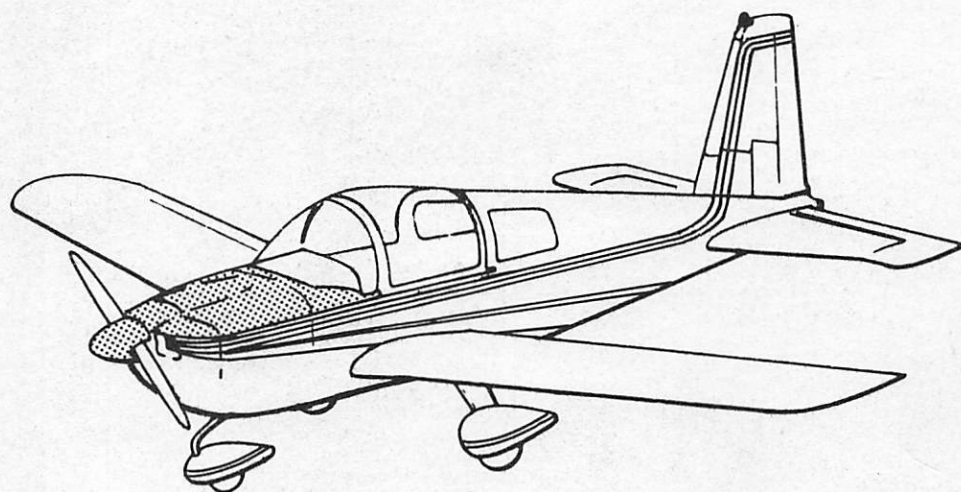


**MAINTENANCE
MANUAL
AA-1C
T-CAT & LYNX**



**ISSUED
DEC 15/76**

GRUMMAN AMERICAN AVIATION CORPORATION

P.O. BOX 2206

SAVANNAH, GEORGIA 31402

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INTRODUCTION

GENERAL

The function of this Maintenance Manual is to acquaint maintenance personnel with the systems and their components of the AA-1C aircraft (Figure 1) and to direct them in the proper procedures for maintaining the aircraft in an airworthy condition.

This manual contains information on installations made in the aircraft during manufacture and optional equipment only. However, information derived from applicable Single Engine Aircraft Service Kits, Service Bulletins, and Service Letters will be included in the manual as soon as possible after the issuance of these documents. Changes or installations made by the operator are not included in this manual.

The ability of maintenance personnel is recognized, and those procedures which are considered common to all aircraft have been either briefly referenced or omitted.

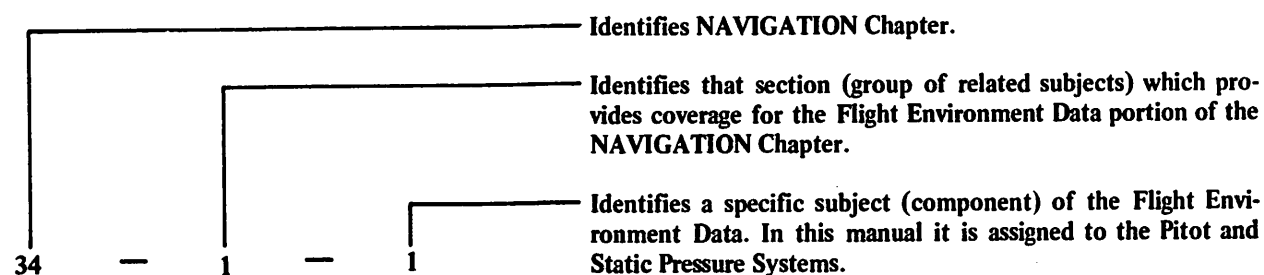
FORMAT

The chapter identification in this manual has been prepared in accordance with Air Transport Association (ATA) Specification No. 100. A functional breakdown is employed whereby all data pertaining to a given system, or component of a system, may be found in one chapter with a minimum of crossreferencing to other chapters.

The Electrical Power Chapter in this manual covers only the power sources and distribution equipment for the electrical system. There is not a chapter in this manual specifically designated for instruments. Details of individual branch electrical or instrument systems will be found in the applicable chapter.

IDENTIFICATION OF SUBJECT MATTER

A three-dash number system is employed to identify subject matter. The first dash number identifies the chapter, the second dash number the section, and the third dash number the component or sub-section of the section. The following example illustrates how the numbering system is used in the NAVIGATION Chapter:



The dash 0 (-0) is provided as a means for covering a complete system or sub-system. The chapter number followed by a zero (34-0) will segregate that material covering the complete system; the chapter-section numbers followed by a zero (34-1-0) is used for further details covering the sub-system or component.

PAGE NUMBER IDENTIFICATION

Page number blocks are used to separate the subject matter into the following categories:

General Coverage and Unit Description	Pages 1 through 100
Trouble Shooting	Pages 101 through 200
Maintenance Practices	(See Below)

Maintenance Practices include as applicable the following sub-topics: Servicing, Removal/Installation, Adjustment/Test, Inspection/Check, Cleaning/Painting, and Approved Repairs.

If all sub-topics, under Maintenance Practices are brief, they are combined into one topic. All such combined topics are numbered within page number block 201-300. Whenever individual sub-topics are so lengthy that a combination requires several pages, each sub-topic is treated as an individual topic. Page number blocks for this sub-topic arrangement are as follows:

Servicing	301 – 400
Removal/Installation	401 – 500
Adjustment/Test	501 – 600
Inspection/Check	601 – 700
Cleaning/Painting	701 – 800
Approved Repairs	801 – 900

Each new subject starts with page 1, 101, 201, etc., and continues through the page block assignment to the extent necessary. The first page of each block is placed on a right-hand page.

FIGURE IDENTIFICATION

Figures (illustrations) are numbered consecutively within each topic (subject) as follows:

Figures in Description –	1, 2, 3, 4, 5, etc.
Figures in Trouble Shooting –	101, 102, 103, etc.
Figures in Maintenance Practices –	
When not sub-divided –	201, 202, 203, etc.
When sub-divided –	
Servicing –	301, 302, 303, etc.
Removal/Installation –	401, 402, 403, etc.
Adjustment/Test –	501, 502, 503, etc.
Cleaning/Painting –	701, 702, 703, etc.
Approved Repairs –	801, 802, 803, etc.

INDEXING

Each chapter is prefaced with a table of contents identifying the subject matter within the chapter in the order of presentation. The table of contents is arranged with the following headings: DESCRIPTION; TROUBLE SHOOTING; and MAINTENANCE PRACTICES.

PART NUMBERS

This manual must not be used for identifying spare parts by number. Consult the Illustrated Parts Catalog for this information. Part numbers are used in this manual only as a means of identification when nomenclature alone is inadequate.

REVISIONS

Revisions to the original text are indicated by vertical lines in the left margin of the page, adjacent to the revised material.

The manual is provided with a "Log of Revisions" page for recording revisions by number and the dates on which they were inserted in the manual.

Each page revised or added to the initial manual will be identified by the date of revision at the bottom of the page. Pages issued with the original manual are identified with the issue date of the manual.

Each revision also contains a "List of Effective Pages". This list contains the chapter, page number, and date of each page which is effective since the issuance of the initial manual. This list is updated for each revision, with page changes indicated by the number of asterisks (*) placed adjacent to the page number as noted below:

- * Pages revised by the current revision.
- ** Pages added by the current revision.
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**TIME LIMITS/MAINTENANCE CHECKS – DESCRIPTION/OPERATION****1. General**

This chapter contains the manufacturer's recommended time limits, scheduled and unscheduled maintenance checks and inspections.

TIME LIMITS – DESCRIPTION/OPERATION

1. General

The Service Guide (Figure 1) contains the manufacturer's recommended time limits for inspection, maintenance and overhaul of the AA-1C aircraft, its systems and units.

All wing and fuselage structural components are subject to normal inspection, maintenance, repair and replacement procedures. In addition, if corrosion is detected on wing and inboard spars, remove it as quickly as possible and protect the surface from further corrosion in accordance with AC 43.13-1, "Acceptable Methods, Techniques and Practices – Aircraft Inspection Repair".

2. Inspection Details

A. Pre-Inspection Procedures

- (1) Just prior to beginning the inspection, perform the engine run up to facilitate oil drainage.
- (2) Observe the following actions and indicators, noting any discrepancies:

Oil and fuel pressures
Magnetor rpm drop
Static rpm
Idling speed
Ammeter

Suction gauge
Fuel Selector (Check operation in all positions)
Carburetor Heat Control
Engine response to change in power
Idle cut-off

B. Post Inspection Procedure

CAUTION: REPLENISH OIL SUPPLY PRIOR TO POST INSPECTION RUN UP.

After completion of the inspection, another engine run up should be performed to ensure that all discrepancies have been eliminated and no new discrepancies have been introduced.

SCHEDULED MAINTENANCE CHECKS – DESCRIPTION/OPERATION**1. General**

The inspection procedures guideline included in this section may be used by the owner, inspector, or mechanic to ensure complete and comprehensive coverage of the inspection requirements. The format of the procedures can be reproduced for ready use by the personnel performing the inspection. The checklist includes the minimum requirements or the 100-Hour or Annual Inspection.

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INSPECTION MAINTENANCE	Inspection Interval (Operating Hours)			NOTE
	50	100	1000	
AIRFRAME				
1. Clean aircraft.		X	X	
2. Aircraft structure (especially the spar around the wing lock shoulder bolts, gear attachments, and fuselage attach collars).		X	X	
3. Windows, windshield and canopy.	X	X	X	
4. Seats, console, interior and seat belts.	X	X	X	
5. Instrument panel instruments and placards.		X	X	
6. Baggage compartment and cargo tie downs.		X	X	
7. Radio antennas.		X	X	
8. Nose gear torque tube assembly.		X	X	
9. Control T-column and bearings.		X	X	
10. Forward empennage attachments.	X	X	X	
LANDING GEAR				
1. Main gear strut and upper and lower strut brackets		X	X	
2. Nose gear strut, fork and boot assy.		X	X	a
3. Nose and main wheel bearing lubrication.				b
4. Nose fork swivel lubrication.		X	X	
5. Brake linings and discs.		X	X	
6. Wheel fairings scraper adjustment.		X	X	
7. Main and nose tires pressure.	X	X	X	
CONTROL SYSTEMS				
1. Cables, turnbuckles, pulleys, guards and terminals.		X	X	k
2. Rudder pedals and springs.		X	X	j
3. Flaps, flap actuator, flap actuator jack screw, flap push-pull rods, flap torque tubes, torque tube bearings, bearing supports and position indicator.		X	X	
4. All control stops.		X	X	
5. Trim wheel, assembly, indicator, bungee, and actuator shaft drive screw.		X	X	
6. Ailerons, aileron torque tubes, aileron balance weights, bearings and bearing brackets.		X	X	

Service Guide
Figure 1 (Sheet 1 of 4)

INSPECTION MAINTENANCE

POWER PLANT

1. Oil change.
2. Oil screens.
3. Replace oil filter if external filter is used.
4. Spark plugs.
5. Ignition harness.
6. Magneto timing.
7. Exhaust system.
8. Throttle, carburetor heat and mixture controls operation.
9. Engine baffles.
10. Air filter.
11. Engine mount.
12. Oil breather vent.
13. All lines, flex ducts and connections.
14. Oil and fuel pressures.
15. Propeller and spinner.
16. Alternator belt.
17. Cylinders, crankcase, accessory section and front crankshaft seal.
18. Engine overhaul.

FUEL SYSTEM

1. **Electric fuel pump filter.**
2. **Fuel cap gaskets.**
3. **Fuel overboard vents.**
4. **Fuel tanks and quick drains (2).**
5. **Fuel gauges, fuel tank selector and placard.**
6. **Fuel tank outlet screens.**
7. **All hoses and lines.**
8. **Fuel primer.**

INSPECTION MAINTENANCE	Inspection Interval (Operating Hours)			NOTE
	50	100	1000	
UTILITY SYSTEMS				
1. Master cylinder fluid level.	X	X	X	
2. Parking brake operation.		X	X	
3. All hoses, lines, and connections.		X	X	
4. Pitot and static systems.		X	X	
5. Pitot line drain.		X	X	
6. Vacuum regulator and filter.		X	X	f
7. Flexible ducts for heating system.		X	X	
8. Cabin heat control operation.		X	X	
9. Compass check.			X	g
10. Vacuum pump.			X	h
ELECTRICAL SYSTEM				
1. Battery fluid level.	X	X	X	
2. Battery hydrometer check.		X	X	
3. All connections		X	X	
4. All lights for operation.	X	X	X	
5. All wiring harnesses and wires.		X	X	
6. Stall warning	X	X	X	
7. Electric flap motor.		X	X	

NOTES:

- a. Remove nose gear strut from torque tube yoke and inspect for corrosion of the faying surfaces every 12 calendar months. Remove corrosion, paint surfaces with zinc chromate primer and reassemble wet. Seal strut to yoke connection with RTV 102 by Dow-Corning.
- b. Clean and repack wheel bearings at first 100 hours. Inspect wheel bearing grease for contamination and solidification at each annual or 100 hour inspection. Do not exceed 500 wheel miles between repacking intervals
- c. Maximum time between magneto timing checks 100 hours. Magneto replacement recommended after 900 hours of service.
- d. Recommend replacement of all flexible pressure lines at engine overhaul or every five years, whichever comes first.
- e. Maximum engine overhaul time 2000 hours.
- f. Replace gyros central air filter each 400 hours. Replace vacuum relief valve filter each 1000 hours. For operation in dusty climates replace filters more frequently.



- g. Check accuracy of compass every 1000 hours or at each time that an item of equipment is installed or removed that could affect the accuracy of the unit.
- h. Recommend replacement at 1000 hours.
- i. Remove and clean every 1000 hours.
- j. Replace rudder springs every 1000 hours.
- k. Thoroughly clean all control cables where they pass under the pulley group forward of the center section spar. Inspect all cables in accordance with AC43.13-1, Par. 105, paying close attention to the rudder cables. Acceptable wire strand breakage limits are a maximum of four (4) wires per cable. Cables with more than the acceptable number of broken wires must be removed from service. In order to adequately inspect the cables, it will be necessary to actuate the controls to the full extent of travel to expose the cable pulley contact area for examination.
- l. Replace mixture control wire every 500 hours.

SCHEDULED MAINTENANCE CHECKS – MAINTENANCE PRACTICES

1. Annual or 100-Hour Inspection Procedures

A. Perform Annual or 100-Hour Inspection

Complete the inspection by performing each of the procedures detailed on the checklist, Figure 201. Indicate completion by sign-off in the appropriate column.

B. In addition to the Service Guide and Annual or 100 Hour Inspection Procedure, the following steps should be adhered to when performing an inspection or overhaul:

- (1) Check any FAA Airworthiness Directive or Grumman American Aviation Service Bulletins/Letters for compliance at the time specified thereon.**
- (2) Check that the following aircraft documents are present and in order:**

Aircraft Airworthiness Certificate (Form FAA 8100-2)
Aircraft Registration Certificate (Form FAA 8050-1 or FAA 8050-3)
Weight and Balance Sheet
Aircraft Equipment List
Any Repair and Alteration Forms if applicable (Form FAA 337)
Aircraft Radio Station License if applicable (Form FCC 566 or FCC 453B)
Aircraft and Engine Log Book

NOTE: All of the above items except the log books must be carried in the aircraft at all times. Form FAA 8100-2, FAA 8050-3 and FCC 556 (FCC 453-B) must be visually displayed.

- (3) Check that Operating Limitations placards (reference Chapter 11) are displayed.**

MODEL AA-1C

ANNUAL OR 100-HOUR INSPECTION PROCEDURE

ANNUAL OR 100 HOUR INSPECTION PROCEDURE GUIDELINE

FAR 43.15 (c) (1) states: "Each person performing an annual or 100 hour inspection shall use a check list while performing the inspection. The check list may be of the person's own design, one provided by the manufacturer of the equipment being inspected, or one obtained from another source. This check list must include the scope and detail of the items contained in appendix D to this part and paragraph (b) of this section." The following pages contain a comprehensive annual or 100 hour inspection procedure check list. This check list has been prepared to assist a mechanic in performing a detailed inspection of such scope and detail that when the inspection is completed, the mechanic is absolutely sure that he has not overlooked any areas, even though he may not have previous experience on this particular model aircraft. Once a mechanic becomes familiar with this aircraft, he may wish to prepare his own check list, which must be within the scope of appendix D of FAR part 43.

OWNER'S NAME		STREET ADDRESS	
	CITY	STATE	ZIP CODE
IDENTIFICATION NUMBER	SERIAL NUMBER	HOURS	DATE INSPECTION COMPLETED
SERVICING AGENCY	CITY	STATE	

NOTE: Check conformity with FAA Specifications, Airworthiness Directives and Grumman American Aviation Corporation and Supplier's Service Bulletins and Letters.

NOTE: It is recommended that reference be made to the applicable maintenance handbook, service bulletins, letters, installation instructions, and vendor specifications for torque values, clearances, settings, tolerances and other specification data.

MODEL AA-1C		
ANNUAL OR 100-HOUR INSPECTION PROCEDURE		
PRE-INSPECTION ENGINE RUN UP	MECH.	INSP
Prior to beginning the annual or 100 hour inspection, an engine run up is to be made to facilitate oil drainage and to observe the following, noting any discrepancies:		
1. Fuel Pressure (0.5 to 8 PSI) Electric Pump only prior to engine start-up _____ Turn pump off for engine start _____ Both _____ Engine Pump only after engine start-up		
2. Oil Pressure (60 to 90 PSI) (Approx. 25 PSI idling) Actual _____ Actual _____		
3. Magneto RPM Drop (Maximum drop on either magneto 175 RPM. No more than 50 RPM difference between magnetos). Actual Drop Left _____ Right _____		
4. Static RPM Cruise Prop (72-56) – 2125-2275 Actual _____ Climb Prop (72-52) – 2325-2475 Actual _____		
5. Idling Speed (600 to 650 RPM) Actual _____		
6. Ammeter (Shows Battery net)		
7. Suction Gauge (4.6 to 5.4 In. Hg.)		
8. Fuel Selector (check operation in all positions)		
9. Carburetor Heat Control		
10. Engine Response to change in power		
11. Idle cut-off.		
A. PROPELLER GROUP	MECH.	INSP.
1. Remove spinner and check for cracks		
2. Inspect blades for erosion, scratches, nicks and cracks. Dress out nicks as required		
3. Inspect backplate for nicks, cracks and damage. Smooth out nicks and scratches as required. Cracks may be welded.		
4. Inspect front crankshaft seal for oil leaks		
5. Check propeller mounting bolt torque to 300 in. lbs. and resafety		
6. Reinstall spinner. Check spinner run out (1/16 inch maximum turn out)		
B. ENGINE GROUP	MECH.	INSP.
1. Remove engine cowl. Clean and check for cracks, wear, distortion, loose or missing fasteners and landing light attachment		
2. Drain oil sump. Remove oil screens, clean and inspect for metal particles. Reinstall and resafety		
3. Check oil temperature sending unit, oil cooler, oil lines and fittings for leaks, chafing and secure mounting		

Inspection Procedure Guidelines
Figure 201 (Sheet 2 of 7)

GRUMMAN AMERICAN AVIATION
 AA-1 SERIES
MAINTENANCE MANUAL

B. ENGINE GROUP (Continued)	MECH.	INSP.
4. Fill engine with oil per lubrication chart		
5. Clean engine		
6. Check engine cylinder compression No. 1. ___ No. 2. ___ No. 3. ___ No. 4. ___		
7. Clean and regap or replace spark plugs as required. (See latest revision of Lycoming Service Instruction No. 1042.)		
8. Check ignition harnesses. Clean and inspect insulators		
9. Check magnetos to engine timing oil seal leakage, and distributor block for cracks, burned areas and corrosion		
10. Remove, clean, inspect, and oil carburetor air filter. Inspect carburetor heat control valve plate, shaft, valve plate to shaft screws and bearings for signs of wear and security. Replace filter and/or gasket if damaged or defective. Reinstall carburetor air filter		
11. Check induction air intake seals for leaks, deterioration and hardness. Check flex ducts for broken or loose strings, loose or displaced supporting wire and general overall condition for signs of wear or perforation		
12. Drain carburetor bowl. Reinstall drain plug. Remove and clean carburetor fuel inlet screen with acetone. Reinstall screen		
13. Remove and clean electric fuel pump filter. Reinstall and resafety		
14. Check fuel pump for proper operation and secure mounting. Pressurize fuel system with electric pump and inspect fuel system and lines for leaks. Check fuel primer for operation and line leaks		
15. Check starter for secure mounting		
16. Check security of throttle arm on carburetor. Check throttle, carburetor heat, and carburetor mixture controls for proper travel, security, operating condition and control cushion. Replace mixture control wire every 500 hours		
17. Remove exhaust shroud and check muffler tailpipe, risers, clamps, gaskets, exhaust system for cracks, leaks and secure mounting. Reinstall shroud		
18. Check breather tube for obstructions and secure mounting		
19. Inspect cylinders for evidence of excessive heat indicated by burned paint on the cylinder. Check for cracks, loose bolts, oil leaks and general condition		
20. Check valve rocker clearance — .007 to .009 inch cold. (See latest revision of Lycoming Service Instruction No. 1068).		
21. Inspect engine mount for cracks, secure mounting and proper safety wiring. Check rubber vibration dampeners for signs of deterioration. Replace as required		
22. Check all baffles for cracks, loose or missing screws and deteriorated seal material		
23. Check alternator for secure mounting and lugs and brackets for cracks. Check condition and tension of alternator drive belt. Replace if required (adjust belt tension to yield a 5/16 in. deflection at the center of the belt when applying a pressure equivalent to 14 pounds for new belts and 10 pounds for used belts)		
24. Check battery electrolyte level and specific gravity. Clean and tighten battery terminals. Check battery box drains and vents for condition and drainage clear of aircraft structure		

B. ENGINE GROUP (Continued)		MECH.	INSP.
25.	Inspect vacuum system components (if installed) for secure mounting. Check vacuum pump drive for evidence of seal leakage. Replace seal and pump if required. Check all interconnecting lines and fittings for leaks, deterioration and damage. Replace as required		
26.	Check ground straps for condition and secure attachment		
27.	Check electrical wiring for condition and secure connections including shielded cable ground connections		
28.	Check voltage regulator, starter relay and master switch relay for secure mounting and proper operation		
29.	Install cowl, checking for proper engagement of air intake duct and cowl latches		
C. CABIN GROUP (See Figure 202)		MECH.	INSP.
1.	Roll up baggage floor covering and remove inspection covers. Remove console forward panels and inspection covers. Leave in this position until flap, aileron, rudder and elevator inspection and adjustments are completed		
2.	Check windshield, windows and canopy for cracks and secure mounting. Clean and lubricate canopy rails. Clean and lubricate canopy cables and pulleys. Check canopy operation and locking devices		
3.	Check seat belts and shoulder harnesses for condition, secure mounting and latch operation . .		
4.	Check elevator trim control for condition, secure mounting, proper operation and indication .		
5.	Check rudder pedal and brake system for proper operation and condition. Check brake fluid level. Replace rudder pedal springs at 1000 hours		
6.	Check control tee for secure mounting and adequate clearance from other equipment		
7.	Check cables, pulleys, turn buckles and cable ends for condition, secure attachment and safeties. Check cables at pulleys for fraying while actuating controls through full travel. (Max. of 4 broken wires acceptable)		
8.	Check cable tension (at the average temperature for aircraft operation)		
9.	Check all controls for clearance and proper operation		
10.	Check all interior bond lines for any indications of damage, peeling, corrosion or cracking . . .		
11.	Check nose gear torque tubes, mounting brackets, bond joints and welds for cracks and secure mounting. Check torque on mounting bolts – center bearing brackets 185-195 in. lbs. and end plate bolts 300-350 in. lbs		
12.	Check flap actuator, push rods, limit switches and indicator for proper operation and secure mounting		
13.	Lubricate flap actuator per lubrication chart (Chapter 12)		
14.	Check all plumbing in cabin for leaks and condition		
15.	Disassemble, clean, lubricate and reassemble fuel selector valve every 500 hours. See Fuel System section for details		
16.	Check gyro system filters (if installed), replace if necessary.		
17.	Check instruments for condition, secure mounting and legible markings		
18.	Check electrical wiring, switches, lights and electronic equipment for condition and security . .		
19.	Inspect baggage compartment and cargo tie-downs		
20.	Inspect all placards in cabin for condition and legibility		
21.	Reinstall baggage floor inspection covers and console forward panels and inspection covers. . .		
22.	Check fresh air vents for proper operation		

Inspection Procedure Guidelines
Figure 201 (Sheet 4 of 7)

D. FUSELAGE AND EMPENNAGE GROUP		MECH.	INSP.
1.	Remove tailcone and empennage covers		
2.	Inspect emergency locator transmitter for security, operation and battery expiration date (See Chapter 11.) (if installed)		
3.	Inspect exterior surfaces for condition and damage. Check all drain holes in the fuselage bottom for obstructions		
4.	Inspect bond lines for any indication of damage, peeling, corrosion or cracks		
5.	Check horizontal and vertical stabilizers for damage and secure mounting. Ensure that horizontal stabilizer and elevator drain holes are open		
6.	Check elevators, elevator tips, elevator bearings and stops, rudder, rudder tip, rudder bearings and stops, tab hinges and bellcranks for damage, travel and proper operation. Maximum allowable torque tube wear limit at bearing supports is .030 in. reduction in wall thickness		
7.	Check elevator trim and bungee mechanism for damage, secure mounting and proper operation. Check outside of bungee housing for correct lubrication and wear (max. .016 deep). Check shear link rivets for security. Replace rivets if loose CAUTION: REPLACE WITH SOFT RIVETS ONLY TYPE MS20470A3-5.		
8.	Check rudder and elevator cables and pulleys for damage, proper operation and safeties. Check bellcrank attaching bolts for wear		
9.	Lubricate per lubrication chart (Chapter 12)		
10.	Inspect antenna mountings, wiring and electronic installations		
11.	Check position and anti-collision lights for secure mounting		
12.	Check static system lines and the alternate air source valve (if so equipped). Drain any accumulated moisture from system drain		
13.	Reinstall inspection covers		
E. WING GROUP		MECH.	INSP.
1.	Remove wing tips and access panels. Inspect surfaces, skins, ribs and tips for damage. Check position and anti-collision (if equipped) lights for secure mounting		
2.	Visually inspect interior and exterior bond lines for any indication of damage, peeling, corrosion or cracks		
3.	Check ailerons, aileron bearings and stops, flaps, and flap bearings for secure mounting, damage, proper travel and wear. Maximum allowable aileron torque tube wear limit at bearing supports is .030 in. reduction in wall thickness. Check that aileron and flap drain holes are open		
4.	Check fuel vents and connecting lines for damage and restrictions		
5.	Check fuel tank outboard end plate for leaks and secure mounting		
6.	Check fuel cap gaskets for air tight seal		
7.	Check wing attaching bolts. See Chapter 57 for torque values		
8.	Check fuel block lines and spar for evidence of leakage at the wing root opening		
9.	Inspect fuel tank placards		
10.	Check pitot heating element for proper operation (if installed)		
11.	Check pitot tube opening and lines. Drain accumulated moisture		
12.	Check for interior corrosion of skin indicated by a white flaking ash		
13.	Install wing tips and access panels		

Inspection Procedure Guidelines
Figure 201 (Sheet 5 of 7)

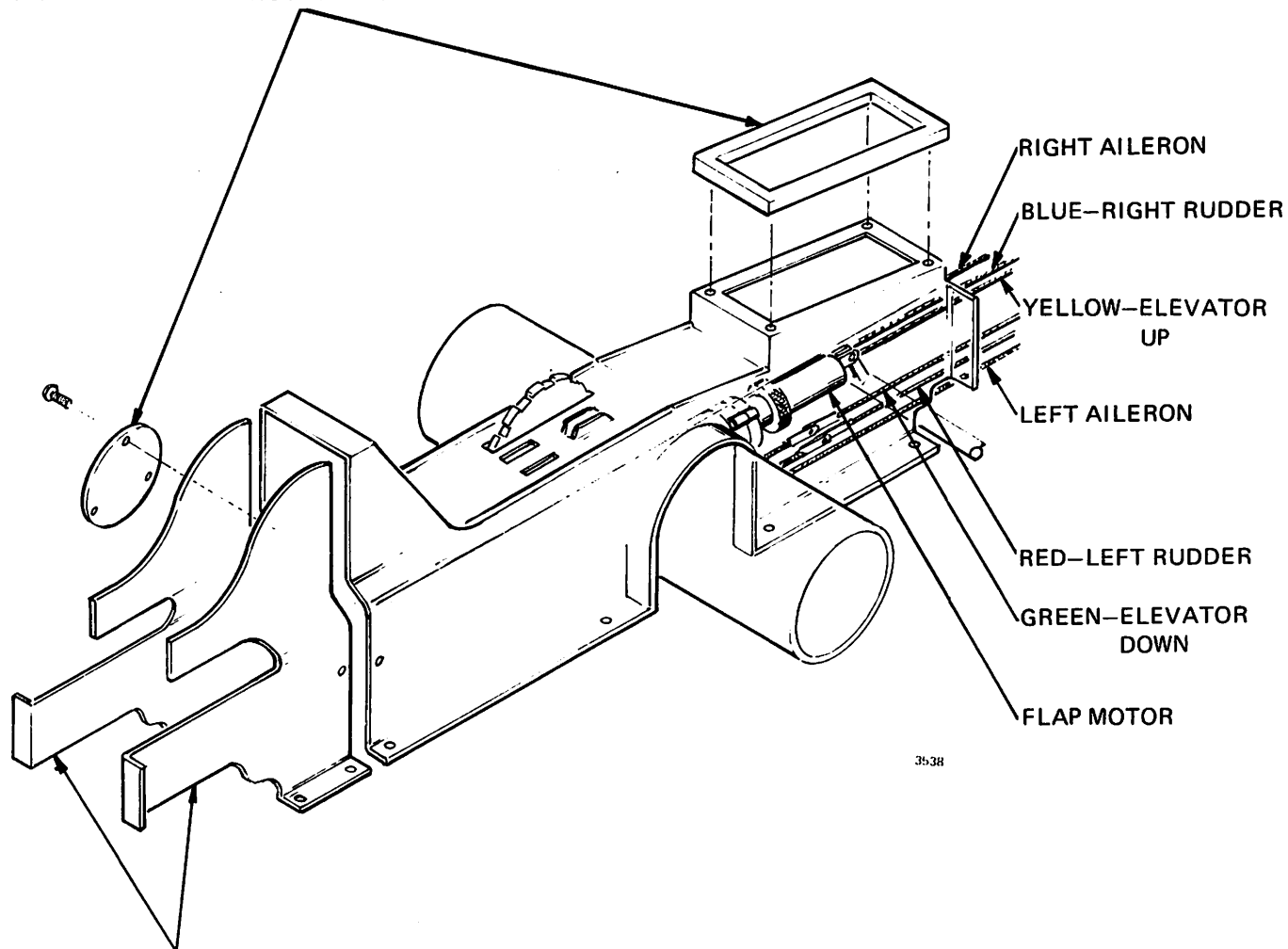
F. MAIN LANDING GEAR GROUP		MECH.	INSP.
1.	Remove wheels and check for cracks. Check condition of brake linings, wheel cylinders, torque plates and mounting pins. Pack wheel bearings, reinstall wheels and key axle nuts at first 100 hours and each 500 hours thereafter. Inspect wheel bearing grease for contamination and solidification at each annual or 100 hour inspection. Do not exceed 500 wheel miles between repacking intervals. For operation in dusty areas or areas of high humidity, repack every 100 hours. Perform a complete wheel inspection when tires are replaced		
2.	Check tires for approved type, wear and proper inflation		
3.	Check brake lines for leaks and secure attachment		
4.	Check struts for secure mounting. Inspect for cracks, delamination and nicks		
5.	Inspect the upper main mounting brackets and spar attaching supports (center spar to fuselage) for wear, cracks and loose bolts		
6.	Inspect wheel fairings for damage and secure mounting (if installed)		
G. NOSE GEAR GROUP		MECH.	INSP.
1.	Check nose gear strut for secure mounting, deformation, damage and cracks		
2.	Remove nose gear strut from torque yoke and inspect for corrosion of the faying surfaces every 12 calendar months. Remove corrosion, if present, paint surfaces with zinc-chromate and reassemble wet. Seal strut to yoke connection with RTV-102 by DOW-CORNING		
3.	Remove and check nose gear fork for deformation, wear and cracks. Maximum fork to strut bearing clearance is .035 in.		
4.	Grease fork and friction dampener, assemble to strut and tighten to 10-21 lb. drag at axle . . .		
5.	Remove nose wheel, check for cracks, clean, inspect and repack bearings, reinstall wheel and safety axle at first 100 hours and each 500 hours thereafter. Inspect wheel bearing grease for contamination and solidification at each Annual or 100-Hour inspection. Do not exceed 500 wheel miles between repacking intervals. For operation in dusty areas or areas of high humidity, repack every 100 hours. Perform a complete wheel inspection when tire is replaced		
6.	Inspect nose wheel for cracks, corrosion and loose or broken bolts		
7.	Check tire for approved type, wear and proper inflation		
8.	Check wheel fairing for damage and secure mounting (if installed)		
H. OPERATIONAL INSPECTION		MECH.	INSP.
1.	Check brake operation (including parking brake)		
2.	Check fuel primer operation and lines for leaks		
3.	Check booster pump operation		
4.	Check fuel pressure		
5.	Check starter for proper operation		
6.	Check oil pressure and temperature		
7.	Check engine controls for proper operation. Check throttle and mixture controls for proper cushion		
8.	Check magneto operation; both on, left off, both on, right off, both on. (Maximum magneto drop 175 RPM with 50 RPM maximum difference between magnetos). With engine at idle turn switch to "off" position momentarily to check magneto grounding		
9.	Check engine static RPM; cruise prop (2125-2275), climb prop (2325-2475)		

H.	OPERATIONAL INSPECTION (Continued)	MECH.	INSP.
10.	Check carburetor heater for proper operation and cushion		
11.	Check alternator output		
12.	Check suction gauge and vacuum system output (4.6 to 5.4 in. Hg.)		
13.	Check fuel selector valve operation and indexing		
14.	Check heating, defrosting and ventilating system for proper operation		
15.	Check radio for proper operation		
16.	Check engine idle speed (600 to 650 RPM) and mixture setting		
17.	Check idle cut-off on carburetor for proper operation		
18.	Check ailerons for proper operation		
19.	Check elevators and trim tab for proper operation		
20.	Check flaps for proper operation		
21.	Check fuel quantity gauges for condition and proper operation		
22.	Check interior lights for proper operation and adjustment		
23.	Check navigation and anti-collision lights for proper operation and landing lights for proper operation and adjustment		
24.	Check pitot heat for proper operation		
25.	Check stall warning device for operation		
26.	Inspect engine after ground run up. Flight test and inspect for oil leaks and secure mounting of all components		
I.	GENERAL	MECH.	INSP.
1.	Aircraft cleaned and serviced		
2.	Aircraft conforms to FAA Specifications		
3.	All FAA Airworthiness Directives complied with		
4.	All manufacturer's Service Letters and Bulletins complied with		
5.	Check for proper Pilot's Operating Handbook		
6.	Aircraft papers in proper order. Make log book entry		

End of Inspection

Inspection Procedure Guidelines
Figure 201 (Sheet 7 of 7)

REMOVE THE INSPECTION COVERS ON THE TOP- AFT AND FORWARD RIGHT SIDE OF THE CONSOLE TO PERMIT INSPECTION AND SERVICING OF THE FLAP MOTOR ASSEMBLY, ELEVATOR, AILERON AND RUDDER CABLES AND TURNBUCKLES. THE MICROPHONE JACK CAN ALSO BE SERVICED BY THIS PROCEDURE.



REMOVE THE TWO FORWARD PANELS TO INSPECT THE CONTROL COLUMN CABLES AND ATTACHING HARDWARE. ALSO THE FUEL SELECTOR VALVE LINES AND TRIM DRIVE MECHANISM AND FLAP SWITCHING WIRING.

Method of Providing Access for Under Console Inspection
Figure 202

UNSCHEDULED MAINTENANCE CHECKS – DESCRIPTION/OPERATION**1. General**

Following a hard or overweight landing, certain items and systems of the aircraft should be inspected for subsequent damage. Applicable groups in Figure 201, 5-2-1 should be used as a guideline when performing the unscheduled inspection required as a result of unusual circumstances. For example, if the landing gear requires an unscheduled inspection each procedure listed under the landing gear group should be completed.

UNSCHEDULED MAINTENANCE CHECKS – MAINTENANCE PRACTICES

1. Inspections Following a Hard or Overweight Landing

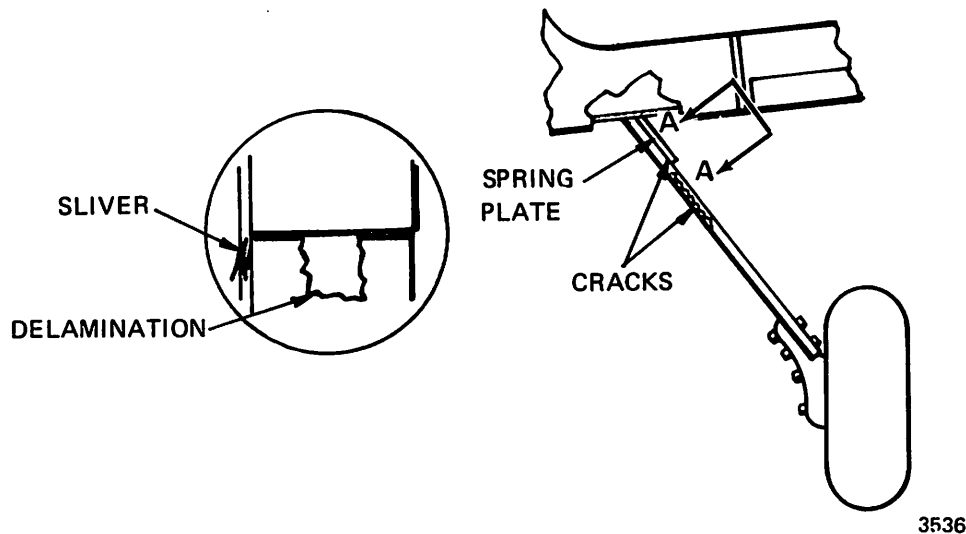
A. Inspect Main Landing Gear Assembly

- (1) Inspect the laminated fiberglass metal reinforced main landing gear struts for evidence of nicks, slivers, cracks, delamination (see Figure 201) and deterioration of protective paint coating.

NOTE:

1. Minor surface delaminations are acceptable only if extended one ply (.010 in.) or less into the surface of the strut.
2. Corner delaminations (slivers) are acceptable if smaller than 1/16 inch x 1/16 inch throughout sliver length.
3. If airworthiness of a damaged laminated fiberglass strut is questionable, close-up photograph of the damaged area may be submitted to the Customer Service Department for analysis and recommendations.

- (2) Minor imperfections may be repaired (see Chapter 32). Struts with other than minor imperfections must be replaced.

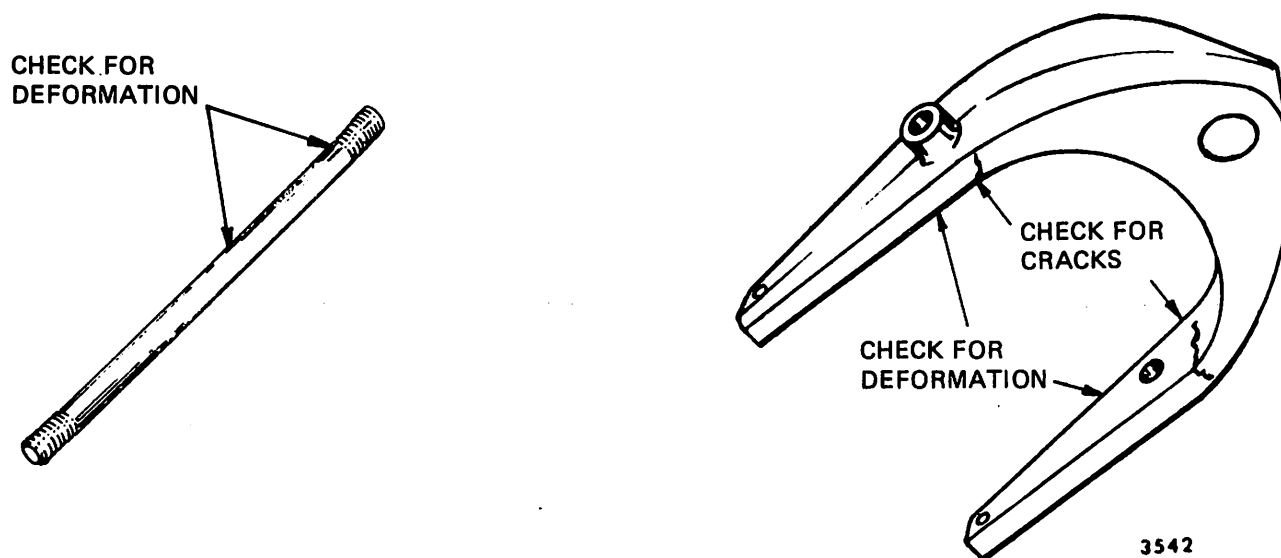


**Main Landing Gear Assembly
Figure 201**

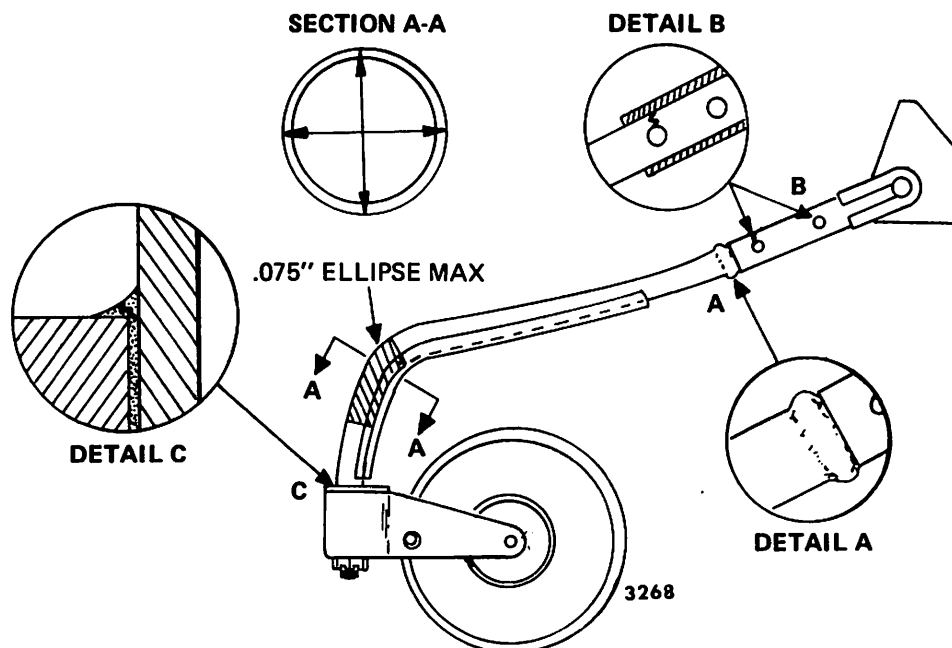
- (3) Inspect main landing gear attach brackets for deformation, proper bolt torque and evidence of movement on spar. If spring plate (20 Figure 201, 32-1-1) between attach brackets and strut is bent, spring plate must be replaced.
- (4) Check attach brackets for hole elongation.

B. Inspect Nose Landing Gear Assembly

- (1) Inspect nose landing gear fork assembly and axle rod for deformation or cracks as shown in Figure 202. This damage normally results from landing at a relatively flat attitude with a high vertical velocity. Any evidence of deformation or cracks is cause for rejection of the fork assembly and/or axle rod.

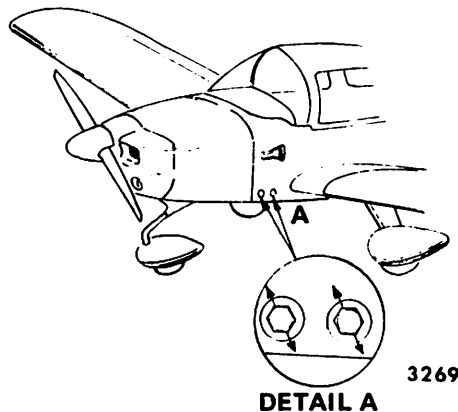


Nose Gear Axle Rod and Fork Assembly
Figure 202.



Nose Gear Strut
Figure 203

- (2) Deformation shown in Detail A, Figure 203 is the result of landing in a relatively flat attitude with high vertical velocity. Replace strut if deformed.
- (3) Inspect the curved area of the strut for flattened condition as shown in Section A-A, Figure 203. An elliptical shaped cross section exceeding .075 in. is cause for rejection of the strut.
- (4) With the weight removed from the nose landing gear, check the fit of the strut assembly into the torque tube yoke assembly (Detail B) by moving the strut up and down in the torque tube Tee. If looseness is noted, the cause for looseness must be determined. If the bolts that attach the strut to the torque tube yoke are worn, they should be replaced with NAS464-P6A31 bolts. If new bolts do not satisfactorily eliminate play, ream and install next larger size NAS bolt (NAS464-P7 maximum).
- (5) Inspect shock absorbers for nicks, distortion, corrosion and security.
- (6) With strut removed, inspect bolt hole areas at strut to torque tube attach point for evidence of elongation or cracking.
- (7) Inspect the nose fork bearing cup to nose strut bond joint for cracks, corrosion, deterioration or damage (see Detail C, Figure 203). Refer to Chapter 32 for repair of bond joint cracks and treatment of corrosion.
- (8) Inspect torque tube assembly attachment to fuselage side panels as shown in Figure 204. Remove snap plugs and check location of attach bolts. If bolts have shifted and are not exactly in the center of the counterbored holes in the fuselage sides, damage may have occurred to the lower engine mount/fuselage area. A very close inspection of this area should be accomplished. Check that attach bolts are torqued to 300-350 in. lbs.

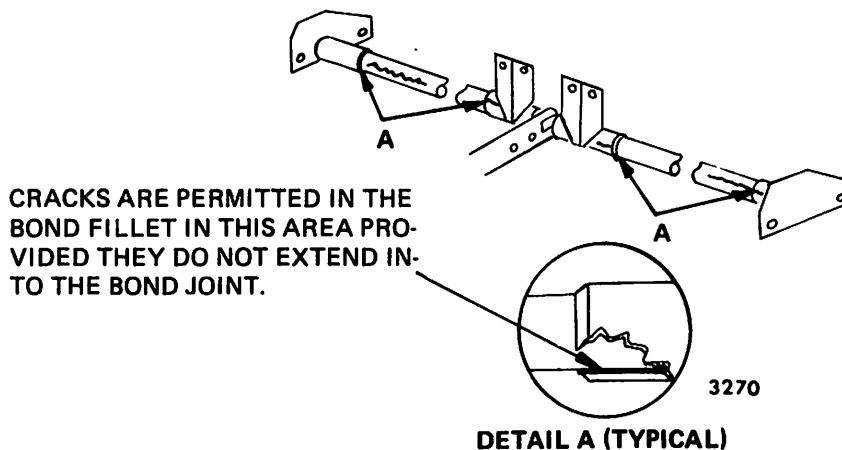


**Torque Tube Assembly Attachment
Figure 204**

- (9) Inspect bond fillets in torque tube and yoke assembly as shown in Figure 205. If cracks are noted in paint or in the bond fillets, they should be carefully sanded out to determine that they do not extend into the bonded joint. Cracks in the bond fillets are permissible. Cracks in the bonded joints are not permissible and torque tube assembly must be removed from service.

NOTE: In cases of severe overload, the bond joints may actually fail in the outboard end of the torque tube and yoke assembly, allowing one or both of the torque tubes to rotate in the end fittings.

- (10) Inspect the torque tubes for longitudinal cracks, as shown in Figure 205.
- (11) Inspect cabin floor and firewall where torque tube center bearing support brackets attach for evidence of deformed honeycomb. Inspect torque tube center bearing brackets for deformation. If torque tube center bearing support brackets are deformed, the entire torque tube assembly must be replaced. Check that center bearing support bracket bolts are torqued to 185-195 in. lbs.



Torque Tube and Yoke Assembly
Figure 205

C. Inspect Engine Mount and Propeller

- (1) Inspect engine mount welded assembly for cracks or any deformation.
- (2) Inspect engine attach fittings at fuselage for deformation and security of attachment to fuselage.
- (3) Inspect propeller tips for evidence of ground contact. Replace a damaged propeller.

D. Inspect Fuselage and Empennage

- (1) Inspect the tailcone structure for damage. Buckled tailcone flanges can normally be repaired using the procedures in AC 43.

- (2) Inspect horizontal and vertical stabilizer, elevator, rudder and aileron mounting brackets for damage, cracks and security of mounting (loose bolts or buckled supports).
- (3) Inspect bondlines for evidence of damage or cracks.

2. Bondline Damage, Inspection Procedures and Repair

A. Identify Types of Bondline Damage

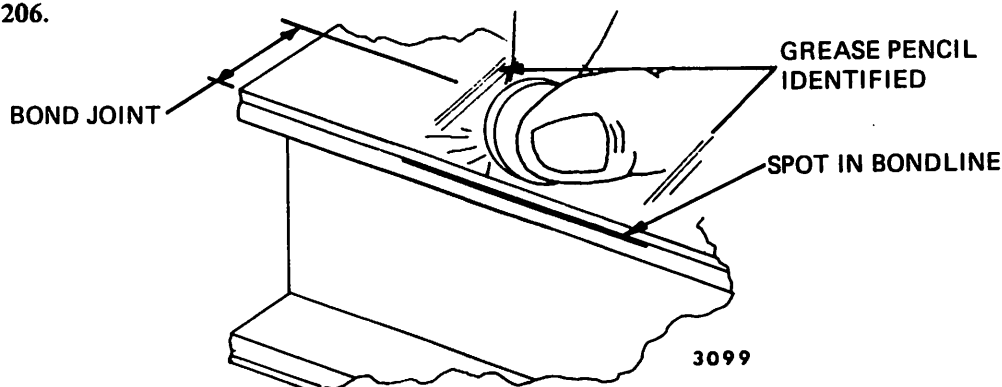
- (1) **Physical Damage** – The most common type of bondline damage is physical damage along the trailing edges of the flaps, ailerons, elevators and rudder. This is caused by persons stepping on the inboard trailing edges of the flaps and general “hangar rash” on the other control surfaces. This type of damage is usually readily visible in the form of joint separation.
- (2) **Corrosion Damage** – A less common type of bondline damage is damage caused by metal corrosion. This type of damage is usually restricted to edges of unfilleted bondlines, such as found on the rear spar to skin joints on the trailing edges of wings and stabilizers, particularly if these edges are not well protected by paint. This type of damage is more likely in tropical and subtropical climates, particularly where an aircraft is located close to the coast.

B. Isolate Most Common Damaged Areas

- (1) Areas which should be given particular attention include: flanges of wing and stabilizer rear spars, trailing edges of control surfaces, the side lap joint between the tailcone and forward cabin section, the joint between the tailcone top and side skin, and the aft tailcone bulkhead joints.
- (2) Inside edges and internal joints which have an undisturbed bondline fillet are generally not affected.

C. Locate and Verify Damaged Areas

- (1) **Visual Scanning** – Carefully scan the edges of all joints in a well lighted hangar or outside in daylight to determine the existence of hairline cracks between two layers of bonded metal. Figure 206 illustrates the appearance of this condition. Identify the location of any cracks with a grease pencil as shown in Figure 206.



Identifying Suspect Areas
Figure 206

- (2) **Tapping** – Gently tap the bondline with a coin or similar metal object to verify the existence of a bondline separation. Slowly move along the bondline, while tapping, and listen for a change in tone as the suspect area is traversed. A bondline separation will produce a flat or hollow sound when “tapped” directly in the damaged area.

- (3) Separation — If the results of (2) are questionable, attempt to insert a .004 in. .006 in. feeler gauge into the bondline to verify that a separation exists.

D. Repair Bondline Damage

WARNING: **USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.**

- (1) After inspection, if the suspected damage proves to be no actual separation, the hairline should be wiped with Methyl Ethyl Ketone and sealed with paint.
- (2) Seal all bondline edges with paint.
- (3) If the suspected area proves to be actual bondline separation, order Service Kit No. SK-125 from the Grumman American Supply Operations and make repairs accordingly.

CHAPTER 6**DIMENSIONS AND AREAS****TABLE OF CONTENTS**

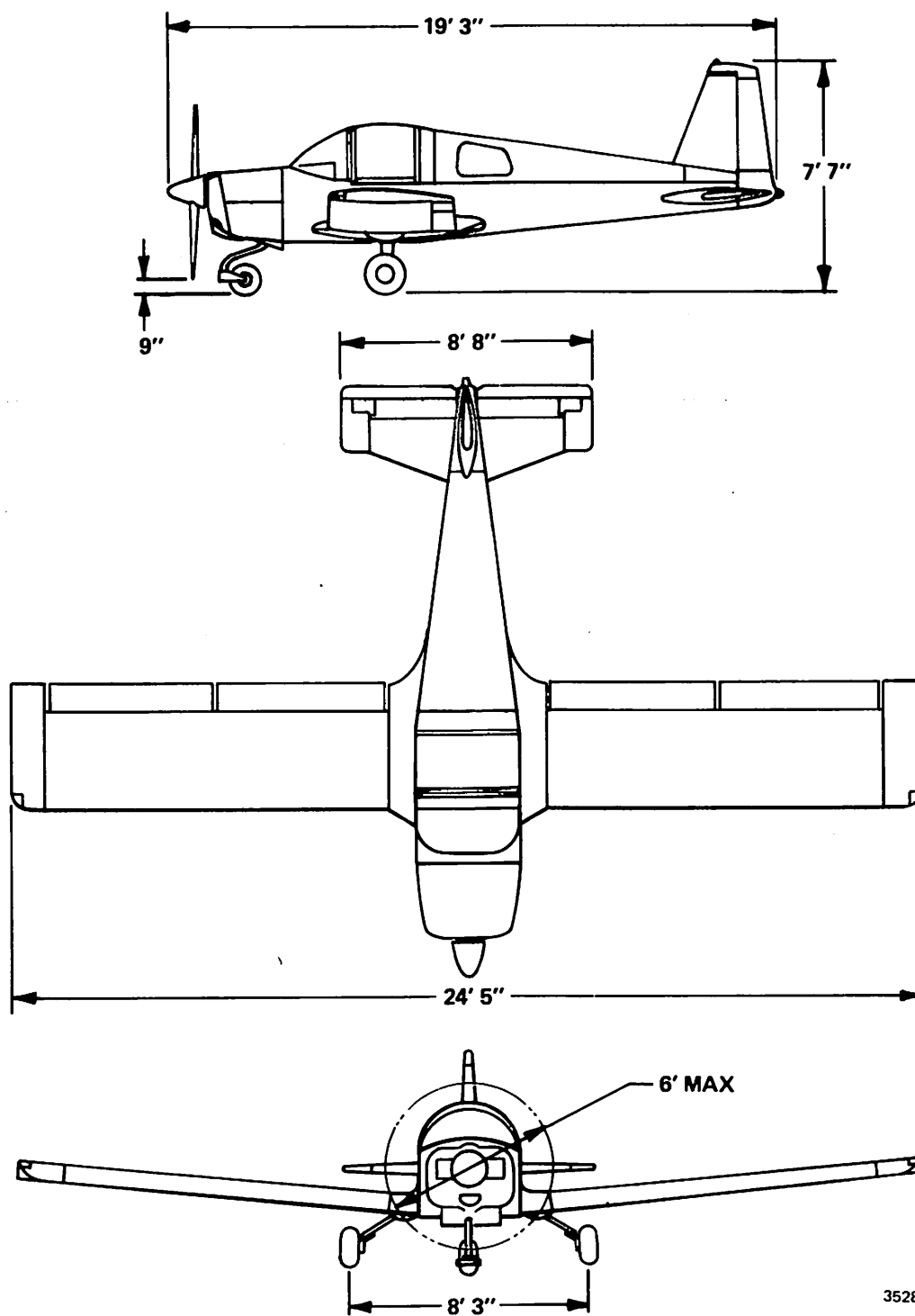
<u>NUMBER</u>		<u>PAGE</u>
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	General	1
	Specifications (AA-1C Aircraft)	1

PRINCIPAL DIMENSIONS**1. General**

This section provides, in diagram form, the principal dimensions for the AA-1C aircraft.

2. Principal Dimensions (AA-1C Aircraft)

Principal dimensions for the AA-1C aircraft are presented in Figure 1.



3528

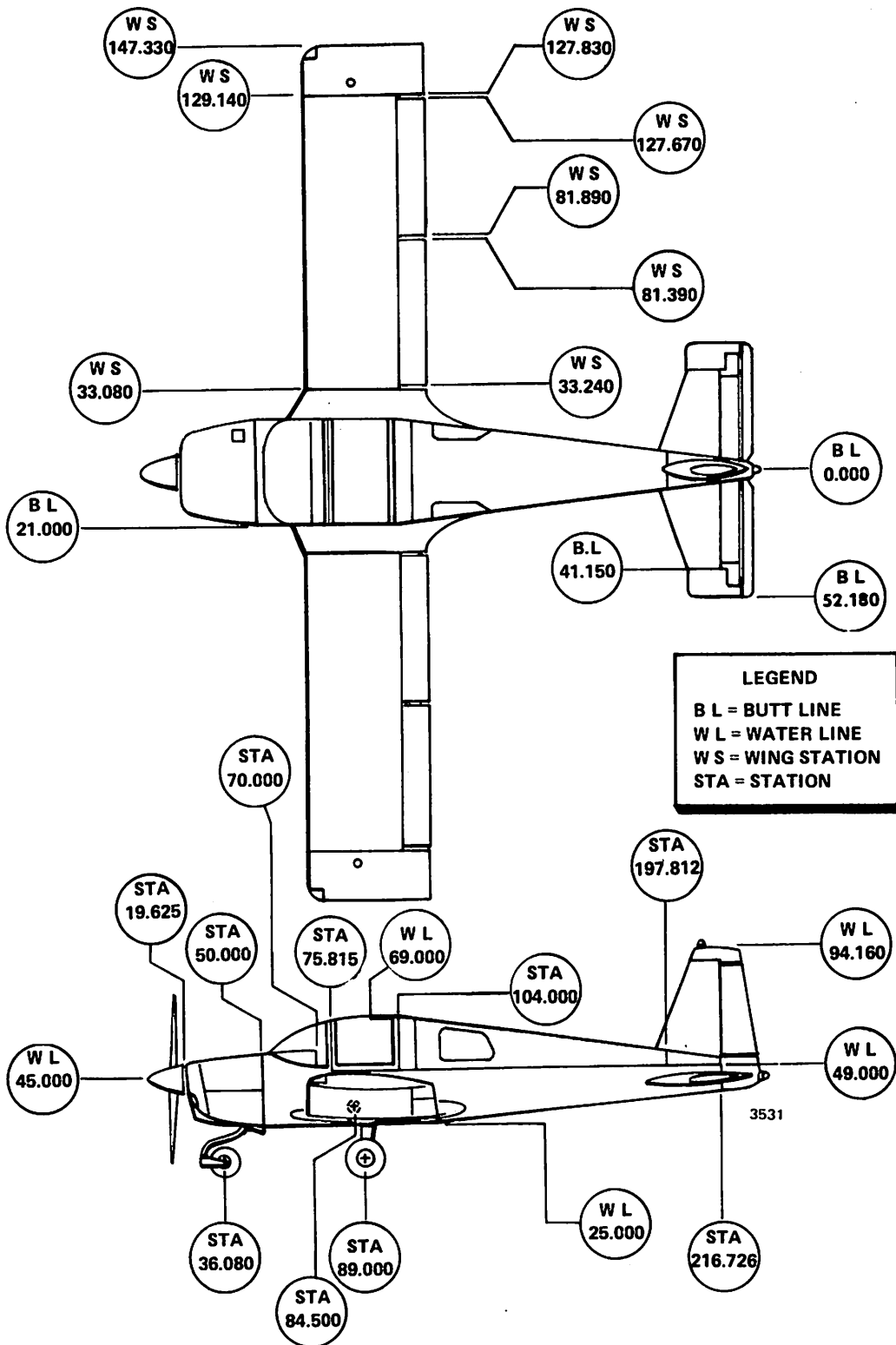
Principal Dimensions (AA-1C Aircraft)
Figure 1

STATION LOCATIONS**1. General**

This section provides, in diagram form, the station locations for the AA-1C aircraft.

2. Station Locations (AA-1C Aircraft)

Station locations for the AA-1C aircraft are presented in Figure 1.



**Station Locations (AA-1C Aircraft)
Figure 1**

SPECIFICATIONS1. General

This section provides, in tabular form, the major specifications for the AA-1C aircraft.

