax, VA 22037-0001
		TRAXON Synthetic SAE 75W-90 Gear Oil	Petro-Canada, Lubricants Centre, 385 Southdown Road, Mississauga, Ontario L5J 2Y3
		Oriofiat W75/M	Fiat Lubricant S.P.A. Via Santena, 1 10029 Villastellone (Tornio) Italy
		Shell SPIRAX EW SAE 75W-90	Shell Oil Products US, Houston, TX 77210-4453
52. Adhesive		1300L or EC1403 (Normal Commercial Designation)	Minnesota Mining & Manufacturing Co., 3M Center St. Paul, MN 55101
53. Coating		Alodine 1200, 1200S, or 1201	Amchem Products, Inc., Spring Garden St., Ambler, PA 19002
54. Translucent Adhesive		RTV-108	General Electric Co., Silicone Products Dept., Waterford, NY 12188

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
55. Tape		No. 474	Minnesota Mining & Manufacturing Co., 3M Center, St. Paul, MN 55101
56. Primer, Epoxy-Polyamide	MIL-P-23377		U.S. Paint, Lacquer and Chemical Co., St. Louis, MO
57. Urethane Paint		Matterhorn White No. 6160	U.S. Paint, Lacquer and Chemical Co. St. Louis, MO
58. Kerosene	VV-K-211		Obtain Locally.
59. Hexane			J.T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, NJ 08865
60. Plexiglass Polish and Cleaner	P-P-560	P/N 403D	Permotex Inc., Kansas City, KS 66115
		Parko Anti-Static Polish	Park Chemical Co., 8094 Military Ave., Detroit, MI 48204
		Meguiar's MGH-10	Mirror Bright Polish Co. Inc., P.O. Box 17177 Irvine, CA 92714
61. Paste Wax		Johnson's J-Wax Paste	S.C. Johnson & Son, Inc., 1521 Howe St., Racine, WI 53403
		Simonize	Simonize Co., P.O. Box 368 Greenville, SC 29602
62. Sealing/Locking, Hydraulic		545	Loctite Corp., 705 No. Mountain Rd., Newington, CT 06111
63. Sealant, Thread		PST 592	Loctite Corp., 705 N. Mountain Rd., Newington, CT 06111
64. Air Conditioning Refrigerant	R-134a		Obtain Locally.

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
65. Oil (R-134a Air Conditioner Compressor)	RL-100S	Ester Oil	ICI Americas Inc., 3411 Silverside Road Wilmington, DE 19850
66. Adhesive/Sealant		Loctite 209	Loctite Corp., 705 N Mountain Rd., Newington, CT 06111-1411
67. Locquic Primer		Primer N	Loctite Corp., 705 N Mountain Rd., Newington, CT 06111-1411
68. Adhesive		Loctite 660	Loctite Corp., 705 N Mountain Rd., Newington, CT 06111-1411
69. Spray Lubricant		WD-40	Obtain Locally.
70. Grease	MIL-T-83483	Royco-1MS	Royal Lubricants Co. River Road Hanover, NJ 07936
71. Cleaner/Disinfectant		QS4	Brulin and Company (317) 923-3211
72. Water (Distilled)			Obtain locally.
73. Lubricating Grease (Wheel Bearing)		Mobil Aviation Grease SHC 100	Exxon Mobil Corp., 3225 Gallows Rd. Fairfax, VA 22037
74. Sealer	MIL-S-8802 Class A/B	CPS-890 Class A/B, CS-3204 Class A/B, PR-1440, or AC-236	PRC-DeSoto, 5454 San Fernando Rd., P.O. Box 1800, Glendale, CA 91209 **or** Advanced Chemistry & Technology, 950 Kingsland Ave., St. Louis, MO 63130
75. Sealer	MIL-S-8802 Type II, Class B	PR1425 Class B	PRC-DeSoto, 5454 San Fernando Rd., P.O. Box 1800, Glendale, CA 91209

Chart 1
Consumable Materials (Continued)

MATERIAL	SPECIFICATION	PRODUCT	SUPPLIER
76. Sealer	MIL-S-8802 Class B1/2	CPS-890 Class B1/2 or CS-3204 Class B1/2	PRC-DeSoto, 5454 San Fernando Rd., P.O. Box 1800, Glendale, CA 91209
77. Threadlocker		Loctite 242 (Blue)	Henkel Corp. - Industrial, 1001 Trout Brook Crossing, Rocky Hill, CT 06067
78. Grease	MIL-G-21164	AeroShell 17	Shell Oil Products US, Houston, TX 77210-4453
79. Lubricant	MIL-PRF-32033	Brayco 300	Air BP Lubricants, Parsippany, NJ 07054-4406

INSTALLATION OF FLARED FITTINGS

When installing flare fittings, make sure they are properly lubricated in accordance with Chart 3. Tighten the fittings in accordance with the FLARED FITTING TORQUE CHART (Refer Chapter 20-06-00, Chart 1). Do not overtighten.

Chart 2
Flared Fitting Torque Chart (in-lbs)

Chart 2 moved. Refer to Chapter 20-06-00, Chart 1.

Chart 3
Thread Lubricants

Type of Line	Type of Thread	Type of Lubricant, Item, Chart 1
Hydraulic		MIL-H-5606
		Loctite 545
Fuel	Alum, Brass, Steel	VV-P-236
Oil	Alum, Brass, Steel	VV-P-236
Oxygen	Tapered	MIL-T-27730 Size 1
	Straight	None
Pitot and Static	Tapered	Loctite 592
	Straight	None
Refrigerant R-12		Sunisco 5 GS or WF-100
Refrigerant R-134a		RL-100S Ester Oil

NOTE: Lubricate engine fittings only with the fluid that will flow through the lines. Air lines are not to be lubricated.

Chart 4
Torquing Coarse Threaded Bolts Loaded in Shear

Chart 4 moved. Refer to Chapter 20-01-00, Chart 2.

Chart 5
Fine Threaded Series, Class 3, Cadmium Plated and Non Lubricated (except as noted)

Chart 5 moved. Refer to Chapter 20-01-00, Chart 1.