

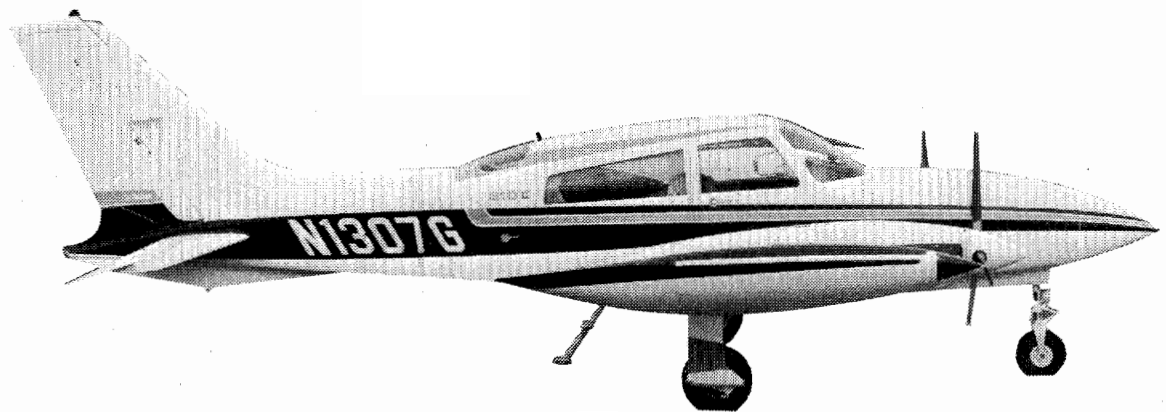
Cessna

Models

310R

And

TURBO 310R



**SERVICE
MANUAL**

ORIGINAL ISSUE OCTOBER 1974

CHANGE 1 MARCH 1975

CESSNA AIRCRAFT COMPANY, WALLACE DIVISION, BOX 1977, WICHITA, KANSAS, 67201

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*Contents	6 Blank		Contents-3	1 thru 2	Oct/74
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- - -	Blank	Oct/74	3-10	12 thru 13	Oct/74
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7-00	5	Oct/74	7-41	4 Blank	Oct/74
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7-10	6 thru 10	Oct/74	7-90	1 thru 2	Oct/74
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*7-11	3	Mar/75	- - -	Blank	Oct/74
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7-12	1 thru 2	Oct/74	*8-00	1	Mar/75
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7-14	1	Oct/74	*8-00	5	Mar/75
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*15-40	5 thru 32	Mar/75
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INTRODUCTION

1. Foreword

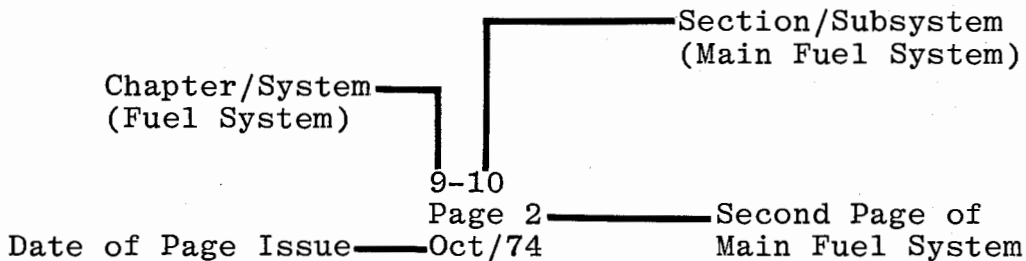
- A. This Service Manual contains factory recommended procedures for ground handling, servicing and maintaining the Cessna 310 Series Aircraft. Where reference is made to the 310 aircraft in this Service Manual, this reference applies to the 310R and Turbo 310R certified aircraft. This Service manual also describes the Cessna 310R II and Turbo 310R II which are the same as the Cessna 310R and Turbo 310R with some optional equipment installed as standard. Where there are specific differences, reference will be made to the individual aircraft. Besides serving as a reference for the experienced mechanic, this Service Manual also covers step-by-step procedures for the less experienced mechanic. This Service Manual should be kept in a handy place for ready reference. If properly used, it will better enable the mechanic to maintain the Cessna 310 Series Aircraft and thereby, establish a reputation for reliable service.
- B. The information in this Service Manual is based on data available at the time of publication, and is supplemented and kept current by Service Letters and Service News Letters published by Cessna Aircraft Company. These are sent to all Cessna Dealers so that they have the latest authoritative recommendations for servicing Cessna airplanes. Therefore, it is recommended that Cessna owners utilize the knowledge and experience of the factory-trained Dealer Service Organization.
- C. In addition to the information in this Service Manual, a group of vendor publications are available from the Cessna Customer Services Department. These manuals describe complete disassembly, overhaul and parts breakdown of some of the various vendor equipment items. A listing of the available publications is issued periodically in Service Letters.

2. Using the Service Manual

- A. This Service Manual is divided into 15 Chapters. A complete Table of Contents for each Chapter can be found in the front of each applicable chapter.

B. Page Numbering System

- (1) The page numbering system used in the service manual consists of two-element numbers separated by a dash, under which the page number and date is printed.



- (2) All chapters in the manual are separated into specific types of information: description, troubleshooting, adjustment/test and maintenance practices.

3. List of Effective Pages

- A. A list of effective pages is provided in the front of the manual. All pages in the manual are listed in sequence on the effectivity pages with the most recent revision date for each page. A revised list of effectivity pages

is provided for each regular service manual revision. Pages revised or added in the current revision will be indicated by an asterisk.

4. Revision Bars

- A. Additions, or revisions to text in an existing section will be identified by a revision bar in the left-hand margin of the page adjacent to the change.
- B. When technical changes cause unchanged text to appear on a different page/pages, a revision bar will be placed in the margin opposite the page number of all affected pages providing no other revision bar appears on the page. These pages will be updated to current regular revision date.
- C. When extensive technical changes are made to text in an existing section that requires complete retype of copy, revision bars will appear full length of the page.
- D. When art in an existing illustration is revised, a pointing hand will appear in the illustration, and will point to the area of the art revision.
- E. New art added to an existing section will be identified by a single pointing hand adjacent to the figure title and figure number.
- F. Revision bars are not shown for:
 - (1) Inductory material, indexes and tabular data.
 - (2) Blank spaces which are the result of text, illustration or table deletion:
 - (3) Correction of minor inaccuracies, such as punctuation, etc., unless such a correction changes the meaning of instructive information and procedures.

5. Service Letters and Service Kits

- A. A record of Service Letters and Service Kits (SK's) prepared for the 310 aircraft is listed on the following pages.
- B. Service Letters and Service Kits (SK's) provide instructions for making modification changes to the aircraft in service.

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- C. When a Service Letter or Service Kit is initially incorporated into this Service Manual, information applicable to the change is referenced in the text or illustrations, and the Service Letter and/or Service Kit is listed under Service Letters and Service Kits on the following pages. At the first revision of the Service Manual, after the information is incorporated, the Reference Data will be eliminated from the Data Record.

SERVICE LETTERS

<u>REFERENCE DATA</u>	<u>ISSUE DATE</u>	<u>TITLE</u>	<u>INCORPORATION DATE</u>
Cessna Service Letter ME73-4 Supplement #1	11-22-74	Tip Tank Nose Cap - Fuel Seal Inspection	MAR/75
Cessna Service Letter ME75-3	1-28-75	Cabin Noise Reduc- tion	MAR/75
Cessna Service Letter ME75-5	2-18-75	Improved Fuel Line Support	MAR/75

CESSNA AIRCRAFT COMPANY

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MAINTENANCE MANUAL

SERVICE KITS

REFERENCE
DATA

ISSUE
DATE

TITLE

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DATE

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3	Airframe
4	Landing Gear and Brake System
5	Flight Controls
6	Environmental Systems
7	Engine
8	Propeller
9	Fuel System
10	Instruments
11	Hydraulic System (Not Used)
12	Equipment and Furnishings
13	Electrical Systems
14	Avionics
15	Structural Repair

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CHAPTER

1

GENERAL INFORMATION

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GENERAL INFORMATION

1. General Description

The 310 and Turbo 310 is an all metal, low wing, twin-engine aircraft, powered by two-by-two Continental engines, (IO-520M on the 310 and TSIO-520B on the Turbo 310), driving a constant-speed, all-metal full feathering propeller. The airframe consists of a fully retractable landing gear, split-type flaps and manually adjustable trim tabs on all three axes controls.

2. Specification and Adjustments

Chapter 1 - General Information

A. Aircraft Weight

(1) Gross Weight - Takeoff	
(a) 310 and Turbo 310	5500 Pounds
(2) Landing Weight	
(a) 310 and Turbo 310	5400 Pounds

B. Aircraft Dimensions

(1) Fuselage Length	383.50 Inches
(2) Fuselage Height	125.74 Inches
(3) Wing Span	443.2 Inches

Chapter 2 - Inspection and Servicing

A. Main Strut Pressure (Aircraft On Jacks)	320 PSI
B. Main Strut Extension (On Ground)	3.00 Inches (Approx)
C. Nose Strut Pressure (Aircraft On Jacks)	49 PSI
D. Nose Strut Extension (On Ground) (Empty Weight with Full Fuel and Oil)	1.60 Inches (Approx)
E. Main Gear Tire Pressure	60 PSI
F. Nose Gear Tire Pressure	40 PSI
G. Oil Sump Capacity (With Filter)	13 Quarts
H. Fuel Capacity (Each Tank)	
(1) Main (Tip) Tank	51 Gallons
(2) Auxiliary Tank	20.5 Gallons
(3) Auxiliary	32.0 Gallons
(4) Wing Locker Fuel Tank	20.3 Gallons
I. Windshield Anti-Ice System (Alcohol)	3.0 Gallons
J. Oxygen Cylinder (48.3 Cu.Ft.) (At 70°F)	1800 PSI
K. Oxygen Cylinder (76.6 Cu.Ft.) (At 70°F)	1800 PSI

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Chapter 5 - Flight Controls

A. Aileron

(1) Aileron Up Travel	20 +1, -0 Degrees
(2) Aileron Down Travel	20 +1, -0 Degrees
(3) Aileron Cable Tension (At 60°F to 90°F)	25 <u>+5</u> Pounds

B. Aileron Trim Tab

(1) Aileron Trim Tab Up Travel	20 +1, -0 Degrees
(2) Aileron Trim Tab Down Travel	20 +1, -0 Degrees
(3) Aileron Trim Tab Cable Tension (At 60°F to 90°F)	10 <u>+3</u> Pounds

C. Rudder (Measured Perpendicular to Hinge Line)

(1) Rudder Travel Left	34 Degrees
(2) Rudder Travel Right	34 Degrees
(3) Rudder Cable Tension Forward of Centering Springs (At 60°F to 90°F)	25 <u>+5</u> Pounds
(4) Rudder Cable Tension Aft of Centering Springs (At 60°F to 90°F)	45 <u>+5</u> Pounds
(5) Nose Wheel Steering Cable Tension (At 60°F to 90°F)	20 <u>+5</u> Pounds

D. Rudder Trim Tab (Measured Perpendicular to Hinge Line)

(1) Rudder Trim Tab Travel Left	25 +1, -0 Degrees
(2) Rudder Trim Tab Travel Right	20 +1, -0 Degrees
(3) Rudder Trim Tab Cable Tension (At 60°F to 90°F)	10 <u>+3</u> Pounds

E. Yaw Damper

(1) Yaw Damper Cable Tension (At 60°F to 90°F)	16 +2 Pounds

F. Elevator

(1) Elevator Up Travel	16 +1/2 -0 Degrees
(2) Elevator Down Travel	15 +1, -0 Degrees
(3) Elevator Cable Tension (At 60°F to 90°F) Aft of Station 132.00	32 <u>+5</u> Pounds

G. Elevator Trim Tab

(1) Elevator Trim Tab Up Travel	10 +1, -0 Degrees
(2) Elevator Trim Tab Down Travel	26 +1, -0 Degrees
(3) Elevator Trim Tab Cable Tension (At 60°F to 90°F)	10 <u>+3</u> Pounds

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- H. Electric Elevator Trim Tab Control
- (1) Elevator Trim Tab Cable Tension
(At 60°F to 90°F) 19 +3 Pounds
 - (2) Actuator Clutch Torque Setting 25 +3 Inch-Pounds
- I. Flaps
- (1) Flaps Down Travel 35 +1, -0 Degrees
 - (2) Flap Extend Cable Tension (At
60°F to 90°F) 85 +10 Pounds
 - (3) Flap Return Cable Tension (At
60°F to 90°F) 225 +25 Pounds

Chapter 7 - Engines

- A. Engine
- (1) 310 Continental IO-520-M
 - (2) Turbo 310 Continental TSIO-520-B
 - (3) Spark Plug Type
 - (a) Champion RHB-32E
 - (b) AC AC-273
 - (4) Timing Spark Occurs Both Mags 22 Degrees BTC
 - (5) Spark Plug Gap 0.016 -0.018
 - (6) Magneto Breaker Point Gap 0.018 +0.006 Inches
 - (7) Magnetos
 - (a) Bendix LH S6RN-201
 - (b) Bendix RH S6RN-205
 - (8) Engine Firing Order 1-6-3-2-5-4
- B. Unmetered Low Fuel Pressure
- (1) 600 RPM (310) 6.5 to 7.5 PSI
 - (2) 600 RPM (Turbo 310) 7.0 to 7.5 PSI
- C. Maximum Fuel Flow Pressure
- (1) Full Throttle 2600 RPM (310) 141 to 150 PPH
 - (2) Full Throttle (Turbo 310) 165 to 175 PPH

Chapter 13 - Electrical System

- A. Battery (Lead Acid) 25 Ampere-Hour 24 Volts
- B. Voltage Regulator 27.5 Volts
- C. Alternator (Standard) 50 Amps
- D. Alternator (Optional) 100 Amps

Chapter 14 - Avionics

- A. 400A Nav-O-Matic Autopilot or IFCS System
- (1) Aileron Control Cable Tension
(At 60°F to 90°F) 12 +3 Pounds

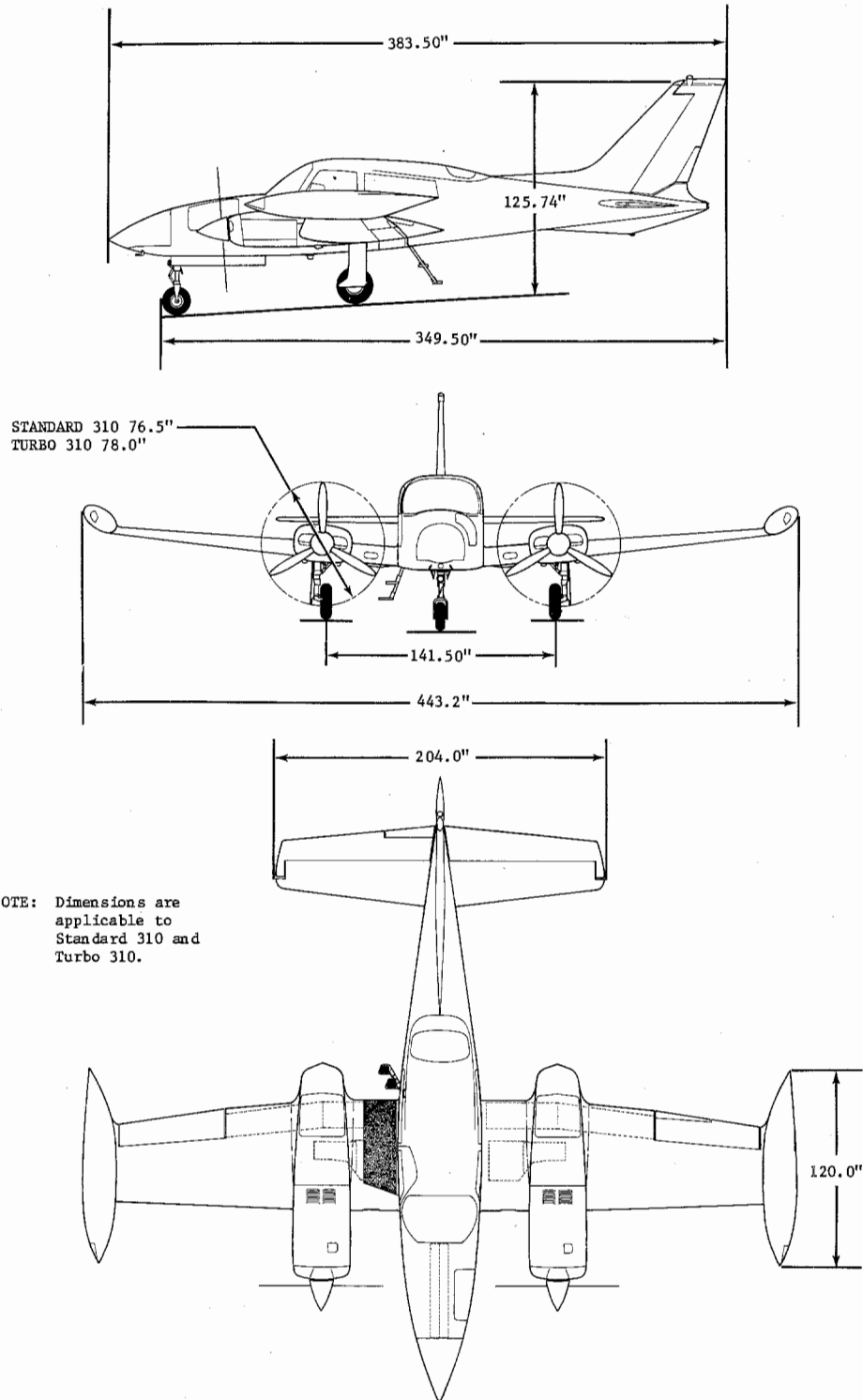
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(2) Elevator Control Cable Tension (At 60°F to 90°F)	12 <u>±</u> 3 Pounds
(3) Elevator Trim Control Cable Tension (At 60°F to 90°F)	
(a) With Electric Trim	19 <u>±</u> 3 Pounds
(b) Without Electric Trim	19 <u>±</u> 3 Pounds

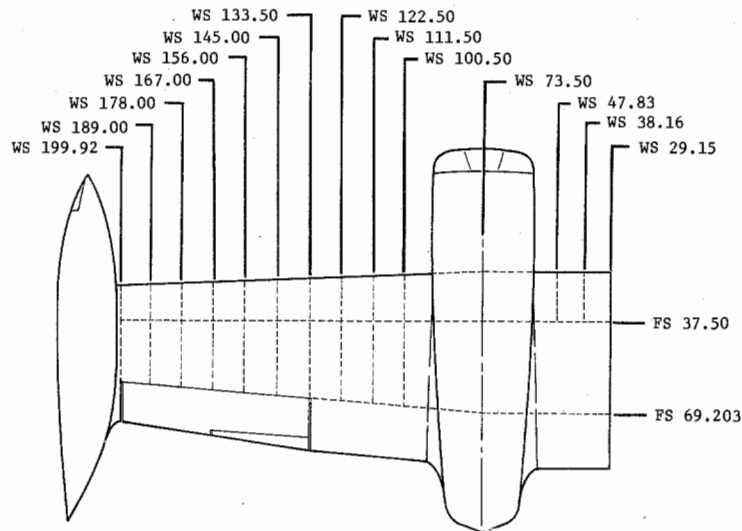
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Aircraft Dimensions
Figure 1

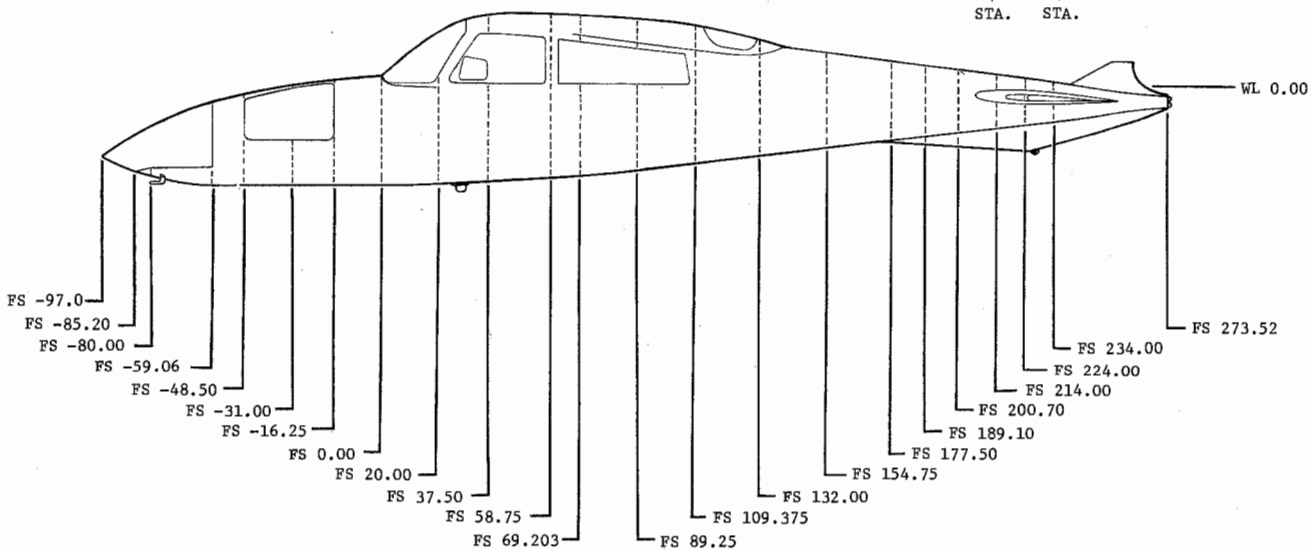
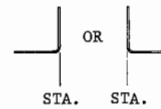
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10104006



FUSELAGE STATIONS

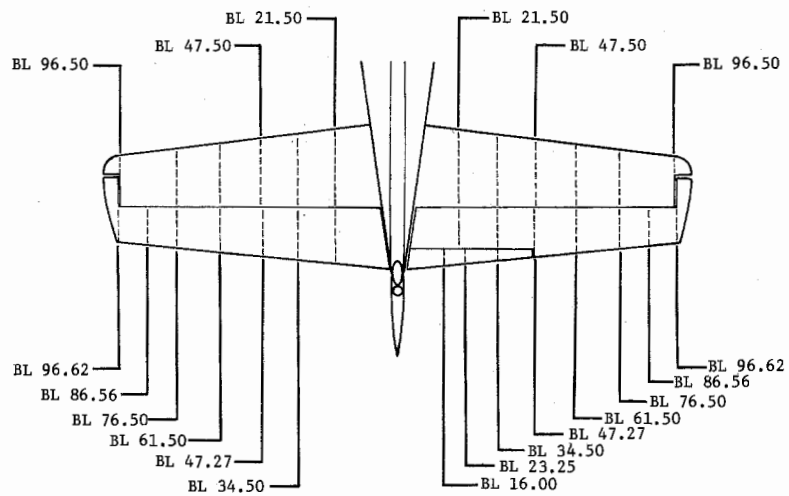
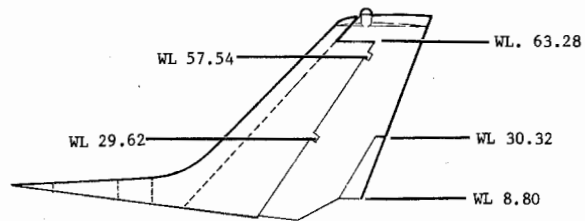
NOTE

FUSELAGE STATIONS ARE MEASURED TO SURFACE OF BULKHEAD. WEB OPPOSITE FLANGED UNLESS NOTED.



10202005
10103006

Station Diagrams
Figure 2 (Sheet 1 of 2)



10103006

Station Diagrams
Figure 2 (Sheet 2)

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LIFTING AND SHORINGDescription

1. The entire aircraft may be lifted at wing and jack points to perform landing gear tests, removal and installation of main and nose gear and major repairs. One wheel may be lifted for tire repair and/or landing gear repair.
2. When possible, the aircraft should be on a level surface when jacking. The jacking site should be protected from the wind preferably inside a hangar.

Lifting

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following items.

Name	Number	Manufacturer
Tripod Jack	2-170	Cessna Aircraft Company
Hydraulic Jack	J-930	Walker Mfg. Co. Racine Wisc.

2. Jacking Instructions (See Figure 1).

- A. Jacking Three Wheels.

- (1) Ensure Static Ground wire is connected to aircraft.

NOTE: Aircraft incorporating flight hour recorder. Remove the flight hour recorder fuse, located behind the circuit breaker panel to deactivate the flight hour recorder. When maintenance requires the battery switch to be ON.

- (2) Position jack beneath each jack pad.
 - (3) Ensure that jack cylinders are vertical at start of jacking operation to prevent side loads and possible gear strut binding.

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- (4) Simultaneously raise wing and fuselage jacks. Keep aircraft level until tires are clear of ground. Maintain follower nut of each jack against jack shoulder.

CAUTION: POSITION PADDED STAND UNDER TAILCONE FOR ADDED SAFETY PRECAUTION.

NOTE: Raise tires no more than required for the maintenance being performed.

- (5) Remove padded tail stand from under tailcone.
 (6) Loosen jack follower nuts; lower fuselage and wing jacks simultaneously.
 (7) Remove jacks.
 (8) If flight hour recorder is incorporated; install fuse.

B. Jacking One Wheel (Main Gear)

- (1) Ensure static ground wire is connected to aircraft.
 (2) Position jack beneath jacking point on main gear.
 (3) Extend jack until tire clears the ground.
 (4) On completion of maintenance, retract jacks until weight is assumed by tire.
 (5) Remove jack.

3. Shoring Instructions.

- A. Shoring the aircraft is accomplished by using contour boards. The boards can be fabricated locally from 1" thick plywood by placing two pieces side by side and contouring to fit the lower surface of the wing and fuselage. The contour boards should be padded with 1/2 inch felt and covered with canvass duct.
- B. Fuselage and wing jacks should be used in conjunction with wing and fuselage shoring.
- C. Contour shoring may be used at the following locations.

Wing Stations

Left and Right W.S. 29.15
 Left and Right W.S. 57.50
 Left and Right W.S. 89.50

Fuselage Stations

F.S. 20.00
 F.S. 37.50
 F.S. 69.203
 F.S. 109.375
 F.S. 154.75

- D. In some instances, it may be necessary to use a sling to raise the aircraft. When using a sling, proceed as follows:

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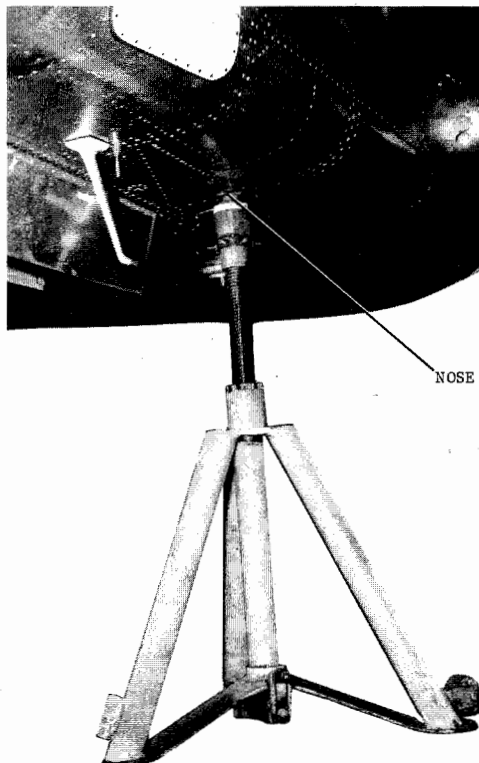
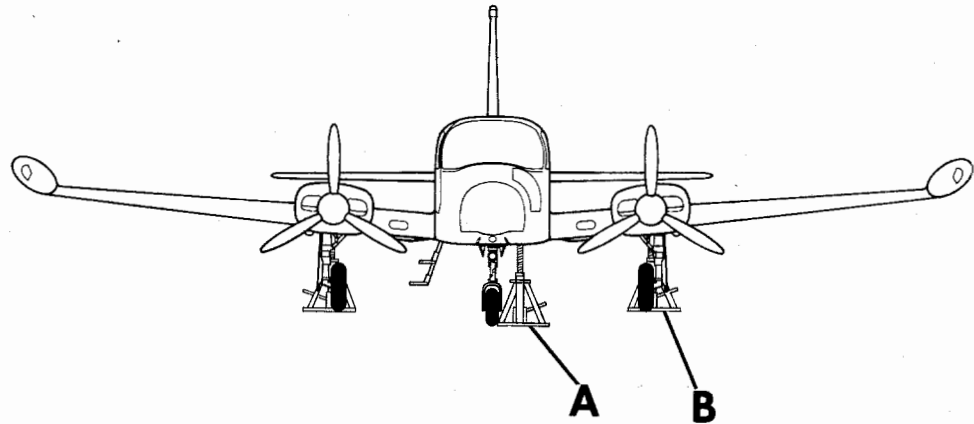
MAINTENANCE MANUAL

NOTE

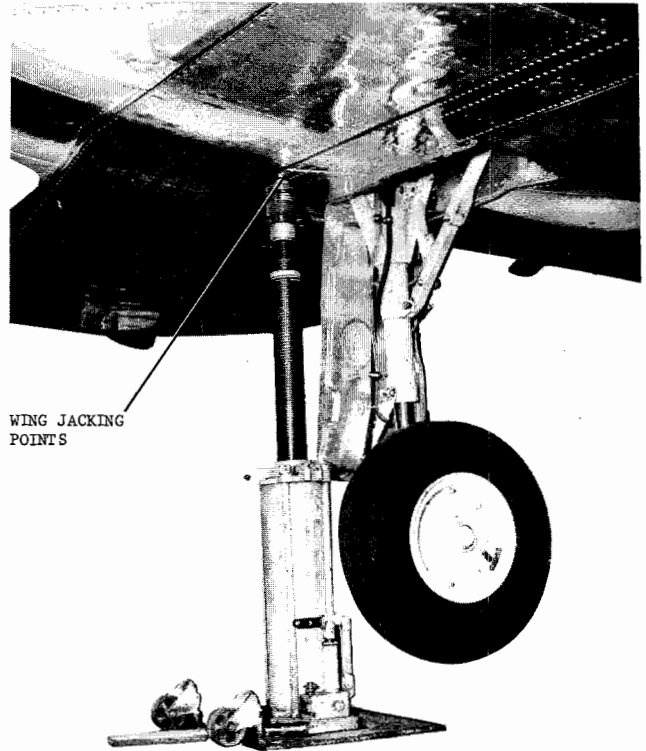
FOR LANDING GEAR REMOVAL AND MAINTENANCE, USE ALL JACKING POINTS.
FOR REMOVAL OF MAIN WHEELS, WHEEL JACKING LUGS MAY BE USED.
FOR REMOVAL OF NOSE WHEEL, THE NOSE JACKING POINT MAY BE USED.

CAUTION

PLACE WEIGHTS IN NOSE SECTION OF FUSELAGE TO PREVENT AIRCRAFT FROM TIPPING BACKWARD WHEN NOSE IS RAISED. TO PREVENT POSSIBLE STRUCTURAL DAMAGE, APPLY EQUAL FORCE WITH NOSE JACKS.



DETAIL A



DETAIL B

Jacking Points
Figure 1

10802005
B1080P6001
A1080P6002

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- (1) Fabricate sling from any suitable material capable of sustaining a 5500 pound load. Attach a hoisting lug to the sling. The lug attaches to the upper bolt which secures the front wing spar to the fuselage spar.
- (2) Access to the wing spar bolts is gained by removing the wing fillet between the fuselage and wing.
- (3) Each lug may be temporarily attached to the upper bolt on each wing for hoisting purposes only.
- (4) The forward spar bolts are located directly in line with the aircraft center of gravity, so the sling should be positioned accordingly.
- (5) Position a man at both the nose and tail section of the aircraft to assure it stays in a level position while hoisting.

NOTE: After removing lugs, torque front spar nuts to 60 $\pm$ 5 foot-pounds, and rear spar nuts to 175 $\pm$ 15 inch-pounds.

LEVELING AND WEIGHINGDescription

1. Leveling lugs are provided for longitudinally leveling on the left side of the fuselage at F.S. 88.90 and 59.10, and approximate water line -14.05. Lateral leveling is accomplished by placing a spirit level centered on the outside skin along the rear spar on the underside of the fuselage.
2. Weighing is accomplished by placing aircraft on electronic type scales placed at each jacking point or using platform scales under each main and the nose wheel tires.

Leveling

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following items:

Name	Number	Manufacturer	Use
Spirit Level	Commercially Available	Purchase Locally 18" length minimum	Level aircraft.
Jacks	Refer to Lifting and Shoring.		

2. Leveling Laterally. (See Figure 1)

- A. Back the leveling screws on the left side of the fuselage out a sufficient length to place spirit level on.
- B. Adjust fuselage jacks as required to level aircraft.

Weighing

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following items.

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Name	Number	Manufacturer	Use
Scales	Commercially Available		Weigh aircraft.
Chocks	Commercially Available		
Jacks	Refer to Lifting & Shoring.		

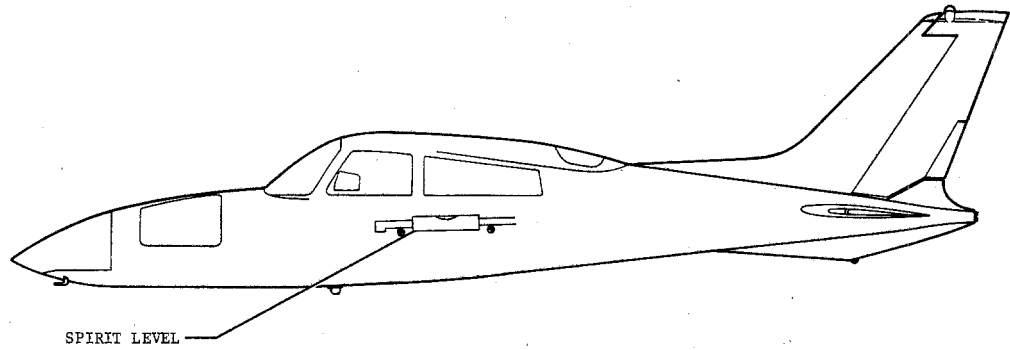
2. Preparation for Weighing.

- A. Remove excessive dirt, grease moisture, etc., from the aircraft before weighing.
- B. Weigh the aircraft inside a closed building to prevent error in scale reading due to wind.
- C. To determine the center of gravity, place the aircraft in a level attitude.
- D. Have all items of equipment included in the certificated empty weight installed in the aircraft when weighing. These items of equipment are listed on the equipment list.
- E. Defuel the aircraft in accordance with defueling procedures and drain the sump. Fuel remaining aboard after draining is residual fuel and is included in the empty weight.
- F. Drain all the oil from the engines by opening the drain cocks. The oil remaining after draining is residual oil and is included in the empty weight.

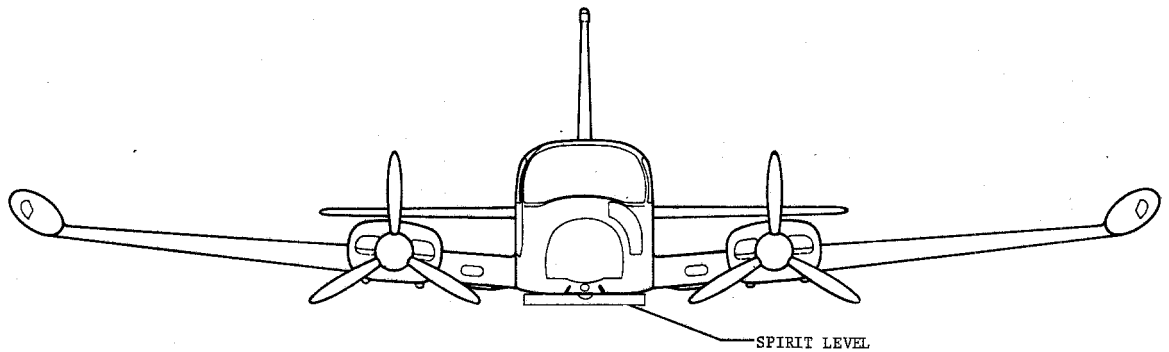
NOTE: When weighed with full oil, actual empty weight equals the actual recorded weight less the weight of the oil in the engines (oil weight = oil capacity in gallons x 7.5 pounds).

- G. Properly calibrate, zero and use scales in accordance with the scale manufacturer's instructions.
- H. Place the scales and suitable supports (jacks) under the aircraft jack pads or wheels and record the scale readings. (See Figure 2.)
- I. Do not set brakes while taking scale readings.
- J. Record tare when the aircraft is removed from the scales.

NOTE: Tare is the weight of the chocks, blocks, stands, etc., used when weighing the aircraft. Tare is included in the scale readings at each respective weighing point where tare is involved to obtain the aircraft weight.



LONGITUDINAL LEVELING POINT



LATERAL LEVELING POINT

10103004

Leveling Aircraft
Figure 1

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LEGEND

- W The weight of the aircraft.
($W_n + W_l + W_r$)
- D The horizontal distance from the datum to the main weighing points.
- L The horizontal distance from the main weighing points to the nose weighing point.
- S The horizontal distance from the datum to the leading edge of the M.A.C.
- C.G. The distance from the datum to the center of gravity of the aircraft
- W_n The weight at the nose weighing point.
- W_l The weight at the left main weighing point.
- W_r The weight at the right main weighing point.
- M.A.C. Mean Aerodynamic Chord.

$$\text{Formula: C.G.} = D - \frac{W_n (L)}{W}$$

$$\% \text{M.A.C.} = \frac{\text{C.G.} - S}{\text{M.A.C.}} (100)$$

NOTE

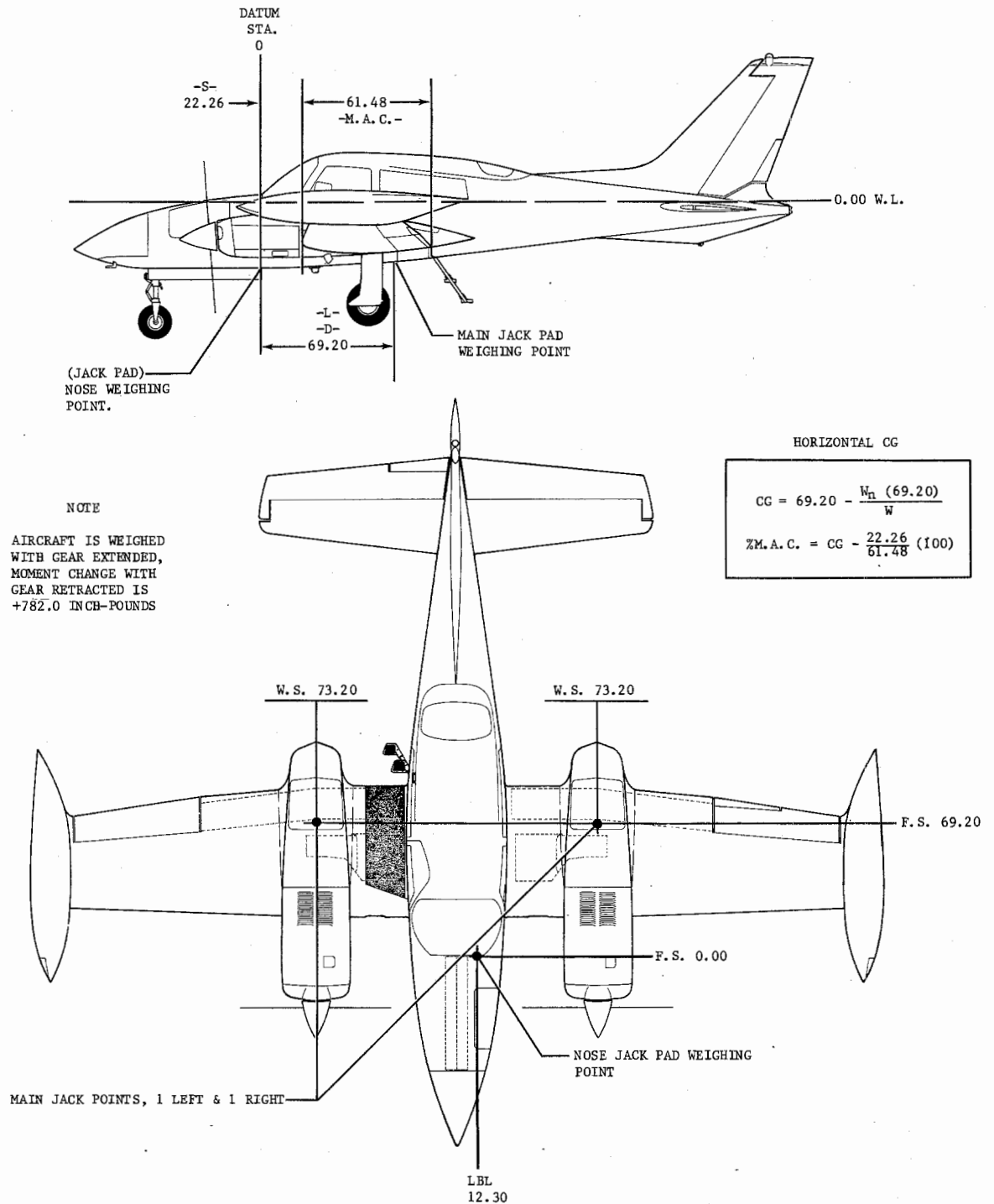
AIRCRAFT IS WEIGHED WITH GEAR
EXTENDED. MOMENT CHANGE
WITH GEAR RETRACTED IS +782.0
INCH-POUNDS.

WEIGHING POINT	SCALE READING (LBS)	TARE (LBS)	NET WEIGHT (LBS)
W_l			
W_r			
W_n			
W (EMPTY WEIGHT)			

Weighing Aircraft
Figure 2 (Sheet 1 of 3)

MAINTENANCE MANUAL

WEIGHING ON JACK POINTS



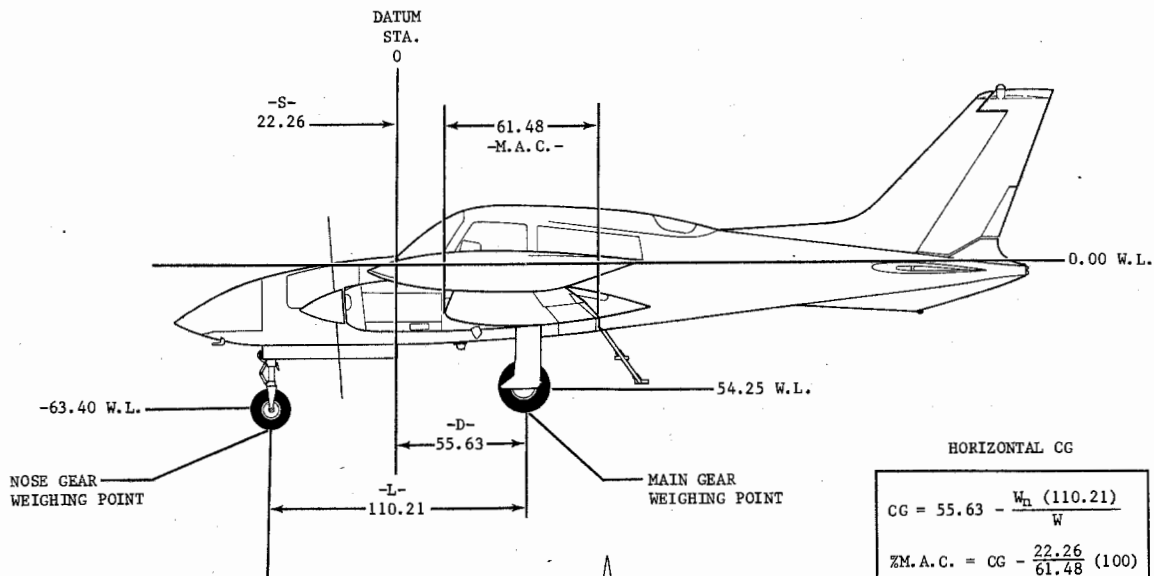
Weighing Aircraft
Figure 2 (Sheet 2)

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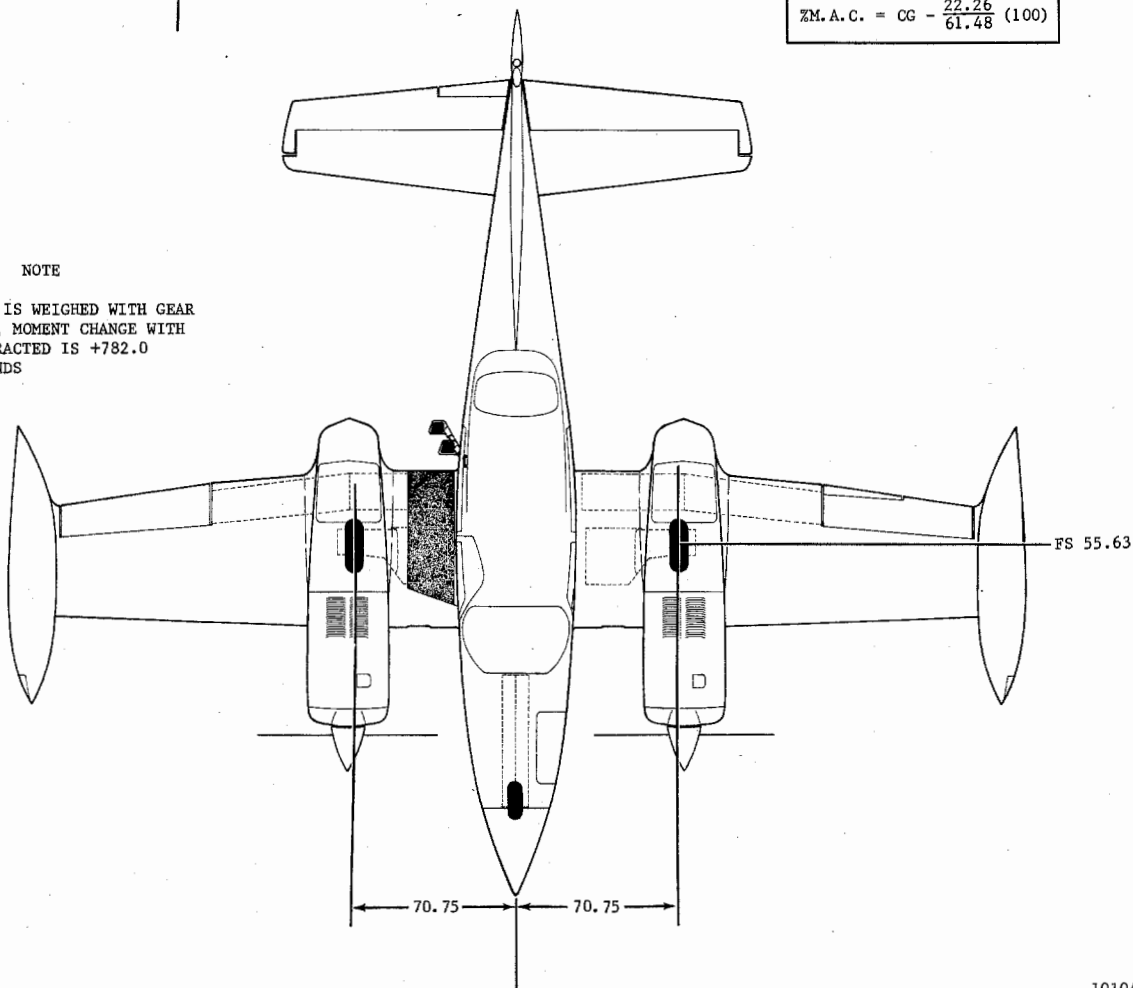
MAINTENANCE MANUAL

WEIGHING ON LANDING GEAR



NOTE

AIRCRAFT IS WEIGHED WITH GEAR
EXTENDED, MOMENT CHANGE WITH
GEAR RETRACTED IS +782.0
INCH-POUNDS



10104007
10104008

Weighing Aircraft
Figure 2 (Sheet 3)

TOWING AND TAXIINGDescription

1. Towing and Taxiing Procedures are basically the same as those used on other aircraft equipped with tricycle gear.
2. The aircraft can be towed forward or pushed aft, on hard surfaces, using a yoke-type tow bar attached to the nose wheel.
3. The aircraft can be towed at the main gear when the aircraft is in soft sand, earth mud, or at anytime damage could result to the nose gear.

Towing

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following items.

Name	Number	Manufacturer	Use
Tow Bar	SE411-1	Cessna Aircraft Company	For nose gear towing.
Cable	Commercially Available		For main gear towing.

2. Nose Gear Towing.

CAUTION: THE PARKING BRAKE MUST BE RELEASED AND THE EXTERNAL AND INTERNAL RUDDER GUST LOCKS REMOVED BEFORE TOWING. FAILURE TO REMOVE LOCKS COULD RESULT IN STRUCTURAL DAMAGE TO THE AIRCRAFT.

- A. Place the tow bar at nose wheel, insert tow bar into nose wheel axle and secure tow bar locking handle.
- B. Connect tow bar to towing vehicle.
- C. Station person in pilot's seat.
- D. Disengage parking brake.
- E. Remove interior rudder gust lock.
- F. Ensure that wheel chocks, static ground cables, external gust locks and mooring cables are removed.

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- G. If area is congested, station wing walkers to check clearance between aircraft and adjacent equipment or structure.
- H. Tow aircraft making smooth starts and stops with towing vehicle. Do not exceed turning limitations. Refer to placard on nose gear strut.
- I. When towing operation is complete, turn nose wheel to center, engage parking brake, chock wheels, connect static ground cable, install external and internal gust locks.

3. Main Gear Towing.

- A. Attach two cables to towing adapters and towing vehicle. Ensure cables are of sufficient length to clear aircraft and the towing vehicle is on a firm surface.
- B. Remove wheel chocks, mooring cables, static ground cables and external gust locks.
- C. Station person in pilot's seat.
- D. Release parking brake and remove internal gust locks.
- E. During towing steer the aircraft by the rudder pedals. Brake aircraft evenly and smoothly using aircraft brakes.
- F. When towing is complete, center nose wheel, chock aircraft wheels, connect static ground cable, install external and internal gust locks and set parking brake if desired.
- G. Disconnect tow cables.

Taxiing

1. Preliminary Procedures.

- A. Clear the area around the aircraft.
- B. Check main gear wheels and remove static ground cable, external and internal gust locks, and wheel chocks.
- C. Assure parking brake is engaged.

2. Taxiing Procedures.

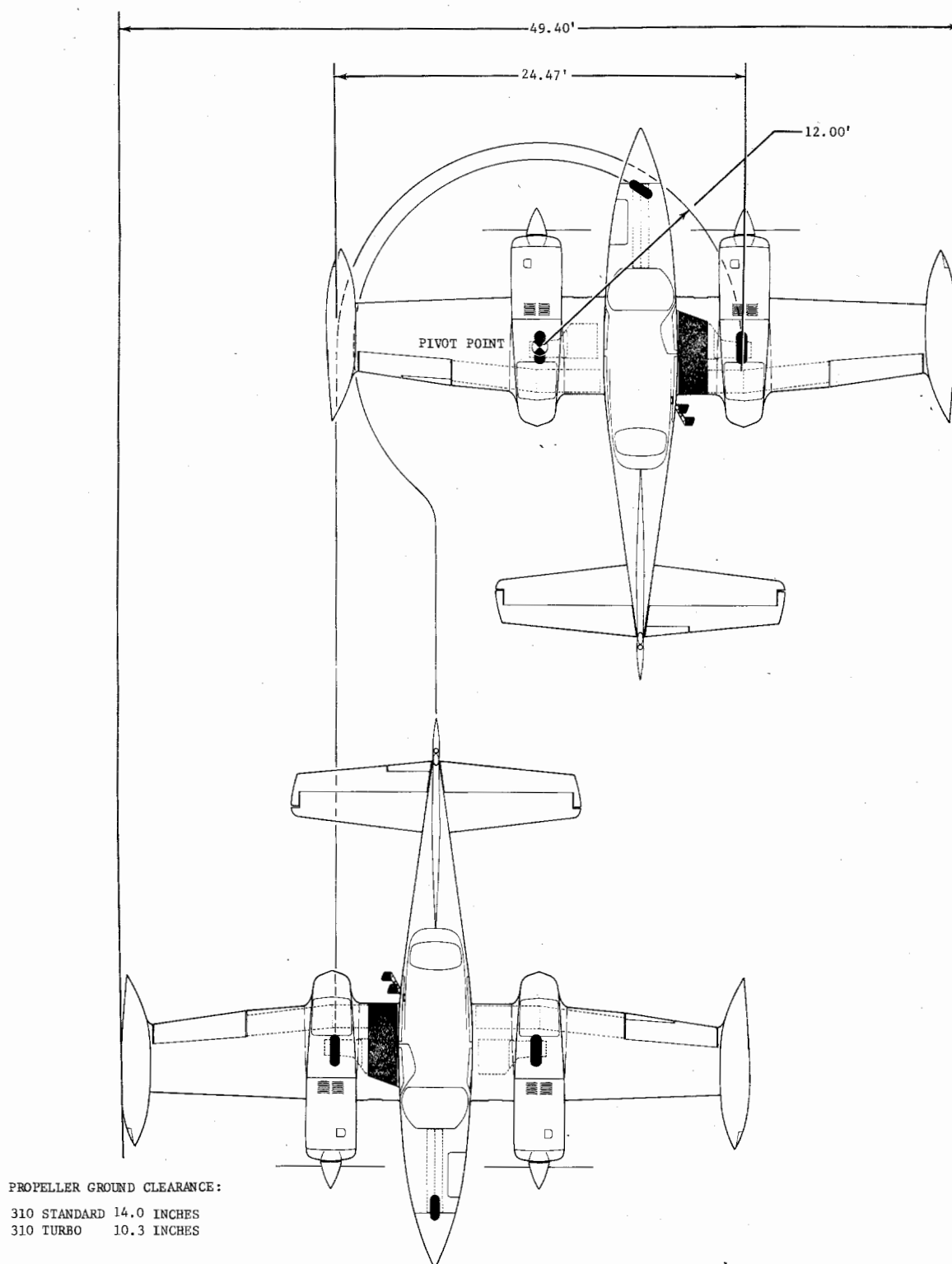
WARNING: ENSURE PERSONNEL AND EQUIPMENT ARE CLEAR OF PROPELLER.

- A. Start engines, refer to owners manual.
- B. Release parking brake.
- C. Apply sufficient power to start taxi roll.

NOTE: It may become necessary to apply brakes to slow taxi speed. Intermittent braking provides a cooling period between brake applications.

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MAINTENANCE MANUAL



Minimum Turning Radius
Figure 1

10803002

- D. Steer the aircraft using the rudder pedals. Nose gear steering is operated by the rudder pedals. While taxiing, make slight turns to determine effectiveness of nose gear steering.
- E. In congested areas, wing walkers should be used as an aid.
- F. Observe minimum turning radius during taxiing (see Figure 1). Avoid high engine RPM while taxiing over ground containing loose stones or gravel to prevent damage to propeller blades.
- G. Taxi aircraft to desired area.
- H. Apply parking brake, shut down engines, chock main gear wheels, connect static ground and install internal gust locks. If the aircraft is to be moored outside, install external gust locks and refer to mooring procedures.

PARKING AND MOORINGDescription

1. The aircraft is normally parked or moored on a hard surface apron where necessary mooring accommodations are available.
2. The aircraft may be parked during normal weather conditions by heading the aircraft into the wind, installing wheel chocks, and engaging parking brake and control locks. Refer to mooring procedures if anticipation of high winds, or anytime the aircraft is to remain outside for a length of time, such as overnight.

Parking

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items:

Name	Number	Manufacturer	Use
Wheel Chocks	Commercially Available		Chock landing gear wheels.
Pitot Tube Cover	Commercially Available		Prevent water entry.
Static Grounding Cables	Commercially Available		Static ground aircraft.

2. Parking Instructions.

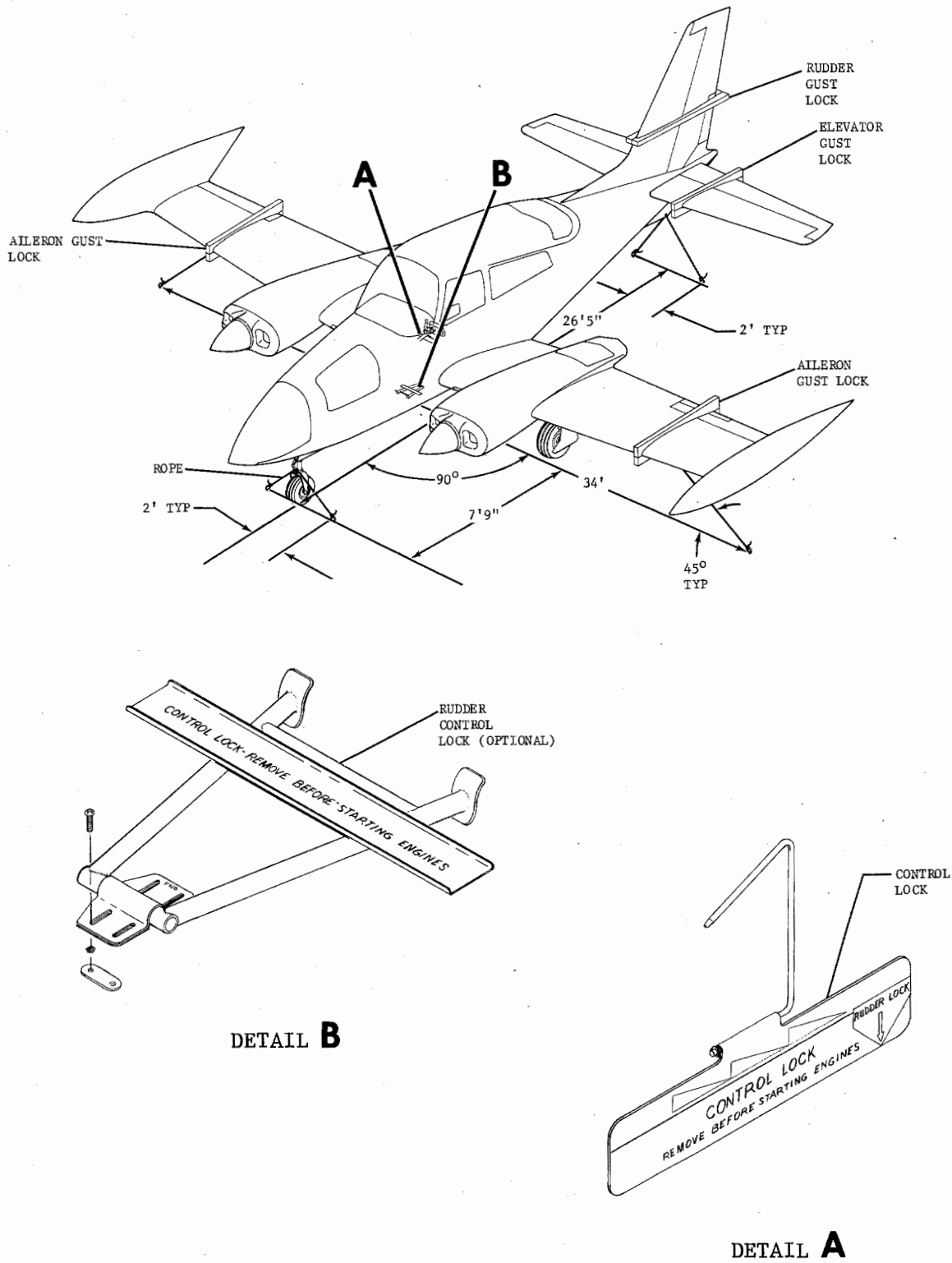
- A. Position aircraft on level surface.
- B. Set parking brake and install internal control locks and external gust locks.

NOTE: If main gear wheels are chocked, the parking brake may remain released.

- C. Chock main gear wheels.
- D. Connect static ground cable to aircraft.
- E. Install protective covers.
- F. Close windows and doors as necessary.

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MAINTENANCE MANUAL



Mooring Points
Figure 1

10803001
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B14141032

Mooring

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used in place of the following items:

Name	Number	Manufacturer	Use
Wheel Chocks	Commercially Available		Chock landing gear wheels.
Pitot Tube cover	Commercially Available		Prevent water entry.

2. Mooring Instructions (See Figure 1).

- A. Park aircraft on level surface.
- B. Set parking brake and install control lock.
- C. Chock main landing gear wheels.
- D. Connect static ground cable.
- E. Install external gust locks on rudder, elevator and aileron (one lock on each control).

NOTE: If external rudder gust lock is not available, turn nose wheel to extreme right or left position.

- F. If aircraft is to be moored on sod surface, proceed as follows:

(1) Drive anchor stakes as shown in Figure 1, to provide a rope angle of 45° to the ground. Secure chains or manila rope of 700 pounds or more tensile strength to the mooring fittings under the wings and secure opposite end to the ground stakes.

- G. Install protective covers.
- H. Close doors and windows as necessary.

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MAINTENANCE MANUAL

STORAGE OF AIRCRAFTDescription

1. There are three recommended categories of storage of the aircraft.
2. Flyable Storage - Aircraft which will not be flown for an indefinite period of time but which are to be kept ready to fly with the least possible preparation.
3. Temporary Storage - Aircraft which will be stored for a period of time up to 60 days.
4. Indefinite Storage - Aircraft which will be stored for an indefinite period of time.
5. Aircraft which are not in daily flight should have the engine rotated by hand-turning the propeller five (5) revolutions at least once each week. In damp climate and in storage areas where the daily temperature variation can cause condensation, the turning operation should be accomplished more frequently. Rotating the engine an odd number of turns redistributes residual oil on cylinder walls, shaft and gear surfaces and repositions the pistons in the cylinders thus preventing corrosion accumulation.

CAUTION: FOR MAXIMUM SAFETY, ACCOMPLISH ENGINE ROTATION AS FOLLOWS: ASSURE MAGNETO SWITCHES ARE "OFF", THROTTLE POSITION "CLOSED", AND MIXTURE CONTROL "IDLE CUT-OFF". DO NOT STAND WITHIN THE ARC OF THE PROPELLER BLADES WHILE TURNING THE PROPELLER.

Storage

1. Flyable Storage Procedures.
 - A. Fill fuel tanks full to minimize condensation in the fuel tanks. Keep battery fully charged to prevent the electrolyte from freezing in cold weather. If the aircraft is stored outside, tie-down should be accomplished in anticipation of high winds.
 - B. Tie ropes or chains to the wing tie-down fittings located on the underside of each wing. Secure the opposite ends of the ropes or chains to ground anchors.
 - C. Secure a rope (no chains or cables) to the upper trunnion of the nose gear and secure opposite end of rope to a ground anchor.

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- D. Secure the middle of a rope to tail tie-down ring. Pull each end of rope away at 45-degree angle and secure to ground anchors at each side of tail.
- E. Install surface control locks on ailerons, rudder and elevators if available.
- F. Install control lock on pilot control column if available; if control lock is not available, tie pilot control wheel back with front seat belt.
- G. After thirty (30) days, aircraft should be flown for thirty (30) minutes or ground run-up until oil has reached operating temperature.

2. Temporary Storage Procedures.

- A. Remove top and bottom spark plugs and atomize spray preservative oil (Lubrication Oil - Contact and Volatile, Corrosion Inhibited, MIL-L-46002, Grade 1) (221° - 250°) through upper spark plug hole of each cylinder with the piston in the down position. Rotate crankshaft as each pair of cylinders is sprayed. Stop crankshaft with no piston at top position.

NOTE: Below are approved preservative oils recommended for use in Continental engines.
(Nucle Oil 105, Petrotect VA, Ferro-Gard 1009-G or equivalent).

- B. Respray each cylinder without rotating crank. To thoroughly cover all surfaces of the cylinder interior, move the nozzle or the spray gun from the top to the bottom of the cylinder.
- C. Reinstall spark plugs.
- D. Apply preservative to engine interior by spraying the above specified oil (approximately 2 oz.) through the oil filler tube.
- E. Seal all engine openings exposed to the atmosphere using suitable plugs, or non-hygroscopic tape, and attach red streamers at each point.
- F. Install pitot tube cover, seal static source, install ground locks on retractable gear aircraft and attach red streamers at each location. Close all vents and plug cowl openings to prevent bird nests in the engine compartment.
- G. Engines, with propellers installed, that are preserved for storage in accordance with this section should have a tag affixed to the propeller in a conspicuous place with the following notation on the tag: "DO NOT TURN PROPELLER - ENGINE PRESERVED."
- H. Disconnect or remove the battery from the aircraft. If the battery is disconnected and left in the aircraft, regular servicing will be required to prevent freezing or discharge. Batteries which are removed from the aircraft

and stored should be checked regularly for state of charge. To assure accurate warranty records, battery should be reinstalled in the same aircraft from which removed.

- I. If the aircraft is stored outdoors, place control locks on all movable control surfaces and tie the aircraft down snugly, not tightly, with enough clearance so wind gusts will not shift aircraft into another. Leave no long chains dangling. Release the parking brake to prevent seizing and chock the wheels.

3. Indefinite Storage Procedures.

- A. Drain the engine oil and service with corrosive preventive mixture.

NOTE: Corrosion preventive mixture consists of one part compound MIL-C-6529, Type I, (Esso Rust-Ban 628, Cosmoline No. 1223 or equivalent) mixed with three parts new lubricating oil of the grade recommended for service. This mixture should be thoroughly mixed and maintained at a temperature of at least 221°F at the time it is added to the engine. Immediately after servicing with the corrosion preventive mixture, fly the aircraft for a period of time not to exceed a maximum of 30 minutes.

- B. Remove the top spark plug from each cylinder and spray with corrosion preventive mixture (221° to 250°F). To thoroughly cover all surfaces of the cylinder interior, move the nozzle of the spray gun from the top to the bottom of the cylinder. If by accident the propeller is rotated following this spraying, respray the cylinders to insure an unbroken coverage of corrosion preventive mixture on all surfaces.
- C. 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 AN4060-1 protectors.
- D. Place a bag of desiccant in the exhaust pipes and seal the openings with moisture resistant tape.
- E. Seal the cold air inlet to the heater muff with moisture resistant tape to exclude moisture and foreign objects.
- F. Seal the engine breather by inserting a protex plug in the breather hose and clamping in place.
- G. 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 the sealed area with safety wire to prevent wicking of moisture into the sealed area.

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- H. Engines, with propellers installed, that are preserved for storage in accordance with this section should have each propeller tagged in a conspicuous place with the following notation of the tag: "DO NOT TURN PROPELLER - ENGINE PRESERVED."
- I. After the engine has been prepared for storage, remove the battery from the aircraft, store in a cool dry place and check regularly for state of charge. Note serial number on battery and reinstall in the same aircraft.
- J. If the aircraft is stored outdoors, place control locks on all movable control surfaces and tie the aircraft down snugly, not tightly, with enough clearance so wind gusts will not shift aircraft into another. Leave no long chains dangling. Release the parking brake to prevent seizing and chock the wheels.
- K. Cover the aircraft with moisture resistant paper and tape as necessary.

NOTE: The necessity of this requirement can be determined by the condition at the storage area.

- L. Install pitot tube cover and seal static source. Close all vents and plug cowl openings to prevent bird nests in the engine compartment.

NOTE: As an alternate method of indefinite storage, the aircraft may be serviced in accordance with the procedures under Temporary Storage providing the aircraft is run-up at maximum intervals of ninety (90) days and then re-serviced per the temporary storage requirements.

- M. Aircraft stored in accordance with the indefinite storage procedures should be inspected per the following instructions:
 - (1) Aircraft prepared for indefinite storage shall have the cylinder protex plugs 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.
 - (2) The cylinder bores of all engines prepared for indefinite storage should be resprayed with corrosion preventive mixture every 6 months. Before spraying, the engines shall be inspected for corrosion as follows: Inspect the interior of at least one cylinder on each engine through the spark plug hole. Remove at least one rocker box cover from each engine and inspect the valve mechanism.

Restoring Aircraft to Service

1. If the proper procedures were followed for indefinite storage, the aircraft should require the following service.

A. Airframe:

- (1) Remove all covers from vents and air inlets.
- (2) Clean aircraft if required.
- (3) Lubricate the aircraft.
- (4) Check the brake cylinders, struts and shimmy damper.
- (5) Drain a small amount of fuel from all fuel lines and check for water sediment.
- (6) Check fuel selector valve for evidence of leakage.

B. Battery:

- (1) Check battery, charge if necessary.
- (2) Install battery.

C. Engines:

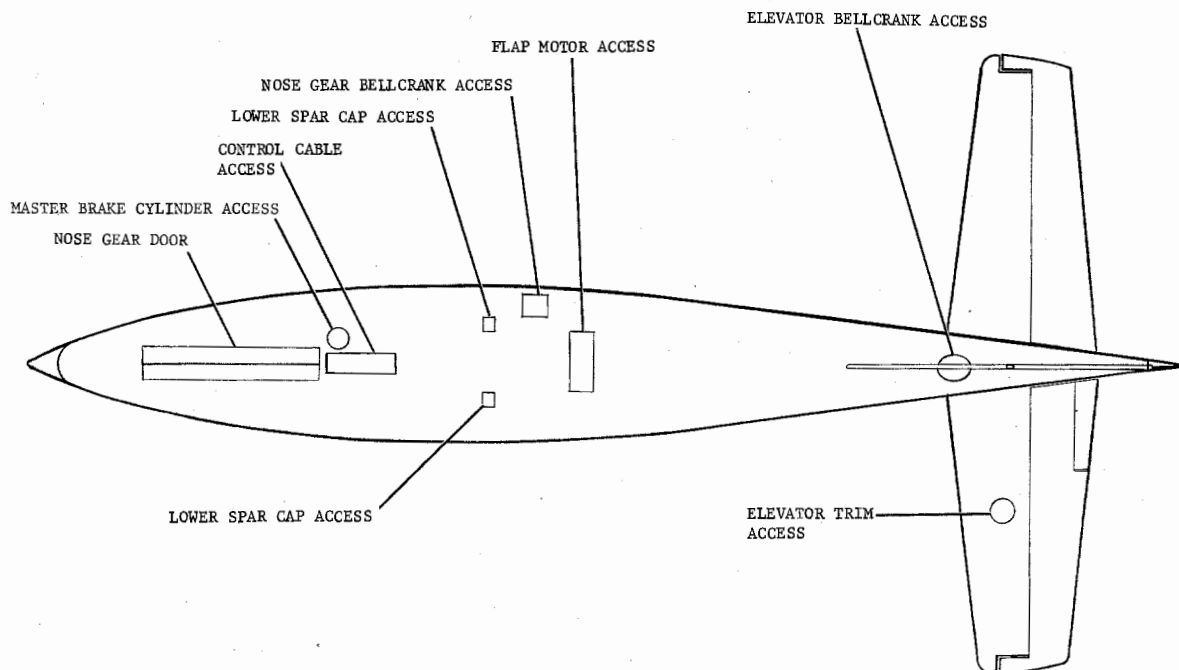
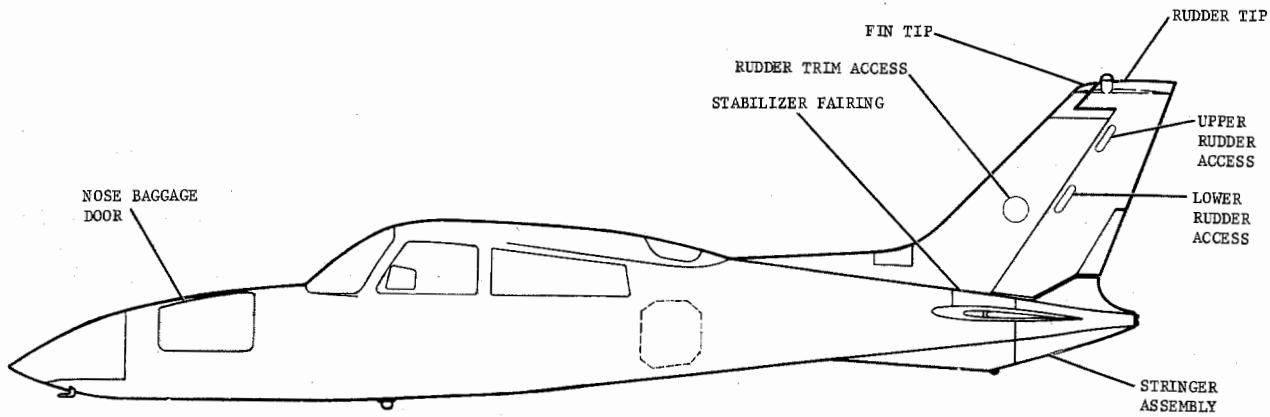
- (1) Remove all vents and opening covers installed.
- (2) Remove oil sump drain plugs.
- (3) Remove plugs from spark plug holes in all cylinders. Rotate engines by hand to remove corrosion preventive oil from cylinders.

CAUTION: IGNITION SWITCHES MUST BE IN THE OFF POSITION WHEN ROTATING THE PROPELLERS BY HAND.

- (4) Install recommended spark plugs which have been properly cleaned and gapped.
- (5) Remove and replace oil filter element.
- (6) Install the oil sump drain plugs and fill oil sump with recommended oil.
- (7) Check propellers for freedom of operation.
- (8) Perform complete ground runup check on engines.

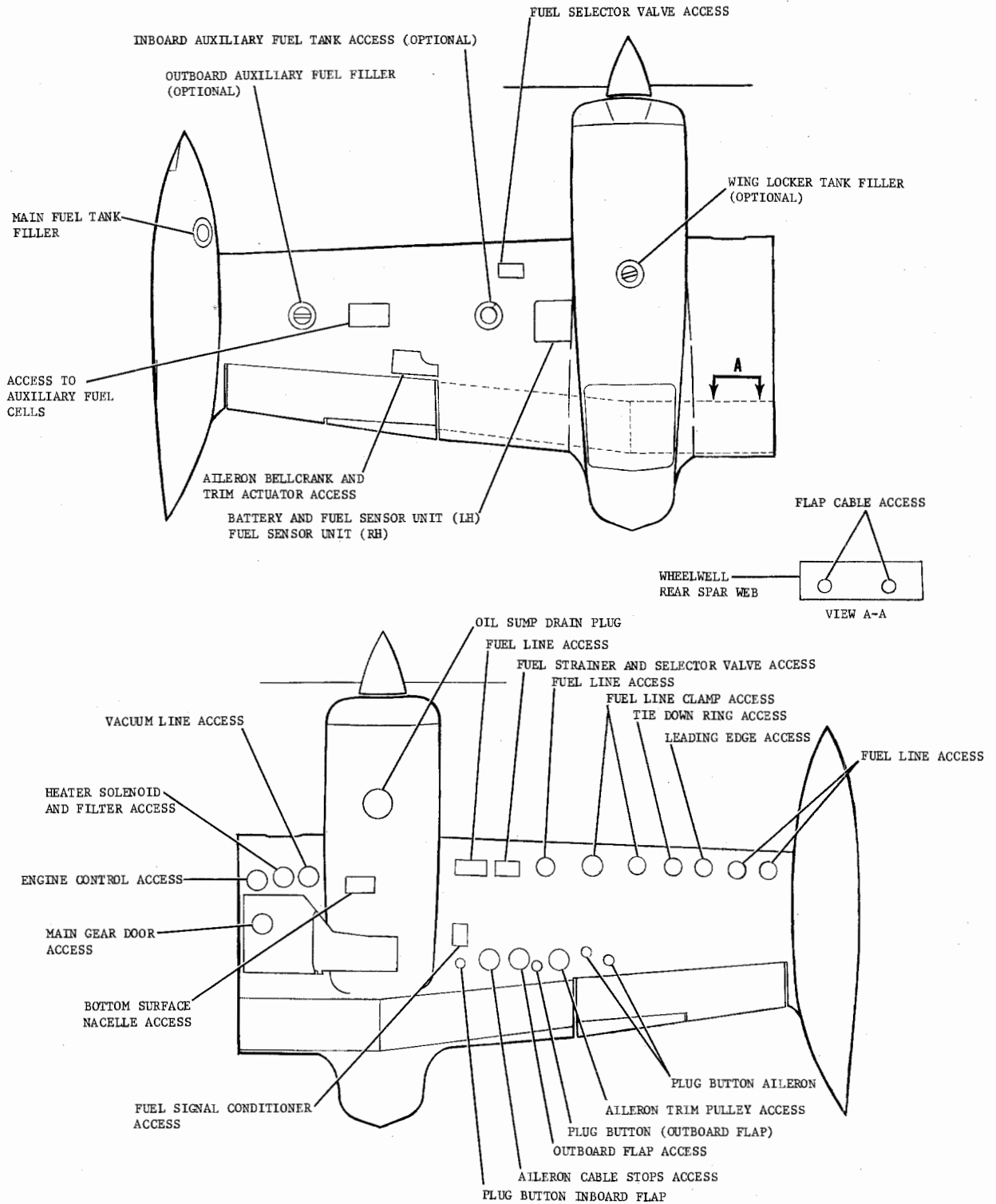
INSPECTION PLATES AND ACCESS PANELSDescription

1. Inspection plates and access panels are provided for inspection and maintenance purposes. Locations of the various plates and panels are shown in Figure 1. Access panels indicated by an asterisk are considered to be structural support items, or integral parts of the aircraft, and must be installed for all functional testing and taxiing of the aircraft.



10102002
10102003

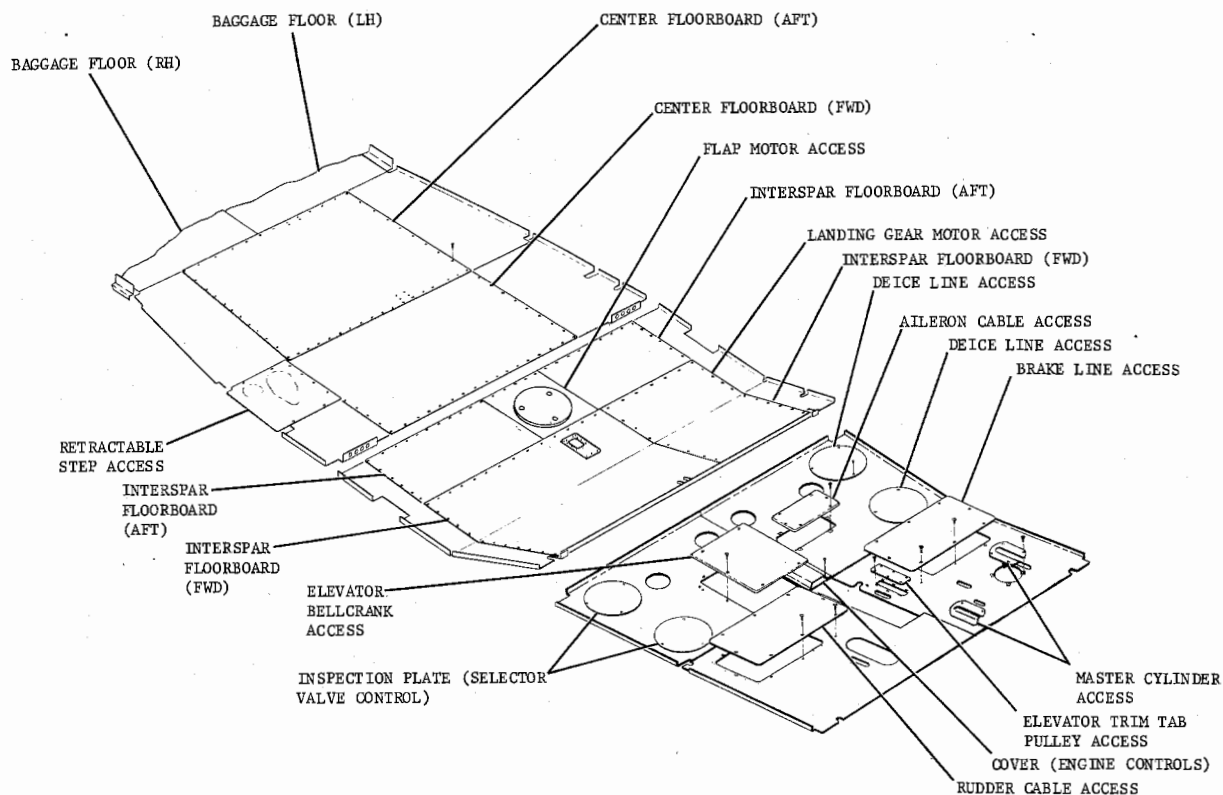
Inspection Plates and Access Panels
Figure 1 (Sheet 1 of 3)



NOTE: LH WING SHOWN, RH IS SIMILAR EXCEPT AS NOTED.

Inspection Plates and Access Panels
Figure 1 (Sheet 2)

10203001



10143022
10143023

Inspection Plates and Access Panels
Figure 1 (Sheet 3)

PLACARDS

Description

1. Manufacturers plates, identification plates, finish and trim plates and their locations on the aircraft are shown in Figure 1.

MAINTENANCE MANUAL

FLYING
CONTINENTAL MOTORS
Aircraft Products Division

MADE IN U.S.A.

MODEL T.C. P.C.

H.P. T.O. R.P.M. WAG

H.P.-M.C. R.P.M. TIMING

FUEL GRADE MIN R

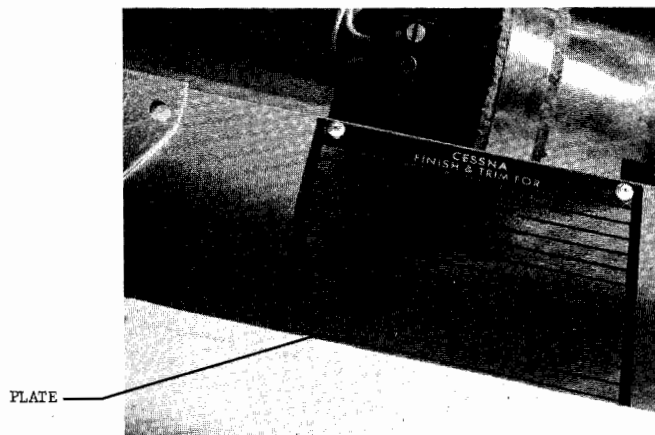
SER. NO. L

UNDER ONE OR MORE OF THE FOLLOWING U.S. PATENTS

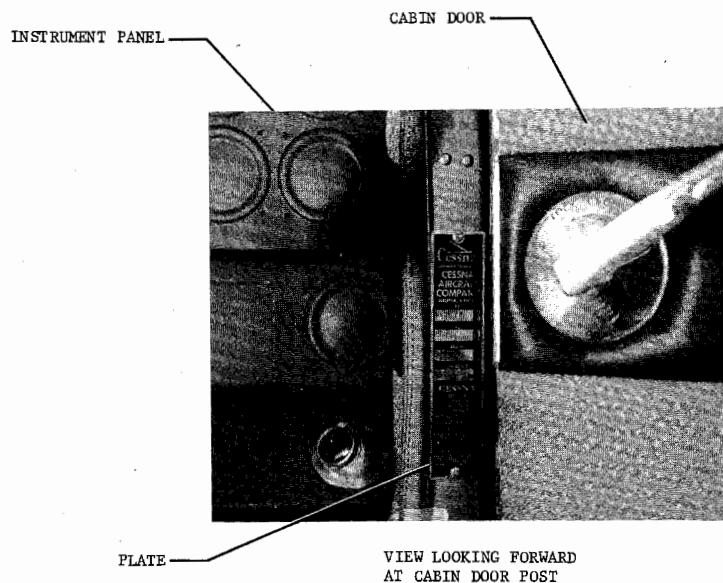
7,354,468	7,235,357	7,895,487	7,895,521	7,861,058
7,264,182	7,866,750	7,901,531	7,912,522	7,868,175
7,782,644	7,818,942	7,903,136	7,953,437	7,967,150

NO FOREIGN PATENTS

1-70
Page 2
Oct/74



VIEW LOOKING UP AND RIGHT
INTO NOSE WHEEL WELL



VIEW LOOKING FORWARD
AT CABIN DOOR POST

1014P6002
1014P6003

Serial Numbers and Identification Plates
Figure 1 (Sheet 2)

CLEANING AND PAINTINGDescription

1. To improve the appearance of the aircraft and retard the formation of corrosion, the aircraft exterior should be cleaned at frequent intervals to remove dirt, exhaust deposits and other contaminants.
2. Materials for maintaining the exterior and interior of the aircraft are listed in this Chapter. It is recommended that chemical supplier's bulletins and instructions be closely followed for proper mixing of solutions, application methods and safety precautions.

WARNING: USE NORMAL SAFETY PRECAUTIONS WHEN USING FLAMMABLE MATERIALS DURING CLEANING AND PAINTING PROCEDURES.

3. Corrosion treatment is applied to surfaces impractical to remove from the aircraft for immersion treatment. Exercise caution to prevent additional damage to aircraft assemblies and finish.
4. Paint stripper solution is harmful to the eyes and skin. Wear goggles, rubber gloves, apron and boots when working with paint stripper.
5. Deicing fluid is used to clear ice and frost from exterior surfaces. Deicing fluid is not intended for snow removal.

Cleaning

1. General Precautions.
 - A. Use chemical supplier's recommendations for mixing and applying cleaning agents and for equipment and personnel safety.
 - B. Use of cleaners while aircraft is hot from being in the sun may cause streaking.
 - C. Start washing operation at the top and work down to prevent streaking previously cleaned areas.
2. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items.

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Name	Number	Manufacturer	Use

GENERAL CLEANING INCLUDING EXHAUST DEPOSITS

Delchem Jet Wash	2271	Pennsalt Chemicals Corp. 2700 South Eastern Ave. Los Angeles, Calif.	To wash exterior surface of the aircraft.
Aerowash		Wyandotte Chemicals Corp. 8921 Dick Road Los Nietos, Calif.	To wash exterior surface of the aircraft.

PAINT REMOVER

Delchem E-2	19B	Pennsalt Chemicals Corp. 2700 South Eastern Avenue	To strip paint.
Paint Remover	Turco 5556AF	Turco Products Inc. Box 1055 Wilmington, Calif.	To strip pain.

CORROSION REMOVAL

Delchem	810	Pennsalt Chemiclas Corp. 2700 South Eastern Ave.	To remove light corrosion or discoloration.
Pennsalt	715	Pennsalt Chemicals Corp. 2700 South Eastern Avenue.	To remove moderate corrosion.

DEICING EXTERIOR SURFACES

Deicing Fluid	WD-20	Jefferson Chemical Co. Houston, Texas	To remove ice and frost from control surfaces.

PRETREATMENT

Iridite Powder	14-2	Allied Research Inc.	To pretreat aluminum against corrosion.

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Name	Number	Manufacturer	Use
<u>INTERIOR CLEANING</u>			
Yosemite	Y999	Yosemite Chemical Co. 1248 Wholesale St. Los Angeles, Calif.	For cleaning vinyl coated fabrics, Mylar, Scotchcal murals, Polyplastex, leathers, vinyl flooring, Formica, linoleum, finished Flexwood, or painted surfaces.
or			
Aliphatic Naphtha		Commercially Available	
Host Dry Cleaning Compound		Host of California 2935 Coleridge Ave. Pasadena, California	For cleaning drapes, curtains, upholstery, fabrics, and carpet.
Wet Rug Shampoo		Commercially Available	Carpeting
Perchloroethylene		Commercially Available	Spot clean carpet.
Stoddard Solvent	Fed.Spec		Cleaning nylon safety belts.
Mild Soap Detergent		Commercially Available	Cleaning nylon safety belts. Cleaning Noryl plastic.

WARNING: CLEANING OPERATIONS USING SOLVENTS SHOULD BE PERFORMED IN A WELL VENTILATED ATMOSPHERE. EXERCISE NORMAL SAFETY PRECAUTIONS DURING USE.

3. Exterior Cleaning.

- A. Connect static ground cables to aircraft.

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MAINTENANCE MANUAL

- B. Install protective covers on engine intake, and engine exhaust, pitot tubes, static ports and tailcone air inlets.
- C. If there are leaks around cabin door, baggage door or foul weather window, seal with tape.
- D. Brush or spray cleaner on surface as specified by the supplier. The strength of the chemical mixture will determine the cleaning power.

CAUTION: DO NOT BRUSH WINDOWS. WINDOWS ARE CONSTRUCTED OF STRETCHED ACRYLIC AND BRUSHING MAY SCRATCH THE WINDOWS.

- E. Rinse covers and tape.
- F. Clean windows.

4. Interior Cleaning

A. Clean Interior Decorative Materials.

- (1) Clean with Yosemite Y-999 (or equivalent) as follows:
 - (a) Spray or wipe on over the soiled surface.
 - (b) Wipe off with a clean cloth dampened in water.
- (2) Clean with Aliphatic Naphtha as follows:
 - (a) Wipe with a clean cloth dampened with naphtha and wipe dry with a clean cloth.
 - (b) When removing tar, asphalt, or chewing gum; remove as much as possible with a knife. Apply naphtha to the residue and then wipe dry with a clean cloth; this has a buffing effect that eliminates the possibility of stain from the solution.

C. Cleaning Rugs, Drapes, Curtains and Upholstery Fabrics.

- (1) Dry-clean commercially.
- (2) Host dry cleaning compound.
 - (a) Sprinkle the compound liberally on the soiled area.
 - (b) Rub the compound into the soiled area.
 - (c) Remove the compound with a vacuum cleaner.

NOTE: This compound is nonflammable and may be used on fueled aircraft.

- (3) Wet shampoo.
 - (a) Remove carpet or upholstery from the aircraft. If at all possible use the spot cleaning method.
 - (b) Vacuum the carpet and upholstery, removing as much dirt and dust as possible.

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- (c) Place a tablespoon of shampoo in a pail and direct a jet of water into the shampoo to produce abundant foam.
- (d) Apply the foam uniformly over the surface to be cleaned.
- (e) Remove the suds by wiping with a brush or clean cotton cloth. Since there is very little moisture in the foam, wetting of the fabric or retention of moisture will not occur.

CAUTION: USE OF A MECHANICAL SHAMPOOER MAY DISTORT THE CARPET.

- (f) If tar, asphalt, or chewing gum is present, remove as much as possible by mechanical means; then perform steps (a) through (d).
- (4) Spot cleaning.
- (a) Spot clean tufted carpet in the aircraft, if at all possible, rather than completely removing the carpet for shampooing.
 - (b) Saturate a clean white or colorless cloth with Perchloroethylene solution.

CAUTION: DO NOT POUR PERCHLOROETHYLENE SOLUTION DIRECTLY ON THE CARPET.

- (c) Hand rub the perchloroethylene saturated cloth in circular motion on the soiled spot.

CAUTION: DO NOT USE A MECHANICAL SHAMPOOER; IT WILL DISTORT THE CARPET.

- (d) An upholstery hand shampooer may be utilized on difficult to clean areas.
- (5) Cleaning acrylic plastic, refer to Chapter 3.

Corrosion Treatment

1. Description

- A. Cleaning the aircraft at regular intervals is helpful in the prevention of corrosion. Where corrosion occurs, complete removal of corrosion deposits is required to prevent recurrence. Partial removal and covering with paint will not halt continued attack, since a small amount of moisture penetrates the surface of all paints and allows corrosion to continue.

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- B. When an area of corrosion is determined to exist, the area must be cleaned and the paint stripped as required. If the area is confined and the use of paint stripper is impractical because of rinsing difficulties, the paint may be removed with solvent material per Federal Specification TT-E-751 or TT-T-266. Apply solvent with soft bristle brush, allow solvent to remain until paint film is loosened, then wipe clean with a clean damp cloth.
- C. Heavy aluminum parts are susceptible to intergranular corrosion attack. Mechanical corrosion removal may be used on areas of heavy corrosion, pitted areas, or in conjunction with chemical corrosion removal. For lightly corroded areas, No. 400 aluminum grit abrasive paper or abrasive mat may be used. For heavily corroded or pitted areas, a carbide tipped scraper, fine fluted rotary file or grinder may be used. To avoid the possibility of stress concentrations, the cleaned area should be blended into the surrounding area to form a saucer shaped depression.

The cleaned area should have a width of 10 times the depth and a length of 20 times the depth when possible. Mechanical corrosion removal must be followed by chemical corrosion removal in order to thoroughly clean the surface for corrosion proofing treatment.

- D. Chemical corrosion removal is used on clad aluminum parts; such as skin, and is other areas of light corrosion. The surrounding parts and materials shall be protected from corrosion remover damage by masking or other appropriate methods. Specific Caution should be exercised in areas where the corrosion remover could become entrapped or attack an uncorroded area.

2. Corrosion Removal.

A. Removal of Light Corrosion and Discoloration:

- (1) Apply Delchem 810 with brush or cloth.
- (2) Agitate with short fiber brush or abrasive mat until all corrosion products are removed. Do not leave conditioner in contact with the surface for more than 20 minutes.
- (3) Rinse of the corrosion remover with a damp cloth, rinsing frequently in water.
- (4) Repeat cycle as required.
- (5) After all corrosion is removed, thoroughly rinse treated area with clean water.
- (6) Apply pretreatment (Iridite 14-2) to aluminum where corrosion was removed. Follow the manufacturer's instructions.

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B. Removal of Moderate Corrosion:

- (1) Dilute Pennsalt 715 with an equal volume of water in a plastic lined container.
- (2) Apply diluted Pennsalt 715 with a brush or cloth wetting the entire corroded surface thoroughly.
- (3) Allow the solution to stand as long as necessary to remove the corrosion products but never longer than 20 minutes.
- (4) Scrub with a short fiber brush just before rinsing with water or a damp cloth.
- (5) Repeat cycle as necessary.
- (6) After all corrosion is removed, thoroughly rinse treated area with clean water and dry.
- (7) Apply pretreatment (Iridite 14-2) to aluminum where corrosion was removed. Follow manufacturer's instructions.

Paint Stripping

1. Description

- A. Stripping of paint is required to reach paint covered corrosion, when new paint is incompatible with existing paint and before repainting an area that has been repaired.
- B. Before applying paint stripper; windows, areas not being painted, openings, rubber and other non-metallic parts must be masked off (refer to masking). If paint stripper should accidentally get on material such as plexiglas, immediately flush with water.
- C. During paint stripping, the following safety precautions should be observed.
 - (1) Have fire extinguishing equipment available.
 - (2) Work area must have adequate ventilation.
 - (3) Wear rubber gloves, apron, goggles or face shield and head covering.

2. Paint Stripping Procedures:

- A. Brush or spray paint stripper on painted surface starting at the top and working down.
- B. Allow paint stripper to set until paint is completely loosened. Add fresh stripper as necessary to keep stripper moist. It may take several minutes for the paint to loosen. Scrubbing with a stiff bristle brush may help loosen dirt.
- C. Remove paint and paint stripper in accordance with paint stripper manufacturer's instructions.

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- D. Repeat process on areas where paint was not completely removed.
- E. Rinse area with water starting at the top and working down.

Masking

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items.

Name	Number	Manufacturer	Use
Kraft Paper	UU-P-268	Commercially Available	Masking off paint area.
Water and Grease Proof Barrier Material	MIL-B-121C Grade A, Type 2 Class 1	Commercially Available	Paint mask for windows.
Tape	P-703	Permacel	Masking.
Tape	6223 Mystic	Commercially Available	Masking.

2. Window Masking:

A. General.

- (1) Acrylic windows may be softened or otherwise damaged by paint stripper, solvent or paint. Use water and grease proof barrier material and polyethylene coated tape to protect windows.

B. Stripping Paint.

- (1) Place barrier material over window and seal around periphery with polyethylene backed masking tape.
- (2) Cut second sheet of barrier material an inch or more larger than window.
- (3) Place second sheet of barrier material over window and seal with polyethylene tape.

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- (4) After stripping paint from panel, remove outer layer of barrier material and hand strip the border around window.
- (5) Place barrier material over window and seal around periphery with polyethylene backed masking tape.
- (6) Refer to exterior finish.

Finish and Trim

1. Description

- A. The finish and trim plate is installed on the forward left hand wheel well web. The plate contains finish and trim information for the aircraft. To read the information contained, convert the number codes stamped on the plate to the detailed description included in the aircraft's parts catalog.
- B. To insure matching colors, supply Cessna Dealers Organization with the proper information from the finish and trim plate when ordering replacement trim items and paint.

Exterior Finish

1. Description

- A. The aircraft exterior finish is vinyl enamel which is comprised of a wash primer and the vinyl enamel topcoat. Optional finish includes polyurethane paint.

2. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following items.

Name	Number	Manufacturer	Use
<u>WASH PRIMER</u>			
Primer	EXZ016G	Enmar Dupont	Base for enamel finish.
Type I-E	818-012	Dupont	Base for enamel finish.

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Name	Number	Manufacturer	Use
Thinner	800 3094	Turco Enmar	Enamel finish coat. Thinner.
Polycarbonate Primer	600SL9953 RV3649	Lacco Red Spot Paint and Varnish Duralac Chemical	Base for polycarbo- nate finish. Base for epoxy fin- ish.
Epoxy Primer (Type) I-M			Base for epoxy fin- ish.
Epoxy Primer (Fiberglass)			Base for epoxy fin- ish on fiberglass.
Sky Spar Surfacer	P-900		Base component.
Catalyst Concentrate	C-918		Component I.
Catalyst Thinner	C-916		Component II
Catalyst Thinner	T-6487		Component II
Thinner	T-262		Component II
Base Catalyst	C-22-Y-7277 66C-7225	U.S. Paint U.S. Paint	Base coat for poly- urethane finish.
<u>INTERMEDIATE COAT</u>			
Base Catalyst Thinner	AA-92-Y-43 AA-92-C-33 T888	U.S. Paint U.S. Paint U.S. Paint	Top coat for poly- urethane finish.
<u>SOLVENT CLEANER</u>			
Methyl Ethyl Ketone	TT-M-261	Commercially Available	To clean aluminum surface.
Pennsalt	2331	Pennsalt	To clean aluminum surface after paint has been stripped.

3. Enamel Finish.

- A. Surfaces to be painted must be thoroughly cleaned. Scuff sand and solvent clean area to be painted with methyl ethyl ketone. Care should be taken to remove all letters, grease and bugs. Area should be masked carefully and all taped edges firmly adhered to metal to prevent a ragged edge. Class "A" wrapping paper and thinner proof masking tape should be used to cover plexiglass.

CAUTION: METALLIC PAPER, METAL FOIL OR METAL OF ANY KIND SHOULD NEVER BE USED AS A PAINT SPRAY MASK OR WINDOWS AND WINDSHIELDS.

- B. Methyl Ethyl Ketone is used on surfaces where pretreatment and/or corrosion proofing is undisturbed. Pennsalt is used when paint stripping was required as part of the rework. Pennsalt will provide a good paint base. Apply wash primer as soon as possible after solvent cleaning.
- C. To assure paint matching when repainting sections or touching up, obtain the code number from the finish and trim plate located in the nose wheel well, front left web.
- D. The number codes recorded on the finish and trim plate are related to Cessna Specifications. To insure matching finish follow ordering instructions defined in the finish and trim plate description.

4. Wash Primer.

- A. Mix one Volume 66C-7225 Catalyst to one Volume C-22-Y-7277 base. Always add catalyst to base with adequate agitation.

NOTE: No induction time is required and pot life is six to eight hours.

- B. Material should be applied in one wet, even coat to a dry film thickness of .0005 to .0007 inches. A minimum of 30 minutes should be allowed before applying finish coat.

NOTE: Clean spraying equipment immediately with methyl ethyl ketone or toluene.

5. Intermediate Coat (Polyurethane Finish).

- A. Mix one part AA-92-C-23 catalyst to two parts AA-92-Y-43 base. Thin spray viscosity of 18 to 20 seconds in a number two Zahn cup with T888 thinner. Always add catalyst to base with adequate agitation.

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NOTE: Induction time is 15 minutes. Pot Life is four to six hours.

- B. Material should be applied to a wet coat application to a dry film thickness of .0006 to .0008 inch. Allow two to four hours at room temperature before applying top coat.

NOTE: Clean spraying equipment immediately with methyl ethyl ketone or toluene.

6. Topcoat (Polyurethane Finish).

- A. Mix one volume AA-92-C-39 catalyst to one volume AA-92 base. Thin if necessary with T732A thinner to a spray viscosity of 18 to 22 seconds in a number two Zahn cup. Always add catalyst to base with adequate agitation.

NOTE: If anti-cratering solution is used, number 92C24 should be used and no more than two ounces per catalyzed gallon.

- B. Induction time is 30 minutes. Pot life to six to eight hours.
- C. Material shall be applied in one wet coat or one mist coat followed by one wet coat to a dry film thickness of .0013 to .0017 inch. Coating may be force dried at 140°F for a period of four hours or air dry for 12 to 14 hours. Stripes should be applied within 24 hours after application of topcoat. If this requirement cannot be met the area under stripe should be scuff sanded and wiped down with methyl ethyl ketone.

NOTE: Clean spraying equipment immediately with methyl ethyl ketone.

7. Epoxy Finish.

- A. Surfaces to be touched up or painted should be feather sanded with #320 grit sandpaper followed by #400 grit sandpaper. Avoid sanding through the primer if possible. If the primer is penetrated over an area of 1/2 inch square or larger, the surface must be reprimed.

8. Epoxy Primer (Type I-M).

- A. Mix thoroughly by volume one part epoxy primer to one part catalyst. Thin mixture with T-6487 thinner to a spray viscosity of 17 to 19 seconds in a number two Zahn cup.

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- B. Allow mixture to set for one hour before using.

NOTE: The work life of the primer is six hours after mixing.

- C. Material should be applied in a wet coat application to a dry film thickness of .0004 to .0007 inch.
D. Allow 20 to 30 minutes drying time between applications of primer coats. Primed surfaces should be allowed to air dry for 30 minutes, then final dry 4 hours at 135°F.

9. Epoxy Enamel Application.

- A. Mix epoxy enamel by adding one part by volume of thinner to one part by volume of enamel. No additional thinning is necessary.
B. Allow mixture to set for 1 hour before using.

NOTE: Work life of epoxy enamel is 8 hours.

- C. Spray coats shall be applied to a dry film thickness of .0008 to .0012 inch.
D. Allow finish to cure for a period of 8 hours at room temperature. As an alternate, finish may be force dried by air for 30 minutes followed by a thirty minute bake at 250°F or 2 hours at 130°F.

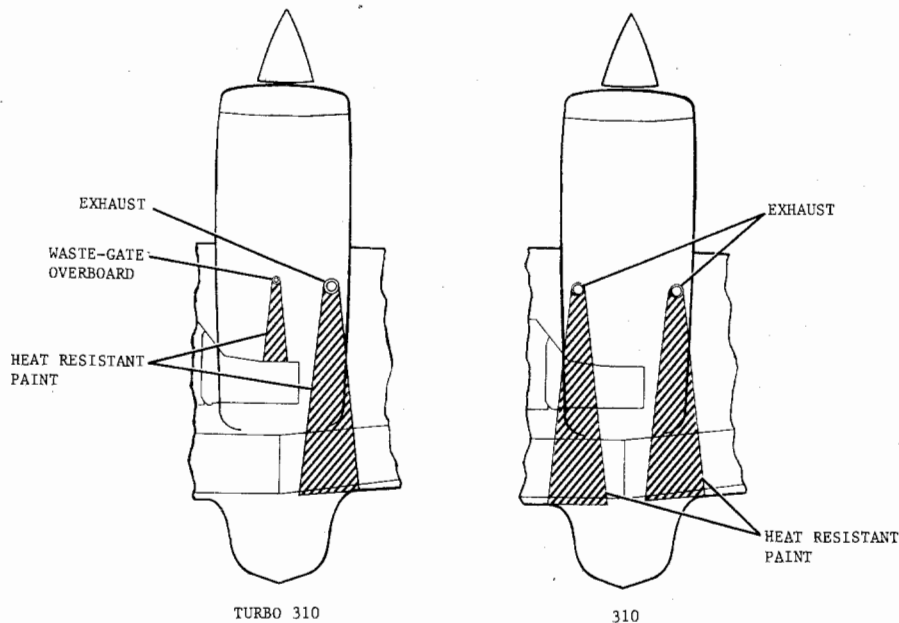
10. Heat Resistant Enamel. (See Figure 1)

- A. The area aft of the exhaust outlet and waste-gate over-board outlet is painted with heat resistant enamel. Surface should be painted as follows:
B. Mask off the area to be painted and strip off old paint using Delchem E-2 Strip 19B or equivalent then rinse area with a clear water spray.
C. Scuff sand and tack rag area to be sprayed.
D. Spray coat Red Iron Oxide Primer to a cure film thickness of .0002 to .0005 inches to the area to be painted.

NOTE: Thin Red Iron Oxide Primer to a one to one ratio with Toluene for spray.

- E. Allow primed surface to air dry approximately one hour.
F. Sand prime surface irregularities and reprime.
G. Spray coat heat resistant enamel to insure a cure film thickness of 0.001 to 0.0015 inch.

NOTE: Heat Resistant enamel should be thinned in a one to one ratio with 1 part xylene or Toluene to four parts enamel and allow to air dry for a period of 24 hours.



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Area Painted with Heat Resistant Enamel
Figure 1

11. Touch Up Vinyl.

- A. When it is necessary to touch up or refinish an area, the edge of the finish adjacent to the defect shall be feathered by sanding with #320 grit followed by #400 grit sandpaper. Avoid, if possible, sanding through the primer. If the primer is penetrated over an area of 1/2-inch square or larger, the surface must be reprimed.

NOTE: Avoid spraying metal primer on the adjacent paint as much as possible.

- B. When touching up vinyl, use EX2016G primer mixed one part primer to one part EX2016A activator. Stir and allow 30 minutes before spraying.
- C. When priming with EX2016G use a light coat of MIL-P-8585 zinc chromate primer thinned four parts toluol to one part primer applied over the EX2016G.
- D. Fill the feathered areas by spraying on several coats of Acme 538 dark grey surfaces and allowing 5 to 8 minutes drying time for each coat.
- E. Sand the entire area with #400 grit sandpaper and apply the top coat.

NOTE: Remove dry overspray by burndown (T-1411) or by compounding with Dupont 808 rubbing compound.

12. Touch Up Landing Gear Finish.

- A. The area of the landing gear to receive touch up paint should be masked off, sanded, cleaned and primed in accordance with Priming Procedures, using Red Oxide Primer P/N BM 111-35.
- B. Apply Epoxy White P/N 54E-511 in accordance with Epoxy Finish.

13. Rain Erosion Coating Application (Radome).

- A. Refer to Chapter 15 for preparation and application of rain erosion coating.

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GENERAL DATAStandard Torque Values

1. Description.

- A. To ensure security of installation and prevent overstressing of components during installation, the torque values outlined in Figure 1 and other applicable chapters of this manual should be used during installation and repair of components.

Alignment and Symmetry Check

1. Description.

- A. Before making an alignment and symmetry check the aircraft should be defueled and leveled in accordance with Leveling. Figure 2 provides the measurements and shows the relative elevation points to be measured during the alignment symmetry check. Measurements are made with a steel tape projected between alignment points.

Checking Wing Twist and Location of Thrust Line (See Figure 3)

- A. Remove wing, refer to Chapter 3. Place wing on suitable supports beneath the root and tip ribs.

NOTE: The wing tip tank must be removed during check.

- B. Locate wing datum plane as follows:

- (1) Locate a line at the root rib (wing station 28.40) which is 4.52 inches up from the lower surface of the front spar, and 4.00 inches up from the lower surface of the rear spar.
- (2) Locate a line at the tip rib (wing station 199.92) which is 1.44 inches up from the lower surface of the front spar, and 0.81 inches up from the lower surface of the rear spar.
- (3) These two lines locate the wing datum plane, and the three degrees of twist will be present if the lines are parallel.
- (4) Figure 3, Detail A, B and C, locate engine thrust line.
- (5) Install wing and wing tip tank.

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Control Surface Balancing Fixture Fabrication

1. Fabrication of Balancing Fixture (See Figure 4).

A. Fabricate Beam.

- (1) Fabricate beam from wood (yellow pine) or equivalent, one by one and one-half inch stock.
- (2) Locate center of beam. (Should be 25.80 inches from end.)
- (3) Locate and drill 3/16 (0.1875 x 3/8 (0.375)) holes 0.25 in from each end of beam.
- (4) (See Detail B.) Fabricate dowel and install in beam, using glue for security.
- (5) Measure from the center point of beam or 25.80 inch station, locate and drill No. 30 (0.128) diameter holes for aileron, elevator and rudder hanger locations.
- (6) Mark off and paint the beam as indicated for aileron, rudder and elevator positions.

B. Fabricate Hanger.

- (1) Fabricate right and left hanger halves per Detail C.
- (2) Assemble the hanger, using three MS20470AD3-5 rivets.

C. Fabricate pin from 1/8 steel rod per Detail D.

D. Fabricate Balance Weight.

- (1) Fabricate balance weight per Detail A.

NOTE: If necessary, grind or file balance weight to obtain four ounce weight.
Scribe centerline after fabrication.

E. Fabricate Mandrel.

- (1) Fabricate mandrel in accordance with Detail E.

NOTE: Mandrel may be fabricated from any suitable material.

Control Surface Balancing

1. Balance Procedures.

- A. It is recommended that control surface balancing be accomplished in a draft-free room/area, using the balancing equipment fabricated from instructions contained in Figure 4.

RECOMMENDED NUT TORQUES

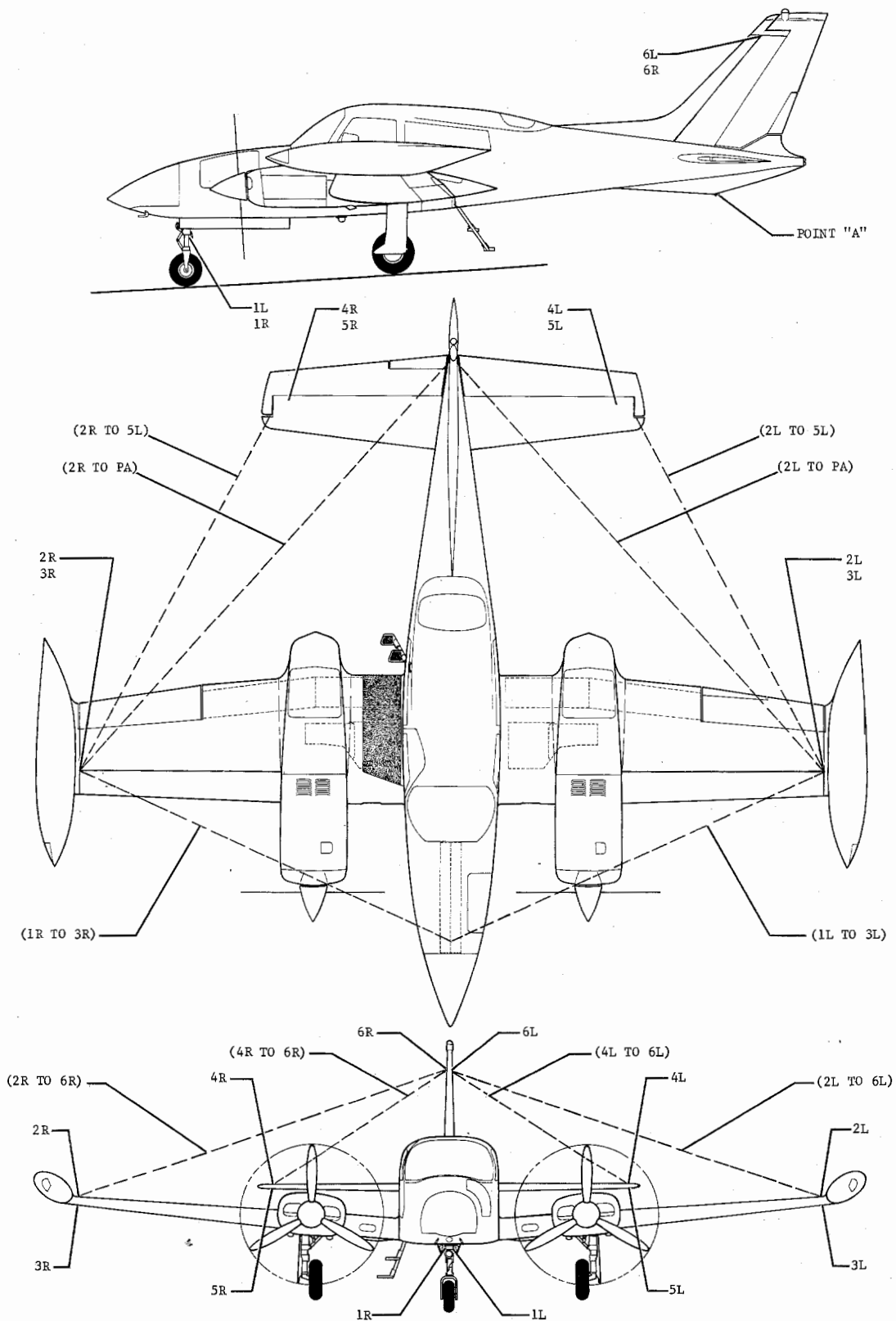
THE TORQUE VALUES STATED ARE POUND-INCHES, RELATED ONLY TO STEEL NUTS ON OIL-FREE CADMIUM PLATED THREADS.				
FINE THREAD SERIES				
TAP SIZE	TENSION NUTS		SHEAR NUTS	
	TORQUE		TORQUE	
	STD (NOTE 1)	ALT (NOTE 2)	STD (NOTE 3)	ALT (NOTE 2)
8-36	12-15		7-9	
10-32	20-25	20-28	12-15	12-19
1/4-28	50-70	50-75	30-40	30-48
5/16-24	100-140	100-150	60-85	60-106
3/8-24	160-190	160-260	95-110	95-170
7/16-20	450-500	450-560	270-300	270-390
1/2-20	480-690	480-730	290-410	290-500
9/16-18	800-1000	800-1070	480-600	480-750
5/8-18	1100-1300	1100-1600	660-780	660-1060
3/4-16	2300-2500	2300-3350	1300-1500	1300-2200
7/8-14	2500-3000	2500-4650	1500-1800	1500-2900
1-14	3700-5500	3700-6650	2200-3300	2200-4400
1-1/8-12	5000-7000	5000-10000	3000-4200	3000-6300
1-1/4-12	9000-11000	9000-16700	5400-6600	5400-10000
COARSE THREAD SERIES				
	(NOTE 4)		(NOTE 5)	
8-32	12-15		7-9	
10-24	20-25		12-15	
1/4-20	40-50		25-30	
5/16-18	80-90		48-55	
3/8-16	160-185		95-100	
7/16-14	235-255		140-155	
1/2-13	400-480		240-290	
9/16-12	500-700		300-420	
5/8-11	700-900		420-540	
3/4-10	1150-1600		700-950	
7/8-9	2200-3000		1300-1800	
1-8	3700-5000		2200-3000	
1-1/8-8	5500-6500		3300-4000	
1-1/4-8	6500-8000		4000-5000	
NOTES				
1. Covers AN310, AN315, AN345, AN362, AN363, AN366, MS17825, MS20365, MS21044, MS21043, MS21044, MS21045, MS21046, MS21047, MS21048, MS21078 and other fine thread tension nuts.				
2. When using AN310, AN320, MS17825 or MS17826 castellated nuts where alignment between the bolt and cotter pin hole is not reached using normal torque values, use alternate torque values or replace the nut.				
3. Covers AN316, AN320, AN7502, MS17826, MS20364, MS21043, MS21083, MS21245 and other fine thread shear nuts.				
4. Covers MS20341, MS20365, MS21042, MS21043, MS21044, MS21045, MS21046 and other coarse thread tension nuts.				
5. Covers AN340, MS20364, MS21083 and other coarse thread shear nuts.				
CAUTION				
During removal and replacement of component parts, all self-locking nuts and castellated self-locking nuts must be replaced with new nuts.				
These torque values are recommended for all procedures contained in this manual except where other values are stipulated. They are not to be used for checking tightness of installed parts during service.				

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Torque Values
Figure 1

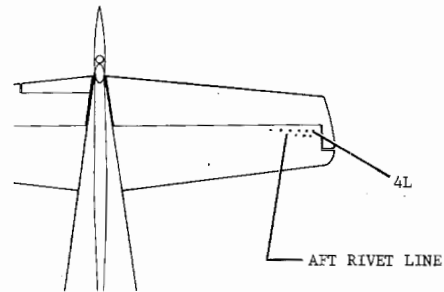
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MAINTENANCE MANUAL

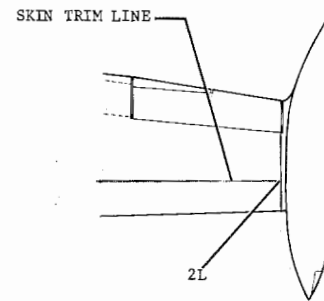
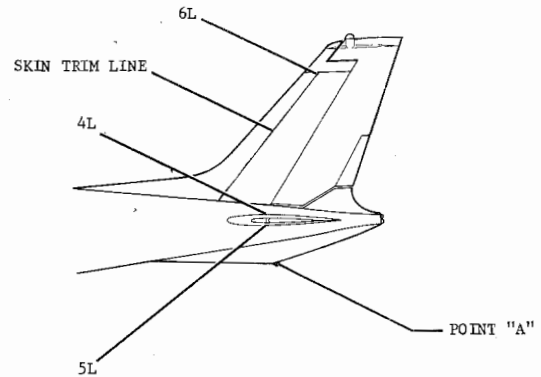
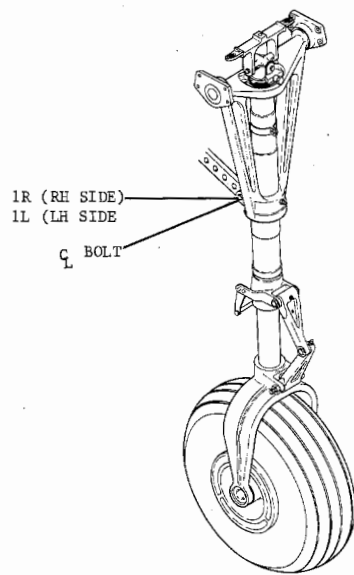


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Alignment and Symmetry Check
Figure 2 (Sheet 1 of 2)



TOP VIEW STABILIZER



TOP VIEW LH WING

Details of Check Points:

- A. Center line aft tail skid bolt.
1. Center line of bolt at gear strut and drag brace attachment. Center line head of bolt RH side and shank of bolt LH side.
2. Skin trim line and inboard edge of tip fairing at front spar.
3. Same as 2 except bottom of wing.
4. Center line aft rivet line of rear stabilizer at outboard edge of stabilizer.
5. Same as 4 except bottom of stabilizer.
6. Skin trim line at forward fin spar and lower edge of tip cap.

ALIGNMENT AND SYMMETRY CHECK	
POINTS	DISTANCE
1L TO 3L 1R TO 3R	18'3.30" ± 1.25 "
2L TO 5L 2R TO 5R	18'6.70" ± 2.00 "
2L TO PA 2R TO PA	23'3.40" ± 1.50 "
4L TO 6L 4R TO 6R	9'6.70" ± 1.00 "
2L TO 6L 2R TO 6R	24'11.00" ± 2.00 "

Alignment and Symmetry Check
Figure 2 (Sheet 2)

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NOTE: Be certain control surface weights are installed, surfaces are clean, all foreign matter inside control surfaces removed, and control surface painted with hinge bolts installed. Surfaces which have trim tabs incorporated must have the tab secured in a streamlined position. Push-pull rods, with attaching hardware on the trim tab and rudder bellcrank, must be installed before starting balancing procedures.

2. Balance Fixture Balancing (See Figure 5).

- A. Install hanger assembly in the appropriate position for the surface being balanced.
- B. Place mandrel on a table or other suitable flat surface and center balancing beam on mandrel at the centerline of beam.
- C. Add washers to dowel pins until a balanced condition is obtained.

NOTE: When balance fixture is in balance, it must assume a position parallel to the work surface.

3. Rudder Balancing Procedure.

A. Balancing Rudder (See Figure 5).

- (1) Remove rudder from aircraft, refer to Chapter 5.
- (2) Insert hinge bolts in place and position rudder on mandrels with bolts resting on the knife edge.

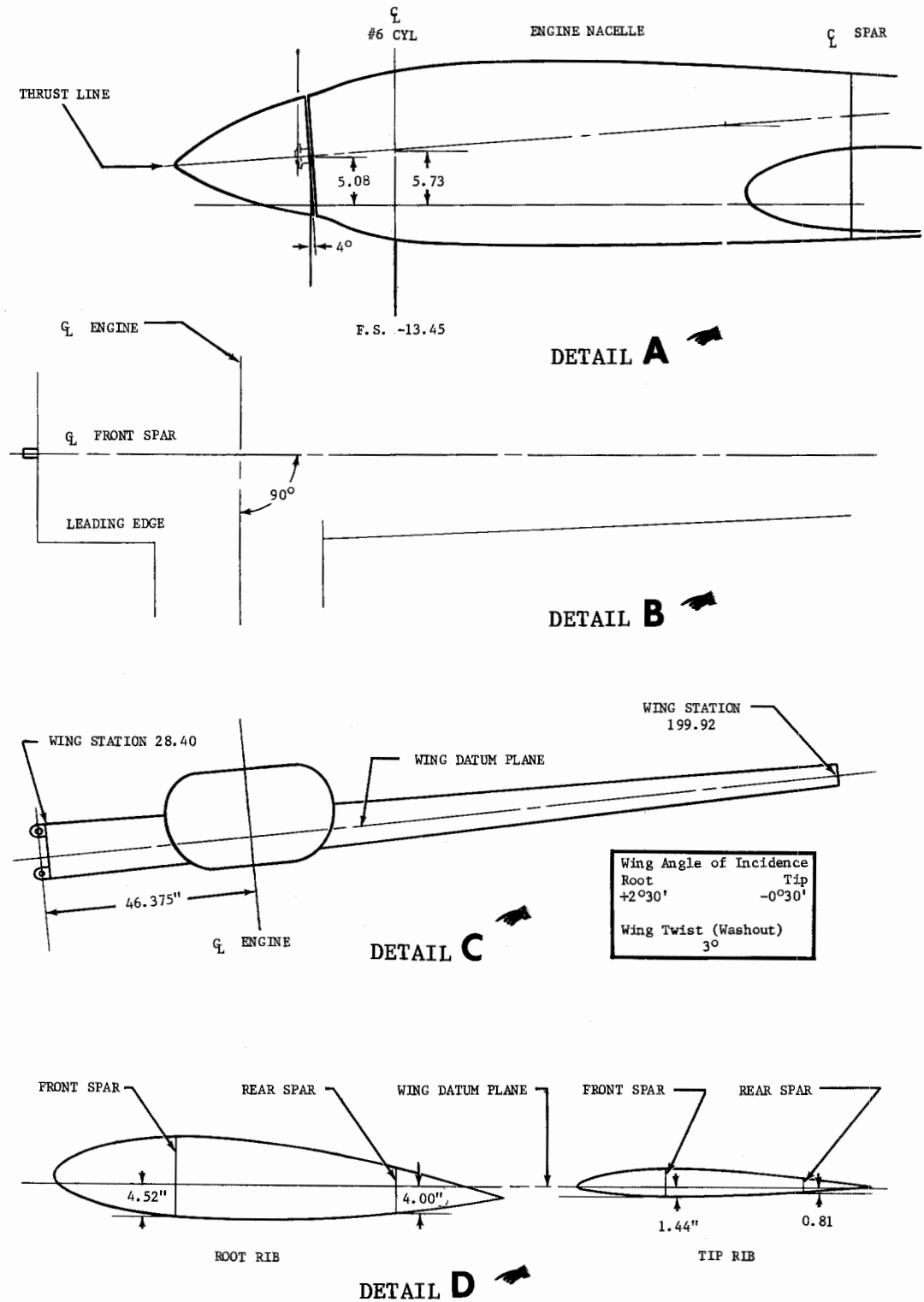
NOTE: Make sure rudder control surface has freedom of movement and does not drag on mandrels and bonding wires do not interfere with movement of control.

- (3) Secure the rudder trim tab in a streamlined position and install associated hardware.
- (4) Locate the position for balancing fixture on the rudder and place balancing beam in position.

NOTE: If balancing beam position falls on a rivet line, it will be necessary to move the beam to one side to provide a flat surface for the balancing beam. The balancing beam must be perpendicular to the hinge centerline and the trailing edge of the rudder control surface must be firmly seated in the cutout of the hanger.

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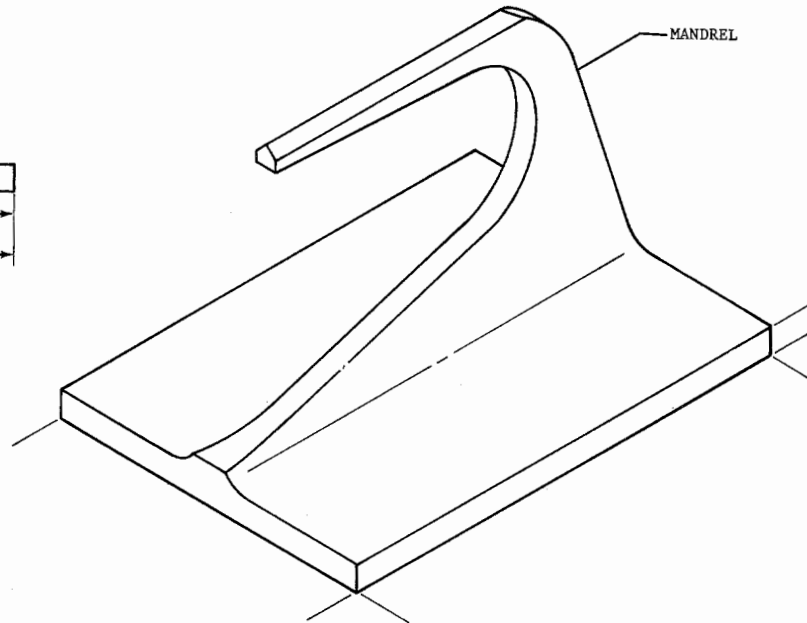
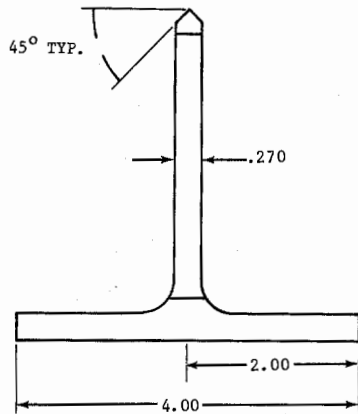


Wing Twist and Thrust Line Data
Figure 3

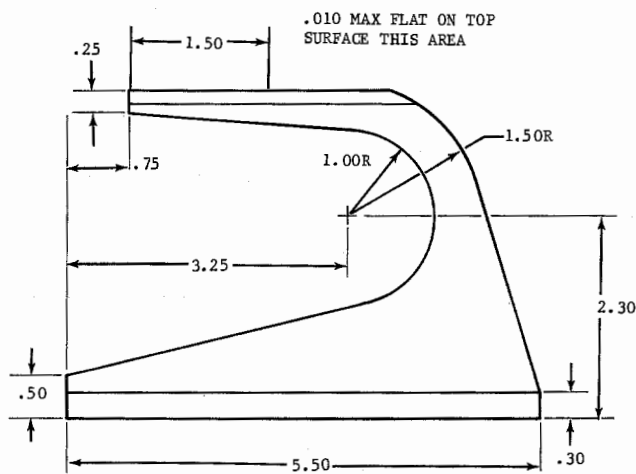
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MATL. COMMERCIAL STEEL

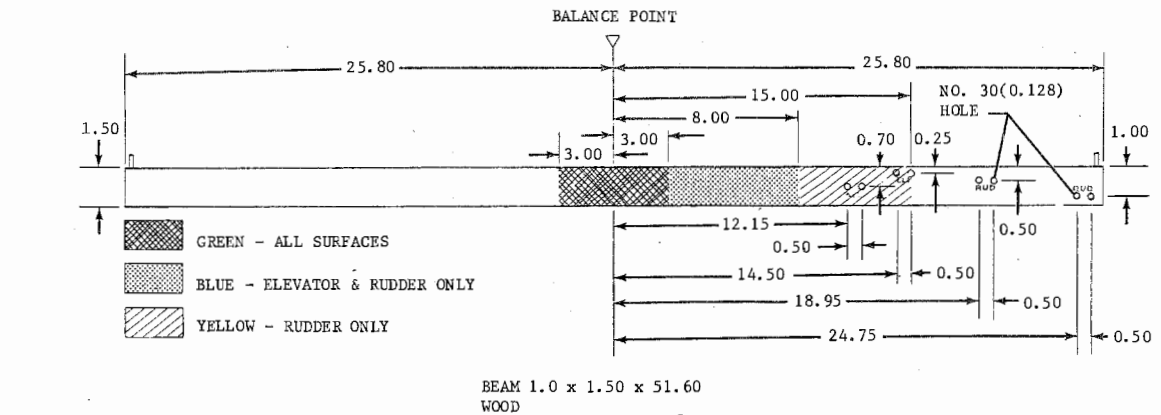


DETAIL E

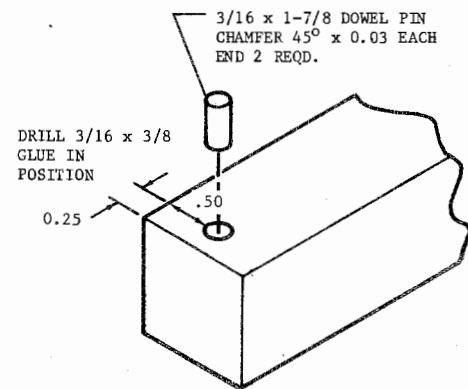
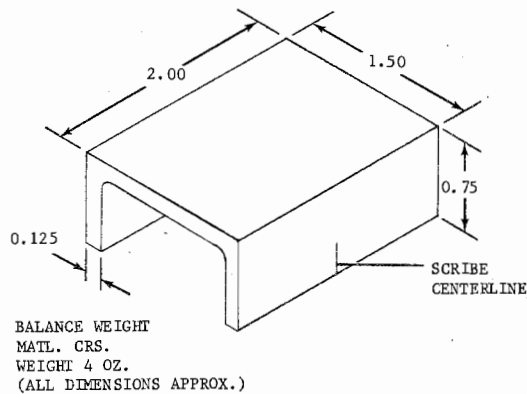
MANDREL FABRICATION

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Balancing Fixture Fabrication
Figure 4 (Sheet 1 of 2)

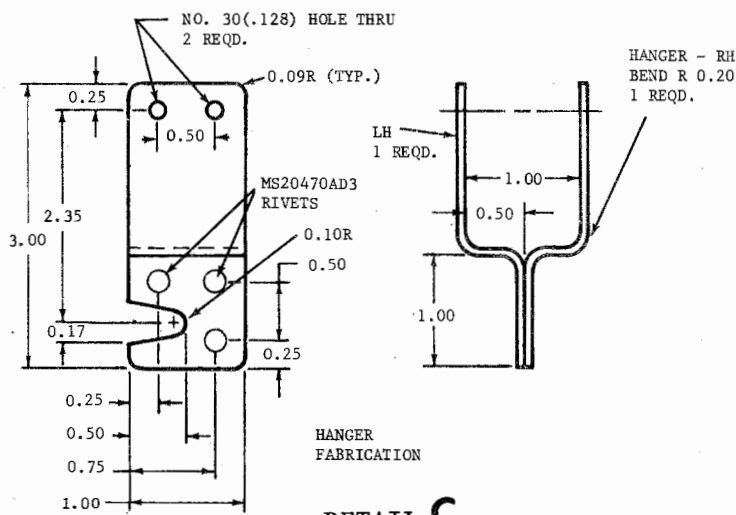


DETAIL A

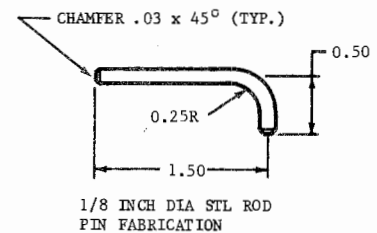


TYPICAL DOWEL INSTALLATION

DETAIL B



DETAIL C



DETAIL D

Balancing Fixture Fabrication
Figure 4 (Sheet 2)

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MAINTENANCE MANUAL

- (5) If the rudder assumes position parallel with base of mandrel and the balance weight is within the Green, Blue and Yellow range, the rudder is statically balanced.
- (6) If rudder assumes a position of trailing edge up, when balance weight is on aft end of range, rudder is overbalanced and needs weight removed.

NOTE: Remove overbalance by using a 1/2 inch drill to remove some of the weight.

- (7) If rudder control surface assumes position of trailing edge down, when balance weight is on forward end of range, rudder surface is underbalanced and needs more balance weight added.
- (8) The approximate amount of weight needed for underbalance may be determined by placing small amounts of loose weight in the balance weight area.
- (9) Additional balance weight may be added by pounding lead into existing holes of weight and staking. If holes are not available to insert added weight, it will be necessary to add 2 nutplates on each side of lightening hole and add a lead bar weight secured by two bolts.

NOTE: The rudder tip and mounting screws must be installed each time the rudder is checked for balance.

- (10) Install rudder, refer to Chapter 5.

4. Aileron Balancing Procedure (See Figure 5).

A. Balance Aileron.

- (1) Remove aileron from aircraft, refer to Chapter 5.
- (2) Balance the fixture for aileron control surface.
- (3) Insert hinge bolt in place and position aileron on the mandrels with bolt and pin resting on the knife edge.

CAUTION: BE SURE BOLT IS INSERTED IN CORRECT HINGE LOCATION (UPPER HOLE).

NOTE: Make sure aileron control surface has freedom of movement, does not drag on mandrel and the bonding straps are free.

- (4) Secure the trim tab on the left hand aileron in a streamlined position and install associated hardware.
- (5) Locate the position for balancing fixture on the aileron and place balancing beam into position.

NOTE: If balancing beam position falls on a rivet line, it will be necessary to move the beam to one side to provide a flat surface for the balancing beam. The balancing beam must be perpendicular to the hinge centerline and trailing edge of the aileron control surface must be firmly seated in the cutout of the hanger.

- (6) If the aileron assumes a position parallel with base of mandrel and the balance weight is within Green range, the aileron is statically balanced.
- (7) If aileron assumes a position of trailing edge up, when balance weight is on aft end of range, the aileron is overbalanced and needs weight removed.

NOTE: Remove overbalance by removing weight as necessary.

- (8) If the aileron assumes position of trailing edge down, when balance weight is on forward end of range, aileron is underbalanced and needs more balance weight added.
- (9) The approximate amount of weight needed for underbalance may be determined by placing small amounts of loose weight in the balance weight area.
- (10) Addition of balance weight may be added by inserting lead into existing holes of the weight. If holes are not available additional weight may be added by removing existing screws and installing longer screws to attach added weight.

NOTE: The aileron balance weight must be removed from the aileron in order to remove excess weight.

CAUTION: MAKE CERTAIN BOLTS SECURING WEIGHT IN PLACE ARE TIGHT BEFORE INSTALLING AILERON ON AIRCRAFT.

- (11) Install aileron, refer to Chapter 5.

5. Elevator Balancing Procedure (See Figure 5).

A. Elevator Balancing.

- (1) Remove elevator, refer to Chapter 5.
- (2) Balance the fixture for elevator control surface.
- (3) Insert hinge bolts in place and position elevator on the mandrels with bolts resting on the knife edge.

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ADD WASHERS AS NECESSARY
TO BALANCE THE FIXTURE

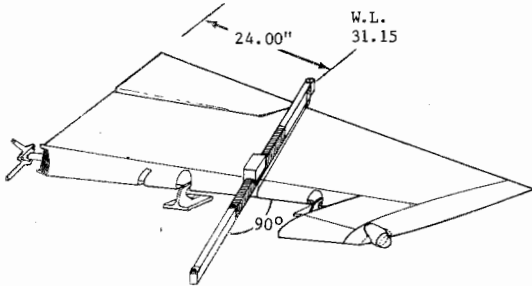
FORWARD END OF BALANCE
TOLERANCE RANGE AILERON,
RUDDER AND ELEVATOR

MANDREL

AFT END OF BALANCE
TOLERANCE RANGE AILERON

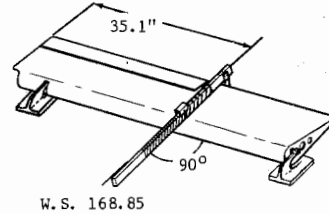
AFT END OF BALANCE
TOLERANCE RANGE
ELEVATOR AND RUDDER

LEFT-HAND SIDE SURFACE DOWN



BALANCING FIXTURE

LOWER SURFACE DOWN

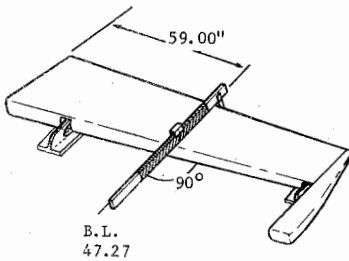


AILERON:

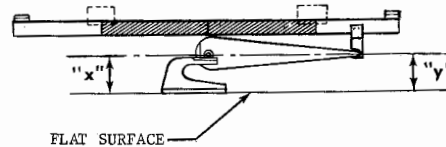
Place balanced fixture (refer to balancing procedures)
on first rib line outboard of trim tab on the aileron

RUDDER:

Place balanced fixture (refer to balancing procedures)
on first rib line above the trim tab on the rudder



LOWER SURFACE DOWN



FLAT SURFACE

TYPICAL BALANCED CONTROL

ELEVATOR:

Place balanced fixture (refer to balancing procedures)
on first rib line outboard of trim tab on the elevator

NOTE: In a 100% static balanced condition
dimensions x and y will be the same.

SURFACE	BALANCE TOLERANCE
AILERON	+ .75 TO - .75 in-lb.
ELEVATOR	+ .75 TO - 2.00 in-lb.
RUDDER	+ .75 TO - 3.75 in-lb.

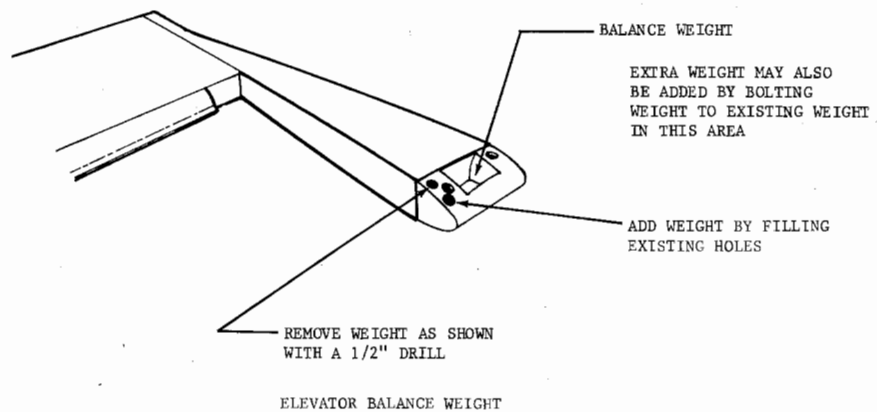
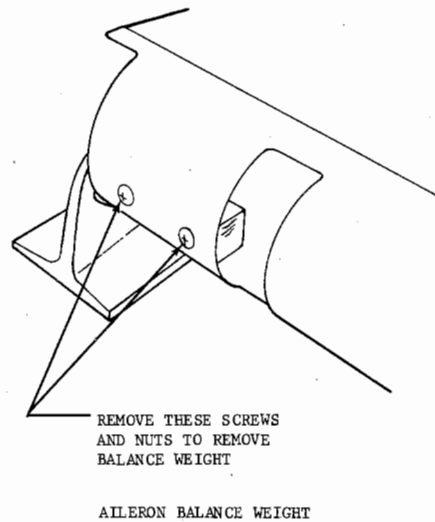
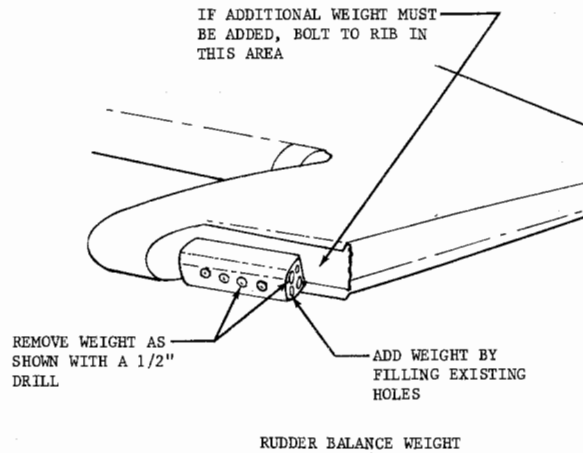
NOTE: The above balance tolerances are provided in the event
the regular balance fixture is not used. The minus
tolerance is forward of hinge line and plus tolerance
is aft of hinge line.

Static Balancing Aileron, Rudder and Elevator

Figure 5 (Sheet 1 of 2)

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MAINTENANCE MANUAL



Static Balancing Aileron, Rudder and Elevator
Figure 5 (Sheet 2)

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MAINTENANCE MANUAL

NOTE: Make sure elevator control surface has freedom of movement, does not drag on mandrels and bonding straps are free.

- (4) Secure the elevator trim tab on right-hand elevator in a streamlined position and install associated hardware.
- (5) Locate the position for balancing fixture on the elevator and place balancing beam into position.

NOTE: If balancing beam position falls on a rivet line it will be necessary to move the beam to one side to provide a flat surface for the balancing beam. The balancing beam must be perpendicular to the hinge centerline and trailing edge of the aileron control surface must be firmly seated in the cutout of the hanger.

- (6) If the elevator assumes a position parallel with base of mandrel, and the balance weight is within the Green and Blue range, the elevator is statically balanced.
- (7) If the elevator assumes a position of trailing edge up, when balance weight is on aft end of range, elevator is overbalanced and needs weight removed.

NOTE: Remove overbalance by using a 1/2-inch drill to remove some of the weight.

- (8) If the elevator assumes position of trailing edge down, when balance weight is on forward end of range, elevator is underbalanced and needs more balance weight added.
- (9) The approximate amount of weight needed for underbalance may be determined by placing small amounts of loose weight in the balance weight area.
- (10) Additional balance weight may be added by inserting lead in existing holes of the weight. If holes are not available, additional weight may be added by bolting a lead bar in the center of existing weight.

NOTE: Each time the elevator is checked for weight and balance, the elevator tip must be installed and elevator tip screws must be in the proper location (short screws toward aft end of elevator).

- (11) Install elevator, refer to Chapter 5.

CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

2

INSPECTION AND SERVICING

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INSPECTION & SERVICING

1. INSPECTION REQUIREMENTS

- A. As required by Federal Aviation Regulations, all civil aircraft of U.S. registry must undergo a complete inspection (ANNUAL) each twelve calendar months. In addition to the required ANNUAL inspection, aircraft operated commercially (for hire) must also have a complete inspection every 100 hours of operation.
- B. In lieu of the above requirements, an aircraft may be inspected in accordance with progressive inspection schedule, which allows the work load to be divided into smaller operations that can be accomplished in shorter time periods.
- C. CESSNA PROGRESSIVE CARE PROGRAM has been developed to provide a modern progressive inspection schedule that satisfies the COMPLETE AIRCRAFT INSPECTION (refer to paragraph 2, (3) for definition) requirements of both the 100 HOUR and ANNUAL inspection as applicable to Cessna Aircraft.

2. INSPECTION CHARTS

- A. The following Inspection Time Limits show the recommended intervals at which items are to be inspected.
- B. As coded in the Inspection Time Limits, there are items to be checked each 50 hours, each 100 hours, each 200 hours, and also Special Inspection Items which require servicing or inspection at intervals other than 50, 100 or 200 hours.
 - (1) When conducting an inspection at 50 hours, all items marked for 50 HOURS would be inspected, serviced or otherwise accomplished as necessary to insure continuous airworthiness.
 - (2) At each 100 hours, the 50 hour items would be accomplished in addition to the items for EACH 100 HOURS as necessary to insure continuous airworthiness.
 - (3) At each 200 hours, the 50 hour items and 100 hour items would be accomplished in addition to the items for EACH 200 HOURS as necessary to insure continuous airworthiness.
 - (4) SPECIAL INSPECTION ITEMS are those items not coded, 50 hours, 100 hours or 200 hours. These items should be checked at each inspection interval to in-

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sure that applicable servicing and inspection requirements are accomplished at the specified intervals.

- (5) A COMPLETE AIRCRAFT INSPECTION includes all 50, 100 and 200 hour items plus those Special Inspection Items which are due at the time of the inspection.

3. INSPECTION PROGRAM SELECTION

- A. AS A GUIDE FOR SELECTING THE INSPECTION PROGRAM THAT BEST SUITS THE OPERATION OF THE AIRCRAFT, THE FOLLOWING IS PROVIDED.

- (1) IF THE AIRCRAFT IS FLOWN LESS THAN 200 HOURS ANNUALLY

- (a) IF FLOWN FOR HIRE

An aircraft operation in this category must have a COMPLETE AIRCRAFT INSPECTION each 100 hours of operation and each 12 calendar months of operation (ANNUAL). A COMPLETE AIRCRAFT INSPECTION consists of all 50, 100, 200 and Special Inspection Items coded in the inspection charts as defined in paragraph 2. above.

- (b) IF NOT FLOWN FOR HIRE

An aircraft operating in this category must have a COMPLETE AIRCRAFT INSPECTION each 12 calendar months of operation (ANNUAL). A COMPLETE AIRCRAFT INSPECTION consists of all 50, 100, 200 and Special Inspection Items coded in the inspection charts as defined in paragraph 2 above. In addition, it is recommended that between annual inspections, all items be inspected at the intervals specified in the inspection charts.

- (2) IF THE AIRCRAFT IS FLOWN MORE THAN 200 HOURS ANNUALLY

Whether flown for hire or not, it is recommended that aircraft operating in this category be placed on the CESSNA PROGRESSIVE CARE PROGRAM. However, if not placed on Progressive Care, the inspection requirements for aircraft in this category are the same as those defined under paragraph 3,(1),(a) and (b).

Cessna Progressive Care may be utilized as a total concept program which insures that the inspection intervals in the inspection charts are not exceeded. Manuals and forms which are required for conducting Progressive Care inspections are available from the Cessna Service Parts Center.

4. INSPECTION GUIDE LINES

- A. MOVABLE PARTS for: lubrication, servicing, security of attachment, binding, excessive wear, safetying, proper operation, proper adjustment, correct travel, cracked fittings, security of hinges, defective bearings, cleanliness, corrosion, deformation, sealing and tension.
- B. FLUID LINES AND HOSES for: leaks, cracks, dents, kinks, chafing, proper radius, security, corrosion, deterioration, obstruction and foreign matter.
- C. METAL PARTS for: security of attachment, cracks, metal distortion, broken spotwelds, corrosion, condition of paint and any other apparent damage.
- D. WIRING for: security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration and corroded terminals.
- E. BOLTS IN CRITICAL AREAS for: correct torque in accordance with torque values given in the chart in Chapter 1, when installed or when visual inspection indicates the need for a torque check.

NOTE: Torque values listed in Chapter 1 are derived from oil-free cadmium-plated threads, and are recommended for all installation procedures contained in this book except where other values are stipulated. They are not to be used for checking tightness of installed parts during service.

- F. FILTERS, SCREENS & FLUIDS for: cleanliness, contamination and/or replacement at specified intervals.
- G. AIRCRAFT FILE.

(1) Miscellaneous data, information and licenses are a part of the aircraft file. Check that the following documents are up-to-date and in accordance with current Federal Aviation Regulations. Most of the items listed are required by the United States Federal Aviation Regulations. Since the regulations of other nations may require other documents and data, owners of exported aircraft should check with their own aviation officials to determine their individual requirements.

- (a) To be displayed in the aircraft at all times:
 - 1) Aircraft Airworthiness Certificate (FAA Form 8100-2).

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- 2) Aircraft Registration Certificate (FAA Form 8050-3).
- 3) Aircraft Radio Station License, if transmitter is installed (FCC Form 556).
- (b) To be carried in the aircraft at all times:
 - 1) Weight and Balance, and associated papers (Latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
 - 2) Aircraft Equipment List.
- (c) To be made available upon request:
 - 1) Aircraft Log Book and Engine Log Book.

H. ENGINE RUN-UP.

- (1) Before beginning the step-by-step inspection, start, run-up and shut down the engine in accordance with instructions in the Owner's Manual. During the run-up, observe the following, making note of any discrepancies or abnormalities:
 - (a) Engine Temperatures and pressures.
 - (b) Static rpm.
 - (c) Magneto drop (refer to Owner's Manual).
 - (d) Engine response to changes in power.
 - (e) Any unusual engine noises.
 - (f) Fuel selector and/or shutoff valve; operate engine(s) on each tank (or cell) position and OFF position long enough to ensure shutoff and/or selector valve functions properly.
 - (g) Idling speed and mixture; proper idle cut-off.
 - (h) Alternator and ammeter.
 - (i) Suction gage.
 - (j) Fuel flow indicator.
- (2) After the inspection has been completed, an engine run-up should again be performed to determine that any discrepancies or abnormalities have been corrected.

5. INSPECTION TIME LIMITS

- A. This section lists, in chart form, all inspection and servicing requirements which must be performed. Servicing requirements shall be used in conjunction with Chapter 2-40 Servicing, which outlines by text and illustrations those items to be serviced. A legend at the bottom of each page provides time limit requirements. Inspection items are listed in Chapter grouping format.

IMPORTANT: READ ALL INSPECTION REQUIREMENTS AND PARAGRAPHS PRIOR TO USING INSPECTION TIME LIMITS.

NOTE: The Inspection Time Limits are to be used in conjunction with Detailed Inspection Procedures.

6. COMPONENT TIME LIMITS

- A. This section lists those components for which a firm replacement or overhaul limit has been established.

7. DETAILED INSPECTION PROCEDURES

- A. This section provides detailed information on the inspections outlined in Inspection Time Limits. It describes, cleaning, inspection, repair and servicing procedures. Highly detailed requirements such as functional checks, operational checks, etc., are listed; however, to perform the inspection, refer to the detailed Chapter for complete detailed information.

8. SERVICING

- A. This section list items to be serviced by fluid replenishment and shows in detailed illustrations items to be lubricated.

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INSPECTION TIME LIMITS1. Inspection Requirements

NOTE: Perform a daily preflight inspection in accordance with aircraft's Owner's Manual.

A. General Information (Chapter 1)

- (1) Placards and Decals - Inspect Security, Presence and Legibility

B. Airframe (Chapter 3)

- (1) Windshield and Windows - Inspect for conditions. Check latches, hinges, seals for condition, operation and security of attachment. Emergency window release handle for position
- (2) Cabin Door - Inspect for Condition and Operation
- (3) Cabin Door Latch Mechanism - Service
- (4) Cabin Door Hinge - Service
- (5) Fuselage Baggage Door - Check for Condition and Operation
- (6) Fuselage Baggage Door Hinge and Door Stop - Service
- (7) Fuselage Baggage Door Latch Mechanism - Service
- (8) Wing Locker Door - Check Condition, Operation, and Security of Hinges, Latches, and Seals
- (9) Wing Locker Door Stop - Service
- (10) Nose Baggage Door - Check for Condition, Operation, Security of Hinges, Latches

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A - Every 50 Hours or Sooner When Local Dust Conditions Exist
 B - Every 50 Hours and at Tire Replacement
 C - First 100 Hours Check Torque; Then Every 100 Hours Check Security and Working. Do Not Torque

D - First 100 Hours and 200 Hours Thereafter
 E - Every 100 Hours or Every 6 Months
 F - Every 500 Hours
 G - Every 1500 Hours
 H - Every 2 Years
 I - Every 3 Years
 J - Every 5 Years

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INSPECTION TIME LIMITS

1. Inspection Requirements (Continued)

B. Airframe (Continued)

- (11) Nose Baggage Door Hinge and Door Stop - Service
- (12) Wing - Check for Loose Rivets, Cracks, Loose Mounting Bolts and Security
- (13) Wing Wheel Well - Check Root Rib and Wheel Well for Fume Proofing .
- (14) Wing Spar Fittings - Check Bolts for Torque and Security
- (15) Vertical and Horizontal Stabilizers - Check Bolts for Security
- (16) Fuselage Exterior and Interior Surfaces - Check Paint, Inspect for Skin Damage
- (17) Control Pedestal - Inspect for Condition and Security
- (18) Control Pedestal Bearings - Service
- (19) Nacelle Firewall - Inspect for Condition and Security

C. Landing Gear (Chapter 4)

- (1) Main Landing System - Check Actuating Time and Motor (Flight Check)
- (2) Main Landing Gear Actuator - Inspect for Condition, Security, and Wiring for Condition Routing, and Support
- (3) Main Landing Gear Actuator - Service
- (4) Emergency Manual Extension System - Inspect for Condition, Operation and Specification Compliance

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A - Every 50 Hours or Sooner When Local Dust Conditions Exist

B - Every 50 Hours and at Tire Replacement

C - First 100 Hours Check Torque; Then Every 100 Hours Check Security and Working. Do Not Torque

D - First 100 Hours and 200 Hours Thereafter

E - Every 100 Hours or Every 6 Months

F - Every 500 Hours

G - Every 1500 Hours

H - Every 2 Years

I - Every 3 Years

J - Every 5 Years

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

C. Landing Gear (Continued)

- (5) Emergency Manual Extension System Support Bearings - Service
- (6) Emergency Manual Extension System Spool and Bellcrank - Service
- (7) Emergency Manual Extension System Crank Handle Linkage - Service
- (8) Emergency Manual Extension System Mitergear - Service
- (9) Main and Nose Landing Gear Assemblies - Inspect for Condition
- (10) Rigging Landing Gear System - Perform Landing Gear Inspection in Accordance with Figure 1
- (11) Nose and Main Gear Shock Struts - Check for Evidence of Leakage, Proper Extension; Check Strut Barrel for Corrosion, Pitting, and Cleanliness
- (12) Shock Struts - Service
- (13) Torque Links - Inspect for Wear and Condition
- (14) Torque Links Nose and Main Gear - Service
- (15) Nose and Main Gear Retraction Linkage - Inspect for Condition
- (16) Nose Gear Trunnion Fitting - Service
- (17) Nose and Main Gear Wheel Bearings - Service
- (18) Nose Gear Pivot Bushings - Service

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A - Every 50 Hours or Sooner When Local Dust Conditions Exist
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D - First 100 Hours and 200 Hours Thereafter
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 I - Every 3 Years
 J - Every 5 Years

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INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

C. Landing Gear (Continued)

- (19) Nose and Main Gear All Spherical Rod Ends - Service
- (20) Nose Gear Shimmy Damper - Check for Leakage and Attach Points for Wear and Condition
- (21) Nose Gear Shimmy Damper - Service.
- (22) Nose Wheel Steering System - Check Cable Tension, Travel and Gimbal Bolts for Condition and Torque
- (23) Nose Gear Fork - Inspect for Cracks, General Condition and Security of Attachment
- (24) Nose and Main Wheel and Tires - Check Wear, Pressure and Condition
- (25) Main Gear Side Brace - Service .
- (26) Main Gear Uplock Bushings - Service
- (27) Main Gear Thrust Washers - Service
- (28) Brakes - Perform Operational Check of Main and Parking Brake System
- (29) Brake System Plumbing - Inspect for Leaks, Condition and Security. Check for Proper Routing and Support
- (30) Brake Assemblies - Check Wear of Lining and Disc Warpage
- (31) Brake Master Cylinders - Service .
- (32) Parking Brake Handle Shaft and Pivot Points - Service

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A - Every 50 Hours or Sooner When Local Dust Conditions Exist
 B - Every 50 Hours and at Tire Replacement
 C - First 100 Hours Check Torque; Then Every 100 Hours Check Security and Working. Do Not Torque

D - First 100 Hours and 200 Hours Thereafter
 E - Every 100 Hours or Every 6 Months
 F - Every 500 Hours
 G - Every 1500 Hours
 H - Every 2 Years
 I - Every 3 Years
 J - Every 5 Years

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

D. Flight Controls (Chapter 5)

	50	100	200	Spl Insp
(1) Control Column - Check for Security, Looseness, Wear and Proper Rigging			*	
(2) Control Column Control Tube - Service				F
(3) Control Column Bearings - Service.				F
(4) Aileron - Inspect Hinge, Bellcrank, Stop Bolt for Looseness and/or Jamb Nut for being Tight, Linkage, Pulleys, and Bolt for Condition, Operation and Security, and Travel			*	
(5) Aileron Trim Tab - Inspect Hinge for Cracks, Wear, Bolt for Proper Safety and Tab Travel			*	
(6) Aileron Trim Tab Actuator - Check Travel Linkage for Condition and Security			*	
(7) Aileron Trim Tab Actuator - Service				G
(8) Aileron and Aileron Trim Cables - Check for Security and Tension, Fraying and Turnbuckles for Safety			*	
(9) Elevator - Check Hinges and Hinge Bolts, Bellcranks and Push-Rod Connecting Bolt, Pulleys and Stop Bolts for Security and Condition .			*	
(10) Elevator Trim Tab - Check Hinge for Cracks, Wear, Bolt for Proper Safety and Tab Travel			*	
(11) Elevator Trim Tab Actuator - Check Travel, Condition and Security			*	
(12) Elevator Trim Tab Actuator - Service				G

A - Every 50 Hours or Sooner When Local Dust Conditions Exist
 B - Every 50 Hours and at Tire Replacement
 C - First 100 Hours Check Torque; Then Every 100 Hours Check Security and Working. Do Not Torque

D - First 100 Hours and 200 Hours Thereafter
 E - Every 100 Hours or Every 6 Months
 F - Every 500 Hours
 G - Every 1500 Hours
 H - Every 2 Years
 I - Every 3 Years
 J - Every 5 Years

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

D. Flight Controls (Continued)

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(13) Elevator and Elevator Trim Tab Cables - Check Security and Tension, Fraying and Turnbuckles for Safety			*	
(14) Electric Elevator Trim (Optional) - Check for Security, Condition and Travel			*	
(15) Electric Elevator Trim Actuator (Optional) - Service				F
(16) Rudder - Check Hinge, Bellcrank, Stop Bolts and Jamb Nut for Looseness, Torque Tube, Pulleys, and Connector Links for Security and Travel, Check Travel			*	
(17) Rudder Trim Tab - Check Security and Condition, Linkage and Travel.			*	
(18) Rudder Trim Tab Actuator - Check Travel, Mountings for Security			*	
(19) Rudder Trim Tab Actuator - Service				G
(20) Rudder and Rudder Trim Tab Cables - Check Tension, Security, Fraying and Turnbuckles for Safety			*	
(21) Rudder Pedal Linkage and Bearings - Service				F
(22) Rudder Pedal Bearing Halves and Rudder Gust Lock - Service				G
(23) Flaps - Check Linkage, Bellcranks, Pulleys and Cables for Condition, Tension and Security			*	
(24) Flap Motor and Position Indica- tor - Check for Travel, Condition and Security			*	

A - Every 50 Hours or Sooner When Local Dust
Conditions Exist
B - Every 50 Hours and at Tire Replacement
C - First 100 Hours Check Torque; Then Every
100 Hours Check Security and Working.
Do Not Torque

D - First 100 Hours and 200 Hours Thereafter
E - Every 100 Hours or Every 6 Months
F - Every 500 Hours
G - Every 1500 Hours
H - Every 2 Years
I - Every 3 Years
J - Every 5 Years

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INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

D. Flight Controls (Continued)

- (25) Flap Actuator Assembly - Check for Condition, Security and Proper Operating Times

E. Heating, Ventilating and Defrosting System (Chapter 6)

- (1) Heater - Check Condition and Operation
- (2) Nose Ram Air - Check Clamps and Hose to Heat and Vent System for Security

F. Oxygen System (Chapter 6)

- (1) Oxygen System - Check Installation, Mountings, Equipment and Pressure
- (2) Oxygen Regulator - Check Pressure and Rate of Flow
- (3) Oxygen Masks and Hoses - Check Condition and Clean
- (4) Oxygen Cylinder - ICC-3HT/DOT-3HT (Light Weight) - Inspect Condition and Hydrostatic Test Date
- (5) Oxygen Cylinder - ICC-3AA/DOT-3AA (Standard Weight) - Inspect Condition and Hydrostatic Test Date

G. Engine Group (Chapter 7)

CAUTION: GROUND MAGNETO PRIMARY CIRCUIT BEFORE WORKING ON THE ENGINE.

- (1) Engine - Wash, Check for Security of Accessories

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A - Every 50 Hours or Sooner When Local Dust Conditions Exist
 B - Every 50 Hours and at Tire Replacement
 C - First 100 Hours Check Torque; Then Every 100 Hours Check Security and Working. Do Not Torque

D - First 100 Hours and 200 Hours Thereafter
 E - Every 100 Hours or Every 6 Months
 F - Every 500 Hours
 G - Every 1500 Hours
 H - Every 2 Years
 I - Every 3 Years
 J - Every 5 Years

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INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

G. Engine Group (Continued)

	50	100	200	Spl Insp
(2) Cowling and Cowl Flaps - Wash and Inspect for Cracks, Dents, Condition of Paint and Other Damage. Check Cowl Fasteners and Cowl Flaps for Condition, Security, and Operation			*	
(3) Cowl Flap Control Cable and Housing - Service			*	
(4) Cowl Flap Hinge - Service		*		
(5) Cowl Flap Linkage Pivot Points and All Spherical Rod Ends - Service		*		
(6) Induction Air Filter - Service	*A			
(7) Induction System - Check Condition and Security of Ducting and Controls		*		
(8) Engine Oil Pressure System - Check for Leaks, Bends, Cracks and Security		*		
(9) Engine Oil - Change		*E		
(10) Engine Oil Filter - Replace Filter and Inspect Adapters (Turbo 310)	*			
(11) Engine Oil Filter - Replace Filter and Inspect Adapters (Standard 310)		*		
(12) Engine Oil Breather Separator (Turbo 310) - Clean	*A			
(13) Engine Compartment - Visually Check for Condition, Oil Leaks, Fuel Leaks, Etc.		*		
(14) Engine Controls - Check Travel and Security	*			
(15) Engine Wire Bundle - Check for Condition and Security		*		
(16) Engine Shock Mounts, Engine Mount Structure, and Ground Straps - Check for Condition and Security and Alignment		*		

A - Every 50 Hours or Sooner When Local Dust Conditions Exist

B - Every 50 Hours and at Tire Replacement

C - First 100 Hours Check Torque; Then Every 100 Hours Check Security and Working. Do Not Torque

D - First 100 Hours and 200 Hours Thereafter

E - Every 100 Hours or Every 6 Months

F - Every 500 Hours

G - Every 1500 Hours

H - Every 2 Years

I - Every 3 Years

J - Every 5 Years

INSPECTION TIME LIMITS

1. Inspection Requirements (Continued)

G. Engine Group (Continued)

- (17) Engine Compartment Hoses - Fuel, (Check Fuel Lines Under Pressure), Oil, Vacuum, Etc., Check for Deterioration, Leaks, Discoloration, Bleaching and Rubber Hoses for Stiffness
- (18) Cylinder Compression - Refer to Manufacturers Service Bulletin M73-19
- (19) Engine Cylinders, Rocker Box Covers and Push-Rod Housings - Check for Fin Damage, Cracks, Oil Leakage, Security of Attachment and General Condition
- (20) Crankcase, Oil Sump and Accessory Section - Inspect for Cracks and Evidence of Oil Leakage, Check Bolts and Nuts for Looseness and Retorque as Necessary
- (21) Spark Plugs - Clean and Rotate (Top Right to Bottom Left, Top Left to Bottom Right)
- (22) Ignition Cables - Check Condition and Security
- (23) Magneto - Check Timing Breaker Gap and Security
- (24) Fuel Pump - Check for Leaks, Condition and Security
- (25) Turbocharger - Check for Condition, Bulges, Warps and Security
- (26) Engine Exhaust System (Standard 310) - Check for Condition, Security, Spring Tension and Muffler

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MAINTENANCE MANUAL

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

G. Engine Group (Continued)

- (27) Engine Exhaust System (Turbo 310) - Check for Security, Cracks, Slip Joints Spring Tension - Visually Inspect (Aft) Slip Joint Seal
- (28) Exhaust Couplings (Turbo 310) - Check for Cracks and Deformation
- (29) Engine Baffles and Seals - Check Condition and Security
- (30) Engine Compartment Fire Extinguisher - Check System, Pressure, Condition and Security
- (31) Starter, Starter Solenoid, and Electrical Connections - Check Condition and Security of Attachment
- (32) Starter - Check Brushes, Commutator and Electrical Connectors
- (33) Waste-Gate Valve and Controllers - Check Condition and Security, Visually Check Springs and Leakage
- (34) Manifold Pressure Relief Valve - Visually Check for Obstructions, Condition, Security and Operation
- (35) Fuel/Air Metering Unit Fuel Screen - Clean
- (36) Fuel Injection System and Manifold - Inspect for Leaking
- (37) Fuel Discharge Nozzles - Inspect Orifices and Clean

H. Propellers (Chapter 8)

- (1) Propeller Spinner - Wash, Check for Cracks and Fractures

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MAINTENANCE MANUAL

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

H. Propellers (Continued)

- (2) Blades - Check for Nicks, Cracks, Scratches and Blade Angles
- (3) Propeller Cylinder - Check Allen Screws for Security
- (4) Propeller Hub - Check General Condition
- (5) Propeller Governor - Check for Operation, Oil Leaks, Condition and Security
- (6) Spinner Bulkhead - Check for Cracks and Security on Crankshaft
- (7) Propeller - Check for Oil Leaks .
- (8) Propeller Mounting - Check Nuts for Security
- (9) Propeller Deice Slip Rings, Brushes, and Boots - Check Condition, Operation and Security of Attachment
- (10) Propeller Unfeathering Accumulator - Check for Leaks, Condition and Proper Charge
- (11) Propeller Synchronizer - Check for Condition and Security . . .

I. Fuel System (Chapter 9)

- (1) Fuel Selector Gear Box and Valve - Perform Operational Check (feel for Detents through 270°), Check Linkage, Bearings, Pins for Condition and Security
- (2) Fuel Selector Gear Box Gears - Clean and Service
- (3) Fuel Selector Valve (Fuel Strainer) - Clean

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SERVICE MANUAL

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

I. Fuel System (Continued)

- (4) Fuel Selector Valve - Clean and Service Detents
- (5) Fuel System Main - Inspect Plumbing and Component Mounting for Condition, Security, System for Leaks
- (6) Tip Tanks - Inspect Mounting Bolts for Security, Tip Tank for Leaks, Cracks and Dents
- (7) Boost Pumps (Auxiliary) - Inspect for Leaks, Operation, Vent and Overboard Drain for Obstruction
- (8) Auxiliary Tanks - Inspect System for Leaks and Security
- (9) Heater Fuel Filter - Remove, Clean and Inspect for Deterioration
- (10) Main Tank Fuel Transfer Pump - Check Security and Mounting
- (11) Main Tank Fuel Transfer Pump Filter - Clean
- (12) Wing Locker Transfer Pump - Check for Leaks and Security of Mounting
- (13) Tip Tank Nose Cap - Inspect Vent Hole for Obstruction

J. Instruments (Chapter 10)

- (1) Instrument Panel - Ground Straps for Security and Condition
- (2) Instruments - Check Markings and Condition

K. Vacuum System (Chapter 10)

- (1) Vacuum Pump - Check for Leaks, Condition and Security

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INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

K. Vacuum System (Continued)

- (2) Vacuum System Filter - Clean and Inspect for Deterioration . . .
- (3) Vacuum System Relief Valve - Check Security and Screen for Obstruction, Clean Filter . . .
- (4) Hoses - Inspect for Hardness, Deterioration, Looseness and Bulging

L. Pitot-Static System (Chapter 10)

- (1) Sump(s) - Check for Cracks, Dents, Leaks and Presence of Water, Drain Sump
- (2) System - Leak Check
- (3) Altimeter - Inspect as Required by FAR Part 91, Paragraph 91.170 in Accordance with FAR, Part 43, Appendix E, by Authorized Repair Station
- (4) Alternate Static Source - Check for Obstructions and Drain

M. Upholstery (Chapter 12)

- (1) Upholstery, Headliner, Trim and Carpet - Check for Condition and Clean
- (2) Seat and Seat Belts - Check for Condition and Security
- (3) Seat Bearings - Service
- (4) Seat Adjusting Screw - Service

N. Surface Deice System (Chapter 12)

- (1) Deice System - Check for Leaks, Condition and Operation of Controls, Lines and Clamps for Security

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A - Every 50 Hours or Sooner When Local Dust Conditions Exist
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MAINTENANCE MANUAL

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

N. Surface Deice System (Continued)

- (2) Deice Boots - Check for Abrasions, Cuts, Nicks and Security of Mounting
- (3) Deice Filter - Remove, Clean, and Replace

O. Windshield Anti-Ice System (Alcohol)
(Chapter 12)

- (1) Check Nozzles for Security of Obstruction
- (2) Pump - Check for Condition and Security

P. Electrical System (Chapter 13)

- (1) Aircraft and System Wiring - Check for Chafing, Broken or Loose Terminals and General Condition . .
- (2) Junction Boxes - Check Terminals for Condition and Security . . .
- (3) Circuit Breaker Panel - Check Terminals, Wiring and Mountings .
- (4) Voltage Regulators - check Wiring, Mounting, Condition and Wire Routing
- (5) Switches - Check Operation, Terminals, Wiring and Mounting . .
- (6) Landing Gear Relay and Limit Switch - Check Mounting and Terminals
- (7) Landing Light Hinge Point - Service
- (8) Landing Light Internal Gears - Service
- (9) Landng Light Exposed Gear Sector - Service

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A - Every 50 Hours or Sooner When Local Dust Conditions Exist

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SERVICE MANUAL

INSPECTION TIME LIMITS

1. Inspection Requirements (Continued)

P. Electrical System (Continued)

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(10) Wing and Fuselage - Check Wiring, Routing, Security and Terminals .			*	
(11) Battery, Electrolyte Specific Gravity	*			
(12) Battery Box and Battery Cables - Inspect Overboard Drain Tube, Check for Corrosion, Cable Routing, Support and Security of Connections	*			
(13) Instruments, Interior and Exterior Lights - Check for Operation, Condition of Lens and Security .	*			
(14) Instrument Panel and Control Pedestal - Check Mountings and Terminals for Security, Check Bonding Between Stationary Panel and Instrument Panel for Proper Ground - Resistance Must be 0.010 OHMS or Less			*	
(15) Flap Limit Switch and Motor - Check Wiring and Terminals for Condition and Security			*	
(16) Warning Lamps - Check Condition .		*		
(17) Alternators - Check Brushes, Leads, Bearings and Slip Rings, and for Condition and Security .				F

Q. Avionics (Chapter 14)

(1) Radio and Navigation System - Check for Operation and Condition			*	
(2) Autopilot - Check Cables, Attachments, Pulleys and Turnbuckles for Tension, Condition and Security			*	

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MAINTENANCE MANUAL

INSPECTION TIME LIMITS1. Inspection Requirements (Continued)

Q. Avionics (Continued)

- (3) Antennas and Cables - Inspect for
Security of Attachment, Connection,
and Conditions
- (4) Emergency Locator Transmitter -
Check Operation, Condition,
Security and Battery Pack for
Proper Charge

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100 Hours Check Security and Working.
Do Not Torque

D - First 100 Hours and 200 Hours Thereafter
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COMPONENT TIME LIMITS

All components not listed herein should be inspected as detailed elsewhere in this Chapter and repaired, overhauled or replaced as required. Items shown here should be overhauled or replaced during the regular maintenance periods falling due closest to the specified limit.

<u>ITEM</u>	<u>REPLACE</u>	<u>OVERHAUL</u>
1. Flight Controls (Chapter 5)		
A. Aileron Trim Tab Actuator		At Engine Overhaul
B. Elevator Trim Tab Actuator		At Engine Overhaul
C. Rudder Trim Tab Actuator		At Engine Overhaul
2. Engine Group (Chapter 7)		
A. Engine (Standard 310) (See Continental Motors Engine Overhaul Manual)		Every 1500 Hours
B. Engine (Turbo 310) (See Continental Motors Engine Overhaul Manual)		Every 1400 Hours
C. Magneto (See Bendix Magneto Overhaul Manual)		At Engine Overhaul
D. Turbocharger (See Cessna Turbocharger and Controls Overhaul/Parts Manual)		At Engine Overhaul
E. Controllers, Absolute and Pressure Ratio (See Cessna Turbocharger and Controls Overhaul/Parts Manual)		At Engine Overhaul
F. Waste-Gate and Waste-Gate Actuator (See Cessna Turbo- charger and Controls Overhaul/Parts Manual)		At Engine Overhaul

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ITEM	REPLACE	OVERHAUL
G. Vacuum Pump (See Manufacturers Overhaul Manual)		At Engine Overhaul
H. Fuel Pump (See Manufacturers Overhaul Manual)		At Engine Overhaul
I. Tachometer Generator (See Manufacturers Overhaul Manual)		At Engine Overhaul
J. Starter (See Manufacturers Overhaul Manual)		At Engine Overhaul
K. Engine Compartment Hoses e.g. Fuel, Oil, Deice etc. Rubber	At Engine Overhaul or 5 Years Whichever Occurs First	
L. Engine Compartment Fuel and Oil Hoses (Teflon)	Every Other Engine Overhaul	
M. Engine Compartment Fire Extinguisher Container & Cartridge	Every 5 Years	
N. Engine Compartment Pneumatic Hoses	At Engine Overhaul	
O. Induction Air Filter	At Engine Overhaul	
P. Engine Mounts	At Engine Overhaul	
Q. Engine Exhaust Multi-Segment V-Band Coupling(s) Down Stream of the Aft Engine Cylinders (Turbo 310)	Every 400 Hours	
3. Propellers (Chapter 8)		
A. Propeller (See McCauley Maintenance and Overhaul Manual)		Every 1200 Hours

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ITEM	REPLACE	OVERHAUL
B. Accumulator, Unfeathering (See Manufacturer Overhaul Manual)		Every 1200 Hours
C. Governor (See Manufacturers Overhaul Manual)		Every 1200 Hours
4. Heater (Chapter 6)		
A. Heater (See Cessna Heater and Components Overhaul/ Parts Manual)		Every 500 Hours of Heater Operation
5. Oxygen System (Chapter 6)		
A. Oxygen Bottle (ICC-3HT/DOT- 3HT)	Every 15 Years or 4380 Cycles	
B. Oxygen Regulator		Every 3 Years or 3000 Hours
C. Oxygen Pressure Gage	Every 3 Years or 3000 Hours	
D. Oxygen Outlet		Every 3 Years or 3000 Hours
6. Vacuum System (Chapter 6)		
A. Vacuum System Filter	Every 500 Hours	
7. Electrical System (Chapter 13)		
A. Alternator (See Cessna Alternator Service/Parts Manual)		At Engine Overhaul

DETAILED INSPECTION PROCEDURESAirframe

1. Windshield and Windows

Remove the dust and dirt from the window panels (reference Chapter 3 for cleaning procedures), then visually inspect all windows for pits, scratches, crazing and deterioration. Pay particular attention to critical vision areas. (Refer to Chapter 15 for repair procedures.)

2. Cabin and Baggage Doors

Clean door by wiping all grease and dirt from door and latching mechanism, then remove upholstery panel and visually inspect component parts for excessive wear, metal breaks, improper threads etc. Operate handle and observe proper function of component parts. Repair as required (reference Chapter 3).

3. Wing

Clean surface (reference Chapter 1), visually inspect wing attach fittings, flap and aileron attach fittings for cracks and visible damage. Visually inspect wing fume proofing materials; sealants, patches and boots for leakage. When fume proofing materials have been damaged or removed, immediate replacement is required. Inspect all fluid lines and hose for leaks, cracks dents, kinks, chafing, bleaching, discoloration, proper radius, security, corrosion, deterioration, obstructions and foreign matter. Inspect wing spar bolts for security and ensure they are not working (reference Chapter 3 for torque of spar bolts. When checking torque on spar bolts always loosen nut first then check torque while tightening nut.

4. Fuselage

Clean surface (reference Chapter 1). Visually inspect surface for damage, cracks, loose rivets and nuts. Inspect stiffeners, stringers, doublers, bulkheads and stringer for loose screws, rivets, cracks or damage. Check all fluid lines and hoses for leaks, cracks, dents, kinks, chafing, bleaching or discoloration, proper radius security, corrosion, deterioration, obstructions and foreign matter. Refer to Chapter 15 for repair of loose rivets and cracks.

5. Control Pedestal

Clean surface (refer to Chapter 1). Visually inspect all parts for evidence of cracking and excessive wear. Inspect the racks and ratchet stops on the mixture levers

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MAINTENANCE MANUAL

for broken teeth. Replace racks, ratchet stops, and ratchet stop springs if worn or too weak to ensure positive locking. For lubrication items, refer to Servicing.

Landing Gear System

1. Landing Gear Actuator

Clean exterior surface. Visually inspect assemblies externally for visible damage such as cracks, nicks, dents and scratches. Inspect upper and lower bellcranks and splines on the protruding portions of sector shaft for visible damage. Check actuator for proper operating times, refer to Chapter 4, Landing Gear System Inspection/Check.

2. Emergency Manual Extension System

Inspect miter gears and sprockets for visible damage such as chipped or broken teeth, nicks, dents, cracks or deep scratches. Inspect around all welds for cracks. Perform an operational check of system, refer to Chapter 4.

3. Nose and Landing Gear Assemblies

Inspect all components for excessive wear, cracks, dents, nicks and scratches. Inspect outer barrel of the lower strut assembly for any defects that may damage seals. Refer to Chapter 4, for approved repairs.

4. Nose and Main Gear Retracting Linkage

Clean linkage component with a suitable solvent. Do not clean sealed bearings or needle bearings which do not have provisions for lubrication. Visually inspect linkage for damage such as cracks, nicks, dents, scratches and excessive wear. Repair is limited to replacement of parts, smoothing out of minor nicks, scratches and repainting of areas where paint has peeled.

5. Nose and Main Wheel and Tires

Clean surface. Inspect wheel castings for cracks, nicks, dents, scratches and corrosion. Inspect disc drive keys for damage, looseness, and excessive wear. Visually inspect bearing cups for damage and wear. (Do not remove bearing cups unless replacement is required). Visually inspect bearing cones for damage. Inspect retainers and snap rings for damage and distortion. Straighten or replace as necessary. Inspect the tire for breaks, cuts, foreign objects imbedded in thread, and flat spots and/or exposed cords. Corroded area on wheel can be repaired, refer to Chapter 4.

CAUTION: BREAKS, FLAT SPOTS, EXPOSED CORDS AND CUTS THAT DAMAGE CORDS ARE CAUSE FOR IMMEDIATE REJECTION OF TIRE. SHOULD THERE BE ANY DOUBT ABOUT A TIRES RELIABILITY, DON'T HESITATE TO REJECT IT.

Brake System

1. Brake System Plumbing

Clean as required, refer to Chapter 4. Inspect fittings for damaged threads and deformed flares on ends of tubing, lines for cracks, dents, deep scratches, flattened bends, and signs of chafing, hoses for swelling, cracking, abrasions through protective plies and leaks. Repairs to brake system plumbing should be made in accordance with best shop practice, using standard parts and procedures and conducted in compliance with applicable regulations. For Repairs, refer to Chapter 4.

2. Brake Assemblies

Clean as required, refer to Chapter 4. Inspect metal parts for wear and thread damage. Inspect brake disc, refer to Chapter 4. Inspect cylinder walls for corrosion, pitting and scouring. For repairs, refer to Chapter 4.

3. Brake Master Cylinder

Clean all metal parts, refer to Chapter 4. Inspect metal parts for wear and thread damage. Inspect cylinder walls for corrosion, pitting and scores. Inspect O-ring seal and O-ring portion of lock-o-seal for swelling, chipping or other evidence of damage. For approved repairs, refer to Chapter 4.

Flight Controls

1. Control Column

Use a clean cloth dampened with a suitable solvent to remove grease and dirt. Inspect control column for security, looseness and wear. Check rigging between pilot and copilot's controls, refer to Chapter 5. Check freedom of movement of controls and bobweight. Visually inspect turnbuckles for proper safety. Check control wheel, control locks for condition and operation. Repairs are made by replacing all worn or damaged components.

2. Aileron and Aileron Trim Control System

A. Aileron and Trim Controls

Inspect hinges, hinge bolts, bellcranks, quadrants and

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stop bolts for cracks, security, wear and damage. Visually inspect for damage such as cracks, dents, nicks, deep gouges and loose balance weights. For repairs, refer to Chapter 15.

B. Aileron and Trim Control Cables

Wipe cables clean with a clean dry cloth. Inspect for freedom of movement (no binding), proper routing, fraying, chafing, corrosion and turnbuckle safetying. Inspect all chains and sprockets for wear, damage and security. Check for proper cable tension and control surface travel, refer to Chapter 5.

C. Aileron Trim Tab Actuator

Inspect for security, wear damage. Inspect attaching parts, linkage and attachments for security, wear and damage.

3. Elevator and Elevator Trim Control System

A. Elevator and Trim Controls

Inspect hinges, hinge bolts, bellcrank and stop bolts for cracks, security, wear and damage. Visually inspect for damage such as cracks, dents, nicks, deep gouges and loose balance weights. For repairs, refer to Chapter 15.

B. Elevator and Trim Control Cables

Wipe cables clean with a clean dry cloth. Inspect for freedom of movement (no binding), proper routing, fraying, chafing, corrosion and turnbuckle safetying. Inspect all chains and sprockets for wear, damage and security. Check for proper cable tension and control surface travel, refer to Chapter 5.

C. Elevator Trim Tab Actuator

Inspect for security, wear, damage. Inspect attaching parts, linkage and attachments for security, wear and damage.

4. Rudder and Rudder Trim Control System

A. Rudder and Trim Controls

Inspect hinges, hinge bolts, bellcrank and stop bolts for cracks, security, wear and damage. Visually inspect for damage such as cracks, dents, nicks, deep gouges and loose balance weights.

B. Rudder and Trim Control Cables

Wipe cables clean with a clean dry cloth. Inspect for freedom of movement (no binding), proper routing, fraying, chafing, corrosion and turnbuckle safetying. Inspect all chains and sprockets for wear, damage and

security. Check for proper cable tension and control surface travel, refer to Chapter 5.

- C. Rudder Trim Tab Actuator
Inspect for security, wear damage. Inspect attaching parts, linkage and attachments for security, wear and damage.

5. Flap Controls

Use Stoddard Solvent to remove dirt and grease in the flap scissor area, refer to Chapter 1. Inspect the external surfaces for dents, nicks, cracks and proper flush fit in the up position. Visually inspect the flap scissors and attaching bolts for wear and security. Inspect bellcranks and push-rods for security. Check for proper cable tensions and flap rigging, refer to Chapter 5. Check flap operation for proper flight operation, refer to Chapter 5. For repair, refer to Chapter 15.

Environmental Systems

1. Cabin Heater System

Refer to Cessna Heater and Components Overhaul/Parts Manual for cleaning, inspection, repair and servicing of heater.

2. Oxygen System

A. Oxygen Mask and Hoses

Inspect mask and hoses for leaks, cracks and deterioration. Check mask stowage compartment for cleanliness and general condition. Check flow indicator for freedom of movement, couplings and adapters for proper insertion. For cleaning, refer to Chapter 6.

B. Oxygen System Plumbing

For cleaning, refer to Chapter 6. Inspect the filler valve and plumbing for nicks, cracks and deep gouges. Repair is limited to replacement of parts. Refer to Chapter 6 for inspection of cylinder and regulator and Hydrostatic Test.

Engine

1. Engine

To clean the engine(s), refer to Chapter 7. Inspect all hoses for evidence of internal swelling, chafing, cuts or breaks. Inspect all fittings for thread damage, damage to chamfered seats and replace fittings as necessary. Inspect oil separators for evidence of restrictions and

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clean as necessary. Visually inspect the engine cylinders for cracks, loose nuts and studs; baffles for cracks and security, push-rod housings and rocker box covers for leaks, cracks and security, crankcase, oil sump and oil cooler for loose bolts, cracks and leakage. Make necessary corrections and repairs in accordance with best shop practices and in compliance with applicable FAA regulations. Perform a cylinder compression check in accordance with the engine manufacturer's Operations Manual. Refer to Engine Overhaul Manual and Chapter 7 for repair and servicing.

NOTE: Instructions concerning inspection of particular engine components, refer to applicable paragraph in Engine Maintenance and Overhaul Manual, Continental Motors Corporation.

2. Engine Cowling

Clean cowling, refer to Chapter 1. Visually inspect cowling for cracks, elongated holes, abrasions and wear due to rubbing. Refer to Chapter 15 for repair of engine cowling.

3. Induction Air Filter

For cleaning filters, refer to Chapter 7. Visually inspect filter for holes, cracks, deterioration and pleats for proper bonding. Refer to Component Time Limits for replacement intervals.

4. Air Induction Manifold

Clean the air induction manifold when washing down engine, using the same procedures. Inspect the induction manifold for security, loose connections, air leaks and condition.

5. Engine Oil Pressure System

Start and run engine for a few moments observing oil pressure gage for fluctuations. Shut down engine and inspect oil pressure lines and fittings for leaks. Anytime the oil pressure indicating system has been removed or repairs have been accomplished, the oil pressure system should be bleed, refer to Chapter 7, Engine Oil Indicating and Cylinder Head Temperature Systems.

6. Oil Breather Separator (310 Turbo)

Wash metal parts and element in suitable solvent. Inspect metal parts for cracks in body and around the weld

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tubes. Inspect filter element for clogging and general deterioration.

7. Engine Exhaust System

To clean the exhaust system, refer to Chapter 7.

A. Inspection of Exhaust System (310 Turbo)

NOTE: A thorough inspection of the engine exhaust system is encouraged to detect any breaks or cracks causing leaks which might result in the loss of optimum turbocharger efficiency and engine power.

- (1) Remove engine cowlings, refer to Chapter 7.
- (2) Remove the heat shields on the turbocharger, refer to Chapter 7.
- (3) Remove shields around the exhaust system slip joints, multi-segment V-band clamps (couplings) at joints, and other items which might hinder inspection of the system.

NOTE: Do not remove clamps.

- (4) Inspect exhaust stacks for burned areas, cracks and looseness. Ensure that attach bolts are properly torqued, refer to Chapter 7.
- (5) Inspect exhaust couplings for cracks, looseness and proper torque, refer to Chapter 7.

NOTE: During inspection particular attention should be given to condition of the coupling flanges, slip joints and welded areas along seams around the slip joints.

- (6) Inspect exhaust joint springs for correct compression only if the joint is disturbed, see Figure 2, 7-60.
 - (a) Before removal of exhaust joint springs, measure installed length of each spring. Those compressed to less than 0.45 inch must be replaced.
 - (b) Remove all springs and measure free length. Springs having a free length of less than 0.57 inch must be replaced.

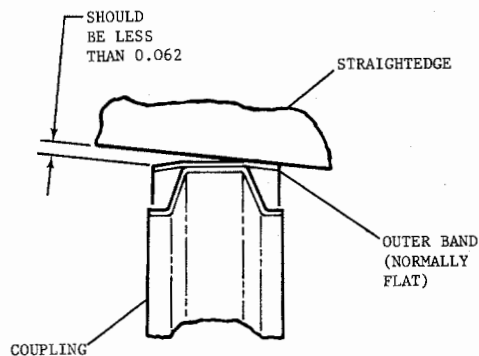
NOTE: Add AN 960-10 washers under head of joint bolts as required to obtain correct dimension.

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NOTE: During installation, joint bolts should be tightened gradually and spring length checked frequently to prevent overcompression of springs.

- (c) Reinstall springs and measure installed length. Length must be $0.51 + .00, - .03$ inch.
- (7) Inspection of Multi-Segment V-Band Couplings.
 - (a) Inspect installed couplings for deformation by checking the flatness of the outer back-up band especially within 2 inches of the spot weld tabs which retain the T-bolt fastener. This can be done by placing a straight edge across the flat part of the outer band as shown in Figure 1, then check the gap between the straight edge and band. This gap should be less than 0.062 inch.
 - (b) If deformation gap exceeds the 0.062 inch limit, the clamp must be replaced with a new part.
 - 1) When replacement is required, install the new clamp over the exhaust flange and torque to the correct value, refer to Chapter 7. As the band is tightened, lightly tap it circumferentially in a radial direction with a rawhide or soft plastic mallet.



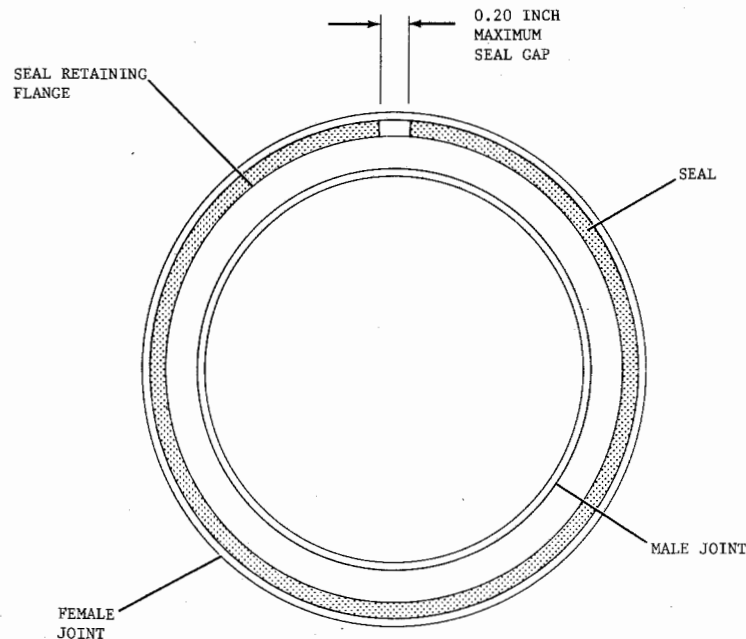
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Exhaust Coupling Deformation Limits
Figure 1

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- (c) Clamps found in acceptable condition should then be checked for looseness and leakage.
 - 1) Only clamps which are obviously loose or leaking should be retorqued. If retorquing is required, refer to Chapter 7.
- (d) Any leakage (minor or major) in all other areas of the exhaust system must be corrected.
- (8) Replacement Schedule of Multi-Segment V-Band Couplings.
 - (a) Multi-Segment V-band coupling(s) down stream of the aft engine cylinders are "Life Limited" to 400 hours. These clamps must be replaced on or before 400 hours of service and every 400 hours thereafter.
- (9) Inspection of Slip Joint Seal.
 - (a) Visually inspect each slip joint seal every 50 hours using a mirror and flashlight. Inspect around the entire slip joint. If an open gap or missing portion of the seal in excess of 0.20 inches (see Figure 2) is detected between the seal retaining flange and the female joint section, the seal must be replaced.



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Exhaust Slip Joint Inspection Limit
Figure 2

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NOTE: Minor exhaust stains on airframe and/or surrounding accessories must be considered normal, since these joints will exhibit a perceptible leakage during their entire service life.

- (b) Repair of the exhaust system is limited to replacement of components only. Refer to Chapter 7 for seal replacement instructions.

B. Inspection of Exhaust System (Standard 310)
Inspect the exhaust system for burned areas, cracks and/or looseness. Inspect attaching bolts for proper torque, springs for correct compression, refer to Chapter 7.

8. Engine Controls

The controls should be cleaned when the engine compartment is cleaned or washed down. Inspect the engine controls for security of mounting, sharp bends, kinks and damage which might affect operation of the control. Repair of engine controls is limited to replacement of parts.

9. Engine Wire Bundles

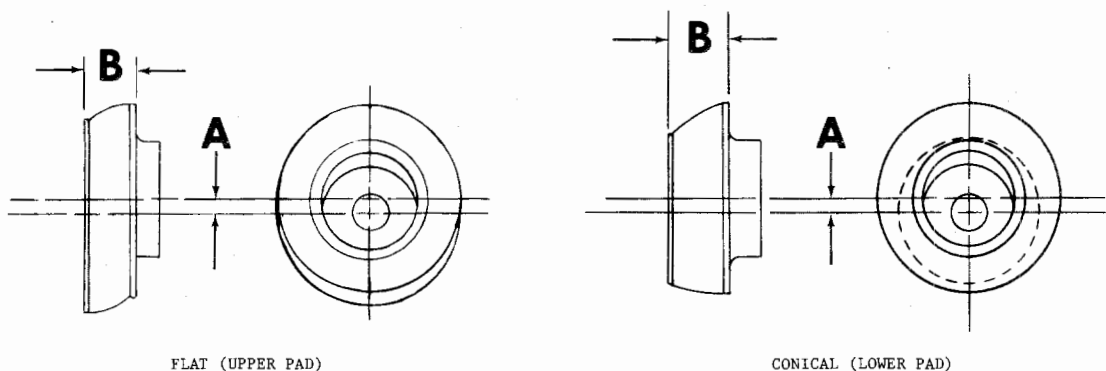
Wire bundles should be wiped clean with a dry cloth. DO NOT use solvents. Inspect the wire bundles for security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration and corroded terminals. Inspect wire bundles in high heat areas, such as close proximity of exhaust stacks or turbocharger for heat damage. If wire bundles are damaged they should be replaced. Wire bundles should be clamped out of high heat areas.

10. Engine Mounts

Clean engine mounts, refer to Chapter 7. Inspect engine mounts for security, safetying, looseness, deterioration, cracked fittings, localized burning, blistering, sagging and end separation. Check engine sag. If the area between the exhaust riser of number six cylinder and the lower cowl panel does not have a minimum of 0.40 inch clearance, refer to Chapter 7 and install engine mount shims. See Figure 3 for inspection requirements. At each engine overhaul period it is recommended that engine mounts be replaced. Engine mounts which have been replaced prior to the normal engine overhaul may be reused providing dimensions are within inspection requirements.

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Model	Engine	Mount Assembly	Mount Component	Max. "A" Eccentricity	Min. "B" Thickness
310 AND TURBO 310	I0520M AND TSI0520B	J-9613-58	J-9612-32 J-9612-33	0.12 0.12	1.20 1.20

Engine Mount Inspection Limits
Figure 3

11. Engine Compartment Hoses

Clean engine compartment hoses by washing engine compartment down with mineral spirits or a suitable solvent (non-inflammable or combustible). Inspect all engine compartment hoses for excessive wear, cracks, nicks, bulges, deterioration, discoloration, bleaching and rubber hoses for hardening. Teflon hose assemblies exhibit considerable stiffness throughout their useful life. Reasonable stiffness is normal and does not indicate that the line should be replaced. Inspect engine compartment fuel hoses under pressure for deformation and leaks as follows: make sure throttles are in idle position and mixture controls are in idle cutoff; turn prime switch on and assure boost pumps are operating in HI position; check hoses for leaks, bulges, deterioration, and deformation. Inspect hoses in the high heat areas such as close proximity of exhaust stacks or turbocharger area for heat deterioration and hardening or cracking due to age. For replacement intervals of engine compartment hoses, refer to Component Time Limits.

12. Spark Plugs

Clean spark plugs, refer to Chapter 7. Inspect spark plugs for proper gap 0.015 to 0.018 inches. Inspect

porcelain for cracks and evidence of arcing. Rotate spark plugs top right to bottom left, and top left to bottom right.

13. Ignition Cables

Clean ignition cables, refer to Chapter 7. Inspect the ignition cable for damaged insulation and the end fitting for evidence of cracks and damage.

14. Magneto

Clean magneto, refer to Chapter 7. Inspect the magneto for proper breaker point gap (refer to Chapter 7), and evidence of moisture and arcing.

15. Pumps

The fuel, vacuum pumps should be washed down at the same time as the engine, using the same solvent. Inspect the pumps for evidence of leaking, condition and security. Repair of the engine-driven pumps is limited to replacement, refer to Component Time Limits.

16. Turbocharger

Clean outer surface of turbocharger with a suitable solvent. Remove turbocharger insulation blanket from turbine and inspect housing for cracks or bulges. Remove the tailpipe from the turbine and visually inspect the impellers and visible portions of turbine for coking, carbonization, oil deposits, nicks or dents. If cracks or bulges do appear on the turbine housing, replace housing in accordance with the Turbocharger and Control Overhaul/Parts Manual. For removing coke and carbonized oil deposits, refer to the Turbocharger and Controls Overhaul/Parts Manual.

17. Manifold Pressure Relief Valve

Clean dirt and debris from valve, with a clean cloth. Inspect relief valve vents for obstructions or foreign material. Check for proper operation as follows: after adequate engine warm up with oil temperature at the lower third of green arc, accelerate the engine rapidly from idle to maximum RPM; (Discontinue acceleration if manifold pressure exceeds 34.5 In. Hg; if maximum manifold pressure exceeds 34.5 In. Hg., immediately reduce power and shut down engine. Manifold pressure relief valve is faulty and must be replaced.

18. Fuel Discharge Nozzles

To clean fuel discharge nozzles, refer to Chapter 7. Inspect the fuel nozzle for damaged orifice, dirt and foreign objects.

19. Fuel-Air Control

For cleaning, refer to Chapter 7. Inspect control connections, levers, and linkage for security of attaching parts, for safetying and lost motion due to wear. Inspect the air control body for cracks and the fuel-air control unit for overall condition.

PROPELLERS

1. Propellers

Cleaning propellers, refer to Chapter 8. Refer to McCauley Industrial Corporation's Service Manual, for inspection. Anytime the propeller attachment has been subjected to excessive engine roughness, the propeller should be removed and dowel pins inspected for looseness, cracks, and visual damage. Check propeller attachment nuts for 80 to 85 foot-pounds torque. If torque is less than 80 foot-pounds, replace nuts with new elastic element locking nuts. Refer to McCauley Industrial Corporation's Service Manual and lubricate only on reassembly. Any repairs should be made as outlined in McCauley Industrial Corporation's Service Manual and FAA Regulations.

2. Propeller Unfeathering System

Clean accumulator with suitable solvent and wipe hoses and accumulator with a clean cloth. Inspect hose assemblies for chafing and fittings for tightness. Inspect accumulator for security in mounting brackets. Always inspect filler valve after charging for leaks. Repair to propeller unfeathering system are limited to replacement of components.

CAUTION: ALWAYS RELEASE SYSTEM PRESSURE BY PLACING PROPELLER CONTROL IN UNFEATHERING POSITION AND RELEASING ACCUMULATOR PRESSURE THROUGH FILLER VALVE, BEFORE DISCONNECTING HOSE BETWEEN ACCUMULATOR AND GOVERNOR OR REMOVING ACCUMULATOR.

3. Propeller Synchronizer

Inspect rod ends, actuator housing, flexible shaft and wiring for condition and security.

Fuel System

1. Fuel Selector Valve and Strainer

Clean selector valve and strainer, refer to Chapter 9. Inspect quick-drain valve, gasket, filter and fuel selector for nicks, dents, scratches, dirt accumulation and other foreign matter.

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2. Fuel System - Main

Visually inspect filler cap gasket. If crushed or damaged, replace filler gasket. Remove main tank nose cap, visually inspect area for evidence of fuel leakage. If fuel leakage is evident, defuel the main tank and replace the stat-o-seals and/or panel gaskets as required.

NOTE: When installing new stat-o-seals and gaskets, apply a small amount of rubber lubricant or petroleum jelly to the new stat-o-seal or gaskets. This will prevent damage to the seals when screws are tightened and will allow the seals to seat evenly.

3. Fuel Selector Valve Control System

Clean the fuel selector valve with a suitable solvent, wipe clean with a dry cloth. Inspect fuel selector valve control system for binding of control, travel, proper operation, excessive wear and safetying. Lubricate detents, refer to Servicing.

4. Main Tank Fuel Transfer Pump

Refer to Chapter 9, Disassembly/Assembly Fuel Transfer Pump, for cleaning and inspection.

Vacuum System

1. Vacuum System

For cleaning system, refer to Chapter 10. Inspect the vacuum system for scratches, chips, nicks, dents, deformed tubes, sharp bends, dirt, proper operation and correct vacuum indication.

Pitot-Static System

1. Pitot-Static System

For cleaning system and testing, refer to Chapter 10. Inspect lines for cracks, chafing and abrasions.

Upholstery

1. Carpet

Clean, refer to Chapter 1. Inspect carpet for excessive wear and security to the floorboard.

2. Seats

Clean, refer to Chapter 1. Inspect the front seats for binding on seat rails. Inspect for proper functioning of adjusting handles and tilting mechanism. Seat belts for

proper security. If electrically operated seats are installed (optional), actuate switches and observe for smooth operation. Replace components which show evidence of excessive wear or binding. Lubricate seat base rolls with oil as required. Wax seat rails with automotive wax to reduce friction between seat rollers and seat rails.

3. Seat Belts

Clean, refer to Chapter 1. Never use thinner or strong solutions on seat belts. Inspect webbing material for fraying. Inspect seat belt installation for security.

4. Upholstery

Clean, refer to Chapter 1. Inspect upholstery for general condition and wear. Observe areas where chafing from other equipment might occur thus damaging the upholstery panels.

Surface Deice System

1. Surface Deice System

For cleaning, refer to Chapter 12. Inspect the deice system for leaks, remove filter and clean with Naptha and dry with a jet of dry compressed air. Repair of the deice system components is limited to the replacement of parts. For repair of the deice system boots, refer to Chapter 12. For replacement of the filter P/N H95888-36, refer to Component Time Limits.

Windshield Anti-Ice System

1. Windshield Anti-Ice System Components

For cleaning, refer to Chapter 12. Inspect lines for cracks, chafing and abrasions. Inspect lines and adjacent areas for evidence of leakage. Inspect pump for security and operation.

Electrical System

1. Electrical

Inspect wiring for chafing, terminals for security, and general condition; circuit breakers for mounting and condition; regulators for mounting, terminals for loose wires; switches for loose wiring proper mounting; relays for wiring and mounting; motors for proper mounting and wires for clamp. Inspect instruments and interior lights for operation and broken glass; instrument panel and control pedestal for loose wiring, clamps and terminals for security. Inspect wing and fuselage wiring for

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proper wire routing, clamped properly and loose terminals. Inspect external power receptacle for proper door closing, terminals for corrosion and looseness. Inspect engine compartment wire bundles for proper clamping, evidence of burning, heat hardness security and chafing. Inspect stall warning vane and heater for proper operations and security.

2. Battery

For cleaning, refer to Chapter 13. Inspect battery case for possible cracks and deterioration. Check electrolyte for specific gravity using a hydrometer for a reading of 1.250 to 1.280, corrected to temperature. Check that specific gravity of the electrolyte does not vary more than 0.025 between cells. Should a greater variation exist, battery should be slow charged and retested. Remove battery from aircraft when charging battery. DO NOT use external power generators for charging purposes.

3. Battery Box

For cleaning, refer to Chapter 13. Inspect the cleaned battery box for physical damage and for areas lacking proper acid proofing. Badly damaged or corroded boxes should be replaced. Inspect surrounding areas of wing adjacent to battery box for damage and corrosion. For acid proofing battery box, refer to Chapter 13.

4. Alternator

Clean the alternator by washing down at the time the engine is cleaned, using the same cleaning procedure. Inspect alternator for condition and security. Inspect all electrical connections for cleanliness and security. For electrical output and operational check, refer to Chapter 13. Refer to Component Time Limits, for overhaul and replacement.

Avionics Systems

1. Avionics

Inspect communications and navigation systems for proper installation, security, proper operation and antennas for damage.

2. Emergency Locator Transmitter

A. Perform the following periodic inspection at the prescribed intervals.

(1) Monthly

(a) Turn aircraft master switch ON.

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- (b) Turn aircraft transceiver ON and set frequency on local tower frequency.
- (c) Contact local tower personnel and alert them of the proposed test.
- (d) Place the ELT function selector switch in the ON position until the emergency tone is heard on the aircraft radio (not over 10 seconds). Immediately place the function selector switch in the ARM position. (Ensure that the transmitter has been deactivated).

NOTE: After accumulated test or operation time equals 1 hour, battery pack replacement is required.

(2) 100 Hours.

- (a) Check ELT operation in accordance with procedure outlined under "Periodic."

NOTE: Check calendar date for replacement of battery pack. This date is supplied on a sticker attached to the outside of the ELT case and to each battery.

(3) 12 Months.

Have your dealer check your ELT for the following:

- (a) Power output (refer to Chapter 14).
- (b) Carrier frequency.
- (c) Modulation.
- (d) Sweep.
- (e) Sweep rate.
- (f) Operation of "g" switch.
- (g) Replacement of battery pack.
- (h) Mounting security.

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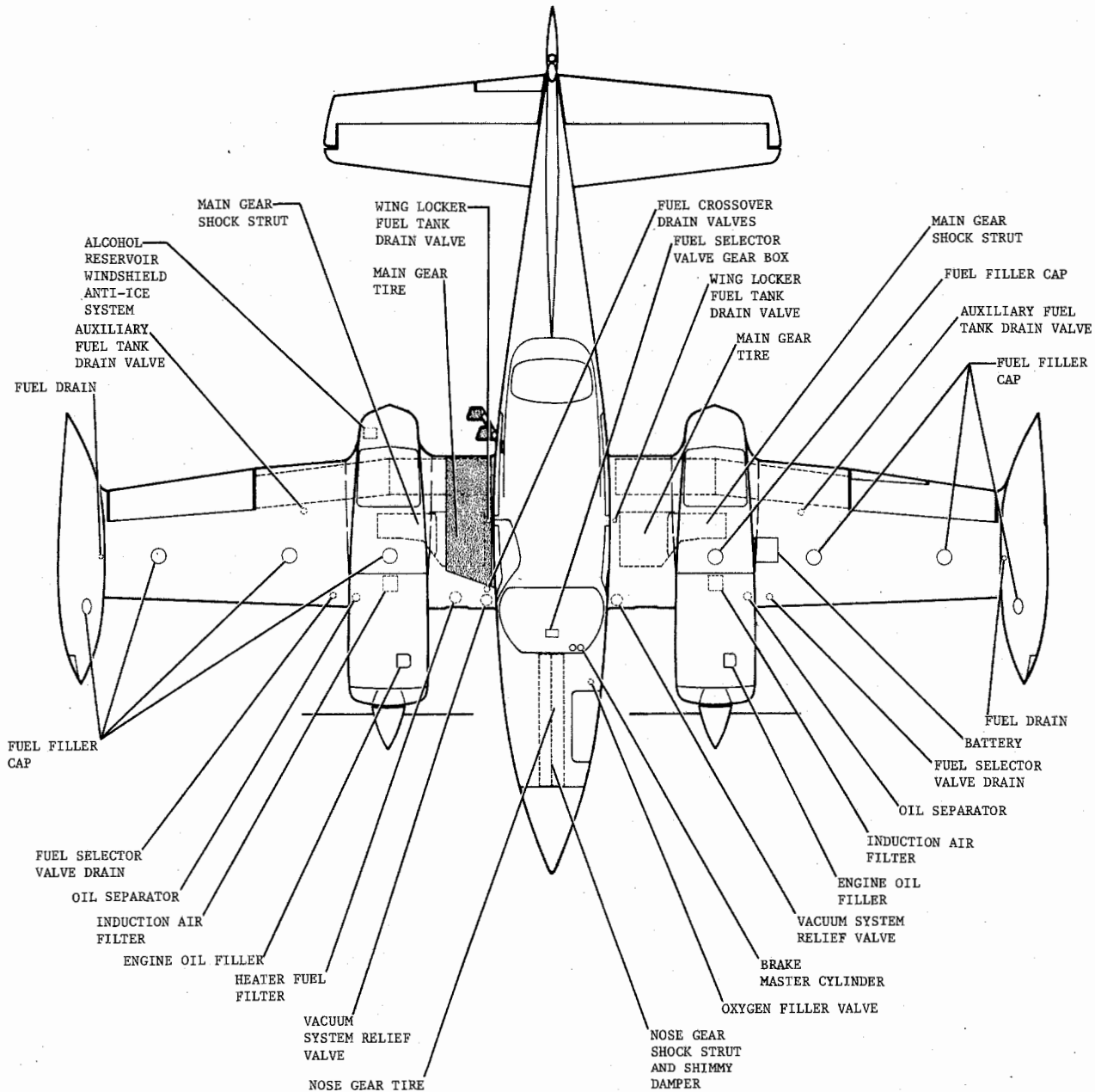
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SERVICINGDescription

1. This text consists of descriptions, illustrations and servicing procedures necessary to locate system or component service points, and to replenish or service equipment as required.
2. Adherence to instructions, cautions, and warnings will avoid injury to personnel and damage to the aircraft and associated equipment.
3. The operational integrity of the aircraft systems can be seriously impaired if unapproved or contaminated fuels, oils, fluids, lubricants and materials are used. Mixture of various brands, kinds and qualities of material should be avoided.
4. The replenishment chart provides capacities and pressures. Additional information concerning servicing of the various aircraft systems and components is provided in the applicable chapter.
5. Items to be serviced and/or lubricated are shown in the various procedures and illustrations. The illustration identifies the item, lube type and type of application. Refer to Inspection Time Limits for servicing frequencies.
6. Specified lubricants will meet requirements for extreme hot or extreme cold temperature operations. Use of substitutes or other lubricants may cause malfunction when operating in extreme temperature conditions, or may cause excessive wear due to improper lubrication.

Servicing - Landing Gear System

1. Service Main Landing Gear Shock Struts.
 - A. Jack aircraft, refer to Chapter 1.
 - B. Deflate strut by loosening valve body 2-1/2 turns (maximum).
 - C. With strut fully compressed, remove valve and fill with hydraulic fluid (MIL-H-5606A).
 - D. Stroke strut slowly three times (minimum).
 - E. Top off fluid with strut compressed.
 - F. Replace valve and inflate strut to 320 PSI with tire clear of ground.
 - G. When aircraft is on the ground, service strut to approximately 3.00 inches extension until strut can be serviced on jacks.



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Aircraft Service Points
Figure 1

2. Service Nose Gear Shock Strut.

- A. Jack aircraft, refer to Chapter 1.
- B. Deflate strut by loosening valve body 2-1/2 turns (maximum).
- C. With strut fully compressed, remove valve and fill with hydraulic fluid (MIL-H-5606A).
- D. Stroke strut slowly three times (minimum).
- E. Replace valve and inflate strut to 49 PSI with tire clear of the ground.
- G. When aircraft is on the ground, service strut to approximately 1.60 inches extension until it can be serviced on jacks.

Servicing - Shimmy Damper

1. Service Shimmy Damper.

- A. Using the tow bar, turn the nose wheel strut to the extreme left position against the 55 degree stop. This will place the shimmy damper piston to the rear of the cylinder and eliminate the possibility of entrapped air in the cylinder.
- B. Remove the filler plug and fill with hydraulic fluid (MIL-H-5606A).
- C. Replace filler plug and turn nose wheel strut through its entire travel several times.
- D. Return strut to the extreme left position against the 55 degree stop.
- E. Remove filler plug and add whatever fluid is needed to fill the cylinder.
- F. Replace and safety filler plug.

Servicing Main and Nose Gear Tires

1. General

- A. Tire air pressure will decrease somewhat as the temperature drops, but excessive deflation could indicate cold weather at the air valve. Avoid unnecessary pressure checks. If it is necessary to check tire inflation in cold climates always apply heat to air valve when checking and adding air.

2. Service Main Gear Tire. (Size 6.50 x 10, 6-Ply Rating)

- A. Tire pressure should be maintained at 60 PSI.

3. Service Nose Gear Tire. (Size 6.00 x 6, 4-Ply Rating)

- A. Tire pressure should be maintained at 40 PSI.

Servicing Brake Master Cylinder

1. General

- A. The hydraulic brake reservoir is incorporated in the master cylinder. The filler cap and air vent is located on the head of each master cylinder.

2. Service Brake Master Cylinder

- A. Remove filler cap and fill reservoir to within one-quarter inch below the filler opening with hydraulic fluid MIL-H-5606A (RED).

CAUTION: ALWAYS RELEASE PARKING BRAKE BEFORE SERVICING MASTER CYLINDER.

Servicing Engine Oil

1. General

- A. The oil system servicing is identical on each engine. The oil sump is an integral part of the crankcase. Oil serves the lubrication requirements of the internal engine components and accessory drive gear box. Oil pressure is supplied to main bearings, journal bearings and propeller governor by the oil pump and is returned to the oil sump by the scavenge pump.
- B. Oil level in the sump is checked by the dipstick in the filler neck. The dipstick access door is located on top of the engine cowl.
- C. Draining the oil is accomplished by removing the lower nacelle access panel and sump drain plug. For removal/installation of the engine oil filter, refer to Chapter 7.

NOTE: Oil should be drained when the engine is warm and the oil is in the normal operating temperature range on the indicator.

- D. Check engine oil level before each flight. DO NOT take-off on less than 9 quarts. When preflight shows less than 9 quarts service with aviation grade engine oil. The aircraft is delivered from the factory with straight mineral oil; therefore, it will be necessary during the break-in period or first 20 to 30 hours of operation to add straight mineral oil Military Specification (MIL-6082). Multi-Viscosity oil with a range of SAE 10W30 is recommended for improved starting and turbocharger con-

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troller operation in cold weather. Ashless Depersant oil, conforming to Continental Motor Specification MHS-24A, must be used after the first 20 to 30 hours of new or overhauled engine operation.

2. Cold Weather Servicing

- A. If the aircraft is to be used frequently in extremely cold weather, the oil should be drained while the engine is hot and stored in a dry warm place until needed for next flight. If desired, the oil may be heated before it is poured into the engine for the next flight. Refer to Chapter 7 for Cold Weather Servicing of Oil Pressure Lines.

WARNING: WHEN PREHEATING THE OIL, DO NOT ALLOW THE TEMPERATURE OF THE HEATED OIL TO RISE ABOVE 121°C (250°F). HEATING THE OIL ABOVE THIS TEMPERATURE MAY CAUSE A FLASH FIRE. JUST BEFORE SHUTTING DOWN THE ENGINE IN COLD WEATHER A QUART OF GASOLINE MAY BE ADDED TO THE OIL IN THE SUMP TO DILUTE THE OIL FOR THE NEXT START.

QUANTITY EACH ENGINE				
SYSTEM	U.S. GALLONS	IMPERIAL GALLONS	METRIC LITERS	NAME, NUMBER, OR TYPE
ENGINE OIL				Aviation Grade SAE 30 Below 40°F, SAE 50 Above 40°F. Refer to Engine Oil Servicing for Break in Oil and Cold Weather Starting Oil Types.
OIL CAPACITY (Including Filter)	3.25	2.71	11.4	

Engine Oil System Replenishment Chart

Servicing Fuel Loading

1. General

- A. The main fuel tanks (tip tanks) are filled through a single filler valve located forward at the forward end of

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each tip tank. The left and right wing auxiliary and optional tanks are gravity filled through a single filler hole in each wing. Wing locker (optional) tanks are filled through the filler hole above the tank. The fuel tank capacities and acceptable fuel specifications are shown on the Fuel Replenishment Chart.

2. Fuel Servicing

CAUTION: DURING ALL FUELING PROCEDURES FIRE FIGHTING EQUIPMENT MUST BE AVAILABLE. TWO GROUND WIRES FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT ACCIDENTAL DISCONNECTING OF ONE GROUND WIRE.

- A. Fuel servicing rates on some ground servicing equipment may tend to exceed the aircraft's fuel system intake rate, thus creating several false "FULL" indications. A slower fueling rate is recommended.

WARNING: DO NOT OPERATE RADIO, RADAR, ELECTRICAL OR ELECTRONIC EQUIPMENT ON THE AIRCRAFT DURING FUELING.

- B. Connect ground wire from fueling nozzle to aircraft grounding receptacle.
 C. Remove filler cap, insert nozzle and fill tank.
 D. Remove fuel nozzle and nozzle ground wire.
 E. Install filler cap.

CAUTION: ENSURE FILLER CAP IS LOCKED DOWN.

TANK CAPACITY	QUANTITY EACH TANK			NAME, NUMBER, OR TYPE
	U.S. GALLONS	IMPERIAL GALLONS	METRIC LITERS	
TIP TANK				Aviation Grade
TOTAL CAPACITY	51.0	42.5	193.0	100/130 MINIMUM (LOW LEAD FUELS Are Approved For Use)
OPTIONAL AUXILIARY TANK (40 GAL. OPTION)	20.5	17.1	77.5	
OPTIONAL AUXILIARY TANK (63 GAL OPTION)	32.0	26.6	121.0	
OPTIONAL WING LOCKER TANK	20.3	16.8	76.8	

Fuel System Replenishment Chart

Defueling Servicing

1. General

- A. The fuel tanks can be defueled by the gravity method or using the defueling pump on the service truck. It is recommended the defueling truck be used prior to using the gravity method to expedite defueling. Procedures are the same for either left or right wing.

2. Defueling

CAUTION: DURING ALL DEFUELING PROCEDURES, FIRE FIGHTING EQUIPMENT MUST BE AVAILABLE. TWO GROUND WIRES FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUND STAKES SHALL BE USED TO PREVENT ACCIDENTAL DISCONNECTING OF ONE GROUND WIRE.

- A. Turn off all electrical power.
B. Turn fuel selector valve handles OFF.
C. Remove fuel filler cap and insert defueling nozzle.
D. Remove as much fuel as possible through the filler opening.
E. Remove drain valves from bottom side of tank and drain remaining fuel in a clean, open container. Use defuel pump to remove fuel from container. Drain right hand crossover drain line at wing gap.

WARNING: RESIDUAL FUEL ACCUMULATION IN THE WING IS A FIRE HAZARD. USE CARE TO PREVENT THE ACCUMULATION OF SUCH FUEL.

Purging Fuel System

1. General

- A. To reduce the possibility of an explosion during repair, purge fuel tanks and fuel cells with an inert gas such as Argon. Since Argon is heavier than air, it will remain in the fuel tank or cell during the repair. Repairs shall be made using non-sparking tools (air motors, plastic scrapers, etc.). The use of a portable vapor detector (Mine Safety Appliance Explosimeter, Model 5 Indicator) to detect the presence of explosive gases is also recommended.

2. Purging Fuel System

- A. Defuel the aircraft, refer to Defueling procedures.
B. Insert hose through filler opening into fuel tank.

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- C. Attach hose to inert gas container and allow inert gas to flow into the fuel tank until all explosive gas vapors are dissipated.

NOTE: The length of time required to fill the fuel tank with inert gas is dependent upon rate of flow and tank capacity.

Windshield Anti-Ice System (Alcohol) Servicing

1. General

- A. The windshield anti-icing system reservoir is located in the aft portion of the right wing locker. The reservoir filler cap is located inside the access door.
- B. The fluid level should be checked and filled as required on preflight.

SYSTEM	U.S. GALLONS	IMPERIAL GALLONS	METRIC LITERS	NAME, NUMBER, OR TYPE
ISOPROPYL ALCOHOL				MILITARY Specification MIL-F-5566
TANK CAPACITY	3.0	2.50	11.4	

Windshield Anti-Ice (Alcohol) Replenishment Chart

Oxygen System Servicing

1. General

- A. The oxygen filler valve is located inside the nose baggage door. A pressure gage is provided on the instrument panel.
- B. The oxygen system gage should be checked for anticipated requirements before first flight each day.
- C. Whenever pressure drops below 300 PSI, refill with aviator breathing oxygen Military Specification MIL-O-27210.

2. Charging Oxygen System

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- A. Open nose baggage door, remove oxygen filler valve cap and connect charging unit.
- B. Slowly charge the oxygen cylinder to proper PSI as indicated on cylinder placard and in accordance with Oxygen Cylinder Filling Pressure Table (corrected pressure using a regulated oxygen supply).

Initial Temp °F	Filling Pressure Psig	Initial Temp °F	Filling Pressure Psig	Initial Temp °F	Filling Pressure Psig
0	1600	40	1775	90	2000
10	1650	50	1825	100	2050
20	1675	60	1875	110	2100
30	1725	70	1925	120	2150
		80	1950	130	2200

- NOTE:
1. Table filling pressure is based on oxygen cylinder filled to 1800 psig at 70°F. Add 50 psig when filling 1850 psig cylinders.
 2. Initial temperature refers to ambient temperature in filling room. A rise of approximately 25°F may be expected as a result of compression. The cylinder should be filled as quickly as possible and allowed to cool by ambient air only.

Oxygen Cylinder Filling Pressure Table

- C. Shut off oxygen supply, disconnect charging unit, install filler cap and close nose baggage door.

Battery Servicing

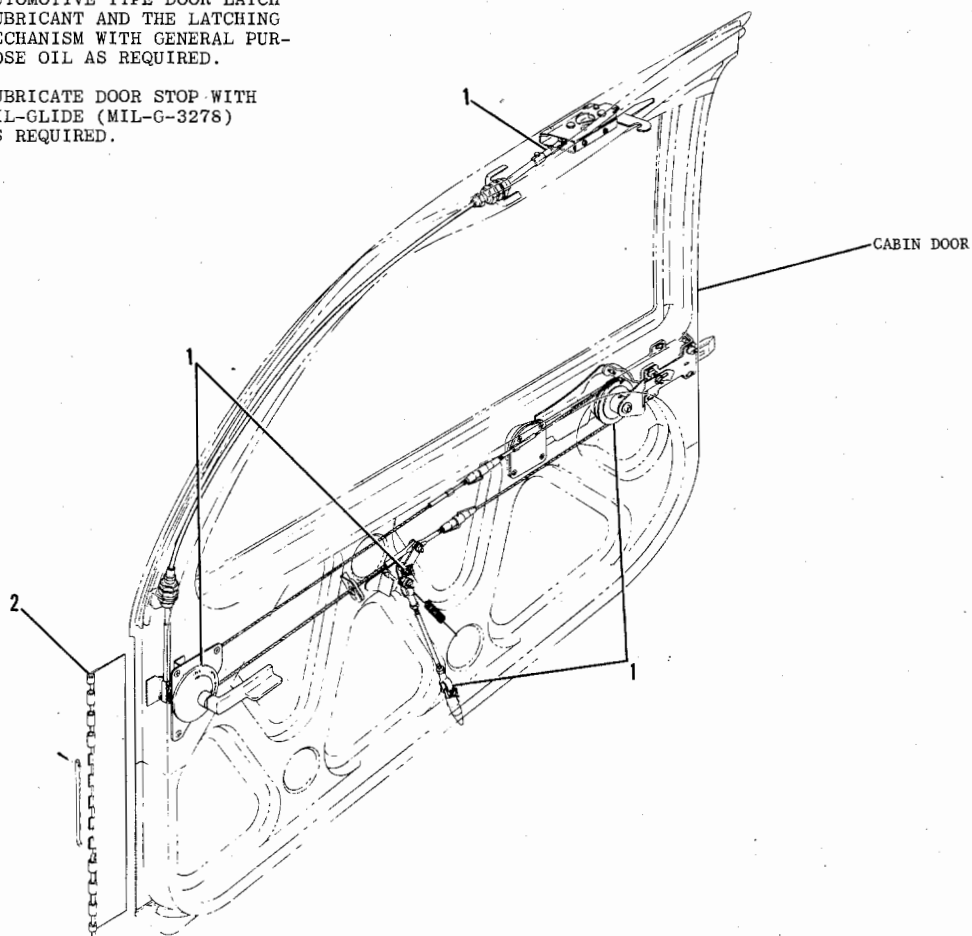
1. General

- A. The electrolyte level must be maintained such that the tops of the plates are covered with electrolyte. Filling instructions are molded in the top of the battery case.
- B. The battery must be removed from the aircraft for checking state of charge, and charging the battery.

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- NOTE: 1. LUBRICATE DOOR LATCHES WITH AUTOMOTIVE TYPE DOOR LATCH LUBRICANT AND THE LATCHING MECHANISM WITH GENERAL PURPOSE OIL AS REQUIRED.
2. LUBRICATE DOOR STOP WITH SIL-GLIDE (MIL-G-3278) AS REQUIRED.

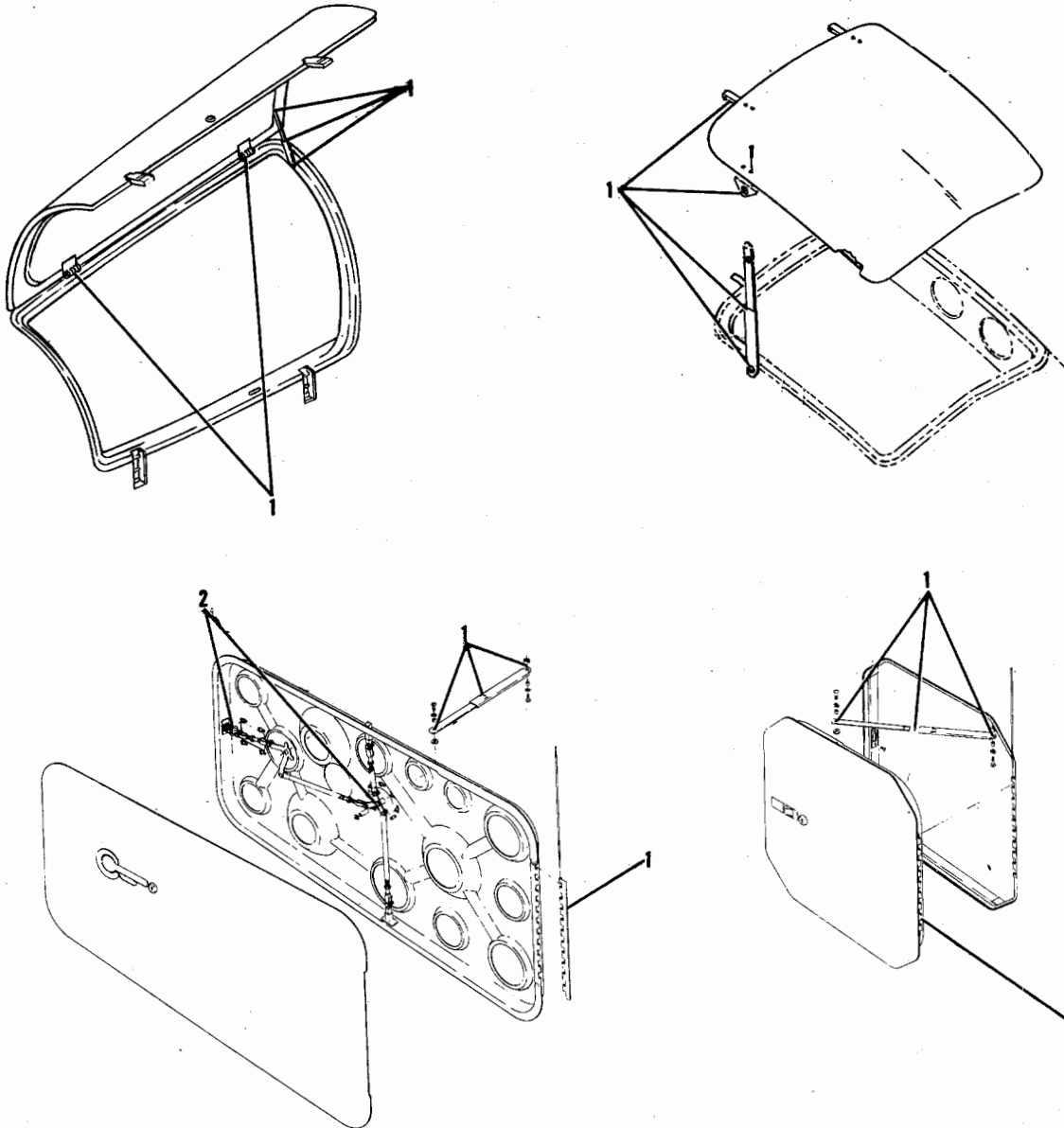


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ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Door Latch Mechanism	GL	Hand	-
2.	Hinge and all Push-Pull Rod Joints	OG	Oil Can	-

GL - Grease, Low Temperature (MIL-G-21164)
OG - Oil, General Purpose (MIL-L-7870)

Cabin Door
Figure 2



ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Hinge and Door Stop	OG	Oil Can	-
2.	Baggage Door	GL	Hand	-

OG - Oil, General Purpose (MIL-L-7870)

GL - Grease, Low Temperature (MIL-G-21164)

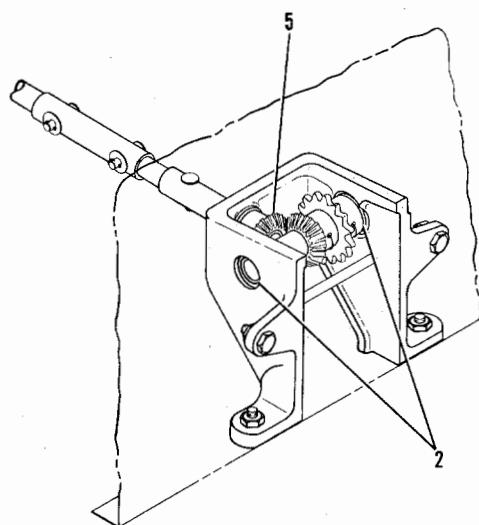
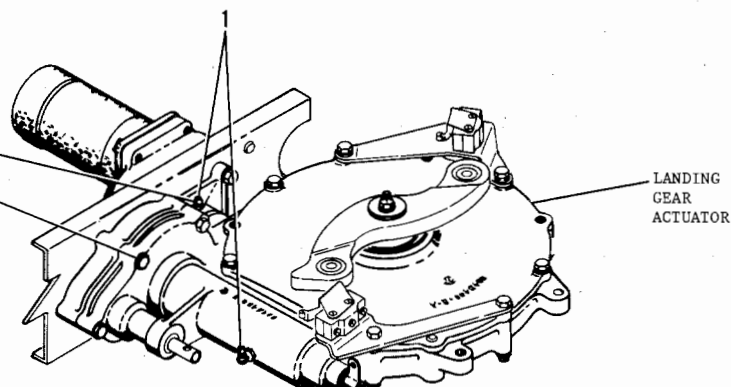
Nose, Wing Locker, and Cabin Baggage Door
Figure 3

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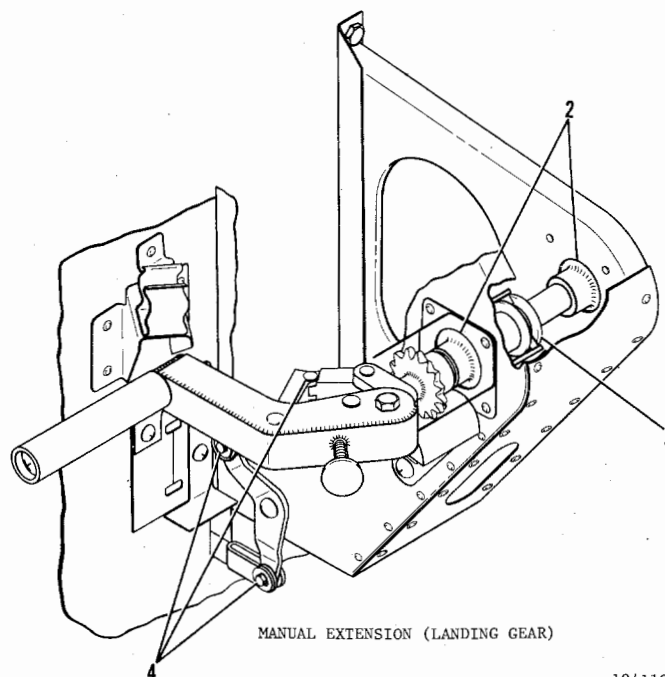
NOTE: WHEN GREASING THIS FITTING REMOVE THIS BOLT TO PREVENT BREAKING SEAL, REINSTALL WHEN FINISHED GREASING.

NOTE: APPROXIMATELY 3 PUMPS ON A HAND GREASE GUN WILL GIVE ADEQUATE LUBRICATION.



NOTE: 1. AFTER LUBRICATING, WIPE OFF EXCESS LUBRICANT ADJACENT TO CRANKING HANDLE.

2. DO NOT OIL THE CHAIN; AN OILED CHAIN MAY COLLECT DIRT AND GRIT. WIPE CHAIN WITH A CLEAN DRY CLOTH.



10411005
10153005

ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Landing Gear Actuator	GL	Gun	2
2.	Support Bearings	OG	Oil Can	-
3.	Spool and Bellcrank	GL	Hand	-
4.	Crank Handle Linkage	OG	Oil Can	-
5.	Miter Gear	GL	Hand	-

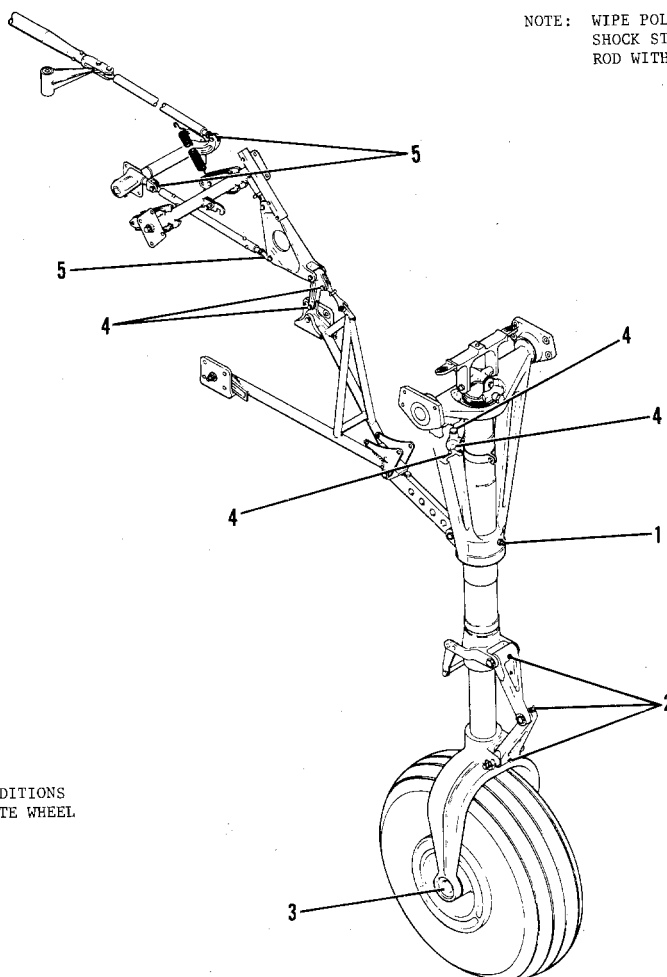
GL - Grease, Low Temperature (MIL-G-21164)

OG - Oil, General Purpose (MIL-L-7870)

Landing Gear and Manual Extension
Figure 4

NOTE: WIPE POLISHED SURFACE OF LANDING GEAR
SHOCK STRUT AND SHIMMY DAMPENER PISTON
ROD WITH A CLEAN DRY CLOTH AS REQUIRED

NOTE: UNDER EXTREME CONDITIONS
CLEAN AND LUBRICATE WHEEL
EVERY 100 HOURS



14424001

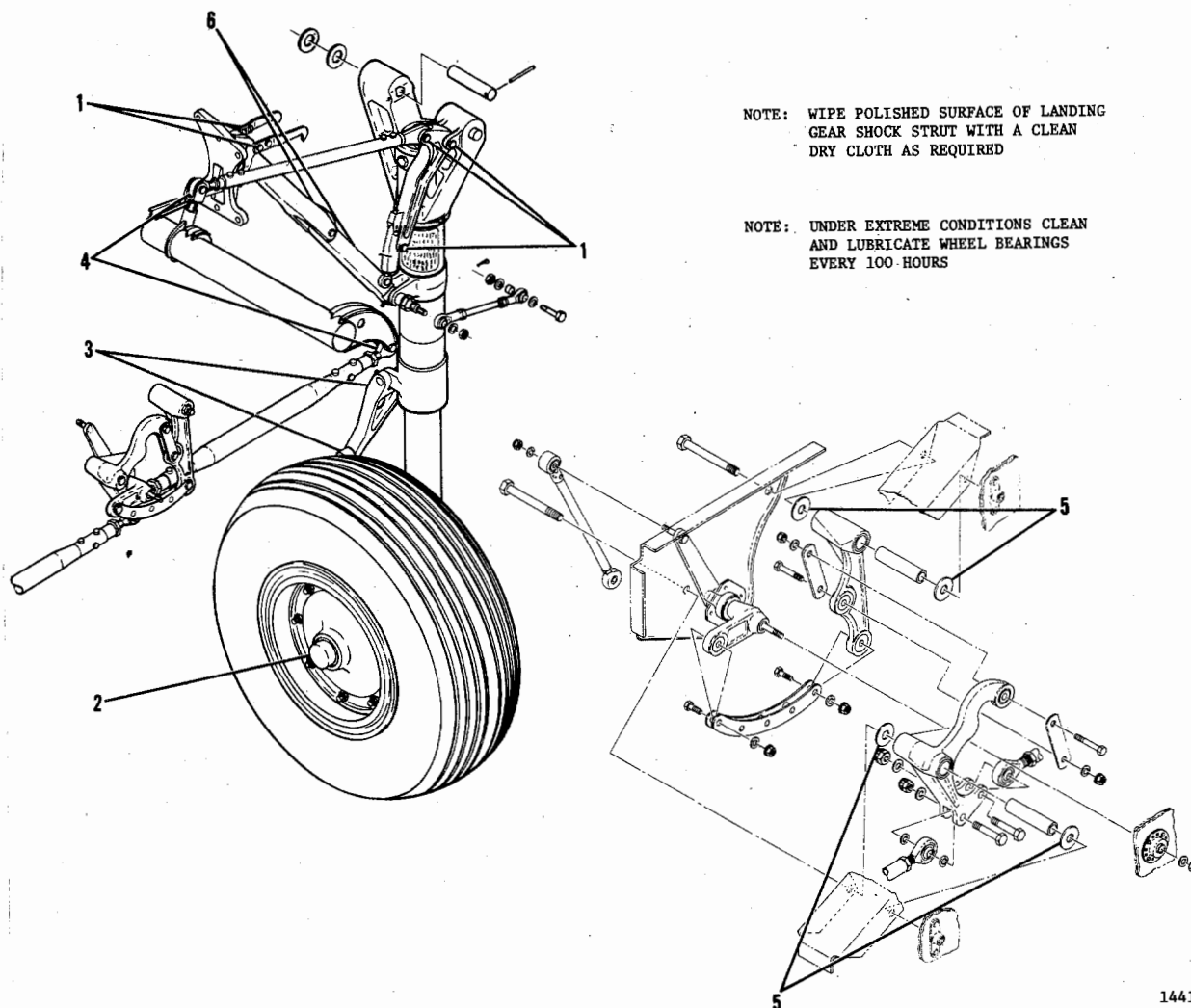
ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Trunnion Fitting	GL	Gun	1
2.	Torque Link	GL	Gun	4
3.	Wheel Bearing	GW	Hand Pack	-
4.	Pivot Bushings	OG	Oil Can	-
5.	All Spherical Rod Ends	GL	Hand	-

OG - Oil, General Purpose (MIL-L-7870)

GW - Grease, Wide Temperature Range (MIL-G-81322)

GL - Grease, Low Temperature (MIL-G-21164)

Nose Gear - Lubrication
Figure 5

14413002
10273001

ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Main Gear Up Lock Bushings	OG	Oil Can	-
2.	Wheel Bearings	GW	Hand Pack	-
3.	Torque Link Fittings	GL	Gun	6
4.	All Spherical Rod Ends	GL	Hand	-
5.	Thrust Washers	OG	Oil Can	-
6.	Side Brace	GL	Gun	2

OG - Oil, General Purpose (MIL-L-7870)

GW - Grease, Wide Temperature Range (MIL-G-81322)

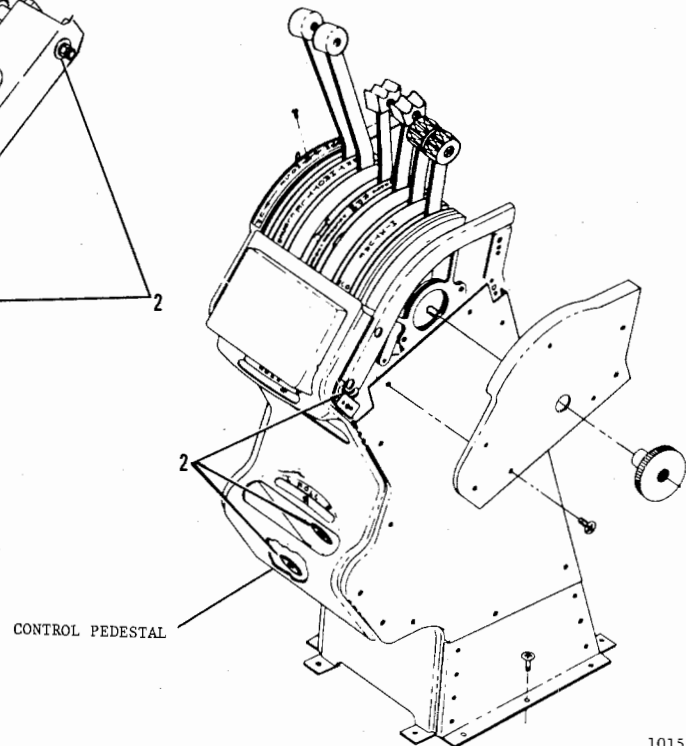
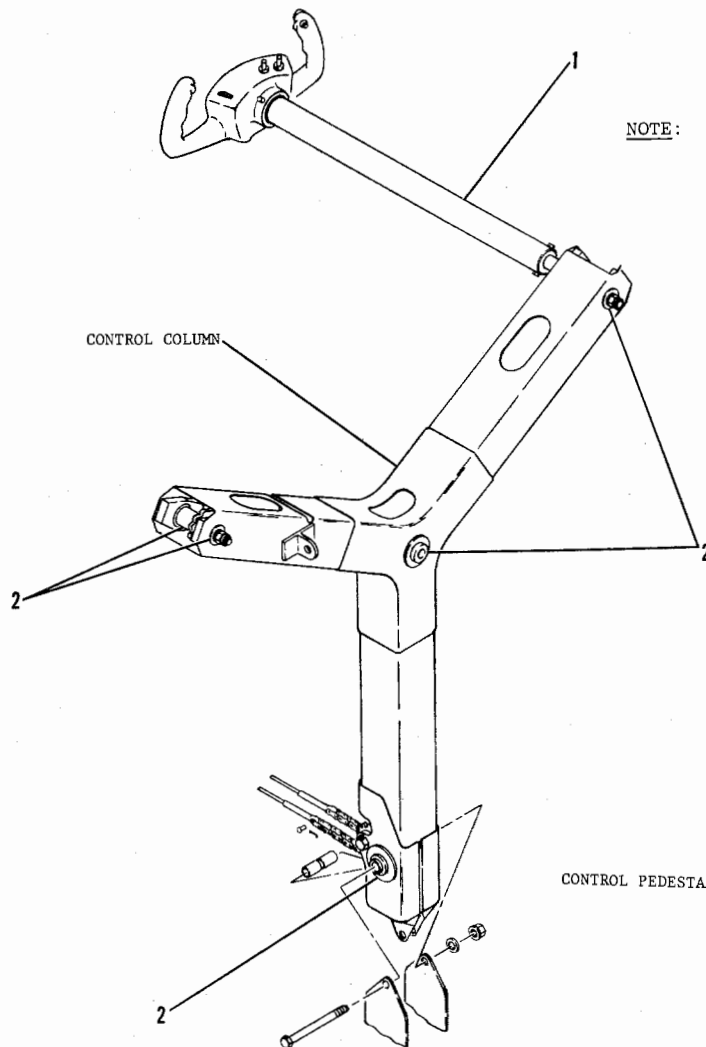
GL - Grease, Low Temperature (MIL-G-21164)

Main Gear - Lubrication
Figure 6

NOTE: APPLY A SMALL AMOUNT OF GENERAL PURPOSE POWDERED GRAPHITE, MIXED WITH LUBRICATING OIL, TO THE WHEEL CONTROL TUBE ADJACENT TO THE SOCKET ASSEMBLY ON THE INSTRUMENT PANEL. ACTUATE THE CONTROL TUBE FORWARD AND AFT TO INSURE PENETRATION OF THE LUBRICANT INTO THE SOCKET ASSEMBLY. WIPE OFF CONTROL TUBE THOROUGHLY.

NOTE: 1. DO NOT LUBRICATE ROLLER CHAINS ON CABLES ON ALL SYSTEMS EXCEPT UNDER SEA COAST CONDITIONS. WIPE WITH A CLEAN, DRY CLOTH.

2. LUBRICATE CONTROL SURFACE HINGES WITH GENERAL PURPOSE OIL (MIL-L-7870) AS REQUIRED.



10151002
10612010

NOTE: LUBRICATE UNSEALED PULLEY BEARINGS, ROD ENDS, OILITE BEARINGS, PIVOT END HINGE POINTS, AND ANY OTHER FRICTION POINT OBVIOUSLY NEEDING LUBRICATION WITH GENERAL PURPOSE OIL AS REQUIRED.

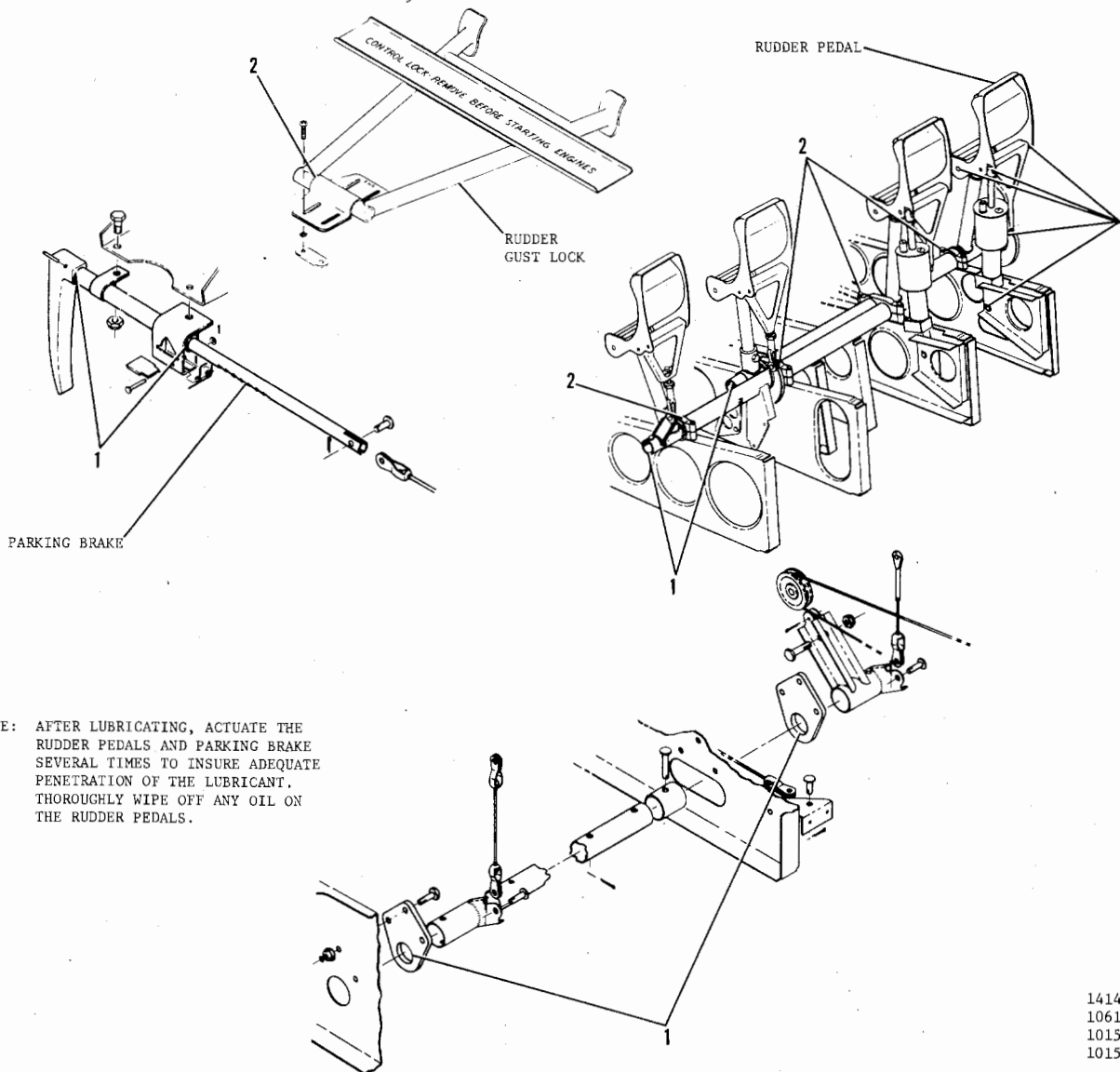
ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Control Tube	FG	Hand	--
2.	Bearings	OG	Oil Can	--

FG - Graphite, Lubricating (SS-G-659)
OG - Oil, General Purpose (MIL-L-7870)

Control Column and Control Pedestal
Figure 7

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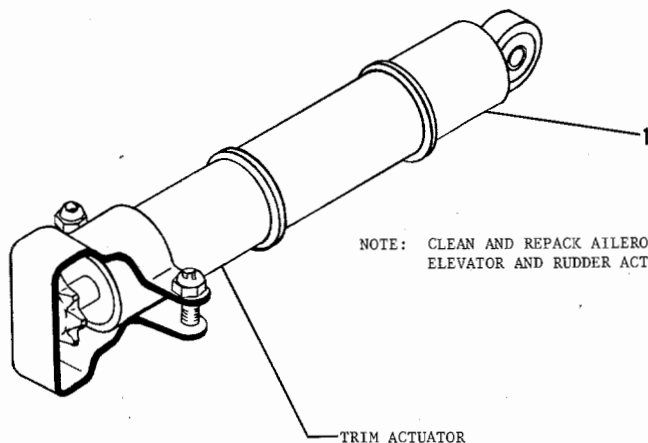
14141032
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10151001
10153006R

ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Pedal Linkage Bearings and Parking Brake Handle Shaft and Pivot Points	OG	Oil Can	-
2.	Bearing Halves and Rudder Gust Lock	GW	Hand	-

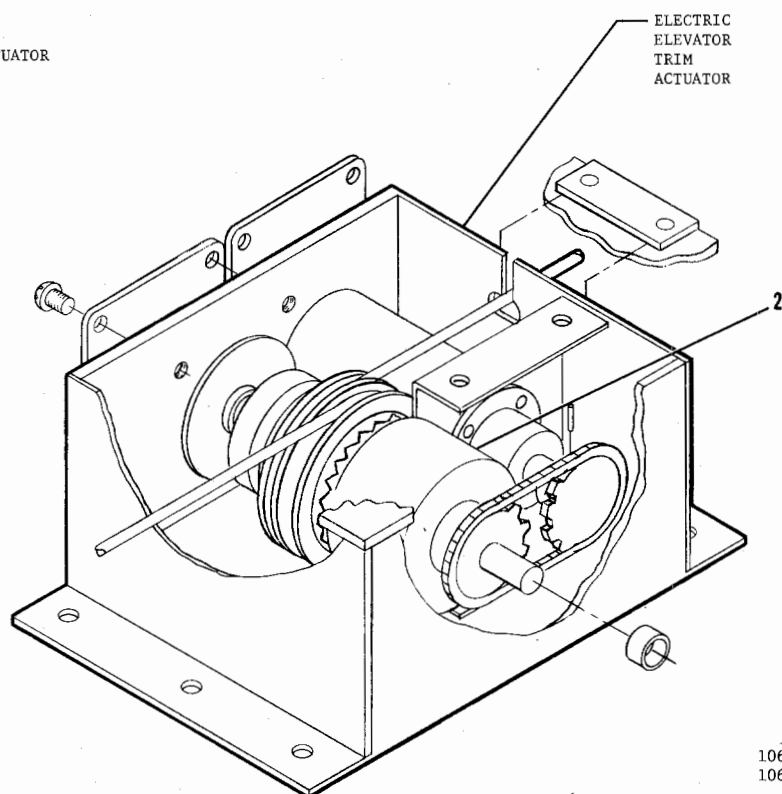
OG - Oil General Purpose (MIL-L-7870)

GW - Grease, Wide Temperature Range (MIL-G-81322)

Rudder Pedals, Gust Lock and Parking Brake
Figure 8



NOTE: CLEAN AND REPACK AILERON,
ELEVATOR AND RUDDER ACTUATORS



NOTE: ELECTRIC TRIM TAB ACTUATOR
DRUM AND CABLE MUST BE FREE
OF GREASE AND OIL.

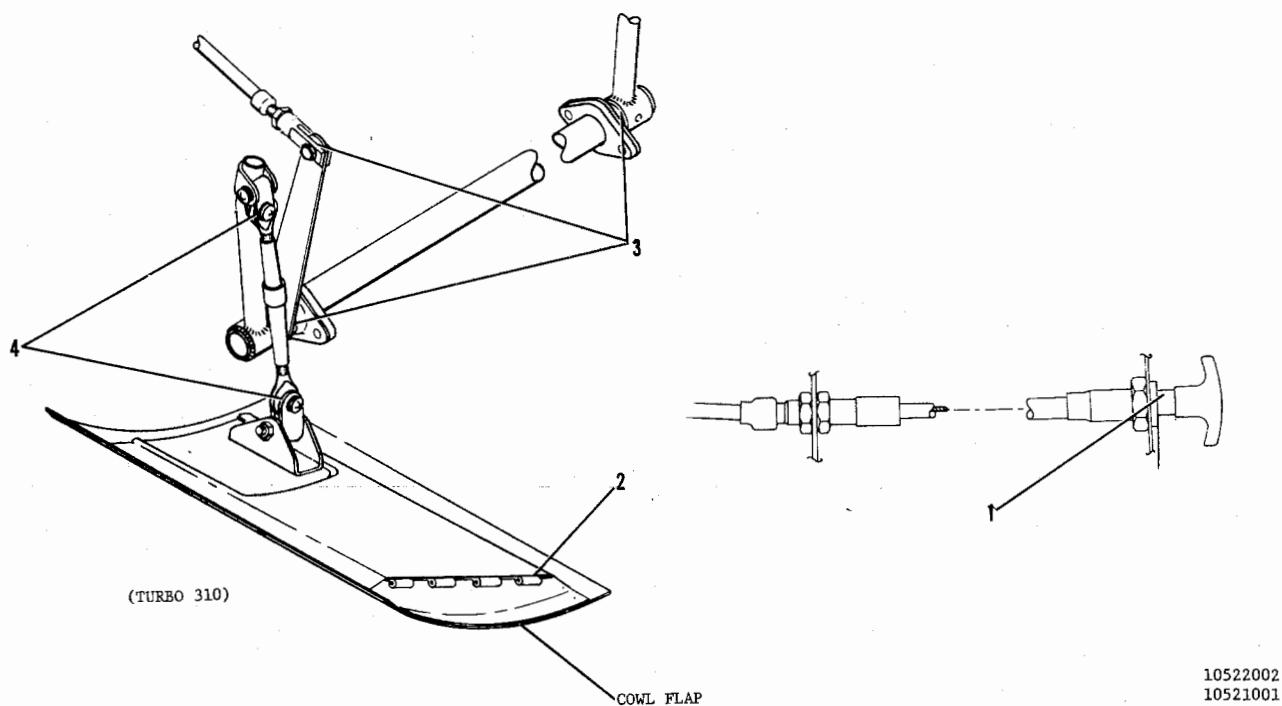
10611013
10611014

ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Internal Threads	GSL	Hand Pack	-
2.	Clutch Assembly	GL	Hand Lubri- cate	-

GL - Grease, Low Temperature (MIL-G-21164)

GWL - Grease, Light Consistency #33, Dow Corning Midland, Mich.

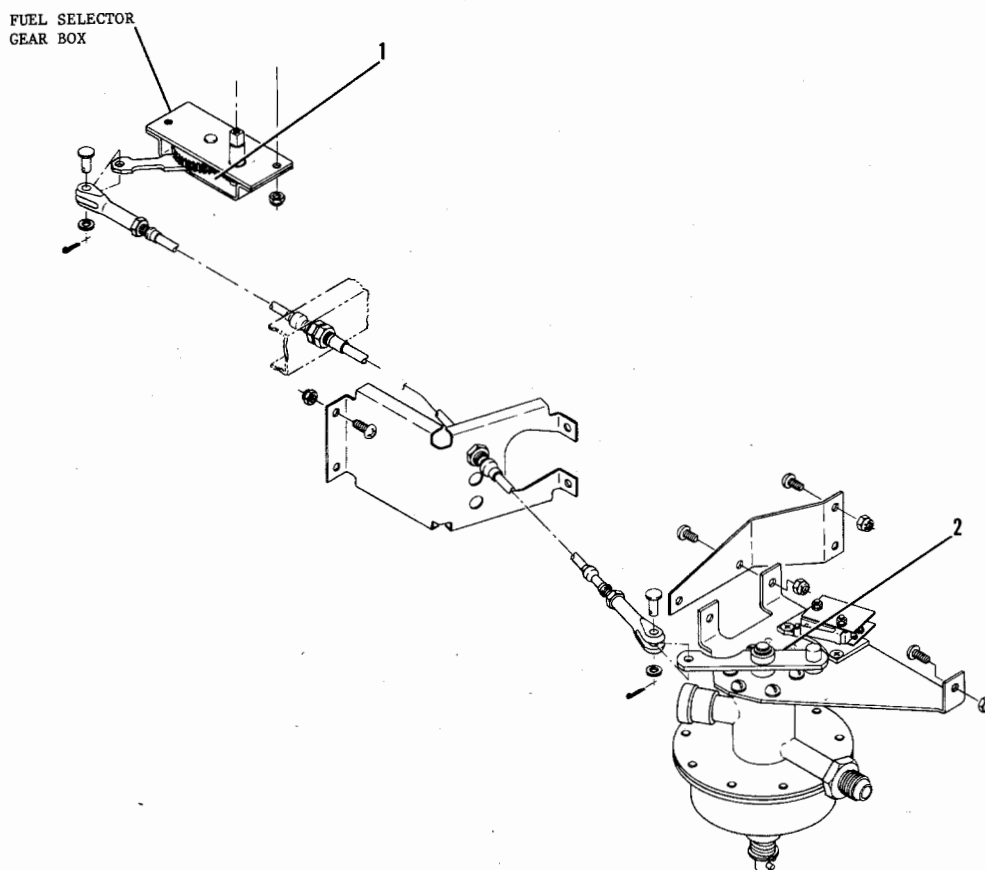
Trim Tab Actuators
Figure 9



ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Control Cable & Housing	FG	Hand	-
2.	Hinge	OG	Oil Can	-
3.	Pivot Points and Linkage	OG	Oil Can	-
4.	All Spherical Rod Ends	OG	Oil Can	-

FG - Graphite, Lubricating (SS-G-659)
OG - Oil, General Purpose (MIL-L-7870)

Cowl Flap
Figure 10

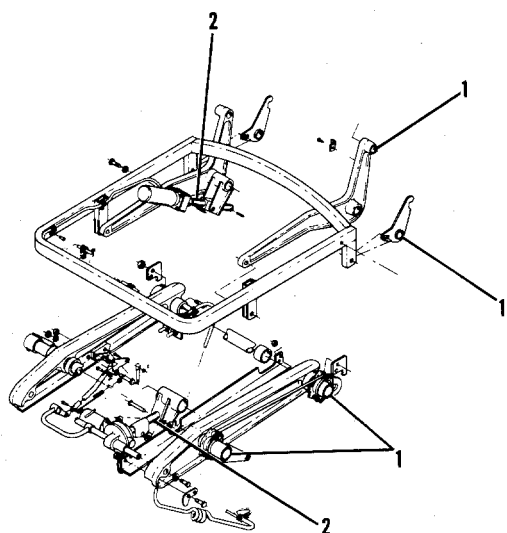


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10263012

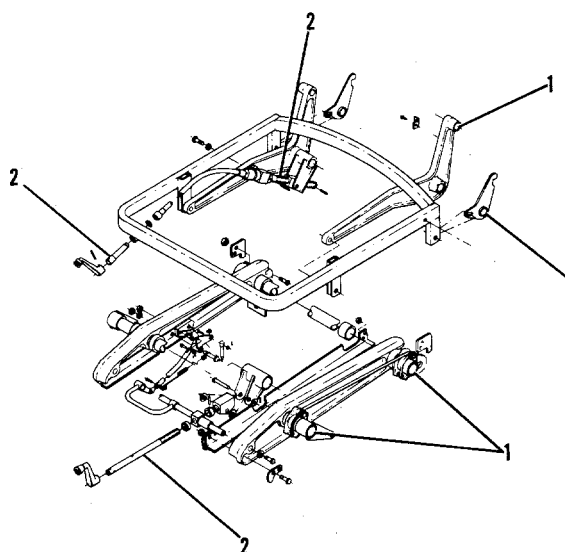
ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Gear	GL	Hand	--
2.	Detents	DS	Hand	--

GL - Grease, Low Temperature (MIL-G-21164)
DS - Dry Spray, Lubricant Camie No. 1000

Fuel Selector Gear Box
Figure 11



ELECTRICAL SEAT



MECHANICAL SEAT

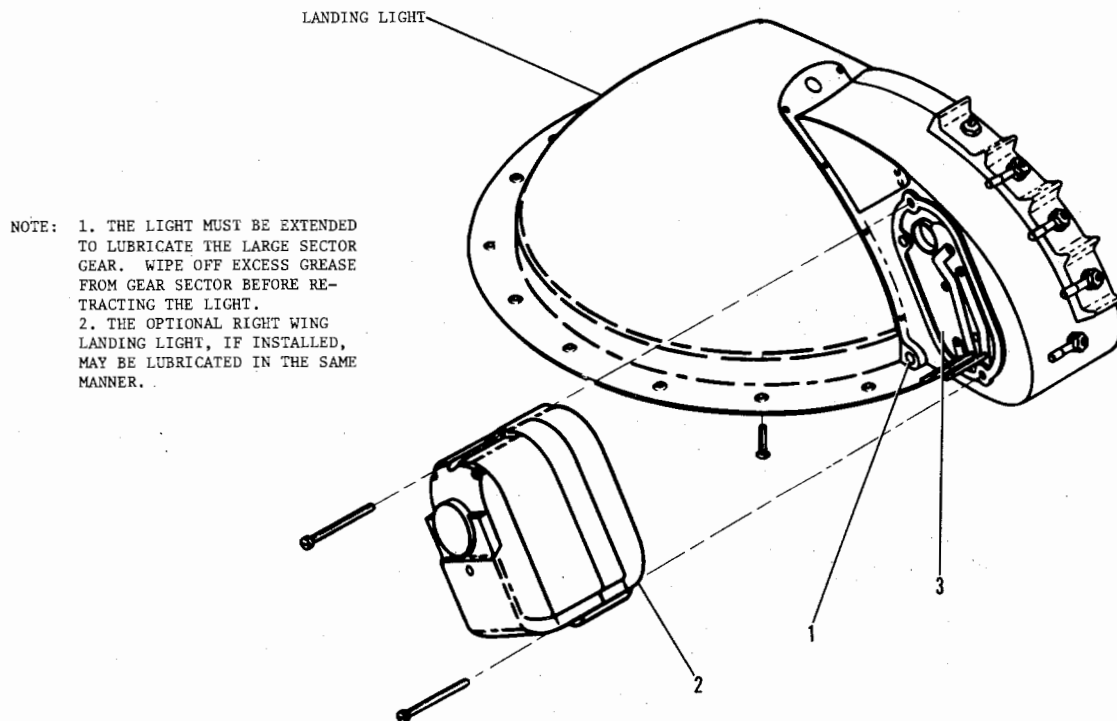
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14144007

ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Bearing	OG	Oil Can	-
2.	Adjusting Screw	GL	Hand	-

OG - Oil, General Purpose (MIL-L-7870)

GL - Grease, Low Temperature (MIL-G-21164)

Mechanical and Electrical Adjusting Seats
Figure 12



51182010R

ITEM NO.	ITEM DESCRIPTION	LUBE TYPE	APPLICATION	NUMBER OF FITTINGS IN AREA
1.	Hinge Point	OG	Oil Can	-
2.	Internal Gears	OI	Oil Can	-
3.	Exposed Gear Sector	GL	Hand	-

OG - Oil, General Purpose (MIL-L-7870)

OI - Oil, Lubricating, Aircraft Instrument (MIL-G-81322)

GL - Grease, Low Temperature (MIL-G-21164)

Landing Light
Figure 13

CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

3

AIRFRAME

310

MAINTENANCE MANUAL

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AIRFRAMEDescription

1. The aircraft structure features all metal construction, conventional design, incorporating aluminum alloys, steel and other materials as appropriate.
2. The fuselage structure is based on a semimonocoque design consisting of bulkheads, stringers and skin. The fuselage consists of the nose section, center section and tail section. Two spars (one forward and one rear) pass through the fuselage and incorporate attach fittings for attaching the wings.
3. Doors are provided for the cabin, cabin baggage compartment, nose baggage and wing locker baggage. All doors are flush fitting and open outward.
4. Windows are provided in the fuselage and permit 360 degrees of visible vision. The windows consist of the windshield, pilot side window, cabin door window, foul weather window, picture windows and omni window.
5. The empennage structure consists of the horizontal and vertical stabilizers. The stabilizers consist of spars, ribs, skin panels and access panels to respective stabilizer components.
6. The wings are attached to the forward and rear spars of the fuselage. Wing structure consists of the two spars, ribs and skins. The wing structure provides attach fittings for the main landing gear, aileron, flap, main fuel tanks and engine nacelle.

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DOORSDescription

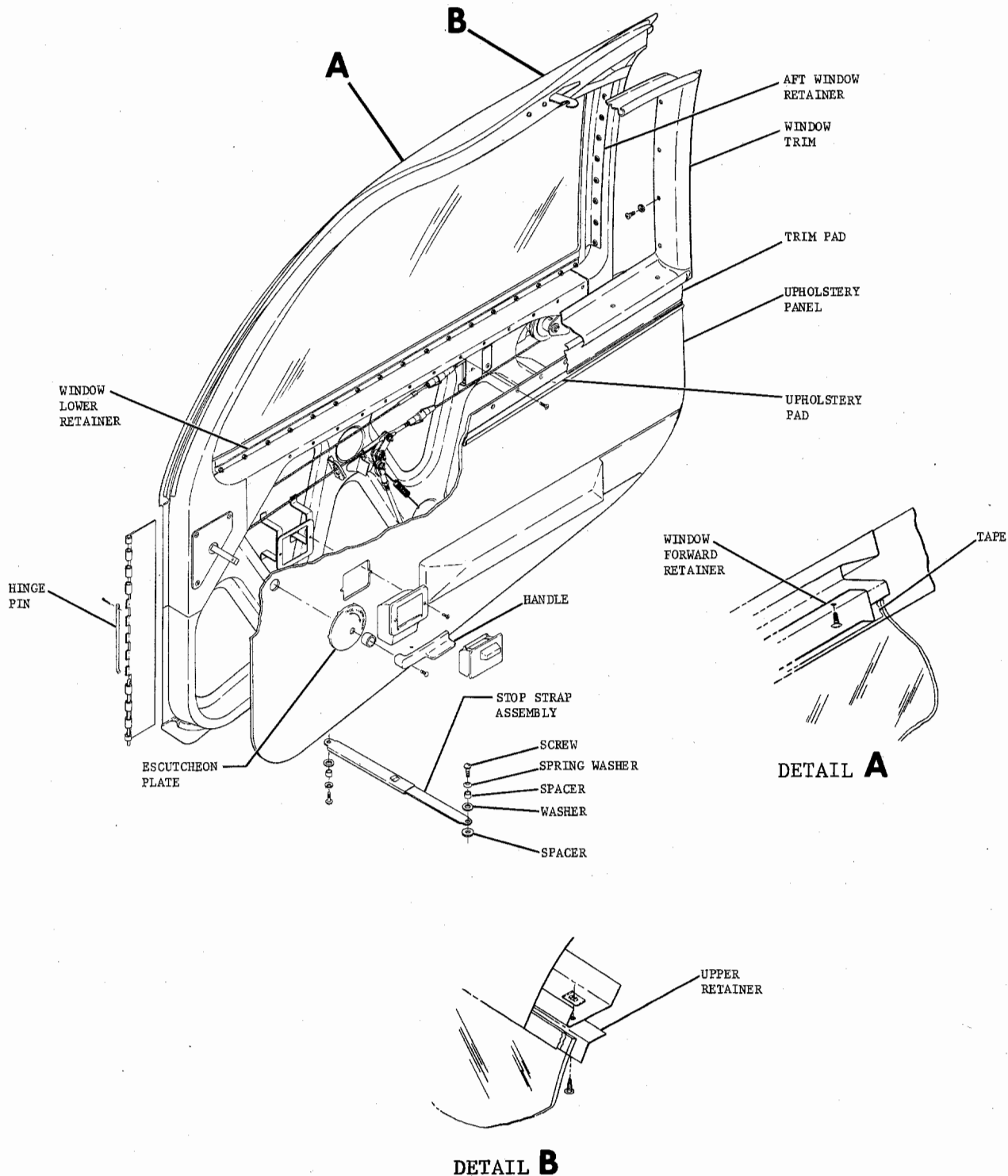
1. Doors are provided for cabin entry, aft baggage storage, nose baggage compartment and wing locker baggage compartment. All doors are flush fitting and open outward. The inner surface of the cabin and aft baggage doors are covered with upholstery panels that blend with the aircraft interior decor.
2. The cabin door is located on the right side of the fuselage at the forward end of fuselage. The door can be opened by either the outside or inside handle. The door is mounted on a single hinge and when it is open, a hold-open assembly on the bottom of the door frame retains the door in this position.
3. The aft baggage door is located on the right side of the aircraft. The baggage door has two configurations, small door (standard) or large door (optional). The door is attached to the fuselage with a single hinge. The door may be opened from the outside only and incorporates a doorstop to hold the door open. The door is equipped with a key lock.
4. The nose baggage door is located on the left-hand side of the nose. The door is attached to the fuselage with two hinges. Two door latches installed in the bottom of the door, secures the door in place. The door incorporates a stop assembly to hold the door open. Also, the door is equipped with a key lock.
5. A wing locker baggage door is located on the aft nacelle portion of each wing. Each door is attached to the structure with two hinges. The door is equipped with a latch and key lock and a door stop assembly.

Maintenance Practices

1. Removal/Installation Cabin Door (See Figure 1).
 - A. Remove Cabin Door.
 - (1) Open and support the cabin door.
 - (2) Remove screw, spring washer, spacer, washer and spacer securing stop strap assembly to fuselage.
 - (3) Remove cotter pins securing hinge pins.
 - (4) Remove hinge pins and cabin door.
 - (5) If further disassembly of cabin door is desired, refer to Disassembly/Assembly Cabin Door.

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Cabin Door Installation
Figure 1

10114003
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B10112003

B. Install Cabin Door.

- (1) Align cabin door hinge halves.
- (2) Install hinge pins and secure with cotter pins.
- (3) Secure stop strap assembly to fuselage structure, using spacer, washer, spacer, spring washer and screw.