2. Specifications, AA-1C Aircraft

The major specifications for the AA-1C aircraft are as follows:

<u>FAA Type Certificate</u>	A11EA	<u>Flap Travel</u>	$30^{\circ} \pm 2^{\circ}$
<u>Gross Weight (Utility Cat.)</u>	1600 lbs.	<u>Max Difference Between Flaps</u>	$\pm 1^{\circ}$
<u>Fuel Capacity</u>	24 gal.		
<u>Oil Capacity</u>	6 qt. (without Oil Cooler) 7 qt. (with Oil Cooler)	<u>Empennage:</u>	
<u>Engine</u>	Lycoming O-235-L2C 115 HP at 2700 RPM	<u>Horizontal Tail Incidence</u>	-3°
		<u>Vertical Tail Offset</u>	0°
		<u>Elevator Travel (Up) (Dn)</u>	$12^{\circ} \pm 2^{\circ}$ $28^{\circ} \pm 2^{\circ}$
<u>Propeller (Fixed Pitch)</u>	Sensenich (72") 72CK-0-56 or 72CK-0-52	<u>Rudder Travel (LT & RT)</u>	$25^{\circ} \pm 2^{\circ}$
<u>Spinner</u>	Req'd Equipment	<u>Trim Tab Travel (Up) (Dn)</u>	$15^{\circ} \pm 4^{\circ}$ $15^{\circ} \pm 2^{\circ}$
<u>Length</u>	19' 2-7/8"	<u>Main Wheel Tire</u>	15 x 6.00-6 4 ply rating
<u>Height</u>	7' 7-1/4"		
<u>Wings:</u>		<u>Pressure</u>	19 PSI
<u>Span</u>	24' 5-1/2"	<u>Nose Wheel</u>	5.00 x 5 4 ply rating
<u>Dihedral</u>	5°	<u>Pressure</u>	22 PSI
<u>Incidence</u>	$1^{\circ} 25'$		
<u>Aileron Travel (Up) (Dn)</u>	$25^{\circ} \pm 2^{\circ}$ $20^{\circ} \pm 2^{\circ}$		

CHAPTER 7

LIFTING & JACKING

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	General	1
	Lifting and Jacking Points	1
7-1-1	LIFTING AND JACKING PROCEDURES	
	General	1
	Lifting Procedures	1
	Jacking Procedures	1



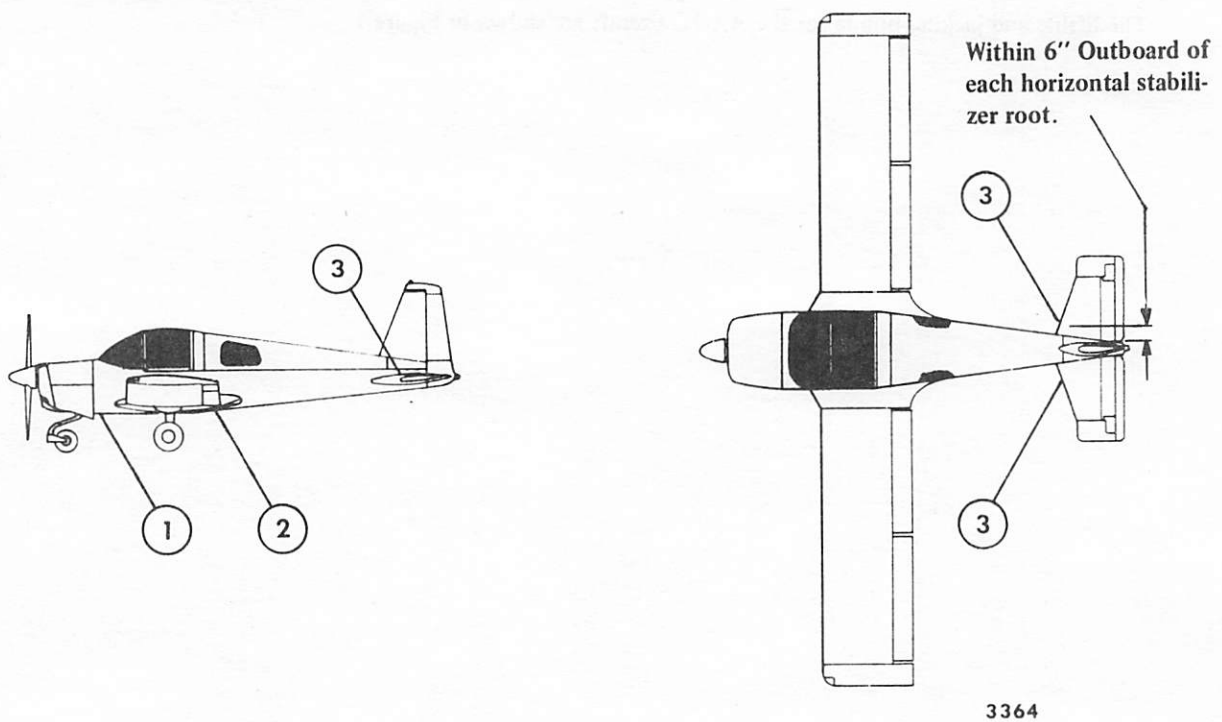
LIFTING AND JACKING POINTS

1. General

This section identifies and locates on illustrations those points that may be used when lifting or jacking of the aircraft is required. Reference is also made to Paragraph 7-3 to indicate what special lifting, jacking, or shoring equipment may be used at each lifting or jacking point.

2. Lifting and Jacking Points

The lifting and jacking points for the AA-1C aircraft are shown in Figure 1.



1. Front Lifting Point – Fuselage Station 51.
2. Aft Lifting Point – Fuselage Station 100.
3. Empennage Lifting Point – Within 6 in. of the horizontal stabilizer root.

**Lifting and Jacking Points
Figure 1**

LIFTING AND JACKING PROCEDURES

1. General

This section provides the recommended procedures for lifting and jacking the aircraft to accomplish maintenance and inspection procedures. Since lifting and jacking of aircraft can be accomplished by a wide variety of procedures, depending primarily upon the equipment available, these procedures provide general instructions that can be modified as necessary by the user, in light of his equipment availability.

2. Lifting Procedures

A. Lifting the nose landing gear is accomplished as follows:

CAUTION: IF A STAND IS USED TO SUPPORT THE FORWARD FUSELAGE WHEN THE NOSE GEAR IS LIFTED, ENSURE THAT THE BEARING SURFACE OF THE STAND EXTENDS THE WIDTH OF THE FUSELAGE AND THAT THE SURFACE IS AT LEAST FOUR INCHES WIDE. THE LOAD BEARING SURFACE SHOULD BE COVERED WITH PADDING OR HARD FOAM RUBBER. THE STAND MUST BE CAPABLE OF SUPPORTING 1500 POUNDS.

- (1) Engage the parking brake or place chocks around both main landing gear.

CAUTION: WHEN THE NOSE OF THE AIRCRAFT IS RAISED ENSURE THAT THE TRIM TAB AND FUSELAGE DO NOT STRIKE THE GROUND. DO NOT PRESS DOWN ON THE OUTBOARD END OF THE HORIZONTAL STABILIZER.

- (2) Press down on the horizontal stabilizer in the area of the stabilizer front spar, and within six in. of the fuselage. (See Figure 1.)
- (3) While holding the aircraft tail down, slide a stand (approximately 30 in. high) beneath the Fuselage Station 51, immediately behind the torque tube center bearing mounting bolts.
- (4) Slowly lower the nose onto the stand by releasing downward pressure on the horizontal stabilizer.

B. Lifting the entire aircraft is accomplished as follows:

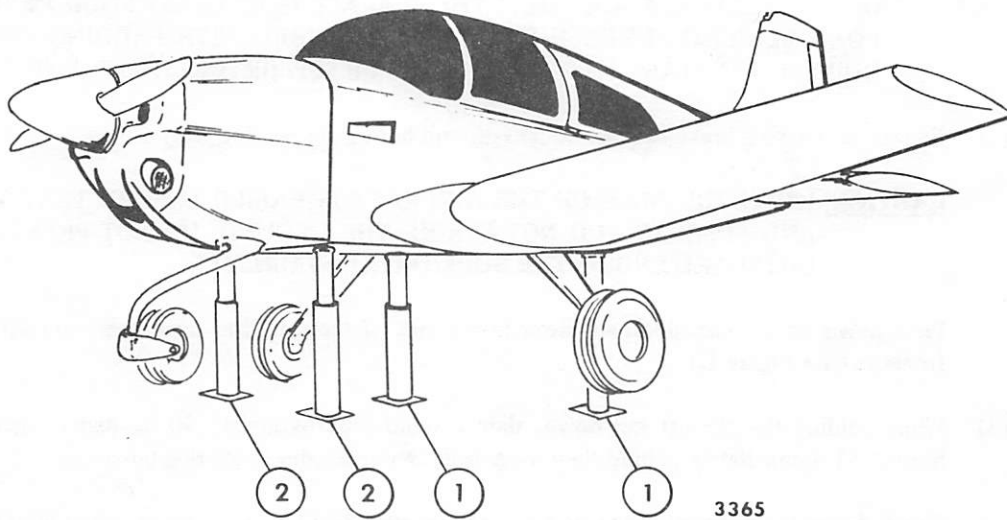
- (1) Lift the aircraft nose and place the forward stand as described in Paragraph A.
- (2) Secure a second stand of the same height and load-bearing capability as the one under the forward fuselage.

NOTE: The aft fuselage requires a lifting force approximately 500 pounds to lift it sufficiently for the stand to be placed under the fuselage.

- (3) Manually lift the aft fuselage, and slide the stand under the fuselage at Fuselage Station 100.
- (4) Lower the aircraft onto the stand.

3. Jacking Procedures

A. Jacking is done by placing jacks, as shown in Figure 2, and jacking the aircraft up.



1. Place jacks beneath aft fuselage at Fuselage Station 100.
2. Place jacks beneath fuselage at Fuselage Station 51, on each side of fuselage.

Jacking Arrangement
Figure 2

CHAPTER 8**LEVELING & WEIGHING****TABLE OF CONTENTS**

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8-2-1	WEIGHING	
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	Weighing Procedure	1
8-3-1	MEASURING ARM	
	General	1
	Measuring Procedure	1
8-4-1	COMPUTING CENTER OF GRAVITY	
	General	1
	Computation Procedure	1

AIRCRAFT PREPARATION

1. General

This section contains the procedure for determining the basic empty weight and moment of the aircraft. Sample forms and the corresponding procedures for their use are provided to enable a rapid calculation of the weight and moment for various operations. A comprehensive list of all available equipment for the aircraft is also provided.

It should be remembered that specific information on weight, arm, moment and installed equipment for this aircraft can only be found in the appropriate weight and balance records carried in the aircraft.

2. Preparation Procedure

Prepare the aircraft for leveling and weighing as follows:

- A. Inflate all tires to recommended operating pressure.
- B. Drain all fuel from the tanks and fuel system.
- C. Drain all oil from the oil system.
- D. Move sliding seats to center of travel position.
- E. Raise flaps to fully retracted position.
- F. Place all controls in neutral position.
- G. Ensure that all objects not a part of the aircraft or its accessories are removed from the aircraft.
- H. Slide canopy to provide a six in. opening between canopy and windshield.

LEVELING1. General

Normally, aircraft leveling is accomplished in conjunction with aircraft weighing. When this is the case, the aircraft should be mounted on the scales prior to leveling.

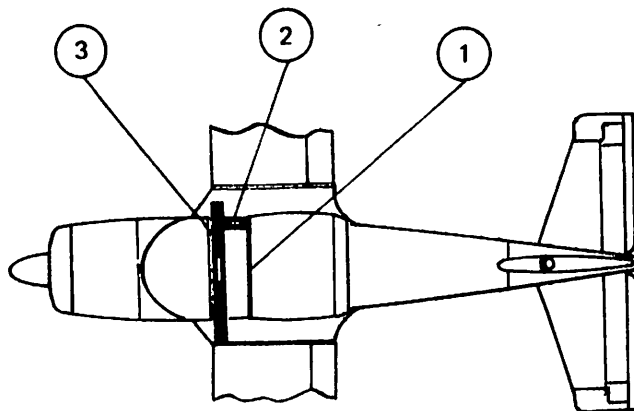
When leveling is done in conjunction with some maintenance procedure (fuel gage calibration, etc.), the aircraft should be parked on a level surface.

2. Leveling Procedure

Level the aircraft as follows:

- A. Place scales under each wheel (minimum capacity 1500 pounds for nose wheel and 1000 pounds capacity for main wheels).
- B. Place levels on canopy track as shown in Figure 1.
- C. Level aircraft both laterally and longitudinally by deflating one or two tires until the bubbles in the levels center.

- (1) Open the canopy approximately six inches;
- (2) Level airplane longitudinally by placing a short spirit level on the right canopy rail forward of the pilot's seat, and deflating nose tire or main gear tires to center the bubble.
- (3) Level the airplane laterally by placing a four-foot level across the canopy rails at windshield and differentially deflating main gear tires to center the bubble. Close canopy.



Aircraft Leveling
Figure 1

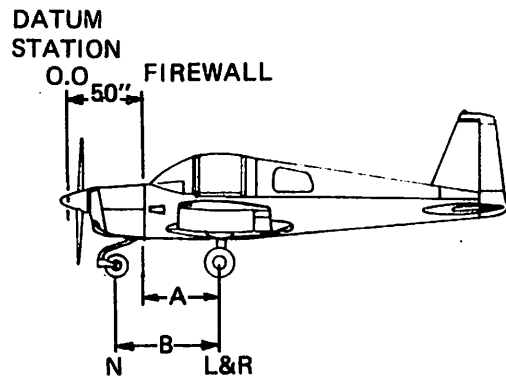
WEIGHING**1. General**

Aircraft weighing should be done in an area such as a hangar where wind or other disturbances do not cause inaccurate scale readings. The scales used should be properly calibrated and of sufficient capacity to support the aircraft.

2. Weighing Procedure

Weigh the aircraft as follows:

- A. Remove the levels, close and lock the canopy.
- B. With aircraft level and brakes released, record the weight shown on each scale as shown in Figure 1.
- C. Deduct tare (chocks, etc.), if any, from the scale readings and record the result in the weighing form.



Scale Position	Scale Reading	Tare	Symbol	Net Weight
Left Wheel			L	
Right Wheel			R	
Nose Wheel			N	
Total of Net Weights			W	

Calculate Arm (in inches) as follows:

NOTE

- $(50 + A)$ = MAIN LANDING GEAR ARM (IN INCHES)
 $50 - (B - A)$ = NOSE LANDING GEAR ARM (IN INCHES)
 L = WEIGHT OF LEFT MAIN LANDING GEAR (IN POUNDS)
 R = WEIGHT OF RIGHT MAIN LANDING GEAR (IN POUNDS)
 N = WEIGHT OF NOSE LANDING GEAR (IN POUNDS)

$$\text{C.G. Arm} = \frac{[(50 + A)(L + R)] + [50 - (B - A)] N}{L + R + N}$$

Item	Weight	C.G. Arm	Moment/ 1000 Lbs. In.
Airplane Net Weight (W)			
Oil, 6 Qt. at 1.875 Lb./Qt.	11.00	39.0	.429
Unusable Fuel 2 Gal. at 6 Lb./Gal.	12.00	84.5	1.014
Equipment Changes			
Airplane Basic Empty Weight			

Sample Aircraft Weighing
Figure 1.

MEASURING ARM

1. General

The following procedures must be performed carefully in order to obtain the accuracy required for proper center of gravity computation. When performing these measurements, ensure that the string is stretched tight enough to prevent deflection during measurement, and that the aircraft is level during the measurements.

2. Measuring Procedure

Measure the arm as follows:

A. Obtain measurement A (Section 8-2-1, Figure 1) as follows:

- (1) Stretch a string laterally across the aircraft from the axle center of one main landing gear to the axle center of the other.
- (2) Connect a plumb bob such that it hangs from the centerline of the engine firewall to the floor.
- (3) Using a tape, measure the distance along the centerline of the aircraft from the plumb bob to the string stretched between the main landing gear.
- (4) Record measurement A in the Weight Form (Section 8-2-1, Figure 1).

B. Obtain measurement B (Section 8-2-1, Figure 1) as follows:

- (1) Ensure that the nosewheel is set straight along the centerline of the aircraft.
- (2) Using a tape, measure from the center of the nose gear axle to the string stretched between the main landing gear wheels.
- (3) Record measurement B in the Weight Form (Section 8-2-1, Figure 1).

COMPUTING CENTER OF GRAVITY

1. General

The following computation is performed in the sample form shown in Section 8-2-1, Figure 1. This computation determines the aircraft basic empty weight moment.

2. Computation Procedure

Perform the computation as follows:

- A. Using the weights previously recorded, calculate the aircraft net weight (W), per Section 8-2-1, Figure 1.
- B. Using the weights and measurements previously recorded, calculate the C.G. Arm according to the formula in Section 8-2-1, Figure 1.
- C. Enter the aircraft net weight (W) and C.G. Arm obtained in Steps A and B in the Aircraft Basic Empty Weight Form at the Bottom of Figure 1, Section 8-2-1.
- D. Obtain moment by multiplying weight times C.G. Arm and dividing by 1000. Enter moment in the appropriate column.
- E. Add the entries in the Weight column to obtain the AIRCRAFT BASIC EMPTY WEIGHT.
- F. Add the entries in the MOMENT/1000 Lbs. In. column to obtain the AIRCRAFT BASIC EMPTY WEIGHT MOMENT.

CHAPTER 9**TOWING & TAXIING****TABLE OF CONTENTS**

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	Towing Procedures	1
9-1-1	TAXIING	
	General	1
	Taxiing Technique	1

TOWING**1. General**

This Section provides the procedures recommended for manual towing of the AA-1C aircraft.

2. Towing Procedures

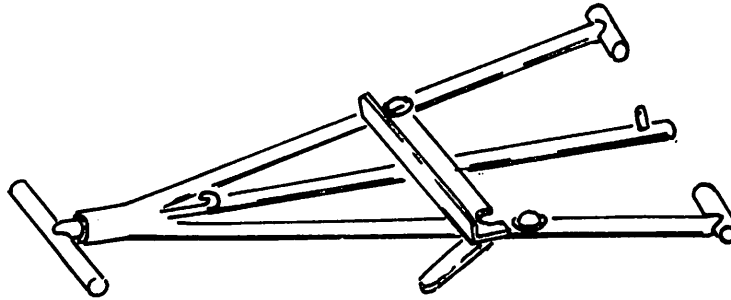
CAUTION: USING THE PROPELLER FOR GROUND HANDLING COULD RESULT IN SERIOUS DAMAGE, ESPECIALLY IF PRESSURE IS EXERTED ON THE OUTER ENDS. DO NOT ATTEMPT TO PUSH THE AIRCRAFT BACKWARD WITHOUT THE AID OF A TOW BAR. THIS ACTION COULD RESULT IN THE NOSE WHEEL PIVOTING ABRUPTLY AND DAMAGING THE NOSE WHEEL STOPS.

Towing of the aircraft should be accomplished by use of the nose gear tow bar (Part No. 5804052-501), as follows:

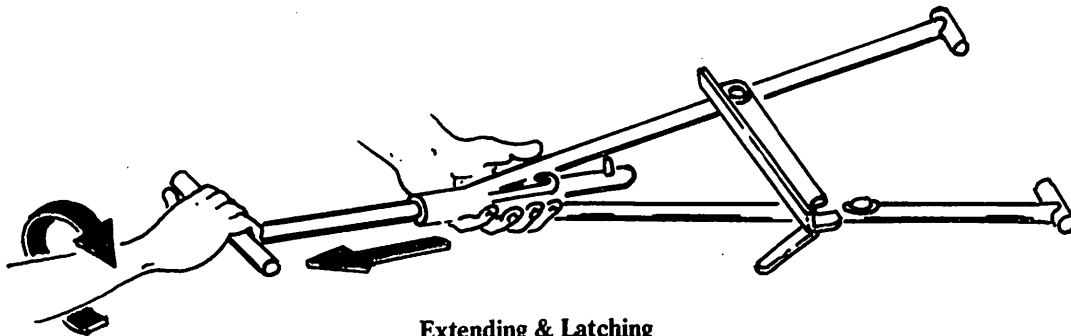
- A. Extend the tow bar by pulling the handle out and rotating it to engage the lock as shown in Figure 1.**
- B. Open the jaws of the tow bar by pulling the latch handle back as shown in Figure 1.**

CAUTION: WHEN USING TOW BAR EXERCISE CAUTION SO THAT FINISH ON NOSE WHEEL FAIRING IS NOT DAMAGED.

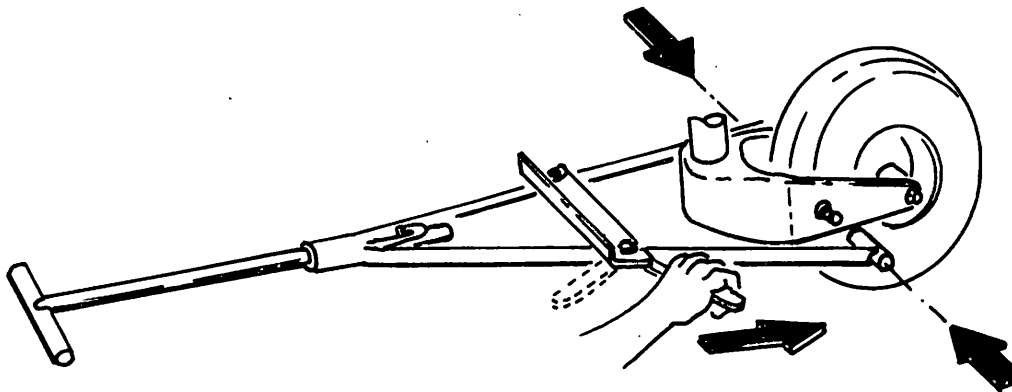
- C. Place tow bar cups over lugs on nose gear and close latch as shown in Figure 1.**
- D. Tow aircraft by pulling or pushing tow bar handle.**



Stowing Position



Extending & Latching



Attaching

**Tow Bar Usage
Figure 1**

TAXIING

1. General

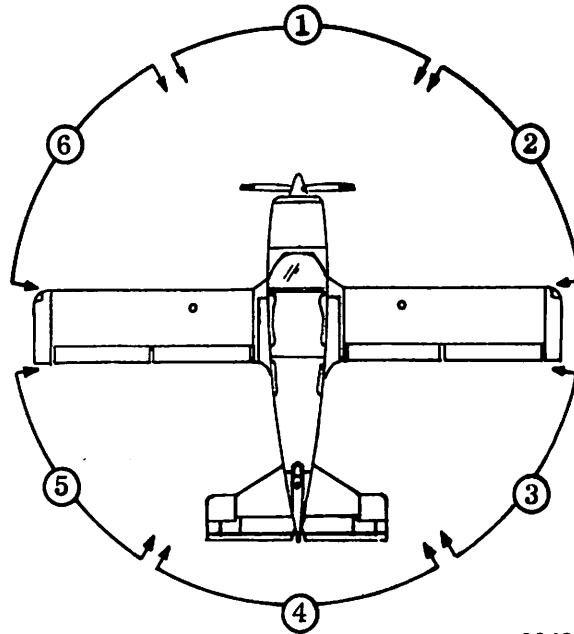
Since the rudder controls on the AA-1C aircraft are not directly coupled to the nose wheel, directional control during taxiing is maintained by use of differential braking.

2. Taxiing Technique

All taxiing should be done at slow speed, and the controls should be positioned such that the affects of gusty wind are minimized. (See Taxiing Diagram, Figure.1)

Taxiing should not be attempted in strong crosswinds. If taxiing in strong crosswinds is necessary the use of "wing walkers" is recommended.

Taxiing over loose gravel or cinders should be done at low engine speed to minimize damage to the propeller tips, horizontal surfaces and landing gear due to stone damage.



3243

NUMBER	WIND DIRECTION	CONTROL	POSITION
(1)	FWD	Wheel Neutral	Back
(2)	FWD RH Quarter	Wheel Right	Back
(3)	Aft RH Quarter	Wheel Left	Forward
(4)	AFT	Wheel Neutral	Forward
(5)	Aft LH Quarter	Wheel Right	Forward
(6)	FWD LH Quarter	Wheel Left	Back

**Taxiing Diagram
Figure 1**

CHAPTER 10**PARKING AND MOORING****TABLE OF CONTENTS**

<u>NUMBER</u>		<u>PAGE</u>
10-0	PARKING	
	General	1
	Parking Practices	1
10-1-1	MOORING	
	General	1
	Normal Tiedown	1
	Severe Weather Precautions	1

PARKING**1. General**

This section provides the procedures recommended to park the aircraft so that the likelihood of ground damage is minimized.

2. Parking Practices

CAUTION: WHEN CHOCKING WHEELS, ENSURE THAT THE CHOCKS USED ARE NOT LARGE ENOUGH TO COME IN CONTACT WITH THE WHEEL FAIRINGS. USE OF CHOCKS THAT ARE TOO LARGE MAY DAMAGE FAIRINGS.

When parking the aircraft, head into the wind and set the parking brakes. Do not set the parking brakes during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated. Install the control wheel lock and chock the wheels. In severe weather and high wind conditions, moor the aircraft as outlined in the following paragraph.

Care should be taken when using the parking brakes for an extended period of time during which an air temperature rise could cause the hydraulic fluid to expand, which in turn could damage the brake system and/or cause difficulty in releasing the parking brake. For prolonged parking, tie-downs and wheel chocks are recommended.

MOORING

1. General

This section provides the procedures recommended for a normal tie-down of the aircraft, and special precautions that may be taken to minimize the likelihood of damage during severe weather.

2. Normal Tie-Down

Proper tie-down procedure is the best precaution against damage to the parked aircraft by gusty or strong winds. To tie-down the aircraft securely, proceed as follows:

- A. Chock all wheels and install the control wheel lock.

CAUTION: WHEN CHOCKING WHEELS, ENSURE THAT THE CHOCKS USED ARE NOT LARGE ENOUGH TO COME IN CONTACT WITH THE WHEEL FAIRINGS. USE OF CHOCKS THAT ARE TOO LARGE MAY DAMAGE FAIRINGS.

- B. Tie sufficiently strong ropes or chains to the wing and tail tie-down fittings and secure each rope to a ramp tie-down.
- C. Ensure that the canopy is closed and latched.

3. Severe Weather Precautions

When it is necessary to moor the aircraft during periods when severe weather is anticipated, the following precautions (in addition to the steps in Paragraph 2) may be employed:

- A. Ensure that the aircraft is positioned so that it is headed directly into the wind.
- B. When manila rope is used for mooring, ensure that the rope has sufficient slack to compensate for shrinkage when the rope gets wet, and subsequently dries.

CHAPTER 11**REQUIRED PLACARDS****TABLE OF CONTENTS**

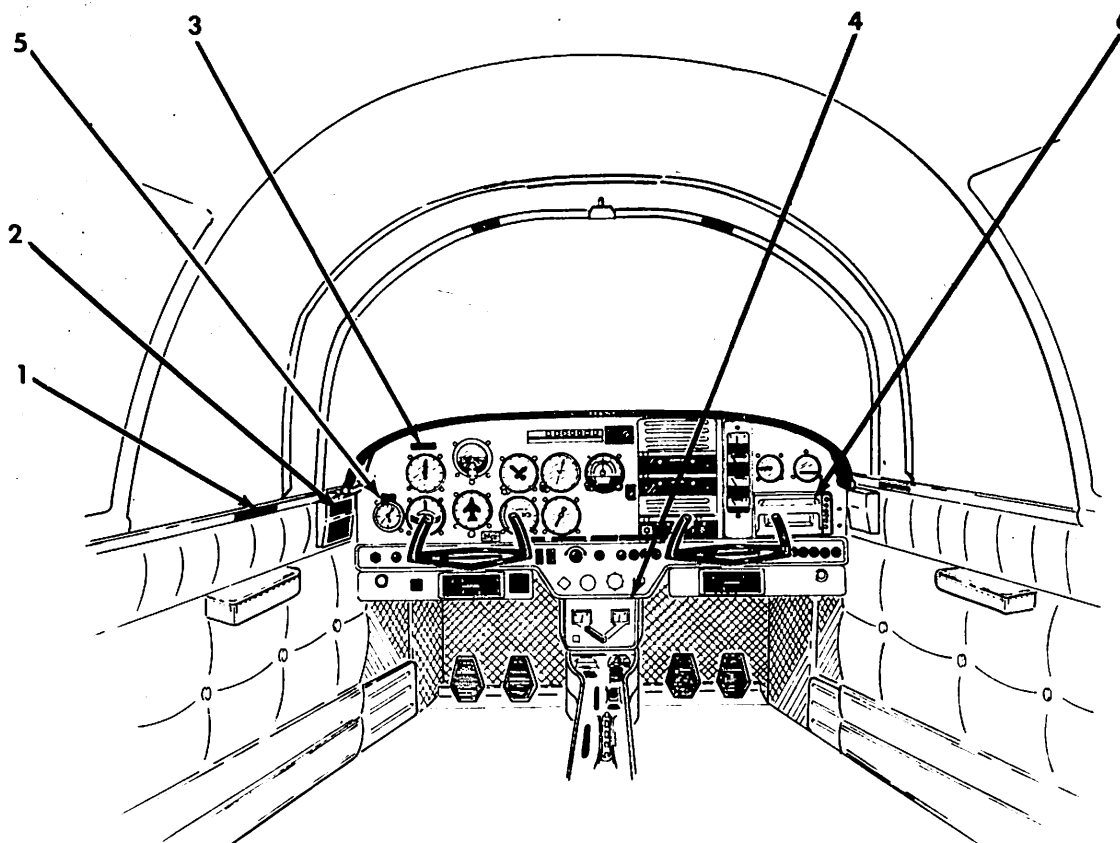
<u>NUMBER</u>		<u>PAGE</u>
11-1	LIMITATIONS PLACARDS	
	General	1
	Placard Locations	1
11-2	OPERATIONS PLACARDS	
	General	1
	Placard Locations	1

LIMITATIONS PLACARDS**1. General**

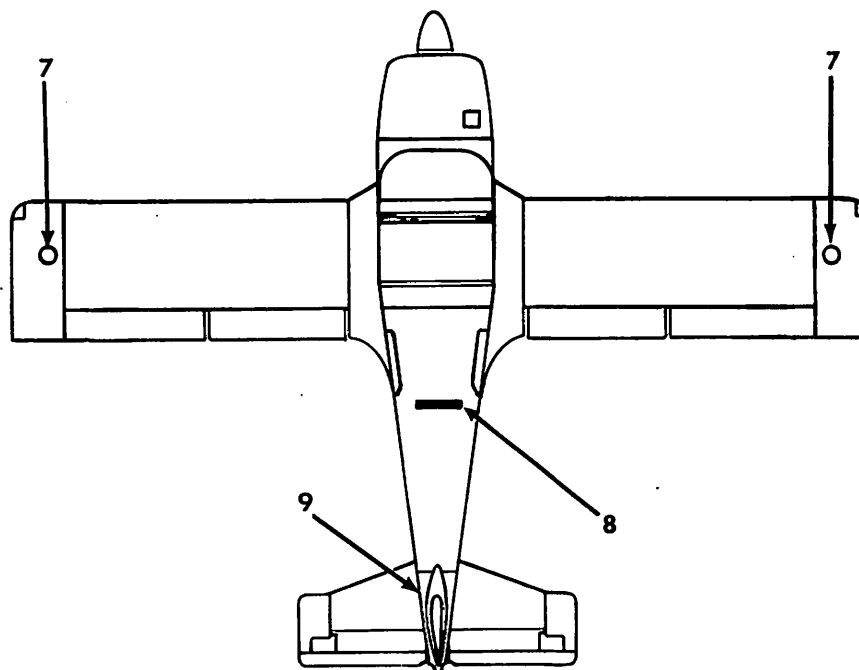
This section contains information relating to all placards aboard the AA-1C aircraft which define aircraft limitations and/or provide flight safety data. FAA regulations require the permanent installation of these placards aboard the aircraft.

2. Placard Locations

The appearance, content, and location of all limitations placards are contained in Figure 1 and accompanying legend.



VIEW A



VIEW B

**Limitations Placards (Sheet 1 of 4)
Figure 1**

1. Located inside canopy rail, left side

**↑ 113 KNOTS MAX WITH CANOPY OPEN TO HERE
NO FLIGHT WITH CANOPY OPEN BEYOND THIS POINT**

2. Located in full view of Pilot — left side

THIS AIRPLANE MUST BE OPERATED AS A UTILITY CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS

**MAXIMUM DESIGN WEIGHT 1600 LBS
DESIGN MANEUVERING SPEED, V_A 117 KNOTS, CAS
FLIGHT LOAD FACTORS:
FLAPS UP +4.4 -1.76 FLAPS DOWN +3.5**

ACROBATIC MANEUVERS ARE LIMITED TO THE FOLLOWING:

MANEUVER	ENTRY SPEED (CAS)
CHANDELLES	117 KNOTS
LAZY EIGHTS	117 KNOTS
STEEP TURNS	117 KNOTS
STALLS (EXCEPT WHIP STALLS)	SLOW DECELERATION

SPINS PROHIBITED

**MAXIMUM ALTITUDE LOSS IN STALL 200 FEET
DEMONSTRATED CROSSWIND VELOCITY 16 KNOTS**

THIS AIRPLANE NOT APPROVED FOR FLIGHT IN ICING CONDITIONS. READ FUEL GAGES IN LEVEL FLIGHT ONLY. FOR NORMAL OPERATION MAINTAIN FUEL BALANCE.

**DEMONSTRATED FUEL UNBALANCE 7 GAL
REFER TO WEIGHT AND BALANCE DATA FOR LOADING INSTRUCTIONS:**

THIS AIRPLANE IS CERTIFICATED FOR THE FOLLOWING OPERATIONS AS OF DATE OF ORIGINAL AIRWORTHINESS CERTIFICATE: IFR VFR DAY NIGHT WHEN PROPERLY EQUIPPED PER FAR 91

16-803007-65

AA1C

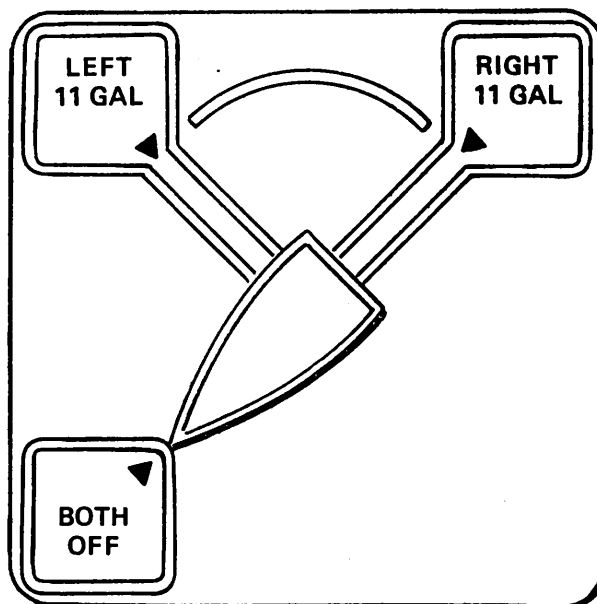
GRUMMAN AMERICAN AVIATION
AA-1 SERIES
MAINTENANCE MANUAL

3. Located on Left side of instrument panel, above airspeed indicator.

CAUTION: MAKE SURE INSTALLED PLACARD MATCHES AIRCRAFT CONFIGURATION.

MODEL AA-1C				
STALL SPEED KNOTS CAS				
BANK ANGLE				
CONDITION	0°	20°	40°	60°
FLAPS UP	57	59	65	81
FLAPS DN	53	55	61	75
1600 LBS. POWER OFF				

4. Located on fuel selector valve, to right of pilot's seat forward.



5. Located on instrument panel in full view of pilot.

SPINS PROHIBITED

Limitations Placards (Sheet 3 of 4)
 Figure 1

GRUMMAN AMERICAN AVIATION
AA-1 SERIES
MAINTENANCE MANUAL

6. Located inside glove compartment

TIRE PRESSURE	NOSE 22 LBS
	MAIN 19 LBS

7. Located on left and right wing at fuel filler cap.



8. Located in baggage compartment

BAGGAGE CAPACITY
100 POUNDS MAX

9. Located on fuselage side under left horizontal stablizer.

GRUMMAN AMERICAN AVIATION CORPORATION SAVANNAH, GEORGIA 31402 U.S.A.	
MODEL NO.	
SERIAL NO.	
TYPE CERT NO.	
PROD CERT NO.	

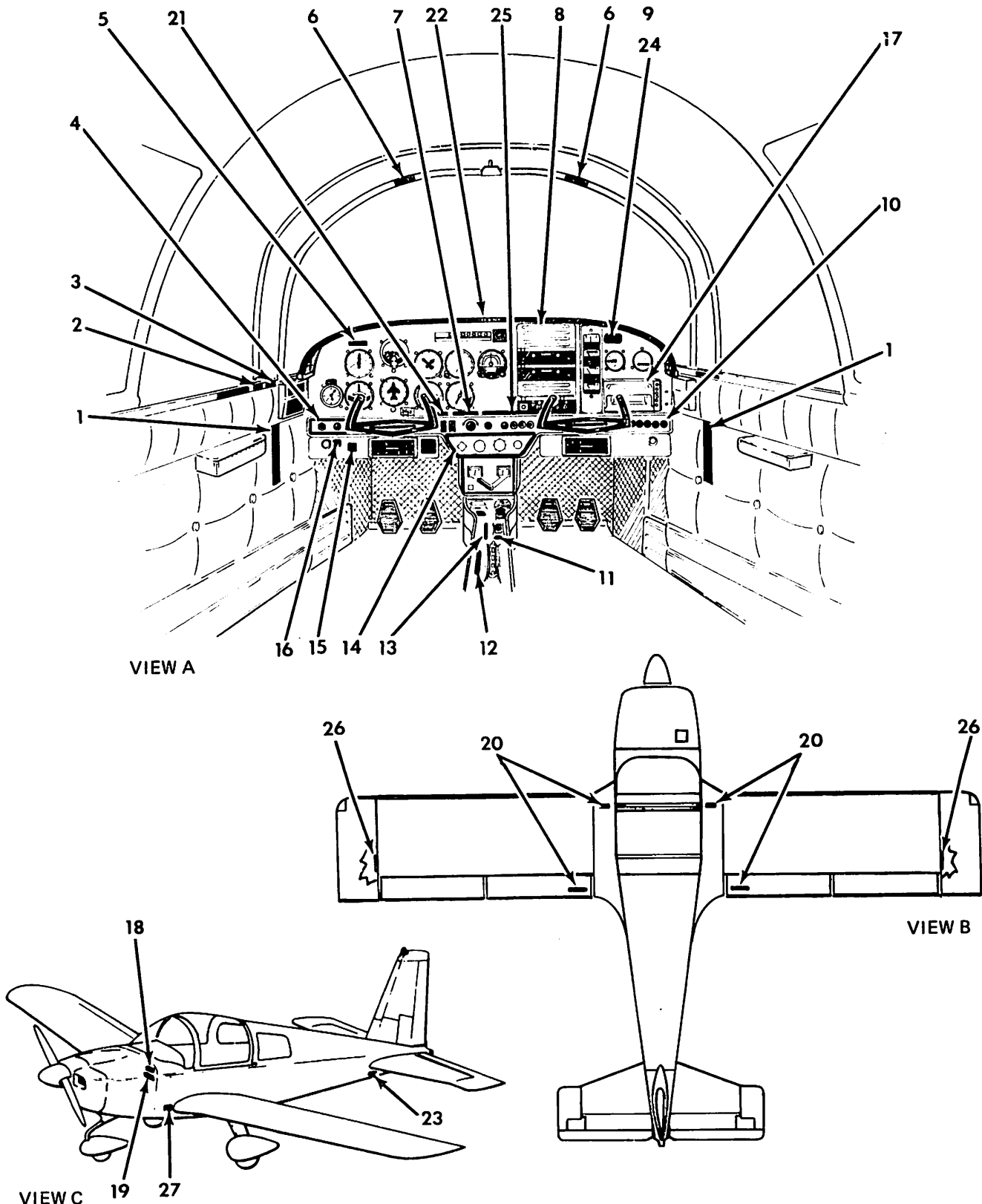
Limitations Placards (Sheet 4 of 4)
Figure 1

OPERATIONS PLACARDS**1. General**

This section contains information relating to all placards aboard the AA-1C aircraft which provide the pilot, passenger, and maintenance personnel with aircraft operation data.

2. Placard Locations

The appearance, content and location of all operations placards are contained in Figure 1 and accompanying legend.

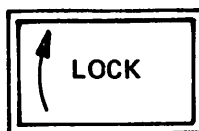


Operations Placards (Sheet 1 of 8)
Figure 2

1. Located below left and right forward canopy rail corners (one gauge for each wing tank)



2. Located forward on left side of canopy rail

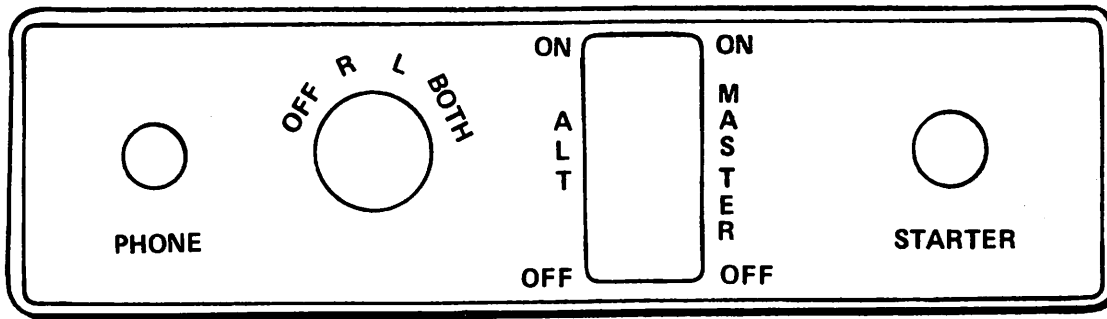


3. Located forward on left side of canopy rail

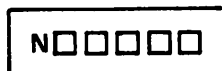


Operations Placards (Sheet 2 of 8)
Figure 2

4. Located on lower left side of instrument panel.



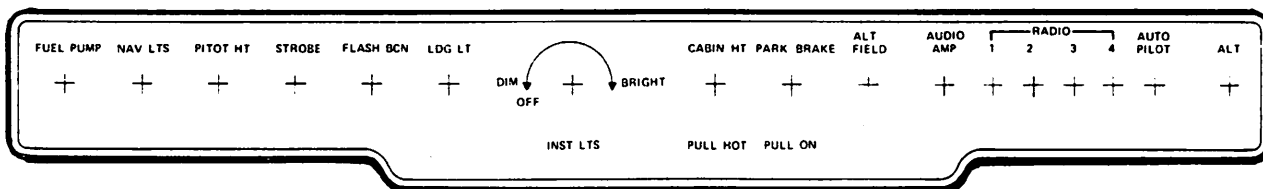
5. Located on instrument panel above airspeed indicator



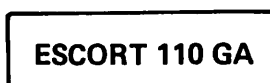
6. Located on top back, left and right centers of windshield framing.



7. Located on lower center of instrument panel

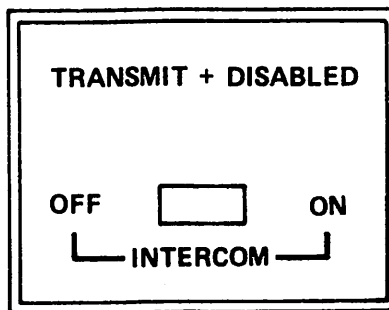


8. Located on back of panel mounted "Escort model aircraft radio."

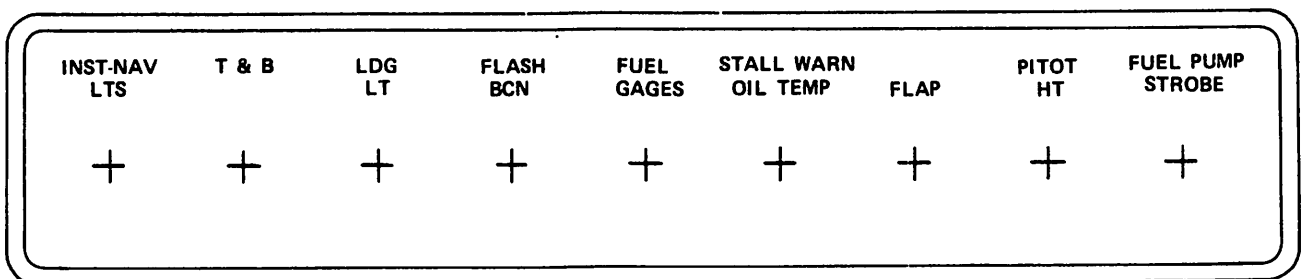


Operations Placards (Sheet 3 of 8)
Figure 2

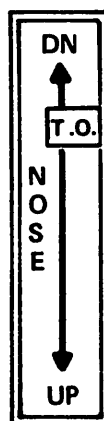
9. Located on upper right side of instrument panel.



10. Located on lower right side of instrument

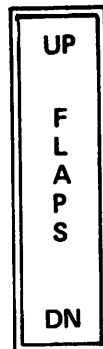


11. Located on top of console, right side

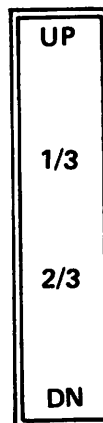


Operations Placards (Sheet 4 of 8)
Figure 2

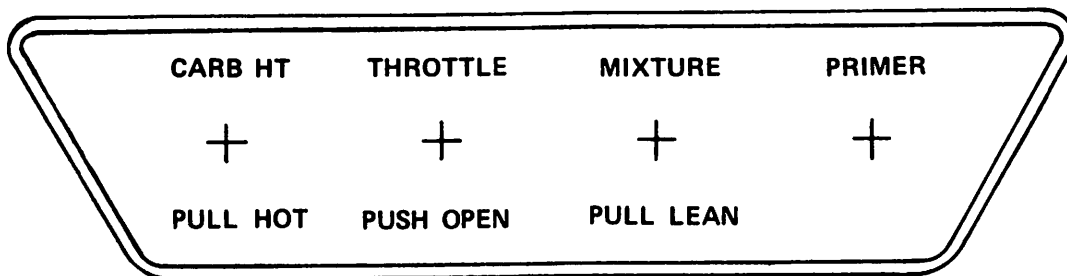
12. Located on top of console, center.



13. Located on top of console, left side



14. Located on lower center of instrument panel



Operations Placards (Sheet 5 of 8)
 Figure 2

15. Located on lower left side of instrument panel left of air vent.

<u>CHECKLIST</u>	
<u>TAKE-OFF</u>	
1	FUEL—FULLEST TANK
2	MIXTURE—RICH
3	AUX PUMP—ON
4	INSTR'S—SET & CHECK
5	TRIM—SET
6	FLAPS—UP
7	THROTTLE—FULL
8	RAISE NOSE—55 KNOTS
<u>LANDING</u>	
1	FUEL—FULLEST TANK
2	MIXTURE—RICH
3	AUX. PUMP—ON
4	CARB HEAT—A/R
5	FLAPS—A/R
6	APPROACH—70 KNOTS

16. Located on lower left side of instrument panel to right of air vent control.

VENT PULL—OPEN

17. In glove box

CONTROL LOCK
Remove Before Starting Engine

18. Located on upper left corner of firewall

FINISH AND TRIM

Operations Placards (Sheet 6 of 8)
Figure 2

19. Located on upper left corner of firewall.



20. Located on left and right wing roots and flaps (2 places on each wing)



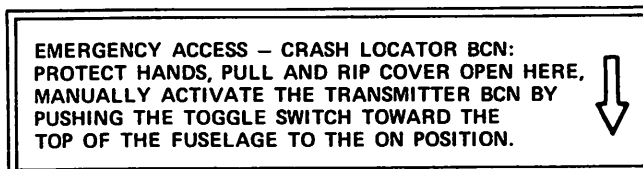
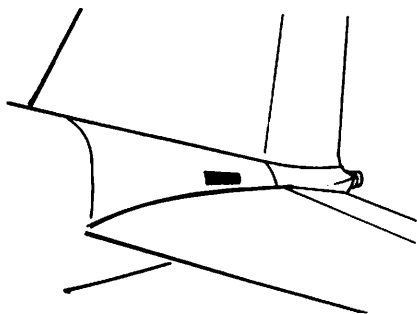
21. Located on instrument panel:



22. Located on instrument panel shield:

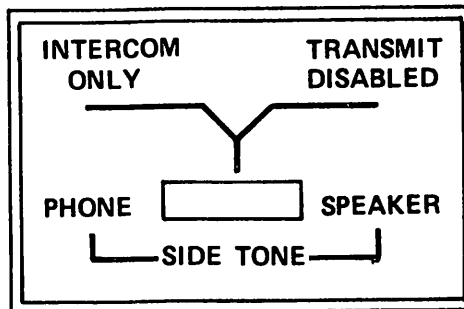


23. Located on aft fuselage above left horizontal stabilizer (optional equipment)



Operations Placard (Sheet 7 of 8)
Figure 2

24. Located on upper right side of instrument panel (optional equipment)



25. On instrument panel (optional equipment)

TURN OFF STROBE IN CLOUD, FOG
OR HAZE. TAXI WITH STROBE OFF

26. On wing outer ribs (optional equipment)

WARNING
— HIGH —
VOLTAGE

WAIT 5 MINUTES AFTER
SHUTTING OFF BEFORE STARTING
ANY WORK ON THIS UNIT

CAUTION

THIS UNIT POLARITY SENSITIVE
WHITE OR RED LEAD POSITIVE
BLACK LEAD AND OR CASE NEGATIVE

27. Adjacent to auxiliary power plug (optional equipment)

CAUTION: 12 VOLT
D.C. ONLY, MASTER
SW. MUST BE OFF

Operations Placards (Sheet 8 of 8)
Figure 2

CHAPTER 12**SERVICING****TABLE OF CONTENTS**

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SERVICING**1. General**

This section describes the procedures and precautions necessary for proper servicing of the AA-1C aircraft. Safety precautions are also presented to acquaint the user with those potential hazards that may not be readily apparent to persons unfamiliar with the aircraft.

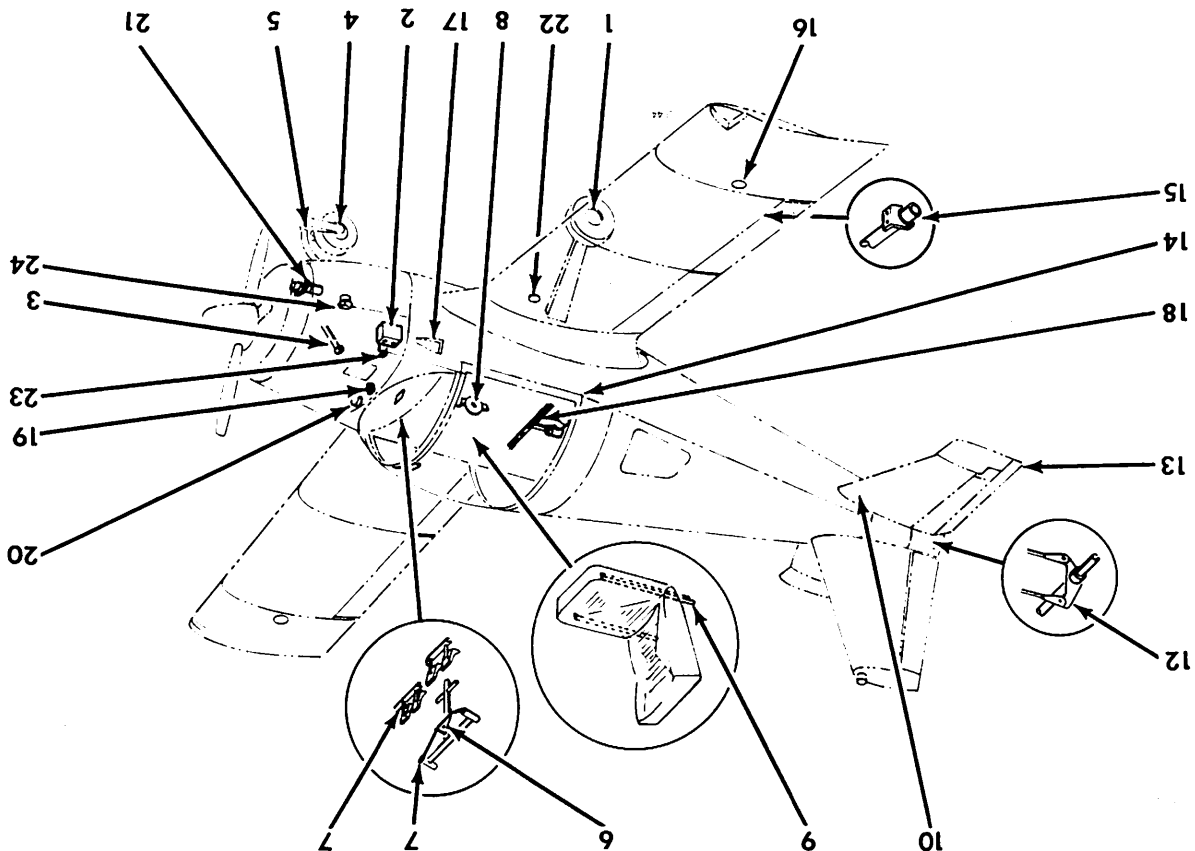
2. Servicing Points

Figure 1 illustrates the locations of the major servicing points on the aircraft. Figure 2 lists approved lubricants.

3. Access and Inspection Provisions

Various openings in the airframe are provided to enable access for inspection or maintenance. In addition to the normal access provided by the engine cowl, other openings, which are covered by removable plates, are listed in Figure 3.

Access to the interior of the aft fuselage is gained by removal of the panel at the rear of the baggage compartment. Control cables are exposed by removal of the center console, and by removal of the access panels beneath the rug in the baggage compartment.



1. MAIN WHEEL BEARINGS (LEFT AND RIGHT) - Grease with MIL-G-25760 (Figure 2) grease every 100 hours or as required.

2. TIRES - Inflate to 24 PSI as required.

3. BATTERY - Fill with distilled water as required to maintain fluid level at top of plates.

4. ENGINE OIL - (See Figure 2.) Change engine oil every 50 hours. Add oil as required to maintain safe level.

5. NOSE WHEEL BEARINGS - Grease with MIL-G-25760 (Figure 2) grease every 100 hours or as required.

6. NOSE WHEEL TIRE - Inflate to 22 PSI as required.

7. T-COLUMN NEEDLE BEARING - Grease with MIL-G-7711 (Figure 2) grease every 100 hours.

8. T-COLUMN, RUDDER AND FLAP TORQUE TUBE OILITE BEARING - Oil with MIL-L-7870 (Figure 2) as required.

9. TRIM WHEEL GEARS - Grease with MIL-G-7711 (Figure 2) grease every 100 hours.

10. SEAT TRACKS - Oil with MIL-L-7870 (Figure 2) oil every 100 hours.

11. TRIM ACTUATOR SHAFT - Grease with MIL-G-7711 (Figure 2) grease as required.

12. TRIM TAB BELLCRANKS - Oil with MIL-L-7870 (Figure 2) oil as required.

13. RUDDER AND ELEVATOR BELLCRANK CLEVIS PINS - Oil with MIL-L-7870 (Figure 2) oil as required.

14. TRIM TAB HINGE - Oil with MIL-L-7870 (Figure 2) oil (Note 2).

15. CANOPY SLIDES - Spray with E-Z-Free Lubricant as required.

16. CANOPY CABLE/PULLEY - Spray with E-Z-Free Lubricant as required.

17. ALL CONTROL SURFACE BEARINGS - Grease with Aeroshell #6 or MIL-G-7711 (Figure 2) grease as required.

Servicing Points (Sheet 1 of 2)
Figure 1

16. **FUEL SELECTOR VALVE AND FUEL CAP GASKET** – Grease with MIL-G-6032A (Figure 2) grease as required.
FUEL TANKS – Fill with 100/130 grade aviation fuel as required.
17. **FRESH AIR VENTS** – Oil with MIL-L-7870 (Figure 2) oil as required.
18. **FLAP DRIVE JACKSCREW** – Grease with MIL-G-7711 (Figure 2) grease. Coat with a light film (Note 1.).
19. **BRAKE RESERVOIRS** – Fill to with 1/4 inch of top with MIL-H-5605 (Figure 2) hydraulic fluid, as required.
20. **VACUUM SYSTEM FILTER** – Replace filter at 400 hours or as required.
21. **ENGINE AIR FILTER** – Clean and service filter element every 50 hours. Replace when torn or damaged.
22. **FUEL TANK DRAINS** – Clear of water and sediment prior to first flight of day.
23. **AUXILIARY FUEL PUMP FILTER** – Clean filter element every 50 hours.
24. **CARBURETOR FILTER** – Drain carburetor bowl and clean filter every 100 hours.

NOTES:

1. Care should be taken to avoid grease contacting outer surface of nylon nut.
2. Acceptable substitute is powdered graphite (MIL-G-6711) (Figure 2).

Servicing Points (Sheet 2 of 2)

Figure 1

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TRADE NAME	MANUFACTURER
MIL-G-21164 GREASE (Note 1)	
Aeroshell Grease 17 Braycote 664 PED 3350 Grease Royco 64 Grease TG-4727 Grease	Shell Oil Company Bray Oil Company Standard Oil Company Royal Lubricants Company Texaco Inc.
MIL-G-6711 GRAPHITE (Note 1)	
Graphite Graphite Graphite	Dixon Company Electrofilm Company Electro-Graph Company
MIL-H-5606 HYDRAULIC FLUID (Note 1)	
3125HVD Oil Brayco Micronic 756C PED-3337, -3335 Royco 756A & B XSL 7828 YT-283	Humble Oil & Refining Company Bray Oil Company Standard Oil Company Royal Lubricants Company Shell Oil Company Union Carbide
VV-P-236 PETROLATUM (Note 1)	
Braycode 236 Parmo 70 Royco 1R	Bray Oil Company Humble Oil & Refining Company Royal Lubricants Company
MIL-L-7870 OIL (Note 1)	
Brayco 363 Cosmolube 263 Enco Instrument Oil Low Temperature Oil 1692 Royco 363	Bray Oil Company E.F. Houghton Company Humble Oil & Refining Company Texaco Inc. Royal Lubricants Company
MIL-G-25760 GREASE (Note 1)	
Aeroshell Grease 16 Braycote 6605 Royco 60R Supermil ASU No. 06752 TG-4971 Grease	Shell Oil Company Bray Oil Company Royal Lubricants Company American Oil Company Texaco Inc.
MIL-G-7711 GREASE (Note 1)	
Aeroshell No. 6 Regal AFB 2	Shell Oil Company Texaco Inc.

Lubricants (Page 1 of 2)
Figure 2

TRADE NAME	MANUFACTURER
MIL-L-6082 STRAIGHT MINERAL OIL – ENGINE (Notes 1 and 2)	
Aeroshell Oil 65 Aeroshell Oil 100 Chevron Aviation Oil 65 Grade 1100 Avrex 101/1065 Avrex 101/1100 Conoco Aero Oil 1065 Conoco Aero Oil 1100 Chevron Aero Oil Grade 120 RT-451 RM-173E RM-180E TX-6309 Premium AD 120 Premium AD 80 Oil E-120 Oil A-100 Oil E-80	Shell Oil Company Shell Oil Company Chevron Oil Company Chevron Oil Company Mobil Oil Company Mobil Oil Company Continental Oil Company Continental Oil Company Standard Oil Company Mobil Oil Company Mobil Oil Company Mobil Oil Company Texaco Inc. Texaco Inc. Texaco Inc. Exxon Company Exxon Company Exxon Company

Note 1: The vendor products listed in this chart have been selected as representative of the specification under which they appear. Other equivalent products conforming to the same specifications may be used.

Note 2: Oils conforming to the latest revision of Lycoming Service Instruction No. 1014 may be used.

Lubricants (Page 2 of 2)
Figure 2



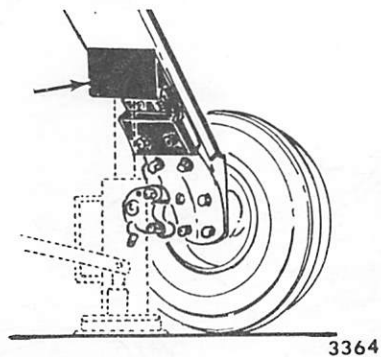
- | | |
|--|--|
| 1. Engine Upper Cowl | 7. Wing Tips |
| 2. Rudder Tip | 8. Wing Inboard Forward Access Plates |
| 3. ELT Access Panel | 9. Landing Gear Root Fairings |
| 4. Tailcone | 10. Wing Inboard Aft Access Plates |
| 5. Nose Gear Torque Tube Bolt Access Plugs | 11. Horizontal Stabilizer Root Fairing |
| 6. Engine Lower Cowl | 12. Elevator Tips |

**Access Openings
Figure 3**

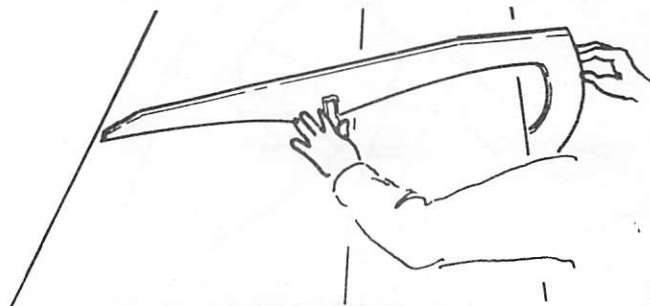
4. Special Tools and Equipment

The following is a list of service tools available from the Parts Department. See the applicable parts catalog for ordering information.

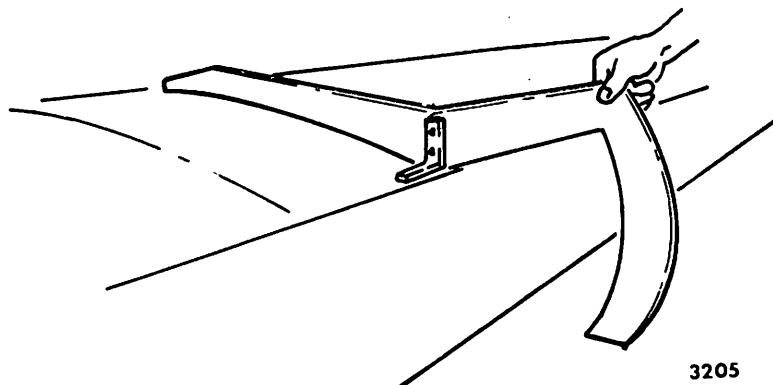
<u>TOOL NUMBER</u>	<u>TOOL NAME</u>	<u>FIGURE SHOWN</u>
DE-0001-501	Main Gear Jack Fitting	4
DE-0002-501	Rudder Rigging Fixture	5
DE-0003-501	Aileron & Flap Rigging Fixture	6
DE-5004-501	Trim Tab Rigging Fixture	7
	Control Wheel/Elevator Rigging Fixture	8
DE-5006-1	Aileron & Flap Bearing Sizing Tool: 1-1/8 inch I.D. & 1-1/2 inch I.D.	Not Shown
ST 1064	Canopy Track Sizing Tool	9
ST 1074	Canopy Track Drilling Tool	9
719-40 MRP	Spring Scale-Chatillon Gauge R (0-40 lb. Range)	10



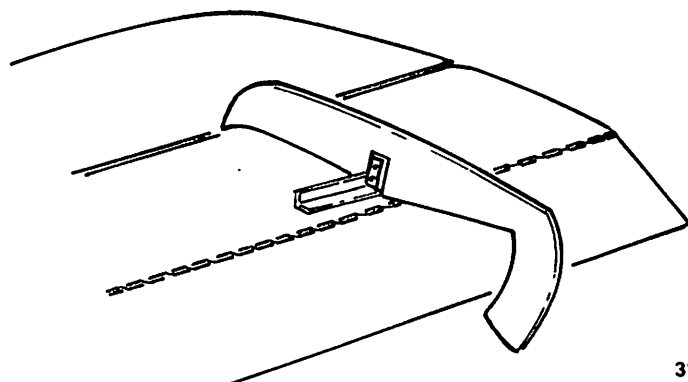
Main Gear Jack Fitting
Figure 4



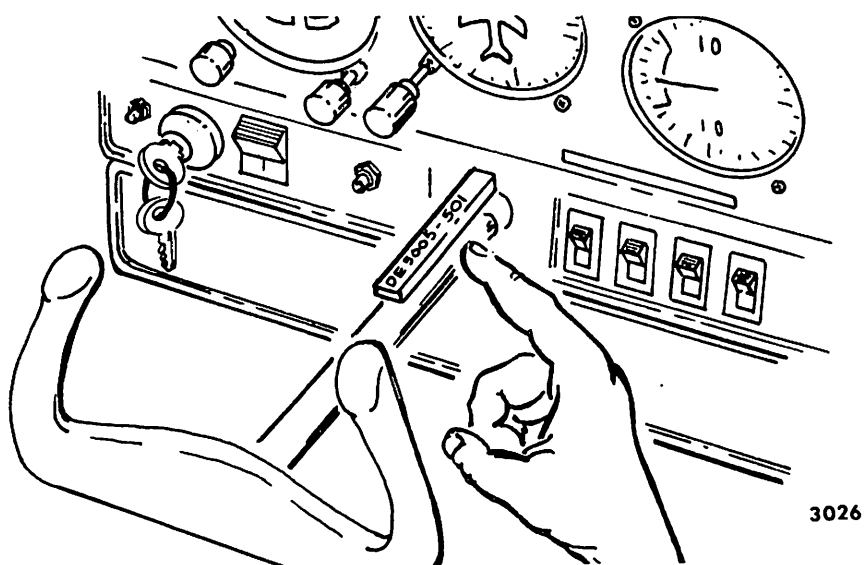
Rudder Rigging Fixture
Figure 5



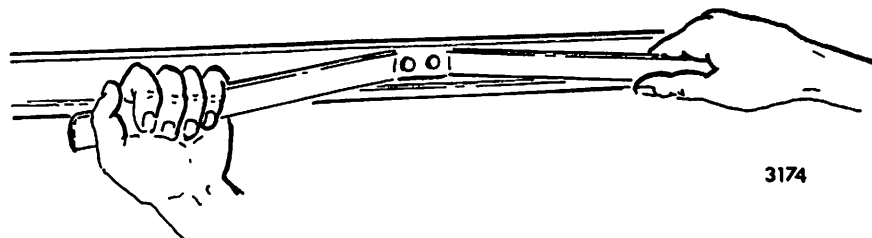
**Aileron & Flap Rigging Fixture
Figure 6**



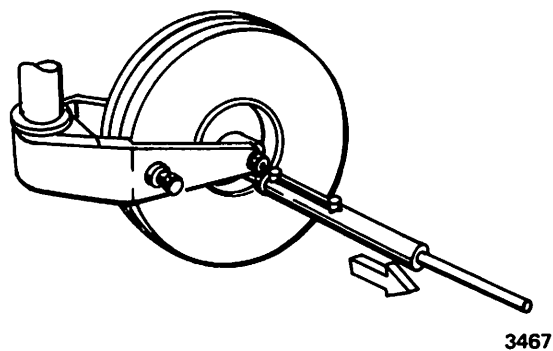
**Trim Tab Rigging Fixture
Figure 7**



**Control Wheel/Elevator System Rigging Fixture
Figure 8**



**Canopy Track Sizing Tool
Figure 9**



**Spring Scale-Chatillon Gauge R
Figure 10**

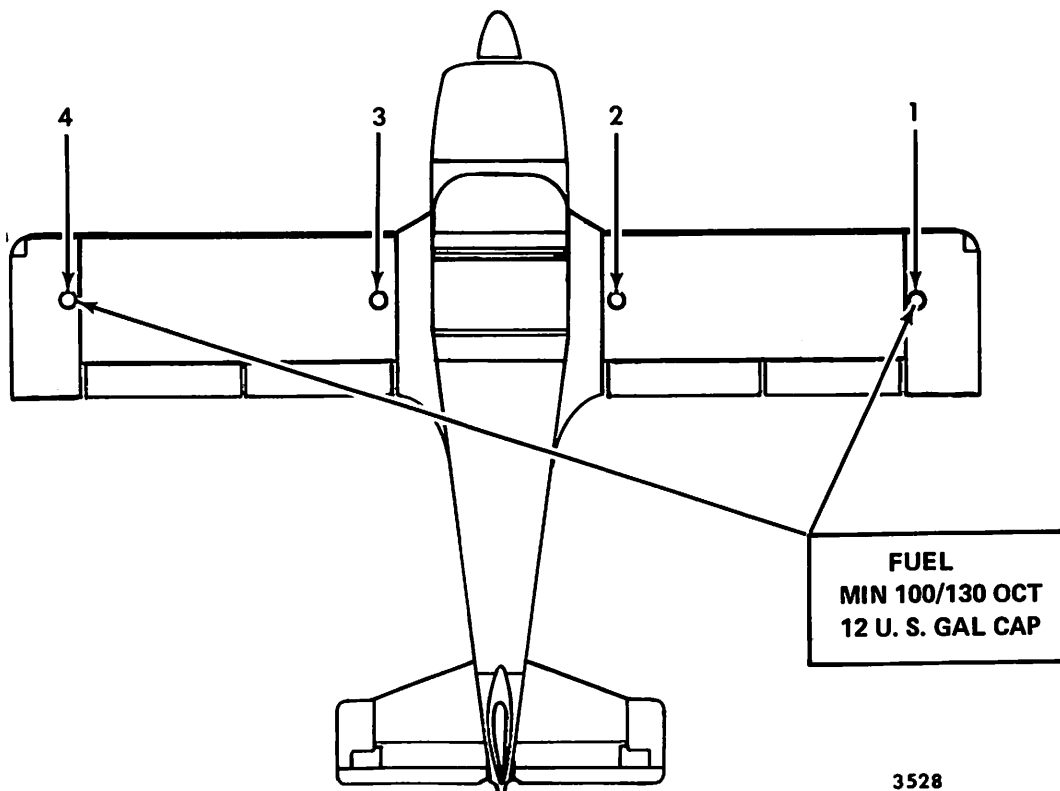
REPLENISHING1. General

The replenishing procedures contained in this section provide the proper methods for replacing consumed fuel, oil, hydraulic fluid, and battery electrolyte. Also included are methods for inflation of tires.

2. Refueling

Refueling is accomplished by pumping or pouring fuel into the two wing tanks through their respective filler caps. (See Figure 11.) When fueling the aircraft, observe the following:

- A. Never refuel the aircraft with the engine running.
- B. Always ensure that the aircraft is grounded before refueling.
- C. Ensure that no one is smoking within 100 feet of the aircraft during refueling.



- 1. Right Fuel Tank Cap
- 2. Right Sump (Under Wing)
- 3. Left Sump (Under Wing)
- 4. Left Fuel Tank Cap

Fueling Points
Figure 11

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- D. Ensure that all aircraft electrical systems are deenergized while refueling.
- E. Ensure that no aircraft radar or other powerful transmitters are operating within 100 feet of the aircraft during fueling.
- F. If fuel is spilled, ensure that the area of spillage is thoroughly flushed with water and that all residual fuel and vapor have dissipated or been neutralized prior to starting the aircraft engine.
- G. Ensure that all fuel used is from an approved source and that the fuel is free of contamination.

The AA-1C aircraft must be fueled with the following fuel.

CAUTION: UNDER NO CIRCUMSTANCES SHOULD FUEL OF A LOWER OCTANE RATING THAN THAT SPECIFIED BELOW OR AUTOMOTIVE FUEL (REGARDLESS OF OCTANE) BE USED.

Grade (and color): 100/130 Minimum Grade Aviation Fuel (Green). 100 Low Lead Aviation Fuel (Blue) is also approved. Refer to the latest revision of Lycoming Service Instruction No. 1070 and other Lycoming Publications for further information concerning fuels.

The AA-1C aircraft fuel system capacities are as follows:

NOTE: The following quantities were measured at an ambient temperature of 70°F. Changes from this temperature will cause a corresponding change in fuel quantities.

	<u>U.S. Gallons</u>	<u>Liters</u>	<u>Imp. Gallons</u>
Total Fuel Capacity, Each Tank	12.0	45.4	10.0
Net Fuel Capacity, Each Tank	11.0	41.6	9.2
Unusable Fuel, Each Tank	1.0	3.8	.8
Total Net Fuel Capacity, Both Tanks	22.0	83.2	18.3

After refueling, ensure that both fuel tank caps are securely installed prior to flight.

3. Defueling

WARNING: WHEN SIPHONING FUEL FROM THE TANKS NEVER ATTEMPT TO START SIPHONING BY MOUTH. INTRODUCTION OF EVEN A SMALL AMOUNT OF FUEL INTO THE LUNGS CAN BE FATAL. USE ONLY SAFETY APPROVED SIPHONING EQUIPMENT.

Defueling is best accomplished by siphoning fuel through a siphon hose introduced into the tank through the fuel filler cap. If the tank is to be completely emptied, the small amount of fuel that cannot be removed by siphoning can be removed through the tank drain beneath the wing. During the aircraft defueling observe the safety precautions specified in paragraph 2.

4. Engine Oil Replenishing

Engine oil replenishment is accomplished by pouring oil into the oil filler spout. Oil quantity can be conveniently checked by use of the dipstick attached to the oil filler spout cap.

Oil quantity is checked as follows:

- A. Open oil access door.
- B. Locate oil filler spout on right hand side of engine accessory section.
- C. Unscrew oil filler spout cap.

- D. Remove dipstick from engine and wipe oil from dipstick with a clean cloth or paper towel.
- E. Return dipstick into filler spout and tighten finger tight.
- F. Unscrew and remove dipstick. Check oil level on dipstick versus the markings stamped on the dipstick.
- G. Wipe oil from dipstick with a clean cloth or paper towel and replace dipstick in filler spout. Tighten filler spout cap finger tight.

NOTE: When tightening the cap, ensure that it is secure. But do not overtighten, as this may damage the O-ring seal in the cap.

Replenish engine oil using oil of the following specifications:

MIL-L-6082 (Figure 2) Aviation Grade Straight Mineral oil shall be used to replenish oil supply during the first 25 hours of operation and at the first 25-hour oil change. Continue to use this grade of oil the first 50 hours of operation.

NOTE: The aircraft is delivered from the factory with corrosion preventive aircraft engine oil. This oil should be drained after the first 25 hours of engine operation.

MIL-L-22851 (Figure 2) Ashless Dispersant Oil: This specification oil shall be used after the first 50 hours of engine operation.

***Recommended Viscosity**

Average Ambient Air Temperature	Mineral Grade	Ashless Dispersant
Above 16°C (60°F)	SAE 50	SAE 40 or SAE 50
-1°C (30°F) to 32°C 90°F	SAE 40	SAE 40
-18°C (0°F) to 21°C (70°F)	SAE 30	SAE 40 or SAE 30
Below -12°C (10°F)	SAE 20	SAE 30

*Refer to latest revision of Lycoming Service Instruction No. 1014 and other Lycoming publications for further information.

Replenish engine oil as follows:

- A. Open oil access door.
- B. Locate oil filler spout and unscrew cap.
- C. Using a clean rag or paper towel wipe any oil or foreign material from the edges of the oil filler spout opening. Also wipe oil from the dipstick.

NOTE: When adding engine oil, ensure that no dirt or foreign material are on the edges of the oil filler spout, and the dipstick/cap is clean prior to reinstallation.

- D. Pour oil of proper specification and viscosity into filler spout to achieve desired oil level.

NOTE: When adding engine oil during extremely cold weather, the change in viscosity due to extreme cold may cause the oil to pour very slowly. Keeping the oil in a heated building or warming it prior to use may expedite oil replenishment.

- E. Replace oil filler spout cap/dipstick and tighten finger tight.

NOTE: Any oil spillage, particularly on exhaust manifolds, should be wiped clean prior to flight.

F. Close oil access door.

The AA-1C aircraft oil system capacities are as follows:

NOTE: The following quantities were measured at an ambient temperature of 70°F.

	<u>U.S. Quarts</u>	<u>Liters</u>	<u>Imp. Quarts</u>
*Total Engine Capacity	6.00	5.69	4.99
Minimum Safe Quantity	2.00	1.89	1.66

* Does not include one quart (undrainable) in oil cooler.

5. Brake Fluid Replenishing

Brake fluid replenishing is accomplished as follows:

NOTE: When replenishing brake fluid, ensure that the fluid used conforms to specification MIL-H-5606, (Figure 2) and that the fluid is uncontaminated.

- A. Locate brake cylinder reservoirs as shown in Figure 12.
- B. Using a clean rag or paper towel, wipe any accumulated dirt or other foreign material from area around filler plugs.
- C. Remove filler plugs.
- D. Using a syringe, hand pump, or other suitable means add brake fluid MIL-H-5606 (Figure 2) to the reservoirs through the filler ports until the level of fluid is one quarter inch from the top of the reservoir.
- E. Replace filler plugs in reservoirs.
- F. Check brake action.
- G. If more fluid is required, repeat steps (B) through (F).

6. Tire Inflation

WARNING: WHEN INFLATING TIRES USE REGULATED AIR PRESSURE THROUGH VALVE STEMS. TIRE PRESSURES ARE AS FOLLOWS:

MAIN LANDING GEAR TIRES – 19 psig
NOSE LANDING GEAR TIRES – 22 psig

7. Battery Fluid Replenishing

WARNING: THE BATTERY CONTAINS A SULPHURIC ACID ELECTROLYTE SOLUTION. DO NOT ALLOW THE ELECTROLYTE TO COME INTO CONTACT WITH CLOTHES OR SKIN. ANY SPILLAGE SHOULD BE FLUSHED WITH WATER OR NEUTRALIZED WITH BAKING SODA IMMEDIATELY.

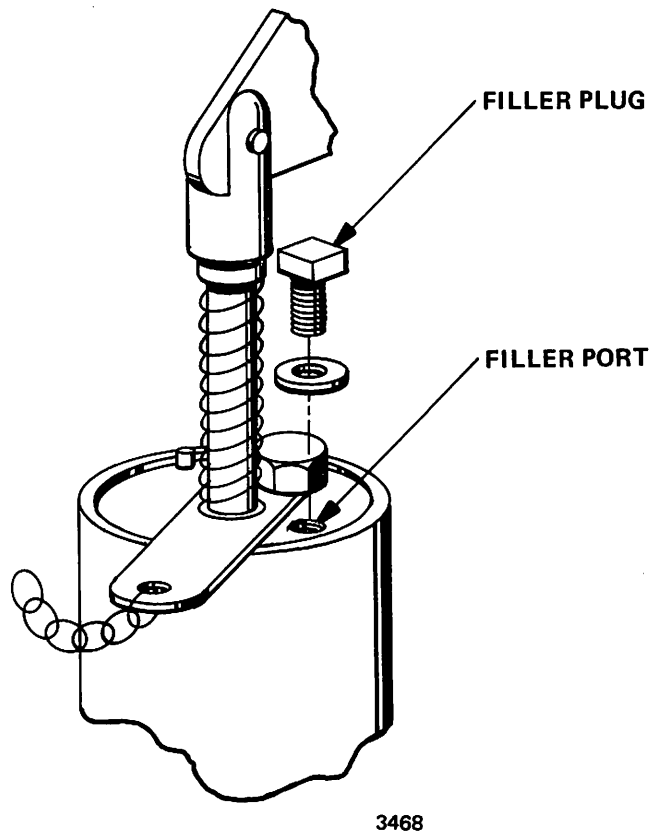
Replenish battery fluid as follows:

- A. Remove top engine cowl.
- B. Remove the two wing nuts (1) from the battery box (2) and remove the strap (3) and battery box cover (4) as shown in Figure 13.

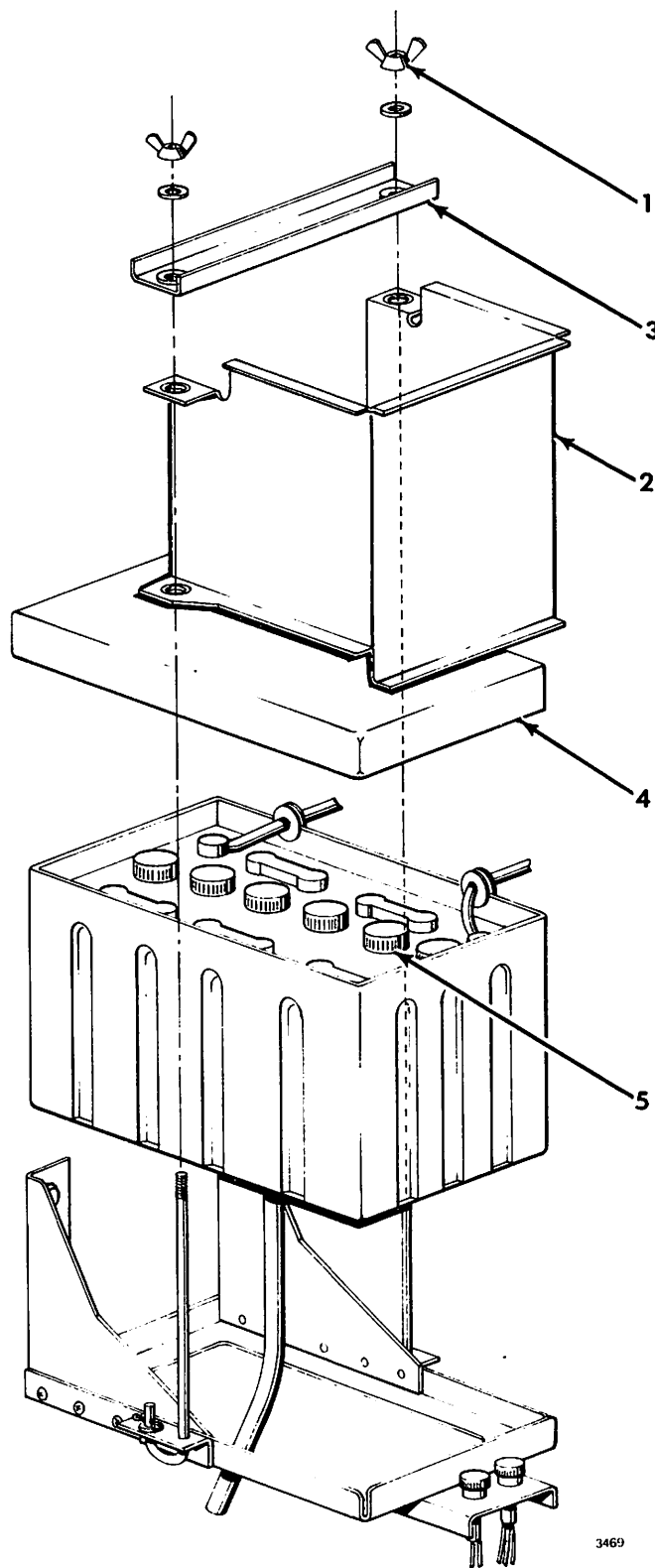
- C. Using a clean rag or paper towel wipe all dirt and foreign material from the area around the battery filler plugs.
- D. Remove filler plugs (5) and visually check electrolyte level in battery. If electrolyte level is below the bottom of the split rings, add distilled water.

NOTE: When replenishing battery water, use only distilled water. Ensure that the electrolyte level in the battery comes to bottom of the split rings. Do not overfill.

- E. Add water to bring electrolyte level to top of plates.
- F. Replace battery filler plugs.
- G. Replace battery box cover, and strap. Secure with the two wing nuts.
- H. Install and secure top engine cowl.



**Brake Cylinder
Figure 12**



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**Battery Servicing
Figure 13**

SCHEDULED SERVICING1. General

This section provides the procedures required to perform servicing that is required on a scheduled basis.

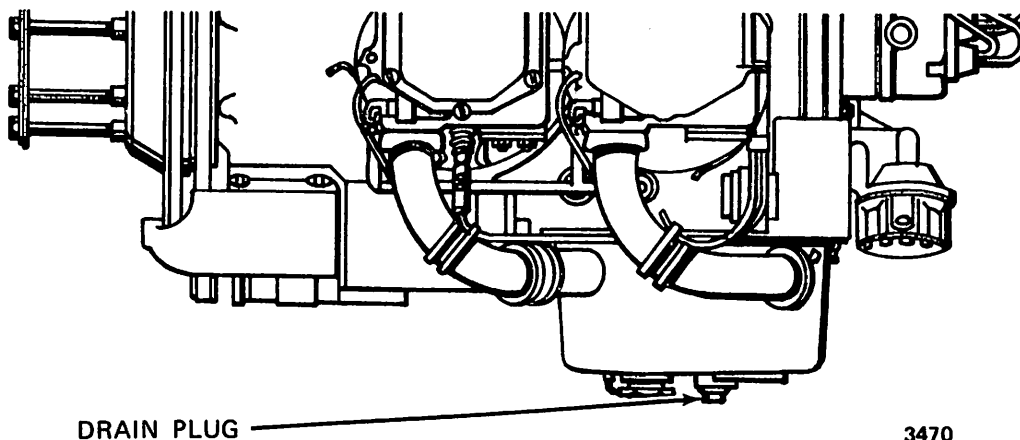
2. Engine Oil Servicing

The engine oil should be changed after the first 25 hours of operation. It should be replaced with straight mineral oil conforming to Specification No. MIL-L-6082 (Figure 2). This straight mineral oil should be used until a total of 50 hours has accumulated, then it should be drained and replaced with dispersant oil. The oil should be changed at least every 50 hours or 6 months whichever occurs first. At the time of each oil change the engine oil strainers should be removed, cleaned, and inspected for metal particles.

Change engine oil as follows:

- A. Remove upper engine cowl.
- B. Remove lower engine cowl. (Not required if oil quick drain is installed.)
- C. Locate engine oil drain plug (Figure 14) and cut safety wire securing plug.

NOTE: On aircraft equipped with a quick oil drain, do not cut safety wire at plug. Place hose over the quick drain and push the fitting up into its detent to drain the oil.
- D. Place a suitable container under the oil drain.
- E. Unscrew the drain plug and allow the oil to drain thoroughly.
- F. Remove remaining safety wire from drain plug and safety wire hole on engine.
- G. Using a clean rag or paper towel, wipe drain plug clean and clean area on engine around oil drain.
- H. Reinstall drain plug and safety wire.
- I. Remove, clean, and inspect engine oil strainers in accordance with Lycoming operating manual.
- J. Replace strainers per Lycoming operating manual.
- K. Unscrew and remove engine oil filler spout plug.
- L. Pour six quarts of oil conforming to Specification No. MIL-L-6082 (Figure 2) or ashless dispersant aviation grade into oil filler spout.
- M. Using a clean rag or paper towel, wipe oil from dipstick, and reinstall engine oil filler spout plug. Tighten finger tight.
- N. Reinstall lower engine cowl.
- O. Reinstall upper engine cowl.
- P. Run engine, check for leaks, and recheck oil level.



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Engine Oil Drain Plug
Figure 143. Engine Air Filter Servicing (See Figure 15.)

- A. Remove upper and lower engine cowl.
- B. Remove the screws attaching the adapter assembly, air filter and air box assembly together.

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

- C. Thoroughly wash the filter in petroleum solvent. Make certain all dirt is removed and filter is in serviceable condition. If filter has flocking worn from screen wire, replace filter.
- D. Dry the filter at room temperature. Filter must be completely dry before proceeding with next step. If the filter is not dry, the solvent will prevent oil from adhering to the filter, thereby reducing the filter efficiency.
- E. Immerse the filter in the grade oil called for on the filter. If none is called out, use engine preservative oil per MIL-L-21260 (Figure 2).
- F. After removing the filter from the oil, allow it to drain thoroughly before installing in the aircraft.
- G. Inspect the gasket between the air filter and air box. If damaged or otherwise defective, replace with a new gasket.
- H. Position the air box assembly, filter, and adapter together and install the screws.
- I. Install the lower and upper engine cowl.

4. Vacuum System Air Filter Servicing

The vacuum system air filter (Figure 17) is located beneath the instrument panel, and attached to the inside of the firewall near its center. The filter elements of both the air filter and the regulator should be checked periodically to ensure that they are not clogged by dirt or foreign material. If either of the filter elements are dirty and appear to be clogged, they should be replaced. The air filter element should be replaced by Part No. 1J7-1. The regulator filter element should be replaced by Part No. B3-5-1.

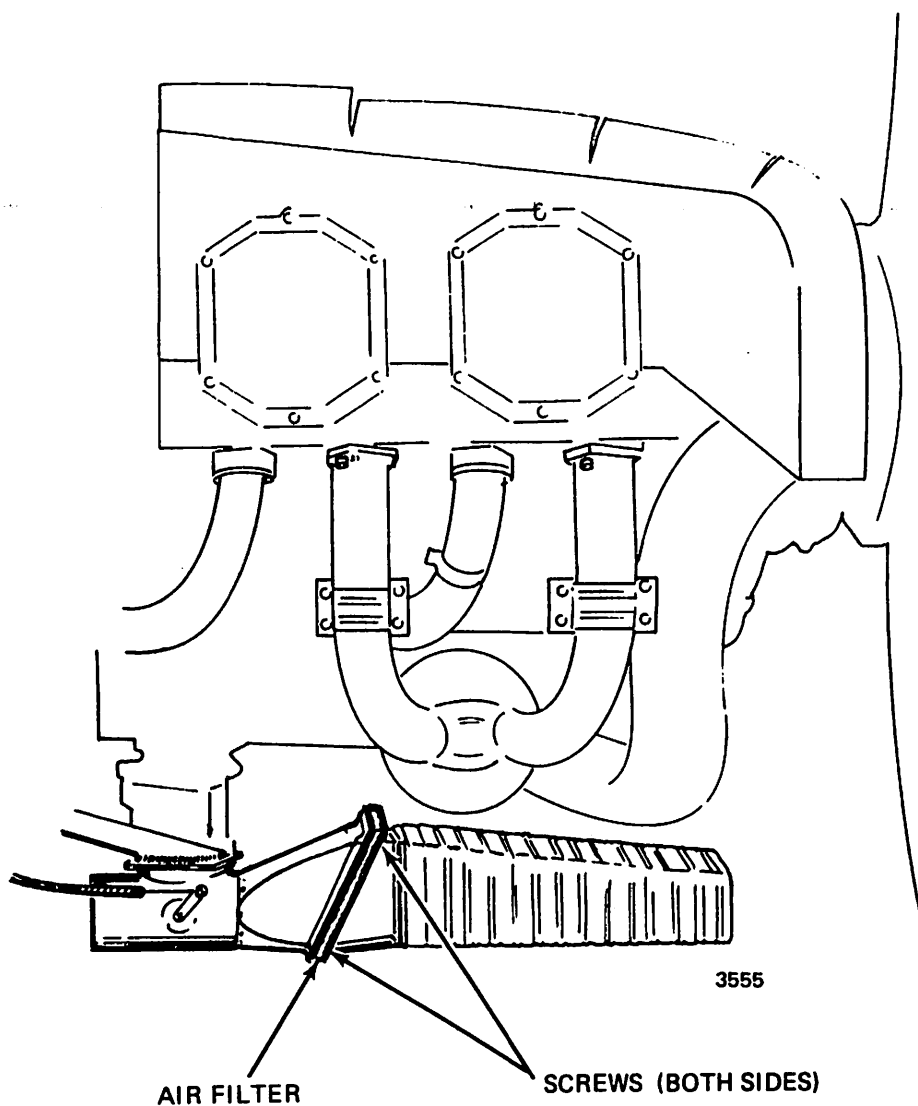
Replace the filter elements as follows:

NOTE: Never blow off filter with compressed air or attempt to wash element in any liquid or soak in oil.

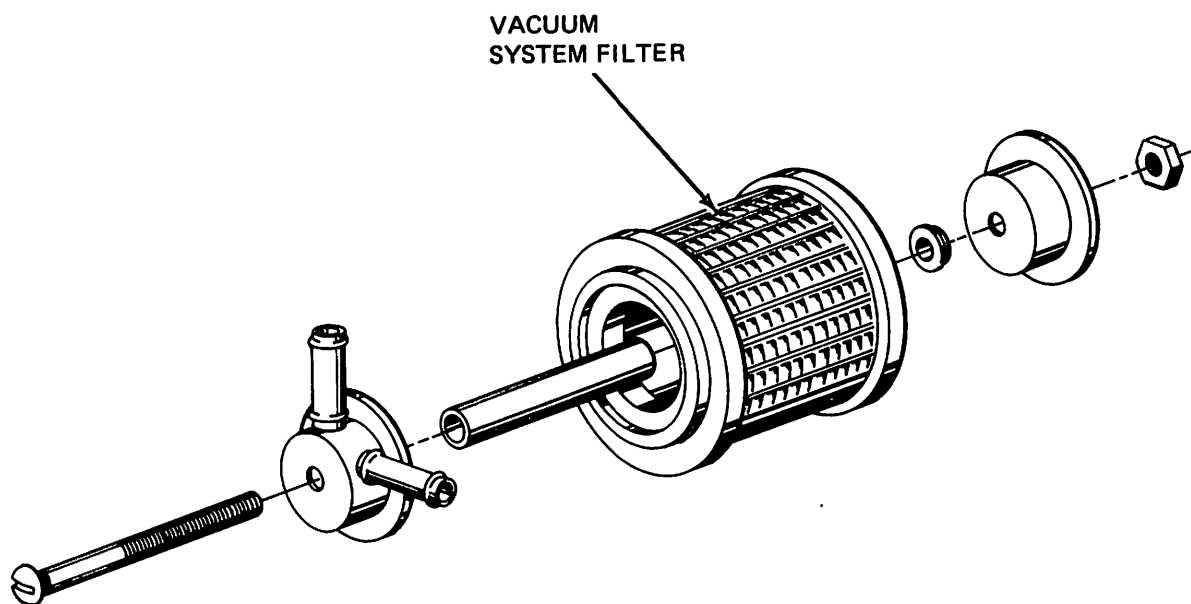
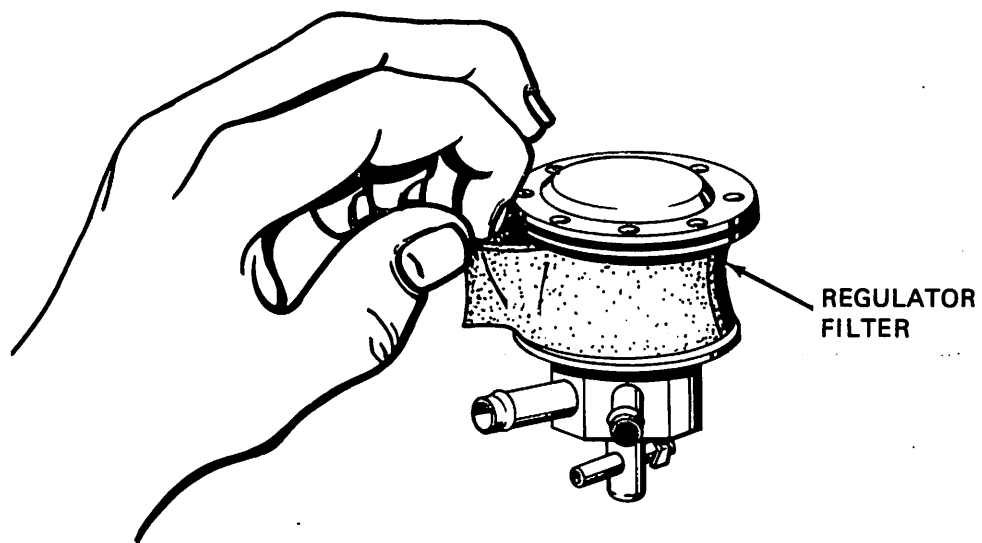
- A. Locate air filter and regulator per Figure 16. Remove fastener attaching filter to firewall.

NOTE: Do not disconnect vacuum hoses from filter unless hoses are to be replaced.

- B. Remove the nut and washer as shown in Figure 16.
- C. Remove old filter element and replace with new element.



Engine Air Filter Servicing
Figure 15



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**Vacuum System Air Filter Servicing
Figure 16**

- D. Reinstall washer and nut.
- E. Reconnect air filter to the firewall.

To replace regulator filter proceed as follows:

- A. Remove old filter element and replace with new element.

7. Airframe Lubrication

Lubricate the airframe in accordance with Figure 1, this Chapter. During airframe lubrication observe the following precautions and procedures:

WARNING: USE CLEANING SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

CAUTION: SYNTHETIC COMPOUNDS SUCH AS THOSE FOUND IN AIRCRAFT OILS AND GREASES CONTAIN ELEMENTS WHICH CAN SOFTEN PAINT, NATURAL RUBBER, NEOPRENE, AND SOME ELECTRICAL INSULATORS. IF THIS TYPE LUBRICANT IS SPILLED ON ANY OF THESE MATERIALS, WIPE IT OFF IMMEDIATELY AND THOROUGHLY WITH A CLEAN CLOTH.

- A. Remove all foreign matter from joints, fittings, or bearing surfaces immediately before application of lubricant. Use a clean cloth saturated with cleaning solvent.
- B. Apply lubricant sparingly to prevent accumulation of contaminants.
- C. Main Gear and Nose Gear Bearings (See Figure 17).

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

CAUTION: DO NOT SPIN BEARINGS WHEN DRYING WITH COMPRESSED AIR. WASH BEARINGS IN STODDARD SOLVENT (P.S.-661 OR EQUIVALENT) AND DRY WITH A CLEAN, SOFT CLOTH.

CAUTION: USE A CLEAN, LINT-FREE CLOTH TO CLEAN AND HANDLE BEARINGS. DO NOT USE A DIFFERENT TYPE GREASE IN WHEEL BEARINGS.

- (1) Clean and repack wheel bearings every 100 hours or as required. Remove wheels (1) and bearings (2). Clean wheel bearings and felt seals (3) with Stoddard solvent (P.S.-661) or equivalent and dry with soft lint-free cloth.
- (2) Inspect bearings (2) and races for wear or damage and replace if necessary.

NOTE: For adjustment of nose wheel and main landing gear bearings refer to Chapter 32.

- (3) Repack bearings only with grease MIL-G-25760 (Figure 2) and lubricate felt seals with oil MIL-L-7870 (Figure 2) before installation.

- D. Nose Gear Fork Assembly (See Figure 18)

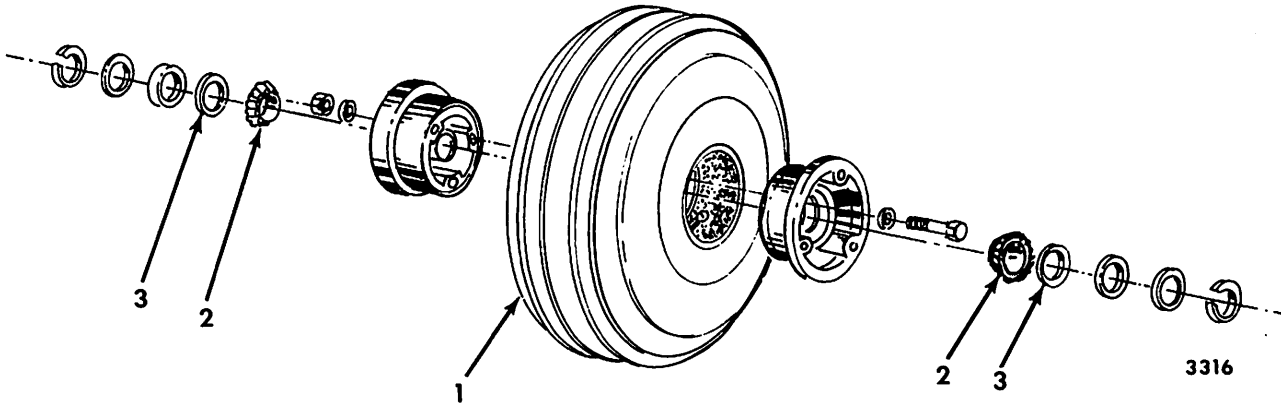
WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

CAUTION: DO NOT HANDLE BEARINGS, BUSHINGS, OR SPRING DISC WASHERS WITH BARE HANDS. USE A CLEAN, LINT-FREE CLOTH. DO NOT USE A DIFFERENT TYPE GREASE IN BEARINGS ON THE SAME AIRCRAFT.

- (1) Clean and grease the nose gear fork assembly, bushings, and spring discs every 100 hours. Remove nose gear fork assembly (1) from strut(2). Clean bushings (3), spring discs (4) and fork (1) with Stoddard solvent (P.S.-661) or equivalent and dry with a soft lint-free cloth.
- (2) Inspect bushings (3), thrust bearing (5), and spring discs (4) for wear or damage and replace if necessary.

NOTE: For adjustment of nose gear fork assembly, refer to Chapter 32.

- (3) Repack nose gear fork assembly, bushings, thrust bearing, and spring discs only with grease MIL-G-7711 (Figure 2) before installation.



Wheel Bearing Lubrication
Figure 17

E. T-Column Bearings

The T-Column needle and thrust bearings should be lubricated when evidence of binding occurs, or when the assembly must be disassembled for repair or replacement of parts. Lubricate the bearings as follows:

CAUTION: DO NOT HANDLE BEARINGS WITH BARE HANDS. USE CLEAN LINT-FREE CLOTH.

- (1) Remove the needle and thrust bearings.

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

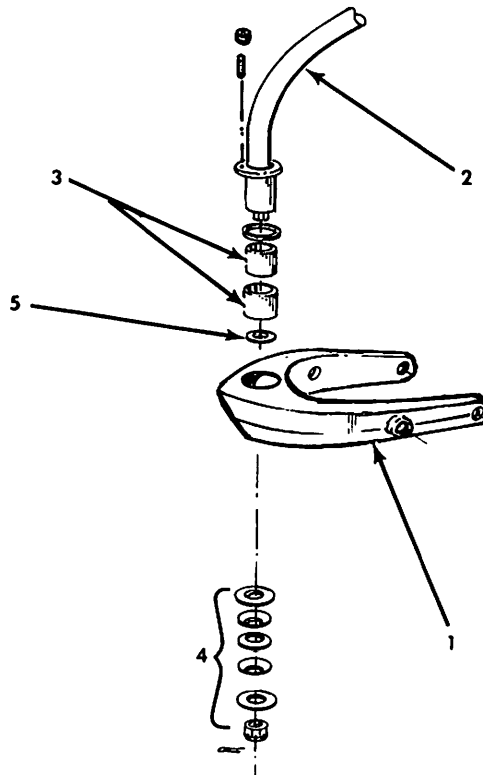
- (2) Clean the bearings and races with Stoddard solvent (P.S.-661) or equivalent and dry with soft lint-free cloth.
- (3) Visually inspect bearings and races for wear or damage and replace if necessary.

NOTE: For adjustment of T-Column refer to Chapter 27.

- (4) Repack bearings only with MIL-G-7711 (Figure 2) grease before installation.

F. Trim Wheel Gears

- (1) Use a clean lint-free cloth to wipe excess grease and foreign material from shaft.
- (2) Apply a thin coating of MIL-G-7711 (Figure 2) grease to the shaft by hand.



Nose Gear Fork Assembly Servicing
Figure 18

G. Trim Actuator Shaft

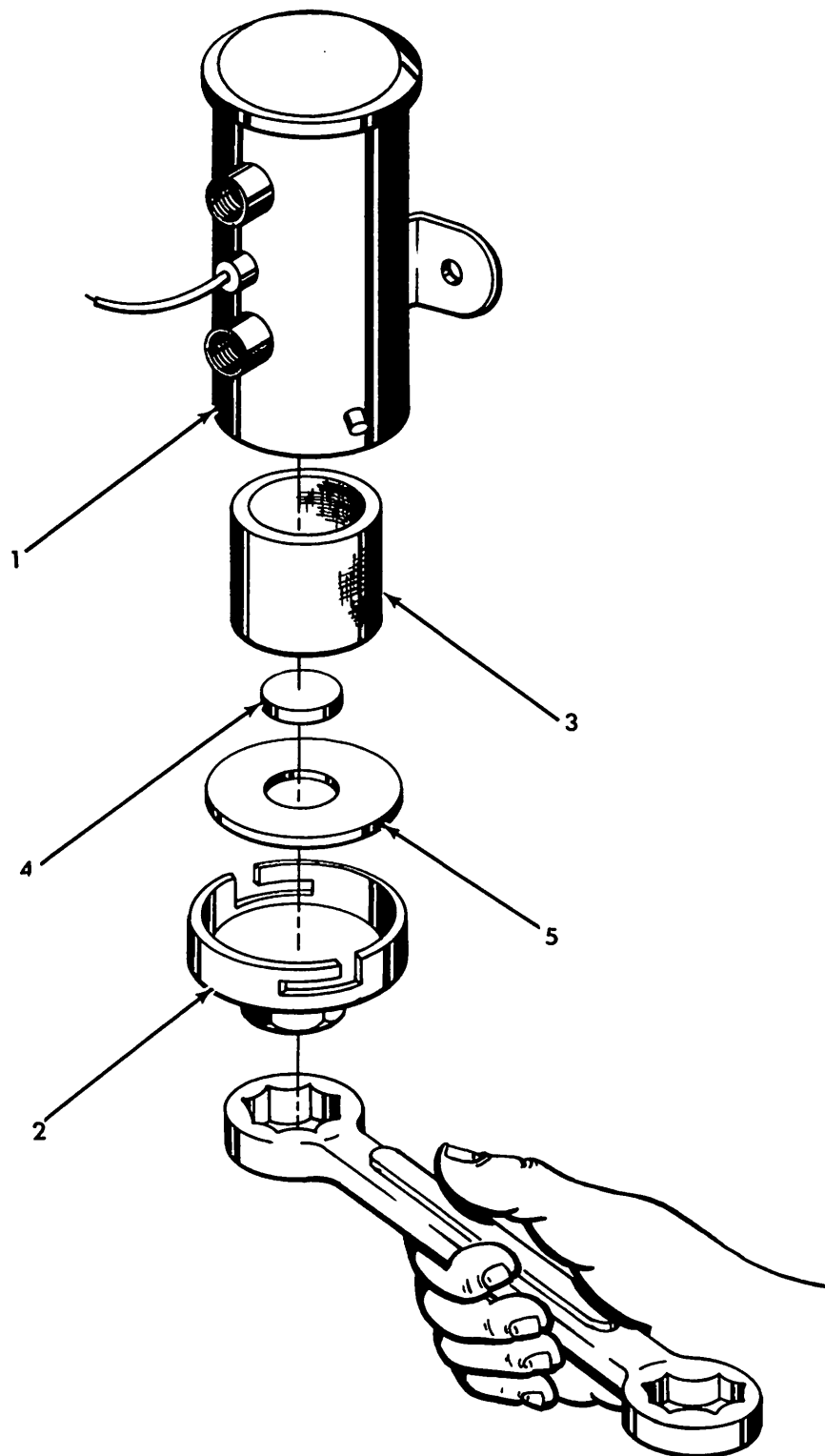
- (1) Use a clean lint-free cloth to wipe excess grease and foreign material from shaft.
- (2) Apply a thin coating of MIL-G-7711 (Figure 2) grease to the shaft by hand.

8. Auxiliary Fuel Pump Filter Servicing (See Figure 19.)

Clean the auxiliary fuel pump filter as follows:

WARNING: PRIOR TO REMOVING FILTER FROM FUEL PUMP, CLOSE AND LOCK CANOPY, OR OTHERWISE ENSURE THAT PUMP IS NOT ENERGIZED WHILE FILTER IS REMOVED. ENERGIZING PUMP WITH FILTER REMOVED WILL RESULT IN RAW FUEL BEING PUMPED INTO THE ENGINE COMPARTMENT.

- A. Locate auxiliary fuel pump (1), cut safety wire and remove bottom cover (2) from pump (1) by turning it clockwise.



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Auxiliary Fuel Pump Servicing
Figure 19

- B. Remove filter element (3) from fuel pump, and remove magnet (4) and gasket (5) from bottom cover.
- C. Use compressed air and a clean, lint-free cloth to remove foreign material from filter (3), magnet (4) and gasket (5).

NOTE: If excessive amounts of foreign material are found in the filter, the Fuel System should be checked for contamination as shown in Chapter 28.

- D. Reinstall filter element (3) in pump (1) and magnet (4) and gasket (5) in bottom cover (2).
- E. Install bottom cover on pump (1) by pressing slots over lugs and rotating cover counterclockwise into detent.
- F. Safety wire bottom cover on pump with .032 wire.
- G. Energize auxiliary fuel pump and check for leakage around bottom cover.

UNSCHEDULED SERVICING

1. General

This section provides the procedures required to perform servicing that may be necessitated by environmental or other conditions not anticipated as a part of scheduled servicing.

2. Ice and Snow Removal

Since accumulations of ice and/or snow on the aircraft can constitute both a flight hazard, and/or a danger of damage during ground handling, removal must be properly accomplished. If facilities are available, the best method of snow and ice removal is by parking the aircraft in a heated hangar. This method is particularly desirable since it will result in the melting of undetected ice that could constitute a hazard. Loose snow on the aircraft surfaces can generally be removed by hand, or brushed off with a soft bristle broom. Ice accumulations on the wings or control surfaces create a hazard if flight is attempted without their removal. When ice has accumulated on the aircraft it should be carefully checked to ensure that accumulations have been removed from the following areas:

- A. Between wings and ailerons and ailerons and flaps.
- B. Between rudder and vertical stabilizer.
- C. Between elevator and horizontal stabilizer.
- D. Between elevator and trim tab.
- E. Around elevator and rudder linkages.
- F. Around brakes, and between wheels and wheel parts.
- G. Inside propeller spinner.

NOTE: Taxiing or towing through snow, slush, etc. can result in ice formation on the wheels, brakes, and inside wheel fairings when the aircraft is parked during freezing weather.

- H. Pitot tube and static ports.
- I. Fuel tank vents.
- J. Engine oil breather pipe.
- K. Propeller blades.

CAUTION: UNDER NO CIRCUMSTANCES SHOULD ALCOHOL, GLYCOL, OR ANY OTHER PETROLEUM DERIVATIVE BE USED FOR ICE OR SNOW REMOVAL. THESE SUBSTANCES CAN DAMAGE PLEXIGLAS, AND REMOVE THE LUBRICATION FROM CONTROL SURFACE HINGES.

- L. Windshield and canopy.

3. Battery Servicing and Charging

Refer to Chapter 24 for battery servicing and charging procedures.

4. External Cleaning

The painted surfaces of the aircraft have a long lasting, all-weather finish and should require no buffing or rubbing out in normal conditions. However, it is desirable to wax and polish it to preserve the outstanding exterior finish. It is recommended that wax or polish operations be delayed (at least 60 days after date of certification) to allow proper curing of paint. The paint can be kept bright simply by washing with water and mild soap. Avoid abrasive or harsh detergents. Rinse with clear water and dry with terry cloth towels or chamois. Oil and grease spots may be removed with kerosene or mineral spirits.

NOTE: No commercial paint removers are to be used on any airframe components unless specific prior approval has been received from the factory. (See Chapter 20.)

If you choose to wax your aircraft, use a good automotive-type wax applied as directed. The use of wax in areas subject to high abrasion, such as leading edges of wings and tail surfaces, propeller, spinner and blade, is recommended.

5. Internal Cleaning

Clean the interior regularly with a vacuum cleaner to remove dust and loose dirt from the upholstery and carpet.

If liquid (coffee, etc.) is spilled on the upholstery or carpet, blot it up promptly with cleansing tissue or rags. Continue blotting until no more liquid is taken up. Sticky materials may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with foam type detergent, used according to the detergent manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

WARNING: USE STODDARD SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

CAUTION: NEVER USE GASOLINE, BENZINE, ALCOHOL, ACETONE, CARBON TETRACHLORIDE, FIRE EXTINGUISHER FLUID, ANTI-ICE FLUID, LACQUER THINNER OR GLASS CLEANER TO CLEAN PLASTIC. THESE MATERIALS WILL DAMAGE THE PLASTIC AND MAY CAUSE SEVERE CRAZING.

The plastic trim, headliner, instrument panel and control knobs can be cleaned with a cloth moistened with Stoddard solvent, (P.S.-661) or equivalent.

6. Windshield and Window Cleaning

CAUTION: NEVER USE GASOLINE, BENZINE, ALCOHOL, ACETONE, CARBON TETRACHLORIDE, FIRE EXTINGUISHER FLUID, ANTI-ICE FLUID, LACQUER THINNER OR GLASS CLEANER TO CLEAN PLASTIC. THESE MATERIALS WILL DAMAGE THE PLASTIC AND MAY CAUSE SEVERE CRAZING.

It is recommended that the plexiglas in the canopy, windshield and cabin windows be kept clean and unscratched. The following procedures are recommended:

- A. If large deposits of mud and/or dirt have accumulated on the plexiglas, flush with cold water. Light rubbing with the hand is recommended to dislodge excess dirt and mud without scratching the plexiglas.
- B. Wash with soap and water. Use a sponge or heavy wadding of a soft cloth. DO NOT rub, as the abrasive action in the dirt and mud residue will cause fine scratches in the surface.

- C. Grease and oil spots may be removed with a soft cloth soaked in kerosene.
- D. After cleaning, wax the plexiglas surface with a thin coat of hard polish wax. Buff with a soft cloth.
- E. If a severe scratch or marring occurs, jeweler's rouge is recommended. Follow directions, rub out scratch, smooth, apply wax and buff.

7. Engine Cleaning

WARNING: USE STODDARD SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES.
KEEP AWAY FROM FLAMES.

CAUTION: PARTICULAR CARE SHOULD BE TAKEN TO PROTECT ELECTRICAL EQUIPMENT BEFORE CLEANING. SOLVENT SHOULD NOT BE ALLOWED TO ENTER MAGNETOS, STARTER OR ALTERNATOR. COVER ANY FUEL, OIL, AND AIR OPENINGS ON THE ENGINE AND ACCESSORIES BEFORE WASHING THE ENGINE WITH SOLVENT. CAUSTIC CLEANING SOLUTIONS SHOULD BE USED CAUTIOUSLY AND SHOULD ALWAYS BE PROPERLY NEUTRALIZED AFTER THEIR USE.

The engine should be cleaned with a suitable solvent, such as Stoddard solvent, (P.S.-661) or equivalent, then dried thoroughly. If caustic or emulsifying cleaners are used, they should be flushed with water and neutralized as soon as possible after cleaning is accomplished.

8. Propeller Care

Damage from foreign objects, sometimes referred to as "nicks", may appear in the leading edges of the propeller from time to time. It is vital that these nicks be corrected as quickly as possible since such minor damage may cause an imbalance and accompanying vibration. Cleaning agents such as mineral spirits are recommended for cleaning the propeller, followed by waxing or coating with a light film of oil.

CHAPTER 20

STANDARD PRACTICES - AIRFRAME

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AIRFRAME STRUCTURAL REPAIR – DESCRIPTION

1. General

The information in this section should be used in conjunction with the AC 43.13-1 "Acceptable Methods, Techniques and Practices – Aircraft Inspection and Repair." Information contained herein is applicable to repair of damage where replacement of the damaged assembly is considered unnecessary. If some doubt exists relative to repair not specifically covered, consult the Grumman American Customer Service Department.

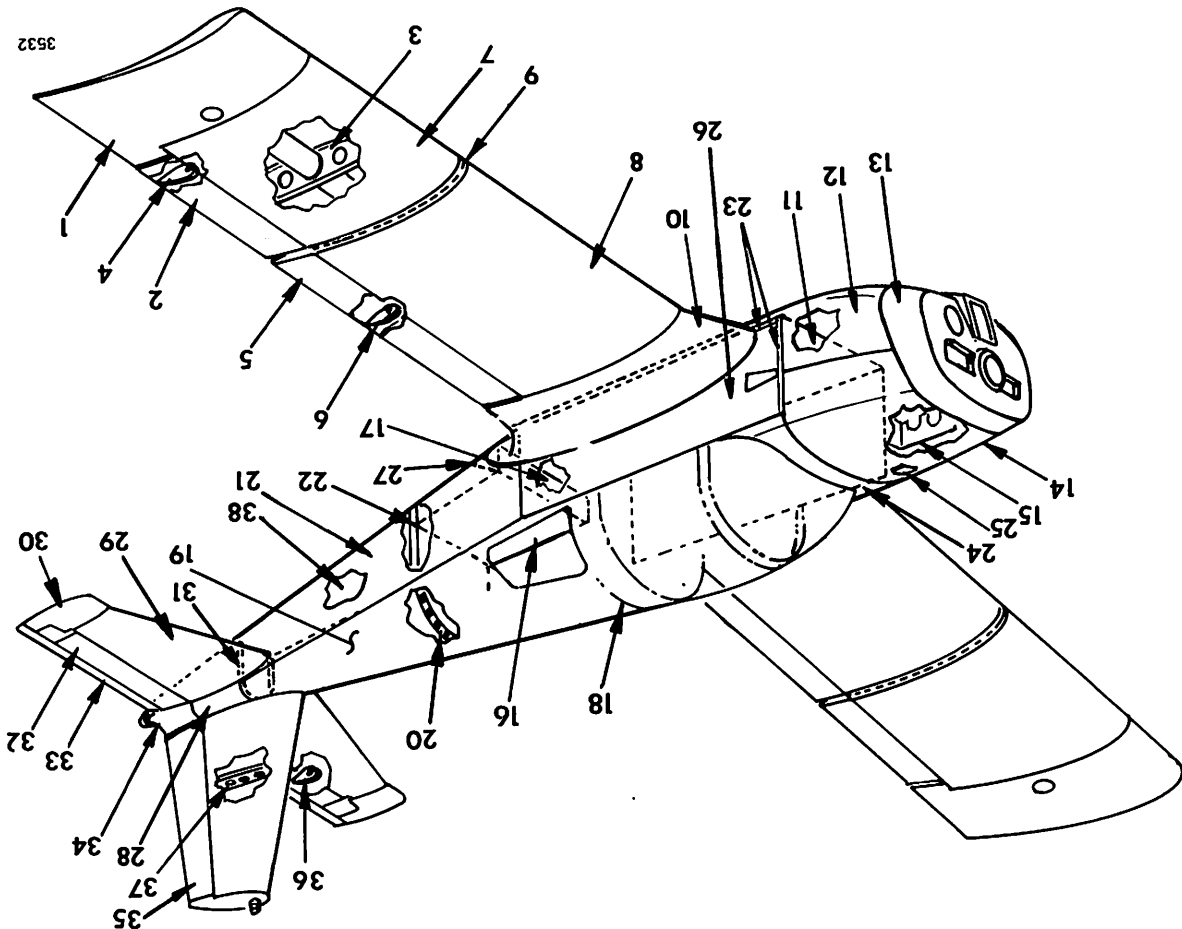
Field repairs of bonded structures can be made using rivets. Flush riveted repairs can be made in both sheet metal and honeycomb areas. These repairs are normally covered with an epoxy filler to maintain surface contour and smoothness.

2. Tools, Jigs, and Fixtures

Very few special tools are required for normal maintenance on the AA-1C. Standard shop tools (including a torque wrench and micrometer) are usually adequate. Required special tools, jigs, and fixtures can be procured through your authorized Grumman American Dealer or Distributor. Special tools are listed in Chapter 12.

3. Materials

Structural repairs should be accomplished using identical material to that being repaired (i.e., .032 2024-T3 Clad Aluminum). Figure 1 shows the various materials utilized and should be used in determining type of material for all repair work. If material shortages make substitution necessary, 2024-T3 in most cases can be substituted for any other aluminum alloys. However, it is important that the 2042-T3 aluminum contain an aluminum coating (designated as "Alclad") for corrosion protection.



ITEM NO.	DESCRIPTION	MATERIAL	ITEM NO.	DESCRIPTION	MATERIAL
1	WING TIP	FIBERGLASS	20	BULKHEAD	.025" 2024-T42 ALCLAD
2	AILERON SKIN	.020" 2024-T3 ALCLAD	21	SKIN	.032" 2024-T3 ALCLAD
3	WING RIB	.025" 6061-T6	22	STIFFENER	.032" 2024-T3 ALCLAD
4	AILERON RIB	.50" HONEYCOMB	23	ANGLES	.025" 2024-T3 ALCLAD
5	FLAP SKIN	.020" 2024-T3 ALCLAD	24	SKIN	.023" 6061-T4
6	FLAP RIB	.050" HONEYCOMB	25	ACCESS DOOR	.063" 6061-T4
7	WING SKIN	.020" 2024-T3 ALCLAD	26	FUSELAGE PANELS	.50" HONEYCOMB
8	WING SKIN	.020" 2024-T3 ALCLAD	27	GUSSET	.040" 2024-T42 ALCLAD
9	DOUBLER	.020" 2024-T3 ALCLAD	28	COVER	.020" 2024-T3 ALCLAD
10	WING ROOT	FIBERGLASS	29	STABILIZER SKIN	.020" 2024-T3 ALCLAD
11	FAIRING	FIBERGLASS	30	STABILIZER TTP	THERMO-PLASTIC
12	LOWER COWL	.040" 6061-T4	31	BULKHEAD	.090" 2024-T42 ALCLAD
13	NOSE COWL	FIBERGLASS	32	SKIN	.016" 2024-T3 ALCLAD
14	UPPER COWL	.032" 6061-T4	33	TRIM TAB SKIN	.016" 2024-T3 ALCLAD
15	BAFFLE	.032" 5052-H32	34	TAILCONE	THERMO-PLASTIC
16	BAGGAGE FLOOR	.032" 2024-T3 ALCLAD	35	SKIN	.016" 2024-T3 ALCLAD
17	BULKHEAD	.50" HONEYCOMB	36	RIB	.025" 2024-T42 ALCLAD
18	BULKHEAD	.032" 2024-T3 ALCLAD	37	STABILIZER RIB	.025" 2024-T42 ALCLAD
19	SKIN	.020" 2024-T3 ALCLAD	38	BOTTOM SKIN	.025" 2024-T3 ALCLAD

Airframe Materials Chart
Figure 1

4. Service Kits

Service Kit No. SK-102 is a potting kit for honeycomb repair and includes REN RP-4032A* Resin and REN RP-4032A Hardener with instructions for proper preparation and application. This kit is available through your authorized Grumman American Dealer or Distributor. Also available is Service Kit No. SK-125, which is a bondline repair kit and includes the materials (except distilled water, alcohol, and metal conditioner) for the repair of delaminated metal to metal bond joints. *REN RP-4032A is available through REN Plastics Inc., Lansing, Michigan 48909.

5. Sheet Metal Repairs (Riveted)

Damage to skin, ribs, and frame areas can generally be repaired using normal sheet metal repair techniques. These are covered in AC43.13-1. Several typical repairs are also discussed in Approved Repairs, Paragraphs 1 and 2. Complete fuselage sections can be replaced using standard rivet practices as discussed in Paragraphs 9, 10, and 13.

Local wing skin damage can be satisfactorily repaired using rivets. However, if extensive wing skin damage exists, it is recommended that the complete skin panel be replaced.

The Grumman American Customer Service Department should be contacted for additional information.

6. Honeycomb Panel Repairs – Riveted

Damage to honeycomb panels can be repaired by removal of the damaged section, sealing any exposed honeycomb core with PR1436GB-2 Inhibited Sealant and splicing in of new repair parts. The splice can be installed with rivets and can be made flush with the external surface if desired. Representative repairs for damaged honeycomb panels are discussed in Approved Repairs, Paragraph 3 through 8.

NOTE: PR1436GB-2 Inhibited Sealant is approved and is available through Products Research and Chemical Corporation, 2919 Empire Avenue, Burbank, California or through your authorized Grumman American Dealer or Distributor.

Critical honeycomb areas are those areas within 6 in. of the wing spar and within 4 in. of the engine mount, tail cone, and nose gear structure. Minor damage to one face sheet of a honeycomb panel which is confined to an area of 1.0 inch or less in diameter, and located in a non-critical area, can be repaired by smoothing sharp edges in the damaged area, sealing any exposed honeycomb core with PR1436GB-2 sealant and filling with an epoxy filler.

Minor damage to a critical area which is equal to or less than 1.0 inch in diameter can be repaired by removal of the damaged face sheet, sealing any exposed honeycomb core with PR1436GB-2 sealant, application of resin filler, and installation of a doubler plate. Service Kit No. SK-102 includes an acceptable resin filler with resin, hardener, and instructions for preparation and application. It is available through your authorized Grumman American Dealer or Distributor. A representative repair is discussed in Approved Repairs, Paragraph 3.

Damaged areas greater than 1.0 inch in diameter or including punctures through both face sheets will require removal of the damaged area and insertion of a honeycomb repair section. Typical repairs are discussed in Approved Repairs, Paragraph 4.

Extensive honeycomb panel damage, such as in the nose gear attachment area can be repaired by splicing in new honeycomb repair assemblies which are available through your authorized Grumman American dealer or distributor. Such a repair is discussed in Approved Repairs, Paragraphs 5 and 7.

When making honeycomb panel repairs which require splicing of the bonding strap angles located at the lower corners of the fuselage, the splice must be so designed to maintain the continuity of the angles from the original panel into the repair panel. This can be achieved with angles riveted over the bonding strap angles across the splice. This is discussed in Approved Repairs, Paragraph 5. The length of the external splice angle can be increased as required for appearance purposes.

All riveted honeycomb repairs must include some means of sealing the repair joint from external moisture. This protection is provided by PR1436GB-2 Inhibited Sealant. Epoxy filler may be used to smooth the repair prior to painting.

All honeycomb edges and repair faying surfaces should be coated with PR1436GB-2 sealant. Also, all rivets should be dipped in this sealant prior to installation. After completion of the repair, the repaired area should be coated with zinc chromate primer.

7. Repair of Formed Thermo-Plastic Parts

Repairs of punctures may be accomplished by cutting out the damaged area, removing the paint and installing an overlapping or flush patch of identical material. A doubler may be added behind the patch if additional strength is required.

The bonding agent can be Trichloroethane or a suitable substitute.

WARNING: WHEN USING TRICHLOROETHANE, ENSURE THAT THE WORKING AREA IS WELL-VENTILATED AND THAT PROTECTIVE EQUIPMENT (GLOVES, EYE PROTECTION) IS WORN. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

Cracks or voids may be repaired by applying a filler composed of solvent and material shavings. Upon completion of the repair, sand the area smooth and repaint.

Extensively damaged parts should be replaced.

8. Engine Mount Repair

Engine mount repairs should be accomplished in strict accordance with Part 43 of the Federal Aviation Regulations. Repair details for the repairs of damaged honeycomb in the areas adjacent to the two upper and lower engine mount extrusions are given in Approved Repairs, Paragraphs 6 and 7.

9. Control Surface Repair

After repair or repainting of any control surface, it is necessary to check the balance and adjust the mass balance weight as required to bring it within tolerance. (Refer to Chapter 27 for control system balancing and rigging.)

10. Bondline Damage and Repair

A. Types of Bondline Damage

(1) Physical Damage

The most common type of bondline damage is physical damage along the trailing edges of the flaps, ailerons, elevators and rudder. This is usually caused by persons stepping on the inboard trailing edges of the flaps and general "hangar rash" on the other control surfaces. This type of damage is usually readily visible in the form of joint separation. A typical bondline repair procedure is discussed in Approved Repairs, Paragraph 14.

(2) Corrosion Damage

A less common type of bondline damage is damage caused by metal corrosion. This type of damage is usually restricted to edges of unfilleted bondlines, such as the trailing edges of wings, rudders, elevators, and trim tabs, particularly if these edges are not well protected by paint. This type of damage is more likely in tropical and subtropical climates, particularly where an aircraft is located close to the coast.

B. Areas Requiring Inspection Emphasis

Areas which should be given particular attention include: flanges of wing and stabilizer rear spars, trailing edges of control surfaces, the side lap joint between the tailcone and forward cabin section, the joint between the tailcone top and side skin, and the aft tailcone bulkhead joints.

Inside edges and internal joints which have an undisturbed bondline fillet are generally not affected. See Approved Repairs, Paragraph 14.

11. Non-Repairable Parts

The following parts are not repairable and must be replaced if damaged:

- A. Center Spar
- B. Wing Spar
- C. Main Gear Leg (If damage exceeds allowable limit specified in Note below.)
- D. Nose Strut
- E. Nose Gear Torque Tubes

NOTE: Minor surface delaminations are acceptable providing they do not extend more than one ply into the surface of the strut. Corner delaminations (slivers) are acceptable if they are smaller than 1/16 x 1/16 inch in size throughout their length. To correct these minor damages see Approved Repairs, Paragraph 15.