2. Disassembly/Assembly Cabin Door (See Figure 1).

A. Disassemble Cabin Door.

- (1) Remove door stop strap assembly from door by removing screws, washers and spacer.
- (2) Press escutcheon plate enough to permit removal of setscrew securing door handle.
- (3) Pull off inside handle from cabin door and remove escutcheon plate.
- (4) Remove trim pad and retainer pad.
- (5) Remove window trim by removing screws and washers.
- (6) Remove screws securing upholstery panel.
- (7) Remove window lower retainer by removing attaching screws and nuts.
- (8) Remove window forward retainer by removing attaching screws.
- (9) Remove window upper retainer by removing attaching screws and remove window.

B. Assemble Cabin Door.

- (1) Position window in door frame. Install window retainers lower, upper and forward using screws and nuts.
- (2) Install upholstery panel, upholstery pad and trim pad, using attaching screws.
- (3) Install window trim using washers and screws.
- (4) Install escutcheon plate, spacer, handle and tighten handle setscrew.
- (5) Secure stop strap assembly to door, using screw, washers and spacer.

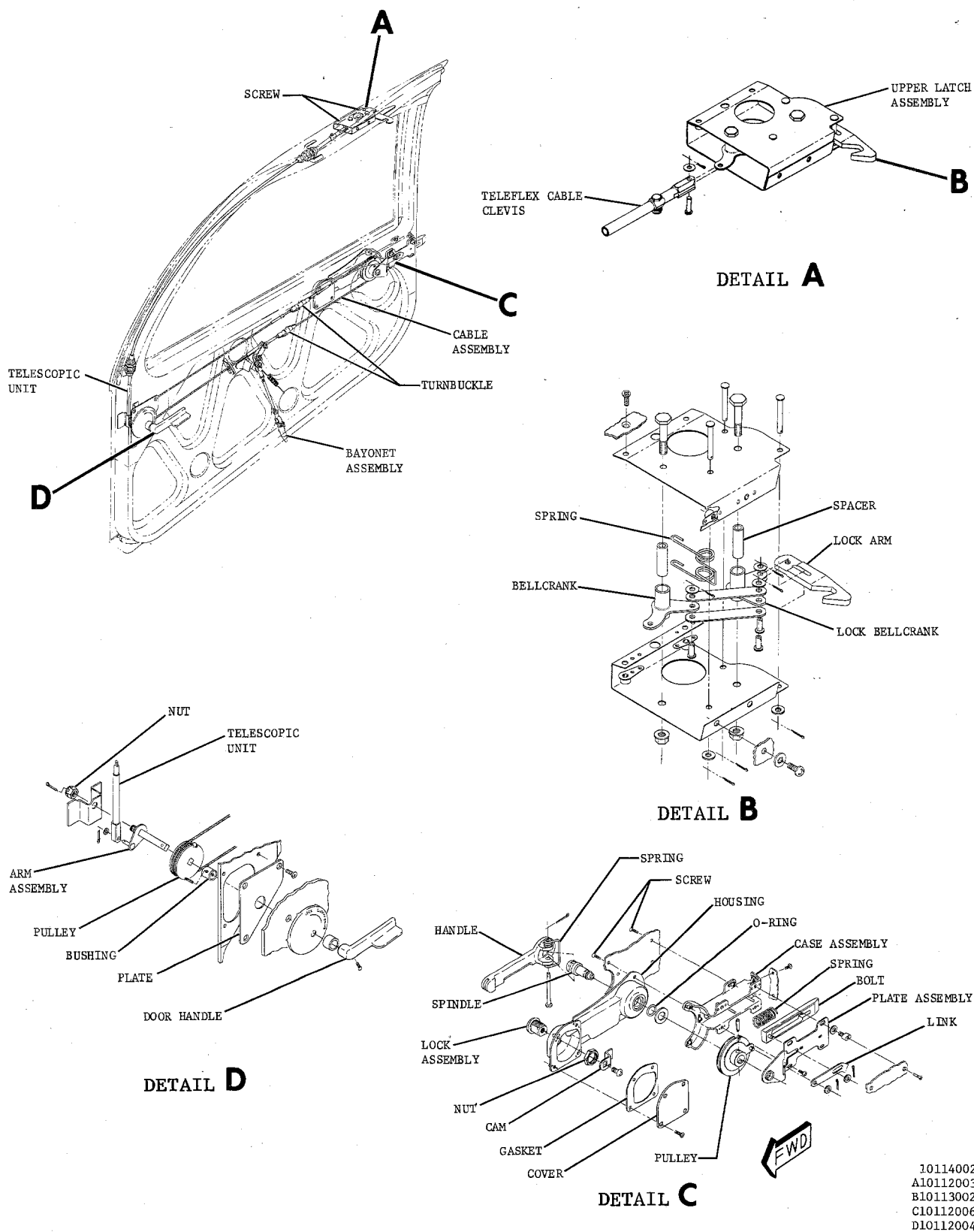
3. Removal/Installation Cabin Door Latch Assemblies (See Figure 2).

A. Remove Cabin Door Latch Assemblies.

- (1) Remove cabin door, refer to Removal/Installation Cabin Door.
- (2) Disassemble cabin door, refer to Disassembly/Assembly Cabin Door.
- (3) Disconnect teleflex cable clevis from upper latch assembly (1) by removing cotter pin, washer and pin.

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B10113002
C10112006
D10112004

Cabin Door Latch Assembly
Figure 2

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- (4) Remove upper latch assembly by removing attaching screws.
- (5) Loosen cable assembly turnbuckles.
- (6) Remove door latch assembly as follows:
 - (a) Remove cotter pins and washers, securing link (2) to the bolt and pulley (3). Remove link.
 - (b) Remove screws and washers, securing plate assembly to case assembly and remove plate assembly.
 - (c) Disengage cable assemblies from pulley (3).
 - (d) Remove screws, securing case assembly to door structure and remove case assembly with bolt and spring.
 - (e) Remove pin, securing pulley to door handle spindle and disengage pulley from door handle spindle.
 - (f) Remove handle from housing by pulling outboard.
- (7) Remove lock assembly as follows:
 - (a) Remove cover and gasket from housing by removing screws.
 - (b) Remove screw and washer, securing cam to lock assembly.
 - (c) Remove nut, securing lock assembly to housing and remove lock assembly.
- (8) Remove door handle plate and slip cables from the pulley (4).
- (9) Remove cotter pin and washer, securing telescopic unit to pulley (4).
- (10) Remove cotter pin and nut and slip arm assembly from door.

B. Install Cabin Door Latch Assemblies.

- (1) Insert arm assembly into door and secure with nut and cotter pin.
- (2) Secure telescopic unit to arm assembly, using washer and cotter pin.
- (3) Install cables on pulley (4).
- (4) Install plate using screws.
- (5) Install lock assembly as follows:
 - (a) Insert lock assembly into housing and secure with nut.
 - (b) Position cam on lock assembly and secure with washer and screw.
 - (c) Install gasket and cover on housing, using screws.
- (6) Install door latch assembly as follows:
 - (a) Install case assembly to housing (with bolt and spring installed in case) and secure to housing and door with screws.
 - (b) Insert door handle with spindle attached into housing and install o-ring.

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- (c) Assemble pulley (3) to spindle and install pin.
- (d) Install cables on pulley (3).
- (e) Install plate assembly on case assembly and spindle, secure with screws and washers.
- (f) Secure link to pulley (3) and bolt, using washers and cotter pins.
- (7) Install upper latch assemble (1) with screws.
- (8) Connect teleflex cable to latch assembly with pin, washer and cotter pin.
- (9) Tighten cable turnbuckles.
- (10) Assemble cabin door, refer to Disassembly/Assembly Cabin Door.
- (11) Install cabin door, refer to Removal/Installation Cabin Door.

4. Removal/Installation Small Baggage Door (See Figure 3).

A. Remove Baggage Door.

- (1) Remove screw, spring washer, spacer and washer, securing door stop to fuselage.
- (2) Remove door hinge pin and remove baggage door from aircraft.
- (3) If disassembly of baggage door is desired, refer to Disassembly/Assembly Small Baggage Door.

B. Install Baggage Door.

- (1) Position baggage door on fuselage and install hinge pin.
- (2) Secure door stop to fuselage, using screw, spring washer, spacer and washer.

5. Disassembly/Assembly Small Baggage Door (See Figure 3).

A. Disassemble Baggage Door.

- (1) Remove screw, spring washer, spacer and washer, securing door stop to baggage door.
- (2) Remove upholstery panel by releasing the attaching trimout studs.
- (3) If removal of lock assembly is necessary; remove screw and washer securing cam to lock assembly.
- (4) If removal of the baggage door latch is necessary; drill out the rivets attaching door latch to baggage door.

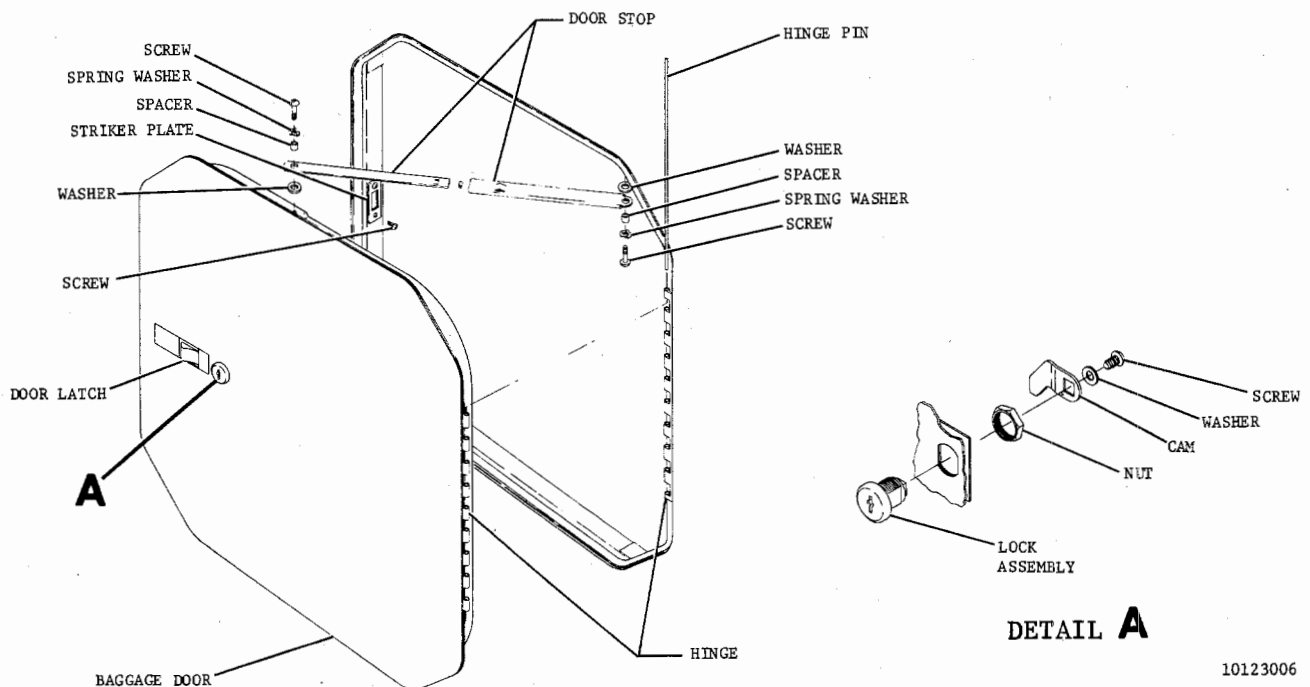
B. Assemble Baggage Door.

- (1) Install baggage door latch, using rivets.
- (2) Install lock assembly and secure with nut, cam, washer and screw.

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- (3) Install upholstery panel on baggage door.
 - (4) Secure door stop to baggage door, using screw, spring washer, spacer and washer.
6. Removal/Installation Large Baggage Door (Optional) (See Figure 4).
- A. Remove Baggage Door.
 - (1) Remove door stop from baggage door by removing screw, spring washer, spacer and washer.
 - (2) Remove hinge pin and remove baggage door from aircraft.
 - (3) If disassembly of baggage door is desired, refer to Disassembly/Assembly Large Baggage Door.
 - B. Install Baggage Door.
 - (1) Position baggage door on fuselage and install hinge pin.
 - (2) Secure door stop on baggage door, using screw, spring washer, spacer and washer.
 - (3) Adjust striker plates to obtain a tight seal around door.

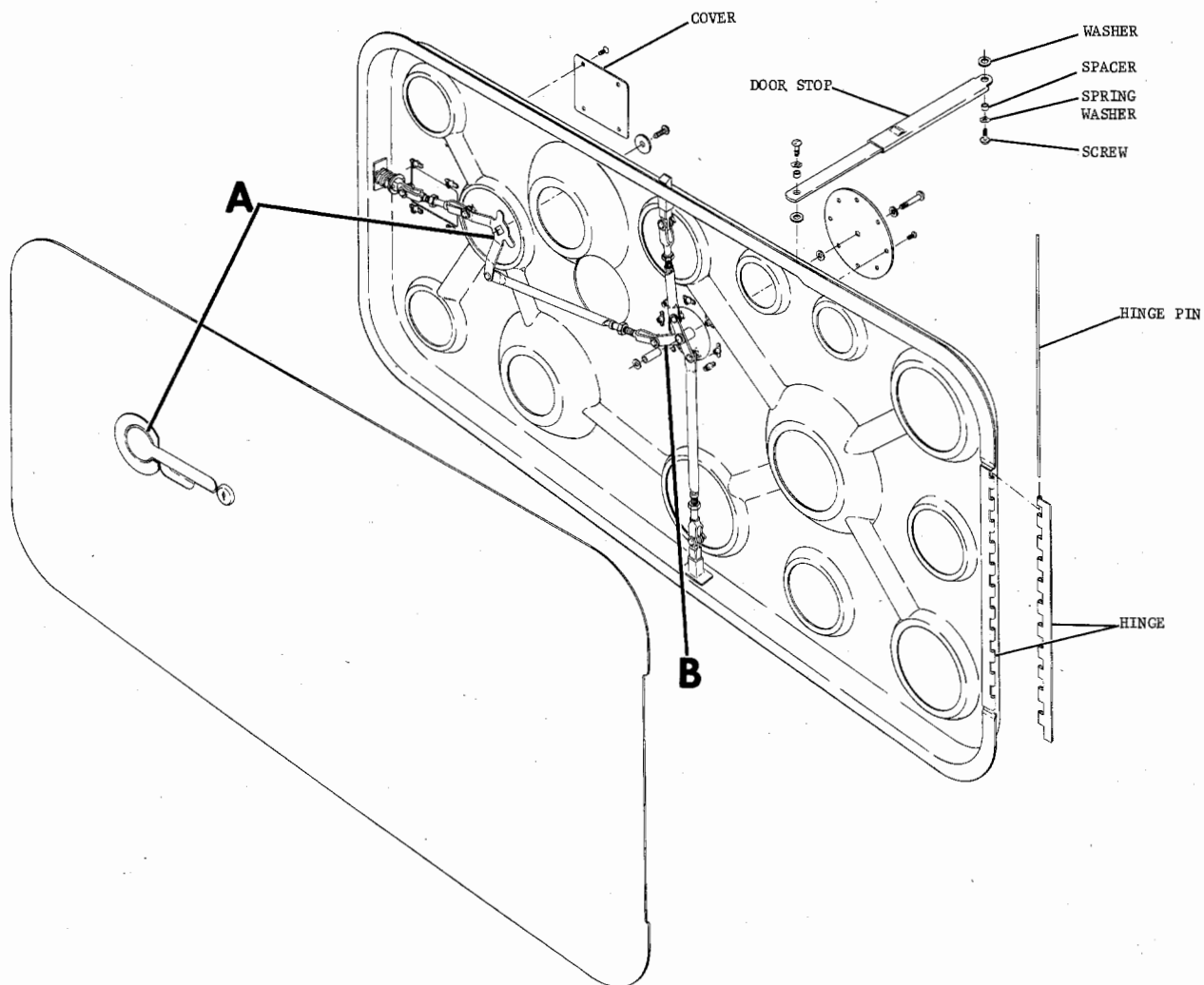


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Small Baggage Door Installation
Figure 3

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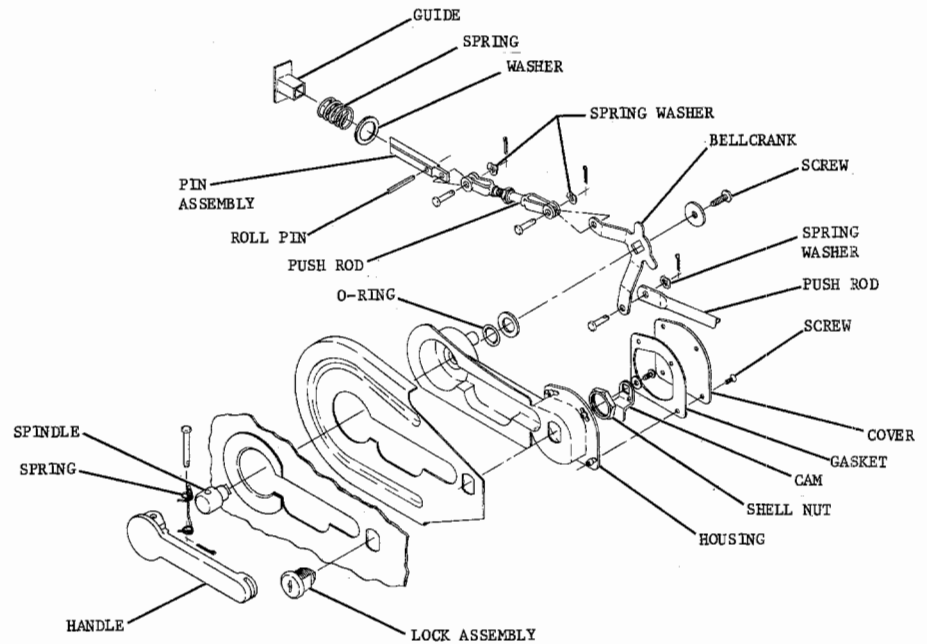
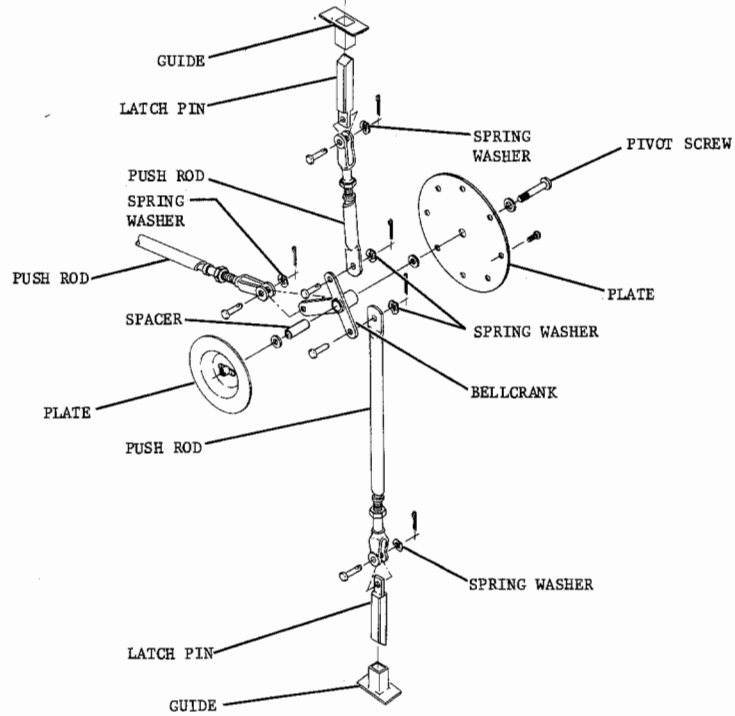


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Large Baggage Door Installation
Figure 4 (Sheet 1 of 2)

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MAINTENANCE MANUAL

**DETAIL A****DETAIL B**Large Baggage Door Installation
Figure 4 (Sheet 2)A10133001
B10133001

7. Disassemble/Assemble Large Baggage Door

A. Disassemble Baggage Door.

- (1) Remove upholstery panel by removing attaching studs.
- (2) If removal of lock assembly is necessary, proceed as follows:
 - (a) Remove cover and gasket by removing screws.
 - (b) Remove screw and washer securing cam to lock assembly.
 - (c) Remove nut and remove lock assembly.
- (3) If removal of door handle is necessary, proceed as follows:
 - (a) Remove screw and washer securing bellcrank to door handle spindle.
 - (b) Pull door handle and spindle free of housing.
- (4) Remove cover to gain access to aft latch assembly.
- (5) Remove plate by removing retaining screws and pivot screw.
- (6) Using details in figure 4, remove door latch mechanism as necessary.

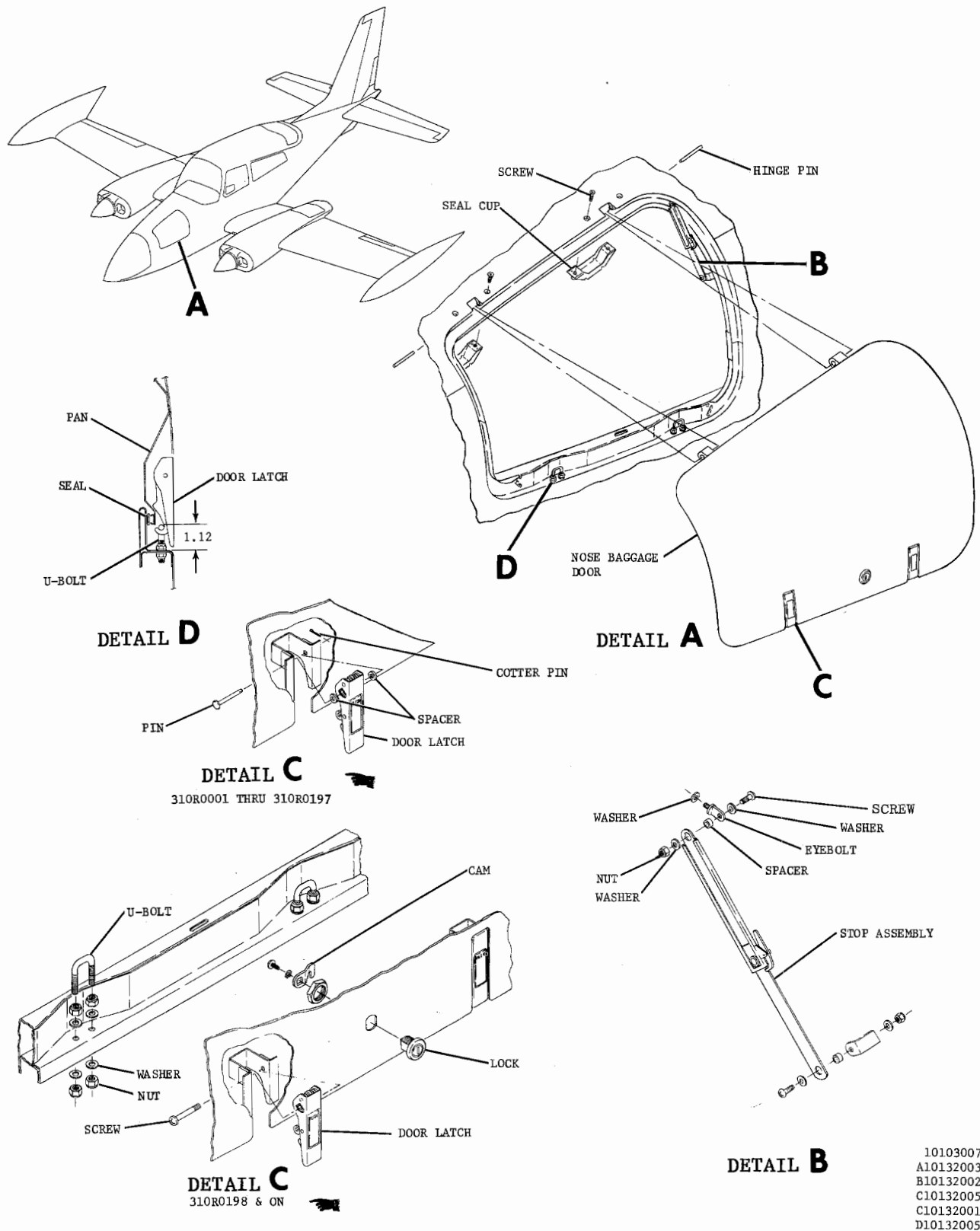
B. Assemble Baggage Door.

- (1) If components of door latch mechanism was removed, assemble as shown in the figure 4.
- (2) Install door handle and spindle into housing and secure to bellcrank, using o-ring, washers and screw.
- (3) Install lock assembly into door, using nut, cam, washer and screw.
- (4) Install gasket and cover at lock assembly, using screws.
- (5) Rig push rods so that latch pins have 3/8 inch engagement within the upper and lower striker plates.
- (6) Ensure all cotter pins are installed.
- (7) Install cover at aft door latch.
- (8) Install upholstery panel.

8. Removal/Installation Nose Baggage Door (See Figure 5).

A. Remove Nose Baggage Door.

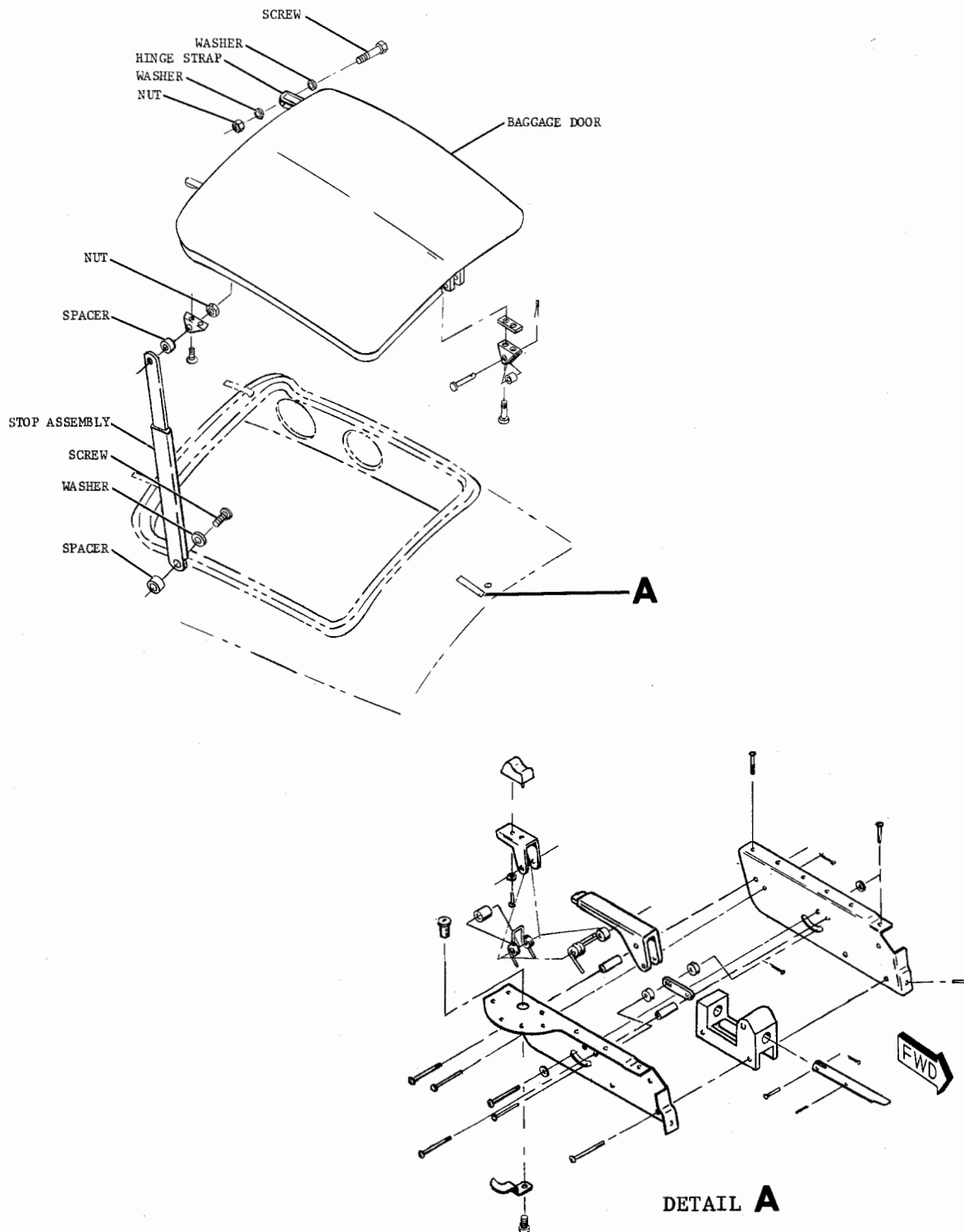
- (1) Open baggage door and remove screws securing seal cups to structure.
- (2) Disconnect stop assembly at eyebolt by removing nut, washer, spacer, washer and screw.
- (3) Remove hinge pins from hinges and remove the baggage door.
- (4) If door latch removal is desired, remove latch by removing cotter pin, pin and spacers, (Aircraft



Nose Baggage Door Installation
Figure 5

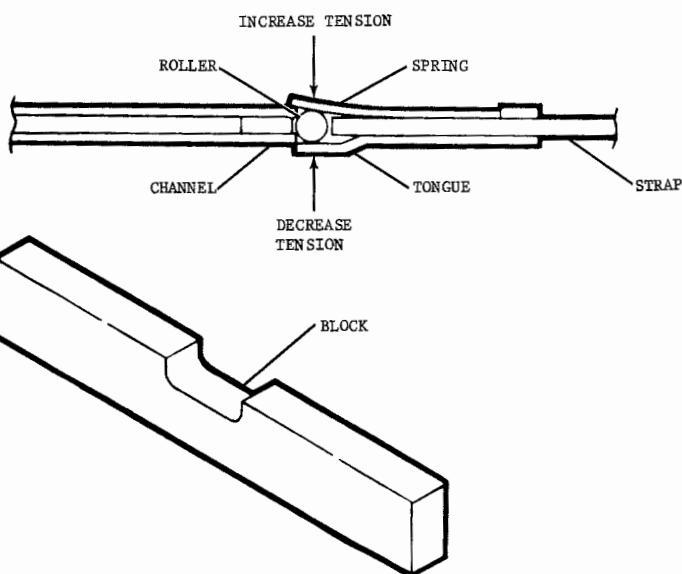
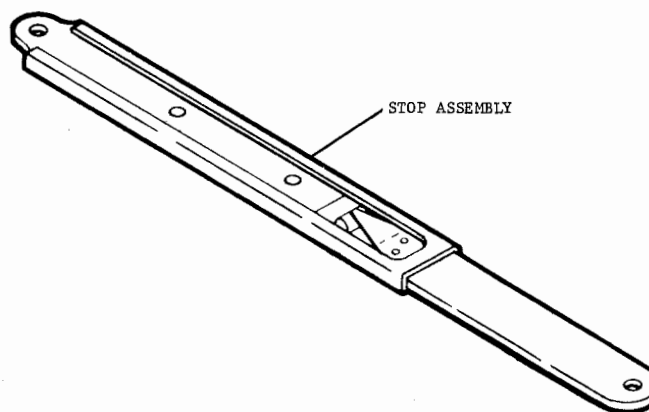
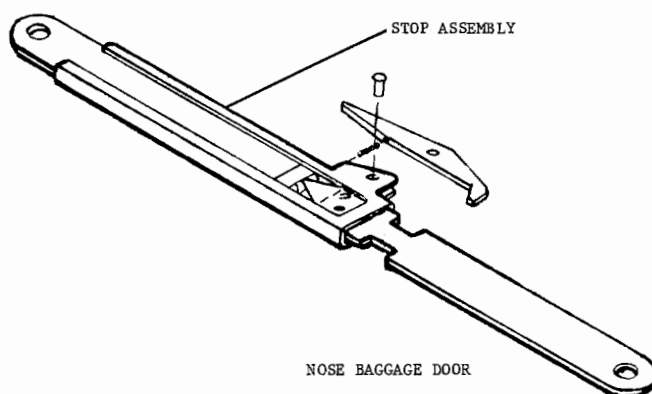
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MAINTENANCE MANUAL



Wing Locker Baggage Door Installation
Figure 6

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Door Stop Assembly Adjustment
Figure 7

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310R0001 thru 310R0197) or screw (Aircraft 310R0198 and On).

B. Install Nose Baggage Door

- (1) If door latch was removed, install door latch in door and secure with pin, spacers and cotter pin, (Aircraft 310R0001 thru 310R0197) or screw (Aircraft 310R0198 and On).
- (2) Secure baggage door to hinge halves, using hinge pins.
- (3) Attach door assembly to door eyebolt, using screw, washer, spacer, washer and nut.
- (4) Ensure hinge pins are centered in hinge. Secure seal cups under hinges using screws.
- (5) Apply sealant (fillet) Pro-Seal 890, Class B around edges of seal cup.
- (6) If adjustment of door latches is necessary, adjust the u-bolts per dimensions shown to obtain proper latch tension.

9. Removal/Installation Wing Locker Baggage Door (See Figure 6).

A. Remove Baggage Door.

- (1) Open wing locker baggage door.
- (2) Remove screw, washer and spacer from lower end of stop assembly.
- (3) Remove nuts, washers, spacers and screws from door hinge and remove door from nacelle.

B. Install Baggage Door.

- (1) Install baggage door to nacelle structure, using screw, washers, spacers and nuts.
- (2) Attach lower end of stop assembly to structure with screw, washer and spacer.

10. Removal/Installation Wing Locker Baggage Door Latch (See Figure 6).

- A. Removal and installation of wing locker latch is not recommended unless replacement or repair is necessary. Use figure as a guide for removal and installation.

11. Adjustment/Test Door Stop Assemblies (See Figure 7).

A. Test Door Stop Assemblies.

- (1) Remove stop assembly from aircraft and set in a vice.

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- (2) Using a spring scale (0 to 50 pounds), measure the tension required to close the stop assembly. Read tension when stop releases to close the stop assembly. Tension should read 25 ± 3 pounds.
- (3) If correct tension is not obtained, proceed as follows:
 - (a) Place stop assembly on block. Block must be fabricated from wood or similar material.
 - (b) To increase the tension on stop assembly, use a drift punch and hammer and tap on roller.
 - (c) To decrease the tension on stop assembly, turn stop assembly over on block and tap on tongue with hammer.
- (4) Reinstall stop assembly on aircraft.

FUSELAGEDescription

1. The fuselage is an all metal semimonocoque structure. The fuselage consists of a nose section, cabin section and a tail section. The nose section contains the nose gear wheel well, avionics equipment compartment and the nose baggage compartment. The cabin section contains the flight and passenger compartment and aft baggage compartment. The tail section contains flight control cables, emergency locator beacon and various optional components, such as electric trim, autopilot actuators and etc.
2. Auxiliary structure consists of the avionics and baggage shelves, floorboards and the pedestal.
3. The fuselage exterior covering consists of aluminum alloy skin panels of various sizes. The panels are attached to frames, stringers and doublers with permanent fasteners.
4. Fittings are provided in the fuselage for the attachment of the wings, doors, seats, brackets and supports. Most of these fittings are secured to the fuselage structure with permanent fasteners.
5. Aerodynamic fairings on the fuselage consist of the nose cap, stinger and wing to fuselage fairings, dorsal fin and ventral fin. The fairings and nose cap provide an aerodynamic smoothness for the fuselage.

Maintenance Practices

1. Removal/Installation Nose Cap (See Figure 1).
 - A. Remove Nose Cap.
 - (1) Remove screws and washers, securing nose cap to nose structure.
 - (2) Move nose cap forward and disconnect the antenna lead to the glide slope antenna (optional) if installed.
 - (3) Remove the nose cap.
 - B. Install Nose Cap.
 - (1) Position nose cap to nose structure.
 - (2) If installed, connect glide slope antenna lead to the glide slope antenna.

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- (3) Secure the nose cap to nose structure, using screws and washers.

2. Removal/Installation Avionics Shelves (See Figure 1).

NOTE: Avionics shelves are optional depending on the avionics package. Removal/installation procedures are for both the upper and lower shelves.

A. Remove Avionics Shelves.

- (1) Ensure electrical power is turned OFF.
- (2) Remove the nose cap. Refer to Removal/Installation Nose Cap.
- (3) Disconnect electrical wiring to upper shelf components and remove components as required.
- (4) Remove screws and nuts securing upper shelf and remove shelf.
- (5) Disconnect electrical wiring to lower shelf components and remove components as required.
- (6) Remove screws and remove lower shelf.

B. Install Avionics Shelves.

- (1) Secure lower shelf to structure with screws.
- (2) Install lower shelf components and connect electrical wiring.
- (3) Assemble support assemblies, angles, to lower shelf (if removed), using screws and nuts.
- (4) Secure upper shelf to structure, support assemblies and angles using screws and nuts.
- (5) Install upper shelf components and connect electrical wiring.
- (6) Install nose cap. Refer to Removal/Installation Nose Cap.

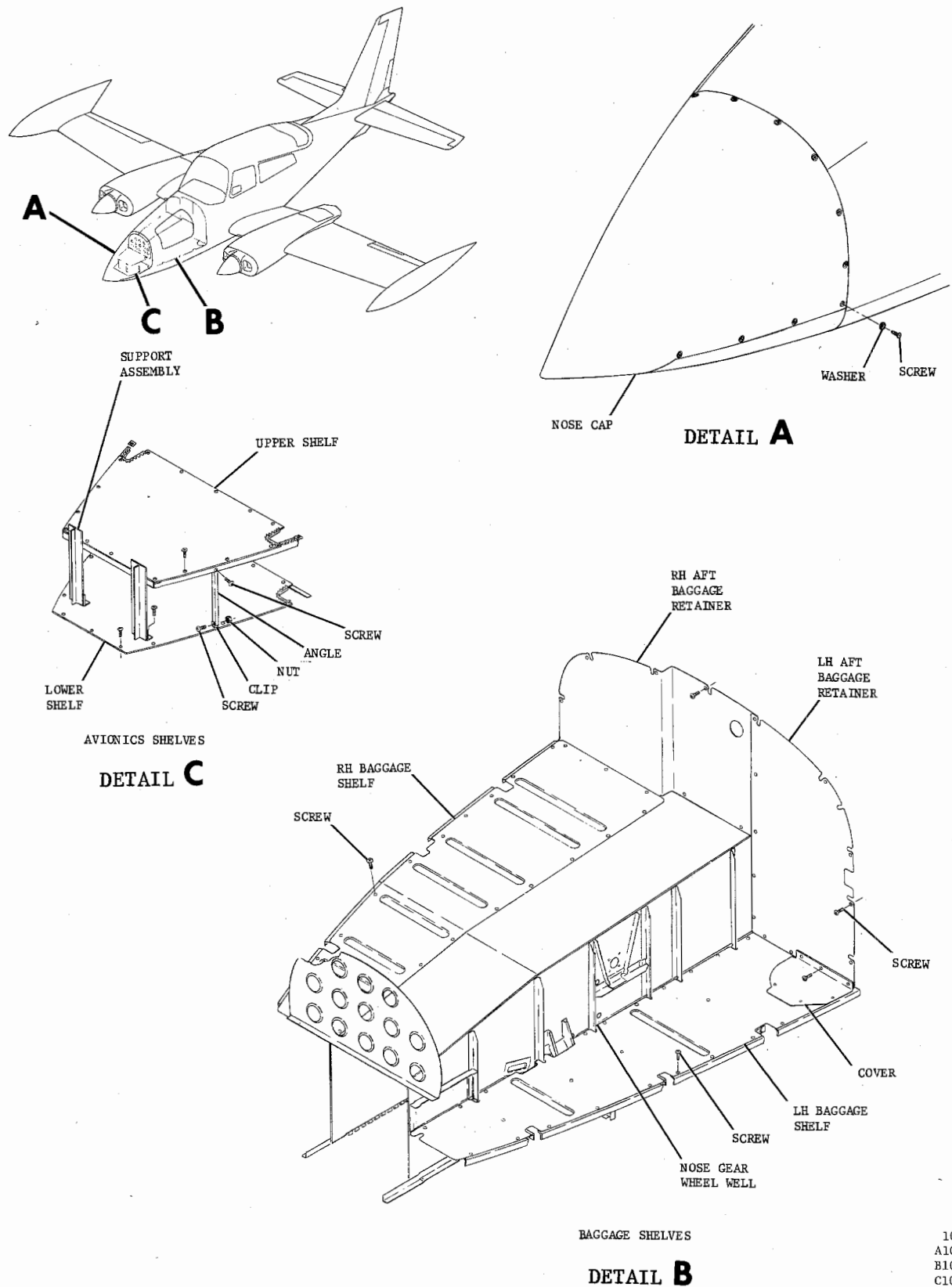
3. Removal/Installation Nose Baggage Shelves (See Figure 1).

A. Remove Nose Baggage Shelves.

- (1) If installed, remove (optional) nose baggage compartment upholstery. Refer to Chapter 12.
- (2) Remove LH aft baggage retainer by removing screws.
- (3) Remove LH baggage shelf by removing screws.
- (4) Remove RH baggage shelf by removing screws.
- (5) Remove RH aft baggage retainer by removing screws.

B. Install Nose Baggage Shelves.

- (1) Install RH aft baggage retainer, using screws.
- (2) Install RH baggage shelf, using screws.
- (3) Install LH baggage shelf, using screws.

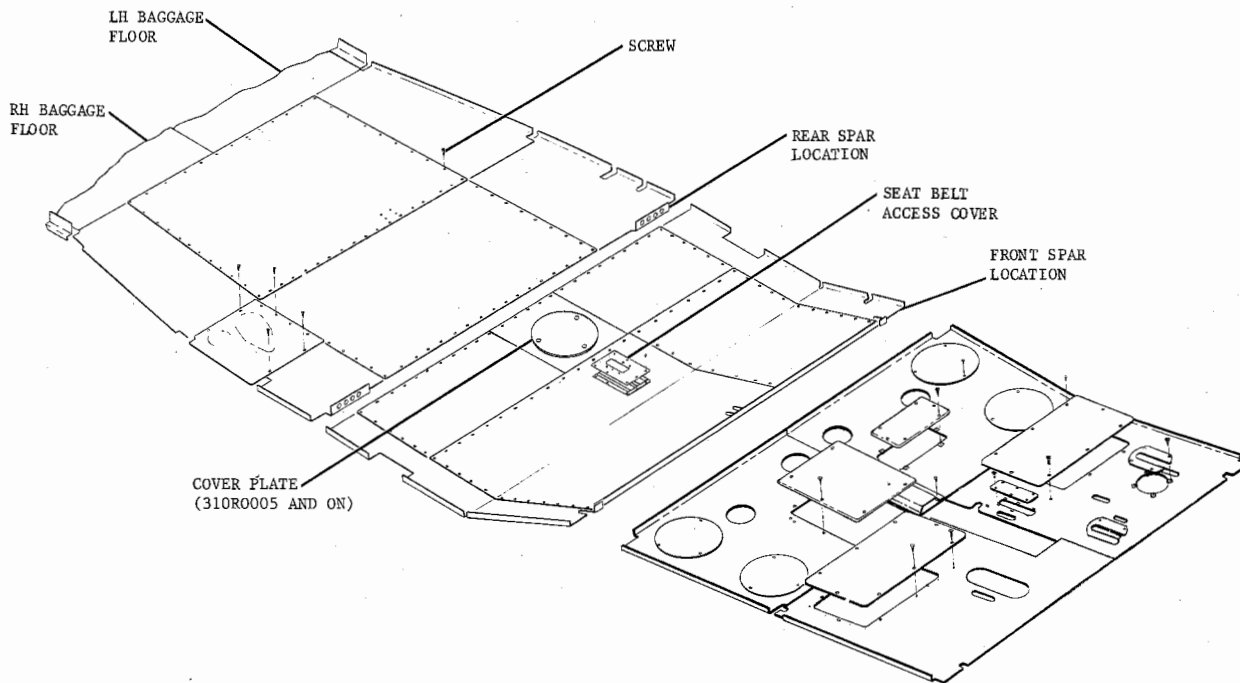


Nose Cap and Shelves Installation
Figure 1

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A10133006
B10133005
C10133005

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10143022
10143023

Floor Panels Installation
Figure 2

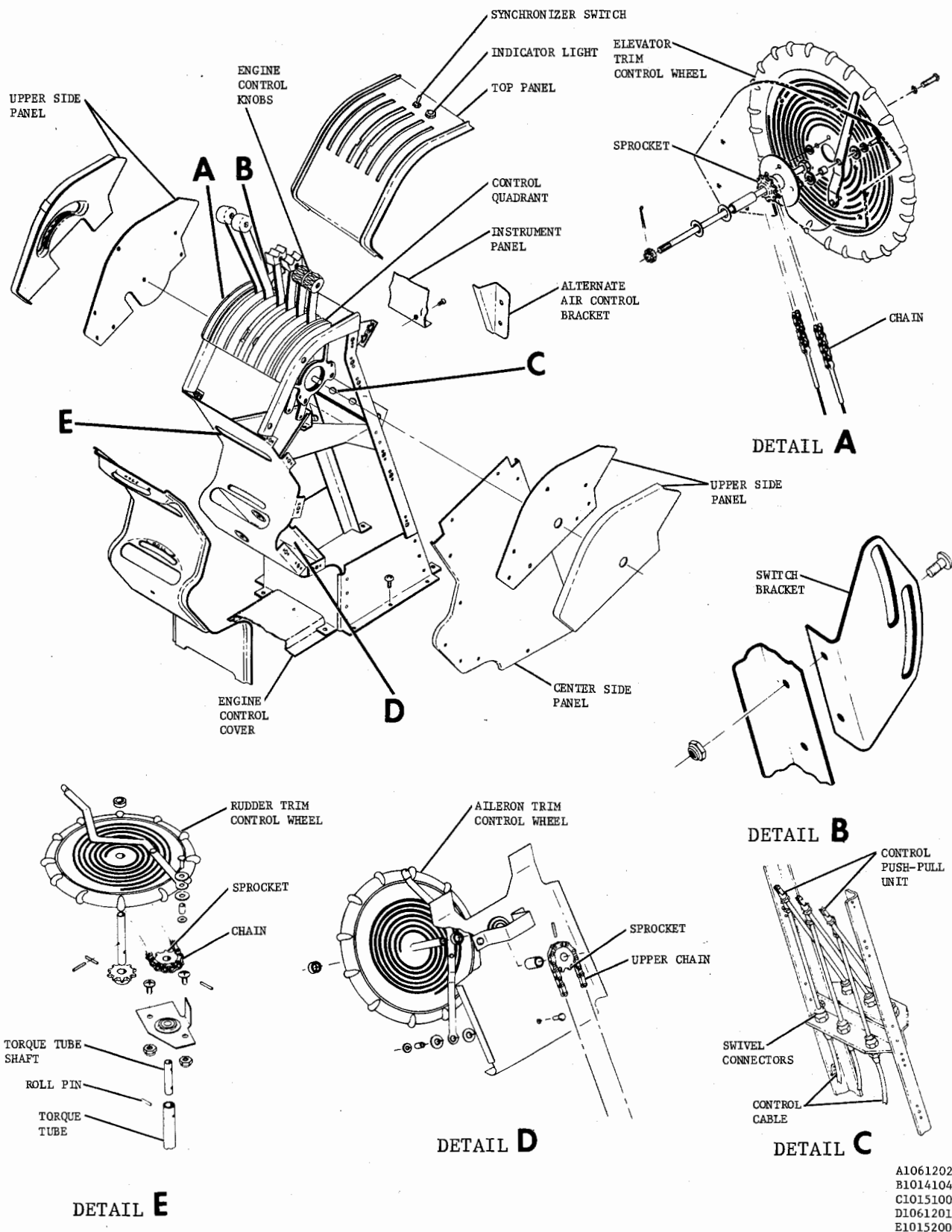
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- (4) Install LH aft baggage retainer, using screws.
 - (5) If installed, refer to Chapter 12 and install nose baggage compartment upholstery.
4. Removal/Installation Floor Panels (See Figure 2).
- A. Remove Floor Panels (Typical).
- NOTE: Any furnishings that prohibit or obstruct removal of, or are attached to the floor panels, must be removed, refer to Chapter 12.
- (1) Remove screws as required. Remove panel from supporting structure.
- B. Install Floor Panels (Typical).
- (1) Place floor panel in position and attach to supporting structure with screws.
 - (2) Install furnishings removed to facilitate removal of floor panels, refer to Chapter 12.
5. Removal/Installation Pedestal (See Figure 3).
- A. Remove Pedestal.
- (1) Refer to Chapter 12. Remove the front seats, front carpet and kick plates.
 - (2) Remove engine control cover.
 - (3) Remove elevator trim control wheel by removing screws and washers.
 - (4) Remove top panel, upper side panels and center side panel by removing attaching screws and engine control handle knob.
- NOTE: If autopilot (optional) is installed disconnect wire bundle from rear of control unit box.
- (5) Refer to Chapter 5. Remove elevator trim control sprocket.
 - (6) Disconnect rudder trim control torque tube from torque tube shaft by removing roll pin.
 - (7) Disconnect upper aileron trim control chain at master link.
 - (8) Route aileron, elevator and rudder trim control cables from pedestal.
 - (9) Disconnect throttle, propeller and mixture control cables by loosening the coupling nuts.
 - (10) Remove alternate air control bracket from control pedestal by removing attaching rivets.

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Pedestal Installation
Figure 3

- (11) Remove screws fastening upper part of control pedestal to stationary instrument panel.
- (12) Remove screws which secure control pedestal to floor.
- (13) Carefully lift control pedestal upward to disengage the rudder trim control torque tube from the torque tube shaft. Tilt the pedestal aft, work it free of all units, and remove from cabin.

B. Install Pedestal.

- (1) Work pedestal carefully into position over control cable and rudder trim control torque tube. Lower into place to align holes in pedestal flanges with nutplates in floor, so that torque tube shaft enters into upper end of torque tube.
- (2) Secure pedestal to floor with screws and to stationary instrument panel with screws.
- (3) Insert roll pin through rudder trim control torque tube and shaft, and safety wire into place.

NOTE: If rudder trim tab position or cable tension has been disturbed while the torque tube was disconnected, it may be necessary to adjust the rigging of the rudder trim control system, refer to Chapter 5.

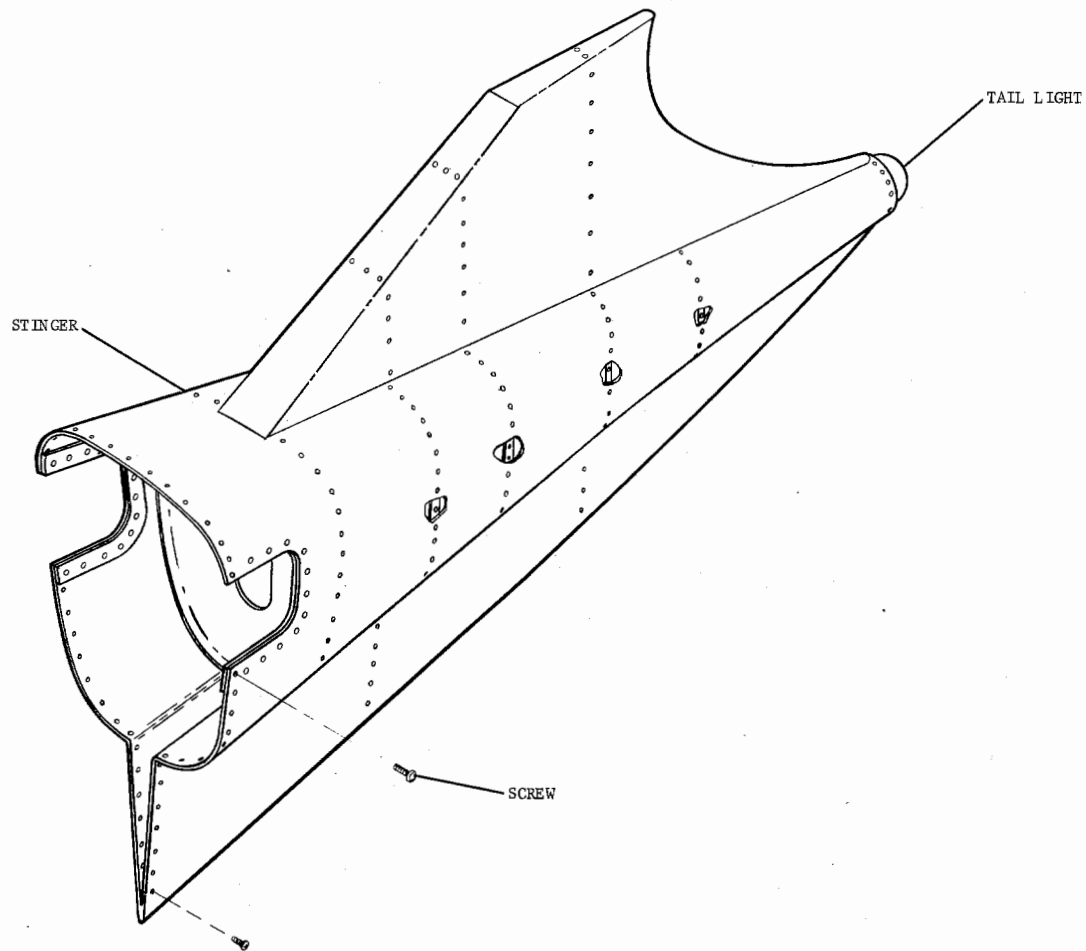
- (4) Install upper aileron trim control chain and fasten at master link.

NOTE: If aileron trim tab position or cable tension has been disturbed while chain was disconnected, it may be necessary to adjust the rigging of the aileron trim control system, refer to Chapter 5.

- (5) Install elevator trim control sprocket, chain, left upper side panel and left center side panel.

NOTE: If elevator trim tab position or cable tension has been disturbed while chain was disconnected, it may be necessary to adjust the rigging of the elevator trim control system, refer to Chapter 5.

- (6) Attach control cables in place by tightening the coupling nuts. (Use a suitable thread lubricant on the male threads of all connectors.)
- (7) Attach all engine controls, refer to Chapter 7.
- (8) Rig all engine controls, refer to Chapter 7.



10123002

Fuselage Stinger Installation
Figure 4

- (9) Install the right center side panel, the right upper side panels and the top panel.
 - (10) Install carpet and kick plates, refer to Chapter 12.
 - (11) Install control cover.
 - (12) Install front seats, refer to Chapter 12.
6. Removal/Installation Stinger (See Figure 4).
- A. Remove Stinger.
- (1) Remove attaching screws and move stinger aft slightly.
 - (2) Disconnect electrical wires to the tail light.
 - (3) Remove stinger assembly from tailcone.
- B. Install Stinger.
- (1) Place stinger near tailcone.
 - (2) Connect electrical wire to tail light.
 - (3) Secure stinger assembly to tailcone with screws.

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WINDOWSDescription

1. The windows consist of the windshield, emergency exit window, foul weather window, picture windows and omni window.
2. The emergency exit or pilot's window is a single window, located on the left forward side of the cabin. This window consists of a plastic panel with an integrally mounted foul weather window. The emergency exit window is mounted inside a spot-welded and riveted frame assembly. This frame assembly is secured to the main fuselage structure by catch assemblies and clips. When the emergency release pull ring is pulled, the cable assemblies release the frame assembly from the fuselage structure, thereby, the frame assembly can be pushed clear of the structure. Operating instructions are contained on a decal, located on the window panel.
 - A. The emergency release mechanism is located in the rear left upholstery panel, just aft of and below the emergency exit window. A red pull ring is secured in the royalite trim pan assembly, covered and identified by an instructional plastic cover. A finger size center hole in the plastic cover provides quick removal to expose the pull ring when an emergency condition exists. When the pull ring is pulled, the catch assembly is released and the window then can be pushed free.

Inspection/Check

1. Visual inspection of windows will locate most defects. Unnecessary replacements may be avoided if the cause of the defect can be eliminated, such as, improper cleaning or use of unapproved cleaning fluids.
2. Plastic Window Inspection Criteria.

<u>DEFECTS</u>	<u>CRITICAL VISION AREA</u>		<u>NON-CRITICAL VISION AREA</u>	
	MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING	MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING

NICKS AND DENTS.

Maximum Diameter.	Not repair- able.	0.025 inch.	0.250 inch.	0.125 inch.

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<u>DEFECTS</u>	<u>CRITICAL VISION AREA</u>		<u>NON-CRITICAL VISION AREA</u>	
	MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING	MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING
Depth.	Not repair- able.	0.016 inch.	0.076 inch.	0.032 inch.
Frequency.	None.	2 per sq. ft.	2 per sq. ft.	1 per sq. ft.
<u>SCRATCHES</u>				
Length.	12 inches total per area.	12 inches total per area.	24 inches total per area.	24 inches total per area.
Width.	0.020 inch.	0.020 inch.	0.050 inch.	0.020 inch.
Depth	0.016 inch.	0.008 inch.	0.008 inch.	0.008 inch.
Frequency.	12 inches total per area.	12 inches per area.	20% of total area.	Total length of scratches e- quals 3 times longest dimen- sion of area.
<u>CRACKS.</u>				
Length.	Cracks ori- ginating at mounting holes or edge of glass and progressing into C.V. ar- ea must not exceed 1 inch.	None.	6.00 inches.	None.
Frequency.	12 inches total per area.	None.	12 inches total per area.	None.

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MAINTENANCE MANUAL

<u>DEFECTS</u>	<u>CRITICAL VISION AREA</u>		<u>NON-CRITICAL VISION AREA</u>	
	MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING	MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING

CRAZING.

Slight.	Not repair- able.	Crazing ad- jacent to the edge of the glass must not ex- tend more than 1 inch into C.V. area.	Not repair- able.	Shall be con- tained in a 9.00 inch cir- cle.
Severe.	Not repair- able.	Crazing ad- jacent to the edge of the glass must not ex- tend more than 1 inch into C.V. area.	Not repair- able.	Shall be con- tained in a 6.00 circle.

DISCOLORATION.

No repair- able.	None.	Not repair- able.	May extend 1 inch from all edges of non- critical areas.

Windows - Cleaning/Painting

1. The surface hardness of acrylic is approximately equal to that of copper or brass. Care must be exercised to avoid scratches and gouges which may be caused by dirty, hard or rough clothes used for cleaning.
2. Tools and Equipment.

NOTE: The following material or equivalent is required.

Name	Number	Manufacturer
Aliphatic Naphtha Type II	TT-N-95	Commercially Available
Stoddard Super Solvent		Anderson Prichard Oil Company Liberty Bank Building Oklahoma City, Oklahoma
Wilco Anti-Static Cleaner		Wilco Company Los Angeles, California
Shell Solvent	TS-1	Shell Chemical Corporation 380 Madison Avenue New York, New York
Triton	X-200	Rohm & Haas Company Washington Square Philadelphia, Pennsylvania
Kerosene		Commercially Available
DuPont Auto Wax		E.I. DuPont de Nemours & Co., Inc. Fabrics and Finishes Department Wilmington, Delaware
Johnson Auto Wax Johnson Car Plate Wax Johnson Kitchen Wax Johnson Paste Wax	W-6000	S.C. Johnson & Son Incorporated Industrial Products Division Racine, Wisconsin
Simonize Wax		Simonize Company 2100 Indiana Avenue Chicago, Illinois
Chamois Skins or Diaper Type Cloths		Commercially Available
Rymplecloth	301	Kendall Company Textile Division 111 West 40th Street New York, New York

3. Cleaning Windows.

- A. Cleaning shall be done with a non-abrasive soap or detergent and water, using the bare hand to feel and dislodge any caked dirt, glue or any other foreign mater-

ials. A soft cloth or chamois may be used as a means of carrying water to the plastic. Dry with a clean damp chamois or rymplecloth.

- B. Aliphatic naphtha or kerosene may be used for removing grease and oil.

CAUTION: DO NOT USE THE FOLLOWING MATERIALS ON ACRYLIC PLASTIC: ALCOHOL, GASOLINE, BENZENE, XYLENE, ACETONE, CARBON TETRACHLORIDE, FIRE EXTINGUISHER OR DEICING FLUIDS, LACQUER THINNERS OR WINDOW CLEANING SPRAYS BECAUSE THEY WILL SOFTEN THE PLASTIC AND/OR CAUSE CRAZING IN THE PLASTIC.

- C. Clean surfaces should be waxed, using a soft cloth to apply and polish the wax.

Windows - Approved Repairs

1. Rework of acrylic windows is permissible. The approved repair instructions apply to repair of small scratches only. For temporary repair of window panel cracks, refer to Chapter 15.
2. Tools and Equipment.

NOTE: The following tools or equivalent is required.

Name	Number	Manufacturer

BUFFING COMPOUNDS

Learock	765 or 881	Lea Manufacturing Company 16 Cherry Avenue Waterbury, Connecticut
Scratch Removing Compound	351	Wilco Company 4425 Bandini Boulevard Los Angeles, California
Tripple A Buffing Compound		Goodison Manufacturing Company P.O. Box 128 Rochester, Michigan

Name	Number	Manufacturer

POLISHES

Plex-i-glo Cleaner and Polish		McAleer Manufacturing Company 101 South Waterman Detroit, Michigan
Simonize Liquid Cleaner		Simonize Company 2100 Indiana Avenue Chicago, Illinois
Turco Cleaner	L-567	Turco Products Incorporated P.O. Box 2649, Terminal Annex Los Angeles, California
DuPont	7	E.O. DuPont de Nemours & Co., Inc. Fabrics & Finishes Department Wilmington, Delaware
Mirror Glaze	MGH-7	Mirror Bright Polish Company Pasadena, California
Permatex Plastic Cleaner		Permatex Company, Inc. Kansas City, Kansas

(Mix as follows: 4 to 5 parts by weight Permatex
Plastic Cleaner, 1 part by weight Johnson's Pride.)

ABRASIVE PAPERS

320 to 600A Grit Wet or Dry Type Sandpaper or Cloth	Commercially Available
Poly Sand 300-800 Grit	Poly Sand Corp. Iowa

PROTECTIVE COATINGS

Spraylat A Spraylat (White) Spraylat (Black)	SC-1058 SC-1072	Spraylat Corporation Mount Vernon, New York
Scotch Brand No-Mar Protective Tape		Minnesota Mining & Mfg. Co. St. Paul, Minnesota

Name	Number	Manufacturer

POLISHING CLOTHS

Chamois Skins or
Diaper Type Cloths

Commercially Available

Rymplecloth

301

Kendall Company Textile Division
111 West 40th Street
New York, New York

EQUIPMENT

Buffing Wheel -
Unstitched Canton
Flannel, 6-inch
Diameter x 20 Ply

Commercially Available

3. Approved Repair for Acrylic Windows.

A. Areas with small scratches may be polished to remove scratches.

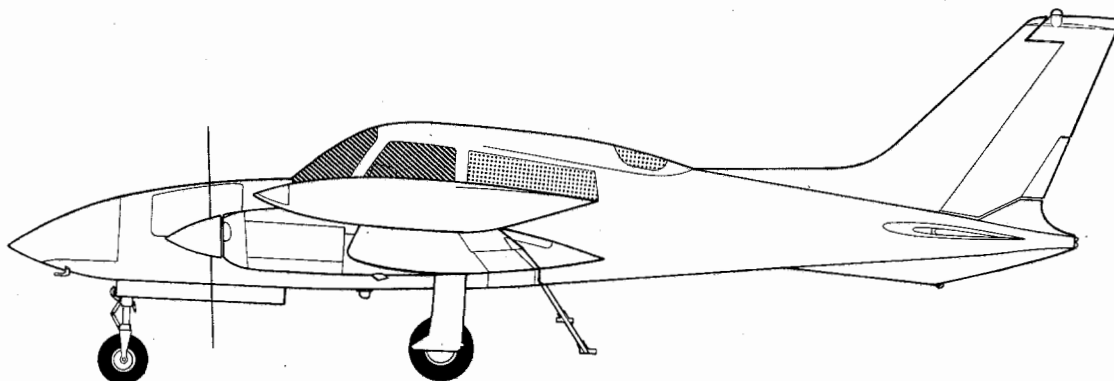
- (1) Clean area to be polished, refer to Cleaning.
- (2) Polish with an approved compound and soft cloth.
- (3) Clean and wax polished area.

B. All scratches, gouges, nicks, etc., exceeding .003 inch depth and those less than .003 inch depth but having sharp enough edges to cause hanging of the fingernail should be locally rounded out or buffed. Complete blending may be accomplished in the optical area of flight compartment windows in lieu of localized buffing if such rework will improve vision.

- (1) Clean area to be repaired, refer to Cleaning.
- (2) Wrap 400A wet or dry abrasive paper around a smooth rubber or wooden block, and using generous amounts of water, lightly sand over and around the imperfection in a circular motion. An area having a diameter equal to two or three times the scratch or defect length should be sanded where optical distortion is to be minimized. Continue sanding only until the initial scratch or defect is no longer apparent. Thoroughly wash or flush the area with water.

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CODE

 CRITICAL VISION AREA NON-CRITICAL VISION AREA

NOTE:
LEFT WINDOWS TYPICAL
FOR RIGHT WINDOWS

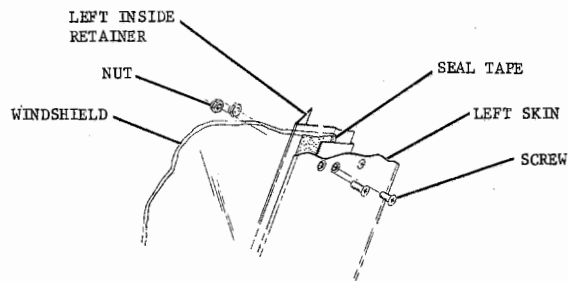
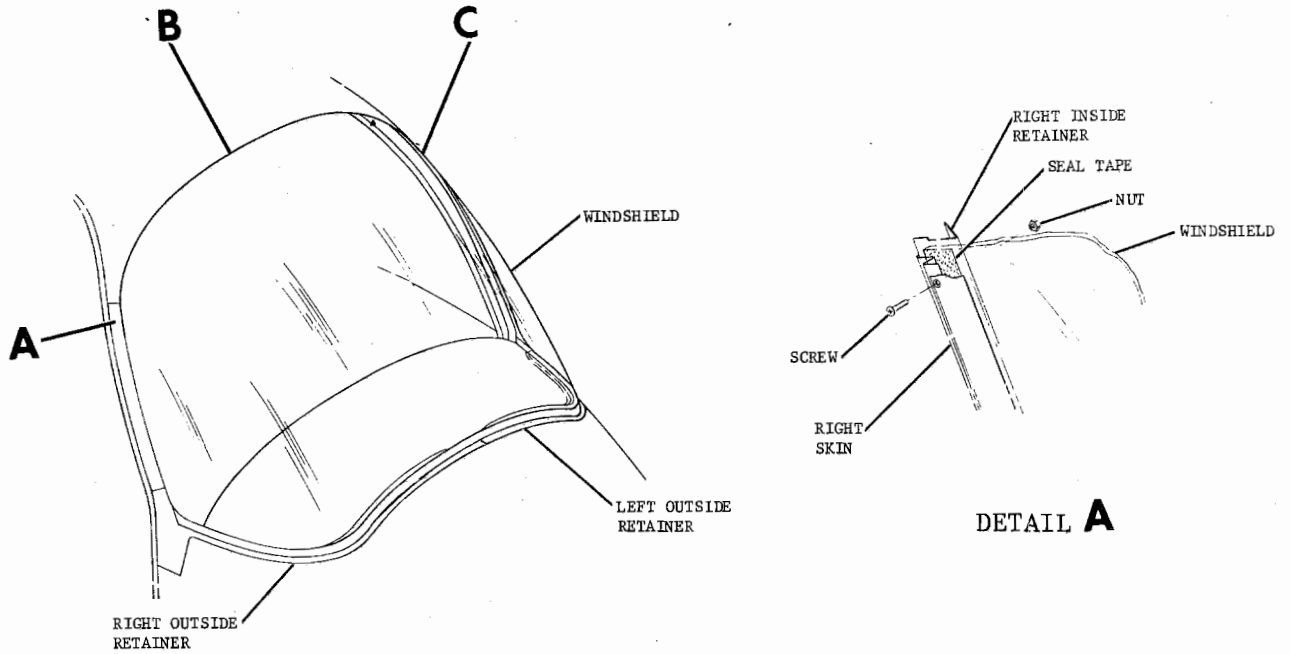
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Critical Vision Areas
Figure 1

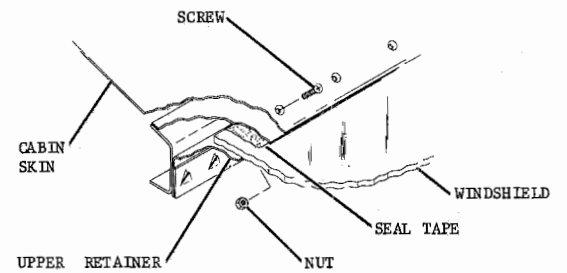
- (3) Using 600A wet or dry abrasive paper, repeat step (2). Continue sanding only until the hairline scratches caused by the coarse sanding are no longer apparent. Sand a larger area than that covered by the original sanding operation. Thoroughly wash and dry the rework area.
- (4) Apply buffing compound to the rework area of the acrylic or to the buffing wheel. Using a buffer with a speed of 1300 foot-per-minute or less, keep the buffing wheel moving across the rework area changing direction often, using light pressure and maintaining a back and forth motion 90 degrees to wheel rotation. Buff a larger area than that covered by the final sanding. Buff until the reworked surface regains its original luster.

Maintenance Practices

1. Removal/Installation Windshield (See Figure 2).
 - A. Remove Windshield.



DETAIL C



DETAIL B

Windshield Installation
Figure 2

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- (1) Refer to Chapter 12. Remove left and right upholstery trim.
- (2) Remove nuts and screws from windshield upper retainer.
- (3) Drill rivets from left and right outside retainers.
- (4) Remove left and right inside retainers by removing nut and screws.
- (5) Remove windshield from aircraft.

B. Install Windshield.

- (1) Place seal tape on windshield edges and applying sealing compound (Presstite Engineering Co. No. 579.6) on all edges of the windshield and retainers.
- (2) Insert upper edge of windshield between upper retainer and cabin skin, until screw holes are aligned.
- (3) Temporarily fasten right and left skins in place.
- (4) Install right and left inside retainers.
- (5) Install left and right skins with screw and nuts.
- (6) Install screws in upper cabin skin, windshield and upper retainer.
- (7) Install left and right outside retainers and secure with MS20426AD4 rivets.

NOTE: NAS507-632R8 screws and MS20365-632 nuts may be used in lieu of rivets for replacing the right and left outside retainers.

- (8) Refer to Chapter 12. Install interior trim.

2. Removal/Installation Omni Window (See Figure 3).

A. Remove Omni Window.

- (1) Remove window trim by removing screws.
- (2) Drill out rivets securing retainer to cabin skin and remove window.

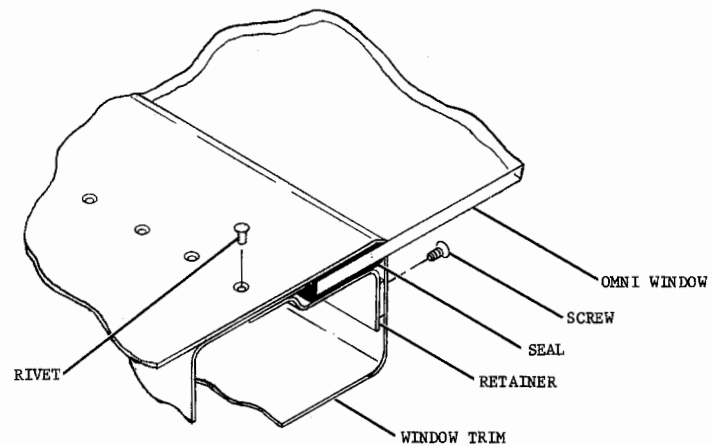
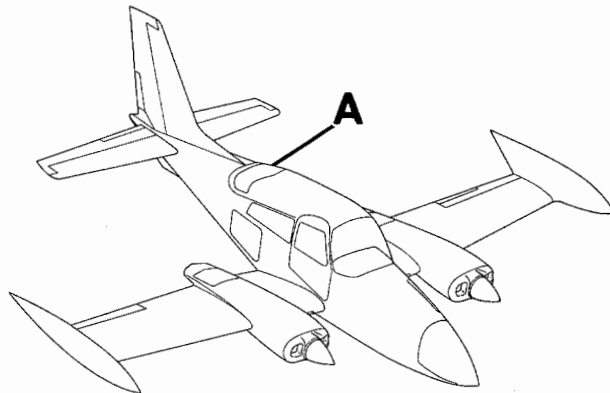
B. Install Omni Window.

- (1) When replacing seal, make splice joint at forward center of omni window.
- (2) Install window and retainer using rivets.
- (3) Install window trim, using screws.

3. Removal/Installation Emergency Exit Window (See Figure 4).

A. Remove Emergency Exit Window.

- (1) Refer to Chapter 12. Remove window post trim, lower, upper and forward window trim.



DETAIL **A**
(TYPICAL)

Omni Window Installation
Figure 3

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A10111003

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- (2) Remove emergency exit window by removing cover and actuating release ring.
- (3) Supporting emergency exit window, push outwards until pivot pins and clips clear fuselage structure.

B. Install Emergency Exit Window.

NOTE: Before installing emergency window, replace clips (four places) if required.

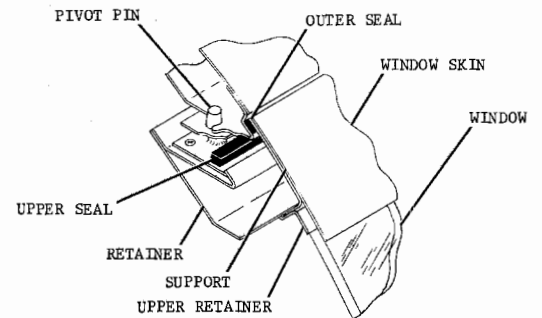
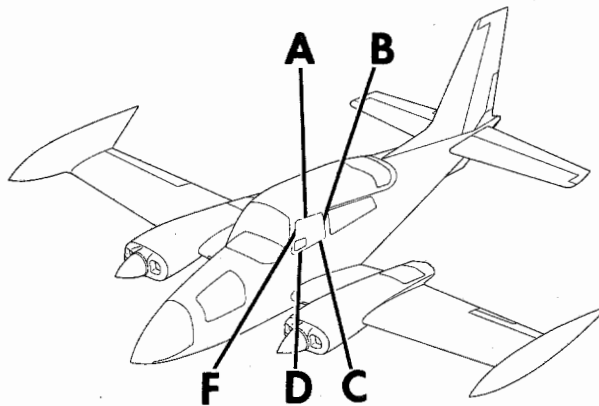
- (1) Hold emergency window assembly at slight angle, engage pivot pins into fuselage structure and position window in fuselage frame.

NOTE: Pivot pins are provided with adjustable mountings. Normally the pivot pins settings are not disturbed during emergency window removal. If pivot pin settings were disturbed, it will become necessary to realign them upon installation. This is accomplished by loosening the four screws in the mounting plate and positioning emergency window in fuselage frame aligning the pivot pin with hole. Scribe an index mark along edge of mounting plate after alignment is achieved. Remove emergency window from fuselage and tighten mounting plate along scribe line with the attaching screws. Several adjustments may become necessary before positive alignment is achieved.

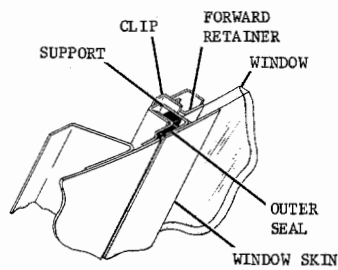
- (2) Position a person outside the emergency exit window to apply pressure on the frame at each point while cable assembly ends are being inserted through latch assemblies. Safety cable assembly ends in place using .011 copper safety wire. Only a single strand of safety wire should be used.

CAUTION: THE BARREL ON AFT EMERGENCY WINDOW CABLE ASSEMBLY END MUST BE HOUSED INSIDE GUIDE TUBE OR SERIOUS BINDING MAY RESULT.

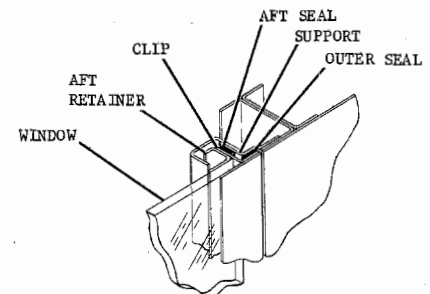
- (3) Using a rubber mallet, bend exposed tab of clips over fuselage window frame.
- (4) Install release ring into ring clip and replace cover.
- (5) Refer to Chapter 12. Install forward window trim, upper, lower and window post trim.



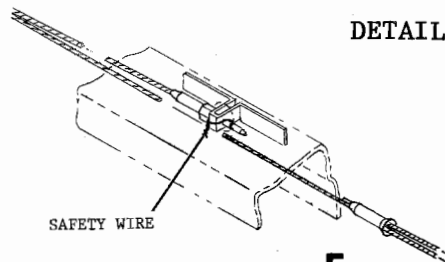
DETAIL A



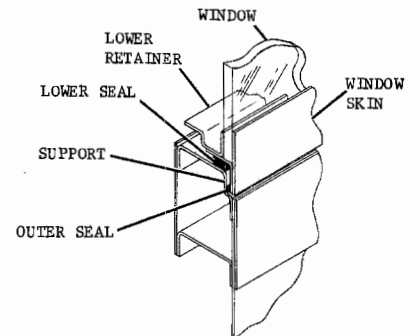
DETAIL F



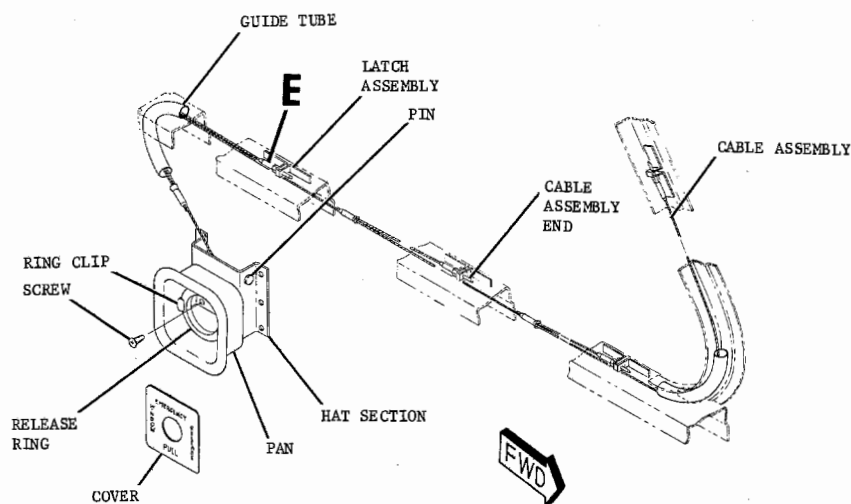
DETAIL B



DETAIL E



DETAIL C



DETAIL D

10103007
A,B10142006
C,F10142006
D,E10142034

Emergency Exit Window Installation
Figure 4

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MAINTENANCE MANUAL

- (6) Using an aerodynamic sealant (579-6 sealer-extruded) pack entire joints of edge of emergency exit window assembly opening trim. Wipe off and remove all excess sealer from exterior of emergency exit window assembly and trim. Mix (Bondtite BTC 20 Aerodynamic smoother and apply a light coat on outer perimeter joints of emergency exit window. This smoother should not overlap the joint by more than 1/10 of an inch, nor should it be more than .02 of an inch in depth. After smoother has cured, sand lightly to fair in edges. Repaint all surfaces affected as required.

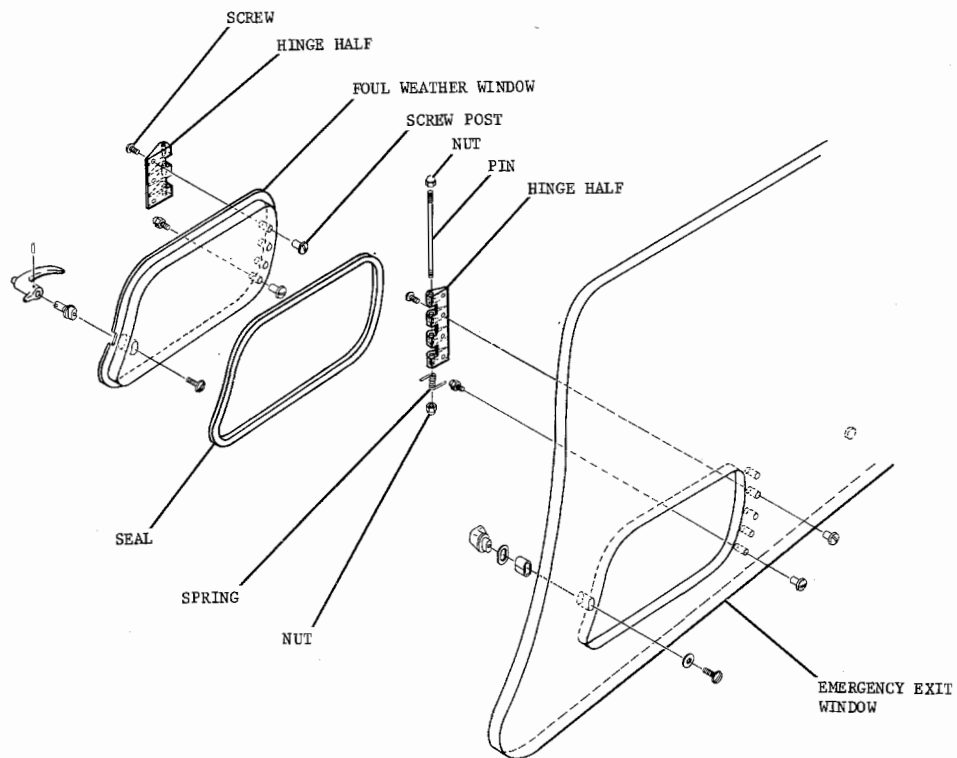
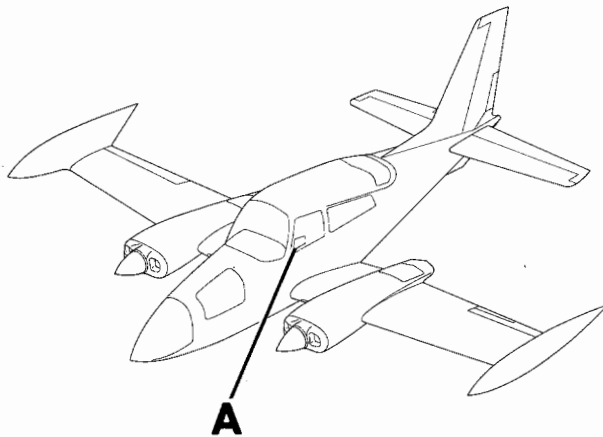
3. Removal/Installation Emergency Window Release Mechanism (See Figure 4).

A. Remove Emergency Window Release Mechanism.

- (1) Refer to Chapter 12. Remove window post trim, lower, upper, and forward window trim and pilot's seat.
- (2) Remove ash tray and wemac. Refer to Chapter 12.
- (3) Remove cover from pan.
- (4) Remove release ring by removing ball from cable assembly.
- (5) If removal of cable assembly is necessary, proceed as follows:
 - (a) Refer to Chapter 12. Remove upholstery side panel.
 - (b) Remove safety wire and disengage cable assembly ends from latch assemblies.
 - (c) Remove pan and ring clip by removing screws.
 - (d) Remove pin and route cable assembly through hat section.

B. Install Emergency Window Release Mechanism.

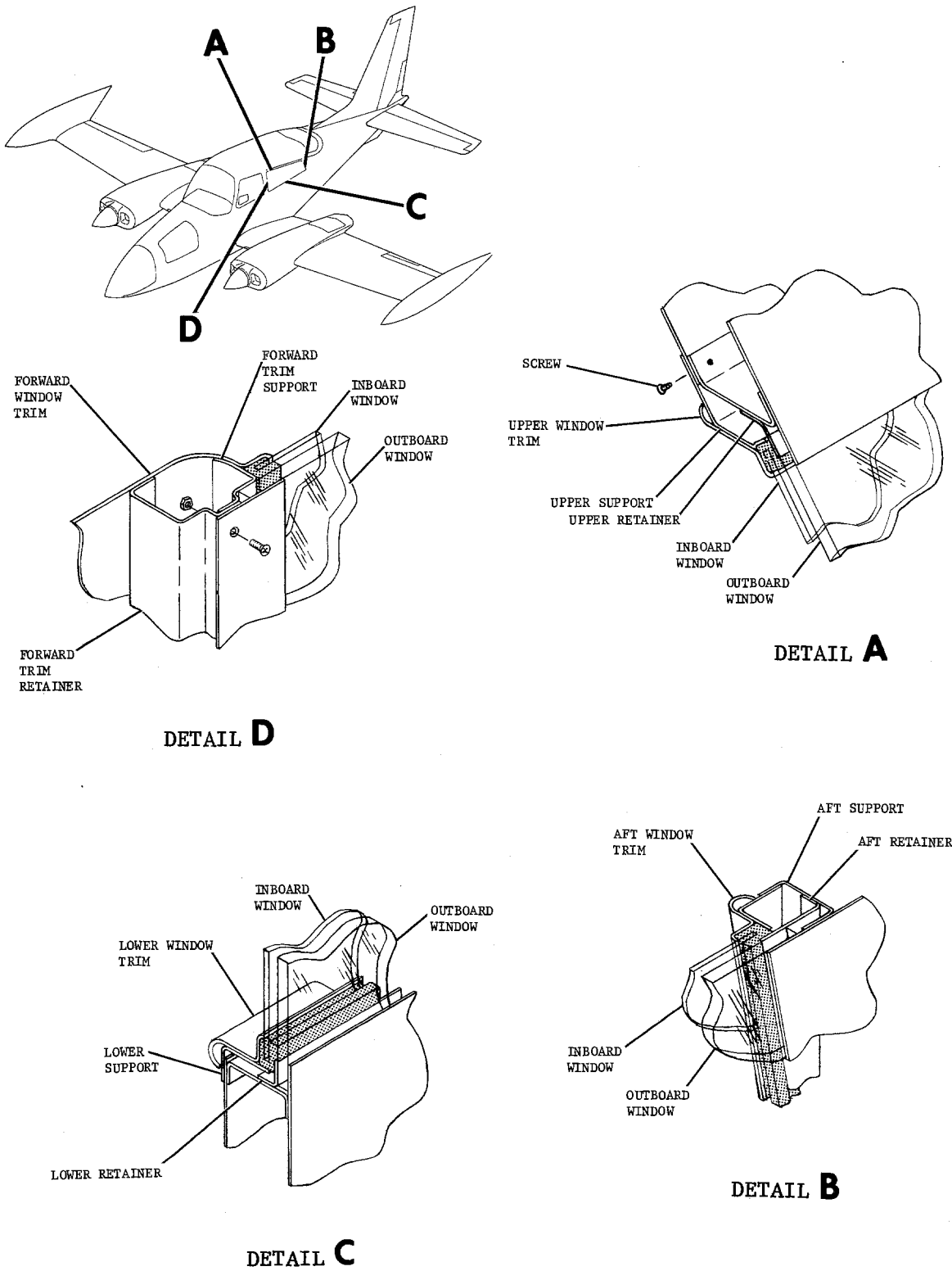
- (1) If cable assembly was removed, proceed as follows:
 - (a) Route cable assembly through hat section to the latch assemblies.
 - (b) Secure cable assembly to hat section, using pin.
 - (c) Install window release pan and ring clip, using screws.
 - (d) Install upholstery panel. Refer to Chapter 12.
- (2) Install release ring to cable assembly by inserting ball.
- (3) Safety cable assemble ends at latch assemblies, using .011 copper safety wire. Only a single strand of safety wire should be used.



DETAIL A

Foul Weather Window Installation
Figure 5

10103007
A52113002



Picture Window Installation
Figure 6

10103007
A,B10141046
C,D10141046

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MAINTENANCE MANUAL

NOTE: The maximum pull required to release the emergency window shall not exceed 80 pounds on the ring.

- (4) Install ash tray and wemac, window post trim, lower, upper and forward window trim and pilot's seat. Refer to Chapter 12.

4. Removal/Installation Foul Weather Window (See Figure 5).

A. Remove Foul Weather Window.

- (1) Tape or mask emergency exit window as necessary to protect the plexiglass during removal and installation of pin.
- (2) Remove nuts, washers and spring and pin.

CAUTION: WHEN REMOVING OR INSTALLING FOUL WEATHER WINDOW, USE FOUL WEATHER WINDOW SPRING TOOL, P/N 5090003 TO PREVENT SPRING FROM ACCIDENTALLY DAMAGING PILOT'S WINDOW.

- (3) Refer to illustration for further disassembly of the foul weather window.

NOTE: If seal is being replaced, bond to foul weather window, using Eastman 910 adhesive (Armstrong Cork Company, Lancaster, Pennsylvania, or equivalent).

B. Install Foul Weather Window.

- (1) Assemble foul weather window to emergency exit window, using nuts, washers, spring and pin.
- (2) Remove protective covering from window.

5. Removal/Installation Picture Windows (See Figure 6).

A. Remove Picture Window.

- (1) Refer to Chapter 12. Remove window trim panels.
- (2) Remove wire tunnels.
- (3) Remove inboard window by removing aft support and attaching screws.
- (4) Remove upper and lower supports from structure by removing screws.
- (5) Remove forward trim retainer and forward trim support by removing screws and nuts.
- (6) Remove upper and lower retainers by removing screws.
- (7) Remove aft retainer by removing screws.
- (8) Remove outboard window.

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MAINTENANCE MANUAL

B. Install Picture Window.

- (1) Position outboard window in the frame.
- (2) Install aft retainer and secure with screws.
- (3) Install lower and upper retainers and secure with screws.
- (4) Install forward trim support and forward trim retainer, using screws and nuts.
- (5) Install lower and upper supports to structure, using screws.
- (6) Install inner window and moulding in frame and secure aft support, using screws.
- (7) Install wire tunnels.
- (8) Install window trim panels. Refer to Chapter 12.

STABILIZERSDescription

1. The vertical stabilizer is constructed with a sweptback design that includes the dorsal fin. Removable panel on the vertical stabilizer permits access to the rudder trim actuator. Aerodynamically balanced rudder is attached to the trailing edge of the vertical stabilizer.
2. The horizontal stabilizer is of one-piece construction. Removable panel on the horizontal stabilizer permits access to the elevator trim tab actuator. Aerodynamically balanced elevators are hinged to the trailing edge of the horizontal stabilizer.

Maintenance Practices

1. Removal/Installation Vertical Stabilizer (See Figure 1).

- A. Remove Vertical Stabilizer.

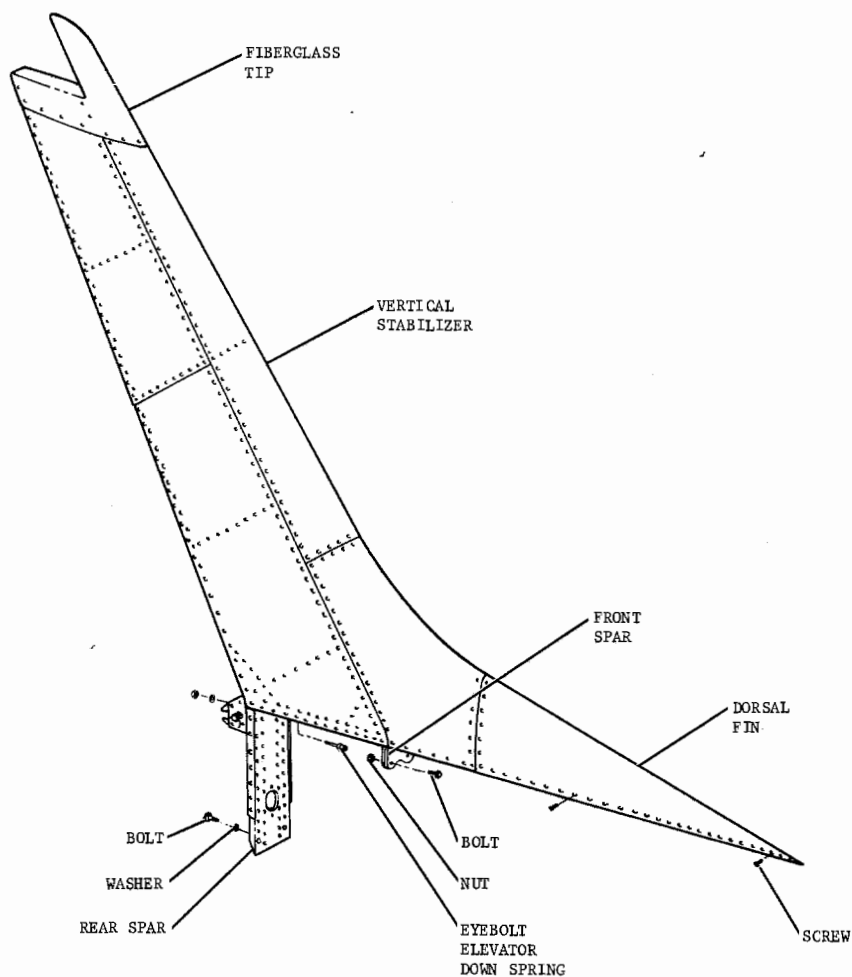
- (1) Place suitable support beneath tail section.
- (2) Remove horizontal stabilizer fairings. Refer to Chapter 1.
- (3) If omni-antenna (optional) is installed, disconnect the coaxial cable in the aft fuselage.

NOTE: If the coaxial cable is disconnected at the vertical fin tip, a wire should be attached to the cable before removal to facilitate installation.

- (4) If anti-collision light (optional) is installed, quick disconnects must be disconnected and the ground wire disconnected at the bulkhead in the aft fuselage.
- (5) If flux detector (optional) is installed, disconnect the electrical wiring.
- (6) Refer to Chapter 5 and remove the following:
 - (a) Rudder.
 - (b) Remove eyebolt attaching elevator down spring to vertical stabilizer rear spar.
 - (c) Remove rudder and trim control cables.
 - (d) Remove elevator push-pull tube.
- (7) Remove screws attaching forward dorsal skin to fuselage.
- (8) Remove nuts and bolts attaching front spar to fuselage.

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MAINTENANCE MANUAL



Vertical Stabilizer Installation
Figure 1

- (9) Remove bolts and washers attaching rear spar to fuselage.
- (10) Lift stabilizer vertically until front spar has cleared fuselage and remove from aircraft.

B. Install Vertical Stabilizer.

- (1) Place vertical fin in position on fuselage and align mounting holes.
- (2) Attach vertical stabilizer rear spar to tailcone bulkhead with bolts and washers.

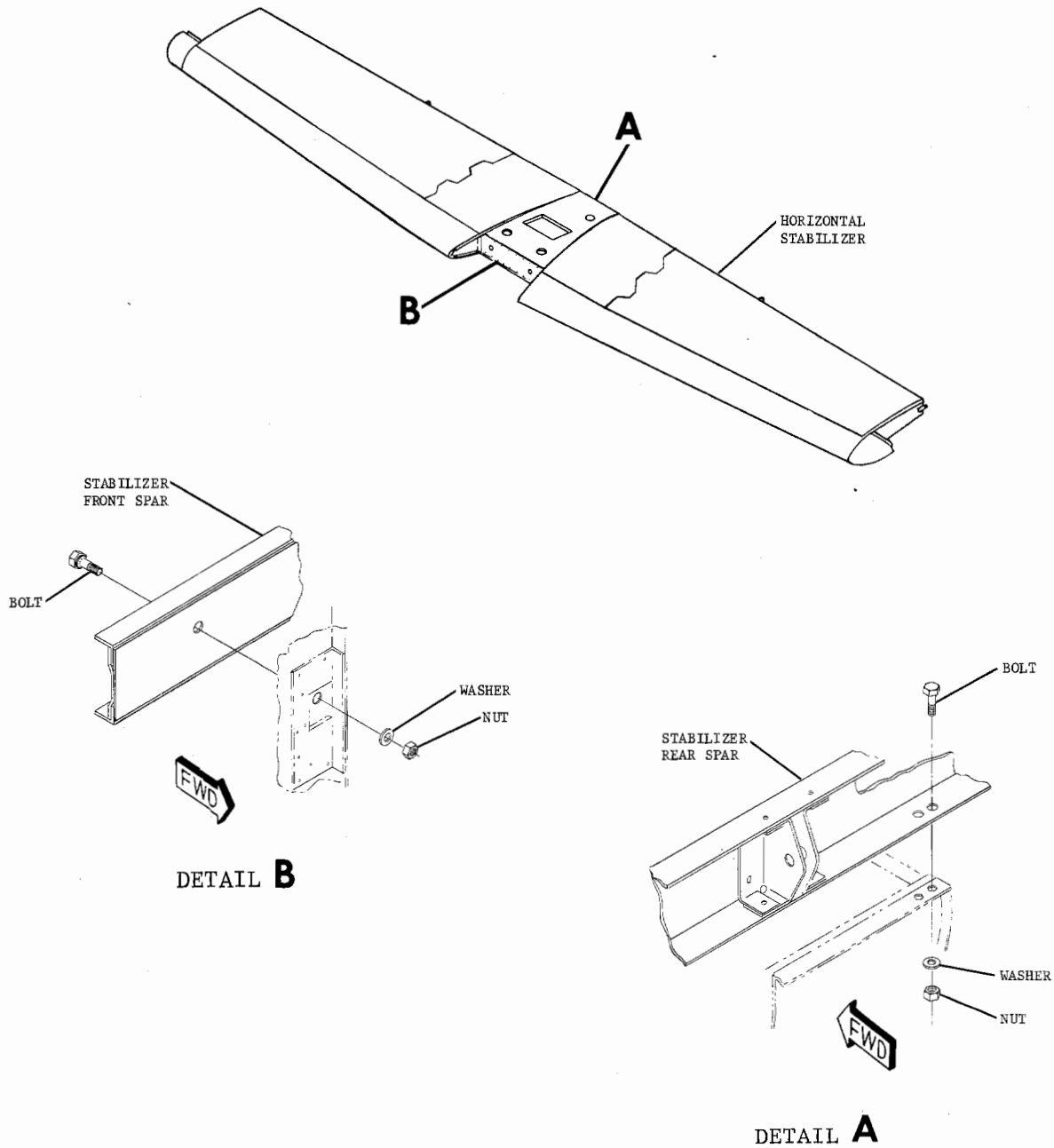
NOTE: Torque vertical fin attaching bolts to 175 ± 15 pound-inches.

- (3) Attach forward dorsal skin to fuselage with screws.
- (4) Attach vertical stabilizer front spar to fuselage with bolts and nuts.
- (5) Refer to Chapter 5 and install the following:
 - (a) Install elevator push-pull tube.
 - (b) Install elevator down spring with eyebolt, washer and nut.
 - (c) Install rudder to vertical stabilizer and connect rudder and trim cables.
- (6) If omni-antenna (optional) is installed, connect the coaxial cable in the aft fuselage.
- (7) If anti-collision is installed, connect electrical wires and attach the ground wire to the bulkhead in the aft fuselage.
- (8) If flux detector (optional) is installed connect electrical wires.
- (9) Refer to Chapter 5, rig the rudder and rudder trim system and elevator system if required.
- (10) Install horizontal fairings.
- (11) Remove support from beneath tail section.

2. Removal/Installation Horizontal Stabilizer (See Figure 2).

A. Remove Horizontal Stabilizer.

- (1) Refer to Chapter 5. Remove the elevator.
- (2) Remove the vertical stabilizer. Refer to Removal/Installation Vertical Stabilizer.
- (3) Refer to Chapter 5. Remove elevator and trim control cables from stabilizer.
- (4) Remove tail navigation light wires by removing screws from attaching clamps and wire terminal.
- (5) If deice system (optional) is installed, disconnect and tag hoses at tee located on support bracket just forward of center bulkhead in tailcone.
- (6) Remove nuts, washers and bolts attaching rear spar to tailcone bulkhead.



Horizontal Stabilizer Installation
Figure 2

A10322001
B10322001

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MAINTENANCE MANUAL

- (7) Remove bolts and washer attaching front spar to fuselage bulkhead.
- (8) Lift the rear spar until the stabilizer is at an angle of approximately 45 degrees, then remove from the aircraft by lifting vertically.

B. Install Horizontal Stabilizer.

- (1) Position horizontal stabilizer on tailcone and align mounting holes.
- (2) Attach stabilizer front spar to fuselage bulkhead with bolts and washers. Torque bolts to 175 ± 15 pound-inches.
- (3) Attach stabilizer rear spar to tailcone bulkhead with bolts, washers and nuts. Torque bolts to 120 ± 20 pound-inches.
- (4) If deice system (optional) is installed, connect hoses to tee located on support bracket forward of center bulkhead in tailcone.
- (5) Install tail navigation light wires by installing screws in attaching clamps and wire terminal.
- (6) Refer to Chapter 5. Install elevator.
- (7) Install vertical stabilizer. Refer to Removal/Installation Vertical Stabilizer.

WINGSDescription

1. The wing is constructed of a forward and rear spar, with rib assemblies installed between the spars, the wing surface is covered with aluminum alloy skin panels. The wing structure provides attach fittings for the main landing gear, aileron, flap, engine nacelle, and main fuel tanks.
2. The wing structure is designed to provide storage space for the auxiliary fuel cells (optional) when installed. Access panels are installed on the lower and upper surface for accessibility to components housed inside the wing structure.

Maintenance Practices

1. Removal/Installation Wing (See Figure 1).

- A. Remove Wing

- (1) Remove battery (left wing only), refer to Chapter 13.
- (2) Defuel the aircraft, refer to Chapter 2.

NOTE: Wings can be removed with all fuel tanks and cells installed. If fuel tank or cell removal is desired, refer to Chapter 9.

- (3) Remove engine, refer to Chapter 7.

CAUTION: IF ONE OR BOTH ENGINES ARE REMOVED, THE AIRCRAFT MAY BECOME TAIL HEAVY. THEREFORE, TO BALANCE THE AIRCRAFT, PLACE EQUIVALENT WEIGHT (SHOT BAGS OR SAND BAGS) IN THE ENGINE NACELLES AND SUPPORT THE TAILCONE WITH PADDED SUPPORT.

- (4) Jack the aircraft, refer to Chapter 1.
- (5) Place suitable padded supports beneath cabin section and wings; then remove jacks.

NOTE: To prevent damage to skin, place padded supports beneath front and rear spars in fuselage and beneath wing ribs. If both engines were removed and weight was placed in the nacelles, remove weight after removing jacks.

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CAUTION: IF ONLY ONE WING IS BEING REMOVED AND THE ENGINE ON THE OPPOSITE WING REMAINS INSTALLED; RELIEVE THE ENGINE WEIGHT ON OPPOSITE WING BY USING ENGINE HOIST BEFORE REMOVING WING OR SERIOUS DAMAGE MAY OCCUR DUE TO AN OVERBALANCE TIPPING CONDITION.

- (6) Disconnect or remove landing gear drive tube, refer to Chapter 4.

NOTE: Wings can be removed with main landing gear installed. If gear removal is desired, refer to Chapter 4.

- (7) Remove flap cables, aileron cables and aileron trim cables (left wing only), refer to Chapter 5.
- (8) Disconnect engine controls in engine nacelle, refer to Chapter 7.
- (9) Remove upholstery panels in cabin as necessary (refer to Chapter 12) to gain access to junction box located on side of aircraft from which wing is to be removed.
- (10) At the junction box, disconnect and tag each wire to affected engine and route wire from fuselage.
- (11) Disconnect tag or route the following items in the wing root area:
- (a) Route all flex cables to fuselage.
 - (b) Disconnect electrical connectors.
 - (c) Route starter cable to fuselage.
 - (d) Disconnect all lines at fittings.
 - (e) Route wing wiring bundle from fuselage.
 - (f) If installed, disconnect deice line at fitting.
- (12) Remove nuts, washers and bolts from wing attachment fittings.

NOTE: If difficulty is encountered in driving out wing bolts or disengaging fittings, it may be necessary to rock wing slightly.

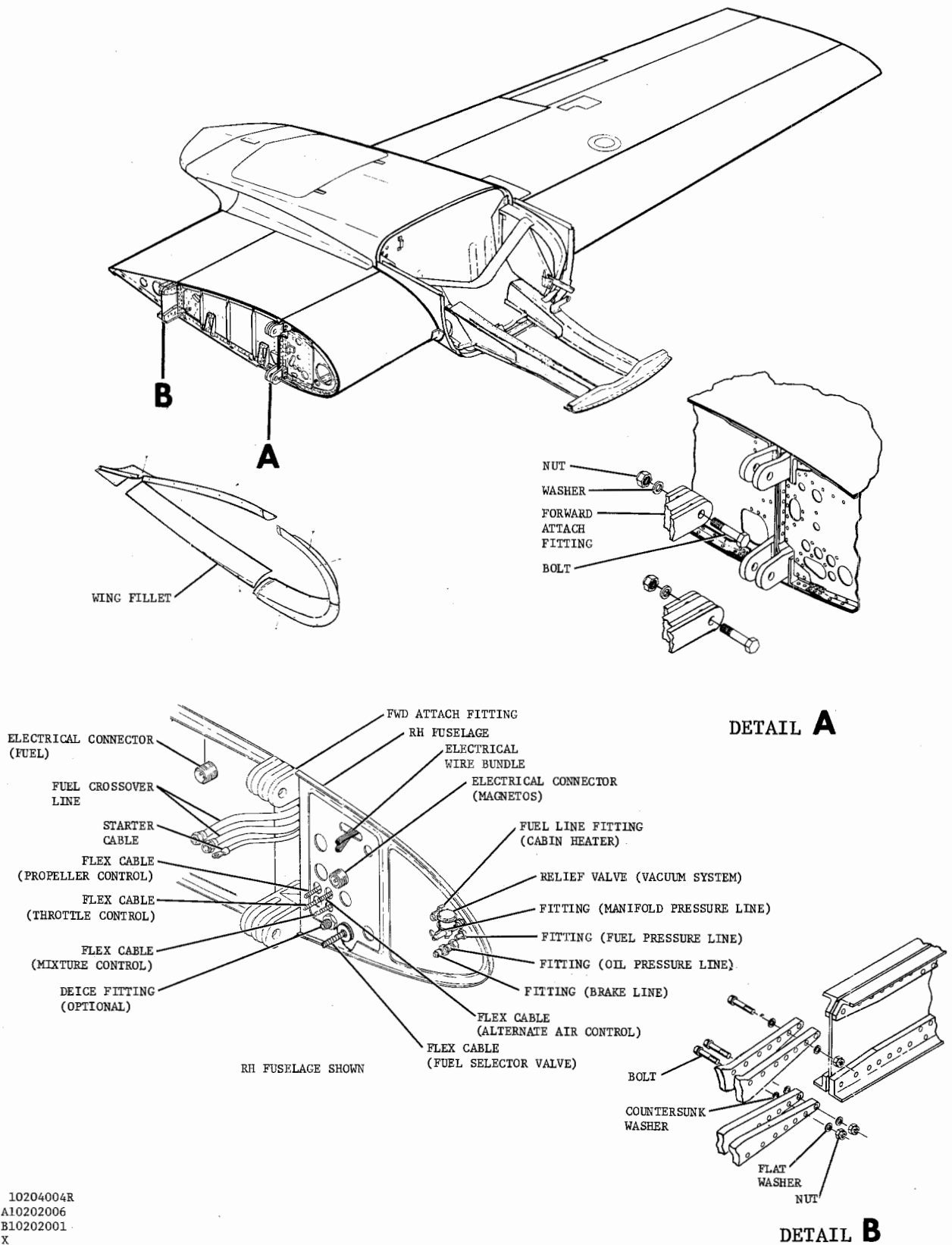
- (13) Move wing and padded wing supports outboard until wing attachment fittings have disengaged.

B. Install Wing.

- (1) Position wing approximately one foot from fuselage.
- (2) Refer to Chapter 2. Clean and/or lubricate engine flex cables fittings, electrical wiring and all other items relating to the wing needing servicing.
- (3) Route flex cables through root rib towards their respective components. Do not secure cables to structure at this time.

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Wing Installation
Figure 1

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MAINTENANCE MANUAL

- (4) Move the wing toward fuselage until wing attachment fittings begin to engage, guide landing gear drive tube through opening in root rib.
- (5) Align bolts in wing attachment fittings and install bolts, washers and nuts on forward attach fitting. Install bolts, countersunk washers, flat washers and nuts on rear attach fitting.

NOTE: Install front spar bolts with heads facing forward and rear spar bolts with heads facing aft. On rear spar bolts place countersunk washers under head of bolts. Torque front spar nuts to 720 + 60 inch-pounds and rear spar nuts to 175 ± 15 inch-pounds.

NOTE: Spar bolts are installed in shear positions, DO NOT OVERTORQUE. It is possible wing spar bolts will turn if a slight torque is applied to bolt head.

- (6) Connect the following items at the wing root area and remove tags.

NOTE: Lubricate all fittings used on fuel, oil and air lines with suitable thread lubricant. Apply lubricant to the male fittings only, omitting the first two threads. Lubricate straight threads of hydraulic fittings with system fluid.

- (a) If installed, connect deice line to respective fitting.
- (b) Connect all lines to their respective fittings.
- (c) Route wing wire bundle through fuselage.
- (d) Connect electrical connectors.
- (e) Route starter cable to wing.
- (f) Connect vacuum hose to relief valve.
- (7) Connect electrical wires to proper terminals in junction box and remove tags.
- (8) Install flap, aileron and aileron (left wing only) trim cables in wing and rig the systems, refer to Chapter 5.
- (9) If wing tip fuel tank was removed, refer to Chapter 9 and install tip tank. Do not install lower fairing at this time.
- (10) Refer to Chapter 1 and jack the aircraft.

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CAUTION: IF BOTH ENGINES WERE REMOVED, THE AIRCRAFT IS TAIL HEAVY. TO BALANCE THE AIRCRAFT, PLACE WEIGHT (SHOT BAGS OR SAND BAGS) IN ENGINE NACELLES PRIOR TO JACKING.

- (11) Remove padded supports from beneath cabin section, tail section and wings.
- (12) Place tailcone support beneath tailcone bumper.
- (13) If landing gear was removed, refer to Chapter 4 and install and rig landing gear.

NOTE: To facilitate rigging of landing gear, use external power source.

- (14) Refer to Chapter 7, install engine and connect flex cables to engine.

NOTE: To prevent serious binding, check flex cables for proper security during rigging of cables.

- (15) Refer to Chapter 9, install flex cable at fuel selector valve and rig the fuel selector control system.
- (16) Remove support beneath tailcone bumper.
- (17) Remove aircraft jacks.
- (18) Refer to Chapter 13 and install battery.
- (19) Service aircraft and check for fuel leaks, especially at the fuel tank and wing root connections.
- (20) Install wing root and fuel tank fairings.
- (21) Refer to Chapter 12. Install upholstery panels.
- (22) Refer to Chapter 7. Perform an engine operation check and observe engine controls and electrical equipment for proper operation.

CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

4

LANDING GEAR AND BRAKE SYSTEM

310

MAINTENANCE MANUAL

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LANDING GEAR SYSTEMDescription

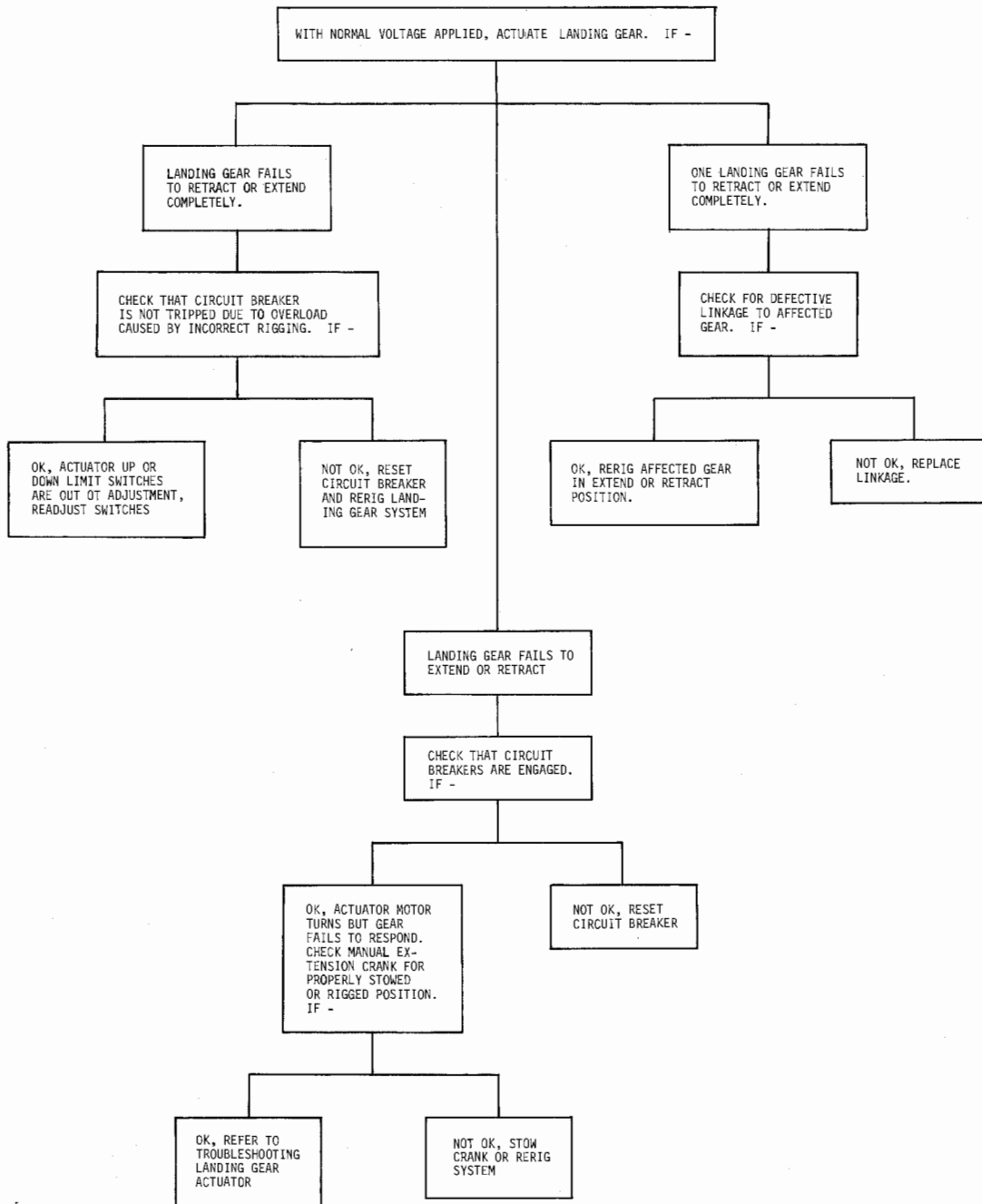
1. The landing gear is a fully retractable gear consisting of the main gear located aft of each engine nacelle and a nose gear located in the nose section of the fuselage. Each gear is mechanically connected to a single gear box driven by an electric motor. Each main gear consists of a pneumatic-hydraulic strut assembly, wheel and tire assembly and a disc type brake assembly. Landing gear retraction linkage is provided to synchronize the operation of the main gear, nose gear and main gear doors.
2. The brake system consists of a master cylinder for each main wheel brake and plumbing. Each master cylinder contains its own hydraulic fluid reservoir.
3. The parking brake system is manually operated through a pull handle and cable arrangement to draw the master brake cylinders into a brake ON condition.
4. The landing gear warning and indicator system provides visual indications of a safe landing gear condition and aural warnings of unsafe conditions. A position indicator switch is located on each gear to actuate indicator lights when the gear is down and locked. A safety switch located on the left main gear prevents accidental retraction while weight of aircraft is on the gear. A gear warning system provides an aural and visual warning any time the gear is in transit or any time the throttles are retarded below a specified manifold pressure setting while gear is in the UP position. A flap-gear warning provides an aural and visual warning when flaps are lowered below 15 degrees while the gear is in the UP position regardless of throttle setting. A press-to-test light circuit is incorporated in each light to test the lamp at any time power is ON.

Troubleshooting

1. Troubleshooting Landing Gear System
 - A. For a guide to troubleshooting the landing gear system, refer to Figure 1. For troubleshooting the electrical functions of the landing gear and landing gear warning, refer to the appropriate wiring diagram in Chapter 13.

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MAINTENANCE MANUAL



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Troubleshooting Chart - Landing Gear System
Figure 1

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Adjustment/Check

1. The following landing gear rigging procedure is designed specifically for the Model 310. A faithful following of this procedure will result in a proper rigged and efficient operating system. Before starting the rigging the "toe-out" should be checked in accordance with main landing gear alignment procedures, the tires inflated to proper pressures and main gear door link tube should be checked for proper adjustment, in accordance with main landing gear door Adjustment/Test procedures.
2. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following listed items:

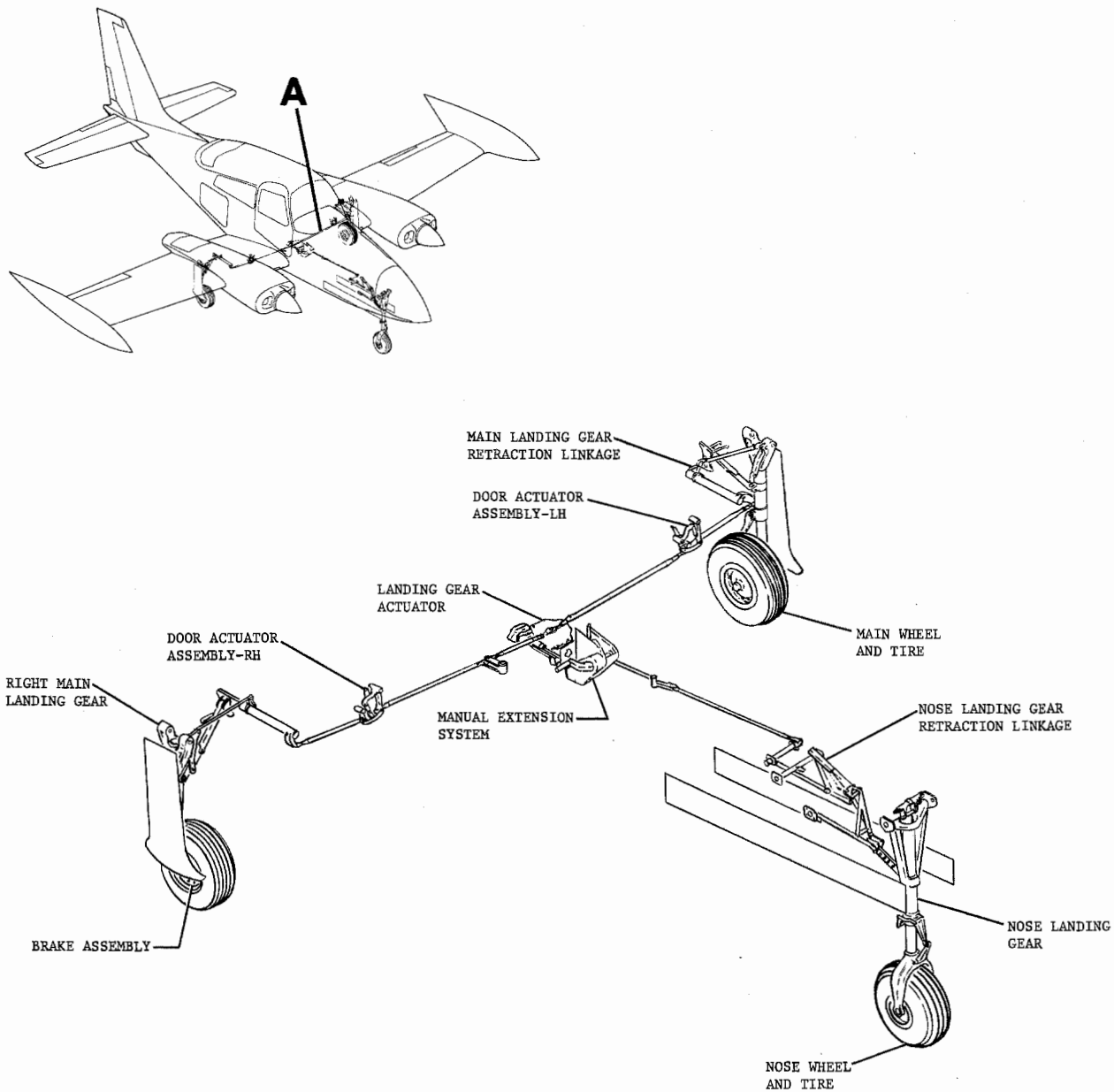
Name	Number	Manufacturer	Use
Main Gear Door	0880001-1	Cessna Aircraft Co. or Local Manufacturer (See Figure 3)	Measuring door ac- tuator arm tension
Spring Scale	0-50 Lbs.	Commercially Available	Measuring door act- uator arm tension.
Spring Scale	Model 140 0-200 Lbs.	John H. Chatillon and Son 83-28 Kew Gardens Kew Gardens, New York	Measuring gear down lock ten- sion.
Straight Edge		Commercially Available	Checking toe-out.
Carpenters Square		Commercially Available	Checking toe-out.
Grease Plates		Local Manufacturer	Checking toe-out.

3. Rig Landing Gear.

- A. Align Main Landing Gear (See Figure 4).

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MAINTENANCE MANUAL



DETAIL A

Landing Gear System
Figure 2

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- (1) Position the aircraft with the main wheels resting on grease plates.

NOTE: For each set of grease plates, use two aluminum sheets approximately 18 inches square with sufficient grease spread between them to permit the top plates to slide freely on the bottom plates.

- (2) Set a straightedge in place against the main wheel tires at axle height as illustrated.
- (3) Place one leg of a carpenter's framing square against the straightedge, with the other leg against the inboard side of the wheel being checked. Measure the distance from framing square leg adjacent to wheel, to wheel rim, at extreme aft circumference of wheel rim. The difference between the two measurements will be the toe-in or toe-out for that wheel. Toe-out for either wheel is $.06 \pm .05$ inch. Toe-out must remain in tolerance throughout the entire range of free play in the system. If tolerance cannot be retained, replace bushings. Refer to Disassembly/Assembly of Main Landing Gear.

NOTE: Remove weight from gear by jacking aircraft before attempting to add or remove washers to torque links.

- (4) Reposition washers between torque links to correct for excessive toe-in. Wheel alignment after adjustment must be within limits prescribed in step "3".

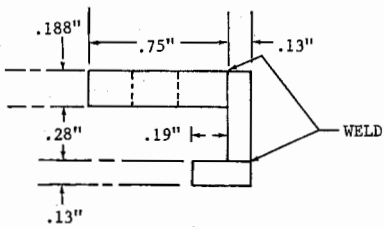
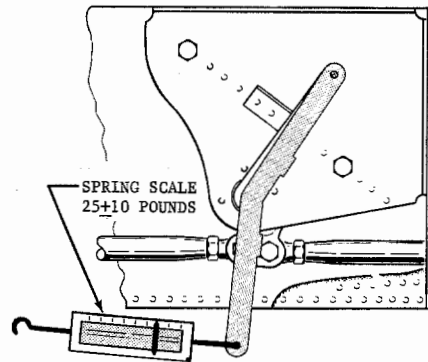
NOTE: AN960716 and AN960716L washers are used as shims between the upper and lower torque links. Combinations of thick and thin washers can be used between the torque links to obtain the correct wheel alignment. Washers that are added or removed between the torque links must also be removed or added to the outside end of the spacer to maintain an .004 to .020 side play of the torque links. Be sure that the spacer washers are centered on the spacer as the nut is being torqued up to proper value. Refer to Assembly of Main Landing Gear.

B. Rig Main Landing Gear Linkage (See Figure 5).

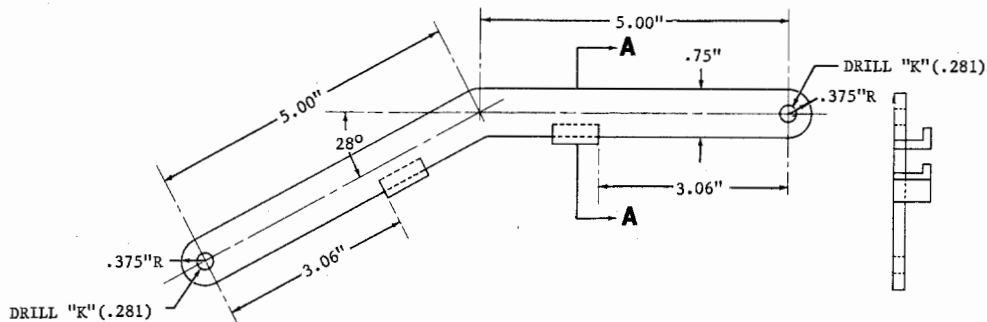
- (1) Jack aircraft. Refer to Chapter 1.

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MAINTENANCE MANUAL



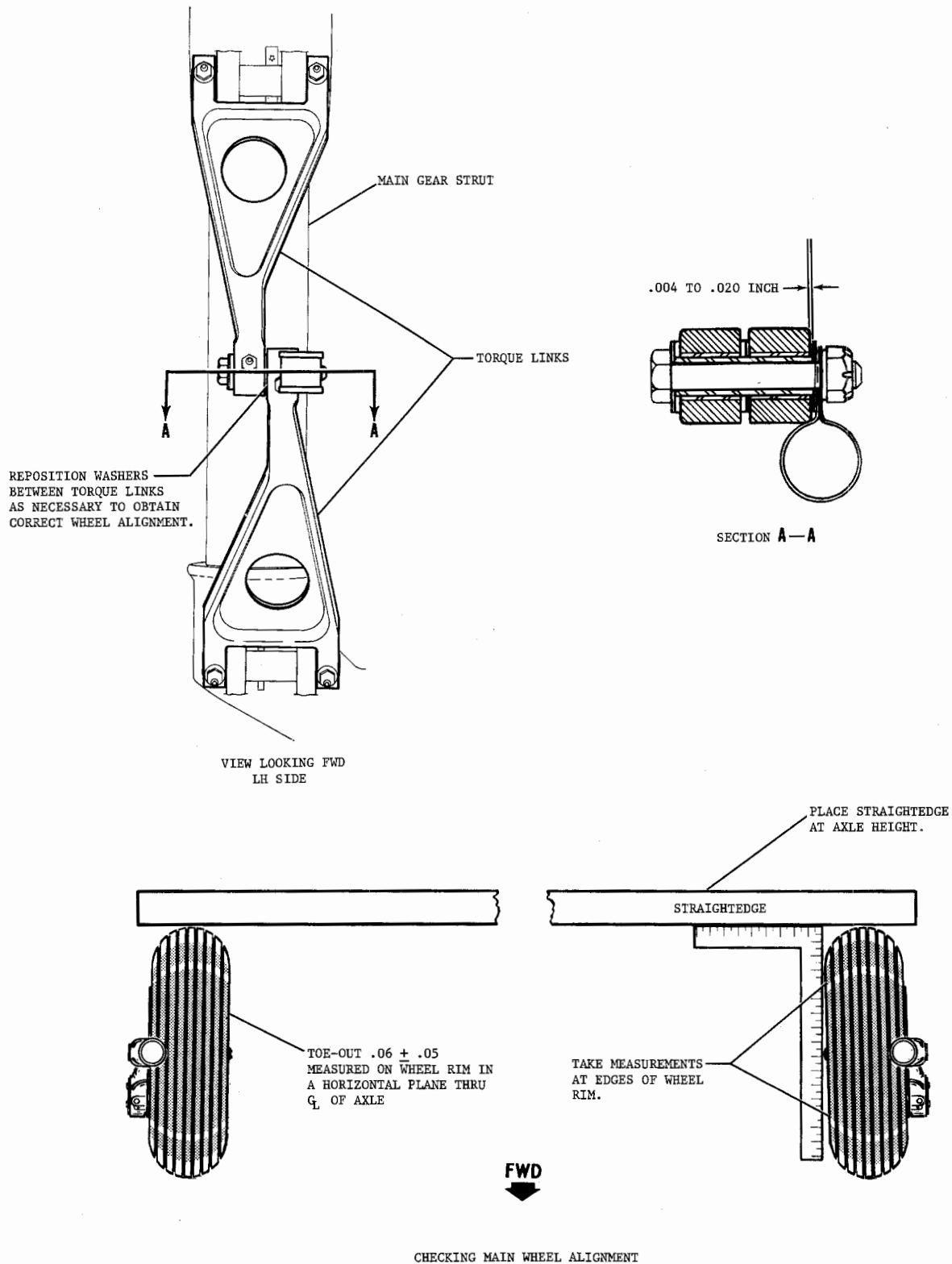
SECTION A-A



MATERIAL - STEEL

10806004
10802002

Main Gear Rigging Tool - Fabrication and Usage
Figure 3



14412002
10411008
10411008

Main Wheel Alignment
Figure 4

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- (2) Remove seats, carpet, floorboard panels and access panels as required to gain access to landing gear actuator and linkage.

CAUTION: ANY TIME THE FLOORBOARDS ARE REMOVED A TEMPORARY PROTECTIVE COVER SHOULD ALWAYS BE USED TO PREVENT DAMAGE AND IMPROPER SETTINGS OF THE LANDING GEAR ACTUATOR SWITCHES.

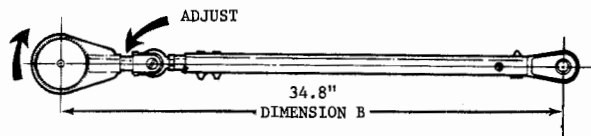
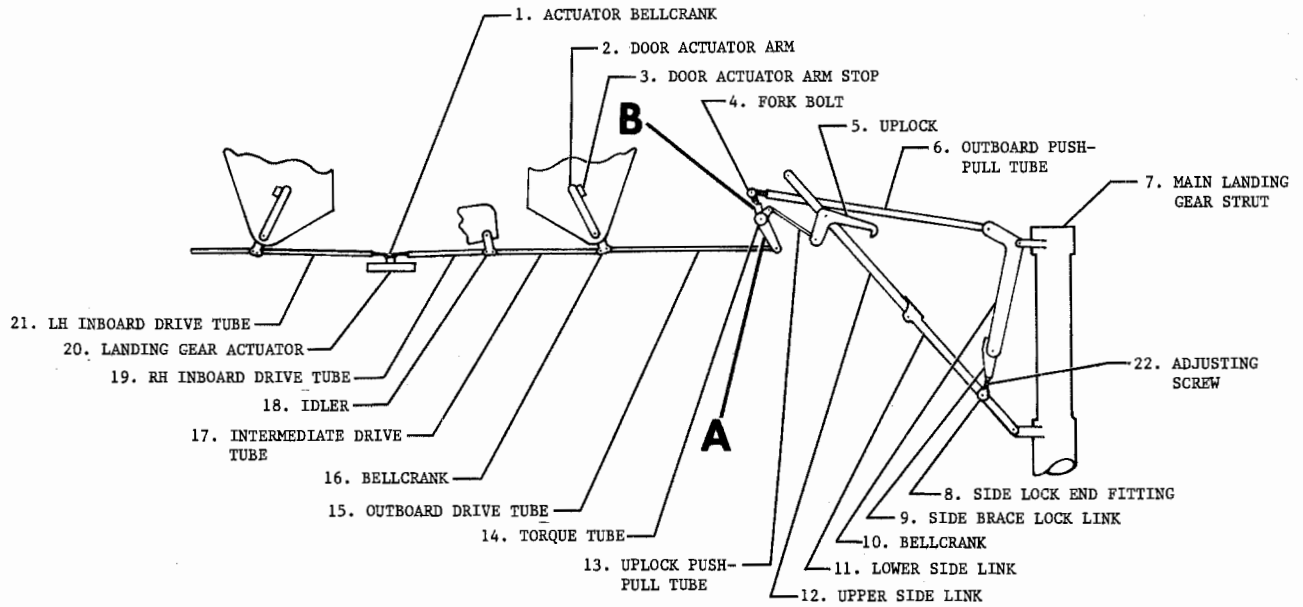
- (3) Disconnect main wheel well doors from door actuators. Refer to Removal/Installation of Main Gear Doors.
- (4) Disconnect nose gear doors. Refer to Removal/Installation of Nose Gear Doors.
- (5) (See Figure 7). Disconnect nose gear retracting linkage in the nose gear wheel well by removing nuts and bolts attaching nose push-pull tube (6) to fork bolt (7) and connector link (3) and removing push-pull tube (6).
- (6) (See Figure 5.) Disconnect the inboard end of both outboard drive tubes (15) by removing nut, spacers and bolt.
- (7) Disconnect LH inboard drive tube (21) and RH intermediate drive tube (17) at idler bellcranks (16).

CAUTION: DURING OPERATION OF LANDING GEAR ACTUATOR BE PREPARED TO STOP TO PREVENT ANY POSSIBLE DAMAGE.

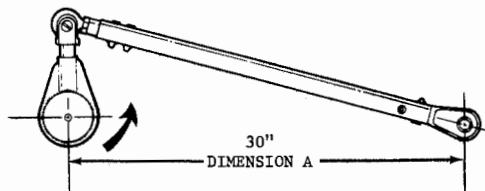
CAUTION: IT IS RECOMMENDED THAT THE INBOARD DRIVE TUBES BE HELD DURING ACTUATION TO PREVENT DAMAGE TO THE STRUCTURE. IT MAY BE NECESSARY TO INSTALL A LENGTH OF SAFETY WIRE IN THE DRIVE TUBE ENDS TO HELP HOLD TUBES IN POSITION DURING OPERATION.

- (8) (See Figures 2, 4-10.) Adjust the UP and DOWN limit switches (10 and 24) on the landing gear actuator as follows:
 - (a) Adjust both limit switches to the end of their adjusting slots in a direction which will permit maximum bellcrank travel.

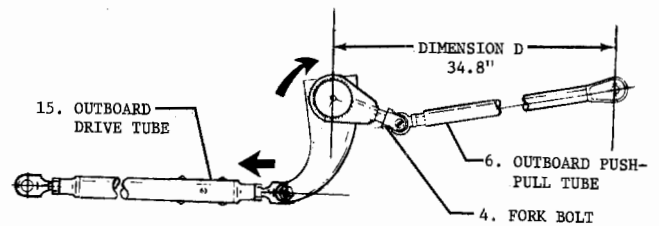
NOTE: When adjusting either limit switch, align switch so that roller is contacted squarely by the bellcrank or drive tube.



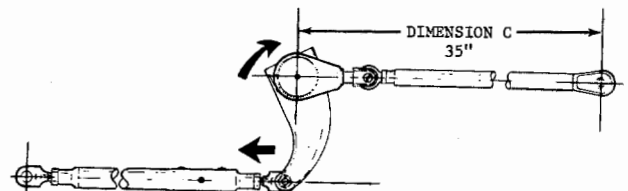
NOTE: DIMENSIONS ARE FOR ILLUSTRATING PRINCIPLE ONLY.



DETAIL B



NOTE: DIMENSIONS ARE FOR ILLUSTRATING PRINCIPLE ONLY



DETAIL A

Rigging Main Landing Gear Retraction Linkage
 Figure 5

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MAINTENANCE MANUAL

- (b) Engage manual extension crank and operate toward the up position until the internal stop in the actuator is reached. To prevent possible damage to the actuator, do not force against the internal stop.
- (c) Note the angular position of the crank when internal stop is reached, back crank off toward the down position 2 turns of the hand crank, then advance crank 1/2 turn toward the up position. Adjust the up limit switch (10) so that it is just actuated at this point.
- (d) Engage manual extension crank and operate toward the down position until the internal stop in the actuator is reached. Do not force against the internal stop.
- (e) Note the angular position of the crank when internal stop is reached, back crank off toward the up position 2 turns of the hand crank, adjust the down limit switch (24) so that it is just actuated at this point.
- (f) After these preliminary adjustments to the limit switches have been made, stow the manual extension crank and operate the actuator electrically to the up position until the up limit switch is actuated.

CAUTION: CAUTION MUST BE OBSERVED DURING ACTUATION TO INSURE THAT NO DAMAGE IS INCURRED BY THE DISCONNECTED ENDS OF THE MAIN DRIVE TUBES.

NOTE: To facilitate rigging of the landing gear, a two-position momentary ON switch with suitable lengths of electrical wires can be connected to the landing gear electrical circuit in such a manner that the landing gear can be observed while being operated during rigging. The use of an external power source is also recommended.

- (g) Engage the manual extension crank and note the angular position of the crank. Operate crank toward the UP position noting the number of turns required to reach the internal stop in the actuator. The minimum number of turns required in the up position is three-fourths of one turn. The desired is 1-1/2 turns. If necessary, adjust the UP limit switch to obtain this requirement.

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MAINTENANCE MANUAL

- (h) Stow the manual extension crank and operate the actuator electrically to the DOWN position until the DOWN limit switch is actuated.
- (i) Engage the manual extension crank and note the position of the crank. Operate crank toward the DOWN position and note the number of turns required to reach the internal stop in the actuator. The minimum number of turns required in the DOWN position is one and the maximum (and desired) number of turns is two turns. If necessary, adjust the DOWN limit switch to meet this requirement.
- (j) (See Figure 5.) Actuate gear electrically to the DOWN position. Manually place the door actuator arm (2) against its stop. Adjust RH intermediate drive tube (17) and LH inboard drive tube (21) to align with hole in idler bellcranks (16); then lengthen the rod ends on the drive tubes (17 and 21) two turns. Actuate gear electrically toward the UP position as required to install bolts, washers and nuts.

CAUTION: BOLTS MUST BE INSTALLED WITH HEAD OF BOLT FORWARD.

- (k) (See Figure 3.) Actuate gear electrically to the DOWN position and check the pull force required to move the door actuator arms from their stops as illustrated.

NOTE: The pull required to move door actuator arm from stop must be measured at a right angle to the arm.

- (l) (See Figure 5.) Adjust the length of both inboard drive tubes (19 and 21) as necessary to obtain a force of 25 ± 10 pounds required to move door actuator arms (2) from stops (3) in the down position.
- (m) Actuate gear electrically to the UP position and adjust the up limit switch as necessary to obtain force of 25 ± 10 pounds and a maximum difference of 10 pounds from the down position required to move the door actuator arms (2) from stop (3) in the up position.

NOTE: If the up limit switch is readjusted recheck the minimum turn requirement in step (g).

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MAINTENANCE MANUAL

- (9) Adjust side brace lock links (9) as follows:
- (a) With landing gear in the down position, adjust side lock end fitting (8) so that lower side link (11) and upper side link (12) are held firmly in overcenter position when side brace lock link (9) is firmly overcenter.
 - (b) During retraction check for clearance between bellcrank (10) and push-pull tube (6). It may be necessary to add or subtract washers to provide clearance.
 - (c) Manually "Break" the lock link from its overcenter position and move the landing gear to a position five to six inches inboard from the down and locked position, then release. The landing gear must free fall and lock when released from this position.
 - (d) Shorten adjusting screw (22) in small increments until the gear will free fall down and locked. Double safety wire screw in adjusted position.
 - (e) Adjust both main landing gear side brace lock links in this manner.

NOTE: After the preceding steps have been completed the main landing gear retracting system is rigged from the limit switches through the door actuator bellcranks, and both side brace lock links are adjusted at the landing gear. The following procedure is to rig the retraction system from the door actuator bellcranks to the side brace lock links.

- (10) Make the following preliminary preparations:
- (a) Remove uplocks (5) and uplock push-pull tubes (13) by removing attaching bolts.
 - (b) Adjust the length of outboard drive tubes (15) to 1/4 inch from as short as possible and install.

NOTE: Attaching bolts must be installed with head of bolt forward.

- (c) Disconnect outboard push-pull tube (6) from fork bolt (4).
- (d) Screw fork bolts (4) into torque tubes (14) as far as possible.
- (e) Operate landing gear actuator to DOWN position.
- (f) With landing gear DOWN, adjust length of outboard push-pull tubes (6) so that rod end holes align with the holes in fork bolts (4), then

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MAINTENANCE MANUAL

shorten one turn. Operate landing gear actuator toward the UP position far enough to permit installation and install outboard push-pull tubes (6). INSTALL WITH THE COLLAR-END OF THE HI-SHEAR RIVETS POINTING UPWARD FOR CLEARANCE.

CAUTION: THE BOLT INSTALLING OUTBOARD PUSH/PULL TUBE (6) TO THE FORK BOLT (4), MUST BE INSTALLED WITH THE BOLT HEAD FORWARD.

NOTE: The preceding preparations will result in incomplete retraction, thus eliminating the possibility of damage to the wing structure caused by retracting too far.

- (11) Operate landing gear to the UP position and observe the highest position reached by the gear during retraction and the amount of drop-off.
- (12) Adjust the highest position reached by the gear during retraction as follows:
 - (a) Lengthen fork bolt (4) in half-turns to increase the highest position during retraction.

NOTE: Detail A illustrates this adjustment. Lengthening the fork bolt increases dimension "B", the longer dimension "B" is, the higher the gear will retract.

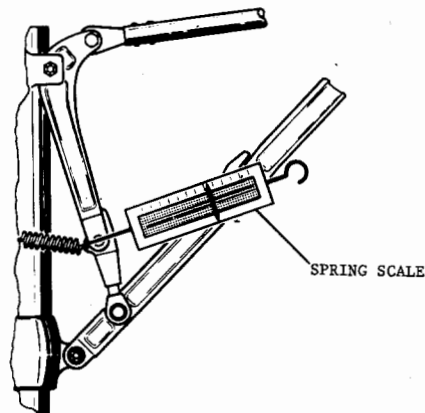
- (b) The axle dust cover should make light contact with the corrugated reinforcement at the top of wheel well, then drop down a specified distance (drop-off).
- (13) Adjust the amount of drop-off as follows:
 - (a) Determine whether drop-off is too little or too much. The minimum and desired amount of drop-off, measured at the center of the wheel, is 1/8 inch. The maximum is 1/4 inch.
 - (b) If drop-off is too much, lengthen outboard drive tube (15) in half-turn increments until drop-off is correct.
 - (c) If drop-off is too little, shorten outboard drive tube (15) in half-turn increments until drop-off is correct.
 - (d) Adjust the amount of drop-off for both main landing gears in this manner.

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MAINTENANCE MANUAL

NOTE: Detail B illustrates the principle used to obtain drop-off. Notice that dimension "C" is 35 inches. If we continue to rotate the torque tube fork bolt past its parallel position with the push-pull tube, dimension "C" will decrease as illustrated by dimension "D". Dimension "C" represents the highest position reached by the main landing gear during retraction. If the fork bolt is rotated past its parallel position, we actually cause the main gear to start extending. This slight past center extension is defined as drop-off.

- (14) Adjust the downlock tension as follows:
- (a) (See Figure 6.) Operate the landing gear to the DOWN position. The main landing gear down lock tension should be 40 to 50 pounds.
 - (b) If downlock tension is too high, lengthen out-board push-pull tube (6) until the correct downlock tension is obtained.



40-50 LBS. DURING RIGGING

40-60 LBS. FOR ROUTINE IN-SERVICE INSPECTION

10801003

Main Landing Gear Down Lock Requirements
Figure 6

- (c) If downlock tension is too low shorten outboard push-pull tube (6) until the correct downlock tension is obtained.

NOTE: Since the highest position during retraction is controlled by the combined length of the outboard push-pull tube (6) and the fork bolt (4), this combined length must remain unchanged to maintain the correct highest position. When adjusting the push-pull tube to obtain the specified downlock tension, the fork bolt must be re-adjusted a corresponding amount in the direction that will not change the combined length of the push-pull tube and fork bolt.

- (d) Adjust the downlock tension for both main landing gears in this manner.
- (15) Adjust uplocks as follows:
- (a) Adjust uplock push-pull tubes (13) to a preliminary length of 5.15 inches and attach to torque tube (14) with bolts, washers and nuts.
- (b) Operate landing gear to the UP position.

CAUTION: USE CAUTION WHEN LANDING GEAR NEARS THE UP POSITION BEFORE ADJUSTMENT OF UPLOCK PUSH-PULL TUBES HAS BEEN COMPLETED. IF NECESSARY, READJUST THE PUSH-PULL TUBE AND/OR UPLOCK HOOKS TO PREVENT DAMAGE.

- (c) Adjust uplock push-pull tubes so that uplock assemblies fully engage the spacers provided on the landing gear and tighten nuts.

NOTE: Elongated slots are provided in the uplock hooks so that each uplock hook can be adjusted vertically to contact the spacers.

- (d) Operate the landing gear several times, observing uplock assemblies. Uplock hooks must engage fully with the spacers provided on the gear and must engage and disengage freely and smoothly with no indication of binding.

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MAINTENANCE MANUAL

NOTE: Visually check the alignment of all rod ends to insure that they align with their attach fittings.

C. Rig Nose Landing Gear Linkage (See Figure 7).

NOTE: Because the aft drive tube (11) is a fixed length, the idler bellcrank (10) is correctly positioned to the actuator bellcrank (12).

- (1) Operate the actuator to the DOWN position, then adjust the length of the forward drive tube (9) as follows:
 - (a) (See Figure 1, 4-53.) Disconnect assist spring (14).
 - (b) Disconnect forward drive tube (9) from outboard bellcrank (15).
 - (c) Adjust the length of forward drive tube (9) so that fork bolt (7) is parallel with the upper flange of the wheel well former adjacent to the fork bolt. The forward end of the fork bolt will point downward any amount caused by less than one turn of the threaded end of the forward drive tube (9). Detail "A" illustrates three possible conditions. The straight configuration is most desired. The fork bolt must never point up.

NOTE: The collar-end of the forward horizontal hi-shear rivet must point inboard for clearance.

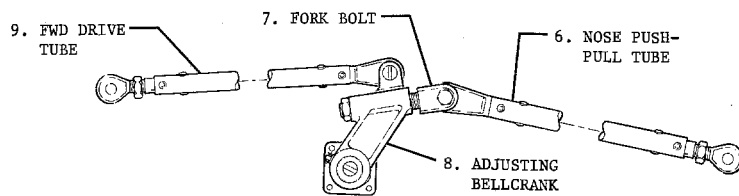
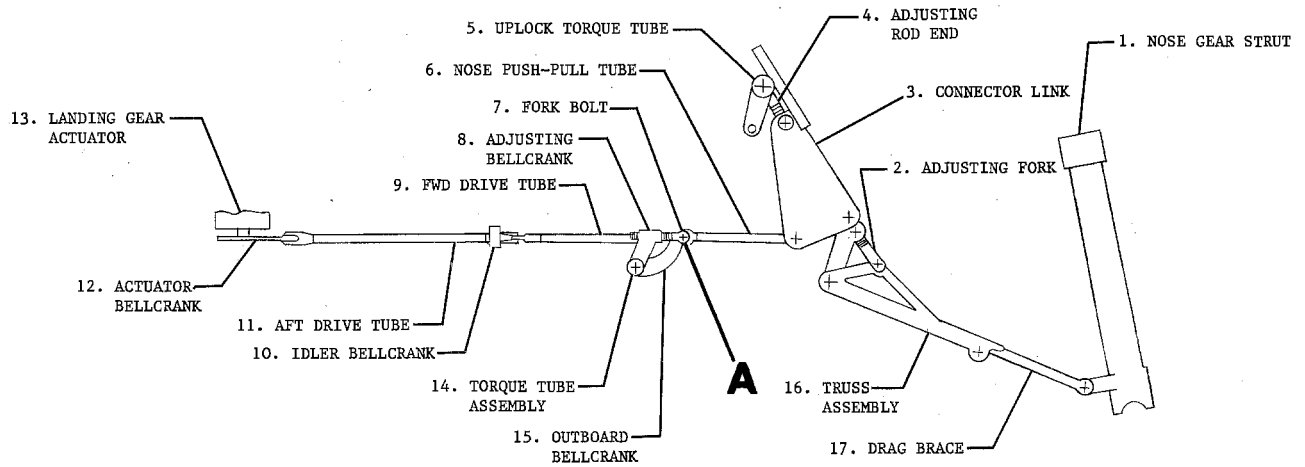
- (2) Make the following preliminary adjustments:
 - (a) Screw fork bolt (7) into adjusting bellcrank (8) as far as possible.
 - (b) Screw adjusting rod end (4) into uplock torque tube (5) as far as possible.
 - (c) Shorten adjusting fork (2) as much as possible. Adjust uplock hook (19, 4-53, Figure 1) to the end of its adjusting slots in the direction that will prevent hook from fully engaging.
- (3) Adjust connector link (3) as follows:
 - (a) With nose gear DOWN, check the overcenter position of connector link (3).

NOTE: A slight force (3 to 7 Lbs.) should be required to snap connector link into its overcenter position.

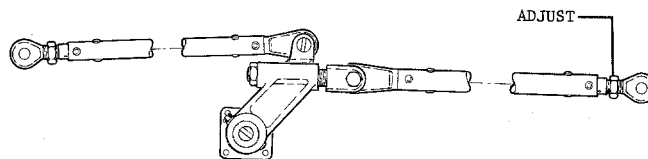
- (b) Lengthen adjusting rod end (4) in half-turn increments to increase the force required to snap connector link overcenter; shorten to decrease.

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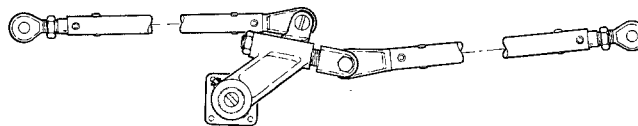
MAINTENANCE MANUAL



NOT ACCEPTABLE



DESIRED



ACCEPTABLE

DETAIL **A**

VIEW LOOKING OUTBOARD

14422002
A14423001Rigging Nose Gear Retracting Linkage
Figure 7

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- (c) Manually place nose gear UP, push upward on door actuator arm to lock connector link over-center, and check the retracted position.

NOTE: The nose gear should retract to a position that will align the center of the uplock hook with the spacer provided on the gear for hook engagement.

- (d) If the retracted position is too low, lengthen adjusting rod end (4) and shorten adjusting fork (2) in half-turn increments.
- (e) If the retracted position is too high, shorten adjusting rod end (4) and lengthen adjusting fork (2) in half-turn increments.

NOTE: Since the combined length of adjusting rod end (4) and adjusting fork (2) determines the force required to snap link overcenter in the DOWN position, this combined length must remain unchanged. When changing the length of adjusting rod end (4) to obtain the correct retracted position, change the length of adjusting fork (2) a corresponding amount in the direction that will not change their combined length.

- (3) Adjust uplock and downlock tensions as follows:
 - (a) Lengthen nose push-pull tube (6) as much as possible. Insure rod end is visible through the inspection hole for thread engagement.
 - (b) Temporarily install nose push-pull tube (6).
 - (c) Retract landing gear electrically.
 - (d) Check the uplock tension at the nose gear door actuator arm, as illustrated in Figure 8. The force required to move the connector link from its position against uplock torque tube must be 75 +10, -15 pounds.
 - (e) Shorten nose push-pull tube (6) in half-turn increments to increase uplock tension; lengthen to decrease.
 - (f) Operate landing gear to the DOWN position and check the downlock tension in the same manner. The force required to move the connector link from its position against the uplock torque tube must be 25 ± 10 pounds.

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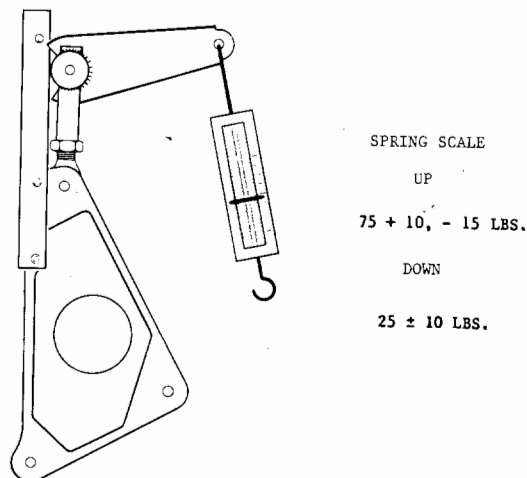
MAINTENANCE MANUAL

- (g) Lengthen fork bolt (7) in half-turn increments to increase downlock tension; shorten to decrease. DO NOT adjust nose push-pull tube (6).

NOTE: Detail "A" illustrates the principle for adjusting the uplock and downlock tension. Adjust length of nose push-pull tube for uplock tension and the length of the fork bolt for downlock tension.

- (h) Operate landing gear to the UP position and recheck the uplock tension. If necessary, readjust nose push-pull tube (6) in accordance with step e.

NOTE: Since the combined length of fork bolt (7) and nose push-pull tube (6) determines the down-lock tension, this combined length must remain unchanged. When changing the length of the nose push-pull tube to obtain the correct uplock tension, change the length of the fork bolt to a corresponding amount in the direction that will not change their combined length.



10801005

Nose Gear Tension Requirements
Figure 8

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- (4) Adjust the uplock hook as follows:
- (a) With landing gear in the UP position, check the clearance between uplock hook and the spacer on the strut with which the hook engages.

NOTE: An access cover is provided in the top of the nose gear wheel well to check uplock hooks in the gear UP position with doors closed.

- (b) Adjust uplock hook to obtain a minimum clearance of 0.003 to 0.060 inch and a maximum clearance of 0.06 inch at the closest point, which should be at the underside of the spacer near the fully engaged position of the hook.

NOTE: For adjustment of uplock hook, elongated holes are provided in the supports to which the hook is attached.

- (c) Operate landing gear several times to observe the uplock hook. The hook must engage and disengage freely, with no indication of binding between the hook and the spacer.
- (5) Connect downlock assist spring (14) (See figure 1, 4-53) and cycle landing gear. The spring must cause no interference with gear operation.
- (6) Connect door link tubes with bolts and nuts and rig nose gear doors in accordance with Nose Gear Door Rigging Procedures.
- (7) Connect main wheel well door link tubes with washer and nut. Rig doors in accordance with Main Gear Landing Doors Rigging Procedure.
- (8) Reinstall floorboards, seats, carpet and access covers. Insure that landing gear is DOWN and locked, then remove jacks.

D. Adjustment of Landing Gear Safety Switch (See Figure 9).

NOTE: The landing gear safety switch is located on the aft side of the left main gear and is actuated by the upper torque link.

- (1) Jack aircraft. Refer to Chapter 1.
- (2) Place landing gear switch in the DOWN position.
- (3) Insure that battery switch is OFF.
- (4) Adjust the landing gear safety switch to operate on the centerline of the stop plate.

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- (5) Place jack under axle and raise strut to 0.75, + 0.75, - 0.12 from full extended position. Cut safety wire and adjust the switch to actuate at this position.

NOTE: To ensure switch is actuating at position described above, refer to Chapter 13 and make a continuity check.

- (6) Tighten jam nuts at safety switch and safety wire nuts.
- (7) Remove jack from under axle.
- (8) Conduct operational check of landing gear system.

Inspection/Check

1. Inspection/Check Landing Gear System.

- A. Inspect landing gear system for proper operation, security of all nuts and installation of cotter pins where required.

NOTE: For landing gear rigging inspection, refer to CHAPTER 2.

2. Operational Check Landing Gear Actuator.

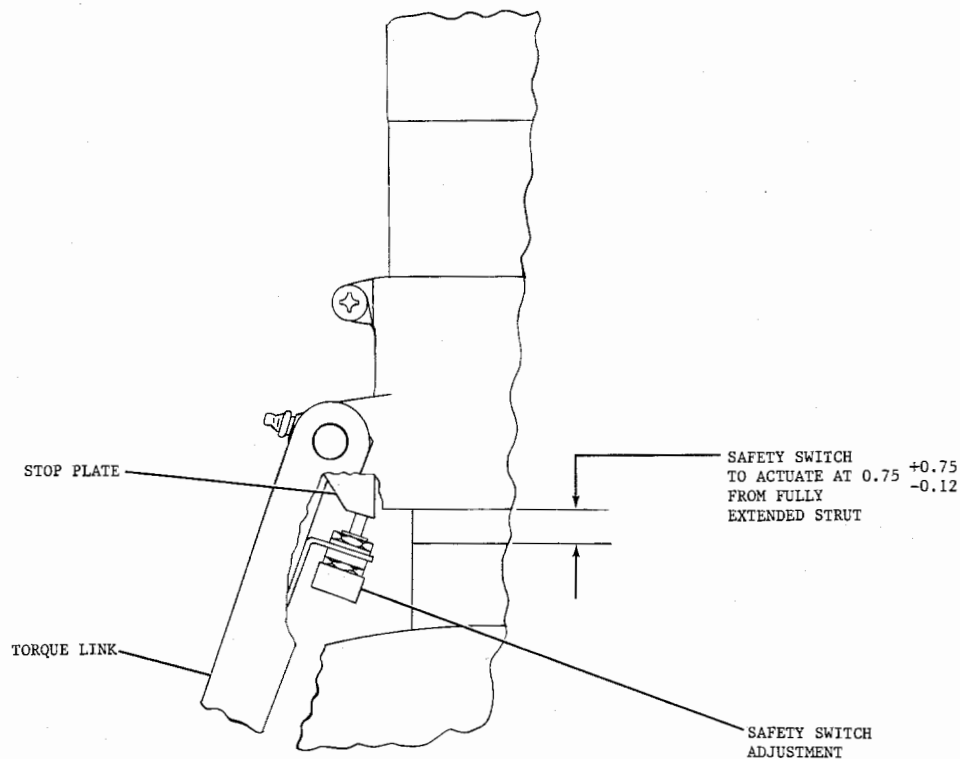
- (1) Check landing gear actuator for proper operating times as follows:
 - (a) Flight check for excessive noise and for free, proper operation.

NOTE: Use maximum airspeeds placarded in aircraft for extension and retraction tests.

- (b) Flight check time for full retraction "UP," amber light on 10 to 14 seconds. Time for full extension "DOWN," green lights on 5 to 9 seconds.
- (c) If during flight check, the landing gear will not retract and extend within the time limit described in step (b), remove the landing gear motor and perform the following no load test:
 - 1) Mount motor securely in a horizontal position.
 - 2) Connect motor as shown in Figure 10 to a variable 30 volt, DC power supply
 - 3) Connect switch S3 for either direction.
 - 4) Open switch S2 to read ammeter.

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Adjustment of Landing Gear Safety Switch
Figure 9

- 5) Close switch S1 to start motor.
- 6) Gradually increase voltage from zero until the brake releases.

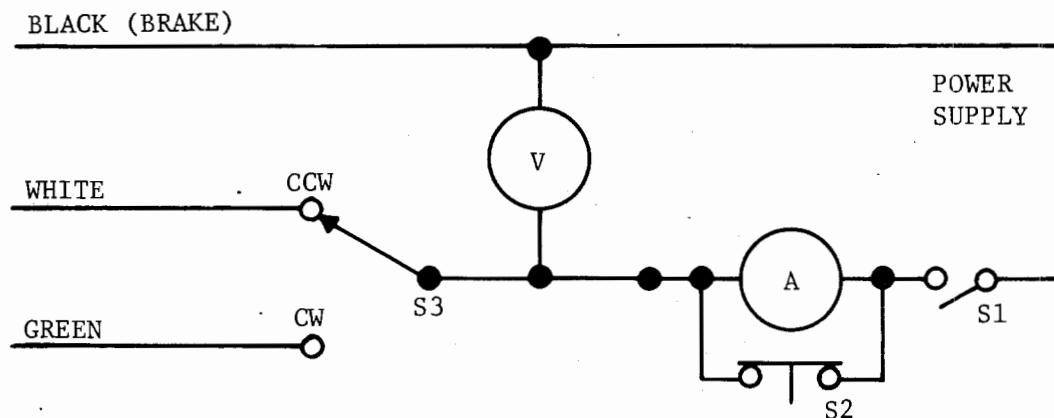
NOTE: The brake releasing may be indicated either by sound or the armature starting to turn.

- 7) Read voltmeter when brake releases. Brake must release at or less than 18 volts.
- 8) Stop motor, close switch S3 for opposite rotation and repeat steps 3) thru 7).
- 9) Voltage must be within the same limits as previous rotation.
- 10) If the voltage is not within the limits as described in step 7), refer to Troubleshooting the Landing Gear Actuator Motor.
- 11) Run motor in each direction as shown connected in Figure 10 with 24 volts DC applied.

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- 12) Open switch S2 and read ammeter current. The ammeter should read approximately 7.5 amperes under no load, when the RPM is approximately 4000 RPM.
 - 13) Stop motor, close switch S3 for opposite rotation and repeat step 12).
 - 14) Motor should operate within limits as described in step 12).
 - 15) If the motor does not operate within the limits as described in step 12), refer to Troubleshooting the Landing Gear Actuator Motor.
- (d) If the motor will not meet operating requirements, after performing no load check, replace motor and repeat step (b).
 - (e) If the gear still will not meet flight check requirements, check all linkage and hinge points for binding or interference.
 - (f) If no evidence of binding or interference is found, landing gear actuator must be replaced or overhauled in accordance with Cessna Landing Gear and Flap System Components Overhaul/Parts Manual.



V = VOLTMETER, DC, 7.5/30/75, TYPE DP-11,
NO. 50-202011 RCPF

A = AMMETER, DC, 5/20/50, TYPE DP-11,
NO. 50-202111 RXPS

S1 = SWITCH, SPST 30 AMPERE CAPACITY,
NO. 707

S2 = SWITCH - PUSH BUTTON NO. CR2940-UA202B

S3 = SWITCH, DPDT NO. 2565K5

10987011

Schematic Test Connection Diagram
Figure 10

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MAINTENANCE MANUAL

LANDING GEAR ACTUATORDescription

1. The landing gear actuator consists of an electric motor, reduction unit and a worm and sector gear assembly. The actuator is normally operated by the electric motor, however, linkage is provided to disengage the motor driven reduction unit and engage a manual extension system. A bellcrank to operate main landing gear drive tubes is attached to the upper end of a sector shaft, which extends vertically through the actuator assembly and a bellcrank to operate the nose gear drive tube is attached to the lower end of the sector shaft. Adjustable limit switches are provided to obtain correct landing gear travel. The actuator motor incorporates a brake to prevent coasting and overtravel of the landing gear.

Troubleshooting

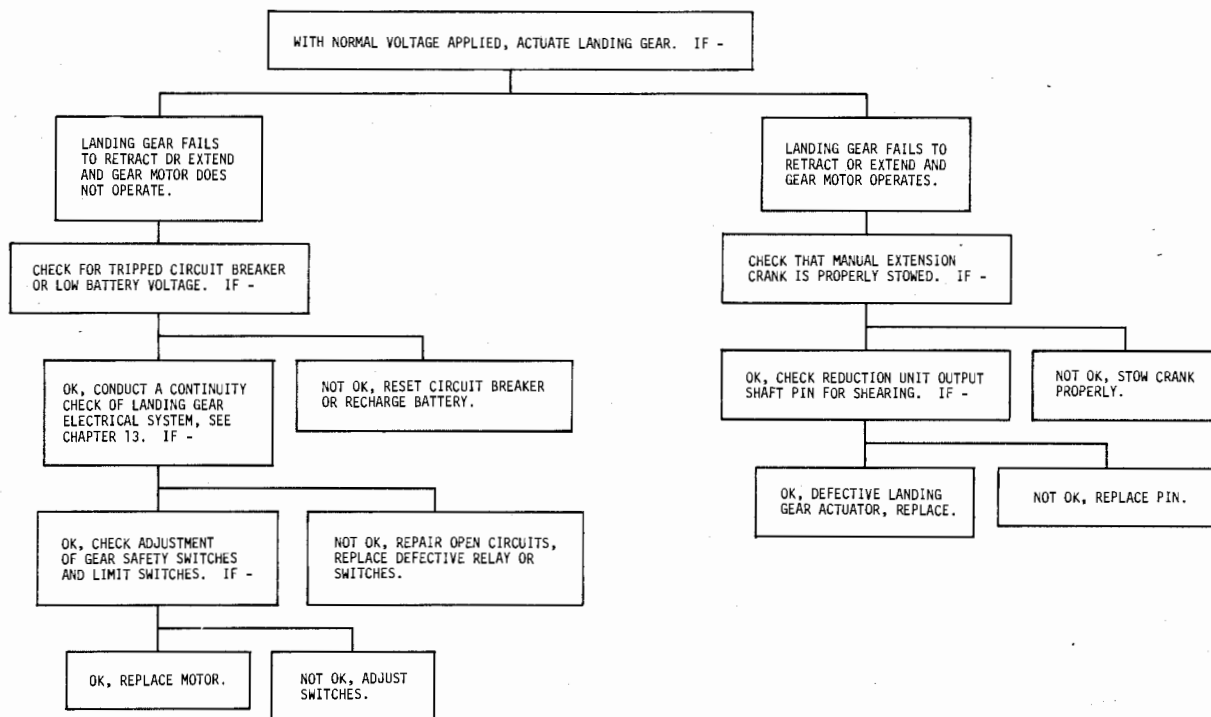
1. Troubleshooting Landing Gear Actuator
 - A. For a guide to troubleshooting the landing gear actuator, see Figure 1.

Maintenance Practices

1. Removal/Installation of Landing Gear Actuator (See Figure 2).
 - A. Remove landing gear actuator.
 - (1) Remove inboard drive tubes (8 and 5) in accordance with removal procedures for inboard retraction linkage components.
 - (2) Remove lower bellcrank (21) and pulley (18) as a unit from sector shaft; leave step cable and aft nose gear drive tube (17) connected.
 - (3) Disconnect manual extension disengage rod (12) by removing cotter pin and pin.
 - (4) Disconnect manual extension drive tubes by removing three cotter pins, washers and pins. To disconnect, slide universal joint (16) aft and inner shaft (15) forward.
 - (5) Remove safety wire from all bolts which must be removed.
 - (6) Remove four bolts and washer attaching reduction unit (2) and actuator assembly (11) to bulkhead (3).

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MAINTENANCE MANUAL



10987007

Troubleshooting Chart - Landing Gear Actuator
Figure 1

NOTE: To remove reduction unit (2) or motor (1) from aircraft, remove four bolts. When removing motor, disconnect and tag electrical wires at the relays to ensure proper reinstallation.

- (7) Remove four nuts, washers and bolts attaching switches (10 and 24) and brackets to actuator assembly (11). Do not disturb switch settings except to replace switches or brackets.
- (8) Remove bolts and washers attaching actuator assembly (11) to support (13).
- (9) Remove remaining bolt, washer and spacer (4) and remove actuator from aircraft.

B. Install actuator assembly.

- (1) Position actuator assembly (11) being sure that lower bellcrank (21) and pulley (18) is positioned so as not to cause damage to lower skin. Install spacer (23) and lower bellcrank (21) on lower end of

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MAINTENANCE MANUAL

sector shaft. Universal joint (16 and inner shaft (15) must be in place before positioning actuator.

NOTE: Support entrance step in retracted position to facilitate installation of lower bellcrank and pulley. When installing lower bellcrank, align the index punch mark on the bellcrank with the chamfered spline on the sector.

- (2) Install spacer (4), washer and bolt attaching actuator to bulkhead (3).

NOTE: To facilitate installation, install all actuator assembly attaching bolts before any are tightened.

- (3) Install two bolts and washers attaching actuator assembly (11) to support (13).
- (4) Install switches (10 and 24) and brackets to actuator assembly (11) with bolts, nuts and washers.
- (5) Install bolts, washers and nuts attaching actuator assembly to mounting channels.
- (6) Install four bolts and washers attaching actuator assembly (11) and reduction unit (2) to bulkhead (3).

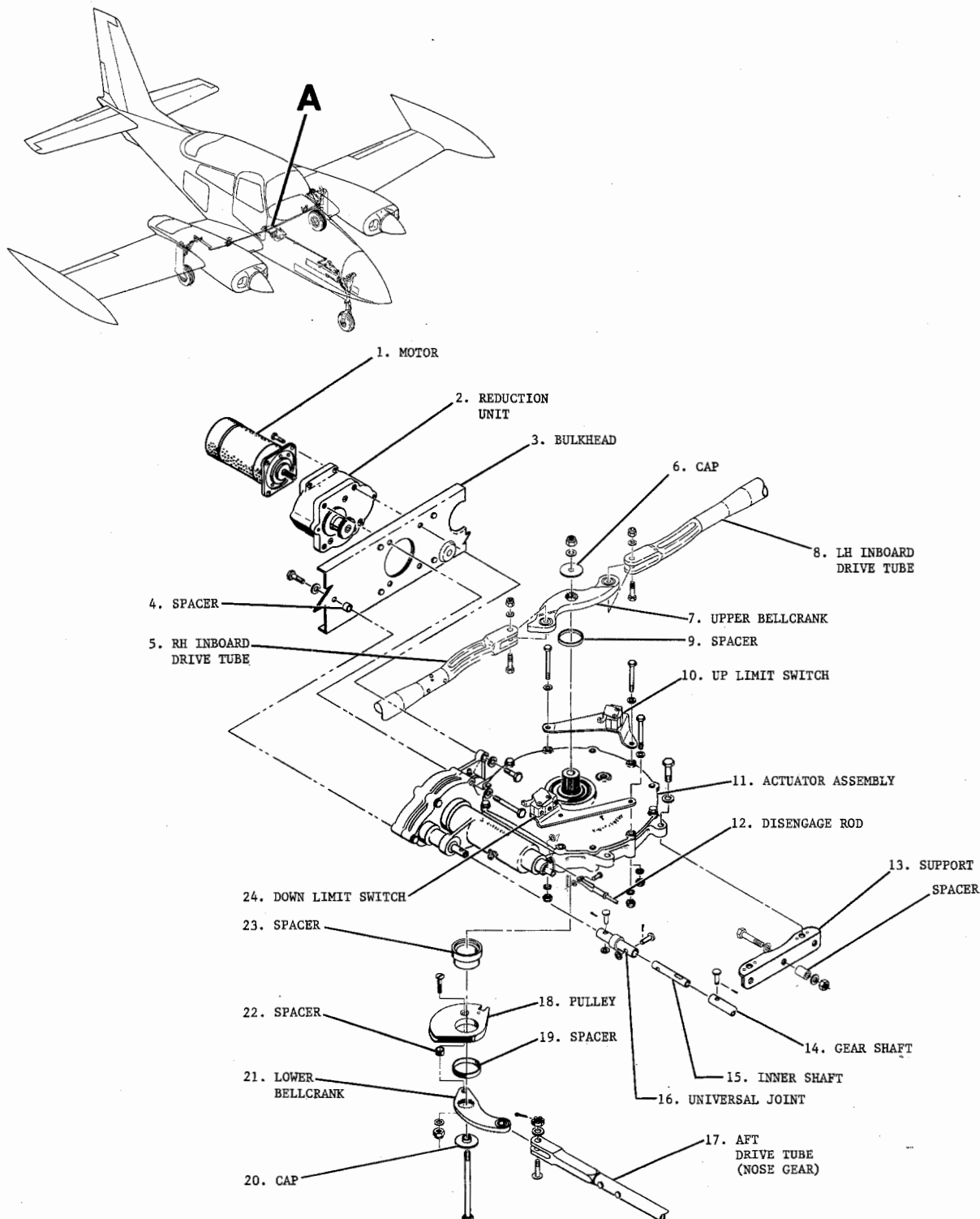
NOTE: Shim as required between reduction unit (2) and bulkhead (3) to align reduction unit gear with the drive gear in the actuator.

CAUTION: USE OF BOLTS OF IMPROPER LENGTH MAY CAUSE DAMAGE OR BINDING.

- (7) If removed, install four bolts attaching motor (1) to reduction unit (2).
- (8) If motor was removed, connect the electrical wires to the relay as previously marked.
- (9) Tighten all nuts and bolts which were installed but not tightened.
- (10) Safety wire bolts attaching motor (1) to reduction unit.
- (11) Safety wire bolts attaching actuator to bulkhead.
- (12) Connect manual extension drive tubes with pins and cotter pins.
- (13) Connect manual extension disengage rod (12) with pin and cotter pin.
- (14) Insert LH inboard drive tube (8) through opening in fuselage skin until upper bellcrank (7) is in position to be installed on sector shaft with the threads of attaching bolts are in the UP position.

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MAINTENANCE MANUAL



DETAIL A

Landing Gear Actuator
Figure 2

10403001
A10413003

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MAINTENANCE MANUAL

NOTE: If inboard drive tubes were disconnected from upper bellcrank, ensure that bow in end fittings is properly positioned.

- (15) Place spacer (9) and upper bellcrank (7) on sector shaft.

NOTE: When installing upper or lower bellcrank, align index punch mark on bellcrank with chamfered spline on the sector shaft.

- (16) Insure that lower bellcrank (21) and spacer (19) are correctly placed and secure with bolt, caps (6 and 20), washer and nut.
- (17) Connect RH inboard drive tube to idler with bolt, washers, spacers and nuts.
- (18) Connect LH inboard drive tube to idler bellcrank with bolt, washer and nut.

CABIN STEP SYSTEMDescription

1. During retraction of the landing gear, a cable connected to the landing gear actuator retracts the cabin step into a well provided for it in the bottom right side of the fuselage. During extension of the landing gear, spring tension forces the step to extend. Extension and retraction are simultaneous with the landing gear operation.

Troubleshooting

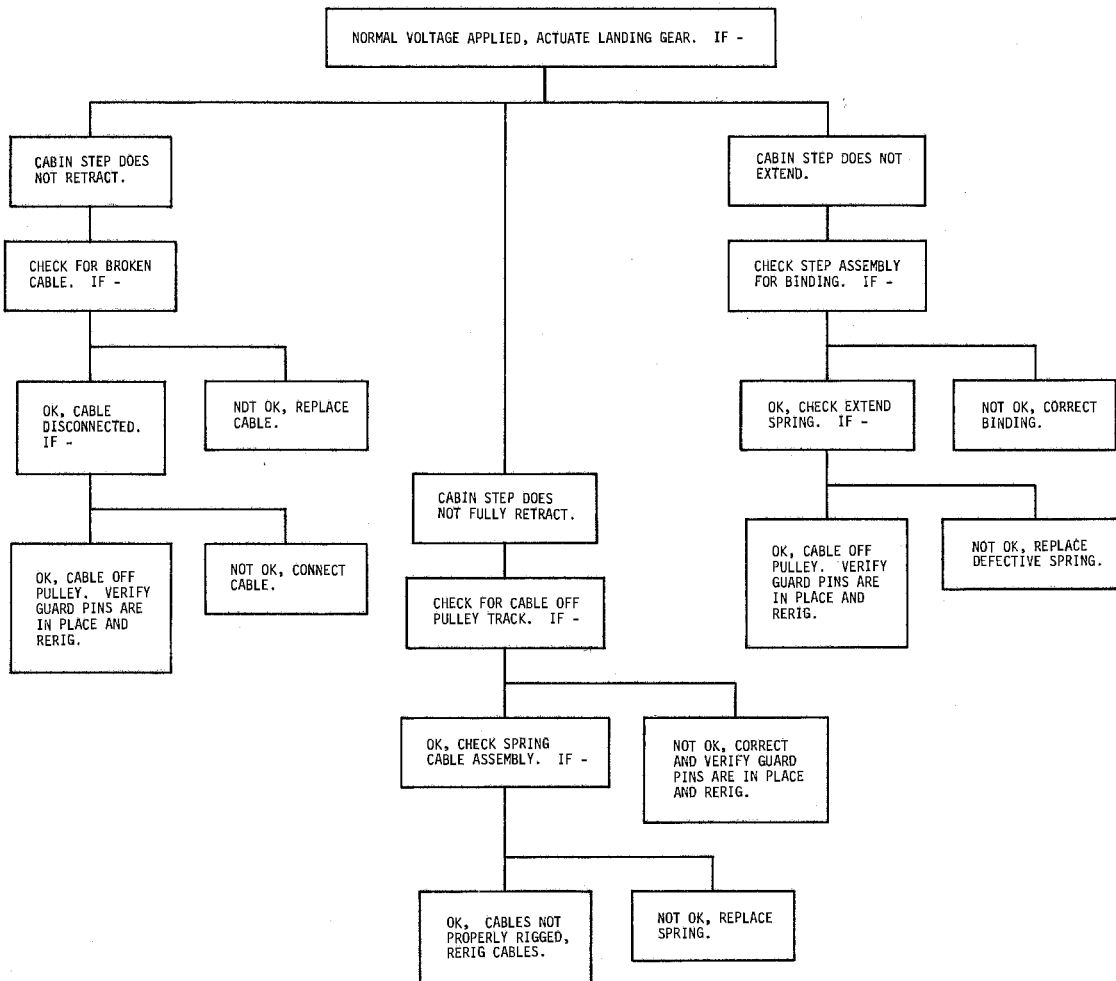
1. Troubleshooting Cabin Step System
 - A. For a guide to troubleshooting the cabin step system see Figure 1.

Adjustment/Test

1. Rigging Cabin Step System (see Figure 2).
 - A. Jack aircraft.
 - B. Raise the cabin step assembly into the step well by hand to ensure there are no binding or obstructions and that cables will not leave the pulley tracks.
 - C. Adjust turnbuckle (2) until step assembly starts to leave the step stop when in down position.
 - D. Retract landing gear using normal retraction system.
 - E. Note that cabin step retracts fully into the step well. If step does not fully retract, refer to Troubleshooting Cabin Step System.
 - F. Safety wire turnbuckle.
 - G. Insure that landing gear is DOWN and remove jacks.

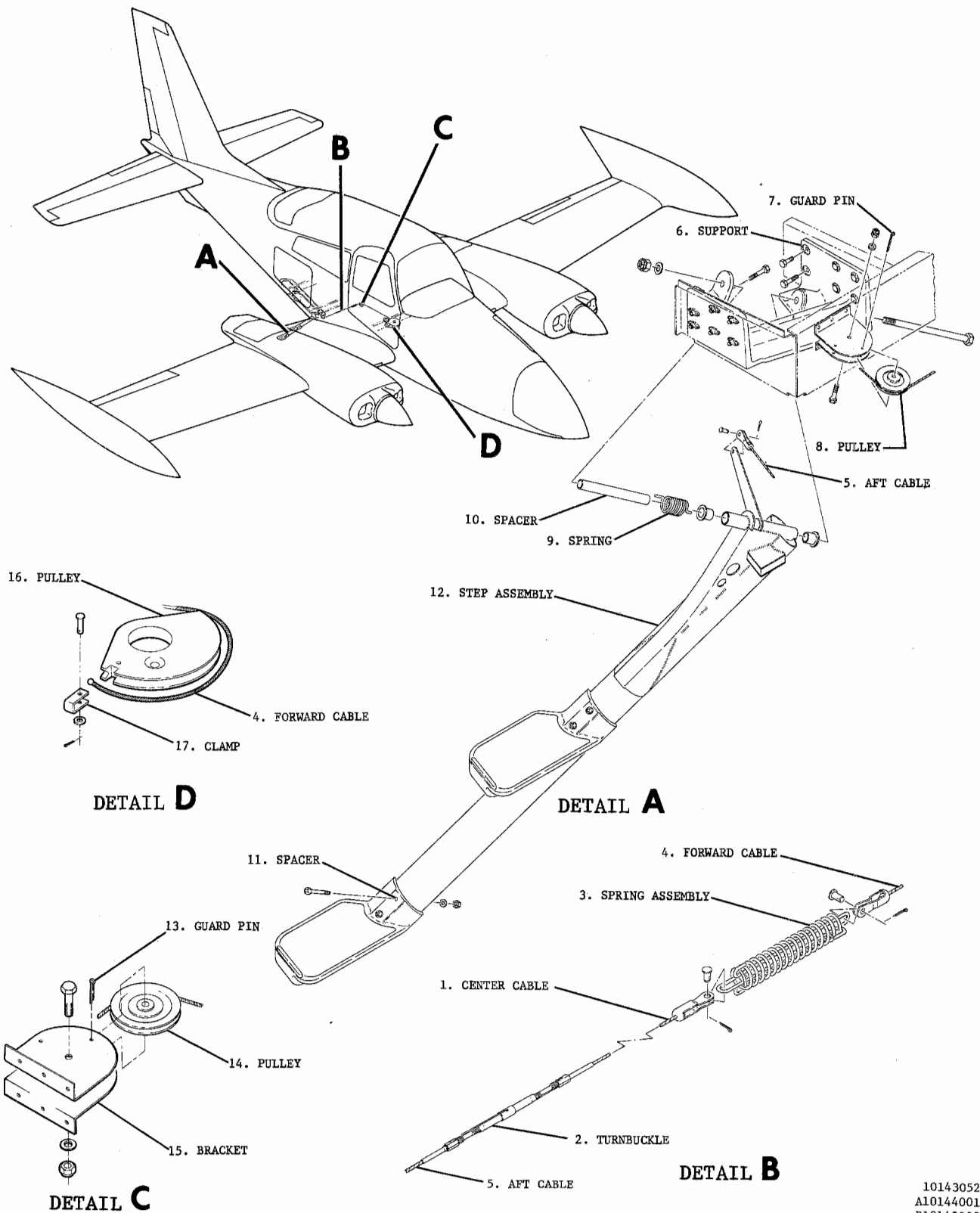
Maintenance Practices

1. Removal/Installation Cabin Step System (See Figure 2).
 - A. Remove cabin step system.
 - (1) Remove seats, carpet, floorboards and access covers as required to gain access to step, step cable and landing gear actuator.
 - (2) Disconnect cables at turnbuckle (2).
 - (3) Disconnect cable (4) from spring assembly (3) by removing cotter pins and pins.



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Troubleshooting Chart - Cabin Step System
Figure 1



Cabin Step System
Figure 2

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B10142028
C10142017
D10142017

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MAINTENANCE MANUAL

- (4) Remove cable (4) from pulley (16) by removing cotter pin, washer, pin and clamp (17). Remove cable from aircraft.
- (5) Disconnect cable (5) from step assembly (12) by removing cotter pin and pin. Remove cable from aircraft.
- (6) Remove cabin step assembly from aircraft, being careful to disengage spring (9) from step support (6) when bolt, nut and washer are removed.
- (7) Step assembly (12) may be disassembled further by removing each step from step assembly. Retain spacer (11) in place to facilitate reassembly.
- (8) For removal of pulley (16) from landing gear actuator refer to Removal of Landing Gear Actuator.

B. Install Cabin Step System.

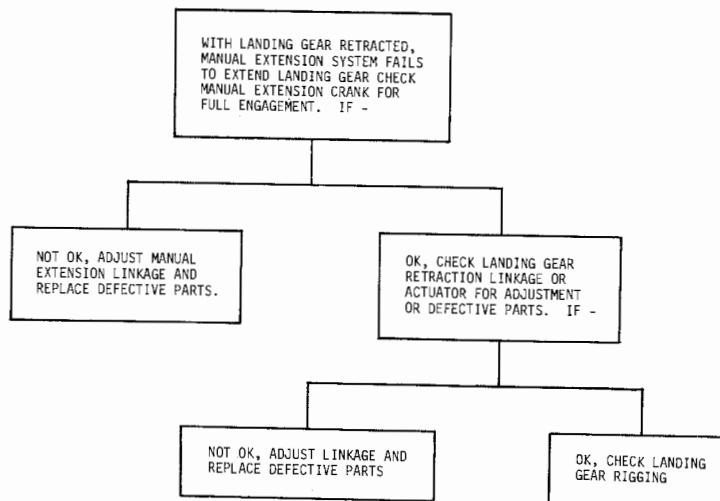
- (1) If step assembly (12) was disassembled, assemble steps in accordance with Figure 1. Make sure spacers (11) are in place before installing attaching screws.
- (2) Install step assembly with spacer (11) and spring (9) in place and secure with bolt, washer and nut. During installation, spring (9) must be coiled to preload 160°.
- (3) Route forward cable (4) around pulley (14) and pulley (16). Secure ball end of cable to pulley (16) with clamp (17), pin, washer and cotter pin.
- (4) Secure aft cable (5) to step assembly (12) with pin and cotter pin. Route cable over pulley (8) and connect aft cable, center cable and spring assembly to forward cable (4) with turnbuckle (2).
- (5) Install guard pins at pulleys (8 and 14) to ensure that cables will not leave pulley track.
- (6) Rig cabin step system, refer to Adjustment/Test.
- (7) Install access covers, floorboards, carpet and seats.

MANUAL EXTENSION SYSTEMDescription

1. The manual extension system consists of a hand crank, which is connected to the landing gear actuator by an arrangement of chain and sprockets, bellcrank, miter gears, and push-pull rods. The hand crank located at the right of the pilot's seat is normally in a stowed position. When unfolded into its operation position the hand crank disengages the normal landing gear operating system, and allows the gear to be operated manually. A release button is provided to unlock the hand crank so that it may be folded and stowed.

Troubleshooting

1. Troubleshooting Manual Extension System
 - A. For a guide to troubleshooting the manual extension system, refer to Figure 1.



10987003

Troubleshooting Chart - Manual Extension System
Figure 1

Adjustment/Test

1. Rig Manual Extension System (see Figure 2).
 - A. Place hand crank in operating position.
 - B. Adjust lower rod assembly (18) to a length of approximately 4.80 inches, measured between the center lines of rod end bolt holes, and install.
 - C. Pull lower rod assembly forward until internal gear in landing gear actuator reaches the end of its travel, and adjust upper rod assembly (16) so that rod end bolt holes align with holes in upper and lower bellcranks (15 and 17).
 - D. Lengthen upper rod assembly (16) one-half turn and install.

NOTE: If the upper rod assembly adjustment cannot be obtained because of excessive amount of threads would be exposed, readjust lower rod assembly to obtain the desired result and repeat steps (3) and (4).

- E. Adjust chain tightener (11) to remove excessive slack from chain (12).
- F. Perform operational check of manual extension system to verify system functions properly.

CAUTION: DO NOT USE THE MANUAL EXTENSION SYSTEM TO FULLY RETRACT THE LANDING GEAR, EXCEPT WHEN MANUALLY PUSHING UPWARD ON ALL LANDING GEAR TO RELIEVE STRAIN ON MANUAL EXTENSION SYSTEM.

Maintenance Practices

1. Removal/Installation Manual Extension System (See Figure 2).
 - A. Remove Manual Extension System.
 - (1) Remove pilot and passenger seat and center carpet in accordance with Chapter 12.
 - (2) Remove floorboards between front and rear spar, above landing gear actuator.
 - (3) Remove chain guards by removing attaching screws.
 - (4) Remove chain (12) by disconnecting at the master link.
 - (5) Remove crank handle and shaft assembly as follows:
 - (a) Remove roll pin, collar (1) and washer (2) from shaft (6).
 - (b) Remove cotter pin and pin attaching spool (4) to shaft (6).

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MAINTENANCE MANUAL

- (c) Pull crank handle and shaft from supports, removing spool (4) as shaft is pulled through it.
- (6) If desired, disassemble crank handle and shaft by removing nut, bolt, cotter pins and pins.
- (7) Remove upper rod assembly (16) by removing cotter pins, washers and pins attaching rod assembly to bellcranks (15 and 17).
- (8) Remove upper bellcrank (15) by removing nut, washers and bolt. Remove bushing (14) from bellcrank.
- (9) Remove lower rod assembly (18) by removing cotter pins, washer and pins attaching rod assembly to lower bellcrank and landing gear actuator.
- (10) Remove lower bellcrank (17) by removing nut, washer, spacer and bolt.
- (11) Remove chain tightener (11) by removing attaching screw and washer, and adjusting screw, washers and nut.
- (12) Remove gear support bracket (21) as follows:
 - (a) Disconnect shafts (27 and 28) and universal joint (29) by removing the three cotter pins, washers and pins.
 - (b) Slide universal joint (29) aft and inner shaft (28) forward to disconnect.
 - (c) Remove two bolts and nuts attaching gear support bracket to front spar.
 - (d) Remove two screws, washers and nuts attaching gear support bracket to bottom of fuselage.
- (13) If desired, disassemble gear support bracket as follows:
 - (a) Remove three roll pins attaching sprocket (23) and gears (24 and 26) to gear shafts (22 and 27).
 - (b) Remove snap ring (25) from gear shaft (22).
 - (c) Remove gear shaft (22) through the left side of the bracket, removing sprocket (23) and gear (24) as shaft is removed.
 - (d) Remove gear (26) and shaft (27) from gear support bracket.

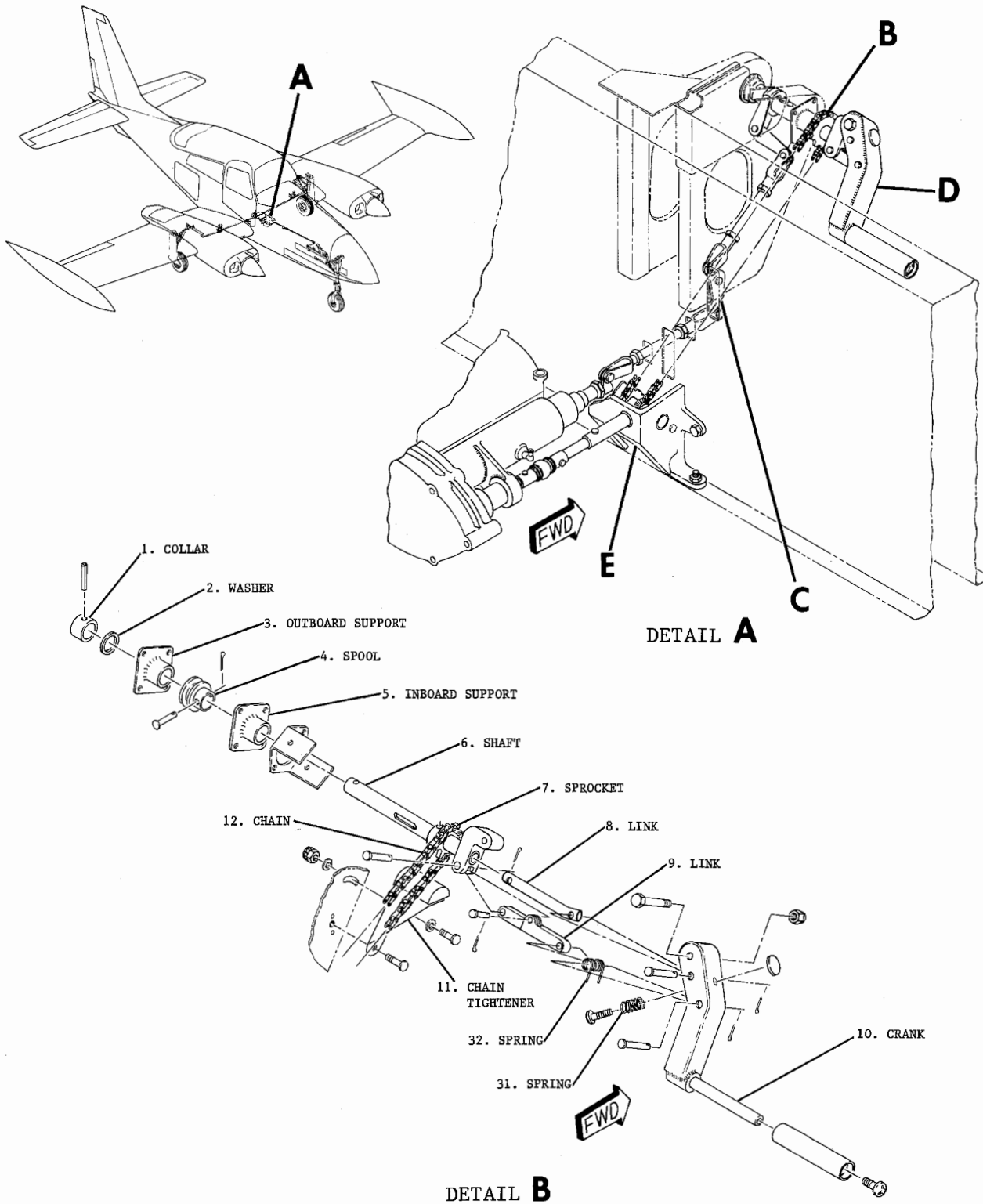
NOTE: The bearings in which the gear shafts rotate are a press fit and should be removed only for replacement.

B. Install Manual Extension System.

- (1) If disassembled, assemble gear support bracket (21) as follows:
 - (a) If removed, press bearings into gear support bracket.

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MAINTENANCE MANUAL

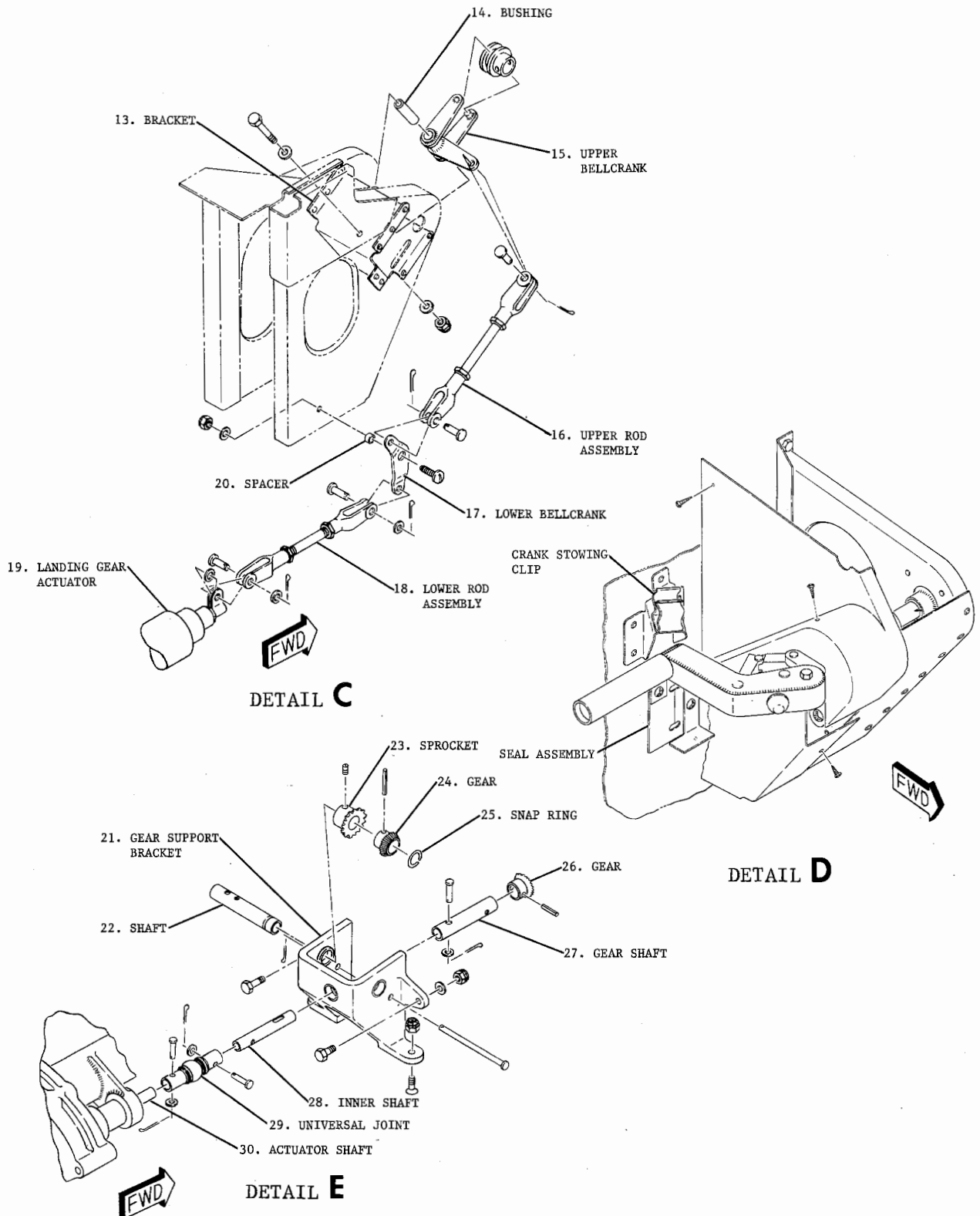


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 A10403003
 B10402001

Manual Extension System
 Figure 2 (Sheet 1 of 2)

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MAINTENANCE MANUAL



Manual Extension System
Figure 2 (Sheet 2)

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D10403004
E10401001

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MAINTENANCE MANUAL

- (b) Assemble gear (26) to shaft (27) with attaching roll pin, and insert into position in gear support bracket.
- (c) Insert shaft (22) through the left side of gear support bracket, through sprocket (23) and gear (24). Install two roll pins attaching sprocket and gear to shaft, and safety all three roll pins.
- (d) Install snap ring (25) on gear shaft (22).
- (2) Install gear support bracket (21) as follows:
 - (a) Place universal joint (29) on actuator shaft (30) and slide aft.
 - (b) Insert inner shaft (28) into gear shaft (27) and slide forward.
 - (c) Position gear support bracket in aircraft and attach to fuselage bottom with two screws, washers and nuts.
 - (d) Install two bolts and nuts attaching gear support bracket to front spar.
 - (e) Align the holes in the shafts connecting miter gear assembly to landing gear actuator, and install pins, washers and cotter pins.

NOTE: AN3-6A bolts, AN960L washers and MS20364428C nuts may be installed in lieu of pins.

- (3) Install chain tightener (11) with attaching screw and washer. Install adjusting screw, washers and nut, but do not tighten at this time.
- (4) Install lower bellcrank (17) with bolt, spacer (20), washer and nut.
- (5) Insert bushing (14) into upper bellcrank (15) and install bellcrank with bolt, washers and nut.
- (6) If disassembled, reassemble crank handle and shaft with pins, cotter pins, nut and bolt.
- (7) Install crank handle and shaft assembly as follows:
 - (a) Insert crank handle and shaft through inboard support (5), spool (4), and outboard support (3).
 - (b) Engage upper bellcrank (15) with spool (4), align spool attaching holes, and install pin and cotter pin.
 - (c) Place washer (2) and collar (1) on shaft (6), install roll pin and safety.

NOTE: Washer (2) is used as required to eliminate end play from the shaft assembly.

- (8) Install chain (12) on sprockets (7 and 23) and connect with master link. Adjust chain tightener (11), and tighten adjusting screw and nut.
- (9) Attach lower rod assembly (18) to lower bellcrank (17) and landing gear actuator (19) with pins, washers and cotter pins.
- (10) Attach upper rod assembly (16) to bellcranks (15 and 17) with pins, washers and cotter pins.
- (11) Install chain guards with attaching screws.
- (12) Install access covers on cabin floor above landing gear actuator.
- (13) Install center carpet and pilot's seat in accordance with Chapter 12.

2. Emergency Manual Extension System Operational Check

A. Operational Check

NOTE: This check must be accomplished during flight.

- (1) Place the landing gear actuator switch in OFF position.
- (2) Manually extend the landing gear, counting the number of turns required to illuminate the green lights. Forty-seven to fifty-four turns are required to illuminate the lights.

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MAINTENANCE MANUAL

MAIN LANDING GEAR1. Description

- A. Each main landing gear consists of a lower piston assembly, cantilever axle, upper trunnion assembly and torque links. The air-oil shock-strut contains an orifice and tapered metering pin which varies the resistance to shock according to severity. During retraction and extension, the landing gear pivots on heavy-duty needle bearings by means of trunnion shafts attached to the upper trunnion assembly.

Troubleshooting

1. Troubleshooting Main Landing Gear

- A. For a guide to troubleshooting the main landing gear, refer to Figure 1.

Maintenance Practices

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items:

Name	Number	Manufacturer	Use
Ring Pack Support Tool	0880004-1	Cessna Aircraft Co. or locally manufactured (See Figure 2)	To insert ring pack support.
Reamer	FT 251	Cessna Aircraft Co. Wichita, Kansas	To line ream torque link bushings.
Hydraulic Fluid	MIL-H-5606	Commercially Available	To lubricate parts and fill strut.

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MAINTENANCE MANUAL

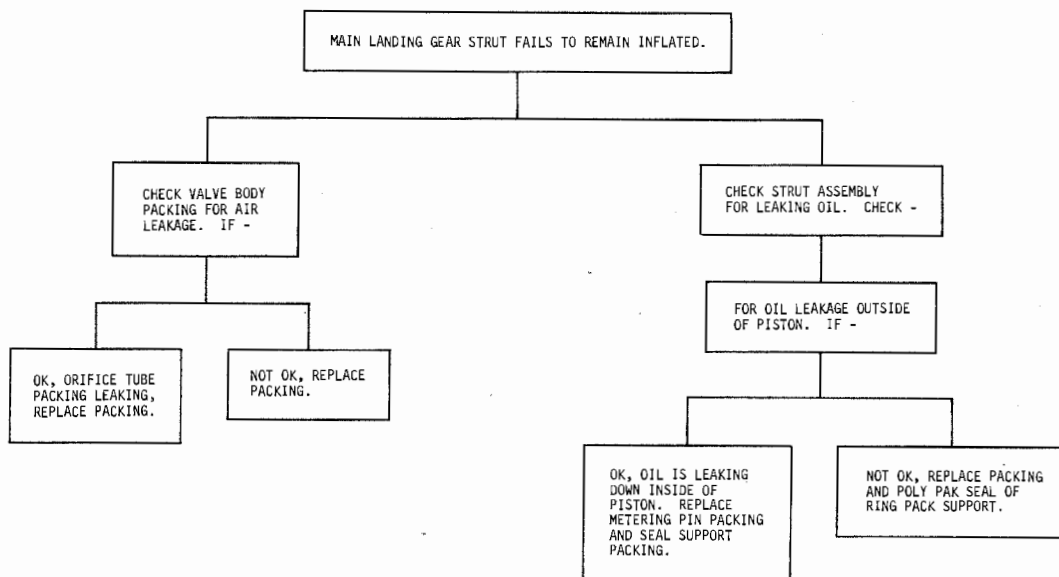
2. Removal/Installation Main Landing Gear (See Figure 3).

A. Remove Main Landing Gear.

- (1) Jack the aircraft. Refer to Chapter 1.
- (2) Remove wheel and tire assembly. (Refer to Removal of Main Wheels and Tires.)
- (3) Remove screws, clamps and spacers securing brake line (16) and wire bundle (17) to strut assembly.
- (4) Remove brake assembly from axle flange and leave suspended by a supporting safety wire or place on a box out of the immediate work area.

NOTE: Using the method outlined in step (4) it is not necessary to drain brake fluid and bleed brakes.

- (5) Remove safety switch (13) and tie so switch will not interfere with gear removal.
- (6) Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- (7) Disconnect door link (21) by removing nut and washer.



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Troubleshooting Chart - Main Landing Gear
Figure 1

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MAINTENANCE MANUAL

- (8) Disconnect drag link (12) from trunnion assembly (10) by removing nut (20) washers, spacers and bolt.
- (9) Disconnect bellcrank (9) from trunnion assembly (10) by removing nut, and bolt. Retain spacer in bellcrank (9). Break down lock of drag brace and bellcrank assembly and tie assemblies where they will not interfere with gear removal.
- (10) Remove pins (8) from trunnion assembly (10) and shaft (7) and insert an AN6 bolt or puller tool in shafts (7).

NOTE: Note the number and location of washers between bearing (6) and trunnion (10). These washers should be installed exactly as they were located before removal to insure proper alignment of side link assemblies.

- (11) Support the gear and pull attaching shafts (11). Remove gear from aircraft.

NOTE: Needle bearings (6) in which the attaching shafts pivot are a press fit and should be removed only for replacement. Bearings must be removed by driving them toward the wheel well.

B. Install Main Landing Gear.

- (1) If needle bearings (6) were removed, install as follows:
 - (a) Press needle bearings into landing gear supports. Bearings must seat against shoulders provided in supports.

NOTE: The attaching shafts (7) are a slip fit and should be lubricated with light oil to aid in the installation of the shafts.

- (2) Position gear in place and insert shafts (7) making sure washers, noted in step B, (10), are in place and pin holes in shaft (7) and trunnion assembly (10) are aligned.
- (3) Remove AN6 bolt used in removal of shafts and install pin (8). Safety wire pin by wiring through center of pin around trunnion.
- (4) Connect bellcrank (9) to trunnion assembly (10) with nut and washer. Make certain spacer is installed in bellcrank, noted in step B, (9).

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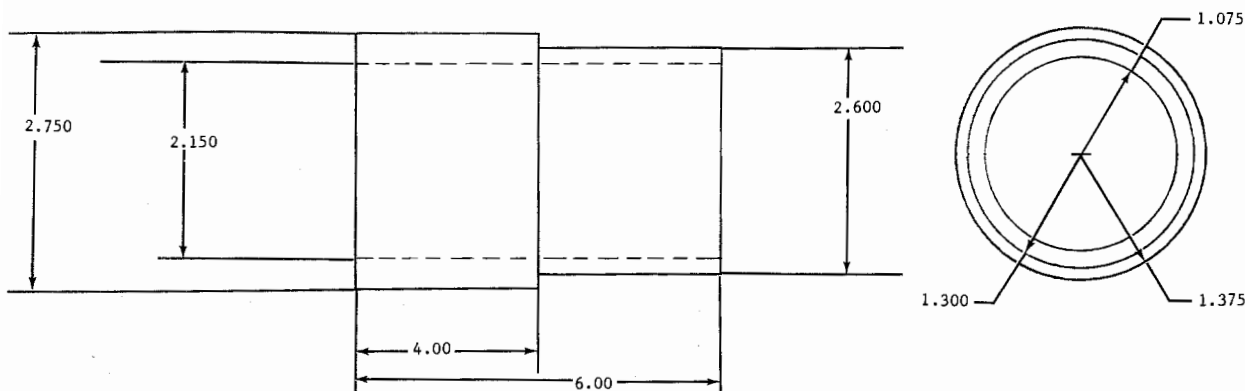
MAINTENANCE MANUAL

- (5) Connect drag link to trunnion assembly (10) with bolt washers, spacers (19) and nut (20). Torque nut (20) to 190 ± 5 in.-lbs.
- (6) Install safety switch (13).
- (7) Install brake assembly to axle flange. (See Installation of Main Wheel Brakes.)
- (8) Attach brake line (16) and wire bundle (17) to strut assembly with screws, spacers and nuts.
- (9) Install wheel and tire assembly. (Refer to Installation of Main Wheel and Tire Assembly.)
- (10) Check setting of safety switch (13).
- (11) Check alignment of main landing gear.

Disassembly/Assembly of Main Landing Gear (See Figure 4).

A. Disassemble Main Landing Gear.

- (1) Completely deflate strut. After air is expelled, remove valve body (1) and drain fluid.
- (2) Remove piston assembly (10) from trunnion assembly (32) and disassemble as follows:
 - (a) Disconnect torque links at apex by removing cotter pin, washer, clamp (16), spacer (18) and bolt.



- NOTES: 1. All dimensions are in inches.
 2. Material to be 4130 Type I steel.
 3. Finish inside bore to smooth finish.
 4. Cut cylinder on center line to form two halves.
 5. Wrap cylinder with mystic tape 5812 (Stock Code F840022) or equivalent. Cut tape on one side to permit halves to hinge open.
 6. Coat tool with light oil to prevent rust.

14801002

Landing Gear Ring Pack Support Tool
Figure 2

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MAINTENANCE MANUAL

WARNING: MAKE CERTAIN ALL AIR IS EXPELLED FROM STRUT ASSEMBLY BEFORE PROCEEDING TO THE NEXT STEP.

- (b) Remove internal lock ring (24), lock ring (25) scraper ring (26). Withdraw piston assembly against ring pack support (28) to remove ring pack support and piston from upper trunnion.

CAUTION: REMOVAL AND HANDLING OF THE LOWER PISTON ASSEMBLY SHOULD BE DONE WITH CARE TO PREVENT THE POSSIBILITY OF DAMAGE TO EXPOSED PARTS.

- (3) Remove external lock ring (31) from piston assembly (10) and remove inner bearing (30), extended stop spacer (29) and ring pack support (28).
- (4) Remove poly pak seal (23) from ring pack support.
- (5) Remove lower torque link (15) and spacer (12) by removing roll pin (14) and shaft (13).

NOTE: Lower piston and axle fitting is a press fit and drilled on assembly. Disassembly is not recommended.

- (6) If further disassembly of torque links is required, the bushings may be pressed out for replacement.
- (7) Remove upper torque link (15) and spacer (22) from trunnion assembly by removing roll pin and shaft.
- (8) Remove orifice tube assembly (4) from trunnion assembly by removing nut, washers and bolt and pull orifice tube straight out from the trunnion.
- (9) Press metering pin (5) and seal support assembly from piston assembly.

B. Assemble Main Landing Gear.

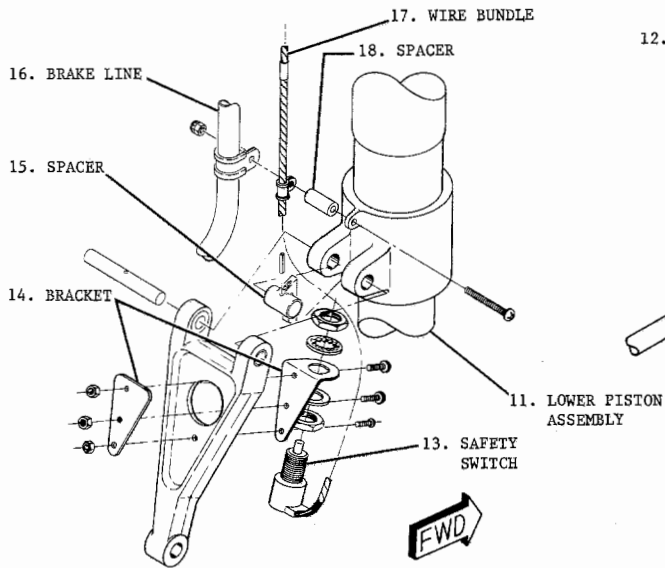
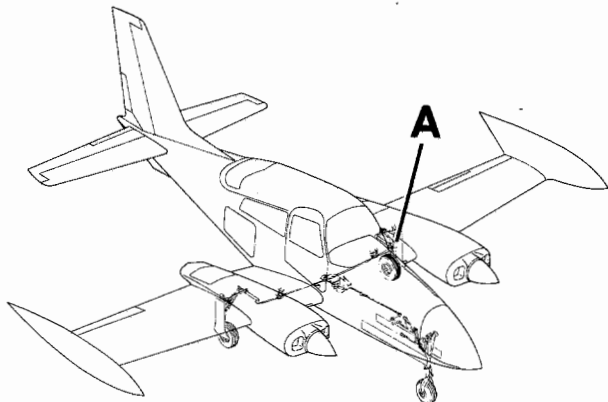
- (1) If bushings (11 and 19) were removed for replacement, install bushings as follows:

NOTE: Bushings (11 and 19) must be pressed in wet using (MIL-P-8585) zinc chromate primer or equivalent and lube fitting holes of bushings must align with torque link lube fitting holes.

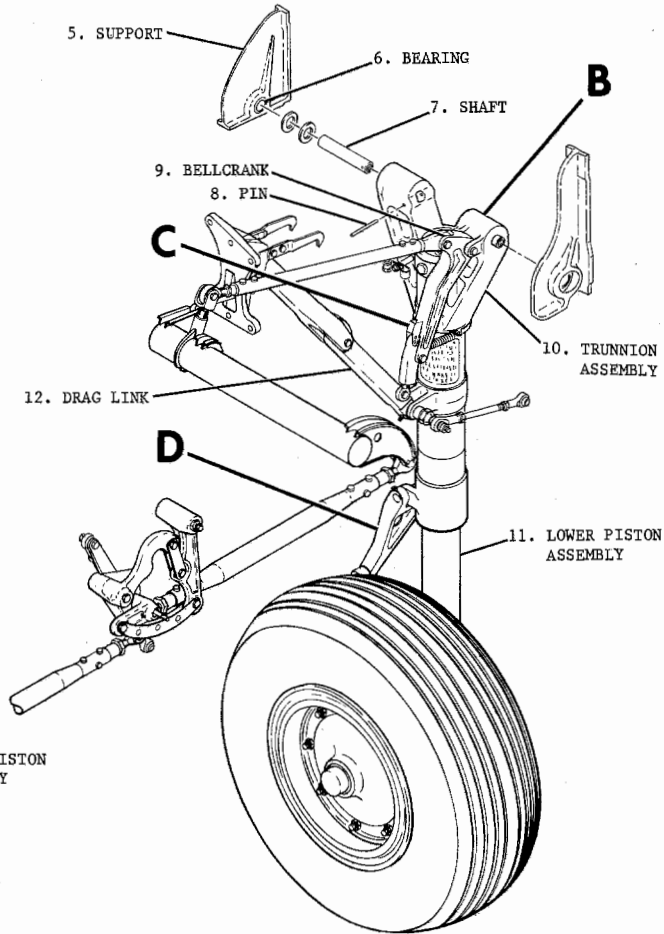
- (a) Press in bushings using a bench vice with necessary wood block and proper size arbor.
- (b) Mill and finish installed bushings flush with outside of torque link.

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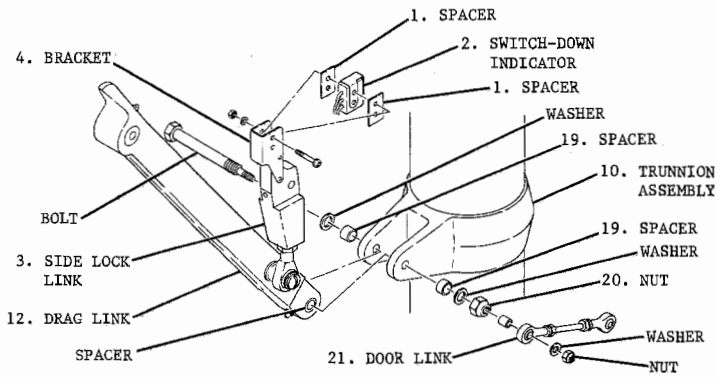
MAINTENANCE MANUAL



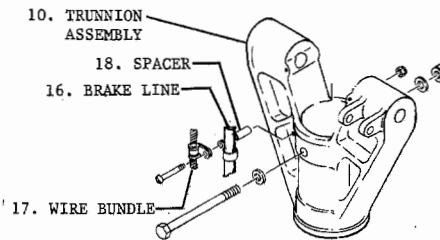
LH GEAR ONLY
DETAIL D



DETAIL A



DETAIL C



DETAIL B

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Main Landing Gear Installation
Figure 3

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MAINTENANCE MANUAL

- (c) Mill an equal amount on each bushing (11) using a flat mill file, to provide a slip fit between the lugs on the torque link and the lugs on the trunnion and or the lugs on the axle.
- (2) Assemble lower torque link (15) and spacer (12) to piston assembly (10) with shaft (13). Secure shaft in place with roll pin (14) through shaft and spacer. Safety wire roll pin with wire through center of roll pin and around shaft.

NOTE: Stop plate on spacers (12 and 22) must be positioned toward landing gear piston assembly.

- (3) Carefully work packing (6) over the threads of metering pin (5) and install on seal support (7) with nut (7). Install packing (8) in groove on outside of seal support (7).

NOTE: Lubricate packings, seals and mating parts liberally with clean MIL-H-5606 hydraulic fluid before installation and assembly.

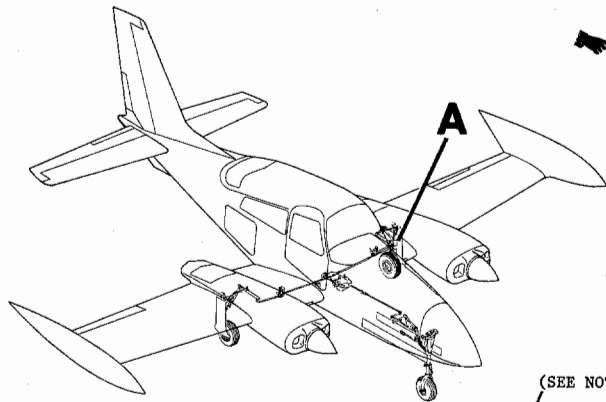
- (4) Press metering pin (5) and seal support (7) assembly into piston assembly (10). Make certain the seal support is completely seated.
- (5) Assemble upper torque link (20) and spacer (22) to trunnion assembly (32) with shaft. Secure shaft in place with roll pin through shaft and spacer. Safety wire roll pin with wire through center of pin and around shaft.
- (6) Carefully work packing (3) into groove in orifice tube (4) and insert into trunnion assembly (32) taking care to align holes.
- (7) Align holes and install bolt, washers and nut.
- (8) Slide internal lock ring (24), lock ring (25) and spacer ring (26) on piston assembly (10).
- (9) Install poly-pak seal (23) on inside of ring pack support (28), work packing (27) over outside into groove on ring pack support and slide ring pack support assembly on piston assembly (10).

CAUTION: INSTALL POLYPAK SEAL WITH WIDE LIP UP (TOWARD PRESSURE SIDE).

- (10) Install spacer (29) on piston assembly.
- (11) Install inner bearing (30) on piston assembly and secure with external lock ring (31).

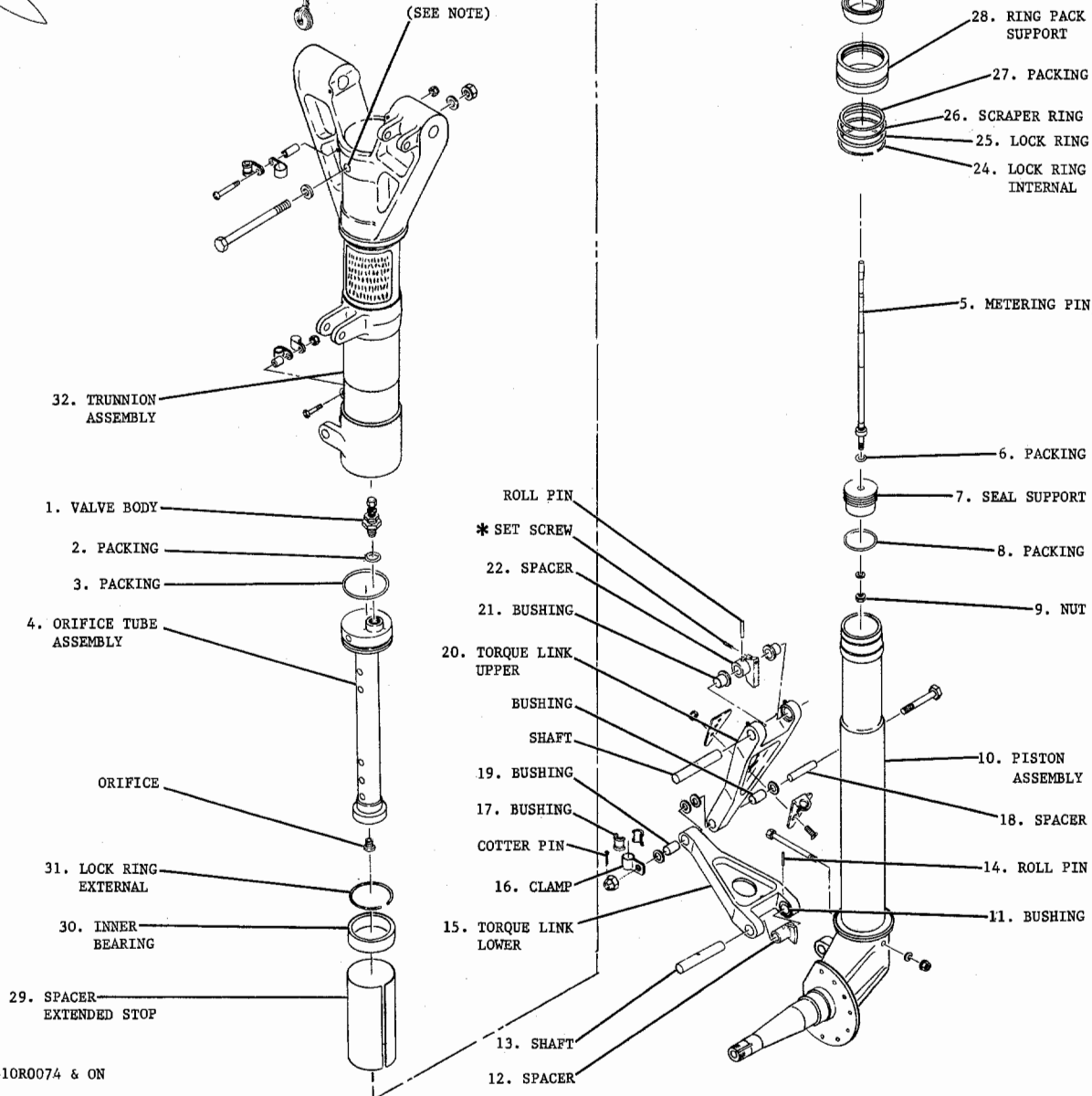
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SERVICE MANUAL



NOTE: CHECK HOLE SIZE OF THE UPPER TRUNNION, ORIFICE TUBE AND BOLT TO INSURE PROPER PART COMPATIBILITY WHEN REPLACING BOLT OR ORIFICE TUBE ASSEMBLY.

(SEE NOTE)



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DETAIL A

Main Landing Gear Strut
Figure 4

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CAUTION: INSTALL INNER BEARING WITH CHAMFERED END UP IN ORDER TO SEAT AGAINST EXTERNAL LOCK RING (31).

- (12) Carefully work piston assembly into trunnion assembly and install ring pack support. Secure ring pack support with scraper ring (26), lock ring (25) and internal lock ring (24). Make certain lock ring is seated in the retaining groove.

NOTE: To prevent damage to piston assembly and ring pack support during installation, a ring pack support tool P/N 0880004-1 should be used. (See Figure 2).

- (13) Connect torque links (15 and 20) with bolt, washers, spacer (18) clamp (16), and nut. Torque nut to firm plus one castellation and install cotter pin.

NOTE: Install AN960-716, AN960-716L and N NAS70CL453-750 washers as required to control gap between torque links to .004 to .020 inch.

- (14) If new bushings (19) were installed in torque links (15 and 20), line ream bushings as follows:
- (a) Align torque links using same number of retained washers positioned between braces in the same order that they were removed.
 - (b) Using a .4300 diameter pilot (bolt or rod), align torque links and washers.
 - (c) Clamp torque links in position using two small "C" clamps.
 - (d) Using a standard 29/64 (.453) inch reamer having a .75 inch length, .4300 pilot or FT251 reamer. Ream bushings to ensure a straight, true hole in both parts.
 - (e) Remove clamps, and clean torque links with a suitable solvent.

3. Cleaning/Painting

A. Cleaning Main Gear Assembly.

- (1) Clean all metal parts with suitable solvent.

CAUTION: IF METAL PARTS ARE NOT TO BE ASSEMBLED IMMEDIATELY, COAT WITH SYSTEM HYDRAULIC FLUID TO PREVENT RUSTING. BEFORE ASSEMBLY IT WILL BE NECESSARY TO AGAIN CLEAN WITH SOLVENT.

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- (2) Clean all o-rings and seals with system hydraulic fluid.

B. Painting Main Gear Assembly.

- (1) Refer to Chapter 1, for painting procedures.

4. Approved Repairs

A. Repair Main Gear Assembly.

- (1) Repair is limited to replacement of parts, smoothing out of minor scratches, nicks and dents and re-painting of areas where paint has chipped or peeled.

MAIN WHEELS AND TIRESDescription

1. Each main wheel consists of two magnesium wheel halves; secured together with eight bolts, bearing cups, bearing cones and a bearing seal. A 6.50 x 10, 6 ply rating, low pressure tire and 6.50 x 10 tube are installed on each main gear wheel assembly.

Maintenance Practices

1. Removal/Installation of Main Wheel and Tire Assembly (See Figure 1).
 - A. Remove Main Wheel and Tire Assembly.
 - (1) Jack aircraft. Refer to Chapter 1.
 - (2) Remove snap ring (8), cap (7), cotter pin, nut (6), and washer (5) from axle.
 - (3) Remove brake disc (14) clips from brake side of wheel as follows:
 - (a) Rotate wheel until a disc clip is opposite the brake unit.
 - (b) Move the brake disc to outer edge of wheel and insert a thin screwdriver or other suitable tool between disc clip and wheel.
 - (c) Pry the inner edge of the disc clip out of groove inside of wheel and pull clip out.
 - (d) Repeat this procedure with each disc clip until all clips are removed.
 - (4) Remove wheel and tire assembly from axle using caution to prevent damage to axle threads and to keep bearings clean.
 - B. Install Main Wheel and Tire Assembly.

CAUTION: ENSURE THAT BEARING CONES (4 AND 12) ARE PROPERLY LUBRICATED BEFORE INSTALLING WHEEL ASSEMBLY. REFER TO CHAPTER 2.

 - (1) Place wheel and tire assembly in position on the axle, aligning brake disc with disc drive keys (15) in wheel half.
 - (2) Install outer bearing cone (4), washer (5) and nut (6).

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NOTE: Tighten wheel bearing nut (6) to 40 inch-pounds while rotating wheel, then back off nut and retighten to 20 inch-pounds while rotating wheel. If nut is not positioned to allow installation of cotter pin at 20 inch-pounds torque, continue tightening to the next locking position that will align cotter pin hole.

- (3) Install cotter pin, bearing cap (7) and snap ring (8).
- (4) Install brake disc clips (14) as follows:
 - (a) Starting opposite the brake unit, insert disc clip between disc and wheel and between any two adjacent drive keys.
 - (b) Install disc clip so that ends of clip contact the disc and the smaller of the two bent center flanges is inserted first.
 - (c) Press disc clip (14) into the wheel until the small bent flange seats in the groove provided in the drive key.
 - (d) Rotate wheel and repeat the above procedure at every other drive key until five disc clips are installed.
- (5) Check that all disc clips are properly installed and that wheel rotates freely.
- (6) Remove jacks from aircraft and inflate tire to proper operating pressure. Refer to Chapter 2.

2. Disassembly/Assembly of Main Wheel and Tire Assembly (See Figure 1).

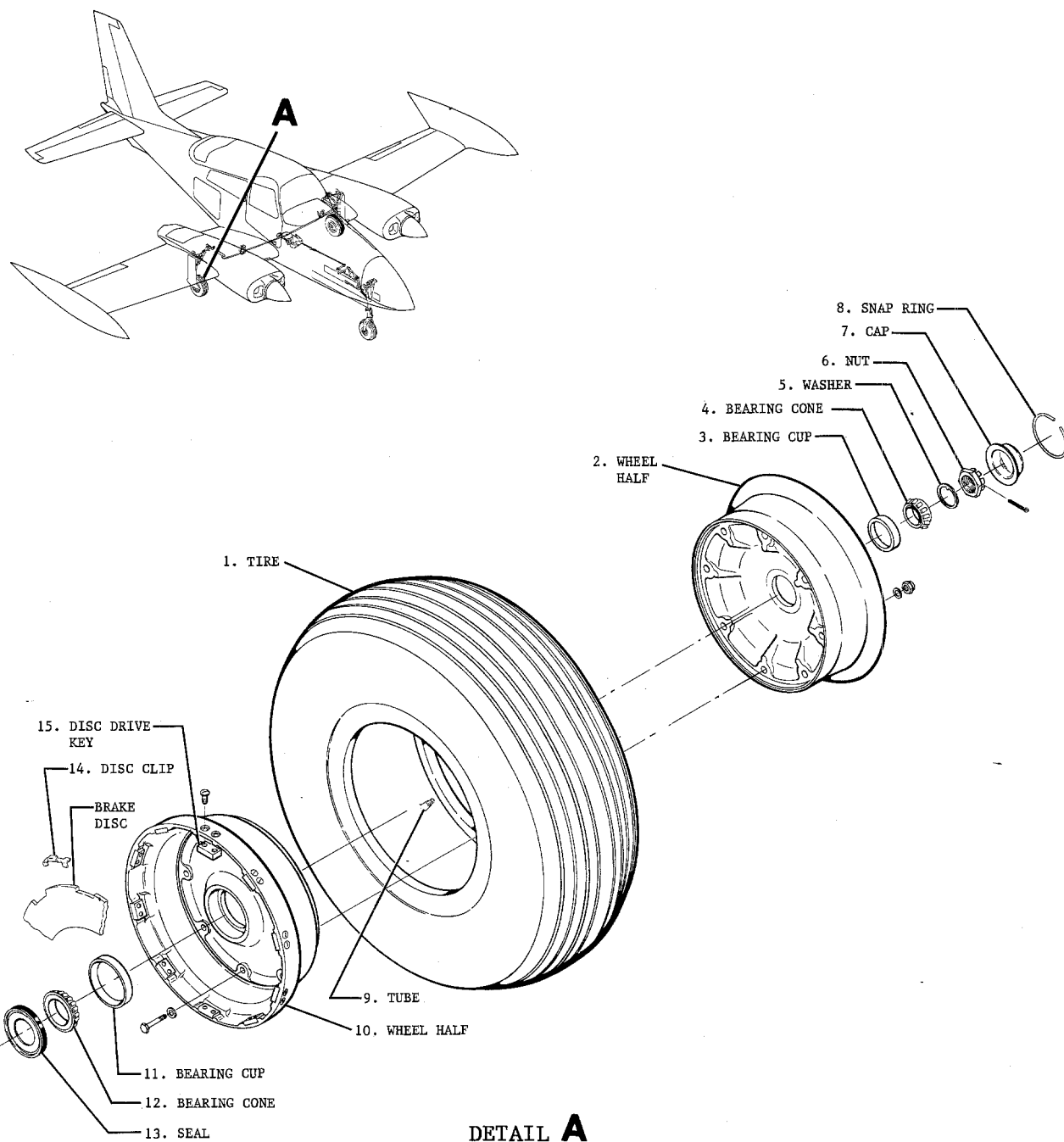
A. Disassemble main wheel and tire assembly.

- (1) Deflate tire (1) and tube (9) by removing valve core.

WARNING: ALWAYS DEFLATE TIRE AND TUBE BEFORE SEPARATING WHEEL HALVES.

- (2) Remove nuts, washers and bolts and separate wheel halves (2 and 10). Remove wheel halves from tire.
- (3) Remove tube (9) from tire (1).
- (4) Bearing cups are a shrink fit and should be removed for replacement only.

NOTE: If removal of bearing cups is necessary, place wheel half in boiling water for at least 30 minutes, then remove bearing cup by tapping cup evenly from the inner side.



Main Wheel and Tire Assembly
Figure 1

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MAINTENANCE MANUAL

- (5) Remove drive keys (15) if worn to a minimum width of 1.116 inches by removing attaching screws.

NOTE: Screws securing drive keys (15) are stacked to the drive keys and should only be removed for replacement of keys.

B. Assemble Main Wheel and Tire Assembly.

- (1) If removed, replace disc drive keys (15) and secure with screws.

NOTE: When replacing drive keys, prime the contact surfaces, torque retaining screws to 60 ± 10 inch-pounds and stake.

- (2) If removed, replace bearing cups (3 and 11).

NOTE: Bearing cups are a shrink fit in wheel. To install, place wheel in boiling water for at least 30 minutes, chill bearing cups with dry ice and tap lightly into position to ensure proper seating.

- (3) Install tube (9) in tire (1).
- (4) Place wheel halves in position on the tire and secure with bolts, washers and nuts. Torque nut to value marked on wheel half.

CAUTION: TIGHTEN NUTS EVENLY AND TORQUE CORRECTLY TO LESSEN THE POSSIBILITY OF BOLT FAILURE.

- (5) Inflate tire enough to seat the beads on the wheels, deflate completely, then reinflate to operating pressure. Refer to Chapter 2.
- (6) Lubricate bearing cones in accordance with Chapter 2. Place cone (12) in wheel assembly and secure in place with seal (13).
- (7) Place bearing cone (4) in bearing cup (3) and cover with cap (7) and snap ring (8) until ready to install wheel assembly.

NOTE: If wheel is not to be installed immediately, cover wheel bearings adequately to prevent contamination of grease.

3. Cleaning/Painting

A. Clean Wheel Assembly.

- (1) All metal parts may be cleaned with a suitable solvent.
- (2) Clean felt seals and bearing cones by washing in suitable solvent and dry thoroughly. Lubricate felt seals with light oil.

4. Approved Repairs

A. Repair Wheels Castings.

- (1) Slightly corroded areas on wheel can be repaired as follows:
 - (a) Clean affected area thoroughly.
 - (b) Repaint with two coats of zinc chromate primer on area which has had the protective coating removed.
 - (c) Finish coat casting with two coats of aluminum lacquer.

NOTE: Replace castings which show evidence of cracks or heavy corrosion.

MAIN LANDING GEAR RETRACTION LINKAGEDescription

1. The main landing gear retraction linkage consists of push-pull tubes, bellcranks, torque tubes, braces, and links interconnected between the landing gear actuator and the main landing gear. A positive down-lock is obtained by rigging the main side links to an overcenter position. The link assemblies which hold the main side links in an overcenter position are also rigged overcenter. Downlock springs, which apply spring tension to the overcenter position of the link assemblies, are provided as an added safety feature. Hook-type mechanical locks are provided to support the landing gear in the retracted position. The main landing gear retraction linkage also operates the main landing gear door operating mechanism.

Maintenance Practices

1. Removal/Installation of Retraction Linkage.

NOTE: The following removal and installation procedures apply to the left gear retraction linkage. The right hand procedures are the same.

- A. Remove Inboard Retraction Linkage Components (See Figure 1).
 - (1) Jack the aircraft. Refer to Chapter 1.
 - (2) Release tension on retracting linkage by engaging hand crank and operating a few turns toward the UP position.
 - (3) Remove access hole covers and wing gap fairing as necessary to remove linkage.
 - (4) Remove seats, carpet and floorboards as necessary to gain access to the landing gear actuator.
 - (5) Remove inboard drive tubes from landing gear actuator as follows:
 - (a) Engage manual extension system and operate gear toward the up (approximately 2 turns) position until the main gear doors open sufficiently to disconnect main wheel well door link (9) from door actuator arm (12).
 - (b) Disconnect the LH inboard drive tube (4) from idler bellcrank (11). Disconnect the RH inboard drive tube (3) from idler (7).

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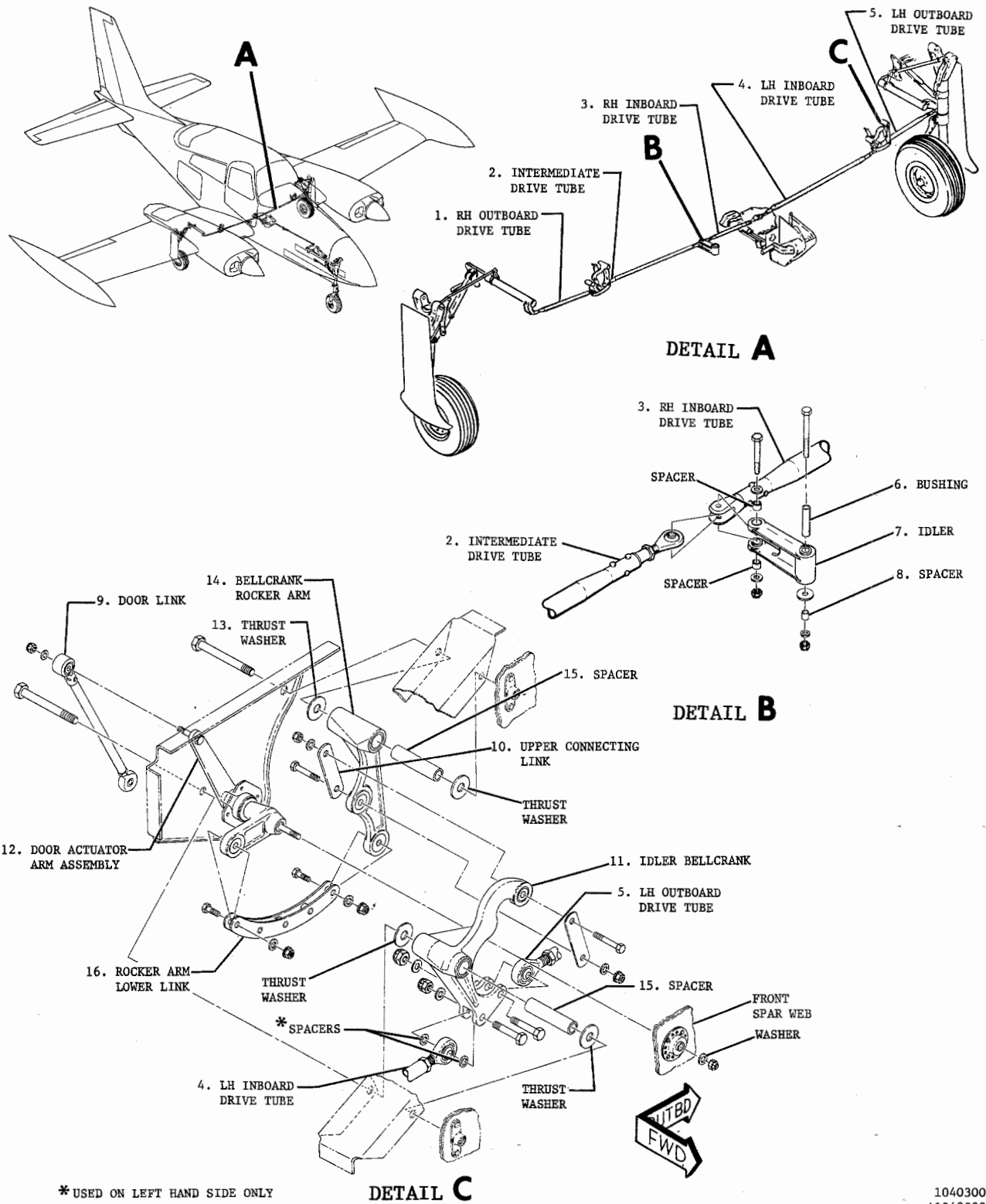
MAINTENANCE MANUAL

NOTE: For ease of bolt removal, support the main gear by hand to remove shear load from bolt. After bolt is removed, gently lower gear to its free full position.

- (c) Hand crank the gear toward the UP position until nose gear drive tube attaching bolt is accessible through the lower access hole. Support nose gear while removing cotter pin, nut, washer and bolt. Gently lower nose gear to its free fall position.
 - (d) Manually crank gear toward the DOWN position until the upper bellcrank on the landing gear actuator is in approximately a lateral position.
 - (e) Remove nut, washer, caps and bolt attaching the upper and lower bellcranks to the sector shaft.
 - (f) Lift upper bellcrank enough to clear sector shaft. Remove upper bellcrank, RH inboard drive tube, and LH inboard drive tube as a unit by pulling inboard until LH tube clears fuselage skin.
- (6) Remove idler bellcrank (11) and door operating linkage as follows:
- (a) Remove nut, washer and bolt attaching rocker arm lower link (16) to door actuator arm (12). Remove four nuts, washers and screws securing arm assembly (12) to web. Remove nut securing door actuator arm assembly to spar web. Remove arm assembly and thrust washer through access in web.

NOTE: The door actuator arm assembly is a matched set and disassembly is not recommended.

- (b) Remove thrust washers, and bolt attaching idler bellcrank (11) to front spar and support web.
- (c) Remove thrust washers, and bolt securing bellcrank rocker arm (14) to the front spar and support web. Pull bellcrank and attaching links from between front spar and support web.
- (d) Retain spacers (15) from bellcrank rocker arm (14) and idler bellcrank (11).
- (e) Remove upper connecting links (10) by removing nuts, washers and bolts.
- (f) Remove rocker arm lower links (16) by removing nuts, washers and bolts.



Main Landing Gear Retracting Linkage - Inboard Components
Figure 1

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MAINTENANCE MANUAL

- B. Remove Outboard Retraction Linkage Components (See Figure 2).
- (1) Remove outboard push-pull tube (8) as follows:
 - (a) Disconnect the push-pull tube from bellcrank (7) by removing cotter pin, nut, washer and bolt.
 - (b) Disconnect outboard push-pull tube (8) from torque tube (23) by removing nut, washer and bolt. Remove outboard push-pull tube.
 - (2) Remove bellcrank (7) and side brace lock link (13) as follows:
 - (a) Remove DOWN indicator switch (10) and spacers (11) by removing nuts and screws.
 - (b) Remove downlock spring (12).
 - (c) Disconnect side brace lock link (13) from lower side link (20) by removing nut, washer and bolt.
 - (d) Remove side brace lock link (13) from bellcrank (7) by removing setscrew (14) and pin (9).
 - (e) Remove bellcrank (7) from strut upper barrel by removing cotter pin, nut and bolt. Retain spacer (6).
 - (3) Remove uplock assembly as follows:
 - (a) Disconnect uplock push-pull tube (5) from uplock assembly by removing cotter pin, nut, washer and bolt.
 - (b) Remove uplock assembly (4) from upper side link (3) by removing screw.
 - (4) Remove side links (3 and 20) as follows:
 - (a) Disconnect lower side link (20) from strut upper barrel by removing door link, nut (17) spacers (18 and 19), washers and bolt. Retain spacer (22) in place.
 - (b) Disconnect upper side link (3) from support (1) by removing cotter pin, nut, washer and bolt. Retain spacer (2).
 - (c) Separate upper side link (3) from lower side link (20) by removing cotter pin, nut, washer and bolt. Retain spacer (21).
 - (5) Remove torque tube (23) as follows:
 - (a) Disconnect push-pull tube (8) from torque tube (23) by removing cotter pin, nut, washer and bolt.
 - (b) Disconnect outboard drive tube (25) from torque tube by removing nut, washer and bolt.
 - (c) Remove nut, washers and bolt securing torque tube to support (24).
 - (d) Remove nut, washers and bolt securing torque tube to support (26).

C. Install Outboard Retraction Linkage Components (See Figure 2).

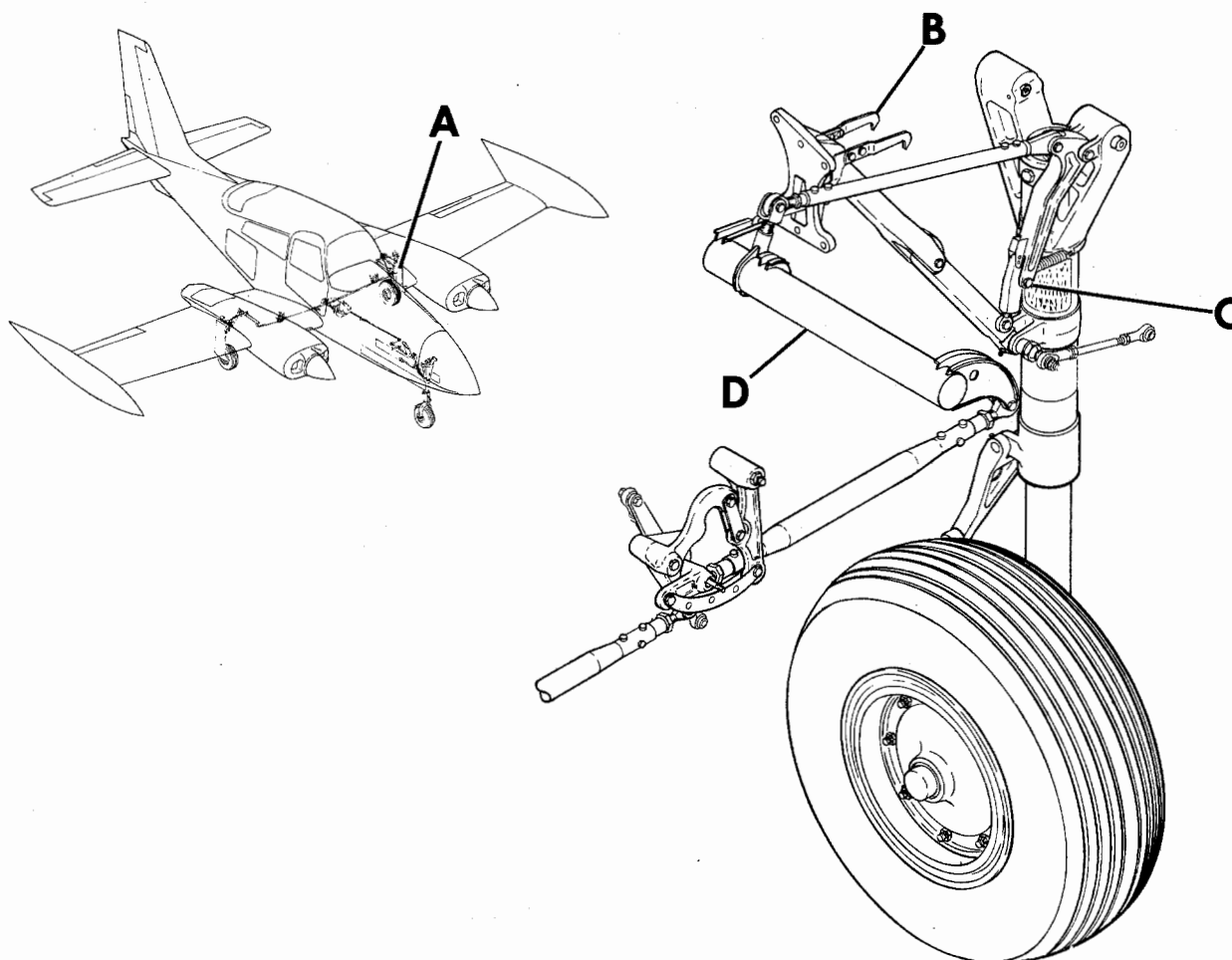
- (1) Install torque tube (23) as follows:
 - (a) Attach torque tube (23) to support (24) with bolt, washers and nut.
 - (b) Attach torque tube to support (26) with bolt, washers and nut.
 - (c) Connect uplock push-pull tube (5) to torque tube (23) with bolt, washer, nut and cotter pin.
 - (d) Connect outboard push-pull tube (8) to torque tube (23) with bolt, washer, nut and cotter pin.
- (2) Install side links (3 and 20) as follows:
 - (a) Insert spacer (22) in lower side link and secure upper side link (3) to lower side link (20) with bolt, washer, and nut. Torque nut to 110 ± 5 inch-pounds. Install cotter pin.
 - (b) Insert spacer in upper side link (3) and secure upper link to support (1) with bolt, washer, and nut torque nut to 200 ± 25 inch-pounds. Install cotter pin.
 - (c) Insert spacer (22) in lower side link (20) and secure lower side link to strut upper barrel with bolt, washers uplock spacers (19 and 18), and nut (17). Torque nut (17) to 110 ± 5 inch-pounds. Install door link.
- (3) Install uplock assembly as follows:
 - (a) Insert uplock assembly (4) through upper side link (3) and secure uplock assembly with screw.
 - (b) Attach uplock push-pull tube (5) to uplock assembly (4) with bolt, washer, nut and cotter pin.
- (4) Install bellcrank (7) and side brace lock link (13) as follows:
 - (a) Attach side brace side lock link (13) to bellcrank (7) with pin (9). Secure pin with set screw (14) and stake set screw (14). Do not stake over existing stake.

NOTE: Ensure arrow (indicating flat surface) located on end of pin (9) is aligned towards set screw (14).

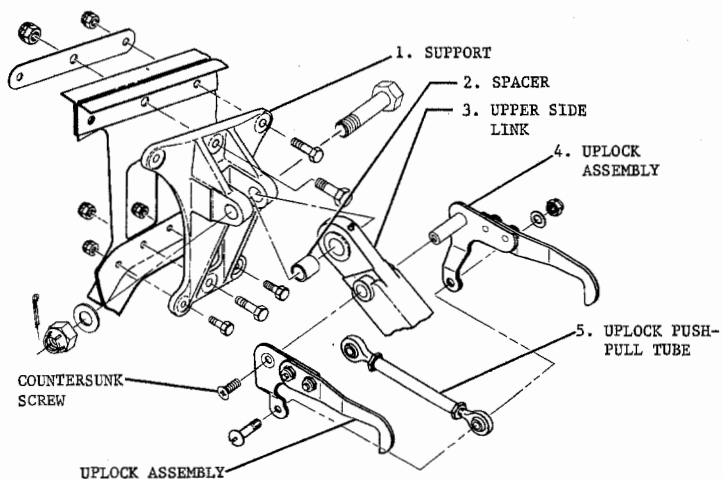
- (b) Insert spacer (6) in bellcrank (7). Attach bellcrank (7) to strut upper barrel with bolt, nut and cotter pin.
- (c) Attach end fitting (16) to side brace lock link with adjusting screw (15). Make certain an equal number of threads are engaged in both parts.

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DETAIL A



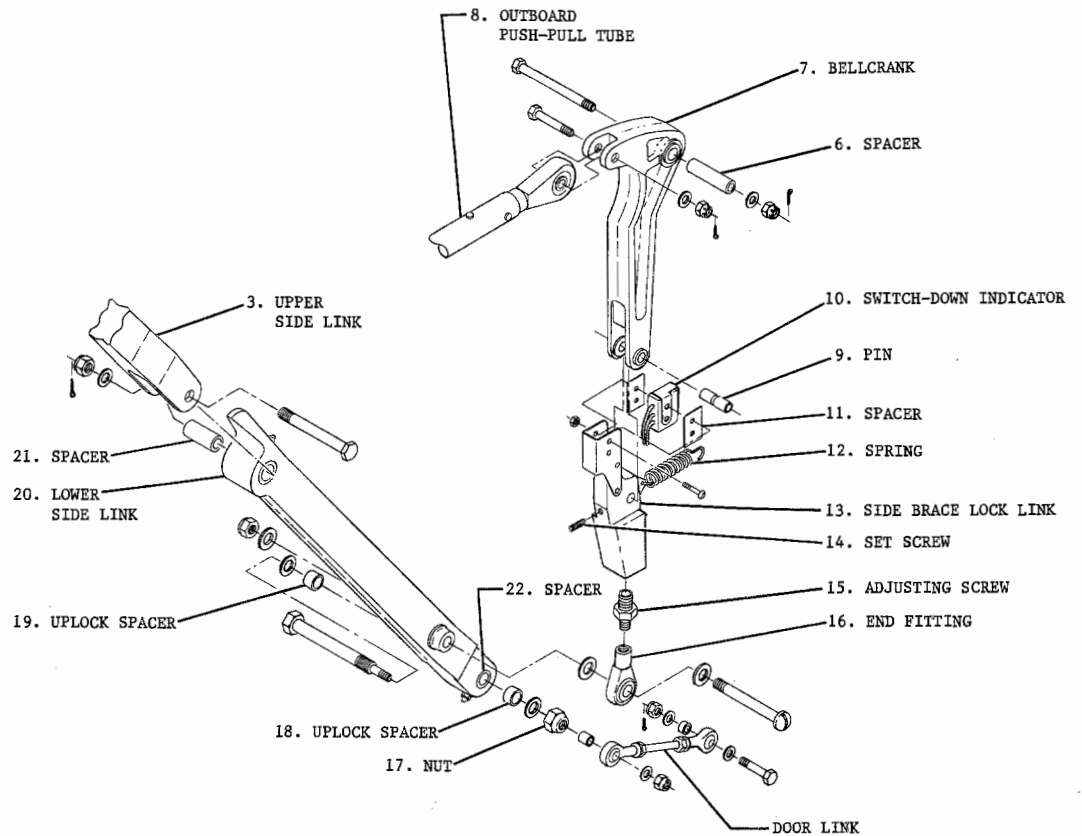
DETAIL B

Main Landing Gear Retracting Linkage - Outboard Components
Figure 2 (Sheet 1 of 2)

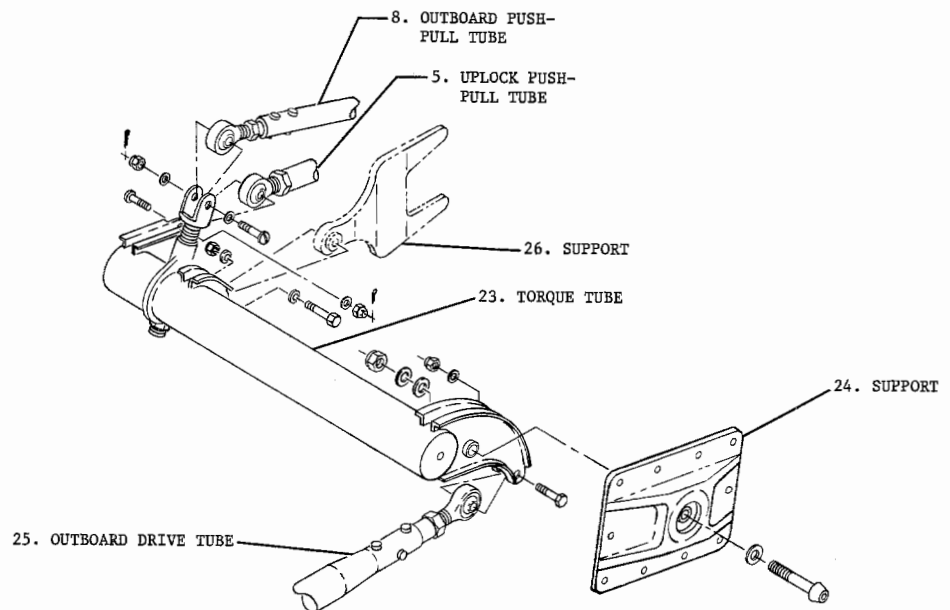
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MAINTENANCE MANUAL



DETAIL C



DETAIL D

Main Landing Gear Retracting Linkage - Outboard Components
Figure 2 (Sheet 2)

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- (d) Attach end fitting (16) to lower side link (20) with bolt, washers and nut.
- (5) Install spring (12).
- (6) Install DOWN indicator switch (10) and spacers (11) with attaching screws and nuts.
- (7) Install outboard push-pull tube (8) as follows:
 - (a) Attach push-pull tube to bellcrank (7) with bolt, washer, nut and cotter pin.
 - (b) Attach push-pull tube to torque tube (23) with bolt, washer, nut and cotter pin.
 - (c) Inspect push-pull tube installation and verify that the heads of the three in-line rivets are facing down to prevent interference with support (1).

D. Install inboard retraction linkage components (See Figure 1).

- (1) Install idler bellcrank (11) and door operating linkage as follows:
 - (a) Attach rocker arm lower link (16) to bellcrank rocker arm (14) with bolt, washer and nut.
 - (b) Attach upper connecting links (10) to bellcrank rocker arm (14) and idler bellcrank (11) with bolts, washers and nuts.
 - (c) Install spacers (15) in idler bellcrank (11) and bellcrank rocker arm (14).
 - (d) Place bellcranks and attached linkage in position between front spar and support web.
 - (e) Secure bellcrank rocker arm (14) with bolt and thrust washers (13).
 - (f) Secure idler bellcrank (11) with bolt and thrust washers.
 - (g) Insert door actuator arm assembly (12) through bracket, thrust washer and spar web. Secure to spar web with washer and nut.
 - (h) Secure bearing flange of door actuator arm assembly to support with four screws, washers and nuts.

NOTE: Washers must be under head of screws and screws installed in direction shown.

- (i) Attach rocker arm lower link (16) to door actuator arm assembly (12) with bolt, washer and nut.
- (j) At landing gear actuator insert LH and RH inboard drive tubes (3 and 4) through fuselage and slide tubes outboard to idler bellcrank (11) and idler (7).

- (k) See Figure 2, 4-10. Install upper and lower bellcranks to actuator sector shaft, using bolt, caps, washers and nut.
- (l) Secure nose drive tube to lower bellcrank, using bolt, washer, nut and cotter pin.
- (m) Connect LH inboard drive tube (4) to idler bellcrank (11), using bolt, spacers, washer and nut.
- (n) Connect RH inboard drive tube (3) to idler (7) and intermediate tube, using bolt, washer, spacers, washer and nut.
- (o) Rig the landing gear system, refer to Chapter 4-00 Adjustment/Test.
- (p) Install floorboards, carpet, seats, access panels and wing gap fairings.

MAIN LANDING GEAR DOORS1. Description

- A. The main landing gear is equipped with wheel well doors and strut doors. Each strut door, pivoting on a continuous hinge located at its outboard end, is operated by a door link attached to the main landing gear strut. Each wheel well door, pivoting on forged aluminum hinges located at its inboard end, is operated by a bellcrank and push-pull tube, which is connected to the landing gear retracting linkage. The operating mechanism is so arranged that the wheel well door is closed when the main gear is either fully extended or fully retracted.

Adjustment/Test

1. Rigging Main Landing Gear Door (See Figure 1).

- A. Remove access hole cover (13).
B. Jack aircraft. Refer to Chapter 1.
C. Disconnect wheel well door by removing nut and bolt attaching door link to actuator arm.
D. Disconnect strut door (11) by removing nut and washer connecting door link (10) to strut.
E. Using normal landing gear retraction system operate gear to UP position.

NOTE: The use of an external power source is recommended for operation of electrical units. Low voltage could cause low downlock tension readings.

- F. Close strut door and adjust door link so that door fits flush.
G. Adjust snubber (12) so there is 0 to .06 inch clearance between door and main gear torque link.
H. Operate gear to DOWN position.
I. Close wheel well door and adjust door link (2) so that door fits flush; then adjust rod end on door link one-half turn shorter and connect.

NOTE: Make sure door link adjustment does not cause deformation of door.

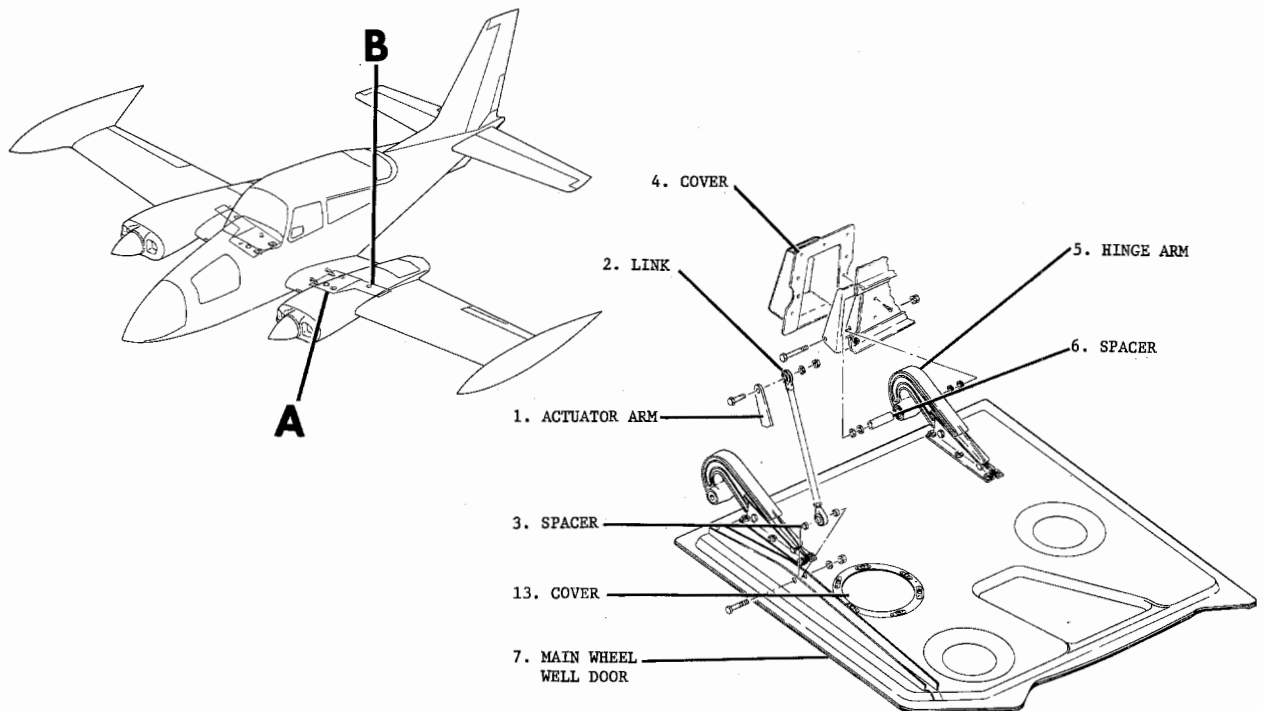
- J. Operate gear to the UP position.

CAUTION: WHEN RETRACTING GEAR WHILE RIGGING DOOR BE PREPARED TO STOP BEFORE DAMAGE CAN OCCUR.

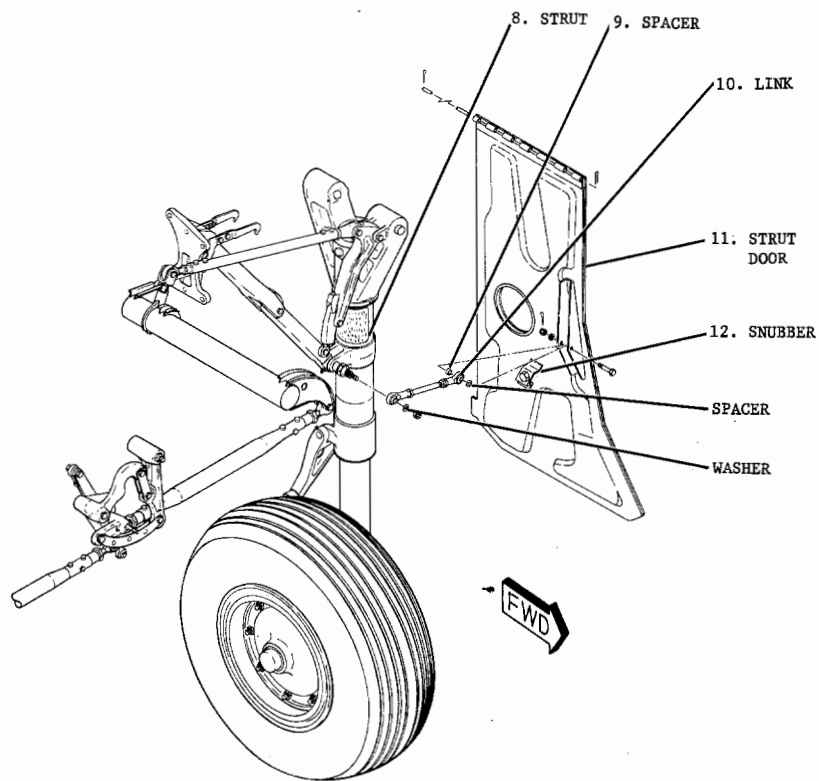
- K. If necessary, readjust door link (2) so that door fits flush.
- L. Repeat steps "D" through "I" as necessary to obtain proper fit of doors, checking that wheel well door clears tire and wheel.
- M. The door link is to be in overcenter condition with actuator arm against its stop in both gear UP and gear DOWN position.
- N. Install access hole cover (13).
- O. Insure that the landing gear is DOWN, remove jacks.

Maintenance Practices

- 1. Removal/Installation of Main Landing Gear Doors (See Figure 1).
 - A. Remove Main Landing Gear Doors.
 - (1) Jack aircraft. Refer to Chapter 1.
 - (2) Engage manual extension crank and operate toward the UP position until the main gear doors open sufficiently to disconnect link (2) from door (7) by removing nut, washer, spacers (3) and bolt.
 - (3) Remove wheel well door by removing nuts, washers and bolts attaching hinge arms to door.
 - (4) Hinge arms (5) may be removed with the wheel well door as follows:
 - (a) Remove lower wing root fillet and remove hinge covers (4) by removing attaching screws.
 - (b) Remove hinge arms from brackets by removing nuts, washers and bolts. Remove hinge arms from brackets. Retain spacers (6) in place.
 - (5) Disconnect door link (10) from strut door (11) by removing nut, washers and spacers.
 - (6) Support door and remove screws securing door to wing assembly. Remove door.
 - B. Install Main Landing Gear Doors.
 - (1) Position strut door (11) to lower wing and secure with attaching screws.
 - (2) Connect door link (10) to strut door with bolt, washer, spacer (9) and nut.
 - (3) Position main wheel well door (7) in place and secure to wing structure brackets with bolts, washers and nuts. Make sure spacers (6) are in place.
 - (4) Secure door link (2) to door (7) with bolt, spacers (3) washer and nut.



DETAIL A



DETAIL B

Main Landing Gear Door Installation
Figure 1

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NOSE LANDING GEARDescription

1. The nose landing gear consists of a wheel and tire assembly, fork, axle, lower piston assembly, upper trunnion assembly, torque links and shimmy damper. The air-oil shock strut contains an orifice and tapered metering pin which vary the resistance to shock according to the severity. During extension and retraction, the nose gear pivots on heavy-duty needle bearings by means of lugs on the trunnion assembly. A wheel straightener and steering mechanism is provided so that the nose wheel is steerable while taxiing, but is straightened during retraction.

Maintenance Practices

1. Removal/Installation of Nose Landing Gear (See Figure 2).

- A. Remove Nose Landing Gear.

- (1) Jack aircraft. Refer to Chapter 1.
- (2) Remove taxi light (optional).
- (3) Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- (4) Disconnect nose gear doors.
- (5) Disconnect drag brace (1) from trunnion assembly (2) by removing nut, washer and bolt.
- (6) Disconnect gimbal assembly (13) from trunnion assembly (2) by removing nut, washers and bolt. Retain spacer (12) in place.
- (7) Remove mud guard (15) and support (16) from nose gear fork by removing washers and bolts securing mud guard braces to the nose gear fork and mud guard support to the nose gear fork.

NOTE: Note location and amount of shims (6) between trunnion and retainer. These shims should be reinstalled exactly as they were.

- (8) Remove four bolts and washers securing retainer (7) to structure, then turn nose gear and slide retainer and gear aft and down to remove gear.
- (9) Remove shimmy damper bracket (14) by removing nut, washer and bolt.
- (10) If desired, gimbal assembly (13) and bellcrank (10) may be removed and disassembled as follows:

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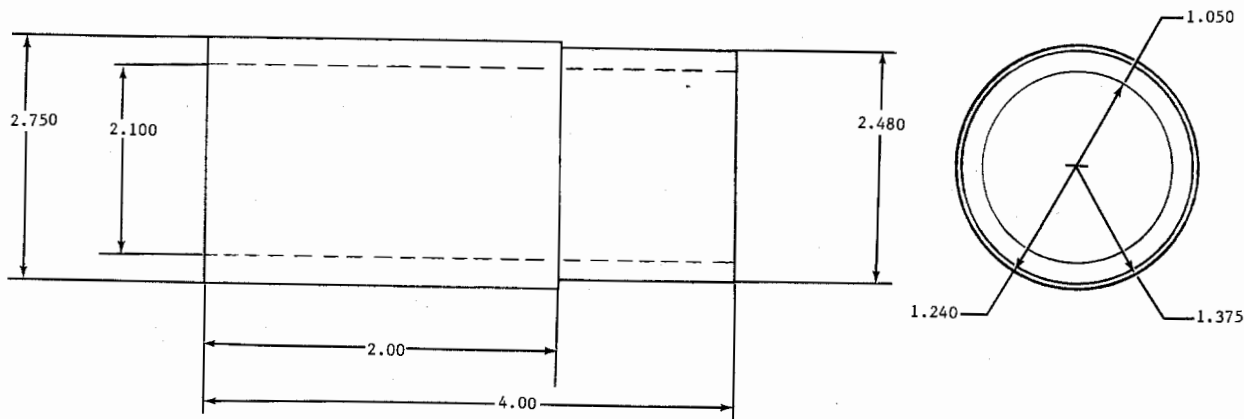
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- (a) Disconnect bellcrank (10) from support (9) by removing nut, washers and bolt.
- (b) Remove gimbal (13) from bellcrank (10) by removing bolts, washers, and spacers (11).

B. Install nose landing gear.

- (1) Install shims (6) on trunnion pivots as required so that when nose gear is installed side movement between trunnion assembly (2) and retainer (7) does not exceed .020 inch.
- (2) Place retainers (7) on trunnion assembly (2) and place nose gear assembly in wheel well. Install shims (8) and align mounting holes.

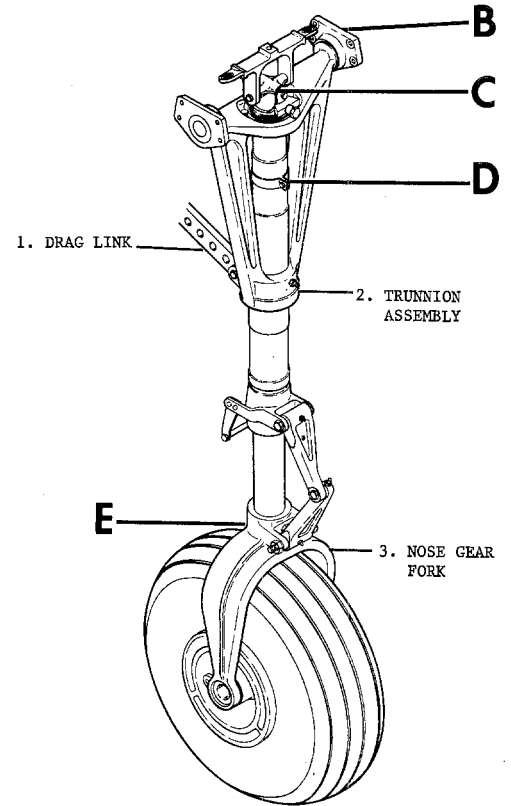
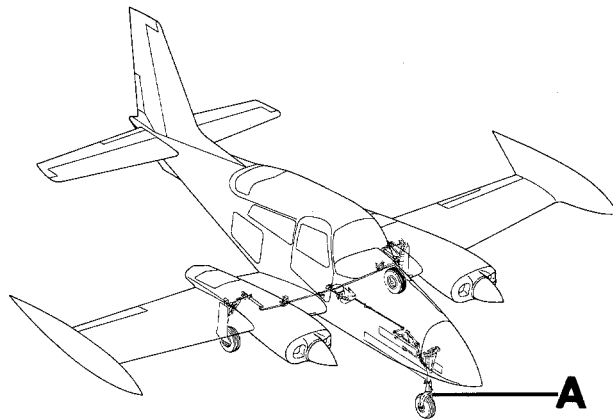
NOTE: To facilitate installation, rub wax or paraffin on the wheel well bulkheads against which the shims must slide.



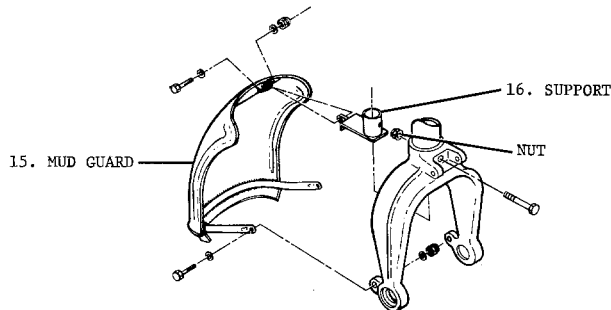
- NOTES:
- 1. All dimensions are in inches.
 - 2. Material to be 4130 Type I steel.
 - 3. Finish inside bore to smooth finish.
 - 4. Cut cylinder on center line to form two halves.
 - 5. Wrap cylinder with mystic tape 5812 (Stock Code F840022) or equivalent. Cut tape on one side to permit halves to hinge open.
 - 6. Coat tool with light oil to prevent rust.