12. Rivet Substitution

Rivets of higher strength than those called out may be used on any structural repair.

13. Primary Structures

The following portions of the aircraft are primary structures:

- A. Fuselage
 - (1) Engine Mount
 - (2) Engine Mount Extrusions
 - (3) Lower Fuselage Honeycomb Corners (4 in. of floor and 4 in. of side panels)
 - (4) Upper 4 in. of Fuselage Honeycomb Side Panels
 - (5) Center spar
 - (6) Center Spar Attach Collars
 - (7) Nose Gear Assembly
 - (8) Main Gear Assembly
 - (9) Aft Fuselage W.L. 49.00 Stiffener Flanges
 - (10) Aft Fuselage Lower Corner Flanges

- (11) Aft Fuselage Bulkhead (Stabilizer Spar Attach)
- (12) Horizontal and Vertical Stabilizer Forward Attach Fuselage Bulkheads
- (13) Forward Turtleback Bulkhead
- (14) Aft Fuselage/Cabin Honeycomb Side and Bottom Bond Joints

B. Control System

- (1) All Components

C. Wing

- (1) Wing Main Spar
- (2) Wing Main Spar Doublers

D. Empennage

- (1) Stabilizer Rear Spars
- (2) Stabilizer Front Spars

E. Control Surfaces

- (1) Support Brackets
- (2) Balance Weight Supports
- (3) Torque Tubes

AIRFRAME STRUCTURAL REPAIR – APPROVED REPAIRS1. Leading Edge Repair

Figure 801 illustrates a typical repair to be employed in patching skin on the leading edge. The repair should be made flush with the external surface of the leading edge skin and surface contour must be maintained.

Repair skin as follows:

- A. Trim out the damaged area in a rectangular pattern and de-burr.
- B. Place repair doubler beneath wing skin as shown in Figure 801 below.

NOTE: Dimensions given in Figure 801 are typical for most repair of the leading edge.

- C. Holding repair doubler in place, drill dimple holes (1/8 in. diameter) through wing skin, spacing holes 5/8 in. apart (from center of hole to center of adjacent hole).

NOTE: This repair can be completed in the area of wing ribs by installing the doubler in two places, one on each side of the rib flange.

- D. Secure doubler to wing leading edge with 1/8 in. diameter countersunk Cherry rivets (CR162) or equivalent. If bucked rivets are used, exercise caution to prevent nearby bond damage.

NOTE: Filler should be of same material and thickness as skin.

- E. Place filler flush with the doubler.
- F. Holding filler piece in place, drill dimple holes through filler, spacing holes 5/8 in. apart (from center of hole to center of adjacent hole).
- G. Secure filler to doubler with rivets as specified in Step D. above.
- H. Use an epoxy filler as necessary and sand smooth.

2. Wing Rib Repair

Figure 802 illustrates typical wing rib repairs. If the wing ribs are extensively damaged, they should be replaced. See Chapter 57.

Repair rib as follows:

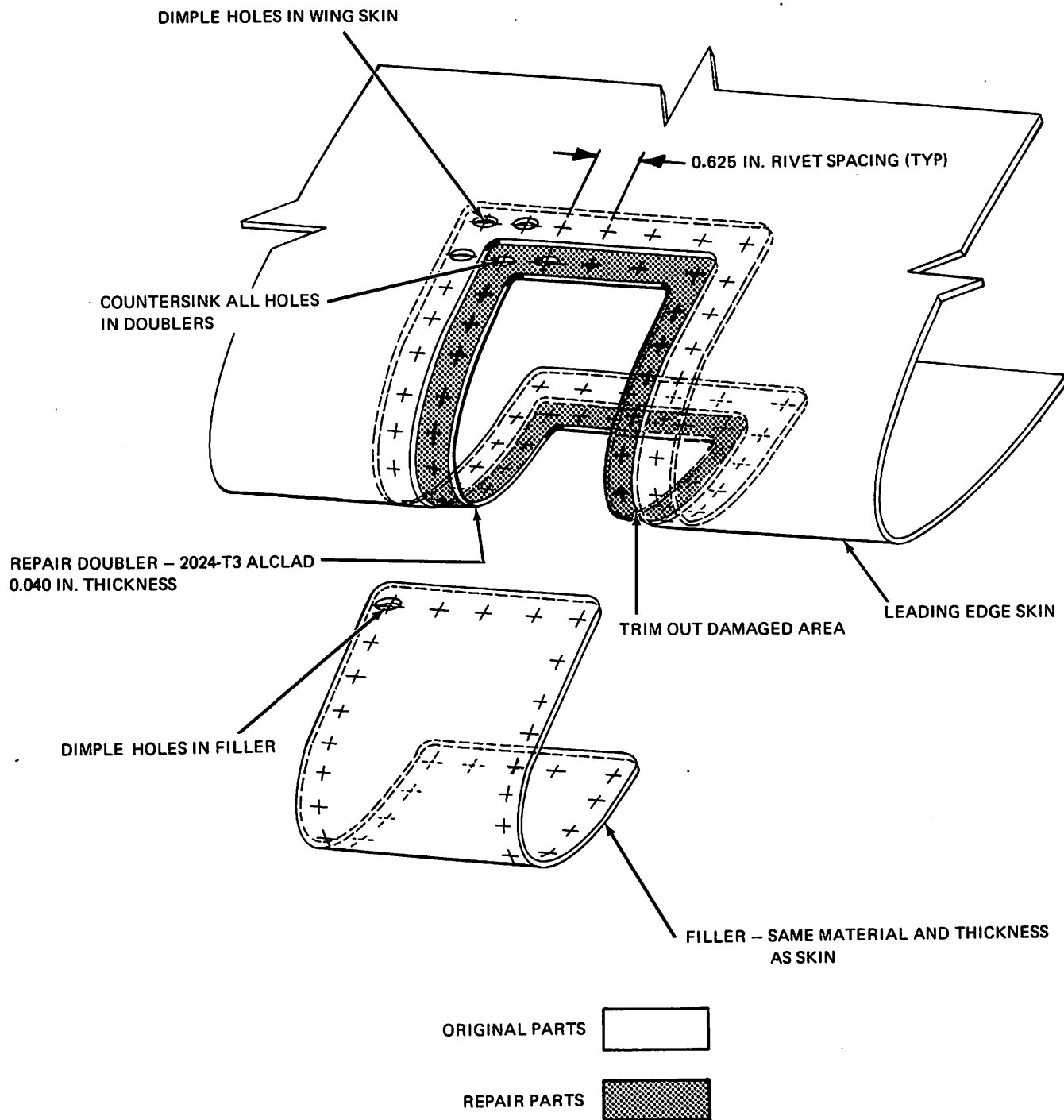
NOTE: If rib damage consists of a crack, stop drill crack if crack does not extend to edge of part and add reinforcement plate to carry stress across damaged portion and stiffen the joints.

- A. If the area to be repaired is damaged extensively, trim out damaged area and de-burr.

NOTE: Repair parts shall be 6061-T6 aluminum or equivalent.

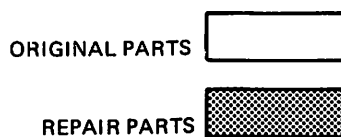
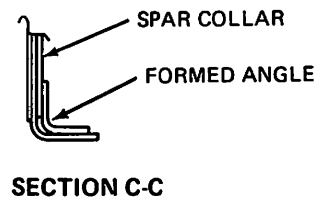
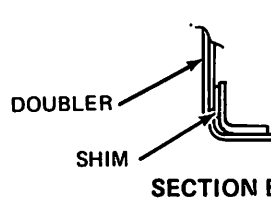
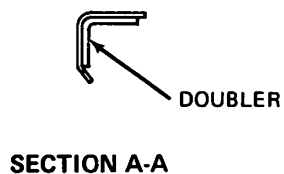
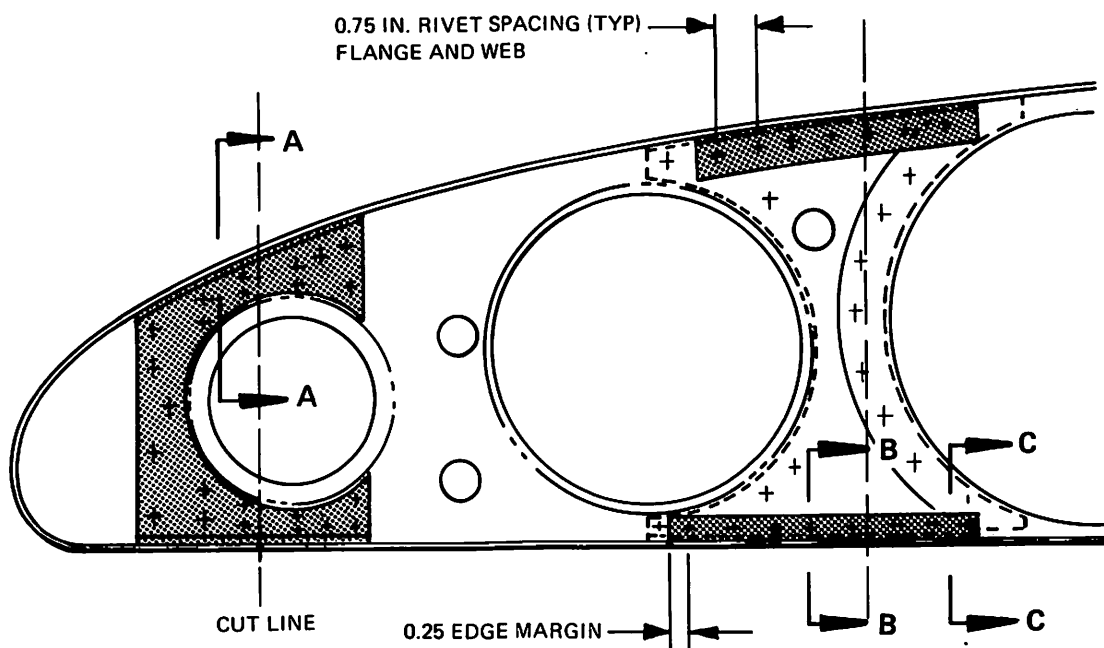
- B. Hold doubler (.032 in. thick) in place against the damaged area on the rib structure. If extra support is needed, place a formed angle against the inside portion of the rib nested under the flange; and place a doubler on the opposite side of the rib against the damaged area.

NOTE: Dimensions given in Figure 802 are typical for most repairs of the wing rib.



**Leading Edge Repair (Riveted)
Figure 801**

- C. With repair parts held in place, drill 1/8 in. diameter holes through repair parts and rib structure, spacing holes 3/4 in. apart (from center of hole to center of adjacent hole). Holes drilled at the ends of the formed angle should be placed 1/4 in. from the edge.
- D. Install all rivets (1/8 in. diameter Cherry rivets CR162, CR163 or equivalent) with wet zinc chromate primer. If bucked rivets are used, exercise caution to prevent nearby bond damage.
- E. After the repair is completed, the repaired area should be coated with zinc chromate primer.



**Wing Rib Repair (Riveted)
Figure 802**

3. Honeycomb Repair, Partial Core Damage

Minor damage extending partially through the core of honeycomb panel and equal to or less than 1 in. diameter (see Figure 803) can be repaired with an external doubler as follows:

- A. Trim out damaged area of face sheet in a circular pattern.
- B. Thoroughly clean the repair area with fine sandpaper and acetone.
- C. Coat all repair parts with zinc chromate primer.
- D. Seal the exposed honeycomb core with PR1436GB-2 Inhibited Sealant.
- E. Using Service Kit SK-102, apply resin filler to area where damaged honeycomb core was removed.

NOTE: Refer to AC43.13-1 for doubler and rivet pattern dimensions. Dimensions given below are typical for repair of this type.

- F. Place 2024-T3 alclad aluminum doubler (.040 in. thick) over repair area and drill out 1/8 in. diameter holes around circumference of doubler.
- G. Dip all rivets (1/8 in. diameter Cherry rivets, CR162, CR163 or equivalent) in PR1436GB-2 Inhibited Sealant and install to secure doubler to honeycomb panel.
- H. Fair external doubler periphery with epoxy filler to maintain a smooth surface.
- I. Coat repaired area with zinc chromate primer.

4. Honeycomb Repair, Extensive Core Damage

Damaged areas greater than 1 in. diameter or areas in which damage extends completely through the core require removal of the damaged area and installation of honeycomb repair section (see Figures 804, 805 and 806).

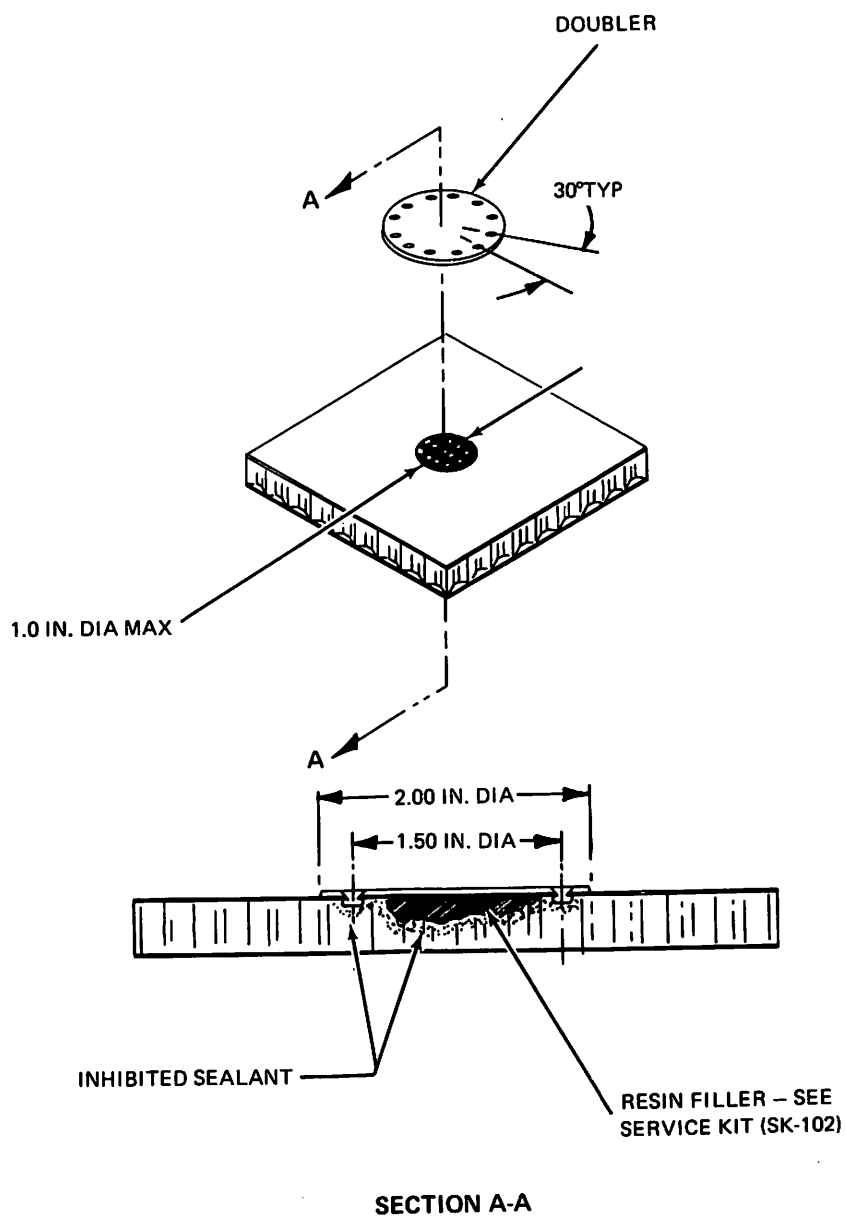
- A. Patch repair using external and internal doublers (Figure 805)

Repair honeycomb as follows:

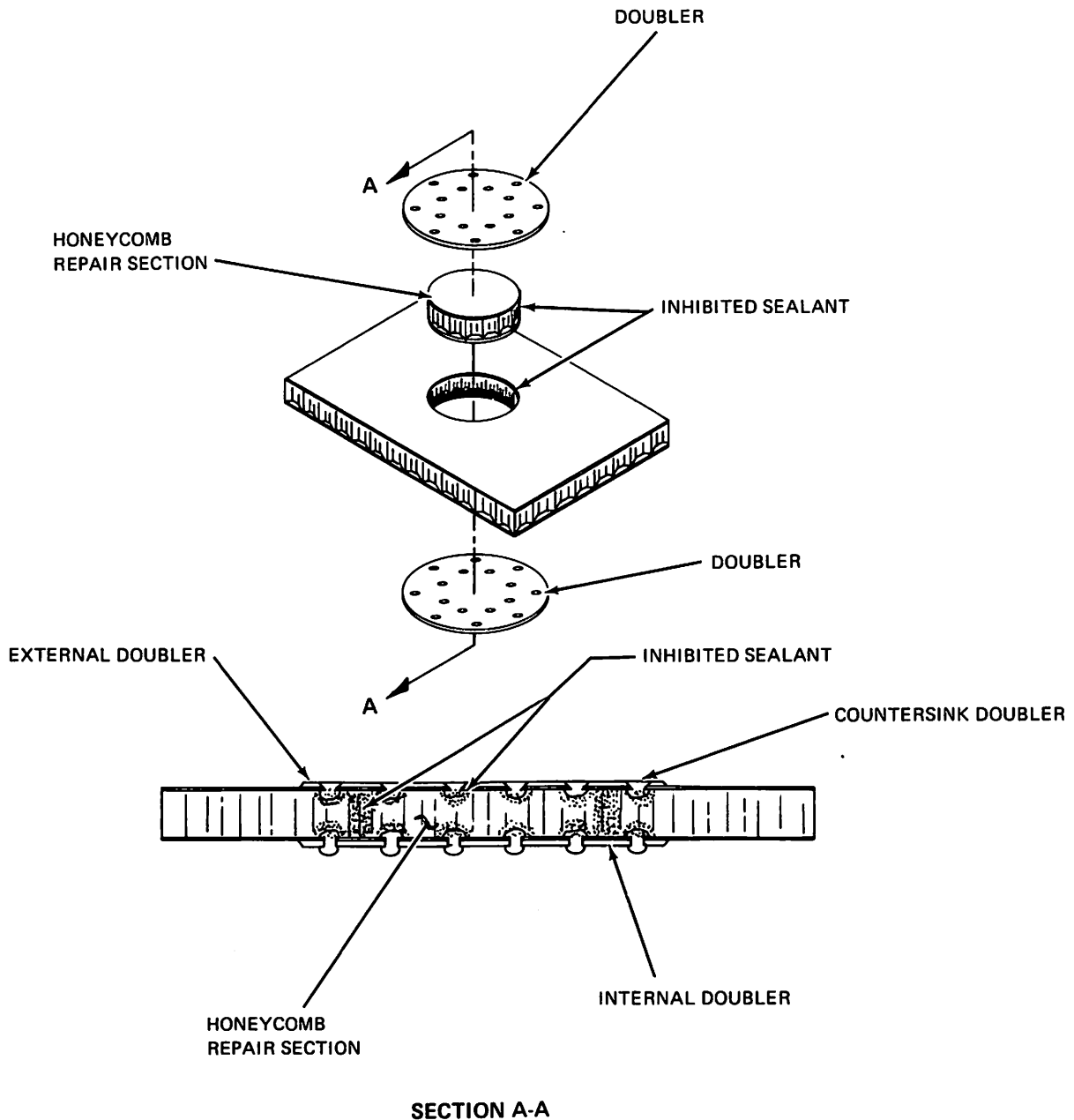
- (1) Trim out damaged area in a circular pattern as shown in Figure 804 below and de-burr.
- (2) Coat all repair parts with zinc chromate primer.
- (3) Seal all exposed honeycomb core areas on the repair section and the panel section with PR1436GB-2 Inhibited Sealant.
- (4) Place internal and external doublers (2024-T3 alclad aluminum, .040 in. thick) over repair area.

NOTE: Refer to AC 43.13-1 for hole diameter limitations and corresponding rivet patterns.

- (5) Dip all rivets (1/8 in. diameter Cherry rivets, CR162, CR163 or equivalent) in PR1436GB-2 Inhibited Sealant and install through the doubler and repair section (both sides) such that maximum distance between any two rivets is 1.5 inches.
- (6) Fair external doubler periphery with epoxy filler to maintain a smooth surface.
- (7) Coat repaired area with zinc chromate primer.



**Honeycomb Repair, Partial Core Damage
Figure 803**



**Honeycomb Patch Repair, External and Internal Doublers
Figure 804**

B. Splicing In New Panel Section (Figure 805)

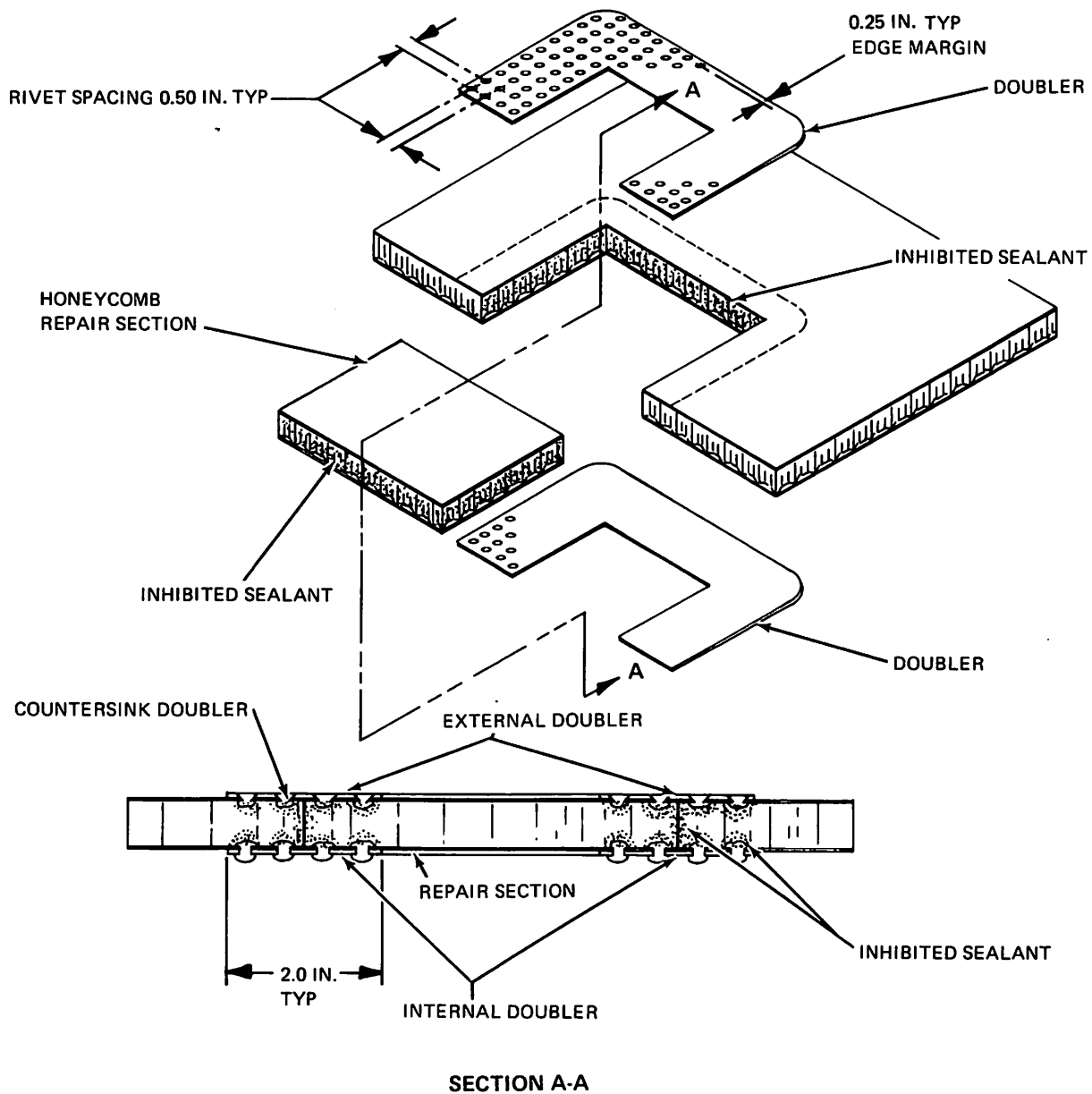
This repair is satisfactory for most honeycomb repairs which require new panel sections to be spliced into existing structure. Repair honeycomb as follows:

- (1) Trim out damaged area in a rectangular pattern as shown in Figure 805 below and de-burr.
- (2) Coat all repair parts with zinc chromate primer.
- (3) Seal all exposed honeycomb core areas with PR1436GB-2 Inhibited Sealant.
- (4) Place internal and external doublers (2024-T3 alclad aluminum) over repair area. The external doubler shall be .040 in. thick, and the internal doubler shall be .032 in. thick.

NOTE: Dimensions given in Figure 805 are typical for most honeycomb repairs using external doublers.

- (5) Dip all rivets (1/8 in. diameter Cherry rivets, CR162, CR163 or equivalent) in PR1436GB-2 Inhibited Sealant and install through the doubler and repair section (both sides).
- (6) Fair external doubler periphery with epoxy filler to maintain a smooth surface.
- (7) Coat repaired area with zinc chromate primer.

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Honeycomb Repair Using Spliced-In Panel Section
Figure 805

5. Honeycomb Repair, Forward Fuselage Section

Repair in the area of the forward fuselage section of the airplane can be accomplished using (a) external doublers as shown in Figure 805 or (b) the sheet metal pan and doubler method as described in Figure 806.

The external doublers are recommended for repair splices in the firewall and floor honeycomb panels. This allows the honeycomb panels to be butted enhancing ease of repair. The decision on whether to use an external or flush repair on the fuselage side panel is a matter of preference.

A. Sheet Metal Pan and Doubler

When using the sheet metal pan and doubler on the fuselage side panel (Figure 806) repair honeycomb as follows:

CAUTION: TO PREVENT DISTORTION, CAREFULLY SUPPORT OUTER FACE SHEETS OF HONEYCOMB PANELS WHILE REMOVING CORE MATERIAL.

- (1) Remove damaged section and carefully trim to match repair section.
- (2) Coat all parts with zinc chromate primer.
- (3) Seal all exposed honeycomb core areas with PR1436GB-2 Inhibited Sealant.

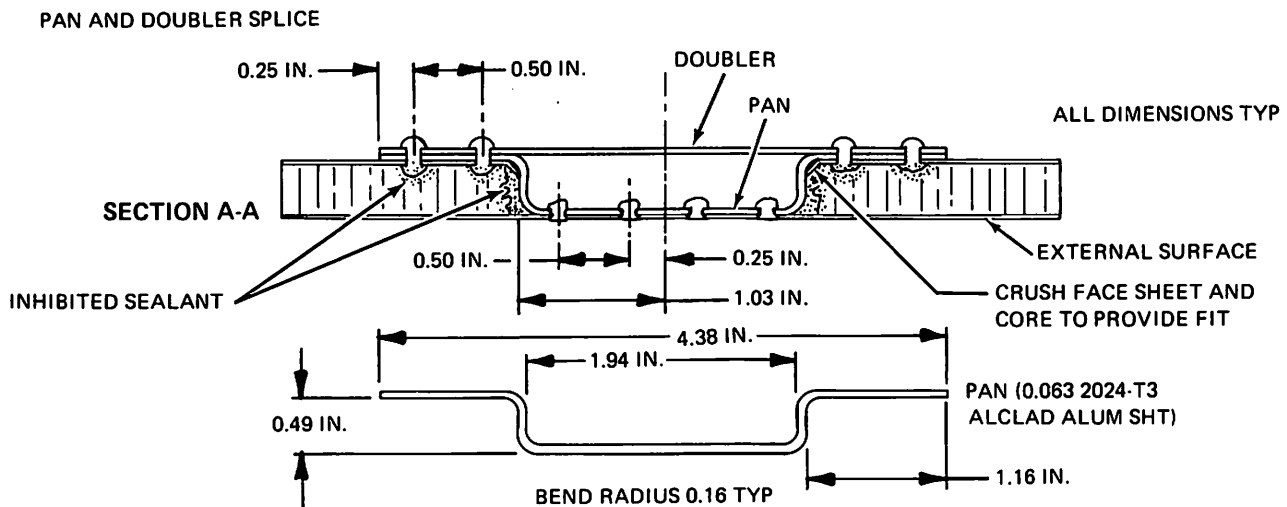
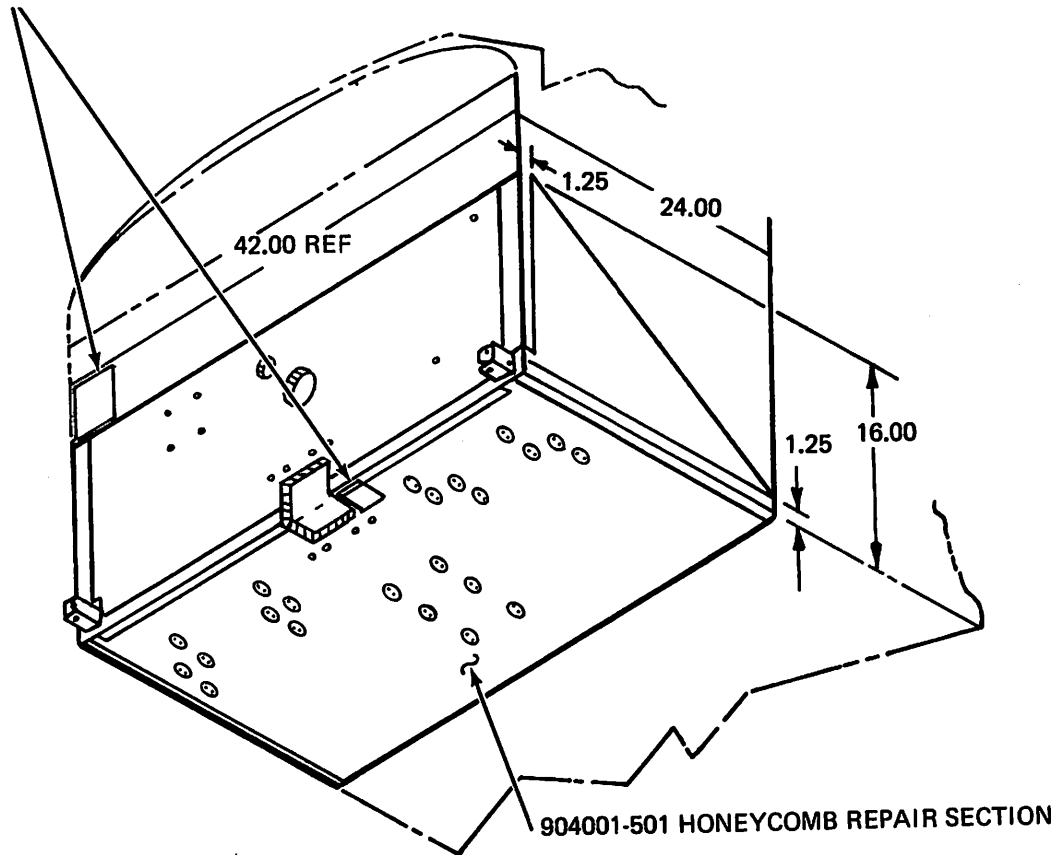
NOTE: Obtain preformed pan sections and doublers through your authorized Grumman American Dealer or Distributor.

- (4) Countersink pan and dimple honeycomb face sheets.
- (5) Provide fit for pan (.063 in. 2024-T3 alclad aluminum or equivalent) by crushing internal face sheet and core edges.
- (6) After fitting pan into panel, install rivets to secure external surface to pan bottom (rivet spacing in Figure 806 typical).
- (7) Place doubler (.063 in. 2024-T3 alclad aluminum or equivalent).

NOTE: Dimensions given in Figure 806 are typical for most honeycomb repairs of this type.

- (8) Dip all rivets (1/8 in. diameter Cherry rivets, CR162, CR163 or equivalent) in PR1436GB-2 Inhibited Sealant.
- (9) Install rivets along outer edge of pan, penetrating doubler, pan and internal surface of panel (rivet spacing in Figure 806 typical).
- (10) Coat the repaired area with zinc chromate primer.

NOTE: FOR REPAIRS IN THESE AREAS, REFER TO FIGURE 805.



Honeycomb Repair – Forward Fuselage Section – (Flush Riveted)
Figure 806

B. Bonding Strap Angle Splice

In order to maintain the continuity of angles from an original panel to a repair panel, angles must be riveted over the bonding strap angles across the splice. See Figure 807 below.

Repair honeycomb panel using the bonding strap angle splice as follows:

- (1) Coat all parts with zinc chromate primer.
- (2) Seal any exposed honeycomb core areas with PR1536GB-2 Inhibited Sealant.
- (3) Install honeycomb repair section at fuselage corner junction with bonding strap angle.
- (4) Place splice angle (2024-T3 alclad aluminum) over the bonding strap angle and across the splice. (Where countersunk rivets are to be installed, angle thickness shall be .040 in. Otherwise, .032 in. thick material is satisfactory.)

NOTE: The length of the external splice angle can be increased as required for appearance purposes. If splice angle length is increased, rivet spacing may be increased proportionately up to 1.0 in. maximum.

- (5) Install a minimum of 8 rivets on each side of splice (rivet spacing as shown in Figure 807 typical).
- (6) Dip all rivets (1/8 in. diameter Cherry rivets, CR162, CR163 or equivalent) in PR1436GB-2 Inhibited Sealant.
- (7) Coat the repaired area with zinc chromate primer.

6. Honeycomb Repair, Lower Engine Mount Area

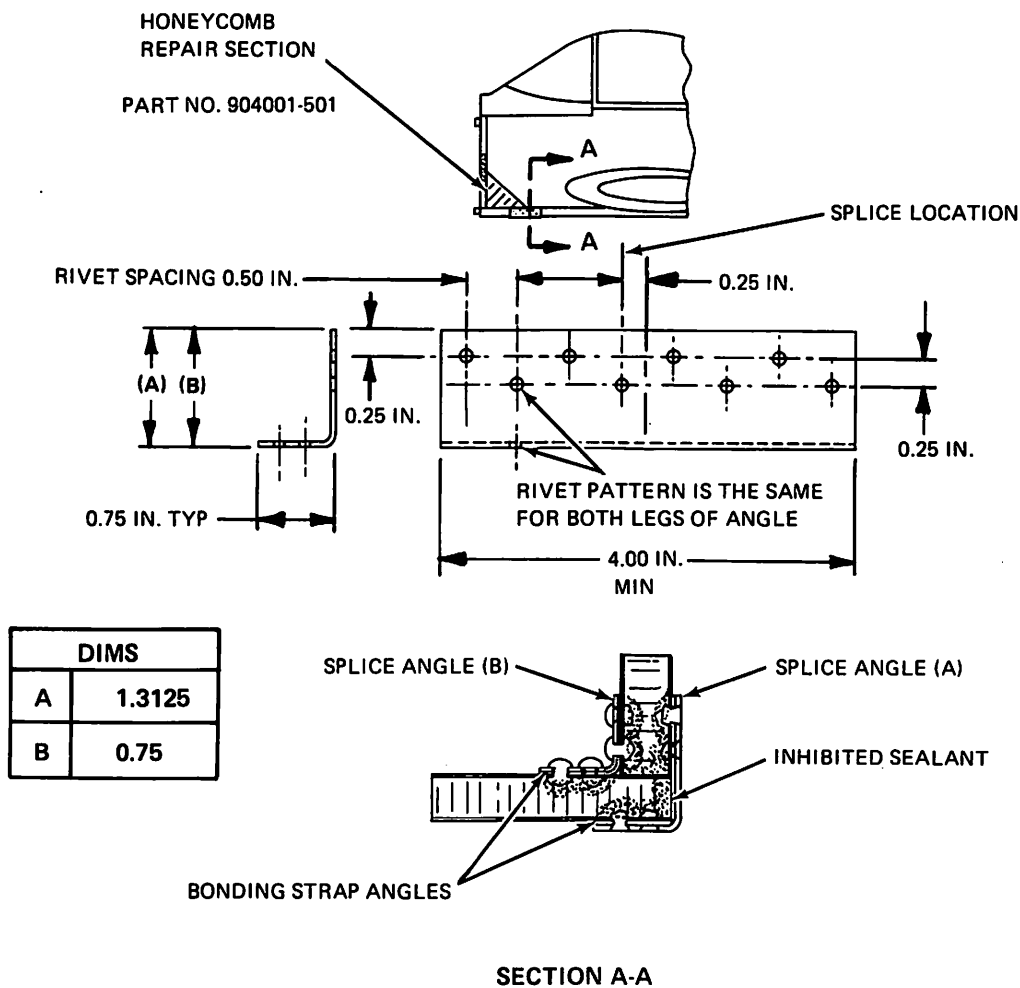
Repair damaged honeycomb in the area adjacent to the two lower engine mount extrusions (Figure 808) as follows:

- A. Remove damaged honeycomb area.
- B. Using fine grain sand paper, clean away all remaining adhesive before riveting in repair section. Coat any remaining exposed bondlines with PR1436GB-2 Inhibited Sealant.
- C. Coat all parts with zinc chromate primer.
- D. Seal all exposed bond lines and honeycomb core areas with PR1436GB-2 Inhibited Sealant.

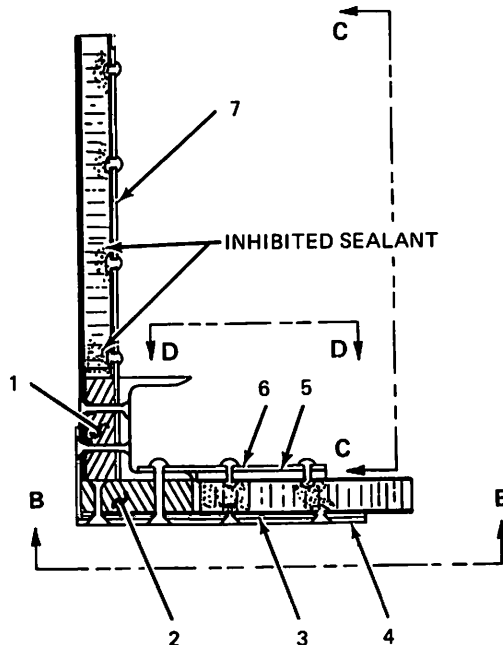
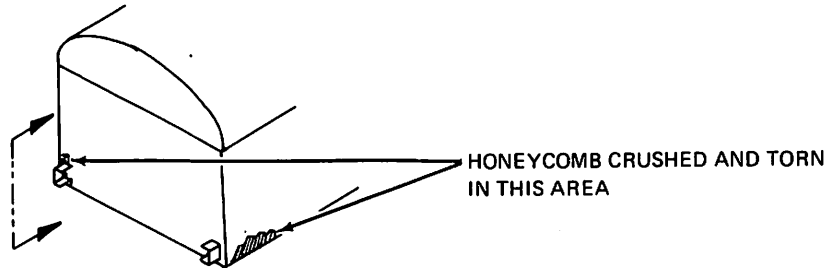
NOTE: Numbers in parentheses denote call-outs in Figure 808 below.

- E. Using 10 MS426AD4-14 rivets dipped in PR1436GB-2 Inhibited Sealant rivet 2024-T3 alclad spacer (3) and 2024-T3 alclad splice (4) to bottom block (2). (See Section B-B, below.)
- F. Fit bottom block with engine mount extrusion into position in repair area, and place 2024-T3 alclad spacer (5) to fit under splice installed in Step E. above.
- G. Using 27 CR2249-4-3 rivets dipped in PR1436GB-2 Inhibited Sealant, rivet through splice (6), spacer (5) and bottom honeycomb panel. (See Section D-D below.)

- H. Using 34 CR2248-4-2 rivets dipped in PR1436GB-2 Inhibited Sealant rivet through splice (4), spacer (3), and underneath side of bottom honeycomb panel. (See Section B-B below.)
- I. Slide side block (1) into place between side honeycomb panel and bottom block.
- J. Slide reinforcement panel (7) between side block and new engine mount extrusion.
- K. Using 48 CR2249-4-2 rivets dipped in PR1436GB-2 Inhibited Sealant rivet reinforcement panel (7) to side honeycomb panel. (See Section C-C below.)
- L. Using 18 MS426AD4-12 rivets dipped in PR1436GB-2 Inhibited Sealant rivet through engine mount extrusion, reinforcement panel (7), and side block (1). (See Section C-C below.)
- M. Fill over rivet heads on exterior areas with epoxy filler and smooth before applying primer.
- N. Coat repaired area with zinc chromate primer prior to application of exterior finish paint.



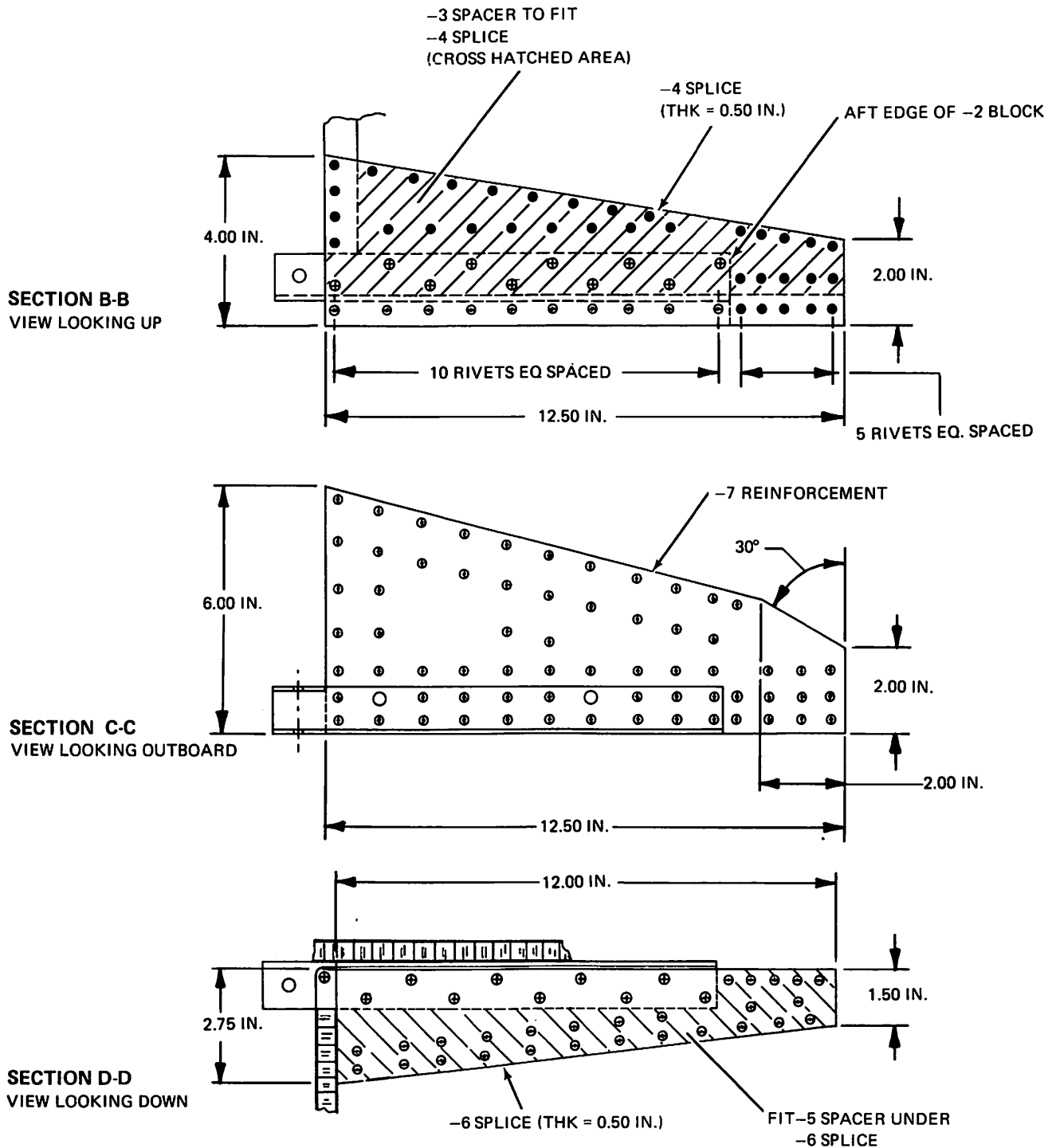
**Bonding Strap Angle Splice (Riveted)
Figure 807**



ITEM	DESCRIPTION	MATERIAL
1.	BLOCK .484 X 1.5 X 9.6	2014-T6 OR 2024-T3
2.	BLOCK .484 X 1.7 X 9.6	2014-T6 OR 2024-T3
3.	SPACER $t = .025$, TRIM TO FIT UNDER ITEM 4.	2024-T3 ALCLAD
4.	SPLICE SEE SECTION B-B	2024-T3 ALCLAD
5.	SPACER $t = .090$, TRIM TO FIT UNDER ITEM 6.	2024-T3 ALCLAD
6.	SPLICE SEE SECTION D-D	2024-T3 ALCLAD
7.	REINFORCEMENT $t = .080$ SEE SECTION C-C	2024-T3 ALCLAD

VIEW B-B, C-C, & D-D ON FOLLOWING PAGE.

Honeycomb Repair, Lower Engine Mount Area (Sheet 1 of 2)
Figure 808



- ⊙ MS426AD4-14 DOUBLE COUNTERSUNK AS SHOWN, SECTION A-A
- CR2248-4-2 LOCATED AS SHOWN 35 REQD
- ⊕ MS426AD4-16 10 REQD

- ⊖ CR2249-4-3 27 REQD
- MS426AD4-12 18 REQD
- ⓪ CR2249-4-2 48 REQD

Honeycomb Repair, Lower Engine Mount Area (Sheet 2 of 2)
Figure 808

7. Honeycomb Repairs, Upper Engine Mount Area

Repair damaged honeycomb in the area adjacent to the two upper engine mount extrusions (Figure 809) as follows:

- A. Trim out damaged honeycomb area with engine mount extrusion.
- B. Using fine grain sand paper, clean away all remaining adhesive before riveting in repair sections.
- C. Coat any remaining exposed bondlines with PR1436GB-2 Inhibited Sealant.
- D. Coat all parts with zinc chromate primer.
- E. Seal all exposed honeycomb core areas with PR1436GB-2 Inhibited Sealant.

NOTE: Numbers in parentheses denote call-outs in Figure 809 below.

- F. Place doubler repair section (1) into place flush against honeycomb side panel and honeycomb front panel (Fuselage Station 50.00).
- G. Using 47 CR2249-4-2 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet doubler to honeycomb side panel and honeycomb front panel.
- H. Place new filler section (2) into repair area, flush against doubler (1).
- I. Install new engine mount extrusion to doubler and filler sections with 18 MS24694-S59 screws, AN960-10 washers, and MS20365-1032 nuts.
- J. Drill new engine mount holes in extrusion.
- K. Fill over rivet heads and bolt heads on exterior areas with epoxy filler and smooth before applying primer.
- L. Coat repaired area with zinc chromate primer prior to application of exterior finish paint.

8. Honeycomb Panel Replacement (Station 50)

Replace the forward fuselage (Station 50) honeycomb panel (Figure 810) as follows:

- A. Remove damaged forward fuselage honeycomb panel without removing existing 102293-3 and 102293-5 angles.
- B. Using fine grain sandpaper, clean away all remaining adhesive before riveting in repair sections. Coat any remaining exposed bondlines with PR1436GB-2 Inhibited Sealant.
- C. Coat all parts with zinc chromate primer.
- D. Seal all exposed honeycomb core areas with PR1436GB-2 Inhibited Sealant.
- E. Place new honeycomb panel into position flush against existing angles, 102293-5 and 102293-3. Rivet panel to angles using CR2249-4-1 rivets dipped in PR1436GB-2 Inhibited Sealant.

NOTE: Numbers in parentheses denote call-outs in Figure 810 below.

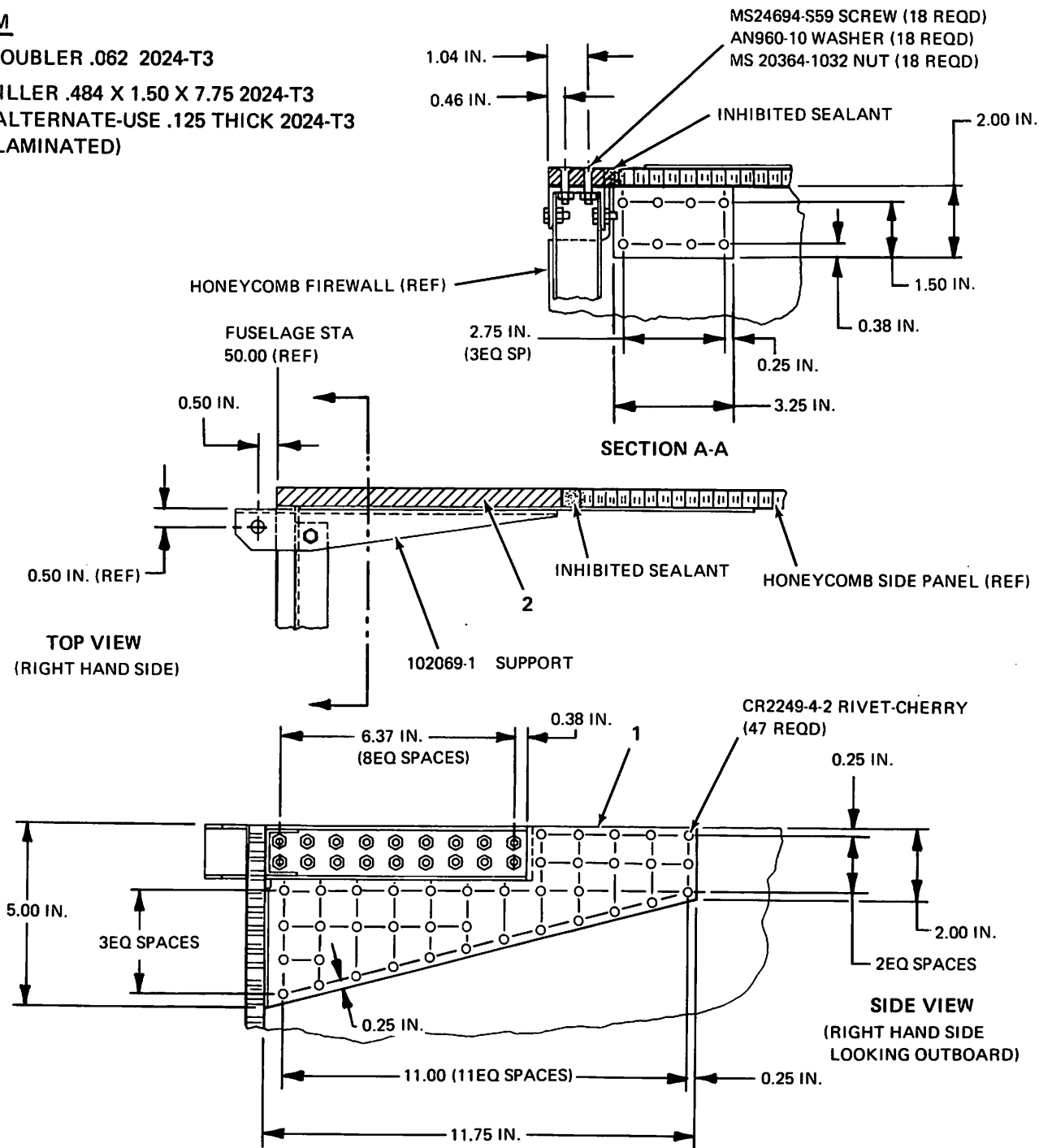
- F. Using CR2248-4-1 rivets dipped in PR1436GB-2 Inhibited Sealant, rivet side angles (1) into place at corner junction of forward fuselage.
- G. Using CR2248-4-1 rivets dipped in PR1436GB-2 Inhibited Sealant, rivet bottom angle (2) into place at bottom edge of forward fuselage.

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- H. Fill over exterior rivets with epoxy filler and smooth before applying primer.
- I. Coat repaired area with zinc chromate primer prior to application of exterior finish paint.

ITEM

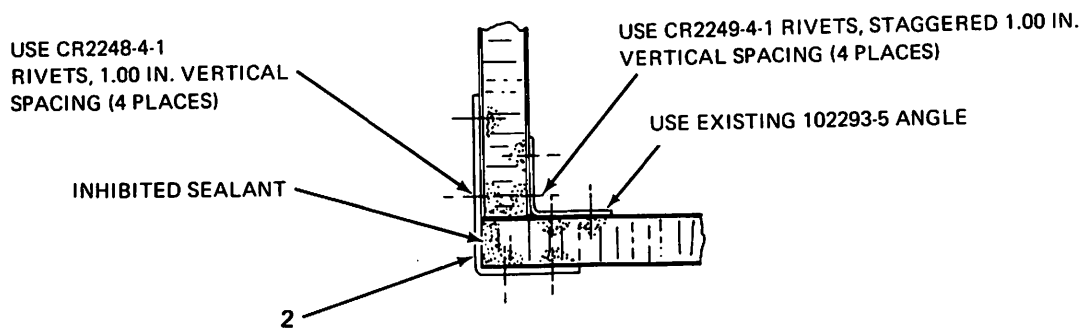
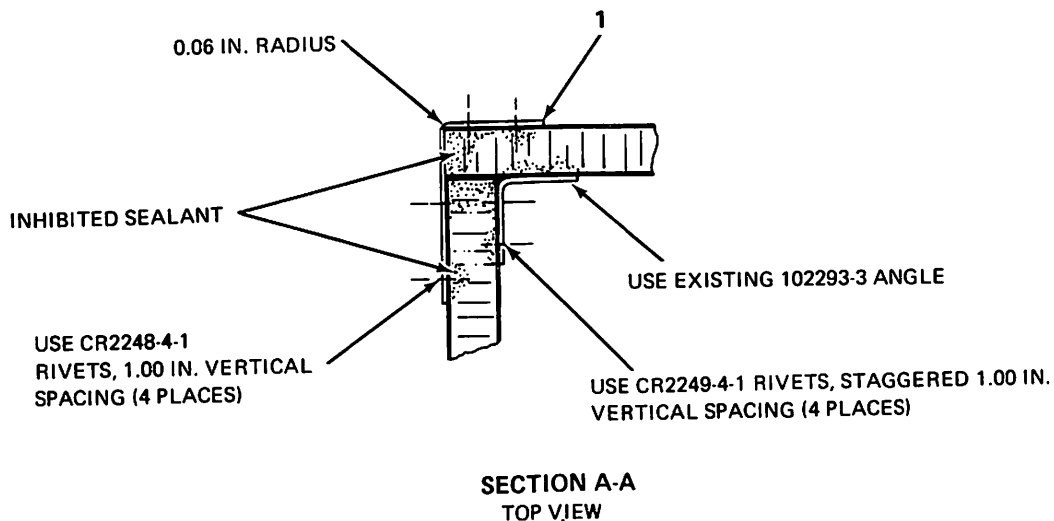
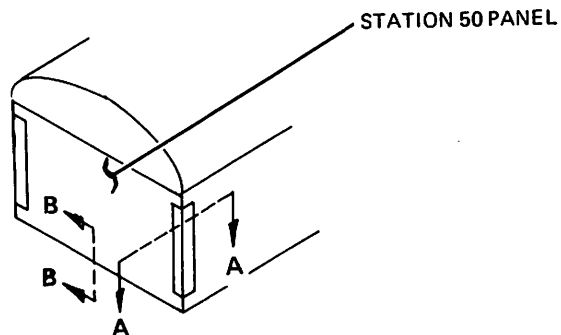
1. DOUBLER .062 2024-T3
2. FILLER .484 X 1.50 X 7.75 2024-T3
(ALTERNATE-USE .125 THICK 2024-T3
LAMINATED)



Honeycomb Repair, Upper Engine Mount Area
Figure 809

ITEM

1. ANGLE 1.00 IN X 1.50 IN., MAKE FROM 2024-T3 ALCLAD
THK = 0.040 IN., LTH = 21.77 IN.
2. ANGLE 1.00 IN. X 1.50 IN. MAKE FROM 2024-T3 ALCLAD
THK = 0.040 IN., LTH = 17.80 IN.



X X
X X
VERTICAL

X
X
STAGGERED
VERTICAL

Honeycomb Panel Replacement (Station 50)
Figure 810

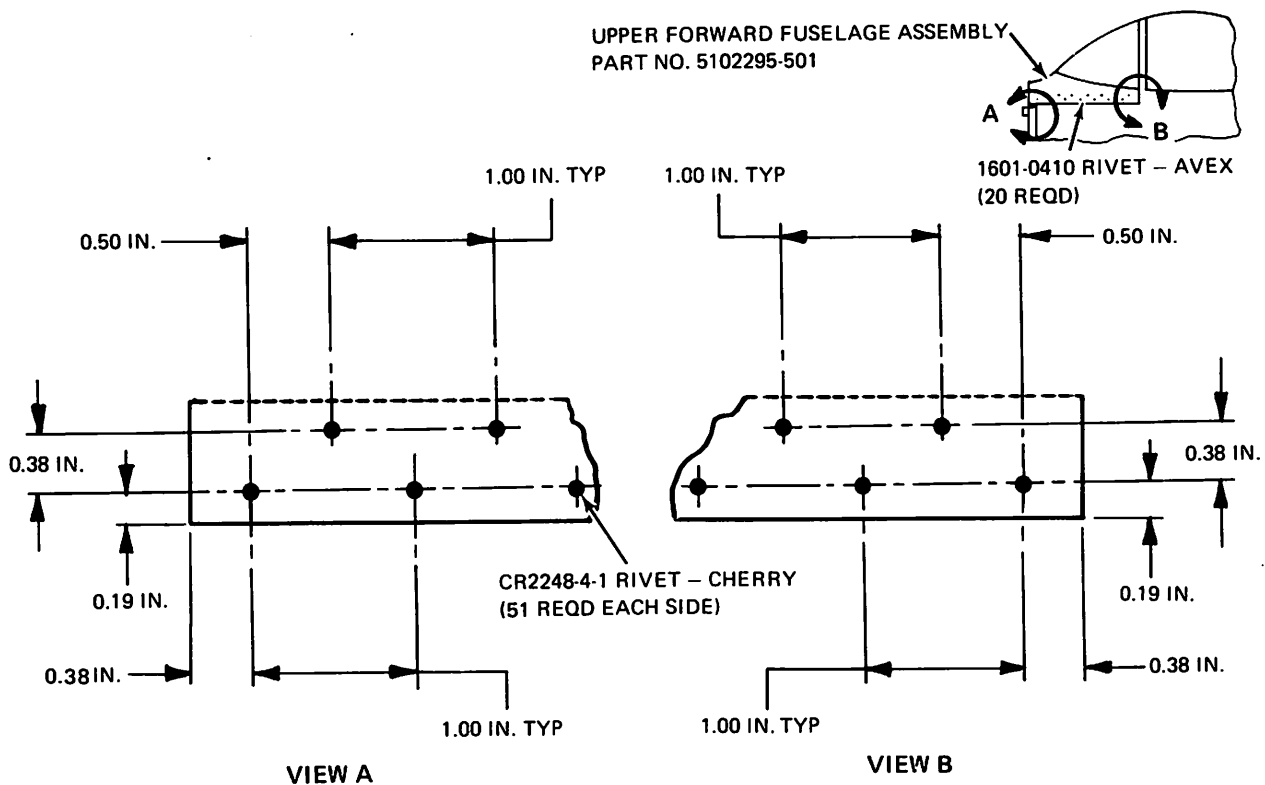
9. Upper Forward Fuselage Assembly Replacement

Replace the entire upper forward fuselage assembly (Figure 811) as follows:

- A. Remove windshield. (See Chapter 56.)
- B. Carefully remove damaged upper forward fuselage assembly.
- C. Using fine grain sandpaper, clean away all remaining adhesive before riveting new assembly in place.
- D. Coat all joints with PR1436GB-2 Inhibited Sealant.
- E. Align upper forward fuselage assembly with honeycomb panel on each side of fuselage according to dimensions given below in Figure 811.

NOTE: Rivet spacing dimensions given in Figure 811 are typical for repairs of the upper forward fuselage assembly.

- F. Using CR2248-4-1 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet upper forward fuselage assembly to honeycomb panel on each side of fuselage (51 rivets required per side).
- G. Using 20 1601-0410 Avex rivets dipped in PR1436GB-2 Inhibited Sealant, rivet upper forward fuselage assembly to firewall arch.
- H. Fill over exterior rivets with epoxy filler and smooth before applying primer.
- I. Coat repaired area with zinc chromate primer prior to application of exterior finish paint.



Upper Forward Fuselage Assembly Replacement
Figure 811

10. Aft Fuselage Assembly Replacement

Replace the entire aft fuselage assembly (Figure 812) as follows:

- A. Remove forward and aft side panel interiors. (See Chapter 25.)
- B. Remove canopy. (See Chapter 52.)
- C. Remove two rivets securing canopy stop to aft fuselage longeron.
- D. Remove pulley from aft fuselage longeron.
- E. Remove seats. (See Chapter 25.)
- F. Remove baggage compartment floor. (See Chapter 25.)
- G. Disconnect all rigging cables (see Chapter 27), electrical wiring, and vacuum system tubing.
- H. Remove bolts attaching four (4) torque tube assembly supports to baggage floor support.
- I. Remove vertical and horizontal stabilizers, if existing stabilizers are to be used on new aft fuselage section. (See Chapter 55.)
- J. Remove wings and wing roots. (See Chapter 57.)
- K. Remove damaged aft fuselage section at fuselage Station 104.0 as follows:
 - (1) Drill out rivets to remove gussets from bottom edge of fuselage (W.L. 25, F.S. 104).
 - (2) On inside of fuselage, forward of F.S. 104, remove rivets from reinforcement which secures aft fuselage to top edge of forward fuselage.
 - (3) Carefully remove aft fuselage section from forward fuselage section.
- L. Using fine grain sandpaper, clean away all remaining adhesive before riveting new assembly in place.
- M. Seal any exposed honeycomb core with PR1436GB-2 Inhibited Sealant.
- N. Align aft fuselage assembly with forward fuselage assembly according to dimensions given in Figures 813 and 814.

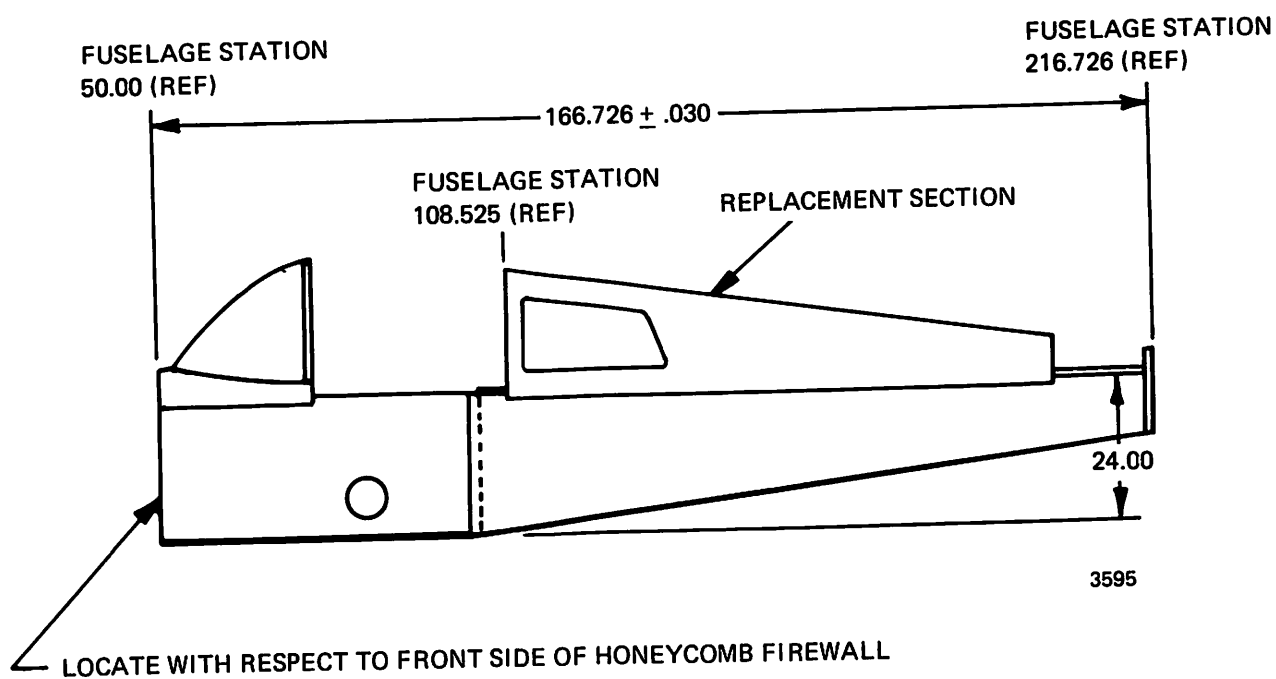
NOTE: Rivet spacing dimensions given in figures below are typical for repairs of the aft fuselage assembly.
- O. Using CR2248-4-1 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet flanges of aft fuselage section to forward fuselage side honeycomb panel. (Twenty-two (22) rivets required for each side of fuselage. See Figure 813.)
- P. Align gusset assemblies in place at bottom edges of forward and aft fuselage sections and secure in place using 1601-0410 Avex rivets dipped in PR1436GB-2 Inhibited Sealant. (Twenty-two (22) rivets required for each side of fuselage. See Figure 813.)
- Q. Using CR2249-4-1 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet bottom flanges of aft fuselage section to forward fuselage bottom honeycomb panel. (Thirty-five (35) rivets required. See Figure 814.)
- R. Apply PR1436GB-2 Inhibited Sealant to exposed edges of honeycomb on forward fuselage section.

- S. Apply PR1436GB-2 Inhibited Sealant to exposed edges of honeycomb doubler sandwich material and align doublers in place on bottom skin of aft fuselage section. (See Figure 814.)
- T. Using CR2249-4-2 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet outside edges of aft fuselage bottom to honeycomb doublers. (Thirteen (13) rivets required for each side of fuselage. See Figure 814.)
- U. Using CR2249-4-1 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, continue to rivet bottom skin of aft fuselage to honeycomb doublers. (Twenty-seven (27) rivets required for each side of fuselage. See Figure 814.)
- V. Place angle flush against baggage floor support and honeycomb doubler. (See Figure 814, Section A-A.)
- W. Using CR2249-4-2 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet angles to honeycomb doublers. (Twenty (20) rivets required for each angle. See Figure 814.)
- X. Align doublers in place on side of baggage floor support opposite angle pieces. (See Figure 814, Section A-A.)
- Y. Using AN3-10A bolts, GAES201-1 spacers, MS20364-1032 nuts, and AN960-10 washers, secure doubler and angle to baggage floor support. (Four (4) bolts, four (4) spacers, four (4) nuts, and four (4) washers required to secure each angle to baggage floor support. See Figure 814, Top View.)
- Z. Align reinforcements along sides of forward and aft fuselage sections (see Figure 814) and secure in place as follows:
 - (1) Using CR2249-4-2 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet reinforcement to side skin of forward fuselage section. (Six (6) CR2249-4-2 Cherry rivets required for each side of fuselage. See Figure 815 for rivet placement.)
 - (2) Using CR2248-4-2 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet reinforcement to side skin of aft fuselage section. (Eight (8) CR2248-4-2 Cherry rivets required for each side of fuselage. See Figure 815 for rivet placement.)
 - (3) Using CR2249-4-2 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet top flange of reinforcement to aft fuselage longeron. (Three (3) CR2249-4-2 rivets required for each side of fuselage. See Figure 815 for rivet placement.)
 - (4) Using CR2249-4-3 Cherry rivets dipped in PR1436GB-2 Inhibited Sealant, rivet canopy stop to aft fuselage longeron and top flange of reinforcement. (Two (2) CR2249-4-3 Cherry rivets required for each side of fuselage. See Figure 815 for rivet placement.)
- AA. Fill over all exterior rivets with epoxy filler and smooth before applying primer.
- AB. Coat all required areas with zinc chromate primer prior to application of exterior paint.
- AC. Install vertical and horizontal stabilizers. (See Chapter 27.)
- AD. Connect all rigging cables (see Chapter 27), electrical wiring, and vacuum system tubing.
- AE. Install wing roots and wing. (See Chapter 57.)
- AF. Install torque tube assembly and install bolts securing four (4) torque tube assembly supports to baggage floor support.
- AG. Install baggage compartment floor. (See Chapter 25.)
- AH. Install canopy track pulley to aft fuselage longeron.
- AI. Install canopy. (See Chapter 52.)

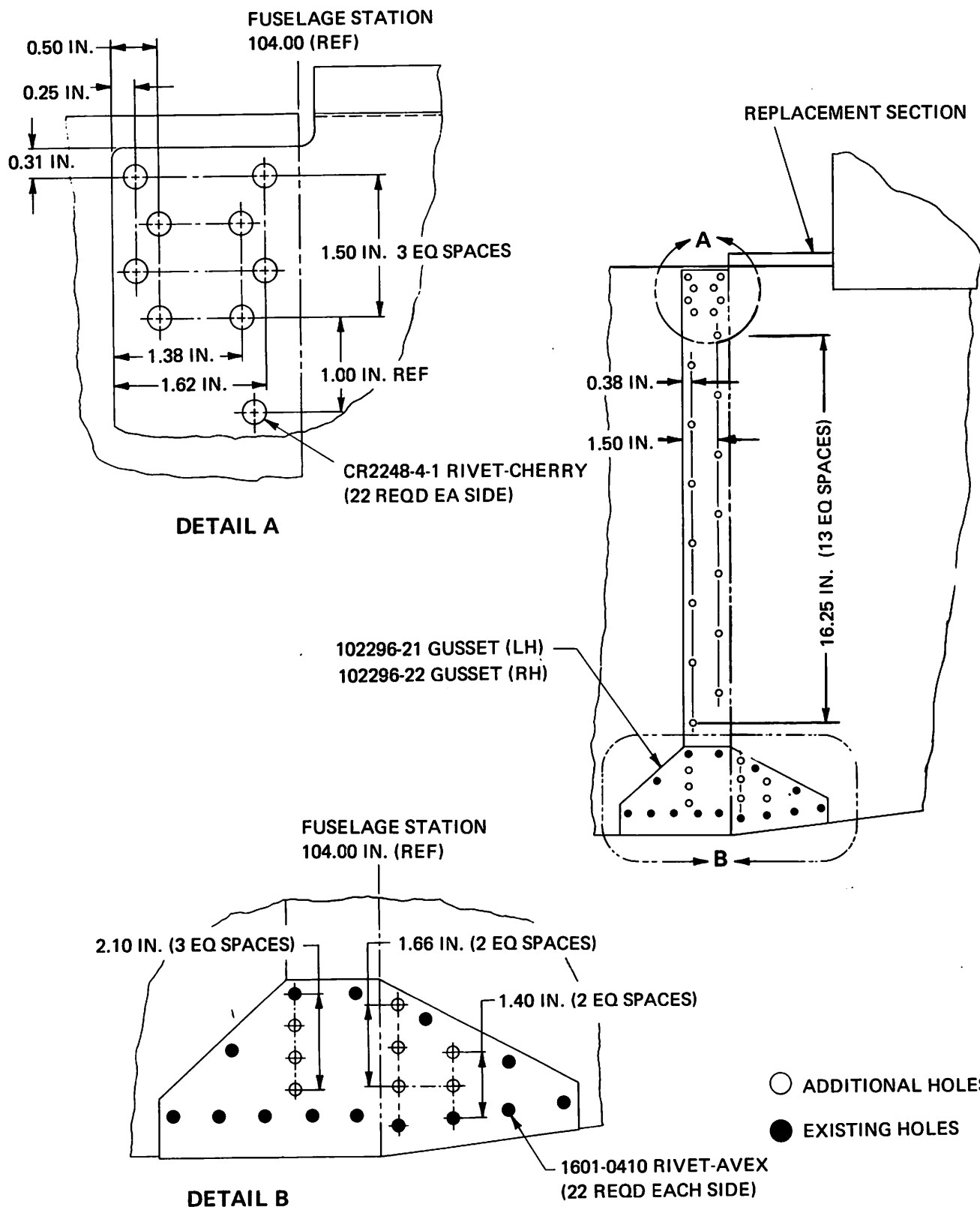
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AJ Install forward and aft side panel interiors. (See Chapter 25.)

AK. Install seats. (See Chapter 25.)

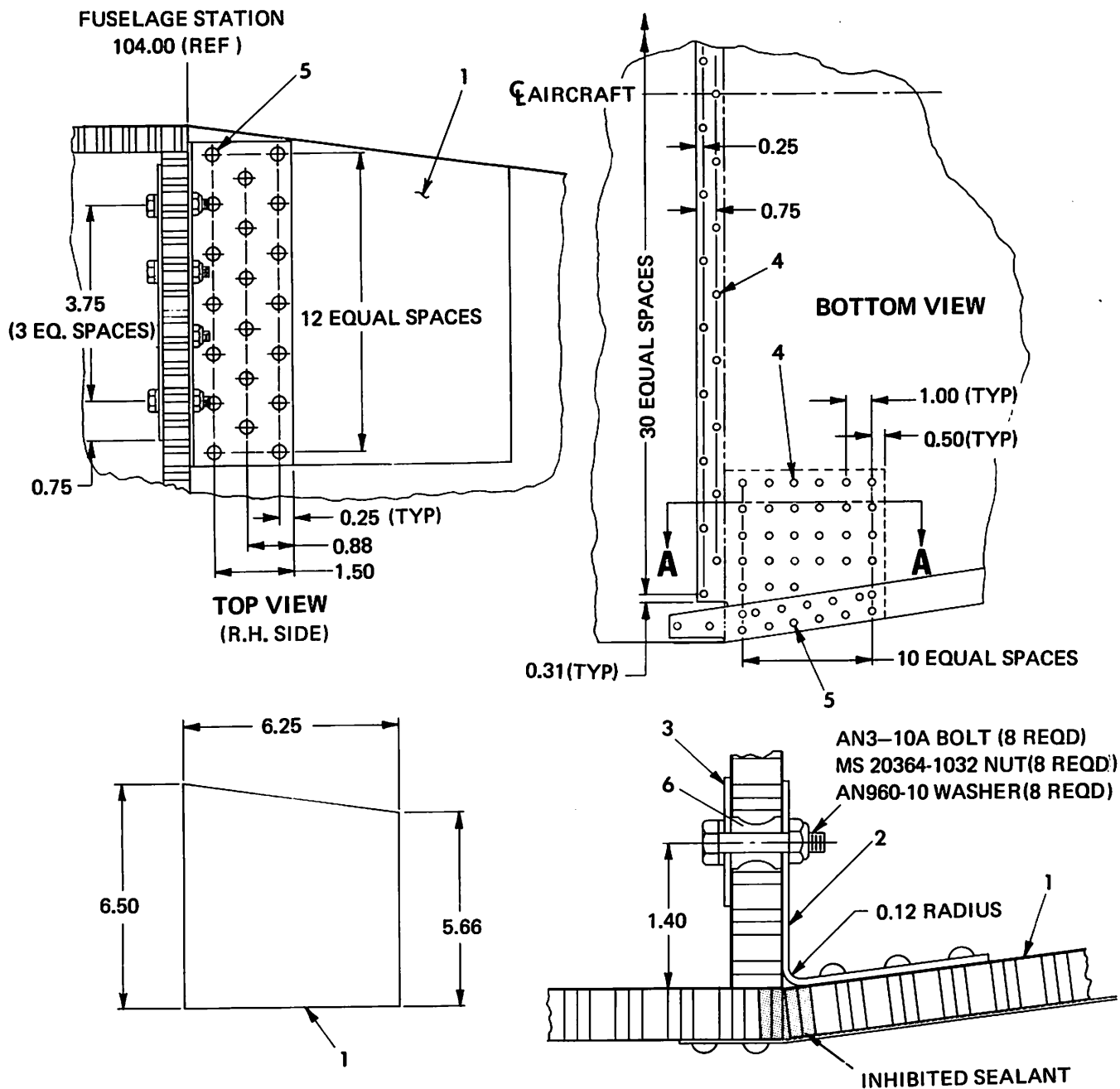


Overall Fuselage Dimensions
Figure 812



Aft Fuselage Side Attachment Details
(View Showing L.H. Side)
Figure 813

1. DOUBLER-HONEYCOMB SANDWICH MATL (2 REQD) .50 THK WITH .016 FACE SHEETS
2. ANGLE - 2.00 X 2.00 X 6.25 X .062 THK (2 REQD) MATL 2024-T3 or EQUIV
3. DOUBLER - 1.25 X 5.25 X .062 THK (2 REQD) MATL 2024-T3 OR EQUIV
4. CR2249-4-1 RIVET - CHERRY (89 REQD)
5. CR2249-4-2 RIVET - CHERRY (66 REQD)
6. GAES201-1 SPACER (8 REQD)



Fuselage Bottom—Inside Doublers and Angle Installation Details
Figure 814

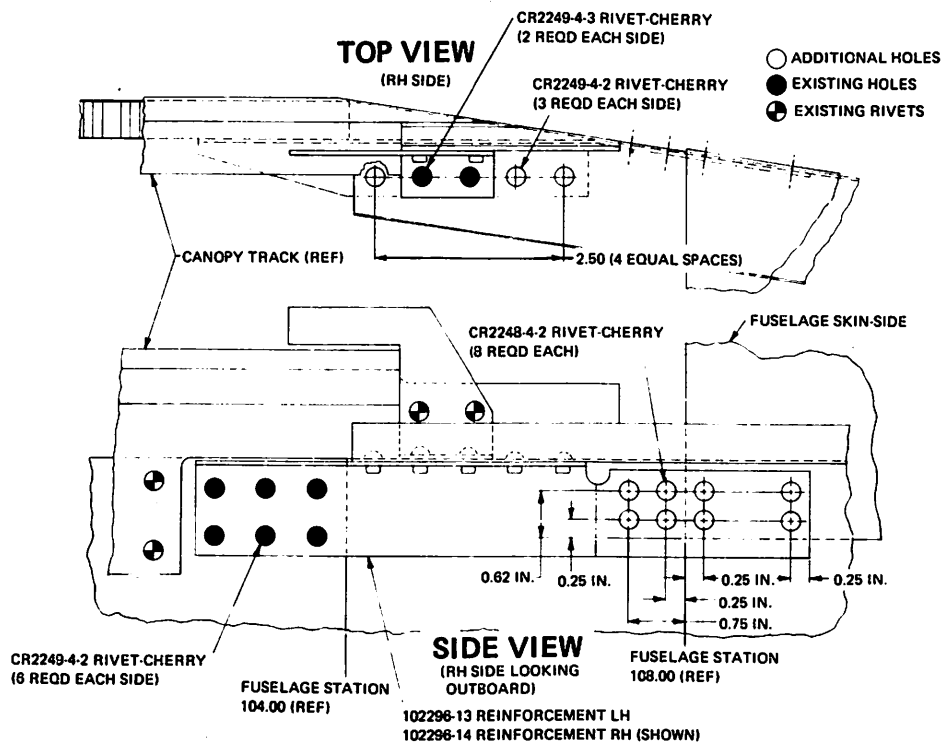
11. Aft Fuselage Bulkhead Replacement

Replace the entire aft fuselage bulkhead (Figure 816) as follows:

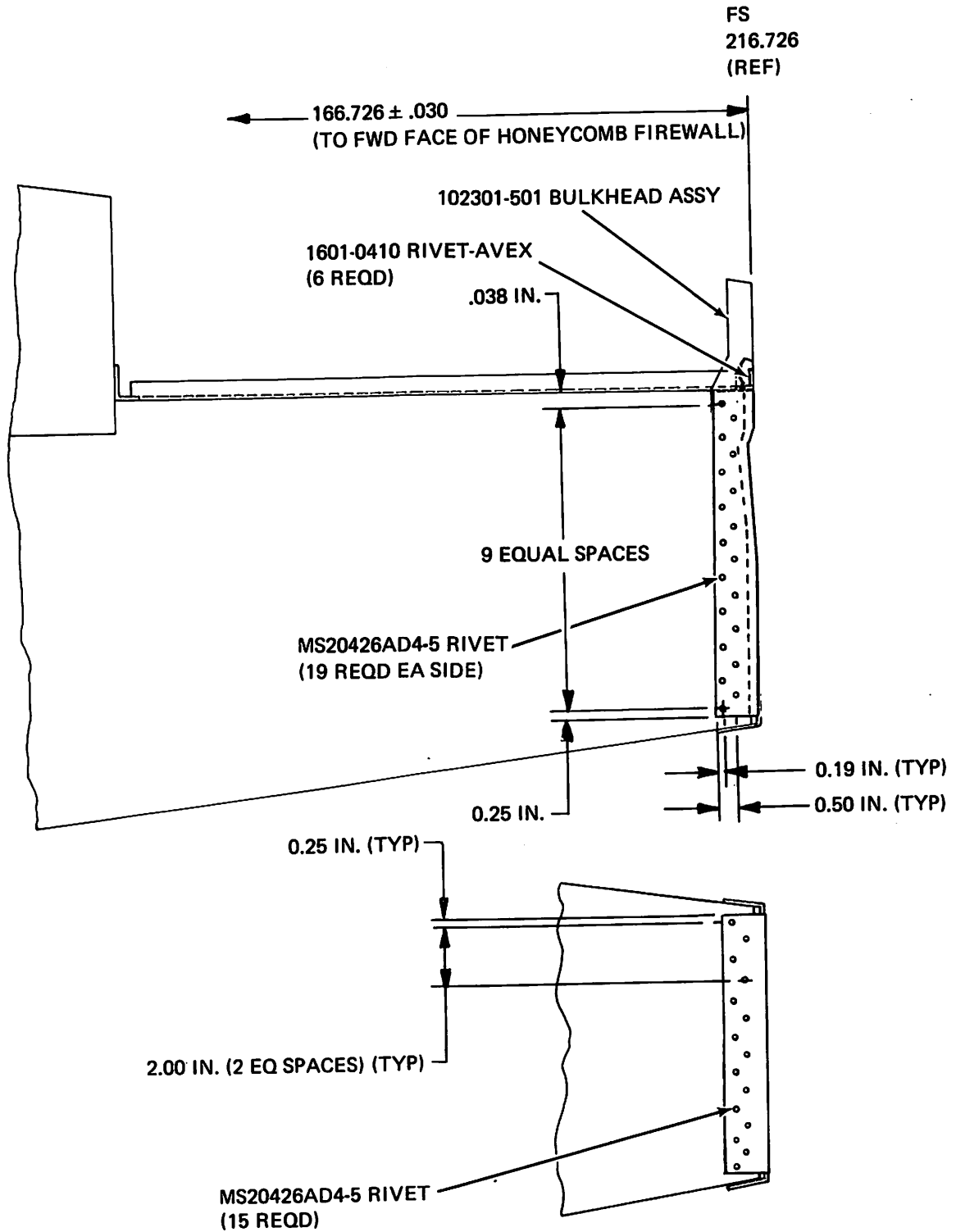
- A. Remove rivets attaching aft fuselage bulkhead to ELT mounting bracket and fuselage structure.
- B. Scrape out bond between bulkhead and fuselage structure.
- C. Remove damaged aft fuselage bulkhead.
- D. Using fine grain sandpaper, clean away all remaining adhesive before riveting new bulkhead in place.
- E. Coat all joints with zinc chromate primer.

NOTE: Rivet spacing dimensions given in Figure 816 are typical for repairs of the aft fuselage bulkhead.

- F. Secure new bulkhead assembly to fuselage with MS20426AD4-5 rivets installed wet with zinc chromate primer. (Install 19 rivets to right fuselage side, 19 rivets to the left side, and 15 rivets to bottom side.)
- G. Secure new bulkhead assembly to panel assembly flanges with six (6) 1601-0410 Avex rivets installed wet with zinc chromate primer.
- H. Fill over exterior rivets with epoxy filler and smooth before applying primer.
- I. Coat repaired area with zinc chromate primer prior to application of exterior finish paint.

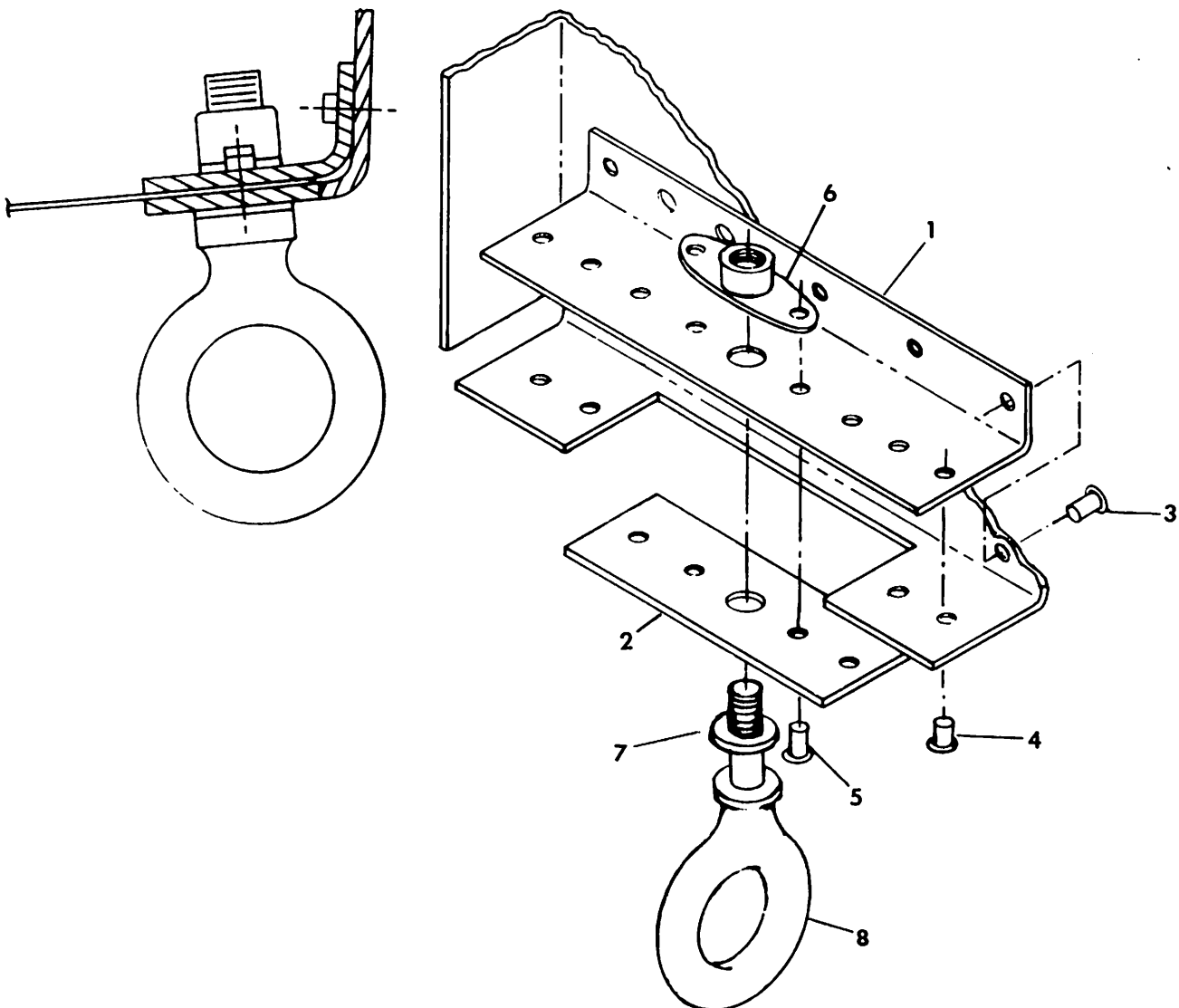


Fuselage Side - Inside Reinforcement Installation Details
Figure 815



Aft Fuselage Bulkhead Replacement
Figure 816

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>MATERIAL</u>
1.	ANGLE DOUBLER 1.16 X .65 X 6.00 X .090 THK.	2024-T3
2.	FLUSH PATCH 1.00 X 3.00 X .090 THK.	2024-T3
3.	MLS100B4-3 HUCK RIVET (4 REQ'D.)	
4.	MLS100B4-4 HUCK RIVET (6 REQ'D.)	
5.	MLS100B4-5 HUCK RIVET (2 REQ'D.)	
6.	NAS680-A5 NUT PLATE	
7.	AN960-516L WASHER	
8.	901033-1 TIE-DOWN RING	



**Tail Tie-Down Ring Replacement
Figure 817**

12. Replacement of Tail Tie-Down Ring

To replace a torn out tail tie-down ring proceed as follows:

- A. Remove tailcone.
- B. Remove ELT access cover and remove ELT. (See Chapter 23.)
- C. Cut out damaged area of aft bulkhead lower flange as required, retaining as much fuselage bottom skin as possible.

NOTE: Numbers in parentheses refer to callouts in Figure 817.

- D. Fabricate flush patch (2) as required to fill area removed in Step C. above.
- E. Fabricate inside angle doubler (1).
- F. Carefully clean away all remaining adhesive in repair joint with fine grain sandpaper.
- G. Coat any remaining exposed bondlines with PR1436GB-2 Inhibited Sealant.
- H. Coat all joints with zinc chromate primer prior to assembly.
- I. Align angle doubler (1) with aft bulkhead lower flanges.
- J. Using MLS100B4-4 Huck rivets (4) wet with zinc chromate primer, rivet angle doubler to aft bulkhead lower flange. (Four (4) MLS 100B4-4 Huck rivets required.)
- K. Using MLS 100B4-3 Huck rivets (3) wet with zinc chromate primer, rivet back flange of angle doubler to aft bulkhead. (Four (4) MLS100B4-3 Huck rivets required.)
- L. Place flush patch (2) into cut out area of aft bulkhead lower flange and align patch with angle doubler.
- M. Using MLS100B4-4 Huck rivets (4) wet with zinc chromate primer, rivet flush patch to angle doubler. (Two (2) MLS100B4-4 Huck rivets required.)
- N. Align nut plate (6) with angle doubler.
- O. Using MLS100B4-5 Huck rivets (5) wet with zinc chromate primer, rivet nutplate to angle doubler and flush patch. (Two (2) MLS 100B4-5 Huck rivets required.)
- P. Coat repaired area with zinc chromate primer.
- Q. Place washer (7) on tie-down ring (8) and screw tie-down ring into nutplate.

13. Upper Aft Fuselage Assembly Replacement

Replace the entire upper aft fuselage assembly (Figure 818) as follows:

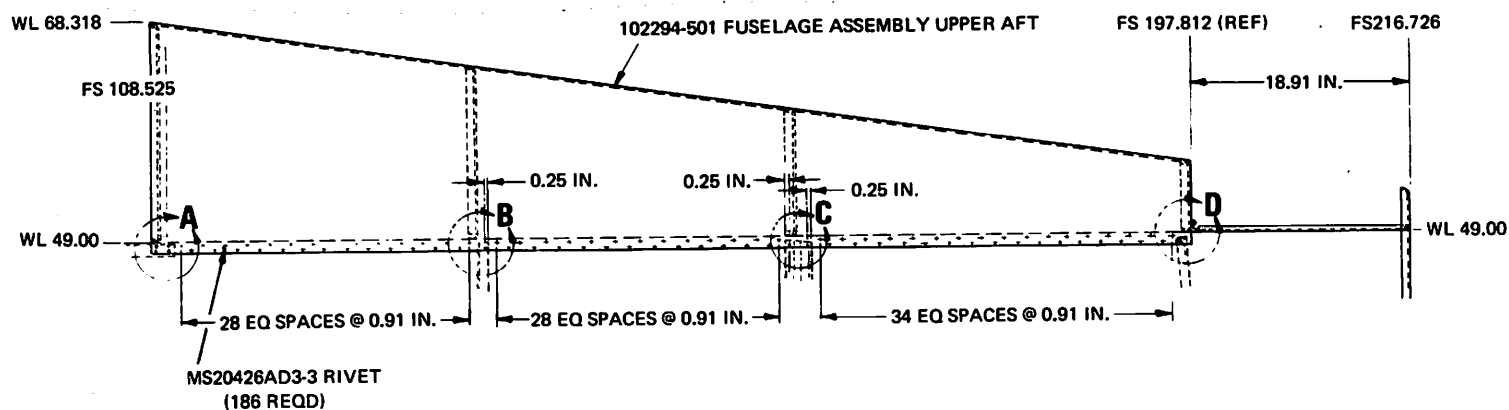
- A. Remove seats. (See Chapter 25.)
- B. Remove overhead speaker on upper aft fuselage assembly. (See Chapter 23.)
- C. Remove headliner assembly, window mouldings, upper and lower baggage panels and insulation, and aft trim panels. (See Chapter 25.)
- D. Remove canopy. (See Chapter 52.)

- E. Remove No. 1 Comm antenna. (See Chapter 23.)
 - F. Remove ELT access covers and remove ELT antenna. (See Chapter 23.)
 - G. Remove bolt securing vertical stabilizer to last rib of upper aft fuselage assembly.
 - H. Remove rivets at W.L. 49 attaching upper fuselage bulkhead and ribs to lower fuselage longeron.
- NOTE:** Care should be taken to pick up existing holes in lower fuselage left by removal of old upper aft fuselage ribs.
- I. To remove upper aft fuselage section, peel upper aft fuselage skin from edges of lower aft fuselage section.
 - J. Using fine grain sandpaper, clean away all remaining adhesive before riveting new assembly in place.
 - K. Coat all joints and honeycomb core edges with PR1436GB-2 Inhibited Sealant.
 - L. Align upper aft fuselage assembly with lower fuselage assembly as shown in Figure 818.
 - M. Picking up existing holes in lower fuselage longeron left by the removal of old upper aft fuselage ribs, use 1601-0410 rivets wet with zinc chromate primer to rivet upper fuselage ribs to lower fuselage longeron (W.L. 49). See Figure 818 for rivet placement.
 - N. Using MS20426AD3-4 rivets wet with zinc chromate primer, rivet upper aft fuselage section to lower aft fuselage section as shown in Details A, B, C, and D of Figure 818.
 - O. Using MS20426AD3-3 rivets wet with zinc chromate primer, continue to rivet upper aft fuselage section to lower aft fuselage section. See Figure 818 for rivet placement.
 - P. Fill over all exterior rivets with epoxy filler and smooth before applying primer.
 - Q. Coat all repaired areas with zinc chromate primer prior to application of exterior finish paint.
 - R. Install bolt securing vertical stabilizer to last rib of upper aft fuselage assembly.
 - S. Install ELT antenna and replace ELT access covers. (See Chapter 23.)
 - T. Install No. 1 Comm antenna. (See Chapter 23.)
 - U. Install canopy. (See Chapter 52.)
 - V. Install headliner assembly, window mouldings, upper and lower baggage panels and insulation, and aft trim panels. (See Chapter 25.)
 - W. Install overhead speaker on upper aft fuselage assembly. (See Chapter 23.)
 - X. Install seats. (See Chapter 25.)

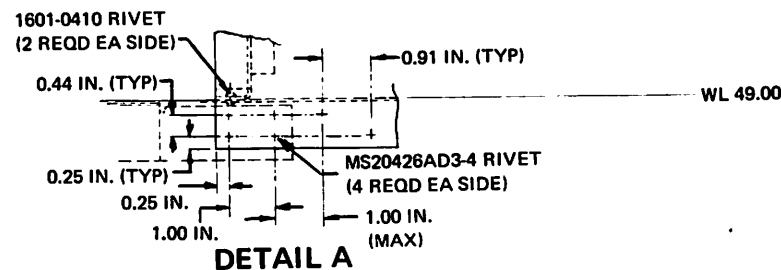
14. Bondline Repair

If inspection of joint edges determine the existence of hairline cracks between two layers of bonded metal, perform the following steps:

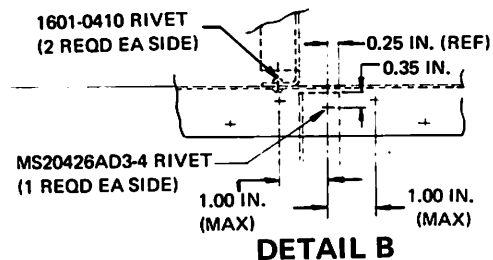
- A. Identify the location of any cracks with a grease pencil as shown in Figure 819 below:



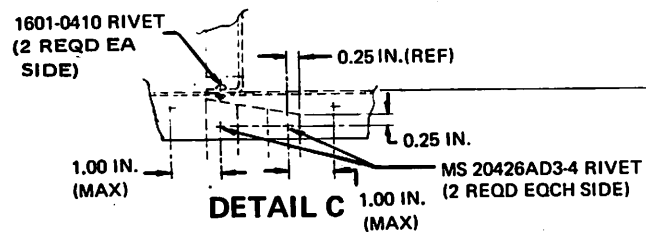
SIDE VIEW



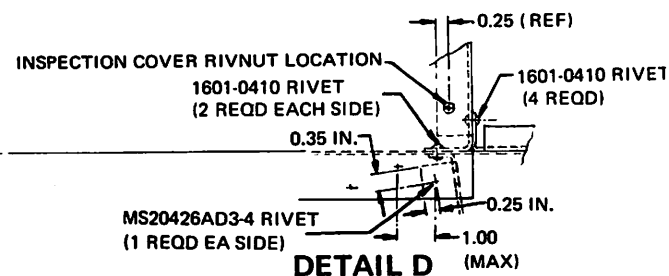
DETAIL A



DETAIL B

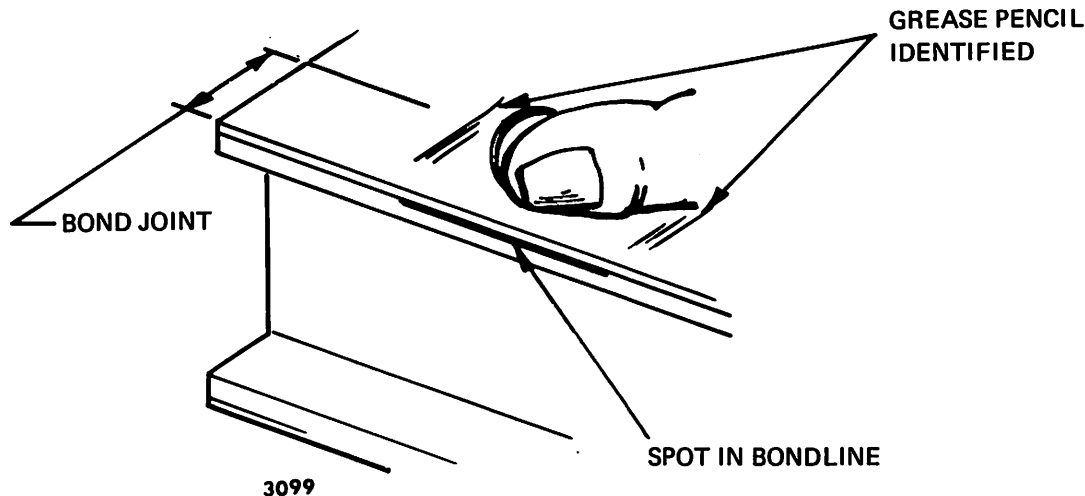


DETAIL C



DETAIL D

Upper Aft Fuselage Assembly Replacement
Figure 818



Identifying Suspect Areas
Figure 819

- B. Gently tap the bondline with a coin or similar metal object to verify the existence of a bondline separation. Slowly move along the bondline, while tapping, and listen for a change in tone as the suspect area is traversed. A bondline separation will produce a flat or hollow sound when "tapped" directly in the damaged area.
- C. If the results of Step B above are questionable, insert a .004 in. to .006 in. feeler gauge into the bondline to verify that a separation exists.

WARNING: WHEN USING TRICHLOROETHANE, ENSURE THAT THE WORKING AREA IS WELL-VENTILATED AND THAT PROTECTIVE EQUIPMENT (GLOVES, EYE PROTECTION) IS WORN. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

- D. If the results of Steps B and C are negative, the hairline should be wiped with Trichloroethane and sealed with paint. Also, any bare bondline edges should be sealed with paint. If the results of either Steps B or C are positive, order Service Kit No. SK-125 from your authorized Grumman American Dealer or Distributor and make the repairs accordingly.

15. Main Gear Strut Repair

The following main gear strut repair procedure covers surface delaminations which do not extend more than one ply into the surface of the strut and govern delaminations which are smaller than 1/16 x 1/16 inch in size throughout their length.

- A. Remove delaminated material.
- B. Smooth out minor paint chips or stone bruises with No. 150 Tri-Mite.

WARNING: WHEN USING TRICHLOROETHANE, ENSURE THAT THE WORKING AREA IS WELL-VENTILATED AND THAT PROTECTIVE EQUIPMENT (GLOVES, EYE PROTECTION) IS WORN. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

- C. Clean unpainted areas thoroughly with Trichloroethane.
- D. Seal minor surface or corner delaminations with two-part epoxy adhesive to seal out moisture from the damaged area.
- E. Clean strut with wax and grease remover.
- F. Prime with two light coats of zinc chromate primer per MIL-P-8585 and paint to match aircraft color.

PREPARATIONS FOR PAINTING - DESCRIPTION**1. General**

The three basic steps involved in the preparation of the aircraft for painting are stripping, cleaning and priming. The directions given in this section are intended to establish procedures for preparing the aircraft for painting. Procedures for the stripping, cleaning, and application of a metal conditioner are presented in this section.

The requirements specified in this section shall apply to all polyurethane coated aircraft manufactured by the Grumman American Aviation Corporation. Any deviation from or modification of these directions shall be approved by the Customer Service Department.

Because paint strippers are formulated to remove a synthetic substance, it must be understood that they are detrimental to all substances of the synthetic family. For this reason, the following procedure has been prepared and must be carefully followed to ensure against damage to synthetic components on the aircraft.

PREPARATIONS FOR PAINTING – CLEANING/PAINTING

1. Stripping and Cleaning Procedure

Reference Specifications:

MIL-R-25134B – Paint and Lacquer, Solvent Type Remover.

APS-1057 (GAAC) – Application of Protective and Decorative Coatings.

WARNING: WHEN USING TRICHLOROETHANE, ENSURE THAT THE WORKING AREA IS WELL-VENTILATED AND THAT PROTECTIVE EQUIPMENT (GLOVES, EYE PROTECTION) IS WORN. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

CAUTION: LONG TERM EXPOSURE OF BOND JOINTS TO PAINT STRIPPERS WILL AFFECT THE INTEGRITY OF THE BOND STRENGTH. ALL AREAS MUST BE COMPLETELY SEALED TO PREVENT THE STRIPPER FROM CONTACTING BOND JOINTS OR GETTING INTO INTERNAL AREAS OF THE AIRCRAFT. IF STRIPPER DOES INADVERTENTLY CONTACT THE BOND JOINT, FLUSH THOROUGHLY WITH TAP WATER WITHIN 1-1/2 HOURS.

- A. Wipe all bond lines and areas with Trichloroethane or a suitable substitute so that they will be free of dust, oily material, wax, cleaning agents or other foreign material.**

CAUTION: APPLY PROTECTIVE TAPE TIGHTLY TO ENSURE AGAINST SEEPAGE OF STRIPPER INTO THE AREAS MENTIONED IN B AND C BELOW.

- B. Using 2 inch wide aluminum tape, mask windows, windshield, wing tips, stabilizer tips, wing roots, nose cowl, tailcone, propeller, main landing gear, drain holes, fasteners and all bond lines as shown in the shaded areas of Figure 701.**
- C. Encase antennas, lights, beacons, de-icer boots, tires, radar domes, windows, windshield and all fiberglass or plastic parts in a double layer of aluminum foil as indicated by cross hatching in Figure 701.**
- D. Apply an approved polyurethane stripper with a suitable paint brush with slow easy strokes so as not to apply stripper on any undesired areas. Allow the stripper to work for 5 to 15 minutes.**

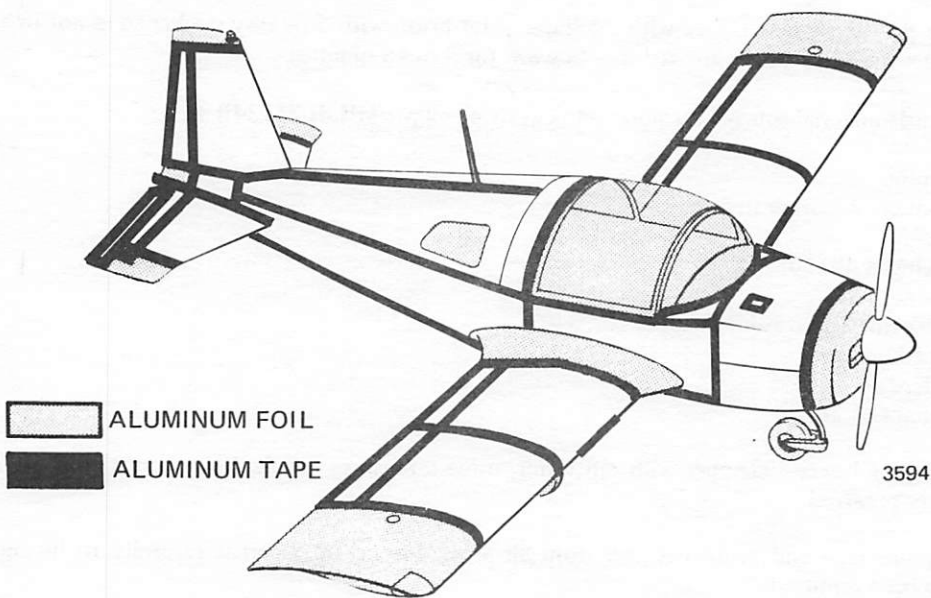
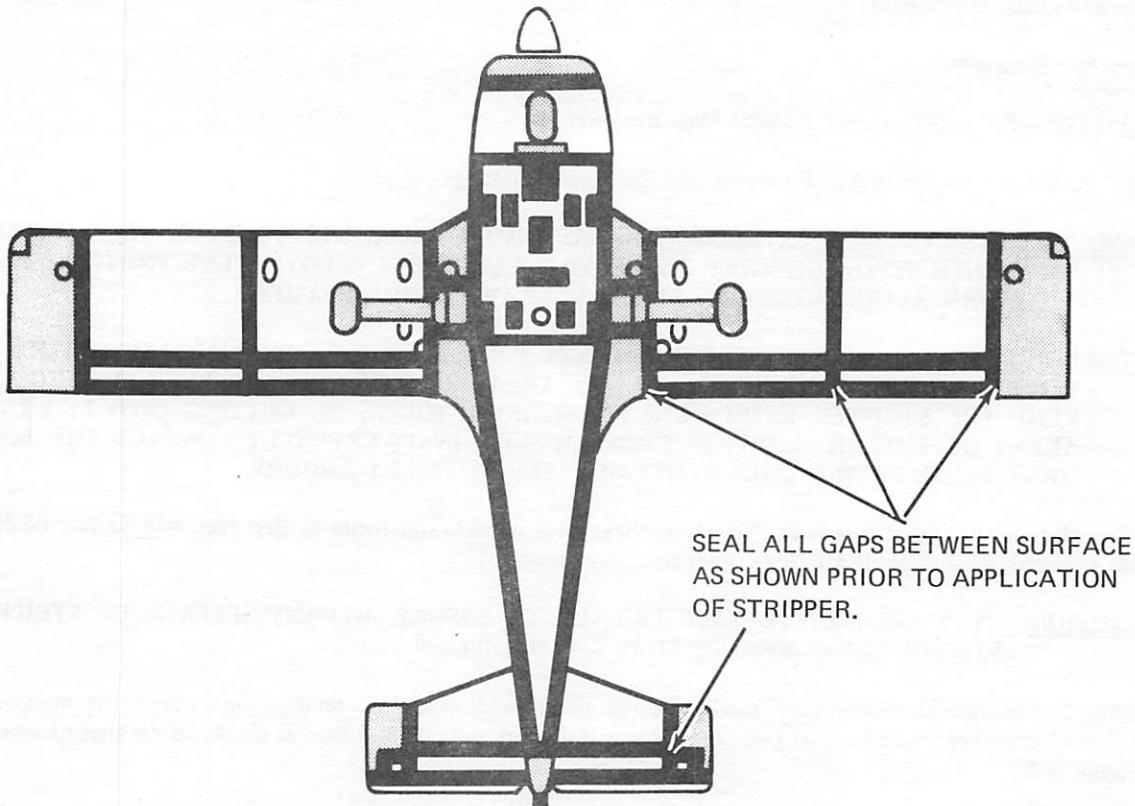
NOTE: Acceptable material sources for polyurethane strippers per MIL-R-25134B are:

- (1) Strip-prep No. 66
Amchem Products, Incorporated
2300 Gainsboro
Ferndale, Michigan 48220**
- (2) Methylene Chloride Based Paint Stripper No. 3403
W.M. Barr and Company
2336 S. Lauderdale
Memphis, Tennessee 38106**

- E. Flush removed paint and excess stripper with tap water, using a pressure nozzle, being sure that all stripper residue is thoroughly removed.**
- F. Remove the aluminum tape and protective foil from all areas. Inspect these areas carefully to be sure all stripper residue has been removed.**

NOTE: It is permissible to sand the paint completely from the bondlines; however, for best bondline protection, it is recommended that these areas be lightly sanded.

- G. After removing the tape and protective foil, sand and feather the painted edge in all areas which had been protected from the stripper.



Aircraft Paint Stripping and Masking
Figure 701

2. Metal Conditioner Application

- A. Prepare metal conditioner solution (see Note below) using manufacturer's instructions.

NOTE: Acceptable material sources for metal conditioners are:

- (1) DuPont 222 Metal Conditioner
 - (2) Magnus No. 852 (wipe off) Metal Conditioner
Economics Laboratory, Incorporated
Magnus Division
Osborn Building
St. Paul, Minnesota 55102
- B. Apply the conditioner by wiping or brushing the solution on all surfaces to be painted. This compound is safe for use on bond joints. Do not allow conditioner to contact the windshield or windows.
- C. Allow the conditioner to work for 2 to 10 minutes depending on the degree of surface cleanliness.
- D. Remove the conditioner per manufacturer's instructions.

CHAPTER 21

AIR CONDITIONING

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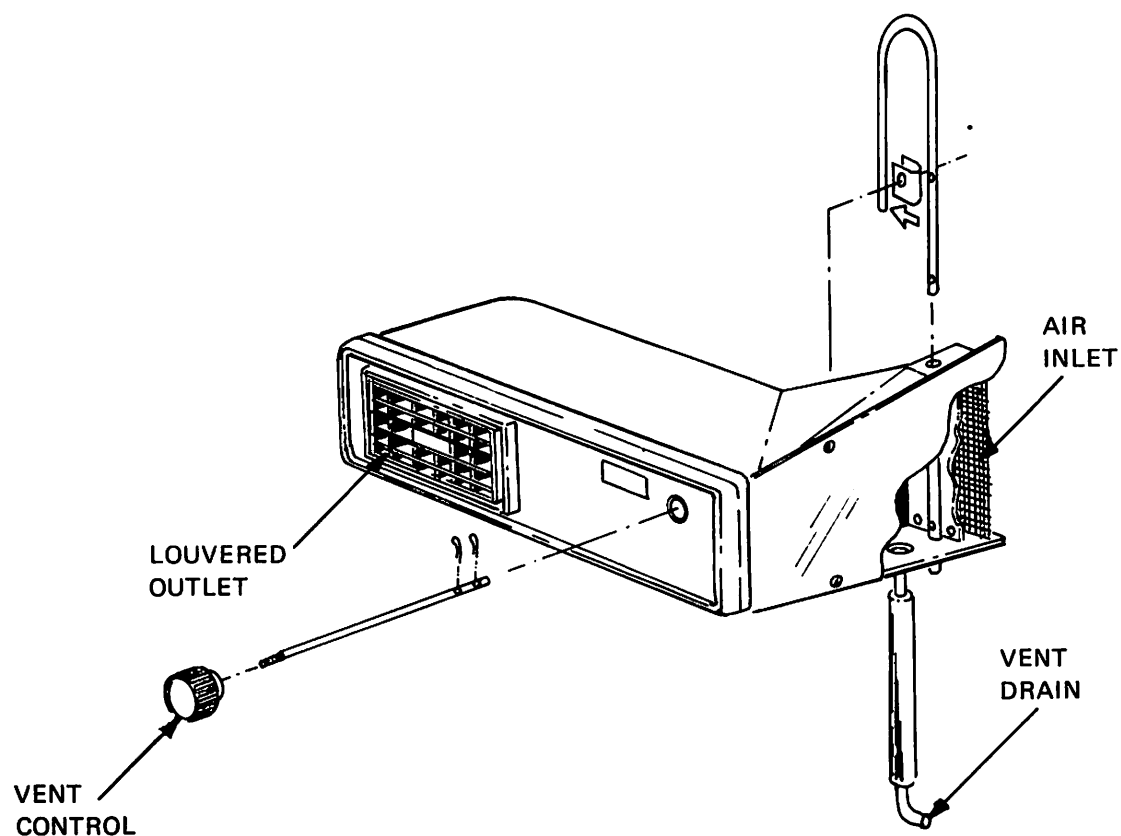
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AIR CONDITIONING – DESCRIPTION/OPERATION**1. General**

Air conditioning, as applicable to this aircraft, is defined as any method used to maintain a desired level of heating, ventilating, or controlling the air within the occupied areas of the aircraft. The system consists of the components and associated controls used for heating and ventilating the aircraft cabin. The system is a completely mechanical system and is manually controlled. The cabin heat control is a push-pull type control located in the lower center of the instrument panel. Each air vent has an individual control. The air vent control for the cabin area is a push-pull type control located at the lower corners of the instrument panel adjacent to the louvered outlets.

VENTILATION SYSTEM – DESCRIPTION/OPERATION**1. General**

Cabin area ventilation is provided by two ventilators, (Figure 1) one in each side of the fuselage. The ventilators are controlled by manually adjustable valves for quantity of air. The flow of fresh air in the cabin can be regulated in the desired direction by movable louvers located in the air vent outlets.



**Cabin Area Air Vent System
Figure 1**

HEATING SYSTEM – DESCRIPTION/OPERATION

1. General

The cabin heating system is basically a controlled air flow in which air passes over the muffler core and is ducted to the cockpit. The amount of heated air is regulated by a valve mounted through the firewall. Cool air picked up by the nose cowl inlet serves two purposes, that of cooling the muffler, and providing heated air for comfort.

Air is routed from the heat exchanger through the in line silencer and to the valve assembly. The valve mounted through the firewall is used to regulate the warm air by either ducting it overboard or into the cabin as desired. The amount the push-pull control is moved determines the amount of heat ducted into the cabin.

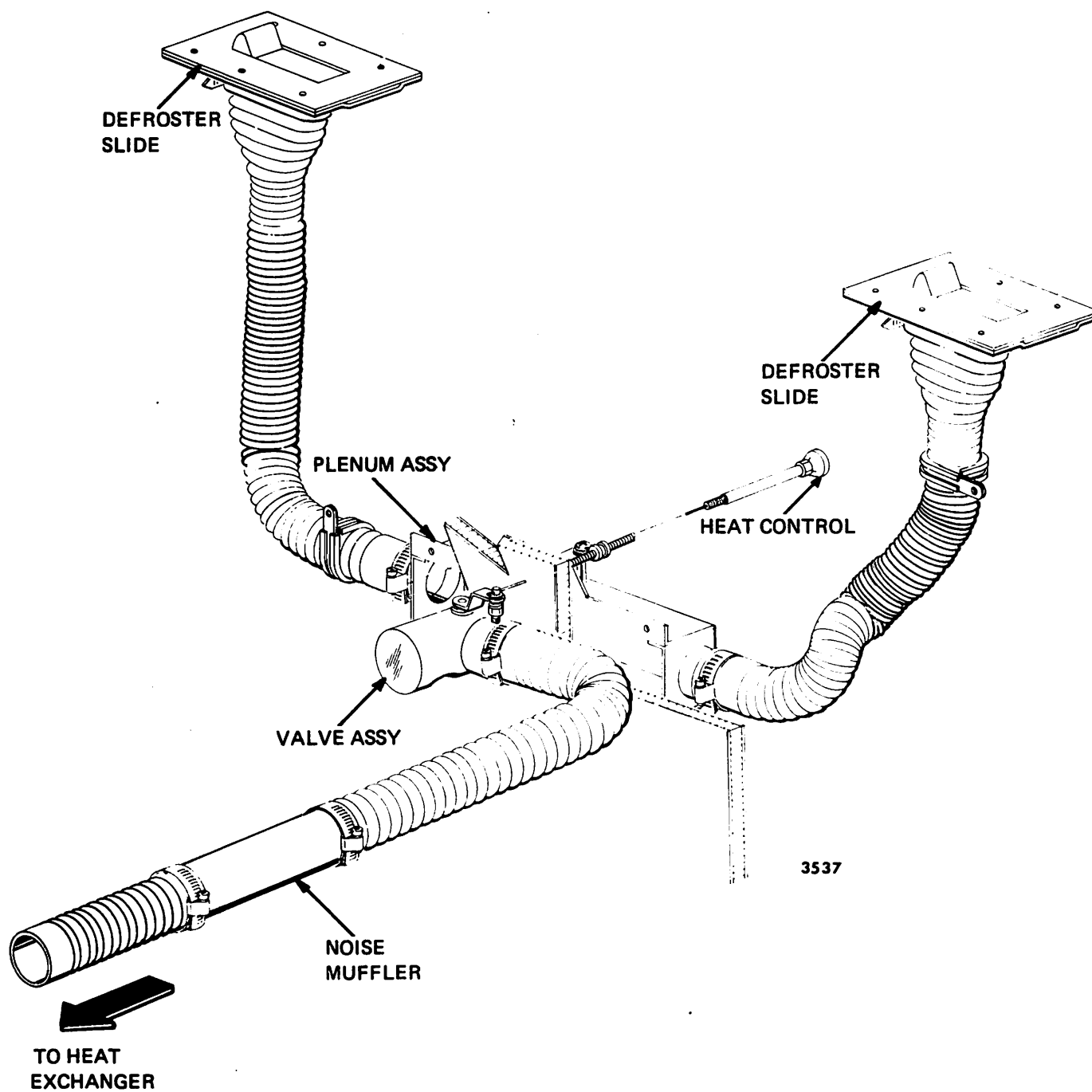
To provide for windshield defrosting, flexible ducts are connected to the valve and terminated just below the sliding doors located on the forward panel deck. Operation of the defroster is accomplished by pulling the push-pull control out and opening the sliding doors.

HEATING SYSTEM – TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Insufficient Heat	Duct damaged or disconnected	Replace or connect duct
	Loose control cable connection	Tighten control cable connection
	Air valve damaged	Replace air valve
Control hard to operate	Control cable binding	Check cable for proper routing and free the cable
	Air valve sticking or binding	Lubricate valve stem bearing and free the valve
Exhaust fumes in cabin	Defective muffler	Inspect muffler and replace if defective

**HEATING SYSTEM – MAINTENANCE PRACTICES****1. General**

Maintenance of the heating system (Figure 201) will probably be confined to replacement of ducting when damaged. Ducts can be replaced by removing clamp and duct and installing new ducts.



**Heating and Defrosting System
Figure 201**

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COMMUNICATIONS SYSTEMS – DESCRIPTION/OPERATION**1. General**

Not all AA-1C aircraft will have identical communication/navigational equipment. The basic items that provide minimum requirements to comply with FAA regulations are available on all aircraft. As new systems with more effective applications become available, presently installed equipment may be replaced by these newer items. It is the intent of this manual to present procedures and instructions adequate for minor inspection and flight line maintenance of all COM/NAV equipment that may be installed on the aircraft, including the optional items. In-depth maintenance of the COM/NAV equipment must be performed in accordance with the data supplied by the individual manufacturer. The information in this Chapter pertains to the VHF communication system only. See Chapter 34 for the navigational systems.

2. VHF Communications

The aircraft is delivered with customer ordered VHF communications equipment. Each aircraft is equipped with a VHF band transceiver for voice communications. As an option additional transceivers can be installed. The VHF transceivers operate in the 118.00 MHz to 139.95 MHz band, with the number of channels available either 360 or 720, depending upon the equipment installed.

3. Audio Integrating System

The audio integrating system consists of those items required to provide audio signals for the pilot. The system is comprised of the microphone, speakers, headset, and audio control panel. For those aircraft equipped with dual VHF communications or various navigation systems, or both, an audio control panel is necessary. The audio control panel provides a central control point for selection and monitoring of all installed communication/navigation equipment.

4. Emergency Locator Transmitter (ELT) System

An optional piece of equipment is the Emergency Locator Transmitter (ELT). The purpose of the ELT is to serve as a radio beacon, should the aircraft make an emergency or crash landing. The transmitter has automatic activation provisions should the aircraft strike an object with a force of 5 g's or more along the flight axis. The ELT can be used as a portable beacon should it be desired to leave the vicinity of the aircraft. It is equipped with its own battery pack, antenna and manual activating switch.

VHF COMMUNICATION SYSTEM – DESCRIPTION/OPERATION**1. General**

The transceivers used in VHF communications exist in a variety of types and forms. One type now in use is the NAV/COM set which combines both the communication and navigation functions. One part of this set is a VHF transceiver, the other a navigation receiver with a separate VOR indicator. Another type that is very common is one that can be used as a VHF communications transceiver. This chapter deals with the communications system only. The NARCO and King transceivers are described in this section. For a detailed coverage of the use and maintenance procedures, refer to the appropriate manufacturer's technical data.

2. NARCO NAV 10/COM 10(), NARCO COM 11()/111() Transceivers

The aircraft can be equipped with a variety of NARCO manufactured communications equipment, the NARCO NAV 10()/COM 10(), COM 11()/111() systems will be described in this section.

The transceivers operate within the frequency range of 118.00 MHz to 135.95 MHz, with a power output of 5 watts (COM 10 & 11) or 8 watts (COM 10A & 11A). The transceiver can operate on any of 360/720 channels with a 50/25 KHz spacing between channels. The number of channels available is determined by the type of transceiver in use. Operation of the transceiver is controlled and monitored by the controls and indicators on the front panel of the transceiver. The controls and indicators are described in Table 1. For location of transceiver controls, see Figure 1.

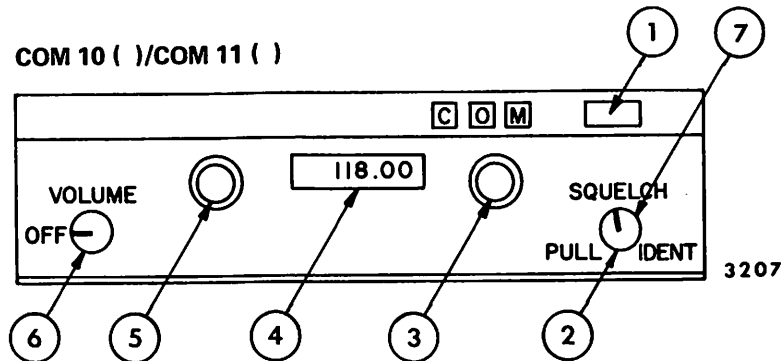
The NARCO NAV10/COM 10() transceiver can operate as a VHF radio or as a VHF navigation (omni) receiver (1 + 0 System). The mode of operation is controlled by the Mode Select switch located on the front panel of the transceiver. See Chapter 34 for the operation in the navigation mode.

The NARCO COM 11()/111() is essentially the same as the COM 10(), less the Mode Select switch. The COM 11()/111() is designed to be used exclusively as a 360/720 channel transceiver. The NARCO COM 11()/111() can be used with a NARCO 11 or 12 to provide navigation. The pair would make a 1 + 1 system.

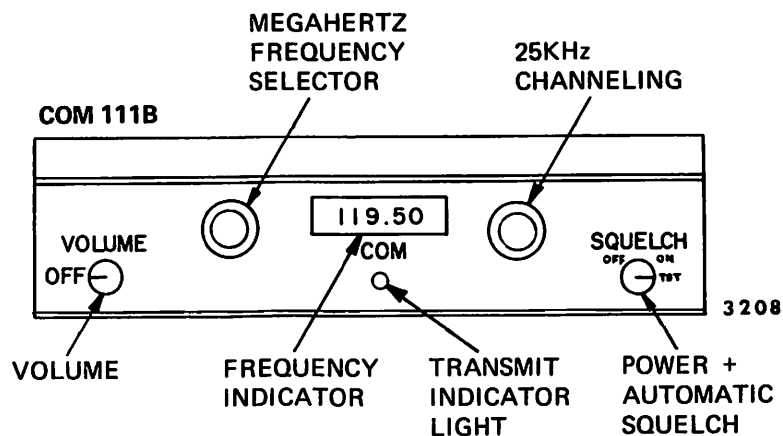
As an optional item, the aircraft can have an intercom switch installed. The switch permits speech from the microphone to be heard over the speakers and the transceiver transmitter will not be keyed. It is essentially for training purposes, allowing the operator to practice and learn correct microphone discipline. A yellow warning light is installed above the intercom switch. The light comes on when the switch is placed in the middle position. This is to remind the operator that the transmit function of the transceiver is disabled. The light is out with the switch in Speaker or Phone position. Use of the Intercom Switch requires the transceivers to be modified to the helicopter version. See the NARCO maintenance Manual for further information.