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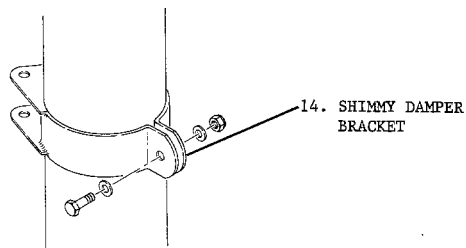
Landing Gear Ring Pack Support Tool
Figure 1



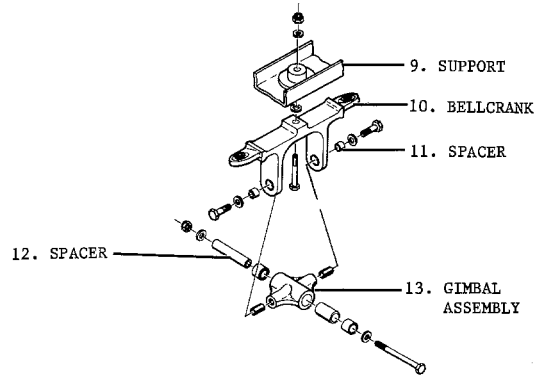
DETAIL A



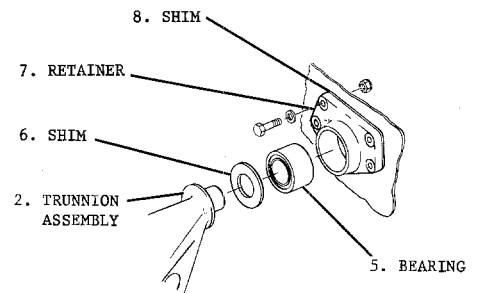
DETAIL E



DETAIL D



DETAIL C



DETAIL B

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Nose Gear Installation
Figure 2

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- (3) Install bolts and washers securing retainers (7) to structure. Torque bolts to 85 ± 15 inch-pounds.
- (4) Secure drag link (1) to trunnion assembly (2) with bolt, washer and nut.
- (5) If gimbal assembly (13) was removed and disassembled, assemble and install as follows:
 - (a) Attach bellcrank (10) to gimbal (13) with bolts, washers and spacers (11). Torque bolts to 50 to 70 inch-pounds.
 - (b) Secure bellcrank and gimbal assembly to support (9) with bolt, washers and nut. Direction of bolt is optional.
- (6) Install spacer (12) in gimbal and secure strut to gimbal with bolt washers and nut.
- (7) Install mud guard to strut fork with support (16), bolts, washers and nuts.

2. Disassembly/Assembly of Nose Landing Gear (See Figure 2).

A. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items:

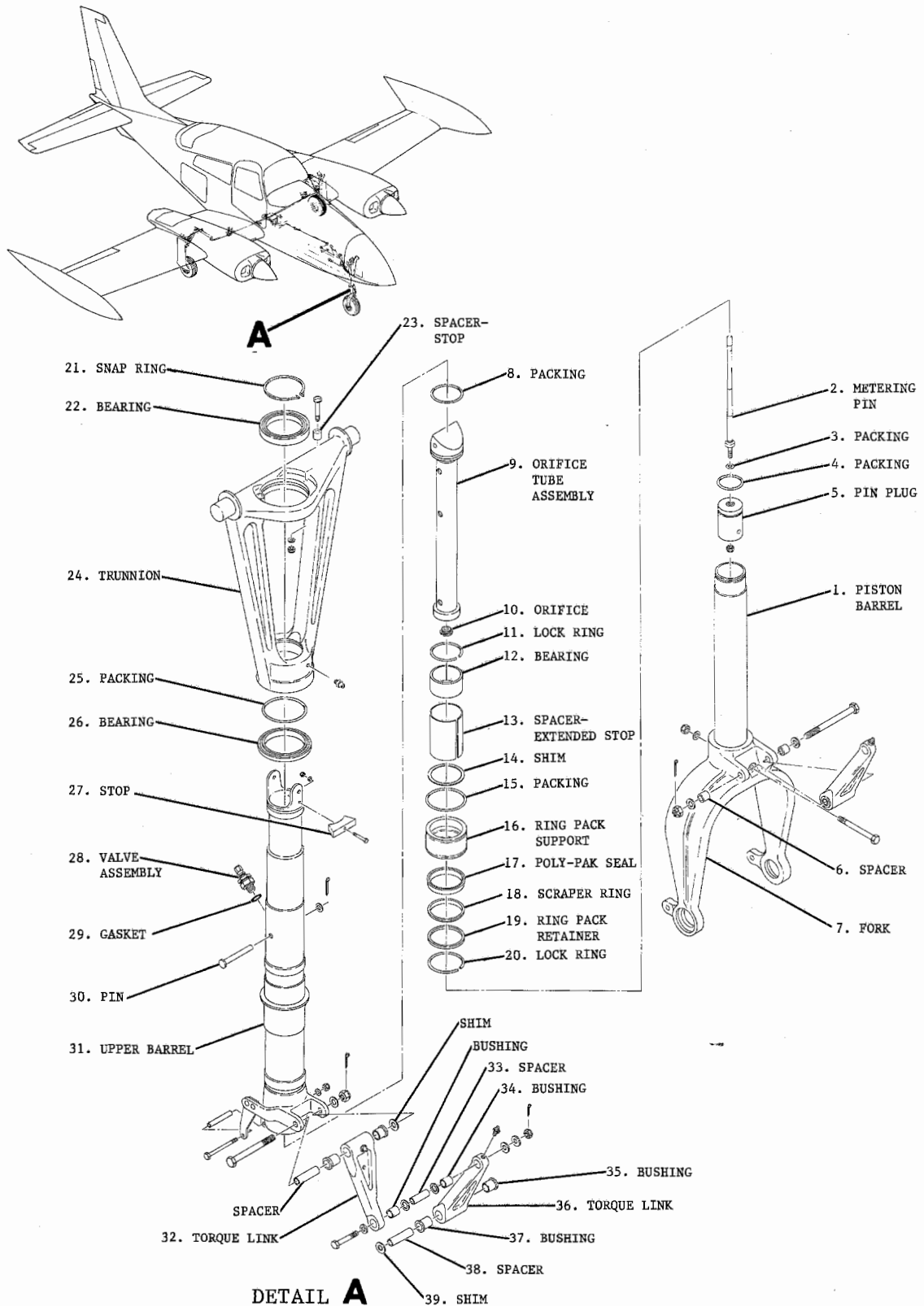
Name	Number	Manufacturer	Use
Ring Pack Support	0880004-2	Cessna Aircraft Co. or locally manufactured (See Figure 1)	To insert ring pack support
Hydraulic Fluid	MIL-H-5606	Commercially available	To lubricate parts and fill strut

B. Disassemble nose landing gear (See Figure 3).

- (1) Completely deflate strut. After air has been expelled, remove valve assembly and drain fluid.
- (2) Remove cotter pin, washer and pin (30) from upper barrel.
- (3) Remove snap ring (21) and stop (27), then pull trunnion (24) from upper barrel (31).
- (4) Remove stop spacers (23) by removing nut and bolt.
- (5) Remove packing (25) and bearing (26) from upper barrel.
- (6) Disconnect torque links (32 and 36) at apex by removing cotter pin, nut, washers and spacer (34).

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MAINTENANCE MANUAL



DETAIL A

Nose Landing Gear
Figure 310403001
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MAINTENANCE MANUAL

WARNING: MAKE CERTAIN ALL AIR IS EXPELLED FROM STRUT BEFORE PROCEEDING TO THE NEXT STEP.

- (7) Remove lock ring (20) and separate piston barrel (1) from upper barrel (31).
- (8) Remove orifice tube assembly (9) from piston barrel (1), then unscrew orifice (10) from orifice tube (9).

NOTE: Orifice (10) is staked in and should only be removed for replacement.

- (9) Remove lock ring (11) from piston barrel and remove bearing (12).
- (10) Slide spacer (13), shim (14), ring pack support (16), scraper ring (18) and ring pack retainer (19) from piston barrel (1).
- (11) Remove nut, washer and bolt and drive pin plug (5) from piston barrel (1).
- (12) Remove metering pin (2) from pin plug (5) by removing nut.

NOTE: Piston barrel (1) and fork (7) are a press fit and drilled on assembly. Disassembly is not recommended.

- (13) Remove torque links (32 and 36) from upper barrel (31) and fork (7) by removing cotter pins, nuts, washers, spacers (38) and bolts.

NOTE: The bushings in the torque links are a press fit and should be removed only for replacement.

C. Assemble Nose Landing Gear.

- (1) If removed, install bushing (34, 35 and 37) in each torque link. Ensure that holes in bushings align with grease fittings.
- (2) Assemble torque link (36) to fork (7) with bolt, spacers (38 and 6), shim (39), washer and nut. Torque nut to firm plus one castellation and install cotter pin.

NOTE: Install shims (39) as required to provide a gap of .004 to .019 inch between attachment fittings and torque links. Ensure that shims are centered over spacer.

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MAINTENANCE MANUAL

- (3) Assemble torque link (32) to upper barrel (31) with bolt, spacer, shim, and nut. Torque nut to firm plus one castellation and install cotter pin.

NOTE: Lubricate packings, seals and mating parts liberally with clean MIL-H-5606 hydraulic fluid before installation and assembly.

- (4) Install packings (3 and 4) and install metering pin (2) into pin plug (5) and secure with nut.
(5) Install metering pin assembly in piston barrel (1). Secure in place with bolt through fork (7), piston barrel (1) and pin plug (5).
(6) Slide lock ring (20), ring pack retainer (19) and scraper ring (18) on piston barrel (1).
(7) Install poly-pak seal (17) inside of ring pack support (16) and packing (15) in the groove on the outside.

NOTE: Install poly-pak seal with wide lip up (toward the pressure side).

- (8) Slide the ring pak support assembly on piston barrel (1), then install shim (14) and spacer (13).
(9) Install bearing (12) on piston barrel (1) and install lock ring (11).

NOTE: Install bearing with chamfered end up in order to seat against external lock ring.

- (10) If orifice (10) was removed, screw orifice into bottom of orifice tube (9) and stake in place.
(11) Install packing (25) and bearing (26) in trunnion.
(12) Install bearing (22) in trunnion. Install spacer stop (23).
(13) Insert upper barrel (31) into trunnion assembly and secure in place with snap ring (21).
(14) Install packing (8) on orifice tube assembly (9) and insert assembled tube into upper barrel (31); align holes and install pin (30), washer and cotter pin.

NOTE: To prevent damage to piston barrel and ring pack support during installation, a ring pack support tool P/N 0880004-2 should be used.

- (15) Install assembled piston barrel assembly into upper barrel (31). Carefully work scraper ring (18) and ring pack retainer (19) into place and secure with lock ring (20).

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MAINTENANCE MANUAL

- (16) Connect torque links (32 and 36) with bolt, washers, spacer (33) and nut. Torque nut to firm plus one castellation and install cotter pin.

NOTE: Install AN960-716 and AN960-716L washers until a gap of .004 to .019 inch exists between torque links. Insure that washers are centered over spacer (33).

- (17) Install stop (27) with bolt, washer and nut.
(18) With strut fully deflated, fill with MIL-H-5606 hydraulic fluid and install gasket (29) and valve body (28).

3. Cleaning/Painting

A. Cleaning Nose Gear Assembly.

- (1) Clean all metal parts with suitable solvent.

CAUTION: IF METAL PARTS ARE NOT TO BE ASSEMBLED IMMEDIATELY, COAT WITH SYSTEM HYDRAULIC FLUID TO PREVENT RUSTING. BEFORE ASSEMBLY IT WILL BE NECESSARY TO AGAIN CLEAN WITH SOLVENT.

- (2) Clean all o-rings and seals with system hydraulic fluid.

B. Painting Nose Gear Assembly.

- (1) Refer to Chapter 1, for painting procedures.

4. Approved Repairs

A. Repair Nose Gear Assembly.

- (1) Repair is limited to replacement of parts, smoothing out of minor scratches, nicks and dents and repainting of areas where paint has chipped or peeled.

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MAINTENANCE MANUAL

NOSE GEAR SHIMMY DAMPERDescription

1. The shimmy damper provided for the nose gear offers resistance to shimmy by forcing hydraulic fluid through small orifices in the piston. The outer housing is attached to the upper nose strut and moves as the strut turns, while the piston and piston rod are attached to the trunnion assembly which does not turn, thus causing motion between the housing and the piston.

Troubleshooting

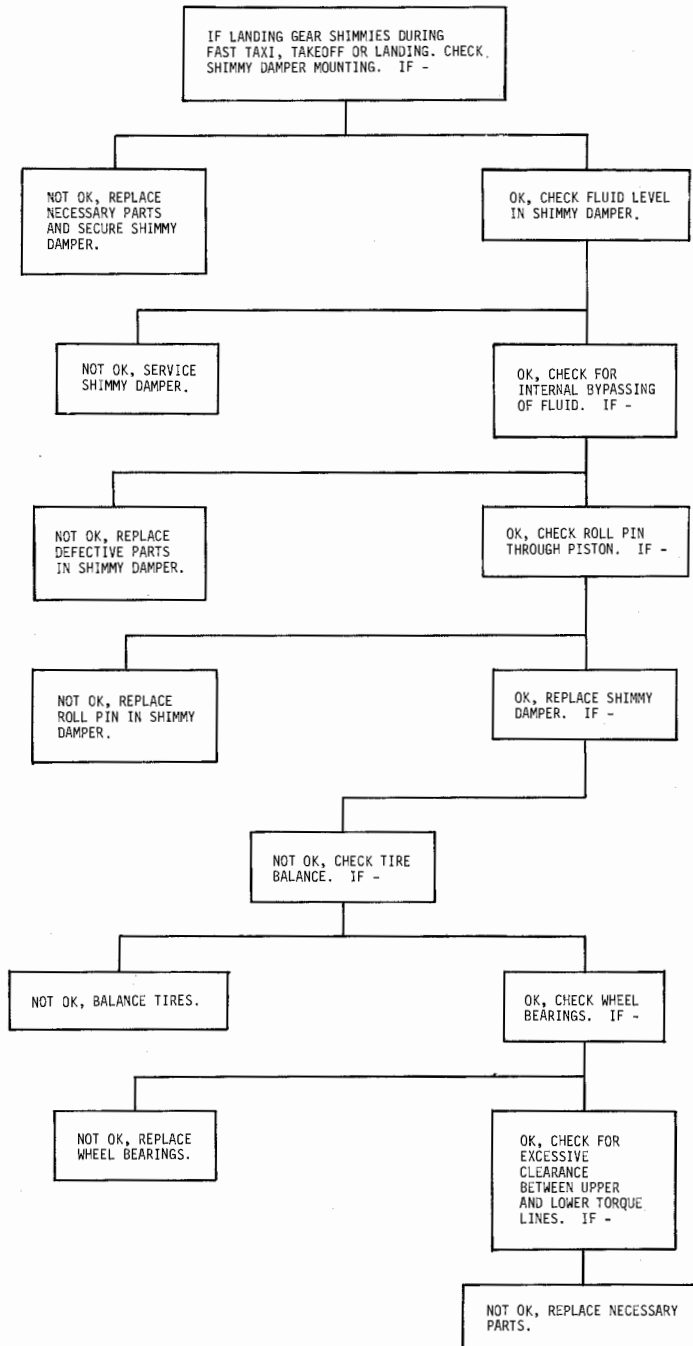
1. Troubleshooting Nose Gear Shimmy Damper
 - A. For a guide to troubleshooting the nose gear shimmy damper, see Figure 1.

Maintenance Practices

1. Removal/Installation of Nose Gear Shimmy Damper (See Figure 2).
 - A. Remove Nose Gear Shimmy Damper.
 - (1) Disconnect piston rod (16) from trunnion assembly by removing cotter pin, nut, washers and bolt.
 - (2) Remove shimmy damper from strut by removing nut, washer, bolt and bushing (17).
 - B. Install Nose Gear Shimmy Damper.

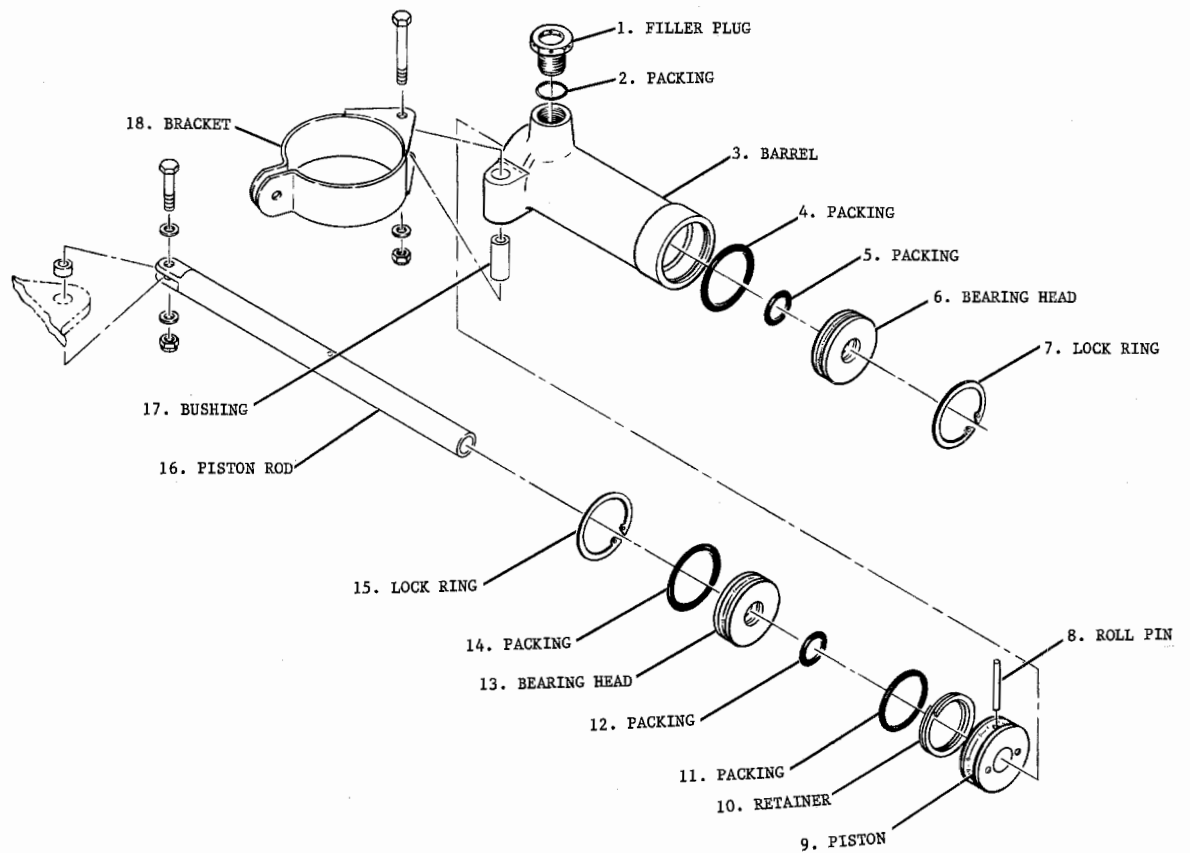
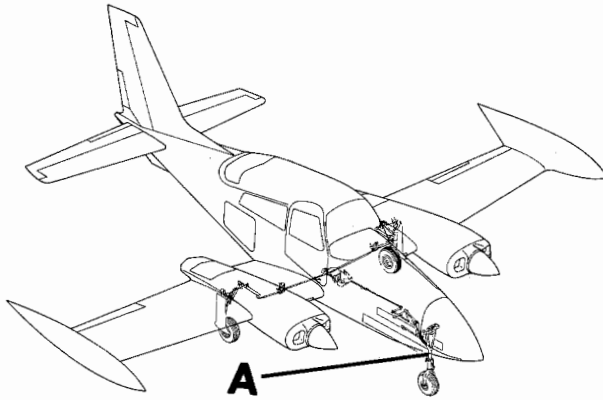
NOTE: Lubricate bushing (17) and attaching bolts with light oil during installation.

 - (1) Place bushing (17) in barrel (3), align mounting holes and secure in place with bolt, washer and nut.
 - (2) Secure piston rod to trunnion assembly with bolt, washers, nut and cotter pin.
2. Disassembly/Assembly of Nose Gear Shimmy Damper (See Figure 2).
 - A. Disassemble Shimmy Damper.
 - (1) Push piston rod (16) into shimmy damper, remove filler plug (1) and packing (2) and drain fluid.



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Troubleshooting Chart - Nose Shimmy Damper
Figure 1



DETAIL A

Shimmy Damper
Figure 2

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- (2) Remove lock ring (15) from the forward end of shimmy damper and pull bearing head (13), piston and rod assembly from barrel (3).
- (3) Remove lock ring (7) from aft end of barrel (3).
- (4) Remove packings (4, 14, 5 and 12) from bearing heads (6 and 13).
- (5) Drive roll pin out and remove piston (9) from piston rod (16).
- (6) Remove packing (11) and retainer (10) from piston.

B. Assemble Shimmy Damper.

NOTE: Before starting assembly of shimmy damper, thoroughly clean each component, then lubricate with MIL-H-5606 hydraulic fluid.

- (1) Install packings (4, 14, 5 and 12) on bearing heads (6 and 13).
- (2) Install bearing head (6) and lock ring (7) on aft end of barrel (3).
- (3) Slide bearing head (13) onto piston rod (16).
- (4) Install retainer (10) and packing (11) on piston (9).
- (5) Install piston (9) on piston rod (16) and insert roll pin (8) through piston and piston rod.
- (6) Insert piston and piston rod assembly into barrel (3), slide bearing head (13) into place and secure with lock ring (15).

CAUTION: INSERT PISTON AND PISTON ROD ASSEMBLY WITH CARE TO PREVENT DAMAGE TO PACKINGS.

- (6) Completely fill shimmy damper with MIL-H-5606 hydraulic fluid and install packing (2) and filler plug (1).

NOTE: For proper operation, shimmy damper must be completely full of hydraulic fluid, with no trapped air present.

- (7) Service shimmy damper. Refer to Chapter 2.

NOSE WHEEL AND TIREDescription

1. The nose wheel consists of two magnesium wheel halves secured together by three bolts, bearing cups, bearing cones and bearing seals. A 6.00 x 6, 4-ply rating, low pressure tire and a 6.00 x 6 tube are installed on the nose wheel assembly. The wheel, tube and tire assembly is mounted to the fork of the nose gear strut assembly.

Maintenance Practices

1. Removal/Installation of Nose Wheel and Tire Assembly (See Figure 1).

- A. Remove Nose Wheel and Tire Assembly.

- (1) Jack aircraft. Refer to Chapter 1.
- (2) Remove cotter pin, nut and bolt securing buckets (7) in place. Remove buckets and remove wheel and tire assembly from nose gear fork.
- (3) Remove spacers (9) and axle tube (8) from wheel.

- B. Install Nose Wheel and Tire Assembly.

CAUTION: ENSURE BEARING CONES (2) ARE PROPERLY LUBRICATED BEFORE INSTALLING WHEEL ASSEMBLY. REFER TO CHAPTER 2.

- (1) Insert axle tube (8) through wheel and place spacers (9) on each end of axle tube.
- (2) Place wheel and tire assembly in position, align with mounting holes in nose gear fork and install axle buckets (7) and secure with bolt and nut. Tighten nut until a slight bearing drag is felt as wheel is rotated. Loosen nut to nearest slot that will align cotter pin hole and install cotter pin.
- (3) Remove jacks from aircraft.

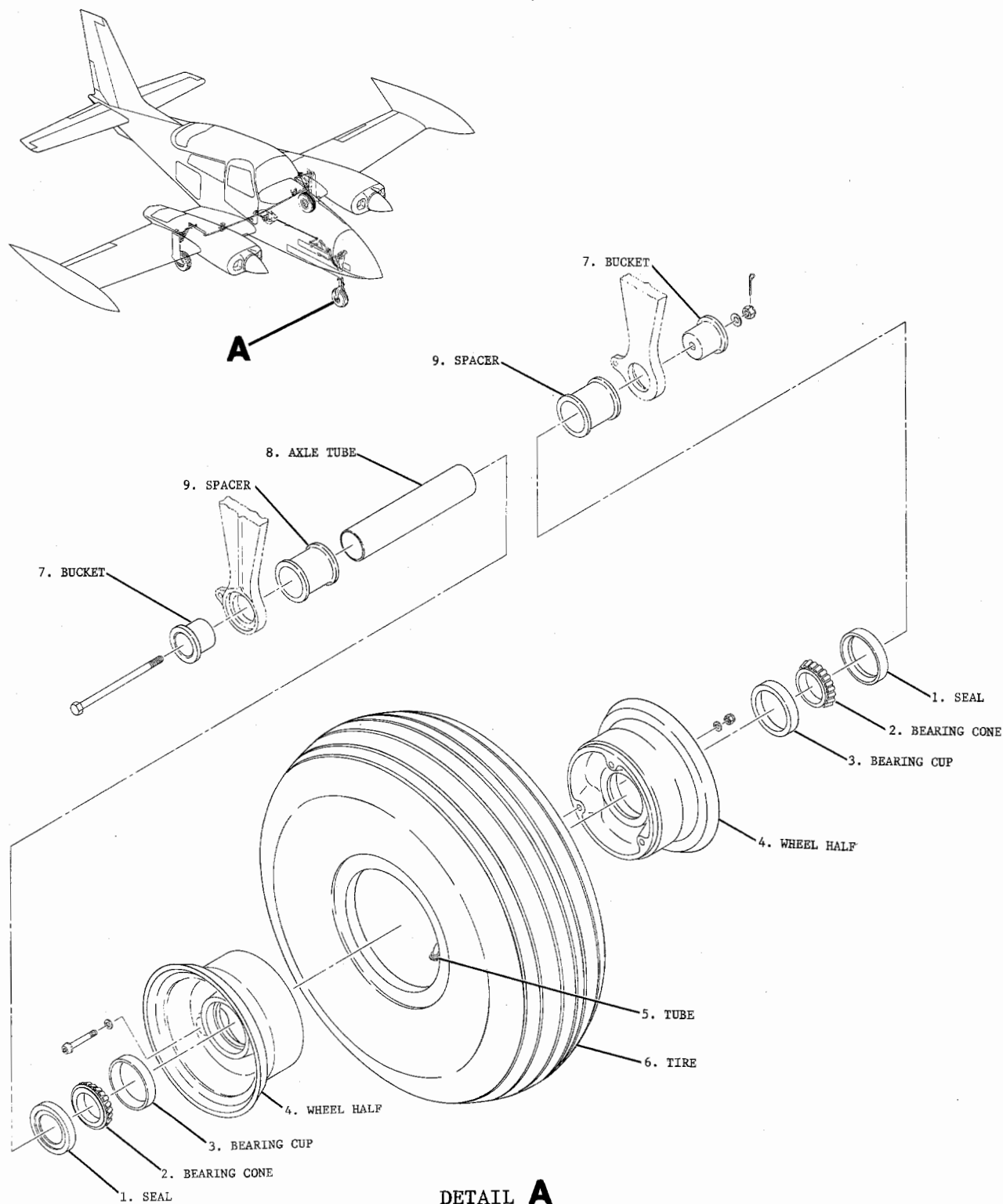
2. Disassembly/Assembly of Nose Wheel and Tire Assembly (See Figure 1).

- A. Disassemble Nose Wheel and Tire Assembly.

- (1) Remove seals (1) and bearing cones (2).
- (2) Deflate tire (6) and tube (5) by removing valve core.

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MAINTENANCE MANUAL



Nose Wheel and Tire Assembly
Figure 1

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MAINTENANCE MANUAL

WARNING: ALWAYS DEFLATE TIRE AND TUBE BEFORE SEPARATING WHEEL HALVES.

- (3) Remove nuts, washers and bolts and separate wheel halves (4).
- (4) Remove each wheel half and remove tube (5) from tire (6).
- (5) Bearing cups (3) are a shrink fit and should be removed only for replacement.

NOTE: If removal of bearing cups is necessary, place wheel half in boiling water for at least 30 minutes, then remove bearing cup by tapping cup evenly from the inner side.

B. Assemble Nose Wheel and Tire Assembly.

- (1) If removed, replace bearing cups.

NOTE: Bearing cups are a shrink fit in the wheel. To install, place wheel in boiling water for at least 30 minutes, chill bearing cups with dry ice, and tap lightly into position to insure proper seating.

- (2) Place wheel halves (4) in position on tire (6) and tube (5) and secure with bolts, washers and nuts. Torque bolts to value marked on wheel half.

CAUTION: TIGHTEN NUTS EVENLY AND TORQUE CORRECTLY TO LESSEN THE POSSIBILITY OF BOLT FAILURE.

- (3) Inflate tire sufficiently to seat the tire beads on the wheel assembly, deflate completely, then reinflate to operating pressure. Refer to Chapter 2.
- (4) Lubricate wheel bearing cones in accordance with Chapter 2. Place cones in wheel assembly and secure in place with seals (1).

NOTE: If wheel is not to be installed immediately, cover wheel bearings adequately to prevent contamination of grease.

3. Clean/Painting

- A. Refer to Main Wheel and Tires for Cleaning/Painting.

4. Approved Repairs

- A. Refer to Main Wheel and Tires for Approved Repair.

NOSE GEAR RETRACTION LINKAGEDescription

1. The nose gear retraction linkage consists of a drag brace, truss assembly, bellcranks, torque tubes, push-pull tubes and drive tubes interconnected between the landing gear actuator and the nose gear. A positive down lock is obtained by rigging the drag brace to an overcenter position. The connector link assembly which holds the drag brace in an overcenter position is also rigged overcenter. A downlock spring which applies tension to the overcenter position of the link assembly is provided as an added safety feature. A hook-type mechanical lock is provided to support the nose gear in the retracted position. The nose gear retracting linkage also operates the nose gear doors.

Maintenance Practices

1. Removal/Installation of Nose Gear Retracting Linkage (See Figure 1).

- A. Remove Nose Gear Retracting Linkage.

- (1) Jack aircraft (refer to Chapter 1).
- (2) Remove seats, carpet, floorboards and access covers as required to gain access to retracting linkage.
- (3) Disconnect nose gear doors.
- (4) Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.

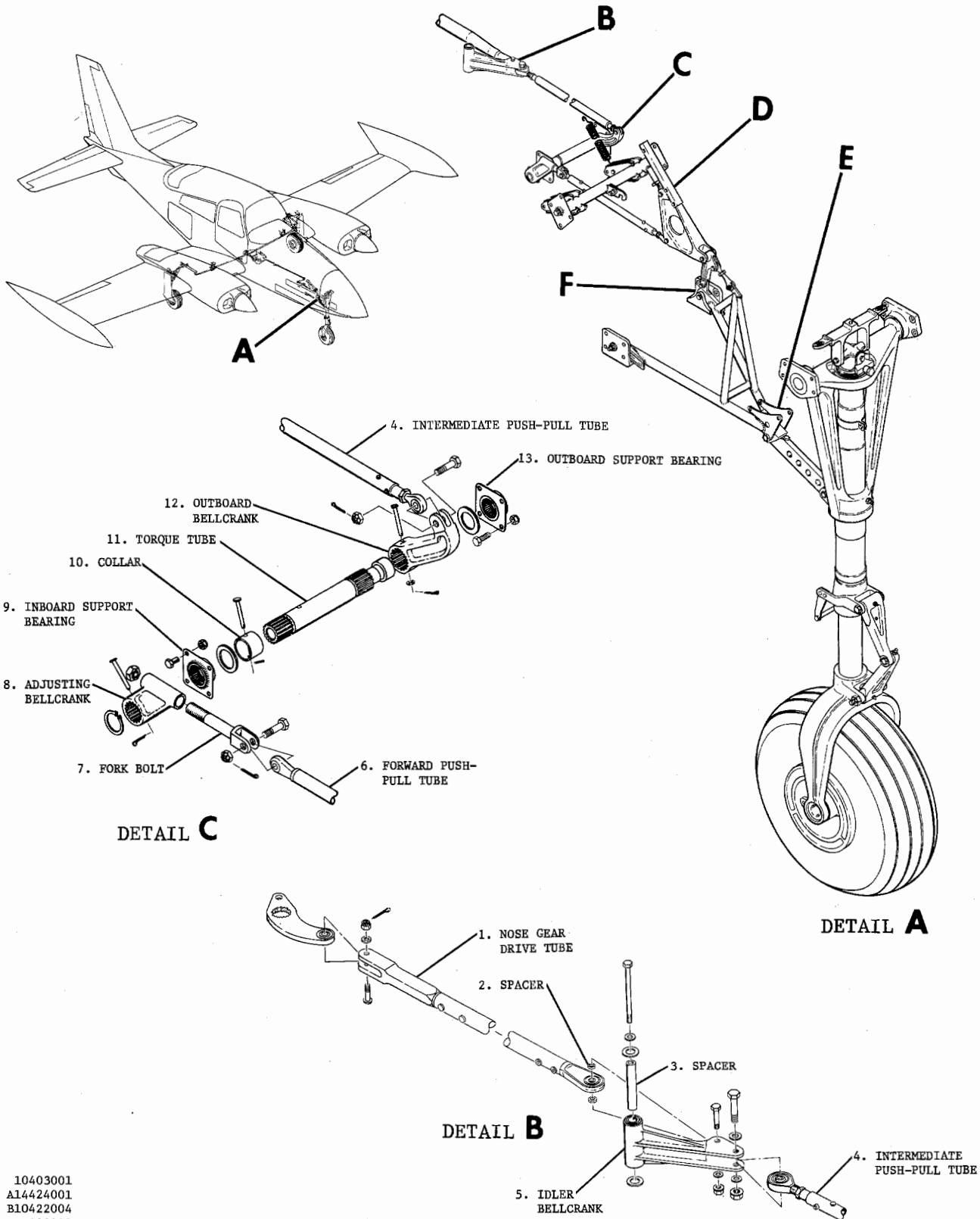
NOTE: Prior to any operation of the nose gear by the manual extension crank, assure that there is no electrical power on the aircraft; or that the landing gear switch is in the neutral position.

- (5) Remove forward push-pull tube (6) as follows:
 - (a) Remove cotter pin, nut and bolt attaching push-pull tube (6) to fork bolt (7).
 - (b) Remove cotter pin, nut and bolt attaching push-pull tube to connector link assembly (17).

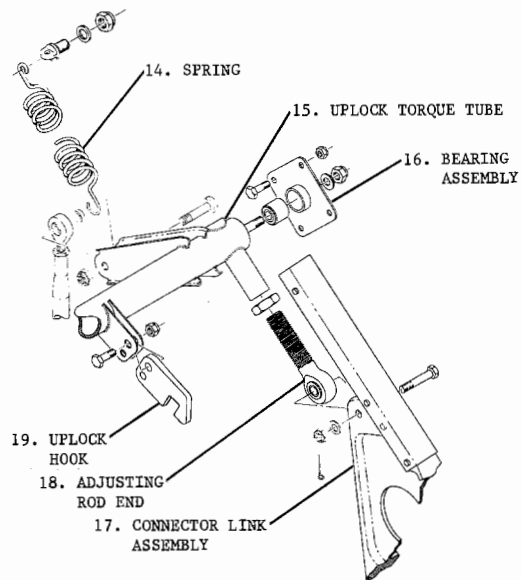
NOTE: During removal of nose gear linkage, manually move gear as required for access to attaching bolts and nuts.

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MAINTENANCE MANUAL

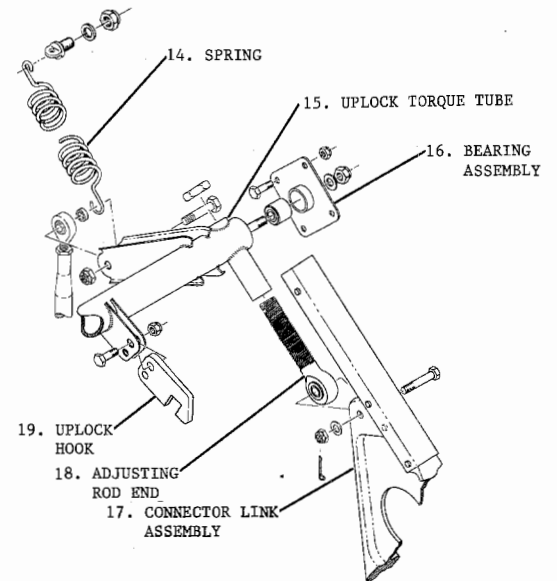


Nose Gear Retracting Linkage
Figure 1 (Sheet 1 of 2)



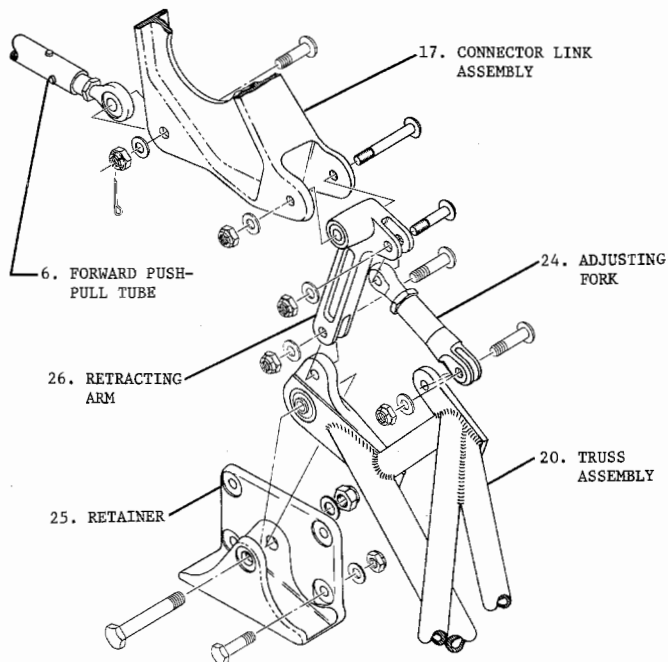
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DETAIL D

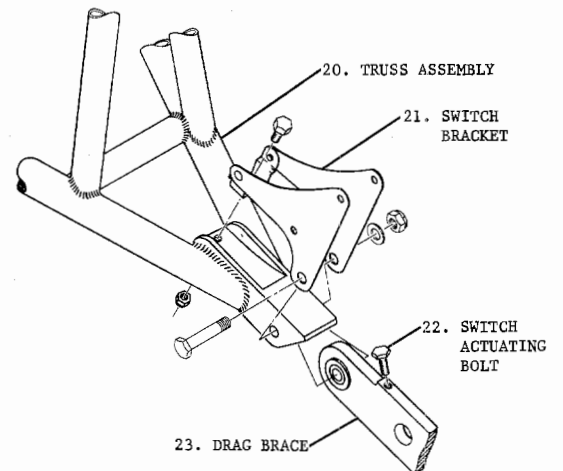


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DETAIL D



DETAIL F



DETAIL E

Nose Gear Retracting Linkage
Figure 1 (Sheet 2)

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MAINTENANCE MANUAL

- (6) Remove nose gear drive tube (1) as follows:
 - (a) Disconnect nose gear drive tube (1) from landing gear actuator bellcrank. Refer to Removal of Inboard Retraction Linkage Components.
 - (b) Move drive tube (1) forward as far as possible to gain access to idler bellcrank (5) attachment point and remove nut, washer, spacers and bolt.
 - (7) Remove intermediate push-pull tube (4) as follows:
 - (a) Remove nut, washer and bolt attaching push-pull tube to idler bellcrank (5).
 - (b) Remove cotter pin, nut, and bolt attaching push-pull tube (4) to outboard bellcrank (12).
 - (8) Remove idler bellcrank (5) by removing bolt and washers. Leave spacer (3) installed.
 - (9) Remove torque tube (11) as follows:
 - (a) Remove adjusting bellcrank (8) by removing cotter pin and pin. Fork bolt (7) and adjusting bellcrank may be removed as a unit.
 - (b) Remove inboard support bearing (9) by removing four nuts and bolts.
 - (c) Pull torque tube (11) inboard until it clears the outboard support bearing (13), then tilt the outboard end upward and remove from nose section.
 - (d) Remove stop collar, if desired, by removing cotter pin and pin.
 - (10) Remove connector link assembly (17) as follows:
 - (a) Remove nut and bolt attaching connector link assembly (17) to retracting arm (26).
 - (b) Remove cotter pin, nut, washer and bolt, attaching connector link assembly (17) to adjusting rod end (18).
 - (11) Remove drag brace (23) as follows:
 - (a) Remove nut, washer, and bolt attaching drag brace (23) to truss assembly (20).
 - (b) Remove nut, washer and bolt attaching drag brace to strut.
 - (12) Remove uplock torque tube (15) as follows:
 - (a) Remove cotter pin, nut and washer at each end of torque tube.
 - (b) Remove bearing assemblies (16) by removing attaching nuts and bolts.
- NOTE: Bearings are a press fit and should be removed only for replacement.
- (13) Remove truss assembly (20), retracting arm (26) and adjusting fork (24) as an assembly as follows:
 - (a) Remove nut and bolt attaching switch bracket (21) to truss assembly (20).

- (b) Remove clamps attaching electrical wires to retracting linkage and tie switch where it will not interfere with linkage removal.
- (c) Remove nuts, washers and bolt securing truss assembly (20) to retainers (25). Pull truss assembly forward and remove from aircraft.
- (d) If desired, retracting arm (26) and adjusting fork (24) may be removed from truss assembly by removing attaching nuts and bolts.

B. Install Nose Gear Retracting Linkage.

- (1) Install truss assembly (20) as follows:
 - (a) If removed install retracting arm (26) and adjusting fork (24) on truss assembly with attaching bolts and nuts.

NOTE: Install bolts as shown for proper clearance. Lower retracting arm attaching bolt is inaccessible after truss assembly is installed.

- (b) Place truss assembly in position and attach to retainers with bolts, washers and nuts.
- (c) Install clamps attaching electrical wires to retracting linkage and attach switch bracket (21) to truss assembly (20) with bolt and nut.
- (2) Install uplock torque tube (15) as follows:
 - (a) If removed, install uplock hook (19) and adjusting rod end (18) to uplock torque tube.
 - (b) Install left bearing assembly (16), then place uplock torque tube in position and install right bearing assembly. Secure bearing assemblies with bolts and nuts.
 - (c) Install washer, nut and cotter pin on each end of uplock torque tube assembly.
- (3) Install drag brace (23) as follows:
 - (a) Attach drag brace to truss assembly (20) with bolt, washer and nut.

NOTE: When installing bolt, insure that down indicator switch bracket (21) is properly in place.

- (b) Connect drag brace (23) to strut with attaching bolt, washer and nut.
- (4) Install connector link assembly (17) as follows:
 - (a) Attach connector link assembly to retracting arm (26) with bolt and nut.
 - (b) Attach connector link assembly to adjusting rod end (18) with bolt, washer, nut and cotter pin.

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MAINTENANCE MANUAL

- (5) Install torque tube (11) as follows:
- (a) Install collar (10) with pin and cotter pin.
 - (b) If removed, install outboard support bearing (13) with bolts and nuts.

NOTE: Torque nuts attaching inboard and outboard support bearings to 13.5 $\pm$ 1.5 inch-pounds.

- (c) Install outboard washer on torque tube and place in position.

NOTE: Insert inboard end of torque tube through the inboard mounting hole from the left, pull into wheel well area until outboard end of torque tube can be inserted into outboard bearing assembly.

- (d) Place inboard washer, then inboard support bearing (9) on inboard end of torque tube. Install support bearing with bolts and nuts.
- (e) If removed, install fork bolt (7) in adjusting bellcrank (8).
- (f) Install adjusting bellcrank (8) on torque tube with pin and cotter pin.

NOTE: Splines must align so that pin can be installed, and bellcranks (8 and 12) both extend forward from torque tube.

- (6) Insert spacer (3) into idler bellcrank (5), place bellcrank into position and secure with bolt and washer.
- (7) Attach intermediate push-pull tube (4) as follows:
- (a) Attach intermediate push-pull tube to outboard bellcrank (12) with bolt, nut and cotter pin.

NOTE: The collar-end of the forward horizontal hi-shear rivet must point inboard for clearance.

- (b) Attach intermediate push-pull tube (4) to idler bellcrank (5) with bolt, washer and nut.

NOTE: To gain access to idler bellcrank attachment points, rotate bellcrank as far forward as possible.

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MAINTENANCE MANUAL

- (8) Install nose gear drive tube (1) as follows:
 - (a) Attach nose gear drive tube to idler bellcrank (5) with bolt, washer, spacers (3) and nut.
 - (b) Attach drive tube to landing gear actuator bellcrank. Refer to installation of Inboard Retraction Linkage Components.
- (9) Install forward push-pull tube (6) as follows:
 - (a) Using the manual extension system, operate gear to the DOWN position, then crank gear a few turns toward the UP position.
 - (b) Attach push-pull tube (6) to connector link assembly (17) with bolt, washer, nut and cotter pin.
 - (c) Attach push-pull tube (6) to fork bolt (7) with bolt, nut and cotter pin.
- (10) Rig nose gear retracting linkage: Refer to Adjustment/Test of Main Gear Linkage.
- (11) Connect and rig nose gear doors. Refer to Adjustment/Test of Nose Gear Doors.
- (12) Install floorboards, carpet, seats and access covers.
- (13) Insure that landing gear is down and locked then remove aircraft from jacks.

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MAINTENANCE MANUAL

NOSE GEAR STEERING SYSTEMDescription

1. The nose gear steering system permits nose gear steering with the rudder pedals, for angles up to 18 degrees, either right or left of center. Spring loaded nose gear steering cables permit continued resisted turning action of the nose gear for steering angles greater than 18 degrees, up to a maximum of 55 degrees. Steering arms welded to the rudder torque tubes, are connected by the steering cables, to a steering gimbal; which pivots in a support mounted directly above the nose gear trunnion assembly. The gimbal allows nose gear steering when the gear is down. When the gear is retracted, the gimbal serves as an idler, permitting free wheeling of the nose gear steering.

Maintenance Practices

1. Removal/Installation of Nose Wheel Steering System (See Figure 1).
 - A. Remove nose wheel steering system.
 - (1) Remove pilot and copilot's seats front carpet and access covers as required to gain access to steering cables.
 - (2) Remove nose baggage shelf and radio equipment as necessary to gain access to steering cables.

CAUTION: DO NOT REMOVE CLEVIS PIN FROM NOSE GEAR STEERING BELLCRANK WITHOUT FIRST RELEASING TENSION ON THE NOSE STEERING CABLES.

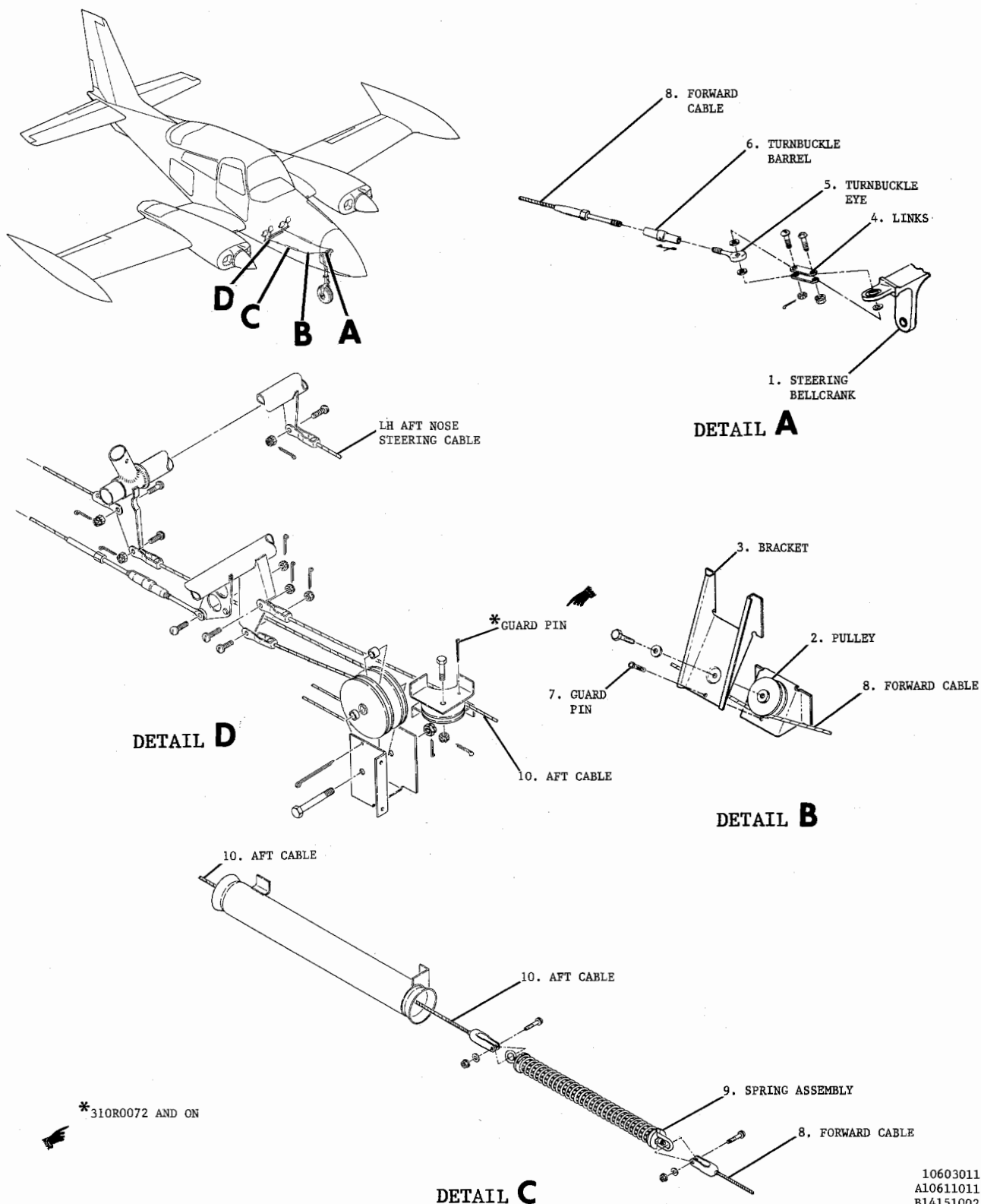
 - (3) Disconnect the nose steering cables at the forward bellcrank in the nose wheel well by loosening turn-buckles (6).

NOTE: Removal procedures are given for the left steering cable. Procedures are the same for the right cable.

- (4) Disconnect aft nose gear steering cable (10) from rudder torque tube by removing cotter pin, nut and bolt.
- (5) Remove cable guard pin (7) from bracket (3). Pull forward cable through wheel well web into nose section and remove cable assembly.

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SERVICE MANUAL



Nose Gear Steering System
Figure 1

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D10613012

- (6) If desired, spring assembly (9) may be removed from forward and aft cables by removing cotter pins, nuts and bolts.

B. Install Nose Wheel Steering System.

- (1) If disassembled, attach spring assembly (9) to forward and aft cables with bolts, nuts and cotter pins.
- (2) Route turnbuckle end of cable through wheel well to steering bellcrank (1) and attach with links (4), bolts, washers, nuts and cotter pins.
- (3) Route aft cable (10) and spring assembly (9) through spring housing to the rudder torque tube and connect with bolt, nut and cotter pin.

NOTE: Nose steering spring assemblies are pre-set at the factory to 85 pounds. Do not alter settings.

- (4) Rig nose gear steering cables. Refer to Chapter 5.
- (5) Install guard pin (7).
- (6) Install radio equipment and baggage shelf.
- (7) Install access panels, carpet and seats.

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MAINTENANCE MANUAL

NOSE GEAR DOORSDescription

1. Right and left nose gear doors are used to enclose the nose gear when in retracted position. The doors are connected to the nose gear retracting linkage and are hinged on continuous hinge on the outer edge of each door. The doors pivot down during gear extension and remains down while the nose gear is down.

Adjustment/Test

1. Rig Nose Gear Doors (See Figure 1).

- A. Jack aircraft. Refer to Chapter 1.
- B. Disconnect door link (1 and 5) from attachment brackets (3) by removing cotter pin, nut, washer and bolt.
- C. Using normal landing gear retraction system, operate gear to UP position.

NOTE: The use of an external power source is recommended for operation of electrical units.

- D. Adjust rod ends on door links (1 and 5) until each door will close snugly while gear is in the UP position.
- E. Extend gear and connect both doors with bolt, washer, nut and cotter pin.

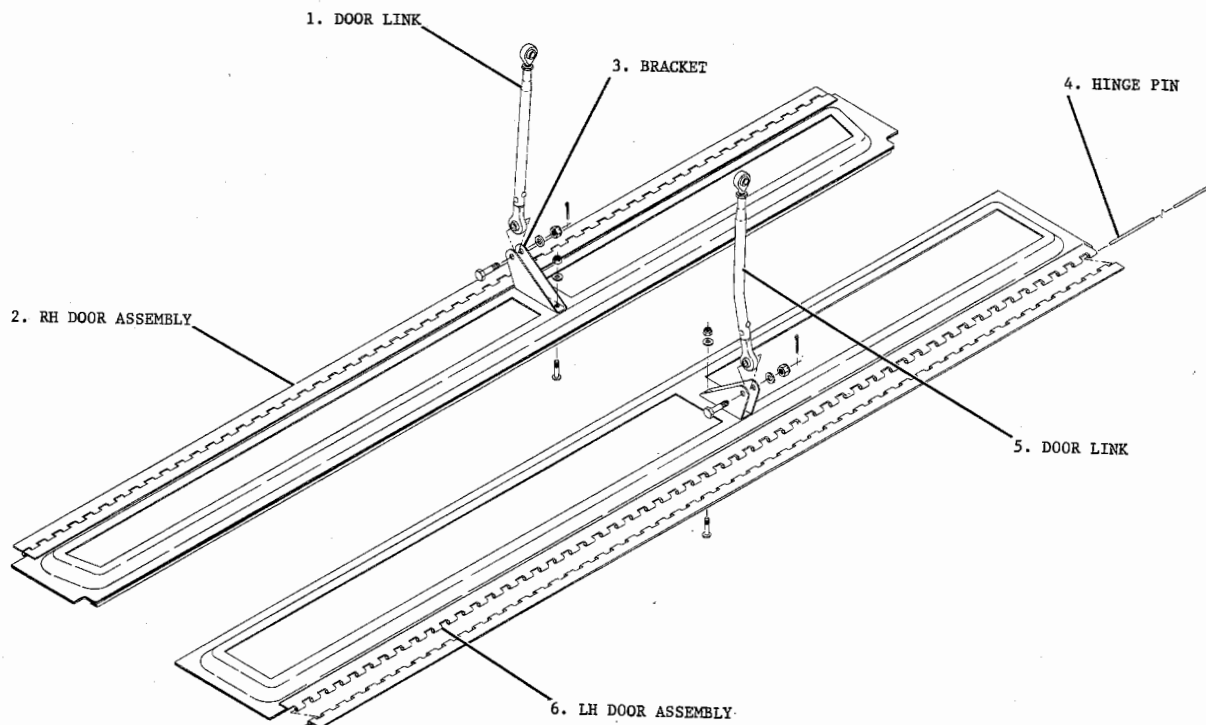
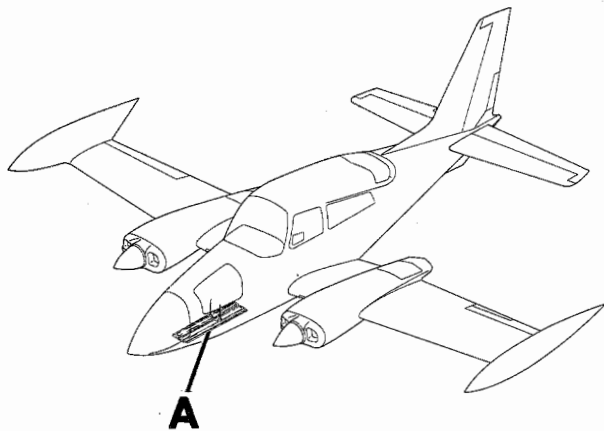
CAUTION: WHEN OPERATING GEAR BEFORE RIGGING IS COMPLETE, BE PREPARED TO STOP BEFORE DAMAGE CAN OCCUR.

- F. Retract and extend gear, check for clearance between nose tire and doors, and readjust door links as necessary for proper fit and proper clearances.
- G. Ensure landing gear is DOWN and locked, then remove aircraft from jacks.

Maintenance Practices

1. Removal/Installation of Nose Gear Doors (See Figure 1).

NOTE: Removal/Installation procedures are given for the right hand nose gear door. The procedures are the same for the left hand door.



DETAIL **A**

Nose Gear Doors Installation
Figure 1

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A. Remove Nose Gear Doors.

- (1) Disconnect door link (1) from bracket (3) by removing cotter pin, nut, washer and bolt.
- (2) Remove cotter pins retaining hinge pin (4); support door and remove hinge pin. Remove door.

B. Install Nose Gear Doors.

- (1) Place door in position and secure in place with hinge pin (4).
- (2) Secure hinge pin in place with cotter pins at forward and aft ends.

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MAINTENANCE MANUAL

BRAKE SYSTEM MAINDescription

1. The aircraft has an hydraulically actuated main brake system. A hydraulic master cylinder is attached to each pilot's rudder pedal and hydraulic lines and hoses are routed from these cylinders through the cabin and through the wing to the brake assemblies on each main landing gear. The brakes are single-disc, non self-adjusting type with two actuating cylinders in each brake assembly. No manual adjustment is required. The brakes can be operated by applying pressure to either the pilot's or copilot's rudder pedals.

Troubleshooting

1. Troubleshooting Brake System

- A. For a guide to troubleshooting the brake system, refer to Figure 1.

Maintenance Practices

1. Removal/Installation of Brake System.

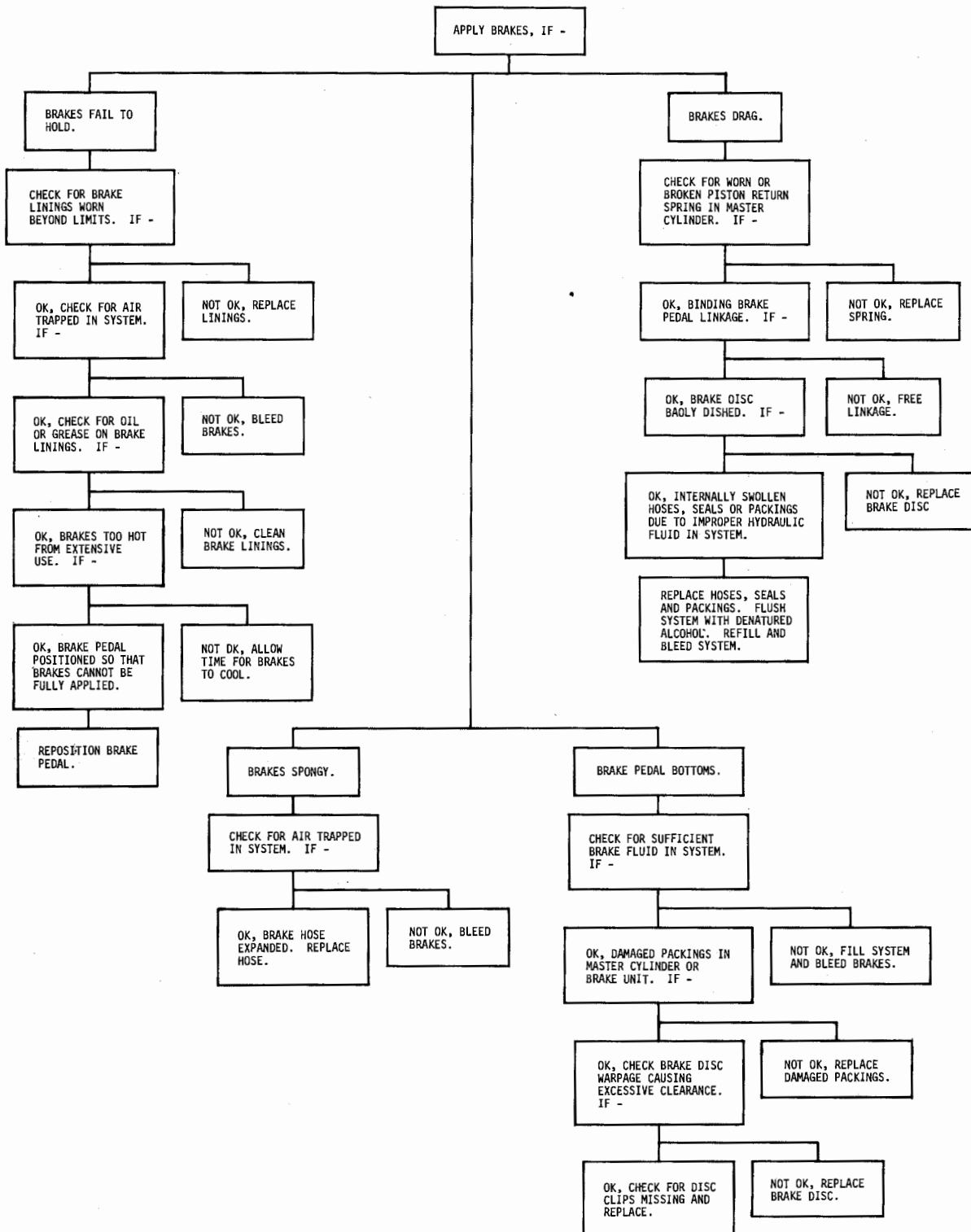
- A. Remove master cylinder (See Figure 2).

NOTE: The removal procedures are typical for either right or left master cylinder.

- (1) Remove pilots seat, left scuff plate, left rudder bar shield and carpet.
 - (2) Drain hydraulic fluid from master cylinder and lines by disconnecting the line at the main wheel brake assembly.

CAUTION: CAP ALL OPEN LINES AND FITTINGS TO PREVENT ENTRY OF FOREIGN MATERIAL.

- (3) Disconnect clevis (1) from brake pedal (20) by removing cotter pin and pin.
 - (4) Disconnect lower end of body (9) from support (19) by removing cotter pin, pin and spacers (18).
 - (5) Lift master cylinder high enough to disconnect hose from elbow (7). Remove cylinder.



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Troubleshooting Chart - Brake System
Figure 1

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MAINTENANCE MANUAL

B. Install Master Cylinder (See Figure 2).

NOTE: The installation procedures are typical for either right or left master cylinder.

- (1) Lift hose end from its position between master cylinder mounting brackets and remove temporary cap. Attach hose to elbow (7) and tighten.
- (2) Position cylinder between supports (19) and secure with pin, spacers (18), and cotter pin.
- (3) Connect clevis (1) to brake pedal (20) with pin. Adjust clevis (1) to align tips of brake pedals (20) with rudder pedals in neutral position. Secure pin with cotter pin and secure clevis (1) with nut (2).

C. Remove Brake Lines (See Figure 3).

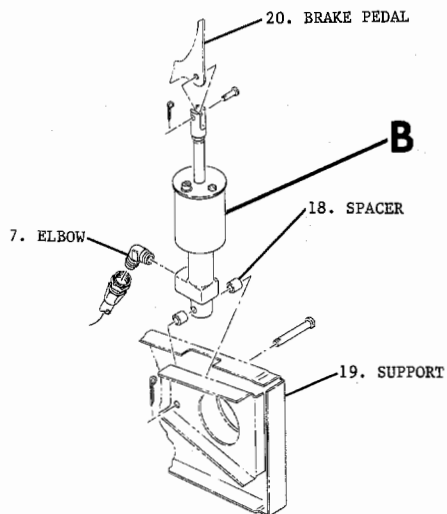
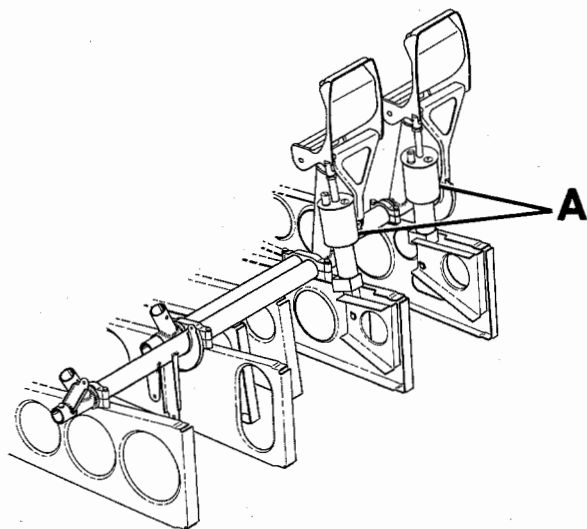
- (1) Remove access panels as necessary to gain access to brake lines.
- (2) Disconnect left master cylinder hose (3) from elbow in web of pilot's left rudder pedal bracket, and remove through access hole.
- (3) Remove left cabin brake line (12) as follows:

NOTE: As removal of this line requires its destruction, it is not recommended that it be removed except as required for replacement. Replacement of the factory installed line (12) will require two separate lines (15 and 16) joined with a union just above the floorboard on the forward side of the bulkhead.

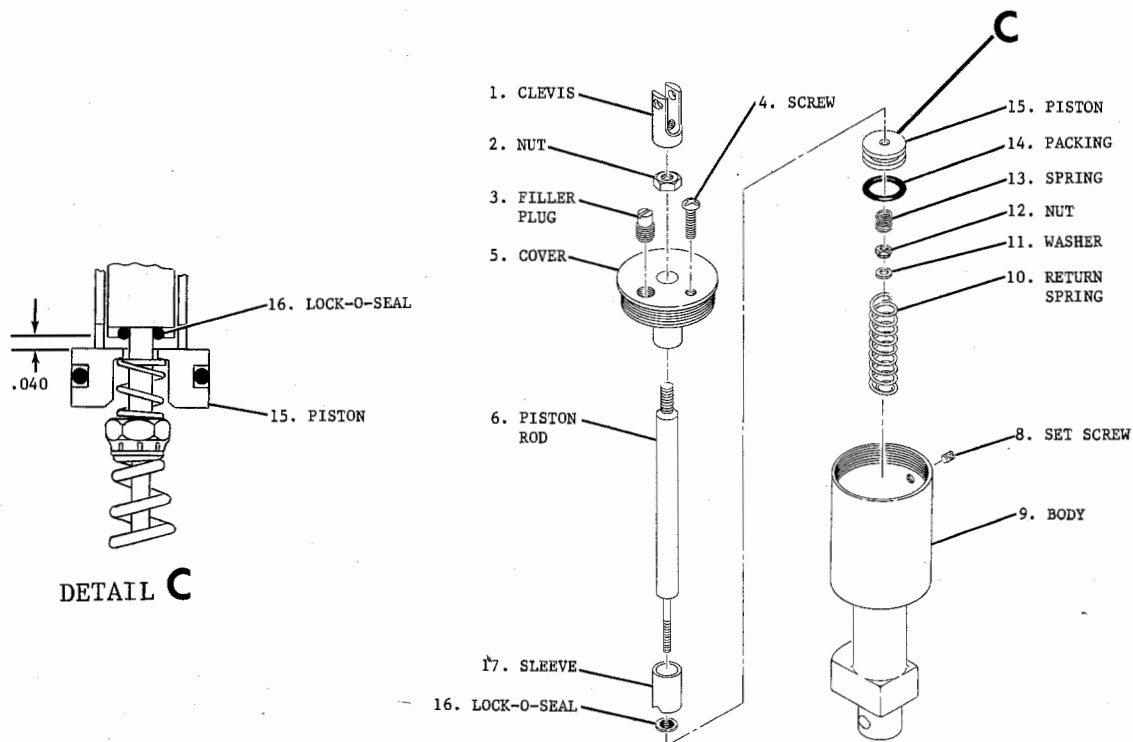
- (a) Cut line at riser portion forward of bulkhead and as close to the floorboard as practical.
 - (b) Loosen coupling nuts from elbows and remove each section of line.
- (4) To remove right master cylinder hose:
- (a) Disconnect cabin crossover brake line (11) from elbow in web of pilot's right rudder pedal bracket.
 - (b) Remove attaching nut and washer from elbow to allow its removal from web or rudder pedal bracket. Remove hose (4), with elbow attached through master cylinder mounting position.
 - (c) Detach hose from elbow.
- (5) Disconnect cabin crossover brake line (11) from elbow in right side of control column well and remove through access hole in left floorboard.
- (6) Remove intermediate cabin brake line (5) as follows:

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DETAIL A



DETAIL B

DETAIL C

Brake Master Cylinder
Figure 2

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MAINTENANCE MANUAL

NOTE: Due to difficulty of access, it is recommended that this line be removed only as necessary for replacement.

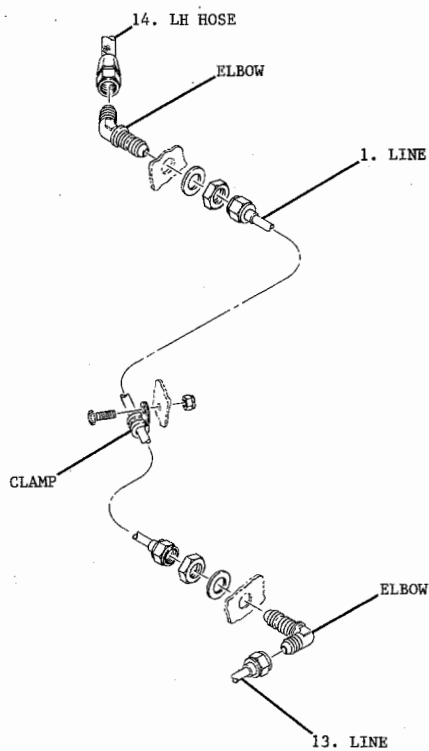
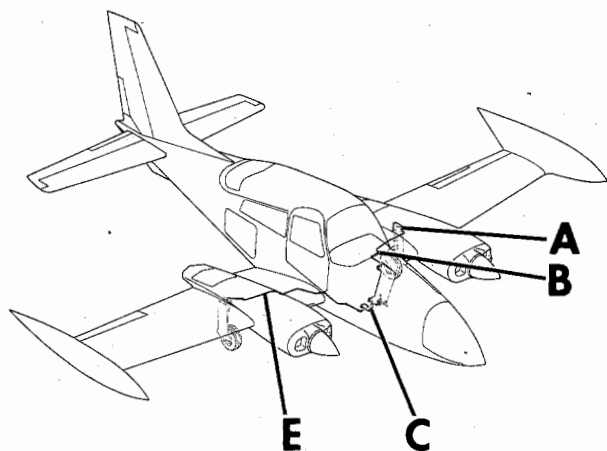
- (a) Remove attaching nut and washers from elbow in right side of control column well to allow its withdrawal from position.
- (b) Disconnect line (5) from aft elbow.

NOTE: Access to the aft coupling nut on this line is through the forward rectangular access hole in the right floorboard and through the lightening hole in the web of the copilot's left rudder pedal bracket. A 9/16 inch crowfoot wrench and extension can be manipulated through this opening to loosen the coupling nut.

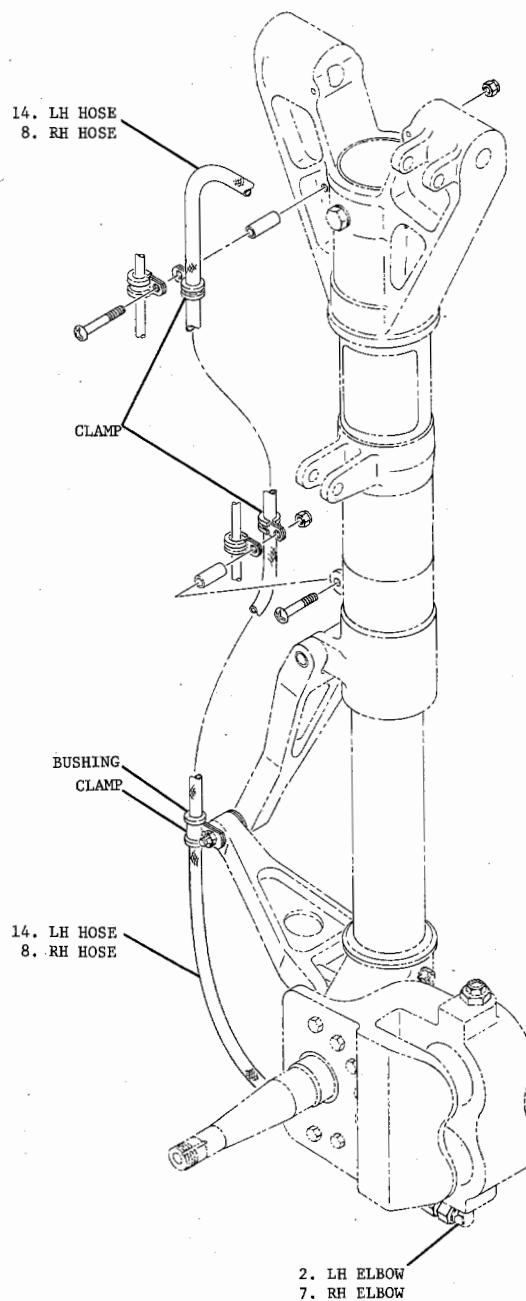
- (c) Remove line through lightening hole, with elbow still attached, by manipulating forward end outboard and forward, to allow aft end to clear edge of lightening hole.
 - (d) Detach line (5) from elbow.
- (7) Disconnect right cabin brake line (6) from elbows. Carefully work line from its position beneath the floorboards, and remove through access hole.

CAUTION: IT MAY BE NECESSARY TO FLEX THIS LINE SLIGHTLY TO FACILITATE REMOVAL. HOWEVER, EXCESSIVE BENDING SHOULD BE AVOIDED TO PREVENT DEFORMATION OR OTHER DAMAGE TO THE LINE.

- (8) Remove forward wing root fillets, and the two inboard access hole covers from underside of each wing leading edge.
- (9) To remove right and left wing inboard brake lines (10 and 13), disconnect each one from fittings at both ends, and carefully work them free of adjacent lines inside the wings so that they can be removed through the rectangular access holes.
- (10) Disconnect right and left wing outboard brake lines (1 and 9) from fittings at both ends, remove clamps and remove lines through main wheel wells.
- (11) Disconnect right and left brake hoses (8 and 14) from elbows at their upper ends. Remove two upper hose clamps. To release hoses, remove hose clamps by removing nuts from bolts in main gear torque link links. Replace nuts and secure with cotter pins after hose clamps have been removed.



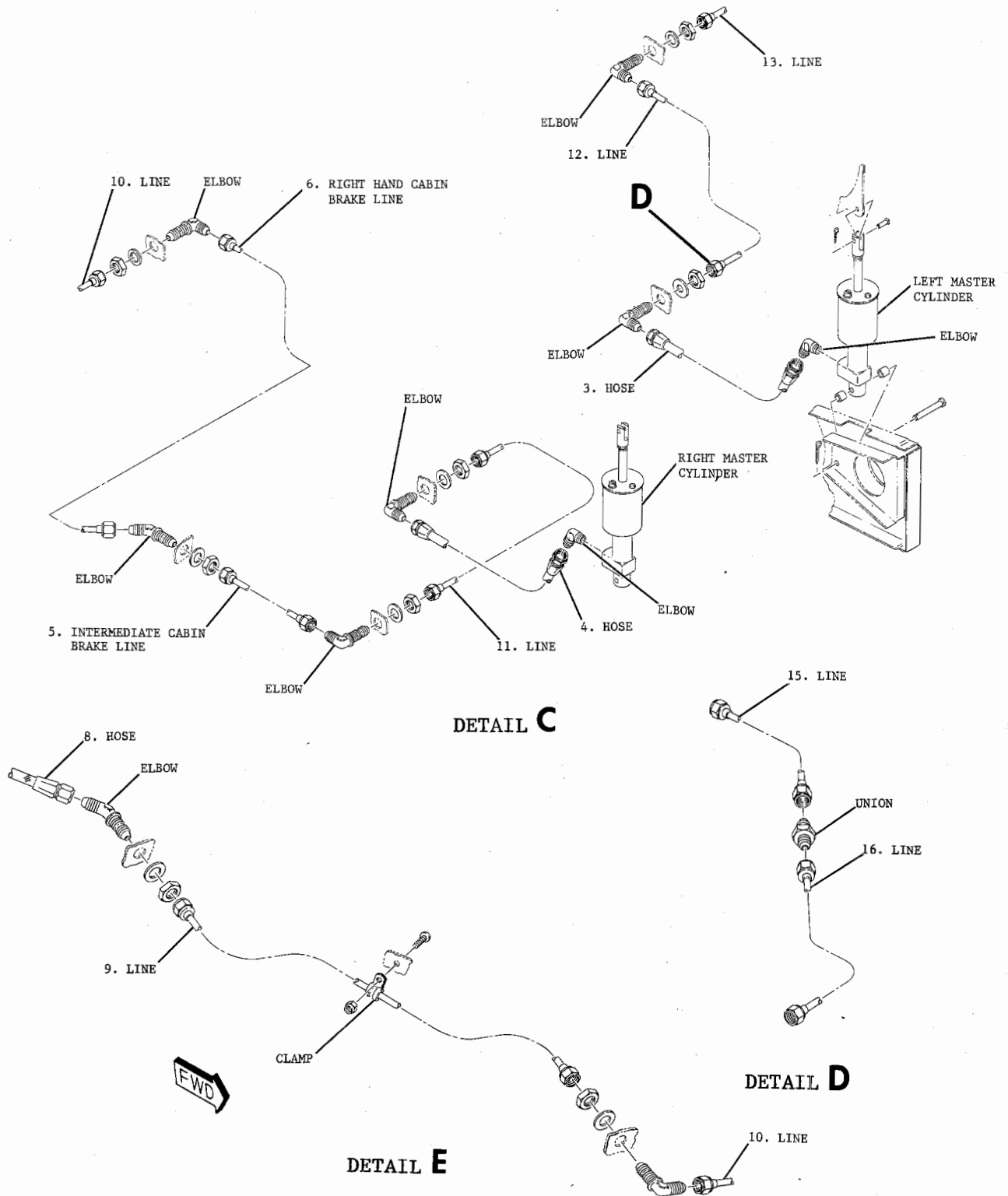
DETAIL B



DETAIL A

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Brake System Plumbing
Figure 3 (Sheet 1 of 2)



Brake System Plumbing
Figure 3 (Sheet 2)

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MAINTENANCE MANUAL

- (12) Remove brake hoses (8 and 14) by detaching coupling nuts from fittings in main brake assemblies. Install temporary caps over brake assembly fittings to prevent entry of foreign material.

D. Install brake lines (See Figure 3).

NOTE: Use only clean system hydraulic fluid as a lubricant for all hydraulic fittings.

- (1) Remove temporary caps from fittings in brake assemblies and attach brake hoses (8 and 14) to fittings.
- (2) Attach upper hose ends to elbows. Fasten hoses (8 and 14) and secure to torque link with clamps, bolts with nuts. Secure nuts with cotter pins. Attach clamps to upper portion of hoses.
- (3) Working through main wheel wells, place right and left wing outboard brake lines (1 and 9) in position and attach ends to elbows. Attach clamps.
- (4) Working through wing access holes, carefully work right and left wing inboard brake lines (10 and 13) into position and attach ends to elbows as illustrated.

CAUTION: SOME FLEXING OF THE LINES MAY BE NECESSARY TO WORK THEM INTO POSITION. HOWEVER, EXCESSIVE BENDING SHOULD BE AVOIDED.

- (5) Replace access hole covers and wing root fillets.
- (6) Working through aft, right rectangular floorboard access hole, carefully work right cabin brake line (6) into position beneath the floorboard, with outboard end extending upward through routing hole in floorboard. Attach ends to elbows.

CAUTION: SOME FLEXING OF THIS LINE WILL BE REQUIRED TO WORK IT INTO POSITION. HOWEVER, EXCESSIVE BENDING SHOULD BE AVOIDED.

- (7) Install intermediate cabin brake line (5) as follows:
 - (a) Attach elbow to forward end of line and set washer in place over elbow.
 - (b) Working through forward right floorboard access hole, and through lightening hole in web of co-pilot's left rudder pedal bracket, work line (5) into position, with elbow extending through routing hole in right side of control column well.

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NOTE: Do not allow washer to drop from elbow while working line into position.

- (c) Using a 9/16 inch crowfoot wrench with extension, attach aft coupling nut on line (5) to elbow.
- (d) Secure elbow in place at right side of control column well with washer and attaching nut.
- (8) Working through left floorboard access hole, position U-shaped cabin crossover brake line (11) beneath left floorboard, with longer leg extending through routing hole in left side of control column well. Attach coupling nut to elbow in right side of control column well.
- (9) To install right master cylinder hose (4):
 - (a) Connect elbow to hose end.
 - (b) Place washer over elbow, and working aft through right master cylinder mounting position, place elbow with hose attached, into position in routing hole through web of pilot's right rudder pedal bracket.

NOTE: Do not allow washer to drop from elbow, while working elbow into position.

- (c) Secure elbow with washer and nut.
- (d) Attach coupling nut on cabin crossover line (11) to elbow.
- (10) To install left cabin brake line (12):

NOTE: If left cabin brake line (12) was removed, three parts which may be fabricated to replace it. This assembly consists of a left floorboard brake line (16), a union, and a left bulkhead brake line (15).

- (a) Join union to short end of left floorboard brake line (16).
- (b) Position left floorboard brake line beneath left floorboard so that end with union attached extends upward through routing hole in floorboard. Attach coupling nut to elbow.
- (c) Position left bulkhead brake line (15) through routing hole in bulkhead, and attach coupling nuts to elbow and union.
- (11) Attach coupling nut on left master cylinder hose (3) to elbow in web of pilot's left rudder pedal bracket.

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E. Remove Main Wheel Brake (See Figure 4).

NOTE: The removal procedures are typical for either right or left wheel brake.

- (1) Jack aircraft. Refer to Chapter 2.
- (2) Remove wheel and tire assembly.
- (3) Disconnect brake line from elbow (10).
- (4) Remove brake housing (4) and brake disc (3) from axle flange (6) by removing five bolts, washers and nuts.

F. Install Main Wheel Brake (See Figure 4).

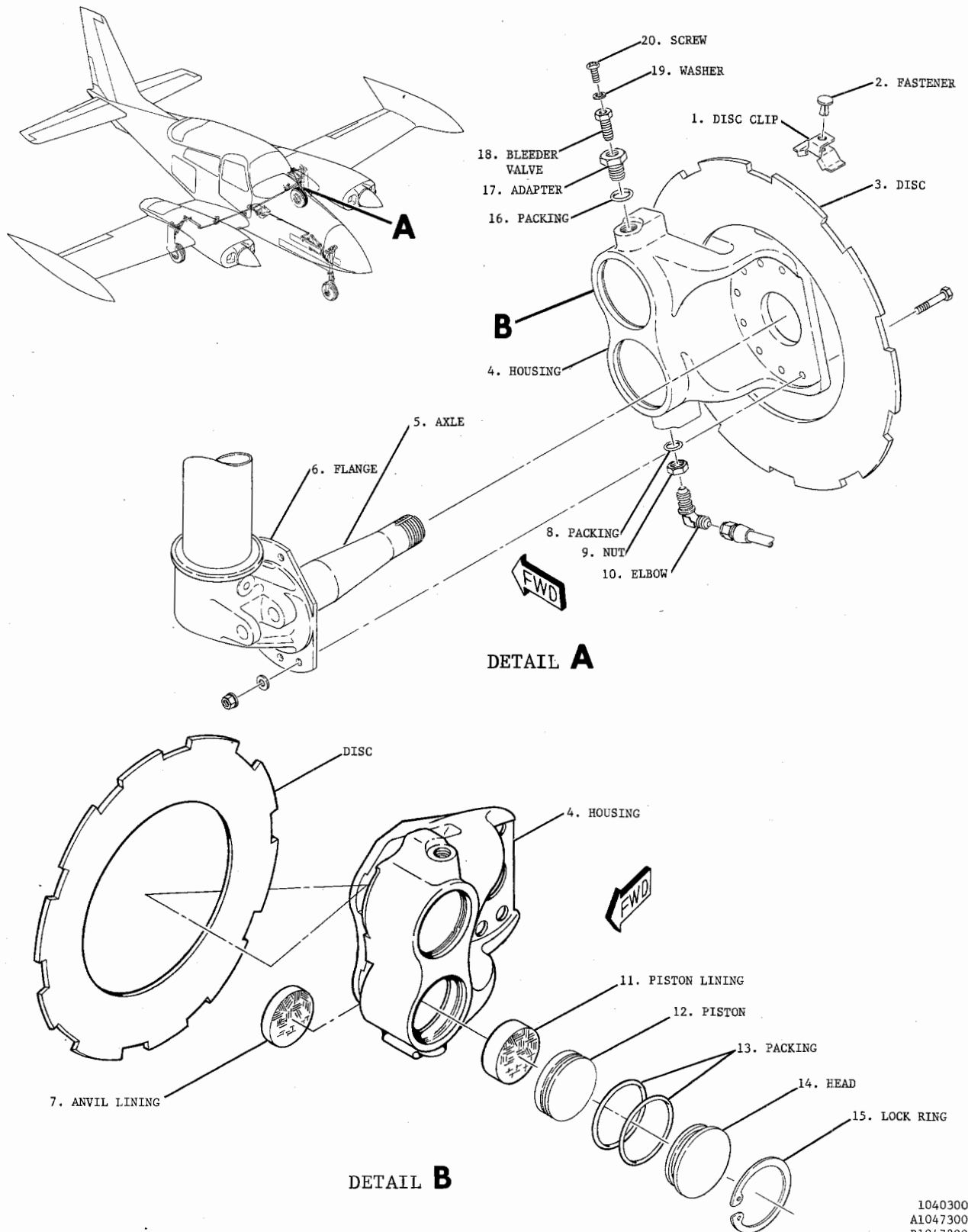
- (1) Position assembled brake housing (4) and disc (3) to axle so that bleeder valve is vertical and secure with five bolts, washers and nuts. Torque nuts to 100 + 10 inch-pounds.
- (2) Install wheel and tire assembly.
- (3) Attach brake line to elbow (10).

G. Disassembly/Assembly of Main Wheel Brake (See Figure 4).

- (1) Disassemble main wheel brake.
 - (a) Remove brake disc (3) and piston linings (7 and 11) from housing.
 - (b) Remove lock ring (15) from recess in housing, then remove cylinder head (14) and piston (12).
 - (c) Remove packings (13) from piston and cylinder head.
 - (d) Remove elbow (10), nut (9) and packing (8).
 - (e) Remove bleeder valve (18), adapter (17) and packing (16).
- (2) Assemble main wheel brake.
 - (a) Install elbow (10), nut (9) and packing (8).
 - (b) Install bleeder adapter (17), packing (16) and bleeder valve (18).
 - (c) Using clean hydraulic fluid as a lubricant, set new packings (13) in place on cylinder head (14) and piston (12).
 - (d) Lubricate cylinder walls and pistons with clean hydraulic fluid and insert piston (12) and cylinder head (14) into cylinder.
 - (e) Secure cylinder head (14) in place with lock ring (15).

NOTE: Make certain lock ring is seated in the retaining groove.

- (f) Install new or serviceable brake linings (7 and 11), setting piston lining (11) in piston



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Main Wheel Brakes
Figure 4

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side, with smooth sides of linings facing each other.

- (g) Set brake disc (3) in place between linings.

Inspection/Check

1. Inspection/Check Main Wheel Brakes (See Figure 4).

A. Check Main Wheel Brakes.

- (1) Check brake lining wear limits as follows:
 - (a) Set the parking brake to force the brake disc (3) against the anvil lining (7).
 - (b) Check clearance between outboard surface of brake disc (3) and flat surface of brake housing (4).
 - (c) Replace linings if space is, or exceeds, $\frac{3}{8}$ (0.375) inch.
- (2) Check brake disc wear limits as follows:
 - (a) Inspect disc for wear. Discard disc when worn to a thickness of 0.225 inch or less.
 - (b) Inspect disc for dishing. Disc must be replaced if dishing exceeds $\frac{1}{16}$ (.0625) inch.
 - (c) Inspect disc keyways for wear and battering. Replace disc if keyway width exceeds 1.188 inch.
- (3) Check drive keys (15, Figure 1) for wear.
 - (a) If drive keys are worn to a minimum width of 1.116 inches, replace drive keys.

NOTE: Drive keys must be replaced as a set.

Cleaning/Painting

A. Cleaning Brake System

- (1) Clean hydraulic components with clean system hydraulic fluid or denatured alcohol.
- (2) Wash metal parts in suitable solvent.
- (3) Wash, o-rings, with clean system hydraulic fluid or denatured alcohol.
- (4) If required, clean brake linings with MEK.

Approved Repairs

A. Repair Brake System.

- (1) Replace worn or damaged parts.
- (2) Polish out minor nicks, using 400 grit wet-or-dry sandpaper with system hydraulic fluid.

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- (3) Replace brake linings at each engine overhaul or when wear approaches limits described in Inspection/Check.
- (4) Replace master cylinder body when damage to cylinder wall is found.
- (5) Repair to master cylinder components are not recommended, only replacement of defective parts.

BRAKE SYSTEM PARKINGDescription

1. The parking brake system consists of manually operated handle assembly connected to the parking brake torque tube through a series of pulleys and cables. The parking brake torque tube is connected to the pilot's rudder pedal brake links by two short cables. The parking brake is set by applying pressure to both rudder pedals and then pulling the parking brake handle. To release the parking brake, turn the parking brake handle approximately 90 degrees and allow handle to move forward.

Maintenance Practices

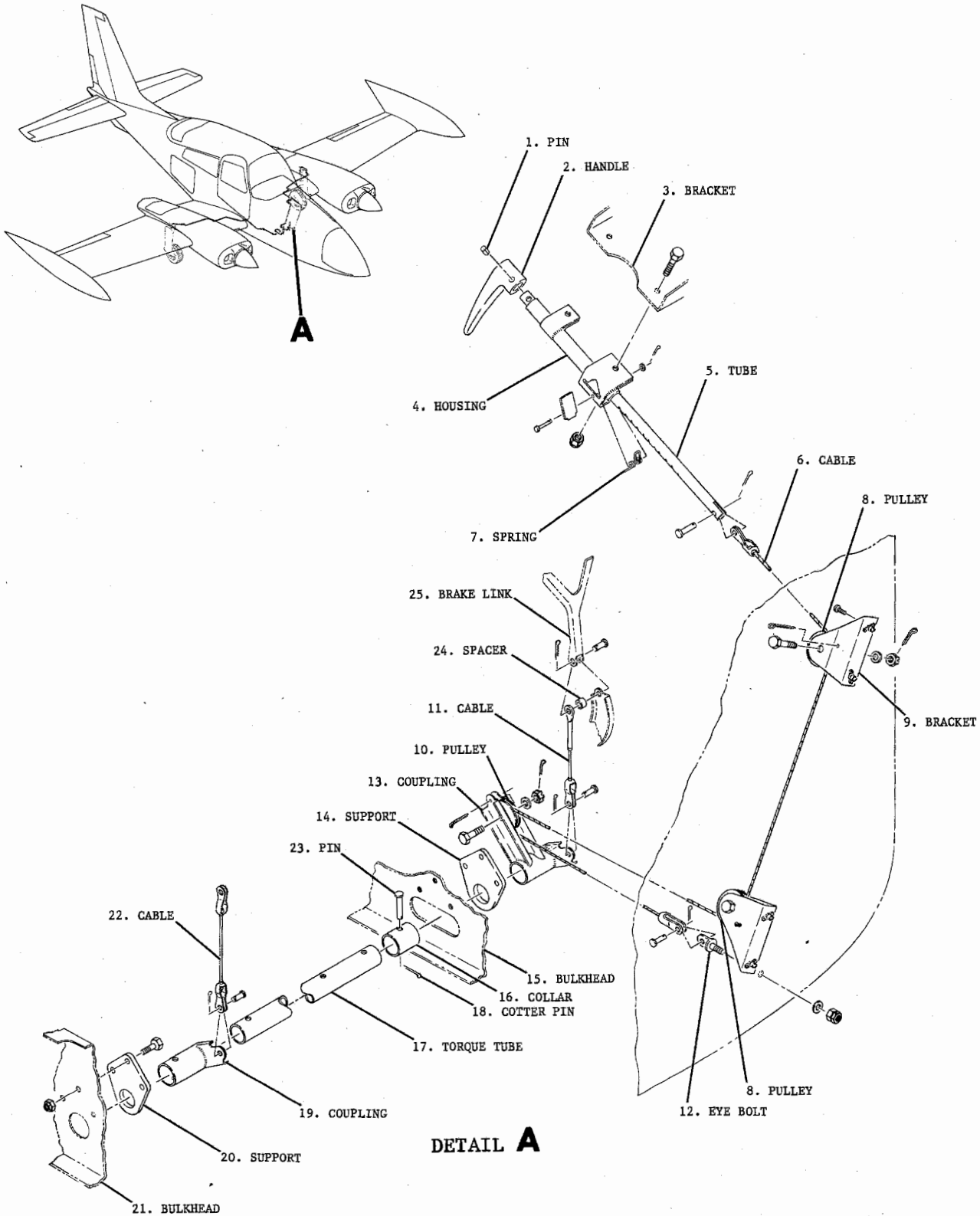
1. Removal/Installation of Parking Brake System (See Figure 1).

- A. Remove Parking Brake System.

- (1) Remove pilot and copilot seats, carpet and access panels as required to gain access to parking brake system.
- (2) Detach left and right parking brake cables (11 and 22) by removing cotter pins and pins.
- (3) Disconnect parking brake cable (6) at tube (5) by removing cotter pin and pin.
- (4) Remove handle assembly from bracket (3) by removing nuts and bolts.
- (5) Remove cable (6) by removing pulleys (8 and 10); remove cotter pin and pin at eye bolt (12).
- (6) Remove parking brake torque tube (17) as follows:
 - (a) Remove cotter pin and pin attaching coupling (13) to torque tube (17).
 - (b) remove nuts and bolts attaching left torque tube support (14) to bulkhead (15) and remove support.
 - (c) Slide torque tube (17) with attached components outboard to clear hole in right torque tube support (20); then work forward to clear floorboards.
 - (d) Further disassembly of the torque tube may be accomplished if desired.

- B. Install Parking Brake System.

- (1) Assemble right parking brake coupling (19) to torque tube (17) and attach right cable (22).
- (2) If removed, attach torque tube support (20) to bulkhead (21) with three screws and nuts.



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Parking Brake System
Figure 1

- (3) Position torque tube (17) between bulkheads (15 and 21) with the inboard end through hole in the right support (19). Position support (14) over the outboard end of torque tube and secure to bulkhead (15) with three bolts and nuts.
- (4) Position coupling (13) over end of torque tube and secure with pin and cotter pin.
- (5) If disassembled, assemble parking brake handle components as illustrated. Attach assembly to bracket (3) with two bolts and nuts.
- (6) Attach cable (6) to eye bolt (12) with pin and cotter pin. Route cable over pulleys (10 and 8) and secure pulleys in place with bolt and nut.

NOTE: If cotter pins used as cable guards were removed, make sure cotter pins are reinstalled.

- (7) Secure end of cable (6) to tube (5) with pin and cotter pin.
- (8) Route free ends of cables (11 and 22) through holes in floorboard and attach to brake links (25) with pin, spacer (24) and cotter pin.
- (9) Install access panels, carpet and seats.

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LANDING GEAR WARNING AND INDICATOR SYSTEMDescription

1. The landing gear warning system provides an aural and visual indication of an unsafe landing gear condition. A safe gear is indicated by three green indicator lights which illuminate when all three landing gears are down and locked. An unsafe gear is indicated by a red light which illuminates when any one or more gear is not in the position selected by the landing gear switch.

An aural warning is provided by a warning horn when both throttle levers are retarded below a specified manifold pressure setting, while landing gear is in any other than a down-and-locked condition, and when flaps are lowered below 15° regardless of position of throttle levers, while landing gear is in any other than a down-and locked condition.

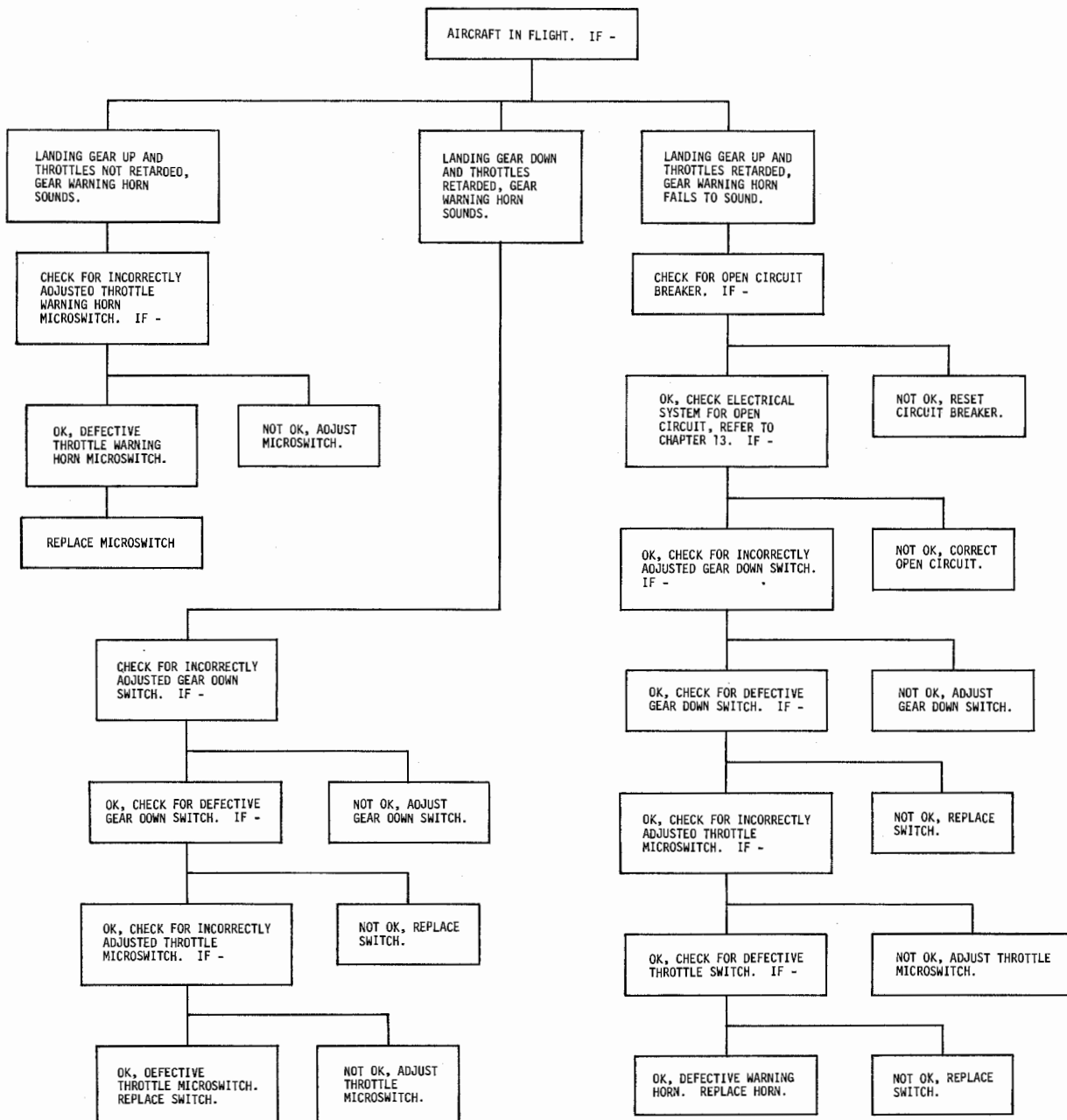
Troubleshooting

1. Troubleshooting Landing Gear Warning and Indicator System
 - A. For a guide to troubleshooting the gear warning system, see Figure 1.
 - B. Refer to Landing Gear wiring diagram, Chapter 13 for conducting continuity checks.
 - C. Conduct a continuity check of electrical circuits before replacing a component suspected of being defective.

Adjustment/Test

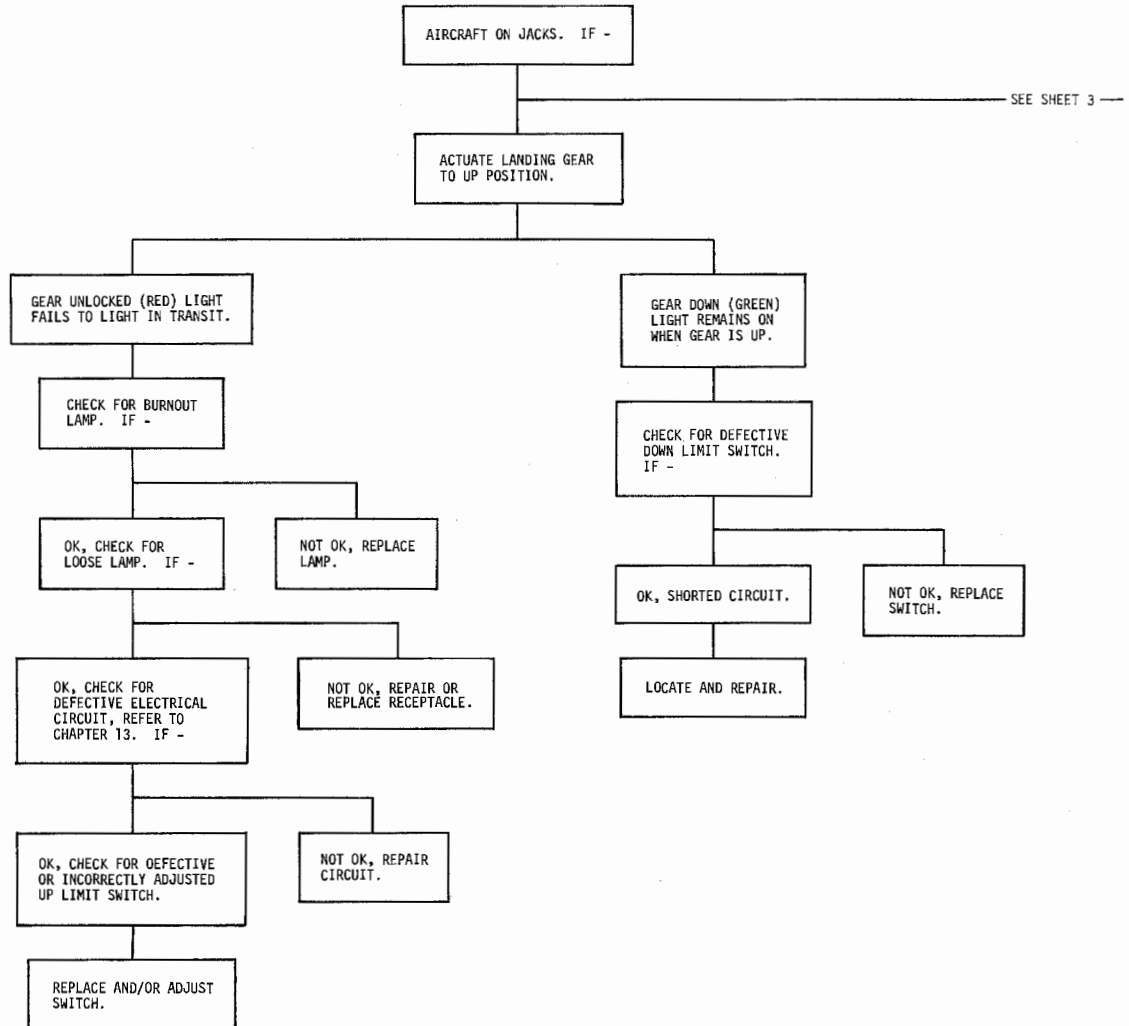
1. Adjustment/Test Landing Gear Warning System (See Figure 2).
 - A. Adjust Landing Gear Warning Switches.
 - (1) Adjust the throttle microswitch (3) as follows:

NOTE: To properly adjust the throttle microswitch, it is necessary to fly the aircraft. As a preliminary adjustment before flight, adjust microswitch to actuate when the aft edges of the throttle levers are approximately 3/16 inch aft of the word "THROTTLE" on the control quadrant.



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Troubleshooting Chart - Landing Gear Warning and Indicator System
Figure 1 (Sheet 1 of 4)

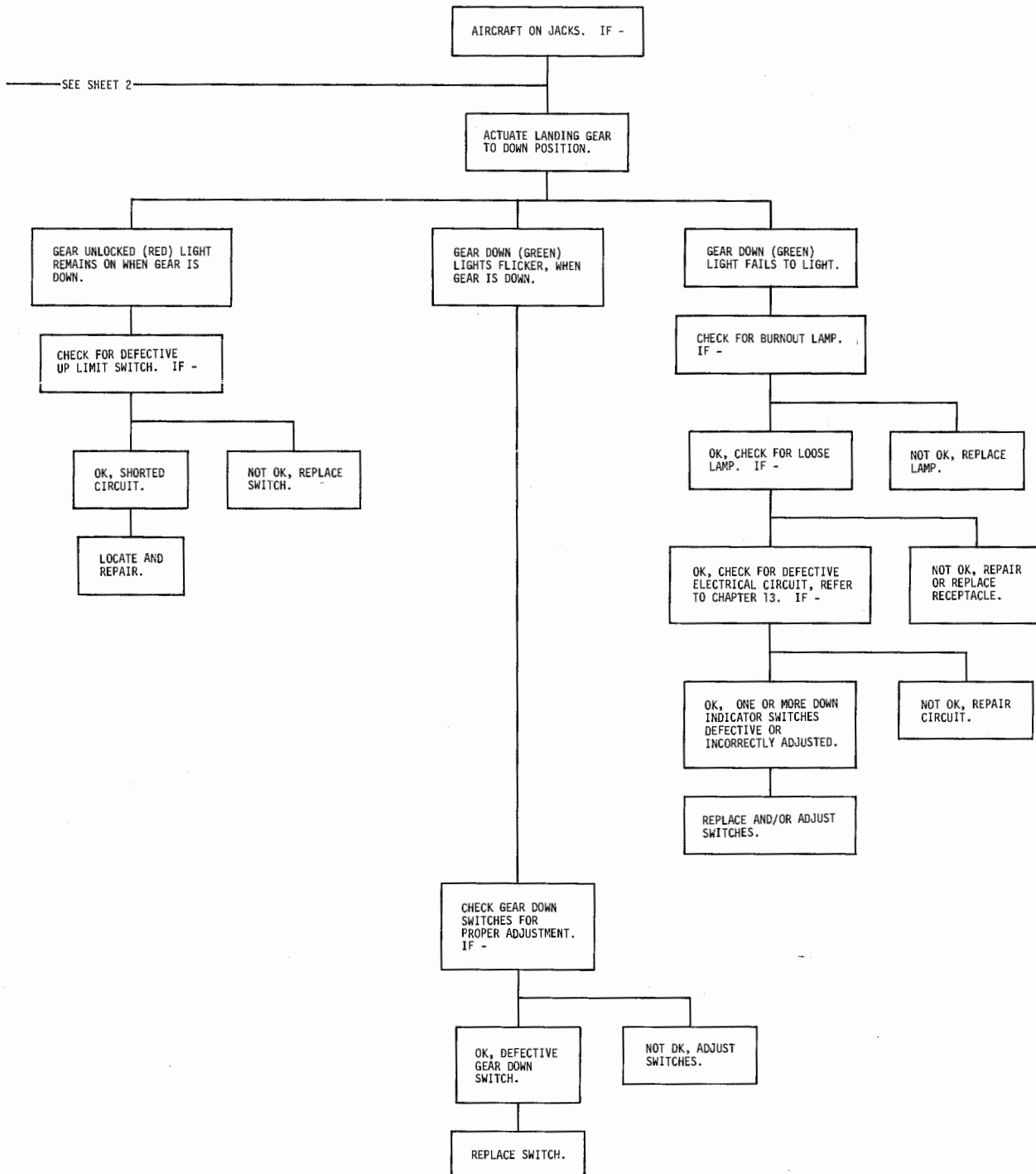


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Troubleshooting Chart - Landing Gear Warning and Indicator System
Figure 1 (Sheet 2)

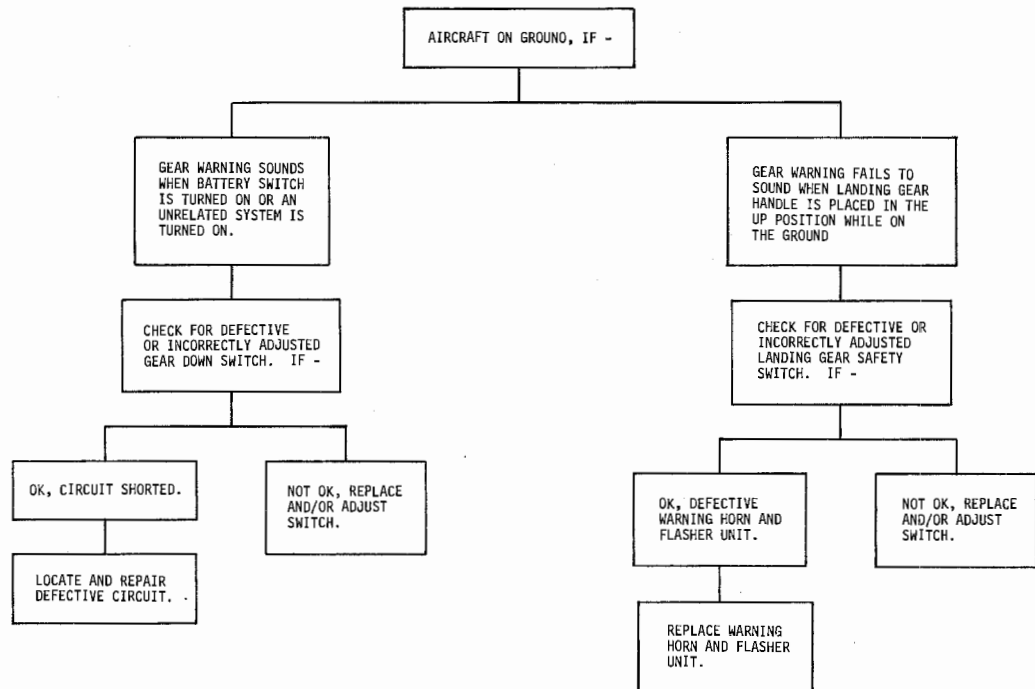
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Troubleshooting Chart - Landing Gear Warning and Indicator System
Figure 1 (Sheet 3)



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Troubleshooting Chart - Landing Gear Warning and Indicator System
Figure 1 (Sheet 4)

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- (a) Obtain a pressure altitude of 2500 feet.
- (b) Adjust propeller pitch levers to obtain 2300 rpm on both engines.
- (c) Place mixture levers in FULL RICH.
- (d) Retard throttle levers to obtain 12 inches of manifold pressure.

NOTE: If throttle levers are retarded below the specified manifold pressure, advance them and repeat the retarding procedure.

- (e) Using a pencil, tape, or other suitable means of marking, index the position of the throttle levers in the control quadrant.

NOTE: The remainder of the adjusting procedure must be accomplished with the aircraft on the ground.

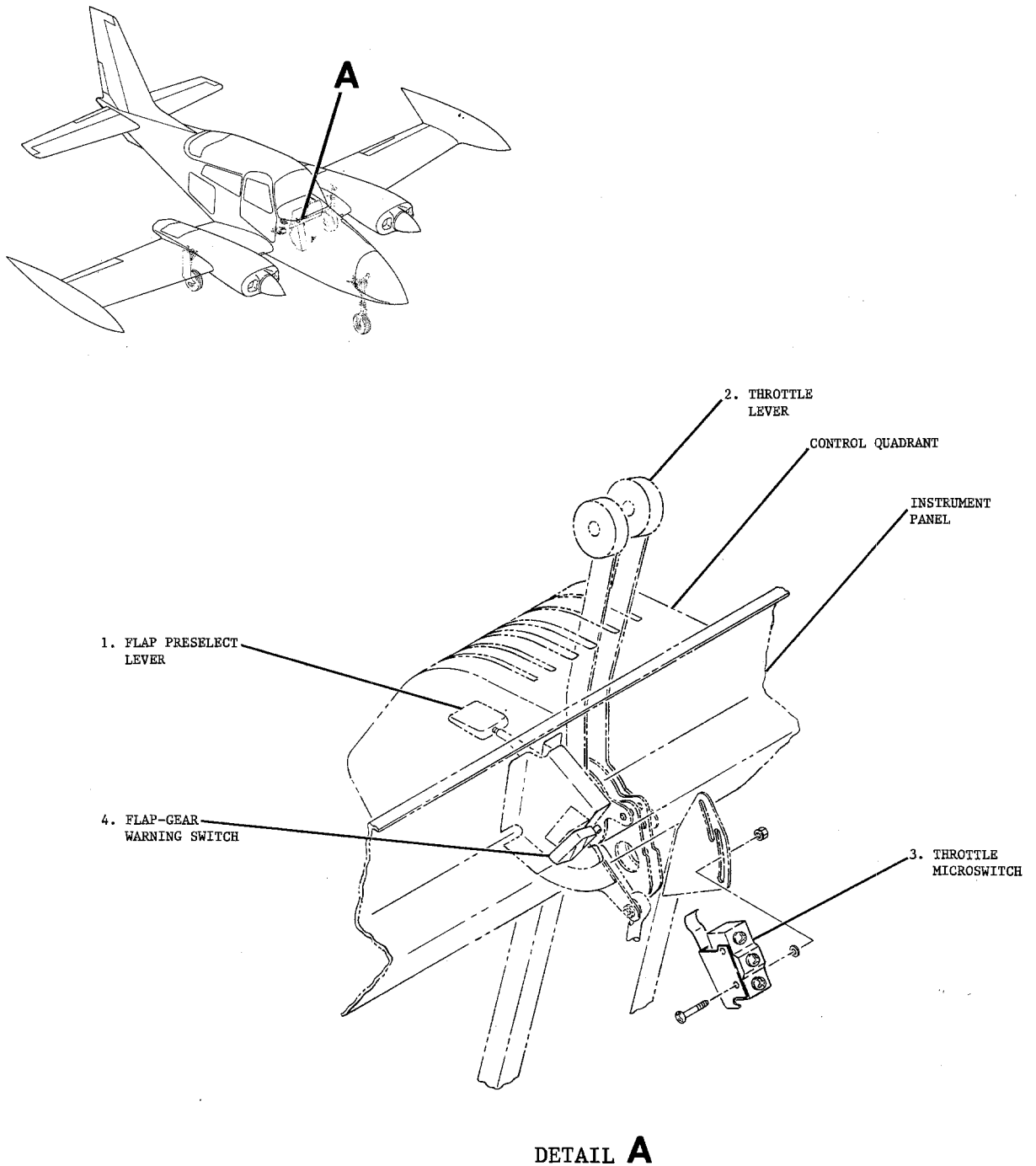
- (f) With engines not being operated, place mixture levers in FULL RICH.

WARNING: INSURE THAT FUEL SELECTOR VALVE HANDLES AND FUEL BOOST PUMP SWITCHES ARE IN THE OFF POSITION.

- (g) Jack aircraft in accordance with Chapter 1.
- (h) Fully advance throttle levers (2), then retard to the position marked on the control quadrant during flight.
- (i) Adjust the throttle microswitch to actuate at this position. Turn battery switch ON and check that warning horn sounds as throttle levers are retarded to this position, then turn battery switch OFF.

NOTE: Elongated slots are provided for vertical adjustment and spacer washers positions the microswitch horizontally.

- (2) Adjust flap-gear warning as follows:
 - (a) Fully advance throttle levers.
 - (b) Position flap preselect lever to $16^{\circ} \begin{smallmatrix} +20 \\ -00 \end{smallmatrix}$.
 - (c) Turn off electrical power.
 - (d) Loosen screws and adjust switch (4) to operate at this position. A definite click should be felt when switch actuates.
 - (e) Tighten screws and turn electrical power on.
 - (f) Operate the landing gear to full up position.



DETAIL A

Adjustment of Landing Gear Warning System
Figure 2

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MAINTENANCE MANUAL

- (g) Operate flaps to full down position and note flap position when warning horn sounds.

NOTE: Anytime the flap preselect lever is placed below 15° detent, the landing gear warning horn should sound when the flaps reach 16° +2°, -0° travel.

- (h) It may be necessary to repeat steps (d) through (g) to properly adjust the landing gear warning system.
- (i) After microswitch adjustment is completed, place throttle levers in the CLOSED position and the mixture levers in IDLE CUT-OFF.

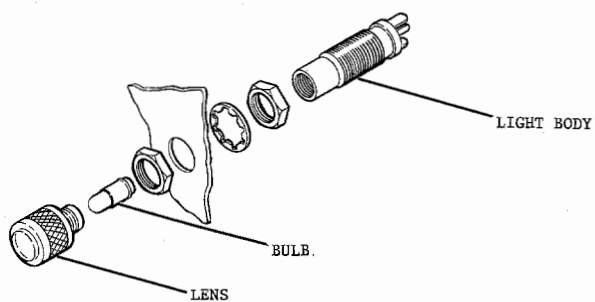
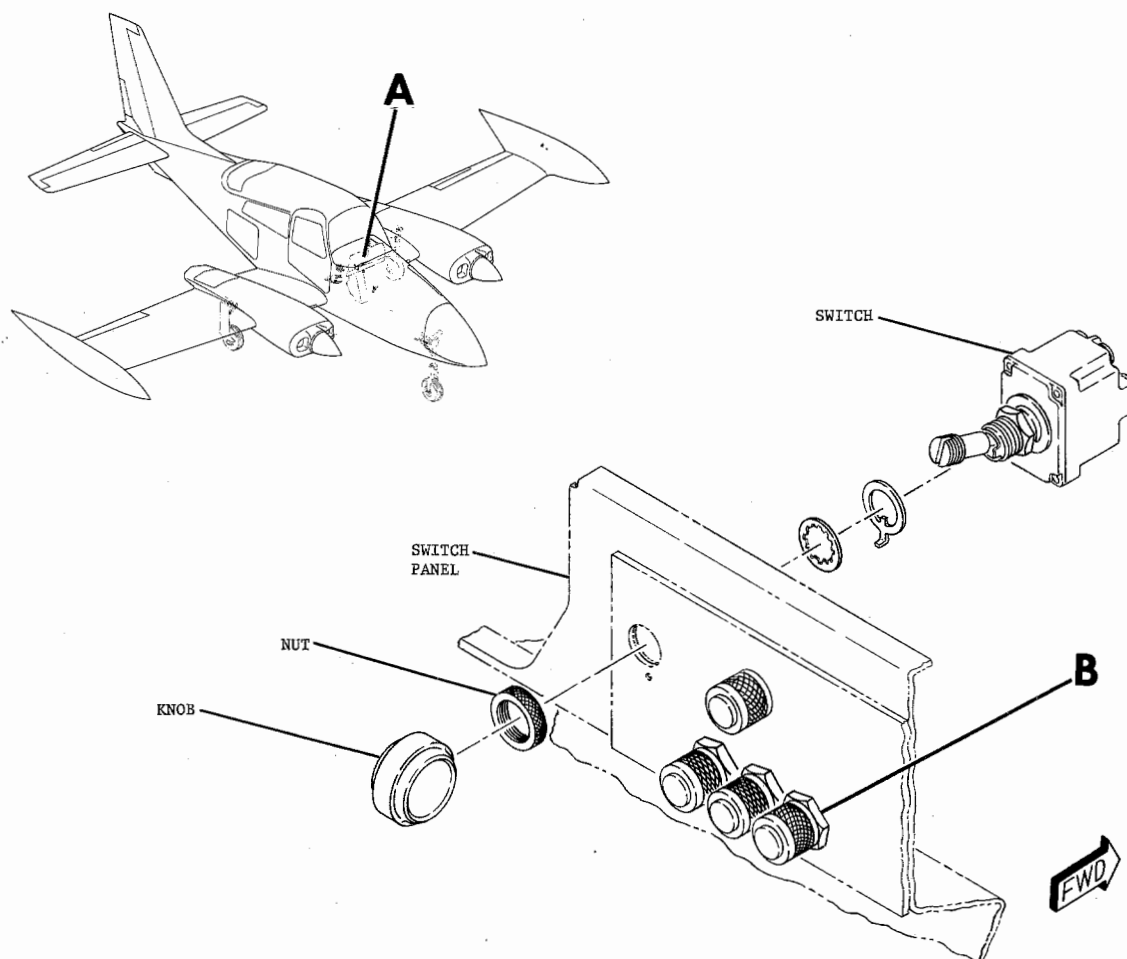
B. Adjustment of Landing Gear Indicator Switches.

- (1) Adjust down indicator switches as follows:
 - (a) Adjust all three DOWN indicator switches so that they are not actuated until landing gear is DOWN and locked by the overcenter linkage. Adjust the main landing gear switches by repositioning. Adjust the nose gear switch by adjusting the switch actuating bolt.
 - (b) Using the normal landing gear retraction system, operate landing gear to the UP position.
 - (c) Place landing gear switch in a neutral position, engage the manual extension crank, and lower the landing gear. Stop cranking immediately when the green light illuminates, and note the exact angular position of the crank.
 - (d) Check that both main gear and nose gear are DOWN and locked in the overcenter position.
 - (e) Resume cranking toward the DOWN position noting the number of turns required, until the internal stop in the landing gear actuator is reached. The number of turns required should not be less than four, nor more than eight for the main landing gears. The number of turns should not be less than eight nor more than fourteen for the nose gear.
 - (f) If necessary, readjust DOWN indicator switches as required to meet the conditions of steps (a) and (e).

Maintenance Practices

- 1. Removal/Installation of Gear Switch and Indicator Lights (See Figure 3).

A. Remove gear switch and indicator lights.



DETAIL B

TYPICAL LANDING
GEAR POSITION
INDICATOR LIGHT
INSTALLATION

Landing Gear Switch and Indicator Light Installation
Figure 3

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MAINTENANCE MANUAL

- (1) Unscrew and remove wheel shaped knob from switch.
- (2) Remove the nut holding switch to the panel and pull the switch from the rear of the panel.
- (3) Tag and disconnect the wires from the switch.
- (4) To remove the indicator lights, remove the lens and bulb.
- (5) Loosen nut securing light to panel and pull light from panel.
- (6) Unsolder and tag wires from light.

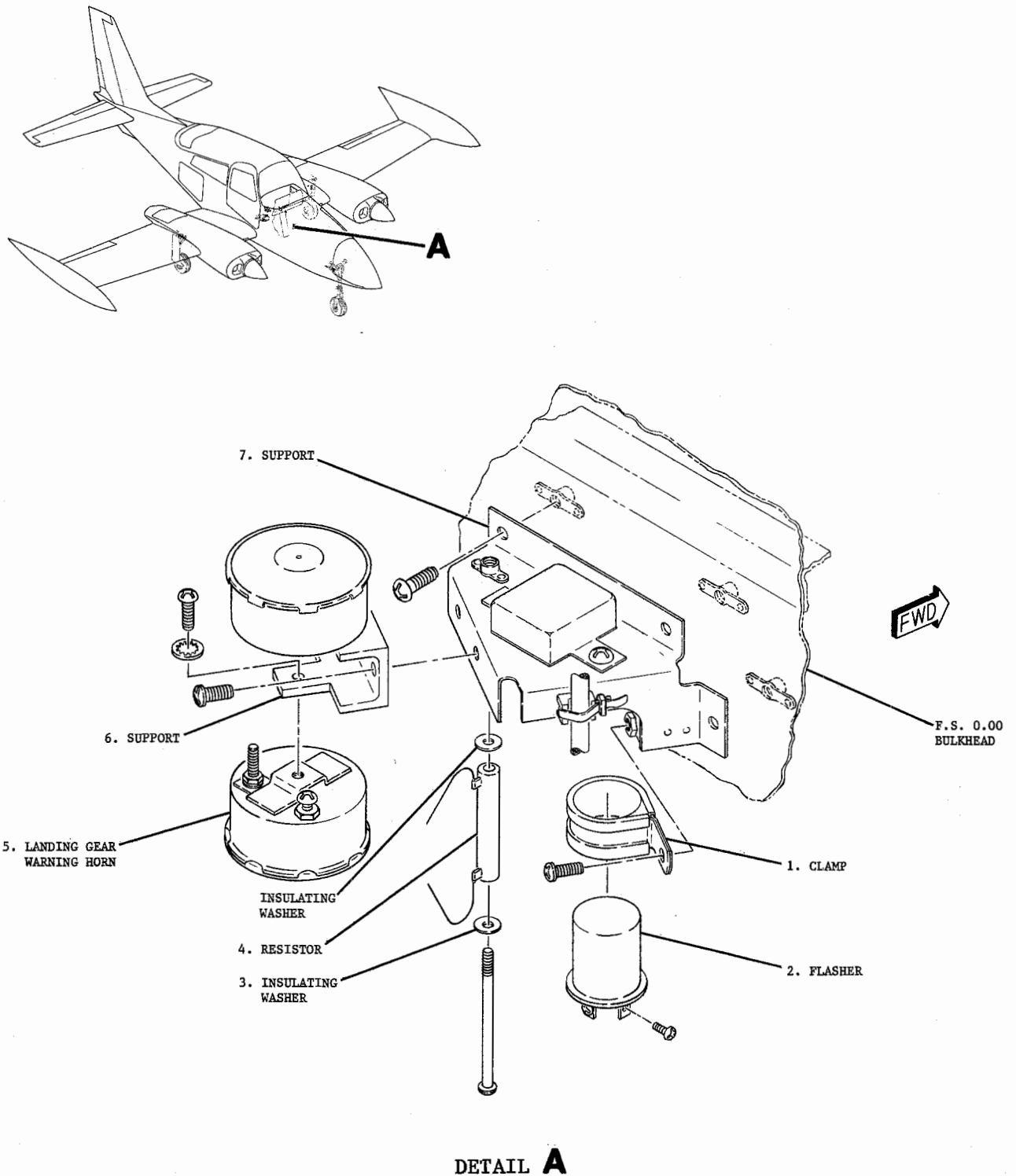
B. Install Gear Switch and Indicator Lights.

- (1) To install the indicator light, solder wires to light and remove identification tags.
- (2) Install nut and lockwasher on light in sequence as shown, install light in panel and secure assembly in panel with nut.
- (3) Install bulb and lens.
- (4) To install landing gear switch, connect wires to switch and remove identification tags.
- (5) Place nut, lockwasher and keyed washer on light as shown and install switch through panel.
- (6) Install knurled nut on switch from face of the instrument panel. Tighten only as far as necessary to obtain full thread engagement.
- (7) Tighten nut on the back side of panel. Make sure keyed washer mates the key hole in the switch panel.
- (8) Screw knob onto the switch toggle.

2. Removal/Installation of Gear Warning Components (See Figure 4).

A. The landing gear warning electrical components consist of a warning horn, flasher and resistor located on a support bracket on the centerline of the fuselage station 0.00 bulkhead. Remove gear warning components as follows:

- (1) Locate and remove landing gear warning horn (5) as follows:
 - (a) Tag and disconnect electrical wires.
 - (b) Remove screw and lockwasher securing warning horn (5) to support (6).
- (2) Remove flasher (2) as follows:
 - (a) Tag and disconnect electrical wires.
 - (b) Remove attaching screw and clamp (1).
- (3) Remove resistor (4) as follows:
 - (a) Tag and disconnect electrical wires.
 - (b) Remove attaching screw and insulating washers (3).



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Warning Horn Components Installation
Figure 4

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B. Install Gear Warning Components.

- (1) Position resistor (4) to support (7) and secure in place with screw and two insulating washers (3) as shown.
- (2) Connect electrical wires.
- (3) Position flasher (2) to support (7) and secure with clamp (1) and screw.
- (4) Connect electrical wires.
- (5) Position landing gear warning horn (5) to support (6) and secure with lockwasher and screw.

CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

5

FLIGHT CONTROLS

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AILERON, AILERON TRIM TAB AND CONTROLSDescription

1. The aileron system consists of: the control wheels, control column "Y" assembly, ailerons and the cable assemblies. The ailerons are attached to the rear spar of each wing outboard of the flaps. When either the pilot's or copilot's (optional) control wheel is rotated, the control column "Y" assembly transmits the wheel rotation by universal joint and cables to the bellcrank in the fuselage, rotating the bellcrank. The bellcrank rotation is transmitted by cables to the quadrant assemblies of each wing, which positions one aileron up and the opposite aileron down. Stop bolts located on the quadrant support prevent overtravel of the ailerons.
2. The aileron trim tab system consists of: one trim tab on the trailing edge of the left aileron; the aileron trim control wheel and mechanism on the pedestal; system control cables and an actuator inboard of the left aileron. The system is controlled mechanically by a trim control wheel on the lower face of the pedestal. When the trim control wheel is rotated, the cable system transmits the movement to the trim tab actuator. As the actuator sprocket rotates, an internal screw in the actuator rotates, driving the actuator screw to push the trim tab up or down. Stop blocks, located in the left wing, prevent overtravel of the trim tab.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS ON LATE MODEL AIRCRAFT USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. Troubleshooting the aileron and tab system is accomplished initially by determining whether the trouble exists in the aileron control system or the aileron trim control system.

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2. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Inclinometer	SE716	Cessna Aircraft Co. Wichita, Kansas	To measure travel of control surfaces.
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif.	To measure cable tension.

NOTE: Inclinometer is available from Cessna Service Center.

3. Troubleshooting Aileron and Trim Tab Control Systems

- A. For a guide to troubleshooting the aileron and trim tab control systems, see Figures 3 and 4.

Adjustment/Test**1. Tools and Equipment**

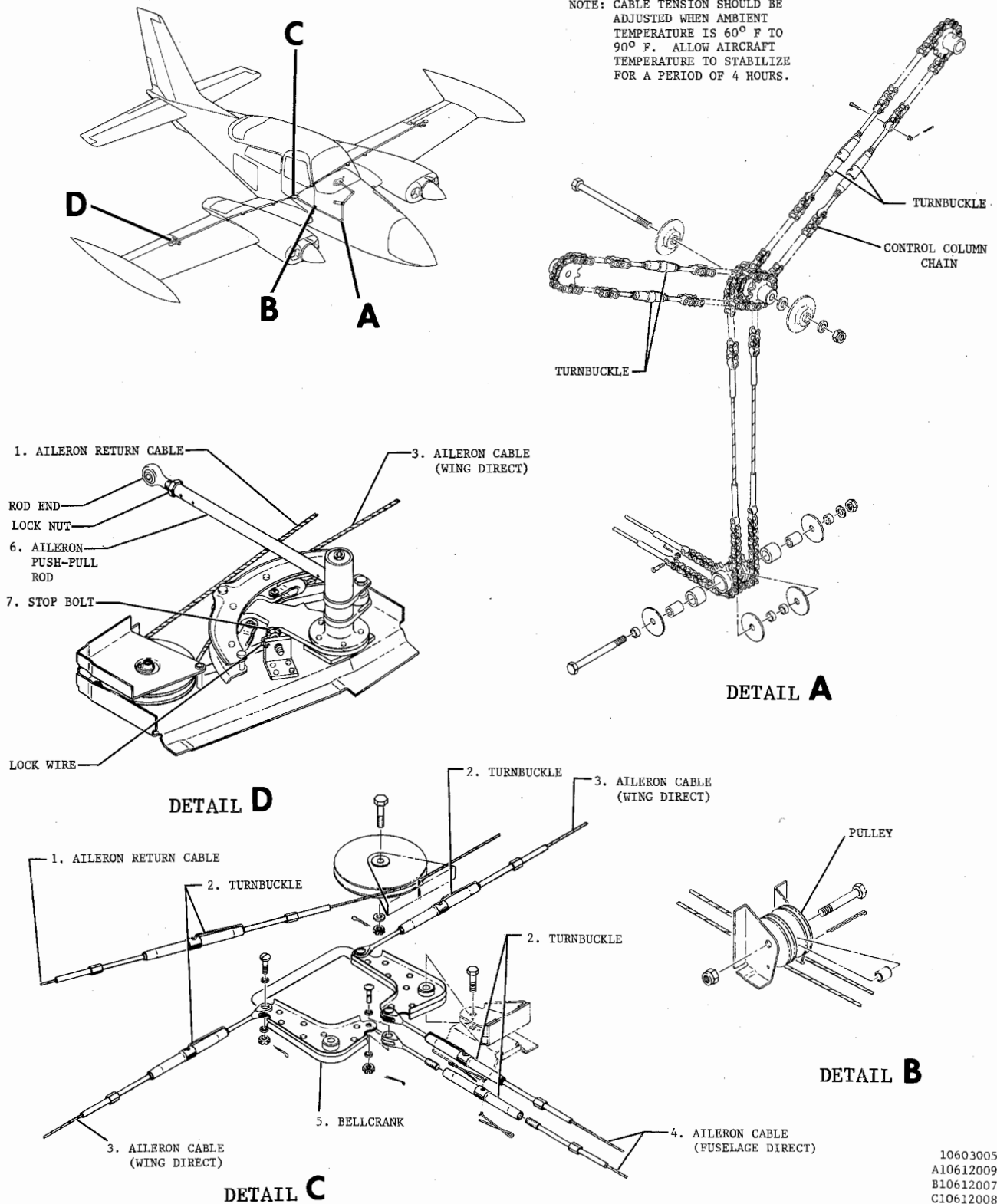
NOTE: Refer to troubleshooting for tools and equipment requirements.

2. Rigging Aileron Control System (See Figure 1)

- A. Refer to Chapter 12, and remove rear seats and rear carpet.
B. Remove floorboard access covers forward of rear spar.
C. Remove wing access covers above aileron quadrant.
D. Align control wheels horizontal and tape a straightedge to lower edge of both control wheels to insure alignment during rigging.

NOTE: Dual control wheels are optional equipment, if only one control wheel is installed, it must be kept in the horizontal position during rigging.

NOTE: CABLE TENSION SHOULD BE ADJUSTED WHEN AMBIENT TEMPERATURE IS 60° F TO 90° F. ALLOW AIRCRAFT TEMPERATURE TO STABILIZE FOR A PERIOD OF 4 HOURS.

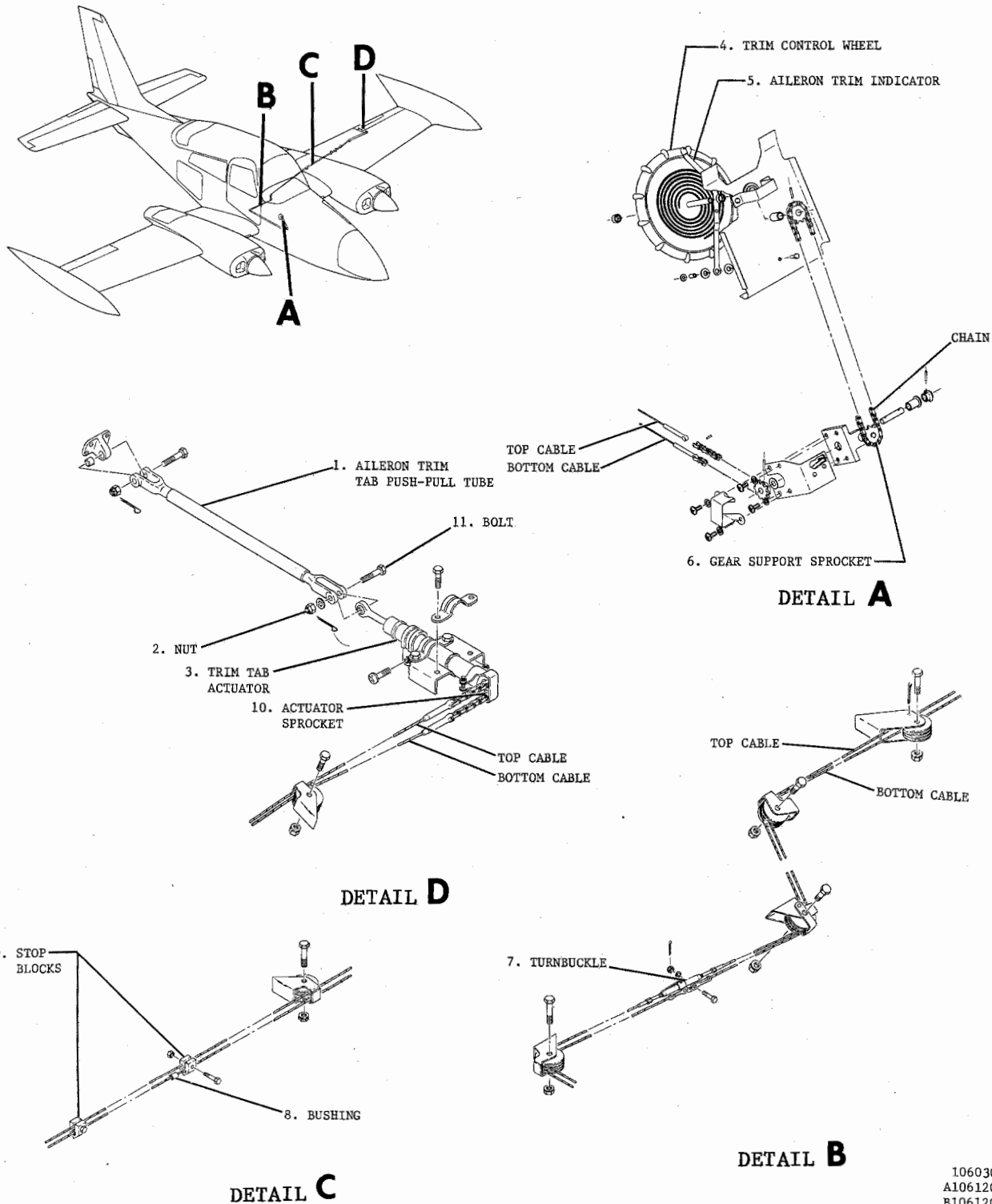


Aileron Control System and Adjustment
Figure 1

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Aileron Trim Tab Control System and Adjustment
Figure 2

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- E. Remove turnbuckle clips from all turnbuckles at the bellcrank (5).
- F. Adjust turnbuckles (2) on aileron cables (3 and 4) so that both halves of bellcrank (5) are aligned in the same relative position in respect to each other.

NOTE: During all aileron rigging adjustments, maintain 25 ± 5 pounds tension on both the wing and fuselage forward cables.

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of 4 hours.

- G. Adjust turnbuckles connecting wing direct cables (3) to bellcrank and turnbuckle connecting return cables (1) so that the ailerons align with the trailing edges of the wings.

NOTE: If length of aileron push-pull tube (6) has been changed, or new push-pull rods are being installed, adjust rod ends so that push-pull rod is as short as possible, prior to alignment of ailerons with trailing edge of wings.

- H. Safety turnbuckles, and remove straightedge which was taped to control wheels during rigging.
- I. Adjust quadrant stop bolts (7) so that aileron travel is 20 ± 1 , -0 degrees up and 20 ± 1 , -0 , degrees down. Safety wire stop bolts after adjustment.

WARNING: ENSURE THAT AILERONS MOVE IN THE PROPER DIRECTION WHEN OPERATED BY THE CONTROL WHEEL.

- J. Install access covers on wing and in fuselage.
- K. Refer to Chapter 12, and install center carpet and seats.

3. Rigging Aileron Trim Control System (see Figure 2)

- A. Refer to Chapter 12 and remove the following items:
 - (1) Front seats, middle and rear seats.
 - (2) Front and center carpets.
- B. Remove access cover from underside of the fuselage just aft of the nose wheel well, the fuselage floorboards above the landing gear actuator, the spar access covers aft of main wheel wells, and the access cover above aileron quadrant.

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- C. Remove turnbuckle clip from turnbuckle (7) connecting aileron trim control cables, adjust to 10 ± 3 pounds tension, and resafety turnbuckle.

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for four hours.

- D. Move aileron trim control system to neutral by rotating trim control wheel (4) so that the chain on actuator sprocket (10) is equal in length, and the chain on gear support sprocket (6) is equal in length.
- E. Adjust aileron trim indicator (5) to neutral by inserting a screwdriver beneath indicator and prying out of track in trim control wheel, moving the indicator to neutral, and re-engaging with track.
- F. Remove cotter pin, nut, bolt and spacer attaching push-pull tube to aileron trim tab. (See Figure 5.)
- G. Align aileron with trailing edge of wing and place trim tab in neutral.
- H. (See Figure 10.) Adjust actuator screw so that aft hole in push-pull tube is aligned with hole in trim tab horn; attach push-pull tube to trim tab horn with bolt, spacer and nut, and cotter pin (see Figure 5).
- I. Loosen stop blocks (9), move trim tab to 20 degrees DOWN, slide outboard stop block against outboard rib (wing station 111.5), and tighten stop block.

NOTE: Stop blocks (9) should be installed so that bottom cable passes through bushings (8), and top cable is clamped by stop blocks.

- J. Move trim tab to 20 degrees UP, slide inboard stop block against inboard rib (wing station 100.5), and tighten stop block.
- K. Tolerance for aileron trim tab travel is plus one degree and minus zero degrees.

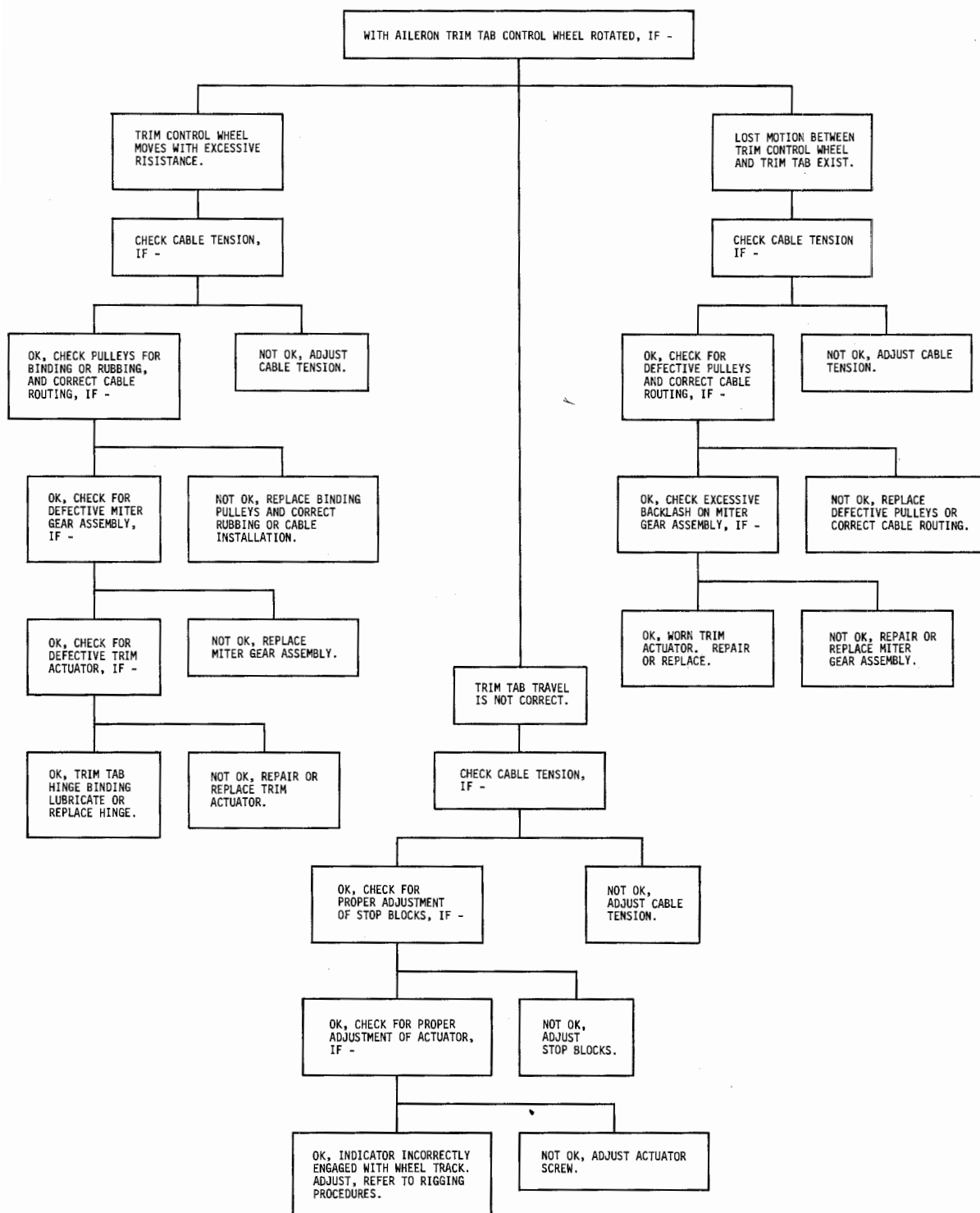
WARNING: INSURE THAT AILERON TRIM TAB MOVES IN THE PROPER DIRECTION WHEN OPERATED BY THE TRIM CONTROL WHEEL.

- L. Install access covers, carpets and seats.

Inspection/Check

1. Tools and Equipment.

NOTE: See Adjustment/Test for Tools and Equipment



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Troubleshooting Chart - Aileron Trim Control System
Figure 4

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2. Aileron and Aileron Trim Tab Check.

NOTE: Angular dimensions for ailerons and trim tab are measured by placing inclinometer on aileron and trim tab surfaces. The aileron is in neutral position when the trailing edge is streamlined with flap trailing edge. The trim tab is in neutral position when streamlined with the aileron trailing edge.

A. Aileron and Aileron Trim Tab Cable Check.

- (1) Place ailerons in neutral position. Install control lock.
- (2) Place tensiometer on aileron fuselage cables and aileron wing cables and read cable tension. See Figure 1 for cable temperature/tension NOTE.

NOTE: Access to the aileron fuselage and aileron wing cables is gained by removing floorboard and wing access panels.

- (3) Place tensiometer on the aileron trim cable and read cable tension. See Figure 2 for cable temperature/-tension NOTE.

NOTE: Access to the aileron trim tab cables is gained by removing the floorboard and wing access panels and extending flaps.

3. Aileron and Trim Tab Deflection Check.

A. Rotate control wheel counterclockwise until stops contact. Hold aileron in this position and make the following checks:

- (1) Check that right aileron is 20 +1, -0 degrees below neutral position.
- (2) Check that left aileron is 20 +1, -0 degrees above neutral position.

B. Rotate control wheel clockwise until stop contact. Hold aileron in this position and make the following checks:

- (1) Check that left aileron is 20 +1, -0 degrees below neutral position.
- (2) Check that right aileron is 20 +1, -0 degrees above neutral position.

C. Return ailerons to neutral position.

D. Rotate aileron trim control knob clockwise until stop contact. Check that trim tab is 20 +1, -0 degrees above neutral position.

E. Rotate aileron trim control wheel counterclockwise until stops contact. Check that trim tab is 20 +1, -0 degrees below neutral position.

- F. Return trim tab to neutral position.
- 4. Aileron and Aileron Trim Tab Inspection
 - A. Extend flaps.
 - B. Remove access plate on control pedestal, wing and floorboard access covers as required to provide visual inspection of cables and pulleys.
 - C. Install access plate on pedestal, floorboard and wings.

Maintenance Practices

- 1. Removal/Installation Aileron (see Figure 5).

NOTE: Removal and installation procedures for left-hand aileron right-hand aileron is typical. Except right aileron does not incorporate a trim tab.

- A. Remove Aileron

- (1) Position the aileron trim tab to UP position to gain access to trim tab push-pull tube (9) at aft attach point.
- (2) Remove cotter pin (10), nut (11), bolt (8) and spacer (7), securing push-pull tube (9) to trim tab.
- (3) Lower flaps and disconnect aileron push-pull rod (4) by removing bolt (2) and washer (3).
- (4) Disconnect bonding strap from aileron by removing attaching screw.
- (5) Remove bolt (2) attaching aileron to hinge assembly (1).

CAUTION: SUPPORT AILERON WHEN HINGE BOLT IS REMOVED.

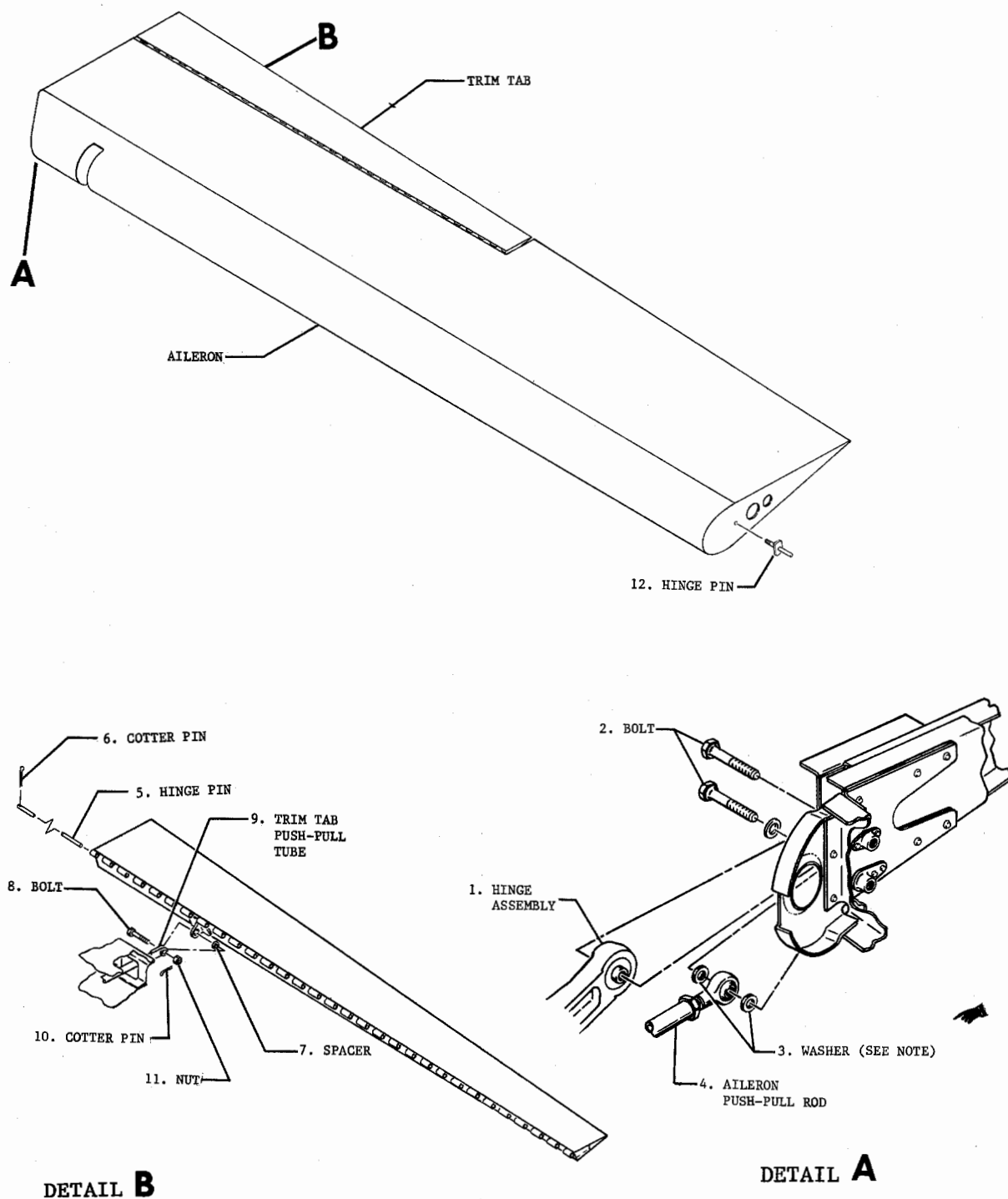
- (6) Move aileron aft, clearing hinge assembly, and slightly inboard until outboard hinge pin (12) is free of bearing.

- B. Install Aileron

- (1) Guide aileron trim tab push-pull tube (9) through opening in aileron.
- (2) Insert hinge pin (12) in the outboard bearing.
- (3) Secure aileron to hinge assembly (1) with bolt (2).
- (4) Connect aileron push-pull rod (4) by installing bolt (2) and washers (3).
- (5) Safety wire bolts (2).
- (6) Secure bonding strap with attaching screw.
- (7) Connect trim tab push-pull tube (9) to trim tab with bolt (8), spacer (7), nut (11) and cotter pin (10).

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NOTE: A MAXIMUM WASHER THICKNESS OF 0.126 MAY BE USED ADJACENT TO EACH SIDE OF ROD END, USE AN960-416 OR AN960-416L WASHERS.

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Aileron and Trim Tab Installation
Figure 5

- 5
- (8) Check aileron and trim tab for proper operation and correct travel. If necessary, rig in accordance with Aileron and Tab Adjustment Test.
2. Removal/Installation Aileron Trim Tab (see Figure 5)
 - A. Remove Trim Tab.
 - (1) Position the trim tab UP to gain access to trim tab push-pull tube (9) at aft attach point.
 - (2) Remove cotter pin (10), nut (11), bolt (8), and spacer (7), securing push-pull tube (9) to trim tab.
 - (3) Remove cotter pins (6); pull hinge pin (5) and remove trim tab.
 - B. Install Trim Tab
 - (1) Position trim tab in hinge; insert hinge pin (5).
 - (2) Secure hinge pin (5) with cotter pins (6).
 - (3) Connect trim tab push-pull tube (9) to trim tab using bolt (8), spacer (7), nut (11) and cotter pin (10).
 - (4) Check trim tab for proper operation and travel. If necessary, rig in accordance with Aileron and Tab Adjustment/Test.
 3. Removal/Installation of Control Column (see Figure 6)
 - A. Remove Control Column.
 - (1) Refer to Chapter 12, remove the following items in accordance with removal procedures:
 - (a) Pilot and passenger seats
 - (b) Bulkhead, pilot's floor and center carpets.
 - (c) Boot, retainer and cover from lower control column.
 - (2) Refer to Chapter 11, remove shock-mounted instrument panel.
 - (3) Drill out rivets and remove upper and lower instrument panel braces on right side only.
 - (4) Refer to Chapter 1, remove access covers just forward of rear spar and just aft of nose wheel well on underside of fuselage.
 - (5) (See Figure 1.) Remove turnbuckle clips and loosen turnbuckles (2) on aileron cables (4) to relieve tension on aileron control system.
 - (6) Refer to Chapter 5, disconnect bob-weight assembly and push-pull tube from control column assembly.
 - (7) Remove control wheels from control column assembly by removing nuts (19), bushings (4) and bolts (3) attaching control tube (2) to universal joint (5).

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NOTE: If autopilot, IFCS, electric trim, mic button is installed, disconnect electrical wires from control tube assembly at the quick-disconnects.

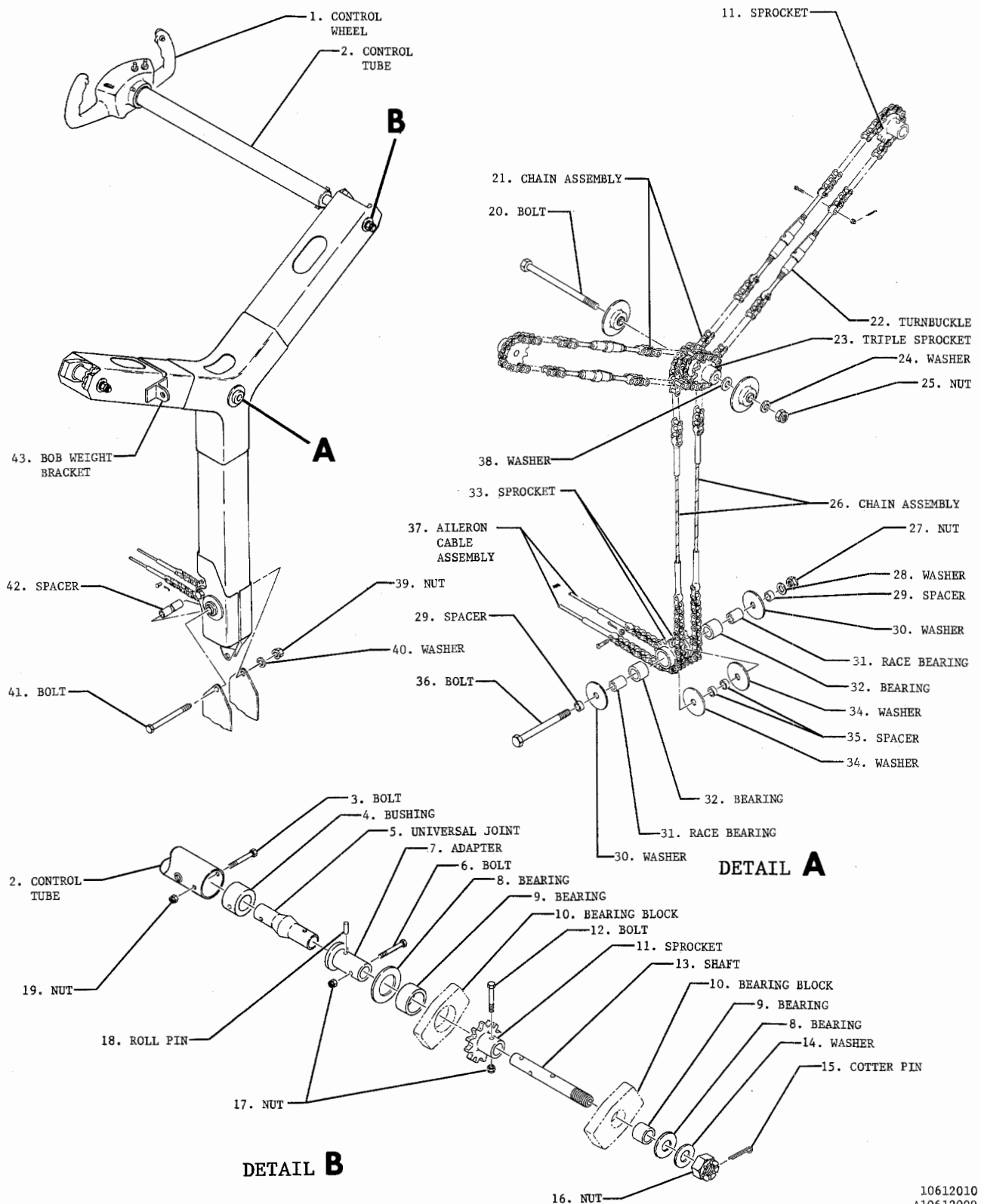
- (8) Disconnect chain assembly (26) from aileron cable assembly (37) by removing cotter pins and clevis pins.
- (9) Remove cotter pin (39), nut (40), washer (41), spacers (43), and bolt (42) attaching control column assembly to fuselage structure.
- (10) Carefully work control column assembly from beneath RH side of stationary instrument panel.
- (11) If control column disassembly is desired, refer to Disassembly/Assembly of Control Column Assembly.

B. Install Control Column.

- (1) Carefully work control column assembly into position from the RH side of instrument panel.
- (2) Secure control column assembly to fuselage structure with bolt (42), spacers (43), washers (41), nut (40) and cotter pin (39).
- (3) Connect chain assembly (26) to aileron cable assembly (37) with clevis pins and cotter pins.
- (4) Install control wheel (1) and control tube (2) on control assembly with bolts (3), bushings (4) and nuts (19).

NOTE: If autopilot, IFCS, electric trim, mic button is installed, disconnect electrical wires from control tube assembly at the quick-disconnects.

- (5) Refer to Chapter 5, connect bob-weight assembly, and push-pull tube to bracket (44) on right leg of control column assembly.
- (6) Install upper and lower instrument panel braces using rivets.
- (7) Refer to Chapter 10, and install shock-mounted instrument panel.
- (8) Rig aileron control cables, refer to Aileron and Trim Tab Adjustment/Test. Safety turnbuckles.
- (9) Replace access covers.
- (10) Refer to Chapter 12, install the following items:
 - (a) Control column assembly boot, retainer and cover.
 - (b) Center, pilot's floor and bulkhead carpets.
 - (c) Pilot and passenger seats (middle individual optional).



Control Column Installation
 Figure 6

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4. Disassembly/Assembly Control Column (see Figure 6)

A. Disassemble Control Column.

- (1) On lower control column assembly, remove spacers, washers, bearings and sprockets by removing nut (27) and bolt (36).
- (2) Disengage chain assembly (26) from sprocket assembly and remove chain assembly from control column assembly.
- (3) Remove triple sprocket (23) from control column assembly by removing nut (25), washers (24 and 38) and bolt (20).
- (4) Disconnect chain assembly (21) by removing turnbuckle (22) and routing chain assembly over sprockets (11).
- (5) Remove cotter pin (15) and nut (16) from shaft (13).
- (6) Remove nuts (17) from bolts (6 and 12) and remove bolts from adapter (7) and sprocket (11).
- (7) Remove shaft (13), bearing (8), adapter (7) and universal joint (5) from control column assembly.

NOTE: Safety wire shaft (13), adapter (7) and universal joint (5) to each other so that they may be retained together as a matched set.

- (8) Refer to Figure 6 for further disassembly of control column components, as necessary.

B. Assemble Control Column.

- (1) Place control column assembly in a suitable padded fixture (such as a vise) facing bob-weight bracket away from the assembler.

NOTE: The following procedure is given for aircraft with dual control wheels installed; single control wheel aircraft need only install upper LH chain assembly (21) and lower chain assembly (26).

- (2) Install washer (38) and triple sprocket (23) inside control column assembly, using a long thin bolt or heavy gauge wire to support components temporarily.
- (3) If disassembled, assemble the long (twenty link) chains and short (fourteen link) chains into chain assemblies (21), using turnbuckles (22). Observe that the terminal ends are equal in length after turnbuckles are installed.

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NOTE: If the assembly of long and short chains into chain assembly (21) was correct, the index link (red) on the long chain should be nine links from the now open end of the chain assembly (21) with all bolt heads facing in the same direction.

- (4) Attach guide wires to each end of chain assembly (21) and route the long chain under the center sprocket on the triple sprocket (23) to LH leg of control column assembly.
- (5) Assemble into LH leg of control column the following components:
 - (a) Insert shaft (13) into universal joint (5) and secure with roll pin (18).
 - (b) Place adapter (7) over universal joint (5) and shaft (13).

NOTE: Adapter (7), universal joint (5) and shaft (13) are drilled as a matched set and cannot be interchanged with other like components.

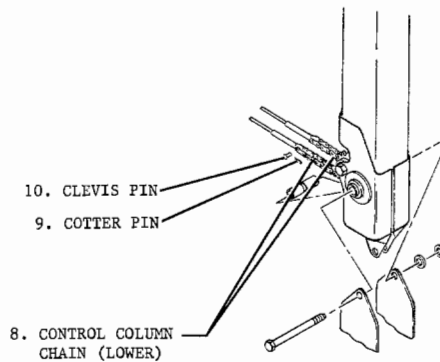
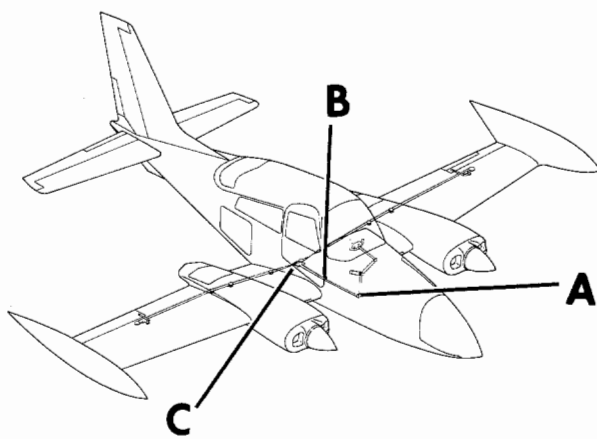
- (c) Place bearing (8) over adapter (7) and position adapter, universal joint, shaft and sprocket (11) into LH leg of control column assembly with universal joint facing aft.

NOTE: Install sprocket (11) with collar of sprocket facing away from adapter (7).

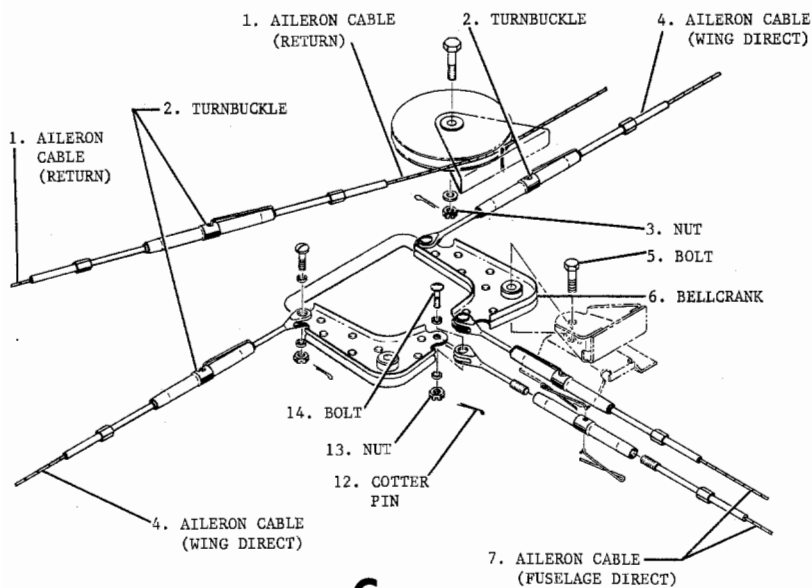
- (d) Align holes and install bolt (6) through adapter (7) and shaft (13); secure with nut.
- (e) Align holes and install bolt (12) through sprocket (11) and shaft (13); secure with nut.
- (f) Place bearing (8) on shaft (13); secure shaft (13) to control column assembly with washer (14), nut (16) and cotter pin (15).
- (6) Route the short chain of chain assembly (21) over the top of the sprocket (11) and align index mark (red) on sprocket with index link (red) on chain.
- (7) Secure chain assembly (21) together with turnbuckle and tighten just enough to take up slack. Observe that the terminals on chain are equal in length after turnbuckles are installed.
- (8) Assemble and install components in leg of RH control column assembly as described in steps "5" through "6" except position collar on sprocket (11) butted against adapter (7).

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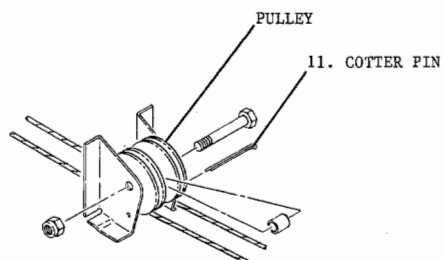
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DETAIL A



DETAIL C



DETAIL B

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Aileron Bellcrank Installation
Figure 7

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- (9) Install lower chain and cable assembly (26) on aft sprocket of triple sprocket (23) and align index mark (red) on chain link with index mark (red) tooth of sprocket.
- (10) Replace temporary bolt or heavy gauge wire which was used to support triple sprocket (23) during assembly with bolt (20), washer (24) and nut (25).

NOTE: Care should be taken to ensure that the washer (38) between triple sprocket (23) and wall of control column "Y" remains in place when bolt (20) is installed.

- (11) Using a bolt or pin as a rigging pin, insert through tube assembly attachment holes in universal joints (5) and tighten turnbuckles (22) on upper chain assemblies (21) until bolts or pins are parallel with vertical leg of control column "Y".

NOTE: After rigging upper chain assemblies (21), safety wire last link on lower chain assemblies (26) to control column "Y", thus preventing chain assemblies from accidentally moving off index tooth on sprocket during installation of control column "Y" in aircraft.

- (12) Insert bolt (36) through lower control column "Y" tab and assemble component part as shown in Figure 6; secure with washer (28) and nut (27).
- (13) Install control column assembly, refer to installation of control column.
- (14) Rig aileron control cables, refer to Aileron and Trim Tab Adjustment/Test.

5. Removal/Installation Aileron Bellcrank (see Figure 7).

A. Remove Aileron Bellcrank.

- (1) Refer to Chapter 12. Remove rear seats and carpets.
- (2) Refer to Chapter 1. Remove floorboard access cover just forward of rear spar.
- (3) Remove turnbuckle clips from turnbuckles (2) and loosen tension on aileron return cable (1).
- (4) Disconnect aileron direct cables (4 and 7) from bellcrank (6) by removing cotter pins (12), nuts (13) and bolts (14).
- (5) Remove bellcrank (6) by removing bolts (5).

B. Install Aileron Bellcrank.

- (1) Position bellcrank (6) and secure with bolts (5).

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- (2) Connect aileron direct cables (4 and 7) to bellcrank (6) with bolts (14), nuts (13) and cotter pins (12).

CAUTION: ENSURE THAT AILERON CABLES ARE IN PLACE ON AILERON QUADRANTS AND PULLEYS IN BOTH WINGS BEFORE RIGGING TENSION ON AILERON SYSTEM. WING STRUCTURE CAN BE DAMAGED BY THE AILERON CABLES IF TENSION IS RIGGED ON THE CABLES WHILE NOT PROPERLY IN PLACE ON AILERON QUADRANTS OR PULLEYS.

- (3) Rig aileron control system, refer to Aileron and Trim Tab Adjustment/Test.
- (4) Install turnbuckle clips on turnbuckles (2).
- (5) Install floorboard access cover.
- (6) Install seats and carpets, refer to Chapter 12.

6. Removal/Installation Aileron Fuselage Cables (see Figure 7).

A. Remove Fuselage Cables.

NOTE: The following procedure is for removing the aileron fuselage direct cables with turnbuckles attached to the cables and pulley cable guard cotter pin removed. If desired turnbuckle barrels may be unscrewed to leave the turnbuckle forks attached to the fuselage bellcrank.

- (1) Refer to Chapter 12 and remove the following items from the aircraft:
 - (a) Pilot and passenger seats.
 - (b) Front, center and rear carpets.
 - (c) Rear upholstery panel if autopilot (optional) is installed.
- (2) Remove boot, retainer and cover from lower control column.
- (3) Refer to Chapter 1 and remove floorboard and access covers.
- (4) At the fuselage bellcrank (6), disconnect aileron fuselage direct cables (7) by removing attaching cotter pins (12) nuts (13) and bolts (14).
- (5) Disconnect aileron fuselage direct cables (7) from lower control column chains (8) by removing attaching cotter pins (9) and clevis pins (10).

NOTE: Attach guide wire to ends of cables before removal.

- (6) Route aileron fuselage direct cables (7) aft to bellcrank and remove from aircraft.

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NOTE: Leave guide wires in aircraft to facilitate installation.

B. Install Fuselage Cables.

- (1) Secure aileron fuselage direct cables (7) to guide wires and route cables from bellcrank (6) to lower control column chains (8).
- (2) Remove guide wires from cables.
- (3) Secure aileron fuselage direct cables to lower control column chains (8) with clevis pins (10) and cotter pins (9).

NOTE: Ensure fuselage direct cables are not crossed and routed on the underneath side of pulley.

- (4) Install cable guard cotter pin (11) on fuselage pulley.
- (5) Secure aileron direct cables (7) to bellcrank (6) with attaching bolts (14), nuts (13) and cotter pins (12).
- (6) Rig aileron control system, refer to Aileron and Trim Tab Adjustment/Test.
- (7) Install boot, retainer and cover on lower control column.
- (8) Refer to Chapter 12 and install the following items:
 - (a) Rear upholstery panel, if autopilot (optional) is installed.
 - (b) Front, center and rear carpets.
 - (c) Pilot and passenger seats.

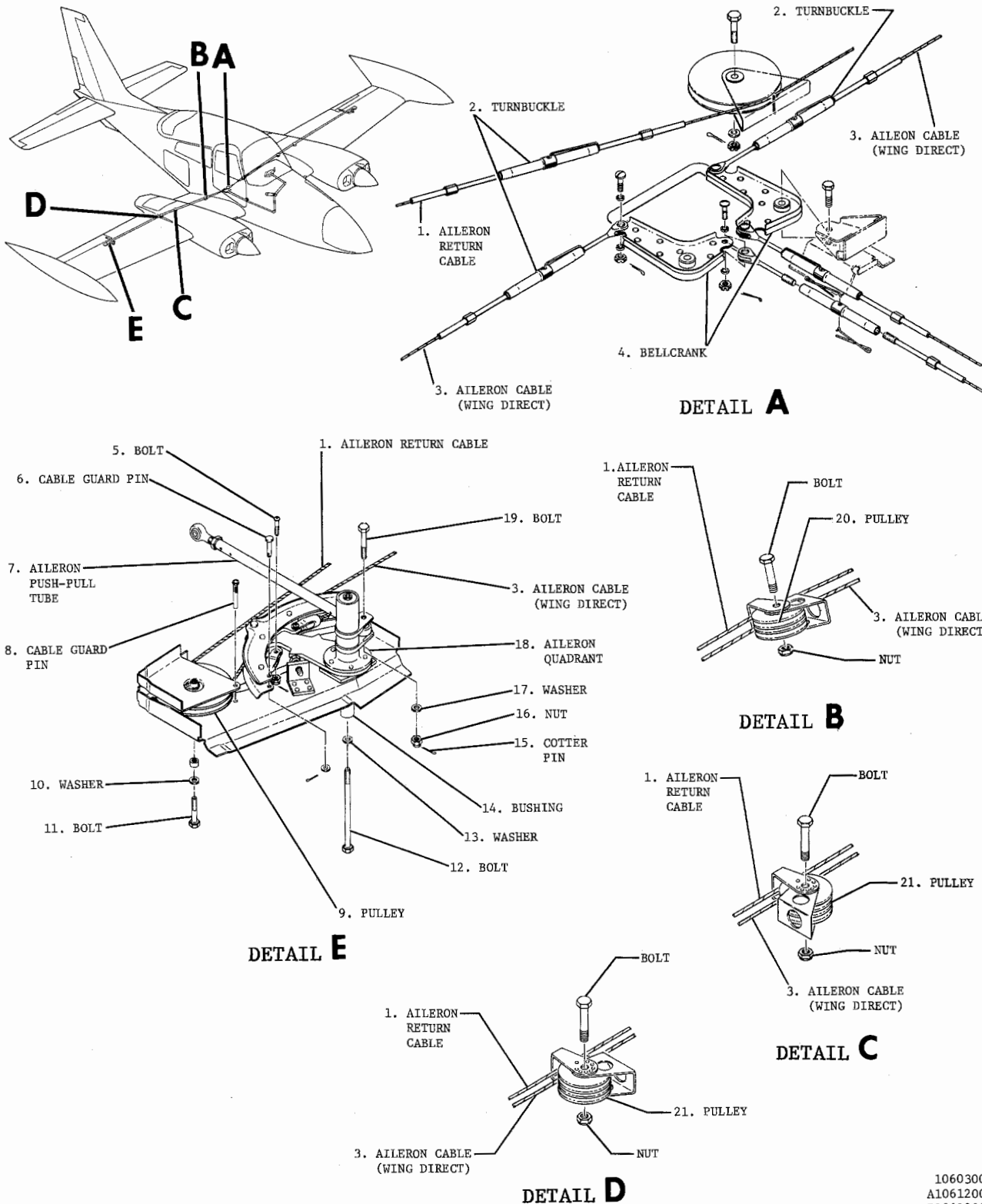
7. Removal/Installation of Aileron Quadrant (see Figure 8).

A. Remove Aileron Quadrant.

- (1) Refer to Chapter 12 and remove the following items:
 - (a) Remove passenger seats.
 - (b) Rear carpet.
 - (c) Rear upholstery panel, if autopilot (optional) is installed.
- (2) Refer to Chapter 1 and remove aft floorboard access covers and wing access cover above quadrant.
- (3) If autopilot (optional) is installed, disconnect autopilot cables from aileron cables.
- (4) Remove turnbuckle clips from turnbuckles (2) on cables (1 and 3) and disconnect cables at bellcrank (4).
- (5) Remove aileron pulley (9) outboard of aileron quadrant (18) by removing cable guard pin (8), bolt (11) and washer (10).

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Aileron Quadrant Installation
Figure 8

- (6) Attach guide wires to cables (1 and 3) to be used as guides on installation.
- (7) Disconnect aileron push-pull tube (7) from aileron quadrant (18) by removing attaching cotter pins (15), nut (16), washer (17) and bolt (19).
- (8) Remove bolt (12) and washer (13) attaching aileron quadrant (18) to wing structure.
- (9) Remove aileron quadrant (18) from wing by working quadrant and cables through wing access hole.

NOTE: To prevent routing cables (1 and 3) through entire wing, disconnect cable ends from quadrant as near to the wing access hole as working room will permit. Care also should be taken to prevent bushing (14) from falling during removal.

- (10) Disconnect aileron cables from quadrant by removing cotter pins, cable guard pins (6), nuts, washers and bolts (5).

B. Install Aileron Quadrant.

- (1) Place aileron quadrant (18) near aft wing access hole and connect aileron cables (1 and 3) to quadrant using bolts (5), washers and nuts; secure cables in position with cable guard pins (6) and cotter pins.

NOTE: Position return cable (1) on bottom groove of quadrant and direct cable (3) on upper groove of quadrant.

- (2) Install quadrant (18) in wing and secure with washer (13), bolt (12) and safety wire to pulley bracket.

CAUTION: ENSURE BUSHING (14) IS REINSTALLED WITH QUADRANT OR SERIOUS BINDING WILL OCCUR DURING RIGGING.

- (3) Connect aileron push-pull tube (7) to quadrant with attaching bolt (19), washer, nut and cotter pin.
- (4) Install pulley (9) (outboard of aileron quadrant) with bolt (11), washer (10) and cable guard cotter pin (8).
- (5) Route aileron cable (3) to bellcrank (4), connect cable to turnbuckle fork with turnbuckle (2).
- (6) Route return cable (1) to center fuselage and connect with turnbuckle (2).
- (7) Rig aileron control system, refer to Aileron and Trim Tab Adjustment/Test.

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CAUTION: ENSURE THAT AILERON CABLES ARE IN PLACE ON AILERON QUADRANTS AND PULLEYS IN BOTH WINGS BEFORE RIGGING TENSION ON AILERON SYSTEM. WING STRUCTURE CAN BE DAMAGED BY THE AILERON CABLES IF TENSION IS RIGGED ON THE CABLES WHILE NOT PROPERLY IN PLACE ON AILERON QUADRANTS OR PULLEYS.

- (8) If autopilot (optional equipment) is installed, connect autopilot cables to aileron cables with attaching clamps.
- (9) Install wing access covers and floorboard access covers.
- (10) Install removed carpets and seats.

8. Removal/Installation Aileron Wing Cables (see Figure 8).

NOTE: The following procedure is for removing the aileron wing cables with turnbuckles attached to the wing direct cables and pulley cable guard cotter pins removed. If desired, turnbuckle barrels may be unscrewed to leave the turnbuckle forks attached to the fuselage bellcrank.

A. Install Wing Cables.

- (1) Refer to Chapter 12 and remove the following items from the aircraft.
 - (a) Pilot and passenger seats.
 - (b) Front, center and rear carpets.
 - (c) Rear upholstery panel if autopilot (optional) is installed.
- (2) Refer to Chapter 1 and remove floorboard and access covers, access panel located on rear spar adjacent to aft wheel well, lower aft wing root fillets and aileron quadrant access cover.
- (3) Remove turnbuckle clips and disconnect turnbuckle (2) to right and left-hand return cables (1).
- (4) Relieve tension on aileron wing direct cable (3) by loosening turnbuckle at the fuselage bellcrank (4).
- (5) At the fuselage bellcrank (4), disconnect aileron wing direct cables (3) by removing attaching cotter pins, nuts and bolts.
- (6) If an autopilot (optional) is installed, disconnect autopilot cables from aileron direct cables (3), refer to Chapter 14.
- (7) Remove aileron pulley (9) outboard of aileron quadrant by removing cable guard pin (8), attaching bolt (11) and washer (10).

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- (8) Disconnect aileron push-pull tube (7) from aileron quadrant (18) by removing cotter pin (15), nut (16), washer (17) and bolt (19).
- (9) Remove two sets of pulleys (21) aft of the wheel well and one set (20) in each wing root by removing cable guard cotter pins and attaching nuts and bolts.

NOTE: When removing control cables, tie guide wires to ends of cables before removal.

- (10) Remove bolt (12) and washer (13) attaching aileron quadrant (18) to wing structure.
- (11) With aileron return and direct cables (1 and 3) attached to aileron quadrant, remove quadrant and cables from wing using aileron quadrant access hole.

NOTE: Leave guide wires in wing and fuselage to facilitate installation.

B. Install Wing Cables

- (1) Secure aileron cables (1 and 3) to guide wires and route cables and quadrant into position.
- (2) Remove guide wire from cables.
- (3) Install quadrant (18) refer to Removal/Installation of Aileron Quadrant.

CAUTION: BE SURE BUSHING (14) IS INSTALLED WITH QUADRANT OR SERIOUS BINDING WILL OCCUR DURING RIGGING.

- (4) Install two sets of pulleys (21) on pulley brackets aft of the wheel well and secure with attaching bolts and nuts.
- (5) Install one set of pulleys (20) on lower aft wing root pulley brackets and secure with attaching bolt and nuts.
- (6) Position aileron direct cables (3) on lower pulleys and aileron return cables (1) on upper pulleys and install cable guard cotter pins.

NOTE: Aileron cables (1 and 3) must be routed on aft side wing pulleys.

- (7) Secure aileron cables (1 and 3) to fuselage bell-crank (4) with attaching bolts, nuts and cotter pins.

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CAUTION: ENSURE THAT AILERON CABLES ARE IN PLACE ON AILERON QUADRANTS AND PULLEYS IN BOTH WINGS BEFORE RIGGING TENSION ON AILERON SYSTEM. WING STRUCTURE CAN BE DAMAGED BY THE AILERON CABLES IF TENSION IS RIGGED ON THE CABLES WHILE NOT PROPERLY IN PLACE ON AILERON QUADRANTS OR PULLEYS.

- (8) If an autopilot (optional equipment) is installed, attach to the aileron cables and rig in accordance with rigging procedures.
- (9) Install lower aft wing root fillets, fuselage floorboard access covers, aft underside wing access covers, and quadrant access cover.
- (10) Refer to Chapter 12 and install the following items:
 - (a) Rear upholstery panel, if autopilot (optional) is installed.
 - (b) Front, center and rear carpets.
 - (c) Pilot and passenger seats.

9. Removal/Installation Aileron Trim Tab Actuator (see Figure 9).

A. Remove Trim Tab Actuator.

- (1) Refer to Chapter 12 and remove passenger seats and rear carpet.
- (2) Refer to Chapter 1 and remove floorboard access covers above landing gear actuator and from aileron quadrant access cover on left wing.
- (3) Remove turnbuckle clip from turnbuckle (15) and disconnect.
- (4) Remove left aileron, refer to Removal/Installation Aileron.
- (5) Remove aileron trim tab push-pull tube (20) from actuator (25) by removing cotter pin (23), nut (24), washer (22) and bolt (29).
- (6) Remove chain guard (26) from actuator (25) by removing nuts and screws.
- (7) Disengage chain from actuator sprocket.
- (8) Remove clamp (31) by removing nut (21) and screw (30).
- (9) Remove clamps (27) by removing bolts and nuts and remove actuator (25) from wing.

B. Install Trim Tab Actuator.

- (1) Place actuator (25) in position, align clamps (27) and secure with bolts and nuts.
- (2) Install clamp (31) on actuator (25) and secure with screw (30) and nut (21).

- (3) Engage chain on actuator sprocket and install chain guard (26) with screws and nuts.
- (4) Connect turnbuckle (15) to fuselage and wing tip cable (11), and rig trim tab cable tension in accordance with Aileron and Trim Tab Adjustment/Test.
- (5) Connect aileron trim push-pull tube (20) to actuator (25) with bolt (29), washer (22), nut (24) and cotter pin (23).
- (6) Install left aileron, refer to Installation of Aileron.
- (7) Rotate aileron trim control wheel to neutral position and align aileron with trailing edge of wing.
- (8) With trim tab in neutral, adjust actuator screw so that push-pull tube (20) is aligned with hole in trim tab horn; install attaching bolt, spacer, nut and cotter pin, see Figure 5.
- (9) Refer to Aileron and Trim Tab Adjustment/Test, and check trim tab for rigging, correct travel and operation.
- (10) Install access covers, carpet and seats.

10. Disassembly and Assembly of Trim Tab Actuator (See Figure 10)

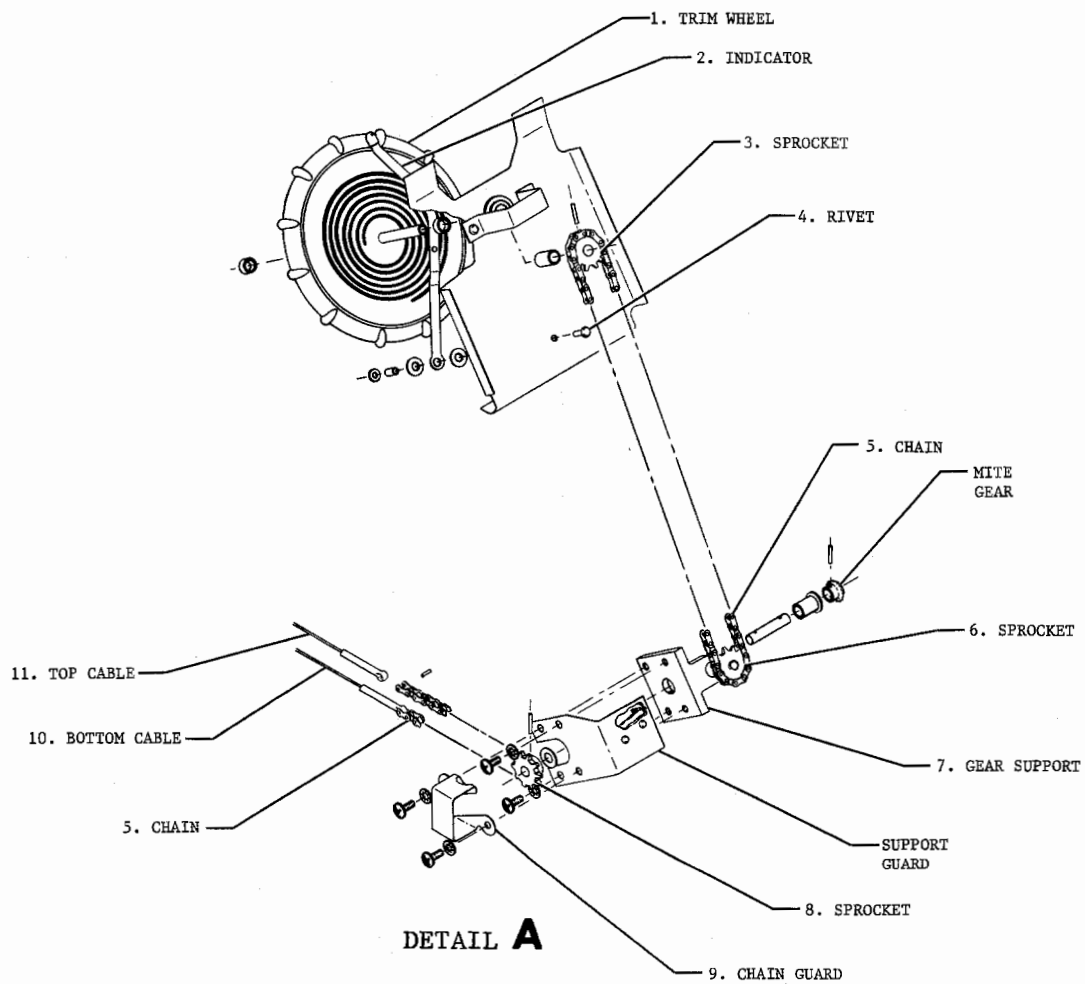
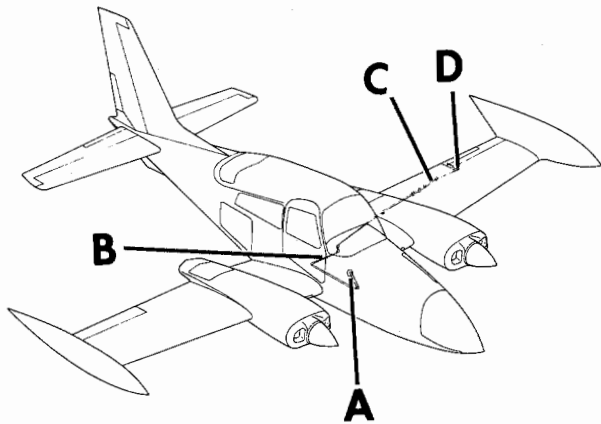
A. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items.

Name	Number	Manufacturer	Use
Silicone Grease (Light Consistency)	No. 33	Dow Corning Corp. Midland, Michigan 48641	To lubricate screw housing and threads in aileron trim tab ac- tuator.

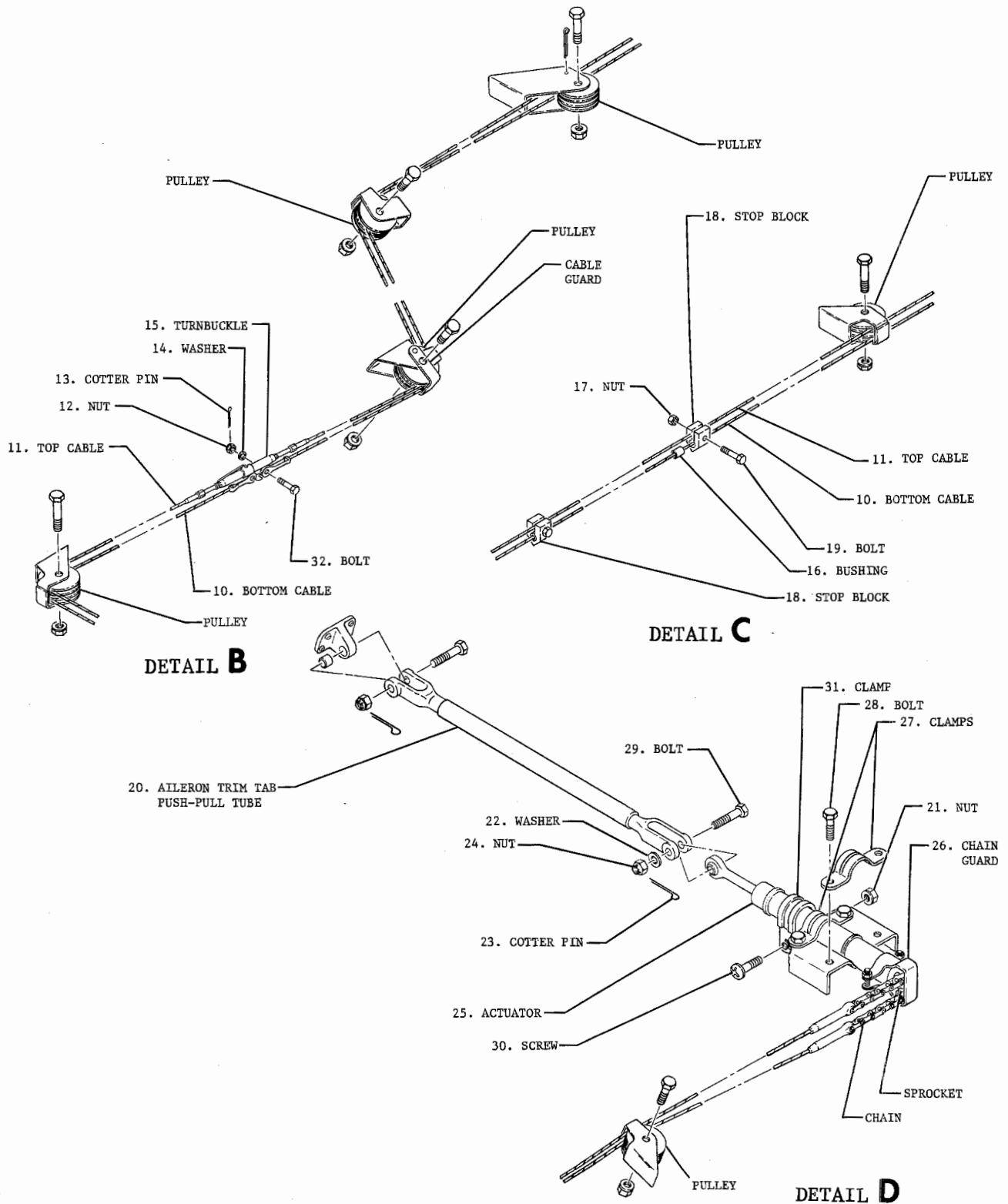
B. Disassemble Trim Tab Actuator.

- (1) Disassemble aileron trim tab actuator assembly in accordance with Figure 10. This view clearly illustrates the proper relationship of all component parts.
- (2) Do not remove bearing (4) from screw (3) unless replacement parts are required.
- (3) Clean all component parts, except bearing (4), by washing in suitable solvent. Do not clean sealed bearing (4).



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Aileron Trim Tab Actuator and Cable Installation
Figure 9 (Sheet 1 of 2)

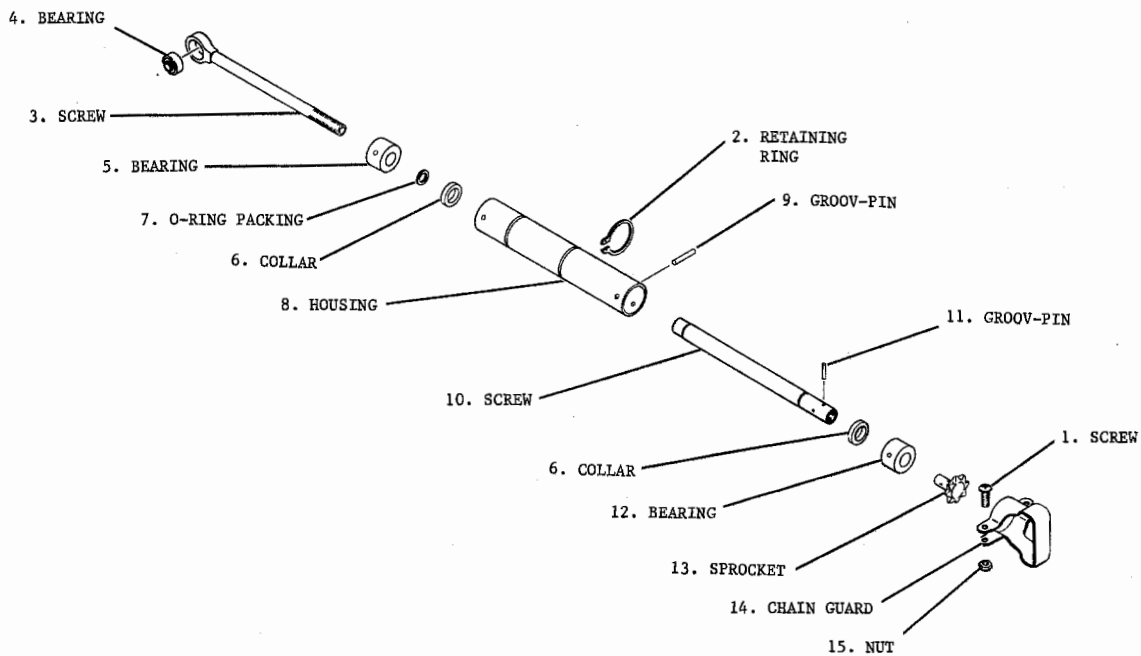
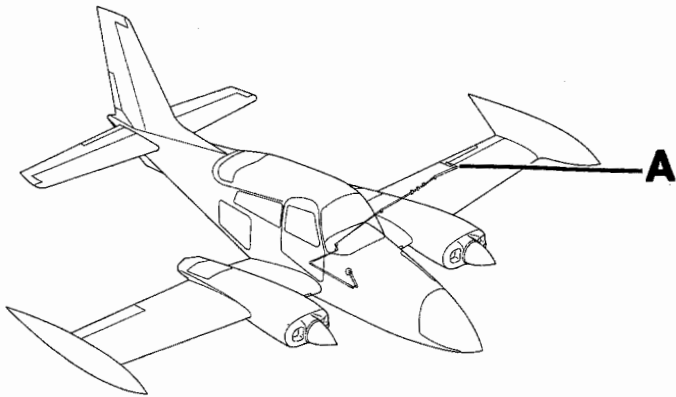


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Aileron Trim Tab Actuator and Cable Installation
Figure 9 (Sheet 2)

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DETAIL A

Trim Tab Actuator
Figure 10

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- (4) Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.
- (5) Check bearing (5 and 12) and screws (4 and 11) for excessive wear and scoring. Dimension of parts shall be as follows:

Front bearing (13) ID	0.373 in. min.
	0.380 in. max.

Rear bearing (6):

Small hole ID	0.248 in. min.
	0.253 in. max.
Large hole ID	0.373 in. min.
	0.380 in. max.
Screw (4) OD (shank)	0.242 in. min.
	0.246 in. max.
Screw (11) OD	0.367 in. min.
	0.370 in. max.

NOTE: Relative linear movement between internal thread screw (10) and bearing (5) should be 0.004 to 0.010 inches on aileron and elevator trim tab actuator when set at room temperature.

NOTE: Relative linear movement between internal threaded screw (11) and bearing (6) should be 0.008 to 0.012 inch on rudder trim tab actuator when set at room temperature.

- (6) Examine screws (3 and 10) for damaged threads or dirt particles that may impair smooth operation.
- (7) Check sprocket (13) for broken, chipped, and/or worn teeth.
- (8) Check bearing (4) for smoothness of operation.

CAUTION: DO NOT ATTEMPT TO REPAIR DAMAGED OR WORN PARTS OF THE ACTUATOR, DISCARD ALL DEFECTIVE ITEMS AND INSTALL NEW PARTS DURING REASSEMBLY.

C. Assemble Trim Tab Actuator.

NOTE: Discard the following items and install new parts during assembly: nuts (15), pins (9 and 11) and o-ring packing (7).

- (1) During reassembly, lubricate collars (6) and screw (10) with light consistency silicone grease.

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- (2) Reassemble actuator in accordance with the following:
 - (a) Press sprocket (13) into hollow end of screw (10), making sure pin holes are aligned. Press new groove-pins (11) into pin holes.
 - (b) Slip bearing (12) and collar (6) on screw (10) and slide down against sprocket (13).
 - (c) Insert screw (10), with assembled parts, into housing (8).

NOTE: Locate sprocket (13) at the end of housing (8) which is farthest from the groove for retaining ring (2).

- (d) Align pin holes in bearing (12) and housing (8). Press new groove-pin (9) into pin holes.
- (e) Insert collar (6), new o-ring (7), and bearing (5) into end of housing (8). Align pin holes in bearing and housing and install new groove-pin (9).
- (f) If new parts are required, press bearing (4) into boss at end of screw (3). Be sure force bears against outer race of bearing. Install screw (3) in housing (8) and screw (10).
- (g) Install retraining rings (2) in grooves provided on outside of housing (8).
- (h) Test actuator assembly by rotating sprocket (14) with fingers while holding bearing end of screw (3). Screw (3) should travel in and out of housing (8) smoothly, with no indication of binding.

11. Removal/Installation Aileron Trim Tab Cables (See Figure 9)

A. Remove Trim Tab Cables.

- (1) Refer to Chapter 12, and remove the following items:
 - (a) Pilot's and passenger seats.
 - (b) Front and rear carpets.
- (2) Remove side panels from control pedestal.
- (3) Refer to Chapter 1 and remove floorboard access covers, bottom fuselage access cover aft of nose wheel well, aileron quadrant access cover on left wing, and aft left wing root fillet.
- (4) In the fuselage, remove turnbuckle clip and disconnect turnbuckle (15) connecting the top cables (11) together.
- (5) In the fuselage, remove cotter pin (13), nut (12), washer (14) and bolt (32) connecting bottom cables (10) together.
- (6) Remove pulleys in wing and fuselage by removing nuts, bolts, and cable guard pins.

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- (7) Remove chain guard (26) from actuator (25) by removing nuts and screws. Remove chain.
- (8) Remove stop blocks (18) and bushings (16) by removing nuts (17) and bolts (19).
- (9) Remove cables from wing by pulling out through aileron quadrant access hole in wing.

NOTE: When removing cables, tie guide wires to ends of cables before removal. Leave the wire in the aircraft to facilitate installation.

- (10) Remove chain guard (9) by removing attaching screws and washers, and pull fuselage cables (10 and 11) out through access hole.
- (11) Remove chain from around sprockets on gear support (7) and trim wheel (1) by disconnecting at master link.

NOTE: If during removal or installation of chain the indicator reaches its extreme travel, it can be disengaged from trim wheel track by inserting a screwdriver beneath indicator (2) and prying out of track. This permits indicator to be moved to a different position or wheel to be turned, before indicator is re-engaged with track.

B. Install Trim Tab Cables.

- (1) Install chain around sprockets on gear support (7) and trim wheel (1) by connecting chain ends with master link.
- (2) Secure fuselage cables (10 and 11) to guide wires and pull aft into position, then remove guide wires.
- (3) Rotate trim wheel (1) to center indicator (2), engage lower chain with sprocket (8) so that ends of chain are equal in length and install chain guard (9) with screws and washers.
- (4) Secure wing cables (10 and 11) to guide wires and route from actuator to fuselage connections, then remove guide wires.
- (5) Align aileron with trailing edge of wing; then rotate sprocket on actuator (25) to move trim tab to neutral. Engage chain with sprocket so that ends of chain are equal in length, install chain guard (26) with attaching screws and nuts.
- (6) Install pulleys in wing and fuselage with bolts and nuts. Position cables in pulley tracks and install guard pins.

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- (7) Connect fuselage and wing top cables (11) together with turnbuckle (15).
- (8) Connect fuselage and wing bottom cables (10) together, using bolt (32), washer (14), nut (12) and cotter pin (13).
- (9) Install stop blocks (18) and bushings (16) on cables (10 and 11) between ribs at wing stations 100.5 and 111.5 with bolts and nuts.
- (10) Rig the trim tab system, refer to Aileron and Trim Tab Adjustment/Test. Safety turnbuckle (15).
- (11) Install aft wing root fillet, and access covers on underside of fuselage aft of nose wheel well, aft underside of left wing, and cabin floor.
- (12) Install side panels on control pedestal.
- (13) Install pilot's and passenger seats, refer to Chapter 12.

12. Removal/Installation Aileron Trim Gear Assembly (See Figure 9)

A. Remove Trim Gear Assembly.

- (1) Refer to Chapter 12 and remove pilot's seat and left front carpet.
- (2) Refer to Chapter 1 and remove access covers from forward cabin floor, aft cabin floor above the landing gear actuator, and underside of fuselage just aft of the nose wheel well.
- (3) Remove turnbuckle clip from turnbuckle (15) and disconnect turnbuckle.
- (4) Remove chain guard (9) by removing screws and washers, and disengage chain (5) from sprocket (8).
- (5) Remove sprocket (8) from shaft by removing roll pin.
- (6) Remove screws and washers attaching gear assembly support (7) and support guard in fuselage.
- (7) Rotate forward side of gear support upward, disengage upper chain from sprocket (6), and remove support guard and gear support (7) through access hole in cabin floor.
- (8) If further disassembly of gear support assembly is desired, see Figure 9.

B. Install Trim Gear Assembly.

- (1) Insert gear assembly support (7) and support guard through access hole in cabin floor, and engage upper chain (5) with sprocket (6).
- (2) With support guard in position, align mounting holes in gear assembly support (7) and install screws and washers. Use the two mounting holes that are not utilized to attach chain guard (9).
- (3) Attach sprocket (8) to shaft in gear support assembly (7) by installing roll pin.

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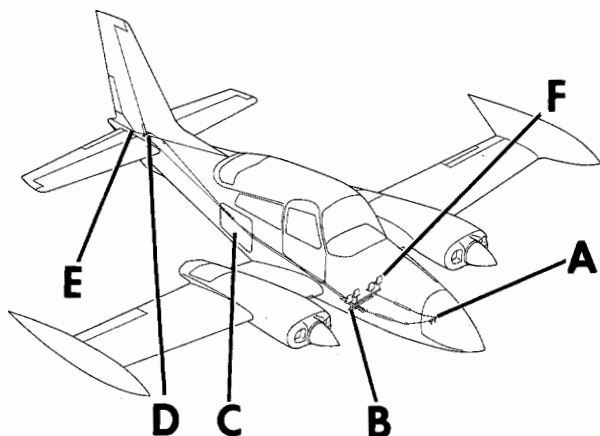
- (4) Engage chain (5) with sprocket (8) and install chain guard (9) with screws and washers.
- (5) Connect cables (11) together with turnbuckle (15).
- (6) Rig trim tab control system, refer to Aileron and Trim Tab Adjustment/Test.
- (7) Safety turnbuckle (15).
- (8) Install access hole covers on forward cabin floor, aft cabin floor and underside of fuselage aft of nose wheel well.
- (9) Install carpets and pilots seats.

RUDDER, RUDDER TRIM TAB AND CONTROLSDescription

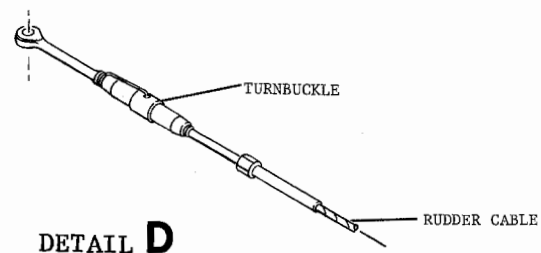
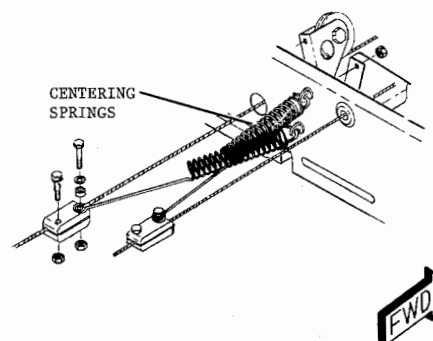
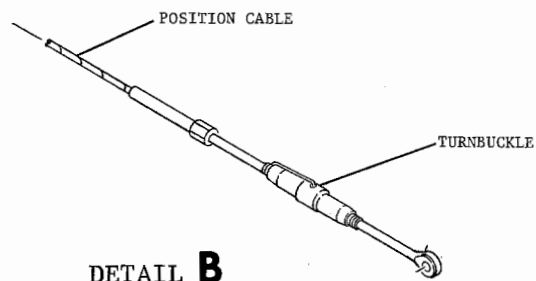
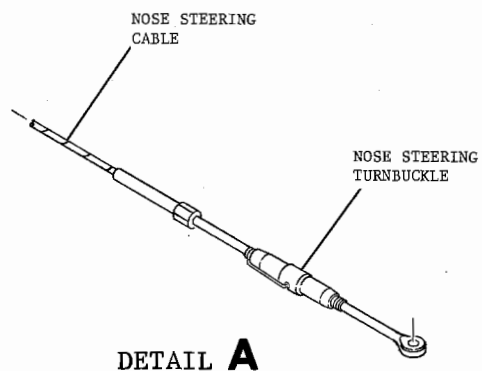
1. The rudder and trim tab system is mechanically actuated and provides directional control of the aircraft about the vertical axis. The system consists of two subsystems; a rudder control system and a rudder trim control system.
2. The rudder control system consists of: rudder, rudder pedals, bellcrank, rudder pedal position cables and control system cables. The rudder is operated by the movement of the rudder pedals. The pedals are connected to torque tubes which have link arms for the attachment of the rudder cables. The rudder cables are attached to the torque tube link arms and routed forward over pulleys and then aft under the floorboards, and through the tailcone by pulleys to the adjustable turnbuckles attached directly to the bellcrank on the bottom of the rudder torque tube. The rudder travel stops, consists of bolts mounted in brackets attached to the lower hinge bracket, are provided for the recommended travel adjustment. The position cable is attached to the left rudder pedal torque tube and routed aft around a pulley then forward to the right rudder pedal torque tube to complete the rudder control system. Nose gear steering cables are also attached to right and left rudder pedal torque tubes and routed forward to springs and then to the nose gear steering yoke, refer to Chapter 4 for nose gear steering information.
3. The rudder trim tab system consists of: control wheel, cable assemblies, stop blocks, rudder trim tab actuator and tab. The rudder trim tab is operated by the control wheel on the pedestal. The control wheel is attached to a torque tube and sprockets which drives the chains and cables. The cables connect to a chain below the pedestal, and then routed aft under the floor through pulleys into the tailcone to an adjustable turnbuckle. In the tailcone, the cables are routed aft to pulleys, then up through the vertical stabilizer, to a chain which operates the trim tab actuator. The trim tab push-pull tube connects the trim actuator to the trim tab horn on the trim tab, which is mounted to the rudder by a continuous hinge. The stop blocks are located in the tailcone for adjustment of the rudder trim tab travel.

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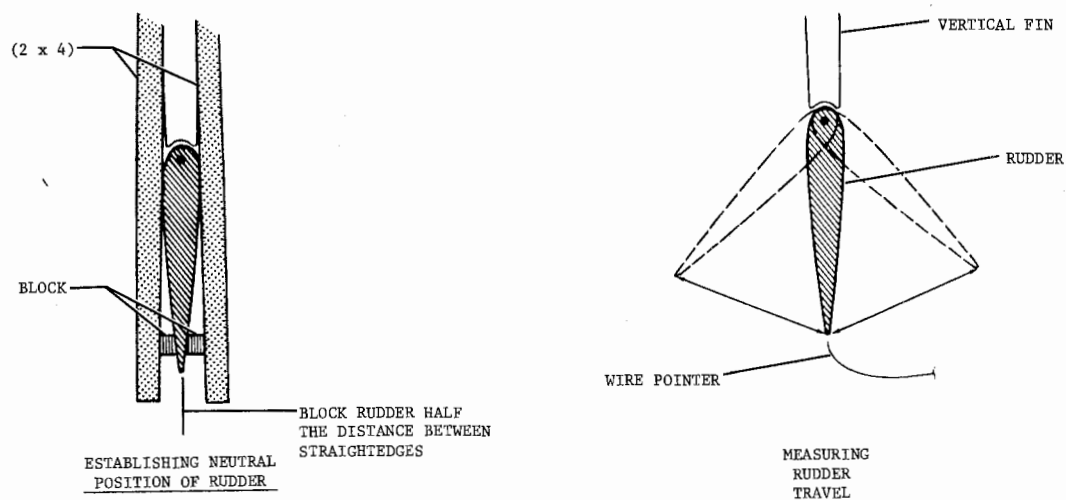
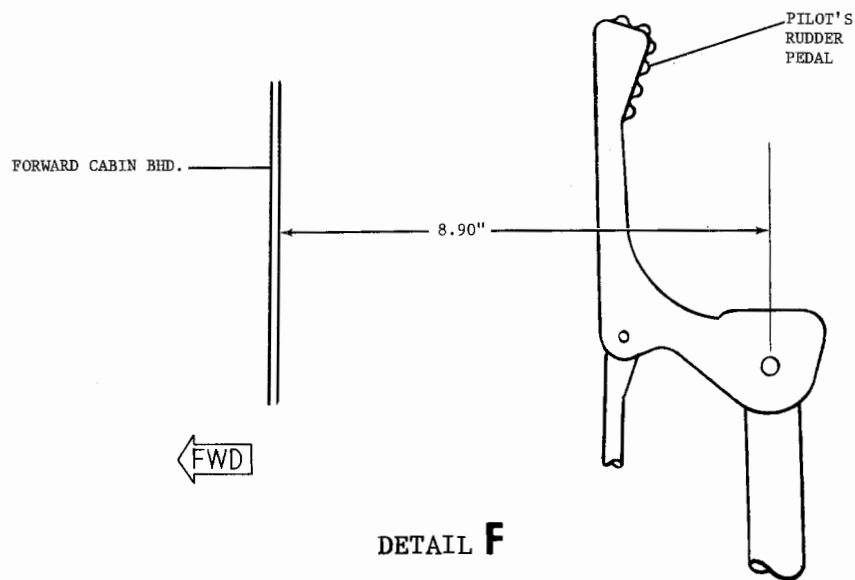


NOTE: CABLE TENSION SHOULD BE ADJUSTED
WHEN AMBIENT TEMPERATURE IS 60°
TO 90° F. ALLOW AIRCRAFT TEMPERATURE
TO STABILIZE FOR A PERIOD OF 4 HOURS.



DETAIL E

Rudder Control System and Adjustment
Figure 1 (Sheet 1 of 2)



1. Establish neutral position of rudder by clamping straightedge (such as wooden 2 x 4) on each side of fin and rudder and blocking trailing edge of rudder half the distance between straightedges as shown.
2. Tape a length of soft wire to the stinger in such a manner that it can be bent to index at the lower corner of the rudder trailing edge.
3. Using soft lead pencil, mark rudder at point corresponding to soft wire indexing point (neutral).
4. Remove straightedges and blocks.
5. Hold rudder against right, then left, rudder stop. Measure distance from pointer to pencil mark on rudder in each direction of travel. Distance should be between 13.75" and 14.25".

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Rudder Control System and Adjustment
Figure 1 (Sheet 2)

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CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS ON LATE MODEL AIRCRAFT USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. Troubleshooting the rudder and trim tab system is determining if the trouble exists in the rudder control system or the rudder trim tab control system.
2. When troubleshooting the rudder and trim tab system, release the rudder gust lock (optional).
3. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed item.

Name	Number	Manufacturer	Use
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif.	To measure cable tension.

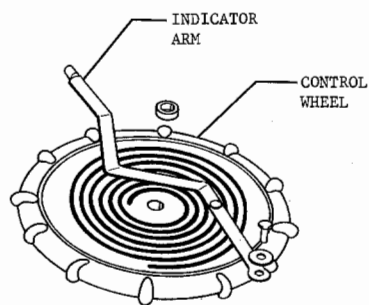
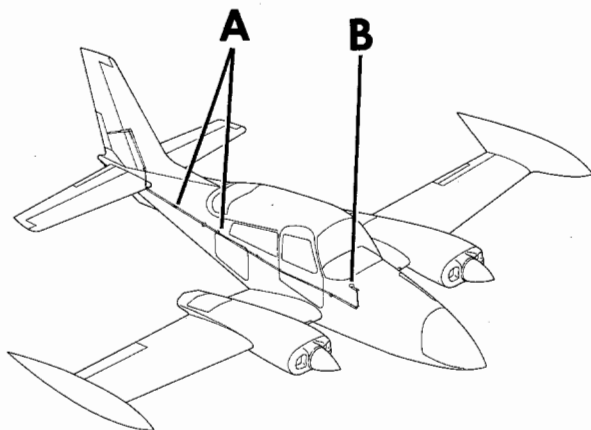
4. Troubleshooting Rudder and Trim Tab Control System
 - A. For guide to troubleshooting the rudder and trim tab control systems, see Figures 3 and 4. When troubleshooting the rudder and trim tab system, position the nose wheel fore and aft centering the rudder.

Adjustment/Test

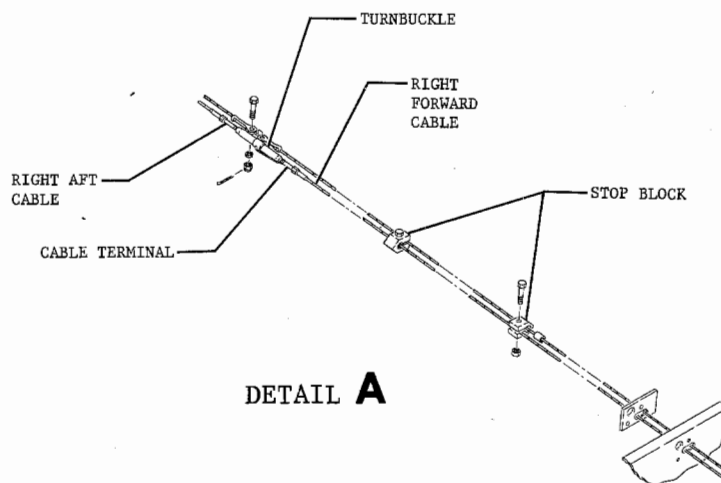
1. Tools and Equipment

NOTE: Refer to troubleshooting for tools and equipment requirements.

2. Rigging Rudder Control System (See Figure 1)



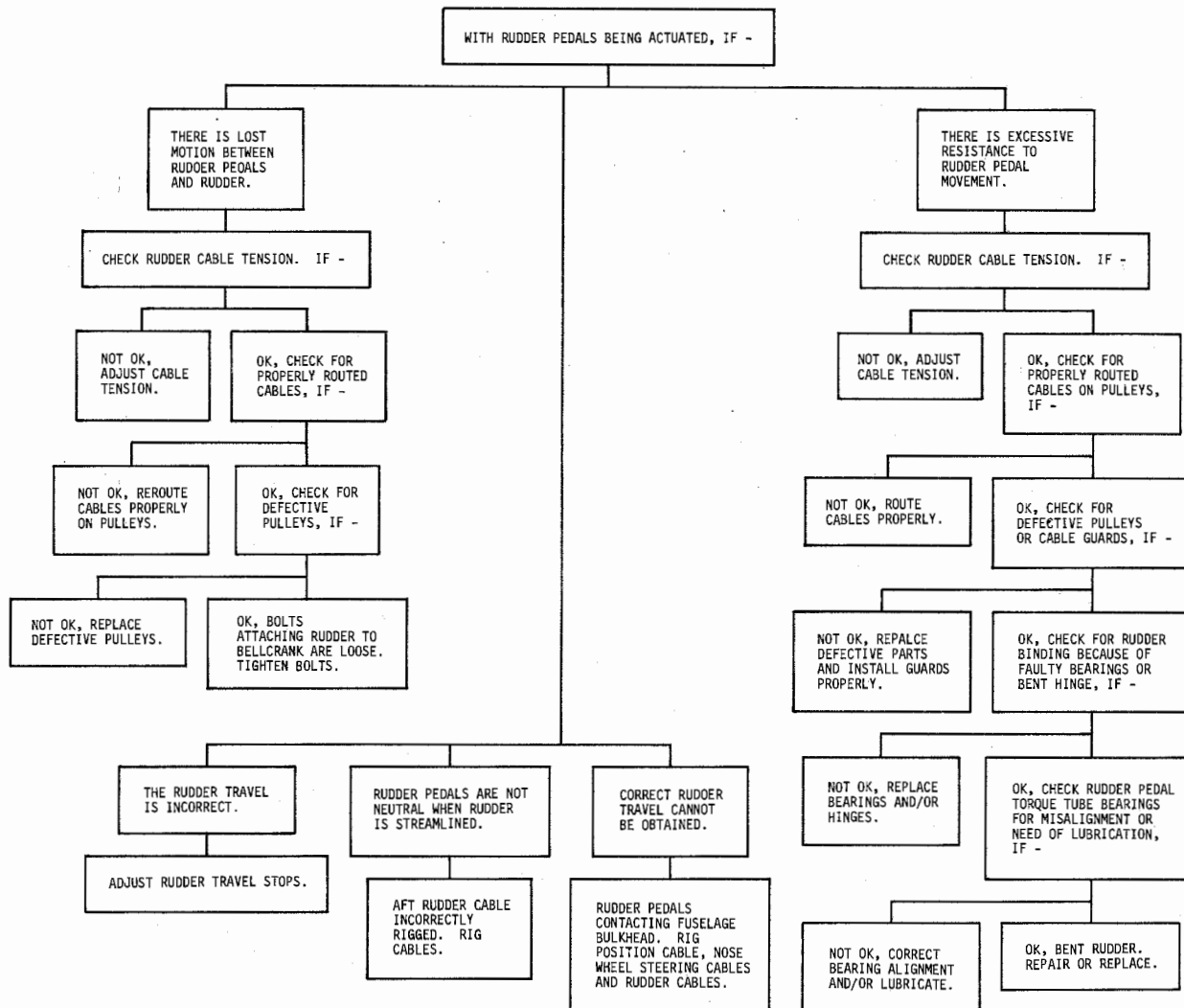
DETAIL B



DETAIL A

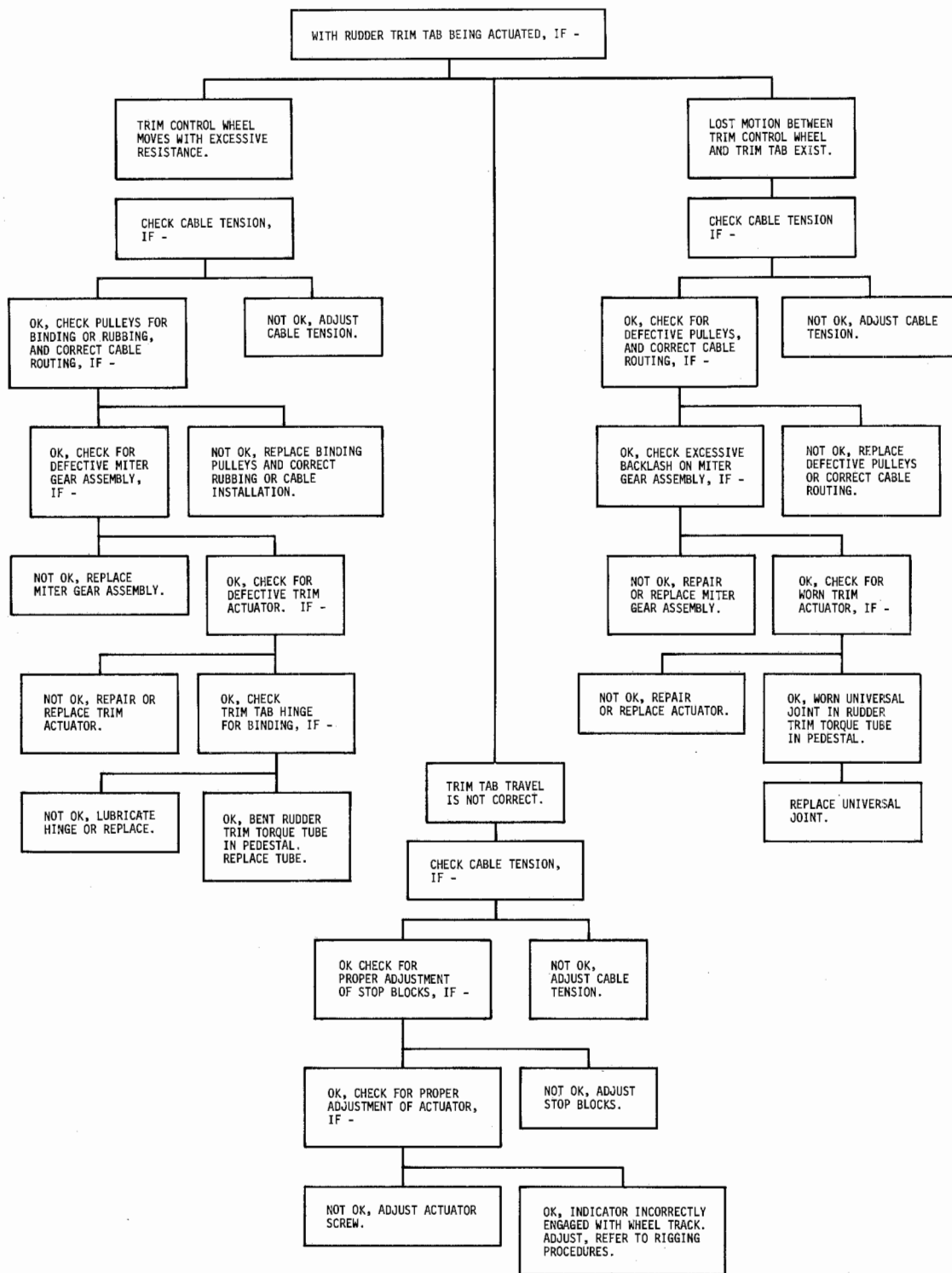
NOTE: CABLE TENSION SHOULD BE ADJUSTED WHEN AMBIENT TEMPERATURE IS 60° TO 90°F. ALLOW AIRCRAFT TEMPERATURE TO STABILIZE FOR A PERIOD OF 4 HOURS.

Rudder Trim Tab Control System and Adjustment
Figure 2



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Troubleshooting Chart - Rudder Control System
Figure 3



10988002

Troubleshooting Chart - Rudder Trim Tab Control System
Figure 4

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SERVICE MANUAL

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of 4 hours.

- A. Position the nose wheel fore and aft in neutral position.
- B. Refer to Chapter 12. Remove the pilots seats, front carpet.
- C. Refer to Chapter 1. Remove access covers on floorboard and stabilizer fairings.
- D. Remove turnbuckle safety clips from any turnbuckle which must be adjusted during rigging.
- E. Adjust the position cable which is a "balance" cable, used to close the rudder system. Adjust the position cable turnbuckle so that the pivot point of the pilot's pedals are 8.90 inches from the forward cabin bulkhead as shown in Figure 1.
- F. Adjust nose wheel steering cable turnbuckles so that tension on nose wheel steering cables is 20 ± 5 pounds.
- G. With nose wheel and rudder pedals in neutral, adjust aft rudder cable turnbuckles so that rudder is in neutral (streamlined) and tension on rudder cables is 25 ± 5 pounds, measured forward of centering springs at Fuselage station 132.00 or 45 ± 5 pounds aft of centering springs. With rudder in neutral, each centering spring should be extended $2 \pm .10$ inches, and clamped to rudder cables.

NOTE: The tension on the nose wheel steering cables and the aft rudder cables operates in the same direction. If either cables are adjusted, it will be necessary to recheck the tension on the cables which were not adjusted.

- H. Resafety bolts. Adjust rudder bellcrank stop bolts so that rudder travel is 34° left and 34° right (measured perpendicular to hinge line). Resafety bolts. See Figure 1 for alternate method of measuring travel.
- I. Safety all turnbuckles from which turnbuckle clips were removed.
- J. Adjust clevis rod ends on brake master cylinders so the tips of the pilot's rudder pedals are aligned. Adjust right brake link tie rods so that tips of copilot's rudder pedals are aligned.

WARNING: ENSURE THAT RUDDER MOVES IN THE PROPER DIRECTION WHEN OPERATED BY THE RUDDER PEDALS.

- K. Install access covers and stabilizer fairings.
- L. Install carpets and pilots seats.

3. Rigging Rudder Trim Control System (See Figure 2)

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of 4 hours.

- A. Refer to Chapter 12. Remove pilot and passenger seats, front; center and rear carpets, and rear upholstery panel in tailcone.
- B. Remove floorboard access covers and cover on vertical stabilizer adjacent to rudder trim tab actuator.
- C. Remove turnbuckle clip from turnbuckle connecting right forward and aft cables, adjust turnbuckle to 10 ± 3 pounds tension. Reinstall turnbuckle clip.
- D. Move rudder trim control system to neutral by rotating the trim control wheel so that the ends of the chain at the actuator are equal in length from actuator sprocket, and the ends of the forward chain are equal length from the sprocket at the gear assembly.
- E. Adjust the indicator arm to neutral position by inserting a screwdriver beneath the indicator arm and prying out of track in the trim control wheel, moving the indicator to neutral, and re-engaging with track.
- F. Remove cotter pin, nut, washer and bolt attaching trim tab push-pull tube to the rudder trim tab.
- G. Place the rudder and rudder trim tab in neutral position. Adjust the actuator screw so that the aft hole in the trim tab push-pull tube is aligned with the hole in the trim tab horn, attach with bolt, washer, nut and cotter pin.
- H. Loosen stop blocks and move the rudder trim tab to $20^\circ + 1^\circ$, $- 0^\circ$ right (measured perpendicular to hinge line. Locate aft stop block adjacent to cable terminal and tighten.
- t I. Move the rudder trim tab to $25^\circ + 1^\circ$, -0° left (measured perpendicular to hinge line). Slide forward stop block against aft stop block and tighten.
- J. Install floorboard access covers and cover on vertical stabilizer.
- K. Install rear upholstery panel rear, center and front carpets and seats.

WARNING: ENSURE THAT THE RUDDER TRIM TAB MOVES IN PROPER DIRECTION WHEN OPERATED BY THE TRIM CONTROL WHEEL.

Inspection/Check

1. Tools and Equipment.

NOTE: See Troubleshooting for tools and equipment.

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2. Rudder and Rudder Trim Tab Check.

NOTE: Angular dimensions for rudder and trim tab are measured perpendicular to rudder and trim tab hinge. The rudder is in neutral position when the nose wheel and rudder are fore and aft. The trim tab is in neutral position when streamlined with the rudder trailing edge.

A. Rudder and Rudder Trim Tab Cable Check.

- (1) Place rudder and rudder trim tab in neutral position.
- (2) Place tensiometer on rudder cables and read tension. See Figure 1 for cable temperature/tension NOTE.

NOTE: Access to the rudder cables is gained by removing the rear upholstery panel.

- (3) Place tensiometer on the rudder trim cable and read cable tension. See Figure 2 for cable temperature/-tension NOTE.

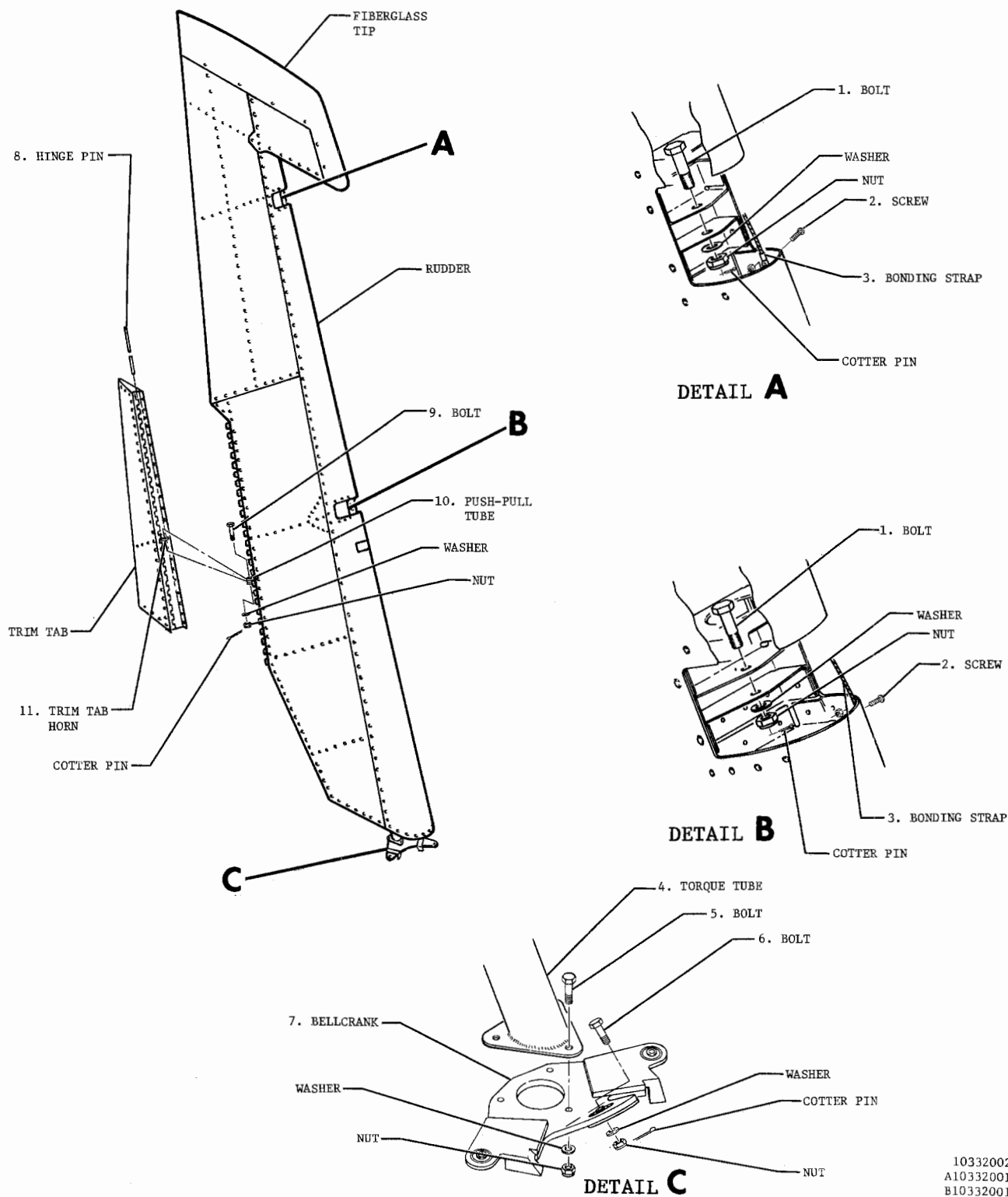
NOTE: Access to rudder trim cable is gained by removing the rear upholstery panel.

3. Rudder and Trim Tab Deflection Check

- A. Place the rudder and rudder trim tab in trail position.
- B. Depress the rudder pedal to full left rudder. The rudder shall deflect 34° to the left.
- C. Depress the rudder pedal to full right rudder. The rudder shall deflect 34° to the right.
- D. Rotate the rudder trim control wheel to full nose left. The rudder trim tab shall deflect $20^{\circ} + 1^{\circ}$, $- 0^{\circ}$ to the right.
- E. Rotate the rudder trim control wheel to full nose right. The rudder trim tab shall deflect $25^{\circ} + 1^{\circ}$, $- 0^{\circ}$ to the left.

4. Inspect Rudder and Rudder Trim Tab

- A. Remove access plate on pedestal, cabin floorboards, rear upholstery panel to tailcone, vertical stabilizer fairings and access cover to provide visual inspection of cables and pulleys.
- B. Install access covers, fairings and floorboards.



Rudder and Trim Tab Installation
Figure 5

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Maintenance Practices

1. Removal/Installation Rudder (See Figure 5)

A. Remove Rudder.

- (1) Place a suitable support beneath the tailcone at station 132.00.
- (2) Refer to Chapter 3 and remove stinger.
- (3) Remove cotter pin, nut, washer and bolt (9) from rudder trim tab push-pull tube (10).
- (4) Remove cotter pins, nuts, washers and bolt (5) attaching rudder torque tube (4) to bellcrank (7).
- (5) Disconnect bonding straps (3) from vertical stabilizer.
- (6) Support rudder and remove cotter pins, nuts, washers and bolts (1) from center and upper hinges.
- (7) Remove rudder from vertical stabilizer by pulling aft and guiding rudder trim tab push-pull tube (10) through rudder.

B. Install Rudder.

- (1) Place rudder into position, guide rudder trim tab push-pull tube (10) through rudder and align mounting holes on upper and center hinges with vertical stabilizer.
- (2) Attach rudder to vertical stabilizer at the upper and center hinges with bolts (1), washers, nuts and cotter pins.
- (3) Attach bonding straps (3) to vertical stabilizer.
- (4) Attach rudder torque tube (4) to bellcrank with bolts (5), washers, nuts and cotter pins.
- (5) Connect rudder trim tab push-pull tube (10) to trim tab horn (11) with bolt (9), washer, nut and cotter pin.
- (6) Remove support from beneath tailcone and check rudder and rudder trim tab for proper operation and correct travel. If rigging is necessary, refer to Rudder and Trim Tab Adjustment/Test.
- (7) Refer to Chapter 3 and install stinger.

2. Removal/Installation Rudder Bellcrank

A. Remove Bellcrank.

- (1) Refer to Chapter 3 and remove stinger.
- (2) (See Figure 6) Loosen rudder cables (3 and 6) at turnbuckles (7).
- (3) Disconnect the cable links from left and right side of bellcrank (1) by removing cotter pins, nuts, washers and bolts.

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NOTE: Tag the cable links to aid reinstallation.

- (4) (See Figure 5) Remove cotter pin, nut, washer, and bolts (6), securing bellcrank (7) to lower bellcrank hinge bracket.
- (5) Remove cotter pins, nuts, washers and bolts (5), securing bellcrank to torque tube (4). Remove bellcrank.

B. Install Bellcrank.

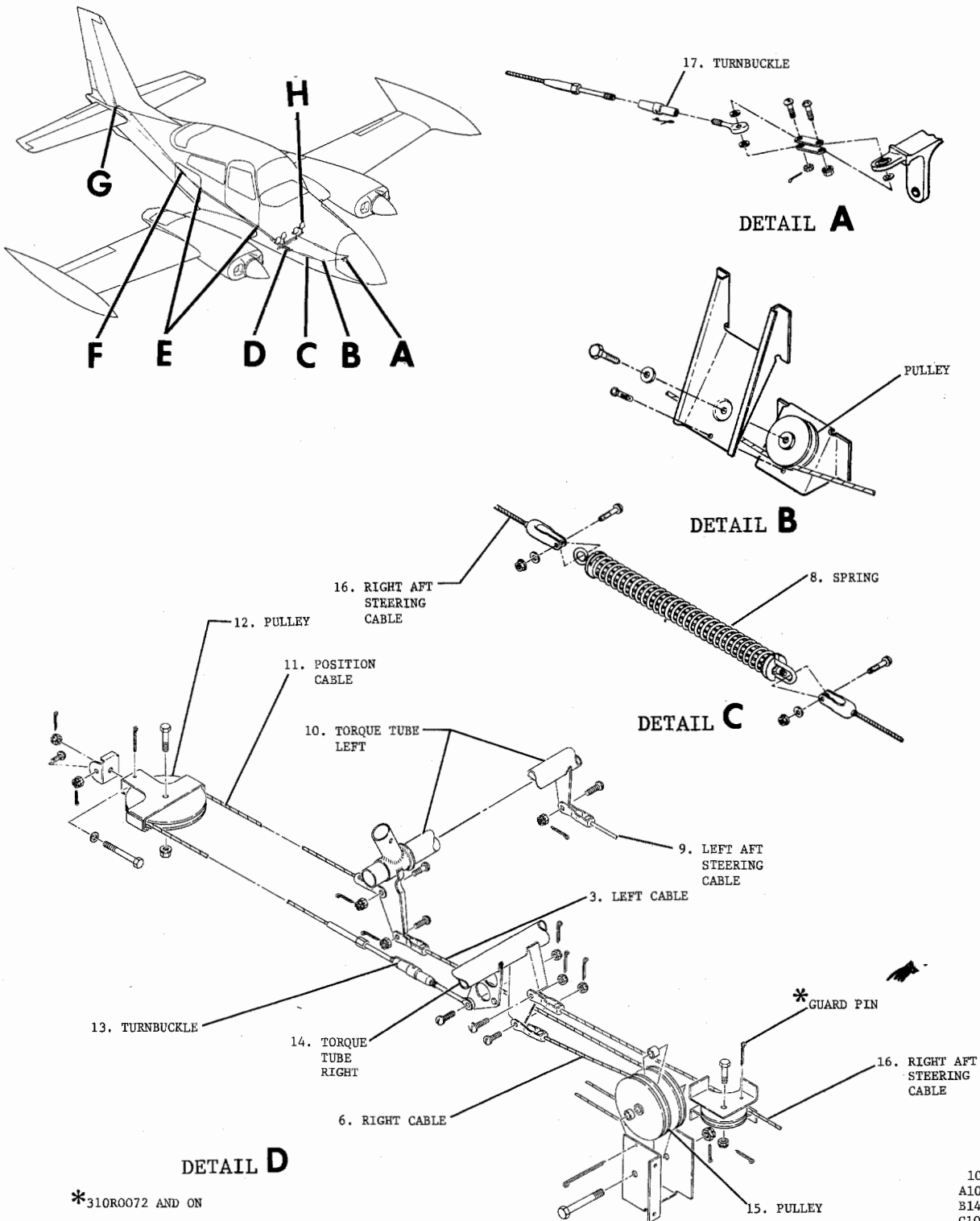
- (1) (See Figure 5) Align bellcrank (7) to torque tube (4) and secure with bolts (5), washers, nuts and cotter pins.
- (2) Secure bellcrank (7) to bellcrank hinge bracket using bolt (6), washer, nut and cotter pin.
- (3) (See Figure 6) Identify cable links and attach cable links to bellcrank (1) with bolts, washers, nuts and cotter pins.
- (4) Rig rudder system, refer to Rudder and Trim Tab Adjustment/Test.
- (5) Install turnbuckle clips on turnbuckles (7).
- (6) Install stinger.

3. Removal/Installation Rudder Pedals and Cables (See Figure 6)

NOTE: The following procedures describe rudder pedals and cables through the tailcone to the rudder cable turnbuckles, located at rudder bellcrank.

A. Remove Rudder Pedal Assembly.

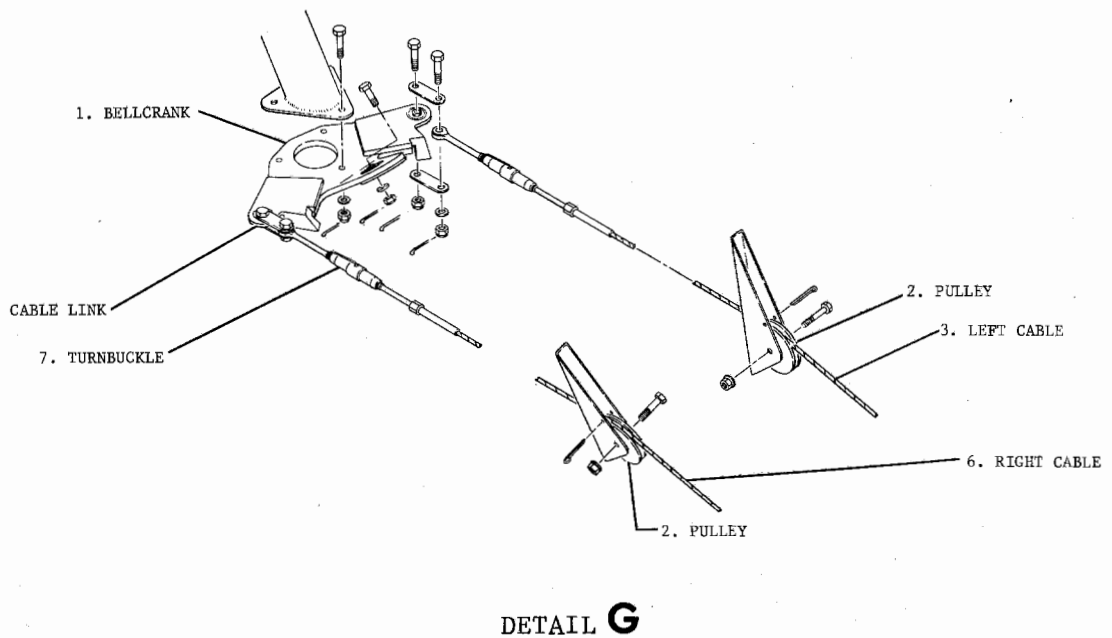
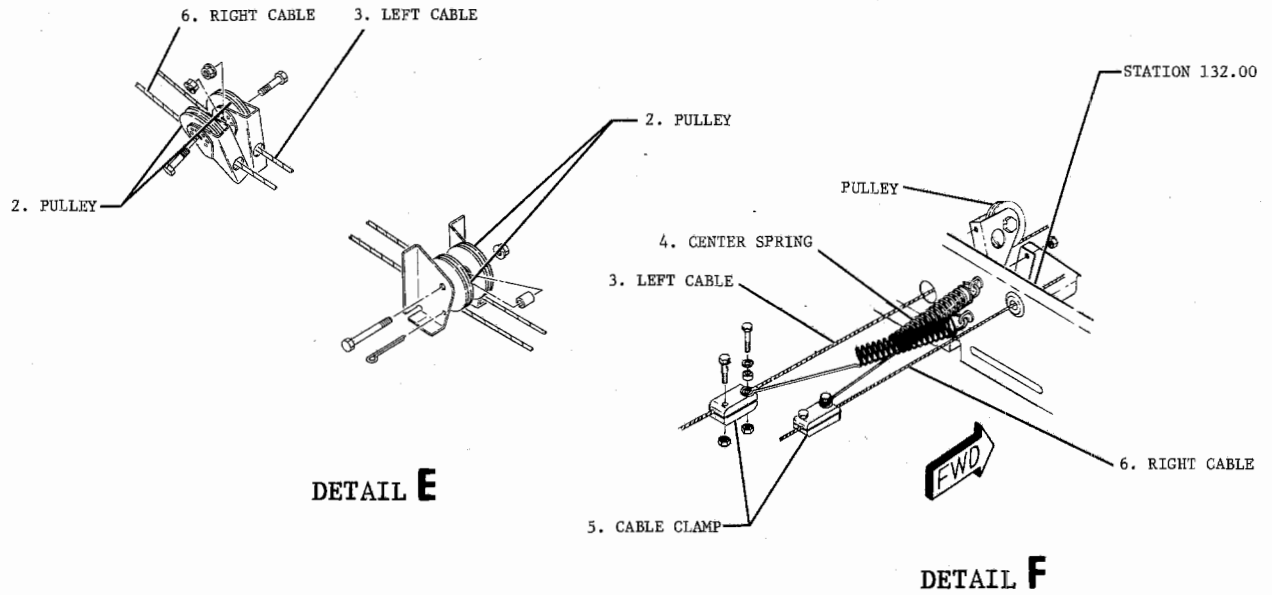
- (1) Refer to Chapter 12 and remove pilots seats and front carpet.
- (2) Remove boot, retainer and covers from lower control column.
- (3) Refer to Chapter 1 and remove access covers from forward cabin floorboards.
- (4) Release tension on nose wheel steering cables by loosening turnbuckles (17).
- (5) Disconnect rudder position cable (11) and right aft nose wheel steering cable (16) from torque tube (14) by removing cotter pins, nuts and bolts.
- (6) Disconnect left aft nose wheel steering cable (9) from torque (10) by removing cotter pin, nut and bolt.
- (7) Disconnect rudder cables (3 and 6) from torque tubes (10 and 14) by removing cotter pins, nuts and bolts.
- (8) Disconnect brake master cylinders (20) from pilot's rudder pedals by removing cotter pins (30) and pins (28).



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Rudder Pedal Installation
Figure 6 (Sheet 1 of 3)

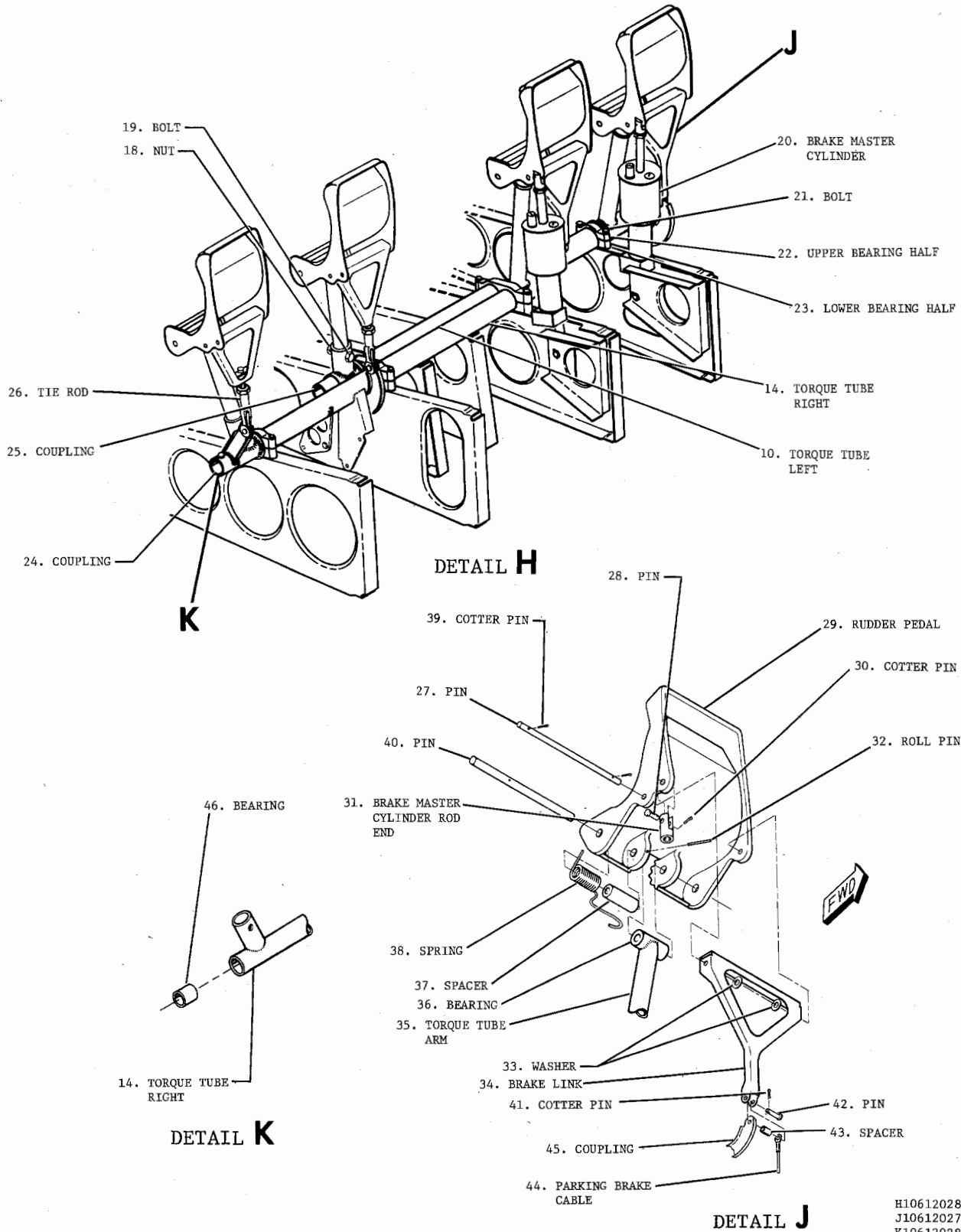


Rudder Pedal Installation
Figure 6 (Sheet 2)

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Rudder Pedal Installation
Figure 6 (Sheet 3)

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- (9) Disconnect two parking brake cables (44) and brake links (34) from rudder pedal torque tubes (10 and 14) by removing cotter pins (41), spacers (43) and pins (42).
- (10) Remove copilot's rudder pedals by removing nuts (18) and bolts (19).
- (11) Remove upper and lower bearing halves (22 and 23) by removing bolts (21). Remove rudder pedal assembly from aircraft.

NOTE: The upper and lower halves of each bearing are matched parts and should be tagged and kept in pairs.

- (12) If additional disassembly of rudder pedal assembly is desired, refer to Disassembly/Assembly Rudder Pedal Assembly.

B. Install Rudder Pedal Assembly.

- (1) Place rudder pedal assembly in position, remove identification tags from bearing halves (22 and 23). Position bearing halves on torque tubes (10 and 14) and secure with bolts (21).

NOTE: During installation of rudder pedal assemblies, lubricate in accordance with Chapter 2. Rudder pedal torque tubes must rotate freely in bearing halves (22 and 23).

- (2) Install copilot's rudder pedal assemblies on torque tubes (10 and 14) with bolts (19 and 18).
- (3) Connect two parking brake cables (44) and brake links (34) to torque tubes (10 and 14) with pins (42), spacers (43) and cotter pins (41).
- (4) Connect brake master cylinders (20) to pilot's rudder pedals with pins (28) and cotter pins (30).
- (5) Connect rudder cables (3 and 6) to torque tubes (10 and 14) with bolts, nuts and cotter pins.
- (6) Connect left aft nose wheel steering cable (9) to torque tube (10) with bolt, nut and cotter pin.
- (7) Connect right aft nose wheel steering cable (16) and position cable (11) to torque tube (14) with bolts, nuts and cotter pins.
- (8) Connect nose wheel steering cables (9 and 16) to springs (8).
- (9) Rig rudder control system, refer to Rudder and Trim Tab Adjustment/Test.
- (10) Safety turnbuckles.
- (11) Install access covers.

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- (12) Install boot, retainer and covers on lower control column.
- (13) Install pilots seats and front carpets. Refer to Chapter 12.

C. Remove Rudder Cables.

- (1) Refer to Chapter 12. Remove the following items:
 - (a) Pilots and passenger seats.
 - (b) Front, center and rear carpets.
 - (c) Rear upholstery panel to tailcone.
- (2) Refer to Chapter 1. Remove stabilizer fairings; access covers on cabin floor as necessary to gain access to rudder cables, pulleys and attachment points.
- (3) Disconnect rudder cables (3 and 6) from bellcrank (1) by disconnecting turnbuckles (7).
- (4) Remove pulleys (2 and 15) by removing attaching nuts, washers, spacers and bolts.

NOTE: Attaching nut and bolt for pulleys (15) must be removed from inside nose wheel well.

- (5) Remove fairleads through hole which rudder cables pass at fuselage rear spar and fuselage station 132.00.
- (6) Disconnect rudder centering springs (4) from cable clamps (5) by removing nuts, spacers, washers and bolts.
- (7) Remove cable clamps (5) by removing attaching nuts and bolts.
- (8) Disconnect rudder cables (3 and 6) from rudder pedal torque tubes (10 and 14) by removing cotter pins, nuts and bolts.
- (9) Tie guide wires to forward ends of rudder cables (3 and 6) and remove cables from aircraft by routing them out through stabilizer fairings.

NOTE: If an autopilot (optional) is installed, disconnect from rudder cables by removing attaching clamps.

- (10) Release tension on nose wheel steering cables (9 and 16) as follows:
 - (a) Manually turn nose wheel to an extreme right or left position to release tension on spring (8).
 - (b) Disconnect nose wheel steering cables (9 and 16) by either separating nose wheel steering spring components or removing cotter pins, nuts, washers and bolts.

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CAUTION: TENSION ON NOSE WHEEL STEERING CABLES MUST BE RELEASED BEFORE RUDDER POSITION CABLE (1) IS DISCONNECTED.

- (11) Disconnect rudder position cable (11) from torque tube (10 and 14) by removing cotter pins, nuts and bolts.
- (12) Remove pulley (12) by removing nut and bolt.
- (13) Tie guide wire on position cable (11) and route from underneath floorboard.

B. Install Rudder Cables.

- (1) Tie guide wire to position cable (11) and pull into position under floorboard. Position cable around pulley (12) and secure pulley with bolt and nut.
- (2) Connect rudder position cable (11) to torque tube (10 and 14) with cotter pins, nuts and bolts.
- (3) Connect nose wheel steering cables (9 and 16) and springs (8) in accordance with the method used to release cable tension.
- (4) Tie rudder cables (3 and 6) to guide wires, pull cables into position, and remove guide wires.

NOTE: When installing pulleys (15), the pulleys and spacers must be aligned and held in position from inside the cabin while attaching bolt and nut are installed from inside the nose wheel well.

- (5) Connect rudder cables (3 and 6) to torque tubes (10 and 14) and secure with bolts, nuts and cotter pins.
- (6) Install pulleys (2) in fuselage and tailcone and secure with bolts, spacers and nuts.
- (7) Connect rudder cables (3 and 6) to bellcrank (1) by installing turnbuckle (7).
- (8) Install fairleads through which rudder cables pass at fuselage station 132.00 and rear spar.
- (9) Install cable clamps (5), attach centering springs (4), and rig springs, refer to Rudder and Trim Tab Adjustment/Test.
- (10) Rig rudder cables, refer to Rudder and Trim Tab Adjustment/Test.

NOTE: If an autopilot (optional) is installed, the autopilot cables must be connected to the rudder cables.

- (11) Install access covers and stabilizer fairings.
- (12) Install upholstery panel, front, center and rear carpets and seats.

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4. Disassembly/Assembly Rudder Pedal Assembly (See Figure 6)

A. Disassemble Rudder Pedal Assembly.

- (1) Remove brake links from rudder pedals (29) by removing cotter pins, washers and pins (27).
- (2) Remove rudder pedals by driving out roll pins (32) and removing springs, spacers and pins (40).

NOTE: Springs and spacers are not used on copilot's rudder pedals.

- (3) Remove couplings (24 and 25) from brake torque tubes by removing cotter pins and pins.
- (4) Remove brake torque tubes from rudder pedal torque tubes (10 and 14).

NOTE: Bearings (46) in rudder pedal torque tubes and bearings (36) in rudder pedal torque tube arms (35) are a press fit and should be removed for replacement only.

B. Assemble Rudder Pedal Assembly.

- (1) Insert brake torque tubes into rudder pedal torque tubes (10 and 14).
- (2) Install couplings (24 and 25) on ends of brake torque tubes with attaching pins and cotter pins.
- (3) Install rudder pedals on rudder pedal torque tube arms (35) with spacers, springs and pins (40). Secure with roll pins (32).

NOTE: Springs and spacers are not used on copilot's rudder pedals.

- (4) Attach brake links (34) to rudder pedals (29) with pins, washers and cotter pins.

NOTE: To facilitate installation, do not attach copilot's rudder pedal assemblies to rudder pedal torque tubes prior to installation.

5. Removal/Installation Rudder Trim Tab (See Figure 5)

A. Remove Rudder Trim Tab.

- (1) Turn rudder trim control wheel on pedestal until indicator is pointing to full right position.
- (2) Disconnect rudder trim tab push-pull tube (10) by removing cotter pin, nut, washer and bolt.

- (3) Remove trim tab from rudder by removing cotter pins hinge pin (8).

B. Install Trim Tab.

- (1) Attach rudder trim tab to rudder with hinge pin (8) and secure with cotter pins.
- (2) Connect rudder trim tab push-pull tube (10) to trim tab with bolt, washer, nut and cotter pin.
- (3) Check rudder trim tab for proper operation and correct travel. If necessary, rig system. Refer to Rudder and Trim Tab Adjustment/Test.

6. Removal/Installation Rudder Trim Tab Actuator (See Figure 7)

A. Remove Trim Tab Actuator.

- (1) Refer to Chapter 12 and remove rear upholstery panel to tailcone.
- (2) Refer to Chapter 1 and remove access hole cover from vertical stabilizer adjacent to rudder trim tab actuator (3).
- (3) Unsafety turnbuckle (13) and disconnect aft cables (9 and 10) from forward cables (12 and 26) by removing turnbuckle (13), cotter pin, nut, washer and bolt (11).
- (4) Remove chain guard (7) by removing nuts and screws.
- (5) Disengage chain (8) from actuator sprocket and tie chain to screw hole in vertical fin.
- (6) Disconnect trim tab push-pull tube (1) from actuator (3) by removing cotter pin, nut, washer and bolt (2).
- (7) Remove clamps (4) by removing bolts (5) and washers. Remove the trim tab actuator (3).
- (8) If further disassembly of actuator is desired, refer to Disassembly/Assembly Aileron Trim Tab Actuator.

NOTE: The instructions for disassembly and assembly of the aileron trim tab actuator, given in Section 5-00, also applies to the rudder trim tab actuator.

B. Install Trim Tab Actuator.

- (1) Insert the rudder trim tab actuator (3) into position in vertical stabilizer, and install clamps (4) with bolts (5) and washers.
- (2) Attach the trim tab push-pull tube (1) to the actuator (3) with bolt (2), washer, nut and cotter pin.
- (3) Rotate actuator sprocket so that rudder trim tab is in the neutral position, and engage chain (8) equal in length from the sprocket.

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- (4) Install the chain guard (7) with screws and nuts.
- (5) Connect the aft cable (9) to forward left cable (12) with bolt (8), washer, nut and cotter pin.
- (6) Connect the aft cable (10) to forward right cable (26) with turnbuckle (13).
- (7) Rig the rudder trim tab system, refer to Rudder and Trim Tab Adjustment/Test.
- (8) Install rear upholstery panel to tailcone.
- (9) Install access hole cover on vertical stabilizer.

7. Removal/Installation Rudder Trim Cables (See Figure 7)

A. Remove Trim Cables.

- (1) Refer to Chapter 12 and remove the following items:
 - (a) Pilots and passenger seats.
 - (b) Front, center and rear carpets.
 - (c) Rear upholstery panel to tailcone.
- (2) Remove side panel from control pedestal, stabilizer fairings, vertical stabilizer access cover at actuator and floorboards.
- (3) Unsafety turnbuckle (13) and disconnect aft cables (9 and 10) from forward cables (12 and 26) by removing turnbuckle, cotter pin, nut, washer and bolt (11).
- (4) Remove aft pulleys by removing nuts, bolts and cable guard cotter pins. Pull cables aft into tailcone.
- (5) Remove chain guard (7) from actuator (3) by removing nuts and screws.
- (6) Disengage chain (8) from sprocket of actuator (3), attach a guide wire to the chain, and remove cables and chain from vertical fin. Disconnect guide wire and leave in vertical fin to facilitate installation.
- (7) Remove stop blocks (25) by removing nuts, bolts.
- (8) Remove forward pulleys from forward cables (12 and 26) by removing nuts, washers and bolts.
- (9) Disengage chain (24) from sprocket of gear assembly (21).

NOTE: Chain guards are flexible enough to allow chain to be disengaged without removing chain guards.

- (10) Remove forward cables (12 and 26) by pulling out through access hole in forward cabin floor.

NOTE: To facilitate installation, tie guide wires to aft ends of cables and leave guide wires in fuselage.

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- (11) Remove chain (17) by disconnecting master link.

NOTE: If, during the removal or installation of the chain, the indicator arm (14) reaches its extreme travel, disengage from control wheel track by inserting a screwdriver beneath the indicator arm and prying out of track. This permits the indicator to be moved, or wheel to be turned, before indicator is re-engaged with track.

- (12) The above procedure does not include removal of rudder trim control wheel, indicator, torque tube or miter gear assembly, because their removal is not recommended. However, removal of these components is possible by the following methods:

- (a) Trim control wheel (15) and indicator arm (14) can be removed by drilling out the rivets which attach the wheel bracket to the control pedestal and the rivet around which the indicator pivots.
- (b) Torque tube (20) can be removed by removing upper roll pin and lower roll pin.

NOTE: To gain access to the lower roll pin, it may be necessary to remove the control pedestal, or to drill out the rivets which attach the lower right side panel.

- (c) The upper sprocket and shaft (19) can be removed by removing the roll pin. Chain guard (18) can be removed by removing nuts and screws.
- (d) The gear assembly (21) can be removed by removing the control pedestal and drilling out enough attaching rivets to allow the section of the floor above the gear assembly to be lifted for access.

B. Install Trim Cables.

- (1) Install chain (17) on upper sprockets and connect with master link.
- (2) Tie ends of cables (12 and 26) to the guide wires, pull into position, and remove guide wires.
- (3) Rotate control wheel (15) to center indicator arm (14), and engage forward chain (24) with sprocket so that the ends of the chain are equal in length from the sprocket.

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- (4) Install forward pulleys with bolts, washers and nuts, ensure that the cables are correctly in place as the pulleys are installed. Install guide pins.
- (5) Tie chain (8) to the guide wire, pull into position in the vertical fin, and remove the guide wire.
- (6) Rotate actuator sprocket so that rudder trim tab is in neutral; engage chain (8) with sprocket so that the ends of the chain are equal in length from the sprocket.
- (7) Install chain guard (7) with screws and nuts.
- (8) Install aft pulleys with bolts, nuts and pulley guide pins.
- (9) Connect aft left cable (9) to forward left cable (12) with bolt (11), washer, nut and cotter pin.
- (10) Connect aft right cable (10) to forward right cable (11) with turnbuckle (13).
- (11) Install the stop blocks (25) with bolts and nuts.
- (12) Rig the trim tab system, refer to Rudder and Trim Tab Adjustment/Test.
- (13) Install access covers on vertical fin and cabin floor and stabilizer fairings.
- (14) Install side panel on control pedestal, rear upholstery panel to tailcone; front, center and rear carpets and front seats.

YAW DAMPER SYSTEM (OPTIONAL)Description

1. The yaw damper system is an independent system consisting of a gyro-computer (turn and slip indicator), control switch, yaw actuator and disengage switch, cables assemblies and electrical wiring.
2. The gyro picks up the signal, routes it through a built-in computer in the gyro, amplifies the signal and sends the amplified signal to the yaw actuator, located in the tailcone. The yaw damper control switch is mounted separately from the flight controller on all installation except the 800 (IFCS) integrated flight control system. On aircraft incorporating the 800 IFCS the yaw damper control switch is part of the autopilot flight controller. The yaw damper disengage switch on the control wheel is connected to the autopilot disengaging switch; disengaging the autopilot will also disengage the yaw damper.
3. The yaw actuator, located in the tailcone is mounted to a bracket attached to a bulkhead and supported by support brackets. The yaw damper actuator drives a chain which is attached to cable assemblies, connected to the rudder bellcrank.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS ON LATE MODEL AIRCRAFT USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. For troubleshooting the yaw damper system, refer to the Yaw Damper System Service/Parts Manual.

Adjustment/Test

1. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items:

Name	Number	Manufacturer	Use
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif.	To measure cable tension.

2. Rigging Yaw Damper System (See Figure 1)

- A. Refer to Rudder, Rudder Trim Tab and Controls Adjustment/Test and verify that the rudder control system is properly rigged.
- B. Refer to Chapter 1. Remove stabilizer fairings, for access to rudder bellcrank.
- C. Unsafety turnbuckle and rig cables to 16 ± 2 pounds tension (rudder at neutral position). Safety turnbuckle.
- D. Install stabilizer fairings.

Maintenance Practices

1. Removal/Installation Yaw Damper Actuator (See Figure 1)

NOTE: The yaw damper motor can be removed from the actuator assembly mounting bracket without disturbing the yaw damper cable assemblies.

A. Remove Yaw Damper Actuator.

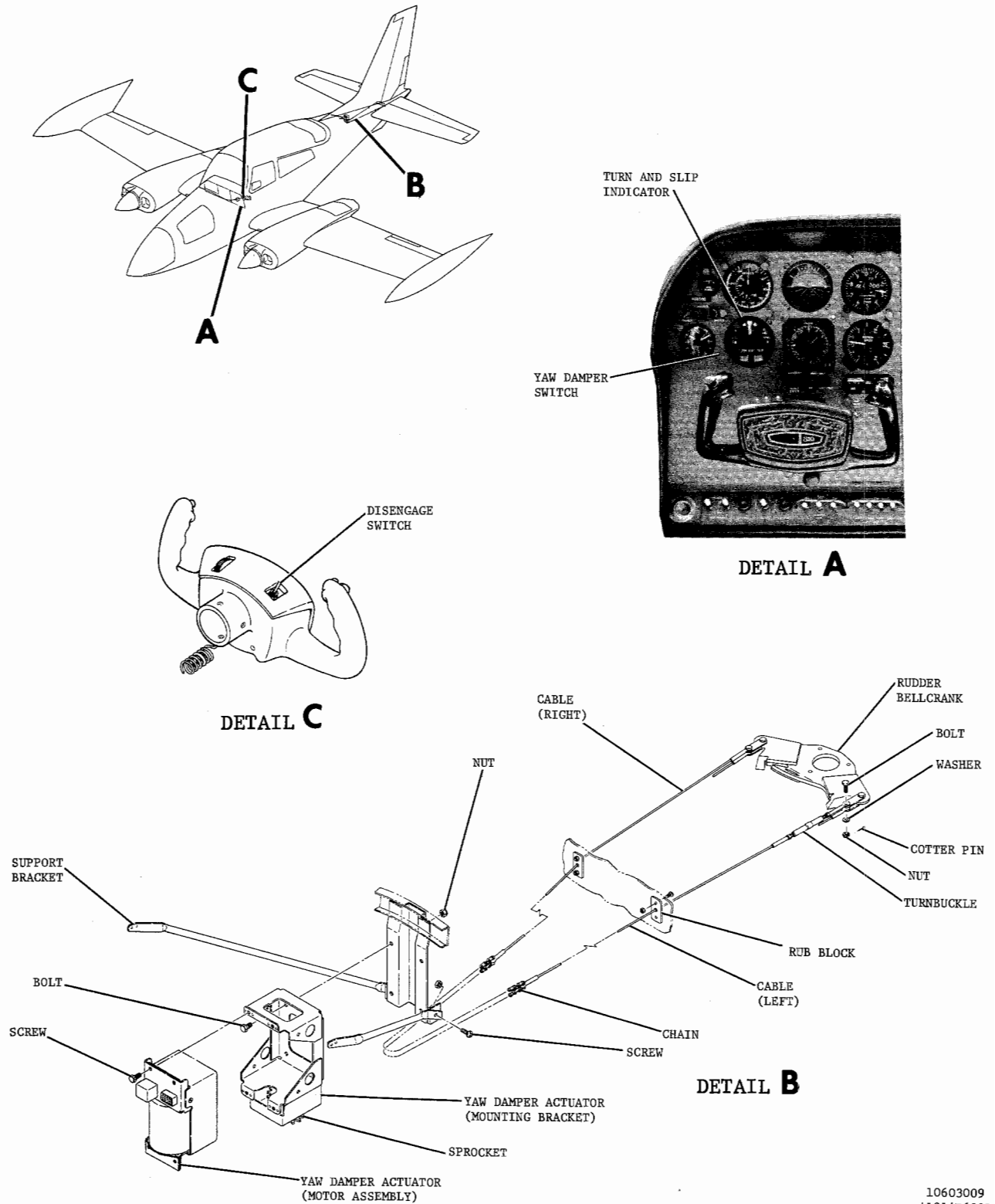
- (1) Ensure aircraft's electrical power is OFF.
- (2) Place a suitable support under tailcone.
- (3) Refer to Chapter 1. Remove stabilizer fairings.
- (4) Refer to Chapter 12. Remove rear upholstery panel.
- (5) Loosen turnbuckle and remove chain.
- (6) Disconnect electrical connector from yaw damper actuator.
- (7) Remove screws, securing motor assembly to mounting bracket assembly and remove motor assembly.
- (8) Remove bolts and nuts, securing mounting bracket assembly to bracket and remove mounting bracket assembly.

B. Install Yaw Damper Actuator.

- (1) Align mounting bracket assembly to bracket and secure with bolts and nuts.
- (2) Slide motor assembly into mounting bracket, engaging gears and secure with screws.
- (3) Connect electrical connector to motor assembly.