NARCO TRANSCEIVER UNIT CONTROLS AND INDICATORSTABLE 1

Index No. (Fig. 1)	Control or Indicator	Position	Function
1.	Mode Select Switch (COM 10 () only)	NAV	VHF navigation mode selected, see Chapter 34.
		COM	VHF radio selected.
2.	Squelch Control		Establishes required input signal level to give an audio output from transceiver.
		Clockwise	Required input signal level is decreased.
		Counterclockwise	Required input signal level is increased.
3.	Tenths/Hundreths Megahertz Frequency Selector		Selects frequency for radio in 50/25 KHz steps.
4.	Frequency Indicator		Indicates operating frequency of radio.
5.	Megahertz Frequency Selector		Selects frequency in one (1) megahertz steps.
6.	Power (Volume) Control	OFF (detent)	Removes power from system.
		Clockwise	Increases audio volume.
		Counterclockwise	Decreases audio volume.
7.	IDENT (Part of Squelch Control) (NAV 10/COM 10 () only)	Pulled	Allows station identification code to be heard. (Function is for VHF NAV Mode)



- | | |
|---|---------------------------------|
| 1. Mode Select Switch (COM 10 () Only) | 4. Frequently Indicator |
| 2. Squelch Control | 5. Megahertz Frequency Selector |
| 3. Tenths/Hundredths MHz Frequency Selector | 6. Power & Volume Control |
| | 7. Ident (Squelch Pulled) |



NARCO Transceiver Control Locations

Figure 1.

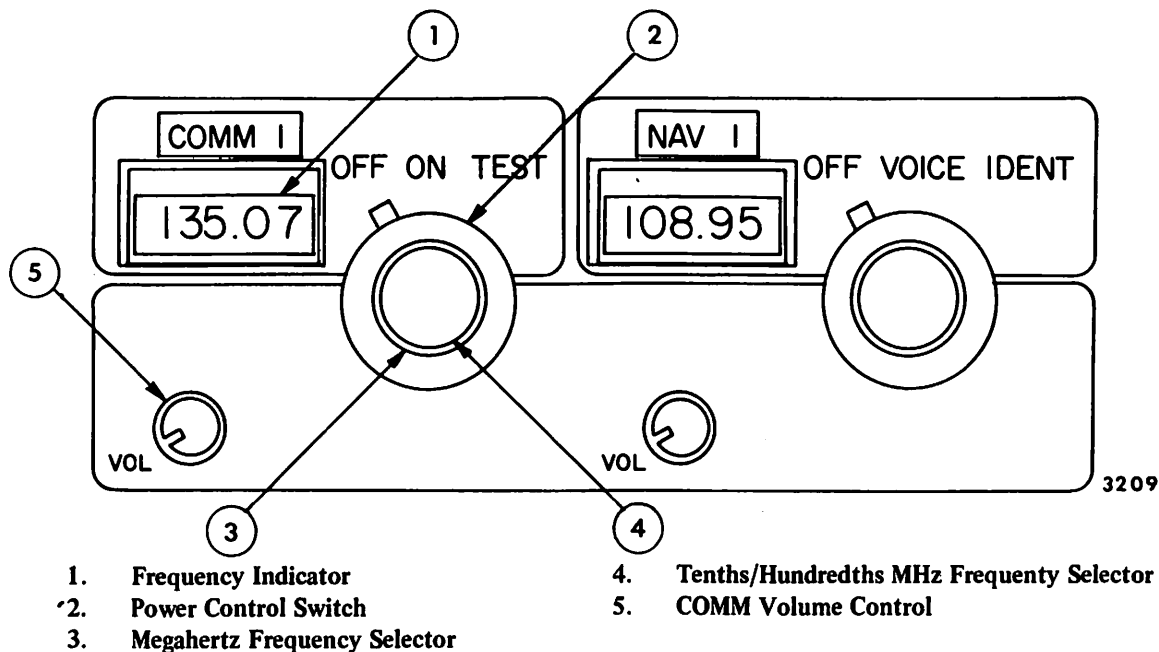
3. King KX-170/175() Transceiver

The King KX-170 () VHF radio consists of a panel mounted unit composing one-half of the KX-170 ()/175() NAV-COM transceiver. This section discusses the COM portion only. The NAV portion is discussed in Section 34. The transceiver operates within the frequency range of 118.00 MHz to 135.95 MHz, with a power output of five (5) watts. The transceiver can operate on any of 360 (KX-170A) or 720 (KX-170B) channels with a 50 KHz or 25 KHz, respectively, spacing between channels. Operation is controlled and monitored by the switches and indicators on the front of the transceiver. For a discussion of switch and indicator functions, see Table 2. For location of transceiver controls, see Figure 2.

KING TRANSCEIVER UNIT CONTROLS AND INDICATORS

TABLE 2

Index No. Figure 2	Control or Indicator	Position	Function
1.	Frequency Indicator		Indicates operating frequency of VHF radio.
2.	Power Control Switch	OFF	Removes power from radio.
		ON	Energizes the radio.
		TEST	Disables automatic squelch.
3.	Megahertz Frequency Selector		Selects frequency in one (1) megahertz steps.
4.	Tenths-Hundredths Megahertz Selector		Selects frequency in 25 KHz or 50 KHz steps.
5.	Volume Control	Clockwise	Increases audio volume.
		Counterclockwise	Decreases audio volume.



**King KX-170/175 () Transceiver Control Locations
Figure 2**

TROUBLE SHOOTING OF VHF COMMUNICATIONS SYSTEMS**1. General**

System problems are sometimes caused by a malfunction of the transceiver. When possible replace the transceiver before proceeding with other trouble shooting.

NOTE: On those aircraft with dual systems, check operation of both transceivers. If neither transceiver works, the trouble is probably in the audio integrating system.

TROUBLE	PROBABLE CAUSE	REMEDY
No reception or transmission	Open circuit breaker	Close circuit breaker
	Dirty or corroded antenna	Clean or replace antenna
	Faulty audio panel (dual system)	Replace audio panel
	Faulty transceiver	Replace transceiver
Weak or no transmission	Faulty microphone	Replace microphone (This may require an adjustment of mike gain in the transceiver)
	Faulty antenna or antenna lead	
	Faulty transceiver	Replace transceiver
Weak or no reception	Faulty speaker or headset	Replace speaker or headset
	Faulty transceiver	Replace transceiver

VHF COMMUNICATION SYSTEM – MAINTENANCE PRACTICES

1. Removal and Installation of VHF Communication Antenna

A. Removal of VHF COM Antenna No. 1 (See Figure 201.)

- (1) Ensure the master switch is OFF.
- (2) Remove the three screws holding the antenna to the aircraft.
- (3) Lift the antenna straight up to gain access to the antenna connector. Disconnect the connector. Secure the connector so that it will not slip through the hole and down into the aircraft.
- (4) Remove rubber gasket. If gasket adheres to the aircraft, remove it using a phenolic scraper.

B. Installation of VHF COM Antenna No. 1 (See Figure 201.)

- (1) Ensure the master switch is OFF.
- (2) Place the antenna rubber gasket in the proper position. (See Figure 201.)
- (3) Connect the antenna to the coaxial cable.
- (4) Place the antenna on the rubber gasket and install with three screws.
- (5) Perform an operational check for the associated transceiver.

C. Removal and Installation of VHF COM Antenna No. 2 (External)

NOTE: The No. 2 VHF COM Antenna consists of two assemblies; the external tubular portion (antenna) and the internal impedance box assembly.

If only the external part is to be replaced all that is required is to disconnect the tubular section from the outside of the aircraft and attach another. Ensure that the antenna is parallel with the centerline of the aircraft. (See Figure 201.)

D. Removal of Complete No. 2 VHF COM Antenna (See Figure 201.)

- (1) Ensure the master switch is OFF.
- (2) Obtain access to the internal portion of No. 2 COM Antenna (impedance box) by moving the rear seats and remove the proper portion of the floor.
- (3) Disconnect the coaxial cable from the impedance box.
- (4) On the outside of the aircraft disconnect VHF COM Antenna No. 2. Be careful not to damage.
- (5) With a phenolic scraper, remove, as much as possible, the sealant from around the impedance box attaching nut.
- (6) Remove the attaching nut.
- (7) From inside the aircraft, remove the impedance box.
- (8) Remove remaining sealant from around the antenna opening. Use aluminum wool.

E. Installation of Complete No. 2 VHF COM Antenna (See Figure 201.)

- (1) Ensure the master switch is OFF.
- (2) From inside the aircraft slip the impedance box down through the antenna opening.
- (3) From outside the aircraft install the impedance box attaching hardware in proper sequence, and tighten.
- (4) Apply 3-M Company, EC-1128, sealant around attaching nut. Make sealant flush with the skin.

NOTE: An acceptable alternate is Presstite Engineering Company No. 579.6 sealer.

- (5) Attach No. 2 VHF COM Antenna. Ensure that the antenna is parallel to the centerline of the aircraft.
- (6) From inside the aircraft connect the coaxial cable to the impedance box.
- (7) Replace any removed furnishing.
- (8) Perform an operational check for the associated transceiver.

F. Removal of the Transceiver Unit

- (1) Removal of the transceiver unit is straight forward.
- (2) Loosen transceiver from mounting case by turning locking (allen) screw clockwise, Use 5/64 inch hex (allen) wrench.
- (3) Slide the unit straight out to avoid bending the connector pins. A slight left to right movement might help to release transceiver from connector plug. Do not use the control knobs as handles. This may damage the associated control.

G. Installation of Transceiver Unit

- (1) Slide unit straight in. Be careful not to bend connector pins.
- (2) Turn locking (allen) screw counterclockwise to secure transceiver to its mounting case. Use 5/64 inch hex (allen) wrench.

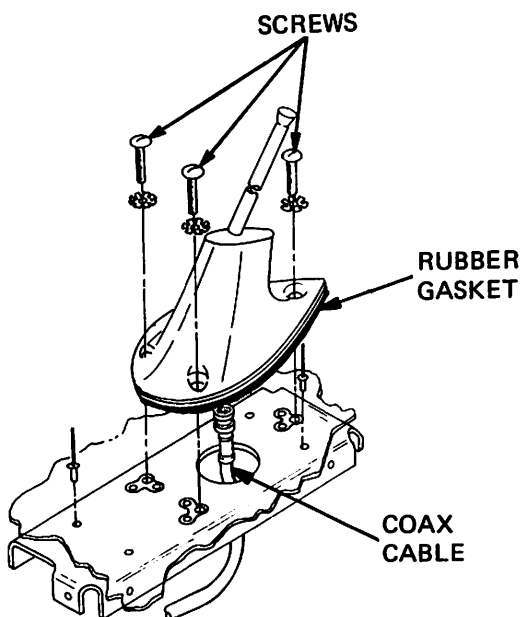
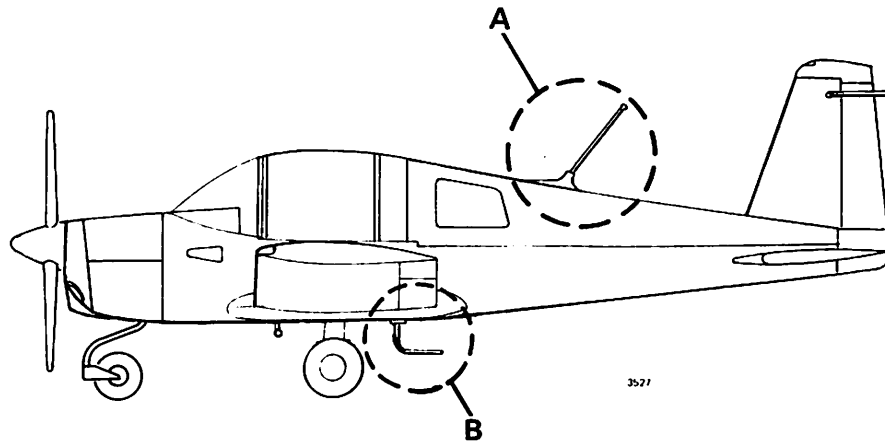
NOTE: The mike gain of the transceiver is normally set for use with the same type microphone (NARCO/King) as transceiver. If another type microphone is used, the mike gain control may require re-adjustment.

2. Adjustment/Test Communication System**A. Mike Gain Adjustment**

CAUTION: THE MINIMUM OF A 2ND CLASS F.C.C. LICENSE IS REQUIRED TO PERFORM THIS ADJUSTMENT.

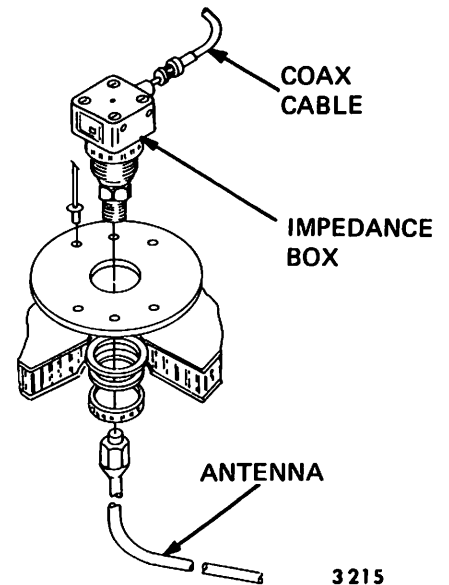
The transceiver is normally shop adjusted for use with the same type microphone (NARCO/King) as transceiver in use. If another type of microphone is used the MIKE GAIN control may require adjustment. It is necessary to remove the transceiver from the instrument panel to obtain access to the MIKE GAIN adjustment. See the appropriate Maintenance Manual, supplied by manufacturer, for adjustment procedure.

After adjustment, perform the operational check/test.



DETAIL A

COM ANTENNA NO. 1



DETAIL B

COM ANTENNA NO. 2

**VHF COM Antenna Installation
Figure 201**

B. Test of NARCO COM System

NOTE: This procedure is for test of the communication portion of the set only. For the NAV portion, consult Chapter 34 of this manual.

NOTE: For Aircraft with an intercom switch, set it to phone or speaker as desired.

NOTE: For Aircraft with an audio control panel installed, ensure that the panel is operating properly before proceeding with this checkout. See Section 23-5-1. Set audio panel as desired.

- (1) Ensure the aircraft battery is installed and operational.
- (2) Ensure the respective radio circuit breaker is closed.
- (3) Place Master switch to ON.
- (4) Set the mode select switch to COM. (NAV 10/COM 10 () units only)
- (5) Move the VOLUME control out of detent; turn clockwise to midposition.
- (6) Rotate the SQUELCH control in both directions. Ensure the hissing noise decreases as the knob is rotated clockwise and increases with knob rotated counterclockwise. Then adjust the squelch as desired.
- (7) Set the frequency selectors to a tower frequency.
- (8) Contact the tower for a radio check. Adjust the volume as required. Contact the tower on several (up to five if available) frequencies.
- (9) Place the ON/OFF volume control to OFF.
- (10) Place the Master switch to OFF.

C. Test of Intercom Switch

- (1) Ensure the aircraft battery is installed and operating.
- (2) Place the Master switch to ON.
- (3) Place intercom switch to the "Middle" position. Observe that yellow light, above switch is illuminated.
- (4) Speak into the microphone. Voice of speaker should be heard over speakers. Transmitter of transceiver is not keyed.
- (5) Place intercom switch to "Speaker" position. Observe that the yellow light, above switch, is out.
- (6) Speak into the microphone. Transmitter of transceiver is keyed. Voice of speaker should be heard over speaker.
- (7) Place intercom switch to "Phone" position. Voice of speaker should be heard in headset. Transmitter of transceiver is keyed.
- (8) Place the Master switch to OFF.

D. Test of King KX-170 () VHF COM System

NOTE: This procedure is for test of the communication portion of the set only. For the NAV portion, consult Chapter 34 of this manual.

NOTE: For aircraft with an audio control panel installed, ensure that the panel is operating properly before proceeding with this checkout. See Section 23-5-1. Set the audio panel to the transceiver under test.

- (1) Ensure that the aircraft battery is installed and operating.
- (2) Ensure the respective radio circuit breaker is closed.
- (3) Place the Master switch to ON.
- (4) Rotate the VOLUME control fully clockwise.
- (5) Place the control switch to TEST. Ensure that there is a hissing noise present.
- (6) Place the control switch to ON. Set in a tower frequency.
- (7) Rotate the VOLUME control to mid position. Contact the tower for a radio check.
- (8) Contact the tower on several (up to five (KX-170A) or ten (KX-170B) if available) frequencies from 118.00 to 135.95 MHz.
- (9) Place the control switch to OFF.
- (10) Place the Master switch to OFF.

AUDIO INTEGRATING SYSTEM – DESCRIPTION/OPERATION**1. General**

The audio integrating system consists of the speakers, microphone, headsets, and an audio control panel. The audio control panel is an optional piece of equipment used on aircraft with dual VHF transceivers and/or multiple navigation systems such as VOR, ADF, or DME. The panel provides a central control point for the operation and monitoring of installed communication and navigation equipment. The speaker is mounted in the upper center of the cabin. The microphone is attached to and plugs into the center console. The headset plugs into a jack located in lower left corner of instrument panel.

2. NARCO CP-125 Audio Control Panel

The NARCO CP-125 audio control panel provides instant pushbutton selection of on-board navigation/communication avionics equipment. The panel is an optional piece of equipment used on aircraft with dual VHF transceivers and/or multiple navigation systems such as VOR, ADF or DME. The panel provides a central control point for operating and monitoring the installed communication and navigation equipment. For description and function of front panel controls see Table 1. Location of controls are shown in Figure 1.

NOTE: The CP-125 panel requires modifying if only one VHF COM radio is installed. See NARCO Maintenance Manual for the modification.

3. Audio Amplifier Switch

An audio amplifier switch (Audio Amp) is installed on the instrument panel for those aircraft with two NARCO VHF transceivers installed. The installation of this switch plus the modification of the transceivers allow the Audio Amplifier of the transceiver to function when the Master switch is placed in the "ON" position, regardless of the position of the transceiver ON/OFF control or the position of the selector switches on the CP-125 Audio Control panel. This provides a safety feature in case the audio amplifier fails in one of the transceivers.

4. King KMA-20 Audio Control Panel

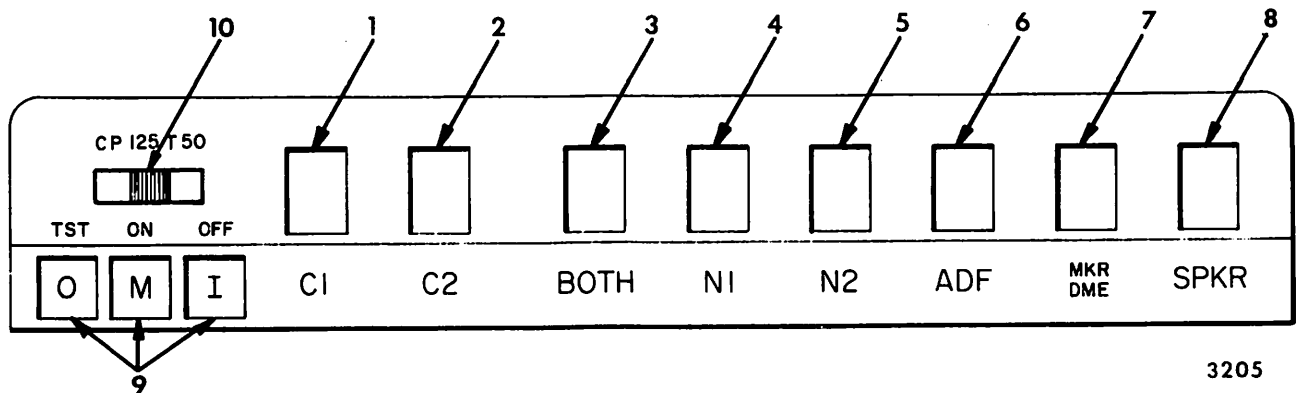
The King KMA-20 audio control panel provides instant and central control of all onboard navigation/communication equipment. The audio panel is an optional piece of equipment used on aircraft with dual communication systems and/or multiple navigation systems such as VOR, ADF, DME. The panel permits monitoring of audio signals from the radio navigation systems and also permits selection of the desired communication system on those aircraft with dual systems. The panel also controls the marker beacon system, see Chapter 34 for a discussion of the system. For a discussion of the functions of the various system switches, see Table 2. Locations of various controls are shown in Figure 2.

NARCO CP-125 AUDIO PANEL CONTROLS

TABLE 1

Index No. (Fig. 1)	Control	Position	Function
1.	COM 1 Control	Depressed (in)	Selects No. 1 VHF transmitter and receiver.
			Deselects No. 2 VHF Radio.
		out	Deselects No. 1 COM
2.	COM 2 Control	Depressed (in)	Selects No. 2 VHF transmitter and receiver
			Deselects No. 1 VHF Radio
		out	Deselects COM No. 2
	NOTE: COM 1 and COM 2 Controls are interlocked, both cannot be depressed at the same time.		
3.	Both COM Control	Depressed (in)	Permits simultaneously monitoring of audio from both VHF COM receivers.
			Audio monitoring of VHF radios is selected by COM 1 or COM 2 controls
		out	
4.	NAV 1 Control	Depressed (in)	Permits monitoring of audio signals from No. 1 NAV System.
		out	Audio monitoring of No. 1 NAV is not available.
5.	NAV 2 Control	Depressed (in)	Permits monitoring of audio signals from No. 2 NAV System.
		out	Audio monitoring of No. 2 NAV is not available.
6.	ADF Control	Depressed (in)	Permits monitoring of audio signals from the ADF.
		out	Audio monitoring of the ADF is not available.
7.	MKR OR MKR DME Control	Depressed (in)	Permits monitoring of Marker Beacon audio. On those aircraft with DME, audio monitoring of DME is also available.

Index No. (Fig. 1)	Control	Position	Function
7. Continued		out	Audio monitoring of the Marker Beacon and DME, if installed is not available.
8.	SPKR Control	Depressed (in)	Audio from selected system or systems is transferred from the headset to the speakers.
		out	Audio monitoring of the selected system is available on the headset only.



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1. COM 1 Control
2. COM 2 Control
3. Both COM Control
4. NAV 1 Control
5. NAV 2 Control
6. ADF Control
7. Marker or DME Control

8. Speaker Control
9. Marker Beacon Indicator
O – Outer
M – Middle
I – Inner
10. Power Control – OFF-ON-TST

NOTE: All controls are the pushbutton type.

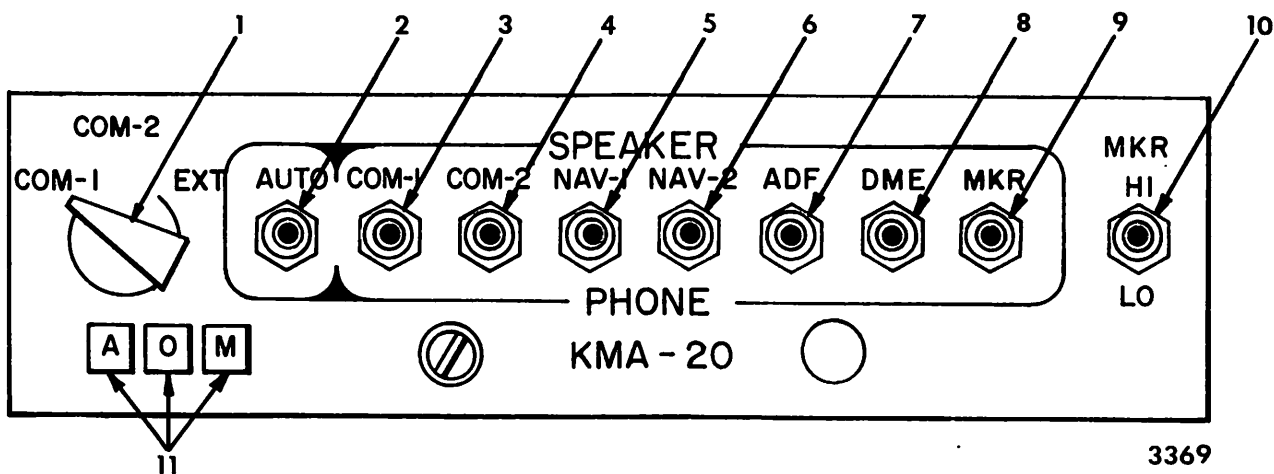
NARCO CP-125 Control Switch Locations
Figure 1

KING KMA-20 AUDIO PANEL CONTROLS

TABLE 2

Index No. (Fig 2)	Control	Position	Function
1.	Microphone Selector	COM-1	Selects No. 1 communication system transmission and reception.
		COM-2	Selects No. 2 communication system transmission and reception.
		EXT	(Not Used)
2.	Auto Selector	SPEAKERS	Audio from the system selected by the Microphone selector (1) is routed to the speaker.
		Center (off)	Audio is controlled by switches (3) and (4).
		PHONE	Audio is routed to the headphones.
3.	COM-1 Audio Selector	SPEAKERS	Audio from the No. 1 communication system is sent to the speakers.
		Center (off)	Audio routing is controlled by the AUTO selector.
		PHONE	No. 1 system audio is sent to the headphones.
4.	COM-2 Audio Selector	SPEAKERS	Audio from the No. 2 communication system is sent to the speakers.
		Center (off)	Audio routing is controlled by the AUTO selector.
		PHONE	No. 2 system audio is sent to the headphones.
5.	NAV-1 Audio Selector	SPEAKERS	Audio from the No. 1 NAV is sent to the speakers.
		Center (off)	Audio from the No. 1 NAV system is not available.
		PHONE	Audio from the No. 1 NAV is sent to the headphones.

Index No. (Fig 2)	Control	Position	Function
6.	NAV-2 Audio Selector	SPEAKERS	Audio from the No. 2 NAV is sent to the speakers.
		Center (off)	Audio from the No. 1 NAV system is not available.
		PHONE	Audio from the No. 2 NAV is sent to the headphones.
7.	ADF Audio Selector	SPEAKERS	Audio from the ADF system is sent to the speakers.
		Center (off)	Audio from the ADF is not available.
		PHONE	Audio from the ADF is routed to the headphones.
8.	DME Audio Selector	SPEAKERS	Ident audio from the DME is sent to the speakers.
		Center (off)	Audio from the DME is not available.
		PHONE	Audio from the DME is sent to the headphones.
9.	MKR Audio Selector	SPEAKERS	Audio from the Marker Beacon is sent to the speakers.
		Center (off)	Audio from the Marker Beacon is not available.
		PHONE	Audio from the Marker Beacon is sent to the headphones.
10.	MKR Beacon Hi-Lo Switch	Hi	Marker Beacon audio twice as sensitive as on Lo.
		Lo	Marker Beacon audio half as sensitive as on Hi.



KMA-20 AUDIO PANEL

- | | |
|------------------------------|--|
| 1. Microphone Input Selector | 8. DME Selector |
| 2. Auto Selector | 9. Marker Beacon Selector |
| 3. COM 1 Selector | 10. Marker Beacon Sensitivity Selector |
| 4. COM 2 Selector | 11. Marker Beacon Indicator |
| 5. NAV 1 Selector | |
| 6. NAV 2 Selector | A – Inner |
| 7. ADF Selector | O – Outer |
| | M – Middle |

NOTE: Switches 2-10 are toggle switches.

**King KMA-20 Control Switch Locations
Figure 2**

TROUBLE SHOOTING THE AUDIO INTEGRATING SYSTEM

TROUBLE	PROBABLE CAUSE	REMEDY
Audio not available on speakers	Faulty speaker	Replace speaker
	Faulty wiring	Replace wiring
	Faulty transceiver	Replace transceiver
	Faulty Audio Control Panel	Replace panel
Audio not available on headset	Faulty headset	Replace headset
	Faulty jack or wiring	Repair jack or wiring
One Communication or Navigation System appears inoperative	Faulty audio panel Faulty System.	Replace panel. Trouble shoot system.
System audio not available on the speakers.	Faulty speaker.	Replace speaker.
	Faulty audio panel	Replace panel.
	Faulty wiring to speaker	Repair wiring.
System audio not available at the headset.	Faulty headset	Replace headset
	Faulty jack	Replace jack.
	Faulty audio panel	Replace panel.
	Faulty wiring to jack	Repair wiring.
System audio available but no transmission.	Faulty microphone	Replace microphone (This may require a readjustment of MIKE GAIN in transceiver.) (See transceiver section in this Chapter for instructions.)
	Faulty microphone jack	Replace jack.
	Faulty wiring to mike jack	Replace wiring.
	Faulty transceiver	Replace transceiver
	Faulty audio control panel	Replace control panel.

AUDIO INTEGRATING SYSTEM – MAINTENANCE PRACTICES

1. Removal and Installation of System Components

A. Removal and Installation of Audio Control Panel

The removal and installation of the Audio Control Panel (NARCO CP-125/King KMA-20) is simple and requires no special instructions. Release the unit from its mounting case by turning locking (allen) screw clockwise, to secure the unit after installation turn locking screw counterclockwise. Use 5/64 inch hex (allen) wrench. Slide unit straight out and in. Be careful not to damage connector pins.

B. Removal of Speaker

- (1) The speaker is mounted in the upper center of the cabin.
- (2) Remove the screw that holds the dome light and speaker mount to the top of the cabin. Speaker mount will drop slightly.
- (3) Remove the four screws that attach speaker to speaker mount.
- (4) Disconnect speaker from aircraft wiring.
- (5) Remove speaker.

C. Installation of Speaker

- (1) Place speaker on speaker mount and attach with four screws.
- (2) Attach speaker wires to aircraft wiring.
- (3) Replace screw that holds speaker mount to top of cabin.

D. Removal and installation of the microphone requires no special instructions.

NOTE: The microphone must be balanced to the transceiver installed. If a new microphone is installed, the MIKE GAIN of the associated transceiver may require readjustment. See the applicable radio section in this chapter for instructions.

2. Adjustment/Test Audio Integrating System

NOTE: This procedure assumes normal operation of communication and navigation equipment installed in the aircraft. Ensure that these systems are operating properly before proceeding.

A. Test of NARCO CP-125 Audio Control Panel.

NOTE: For those aircraft without Audio Amp or Intercom switch, disregard Steps 3, 6, 8, 10, 12, 13, 15, and 17.

- (1) Ensure the aircraft battery is installed and operating.
- (2) Place the Master switch to ON.
- (3) Place Audio Amp switch to 1.
- (4) If two communication systems are available, tune each to a different operating frequency. Plug the headset into the jack. Plug in the microphone.

- (5) Ensure that the SPKR button is out.
- (6) Place Intercom switch to Phone.
- (7) Press the COM 1 button. Check that COM 1 audio is available in the headphones.
- (8) Place Intercom switch to Speaker.
- (9) Press the SPKR button. Check that COM 1 audio is available on the speakers. Push out the SPKR button.
- (10) Place Intercom switch to Phone.
- (11) Press the COM 2 button. Check that COM 2 audio is available in the headphones.
- (12) Place Intercom switch to speaker. Press the SPKR button. COM 2 audio is available on the speakers.
- (13) Place Intercom switch to Phone.
- (14) Press the BOTH COM button. Both systems are heard on the headphones. (Rotate SQUELCH control if necessary.)
- (15) Place Intercom switch to Speaker.
- (16) Press the SPKR button. Check that both systems can be heard over the speakers. Push the SPKR button out.
- (17) Place Intercom switch to Phone.
- (18) During the following checks, place the Audio Amp switch to 2. There should be little or no difference in audio reception.
- (19) In turn test the following as applicable VHF NAV No. 1, VHF NAV No. 2, ADF, DME, Marker Beacon. In each case check both headphone and SPKR operation.

NOTE: In order to check Marker Beacon operation, it is necessary to perform a flight test over a beacon. If available, a beacon ramp generator can be used, avoiding a flight check.
- (20) Turn OFF all of the radios and navigation systems.
- (21) Place Master switch to OFF.

B. Test of King KMA-20 Audio Control Panel

NOTE: This procedure assumes normal operation of the communication and navigation equipment installed in the aircraft. Ensure that these systems are operating properly before proceeding.

- (1) Ensure the aircraft battery is installed and operating.
- (2) Ensure all RADIO circuit breakers are closed.
- (3) Place the Master switch to ON.
- (4) If two communication systems are installed, tune each to a different operating frequency. Plug the microphone and headset into the appropriate jacks.

- (5) Set all toggle switches to mid-position.
- (6) Set microphone selector to COM-1.
- (7) Set Auto selector to speaker.
- (8) Contact the tower on the No. 1 VHF communication system. Tower reply should be heard on speaker.
- (9) Place the microphone selector to COM-2. Repeat Step 8 using the No. 2 VHF Communication system.
- (10) Repeat Steps (6) (8) and (9) with the AUTO switch in Phone. The COM audio is heard on the headphone.
- (11) Return the AUTO switch to OFF. Place COM-1 switch to SPEAKER and then PHONE. Check that the COM-1 audio is in turn available on the speakers and then headphones.
- (12) Test the following NAV-1, NAV-2, ADF, DME and MKR (Marker Beacon). In each case, check both SPEAKER and PHONE operation.

NOTE: In order to check Marker Beacon operation, it is necessary to perform a flight test over a beacon. If available, a beacom ramp generator can be used, avoiding the check flight.

- (13) Turn off all of the radios and navigation systems.
- (14) Place the Master switch to OFF.

EMERGENCY LOCATOR TRANSMITTER (ELT) SYSTEM – DESCRIPTION/OPERATION**1. General**

The emergency locator transmitter (ELT) is a self-contained, battery powered radio transmitter which transmits a CW signal at 121.5/243.0 MHz to assist in locating a downed aircraft. The ELT is automatically activated by a deceleration of 5 g's along the flight axis of the aircraft. The ELT consists of a transmitter located in the aft fuselage section under the vertical stabilizer and a transmitting antenna located on the top of the aft fuselage. The ELT can be manually activated by removing the left side empennage inspection cover and placing the control switch to the ON position.

2. NARCO ELT 10 Unit

The NARCO ELT 10 is an optional item designed to meet the requirements as established by the FAA. If it is required to leave the area of the aircraft, the ELT unit can be removed from the aircraft and hand carried. In this condition, extend the built-in antenna and place the control switch to ON. Table 1 contains a discussion of the controls and their function. For location of controls, see Figure 1.

3. NARCO ELT 10C Unit

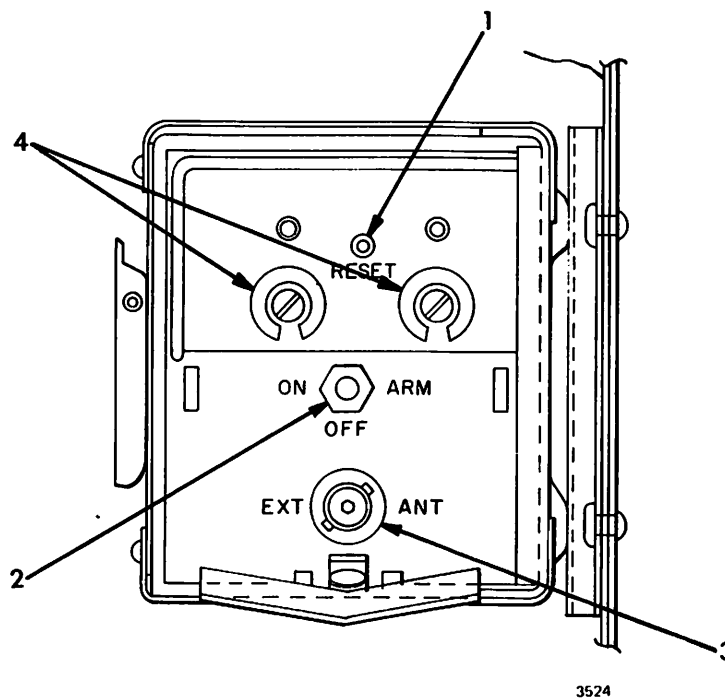
NOTE: The NARCO ELT 10C will not meet the requirements as established by FAA. Therefore the NARCO ELT 10C must not be installed in aircraft registered in the United States.

The NARCO ELT-10C was designed and built for use in Canada.

NARCO ELT 10() TRANSMITTER CONTROLS

TABLE 1

Index No. (Fig.1)	Control	Position	Function
1.	RESET button	Depressed	Resets impact switch and stops transmission.
2.	Transmission Control switch	ON	Electrically activates transmitter.
		OFF	Electrically deactivates transmitter.
		ARM	Energizes crash circuit, automatically transmits after 5g impact.



1. Reset Button
2. Control Switch (ON-OFF-ARM)
3. Antenna Connector Jack
4. Remote Control Switch Connection

NARCO ELT-10 Control Switch Locations
Figure 1

TROUBLE SHOOTING OF THE ELT-10 EMERGENCY LOCATOR TRANSMITTER

TROUBLE	PROBABLE CAUSE	REMEDY
No transmission.	Faulty transmitter.	Replace transmitter.
	Faulty wiring to antenna.	Repair wiring.
	Faulty battery	Replace battery pack.
Weak transmission	Faulty antenna or wiring to antenna	Replace antenna assembly. Repair wiring.
	Faulty transmitter	Replace transmitter.
	Faulty battery	Replace battery pack.

EMERGENCY LOCATOR TRANSMITTER – MAINTENANCE PRACTICES

1. Servicing the NARCO ELT-10

NOTE: The ELT-10 contains nine dry cell batteries in a separate battery pack. Since the batteries are not kept charged by aircraft power, they must be periodically replaced. See NARCO Owners Manual, 03716-0601 for battery replacement schedule.

A. Removal of Battery Pack

- (1) Set the ON-OFF-ARM switch to OFF. Disconnect antenna.
- (2) Remove the ELT unit from the aircraft.
- (3) Extend the built-in antenna.
- (4) Remove the four screws that attach the battery pack to the transmitter.
- (5) Carefully pull the transmitter away from the battery pack. Do not jerk on the wires.

CAUTION: IN DISPOSITION OF THE BATTERY, DO NOT THROW IN FIRE.

- (6) Release the battery pack wires (quick disconnect) from the terminals at the transmitter. Dispose of battery pack.

B. Installation of Battery Pack

- (1) Connect the battery pack wires to the transmitter.
- (2) Insert the transmitter into the battery pack, be careful not to pinch wires.

NOTE: The battery pack is shipped with a sealant on the inside lip so a watertight seal will be retained. DO NOT REMOVE THIS SEALANT!

- (3) Replace the four attaching screws. If the four holes do not line up, rotate the battery pack 180° and reinsert.
- (4) Slide the built-in antenna into its holding slot.
- (5) Install the ELT unit in the aircraft.
- (6) Attach the antenna lead to the ELT. Make sure the antenna separator prevents contact between the portable antenna finger and the ELT antenna.
- (7) Perform checkout of ELT system. See test section of this chapter.
- (8) After completion of test, depress RESET button.
- (9) Place the ON-OFF-ARM switch to ARM.

2. Servicing the NARCO ELT-10C

NOTE: The ELT-10C contains a lithium hydroxide battery and must be carefully handled. See the NARCO Owners Manual on the ELT-10C for battery replacement schedule.

A. Removal of Battery Pack

- (1) Gain access to ELT unit by removing inspection cover on left side of empennage.
- (2) Set control switch to OFF. Disconnect antenna.
- (3) Remove ELT unit from aircraft.
- (4) Extend the built-in antenna.
- (5) Remove the four screws that attach battery pack to the transmitter.
- (6) Separate the two sections.
- (7) Unsnap the battery pack from the transmitter. Remove the remaining sealant by rubbing with fingers.

B. Installation of Battery Pack

- (1) Snap new or replacement battery pack to transmitter section.
- (2) Apply thin bead of RTV sealant around perimeter of transmitter section.
- (3) Fit the two sections together. Ensure that screw holes align properly.
NOTE: Do not press sections together.
- (4) Apply a very small amount of sealant to countersink of each screw hole.
- (5) Replace the four attaching screws. Tighten screws to bring the two sections together. **DO NOT OVER-TIGHTEN!!**
- (6) Wipe away excess sealant.
- (7) Slide the built-in antenna into its holding slot.
- (8) Install the ELT unit in the aircraft. Attach antenna.
- (9) Perform checkout of ELT system. See test section of this chapter.
- (10) Depress the RESET button and place control switch to ARM.
- (11) Replace inspection cover.

3. Removal and Installation of ELT-10 System Components

A. Removal and Installation of ELT-10 Unit

To gain access to the ELT-10 unit, remove the left side empennage inspection cover. Disconnect antenna lead and remove mounting hardware. Remove ELT-10 unit. Reverse the procedure to install ELT-10 unit.

NOTE: Ensure that the ON-OFF-ARM switch is OFF when removing or installing ELT-10 unit. Depress the reset button and place switch in ARM position after installation.

B. Removal of ELT Antenna (See Figure 201.)

- (1) Locate ELT antenna on top of fuselage just forward of rudder.

- (2) Loosen and remove nut cap from antenna.
- (3) Remove flat washer and spring washer.
- (4) Obtain access to the ELT unit. Disconnect antenna.
- (5) Release coax cable from three stick clamps.
- (6) Pull the antenna down and through the aircraft structure.

NOTE: The antenna and coaxial lead are furnished as one assembly.

- (7) Remove washers and seal assembly (O-ring and washer) from antenna.

C. Installation of ELT Antenna (See Figure 201.)

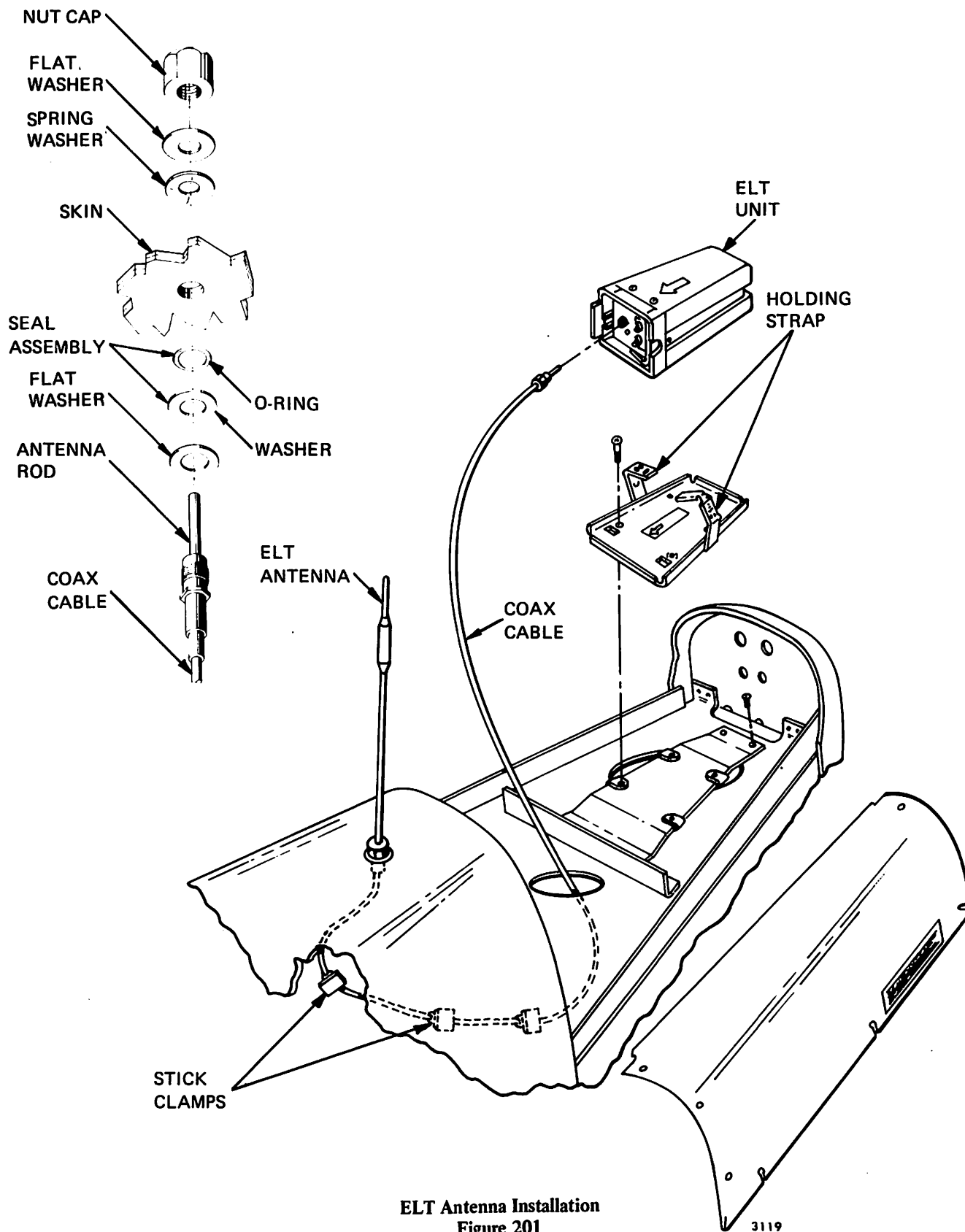
- (1) Place the washers and seal assembly (O-ring and washer) on the antenna in proper sequence.
- (2) Run the antenna through the structure and out through the skin. Be extremely careful not to damage skin of aircraft.
- (3) Attach coax cable to the three stick clamps.
- (4) Replace spring washer and flat washer on the antenna on the outside of the aircraft.
- (5) Replace nut cap and tighten.
- (6) Connect antenna to ELT unit.
- (7) Perform operational test of ELT. See test section of this chapter.
- (8) Depress reset button and place control switch to ARM.
- (9) Replace access cover.

4. Adjustment/Test of NARCO ELT-10

A. Test of NARCO ELT-10 System

WARNING: COORDINATE THIS PROCEDURE WITH LOCAL ATC BEFORE STARTING. THIS PROCEDURE ENTAILS A TEST OF EMERGENCY TRANSMISSIONS, AND A LACK OF COORDINATION MAY LEAD TO AN UNTIMELY DISPERSAL OF EMERGENCY PERSONNEL AND VEHICLES.

- (1) Obtain access to the ELT, see Figure 201.
- (2) After coordination, depress the RESET button, then place the ON-OFF-ARM switch to ON. As soon as ATC acknowledges transmission, place switch to OFF. Depress the RESET button, then place switch to ARM.
- (3) Recheck with ATC to ensure there is no transmission from the ELT.
- (4) Monitor for transmission on COM radio by selecting 121.5 MHz.



**ELT Antenna Installation
Figure 201**

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ELECTRICAL POWER – DESCRIPTION**1. General**

This chapter describes the electrical power system and its operation. This covers the battery system, alternator system and external power system.

The battery system consists of the battery, battery contactor and associated wiring. The alternator system consists of the alternator, voltage regulator and alternator overvoltage protection diode. The external power system consists of the external power receptacle and associated wiring.

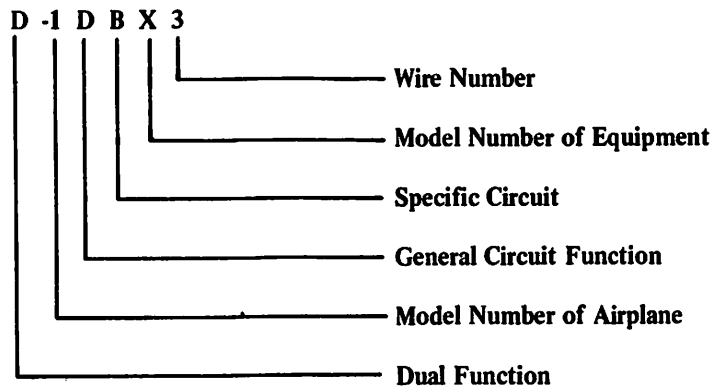
GENERAL ELECTRICAL INFORMATION – DESCRIPTION**1. General**

This section covers general aspects of design and construction common to all electrical systems. Details of actual systems are discussed in their appropriate section of this manual. The following information is intended to lay the ground work for a basic understanding of the overall electrical system design so that maintenance personnel can better troubleshoot those systems causing difficulty.

2. Wire Identification

There are two schemes employed in assigning electrical wire codes. One scheme is used when several wiring diagrams are used. Another is used for color coding wires in the circuits specified in all radio systems and/or autopilots as applicable.

A. When multiple wiring diagrams are used for a model, the code is as follows:



- (1) **Dual Function:** In the case of duplicate circuits performing the same function having the same circuit codes, wire sequence numbers are assigned in consecutive order for one of the circuits and then begin again at the source of power with the same circuit codes preceded by the coded letter "D".
- (2) **Model Number of Aircraft:** A number is used to represent the aircraft model. In the case where a wire is used on both aircraft, both model numbers will be present.
- (3) **General Circuit Function:** An alphabetical character used to indicate general system in which the wire is used.
- (4) **Specific Circuit:** An alphabetical character used to indicate specific systems in which the wire is used.
- (5) **Model number of Equipment:** When required, a third letter will be used to designate model number of equipment.
- (6) **Wire Number:** Wire sequence numbers are assigned to each individual wire within a circuit at the time of preparation of the wiring diagram. The sequence number shall be assigned in numerical order, beginning with the number one (1) for each specific circuit. Number of individual wires should begin at the source of power and run in consecutive order throughout the circuit.

CIRCUIT FUNCTION AND SPECIFIC CIRCUIT CODE LETTERS

- A — Unassigned**
- B — Photographic**
- C — Control Surface**
 - CA — Automatic Pilot**
 - CB — Not Used**
 - CC — Wing Flaps**
 - CD — Elevator trim**
- D — Instrument (Other than Flight or Engine Instrument)**
 - DA — Ammeter**
 - DB — Flap Position Indicator**
 - DC — Clock**
 - DD — Voltmeter**
 - DE — Outside Air Temperature**
 - DF — Flight Hour Meter**
- E — Engine Instrument**
 - EA — Carburetor Air Temperature**
 - EB — Fuel Quantity Gage and Transmitter**
 - EC — Cylinder Head Temperature**
 - ED — Oil Pressure**
 - EE — Oil Temperature**
 - EF — Fuel Pressure**
 - EG — Tachometer**
 - EH — Torque Indicator**
 - EJ — Instrument Cluster**
- F — Flight Instrument**
 - FA — Bank and Turn**

- FB -- Pitot Static Tube Heater and Stall Warning Heater
- FC -- Stall Warning
- FD -- Speed Control System
- FE -- Indicator Lights
- G -- Landing Gear
 - GA -- Actuator
 - GB -- Retraction
 - GC -- Warning Device (Horn)
 - GD -- Limit Switches
 - GC -- Indicator Lights
- H -- Heating, Ventilating and De-icing
 - HA -- Anti-icing
 - HB -- Cabin Heater
 - HC -- Cigar Lighter
 - HD -- De-ice
- I -- Not Used
- J -- Ignition
 - JA -- Magneto
- K -- Engine
 - KA -- Starter
- L -- Lighting
 - LA -- Cabin
 - LB -- Instrument
 - LC -- Landing
 - LD -- Navigation
 - LE -- Taxi
 - LF -- Rotating Beacon
 - LG -- Radio
 - LH -- De-ice

- LJ — Fuel Selector
- M — Miscellaneous
 - MA — Cowl Flaps
 - MB — Electrically Operated Seats
- N — Unassigned
- O — Not Used
- P — DC Power
 - PA — Battery Circuit
 - PB — Generator Circuits
 - PC — External Power Source
- Q — Fuel and Oil
 - QA — Auxiliary Fuel Pump
 - QB — Oil Dilution
 - QC — Engine Primer
 - QD — Main Fuel Pumps
 - QE — Fuel Valves
- R — Radio (Navigation and Communication)
 - RA — Instrument Landing
 - RB — Command
 - RC — Radio Direction Finding
 - RD — VHF
 - RE — Homing
 - RF — Marker Beacon
 - RG — Navigation
 - RH — High Frequency
 - RK — UHF
 - RL — Low Frequency
 - RM — Frequency Modulation
 - RP — Audio System and Audio Amplifier
 - RR — Distance Measuring Equipment (DME)
- S — Radar
- T — Unassigned
- U — Miscellaneous Electronic
- V — Unassigned
- W — Warning and Emergency
- X — AC Power

Y -- Unassigned

Z -- Unassigned

B. When color coding is employed, colors are assigned as tabled below:

FUNCTION CIRCUITS	GAUGE	BASE COLOR (or solid)	STRIPE COLOR
A+ Power	16	Red	None
	18	Red	Black
		Red	White
	20	Red	Green
	22	Red	Yellow
Ground	16	Black	None
	18	Black	White
Mike Ground	22	Black	None
Radio Lights Dim	18	Black	None
Mike Audio	22	Tan	None
		Tan (shielded)	None
Mike Key	22	White	Black
Radio Speaker	20	Green	None
Headphones	22	Blue	None
Dev + 1	22	Gray	Red
Dev - 1	22	Gray	Green

NOTES:

1. "Dev +" and "Dev-" circuits are for use in autopilots and any associated omni indicator circuit to which it connects.
2. All other color coded wires are for general use in multi-conductor radio and autopilot harness assemblies.

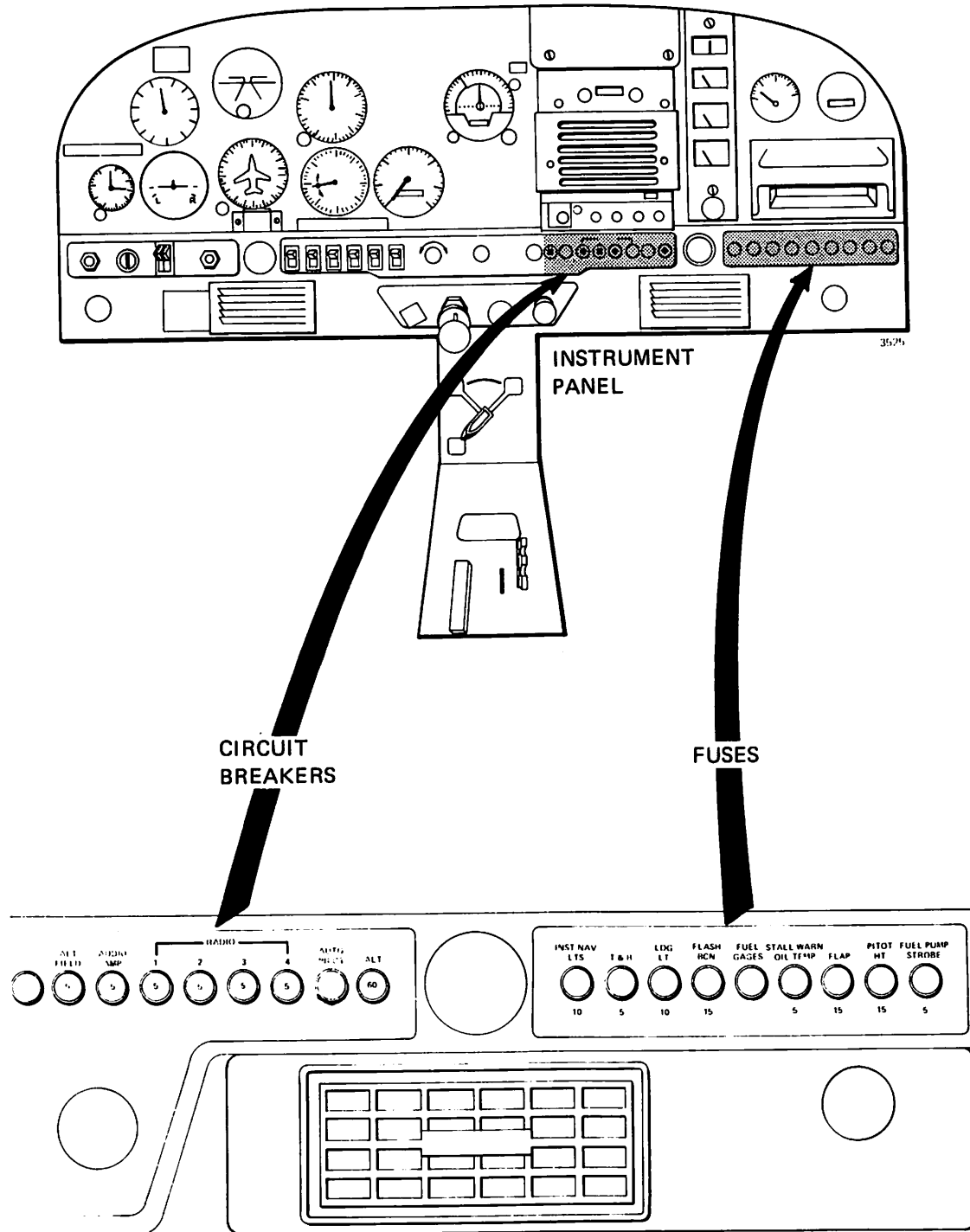
ELECTRICAL LOAD ANALYSIS

		CURRENT DRAIN AMPS
CONTINUOUS LOADS		
Oil Temperature Gauge		0.50
Battery Contactor		0.60
Flashing Beacon		11.00
Pitot Heat		6.50
Navigation Lights		4.52
Instrument Lights		2.31
Turn and Bank Indicator		0.30
Electric Clock		0.10
Hour Meter		0.50
Wing Tip Strobes		2.00
	TOTAL	28.33
SHORT TERM LOADS		
Stall Warning System		0.40
Electric Fuel Pump		0.65
Electric Flap Motor		9.80
Dome Light		0.33
Cigar Lighter		6.50
Landing Light		7.30
	TOTAL	24.98

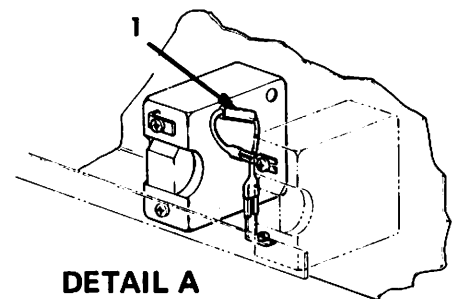
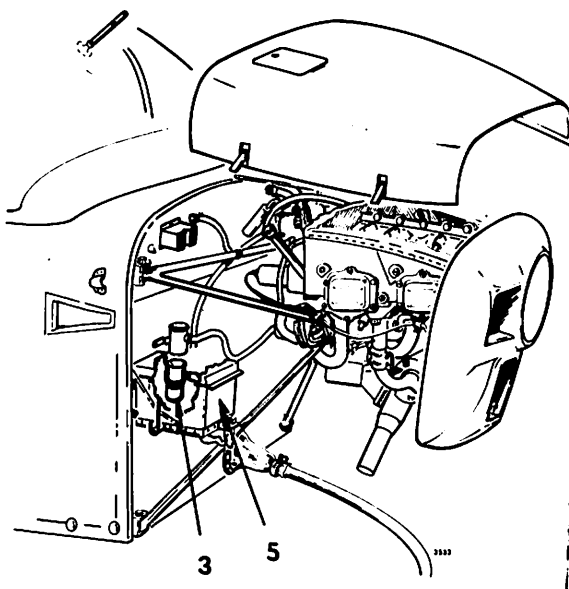
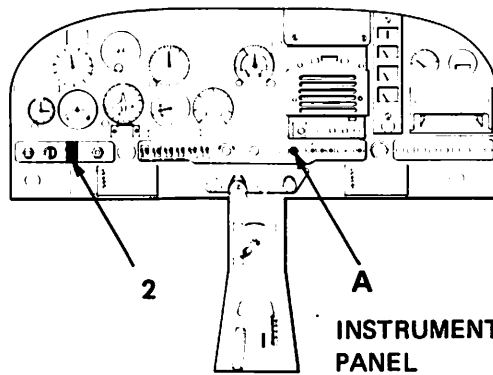
ELECTRICAL LOAD ANALYSIS (Continued)

AVIONICS EQUIPMENT

Genave	REC	TRANS	Narco (Continued)	REC	TRANS
Alpha-200 Transceiver	2.10	2.82	Nav-114	0.92	—
Alpha-200A Transceiver	2.10	2.82	PDF-35	0.93	—
Alpha-300 Transceiver	2.10	2.82	ADF-140	1.125	—
Alpha-360 Transceiver	1.18	3.10	UGR-2A	0.23	—
Theta-100/200 ILS Converters . . .	0.43	—	UGR-3	0.23	—
Beta-500 X-Ponder	1.40	2.40	CP-25	0.41	—
Beta-4096 X-Ponder	1.40	2.40	CP-25B	0.41	—
TAU-81 Audio Amp	1.00	—	CP-125	0.41	—
Delta-202 Marker Rec	0.08	—	AT-50A	1.60	1.60
PHI-20 Glide Slope Rec	0.15	—	DME-190	3.00	3.00
Narco	REC	TRANS	King	REC	TRANS
Escort-110 Transceiver	2.10	2.80	KX-170 Transceiver	1.00	3.00
Com-10 Transceiver	0.66	2.16	KI-201C Omni Converter	0.10	—
Nav-10 Rec/Converter	0.82	—	KI-211C ILS System	0.20	—
Com-11 Transceiver	0.66	2.16	KR-85 ADF Rec	1.00	—
Nav-12 Rec/Converter/ILS	0.62	—	KT-225 ADF Indicator	0.16	—
Nav-14 Rec	0.92	—	KN-60C DME	3.00	3.00
DGO-10 DG/ILS/Converter	1.20	—	KT-75 X-Ponder	1.80	1.80
ADF-31 ADF Receiver/Indicator . . .	0.64	—	KX-170A	1.25	4.50
UGR-2 Glideslope Rec	0.23	—	KX-170B	1.38	4.50
MBT Marker Rec	0.19	—	KX170BE	1.38	4.50
AT-50 X-Ponder	1.10	1.10	KX-175	1.26	4.50
Com-10A	0.96	2.50	KX-175BE	1.38	4.50
Com-11A	0.96	2.50	KT-76	1.30	1.30
Com-11B	0.76	3.50	KT-78	1.30	1.30
Com-111	0.96	2.50	KI-214	0.34	—
Com-111B	0.76	3.50	KMA-20/with Marker	1.40	—
Nav-111	0.62	—	KR-86	0.66	—
Nav-112	0.62	—	KX-175B	1.38	4.50

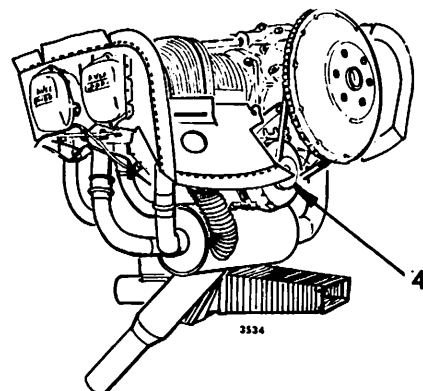


Circuit Breaker and Fuse Panel – Locations



**DETAIL A
ALT FIELD
CIRCUIT BREAKER
(REAR OF INSTRUMENT PANEL)**

1. Overvoltage Protection Diode
2. Master Switch
3. Battery Contactor
4. Alternator
5. Battery



Electrical Component Location Chart

DIODES – MAINTENANCE PRACTICES

Whenever a solenoid or switch, that uses a diode, is replaced, the corresponding diode should be checked.