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Yaw Damper Installation
Figure 1

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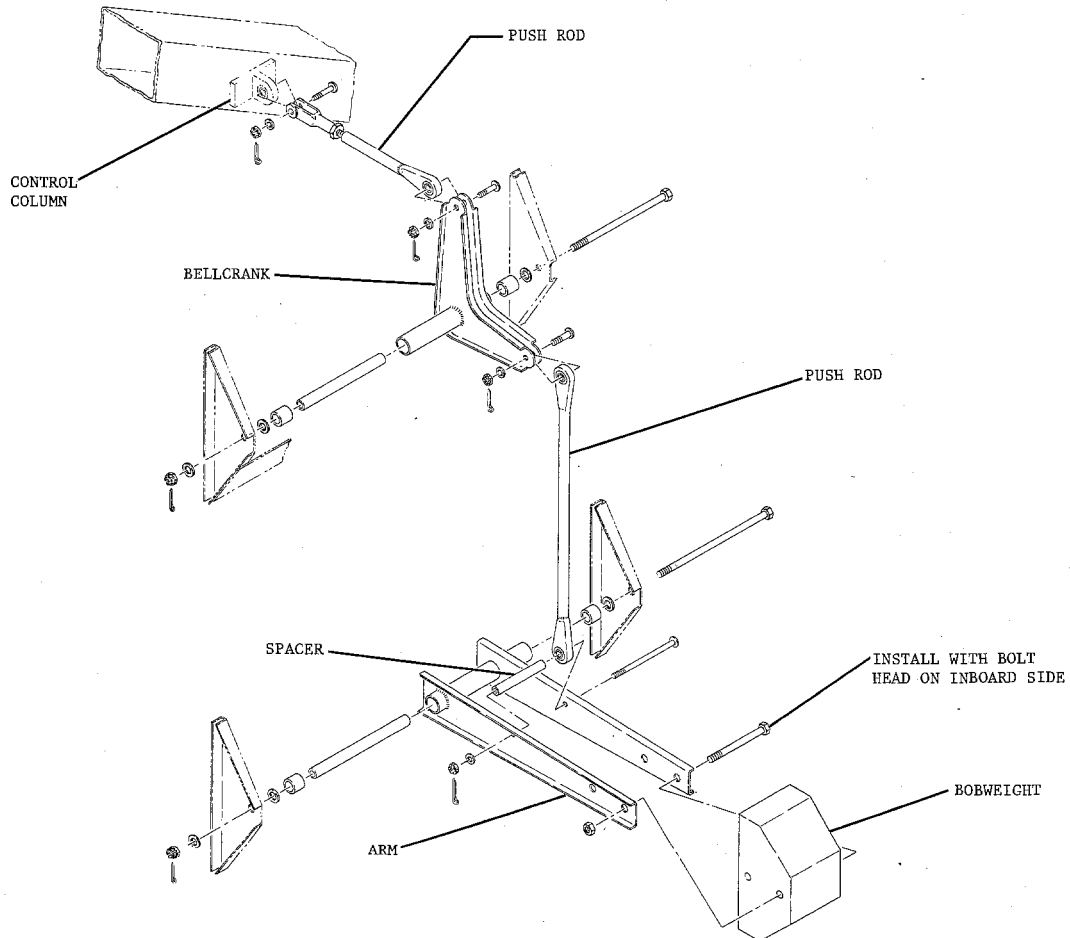
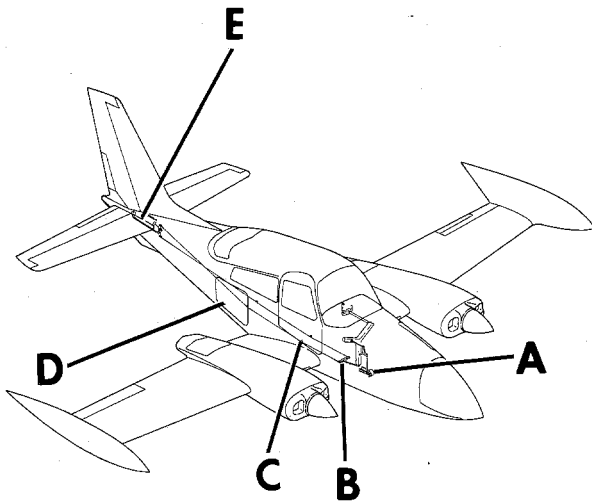
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- (4) Engage chain on sprocket. Ensure chain ends are even after engaging sprocket.
- (5) Rig yaw damper system, refer to Adjustment/Test.
- (6) Install rear upholstery panel.
- (7) Install stabilizer fairings.
- (8) Remove support from tailcone.

ELEVATOR, ELEVATOR TRIM TAB AND CONTROLDescription

1. The elevator system which is mechanically operated, provides longitudinal control of the aircraft. The elevator trim system is operated mechanically and/or electrically.
2. The elevator control system consists of: Two elevator assemblies, forward and aft bellcranks with push-pull tubes attached; elevator torque tubes which are attached to a pylon. Each elevator is attached to the rear spar of the horizontal stabilizer at two hinge points. Each elevator tip incorporates balance weights inside the fiberglass tip. Each elevator is 100 percent static balanced with the elevator trim tab attached, at the time of installation. The elevators are operated by the fore and aft movement of the control column. The elevator cable assemblies and adjustable turnbuckles are attached to the forward bellcrank and then routed under the floor, through pulleys to the aft bellcrank in the tailcone. Two push-pull tubes are utilized, one connects from the bottom of the control column to the forward bellcrank, and the other push-pull tube connects from the aft bellcrank to the pylon, which is connected to each elevator torque tube. Elevator travel stops, which are mounted in the aft bellcrank bracket, provide the maximum travel adjustment for the elevators. A bob weight is attached to the control column by a push-pull tube. The bob weight is utilized to stabilize the aircraft in flight. An elevator down spring is connected to the aft bellcrank by cables to provide for better elevator balance during flight.
3. The elevator trim tab is operated by a control wheel mounted on the left side of the pedestal. The control wheel is attached to a sprocket which drives a chain and cables. The chain and cables are routed through pulleys under the floorboard and aft to the tailcone of the aircraft. In the tailcone, the cables are routed up and through the right horizontal stabilizer to a chain which operates the trim tab actuator. The trim tab push-pull tube connects the trim tab actuator to the elevator trim tab, mounted to the right elevator by a continuous hinge. Adjustable turnbuckles are located in the tailcone for cable tension adjustment. Stop blocks are located, in the tailcone for adjustment of the elevator trim tab travel.
4. The electric elevator trim control system (optional) consists of: electric trim disengage switch, electric trim control switch; and an electric actuator assembly mounted on a support in the tailcone; a control cable attached to the left forward elevator trim control cable and routed around the actuator



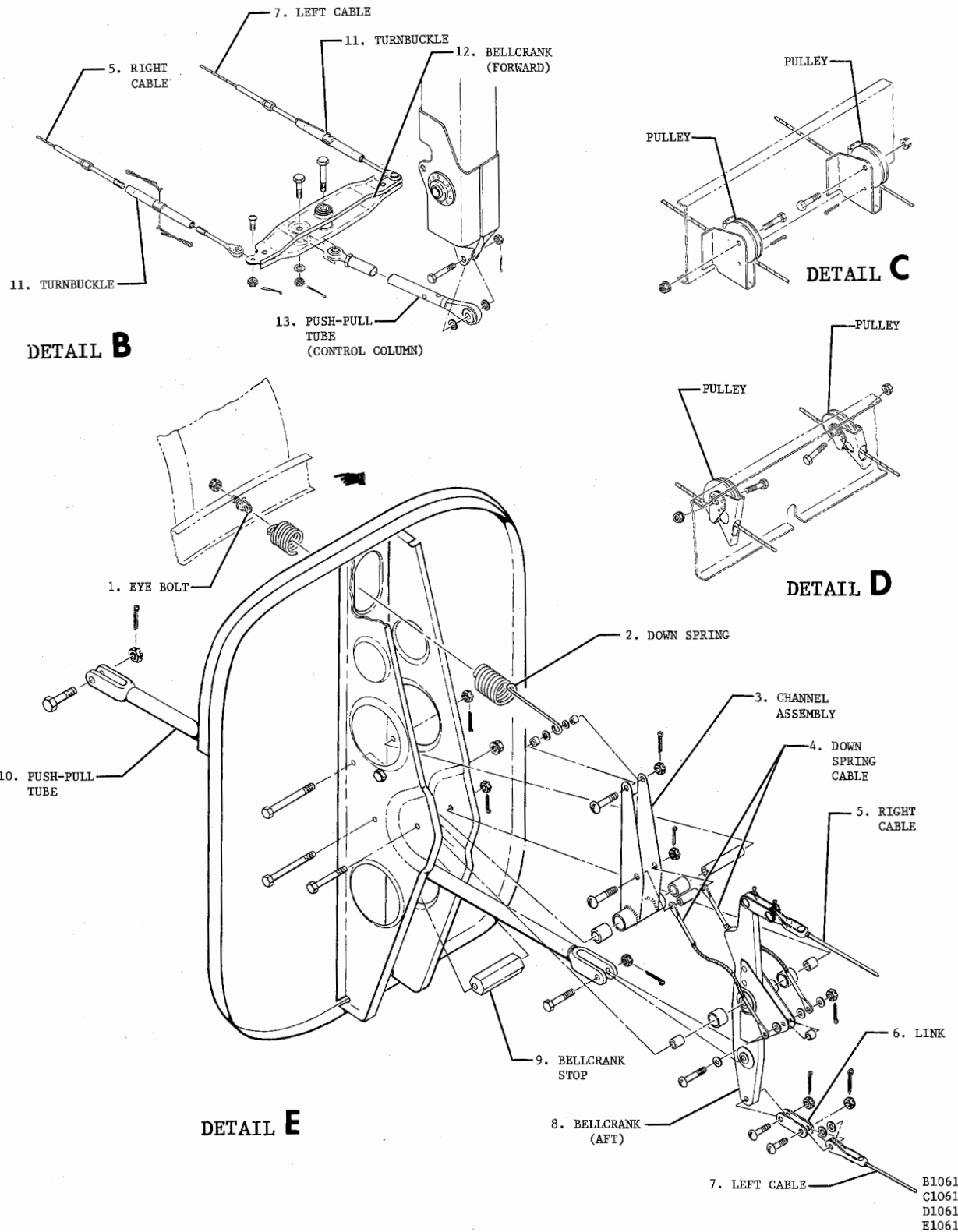
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Elevator Control System Installation
Figure 1 (Sheet 1 of 2)

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Elevator Control System Installation
Figure 1 (Sheet 2)

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clutch assembly drum then aft connecting to the left aft trim control cable; and associated electrical wiring. The system is energized, when the electric trim disengage switch on the left-hand control wheel is positioned ENGAGE and the electric trim control switch (slider switch) on the left-hand control wheel is positioned forward (DOWN) or aft (UP) position. The actuator motor drives the clutch assembly, which moves the elevator trim control cables and places the elevator trim tab in the corresponding UP or DOWN position. Manual override of the system can be accomplished by operating the elevator trim control wheel, mounted on the left side of the pedestal.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS ON LATE MODEL AIRCRAFT USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. Troubleshooting the elevator and tab system is to determine if the trouble exists in the elevator control system or in the elevator trim control system. Remove the control column lock when troubleshooting.
2. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Inclinometer	SE716	Cessna Aircraft Co. Wichita, Kansas	To measure travel of control surfaces.
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif.	To measure cable tension.

NOTE: Inclinometer is available from Cessna Service Center.

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3. Troubleshooting Elevator and Trim Tab Control Systems

- A. For a guide to troubleshooting the elevator and trim tab systems, see Figures 4, 5 and 6.

Adjustment/Test

1. Tools and Equipment

NOTE: Refer to troubleshooting for tool and equipment requirements.

2. Rigging Elevator Control System (See Figure 1)

- A. Refer to Chapter 12, and remove pilots seats, front carpet and rear upholstery panel to tailcone.
- B. Remove access covers from cabin floor above forward elevator bellcrank (12) and tailcone access cover below aft push-pull tube (10).
- C. Install an inclinometer on trailing edge of the elevator and adjust elevator bellcrank stops (9) so that the elevator travel is $16 + 1/2$, - 0 degrees UP and $15 + 1$, - 0 degrees DOWN.

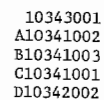
CAUTION: WHEN CHECKING ELEVATOR TRAVEL, DO NOT OPERATE ELEVATOR FROM THE ELEVATOR TIP OR SERIOUS DAMAGE TO THE ELEVATOR MAY RESULT.

NOTE: The hole through the elevator bellcrank stop (9) is drilled off-center to provide a positive means of adjusting the elevator travel. At the extreme elevator travel limits ($16 + 1/2$, - 0 degrees UP and $15 + 1$, - 0 degrees DOWN), the bellcrank (8) should be tangent with the flat surface of stop (9). Adjustments (0 and $1/2$ degree) are accomplished by rotating stop (9) approximately 60 degrees or until another side of the stop is encountered and tangent with bellcrank surface.

- D. Unsafety turnbuckles (11) and adjust so that tension on elevator cables (5 and 7) is 32 ± 5 pounds, ensuring that forward elevator bellcrank (12) does not contact the bulkhead, located just forward of the bellcrank. When elevators are in either position, the forward bellcrank should clear the bulkhead by approximately $1/4$ inch.

NOTE: Cable tension readings should be taken just aft of rear cabin bulkhead (fuselage station 132.00) with bob weight push-pull tube disconnected from control column.

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NOTE: Check cable tension when ambient temperature is 60°F to 90°F after temperature has stabilized for a period of four hours.

- E. Resafety turnbuckles (11).

WARNING: ENSURE THAT ELEVATOR MOVES IN THE PROPER DIRECTION WHEN OPERATED BY THE CONTROL WHEEL.

- F. Adjust length of forward push-pull tube (13) so that control column clears instruments in aft position and fuselage bulkhead in forward position.

NOTE: When elevator system is correctly rigged, the length of push-pull tube (13) should be approximately 12 inches, measured between centerlines of the rod end bolt holes.

- G. Install access covers.

- H. Install rear upholstery panel, carpets and pilot's seats.

3. Rigging Elevator Trim Control System (See Figure 3)

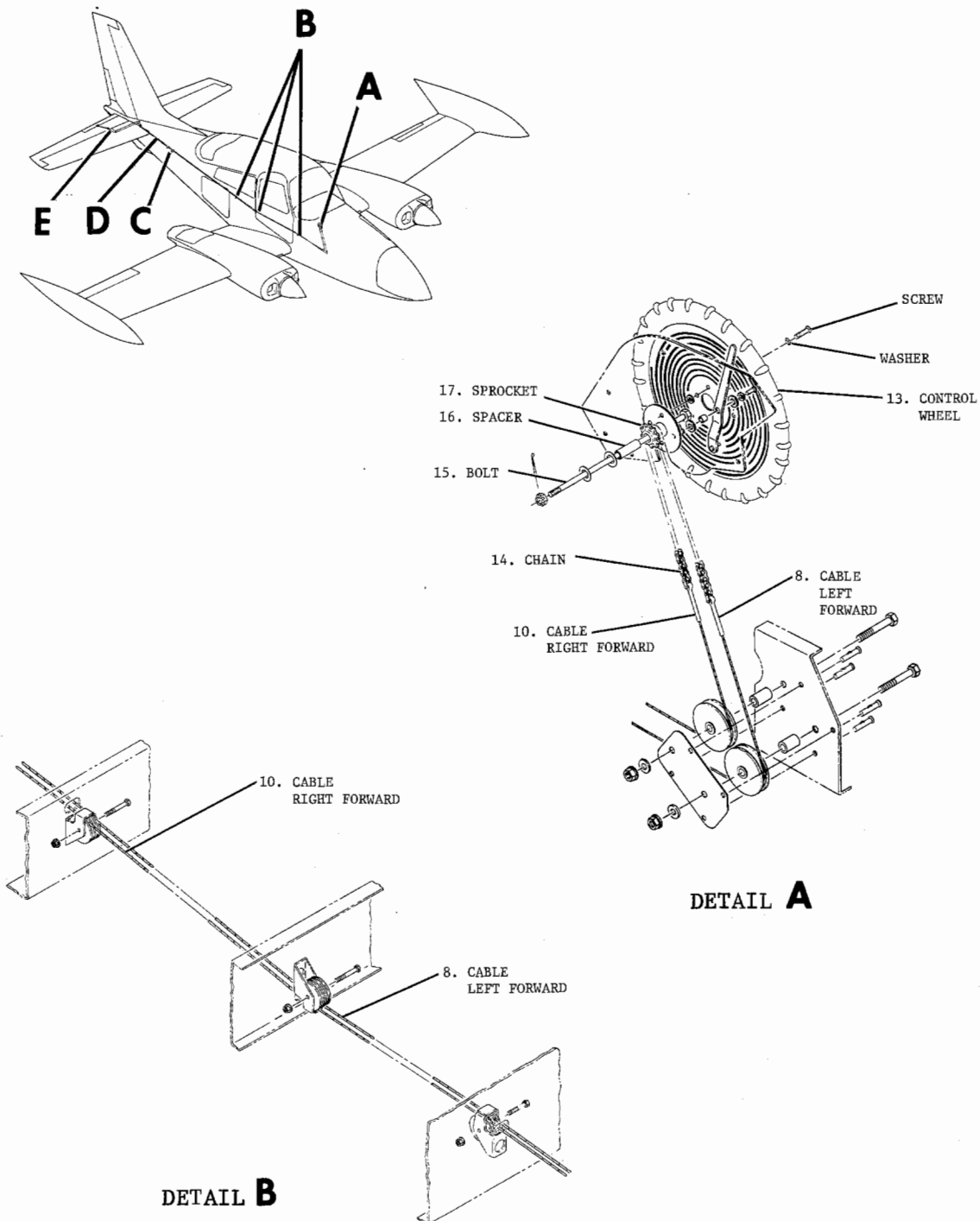
- A. Refer to Chapter 12. Remove the rear upholstery panel to tailcone.
B. Loosen stop blocks (11) by loosening nuts.
C. Unsafety turnbuckles (9), adjust so that tension on the elevator trim control cables is 10 ± 3 pounds, and resafety turnbuckles.

NOTE: If an autopilot with or without electric elevator trim is installed, adjust tension on elevator trim control cables to 19 ± 3 pounds.

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of four hours.

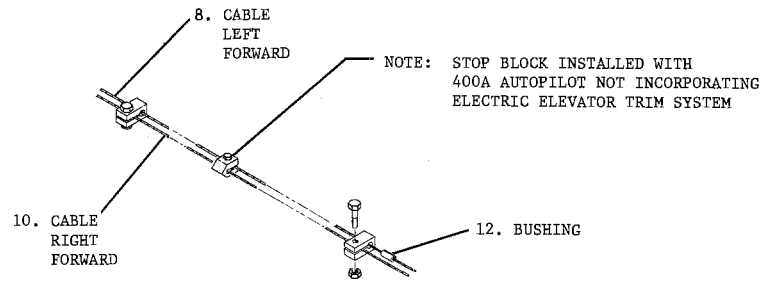
- D. (See Figure 2) Disconnect push-pull tube (3) from horn (5) by removing cotter pin, nut, washer and bolt.
E. Rotate elevator trim control wheel (13) forward (nose down) until aft chain (5) and forward chain (14) have approximately two links clearing the sprockets.

NOTE: If the elevator trim indicator reaches its extreme travel during rigging, it can be relocated by removing elevator trim control wheel, moving the indicator, and reinstalling wheel.

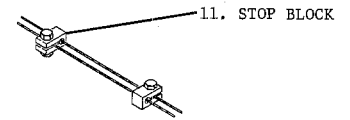


Elevator Trim Control Installation
Figure 3 (Sheet 1 of 2)

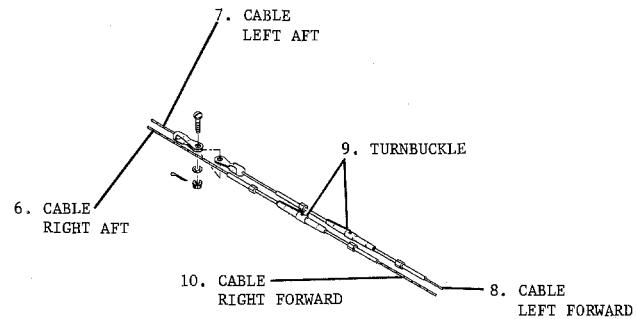
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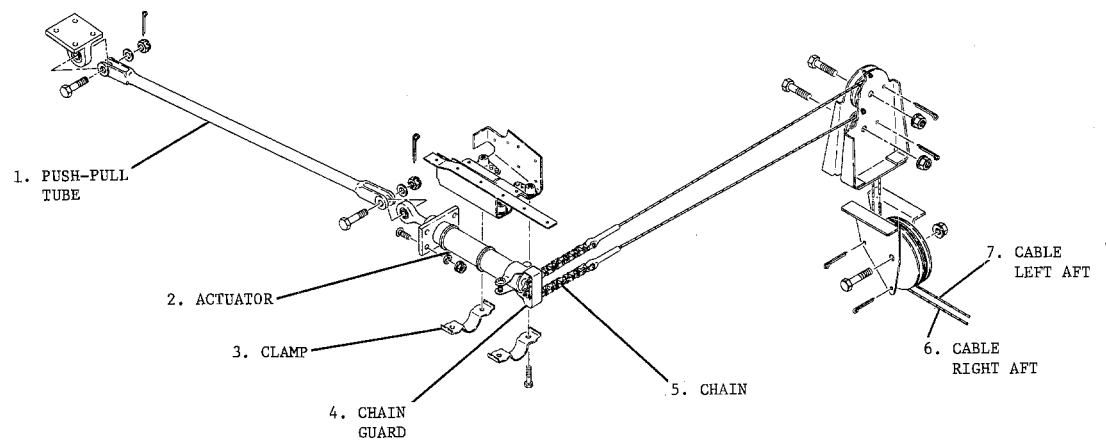
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DETAIL C



DETAIL D



DETAIL E

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Elevator Trim Control Installation
Figure 3 (Sheet 2)

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- F. With the chains in the position described in Step "E" and the elevators in neutral (elevator horns aligned with stabilizer), adjust actuator (2) screw by rotating push-pull tube so that aft bolt hole in push-pull tube aligns with bolt hole in the trim tab horn when the elevator trim tab is approximately 10 degrees up.
- G. (See Figure 2) Connect push-pull tube (3) to horn (5) with bolt, washer, nut and cotter pin.

NOTE: The threaded end of bolt attaching the elevator trim tab push-pull tube to actuator screw must be inboard; therefore, exact travel adjustment is not made by this means.

- H. Rotate elevator trim control wheel so that the elevator trim tab is $26^{\circ} + 1^{\circ}$, - 0° down. Slide forward stop block (11) against aft side of station 132.00 bulkhead and secure stop block.

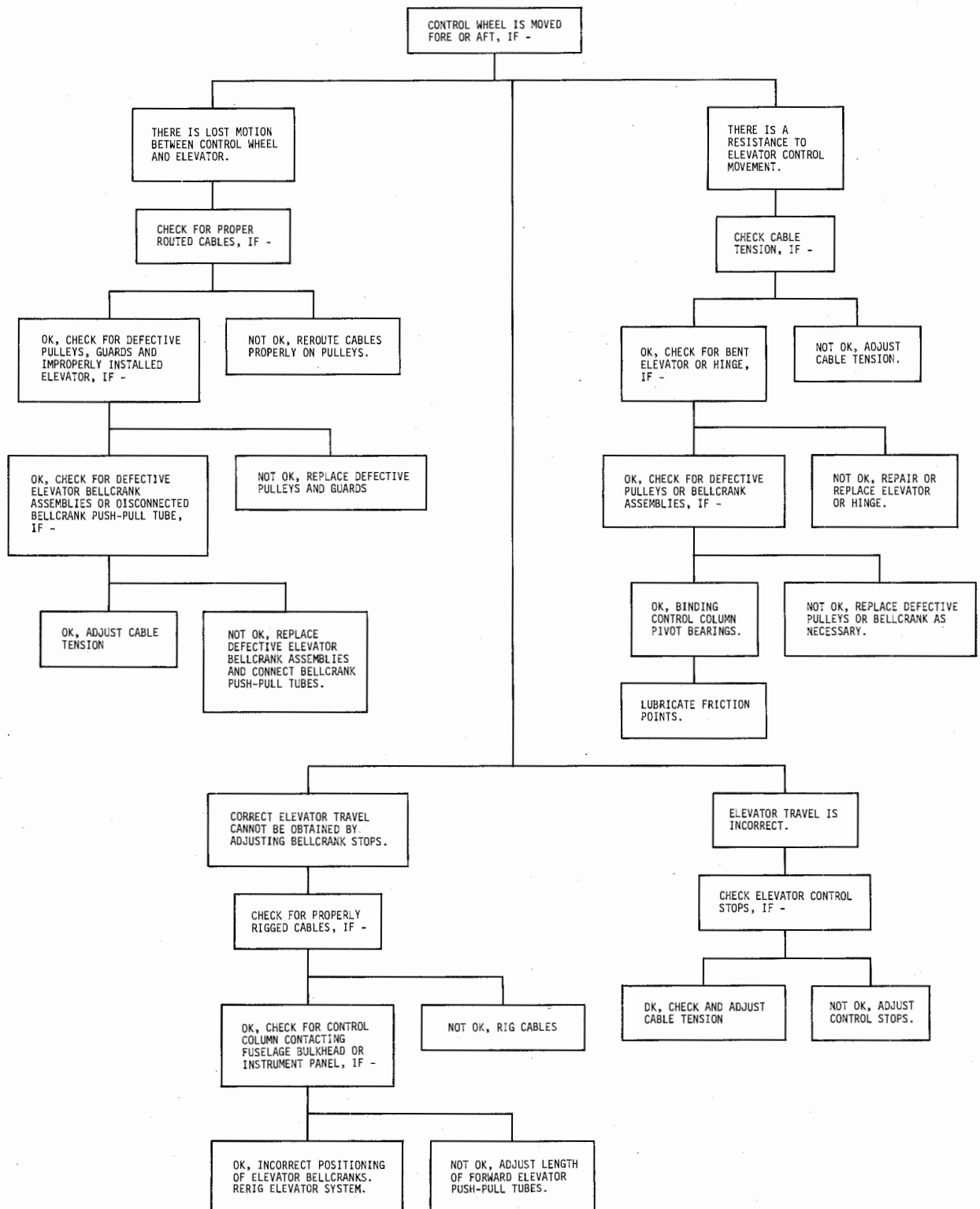
NOTE: If an autopilot (optional) is installed, refer to Chapter 14 for rigging of stop blocks.

- I. Rotate elevator trim control wheel so that elevator trim tab is $10^{\circ} + 1^{\circ}$, - 0° up, located aft stop block (11) against forward stop block and secure stop block.
- J. When the elevator trim control system is in either extreme position, the elevator trim indicator should be in the same relative position to the NOSE UP and NOSE DOWN position on the decal. To adjust the indicator, use the following procedure:
- (1) Rotate elevator trim control wheel (13) so that elevator trim control system is in the extreme NOSE DOWN position.
 - (2) Remove elevator trim control wheel (13) by removing screws and washers, and place the elevator trim indicator at the NOSE DOWN position on the decal.
 - (3) While the elevator trim indicator is in this position, install the elevator trim control wheel (13) with washers and screws.

NOTE: The elevator trim control wheel (13) can be installed in any one of four positions. Select the position which causes the least indicator movement as it engages with the wheel track.

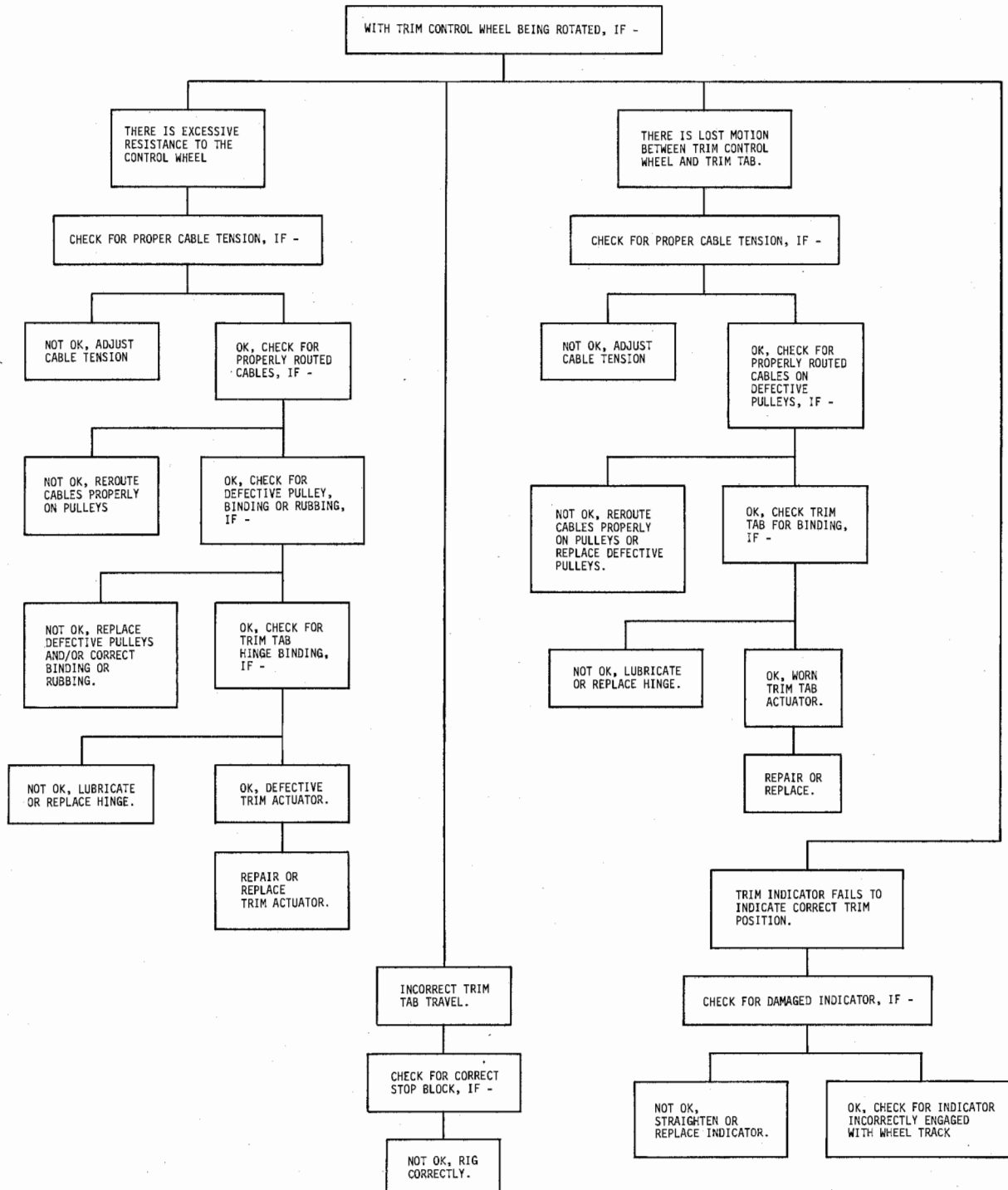
WARNING: ENSURE THAT ELEVATOR TRIM TAB MOVES IN THE PROPER DIRECTION WHEN OPERATED BY THE TRIM CONTROL WHEEL.

- K. Refer to Chapter 12. Install near upholstery panel to tailcone.



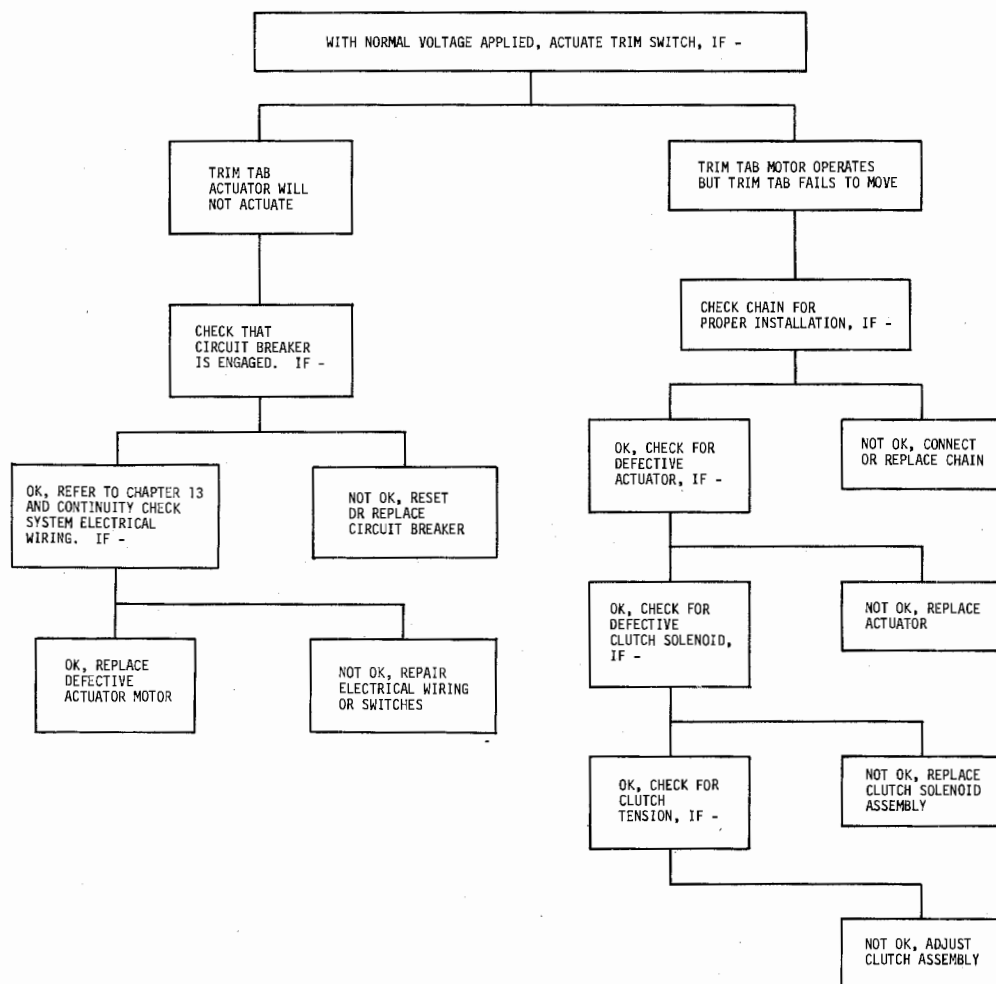
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Troubleshooting Chart - Elevator System
Figure 4



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Troubleshooting Chart - Elevator Trim
Figure 5



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Troubleshooting Chart - Elevator Electric Trim
Figure 6

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4. Rigging Electric Elevator Trim Control System (See Figure 7)

- A. Refer to Chapter 12. Remove the rear upholstery panel to tailcone.
- B. (See Figure 3) Loosen stop blocks (11) by loosening nuts.
- C. Unsafety turnbuckles (2 and 4) adjust tension on elevator cables to 19 ± 3 pounds. Resafety turnbuckles.

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of four hours.

- D. (See Figure 2) Disconnect push-pull tube (3) from horn (5) by removing cotter pin, nut, washer and bolt.
- E. (See Figure 3) Rotate elevator trim control wheel (13) forward (nose down) until aft chain (5) and forward chain (14) have approximately two links clearing the sprockets.

NOTE: If the elevator trim indicator reaches its extreme travel during rigging, it can be relocated by removing elevator trim control wheel, moving the indicator, and reinstalling wheel.

- F. With the chains in position described in Step "E" and the elevators in neutral (elevator horns aligned with stabilizer), adjust actuator (2) by rotating push-pull tube so that aft bolt hole in push-pull tube aligns with bolt hole in the trim tab horn when the elevator trim tab is approximately 26 degrees down.
- G. (See Figure 2) Connect push-pull tube (3) to horn (5) with bolt, washer, nut and cotter pin.

NOTE: The threaded end of bolt attaching the elevator trim tab push-pull tube to actuator screw must be inboard; therefore, exact travel adjustment is not made by this means.

- H. Rotate elevator trim control wheel so that the elevator trim tab is $26^{\circ} + 1^{\circ}$, $- 0^{\circ}$ down. Slide forward stop block (11) (see Figure 3) against aft side of station 132.00 bulkhead and secure stop block. If an autopilot (optional) is installed slide aft stop block (10) against actuator (7) and secure stop block.
- I. Rotate elevator trim control wheel so that elevator trim tab is $10^{\circ} + 1^{\circ}$, $- 1^{\circ}$ up, locate aft stop block (11) (see Figure 6) against forward stop block and secure stop block. If an autopilot (optional) is installed, slide forward stop block (10) against actuator (7) and secure stop block.

- J. When the elevator trim control system is in either extreme position, the elevator trim indicator should be in the same relative position to the NOSE UP and DOWN position on the decal. To adjust the indicator, use the following procedure (see Figure 3):
- (1) Rotate elevator trim control wheel (13) so that elevator trim control system is in the extreme NOSE DOWN position.
 - (2) Remove elevator trim control wheel (13) by removing screws and washers, and place the elevator trim indicator at the NOSE DOWN position on the decal.
 - (3) While the elevator trim indicator is in this position, install the elevator control wheel (13) with washers and screws.

NOTE: The elevator trim control wheel (13) can be installed in any one of four positions. Select the position which causes the least indicator movement as it engages with the wheel track.

WARNING: ENSURE THAT ELEVATOR TRIM TAB MOVES IN THE PROPER DIRECTION WHEN OPERATED BY THE TRIM CONTROL WHEEL.

- K. Refer to Chapter 12. Install rear upholstery panel to tailcone.

INSPECTION/CHECK

1. Tools and Equipment

NOTE: Refer to troubleshooting for tools and equipment requirements.

2. Elevator and Elevator Trim Tab Check.

NOTE: Angular dimensions for checking elevators and elevator trim tab are measured by placing an inclinometer on the elevator or elevator trim tab surface. Elevator is in neutral position when the elevator horns align with stabilizer. The elevator trim tab is in neutral position when streamline with the elevator.

A. Elevator and Elevator Trim Tab Cable Check.

- (1) Place elevator and trim tab in neutral position.
- (2) With bob weight push-pull tube disconnected from control column, place tensiometer aft of station 109.00 and read cable tension.

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- (3) Place tensiometer aft of station 132.00 and read cable tension.

NOTE: Access to the elevator and elevator trim cables is gained through the tailcone.

3. Elevator and Trim Tab Deflection Check

- A. Place the elevator and elevator trim tab in neutral position.
- B. Place the inclinometer to the elevator and pull the control wheel aft. The elevator shall deflect up $16 + 1/2$, - 0 degrees.
- C. Push the control wheel forward. The elevator shall deflect down $15 + 1$, - 0 degrees.
- D. Rotate the elevator trim control wheel to full nose up position. The elevator trim tab will deflect $26 + 1$, - 0 degrees down.
- E. Rotate the elevator trim control wheel to full nose down position. The elevator trim tab will deflect $10 + 1$, 0 degrees up.
- F. If electric elevator trim (optional) is installed:
 - (1) Apply electrical power to operate the electric trim.
 - (2) Operate the elevator trim control switch on the left-hand control wheel left grip. The tab deflection shall correspond to elevator and trim tab deflection check.

Maintenance Practices

1. Removal/Installation Elevator (See Figure 2)

A. Remove Elevator.

- (1) Refer to Chapter 3 and remove stinger.
- (2) Disconnect elevator trim tab push-pull tube (3) by removing cotter pin, nut, washer and bolt.
- (3) Disconnect elevator torque tubes (22) from elevator pylon (21) by removing nuts, washers and bolts (23).
- (4) Disconnect bonding straps (8) by removing attaching screws.
- (5) Remove fiberglass tips (7) by removing attaching screws.
- (6) Remove each elevator by removing cotter pins, nuts, washers and bolts (9).
- (7) When removing right elevator, guide elevator trim tab push-pull tube (3) out through elevator.

B. Install Elevator.

- (1) Place elevators in position, guiding elevator trim tab push-pull tube (3) through opening in right elevator, and align mounting holes.
- (2) Attach each elevator (6) to horizontal stabilizer with bolts (9) washers, nuts and cotter pins.
- (3) Attach elevator torque tubes (22) to elevator pylon (21) by installing bolts (23), washers and nuts.
- (4) Attach bonding straps (8) with attaching screws.
- (5) Install fiberglass tips (7) with attaching screws.
- (6) Attach elevator trim tab push-pull tube (3) to trim tab (1) with bolt, washer, nut and cotter pin.
- (7) Refer to Elevator and Trim Tab Adjustment/Test and check elevators and elevator trim tab for proper operation and travel.
- (8) Install stinger.

2. Removal/Installation Aft Bellcrank (See Figure 1)

A. Remove Aft Bellcrank.

- (1) Refer to Chapter 12 and remove front seats, front carpet and rear upholstery panel to tailcone.
- (2) Refer to Chapter 1 and remove access covers from cabin floor above forward bellcrank (12).
- (3) Unsafety and loosen either turnbuckle (11) to release tension on elevator cables.
- (4) Disconnect elevator cables (5 and 7) from aft elevator bellcrank (8) by removing cotter pins, nuts and bolts.

NOTE: If an autopilot (optional) is installed, disconnect from aft elevator bellcrank.

- (5) Disconnect aft elevator push-pull tube (10) from elevator bellcrank (8) by removing cotter pin, nut and bolt.
- (6) Release tension on elevator down spring cables (4) by either disconnecting elevator down spring (2) or blocking elevator down spring channel assembly (3) forward.
- (7) Disconnect elevator down spring cables (4) from elevator bellcrank (8) by removing cotter pin, nut, washers, spacer and bolt.
- (8) Remove aft elevator bellcrank (8) by removing cotter pin, nut, spacers and bolt.

B. Install Aft Bellcrank.

- (1) Place aft elevator bellcrank (8) in position, and install with bolt, spacers, nut and cotter pin.

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- (2) Connect elevator down spring cables (4) to elevator bellcrank (8) with bolt, spacer, washers, nuts and cotter pins.
- (3) Connect elevator down spring (2) or remove block aft of elevator down spring channel assembly (3) in accordance with the method used to release tension on elevator down spring cables.
- (4) Attach aft elevator push-pull tube (10) to elevator bellcrank (8) with bolt, nut, and cotter pin.
- (5) Attach elevator cables (5 and 7) to elevator bellcrank (8) with bolts, nuts and cotter pins.

NOTE: If an autopilot (optional) is installed, connect to aft elevator bellcrank.

- (6) Rig elevator control system, refer to Elevator and Trim Tab Adjustment/Test.
- (7) Install access cover above forward elevator bellcrank.
- (8) Install rear upholstery panel, front carpet and front seats.

3. Removal/Installation Elevator Pylon (See Figure 2)

A. Remove Elevator Pylon.

- (1) Refer to Chapter 3 and remove stinger.
- (2) Disconnect aft elevator push-pull tube (19) by removing cotter pin, nut and bolt (20).
- (3) Remove nuts, washers and bolts (23) attaching elevators to elevator pylon (21). Remove nut, washers, and bolt (13) attaching elevator pylon (21) to hinge bracket (16) and remove pylon by sliding aft.

B. Install Elevator Pylon.

- (1) Position elevator pylon (21) in hinge bracket (16) and secure with bolt (13), washers and nut.
- (2) Connect torque tubes (22) to pylon (21) with bolts (23), washers and nuts.
- (3) Connect elevator push-pull tube (19) to pylon (21) with bolt (20), nut and cotter pin.
- (4) Install stinger.

4. Removal/Installation Elevator Down Spring and Channel Assembly (See Figure 1)

A. Remove Elevator Down Spring and Channel Assembly.

- (1) Refer to Chapter 12. Remove rear upholstery panel to tailcone.

- (2) Refer to Chapter 1 and remove stabilizer fairings.
- (3) Stretch elevator down spring (2) aft and unhook from eyebolt (1).
- (4) Remove elevator down spring (2) from channel assembly (3) by removing cotter pin, nut, washers, spacers and bolt.
- (5) Disconnect down spring cables (4) by removing cotter pin, nut, spacer and bolt.
- (6) Remove channel assembly (3) by removing nut, spacer and bolt.

B. Install Elevator Down Spring and Channel Assembly.

- (1) Install channel assembly (3) with bolt, spacer and nut.
- (2) Connect down spring cables (4) with bolt, spacer, nut and cotter pin.
- (3) Assemble down spring (2) to channel assembly (3) with bolt, spacers, washers, nut and cotter pin. Leave spring free to rotate.
- (4) Stretch down spring (2) aft and hook to eyebolt (1).
- (5) Install stabilizer fairings and rear upholstery panel to tailcone.

5. Removal/Installation Forward Elevator Bellcrank (See Figure 1)

A. Remove Forward Bellcrank.

- (1) Refer to Chapter 12. Remove the pilots seats and front carpet.
- (2) Refer to Chapter 1. Remove access covers from cabin floorboard above forward elevator bellcrank.
- (3) Unsafety and loosen either turnbuckle (11) to release tension on elevator cables (5 and 7).
- (4) Disconnect elevator cables (5 and 7) from forward bellcrank (12) by removing cotter pins, nuts and bolts.
- (5) Disconnect push-pull tube (13) from forward bellcrank (12) by removing cotter pin, nut, washer and bolt.
- (6) Remove forward bellcrank (12) by removing bolt.

B. Install Forward Bellcrank.

- (1) Place forward bellcrank (12) in position, and install with bolt.
- (2) Attach push-pull tube (13) to forward bellcrank (12) with bolt, washer, nut and cotter pin.
- (3) Attach elevator cables (5 and 7) to forward bellcrank (12) with bolts, nuts and cotter pins.
- (4) Rig elevator control system. Refer to Elevator and Trim Tab Adjustment/Test.

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- (5) Install access covers on cabin floor.
- (6) Install front carpet and front seats.

6. Removal/Installation of Forward Elevator Push-Pull Tube (See Figure 1)

A. Remove Forward Push-Pull Tube.

- (1) Refer to Chapter 12. Remove pilots seats and front carpet.
- (2) Refer to Chapter 1. Remove access covers from cabin floor above the forward elevator bellcrank (12) and from underside of the fuselage aft of nose wheel well.
- (3) Disconnect push-pull tube (13) from forward bellcrank (12) by removing cotter pin, nut, washer and bolt.
- (4) Disconnect push-pull tube (13) from control column by removing cotter pin, nut, spacers and bolts.

B. Install Forward Push-Pull Tube.

- (1) Connect push-pull tube (13) to control column, using bolts, spacers, nuts and cotter pin.
- (2) Connect aft end of push-pull tube (13) to forward bellcrank (12), using bolt, washer, nut and cotter pin.

NOTE: If length of push-pull tube (13) has been changed or a new push-pull tube is being installed, adjust length to approximately 12 inches, measured between centerlines of the rod end bolt holes.

- (3) Check elevator system for proper operation and correct travel. If necessary, rig system. Refer to Elevator and Trim Tab Adjustment/Test.
- (4) Install access covers.
- (5) Install front carpet and front seats.

7. Removal/Installation Elevator Control Cables (See Figure 1)

A. Remove Elevator Cables.

- (1) Refer to Chapter 12 and remove the following items:
 - (a) Pilot and passenger seats.
 - (b) Front, center and rear carpets.
 - (c) Rear upholstery panel to tailcone.
- (2) Refer to Chapter 1. Remove access hole covers from floor as necessary to gain access to cables, pulleys and attachment points.

- (3) Unsafety turnbuckles (11) and disconnect elevator cables (5 and 7) from forward elevator bellcrank (12) by removing turnbuckles.
- (4) Remove pulleys by removing nuts, bolts and cable guards.
- (5) Remove fairleads through which elevator cables pass at fuselage rear spar.
- (6) Disconnect elevator cables (5 and 7) from aft elevator bellcrank (8) by removing cotter pins, nuts, washers and bolts.
- (7) Tie guide wires to forward ends of elevator cables (5 and 7), remove cables by pulling them out aft of baggage compartment, and disconnect guide wires.

B. Install Elevator Cables.

- (1) Tie elevator cables (5 and 7) to guide wires, pull into position, and remove guide wires.
- (2) Install fairleads through which elevator cables pass at fuselage rear spar.
- (3) Install pulleys with bolts, cable guards and nuts, ensuring that cables are correctly in place as pulleys are installed.
- (4) Attach elevator cables (5 and 7) to aft elevator bellcrank (8) with bolts, washers, nuts and cotter pins.
- (5) Connect elevator cables (5 and 7) to forward elevator bellcrank (12) with turnbuckles (11).
- (6) Rig the elevator control system. Refer to Elevator and Trim Tab Adjustment/Test.
- (7) Install removed access panels.
- (8) Install the necessary upholstery panels, carpets and seats.

8. Removal/Installation Elevator Trim Tab (See Figure 2)

A. Remove Trim Tab.

- (1) Disconnect elevator trim tab push-pull tube (3) from horn (5) by removing cotter pin, nut, washer and bolt.
- (2) Remove cotter pins from hinge pin (2) and detach trim tab (1) from elevator (6) by removing hinge pin (2).

B. Install Trim Tab.

- (1) Attach trim tab (1) to elevator (6) with hinge pin (2) and safety in place with cotter pins.
- (2) Connect elevator trim tab push-pull tube (3) to trim tab horn (5) with bolt, washer, nut and cotter pin.

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- (3) Check elevator trim tab for proper operation and correct travel. Refer to Elevator and Trim Tab Adjustment/Test.

9. Removal/Installation Elevator Trim Tab Actuator (See Figure 3)

A. Remove Trim Tab Actuator.

- (1) Refer to Chapter 12. Remove rear upholstery panel to tailcone.
- (2) Refer to Chapter 1. Remove access cover from underside of the horizontal stabilizer beneath elevator trim tab actuator.
- (3) Unsafety and loosen turnbuckle (9) to release tension on elevator trim control cables.
- (4) Remove chain guard (4) from actuator (2) by removing nuts and screws, and disengage chain (5) from actuator sprocket.
- (5) Remove right elevator, refer to Removal/Installation of Elevator.
- (6) Remove elevator trim tab push-pull tube from actuator (2) by removing cotter pin, nut, washer and bolt.
- (7) Remove clamps (3) by removing bolts, and remove actuator (2).
- (8) If further disassembly of actuator (2) is desired, refer to Disassembly/Assembly Aileron Trim Tab Actuator.

NOTE: The instructions for disassembly and assembly of the aileron trim tab actuator, given in Section 5-00, also applies to the elevator trim tab actuator.

B. Install Trim Tab Actuator.

- (1) Insert actuator (2) through access hole, place in position, and install clamps (3) with bolts.
- (2) Attach push-pull tube (1) to actuator (2) with bolt, washer, nut and cotter pin.
- (3) Install right elevator. Refer to Removal/Installation of Elevator.
- (4) Engage chain (5) with actuator sprocket, and install chain guard (4) with screws and nuts.
- (5) Rig elevator trim control system. Refer to Elevator and Trim Tab Adjustment/Test.
- (6) Install access hole cover on underside of horizontal stabilizer.
- (7) Install rear upholstery panel to tailcone.

10. Removal/Installation Elevator Trim Control Wheel, Sprocket and Indicator Assembly (See Figure 3)

A. Remove Control Wheel, Sprocket and Indicator Assembly.

- (1) Remove rear upholstery panel from tailcone.
- (2) Unsafety and loosen turnbuckle (9) to release tension on elevator trim control system.
- (3) Remove trim control wheel (13) by removing screws and washers.
- (4) Remove upper left side panel from control pedestal.

NOTE: To remove the elevator trim indicator assembly, the rivets around which the indicator pivots must be removed.

- (5) Disengage chain (14) from sprocket (17), remove upper right side panel from control pedestal. Remove sprocket (17) by removing cotter pin, nut, washer, spacer (16) and bolt (15).

B. Install Control Wheel, Sprocket and Indicator Assembly.

- (1) Install sprocket (17) with bolt (15), spacer (16), washer, nut and cotter pin.
- (2) Install upper right side panel on control pedestal.
- (3) Engage chain (14) with sprocket (17) and install upper left side panel on control pedestal.
- (4) Install trim control wheel (13) with washers and screws.
- (5) Rig the elevator trim control system. Refer to Elevator and Trim Tab Adjustment/Test.
- (6) Install rear upholstery panel to tailcone.

11. Removal/Installation Elevator Trim Cables (See Figure 3)

A. Remove Trim Cables.

- (1) Refer to Chapter 12, remove the following items:
 - (a) Pilot and passenger seats.
 - (b) Front, center and rear carpet.
 - (c) Rear upholstery panel to tailcone.
- (2) Remove stabilizer fairings and stinger.
- (3) Remove access covers on floorboard as necessary to gain access to cables and access covers from underside of fuselage, aft of nose wheel well and stabilizer.
- (4) Unsafety turnbuckles (9) and disconnect aft cables (6 and 7).
- (5) Remove aft pulleys by removing nuts, bolts and cable guard cotter pins.

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- (6) Remove chain guard (4) from actuator (2) by removing nuts and screws.
- (7) Disengage chain (5) from actuator sprocket, attach a guide wire to the chain. Remove cables and chain by pulling out through opening in tailcone. Disconnect guide wire and leave in horizontal stabilizer to facilitate installation.
- (8) Remove stop blocks (11) by removing nuts, bolts.
- (9) Remove three sets of pulleys aft of pedestal.
- (10) Remove trim control wheel (13) by removing screws and washers.
- (11) Remove upper left side panel from control pedestal.
- (12) Remove four cable guard pins.
- (13) Tie guide wires to aft ends of cables (8 and 10) and pull chain and cables out through control pedestal. Disconnect guide wires and leave in position to facilitate installation.

NOTE: Pulleys below pedestal are difficult to reinstall and should be removed only for replacement.

B. Install Trim Cables.

- (1) Tie aft ends of cables (8 and 10) to guide wires, pull into position, and remove guide wires.
- (2) Engage chain (14) with sprocket (17) and install upper left side panel on control pedestal.
- (3) Install four pulley cable guards.
- (4) Install three sets of pulleys aft of control pedestal.
- (5) Tie aft chain (5) to the guide wire, pull into position, and remove guide wire.
- (6) Engage aft chain (5) with actuator sprocket and install chain guard (4) with screws and nuts.
- (7) Install aft pulleys with bolts, nuts and cable guard cotter pins, ensuring that the cables are correctly in place.
- (8) Connect cables (7 and 8) and cables (6 and 10), using turnbuckles (9).
- (9) Install stop blocks (11) and bushings (12) with bolts and nuts. Do not tighten at this time.
- (10) Install elevator trim control wheel (14) with washers and screws.
- (11) Rig elevator trim control system. Refer to Elevator and Trim Tab Adjustment/Test.
- (12) Install access covers, stinger and stabilizer fairings.
- (13) Install rear upholstery panel to tailcone; front, center and rear carpet; front and rear seats or; middle and aft seats (optional equipment).

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12. Removal/Installation Electric Trim Actuator (Optional) (See Figure 7)

A. Remove Electric Trim Actuator.

- (1) Refer to Chapter 12. Remove rear upholstery panel from tailcone.
- (2) Unsafety and disconnect turnbuckle (2).
- (3) Disconnect fork (6) by removing cotter pin, nut and bolt.
- (4) Remove screws (9) attaching actuator (7) to support (8) disconnect electrical wiring and remove actuator.
- (5) If further disassembly of actuator is desired, refer to Disassembly/Assembly Electric Trim Actuator.

B. Install Electric Trim Actuator.

- (1) Install actuator (7) on support (8) and secure with screws (9).
- (2) Connect fork (6) to actuator control cable, using bolt, nut and cotter pin.
- (3) Connect cable (1) to actuator control cable, using turnbuckle (2).
- (4) Rig electric trim control system. Refer to Elevator and Trim Adjustment/Test.
- (5) Install rear upholstery panel to tailcone.

13. Disassembly/Assembly Electric Trim Actuator (See Figure 8)

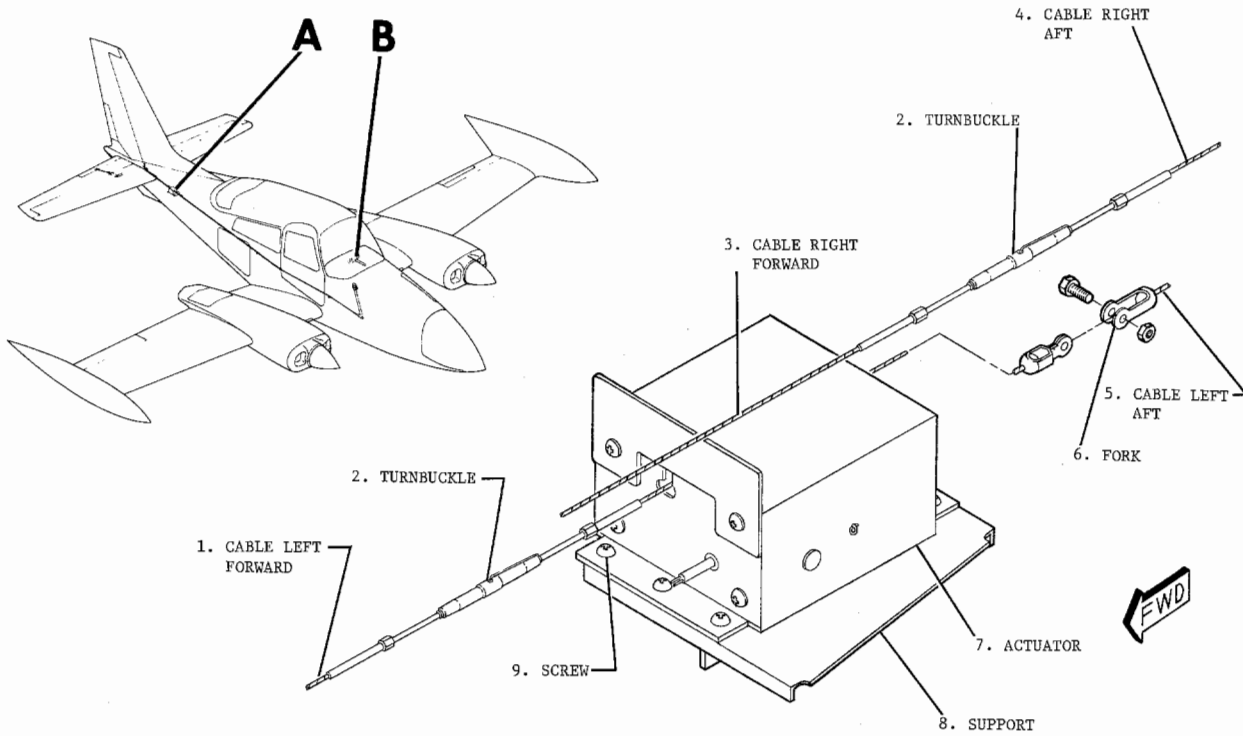
A. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed item.

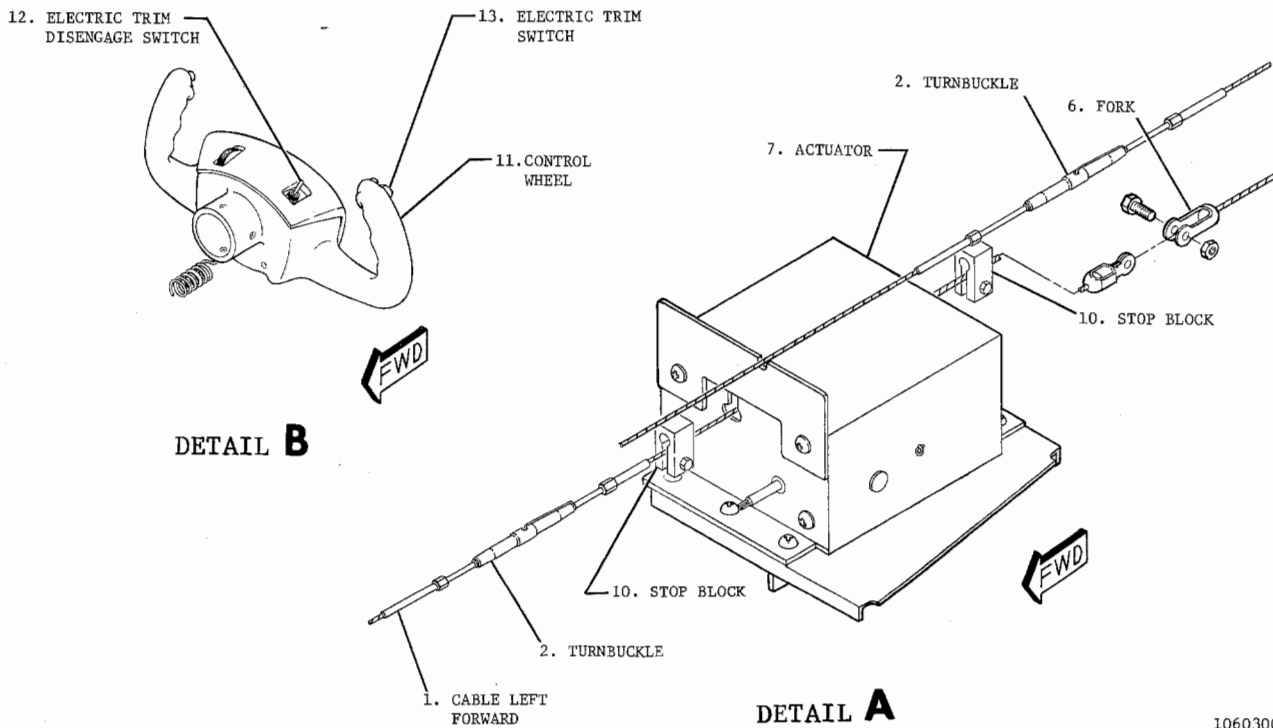
Name	Number	Manufacturer	Use
Low Temperature Grease	MIL-G-21164		To lubricate clutch assembly.

B. Disassemble Electric Trim Actuator.

- (1) Remove screws (8 and 11) and remove top and side covers (7 and 13).
- (2) Remove screws (15 and 19) and remove cover assembly (14) support assembly (2) and cable guard (10).



DETAIL A



DETAIL B

DETAIL A

WHEN 400A AUTOPILOT
IS INSTALLED

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Electric Elevator Trim Control Installation
Figure 7

- (3) Slide clutch assembly (16) from housing (9) and remove chain (6) from clutch assembly sprocket and sprocket (5).
- (4) Remove control cable (18) from clutch assembly (16).
- (5) Remove motor (1) from housing (9).
- (6) Clean component parts by wiping with a clean cloth saturated with a suitable solvent.
- (7) Check clutch assembly sprocket and sprocket (5) for broken, chipped or worn teeth.

CAUTION: DO NOT ATTEMPT TO REPAIR DAMAGED OR WORN PARTS OF THE ACTUATOR ASSEMBLY. DISCARD ALL DEFECTIVE PARTS AND INSTALL NEW PARTS DURING REASSEMBLY.

C. Assemble Electric Trim Actuator.

- (1) During assembly, lubricate clutch assembly (16).
- (2) Install motor (1) in housing (9).
- (3) Install control cable (18) on clutch assembly (16).

NOTE: Clutch assembly cable drum and control cable shall be free of grease and oil. The control cable must make 3 full wraps around the cable drum.

- (4) Install chain (6) on sprocket (5) and clutch assembly sprocket, slide clutch assembly (16) into housing (9).
- (5) Install support assembly (2), cover assembly (14) and secure with screws (15 and 19).
- (6) Install cable guard (10) in housing (9).
- (7) Install top and side covers (7 and 13), secure with screws (8 and 11).
- (8) Adjust clutch assembly (16) to slip at 25 ± 3 inch-pounds.

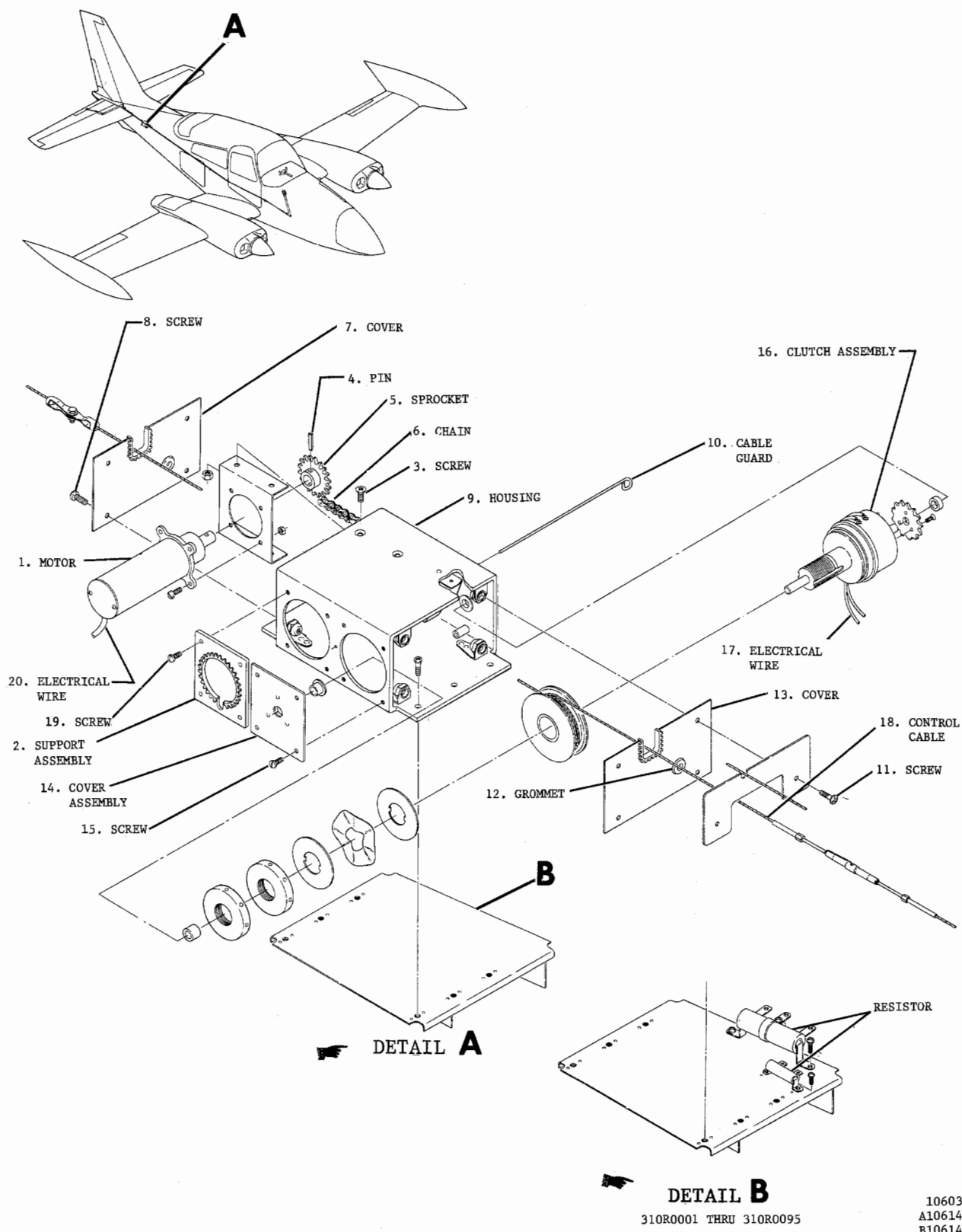
D. Testing Electric Trim Actuator (See Figure 9).

NOTE: It is recommended that the electric trim actuator assembly be secured to a suitable work bench and test equipment be provided as shown in Figure 9.

- (1) Conduct test as follows:
 - (a) Disconnect alligator clamps to clutch assembly.
 - (b) Actuate switch to provide 28 vdc to motor. Note direction of rotation of motor and clutch is disengaged. Motor drive sprocket should rotate at 7 - 7.4 rpm. Turn switch off.

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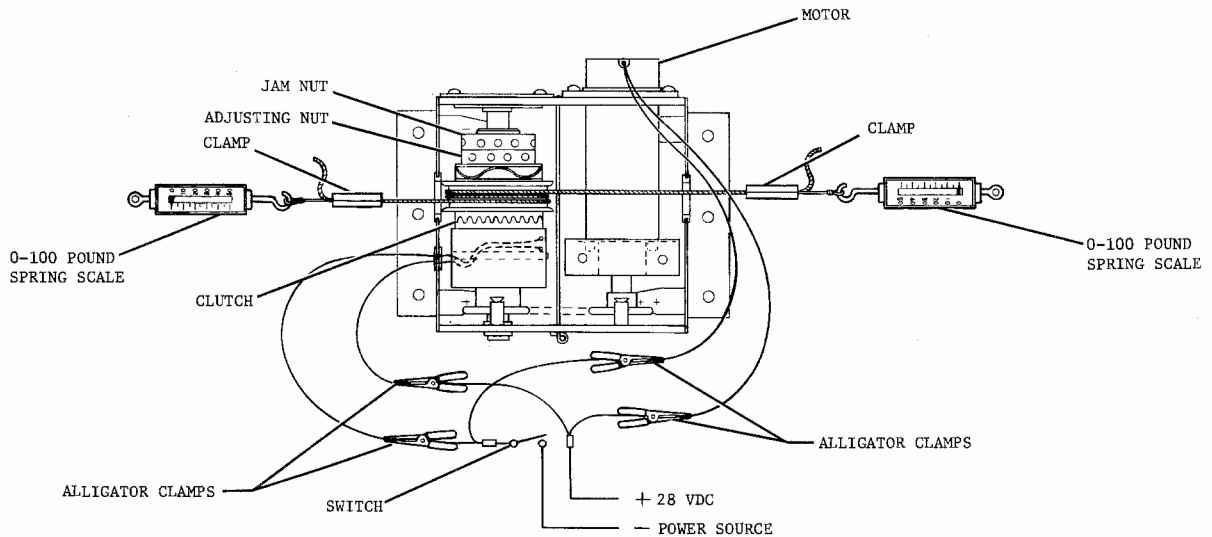
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Electric Elevator Trim Actuator Assembly
Figure 8

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Electric Trim Actuator Test Set-Up
Figure 9

- (c) Reverse polarity of wires to motor and actuate switch. Direction of rotation of motor should reverse. Turn switch off.
- (d) Connect alligator clamps to clutch wires.
- (e) Actuate switch to provide 28 vdc to motor and clutch assembly. Motor should rotate and clutch should engage.

CAUTION: BE PREPARED TO STOP MOTOR IF CLUTCH SHOWS NO INDICATION OF SLIPPING BEFORE SCALE BOTTOMS OUT.

- (f) Clutch should slip when scale indicates 25 ± 3 inch-pounds tension. If not, adjust in accordance with step (2).
- (g) Reverse direction of rotation of motor and again check slippage tension. Scales should indicate 25 ± 3 inch-pounds.
- (2) Adjust clutch slippage as follows:
 - (a) Remove side cover to gain access to adjusting nut.

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SERVICE MANUAL

- (b) Using two 1/8 inch punches as holding tools, loosen jam nut and turn adjusting nut until slippage of the drum occurs at 25 ± 3 inch-pounds tension.

CAUTION: MAKE SURE ELECTRICAL POWER IS OFF WHILE MAKING ADJUSTMENTS.

NOTE: The inch-pound angular torque may be converted to pound tension and measured by a spring scale.

- (3) When adjustment is correct, tighten jam nut while holding adjustment nut position.
(4) Install side cover.

FLAP CONTROL SYSTEMDescription

1. The flap system is electrically actuated. The flap system provides lift to the wing when partially extended and increases drag to reduce speed when fully extended during landing. The system consists of a flap preselect assembly and flap actuator assembly. The flap actuator assembly is an electric motor which drives a gear reduction unit. Sprockets (two), connected in tandem to the reduction unit output shaft; drive two chain cables. The chain cables actuate four bellcranks in each wing. The bellcranks are interconnected by push-pull tubes. The flap preselect assembly consists of a preselect lever assembly mounted on the instrument panel and a flap preselect control cable. The flap preselect control cable is attached to the preselect lever assembly and routed aft under the floorboard and connected to the right flap return cable. When the preselect lever assembly is placed in the 0° (UP), 15° or 35° (DOWN) positions, microswitches attached to the preselect lever assembly arm actuates the flap motor, which drives the flaps until the corresponding flap position is reached. As the flaps reach the preselected position, the preselect micro switches are de-energized. Also, a flap and landing gear warning switch is mounted on the preselect bracket to provide an aural warning any time the flap preselect lever is lowered past the 15° position with the landing gear not extended and locked. For more information on flap/landing gear switch, refer to Chapter 4.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS ON LATE MODEL AIRCRAFT USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Troubleshooting

1. Troubleshooting of the flap control system is determining if the trouble exists in the flap preselect system, flap actuation system.
2. Tools and Equipment

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NOTE: Equivalent substitutes may be used instead of the following listed items:

Name	Number	Manufacturer	Use
Inclinometer	SE716	Cessna Aircraft Co. Wichita, Kansas	To measure travel of control surfaces.
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif.	To measure flap extend cables.
Tensiometer	T60-100-1	Pacific Scientific Co. Los Angeles, Calif.	To measure flap return cables.
Multimeter	Model 260	Simpson	To measure voltage and resistance in electrical circuits.

NOTE: Inclinometer is available from Cessna Service Center.

3. Troubleshooting Flap Control System

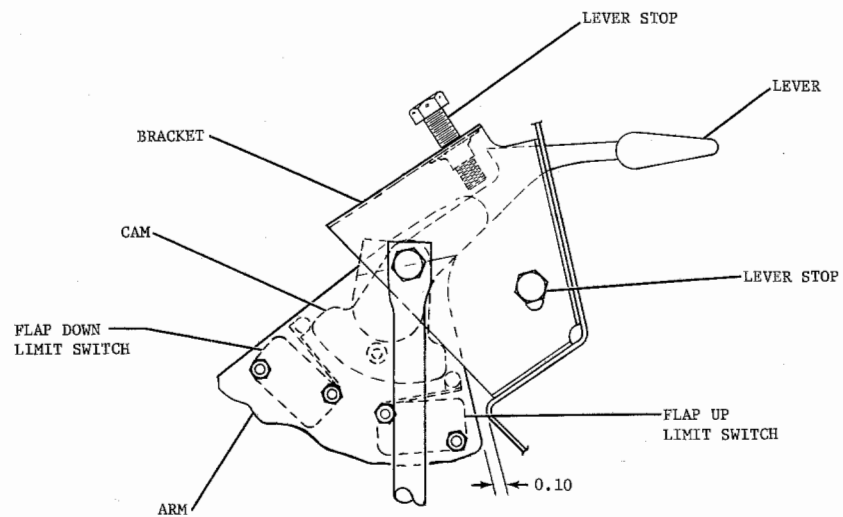
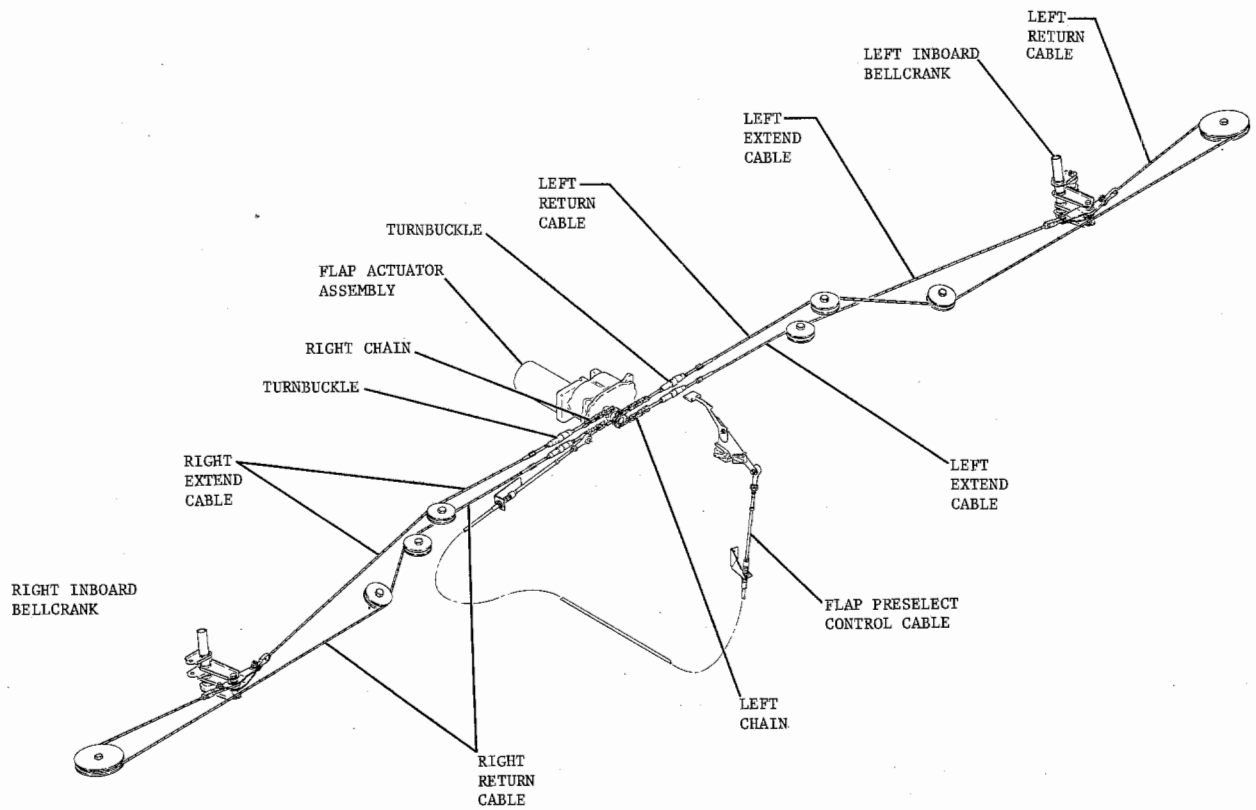
- A. For a guide to troubleshooting the flap control system, see Figure 2.

Adjustment/Test

1. Tools and Equipment

NOTE: Equivalent substitutes may be used instead of the following listed items:

Name	Number	Manufacturer	Use
Inclinometer	SE716	Cessna Aircraft Co. Wichita, Kansas	To measure travel of control surfaces.
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif	To measure flap extend cables.



FLAP PRESELECT DIMENSION
REQUIREMENT

Flap Control System and Adjustment
Figure 1

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Name	Number	Manufacturer	Use
Tensiometer	T60-100-1	Pacific Scientific Co.	To measure flap return cables.

NOTE: Inclinator is available from Cessna Service Center.

2. Rigging Flap Control System (See Figure 1)

- A. Refer to Chapter 12. Remove passenger seats and carpets.
- B. Remove floorboard above flap actuator assembly.
- C. Connect 24 volt external power source.
- D. Extend the flaps.
- E. (See Figure 3) Check length of inboard push-pull rod (3) on each inboard flap and adjust to 10.45 inches.

NOTE: Length of push-pull rods are measured between center line of rod and bolt holes.

- F. Check length of interconnecting push-pull tubes and adjust, if necessary, to the following dimensions:

Outboard interconnecting push-pull tubes	33.35 inches
Center interconnecting push-pull tubes	23.80 inches
Inboard interconnecting push-pull tubes	23.80 inches

- G. Adjust remaining push-pull rods from bellcranks to flap scissors so that flaps fits evenly when in the UP position.
- H. (See Figure 1) With flaps in the UP position, check flap chains on flap actuator assembly sprockets, if necessary, adjust as follows:
 - (1) Tape flap in the UP position.
 - (2) Unsafety and disconnect turnbuckles and disengage chains.
 - (3) Engage right chain with aft sprocket, so that approximately 3 1/2 links extend around bottom side of sprocket.
 - (4) Engage left chain with forward sprocket, so that three links extend around the top side of sprocket.
 - (5) Connect turnbuckles.
- I. With flaps secured in UP position, tighten turnbuckles until all slack is out of cables. Temporarily rig both return cables with 185 pounds tension.

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NOTE: At this point, recheck flap positions as to being in proper position with respect to wing trailing edge. Should further adjustment of push-pull rods be necessary, this must be accomplished before final setting of cable tension.

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of four hours.

- J. Remove tape and lower flaps a few degrees at a time, observing for any unusual tension build-up in the cables or binding of push-pull tubes and bellcranks, until flaps reach $37^{\circ} + 1^{\circ}$, $- 0^{\circ}$ flap travel.
- K. (See Figure 5) Adjust top limit (down) switch (8) to provide $37^{\circ} + 1^{\circ}$, $- 0^{\circ}$ flap travel. Adjust extend cables to 85 ± 10 pounds, differential cable tension between right and left should not exceed 25 pounds.
- L. Retract flap to 0 degree and adjust bottom limit (up) switch (8) to provide 0 degree flap travel. Adjust return cable tension to 280 ± 20 pounds.
- M. (See Figure 6) Center flap preselect control cable in brackets and secure with nuts.
- N. At flap preselect assembly adjust down and up limit switch rollers snug against cam ends.
- O. Tighten bolt securing the flap select assembly in bracket to obtain $2 \pm .5$ pound friction load measured at end of preselect lever with lever between 0° and 15° setting.
- P. Adjust flap preselect control cable rod end (See Figure 6) and/or cable housing such that 15° flap selection results in $15^{\circ} \pm 0^{\circ}$ flap travel.
- Q. Check for .10 minimum clearance between flap arm and stationary panel.
- R. Adjust pointer (bend wire) on arm to center on 15° mark.
- S. Adjust flap preselect lever upper lever stop to limit 0° flap setting with 225 ± 25 pounds return cable tension. Flap angular travel must be 0° retracted.

NOTE: Differential cable tension between right and left should not exceed 25 pounds.

- T. Position flap preselect lever to 35° (DOWN) bottom lever stop to limit flap travel to $35^{\circ} + 1^{\circ}$, $- 0^{\circ}$. When preselect lever is placed in 35° (DOWN) position, the angular travel must be $35^{\circ} + 1^{\circ}$, $- 0^{\circ}$.
- U. Adjust flap/landing gear warning switch, refer to Chapter 4.
- V. Check flap surface travel tolerances at the following locations: $15^{\circ} \pm 0^{\circ}$ DOWN; $35^{\circ} + 1^{\circ}$, $- 0^{\circ}$ DOWN; $15^{\circ} + 0^{\circ}$, $- 2^{\circ}$ from DOWN to UP.

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- W. Check the extension and retraction time. The flaps should extend in 6.5 to 9.5 seconds and retract in 6.5 to 9.5 seconds.

NOTE: If the flaps will not extend or retract in 6.5 to 9.5 seconds, the flap motor should be replaced.

- X. Disconnect 24 volt external power source.
Y. Safety all turnbuckles.
Z. Install floorboard.
AA. Install center carpet and passenger seats. Refer to Chapter 12.

Inspection/Check

1. Tools and Equipment

NOTE: See Adjustment/Test for tools and equipment.

2. Flap Control System Check

NOTE: Angular dimensions for checking flaps are measured by placing inclinometer on flap surface. Flap is in zero degree position when the trailing edge is streamlined with bottom surface of wing trailing edge.

3. Flap Deflection Check

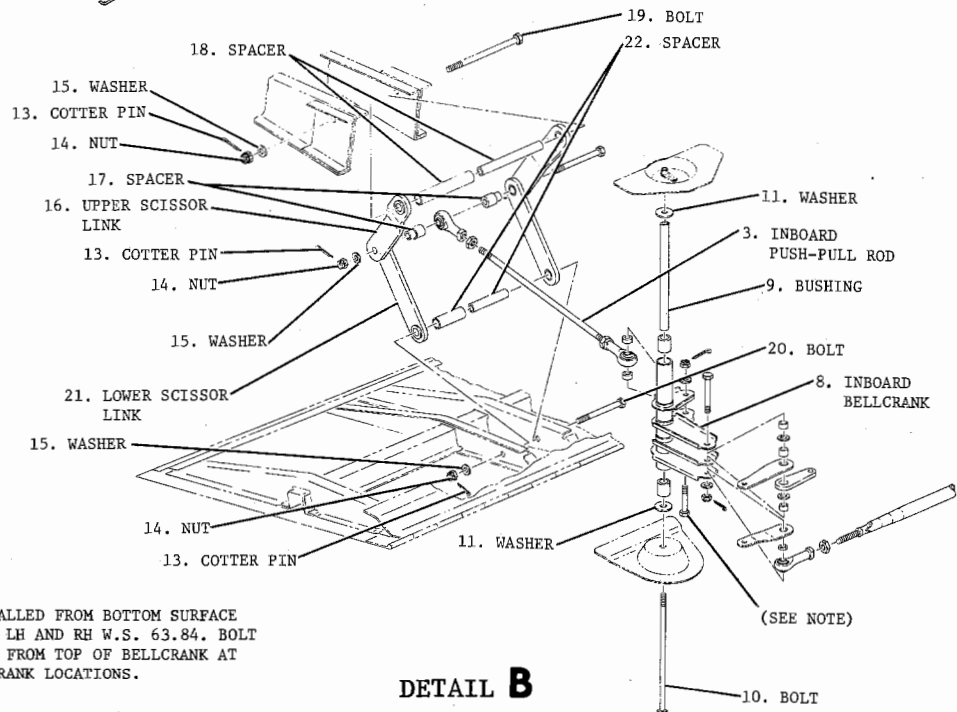
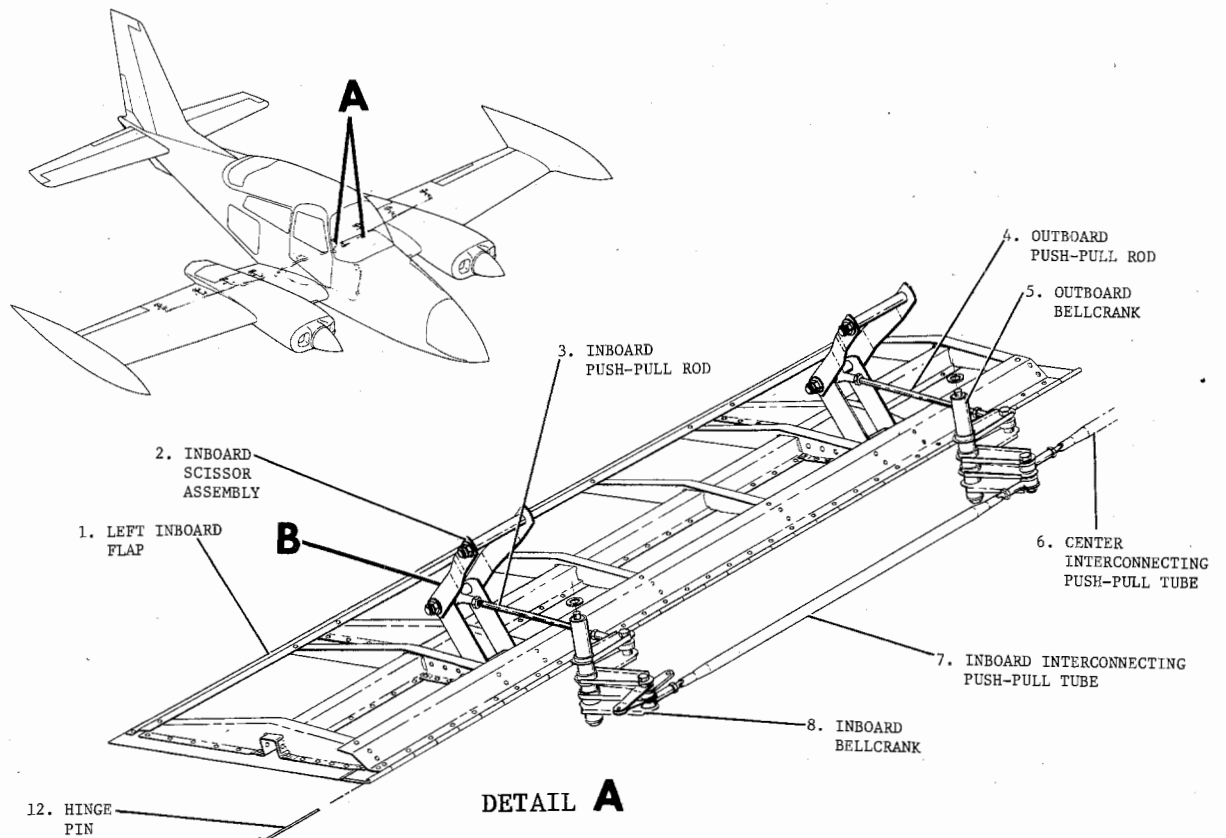
- A. Move flap lever to zero degree position, measure angle of flap.
B. Move flap lever to $15^{\circ} \pm 0^{\circ}$ down, measure angle of flap.
C. Move flap lever to $35^{\circ} \pm 1^{\circ} - 0^{\circ}$ down, measure angle of flap.

4. Flap Cable Check

- A. Refer to Chapter 12. Remove passenger seats and carpet.
B. Refer to Chapter 1. Remove aft interspar floorboards.
C. Place tensiometer on the return cables and read cable tension.
D. Extend flaps, place tensiometer on the extend cables and read cable tension. See Figure 1 for cable temperature/-tension NOTE.
E. Reinstall floorboards, passenger seats and carpet.

5. Flap Inspection

- A. Extend flaps.



NOTE: BOLT TO BE INSTALLED FROM BOTTOM SURFACE OF BELLCRANK AT LH AND RH W.S. 63.84. BOLT TO BE INSTALLED FROM TOP OF BELLCRANK AT ALL OTHER BELLCRANK LOCATIONS.

Flap Installation
Figure 3

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- B. Remove seats, carpets and floorboards as required to provide visual inspection of flap actuator assembly, cables and pulleys.
- C. Install floorboards, carpets and seats.

Maintenance Practices

1. Removal/Installation Flap (See Figure 3)

NOTE: The following is a removal/installation procedure for the left inboard flap. Removal/installation of the other flaps is a similar method.

A. Remove Flap.

- (1) Extend flaps.
- (2) If inboard flap is being removed, remove lower aft wing fillet.
- (3) Disconnect lower scissor links (21) by removing cotter pins (13), nuts (14), washers (15), spacers (22) and bolts (20).
- (4) Remove the safety from the bent end of hinge pin (12). Detach flap by removing hinge pin (12).

NOTE: If difficulty is encountered in removing outboard flap hinge pin, it may be necessary to remove aileron (Refer to Section 5-00) to gain better access to hinge pin.

B. Install Flap.

- (1) Attach flap to wing with hinge pin (12). Safety bent end of hinge pin.

NOTE: To facilitate hinge pin installation, check the hinges and pin for distortion, lubricate hinge pin and taper end of hinge pin.

- (2) Connect lower scissor links (21) to flap by installing bolts (20), spacers (22), washers (15), nuts (14) and cotter pins (13).
- (3) If lower aft wing fillet was removed, install with attaching screws.
- (4) Check flap for proper operation and correct travel. Refer to Flap Adjustment/Test.

2. Removal/Installation Flap Bellcrank (See Figure 3)

NOTE: Eight bellcranks are used to operate the flaps. The following procedures are for the left inboard bellcrank of the left inboard flap. Remove the other bellcranks in a similar manner.

A. Remove Flap Bellcrank.

- (1) Remove passenger seats and carpet. Refer to Chapter 12.
- (2) Remove access cover from above flap actuator and aft wheel well.
- (3) (See Figure 4) Lower flaps several degrees to decrease tension on return cables, remove safety from turnbuckles (8), and loosen turnbuckles to release tension on cables which route to affected bellcrank only.
- (4) (See Figure 4) Disconnect flap cables (4 and 5) from bellcrank by removing cotter pins, nuts and bolts.

NOTE: Steps 1 through 4 apply only to removal of the inboard bellcrank of each inboard flap. To remove any other bellcrank, remove access hole covers from underside of wing adjacent to affected bellcrank.

- (5) Disconnect push-pull rod (3) from bellcrank (8) by removing cotter pin, nut, washer, spacers and bolt.
- (6) Disconnect interconnecting push-pull tube (7) from bellcrank by removing cotter pin, nut and bolt.
- (7) Remove bellcrank by removing safety wire from bolt (10); removing bolt (10) and washers (11), taking care that bushing (9) does not fall from bellcrank during removal.

NOTE: Access to bolt is gained by removing a plug button from the underside of the wing beneath bolt.

B. Install Flap Bellcrank.

- (1) Insert bellcrank (8) through access hole and install washers (11) and bolt (10). Safety bolt and install plug button on underside of wing beneath bolt.

NOTE: Washers (11) and bushing (9) must be in place before installing bolt (10).

- (2) Attach interconnecting push-pull tube (7) to bellcrank (8) with attaching bolt, nut and cotter pin.

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- (3) Connect push-pull rod (3) to bellcrank (8) with attaching bolt, spacers, nut and cotter pin.
- (4) (See Figure 4) Connect flap cables (4 and 5) to bellcrank (8) with bolts, nuts and cotter pins.
- (5) Rig flaps, refer to Flap Adjustment/Test.
- (6) Reinstall access covers.
- (7) Install carpet and seats. Refer to Chapter 12.

3. Removal/Installation Flap Scissors Assembly (See Figure 3)

NOTE: The following procedures are for the left inboard flap scissor assemblies. Remove the other scissor assemblies in a similar manner.

A. Remove Flap Scissor Assembly.

- (1) Extend flaps.
- (2) Disconnect upper and lower scissor links (16 and 21) by removing cotter pins (13), nuts (14), spacers (18 and 22) and bolts (19 and 20).
- (3) Disconnect upper and lower scissor links by removing cotter pin (13), nut (14), washer (15), spacers (17), push-pull rod (4) and bolt.

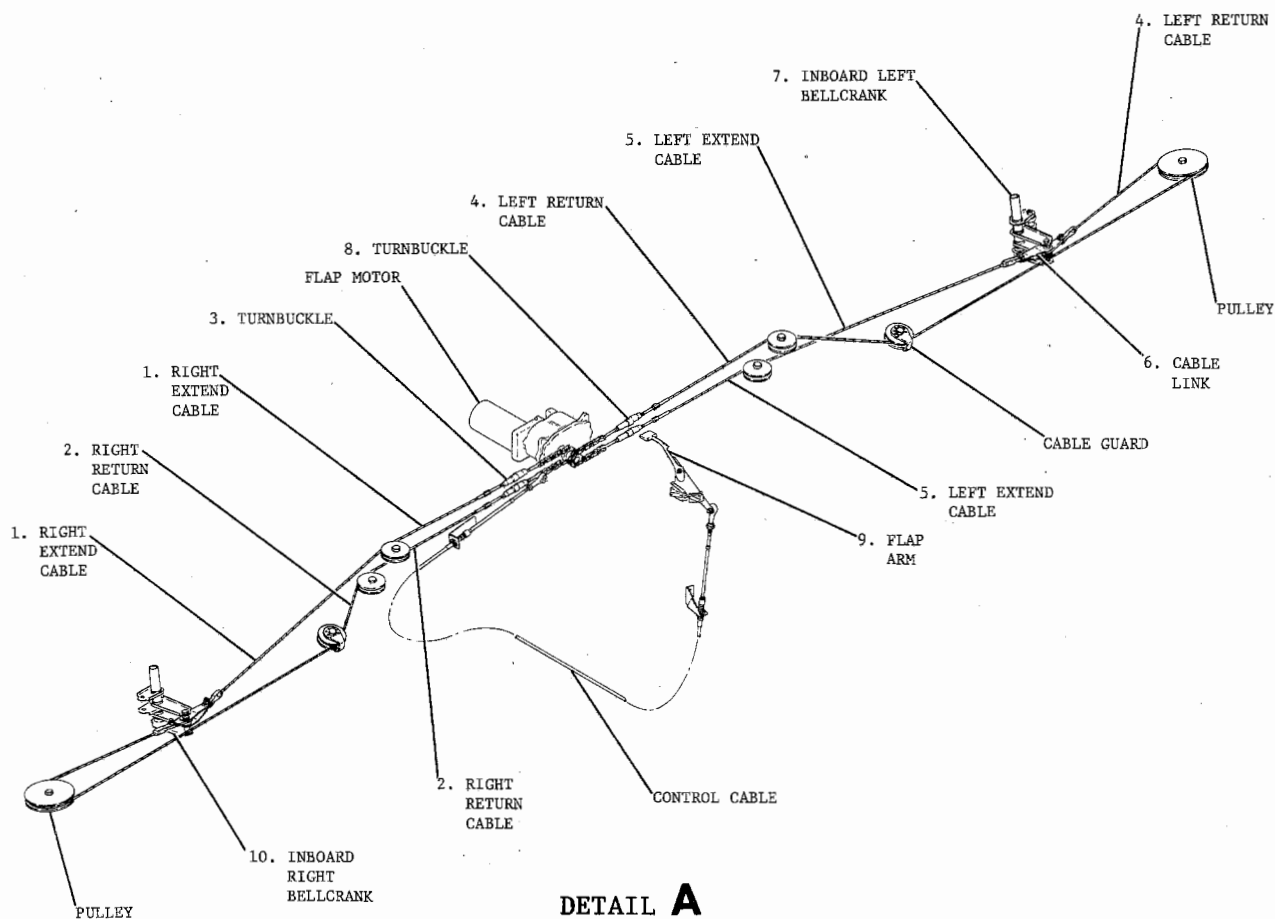
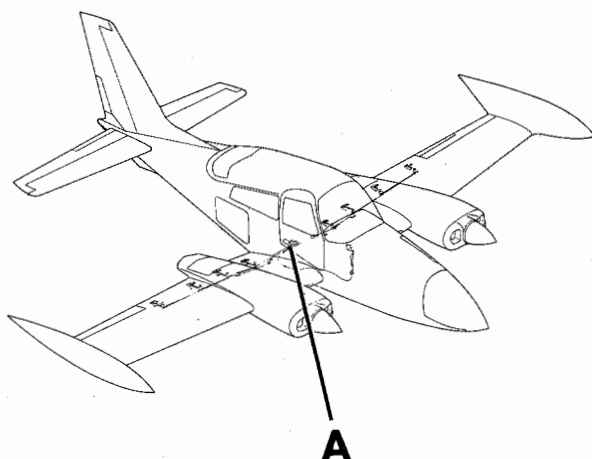
B. Install Flap Scissor Assembly.

- (1) Assemble scissor links (16 and 21) to push-pull rod (2) using bolt, spacers (17), washer (15), nut (14) and cotter pin (13).
- (2) Connect upper and lower scissor links (16 and 21), using bolts (19 and 20), spacers (18 and 22), washers (15), nuts (14) and cotter pins (13).
- (3) Check flaps for proper operation and correct travel. Refer to Flap Adjustment/Test.

4. Removal/Installation Flap Control Cables. (See Figure 4)

A. Remove Flap Control Cables.

- (1) Refer to Chapter 12. Remove center seats and center carpet.
- (2) Remove access covers above and below flap motor.
- (3) Remove aft wing root fillet and aft wheel wells access cover.
- (4) Lower flaps several degrees to decrease tension on return cables, remove safety from turnbuckles (3 and 8) and disconnect turnbuckles.
- (5) Disconnect flap extend and return cables from bellcranks by removing cotter pins, nuts and bolts.
- (6) Remove outboard pulleys by removing nut and bolts.



DETAIL A

Flap Cable Installation
Figure 4

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NOTE: Cable guard cotter pins are quite difficult to install and should be removed only for replacement.

- (7) Remove inboard pulleys and cable guards by removing nuts and bolts.
- (8) Tie guide wires to flap cables, pull out through access hole in cabin floor, and disconnect guide wires.
- (9) Disengage chains from reduction unit sprockets.

B. Install Flap Control Cables.

- (1) Tie flap extend and return cables to guide wires and pull into position.
- (2) Attach flap extend and return cables to links of bellcranks (7 and 10) with bolts, nuts and cotter pins.
- (3) Place return cables (2 and 4) in position on outboard pulleys and install with bolts and nuts and cable guards.
- (4) Install inboard pulleys, using bolts, nuts and cable guards.
- (5) Engage chains with reduction unit sprockets, connect to the cables with turnbuckles (3 and 8).
- (6) Rig flap system. Refer to Flap Adjustment/Test.
- (7) Install aft wing root fillet and aft wheel wells access cover.
- (8) Install access covers above and below flap actuator.
- (9) Refer to Chapter 12. Install carpet and passenger seats.

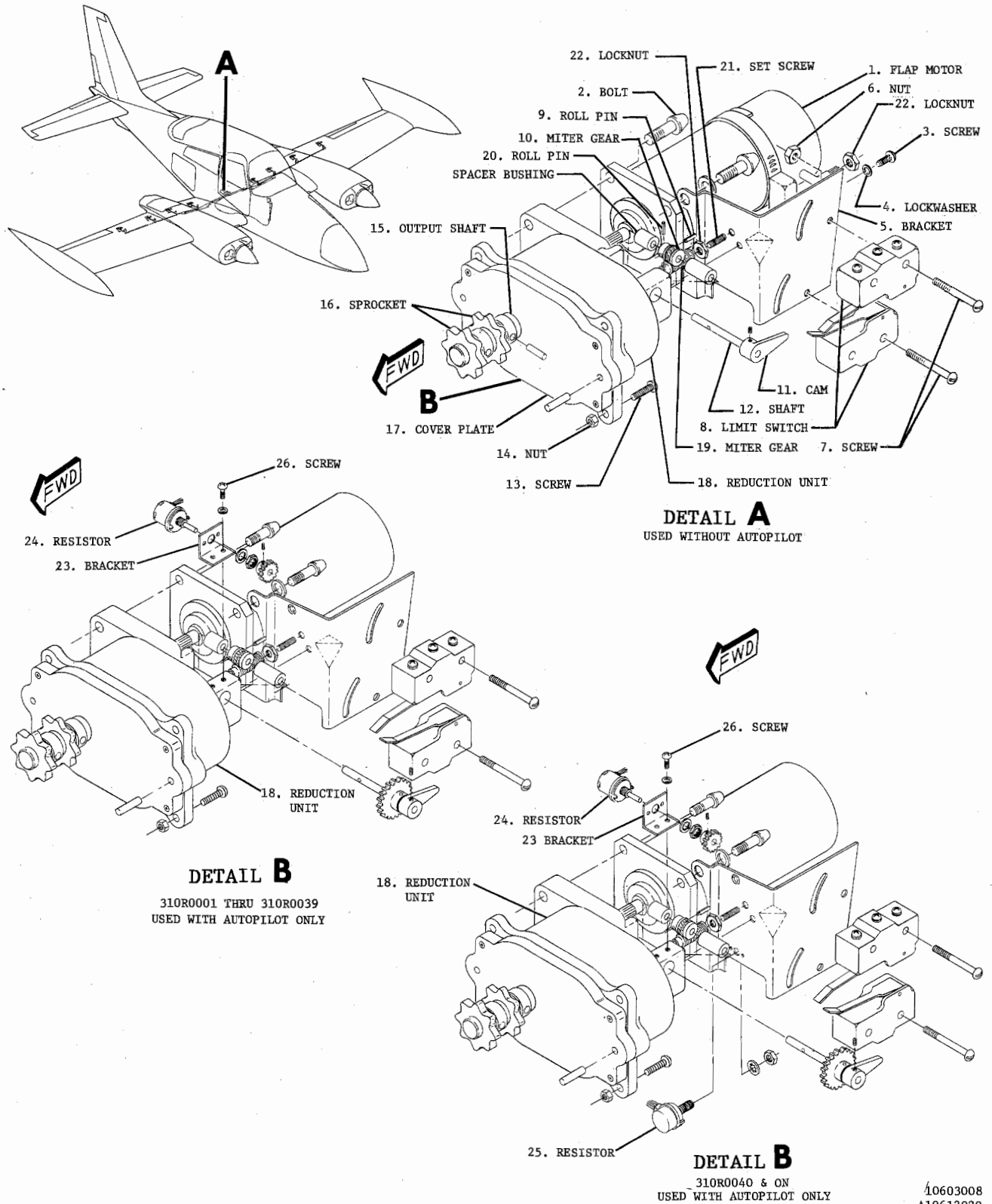
5. Removal/Installation Flap Actuator Assembly (See Figure 5)

A. Remove Flap Actuator Assembly.

- (1) Disengage Flap Motor circuit breaker.
- (2) Refer to Chapter 12. Remove center seats and center carpet.
- (3) Remove access covers above flap actuator and underside of fuselage beneath flap motor.
- (4) Lower flaps several degrees to release tension on return cables.
- (5) Remove safety from turnbuckles (3 and 8, Figure 4). Loosen the turnbuckles enough to disengage chains from sprockets (16).
- (6) Identify and disconnect electrical wires from limit switches (8).
- (7) If Autopilot (optional) is installed, remove two screws (26), securing bracket (23) to reduction unit (18).

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Flap Actuator Assembly
Figure 5

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- (8) Remove nuts (14) and screws (13) attaching reduction unit (18) to fuselage rear spar.
- (9) Pull actuator assembly aft, tilt actuator and remove through access hole.

NOTE: If an autopilot (optional) is installed, disconnect autopilot cables from clamps attaching them to aileron cables, and separate beneath flap actuator to remove actuator from aircraft.

- (10) If limit switch bracket (5), removal is desired, proceed as follows:
 - (a) Identify and disconnect flap motor (1) electrical wires from limit switches (8).
 - (b) Remove safety wire from bolts (2).
 - (c) Remove screw (3) and lockwasher (4) and bolt (2).

NOTE: The lower bolt (2) attaching bracket (5) to flap motor only needs loosening. The bracket hole is slotted for removal.

- (d) Remove bracket (5) with limit switches (8) attached.
- (11) If further disassembly of flap actuator assembly is desired, refer to Landing Gear and Flap System Components Overhaul Parts Manual.

B. Install Flap Actuator Assembly.

- (1) If limit switch bracket (5) was removed proceed as follows:
 - (a) Position bracket (5) with limit switches (8) attached to flap motor (1). Secure bracket with bolts (2), lockwasher (4) and screw (3). Safety wire bolts (2).
 - (b) Route flap motor electrical wires through grommet of bracket (5). Identify wires and connect wires to limit switches (8).
 - (c) Check that reduction unit output shaft (15) does not turn when 800 pound-inches torque is applied.
 - (d) Adjust setscrew (21) to provide 0.005 maximum transfer shaft movement and secure with lock-nuts (22).

NOTE: Shaft movement measurement should be measured between miter gear (19) and miter gear (10).

- (e) Prior to flap actuator assembly installation, ensure that limit switches (8) operate properly.
- (2) Adjust limit switches (8) at the end of the adjusting slot on bracket (5). Which is farthest from cam (11) to allow for travel when rigging.
- (3) Identify wires to limit switches (8) and connect wires to limit switches. Connect flap motor ground.
- (4) Insert flap actuator assembly through access hole in underside of fuselage. Secure flap actuator assembly to rear spar, using screws (13) and nuts (14).

NOTE: If an autopilot (optional) is installed, connect the autopilot cables to the clamps which attach them to the aileron cables.

- (5) Engage chains with sprockets (16).
- (6) Engage Flap Motor circuit breaker.
- (7) Rig flap control system. Refer to Flap Adjustment/-Test.
- (8) If autopilot (optional equipment) is installed, refer to Chapter (14) for rigging procedures.
- (9) Install access cover above and below flap actuator.
- (10) Install carpet and seats. Refer to Chapter 12.

6. Removal/Installation Flap Preselect Assembly (See Figure 6)

A. Remove Flap Preselect Assembly.

- (1) Remove knob from lever.
- (2) Disconnect control cable arm by removing nut and bolt.
- (3) Remove nut and bolt securing flap preselect assembly to bracket. Remove preselect assembly from bracket.
- (4) If further disassembly of flap preselect assembly is desired, proceed as follows:
 - (a) Remove washers.
 - (b) Remove bushings and washer from arm.
 - (c) Remove flap preselect switches from arm.

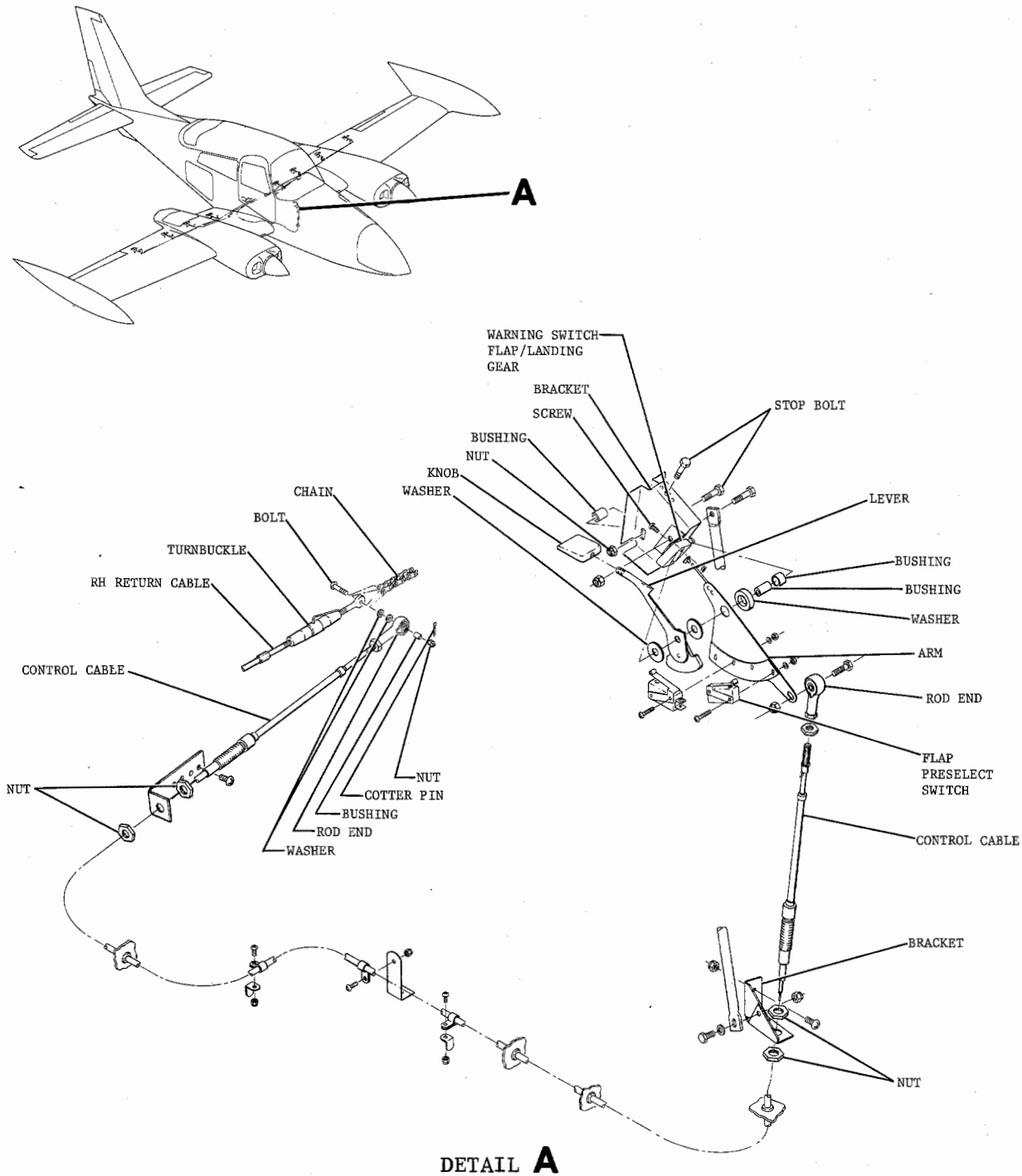
B. Install Flap Preselect Assembly.

- (1) If preselect assembly was disassembled, proceed as follows:
 - (a) Install flap preselect switches on arm, using screws, washers and nuts.
 - (b) Assemble arm to lever, using washers and bushings.
- (2) Insert preselect assembly into the bracket and secure with nut and bolt.

NOTE: Ensure washer is installed between lever and bracket.

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Flap Preselect System Installation
Figure 6

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- (3) Connect control cable to arm, using nut and bolt.
 - (4) Install knob on lever.
 - (5) Rig flap preselect assembly. Refer to Flap Adjustment/Test.
7. Removal/Installation Flap Preselect Control Cable (See Figure 6)
 - A. Remove Flap Preselect Control Cable.
 - (1) Remove necessary seats, carpet and floorboards to gain access to flap preselect control cable.
 - (2) Disconnect control cable from arm by removing nut and bolt. Then remove rod end from control cable.
 - (3) Remove control cable from bracket by removing nut.
 - (4) Disconnect control cable from turnbuckle by removing cotter pin, nut, bushing and washers.
 - (5) Remove control cable from bracket by removing nut.
 - (6) Remove nut remaining on the control cable. Then remove clamps securing cable to structure and pull cable from the aircraft.
 - B. Install Flap Preselect Control Cable.
 - (1) Route control cable through grommets in structure and secure with clamps.
 - (2) Install nuts on control cable and insert cable through forward and aft brackets. Install remaining nuts on control cable.
 - (3) Install rod ends on forward and aft end of cable.
 - (4) Connect forward end of control cable to arm, using bolt and nut.
 - (5) Connect aft end of cable to turnbuckle, using washers, bushing, nut and cotter pin.
 - (6) Rig flap preselect system. Refer to Flap Adjustment/Test.
 - (7) Install floorboards, carpet and seats.
8. Operational Check Flap System
 - A. Flight Operational Check.
 - (1) Check flap operation for proper operating times as follows:
 - (a) Flight check to verify that flaps fully extend in 9 - 14 seconds, and retract in 6 - 10 seconds. Check extension and retraction times at 140 KIAS.
 - (b) If during flight check, the flaps will not extend and retract within the time limits described in step (a), remove the flap actuator motor and perform the following no load test:

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- 1) Mount motor securely in a horizontal position.
- 2) Connect motor as shown in Figure 10, Chapter 4-00 to a variable 30 volt DC power supply.
- 3) Close switch S3 for either direction.
- 4) Open switch S2 to read ammeter.
- 5) Close switch S1 to start motor.
- 6) Gradually increase voltage from zero until the brake releases.

NOTE: The brake releasing may be indicated either by sound or the armature starting to turn.

- 7) Read voltmeter when brake releases. Brake must release at or less than 18 volts.
 - 8) Stop motor, close switch S3 for opposite rotation and repeat steps 3) thru 7).
 - 9) Voltage must be within the same limits as previous rotation.
 - 10) If the voltage is not within the same limits, refer to Troubleshooting.
 - 11) Run motor in each direction as shown connected in Figure 10, Chapter 4-00 with 24 volts DC applied.
 - 12) Open switch S2 and read ammeter current. The ammeter should read approximately 3.5 amperes under no load, when the RPM is approximately 1100 RPM.
 - 13) Stop motor, close switch S3 for opposite rotation and repeat step 12).
 - 14) Motor should operate within limits as described in step 12).
 - 15) If the motor does not operate within the limits as described in step 12), refer to Troubleshooting.
- (c) If the motor will not meet operating requirements, after performing no load test, replace motor and repeat step (a).
- (d) If the flaps still will not meet flight check requirements, check system for binding or interference.
- (e) If no evidence of binding or interference is found, flap actuator must be replaced or overhauled in accordance with Cessna Landing Gear and Flap System Components Overhaul/Parts Manual.

CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

6

ENVIRONMENTAL SYSTEMS

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ENVIRONMENTAL SYSTEMS

Description

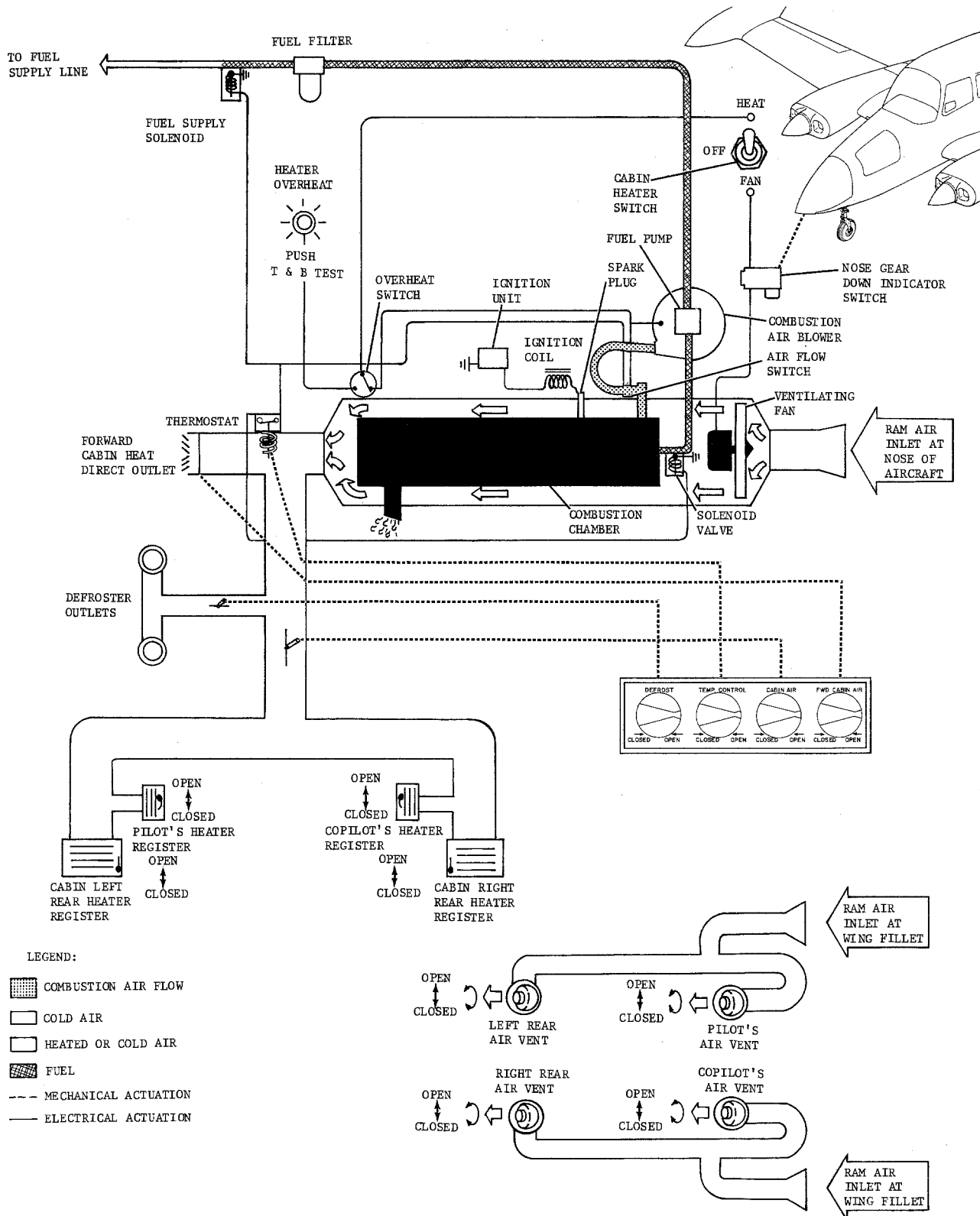
1. The environmental systems are defined as the aircraft systems that are necessary for the comfort and safety of the flight crew and passengers. In this manual, these systems consist of the heating, ventilating and defrosting system and the oxygen system.

HEATING, VENTILATING AND DEFROSTING SYSTEMDescription

1. The heating, ventilating and defrosting system provides controlled air, either heated or cool, to all areas of the cabin. Air is supplied to the heater through a ram air opening in the nose of the aircraft. From the heater, air is ducted to controllable heat outlets in the cabin. Two heat outlets are provided at the base of the windshield for defrosting purposes, two are located in the forward upholstery side panels, two are on the aft face of the main spar beneath the pilot and copilot's seat and a direct air outlet located on the forward cabin bulkhead.

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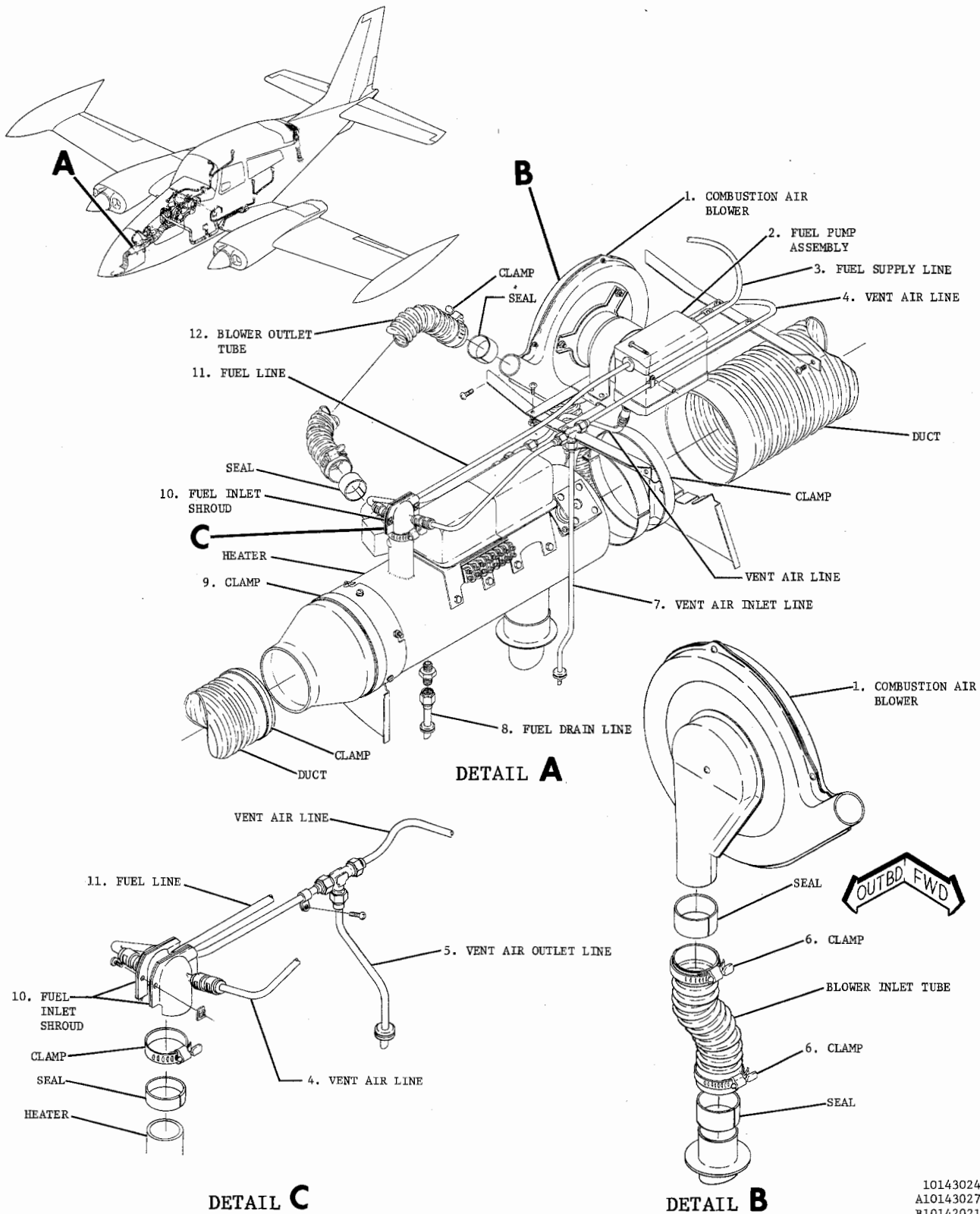
Heating, Ventilating and Defrosting Schematic
Figure 1

HEATING SYSTEMDescription

1. The heater is a gasoline combustion type, mounted in the right side of the nose section. Fuel is routed from a tee in the fuel crossfeed line through a solenoid valve-regulator which regulates the fuel pressure to 7 psi and a filter. A fuel pump is mounted on the combustion blower motor. Fuel from the solenoid valve is routed through the fuel line to the heater fuel pump. The heater fuel pump assembly is enclosed in a metal housing. The housing is vented and drained as a precaution against fire in the event of a fitting leakage. Fuel routed through the fuel line assembly enters the heater solenoid valve which allows fuel to pass through the combustion chamber spray nozzle. Electrical current is supplied to the combustion air blower, combustion air pressure switch and ignition coil when the heater switch is placed in the HEAT position. When the nose gear is in the DOWN position, electrical current is also supplied to the ventilating fan. As the combustion air flow increases, the combustion air pressure switch closes and actuates the ignition coil and heater solenoid valve. Fuel then flows through the heater solenoid valve into the combustion chamber spray nozzle which injects a conical shaped spray cone of fuel into the combustion chamber where the spark plug is already sparking, thus combustion occurs. As the heated air flowing from the heater to the cabin exceeds the thermostat setting, the thermostat automatically closes the solenoid valve, stopping fuel flow into the heater. As the heater cools, the thermostat opens the solenoid valve, allowing fuel to flow and combustion takes place since the spark plug is continually sparking. By cycling on and off, the heater maintains an even air temperature in the cabin. The heater combustion chamber is completely separate from the ventilating system to prevent any exhaust gases from contaminating the cabin air. All exhaust gases are vented overboard through an exhaust tube directly beneath the heater.

Troubleshooting

1. Troubleshooting the Heater.
 - A. For troubleshooting the heater, refer to Heater and Components Overhaul/Parts Manual.



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Heater Assembly Installation
Figure 1

Maintenance Practices

1. Removal/Installation of Heater Assembly (See Figure 1).

A. Remove heater assembly.

- (1) Tag and disconnect electrical wires from the heater terminal strip.
- (2) Loosen clamps securing blower outlet tube and remove tube from combustion air blower and heater.
- (3) Loosen clamps securing blower inlet tube and remove tube from combustion air blower.
- (4) Remove four screws and remove cover from fuel pump assembly (2).
- (5) Remove fuel inlet shroud by removing two screws and clamp.
- (6) Disconnect fuel supply line (3).
- (7) Disconnect and remove fuel line.
- (8) Disconnect and remove vent air inlet lines and vent air outlet lines.
- (9) Remove four screws securing combustion air blower and fuel pump assembly to support brackets. Remove assemblies from aircraft.
- (10) Loosen clamp and slide ducts from heater.
- (11) Remove clamp (9) and lift heater from aircraft.
- (12) Remove fuel drain line (8).

B. Install Heater Assembly.

- (1) Install drain line (8) to heater assembly prior to installation of heater.
- (2) Guiding fuel drain line (8) through the grommet in the lower skin, lower heater into place resting on the support brackets.
- (3) Clamp forward end of heater to support with clamp (9).
- (4) Slide fwd & aft ducts onto heater and secure with clamps.
- (5) Position combustion air blower and fuel pump assembly in place and secure bracketry with four screws.
- (6) Connect fuel line (11) to fuel pump (2) and at heater fuel inlet.
- (7) Connect fuel supply line (3).
- (8) Install blower inlet tube and secure with clamps (6).
- (9) Install blower outlet tube (12) and secure with clamps.

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NOTE: Operate heater and verify no leaks exist at fuel line connections before installing fuel pump cover and fuel inlet shroud.

- (10) Install fuel pump cover with four screws.
- (11) Install fuel inlet shroud (10) with two screws and clamp.
- (12) Install vent air inlet lines and vent air outlet lines as shown in Figure.

NOTE: Make sure vent air inlet line (7) is scarfed on the forward side and vent air outlet line (5) is scarfed on the aft side.

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CABIN AIR FLOW AND CONTROLSDescription

1. Fresh air is routed through ducting from inlets located in the wing gap leading edge and expelled through individually controlled valves positioned by each seat. Air is expelled from the cabin through an overboard vent located at the aft end of the cabin. A muffler is incorporated in the overboard vent on the 310 Standard Aircraft.
2. The cabin is heated by five warm air vents. Warm air is routed from the heater through air ducting and expelled into the cabin through four heat registers and a forward cabin outlet. Warm air is directed to the forward cabin, aft cabin or defrost outlets by means of valves manually controlled by control knots on the right instrument panel. Warm air outlets also have individual air control knobs which regulate the amount of warm air entering the cabin. A thermostat mounted on the heat control assembly controls the temperature of air entering the cabin.
3. The temperature of the cabin air is controllable by a control mounted on the instrument panel. The control knob mechanically controls the setting of a thermostat located on the heat control assembly. The thermostat cycles the heater to maintain the cabin temperature selected with the control knob.

Maintenance Practices

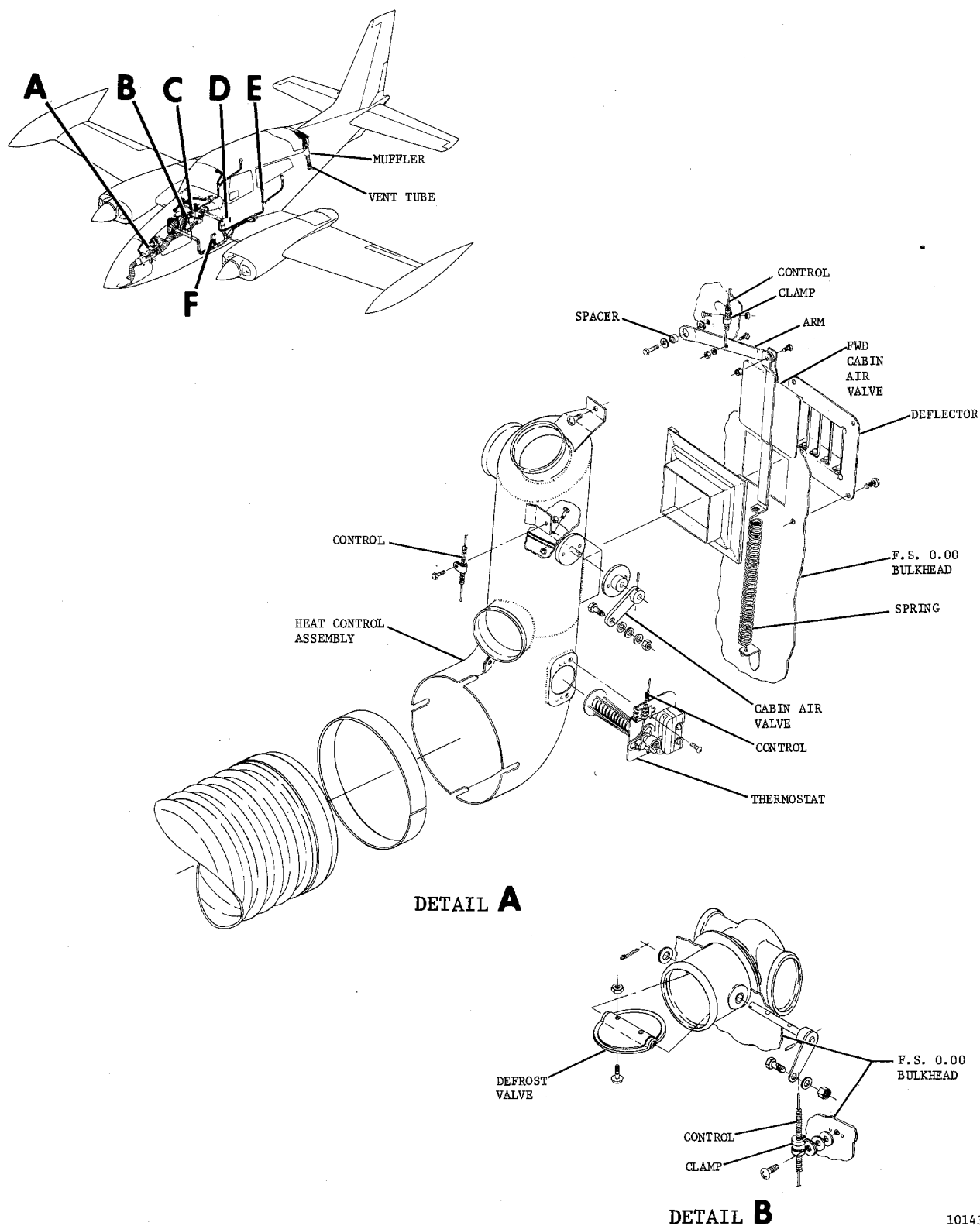
1. Tools and Equipment.

Name	Number	Manufacturer	Use
Methyl-Ethyl-Ketone (MEK)		Commercially available	Cleaning
Adhesive	EC2262	Minnesota Mining	Bonding duct to fittings.

2. Removal/Installation of Air Vents and Ducting (See Figure 1).
 - A. Remove Air Vents and Ducting.

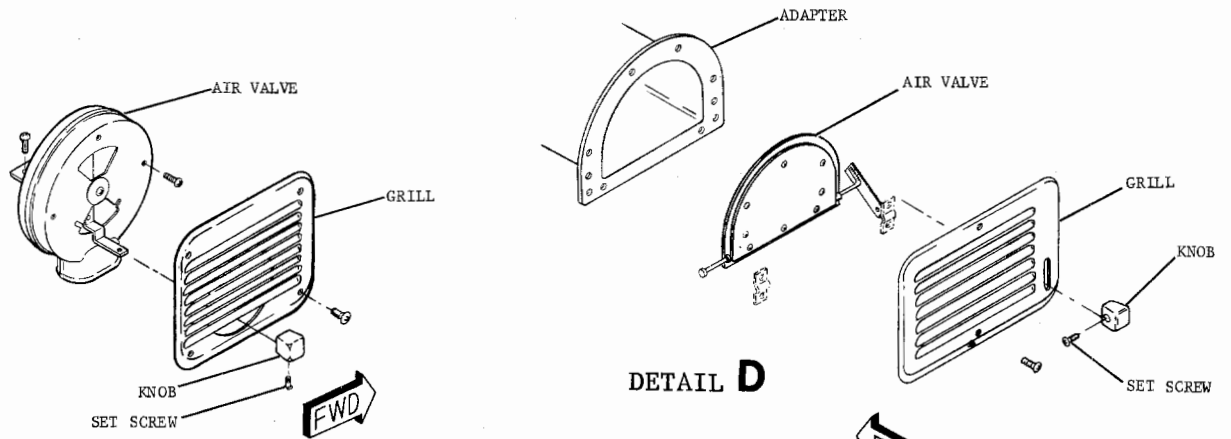
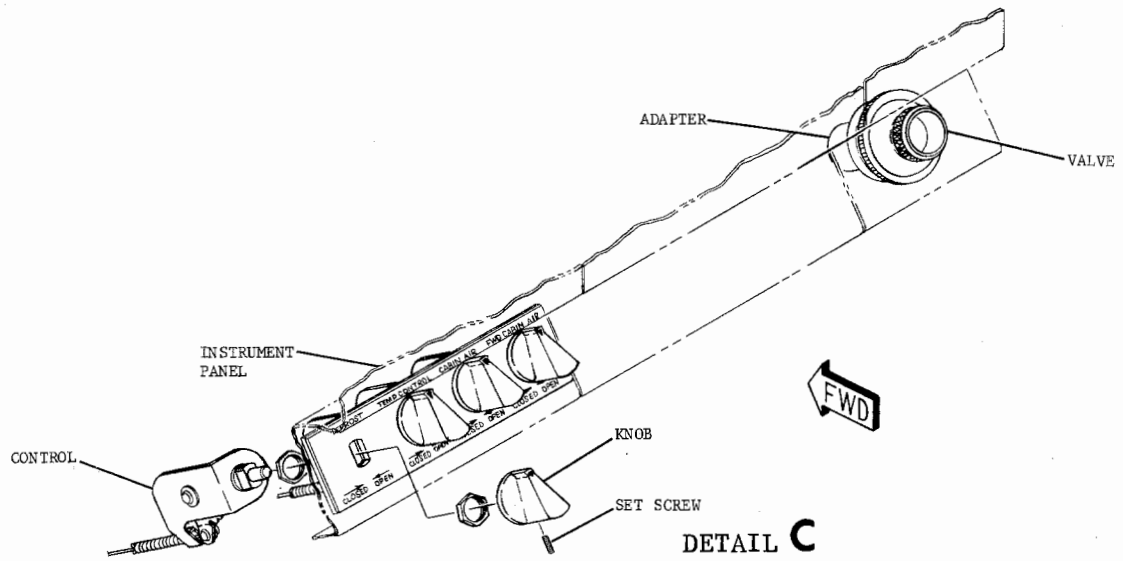
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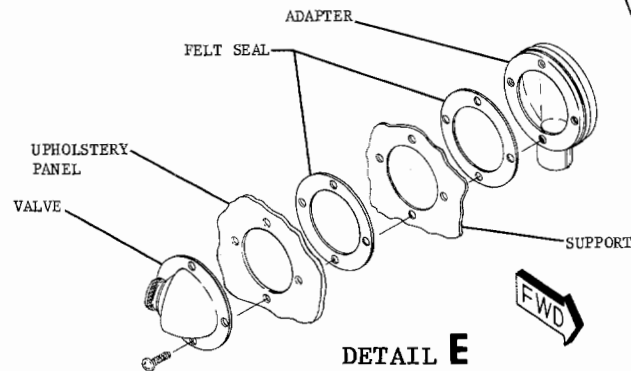


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Heating, Ventilating and Defrosting System Installation
Figure 1 (Sheet 1 of 2)



DETAIL F



DETAIL E

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Heating, Ventilating and Defrosting System Installation
Figure 1 (Sheet 2)

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NOTE: All fresh air inlet ducting is bonded to the adapters and fittings. Do not remove tubes except for replacement. A tube may be cut from a component and still have sufficient length for reinstallation when replacing a fitting or adapter.

- (1) Remove seats, carpet and upholstery panels as required to gain access to ducting. Refer to Chapter 12.
- (2) Remove access panels and wing gap fairings as required to gain access to ducting. Refer to Chapter 1.
- (3) Cut ducting off at the adapter or fitting and cut remainder from fitting with a knife. Clean bonding cement from fittings with methyl-ethyl-ketone (MEK).
- (4) Remove air vent adapters by removing screws.

B. Install Air Vents and Ducting.

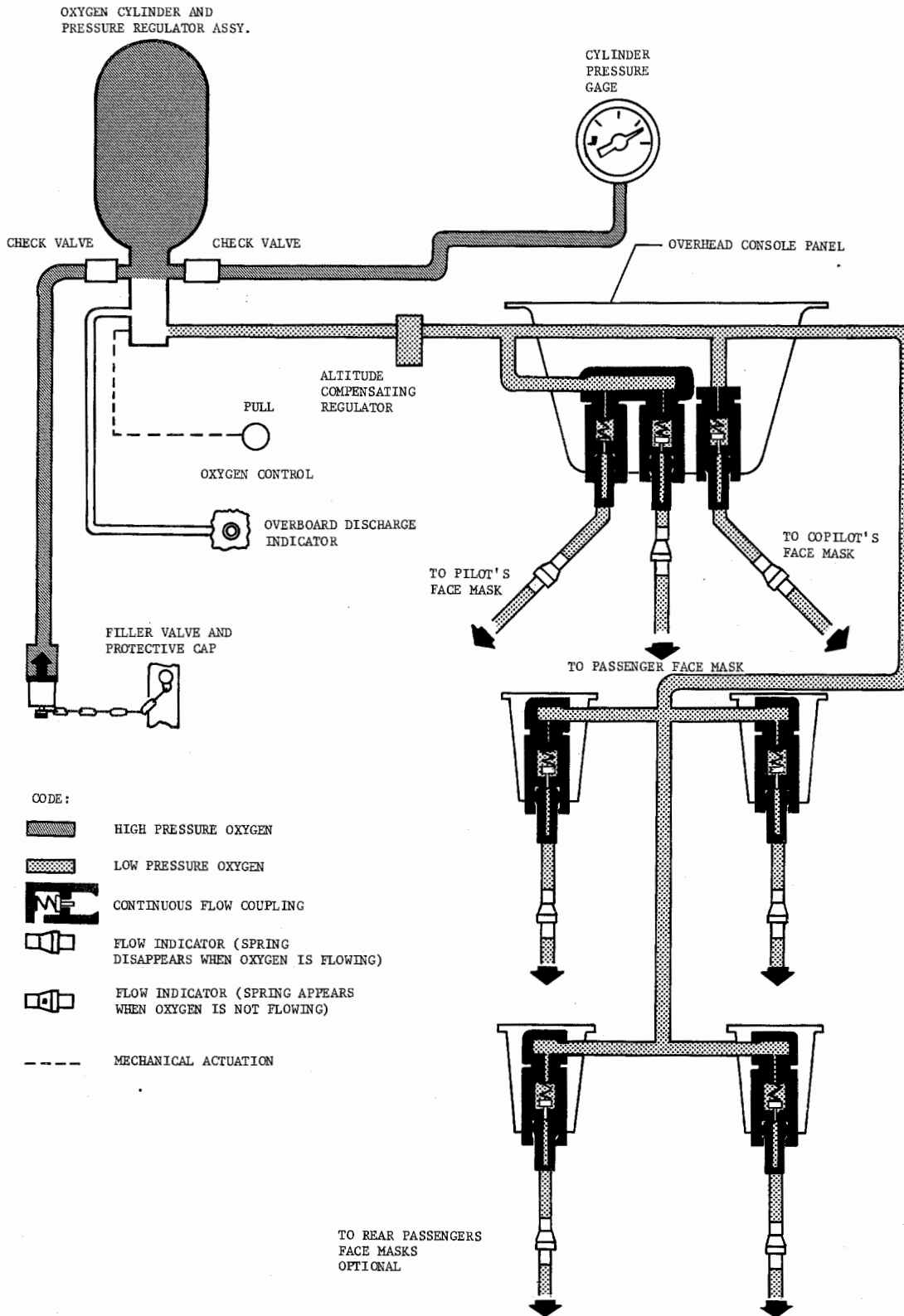
- (1) Install air vent adapters as shown in Detail A and Detail B.
- (2) Route new ducting into position and bond to adapters or fittings with EC2262 adhesive. Prepare and apply adhesive in accordance with the manufacturer's instructions.
- (3) Install access panels and wing gap fairing.
- (4) Install upholstery panels, carpet and seats.

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OXYGEN SYSTEMDescription

1. The oxygen system is an optional system. The aircraft owner has a choice of a 48.3 cu. ft. or 76.6 cu. ft. capacity oxygen bottle. Also, the oxygen system plumbing will vary with the seat arrangement of the aircraft. The oxygen system consists of: a cylinder-regulator, altitude compensating regulator, filler valve, overboard discharge indicator, control cable and knob, cylinder pressure gage, outlets, oxygen masks and associated plumbing.
 - A. The cylinder-regulator (oxygen bottle) is located in the nose baggage compartment on the aft left-hand side. Access to the cylinder is gained by removing the partition. The cylinder-regulator is secured into position with quick-disconnect clamps and a support. A supply regulator is attached to the cylinder to reduce high cylinder pressure to a lower constant pressure. The regulator incorporates a manual shutoff valve (cable operated); ports for a filling line, pressure gage line (capillary), outlet line (supply) and overboard discharge indicator line.
 - B. The altitude compensating regulator, located on the right-hand side of the fuselage forward of the instrument panel, reduces oxygen expenditures at lower altitudes and increases oxygen duration.
 - C. A control knob on the instrument panel when pulled to the ON position, provides a continuous flow of oxygen to the oxygen mask, when the mask hoses are engaged in the outlets. The mask hose contains a flow indicator for visual verification of oxygen flow. The masks, hoses, and flow indicators are stored in plastic bags where readily available.
 - D. The oxygen outlets are installed in the overhead console and above the passengers seats. Each outlet contains a spring-loaded valve which prevents oxygen flow until the mask hose is engaged with the outlet.
 - E. The oxygen filler valve is located inside the nose baggage compartment. The filler valve is secured to the bulkhead with rivets and consists of the valve incorporating a filter and valve cap. A check valve is installed in the high pressure line (filler line) at the regulator to prevent the escape of oxygen from the cylinder at the filler line port.



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Oxygen Supply System Schematic
Figure 1

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- F. The overboard discharge indicator is located on the bottom surface of the nose skin below the oxygen bottle. A low pressure (60 ± 20 psi) green disc is provided to prevent dust and contamination from entering the line. The indicator line is connected to the high pressure rupture fitting of the regulator. A disc disappearance in the indicator, indicates oxygen cylinder overpressure existed and oxygen was routed overboard.
- G. The oxygen pressure gage is located on the right-hand side of the instrument panel. The gage is electrically illuminated and the range markings are: yellow arc 0-300, green arc 1550 to 1850, and red line 2000 psi.

Troubleshooting

NOTE: Before attempting maintenance, personnel should adhere to General Maintenance Precautions and procedures described in Maintenance Practices.

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following listed item.

Name	Number	Manufacturer	Use
Sherlock Leak Detector	Type CG (MIL-L-25567A, Type 1)	Zep Aero Corp. El Segundo, Calif.	For leak test fluid.

2. Troubleshooting Oxygen System.

- A. For a guide to troubleshooting the oxygen system, see Figure 2.

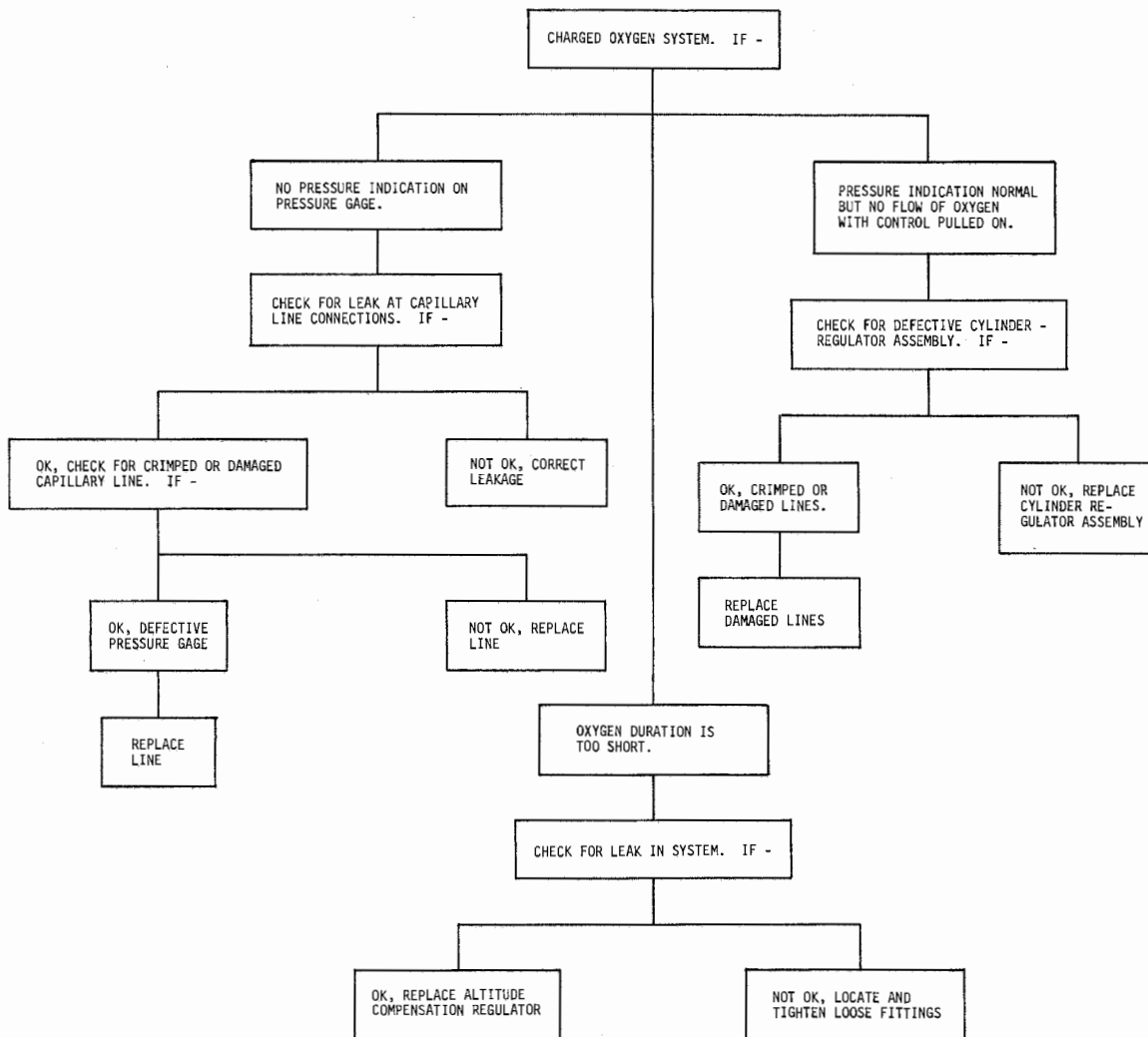
Maintenance Practices

1. General Maintenance Precautions.

- A. Before any maintenance is performed on the oxygen system, personnel should read and thoroughly understand the following. Careful adherence to these instructions will aid in maintaining a trouble-free system.

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Troubleshooting Chart - Oxygen System
Figure 2

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- B. If maintenance on the aircraft oxygen system or on any other system in the aircraft is performed, requiring removal of an oxygen system component, strict adherence to the following procedures and precautions is required.

WARNING: DO NOT PERMIT SMOKING OR OPEN FLAME NEAR AIRCRAFT WHILE MAINTENANCE IS BEING PERFORMED ON THE OXYGEN SYSTEM. ASSURE ALL ELECTRICAL POWER IS DISCONNECTED AND THAT THE AIRCRAFT IS PROPERLY GROUNDED. IN ADDITION, OILS, GREASE, AND SOLVENTS MAY BURN OR EXPLODE SPONTANEOUSLY WHEN CONTACTED BY OXYGEN UNDER PRESSURE.

- (1) Use extreme caution to assure every port on the system is kept thoroughly clean and free of water, oil, grease, and solvent contamination.
- (2) Cap all openings immediately upon removal of any component. Do not use tape or caps which will induce moisture.
- (3) Lines and fittings shall be clean and dry. One of the following methods may be used to clean lines.
 - (a) A vapor degreasing solution of stabilized trichorethylene conforming to Specification MIL-T-7003, followed by blowing tubing clean and dry with a jet of nitrogen gas (BB-N411) Type 1, Class 1, Grade A or Technical Argon (MIL-A-18455).

CAUTION: MOST AIR COMPRESSORS ARE OIL LUBRICATED, AND A MINIMUM AMOUNT OF OIL MAY BE CARRIED BY THE AIR STREAM. A WATER LUBRICATED COMPRESSOR SHOULD BE USED TO BLOW TUBING CLEAN ONLY WHEN NITROGEN OR ARGON ARE NOT AVAILABLE. THE AIR MUST BE CLEAN, DRY AND FILTERED.

- (b) Flush with naphtha conforming to Specification TT-N-95, then blow clean and dry with clean, dry, filtered air. Flush with anti-icing fluid conforming to MIL-F-5566 or anhydrous ethyl alcohol. Rinse thoroughly with fresh water and dry with a jet of nitrogen gas (BB-N-411) Type 1, Class 1, Grade A or Technical Argon (MIL-A-18455).
 - (c) Flush with hot inhibited alkaline cleaner until free from oil and grease. Rinse with fresh water and dry with a jet of nitrogen gas (BB-N411) Type 1, Class 1, Grade A or Technical Argon (MIL-A-18455).

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NOTE: Cap all lines immediately after drying.

- (d) Fabrication of pressure lines is not recommended. Lines should be replaced from the factory by part number.
- (e) All compounds used on fittings must conform to MIL-T-5542. No compounds shall be used on aluminum alloy flared fittings. Compounds are used only on the first three threads of male fittings. No compound is used on coupling sleeves, or outside of the flares.
- (f) Maintenance personnel must assure that their hands are free of dirt or grease prior to installation of oxygen tubing or fittings.
- (g) All tools used for installation of oxygen tubes or fittings must be free of dirt, grease, or oils.

WARNING: USE NON-SPARKING TOOLS.

CAUTION: WITH OXYGEN BOTTLE CHARGED, DO NOT MOVE CONTROL TO THE ON POSITION WITH OUTLET PORTS (LOW PRESSURE) OPEN TO ATMOSPHERE. DAMAGE TO REGULATOR METERING POPPET MAY OCCUR.

CAUTION: WHENEVER A COMPONENT OF THE OXYGEN SYSTEM HAS BEEN REMOVED, RE-INSTALLED, REPLACED OR SYSTEM HAS BEEN DISASSEMBLED IN ANY WAY, THE OXYGEN SYSTEM MUST BE LEAK CHECKED AND PURGED.

- C. Inspection of the cylinder is required before charging. Do not attempt to charge the cylinder if any of the following conditions exists:
 - (1) Contaminated or corroded fitting on servicing cylinder or filler valve.
 - (2) Cylinder out of hydrostatic test date.
 - (3) Cylinder bears no D.O.T. designation.
 - (4) Cylinder completely empty after shutoff valve has been turned off for a length of time. Must be completely disassembled and inspected in an FAA approved facility before charging.
- D. To assist in cylinder identification, the following information is reflected on each oxygen cylinder.
 - (1) Cylinder specification followed by service pressure such as "ICC-3AA1800 or ICC-3HT1850" will be stamped on the shoulder or neck of each cylinder.

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NOTE: Effective January 1, 1970, all newly manufactured cylinders will be stamped "DOT" (Department of Transportation) in lieu of "ICC" (Interstate Commerce Commission).

- (2) Cylinder serial number will be stamped below or directly following the cylinder specification.
- (3) Hydrostatic test date will be stamped directly below the original manufacture date and shall include the month and year of the hydrostatic test date.

2. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following items.

Name	Number	Manufacturer	Use
Anti-seize compound	MIL-T-5542	Commercially available	To lubricate threads and fittings.
Trichlorethylene	MIL-T-7003	Commercially available	To clean oxygen lines.
Sherlock Leak Detector	Type CG (MIL-L-25567A Type 1)	Zap Aero Corp. El Segundo, Calif.	For leak test fluid.
Pressure Gage (0-100 PSIG)		Commercially available	To check oxygen flow pressure.

3. Servicing Oxygen System.

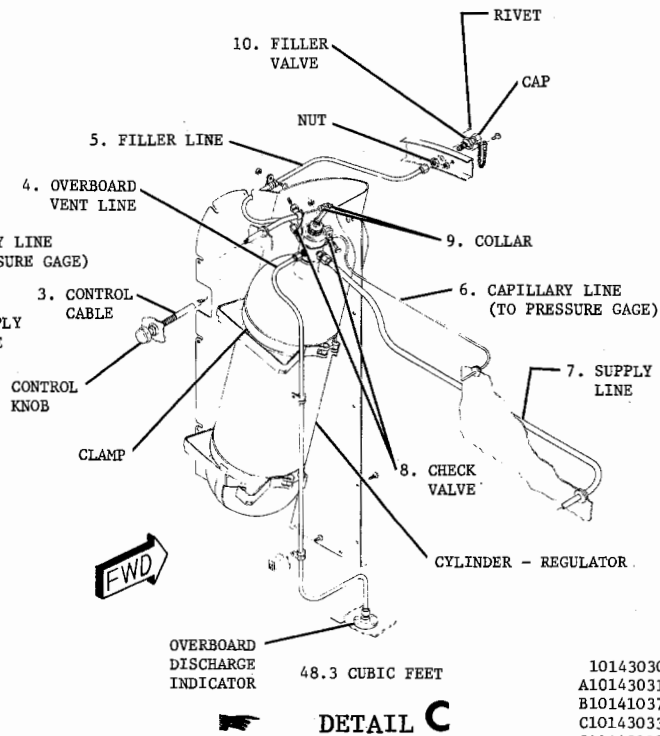
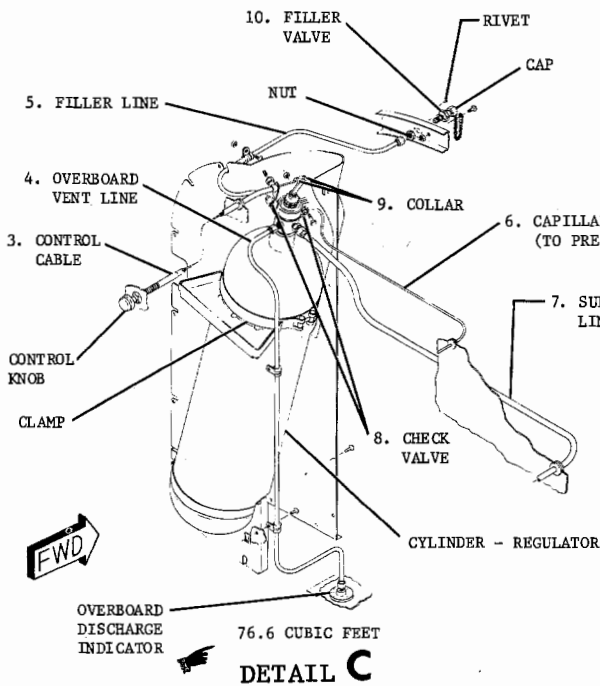
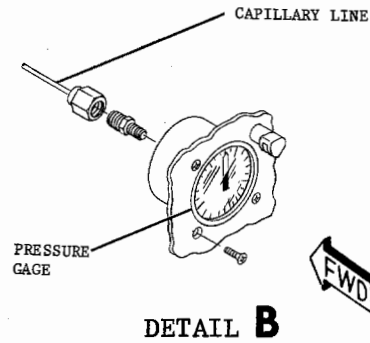
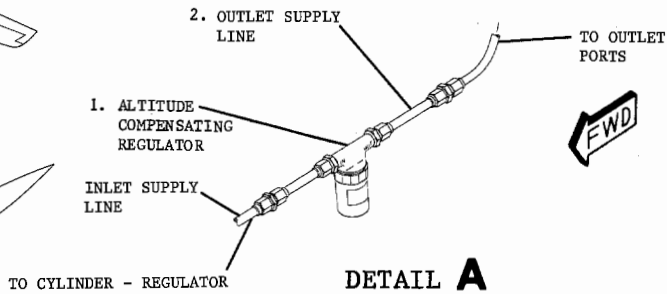
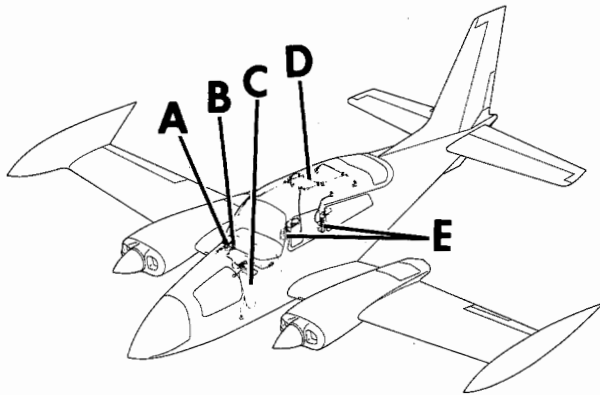
A. Charging System.

- (1) Refer to Chapter 2, for charging the oxygen system.

B. Discharge Oxygen System.

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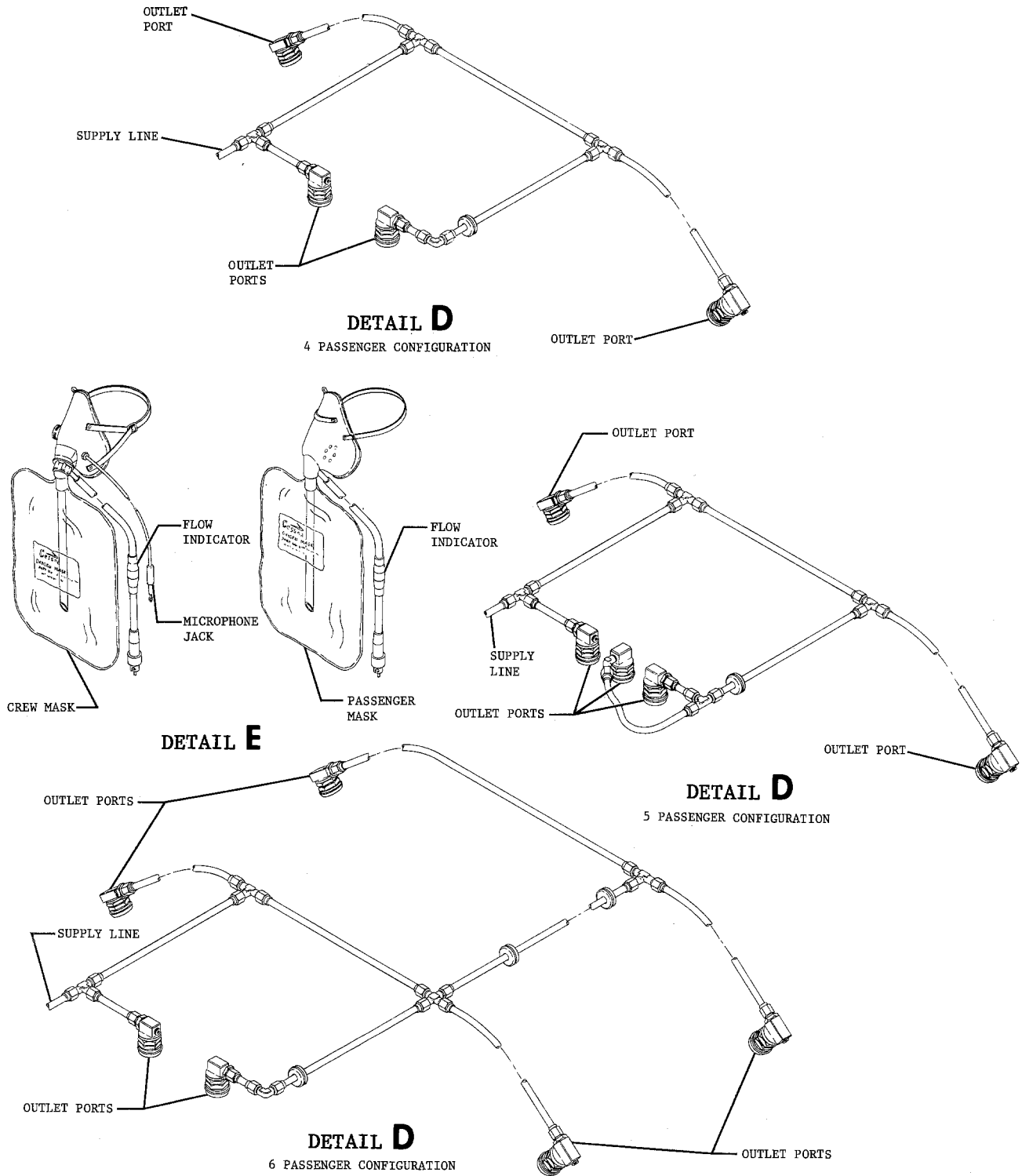


10143030
A10143031
B10141037
C10143033
C10143032

Oxygen System Installation
Figure 3 (Sheet 1 of 2)

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Oxygen System Installation
Figure 3 (Sheet 2)

D10143034
D10143035
D10143036
E10142022

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WARNING: THE DISCHARGING PROCEDURE SHOULD BE ACCOMPLISHED OUTDOORS. IF THE DISCHARGING IS DONE INDOORS, EXTREME CARE MUST BE EXERCISED TO PREVENT OXYGEN FLOW FROM OILS, GREASE, CONTAMINATES AND ELECTRICAL SPARKS. THE AREA SHOULD BE ROPED OFF AND NO SMOKING OR OPEN FLAME ALLOWED IN OR NEAR THE AREA.

NOTE: Discharging the oxygen system into the cabin area is not recommended.

- (1) Pull oxygen control knob to ON position.
- (2) Remove tubing from the mask end of one of the passengers oxygen masks and insert into oxygen outlet port. Route the hose outside the cabin and through the pilot's foul weather window.

C. Purge the Oxygen System.

- (1) Charge the oxygen system. Refer to Chapter 2.
- (2) Move aircraft outdoors if possible. If unable to move aircraft outdoors, make sure area is roped off, no smoking or open flame permitted in the area, no grease or lubricant near area, cabin door and pilot windows open.
- (3) Plug all masks into outlets and purge system by allowing the oxygen to flow for at least 10 minutes. Smell the oxygen flowing from the outlets and continue to purge until the oxygen is odorless. Refill cylinder as required during and after purging, refer to Chapter 2.

4. Removal/Installation Oxygen Cylinder - Regulator Assembly (See Figure 3).

A. Remove Oxygen Cylinder - Regulator Assembly.

- (1) Position control knob to OFF.

WARNING: THE OXYGEN CYLINDER-REGULATOR MAY BE REMOVED WITH THE CYLINDER CHARGED; HOWEVER, EXTREME CARE MUST BE TAKEN WHEN INSTALLING OR WORKING NEAR THE CYLINDER-REGULATOR TO PREVENT DAMAGING THE CYLINDER.

- (2) In the nose baggage compartment, remove screws and partition for access to cylinder-regulator assembly.
- (3) Disconnect lines (4, 5, 6 and 7) from cylinder-regulator and cap lines.

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CAUTION: DO NOT MOVE CONTROL TO ON POSITION WITH OUTLET PORTS (LOW PRESSURE) OPEN TO ATMOSPHERE. DAMAGE TO REGULATOR METERING POPPET MAY OCCUR.

- (4) Disconnect control cable (3) from cylinder-regulator.
- (5) Loosen clamps, securing cylinder-regulator and remove cylinder-regulator.

B. Install Oxygen Cylinder-Regulator.

- (1) Position cylinder-regulator and secure with clamps.
- (2) Remove caps and connect lines (4, 5, 6 and 7) to cylinder-regulator.
- (3) Connect control cable (3) to cylinder-regulator.
- (4) Install partition and secure with screws.

5. Removal/Installation Altitude Compensating Regulator (See Figure 3).

A. Remove Altitude Compensating Regulator.

- (1) Move oxygen control knob to OFF position.
- (2) Disconnect inlet and outlet lines from altitude compensating regulator (1). Cap all openings.

NOTE: Repair or maintenance of the compensating regulator is not recommended. If malfunction should occur, replace unit.

B. Install Altitude Compensating Regulator.

- (1) Remove protective caps and plugs from altitude compensating regulator (1) and oxygen lines.
- (2) Connect inlet and outlet lines to altitude compensating regulator (1).

6. Removal/Installation Oxygen Pressure Gage and Capillary Line (See Figure 3).

A. Remove Oxygen Pressure Gage and Capillary Line.

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NOTE: The oxygen pressure gage may be removed without discharging the oxygen system. A check valve is installed in the pressure gage outlet of the regulator to shutoff the flow of oxygen from the cylinder when the capillary line is disconnected at the oxygen cylinder-regulator.

- (1) Remove partition for access to oxygen cylinder.
- (2) Disconnect capillary line (6) at cylinder-regulator. The check valve should close as the line is loosened.

CAUTION: IF OXYGEN CONTINUES TO FLOW WHEN CAPILLARY LINE IS LOOSENED, RETIGHTEN LINE AND DISCHARGE SYSTEM IN ACCORDANCE WITH DISCHARGING PROCEDURES. REPLACE CHECK VALVE.

- (3) Disconnect capillary line (6) at pressure gage and route line from aircraft.
- (4) Check valve may be removed from cylinder-regulator if desired or if faulty by screwing valve from regulator.
- (5) Remove light assembly, refer to Chapter 13. Remove screws from oxygen gage and remove gage.

B. Install Oxygen Pressure Gage and Capillary Line.

- (1) Install oxygen gage with screws and light assembly.
- (2) If removed, install check valve in regulator.
- (3) Route capillary line (6) into place and connect line to oxygen gage.
- (4) Connect capillary line (6) to check valve and install partition.
- (5) If system pressure was depleted purge oxygen system and service system.

7. Removal/Installation Oxygen Filler Valve (See Figure 3).

A. Remove Oxygen Filler Valve.

NOTE: The oxygen filler valve may be removed without discharging the oxygen system. A check valve is installed in the high pressure side of the oxygen regulator to shut off the flow of oxygen from the cylinder.

- (1) Disconnect filler valve line (5) from filler valve (10).

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CAUTION: IF OXYGEN CONTINUES TO FLOW WHEN LINE IS LOOSENED, RECONNECT THE LINE AND DISCHARGE SYSTEM IN ACCORDANCE WITH DISCHARGING PROCEDURES. REPLACE CHECK VALVE.

- (2) Remove filler valve (10) protective cap and remove retaining nut.
- (3) Remove filler valve (10) from bulkhead by removing attaching rivets.
- (4) Check valve may be removed if desired or if faulty by disconnecting filler line (5) from check valve, then removing check valve from regulator.

B. Install Oxygen Filler Valve.

- (1) If removed, ascertain that check valve is installed and filler line is connected.
- (2) Attach filler valve (10) to structure with attaching rivets and retaining nut.
- (3) Connect filler line to filler valve (10).
- (4) Install protective cap.

8. Adjustment/Test Oxygen System.

A. Leak Test Oxygen System.

- (1) Charge the oxygen system. Refer to Chapter 2.
- (2) Allow thirty minutes for cylinder pressure to stabilize between 1750 and 1800 PSIG, indicated on pressure gage.
- (3) Record the cylinder pressure and ambient temperature.
- (4) After 24 hours, record cylinder pressure and ambient temperature. Maximum allowable pressure drop is 50 PSIG (correcting for temperature change, using formula of $+1^{\circ} = +3.4$ PSIG).
- (5) If the pressure drop derived from the formula in the preceeding step exceeds 50 PSIG, test the oxygen system for leakage by applying detector fluid type CG-1 or equivalent to all fittings and connections and observe for formation of bubbles.
- (6) Remove all traces of solution and repair or replace leaky fittings and repeat the preceeding procedures.

B. Functional Test Oxygen System.

NOTE: Whenever the oxygen system regulator (cylinder-regulator assembly) has been replaced or overhauled, perform a flow test to determine that system functions properly.

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- (1) Fully charge the oxygen system. Refer to Chapter 2.
- (2) Install an oxygen outlet adapter (P/N C166005-0506) into a pressure gage (calibrated in one pound increments from 0 to 100 PSIG) and insert adapter into pilot's oxygen outlet.
- (3) Pull oxygen control to ON position.
- (4) Insert adapters or mask line assemblies into all remaining outlets. With oxygen flowing from all outlets, the pressure should then conform to schedule below.

<u>Altitude Above Sea Level</u>	<u>Gage Pressure</u>
Sea Level	7.30 ± 2.5
1,330	8.00 ± 2.5
2,000	8.34 ± 2.5
3,000	8.83 ± 2.5
4,000	9.31 ± 2.5
5,000	9.77 ± 2.5
6,000	10.22 ± 2.5
8,000	11.08 ± 2.5
10,000	11.89 ± 2.5
14,000	17.57 ± 2.5
17,000	21.55 ± 2.5
20,000	24.45 ± 2.5

NOTE: If pressure at given altitude is different than shown above, check oxygen pressure on inlet to altitude compensating regulator; it should be 70 ± 10 PSIG.

- (5) If pressure cannot be obtained in the schedule and pressure is 70 ± 10 PSIG at line to inlet port of compensating regulator; replace compensating regulator. If pressure (70 ± 10 PSIG) cannot be obtained at compensating regulator; replace cylinder-regulator. Repeat test procedures.
- (6) Position control to OFF and return all masks to mask case.
- (7) Recharge oxygen system as required. Refer to Chapter 2.

C. Hydrostatic Test Oxygen System Cylinder.

- (1) Standard weight (ICC or DOT-3AA 1800) cylinder must be hydrostatically tested to 5/3 their working pressure every five years starting with the date of the last hydrostatic test.

NOTE: These test requirements are established by the Interstate Commerce Commission Code of Federal Regulations, Title 49, Chapter 1, Paragraph 173.34.

- (2) Standard weight (ICC or DOT-3AA 1800) cylinders have no life limitations and may be used until they fail hydrostatic testing.
- (3) Light weight (ICC or DOT-3HT 1850) cylinders must be hydrostatically tested to 5/3 their working pressure every three years starting with the date of the last hydrostatic test.
- (4) Light weight (ICC or DOT-3HT 1850) cylinders must be retired from service after fifteen years or 4,380 filling cycles after date of manufacture, whichever occurs first.

9. Inspection/Check Oxygen System.

A. Inspect Oxygen System Components.

- (1) A careful visual inspection of the oxygen cylinder should be performed during routine maintenance and periodic inspections. If any bad dents, scratches or areas of corrosion are found, the cylinders must be checked per the Inspection Criteria for Acceptance of Oxygen Cylinder, Figure 4.

NOTE: If the acceptability of the cylinder is questionable after using inspection criteria, do not hesitate to return cylinder to manufacturer.

- (2) Regulator shall be removed and overhauled by manufacturer or an FAA approved facility during hydrostatic testing.
- (3) The pressure gage shall be checked for accuracy and cleaned by the manufacturer every three years or 3000 flight hours, whichever occurs first.
- (4) Individual outlets shall be disassembled and inspected, and the sealing core, and/or all rubber parts replaced, regardless of condition every 3 years or 3000 flight hours, whichever occurs first.
- (5) High pressure lines should be inspected for scratches, dents, cracks, deep gouges if a leak is indicated. Lines should be tested to not less than 3000 PSIG if trouble is indicated.

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Cylinder Classification

Discrepancies	ICC-3AA 1800			ICC-3HT 1850		
Isolated pitting or corrosion (Depth)	.020	2	3	.010	2	3
Local pitting or corrosion or line corrosion (Depth)	.010	3	4	.005	3	4
General corrosion	Not allowed	5		Not allowed	5	
Cuts, Digs, Gouges (Depth)	.010	6		.005	6	
Dents (Depth)	.062	7		.031	7	
Fire damage	Not allowed	8		Not allowed	8	
Bulges	Not allowed	9		Not allowed	9	

- 2 Isolated pits of small cross section involving loss of wall thickness by corrosive media. Small isolated pits with a maximum depth as shown are acceptable.
- 3 If depth exceeds figure shown, cylinder must be returned to the manufacturer for disposition.
- 4 Local pitting or corrosion or line corrosion involving loss of wall thickness by corrosive media with a pattern of pits which are connected to others in a band or line. A small area with a minimum depth as shown is acceptable. Areas extending beyond 3 inches in diameter or 4 inches long shall be considered general corrosion.
- 5 General corrosion (sometimes accompanied by pitting) involving loss of wall thickness by corrosive media covering a considerable area. Cylinder must be returned to the manufacturer for hydrostatic testing.
- 6 Deformations caused by contact with a sharp object cutting or upsetting the material of the cylinder, decreasing the wall thickness. Maximum defect permissible without corrective action. If this depth is exceeded, the cylinder must be returned to the manufacturer for removal of defects and verification of cylinder strength by hydrostatic testing.
- 7 Deformations caused by contact with blunt objects in such manner that the thickness of the metal is not impaired. The major diameter of the dent must be equal to or greater than 32 times the depth of the dent. Sharper dents (or deeper dents) than this are considered too abrupt and must be returned to the cylinder manufacturer for disposition.
- 8 Fire damage is indicated by charring or burning or sintering of the metal, charring or burning of the paint, distortion of the cylinder, functioned safety relief devices, melting of valve parts, etc. Cylinders must be returned to the cylinder manufacturer for disposition.
- 9 Bulged cylinders are not acceptable. Cylinders must be returned to the cylinder manufacturer for disposition.

NOTE: The above data may be used to determine that oxygen cylinders are acceptable for service. This criteria should be used prior to charging cylinders.

Inspection Criteria for Acceptance of Oxygen Cylinder Figure 4

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WARNING: WHENEVER COMPONENTS HAVE BEEN REMOVED AND REPLACED OR OXYGEN SYSTEM HAS BEEN ALLOWED TO DEplete TO BELOW 50 PSIG, THE SYSTEM MUST BE PURGED IN ACCORDANCE WITH PURGING PROCEDURES BEFORE CHARGING THE SYSTEM.

10. Cleaning Oxygen System Components

A. Cleaning Filler Valve.

- (1) The filler valve should be cleaned with trichloroethylene MIL-T-7003.
- (2) Clean Freon MIL-C-8638 or alcohol may be used as an alternate.

B. Cleaning Regulator and Cylinder.

- (1) Clean regulator and cylinder with a clean cloth.

C. Cleaning Oxygen Masks and Hoses.

- (1) Clean the mask and hoses with a mild solution of soap and water. Rinse thoroughly with clean water and allow to dry.

NOTE: Ensure all soap is removed by rinsing. Masks may be disinfected with a hospital type antiseptic spray or Zep Aero SBT-12.

CAUTION: REMOVE MICROPHONE FROM PILOT'S MASK BEFORE CLEANING.

CESSNA AIRCRAFT COMPANY

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CHAPTER

7

ENGINE

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ENGINEDescription

1. The 310 and Turbo 310 Aircraft incorporate two continental six-cylinder horizontally- opposed engines. The Detailed Engine Specifications lists the Specifications for both the IO-520M and TSIO520-B engines. Where there is a specific difference reference will be made to individual engines.
2. Each engine is equipped with magnetos, spark plugs, ignition harness, oil pump, oil cooler, fuel pump, fuel distribution lines, starter and alternator.
3. Detail Engine Specifications (IO-520-M and TSIO-520-B)

Propeller Drive Ratio	Direct
Propeller Shaft Rotation (Looking Forward)	Clockwise
Bore, Inches	5.25
Stroke, Inches	4.00
Displacement, Cubic Inches	520
Compression Ratio	7.5:1
Oil SAE Number Above 40°F	SAE #50
Below 40°F	SAE #30
Oil Sump Capacity (Without Filter)	12 Qts
Fuel, Aviation Grade, Octane (Minimum) (Low Lead Fuels are Approved for Use)	100/130
Fuel System	Continental Fuel Injection
Fuel Injector	Continental Fuel Injection
Magneto Drive, Ratio to Crankshaft	1.5:1
Magnetos Rotation	Counterclockwise*
Tachometer Drive, Ratio to Crankshaft	5:1
Rotation	Counterclockwise*
Starter Drive, Ratio to Crankshaft	48:1
Rotation	Counterclockwise*

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Alternator, Ratio to Crankshaft	3:1
Rotation	Clockwise*
Vacuum-Pressure Pump Drive, Ratio to Crankshaft	1.5:1
Rotation	Clockwise*
Propeller Governor Drive, Ratio to Crankshaft	1:1
Rotation	Clockwise*
Spark Plug Type, Champion	RHB-32E
AC	AC-273
Spark Occurs (Degrees BTC) Both MAGS	22°
Spark Plug Gap	0.016-0.018
Firing Order	1-6-3-2-5-4
Oil Pressure (Lbs. Per Sq. Inch)	
Normal	30 To 60
Maximum	100
Idling (Minimum)	10
Oil Temperature (Degrees F°)	
Normal	170°
Max	240°
Cylinder Head Temperature (Degrees F°)	
Maximum	460°
Cruise	380°
Minimum (Takeoff)	200°
Standard Engine Dry Weights (Lbs)	
With Turbocharger Accessories (Approximately)	477.50
Without Turbocharger Accessories (Approximately)	434.5

*Direction of Rotation Facing Engine Drive Pad.

Troubleshooting

1. Troubleshooting Engine Operation.

A. For troubleshooting engine operation, see Figure 1.

Maintenance Practices

1. Tools and Equipment

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Name	Number	Manufacturer	Use
Hoist	4180350	Cessna Aircraft Co.	Engine Removal
Maintenance Stand		Fabricate Locally	Engine Build Up and/or Maintenance
Engine Mount Wrench	SE608	Cessna Aircraft Co.	Crimping Lock-washer
Multimeter		Commercially Available	Checking Electrical bonds and electrical circuits

2. Removal/Installation Engine (See Figure 2).

CAUTION: PLACE A SUITABLE PADDED SUPPORT UNDER FUSELAGE BULKHEAD AT APPROXIMATELY F.S. 132.00 TO PREVENT AIRCRAFT FROM TIPPING BACKWARDS.

NOTE: If engine is being removed to be placed in storage, proper preparatory steps as outlined in Chapter 1 "Extended Storage" must be observed. In addition to the above mentioned procedures, cover all engine and accessory vents and other openings, including the crankcase breather, with other vapor-proof material.

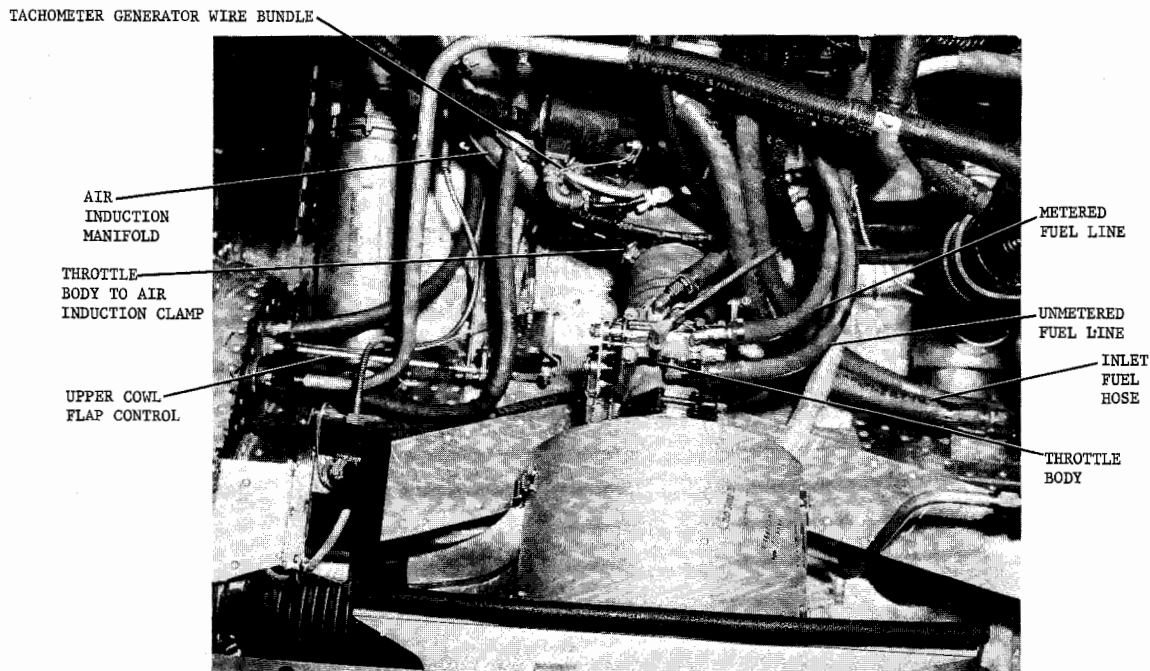
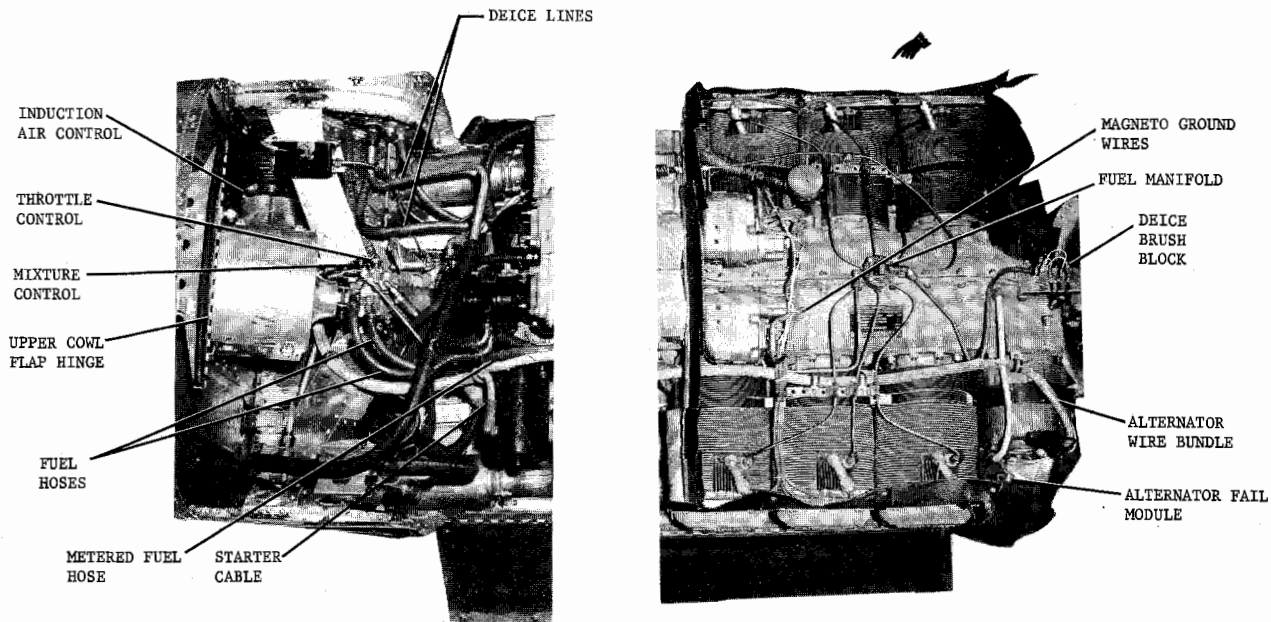
A. Remove Engine.

- (1) Turn off all cockpit switches and fuel selector valves OFF.
- (2) Open the battery circuit by disconnecting the battery ground cable.
- (3) Remove engine cowl and upper cowl flap in accordance with removal procedures.
- (4) Disconnect magneto ground wires at the magnetos and withdraw them aft through the right rear engine baffle.

WARNING: THESE MAGNETOS DO NOT HAVE INTERNAL GROUNDING SPRINGS. GROUND THE MAGNETOS TO THE CRANKCASE TO PREVENT ACCIDENTAL FIRING.

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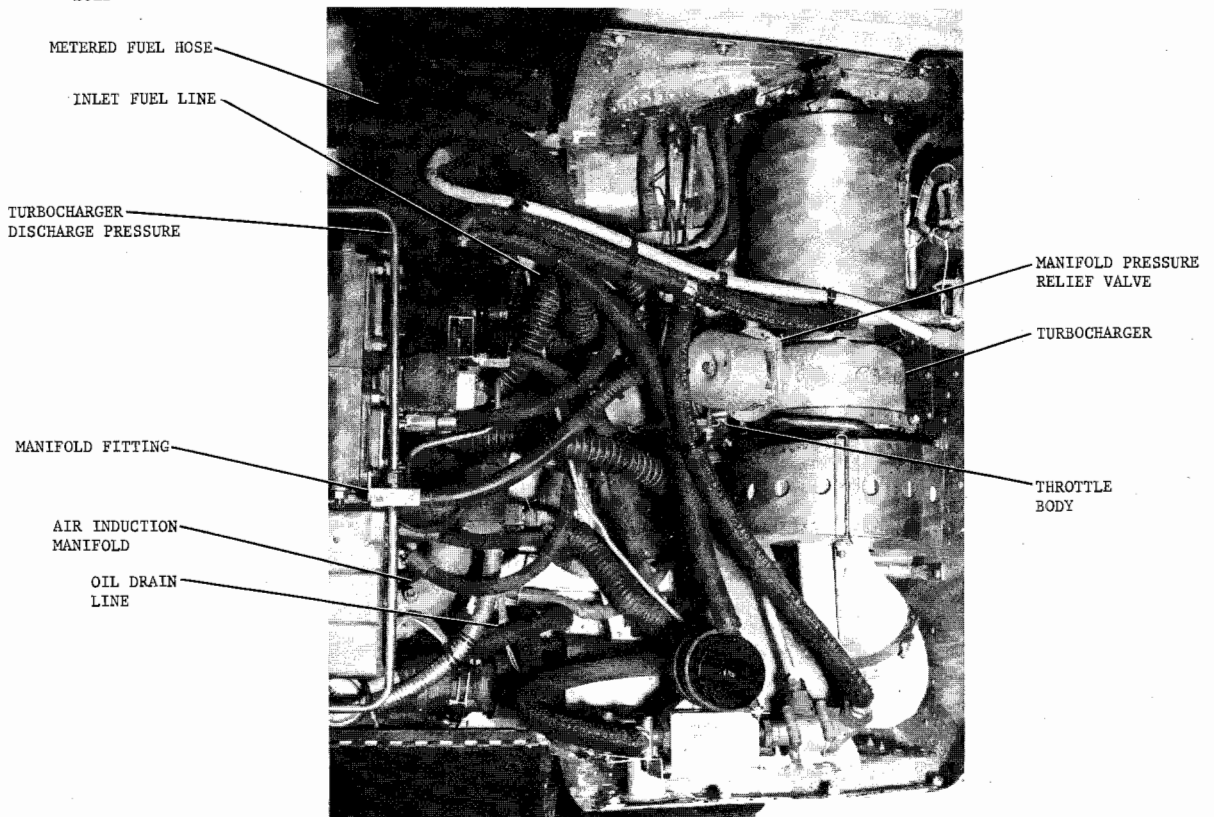
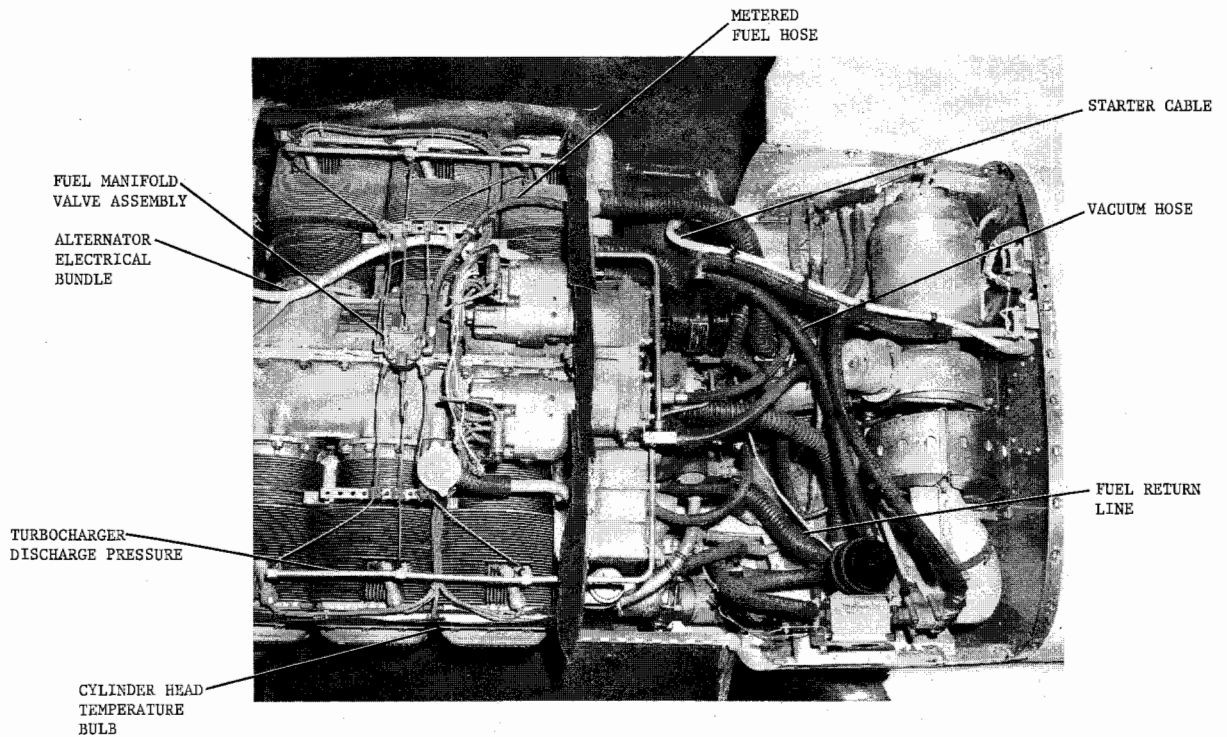
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STANDARD 310

Engine Installation
Figure 2 (Sheet 1 of 2)

1050P6004
1050P6012
1050P6003



TURBO 310

1050P6005
1050P6006

Engine Installation
Figure 2 (Sheet 2)

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- (5) Drain the oil in accordance with Chapter 2. Replace the drain plug.
- (6) Remove the propeller in accordance with Chapter 8.
- (7) Disconnect the engine controls as follows:
 - (a) Disconnect the induction air control, mixture control, and throttle control.
 - (b) Disconnect the propeller control at the governor. Remove the propeller control bracket from the intake manifold by loosening the bracket clamps.
- (8) If installed, remove propeller unfeathering system hose at governor.

CAUTION: THE PROPELLER UNFEATHERING ACCUMULATOR IS NORMALLY PRESSURIZED. RELEASE PRESSURE BEFORE ATTEMPTING TO DISCONNECT HOSE FROM GOVERNOR. REFER TO CHAPTER 8.

- (9) Disconnect wires and cables as follows:
 - (a) Disconnect oil temperature electrical connector located directly below the oil cooler. Disconnect the oil temperature ground wire.
 - (b) Disconnect tachometer generator electrical cable.
 - (c) Disconnect Starter Cable.
 - (d) Remove the cylinder head temperature bulb.
 - (e) Disconnect alternator cables and cable shielding ground.
 - (f) Disconnect fuel pressure switch and tag wires.
 - (g) Disconnect wiring at radio noise filter.
 - (h) Remove all clamps attaching wires or cables to the engine. Pull all wires and cables aft to clear the engine assembly.
- (10) Remove engine ground strap from engine mount assembly by removing existing bolt.
- (11) Disconnect lines and hoses as follows:
 - (a) Separate crankcase breather line at hose connector just aft of right rear engine baffle.
 - (b) Disconnect vacuum line from vacuum pump.
 - (c) Disconnect fuel vapor return line from the outboard rib.
 - (d) Disconnect the fuel pressure gage line from the right rear engine baffle.
 - (e) Disconnect the manifold pressure hose from the intake tube at the right rear of the engine.
 - (f) Disconnect oil pressure hose at the inboard nacelle rib and remove the clamp which fastens it to the canted bulkhead. Pull the hose free of the canted bulkhead.

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- (g) Disconnect fuel pump supply line at the fuel pump.

WARNING: FUEL AND OIL DRAINING FROM LINES AND HOSES IS A FIRE HAZARD. PREVENT FUEL AND OIL ACCUMULATION IN NACELLE.

- (h) Disconnect the two manifold drain hoses from rear intake elbows.
- (12) Disconnect exhaust stacks from each cylinder by removing attaching nuts.
- (13) Disconnect Turbocharger inlet duct on (Turbo 310 ONLY).
- (14) Attach a hoist to the lifting eye at the top center of the engine crankcase. Lift the engine just enough to relieve its weight from the engine mount.

CAUTION: PLACE STAND UNDER THE AIRCRAFT TAIL-CONE BUMPER BEFORE REMOVING THE ENGINE. REMOVAL OF ENGINE MAY ALLOW AIRCRAFT TO TIP BACKWARDS.

- (15) Remove engine as follows:
- (a) Remove bolts from engine mounts.
- (b) Hoist engine out of nacelle and clear of the aircraft.

CAUTION: HOIST ENGINE SLOWLY AND MAKE CERTAIN ALL WIRES, LINES, AND HOSES HAVE BEEN DISCONNECTED.

- (c) See Figure 3. Remove upper and lower engine mount (1) and (3) and spacers (2) from engine mount bracket.

B. Disassemble Engine.

NOTE: The disassembly procedure is the same for either engine and is intended to cover only those items which could normally be expected to require removal or are not noted by Continental Motor Corporation "Engine Overhaul" manual for the specified engine.

- (1) Hoist engine assembly to a convenient working height or place on engine maintenance stand.
- (2) Clean engine assembly in accordance with engine manufacturers manual.

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CAUTION: CARE SHOULD BE GIVEN TO ELECTRICAL COMPONENTS BEFORE CLEANING. SOLVENTS SHOULD NOT BE ALLOWED TO ENTER MAGNETOS, STARTERS, ALTERNATORS OR ANY LUBRICATED CONTROLS. THESE ITEMS MUST BE PROTECTED WITH COVER BEFORE SATURATING THE ENGINE WITH SOLVENT. ANY OIL, FUEL, OR AIR OPENINGS ON THE ENGINE ACCESSORIES SHOULD BE COVERED BEFORE WASHING DOWN THE ENGINE WITH SOLVENT. CAUSTIC CLEANING SOLUTIONS SHOULD BE USED CAUTIOUSLY AND SHOULD ALWAYS BE PROPERLY NEUTRALIZED AFTER THEIR USE.

NOTE: As each item is removed from the engine, place a temporary cover over the hole left by the removal of the item. This procedure will prevent addicental entry of foreign material that could cause engine damage or serious malfunction.

- (3) Remove propeller deice brush block assembly by removing engine crankcase through bolts securing brush block bracket.
- (4) Remove oil separator (Turbo 310) by removing clamps.
- (5) Remove vacuum pump by removing nuts and washers.
- (6) Remove tachometer generator by removing four nuts and washers, securing tachometer generator to accessory case, disconnecting electrical connector and lifting tachometer generator free of drive adapter.
- (7) Disconnect (optional) propeller unfeathering line and remove four nuts and washers securing governor to engine and remove governor. Cap fittings and lines.
- (8) Remove engine baffles in accordance with removal procedures.
- (9) Remove all other fittings, hoses, lines, and attaching parts necessary to facilitate maintenance of engine.

C. Assemble Engine.

- (1) Remove temporary protective covers and caps.
- (2) Install all fittings, hoses, lines and attaching parts that were removed to facilitate disassembly.
- (3) Install engine baffles in accordance with installation procedures.
- (4) Install (optional) propeller unfeathering line to governor and install governor to engine.
- (5) Remove cover plates and install tachometer generator. Align drive adapter to tachometer shaft, to assist installation.

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- (6) Connect electrical connector to tachometer generator.
- (7) Install vacuum pump to engine accessory case and connect lines at pump if removed from nacelle.
- (8) Install oil separator (Turbo 310).
- (9) Install (optional) propeller deice brush block assembly.

NOTE: Make sure all nuts and bolts are torqued and safetied.

D. Install Engine.

- (1) Attach a hoist to the lifting eye at the top center of the engine crankcase and hoist engine a sufficient height just above the nacelle.

NOTE: The installation procedure is the same for either engine. Although there is some difference in the routing of wire bundles, lines, hoses and conduit, the following procedures are typical for either engine.

- (2) Install engine mounts: (See Figure 3).
 - (a) Position upper mount (1) on fitting assembly.
 - (b) Using a shop punch, or similar tool to assist in alignment, guide engine on upper mount (1) and fitting assembly.

NOTE: Align exhaust stack assemblies with engine studs as engine is being lowered on mounts.

- (c) Assemble lock washer, lower mount (3) and spacer on bolt (4). Position these items on fitting assembly and index lower mount (3) with roll pin.
 - (d) Torque bolt (4) to 300 + 50, - 0 inch-pounds.
 - (e) Safety bolt (4) by crimping the ears on lock-washer over the flat surfaces of the bolt head using engine mount wrench SE 608.
- (4) Connect oil separator drain line to oil separator.
- (5) Connect intake manifold hose to throttle body and secure with clamp.
- (6) Secure exhaust stacks to each cylinder with attaching washers and nuts.
- (7) On Turbo 310 connect drain line to intake manifold crossover tube.

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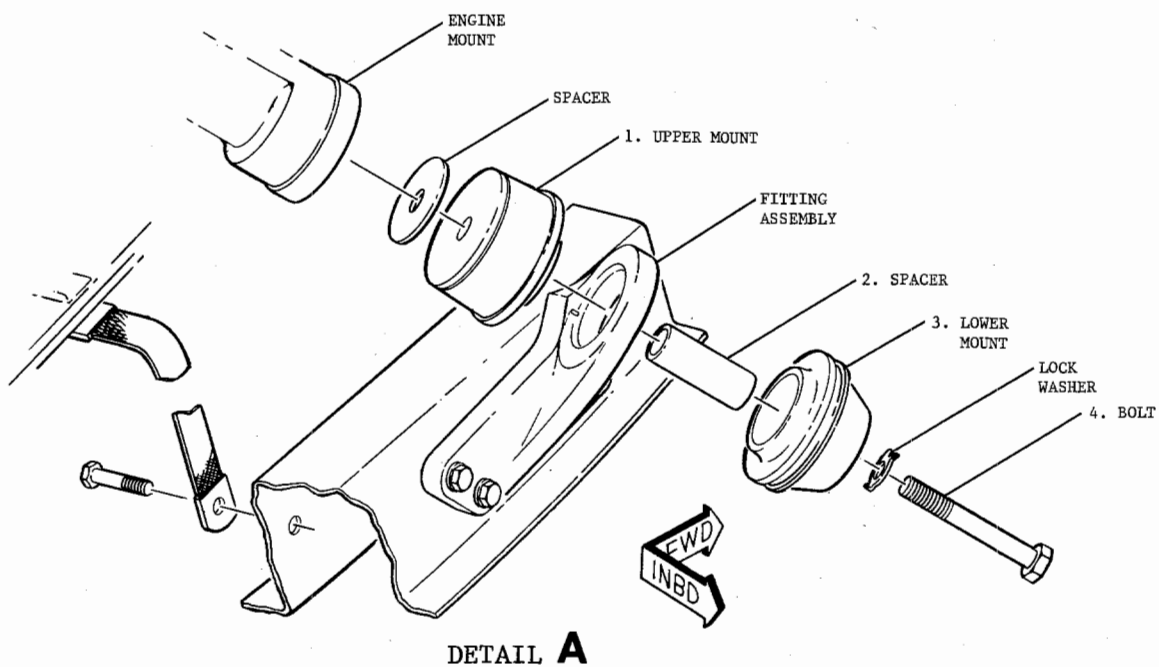
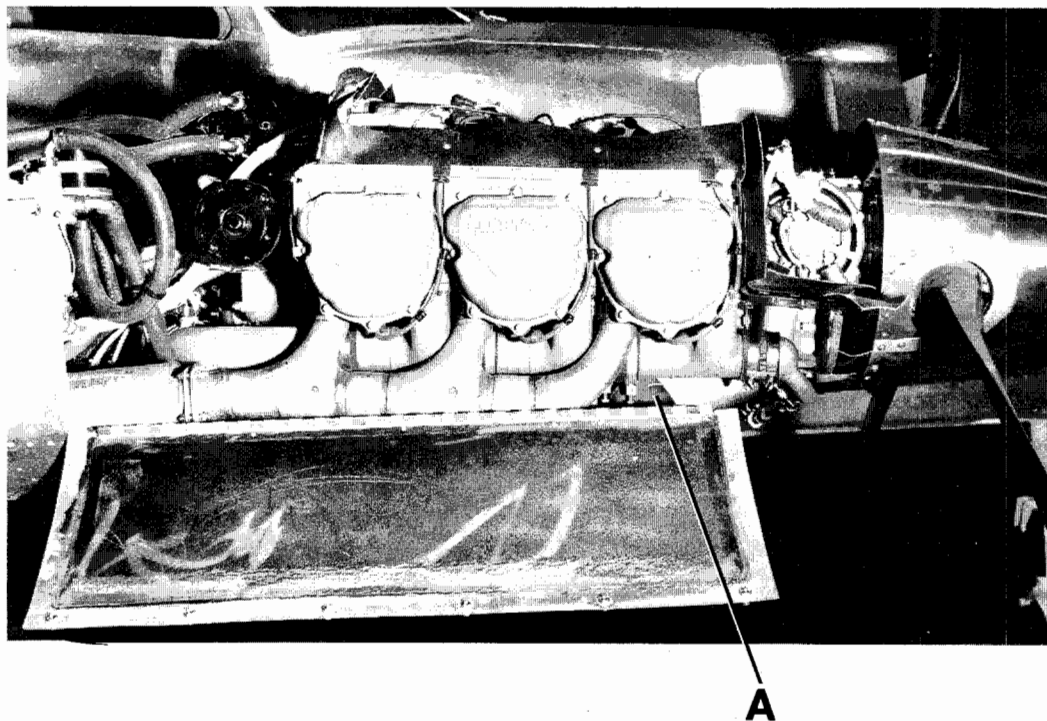
MAINTENANCE MANUAL

NOTE: Remove all protective covers, plugs, caps and identification tags, as each item is installed or connected.

- (8) Connect the following lines and hoses to the engine assembly.
 - (a) Oil return at the crankcase fitting.
 - (b) Turbocharger oil return hose to scavenger pump.
 - (c) Oil cooler hose from oil cooler.
 - (d) Route metered fuel hose through baffle and connect to manifold valve assembly.
 - (e) Shroud housing metered fuel hose to baffle and securing with clamps.
 - (f) Line and hose assemblies to fuel pump. Slide shrouds over hoses and connect.
 - (g) Aft air intake manifold drain hose to intake manifold fitting.
 - (h) Air intake manifold pressure hose to manifold fitting.
 - (i) Fuel pressure hose to baffle fitting.
- (9) (See Figure 1, 7-50.) Position and secure propeller control mounting bracket to engine intake manifold with clamps.
- (10) Connect propeller control rod end to the governor with attaching bolt, spacers and nuts.
- (11) (See Chapter 8.) Install propeller in accordance with Installation procedures.
- (12) Connect engine ground strap to engine beam assembly with existing bolt.

NOTE: Use multimeter to assure proper bond between engine and aircraft structure. Resistance should be 0.00 ohms.

- (13) Connect engine wire bundle to the following components and remove tags.
 - (a) Cylinder head temperature bulb to adapter in Number three cylinder of right engine and number two cylinder of the left engine.
 - (b) Oil temperature bulb (located on lower oil cooler).
 - (c) Tachometer.
 - (d) Starter.
 - (e) Propeller deice brush holder assembly.
 - (f) Alternator.
 - (g) Magnetos.
- (15) Connect Starter Cable to starter.
- (16) Rig engine controls in accordance with rigging procedures.
- (17) Make a magneto switch ground-out and continuity check. Connect magneto ground wires to the magnetos.



Engine Mount Installation
Figure 3

1050P6009
A10511003

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- (18) Service the engine with oil in accordance with Servicing Procedures, Chapter 2.
- (19) Close battery circuit by connecting the battery ground cable.
- (20) Install upper cowl flap and connect linkage.
- (21) Install engine cowlings.
- (22) Perform an engine operational check.

Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Tool Pressure Ratio Controller	5090002-1	Cessna Aircraft Co.	Controller Adjustment
Fuel Pressure Test Kit	SK320-2	Cessna Aircraft Co.	Fuel Pressure Adjustment
Cylinder Head Calibration Unit	SK182-43	Cessna Aircraft Co.	Calibrate Cylinder Head Temperature

2. Engine Operation Check.

CAUTION: GROUND OPERATION TIME SHOULD BE HELD TO A MINIMUM TO PREVENT OVERHEATING THE ENGINE. AT NO TIME SHOULD THE ENGINE TEMPERATURES BE ALLOWED TO EXCEED THEIR MAXIMUM LIMITS. DO NOT OPERATE THE ENGINE WITH COWLING REMOVED.

- A. Park aircraft with nose headed into prevailing wind and clear area directly in front and to the rear of all objects that may be affected by the propeller and propeller slipstream.

CAUTION: AVOID ENGINE RUN-UP WITH AIRCRAFT PARKED IN AN AREA WHERE THERE IS LOOSE GRAVEL. THE PROPELLER WILL PICK UP SMALL STONES WHICH CAN DAMAGE PROPELLER BLADES.

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- B. Install wheel chocks and position a fire extinguisher for easy access in the event of engine fire.
- C. Release parking brake, if previously set, and test-operate brakes. Take note of any sponginess or excessive pedal travel. Reset parking brake after completion of test.

CAUTION: IF PARKING BRAKE ACTION IS NOT NORMAL, DO NOT PERFORM ENGINE RUNUP UNTIL CORRECTIVE ACTION IS ACCOMPLISHED ON THE BRAKE SYSTEM.

- D. Refer to Owners Manual and perform "Before Starting Engines" and "Starting Engine" procedures.
- E. Warm-up Engines as Follows:

- (1) Throttles - 750 to 900 RPM.
- (2) Fuel Flow Gage - 12 to 35 lbs/hr.
- (3) Oil pressure 10 PSI minimum in 30 seconds in normal weather or 30 seconds in cold weather.
- (4) Vacuum System 5.00 + 0.25 In. Hg.
- (5) Cowl Flaps FULL OPEN.
- (6) After the engine has reached normal operating cylinder head temperature and oil temperature, perform magneto ground-out check as follows:
 - (a) Throttle engine back to idle RPM.
 - (b) Momentarily switch both magnetos to OFF.
RESULT: The tachometer will indicate a sudden RPM drop when magnetos cease firing.

CAUTION: IF MAGNETO SWITCHES ARE LEFT OFF FOR A PROLONGED PERIOD, AFTER-FIRING MAY OCCUR WHEN THEY ARE SWITCHED BACK ON. IF THE ENGINE CONTINUES TO RUN WITH SWITCHES TURNED OFF, STOP THE ENGINE BY PLACING MIXTURE CONTROL TO IDLE CUTOFF AND CHECK MAGNETO GROUNDING CIRCUIT.

- (7) Advance throttle to 1700 RPM and perform magneto check as follows:
 - (a) Place right magneto switch to OFF position and rate RPM drop. Return switch to ON position. Repeat check with left magneto switch.
RESULT: Engine speed should drop no more than a maximum differential between right and left magnetos of 50 RPM with no appreciable roughness.

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- (8) With engine at 1700 RPM, exercise the propeller as follows:
- (a) Retard the propeller pitch lever to obtain a 1200 RPM tachometer indication.
 - (b) Return the propeller pitch lever to HIGH RPM position.
- RESULT: During exercise, watch for any indication of sluggish or erratic operation.
- (9) Make a mixture control check at 100 RPM by slowly moving the mixture lever toward IDLE-CUTOFF.
- RESULT: When a slight drop in RPM is noted immediately return mixture lever to FULL RICH position.
- (10) Stop engine by placing the mixture lever in IDLE CUT-OFF. As soon as propeller has stopped turning, place ignition switches OFF. Turn all switches OFF.

CAUTION: IDLE ENGINES BEFORE SHUTTING DOWN TO ALLOW TURBINE BEARINGS TO COOL. A MINIMUM OF FIVE MINUTES IDLING SHOULD BE ALLOWED AFTER FULL POWER RUNUPS OR 2 TO 3 MINUTES ON RUNUPS OF 1500 TO 2000 RPM.

Inspection/Check

1. Engine Inspection/Check.

- A. Remove cowlings in accordance with removal procedures.
- B. Remove lower nacelle access covers.

Cleaning/Painting

A. Cleaning Engine.

- (1) Wash down the engine with Stoddard Solvent and dry with a jet of low pressure air.

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ENGINE COWLINGDescription

1. The engine nose cowling is a two piece fiberglass cowling secured to the lower section of the engine cowling and connected in the center of the nose cap.
2. The upper engine cowling is a one piece bonded honeycomb construction, with fasteners on the four sides of cowl.

Maintenance Practices

1. Removal/Installation Engine Cowl (See Figure 1)

- A. Remove Engine Cowl

NOTE: The Removal Procedures are the same for either engine.

- (1) Release fasteners retaining side doors to upper cowl assembly.
 - (2) Release fasteners retaining upper cowl assembly to engine nacelle structure and nose cap and remove upper cowl.
 - (3) Remove screws attaching lower portion of cowls to engine beam assembly.
 - (4) Release fasteners retaining nose cap assemblies to forward engine mount beam.
 - (5) Remove screws securing nose cap assemblies together and remove nose cap assemblies.

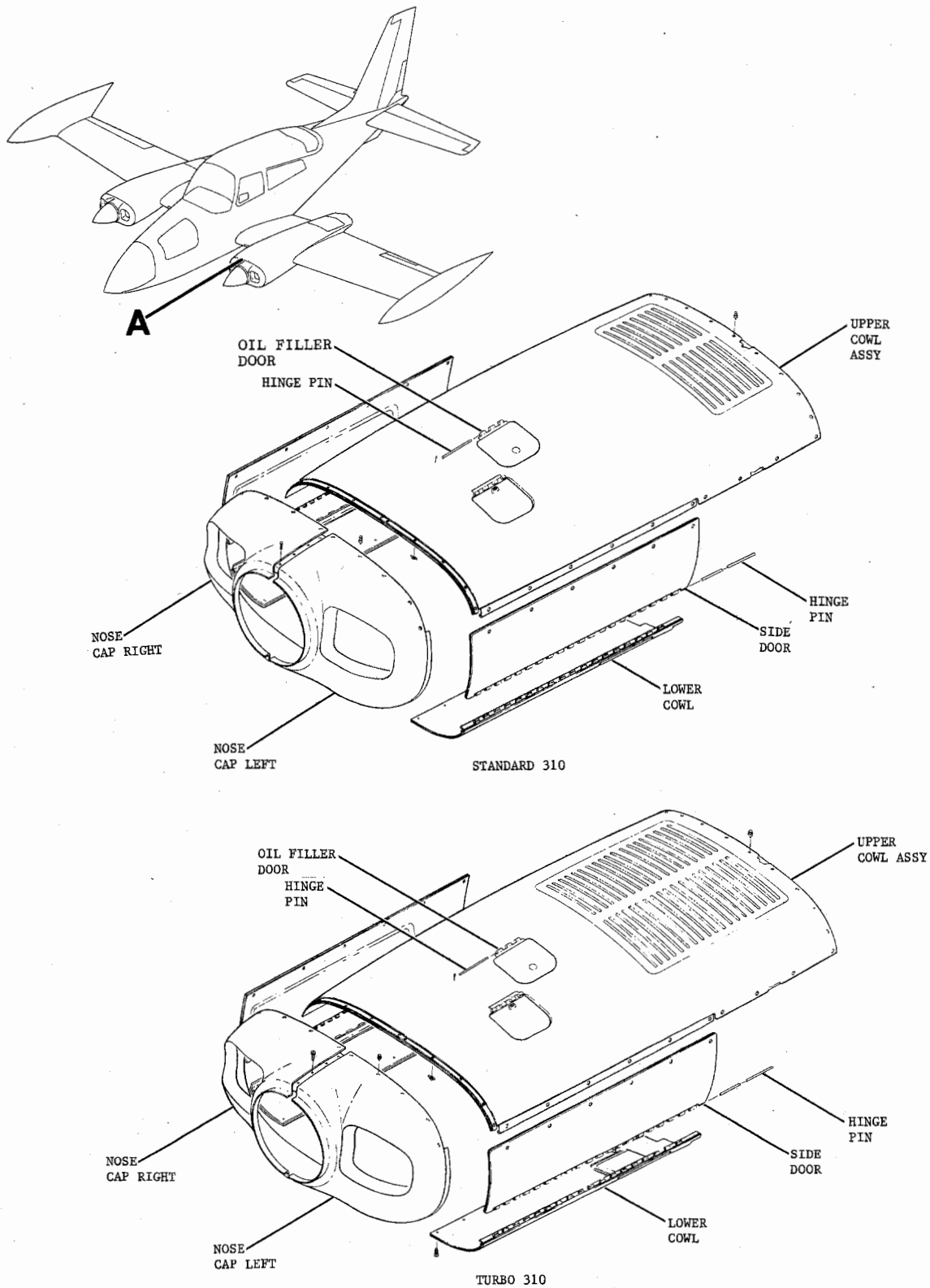
NOTE: To remove oil filler door from upper cowl section, pull hinge pin.

- B. Install Engine Cowl.

- (1) If removed, install oil filler door on upper cowl section with hinge pin.
 - (2) Install lower cowl to engine beam assembly.
 - (3) Assemble nose caps and install on forward engine beam with fasteners.
 - (4) Position upper cowl in place and secure fasteners.
 - (5) Install cowl doors to upper cowl assembly.

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MAINTENANCE MANUAL



DETAIL A
Engine Cowling
Figure 1

10103007
A10522004
A10522003

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ENGINE COWL FLAPSDescription

1. Engine Cowl flaps are utilized to exhaust hot air from each engine nacelle on both the 310 and 310 Turbo aircraft. The cowl flaps are operated by the push-pull controls mounted on the control pedestal.
2. (Standard 310) The cowl flap is located below the louvers of the upper engine cowl of each engine, inside the engine compartment. The system consists of the control cable, cowl flap and mechanical linkage.
3. (310 Turbo) The cowl flap is located on the lower engine nacelle of each engine. The system consists of the control cable, cowl flap and mechanical linkage.

Maintenance Practices

1. Removal/Installation Engine Cowl Flaps (Standard 310) (See Figure 1)

- A. Remove Engine Cowl Flaps

NOTE: The removal procedures are the same for either engine.

- (1) Remove upper engine cowl.
- (2) Disconnect pushrod (21) from bracket (22) by removing nut, washer and bolt.
- (3) Remove hinge pin (11) securing cowl flap (23) and remove cowl flap.

- B. Install Cowl Flaps

- (1) Align cowl flap (23) to hinge half and install hinge pin (11).
- (2) Connect pushrod (21) to bracket (22) using bolt, washer and nut.
- (3) Install upper engine cowl.

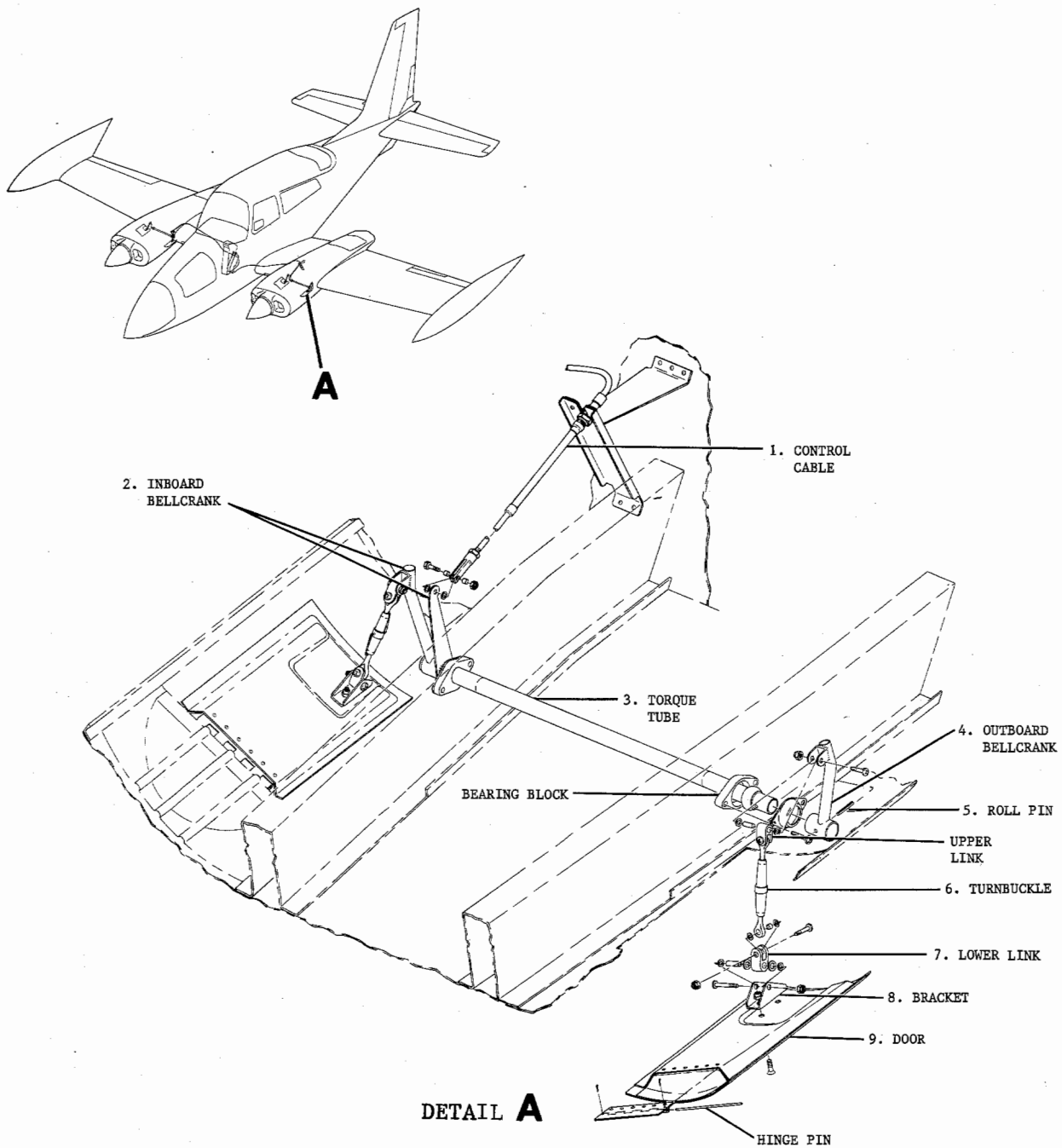
2. Removal/Installation Cowl Flap Crank Assembly (Standard 310) (See Figure 1)

- A. Remove Cowl Flap Crank Assembly

- (1) Remove upper engine cowl.
- (2) Open cowl flap.
- (3) Disconnect spring (18) from eyebolt (19).

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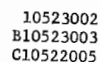


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10521003
10521002

Cowl Flap
Figure 1 (Sheet 1 of 2)

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Cowl Flap
Figure 1 (Sheet 2)

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- (4) Disconnect pushrod (21) from crank assembly (20) by removing nut, eyebolt (19), washers and spacer (RH only).
- (5) Disconnect control cable (12) from crank assembly (20) by removing nut, bolt (13), spacer and washer.
- (6) Remove crank assembly (20) from bracket (16) by removing nut, washer, bolt (17) and tube (14).

B. Install Cowl Flap Crank Assembly

- (1) Install tube (14) in crank assembly (20); position crank assembly in bracket (16) and secure with bolt (25), washer and nut.
- (2) Secure control cable (13) to crank assembly (31) using bolt (17), washers, spacer (RH only) and nut.
- (3) Connect pushrod (21) to crank assembly (20) using eyebolt (19), washer, spacer and nut.
- (4) Connect spring (18) from tab (15) to eyebolt (19).
- (5) Check for proper operation and install upper engine cowl.

3. Removal/Installation Cowl Flap Control Cable (Standard 310)
(See Figure 1)**A. Remove Cowl Flap Control Cable**

- (1) Remove engine cowl.
- (2) Remove center panel and control cover from center pedestal.
- (3) Open cowl flaps.
- (4) Disconnect clevis end of control cable (12) from crank assembly (20) by removing nut, bolt (13), washer and spacer.
- (5) Remove nuts retaining control cable (12) to nacelle rib.
- (6) Loosen nut retaining control cable (12) to pedestal.
- (7) Tie guide wire to control cable (12) and route from wing to pedestal.

B. Install Cowl Flap Control Cable.

- (1) Connect control cable (12) to guide wire and route into position from pedestal to wing.
- (2) Position control cable (12) in pedestal and install nut.
- (3) Install cable through nacelle rib and install nut.
- (4) Connect control cable (12) to crank assembly (20) using bolt (13), washer, spacer and nut.
- (5) Refer to Adjustment/Test and rig cowl flap.
- (6) Replace access covers and engine cowl.

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4. Removal/Installation Engine Cowl Flaps (Turbo 310) (See Figure 1).

A. Remove Engine Cowl Flaps.

NOTE: The removal procedures are the same for either engine.

- (1) Open cowl flaps.
- (2) Disconnect lower link (7) from bracket (8) on door assembly (9) by removing attaching nut and bolt.
- (3) Remove hinge pin from hinge halves and remove door assembly (9) from engine nacelle.

B. Install Engine Cowl Flaps.

- (1) Position door assembly (9) to engine nacelle hinge half and insert hinge pin.
- (2) Connect lower link (7) to bracket (8) on door assembly (9) and install attaching bolt and nut.
- (3) Secure hinge pin by installing cotter pins in hinge half.

5. Removal/Installation Torque Tube Assembly (Turbo 310) (See Figure 1).

A. Remove Torque Tube Assembly.

- (1) Position cowl flaps to OPEN.
- (2) Disconnect turnbuckle (6) from inboard bellcrank assembly (2) by removing nut, bushing, washers and screws attaching upper link to bellcrank.
- (3) Disconnect control cable (1) from bellcrank (2) by removing nut, bushing, washer and bolt.
- (4) Unsafety and remove roll pin securing outboard bellcrank (4) to torque tube assembly (3).
- (5) Remove torque tube assembly (3) from engine nacelle through the inboard cowl flap opening.

B. Install Torque Tube Assembly.

- (1) Insert torque tube assembly into position through the inboard cowl flap opening.
- (2) Install outboard bellcrank (4) to torque tube assembly (3). Install roll pin (5) and safety wire to bellcrank (4).
- (3) Connect control cable (1) to bellcrank (2) by installing bolt, bushing, washer and nut.
- (4) Connect turnbuckle (6) to inboard bellcrank assembly (2) by installing screw, bushing, washer and nut attaching upper link to bellcrank.

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6. Removal/Installation Control Cable (Turbo 310) (See Figure 1).

A. Remove Control Cable.

- (1) Remove engine cowling.
- (2) remove center panel and control cover from center pedestal.
- (3) Open cowl flaps.
- (4) Disconnect clevis end of control cable (1) from inboard bellcrank (2) by removing attaching nut, bushing, washer and bolt.
- (5) Remove nuts retaining control cable (1) to nacelle bracket.
- (6) Loosen nut retaining control cable (1) to pedestal.
- (7) Tie guide wire to control cable (1) and route from wing to control pedestal.

B. Install Control Cable.

- (1) Connect control cable (1) to guide wire and route into position from pedestal to wing.
- (2) Position control cable (1) in pedestal and install nut.
- (3) Install cable into nacelle bracket and install nut.
- (4) Connect control cable (1) to inboard bellcrank (2) with bolt, washer, bushing and nut.
- (5) Refer to Adjustment/Test and rig cowl flaps.
- (6) Replace access covers and engine cowling.

Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following items:

Name	Number	Manufacturer	Use
0-12" Scale		Lufkin	Measuring Travel Dimensions

2. Adjustment/Test Cowl Flap (Standard 310) (See Figure 1)

A. Rigging Cowl Flaps

- (1) Pull control cable handle to CLOSE position.

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- (2) With control cable (12) disconnected from crank assembly (20), position crank assembly in bracket (16) so bottom attach bolt (17) and eyebolt (19) holes are perpendicular on the crank assembly (20). The crank assembly will be positioned to just before the overcenter condition outboard or inboard.
 - (3) Adjust control cable (12) length at nacelle rib, so control cable clevis will align with crank assembly hole at position described in step (2). Tighten control cable nuts.
 - (4) Connect control cable (12) to crank assembly (20) using bolt (13), washer, spacer and nut.
 - (5) Adjust pushrod (21) until cowl flap seal fits snug against the bottom surface of the cowl.
 - (6) Check cowl flap for smooth and proper operation.
3. Adjustment/Test Cowl Flaps (Turbo 310) (See Figure 1).
- A. Rigging of Cowl Flaps.
- (1) Position cowl flaps to OPEN.
 - (2) Locate the centerline of cowl flap door (9) and nacelle opening. Measure the distance of travel for $4.50 + 0.50, - 0.10$ inches.
 - (3) Adjust travel of cowl flap doors by increasing or decreasing the length of clevis end on control cable (1).
 - (4) Close cowl flaps.
 - (5) Check the extension of control handle for not more than $3.50 + 0.00, - 0.50$ inches of travel from control pedestal.

Inspection/Check

1. Tools and Equipment.

NOTE: See Adjustment/Test for Tools and Equipment.

2. Inspection/Check Cowl Flaps.

- A. Cowl Flap Check.

- (1) Open cowl flaps.
- (2) Remove center pedestal side cover.

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ENGINE MOUNTSDescription

1. The engine mounts consist of four mounts with each mount incorporating two rubber pads, one washer, one spacer, one bolt and a lockwasher.

Maintenance Practices

1. Tools and Equipment.

Name	Number	Manufacturer	Use
Hoist	4180350	Cessna Aircraft Co.	Hoist Engine
Engine Mount Wrench	SE608	Cessna Aircraft Co.	Crimping Lock-washer
Spacer	5056010-1 - 0.125 inch	Cessna Aircraft Co.	Shimming
Spacer	5056010-2 - 0.188 inch		Engine
Spacer	5056010-2 - 0.250 inch		Mount

2. Removal/Installation of Engine Mounts (Refer to Section 7-00).

- A. Remove Engine Mount.

- (1) Remove engine cowling.

NOTE: The engine must be supported with an engine hoist before attempting removal of engine mount. If engine is being removed, refer to Engine Removal Procedures for parts to be disconnected.

- (2) Place a suitable support under tailcone.
 - (3) Remove bolt (4) and lockwasher from engine mount.
 - (4) Disconnect hose between throttle body and engine air intake manifold.
 - (5) Disconnect oil separator drain hose (Turbo 310) from overboard drain tube.
 - (6) Disconnect intake manifold drain line from manifold.

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- (7) Hoist engine slowly to a height of 2 to 3 inches above normal mounting position.

NOTE: Care should be taken not to induce adverse stresses on other items attached to engine while hoisting engine.

- (8) Remove upper mount (1) spacer (2) and lower mount (3) from fitting assembly.

B. Install Engine Mount.

- (1) Install lower mount (3) to fitting assembly.
- (2) Assemble upper mount (1) and spacer (2) to fitting assembly and install lockwasher and bolt (4).
- (3) Torque bolt (4) to 300 + 50, - 00 inch-pounds.
- (4) Lower engine hoist and remove.

NOTE: Check the area between the exhaust riser of number six cylinder and the lower cowl panel. If the area does not have sufficient clearance, 0.40 inch minimum refer to Shimming Procedures and install shims to obtain proper clearance.

- (5) Safety bolt (1) by using tool SE608 making sure the ears of lockwashers, lock over the flat surfaces on the bolt head.
- (6) Connect intake manifold drain line to manifold.
- (7) Connect oil separator drain line hose to overboard drain line.
- (8) Connect hose between throttle body and air intake manifold.
- (9) Install cowling.

3. Shimming Engine Mounts (Refer to Section 7-00).

- A. Although engine mount sag is normal and occurs over a period of time in-service, it can be corrected by shimming the mount back to its original position with spacers. Engine mount sag which has resulted in a loss of clearance between the engine mount and/or cowling components should be corrected by shimming.

- B. If the area between the exhaust riser of number six cylinder and the lower cowl panel does not have sufficient clearance, 0.40 inch minimum shim engine mounts as follows:

- (1) Remove engine cowling.
- (2) Hoist engine and support as required to insert spacers.

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NOTE: Spacers may be obtained from the Cessna Dealer's Organization. Refer to Tools and Equipment for part number and thickness desired. If the total thickness of spacers installed on any mount exceeds 0.312 inch, the mount must be removed and inspected in accordance with Chapter 2.

- (3) Insert spacers between the engine fitting assembly and upper mount (1) as required to obtain 0.40 inch minimum clearance.

NOTE: Align propeller spinner with cowling nose cap contours, to assist in determining correct engine mount position.

CAUTION: FOR EACH 0.125 INCH SPACER THICKNESS ADDED, IT WILL BE NECESSARY TO ADD THE NEXT LENGTH LONGER BOLT IN THE ENGINE MOUNT.

- (4) Secure engine mount in place and safety in accordance with engine mount installation procedures.
- (5) Remove engine hoist and recheck all clearances, especially in the exhaust stack area.
- (6) Safety bolts (4) with lockwashers, using engine mount wrench SE608.

Cleaning/Painting

1. Cleaning Engine Mounts

- A. Clean engine mounts with a suitable solvent.

NOTE: Never use a wire brush or sandpaper to clean engine mounts.

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ENGINE FUEL SYSTEMDescription

1. The engine fuel injection system is a simple, low pressure system for injecting fuel into the intake valve port in the cylinder head. It is a multi-nozzle, continuous flow type system which controls fuel flow to match engine airflow. Any change in throttle position, engine speed, or combination of both, causes changes in fuel flow in the correct relation to engine airflow.
2. A manual mixture control and a flow gage, which indicates metered fuel pressure, provide for precise leaning at any combination of altitude and power setting.

Troubleshooting

1. For troubleshooting the fuel injection system, see Figure 1.

Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used for the following listed items.

Name	Number	Manufacturer	Use
Fuel Pressure Test Kit	SK320-2	Cessna Aircraft Co.	Fuel Pressure Adjustment
Screw Driver Flat Blade		Commercially Available	Adjust Fuel/ air Control Unit

2. Fuel Mixture Check.

- A. Warm-up engine in accordance with owners manual and move throttles back to (600 RPM).
- B. Place mixture control to full rich and propeller control full forward.

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- C. Position auxiliary fuel pump to LOW, advance throttle to 1000 RPM and slowly reduce mixture control, if both the fuel mixture control and fuel injection pumps are set properly, NO RPM rise will occur when the mixture control is gradually moved toward IDLE CUT-OFF.
- D. Using the above procedure set throttle to 1300 RPM and reduce mixture control slowly. If mixture control and fuel injection pumps are properly set the RPM should increase 10 RPM when mixture control is gradually moved towards IDLE CUT-OFF.

NOTE: If RPM increases when mixture is reduced, fuel mixture is too rich; conversely, if RPM diminishes rapidly when mixture is reduced, fuel mixture is too lean.

- E. If Fuel mixture check indicates a too rich or too lean idle condition refer to Fuel-Air Control Unit Adjustment/Check and Adjust Fuel Air-Control.

3. Unmetered Fuel Test Hook-Up, Check and Adjustment (Standard 310) (See Figure 3).

The following procedures for adjusting and checking the unmetered fuel pressure are factory recommended and must be followed to insure engines are properly adjusted.

NOTE: Excessive leaning is difficult to detect unless these procedures are followed.

- A. Connect test gage to fuel pump as follows:

- (1) Place fuel selector valves in the OFF position.
- (2) Attach hose (6) to aft side of gage (7).
- (3) Install tee (5) on gage hose (6).
- (4) Attach test hose (2) to tee (5).
- (5) Disconnect unmetered fuel pressure hose (4) from the fuel pump fitting located at the rear underside of pump.
- (6) Connect the unmetered fuel pressure hose (4) to tee (5).
- (7) Connect test hose (2) to fuel pump fitting located at the rear underside of engine fuel pump.
- (8) Vent test gage to atmosphere.

- B. Adjust low unmetered fuel pressure as follows:

- (1) Allow engines to warm-up, then set idle RPM to 600 and check unmetered fuel pressure. Pressure should indicate 6.5 to 7.5 P.S.I. on test hook-up pressure gage.

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NOTE: The test gage should be placed as near the same level of the fuel pump as possible or erroneous readings could result.

- 10
- (2) If unmetered fuel pressure does not indicate 6.5 to 7.5 P.S.I., the low unmetered fuel adjustment screw (1) must be adjusted to 6.5 to 7.5 PSI. Turn low unmetered fuel adjustment screw (1) in (cw) to increase out (ccw) to decrease. After correct unmetered fuel pressure is obtained, position auxiliary fuel pump to Low, observe that fuel pressure does not exceed 7.5 P.S.I. If fuel pressure exceeds 7.5 P.S.I., the auxiliary fuel pump may require adjusting. Refer to Chapter 9.

C. Adjust Maximum Fuel Flow as Follows:

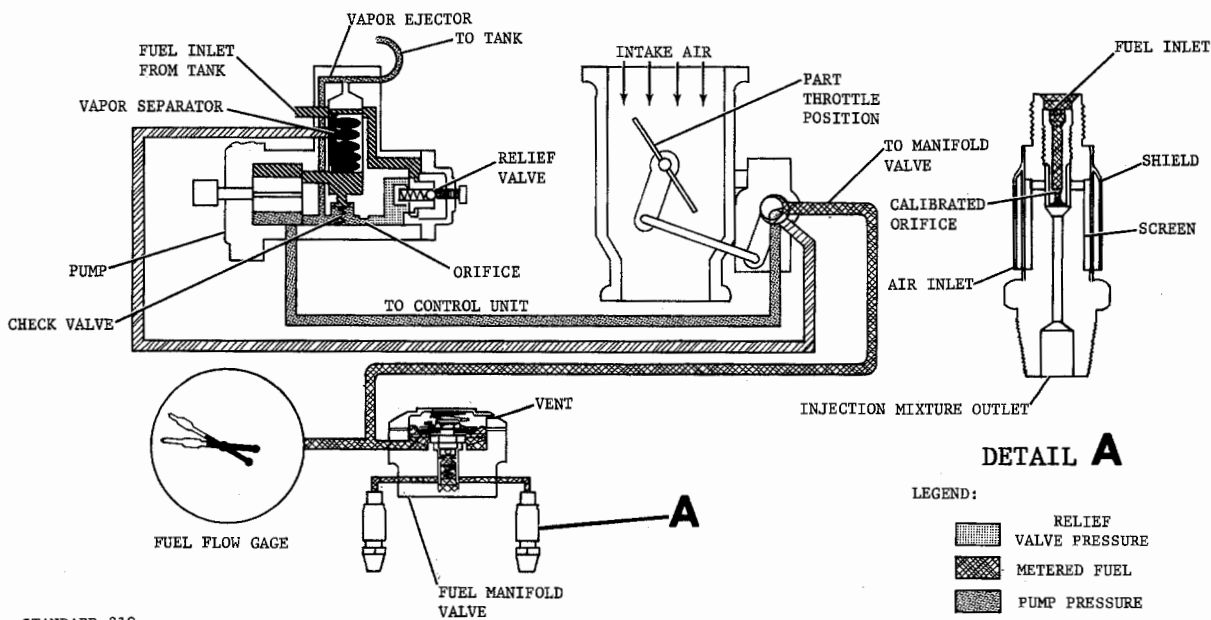
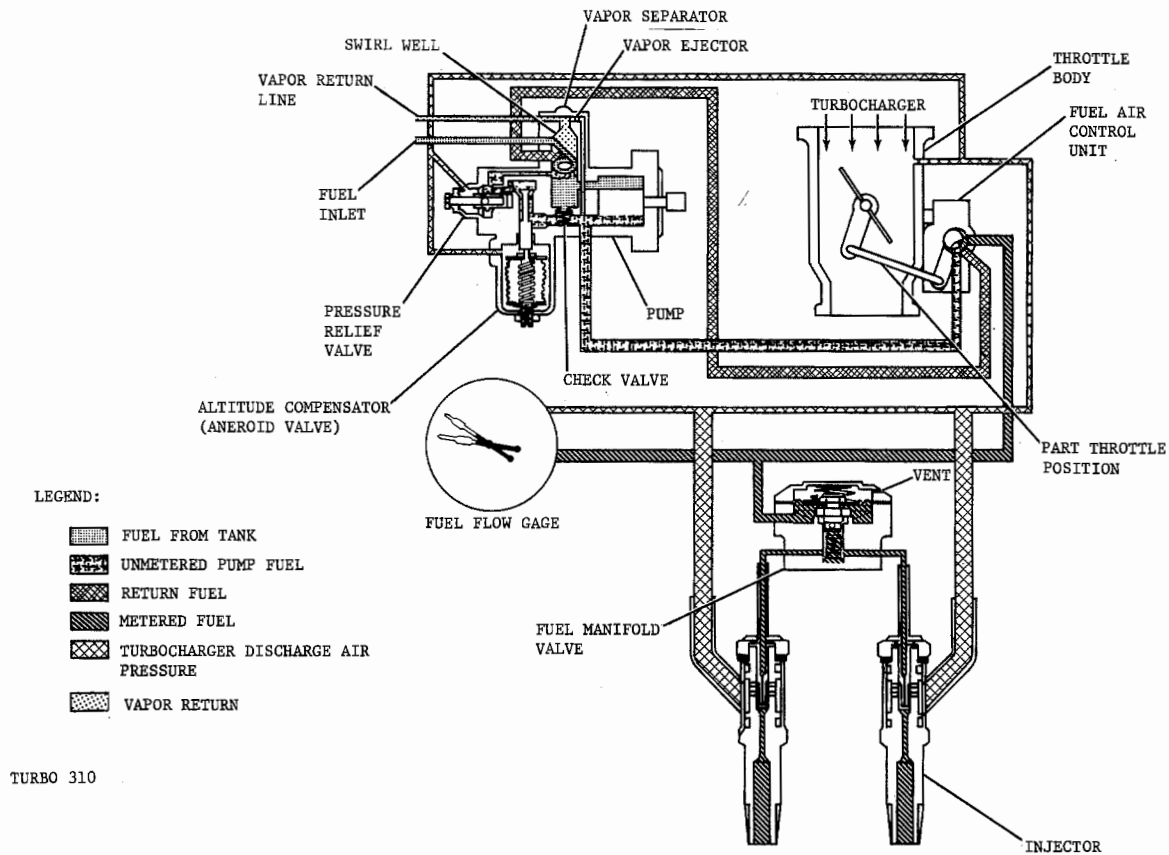
- (1) Allow oil temperature to reach an indication in the upper 1/3 of the green arc of the oil temperature indicator, run engine at full throttle and check fuel flow gage on instrument panel. Refer to Figure 4 for proper fuel flow. If this reading is not within the prescribed tolerance, turn high setting adjustment screw located on the lower left side of the fuel pump (turn IN to increase pressure or turn OUT to decrease pressure) until proper fuel pressure is obtained.
- (2) The engines, when properly warmed, should respond to a rapid throttle acceleration without hesitation with auxiliary fuel pump on and off and mixture full rich.
- (3) After adjusting unmetered fuel pressure, check idle RPM and idle mixture in accordance with Fuel Mixture Check.
- (4) After completion of unmetered fuel adjustments; with test equipment removed and fuel lines connected in normal position, it may be necessary to purge air from the fuel pressure lines to prevent indicator needle fluctuations or erroneous readings.
- (5) Purge air from fuel pressure hoses in the following manner:

WARNING: FUEL WILL RUN FROM THE INTAKE DRAIN UNDER EACH NACELLE DURING PURGING. A CONTAINER SHOULD BE PROVIDED TO CATCH DRAINING FUEL.

- (a) Place throttle to full open position and mixture to full rich.

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Fuel Injection System Schematic
Figure 2

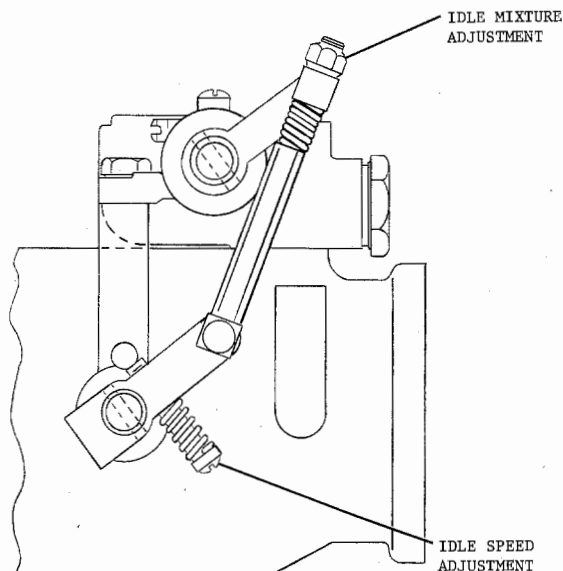
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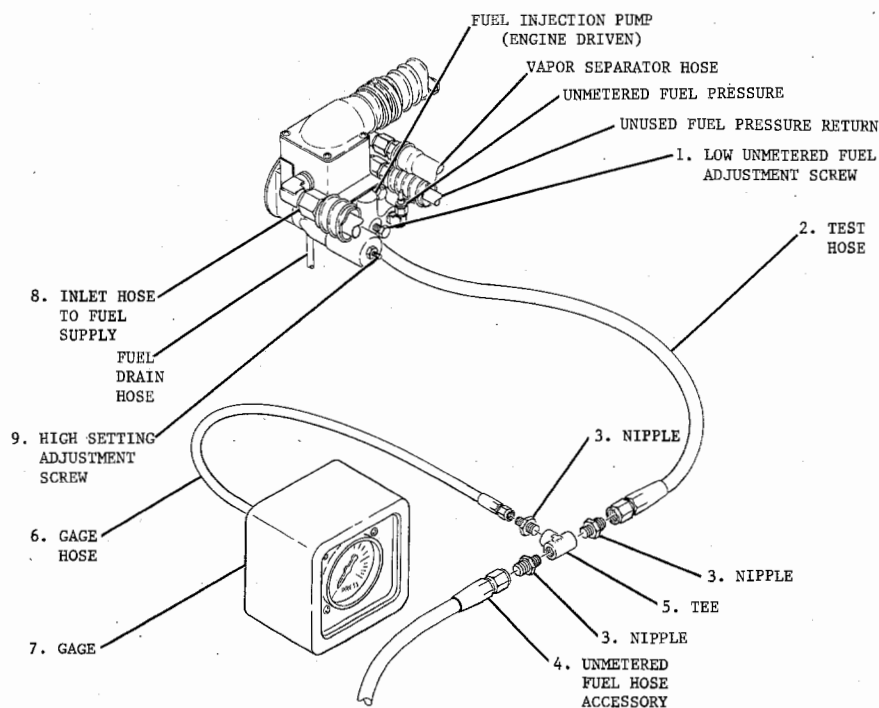
- (b) Disconnect full pressure hoses at fuel flow gage, operate auxiliary fuel pump (primer switch) until at least one (1) pint of fuel has discharged from each pressure hose.
 - (c) Reconnect hoses to flow gage, tighten "finger tight" then back-off one-half turn.
 - (d) Operate auxiliary pump (primer switch) until a solid stream of fuel is discharged from gage connection. Tighten connection, with pump still operating, then turn pump off.
4. Unmetered Fuel Test Hook-Up Check and Adjustment (Turbo 310)
(See Figure 3).
- A. Connect test gage to fuel pump (Refer to Unmetered Fuel Test Hook-Up Check and Adjustment Standard 310, Steps a(1) through a(8).
 - B. Adjust low unmetered fuel pressure as follows:
 - (1) Allow engines to warm-up, then set idle RPM to 600 and check unmetered fuel pressure. Pressure should indicate 6.0 to 7.0 P.S.I. on test hook-up pressure gage. If the indicated pressure does not indicate 6.0 to 7.0 P.S.I., turn Low unmetered adjustment screw (1) on pressure relief valve (turn IN to increase and OUT to decrease fuel pressure) until proper fuel pressure is obtained. Position auxiliary fuel pump to LOW, observe that unmetered fuel pressure does not exceed 7.5 P.S.I.
 - (2) Adjust maximum fuel flow as follows:
 - (a) Allow engine oil to reach a temperature indication in the upper 1/3 of the green arc. With engine power setting at maximum RPM, 32 ± 0.5 inches HG manifold pressure, auxiliary fuel pump OFF and reading from the aircraft's fuel flow indicator on the instrument panel; check fuel flow from 165 to 175 PPH. If indicated flow is not within the prescribed tolerance, loosen locknut and turn High Setting adjustment screw (10) or altitude compensator (turn OUT to increase and turn IN to decrease) until proper fuel flow is obtained. Position auxiliary fuel pump to ON, check that fuel flow does not exceed 175.0 PPH.
5. Fuel-Air Control Unit Adjustments (See Figure 3).
- A. The idle speed adjustment is a conventional spring-loaded screw located in the air throttle lever. The idle mixture adjustment is accomplished by the locknut at the metering valve end of the linkage. Tightening the nut to shorten the linkage provides a richer mixture. A leaner

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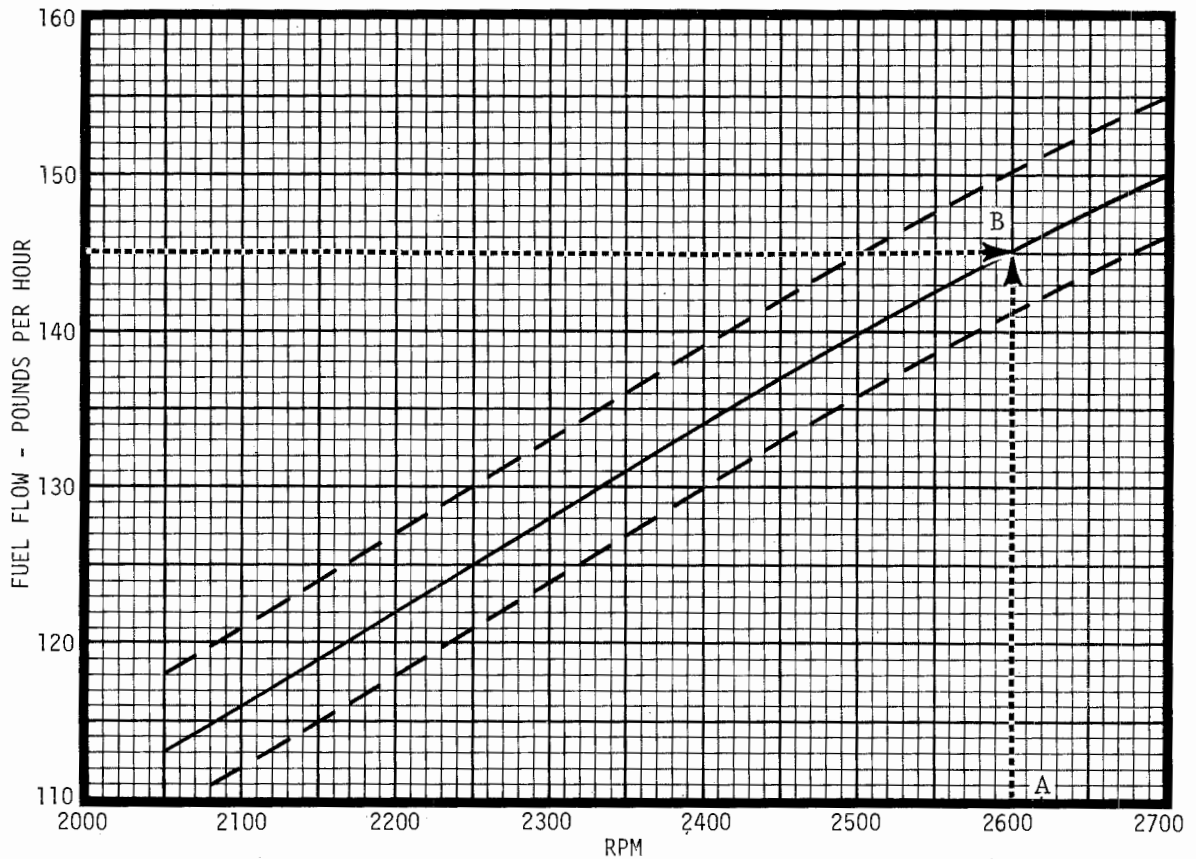
FUEL AIR CONTROL UNIT ADJUSTMENT



TYPICAL UNMETERED FUEL PRESSURE TEST EQUIPMENT FOR TURBO 310 ONLY. ON THE STANDARD 310, THE HIGH SETTING ADJUSTMENT SCREW IS LOCATED ON THE LOWER LEFT SIDE OF THE FUEL INJECTION PUMP.

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Fuel Injection Pump Test Hook-Up
Figure 3



APPLICABLE TO STANDARD 310 ONLY

EXAMPLE:

"A" ENGINE RPM 2600

"B" FUEL FLOW 145 PPH

CONDITIONS:

BOOST PUMP ON

FULL THROTTLE

FLOWS SHOWN ARE NOMINAL

Fuel Flow Versus RPM
Figure 4

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mixture is obtained by backing off the nut to lengthen the linkage. With engine running at 1000 RPM and auxiliary pumps set to the LOW position, adjust idle mixture as rich as possible without obtaining an increase in engine RPM when mixture control is slowly moved toward IDLE CUT-OFF. Check idle mixture with auxiliary pumps off to assure that idle mixture has not changed.

Inspection/Check

1. Engine Fuel System Inspection/Check.
 - A. Remove cowling in accordance with removal procedures.
 - B. Remove lower nacelle access covers.
 - C. Remove fuel injection pump shroud.

FUEL INJECTION PUMPDescription

1. The fuel injection pump is a positive displacement, rotating vane type. The pump is connected to the accessory section of the engine and is driven by a splined shaft. Fuel enters the pump at the swirl well of the vapor separator where it is separated by a swirling motion so that only liquid fuel is fed to the pump. The vapor is drawn off from the top center of the swirl well by a small pressure jet of fuel and is fed into the vapor return line and returned to the fuel tank. Since the pump is engine-driven, changes in engine RPM affect pump flow proportionally. The pump supplies more fuel than is required by the engine, therefore; a relief valve is provided to maintain a constant pressure. On the Turbo 310 a recirculation path within the pump is provided using a calibrated variable orifice (aneroid valve) and a relief valve to maintain pressure at altitude. A check valve is provided so that auxiliary pump pressure can by-pass the engine driven fuel pump for starting.

Maintenance Practices

1. Removal/Installation of Fuel Injection Pump (See Figure 1).

- A. Remove Fuel Injection Pump.

- (1) Place fuel selector valve handles OFF.
- (2) Remove engine cowlings.
- (3) Tag and disconnect all lines and fittings attached to the fuel injection pump.

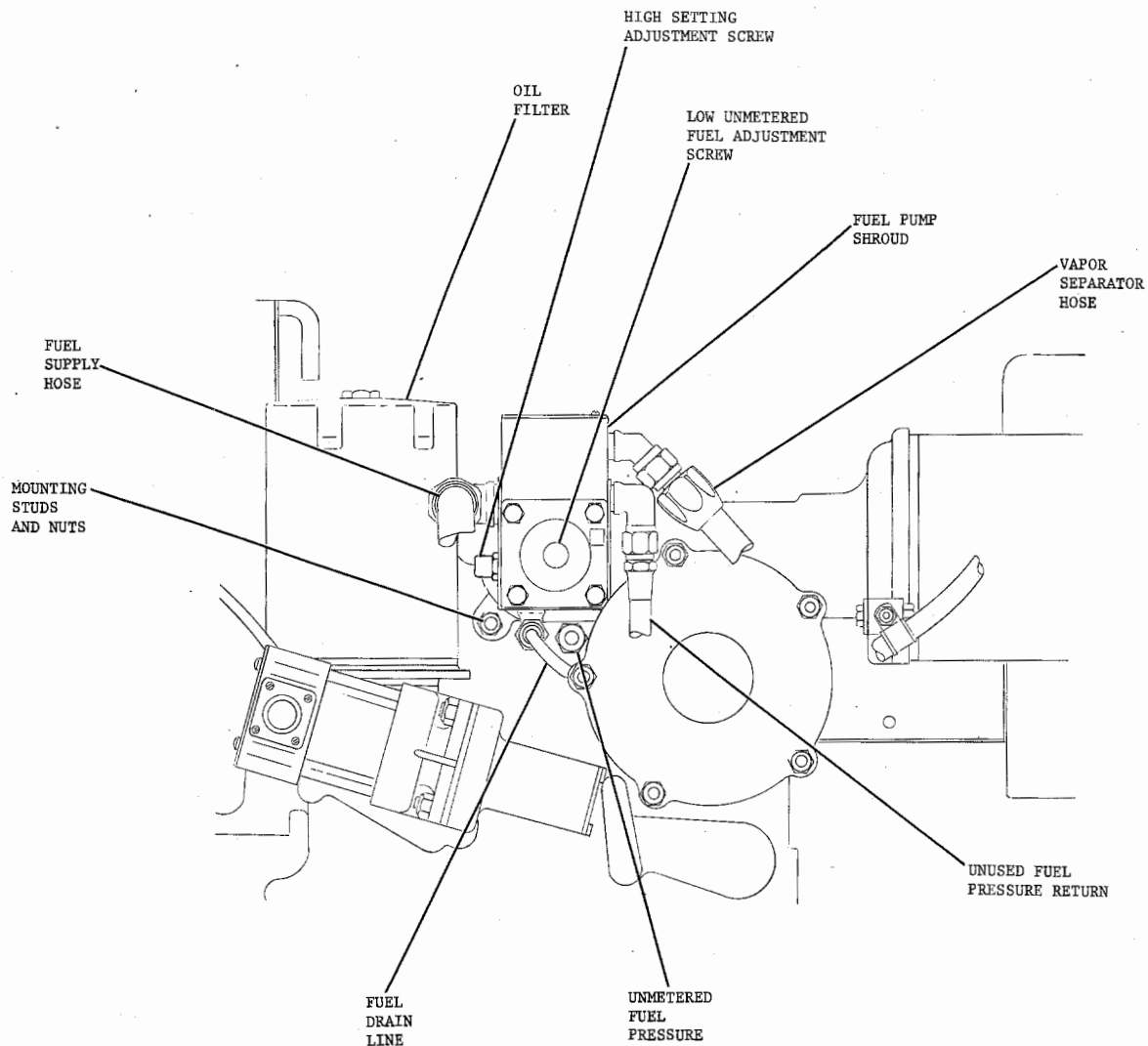
NOTE: Plug or cap all disconnected lines, hoses and fittings.

WARNING: RESIDUAL FUEL DRAINING FROM LINES AND HOSES IS A FIRE HAZARD. USE CARE TO PREVENT THE ACCUMULATION OF SUCH FUEL WHEN LINES OR HOSES ARE DISCONNECTED.

- (4) Remove shroud surrounding the fuel injection pump.
- (5) Remove the four nuts and washers attaching pump to the engine.
- (6) Remove fuel injection pump and gasket.
- (7) If a replacement pump is not being installed immediately, a temporary cover should be installed on the mount pad to prevent entry of foreign material.

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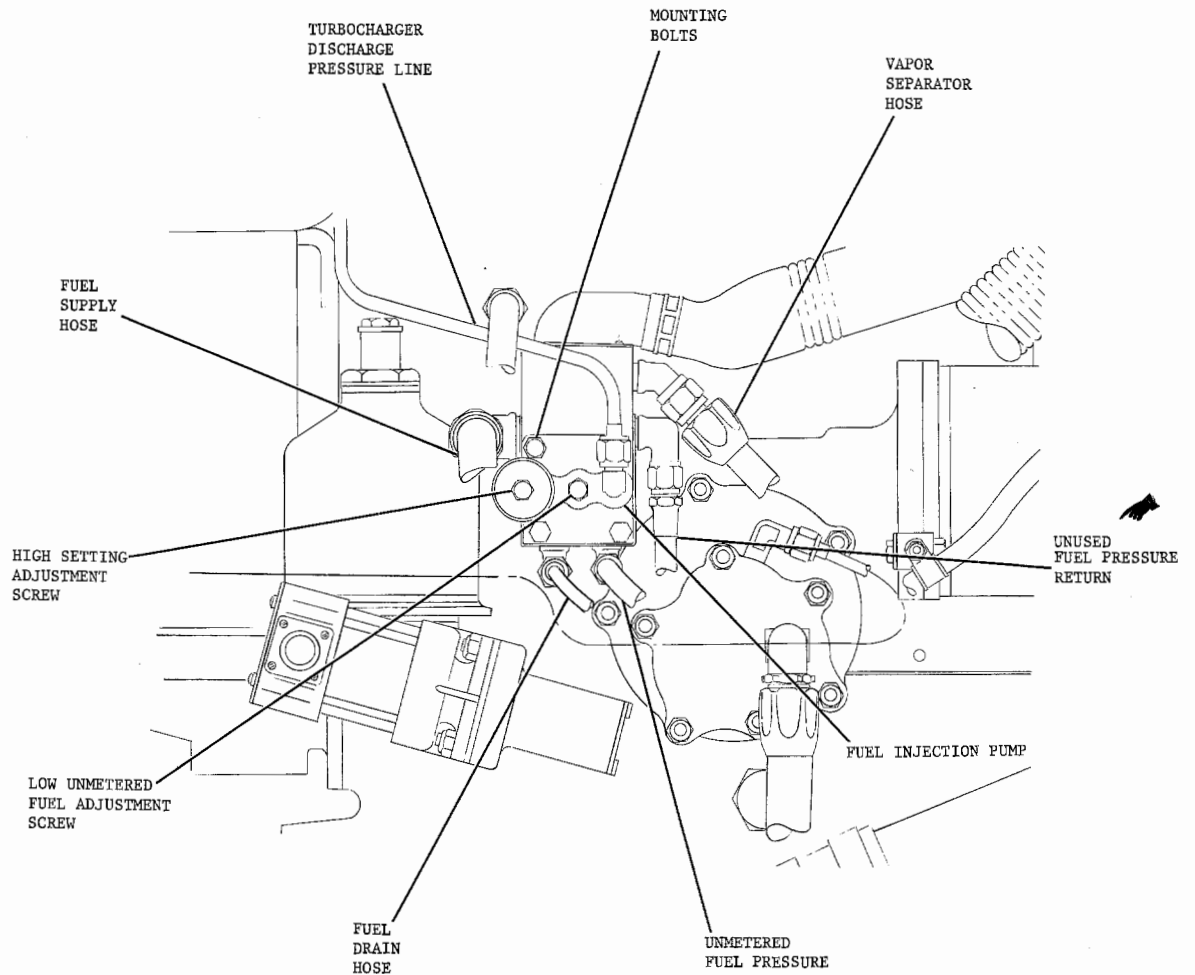
STANDARD 310

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Engine Driven Fuel Pump
Figure 1 (Sheet 1 of 2)

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TURBO 310

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Engine Driven Fuel Pump
Figure 1 (Sheet 2)

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B. Install Fuel Injection Pump.

- (1) If installed, remove temporary cover.
- (2) Place gasket on engine mount pad.
- (3) Place fuel injection pump in position and secure with four flat washers, four internal tooth lock-washers and nuts.

NOTE: When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

- (4) Install the cooling shroud on the fuel pump.
- (5) Install all fittings and connect all lines as tagged and remove tags.
- (6) Install engine cowlings.

Inspection/Check**1. Injection Pump Inspection/Check.**

- A. Remove engine cowlings.
- B. Remove fuel injection pump shroud.

FUEL MANIFOLDDescription

1. The fuel manifold provides a central point for distribution of fuel to individual cylinders. In the fuel manifold, a diaphragm and plunger valve raises and lowers; by fuel pressure, to open or close the individual cylinder fuel supply port simultaneously. A fine mesh screen is provided for protection of the injection nozzle against dirt or foreign matter. The fuel manifold is calibrated to operate at 4 P.S.I.

Maintenance Practices

1. Removal/Installation of Fuel Manifold (See Figure 2, Section 7-00).

- A. Remove Fuel Manifold.

NOTE: Plug or cap all disconnect lines, hoses and fittings.

- (1) Tag and disconnect the six fuel injection lines routing to each individual cylinder and the lines and hoses routing to fuel pump.
- (2) Remove engine crankcase through bolts securing fuel manifold to engine and remove fuel manifold.

- B. Install Fuel Manifold.

- (1) Position fuel manifold in place on engine and install engine crankcase through bolts.
- (2) Remove plugs, caps, connect lines and hoses, and remove tags.

NOTE: When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

Inspection/Check

1. Fuel Manifold Inspection/Check.

- A. Remove engine cowling.

Cleaning/Painting

1. Cleaning Fuel Manifold

- A. Hold the top cover down against internal spring until all four attaching screws have been removed, then gently lift off the cover. Use care not to damage the spring-loaded diaphragm below it.

CAUTION: DO NOT ATTEMPT TO REMOVE NEEDLE OR SPRING FROM INSIDE VALVE. REMOVAL OF THESE ITEMS FROM THE VALVE WILL DISTURB THE 4 PSI FACTORY CALIBRATION.

- B. Remove the flushing plug located opposite the inlet fitting.

CAUTION: THE FILTER SCREEN IS A TIGHT FIT AND MAY BE DAMAGED IF REMOVAL IS ATTEMPTED. IT SHOULD BE REMOVED ONLY IF A NEW SCREEN IS TO BE INSTALLED.

- C. Using clean gasoline, flush out the chamber below the screen.
- D. Flush above the screen and inside the center bore making sure that outlet passages are open. Use only a gentle stream of compressed air to remove dust and dirt and to dry.
- E. Replace flushing plug.
- F. Clean the diaphragm valve, top cover and springs in the same manner.
- G. Carefully replace diaphragm and valve in manifold body. Check that valve works freely.
- H. Place upper spring in position.
- I. Align mounting holes in body, diaphragm and top cover locating the small vent hole in the cover to the side. Hold the cover down against the spring while installing and tighten all four screws. Safety the screws.

FUEL DISCHARGE NOZZLESDescription

Fuel nozzles are installed in each cylinder head outside each intake valve. An air bleed arrangement is incorporated in each nozzle. The air bleed arrangement aids in vaporization of fuel and, by breaking the high vacuum at idle, maintains fuel in the fuel lines, solidly filled and ready for instant acceleration of engine. Nozzles are stamped with a letter on the hex of the nozzle body. Each engine has matched (same letter) nozzles. Replacement nozzles must match but a matched set of nozzles of another letter may be used.

Maintenance Practices

1. Removal/Installation of Fuel Nozzles.

A. Remove Fuel Nozzles.

- (1) Disconnect the fuel injection lines at the fuel nozzles.

NOTE: Plug or cap all disconnected lines and fittings.

- (2) Remove fuel nozzles from cylinders.

B. Install Fuel Nozzles.

- (1) Remove protective plugs and install fuel nozzles in cylinder.
- (2) Remove plugs and caps from lines and install fuel injection lines at fuel nozzles.

NOTE: When replacing fuel lines, use only a full soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

Inspection/Check

1. Fuel Nozzles Inspection/Check.

- A. Remove engine cowling.
- B. Disconnect lines at fuel nozzles and remove nozzles.

Cleaning/Painting

1. Clean Fuel Discharge Nozzles

- A. To clean fuel discharge nozzles, immerse in fresh cleaning solvent.

CAUTION: DO NOT USE A WIRE BRUSH OR OTHER SHARP METAL OBJECTS TO CLEAN ORIFICES. THIS WILL DAMAGE ORIFICE.

FUEL-AIR CONTROL UNITDescription

1. The fuel-air control unit consists of the throttle body and the metering body. This unit occupies the position ordinarily used for a carburetor at the intake manifold inlet. The function of this unit is to control engine air intake and to set the metered fuel pressure for proper fuel-air ratio. There are three control elements in this unit, one for air and two for fuel, one of which is for fuel mixture and the other for fuel metering. Main fuel enters the control unit through a strainer and passes to the metering valve. The position of the metering valve controls the fuel passed to the manifold valve and nozzles. A linkage connecting the metering valve to the air throttle proportions airflow to fuel flow. The position of the mixture valve determines the amount of fuel returned to the fuel pump. The fuel control portion of the fuel-air control is enclosed in a shroud and is blast air cooled to help prevent vapor lock. A fuel pressure switch, connected to fuel control unit, actuates to cause the auxiliary fuel pump to operate at a high speed if the engine-driven fuel pump pressure drops below 4 to 5 psi. The auxiliary fuel pump switch must be ON for the fuel pressure switch to operate.

Maintenance Practices

1. Removal/Installation of Fuel-Air Control Unit (See Figure 1).

- A. Remove Fuel-Air Control Unit.

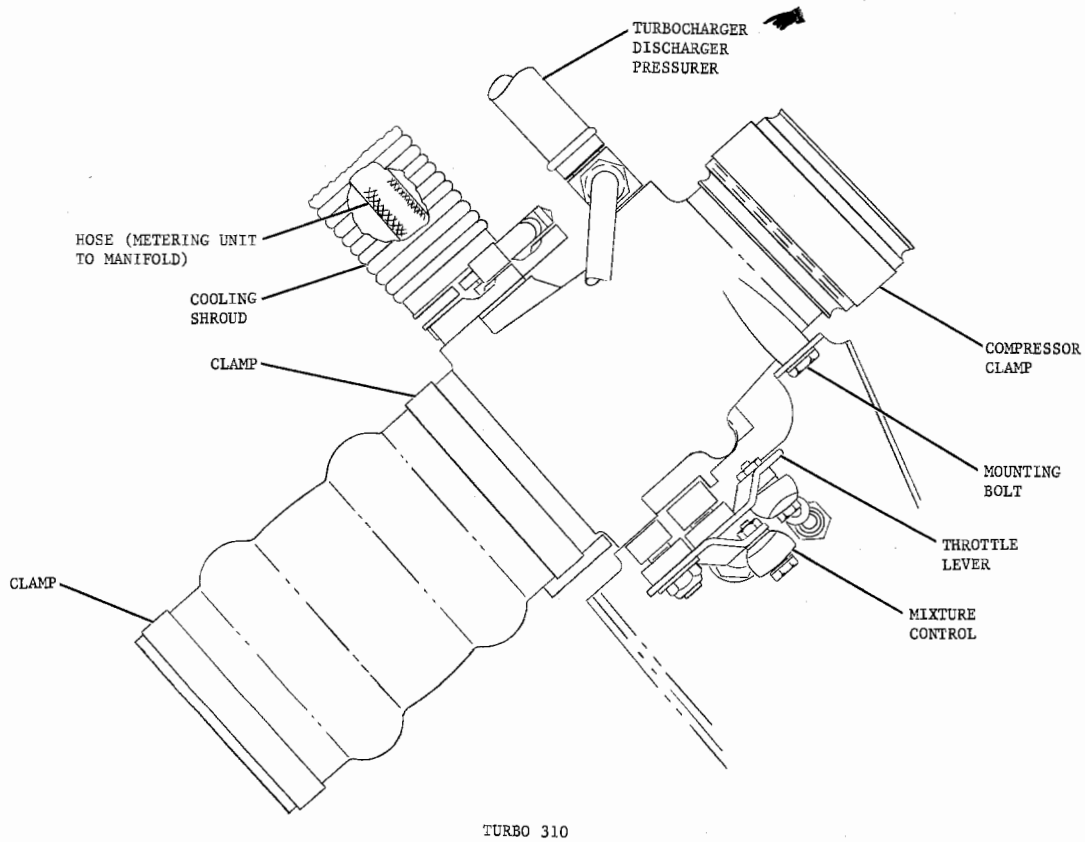
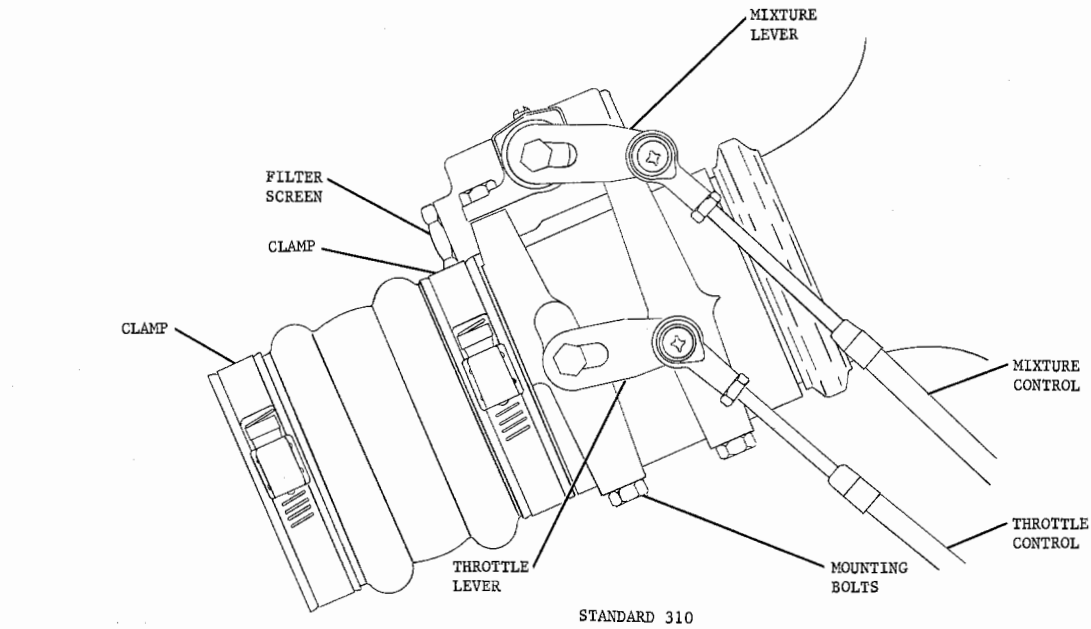
- (1) Remove the engine cowling.
- (2) Place the fuel selector valve handles OFF.
- (3) Loosen clamp on ram air tube at the metering body and slide tube clear of hose connection.
- (4) Remove sheet metal screws retaining cover on metering body cooling shroud.
- (5) Disconnect hose to the fuel pressure switch.
- (6) Slide cooling shroud cover aft and down to expose the three nose connections at the metering body. These hoses are to be disconnected at this time.

NOTE: Plug or cap all open lines, hoses and fittings.

- (7) Loosen the clamps which secure the throttle body to both the right and left intake manifold.
- (8) Remove clamp securing throttle body to turbocharger compressor.

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SERVICE MANUAL



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Fuel Air Control
Figure 1

- (9) Remove two forward bolts attaching throttle body to upper support.
- (10) Remove two nuts attaching throttle body to the lower support braces.
- (11) Disconnect the throttle and mixture controls.
- (12) Remove fuel-air control unit.

NOTE: The metering body may be removed from the throttle body by removing the three special bolts which are safetied with tang washers.

B. Install Fuel-Air Control.

- (1) Place the fuel-air control unit in position.
- (2) Temporarily install upper support bolts to obtain the correct position for the fuel-air control unit.
- (3) Install two lower support braces and install lock-washers and nuts.
- (4) Install hose connectors and clamps which secure the unit to the intake manifold.
- (5) Install clamp securing throttle body to turbocharger compressor.

NOTE: When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

- (6) Attach the unmetered fuel hose, the metered fuel hose, and the vapor return hose to the metering body.
- (7) Slide cooling shroud cover into place and attach with sheet metal screws.
- (8) Connect hose from fuel pressure switch.
- (9) Slide ram air tube onto metering body cooling shroud and secure with clamp.
- (10) Connect throttle and mixture controls.
- (11) Inspect completed installation.
- (12) Refer to Engine Controls, Chapter 7-50 and rig throttle control.
- (13) Install engine cowling.

Inspection/Check

1. Fuel-Air Control Inspection/Check.

A. Remove upper engine cowling.

Cleaning/Painting

1. Clean Fuel-Air Control

- A. Remove the fuel strainer and clean the screen in fresh cleaning solvent. Reinstall and safety.

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SERVICE MANUAL

ENGINE FUEL INDICATING SYSTEM

Description

1. The engine fuel indicating system consists of a dual fuel flow gage calibrated in pounds per hour and gallons per hour. The dual flow gage senses fuel pressure delivered to the fuel nozzles.

Maintenance Practices

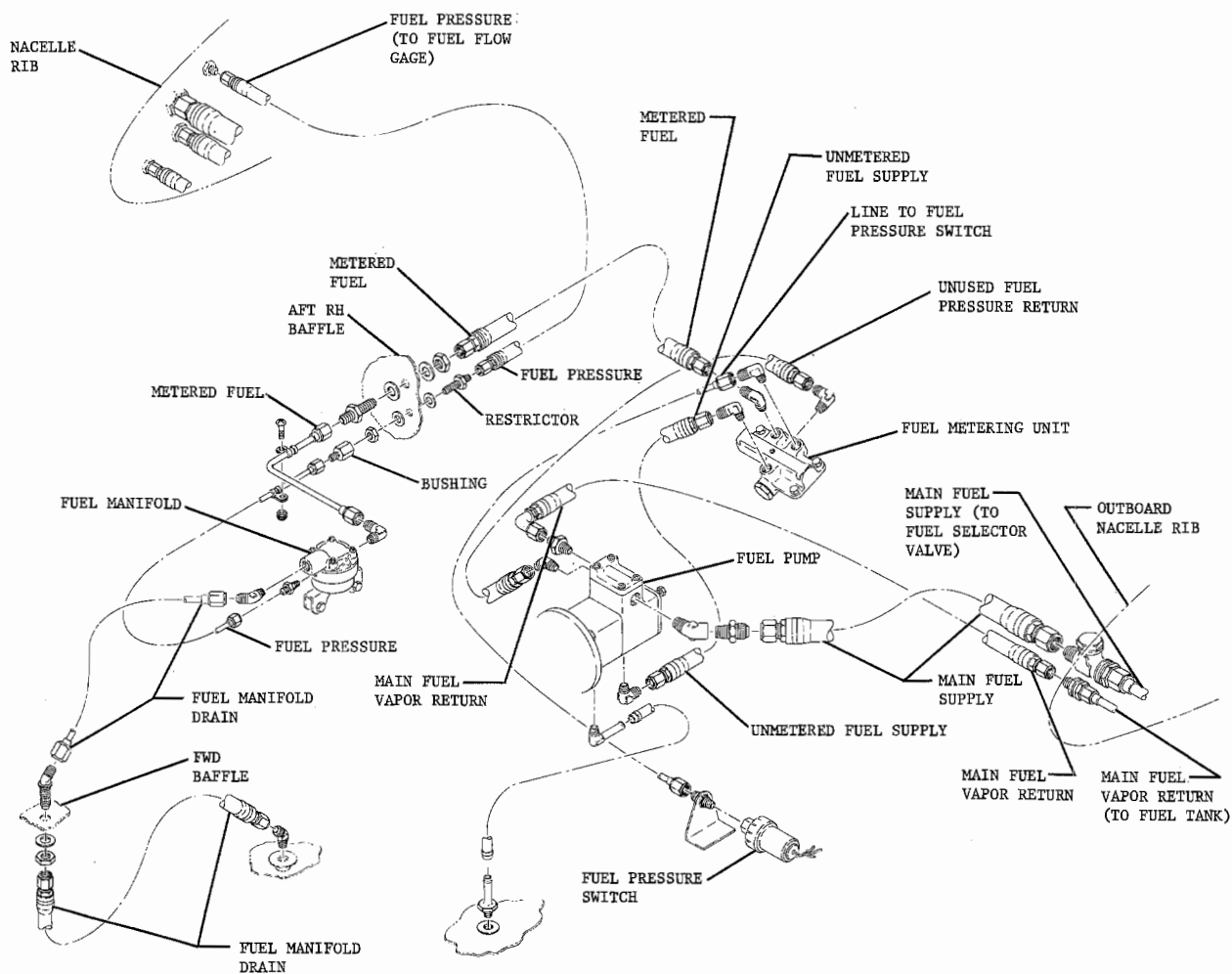
1. Removal/Installation of Fuel Indicating System (See Figure 1 or 2).
 - A. For Removal/Installation of fuel flow gage, refer to Chapter 10, Removal/Installation Typical Instruments.

Inspection/Check

1. Inspection/Check of Fuel Indicating System.
 - A. Remove engine cowlings.

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SERVICE MANUAL



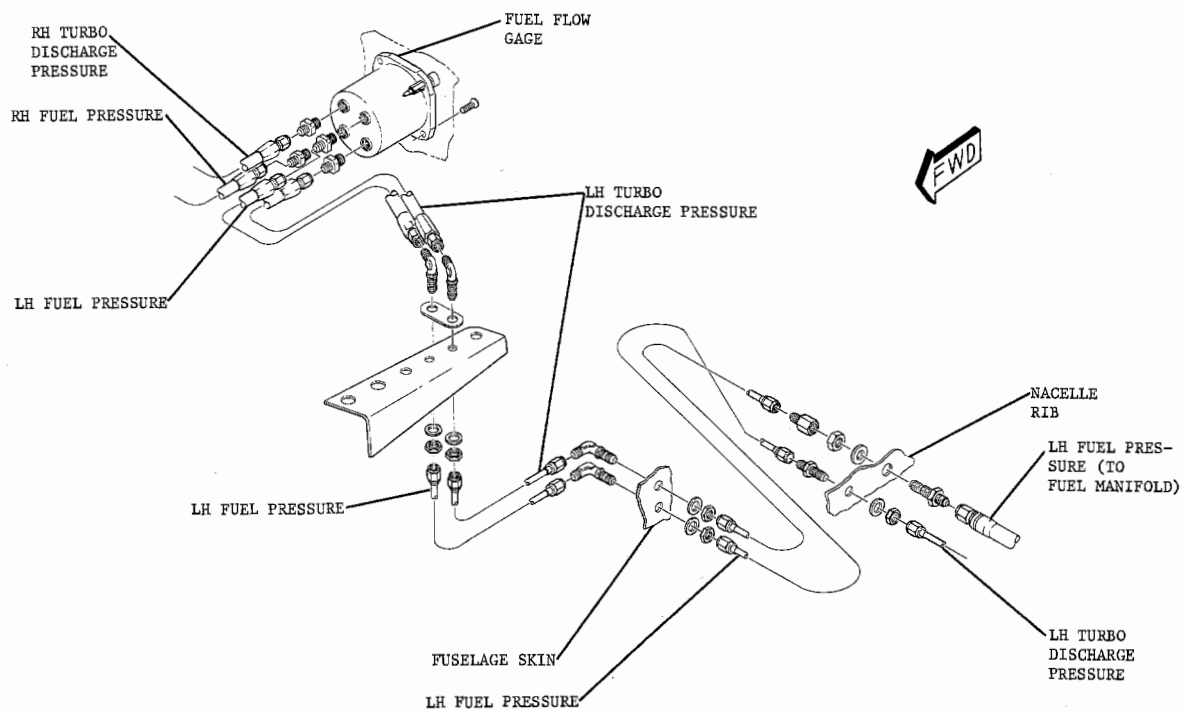
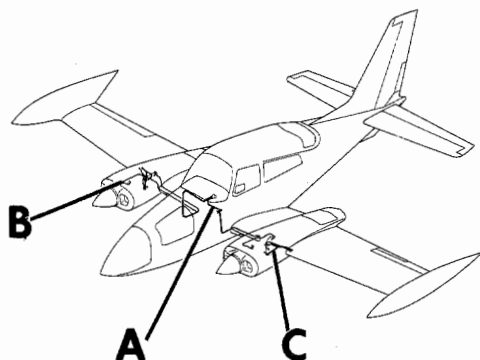
DETAIL C

Engine Fuel System and Plumbing (Standard 310)
Figure 1 (Sheet 2)

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310

SERVICE MANUAL



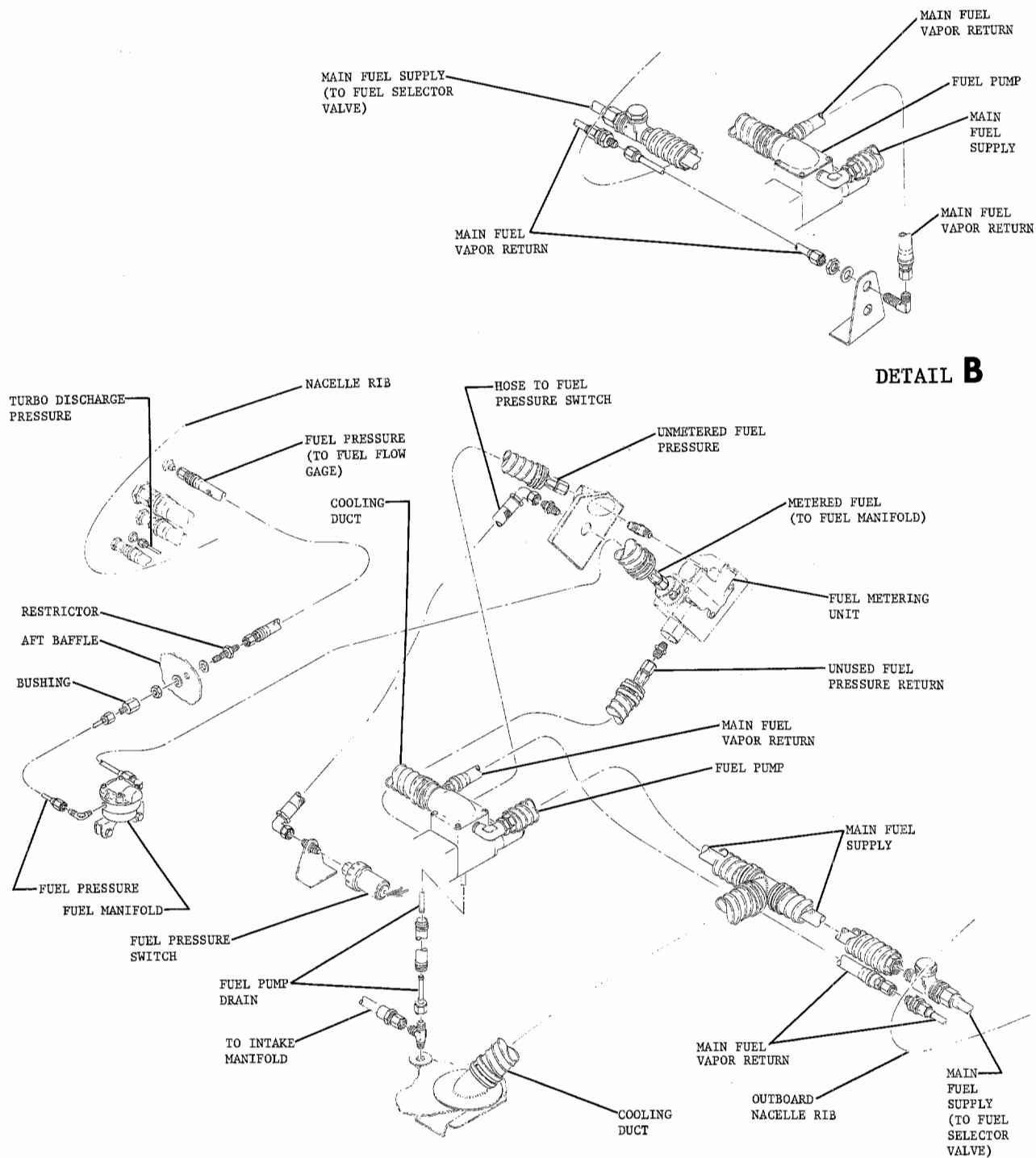
DETAIL **A**

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Engine Fuel System and Plumbing (Turbo 310)
Figure 2 (Sheet 1 of 2)

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SERVICE MANUAL



Engine Fuel System and Plumbing (Turbo 310)
Figure 2 (Sheet 2)

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MAINTENANCE MANUAL

ENGINE IGNITION SYSTEMDescription

1. The engine ignition system consists of the magneto, ignition cables and spark plugs. Ignition for the engine is provided by two magnetos on each engine. The left magneto fires the upper spark plugs on the left bank of cylinders and the lower spark plugs on the right bank of cylinders. The right magneto fires the lower spark plugs on the left bank of cylinders and the upper spark plugs on the right bank of cylinders.

Troubleshooting

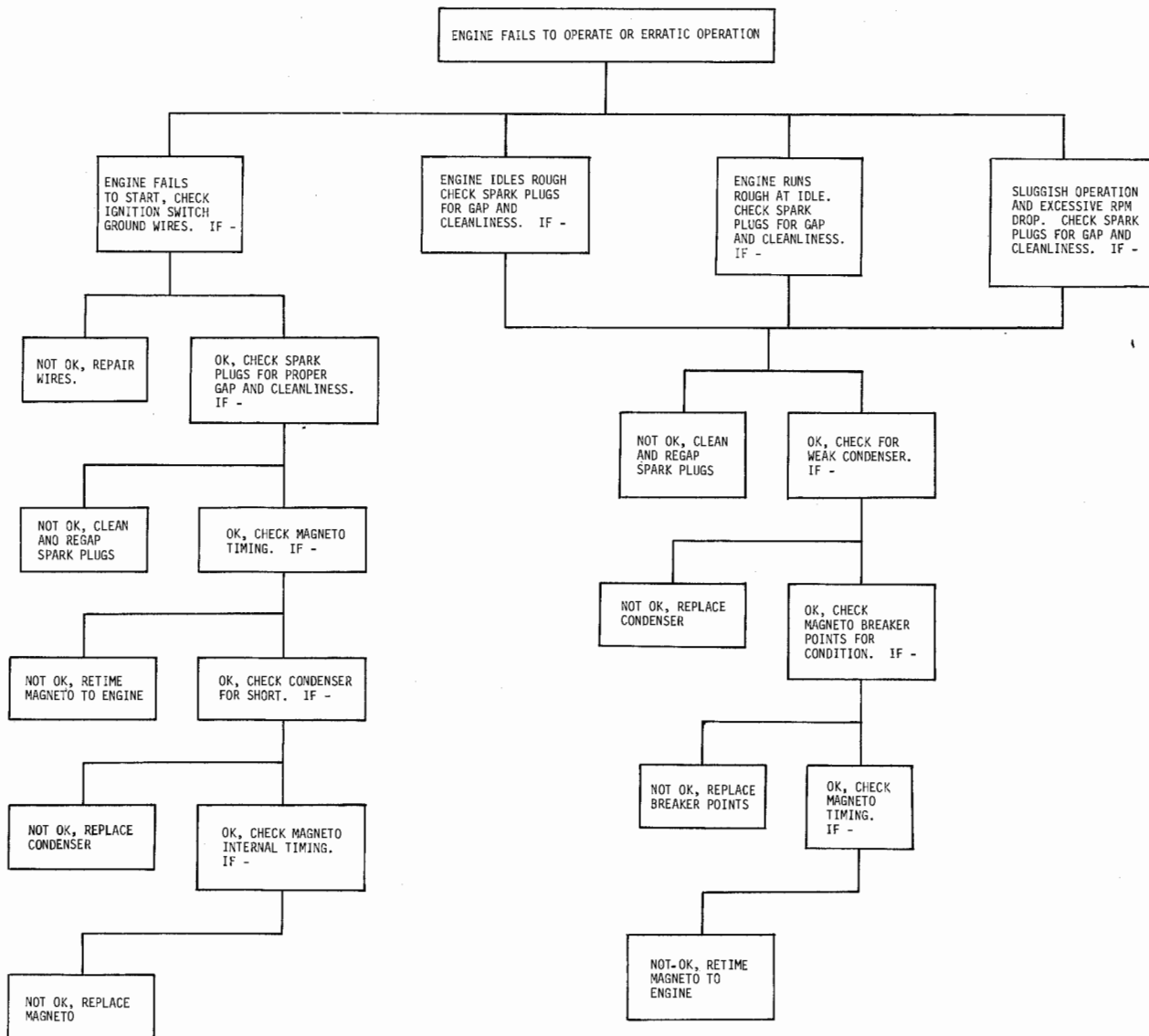
1. For troubleshooting the engine ignition system, see Figure 1.

Adjustment/Test

1. Tools and Equipment.

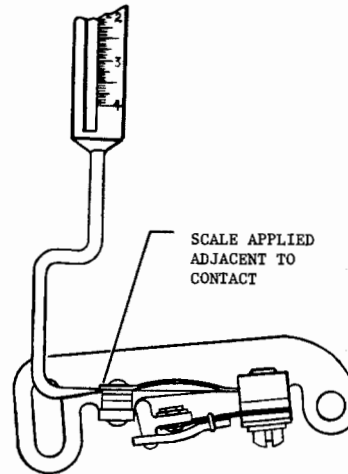
NOTE: Equivalent substitutes may be used for the following listed items:

Name	Number	Manufacturer	Use
Spring Scale	0-30 Ounces	Commercially Available	Checking Main Spring Tension on Breaker Points
Timing Light	11851	Bendix Electrical Components Div. Sidney, N.Y.	Point Gap Setting
Timing Kit	1181501	Bendix Electrical Components Div. Sidney, N.Y.	Magneto Timing
Tester	118950	Bendix Electrical Components Div. Sidney, N.Y.	Testing High Tension Leads



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Troubleshooting Chart - Engine Ignition System
Figure 1



10801002

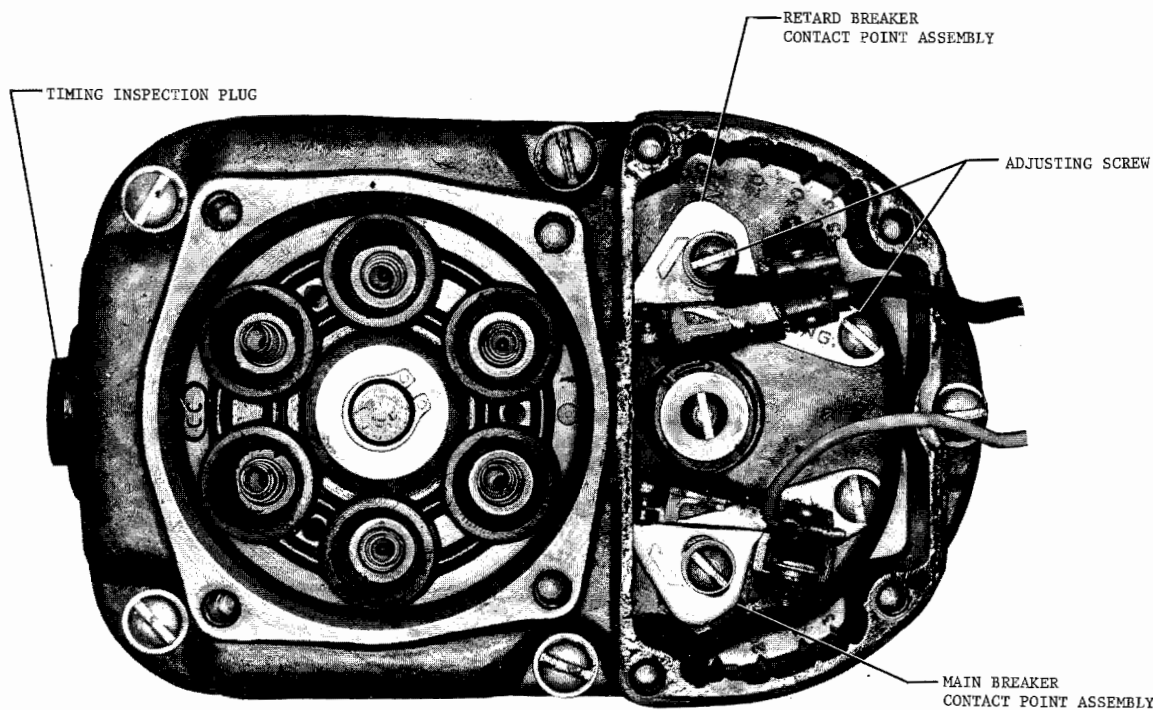
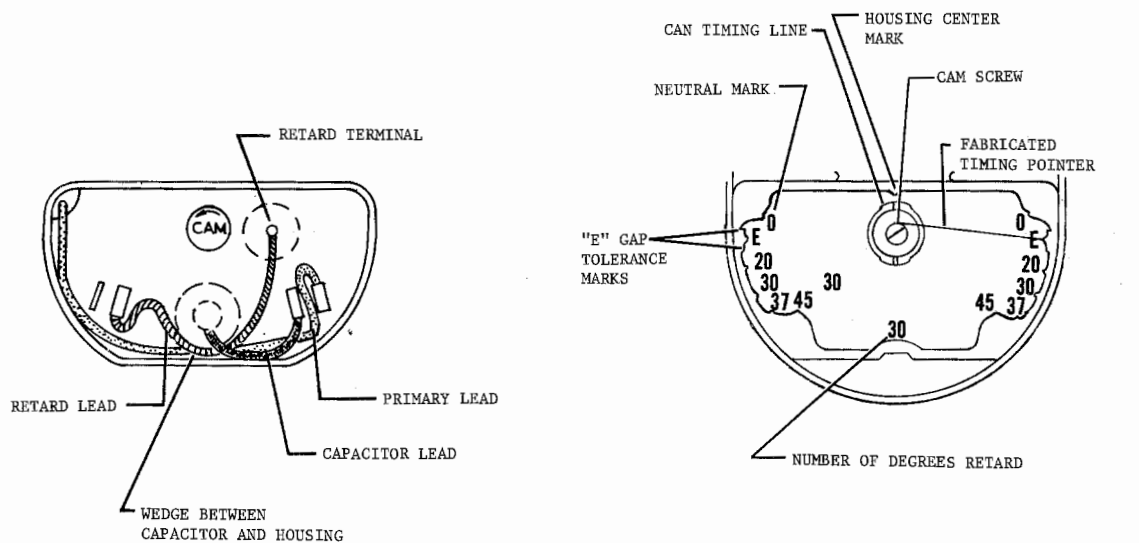
Checking Main Spring Tension
Figure 2

2. Breaker Assembly Main Spring Scale Check (See Figure 2).
 - A. Check the main springs of the breaker assemblies for proper tension. Tension must be between 12 and 24 ounces at the instant the breaker opens.
 - (1) Check that the cam follower is securely riveted to the follower spring and that the screw which holds the parts of the breaker is tight. Torque breaker assembly screw for 10 to 12 inch-pounds.
 - (2) Examine the contact points for excessive wear or burning.

NOTE: Normal points will show a dull, slightly rough contact surface. Points which have deep pits or excessively burned areas should be discarded. If any part of the breaker is defective, the complete breaker assembly must be replaced.
3. Internal Timing (See Figure 3).
 - A. On each side of the breaker compartment are timing marks indicating "E" gap and various degrees of retard breaker timing. The marks on the left side, viewed from the

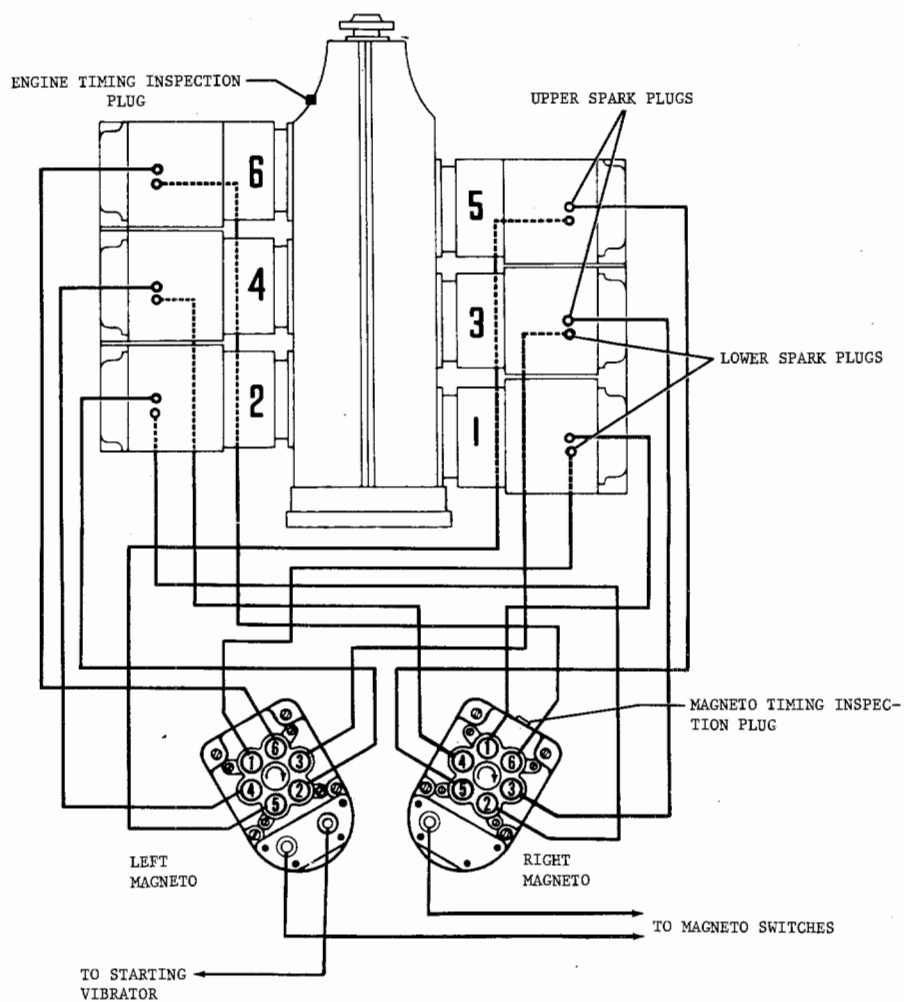
310

MAINTENANCE MANUAL



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Magneto Timing Adjustment
Figure 3



NOTE

NUMBER 1 CYLINDER
LEAD IS MARKED ON
MAGNETO CASE.

Ignition Cable Numbering
Figure 4

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MAINTENANCE MANUAL

breaker compartment, are for clockwise rotating magnetos. Those on the right side are for counterclockwise rotating magnetos. The rotation of the magneto is determined by viewing the magneto from the drive end. The point in the center of the "E" gap boss indicates the exact "E" gap position. The width of the boss on either side of this point is allowable tolerance of ± 4 degrees. In addition to these marks, the cam has an indented line across its end for locating "E" gap position of the rotating magnet when aligned with the mark at the top of the breaker housing.

- B. Fabricate a timing pointer by soldering a piece of soft wire to a flat washer similar to the one used with cam screw (See Figure 2).
- C. Remove timing window plug from top of magneto.
- D. Turn engine crankshaft in its normal direction of rotation until painted chamfered tooth of distributor gear is just becoming visible in window. Continue turning slowly until line on end of cam is aligned with mark at top of breaker housing.
- E. Affix timing pointer to cam screw so that it indexes in center of "E" gap mark on breaker housing.
- F. Connect timing light across main breaker. Adjust main breaker contacts to open at this point. Turn engine crankshaft until cam follower is on high point of cam lobe and measure contact clearance. If clearance is not 0.018 ± 0.006 inches, readjust breaker and verify that contacts will open within "E" gap tolerance of $\pm 4^\circ$. Replace breaker assembly if both "E" contact opening point tolerance and contact clearance cannot be obtained.
- G. On retard breaker magnetos, the retard breaker is set to open a predetermined number of degrees after the main breaker opens. To adjust retard breaker, turn engine crankshaft until it is back to the point of main breaker opening. Position pointer at 0° mark. Continue turning crankshaft until pointer is over required retard degree mark.

NOTE: When 25° retard is required on magnetos with cast in timing marks, advance pointer until it is over the 20° mark. Then rotate engine crankshaft until pointer is over the 45° mark. This will give a total of 25° retard.

- H. Connect timing light across retard breaker. Adjust retard breaker contacts to open at this point. Turn engine crankshaft until cam follower is on high point of cam lobe and measure contact clearance. If clearance is not 0.018 ± 0.006 inches, readjust breaker and verify that contacts open at retard degree marks on housing. A tolerance of $1/16$ inch rotation past this mark ($+2^\circ$, -0°)

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MAINTENANCE MANUAL

is allowed to make contacts open. Replace breaker assembly if both retard breaker opening point and contact clearance cannot be obtained.

- I. Certain magnetos may not incorporate timing marks in the breaker compartment. To check internal timing of these magnetos, install timing kit to breaker compartment and follow the procedure outlined in steps "C" through "H".

CAUTION: IF CAM SCREW WAS REMOVED FOR INSTALLATION OF POINTER, REPLACE FLAT WASHER, LOCK-WASHER AND SCREW WHEN FINISHED. TIGHTEN TO 16 - 20 INCH POUNDS OF TORQUE.

MAGNETOSDescription

1. Each magneto installation consists of a single breaker magneto retard breaker magneto, starting vibration and a combination ignition and starter switch. The starting vibrator is used in conjunction with the retard breaker magneto to obtain the voltage necessary at cranking speeds. The magneto is a completely self-contained unit. The rotating magnet turns on two ball bearings one located at the breaker end and the other at the drive end. The retard breaker is actuated by the same cam as the main breaker and is so positioned that its contacts open a predetermined number of degrees after the main breaker contacts open.

Maintenance Practices

1. Removal/Installation of Magnetos (See Figure 1).

- A. Remove magneto.

- (1) Remove engine cowling.
- (2) Disconnect the ground wire and tag.

WARNING: MAGNETOS ARE IN SWITCH ON CONDITION
WHEN GROUND WIRES HAVE BEEN REMOVED.

- (3) Detach the high tension outlet plate from the magneto to be removed.
- (4) Rotate propeller by hand in the normal direction of rotation until the number one cylinder is coming up on its compression stroke.

NOTE: To facilitate installation of a replacement magneto, it is good practice to position the crankshaft at the advance firing angle for number one cylinder. Any standard timing device or method can be used to obtain this position, or if the magneto being removed is correctly timed to the engine, the crankshaft can be rotated to a position at which the breaker points will be just opening to fire the number one cylinder.

- (5) Remove the two magneto flange clamp nuts, washers, and clamps. Pull the magneto forward from the crankcase mounting pad.

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MAINTENANCE MANUAL

NOTE: As the magneto flange clears the crankcase hole, watch the rubber drive bushings and steel retainer in the gear hub to make sure they will not drop out.

B. Install Magneto.

- (1) Remove the magneto timing inspection hole plug. Rotate the magneto shaft until the timing pointer inside the magneto case is aligned with marked gear tooth.
- (2) Remove either the upper or lower spark plug from number one cylinder.
- (3) Remove timing inspection plug located on the side of the crankcase and forward of number six cylinder.
- (4) Rotate propeller to locate timing mark scribed on ring gear through timing inspection hole, when number one cylinder is on the compression stroke.

NOTE: The number one cylinder firing position is 22° BTC. This can be accomplished by rotating the propeller shaft and centering the timing mark on ring gear with the centerline of the crankcase timing inspection hole.

- (5) Check magneto to assure it is internally timed for right-hand drive rotation.

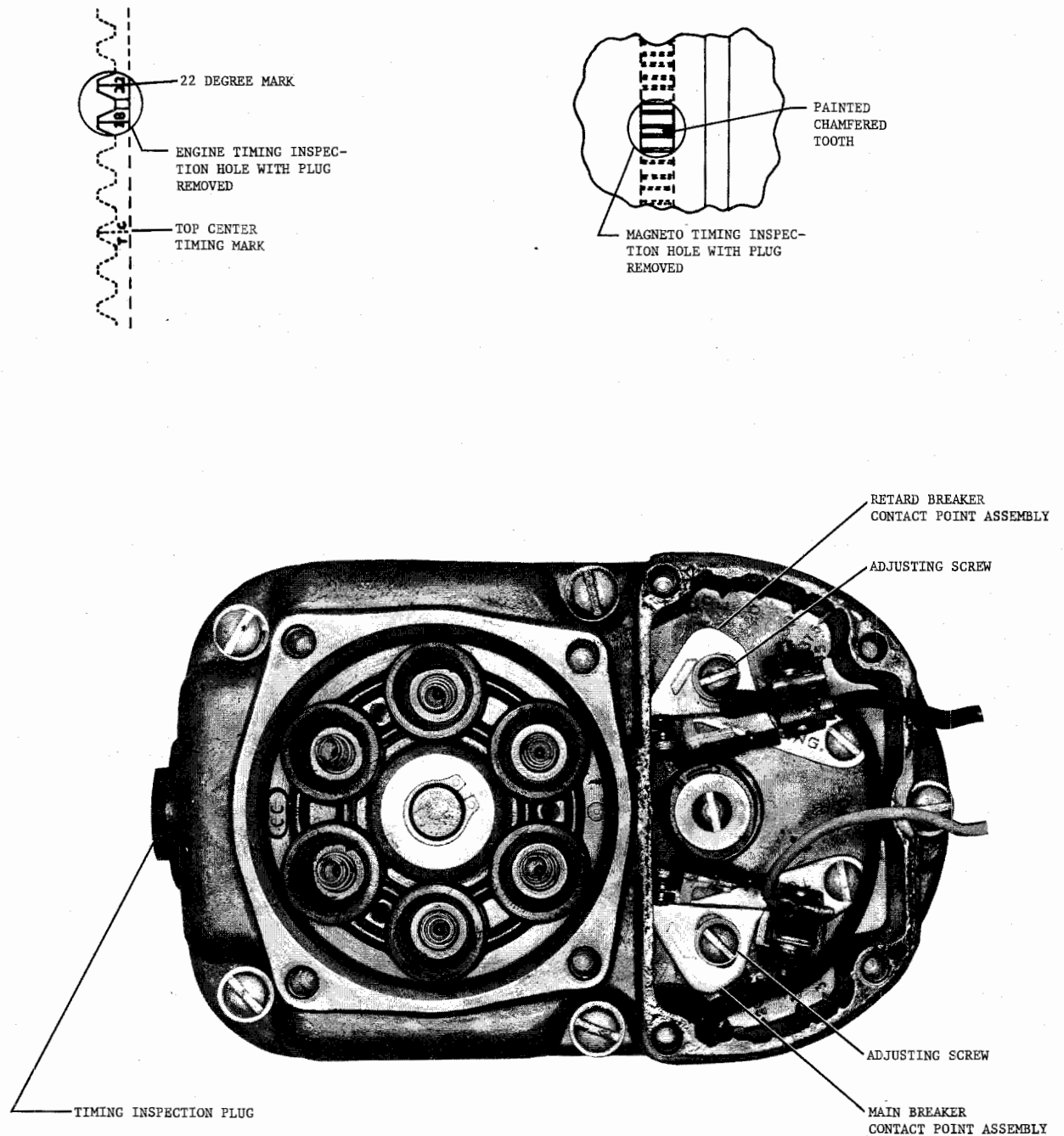
NOTE: The magneto installation procedure is identical for installing either magneto on either engine.

- (6) Position magneto in place on the crankcase accessory mounting pad.
- (7) Attach a timing light to magneto in accordance with timing light manufacturers instructions.
- (8) If the timing light is out, rotate magneto housing in direction of its magneto rotation a few degrees beyond point where light illuminates. Slowly rotate magneto in opposite direction until light is out.
- (9) Install Spark Plug.
- (10) Install engine cowling.

Inspection/Check

1. Magneto Inspection/Check.

- A. Remove engine cowling.
- B. Remove magneto breaker point cover plate.



Magneto Installation
Figure 1

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Cleaning/Painting

1. Clean Magnetos

- A. Clean the magnetos with a suitable solvent such as Stoddard solvent and dry with dry compressed air.

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MAINTENANCE MANUAL

IGNITION CABLESDescription

1. The ignition harness for each engine consists of twelve shielded, high tension cable assemblies with attaching brackets. Six cables are routed from the left magneto, three routing to the upper spark plugs on the left magneto, three routing between number one and number three cylinders to the lower spark plugs on the right bank of cylinders. The remaining six cables are similarly routed from the right magneto, with three cables going to the upper spark plugs on the right bank of cylinders and the remaining three being routed between number two and number four cylinders to the lower left spark plugs.

Maintenance Practices

1. Removal/Installation Ignition Cables.

- A. Remove Ignition Cables.

- (1) Remove engine cowling.
- (2) Remove the cables from spark plug and withdraw the contactor from the spark plug barrel.
- (3) Loosen attaching clamps.
- (4) Remove screws which secure high tension plate to magnetos.
- (5) Remove the slotted-head screw and brass washer from plate grommet base which is in line with cable to be detached.
- (6) Withdraw cable.

- B. Install Ignition Cable.

- (1) All cables can be installed in the same manner. If a new cable is being installed, check it for correct length by comparing it with the cable which is being replaced.
- (2) By using good ignition maintenance practices in addition to the Do's and Don'ts listed herein, the normal life expectancy of the harness can be reached. Avoid sloppy installation and maintenance to gain full harness service life. Don't let poor practices reduce reliability.

Do - Use the Bendix 11-8950 High-Tension Lead Tester to avoid unnecessary handling and replacement of leads.

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MAINTENANCE MANUAL

Do - Route leads to avoid all contact with engine, engine components, oil lines, airframes, etc.

Don't - Allow leads to chafe on engine, engine components, oil lines, airframes, etc.

Do - Make necessary bends as gradual as possible. Keep leads straight wherever possible. Use an elbow clamp, screw and nut where a bend at the spark plug is required.

Don't - Make sharp bends or stretch leads.

Do - Torque spark plug coupling nuts accurately: 90-95 inch-pounds for 5/8" -24 nut and 110-120 inch-pounds for the 3/4" -20 coupling nut.

CAUTION: DON'T OVER-TORQUE OR UNDER-TORQUE
SPARK PLUG COUPLING NUTS. ALWAYS USE
A TORQUE WRENCH.

Do - Hold the hex-shaped crimped portion of the spark plug terminal ferrule with a crescent wrench. This will prevent the ferrule from turning and twisting the lead while tightening or loosening the coupling nut. A four-inch crescent-type wrench is about the right size.

Don't - Allow the leads to twist while coupling. Twisting leads may rupture the insulating material.

Do - Use as many clamps and wire bundle ties as necessary. When in doubt, use another clamp or tie.

Do - Redress harnesses when engines are mounted in their nacelles to prevent chafing against airframe components, etc. Change nylon ties or clamps if they will hold better in a new position. Check harnesses, ties and clamps when other checks are being made on the engine.

Don't - Allow leads and wire bundles to hang loosely from their clamps. Don't allow leads to come near the exhaust manifold - keep them as far away as possible. Retighten or reposition clamps or ties if they are loosened for any reason.

Do - Check lead terminals, especially bottom cylinder plug terminals (which seem to run the hottest). The heat may cause the insulating sleeve of the plug terminal to stick in the barrel of the spark plug. If stuck, the insulating sleeve should be removed

from the spark plug in such a manner as to protect the silicone insulating on the lead as much as possible. The insulating sleeve, which is readily replaceable, will receive most of any damage incurred during removal.

Don't - Bend and twist the spark plug lead until the insulation is damaged or cut by the edge of the terminal ferrule. Do not damage the 5mm high-tension wire by allowing a screwdriver blade or other sharp tool to pierce it.

Do - Remember to clean the spark plug well ceramic and terminal insulating sleeve. Clean with a cloth dampened in alcohol.

Don't - Touch the terminal insulating sleeve after washing.

Do - Use a high-temperature mold (MS-122 Fluorocarbon Spray, Miller-Stepenson Chemical Co., Inc., 16 Sugar Hollow Rd., Danbury, Connecticut), release on terminal sleeves and on grommets at the magneto cable outlet plates. This will help prevent the hotter running plug insulating sleeves from sticking.

Don't - Apply mold release to dirty plugs or insulating sleeves.

NOTE: During maintenance check, carefully inspect the silicone lead insulating between the braided conduit and insulating sleeve. Remove the elbow clamp, if installed, to facilitate this inspection. Any lead that is torn or cut must be replaced. A longitudinal or cross-shaped tear may be caused by spark plug leakage. This leakage usually causes a gray or black discoloration of the lead at the torn area.

- (3) Connect cable to high tension outlet by inserting cable end, with ferrule and coupling nut in place, through high tension cable outlet plate and into proper hole in outlet plate grommet.
- (4) Fasten cable in place with cable piercing screw and brass washer.

CAUTION: DO NOT OVER-TIGHTEN SCREWS. AVOID BENDING THE LEAD OVER THE EDGE OF THE HARNESS FERRULE; THIS MAY RESULT IN CUTTING THE LEAD.

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NOTE: Whenever a 3/4-20 spark plug is used, insure that the compression spring is fully seated in the ferrule counterbore. If this precaution is not observed, a "Z" or "S" shaped bend can occur in the lead when assembled to plug.

- (5) Attach high tension outlet plate, with cables in place, to magneto with four attaching screws.
- (6) Replace cable on proper spark plug.
- (7) Install the engine cowling removed.

Inspection/Check

1. Ignition Cable Inspection/Check.
 - A. Remove engine cowling.

Cleaning/Painting

1. Clean Ignition Cables
 - A. The ignition cables should be wiped clean using a clean cloth and DC4 Silicone grease.

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MAINTENANCE MANUAL

SPARK PLUGSDescription

1. There are two spark plugs in each cylinder. The spark plugs are 18mm short reach type and screw into heli-coil inserts in the cylinders. The spark plugs are shielded to prevent radio interference and have an internal resistor to provide longer gap life. An average life of 200 hours can be expected, however, this time will vary with operating conditions. The proper gap setting is .015 to .018 inches.

Maintenance Practices

1. Removal/Installation of Spark Plugs

- A. Remove Spark Plugs.

- (1) Remove engine cowling.
 - (2) Loosen coupling nut on spark plug ignition harness.
 - (3) Lift terminal sleeve out of spark plug shielding barrel well.

CAUTION: WHEN REMOVING TERMINAL SLEEVE FROM SPARK PLUG, USE EXTREME CARE TO KEEP THE CABLE TERMINAL SLEEVE STRAIGHT IN THE SHIELDING BARREL. ANY MISALIGNMENT COULD SCRATCH OR BREAK THE SLEEVE OR THE CERAMIC INSULATION IN THE SPARK PLUG, NECESSITATING REPLACEMENT OF EITHER OR BOTH.

- (4) Unscrew the spark plug from the cylinder using a deep socket wrench of suitable size. Make certain that the copper gasket is removed with the spark plug.

- B. Install Spark Plug as follows:

- (1) To install a spark plug, first make certain the heli-coil insert in the cylinder is undamaged and that the old copper gasket was removed along with the spark plug.

NOTE: If there is any damage to the heli-coil insert, it should be replaced before installing a spark plug.

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MAINTENANCE MANUAL

Cleaning/Painting

1. Clean Spark Plugs

A. Clean the spark plugs with an abrasive type cleaner.

- (1) Apply anti-seize compound sparingly to spark plug threads, being careful not to allow any compound to get on the ground electrodes. A good practice is to leave the bottom two threads of the spark plug uncoated. The anti-seize compound is electrically conductive and any of this material on the electrodes would short out the spark plug.
- (2) Screw the spark plug into the cylinders, first installing a new copper gasket. The plugs should be tightened to the specified torque, 330 ± 30 inch-pounds using a deep socket wrench with a torque indicating handle.

CAUTION: MAKE CERTAIN THAT THE SOCKET IS PROPERLY SEATED ON THE SPARK PLUG HEXAGON AS DAMAGE TO THE PLUG COULD RESULT IF THE WRENCH IS COCKED TO ONE SIDE WHEN PRESSURE IS APPLIED.

- (3) Install engine cowling.

Inspection/Check

1. Spark Plug Inspection/Check.

A. Remove engine cowling.

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MAINTENANCE MANUAL

ENGINE OIL SYSTEMDescription

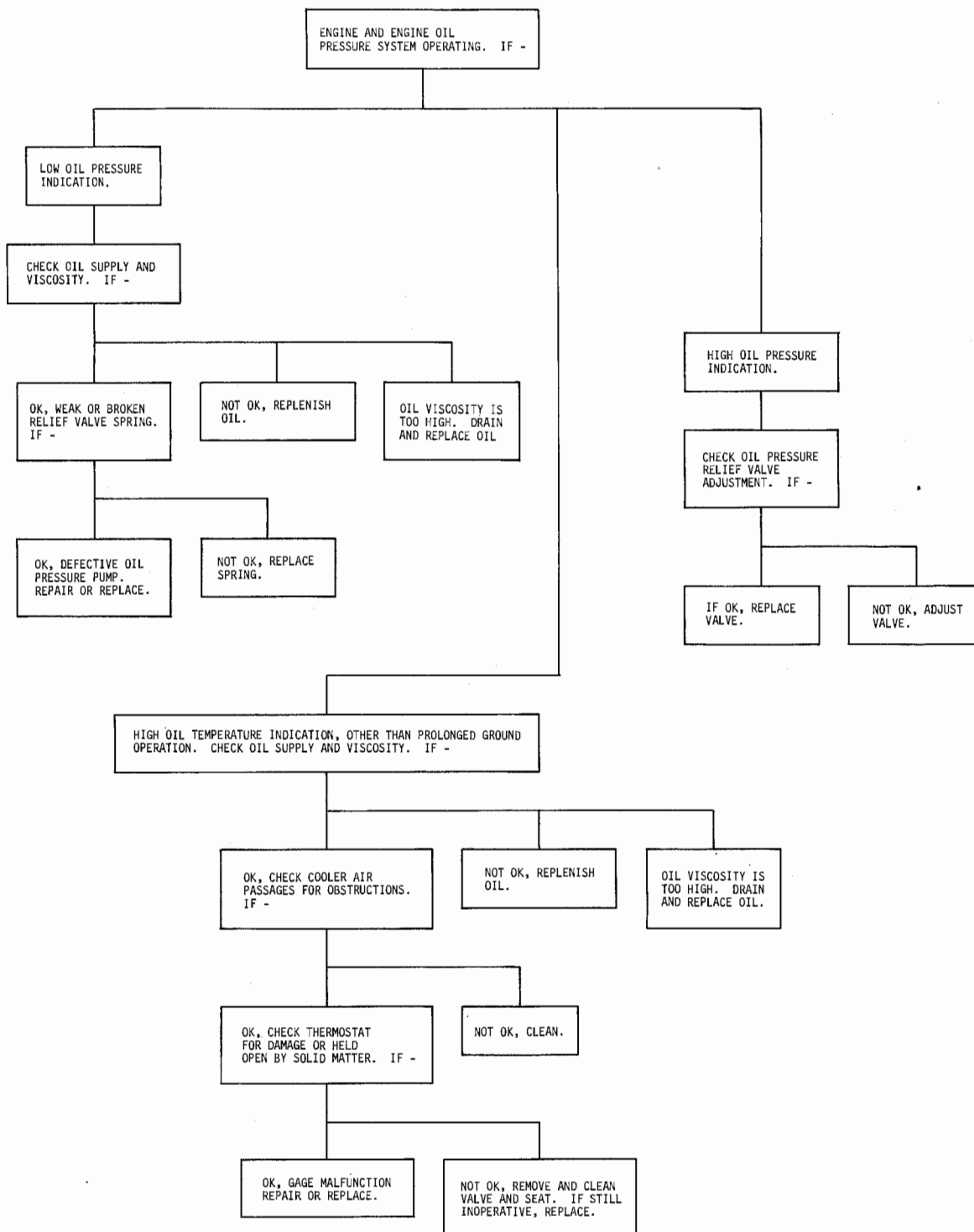
1. The oil pressure system consists of a wet sump type pressure lubricating system. Oil temperature in each engine is controlled by a thermally operated valve which either bypasses the oil around the external mounted cooler or routes the oil through the cooler passages for cooling. Oil furnished to the propeller governor for propeller operation is also routed through internal passages. Engine oil is routed externally for use in actuating the turbocharger waste-gate and turbocharger lubrication on the Turbo 310. Engine oil is filtered through an internally mounted screen and externally mounted oil filter. A bypass valve will rotate the oil around the filter if it becomes clogged. Oil pressure is maintained by a spring-loaded adjustable pressure relief valve.
2. Oil temperature is sensed through a heat variable resistor type temperature bulb which is located in the main oil passage of the crankcase directly below the cooler. Changes in oil temperature are transmitted from the oil temperature bulb to the oil temperature gage through electrical wiring.

Troubleshooting

1. For troubleshooting the engine oil system, see Figure 1.

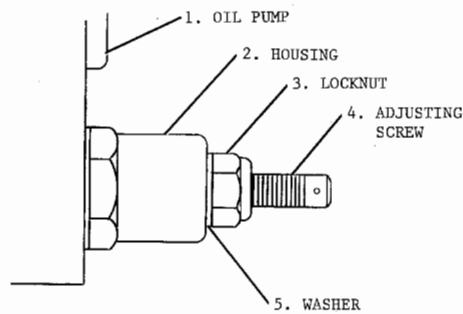
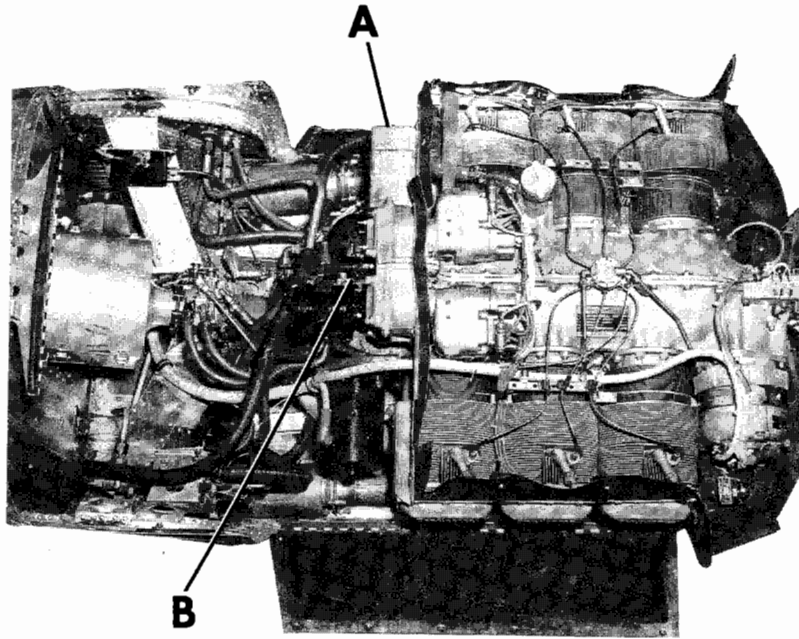
Adjustment/Test

1. Oil Pressure Adjustment (See Figure 2).
 - A. Adjust Oil Pressure.
 - (1) Start engines and allow engine to warm-up. Refer to owner's manual.
 - (2) Check oil pressure with engine operating 1700 RPM reading the engine gage on instrument panel.
 - (3) If oil pressure is not 30 to 60 psi, turn adjusting screw (4) to obtain correct pressure. Turn in (cw) to increase pressure, turn out (ccw) to decrease pressure.
2. Oil Temperature Adjustment (See Figure 2).
 - A. Adjust Oil Temperature.
 - (1) Start engines and allow engines to warm-up (refer to owners manual).

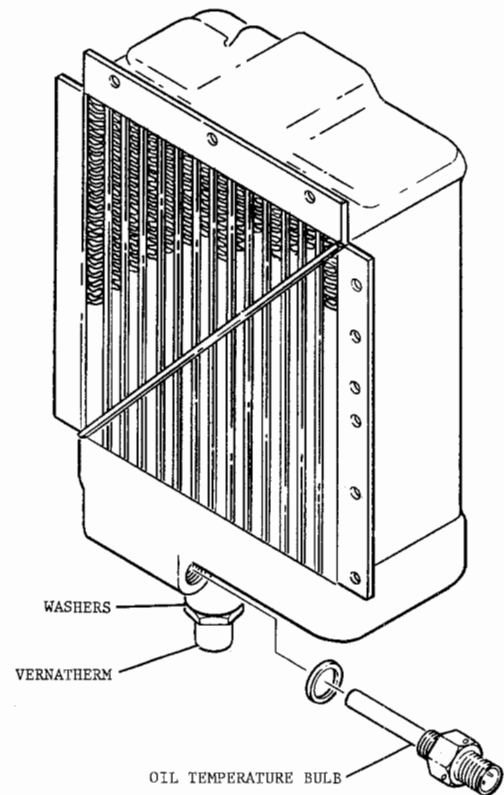


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Troubleshooting Chart - Engine Oil System
Figure 1



DETAIL B



DETAIL A

Oil Pressure and Temperature Adjustment
Figure 2

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A10561009
B10561009

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MAINTENANCE MANUAL

- (2) Operate engines at 1700 RPM.
- (3) Oil temperature should read in upper 20% of green arc and be within 20% of opposite engine temperature indication.
- (4) If the oil temperature is not within the prescribed tolerances, adjust temperature by removing or adding washers on the Vernatherm located in the bottom of the oil cooler.

NOTE: Adding washers will increase temperature and removing washers will decrease temperature.

Inspection/Check

- 1. Inspection/Check of Engine Oil System.
 - A. Remove upper engine cowling.

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MAINTENANCE MANUAL

ENGINE OIL FILTERDescription

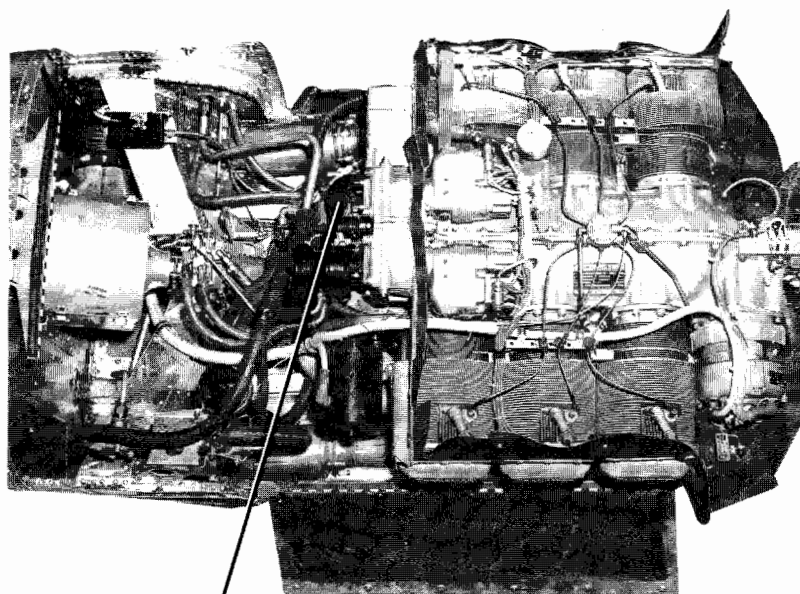
1. The engine oil filter is a full flow spin on type filter. A by-pass valve will open should the element become clogged. Oil pressure opens the by-pass valve, which is set at a pre-determined pressure, so unfiltered oil will lubricate the engine and prevent oil starvation in the event the filter becomes clogged.

Maintenance Practices

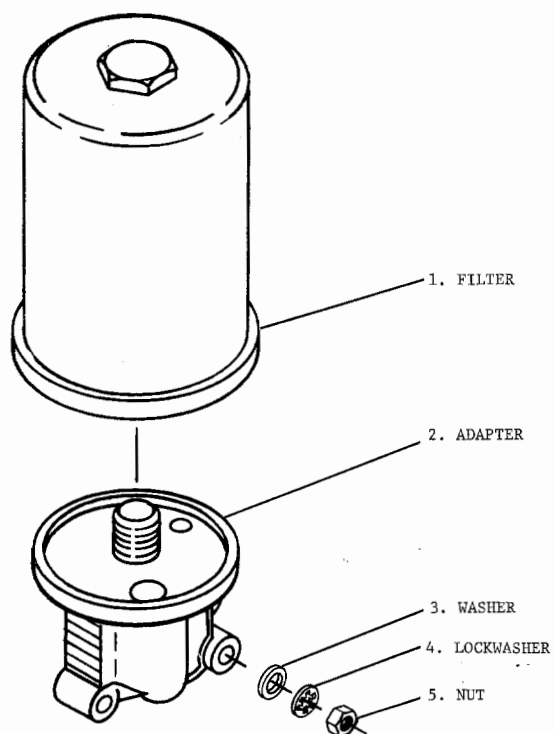
1. Removal/Installation of Oil Filter (See Figure 1).
 - A. Remove Oil Filter.
 - (1) Remove upper engine cowl.
 - (2) Cut safety wire on oil filter.
 - (3) Loosen filter and remove.
 - B. Install Oil Filter.
 - (1) Wipe adapter clean with a lint free dry cloth.
 - (2) Install new filter and torque in accordance with instructions on the side of filter element.
 - (3) Safety wire.
 - (4) Install upper engine cowl.

Inspection/Check

1. Oil Filter Inspection/Check.
 - A. Remove Upper Engine Cowl.



A



DETAIL A

Engine Oil Filter Installation
Figure 1

1050P6004
A10561005

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MAINTENANCE MANUAL

ENGINE OIL INDICATING AND CYLINDER HEAD
TEMPERATURE SYSTEMSDescription

1. The engine oil and cylinder head temperature indicating system consist of the engine combination gage, oil temperature bulb, the cylinder head temperature thermacouple along with their associated lines and wiring. The oil temperature indicator is electrically operated, connected to a temperature bulb located in the bottom of the engine oil cooler. The cylinder head temperature indicator is operated from a thermocouple inserted in the bottom of the #2 cylinder on the left and right engine. The engine oil pressure indicator is a direct reading P.S.I. gage connected to the engine oil pressure system.

Maintenance Practices

1. Removal/Installation of Oil Pressure Indicating System (See Figure 1).

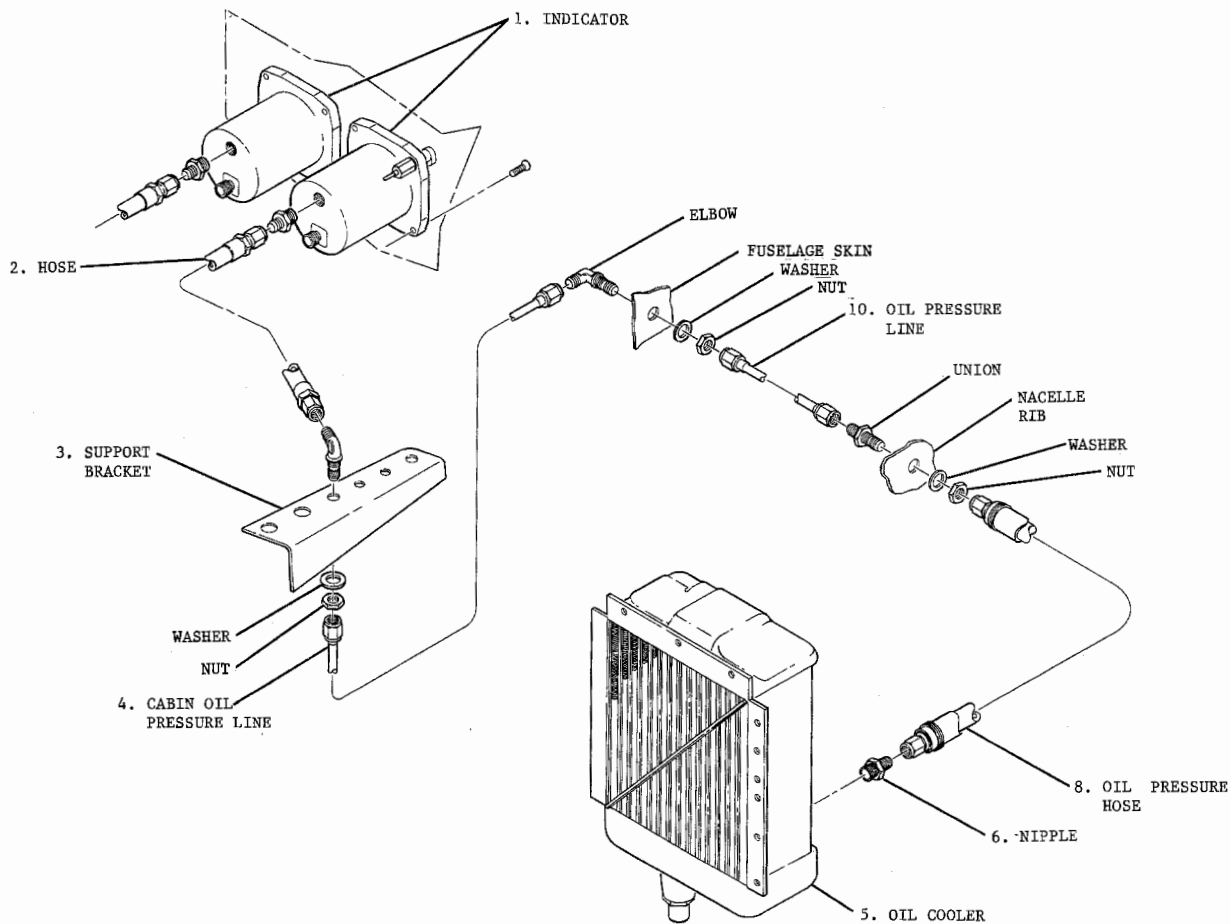
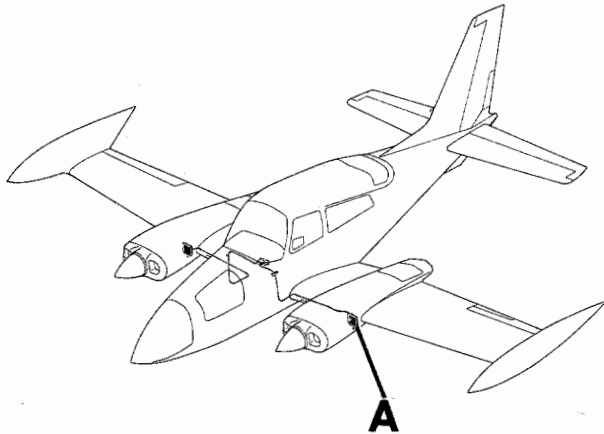
- A. Remove Oil Pressure Indicating System.

NOTE: Cap all openings and lines on removal.

- (1) Remove engine cowling.
- (2) Disconnect oil pressure hose (2) from indicator (1) and fitting in support bracket (3).
- (3) Disconnect cabin oil pressure line (4) at support bracket (3) and fuselage skin elbow.
- (4) Disconnect oil pressure line (10) from fuselage skin elbow and nacelle rib union.
- (5) Disconnect oil pressure line (9) from nacelle rib union and tee (7) (Turbo 310).
- (6) On Standard 310, disconnect oil pressure hose (8) from nacelle rib union and nipple (6).
- (7) Remove indicator in accordance with typical instrument removal, Chapter 10.

- B. Install Oil Pressure Indicating System.

- (1) On Standard 310, install oil pressure hose (8) between nipple (6) and nacelle rib union.
- (2) Connect oil pressure line (9) to tee (7) and nacelle rib union (Turbo 310).
- (3) Connect oil pressure line (10) to fuselage skin elbow and nacelle rib union.
- (4) Connect oil pressure line (4) to fuselage skin elbow and support bracket (3) fitting.

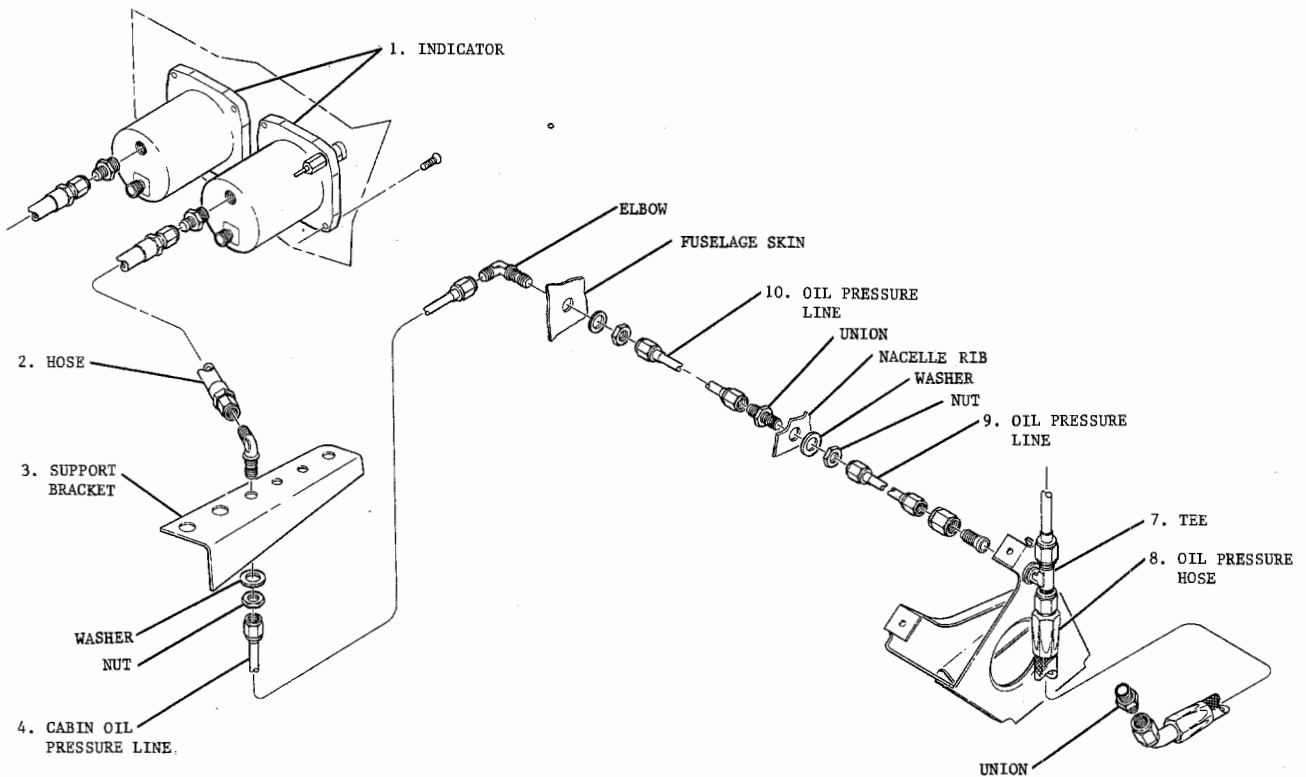
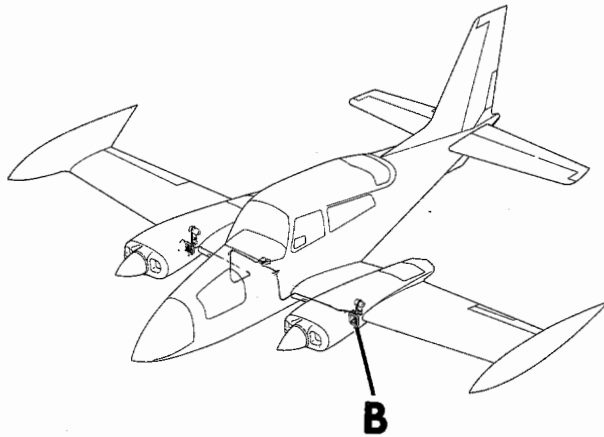


DETAIL A

STANDARD 310

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A10563005

Engine Indicating System
Figure 1 (Sheet 1 of 2)



DETAIL B

TURBO 310

Engine Indicating System
Figure 1 (Sheet 2)

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- (5) Connect oil pressure hose to fitting in support bracket (3) and indicator fitting.
- (6) Install engine cowling.
- (7) Anytime the oil pressure indicating system has been removed or repairs have been made, the oil pressure system should be bleed as follows:
 - (a) With all connections tightened, start engine and allow time for the engine pumps to fill the oil pressure lines.
 - (b) After a positive indication of oil pressure has been noted, loosen the hose fittings on the rear of the engine gage units and allow a few drops of oil to leak from the fittings. This will bleed the trapped air from the lines and provide an accurate oil pressure indication.

2. Removal/Installation of Oil Temperature Indicating System (See Figure 1).

A. Remove Oil Temperature Indicating System.

NOTE: Cap all openings and lines on removal.

- (1) Remove engine cowling.
- (2) Disconnect electrical connector from temperature bulb located on underside of oil cooler.

CAUTION: PLACE CONTAINER OR RAGS UNDER OIL COOLER TO PREVENT OIL DRIPPING IN ENGINE NACELLE.

- (3) Loosen oil temperature bulb and remove from oil cooler.
- (4) Remove wiring from engine wire bundle.
- (5) Remove indicator in accordance with typical instrument removal, Chapter 10.

B. Install Oil Temperature Indicating System.

- (1) Install Indicator in accordance with typical instrument installation procedures, Chapter 10.
- (2) Route wires from indicator to engine nacelle and secure to the engine wiring bundle assembly with clamps.
- (3) Remove plug and install oil temperature bulb in oil cooler.
- (4) Connect electrical connector to oil temperature bulb.
- (5) Install engine cowling.

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3. Removal/Installation of Cylinder Head Temperature Indicating System.

A. Remove Cylinder Head Temperature Indicating System.

- (1) Remove engine cowling.
- (2) Disconnect quick disconnect on the lower side of number 2 cylinder on the engine.

NOTE: Cap all fitting openings on removal of fittings.

- (3) Loosen thermocouple fitting and remove.
- (4) Remove thermocouple wires from engine wiring bundle.
- (5) Remove indicator in accordance with typical instrument removal, Chapter 10.

B. Install Cylinder Head Temperature Indicating System.

- (1) Install indicator in accordance with typical instrument installation procedures, Chapter 10.
- (2) Route thermocouple wires from indicator to engine nacelle and secure to the engine wiring bundle with clamps.
- (3) Remove cap and install thermocouple fitting.
- (4) Connect quick disconnect.
- (5) Install engine cowling.

Inspection/Check

1. Inspection/Check of Oil Pressure Indicating System.

- A. Remove Upholstery side panel.
- B. Remove necessary access plates and wing gap cover.
- C. Remove upper engine cowling.

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ENGINE INDUCTION AIR SYSTEMDescription

1. The engine induction air system consists of air routed from the air canister filter assembly to the throttle body on 310 aircraft and routed from air canister filter through the turbocharger to the throttle body on Turbo 310 aircraft. A manually controlled alternate air valve is located on the air canister to provide alternate air (heated engine compartment air) should the air induction filter become clogged or if a requirement for heated air is needed. Air filter service and maintenance is very important to the life of the engine and turbocharger, particularly in areas where dust is prevalent.

Troubleshooting

1. For troubleshooting the engine induction air system, see Figure 1.

Maintenance Practices

1. Removal/Installation of Air Canister (See Figure 3) Standard 310.
 - A. Remove Air Canister.
 - (1) Remove upper engine cowl.
 - (2) Disconnect cowl flap, refer to Cowl Flaps Chapter 7.
 - (3) Loosen duct clamp from canister and remove.
 - (4) Disconnect clamp (2) securing canister to throttle body.
 - (5) Disconnect alternate air control from alternate air door by removing nut, washer, and screw.
 - (6) Remove four bolts from brackets securing canister to nacelle and lift canister out.
 - B. Install Air Canister.
 - (1) Position air canister in place and install four washers and bolts to mounting brackets.
 - (2) Connect alternate air control on aft side of canister with screw, washer and nut.
 - (3) Align canister to throttle body and install clamp (2).
 - (4) Install inlet air duct in place on canister and tighten clamp.
 - (5) Connect cowl flap, refer to Cowl Flaps Chapter 7.
 - (6) Install engine cowl.

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C. Remove Induction Air Filter Element.

- (1) Remove upper engine cowling.
- (2) Disconnect cowl flap, refer to Cowl Flaps Chapter 7.
- (3) Release fasteners and hinge air canister top open.
- (4) Slide induction air filter element out of air canister.

D. Install Induction Air Filter Element.

NOTE: Insure inside of air canister is clean before installing element.

- (1) Insert induction air filter element in place in canister and close cover.
- (2) Connect cowl flap, refer to Cowl Flaps Chapter 7.
- (3) Lock fasteners on cover.
- (4) Install upper engine cowling.

2. Removal/Installation of Air Canister (See Figure 3) Turbo 310.

A. Remove Air Canister as follows:

- (1) Remove upper engine cowling.
- (2) Loosen clamp securing air canister to turbocharger.
- (3) Remove quick release pin (8) from clevis (9) and disconnect control assembly (10) from arm (7).
- (4) Loosen duct clamp (6) from air canister and lift canister out of nacelle.

B. Install Air Canister.

- (1) Position air canister in place and install inlet air duct and secure with clamp (6).
- (2) Install air canister to turbocharger. Compressor and tighten clamp.
- (3) Connect control assembly (10) to arm (7) by installing quick release pin (8) in clevis (9).

NOTE: It may be necessary to adjust control assembly (10) after installing a new air canister.

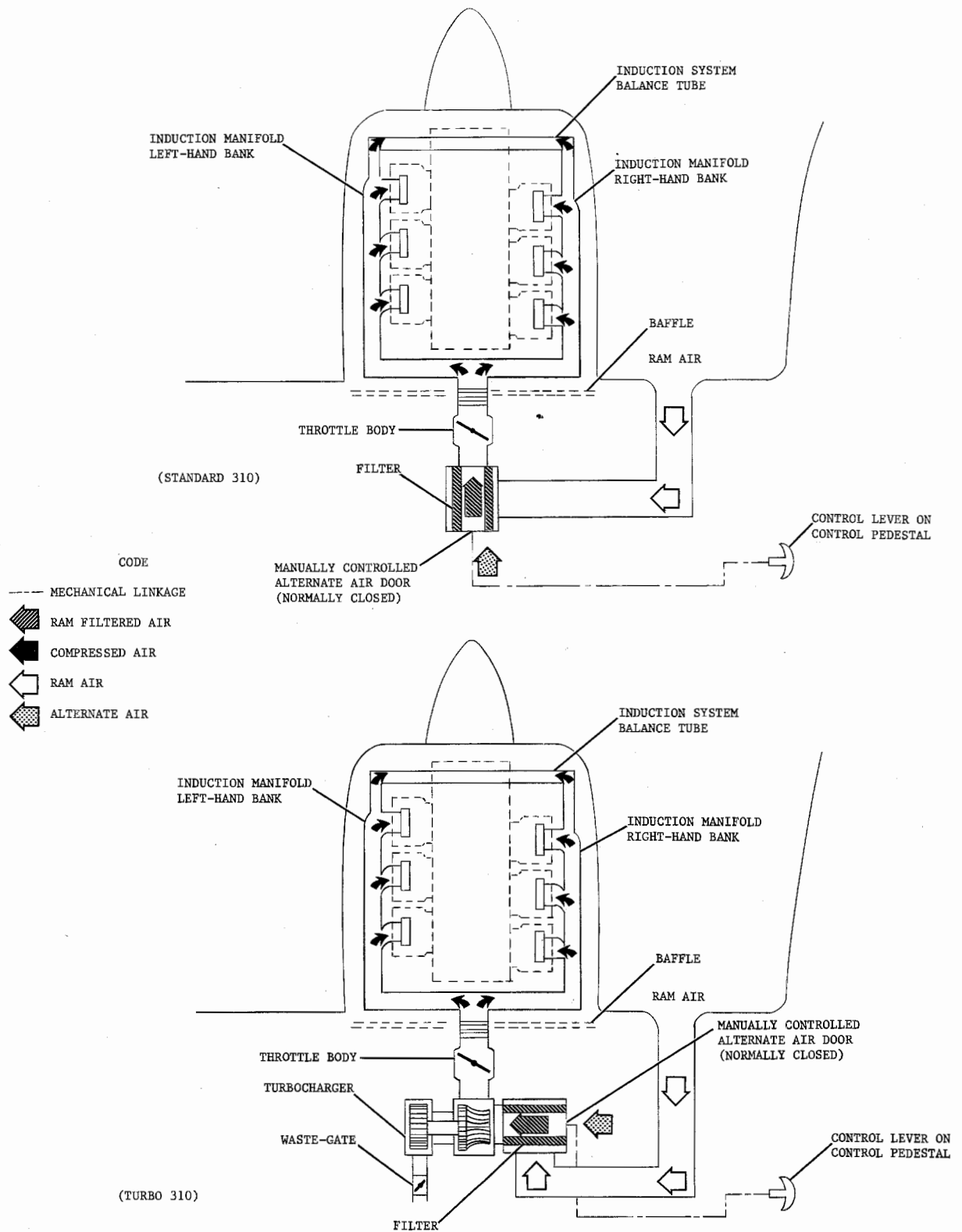
- (4) Clamp cable assembly (10) so that control handle has .06 to .09 inches cushion at the control handle in the closed position, and control operates free and no binding.
- (5) Install upper engine cowling.

C. Remove Air Canister Filter Element.

- (1) Remove upper engine cowling.

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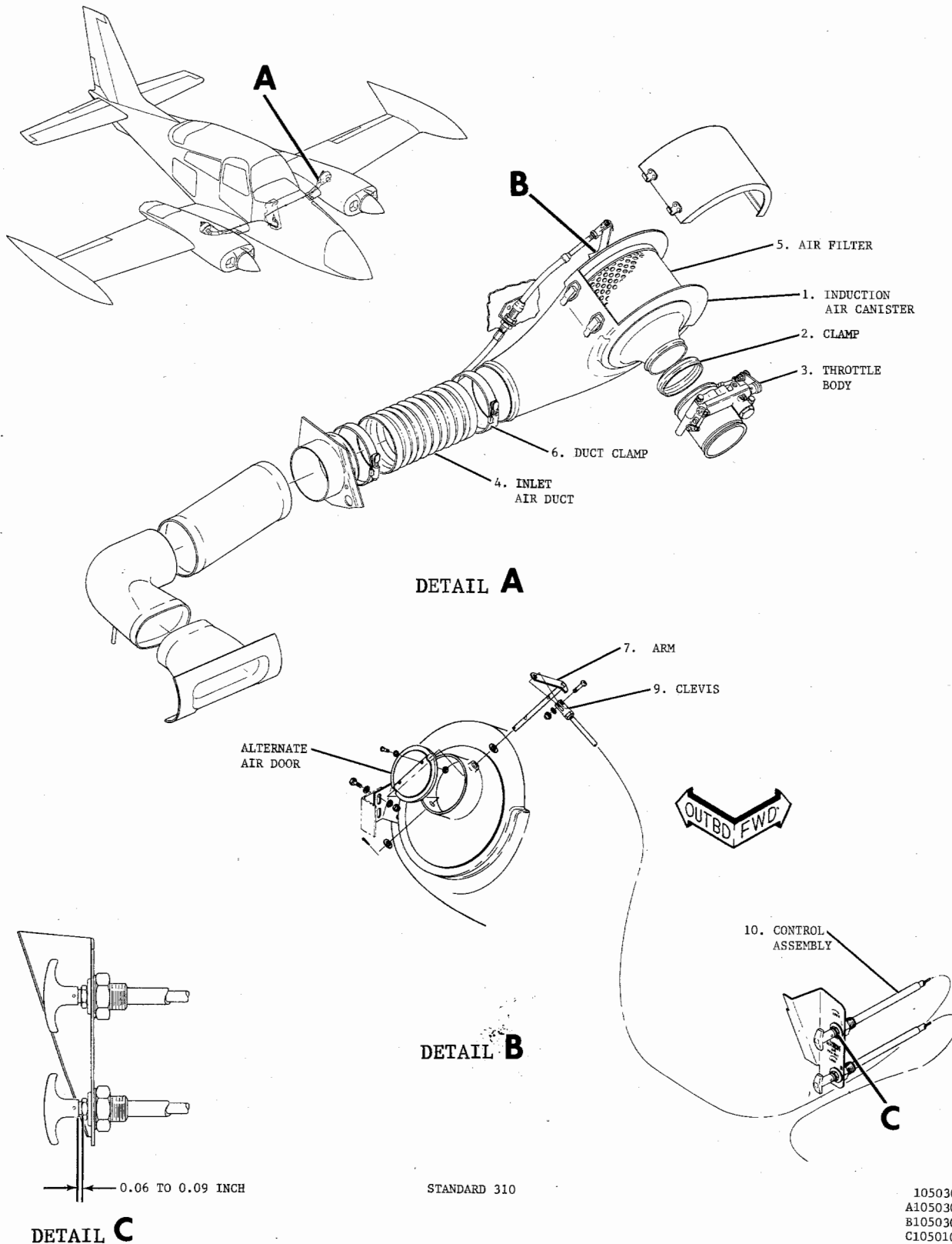


Induction Air Schematic
Figure 2

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MAINTENANCE MANUAL

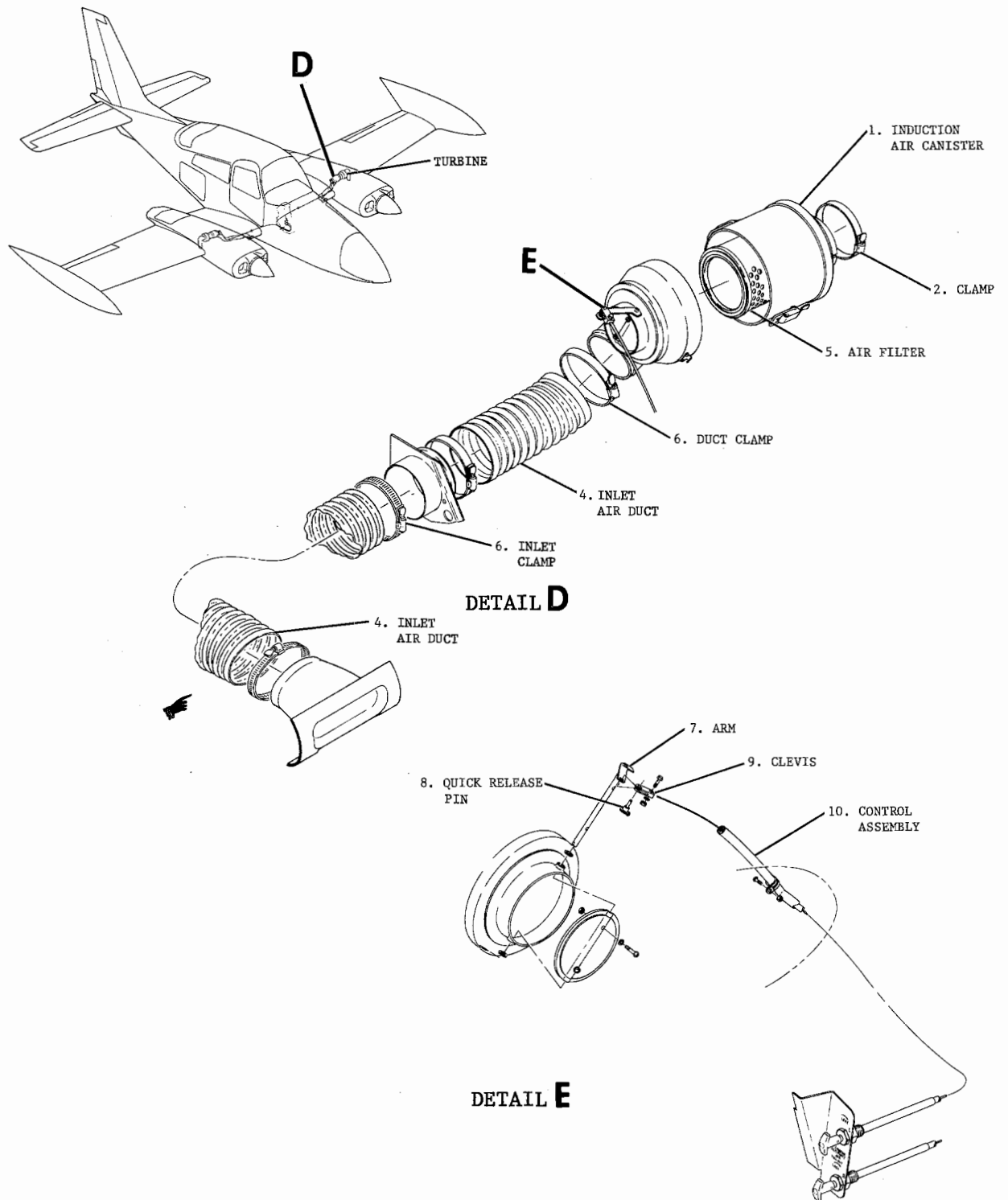


10503017
A10503018
B10503019
C10501006

Induction Air Canister
Figure 3 (Sheet 1 of 2)

310

SERVICE MANUAL



TURBO 310

10503013
D10503020
E10503011

Induction Air Canister
Figure 3 (Sheet 2)

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- (2) Release fasteners securing end valve (10) on canister and slide end valve off.
- (3) Remove induction air filter element.

D. Install Air Canister Filter Element.

NOTE: Assure inside of air canister is clean before installing element.

- (1) Insert induction air filter element in place in the canister and install end valve (10).
- (2) Lock fasteners on cover.
- (3) Install upper engine cowl.

Inspection/Check

1. Inspection/Check of Induction Air System.

- A. Remove upper engine cowl.
- B. Remove induction air filter element.

Cleaning/Painting

1. Cleaning Induction Air Filter

NOTE: Under extremely dusty conditions, daily maintenance of the filters are recommended. One method is to use dry compressed air at not over 100 PSI and blow through the filter. Blow from the inside to outside to remove dirt and dust.

A. Clean the filter as follows:

- (1) Remove the filter from the canister.
- (2) Slightly rap the filter to remove heavy dirt accumulations.
- (3) Wash thoroughly, using a mild detergent, nonsudsing soap and water solution.
- (4) Rinse filter with a stream of water until water is clear.
- (5) Dry thoroughly using dry compressed air. Air pressure should not exceed 100 PSI.

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TURBOCHARGERDescription

1. On Turbo 310 the turbocharger is driven by exhaust gases to provide engine induction air. An actuator positions the waste gate which allows exhaust gases to by-pass the turbocharger when less pressure is required as determined by the controller.
2. The Turbocharger shield is a two piece shield hinged together around the turbocharger turbine and held in place with Monel wire.

Maintenance Practices

1. Removal/Installation of Turbocharger (See Figure 1).

A. Remove Turbocharger as follows:

- (1) Remove engine cowling.
- (2) Remove turbocharger heat shield.
- (3) Disconnect oil inlet line (10) from top of turbocharger center housing and oil drain line (7) from the bottom of the center housing.
- (4) Remove clamps securing turbocharger compressor to throttle body and air canister assembly.
- (5) Remove clamp (1) securing turbocharger turbine to exhaust tube.
- (6) Remove nut (3), washer (2) and remove brace (5).
- (7) Remove the four nuts and bolts securing turbocharger assembly to exhaust manifold header (6).
- (8) Lift turbocharger straight up and remove from nacelle.

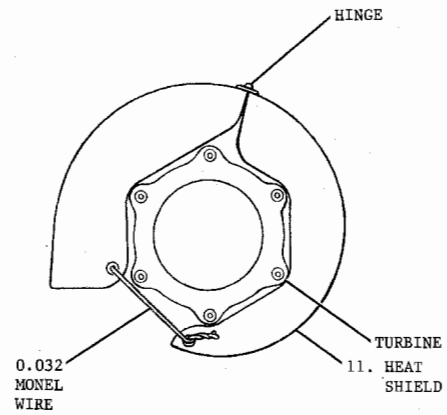
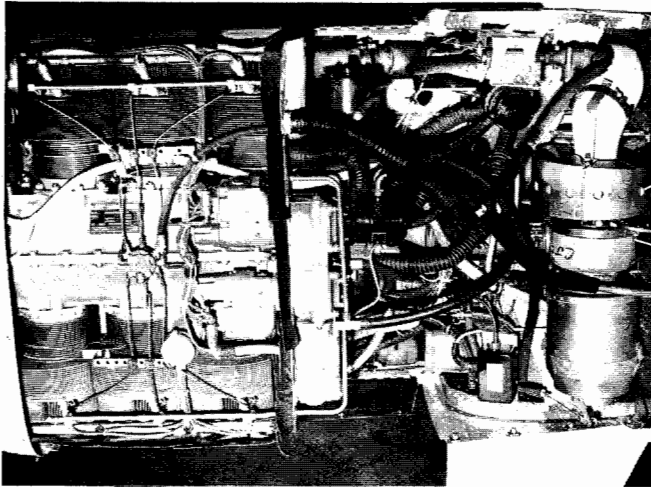
NOTE: Cap and plug oil lines and seal turbine and compressor air openings to prevent the entry of foreign material.

B. Install Turbocharger.

- (1) Remove plugs and caps from oil lines, fittings, turbocharger openings, and position turbocharger on exhaust manifold header (6).
- (2) Install four bolts and nuts securing turbocharger to exhaust manifold header (6).
- (3) Install washer (2) and nut (3) to brace (5).
- (4) Install clamp (1) securing exhaust tube. Torque is 1 to 40 inch-pounds.

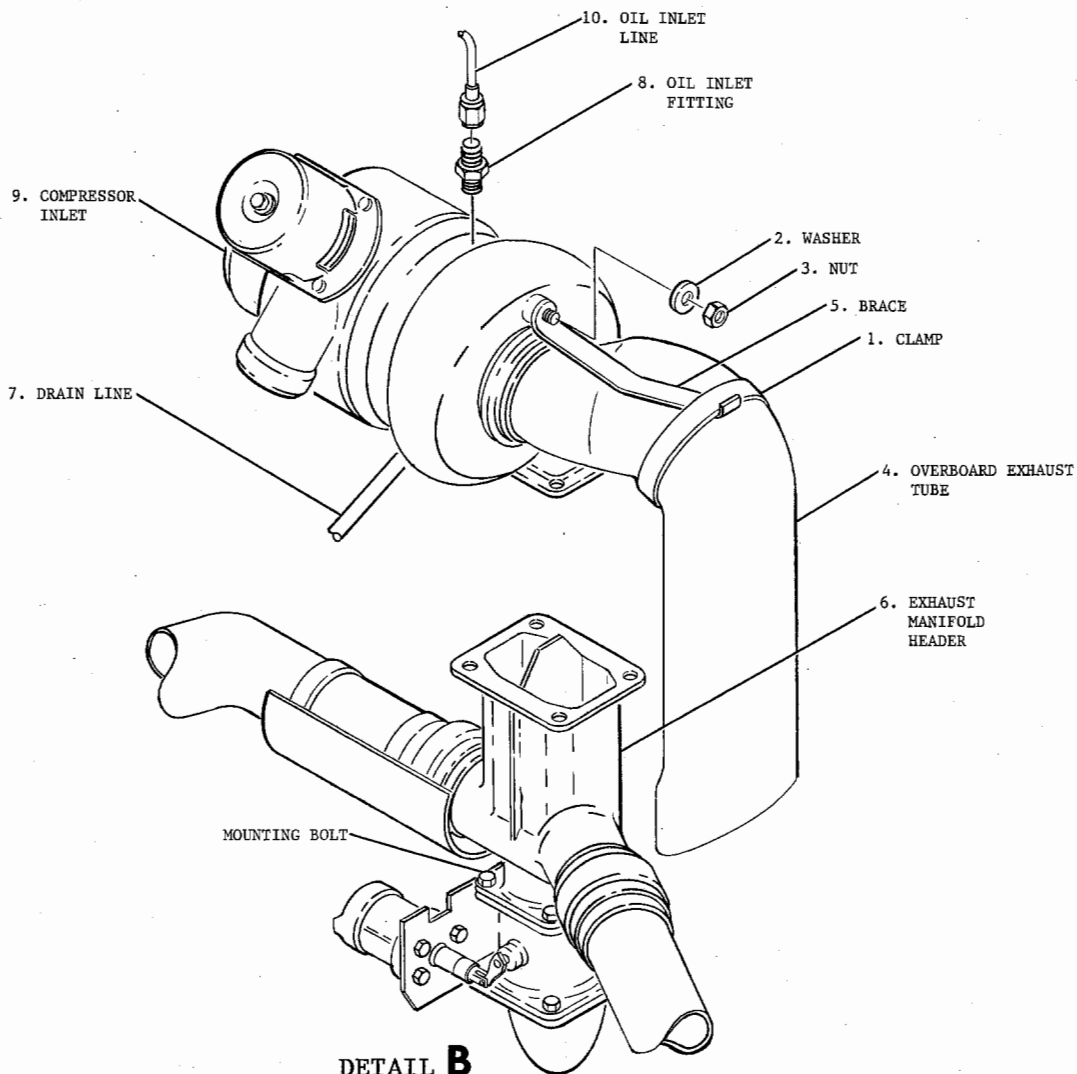
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SAFETY WIRE INSTALLATION

DETAIL A



DETAIL B

Turbocharger 310 Turbo
Figure 1

1050P6008
A10502006
B10502006

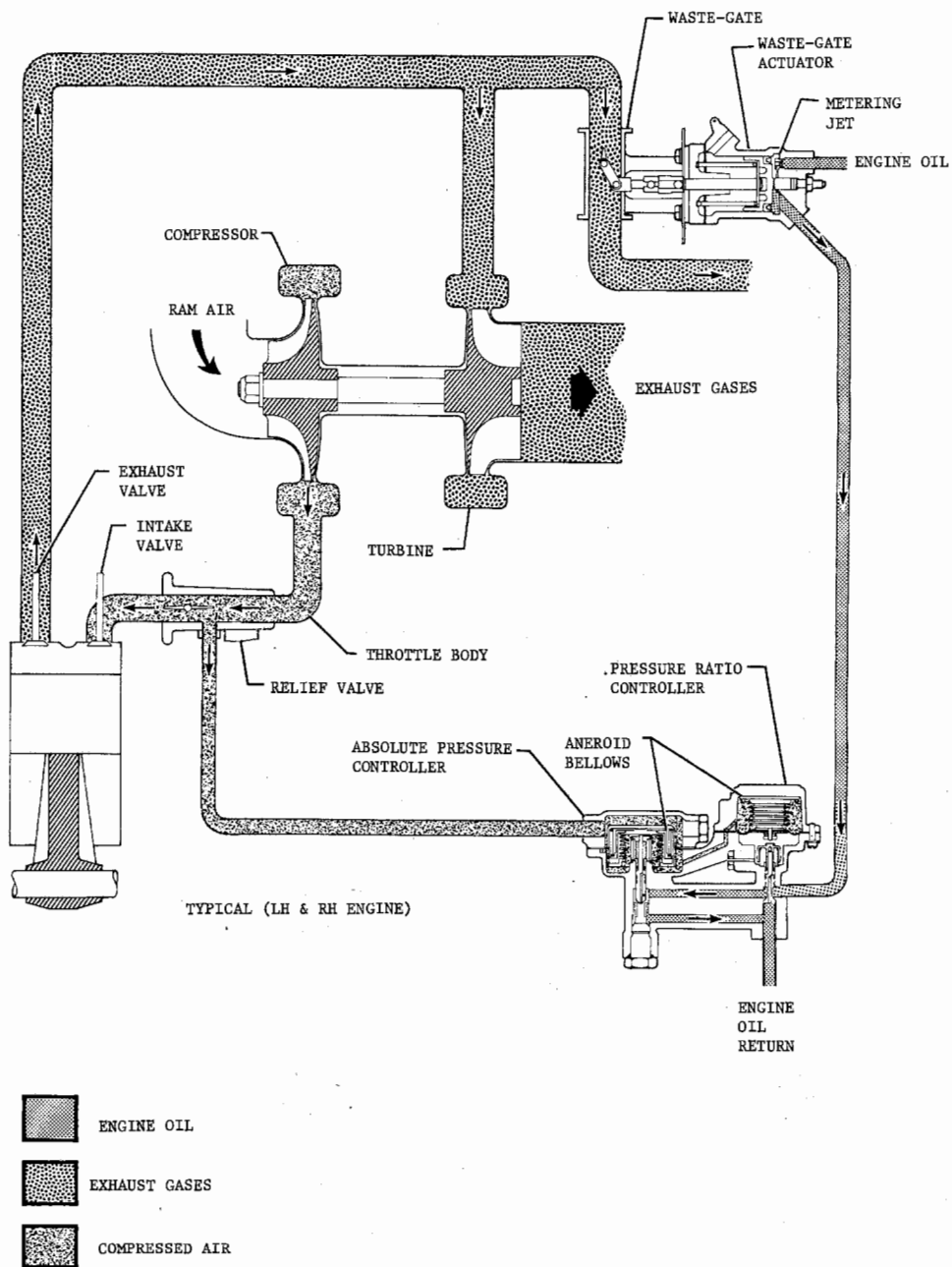
- (5) Install clamps securing turbocharger compressor to throttle body and canister assembly.
 - (6) Connect oil inlet line (10) and oil drain line (7) to center housing of turbocharger.
 - (7) Install turbocharger heat shield and safety with Monel 0.032 wire.
- C. Remove Turbocharger Heat Shield.
- (1) Remove upper engine cowling.
 - (2) Cut safety wire securing the turbocharger heat shield in place.
 - (3) Open shield assembly and remove from turbocharger.
- D. Install Turbocharger Heat Shield.
- (1) Position heat shield (11) in place on turbine.
 - (2) Install safety wire as shown in Figure 2.
 - (3) Install upper engine cowling.

Inspection/Check

1. Inspection/Check of Turbocharger.
 - A. Remove Engine Cowling.
 - B. Remove turbocharger heat shields.

ABSOLUTE PRESSURE, PRESSURE RATIO CONTROLLER AND WASTE-GATE ACTUATORDescription

1. The waste-gate actuator and controllers use engine oil for power supply. The turbocharger is controlled by the waste-gate and waste-gate actuator, absolute pressure controller and above critical altitudes by the pressure ratio controller. The waste-gate bypasses the engine exhaust gases around the turbocharger turbine inlet. The waste-gate actuator, which is physically connected to the waste-gate by mechanical linkage, controls the position of the waste-gate butterfly valve. The manifold pressure relief valve will open and prevent engine overboost should the engine manifold pressure exceed 34.5 inches of mercury. The absolute pressure controller controls the maximum turbocharger compressor discharge pressure ($32 + 0.5$ in. Hg. to critical altitude, approximately 16,000 feet). The pressure ratio controller begins to function at approximately critical altitude and controls the maximum turbocharger compressor discharge pressure at a ratio of 2.2 times nacelle ambient pressure.
2. The waste-gate actuator is spring-loaded to position the waste-gate to the normally open position when there is not adequate oil pressure in the waste-gate actuator power cylinder during engine shut down. When the engine is started, oil pressure is fed into the waste-gate actuator power cylinder through the capillary tube. This automatically fills the waste-gate actuator power cylinder and lines leading to the controllers, blocking the flow of oil by normally closed metering and/or poppet valves. As the oil pressure builds up in the waste-gate actuator power cylinder, it overcomes the force of the waste-gate open spring, closing the waste-gate. When the waste-gate begins to close, the exhaust gases are routed through the turbocharger turbine. As the engine increases its power and speed, the increase of temperature and pressure of the exhaust gases causes the turbocharger to rotate faster, raising the turbocharger compressor outlet pressure. As the compressor outlet pressure rises, the aneroid bellows in the absolute pressure controller sense the increase in pressure. When at high engine speed and load and the proper absolute pressure is reached, the force on the aneroid bellows opens the normally closed metering valve. When the oil pressure in the waste-gate actuator power cylinder is lowered sufficiently, the waste-gate actuator open spring forces the mechanical linkage to open the waste-gate. A portion of the exhaust gases then bypasses the turbocharger turbine, thus preventing further increase of turbocharger speed and holding the compressor discharge absolute pressure to the desired value. Conversely at engine idle, the turbocharger runs slowly with low compressor pressure output, therefore, low pressure ap-



Turbocharger and Controllers Schematic
Figure 1

plied to aneroid bellow is not sufficient to affect the unseating of the normally closed metering valve. Consequently, engine oil pressure keeps the waste-gate closed. After critical altitude is reached (approximately 16,000 feet), the absolute pressure controller is unable to maintain 32 ± 0.5 inches of manifold pressure.

3. The pressure ratio controller, which senses both nacelle ambient pressure and discharge pressure, begins the function of controlling turbocharger discharge pressure at a ratio of 2.2 times ambient pressure. When the proper discharge pressure is reached inside the pressure ratio controller, the force on the aneroid bellows opens the poppet valve and lowers the oil pressure in the waste-gate actuator power cylinder.

Maintenance Practices

1. Removal/Installation of Absolute Pressure, Pressure Ratio Controller (See Figure 2).

- A. Remove Absolute Pressure, Pressure Ratio Controller.

- (1) Disconnect oil line (2) oil hose (5) and pressure hose (4) from controller (3).
- (2) Remove nuts and bolts securing controller.

NOTE: Plug and cap all lines and hoses as they are disconnected to prevent entry of foreign material.

- (3) If controller is being replaced, the existing fittings must be removed.

- B. Install Absolute Pressure, Pressure Ratio Controller.

- (1) Position controller in place and remove caps and plugs.
- (2) Install bolts and nuts to secure controller.

NOTE: If a new controller is being installed the existing fittings with new packings should be installed.

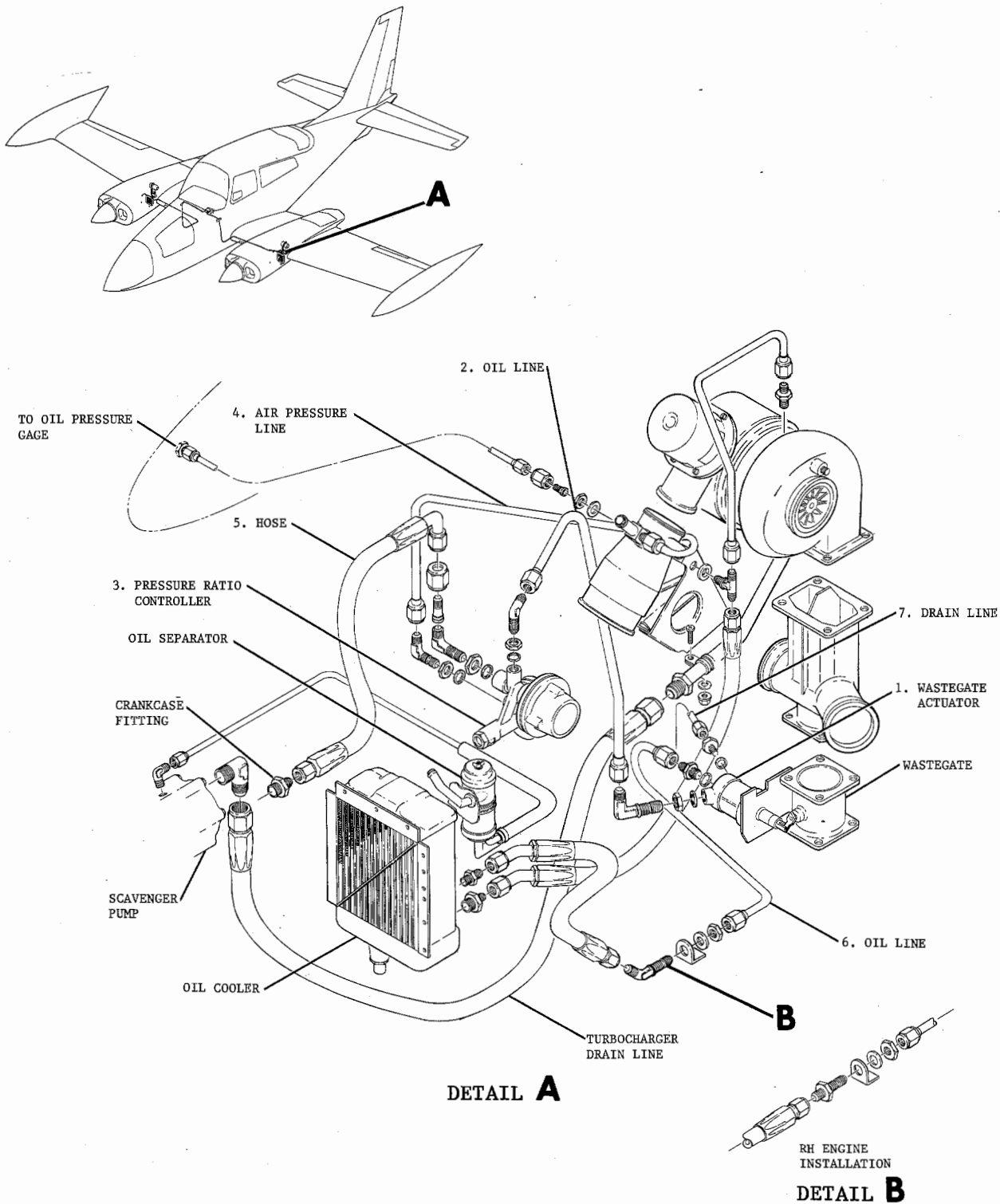
- (3) Connect oil lines (2), oil hose (5) and air pressure hose (4) and tighten.

2. Removal/Installation of Waste-Gate and Waste-Gate Actuator (See Figure 2).

- A. Remove Waste-Gate and Waste-Gate Actuator.

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Absolute Pressure, Pressure Ratio Controller
Figure 2

10563007
A10504001
B10504001

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MAINTENANCE MANUAL

NOTE: The waste-gate and waste-gate actuator are considered matched sets and must be removed and replaced as matched sets.

- (1) Remove necessary access covers.
- (2) Disconnect drain line (7), oil lines (2) and (6) from waste-gate actuator (1).

NOTE: Plug and cap all lines and openings to prevent entry of foreign material.

- (3) Remove four nuts and bolts attaching waste-gate to manifold header. Allow manifold header and waste-gate actuator to rest on engine nacelle.
- (4) Remove four nuts and bolts attaching waste-gate overboard tube to waste-gate. Remove waste-gate overboard tube from aircraft through access hole.
- (5) Rotate waste-gate and waste-gate actuator within the lower aft nacelle until the spring on the actuator is facing towards the nacelle firewall. With the waste-gate and actuator in this position, work waste-gate and actuator out through the nacelle access hole.

B. Install Waste-Gate and Waste-Gate Actuator.

- (1) Position waste-gate and waste-gate actuator in place in the lower nacelle. Clock the waste-gate with the spring on the actuator facing toward the firewall.
- (2) Secure waste-gate and waste-gate actuator to exhaust manifold header with bolts and nuts.

NOTE: When installing waste-gate actuator to the manifold header, always use a new gasket.

- (3) Attach overboard tube to waste-gate and secure with bolts and nuts.
- (4) Remove caps and plugs from lines and connect to actuator.
- (5) Refer to Turbocharger and Controls Overhaul/Parts manual and rig waste-gate in accordance with rigging instructions.

Adjustment/Test

1. Tools and Equipment.

A. Refer to Chapter 7-00 for Tools and Equipment.

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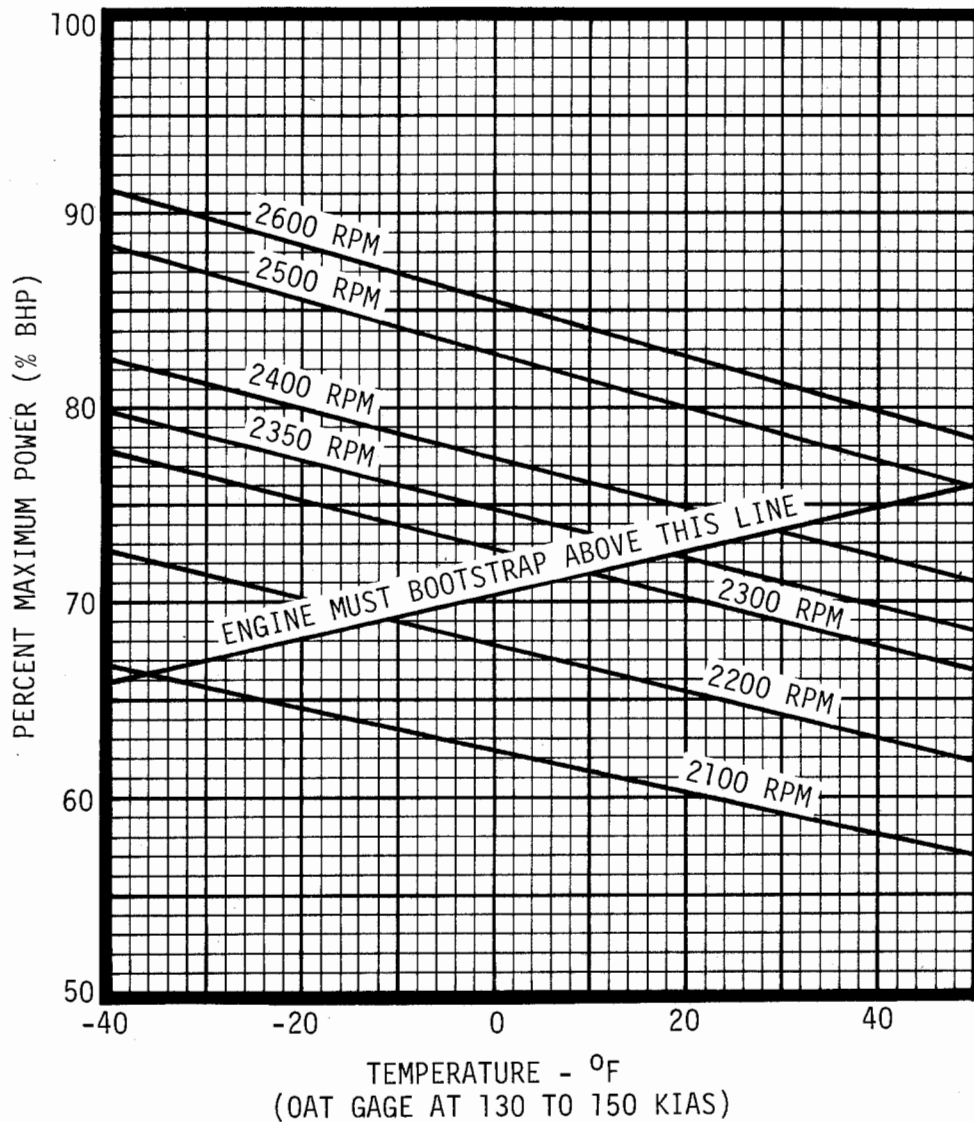
MAINTENANCE MANUAL

TURBO 310

BOOTSTRAP LIMIT

16,000 FEET

29 IN.. MANIFOLD PRESSURE



Bootstrapping Tolerance Chart
Figure 3

10986003

2. Controller Operation Flight Check Procedure.

A. The flight check procedure details the method of checking the operation of the absolute pressure, pressure ratio controllers. This procedure is to be used for aircraft suspected of improper controller operation. To aid in recording the necessary flight readings, sample form, as shown in Figure 4 is provided. This sample form or one with similar content should be used in conjunction with the flight check procedure. To determine at which conditions bootstrapping is most likely to occur, refer to the Bootstrapping Tolerance Chart in Figure 3.

B. Takeoff - Absolute Controller.

- (1) Cowl flaps - open.
- (2) Airspeed - 105 MPH IAS.
- (3) Oil temperature - upper 1/3 of green arc.
- (4) Engine speed - 2700 ± 25 RPM.
- (5) Fuel flow - 27.5 to 29.2 GPH.
- (6) Full throttle M.P. - $32 \pm .5$ in. Hg.

C. Climb - Absolute Controller.

- (1) Cowl flaps - open.
- (2) Airspeed - 120 MPH IAS.
- (3) Pressure altitude - 16,000 ft.
- (4) Engine speed - 2700 ± 25 RPM.
- (5) Fuel flow - 29.0 PSI to 31.0 PSI.
- (6) Full throttle M.P. - $32 \pm .5$ in. Hg.

D. Climb - Manifold Pressure Relief Valve.

- (1) Cowl flaps - open.
- (2) Airspeed - 120 IAS.
- (3) Pressure altitude - below 16,000 ft.
- (4) Engine speed - 2700 ± 25 RPM.
- (5) Fuel flow - full rich.
- (6) Throttle (one engine at a time).
- (7) Idle until M.P. stabilizes.
- (8) Rapidly advance to full throttle.

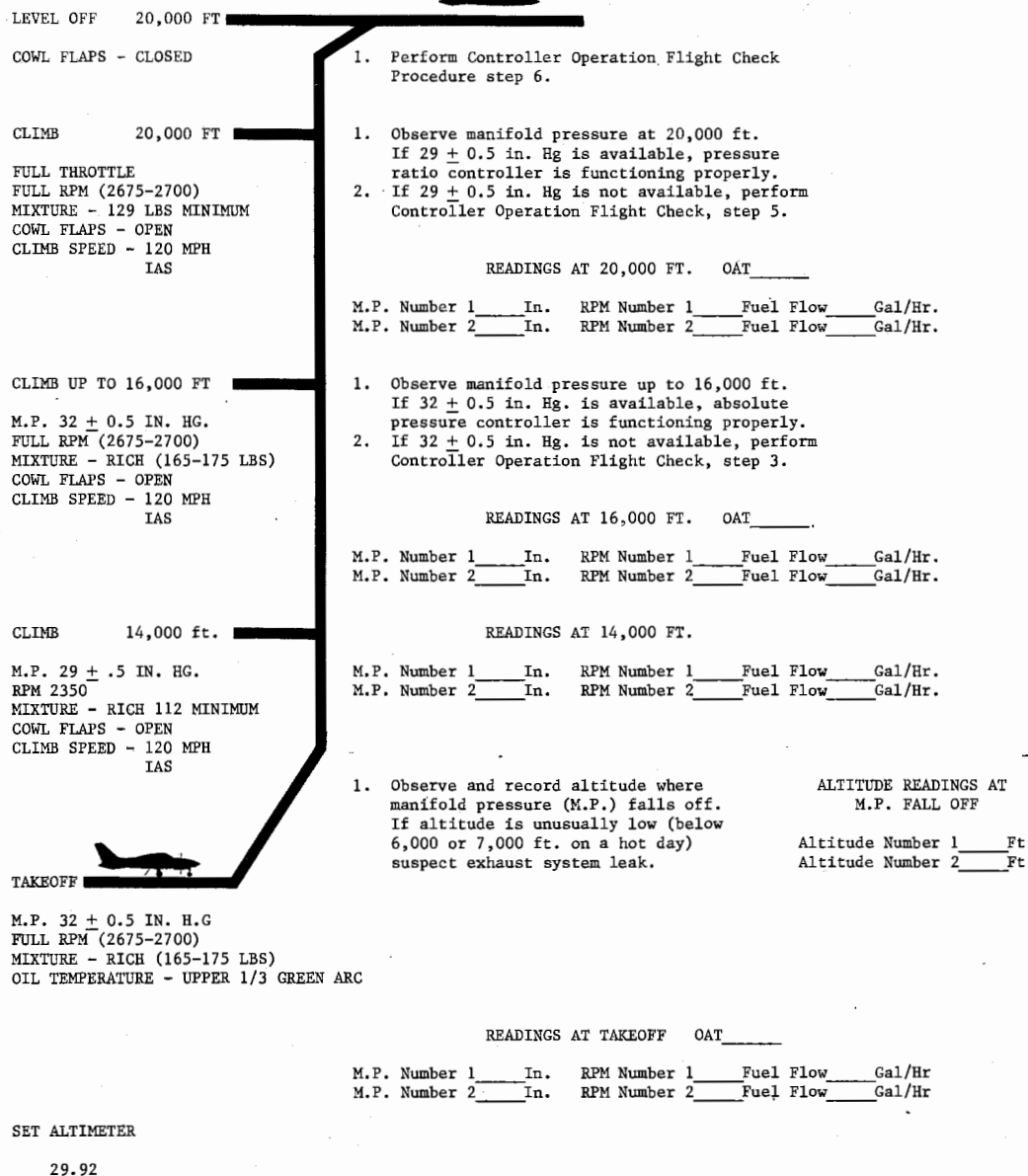
NOTE: If at full throttle maximum manifold pressure is not reached 32 ± 0.5 inches of Hg. manifold pressure relief valve is operating improperly.

E. Cruise - Bootstrapping Determination.

- (1) Cowl flaps - closed.
- (2) Airspeed - level flight.
- (3) Pressure altitude - 16,000 feet.

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Turbocharger System Operational Check Chart
Figure 4

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- (4) Engine speed - 2700 RPM.
- (5) Manifold pressure - 28 in. Hg.
- (6) Fuel flow - full rich.
Prop controls (one engine at a time).
- (7) Slowly decrease RPM until M.P. drop indicates waste-gate is closed.
- (8) The manifold pressure, RPM, outside air temperature and pressure altitude at the instant of waste-gate closing should be recorded.
- (9) The actual power being developed when the waste-gate closed should be less than 77% power.
Engine speed - increase 50 RPM.
Mixture - normal lean.
Engine should not bootstrap.

F. Climb - Pressure Ratio Controller.

- (1) Cowl flaps - open.
- (2) Airspeed - 120 MPH.
- (3) Pressure altitude - 20,000 feet.
- (4) Engine speed - 2700 $\pm$ 25 RPM.
- (5) Fuel flow - full rich.
- (6) Full throttle M.P. - 29 $\pm$.5 in. Hg.

G. Cruise - Bootstrapping Determination.

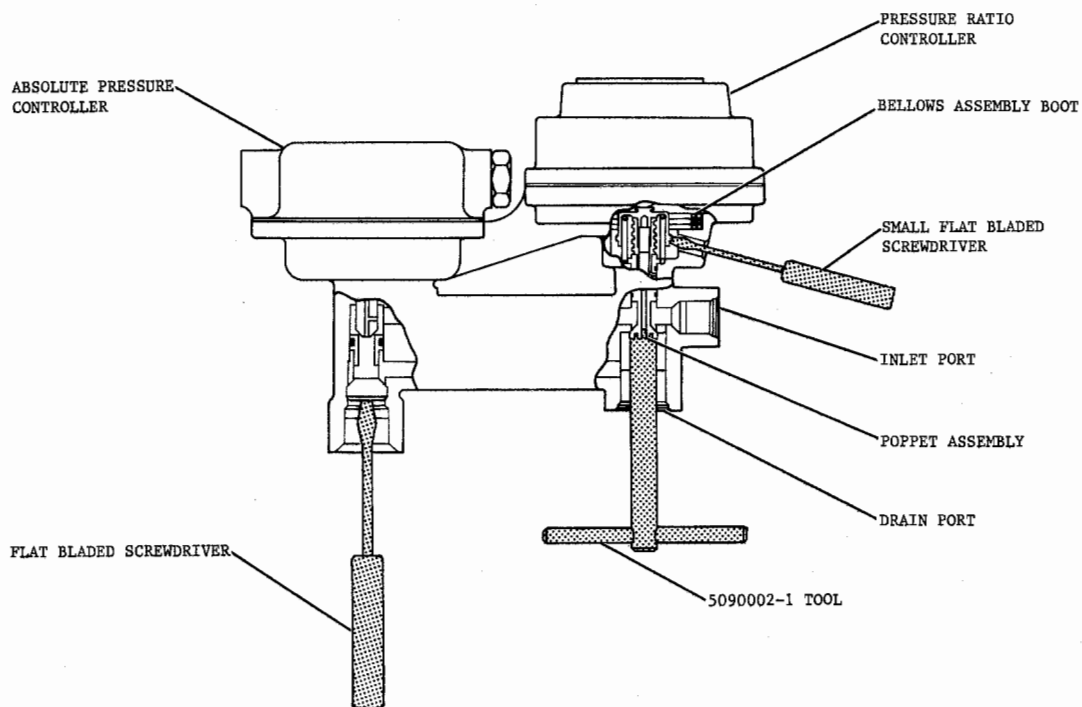
- (1) Cowl flaps - closed.
- (2) Airspeed - level flight.
- (3) Pressure altitude - 20,000 feet.
- (4) Engine speed - 2700 RPM.
- (5) Fuel flow - full rich.
- (6) Throttle - full throttle.
- (7) Prop control (one engine at a time).
- (8) Slowly decrease RPM until M.P. drop indicates waste-gate is closed.
- (9) The M.P. RPM, OAT, and Hp at the instant of waste-gate closing should be recorded.
- (10) The actual power being developed should be less than 67.5% power.
- (11) Engine speed - increase 50 RPM.
- (12) Mixture - normal lean.
- (13) Engine should not bootstrap.

3. Absolute Pressure Controller Adjustment (See Figure 5).

- A. Remove engine cowlings.
- B. (See Figure 2.) Remove adjustment plug from absolute pressure controller.
- C. Using a flat bladed screwdriver, rotate metering valve seat (1/16th of one full turn changes manifold pressure 1 inch Hg.), clockwise to increase or counterclockwise to decrease.

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MAINTENANCE MANUAL



NOTE

ABSOLUTE PRESSURE
CONTROLLER HAS BEEN
ROTATED 90 DEGREES
FOR CLARITY.

14981004

Controller Adjustment
Figure 5

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- D. (See Figure 2.) Install absolute pressure controller adjustment plug.
- E. Install engine cowling in accordance with installation procedures.
- F. Start engine, allow engine oil to reach operating temperature (upper 1/3 of green arc), ground check manifold pressure for 32 ± 0.5 inches Hg. at 2700 RPM.

NOTE: Several adjustments and checks may be necessary to achieve correct manifold pressure.

4. Pressure Ratio Controller Adjustment (See Figure 5).

- A. Remove engine cowling in accordance with removal procedures.
- B. Remove pressure ratio controller in accordance with removal procedures.
- C. (See Figure 2.) Remove ambient air plug from low pressure port. Remove tee and reducer from drain port.

NOTE: Protect all fittings and lines to prevent entry of foreign materials.

- D. Insert tool 5090002-1 into drain port. Insert small bladed screwdriver into low pressure port. Rotate poppet assembly until screwdriver blade engages slot provided in bellows assembly boot.
- E. Holding bellows assembly boot, rotate poppet assembly (1/16 of one full turn changes manifold pressure 1 inch Hg.), clockwise to increase, counterclockwise to decrease.
- F. (See Figure 2.) Install ambient air plug reducer and tee.
- G. Install pressure ratio controller.
- H. Install engine cowling in accordance with installation procedures.
- I. Repeat climb-pressure ratio procedure, Steps (1) through (6).

NOTE: Several adjustments may be necessary to achieve correct manifold pressure.

Inspection/Check

- 1. Inspection/Check of Absolute Pressure, Pressure Ratio Controller and Waste-Gate and Actuator.
 - A. Remove engine cowling.
 - B. Remove necessary lower access plates.

MANIFOLD PRESSURE RELIEF VALVEDescription

1. The manifold pressure relief valve is mounted on the turbo-charger compressor adapter plate and is provided to prevent engine damage from excessive intake manifold pressure. The non-adjustable manifold pressure relief valve will be actuated if the manifold pressure exceeds 36.5 in. Hg. If the relief valve is defective or malfunctions, it must be replaced.

Maintenance Practices

1. Removal/Installation of Manifold Pressure Relief Valve (See Figure 1).

- A. Remove manifold pressure relief valve.

- (1) Remove engine cowling.
- (2) Remove screws (1) and washers (5) from manifold pressure relief valve (2).
- (3) Lift valve (2) from nacelle. Discard o-ring (3).

NOTE: If the manifold pressure relief valve is not being replaced or immediately reinstalled, protective covers must be installed to prevent entry of foreign material.

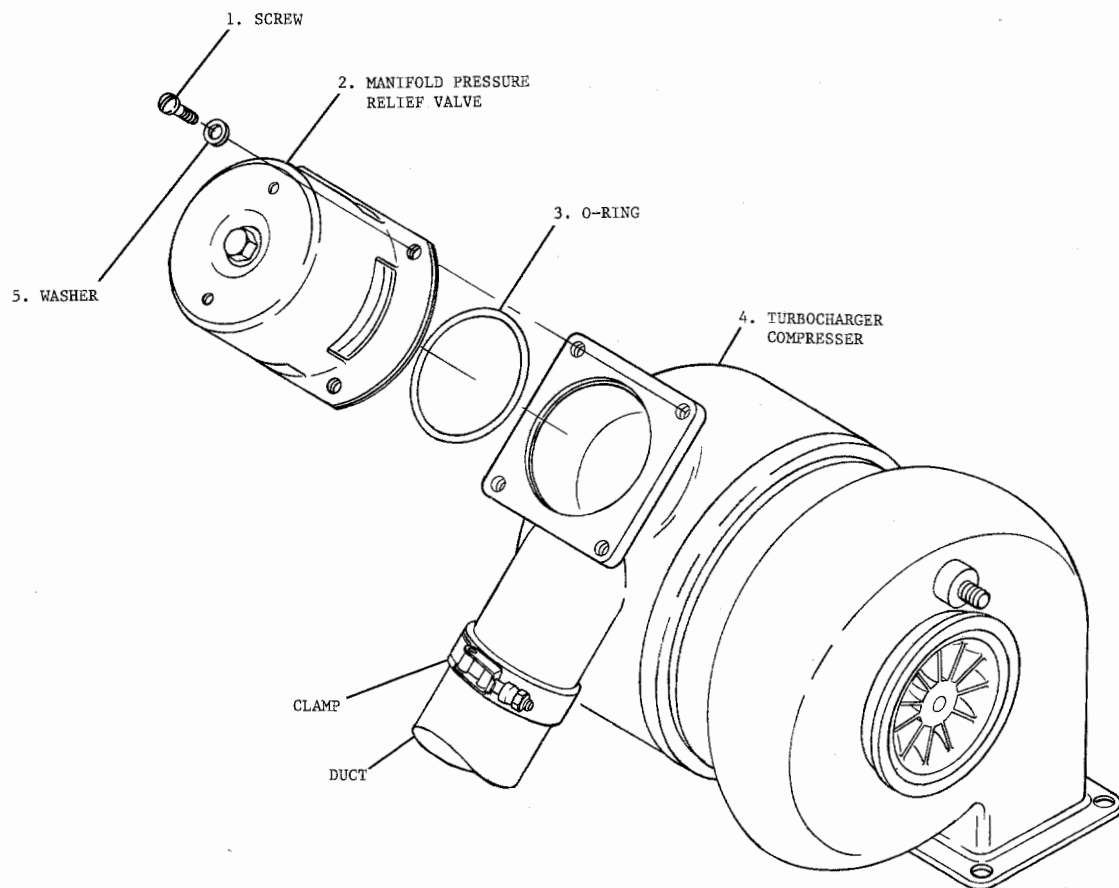
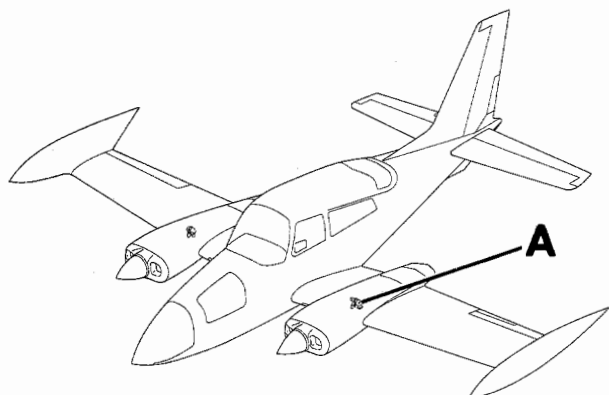
- (4) On the right hand engine loosen the clamp attaching the compressor housing to the turbocharger and air canister.
- (5) Remove clamp from compressor outlet.
- (6) Remove compressor housing from turbocharger and lift out of nacelle.
- (7) Repeat Steps 1 through 3 to remove manifold pressure relief valve.

- B. Install Manifold Pressure Relief Valve.

- (1) Remove protective covers and position new o-ring in place.
- (2) Install manifold pressure relief valve with screws (1) and washers (5).
- (3) On right hand engine install turbocharger compressor housing and connect clamps securing compressor housing to center housing and the air canister.
- (4) Connect compressor outlet duct and tighten clamp.

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MAINTENANCE MANUAL



DETAIL **A**

10503010
A10502004

Manifold Pressure Relief Valve
Figure 1

Inspection/Check

1. Inspection/Check of Manifold Pressure Relief Valve.
 - A. Remove Engine Cowling.

MANIFOLD PRESSURE INDICATING SYSTEMDescription

1. The manifold pressure indicating system consists of a dual manifold pressure gage mounted on the instrument panel. The manifold pressure lines are routed from the intake manifold on each engine to separate connections at the back of the gage. The gage is calibrated in inches of mercury, indicating the absolute pressure in the intake manifold of each engine.

Maintenance Practices

1. Removal/Installation of Manifold Pressure Indicating System (See Figure 1).
 - A. Remove Manifold Pressure Indicating System.
 - (1) Remove indicator in accordance with Chapter 10.
 - (2) Remove indicator line (6), fuselage line (5), wing line (4), nacelle line (3), and nacelle hose (1) from intake manifold (2).

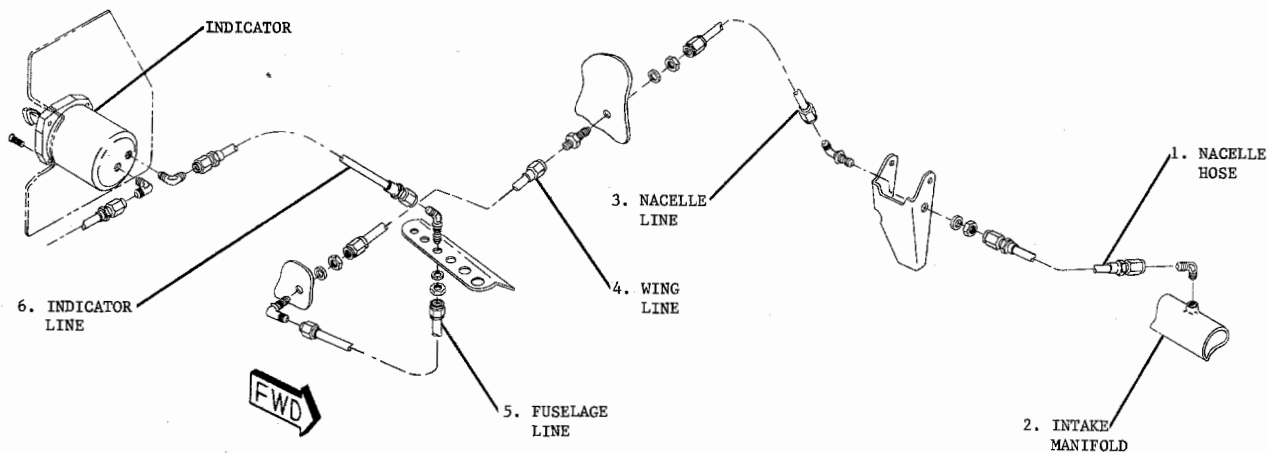
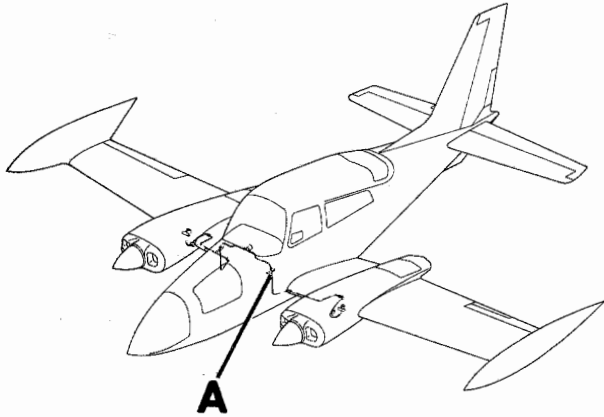
NOTE: Plug and cap all lines and fittings to prevent entry of foreign material.
 - B. Install Manifold Pressure Indicating System.
 - (1) Remove all caps and plugs from lines and fittings.
 - (2) Install nacelle hose (1) to intake manifold (2), wing line (4), fuselage line (5) and indicator line (6) and tighten all fittings.
 - (3) Install indicator in accordance with Chapter 10.

Inspection/Check

1. Inspection/Check of Manifold Pressure Indicating System.
 - A. Remove upholstery side panel.
 - B. Remove necessary wing access plates.
 - C. Remove engine cowling.

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MAINTENANCE MANUAL



DETAIL A

10143051
A10142030

Manifold Pressure Indicating System
Figure 1

ENGINE CONTROL SYSTEMDescription

1. The engine control system consists of the control quadrant, propeller controls, mixture control, cowl flap controls, alternate air controls, their cables, mounting, routing and connection to individual components.

Maintenance Practices

1. Removal/Installation of Engine Controls (See Figure 1).

- A. Remove Engine Controls.

- (1) Remove elevator trim control wheel cover plate, friction knob, upper RH panel and RH side panels.
- (2) Disconnect throttle, propeller and mixture control cables from control quadrant levers by removing attaching clevis pins.
- (3) Remove bulkhead locknuts (7) from control cables at the control pedestal support bracket and nacelle firewall rib.
- (4) Remove bulkhead locknuts (7) from propeller control cable on propeller control cable mounting bracket and disconnect rod end (6).
- (5) Remove clamps securing throttle and mixture control cables to aft firewall.
- (6) Disconnect rod ends (6) from serrated levers (8) on mixture and throttle control cables by removing attaching nuts, washers and bolts.
- (7) Remove rod ends (6) from control cables.
- (8) Remove locknuts from throttle and mixture control cables at mounting bracket.
- (9) Attach guide wires to control cables.
- (10) Disconnect control cables from guide wire.

NOTE: To facilitate installation, leave guide wire in aircraft.

- B. Install Engine Control Cables.

- (1) Attach guide wires to control cable ends.
- (2) Route the propeller, throttle, and mixture control cables to their proper location in the engine nacelle and the control pedestal.
- (3) Remove guide wires from control cables.
- (4) Install rod ends (6) on mixture and throttle control cables.

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NOTE: Do not connect rod ends to serrated levers at this time.

- (5) Secure control cables to nacelle firewall outboard nacelle rib and control pedestal support bracket with bulkhead locknut (7).
- (6) Connect control cables clevis ends to quadrant control levers with attaching clevis pins and safety with cotter pin.
- (7) Route propeller cable through pedestal support bracket and secure with bulkhead locknuts (7).
- (8) Secure rod end (6) to propeller cable and connect rod end to propeller governor with bolt, spacer and nut.

NOTE: On Standard 310, secure governor control to the outboard hole on the control arm.
On Turbo 310, secure governor control to the inboard hole on the control column.

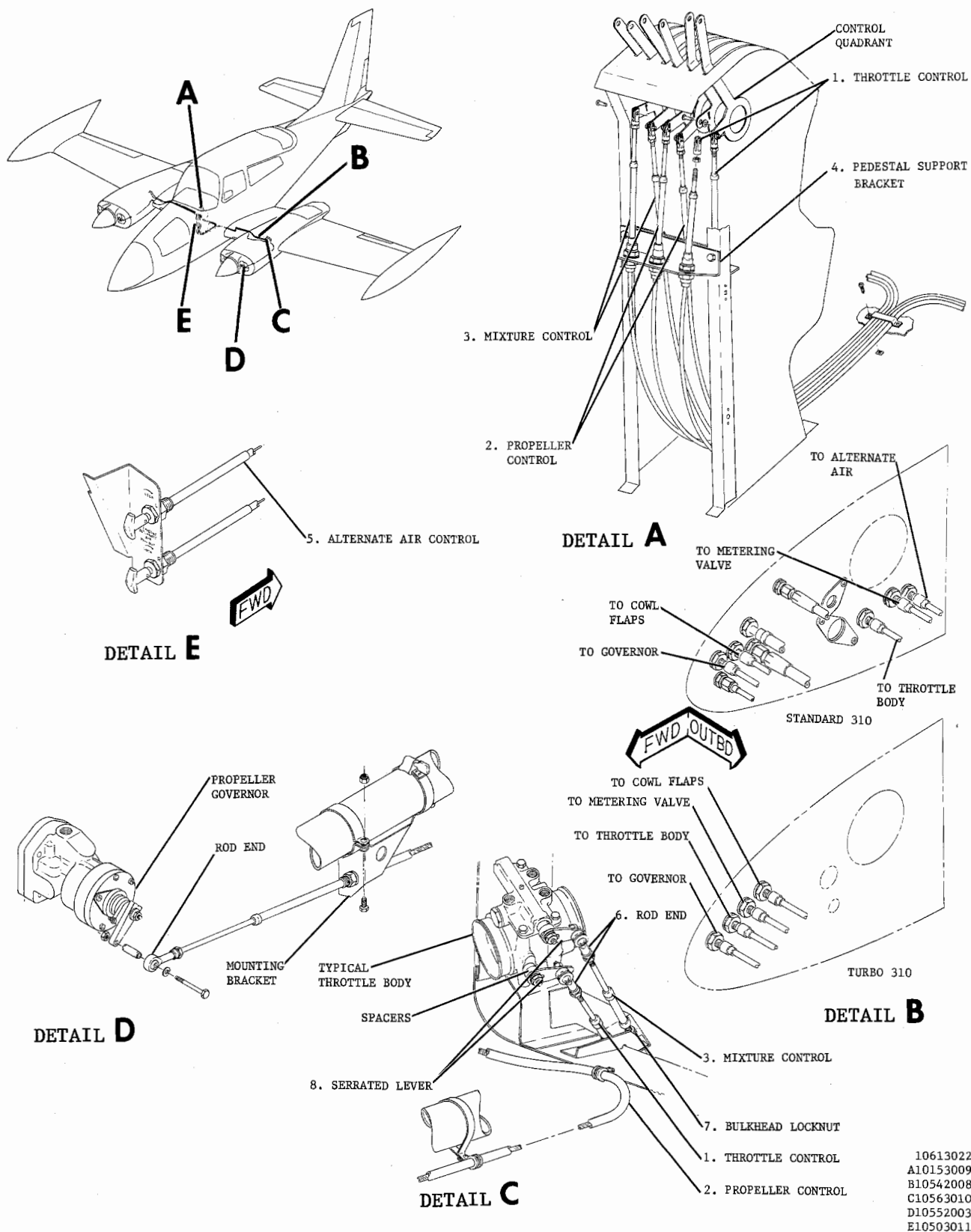
- (9) Refer to Chapter 8 and rig propeller control in accordance with rigging procedures.
- (10) Connect mixture and throttle rod ends (6) to serrated levers (8) with attaching bolts, washers, spacers and nuts. Rig in accordance with rigging procedures.
- (11) Install elevator trim control wheel cover plate friction knob, upper RH panel and RH side panel.

Adjustment/Test

1. Rigging Mixture and Throttle Controls (See Figure 1).

A. Rig control cables on throttle valve and metering unit.

- (1) Find the neutral position of the throttle shaft by rotating the throttle shaft clockwise and then counterclockwise until the shaft comes to rest on the internal stops. Scribe an index mark on shaft and throttle body at these positions. Rotate throttle shaft to the midpoint between the marks and scribe a neutral position mark. The neutral position on the metering unit can be determined by visually positioning the pin on the metering unit shaft at the midpoint between the two stop pins. Position both the throttle and metering unit shafts to neutral.
- (2) Align serrated spacers on throttle and metering unit shafts so that serration lines on the face of the spacer are perpendicular to the neutral position of the shafts.



Engine Control System
Figure 1

10613022
A10153009
B10542008
C10563010
D10552003
E10503011

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CAUTION: CARE SHOULD BE EXERCISED IN ORDER TO MAINTAIN ORIGINAL FACTORY SETTING OF SERRATED SPACERS ON SHAFTS.

- (3) Install levers (8) on spacers aligning the serrations.
- (4) Secure levers and spacers to throttle and metering unit shafts with washers and nuts.
- (5) On the control quadrant, place throttle and mixture control levers at the midpoint between stops.
- (6) With the throttle and metering unit shafts in the NEUTRAL position and the throttle and mixture control levers on quadrant set at the midpoint, adjust control cables rod ends (6) so that when attached to levers (8), a 90 degree angle is formed between centerline of lever (8) and centerline of control cables.

NOTE: If throttle and mixture controls on the quadrant were not set at a true midpoint as described in Step 5 above, the 1/4 inch tolerance as noted in following steps b and d will not be available. Readjustment for 1/4 inch travel (cushion) will be necessary and should be made as specified in Rigging Procedures Chart.

- B. Adjustment of the idle mixture is accomplished by the use of a locknut which is attached to the metering unit lever on the metering unit. Tightening locknut, to shorten the interconnecting linkage, provides a richer mixture. Adjust to obtain a slight and momentary gain in idle speed as the mixture control is moved toward IDLE CUT-OFF (if set too lean, idle speed will drop under the same condition). Mixture control levers in the cabin should end their travels approximately 1/4 of an inch before reaching the quadrant stops. At the same time, the metering unit levers on the engines should rest against the corresponding stops.
- C. Metering unit levers should be uniform within 1/2 of a knob through the cruising range. This can be checked by adjusting both flow meter readings to an identical value at uniform RPM and manifold pressure on both engines.
- D. Adjust the throttle control levers in the cabin so that their travel ends 1/4 of an inch before reaching the quadrant stops. At the same time the throttle levers on the engines should rest against the corresponding stops.
- E. Throttle control levers should be uniform within 1/8 of an inch of the knobs through the entire travel. The rigging procedures chart provides corrective instructions in order to meet the above control requirements.

<u>CONDITION</u>	<u>PROBABLE CAUSE</u>	<u>CORRECTION</u>
MIXTURE CONTROL LEVER REACHES QUADRANT BEFORE COVERING FULL TRAVEL	Insufficient control travel.	Shorten travel of serrated lever (8) by resetting lever higher on serrated spacer.
MIXTURE CONTROL LEVER STOPS SHORT AT BOTH ENDS OF QUADRANT	Excessive control travel.	Lengthen travel of serrated lever (8) by resetting lever lower on serrated spacer.
MIXTURE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES THE QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	Disconnect rod end (6) from lever (8) and turn rod end until desired adjustment is achieved. Connect rod end to lever.
UNEVEN MIXTURE RESPONSE BETWEEN ENGINES (MORE THAN HALF KNOB DIFFERENCE AT BALANCED FLOW METER READINGS, RPM AND MANIFOLD PRESSURE)	Different mixture control sensitivities.	Refer to Rigging Mixture and Throttle Controls.
THROTTLE CONTROL LEVER REACHES QUADRANT STOPS BEFORE COVERING FULL TRAVEL	Insufficient control travel.	Shorten travel of serrated lever (8) by resetting lever higher on serrated spacer.
THROTTLE CONTROL LEVER STOPS SHORT AT BOTH ENDS OF QUADRANT	Excessive control travel.	Lengthen travel of serrated lever (8) by resetting lever lower on serrated spacer.
THROTTLE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES THE QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	Disconnect rod end (6) from lever (8) and turn rod end until desired adjustment is achieved. Connect rod end to lever.
UNEVEN THROTTLE SETTING RESPONSE BETWEEN ENGINES. MORE THAN 1/8 INCH DIFFERENCE BETWEEN KNOBS (AT SAME FLOW METER MANIFOLD PRESSURE AND RPM READINGS)	Different throttle control sensitivities.	Refer to Rigging Mixture and Throttle Controls

NOTE

If described corrective measures do not provide adequate throttle control operation, check throttle body, control valve operation and air intake system for leaks.

Rigging Procedures Chart for Mixture and Throttle Controls

Inspection/Check

1. Inspection/Check of Engine Control System.
 - A. Remove pedestal upper left and right side panels.
 - B. Remove front carpet.
 - C. Remove upholstery side panel.
 - D. Remove wing gap fairing.
 - E. Remove necessary access plates on underside of wing.
 - F. Remove upper engine cowl.

ENGINE CONTROL QUADRANTDescription

1. The engine control quadrant mounted in the center pedestal contains throttle levers, propeller pitch levers, and mixture levers. The components are fastened together in a manner which allows a friction control knob at the right side of the control quadrant to vary the amount of friction on the various control levers. This provides a means of locking the control levers in the desired position.

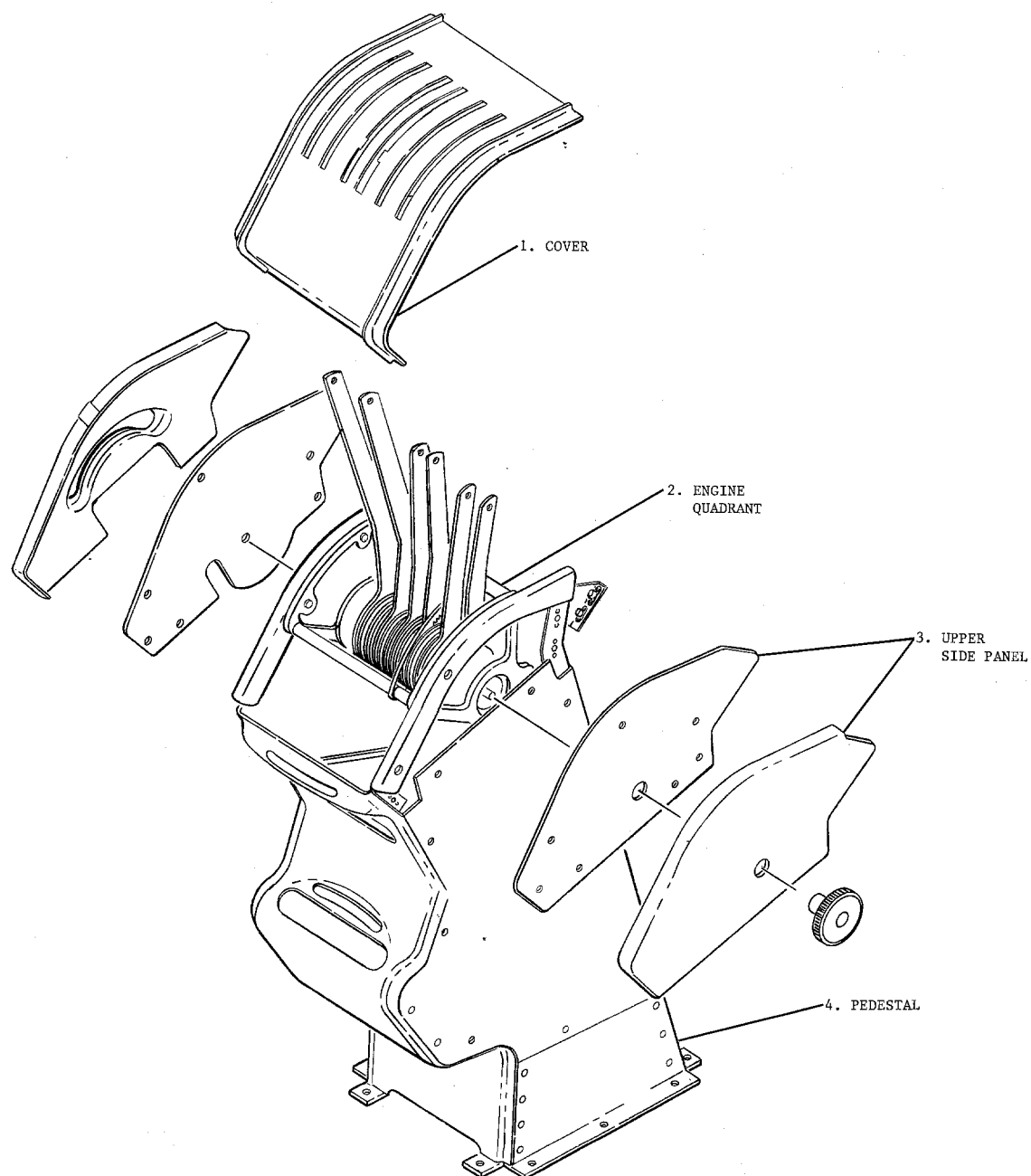
Maintenance Practices

1. Removal/Installation of Engine Control Quadrant (See Figure 1)
 - A. Remove Engine Control Quadrant as follows:
 - (1) Remove LH and RH upper side panels (3), friction knob, and elevator trim control wheel.
 - (2) Disconnect throttle, propeller, and mixture controls from engine quadrant (2).
 - (3) Remove screws securing quadrant to pedestal and lift out.
 - B. Install Engine Control Quadrant as follows:
 - (1) Place quadrant in position on pedestal.
 - (2) Connect throttle, propeller and mixture control to quadrant.
 - (3) Install screws securing quadrant in place.
 - (4) Install elevator trim wheel, LH and RH upper side panels (3), friction control knob, and check all controls for freedom of movement.
2. Disassembly and Assembly of Control Quadrant (See Figure 2).
 - A. Disassemble Engine Control Quadrant.
 - (1) Remove three screws (1) attaching right mounting plate (14) to guide rods (9).
 - (2) Remove washer (17) and spring (18) from end of center stud (16).

NOTE: Spacers 5, 7, and 8 are of different thickness.

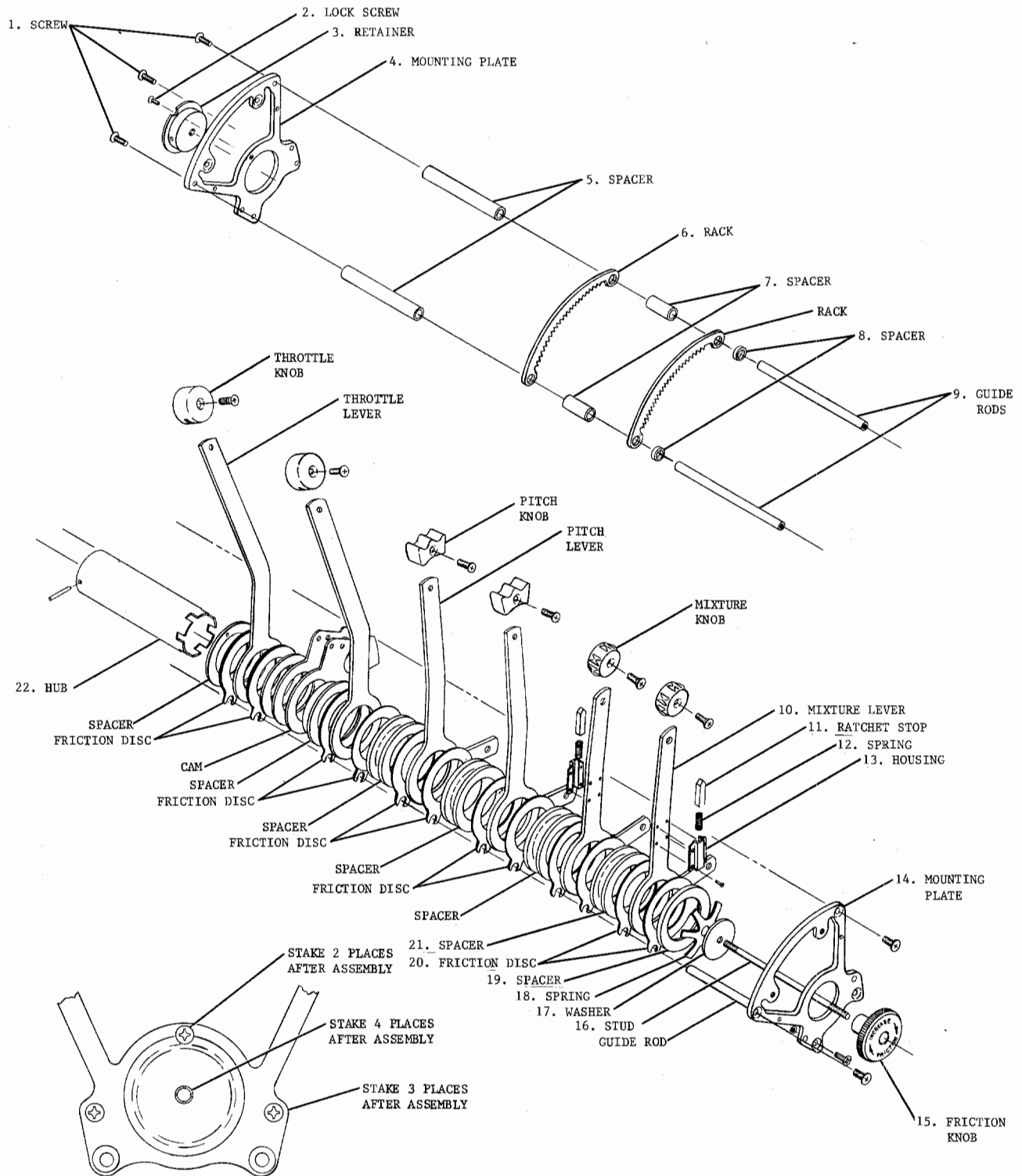
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Engine Control Quadrant Installation
Figure 1

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10613021
10611015Engine Control Quadrant Assembly
Figure 2

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- (3) Remove rack (6) and spacers (8) from guide rods, then remove spacer (19), friction disc (20) and control lever (10) from hub (22). Follow this sequence and remove the remaining parts assembled on the guide rods and hub.

CAUTION: HOLD THE RATCHET STOP (11) ON MIXTURE CONTROL LEVERS DOWN WHEN REMOVING THE RACKS TO PREVENT THEM FROM SPRINGING OUT OF THEIR HOUSINGS.

- (4) Remove three screws (1) attaching rods to left mounting plate (4) and remove guide rods.
- (5) Remove lock screws (2) from left mounting plate (4) and remove hub (22) from mounting plate.
- (6) Unscrew retainer (3) from hub (22) and center stud (16) from retainer, to complete disassembly.

B. Assemble Engine Control Quadrant.

- (1) Screw center stud (16) into retainer (3).
- (2) Screw retainer into hub (22) and install hub in left mounting plate (4). Secure hub to mounting plate with lock screw (2).
- (3) Stake with a punch edge of lock screw after installing to prevent it from becoming loose and dropping out.
- (4) Install three guide rods (9) on left mounting plate (4) with three attaching screws (1).

NOTE: Do not lubricate the parts to be assembled on the hub. These parts must remain dry for proper operation of the control friction lock.

- (5) Assemble control levers, spacers, guides, etc., on hub and guide rods as illustrated.
- (6) Install right mounting plate (14) with three screws (1), attaching mounting plate to guide rods (9).

Inspection/Check

1. Inspection/Check of Engine Control Quadrant.

- A. Remove pedestal upper left and right side panels.

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ENGINE EXHAUST SYSTEMDescription

1. The engine exhaust system consists of a forward, center, and aft riser connected together by slip joints, below each engine exhaust port, and then to the muffler on the 310 aircraft, or on the Turbo 310 aircraft to the aft slip joint and inboard and outboard exhaust tubes which are connected to the turbo-charger.
2. The aft slip joint assembly is the only slip joint on the Turbo 310 aircraft incorporating a seal. The seal assembly connects to the inboard and outboard exhaust tubes and the aft stack assembly by a balljoint clamped together on each end using a flange, bolt spring, washer and nut.

Maintenance Practices

1. Tools and Equipment

Name	Number	Manufacturer	Use
Exhaust System Seal Replacement	SK421-40	Cessna Aircraft Co.	Replace slip joint seal in exhaust system
FEL-PRO	C-5	Felt Products Mfg. Co. Chicago, Ill.	

2. Removal/Installation of Engine Exhaust System (Standard 310)
(See Figure 1).

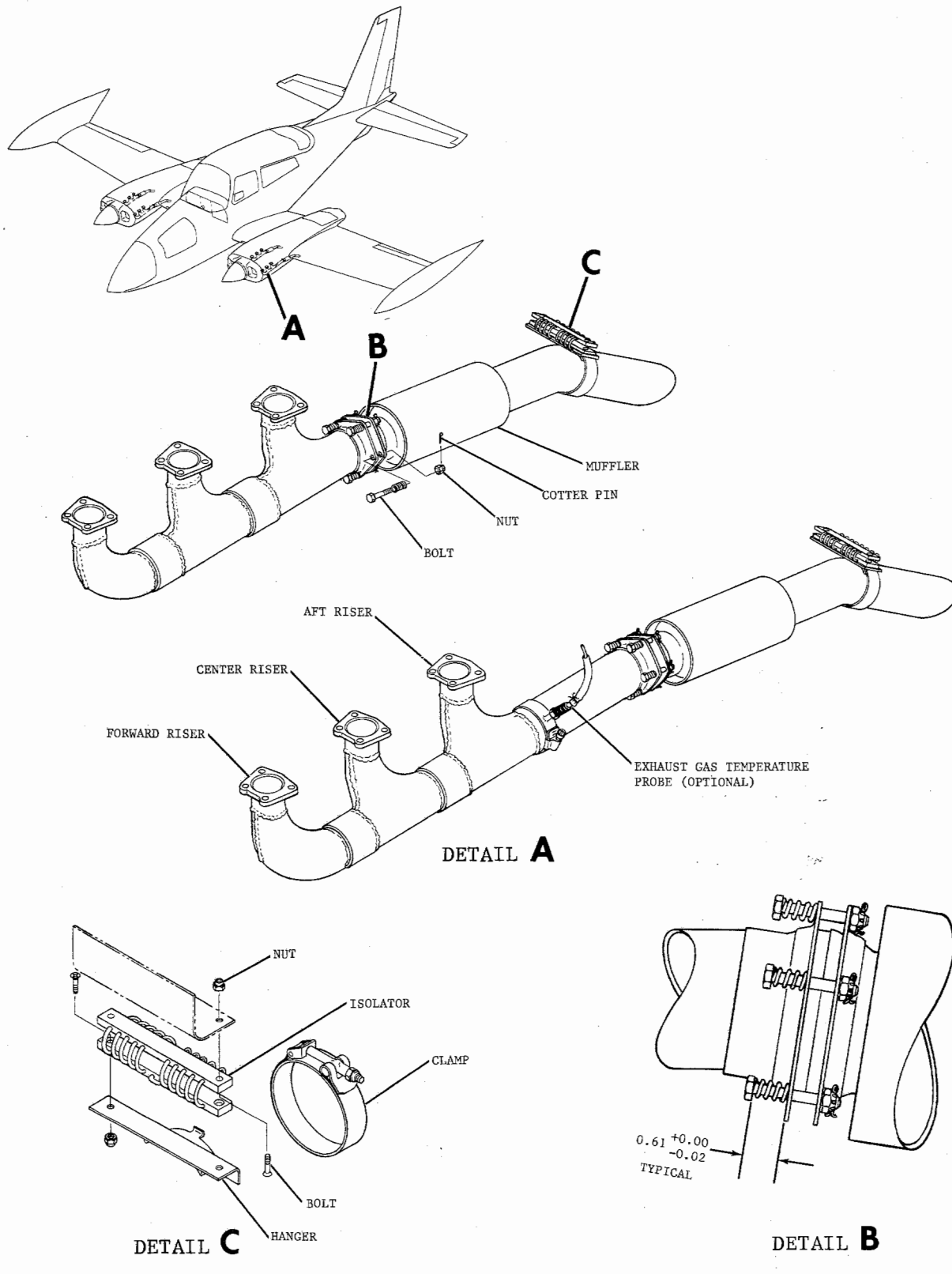
A. Remove Exhaust System.

NOTE: Removal procedures are the same for either left or right engine.

- (1) Remove upper engine cowl.
- (2) Remove lower portion of engine nacelle and cowl by removing attaching screws.
- (3) Disconnect optional exhaust gas temperature probe if installed.
- (4) Loosen clamp and disconnect from hanger.

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Engine Exhaust System (Standard 310)
Figure 1

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- (5) Disconnect muffler from aft riser by removing cotter pins, nuts, bolts and springs. Remove muffler.
- (6) Remove the four nuts holding each riser to its respective cylinder.
- (7) Work risers down and free of cylinder studs.
- (8) Separate center riser from forward and aft risers and remove from nacelle.

NOTE: If difficulty is encountered in removing an exhaust stack assembly, refer to engine removal procedures and raise the engine from its mounts high enough to provide removal clearance.

B. Install Engine Exhaust System.

- (1) Position muffler in nacelle.
- (2) Assemble center riser to forward and aft risers and position in place on cylinder studs.
- (3) Install the four nuts on each riser and tighten. Torque nuts 100 to 110 inch-pounds.
- (4) Install exhaust optional gas temperature probe if removed.
- (5) Align and connect muffler to aft riser, using bolts, springs, nuts and cotter pins. Tighten to dimension shown in Figure 1.
- (6) Secure muffler extension to hanger, using clamp. Tighten clamp.
- (7) Install lower portion of engine nacelle cowling with attaching screws.
- (8) Install upper engine cowling.

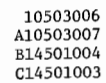
3. Removal/Installation of Engine Exhaust System (Turbo 310) (See Figure 2).

A. Remove Exhaust System.

NOTE: Removal procedures are the same for either left or right engine.

- (1) Remove engine cowling.
- (2) Remove lower portion of engine nacelle and cowling by removing attaching screws.
- (3) Disconnect optional exhaust gas temperature probe if installed.
- (4) Remove the four nuts holding each riser to its respective cylinder.
- (5) Remove the ten bolts securing slip joint (9) to aft riser (4), inboard tube (7) and outboard tube (8) by removing cotter pin, nut, washers and springs.
- (6) Compress slip joint (9) and remove.

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- (7) Remove the forward, center and aft risers by pulling apart.

NOTE: If difficulty is encountered in removing an exhaust, refer to engine removal procedures and raise the engine from its mount high enough to provide removal clearance.

- (8) Refer to induction air maintenance practices and remove air canister assembly.
- (9) Refer to Turbocharger maintenance practices and remove Turbocharger.
- (10) Remove shield (11) from inboard tube (7).
- (11) Disconnect inboard tube (7) and outboard tube (8) from exhaust manifold header by removing clamps.
- (12) Route tubes (7) and (8) through canted bulkhead and out of engine nacelle.
- (13) Remove four nuts and bolts securing manifold header to waste-gate and remove from engine nacelle.

NOTE: Refer to SK421-40 for replacement of seal (13) and expansion ring (12).

B. Install Engine Exhaust System as follows:

NOTE: Apply Fel-Pro Compound to threads in high heat areas.

- (1) Position manifold header in place on waste-gate and install four bolts and nuts. Torque nuts 35 inch-pounds.
- (2) Route inboard tube (7) and outboard tube (8) through canted bulkhead into position.
- (3) Clamp inboard tube (7) and outboard tube (8) to manifold header with clamps. Torque clamps to 35 inch-pounds.
- (4) Install shield (11) on inboard tube (7).
- (5) Install Turbocharger in accordance with turbocharger installation procedures.
- (6) Install air canister assembly in accordance with air canister installation procedures.
- (7) Position forward, center and aft risers in place on respective cylinders and tighten nuts. Torque nuts 100 to 110 inch-pounds.

NOTE: Make sure seal (13) in slip joint (9) is good before installing.

- (8) Compress slip joint (9) and install in position. Secure with 10 bolts, springs, washers and nuts.

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NOTE: Be sure springs are compressed the proper dimension by adding or removing washers during installation.

- (9) Safety with cotter pins.
- (10) If removed, connect optional exhaust gas temperature probe.
- (11) Install lower portion of engine nacelle with attaching screws.
- (12) Install upper engine cowling.

Inspection/Check

- 1. Inspection/Check of Engine Exhaust System.
 - A. Remove Upper Engine Cowling.

Cleaning/Painting

- 1. Cleaning Engine Exhaust System
 - A. Cleaning.
 - (1) Spray engine exhaust system with a suitable solvent and allow to drain dry.

WARNING: NEVER USE A FLAMMABLE SOLVENT ON ENGINE EXHAUST SYSTEM.
 - (2) Wipe dry with a clean cloth.

NOTE: Never use a wire brush or abrasives to clean exhaust system.

ECONOMY MIXTURE INDICATING SYSTEMDescription

The economy mixture indicator (optional) consists of the indicator and a sensing probe connected by electrical wires. The probe mounted in the exhaust system senses the most economical fuel-air mixture for cruising flight at a power setting of 75 percent or less. Exhaust gas temperature varies with the ratio of fuel-to-air mixture entering the engine cylinders.

Maintenance Practices

1. Removal/Installation of Economy Mixture Indicating System (See Figure 1).

A. Remove Economy Mixture Indicating System.

- (1) Tag and disconnect electrical leads to indicator.
- (2) Remove indicator from instrument panel by removing attaching post lights and screws.
- (3) Remove upper engine cowling.
- (4) Disconnect electrical leads at probe mounted in exhaust system and route wiring from fuselage through wing and out from nacelle.
- (5) Loosen clamp securing probe and remove.

B. Install Economy Mixture Indicating System.

- (1) Install probe in position and secure with clamp.

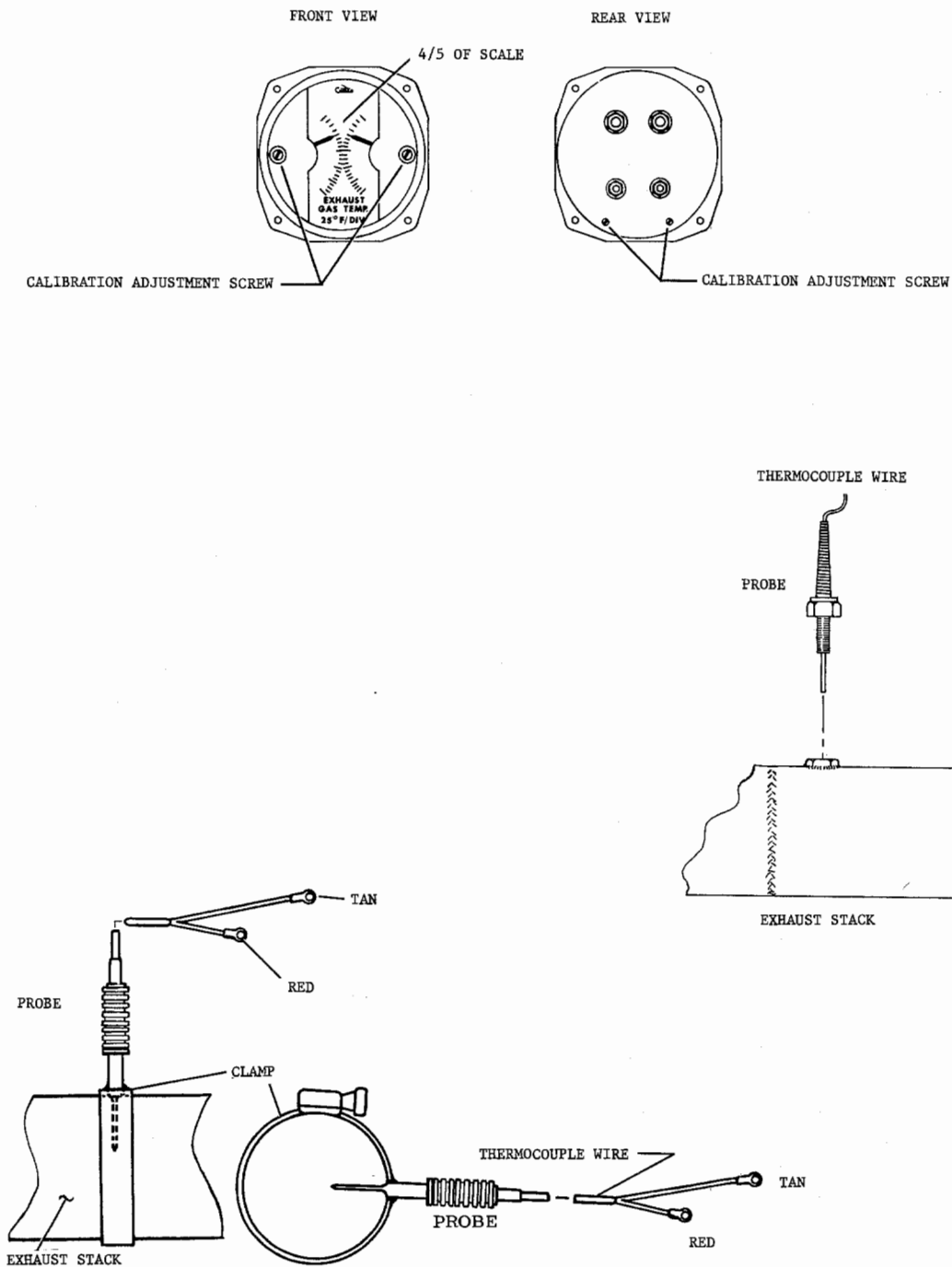
NOTE: Do not alter length of electrical leads.

- (2) Route electrical leads from probe in nacelle through wing into the fuselage and in place forward of instrument panel.
- (3) Connect electrical leads at probe and on the rear of the instrument panel.
- (4) Install indicator in instrument panel with attaching screws and post lights.
- (5) Install engine cowling.

Adjustment/Test

1. Calibration Check of Economy Mixture Indicating System.

A. Check Calibration.



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14551001R

Economy Mixture Indicating System
Figure 1

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NOTE: To check calibration, it will be necessary to fly the aircraft.

- (1) Obtain an average cruise condition of 65% power at 7500 feet altitude and lean mixture to peak exhaust temperature on indicator.

NOTE: To obtain peak exhaust temperature, lean out mixture control slowly enough for pointer to follow. When the pointer stops going up and starts back down the scale, enrich mixture enough to regain peak reading.

- (2) Record reading achieved after system has stabilized.
- (3) Repeat Step (1) several times to insure a positive reading has been achieved.
- (4) Lean mixture to a setting of not less than 25 degrees below peak exhaust gas temperature.
- (5) Use adjust screw on face of the indicator and position pointer to 4/5 scale.

NOTE: Adjustment should not exceed $\pm 75^{\circ}\text{F}$ or three divisions on the indicator scale.

- (6) If adjustment for more than $\pm 75^{\circ}\text{F}$ is required, proceed as follows:
 - (a) Gain access to rear of indicator.
 - (b) Viewing meter from the rear, turn calibration screws one turn clockwise for increase in indicator reading of 25°F one division on the indicator scale or one turn counterclockwise for 25°F decrease.

Inspection/Check

1. Inspection/Check of Economy Mixture Indicating System.
 - A. Remove Upper Engine Cowling.

ENGINE BAFFLESDescription

1. The sheet metal baffles installed on each engine direct the flow of air around the cylinders and other engine components. These baffles incorporate rubber-asbestos composition seals at points of contact with the engine nacelle to help confine and direct the airflow to the desired area. It is very important to the engine cooling to install the baffles properly.

Maintenance Practices

1. Removal/Installation of Engine Baffles (See Figure 1).

- A. Remove Engine Baffles.

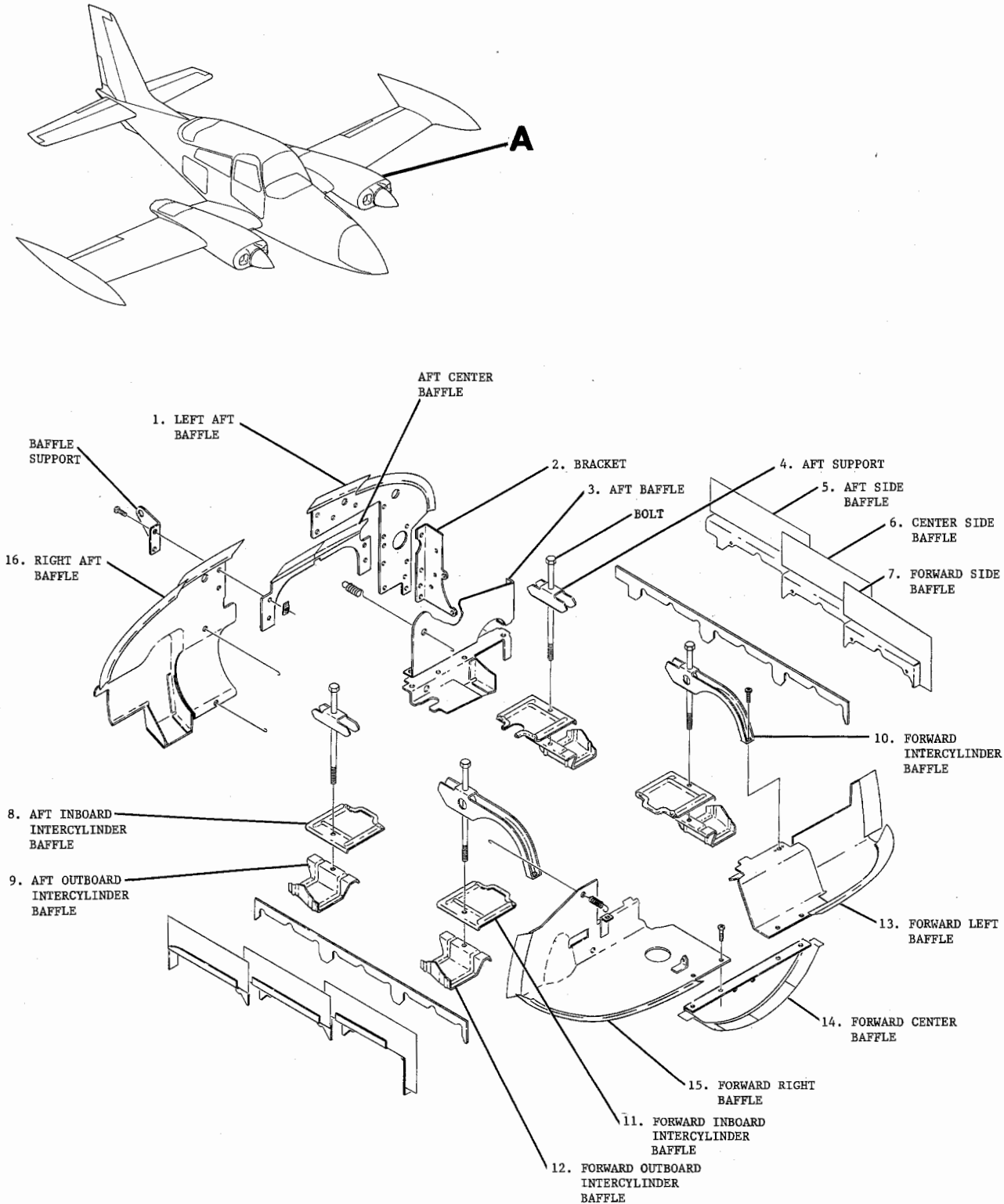
- (1) Remove upper engine cowling.
- (2) Remove lower engine cowling by removing attaching screws.
- (3) To remove right and left baffles 5, 6, and 7, remove the upper rocker box cover screws which attach baffles.
- (4) Remove forward left baffle (13) by removing attaching screws.
- (5) Remove bolts from left and right aft supports (4) and forward intercylinder supports (10) and remove forward inboard intercylinder baffles (11) forward outboard intercylinder baffles (12), aft inboard intercylinder baffles (8) and aft outboard intercylinder baffles (9).
- (6) Remove forward center baffle (14) by removing attaching screws.

NOTE: To gain access to baffle (15), remove alternator and route alternator wiring to aft nacelle section.

- (7) Remove forward right baffle (15) by removing attaching screws.
- (8) Remove fasteners from right aft baffle (16), remove attaching screws from baffle support and aft center baffle and remove right aft baffle (16).
- (9) Remove screws securing left aft baffle from aft center baffle and bracket (2).
- (10) Disconnect fuel lines, pressure lines, and oil lines necessary to remove rear baffles.
- (11) Remove aft baffle (3) by removing attaching screws to oil cooler and aft cylinder rocker box cover mounting screws.

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DETAIL A

Engine Baffle Installation
Figure 1

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A10503016

B. Install Engine Baffles.

- (1) Install aft baffle (3) in position and attach to aft cylinder rocker box cover mounting screws and attaching screws around the oil cooler.
- (2) Attach aft center baffle to left aft baffle with attaching screws.
- (3) Install right aft baffle (16). Attach to baffle support and connect fasteners together around cylinder.
- (4) Install both right and left aft side baffles (5) center baffles (6) and forward side baffles (7) by securing under rocker box cover upper mounting screws.
- (5) Install aft inboard intercylinder baffles (8), aft outboard intercylinder baffles (9) aft supports (4) with bolts.
- (6) Install forward outboard intercylinder baffles (12), forward inboard intercylinder baffles (11), and forward intercylinder supports (10) with bolts.
- (7) Install forward right baffle (15) with attaching screws.
- (8) Install forward center baffle (14) attaching to forward right baffle (15) with attaching screws.
- (9) Install forward left baffle (13) to center baffle (14) and attach with screws.
- (10) Install alternator, route electrical wiring through baffles and connect.
- (11) Route oil lines, fuel lines and pressure lines and connect.
- (12) Install engine cowling.

Inspection/Check

1. Inspection/Check of Engine Baffles.

A. Remove Engine Cowling.

ENGINE COMPARTMENT FIRE EXTINGUISHERDescription

1. The engine compartment fire extinguisher consists of three major components, the annunciator panel, thermal detectors, and the extinguisher unit. The annunciator panel is mounted in a standard three-inch instrument hole. Three thermal detectors are mounted in the high heat areas of each engine nacelle and the extinguisher unit is mounted in the aft section of the nacelle. An exit line is routed from the extinguisher into the forward section of the engine where the freon gas is expelled. A smaller discharge hose which routes off the large discharge hose expels freon gas from the center of the nacelle area towards the inboard side of the nacelle.

NOTE: The test switch does not check the detector system.

2. A test function is provided to test the system circuit. When the test switch is pushed, all lights on the annunciator panel should illuminate.
3. If an overheat condition is detected, the appropriate FIRE light will annunciate the engine to be extinguished. The extinguisher is activated by opening the appropriate guard and pressing the FIRE light. The E light (amber) will illuminate after the extinguisher has been discharged and will continue to show empty until a new bottle has been installed. The FIRE light will remain illuminated until the temperature in the compartment cools.

NOTE: Only one discharge is available per engine.

Troubleshooting

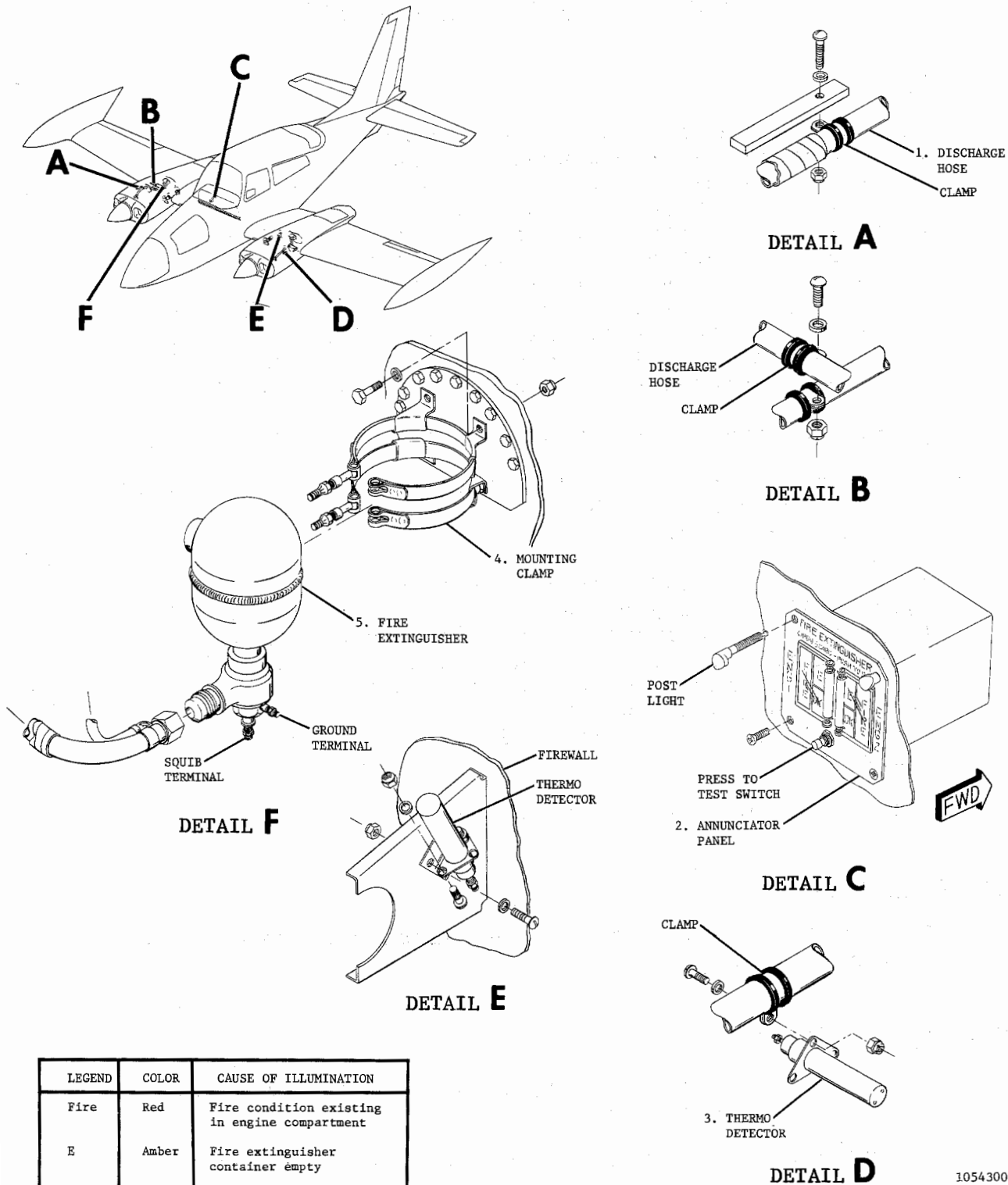
1. For troubleshooting the fire extinguisher, refer to vendor information manual.

Maintenance Practices

1. Removal/Installation of Engine Compartment Fire Extinguisher (See Figure 1 and Figure 2).
 - A. Remove Engine Compartment Fire Extinguisher.
 - (1) Turn electrical power OFF.
 - (2) Remove engine cowling.

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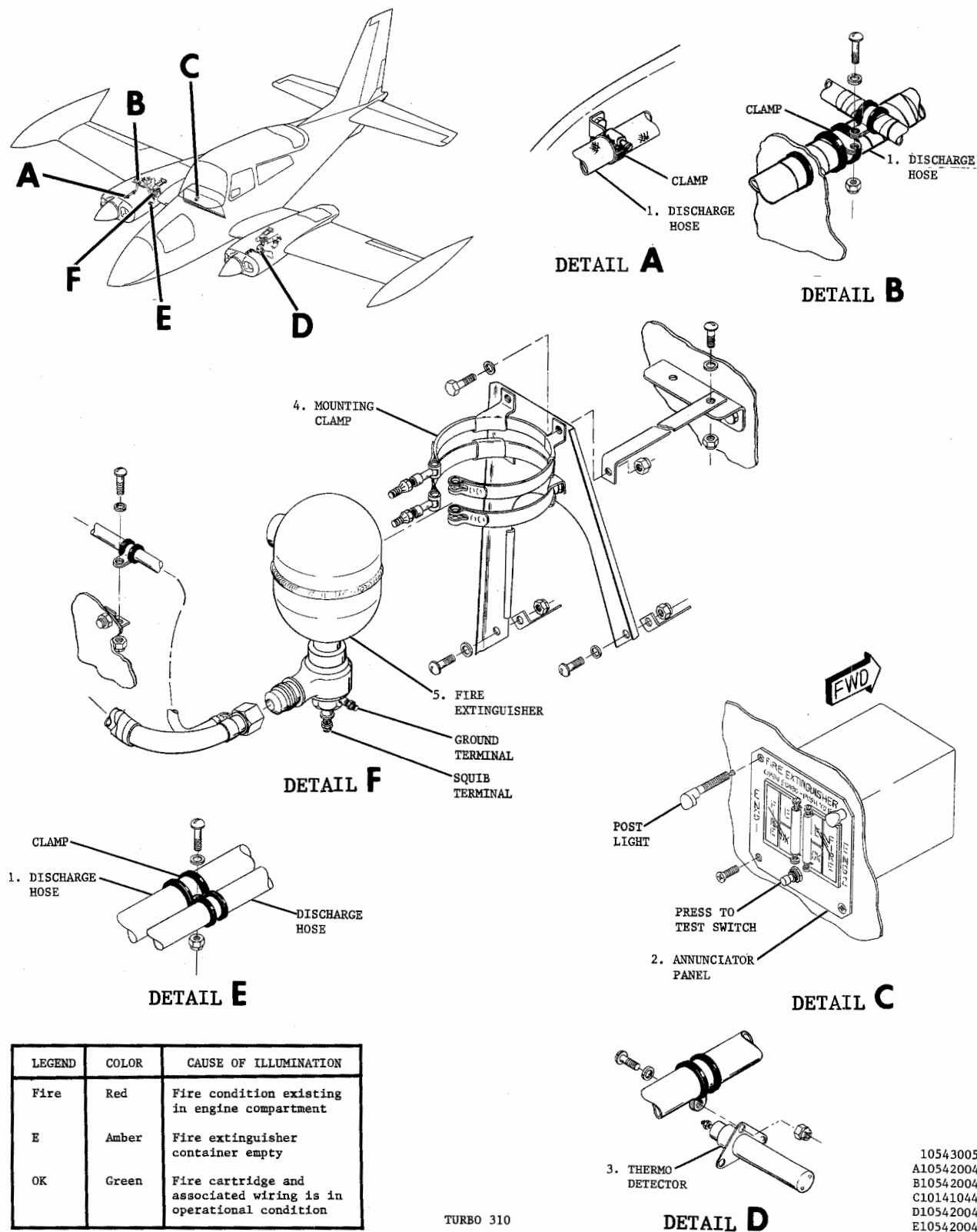
STANDARD 310

10543006
A10542001
B10542001
C10141044
D10542004
E10542001
F10542006

Engine Compartment Fire Extinguisher
Figure 1

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Engine Compartment Fire Extinguisher
Figure 2

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MAINTENANCE MANUAL

WARNING: INSTALL A GROUNDING WIRE BETWEEN GROUND TERMINAL AND SQUIB TERMINAL BEFORE ATTEMPTING TO REMOVE A CHARGED EXTINGUISHER UNIT OR CARTRIDGE.

- (3) Tag and disconnect wiring from fire extinguisher.
- (4) Disconnect discharge hose (1) by disconnecting mounting clamps.
- (5) Loosen mounting clamp (4) from fire extinguisher and remove fire extinguisher (5) and discharge hoses (1) out of nacelle.

B. Install Engine Compartment Fire Extinguisher.

- (1) Position fire extinguisher in mounting clamp (4), tighten clamps and route discharge hoses in place.

WARNING: DO NOT REMOVE GROUNDING WIRE FROM FIRE EXTINGUISHER UNIT OR CARTRIDGE UNTIL INSTALLATION IS COMPLETE IN ENGINE NACELLE.

- (2) Clamp discharge hoses (1) in place with mounting clamp, bolts and nuts.

WARNING: BEFORE CONNECTING ELECTRICAL TERMINALS TO CARTRIDGE, CHECK CONNECTORS WITH A MULTIMETER TO ENSURE NO VOLTAGE IS PRESENT AT CONNECTOR.

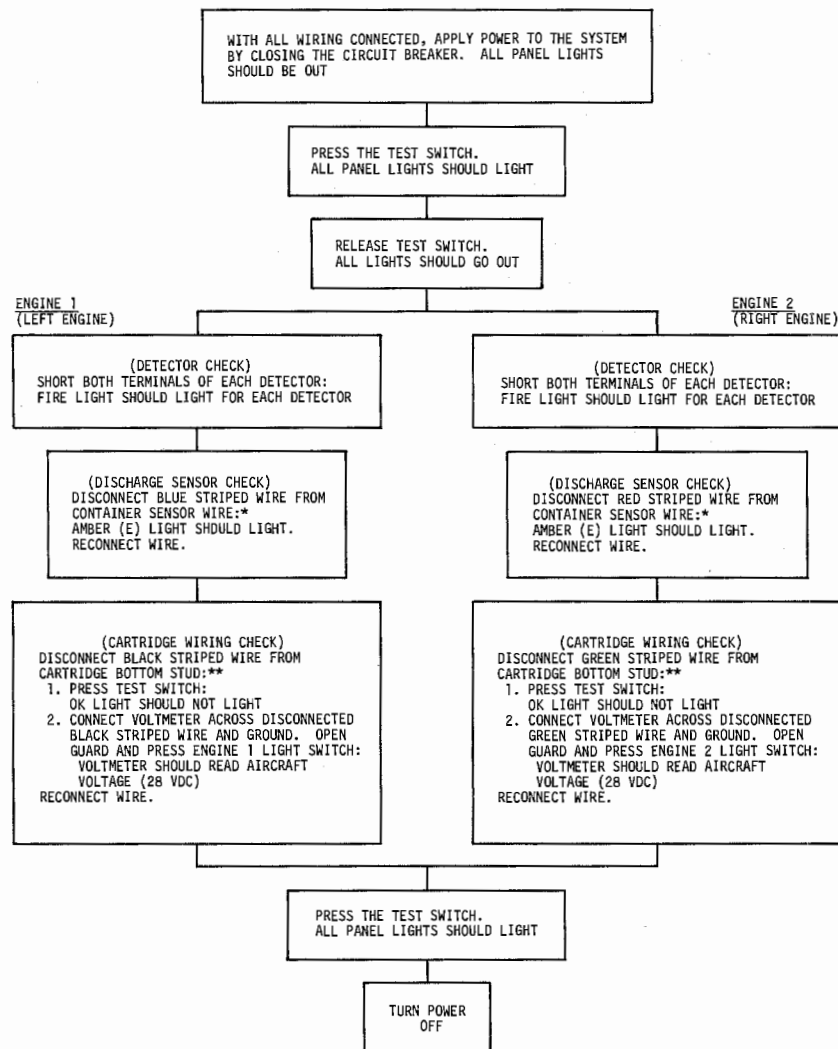
- (3) Connect electrical wires.
- (4) Turn on electrical power and check system for proper operation at control panel. Press the test switch.
- (5) Install engine cowling.

C. Remove Fire Extinguisher Thermo Detectors.

- (1) Turn electrical power OFF.
- (2) Remove engine cowling.
- (3) Loosen and remove nuts, washers and bolts attaching thermo detector to bracket or clamp.
- (4) Tag and disconnect electrical wire from detector.
- (5) Remove detector from nacelle.

D. Install Fire Extinguisher Thermo Detectors.

- (1) Position thermo detector in place and secure with bolt, washers and nuts.
- (2) Connect electrical wire to detector and remove tag.
- (3) Install engine cowling.



* If amber light does not light, but green light stays out when test button is depressed, indicates that sensor and cartridge wires have been interchanged.
 ** If amber light lights, sensor and cartridge wires have been interchanged.

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Checkout Chart - Fire Extinguisher System
Figure 3

E. Remove Annunciator Panel.

- (1) Turn electrical power OFF.
- (2) Disconnect electrical connector.
- (3) Disconnect wiring from post lights and remove post lights.

F. Install Annunciator Panel.

- (1) Position annunciator panel in place and install the lower screws.
- (2) Install the two post lights in upper mounting holes and connect electrical wiring.
- (3) Connect electrical connector to annunciator panel.
- (4) Turn on electrical power and check the operation of annunciator panel.

Adjustment/Test

1. Check out engine compartment fire extinguisher, see Figure 3.

Inspection/Check

1. Inspection/Check of Engine Compartment Fire Extinguisher.

A. Remove upper engine cowl.

ENGINE STARTERDescription

1. The engine starter system consists of the engine starters (24 volt DC), start switches, start relays, a starter vibrator and associated electrical wiring. The system is protected by the Start Relay circuit breaker. The start relays are mounted on the left nacelle firewall. The starter vibrator is located on forward of the instrument panel on the left-hand panel brace.
2. For system operation position Master and Magnetos switches to ON. Press Start switch, the respective Start Relay for that engine will actuate. Applying power to the starter for engine cranking. Simultaneously, the starter vibrator will supply ignition voltage in conjunction with the magneto retard breaker to start the engine.

Maintenance Practices

1. Removal/Installation of Engine Starter (See Figure 1).
 - A. Remove Engine Starter.
 - (1) Turn electrical power OFF.
 - (2) Remove engine cowling.
 - (3) Disconnect starter cable.
 - (4) Remove two mounting bolts securing starter to accessory drive and remove starter.

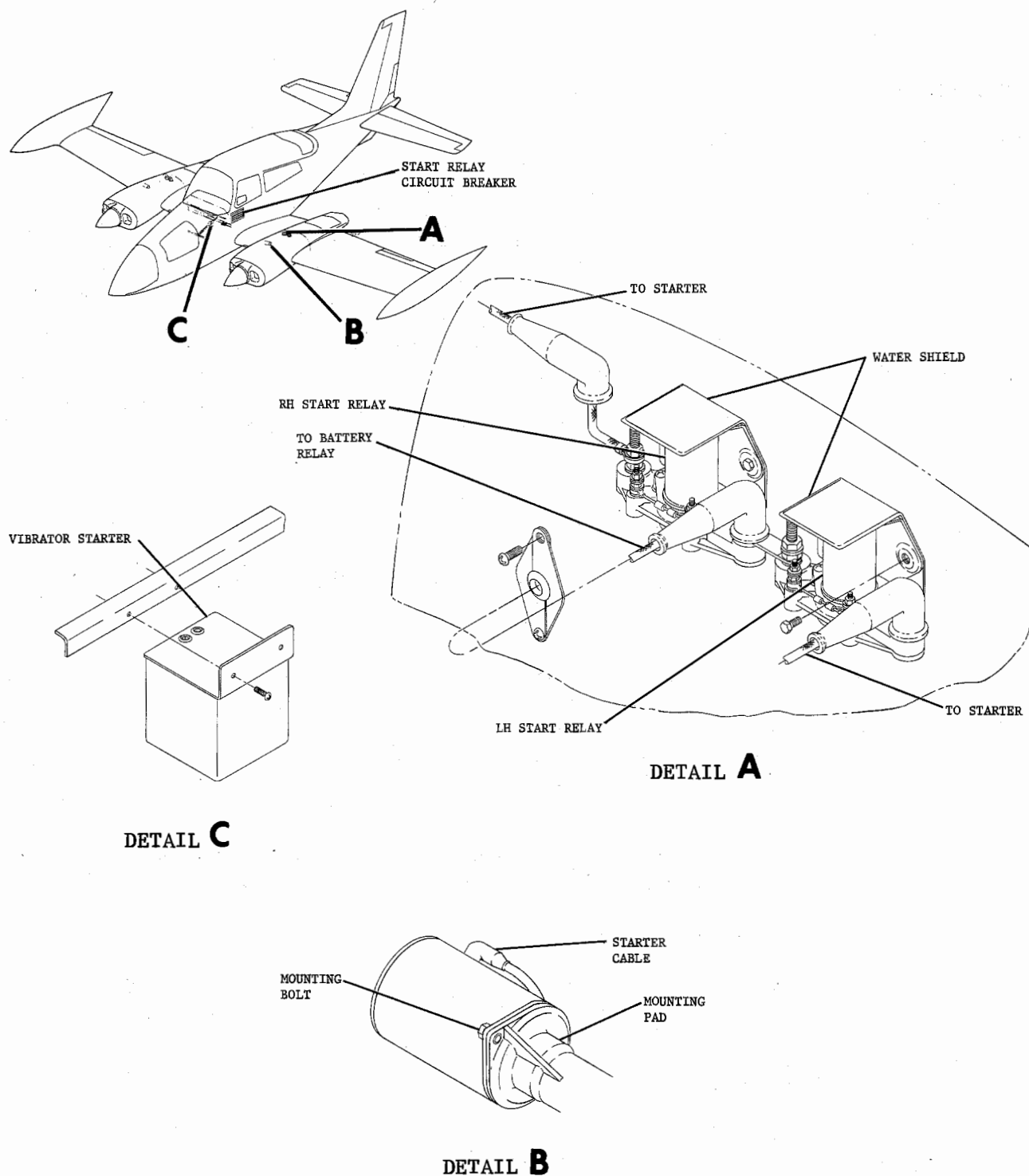
NOTE: If starter is not being replaced immediately, a cover should be installed to prevent entry of foreign material.
 - B. Install Engine Starter.
 - (1) Position starter on accessory drive and install two mounting bolts.
 - (2) Connect starter cable and slide terminal boot in place.
 - (3) Install engine cowling.

Inspection/Check

1. Inspection/Check of Engine Starter.
 - A. Remove upper engine cowling.

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Engine Starter
Figure 1

10583001
A10582002
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CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

8

PROPELLER

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PROPELLERDescription

1. The aircraft is equipped with all metal, three bladed, constant speed, full-feathering, single acting, and governor regulated propellers. Each propeller utilizes hydraulic pressure which opposes the forces of springs and counter-weights to obtain the correct pitch for engine load. Hydraulic pressure from the engine-mounted governor urges blades toward low pitch (increasing rpm) while the springs and counter-weights urge blades toward high pitch (decreasing rpm). The source of hydraulic pressure for propeller operation is furnished by the engine oil system, boosted in pressure by the governor gear pump, and supplied to the propeller hub through engine shaft flange. When the engine is not in operation, the high pitch latch mechanism prevents the propeller blades from moving into the feathered position. To feather the propeller blades, the propeller control levers on the control pedestal must be placed in the feathered position. Unfeathering the propeller is accomplished by positioning the propeller control levers to increase rpm position and rotating the blades to the low pitch position, or by starting the engine. If installed, the optional unfeathering system uses accumulator air and oil to force the propeller to the low pitch condition.

Troubleshooting

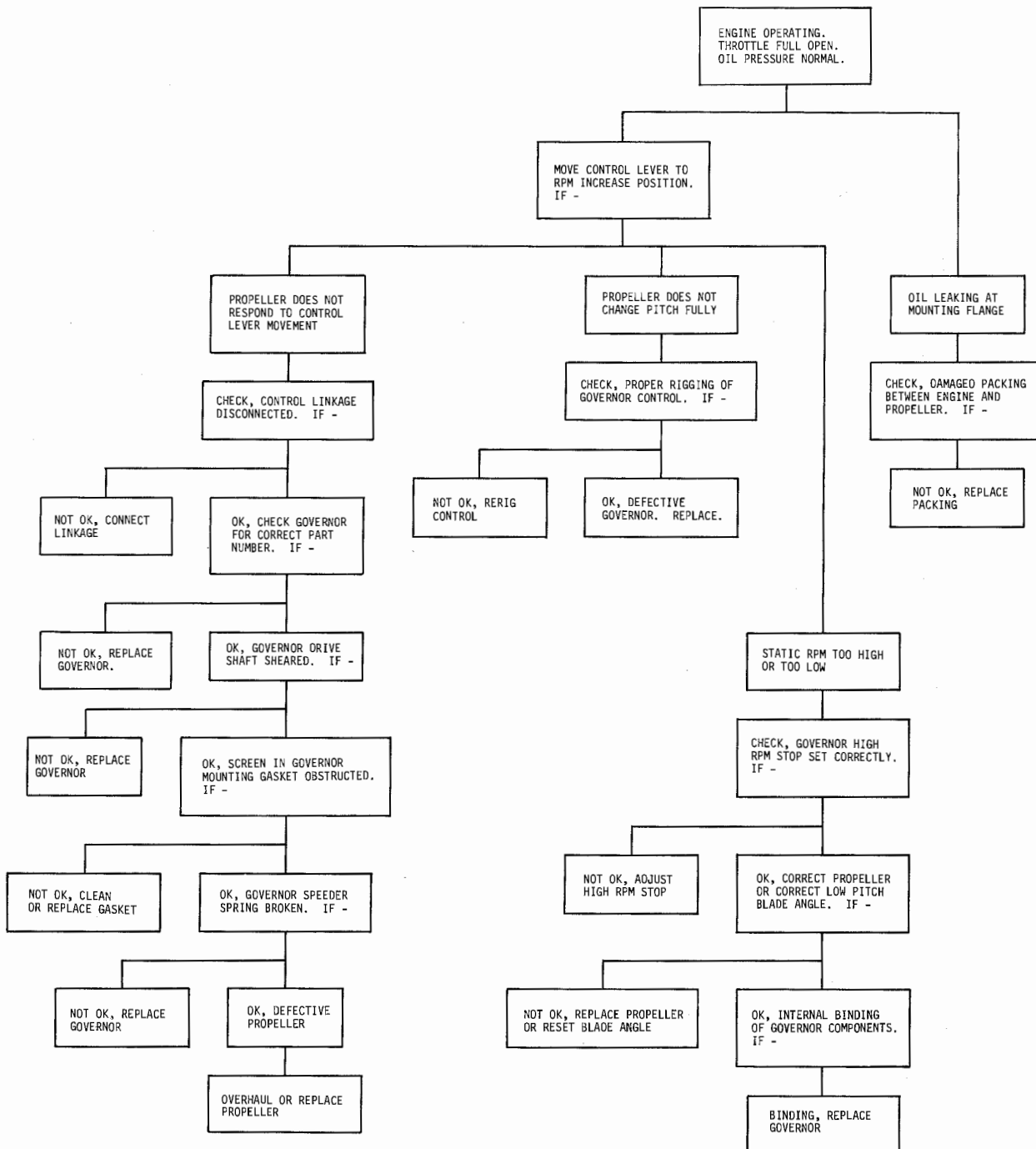
1. Troubleshooting the Propeller
 - A. For a guide to troubleshooting the propeller system, refer to Figure 1.
 - B. When troubleshooting a propeller-governor combination, it is recommended that a governor known to be in good condition be installed to check whether the propeller or the governor is at fault.
 - C. Refer to Adjustment of Governor for typical malfunctions and corrections of malfunctions of the governor.

Adjustment Test

1. Operational check of propellers is provided in this manual; for additional information, refer to McCauley Service/Parts Manuals.

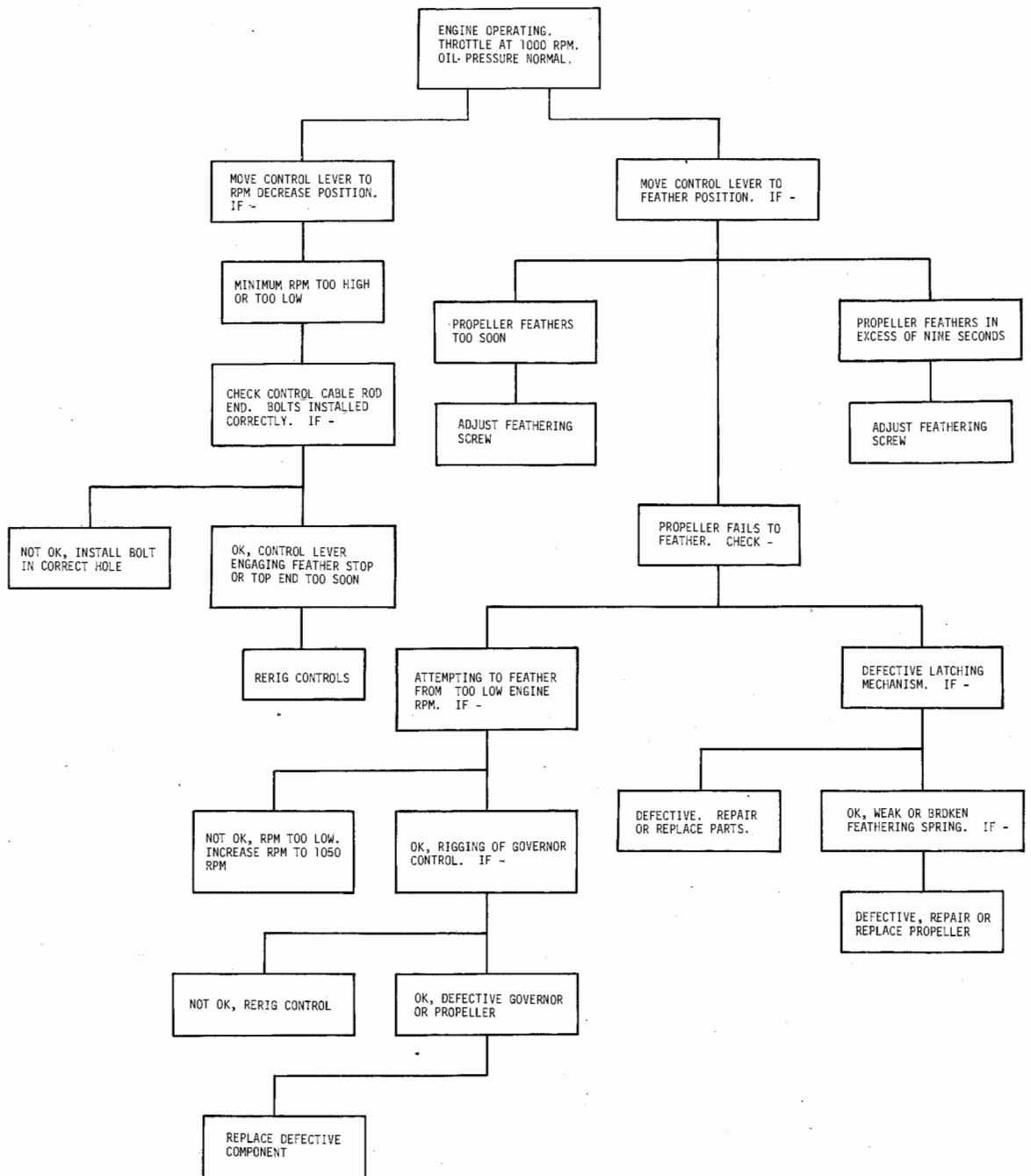
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Troubleshooting Chart - Propeller System
Figure 1 (Sheet 1 of 3)

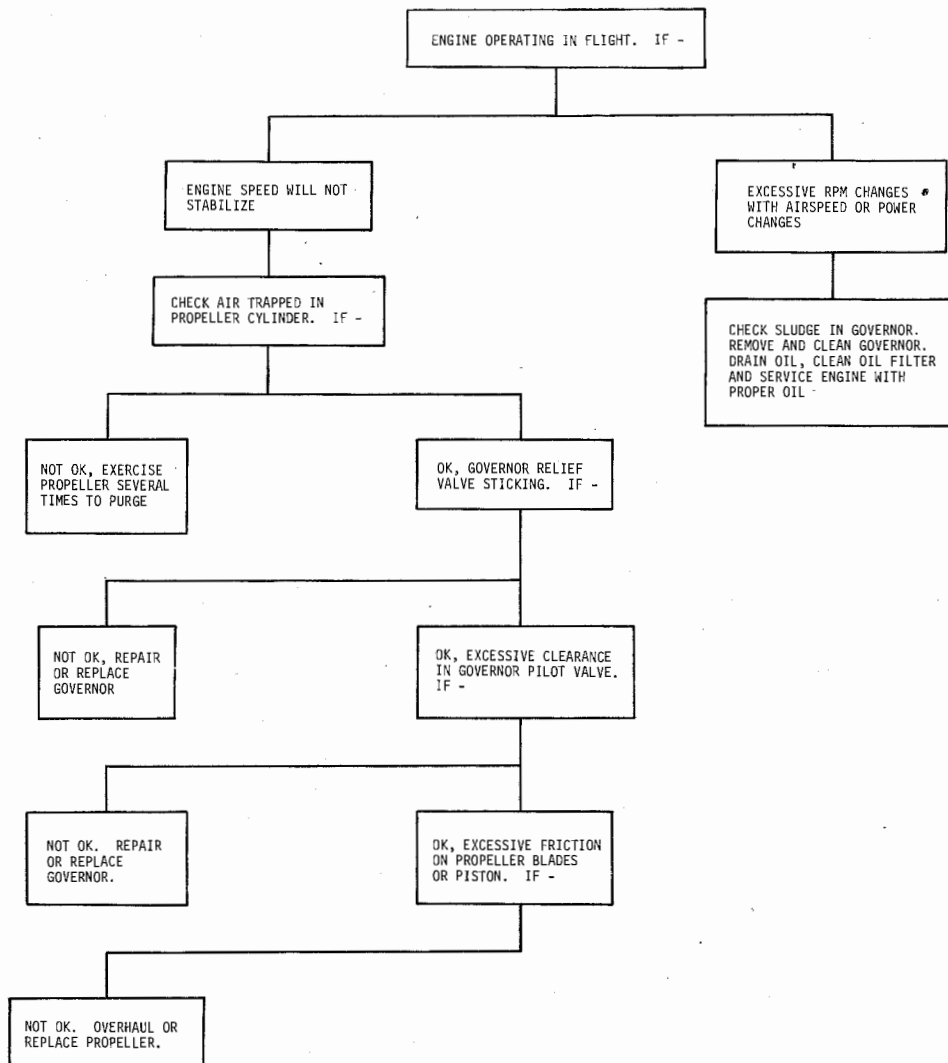


Troubleshooting Chart - Propeller System
Figure 1 (Sheet 2)

10988015

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10988016

Troubleshooting Chart - Propeller System
Figure 1 (Sheet 3)

2. Operational Check of Propellers.

A. Anytime the propellers or propeller governor have been removed, the following check should be performed after reinstallation. This will insure that the engine-propeller-governor combination is in good operating condition and properly adjusted to give maximum performance.

- (1) Face aircraft into the wind. Start engines and allow to warm up with the oil temperature operating in the upper two thirds of the operating range, on the oil temperature indicator.

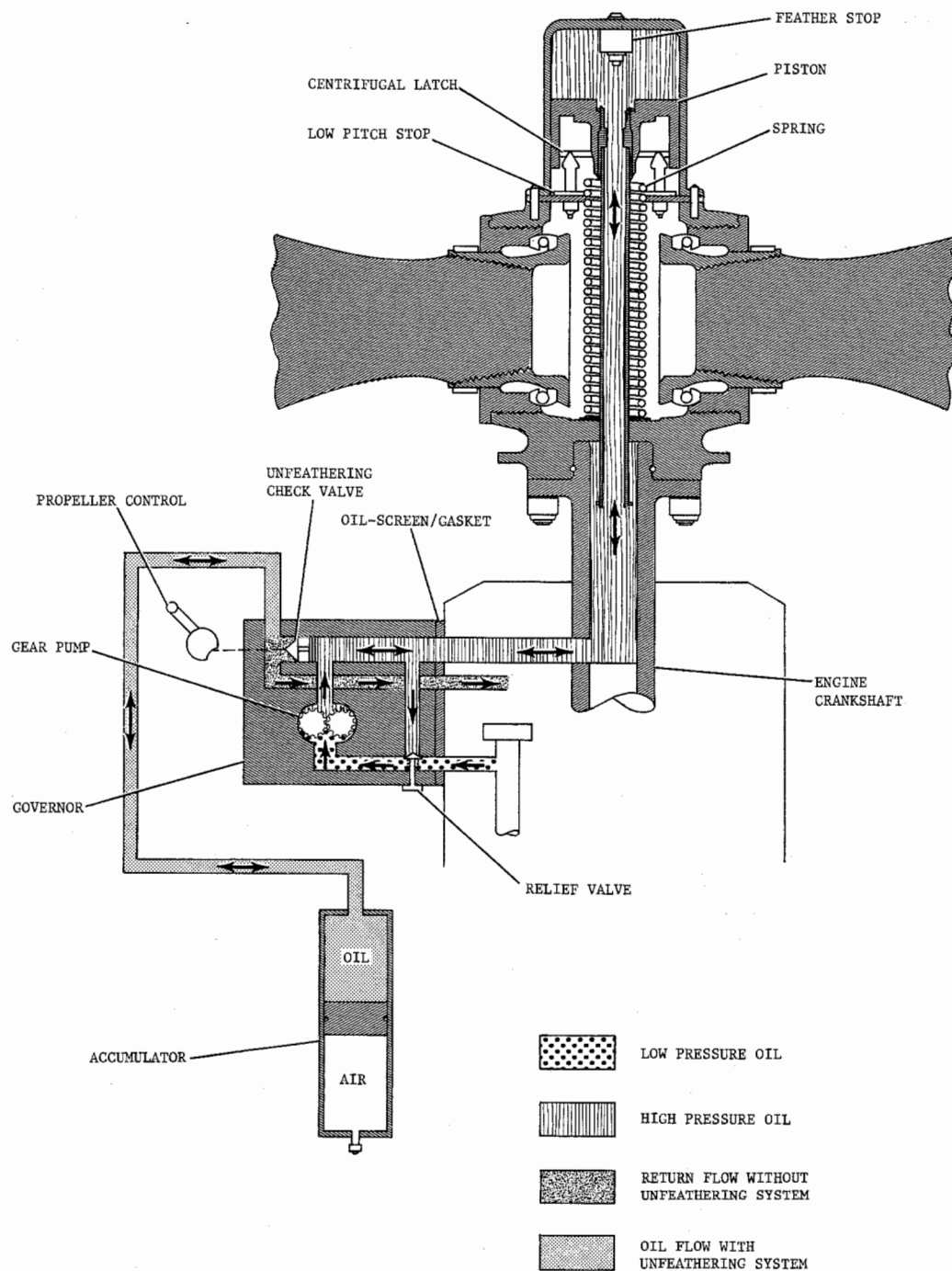
NOTE: Avoid running up engines where loose stones or cinders can be picked up by an inflow of air and damage the propeller blades.

- (2) Maximum rpm check. If local wind and ambient temperature conditions allow ground attainment of maximum rpm, verify and/or adjust control system as follows:
 - (a) Check maximum rpm $2700 + 25$.
 - (b) Check top end of control lever for a minimum of 0.20 inches cushion. If necessary, adjust control lever to obtain proper cushion.
 - (c) Check override of control cable travel limits. Control cable should not reach internal stops before contact is established at governor or control quadrant stops.
 - (d) If local wind and ambient temperature conditions do not allow ground attainment of maximum rpm, the aircraft may be flown for flight testing only, providing the engine speed is not lower than 50 rpm from maximum rpm, and the difference between both engines does not exceed 25 rpm. For Adjustment of Governor, refer to Section 8-10, Adjustment/Test.

CAUTION: IF ADJUSTMENTS PERFORMED ON THE MAXIMUM RPM SETTING SCREW ON THE GOVERNOR FAIL TO PROVIDE INCREMENTS OF GROUND MAXIMUM STATIC RPM'S (AS AN INDICATION OF INABILITY TO ATTAIN MAXIMUM GOVERNING SPEEDS), THE GOVERNOR SETTING SCREW MUST BE RETURNED TO THE ORIGINAL ADJUSTMENT. THIS IS REQUIRED TO PREVENT THE POSSIBILITY OF AN OVERSPEED CONDITION DURING FLIGHT.

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10983003

Propeller System Schematic
Figure 2

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- (3) Minimum control check.
 - (a) With manifold pressure maintained at 24" Hg., gradually retard the propeller control levers and verify that with levers firmly against the feather gate stops, the indicated engine speed drop is within the 1800-2000 rpm range. If required, adjust control system as required.
 - (b) Gradually advance the propeller control levers and verify that identical engine speeds are available within a half knob differential between control levers.
- (4) Check control lever cushion as follows:
 - (a) With engine control quadrant friction lock completely relaxed, verify that a minimum top end cushion of 0.20 inches is maintained. Any control cable system adjustments performed to correct inadequate cushion conditions, requires a new verification of maximum rpm Step (2) and minimum rpm Step (3).
- (5) Check operation of feathering as follows:
 - (a) With propeller control full forward and mixture control in full rich position, reduce throttle to attain 1000-1050 rpm.

CAUTION: DO NOT FEATHER FROM A HIGH RPM
AS THIS WILL CAUSE EXCESSIVE
MANIFOLD PRESSURE AND POSSIBLE
DAMAGE TO THE ENGINE.

- (b) After engine speed stabilizes between 1000-1050 rpm, place the propeller control lever behind the feather gate stop on the control pedestal. This motion must be carried at a rapid rate and feathering periods must be timed from the instant the propeller control lever reaches the feather cushion position.
- (c) Immediately retard the mixture control lever to the idle cut-off position.
- (d) Feathering periods terminate when the propeller blades cease to rotate about their axis, and must not exceed 9.0 seconds.
- (e) On aircraft incorporating an unfeathering system, move the propeller control lever to the feather gate stop position; propeller should return to the low pitch position.

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Maintenance Practices

1. Tools and Equipment

NAME	NUMBER	MANUFACTURER	USE
Propeller Wrench	50900069	Cessna Aircraft Company Wichita, Kansas	Checking torque of propeller nuts.

2. Removal/Installation of Propeller (See Figure 3).

A. Remove Propeller.

NOTE: The removal procedure is the same for either propeller. Before removing the propeller it should be placed in the FEATHERED position. This will allow the oil in the blade actuating cylinder to drain back into the engine and will protect the blade actuating cylinder wall from damage during the removal procedure.

- (1) Feather the propeller. Refer to Adjustment/Test, Operational Check of Propellers.
- (2) If optional propeller unfeathering system is installed, it is necessary to relieve pressure in the propeller system with the propeller blades remaining in the feathered position. To accomplish this, proceed as follows:
 - (a) After the propeller has been feathered and the engine shutdown, move propeller control out of the FEATHER position until blades start to unfeather, then quickly pull the control back into FEATHER.
 - (b) Continue to "milk" pressure out of the system with the propeller control until the propeller blades will no longer move. This may require from 15 to 20 movements of the propeller control.

NOTE: Do not allow propeller blades to rotate far enough to let high pitch latches engage, or engine will have to be restarted, propeller feathered again, and the procedure repeated.

- (3) Remove cowling nose cap. Refer to Chapter 7.

NOTE: It is permissible to remove and install propeller without removing propeller spinner, if desired.

- (4) Remove screws attaching spinner (1) to spinner bulkhead (8). Retain all spacers (3) from behind support (2).

NOTE: If the aircraft is equipped with a propeller deice system, remove the deice wires from terminals and retainer from bulkhead.

- (5) Remove six attaching nuts securing the propeller hub (4) to engine crankshaft (6).

CAUTION: SUPPORT THE PROPELLER BEFORE REMOVING THE LAST NUT, TO PREVENT THE POSSIBILITY OF DROPPING PROPELLER.

- (6) Remove propeller from engine crankshaft.
(7) Remove spinner bulkhead (8) and adapter (7) (or slip ring if propeller deice is installed) from propeller hub.

B. Install Propeller.

- (1) Position spinner bulkhead over propeller hub, attach studs.
(2) Wipe all dust and foreign particles from the propeller hub flange, the propeller hub oil passage, the crankshaft flange and the crankshaft oil passage with a clean cloth.
(3) Install or check packing in the propeller hub and lubricate lightly with engine oil.
(4) Position propeller and spinner bulkhead on the crankshaft.

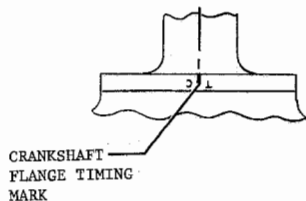
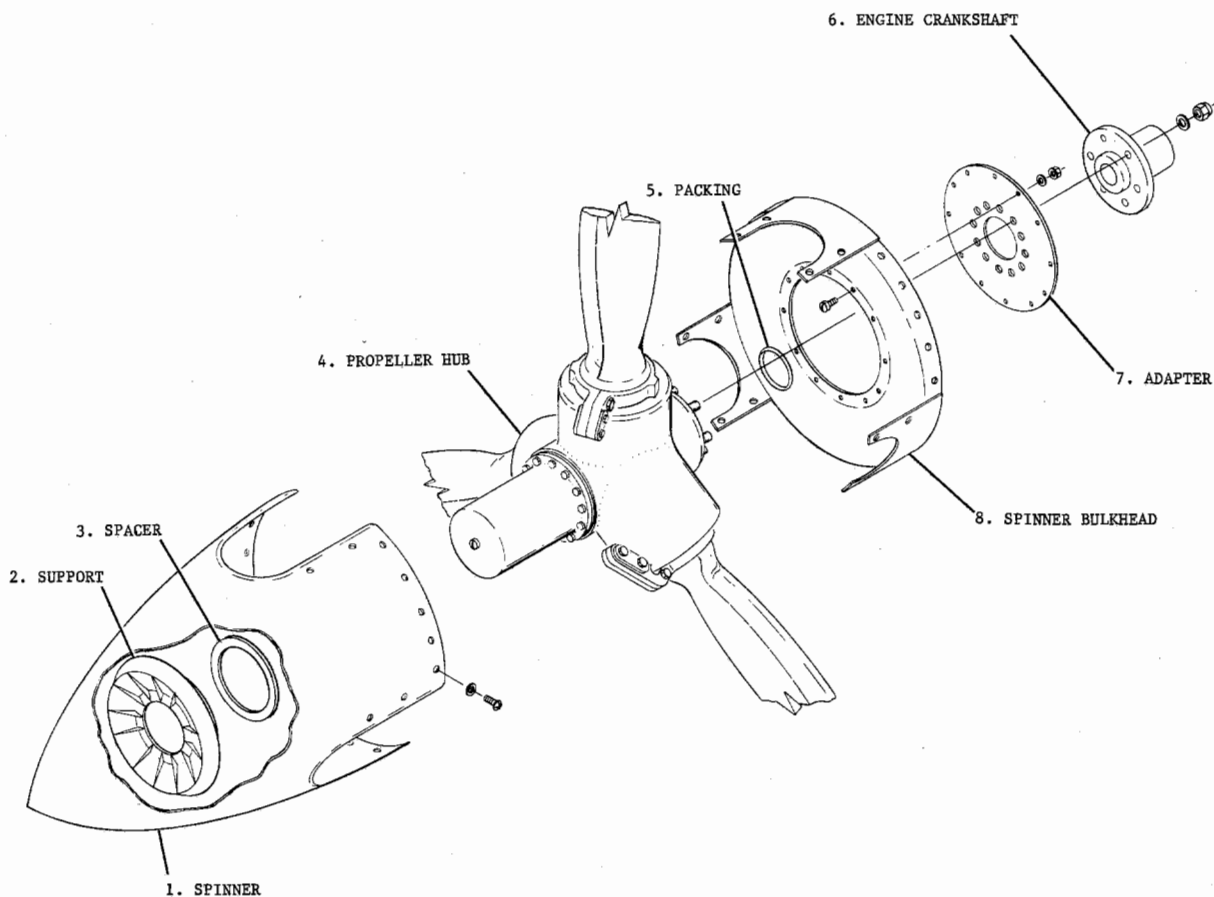
NOTE: Install propeller such that one blade is positioned over and aligned with T/C mark, located on flange of the engine crankshaft.

- (5) Secure propeller to crankshaft with six nuts.

WARNING: DO NOT USE ALL STEEL LOCKNUTS. USE ONLY NEW ELASTIC ELEMENT LOCKNUTS WHEN INSTALLING PROPELLER.

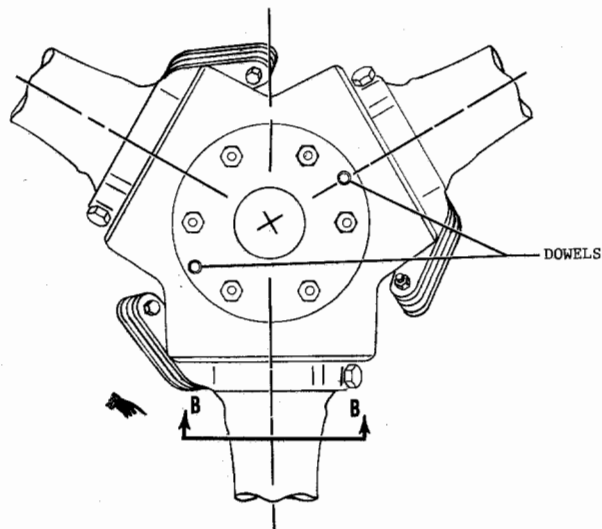
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VIEW B-B

NOTE: INSTALL PROPELLER SUCH THAT ONE BLADE IS POSITIONED OVER AND ALIGNED WITH T/C MARK, LOCATED ON FLANGE OF THE ENGINE CRANKSHAFT.



VIEW A-A
LOOKING FORWARD

10503004
10501002

Propeller Installation
Figure 3

- (6) Torque nuts 80 to 85 foot-pounds.

NOTE: Torque wrench reading will be 48 foot-pounds when using a 12 inch torque wrench with a 5090006-9 adapter or 56 foot pounds when using an 18 inch torque wrench. Refer to Cessna Service Letter ME68-9.

NOTE: If the propeller is equipped with a deice system, connect the wires by connecting to terminal strip.

- (7) Install spinner as follows:
- (a) Install spacer (3) and support (2).
 - (b) Lightly press spinner (1) to hold snug against support and check alignment of spinner holes with bulkhead (8).
 - (c) Alignment lack of 3/64 is approximate fit: add or remove shims to produce this condition.
 - (d) Pushing hard on the shell, install attaching screws and washers. Remove shims, if necessary, until just possible to install screws.
- (8) Replace cowlings nose cap and check propeller for operation in accordance with the Operational Check procedure.
- (9) If optional propeller unfeathering system is installed, charge accumulator. Refer to Chapter 2.

Cleaning/Painting

1. Cleaning Propellers

- A. Clean all metal parts in a mixture consisting of 1/3 lubricating oil, Specification MIL-L-6082, Grade 1030, and 2/3 solvent, Federal Specification P-S-661. Clean small, highly finished parts separately, exercising care not to cause damage, particularly to working surfaces.

NOTE: Inside diameter of counterweight halves and ferrule groove in which they mount, must be free of all oil. Use solvent only - not the mixture - to clean these surfaces. Should cleaning mixture or other lubricant accidentally come into contact with these surfaces, clean thoroughly prior to reassembly.

- B. Clean non-metallic parts (except gaskets, packings and seals) by wiping with a soft, lint-free cloth dampened with cleaning mixture.

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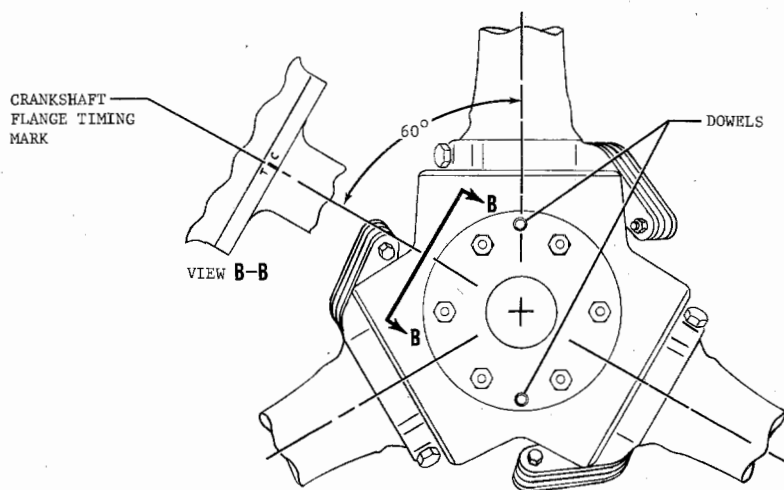
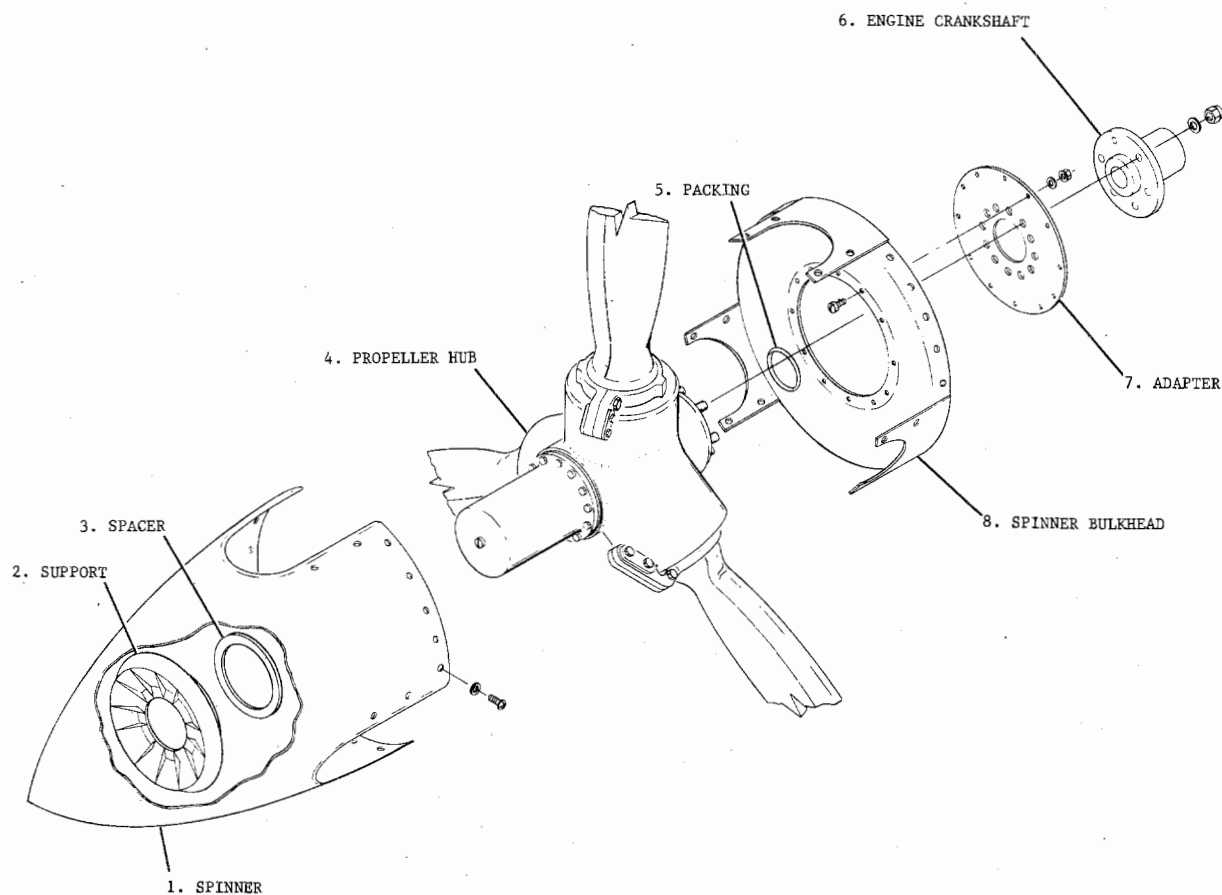
- C. Heavy and tightly adhering deposits may be removed with a soft brush.

CAUTION: UNDER NO CIRCUMSTANCES ARE ANY PARTS TO BE CLEANED WITH A STEEL, OTHER METAL, OR HARD BRISTLE BRUSH, OR TOOL OF ANY TYPE.

- D. After cleaning, allow parts to air dry, or remove excess mixture with a gentle stream of clean, dry compressed air. Keep nozzle well away from parts.
- E. Protect parts from collecting dust and dirt during storage and handling for overhaul. It is recommended that small parts be kept in transparent plastic bags.
- F. Parts which are to be coated with dry film lubricant are to be cleaned with ethyl acetate immediately prior to application of lubricant (refer to McCauley Industrial Corporation's Service Manual).

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NOTE: (STANDARD 310) INSTALL PROPELLER SUCH THAT DOWEL ON BLADE CENTERLINE IS CLOSEST TO CRANKSHAFT FLANGE TIMING MARK. (NOTE THAT SECOND DOWEL FALLS BETWEEN BLADE CENTERLINES).

VIEW A-A
LOOKING FORWARD
(STANDARD 310)

Propeller Installation
Figure 5

10503004
10501002

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MAINTENANCE MANUAL

- (4) Position propeller and spinner bulkhead on the crankshaft.

NOTE: Standard 310, install propeller such that dowel on blade centerline is closest to crankshaft flange timing mark. (Note that second dowel falls between blade centerlines.)

- (5) Secure propeller to crankshaft with six nuts.

WARNING: DO NOT USE ALL STEEL LOCKNUTS. USE ONLY NEW ELASTIC ELEMENT LOCKNUTS WHEN INSTALLING PROPELLER.

- (6) Torque nuts 80 to 85 foot-pounds.

NOTE: Torque wrench reading will be 48 foot-pounds when using a 12 inch torque wrench with a 50900069 adapter or 56 foot pounds when using an 18 inch torque wrench. Refer to ME689.

NOTE: If the propeller is equipped with a deice system, connect the wires by connecting to terminal strip.

- (7) Install spinner as follows:
- (a) Install spacer (3) and support (2).
 - (b) Lightly press spinner (1) to hold snug against support and check alignment of spinner holes with bulkhead (8).
 - (c) Alignment lack of 3/64 is approximate fit: add or remove shims to produce this condition.
 - (d) Pushing hard on the shell, install attaching screws and washers. Remove shims, if necessary, until just possible to install screws.
- (8) Replace cowl nose cap and check propeller for operation in accordance with the Operational Check procedure.
- (9) If optional propeller unfeathering system is installed, charge accumulator. Refer to Chapter 2.

Cleaning/Painting

1. Cleaning Propellers

- A. Clean all metal parts in a mixture consisting of 1/3 lubricating oil, Specification MIL-L-6082, Grade 1030, and 2/3 solvent, Federal Specification P-S-661. Clean

small, highly finished parts separately, exercising care not to cause damage, particularly to working surfaces.

NOTE: Inside diameter of counterweight halves and ferrule groove in which they mount, must be free of all oil. Use solvent only - not the mixture - to clean these surfaces. Should cleaning mixture or other lubricant accidentally come into contact with these surfaces, clean thoroughly prior to reassembly.

- B. Clean non-metallic parts (except gaskets, packings and seals) by wiping with a soft, lint-free cloth dampened with cleaning mixture.
- C. Heavy and tightly adhering deposits may be removed with a soft brush.

CAUTION: UNDER NO CIRCUMSTANCES ARE ANY PARTS TO BE CLEANED WITH A STEEL, OTHER METAL, OR HARD BRISTLE BRUSH, OR TOOL OF ANY TYPE.

- D. After cleaning, allow parts to air dry, or remove excess mixture with a gentle stream of clean, dry compressed air. Keep nozzle well away from parts.
- E. Protect parts from collecting dust and dirt during storage and handling for overhaul. It is recommended that small parts be kept in transparent plastic bags.
- F. Parts which are to be coated with dry film lubricant are to be cleaned with ethyl acetate immediately prior to application of lubricant (refer to McCauley Industrial Corporation's Service Manual).

Approved Repairs

1. Federal Aviation Regulations define major and minor repairs and alterations and who may accomplish them. This Section may be used as a guide, but the Federal Aviation Regulations and the propeller manufacturer's instructions must be observed. Repair of metal propellers first involves evaluating the damage and determining whether the repair will be a major or a minor one and, in accordance with Federal Aviation Regulations, who is permitted to accomplish the repair.

A. General Repair Considerations.

- (1) Under no circumstances are the raised edges of defects to be corrected by peening. No welding, soldering or compounds of any nature are to be used to fill or correct defects. All repair is to be in accordance with standard approved and accepted practice.

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- (2) More than one defect on blade is not cause for considering blade not airworthy if repair is within indicated limits. A reasonable number of repairs per blade is permissible if their location with respect to each other is not such as to form a continuous line that may materially weaken the blade. Any transverse crack shall be cause for considering blade not airworthy.
- (3) Repair necessitating the removal of an appreciable amount of metal shall be reason to check horizontal and vertical balance.
- (4) The repair of defects is permissible providing the treatment does not materially weaken the blade, reduce its weight, or impair its performance.

B. Defects on Thrust Face or Camber Side:

- (1) Repair by removal of metal to form shallow, large radius, round bottomed depressions. Periodic inspection during repair should be made to avoid removal of excessive amounts of metal. All raised edges should be carefully smoothed out to reduce the area of the defect and the amount of metal to be removed. Repair with suitable fine cut files and coarse grain emery cloth and smooth all edges and surfaces with fine grain emery cloth. Any blade repair on these surfaces which necessitates a depression that exceeds the manufacturer's tolerances or those listed in FAA Advisory Circular AC43. 13-1 shall be cause for considering blade not airworthy.

C. Defects on Leading and Trailing Edge.

- (1) Repair defects with suitable half-round file and emery cloth. Carefully smooth all edges of repaired defect. Any blade repair on leading and trailing edges which necessitates metal removal that exceeds the manufacturer's tolerances or those listed in FAA Advisory Circular AC43. 13-1 shall be cause for considering blade not airworthy.
- (2) Blades that have leading or trailing edges pitted from normal wear may be reworked by removing sufficient metal to eliminate the pitting. Start well back from the edge and work over the edge in such a manner that the contour of the blade remains substantially the same. Avoid abrupt section changes and blunt edges. Permissible reductions in blade thickness and width, listed in the manufacturer's publications or FAA Advisory Circular AC43. 13-1, must be observed.

D. Tip Damage.

- (1) Damage on blade tips may be removed as long as metal removal is within the tolerances specified. Damage which cannot be repaired by local removing of metal may be repaired by removing metal so as to shorten blades, although shortening blades is a propeller major repair. Any shortening of one blade requires an identical shortening of the other one, and any change in tip plan form or contour of one blade requires an identical change on the other one. Limitations concerning shortening of blades are specified in the manufacturer's publications or FAA Advisory Circular AC43. 13-1.

E. Refinishing.

- (1) Prior to corrosion protection treatments, all repair areas should be smoothly polished out and blended in to finish repair and improve appearance. Whenever possible, all repaired blades should be anodized in a sulfuric acid anodize bath. The blades must be anodized with loose blade retention hardware on shank end; therefore, the blade must be supported vertically with steel hardware out of the solution and suitably protected to be unaffected by fumes. The same holds true for caustic baths.
- (2) When anodizing is not readily available, local repaired or inspected areas may be treated by other approved methods for corrosion protection; so-called chromodizing, alodine solution, painting, etc. It is doubtful that the finish of these treatments, other than sulfuric acid anodize, will blend in with regard to appearance. If desired, both camber and thrust face sides may be painted with zinc chromate primer and black lacquer to improve appearance. The thrust face side should always be painted.

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PROPELLER GOVERNORDescription

1. A lever head, base-mounted, constant-speed, single-acting governor is installed on each engine to control the propeller pitch. The governors are engine-driven and mounted on the left side of the crankcase just below the forward cylinder. A gear type pump and relief valve is incorporated in each governor to boost engine oil pressure which, regulates aircraft engine speed by varying the pitch of the propeller to match load torque to engine torque in response to changing conditions of flight. Internal flyweights are attached to a pilot valve that directs high pressure oil to the propeller piston or allows oil to drain from the piston.

Troubleshooting

1. Troubleshooting Propeller Governor.
 - A. Refer to Adjustment of Governor for Troubleshooting the Governor.

Adjustment/Test

1. Adjustment/Test Propeller Governor System.
 - A. Rigging Propeller Governor Controls. (See Figure 1)
 - (1) Disconnect the propeller control rod end at the governor arm by removing nut, spacer, washer and bolt.
 - (2) Move propeller control lever from maximum to minimum rpm position (against feather gate stop).
 - (3) Adjust control system cable rod ends, cable housing and support bracket as required to align rod end hole with rigging pin (No. 8 drill shank or equivalent) installed and positioned over the 2000 rpm index mark (3).
 - (4) Remove rigging pin and install bolt, washer, spacer and nut on outboard arm hole. On Turbo 310, install bolt in inboard hole of governor arm.
 - (5) Cycle propeller control lever to insure a minimum top end cushion of 0.20 inch. Make minor adjustments as required to attain minimum cushion at top end and minimum control rpm of 1800 to 2000 rpm at the lower end of lever travel.

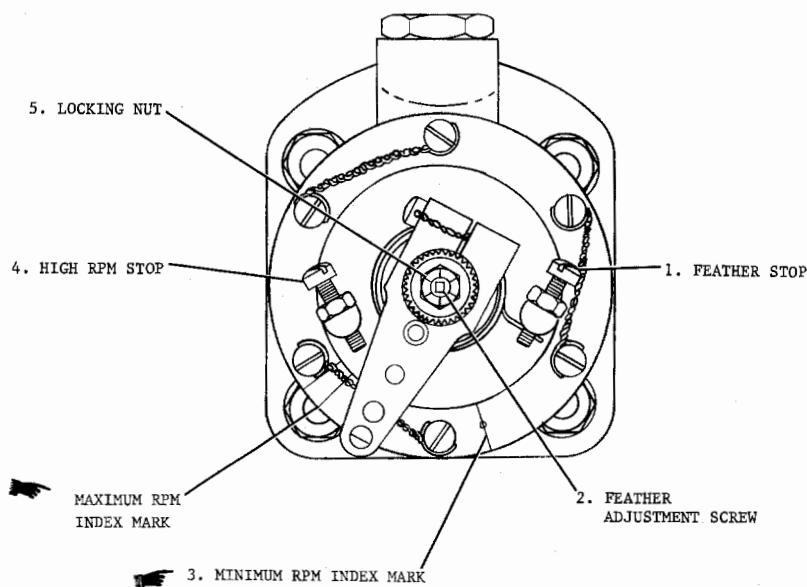
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B. Adjustment of Governor (See Figure 1).

If maximum rpm, low minimum rpm or propeller feathering periods are incorrect, adjust as required.

- (1) If static rpm is too high, reduce by adjusting high RPM stop screw (4). Turn clockwise one revolution for each 25 rpm decrease. This reduction prevents possible overspeeding at takeoff.
- (2) If static rpm is too low, it is possible that either the high RPM stop screw (4) or the propeller low pitch stop is the limiting factor. Move the propeller control lever toward decrease rpm and then to increase rpm position; if the maximum attainable rpm is reached at the same time as the governor stop, the governor is the limiting factor. Correct by adjusting the high RPM stop screw. Turn counterclockwise one revolution for each 25 rpm increase. If the maximum obtainable is reached before governor stop is reached, the propeller low pitch stop may be the limiting factor. This would require an adjustment of the propeller blades to decrease the low pitch angle.



54551001

Propeller Governor Adjustment
Figure 1

- (3) If feathering time period is in excess of 9 seconds, adjust by loosening locking nut (5) and turn feather adjustment screw (2) counterclockwise. Hold screw position while securing locknut.
- (4) If propeller feathers before control lever reaches a point 0.20 inch aft of the feather gate stop position, ascertain that propeller control is properly rigged and that minimum rpm is on the high end of the 1800-2000 rpm range. If control rigging is correct, turn feather adjustment screw (2) clockwise to lower the feather position.
- (5) If propeller fails to unfeather when propeller control lever is advanced forward of the feather gate stop, turn feather adjustment screw clockwise.
- (6) For minimum rpm adjustments, adjust controls in accordance with rigging procedures.

Maintenance Practices

1. Removal/Installation of Propeller Governor (See Figure 2).

A. Remove Propeller Governor.

NOTE: The removal procedure is the same for either propeller governor.

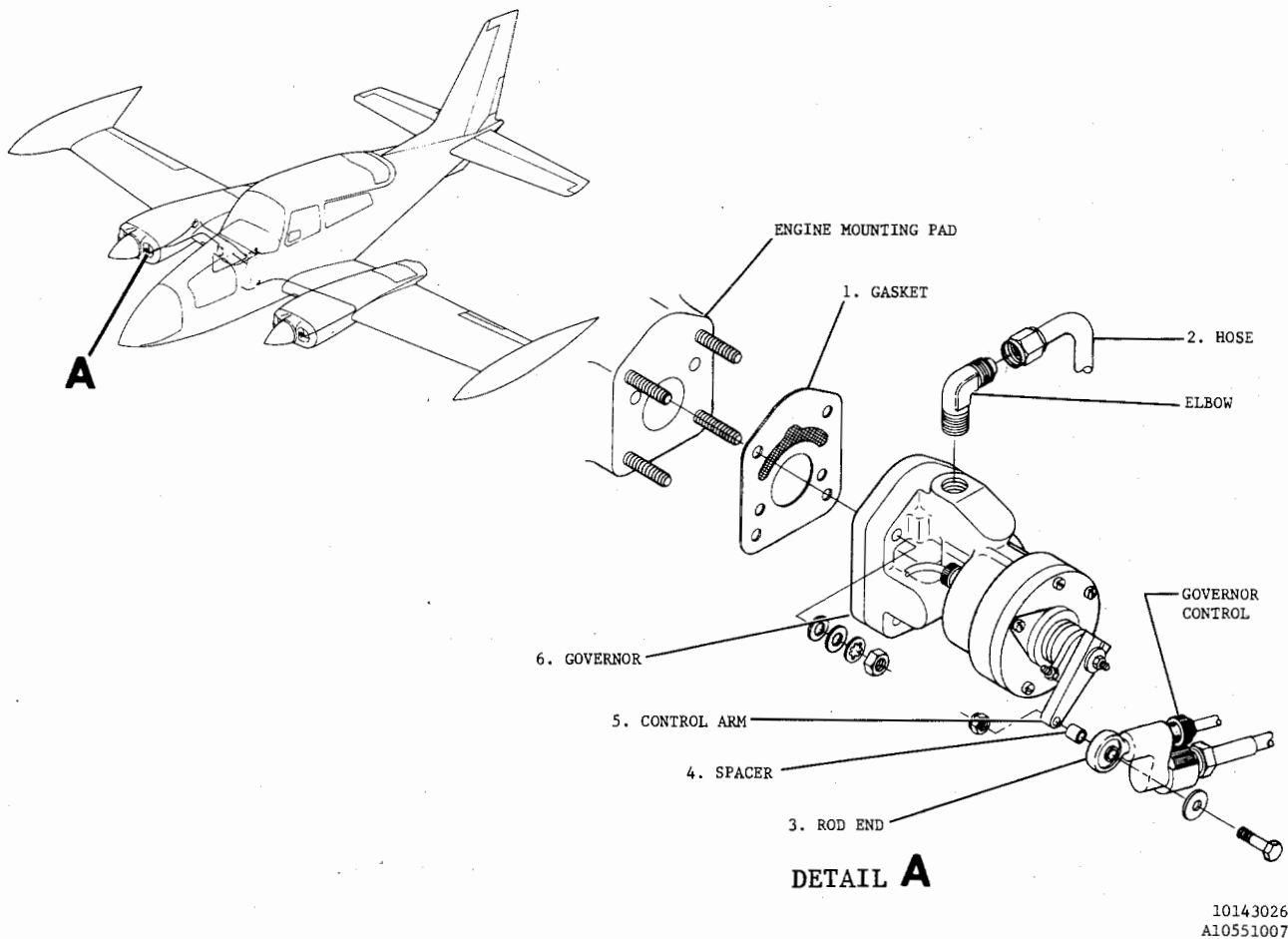
- (1) Refer to Chapter 7; remove engine cowlings and baffles as necessary to gain access to propeller governor.
- (2) Remove rod end (3) from governor control arm (5) by removing attaching nut, spacer (4), washer and bolt.

CAUTION: IF AIRCRAFT IS EQUIPPED WITH OPTIONAL UNFEATHERING SYSTEM, RELEASE ACCUMULATOR PRESSURE PRIOR TO DISCONNECTING HOSE (2).

- (3) Remove governor (6) and mounting gasket (1) by removing the four nuts, internal tooth lockwashers, and plain washers.

B. Install Propeller Governor.

- (1) Place mounting gasket (1) over the governor mount studs with the raised surface of gasket screen facing away from the engine.
- (2) Align the splines on the governor shaft with the engine drive, and slide the governor into position.
- (3) Secure the governor in place with the four plain washers, lockwashers and nuts on the governor mount studs. Tighten nuts to 160 inch-pounds.



Propeller Governor Installation
Figure 2

- (4) Rig propeller governor controls in accordance with rigging procedures.
- (5) Refer to Chapter 7; install engine baffles and cowling in accordance with installation procedures.
- (6) Perform an operational check of propellers.
- (7) If optional propeller unfeathering system is installed, service accumulator. Refer to Propeller Unfeathering System Maintenance Practices.

PROPELLER UNFEATHERING SYSTEMDescription

1. Each optional unfeathering system consists of a dry air or nitrogen-charged accumulator, a special governor, and a hose running between the governor and the accumulator. The governor contains a spring-loaded check valve which is unseated while the propeller control is in any position except FEATHER, thus permitting governor-pressurized oil to flow to and from the accumulator. When the propeller control is moved to the FEATHER position, the check valve is seated and oil under governor-pressure is trapped in the accumulator and hose. As the propeller control is moved out of the FEATHER position, the trapped oil flows back through the governor to the propeller to unfeather it.

CAUTION: ALWAYS LEAVE PROPELLER CONTROL IN THE UNFEATHERED POSITION WHEN THE AIRCRAFT IS ON THE GROUND. THIS PROCEDURE PREVENTS THE POSSIBILITY OF HEAT CAUSING TRAPPED OIL TO EXPAND TO PRESSURES WHICH COULD DAMAGE THE ACCUMULATOR.

Troubleshooting

1. Troubleshooting Propeller Unfeathering System
 - A. For a guide to troubleshooting the propeller unfeathering system, see Figure 1.

Maintenance Practices

1. Removal/Installation of Propeller Accumulator System (See Figure 2).
 - A. Remove Accumulator System.

CAUTION: RELEASE SYSTEM PRESSURE BY PLACING PROPELLER CONTROL IN UNFEATHER POSITION AND RELEASE ACCUMULATOR PRESSURE THROUGH THE FILLER VALVE.

- (1) Disconnect hose (1) from governor (4) and accumulator (2). Remove clamp (3).
- (2) Remove accumulator and heatshield by removing bolts attaching accumulator to engine beam.
- (3) Remove governor. Refer to governor removal procedures.

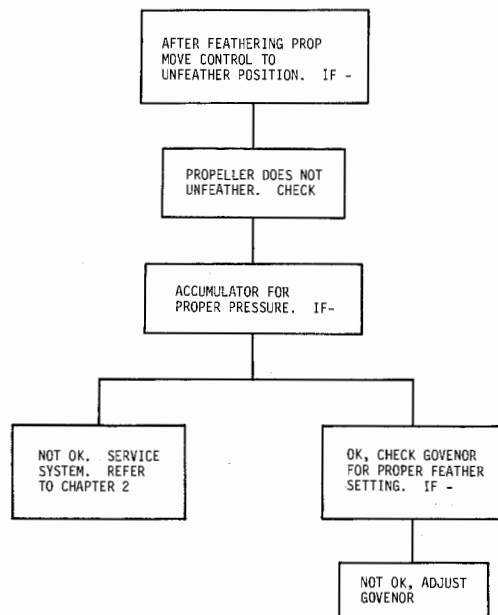
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NOTE: The unfeathering accumulator must be overhauled by an approved propeller governor repair station.

B. Install accumulator system.

- (1) Install governor. Refer to governor installation procedures.
- (2) Secure accumulator (2) to engine beam with bolts.
- (3) Install hose (1) and secure in place with clamp (3).
- (4) Clock heatshield on accumulator and secure with clamps.
- (5) Service accumulator:
 - (a) Place propeller control in the unfeathered position before charging the accumulator to prevent the possibility of oil under pressure being trapped in the accumulator.
 - (b) Although the accumulator will function properly when charged with air, dry nitrogen gas is recommended to minimize corrosion.
 - (c) Either too much pressure or not enough pressure in the accumulator will reduce efficiency of the unfeathering system. With a normal amount of friction within the propeller a range of 125 - 130 psi is acceptable.

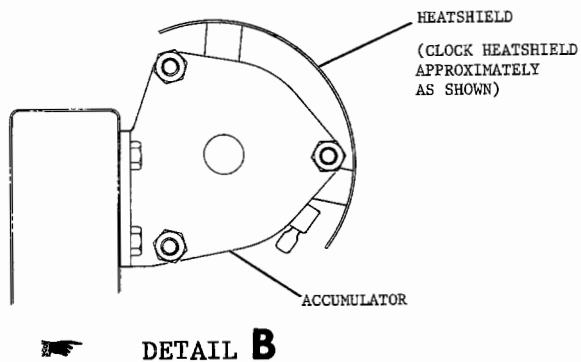
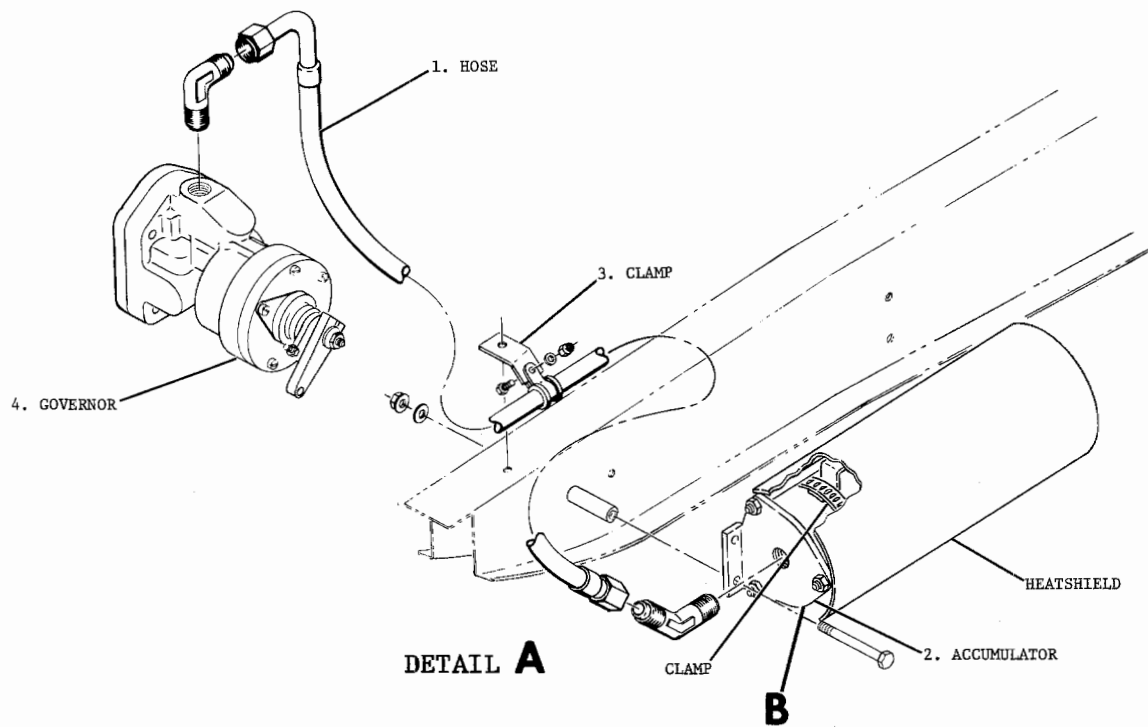
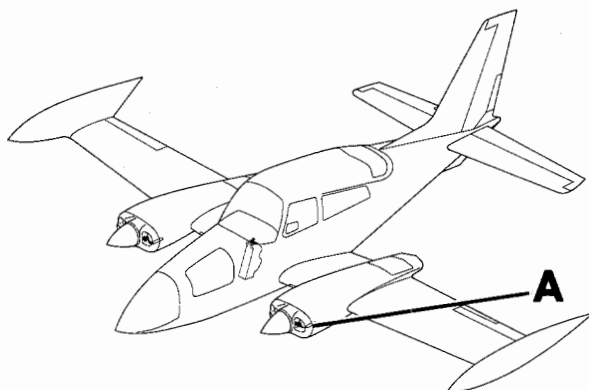


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Troubleshooting Chart - Propeller Unfeathering
Figure 1

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Propeller Accumulator System Installation
Figure 2

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PROPELLER DEICE SYSTEMDescription

1. The propeller deice system is the electrothermal type. It consists of the following components added to the propeller installation: propeller blade deice boots bonded to the propeller blades, slip ring assembly mounted to engine spinner bulkhead, brush holder assembly mounted to the engine crankcase, a repeat cycle timer, ammeter mounted in the instrument panel, a switch and circuit breaker. The propeller blade deice boots are designed to remove ice under all probable icing conditions. Deicing is accomplished by raising the temperature of the ice and deice boot interface to a point at which centrifugal force removes the ice. The cycle timer used on the deicing system heats the propeller deice boots from 28 to 40 seconds. For example: if the timer should start on cycle number 1, the deicing system heats the outer element on the right propeller from 28 to 40 seconds (the timer pauses one second between cycles), then proceeds into cycle number 2, which heats the inner element on the right propeller from 28 to 40 seconds. It then cycles to the outer element on the left propeller from 28 to 40 seconds and to the inner element for 28 to 40 seconds to complete cycles numbers 3 and 4. The cycling is done in order to maintain a balance between the left and right propellers and reduce power drain on the electrical system.

Troubleshooting

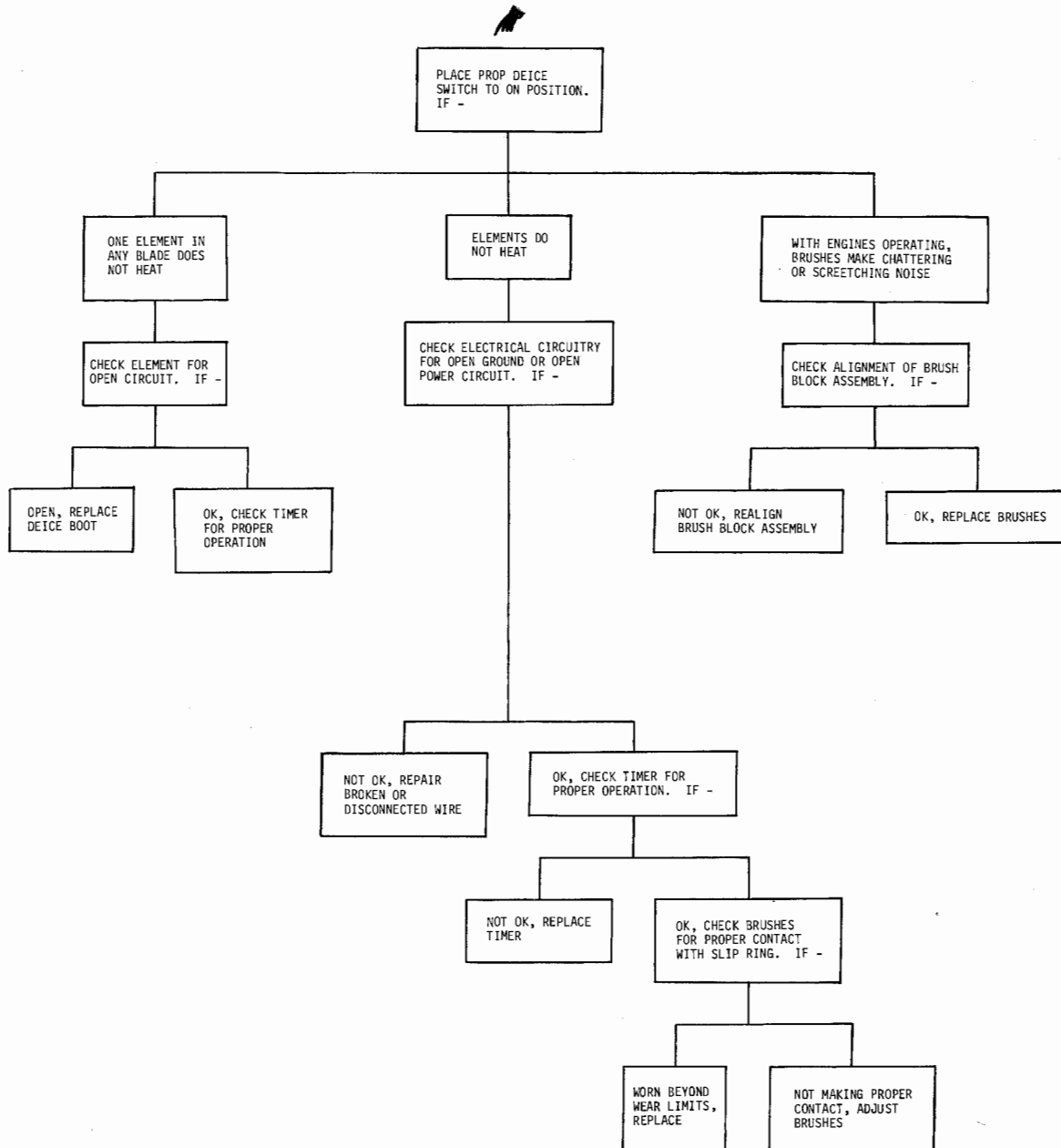
1. Troubleshooting Propeller Deice System.
 - A. For a guide to troubleshooting the propeller deice system, see Figure 1.
 - B. Refer to Chapter 13 for conducting electrical continuity checks.

Maintenance Practices

1. Tools and Equipment.

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Troubleshooting Chart - Propeller Deice System
Figure 1

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NAME	NUMBER	MANUFACTURER	USE
Safetywire	.020	Commercially available	Safetying screws
Methyl-Ethyl-Ketone (MEK)	TT-M-261	Commercially available	Installing deice boots.
Toluol	TT-T-548	Commercially available	Soften cement
Cement	EC1300LP	Minnesota Mining and Mfg.Co., St.Paul, Minn	Installing boots
Coating	EC539P	Minnesota Mining and Mfg.Co., St.Paul, Minn	Dress edge of boots.
Roller, Hand	One-fourth inch wide, metal, stitcher roller.		Installing boots
MULTIMETER	Simpson Model 260	Commercially available	Check continuity and voltage of electrical circuits.

2. Removal/Installation of Slip Ring (See Figure 2).

A. Remove Slip Ring.

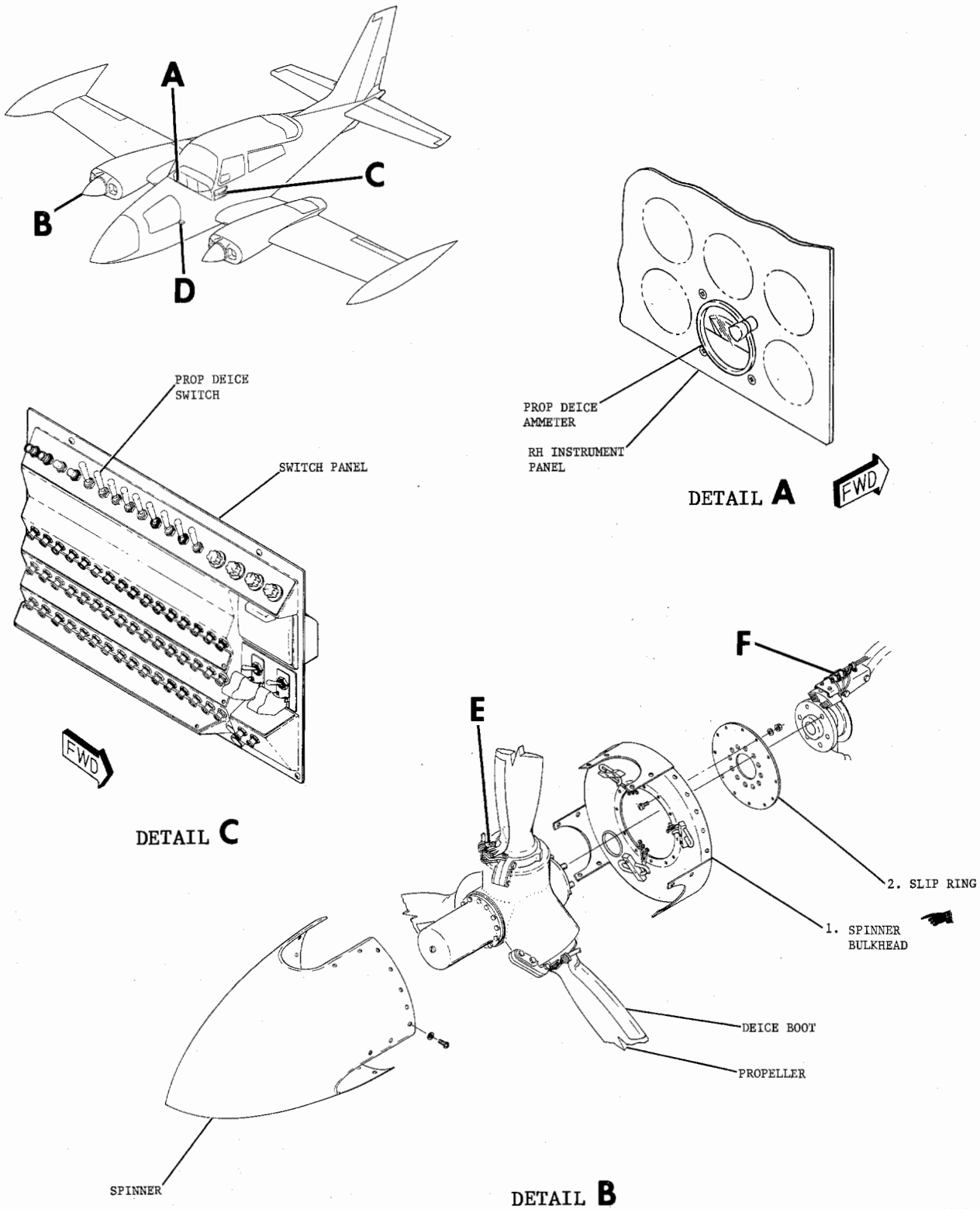
- (1) Remove propeller, spinner bulkhead and slip ring from engine crankshaft. Refer to Removal of Propeller.
- (2) Remove deice wires from terminals of slip ring (2). Remove electrical cable (10) from retainer (9).
- (3) Remove slip ring (2) from spinner bulkhead (1) by removing attaching screws and washers.

B. Install Slip Ring.

- (1) Position slip ring (2) to spinner bulkhead (1) so that slip ring terminals align with retainers (9). Secure in place with twelve screws and washers. Safety wire screws.
- (2) Place bulkhead assembly on propeller hub studs. Install propeller. Refer to installation of Propeller.

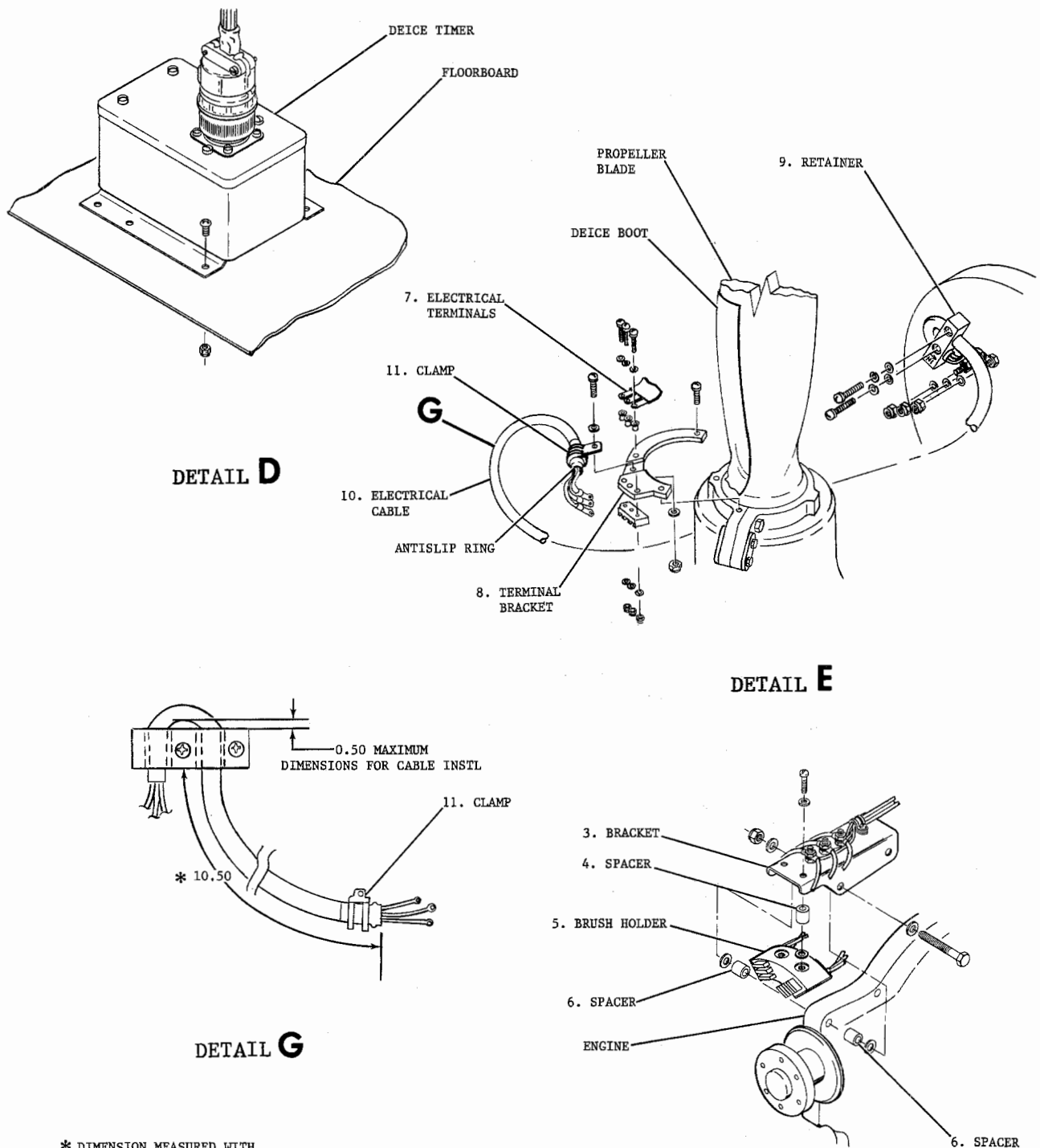
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Propeller Deice System Installation
Figure 2 (Sheet 1 of 2)



* DIMENSION MEASURED WITH
CABLE IN STRAIGHT LINE.

Propeller Deice System Installation
Figure 2 (Sheet 2)

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G14581002

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- (3) Connect terminals of electrical cable. Secure cable (10) to spinner bulkhead (1) with retainer (9).

NOTE: Make certain that cable has sufficient length between bulkhead retainer and propeller terminal bracket so that there is no tension on the cable when propeller is in feathered position.

CAUTION: MAKE CERTAIN CLAMP (11) IS SEATED BEHIND THE ANTISLIP RING OF CABLE (10) TO PREVENT CABLE DAMAGE BY CENTRIFUGAL FORCE.

3. Removal/Installation of Brush Holder and Mounting Bracket (See Figure 2).

A. Remove brush holder and mounting bracket.

- (1) Disconnect electrical terminals from brush holder (5).
- (2) Remove brush holder (5) from bracket (3) by removing nuts, spacers (4), washers and screws.
- (3) Remove wire bundle clamp from bracket by removing nut, washers and screw.
- (4) Remove brush holder bracket from engine by removing attaching nuts, spacers (6), washers and bolts.

B. Install brush holder and mounting bracket.

- (1) Install brush holder mounting bracket to engine with bolts, spacers (6), washers and nuts in sequence as shown.
- (2) Attach brush holder (5) to mounting bracket (3) with two washers and screws. Safety wire the screw heads.
- (3) Secure wire bundle to bracket with clamp screw, washer and nut.
- (4) Connect brush wires to terminals.

4. Removal/Installation of Deice Timer (See Figure 2).

A. Remove Deice Timer.

- (1) Locate timer on floorboard at center of aircraft, just aft of forward cabin bulkhead.
- (2) Disconnect electrical connector from timer.
- (3) Remove timer by removing four attaching screws.

B. Install Deice Timer.

- (1) Position deice timer in place and secure with four screws.
- (2) Connect electrical connector and safety wire connector.

5. Removal/Installation of Deice Ammeter (See Figure 2).

- A. Refer to Chapter 10, Typical Instrument Removal and Installation.

6. Removal/Installation of Deice Switch (See Figure 2).

- A. Refer to Chapter 13, Typical Switch Removal/Installation.