1. Diodes can be tested as follows:

- A. Obtain an ohmmeter and set up on OHMS.**
- B. Position the test leads across the diode and record the ohmic reading.**
- C. Reverse the test leads and again record the ohmic reading.**
- D. The first reading must be ten times greater or less than the second reading.**
- E. Replace diodes not meeting (D) above.**

ELECTRICAL POWER SUPPLY SYSTEM – DESCRIPTION/OPERATION1. General

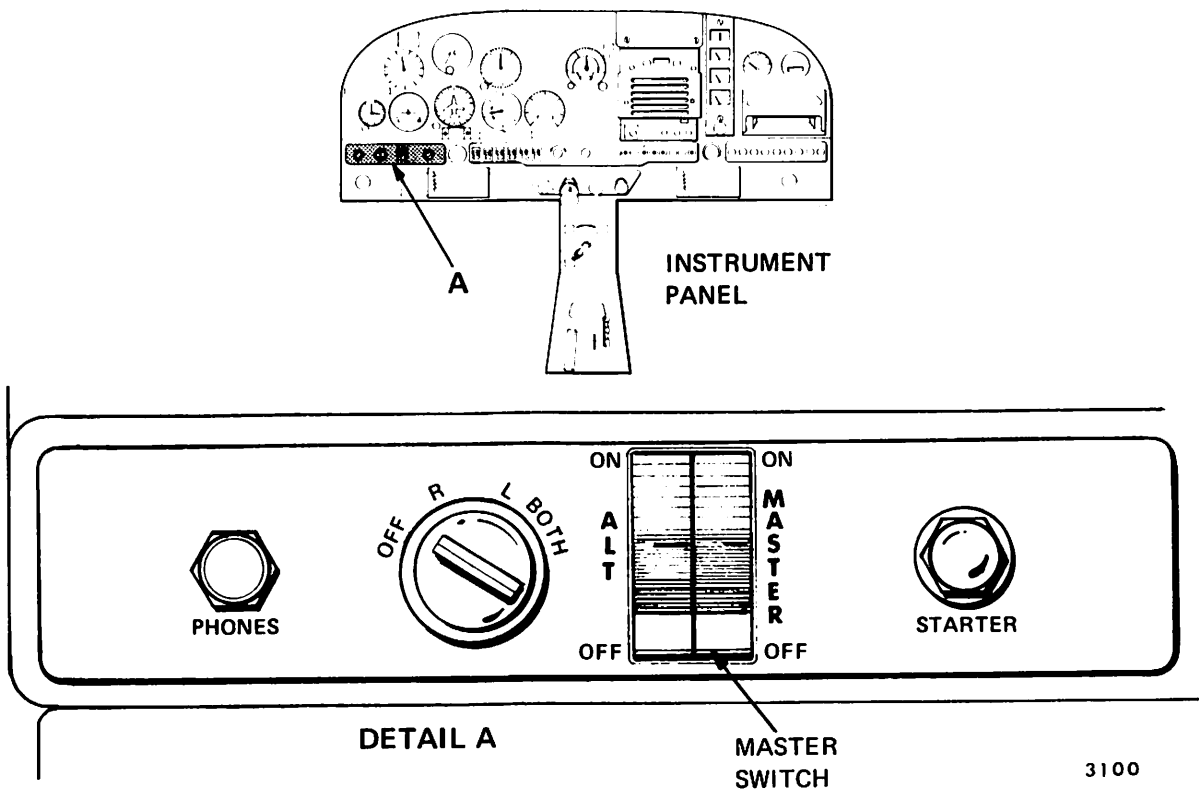
Power for the electrical system is provided by an alternator and/or battery. The alternator serves as the main component to power the electrical system and charge the battery during normal conditions. The battery is used for starting the engine and powering the electrical system when alternator power is not available (engine not running). The battery also powers the electrical system in case of alternator system failure.

A split rocker type master switch is used which performs two functions. The right side energizes the battery contactor and the left side supplies power to the voltage regulator. The battery contactor when energized, connects power to the electrical system and the starting system. The voltage regulator, receiving power from the battery via the alternator switch, energizes the alternator field. With the alternator field energized, the operating alternator will produce an output to the electrical system. The voltage regulator varies the output voltage of the alternator to meet the requirements of the electrical system loads. An ammeter is installed into the system to provide an indication of current flow from or to the battery.

An external power receptacle is offered as optional equipment to supplement the battery system for starting and ground operation.

Diodes are used in the aircraft electrical system across some contactors and switches (including the master switch) to dissipate back EMF and provide extended contactor life. These contactors and switches will function with defective diodes but contactor life will be shortened.

The negative side of the battery is connected to the aircraft structure (negative ground). This provides a ground for system through use of aircraft structure. The positive side of the battery is connected to the coil of the battery contactor. This contactor remains in a relaxed state until the master switch is placed to the ON position.

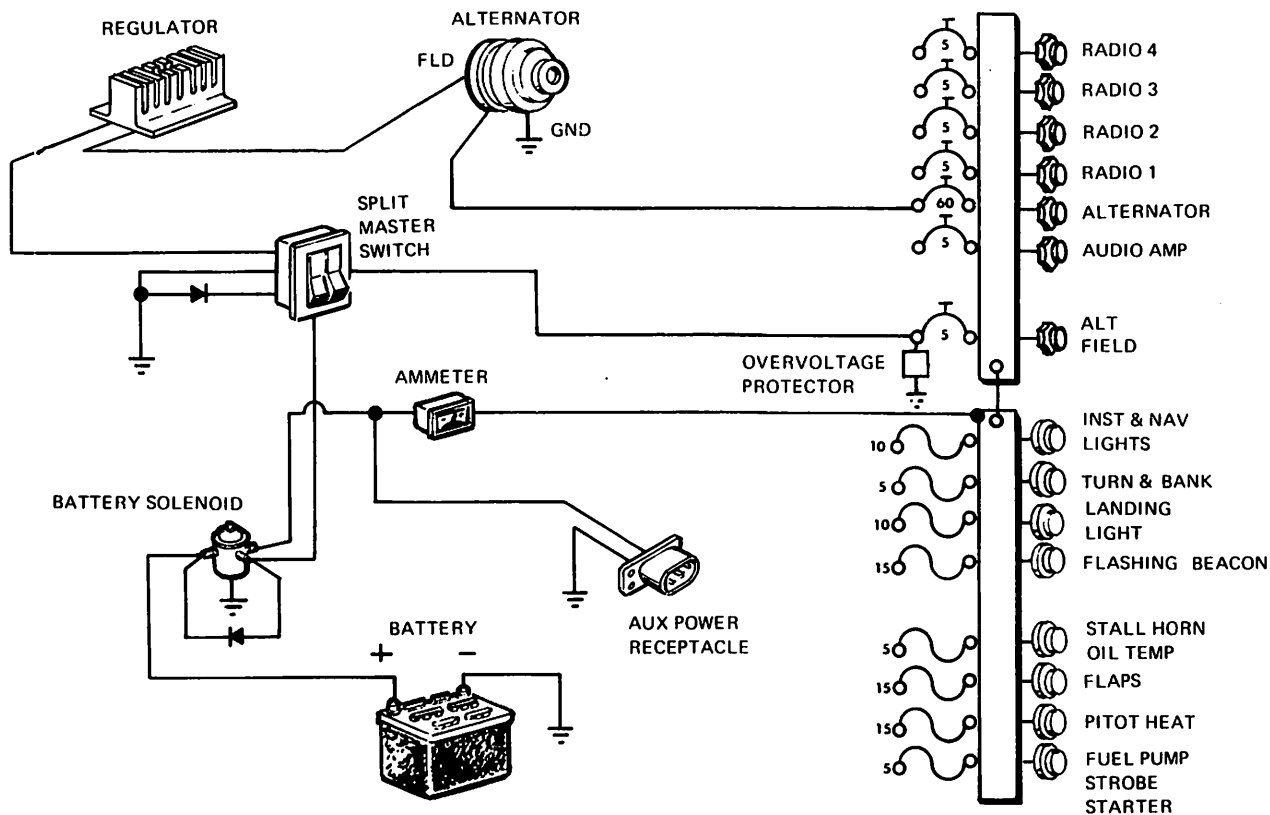


Master Switch
Figure 1

Placing the master side of the split master switch in the ON position provides a ground for the battery contactor energizing this contactor. With the battery contactor energized, a circuit exists from the battery through an ammeter to the bus bar.

The bus bar powers the electrical equipment and accessories furnished on the aircraft (excluding hourmeter, dome light, and clock). The energized contactor will also allow power from the battery to the starter solenoid.

Placing the ALT. side of the split master switch to the ON position will provide a circuit from the bus bar through a 5 amp ALT. FIELD circuit breaker to the voltage regulator. The voltage regulator will supply and regulate voltage to the alternator field. With the alternator operating (engine running) and the field energized, the alternator will develop electrical power. The alternator supplies power to the bus bar through a 60 amp ALT. circuit breaker. An overvoltage diode in the alternator field protects the aircraft electrical system against damage due to overvoltage. With alternator power available, the battery will be charged from the bus bar. The ammeter, which is in series with the battery and bus bar will indicate the current flow to or from the battery. When the battery reaches a state of full charge, the ammeter needle will be slightly right of center.



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DC Power System
Figure 2

BATTERY SYSTEM – DESCRIPTION/OPERATION**1. Battery (See Figure 1)**

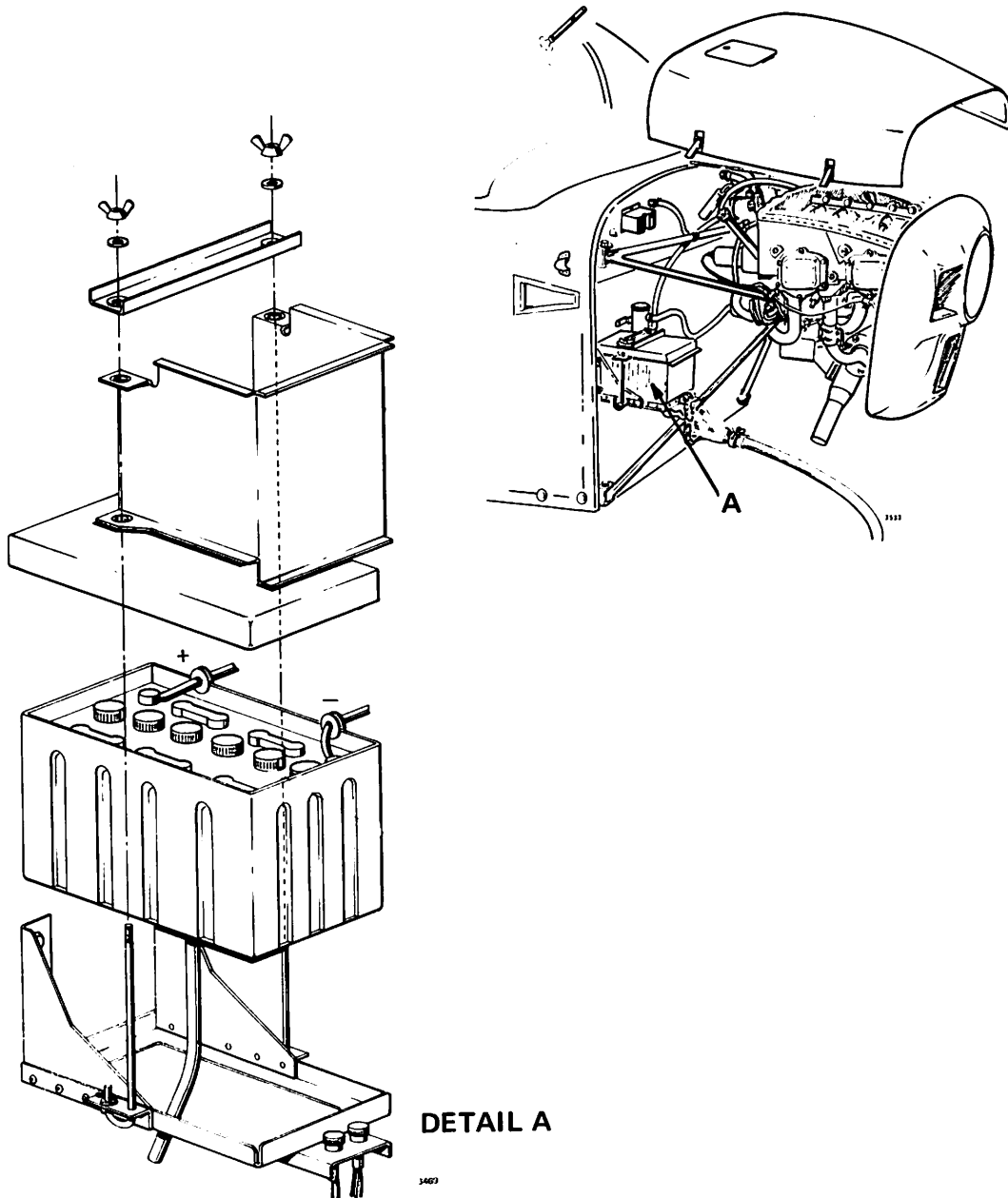
The battery is a 12V, 25 ampere hour, dry-charge type. The battery is located on the right forward side of the firewall. The battery is used to provide engine starts and supply power to the electrical system when alternator power is not available. The battery is also used as an emergency supply in the event of alternator failure.

Under normal use, a battery being charged and discharged will decompose the water from the electrolyte by electrolysis. When the water is decomposed hydrogen and oxygen gases are formed which escape into the atmosphere through the battery vent system. The low water level is caused by this decomposition of water from the electrolyte. Distilled water should be added as necessary to maintain the electrolyte level.

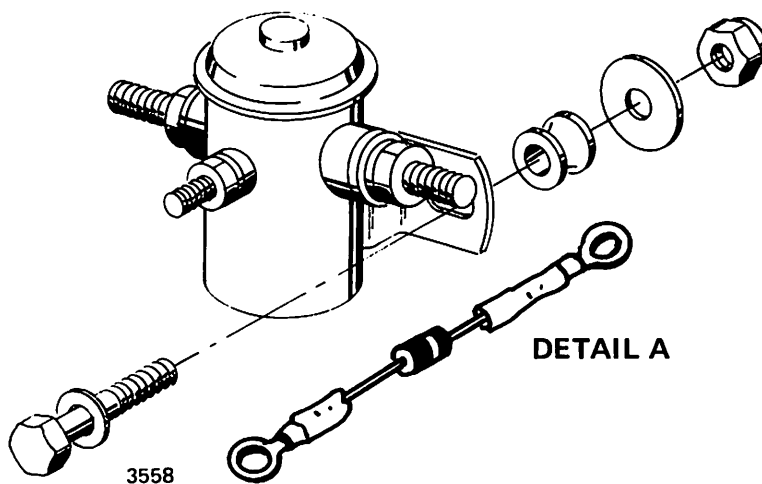
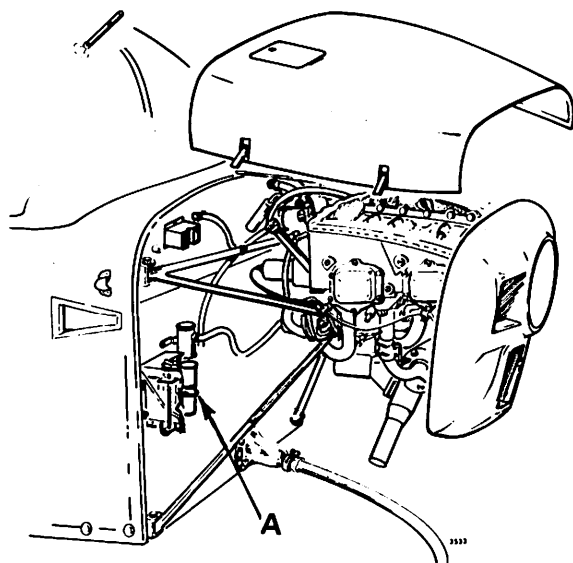
An ammeter is incorporated into the battery system to indicate the current flow either to or from the battery. The ammeter is wired in series from the battery to the bus. Current will flow from the battery to the bus to power the electrical system when alternator power is not available. This will give a negative indication on the ammeter. With the alternator on the line, the flow of current will be to the battery. This will show a positive indication on the ammeter. The rate of charge (positive indication) will vary at the demand of the battery.

2. Battery Contactor (See Figure 2)

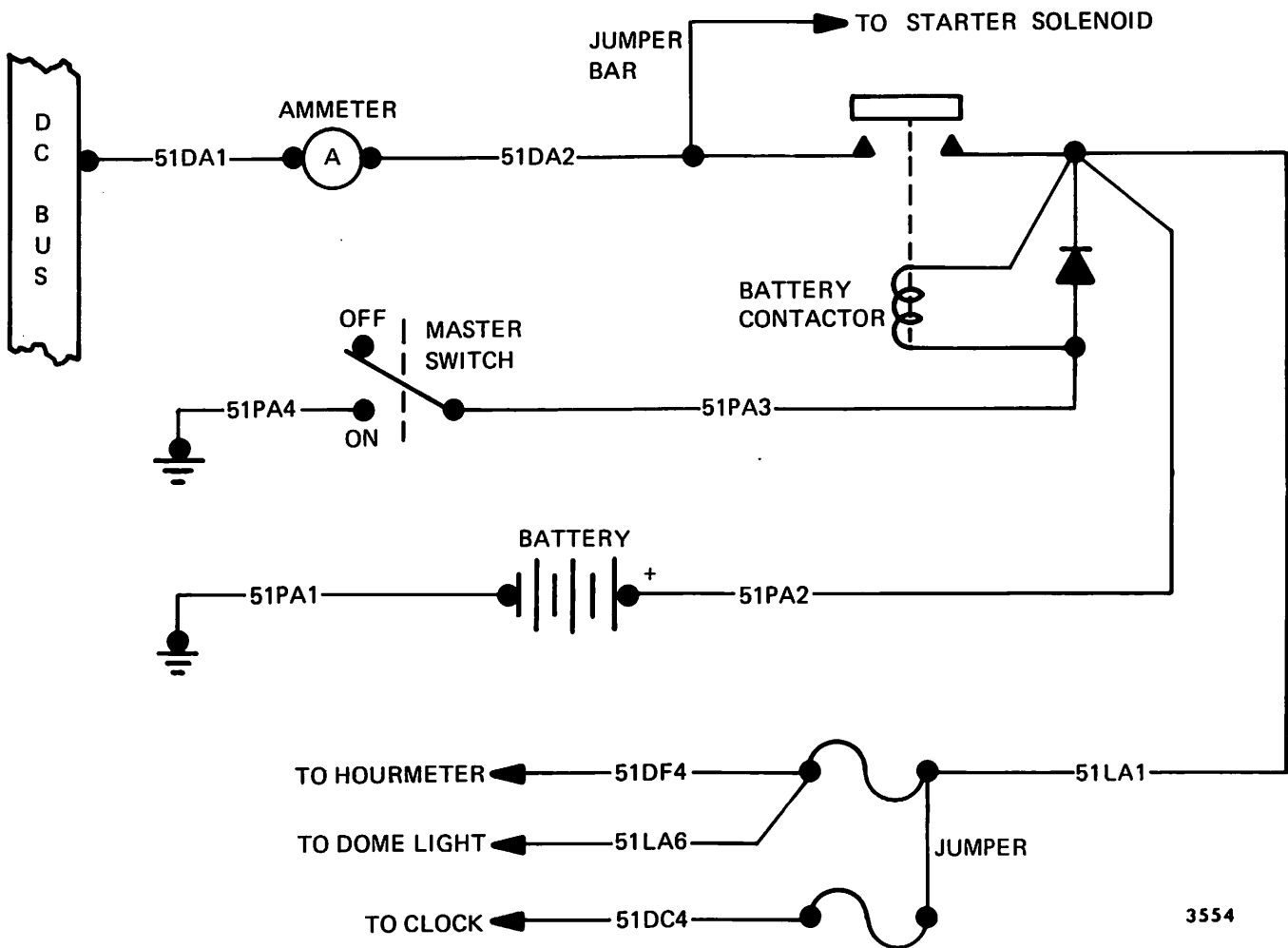
The battery contactor is located on the right side of the forward firewall. The contactor is a plunger type which is actuated when the master switch is placed to the ON position. With the master switch in the OFF position, the contactor isolates the battery from the electrical system. A diode is used across the contactor to dissipate back EMF and provide extended contactor life. The contactor is energized when the master switch is placed to the ON position. A circuit is completed between the battery, through an ammeter to the bus bar. The contactor when energized, also provides a circuit to the starting system.



Exploded View of Battery & Battery Box
Figure 1



**Exploded View of Battery Contactor
Figure 2**



Battery Circuit
Figure 3

BATTERY SYSTEM – TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
System not energized when master switch is turned on	Dead battery	Recharge or replace
	Defective wiring	With master switch OFF, check entire DC power system for open circuit with a continuity tester
	Defective battery contactor	Connect in sequence a voltmeter to each battery contactor terminal and check voltage with master switch on. If no voltage is indicated from either terminal, check and/or replace relay
	Defective master switch	Remove switch from airplane and check with continuity tester. Replace switch if defective.
Battery discharge	Charging rate too low	Replace voltage regulator
	Battery left standing too long	Recharge or replace
	Equipment left on accidentally	Recharge battery
	Impurities in electrolyte	Replace battery
	Cell separator broken	Replace battery
	Short circuit in wiring	Check wiring
	Loose or broken alternator belt	Tighten or replace
	Corroded or loose battery connections	Clean and tighten
Short battery life	Low charging rate	Replace voltage regulator
	Impurities in electrolyte	Replace battery
	Battery left standing too long	Recharge or replace
	Sulfation due to non-use	Replace
	Level of electrolyte being below top of plates	Maintain
Battery uses excessive amount of water	Charging rate too high	Correct charging rate

TROUBLE	PROBABLE CAUSE	REMEDY
Battery uses excessive amount of water (continued)	Cracked case	Replace battery
	Shorted cell	Replace battery
	Shorted diode in alternator	Test diodes and replace as required
Battery polarity reversed	Connected backwards on airplane or charger	Battery should be slowly discharged completely and then charged correctly and tested
Battery freezes	Undercharged or discharged battery	Replace
	Water added and battery not charged immediately	Always recharge battery for 1/2 hour following addition of water in freezing weather
Ammeter indicates discharge with engine operating	Alternator belt loose or broken	Tighten or replace belt
	Open circuit between alternator and bus bar	Check wiring for clean, secure connections and repair as necessary
	Alternator system inoperative	(See alternator system Trouble Shooting)

BATTERY – MAINTENANCE PRACTICES

1. Visual Check

- A. Remove battery cover – (see Battery – Removal/Installation).
- B. Inspect battery terminals for corrosion. If corrosion exists terminal should be cleaned, as described in (Cleaning Battery).
- C. Inspect for a low water level condition. Distilled water should be added as required to bring the level up to the split rings.
- D. Inspect for plugged vents and clean if necessary.
- E. Replace battery cover (see Battery – Removal/Installation).

2. Cleaning Battery

WARNING: ENSURE THAT EXTERNAL POWER IS DISCONNECTED BEFORE REMOVING BATTERY.

- A. Remove battery from aircraft (see Battery – Removal/Installation).
- B. Tighten filler caps and plug vents to prevent cleaning solution from entering battery.
- C. Wipe down entire battery with a clean cloth dampened with a solution of bicarbonate of soda (baking soda) and water.
- D. Wipe battery cable ends with same solution used in Step C.
- E. Rinse areas being cleaned with clear water and wipe off excess water. Allow battery to dry before installation.
- F. Use a brass wire brush or emery cloth to finish cleaning on battery cable ends and battery terminals.

3. Determining State of Charge

To determine the state of battery charge, the specific gravity of the battery is checked using a hydrometer. A reading of 1.260 indicates a fully charged battery whereas a reading of 1.225 or below indicates that the battery should be recharged.

4. Battery Charging

WARNING: ALWAYS KEEP SPARKS OR ANY FORM OF IGNITION AWAY FROM BATTERY BEING CHARGED BECAUSE EXPLOSIVE GASES ARE BEING GENERATED DURING THE CHARGING PROCESS.

- A. Remove battery from aircraft (see Battery – Removal/Installation).
- B. Place battery in well ventilated area.
- C. Remove vented caps and check the level of electrolyte. Distilled water should be added as needed to bring level to top of split rings.
- D. Charge battery as required.
- E. Replace vent caps and reinstall battery (see Battery – Removal/Installation).

5. Battery Box

WARNING: BE CAREFUL WHEN WORKING AROUND BATTERY ACID DEPOSITS. SERIOUS ACID BURNS COULD RESULT IF CONTACT IS MADE WITH ACID DEPOSITS. IF CONTACT IS MADE, WASH IMMEDIATELY WITH SOAP AND WATER.

The battery box cover and drain tube should be inspected and cleaned when the battery is removed. The battery box, cover, and drain tube can be cleaned with a strong solution of bicarbonate of soda (baking soda) and water. After cleaning box, cover, and drain tube flush them thoroughly with water. Inspect box, cover, and drain tube for physical damage. If damaged, they should be replaced.

BATTERY SYSTEM – REMOVAL/INSTALLATION

1. Battery Removal (See Figure 1)

- A. Remove top engine cowl.
- B. Remove the two wing nuts. Withdraw the battery hold-down bracket.
- C. Remove the battery box lid (cover).

CAUTION: REMOVE THE GROUND (NEGATIVE) CABLE FIRST TO PREVENT ACCIDENTAL SHORT.

- D. Disconnect the battery cables.
- E. Remove the battery heat shield.
- F. Remove the battery and battery box by lifting and sliding forward.

2. Battery Installation (See Figure 1)

CAUTION: WHEN INSTALLING THE BATTERY, BE SURE TO CHECK FOR CORRECT POLARITY (NEGATIVE TO GROUND) TO PREVENT DAMAGE TO THE ELECTRICAL SYSTEM.

- A. Install battery into battery box and slide battery box onto battery box support bracket.
- B. Install battery heat shield.

CAUTION: CONNECT GROUND (NEGATIVE) CABLE LAST TO PREVENT ACCIDENTAL SHORT CIRCUITING DURING INSTALLATION.

- C. Connect battery cables and coat terminals with petroleum jelly to reduce corrosion.
- D. Replace the battery box lid (cover).
- E. Replace the two wing nuts.
- F. Replace top engine cowl.
- G. Perform Operational Check.

3. Battery Contactor Removal (See Figure 2)

- A. Remove upper cowl and lower cowl.
- B. Remove ground (negative) cable from battery terminal. Pull cable clear of battery and battery box (see Battery – Removal Steps B through D).
- C. Pull rubber insulators clear of battery terminal on battery contactor. Remove hardware and remove battery cables from battery contactor.
- D. Remove attaching hardware and wire which is connected to the master switch.
- E. Remove attaching hardware and remove battery contactor.

4. Battery Contactor Installation (See Figure 2.)

CAUTION: ENSURE GROUND (NEGATIVE) CABLE IS DISCONNECTED AND CLEAR OF BATTERY TERMINAL BEFORE INSTALLING CONTACTOR.

NOTE: Diode used on contactor should be tested and replaced if necessary before installing contactor (See Diode — Maintenance).

- A. Secure battery contactor on firewall and install attaching hardware.
- B. Install wire and attaching hardware which is routed to the master switch.
- C. Install battery cables and attaching hardware to contactor. Slide rubber insulators over the terminals.
- D. Connect ground (negative) cable to battery (see Battery Installation Steps C through F).
- E. Replace lower cowl and upper cowl.
- F. Perform operational check.

5. Operational Check

- A. Place master switch to ON position (Engine OFF).
- B. Place a moderate drain on the battery (this can be accomplished by turning on the flashing beacon and/or landing light).

NOTE: If light is inoperative, ensure all applicable fuses are good and all circuit breakers are in.

- C. Check for correct operation of flashing beacon and/or landing light.
- D. Turn flashing beacon and/or landing light off.
- E. Turn master switch off.

ALTERNATOR SYSTEM – DESCRIPTION/OPERATION**1. Alternator**

The 60 ampere alternator is three phase, delta connected with integral silicon diode rectifiers. It is rated at 14 volts, 60 amperes continuous output. The rotor consists of an axial winding with radial interlocking poles which surround the winding. The stator windings are three phase, delta connected and are attached to two diode plates, each of which contains three silicon diodes.

The alternator is susceptible to reverse polarity current because of the silicon diodes. The diodes, having a very high resistance to reverse current flow, are used without a cutout relay such as used on a generator system. The alternator diodes are arranged with their cathodes connected to the bus bar, which is positive, and no back current will flow. If the polarity of the battery is reversed, the diodes will offer no resistance to current flow. If the current rating of the diodes is exceeded, diode failure may result.

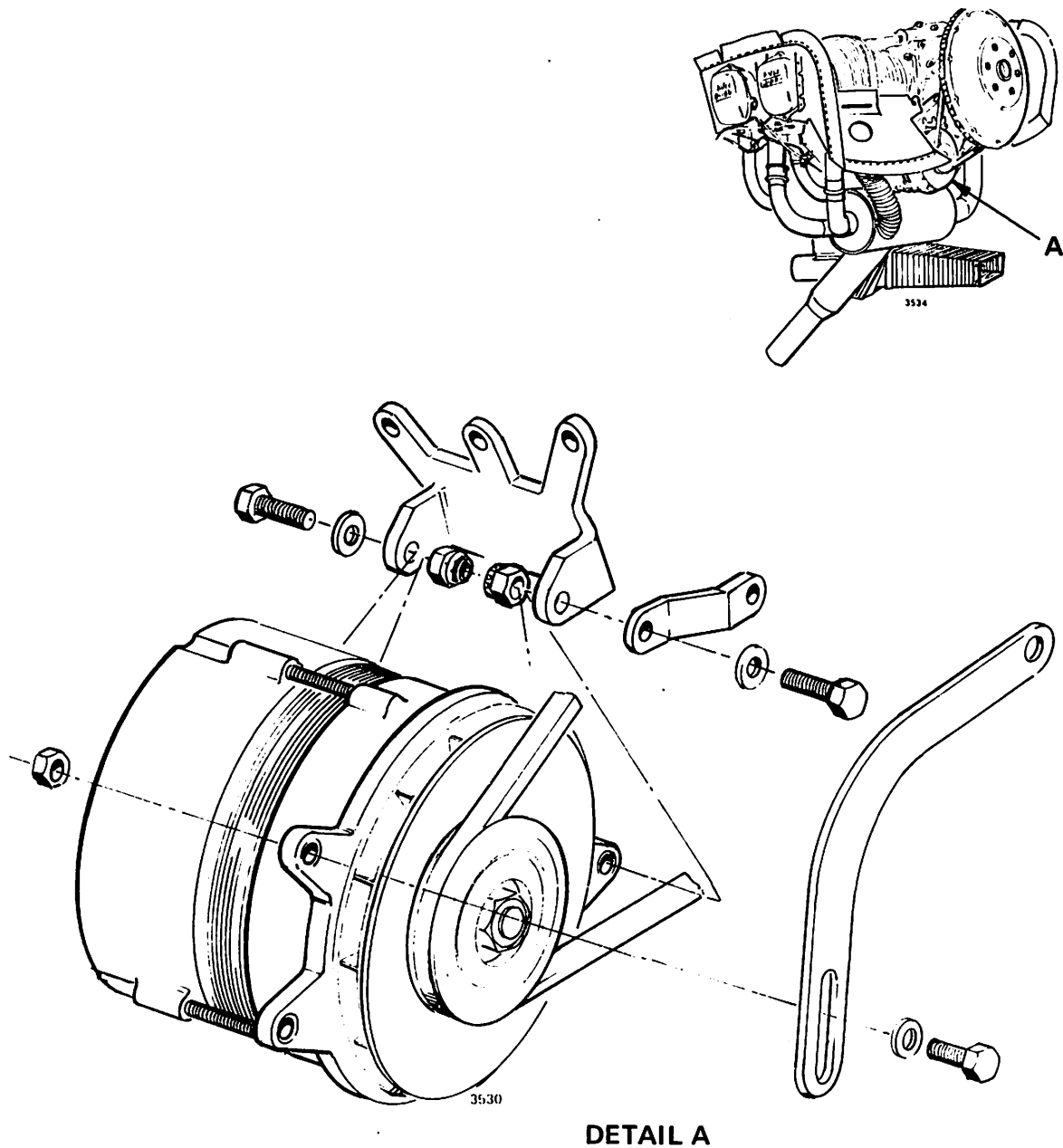
The diode plates are connected to the stator windings to accomplish full-wave rectification of AC. The resulting DC output is applied to the bus and sensed by the voltage regulator. The regulator controls the excitation applied to the alternator field thus controlling the output of the alternator. A five amp ALT FIELD circuit breaker, located on the instrument panel is placed in series with the bus and the voltage regulator to protect the alternator field circuit.

2. Alternator Overvoltage Protection

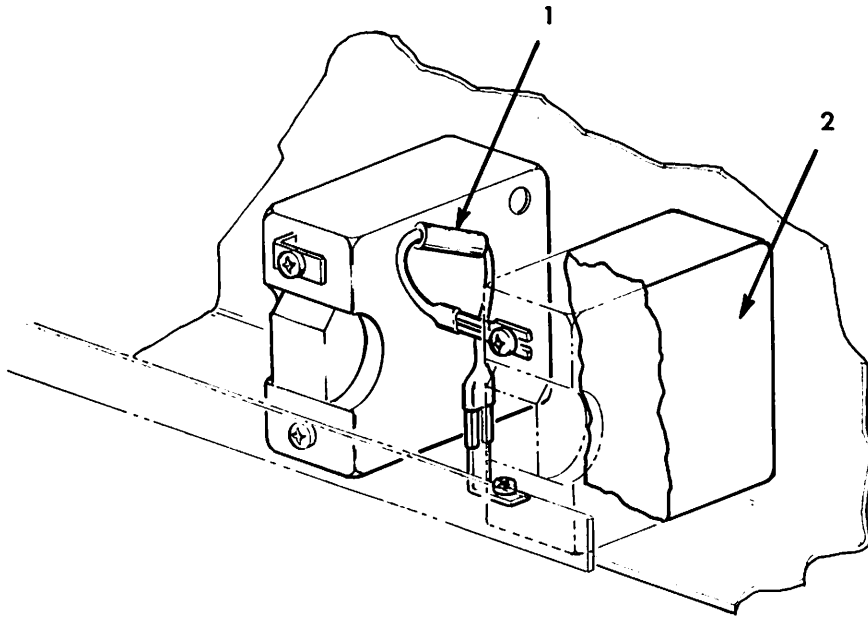
Alternator charging system is susceptible to overvoltage due to a malfunction of the voltage regulator or intentional or accidental removal of the battery from the circuit. To protect the aircraft electrical system against this, an avalanche overvoltage diode has been shunted across the load side of the ALT. FIELD circuit breaker to ground. This diode will withstand the aircraft's normal bus voltage, but will break down under excessive voltages and eventually short the ALT. FIELD circuit breaker to ground. This will cause the breaker to open, deenergizing the alternator field, disabling the alternator. Reactivation of the field circuit breaker cannot be accomplished until the electrical failure has been corrected and the avalanche diode replaced.

3. Voltage Regulator

The alternator voltage regulator is located on the upper right side of the firewall. This regulator is a transistorized device containing a solid-state voltage regulator. When the alternator switch is on, voltage from the DC bus is applied to the red lead of the voltage regulator. The regulator senses the bus voltage level, and applies a control voltage to the field of the alternator. The level of this DC field voltage controls the DC voltage output of the alternator, hence the voltage level on the DC bus.



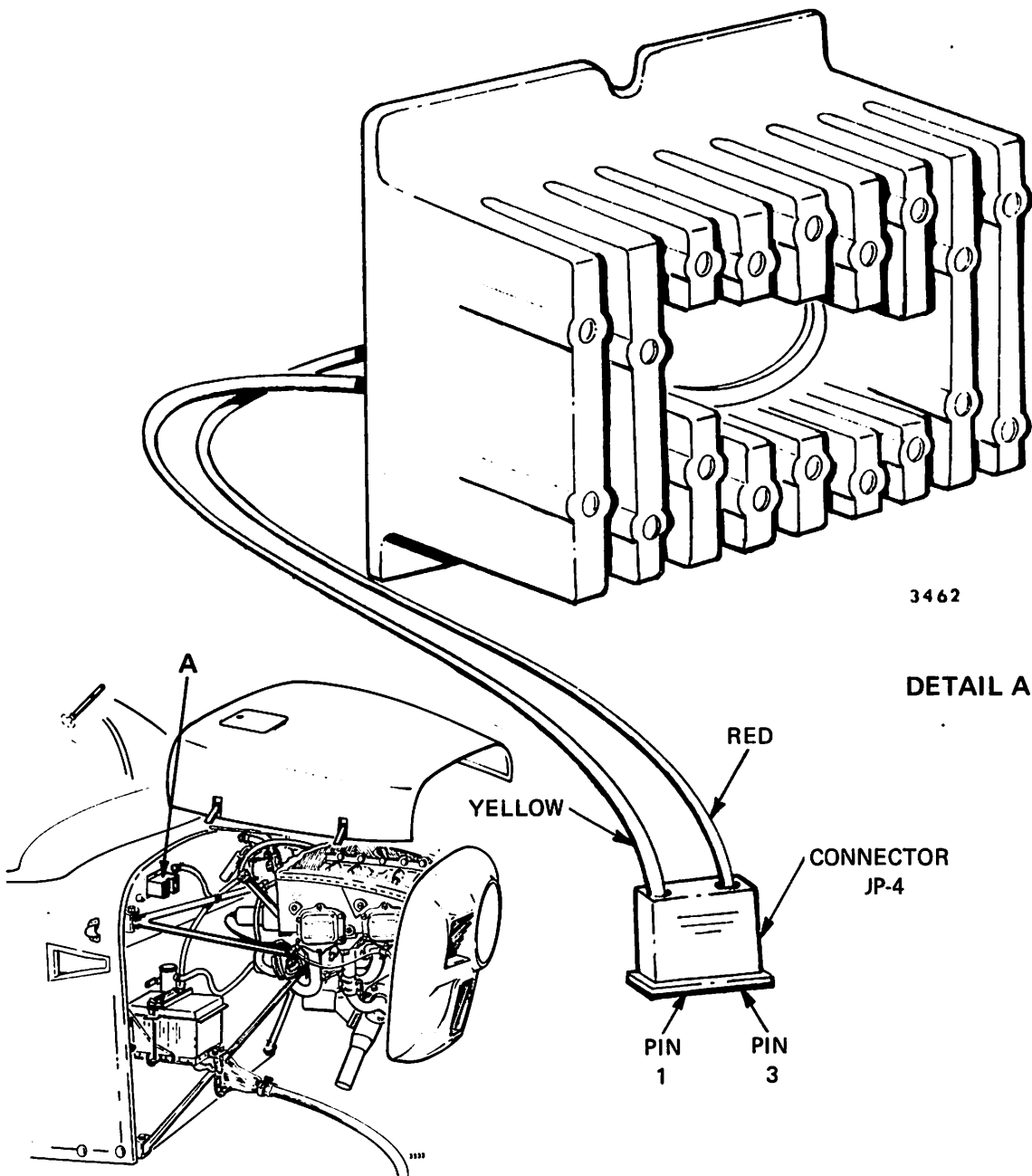
**Alternator — Exploded View
Figure 1**



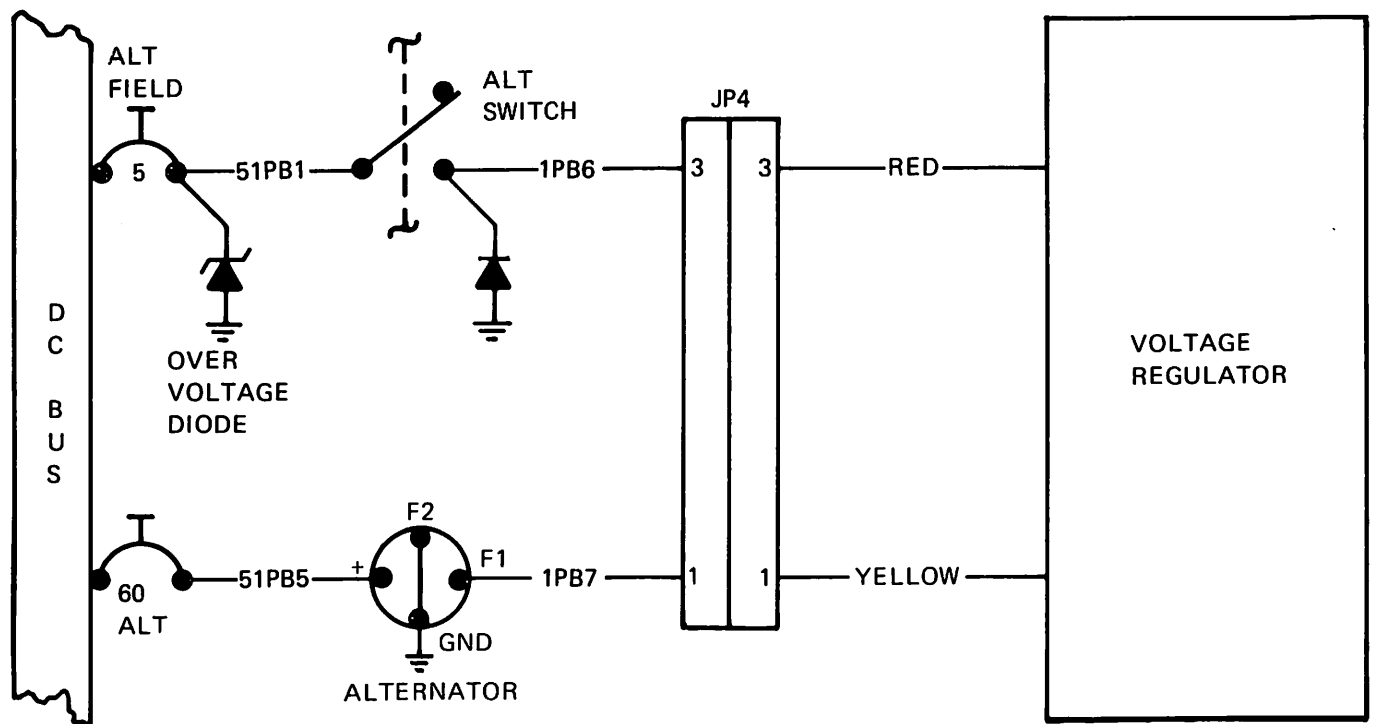
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- 1. Diode
- 2. Field Circuit Breaker

**Overvoltage Protection Diode
Figure 2**



**Voltage Regulator
Figure 3**



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Alternator Circuit – Wiring Diagram
Figure 4

ALTERNATOR SYSTEM – TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Alternator overcharges battery	Regulator faulty	Observe aircraft ammeter. Ammeter should indicate near zero after ten minutes of engine operation. Replace voltage regulator if defective.
ALT FIELD circuit breaker trips	Circuit shorted to ground through overvoltage diode	Check overvoltage diode by measuring its resistance in each direction. The front-to-back resistance shall be 10:1. Replace if defective.
	Field circuit shorted through diode on master switch	Check diode by measuring its resistance in each direction. The front-to-back minimum resistance shall be 10:1. Replace if defective.
	Circuit shorted in wiring.	Disconnect JP-4 of regulator, and reset circuit breaker. If circuit breaker trips check wiring. Repair as required. If breaker does not trip, replace regulator. Reconnect lead to JP-4 of regulator. Set MASTER switch to ON and check for 12V at pin 3 of JP-4. Repair wiring if no voltage is present.
ALT circuit breaker trips	Short circuit in wiring.	Disconnect lead from + post of alternator, and reset ALT circuit breaker. If circuit breaker trips check wiring between alternator and circuit breaker.
	Short circuit in alternator.	Replace alternator.

TROUBLE	PROBABLE CAUSE	REMEDY
ALT circuit breaker trips (Continued)	Defective regulator	Disconnect JP-4 of regulator and reset circuit breaker. If circuit breaker does not trip, replace regulator.
Alternator will not keep battery charged.	Battery malfunction	1. Start engine and adjust for 1500 RPM. Ammeter should indicate a heavy charge rate with all electrical equipment turned off. Rate should taper off in 10-15 minutes. If charge rate tapers off very quickly, check battery for malfunction. If ammeter shows a low charge rate or any discharge rate, proceed to Step 3.
	Defective wiring	2. Check voltage at Pin 3 of JP-4 with alternator switch closed. Alternator switch should indicate bus voltage. If voltage is not present, check wiring between regulator and bus.
	Regulator faulty	3. Disconnect JP-4 and start engine. Momentarily (one second) jump pins 1 and 3 of JP-4 together on the plug. The aircraft ammeter should show a heavy charge rate. Replace regulator. If a heavy charge rate is observed, proceed to Step 5.
Alternator will not keep battery charged	Defective wiring regulator to alternator	4. Check resistance from F1 terminal of alternator to pin 1 of JP-4. Normal indication is very low (less than 1 ohm) resistance. If reading indicates no, or low continuity, repair or replace wiring from regulator to alternator.
	Defective alternator	5. Check resistance from F1 terminal of alternator to alternator case. Normal indication is 3-4 ohms. If resistance is high or low, repair or replace alternator.

ALTERNATOR SYSTEM – MAINTENANCE PRACTICES

1. Alternator Removal (See Figure 1.)

- A. Remove upper and lower cowling. The propeller and forward cowl must also be removed.
- B. Disconnect the ground (negative) cable from the battery terminal. Pull cable clear of battery and battery box. (See Battery Removal – Steps B through D).
- C. Cut the safety wire and remove the bolt attaching the alternator to the adjustment link.
- D. Remove the nuts from the support bolts and slide the main alternator support bolts out, at the same time removing the drive belt.
- E. Lower alternator and gain access to the leads. Remove and identify leads from alternator.
- F. Remove the alternator.

NOTE: Service work performed on the alternator should be in accordance with any manuals or bulletins published by the alternator manufacturer.

2. Alternator Installation (See Figure 1.)

CAUTION: ENSURE GROUND (NEGATIVE) CABLE IS DISCONNECTED AND CLEAR OF BATTERY.

NOTE: When a new belt has been installed, recheck the belt tension within 10 to 20 hours operation.

- A. Place alternator near mount and connect leads to alternator.
- B. Slide alternator into mount. At same time, place belt on pulley of alternator.
- C. Slide main alternator support bolts into position and replace nuts.
- D. Replace bolt attaching the alternator to the adjustment link. Adjust the belt tension to yield a 3/8 inch deflection at the center of the belt when applying a pressure equivalent to 12 pounds.
- E. Safety wire bolt attaching the alternator to the adjustment link.
- F. Connect ground (negative) cable to the battery (see Battery Installation Steps C through F).
- G. Replace forward cowl and propeller.
- H. Replace upper and lower cowling.
- I. Perform operational check.

3. Alternator Overvoltage Protection Diode – Replacement

- A. Disconnect the ground (negative) cable from the battery terminal. Pull cable clear of battery and battery box. (See Battery Removal Steps A through D.)
- B. Locate diode on reverse side of circuit breaker panel and replace.
- C. Connect the ground (negative) cable to battery terminal (See Battery Installation.)
- D. Perform an operation check.

4. Voltage Regulator Removal (See Figure 3.)

NOTE: The voltage regulator is a sealed unit; therefore, no field adjustments are possible.

- A. Remove upper cowl.
- B. Disconnect ground (negative) cable from battery terminal. Pull cable clear of battery and battery box. (See Battery Removal.)
- C. Disconnect connector JP-4 from voltage regulator.
- D. Remove the attaching hardware and remove voltage regulator from firewall.

5. Voltage Regulator Installation (See Figure 3.)

NOTE: Ensure that the connections for grounding the alternator, wiring shields and the base of the regulator are clean before installation. This will eliminate the possibility of poor voltage regulation and/or excessive radio noise.

- A. Place regulator against firewall and install attaching hardware.

CAUTION: BEFORE CONNECTING WIRES TO VOLTAGE REGULATOR, ENSURE NEGATIVE CABLE IS DISCONNECTED FROM BATTERY.

- B. Connect connector JP-4 to voltage regulator.
- C. Connect negative cable to battery. (See Battery Installation.)
- D. Perform operational check.

6. Operational Check

WARNING: BEFORE STARTING ENGINE, BE SURE PROPELLER AREA IS CLEAR.

- A. Start engine in accordance with the Pilot's Operating Handbook. Set engine at 1500 RPM.
- B. Ammeter should indicate a heavy charge rate (positive) with all electrical equipment off.
- C. Observe that charge rate (positive) tapers off in 10 to 15 minutes.
- D. Turn on flashing beacon. Ammeter should still show a charge rate (positive).
- E. Turn off flashing beacon.
- F. Shut down engine in accordance with the Pilot's Operating Handbook.

EXTERNAL POWER – DESCRIPTION/OPERATION**1. General**

A ground service receptacle is offered as optional equipment to provide a means of providing an external power source for cold weather starting or when performing lengthy electrical maintenance.

When external source is applied, power goes through the ammeter to the bus. The master switch should be placed in the OFF position when external power is applied.

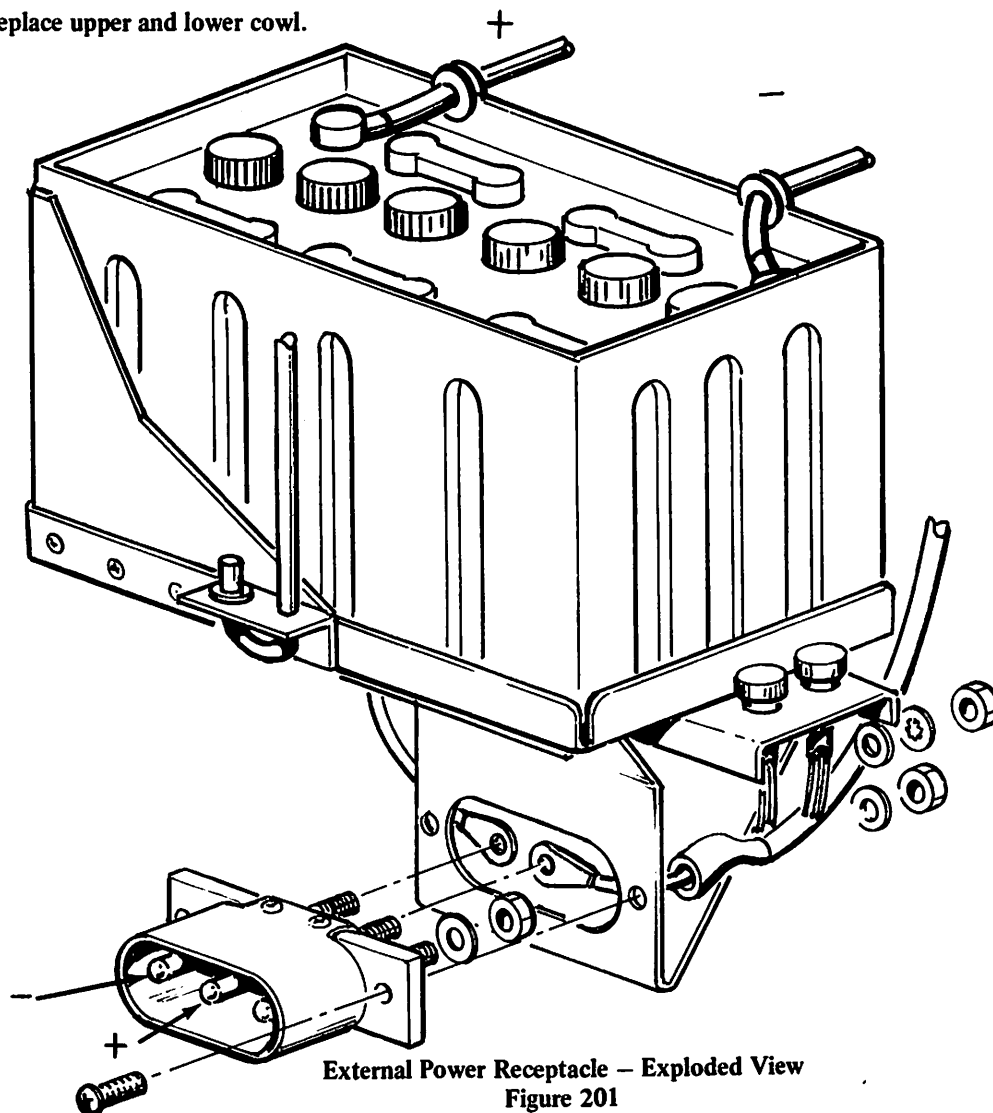
EXTERNAL POWER RECEPTACLE – MAINTENANCE PRACTICES**1. External Power Receptacle Removal (See Figure 201.)**

- A. Remove upper and lower cowl.
- B. Disconnect ground (negative) cable from the battery terminal. (See Battery Removal.)
- C. Remove cable attaching hardware and remove cables from receptacle.
- D. Remove receptacle attaching hardware and remove receptacle.

2. External Power Receptacle Installation (See Figure 201.)

CAUTION: ENSURE GROUND (NEGATIVE) CABLE IS CLEAR OF BATTERY TERMINAL.

- A. Replace receptacle, cables and attaching hardware. Place rubber insulator over positive terminal.
- B. Connect ground (negative) cable to battery terminal. (See Battery Installation.)
- C. Replace upper and lower cowl.



CHAPTER 25

EQUIPMENT AND FURNISHINGS

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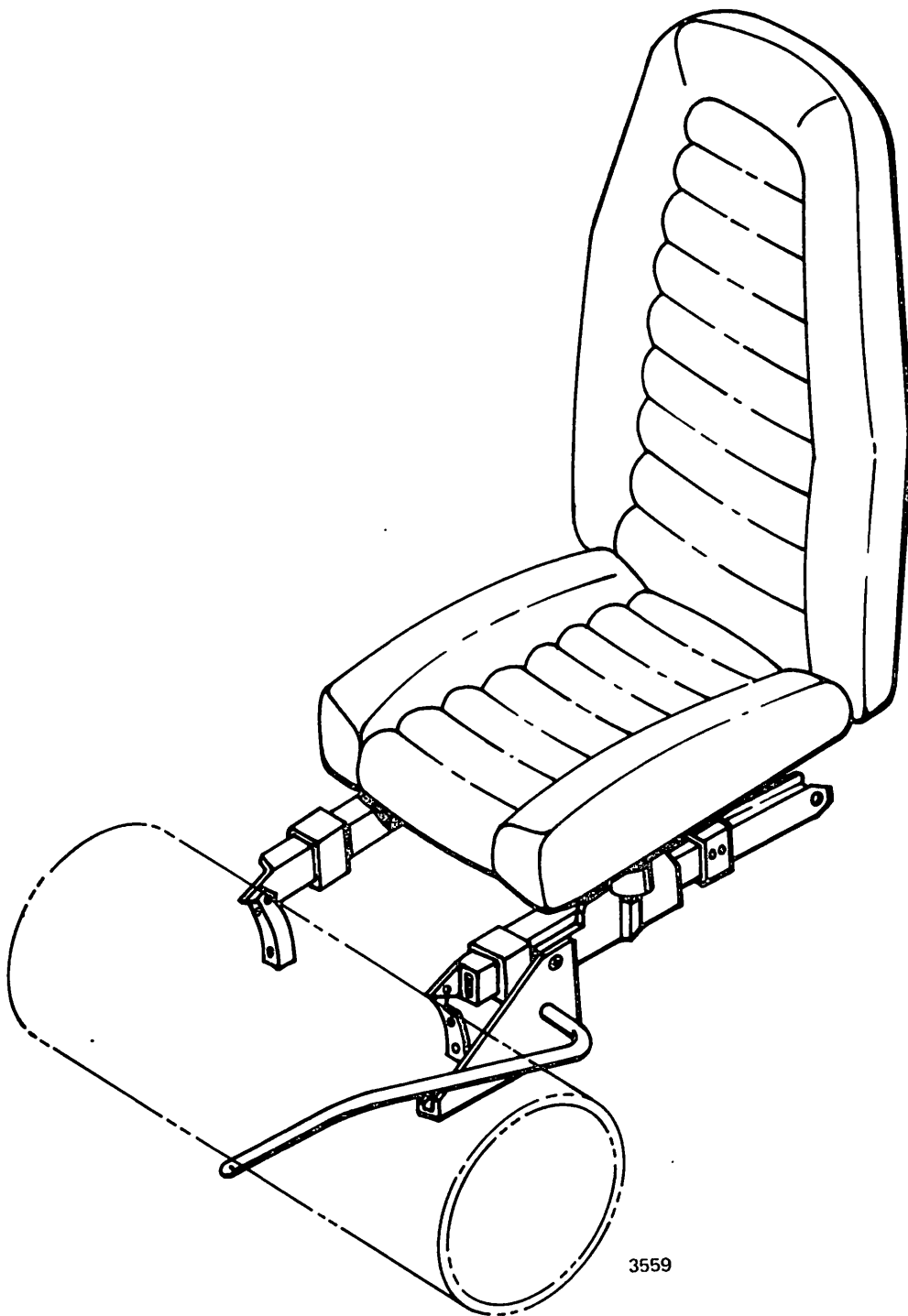
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SEATS – DESCRIPTION/OPERATION**1. General**

The seats in the AA-1C model are horizontally adjustable bucket seats, independently mounted on brackets located on the spar and aft cabin bulkhead. (See Figure 1.) Covering for the seats consists of a vinyl/fabric combination.

A spring-loaded lever is located on the outboard side of each seat to release the seat to move forward or aft along the guide track. Detents along the adjusting plate attached to the outer track are engaged by the lever to lock the seat in place.

Model AA-1C aircraft feature folding seat backs and folding seat cushions.



**Seat Assembly
Figure 1**

SEATS – MAINTENANCE PRACTICES**1. Seat Removal**

- A. Lift the seat cushion to expose the seat tracks.
- B. Remove the bolts which fasten the seat tracks to the spar mounting brackets.
- C. Remove the spring which is attached to the seat adjustment lever.
- D. Remove the seat adjustment boost springs which are connected to the bottom of the seat and to a bracket mounted on the carry-through spar.
- E. To remove seat, pull seat forward from aft mounting bracket slots.

2. Seat Installation

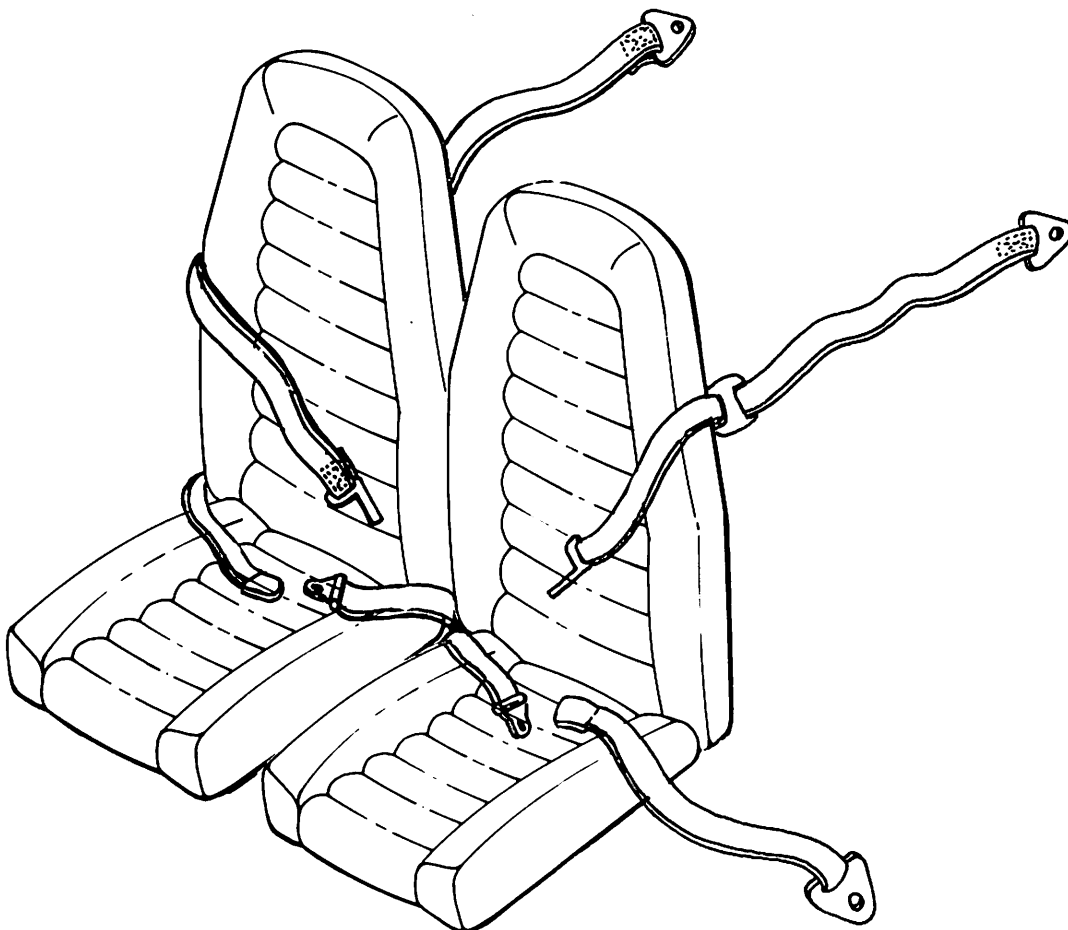
- A. Insert slide assembly of seat into slots on aft mounting brackets.
- B. Install bolts which attach seat tracks to the spar mounting brackets.
- C. Install seat adjustment boost springs which are connected to the bottom of the seat and to the bracket mounted on the carry-through spar.
- D. Install spring which attaches to the seat adjustment lever and aircraft floor.

SAFETY BELTS – DESCRIPTION/OPERATION**1. General**

The safety belts for the AA-1C model consist of 2 lap straps and 2 shoulder harnesses. (See Figure 1.) The end fitting on each shoulder harness has a slit-opening through which the lap strap end fitting passes and engages the buckle receptacle. The shoulder harnesses may be lengthened or shortened by means of an adjustable slide buckle. The outboard lap strap may be lengthened or shortened by sliding the end fitting along the strap.

The shoulder harnesses are anchored to mounting plates located on the fuselage side walls below the cabin windows at the aft end of the baggage compartment. When not in use, the shoulder harness straps are held in place by retainer clips mounted on the fuselage side walls.

The inboard and outboard lap belt assemblies are anchored to brackets which are mounted to the floor and located to the left and right sides of each seat assembly.



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Lap Belts and Shoulder Harnesses
Figure 1

SAFETY BELTS – MAINTENANCE PRACTICES

1. Shoulder Harness Removal

- A. Locate point at which shoulder harness is attached to the stringer on the fuselage side wall below the cabin window at the aft end of the baggage compartment.
- B. Remove bolt securing harness end fitting to the stringer. Note the order of part alignment when removing bolt, washers, bushing and nut.

2. Shoulder Harness Installation

- A. Align hole in harness end fitting with hole in stringer.
- B. Secure harness end fitting to stringer with attaching hardware: bolt, washers, bushing and nut.

3. Inboard and Outboard Lap Belt Removal

- A. Locate brackets which are mounted to the floor to the left and right sides of each seat assembly. Locate point at which lap belts are attached to brackets.
- B. Remove bolt securing lap belt end fitting to bracket. Note the order in which the parts are aligned: bolt, bushing, bracket, lap belt end fitting, washer, and nut.