7. Removal/Installation of Deice Boot.

- A. Remove Deice Boot.

CAUTION: DO NOT USE SHARP TOOLS OR OBJECTS TO REMOVE BOOT AS DAMAGE TO THE PROPELLER MAY RESULT.

- (1) Remove deice boot from the propeller by softening the bond line of boot with Toluol until loosened.
- (2) Pull deice boot slowly from propeller blade as bond line is loosened.

B. Install Deice Boot.

- (1) Place deice boot on hub end of propeller blade, centered on blade leading edge and lead strap (terminal end) of boot aligned and against attach holes of installed terminal bracket.
- (2) Mark off an area on propeller blade (using masking tape) 1/2 inch from each side and outer end of deice boot.
- (3) Remove boot and clean the masked area of propeller blade using Methyl-Ethyl-Ketone (MEK) cleaning solvent. For final cleaning, wipe the solvent film off quickly with a clean dry cloth before it has time to dry.

CAUTION: METHYL-ETHYL-KETON (MEK) MUST BE USED IN A WELL VENTILATED AREA: AVOID PROLONGED BREATHING OF FUMES. DURING ALL SURFACE CLEANING OPERATIONS TAKE PRECAUTION TO GUARD AGAINST SPARK OR OPEN FLAME IN WORK AREA.

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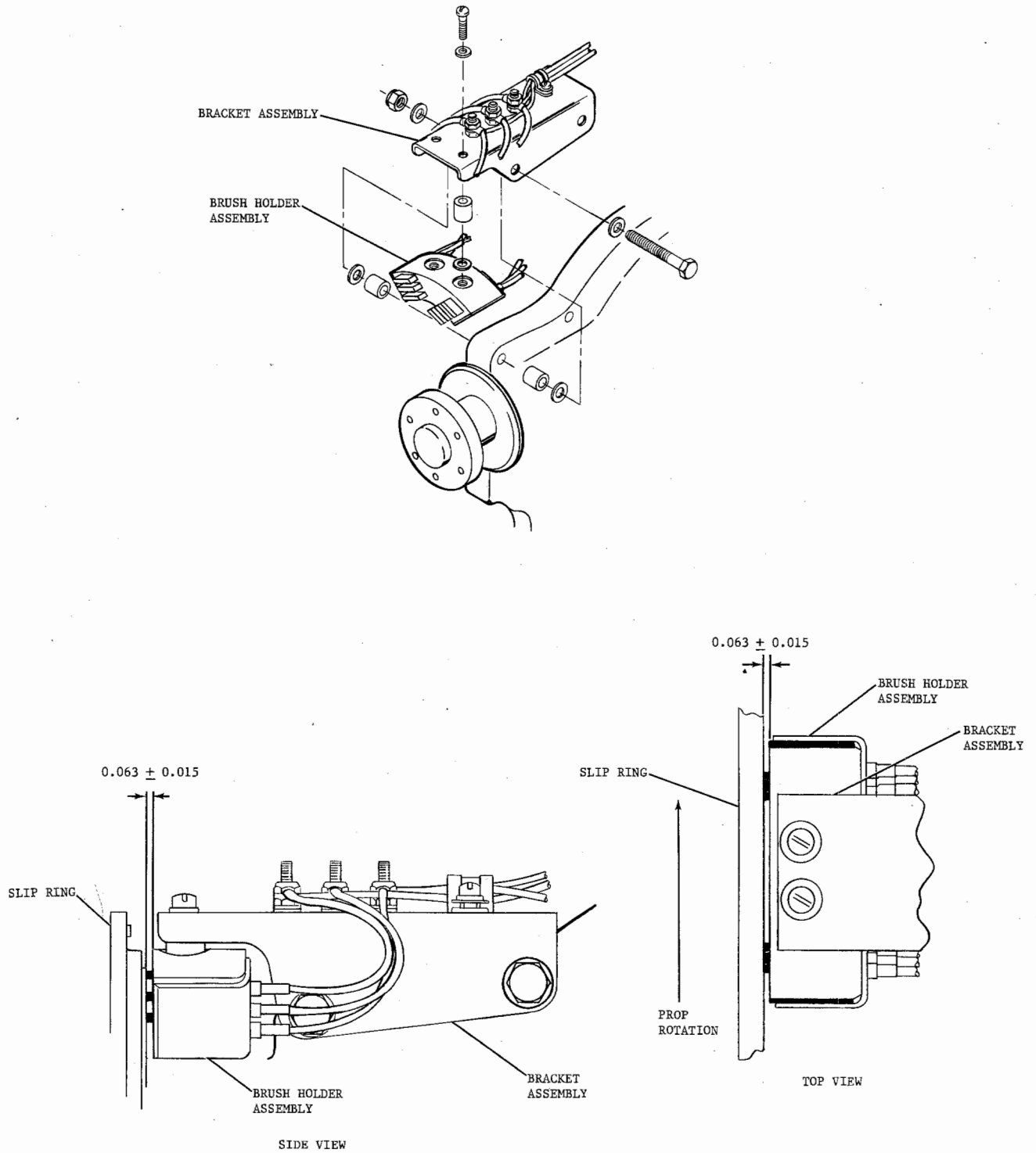
- (4) Mix thoroughly the EC1300LP cement and apply one brush coat evenly to the cleaned metal surface. Allow to air dry for a minimum of one hour and then apply a second coat of EC1300LP cement.
- (5) Moisten a clean cloth with MEK and clean the unglazed back surface of the deice boot, changing cloth frequently to avoid contamination of the area.
- (6) Apply an even brush coat of EC1300LP cement to the unglazed back surface of the deice boot.
- (7) Allow cement to dry; then using a silver (non-graphite, greaseless) pencil, mark a centerline along the leading edge of the propeller blade and a corresponding centerline on the cemented side of the deice boot.
- (8) Reactivate the surfaces of the cement using a clean, lint-free cloth, heavily moistened with Toluol solvent. Avoid excessive rubbing of cement which would remove it from surfaces.
- (9) Position the deice boot centerline on the propeller leading edge, with all marks and terminal leads aligned. Tack the deice boot centerline to the leading edge of the propeller blade.

NOTE: If the deice boot is allowed to get off centerlines, pull up with a quick motion and reposition properly. Roll firmly along centerline with a rubber roller.

- (10) Roll outwardly from the centerline to the edge. If excessive material at the edges tend to form puckers, work them out smoothly and carefully with fingers.
- (11) Roll the tapered edges of the deice boot with a metal hand-stitch roller and ensure there are no bubbles entrapped under the boot and that all edges firmly adhere to the propeller.

NOTE: In the event it becomes necessary to remove or loosen installed deice boots Toluol shall be used to soften the "cement" line. A minimum amount of this solvent should be applied to the cement line as tension is applied to peel back the deice boot. The removal should be slow enough to allow the solvent to undercut the cement so that parts will not be damaged.

- (12) Apply one brush coat of EC539P coating, mixed per manufacturer's instructions, evenly around the edges of the installed deice boot.



Brush Holder Alignment
Figure 3

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- (13) Remove masking tape from the propeller blade and clean the surface of the blade with a clean cloth dampened with Toluol.

Adjustment/Test

1. Adjustment of Brush Holder Assembly (See Figure 3).

- A. When a chattering or screeching noise is emitted from the brush slip ring area, the probable cause is the improper alignment of the brushes and slip ring.

NOTE: If this chattering or screeching is noticed over idling engine noises, the trouble is severe and should be remedied immediately. A less severe chattering or screeching may be detected by pulling each propeller through slowly in the direction of rotation.

- B. The brush holder assembly should be positioned as follows:

- (1) Loosen screws through bracket assembly and brush holder.
- (2) Adjust brush holder assembly by twisting brush holder assembly in brackets so that the brushes are perpendicular to the slip ring surfaces.
- (3) Check each brush for correct alignment with the slip ring surfaces through 360° rotation. Add or remove washers for correct alignment.
- (4) Check for a 0.063 ± 0.015 inch (nominal) clearance between the main body of the brush holder assembly and the slip ring through 360° rotation.
- (5) Check flatness of slip ring as follows:
 - (a) Mount a dial indicator on engine.
 - (b) Rotate slip ring through 360° of rotation.
 - (c) Observe dial indicator for a T.I.R. (Total Indicator Reading) of .012 to .015.
 - (d) If reading is not in tolerance, replace slip ring.

Inspection/Test

1. Inspect and Test Propeller Deice System.

- A. Inspect the completed installation.

- (1) Check propeller deice boots for wrinkling or loose spots.

- (2) Check wiring connections for correctness and tightness.
- (3) Check continuity of wiring. Remove plug from timer. Using ohmmeter, check continuity from:
 - (a) Pin C of the plug to Terminal A of one prop boot on the right engine.
 - (b) Pin D of the plug to Terminal B of one prop boot on the right engine.
 - (c) Pin E of the plug to Terminal A of one prop boot on the left engine.
 - (d) Pin F on the plug to Terminal B of one prop boot on the left engine.
 - (e) Pin G of the plug to ground.
 - (f) Terminal C of one prop boot on the right engine to ground.
 - (g) Terminal C of one prop boot on the left engine to ground.

B. System Tests.

- (1) Propeller Deice Boots Resistance Check:
 - (a) Using an ohmmeter, check the resistance between terminals A-C, B-C of prop boots in both engines. Resistance should be 2.23 to 2.58.
- (2) Timer Tests:
 - (a) 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.
 - (b) Place the prop deice system switch in the "ON" position.
 - (c) Using a voltmeter check the DC volts to ground from Pin B of the timer. This should be approximately 24 volts DC.
 - (d) Check DC volts to ground from Pins C, D, E, F; these are the points at which the system voltage is applied in sequence to cycle power to the propeller deice boots. The following cycling action of the timer should be:
 - 1) Timing sequence Pin C, 30 seconds, right engine propeller outboard halves.
 - 2) Timing sequence Pin D, 30 seconds, right engine propeller inboard halves.
 - 3) Timing sequence Pin E, 30 seconds, left engine propeller outboard halves.
 - 4) Timing sequence Pin F, 30 seconds, left engine propeller inboard halves.

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NOTE: On time is approximately 30 seconds when operating on alternator voltage. When operating on battery voltage as in this checkout procedure, on time may be longer.

NOTE: The timer does not reposition itself to start at Pin C when the system is turned off, but will begin its cycling at the same position in which it was last turned off. Cycling will then proceed in the order of C, D, E, F, as shown.

NOTE: Check Pins C, D, E, F, until a voltage reading of approximately 24 volts DC is obtained. Hold the voltmeter probe on the pin until the voltage drops to 0. Move the probe to the next pin in the sequence C, D, E, F. Check volts DC at each pin in sequence, 24 volts DC should be measured at each pin in the sequence C, D, E, F. When correctness of the cycling sequence is established, turn prop deice system switch off at the beginning of one of the on time periods and record the letter of the pin at which the voltage supply is present.

(3) Propeller Deice Heat Test:

- (a) Remove the jumper wire installed in paragraph B(2)(a) and replace the connector plug in the timer receptacle.
- (b) Referring to the position in which the timer was left in paragraph B(2)(d) have an assistant place the prop deice system switch in the "ON" position. As the switch is turned on, place a hand on each of the two deice areas which should be heated per paragraph B(2)(d).
- (c) The assistant in the cabin should note and record the prop deice system ammeter reading. This should be from 11 to 18 amps. Keep a close watch on the ammeter needle. The ammeter needle will deflect every 30 seconds be-

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cause of the switching action of the timer. Each deflection will indicate a change in the heating areas of the prop deice boots.

NOTE: The observer in the cabin should call out these 30 second interval deflections and the inspector at the propellers should change the position of his hands on the prop deicers accordingly, to check proper heating sequence of the prop deicer areas.

NOTE: If any irregularities are noted, recheck the wiring from the timer to the brush holder assembly and the prop deicer terminal connections. Make corrections as necessary and retest.

C. Slip Ring and Holder Assembly Check.

(1) Check for out of flatness:

- (a) Allowable tolerance is .008. If .008 is exceeded, shim under mounting bolts to bring within tolerance.

NOTE: Ground checkout of the system is allowed, with the engines not running.

Allow a minimum of 5 hours of engine running time to allow the brushes to become seated before turning on the propeller deice system.

PROPELLER SYNCHRONIZER SYSTEMDescription

1. The component parts of the propeller synchronizer system are two electrical pulse pickups, trimmer assembly, actuator motor assembly, switch, interconnecting electrical cable assemblies, and an indicator light. The control box assembly, located on the underside of the glove compartment box, contains an all transistorized circuitry. The actuator motor is a stepping-type that operates on command from the control box and is located in the right engine nacelle. The flexible rotary shaft is connected to the actuator motor and trimmer assembly to trim the right engine speed setting. Magnetic pickups are mounted in each propeller governor to provide engine speed indicators to the control box assembly. The function of the propeller synchronizer system is to automatically match the rpm between the two engines; therefore, the left engine is designated as the "master" engine while the right engine is termed the "slave" engine. The electrical pulse from both magnetic pickups are fed into the control box from the governors. Any difference in these pulse rates will cause the control box assembly to run the actuator motor and through the flexible shaft, trim the "slave" engine governor speed setting to exactly match the "master" engine rpm. Normal governor operations and functions are unchanged but the synchronizer system will continuously monitor engine rpm and reset the "slave" engine governor as required. The limited range feature prevents the "slave" engine losing more than a fixed amount of rpm in case the "master" engine is feathered with the synchronizer on.

Troubleshooting

1. Troubleshooting Propeller Synchronizer System.
 - A. Refer to Woodward Governor Company, Rockford, Illinois, Bulletin 33049E for troubleshooting and remedial correction information.

Inspection/Check

1. Operational Check Propeller Synchronizer System.
 - A. To check the operation of the synchronizer in flight, first synchronize propellers manually and turn the synchronizer switch ON. Then slowly adjust the master engine propeller governor control lever, in small increments, to increase or decrease rpm. The rpm range over

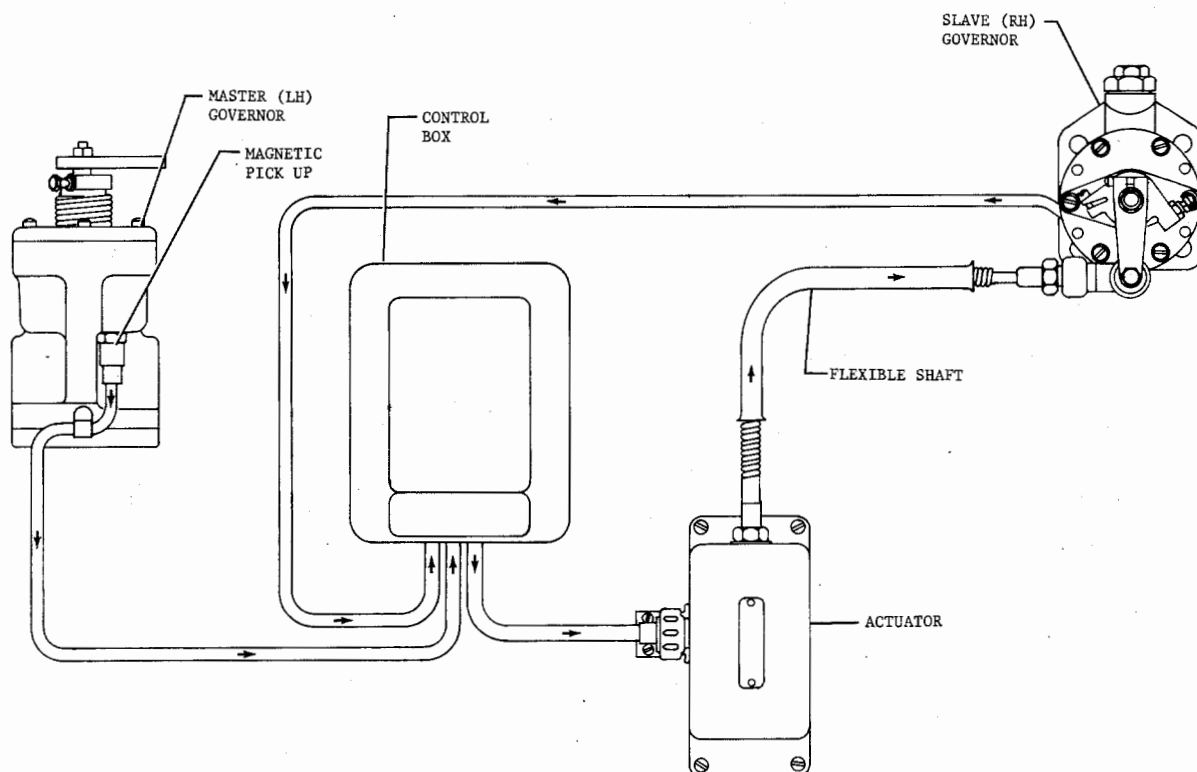
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which the slave engine will remain synchronized with the master engine is the limited range mentioned above. With the synchronizer ON, move the master engine propeller governor control lever to a point which is close to the end of this limited travel. Turn the synchronizer OFF. An unsynchronized condition will develop as the actuator moves to its mid-position. When the synchronizer is turned ON again, synchronization will result. If the units do not become synchronized, the actuator has reached the end of its travel and must be recentered in this manner:

- (1) Turn the switch OFF.
- (2) Synchronize the engines manually.
- (3) Turn the switch ON.

2. To check electrical continuity and voltage check of the synchronizer system, refer to Woodward Governor Company, Rockford Illinois, Bulletin 33049E.



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Propeller Synchronizer Schematic
Figure 1

Adjustment/Test

1. Adjustment/Check Propeller Synchronizer System.

A. Adjust Propeller Synchronizer System (See Figure 2).

- (1) Start rigging procedures by disconnecting flexible shaft (10) from actuator (5).
- (2) Rotate free end of flexible shaft (10) counting total turns available on the "slave" governor trimmer assembly (11).
- (3) Return trimmer assembly to its center range.
- (4) When trimmer assembly is centered, rig governor (4) and control cable (9) in accordance with Rigging Propeller Controls.
- (5) Manually rotate trimmer assembly (11) to either end of its travel.
- (6) Move propeller pitch levers on the pedestal through its entire range, observing the governor speed adjusting lever to be certain it travels to the maximum and minimum rpm limits.
- (7) Manually rotate the trimmer assembly (11) to opposite end of its travel.
- (8) Perform step 6. again.
- (9) Recenter the trimmer assembly.
- (10) Insert a squared shaft into drive of actuator (5) and count total turns available.
- (11) Place actuator in its center range.
- (12) With both actuator and trimmer assembly centered, connect the flexible shaft to actuator motor.
- (13) Check flexible shaft for binding and a clearance of 7.75 inches in the full rpm position.

Maintenance Practices

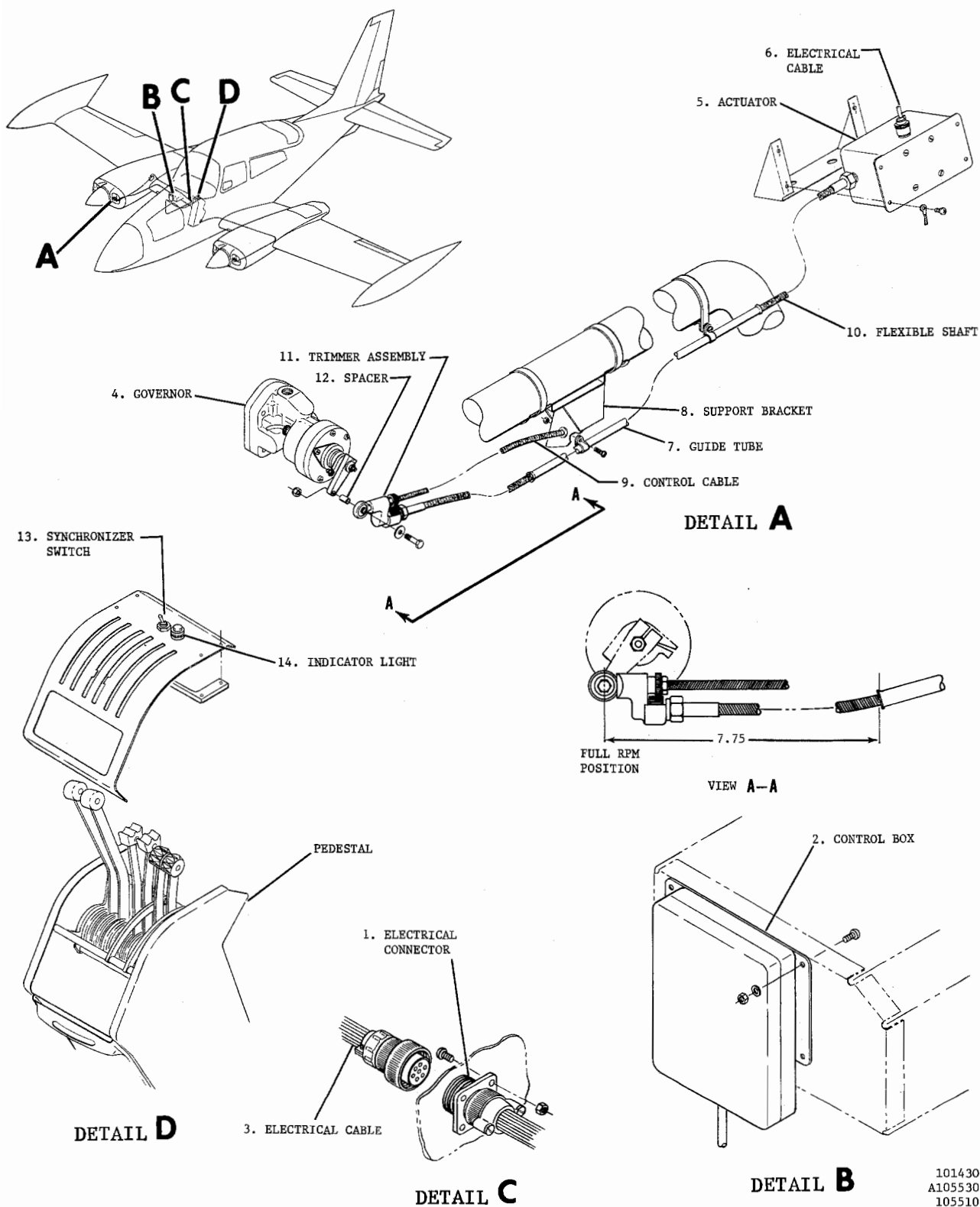
1. Removal/Installation Propeller Synchronizer System (See Figure 2).

A. Remove Synchronizer System.

- (1) Remove flexible shaft (10) as follows:
 - (a) Disconnect flexible shaft from actuator (5) and trimmer assembly (11).
 - (b) Remove the lock ring and hex nut from either end of flexible shaft.
 - (c) Remove flexible shaft from engine nacelle by routing through guide tube.
- (2) Remove trimmer assembly (11) from governor (4) by disconnecting flexible shaft (10), propeller control cable (9) and attaching nut, spacer, washer and bolt.

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Propeller Synchronizer System Installation
Figure 2

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- 14
- (3) Remove actuator (5) by disconnecting flexible shaft (10) and electrical cable (6). Remove four screws attaching motor to brackets.
 - (4) Remove control box (2) as follows:
 - (a) Disconnect electrical cable (3) from synchronizer switch (13) and indicator light (14) and route from stationary instrument panel to control box assembly.
 - (b) Disconnect control box electrical cable at electrical connector (1).
 - (c) Remove four screws attaching control box (2) to glove compartment.
 - (5) Remove switch (13) and indicator light (14) as follows:
 - (a) Remove four screws attaching upper pedestal panel to pedestal.
 - (b) Disconnect electrical wiring.
 - (c) Remove switch and light in accordance with removal procedures outlined in Chapter 13.

NOTE: For removal and installation of magnetic pickup, refer to Woodward Governor Company, Rockford, Illinois, Bulletin 33049E.

B. Install Synchronizer System.

- (1) Secure actuator (5) to brackets with screws.
- (2) Install trimmer assembly (11) to governor (4) with bolt, spacer, washer and nut.
- (3) Route flexible shaft (10) through guide tube (7), install hex nut and secure with lock ring. Attach flex shaft to actuator and trimmer assembly.
- (4) Install control box (2) to glove compartment with four screws.
- (5) Install switch (13) and indicator light (14) to upper pedestal panel.
- (6) Connect electrical cables and wires to light (14) switch (13) control box and actuator.
- (7) Rig synchronizer system. Refer to Adjustment/Test.
- (8) Conduct operational check. Refer to Inspection/Check.

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CHAPTER

9

FUEL SYSTEM

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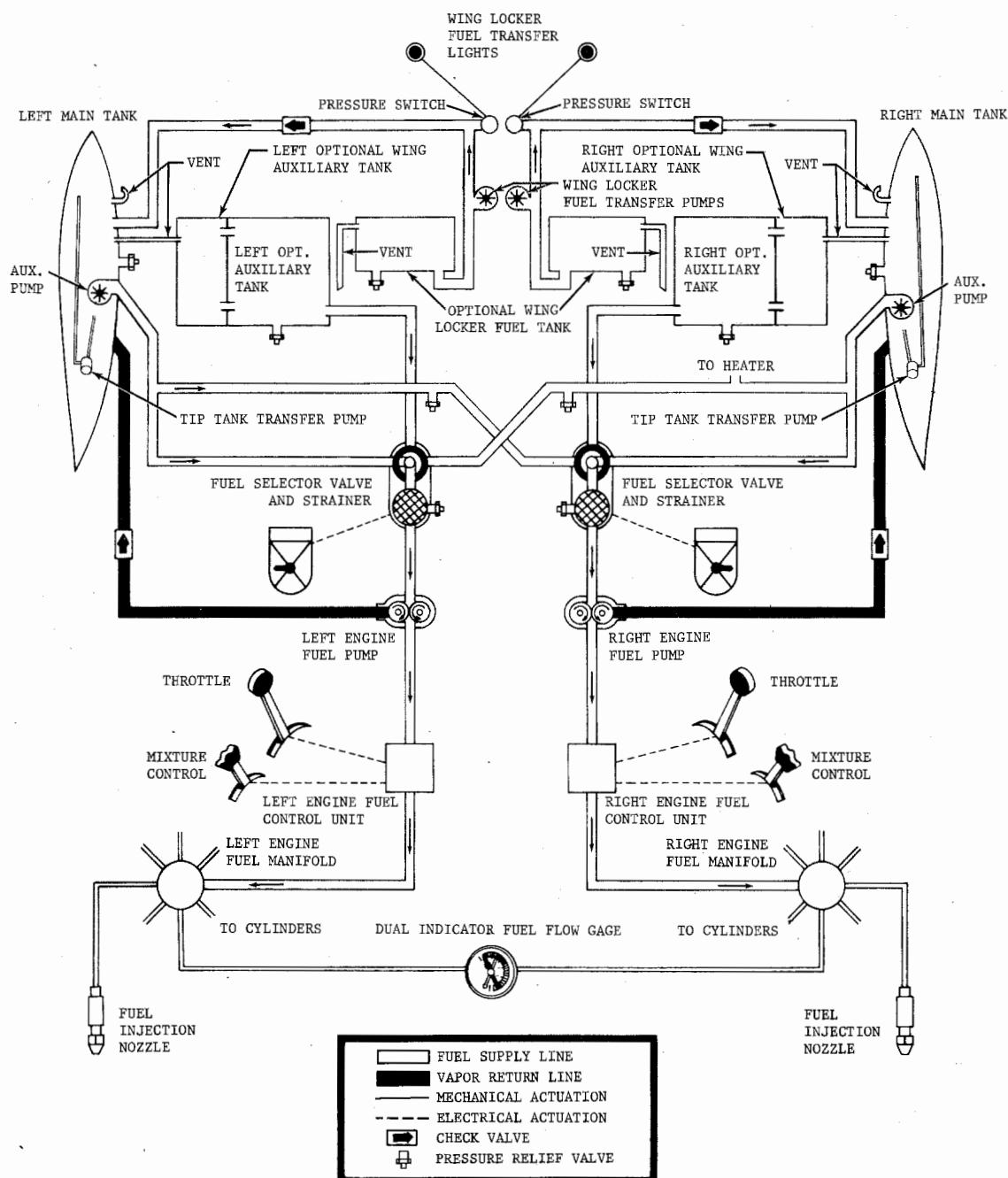
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FUEL SYSTEMDescription

1. The fuel system consists of, the main fuel supply (50 gallons usable each side) housed in wing tip tanks located on each wing tip. Two optional wing auxiliary fuel systems can be installed in addition to the main fuel system, providing either 40 or 63 usable gallons of additional fuel and an optional wing locker fuel system (20 gallons usable each side) may be installed in the forward section of each wing locker. Dual or single wing locker fuel system installations may be made. The entire fuel system has a maximum capacity of 203 gallons usable. The fuel capacities for all the different fuel systems are specified in Chapter 2, Servicing.
2. Fuel may be fed from either main tank to either engine. Right and left auxiliary wing tanks are fed directly to their respective engines. Wing locker fuel is transferred to the main tanks where it is fed to the engines. Fuel transfer switches for wing locker fuel tanks are located on the panel and an indicator light illuminates when the corresponding wing locker fuel has been transferred.
3. Each engine is provided fuel pressure by an engine-driven pump. In addition, each main tank contains an auxiliary fuel pump which automatically takes over should the engine-driven pumps become inoperative while the fuel pump switch is on during landings and takeoffs.
4. Fuel transfer pumps are installed in each main tank. The fuel transfer pump transfers fuel from the forward end of the main tank to the center baffle area. Where the fuel is picked up and routed to the engine by either the engine-driven pump or the auxiliary fuel pump.
5. Fuel selection and fuel flow to the engine-driven fuel pumps is controlled by the fuel select control handles, located in the forward cabin area between the pilot's and copilot's seats. Each control handle operates a fuel selector valve (in each wing) by a flex cable and positions the respective selector valve to the desired fuel selection as indicated at the control handle.
6. The fuel indicating system is a capacitance type system. The system consists of: a fuel quantity indicator, fuel sensor units (one in each main tank) and two signal conditioners (one in each wing). The number of fuel sensor units installed in the fuel system will vary depending on the optional auxiliary fuel system installed in the aircraft. The fuel quantity indicator, displays the fuel quantity in both pound and gal-



10983006

Fuel System Schematic
Figure 1

lons. In addition, when the 40 gallon or 63 gallon auxiliary fuel systems (optional) are installed, a fuel quantity switch and indicator lights are utilized to provide a means of reading the fuel quantity of the main fuel system in auxiliary position or auxiliary fuel in the main position.

Troubleshooting

1. Troubleshooting the fuel system, is a matter of knowing what part of the system can cause the trouble; isolating the trouble, correcting the system or replacing the components.
2. Tools and Equipment

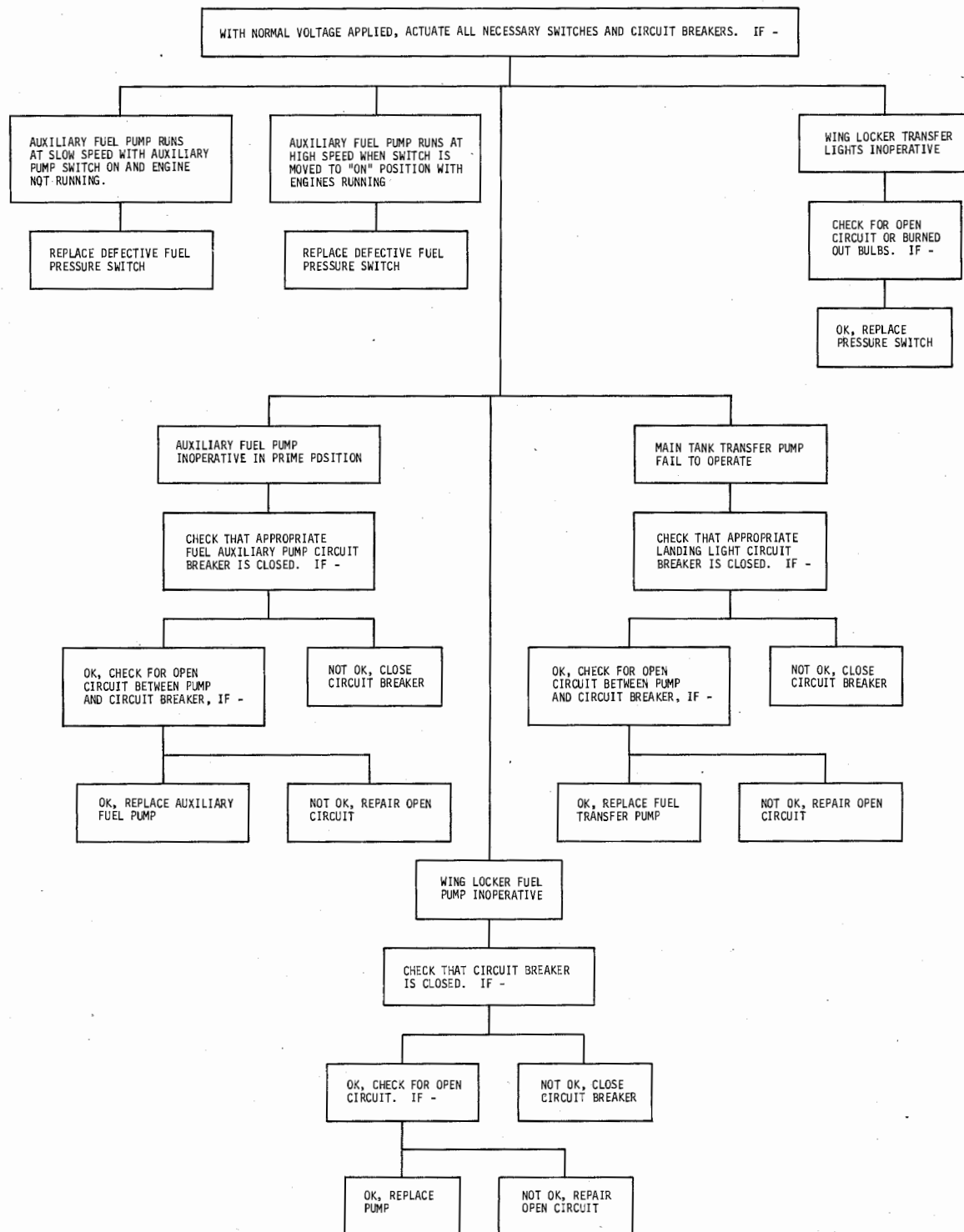
NOTE: Equivalent substitutes may be used instead of the following:

Name	Number	Manufacturer	Use
Capacitance Fuel System Test Box	9910111-12	Cessna Aircraft Co. Wichita, Kansas	Calibrate the fuel indicating system.
Multimeter	Model 260	Simpson Electric Co.	Test circuits.
Screwdriver/ Fuel Sampler	CM3	Cessna Aircraft Co. Wichita, Kansas	Fuel sample.

4. Troubleshooting Fuel System.
 - A. For a guide to troubleshooting the fuel system, see Figure 2.
5. Troubleshooting Fuel Indicating System.
 - A. For a guide to troubleshooting the indicating system, see Figure 3.

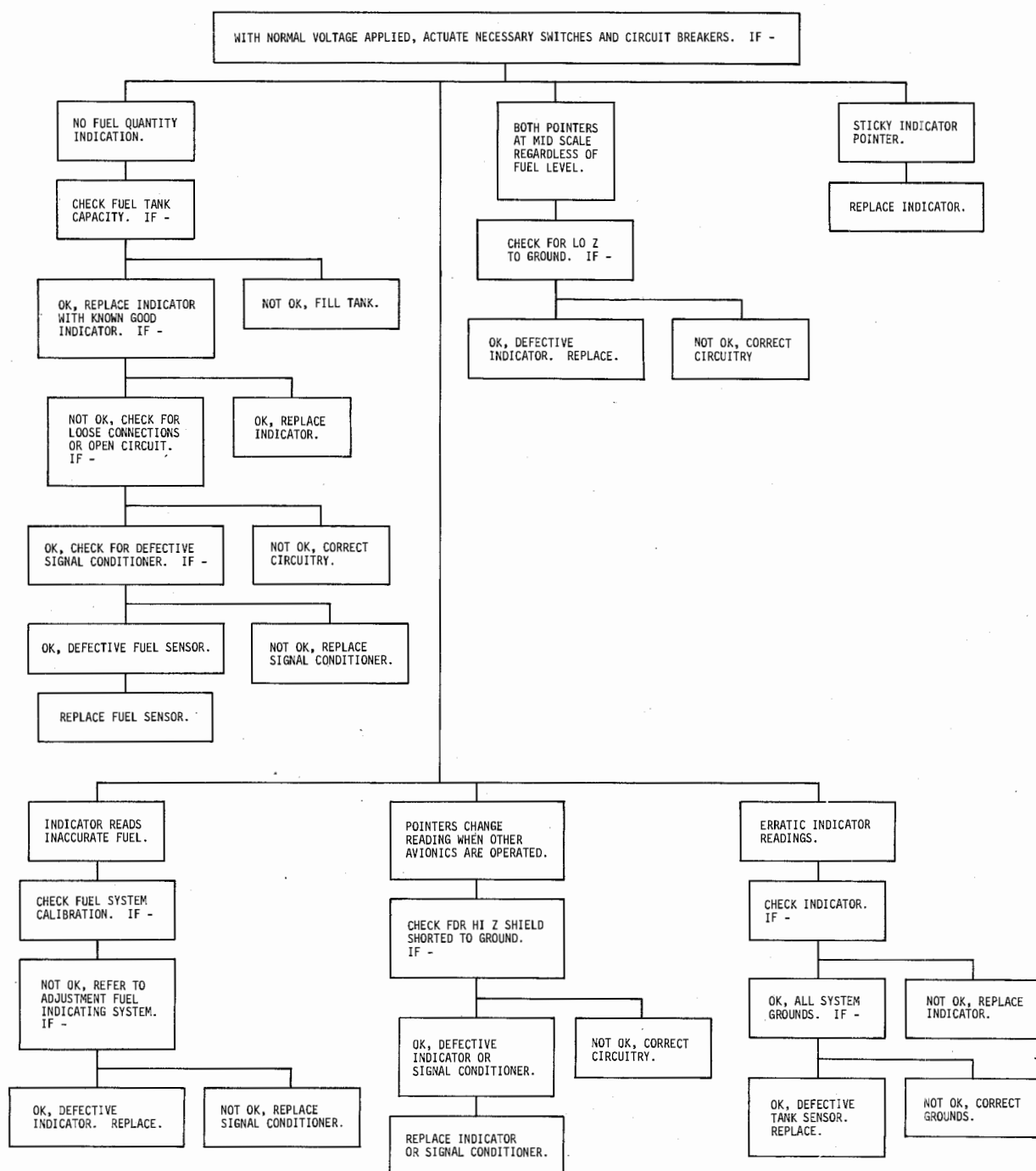
Adjustment/Test

1. Tools and Equipment.



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Troubleshooting Chart - Fuel System
Figure 2



NOTE: THE CAPACITANCE FUEL SYSTEM TEST BOX IS RECOMMENDED WHEN TROUBLESHOOTING THE FUEL INDICATING SYSTEM. THE TEST BOX IS DESIGNED FOR COMPLETE MAINTENANCE, TROUBLESHOOTING AND CALIBRATION OF THE FUEL INDICATING SYSTEM.

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Troubleshooting Chart - Fuel Quantity Indicating System
Figure 3

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MAINTENANCE MANUAL

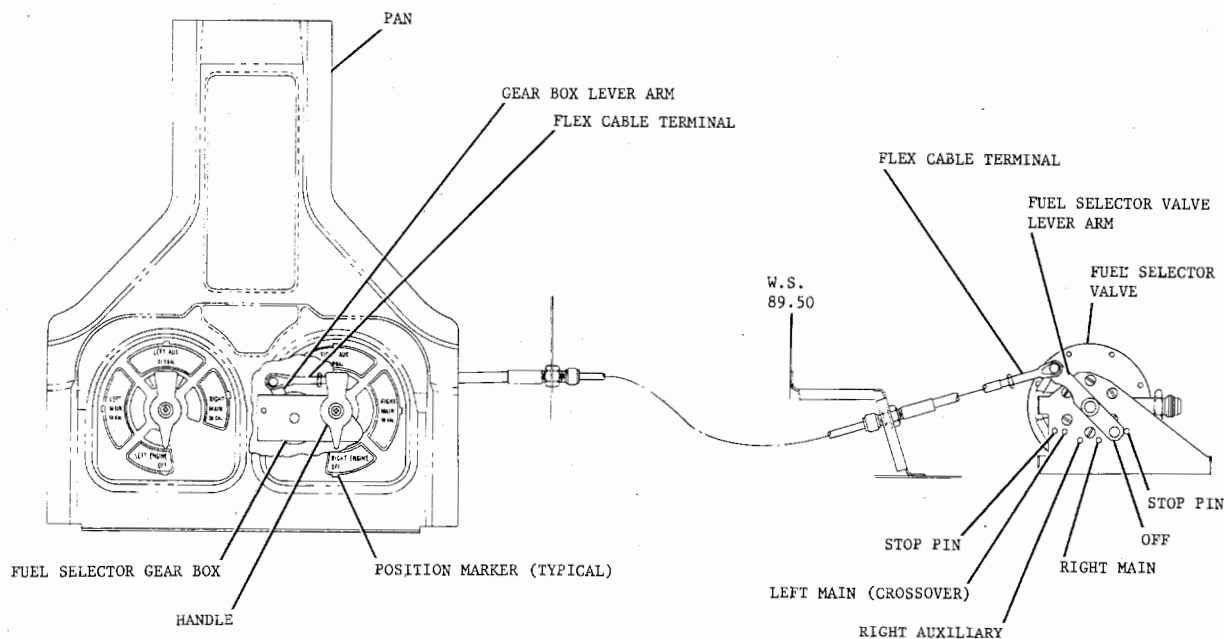
NOTE: Refer to troubleshooting for tools and equipment requirements.

2. Adjustment of Fuel Selector Valve (See Figure 4).

NOTE: Adjustment procedures are for the right fuel selector valve. Procedures are the same for the left fuel selector valve.

A. Adjust Fuel Selector Valve.

- (1) (See Figure 4, Section 9.10.) Remove control handles by removing screws and washers.
- (2) Remove the fuel selector pan by removing attaching screws.
- (3) Loosen carpet and pull back just enough to gain access to floorboard access covers and remove access covers.



VIEW OF RH WING SHOWN, LH WING IS SIMILAR

10163001

Adjustment Fuel Selector Valve
Figure 4

- (4) Disconnect control cable from gear box by removing cotter pin, washer and pin.
- (5) Refer to Chapter 1. Remove access covers at the fuel selector valve.
- (6) Disconnect control cable from selector valve by removing cotter pin, washer and pin.
- (7) Position lever arm on fuel selector valve in wing to the most outboard detent and resting against the stop pin.

NOTE: Observe that the attaching hole in lever arm is pointing inboard.

- (8) Connect terminal of control cable to the fuel selector valve lever arm with pin, washer and cotter pin.
- (9) On the cabin floorboard, rotate (counterclockwise for LH and clockwise for RH) the handle on the gear box until lever arm comes to rest against gear box bracket.
- (10) Rotate handle (clockwise for LH and counterclockwise for RH) approximately 5 degrees until pointer on handle is aligned with the OFF position marker.

CAUTION: OBSERVE THAT THE HANDLE IS PARALLEL WITH THE CENTERLINE OF AIRCRAFT AND POINTER ON HANDLE IS INDEXED TO THE OFF POSITION (AFT).

- (11) With the handles in the position described in step (10), adjust terminal and nuts of the control cable until attach holes on gear box lever arm and cable terminal are aligned.
- (12) Connect terminal to gear box lever arm with pin, washer and cotter pin.
- (13) Start from the OFF position and rotate (clockwise for LH and counterclockwise for RH) the handle to the RIGHT MAIN.
- (14) Observe that the pointer end of handle nearly aligns with marker on placard after traveling approximately 90 degrees from the OFF position and the fuel selector valve lever arm seats in the main tank detent on the fuel selector valve.
- (15) If the fuel selector valve lever arm has not seated in proper detent after handle has been rotated 90 degrees from the OFF position, lengthen or shorten terminals and/or control cable as necessary to achieve proper rigging.
- (16) Continue from the RIGHT MAIN position, rotate handle to the RIGHT AUXILIARY position.

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- (17) Observe that pointer end of handle nearly aligns with marker on placard after traveling approximately 180 degrees from the OFF position and the fuel selector valve lever arm seats in the auxiliary tank detent on the fuel selector valve.
- (18) If the fuel selector valve lever arm has not seated in proper detent after handle has been rotated 180 degrees from OFF position, lengthen or shorten terminals and/or control cable as necessary to achieve proper rigging.
- (19) Continue from the RIGHT AUXILIARY position, rotate handle to LEFT MAIN (crossover).
- (20) Observe that the pointer end of handle nearly aligns with marker on placard after traveling approximately 270° from the OFF position and the fuel selector lever arm seats in the inboard crossover tank detent on the fuel selector valve and against stop pin.
- (21) If the fuel selector valve lever arm has not seated in proper detent after handle has been rotated 270 degrees from the OFF position, lengthen or shorten terminals and/or control cable as necessary to achieve proper rigging.
- (22) Install all access covers and panels.
- (23) Position the front carpet and install fuel selector pan with screws.
- (24) Assemble control handles to gear box levers, using placard covers, washers and screws.

B. Operational Check.

- (1) Place the left fuel selector valve handle in the LEFT MAIN position, and the right fuel selector valve handle in the OFF position. Start the left engine. When the engine is sufficiently warmed up, advance the throttle to 1500 RPM. Observe the fuel flow gage to assure there are no radical fluctuations and for proper fuel flow. Observe the engine for a proper short continuous run. Place the left selector valve handle to the RIGHT MAIN position, repeat the above steps and observations. With engine at idle RPM place the left fuel selector valve handle to the OFF position. The engine should run momentarily, then fail. Check the right fuel selector valve handle in the RIGHT MAIN position, and left fuel selector valve handle in the OFF position. Start the right engine and check the right selector valve in accordance with above procedures for the left fuel selector valve.

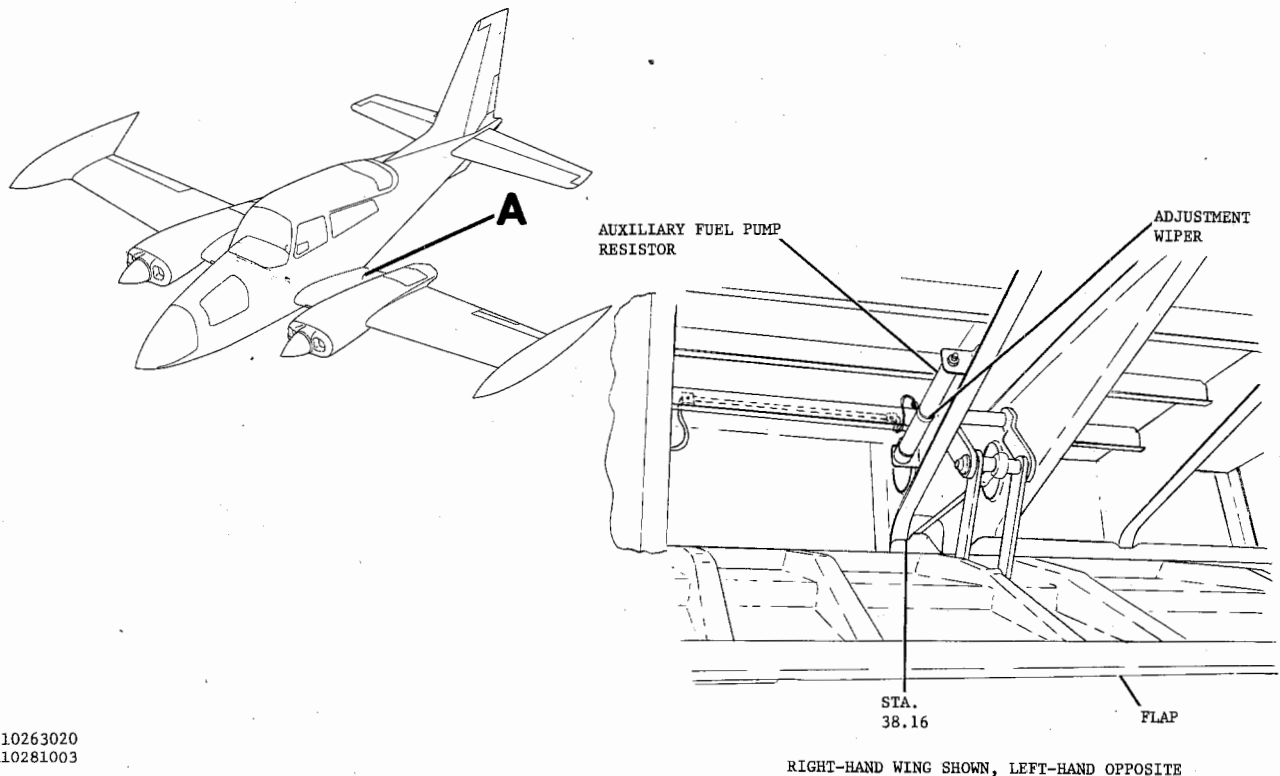
NOTE: The crossfeed system allows fuel to be used from the opposite main tanks only. There are no provisions to crossfeed fuel from auxiliary fuel tanks.

2. Adjustment of Main Tank Auxiliary Fuel Pump (See Figure 5).

NOTE: Adjustment procedures are for the right auxiliary fuel pump. Procedures are the same for left auxiliary pump.

A. Adjust Auxiliary Fuel Pump.

- (1) Service the fuel system.
- (2) Lower the flaps.
- (3) Place fuel selector control handles to the desired tank.
- (4) Refer to Chapter 7 Unmetered Fuel Test Hook-Up, Check and Adjustment and connect test pressure gage at engine-driven fuel pump inlet line.
- (5) Connect a 28 volt dc auxiliary power unit to aircraft or run opposite engine at 1500 RPM with no other electrical equipment on to assure full electrical bus voltage.



DETAIL A

Adjustment Auxiliary Fuel Pump
Figure 5

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- (6) Position right auxiliary fuel pump to LOW and check test pressure gage connected to engine-driven inlet line for 5.5 PSI of fuel pressure.
- (7) If fuel pressure is not 5.5, adjust auxiliary fuel pump resistor, until required pump pressure is obtained.

NOTE: Cool resistor with air blast, while making adjustment.

- (8) Turn all switches OFF, place fuel selector control handle to OFF position.
- (9) Remove test pressure gage.

B. Ground Check of Auxiliary Fuel Pump

- (1) Turn master switch ON.
- (2) Position auxiliary fuel pump switch to LOW position. Make audible check of pump for low speed operation.
- (3) Momentarily position auxiliary fuel pump switch to ON position. Check pump operation for high speed.
- (4) Start engines and run at 1000 RPM.
- (5) Position auxiliary fuel pump switch to ON and check pump operation for low speed.
- (6) Momentarily position mixture lever to IDLE CUT-OFF. Make audible check for pump going to high speed.

NOTE: If pump goes to high speed, fuel pressure switch is functioning normally.

- (7) Turn auxiliary fuel pump switch OFF when pump goes to high speed.
- (8) If auxiliary fuel pump does not go into high speed, proceed as follows:
 - (a) Auxiliary fuel pump switch OFF.
 - (b) With the engine not running, momentarily position the auxiliary fuel pump switch to ON, make audible check of pump for high speed operation.

NOTE: If auxiliary fuel pump goes into high speed, the fuel pressure switch and pump are functioning normally.

3. Adjustment Fuel Indicating System.

- A. Two methods of calibrating the fuel quantity system are given. Dry Calibration and Alternate Calibration.
- B. Dry Calibration is the preferred method, being the most accurate. Dry Calibration, uses the actual tank units for Zero Calibration, this compensates for the sensor unit and wiring harness tolerances. A fixed capacitance is added in parallel with the actual dry sensor unit to

represent the fuel in the tank to provide for calibration in the full condition.

NOTE: To calibrate the fuel system with the Dry method, it will be necessary to fabricate a capacitance test box in accordance with Figure 6 or use the Field Calibration Unit Test Box. The part for fabricating the capacitance test box may be purchased locally or through your Cessna Dealer's Organization. The Field Calibration Unit Test Box is designed for complete maintenance, troubleshooting and calibration, enabling the technician to measure capacitance of system, individual components, harness insulation breakdown, resistance of system components and substitute capacitance to simulate the tank sensor units or actual fuel in the tank.

- C. The alternate method of calibrating the fuel quantity system may be accomplished without the capacitance test box. This method checks fuel temperature and density versus total capacitance of fuel. The Alternate method of calibration has a greater chance for error than the Dry Fuel System Calibration.
- D. Dry Calibration (See Figure 6).

- (1) Defuel aircraft. Refer to Chapter 2.

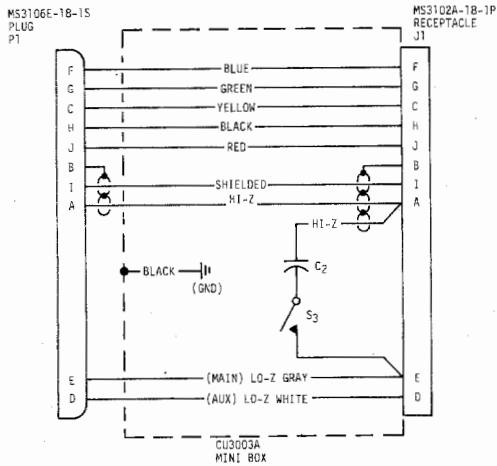
WARNING: DURING ALL DEFUELING AND TANK CALIBRATION, THE AIRCRAFT MUST BE LOCATED A SAFE DISTANCE FROM OTHER AIRCRAFT AND BUILDINGS. FIRE FIGHTING EQUIPMENT MUST BE AVAILABLE. TWO GROUND WIRES FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT ACCIDENTAL DISCONNECTING OF ONE GROUND WIRE.

- (2) Refer to Chapter 1 and remove signal conditioner access panel, do not electrically disconnect signal conditioner.

NOTE: The fuel quantity indicator visually displays fuel quantity for each wing separately. Therefore, calibration is accomplished on one wing fuel system at a time.

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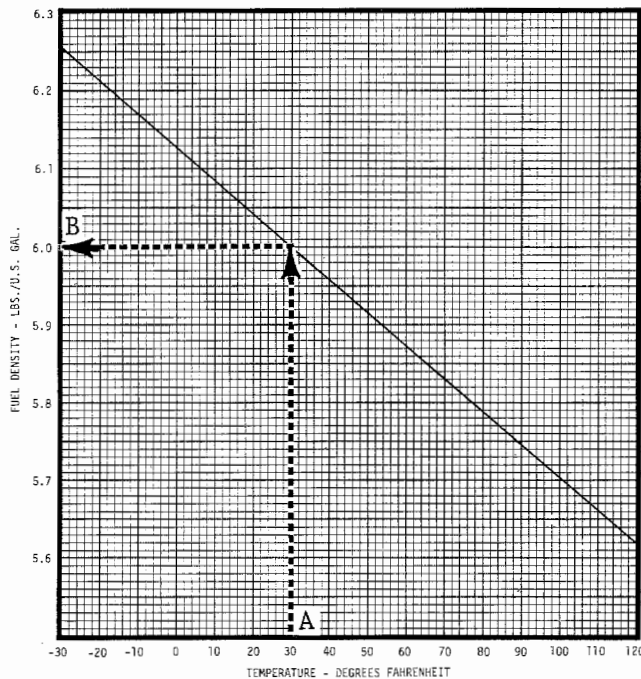
Part Number	Description	Quantity
MS3106E-18-1S (P1)	Plug	1
CU3003A	Mini Box	1
MS3102A-18-1P (J1)	Receptacle	1
VV13C32R6F (C2)	32.6 PF Capacitor	1
D15 (Alternate C1)	32.6 PF Capacitor	1
MST-105D (S3)	Switch	1
MS35489-5	Grommet	1
No. 70	Alligator Clip, P/N of Mueller Electric Co.	1

(S3) SWITCH POSITIONS

1. OFF
2. MAIN FULL

- NOTE: 1. PLUG (P1) MATES WITH RECEPTACLE ON SIGNAL CONDITIONER AND RECEPTACLE (J1) MATES WITH SIGNAL CONDITIONER. REFER TO CAPACITANCE FUEL SYSTEM WIRING DIAGRAM CHAPTER 13.
2. ALL WIRE EXCEPT FOR HI-Z WIRES TO BE 22 GAGE PER MIL-W-16878D/4 TYPE "E" OR EQUIVALENT. HI-Z WIRES TO BE PER MIL-W-16878D TYPE "E" 20 GAGE SHIELDED WITH TEFLON INSULATION OVER SHIELD.

FABRICATION OF FUEL QUANTITY CALIBRATION TEST BOX



EXAMPLE: A - Fuel Temperature, 30°F
 B - Fuel Density, 6.0 Pounds Per Gallon
 Density x Total Gallons =
 Total Fuel Quantity in Pounds

TEMPERATURE CONVERSION CHART

10987012
 10987013

Fabrication of Fuel Quantity Calibration Test Box and Temperature Conversion Chart

Figure 6

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- (3) Apply electrical power. If battery is used be sure voltage is not less than 22 volts.
- (4) Place fuel select control handle to MAIN position.
- (5) Adjust the Main Empty potentiometer on signal conditioner to read exact zero pounds indication of the fuel quantity indicator.

NOTE: Tap the indicator slightly when reading indicator, this will help overcome friction of the needle when the indicator is in a static condition.

- (6) Interconnect capacitance test box, see Figure 6.

NOTE: Fabricate test box in accordance with Figure 6.

- (7) Adjust the Main Full potentiometer on the signal conditioner to read 50 gallons (full scale indication).

NOTE: Tap indicator when reading indicator.

- (8) Position selector switch on the capacitance test box to OFF and recheck zero indication.

NOTE: If the zero indication has changed readjust zero and full indication until no change is evident by the adjustment setting of the other.

- (9) Turn off power and return aircraft to original configuration and remove capacitance test box.
- (10) Turn power on and recheck main zero indication.

NOTE: This will assure that calibration of the main tank was good and not affected by a defective test box.

- (11) Place fuel select control handle to AUX position.
- (12) Adjust the Empty Auxiliary potentiometer on the signal conditioner, to read exact zero on the fuel indicator.
- (13) With power on the aircraft, place fuel select control handle to Main position and check Main Empty potentiometer setting.

NOTE: It may be necessary to readjust main and auxiliary empty potentiometers by switching back and forth the main and auxiliary positions respectively until NO deviation reading is evident.

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- (14) Turn power OFF.
- (15) Interconnect capacitance test box, and recheck Main Full indication.
- (16) If calibration has changed, repeat Steps 4 thru 12 until a full indication; without change in both main and auxiliary zero indication, is obtained.
- (17) After both LH and RH systems have been restored to their original configurations, read indication on auxiliary tank by actuating the override switch, located below the fuel quantity indicator and verify that zero corresponds to that of main.
- (18) Turn off electrical power. Reinstall signal conditioners.
- (19) Service the fuel system. Refer to Chapter 2.

E. Alternate Method (See Figure 6).

NOTE: The alternate method of calibrating the fuel system should be used only as a temporary calibration until the preferred method of calibration can be accomplished. The alternate method of calibration will require a thermometer with a scale reading of - 30°F to 150°F.

- (1) Defuel aircraft. Refer to Chapter 2.

WARNING: DURING ALL DEFUEL AND TANK CALIBRATION THE AIRCRAFT MUST BE LOCATED A SAFE DISTANCE FROM OTHER AIRCRAFT AND BUILDINGS. FIRE FIGHTING EQUIPMENT MUST BE AVAILABLE. TWO GROUND WIRES FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT ACCIDENTAL DISCONNECTING OF ONE GROUND WIRE.

- (2) Refer to Chapter 1. Remove signal conditioner access panel, do not electrically disconnect signal conditioner.
- (3) Turn on electrical power.
- (4) Place fuel select control handles to Main position.
- (5) Adjust the Main Empty potentiometer on the signal conditioner to exact zero on the fuel quantity indicator.

NOTE: Tap the indicator lightly when reading indicator. This will overcome friction of the needle when the indicator is in static condition.

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- (6) Position fuel select control handles to Auxiliary and adjust the Auxiliary Empty potentiometer exact zero on the fuel quantity indicator.
- (7) Using a thermometer, measure the temperature of the fuel and determine density of the fuel from, Temperature Conversion Chart.
- (8) Service the fuel system or tank being calibrated. Refer to Chapter 2.
- (9) Record the total number of gallons in the tank or system.
- (10) Reinstall the signal conditioner.

MAIN FUEL SYSTEMDescription

1. The main fuel system consists of: the main tanks, auxiliary fuel pumps, fuel transfer pumps, fuel selector control system, indicating system, overboard vent and necessary fuel plumbing.
2. The main fuel tanks (wing tip tanks) integrally sealed (wet) are, located at the tip of each wing. Each tank consists of: a tail cap, nose cap, fuel filler, auxiliary fuel pump, fuel transfer pump, fuel sensor, drain valve, plumbing and electrical wiring. A snuffle valve is located on top of each tank aft of the filler cap. The valve will vent the tank should the overboard vent become clogged or obstructed. The main tank, also, incorporates a vapor return line, routed from the tank to the engine-driven fuel pump, the line is utilized to return unused fuel from the engine fuel pump to the main tank.
3. The auxiliary fuel pump which is electrically operated, is located at the bottom of each main tank. The fuel pump provides fuel under pressure for priming during engine starting and supplies fuel to the engine in an emergency. The pump feeds fuel to the selector valve and in turn the selector valve routes fuel to the engine-driven fuel pumps. The auxiliary pump is controlled by three switches. When the prime switch is placed in the left position, the left auxiliary pump, provides priming for the left engine. When the prime switch is placed in the right position, the right auxiliary pump, provides priming for the right engine. During the priming operation, the auxiliary pumps operate at high speed. The auxiliary pumps switches are a two-position center off switch. When placed in the LOW position, the auxiliary pump provides pressure for purging. When the auxiliary pump switch is placed in the ON position, the auxiliary pump operates at low speed. In case of an engine-driven fuel pump failure, the auxiliary pump will automatically operate at high speed. During takeoff and landing, the auxiliary pump switch is positioned to ON.
4. The fuel transfer pump which is electrically operated is mounted on the aft bulkhead access cover of each main tank. Transfer pump access is gained by removing the tail cap. The pump transfers fuel from the nose section of the main tank to the center baffle area. Where the fuel is picked up and routed to the engine by either the engine-driven fuel pump or the main tank auxiliary fuel pump. The fuel transfer pump prevents the possibility of fuel starvation to the engine during steep angles of descent and a low quantity of fuel.

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5. The fuel selector control system consists of: left and right fuel selector controls located between the front seats of the cabin floor; a left and right fuel selector valve, located in each wing just forward of the main spar, and outboard of the nacelle. Each selector valve has four positions which allows fuel to flow to the respective engine from the left tank, right tank, the auxiliary tank (optional), or stop all fuel flow through the valve. Each fuel selector valve has a fuel strainer located on the bottom of the valve, and a quick-drain valve to remove moisture and sediment. Each selector is connected to the corresponding fuel selector control by a flex cable.
 - A. The fuel selector control on the right, controls fuel flow to the right engine through the corresponding selector valve by allowing fuel to be used from right main tank, right auxiliary tank (optional) or through the crossfeed system, from left main tank. The fuel selector control on the left, controls fuel flow to the left engine through the corresponding selector valve by allowing fuel to be used from the left main tank, left auxiliary tank, or through the crossfeed system from the right main tank. The fuel selection controls are rotary-type and operate mechanically through a 270 degree range by a gear arrangement and a flex cable to each fuel selector valve. The fuel selector control has four positions. The positions are: LEFT MAIN, RIGHT MAIN, LEFT AUXILIARY and OFF; RIGHT MAIN, LEFT MAIN, RIGHT AUXILIARY and OFF. The fuel selector control handles indicate the position of the selector valves. The fuel selector control handles are protected by a guard to prevent the possibility of switching or movement by pilot's or copilot's feet.
6. The main and auxiliary (optional) fuel systems have a capacitance type fuel quantity indicating system that is compensated for specific gravity and reads in both pounds and gallons. The system consists of: an indicator, a fuel indicator selector switch mounted in the bottom of each wing outboard of the nacelle; one, fuel sensor mounted in each main tank. If auxiliary (63 gallon) fuel tanks (optional) are installed two fuel sensors are, located in the inboard tank and one fuel sensor in the outboard tank. Each fuel sensor unit consists of two concentric electrodes. The inner electrode consists of a main body of insulating material with two conducting surfaces, separately insulated around the outboard surface of the sensor unit. One conducting surface is grounded to a single point ground in the indicator and the other surface is connected to the signal conditioner input bridge. The outer electrode is an aluminum tube coated with insulating material on the outside. Openings in the sensor unit allow fuel to flow between electrodes to the same level as that in the tank.

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Fuel between the electrodes is the variable dielectric factor of the capacitor. Capacitance of the sensor units which are part of the system bridge circuit provide a continuous signal conditioner and is amplified to the fuel quantity indicator.

- A. The fuel quantity indicator is a dual indicator, providing a left and right-hand indication for the main fuel system as well as left and right-hand indication for the auxiliary fuel tanks (optional). When the fuel selector control handle is placed in the main position, the fuel quantity indicator will indicate fuel in the main tanks. When the fuel selector control handle is placed in the auxiliary position, an indicator light located under the indicator will be illuminated, indicating that the fuel selector valve is in the auxiliary position and the fuel quantity indicator will indicate auxiliary fuel. An override switch is provided for monitoring the fuel quantity in the opposite system. When the fuel selector control handles are placed in the main position and the override switch is positioned to "AUX" the fuel quantity indicator will read Auxiliary Fuel. When the fuel selector control handles are placed in the "Auxiliary" position, the light will illuminate and the indicator will indicate Auxiliary Fuel. If the override switch is placed in the main position the fuel quantity indicator will indicate Main Fuel. The auxiliary indicator lights are illuminated any time the selector switches are in the Auxiliary position, regardless of the position of the override switch.
7. Aircraft 310R0001 thru 310R0023, a vent heater is utilized on each main tank overboard vent line. The vent heater is electrically operated and prevents the vent line from freezing of vapors. Aircraft 310R0024 and on, a vent scoop is utilized on the overboard vent line to prevent the forming of ice.

Troubleshooting

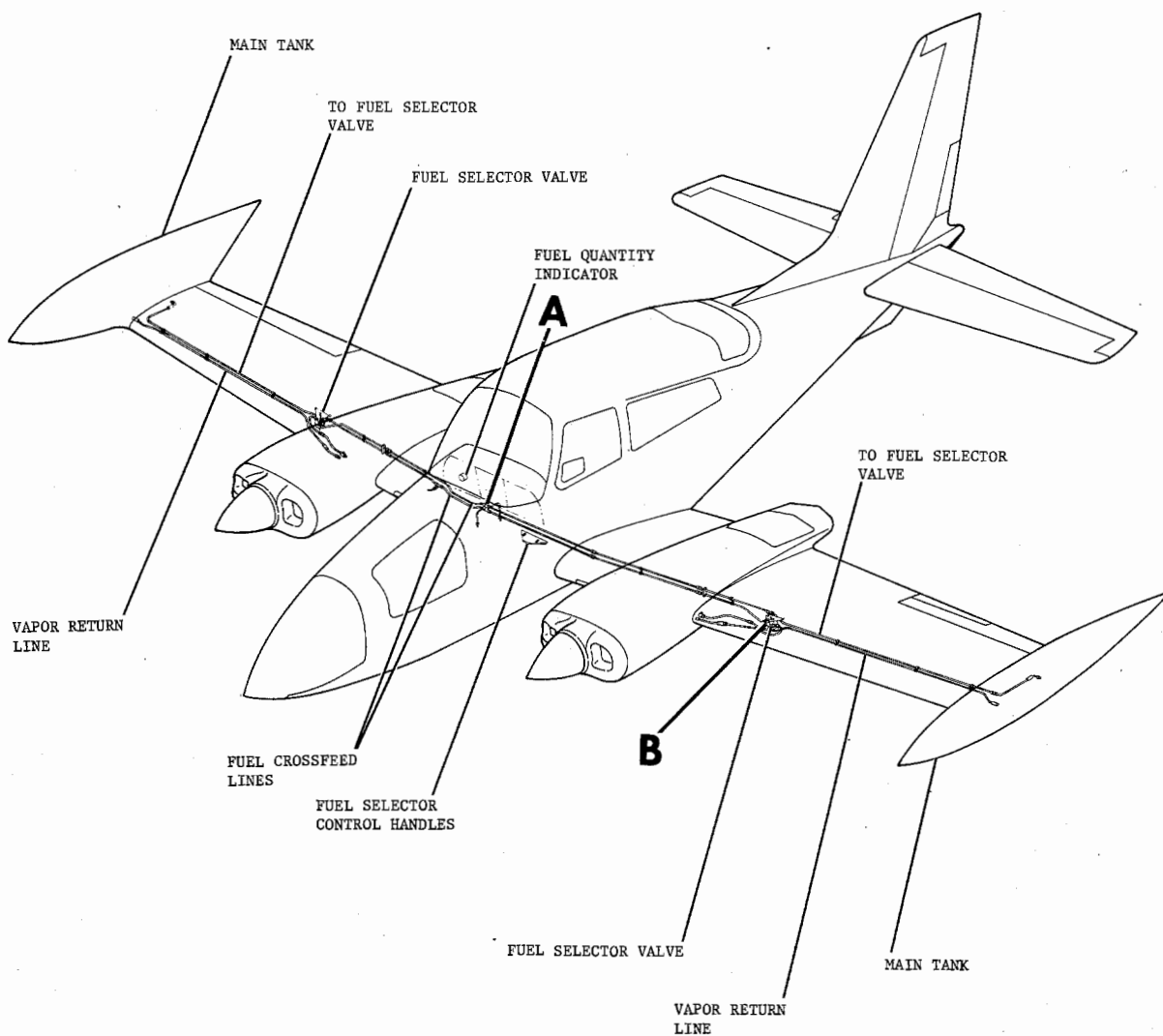
NOTE: For troubleshooting the main fuel system, refer to Fuel System Troubleshooting.

Adjustment/Test

NOTE: For adjustment/test of main fuel system, refer to Fuel System Adjustment/Test.

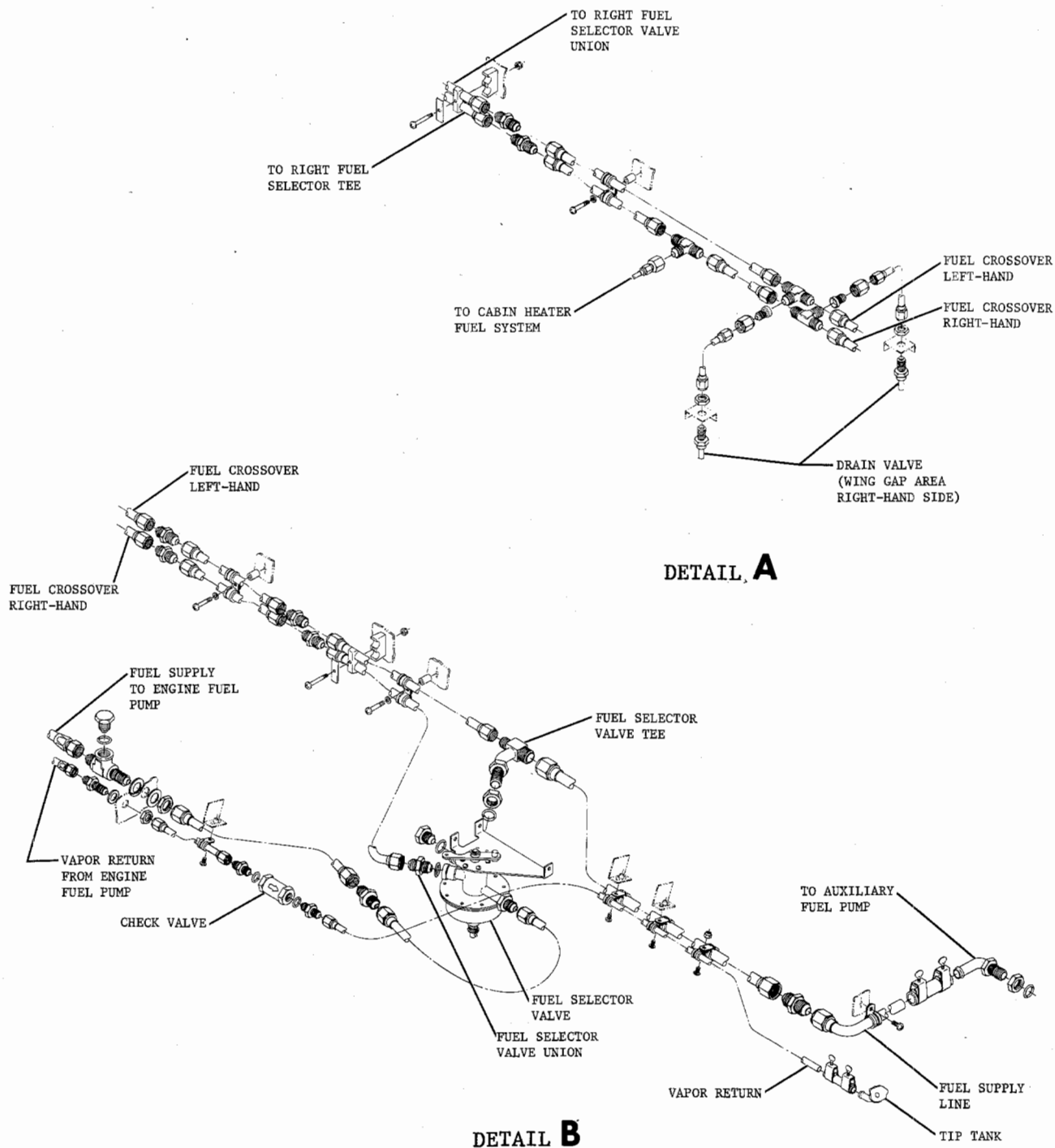
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Main Fuel System and Plumbing Installation
Figure 1 (Sheet 1 of 2)



10264001

Main Fuel System and Plumbing Installation
Figure 1 (Sheet 2)

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Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

NOTE: During removal/installation of fuel system components, all openings or fittings shall be capped or plugged.

1. Removal/Installation Main Fuel Tank (See Figure 2).

NOTE: Removal/Installation procedures are the same for either tank.

A. Remove Main Fuel Tank.

- (1) Defuel the aircraft. Refer to Chapter 2.
- (2) Remove fairings drip fence (Aircraft 310R0024 and On) and tail cap to gain access to attach points.
- (3) Open drain valve and drain residual fuel from tank.
- (4) Disconnect hoses and electrical connections.
- (5) Remove main tank by removing nuts, washers and bolts.
- (6) If tank disassembly is desired, disassemble tank as shown in Figure 2.

B. Install Main Tank.

- (1) If tank was disassembled, reassemble as shown in Figure 2 and proceed as follows:
 - (a) Clean all surfaces to be sealed with a low moisture solvent, using a lintless cloth for solvent application.

NOTE: Do not allow cleaning solvent to evaporate; wipe dry.
 - (b) Mix sealing MIL-S-8802 per manufacturer's instructions. Apply sealant with a spatula over all seams, rivets, fittings and possible leak areas.
 - (c) Inspect tank as follows:
 - 1) Seal off all hose and access holes in tank. Close vent hole by covering inside with tape.
 - 2) Saturate a clean rag with 25 cubic centimeters of household ammonia. Insert rag into fuel tank and close filler cap.

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- 3) Pressurize fuel tank to a maximum of 2 PSI.
- 4) Saturate a large clean cloth with indicated solution (1/2 gallon distilled water, 1/2 gallon desaturated alcohol and 1/2 ounce of phenolphthalein crystal or powder) and spread smoothly on tank surface.
- 5) A leak will appear as a pink spot on the cloth. Repair all leaks and repeat testing until tank surface has been tested.

WARNING: REMOVE TAPE AND RAG FROM TANK AND ALLOW FUEL TANK TO AIR OUT BEFORE USING.

- (2) Position main tank on wing tip and secure with bolts, washers and nuts. Torque nuts to 50 ± 10 inch-pounds.
- (3) Connect hoses and electrical connections.
- (4) Install tail cap drip fence (Aircraft 310R0024 and On) and fairings.

CAUTION: AIRCRAFT 310R0024 AND ON, APPLY SEALANT (PRO-SEAL 890, CLASS B) ON JOINTS BETWEEN LOWER FAIRING, TAIL CAP AND DRIP FENCE, TO PREVENT DISCHARGE FUEL FROM VENT SCOOP FROM ENTERING WING STRUCTURE.

- (5) Close drain valve.

2. Removal/Installation Sniffle Valve (See Figure 2).

NOTE: Removal/Installation procedures are the same for either main tank sniffle valve.

A. Remove sniffle valve.

- (1) Defuel the main tank. Refer to Chapter 2.

CAUTION: CARE SHOULD BE TAKEN TO GUARD AGAINST FOREIGN MATTER ENTERING TANK.

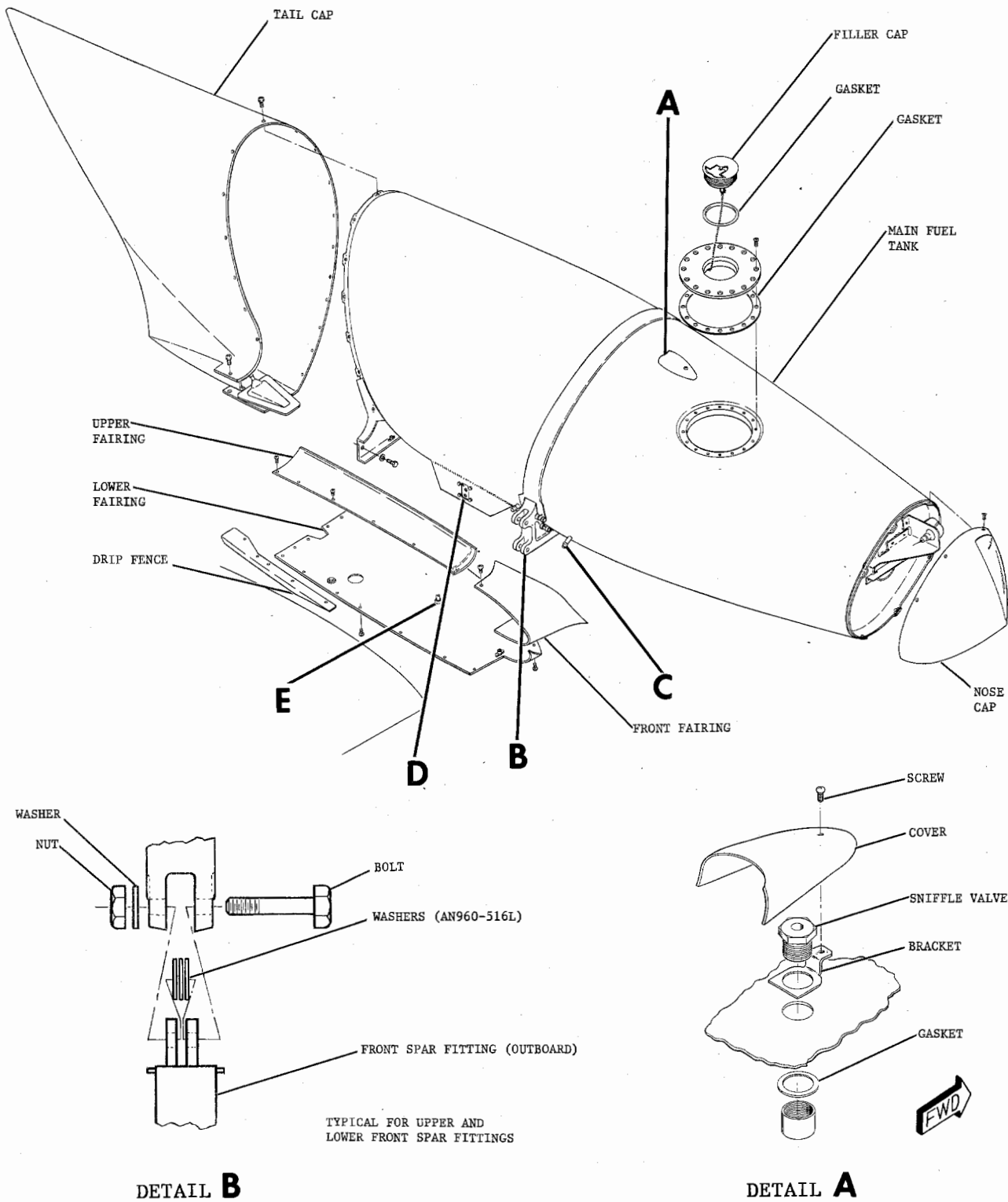
- (2) Remove screw securing cover.
- (3) Holding top half of sniffle valve, remove bottom of valve, washer and gasket.

B. Install Sniffle Valve.

CAUTION: CARE SHOULD BE TAKEN TO GUARD AGAINST FOREIGN MATTER ENTERING TANK.

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MAINTENANCE MANUAL

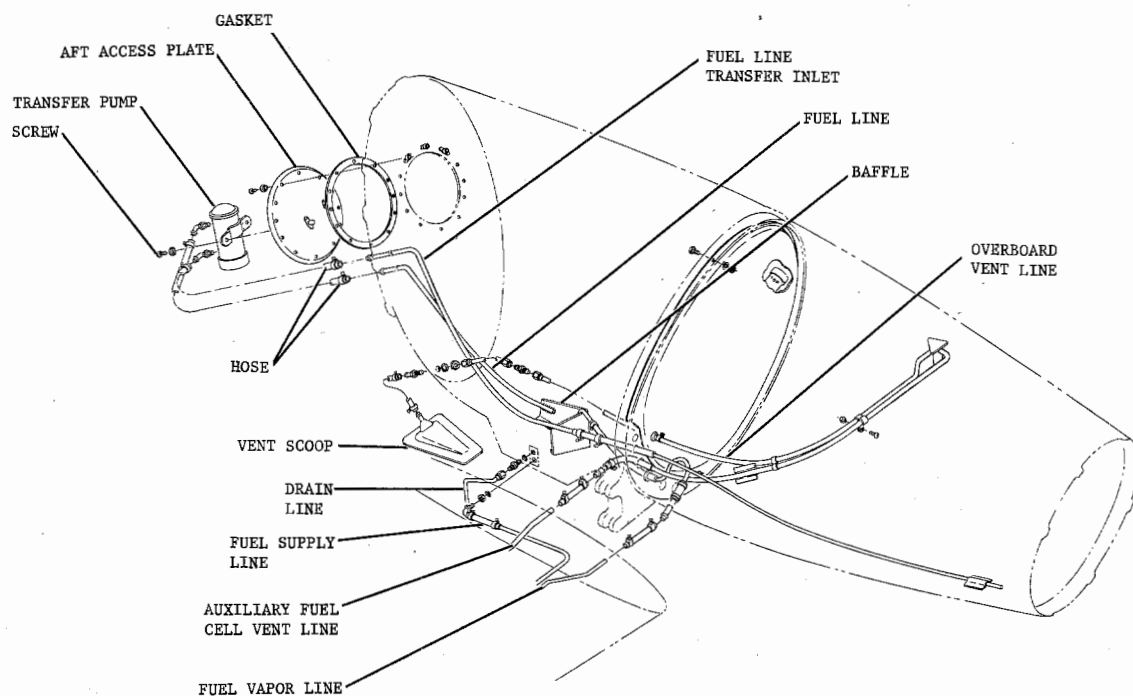


Main Fuel Tank Installation
Figure 2 (Sheet 1 of 2)

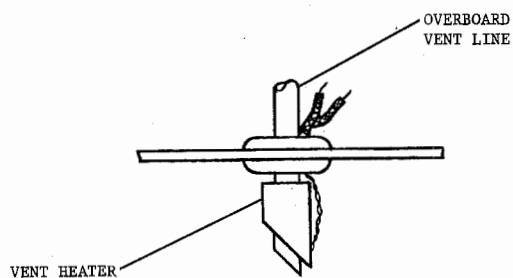
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MAINTENANCE MANUAL

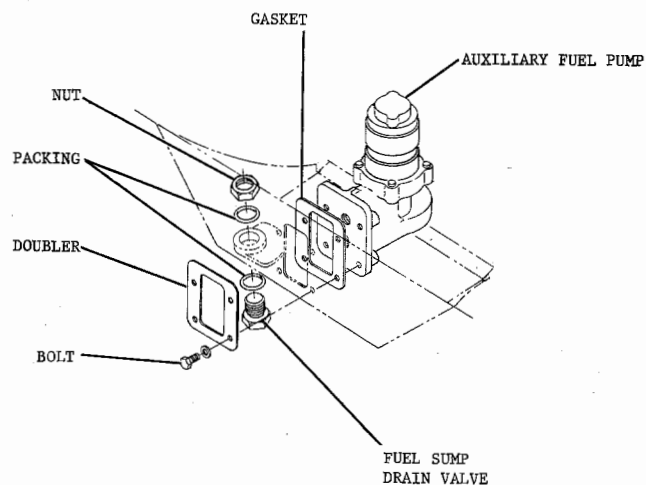


DETAIL C



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DETAIL E



DETAIL D

**Main Fuel Tank Installation
Figure 2 (Sheet 2)**

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MAINTENANCE MANUAL

- (1) Position top half of snaffle valve in tank. Secure with bottom half of valve, washer and gasket.
- (2) Install cover and secure with screw.

3. Removal/Installation Auxiliary Fuel Pump (See Figure 2).

NOTE: Removal/Installation procedures are the same for either auxiliary fuel pump.

A. Remove Auxiliary Fuel Pump.

CAUTION: CARE SHOULD BE TAKEN TO GUARD AGAINST FOREIGN MATTER ENTERING TANK.

- (1) Ensure fuel selector control handles are OFF.
- (2) Defuel applicable main tank. Refer to Chapter 2.
- (3) Remove wing fairings.
- (4) Disconnect electrical wiring.
- (5) Remove drain line, hose connecting fuel line, elbow and nipple.
- (6) Remove tail cap and fuel transfer pump. Refer to Fuel Transfer Pump Removal.
- (7) Remove aft access plate and gasket.
- (8) Remove the mounting bolts, securing auxiliary pump and remove pump from the main tank.

B. Install Auxiliary Fuel Pump.

NOTE: Anytime the auxiliary fuel pump has been replaced or altered, the auxiliary fuel pump low adjustment must be performed. Refer to Fuel System Adjustment/Test.

- (1) Insert auxiliary fuel pump into main tank. Secure the pump to mounting, using gasket and bolts.
- (2) Install elbow to auxiliary pump, using nut and new packing.
- (3) Connect fuel line to elbow, using hose and clamps.
- (4) Connect drain line to fuel pump, using nipple and new packing.
- (5) Install gasket and access cover.
- (6) Install fuel transfer pump. Refer to Fuel Transfer Pump Installation.
- (7) Install tail cap.
- (8) Connect electrical wiring and install wing fairings.

4. Removal/Installation Fuel Transfer Pump (See Figure 2).

NOTE: Removal/Installation procedures are the same for either fuel transfer pump.

A. Remove Fuel Transfer Pump.

- (1) Position fuel selector control handles to OFF.
- (2) Defuel applicable main tank. Refer to Chapter 2.
- (3) Remove wing fairings and tail cap.
- (4) Disconnect electrical wiring to fuel transfer pump.
- (5) Disconnect fuel lines from fuel transfer pump.
- (6) Remove screws attaching fuel transfer pump to access plate and remove pump.
- (7) If further disassembly of fuel transfer pump is desired, refer to Fuel Transfer Pump Disassembly/Assembly.

B. Install Fuel Transfer Pump.

- (1) Secure fuel transfer pump to access plate, using screws.
- (2) Connect fuel lines to fuel transfer pump, using hoses clamps and fittings.

CAUTION: OBSERVE IN AND OUT MARKINGS ON PUMP RELATIVE TO LINES BEING CONNECTED FOR CORRECT INSTALLATION. OUTLET PORT MUST BE UP. THE TRANSFER PUMP MUST BE PUMPING FROM FORWARD SECTION OF MAIN TANK TO THE CENTER BAFFLE AREA.

- (3) Connect electrical wiring.
- (4) Perform the following operational check of transfer pump:
 - (a) Pour approximately 5 gallons of fuel into main tank.
 - (b) Turn master switch ON.
 - (c) Observe that transfer pump is functioning properly.
- (5) Install tail cap and wing fairings.
- (6) Refuel aircraft.

5. Disassembly/Assembly Fuel Transfer Pump (See Figure 3).

A. Disassemble Fuel Transfer Pump.

NOTE: The interrupter end of the main tank fuel transfer pump is sealed (air has been removed and an atmosphere of a special dry gas injected). Should any of the electrical components become inoperative, the fuel pump must be replaced. A gas seal is located in the center of the mounting bracket and no attempt should be made to break this seal, as it would render the pump useless.

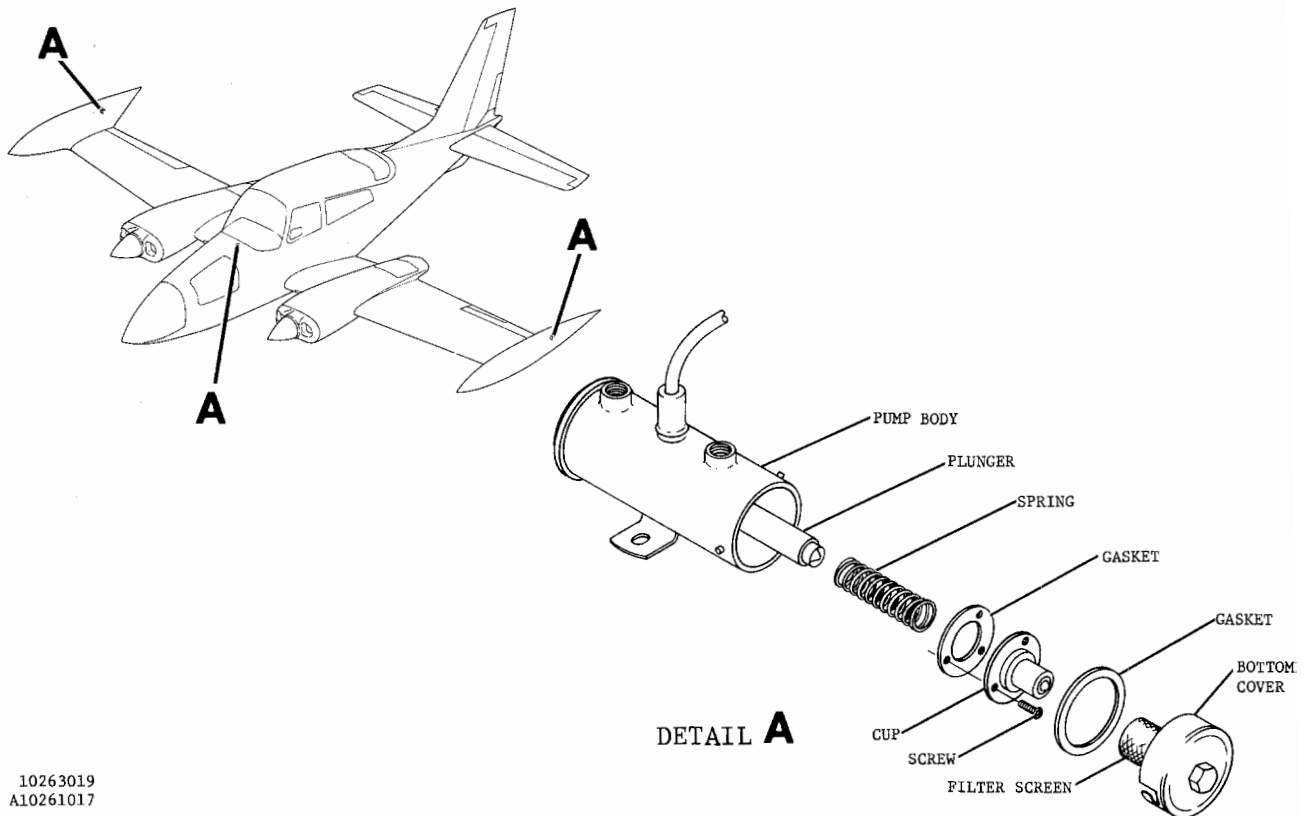
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MAINTENANCE MANUAL

- (1) Hold the pump body securely in one hand and release the bottom cover from the bayonet fittings by rotating it counterclockwise with a 5/8 inch wrench.
- (2) Remove the gasket from the cover.
- (3) Carefully remove the filter screen.
- (4) Remove the screws that hold the plunger spring cup to the pump body.
- (5) Remove the gasket and plunger spring.
- (6) Carefully withdraw the plunger from the pump body. Do not drop or mutilate the plunger.
- (7) Clean and inspect the transfer pump as follows:
 - (a) Wash the plunger assembly in Stoddard Solvent or gasoline. If it fails to become thoroughly clean or if any rough spots are present, dress the surface carefully with crocus cloth. Rinse thoroughly to remove all foreign material.
 - (b) Dip the pump body in clean solvent, shake it lightly, then remove it and dry with compressed air.
 - (c) Blow out the plunger tube with compressed air and check for any rough spots, deposits or foreign material. If not smooth, wrap a piece of cloth around a wooden dowel, dip cloth in Stoddard Solvent (Federal Specification P-D-680), and swab the plunger tube until clean.
 - (d) Rinse remaining parts in the solvent and dry with compressed air. Exercise care when drying the screen to prevent damage.
 - (e) Inspect all parts visually for damage.
 - (f) Inspect the fuel pump electrical resistance by connecting an ohmmeter between the connector terminal and ground on the pump housing. Resistance should be between 19.0 and 19.5 ohms. If the resistance is not within limits, replace the pump assembly.

B. Assemble Fuel Transfer Pump.

- (1) Insert the plunger assembly in the tube with buffer-spring end first. Check for proper fit by slowly raising and lowering the plunger in the tube; it should move freely without any tendency of sticking. A click should be heard each time the plunger approaches the top of the tube. If this click cannot be heard, the interrupter assembly in the sealed portion of the pump is not functioning properly, and the pump assembly must be replaced.
- (2) Install the plunger spring.
- (3) Place the spring cup gasket in position on the plunger spring cup and carefully attach this assembly to the pump body, with the screws. Tighten screws securely.



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Fuel Transfer Pump Assembly
Figure 3

- (4) Carefully install the screen, place cover gasket in position in cover and attach the cover to the pump body.
- (5) Hold the pump body securely with one hand and tighten the cover in place on the pump body bayonets with a 5/8 inch open-end wrench or box socket.

6. Removal/Installation Fuel Selector Valve (See Figure 4)

WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN THE WING.

NOTE: Removal/Installation procedures are the same for either selector valve.

A. Remove Fuel Selector Valve.

- (1) Drain all fuel from wing. Refer to Chapter 2.
- (2) Remove upper and lower access cover plates.
- (3) Disconnect fuel lines and fittings.

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SERVICE MANUAL

- (4) Remove fuel select switch mounting bracket by removing screws and nuts (installed with auxiliary fuel system).
- (5) Disconnect flex cable from selector valve by removing cotter pin, washer and pin.
- (6) Remove bolts securing selector valve mounting bracket. Remove valve from wing.

B. Install Fuel Selector Valve.

- (1) Install fittings in selector valve and clock to correct position.
- (2) Install selector valve and secure in position with bolts.
- (3) Secure fuel selector switch bracket to fuel selector bracket with screws and nuts.
- (4) Connect fuel lines to the fuel selector valve fittings.
- (5) Connect flex cable to fuel selector valve, using pin, washer and cotter pin.
- (6) Install access plates.

C. Cleaning Fuel Selector Valve.

- (1) Fuel selector valve handles OFF.
- (2) Drain fuel from sediment bowl with quick-drain.
- (3) Remove the lower access plate.
- (4) Remove the screws securing sediment bowl and filter assembly.
- (5) Clean filter in fresh solvent and air dry.
- (6) Inspect quick-drain valve, gasket, filter, and fuel selector for nicks, dents, scratches, dirt accumulation, and other foreign matter.
- (7) Reinstall filter and new gasket. Filter installed with large hole facing up, engaging spring.

7. Removal/Installation Fuel Selector Gear Box (See Figure 4).

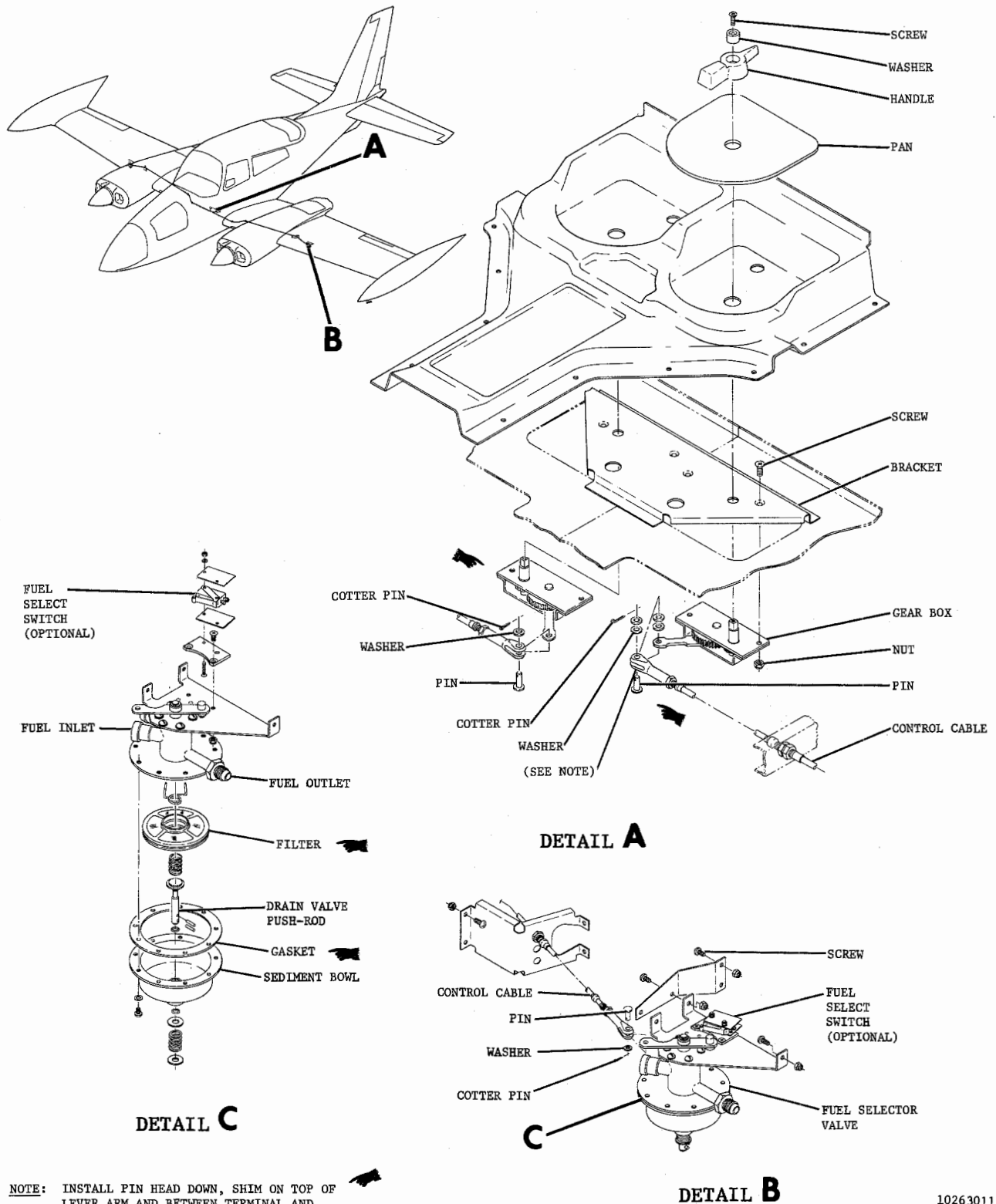
NOTE: Removal/Installation of the fuel selector gear box is same for either fuel selector gear box.

A. Remove Fuel Selector Gear Box.

- (1) Position fuel selector control handles to OFF.
- (2) Remove front seats and front carpet. Refer to Chapter 12.
- (3) Remove fuel selector control handles by removing screws and washers. Remove fuel selector pan.
- (4) Remove access covers forward of gear box. Refer to Chapter 1 for location.
- (5) Disconnect flex cable from gear box by removing pin, washer and cotter pin.

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Fuel Selector Control Installation
Figure 4

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MAINTENANCE MANUAL

- (6) Remove gear box from bracket by removing nuts and screws.

B. Install Fuel Selector Gear Box.

- (1) Attach gear box to bracket, using screws and nuts.
- (2) Connect flex cable to gear box lever, using pin, washer and cotter pin.
- (3) Check operation of system and rig fuel control system if necessary. Refer to Fuel Control System Adjustment/Test.
- (4) Install access covers on floorboard.
- (5) Place carpet into position and install fuel pan.
- (6) Install control handles, using washers and screws.
- (7) Install front seats.

8. Removal/Installation Fuel Selector Control Systems Flex Cable
(See Figure 4).

NOTE: Removal/Installation of the flex cables are the same for either cable.

A. Remove Flex Cable.

- (1) Position fuel selector control handles to OFF.
- (2) Remove front seats and carpet. Refer to Chapter 12.
- (3) Remove fuel selector control handles by removing screws and spacers. Remove fuel selector cover.
- (4) Refer to Chapter 1. Remove the access cover to fuel selector gear box, bottom and upper fuel selector valve access panel, wing to fuselage fairings and leading edge access panels as required.
- (5) Disconnect flex cable at the fuel selector gear box and valve by removing pins, washers and cotter pins.
- (6) Remove cable terminals and jam nuts and pull the cable out through the wing gap area.

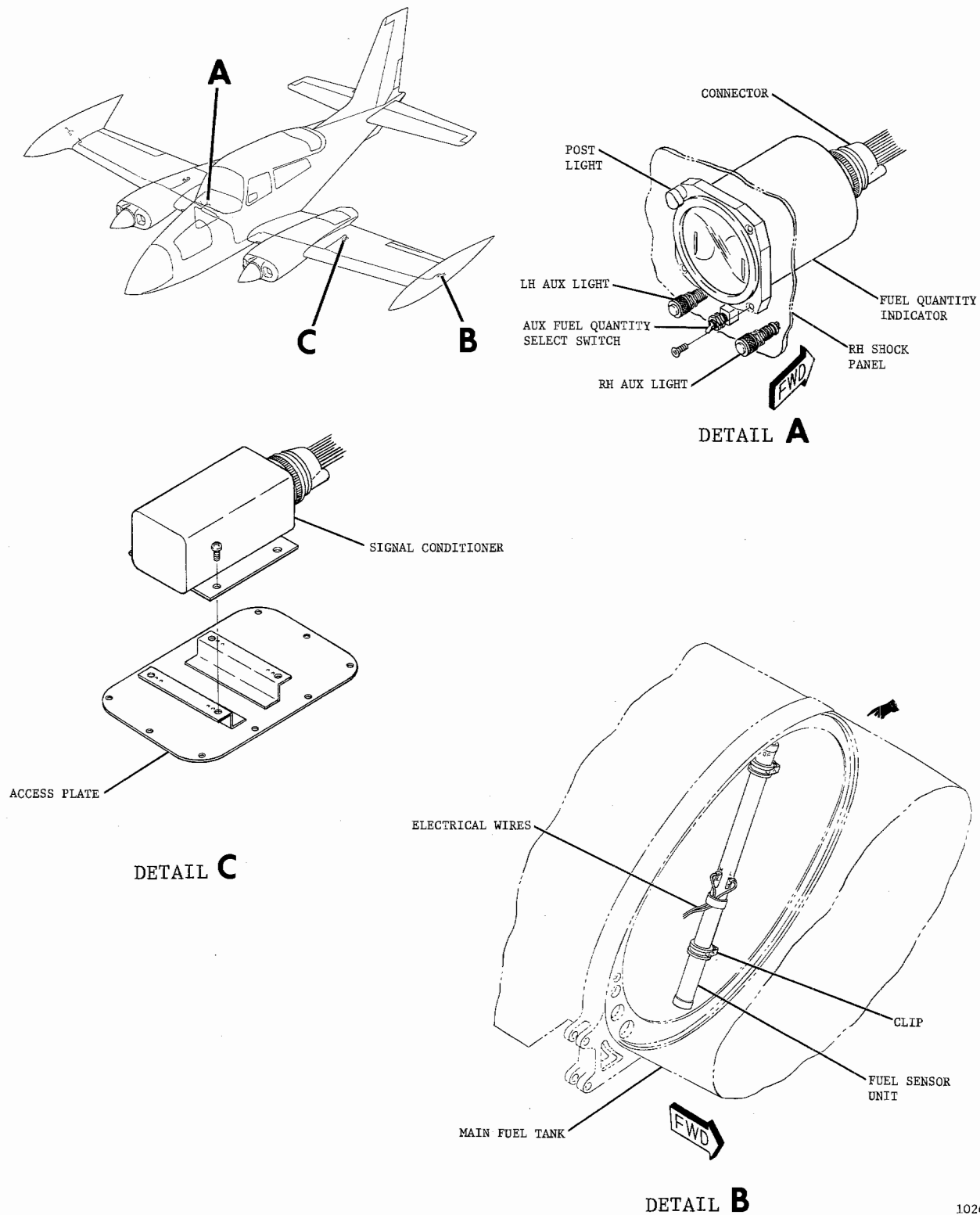
B. Install Flex Cables.

- (1) Route flex cable in wing and fuselage and install jam nuts at this time.
- (2) Connect the flex cable to the fuel selector gear box and valve, using pins, washers and cotter pins.
- (3) Rig the fuel control system. Refer to Fuel Control System Adjustment/Test.
- (4) Ensure flex cable jam nuts are tight.

NOTE: Support and security of the fuel selector flex cables is most essential to provide the optimum fuel selector valve operation. Inspect the fuel control valve support joints for adequate tightness and security.

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SERVICE MANUAL



Main Fuel Indicating System Installation
Figure 5

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MAINTENANCE MANUAL

- (5) Install all access covers, access panel and wing fairings.
- (6) Install carpet and fuel selector cover.
- (7) Install fuel control handle with spacers and screws.
- (8) Install front seats.

9. Removal/Installation Main Fuel Tank Sensor Unit (See Figure 5).

NOTE: Removal/Installation of the main fuel tank sensor unit is the same for either main tank.

A. Remove Fuel Sensor Unit.

- (1) Position fuel selector control handles to OFF.
- (2) Defuel applicable main fuel tank. Refer to Chapter 2.
- (3) (See Figure 2). Remove wing fairings and tail cap.
- (4) (See Figure 2). Disconnect fuel lines to transfer pump.
- (5) (See Figure 2). Remove access plate and gasket to gain access to fuel sensor.
- (6) Cut safety wire and pull the fuel sensor unit from the mounting clips.
- (7) Disconnect electrical wires and remove sensor unit.

B. Install Fuel Sensor Unit.

- (1) Connect electrical wires to sensor unit. Wire must route through cable strain relief.
- (2) Position sensor unit in mounting brackets and safety wire.
- (3) (See Figure 2.) Install gasket and access cover.
- (4) (See Figure 2.) Connect fuel lines to transfer pump.
- (5) Service main tank. Refer to Chapter 2.
- (6) Check for leaks.
- (7) Check fuel calibration. Refer to Fuel System Adjustment/Test.
- (8) Install tail cap and wing fairings.

10. Removal/Installation Fuel Signal Conditioner (See Figure 5).

NOTE: Removal/Installation for the signal conditioner is the same for either side.

A. Remove signal Conditioner.

- (1) Remove access plate on bottom surface of wing outboard of nacelle, refer to Chapter 1.
- (2) Disconnect electrical connector from signal conditioner.

- (3) Remove signal conditioner from access plate by removing nuts, washer, screws and bonding jumper.
 - B. Install Signal Conditioner.
 - (1) Assemble signal conditioner to access plate, using screws, washers, bonding jumper and nuts.
 - (2) Install electrical connector to signal conditioner.
 - (3) Check fuel calibration. Refer to Fuel System Adjustment/Test.
 - (4) Install access plate.
11. Removal/Installation Fuel Quantity Indicator (See Figure 5).
 - A. Remove Fuel Quantity Indicator.
 - (1) Remove the deck cover from the instrument panel. Refer to Chapter 10.
 - (2) Ensure electrical power is OFF.
 - (3) Disconnect the electrical connectors at the fuel indicator and post light.
 - (4) Remove post light and screws, securing fuel indicator to shock panel. Remove the fuel indicator.
 - B. Install Fuel Quantity Indicator.
 - (1) Position fuel indicator in shock panel, secure with post light and screws.
 - (2) Connect electrical connectors to fuel indicator and post light.
 - (3) Check calibration of fuel system. Refer to Fuel System Adjustment/Test.
 - (4) Install deck cover. Refer to Chapter 10.
12. Removal/Installation Fuel Vent Heater (See Figure 2).
 - A. Remove Fuel Vent Heater.
 - (1) Removal of the vent heater is not recommended if heater is removed, refer to installation procedures.
 - B. Install Fuel Vent Heater.
 - (1) Clean vent tube surface in the area where heater is to be installed with 280 grit sandpaper and Ketone (MEK).
 - (2) Bond vent heater to vent tube per dimensions shown, using epoxy cement Epon 834 with curing agent TTA in accordance with the manufacturer's instructions.
 - (3) Pot heater wires with Hysol EA9309 (Hysol Corp.) per manufacturer's instructions, to prevent damage.

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- (4) Connect heater electrical wires to aircraft wiring.
Refer to Chapter 13.
- (5) Check vent heater operation.

AUXILIARY FUEL SYSTEM (40 GALLON)Description

1. The auxiliary fuel system (optional) consists of: A rubber fuel cell, just outboard of the nacelle of each wing; two fuel sensor units, one in each fuel cell; a fuel drain in each fuel cell; fuel filler caps, fuel select switch, override switch and necessary plumbing. The auxiliary fuel system plumbing connects to the fuel selector valve in each wing and the system is vented by plumbing to each wing main tank. The fuel select switches are mounted on a bracket on top of each fuel selector valve. When the fuel selector control handles are positioned to Auxiliary, the fuel select switches will actuate and illuminate the corresponding auxiliary fuel indicator light, regardless of the position of the fuel indicating override switch. The fuel indicating override switch is mounted on the instrument panel. The switch is normally positioned to OFF and has two momentary positions Main and Aux. The override switch is utilized in the system to provide a means for reading Auxiliary fuel quantity when the fuel selector control handles are in main or reading main fuel quantity when the fuel select control handle are in Auxiliary position.

Troubleshooting

NOTE: For troubleshooting the auxiliary fuel system, refer to Fuel System Troubleshooting.

Adjustment/Test

NOTE: For adjustment/test of auxiliary fuel system, refer to Fuel System Adjustment/Test.

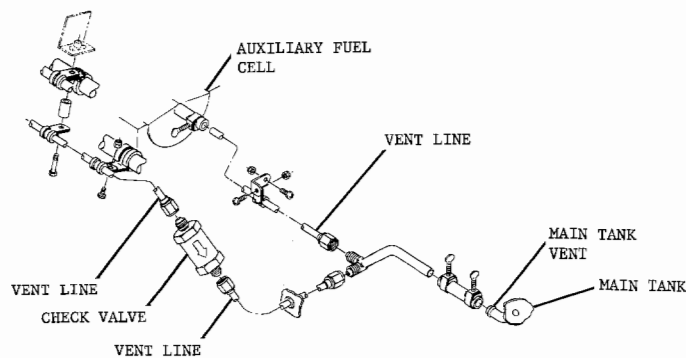
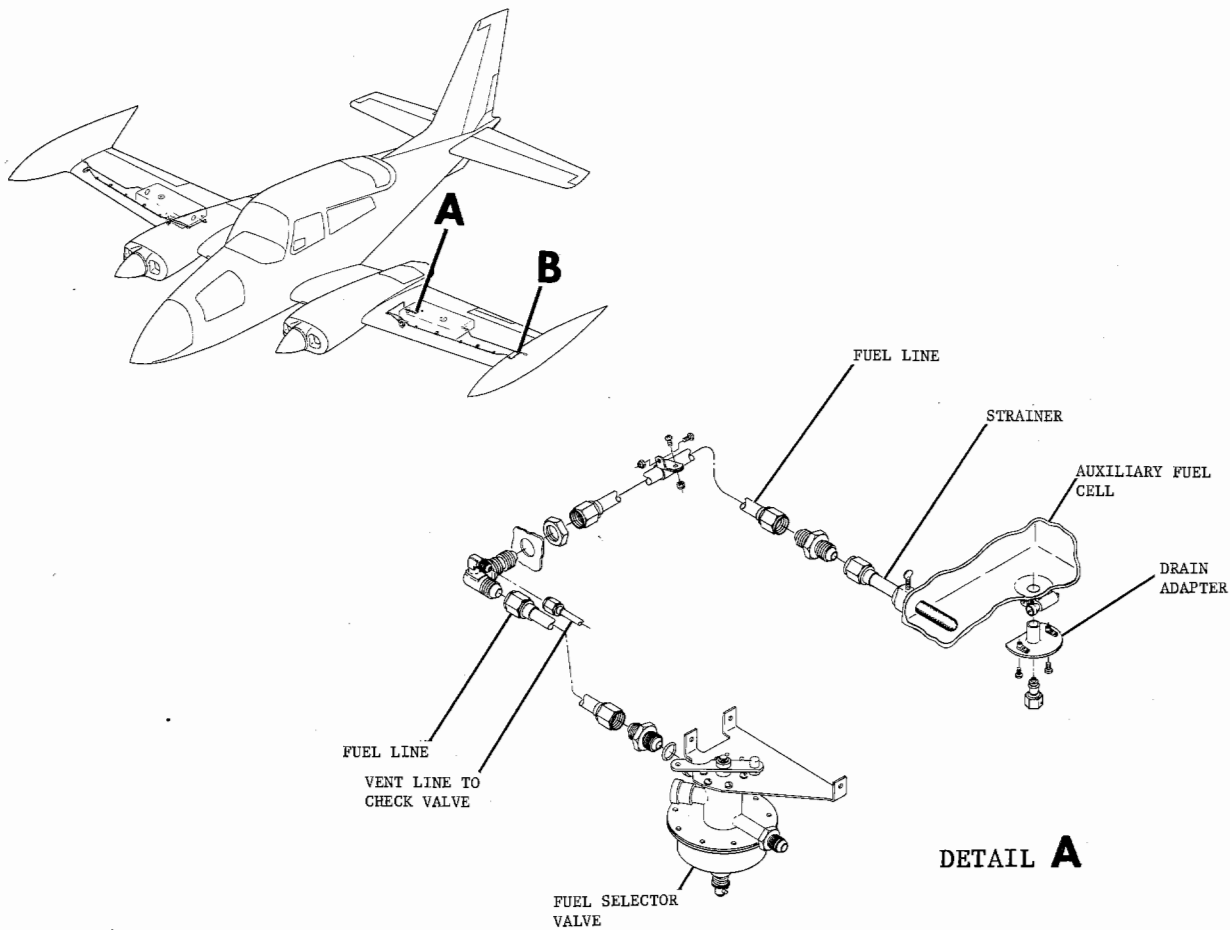
Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN THE WING.

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MAINTENANCE MANUAL



DETAIL B

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Auxiliary Fuel System (40 Gallon) and Plumbing Installation
Figure 1

NOTE: During removal/installation of fuel system components, all openings or fittings shall be capped or plugged.

1. Removal/Installation Auxiliary Fuel Cell (See Figure 2).

NOTE: Removal/Installation procedures are the same for either fuel cell. However, on the left side the battery box must be removed.

A. Remove Auxiliary Fuel Cell.

- (1) Position fuel selector control handles to OFF.
- (2) Defuel wing affected. Refer to Chapter 2.
- (3) Refer to Chapter 1. Remove access panels to gain access to fuel selector valve, sensor unit, and other wing access panels as required to gain access to fuel plumbing connections.
- (4) Remove the fuel cap assembly and gasket by removing the attaching screws.
- (5) Remove the fuel sensor unit. Refer to Removal/Installation Fuel Sensor Unit.
- (6) Remove the flange at outboard end of fuel cell by removing nuts, washers, doubler, gasket and flange (with electrical cable attached).
- (7) (See Figure 1.) Loosen clamps and disconnect fuel strainer and vent line from fuel cell.
- (8) (See Figure 1.) Remove the screws, securing the drain adapter to the lower skin.
- (9) Disconnect the fuel cell fasteners and remove the fuel cell through the upper wing opening, vacated by the fuel cap assembly.
- (10) If repair of the fuel cell is desired, refer to Fuel Cell Repair.

B. Install Auxiliary Fuel Cell.

NOTE: Inspect gaskets for damage prior to installation, if necessary replace.

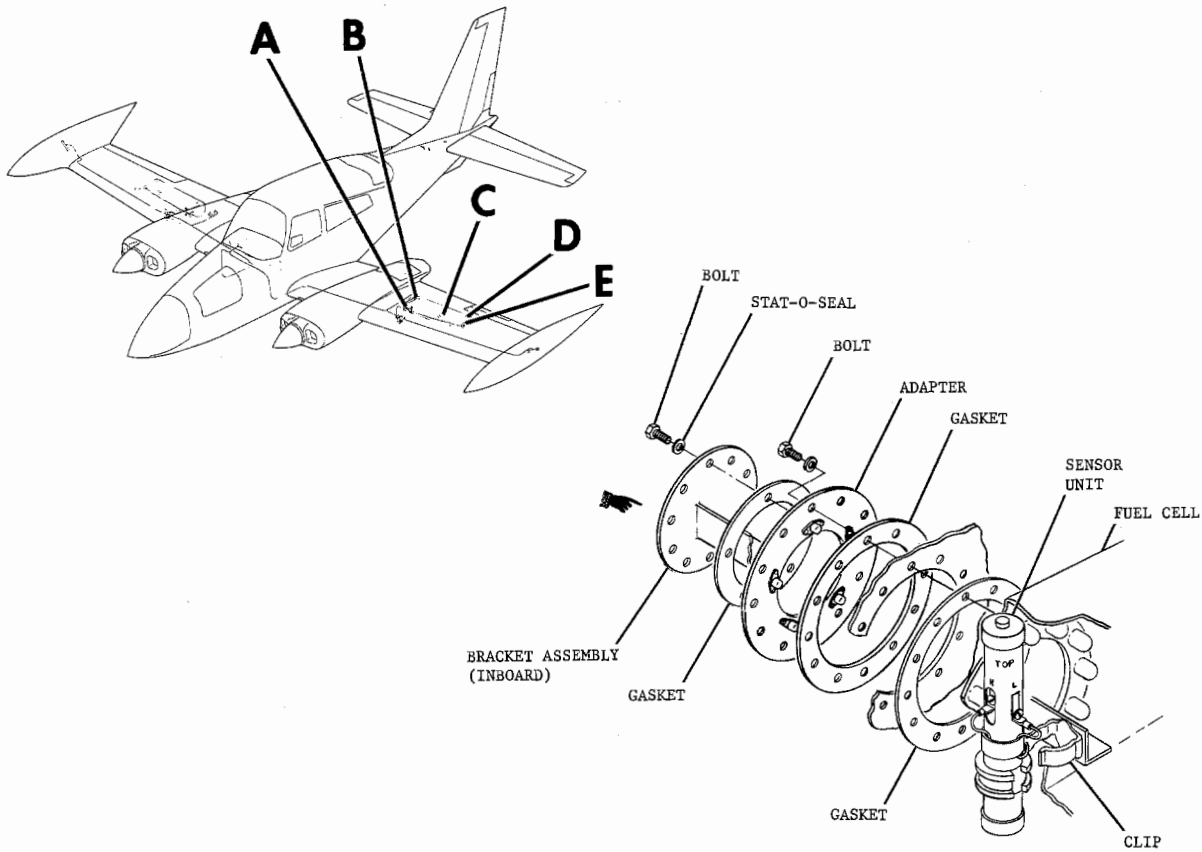
- (1) Before installing the fuel cell, inspect carefully the interior of the fuel cell cavity and cell bulkheads or supports for possible damage or corrosion.

NOTE: All internal rivets and protrusions must be protected by the proper type tape (one inch wide P/N Y9265 3M Co. or equivalent).

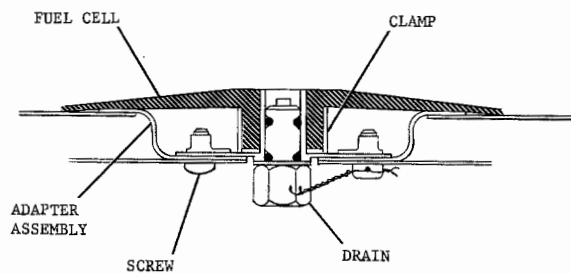
- (2) Ensure drain assembly is installed on tank and secured with clamp.
- (3) Insert fuel cell through fuel cap assembly opening. Arrange the cell in the correct position.

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SERVICE MANUAL



DETAIL A



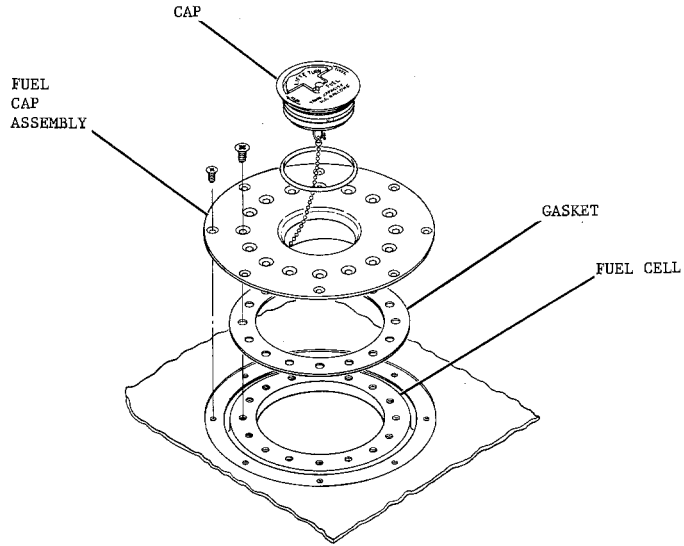
DETAIL B

Auxiliary Fuel Cell Installation
Figure 2 (Sheet 1 of 2)

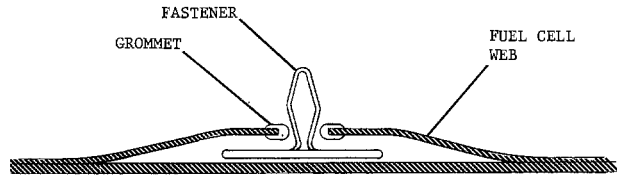
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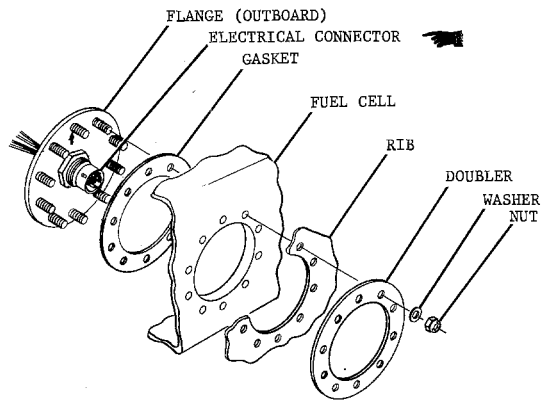
SERVICE MANUAL



DETAIL C



DETAIL D



DETAIL E

Auxiliary Fuel Cell Installation
Figure 2 (Sheet 2)

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- (4) Secure the fuel cell in place with fasteners.
- (5) (See Figure 1.) Attach drain assembly to the lower wing skin with screws.
- (6) Install fuel strainer and vent line to fuel cell with clamps.
- (7) Install flange (with electrical cable attached) in the outboard fuel cell opening, using gasket, doubler, washers and nuts.
- (8) Install fuel sensor unit. Refer to Fuel Sensor Unit Removal/Installation.
- (9) Install fuel cap assembly, using gasket and screws.
- (10) Check fuel calibration. Refer to Fuel System Adjustment/Test.
- (11) Refer to Chapter 2. Service the fuel system and leak check.
- (12) Install access panels.

2. Removal/Installation Fuel Sensor Unit. (See Figure 2).

NOTE: Removal/Installation procedures are the same for either fuel sensor unit. However, on the left side the battery box must be removed.

A. Remove Fuel Sensor Unit.

- (1) Refer to Chapter 1. Remove access panels, just outboard of engine nacelle, forward of inboard end of aileron.
- (2) Position fuel selector control handles to OFF.
- (3) Defuel applicable wing. Refer to Chapter 2.
- (4) Remove fuel cap assembly by removing screws and gasket.
- (5) Reach inside fuel cell and remove sensor unit from bracket mount.
- (6) Disconnect electrical wires from sensor unit and remove sensor unit.
- (7) To remove inboard bracket assembly and adapter plate proceed as follows:
 - (a) Remove bracket assembly by removing bolts and gasket.
 - (b) Remove adapter plate by removing bolts and gaskets.

B. Install Fuel Sensor Unit.

- (1) Install inboard bracket assembly and adapter plate as follows:
 - (a) Install adapter plate to fuel cell, using gaskets and bolts. Torque bolts to 50 ± 5 inch-pounds.
 - (b) Assemble bracket assembly to adapter plate, using gasket, stat-o-seals and bolts.

- (2) Connect electrical wires to proper terminals (Marked) on sensor unit. Ensure wires are routed through the clamp strain relieve.
- (3) Insert sensor unit into fuel cell and mount on bracket assembly clip. Ensure sensor unit is positioned properly in clip.
- (4) Assemble fuel cap assembly to fuel cell, using gasket and screws.
- (5) Calibrate the fuel system. Refer to Fuel System Adjustment/Test.
- (6) Service fuel system, refer to Chapter 2. Check for leaks.
- (7) Install battery box, if removed and all access panels.

3. Fuel Cell Repair.

A. Repair Fuel Cell (See Figure 3).

- (1) The fuel cells installed in the wings are a bladder-type, known as Construction BTC-39, manufactured by Goodyear Tire and Rubber Company. Cold patch repair procedures are approved repair practices of Vithane BTC-39 fuel cells. These procedures apply only to BTC-39 fuel cells and deviations from these procedures should not be permitted.

CAUTION: REPAIR OF THE BTC-39 VITHANE FUEL CELLS IS RESTRICTED TO AUTHORIZED PERSONNEL, AND/OR THOSE CERTIFIED OR APPROVED BY FACTORY TRAINED SCHOOLS.

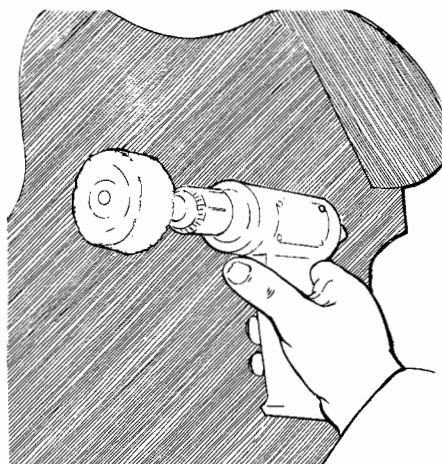
- (2) Tools and equipment.

Name	Number	Manufacturer	Use
Repair Kit	2F1-3-35342	Cessna Aircraft Co.	Repair fuel cells.
Paint Brush	1-inch diameter	Commercially Available	Apply cement.
Roller	1-inch diameter x 3/4-inch flat, or equivalent	Commercially Available	Apply pressure to patch area.

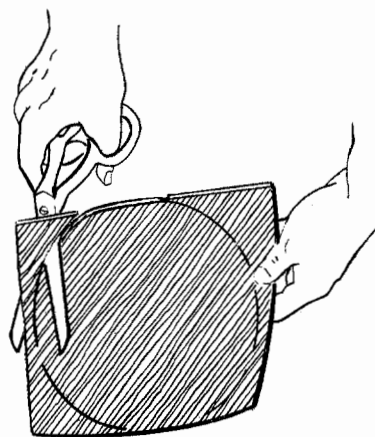
NOTE: Kit available thru Cessna Service Parts Center.

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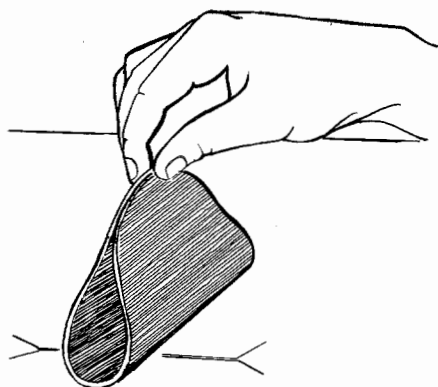
MAINTENANCE MANUAL



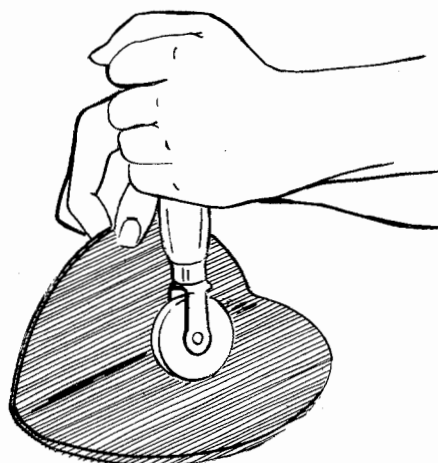
BUFFING WITH AIR DRILL



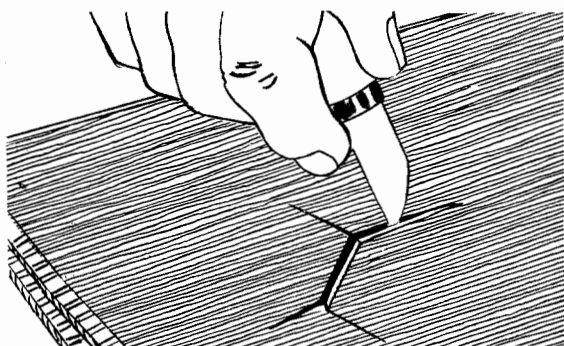
FABRICATION OF PATCH



CENTERING PATCH OVER INJURY



USE OF ROLLER STITCHER



REPAIR OF BLISTERS



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Fuel Cell Repair
Figure 3

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- (3) Repair Kit Components.
 - (a) 2331 Repair Cement (1/2 pint cans, 173 cc in each can).
 - (b) 2328C Cross-linker (1 Oz. bottle, 28 cc in each bottle).
 - (c) Methyl Ethyl Ketone (1 pint cans).
 - (d) FT-160 Repair Fabric (Sheet 12 x 12 inches).
 - (e) Cellophane (Sheet 12 x 24 inches).
 - (f) Foam rubber, cloth back (Sheet 12 x 12).
- (4) Repair Limitations.

WARNING: REPAIR AREA MUST BE WELL VENTILATED
AND NO OPEN FLAME OR SMOKING IN AREA
OF FUEL CELL REPAIR.

NOTE: The repair should be made on a well
lighted table and natural contours
maintained if possible. Prevent cell
from contact with sharp edges, corners,
dirty floors or other surfaces.

- (a) FT-160 repair fabric is for repair of simple contours only. Patches, referred to in these procedures are of this material.
 - (b) Inside patches are to lap defect edges two inches (2") in each direction.
 - (c) Outside patches are to lap two and one-quarter inches (2-1/4") in each direction.
 - (d) Outside patches are to be applied and cured prior to applying an inside patch.
 - (e) Blisters between interliner and fabric larger than 1/4" in diameter, require an outside and an inside patch.
 - (f) Separations between outer plies larger than one-inch (1") in diameter require an outside and inside patch. Holes and punctures require an outside and inside patch.
 - (g) Slits and tears, up to three-inches (3") maximum length, require an outside and inside patch.
 - (h) External abraided or scuffed areas, without fabric damage, require an outside patch only.
 - (i) A loose lap may be trimmed, provided that a one-inch (1") effective bond remains.
 - (j) Air cure repair patches are to remain clamped and undisturbed for 72 hours at room temperature of approximately 75°F.
- (5) Repair Patch.
 - (a) Prepare exterior cell wall and exterior patch first. Cut repair patch from FT-160 material to size required to insure proper lap over injury in all directions in accordance with Repair Limitations. Hold shears at an angle to

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produce a beveled edge (feather) on patch when cutting patch. Round corners of patch. Dull side or gum contact face of repair patch should be the largest surface after beveling.

- (b) Wash one square foot of cell wall surrounding injury, and repair patch contact side with a clean cloth soaked with Methyl Ethyl Ketone solvent.
- (c) Abrade cell wall surface about injury and contact side of patch with fine emery cloth or emery buffer wheel to remove shine.
- (d) Repeat Methyl Ethyl Ketone washings two more times. A total of three washings each surface.
- (e) Tape a piece of cellophane inside cell over injury.
- (f) When all the above preparatory work has been completed, and all has been positioned for patch application on repair table, mix the 2331C cement (173 cc) with the cross-linker 2328C (28 cc), and stir mixture thoroughly.
- (g) Brush one even coat of mixed repair cement on the cell wall around injury and on the contact side of repair patch. Allow to dry for twenty minutes.
- (h) Repeat a second mixing of repair cement and brush on a second coat.

CAUTION: DO NOT USE FIRST CAN OF MIXED CEMENT FOR THIS COAT.

- (i) Allow cement to dry approximately ten minutes and then center patch over injury as shown in figure.
- (j) Lay repair patch by rolling down on surface from center of edge without trapping air. Hold the unrolled portion of repair patch off the cemented surface until roller contact insures an air-free union. At this time repair patch may be moved by hand on wet surface to improve lap. Do not lift repair patch, slide it.

CAUTION: MAKE SURE CELLOPHANE INSIDE CELL OVER INJURY REMAINS IN PLACE, BECAUSE ANY CEMENT WILL STICK CELL WALLS TOGETHER WITHOUT IT AS A SEPARATOR.

- (k) Cover one smooth surface each of two aluminum plates (plates must be larger than patch, with 1/4" fabric-backed airfoam, fabric side out. Tape airfoam in place. Foam must cover edges of plate for protection.

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- (l) Fold cell adjacent to patch and place prepared plates, one over repair patch, and one on opposite side.
- (m) Secure the assembly with a "C" clamp, tighten by hand. Check cement flow to determine pressure.

CAUTION: MAKE SURE THAT CELL FOLD IS NOT CLAMPED BETWEEN PLATES. THIS WOULD CAUSE A HARD PERMANENT CREASE. ALSO, BE SURE PATCH DOES NOT MOVE WHEN CLAMP IS TIGHTENED.

- (n) Inside patch is applied in the same manner as the outside patch. See Repair Limitations paragraph for size of inside patch, after outside patch has been cured.

CAUTION: SUCCESS OF APPLYING BOTH AN OUTSIDE AND INSIDE REPAIR SIMULTANEOUSLY IS DOUBTFUL AND NOT RECOMMENDED.

(6) Metal Fitting - Sealing Surfaces.

- (a) Rub off roughness of effected area with a fine file, emery cloth or emery wheel as shown in figure.
- (b) Clean metal surfaces using a clean cloth dipped in Methyl Ethyl Ketone. Moisten cleaned surface with clean cloth dipped in water. Apply Alodine 1200 solution, undiluted, to the affected area with a small nylon brush. Allow solution to dry until a light golden color appears. When coating has been formed, remove excess solution by wiping with a clean water-moistened cloth. Wipe dry.

WARNING: DO NOT ALLOW SOLUTION TO COME IN CONTACT WITH HANDS, EYES OR CLOTHING.

(7) Accessory Replacement.

- (a) Obtain cured repair accessory from manufacturer.
- (b) Mark location of old accessory and preserve marking for guide lines to locate new part.
- (c) Remove old accessory by gradually loosening an edge with a blunt probe-like instrument.
- (d) When an edge is loose, grasp accessory by loose edge with pliers and gently pull accessory off fuel cell wall. Be careful not to pull cell

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lap open while peeling accessory off. Pull from blind side of cell lap toward the exposed edge.

- (e) Buff the cell surface under accessory with emery cloth or emery buffer wheel to smooth roughness and prepare for cement.

NOTE: Removal of accessory may leave an uneven cavity and surface. The surface under accessory should be buffed even and smooth.

- (f) Prepare replacement accessory by buffing and washing contact surface. Also wash cell surface (see Repair Patch paragraph).
 - (g) Apply mixed 2331C repair cement to both surfaces.
 - (h) Roll new accessory into place as with a repair patch and place suitable padded plates in position to insure adequate pressure when clamped. Use cellophane separator to prevent cement sticking in wrong places.
 - (i) Cure as with repair patch procedure cure method.
- (8) Defects Repair.
- (a) Blisters.
 - 1) Remove loose material by buffing or trimming. Apply an outside and inside patch.
 - (b) Holes, punctures, cuts, tears and deep abraded areas.
 - 1) Trim away any ragged material and apply an outside and inside repair patch.
 - (c) Loose seams.
 - 1) Buff loose edge and contact surface. Wash three times with MEK. Apply 2331C mixed cement, two coats, as with repair patch. Clamp and cure. Loose seams may be trimmed if minimum lap remains.
 - (d) Loose fitting flange - Inside.
 - 1) Buff edge of flange and contact surface under flange.
 - 2) Apply 2331C mixed repair cement, cellophane padded plates and clamp.
 - 3) Follow procedure as outlined for repair patch except patch itself.
 - (e) Missing coat.
 - 1) Buff surface.
 - 2) Wash three times with MEK.
 - 3) Apply 2331C mixed cement two coats as with repair patch.
 - 4) Clamp and cure.

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- (f) Looseness against metal.
 - 1) Prepare metal as per metal fitting-sealing surface.
 - 2) Apply 2331C mixed cement and cure.
- (9) Testing.
 - (a) Attach test plates to all fittings.
 - (b) Inflate the cell with air to a pressure of 1/4 PSI maximum.
 - (c) Apply soap suds to patched area and check for leaks.

AUXILIARY FUEL SYSTEM (63 GALLON)Description

1. The auxiliary fuel system (optional) consists of: Two auxiliary fuel cells, located outboard of each wing nacelle; three fuel sensor units (two in the inboard fuel cell and one in the outboard fuel cell); fuel filler caps, fuel select switch, override switch, fuel drains (inboard fuel cell), and necessary plumbing. The auxiliary fuel system plumbing connects the two fuel cells of each wing together, then routes the fuel from the inboard fuel cell to the corresponding fuel selector valve. The system is vented by plumbing to each wing main tank. At the inboard fuel cell bottom surface a drain valve is utilized to drain residual fuel from the cell. The fuel select switches are mounted on a bracket on top of each fuel selector valve. When the fuel selector control handles are positioned to Auxiliary, the fuel select switches will actuate and illuminate the corresponding auxiliary fuel indicator light regardless of the position of the fuel indicating override switch. The fuel indicating override switch is mounted on the instrument panel. The switch is normally positioned to OFF and has two momentary positions, Main and Aux. The override switch is utilized in the system to provide a means for reading Auxiliary fuel quantity, when the fuel selector control handles are in main or reading Main fuel quantity when the fuel select control handles are in Auxiliary position.

Troubleshooting

NOTE: For troubleshooting the auxiliary fuel system, refer to Fuel System Troubleshooting.

Adjustment/Test

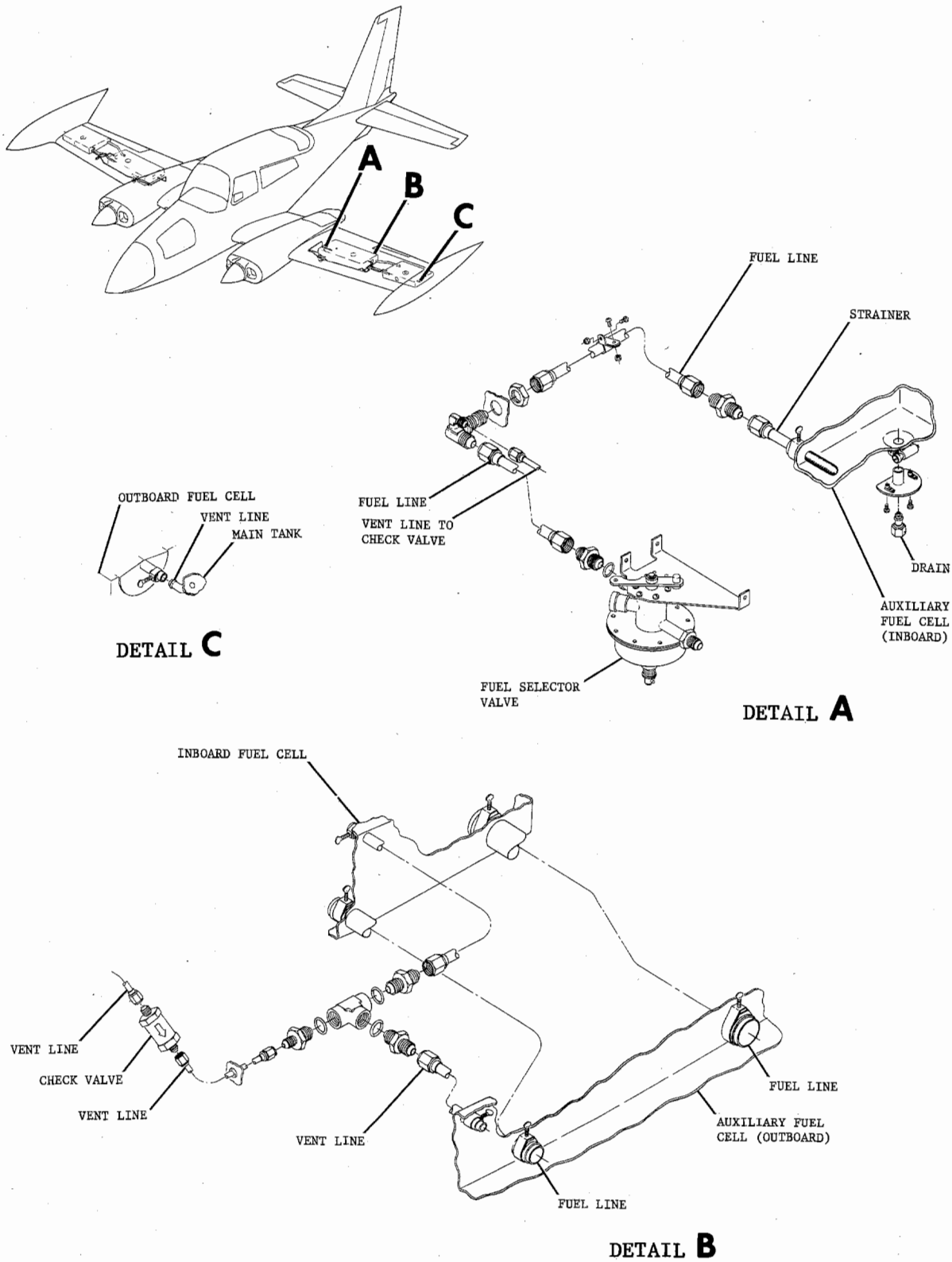
NOTE: For adjustment/test of auxiliary fuel system, refer to Fuel System Adjustment/Test.

Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

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MAINTENANCE MANUAL



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A10262011
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Auxiliary Fuel System (63 Gallon) and Plumbing Installation
Figure 1

WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN THE WING.

NOTE: During removal/installation of fuel system components, all openings or fittings shall be capped or plugged.

1. Removal/Installation Inboard Auxiliary Fuel Cell (See Figure 2).

NOTE: Removal/Installation procedures are the same for either fuel cell. However, on the left side the battery box must be removed.

A. Remove Inboard Fuel Cell.

- (1) Position fuel selector control handles to OFF.
- (2) Defuel applicable wing. Refer to Chapter 2.
- (3) Refer to Chapter 1. Remove access panels to gain access inboard and outboard sensor units, fuel selector valve, and other wing access panels as required to gain access to fuel plumbing connections.
- (4) Remove inboard fuel cell cover plate by removing screws and gasket.
- (5) Remove the fuel sensor units. Refer to Removal/Installation Fuel Sensor Units.
- (6) (See Figure 1.) Loosen clamps and disconnect strainer, vent line and fuel lines from fuel cell.
- (7) Remove the screws, securing the drain assembly adapter to the lower skin.
- (8) Disconnect the fuel cell fasteners and remove the fuel cell through cover plate opening.
- (9) If repair of the fuel cell is desired, refer to Fuel Cell Repair.

B. Install Inboard Fuel Cell.

NOTE: Inspect gaskets for damage prior to installation, if necessary replace.

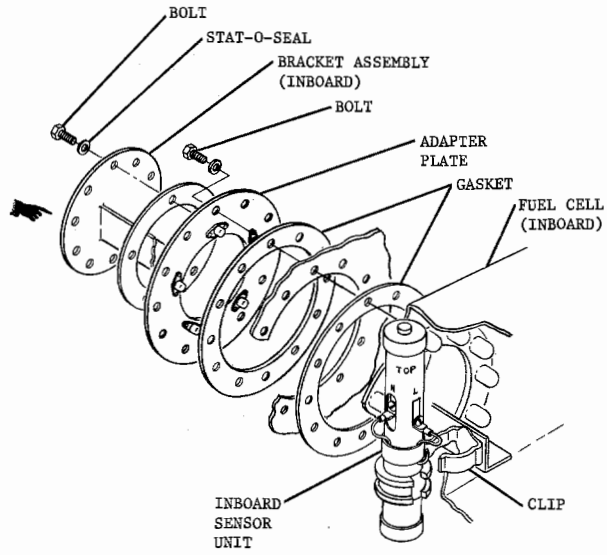
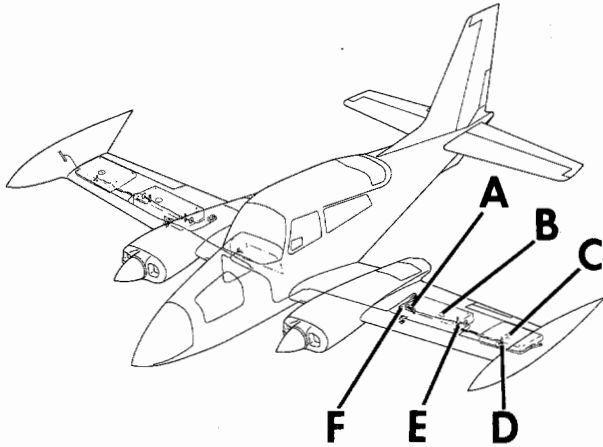
- (1) Before installing the fuel cell, inspect carefully the interior of the fuel cell cavity and cell bulkheads or supports for possible damage or corrosion.

NOTE: All internal rivets and protrusions must be protected by the proper type tape (one inch-wide P/N Y9265 3M Co. or equivalent).

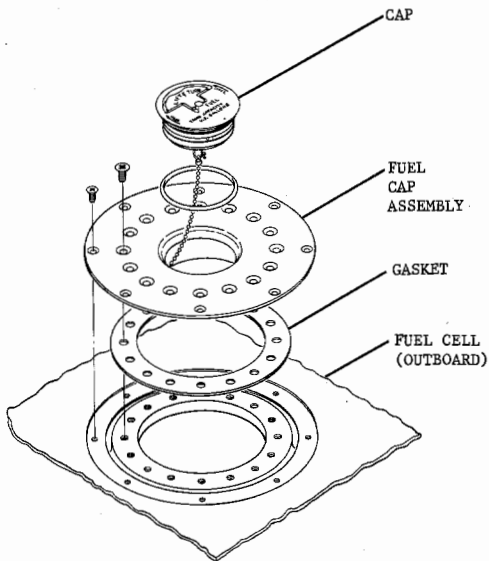
- (2) Ensure drain assembly is installed on tank and secure with clamp.

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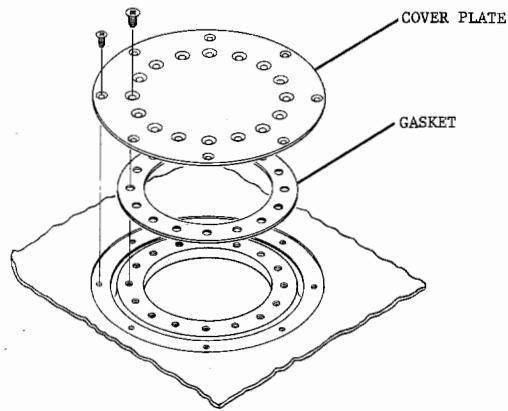
SERVICE MANUAL



DETAIL A



DETAIL C



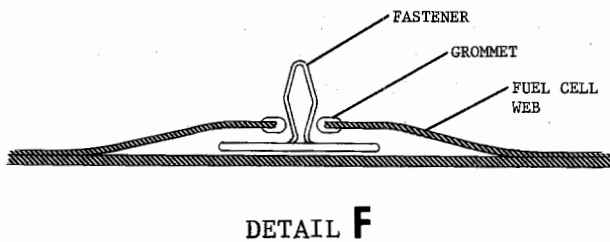
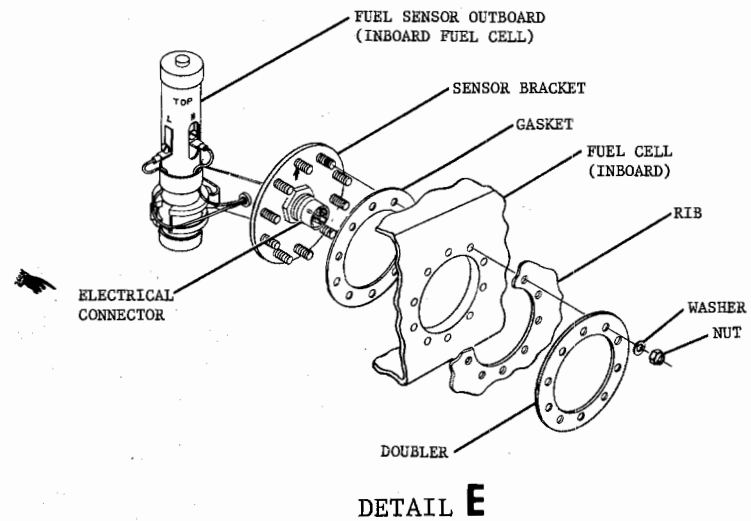
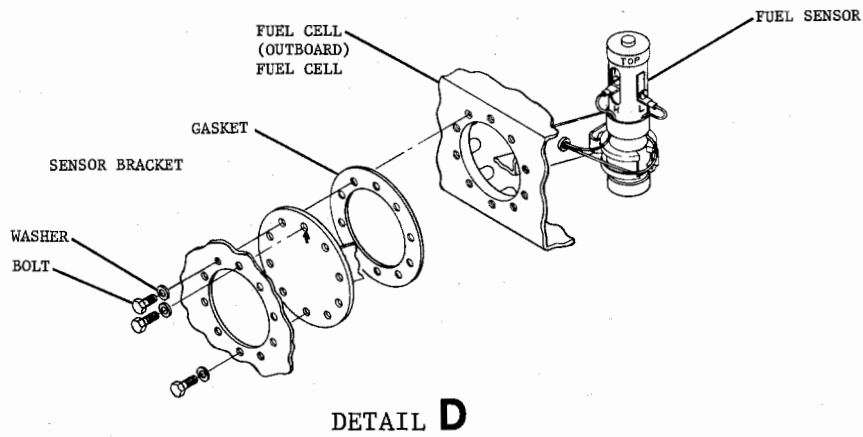
DETAIL B

Auxiliary Fuel Cell (63 Gallon) Installation
Figure 2 (Sheet 1 of 2)

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A10261021
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Auxiliary Fuel Cell (63 Gallon) Installation
Figure 2 (Sheet 2)

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- (3) Insert fuel cell through cover plate opening. Arrange the fuel cell in the correct position.
- (4) Secure the fuel cell in place with fasteners.
- (5) (See Figure 1.) Attach drain assembly to the lower wing skin with screws.
- (6) Install strainer, vent lines and fuel lines to fuel cell with clamps.
- (7) Install fuel sensor units. Refer to Fuel Sensor Unit Removal/Installation.
- (8) Install cover plate, using gasket and screws.
- (9) Check fuel calibration. Refer to Fuel System Adjustment/Test.
- (10) Refer to Chapter 2. Service the fuel system and leak check.
- (11) Install access panels.

2. Removal/Installation Outboard Auxiliary Fuel Cell (See Figure 2).

NOTE: Removal/Installation procedures are the same for either fuel cell.

A. Remove Outboard Fuel Cell.

- (1) Position fuel selector control handles to OFF.
- (2) Defuel applicable wing. Refer to Chapter 2.
- (3) Refer to Chapter 1. Remove wing access panels and fairings to gain access to outboard fuel cell sensor, and to fuel plumbing as necessary.
- (4) Remove fuel cap assembly by removing screws and gasket.
- (5) Remove the fuel sensor unit. Refer to Removal/Installation Fuel Sensor Units.
- (6) (See Figure 1.) Loosen clamps and disconnect vent lines and fuel lines from the fuel cell.
- (7) Disconnect the fuel cell fasteners and remove the fuel cell through the fuel cap assembly opening.
- (8) If repair of the fuel cell is desired, refer to Fuel Cell Repair.

B. Install Outboard Fuel Cell.

NOTE: Inspect gaskets for damage prior to installation, if necessary replace.

- (1) Before installing the fuel cell, inspect carefully the interior of the fuel cell cavity and cell bulkheads or supports for possible damage or corrosion.

NOTE: All internal rivets and protrusions must be protected by the proper type tape (one-inch wide P/N Y9265 3M Co. or equivalent).

- (2) Carefully insert fuel cell through the fuel cap assembly opening. Arrange the fuel cell in the correct position.
- (3) Secure the fuel cell in place with fasteners.
- (4) Connect the vent lines and fuel lines to the fuel cell and secure with clamps.
- (5) Install the fuel sensor unit. Refer to Removal/Installation Fuel Sensor Units.
- (6) Install the fuel cap assembly, using gasket and screws.
- (7) Check fuel calibration. Refer to Fuel System Adjustment/Test.
- (8) Refer to Chapter 2. Service the fuel system and leak check.
- (9) Install all access panels and main tank fairings.

3. Removal/Installation Fuel Sensor Units (See Figure 2).

NOTE: Removal/Installation procedures are the same for left and right-hand fuel sensor units. However, on the left-hand inboard fuel sensor the battery box must be removed.

A. Remove Fuel Sensor Units.

- (1) Position fuel selector control handles to OFF.
- (2) Defuel applicable wing. Refer to Chapter 2.
- (3) Refer to Chapter 1. Remove wing access panel to gain access to fuel sensors in inboard fuel and outboard fuel cell as required.
- (4) Remove inboard fuel cell sensor units as follows:
 - (a) Remove inboard fuel cell cover plate by removing screws and gasket.
 - (b) Reach inside the fuel cell and remove inboard sensor unit from bracket assembly. Disconnect electrical wires from the sensor unit and remove sensor unit.
 - (c) Remove inboard bracket assembly by removing bolts and gaskets.
 - (d) Remove adapter plate by removing bolts and gaskets.
 - (e) Reach inside the fuel cell and remove the outboard fuel sensor unit from the sensor bracket. Disconnect electrical wires from the sensor unit and remove sensor unit.
 - (f) Remove sensor bracket by removing nuts, washers, doubler and gasket. Disconnect electrical

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- connector from bracket and remove the bracket.
- (5) Remove outboard fuel cell sensor unit as follows:
- (a) Remove fuel cap assembly by removing screws and gasket.
 - (b) Reach inside the fuel cell and remove the sensor unit from the sensor bracket. Disconnect the electrical wire from the sensor and remove sensor unit.
 - (c) Remove sensor bracket by removing bolts, washers and gasket.

B. Install Fuel Sensor Units.

NOTE: Inspect gaskets for damage prior to installation, if necessary replace.

- (1) Install outboard fuel cell sensor unit as follows:
 - (a) Assemble sensor bracket to fuel cell and structure, using bolts, washers and gasket.
 - (b) Route electrical wires through strain relief clamp on sensor unit and connect wires to sensor. Mount the sensor unit in the sensor bracket.
 - (c) Assemble fuel cap assembly to fuel cell, using screws and gasket.
- (2) Install inboard fuel cell sensor units as follows:
 - (a) Connect electrical connector to outboard sensor bracket, using gasket and nut.
 - (b) Assemble sensor bracket to fuel cell and structure, using gasket, doubler, washers and nuts.
 - (c) Route electrical wires through strain relief clamp on sensor unit and connect wires to sensor. Mount the sensor unit in the sensor bracket.
 - (d) Assemble adapter plate to fuel cell using bolts and gaskets. Torque bolts to 50 ± 5 inch-pounds.
 - (e) Assemble bracket assembly to adapter plate, using bolts, stat-o-seals and gasket.
 - (f) Route electrical wire through strain relief on sensor unit and connect wires to sensor. Mount the sensor unit in the bracket assembly.
 - (g) Assemble cover plate to fuel cell; using screws and gasket.
- (3) Calibrate the fuel system. Refer to Fuel System Adjustment/Test.
- (4) Refer to Chapter 2. Service the fuel system and leak check.
- (5) Install all access panels.

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WING LOCKER FUEL SYSTEMDescription

1. The wing locker fuel system (optional) consists of: a fuel cell (total capacity of 20.3 U.S. gallons each wing) mounted in the forward portion of each wing locker; an electrically operated, manually controlled fuel transfer pump; a pressure switch to control the panel indicating lights and transfer switches; a drain valve, check valve, vent, heater, and necessary plumbing. There are no separate fuel selector controls or fuel quantity indicator for the wing locker fuel system. Fuel is pumped directly into the corresponding wing main fuel tank with independent fuel transfer pumps. There are no fuel return lines installed in the wing locker fuel system; therefore, it is necessary the aircraft be flown with the fuel selector control handles on MAIN until thirty gallons of fuel remains in the main tanks, before transferring fuel from the wing locker fuel cells. Switches are provided on a panel mounted on the instrument panel to control the individual wing locker fuel transfer pumps. Individual indicator lights (press to test) are mounted directly below each transfer switch. The indicator light for each wing locker fuel cell will illuminate, indicating that fuel from that fuel cell has been transferred when the fuel pressure from that fuel cell drops actuating the fuel pressure switch.

Troubleshooting

NOTE: For troubleshooting the wing locker fuel system, refer to Fuel System Troubleshooting.

Adjustment/Test

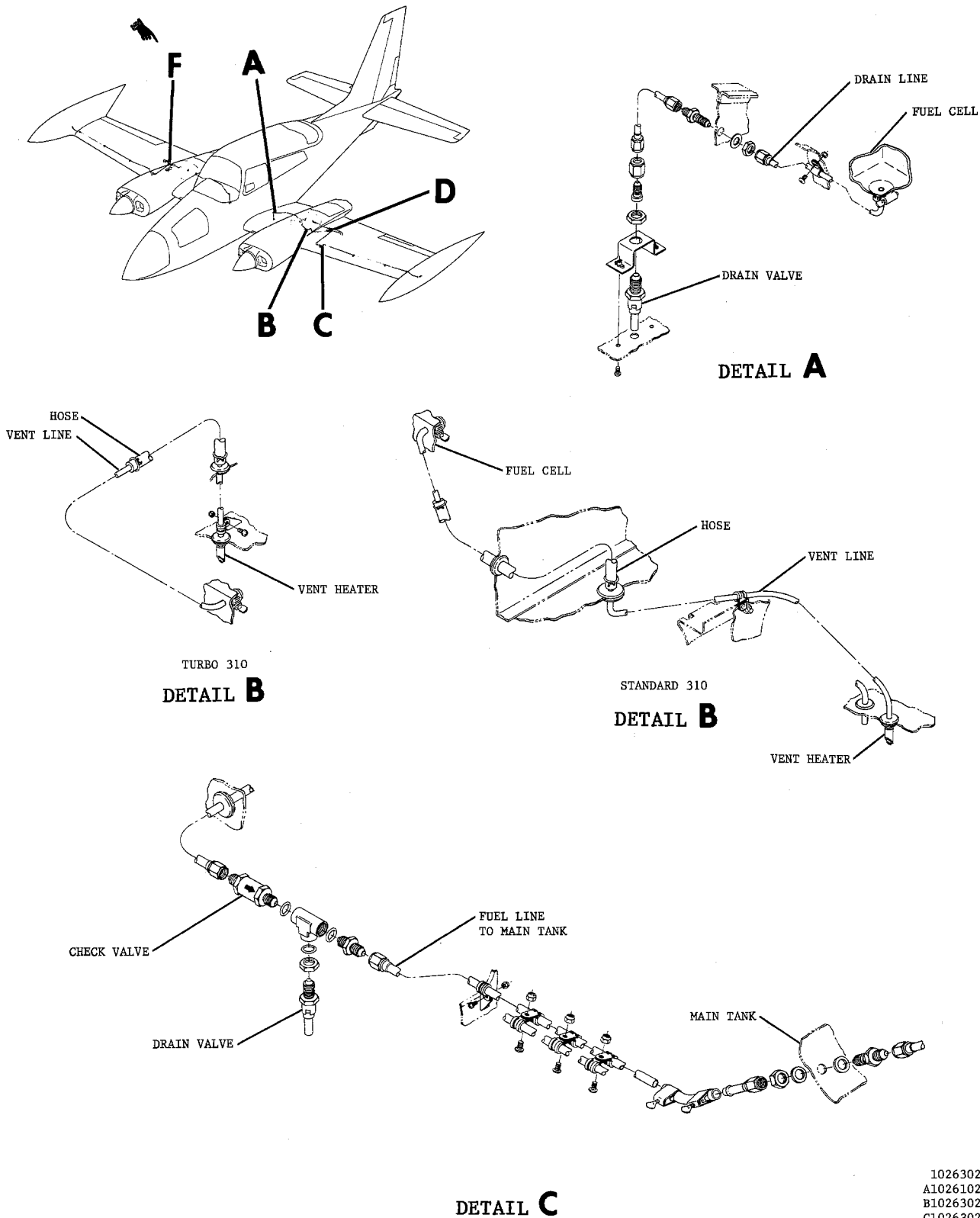
NOTE: For adjustment/test of wing locker fuel system, refer to Fuel System Adjustment/Test.

Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

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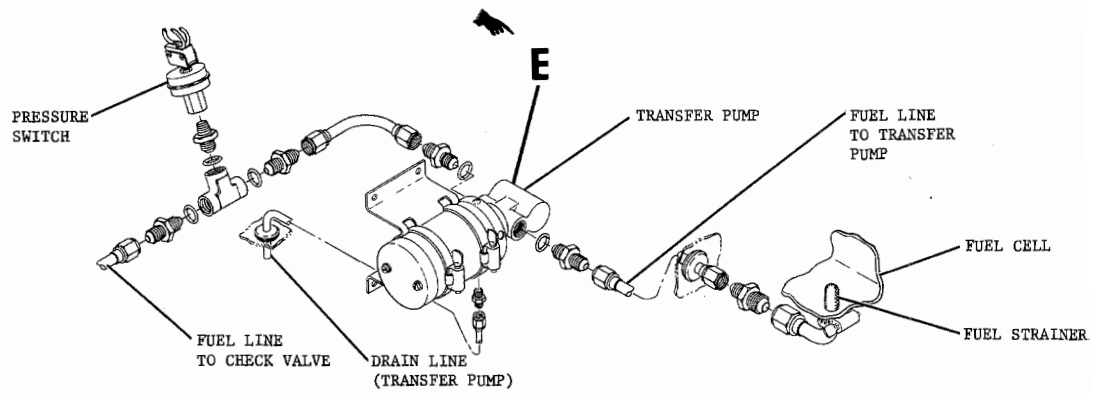


Wing Locker Fuel System
Figure 1 (Sheet 1 of 2)

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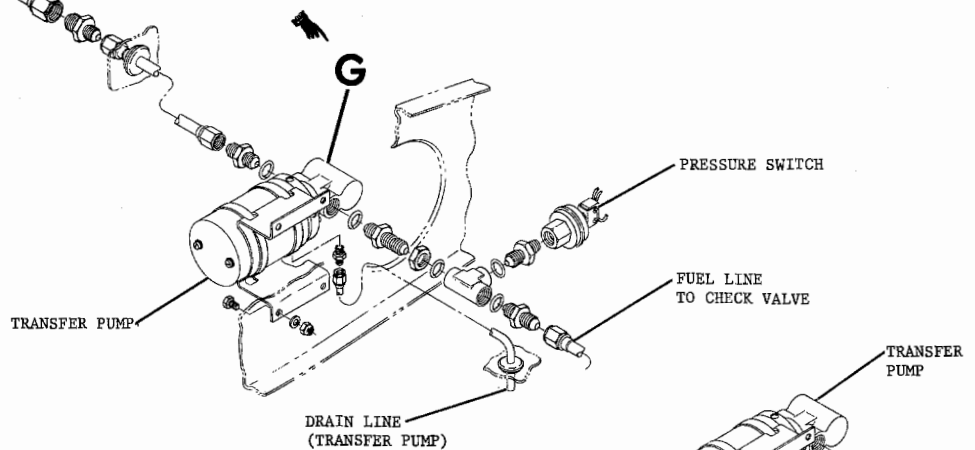
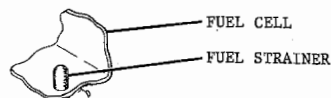
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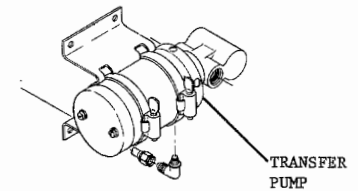
LH INSTALLATION

DETAIL D
310R0103 AND ON

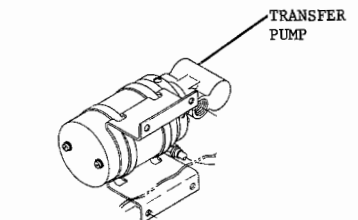


RH INSTALLATION

DETAIL F
310R0103 AND ON



DETAIL E
310R0001 THRU 310R0102



DETAIL G
310R0001 THRU 310R0102

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Wing Locker Fuel System
Figure 1 (Sheet 2)

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WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN THE WING.

NOTE: During removal/installation of fuel system components, all openings or fittings shall be capped or plugged.

1. Removal/Installation Wing Locker Fuel Cell (See Figure 1).

NOTE: The removal/installation procedures are the same for either left or right wing locker fuel cell.

A. Remove Wing Locker Fuel Cell.

- (1) Defuel applicable wing locker fuel cell. Refer to Chapter 2.

NOTE: If main tank fuel quantity is low, wing locker fuel can be transferred by the wing locker transfer pump to the main tank.

- (2) Turn off all power.
- (3) Refer to Chapter 1. Remove wing access panels as required to gain access to plumbing connections.
- (4) Remove fuel cap assembly by removing screws and gasket.
- (5) Loosen clamps and remove fuel strainer, vent line and drain line from fuel cell.
- (6) Pull fuel cell fasteners down; carefully fold the cell and remove cell through filler opening.

B. Install Wing Locker Fuel Cell.

- (1) Ensure fuel cell is clean, free from dirt and foreign material.
- (2) Carefully insert fuel cell through the filler opening and arrange the cell in the correct position by fastening the fasteners in place.
- (3) Install fuel strainer, drain line and vent line into fuel cell and tighten with clamps.

NOTE: When tightening clamps, be careful not to overtorque.

- (4) Install fuel cap assembly, using gasket and screws.
- (5) Refer to Chapter 2. Service the fuel system and leak check.
- (6) Install access panels.

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2. Removal/Installation Fuel Transfer Pump (See Figure 1).

NOTE: The removal/installation procedures are the same for either fuel transfer pump.

A. Remove Fuel Transfer Pump.

- (1) Defuel wing locker fuel cell to be removed. Refer to Chapter 2.
- (2) Refer to Chapter 1. Remove access panels as required to gain access to transfer pump.
- (3) Tag and disconnect transfer pump electrical wiring.
- (4) Disconnect fuel lines and drain line from transfer pump.
- (5) Remove fuel pump by removing nuts, washers and bolts.

B. Install Fuel Transfer Pump.

- (1) Secure transfer pump to structure, using bolts, washers and nuts.
- (2) Connect fuel lines and drain line to transfer pump.

NOTE: Aircraft 310R0103 and On, install nipple in transfer pump, finger tight and torque 1/4 turn.

- (3) Identify and connect electrical wiring to fuel pump.
- (4) Refer to Chapter 2. Service fuel system and leak check.
- (5) Install access panels.

CABIN HEATER FUEL SYSTEMDescription

1. The cabin heater fuel system consists of the solenoid valve, fuel filter assembly and necessary plumbing for connection to the aircraft's fuel system. The solenoid valve and filter assembly are mounted inside the right wing leading edge in-board of station 38.16. The solenoid valve is electrically operated and controls the fuel flow to the heater fuel pump. If an overheat condition exists in the heater, the solenoid will automatically be shut off. For more information on the cabin heater, refer to Chapter 6.

Maintenance Practices

WARNING: DURING FUEL SYSTEM MAINTENANCE PRACTICES, TWO GROUND WIRES ATTACHED FROM DIFFERENT POINTS ON THE AIRCRAFT TO SEPARATE APPROVED GROUNDING STAKES SHALL BE USED TO PREVENT UNGROUNDING OF THE AIRCRAFT, DUE TO ACCIDENTAL DISCONNECTION OF ONE GROUND WIRE.

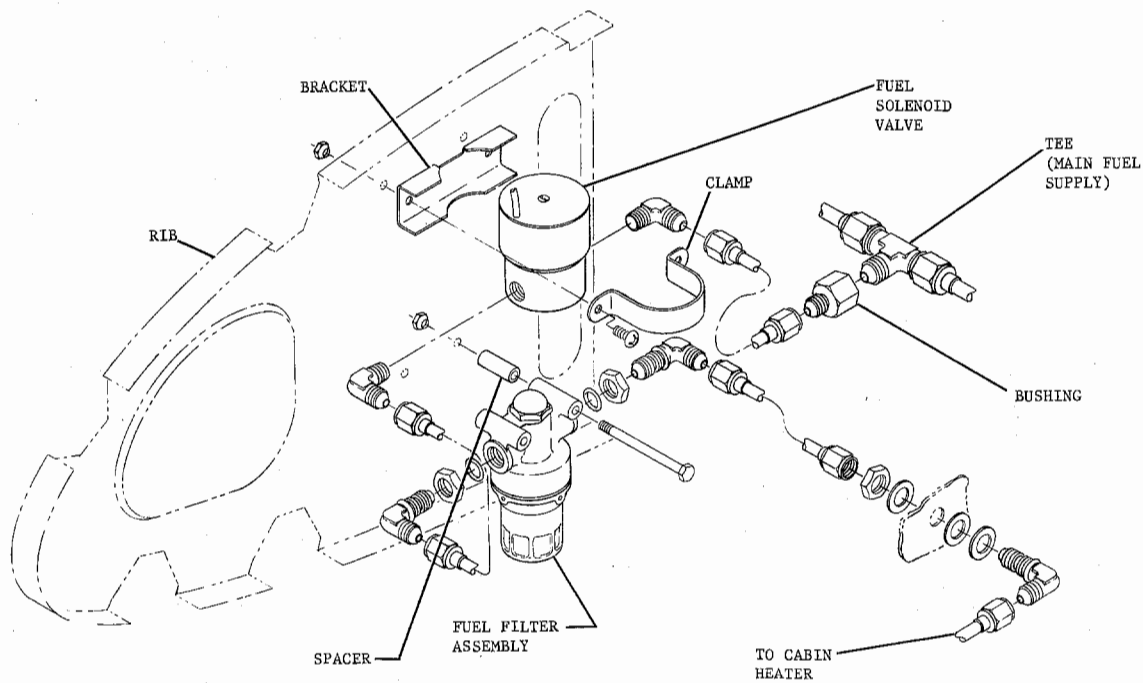
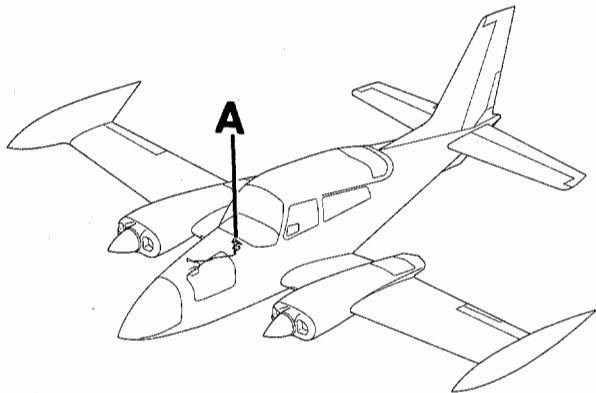
WARNING: RESIDUAL FUEL DRAINING FROM THE LINES IS A FIRE HAZARD. CARE SHOULD BE EXERCISED IN DISPOSAL OF SUCH FUEL WHEN LINES ARE DISCONNECTED TO PREVENT ITS ACCUMULATION IN THE WING.

NOTE: During removal/installation of fuel system components, all openings or fittings shall be capped or plugged.

1. Removal/Installation Solenoid Valve (See Figure 1).
 - A. Remove Solenoid Valve.
 - (1) Remove access covers from lower leading edge of right wing station 38.16.
 - (2) Position fuel selector control handles to OFF.
 - (3) Ensure electrical power is OFF.
 - (4) Identify and disconnect electrical wiring to solenoid valve.
 - (5) Disconnect fuel lines to the solenoid valve.
 - (6) Remove solenoid valve by removing screws and nuts.
 - B. Install Solenoid valve.
 - (1) Attach solenoid valve to rib, using screws and nuts.
 - (2) Connect fuel lines to solenoid valve.
 - (3) Identify and connect electrical wires to solenoid.

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DETAIL A

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A10262007

Cabin Heater Fuel System Installation
Figure 1

- (4) Refer to Chapter 6. Conduct and operational check and check for fuel leaks.
- (5) Install access covers.

2. Removal/Installation Fuel Filter Assembly.

A. Remove Fuel Filter Assembly.

- (1) Remove access covers from lower leading edge of right wing station 38.16.
- (2) Ensure electrical power is OFF.
- (3) Disconnect fuel lines from the filter assembly.
- (4) Remove filter assembly by removing nut, spacers and bolts.
- (5) For disassembly of fuel filter, refer to Cessna Heater and Components Overhaul/Parts Manual.

B. Install Fuel Filter Assembly.

- (1) Attach filter assembly to rib, using bolts, spacers and nuts.
- (2) Connect fuel lines to filter assembly.
- (3) Refer to Chapter 6. Conduct an operational check and check for fuel leaks.
- (4) Install access covers.

CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

10

INSTRUMENTS

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SERVICE MANUAL

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INSTRUMENT PANELDescription

1. The stationary instrument panel is a part of the fuselage structure and is ordinarily not considered removable. Two individual shock-mounted panels, which may be removed individually, are attached to the stationary panel by the use of spacers, an angle assembly, nuts and screws. The LH shock mounted panel houses the flight instruments while the RH panel houses the fuel and engine operational instruments. Individual instruments are positioned behind and secured to each panel with screws, nuts and post lights. Since all instruments are mounted in a similar manner, a typical removal and installation procedure is provided in this chapter. The individual system instruments are shown in their applicable chapter.

Maintenance Practices

1. Removal/Installation Shock Panels (See Figure 1).

- A. Remove Shock Panel.

- (1) Disconnect lines and tubing to instruments and tag.

NOTE: Most hose fittings are more accessible if disconnect from the forward bulkhead.

- (2) Remove screws and pull shock panel away from stationary panel enough to disconnect electrical leads.

NOTE: Tag all electrical leads.

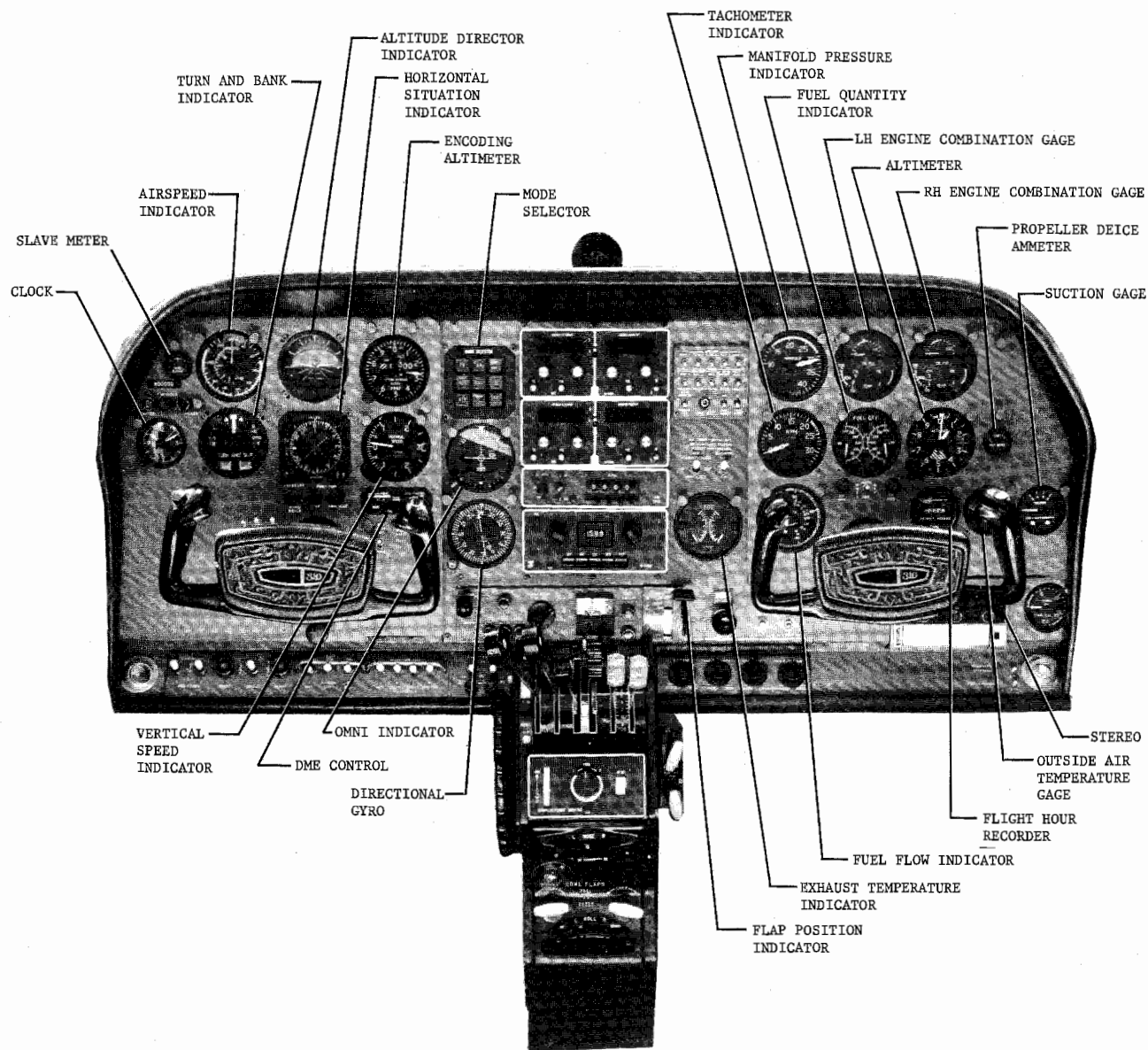
- (3) Plug hoses and cap all fittings to prevent entry of foreign matter.
 - (4) Remove shock panel from aircraft.

- B. Install Shock Panels.

- (1) Remove plugs and caps in all lines and fittings.
 - (2) Connect electrical leads.
 - (3) Connect all hoses and lines to instruments.
 - (4) Secure shock panel to support angles with screws, spacers, washers and nuts.

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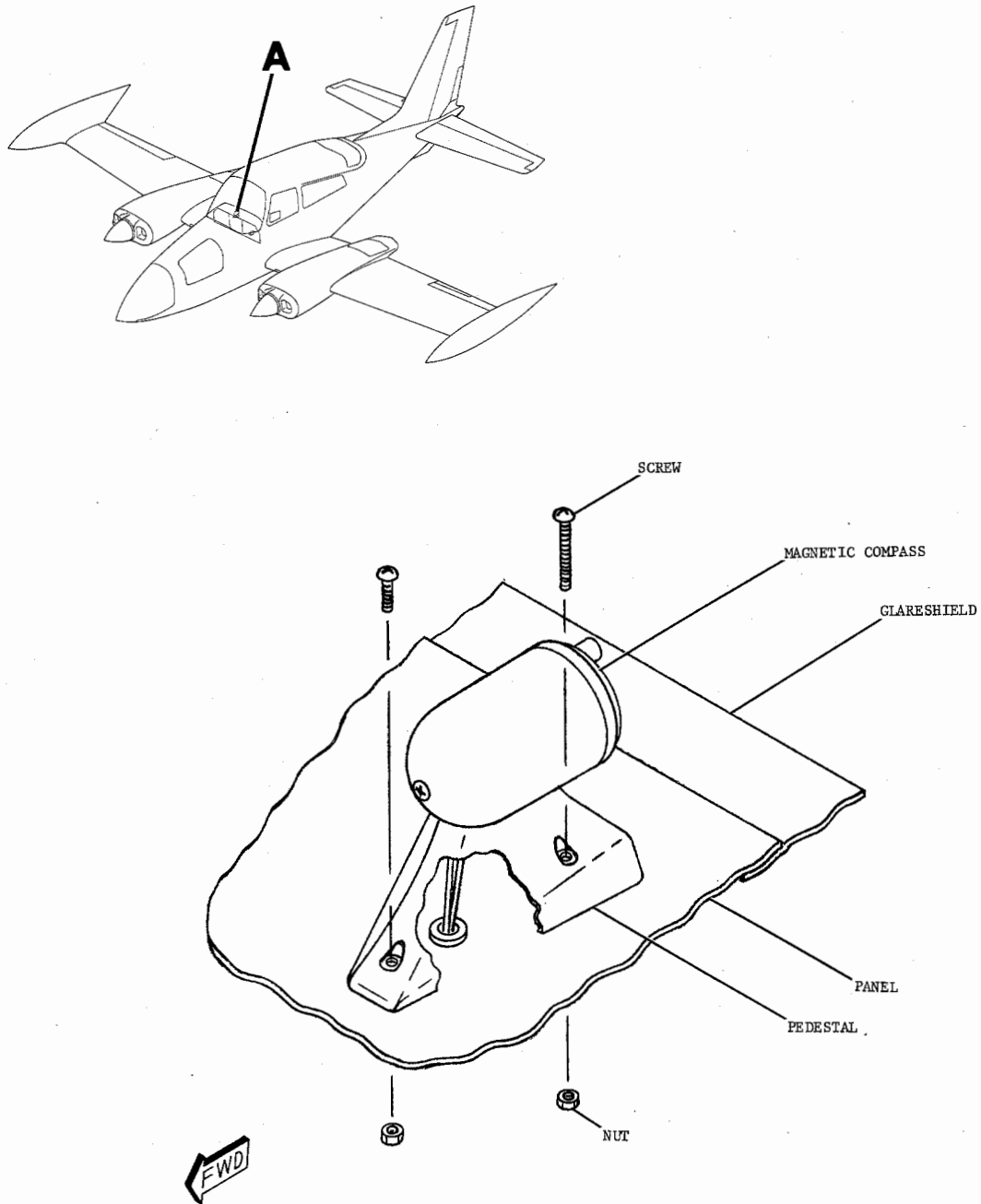
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NOTE: This instrument panel illustration is a "TYPICAL" instrument location arrangement. Panel arrangement is optional.

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Instrument Panel
Figure 1



DETAIL A

Magnetic Compass Installation
Figure 2

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Maintenance Practices

1. Removal/Installation Typical Instruments (See Figure 1).

A. Remove Typical Instruments.

- (1) Remove the glare shield and deck cover.
- (2) Tag and disconnect electrical wires and hoses from back of instrument being removed.
- (3) Plug all hoses and cap fittings to prevent the entry of foreign matter.
- (4) Remove the connectors, nuts and lockwashers.
- (5) Remove lower attaching nuts and screws.

NOTE: If the instrument is to be replaced, remove the hose fittings or attaching hardware and install on replacement unit.

B. Install Typical Instruments.

NOTE: Lubricate straight threads with VV-P-236 petrolatum; tapered threads with JAN-A-669 anti-seize compound. Apply lubricant to male threads only, omitting the first two threads.

- (1) Position instrument on back of shock panel and secure with screws and nuts.
- (2) Install lighting fixtures and rubber washers, secure with lockwashers and nuts.
- (3) Attach connectors to lighting fixtures.
- (4) Identify and connect hose or electrical connector as tagged at removal.
- (5) Install deck cover and glare shield.

2. Removal/Installation Magnetic Compass (See Figure 2).

A. Remove Magnetic Compass.

- (1) Remove panel to gain access to nuts.
- (2) Remove screws and nuts, securing pedestal to panel.
- (3) Identify and disconnect electrical wires.
- (4) Remove magnetic compass.

B. Install Magnetic Compass.

- (1) Insert wire through grommet and connect wires.
- (2) Install pedestal to panel using screws and nuts.

NOTE: Use non-magnetic screws and nuts for mounting compass and pedestal.

- (3) Secure panel.

3. Adjustment Magnetic Compass.

A. Compass Alignment

NOTE: The compass alignment shall be performed on a calibrated compass rose.

- (1) Ensure compensator adjustments are set to a neutral position. The compensators are located on the lower face of compass behind the metal disc.
- (2) Using a hand-held magnetic compass, check all ferrous material parts for magnetism near the magnetic compass.
- (3) Degauss any parts within two feet which cause greater than 10° deflection of the magnetic compass, and any part within four feet which cause greater than 90° deflection of the magnetic compass.
- (4) Ensure that each of the applicable systems are controlled from the proper circuit breakers, and the corresponding "HDG" flag appears when the circuit breaker is disengaged.
- (5) Ensure all electrical instruments for the aircraft are installed and operative.
- (6) Ensure other aircraft and vehicles are a safe out of way distance.
- (7) Position aircraft on the 270° heading of the compass rose.
- (8) With both engines running 1000 RPM, turn on the following:
 - (a) All circuit breakers.
 - (b) Inverters.
 - (c) All lights except landing lights and reading lights.
 - (d) All avionics systems.
 - (e) All electrical systems except pitot heat, stall and static heaters.
 - (f) Record the compass error in degrees.

NOTE: High readings are positive errors, low readings are negative errors.

- (9) Position aircraft on the 360° heading of the compass rose and repeat Step (8), (a) thru (f).
- (10) Position aircraft on the 90° heading of the compass rose and repeat Step (8), (a) thru (f).
- (11) Position aircraft on the 180° heading of the compass rose and repeat Step (8), (a) thru (f).

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B. Compensation Adjustments.

- (1) The errors obtained in the Compass Alignment procedure Step (8), (a) thru (f) will be used to determine the required amount and degree of compensation for the compass.

C. Compass Compensation.

- (1) At one cardinal heading, adjust the appropriate compensator the amount calculated in Compass Alignment procedure Step (8), (a) thru (f).
- (2) Rotate the aircraft 90° and adjust the appropriate compensator the amount calculated.
- (3) Rotate the aircraft to the next two cardinal headings and ensure that no error greater than five degrees is present.
- (4) With normal aircraft power, all electrical systems on, rotate the aircraft to 30° headings (including cardinals). Stop on each heading long enough to allow compass to stabilize.
- (5) Record the headings indicated by the compass at the 30° positions. No error greater than $\pm 5^{\circ}$ shall be indicated by the compass.

VACUUM SYSTEM AND RELATED INSTRUMENTSDescription

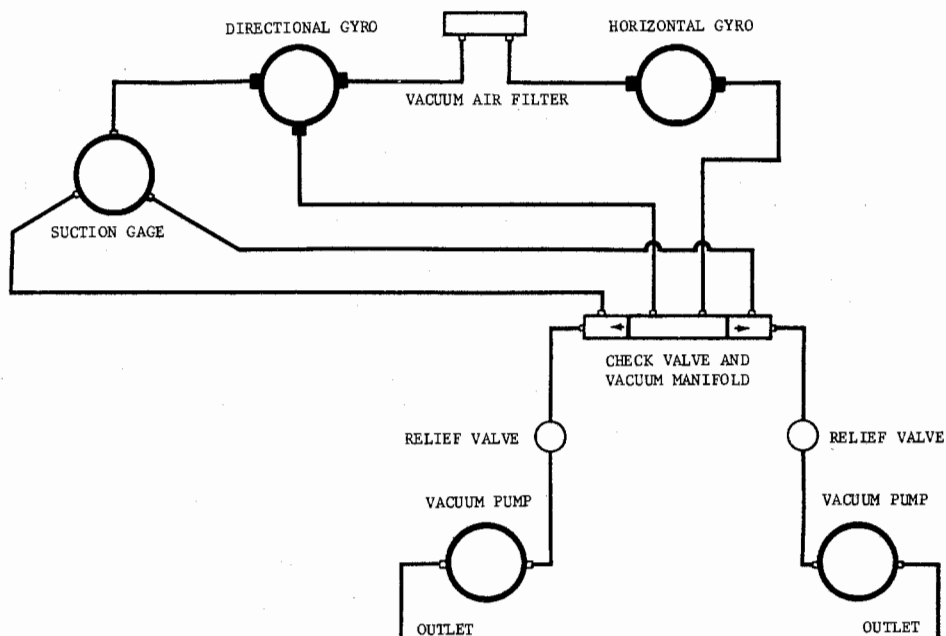
- 16
1. The vacuum system consists of: A vacuum pump on each engine, two relief valves, a manifold, air filter, vacuum operated instruments and necessary plumbing. A dry vacuum pump, which requires no lubrication of any kind, is located on the aft right accessory mount pad of each engine. The vacuum system plumbing is routed from the vacuum pumps through the nacelles and wings to the respective regulator valve in the wing gap area. The adjustable regulator valves are utilized to give the desired vacuum system pressure. From the relief valve, the plumbing of each vacuum pump is routed to the vacuum manifold located on the right side of the forward cabin bulkhead, forward of the instrument panel. The manifold has check valves included to prevent reverse flow, in the event of failure of either vacuum pump. Hoses are routed from the manifold to the directional gyro, horizontal gyro and suction gage. Other hoses connect the gyros to the vacuum air filter.
 2. The vacuum system instruments consists of: A directional gyro, horizontal gyro and suction gage for a standard aircraft. The optional vacuum system instruments consists of: Two directional gyros, two horizontal gyros and the suction gage. For slaved directional gyro information, refer to Chapter 14.
 - A. The directional gyro is a flight instrument incorporating an air-driven gyro stabilized in the vertical plane. The gyro is rotated at high speed by lowering the pressure in the air tight case with the engine-driven vacuum pumps and simultaneously allowing air at atmospheric pressure to enter against the gyro buckets. Due to gyroscopic inertia, the spin axis continues to point in the same direction, even though the aircraft yaws to the left or right. This relative motion between the gyro and the instrument case is shown on the instrument dial which is similar to a compass card. The dial, when set to agree with the aircraft's magnetic compass, provides a "dead beat" azimuth indicator that is free from "swing".
 - B. The horizontal gyro is essentially an air-driven gyroscope rotating in a horizontal plane. The gyro is operated by the same supply of vacuum as the directional gyro. Due to gyroscopic inertia, the spin axis continues to point in the vertical direction providing a constant visual reference to the attitude of the aircraft relative to its pitch and roll axis. A bar across the face of the instrument represents the horizon and a miniature adjustable aircraft is mounted to the case. Aligning the miniature aircraft to the horizontal bar simulates the

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alignment of the aircraft to the actual horizon and any deviation simulates the deviation of the aircraft from the true horizon. The horizontal gyro is marked from zero to 90 degrees.

- C. The suction gage is calibrated in inches of mercury and visually displays the amount of vacuum created by the engine-driven vacuum pumps. The suction gage has three connecting lines. The upper line is routed directly to the directional gyro to monitor vacuum. The lower lines are attached to the vacuum system manifold for the purpose of monitoring vacuum pump function. The suction gage, also, incorporates red inoperative indicator buttons for each engine-driven vacuum pump.
- D. Directional and attitude gyro precession. Acceptable limits for gyro drift is four degrees in either direction from a heading during a ten-minute period. Excessive gyro precession can be caused by low vacuum system pressure.



Vacuum System Schematic
Figure 1

Troubleshooting

1. Troubleshooting Vacuum System.

- A. For a guide to troubleshooting the vacuum system, see Figure 3.

Adjustment/Test

1. Adjustment Vacuum Relief Valve.

NOTE: Since a relief valve is used for each vacuum source, each relief valve must be adjusted separately.

- A. Remove wing fairings by removing attaching screws.
- B. Start the engines and idle the right engine.
- C. With left engine operating and tachometer reading 1700 RPM, the suction gage should read 4.80 inches of mercury.
- D. Adjust the left relief valve by loosening the knurled screw locknut and adjusting to obtain the desired reading. Clockwise rotation of the adjusting screw increases the vacuum.
- E. Idle the left engine and operate the right engine so tachometer reads 1700 RPM.
- F. Adjust the right relief valve by loosening the knurled screw locknut and adjusting to obtain the 4.80 vacuum reading. Clockwise rotation of the adjusting screw increases the vacuum.
- G. With both engines operating at tachometer RPM of 1700, the suction gage should read 5.00 ± 0.25 inches of mercury.

NOTE: If the suction gage reading is not within limits described, both relief valves should be readjusted to those limits.

- H. Shut down both engines and check that the locknuts on the knurled adjustment screws are tight.
- I. Install wing fairings.

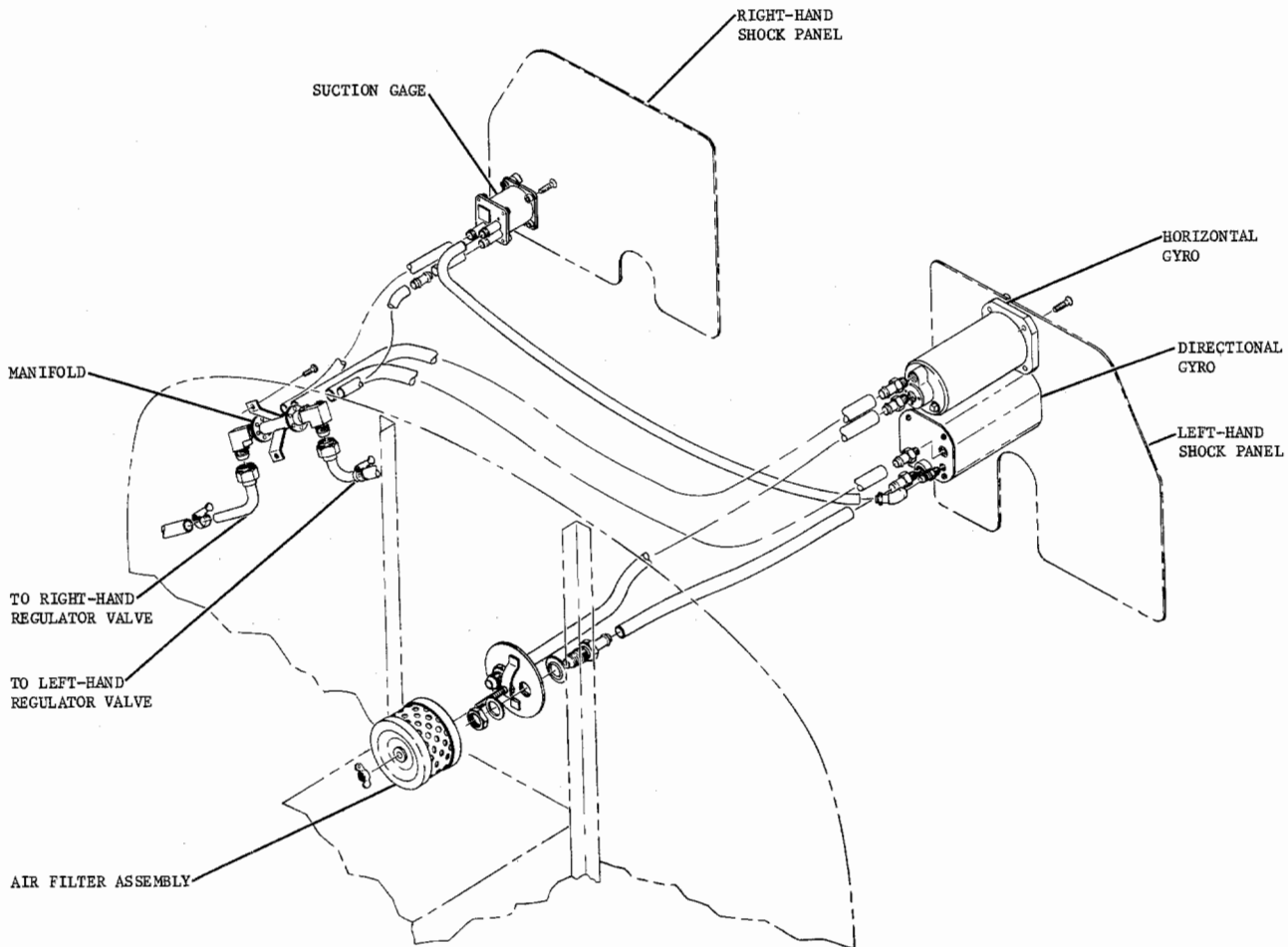
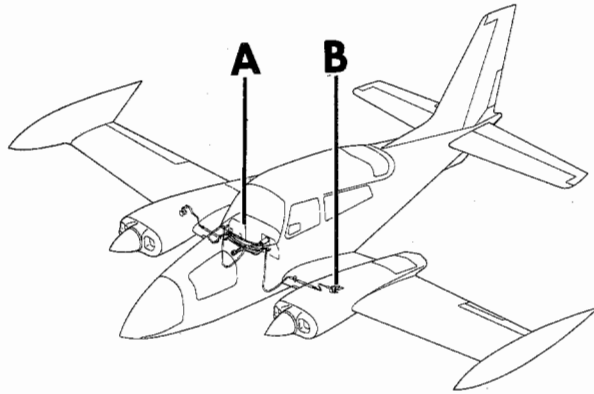
Inspection/Check

1. Inspection Vacuum System.

NOTE: Vacuum system inspection is a visual inspection of the plumbing.

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DETAIL A

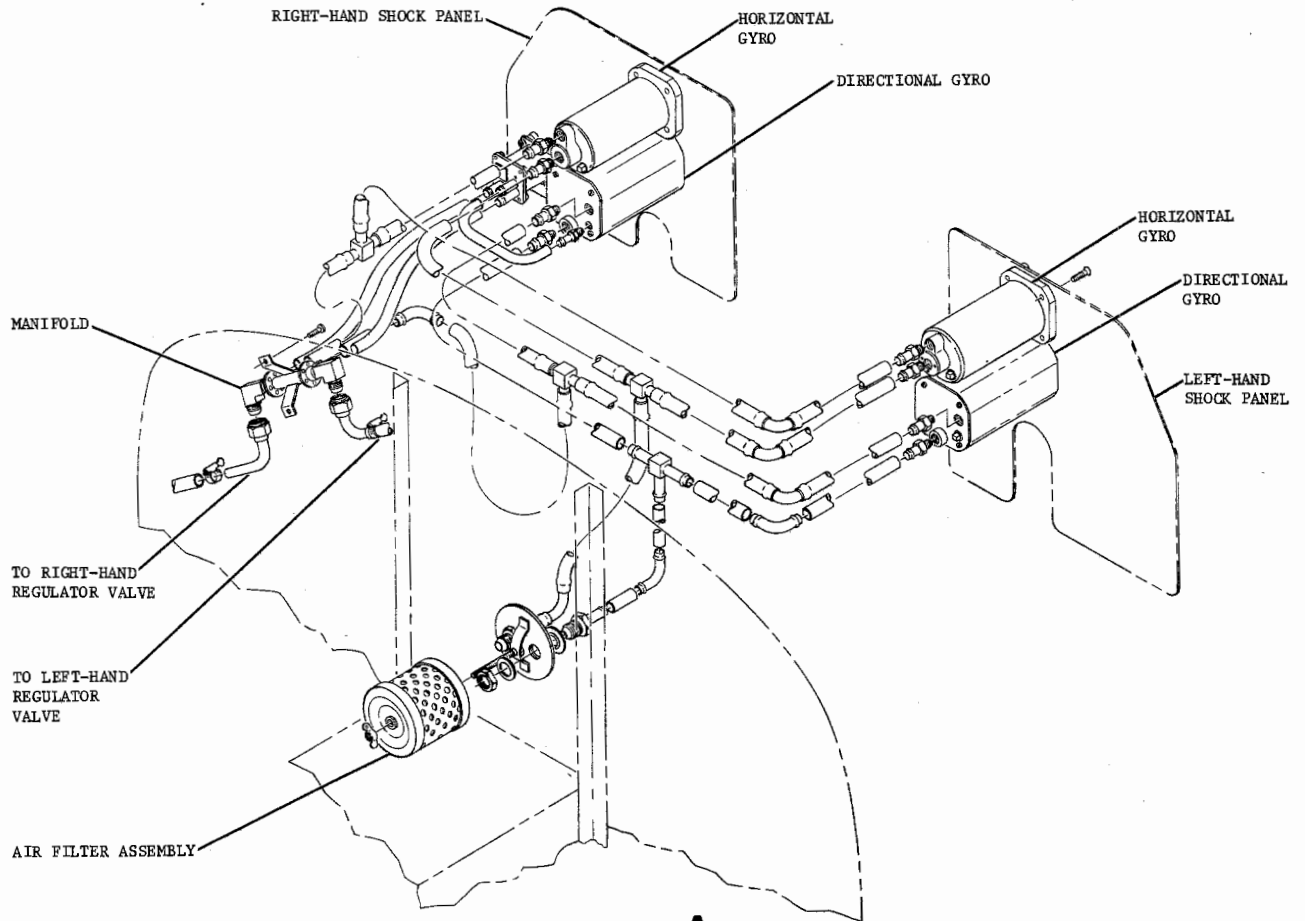
STANDARD INSTALLATION

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Vacuum System Installation
Figure 2 (Sheet 1 of 2)

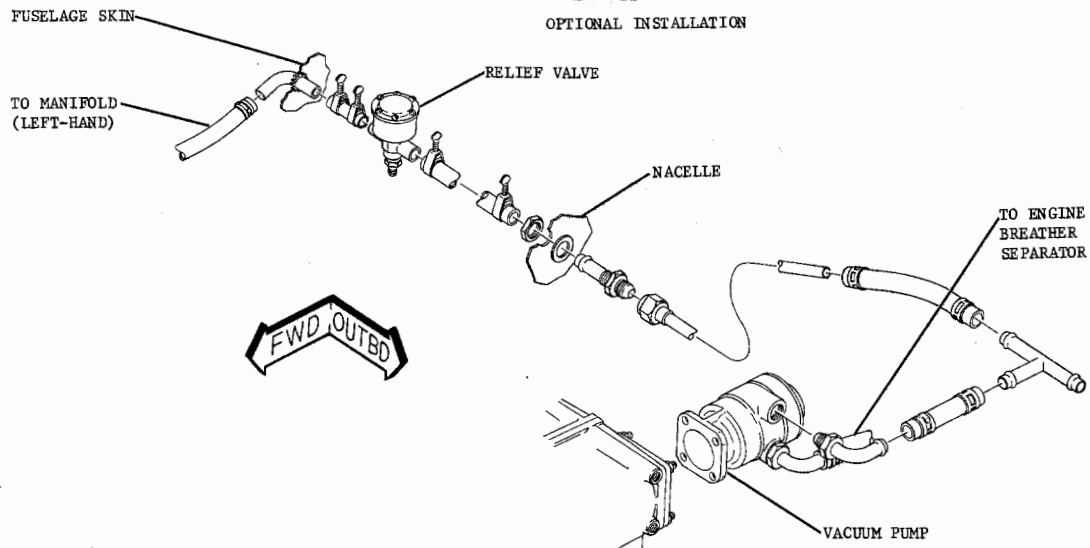
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DETAIL A

OPTIONAL INSTALLATION



DETAIL B

LEFT-HAND INSTALLATION SHOWN

Vacuum System Installation
Figure 2 (Sheet 2)

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- A. Remove upper engine cowls, wing fairings and wing lower surface access panels as required to inspect plumbing.
- B. Reinstall upper engine cowls, wing fairings and access panels.

Cleaning/Painting

1. Cleaning Vacuum System Components

A. Cleaning.

- (1) The vacuum system components may be cleaned by immersing lines and hoses in dry cleaning solvent, and dried with filtered dry compressed air.
- (2) Wipe exterior of lines and hoses with a clean, dry cloth.
- (3) Clean vacuum system filter with a jet of clean, dry air and tapping lightly while blowing air over the filter.
- (4) Remove the relief valve screen and submerge in suitable solvent. Allow to soak or wash until all foreign particles are dislodged.
- (5) Clean relief valve if required by washing in suitable solvent and drying with filtered dry compressed air.

Maintenance Practices

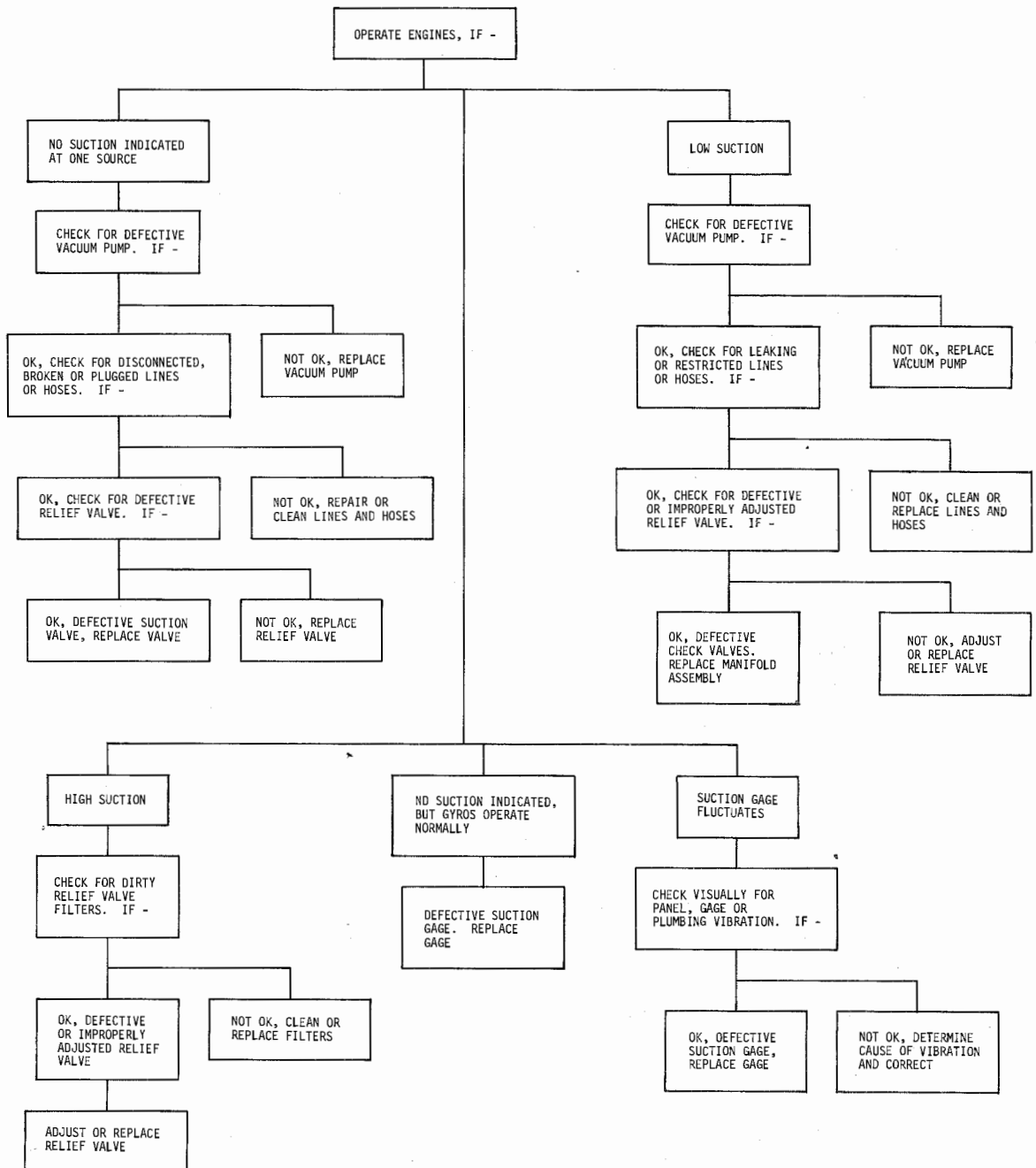
NOTE: All flexible and fixed line fittings, clamps, regulator valves, and filters must be cleaned and suitably protected by caps or bags until installed in aircraft. The vacuum system shall not be open while awaiting the remaining parts to be installed. Prior to running of the engine-driven vacuum pumps, the lines shall be flushed with air to approximately seven cubic feet per minute while alternately closing off the ends of the lines. This will create pressure pulses to dislodge and eject foreign matter.

1. Removal/Installation Vacuum Pump (See Figure 2).

NOTE: Removal/Installation for both vacuum pumps are the same.

A. Remove Vacuum Pump.

- (1) Remove upper engine cowl.
- (2) Loosen the two hose clamps securing hoses to vacuum pump fittings and disconnect hoses.



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Troubleshooting Chart - Vacuum
Figure 3

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- (3) Remove vacuum pump by removing nuts and washers securing pump to engine accessory pad.

CAUTION: DO NOT CLEAN VACUUM PUMP IN SOLVENT.
CLEAN BY WIPING WITH A CLEAN CLOTH.

B. Install Vacuum Pump.

NOTE: If a new vacuum pump is being installed, remove the serviceable fittings from the old pump and install the fittings on the new pump. Use no oil of any sort, no thread lubricant of any description on any fitting used on the inlet side of the vacuum pump.

- (1) Align splines on the vacuum pump drive with splines on the engine drive. Slide vacuum pump into position so the ports are facing to the right.
- (2) Secure vacuum pump to the engine with washers and nuts.
- (3) Connect hoses to the vacuum pump.
- (4) Install upper engine cowl.

2. Removal/Installation Vacuum Relief Valve (See Figure 2).

A. Remove Vacuum Relief Valve.

- (1) Remove wing root fairings by removing attaching screws.
- (2) Remove clamps attaching hoses to relief valve and remove the relief valve.

B. Install Vacuum Relief Valve.

- (1) Position the relief valve and connect the hoses to the valve, using clamps.
- (2) Adjust the vacuum relief valve. Refer to Adjustment/Test.
- (3) Install wing root fairings with screws.

3. Removal/Installation Vacuum Manifold (See Figure 2).

A. Remove Vacuum Manifold.

- (1) Remove deck cover from top of instrument panel for access to manifold.
- (2) Identify and disconnect hoses from the manifold.
- (3) Remove manifold by removing screws.

- B. Install Vacuum Manifold.
- (1) Secure manifold to bulkhead, using screws.
 - (2) Identify and connect hoses to manifold, using clamps.
 - (3) Install deck cover with screws.
4. Removal/Installation Vacuum Air Filter Element (See Figure 2).
- A. Remove Air Filter Element.
- (1) Open nose baggage compartment.
 - (2) Refer to Chapter 12. Remove upholstery panel at fwd bulkhead (optional).
 - (3) Remove wing nut and remove air filter element.
- B. Install Air Filter Element.
- (1) Install air filter element and secure with wing nut.
 - (2) Install upholstery panel to bulkhead.
5. Removal/Installation Vacuum System Instruments.
- NOTE: Refer to Miscellaneous Instruments, Removal/Installation Typical Instruments.

PITOT-STATIC SYSTEM AND RELATED INSTRUMENTSDescription

1. Pitot System.

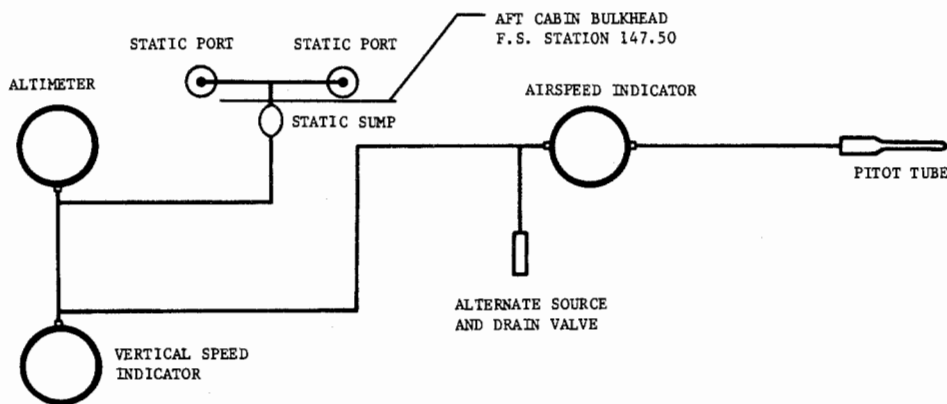
- A. The single pitot system (standard aircraft) utilizes one pitot tube, located on the left-hand side of the nose. The pitot tube, incorporates an electrical heating element to prevent ice from obstructing the passage of ram air through the pitot tube. Ram air passing through the pitot tube is routed to the pilot's airspeed indicator through lines and hoses.
- B. The dual pitot system (optional) utilizes two pitot tubes, located one on each side of the nose. Both pitot tubes incorporate an electrical heating element to prevent pitot tube icing. Each pitot system is independent of the other pitot system and supplies ram air through lines and hose to the respective airspeed indicator. The left pitot system supplies ram air to the pilot's airspeed indicator. The right pitot system supplies ram air to the copilot's airspeed indicator.

2. Static System.

- A. The single static system (standard aircraft) utilizes two static ports (heated optional), static sump, drain valve and necessary plumbing to the pilot's airspeed indicator, vertical speed indicator and the altimeter. Static pressure is routed from the two static ports, mounted on opposite sides of the aft fuselage through the static sump to the airspeed indicator, vertical speed indicator and altimeter. A drain valve, located in the forward left-hand cabin area is connected to the static line to release accumulated moisture and serve as an alternate static pressure source.
- B. The dual static system (optional) is used with the dual pitot system (heated optional). The static system has two independent systems, one system provides static pressure to the pilot's airspeed indicator, vertical speed indicator and altimeter. The other static system provides static pressure to the copilot's airspeed indicator, vertical speed indicator and altimeter. Each static system consists of a two static ports, static sump, drain valve and necessary plumbing.

3. Pitot-Static Instruments.

- A. The Sensitive Altimeter is a pressure instrument that measures the change in static pressure and by means of an indicator, translates this change into altitude above sea level. A barometric scale is incorporated in the instrument. The barometric pressure scale is calibrated in inches of mercury and is set manually by a knob on the lower left-hand corner of the altimeter case. Three pointers on the dial of the instrument indicate altitude in units of 100 feet, 1,000 feet and 10,000 feet.
- B. The encoding altimeter system (optional) provides altitude information and encoded information for ATC (Air Transport Command) when the ALT mode is selected on the transponder. The system consists of an encoding altimeter in the pilot's panel, a standard back-up altimeter in the copilot's panel and a transponder. The encoding altimeter is servo driven, using 28 VDC power. The altimeter will function whenever the battery switch is on and the altimeter failure bar is retracted from the altitude display. In addition, altitude encoding will be provided when the ALT mode is selected on the transponder. At altitudes less than 10,000 feet, a warning flag will be presented in the 10,000 foot window.



Pitot-Static System Schematic
Figure 1

- C. The Airspeed Indicator (standard) measures the differential between ram air, or impact air pressure taken at the pitot tube, and static air pressure. The instrument dial is calibrated in both knots and miles per hour.
- D. The True Airspeed Indicator (optional) is composed of three elements; airspeed, altitude and temperature. The altitude and temperature mechanisms are correlated to operate a rotating dial over which the indicated airspeed indicates the true airspeed. The true airspeed indicator senses changes in pressure and temperature. This combination of altitude and temperature change results in a sum total of airspeed corrections to indicate true airspeed.
- E. The Vertical Speed Indicator measures the rate of change in static pressure when the aircraft is climbing or descending. By means of a pointer and dial it indicates the rate of ascent and descent of the aircraft in feet per minute.

Maintenance Practices

1. Servicing Pitot-Static System (See Figures 2 and 3).

A. Purge Pitot System.

NOTE: Each pitot system must be purged separately.

- (1) Disconnect pitot hose to airspeed indicator.
- (2) Connect purging source (low pressure) clean dry air to disconnected hose behind instrument panel.
- (3) Blow air from the indicator end of hose toward the pitot tube.

CAUTION: NEVER BLOW AIR THROUGH THE PITOT LINES TOWARD INSTRUMENTS.

- (4) Connect hose to airspeed indicator.
- (5) Perform leak check. Refer to Adjustment/Test.

B. Purge Static System.

NOTE: Each static system must be purged separately.

NOTE: If autopilot (optional) is installed, disconnect static line from computer.

- (1) Disconnect static line to instruments from the static line drain valve tee.
- (2) Cap or plug open end of tee.
- (3) Open static system drain valve.

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- (4) Plug one static port.
- (5) Purge the system from the drain valve with clean dry air for a period of at least two minutes.

CAUTION: NEVER BLOW AIR THROUGH THE STATIC LINES TOWARD THE INSTRUMENTS.

- (6) Plug opposite static port and repeat step (5).
- (7) Remove cap or plug from static line drain valve tee.
- (8) Connect static line from instruments to the tee.

NOTE: If autopilot (optional) is installed, connect static line to computer.

- (9) Leak check static system. Refer to Adjustment/Test.

2. Removal/Installation Pitot Tube (See Figures 2 and 3).

A. Remove Pitot Tube.

- (1) Refer to Chapter 3. Remove nose cap.
- (2) Remove the radio shelf.
- (3) Disconnect electrical connector from pitot tube.
- (4) Disconnect pitot line from pitot tube.
- (5) Remove pitot tube by removing attaching screws and washers.

B. Install Pitot Tube.

- (1) Position pitot tube in mount and secure with washers and screws.
- (2) Connect pitot line to pitot tube, using union.
- (3) Connect electrical plug to pitot tube.
- (4) Install radio shelf.
- (5) Install nose cap.

3. Removal/Installation Pitot-Static System Instruments.

NOTE: Refer to Miscellaneous Instruments, Removal/Installation Typical Instruments.

4. Adjustment/Test Pitot-Static System (See Figure 4).

A. Test Pitot System.

NOTE: If dual pitot system (optional) is installed, test each system separately.

- (1) Connect a pressure source to opening in pitot tube.

CAUTION: DO NOT APPLY SUCTION TO PITOT PRESSURE LINE.

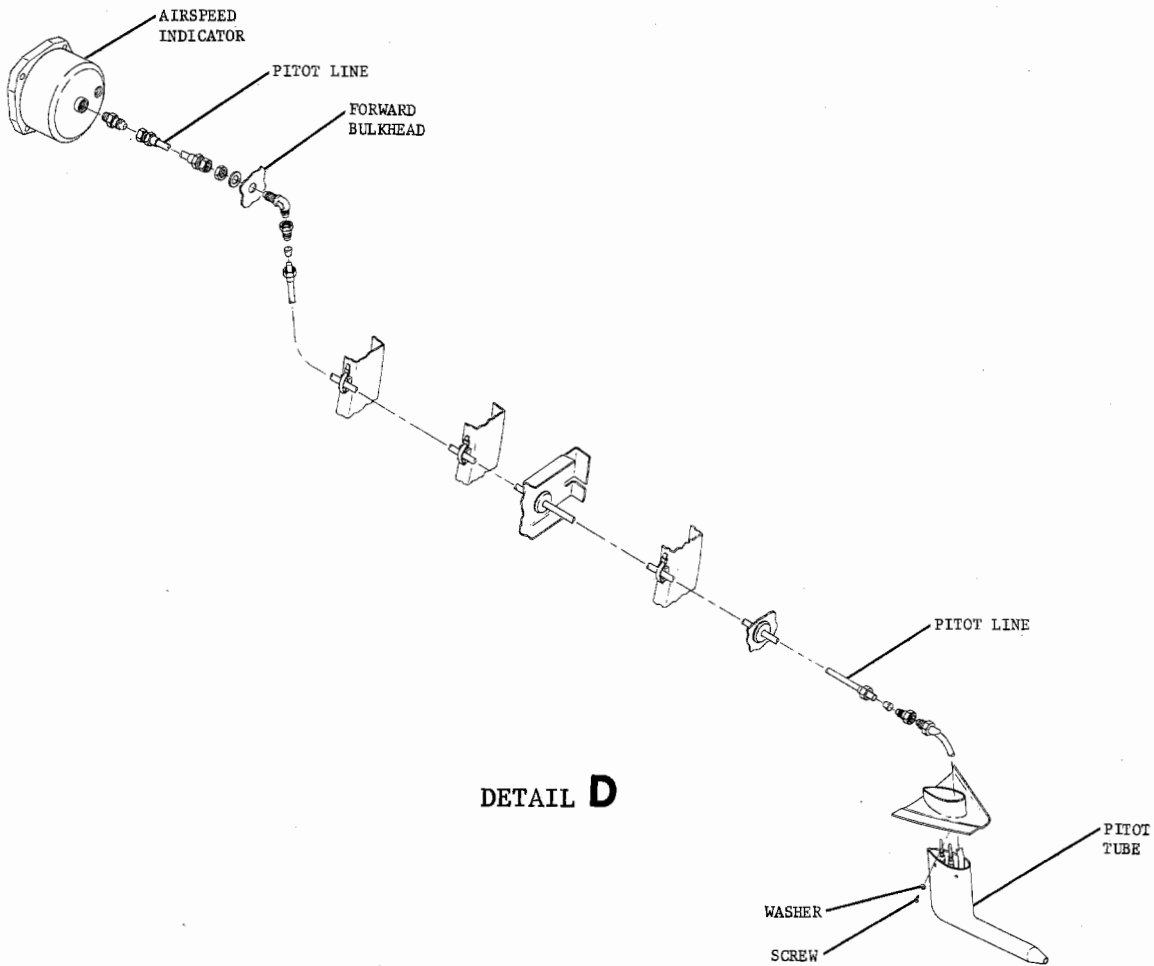
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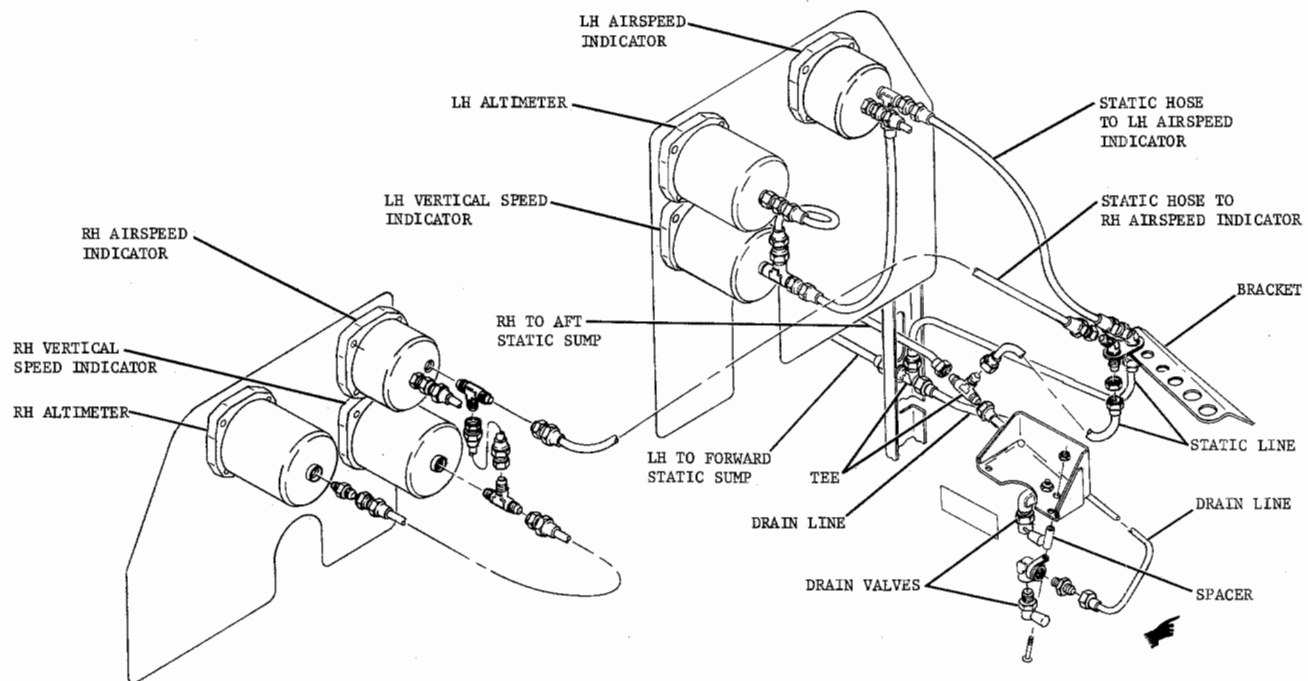
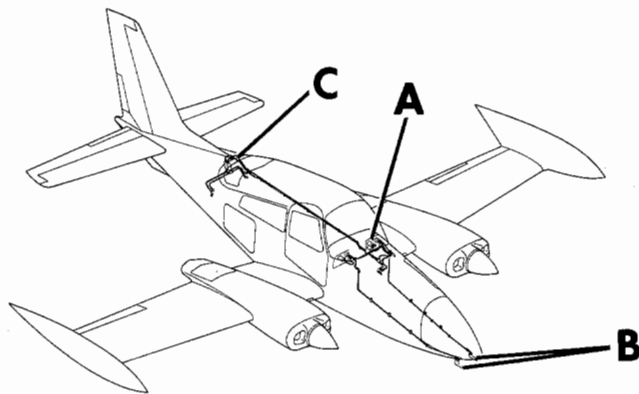
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Pitot-Static System Single Installation
Figure 2 (Sheet 2)

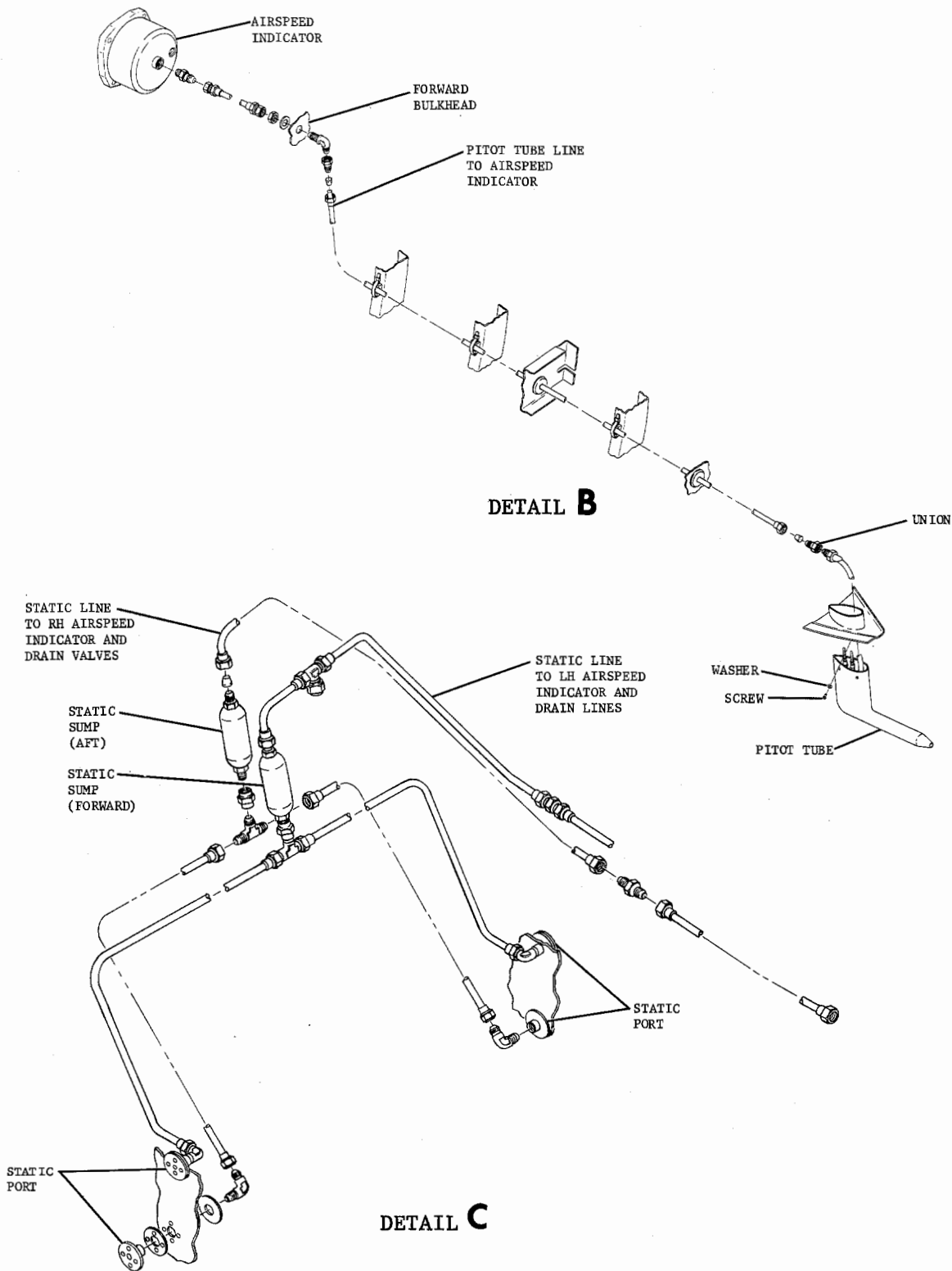


DETAIL A

10143048
A10143050Pitot-Static System Dual Installation
Figure 3 (Sheet 1 of 2)

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Pitot-Static System Dual Installation
Figure 3 (Sheet 2)

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- (2) Apply pressure slowly until airspeed indicator reads 150 knots. Clamp off the pressure source, hold at this point for one minute.

CAUTION: THE AMOUNT OF PRESSURE REQUIRED FOR A 150 KNOT INDICATION IS LESS THAN 1/2 PSI. AVOID HIGH PRESSURE AS INSTRUMENT DAMAGE WILL RESULT.

- (3) If airspeed indicator drops more than 10 knots in one minute, disconnect hose from airspeed indicator.
(4) Plug hose and apply pressure.
(5) Coat lines and connections with a solution of soap and water to locate leak.
(6) Tighten or repair faulty connections. Connect hose to airspeed indicator and repeat test procedure.

B. Test Static System.

NOTE: If dual static system (optional) is installed, test each system separately.

NOTE: If autopilot is installed, the autopilot static line must be disconnected and plugged during test.

- (1) Set altimeter to read 1500 feet by rotating pressure setting knob.

NOTE: Ensure that static drain valve is closed.

- (2) Seal static port on one side of fuselage with masking tape.
(3) Connect a suction source to static port on opposite side of fuselage.
(4) Slowly apply suction until altimeter shows a 2000 foot increase in altitude (3500 feet reading), pinch off tube and hold for one minute.

CAUTION: WHEN APPLYING OR RELEASING SUCTION, TAKE CARE NOT TO EXCEED RATE RANGE OF VERTICAL SPEED INDICATOR.

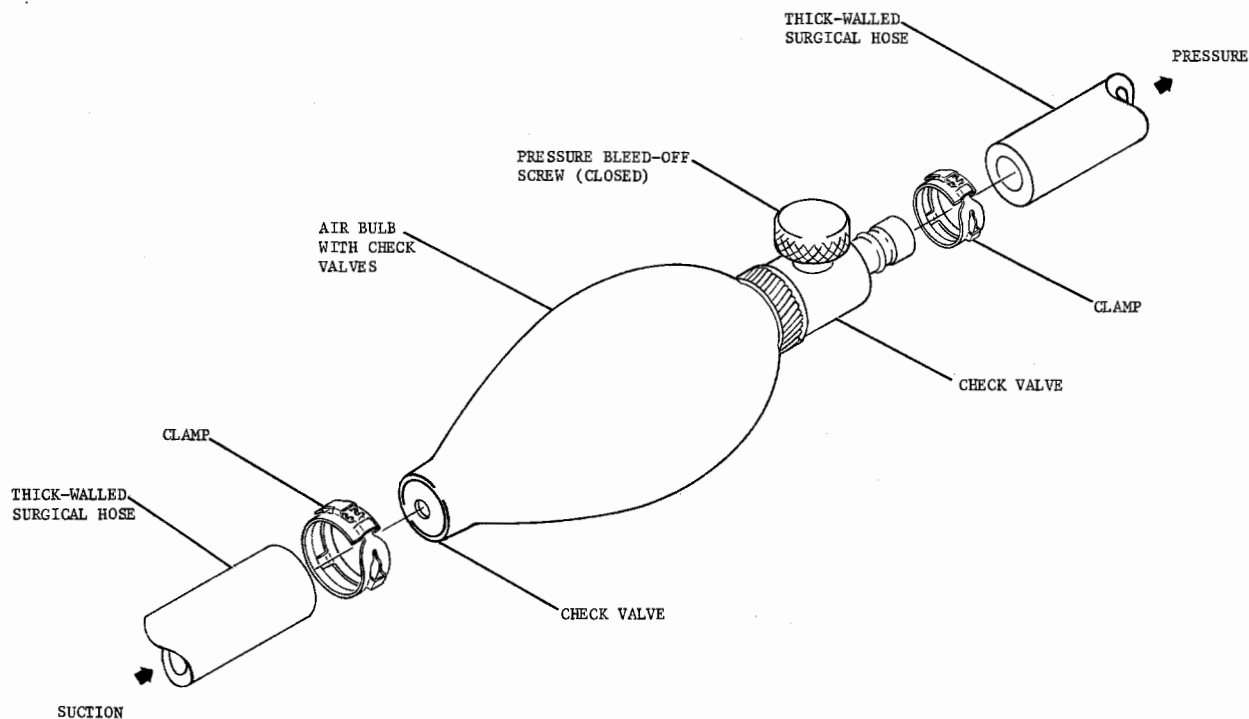
- (5) The leak down rate should not exceed 100 feet of altitude in one minute (3400 feet reading).
(6) If leak down rate exceeds 100 feet per minute, slowly remove suction source and proceed as follows:
(a) Disconnect static lines from altimeter, vertical speed indicator and airspeed indicator. Plug static lines and attach a source of pressure to static port.

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NOTE

Air bulb with check valves may be obtained locally from a surgical supply company. This is the type used in measuring blood pressure.



TO APPLY SUCTION:

1. Squeeze air bulb to expel as much air as possible.
2. Hold suction hose firmly against static pressure source opening.
3. Slowly release air bulb to obtain desired suction, then pinch hose shut tightly to trap suction in system.
4. After leak test, release suction slowly by intermittently allowing a small amount of air to enter static system. To do this, tilt end of suction hose away from opening, then immediately tilt it back against opening. Continue to admit this small amount of air intermittently until all suction is released, then remove test equipment.

TO APPLY PRESSURE:

1. Connect pressure hose to pitot tube.
2. Slowly squeeze air bulb to apply desired pressure to pitot system. Desired pressure may be maintained by repeatedly squeezing bulb to replace any air escaping through leaks.
3. Release pressure by slowly opening pressure bleed-off screw, then remove test equipment.

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Fabrication Pitot-Static System Test Equipment
Figure 4

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CAUTION: DO NOT APPLY POSITIVE PRESSURE TO STATIC LINES WITH INSTRUMENTS CONNECTED. ENSURE THAT THE ALTITUDE HOLD ON AUTOPILOT COMPUTER IS DISCONNECTED.

- (b) Apply a slight pressure and coat lines with a mild solution of soap and water to locate leak.
- (c) Tighten or repair faulty connections or replace damaged lines. Remove line plugs and pressure source and reconnect hose to respective instruments.
- (d) Repeat test procedure.
- (7) If scale drop of altimeter pointer is less than 100 feet in one minute, leak is negligible. Slowly remove static suction source.
- (8) Remove tape from static port.

5. Cleaning Pitot-Static System Components

A. Cleaning.

- (1) Immerse lines in dry cleaning solvent.

NOTE: All pitot static components must be disconnected from instruments and removed from the aircraft when cleaning.

- (2) Dry lines with filtered compressed air.
- (3) Wipe exterior of lines with a clean, dry cloth.

ANGLE OF ATTACK SYSTEMDescription

1. The angle of attack system (optional) continuously monitors the aircraft's wing lift loading and visually displays the angle of attack by an indicator. The angle of attack system consists of an indicator incorporating a press-to-test circuit (for ground test or inflight test of the system) and a transducer. The indicator is mounted forward of the instrument panel glare shield. The transducer is located on the leading edge of the left wing and transmits electrical signals to the indicator for angle of attack display. The transducer incorporates a heater element operated by the pitot heater switch, to prevent ice from hampering the operation of the transducer. The system also incorporates a stall warning circuit which, when energized, causes the stall warning horn to sound.

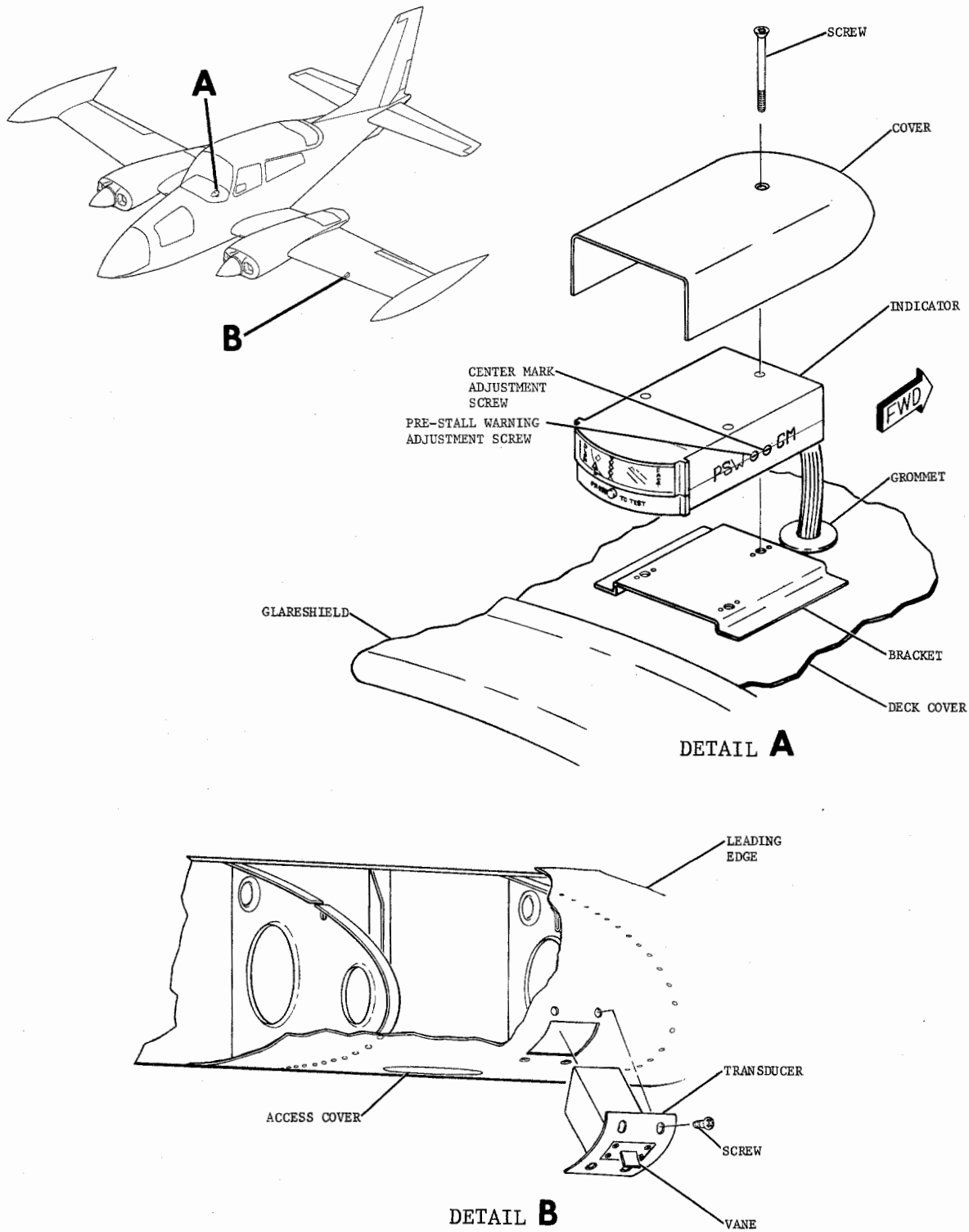
Maintenance Practices

1. Removal/Installation Angle of Attack Indicator (See Figure 1).
 - A. Remove Indicator.
 - (1) Assure aircraft electrical power is off.
 - (2) Disconnect electrical connector to indicator.
 - (3) Remove cover from indicator by removing screw.
 - (4) Remove screws securing indicator to mounting bracket.
 - (5) Remove grommet from deck cover; remove indicator.
 - B. Install Indicator.
 - (1) Insert wire cable of indicator through hole in deck cover.
 - (2) Install grommet in deck cover.
 - (3) Position indicator on mounting bracket and secure with screws.
 - (4) Install cover on indicator with screw.
 - (5) Reconnect electrical plug.
2. Removal/Installation Angle of Attack Transducer (See Figure 1).

NOTE: Before removal of transducer, it is important that the exact fore-aft location of the vane be marked on the wing so that the replacement unit may be installed indentially.

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MAINTENANCE MANUAL



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Angle of Attack System Installation
Figure 1

A. Remove Transducer.

- (1) Assure aircraft electrical power is off.
- (2) Remove access cover.
- (3) Disconnect electrical plug to transducer.
- (4) Remove screws securing transducer to leading edge.
Remove transducer.

B. Install Transducer.

- (1) Insert wire cable of transducer through transducer mounting hole.
- (2) Secure transducer to leading edge with screws.
- (3) Reconnect transducer electrical plug.
- (4) Replace access cover.

3. Adjustment/Test Angle of Attack System.

A. Test Angle of Attack System.

- (1) Move battery switch to ON position. Push the Press-to-Test button on the indicator.
- (2) Check that the indicator needle moves to the left (SLOW) end of scale and the stall warning horn sounds with the needle in the red zone. The needle should return to the SLOW diamond when the button is released.
- (3) Turn the pitot heat switch ON and check to see that the transducer mounting plate on the left wing leading edge heats up.
- (4) Turn pitot heat OFF.

NOTE: The pitot heat switch should not be left on any longer than necessary to determine that mounting plate is heating.

- (5) Push the transducer vane gently aft (down). Check that the needle moves to the right (FAST) end of scale. When released, the vane should return to approximate center of its travel and the needle should return to the SLOW diamond.
- (6) Push the transducer vane gently forward (up). The indicator needle should move to the left (SLOW) end of scale and the stall warning horn should sound. When released, the vane should return to the approximate center of travel, the needle to the SLOW diamond, and the stall warning horn should stop.
- (7) Turn battery switch OFF.

B. Ground Adjustment Check Angle of Attack System.

- (1) Before applying electrical power to the system, check the SLOW/FAST needle position. It should be at a position midway between the SLOW (left) diamond and the SLOW legend.
- (2) Turn on battery master switch. Check that the aircraft voltage is at least 24 volts.
- (3) Press the test button on the front of the indicator. The needle shall move to the left end of the scale and the pre-stall warning horn shall sound. Release the test button. The SLOW/FAST needle shall return to a position near the SLOW diamond and the pre-stall warning horn shall stop.
- (4) Remove cover, using a small screwdriver, turn the adjustment screw marked PSW (Pre-Stall Warning), located on the side of the indicator, clockwise until the pre-stall warning horn sounds. Then turn the PSW screw counterclockwise until the horn stops.
- (5) Push the vane on the lift transducer, located on the leading edge of the left wing forward (up). The pre-stall warning horn shall sound. Release the vane and the horn shall stop. If it does not stop within 3 to 4 seconds after the vane is released, turn the PSW adjustment screw counterclockwise one complete turn. Recheck by pushing the vane forward and releasing it to ensure that the horn will stop within 3 to 4 seconds after the vane is released. The system is now ready for flight check and adjustment.

4. Flight Check and Adjustment Angle of Attack System.

A. Flight Check.

- (1) The flight check should be performed in smooth air at a safe altitude to perform stalls. Using the data recorded in the Flight Check portion of the Operational Check of Stall Warning System (Chapter 13), adjust the angle of attack system to provide an "on speed" indication when the indicated airspeed is within ± 2 knots of the approach speed determined from the Approach and Stall Speed Chart, correct for weight at time of the test for the following configurations:
 - (a) Landing gear down.
 - (b) Flaps full down.
 - (c) Power as required to maintain a stable rate of descent at 500 FPM.

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SERVICE MANUAL

- (2) With power off (IDLE), flaps down, gear down, trim the aircraft for a speed approximately 20 knots above the stall speed determined from the Approach and Stall Speed Chart. Then slowly reduce speed to no more than 1 knot per second, and observe the speed at which the pre-stall warning horn sounds. Continue to reduce speed at no more than 1 knot per second until the aircraft stalls, and observe the stall speed. The pre-stall warning horn shall sound 3 to 5 knots before stall. If it does not, proceed as in steps 3 and 4.
- (3) If the speed at which the horn sounded was greater than 5 knots before stall, turn the PSW (Pre-Stall Warning) adjustment screw on the side of the indicator counterclockwise approximately 1/2 turn for each knot the warning speed must be reduced. Then repeat step (2) until the warning horn sounds at 3 to 5 knots before stall speed. Do not allow the speed to decrease at greater than 1 knot per second during these checks.
- (4) If the speed at which the pre-stall warning sounded was less than 3 knots before stall, adjustment of the lift transducer location on the wing is required. Land and loosen the screws in the slotted holes in the corners of the lift transducer mounting plate, and slide the transducer forward (up) on the wing. Retighten screws and repeat step (2) and step (3) if necessary. Do not attempt to increase the warning horn speed by turning the PSW adjustment screw clockwise, as the maximum clockwise setting was determined in the ground adjustment check steps 4 and 5. Any further clockwise adjustment will cause the horn to sound when the aircraft is at rest on the ground.
- (5) After the pre-stall warning horn is properly adjusted, determine the weight of the aircraft. Using the Approach and Speed Chart, find the approach speed.
- (6) With flaps and gear down, trim the aircraft for level flight at speed determined in step (5). Altitude hold may be used to facilitate this adjustment, if available. Maintaining this speed, observe the position of the SLOW/FAST needle. It should be at the center mark. If the needle is to the left of the center mark, turn the adjustment screw marked CM (Center Mark), located on the side of the indicator, clockwise. If it is to the right of the center mark, turn the adjusting screw counterclockwise. Make the adjustment in steps of 2 to 3 turns in the appropriate direction, then recheck

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- the needle position and the airspeed to ensure that the speed is being maintained at the proper value.
- (7) After completion of the flight check and alignment, replace the cover on the indicator and secure in place.

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CHAPTER

12

EQUIPMENT AND FURNISHINGS

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UPHOLSTERY AND TRIMDescription

1. The aircraft's interior upholstery and trim consists of upholstery panels, headliner and trim. The upholstery panels and window trims are secured to the structure by screws. The headliner is attached to the structure by channels, hangers, and screws.
2. The main upholstery (side) panels are divided into upper and lower sections to provide for an electrical wire tunnel along the side of the fuselage. The upper and lower panels are connected together with the wire tunnel and arm rest covers.
3. The wing locker baggage area of each wing has upholstery installed and attached to the structure with retainers and screws. Optional nose baggage compartment upholstery may be installed in the nose section.

Maintenance Practices

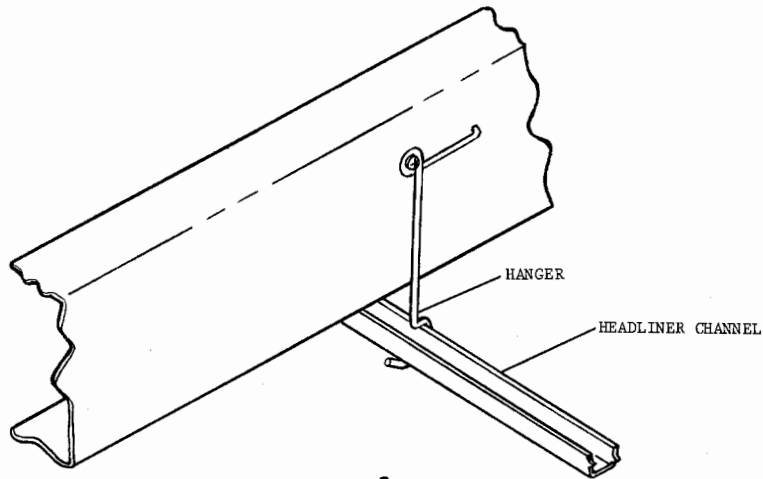
1. Removal/Installation Upholstery and Trim
 - A. For removal and installation of upholstery and trim, see Figures 1 and 2.

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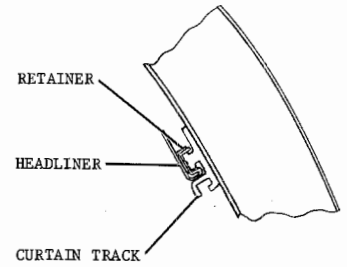
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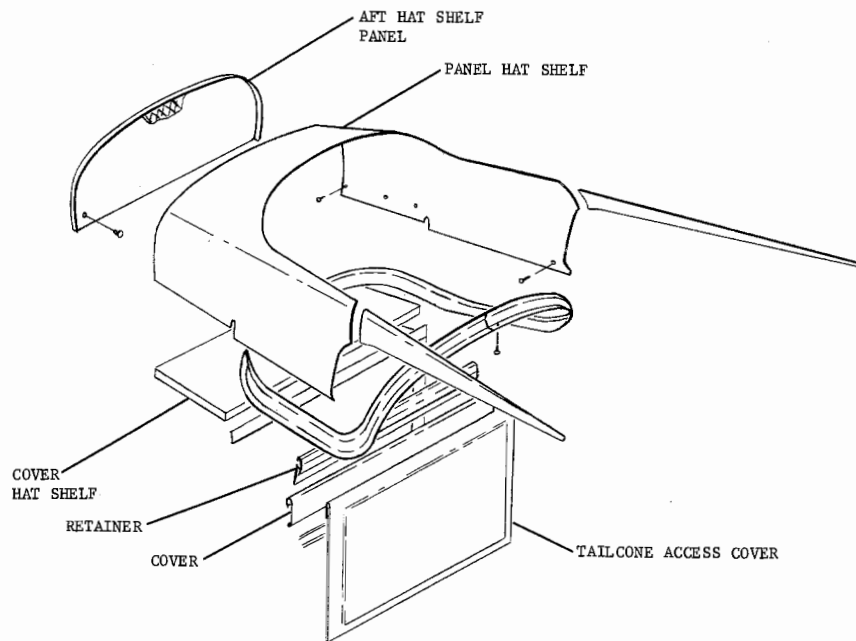
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DETAIL A



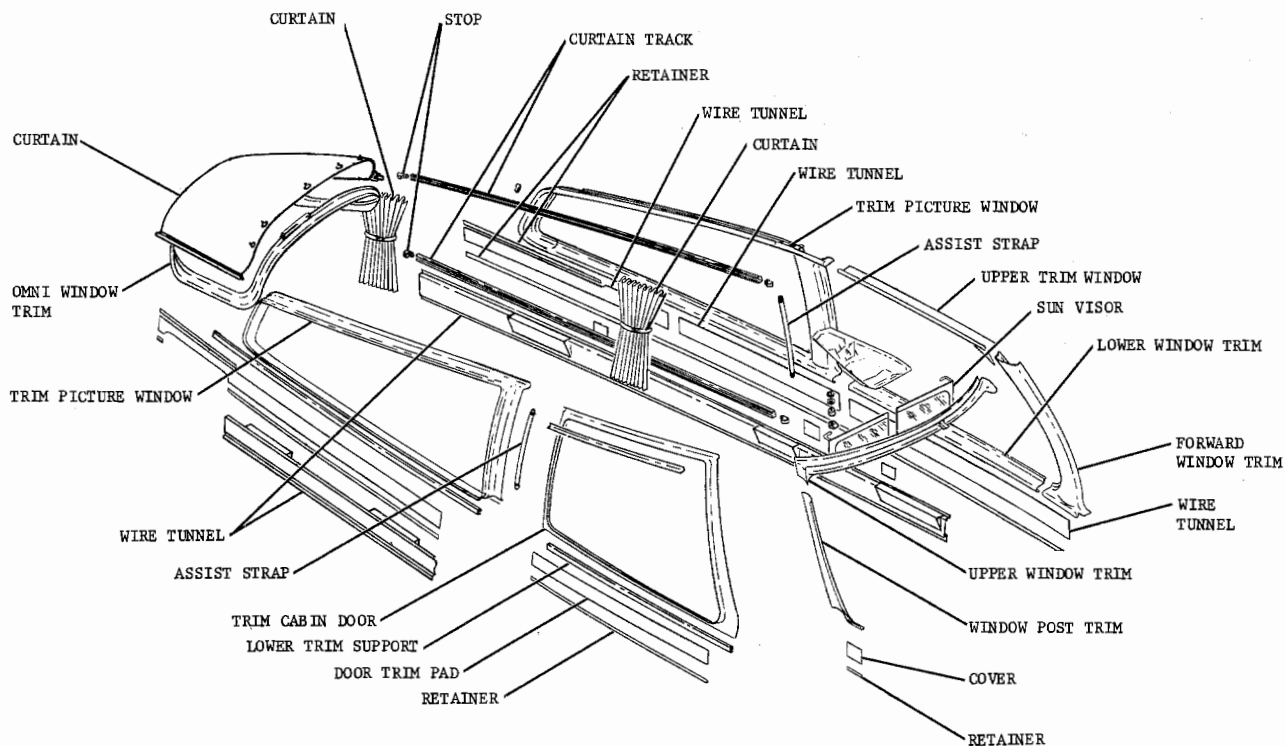
DETAIL B



DETAIL C

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Upholstery Installation
Figure 1 (Sheet 2)



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Upholstery Trim Installation
Figure 2

PILOT AND COPILOT SEATS AND SEAT BELTSDescription

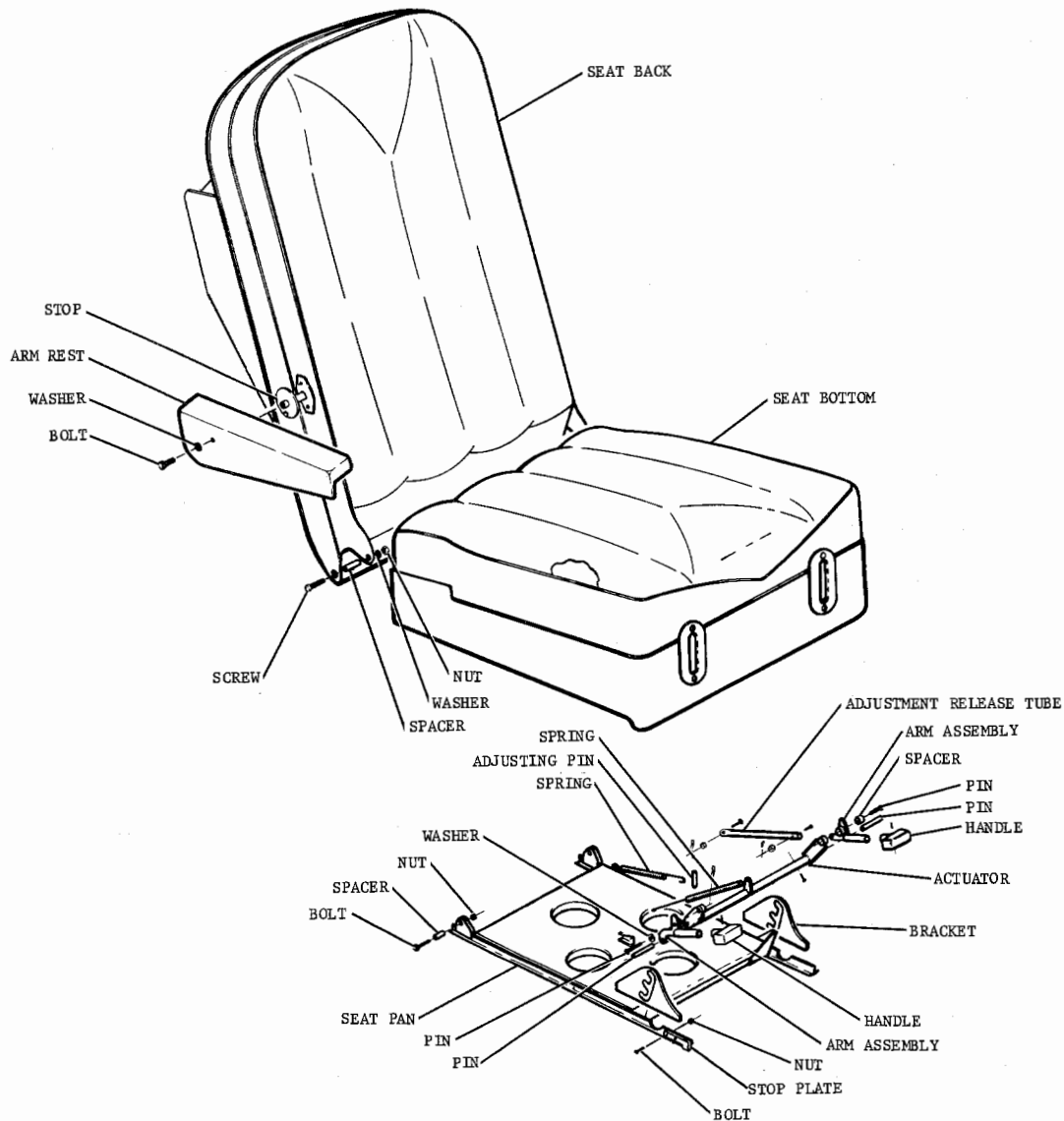
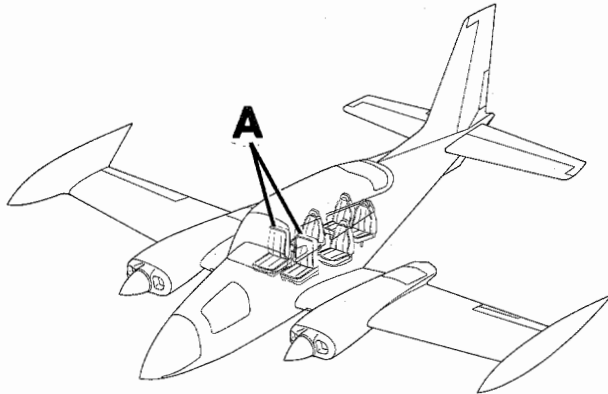
1. The standard pilot and copilot seats are identical. The seats are adjustable to the forward/aft and recline positions by the two knobs, located on the front of the seat.
2. Seat belts and shoulder harnesses are utilized to secure the individual in the seat. An inertia reel shoulder harness (optional) can be installed to further protect the individual.

Maintenance Practices

1. Removal/Installation Front Seats (See Figure 1).
 - A. Remove Front Seats.
 - (1) Pull on seat right-hand handle and tilt the seat back as far as possible.
 - (2) Remove two bolt and nuts, securing the seat front stop plates on both sides of the seat pan.
 - (3) Remove stop plates.
 - (4) Pull up on the fwd and aft adjusting knob and slide the seat aft to clear it from the tracks.
 - (5) Remove the seat from the aircraft and disassemble and assemble front seat in accordance with Figure 1.
 - B. Install Front Seats.
 - (1) Pull up on seat right-hand adjusting handle and tilt the seat as far as possible.
 - (2) Install seat pan assembly on floorboard seat supports.
 - (3) Pull up on the left-hand adjusting handle and slide seat forward until the rear seat stops come to rest against the seat supports.
 - (4) Install the front stop plates on seat pan with bolts and nuts.
- WARNING: AFTER SEAT HAS BEEN INSTALLED, ENSURE THAT STOP PLATE HAS BEEN INSTALLED PROPERLY AND THAT THE SEAT ADJUSTMENT MECHANISM FUNCTIONS PROPERLY.
2. Removal/Installation Seat Belts (See Figure 2).
 - A. Remove Seat Belts.
 - (1) Remove escutcheon from floorboard.

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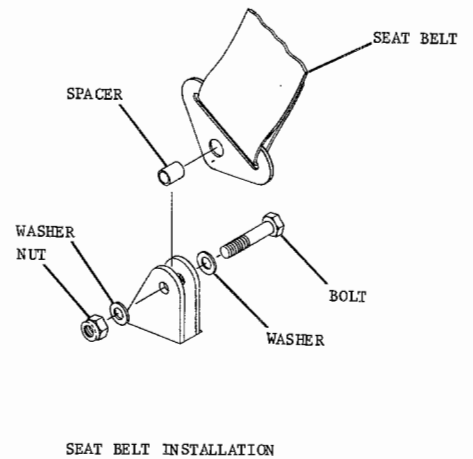
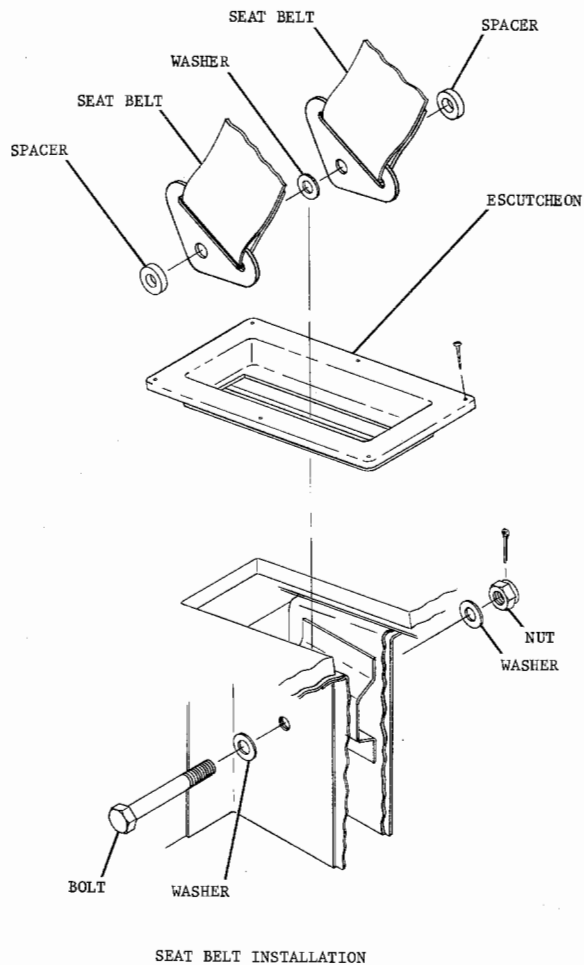
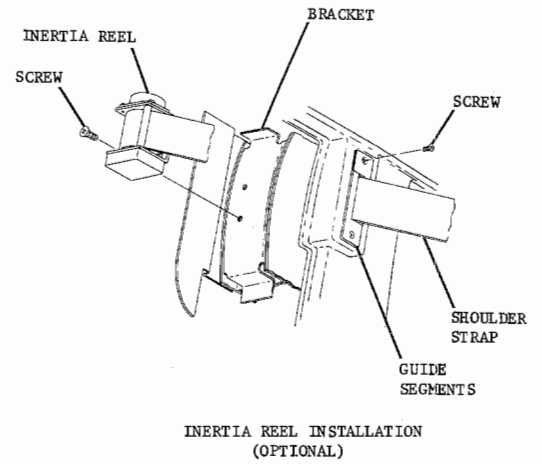
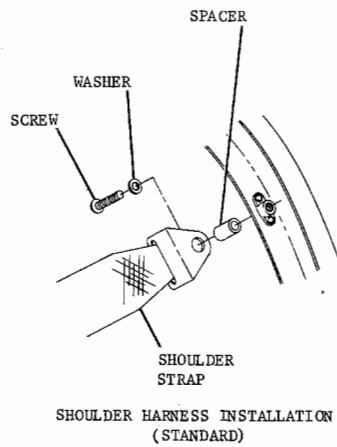
MAINTENANCE MANUAL



DETAIL A

Front Seat Installation
Figure 1

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Seat Belt and Shoulder Harness Installation
Figure 2

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- (2) Remove cotter pin, nuts, washers, spacers and bolts securing seat belts to structure, and remove seat belts.

B. Install Seat Belts.

- (1) Secure seat belts to structure, using bolts, washers, spacers nuts and cotter pins.
- (2) Install escutcheon to floorboard.

NOTE: Make sure seat belts are properly threaded through the seat belt bracket to assure length of seat belts can be adjusted.

3. Removal/Installation Shoulder Harness (See Figure 2).

A. Remove Shoulder Harness.

- (1) Remove mounting bracket cup.
- (2) Remove bolt, washer and spacer.
- (3) Remove shoulder harness.

B. Install Shoulder Harness.

- (1) Make sure shoulder strap is properly threaded through bracket.
- (2) Secure shoulder strap to structure, using screw, washer and spacer.
- (3) Install mounting bracket cup.

4. Removal/Installation Inertia Reel (Optional) See Figure 2.

A. Remove Inertia Reel.

- (1) Remove screws, securing guide segments and remove guide segments.
- (2) Remove window trim.
- (3) Pull out on shoulder strap to gain access to screws securing inertia reel to bracket and remove inertia reel.

B. Install Inertia Reel.

- (1) Secure inertia reel to bracket with screws.
- (2) Install window trim.
- (3) Install guide segments to window trim, using screws.

PILOT AND COPILOT MANUAL AND ELECTRICAL ADJUSTABLE SEATDescription

1. Two different optional pilot and copilot seats can be installed in the aircraft, either manual or electrical operated. The difference between the manual and electrical is the electrical seat utilizes electric motors in lieu of the manual cranks for the up and down and tilting movements.

Maintenance Practices

1. Removal/Installation Pilot's and Copilot's Manual and Electrical Adjustable Seat (See Figure 1).

NOTE: The procedures given pertain to either the pilot's or copilot's manual or electrical adjustable seat.

A. Remove Pilot or Copilot Seat.

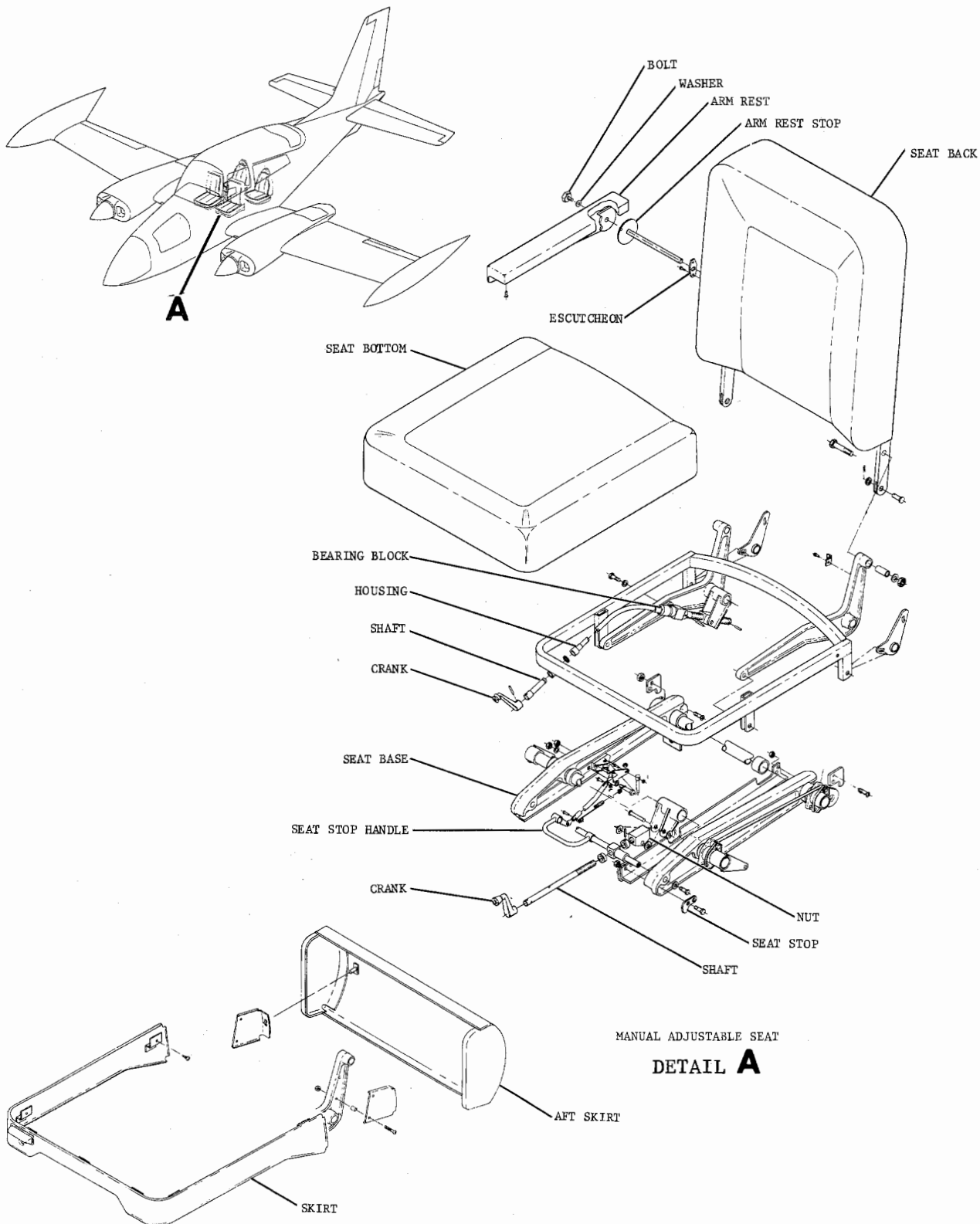
- (1) Raise seat to the highest position.
- (2) Remove front seat stops on each side of the rail by removing nuts and bolts.
- (3) If electric seat is installed, tag and disconnect wiring.
- (4) Pull up on seat stop handle and slide seat aft and remove seat from its mountings.
- (5) If disassembly and assembly are required, see Figure 1.

B. Install Pilot or Copilot Seat.

- (1) Insert seat on seat rails and slide forward.
- (2) Pull up on seat stop handle and allow seat to move forward far enough to install front seat stops.
- (3) If electric seat is being installed, connect wiring and remove tags.
- (4) Install front seat stops with bolts and nuts.
- (5) Turn on electrical power and check seat operation.
- (6) If seat is not electrical, check operation using cranks provided on the front of the seat.

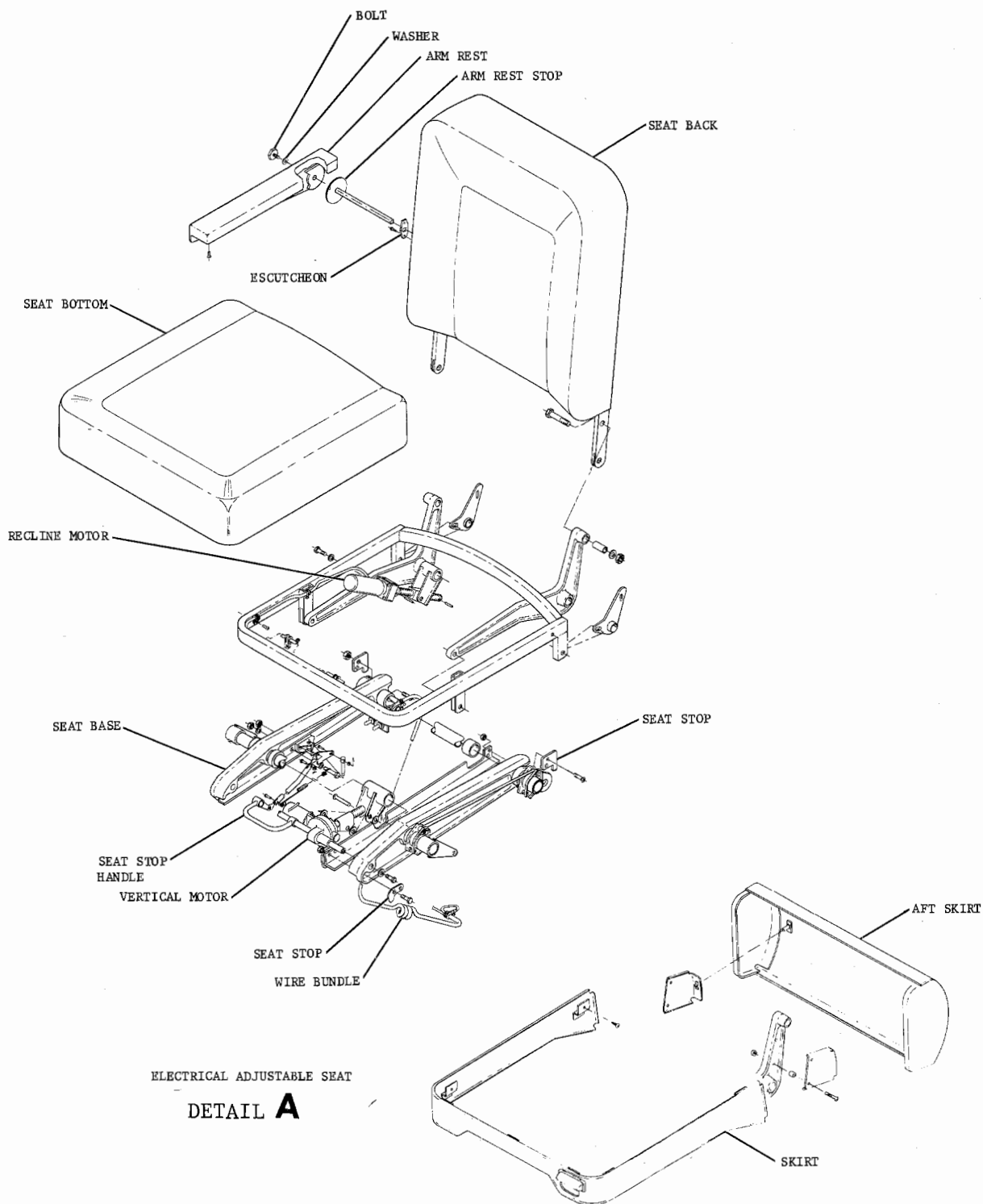
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Pilot and Copilot Manual and Electrical Adjustable Seat
Figure 1 (Sheet 1 of 2)



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Pilot and Copilot Manual and Electrical Adjustable Seat
Figure 1 (Sheet 2)

RECLINING REAR SEATDescription

1. The rear seat, is a double seat incorporating individual seat reclining adjustments. The seat is secured to the floor structure with bolts.

Maintenance Practices

1. Removal/Installation Reclining Rear Seat (See Figure 1).

- A. Remove Reclining Rear Seat.

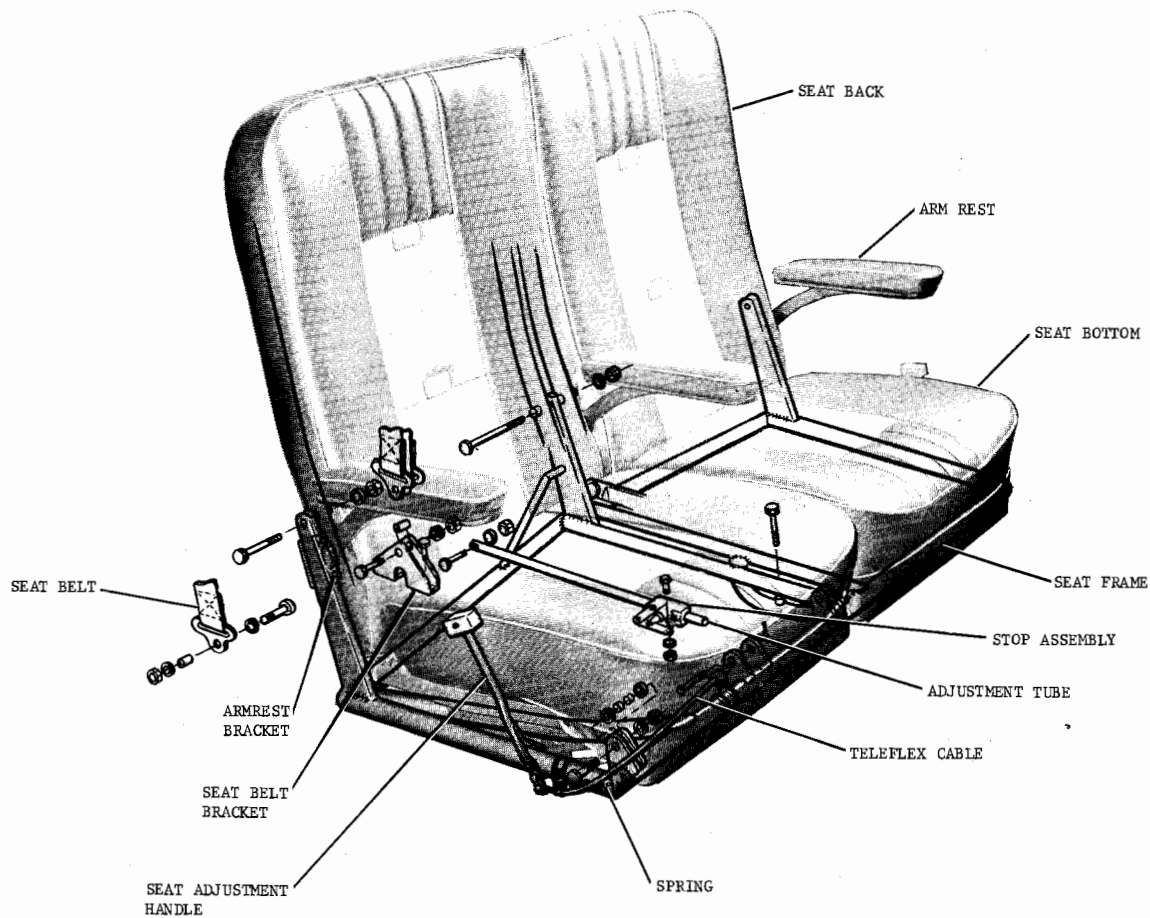
- (1) To remove the rear seat, enter the baggage compartment and proceed as follows:
 - (a) Unfasten snaps securing the upholstery at the bottom of the seat backs.
 - (b) Remove bolts securing seat back to seat frame.
 - (c) Tilt the seat back forward and remove the two bolts securing the seat back to the seat bottom.
 - (d) Remove the seat back from the aircraft.
 - (e) Repeat this procedure to remove the other seat back.
 - (f) Remove the two seat belts, by removing nuts, washers, spacers and bolts.
 - (g) Tilt the seat bottoms as far forward as possible.
 - (h) Remove the three bolts securing the seat frame to the aircraft structure.
 - (i) Remove the seat frame, with seat bottoms attached, from the aircraft.

- B. Install Reclining Rear Seat.

- (1) Position seat frame with seat bottoms attached and secure seat to structure using bolts.
- (2) Install the seat belts using nuts, washers, spacer and bolts.
- (3) Install the seat backs on the seat.
- (4) Secure the upholstery at the bottom of the seat backs.

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Individual Reclining Rear Seat
Figure 1

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CENTER INDIVIDUAL SEATDescription

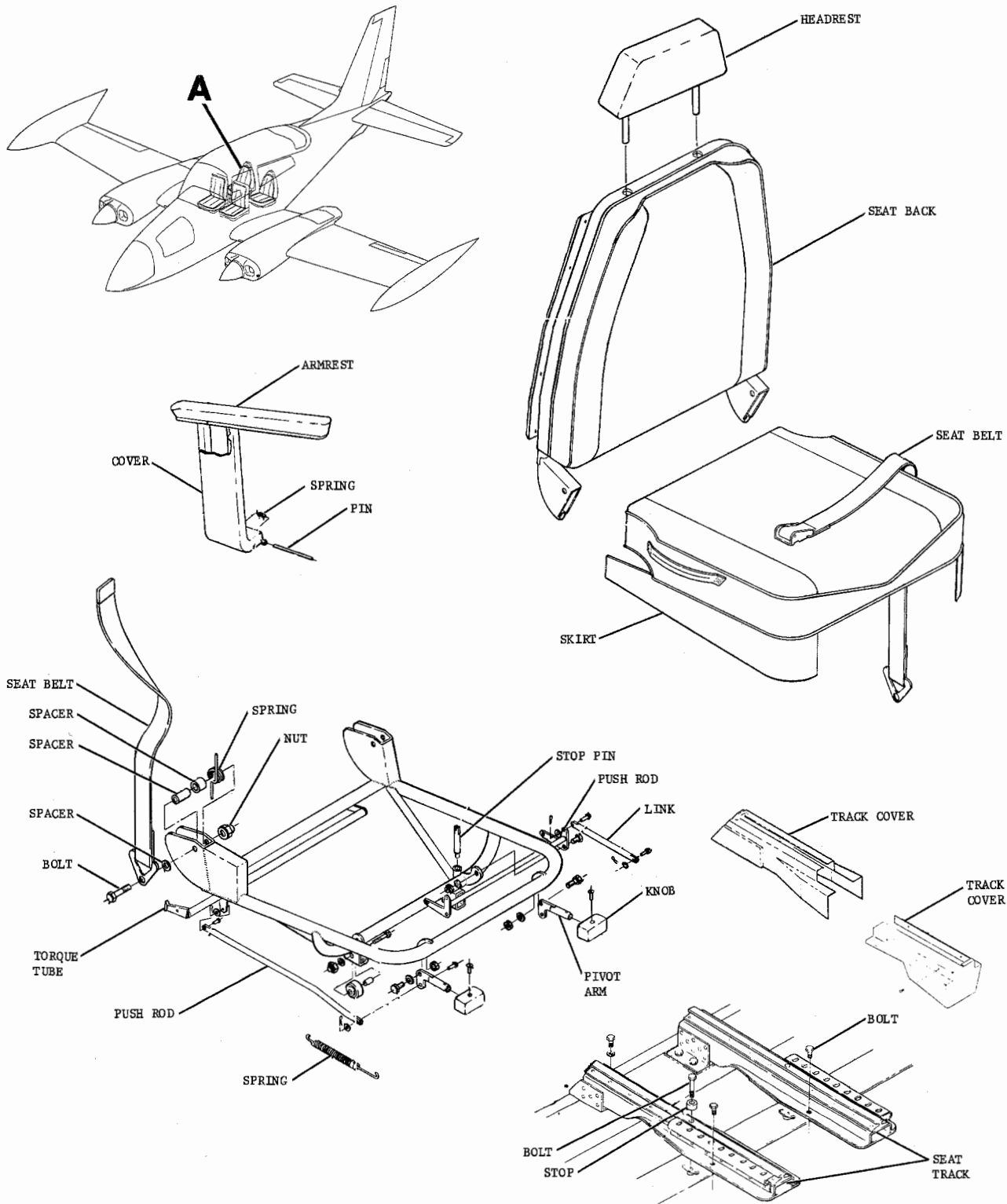
1. Individual center seats are optional. The seats are mounted on seat tracks and may be adjusted forward and aft.

Maintenance Practices

1. Removal/Installation Center Individual Seats (See Figure 1).
 - A. Remove Center Seats.
 - (1) Pull up on left-hand adjusting knob and move front seat as far forward as possible.
 - (2) Remove bolt and stop from seat track.
 - (3) Pull up on left-hand adjusting knob and move center seat forward until it clears the support assemblies.
 - (4) Remove center seat from aircraft through cabin door. If desired, disassemble and assemble in accordance with Figure 1.
 - B. Install Center Seats.
 - (1) Slide seat on the seat tracks.
 - (2) Install bolt and stop.

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DETAIL **A**

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Center Seat Installation
Figure 1

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AFT SEATDescription

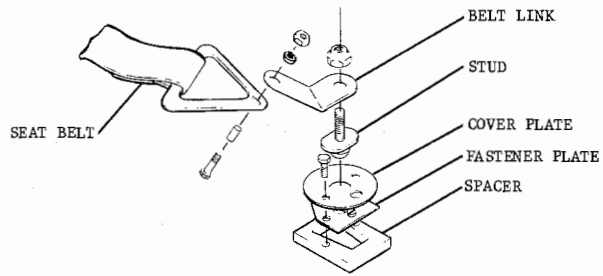
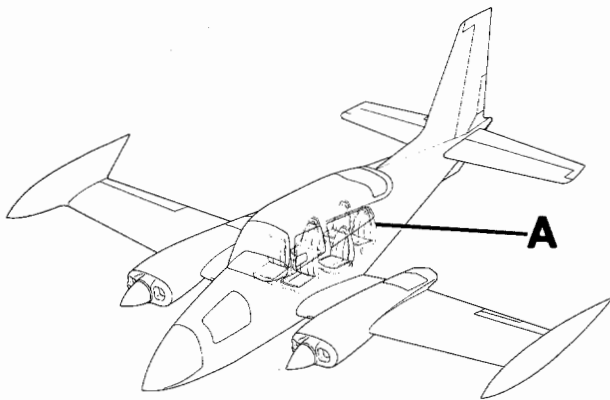
1. The individual aft seats are optional. The seats are secured to the floor structure with quick-disconnect fasteners. Each seat incorporates an adjustable mechanism and may be adjusted to the recline position.

Maintenance Practices

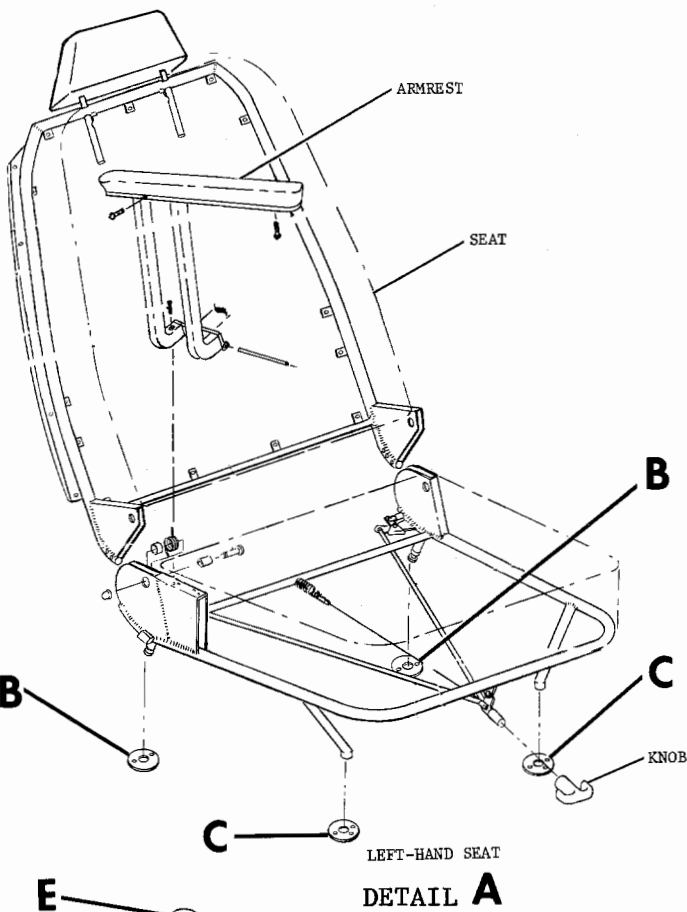
1. Removal/Installation Aft Seats (See Figure 1).
 - A. Remove Aft Seats.
 - (1) Turn slotted screws on fastener plates and lift seat from the floor.
 - B. Install Aft Seats.
 - (1) Align the four round headed studs with the receptacle in the fastener plates. Apply pressure downward on the seat until the studs snap into position.

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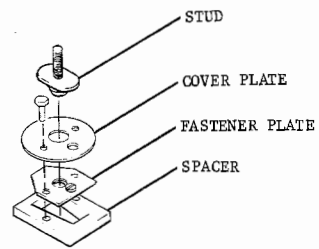
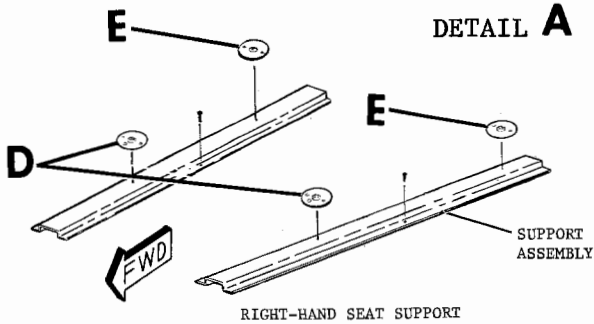
MAINTENANCE MANUAL



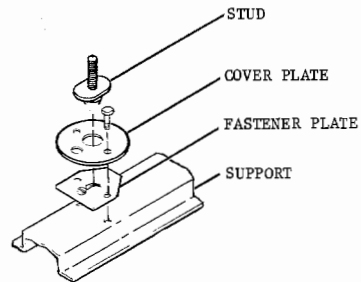
DETAIL B



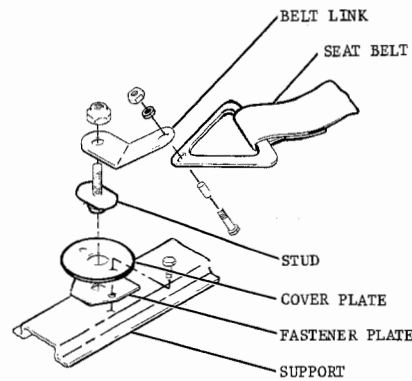
DETAIL A



DETAIL C



DETAIL D



DETAIL E

Aft Seat Installation
Figure 1

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CARPETDescription

1. The aircraft's carpet is installed in sections on the floor for ease of removal and installation. Screws secure the carpet on the floor along with covers and seat cover plates.

Maintenance Practices

1. Removal/Installation Carpet (See Figure 1).

- A. Remove Carpet.

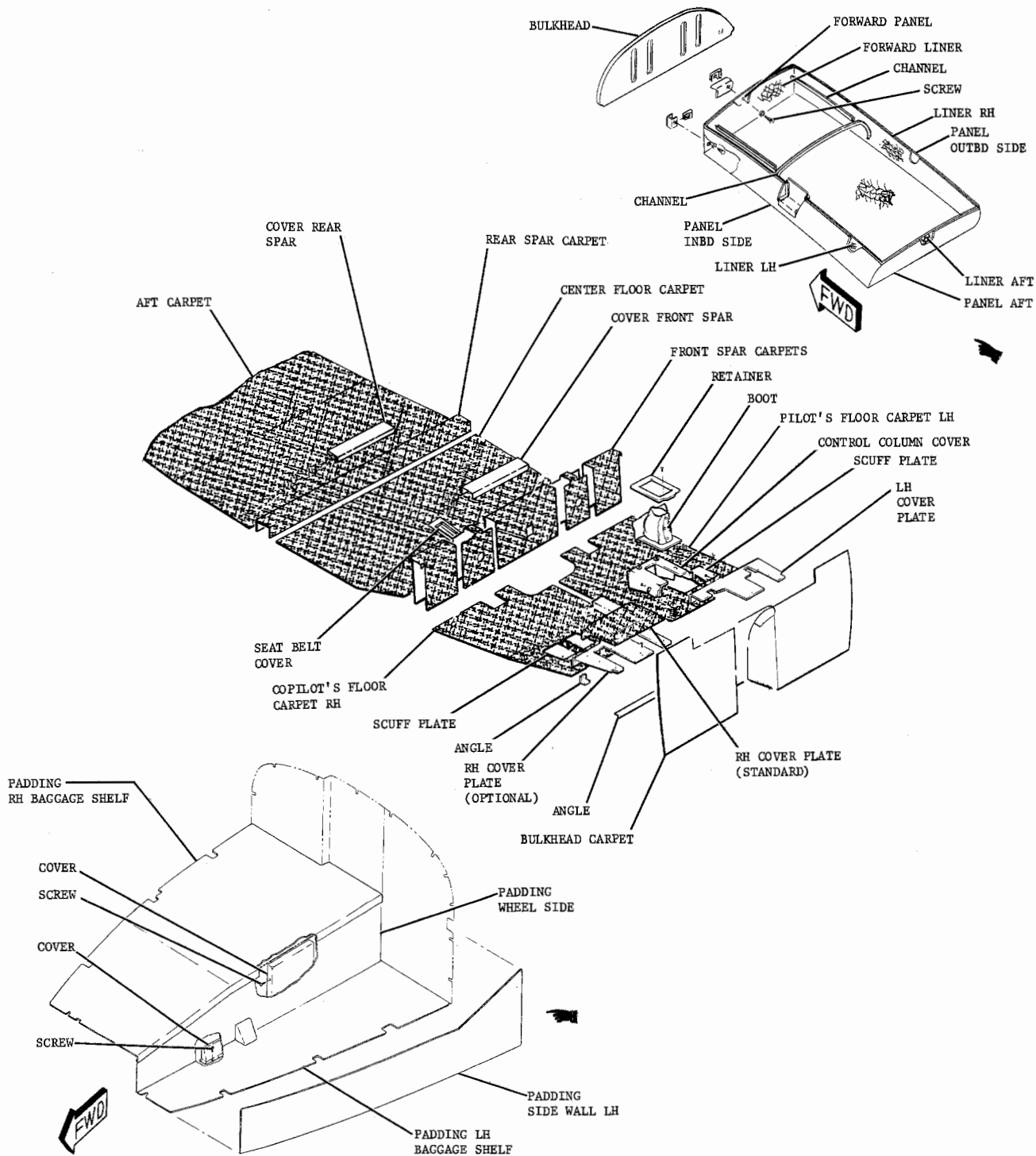
- (1) Remove front and rear seats, refer to seat removal procedures.
- (2) Remove the regulator shield by removing attaching screws. The shield is located under the copilot's seat.
- (3) Remove screws from angles, securing the bulkhead carpet. Remove angles and bulkhead carpet.
- (4) Remove left and right cover plates by removing attaching screws.
- (5) Remove the scuff plates by removing the attaching screws.
- (6) Remove the control column boot, retainer and cover by removing screws.
- (7) Remove pilot and copilot's carpet by removing attaching screws and freeing carpet from glued insulation.
- (8) Remove center carpet by removing attaching screws and removing carpet.
- (9) Remove the aft carpet by removing the attaching screws.
- (10) For removal of nose baggage or wing locker baggage carpet, refer to Figure 1.

- B. Install Carpet.

- (1) Install aft carpet on floor and secure with attaching screws.
- (2) Install center carpet on floor and secure with attaching screws.
- (3) Install the pilot's and copilot's carpet on the floor with attaching screws.
- (4) Install left and right cover plates using attaching screws.
- (5) Install bulkhead carpet, with angles and attaching screws.

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Carpet Installation
Figure 1

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SERVICE MANUAL

- (6) Install control column cover, boot and retainer, using screws.
- (7) Install scuff plates and secure with screws.
- (8) Install the regulator shield and secure with screws.
- (9) Install front and rear seats, refer to seat installation.
- (10) If nose baggage or wing locker baggage carpet is to be installed, refer to Figure 1.

C. Cleaning Carpet.

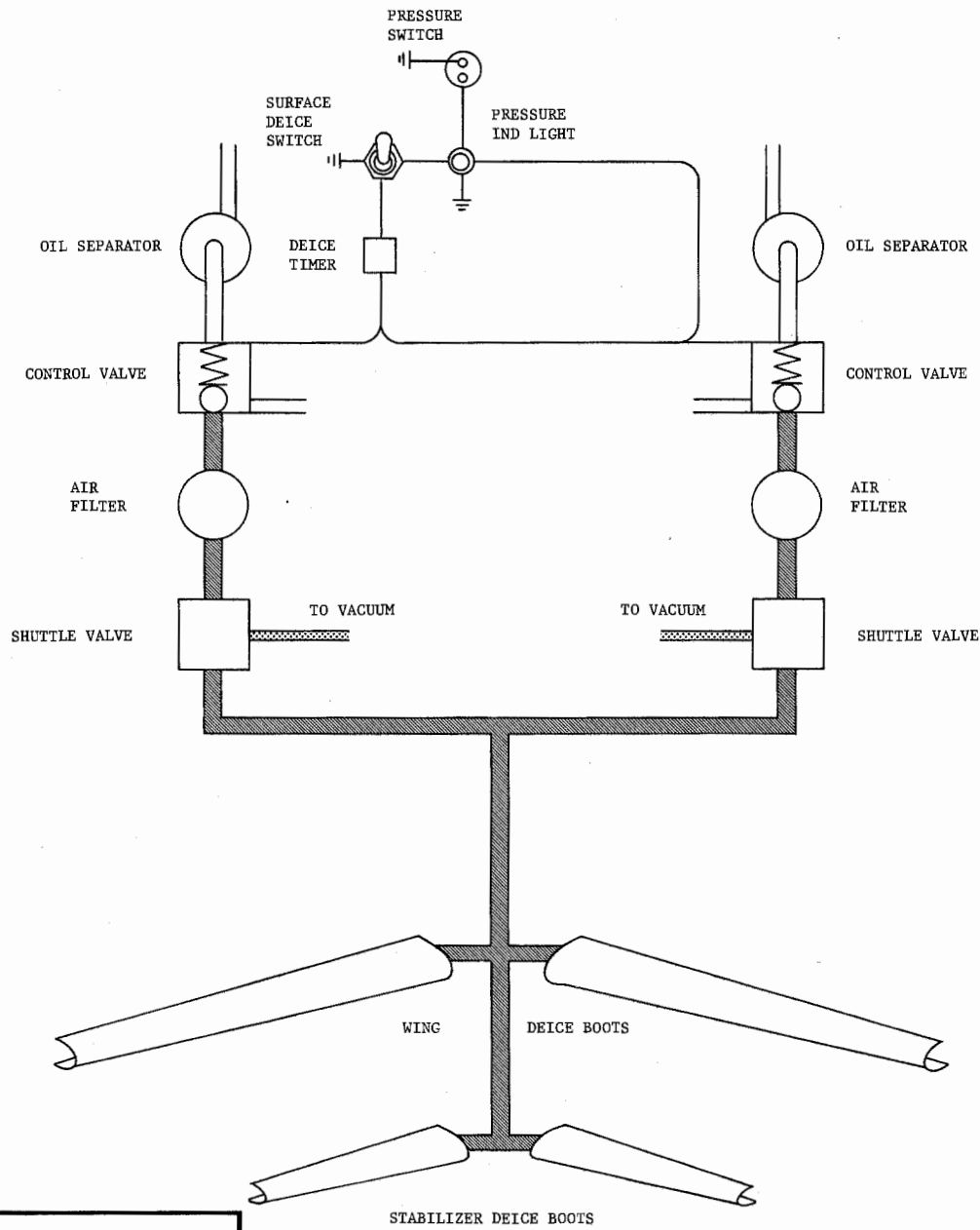
- (1) Refer to Chapter 2, for cleaning carpet.

SURFACE DEICE SYSTEMDescription

1. A pneumatic airfoil deice system (optional) is utilized to break up ice accumulation on the outboard wing leading edge and the horizontal stabilizer leading edge. Air is routed from each engine-driven vacuum pump by tubing to the rubber boots bonded to the leading edge of the airfoils.
2. The system consists of: engine-driven vacuum pumps, shuttle valves, control valves, oil separators, air filter assemblies, a pressure switch, electrical timer and inflatable rubber deice boots. The system is electrically controlled and pneumatically operated. Air for inflation of the boots is supplied by the pressure side of each engine-driven vacuum pump. A wing deice light is incorporated on the outboard side of the left engine nacelle to provide and aid in observing ice formations during night operation.
3. To operate the deice system, the engine(s) shall be operating to supply air. Momentarily position the surface deice switch, located on the circuit breaker panel to ACTUATE; bus voltage is applied to the timer which initiates the time circuit and supplied bus voltage to the control valves. The control valve actuates, closing the overboard port and opening the inflate port to direct pressure air through the air filter and shuttle valve to inflate the boots. The time circuit will elapse in six seconds after initiation, deactuating the control valves. The boots will deflate by bleeding the air back through the control valve dumping the air overboard. When the control valve has less than one psi against it, the valve closes and the vacuum side of the vacuum pump holds the boots in the deflated position. The boots will remain in the deflated position until the timer is again cycled by positioning the surface deice switch to ACTUATE position. Reset position on the surface deice switch interrupts the normal cycle to return the boots to the deflated airfoil position. The pressure indicator light (amber) will illuminate when the surface deice switch is moved to ACTUATE and the system reaches 10 psi.

Troubleshooting

1. Troubleshooting the pneumatic deice system is isolating the fault to the air or the electrical part. Refer to Chapter 13 for wiring diagrams.
2. Tools and Equipment.



SCHEMATIC FOR AIRCRAFT
EQUIPPED WITH LIGHT WEIGHT
DEICE SYSTEM

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Surface Deice Schematic
Figure 1

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NOTE: Equivalent substitutes may be used for the following listed item.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	To check voltage and continuity in the electrical circuits.

3. Troubleshooting.

A. For troubleshooting the deice system, see Figure 2.

Adjustment/Test

1. Test Surface Deice System.

A. Electrical Test.

- (1) Position deice control switch to OFF position.
- (2) Position battery switch to ON position.
- (3) Press indicator light to check light circuit and bulb.
- (4) Position deice control switch to ACTUATE and repeat step (3).
- (5) If indicator light does not function in step (3) and (4), the circuit breaker may have opened. Check for short in system. Reset circuit breaker and recheck step (3).

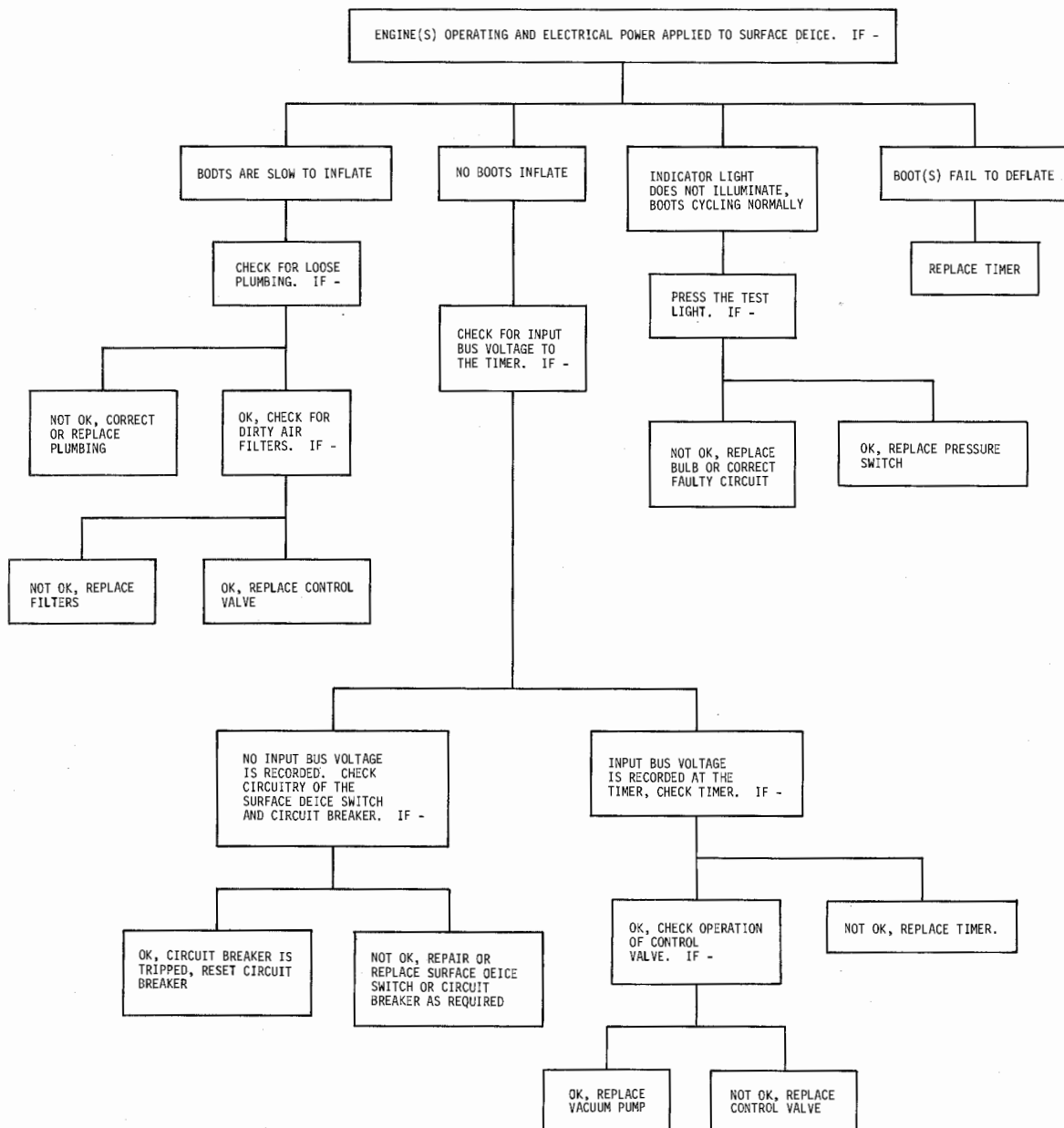
B. Air Leakage Test.

NOTE: This test can be performed in either the left or right nacelles. The following steps refer to the left nacelle.

- (1) Disconnect pressure hose from the control valve inlet fitting.
- (2) Disconnect tube from overboard port and cap the port with an AN929-10 cap assembly.
- (3) Connect a source of clean air to the control valve inlet port. It is necessary that the inlet pressure be a minimum of 18-20 PSIG to perform this test. Include a pressure gage in the air line to observe the system pressures.

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Troubleshooting Chart - Pneumatic Deice System
Figure 2

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- (4) Apply 18 PSIG pressure to the system and by means of a hand-operated valve, trap the pressure on the deice system. Observe the system for leakage. The leakage rate should not exceed a pressure drop of 4.0 PSIG per minute.
- (5) To check the pressure switch, turn on the aircraft battery switch while the deice system is under pressure. The indicator light should glow.
- (6) Remove test equipment, lubricate all threads, and replace all system components.
- (7) Disassembly or rework of the operating equipment in this system should not be attempted, replace any unit which does not function correctly.

Cleaning/Painting

1. Cleaning Deice System Components

A. Cleaning.

- (1) The deice system components can be washed down with the engine using Stoddard Solvent.
- (2) The deice boots can be cleaned using soap and water, refer to Chapter 1.

NOTE: Never use thinners, Ketone or harsh solvents on deice boots.

Maintenance Practices

1. Tools and Equipment

Name	Number	Manufacturer	Use
Methyl Ethyl Ketone	TT-M-261		Clean deice boot and mating surface.
Technical Toluene	TT-T-548		Remove deice boot.
Paint and Lacquer Remover	TT-4-248		Remove paint prior to installing deice boot.

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Name	Number	Manufacturer	Use
Adhesive	EC-1300-L	Minnesota Mining and Mfg. Co. St. Paul, Minn.	To bond deice boot to wing.
Accelerator	EC-539 Coating with EC-566	Minnesota Mining and Mfg. Co. St. Paul, Minn.	To dress edge of deice boot.
Rymplecloth	301	Kendall Textile Div. New York, N.Y.	To clean sur- faces.
Roller, Hand	One-fourth inch wide, metal, hand stitcher - rollers		
Chalk Line	Carpenter's Chalk Line		
Cold Patch Repair Kit	74-451-C	B.F. Goodrich Co. Aerospace & Defense Products Akron, Ohio	Repair deice

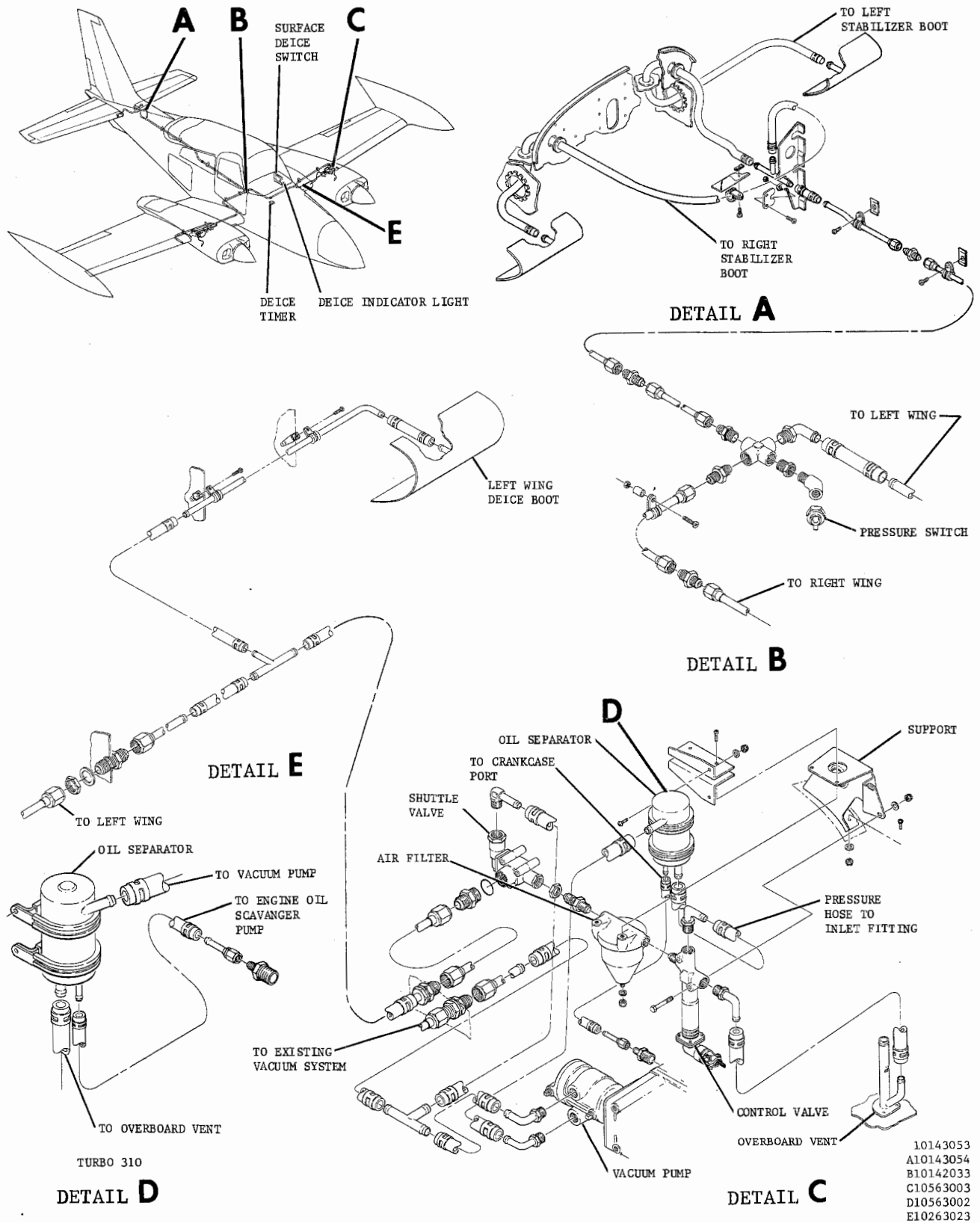
2. Removal/Installation Control Valve (See Figure 3).

A. Remove Control Valve.

- (1) Remove upper cowl from engine.
- (2) Disconnect electrical connector from control valve.
- (3) Disconnect plumbing from the control valve.
- (4) Remove bolts, washer and nuts, securing control valve to support.
- (5) Disconnect control valve from air filter and remove control valve.

B. Install Control Valve.

- (1) Connect control valve to the air filter.
- (2) Secure control valve to support, using bolts, washers and bolts.
- (3) Connect plumbing to the control valve.
- (4) Connect electrical connector to control valve.
- (5) Install upper engine cowl.



Surface Deice System Installation
Figure 3

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3. Removal/Installation Shuttle Valve (See Figure 3).

A. Remove Shuttle Valve.

- (1) Remove upper engine cowl.
- (2) Disconnect plumbing from the shuttle valve.
- (3) Disconnect shuttle valve from air filter and remove shuttle valve.

B. Install Shuttle Valve.

- (1) Connect shuttle valve to air filter, using union and nut.
- (2) Connect plumbing to shuttle valve.
- (3) Install engine cowl.

4. Removal/Installation Air Filter (See Figure 3).

A. Remove Air Filter.

- (1) Remove upper engine cowl.
- (2) Remove shuttle and control valve from air filter.
- (3) Cut safety wire and remove screws and washers, securing air filter to support.

B. Install Air Filter.

- (1) Secure air filter to support, using screws and washers. Safety wire screws.
- (2) Connect control valve and shuttle valve to air filter.
- (3) Install engine cowl.

5. Removal/Installation Vacuum Pump (See Figure 3).

- A. For vacuum pump removal/installation, refer to Chapter 10.

6. Removal/Installation Deice Boot.

A. Remove Deice Boot.

NOTE: To remove or loosen an installed boot Technical Toluene solvent shall be used to soften the bond line. A minimum quantity of solvent should be applied to the bond line while tension is carefully applied to peel back the boot. The removal should be slow enough to allow the solvent to undercut the adhesive so that the boot will not be damaged. Excessive quantities of the solvent must not be allowed on the aircraft surface.

- (1) Refer to Chapter 10 or 13. If installed, remove angle of attack transducer, if not, remove stall warning transmitter.
- (2) Remove access plates as required to remove clamp and tube from boot.
- (3) Remove boot.

B. Install Deice Boot.

- (1) Requirements.
 - (a) Adhesives, primers and coatings shall not be used beyond the original expiration date even though they have been retested and approved. Gelled or contaminated adhesives shall not be used.
 - (b) Containers for adhesives, primers and coatings shall be kept tightly closed, when the materials are not being used, unless otherwise specified.
 - (c) Pre-assembly operations such as fittings, drilling, deburring, punching, trimming, masking, etc., shall be completed prior to cleaning and bonding. Boots shall not be stretched either prior to or during bonding.
 - (d) Surfaces must be clean and dry, free from dust, lint, chips, grease, oil, condensation or other moisture and all other contaminating substances prior to the application of adhesives, primers and coatings.
 - (e) Deice boots shall be cleaned with Methyl Ethyl Ketone.
 - (f) All paints, lacquers, primers, etc., shall be removed prior to cleaning and bonding.
 - (g) Cleaning and bonding shall not be accomplished when the temperature of the structure, deice boots or bonding materials is below 60 degrees Fahrenheit nor when the relative humidity is 90 percent or more.
 - (h) Bonding must be accomplished before the adhesive becomes too dry on either surface. The adhesive must be tacky on both surfaces throughout the entire attachment of the deice boot.
 - (i) Bonds shall be free of wrinkles and entrapped air bubbles. They shall not be loose at the edges nor exhibit poor adhesion.
 - (j) Aircraft may be flown 12 hours after bonding on pneumatic deice boots but shall not be operated for 24 hours after bonding.
 - (k) Adhesives, primers and coatings shall be stirred thoroughly prior to application.

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(2) Positioning.

- (a) Indexing marks shall be placed on the metal surface outside of the bonding area or a chalk line shall be snapped lengthwise down the bonding area approximately on the centerline of the leading edge. The faying surface of the boot shall be marked in a similar manner if necessary, to provide for correct alignment during the installation and attachment of the boot.
- (b) Either the deice boot or a pattern shall be positioned on the metal surface, to which the boot is to be bonded, in order to provide a guide for masking and to check the fit of the boot.
- (c) Leaving an edge margin of approximately one-half inch from the boot or pattern, a single strip of one inch wide masking tape shall be applied to the metal surface around the periphery of the boot or pattern. (Masking should be accurate so that clean-up time will be minimal.) The boot or pattern shall then be removed.

(3) Cleaning.

- (a) All paint in the masked off area shall be removed with paint and lacquer remover. The loosened paint and remover shall be wiped off and the area shall be thoroughly rinsed with clean water and dried with rymplecloth.
- (b) All surfaces to be bonded shall be clean and dry.
- (c) Cleaning shall be accomplished by scrubbing the metal surface in the masked off area and the rough, unglazed faying surface of the deice boot using rymplecloth moistened with Methyl Ethyl Ketone. The cloth should not be saturated to the point where dripping will occur. Methyl Ethyl Ketone shall be wiped from the surfaces before evaporation using rymplecloth in order that oils, grease, wax, etc., will not be redeposited.
- (d) Cleaning solvent should never be poured or sprayed on a structure.
- (e) Final cleaning shall be accomplished immediately prior to bonding. The areas cleaned previously shall be thoroughly recleaned. When the area is being scrubbed with a moistened cloth in one hand, another clean dry cloth shall be held in the other hand and shall be used to dry the area. The solvent must be wiped from the surfaces before it evaporates.

- (f) Bonding procedures shall be started as soon as possible after cleaning and drying the surfaces. Do not allow handling of the surfaces between the cleaning and bonding operations.
 - (g) Caution should be observed during cleaning and bonding. The solvents, adhesives, etc., are toxic and flammable. Fresh air masks and/or adequate ventilation are required for all closed areas. The structure shall be electrically grounded before starting any cleaning or bonding operation.
- (4) Preparation and Application of Bonding Materials.
- (a) Adhesive EC-1300-L must be thoroughly stirred prior to application. A uniform coat of adhesive shall be brushed onto the masked off metal surface and onto the faying surface of the deice boot. The adhesive shall be allowed to dry thoroughly and should not have any tack. A second uniform coat of adhesive shall be brushed onto each of the faying surfaces and allowed to dry until the adhesive exhibits an aggressive tack. This condition can be determined by touching the adhesive lightly, using the back of the knuckle instead of fingertips in order to minimize contamination. When the adhesive is quite tacky, but no longer transfers to the back of the knuckle, the surfaces are ready for bonding. This normally requires from 3 to 15 minutes, depending upon film thickness, humidity and temperature. In the event that the second coat becomes too dry, the adhesive may be reactivated within 48 hours, if kept clean, by wiping lightly with clean rymple-cloth slightly moistened with Technical Toluene and then tested for tack as described above. Excessive rubbing or solvent shall be avoided when reactivating so that adhesive will not be removed.
- (5) Installation of Deice Boot.
- (a) Needed chalk lines and/or indexing marks, removed or covered by the cleaning and adhesive application procedures, shall again be applied.
 - (b) The boot shall be held near but not touching the metal surface and necessary connections and alignment shall be made. Then, while the adhesive exhibits the proper tack for bonding, the boot shall be attached down the centerline. If the boot is allowed to get off course or out of position, it shall be pulled up with a quick motion or by using Technical Toluene and then repositioned properly. A rubber roller shall be rolled firmly along the centerline of the

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- boot and from there in spanwise strips over the entire surface, being careful not to trap any air under the boot. Distortion of the boot shall be held to a minimum. Pneumatic boots shall be rubber rolled parallel to the inflatable tubes. The stitcher-roller shall be used around boot edges, air hose attachments, etc.
- (c) The two components EC-539, coating with EC-566 accelerator, must be mixed together per the manufacturer's instructions and thoroughly stirred prior to application. A uniform film of the coating shall be brushed around the periphery of the deice boot in order to edge-seal and dress up the appearance. Coverage should include the entire exposed adhesive surface and approximately a one-half inch margin on the boot itself. The masking tape should be removed immediately after the coating is applied.
 - (d) Install angle of attack transducer or stall warning transmitter. Refer to Chapter 10 or Chapter 13.
 - (e) Secure tube to boot, using clamp.
 - (f) Install access plates.

7. Approved Repairs.

A. Cold Patch Repair of Deice Boots.

- (1) There are four types or areas of damage that are most common to the deice boots. An outline of the cold patch repair procedure for each follows:

NOTE: When repairing the deice boots and replacement layers are being installed, exercise care to prevent trapping air beneath the replacement layers. If air blisters appear after material is applied, remove them with a hyperdermic needle. Should air blisters appear after boots have been installed, for a length of time, it is permissible to cut a slit in the deice boot, apply adhesive and repair in accordance with the following cold patch repair procedures. An alternate method of repair is to peel the deice boot back using Ketone solvent, and reapply using normal adhesives.

- (2) Scuff or Surface Damage. This type of damage is the most commonly encountered and is usually caused by scuffing the outer surface of the deice boots while

using scaffolds, refueling hoses, ladders, etc. Repair is generally not necessary because the thick outer veneer provides protection to the natural rubber underneath. If the scuff is severe and has caused removal of the entire thickness of veneer (exposing the brown natural rubber underneath) the damage should be repaired as outlined below:

- (a) Select a patch (Part Number 74-451-16, 74-451-17, or 74-451-18) of ample size to cover the damaged area.
- (b) Clean the area to be repaired with a cloth dampened slightly with solvent.
- (c) Buff the area around the damage with steel wool so that the area is moderately but completely roughened.
- (d) Wipe the buffed area clean with a cloth slightly dampened in solvent to remove all loose particles.
- (e) Apply one even thorough coat of cement (Part Number 74-451-20) to the patch and to the corresponding damaged area of the deice boot. Allow cement to set until it becomes tacky.
- (f) Apply patch to the deice boot with an edge or the center adhering first, then work the remainder of the patch down, being careful to avoid trapping air pockets.
- (g) Roll the patch thoroughly with a stitcher-roller (Part Number 74-451-73) and allow to set for ten to fifteen minutes.
- (h) Wipe the patch and surrounding area from the center of the patch outward, with a cloth slightly dampened with solvent.
- (i) Apply one light coat of A-56-B conductive cement (Part Number 74-451-11) to the patched area.

NOTE: Satisfactory adhesion should be obtained in four hours; however, if the patch is allowed to cure for a minimum of 20 minutes, the deice boots may be inflated to check the repair.

- (3) Damage to Tube Area. This type of damage consists of cuts, tears, or ruptures to the inflatable tube area and a fabric reinforced patch must be used for this repair. Damage to the tube area should be repaired as outlined below:

- (a) Select a patch (Part Number 74-451-16, 74-451-17, 74-451-18, or 74-451-19) of ample size to extend at least 5/8 inch beyond the damaged area.

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NOTE: If none of these patches are of proper size, one may be cut to the size desired from one of the larger patches. If this is done, the edge should be beveled by cutting with the shears at an angle. These patches are manufactured so they will stretch in one direction only. Be sure to cut the patch selected so that the stretch is in the widthwise direction of the inflatable tubes.

- (b) Clean the area to be repaired with a cloth dampened slightly with solvent.
- (c) Buff the area around the damage with steel wool so that area is moderately but completely roughened.
- (d) Wipe the buffed area clean with a cloth slightly dampened in solvent to remove all loose particles.
- (e) Apply one even thorough coat of cement (Part Number 74-451-20) to the patch and the corresponding damaged area of the deice boot. Allow cement to set until it becomes tacky.
- (f) Apply the patch to the deice boot with the stretch in the widthwise direction of the inflatable tubes, sticking edge of patch in place first and working remainder down with a very slight pulling action so the rupture is closed. Use care not to trap air between patch and deice surface.
- (g) Roll the patch thoroughly with a stitcher-roller (Part Number 74-451-73) and allow to set for ten to fifteen minutes.
- (h) Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.
- (i) Apply one light coat of A-56-B conductive cement (Part Number 74-451-11) to restore conductivity.

NOTE: Satisfactory adhesion of patch to deice boot should be reached in four hours; however, if the patch is allowed to cure for a minimum of 20 minutes, the deice boots may be inflated to check the repair.

- (4) Damage to Fillet Area. This includes any tears or cuts to the tapered area aft of the inflatable tubes. Damage to the fillet area should be repaired as outlined below:

- (a) Trim damaged area square and remove excess material. Cut must be sharp and clean to permit good butt joint in inlay.
- (b) Cut inlay from tapered fillet (Part Number 74-451-21) to match cutout area.
- (c) Using solvent, loosen edges of the deice boot around area approximately 1-1/2 inch from all edges.
- (d) Clean the area to be repaired with a cloth dampened slightly with solvent.
- (e) Lift back edges of cutout and apply one coat of EC-1300L cement to the underneath side of loosened portion of the boot.
- (f) Apply one coat of EC-1300 cement to the wing skin underneath the loosened edges of the deice boot and extending 1-1/2 inch beyond edges of deice boot into the cutout area.
- (g) Apply second coat of cement to underneath side of deice boot as outlined in step (e).
- (h) Apply one coat of EC-1300 cement to one side of a 2-inch wide neoprene coated fabric tape (Part Number 74-451-22 and allow to dry and trim to size.
- (i) Reactivate cemented surfaces with solvent and apply reinforcing tape to wing skin, using care to center tape under all edges of cutout.
- (j) Roll down tape on wing skin with stitcher-roller (Part Number 3306-10) to assure good adhesion, being careful to avoid air pockets.
- (k) Apply one coat of EC-1300 cement to top surface of tape and allow to dry approximately 5 to 10 minutes.
- (l) Reactivate cemented surfaces with solvent. Working toward cutout, roll down the edges of the loosened deice boot, being careful to avoid trapping air pockets. The edges should overlap on the tape approximately 1 inch.
- (m) Roughen back surface of inlay repair material (Part Number 74-451-21 previously cut to size) with buffing stick P/N 74-451-75. Clean with solvent and apply one coat of EC-1300 cement.
- (n) Apply one coat of EC-1300 cement to wing skin inside of the cutout area and allow to dry.
- (o) Apply the second coat of EC-1300 cement to back side of inlay material and allow to dry.
- (p) Reactivate cemented surfaces with solvent and carefully insert inlay material with feathered edge aft. Working from the leading edge of wing aft, roll down the inlay material carefully to avoid trapping air.

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- (q) Roughen area on outer surface of deice boot and inlay with steel wool 1-1/2 inch on each side of the splice. Clean with solvent and apply one coat of EC-1300 cement to this area.
 - (r) Apply one coat of EC-1300 cement to one side of 2-inch wide neoprene coated fabric tape (Part Number 74-451-22 trim to size and center tape over splice on all three sides.
 - (s) Roll down tape on deice boot with stitcher-roller (Part Number 74-451-73) to assure good adhesion, being careful to avoid air pockets.
 - (t) Apply one light coat of A-56-B conductive cement (Part Number 74-451-11) to restore conductivity.
- (5) Damaged Veneer - Loose from Deice Boot. If the veneer should become loosened from the deice boot, repairs should be made as outlined below.
- (a) Peel and trim the loose veneer to the point where the adhesion of veneer to the deice boot is good.
 - (b) Roughen the area in which veneer is removed with steel wool, rubbing parallel to cut edge of veneer ply to prevent loosening it.
 - (c) Taper edges of veneer down to the tan rubber ply by rubbing parallel to the edges with steel wool and solvent.
 - (d) Cut a piece of veneer material (Part Number 74-451-23) to cover the damaged area and extend at least 1 inch beyond in all directions.
 - (e) Mask off an area 1/2 inch larger in length and width than the size of veneer patch.
 - (f) Apply one coat of 74-451-20 cement to the damaged area and one coat to the veneer ply. Allow cement to set until it becomes tacky.
 - (g) Roll the veneer ply to the deice boot with a 2-inch rubber roller, applying a slight tension on the veneer ply when applying to prevent trapping air.
 - (h) Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.
 - (i) Apply one light coat of A-56-B conductive cement (Part Number 74-451-11) to restore conductivity.

WINDSHIELD ANTI-ICE SYSTEM (ALCOHOL)Description

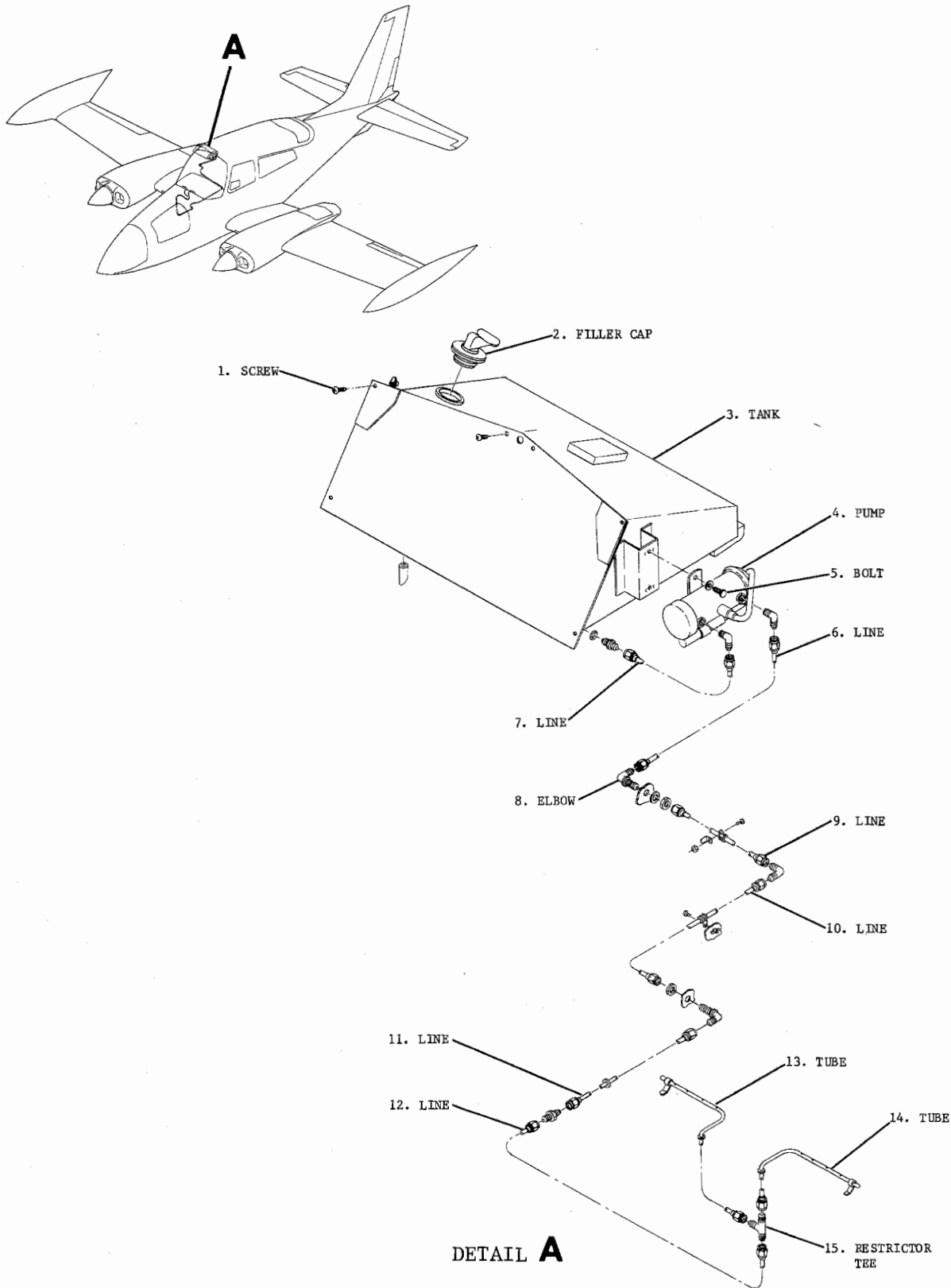
1. The alcohol windshield anti-ice system (optional), consists of: a three gallon capacity tank which provides approximately one hour anti-icing capability; an electrically operated pump actuated by a switch breaker, located on the circuit breaker panel; and orificed tubes to disperse the anti-ice fluid over the windshield. A restrictor orifice is utilized in the dispersal system to meter the alcohol for maximum efficiency.
2. The tank and electric pump are located in the aft portion of the right wing nacelle baggage compartment. A service door is provided for access to the tank filler cap. The system is serviced with isopropyl alcohol (Refer to Chapter 2).

Maintenance Practices

1. Removal/Installation Windshield Anti-Ice System (See Figure 1).
 - A. Remove Windshield Anti-Ice System.
 - (1) Remove aft nacelle baggage compartment upholstery panel.
 - (2) Extend flaps.
 - (3) Disconnect line (6) at elbow and using a suitable tube attached to the line, pump remaining fluid from tank (3).
 - (4) Disconnect line (6) from pump (4) and remove line (7).
 - (5) Disconnect electrical wire from pump (4) at splice.
 - (6) Remove pump (4) from tank (3) by removing bolts (5) and washers.
 - (7) Remove screws (1) securing tank (3) to structure.
 - (8) Lift forward end of tank (3) until vent tube clears bottom skin and carefully slide tank forward until clear of structure, then lift tank from baggage compartment.
 - (9) Remove RH wing gap fairings to gain access to lines.
 - (10) Remove clamps and remove lines (9 and 10).
 - (11) Remove RH forward side panel to gain access to line (11). Remove clamp and remove line.
 - (12) Working through nose baggage door, remove line (12), restrictor tee (15) and tubes (13) and (14). Refer to Chapter 3 for removal of baggage retainer.

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Alcohol Windshield Anti-Ice System
Figure 1

B. Install Windshield Anti-Ice System.

- (1) Position tank (3) in place and secure with screws (1).

NOTE: Make certain vent extends below lower skin 0.40 inch and scarfed side is forward.

- (2) Install pump (4) with bolts (5) and washers.
- (3) Install lines (9 and 10) and clamp in place.
- (4) Install line (11) and clamp in place.
- (5) Install line (12) and restrictor tee (15).

NOTE: Restrictor tee must be installed with restrictor end upstream and arrow pointing downstream of flow.

- (6) Install tubes (13 and 14), and clamp in place.

NOTE: Make certain tubes maintain a minimum gap of 0.10 inch between tubes and windshield retainer.

- (7) Install nose baggage retainer, refer to Chapter 3.
- (8) Connect electrical wire to pump.
- (9) Service system, check operation and for leaks.
- (10) Install aft nacelle baggage compartment upholstery panel, forward right cabin upholstery panel.
- (11) Install wing gap fairings.

2. Clean Windshield Anti-Ice Components.

A. Cleaning.

- (1) Immerse lines in a dry cleaning solvent.

NOTE: Lines not readily removable from aircraft may be flushed with cleaning solvent. Take necessary precautions to protect windshield.

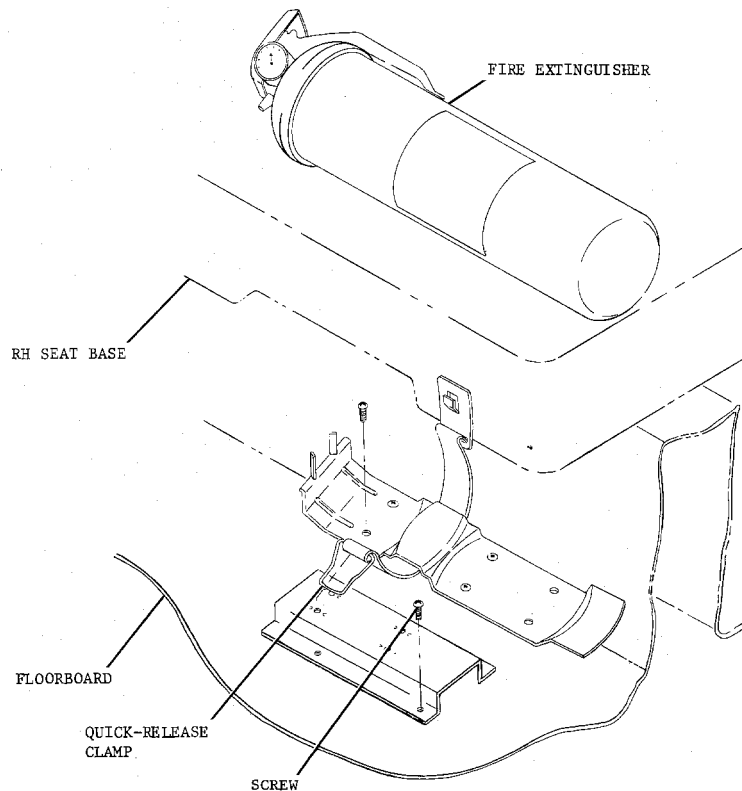
- (2) Dry lines with filtered compressed air.
- (3) Clean pump filter screen, refer to Chapter 9 Disassembly/Assembly Fuel Transfer Pump.

HAND FIRE EXTINGUISHERDescription

1. The fire extinguisher (optional) mounted on the copilot's seat contains a pressurized Dry Chemical Charge. The fire extinguisher may be used on combustible, liquid, or electrical fires. The dry charge is non-toxic and non-corrosive. Residue left after use may be wiped off with a damp cloth or picked up with a vacuum source. The fire extinguisher may be recharged by most Fire Equipment Dealers.

Maintenance Practices

1. Removal/Installation Hand Fire Extinguisher (See Figure 1).
 - A. Remove Fire Extinguisher.
 - (1) Release quick-release clamp.
 - (2) Remove fire extinguisher from mounting bracket.



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Hand Fire Extinguisher Installation
Figure 1

B. Install Fire Extinguisher.

- (1) Position fire extinguisher in mounting bracket.
- (2) Secure fire extinguisher to mounting bracket with quick-release clamp.

CESSNA AIRCRAFT COMPANY

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CHAPTER

13

ELECTRICAL SYSTEMS

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POWER DISTRIBUTIONDescription

1. DC electrical power is the aircraft's main source of electrical power. The dc electrical power system is divided into two independent systems; the left-hand and right-hand. Each system has a power source. A cross-tie bus connects the systems together to supply power to the various load demands throughout the aircraft. Normally both systems operate in parallel. In the event of a power loss of one alternator system, electrical power is supplied from the opposite system through the cross-tie bus. When the aircraft is on the ground, a dc external power receptacle (optional) is utilized to supply dc power to the aircraft's electrical system.
2. Two engine-driven alternators, one on each engine, are normally the source of power supplied to all dc load buses and to charge the storage battery. The standard alternator system includes two 50-ampere alternators, the optional system includes two 100-ampere alternators.
3. One 24-volt lead-acid battery, located in the left wing outboard of the engine nacelle; is the aircraft's secondary dc power source. Battery power is utilized to start the engines. Also, if the alternator systems fail, the battery will supply power to the electrical systems.
4. External dc power can be connected to the aircraft through the external power receptacle (optional), located on the aft lower surface of the left-hand nacelle baggage compartment. When external power is connected, the auxiliary power relay energizes, connecting the external power source to the hot battery bus, supplying dc power to the electrical systems. When external power provisions are available on the aircraft, its use is recommended for engine starting and electrical ground maintenance operations.
5. Electrical load distribution, from the power sources to the various using systems throughout the aircraft, is accomplished by wiring, buses and circuit breakers. The circuit breaker panel is located on the left cabin wall forward of the pilot's seat.
6. Controls and Indicators.
 - A. The electrical power source control switches and indicators are located on the various switch panels mounted on the instrument panel.

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- (1) The battery master switch is located between the left and right alternator switches on the left side of the instrument panel. A switch bar is installed across the top of the three switches to permit simultaneous shutoff. When the battery switch is placed in ON position, it actuates the battery relay which connects the battery to the battery shunt.
- (2) Two alternator switches marked L ALT and R ALT have two positions ON and OFF. With the alternator switch in the ON position, the alternator control for regulation, protection and load bus connection is automatic. Placing the switch to OFF will isolate the alternator from its load bus. Should an overvoltage in the system result, causing tripping of the overvoltage relay, repositioning the respective alternator switch from ON to OFF, back to ON will reset the overvoltage relay.
- (3) A voltammeter, located on the instrument panel, is provided to monitor alternator current output, battery charge or discharge rate and bus voltage. An AMP METER SELECT switch, labeled L ALT, R ALT, BAT and VOLTS is located to the left of the voltammeter. Positioning the switch L ALT, R ALT, or BAT position, the respective alternator or battery amperage can be monitored. Positioning the switch to VOLTS position, the electrical system bus voltage can be monitored.

B. Indicator Lights.

- (1) The alternator failure lights, located on the instrument panel adjacent to the voltammeter, will illuminate when the respective alternator system malfunctions.
- (2) The battery voltage monitor light, located on the instrument panel adjacent to the turn and bank light, provides a warning when illuminated that the electrical system is operating on battery power. The battery voltage monitor system, consists of a low voltage monitor assembly, located on the forward bulkhead station 0.00; the warning light and electrical wiring. The monitor assembly will illuminate the warning light with decreasing voltage between 24.5 and 25.5 volts and remain ON with voltage lower than turn on voltage. The warning light will turn OFF with increasing voltage between 24.5 and 26.0 and remain off with voltage higher than turn off voltage.

7. The aircraft's major light circuits are; the interior lights and exterior lights.

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8. A stall warning system with a transmitter installed in the leading edge of the left wing, provides audio warning from a warning horn when the aircraft approaches a stall.

CIRCUIT BREAKER AND SWITCHESDescription

1. Electrical load distribution from the power sources to the various using systems throughout the aircraft, is accomplished by wiring, buses and circuit breakers. The circuit breaker panel is located on the left cabin wall forward of the pilot's seat. Various systems of the aircraft are controlled by switches, located on the instrument panel and switch panels installed on the instrument panel.
2. Left and right junction boxes are utilized in the aircraft's electrical system. The junction boxes incorporate a terminal strip in each box, and provides a means of connecting the respective wing electrical wiring to the fuselage wiring, for ease of removal/installation of the wing.
3. All switches mounted on the left-hand switch panel are a two position, one hole mounting, toggle-type switch, except the starter switches, which are a button-type switch with a safety guard. Rheostats mounted on the switch panel of the circuit breaker panel provide dimming capabilities for lights on the flight instruments and radio, engine instruments, switch panels, fuel selector and compass lights.

Maintenance Practices

NOTE: For identification and connection of electrical wires to components, refer to wiring diagrams of Chapter 13.

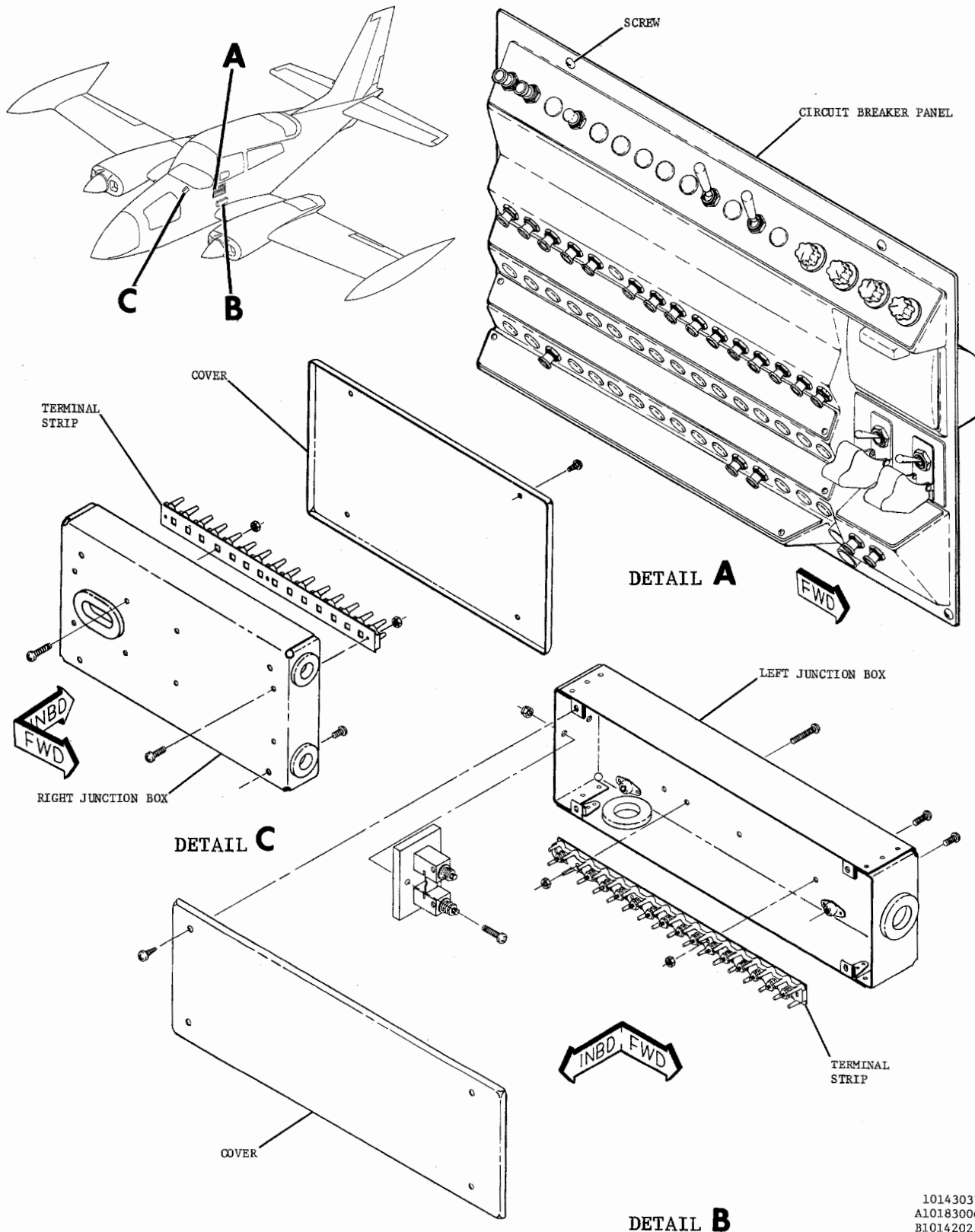
1. Removal/Installation Circuit Breaker Panel (See Figure 1).

A. Remove Circuit Breaker Panel.

- (1) Master battery switch OFF.

CAUTION: WHEN REMOVING THE CIRCUIT BREAKER PANEL, THE MASTER BATTERY SWITCH SHALL REMAIN IN THE OFF POSITION OR GROUND CABLE SHOULD BE DISCONNECTED FROM THE BATTERY.

- (2) Remove the screws from the front of the circuit breaker panel. If complete removal of the panel is desired, remove the breakers from the panel or disconnect the wiring from the breakers and bus bars.



10143037
A10183006
B10142023
C10141041

Circuit Breaker and Junction Box Installation
Figure 1

B. Install Circuit Breaker Panel.

- (1) Install or connect wiring to circuit breakers and bus bars.
- (2) Secure circuit breaker panel to structure, using screws.

2. Removal/Installation Junction Box (See Figure 1).

A. Remove Junction Box.

- (1) Master battery switch OFF.
- (2) Access to the left junction box is accomplished by grasping the upholstery panel (small panel containing the map pocket and pushing it down to disengage it from the upholstery along the left cabin wall.
- (3) Access to the right junction box is accomplished by removing screws along the forward end of the upholstery retaining strip (adjacent to the lower cabin door jam) and pulling the small upholstery panel from under the retaining strip and away from the right cabin wall.
- (4) Remove the junction box cover by removing screws securing cover and pulling cover from the box.
- (5) Remove the bundled electrical leads from the junction box by removing the small nuts, securing the leads to the terminal strip. Pull the bundled leads from the junction box.
- (6) Remove the wing fairing to gain access to the screws that secure the left junction box to the fuselage. Removing the screws will allow the left junction box to be removed. The screws that mount the right junction box are accessible from inside the cabin.

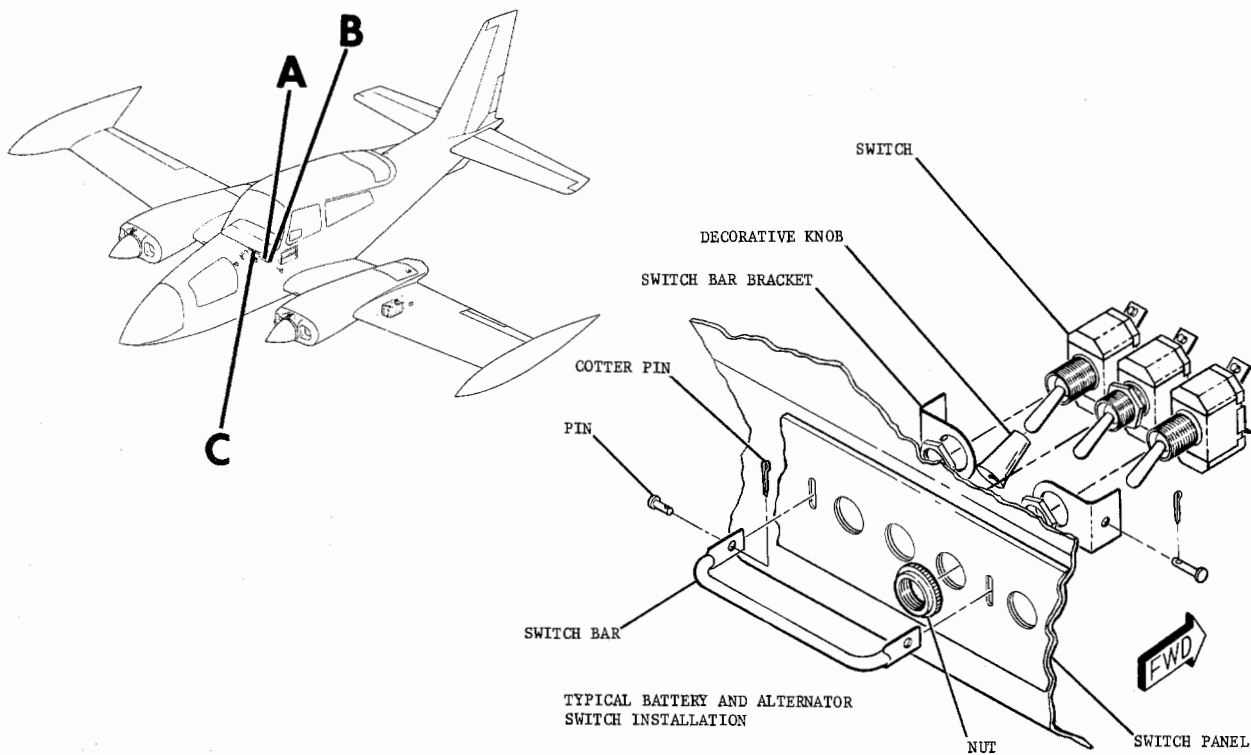
B. Install Junction Box.

- (1) Secure junction box to structure, using screws.
- (2) Using wiring diagrams, connect electrical wires to terminal strip, using nuts.
- (3) Install cover on junction box and secure with screws.
- (4) Reinstall upholstery.
- (5) If left junction box was removed, install wing fairings.

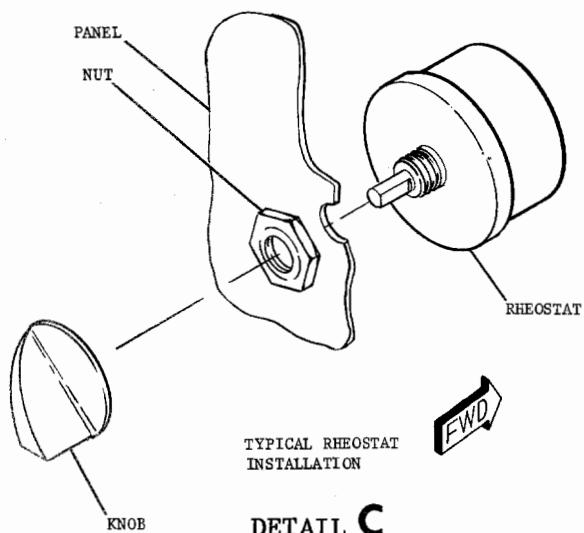
3. Removal/Installation Battery, Alternator and Ignition Switches (See Figure 2).

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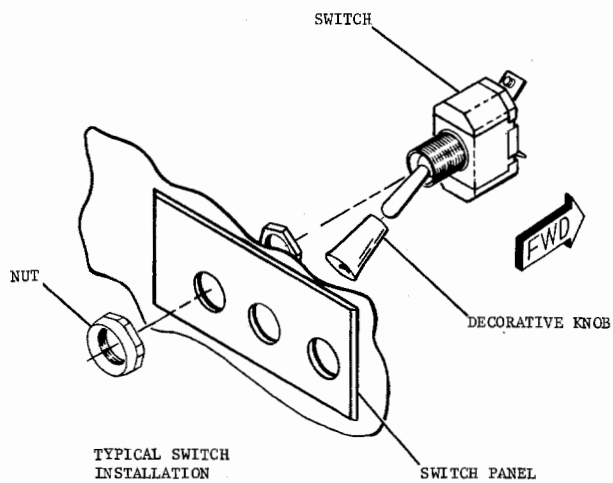
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DETAIL A



DETAIL C



DETAIL B

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A10141040
B10141039
C10141038

Typical Switch and Rheostat Installation
Figure 2

WARNING: DURING REMOVAL OF ANY SWITCH EXCEPT THE BATTERY SWITCH, THE BATTERY SWITCH MUST REMAIN OFF. WHEN REMOVING THE BATTERY SWITCH, DISCONNECT THE BATTERY GROUND CABLE AT THE BATTERY TO PREVENT AN ACCIDENTAL SHORT CIRCUIT.

A. Remove Battery and Alternator Switches.

- (1) Master battery switch OFF.
- (2) Remove cotter pin and pin securing switch bar to switch bar bracket.
- (3) Remove nut securing switch to left control panel.
- (4) Remove the wires from the switch.

B. Install Battery and Alternator Switches.

- (1) Connect the wires to the proper switches.
- (2) Insert switch in proper position in the switch panel and secure with nut. Ensure switch bar bracket is installed on applicable switch.
- (3) Install switch bar using pin and cotter pin.

4. Removal/Installation Typical Switch (See Figure 2).

A. Remove Typical Switch.

- (1) Master battery switch OFF.
- (2) Remove nut securing switch to the switch panel.
- (3) Remove switch.
- (4) Disconnect wires from switch.

B. Install Typical Switch.

- (1) Connect wires to switch.
- (2) Install switch in switch panel.
- (3) Secure switch with nut.

5. Removal/Installation Rheostats (See Figure 2).

A. Remove Rheostats.

- (1) Master battery switch OFF.
- (2) Loosen set screw securing rheostat knob and remove knob.
- (3) Remove nut securing rheostat to switch panel and remove rheostat.
- (4) Disconnect the wires from the rheostat.

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B. Install Rheostats.

- (1) Connect wires to rheostat.
- (2) Secure rheostat to panel, using nut.
- (3) Install knob on rheostat.

ALTERNATORS AND VOLTAGE REGULATORSDescription

1. Two engine-driven alternators, one on each engine, supply the power source to all dc load buses and to charge the storage battery. Each alternator system consists of the alternator, voltage regulator, overvoltage relay, alternator fail sensor, alternator out indicator light and alternator switch.
2. There are two solid state voltage regulators, located under the copilot's seat. Each voltage regulator incorporates an adjustment screw and terminal connections. The voltage regulator controls the voltage output of its respective alternator. The voltage regulators are electrically connected in parallel in the system. Once the voltage regulator is adjusted, the voltage remains almost constant, since the regulator is unaffected by either length of service, by change in temperature or by changes in the alternator output and speed. Should adjustment of a voltage regulator be required, turn adjustment screw clockwise to increase and counterclockwise to decrease voltage output.
3. There are two overvoltage relays, located under the copilot's seat on the front spar. Each overvoltage relay, provides overvoltage protection for its respective alternator system. Each overvoltage relay will trip, disabling its alternator system when an overvoltage of 32.3 ± 1 volts is sensed at the relay. The overvoltage relay can be reset by switching the respective alternator switch OFF then back to ON position.
4. Two alternator fail sensor units are utilized in the alternator system, one sensor for each alternator. The alternator fail sensor is located adjacent to its respective alternator on the engine baffle. The sensor senses alternator low voltage and activates (illuminates) the respective alternator out indicator light on the instrument panel, when the alternator is off or on out condition occurs, caused by a failure in the alternator or by other means.

Troubleshooting

1. Troubleshooting the alternator system is considerably simplified by the incorporation of the amp meter select switch which allows the left or right alternator and battery dc output power to be visually displayed on the voltammeter. The left and right alternator failure lights illuminate when the respective alternator is removed from the load bus.

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2. Tools and Equipment.

NOTE: Refer to Adjustment/Test for tools and equipment required.

3. Troubleshooting Alternators.

A. For troubleshooting the alternator system, see Figure 1.

Adjustment/Test

1. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	Voltage and continuity checks.
Volt-Ohm-Milliammeter	Model 630	Triplett Corp.	Voltage and continuity checks.

2. Adjustment/Test Voltage Regulator (See Figure 2).

A. Adjust Voltage Regulator.

- (1) Install a 2 percent voltmeter connected to the aircraft power bus. (The power bus is considered to be between the alternator power circuit breakers and the individual circuit breakers for each system and not at the cigar lighter.)
- (2) Disconnect the paralleling wire (terminal marked "PAR") from either voltage regulator and leave it disconnected.

NOTE: All adjustments are performed while operating the LH engine. (RH engine shall not be running.)

- (3) With LH engine running at 1200 prop RPM, position LH ALT switch ON. (RH ALT switch must be OFF.) Add 10 to 15 amp load to LH alternator system. Run this load for at least two minutes.

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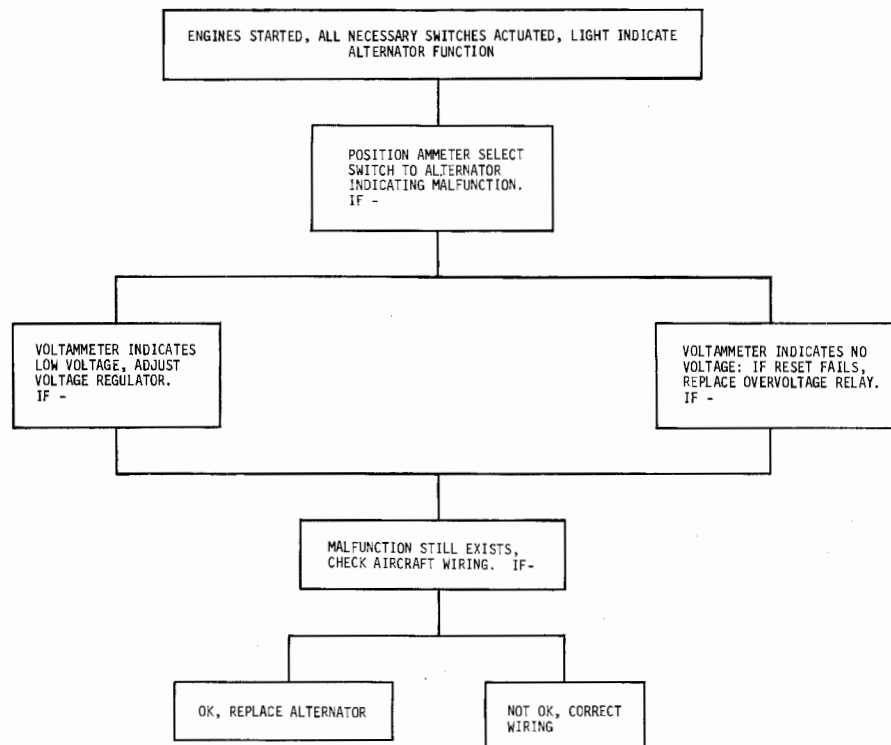
NOTE: To adjust voltage regulator, turn adjustment screw clockwise to increase and counterclockwise to decrease voltage.

- (4) Adjust LH voltage regulator to read 27.5 volts on the voltmeter, connected to the aircraft's power bus. Allow sufficient time for voltage to stabilize between adjustment.

NOTE: The aircraft's voltmeter shall not be used for voltage setting.

- (5) While continuing to operate the LH engine and alternator with the same electrical load as before, turn the RH ALT switch ON. (RH engine is still not running.)
- (6) The remaining adjustments should be made using either a Simpson 260 or a Triplet 630 VOM.

CAUTION: OBSERVE WITH CAUTION THAT THE FIELD CIRCUITS OF EITHER ALTERNATOR SYSTEM NEVER TOUCH GROUND OR OTHER ELECTRICAL CIRCUITS, EVEN FOR AN INSTANT, OR THE VOLTAGE REGULATORS MAY BE DAMAGED.



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Troubleshooting Chart - Alternator System
Figure 1

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- (7) Select VOM to 0-50 V scale and connect VOM between the field terminals of the left and right voltage regulators (plus side meter to LH voltage regulator).
- (8) Now very slowly rotate the RH voltage regulator adjustment screw while observing the VOM which has been connected to the two field terminals.
 - (a) If a reverse (down scale) reading is obtained, turn the RH voltage regulator adjustment counterclockwise, this should bring the meter scale up.
 - (b) Then very slowly turn RH voltage regulator adjustment clockwise to the point where the field VOM will read near zero.

NOTE: A stable reading should not be expected, voltage will fluctuate.

- (c) Then using the 0-10 volt and 0-2.5 volt scales on the VOM, continue adjustment of the RH voltage regulator to a lower voltage differential. (The 0-2.5 volt scale is recommended for making the final adjustment.) The correct adjustment has been achieved when the VOM will remain briefly in the vicinity of zero, swinging both up scale and down scale.
- (9) Shutdown all power to the aircraft and disconnect VOM from field terminals.
- (10) Reconnect the paralleling wire to terminal marked "PAR" on the voltage regulator the wire was disconnected from.
- (11) After aircraft has been restored to original configuration, the RH engine should be started, both alternator switches turned ON and system should be operated at different loads to verify that paralleling is within 10 percent of load and bus voltage has remained within the $27.5 \pm .25$ volt limit.

3. Operational Check of Alternators and Regulators.

A. Operational Check.

- (1) With both engines operating at 1000 RPM and the Battery and Alternator switches ON, check the following:
 - (a) Select voltage position on voltmeter and assure bus voltage is 27.5 ± 1.0 volts.
 - (b) Select Battery position on voltmeter and note battery is charging; charging amperage indication will vary as the battery builds up to normal charge.

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- (c) Load electrical system with all external lights, fuel pumps, pitot heat, etc., and check the alternator output; it should be positive and equal within 10 amps when loaded up to 100 amps total load.

NOTE: If total load is below 15 amps, one alternator may show little or no output. If so, turn producing alternator OFF; the other alternator should pick up the load. Also, when one alternator is not carrying any load, the corresponding light may come on or flicker ON and OFF. This is normal.

4. Operational Check of Alternator Failure Circuit.

A. Operational Check.

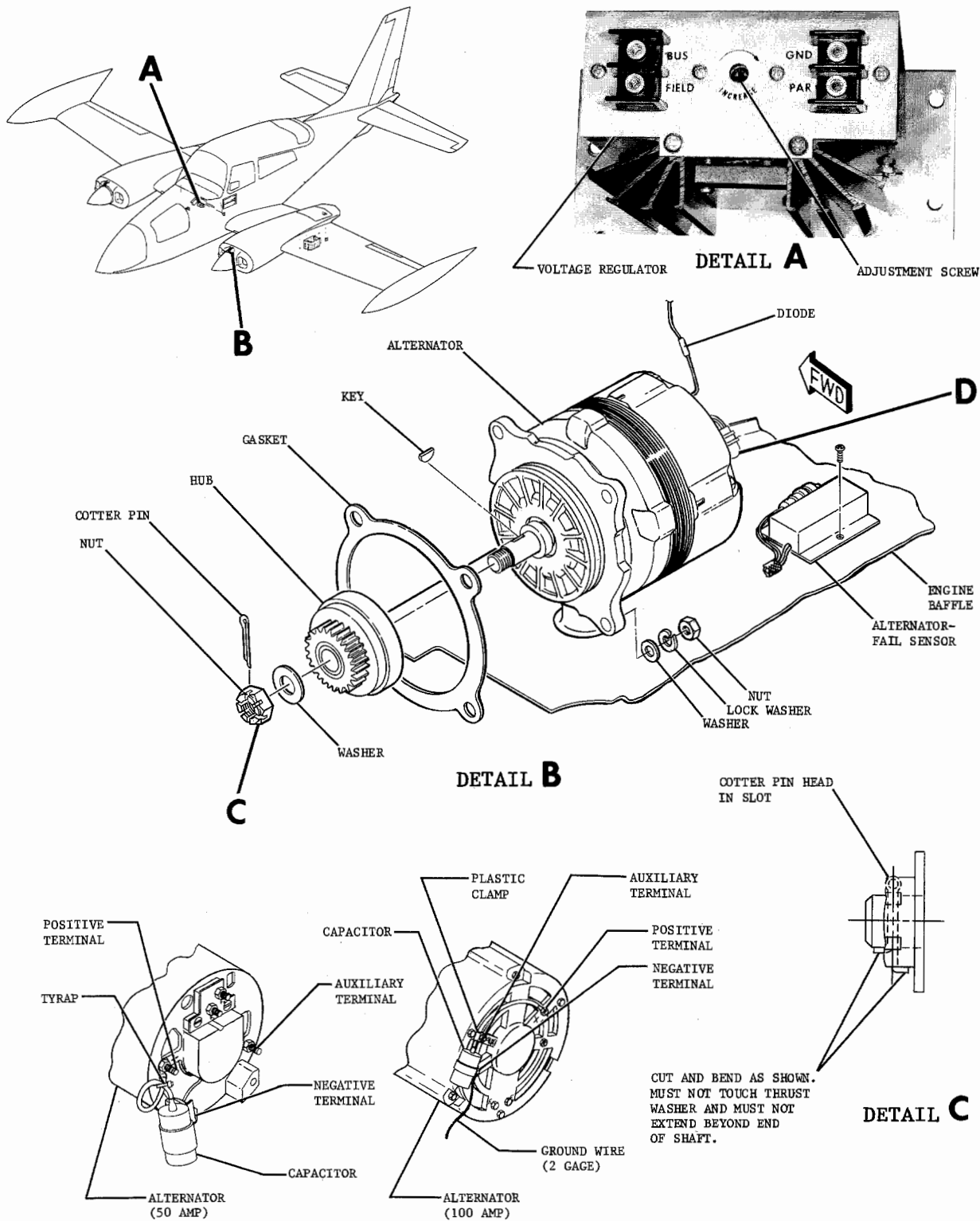
- (1) With both engines operating at idle RPM, place Battery switch and Alternator switches to OFF, and observe that failure lights are out.
- (2) Reduce electrical load to minimum to avoid discharging the battery.
- (3) Turn ON Battery switch and observe both Alternator Failure lights illuminate.
- (4) Increase engine RPM to 1800 and ensure Failure Light remains ON.

NOTE: The reference voltage used for alternator out indication is approximately one half of whatever voltage the alternator is producing. When the alternator is turned OFF, it is capable of producing some voltage which will be a function of load and RPM of unit. At high RPM such as maximum power, the residual voltage at times can exceed the fail triggering level of the alternator fail sensor, turning the Failure lights OFF; this is acceptable.

- (5) With both Alternators and Battery switches ON and light electrical load of 15 amps operate both engines at idle RPM and observe that lights remain OFF without any flickering. Simultaneously increase RPM on both engines, to 1800 RPM and again observe Alternator Failure lights for any flickering.

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Alternator and Voltage Regulator
Figure 2

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A1018P6001
B10582001
C10582001
D10581004

NOTE: It is important that both engine RPM be as close to each other as possible because at light loads, the alternator which is set at higher RPM will tend to take all of the load and the alternator running at lower RPM will be at a NO load condition, which will tend to give a false alternator out indication.

5. Operational Check of Alternator Warning System.

A. Operational Check.

- (1) With both engines operating 1700 RPM and normal electrical load applied, push the press-to-test switch and hold in for at least 30 seconds and ensure both Alternator Failure lights are ON.
- (2) Ensure that pushing the press-to-test switch does not trip the landing gear motor breaker.

Maintenance Practices

1. Removal/Installation Alternator (See Figure 2).

NOTE: The alternator removal/installation procedure is the same for both alternators.

A. Remove Alternator.

- (1) Remove engine cowlings, refer to Chapter 7.
- (2) Disconnect and tag electrical leads and stow out of the area.
- (3) Remove nuts, lockwashers and washers securing alternator to engine.
- (4) Carefully work alternator from the engine pad.

CAUTION: USE CARE WHEN REMOVING ALTERNATOR TO PREVENT DAMAGE TO SPLINES ON THE ALTERNATOR.

- (5) Install protective cover on engine pad to prevent entry of foreign material.

B. Install Alternator.

- (1) Remove protective cover from engine pad.
- (2) Make sure gasket has not been damaged or has been replaced.
- (3) Position alternator on engine pad.

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CAUTION: BEFORE INSTALLING ALTERNATOR, ALWAYS MAKE SURE THE NUT ON THE DRIVE SHAFT OF THE ALTERNATOR IS SAFETIED WITH THE COTTER PIN INSTALLED AS SHOWN IN FIGURE 2. IF THE NUT IS NOT SAFETIED PROPERLY, DAMAGE COULD RESULT TO THE GEARS AND ALTERNATOR SHAFT.

- (4) Work alternator in position and install washers, lockwashers, and ground lead terminal and install the nuts securing alternator.
- (5) Torque nuts to 155 to 175 inch-pounds.
- (6) Connect electrical wiring.

CAUTION: ENSURE ALTERNATOR WIRING IS CONNECTED PROPERLY. REVERSE POLARITY WILL DESTROY DIODES IN THE ELECTRICAL SYSTEM.

NOTE: Ensure ground wire (size 2 gage) is connected to negative terminal and structure ground 100 amp alternator only.

- (7) Install engine cowlings, refer to Chapter 7.

2. Removal/Installation Voltage Regulator (See Figure 2).

A. Remove Voltage Regulator.

- (1) Remove copilot's seat, refer to Chapter 12.
- (2) Remove electrical wires from voltage regulator.
- (3) Remove the screws securing the regulator to the support bracket and remove voltage regulator.

B. Install Voltage Regulator.

- (1) Attach voltage regulator to support bracket, using screws.
- (2) Connect electrical wires to voltage regulator.
- (3) Adjust the alternator system, refer to Adjustment/Test.
- (4) Install copilot's seat, refer to Chapter 12.

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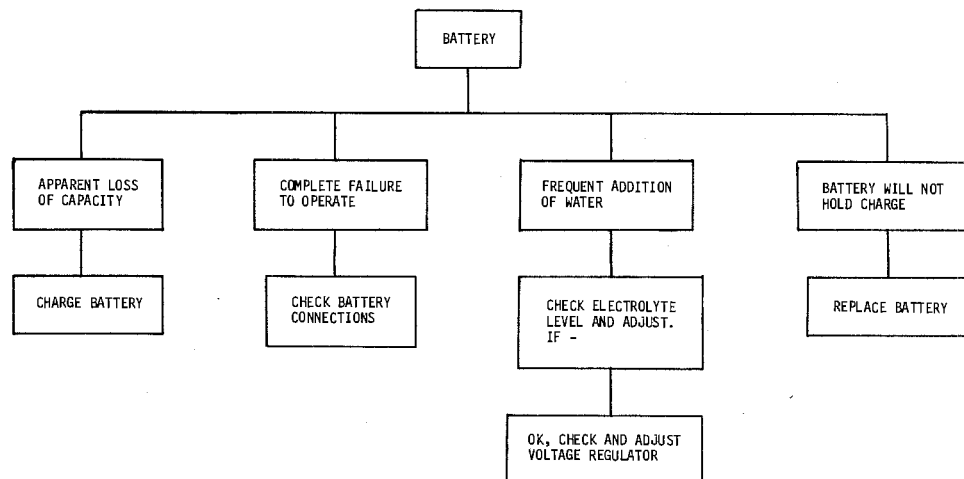
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BATTERYDescription

1. One 24 volt, 25 ampere-hour, lead-acid type battery is located in a battery box in the left wing. The battery supplies power for the engine starter system and electrical system when the engines are not operating. Positive and negative terminals of the battery are clearly marked on the battery case adjacent to each battery post. Each cell of the battery incorporates an electrolyte level indicator to prevent overfilling the cell above the separators. Filling instructions are molded in the top of the battery case. Only distilled water should be used when servicing the battery, tap water will shorten the life of the battery. An acid resistance lift cord is permanently attached to the battery case to aid in removal and installation.
2. The battery box is located in the left-hand wing outboard of the engine nacelle. Access to the battery and box is gained by removing the wing access panel above the battery box. A drain and vent tube are incorporated on the battery box to provide drainage for fluid and vapors. The battery box is secured to the wing structure with screws. A tie-down strap is utilized and attaches to the top of the battery box to secure the battery in place.

Troubleshooting

1. Troubleshooting the battery, see Figure 1.



10987001

Troubleshooting Chart - Battery
Figure 1

Maintenance Practices

1. Removal/Installation Battery (See Figure 2).

A. Remove Battery.

- (1) Refer to Chapter 1. Remove left-hand wing access panel above the battery.
- (2) Disconnect the ground cable from the negative terminal of the battery.

CAUTION: ALWAYS REMOVE THE GROUND CABLE FIRST
AND INSTALL IT LAST TO PREVENT ACCI-
DENTAL SHORT CIRCUITS.

- (3) Disconnect the power cable from the positive terminal of the battery.
- (4) Remove the tie-down strap by removing screws and washers.
- (5) Remove the battery from battery box.

B. Install Battery.

- (1) Position battery in battery box; battery terminals facing aft.

NOTE: Coat battery terminals and cable terminals with a light coating of grease.

- (2) Secure the battery in position, using tie-down strap, washers and screws.
- (3) Connect the power cable to positive terminal of battery, using wing nut, lockwasher and flat washer.

CAUTION: WHEN CONNECTING THE BATTERY CABLES TO THE BATTERY, ENSURE CABLE GROMMETS ARE PROPERLY INSTALLED OVER THE EDGE OF THE BATTERY BOX CABLE HOLES.

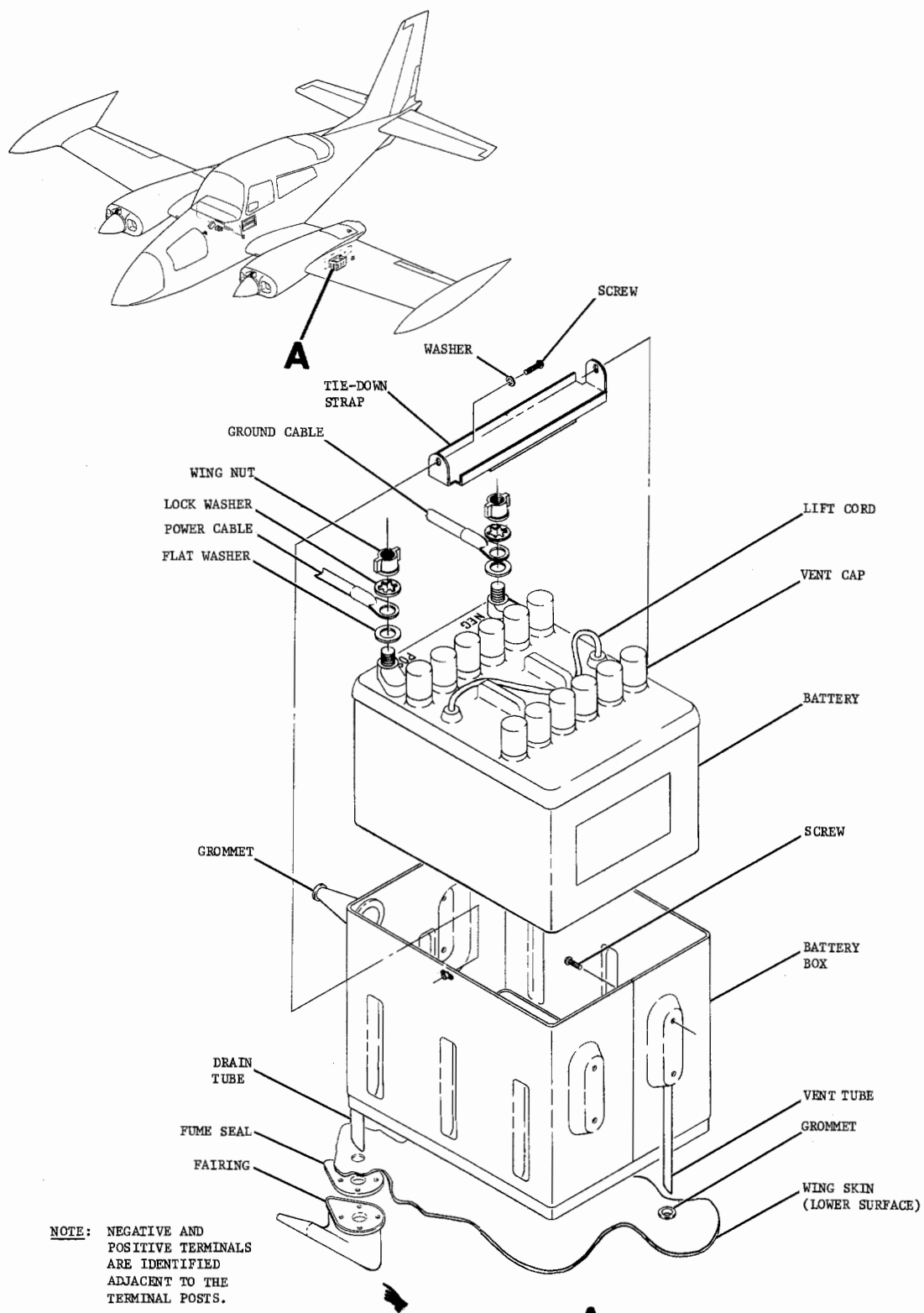
- (4) Connect the ground cable to negative terminal of battery, using wing nut, lockwasher and flat washer.

CAUTION: ENSURE BATTERY CABLES ARE CONNECTED CORRECTLY. REVERSE POLARITY WILL DAMAGE DIODES IN THE ALTERNATORS.

- (5) Install wing access panel.

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DETAIL A

Battery and Battery Box Installation
Figure 2

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2. Removal/Installation Battery Box (See Figure 2).

A. Remove Battery Box.

- (1) Refer to Removal/Installation Battery and remove the battery.
- (2) Remove the battery cables and grommets from battery box.
- (3) Remove the screws attaching battery box to the structure.
- (4) Lift the battery box from wing.

B. Install Battery Box.

- (1) Align battery box drain and vent tubes with holes in the wing lower surface and insert tubes into fume seal and grommet.
- (2) Secure battery box to structure, using screws.
- (3) Install battery cables and grommets in battery box.
- (4) Install battery, refer to Removal/Installation Battery.

3. Inspection/Check Battery and Battery Box.

A. Inspect Battery and Battery Box.

- (1) Remove wing access panel above battery, refer to Chapter 1.
- (2) Refer to Chapter 2 for inspection procedures.

4. Cleaning/Painting Battery and Battery Box.

A. Cleaning Battery

- (1) Clean battery with a mild solution of bicarbonate of soda (baking soda) and water to remove acid corrosion.

NOTE: Remove battery from aircraft before cleaning.

- (2) Rinse with clear water and sponge off excess water and allow battery to dry.

NOTE: Remove battery from aircraft before cleaning.

- (3) Rinse with clear water and sponge off excess water and allow battery to dry.

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CAUTION: TAKE SPECIAL PRECAUTIONS TO INSURE THAT BATTERY CELL FILLER CAPS ARE TIGHT BEFORE CLEANING THE BATTERY. ENTRANCE OF SODA WATER INTO BATTERY CELLS WILL NEUTRALIZE THE CELL ELECTROLYTE.

CAUTION: DO NOT ALLOW ACID DEPOSITS TO COME IN CONTACT WITH SKIN OR CLOTHING. SERIOUS ACID BURNS MAY RESULT UNLESS THE AFFECTED AREA IS WASHED IMMEDIATELY WITH SOAP AND WATER. CLOTHING WILL BE RUINED UPON CONTACT WITH BATTERY ACID.

- (4) Clean battery terminals as needed with a wire brush to brighten the terminals for good electrical contact. Coat with Petrolatum to prevent corrosion.

B. Cleaning Battery Box.

- (1) Battery lead should be cleaned with a strong solution of bicarbonate of soda (baking soda) and water.
- (2) Clean hard deposits of spilled acid and corrosion products using a wire brush.
- (3) When all foreign materials have been removed from the box, flush it thoroughly with clean water.
- (4) After cleaning battery box, flush surrounding skin with clean water to ensure that all corrosive material has been removed.

CAUTION: DO NOT ALLOW ACID DEPOSITS TO COME IN CONTACT WITH SKIN OR CLOTHING. SERIOUS ACID BURNS MAY RESULT UNLESS THE AFFECTED AREA IS WASHED IMMEDIATELY WITH SOAP AND WATER. CLOTHING WILL BE RUINED UPON CONTACT WITH BATTERY ACID.

EXTERNAL POWER RECEPTACLEDescription

1. The dc external power system (optional) consists of an external power receptacle, located on the aft bottom surface of the left nacelle baggage compartment and an external power relay, located in the left wing at W.S. 100.50 approximately 8.60 inches forward of the rear spar. The external power system components provides a means of connecting 28 VDC external power to the aircraft's electrical system.
2. The dc external power receptacle is a three-pin receptacle, housed in a plastic material. The positive and negative pins are permanently marked on the front and rear of the receptacle. Connecting the 28 VDC external power source energizes the external power relay, connecting the external power source to the battery shunt and to the bus of the circuit breaker panel.

Maintenance Practices

1. Removal/Installation External Power Receptacle (See Figure 1).

CAUTION: THE BATTERY SWITCH MUST REMAIN IN THE OFF POSITION WHILE THE EXTERNAL POWER RECEPTACLE IS BEING REMOVED OR INSTALLED. IF THERE IS ANY POSSIBILITY OF THE SWITCH BEING TURNED ON DURING THIS PROCEDURE, IT IS ADVISABLE TO DISCONNECT THE GROUND CABLE FROM THE BATTERY.

A. Remove External Power Receptacle.

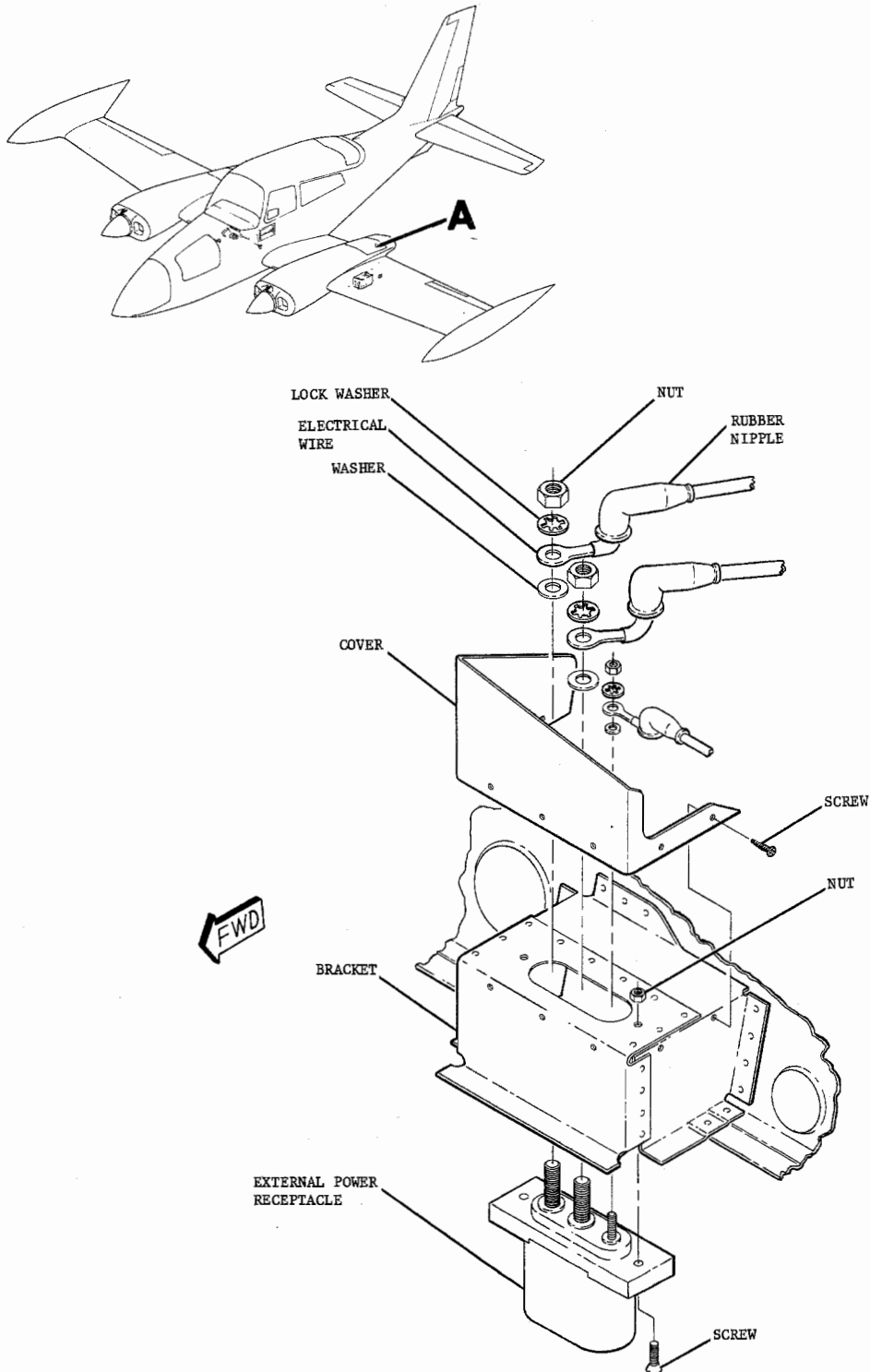
- (1) Ensure Master Battery switch is positioned to OFF.
- (2) Open left-hand nacelle baggage door.
- (3) Remove cover from bracket by removing screws.
- (4) Disconnect electrical wires from external power receptacle by removing nuts and lockwashers.
- (5) Remove external power receptacle from bracket by removing attaching screws and nuts.

B. Install External Power Receptacle.

- (1) Position external power receptacle in bracket and secure with screws and nuts.
- (2) Identify and connect electrical wires to external power receptacle, using washers, lockwasher and nuts.

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MAINTENANCE MANUAL



DETAIL A

External Power Receptacle Installation
Figure 1

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MAINTENANCE MANUAL

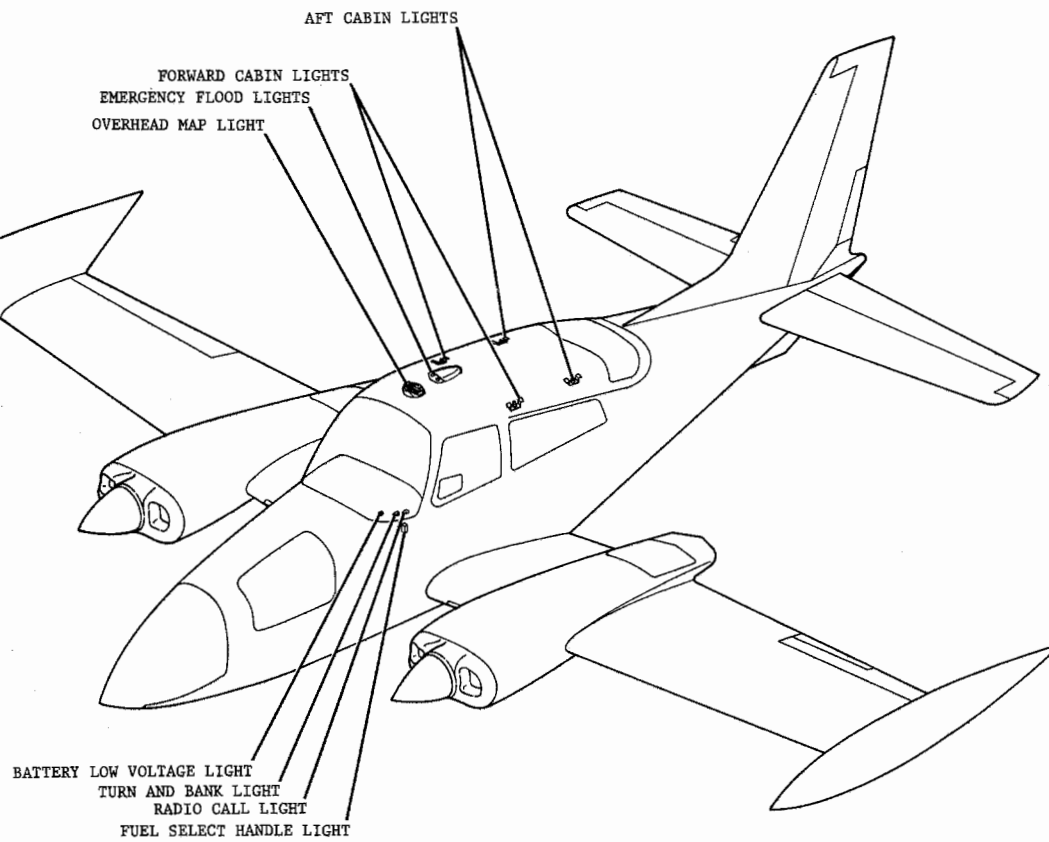
- (3) Install cover, using screws.
- (4) Replace battery ground cable, if it was disconnected.
- (5) Close baggage door.

LIGHTS INTERIOR AND EXTERIORDescription

1. This text on lights presents all lights on the aircraft. It is intended for use in conjunction with the wiring diagrams to maintain the light systems in the best operating condition. The text is supported by illustrations to provide additional assistance to the mechanic during maintenance. The major light circuits are the interior and exterior lights.
2. The interior lights consists of: instrument panel post lights, overhead flood lights, fuel select handle light, various switch panel lights, pilot's overhead map light, radio call light, forward overhead cabin lights, compass light and indicator lights of various systems. Optional interior lights consists of copilot's map light, aft overhead cabin lights, electroluminescent lighting (switch panels) and oxygen gage light. Most instrument and panel lights are dimmed by rheostats located on the circuit breaker panel. The overhead floodlights, map lights and cabin lights are controlled by their respective switches.
 - A. The electroluminescent light panels (optional) emanates light from crystalline powders, or phosphors, sandwiched between two electrically conducted surfaces, of which one surface is translucent. When the panel lights are illuminated, the powders absorb electrical AC energy and convert it to light without the use of starters, or ballasts and with minimal heat. Electrical power is supplied to the panels by an inverter which converts dc electrical power to 115 volt ac electrical power. The inverter is located forward of the instrument panel at station 0.00 at centerline of the aircraft.
3. The exterior lights consist of: standard navigation lights, a retractable landing light, located in the main fuel tank tail cap of the left wing. Optional exterior equipment lights include: a right-hand landing light, nose taxi light, wing deice light (left and/or right), strobe lights, anti-collision lights (one or two), baggage compartment lights (wing and nose), upper and lower wing walk lights.
4. The light circuits require minor maintenance such as replacement of lamps or switches. Most light assemblies and components are readily accessible and can be maintained without the use of special tools.

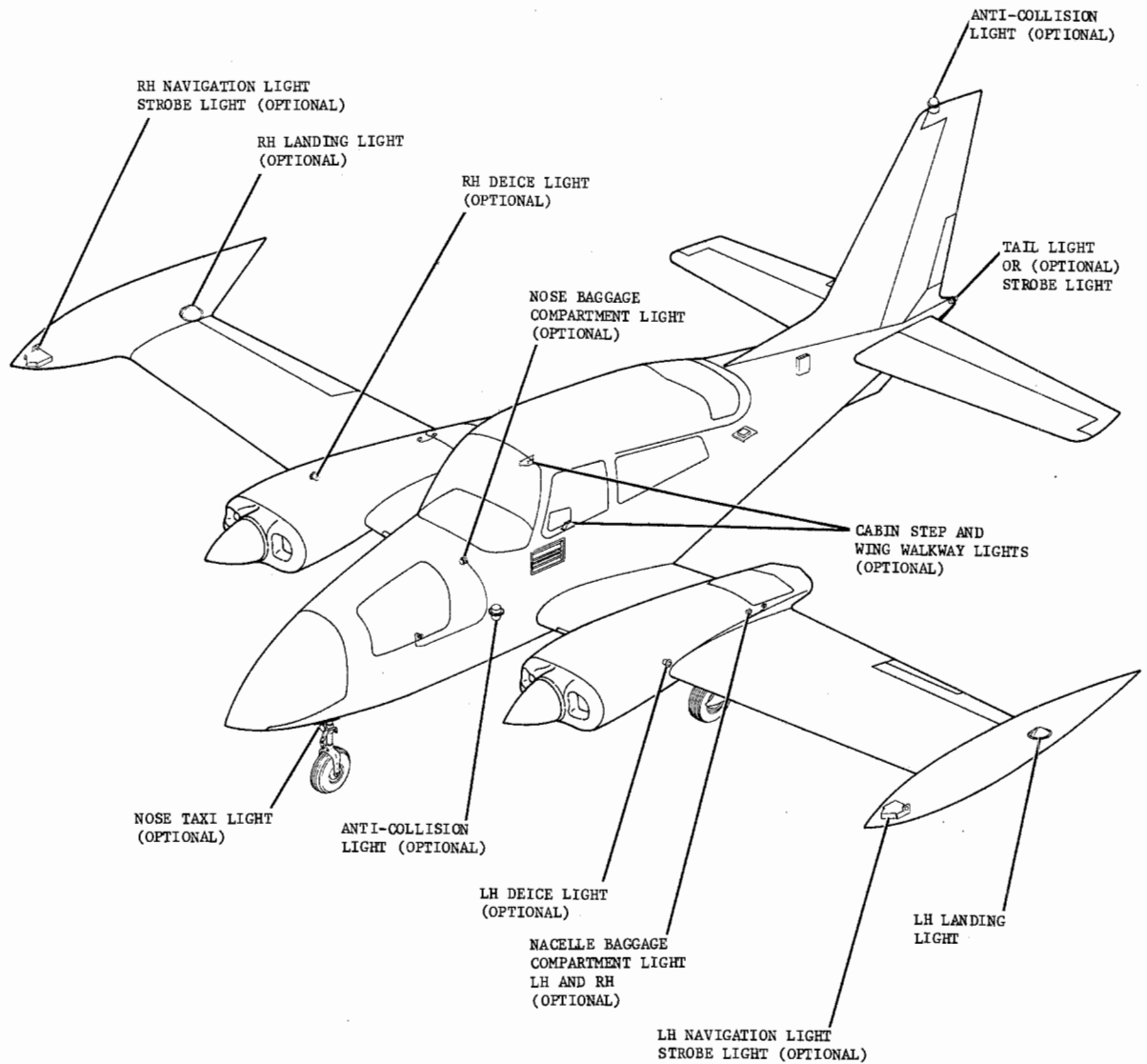
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MAINTENANCE MANUAL



10183009

Interior Lights
Figure 1



10183007

Exterior Lights
Figure 2

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MAINTENANCE MANUAL

5. When defective lamps, light assemblies and components are replaced, equipment with identical part numbers should be installed unless substitutes have been authorized. After replacing equipment, functional test should be performed to verify proper circuit operation.
6. Troubleshooting procedures are provided only as general troubleshooting, because most light circuits require the same steps to locate trouble. In most cases, inoperative lamps, open circuit breakers, blown fuses and such troubles are obvious.

Troubleshooting

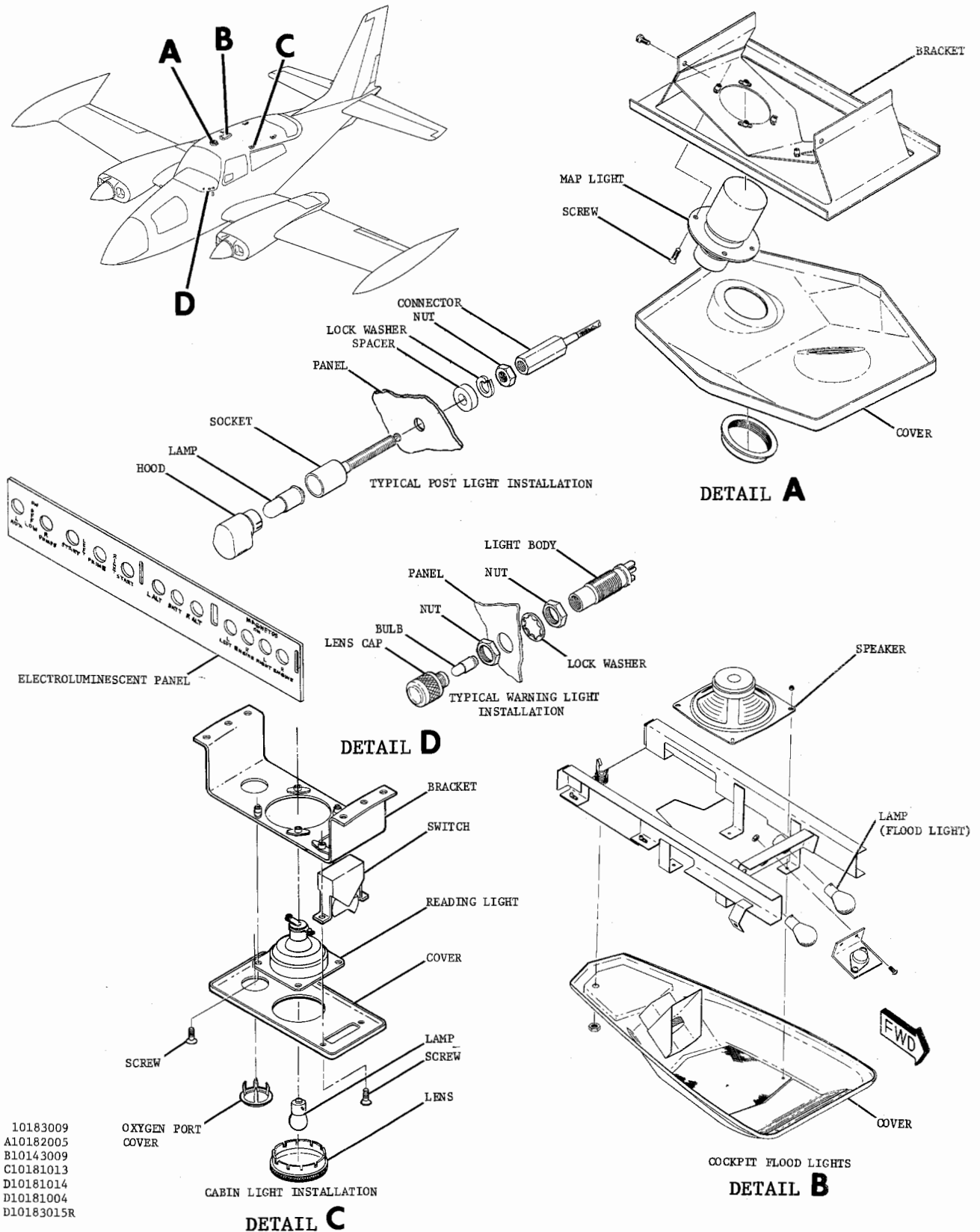
1. The following troubleshooting steps are provided to augment specific circuit information found in the wiring diagrams and to serve as a basis for developing the more detailed procedures required to locate cause of infrequent light system troubles.
2. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following item.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	Voltage and continuity check.

3. Troubleshooting Light Circuits.

- A. When possible, investigate report of trouble at source to ascertain conditions leading to, and under which, trouble occurred and whether failure of other light circuits or electrical systems occurred simultaneously. Careful analysis of such information is often indicative of nature, and most likely location of trouble.
- B. Study circuit wiring diagrams covering affected light system and its related power supply. A thorough understanding of the function is necessary before a troubleshooting procedure can be effectively planned and executed. By combining a knowledge of applicable circuits with



DETAIL C
 Cabin Interior Lighting Installation
 Figure 3

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MAINTENANCE MANUAL

information gained from trouble report, an investigation usually indicates circuit, or section of circuit, in which trouble is located.

- C. Visually inspect circuit for open circuit breakers, blown fuses, broken wiring, loose wire connections, loose electrical connectors, and evidence of shorting. Observe particularly, security of connections and pressure of foreign matter.
- D. Perform continuity check. A blown fuse, burned wires, or other evidence of shorting indicates that a power-on check would create a hazardous condition. With power off, isolate defective circuit and check one section at a time until shorted or open circuit section is found.
- E. Perform power-on check only when it has been determined that such a check cannot create a hazardous condition. With power on, perform operational tests to confirm report of trouble and to determine, if possible, whether cause of trouble is in light circuit or in power supply system. A voltmeter or test light may also be used for a power check at various break points in circuit, such as terminal strips and equipment input terminals, to determine if power is available at these points.
- F. Replace any light assembly or component that remains inoperative after making certain that power is available at unit and that ground connections are secure at unit.

Maintenance Practices

- 1. Removal/Installation Post Lights (See Figure 3).
 - A. Remove Post Light.
 - (1) Remove connector from socket.
 - (2) Remove nut and lockwasher, securing socket to panel and remove light assembly.
 - B. Install Post Light.
 - (1) Position light assembly in panel and secure with lockwasher and nut.
 - (2) Connect connector to socket.
- 2. Removal/Installation Electroluminescent Panels (See Figure 3).
 - A. Remove Electroluminescent Panel.
 - (1) Turn off power.
 - (2) Remove the necessary components, securing the panel.
 - (3) Lift panel off, identify and disconnect electrical wires.

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NOTE: Operational checks on the electroluminescent panels should be performed using 120 volt, 400 cycle AC. However, panel will operate without damage on 120 volt, 60 cycle AC.

B. Install Electroluminescent Panels.

- (1) Identify and connect panel electrical wires.
- (2) Install components to secure panel.

3. Removal/Installation Fuel Selector Handle Light.

A. Remove Fuel Selector Handle Light.

- (1) Remove the screws, securing the light cover to the spar. Remove the cover.
- (2) Push the bulb and twist to the left to unlock it, and remove the bulb from the socket.
- (3) Straighten the tabs of the bulb socket, and push the socket down and out of the socket bracket.
- (4) Loosen the small screw securing the electrical lead to the socket. Pull the lead from the socket.

B. Install Fuel Selector Handle Light.

- (1) Position the socket of the light so that the two tabs of the socket fit up into slots provided in the socket bracket on the front spar. Bend or twist the tabs of the socket to secure it in place.
- (2) Insert the end of the light electrical lead into the socket and tighten the small lead, securing the screw.
- (3) Push the bulb into the socket and twist it to the right to lock into position.
- (4) Position the light cover and install screws to secure it in place.

4. Removal/Installation Cockpit Floodlights (See Figure 3).

A. Remove Cockpit Cabin Floodlights.

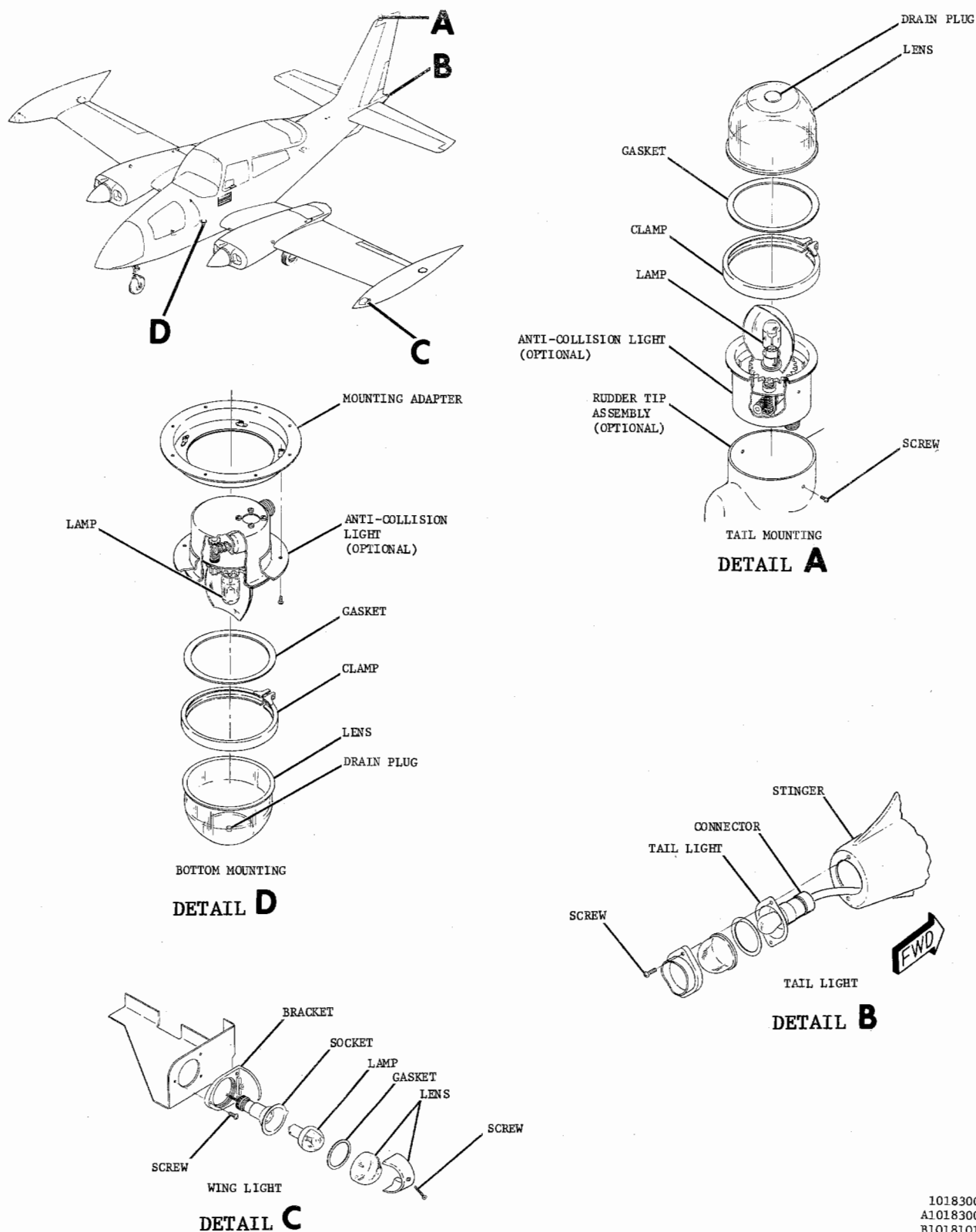
- (1) Remove cover from overhead console and lower the cover.
- (2) Remove lamps.

B. Install Cockpit Cabin Floodlights.

- (1) Install lamps.
- (2) Install cover.

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MAINTENANCE MANUAL



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A10183002
B10181012
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D10183002

Navigation and Anti-Collision Lights Installation
Figure 4

5. Removal/Installation Cabin Lights (See Figure 3).
 - A. Remove Cabin Lights.
 - (1) Remove screws, securing switch and oxygen outlet cap and remove cover.
 - (2) Remove screws, securing lights to bracket; identify and disconnect electrical wires.
 - B. Install Cabin Lights.
 - (1) Identify and connect electrical wires; secure light to bracket with screws.
 - (2) Install cover with screws and install oxygen outlet cap.
6. Removal/Installation Map Lights (See Figure 3).
 - A. Remove Map Light.
 - (1) Turn electrical power OFF.
 - (2) Remove screws, securing cover and light to bracket.
 - (3) Disconnect electrical wire and remove light.
 - B. Install Map Light.
 - (1) Connect electrical wire to light.
 - (2) Secure light and cover to bracket with screws.
7. Removal/Installation Wing Navigation Lights (See Figure 4).
 - A. Remove Wing Navigation Lights.
 - (1) Turn off electrical power.
 - (2) Remove the tip tank nose cap.
 - (3) Remove screw, securing lens retainer.
 - (4) Remove lens, gasket and lamp.
 - (5) Remove screws, securing bracket, disconnect electrical wire and remove light assembly.
 - B. Install Wing Navigation Lights.
 - (1) Install light assembly, bracket and screws; connect electrical wire.
 - (2) Assemble lamp, gasket, lens, lens retainer to socket and secure with screw.
 - (3) Install tip tank nose cap.

8. Removal/Installation Tail Navigation Light (See Figure 4).

A. Remove Tail Navigation Light.

- (1) Turn off electrical power.
- (2) Remove screws, securing the tail light assembly to the stinger.
- (3) Disconnect the electrical connector from the rear of the light assembly and remove tail light assembly.

NOTE: If the tail light wiring is to be removed, the stinger assembly must be removed to disconnect the wires at the rear fuselage bulkhead.

B. Install Tail Navigation Lights.

- (1) Connect electrical connector to tail light assembly.
- (2) Position light assembly in stinger and secure with screws.

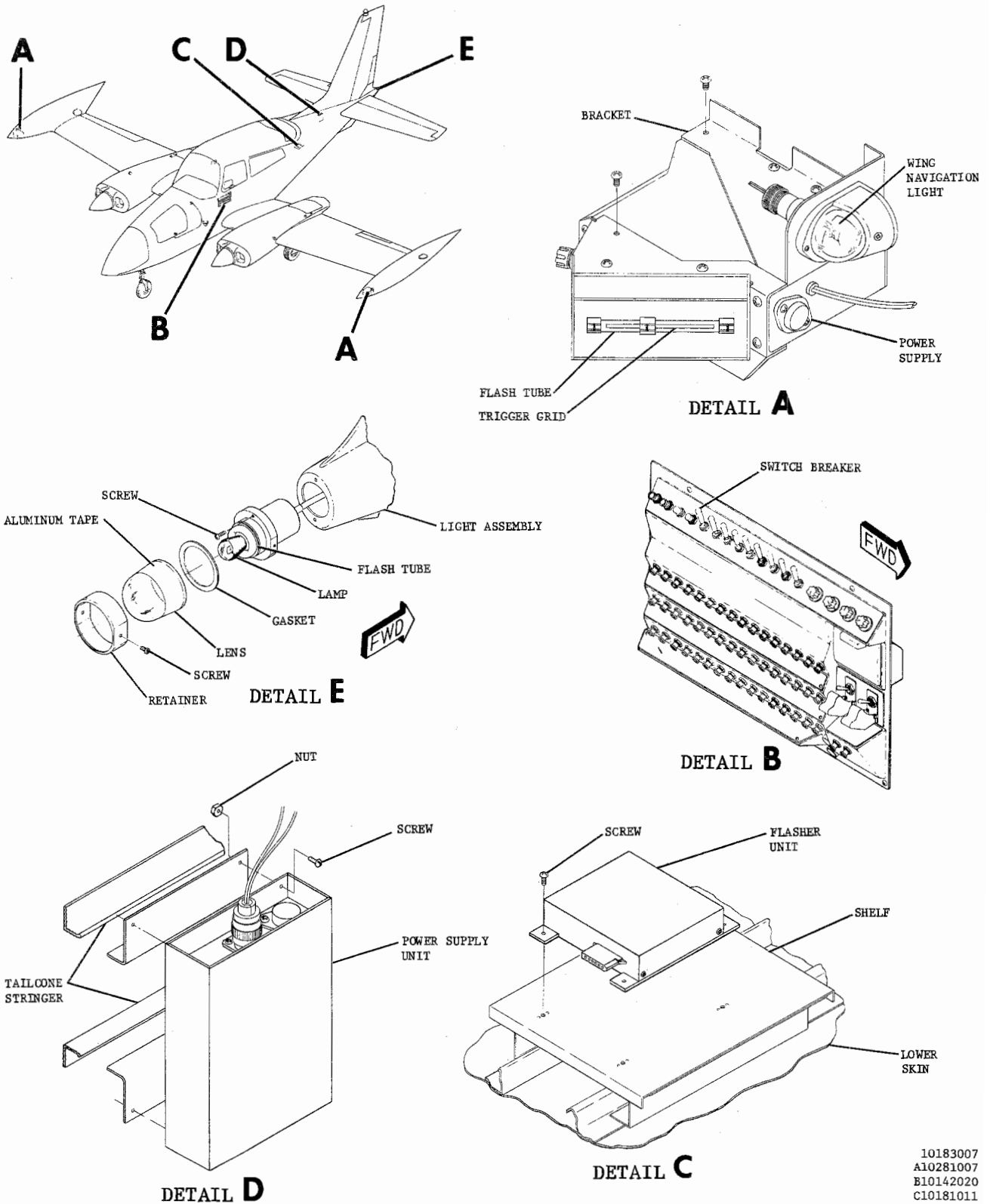
9. Removal/Installation Anti-Collision Lights (Optional) (See Figure 4).

A. Remove Anti-Collision Lights.

- (1) Turn off electrical power.
- (2) To remove rudder mounted anti-collision light, proceed as follows:
 - (a) Remove the screws in the rudder tip assembly and lift the anti-collision light from the tip assembly.
 - (b) Disconnect electrical connector from light assembly.
- (3) To remove bottom fuselage mounted anti-collision light proceed as follows:
 - (a) Remove the screws, securing mounting adapter to fuselage.
 - (b) Disconnect electrical connector from light assembly.
- (4) To remove lamp proceed as follows:

NOTE: Removal of lamp is typical for both anti-collision lights. It is not necessary to remove the anti-collision light assembly when lamp is removed.

- (a) Loosen clamp and remove lens. Remove lamp.



Strobe Light System
Figure 5

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E10181010

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CAUTION: WHEN REMOVING LAMP, DO NOT ALLOW THE REFLECTOR TO MOVE. ALWAYS GRASP THE LAMP BASE AND UNSCREW LAMP FROM BAYONET FITTINGS. THIS WILL PREVENT MOTOR DRIVE SPRING DAMAGE.

B. Install Anti-Collision Lights.

- (1) To install rudder mounted anti-collision light, proceed as follows:
 - (a) Connect electrical connector to light assembly.
 - (b) Align mounting holes and insert anti-collision light assembly into rudder tip assembly and secure with screws.
- (2) To install bottom fuselage mounted anti-collision light, proceed as follows:
 - (a) Connect electrical connector to light assembly.
 - (b) Secure anti-collision light to mounting adapter, secure mounting adapter to fuselage.
- (3) To install lamp, proceed as follows:
 - (a) Install lamp in light assembly.

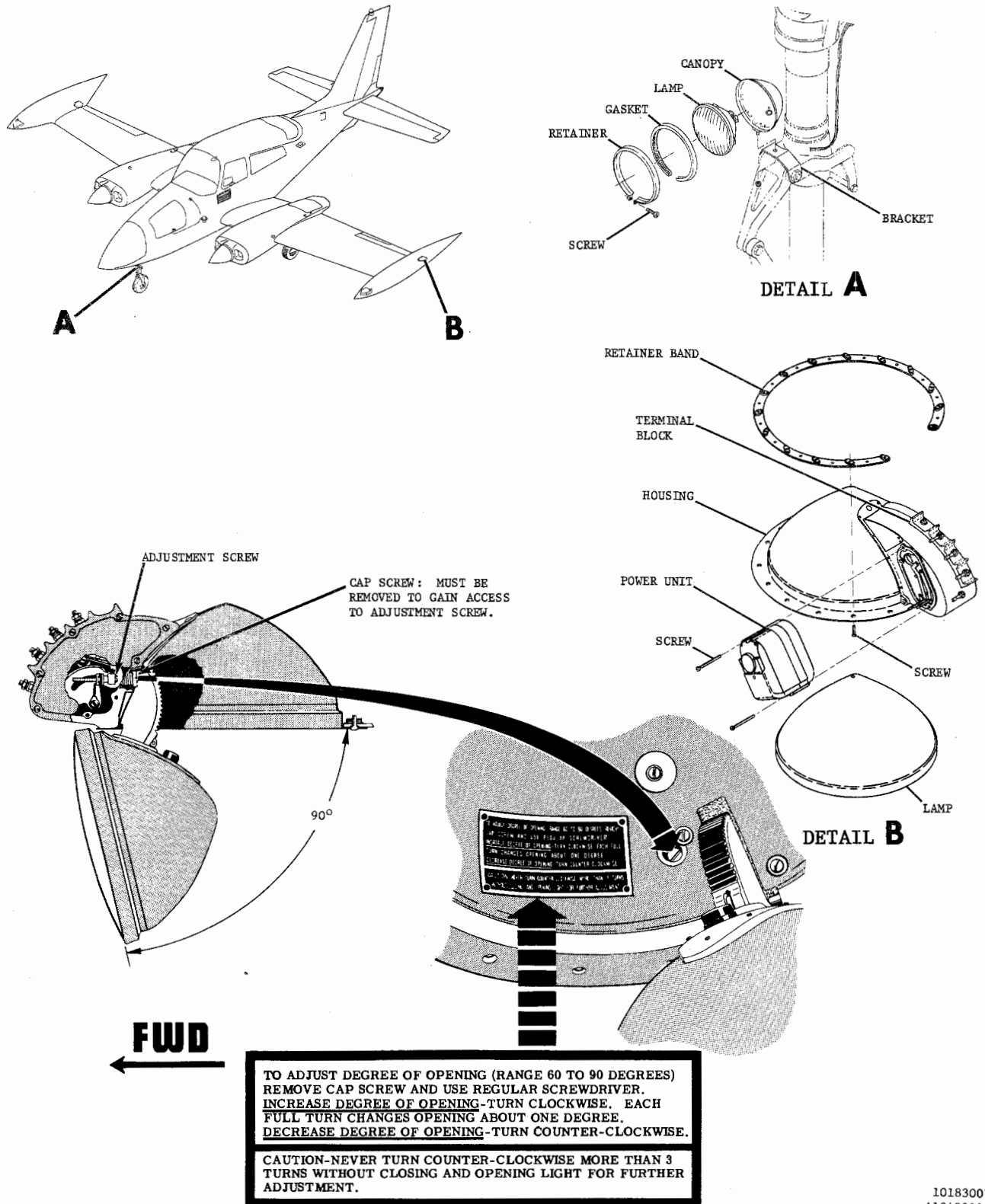
CAUTION: WHEN REPLACING THE LAMP, DO NOT ALLOW THE REFLECTOR TO MOVE. ALWAYS GRASP THE LAMP BASE AND INSTALL LAMP IN BAYONET FITTINGS. THIS WILL PREVENT MOTOR DRIVE SPRING DAMAGE.

- (b) Position gasket and lens on light assembly and secure with clamp.

9. Removal/Installation (Optional) Strobe Light System Components (See Figure 5).

A. Remove Strobe Light System Components.

- (1) Remove wing strobe lights as follows:
 - (a) Remove nose cap on wing tip tank.
 - (b) To remove strobe flash tube, unsafety and remove from clips.
 - (c) Disconnect electrical wiring to strobe light.
 - (d) Remove strobe light assembly from supporting bracket.
- (2) Remove power supply and flasher units as follows:
 - (a) Remove tailcone upholstery panel, refer to Chapter 12.
 - (b) Disconnect electrical wiring to flasher unit and remove flasher unit from shelf.
 - (c) Disconnect electrical plug and remove power supply from tailcone stringer.



Landing and Taxi Light Installation
Figure 6

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MAINTENANCE MANUAL

- (3) Remove tail strobe light as follows:
 - (a) Remove screws from retainer and remove retainer, lens and gasket.
 - (b) Remove screws securing light assembly to stinger. Disconnect electrical connector and remove light assembly.

B. Install Strobe Light System Components.

- (1) Install wing strobe lights as follows:
 - (a) Position strobe light assembly to supporting bracket and secure with screws.
 - (b) Connect electrical wiring to light assembly.
 - (c) If strobe light flash tube was removed; install flash tube with trigger grid facing outward towards the lens and away from the reflector. Safety flash tube.
 - (d) Install nose cap on tip tank.
- (2) Install power supply and flasher units as follows:
 - (a) Install flasher unit on shelf, using screws and connect electrical wiring.
 - (b) Install power supply unit to tailcone stringer, using screw and nuts. Connect electrical connector to power supply.
 - (c) Install tailcone upholstery panel.
- (3) Install tail strobe light as follows:
 - (a) Connect electrical connector and secure light assembly to stinger with screws.
 - (b) Assemble gasket, lens, retainer to light assembly and secure retainer using screws.

10. Removal/Installation Landing Light (See Figure 6).

A. Remove Landing Light.

- (1) Turn off electrical power.
- (2) Support the light assembly and remove screws which secure lamp housing to retainer band.
- (3) Lower the light assembly out of the tip tank tail cap and place on a stand of suitable height.

NOTE: The wiring to the light contains sufficient slack to permit the light assembly to be brought down below the tip tank tail cap for removal of light wiring.

- (4) Tag and remove the wires from the terminal block on the light.

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- (5) To remove the lamp from the landing light, extend the light approximately 60 degrees and remove the lamp retainer ring. Pull the lamp from the inner canopy and disconnect the wires from the lamp.

NOTE: When the light assembly is removed from the aircraft, the light may be extended by applying a 28 volt power source across the OPEN and ground terminals.

- (6) Remove the two screws securing the power unit to the housing.

B. Install Landing Light.

- (1) Position power unit within drive housing of light assembly and secure with screws.
- (2) To install a new lamp, connect the wires to the lamp and position the lamp within the canopy with the filament shield inboard. Position the lamp retainer band over the edges of the lamp and canopy with the flat side toward the apex of the canopy. Using needle nose pliers, pull the retainer band tight around the lamp and canopy and fasten the clip on the band.

NOTE: Before installing a new lamp, it will be necessary to extend the light approximately 60 degrees to gain access to the retainer band.

- (3) Position the retainer ring inside the tip tank tail cap with the open side forward and tape it to the tip tank tail cap to hold it in position temporarily while the light assembly is installed.
- (4) Identify and connect wires to the light assembly terminal block.
- (5) Place the light assembly into the tip tank tail cap and secure with screws.

CAUTION: START ALL SCREWS THROUGH THE NUTPLATES ON THE RETAINER BAND BEFORE ATTEMPTING TO TIGHTEN ANY OF THEM TO PREVENT DISTORTION OF MISALIGNMENT OF THE BAND.

11. Adjustment/Test Landing Light (See Figure 6).

- A. Landing lights are adjusted in the factory to extend to an angle of 90 degrees from the full retracted position. The angle of extension may be altered by means of an adjustment screw.

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MAINTENANCE MANUAL

NOTE: Do not turn the adjusting screw counterclockwise more than three full turns without closing and opening the light before further adjustment. Excessive turns of the screw in a counterclockwise direction will distort an actuator contact within the assembly, thus changing the fixed setting which controls the light retract position.

B. Adjust Landing Light.

- (1) The angle of extension of the landing light may be checked with a bubble protractor. Check the degree of opening according to the following steps:

- (a) Retract the landing light and place the flat surface of the protractor across the retainer band which secures the lamp within the inner canopy.

NOTE: Two blocks of equal thickness may be placed on the retainer band to raise the protractor so it will clear the surface of the lamp for a more positive location of the protractor.

- (b) Run the landing light full down and measure the angle of extension. If light has not reached the desired degree of extension, turn the landing light adjustment screw in the direction necessary to achieve the desired angle of extension.
- (c) Retract the light to the full up position, fully extend the light, and check the angle of extension.

12. Removal/Installation Taxi Light (See Figure 6).

A. Remove Taxi Light.

- (1) To remove lamp; remove retainer, gasket and lamp.
- (2) To remove light assembly; disconnect electrical wires to light and remove nut securing light assembly to bracket.

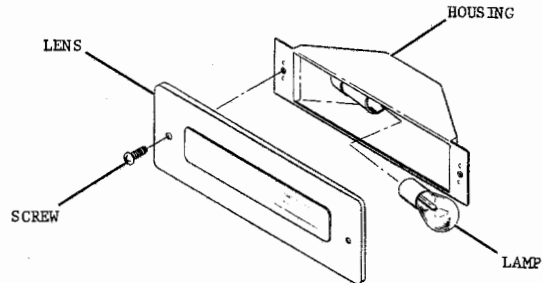
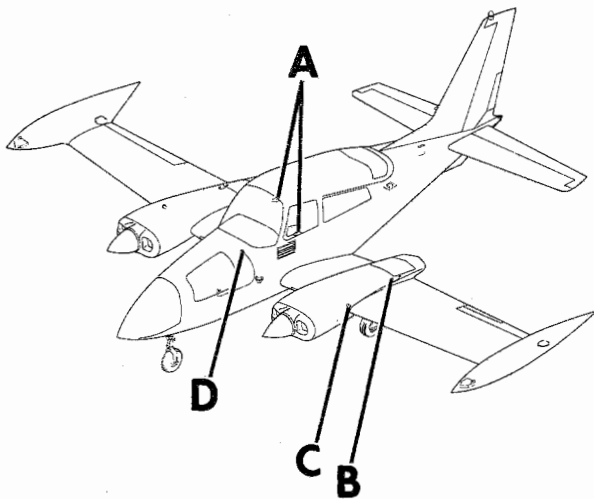
B. Install Taxi Light.

- (1) To install lamp; install lamp in canopy and secure with gasket and retainer.
- (2) To install light assembly; position light assembly on bracket and secure with nut. Connect electrical wiring to light.

13. Removal/Installation Cabin Step Light and Wing Walkway Light (Optional) (See Figure 7).
 - A. Remove Cabin Step Light and Wing Walkway Light.
 - (1) Remove screws holding lens assembly.
 - (2) Remove lens assembly from housing assembly.
 - (3) Remove lamp from socket.
 - (4) If further disassembly is required, lift out housing, remove wires from socket and tag.
 - B. Install Cabin Step Light and Wing Walkway Light.
 - (1) Connect wires to socket and remove tags. Install housing.
 - (2) Install lamp and secure lens assembly with screws.
14. Removal/Installation Deice Light (Optional) (See Figure 7).
 - A. Remove Deice Light.
 - (1) Remove upper cowling from engine.
 - (2) Remove screw securing socket assembly and clamp holding wires.
 - (3) Pull socket assembly apart from lamp shield to remove lamp.
 - (4) If further disassembly is required, identify and remove wires. Drill out rivets securing shield assembly to nacelle skin.
 - B. Install Deice Light.
 - (1) If removed, rivet shield assembly to nacelle skin and connect wires.
 - (2) Install lamp in socket assembly. Secure lamp assembly to shield assembly using screws.
 - (3) Install upper engine cowling.
15. Removal/Installation (Optional) Wing Locker Courtesy Light (See Figure 7).
 - A. Remove Wing Locker Courtesy Light.
 - (1) Remove upper left engine cowl.
 - (2) Remove the 5 amp fuse to the wing locker light from fuse holder.
 - (3) Remove screws securing the light and remove lamp.
 - B. Install Wing Locker Courtesy Light.
 - (1) Install lamp into socket.
 - (2) Install lens, lens retainer and secure with screws.

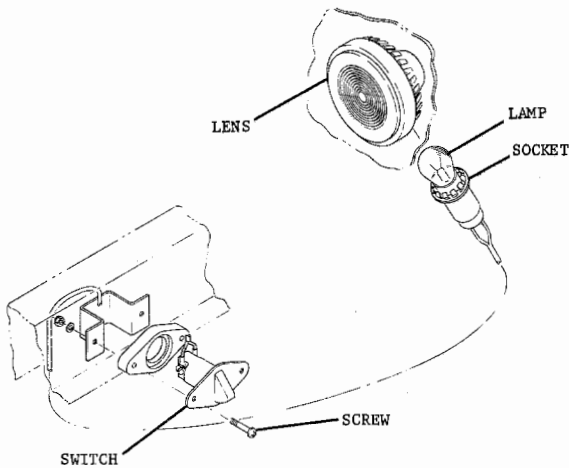
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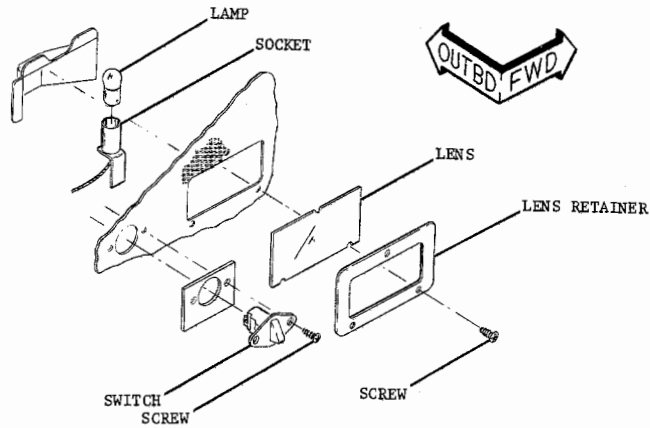
WING WALK-WAY AND CABIN STEP LIGHTS
(OPTIONAL)

DETAIL A



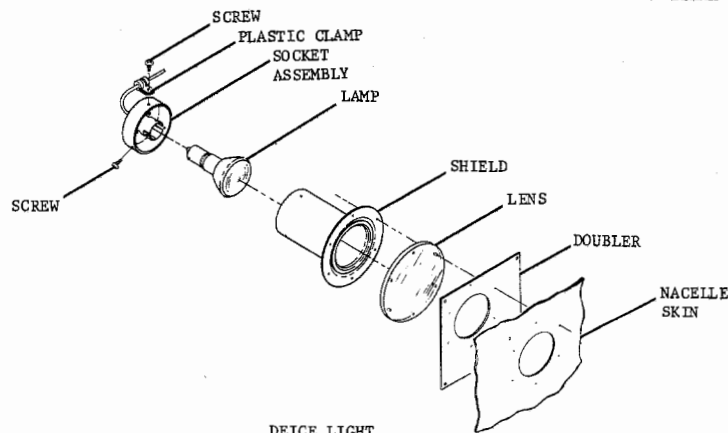
NOSE BAGGAGE LIGHT
(OPTIONAL)

DETAIL D



WING LOCKER COURTESY LIGHT
(OPTIONAL)

DETAIL B



DEICE LIGHT
(OPTIONAL)

DETAIL C

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A10182001
B14282002
C10281009
D10182006

Courtesy and Deice Light Installation
Figure 7

- (3) Replace fuse and check operation.
 - (4) Install upper engine cow.
16. Removal/Installation (Optional) Wing Locker Courtesy Light Switch (See Figure 7).
- A. Remove Wing Locker Courtesy Light Switch.
 - (1) Remove upper left engine cowl.
 - (2) Remove 5 amp fuse to wing locker light from fuse holder.
 - (3) Remove screw from switch. Identify and disconnect electrical wires.
 - B. Install Wing Locker Courtesy Light Switch.
 - (1) Connect electrical wires to switch and secure switch with screws.
 - (2) Replace fuse and check operation.
 - (3) Install upper left engine cowling.
17. Removal/Installation (Optional) Nose Baggage Light (See Figure 7).
- A. Remove Nose Baggage Light.
 - (1) Remove upper left engine cowl.
 - (2) Remove 5 amp fuse to nose compartment light from fuse holder.
 - (3) Pull lens from baggage retainer.
 - (4) Remove socket and remove lamp.
 - B. Install Nose Baggage Light.
 - (1) Install lamp in socket and insert socket into lens.
 - (2) Insert lens into baggage retainer.
 - (3) Replace fuse and check operation.
 - (4) Install left engine cowl.

STALL WARNING SYSTEMDescription

1. The stall warning system consists of a warning transmitter and warning horn. The stall warning horn is mounted behind the instrument panel and the warning transmitter is mounted on the leading edge of the left wing. The electrical circuits of the system energizes the warning horn sounding the horn when the aircraft approaches a stall. The stall warning transmitter incorporates a heater element, operated by the pitot heater switch, to prevent ice from hampering its operation.

Maintenance Practices

1. Removal/Installation Stall Warning Transmitter (See Figure 1).

- A. Remove Stall Warning Transmitter.

NOTE: Before removal of stall warning transmitter, it is important that the exact fore-aft location of the vane be marked on the wing so that the replacement unit may be adjusted identically.

- (1) Turn electrical power OFF.
- (2) Remove access cover from lower surface of wing.
- (3) Remove screws attaching stall warning transmitter to wing skin.
- (4) Identify and disconnect electrical wires from transmitter.
- (5) Remove transmitter.

- B. Install Stall Warning Transmitter.

- (1) Connect electrical wires to transmitter.
- (2) Secure transmitter to wing skin with screws.
- (3) Install access cover on lower surface of wing.
- (4) Perform operational check of stall warning system.

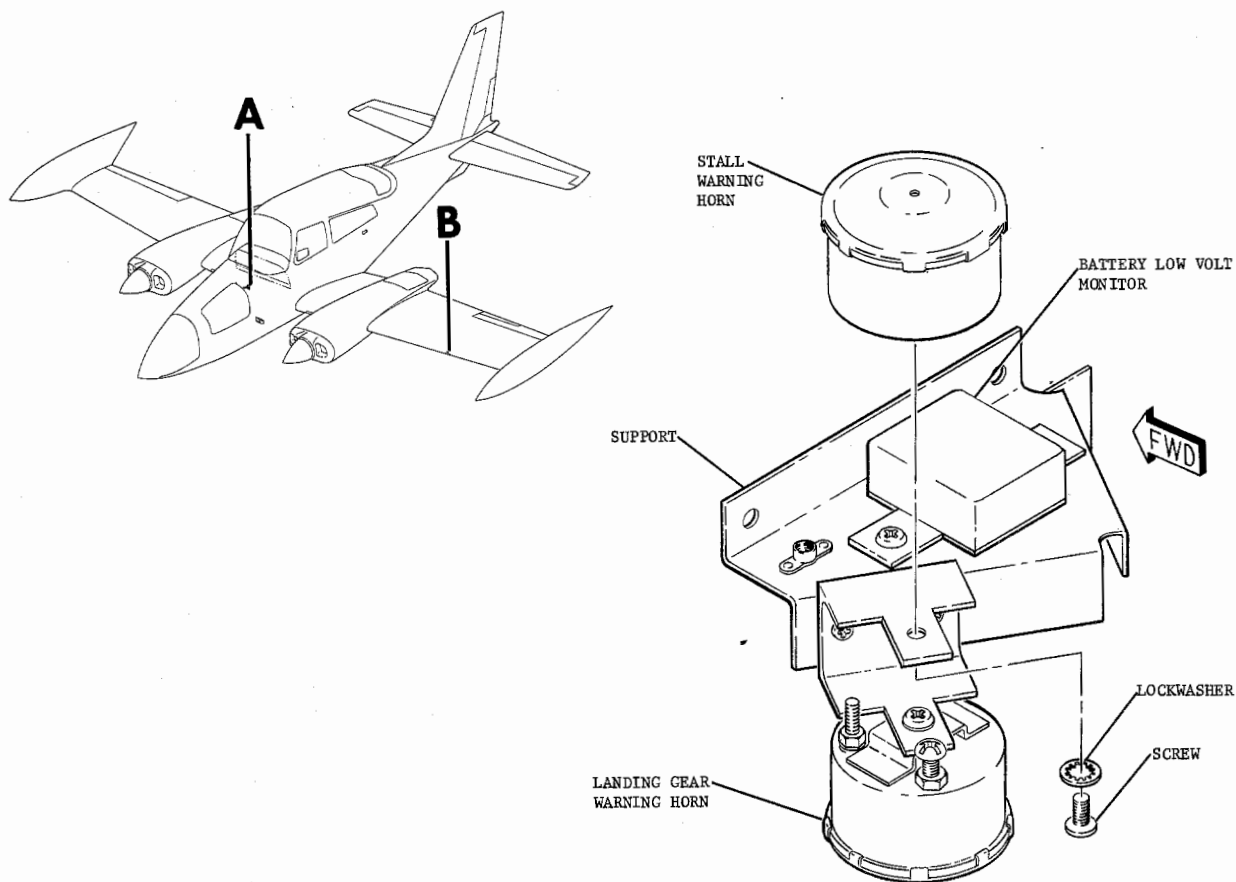
2. Removal/Installation Stall Warning Horn (See Figure 1).

- A. Remove Stall Warning Horn.

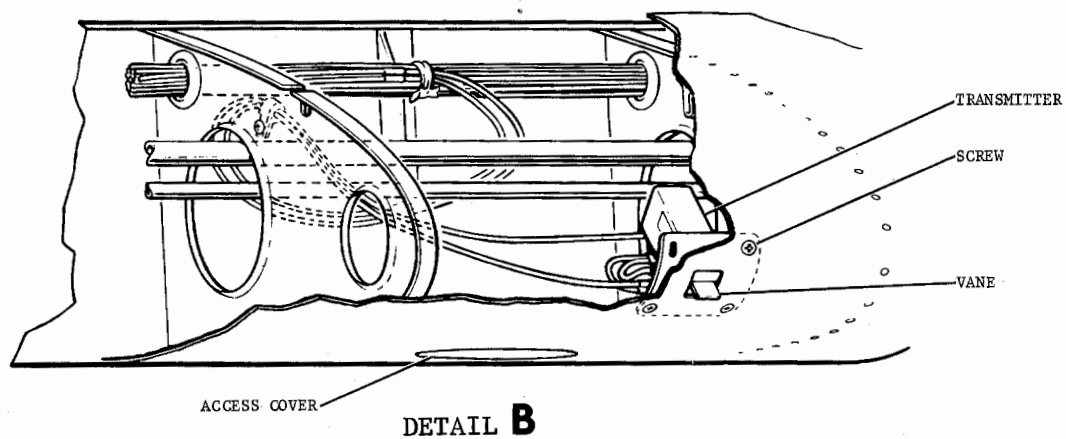
- (1) Turn electrical power OFF.
- (2) Identify and disconnect electrical wires from stall warning horn.
- (3) Remove screw and lockwasher securing warning horn to support and remove warning horn.

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DETAIL A



Stall Warning System
Figure 1

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A10183012
B10141043

B. Install Stall Warning Horn.

- (1) Secure warning horn to support using lockwasher and screw.
- (2) Identify and connect electrical wires to warning horn.
- (3) Perform operational ground check of stall warning system.

3. Operational Check Stall Warning System.

A. Ground Check.

- (1) Turn electrical power ON.
- (2) Activate vane on stall warning transmitter and observe audible warning signal.

NOTE: The stall warning transmitter incorporates an electrical heating element which is activated by the pitot heat switch. Insure this switch is off when checking the transmitter.

B. Flight Check.

- (1) Check the stall warning system in two configurations: landing gear up, flaps up and gear down, flaps full down.
- (2) Check each configuration in step (1) at 65 percent power, and at idle power, and in the weight and center-of-gravity range shown in Figure 2.
- (3) Approach the stall by reducing airspeed at a rate as close as possible to one knot per second. In the stall the aircraft roll altitude should be controllable up to the time the aircraft nose pitches downward or full up elevator stop is reached. The fuel should be managed to minimize asymmetric fuel prior to conducting the stall.

NOTE: Prior to conducting a stall, close all fresh air vents and check for presence of exhaust fumes in cockpit during approach to stall.

- (4) The indicated stall speed in the landing configuration at idle power should fall within ± 4 knots IAS of the stall speed line (see Figure 2).
- (5) Record the stall speed for each configuration.

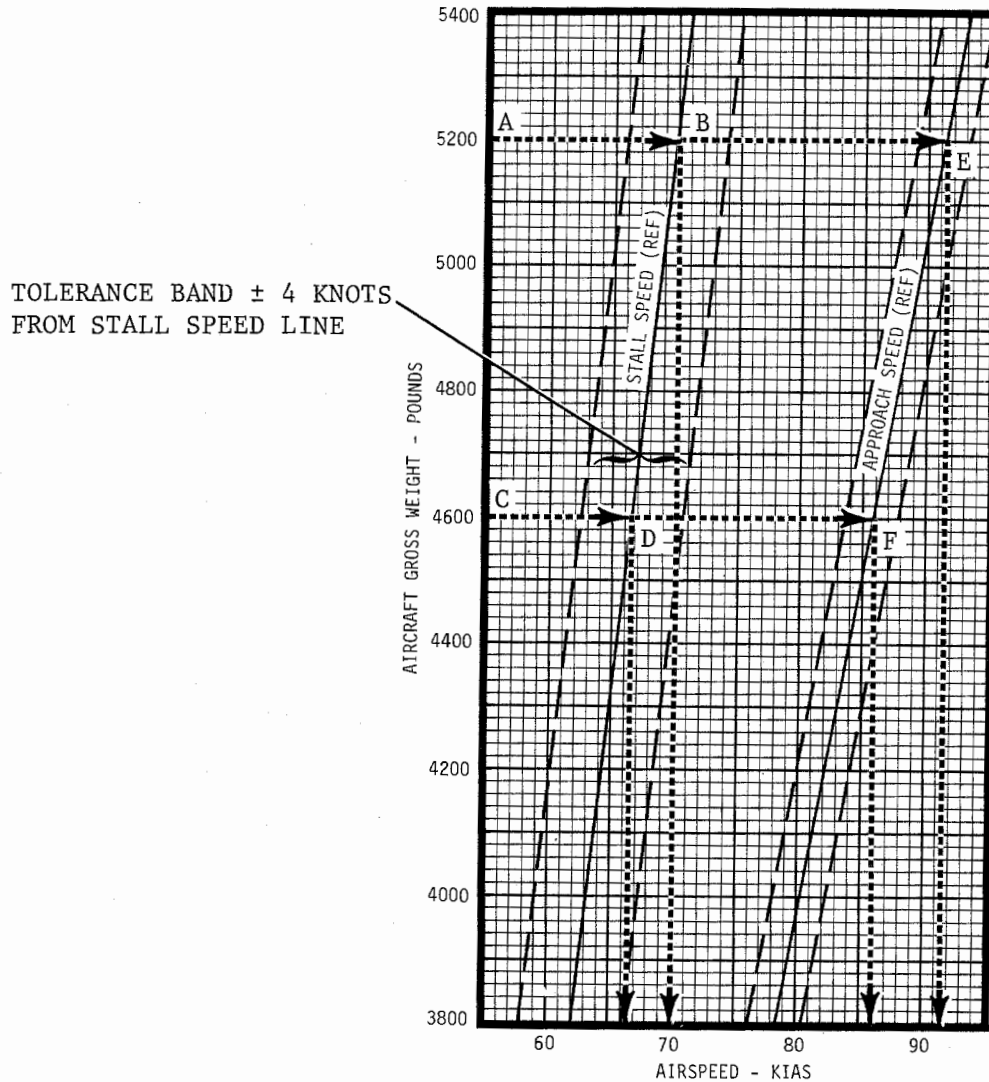
4. Adjustment Stall Warning System.

A. Adjust Stall Warning System.

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MODEL	TAKEOFF WEIGHT RANGE - LBS.	TAKEOFF C.G. RANGE - %
310	4440 - 5200	20 - 25
T310	4550 - 5310	19 - 24



EXAMPLE

- "A" POINT "A" WEIGHT (HEAVY WEIGHT)
- "B" STALL SPEED AT POINT "A" WEIGHT (70 KIAS)
- "C" POINT "C" WEIGHT (LIGHT WEIGHT)
- "D" STALL SPEED AT POINT "C" WEIGHT (66.5 KIAS)
- "E" APPROACH SPEED AT POINT "A" WEIGHT (91.5 KIAS)
- "F" APPROACH SPEED AT POINT "C" WEIGHT (86 KIAS)

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Approach and Stall Speed Chart
Figure 2

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- (1) Using the data recorded in the Flight Check portion of Operational Check Stall Warning System, adjust the stall warning vane to provide a stall warning horn at 3 to 5 knots IAS prior to the idle power landing configuration stall.
- (2) Raising the stall warning vane position will increase the stall warning indication and lowering the stall warning vane will lower the stall warning indication.

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ELECTRICAL LOADDescription

1. An electrical load chart is provided to give the load in amps for aircraft equipment.

CONTINUOUS ELECTRICAL LOAD CHART (STANDARD)

	Amps Req'd.
Battery Relay	0.60
Cabin Heater	6.00
Compass Light	0.08
Engine Gage Units	0.64
Turn & Bank Indicator	0.15
Post Lights - Instrument Panel	1.16
Fuel Gages - Auxiliary Indicator Light	0.08
Fuel Selector Light	0.30
Gear Indicator Light	0.04
Heater - Stall Warning	0.72
Heaters - Tip Tank Vent	0.50
Heaters - Auxiliary Tank Vent	0.58
Heater - Pitot	4.00
Navigation Lights	1.86
Tail Light	0.51
Switch Panel (E.L.)	0.50
Fuel Pumps - Tip Tank	10.00
Fuel Transfer Pumps - Tip Tank	0.80
Voltage Regulator	1.50

CONTINUOUS ELECTRICAL LOAD CHART (OPTIONAL)

Air Conditioning - Cabin	60.00
Prop Deicer - Electric (three bladed)	15.00
Prop Synchronous	3.00
Windshield Deice (Alcohol)	0.40
Flight Hour Recorder	0.04
Fuel Pumps - Wing Locker	6.00
Outside Air Temperature	0.08
Anti-Collision Beacon	1.90
Strobe Light System	3.00
Heater - Static Ports	0.72
Heater - Wing Locker Vent	0.53
Heater - Dual Pitot	8.00

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NON-CONTINUOUS ELECTRICAL LOAD CHART

	Amps Req'd.
Cabin Dome Lights	1.20
Map Light (Each)	0.51
Cigarette Lighter (Each) 24 volt	6.80
Walkway Lights (Each)	0.51
Wing Locker Baggage Compartment Lights (Each)	0.52
Console Lights	1.11
Flap Motor	10.00
Gear Warning	1.50
Stall Warning	1.50
Wing Deice System	2.80
Deice Light (Each)	0.70
Landing Gear Motor	25.00
Landing Gear Relay	0.45
Landing Light (Each)	9.10
Taxi Light	3.50
Starting Relay (Each)	0.60
Starting Vibrator	2.50
Electric Trim	0.60

NOTE

Total continuous load should not exceed
80% of total rated alternator capacity.

WIRING DIAGRAMS

REFERENCE DESIGNATOR CODE:

Reference designators are used in these diagrams to more quickly identify and locate a part or assembly used in any electrical system. A part is identified by reference number on a diagram. The reference number called out in wiring reference designators identifies by part number, the description and diagram sheet location.

EXAMPLE -

REF. DESIGNATOR	DIA. SHT. NO.	PART NO.	DESCRIPTION
BB20	6	0820001-1	Battery Bus

NOTE

Part numbers referred to on Wiring Diagrams are for reference only. When ordering spare or replacement parts, refer to applicable Parts Catalog.

The wiring diagrams contained in this section clearly show the complete wiring on each item of electrical components listed in the Wiring Diagram Index. The first portion of wire number indicates the Aircraft System, the center portion indicates Wire Number, and the last portion indicates Wire Gauge Size. Each wiring diagram contains part number and nomenclature for each component.

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WIRING REFERENCE DESIGNATORS

<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
AMP3	10	Signal Conditioner	
AMP4	10	Signal Conditioner	
AMP5	16	Stereo Player	
AR5	6.01	Alternator 50 Amp	
AR6	6.01	Alternator 50 Amp	
AR7	6.01	Alternator 100 Amp	
AR8	6.01	Alternator 100 Amp	
B1	9	Fuel Pump Tip Tank	
B2	9	Fuel Pump Tip Tank	
B5	9	Fuel Pump Wing Locker	
B6	9	Fuel Pump Wing Locker	
B8	5	R Starter	
B9	5	L Starter	
B10	7	Motor	
B11	14	Motor	
B14	13	Blower and Pump	
B16	14	Actuator Assembly	
B17	8	Motor	
B18	8	Motor	
B19	8	Elec Trim Act	
B21	8	Motor	

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MAINTENANCE MANUAL

<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
B22	8	Motor	
B23	9	XFER Pump	
B24	9	XFER Pump	
B25	14	Pump W/S Anti-Ice	
BB7	5	Bus Bar	
BB8	11	Bus	
BB9	11	Bus	
BB10	11	Bus	
BB11	11	Bus	
BB12	11	Bus	
BB21	6.01	Bus Bar	
BB22	6.01	Bus Bar	
BB23	6.01	Bus Bar	
BB24	6.02	Bus Bar	
BB25	6.02	Bus Bar	
BB26	6.02	Bus Bar	
BB27	6.02	Bus Bar	
BT3	6.01	Battery	
CB1	9	CB R Aux Pump	
CB2	9	CB L Aux Pump	
CB3	5	CB Start Relay	
CB4	12	CB R LND LT	
CB5	12	CB L LND LT	
CB6	7	CB Gear Motor	
CB7	7	CB Gear Warn	
CB8	8 & 13	CB Stall Horn	
CB9	14	CB Flap	
CB10	8	CB R Eng Gage	
CB11	8	CB L Eng Gage	
CB12	10	Fuel Gage	
CB13	10	Fuel Gage	
CB14	13	CB Cab HT & OAT	
CB15	11	CB Eng Sw Lts	
CB16	11	CB Flt Inst Lts	
CB17	11	CB Radio Lts	
CB18	11	CB Cabin Lts	
CB35	14	CB Prop Synch	
CB37	14	CB Wing De-Ice	
CB38	13	CB Stl & F1 VT HT	
CB39	13	CB Dual Pitot	
CB39	13	CB Pitot Ht	
CB40	8	CB RH T & B	
CB41	9	CB Wing L Fuel	
CB42	8	CB Elec Seat	
CB43	8	CB Elec Seat	
CB44	8	CB Elec Elev Trim	
CB48	13	CB Cigar LTR	
CB49	6	CB L Alt 100A	
CB50	6	CB L Alt 100A	
CR1	15	Diode	

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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
CR2	15	Diode	
CR4	6.01	Diode	
CR5	6.01	Diode	
CR6	6.01	Diode Assy	
CR7	6.01	Diode Assy	
CR8	6.01	Diode	
CR9	6.01	Diode	
CR10	6.01	Diode	
CR11	6.02	Diode	
CR12	13	Diode	
CR24	13	Diode Htr	
DS1	7	Light	
DS2	7	Light	
DS3	7	Light	
DS4	7	Light	
DS5	12	L Nav Lt Assy	
DS6	12	R Nav Lt Assy	
DS7	12	T Nav Lt	
DS8	12	Light Anti-Collision	
DS9	12	Light Anti-Collision	
DS10	12	Taxi Lt	
DS11	11	Bulb	
DS12	11	Bulb	
DS13	11	Light	
DS14	11	Light	
DS15	11	Light	
DS16	11	Light	
DS17	12	Lamp	
DS18	12	Lamp	
DS20	12	Lnd Lt Assy	
DS21	12	Lnd Lt Assy	
DS25	12	LH Deice Lt	
DS26	12	RH Deice Lt	
DS27	12	Light Assy	
DS28	12	Light Assy	
DS29	13	Light	
DS30	11	Fuel Sel Lt	
DS31	11	Sw Lt	
DS32	11	Sw Lt	
DS33	11	Sw Lt	
DS34	11	Sw Lt	
DS35	11	Sw Lt	
DS36	11	Sw Lt	
DS37	11	Sw Lt	
DS38	11	Comp Lt	
DS39	11	Flap Pres Lt	
DS40	11	Comf Cont Lt	
DS41	6	LH Alt Lt	
DS42	6	RH Alt Lt	
DS43	8	Light	

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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
DS44	9	Light	
DS45	9	Light	
DS54	14	Light	
DS55	14	Light	
DS71	10	Light	
DS72	10	Light	
DS84	11	Fld Lt	
DS85	11	Fld Lt	
DS86	11.0	Oxy Lt	
DS87	11.0	Sw Lt	
DS90	6.02	Ind. Lt Low Volt Monitor	
DSS1	12	Lt Tail Strobe	
DSS2	12	Lt Wing Strobe	
DSS3	12	Lt Wing Strobe	
E3	13	Cabin Hrt	
E4	6	O.V. Relay	
E5	6	O.V. Relay	
E6	14	Brush Assy	
E7	14	Brush Assy	
E8	14	Control Box A	
E9	14	Governor	
E10	14	Governor	
E11	13	LH P.T. Htr	
E12	13	RH P.T. Htr	
E13	14	Governor	
E14	14	Governor	
E15	14	Brush Assy	
E16	14	Brush Assy	
EL1	11	Panel	
EL2	11	Panel	
EL3	11	Panel	
EL4	11	Panel	
EL5	11	Panel	
EL6	11	Panel	
EL7	11	Panel	
EL8	11	Panel	
EL9	11	Panel	
EL10	11	Panel	
EL11	11	Panel	
EL12	11	Panel	
EL13	11	Panel	
EL14	11	Panel	
EL15	11	Panel	
F1	6	Amp Fuse	
F2	6	Amp Fuse	
F3	6	Amp Fuse	
F4	6	Amp Fuse	
F5	6.0	Amp Fuse	
F6	6.0	Amp Fuse	
F7	6	Amp Fuse	

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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
F8	6	Amp Fuse	
F9	6	Emer Fld Fuse	
F10	12	Fuse	
F11	12	Flasher	
F12	7	Flasher	
F13	14	Fuse	
FB1	6.01	Fuse Block	
G1	5	L Magneto	
G2	5	Magneto	
G3	5	R Magneto	
G4	5	Magneto	
G5	5	Start Vibrator	
HR1	13	Cigar Ltr	
HR2	13	Cigar Ltr	
HR5	14	De-Ice Boot	
HR6	14	De-Ice Boot	
HR7	14	De-Ice Boot	
HR8	14	De-Ice Boot	
HR9	14	De-Ice Boot	
HR10	14	De-Ice Boot	
HR11	13	Vent Htr	
HR12	13	Vent Htr	
HR13	13	Htr	
HR14	13	Htr	
HR15	13	Htr	
HR16	13	Htr	
INV1	11	Inverter	
J1	3	Recpt	
J3	5	Recpt	
J5	15	Jack Mic	
J6	15	Jack Mic	
J7	15	Jack Mic	
J11	15	Jack HD PH	
J12	15	Jack HD PH	
J29	14	Recpt	
J32	5	Recpt	
J33	5	Recpt	
J35	10	Recpt	
J36	10	Recpt	
J37	3	Recpt	
J47	15	Mic Jack	
J49	11	Recpt	
J50	15	Conn A.O.A.	
J54	15	Conn A.O.A.	
J55	10	Recpt & Cable Assy	
J55A	10	Recpt & Cable Assy	
J56	10	Recpt & Cable Assy	
J56A	10	Recpt & Cable Assy	
J70	6.02	Jack Low Volt Monitor	
JB1	4	LH J Box	

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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
JB2	4	RH J Box	
K1	7	Relay	
K2	6	Battery Relay	
K5	5	Start Relay	
K6	5	Start Relay	
K7	5	APU Relay	
K12	13	Relay	
L1	13	Valve	
L2	14	Valve	
L3	14	Valve	
L7	9	Relay	
L8	9	Relay	
LS2	15	Speaker	
LS3	16	Speaker	
LS4	16	Speaker	
LS5	16	Trans Assy	
LS6	16	Trans Assy	
LS7	16	Trans Assy	
LS8	16	Trans Assy	
LS9	16	Speaker	
LS10	16	Speaker	
LS13	7	Gear Horn	
LS14	13	Stall Warn Horn	
M1	8	L Engine Gage	
M2	8	R Engine Gage	
M3	10	Fuel Gage	
M5	8	Tach Gen	
M7	8	Ind OAT	
M8	8	Indicator	
M9	8	Indicator	
M11	6	Volt Meter	
M14	14	Timer Assy	
M15	14	Ammeter - 3 Blade	
M16	8	Tach Gen	
M17	14	Recorder	
M19	14	EM211-2	
MT1	8	Tach Gen	
MT2	8	Tach Gen	
MT3	10	Fuel Probe	
MT4	10	Fuel Probe	
MT5	10	Fuel Probe	
MT6	10	Fuel Probe	
MT9	8	L Oil Temp	
MT10	8	R Oil Temp	
MT11	8	LH CYL Temp	
MT12	8	RH CYL Temp	
MT14	8	OAT Bulb	
MT17	13	Stall Act & Htr	
MT21	10	Fuel Probe	
MT22	10	Fuel Probe	

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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
MT23	10	Fuel Probe	
MT24	10	Fuel Probe	
MT30	6.02	Low Volt Probe	
P1	3	Plug	
P3	8	Plug	
P4	8	Plug	
P5	8	Plug	
P6	8	Plug	
P7	8	Plug	
P8	8	Plug	
P9	8	Plug	
P10	8	Plug	
P11	13	Plug	
P12	10	Plug	
P13	10	Plug	
P14	8	Plug	
P17	10	Plug	
P18	8	Plug	
P20	12	Plug	
P21	12	Plug	
P25	14	Plug	
P26	14	Plug	
P31	14	Plug	
P32	5	Plug	
P33	5	Plug	
P35	10	Plug	
P36	10	Plug	
P37	3	Plug	
P38	13	Plug	
P39	13	Plug	
P43	8	Plug	
P44	8	Plug	
P45	10	Plug	
P46	10	Plug	
P49	11	Plug	
P50	15	Conn A.O.A.	
P51	13	Plug	
P52	13	Plug	
P53	12	Plug	
P54	15	Conn A.O.A.	
P55	10	Plug	
P56	10	Plug	
P66	12	Plug Flasher	
P70	6.02	Plug Low Volt Monitor	
PH1	15	Boom Mic	
PS1	12	Power Supply	
Q3	11	Transistor	
Q4	11	Transistor	
Q5	11	Transistor	
Q6	11	Transistor	

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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
Q7	11	Transistor	
QD3	10	Disconnect	
R3	9	Resistor	
R4	9	Resistor	
R5	9	Resistor	
R6	9	Resistor	
R7	6.01	Batt Shunt	
R8	6	Resistor	
R11	6.01	LH Alt Shunt	
R12	6.01	RH Alt Shunt	
R15	11	Rheostat	
R17	11	Rheostat	
R18	11	Rheostat	
R19	13	Resistor	
R20	13	Resistor	
R26	7	Resistor	
R35	11.0	Resistor	
R50	7	Resistor	
RF1	15	Filter	
RF2	15	Filter	
S1	7	Switch	
S2	7	Switch	
S3	7	Switch	
S4	7	Switch	
S5	7	Switch	
S7	7	Switch	
S8	7	Switch	
S9	7	Switch	
S10	7	Switch	
S11	9	Switch	
S12	9	Switch	
S13	9	Switch	
S14	14	Switch	
S15	14	Switch	
S16	14	Switch	
S18	6.02	Switch	
S19	14	Switch	
S20	9	Switch	
S21	9	Switch	
S23	11	Switch	
S24	11	Switch	
S25	11	Switch	
S26	11	Switch	
S27	12	Switch	
S29	5	Switch	
S30	5	Switch	
S31	5	Switch	
S32	5	Switch	
S33	5	Switch	
S34	5	Switch	

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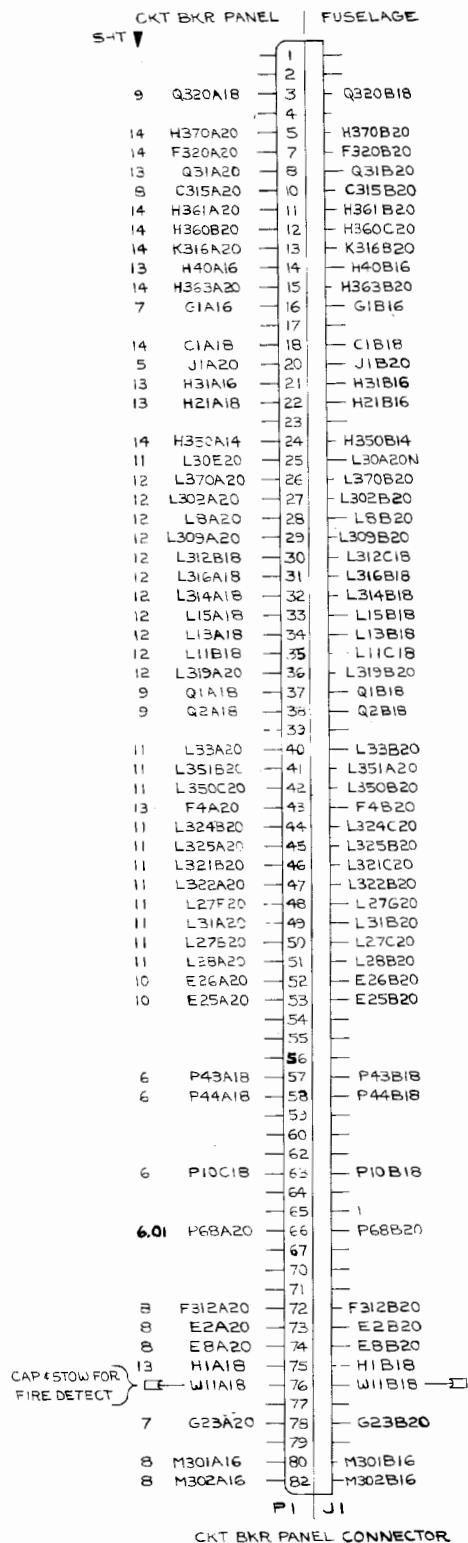
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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
S35	6	Switch	
S36	6	Switch	
S37	6	Switch	
S38	6	Switch	
S39	9	Switch	
S40	9	Switch	
S41	13	Thermostat	
S42	13	Switch	
S46	15	Switch Assy	
S49	14	Switch	
S50	15	Switch	
S51	9	Switch	
S52	9	Switch	
S53	12	Switch	
S54	12	Switch	
S55	13	Switch	
S58	12	Switch	
S59	12	Switch	
S61	8	Switch	
S62	8	Switch	
S63	8	Switch	
S64	8	Switch	
S65	9	Switch	
S66	9	Switch	
S67	14	Switch	
S68	8	Switch	
S69	8	Switch	
S71	10	Switch	
S72	14	Switch	
S75	10	Switch	
S76	10	Switch	
S77	13	Switch	
S87	12	Switch	
S88	16	Switch	
S89	16	Switch	
SCB2	12	SCB Taxi Light	
SCB4	14	SCB W/S Anti-Ice	
SCB5	14	SCB Prop De-Ice	
SCB7	12	SCB De-Ice Lt	
SCB8	12	SCB Strobe	
SCB9	12	SCB Nav Lts	
SCB10	12	SCB Anti-Collision Lts	
SR3	15	Diode	
SR6	15	Diode	
SR8	15	Diode	
SR13	5	Diode	
SR29	7	Diode	
ST3	6	Alt Fail Sensor	
ST4	6	Alt Fail Sensor	
TB14	11	Term Blk	

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<u>REFERENCE</u>	<u>SHEET</u>	<u>DESCRIPTION</u>	<u>EFFECTIVITY</u>
TB15	11	Term Blk	
TB16	11	Term Blk	
TR1	12	Transmitter	
VR1	6	Volt Reg	
VR2	6	Volt Reg	
VR3	16	Reg Assy	
WC6	9	Noise Filter	
WC7	9	Noise Filter	



▼ SYSTEM ▼

GLIDESLOPE 1
GLIDESLOPE 2

GYRO PWR 2

AUTO PILOT

NAV 2

NAV 1

COMM 2

COMM 1

ADF 2

ADF 1

XPDR 1

MKR BCN

RADAR

AUDIO AMP

COMM 3

GYRO PWR 1

DME

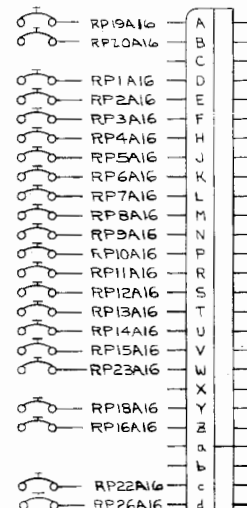
AC INV

RM1

RADAR ALT

XPDR 2

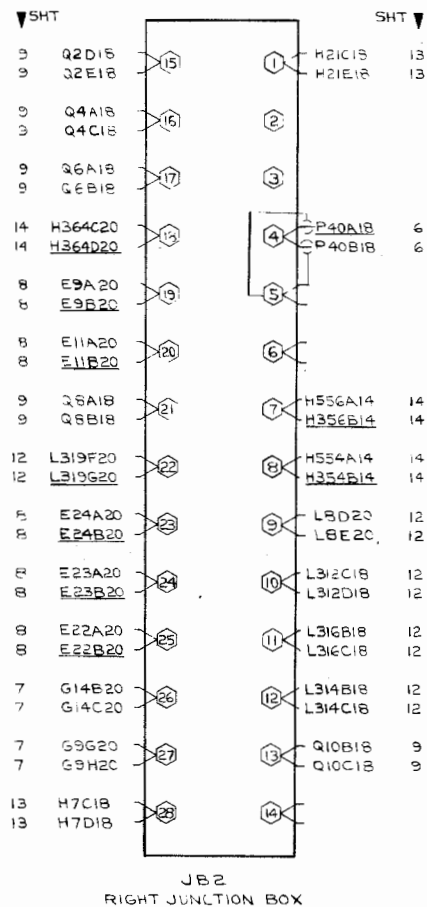
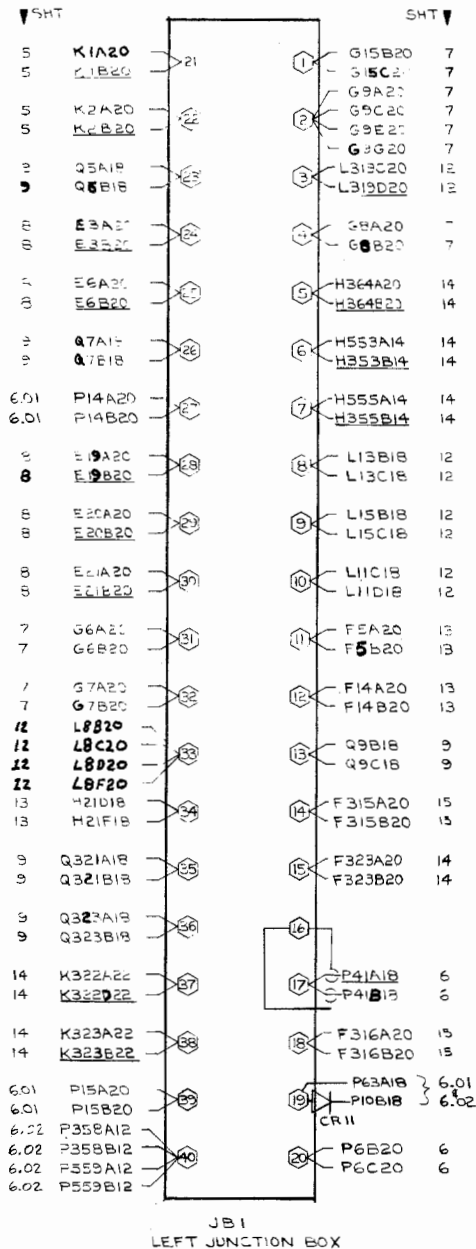
ALT



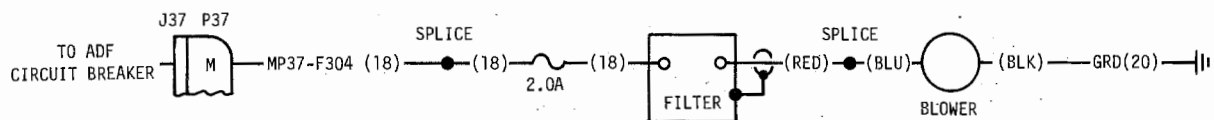
P37 J37

AVIONICS CKT BKR PANEL CONNECTOR

Cessna		AIRCRAFT CO.		P. O. BOX 1877 MILITARY & TWIN DIVISION WICHITA, KANSAS 67201	
TITLE: CONNECTORS					
SIZE: D	CODE IDENT. NO. 71379	DRAWING NO. 0808080			
SCALE: NONE	REF: G	SHEET 3 OF 16			



Cessna [®]		AIRCRAFT CO.		P. O. BOX 1977 MILITARY & TWIN DIVISION WICHITA, KANSAS 67201	
TITLE TERMINAL BOARDS (JUNCTION BOX CONNECTIONS)					
SIZE	CODE IDENT. NO.	DRAWING NO.			
D	71379	0808080			
SCALE: NONE	REF	G	SHEET 4 OF 16		



10986005

Avionics Cooling Blower

CESSNA AIRCRAFT COMPANY

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SERVICE MANUAL

CHAPTER

14

AVIONICS

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AVIONICSDescription

1. Avionics systems in this chapter pertain to the autopilot system, integrated flight control system, audio control panel and emergency locator transmitter. Refer to the applicable avionics system wiring diagram furnished with the aircraft for the various (optional) factory-installed avionics. Optional avionics shelves are located in the nose section of the aircraft, refer to Chapter 3. Access to the avionics shelves are gained by removing the nose cap. The avionic junction blocks are located below the left-hand nose baggage shelf.
2. Electrical power to the (factory-installed) avionics bus is supplied by the avionics circuit breaker, located in the left wing outboard of the engine nacelle. Electrical power is routed from the wing circuit breaker to the AVIONICS Master switch/breaker, which controls the ON and OFF electrical power at the avionics bus. An ALTERNATE AVIONICS POWER switch/breaker is provided on the circuit breaker panel for backup, electrical power in the event the wing circuit breaker, master switch or their associated circuits become inoperative.
3. Radio Noise.
 - A. Radio noise is a problem of great importance to the aircraft industry. A noisy radio system may actually imperil the safety of the aircraft occupants. The performance of radio navigation equipment can be completely erroneous if radio noise is excessive. For this reason, radio installations should be made only by persons who are qualified. Radio noise is not generated in a properly operating radio set, but is merely presented to the listener in an audible form exactly the same way that a radio station is received. Many forms of noise can exist in any particular aircraft and, ironically, sometimes certain aircraft can be amazingly quiet. This condition is unusual and even though the aircraft is quiet without noise suppression, it cannot be released without proper suppression. A quiet aircraft without suppression may degenerate into a noisy aircraft with changes in age, temperature, and humidity. Common radio noise is generated by ordinary electrical devices in the aircraft such as flap or gear motors, navigation light flashers and ignition or alternator systems. By properly installing capacitive and inductive devices in these circuits, the noise can usually be reduced to a tolerable level. A more difficult type of noise to suppress, is that generated by friction between two components or by rectification. Another difficult problem is noise that is

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carried to sensitive areas by grounding loops. The following paragraphs contain solutions that have been effective for the factory. It is important to remember that each aircraft may present a lightly different problem and, therefore, a "fix" on one aircraft will not necessarily be effective in all cases.

4. Alternator Noise.

- A. While the alternators are relatively free from radio noise, there is the possibility the alternators will produce an audible noise in the radio and electronic systems. Inside the alternator a three phase AC voltage is applied to a full wave rectifier assembly, thus converting the AC voltage to DC. During the rectification, an AC ripple appears on top of the DC voltage, thus the bus voltage is actually fluctuating. While the battery acts as a capacitance, it is also necessary to have additional filtering. This is accomplished by the use of a capacitor from the output terminal to ground at the alternator. The use of solid state regulators reduces the possibility of regulator noise to a minimum and will not require filtering.

5. Ignition Noise.

- A. The sound of ignition noise is easily identified because of its timing. The 310 aircraft has a shielded magneto ignition system. Each secondary lead from the magneto to the plug is a shielded wire. Double shielded wiring is used in the primary circuit with a special suppressor in series with the switch lead. The suppressor is constructed coaxially with a shielded lead coming out of the end which is connected to the magneto cigarette cartridge. The double shielded wire is connected to the terminal end of the filter (the shield is grounded). The double shielded wire enters the cabin area through connectors in the wing root rib to prevent noise transfer to the junction box wiring. The double shielding is continued to the inside of the cabin to the magneto switch. The magneto switches are enclosed in a shielded case to which the double shield of the wire is grounded. If ignition noise is prevalent in the radio system, the entire magneto system should be checked for tight connections, especially in the root rib connectors and at the switch and suppressor. All ground connections in the circuit are critical and any oil or dirt accumulation should be cleaned from the connection and the metal should be brightened to provide the best possible ground. Ignition harness should be replaced if the shielding becomes questionable.

6. Flap and Landing Gear Motor Noise.

- A. During a landing approach, an unfiltered motor in the flap or gear circuits can produce a startling volume of noise which is very distracting. There is also the possibility of the noise blanketing a message from the tower during the approach. It is possible that sufficient noise could be created through these circuits to blanket an ILS signal, creating a hazardous situation. For these reasons, the circuits have a filter section built into the motor. The filter should be very effective if the unit is properly grounded. If noise becomes excessive with good grounding, a motor overhaul or replacement may be necessary.

7. Auxiliary Fuel Pump Noise.

- A. Coaxial type capacitors produce effective results when installed on the base of the fuel boost pumps. Because of the location of the fuel pump and capacitors, the connections must be kept tight to avoid any possible arcing. When proper filtering and grounding do not produce the desired filtering results, a new pump should be tried.

8. Lighting Circuit Noise.

- A. All lighting components on the 310 aircraft have internal filters and usually do not require external capacity. The light wiring, however, because of its route to the extremities of the aircraft can, in unusual cases, conduct noise to vital areas. The light wires and electrical wiring bundles should be routed away from the antenna and loop antenna cables to prevent picking up noise in the radio systems. Shielding should be properly grounded.

Troubleshooting

1. Troubleshooting Electronic Interference Guide.

NOTE: The following general troubleshooting information is presented as a guide to determine the system or systems producing the interference.

2. Troubleshooting General.

- A. Pinpoint the particular system causing the noise by the process of elimination.

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- B. Once the system causing a particular noise is isolated, investigate the particular system or systems to determine which component or components are causing the noise, by observing which components are actually operating when the noise occurs.
- C. Check the component for proper operation or damage.
- D. Check wiring connections and wiring coming in contact with moving parts.
- E. Check wire routing for proper separation.
- F. Check wire shielding where applicable.
- G. Check all system grounds.

3. Troubleshooting Alternator Noise.

NOTE: If alternator noise is experienced and it is determined it is coming from the output of the alternator, the following troubleshooting should be accomplished before attempting additional filtering.

- A. Check attenuator output bypass filter for broken leads or inadequate ground.
- B. Check the lead attaching to alternator power (+) terminal is as short as possible or approximately 1 to 2 inches long.
- C. Check alternator ground wire for any damage or improper contact or corrosion between terminal and grounding point.
- D. Check alternator brushes for damage that could be arcing.
- E. Check alternator brush tension for proper seating.

4. Troubleshooting Voltage Regulator Noise.

NOTE: If regulator noise is present and traced to the regulator and its associated control leads the following checks should be made before attempting to add additional filtering.

- A. Check regulator adjustment for proper setting (27.25 to 27.75 volts).
- B. Check regulator noise filter for damage, loose wires, broken leads, or improper connections.
- C. Check shield wire on regulator to alternator field wires for proper termination (single point ground), shield damage, check for adequate coverage at termination ends.
- D. Check alternator for brush arcing.

5. Troubleshooting Electroluminescent Panels Inverter Noise.

- A. In most cases noise produced by the E.L. inverter could be due to the light capacitive load on inverter. When this problem occurs, it can be eliminated by the addition

of .01 to .05 ufd 200 WV capacitor to the output terminals of the inverter. If the noise cannot be eliminated it should be determined whether the noise is due to one of the following:

- (1) Radiation from AC wiring, requiring shielding.
- (2) Noise conducted to the power bus by the DC input, requiring filtering.
- (3) Radiation from DC power leads requiring shielding.
- (4) Radiation from inverter, necessitating replacement of inverter.
- (5) If the aircraft has an ADF installed, the following guidelines may be used to locate electroluminescent inverter noise:
 - (a) Tune ADF to a low frequency band.
 - (b) Place all panel light controls in the lowest position.
 - (c) Turn each panel control fully on one at a time and listen for a high pitched buzzing sound similar to an electric drill motor.
 - (d) After isolation of the noise control, check panels on that control for operation.
 - (e) If the inverter has a capacitor across its output terminals, check the capacitor for damage or substitute a capacitor known to be good.

6. Troubleshooting Electric Trim Motor Noise.

- A. In the event of noise difficulties caused by the trim system motors, the following should be checked to insure standard noise suppression equipment is properly installed.
- B. Check that motor frame and actuator assembly are properly grounded.
- C. Check capacitors inside of motor for broken leads or damage.
- D. Check to make sure shielded wires are properly grounded at the actuator assembly and that the shields are not shorted in other areas to structure which could create noise loops.
- E. If the filters are good and noise is not totally eliminated the following procedures should be attempted to eliminate the noise.
 - (1) Change C_1 to .05 microfarad.
 - (2) Add a 1.0 microfarad feed-thru capacitor with shielded lead to (+) lead of the side producing the noise. Attach the housing or capacitance ground to the actuator housing assembly.
 - (3) Make sure shielding wire and motor frame are making good ground.

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- (4) If the motor is noisy in both directions of rotation add a 1.0 microfarad feed-thru capacitor to both leads and insure that shield and housing or capacitor ground are attached to the actuator housing assembly.
- (5) The addition of larger capacitors, inductors or RF chokes is not recommended; experience has proven no significant change in additional filtering.

7. Troubleshooting Fuel Boost and Auxiliary Transfer Pump Noise.

- A. If boost pump noise is experienced in the audio system, check for following:
 - (1) Insure that wiring is properly shielded.
 - (2) Insure shields are properly grounded.
 - (3) Check loose wiring connections for looseness and breaks.

NOTE: If the cause of the noise cannot be eliminated, a .47 microfarad 50 WVDC feed-thru capacitor should be installed in the power (AX) lead as close to the pump as possible and insure the case of the capacitor is properly grounded to the airframe.

8. Troubleshooting Tip Tank Transfer Pump Noise.

- A. If the tip tank transfer pump is causing noise in the audio system, check the following:
 - (1) Check capacitor case ground.
 - (2) Check capacitor for damage, open circuit, short circuit, loose wiring and damaged shielding.
 - (3) Substitute a capacitor of the same value known to be good in place of the original capacitor.

9. Troubleshooting Anti-Collision Lights.

- A. If the anti-collision lights are causing noise in the audio system, the following should be checked:
 - (1) Filter for proper ground.
 - (2) Lamp circuit for loose connections and wiring.
 - (3) Bulb for loose socket.
 - (4) Internal filter for damage.
 - (5) External light for proper ground to frame or structure of aircraft.

10. Troubleshooting Strobe Light Noise.

- A. If the strobe lights are causing noise in the audio system from radiation or in-line interference, the following should be checked:

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- (1) Make sure all power supply units are grounded properly to the airframe.
- (2) Insure the shielded wires and twisted pairs from the tail light are grounded.

NOTE: Grounds must be terminated at the power supply.

- (3) Insure tail Nav light is adequately grounded.

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AUTOPILOTDescription

1. The Cessna 400A Nav-O-Matic Autopilot (optional) is a two-axis automatic flight control system that governs the positions of the ailerons and elevators. About the roll axis, it provides lateral stability, heading hold, command turn and automatic intercept and tracking of any VOR radial. In addition to holding the wings level and compensating for rotation about the pitch axis, the system provides an automatic intercept and track of any magnetic heading or VOR radial. About the pitch axis, it provides command pitch attitude hold, aircraft altitude hold, automatic pitch trim, and an optional ILS coupler.
2. The system consists of: one each vacuum directional gyro and attitude gyro, controller, roll actuator, computer amplifier, pitch actuator, trim follow-up actuator, trim sensor, cable assemblies, autopilot disengage switch and associated electrical wiring.
3. The following offerings are options to the basic autopilot: ILS approach coupler and slaved directional gyro. The ILS approach coupler enables the pilot to fly inbound on ILS front course or back course, this option is installed in the computer and connects to the indicator at the nose junction and connects to the indicator at the nose junction box. The slaved directional gyro replaces the standard directional gyro and provides heading information for the 400A Nav-O-Matic.
4. Refer to Cessna 400A Nav-O-Matic Autopilot Service/Parts manual, for additional information of components, troubleshooting and wiring diagrams.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS ON LATE MODEL AIRCRAFT USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Adjustment/Test

1. Tools and Equipment

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NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Tensiometer	T5-2002-101	Pacific Scientific Co. Los Angeles, Calif.	To measure cable tension.

2. Rigging 400A Nav-O-Matic Autopilot Control Cables (See Figure 1).

NOTE: Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of four hours.

A. Rigging Autopilot Aileron Control Cables.

- (1) Verify that aileron control system is properly rigged. Refer to Chapter 5.
- (2) Using a clamp or other locking device, lock ailerons in the neutral position.
- (3) Ensure chain is evenly distributed over aileron roll actuator sprocket.
- (4) Slide cable clamp of aileron roll actuator cables outboard from pulley bracket until slack is removed from cables. Tighten cable clamps in place on RH and LH aileron cables.

NOTE: Cable clamps must be equal distance from pulley bracket to properly rig aileron cables.

- (5) Place the tensiometer on cables to aileron roll actuator and rig cables to 12 ± 3 pounds tension by tightening turnbuckles.
- (6) Remove locking device from aileron control surfaces and move aileron through entire travel. Observe chain over sprocket of aileron roll actuator for sufficient remaining links at the extreme travel limits.
- (7) Safety turnbuckles.

B. Rigging Autopilot Elevator Control Cables.

- (1) Verify that elevator control system is properly rigged. Refer to Chapter 5.
- (2) Using a clamp or other locking device, lock elevator in the neutral position.

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- (3) With elevator control surface in the neutral position, ensure chain is distributed evenly over sprocket on elevator pitch actuator.
- (4) Place tensiometer on cables to elevator pitch actuator and tighten cable turnbuckle to obtain 12 ± 3 pounds cable tension.
- (5) Remove locking device from elevator control surfaces and move elevator through entire travel. Observe chain on sprocket of pitch actuator for sufficient remaining links at the extreme travel limits.
- (6) Safety turnbuckle.

C. Rigging Autopilot Elevator Trim Control Cables.

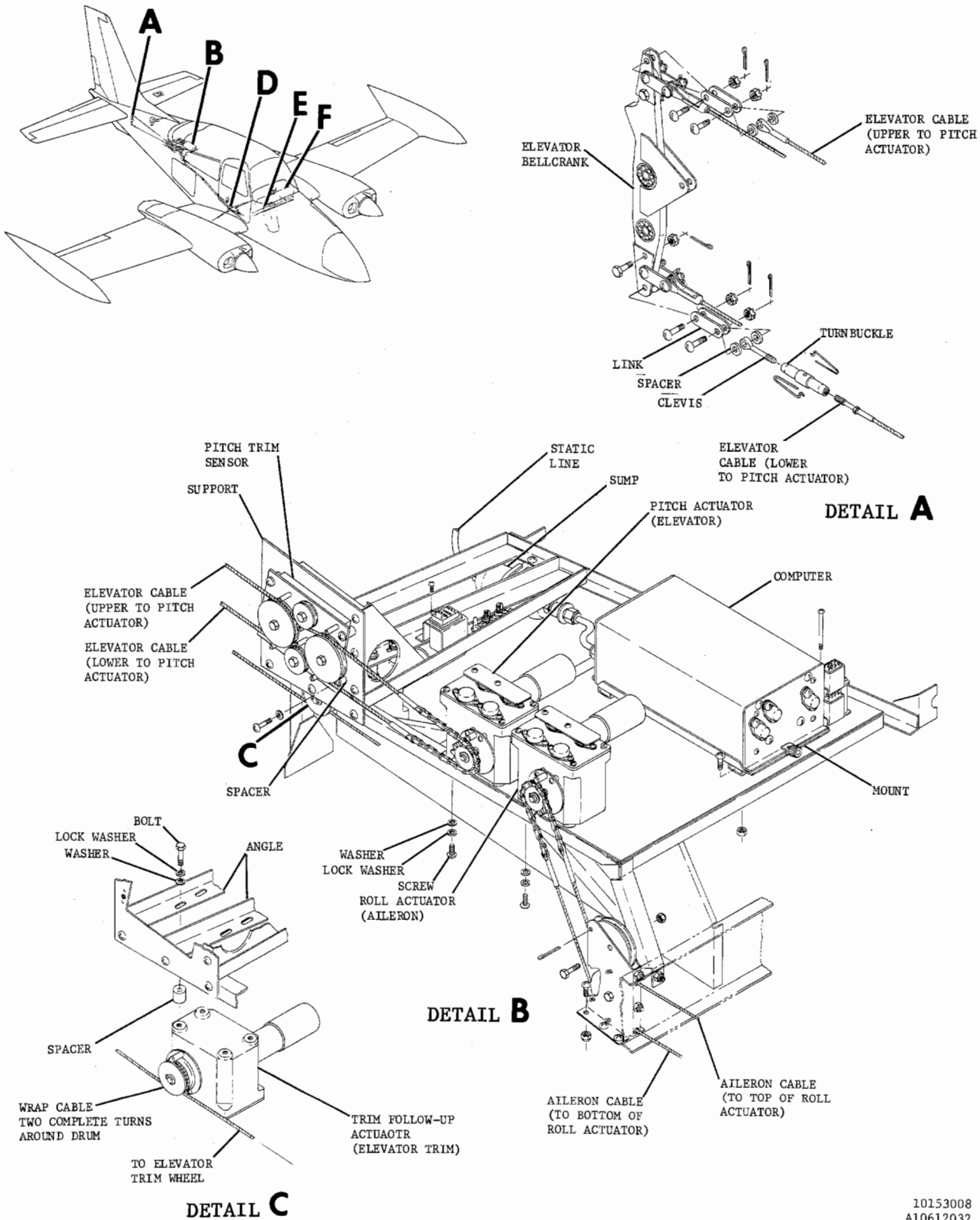
NOTE: Before rigging the trim follow-up cables, ensure cable makes two complete turns on the trim follow-up actuator drum.

- (1) Rig elevator trim follow-up cables (without electric trim) as follows:
 - (a) Verify trim tab system is properly rigged, refer to Chapter 5. Cable tension shall be 19 ± 3 pounds.
 - (b) Adjust the trim tab stop blocks as follows:
 - 1) Rotate elevator trim control wheel so that trim tab is $10^\circ + 1^\circ$; -0° up, locate aft stop block adjacent to cable terminal, and tighten. Slide the center stop block against aft stop block, and tighten.
 - 2) Rotate elevator trim control wheel so that the elevator trim tab is $26^\circ + 1^\circ$, -0° down. Slide forward stop block against the center stop block and tighten.
- (2) Rig elevator trim follow-up cables (with electric trim) as follows:
 - (a) Verify electric trim tab system is properly rigged. Refer to Chapter 5. Cable tension shall be 19 ± 3 pounds.
 - (b) Refer to Chapter 5. Rig electric trim stop blocks.

NOTE: After rigging of autopilot system is complete, turn on autopilot and verify that the control surfaces respond in the correct direction. Assist the movement of the elevator by pulling back on control wheel, this will aid in overcoming the counterbalance of the elevator bob-weight.

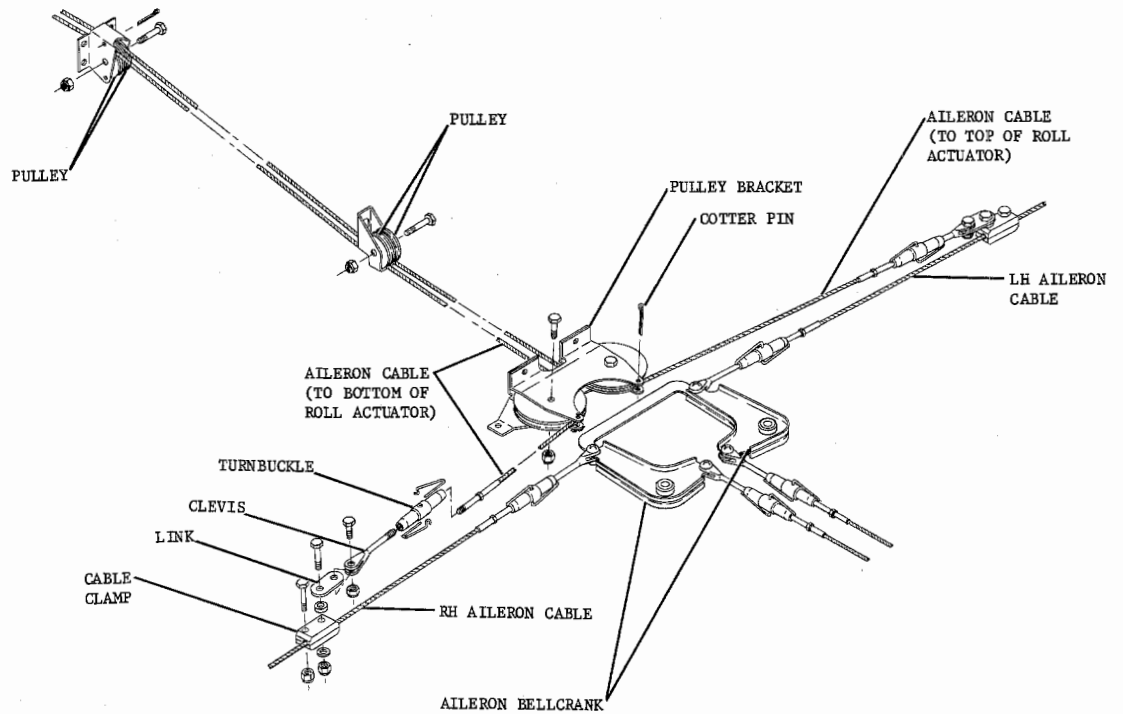
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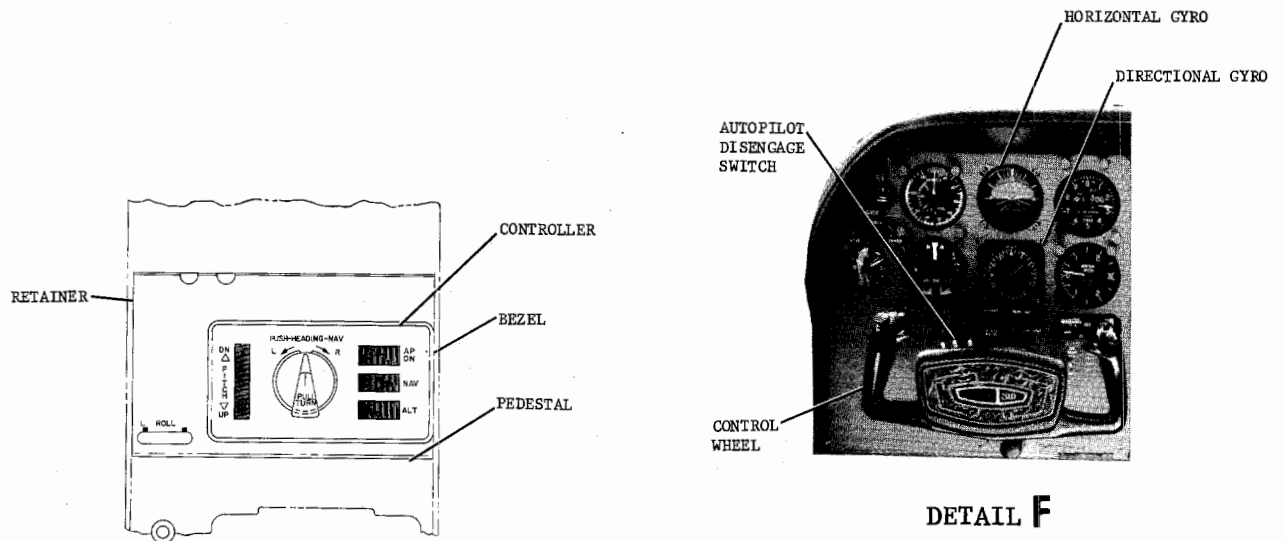


400A Nav-O-Matic Installation
Figure 1 (Sheet 1 of 2)

10153008
A10612032
B10153007
C10152007



DETAIL D



DETAIL E

DETAIL F

400A Nav-O-Matic Installation
Figure 1 (Sheet 2)

D10613018
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E51141092R

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Maintenance Practices

1. Removal/Installation Roll Actuator (See Figure 1).

A. Remove Roll Actuator.

- (1) Refer to Chapter 12. Remove rear upholstery panel, rear seats and rear carpet.
- (2) Refer to Chapter 3. Remove floorboard above aileron bellcrank.
- (3) Relieve tension on cables to roll actuator by loosening turnbuckles near cable clamps.
- (4) Disengage chain from sprocket on roll actuator.
- (5) Disconnect electrical connector from roll actuator.
- (6) Remove roll actuator from shelf by removing screws, lockwashers and washers.

B. Install Roll Actuator.

- (1) Secure roll actuator to shelf, using screws, lockwashers and washers.
- (2) Connect electrical connector to roll actuator.
- (3) Position chain on sprocket of roll actuator. Chain must be distributed evenly around the sprocket.
- (4) Rig autopilot aileron cables, refer to Adjustment/Test.
- (5) Install floorboards, rear carpet, rear upholstery panel and seats.

2. Removal/Installation Roll Actuator Cables (See Figure 1).

A. Remove Roll Actuator Cables.

- (1) Refer to Chapter 12. Remove rear upholstery panel, rear seats and rear carpet.
- (2) Refer to Chapter 3. Remove floorboard above aileron bellcrank and autopilot pulley.
- (3) At the aileron bellcrank, loosen turnbuckles to roll actuator cables.
- (4) Disconnect clevis from link at each end of roll actuator cables by removing bolts and nuts. Unscrew turnbuckle from cable terminals and connect guide wires to terminals.
- (5) Remove cotter pins from pulley bracket aft of aileron bellcrank.
- (6) Remove three sets of pulley aft of pulley bracket by removing nuts, bolt and cotter pins.
- (7) With guide wires attached; remove chain and cables at roll actuator. Leave guide wires in aircraft.

B. Install Roll Actuator Cables.

- (1) Attach guide wires to cable terminals and pull cables forward into position at aileron bellcrank area. Remove guide wires.
- (2) Install chain on sprocket of roll actuator. Chain must be distributed evenly on sprocket.
- (3) Install three sets of pulleys, using bolts, nuts and cotter pins.

NOTE: Install pulleys at Fuselage Station 132.00 so upper cable is routed beneath the upper pulley and beneath left-hand pulley at Fuselage Stations 109.37 and 89.25. Likewise, bottom cable is routed beneath lower and right-hand pulleys.

- (4) Install cotter pins at pulley bracket.
- (5) Connect clevis and turnbuckle to each end of cable terminals.
- (6) Connect cable clevises to links at cable clamps, using bolts and nuts.
- (7) Rig roll actuator cables. Refer to Adjustment/Test.
- (8) Install floorboards, carpet, seats and rear upholstery panel.

3. Removal/Installation Computer (See Figure 1).

A. Remove Computer.

- (1) Refer to Chapter 12. Remove rear upholstery panel.
- (2) Disconnect static line and electrical connectors from computer.
- (3) Remove computer from shelf by removing attaching screws, lockwashers and washers.

B. Install Computer.

- (1) Secure computer to shelf, using screws, lockwashers and washers.
- (2) Connect electrical connectors and static line to computer.
- (3) Install rear upholstery panel.

4. Removal/Installation Pitch Actuator (See Figure 1).

A. Remove Pitch Actuator.

- (1) Refer to Chapter 12. Remove rear upholstery panel.
- (2) Refer to Chapter 1. Remove stabilizer fairings.
- (3) Relieve tension on pitch actuator cables by loosening turnbuckle.

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- (4) Disengage chain from sprocket on pitch actuator.
- (5) Disconnect electrical connector from pitch actuator.
- (6) Remove pitch actuator from shelf by removing screws, lockwashers and washers.

B. Install Pitch Actuator.

- (1) Secure pitch actuator to shelf, using screws, lockwashers and washers.
- (2) Connect electrical connector to pitch actuator.
- (3) Install chain on sprocket of pitch actuator. Chain must be distributed evenly on sprocket.
- (4) Rig pitch actuator cables. Refer to Adjustment/Test.
- (5) Install stabilizer fairings and rear upholstery panel.

5. Removal/Installation Pitch Actuator Cables (See Figure 1).

A. Remove Pitch Actuator Cables.

- (1) Refer to Chapter 12. Remove rear upholstery panel.
- (2) Refer to Chapter 1. Remove stabilizer fairings.
- (3) Relieve pitch actuator cable tension by loosening turnbuckle at elevator bellcrank.
- (4) Disconnect pitch actuator cables from elevator bellcrank links by removing bolts, spacers, nuts and cotter pins.
- (5) Remove turnbuckle with clevis attached from cable terminal.
- (6) Remove pulleys at pitch trim sensor to allow cables to pass through.
- (7) Attach guide wires to cable terminals and pull cables from aircraft at pitch actuator.

B. Install Pitch Actuator Cables.

- (1) Connect guide wires to cables and pull cables into position at elevator bellcrank. Disconnect guide wires.
- (2) Install chain on sprocket of pitch actuator. Chain must be distributed evenly on sprocket.
- (3) Install pulley at pitch trim actuator.
- (4) Connect clevis and turnbuckle to cable terminal. Attach cables to links, using bolts, spacers, nuts and cotter pins.
- (5) Rig pitch actuator cables. Refer to Adjustment/Test.
- (6) Install stabilizer fairings and rear upholstery panel.

6. Removal/Installation Elevator Trim Follow-Up Actuator (See Figure 1).

A. Remove Elevator Trim Follow-Up Actuator.

- (1) Refer to Chapter 12. Remove rear upholstery panel.
- (2) Disconnect electrical connector from follow-up actuator.
- (3) Remove follow-up actuator from angles by cutting safety wire and removing bolts, washers, spacers and lockwashers.
- (4) Slide follow-up actuator aft far enough to unwind cable from drum and remove follow-up actuator.

B. Install Elevator Trim Follow-Up Actuator.

- (1) Wrap cable two complete turns around the drum of the follow-up actuator.
- (2) Secure follow-up actuator to angles, using bolts, washers, spacers and lockwashers. Safety wire bolts.
- (3) Rig elevator trim follow-up cables. Refer to Adjustment/Test.
- (4) Install rear upholstery panel.

7. Removal/Installation Elevator Trim Follow-Up Cables.

NOTE: If elevator trim follow-up cables are to be removed, refer to Chapter 5, Elevator Trim Tab. Rig cables in accordance with Adjustment/Test of this Chapter.

8. Removal/Installation Elevator Pitch Trim Sensor (See Figure 1).

A. Remove Pitch Trim Sensor.

- (1) Refer to Chapter 12. Remove rear upholstery panel.
- (2) Refer to Chapter 1. Remove stabilizer fairings.
- (3) Remove pulleys from pitch trim sensor as required to free cables.
- (4) Disconnect electrical connector from pitch trim sensor.
- (5) Remove pitch trim sensor from support by removing screws, washers and spacers.

B. Install Pitch Trim Sensor.

- (1) Secure pitch trim sensor to support, using screws, washers and spacers.

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NOTE: Ensure pitch trim sensor is installed with overhanging pulley on sensor positioned forward.

- (2) Position cables on pulleys and install removed pulleys.
- (3) Connect electrical connector to pitch trim sensor.
- (4) Check autopilot elevator, cables for proper rigging. Refer to Adjustment/Test.
- (5) Install stabilizer fairings and rear upholstery panel.

9. Removal/Installation Gyros.

NOTE: Refer to Chapter 10 for typical instrument removal/installation.

10. Removal/Installation Switches.

NOTE: Refer to Chapter 13 for typical removal/installation of electrical switches.

11. Removal/Installation Controller (See Figure 1).

A. Remove Controller.

- (1) Remove controller from retainer by loosening screw in face of controller.

B. Install Controller.

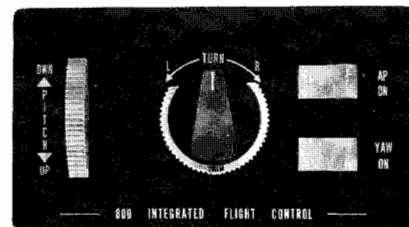
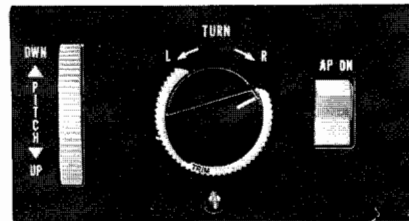
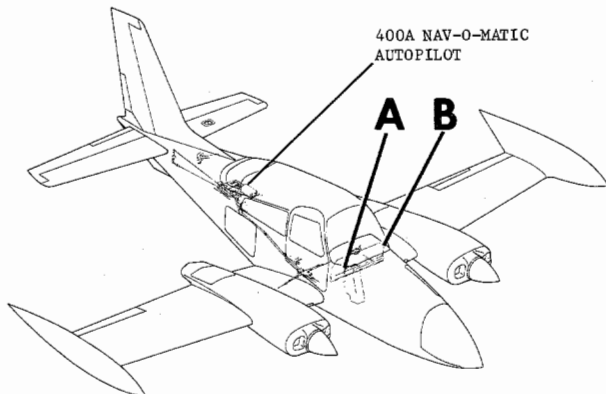
- (1) Install controller in retainer and tighten screw.

INTEGRATED FLIGHT CONTROL SYSTEMDescription

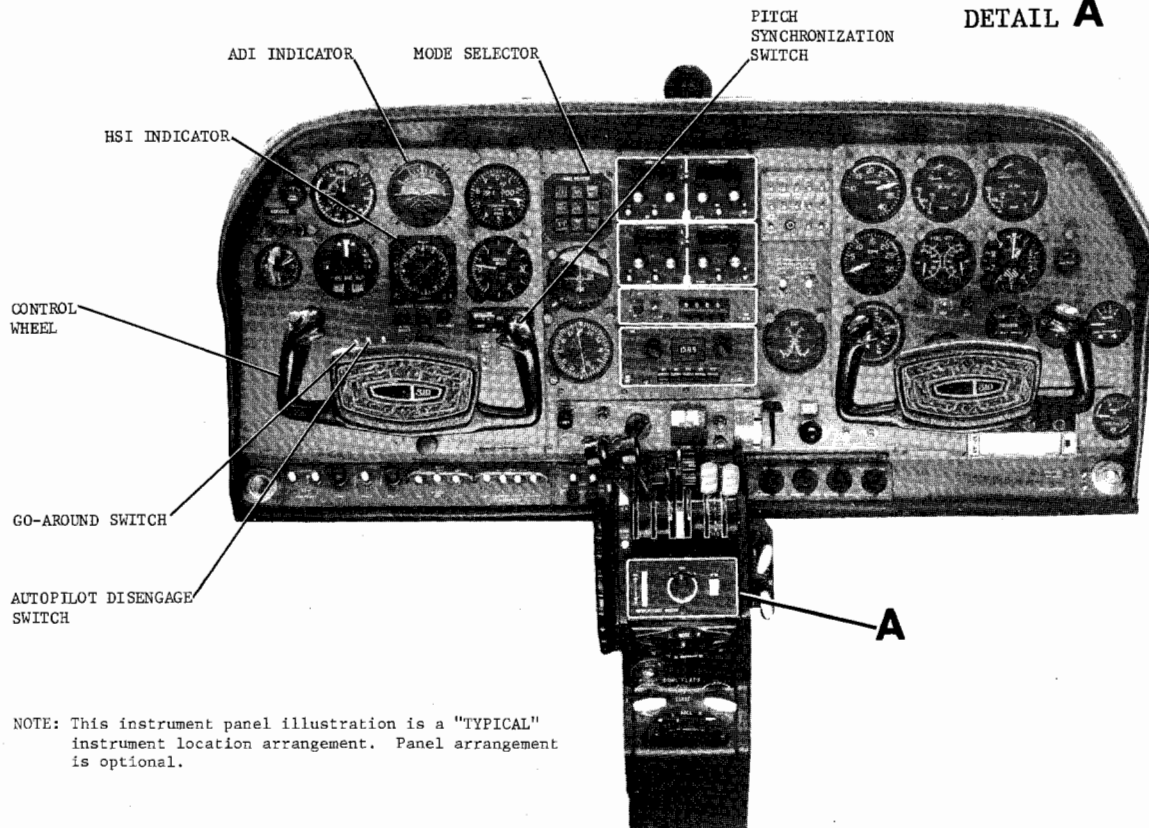
1. The Integrated Flight Control System (optional) is a two-axis (aileron and elevator automatic flight control system consisting of the autopilot and flight director). Either the flight director or the autopilot may be used separately or as a combination. As an autopilot, in addition to holding the wings level and compensating for rotation about the pitch axis, the autopilot provides an automatic intercept and track of any magnetic heading or VOR radial. Also included is an automatic pitch trim, turn command, pitch command, altitude hold and an ILS approach feature. As a flight director, the integrated flight control system provides steering information, visually presented on the attitude director indicator (ADI), for climb, cruise, descent and altitude hold. Heading, VOR navigation, glide slope and ILS approaches are visually presented on the horizontal situation indicator (HSI).
2. Three different series of the integrated flight control system are offered as options, these are: 300, 400 and 800 series integrated flight control systems.
3. 300 and 400 Series Integrated Flight Control Systems.
 - A. The 300 and 400 Integrated Flight Control Systems consists of the 400A Nav-O-Matic autopilot and flight director, ILS coupler, slaved directional gyro, pitch synchronization and associated avionics. Simultaneous or independent operation of the autopilot and flight director is provided and in addition to the autopilot features, the flight director includes pitch synchronization and go-around commands as selected by the pilot. The 300 and 400 Integrated Flight Control System includes a vacuum, slaved directional gyro with ADF presentation and the 400 IFCS includes a horizontal situation indicator (HSI). Nav 1 is connected to the HSI (400 IFCS), and Nav 2 is connected to an individual course indicator.
4. 800 Series Integrated Flight Control System.
 - A. The 800 Integrated Flight Control System consists of 400A Nav-O-Matic autopilot and flight director, with yaw damper, altitude hold, automatic pitch trim, pitch synchronization, heading preselect, omni/ILS couplers and turn and pitch command. Simultaneous or independent operation of the autopilot and flight director is provided and in addition to the autopilot features, the flight director includes pitch synchronization and go-around commands as selected by the pilot. The 800 Integrated Flight Control

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DETAIL A



DETAIL B

NOTE: This instrument panel illustration is a "TYPICAL" instrument location arrangement. Panel arrangement is optional.

Integrated Flight Control System
Figure 1

10153008
A1014P6005
A1014P6004
B1014P6001

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System includes a vacuum, slaved directional gyro with ADF presentation and an horizontal situation indicator (HSI). Nav 1 is connected to the HSI and Nav 2 is connected to an individual course indicator. 400 or 800 avionics system may be used with the 800 Integrated Flight Control System.

5. For additional description, installation adjustments, troubleshooting, schematic and parts listing, refer to Cessna Integrated Flight Control System Service/Parts Manual.

CAUTION: PRIMARY AND SECONDARY FLIGHT CONTROL CABLES, PUSH-PULL TUBES, BELLCRANKS AND MOUNTINGS ON LATE MODEL AIRCRAFT USE DUAL LOCKING FASTENERS. THE LOCK NUTS FOR THESE FASTENERS INCORPORATE A FIBER LOCK, AND ARE CASTELLATED FOR SAFETYING WITH A COTTER PIN. WHEN ANY OF THESE AREAS ARE DISCONNECTED ON ANY AIRCRAFT, NEW DUAL LOCKING FASTENERS SHOULD BE INSTALLED. SEE THE AIRCRAFT PARTS CATALOG FOR PART NUMBERS AND LOCATION OF THESE FASTENERS.

Maintenance Practices

1. Refer to Autopilot Maintenance Practices for removal/installation of 400A Nav-O-Matic Autopilot.
2. Refer to Autopilot Adjustment/Test for rigging the 400A Nav-O-Matic component cables.
3. Refer to Chapter 10, for typical instrument removal/installation.
4. Refer to Chapter 13, for typical electrical switch removal/installation.
5. Refer to Chapter 5, for Yaw Damper System Maintenance Practices.

AUDIO CONTROL PANELDescription

1. The audio control panel installed on the instrument panel, provides audio control; both transmission and reception for the communications and navigation equipment installed in the aircraft.
 - A. The microphone selector switch, selects transmitter 1, 2 or 3 for audio communications. The speaker/phone toggle switches permit the operator to monitor various received signals. The received signal (by the selection on speaker/ phone switches) may be audible on the headphone or the speaker. To receive a signal the toggle shall be positioned to either the speaker or phone.
 - B. The audio control panel, incorporates an automatic speaker and phone toggle switch. This switch is used with the microphone select switch, to provide automatic audio through the speaker or headphone. When the Com 1, 2, or 3 toggle switches are OFF and transmit selections for Com 1, 2 or 3 is made at the microphone select switch.
2. To operate the audio system, apply power to the system.
 - A. Transmit --- The speaker/headphone toggle switches have three positions, SPEAKER - OFF - HEADPHONES. Position a switch to SPEAKER, the received audio in that system will be audible in the speaker. Position a switch to HEADPHONE, the received audio in that system will be audible in the headphone. The OFF position prevents received audio from entering the speaker or headphones. Also, audio may be received at the speaker or headphone automatically when the AUTO SPEAKER/PHONE switch is in the desired position (toggle switches OFF) and selection is made at the MIC SEL switch. Audio volume is controlled at the respective transmitter for both speaker and headphone.

Troubleshooting

1. Troubleshooting of the audio control panel includes checking of communications and navigation radios for a complete operational system.
2. Tools and Equipment.

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NOTE: Equivalent substitutes may be used for the following listed item.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	General

3. Troubleshooting Audio Control Panel.

- A. For troubleshooting, see Figure 2.
- B. For wiring diagram, see Figure 1.

NOTE: Audio control panel wiring diagram should be used with optional communication and navigation wiring diagrams furnished with the aircraft to aid in troubleshooting.

Adjustment/Test

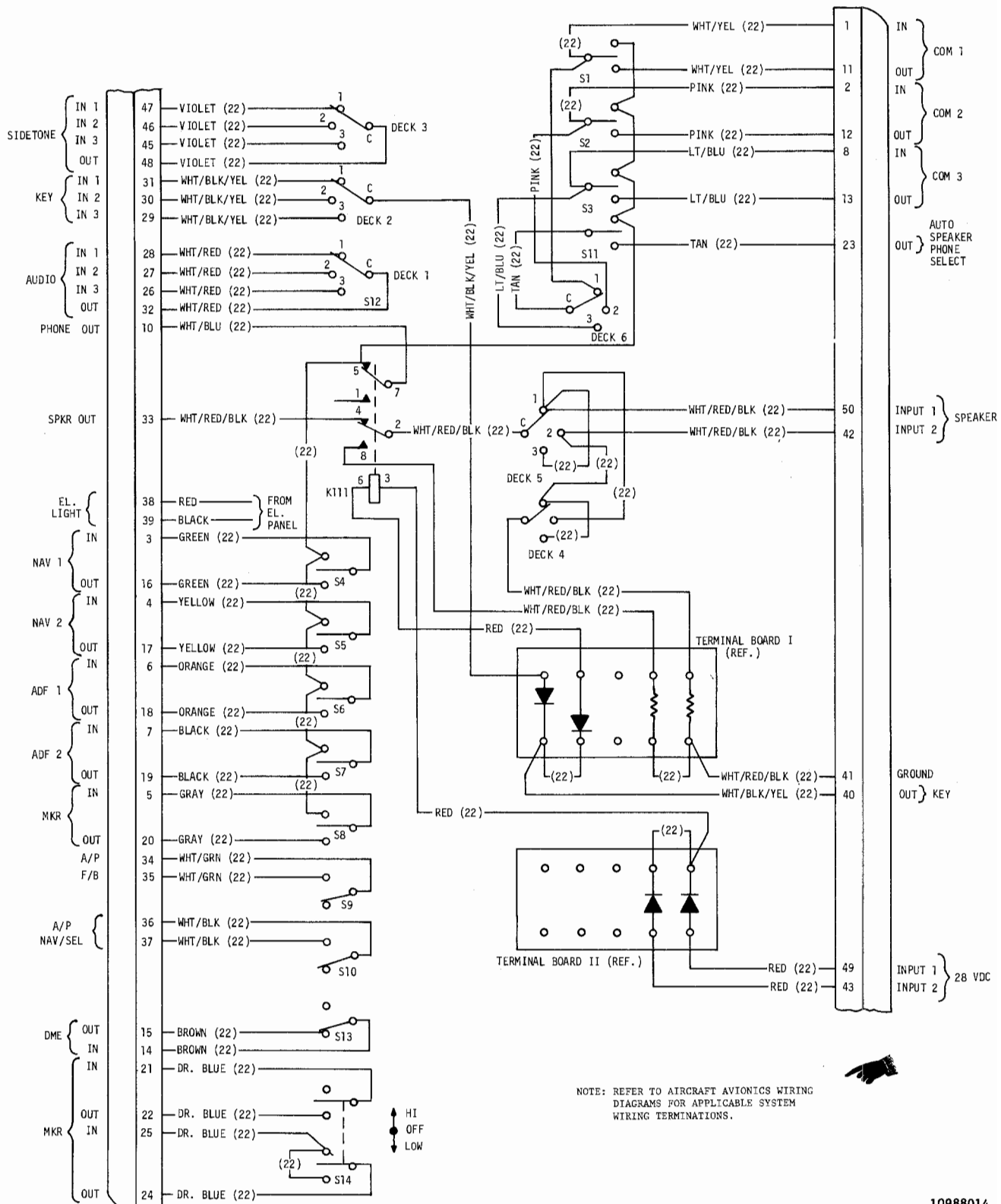
1. Audio Control Panel Operational Check.

- A. Turn on battery switch or connect external power unit. Turn all radios on and tune to a transmitting frequency.
- B. Turn microphone select switch to Com 1 and then to Com 2 positions, communicate with another station on both radios.
- C. Move each receiver switch to speaker and headphone positions. Each radio should be heard in the speaker and headphone as switches are moved.
- D. Turn off each receiver switch to radios.
 - (1) Turn microphone selector switch to Com 1, Com 2 or Com 3 (if installed) communicate with another station or radios.
 - (2) Move automatic receiver switch to speaker and headphone positions. Each radio should be heard in the speaker and headphone as switch is moved.

NOTE: If radio receiver switch was left in speaker position and automatic receiver switch is in headphone position, audio will be heard at speaker and headphone or vice versa.

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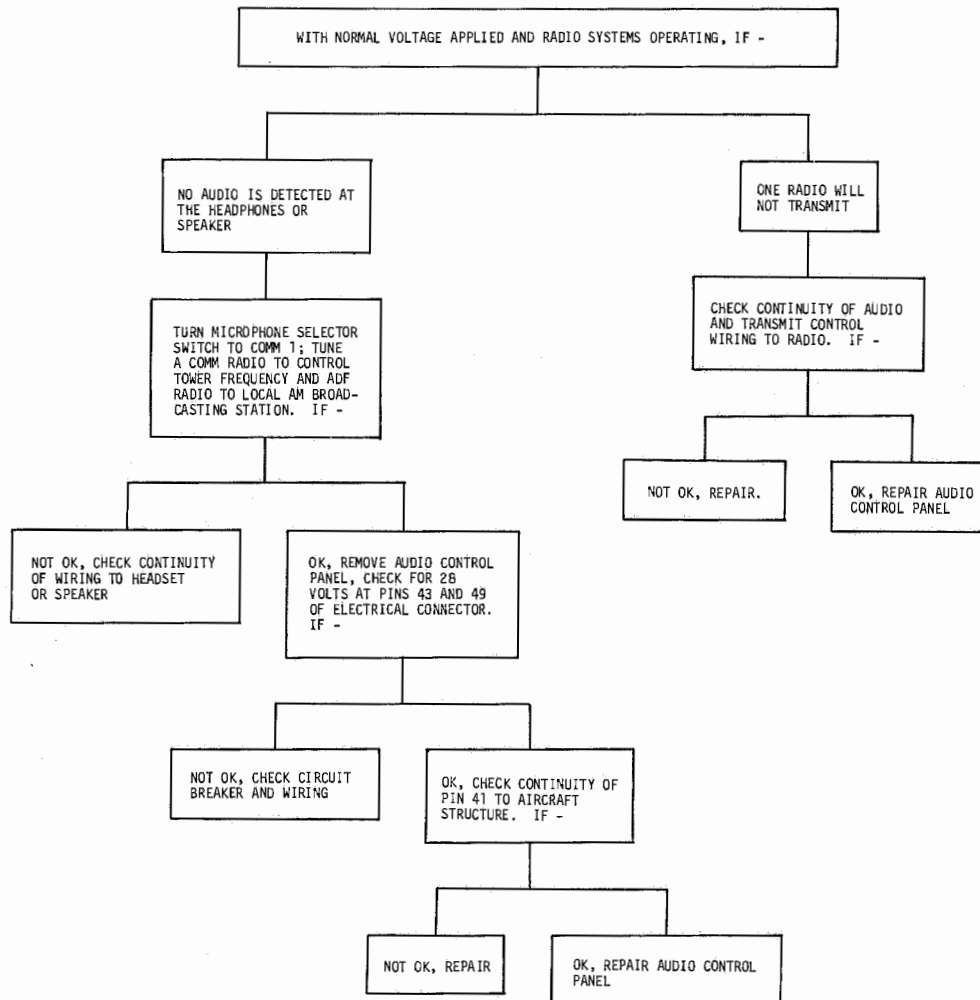


Audio Control Panel Wiring Diagram
Figure 1

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Troubleshooting Chart - Audio Control Panel
Figure 2

Maintenance Practices

1. Removal/Installation Audio Control Panel.

A. Remove Audio Control Panel.

- (1) Turn electrical power off.
- (2) Remove screws, securing audio control panel to instrument panel.
- (3) Pull audio control panel aft and disconnect electrical plug.

B. Install Audio Control Panel.

- (1) Connect electrical plug to audio control panel.
- (2) Position audio control panel in instrument panel and secure with screws.
- (3) Perform operational check, refer to Adjustment/Test.

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EMERGENCY LOCATOR TRANSMITTERDescription

1. The emergency locator transmitter (ELT) is a self-contained, solid-state unit, having its own power supply with an external mounted antenna. The transmitter is designed to transmit on dual emergency frequencies of 121.5 and 243.0 megahertz simultaneously. The emergency locator transmitter is mounted in the tailcone on the side of the fuselage.
2. The transmitter is entirely portable operating on the power supplied by a battery pack containing dry cell batteries wired in series. The battery pack service life is placarded on the batteries and also on the outside of the cover on the end of the transmitter.
3. The transmitter broadcast tone is audio modulated in a swept manner over the range of 1600 to 300 Hz and is a distinct, easily recognizable distress signal for reception by search and rescue personnel, and others monitoring the emergency frequencies. The transmitter meets or exceeds the requirements of the following specifications.
 - (1) R.S.S. 147 Issue 2, D.O.C.
 - (2) TSO C612, F.A.A.
 - (3) F.C.C. Part 87, F.C.C.
 - (4) TSO C91, F.A.A.
4. Under favorable conditions, a distress signal from the ELT can be intercepted at a distance of 100 miles. It exhibits line of sight transmission characteristics which correspond approximately to 100 miles at a search altitude of 10,000 feet.
5. When battery inspection and replacement schedules are adhered to, the transmitter will broadcast an emergency signal at rated power, for a continuous period of at least 48 hours at temperatures from +55°C to -20°C after an emergency landing.
6. The military monitors 243.0 MHz. The 121.5 MHz frequency is monitored by the general aviation aircraft as well as C.A.P., D.O.T., F.A.A. and some commercial aircraft.
7. A three-position switch on the forward end of the unit controls operation. Placing the switch in the ON position will energize the unit to start transmitting emergency signals. In the OFF position, the unit is inoperative. Placing the switch in the ARM position will set the unit to start transmitting emergency signals only after the unit has received a 5G (tolerances are +2G and -0G) impact force.

Troubleshooting

1. Should the ELT fail the Periodic or 100 Hours performance checks, refer to Chapter 2, it is possible to a limited degree, to isolate the fault to a particular area of the equipment.

CAUTION: IN ORDER TO PROTECT YOUR WARRANTY, TROUBLESHOOTING SHOULD BE CONDUCTED WITHOUT REMOVING THE UNIT COVER.

2. In performing the troubleshooting to test, peak effective radiated power, you will be able to determine if battery replacement is necessary or if the unit should be returned to your dealer for repair.

CAUTION: DO NOT LEAVE THE ELT IN THE ON POSITION LONGER THAN 10 SECONDS. THIS COULD INITIATE DOWNED AIRCRAFT SEARCH PROCEDURES BY C.A.P., D.O.T., OR F.A.A. PERSONNEL.

3. Tools and Equipment.

NOTE: Equivalent substitutes may be used instead of the following listed items.

Name	Number	Manufacturer	Use
Multimeter	Model 260	Simpson Electric Co.	To measure voltage.
Ammeter	Model 1223	Simpson Electric Co.	To measure battery current.
Jackplug	P/N 750	Switchcraft Inc.	Connect to remote jack of ELT.

4. Troubleshooting Emergency Locator Transmitter (See Figure 2).

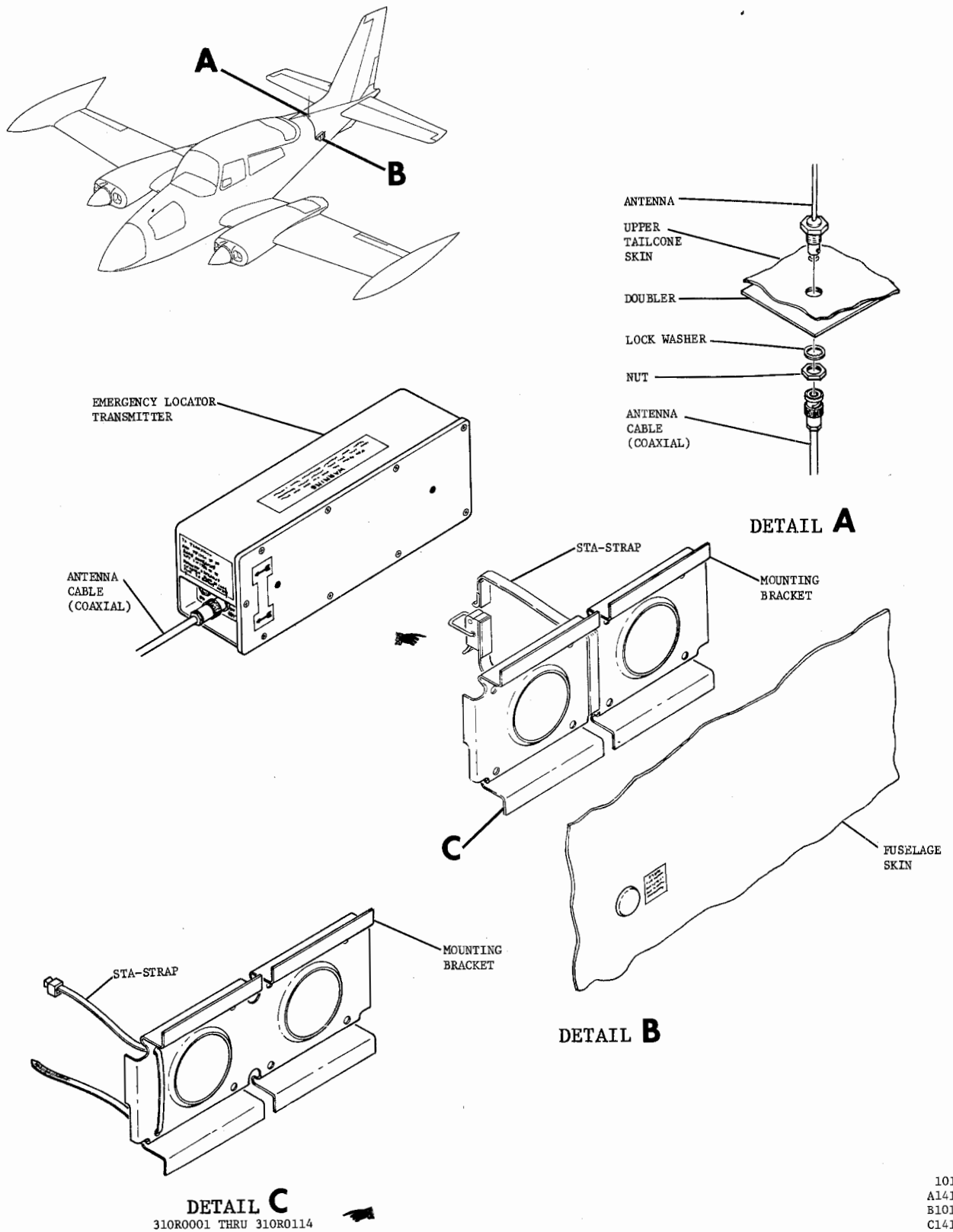
A. For troubleshooting the emergency locator beacon, see Figure 2.

Maintenance Practices

1. Removal/Installation Emergency Locator Transmitter (See Figure 1).

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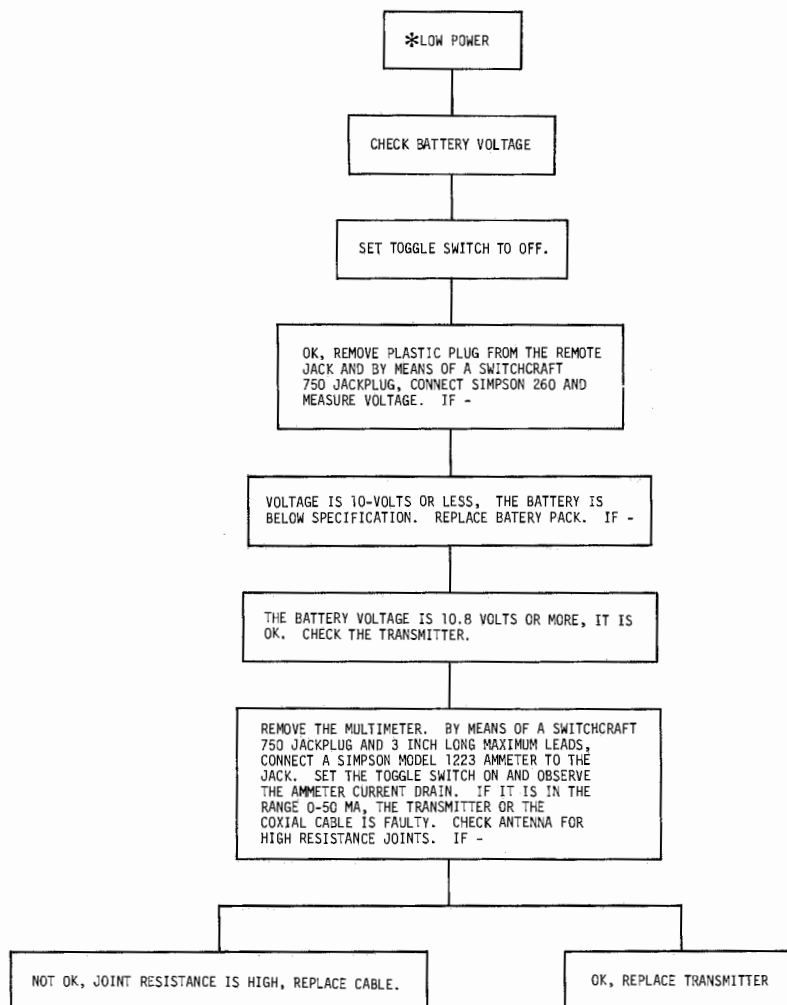


Emergency Locator Transmitter
Figure 1

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A14142021
B10142041
C14142021

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*USE ANTENNA COAXIAL CABLE, PROVIDED WITH TRANSMITTER

10988011

Troubleshooting Chart - Emergency Locator Beacon
Figure 2

A. Remove Emergency Locator Transmitter

- (1) Refer to Chapter 12. Remove upholstery panel.
- (2) Disconnect antenna cable from end of transmitter.
- (3) Cut sta-straps or unfasten strap securing transmitter and remove transmitter from mounting bracket.

B. Install Emergency Locator Transmitter.

- (1) Assure that the direction of flight arrows (placarded on the transmitter) are pointing towards the nose of the aircraft.
- (2) Secure transmitter to mounting bracket with new sta-straps or strap.

NOTE: Aircraft 310R0115 and On, install strap with latch on side of transmitter case, not across cover plate, on center of transmitter.

- (3) Connect antenna cable to transmitter.
- (4) Check operation of emergency locator transmitter, refer to Chapter 2.
- (5) Position on-off switch to ARM.
- (6) Install rear upholstery panel.

2. Removal/Installation Emergency Locator Transmitter Antenna
(See Figure 1).

A. Remove Emergency Locator Transmitter Antenna.

- (1) Refer to Chapter 12. Remove rear upholstery panel.
- (2) Disconnect antenna cable from base of antenna.
- (3) Remove antenna by removing nut and lockwasher.

B. Install Emergency Locator Transmitter Antenna.

- (1) Secure antenna to tailcone skin, using lockwasher and nut.
- (2) Connect antenna cable to base of antenna.
- (3) Install rear upholstery panel.

3. Removal/Installation Emergency Locator Transmitter Battery Pack.

A. Remove Battery Pack.

- (1) Remove emergency locator transmitter, refer to removal/installation of transmitter.
- (2) Remove screws attaching the cover to the case and remove cover. Remove rubber gasket to gain access to battery pack.

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- (3) Disconnect battery pack and remove.

B. Install Battery Pack.

NOTE: Before installing the new battery pack, check to ensure that its voltage is 10.8 volts or greater.

- (1) Install the new battery in the transmitter.
- (2) Install the transmitter cover by positioning the rubber gasket on the cover and pressing the cover and case together and secure with screws. Care should be taken to avoid trapping the gasket and overtightening screws.
- (3) Remove the old battery placard from the end of transmitter and replace with new battery placard supplied with the new battery pack.

CAUTION: BE SURE TO ENTER THE NEW BATTERY PACK EXPIRATION DATE IN THE AIRCRAFT RECORDS.

- (4) Install transmitter, refer to removal/installation.
- (5) Check operation of the ELT, refer to Chapter 2.

CAUTION: DO NOT LEAVE THE ELT IN THE ON POSITION LONGER THAN 10 SECONDS. THIS COULD INITIATE DOWNED AIRCRAFT SEARCH PROCEDURES BY C.A.P., D.O.T., OR F.A.A. PERSONNEL.

Inspection/Check

1. Refer to Chapter 2, for inspection procedures of emergency locator transmitter.

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AVIONICS COOLING BLOWERDescription

1. The avionics cooling blower is located forward of the control pedestal at Fuselage Station 0.00. The blower system consists of: a filter, fuse holder, fuse and electrical wiring. The blower is utilized to cool the avionics equipment mounted on the radio panel of the instrument panel.

Maintenance Practices

1. Removal/Installation Avionics Cooling Blower (See Figure 1)

- A. Remove Avionics Cooling Blower

- (1) Ensure electrical power is OFF.
- (2) Remove LH and RH side panels from control pedestal as required to gain access to work area.
- (3) Identify and disconnect blower ground wire (black) from structure; disconnect blower wire (blue) at splice.
- (4) Remove blower from bracket by removing nut, washers and bolt.
- (5) Remove clamp from blower.

- B. Install Avionics Cooling Blower

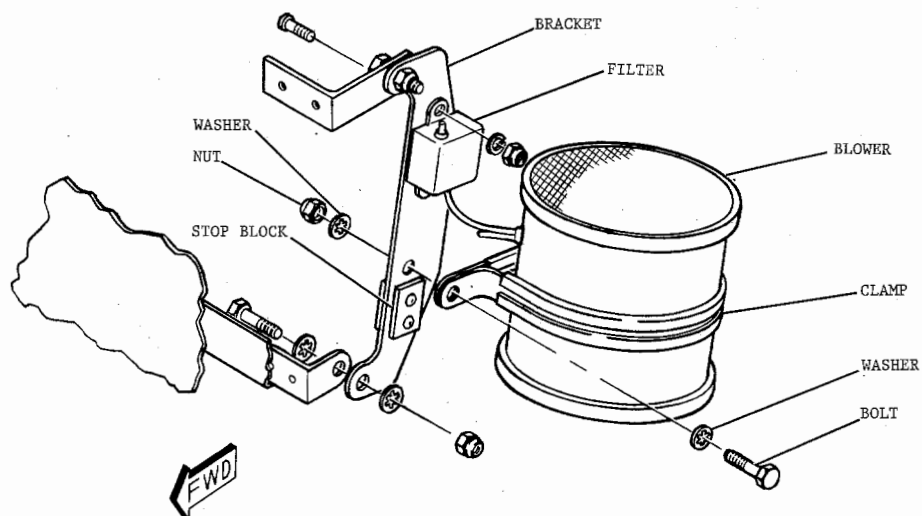
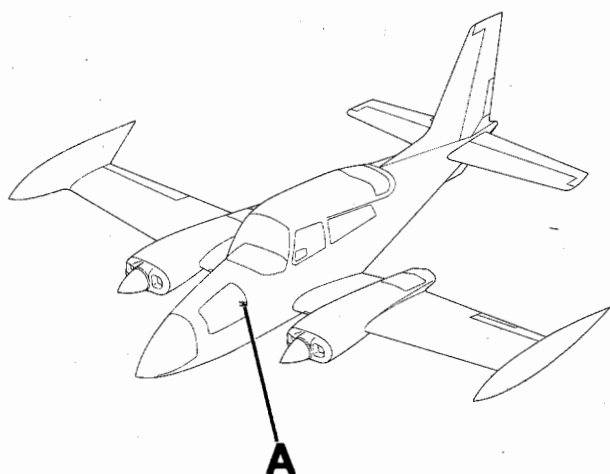
- (1) Position clamp on blower.
- (2) Secure clamp to bracket, using bolt, washers and nut.

NOTE: Clamp is to be positioned against stop block. Install blower with flow arrow pointing up.

- (3) Identify and connect electrical wires of the blower.

NOTE: Ensure ground wire is properly grounded.

- (4) Install LH and RH side panels on control pedestal.



DETAIL A

Avionics Cooling Blower Installation
Figure 1

10142031
A10141049

SLAVED DIRECTIONAL GYRO AND FLUX DETECTORDescription

1. The slaved directional gyro, includes a single, synchro-driven pointer and in some gyros, a dual pointer for use with ADF/VOR inputs to provide continuous indication of the bearing to specific ground stations. The slaved directional gyro operates with a slaving meter and a flux detector to produce input to the electronic compass circuit in the gyro.
2. The slaving meter is a zero-center-scale meter mounted on the instrument panel, used to monitor heading displacement between a slaved directional gyro and a flux detector. When an error exists between the two heading signals, the slaving meter deflects in either direction depending on the polarity of the error. As the gyro slaving circuit acts to correct the error, the needle slowly returns to the center position of the meter. A null position of the meter needle indicates that the gyro heading indication is correct.
3. The flux detector is a remotely mounted device mounted in the horizontal or vertical stabilizer, depending on the avionics package. The flux detector furnishes long-term information to maintain the slaved directional gyro position properly with the earth's magnetic field. The flux detector is a sealed unit. When the unit is installed in the aircraft and aligned with the line of flight, it usually requires no further servicing. Electrical interface with the unit is provided by an attached cable and connector plug. Slotted cutouts in the mounting flange are used for mounting.
4. For location of slaved directional gyro and slaving meter, refer to Chapter 10, Instrument Panel.

Adjustment/Test

1. Adjustment Slaved Direction Gyro.

- A. Compass Alignment

NOTE: The compass alignment shall be performed on a calibrated compass rose.

- (1) Ensure compensator adjustments are set to neutral position. The compensators are located on the flux detector.
- (2) Using a hand-held magnetic compass, check all ferrous materials parts for magnetism near the flux detector.

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- (3) Degauss any parts within two feet which cause greater than 10° deflection of the magnetic compass, and any part within four feet which cause greater than 90° deflection of the magnetic compass.
- (4) Ensure that each of the applicable systems are controlled from the proper circuit breakers, and the corresponding "HDG" flag appears when the circuit breaker is disengaged.
- (5) Ensure slave meter is operative.
- (6) Ensure the systems fast slave circuitry is operational.
- (7) Ensure all electrical instruments for the aircraft are installed and operative.
- (8) Ensure other aircraft and vehicles are a safe out of the way distance.
- (9) Position aircraft on the 270° heading of the compass rose.
- (10) With both engines running 1000 RPM, turn on the following:
 - (a) All circuit breakers.
 - (b) Inverters.
 - (c) All lights except landing lights and reading lights.
 - (d) All avionics systems.
 - (e) All electrical systems except pitot heat, stall and static heaters.
 - (f) Allow slaved gyro system to stabilize (stabilization speed may be increased by using fast slave).
 - (g) Record the slaved gyro system error in degrees and direction with the slave meter nulled.

NOTE: High readings are positive errors,
low readings are negative errors.

- (h) Position aircraft on the 360° heading of the compass rose and repeat Steps (a) thru (g).
- (i) Position aircraft on the 90° heading of the compass rose and repeat Steps (a) thru (g).
- (j) Position aircraft on the 180° heading of the compass rose and repeat Steps (a) thru (g).

B. Index Error Alignment

NOTE: This alignment should ensure that the compass system flux detector is positioned for minimum index error.

- (1) Algebraically sum the four cardinal heading errors obtained in paragraph A Steps (10), (a) thru (g).

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- (2) Divide the sum obtained by four. This result is the index error correction and direction of rotation of the flux detector.
- (3) Rotate flux detector the direction and amount as calculated in Steps (1) and (2). CCW rotation of the flux detector is required to correct a positive error.

NOTE: Approximately five degrees rotation equals approximately 1/8 inch distance measured on the outer circumference of the flux detector.

- (4) Repeat compass alignment procedure Step (10), (a) thru (g).
- (5) The remaining error at the cardinal headings as received in Step (4) should equal the difference between the initial cardinal heading errors obtained originally in Compass Alignment procedure Step (10), (a) thru (g).
- (6) Recalculate error and assure the remaining error is 0 ± 0.5 degrees.

C. Compensation Adjustment.

- (1) If the corrected error as calculated in Index Error Alignment paragraph Step (1) is greater than $+2^{\circ}$ the compensators must be adjusted. The errors obtained in the compass alignment procedure Step (10), (a) thru (g) will be used to determine the required amount and degree of compensation.

D. Compensation Calculations.

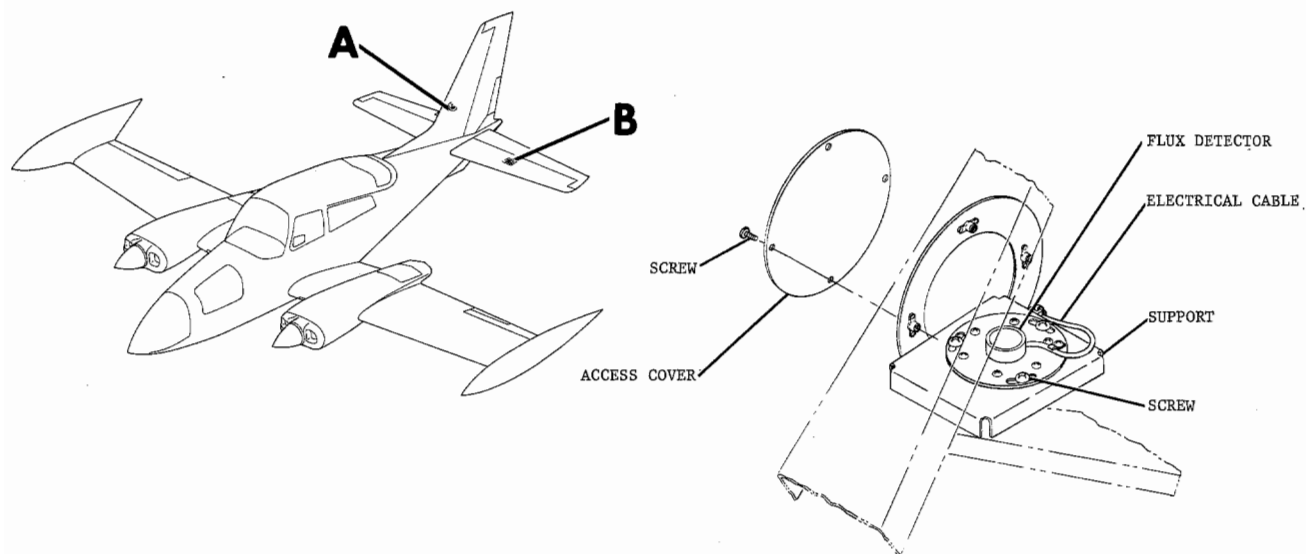
- (1) Using cardinal heading errors calculated in Index Error Alignment Step (5), algebraically sum the north and south errors, divide this sum by two and change the sign of the result. The resulting number is the amount and direction of north/south compensator adjustment.
- (2) Repeat Step (1) for east/west errors.

E. Compass Compensation.

- (1) At one cardinal heading, adjust the appropriate compensator the amount calculated in the Compensation Calculations paragraph Step (1).
- (2) Rotate the aircraft 90° and adjust the appropriate compensator the amount calculated.
- (3) Rotate the aircraft to the next two cardinal headings and ensure that no errors greater than two degrees are present.

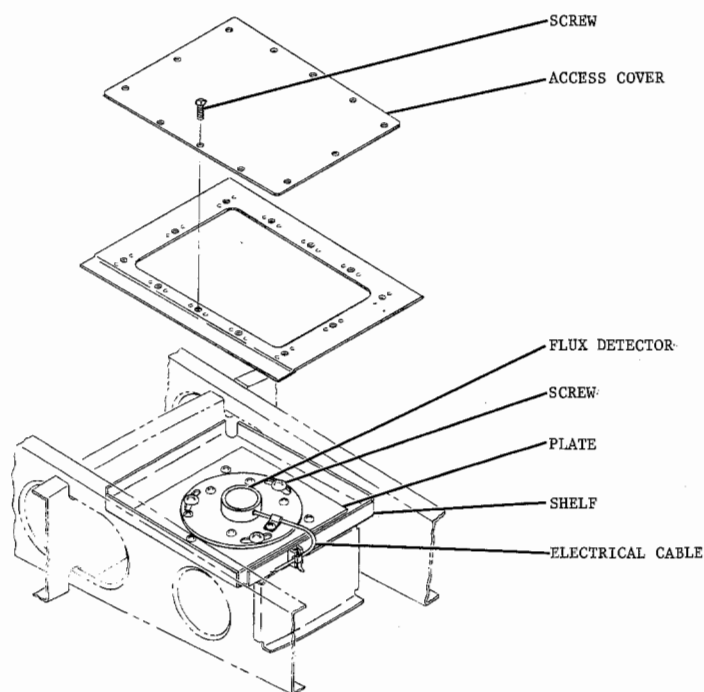
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VERTICAL STABILIZER INSTALLATION

DETAIL A



HORIZONTAL STABILIZER INSTALLATION

DETAIL B

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Flux Detector Installation
Figure 1

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- (4) With normal aircraft power, all electrical systems on, rotate the aircraft to 30° heading (including cardinals). Stop on each heading long enough to allow the gyro to stabilize and the slave meter to null.
- (5) Observe and record the headings indicated by the slaved gyro system.
- (6) There shall be no error greater than two degrees at any heading indicated by the slaved gyro.

Maintenance Practices

1. Removal/Installation Flux Detector (See Figure 1).

A. Remove Flux Detector.

- (1) Remove access cover from stabilizer.
- (2) Disconnect electrical cable from flux detector.
- (3) Remove screws securing flux detector.

NOTE: Mark position of flux detector for reinstallation.

- (4) Remove flux detector.

B. Install Flux Detector.

- (1) If new flux detector is not being installed, align flux detector to index mark and secure with screws.
- (2) Connect electrical cable to flux detector.
- (3) If new flux detector is being installed, refer to Adjustment/Test.
- (4) Install access cover.

CESSNA AIRCRAFT COMPANY

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CHAPTER

15

STRUCTURAL REPAIR

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GENERAL

1. Description

- A. The aircraft is all-metal of semimonocoque type construction with the skin carrying a portion of all structural loads. The fuselage is comprised of a forward cabin section and a tailcone. It is constructed of formed bulkhead stringers, and stiffeners all of which are riveted to the external skin. The wing, horizontal stabilizer and vertical fin are built up around two main spars, with ribs, formers and riveted skin forming the basic structure. Torsional stiffness of this structure is afforded by the skin closure of areas between the spars forming enclosed "boxes". Each movable surface consists of a hinge support spar with ribs, formers and riveted outer covering skin. Typical repair illustrations are shown in this Chapter.

2. Ground Handling

- A. Leveling, jacking and other ground handling details are covered in Chapter 1.

3. Investigation of Damage

- A. After a thorough cleaning of the damaged area, all structural parts should be carefully examined to determine the extent of damage. Frequently the force causing the initial damage is transmitted from one member to the next, causing strains and distortions. Abnormal stresses incurred by shock or impact forces on a rib, bulkhead or similar structure may be transmitted to the extremity of the structural member, resulting in secondary damage such as sheared or stretched rivets, elongated bolt holes, canned skin plate or bulkheads. Points of attachment should be examined particularly for distortion and security of fastenings in the primary and secondary damaged areas.

4. Definition of Damage

- A. Structural Damage to the aircraft is divided into the following classifications:
- (1) Negligible Damage shall be considered damage that will not affect the airworthiness of the aircraft and can be permitted to exist as is or can be corrected with a simple repair such as removing dents, burnishings scratches and stop drilling cracks in non-structural parts.

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- (2) Damage Repairable by Patching will be considered damage that may be repaired by covering or reinforcing a portion of the aircraft.
- (3) Damage Repairable by Insertion will be considered damage requiring replacement of a section with the correct repair material.
- (4) Damage Necessitating Replacement of Parts will be considered as damage not repairable by patching or insertion, but that may be repaired by installing a new or reconditioned part. If a part or area of an assembly is damaged to the extent that it requires replacement, and a replacement cannot be made because of tooling or jig requirements, the entire assembly must be replaced.

5. Preparing Damaged Area for Repairs

- A. To prepare an area for repair, examine and classify the damage. Make a thorough check before beginning repairs. In some cases a damaged part may be classified as needing replacement; however after removal, closer inspection indicates the part may be repaired. Take more time for the damage estimate and save man-hours on repairs. To prepare a damaged area for patch or inserting repairs:

- (1) Remove all ragged edges, dents, tears, cracks, punctures and similar damages.
- (2) Leave edges, after removal of damaged area, parallel to any square or rectangular edges of the unit.
- (3) Round all square corners.
- (4) Smooth out abrasions and dents.
- (5) Brush Iridite all rough edges and scratches with a solution of Iridite mixed in a ratio of 1 ounce of Iridite to 1 gallon of water and rinse thoroughly.
- (6) Apply two coats of zinc-chromate primer to all internal surfaces and edges lapping over another.

NOTE: Damage adjacent to a previous repair requires removal of the old repair and inclusion of the entire area in the new repair.

6. Rivets

- A. The following rivets are commonly used in aircraft structures: standard solid shank, hi-shear, and blind. Rivets used in aircraft construction are most generally fabricated from aluminum alloys. In special cases monel, corrosion - resistant steel, mild steel, copper and iron rivets are used.

B. Types.

- (1) Standard solid shank rivets are those generally used in aircraft construction. They are fabricated in the following head types: roundhead, flathead, countersunk-head, and brazier-head. Roundhead rivets are generally used in the interior of aircraft except where clearance is required for adjacent members. Flathead rivets are generally used in the interior of the aircraft where head clearance is required. Countersunk-head rivets are used on the exterior surfaces of the aircraft to minimize turbulent airflow. Brazier-head rivets are used on the exterior surfaces of the aircraft where strength requirements necessitate a stronger rivet head than that of the countersunk-head rivet. Both the brazier-head and the countersunk-head rivets are used on the exterior of the aircraft where head clearance is required.
- (2) Hi-shear rivets are special patented rivets having a high shear strength equivalent to that of the standard AN bolts. They are used in special cases in locations where high shear loads are present, such as spars, wings and heavy bulkhead ribs. The rivet consists of a cadmium plated pin of alloy steel and a collar of aluminum alloy. The installed rivet can be readily identified by the presence of the attached collar in place of the formed head on standard rivets.
- (3) Blind rivets are used (where strength requirements permit) when one side of the structure is inaccessible making it impossible or impractical to drive standard solid shank rivets.

C. Substitution of Rivets.

- (1) Standard solid shank rivets.
 - (a) In the replacement of rivets in installations which require the raised head rivets it is desirable to use whichever of the rivets that correspond to the type of rivet removed.
 - (b) Countersunk head rivets are to be replaced by rivets of the same type and degree of countersink.
 - (c) When rivet holes become enlarged, deformed, or otherwise damaged, use the next larger size as replacement.
 - (d) Replacements shall not be made with rivets of lower strength material unless they are larger than those removed.

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- (e) In the absence of aluminum rivets, stainless, monel, or iron rivets may be used with generous application of zinc chromate primer only to permit necessary flights of the aircraft. The proper replacement shall be made as soon as facilities are available.
- (2) Hi-shear rivets. When hi-shear rivets are not available, replacement of sizes 3/16 or greater shall be made with bolts of equal or greater strength than the rivet being replaced and with self-locking nuts of the same diameter. The flush-type hi-shear rivet may be temporarily replaced by like diameter flush-type steel screws of equal or greater strength and self-locking nuts provided the threaded part of the screw does not extend into the material being fastened together. This latter procedure is temporary only and replacement with the hi-shear flush-type rivet must be accomplished as soon as they become available.
- (3) Blind rivets. Blind rivets have higher deflection rates in shear than standard solid rivets. For this reason, it is not advisable to replace any considerable number of solid rivets in a given joint by blind rivets because this may result in over-stressing the remaining solid rivets. The following specific instructions apply.
 - (a) The hollow blind rivet shall not be used.
 - (b) The blind rivet used shall be of the same or greater strength and one size larger than the rivet it replaces, except that blind rivets may be replaced size for size.
 - (c) In cases of dimpled assembly, the rivet holes shall be drilled after the sheets are dimpled.
 - (d) When possible, the exposed end of each clipped plug shall be coated with a 10 per cent chromic acid solution or with zinc chromate primer.
 - (e) Blind rivets shall not be used in hulls, floats, or tanks except in cases of absolute necessity.
 - (f) If blind fasteners other than the blind rivets are encountered, it is recommended that replacements be made by either of these fasteners or by standard rivets.

D. Diameters.

- (1) Rivet diameters range from 3/32 inch to 3/8 inch. The 1/8, 5/32 and 3/16 inch sizes are the most frequently used.

- (2) Since smaller rivets lack the proper structural qualities and larger rivets may dangerously reduce the splice or patch area, care must be exercised before substituting other than the specified sizes of rivet diameter.

E. Lengths

- (1) The proper length of rivet is an important part of the repair. Should too long a rivet be used, the formed head will be too large, or the rivet may bend or be forced between the sheets being riveted. Should too short a rivet be used, the formed head will be too small or the riveted material will be damaged.
- (2) If proper length rivets are not available, longer rivets may be cut off to equal the proper length (not grip).
- (3) The rivet length is based on the grip.

F. Removal of Solid Rivets (See Figure 1).

- (1) When it becomes necessary to replace rivets, great care should be taken in their removal so that the rivet hole will retain its original size and not acquire replacement with a larger size rivet.
- (2) To remove a rivet, file a flat on the manufactured head. It is always preferable to work on the original head rather than on the one that is bucked over since the former will always be more symmetrical about the shank. Indent the flat surface with a counter-punch so the drill may be correctly centered. A drill slightly less in diameter than the rivet shank should be used to drill and weaken the head. Take care that the rivet shank does not turn with the drill and cause a tear. If the other end of the rivet is supported, the head may be sheared off with a sharp chisel. This cutting should always be done along the direction of the plate edge. If the shank is unduly tight after the removal of the head, the rivet should be drilled out completely. It may be forced out with a counterpunch of a smaller diameter than the rivet, provided the sheet is properly supported from the opposite side; however, there is greater danger of damaging the sheet and enlarging the hole when using this method. This procedure will also apply to flush rivets.

G. Riveting Installation (See Figure 1).

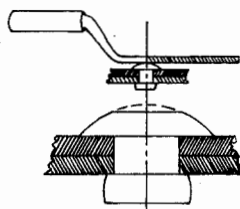
- (1) Riveting procedure. A large percentage of the riveting of aircraft structures is done on thin gage

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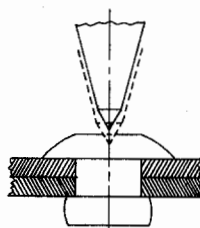
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aluminum alloy and the work must be so accomplished that the material is not distorted by hammer blows or injured with riveting tools. All aircraft power riveting is done by upsetting or heading the rivets against a bucking bar instead of striking the shank with a hammer.

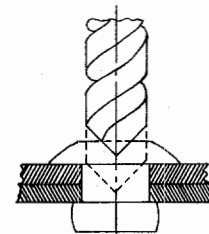
- (a) To prevent deforming of its head a rivet set must be selected to fit each type. The depth of this set must be such that it does not touch the material being riveted.
- (b) Parts which are to be heat-treated should be heat-treated before riveting since heat treating after this process causes warping. This is also necessary when assemblies are heated in a salt bath as the salt cannot be entirely washed out of the cracks.
- (c) Rivets of a diameter smaller than three thirty-seconds inch must not be used for any structural parts, control parts, wing covering, cowlings or similar sections of aircraft except where there are actual replacements.
- (d) Rivets through hollow tubes, which are loaded only in shear, should be hammered just enough to form a small head. No attempt should be made to form the standard round head as the amount of hammering required often causes the rivet to buckle inside the tube, with resultant injury to the member.
- (e) Aluminum alloy rivets must never be used in tension for structural, control, or other critical parts of aircraft. Whenever such an installation is required, bolts should be used.
- (f) The use of hollow rivets in joining highly stressed parts is not permitted. When rivets cannot be driven because of the inaccessibility of the end for bucking or driving, the next size self-plugging cherry rivet may be used.
- (g) The selection of the proper rivet and proper number of rivets is very important.
- (h) The rivets must be of the proper length for the total thickness of the pieces being riveted. Ordinarily, from 1-1/2 to 2 times the diameter of the rivet is about the right amount for the rivet shank to protrude through the material to form the head. For heavy material such as plates or fittings, from 2 to 2-1/2 diameters may be used.
- (i) The rivet should not be too loose in the hole as this condition will cause it to bend over while being headed, and the shank will not be



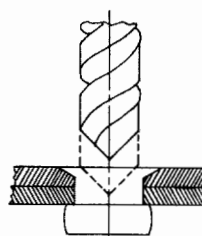
1. FILE A FLAT ON THE MANUFACTURED HEAD



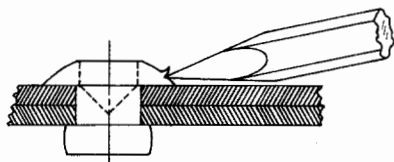
2. CENTER PUNCH THE FLAT



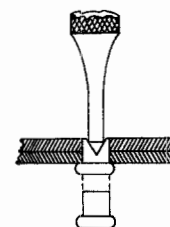
3. DRILL THROUGH HEAD USING DRILL ONE SIZE SMALLER THAN RIVET SHANK



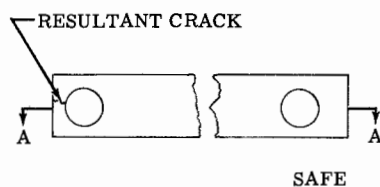
4. DRILL THROUGH DIMPLE COUNTER-SUNK OR COUNTERSUNK HEAD USING DRILL ONE SIZE SMALLER THAN RIVET SHANK



5. REMOVE WEAKENER HEAD WITH SHARP CHISEL

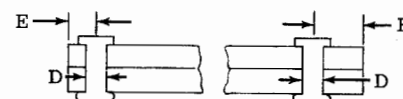


6. PUNCH OUT RIVET WITH MACHINE PUNCH



DISTANCE "E" SHOULD EQUAL TWICE THE RIVET DIAMETER

SECTION A-A



INCORRECT - TOO CLOSE TO EDGE

CORRECT
 $E = 2D$

Rivet Removal and Rivet Edge Distance
Figure 1

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sufficiently expanded to completely fill the hole. A drill from 0.002 to 0.004 inch larger than the rivet should be used for sheet and plate riveting.

- (j) Pieces should be held firmly together by clamps, screws or bolts while they are being drilled and riveted.
- (k) Where rivets are headed on the inside of the structure, the bucking bar is held against the end of the rivet shank. Care must be exercised doing this operation to prevent unseating the rivet by the application of too much pressure. For the first few blows the bucking bar should be held lightly against the rivet shank so that it will receive the impact of the blow through the rivet. The bucking bar must be held square with rivet to avoid turning it over.
- (l) Only a sufficient number of blows should be struck to properly upset a rivet. The blows must be as uniform as possible.
- (2) Sparing and diameter of rivets. There are no specific rules which are applicable to every case or type of riveting. There are, however, certain general rules which should be understood and followed.
 - (a) The edge distance of rivets should not be less than two diameters of the rivet measured from the edge of the sheet or plate to the center of the rivet hole (See Figure 1).
 - (b) The spacing between rivets, when in rows, depends upon several factors, principally the thickness of the sheet, the diameter of the rivets and the manner in which the sheet will be stressed. This spacing is seldom less than four diameters of the rivet, measured between the centers of the rivet holes. Rivets spaced four diameters apart are found in certain seams of monocoque and seminocoque fuselages, webs or built-up spars, various plates or fittings, and floats or hulls.
 - (c) Where there are two rows of rivets, they are usually staggered. The transverse pitch or distance between rows should be slightly less than the pitch of the rivets, 75% of the rivet pitch being the usual practice.
 - (d) An average spacing or pitch of rivets in the cover or skin of most structures, except at highly stressed joints, will be from 6 to 12 diameters of the rivet.
 - (e) The best practice in repair jobs is to make the pitch of the rivets equal to those in the original structure.

H. Loose or Working Rivets in Outboard Section of Wing.

- (1) Loose or working rivets attaching skin to upper and lower front spar cap may be repaired by adding MS20470AD4 or equivalent rivets midway between and in line with existing working rivets and four rivets beyond the last loose rivet, starting repair at the wing tip and working inboard. This repair is limited to the area between the nacelle and tip tank fitting.

NOTE: Care must be taken to avoid damage to fuel tanks and wiring.

I. Loose or Working Rivets.

- (1) Rivets which appear to be loose shall be checked by the use of a 0.002 feeler gage by inserting the gage around the head of the rivet in question. If the feeler gage can be inserted to the shank of the rivet, it shall be classified as a loose rivet and shall be replaced.
- (2) If the feeler gage can be inserted approximately half-way to the shank for 30% of the circumference of the rivet head, it shall not be classified as a loose rivet.
- (3) The feeler gage shall be used to check the shear section between the riveted members, such as skin to spar or different sections of skins in a similar manner to that used around the rivet head.
- (4) If the skin around the brazier head or countersunk rivet can be moved by depressing the skin with finger pressure around the rivet, the rivet shall be replaced.
- (5) If rivets are found to turn by applying a rotating load to the head of the rivet, they should be replaced.
- (6) In areas where exterior paint has been applied to rivet heads, the paint may harden due to aging processes and show hairline cracks around the edge of the rivet heads. This should not be used as a basis for determining whether the rivet is loose or not. The hardened paint may crack at times and collect dirt or exhaust fumes which will appear as discoloration. It is not possible to detect loose rivets visually.
- (7) When replacing rivets, it is desirable to replace them with like size and type. In some instances, it will be necessary to go to the next size larger diameter. For general repair practices, the spacing between the centerlines of adjacent rivet holes shall be four diameters or greater. In areas where

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the spacing between rivets prohibits the use of the next size larger rivets, special repair instructions and procedures shall be utilized.

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WINGS

1. Description

- A. The wings are all-metal, full cantilever, semimonocoque type construction, utilizing two main spars. Each wing consists of a wing panel, aileron, flaps, engine nacelle, wing tip fuel tank, and main landing gear. The landing gear is attached to and retracts into the wing.

2. Wing Skin

- A. All wing, aileron and flap skin thickness and temper are listed in Figure 1.

B. Negligible Damage.

- (1) Any smooth dents in the wing skin that are free from cracks, abrasions and sharp corners, which are not stress wrinkles and do not interfere with any internal structure or mechanism may be considered as negligible damage. In areas of low stress intensity, cracks, deep scratches, or deep sharp dent, which by trimming or stop drilling can be enclosed by a two-inch circle, can be considered as negligible if the damaged area is at least one diameter of the enclosing circle away from all existing rivet lines. Stop drilling is considered a temporary repair.

C. Repairable Damage

- (1) Skin damage ahead of the front spar and also where the optimum in appearance is desired should be repaired by the insertion method. Typical insertion repairs are illustrated in Figure 10, 15-40. Skin damage aft of the front spar which exceeds the negligible damage limit but is not extensive enough to necessitate replacement of a skin panel can be repaired by patching. Typical wing repairs are illustrated in Special Repairs, 15-40.

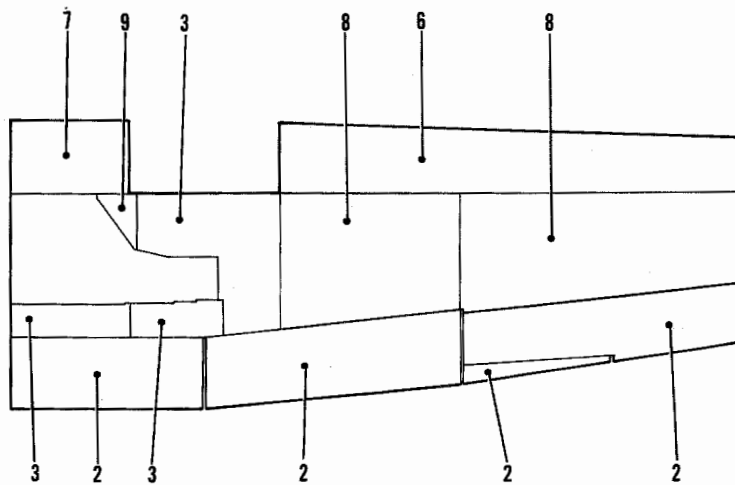
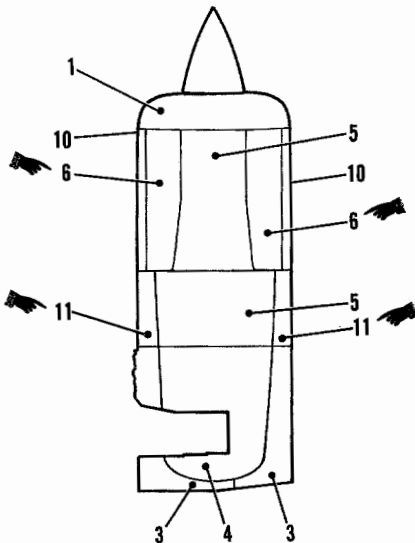
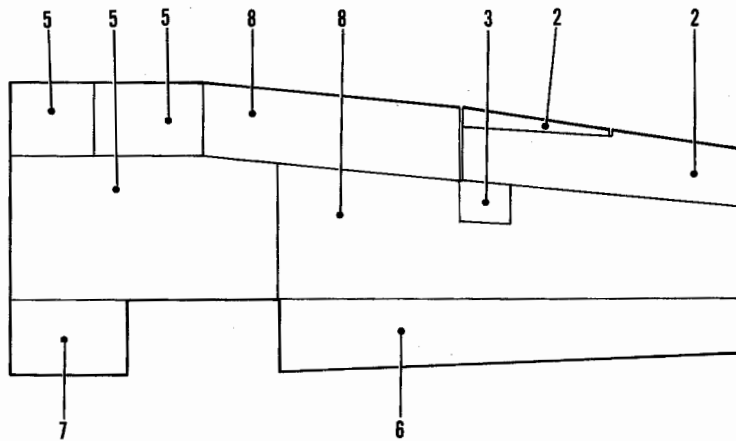
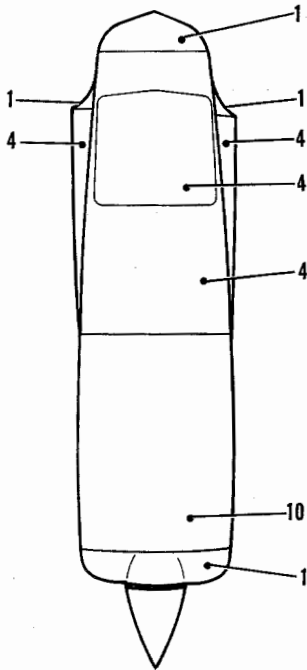
D. Damage Necessitating Replacement of Parts

- (1) In case the skin is extensively damaged, repairs should be made by replacing an entire sheet panel from one structural member to the next. The repair seams should be made to lie along stiffening members, or bulkheads, and each seam should be made exactly the same in regard to rivet size, spacing and rivet pattern as the manufactured seam at the

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1. FIBERGLASS	7. .040 INCH 2024 T42 ALCLAD
2. .016 INCH 2024 T3 ALCLAD	8. .020 INCH 2024 T3 ALCLAD
3. .025 INCH 2024 T3 ALCLAD	9. .040 INCH 2024 T3 ALCLAD
4. .025 INCH 2024 T42 ALCLAD	10. HONEYCOMB
5. .032 INCH 2024 T3 ALCLAD	11. .020 INCH 2024 T42 ALCLAD
6. .032 INCH 2024 T42 ALCLAD	



Wing Skin
Figure 1

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edges of the original sheet. If the two manufactured seams are different, the stronger one should be copied.

3. Wing Ribs

A. All ribs except those exposed to the wheel well contain flanged lightening holes. Flanged upper and lower edges of all ribs serve as cap-strips in addition to providing rigidity to the rib. The skin riveted directly to each rib flange provides the cellular strength for each successive rib bay. The nose, center and trailing edge rib segments are riveted together through the front and rear spars to form the basic airfoil sections. Spanwise alclad stringers stiffen the skin between ribs.

B. Negligible Damage.

(1) Refer to negligible damage paragraph under wing skin.

C. Repairable Damage.

(1) Repairs for wing rib webs and flanges are shown in Figure 19 and 20, 15-40. Before repair is attempted, all cracks or deep scratches must be stop-drilled with a 3/32-inch drill, and all sharp corners and ragged edges must be trimmed and deburred.

D. Damage Necessitating Replacement of Parts.

(1) Parts such as stiffeners, small ribs, clips and brackets should be replaced if their damage exceeds that specified as negligible. These parts, due to their size, are usually impractical to repair. In many instances, the time required to replace the damaged part may be considerably less than the time required to repair it. This should be considered carefully prior to making any repair whether it be only a small part or a complete component.

4. Wing Spars.

A. Repair of spar damage affecting the alignment of the wing spar should not be attempted in the field. Permissible spar repairs are illustrated in Special Repairs, 15-40.

5. Flaps and Ailerons

A. Negligible Damage.

- (1) Minor skin dents and nicks are considered negligible and can be worked out by burnishing.

B. Repairable Damage.

- (1) Skin damage exceeding that considered negligible damage can be repaired by patching. Typical skin repairs are illustrated in Special Repairs, 15-40.

C. Damage Necessitating Replacement of Parts.

- (1) Warped and cracked skin, ribs, hinge brackets and torque tubes are replaceable items. Any damage that covers more than half of the unit will require replacement of the entire unit.

6. Landing Gear

- A. The main gears are carried by the wings and are housed within the wing wheel wells when retracted. The nose gear retracts into the fuselage nose wheel well. Doors covering the wells are regarded as parts of the landing gear assemblies but the wells are structural features of the wings and fuselage.

B. Repairs of Landing Gear.

- (1) The landing gear assemblies are composed of parts that are not regarded as repairable. Minor repairs are permissible on the doors but when they are re-installed there must be no distortion that will prevent perfect operation.

7. Engine Nacelle

- A. The engine nacelle group, located in each wing, is composed of the semicantilever bed-type mount, the stainless steel firewall, and the cowling group. The engine mount structure is made of .063 inch 2024-T4 aluminum and 4130 cad-plated steel. The cowling is made up of three sections: the upper, the lower which includes the left and right access doors, and the two piece nose section which fastens in the center of the cowling. All sections fasten in place with Camloc quick fasteners. The nacelle firewall is made up of stainless steel sheet with a clad aluminum angle riveted around its contour.

B. Negligible Damage.

- (1) Minor dents in the firewall and cowlings, if straightened, may be classified as negligible damage. Scratches and dents should be burnished out.

8. Engine Firewall

A. Repair of Stainless Steel Firewall.

- (1) The firewall may be repaired by using the clear-of-structure-type patch, as shown in Figure 18, 15-40, providing the patch is of the same thickness as the firewall and monel rivets are used. Maximum diameter on holes that can be patched is 2 inches. The holes should be routed and repaired. Cracks should be stop drilled and repaired. Parts having cracks extending to the edge of the part must be replaced. Maximum allowable length of cracks to be repaired is 3 inches.

9. Engine Firewall Sealing

- A. The engine firewall should be sealed with pro-seal #700 (Coast Pro-Seal Company) using the following procedures:
 - (1) Clean area on surface to be sealed with solvent.
 - (2) Mix 1 part of Pro-seal #700 curing agent with 100 parts of Pro-seal #700 sealant.

NOTE: Sealant should be mixed by weight. It is important that accelerator be completely and uniformly dispersed throughout the base compound.

- (3) Using a spatula, caulking gun, or flow gun, apply a fillet of sealer along cracks, seams, joints and row of rivets.

NOTE: If the sealing is done before the parts are mated, use enough sealing compound to completely fill the joint and wipe away the excess after parts are mated.

NOTE: If the sealant is applied with a brush or a brush flow gun, more than one coat of sealant will be necessary on very porous material. The sealant should be allowed to air dry 10 minutes between coats.

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- (4) Pro-seal #700 is the only sealant authorized for the stainless steel firewall. If sealant other than pro-seal #700 has been used it should be removed from the firewall and resealed using only the recommended sealant.

10. Engine Mount.

- A. Replacement of mount is the only recommended procedure.

11. Repair of Engine Cowling

- A. Skin, if damaged extensively, should be replaced with a section of original manufacture. Small damaged areas should be reinforced with a doubler installed on the inner side. Material selected should be of the same thickness and characteristics as the original part.

12. Repair of Cowling Reinforcement.

- A. Cowling reinforcements, if damaged, should be replaced. Due to their small size and complex angles they are easier to replace than to repair.

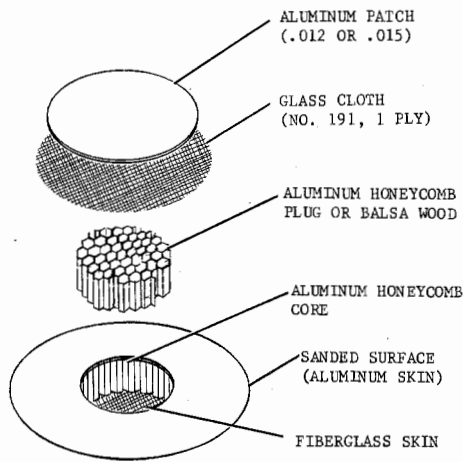
13. Repair Procedures for Bonded Honeycomb Engine Cowls (See Figure 2).

- A. The engine cowling is fabricated using a sandwich type honeycomb construction. Sometime during the life of the aircraft damage may occur to the skin and/or honeycomb which will require repairs. In the event damage does occur, the following repair procedures have been developed with the objective of equaling, as nearly as possible, the strength of the original part with a minimum loss of aerodynamic characteristics, electrical properties and minimize increase in overall weight.
- B. Damages to sandwich honeycomb construction are divided into classes according to severity and possible effect upon the airframe structure. Damage classifications are as follows:

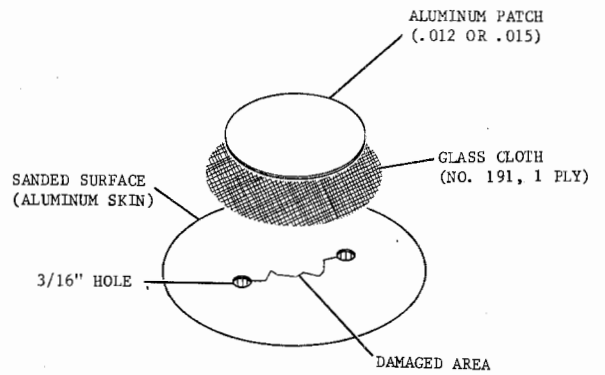
Class 1. Dents, scars, scratches, cracks, etc., in the facings not accomplished by a puncture or a fracture.

Class 2. Punctures or fractures on one facing only, possibly accompanied by damage to the honeycomb core but without damage to the opposite facing.

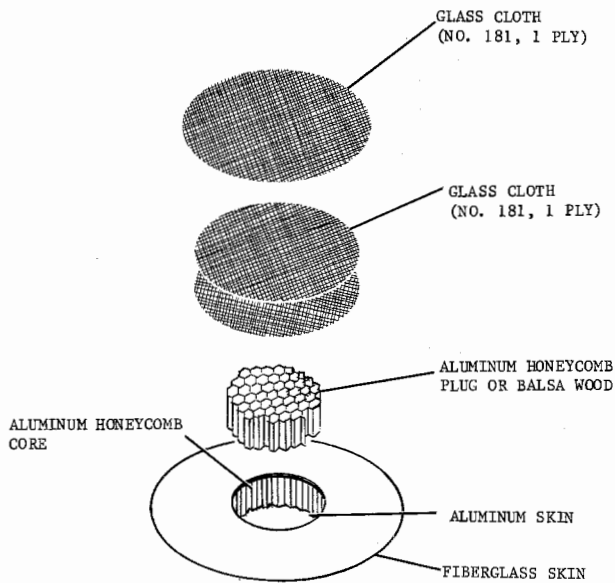
Class 3. Holes or damage extending completely through the sandwich, affecting both facings and the core.



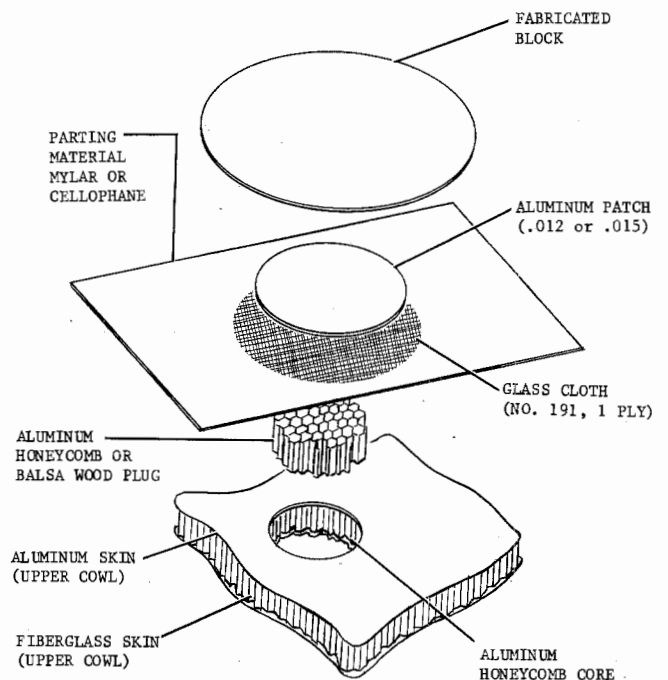
CLASS 2: DAMAGE THROUGH ALUMINUM OUTER SKIN AND ALUMINUM HONEYCOMB CORE (UPPER COWL)



CLASS 1: DAMAGE RESULTING IN CRACK (UPPER COWL)



CLASS 2: DAMAGE THROUGH FIBERGLASS INNER SKIN AND ALUMINUM HONEYCOMB CORE (UPPER COWL)



CLASS 3: DAMAGE THROUGH ALUMINUM HONEYCOMB CORE, ALUMINUM AND FIBERGLASS SKINS

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Repair of Upper and Side Engine Cowling
Figure 2

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Class 4. Adhesive voids between skin and honeycomb core.

WARNING: SOLVENTS USED MUST BE STORED IN, TRANSPORTED IN, AND USED FROM SAFETY CONTAINERS. ADEQUATE VENTILATION MUST BE PROVIDED IN STORAGE AND USAGE AREAS. THE SOLVENTS SPECIFIED ARE FLAMMABLE AND CAUTION TO PREVENT FIRES MUST BE TAKEN. NO SMOKING, SPARKS OR OPEN FLAMES SHALL BE PERMITTED IN THE IMMEDIATE AREA WHERE THE SOLVENTS ARE BEING USED. STORAGE AND USAGE AREAS SHALL BE FREE FROM EXCESSIVE HEAT, SPARKS, AND OPEN FLAMES WHEN POSSIBLE AND PRACTICAL, RUBBER GLOVES SHALL BE WORN WHEN PERFORMING SOLVENT OPERATIONS.

C. Repair of Class 1 damage shall be as follows:

- (1) Class 1 damage resulting in a hole not exceeding 1-1/2 inches diameter, dents, scratches or scars of .030 inch deep shall be repaired as follows:
 - (a) Remove paint to bare metal using either 400 or 600 grit wet sandpaper.
 - (b) Mask area adjacent to sanded area.
 - (c) Mix thoroughly equal portions, by volume, of Epon 828 and Versamid 125. Add aluminum powder until a thick non-flowing paste is obtained.

NOTE: Prepare only that quantity of material that will be used in 30 minutes.

- (d) Fill damaged area with mix and smooth with a putty knife or spatula.
 - (e) Allow the mix to cure at room temperature until hard (approximately 4 hours).
 - (f) Wet sand the repaired area with 400 grit wet sandpaper until smooth.
 - (g) Clean the repaired area with a clean cloth moistened with Isopropyl Alcohol, Naphtha or Toluene. Allow to air dry.
 - (h) Brush a minimum of two coats of Zinc Chromate primer over the repaired area, allowing each coat to dry.
 - (i) Refer to Chapter 1 and paint in accordance with applicable finish specifications.
 - (2) Class 1 damage resulting in cracks shall be repaired as follows:
 - (a) Stop drill crack at both ends with 3/16 inch diameter holes.
 - (b) Prepare a circular external patch, which will extend one inch beyond damage area from .012 or .015 aluminum.

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- (c) Remove all paint and primer around damage area by sanding with 400 or 600 grit wet sandpaper.

NOTE: Sanded area must be approximately 1/2 inch wider than aluminum patch.

- (d) Lightly sand entire damage area with 400 grit sandpaper until a satin finish is obtained. Mask off around damage area.
- (e) Wipe damage area with a clean cloth moistened with Isopropyl Alcohol, Naphtha or Toluene. Wipe dry with a clean cloth.
- (f) Mix thoroughly 100 parts (by weight) Epon VIII Adhesive with 6 parts (by weight) of curing agent "A".

NOTE: Prepare only that quantity of material that will be used in two hours.

- (g) Work some of the prepared adhesive in the crack and drilled holes. Apply a thin film over sanded surface.
- (h) Prepare a one-ply No. 191 glass cloth or similar scrim cloth 1/8 inch wider than aluminum patch.
- (i) Apply a thin film of the adhesive on the aluminum patch and, then place cloth between patch and damaged assembly and apply sufficient pressure to assure positive contact.
- (j) Using mylar or cellophane over aluminum patch, place a clamping device on patch to insure complete contact of all bonding surfaces.
- (k) Remove excess adhesive with a clean cloth dampened with Naphtha or Toluene.
- (l) Cure at 150° to 200°F using heat lamps or oven.
- (m) Remove clamps, pressure pads, etc., and sand away remaining excessive adhesive.
- (n) Brush a minimum of two coats of Zinc Chromate primer over the repaired area, allowing each coat to dry.
- (o) Refer to Chapter 1, and paint in accordance with applicable finish specifications.

D. Repair of Class 2 damage shall be as follows:

- (1) Class 2 damage to upper cowl resulting in damages that extend completely through the aluminum outer skin and into the aluminum honeycomb core but without damage to the inner skin:
 - (a) Carefully trim out skin to a circular or oval shape with a hole saw or fly cutter removing honeycomb core completely to the opposite skin.

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CAUTION: EXTREME CARE SHOULD BE TAKEN NOT TO DAMAGE THE INNER SKIN.

- (b) Remove completely all the damaged honeycomb core.
- (c) Prepare either an aluminum honeycomb core or balsa wood replacement plug as follows:
 - 1) If balsa wood is used, fabricate plug so that the grain will be perpendicular to the skins.
 - 2) Lightly sand balsa plug with 400 grit sandpaper and wipe off dust with a clean cloth.

NOTE: Do not touch the bare surface with bare hands after sanding. If the balsa wood is cut too short, the distance between shall be shimmed up until positive contact is made with all surfaces.

- 3) Wrap balsa plug in clean waxed paper until ready for use.
- 4) When aluminum honeycomb plug is used, the core shall be the approximate density of the original core.
- 5) Cut aluminum honeycomb plug so that the top edge will be even with the adjacent skins and completely fills the damaged area.
- (d) Remove all paint and primer (approximately 1-1/2 inches larger in diameter than cutout) from around damage area with either 400 or 600 grit wet sandpaper.
- (e) Mask around sanded area and cut out area.
- (f) Mix thoroughly 100 parts (by weight) Epon VIII adhesive with 6 parts (by weight) of curing agent "A".

NOTE: Prepare only that quantity of material that will be used in two hours.

- (g) If balsa plug is being used, spread the adhesive lightly over all surfaces. If aluminum plug is being used, brush or trowel adhesive on the internal side of the existing skin and where the plug will make contact with core.
- (h) Position balsa wood or aluminum plug into place.

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- (i) Prepare a circular external patch, which will be one inch larger than plug hole, from .012 or .015 aluminum.
- (j) Prepare a one-ply circular No. 191 glass cloth or similar scrim cloth 1/8 inch larger than plug hole.
- (k) Apply a thin film of adhesive over sanded surface and place the No. 191 glass cloth or similar cloth over the plug.
- (l) Clean the bond surface of aluminum patch and coat with adhesive.
- (m) Assemble patch over glass cloth and plug and apply sufficient pressure to assure positive contact.

NOTE: Care should be taken to insure that plug and glass cloth remain in place.

- (n) Using mylar or cellophane over aluminum patch, place a clamping device on patch to insure complete contact of all bonding surfaces.
 - (o) Remove excessive adhesive with a clean cloth moistened with Naphtha or Toluene.
 - (p) Cure at 150° to 200°F using heat lamps or oven.
 - (q) Remove clamps, pressure pads, etc., and sand away excessive adhesive.
 - (r) Brush a minimum of two coats of Zinc Chromate primer over the repaired area, allowing each coat to dry.
 - (s) Refer to Chapter 1, and paint in accordance with applicable finish specifications.
- (2) Class 2 damage to upper cowl resulting in damage which extends completely through the fiberglass inner skin and into aluminum honeycomb core but without damage to the outer aluminum skin.
- (a) Carefully trim out skin to a circular or oval shape with a hole saw or fly cutter removing aluminum honeycomb core completely to opposite skin.
 - (b) Prepare a balsa wood or aluminum honeycomb plug as stated in step (1)(c) above.
 - (c) Sand undamaged fiberglass skin lightly approximately 2 inches out from around the hole.

CAUTION: DO NOT SAND THROUGH FIBERGLASS SKIN.

- (d) Prepare two No. 181 glass fabric patches, 1/8 inch larger than hole diameter.

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- (e) Mix thoroughly 100 parts (by weight) Epon 828 and 10 parts (by weight) Diethlenetriamine (DTA).
- (f) Coat plugs with Epon 828 and DTA mix as described in step (1)(g).
- (g) Impregnate the two No. 181 glass patches with mixture to the content of approximately 50% and assemble patches over plug.

NOTE: Smooth out all wrinkles.

- (h) Prepare one No. 181 glass fabric patch large enough to cover sanded area and impregnate with mixture.
 - (i) Assemble third patch over the two previous layers and remove all wrinkles as before.
 - (j) Using mylar or cellophane, cover patches and apply a clamping device.
 - (k) Cure assembly at 150° to 200°F for approximately 90 minutes.
 - (l) Remove clamps, pressure pads, etc., and sand smooth to original contour.
- (3) Class 2 damage to side cowl which extends completely through aluminum skin and the aluminum honeycomb core shall be repaired as follows:
- (a) Repair damage as described under step (1)(d), except use Bloomingdale's HT-424 or Narmco's Metlbond 302 adhesives.
 - (b) The cure time for adhesives described in step (a) above, will be a minimum of 5 hours.
- (4) Class 2 damage to side cowl which extends completely through fiberglass skin and aluminum honeycomb core shall be repaired as follows:
- (a) Repair damage as described under step (2)(d), except, use either Bloomingdale's HT-424 or Narmco's Metlbond 302 adhesives.
 - (b) The skins shall be fabricated from either Cordo's Pyroreg AC, U.S. Polymeric's Poly Preg 502, or Narmco's 506 (color black).
 - (c) The reinforcement shall be 181-150 Valan.
 - (d) Cure time for adhesives described in step (a) above, will be a minimum of 5 hours.

E. Repair of Class 3 damage is as follows:

- (1) Class 3 damage to upper and side cowls resulting in damage to both aluminum and fiberglass skins having a minimum damage size of 1.0 inch or maximum damage size of 4 inches.
 - (a) Prepare surfaces, plugs and patches as described in step D.

- (b) Fabricate a temporary mold or block to hold the plug in place while aluminum outer skin is being repaired.
- (c) Repair outer aluminum skin in accordance with step D.
- (d) Remove temporary mold or block and repair fiberglass skin in accordance with step D, and flare in patch with existing skin contour.

F. Repair of Class 4 damage is as follows:

- (1) Class 4 repairs are those repairs needed to fill voids between aluminum core and skin surfaces.
 - (a) Drill sufficient 1/8 inch holes in the fiberglass inner skin adjacent to voids.
 - (b) Remove all burrs around drilled holes.
 - (c) Mix thoroughly 100 parts (by weight) Epon 828 with 10 parts (by weight) curing agent "D".

NOTE: Prepare only that quantity that can be used in one hour.

- (d) Using a syringe or pressure gun, inject resin mix into the aluminum honeycomb cells until they become filled.
- (e) Wipe off excess resin with a cloth that has been dampened with MIBK or MEK and cover the holes with masking tape.
- (f) Position the structure so that both skins will be in positive contact with resin.
- (g) Cure adhesive for 2 hours at 150° to 200°F.
- (h) Remove masking tape and sand away excess resin.

EMPENNAGE

1. Description

- A. The all-metal tail group is of full cantilever design, consisting of the conventional arrangement of vertical fin and rudder, horizontal stabilizer and elevators. The right elevator and the rudder both contain flight adjustable trim tabs, actuated by a system of cables and pulleys controlled from the pilot's tab control wheels.

2. Vertical Fin and Dorsal Group.

- A. The vertical fin and dorsal area are constructed jointly to form a single unit. Basically the unit consists of formed sheet metal spars and ribs to which the outer skin is attached. The front spar is reinforced at its root end and drilled to facilitate the installation of two attachment bolts. Stiffness to the entire fin and dorsal assembly is provided by the attachment of the skins and the forward leading edge skin.

B. Negligible Damage.

- (1) Refer to negligible damage paragraph under wing skin, refer to 15-10.

C. Repairable Damage.

- (1) Repair of the skins, ribs and spars can be accomplished as illustrated in Chapter 15-40. Access to the internal fin structure is best gained by removing the skin attaching rivets on one side of the rear spar and springing back the skin.

D. Damage Necessitating Replacement of Parts.

- (1) Extrusion, hinge brackets and small ribs should be replaced rather than repaired. In general, where parts are available, the easiest and most satisfactory repairs can be accomplished by replacing the damaged parts.

3. Rudder

A. Negligible Damage.

- (1) Minor skin dents and nicks are considered negligible and will be worked out by burnishing.

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B. Repairable Damage.

- (1) Skin damage, exceeding that considered negligible damage, can be repaired by patching. Typical skin repairs are illustrated in Chapter 15-40, Special Repairs.

C. Damage Necessitating Replacement of Parts.

- (1) Warped and cracked skin, ribs, hinge brackets and torque tubes are replaceable items. Any damage that covers more than half of the rudder will require replacement of the rudder.

4. Horizontal Stabilizer

A. Negligible Damage.

- (1) Refer to negligible damage paragraph under wing skin, 15-10.

B. Repairable Damage.

- (1) Skin damage, exceeding that considered negligible damage, can be repaired by patching. Typical skin repairs are illustrated in Chapter 15-40. Repairs to spars should consist of channels formed of the same material and bend radius as the spar and extending at least three inches each side of the damaged area. Access to the internal stabilizer structure may be gained by removing a portion of the rivets along the rear spar and ribs and springing back the skin. By using the proper bucking bars through holes in the spar web, the skins may be closed with a minimum of blind rivets.

C. Damage Necessitating Replacement of Parts.

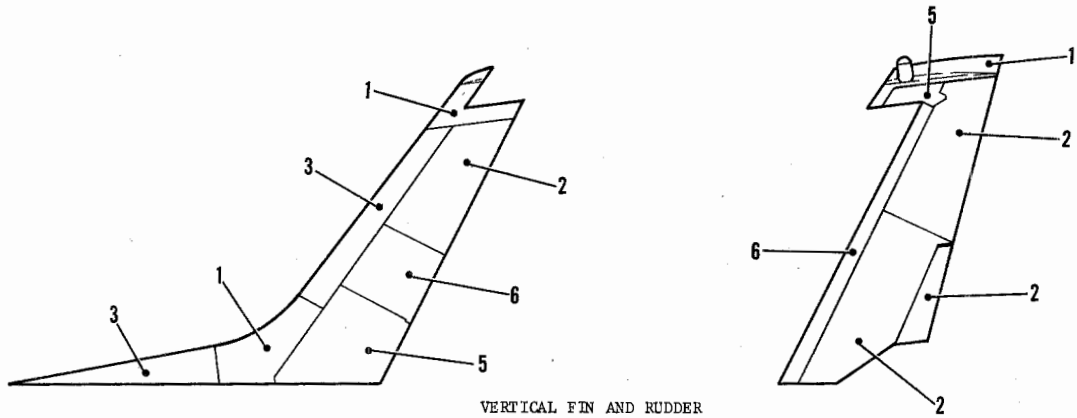
- (1) Extrusions, hinge brackets, stabilizer tab, spar and ribs should be replaced rather than repaired. In general, where parts are available, the easiest and most satisfactory repairs can be accomplished by replacing the damaged parts.

5. Elevators

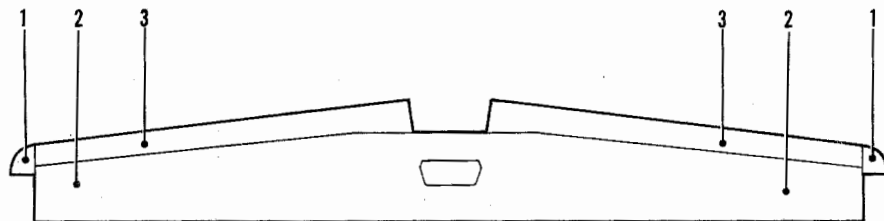
A. Negligible Damage.

- (1) For a description of negligible damage, refer to negligible damage paragraph under Wing Skin, Chapter 15-10. The exception to negligible damage on the elevator surfaces is the front spar, a crack appear-

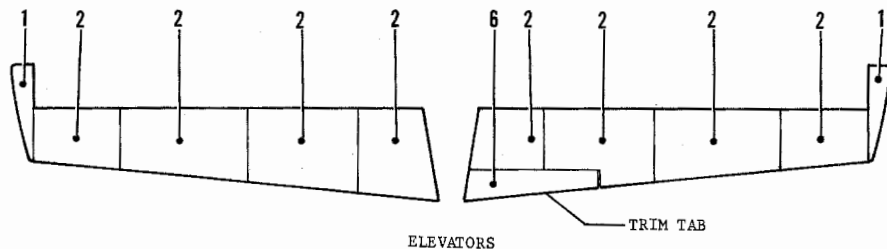
1. FIBERGLASS
2. .016 INCH 2024 T3 ALCLAD
3. .025 INCH 2024 T3 ALCLAD
4. .025 INCH 2024 T42 ALCLAD
5. .032 INCH 2024 T3 ALCLAD
6. .020 INCH 2024 T3 ALCLAD



VERTICAL FIN AND RUDDER



HORIZONTAL STABILIZER



ELEVATORS

TRIM TAB

Empennage Skin
Figure 1

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ing in the web at the hinge fittings or in the tip rib which supports the overhanging balance weight is not considered negligible. Cracks in the overhanging tip rib, in the area at the front spar intersection with the web of the rib, also cannot be considered negligible.

B. Repairable Damage.

- (1) Skin damage, exceeding that considered negligible damage, can be repaired by patching. Typical skin repairs are illustrated in Chapter 15-40.

C. Damage Necessitating Replacement of Parts.

- (1) Warped and cracked skin, ribs, hinge brackets and torque tubes are replaceable items. Any damage that covers more than half of the elevators will replacement of the elevators.

FUSELAGE

1. Description

- A. The fuselage is of semimonocoque construction consisting of formed bulkhead, longitudinal stringers, reinforcing channels and skin platings. The fuselage forward section consists of all the fuselage structure from the nose to station 109.37. Formed bulkhead channels and extrusions constitute the frame members of the cabin area.

2. Negligible Damage

- A. Refer to negligible damage paragraph under wing skin, Chapter 15-10.

3. Repairable Damage

- A. Mild wrinkles occurring in the upper or lower skin panels in the bay forward of the horizontal stabilizer and which extend through the corners (shoulder areas) may be repaired by the addition of a stringer. A wrinkle, which is hand removable, should be reinforced by a 2 1/2 x 1/2 x .050-inch 2024-T42 extruded angle. The angle should be inserted fore and aft across the center of the wrinkle and should extend to within 1/16 to 1/8-inch of the fuselage bulkheads comprising the ends of the bay. If wrinkles cannot be removed by hand, the damaged area should be repaired.

4. Damage Necessitating Replacement of Parts.

- A. All forgings and castings of any material and structural parts made of steel must be replaced if damaged. Structural members of a complicated nature that have been distorted or wrenched should be replaced. Major skin damage should be repaired by replacing the entire damaged sheet.

NOTE: When replacing entire skin panels, duplication of the forward edge of the original sheet is required. In effect, this flange is a structural member, carrying specific loads across the open areas.

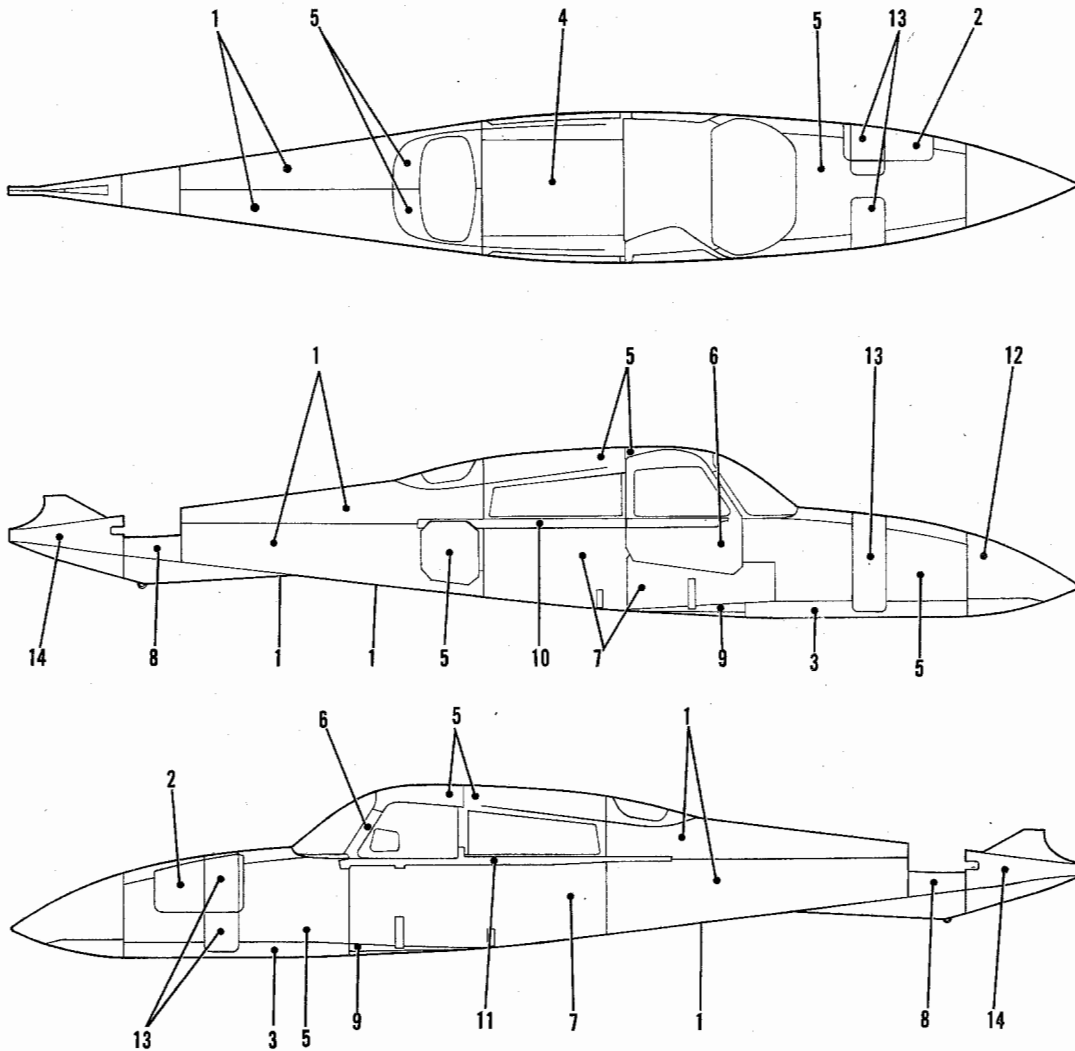
5. Bulkheads.

- A. Bulkheads are composed of formed "U" channel sections. The principle material of construction is 2024-0 alclad aluminum alloy, which after forming is heat treated to a

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1. 0.016 INCH 2024 T3 ALCLAD	8. 0.040 INCH 2024 T3 ALCLAD
2. 0.020 INCH 2024 T3 ALCLAD (BOND ASSY.)	9. 0.040 INCH 2024 T42 ALCLAD
3. 0.020 INCH 2024 T42 ALCLAD	10. 0.080 INCH 2024 T42 ALCLAD
4. 0.025 INCH 2024 T3 ALCLAD	11. 0.090 INCH 2024 T3 ALCLAD
5. 0.025 INCH 2024 T42 ALCLAD	12. FIBERGLASS
6. 0.032 INCH 2024 T3 ALCLAD	13. POLY-CARB
7. 0.032 INCH 2024 T42 ALCLAD	14. ROYALITE



10103003

Fuselage Skin
Figure 1

2024-T42 condition. All bulkheads in the fuselage are of the formed sheet metal or the reinforced formed sheet metal type.

6. Cracked Bulkhead Webs or Flanges.

- A. Acceptable methods of repairing various types of cracks occurring in service are shown in Special Repair, 15-40. Small holes (3/32-inch) should be drilled at the extreme ends of the cracks to prevent further spreading. Reinforcement should be added to carry the stresses across the damaged portion and stiffen the joints. The condition causing such cracks to develop at a particular point may be stress concentration at that point, in conjunction with repetition of stress (such as produced by vibration of the structure). The stress concentration may be due to defects such as nicks, scratches, tool marks and initial stresses or cracks from forming or heat treating operations.

NOTE: An increase in sheet thickness alone is usually beneficial but does not necessarily remedy the conditions leading to cracking. Patch type repairs are generally employed and are usually satisfactory in restoring the original material strength characteristics.

7. Severely Bent, Kinked or Torn Channels.

- A. If practical, severely bent, kinked or torn portions of bulkheads should be removed and a replacement section installed and joined at the original splice joint. If this is not justified, cutting away the damaged portion and inserting a trimmed portion of the original section, adequately reinforced by splice plates or doublers, will prove satisfactory. This is known as an insertion type repair.

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SPECIAL REPAIRS

1. Fiberglass Parts (See Figure 1).

A. The engine cowlings nose caps, tail stinger, tail surface tips, fairings, heater ducts, and other parts of the aircraft are made of fiberglass.

B. Repairable Damage.

- (1) Damaged fiberglass parts may be repaired by the methods shown in Figure 1. Cut and trim the area just beyond the noticeable damage. If the parts are painted, remove paint and sand clear an area at least two inches beyond the edge of the cutout. Prepare the necessary size and number of patches of glass cloth. Mix a sufficient amount of resin in accordance with the manufacturer's instructions.

WARNING: ALWAYS FOLLOW THE MANUFACTURER'S MIXING INSTRUCTIONS CAREFULLY AS THE MIXING OF PEROXIDE AND COBALT TOGETHER WILL RESULT IN A SPONTANEOUS FIRE.

- (2) Be sure that your hands are free from oil, grease, and dirt. Apply an even coat of resin on the sanded area. Impregnate all the glass cloth patches by laying them on a clear paper and working the resin through the fabric with a small brush. Place the larger patch over the cutout area, working out all air bubbles and wrinkles. If the cutout is large enough to cause the patch to sag, place a suitable support behind the repair area. Coat the support with automobile wax or wax paper to prevent the resin from adhering to the support. Apply a second patch over the first patch, etc., working out all wrinkles and air bubbles. After all the patches have been applied, brush the area with an even coat of resin and allow to cure. Smooth the patch area with fine sandpaper until the desired finish is obtained. Repaint the finished area with matching paint.

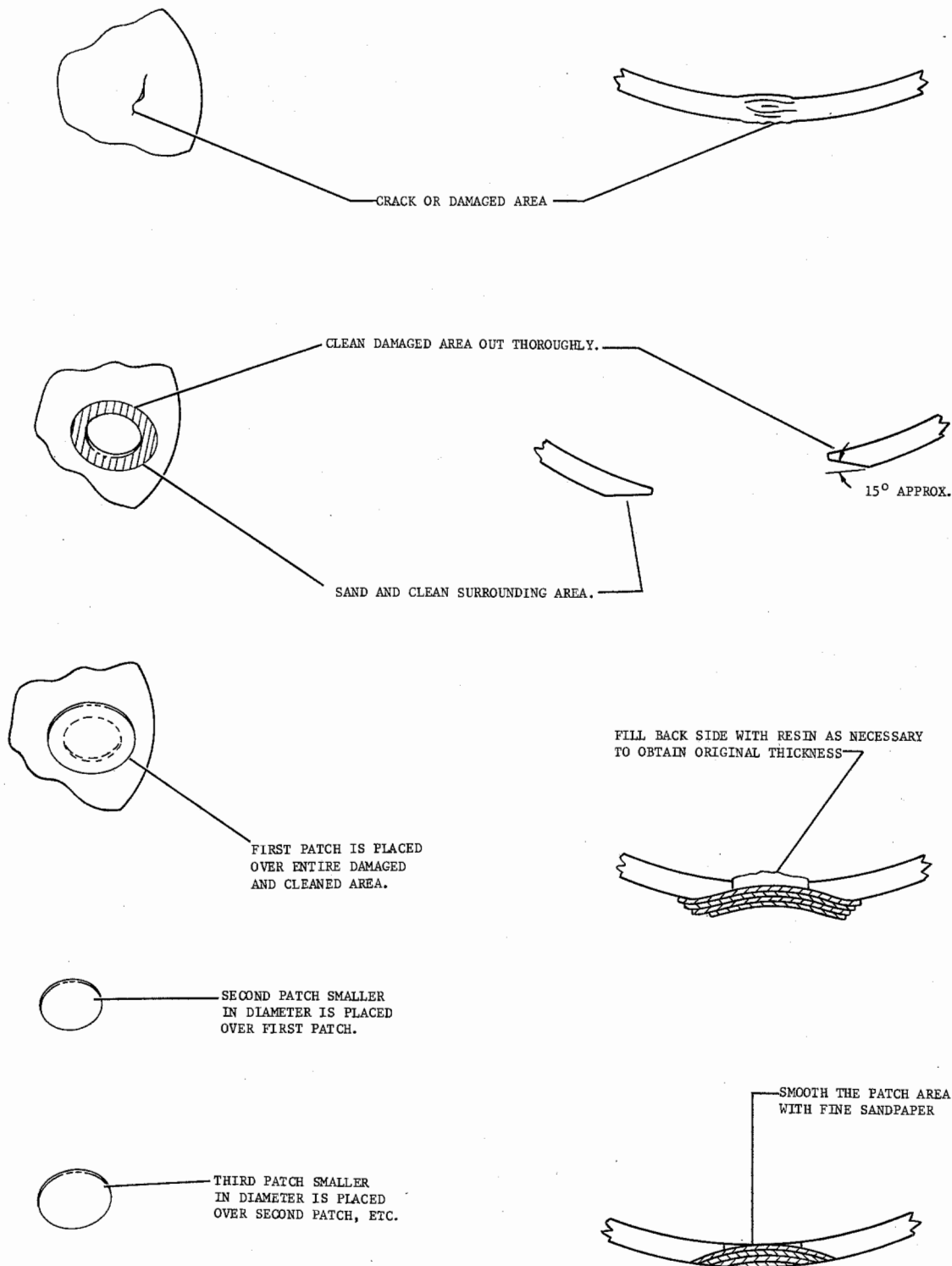
C. Damage Necessitating Replacement of Parts.

- (1) When the fiberglass parts are torn or cracked over a large area or show signs of strain through the appearance of small cracks or shows signs of loss of rigidity through the use of too much pressure on the surface, then the parts shall be removed and replaced.

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NOTE: SEE FIBERGLASS PARTS PARAGRAPH
BEFORE ATTEMPTING A FIBERGLASS
REPAIR.



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Fiberglass Repair
Figure 1

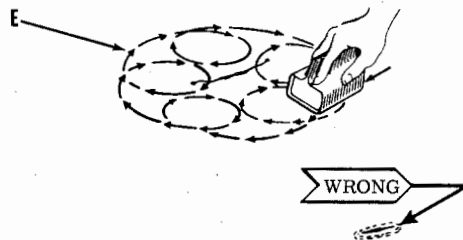
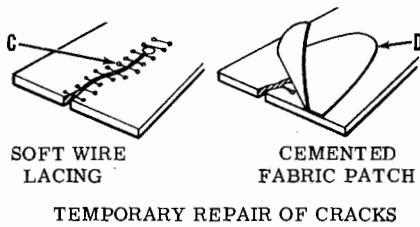
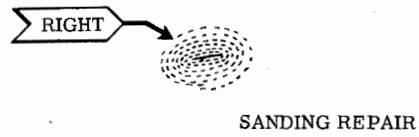
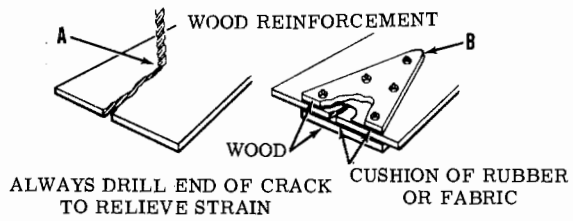
2. Repair of Plastic Window Surfaces (See Figure 2).

- A. Damaged window panels and windshield of this aircraft are ordinarily removed and replaced if the damage is extensive. However, certain repairs as prescribed in the following paragraphs can be made successfully without removing the damaged part from the aircraft. Three types of temporary repairs for cracked plastic are possible. No repairs of any kind are recommended on highly-stressed or compound curves where the repair would be likely to affect the pilot's or copilot's field of vision. Curved areas are more difficult to repair than flat areas and any repaired area is both structurally and optically inferior to the original surface.
- B. When a crack appears in a panel, drill a hole at the end of the crack to prevent further spreading. The hole should be approximately 1/8 inch in diameter, depending on the length of the crack and thickness of the material.
- C. Temporary repairs on flat surfaces can be effected by placing a thin strip of wood over each side of the surface and then inserting small bolts through the wood and plastic. A cushion of sheet rubber or aircraft fabric should be placed between the wood and plastic on both sides.
- D. A temporary repair can be made on a curved surface by placing fabric patches over the affected areas. Secure the patches with aircraft dope, Specification No. MIL-D-5549, or lacquer, Specification No. MIL-L-7178. Lacquer thinner, Specification No. MIL-T-6094 can also be used to secure the patch temporarily.
- E. A temporary repair can be made by drilling small holes along sides of the crack 1/4 to 1/8 inch apart and lacing the edges together with a soft wire. Small stranded antenna wire makes a good temporary lacing material. This type of repair is used as a temporary measure only, and as soon as facilities are available, the panel should be replaced.
- F. Scratches on transparent plastic surfaces can be removed by hand-sanding operations followed by buffing and polishing, provided subsequent instructions are followed carefully. Wrap a piece of No. 320 (or finer) sandpaper or abrasive cloth around a rubber pad or wood block. Rub the surface around the scratch with a circular motion, keeping the abrasive constantly wet with clean water to prevent scratching the surface further. Use minimum pressure and cover an area large enough to prevent the formation of the "bull's-eye" or other optical distortions.

CAUTION: DO NOT USE A COARSE GRADE OF ABRASIVE; NO. 320 IS THE MAXIMUM COARSENESS PERMITTED.

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Plastic Repair
Figure 2

- G. Continue the sanding operation, using progressively finer grade abrasives.
- H. When the scratches have been removed, wash the area thoroughly with clean water to remove all the gritty particles. The entire sanded area will be clouded with minute scratches which must be removed to restore transparency.
- I. Apply fresh tallow and buffing compound to a motor-driven buffing wheel. Hold the wheel against the plastic surface, moving it constantly over the damaged area until the cloudy appearance disappears. A 2000-foot-per-minute surface speed is recommended to prevent heating, distortion, or burns.

NOTE: Polishing can be accomplished by hand, but it will require a considerably longer period of time to attain the same result as produced by the buffing wheel.

- J. When buffing is finished, wash the area thoroughly and dry it with a soft flannel cloth. Allow the surface to cool and inspect the area to determine if full transparency has been restored. Then apply a thin coat of hard wax and polish the surface lightly with a clean flannel cloth.

NOTE: Rubbing a plastic surface with a dry cloth will build up an electrostatic charge which attracts dirt particles and may eventually cause scratching of the surface. After the wax has hardened dissipate this charge by rubbing the surface with a slightly damp chamois. This will also remove the dust particles which have collected while the wax was hardening.

3. Radome Repair Procedures

- A. Remove radome in accordance with Chapter 3. Repair procedures are developed with the objective of equaling as nearly as possible the electrical and strength properties of the original part with a minimum increase in weight. This can only be accomplished by repairing damaged parts with approved materials and working techniques. For convenience in presentation and for clarity in designating repair procedures to be used, damages to radomes in this procedure shall be divided into classes according to severity, as follows:

- (1) Class I Repair. Surface scratches, scars or erosion not penetrating through the first ply of fabric.

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- (2) Class II Repair. Punctures, delaminations, contaminants or fractures extending through the first ply.
- (3) Class III Repair. Damage extending completely through face sheets.

B. Repair Techniques.

- (1) Class I Repair. Surface scratches, scars or erosion not penetrating through the first ply shall be repaired as follows:
 - (a) Clean damaged area thoroughly and carefully using a clean cloth saturated with methyl-ethyl-ketone or another approved cleaning agent.
 - (b) Lightly sand the damaged area, using No. 280 grit sandpaper, clean the sanded surface thoroughly, using methyl-ethyl-ketone, Specification TT-M-261.
 - (c) Apply one or two coats (depending on severity of the abrasion) of the following material to the abraded surface:

Composition

Bostik 464-3-1 Surfacer
CA-142 Catalyst
TL-52 Thinner

Vendors

Bostik-Finch, Boston Street, Middleton, Mass.

Mixing Procedure

Mix in a ratio of 3 parts by volume 464-3-1 base to one Part CA-142 catalyst. Surfacer may be thinned with TL-52 to approximately 25 seconds #2 Zahn cup.

Bench Life

Approximately 30 minutes at room temperature.

- (d) Material may be applied by spray gun. The coating will dry to sand in 3 hours at normal temperatures. Sand with 320 grit paper and reapply paint.
- (2) Class II Repair. Punctures, delaminations extending through the outside face sheet.

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- (a) Punctures outside the radar window, not exceeding one inch in diameter.
 - 1) Mix EA960F and apply to core area of damage. Allow to harden, sand smooth and paint.
- (b) Punctures inside the radar window, not exceeding 1/2 inch in diameter.
 - 1) If face sheet and core are damaged beyond use, fill core area with EA960F, allow to harden, sand smooth and paint.
 - 2) If face sheet and core are not damaged beyond use, bond back together with the following adhesive mix:

Composition

EA9309 Adhesive Mix

VendorHysol Division - The Dexter Corporation,
Olean, New York 14760.Mixing Procedures

Combine 100 parts "A" with 23 parts "B" by weight and mix thoroughly.

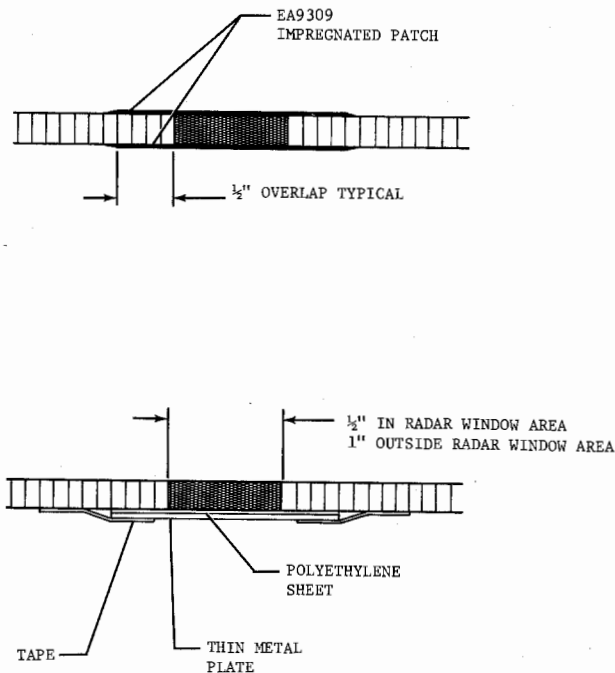
Bench Life

Approximately 40 minutes for one pound mass at 75° Fahrenheit.

- 3) Sand, paint and gloss surface at least 1/2 inch around damaged area. Apply sufficient adhesive to face sheet to rebond to core. Impregnate a patch of 181 or 1581 dry glass cloth with the 9309 adhesive mix. The patch should be 1/2 inch larger than the damaged area. Apply this patch to damaged area. Over this tape a sheet of polyethylene until adhesive hardens. Remove, sand lightly and paint.
- (c) Delaminations in the edge bond. Delamination in the attachment edge bond may be bonded back together with EA9309 adhesive. If several plies of glass cloth are damaged, remove and replace with equal number of 181 or 1581 glass. Impregnate the glass cloth with EA9309, apply and allow to harden. Sand to shape or fit and repaint.

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Typical Class III Radome Repair
Figure 3

- (2) Class III Repair (See Figure 3). Damage through both face sheets. This damage covers $\frac{1}{2}$ inch diameter in the radar window area and one inch outside the window area. Damage beyond these limits should require replacement of the radome.
- (a) Remove damaged face sheet. Apply polyethylene sheet to core and backup with a thin sheet of metal. Tape in place. Apply EA960F to fill core flush. Allow to harden and remove sheet metal backup. Apply EA9309 impregnated patches over damaged area overlapping by $\frac{1}{2}$ inch all around. Tape a polyethylene sheet over impregnated patches and rub polyethylene sheet to smooth the adhesive and remove air from patch. Allow to harden, remove polyethylene sheet and sand lightly.

■ 4. Repair of Ice Protection Panels (See Figure 6).

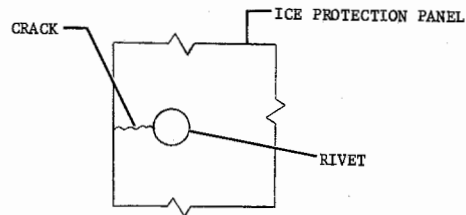
- A. The following repair procedures should be used for repairing the polycarbonate type ice protection panels. The illustrations in the figure show two types of cracks and method of repair.
- B. Repairing Crack in Ice Protection Panel.
- (1) Route the crack using router bit. Route material approximately $1/32$ wide and $1/2$ the depth of the panel thickness.
 - (2) Clean routed crack with isopropyl or ethyl alcohol.
 - (3) Fill crack with Epibond 1331 in accordance with manufacturer's instructions. Epibond 1331 may be procured from Furane Plastics, 4514 Brazil Street, Los Angeles, Calif. 90039.
- C. Repairing Combination of Cracks in Ice Protection Panel.
- (1) Cracks which do not extend to the outer edge of the ice protection panel shall be drilled through the ice protection panel with a #40 drill.
 - (2) Fill the stop drilled hole with Epibond 1331 per manufacturer's instructions.

NOTE: Bondtite or Ditzler DX-666 may be used as an alternate for Epibond 1331.

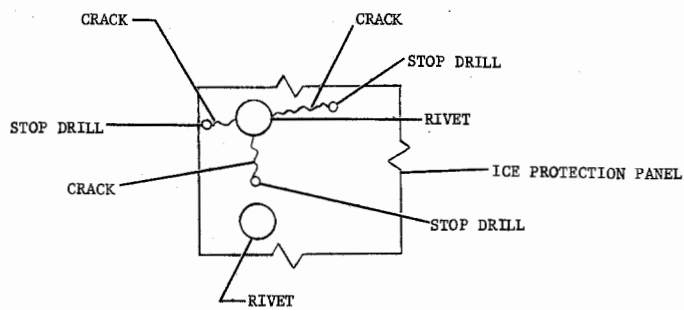
NOTE: Normal finishing, priming and painting shall be accomplished following repairs, refer to Chapter 1.

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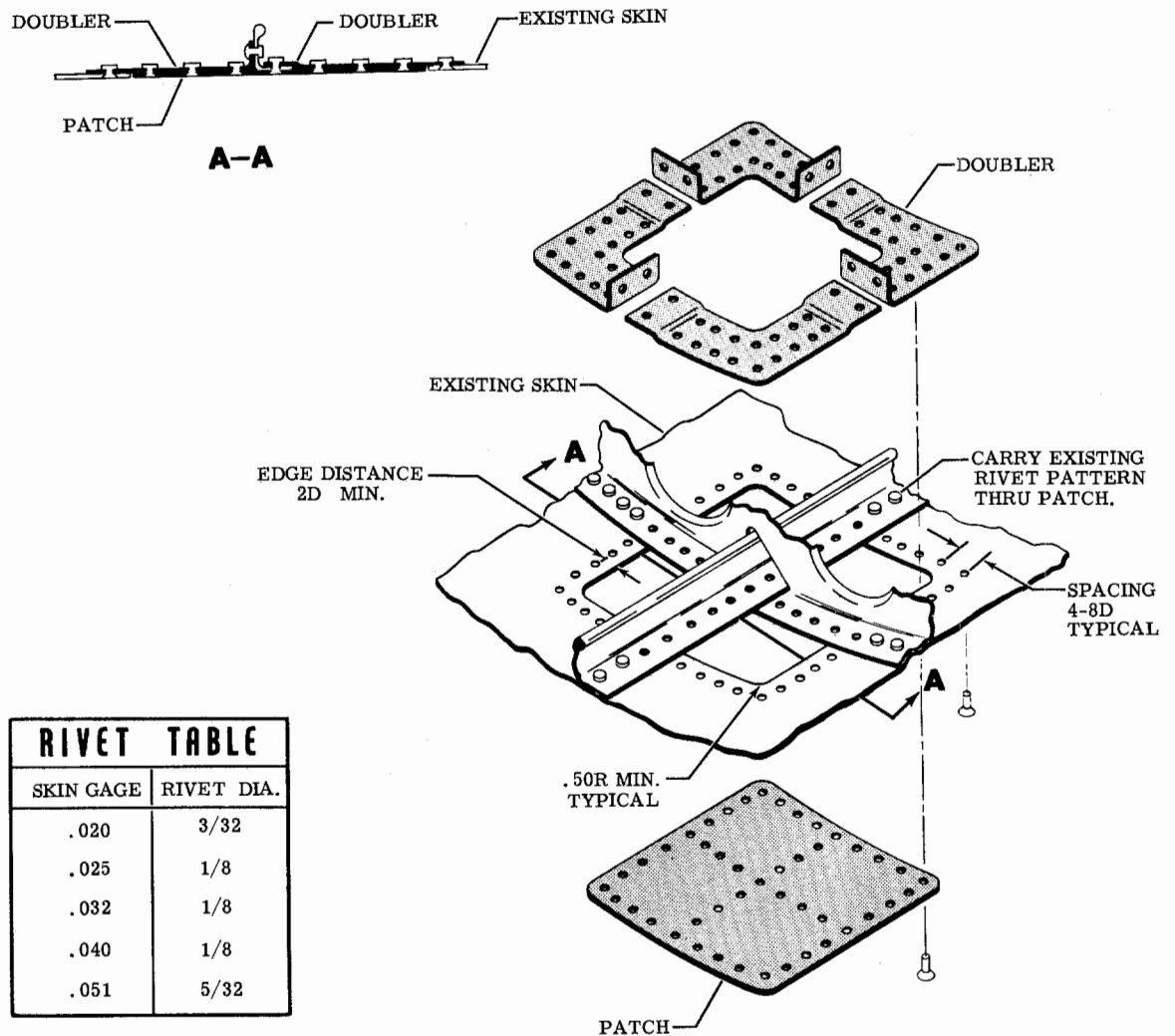
CRACK IN ICE PROTECTION PANEL



COMBINATION OF CRACKS IN ICE PROTECTION PANEL

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Repairing Ice Protection Panel
Figure 4



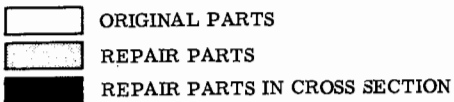
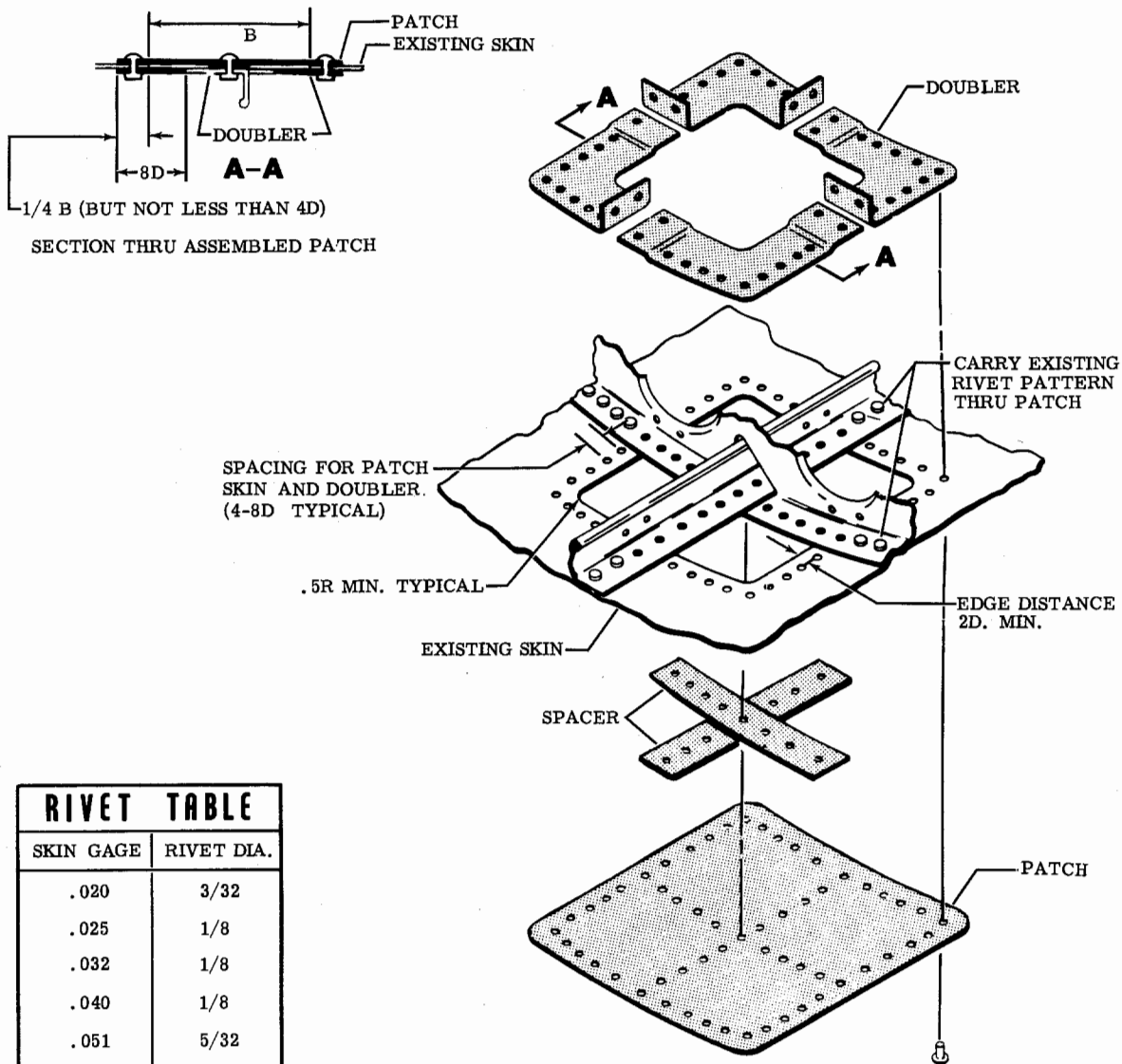
RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	3/32
.025	1/8
.032	1/8
.040	1/8
.051	5/32

	ORIGINAL PARTS
	REPAIR PARTS
	REPAIR PARTS IN CROSS SECTION

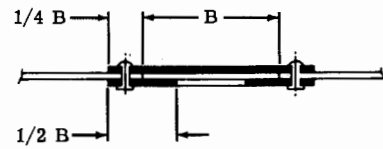
Typical Over-Structure Skin Repair
Figure 5 (Sheet 1 of 2)

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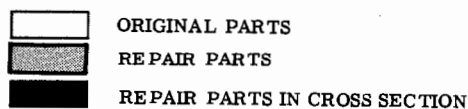
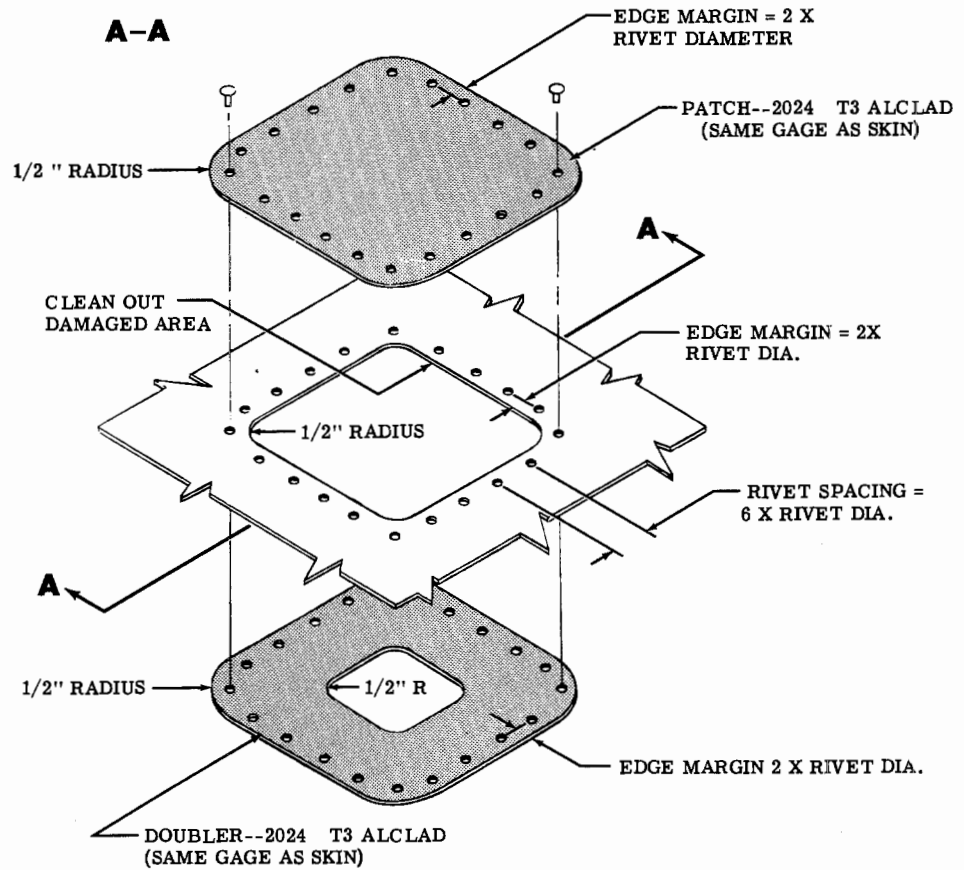
SERVICE MANUAL



Typical Over-Structure Skin Repair
Figure 5 (Sheet 2)



SECTION THRU ASSEMBLED PATCH

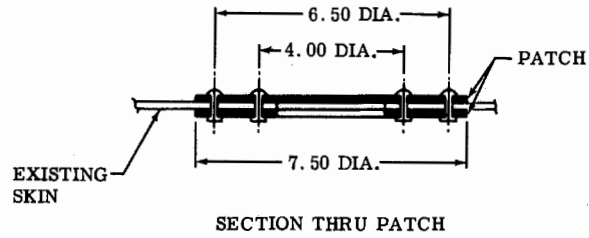
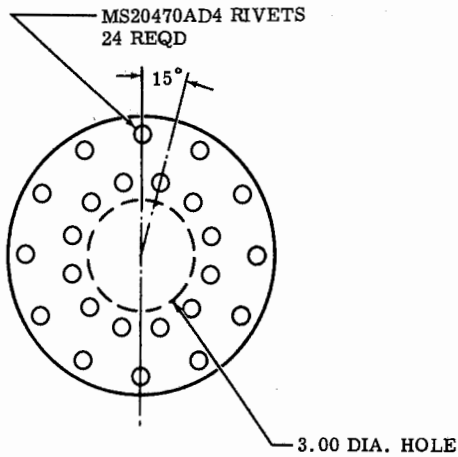


RIVET TABLE	
SKIN GAGE	RIVET DIA.
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0.025	1/8
0.032	1/8
0.040	1/8
0.051	5/32

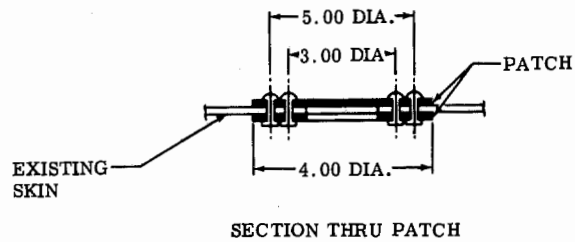
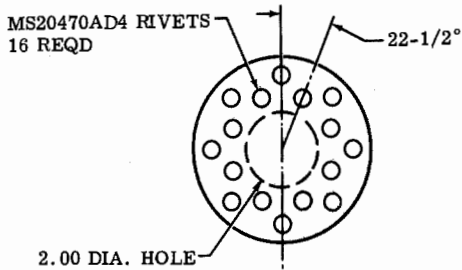
Typical Clear-of-Structure Skin Repair
Figure 6

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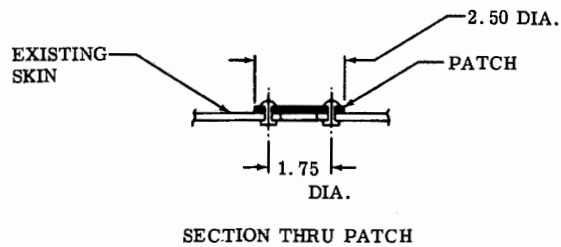
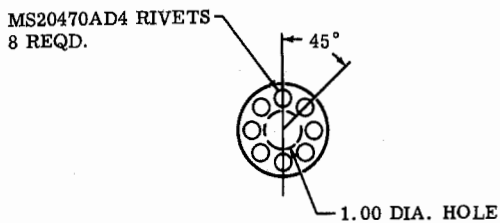
SERVICE MANUAL



PATCH REPAIR FOR 3 INCH DIAMETER HOLE

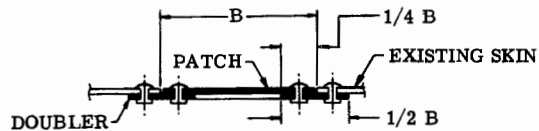


PATCH REPAIR FOR 2 INCH DIAMETER HOLE



PATCH REPAIR FOR 1 INCH DIAMETER HOLE

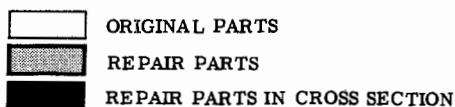
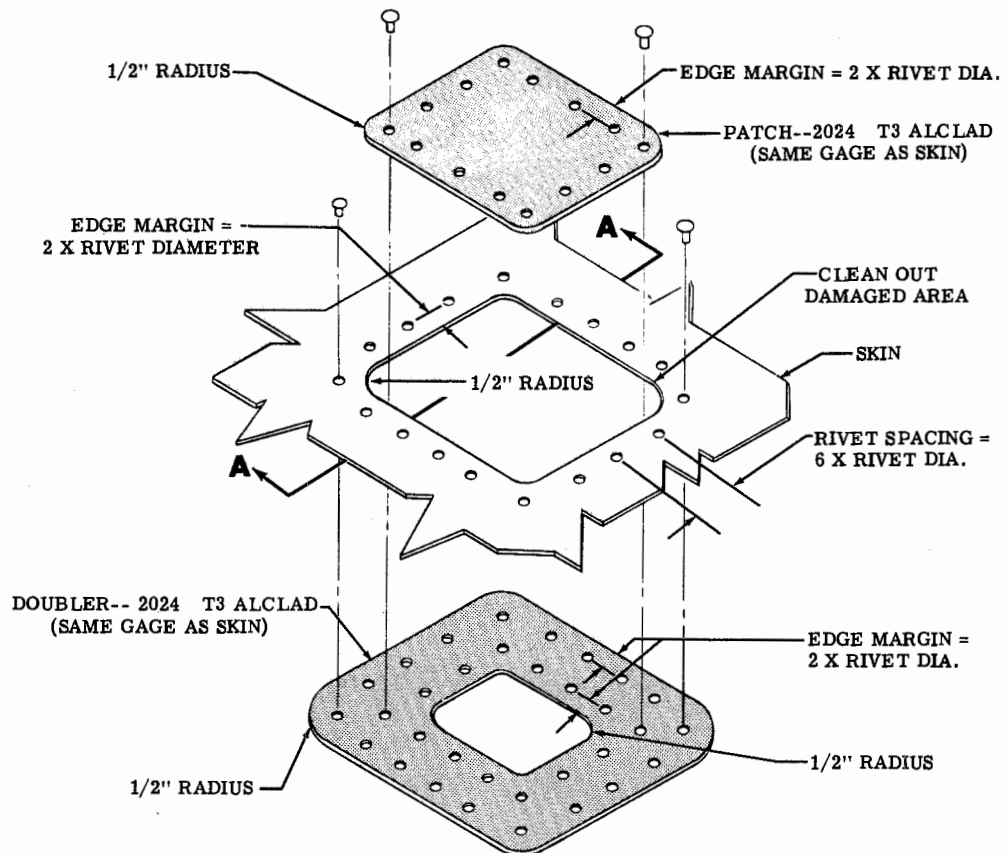
Typical Patch Repair of Circular Holes
Figure 7



SECTION THRU ASSEMBLED PATCH

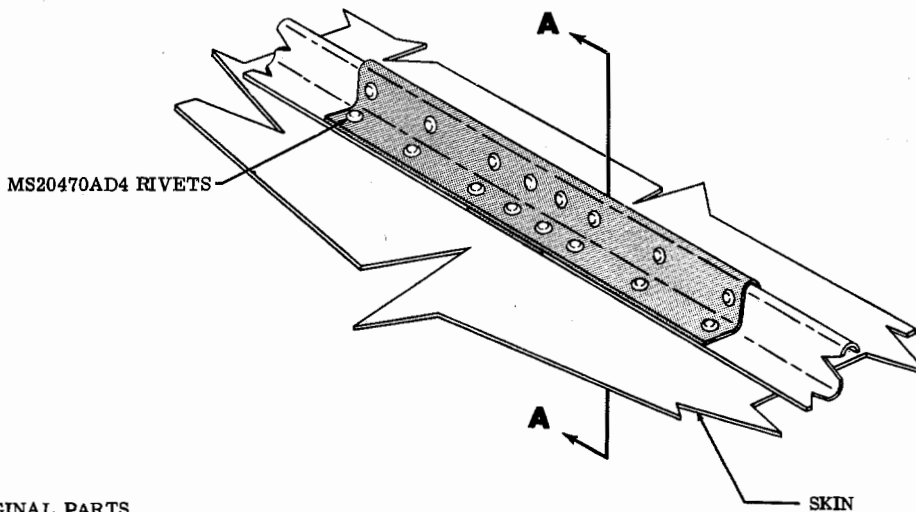
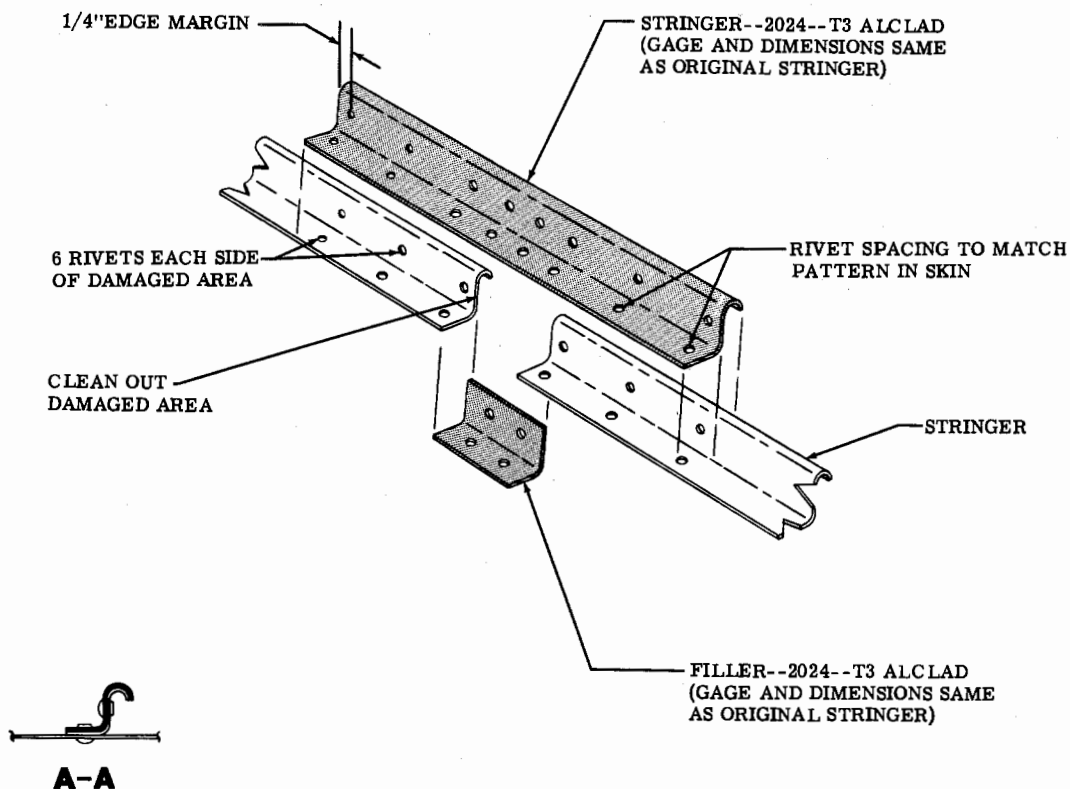
A-A

RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	3/32
.025	1/8
.032	1/8
.040	1/8
.051	5/32

Typical Insert Patch
Figure 8

310

SERVICE MANUAL

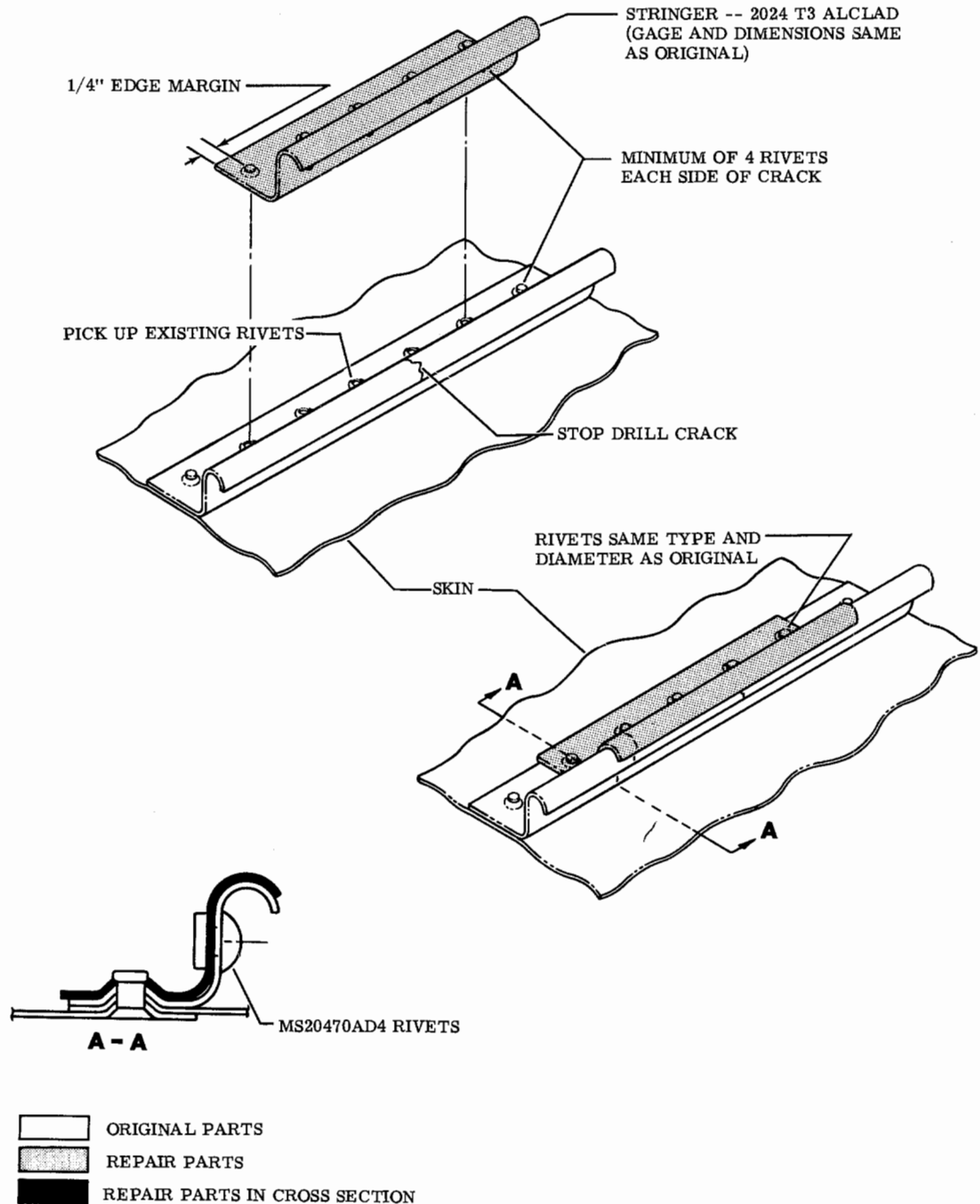


- ORIGINAL PARTS
- REPAIR PARTS
- REPAIR PARTS IN CROSS SECTION

Typical Fuselage Stringer Repair
Figure 9 (Sheet 1 of 2)

310

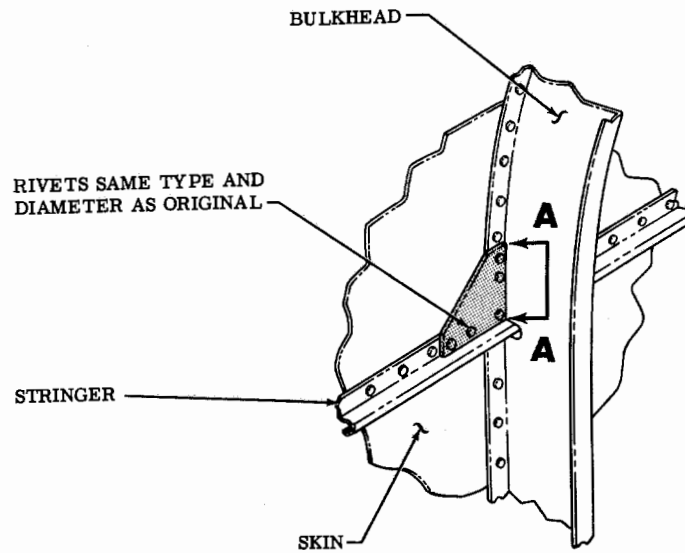
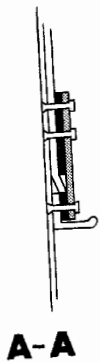
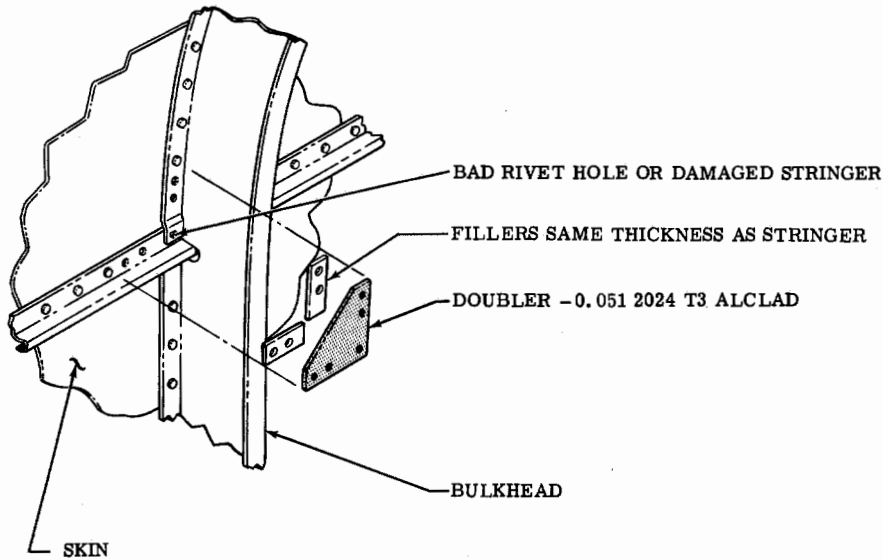
SERVICE MANUAL



Typical Fuselage Stringer Repair
Figure 9 (Sheet 2)

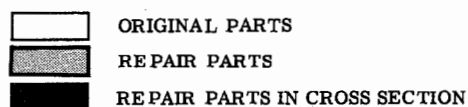
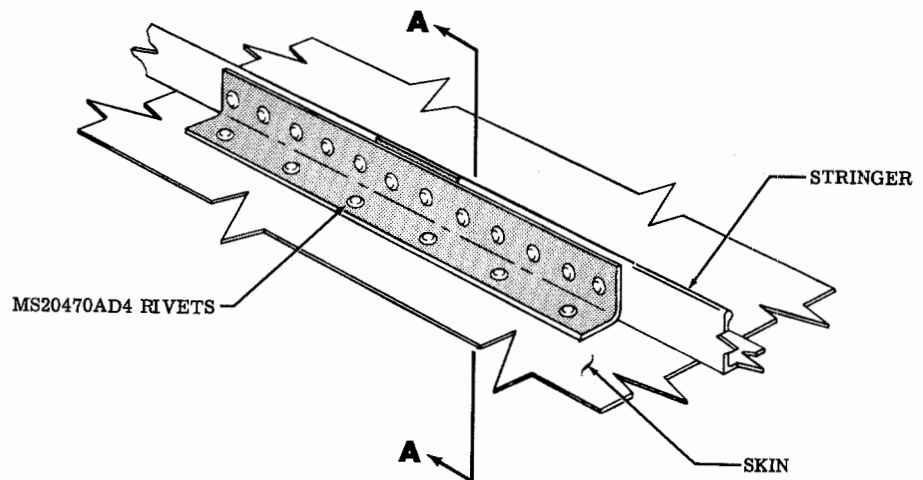
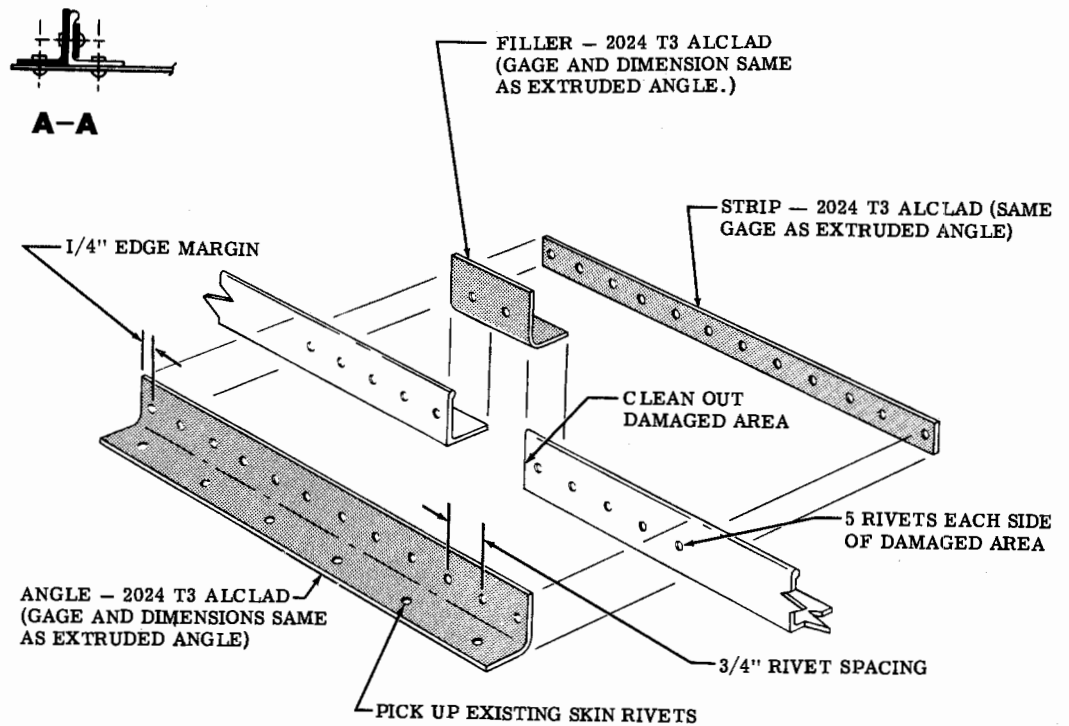
310

SERVICE MANUAL



	ORIGINAL PARTS
	REPAIR PARTS
	REPAIR PARTS IN CROSS SECTION

Typical Stringer to Bulkhead Repair
Figure 10

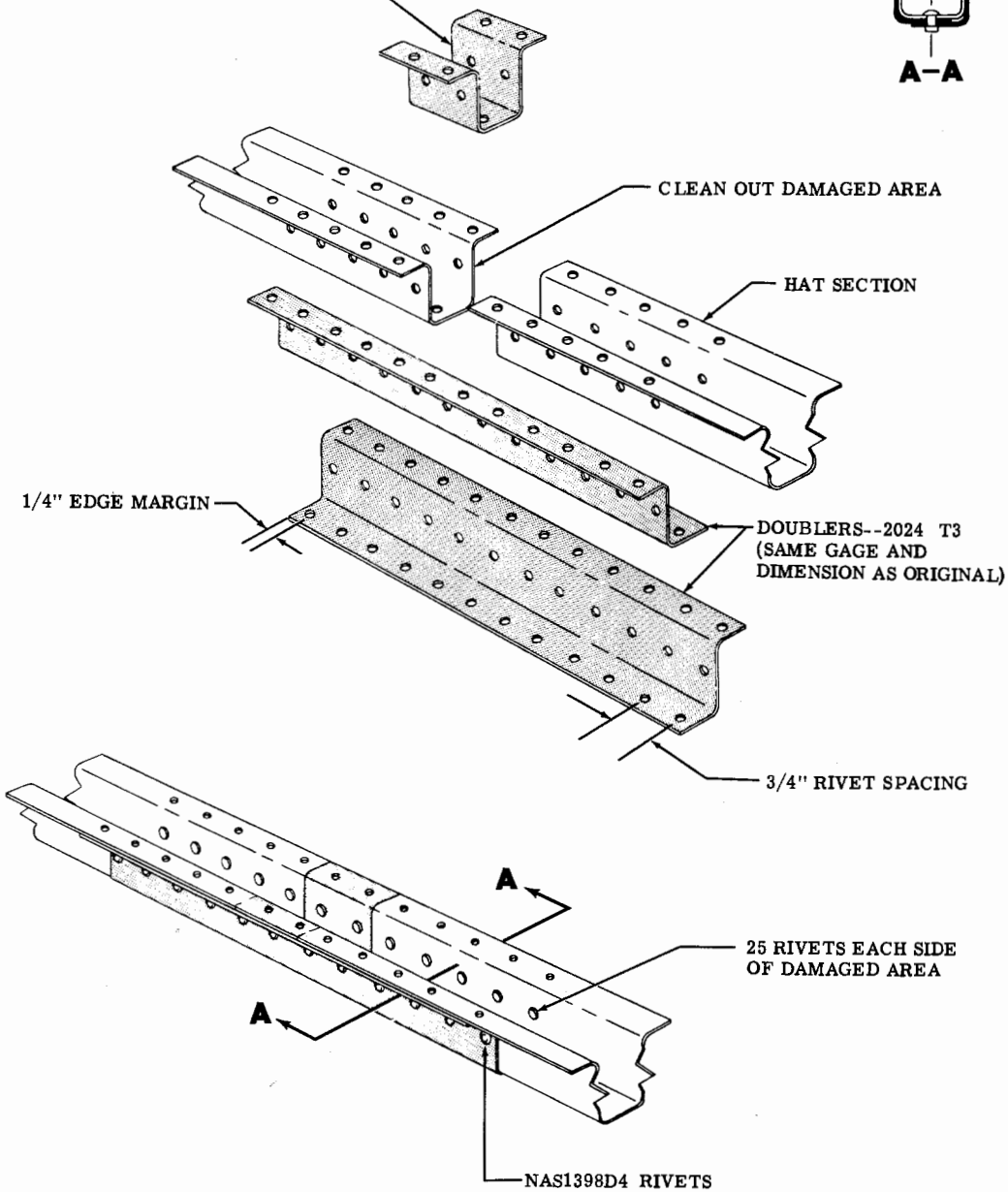
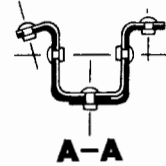


Typical Stringer Repair
Figure 11

310

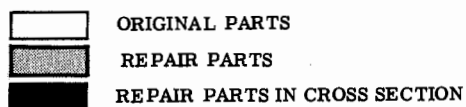
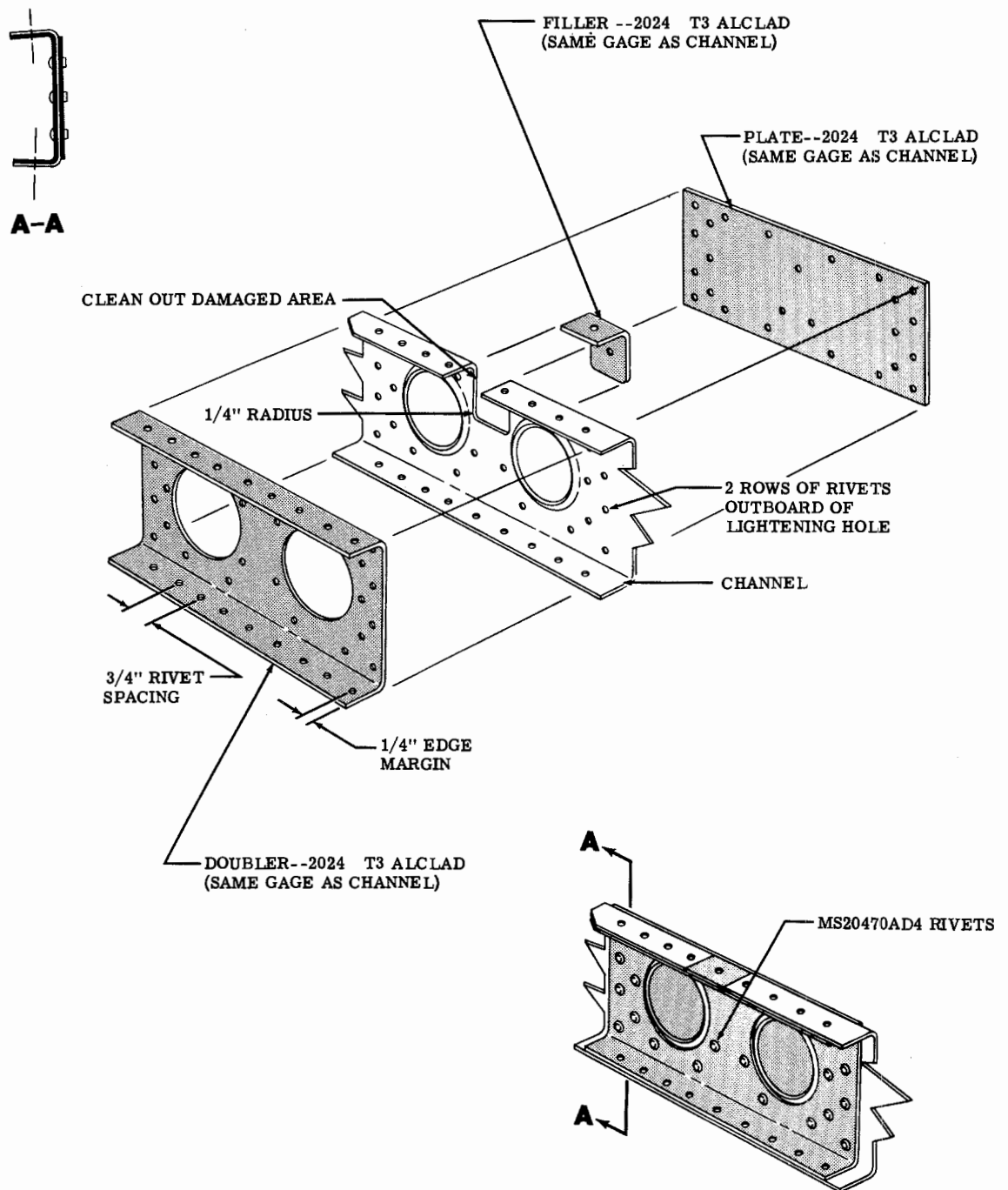
SERVICE MANUAL

FILLER--2024 T3 (SAME GAGE AND DIMENSIONS AS ORIGINAL)



	ORIGINAL PARTS
	REPAIR PARTS
	REPAIR PARTS IN CROSS SECTION

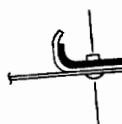
Typical Hat Section Repair
Figure 12



Typical Channel Flange Repair
Figure 13

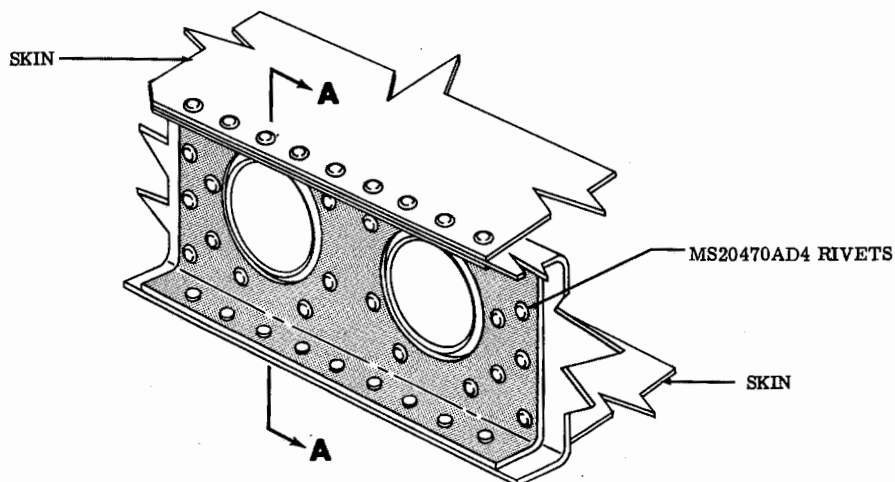
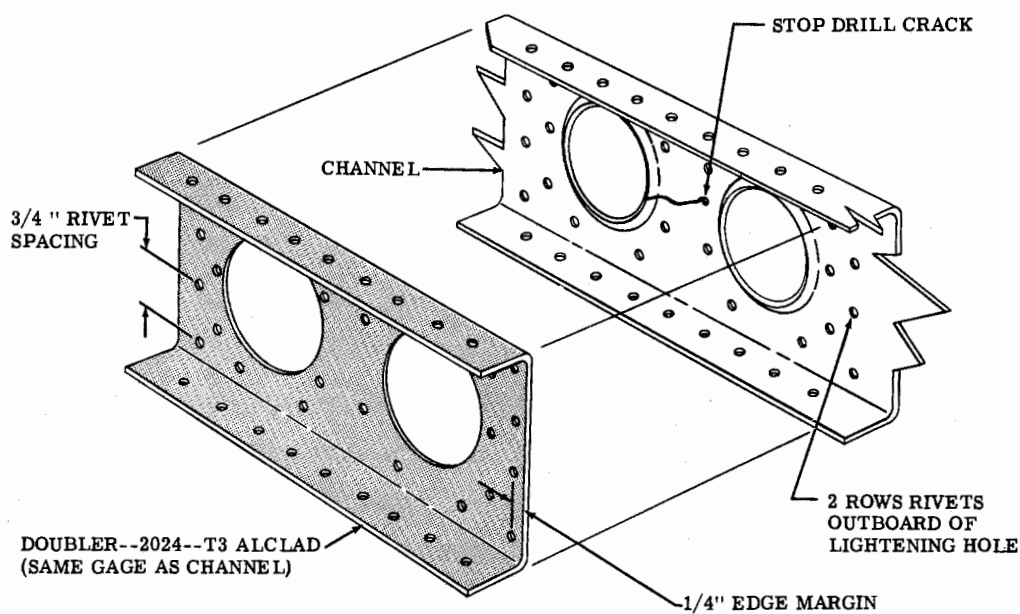
310

SERVICE MANUAL

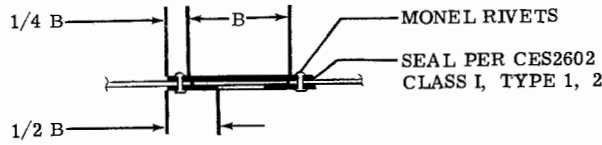


A-A

-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION



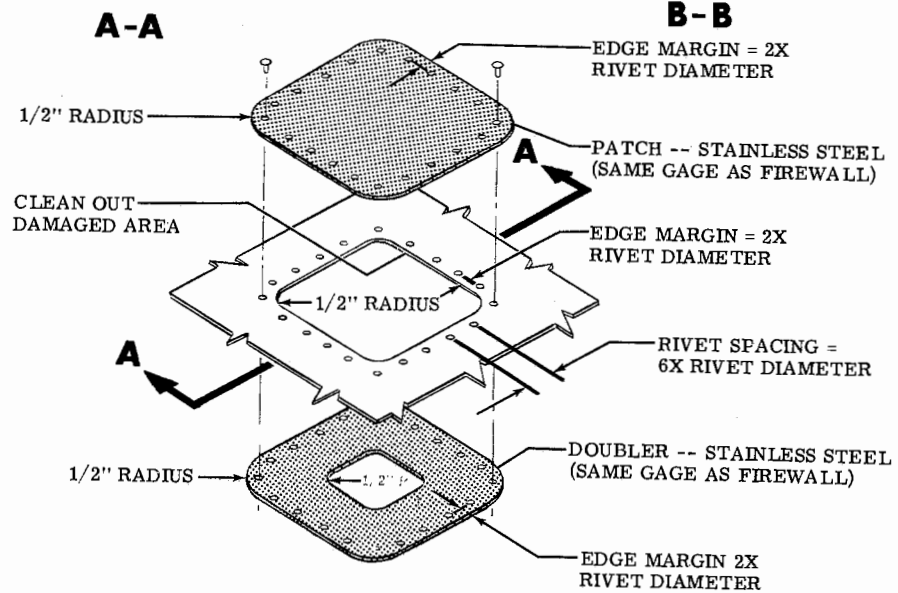
Typical Channel Repair
Figure 14



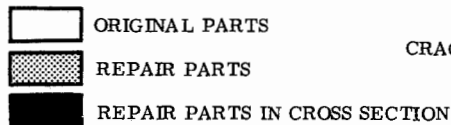
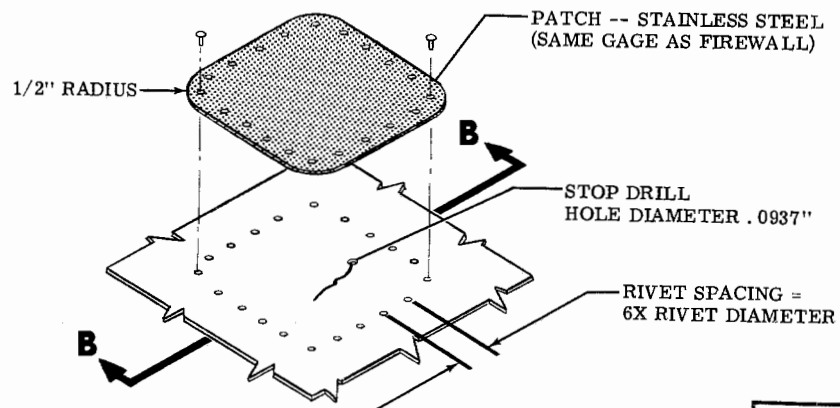
SECTION THRU ASSEMBLED PATCH



SECTION THRU ASSEMBLED PATCH



HOLE REPAIR METHOD

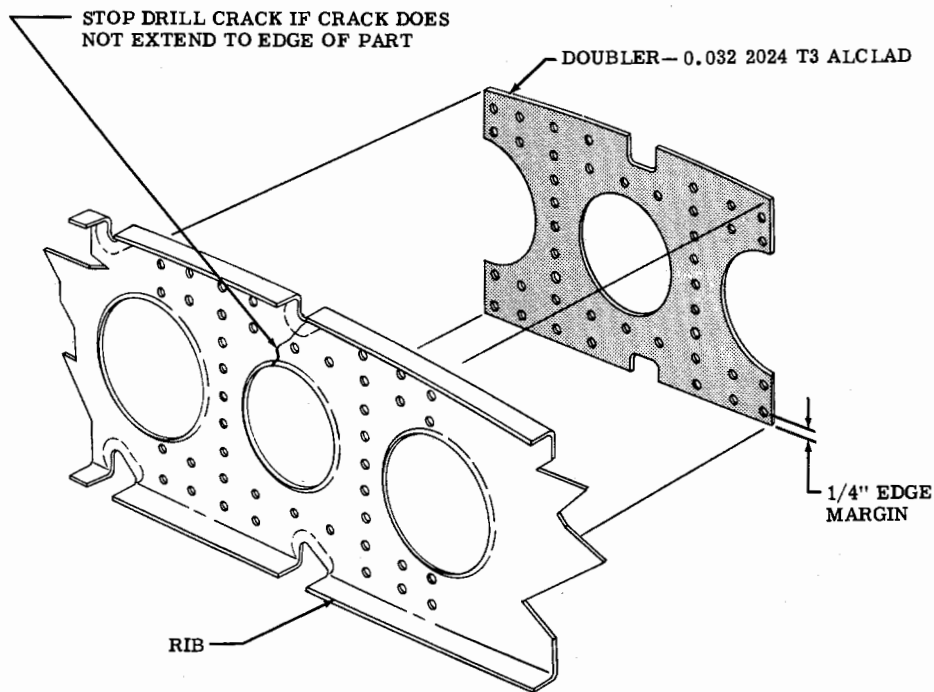


STAINLESS STEEL GAGE	RIVET
.016	3/32

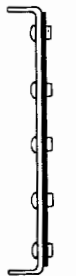
Repair of Firewall
Figure 15

310

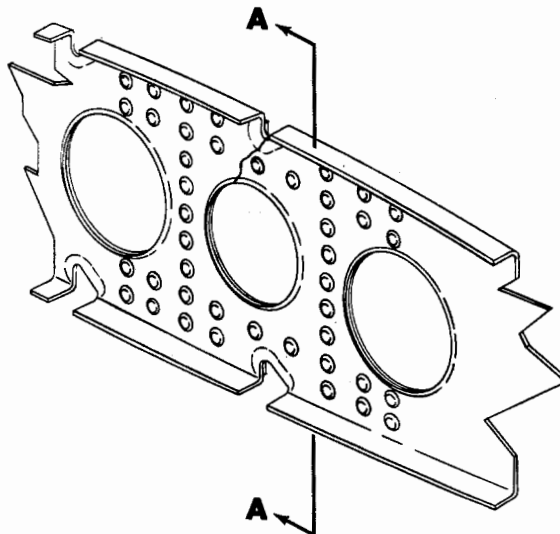
SERVICE MANUAL



RIVET TABLE	
SKIN GAGE	RIVET DIA.
0.020	3/32
0.025	1/8
0.032	1/8
0.040	1/8
0.051	5/32



A-A

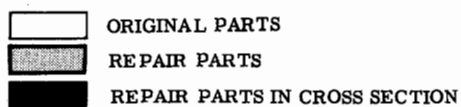
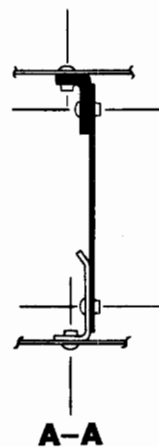
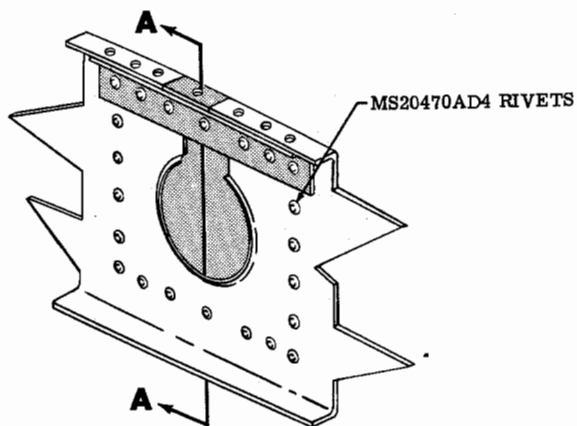
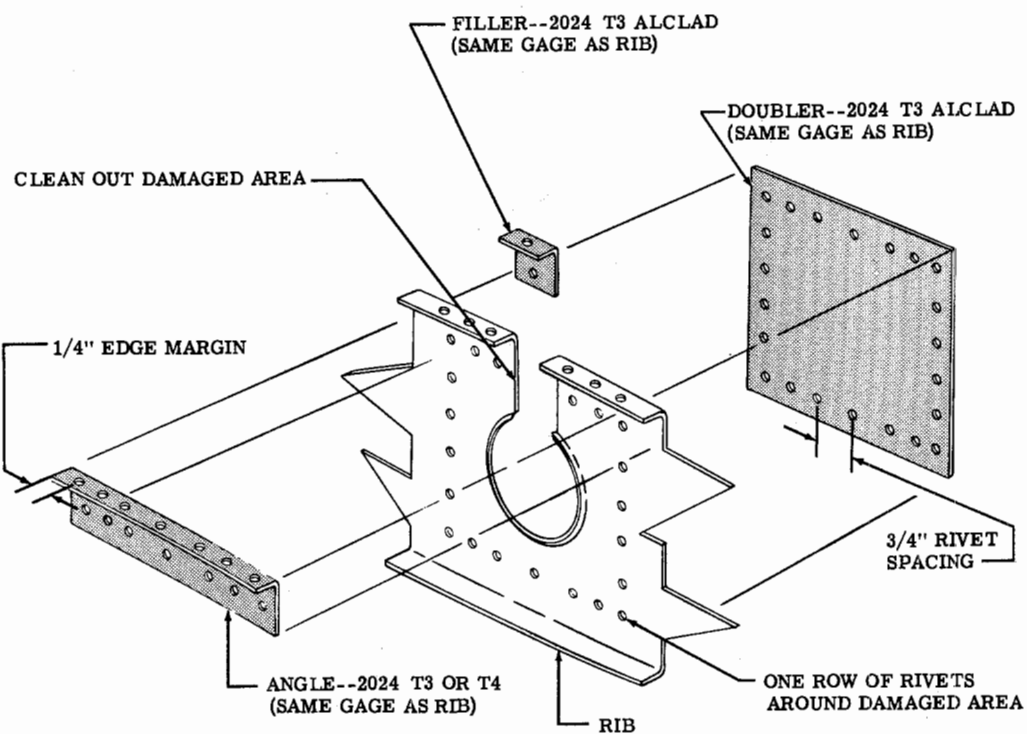


-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION

Typical Rib Web Repair
Figure 16

310

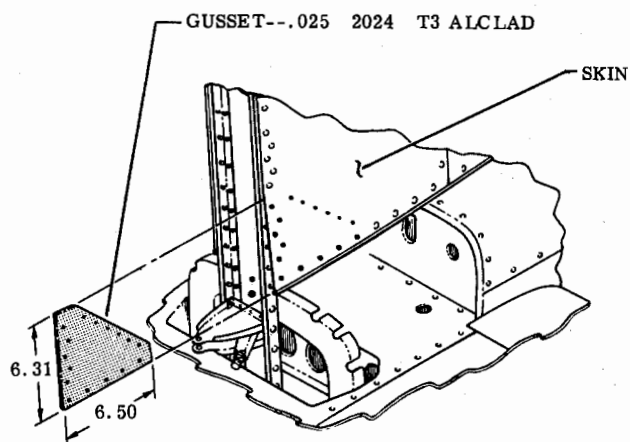
SERVICE MANUAL



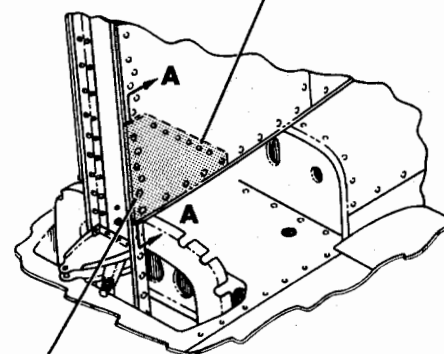
Typical Rib Flange Repair
Figure 17

310

SERVICE MANUAL



MS470AD3 RIVETS THROUGH
SKIN AND GUSSET ONLY



MS470AD4 RIVETS THROUGH
STRUCTURE, GUSSET AND SKIN

- ORIGINAL PARTS
- REPAIR PARTS
- REPAIR PARTS IN CROSS SECTION

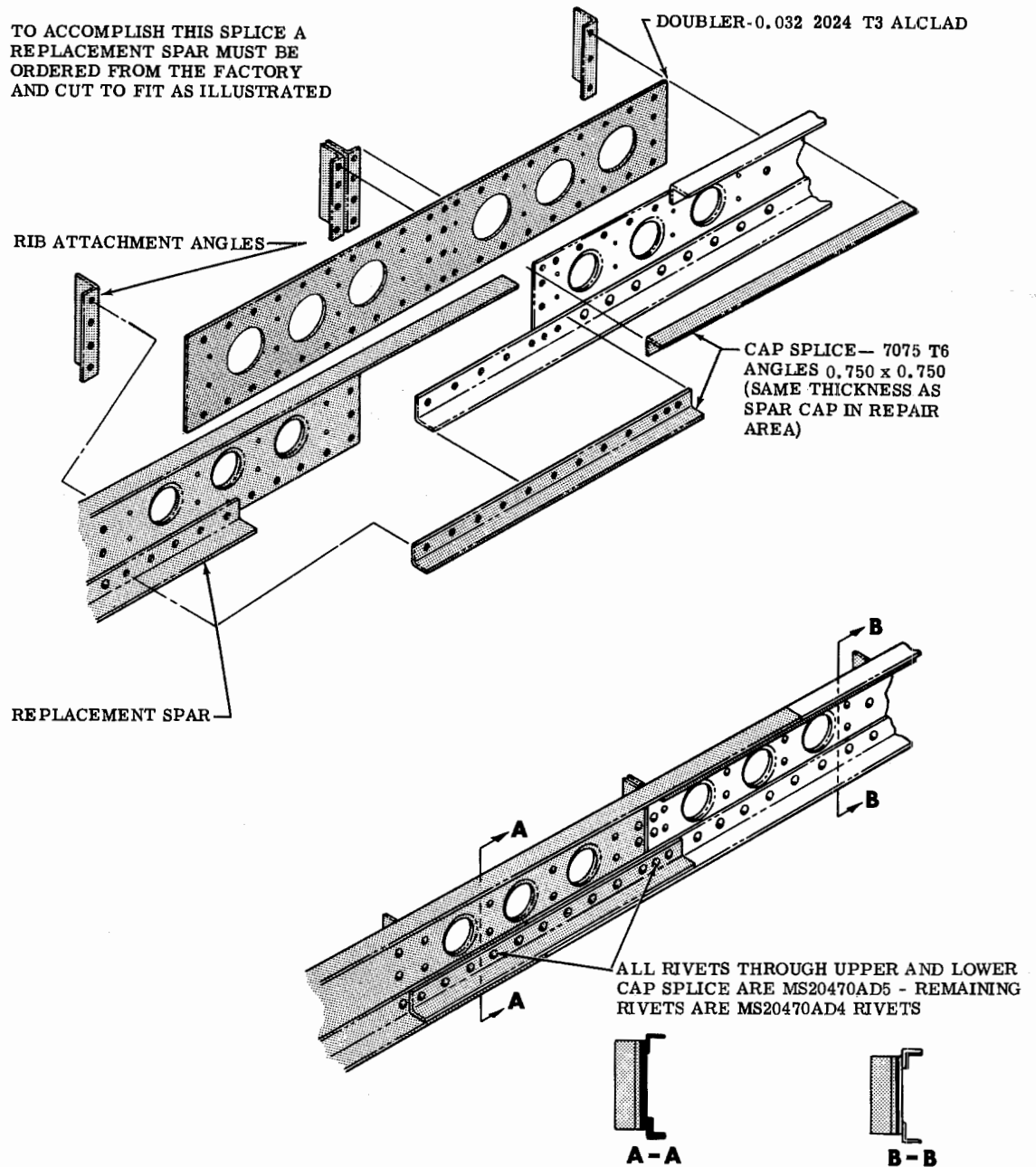
Typical Vertical Fin Repair
Figure 18

310

SERVICE MANUAL

NOTE

TO ACCOMPLISH THIS SPLICE A
REPLACEMENT SPAR MUST BE
ORDERED FROM THE FACTORY
AND CUT TO FIT AS ILLUSTRATED

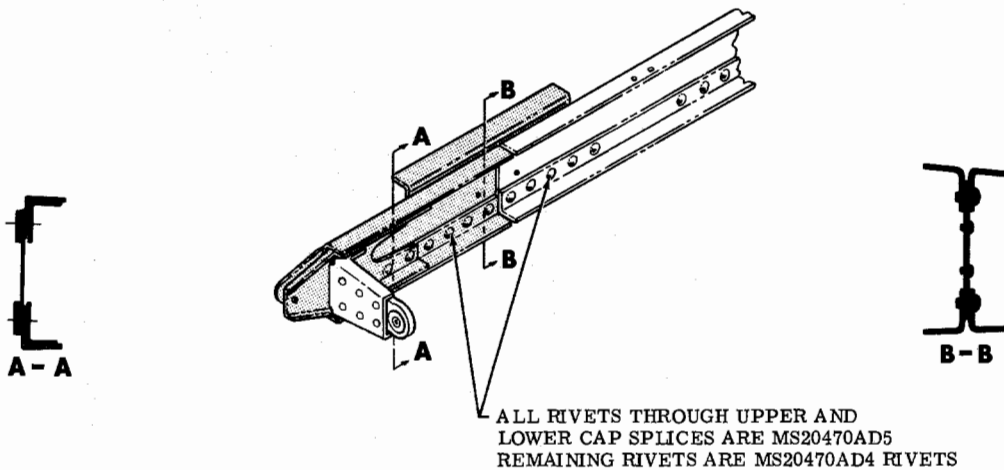
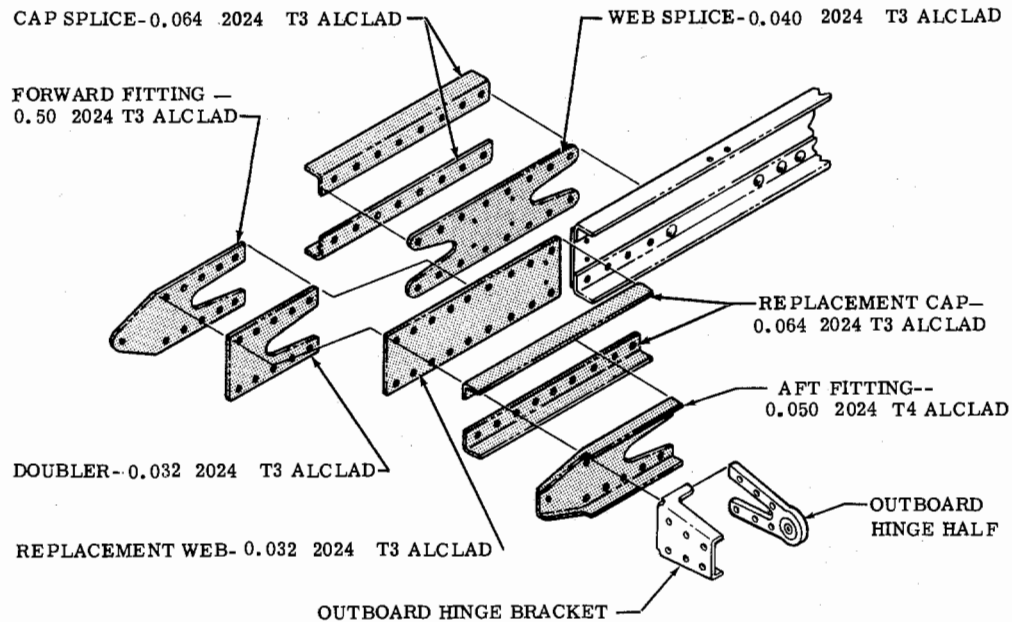


	ORIGINAL PARTS
	REPAIR PARTS
	REPAIR PARTS IN CROSS SECTION

Typical Rear Spar Repair (Station 111.12 and Outboard)
Figure 19

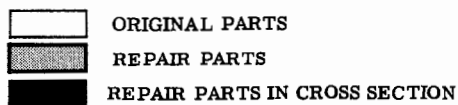
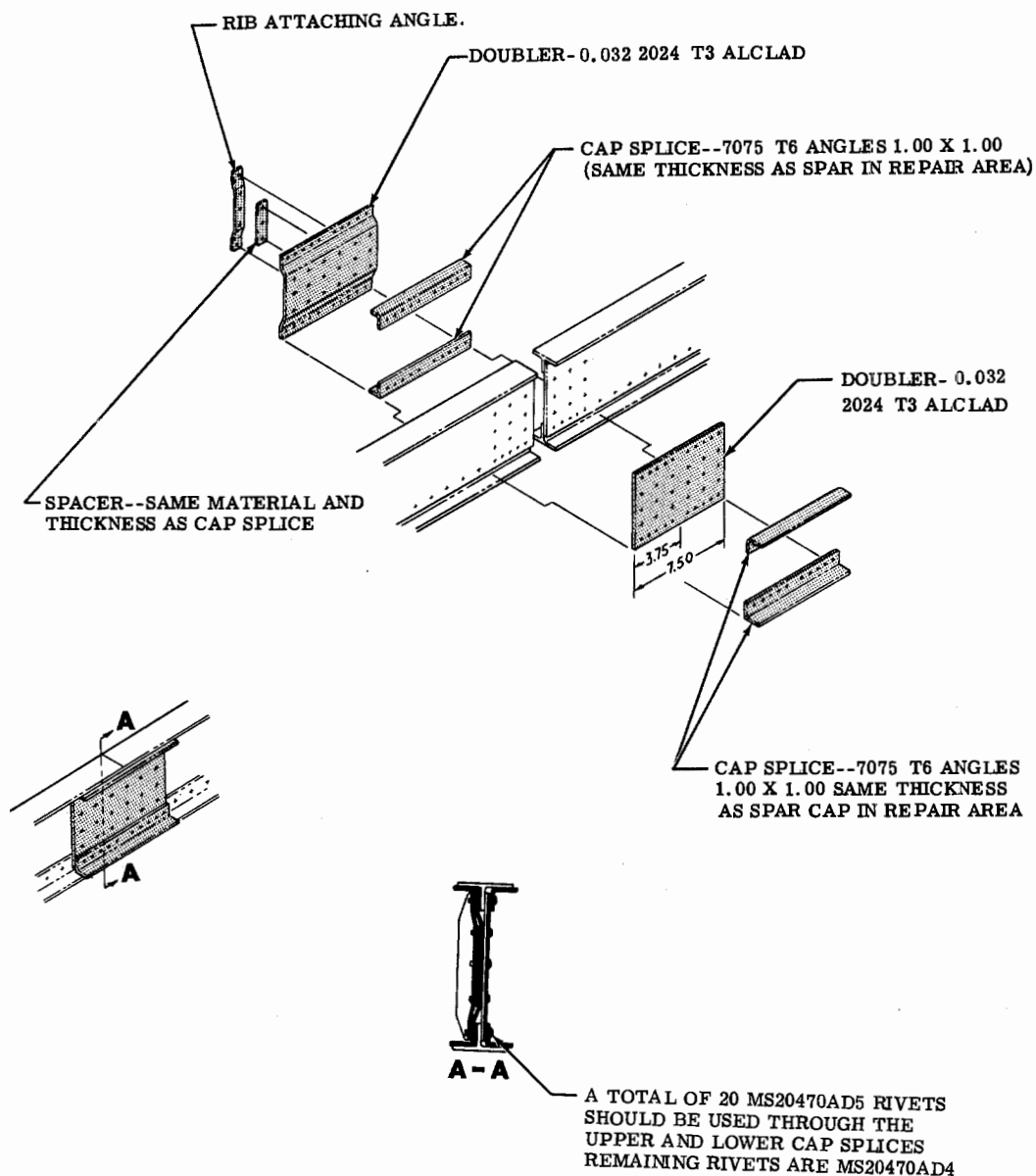
310

SERVICE MANUAL



-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION

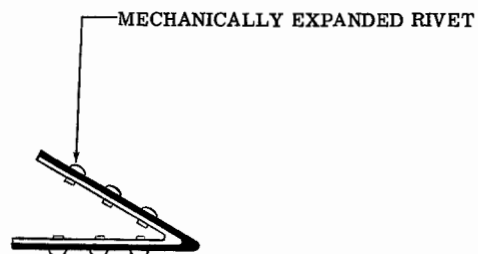
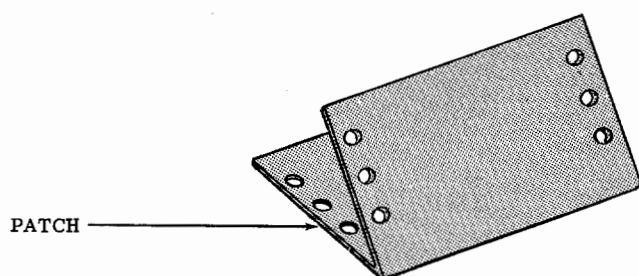
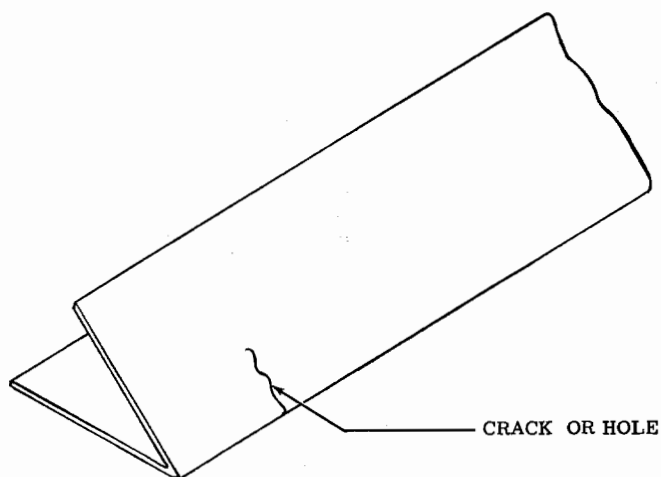
Typical Rear Spar Repair (Station 189.20 and Outboard)
Figure 20



Typical Front Spar Repair (Station 168.75 and Outboard)
Figure 21

310

SERVICE MANUAL

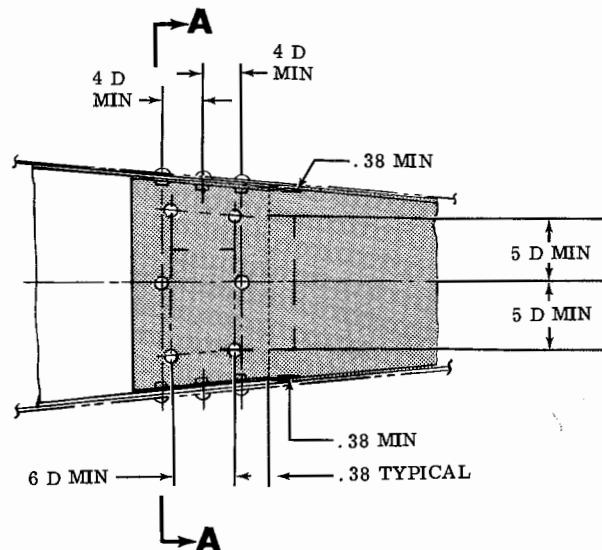
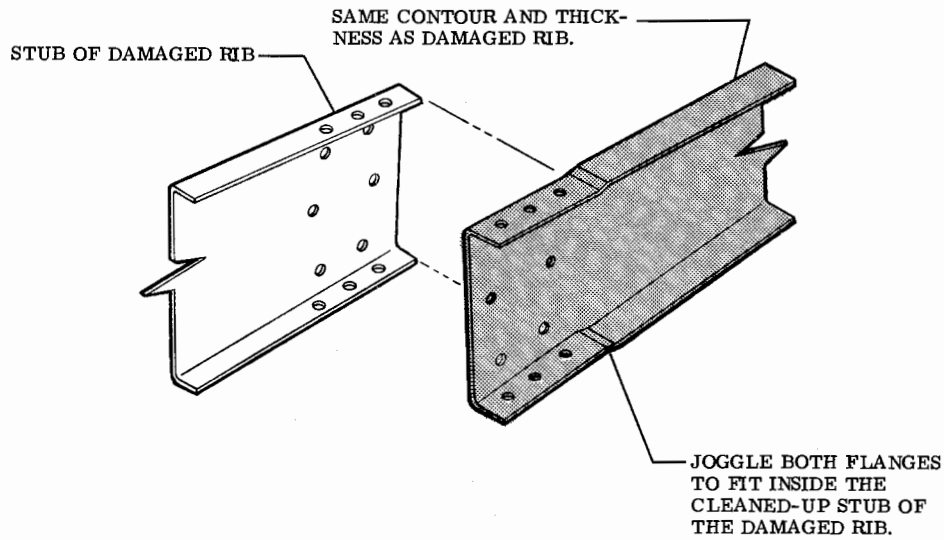


-  ORIGINAL PART
-  REPAIR PART
-  REPAIR PART IN CROSS SECTION

Typical Repair of Trailing Edge of a Control Surface
Figure 22

310

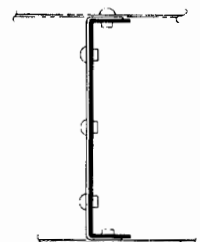
SERVICE MANUAL



NUMBER OF ROWS OF RIVETS IN WEB DEPENDS ON AREA AVAILABLE. SEE MINIMUM SPACING. MAXIMUM SPACING IS ONE INCH. RIVETS IN FLANGES MUST BE AS SHOWN.

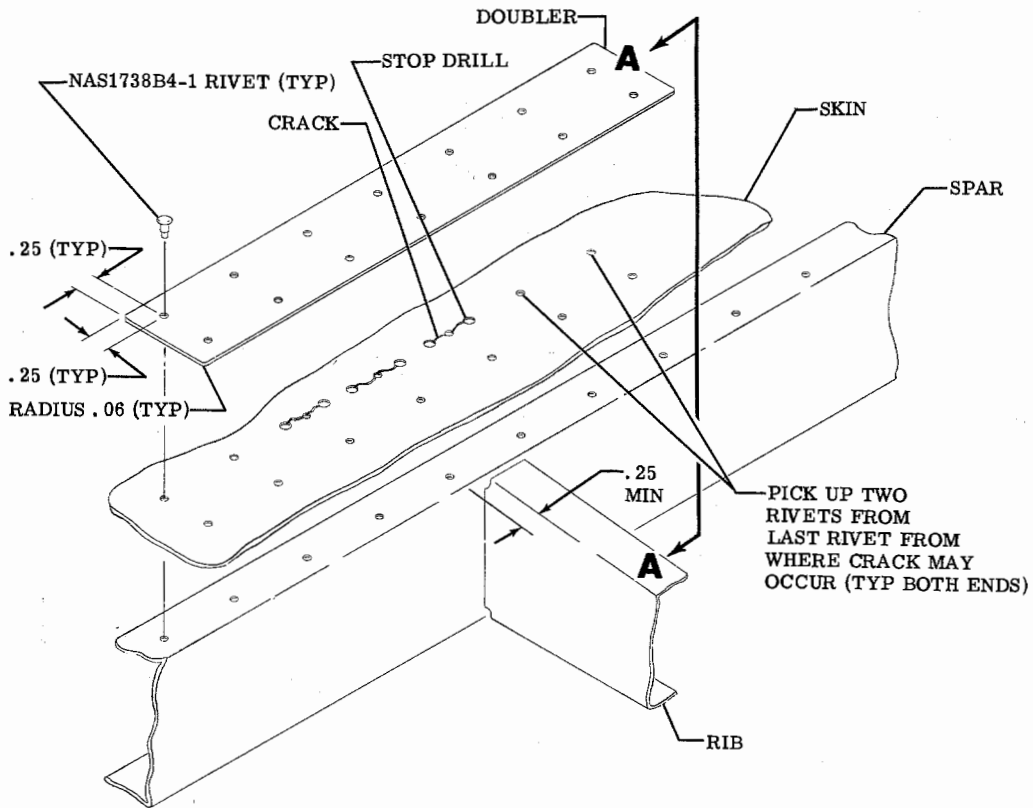
FOR RIB THICKNESS OF .032 OR LESS USE AD-3 RIVETS AND FOR THICKER MATERIAL USE AD-4.

-  ORIGINAL PARTS
-  REPAIR PARTS
-  REPAIR PARTS IN CROSS SECTION



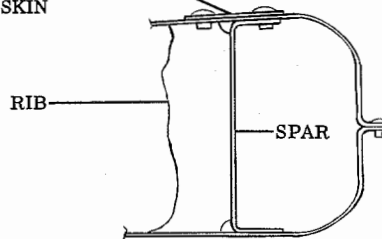
A-A

Typical Repair of Control Surface Rib
Figure 23



DOUBLER TO BE .016 x 1.25 x LENGTH—
AS REQUIRED 2024T3 ALCLAD
QQ-A-250/5. DOUBLER MAY BE
INSTALLED INSIDE OR OUTSIDE OF SKIN

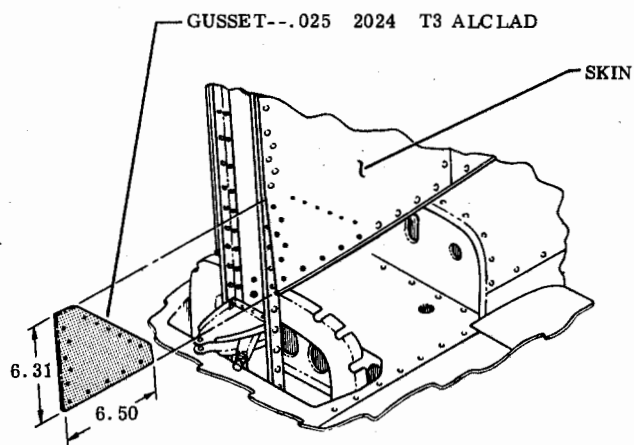
STOP DRILL BOTH ENDS OF CRACK WITH
.098 DIA. DRILL (THRU SKIN ONLY)



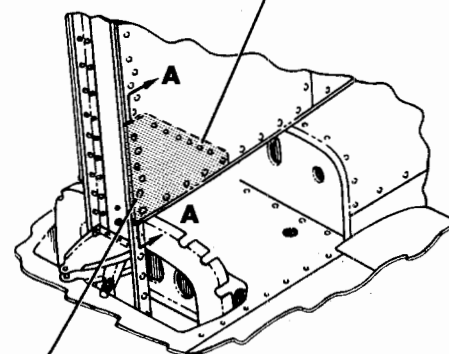
SECTION A-A

51342001

Typical Elevator Skin Repair
Figure 24



MS470AD3 RIVETS THROUGH
SKIN AND GUSSET ONLY



MS470AD4 RIVETS THROUGH
STRUCTURE, GUSSET AND SKIN

- ORIGINAL PARTS
- ▨ REPAIR PARTS
- REPAIR PARTS IN CROSS SECTION

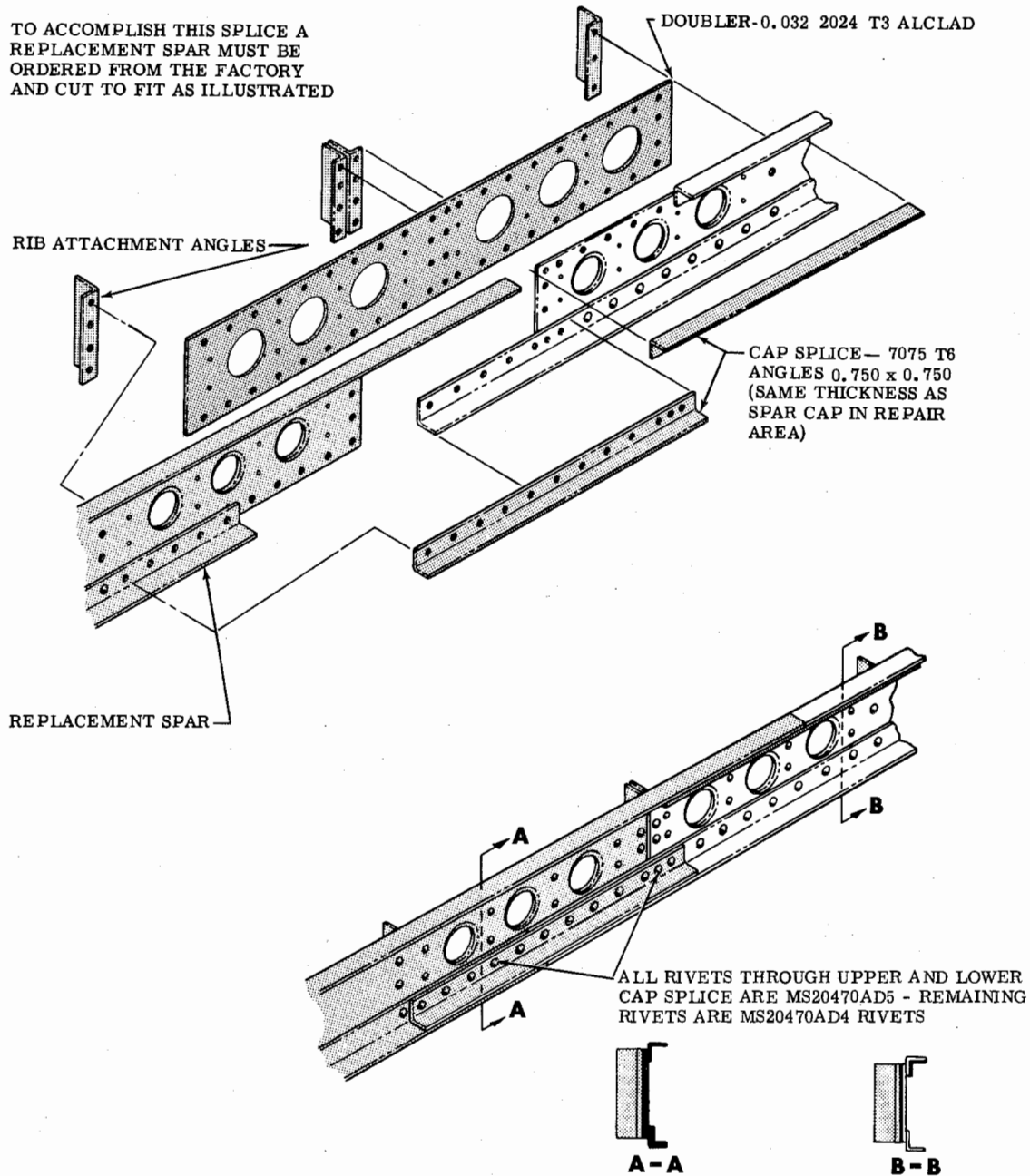
Typical Vertical Fin Repair
Figure 20

310

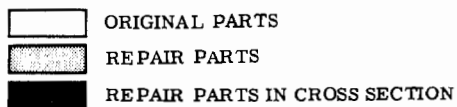
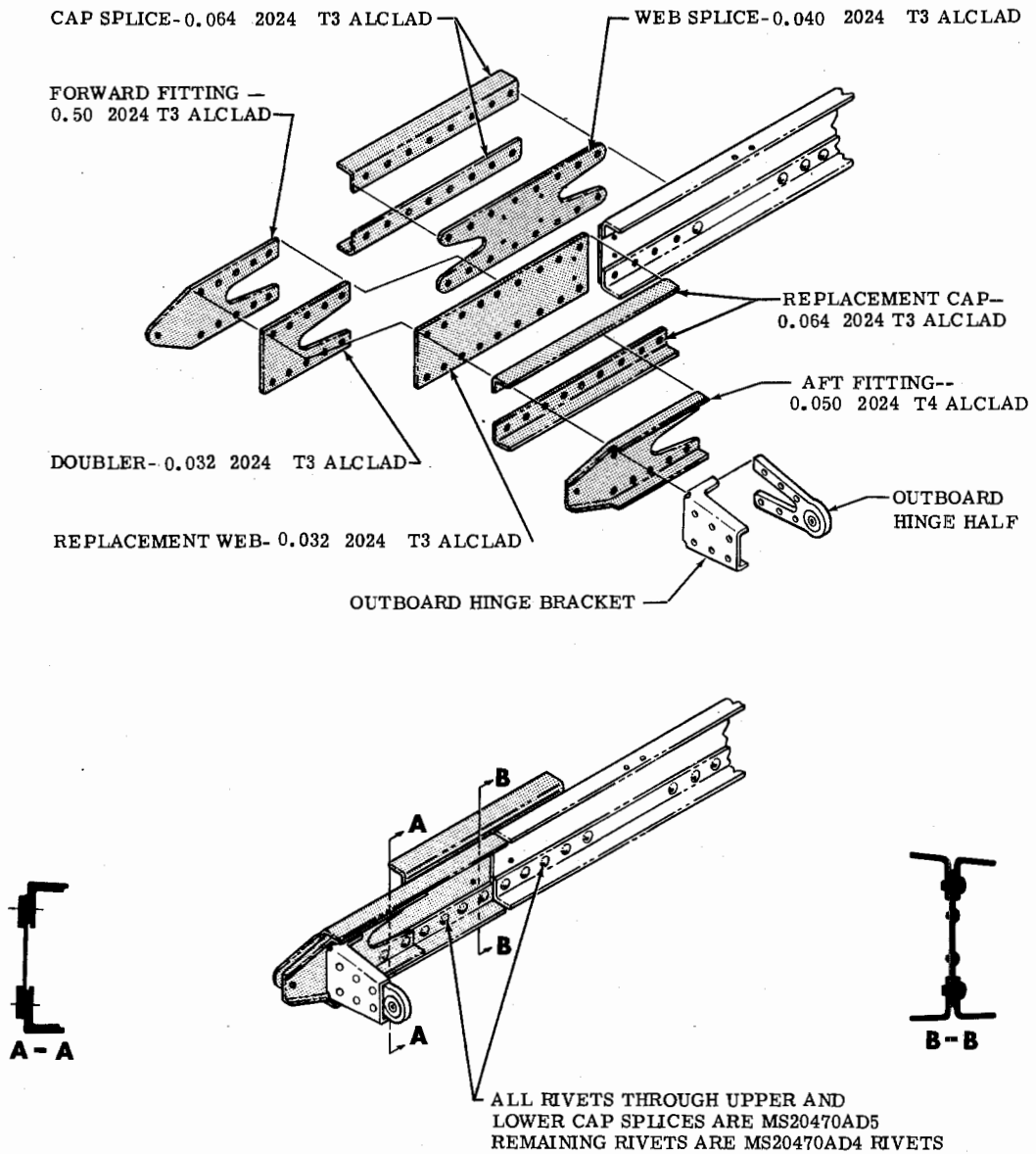
MAINTENANCE MANUAL

NOTE

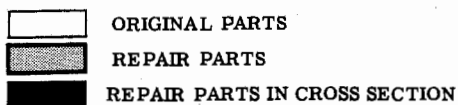
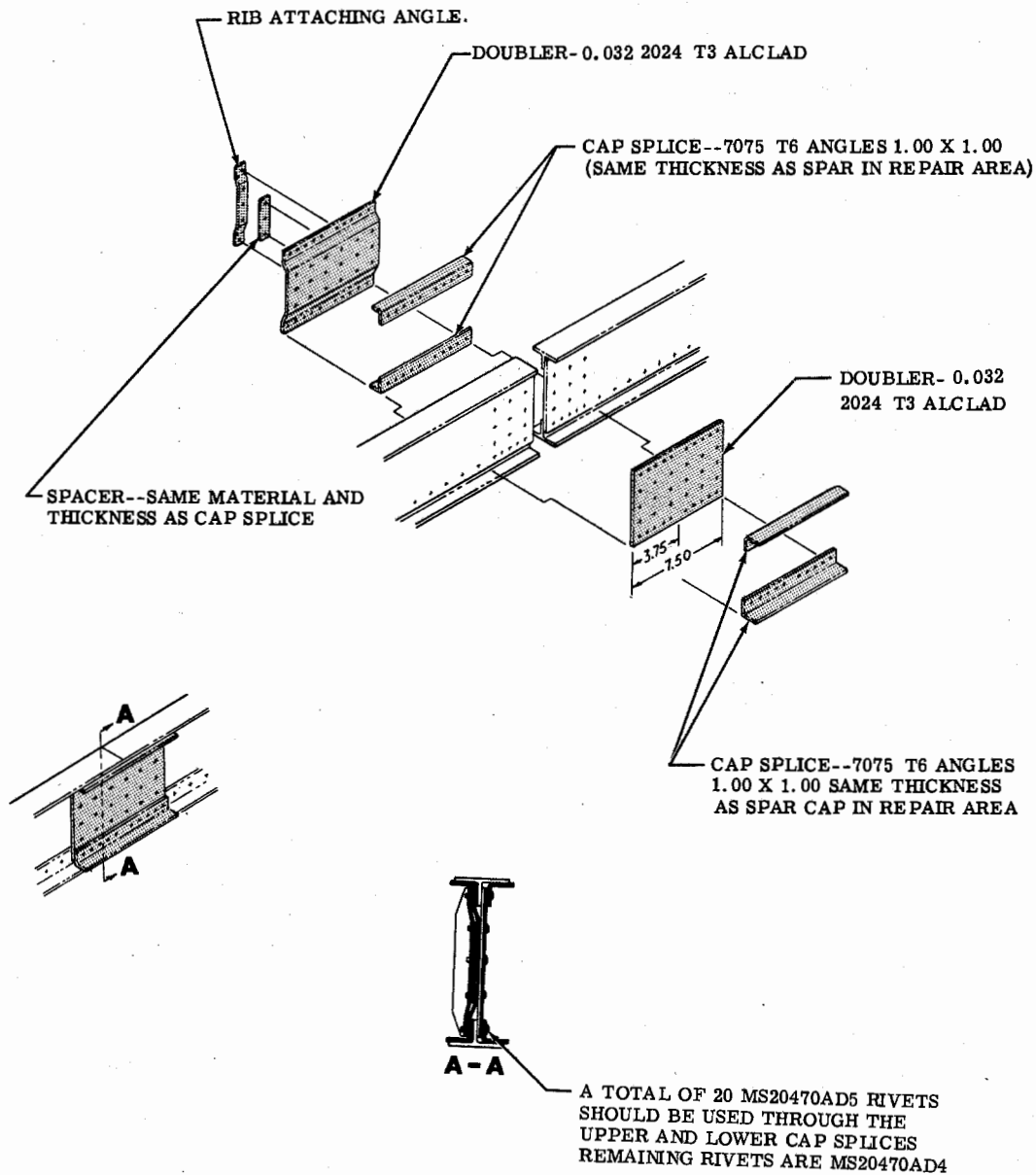
TO ACCOMPLISH THIS SPLICE A
REPLACEMENT SPAR MUST BE
ORDERED FROM THE FACTORY
AND CUT TO FIT AS ILLUSTRATED



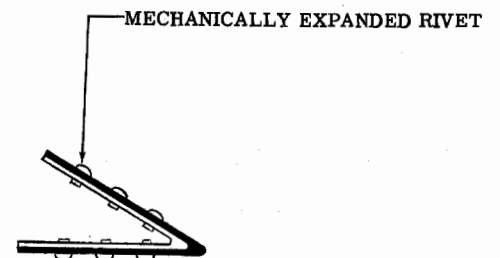
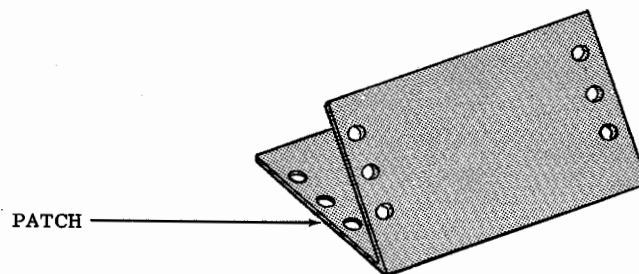
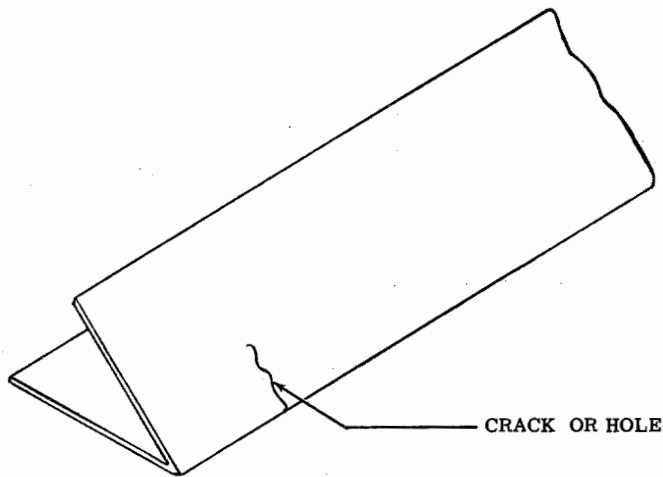
Typical Rear Spar Repair (Station 111.12 and Outboard)
Figure 21



Typical Rear Spar Repair (Station 189.20 and Outboard)
Figure 22



Typical Front Spar Repair (Station 168.75 and Outboard)
Figure 23

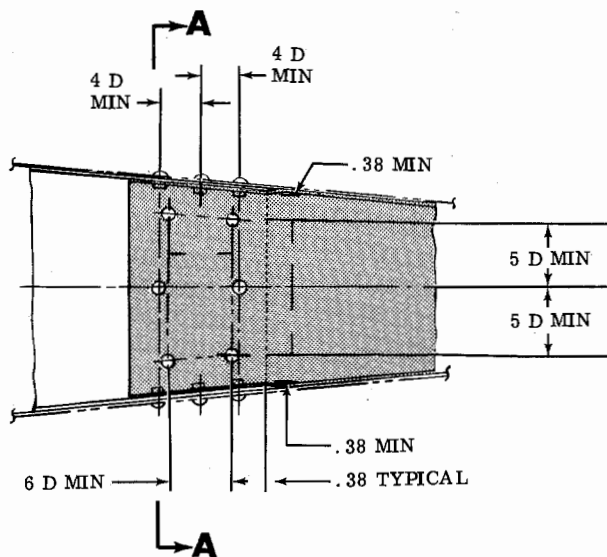
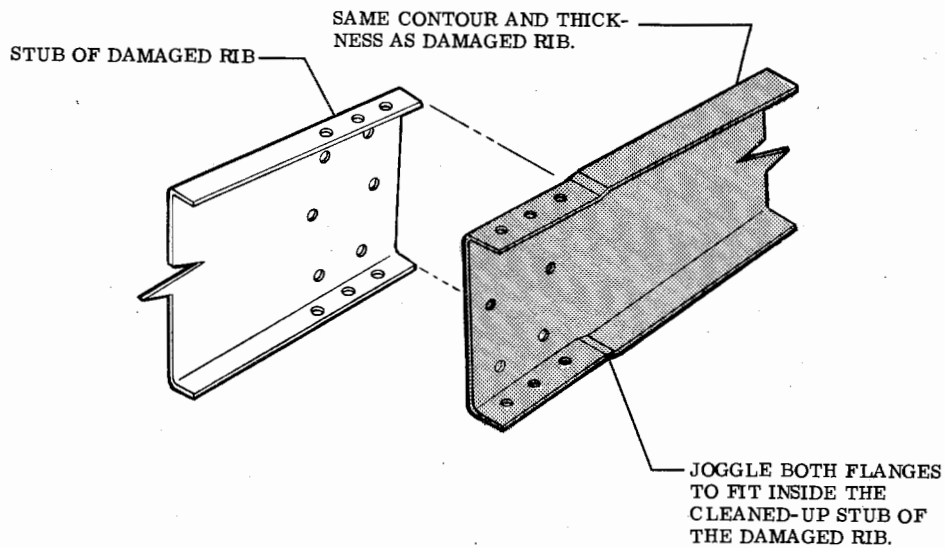


-  ORIGINAL PART
-  REPAIR PART
-  REPAIR PART IN CROSS SECTION

Typical Repair of Trailing Edge of a Control Surface
Figure 24

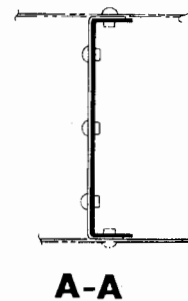
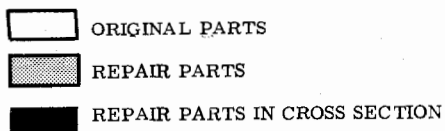
310

MAINTENANCE MANUAL



NUMBER OF ROWS OF RIVETS IN WEB DEPENDS ON AREA AVAILABLE. SEE MINIMUM SPACING. MAXIMUM SPACING IS ONE INCH. RIVETS IN FLANGES MUST BE AS SHOWN.

FOR RIB THICKNESS OF .032 OR LESS USE AD-3 RIVETS AND FOR THICKER MATERIAL USE AD-4.



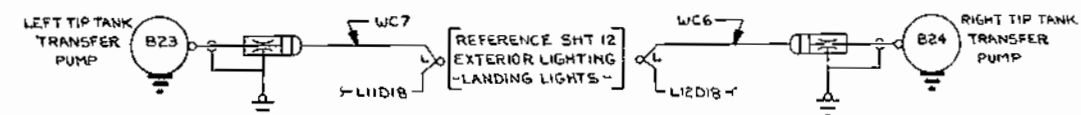
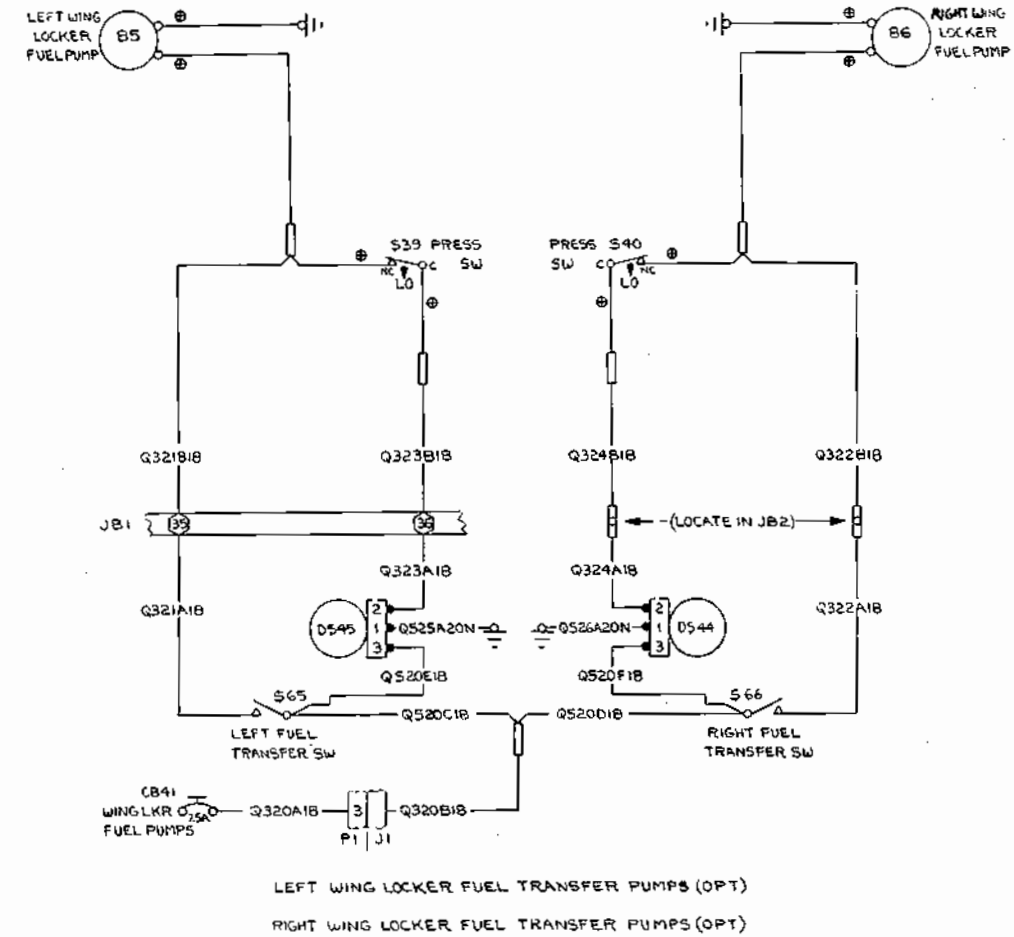
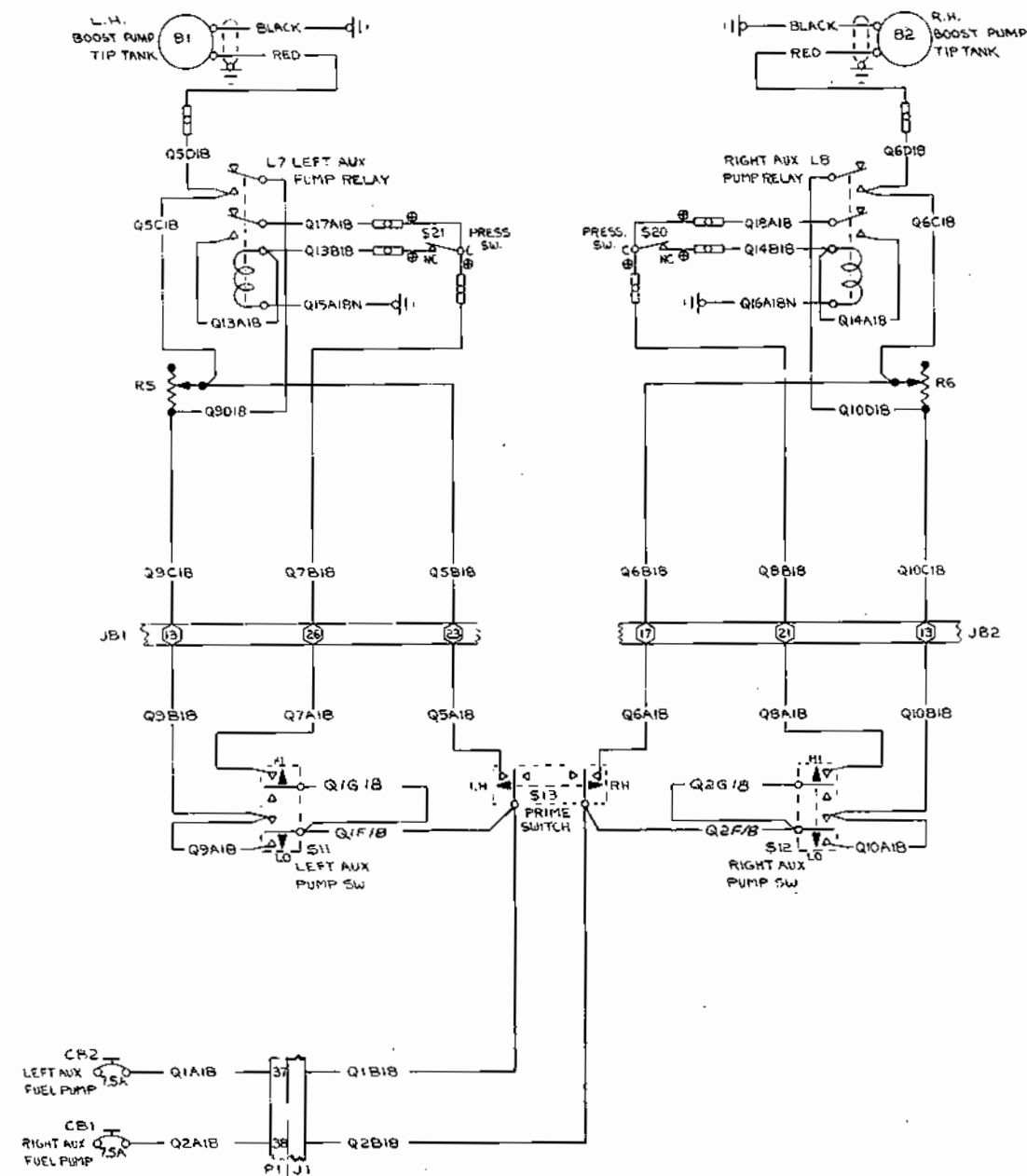
Typical Repair of Control Surface Rib
Figure 25

310

Cessna.		AIRCRAFT CO.		P.O. BOX 1877 MILITARY & TRAVEL DIVISION WICHITA, KANSAS 67201	
TITLE					
INTERIOR LIGHTING ~ (OPT)					
SIZE		CONFIG/IDENT NO		DRAWING NO	
D 71379				0808080	
SCALE		NONE		REV	
				G	
				SHEET 100 OF 100	

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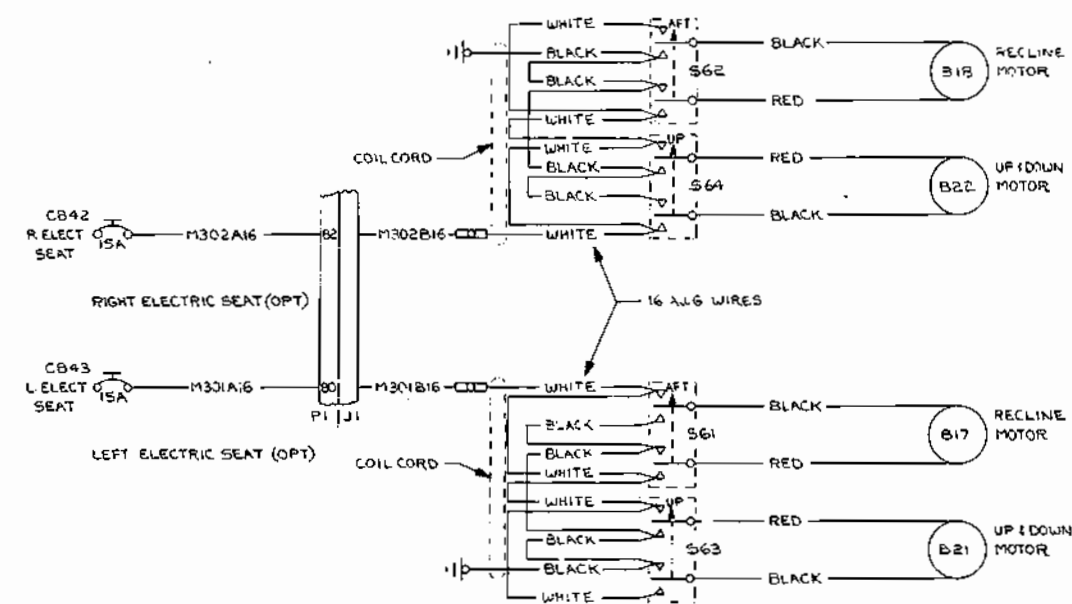
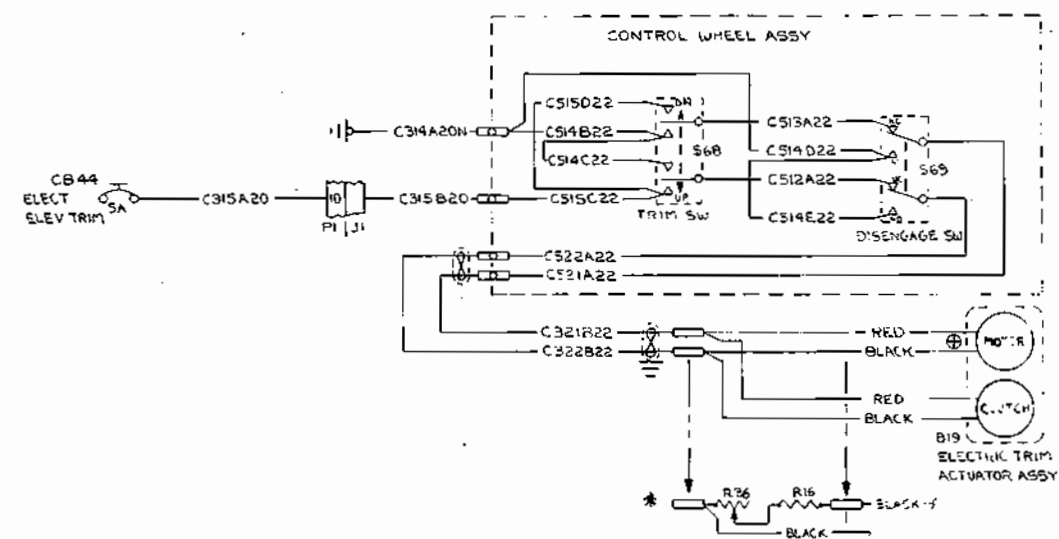
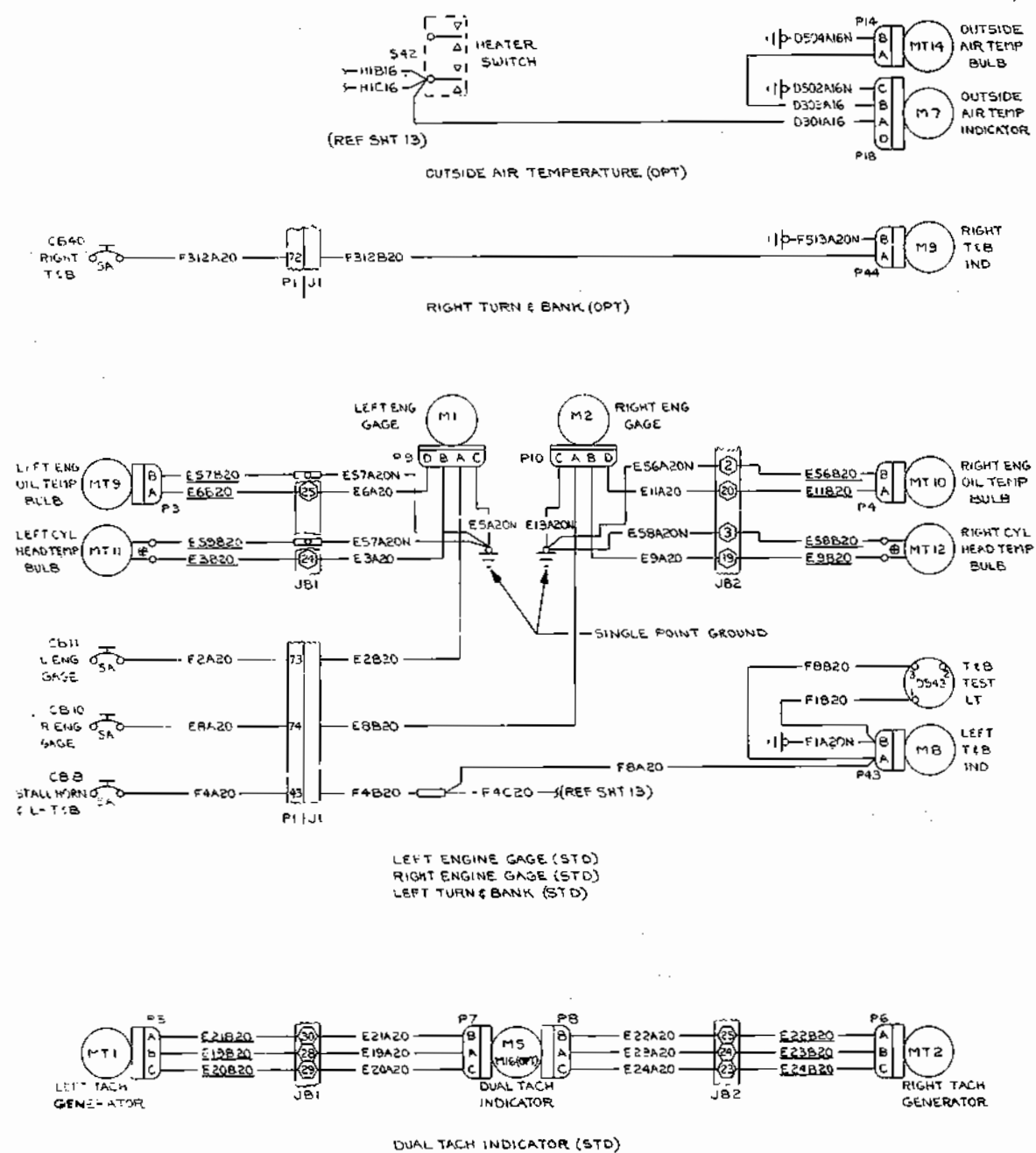
MAINTENANCE MANUAL



Cessna		AIRCRAFT CO.		P.O. BOX 1877 MILWAUKEE, WISCONSIN 53218	
TITLE FUEL PUMPS ~ STD & OPT					
SIZE D	CODE IDENT NO 71379	DRAWING NO C808080			
SCALE NONE	REF	G	SHEET 9 OF 16		

310

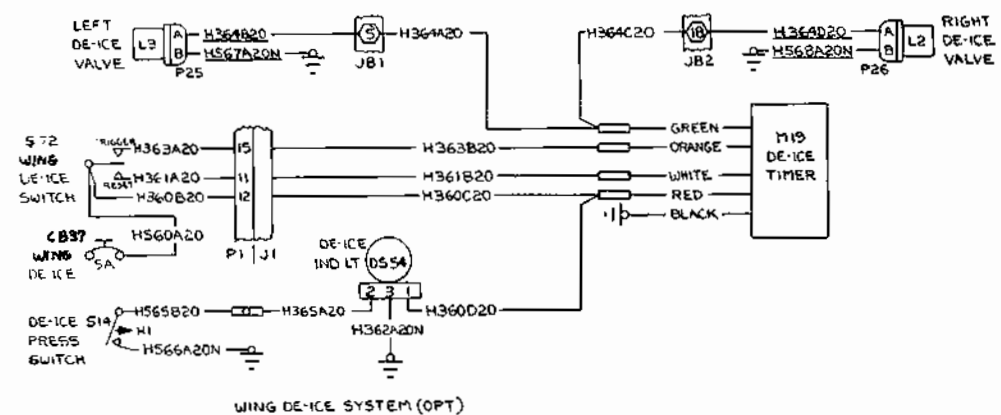
Cessna.		AIRCRAFT CO.	P. O. BOX 1897 MILITARY & TWIN CISION WICHITA, KANSAS 67201
TITLE LANDING GEAR			
SIZE D	CODE IDENT NO 71379	DRAWING NO. 0808080	
SCALE NONE	REF	G	INSET 7 OF 16



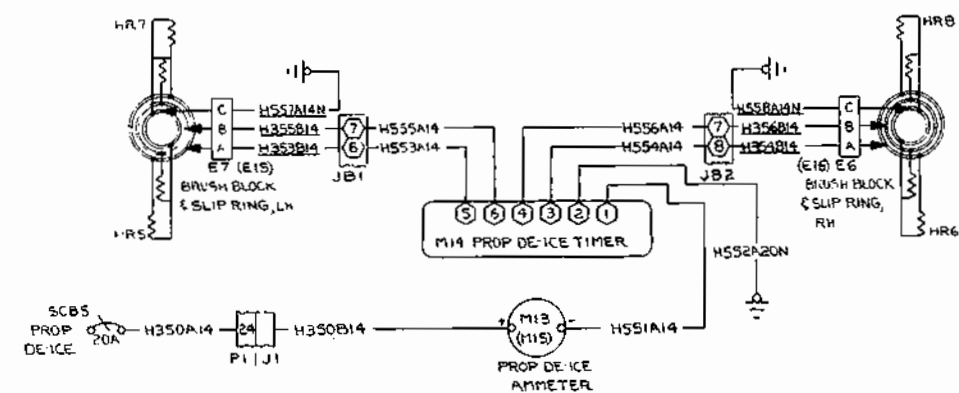
Cessna		AIRCRAFT CO.		P.O. BOX 1877 MILWAUKEE, WISCONSIN 53218	
TACH GEN, ENGINE INSTR, T&B (LH & RH), OAT, ELECT TRIM & ELECT SEAT (LH & RH)					
REV	CODE IDENT NO.	DRAWING NO.			
D	71379	0808C80			
SCALE	NONE	REF	G	SHEET 8 OF 16	

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SERVICE MANUAL

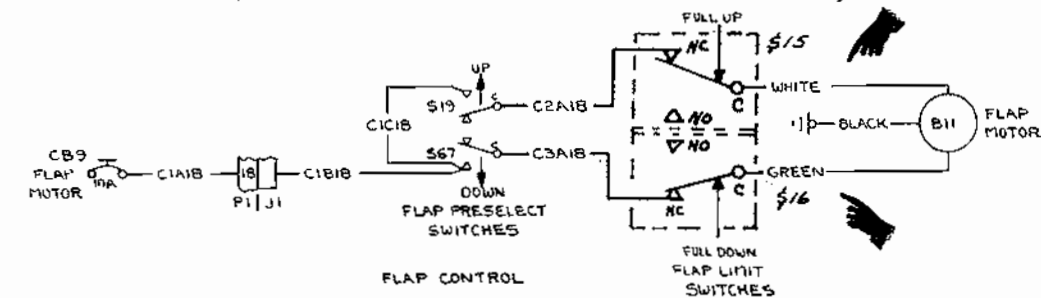


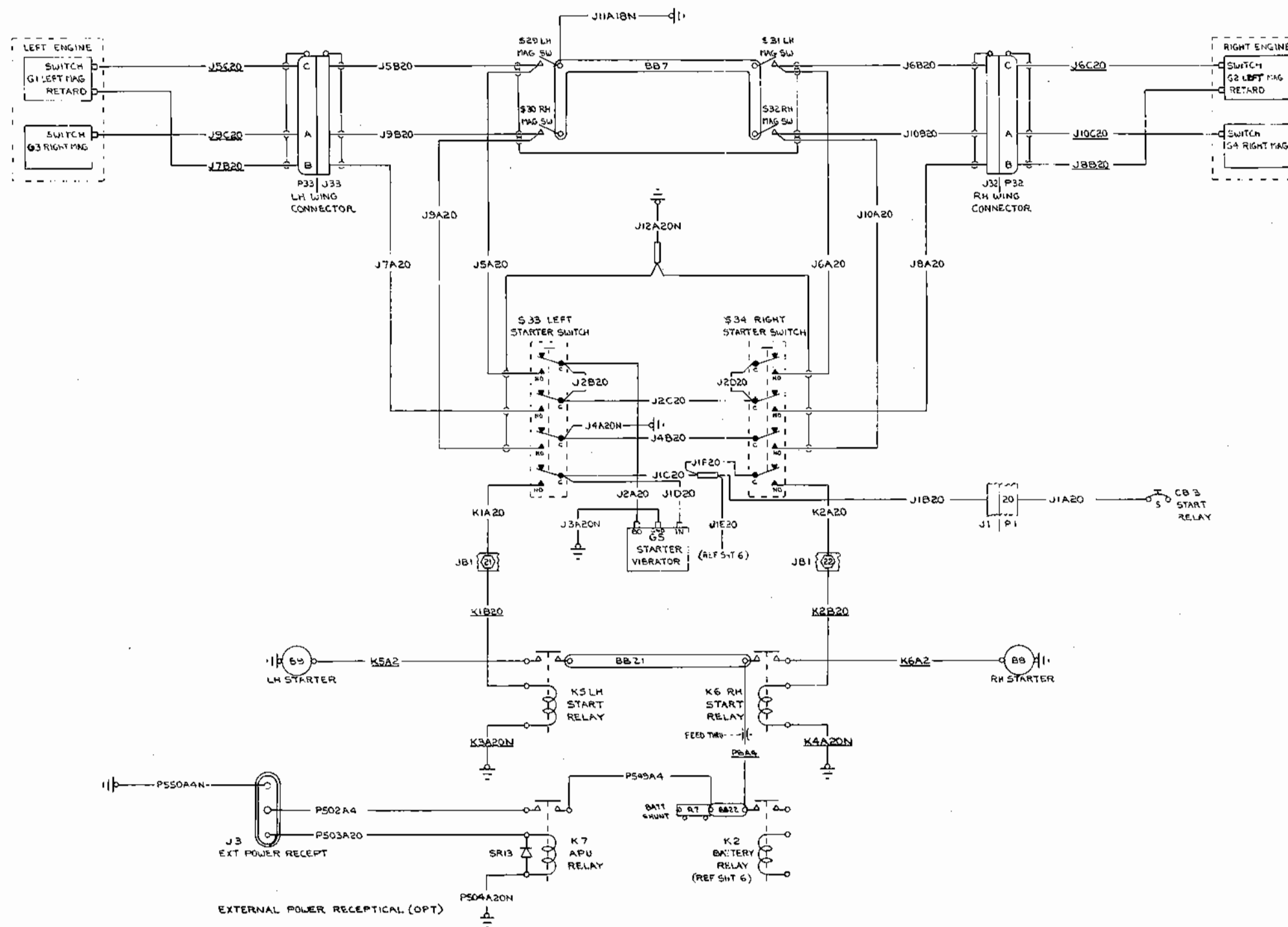
WING DE-ICE SYSTEM (OPT)



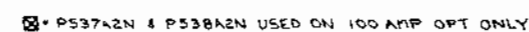
PROPELLER DE-ICE SYSTEM (OPT)

(ADD HR9 TO LH SLIP RING, HR10 TO RH SLIP RING FOR 3-BLADE PROPS)

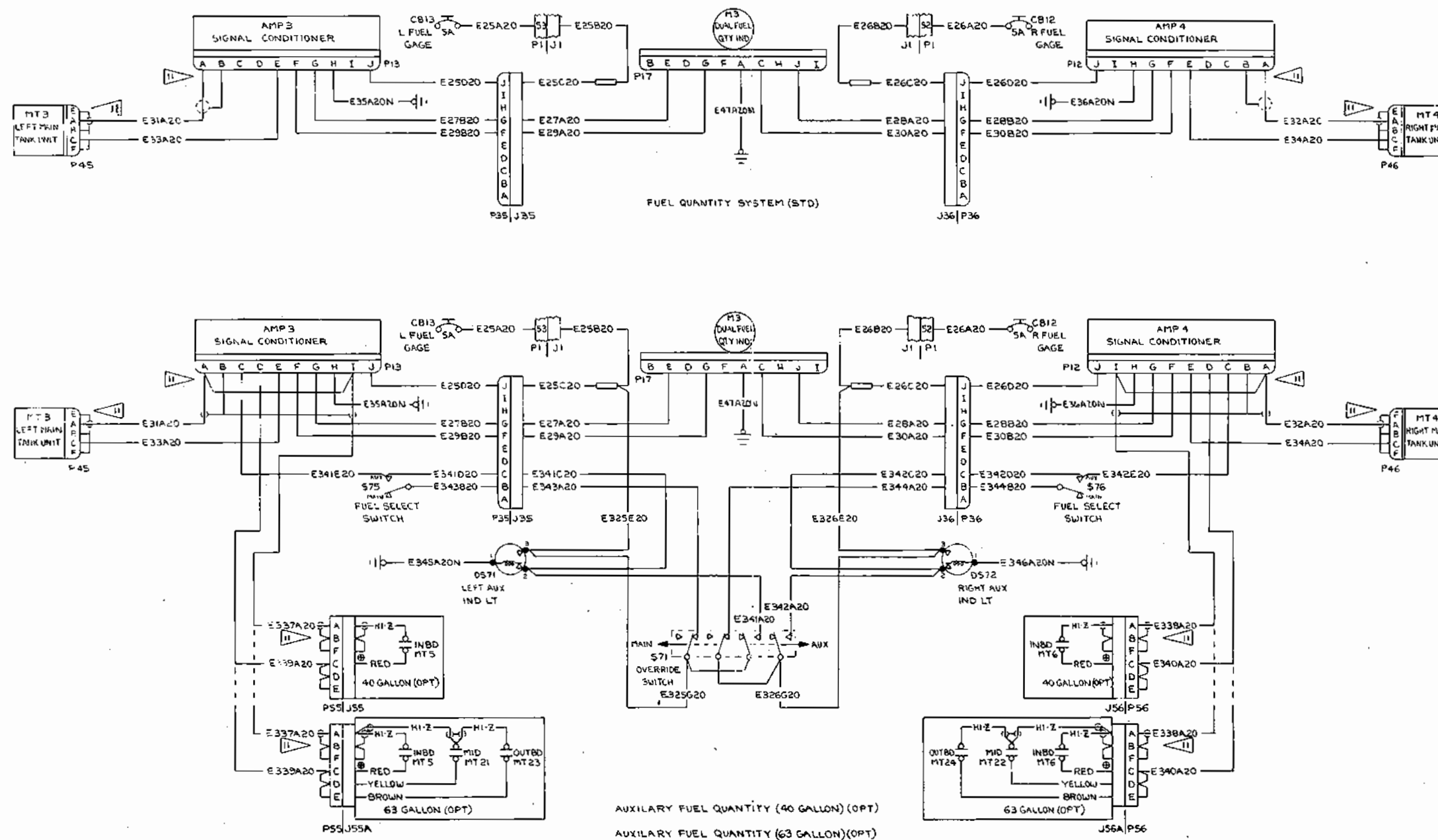




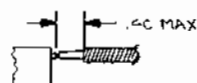
Cessna		AIRCRAFT CO.		P.O. BOX 1977 MILITARY & TWIN DIVISION WICHITA, KANSAS 67201	
TITLE STARTER, IGNITION & APU (OPT)					
SHEET	CODE/IDENT NO	DRAWING NO			
D	71379	0808080			
SCALE	NONE	REF	G	SHEET 5 OF 16	



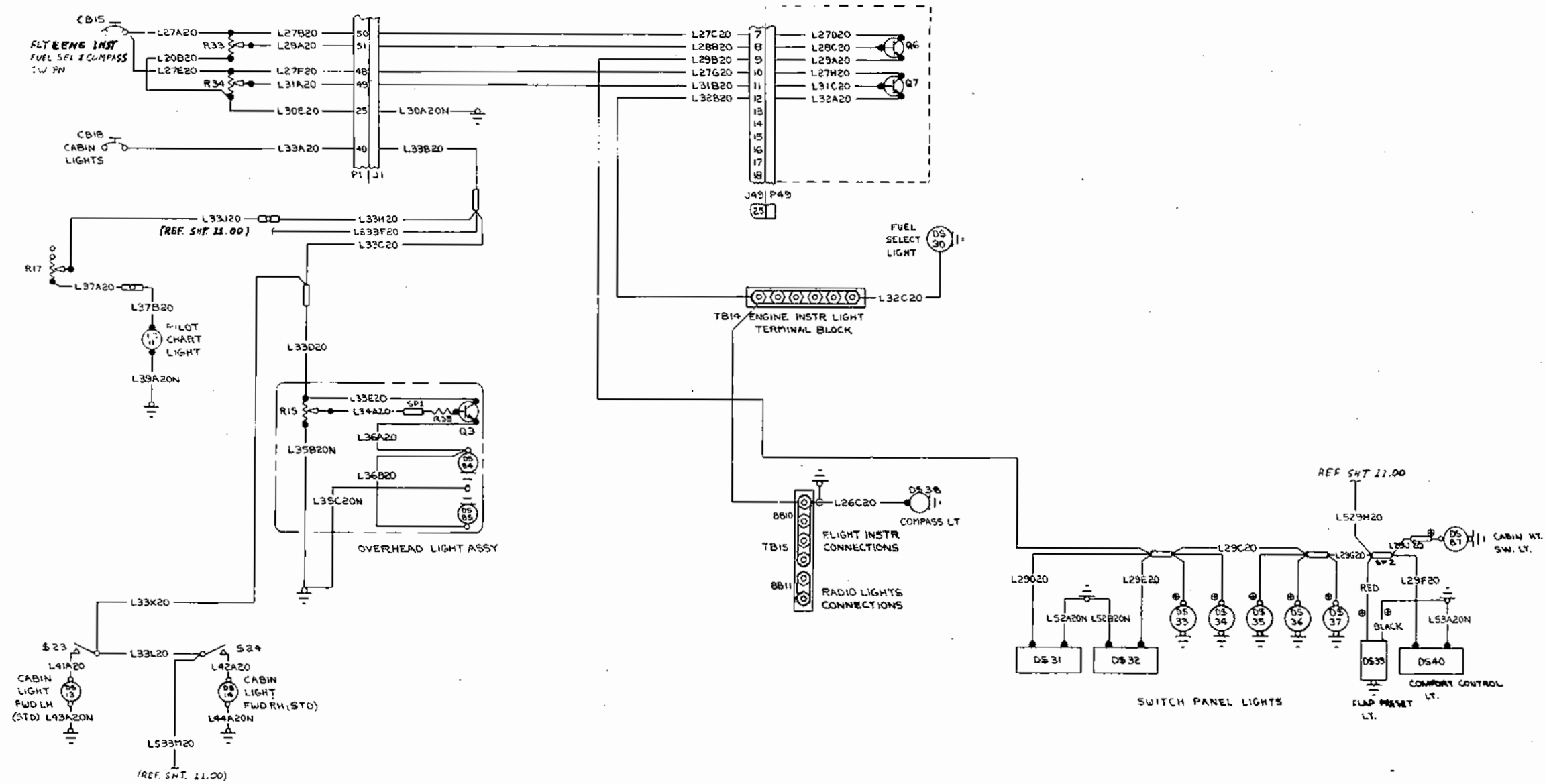
13-80
Page 17
Oct/74



ALL HI-Z SHIELDS SHOULD TERMINATE AT LESS THAN .40 IN. FROM AFT END OF HI-Z PIN (AS SHOWN). ALL HI-Z JUMPER WIRES SHOULD REMAIN INSIDE THE AFT PLUG HOUSING, BUT THE SHIELD JUMPERS MAY BE LOOPED EXTERNALLY

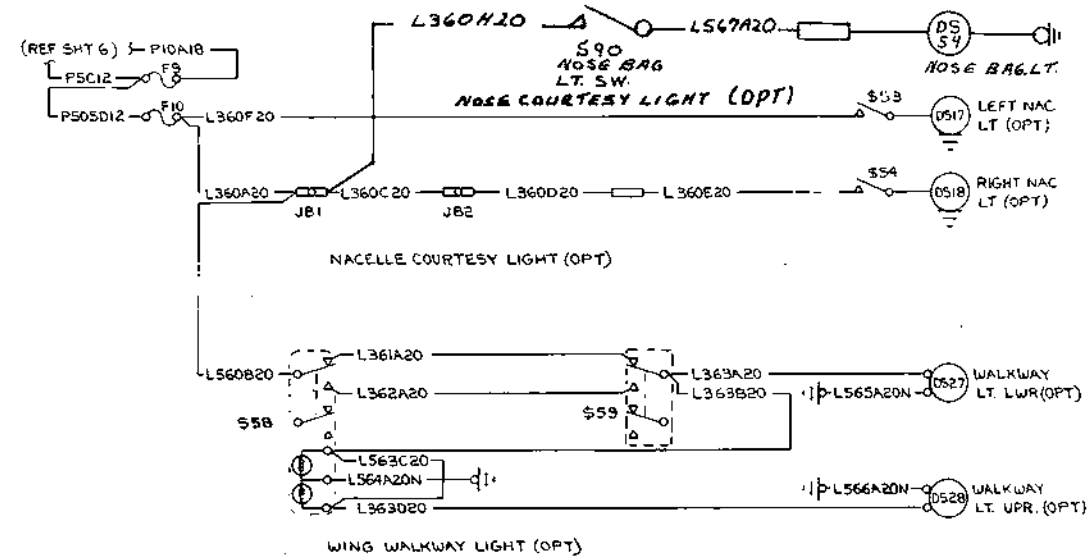
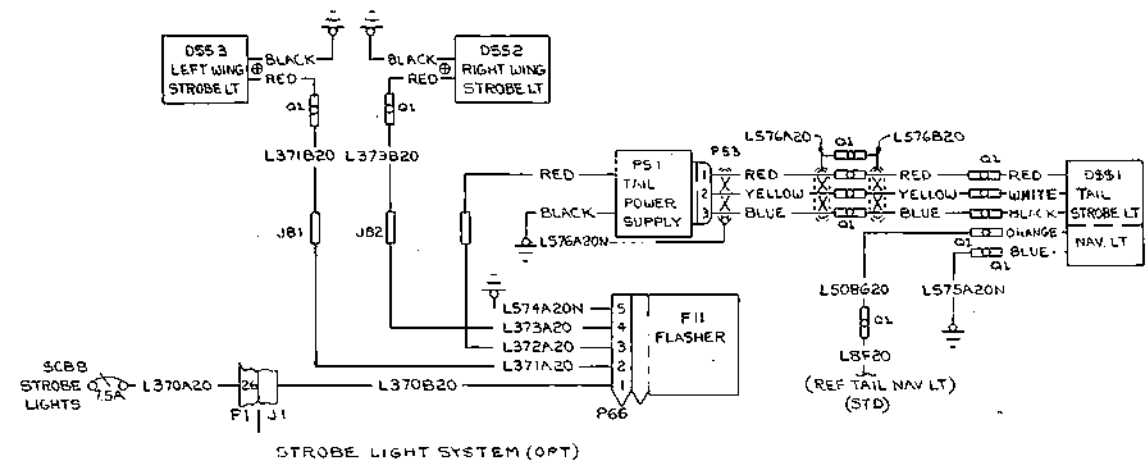


Cessna		AIRCRAFT CO.		P.O. BOX 1877 MILWAUKEE, WISCONSIN 53218	
FUEL QUANTITY SYSTEM - STD & OPT (CAPACITANCE)					
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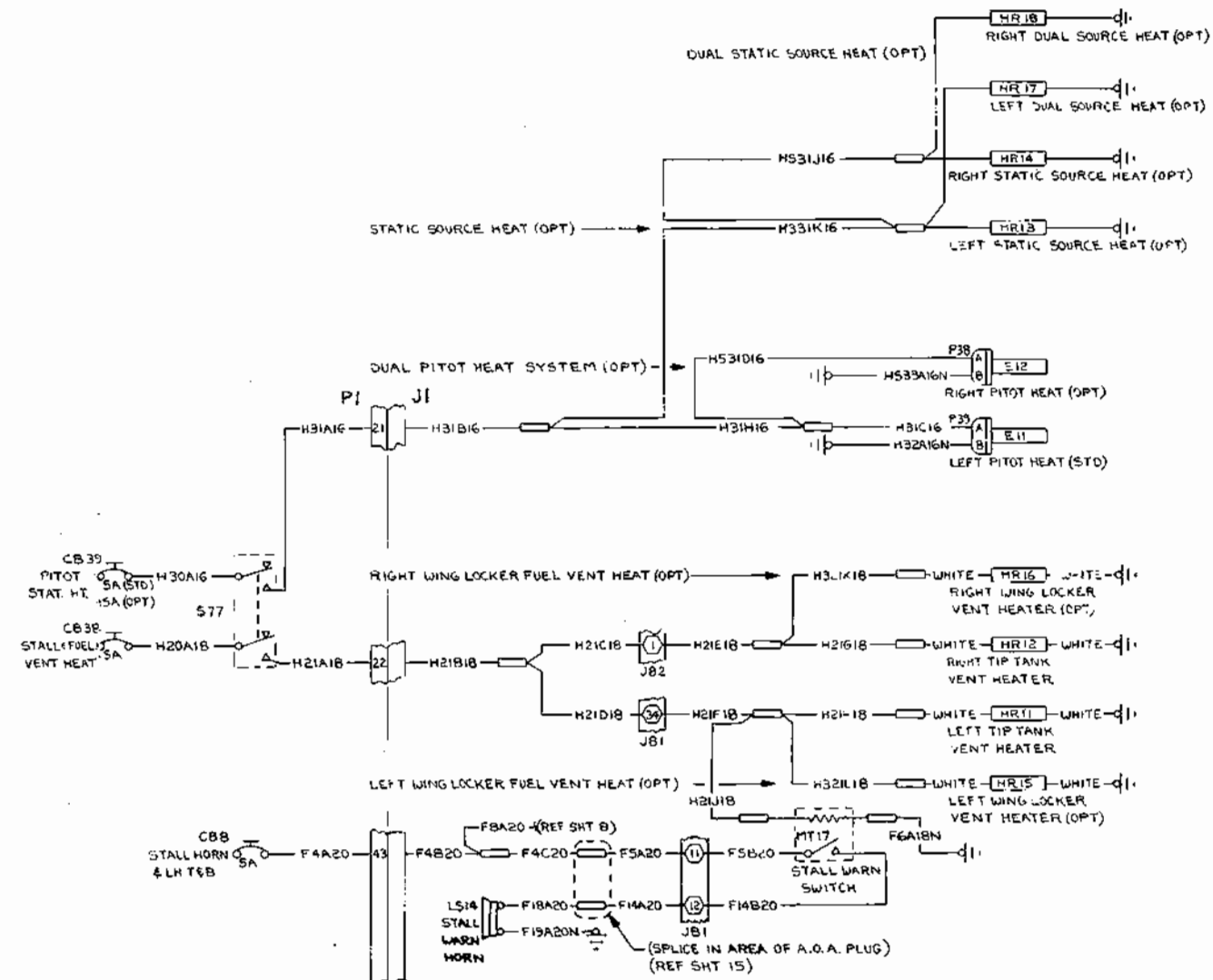
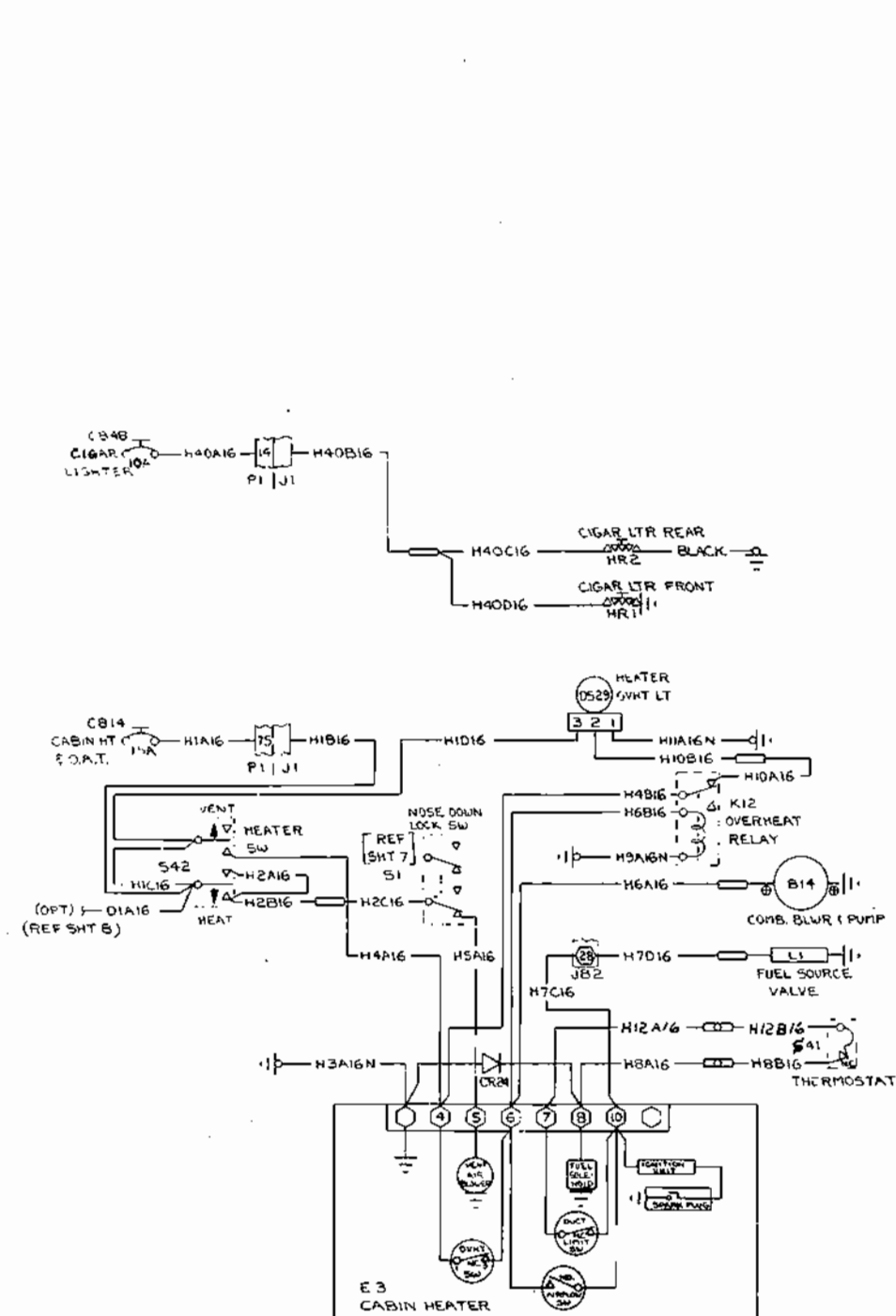


Cessna		AIRCRAFT CO.		P.O. BOX 1873 WICHITA, KANSAS 67201	
TITLE: INTERIOR LIGHTING - STD					
SIZE: D	CODE IDENT NO: 71379	DRAWING NO: 0808080			
SCALE: NONE	REP: 6	SHEET 11 OF 16.02			

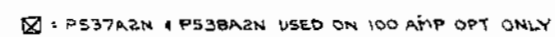
MAINTENANCE MANUAL



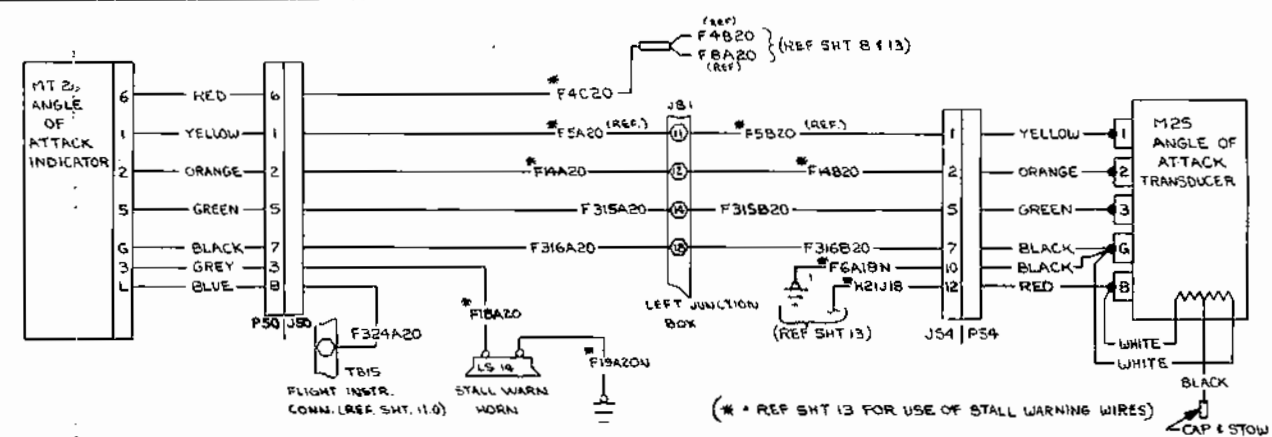
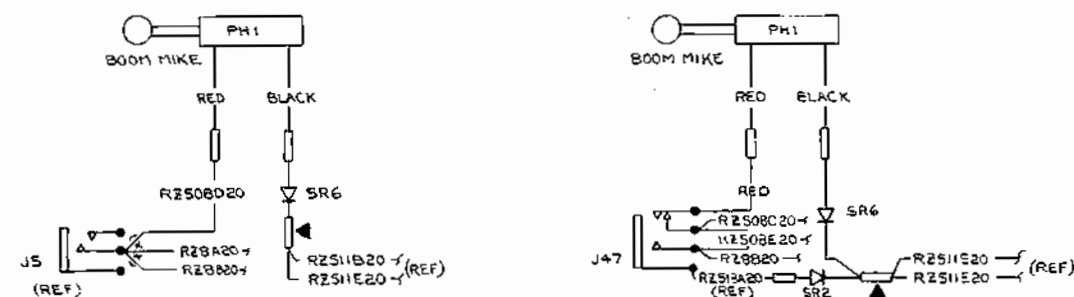
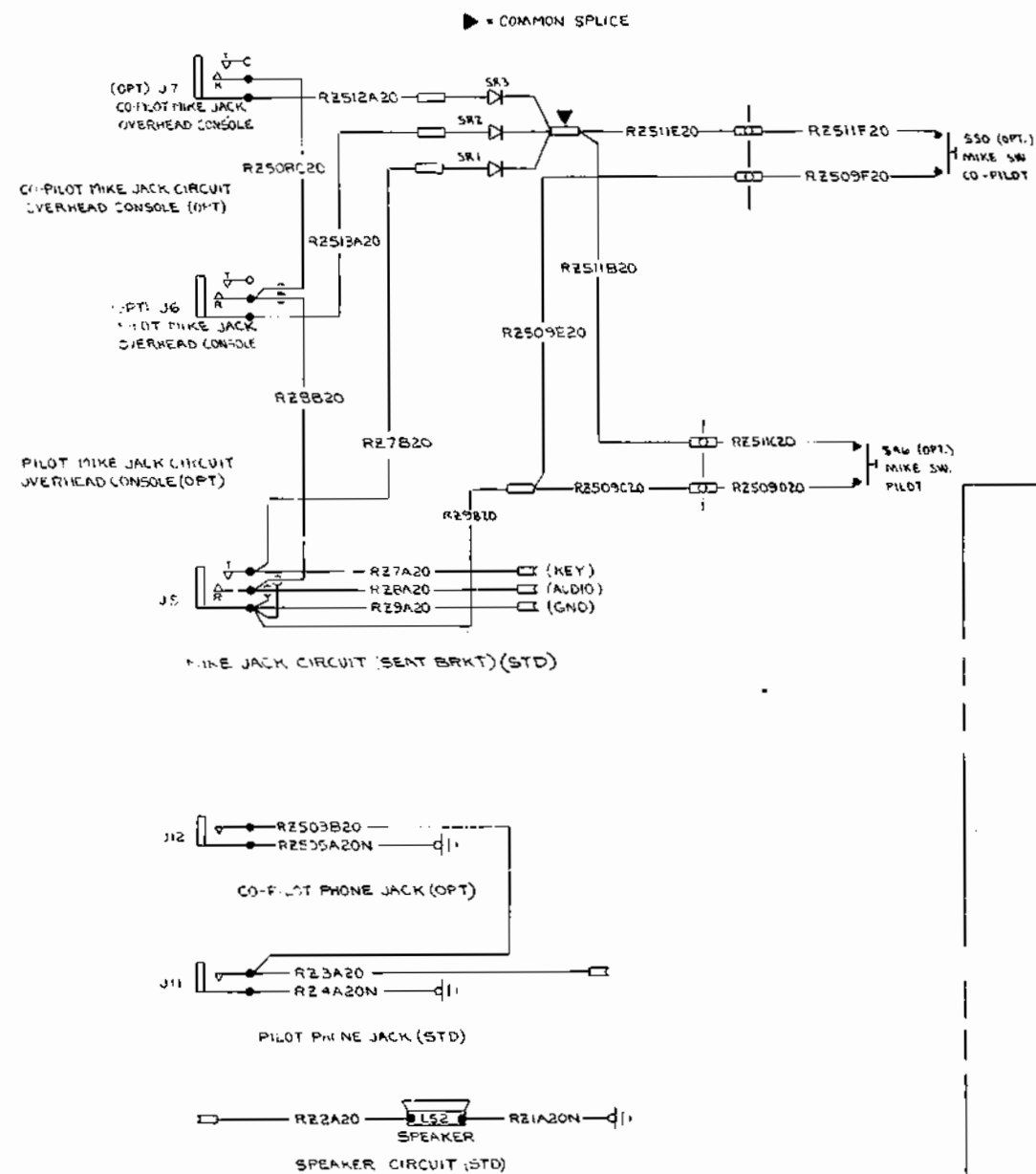
Cessna.		AIRCRAFT CO.		P. O. BOX 1077 MILITARY & TRIM DIVISION WICHITA, KANSAS 67201	
TITLE EXTERIOR LIGHTING ~ STD & OPT					
SHEET D	COORDINANT NO. 71379	DRAWING NO. 0808080			
SCALE NONE	REF G	SHEET 12 OF 16			



Cessna		AIRCRAFT CO.		P.O. BOX 1897 WICHITA, KANSAS 67201	
TITLE: CABIN HEAT, CIGAR LTRS, PITOT STATIC HT, STALL HORN, FUEL VENT HT.					
SIZE	CODE IDENT NO	DRAWING NO			
D	71379	0808080			
SCALE	NONE	REF	G	SHEET 13 OF 16	



Cessna.		AIRCRAFT CO.		P.O. BOX 1977 MILITARY & TOWN DIVISION WICHITA KANSAS 67201	
TITLE POWER DISTRIBUTION (STD.)					
SIZE D	CODE IDENT NO 71379	DRAWING NO 0808080			
SCALE NONE	REF G	SHEET 6.01 OF 16.0			



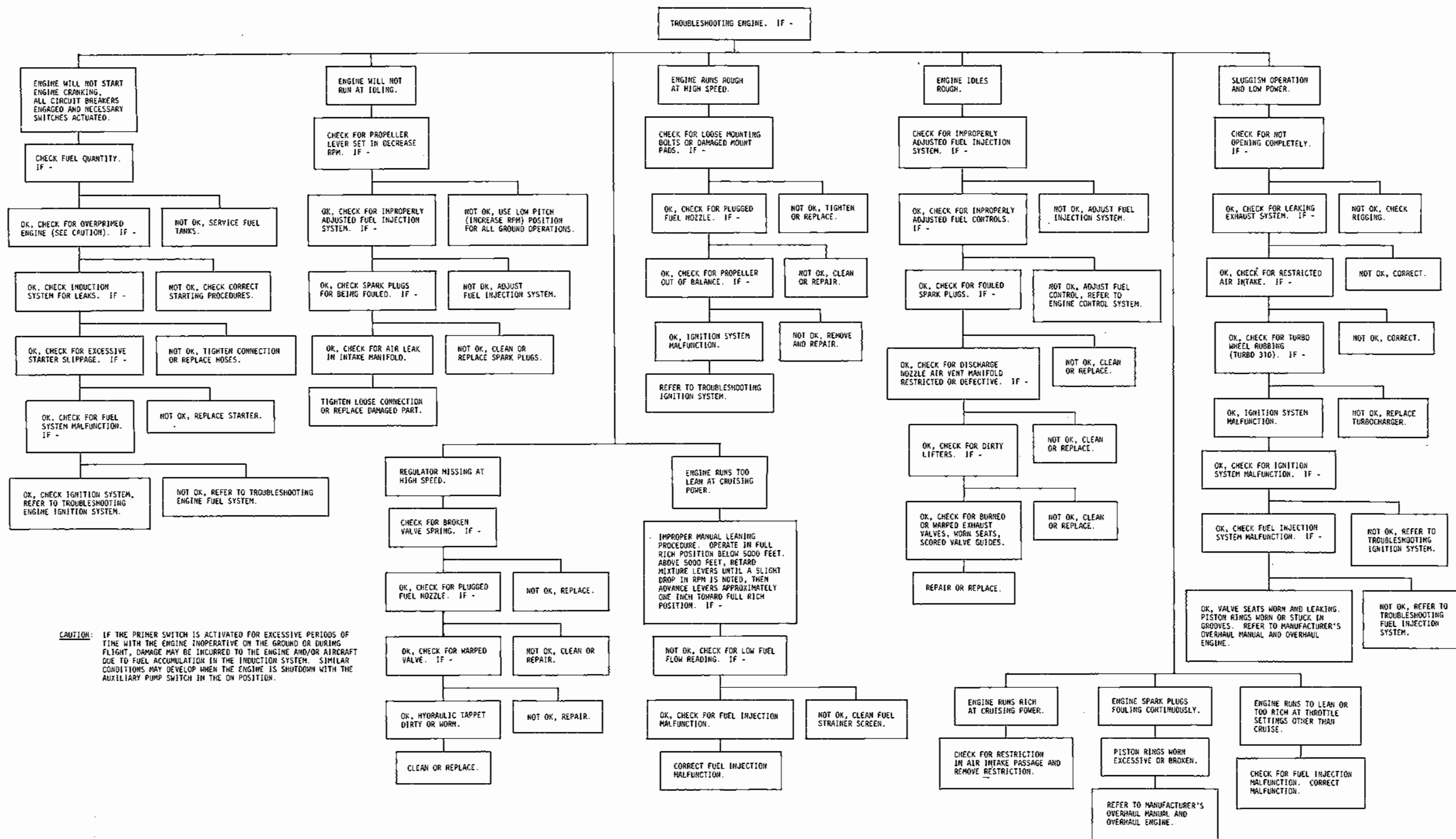
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TITLE: SPEAKER, PHONE JACKS, MIKE JACKS, BOOM MIKES & ANGLE OF ATTACK					
SIZE	CODE IDENT NO	DRAWING NO			
D	71379	0808080			
SCALE: NONE	REF	G	SHEET 15 OF 16		

310

- ⑦ CONNECT THIS WIRE TO SERIES OF LIGHTS BEING CONTROLLED BY THE APPLICABLE INSTRUMENT PANEL SECTION DIMMING CONTROL.
- ⑦ SPLICE WIRE SEGMENTS TOGETHER AT THIS POINT, CONNECTORS P1, J1, P2 AND J2 NOT APPLICABLE FOR 310 AIRCRAFT.

PARTS LIST		
SYMBOL	PART NO.	PART NAME
CB	7277-2-10	CIRCUIT BREAKER
FE101	30101101	FIRE EXTINGUISHER
FE102	30101101	FIRE EXTINGUISHER
SP1	5-1370-1	SPICE
TD501	107-700	THERMAL DETECTOR
TD502	107-700	THERMAL DETECTOR
TD503	107-700	THERMAL DETECTOR
TD504	107-700	THERMAL DETECTOR
TD505	107-700	THERMAL DETECTOR
TD506	107-700	THERMAL DETECTOR
TP501	33370500	TEST PANEL

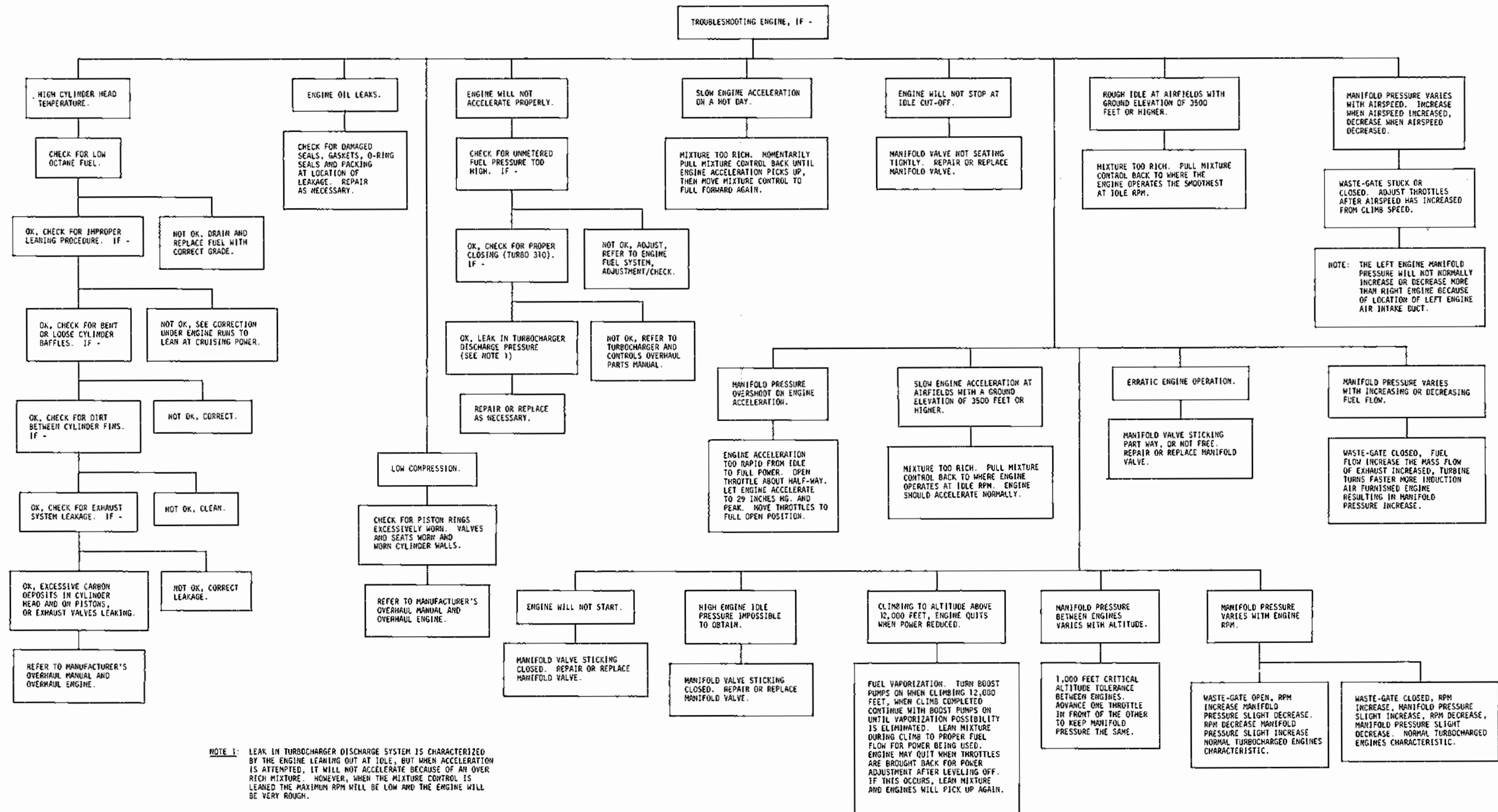
Cessna.		AIRCRAFT CO.	P O BOX 1877 MILITARY & TWIN D'USION WICHITA, KANSAS 67201
TITLE:			
FIRE DETECT SYSTEM WIRING ASSY			
SIZE	CODE IDENT NO	DRAWING NO	
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SCALE: NONE		C	SH1232



Troubleshooting Chart - Engines
Figure 1 (Sheet 1 of 2)

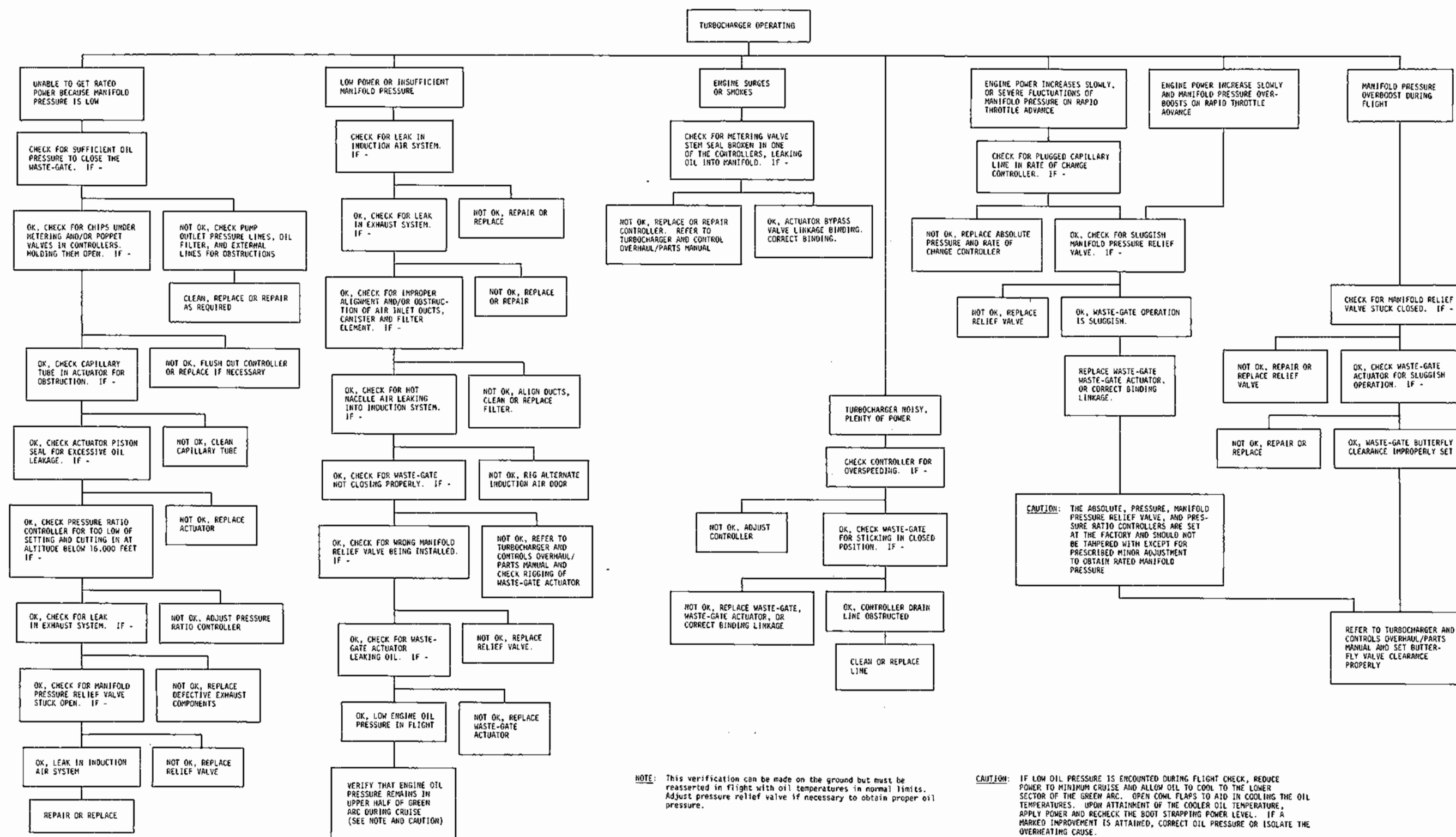
310

MAINTENANCE MANUAL



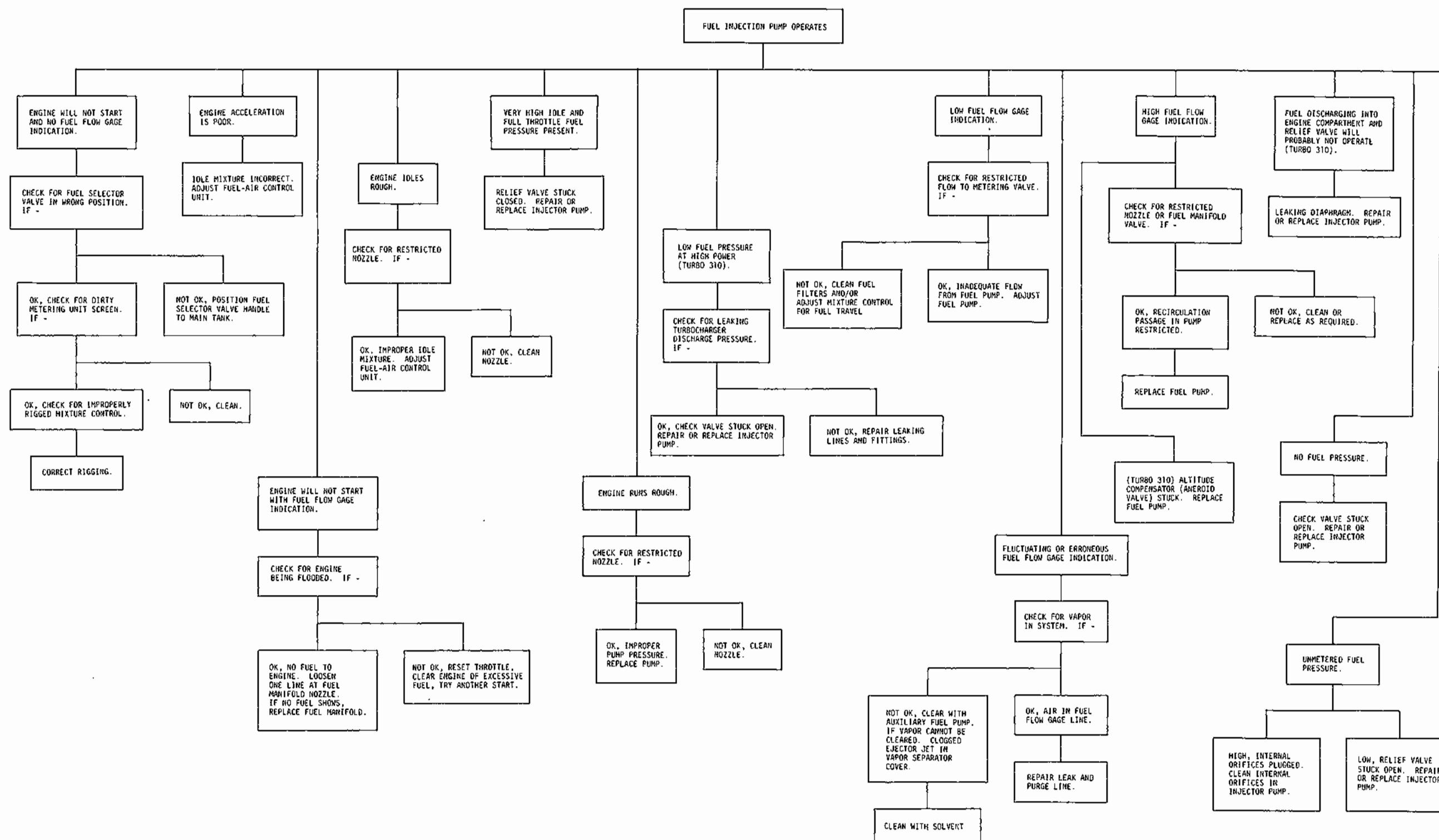
Troubleshooting Chart - Engines
Figure 1 (Sheet 2)

10289006



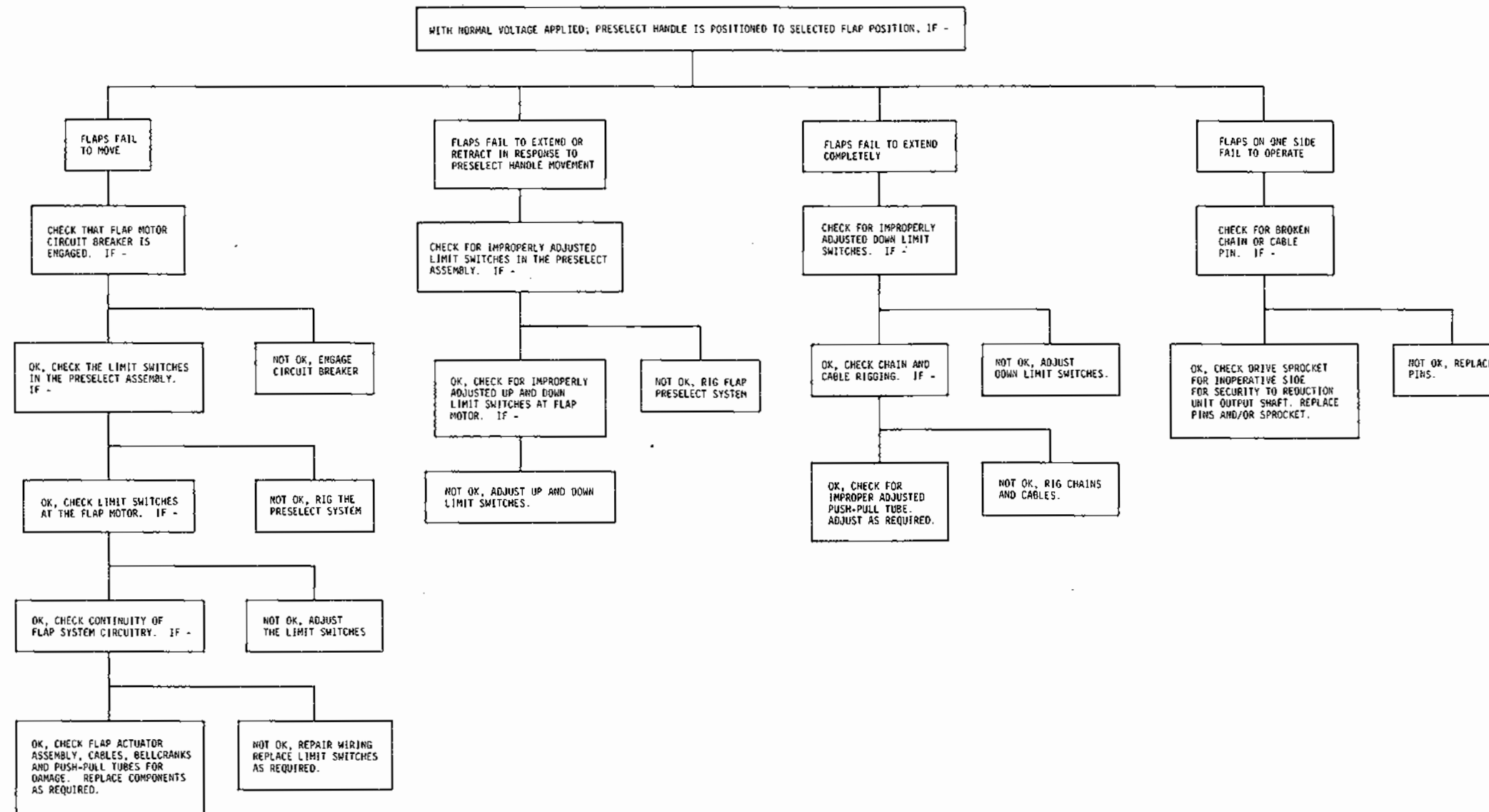
Troubleshooting Chart - Controllers and Waste-Gate Actuator
Figure 1

10989003

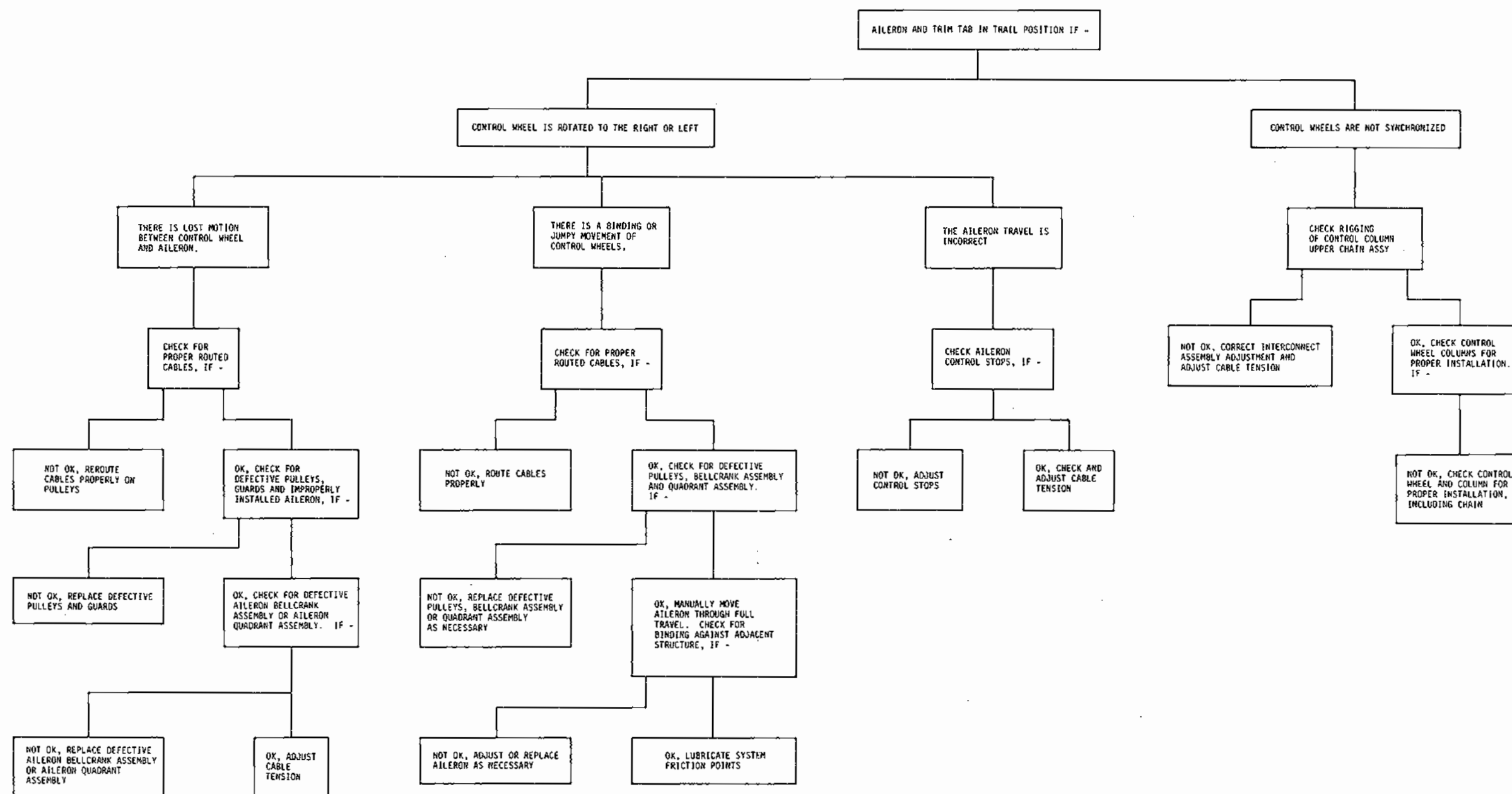


Troubleshooting Chart - Fuel Injection System
Figure 1

10989004



Troubleshooting Chart - Flap Control System
Figure 2

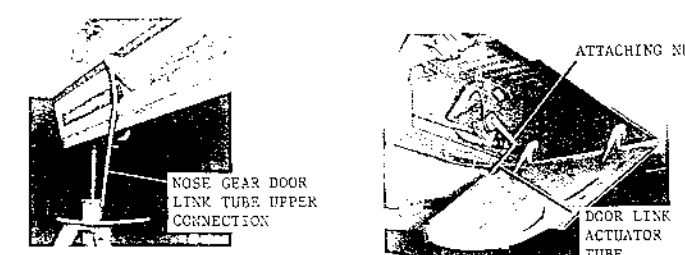


Troubleshooting Chart - Aileron Control System
Figure 3

10989001

start here

DETAIL A
DISCONNECTING Landing Gear Doors



1. Disconnect nose and main landing gear doors.

CAUTION: WHEN DISCONNECTING THE LANDING GEAR DOORS, ALWAYS RUN THE LANDING GEAR UP APPROXIMATELY 20 TO 30 DEGREES AND DISCONNECT MAIN GEAR DOOR BY REMOVING ATTACHING NUT FROM ACTUATOR ARM.

--READ THIS--BEFORE STARTING INSPECTION 2

NOSE AND MAIN LANDING GEAR RIGGING INSPECTION.

The nose and main landing gear rigging inspection should be performed indoors with proper jacks, 28 volt power supply, 0 to 150 pound spring scale and an 0680001 actuator arm tension tool available.

The aircraft should be placed on jacks, the necessary access plates, seats, carpets, floorboards removed, and the landing gears cleaned with a suitable solvent prior to inspection. Step by step procedures are presented and each step must be completed before performing the next step.

NOTE: The operational checks and tension measurements requirements of this inspection will require the services of two people.

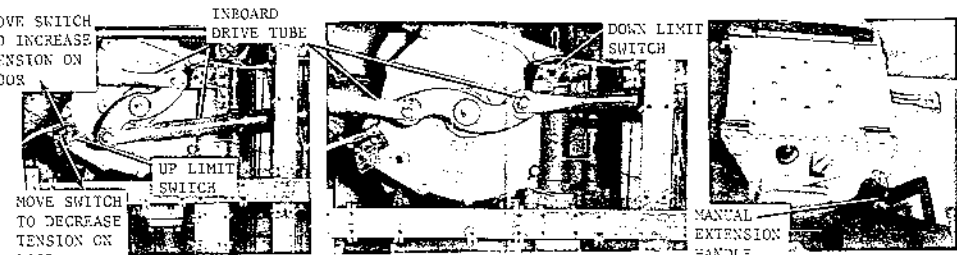
CAUTION: WHEN OPERATING THE LANDING GEAR ALWAYS BE PREPARED TO STOP TO PREVENT DAMAGE TO THE SYSTEM.

AFTER REMOVAL OF RETRACTION LINKAGE, ASSIST SPRINGS OR COMPONENTS PARTS FOR CHECKING, THEY MUST BE REINSTALLED BEFORE PROCEEDING TO THE NEXT STEP.

TABLE I

Check	Adjustment If Required
Detail A	---
Detail B	---
Detail C	---
Detail D	D-1
Detail E	E-1
Detail F	---
Detail G	G-1
Detail H	H-1
Detail J	J-1
Detail K	K-1
Detail L	L-1
Detail M	---
Detail N	N-1 - N-2
Detail P	---
Detail Q	Q

DETAIL B
CHECKING Up and Down Limit Switches



1. Operate landing gear to the up and locked position and turn switch OFF.

2. Engage manual extension crank and note the angular position of the crank handle.

3. Turn handle (CCW) AFT until the internal up stop in the actuator is reached.

NOTE: The internal stop should be reached in approximately 3/4 to 1-1/2 turns.

4. If the internal stop is not reached in 3/4 to 1-1/2 turns, run landing gear down and disconnect inboard main drive tube (D-1). Adjust up limit switch until the correct number of turns are obtained.

NOTE: Each time the actuator switches are adjusted the landing gear must be operated approximately half way down then back up before noting the number of turns required to reach the internal stop.

5. Operate the landing gear to the down and locked position.

6. Engage manual extension crank and note the angular position of the crank handle.

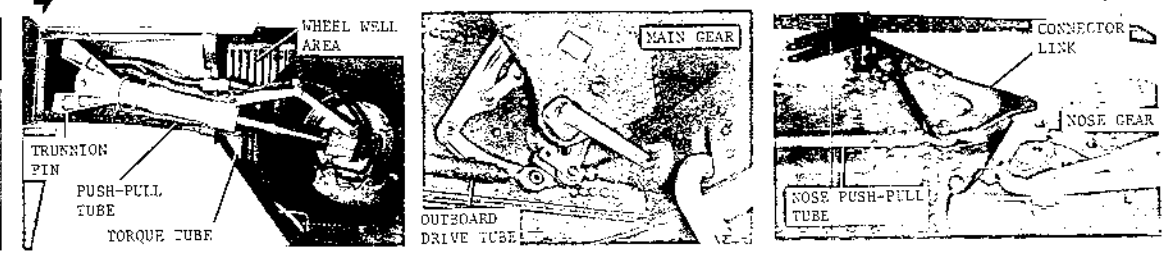
7. Turn handle (CW) FWD until the internal down stop in the actuator is reached.

NOTE: The internal stop should be reached in approximately 1 to 2 turns.

8. If the internal stop is not reached in 1 to 2 turns the landing gear actuator down limit switch must be adjusted until the proper number of turns are obtained.

CAUTION: DURING MANUAL EXTENSION OF THE LANDING GEAR, NEVER RELEASE THE MANUAL EXTENSION CRANK, DAMAGE COULD RESULT TO PERSONNEL AND THE SKIN OF THE PILOT'S SEAT.

DETAIL C
CHECKING Drive Tubes, Trunnions, Retracting Linkage, and Wheel Well Area



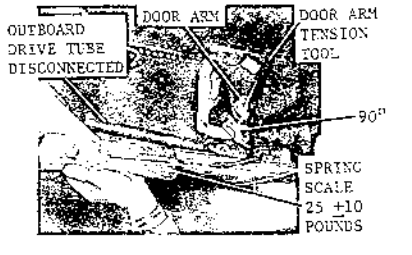
1. Check the operation of the landing gear. Visually inspect drive tubes, idlers, trunnions, and wheel well area for nicks, cracks, dents, bends, looseness, wear and other visual damage.

NOTE: If any part of the landing gear system is questionable, do not hesitate to reject it.

2. Inspect the landing gear retraction linkage for excessive wear, looseness, dents, cracks, bends, and deep scratches.

3. Check main gear trunnion roll pin in pivot shaft for looseness.

DETAIL D
CHECKING Main Gear Door Arm Tension



1. Check main gear doors for tension as shown 25 ± 10 pounds.

2. Shortening rod end will increase door tension (CCW).

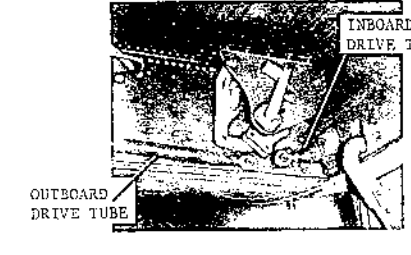
3. Lengthening rod end will decrease door tension.

4. After checking door tension with the gear down, run the landing gear up and check the door tension.

5. The tension should be 25 ± 10 pounds in the up position and a maximum of 10 pounds difference from the down position. Adjust up limit switch (see Detail B) to obtain proper tension.

NOTE: Check hand crank for numbers of turns to internal stop after obtaining tension, 3/4 to 1-1/2 turns.

DETAIL D-1
ADJUSTING Main Gear Door Arm Tension



1. If the main gear door tension is not 25 ± 10 pounds, adjust inboard drive tube rod end in half turn increments to obtain proper tension.

2. Shortening rod end will increase door tension (CCW).

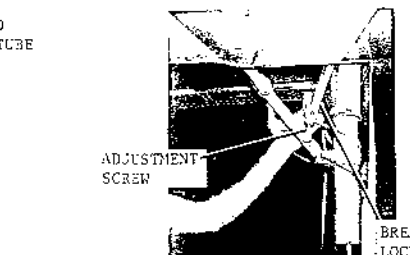
3. Lengthening rod end will decrease door tension.

4. After checking door tension with the gear down, run the landing gear up and check the door tension.

5. The tension should be 25 ± 10 pounds in the up position and a maximum of 10 pounds difference from the down position. Adjust up limit switch (see Detail B) to obtain proper tension.

NOTE: Check hand crank for numbers of turns to internal stop after obtaining tension, 3/4 to 1-1/2 turns.

DETAIL E
CHECKING Main Landing Gear Free Fall



1. Check main gear free fall by breaking main lock links as shown, raise gear approximately six (6) inches by hand, then release.

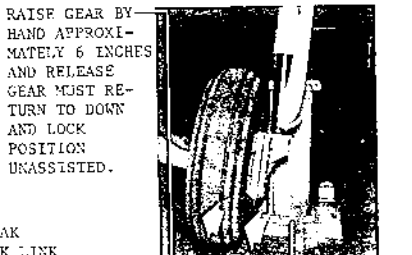
NOTE: When checking main gear for free fall the outboard drive tube must be disconnected as shown in Detail D.

2. If the gear does free fall down and locked, disconnect and fitting and lengthen 1/2 turn, reconnect and check free fall.

3. If the gear does not free fall to a down and lock position, visually check the following:

- Drive tubes for bends, breaks, binding and damage.
- Trunnion bolts for seizing, binding, alignment and lubrication.
- Lock link brace for alignment, overcenter travel, bending and breaks.
- Side brace for proper overcenter engagement, bolts for proper torque, (refer to Torque Chart, Chapter 1).
- Bolts in wheel well area for binding and interference.

DETAIL E-1
ADJUSTING Main Landing Gear Free Fall



4. If items "a" thru "c" check satisfactorily, shorten adjustment screw in small increments until gear will free fall down and locked.

NOTE: Shorten adjustment screw in small increments to allow gear to free fall and the side brace, down links to go overcenter. Check safety and secure.

5. After adjusting, make sure the landing gear is down and locked and the down and lock indicator light is properly adjusted. (See Detail N.)

DETAIL F
CHECKING Landing Gear Drop Off



1. (See Detail G-1.) Disconnect uplock push-pull tubes.

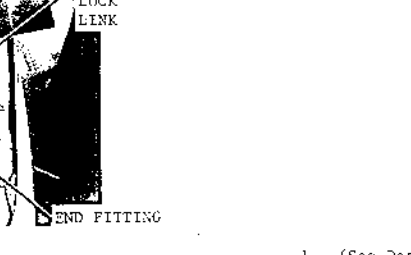
2. Operate landing gear up and measure drop off as shown.

3. If drop off is not 1/8 to 1/4 inches refer to Detail D-1 and adjust outboard drive tube.

NOTE: Lengthen the outboard drive tube to decrease the amount of drop off. Shorten the outboard drive tube to increase drop off.

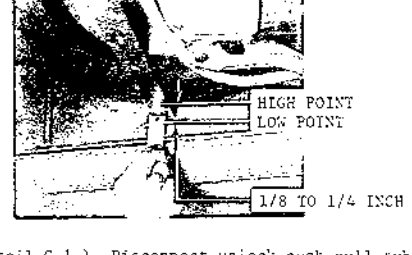
4. Reconnect uplock hooks.

DETAIL G
CHECKING Uplock Hooks for Engagement



1. Inspect main gear uplock hooks for proper engagement, when gear is retracted.

DETAIL G-1
ADJUSTING Uplock Hook for Engagement



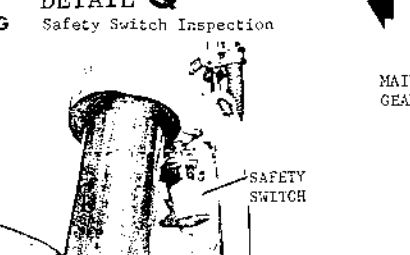
1. If the main gear uplock hooks do not engage properly adjust the uplock hooks until the hooks make full contact with the surface of the spacers.

2. Lengthening the uplock push-pull tube (CCW) will move the uplock hooks away from the spacers.

3. Shortening the uplock push-pull tube will pull the uplock hooks in closer to the spacers.

4. After adjustment the uplock hooks must engage and disengage freely with no binding.

DETAIL Q
CHECKING Safety Switch Inspection

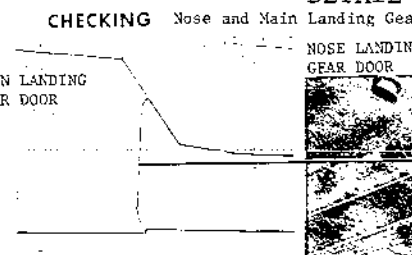


1. Refer to Chapter 4 for checking and adjustment of Landing Gear Safety Switch.

NOTE: If adjustments were made, make sure all bolts have been torqued, cotter pins installed and doors connected, before installing access plates, floorboards, seats, carpets and removing aircraft from jacks.

complete

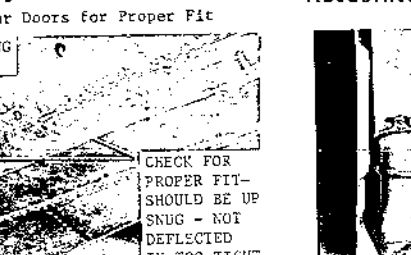
DETAIL P
CHECKING Nose and Main Landing Gear Doors for Proper Fit



1. Operate the landing gear through one complete cycle and visually inspect nose and main landing gear doors for operation, proper fit and other damage.

2. Operate the landing gear through one complete cycle and check the gear indicator lights and warning horn. Check for operation with gear extended and retracted.

DETAIL N-2
ADJUSTING Main Landing Gear Down Indicator Light Switch



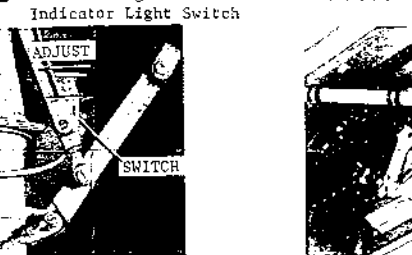
1. If the indicator lights do not illuminate within the required number of turns or the overcenter linkage is not overcenter when the light illuminate make the following adjustments.

2. Adjust the nose gear down and locked indicator light switch by adjusting the switch actuating bolt. Turn bolt CCW to actuate switch farther from the internal stop inside the actuator. Turn bolt CW to actuate switch closer to the internal stop inside the actuator.

3. Adjust the main landing gear switches by repositioning. Loosen mounting screws and move switch towards the bellcrank to actuate switch farther from the internal stop in the actuator. Move the switch away from the bellcrank to actuate it closer to the internal stop in the actuator.

NOTE: After adjusting indicator switches check to see that gear indicator lights do not illuminate before gear is down and locked by overcenter linkage.

DETAIL N-1
ADJUSTING Nose Gear Down Indicator Light Switch



1. Retract landing gear approximately halfway.

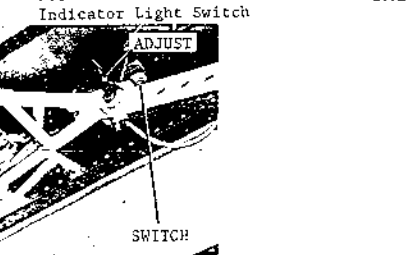
2. Engage manual extension handle (see Detail B). Crank lock switch the down position and stop when green light comes on. Note the angular position of the manual extension handle.

3. Check applicable gear of illuminated light for being down and locked with the overcenter linkage overcenter.

4. Resume cranking toward the down position noting the number of turns required to reach the internal stop in the actuator.

5. The number of turns required to reach the internal stop should not be less than 8 or more than 14 for the nose gear. Set less than 4 or more than 8 on the main gear.

DETAIL N
CHECKING Gear Down Indicator Light Switches for Proper Adjustment

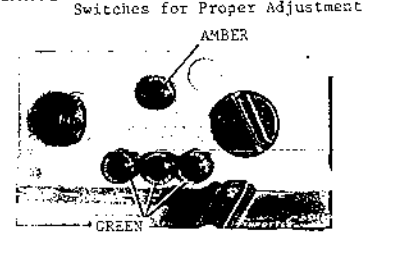


1. Inspect nose gear uplock for proper engagement.

2. Uplock hook must be fully engage with hook against the nose strut bolt and spacer engages and disengages freely with no binding.

3. Uplock hook must be engaged with .003 to .050 inches clearance between the spacer on the nose strut and surface of the hook.

DETAIL M
CHECKING Nose Gear Uplock Engagement



1. If the nose gear uplock tension is not 75 ± 10, - 15 pounds, adjust nose push-pull tube in half turn increments.

2. Lengthen the nose push-pull tube (CCW) to decrease the uplock tension.

3. Shorten nose push-pull tube to increase (CW) uplock tension.

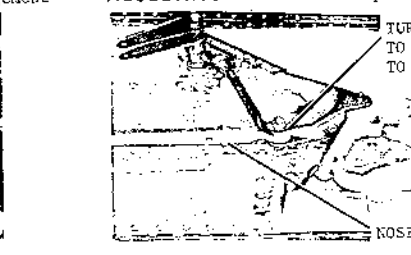
DETAIL L-1
ADJUSTING Nose Gear Uplock Tension



1. Inspect nose gear uplock tension (75 ± 10, - 15 pounds).

2. Adjust fork bolt in half turn increments. Lengthen (CCW) for bolt to increase down lock tension. Shorten (CW) to decrease tension.

DETAIL L
CHECKING Nose Gear Uplock Tension

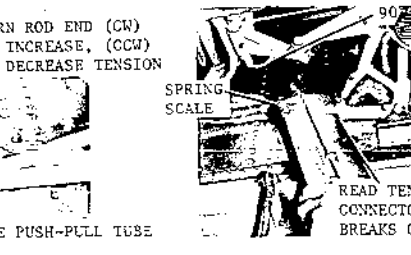


1. Connect nose push-pull tube. (See Detail L-1.)

2. Inspect the nose gear down lock tension (25 ± 10) pounds. Make sure the overcenter spring is disconnected when checking tension and adjustment.

3. If the nose gear down lock tension is not 25 ± 10 pounds, make sure the nose gear fork is properly adjusted (K-1).

DETAIL K-1
ADJUSTING Fork Bolt

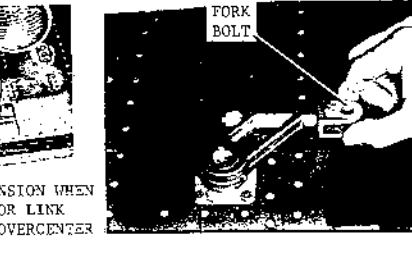


1. See Detail L-1, disconnect drive tube and assist spring.

2. Inspect nose gear connector link for proper overcenter adjustment.

3. A slight force (3 to 7) pounds should be required to snap connector link overcenter.

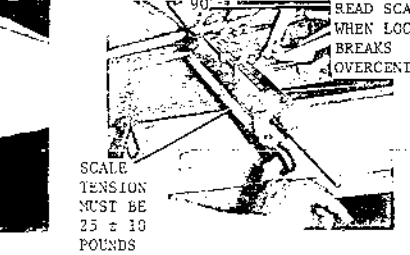
DETAIL K
CHECKING Nose Gear Down Lock Tension



1. If the nose gear connector link is not snapping overcenter properly adjust rod end as shown.

2. Lengthen rod end (CCW) to increase force, shorten (CW) to decrease force.

DETAIL J-1
ADJUSTING Nose Gear Connector Link for Overcenter Travel

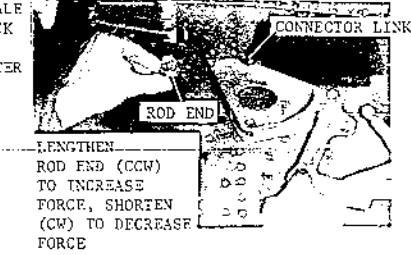


1. See Detail L-1, disconnect drive tube and assist spring.

2. Inspect nose gear connector link for proper overcenter adjustment.

3. A slight force (3 to 7) pounds should be required to snap connector link overcenter.

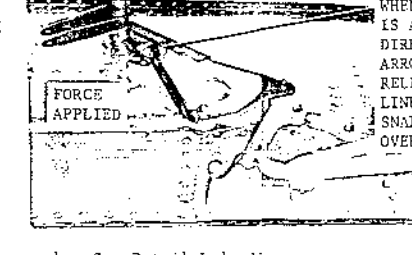
DETAIL J
CHECKING Nose Gear Connector Link for Overcenter Travel



1. If the down lock tension is not 40 to 60 pounds, adjust outboard drive tube in one half turn increments until proper tension is obtained. If the down lock tension is in excess of 60 pounds the down lock tension should be rigged 40 to 50 pounds. Lengthening the outboard drive tube (CCW) decreases and shortening the outboard drive tube (CW) increases tension.

NOTE: When shortening or lengthening the outboard push-pull tube the fork bolt must be lengthened or shortened a corresponding amount of turns so that the combined length of the two parts does not change.

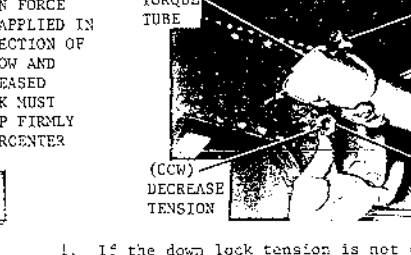
DETAIL H-1
ADJUSTING Down Lock Tension



1. Inspect main landing gear down lock for proper engagement and tension (40 to 60 pounds).

NOTE: When checking down lock tension always place finger on the down lock switch, pull scales at a right angle to the lock link and read scale at the point when a definite switch actuation is felt.

DETAIL H
CHECKING Down Lock Tension



1. Inspect main landing gear down lock for proper engagement and tension (40 to 60 pounds).

NOTE: When checking down lock tension always place finger on the down lock switch, pull scales at a right angle to the lock link and read scale at the point when a definite switch actuation is felt.

Nose and Main Landing Gear Rigging Inspection
Figure 1