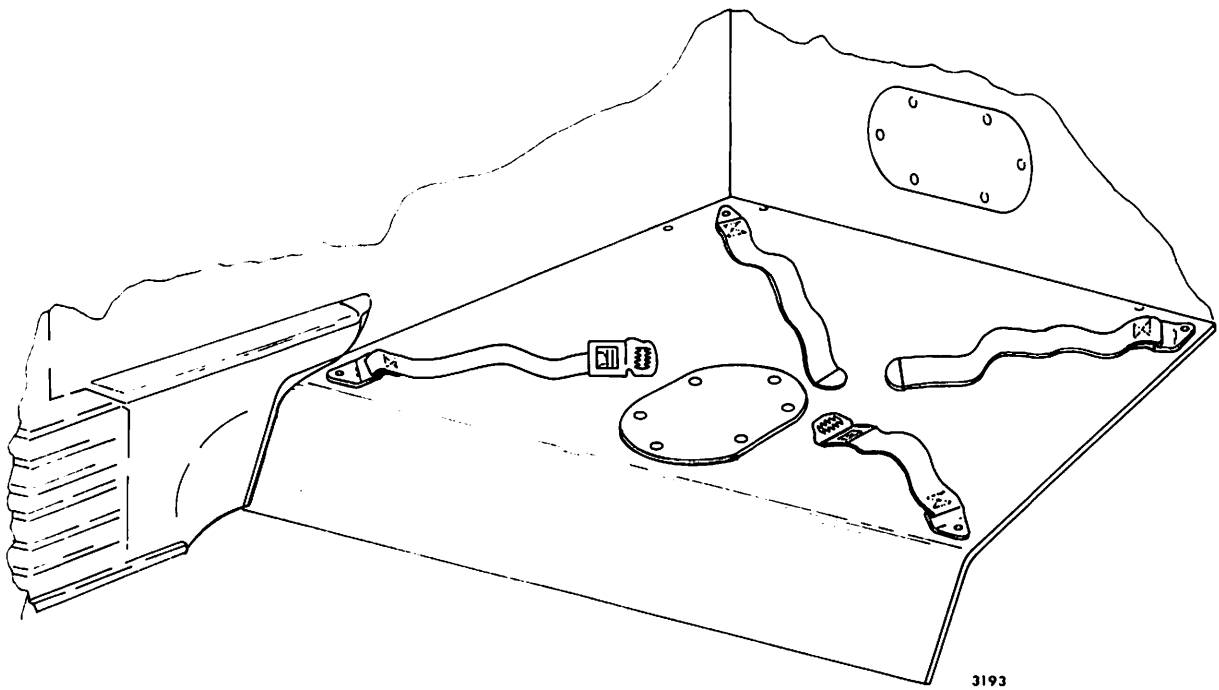
4. Inboard and Outboard Lap Belt Installation

- A. Secure lap belt end fitting to bracket, aligning hardware in the following order: bolt, bushing, bracket, lap belt end fitting, washer and nut.

BAGGAGE STRAP ASSEMBLIES – DESCRIPTION/OPERATION**1. General**

The baggage strapping consists of four strap assemblies, each anchored to the corner of the baggage compartment floor (see Figure 1).

The straps are normally arranged in a crossed position for securing baggage. Each of the two straps directly behind the rear seat is equipped with a buckle which accepts and clamps the strap anchored at the diagonally opposite corner of the baggage floor.



**Baggage Strap Assemblies
Figure 1 .**

BAGGAGE STRAP ASSEMBLIES – MAINTENANCE PRACTICES**1. Baggage Strap Assembly Removal**

- A. Remove baggage floor carpet.
- B. Remove aft trim panel.
- C. Remove inspection cover assembly on baggage floor to gain access to washer and nut for particular strap assembly being removed.
- D. Remove screw securing strap end fitting to baggage floor. Note the order in which the parts are aligned: screw, washer, bushing, washer, and nut.

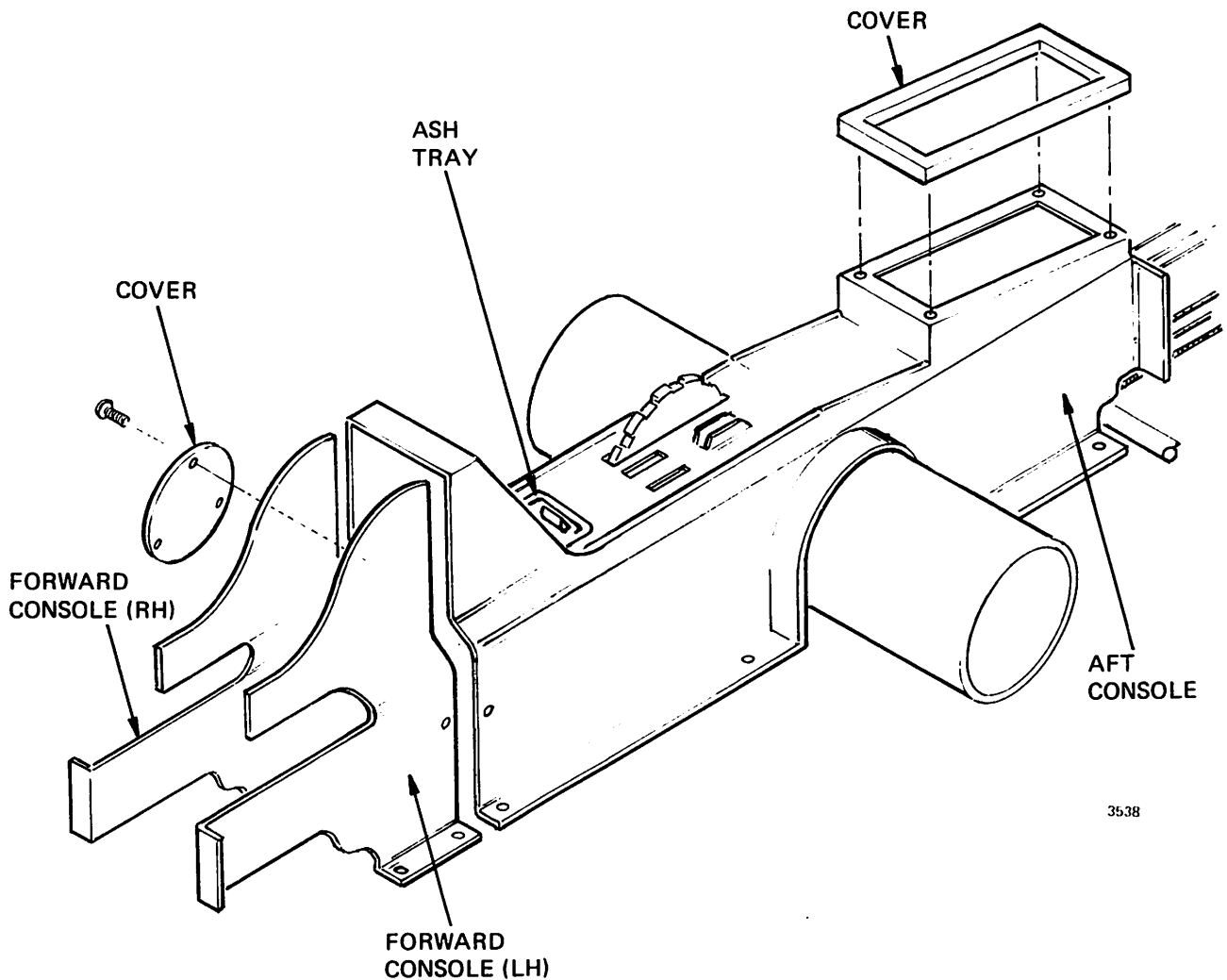
2. Baggage Strap Assembly Installation

- A. Secure strap end fitting to baggage floor, aligning the hardware in the following order: screw, washer, bushing, washer and nut.
- B. Install inspection cover assembly.
- C. Install aft trim panel.
- D. Install baggage floor carpeting.

CONSOLE ASSEMBLY – DESCRIPTION1. General

The royalite console assembly is located between the front seats and consists of a main body and two forward side panels. (See Figure 1.) The console assembly contains the fuel selector valve, ash tray, trim wheel, trim indicator, flap switch, flap position indicator and microphone mount. The console assembly also covers the control cable pulley group, the control cables and the flap drive motor.

Inspection covers located on the aft top and the forward right hand sides of the console provide access for inspection and minor maintenance purposes. Limited inspection of components under the console can be accomplished by removing the ash tray and using a hand mirror.



Console Assembly
Figure 1

CONSOLE ASSEMBLY – MAINTENANCE PRACTICES

1. Console Assembly Removal

- A. Remove seats. (See 25-1-0.)
- B. Remove microphone and remove retaining nut from microphone jack at aft end of console.
- C. Remove two screws located alongside the flap position indicator.
- D. Remove the fuel valve handle.
- E. Unsnap carpet along forward edge of baggage compartment floor.
- F. Remove screws attaching sill trim to top edge of baggage compartment floor and remove sill trim.
- G. Remove the six screws attaching the console to the floor.
- H. Remove the six screws attaching the aft console to the forward console.
- I. Spread the sides of the console aft of the spar, and lift up. Repeat this process for the sides of the console forward of the spar.
- J. To remove the forward section of the console, remove the two additional screws from the floor and remove console section.

2. Console Assembly Installation

CAUTION: ENSURE THAT CONSOLE AFT OF THE SPAR IS OUTSIDE OF ALL CONTROL CABLES ON REASSEMBLY.

- A. Install microphone jack on aft console section.
- B. Position aft console section in place over spar and install six screws attaching the aft console section to the floor.
- C. Install two screws alongside the flap position indicator.
- D. Install the fuel valve handle.
- E. Install screws attaching sill trim to top edge of baggage compartment floor.
- F. Snap carpet to forward edge of baggage compartment floor.
- G. Install the six screws attaching the forward console section to the aft console section.
- H. Install two screws attaching forward console section to the floor.
- I. Install seats. (See 25-1-0.)

UPHOLSTERY – DESCRIPTION**1. General**

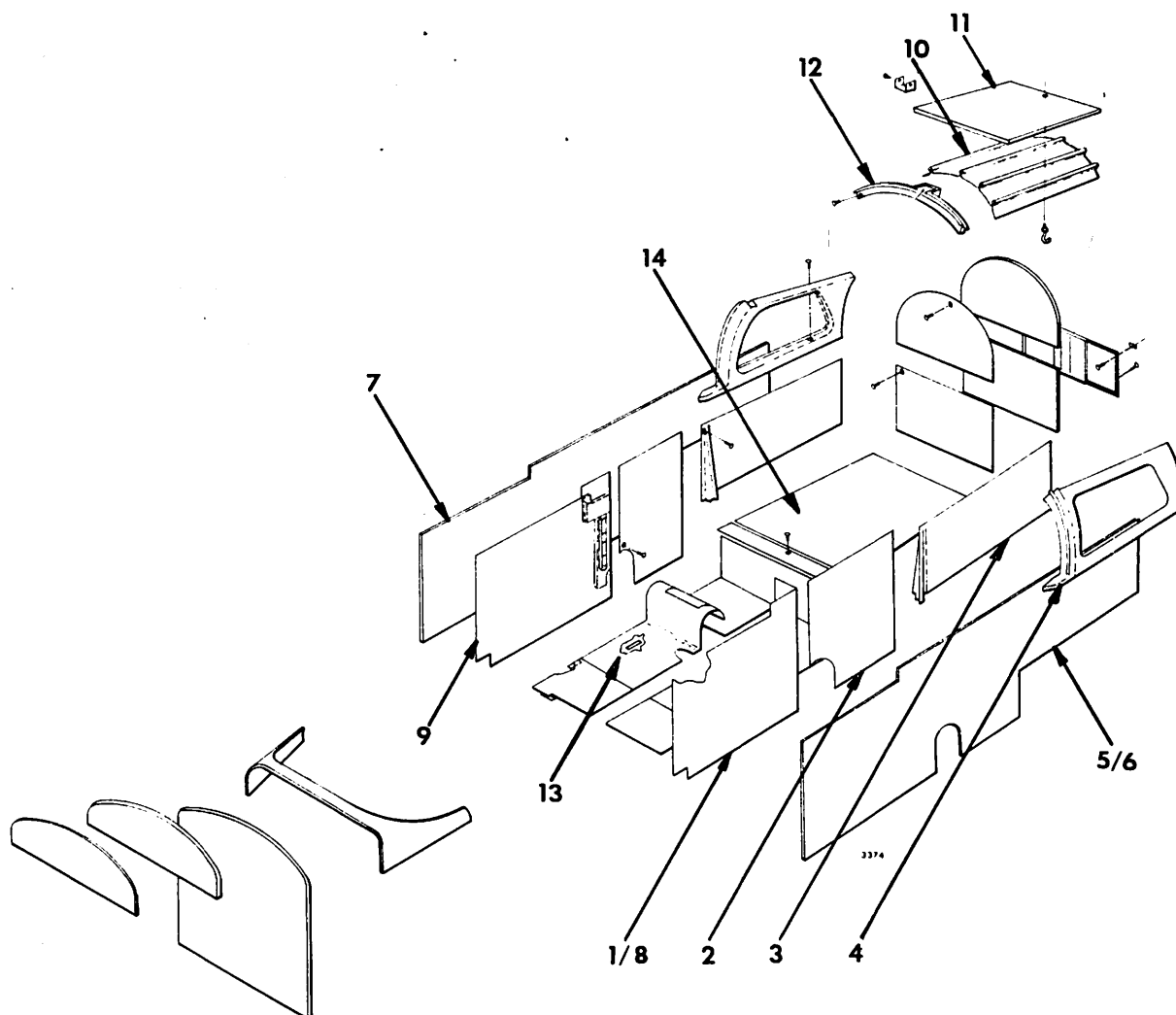
The AA-1C Model upholstery furnishings consist of the fuselage side trim paneling (forward, center and aft), baggage paneling (upper, lower), cabin top and window mouldings, headliner assembly, and floor and baggage carpeting. (See Figure 1.)

The forward and aft fuselage side trim paneling, baggage paneling, and cabin top and window mouldings are made of a thermo-plastic material, which may be cleaned with a damp cloth. These panels and mouldings are secured to the fuselage with screws.

The center section of the side trim paneling consists of a vinyl/fabric combination. The center section is held in place by the flange of the canopy track and is secured to the fuselage side with screws. The vinyl portions of this section may be cleaned with a damp cloth. Spots and stains on fabric portions of this panel may be removed with a household spot remover, used sparingly.

Carpeting is secured to the cabin and baggage compartment floor with snap attachments, allowing easy removal and replacement. An adhesive glue application is used to secure carpeting to the cabin floor between the spar and the scuff plate. Spots or stains on carpeting may be removed with a household spot remover, used sparingly.

The headliner assembly for the aft fuselage overhead section is made of a vinyl material which is held in place with metal tubes and secured to the aft fuselage bulkheads and window retainer with an adhesive glue application. The headliner vinyl material may be cleaned with a damp cloth.



- | | |
|----------------------------|-----------------------------|
| 1. Forward Side Trim Panel | 8. Upper Baggage Insulation |
| 2. Center Side Trim Panel | 9. Lower Baggage Insulation |
| 3. Aft Side Trim Panel | 10. Headliner Assembly |
| 4. Window Moulding | 11. Headliner Insulation |
| 5. Sidewall Insulation | 12. Cabin Top Moulding |
| 6. Upper Baggage Panel | 13. Forward Carpet |
| 7. Lower Baggage Panel | 14. Baggage Floor Carpet |

**Upholstery Installation
Figure 1**

UPHOLSTERY – MAINTENANCE PRACTICES

1. Forward Side Trim Panel Removal

- A. Remove four screws securing forward side trim panel to fuselage side wall.
- B. Remove two screws from bottom flange of panel.
- C. Pull top edge of panel from beneath canopy track and remove panel.

2. Forward Side Trim Panel Installation

- A. Align forward side trim panel in position against fuselage side wall and place top edge of panel beneath canopy track.
- B. Install four screws securing panel to fuselage side wall.
- C. Install two screws securing bottom flange of panel to fuselage floor.

3. Center Side Trim Panel Removal

- A. Remove seat. (See 25-1-0.)
- B. Remove safety belt retainer clip from center side trim panel.
- C. Remove two screws from side pocket at bottom of panel.
- D. Pull top edge of panel from beneath canopy track and window moulding and remove panel.

4. Center Side Trim Panel Installation

- A. Align center side trim panel in position against fuselage side wall and place top edge of panel beneath canopy track and window moulding.
- B. Install two screws to side pocket at bottom of panel.
- C. Install safety belt retainer clip.
- D. Install seat. (See 25-1-0.)

5. Aft Side Trim Panel Removal

- A. Unsnap carpet from baggage floor.
- B. Remove three screws securing aft side trim panel to baggage floor.
- C. Remove one screw securing side panel to lower baggage panel.
- D. To remove, pull panel from beneath window moulding by pulling from bottom of panel.

6. Aft Side Trim Panel Installation

- A. Align aft side trim panel against fuselage wall, placing top edge of panel beneath window moulding.
- B. Install one screw securing side panel to lower baggage panel.

- C. Install three screws securing panel to baggage floor.
- D. Snap carpet into place along edges of baggage floor.

7. Window Moulding Removal

- A. Remove ten screws securing window moulding to flanges around window.
- B. Remove one screw securing window moulding to top moulding.
- C. Remove one screw at aft end of window moulding securing window moulding to top baggage panel.
- D. Remove harness strap from mounting plate and pull out moulding.

8. Window Moulding Installation

- A. Place window moulding over harness strap mounting plate and align moulding to flanges around window.
- B. Install ten screws securing window moulding to flanges around window.
- C. Install one screw securing window moulding to top moulding.
- D. Install one screw at aft end of window moulding securing window moulding to top baggage panel.
- E. Install harness strap to mounting plate.

9. Cabin Top Moulding Removal

- A. Remove one screw attaching dome light and speaker encasement to headliner.
- B. Carefully bend encasement down far enough to disconnect dome light and speaker wiring.
- C. Remove two screws attaching cabin top moulding to window moulding and remove cabin top moulding.

10. Cabin Top Moulding Installation

- A. Align cabin top moulding in place at top of cabin and connect dome light and speaker wiring.
- B. Install one screw attaching dome light and speaker encasement to headliner.
- C. Install two screws attaching cabin top moulding to window moulding.

11. Lower Baggage Panel Removal

- A. Remove three screws from top edge of lower baggage panel.
- B. Remove two screws from aft flanges of aft side panels.
- C. Remove three screws from bottom edge of lower baggage panel and pull panel out.

12. Lower Baggage Panel Installation

- A. Place lower baggage panel into position behind aft flanges of aft side panels.
- B. Install two screws attaching aft flange of each aft side panel to lower baggage panel.

- C. Install three screws to top edge of lower baggage panel.
- D. Install three screws to bottom edge of lower baggage panel.

13. Upper Baggage Panel Removal

- A. Remove window moulding. (See Paragraph 7 above.)
- B. Remove two screws at top edge of upper baggage panel.
- C. Remove three screws from top edge of lower baggage panel, and remove upper baggage panel.

14. Upper Baggage Panel Installation

- A. Place upper baggage panel into position behind lower baggage panel.
- B. Install three screws attaching top edge of lower baggage panel to bottom edge of upper baggage panel.
- C. Install two screws at top edge of upper baggage panel.
- D. Install window moulding. (See Paragraph 8 above.)

15. Headliner Assembly Removal

- A. Remove window mouldings. (See Paragraph 7 above.)
- B. Remove top moulding. (See Paragraph 9 above.)
- C. Remove upper baggage panel. (See Paragraph 13 above.)
- D. Unscrew coat hanger hook.
- E. Strip headliner vinyl material from forward bulkhead of aft fuselage section and top cabin window retainer. Remove any excess glue left on bulkhead and retainer.
- F. Just forward of rib behind baggage compartment, take crimps out of headliner rods with a pair of pliers.
- G. Slide rods aft enough to release rods from forward bulkhead retainers. Pull rods forward to release rods and assembly from holes in rib behind baggage compartment.

16. Headliner Assembly Installation

NOTE: If new headliner is being installed, cut away material from rod ends.

- A. Insert rod ends of headliner assembly into holes in rib behind baggage compartment.
- B. Insert other end of rods into forward bulkhead retainers and slide rods as far forward as possible.
- C. Just forward of rib behind baggage compartment, crimp headliner rods with a pair of pliers.
- D. Glue overlapping headliner vinyl material to forward bulkhead of aft fuselage section and top window retainers.
- E. Install coat hanger hook.
- F. Install upper baggage panel. (See Paragraph 14 above.)

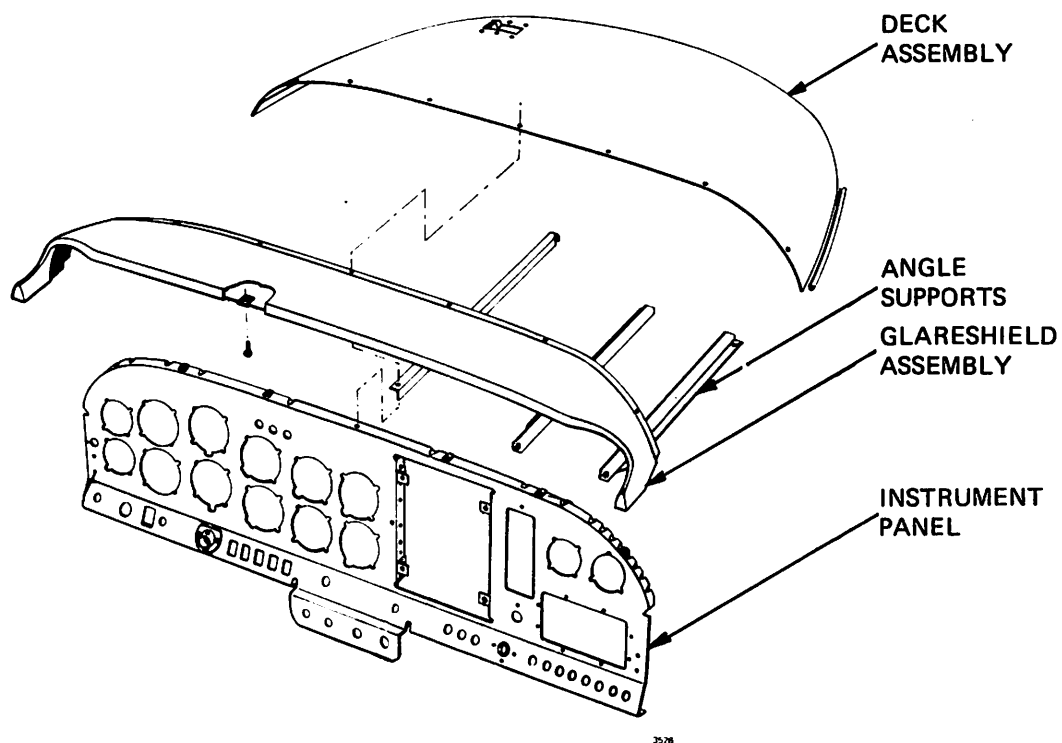
- G. Install top moulding. (See Paragraph 10 above.)**
- H. Install window mouldings. (See Paragraph 8 above.)**

MISCELLANEOUS FURNISHINGS – DESCRIPTION**1. Glareshield and Deck Assemblies**

The glareshield and deck assemblies are secured to the top of the instrument panel. The deck assembly is supported by left and right angle structures and contains the defroster outlet assembly. The glareshield assembly houses three instrument panel lights. (See Figure 1.)

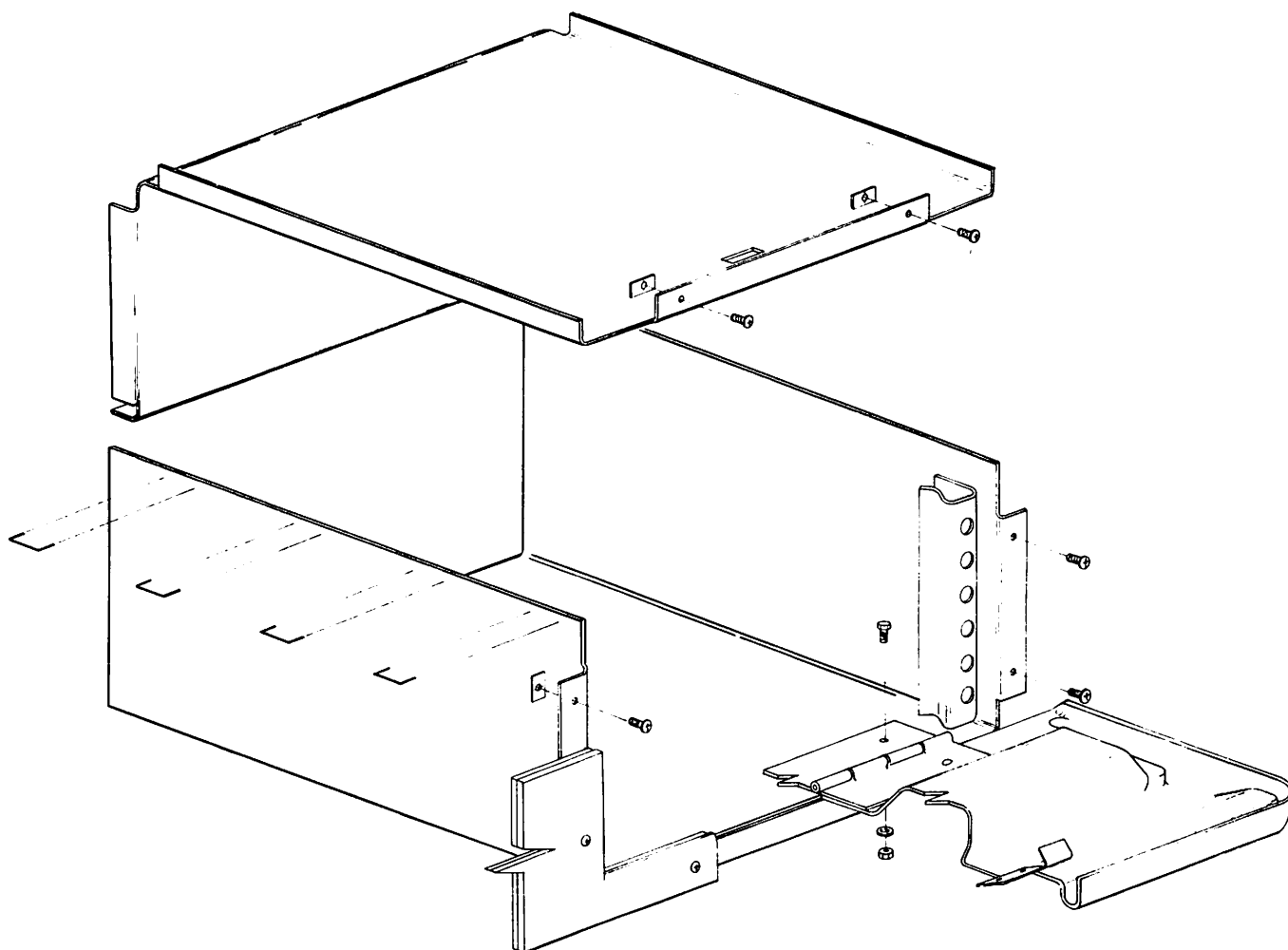
2. Glove Box

The glove box is located on the right hand side of the instrument panel and contains a fuseholder assembly. (See Figure 2.)



**Glareshield and Deck Assemblies
Figure 1**

GRUMMAN AMERICAN AVIATION
AA-1 SERIES
MAINTENANCE MANUAL



Glove Box
Figure 2

MISCELLANEOUS FURNISHINGS – MAINTENANCE PRACTICES

1. Glareshield and Deck Assemblies Removal

- A. Remove seven (7) screws securing deck and glareshield assemblies to instrument panel.
- B. Lift deck assembly, disconnect hose from defroster outlet, and remove deck assembly.
- C. Disconnect electrical wires to glareshield lights and remove glareshield.

2. Glareshield and Deck Assemblies Installation

- A. Connect hose to defroster outlet.
- B. Align glareshield into place along top of instrument panel and connect electrical wires to glareshield lights.
- C. Align deck assembly into place along top of instrument panel and install seven screws securing deck and glareshield assemblies to the instrument panel.

3. Glove Box Removal

- A. Open glove box door.
- B. Remove two screws securing door hinge to glove box.
- C. Remove eight screws securing glove box to instrument panel.

4. Glove Box Installation

- A. Install eight screws securing glove box to instrument panel.
- B. Install two screws securing door to glove box.

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FLIGHT CONTROLS – DESCRIPTION/OPERATION

1. General

The flight control system consists of a dual control column of the "T" configuration which operates conventional ailerons and an anti-servo elevator, dual rudder pedals which operate the rudder, and motor-driven flaps, actuated by a switch on the center console. The elevator trim tab is operated by a trim wheel located on the center console.

A. Lateral Control System

The lateral control system consists of torque-tube actuated ailerons positioned by cables extending from the control column. As either control wheel is turned, the linkage to which it is coupled actuates a bellcrank to which the aileron control cables are attached. A fixed trim tab is located on the trailing edge of each aileron.

B. Directional Control System

The directional control system consists of a conventional rudder actuated by control cables extending from the rudder pedal linkage. A fixed trim tab is located on the trailing edge of the rudder.

C. Longitudinal Control System

The longitudinal control system consists of an anti-servo elevator actuated by control cables extending from the control column. Longitudinal trim is provided by a hinged trim tab mounted on the trailing edge of the elevator. The trim tab is actuated by a linkage that is adjusted by the trim wheel mounted on the console.

D. Flap System

The flap system consists of two wing flaps, one of which is located on the inboard end of each wing, and an electrically-operated flap drive mechanism. The flaps are actuated by torque tubes extending into the fuselage. Linkages transmit the linear motion of the actuator to the torque tubes.

E. Gust Lock

The gust lock consists of a metal pin that can be inserted through a hole in the control column to secure the ailerons and elevators against wind damage. The gust lock is designed to cover the master switch and magneto switch when properly installed.

F. Stall Warning System

The stall warning system consists of a stall detector switch in the leading edge of the right wing, a delay circuit, and a stall warning horn located on the left wall of the forward fuselage.

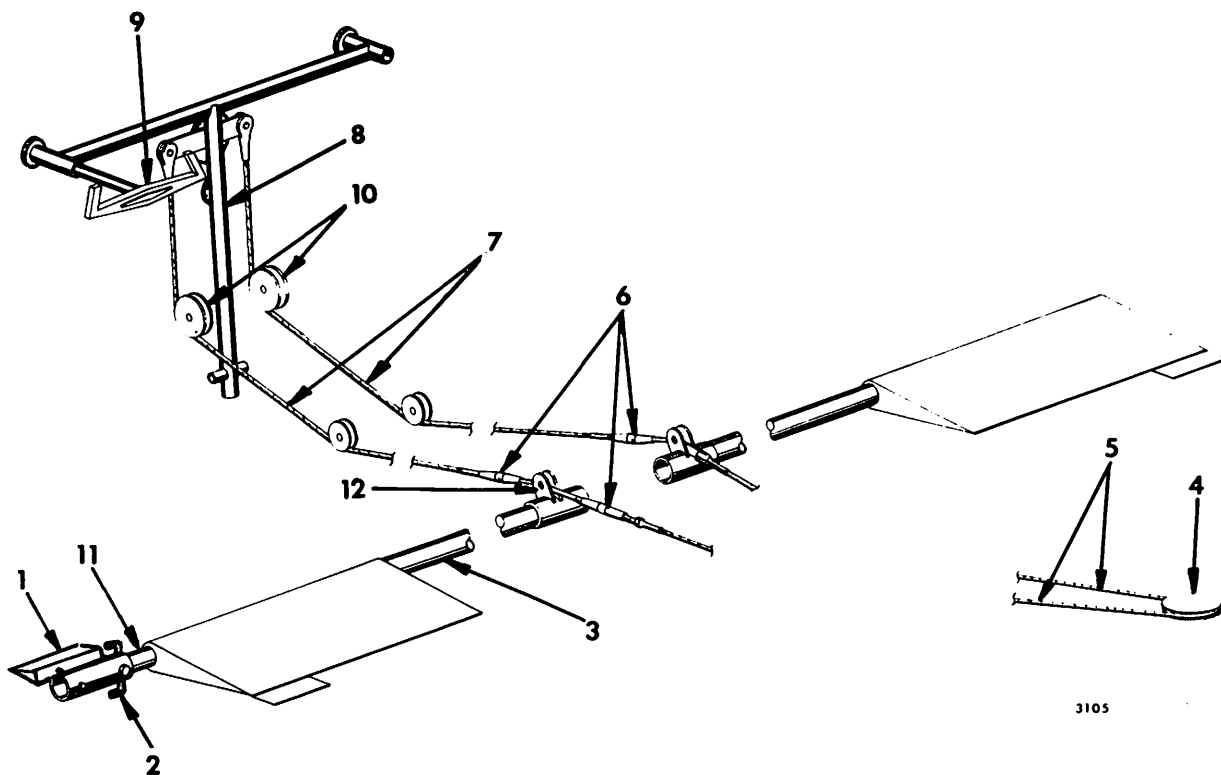
2. Control Rigging

All aircraft are rigged at the factory so that they will be slightly heavy at the left wing during solo flight. This results in a slight heaviness in the right wing with two people. The condition can be altered to suit individual preference by adjusting the trim tabs on the outboard trailing edge of the ailerons. Do not exceed 45° on either tab, as it will not contribute any more toward trim.

AILERON & TAB – DESCRIPTION/OPERATION1. General (See Figure 1.)

As the control wheel is rotated, its angular displacement is transmitted through a mechanical linkage on the control column to the bellcrank. Control cables attached to the bellcrank are routed through idler pulleys to the control horns attached to the aileron torque tubes. The control horns rotate the torque tubes and position the aileron control surfaces in direct proportion to the control wheel displacement. A carry-through cable, attached to the control horns, extends to the carry-through pulley in the aft fuselage. The carry-through cable provides completion of the aileron control loop and one aileron moves up as the other aileron moves down.

The ailerons are mounted on bearings that fit over the torque tube at each end of the control surface. The ailerons are composed of a torque tube and honeycomb ribs covered with an aluminum skin. The aileron counterweight and control stop are mounted on the outboard end of the torque tube. This type of structure allows rotational movement applied to the torque tube in the cabin to position the control surface. Ground-adjustable trim tabs are attached to the trailing edge of each aileron at the outboard end.



3105

- | | |
|-------------------------|--------------------------|
| 1. Counterweight | 7. Aileron Cable |
| 2. Aileron Stop | 8. Control Column |
| 3. Torque Tube | 9. Control Wheel |
| 4. Carry-Through Pulley | 10. Idler Pulley |
| 5. Carry-Through Cable | 11. Outboard Hinge Point |
| 6. Turnbuckle | 12. Horn Assembly |

Aileron Control System
Figure 1

AILERON & TAB – MAINTENANCE PRACTICES1. Aileron Removal (See Figure 201.)

- A. Remove baggage floor covering and access panels (Chapter 25) as required to gain access to the aileron control horns.

NOTE: Aileron can be removed without disturbing rigging if control horn is removed from aileron as indicated below. Do not disturb turnbuckle settings.

- B. Remove nut (1) and washer (2) from bolt (3) that secures control horn (4) to torque tube. Remove horn from torque tube by rotating and removing from end of torque tube.
- C. Remove wing tip (Chapter 57).
- D. Remove nuts (5), washers (6), and bolts (7) from wing and remove control stop (8) and bearing support assembly (9) from wing. Note position and number of shims (13) for installation.

CAUTION: MAINTAIN ALIGNMENT OF AILERON AND TORQUE TUBE WITH TRAILING EDGE OF WING DURING REMOVAL AND INSTALLATION. ANY SIDE PRESSURE APPLIED MAY DAMAGE OR MISALIGN FLAP.

- E. Pull aileron outboard until torque tube clears inboard hinge.

2. Aileron Installation (See Figure 201.)

CAUTION: MAINTAIN ALIGNMENT OF AILERON AND TORQUE TUBE WITH TRAILING EDGE OF WING DURING REMOVAL AND INSTALLATION. ANY SIDE PRESSURE APPLIED MAY DAMAGE OR MISALIGN FLAP.

NOTE: When installing the aileron, the torque tube may catch on the ribs in the flap as the tube is pushed through. A guide such as the one shown in Figure 202 may be helpful.

- A. Slide aileron torque tube (11) through the flap until it extends into the fuselage.
- B. Position torque tube in control horn (4) so that the holes align.
- C. Position bearing support assembly (9) and control stop (8) so that their mounting holes align with those in the wing. Install shims (13).

NOTE: Shim bearings as required to obtain .020 to .060 inch end play.

- D. Secure with bolts (7), washers (6) and nuts (5). Torque to standard value. (See Chapter 91.)
- E. Secure with bolt (3), washers (2) and nut (1).
- F. Rig aileron controls as described in Paragraph 7 below.
- G. Install wing tip as described in Chapter 57.
- H. Install access panels and baggage floor covering (Chapter 25).

3. Bearing and Torque Tube Wear Limits

- A. Bearings

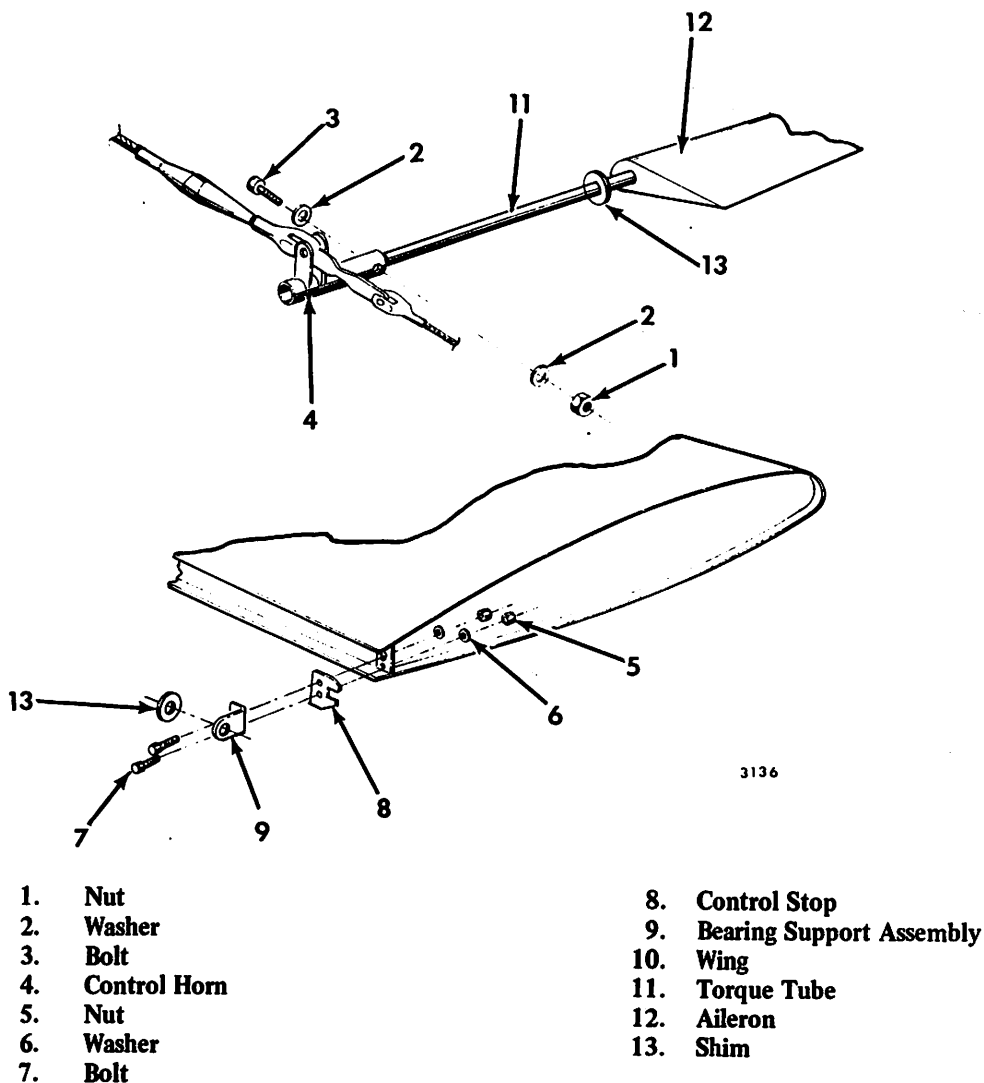
The maximum wear limit for the bearing is as follows:

Minimum radial wall thickness — .030 inch

Any bearings that have been worn to the above limit must be replaced. Any bearings with a cracked or separated flange must be replaced.

B. Torque Tube

Maximum control surface torque tube wear is .030 inch wall thickness reduction. Wear greater than this requires replacement of the control surface. Service Kit No. SK-121, Control Surface Torque Tube Repair Kit, is available from the Grumman American Supply Operations Department for worn torque tubes that have not exceeded the maximum wear limits.



Aileron Removal/Installation
Figure 201

4. Bearing Replacement (See Figure 203.)

A. Remove aileron as described in Paragraph 1. above.

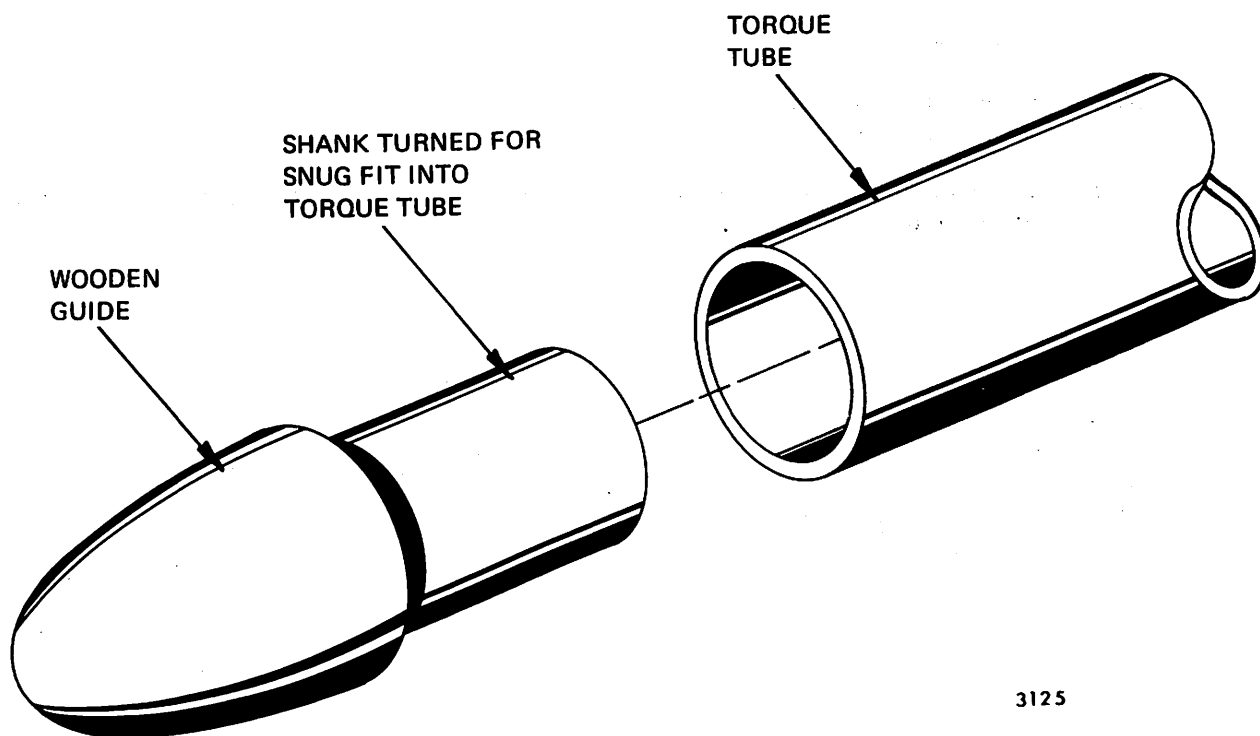
- B. Collapse bearing as shown in Figure 203 and remove from bearing support.

CAUTION: DO NOT ATTEMPT TO COLLAPSE A NEW BEARING IF AMBIENT TEMPERATURE IS BELOW 70°. BEARING MATERIAL BECOMES STIFF AND MAY BREAK IF IT IS COLLAPSED WHILE COLD. BEARING INSTALLATION CAN BE FURTHER FACILITATED BY WARMING THE BEARING TO BODY TEMPERATURE.

- C. Collapse new bearing and install it in bearing support as shown in Figure 203.

NOTE: New bearings should be sized to prevent control stiffness.

- D. Use aileron and flap bearing sizing tool, 1-1/8 in. I.D. to seat bearing. Once inserted in the support bracket, the bearing I.D. should be rounded out or "sized" by inserting the correct bearing sizing tool and rolling the new bearing into proper position.
- E. Install aileron as described in Paragraph 2. above.



3125

Torque Tube Guide
Figure 202

5. Aileron Control Cable Replacement (See Figure 204.)

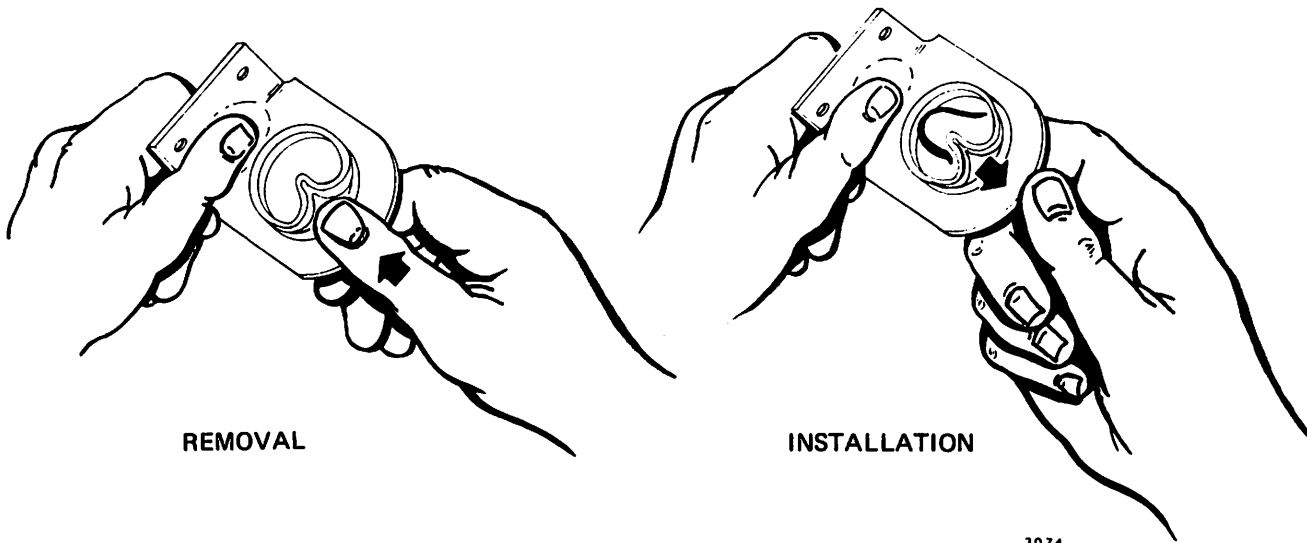
A. Control Cable Removal

- (1) Remove baggage floor covering and access covers as required to gain access to the aileron control horns.
- (2) Remove center console (Chapter 25). Adjust turnbuckles (23) as required to relieve tension on cables.
- (3) Remove cotter pin (1), nut (2), washer (3), and bolt (4) from cable clevis end (5), and remove control cable (12) from bellcrank (6).
- (4) Remove nuts (7), washers (8), and bolts (9).
- (5) Remove guards (10) and pulleys (11) to clear cables (12).
- (6) Remove nuts (13) and washers (14) and lift control pulley assembly (15) to clear control cables (12).
- (7) Pull control cables (12) from beneath control pulley assembly (15).
- (8) Remove cotter pin (16), nut (17), washer (18), and bolt (19).
- (9) Remove clevis (20) from control horn (21). Remove link (22).

B. Control Cable Installation (See Figure 204.)

NOTE: If new cables are being installed, lubricate pulley contact area of cables with commercial grade paraffin before installation.

- (1) Position clevis (20) and link (22) in control horn (21) and secure with bolt (19), washer (18), nut (17), and cotter pin (16).



Aileron Bearing Removal/Installation
Figure 203

WARNING: **MAKE SURE CABLES ARE ROUTED THROUGH PROPER PULLEYS. SEE FIGURE 204.**

- (2) Route control cables (12) under spar center section and under outboard pulleys of control pulley assembly (15).
- (3) Secure control pulley assembly (15) with washers (14) and nuts (13).
- (4) Position clevis end (5) into bellcrank (6) and secure with bolt (4), washer (3), nut (2), and cotter pin (1).
- (5) Rig aileron controls as described in Paragraph 7. below.
- (6) Install access covers. Pull floor covering into place and secure with fasteners.
- (7) Install center console (Chapter 25).

C. Carry-Through Cable Removal (See Figure 205.)

- (1) Remove baggage floor covering and access panels (Chapter 25) as required to provide access to the aileron control horns.
- (2) Remove screws and emergency locator transmitter access panels (Chapter 53).
- (3) Adjust turnbuckles (23) to relieve cable tension.
- (4) Remove cotter pin (1), nut (2), washer (3), and bolt (4) from link (5). Remove clevis (6) from link (5).
- (5) Remove cotter pin (7), nut (8), washer (9), and bolt (10) from clevis (11), and remove eye end (12) from horn (13).
- (6) Remove nut (17), washer (18), and bolt (19) from bracket (16) and remove guard (20) and pulley (21) from bracket (16).
- (7) Attach a cord or wire to cable end under baggage floor. Pull cable (22) out through emergency locator transmitter access panel, simultaneously pulling the cord or wire through. Disconnect cord or wire and leave in position for installation.

D. Carry-Through Cable Installation (See Figure 205.)

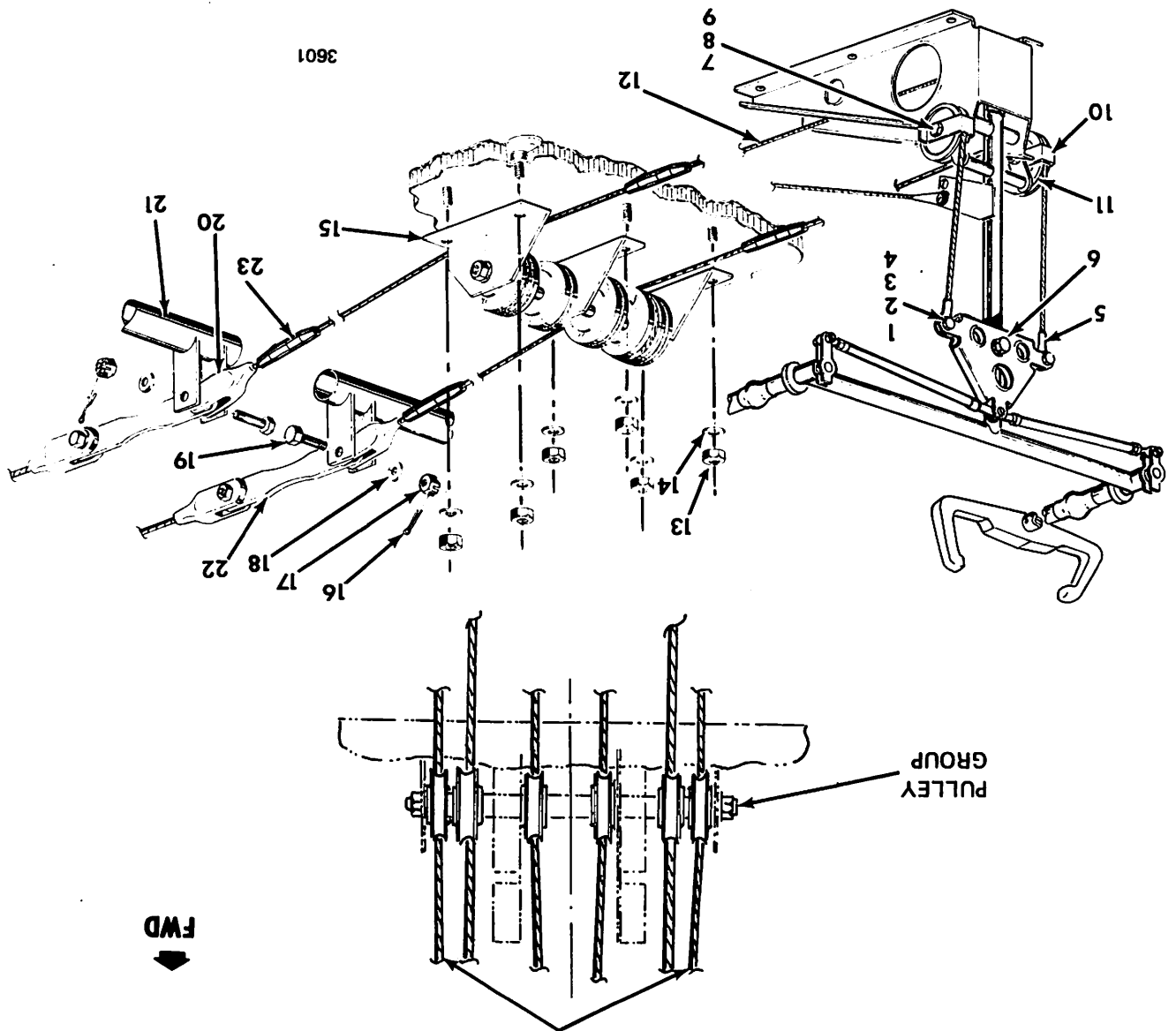
NOTE: If new cables are being installed, lubricate pulley contact area of cable with commercial grade paraffin before installation.

- (1) Place carry-through cable (22) on pulley (21) and insert pulley into bracket (16).
- (2) Install guard (20), bolt (19), washer (18), and nut (17). Torque to standard value per Chapter 91.
- (3) Attach cord or wire to free ends of cable (22). Pull cable ends into position under baggage floor. Remove wire or cable.
- (4) Route cable (22) to horns (13).
- (5) On the right-hand side of the aircraft, place clevis (6) over link (5) and secure with bolt (4), washer (3), nut (2), and cotter pin (1).
- (6) On the left-hand side of the aircraft, place eye end (12) inside clevis (11) and place clevis (11) in control horn (13) so that holes align. Secure with bolt (10), washer (9), nut (8), and cotter pin (7).

FWD
↓

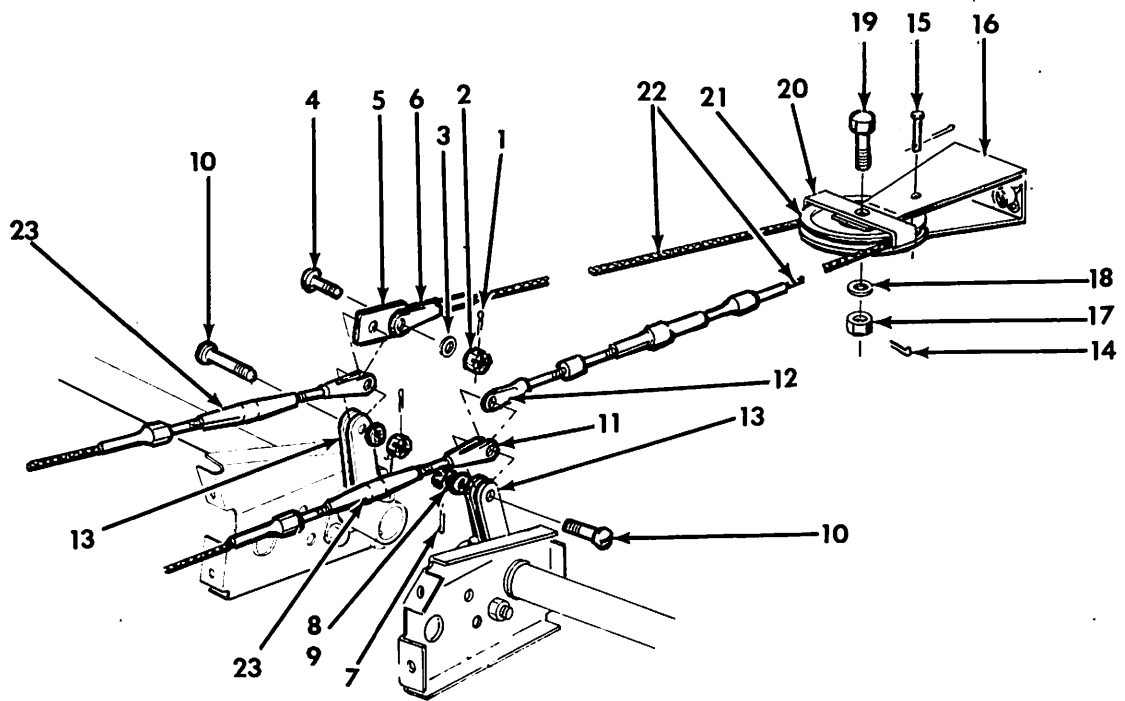
AILERON CABLES

PULLEY GROUP



- | | | | |
|-----|---------------|-----|-------------------------|
| 1. | Cotter Pin | 13. | Nut |
| 2. | Nut | 14. | Washer |
| 3. | Washer | 15. | Control Pulley Assembly |
| 4. | Bolt | 16. | Cotter Pin |
| 5. | Clevis End | 17. | Nut |
| 6. | Bellcrank | 18. | Washer |
| 7. | Nut | 19. | Bolt |
| 8. | Washer | 20. | Clevis |
| 9. | Bolt | 21. | Control Horn |
| 10. | Guard | 22. | Link |
| 11. | Pulley | 23. | Turnbuckles |
| 12. | Control Cable | | |

Aileron Cable Removal/Installation
Figure 204



1. Cotter Pin
2. Nut
3. Washer
4. Bolt
5. Link
6. Clevis
7. Cotter Pin
8. Nut
9. Washer
10. Bolt
11. Clevis
12. Eye End

13. Horn
14. Cotter Pin
15. Guard
16. Bracket
17. Nut
18. Washer
19. Bolt
20. Guard
21. Pulley
22. Cable
23. Turnbuckles

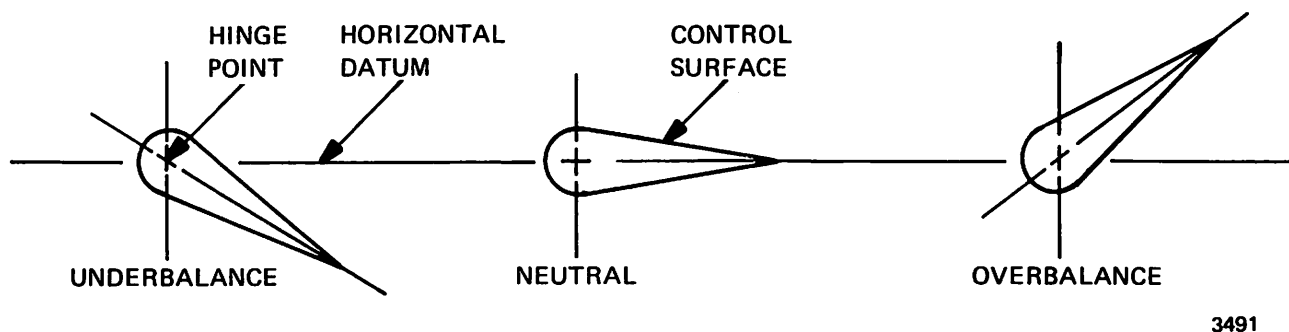
**Carry-Through Cable Removal/Installation
Figure 205**

- (7) Install emergency locator transmitter access panel per Chapter 53.
- (8) Rig aileron controls per Paragraph 7. below.
- (9) Install access panels and baggage floor covering (Chapter 25).

6. Aileron Balancing

A. Definitions (See Figure 206.)

- (1) Underbalance shall be defined as the condition that exists when the control surface in question is trailing-edge heavy, and shall be symbolized by the plus (+) sign.



Control Surface Static Balance
Figure 206

- (2) Neutral static balance shall be defined as the condition that exists when the chord line of the control surface in question is horizontal when the surface is balanced.
- (3) Overbalance shall be defined as the condition that exists when the control surface in question is leading-edge heavy and shall be symbolized by the minus (-) sign.

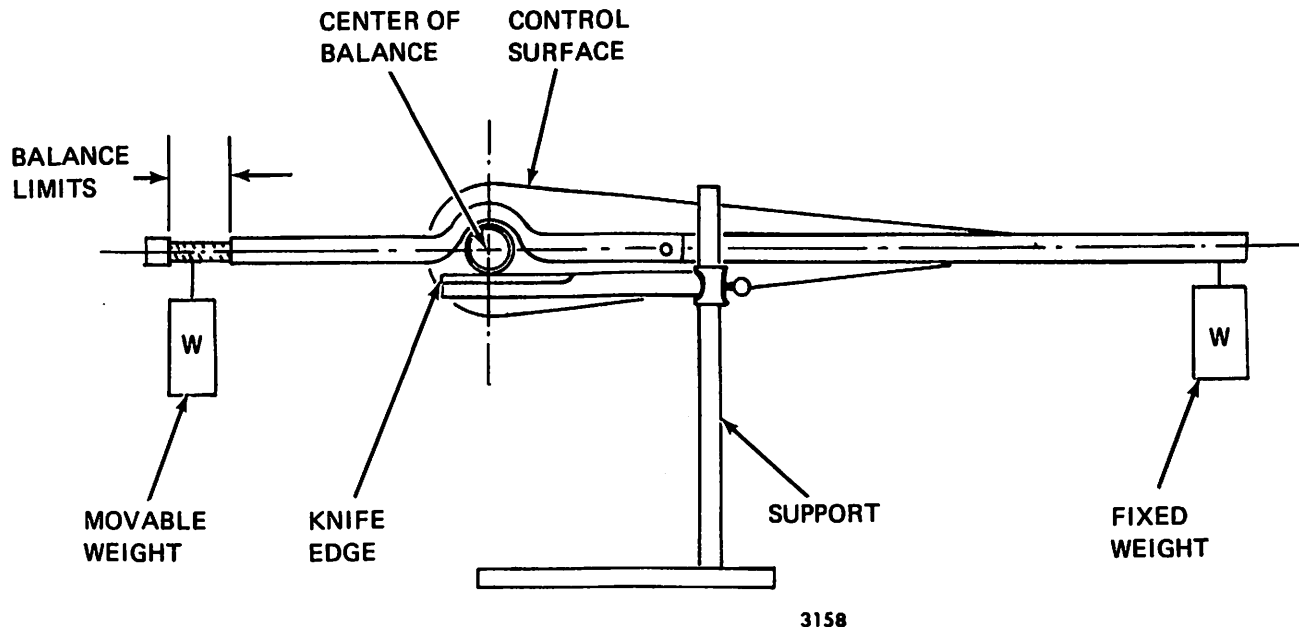
NOTE: This information is furnished for facilitating the balancing of movable control surfaces.

B. Aileron Tolerance, (after painting) -16 to +20 in. oz.

C. Balancing Device

This balancing device can be constructed in any manner as long as it meets the following requirements:

- (1) The balancing device must hold the control surface so that its torque tube is horizontal and level.
- (2) The device must balance perfectly about a point within itself (Figure 207), which will lie in a vertical line through the hinge line of the control surface when it is engaged with the surface balancing. The balancing of the device must be accomplished before attachment to the control surface.
- (3) The arm of the fixture that is to hold the balance weight shall have its upper edge horizontal when the control surface is in a balanced condition.
- (4) A means should be established for determining when the balance arm is horizontal during the balancing operation.
- (5) A balance weight can be of any weight. However, the most practical size would be one whose weight would require a balance arm of from 6 to 16 in. to properly balance the control surface. Refer to examples on Figure 207.
- (6) The balancing device should have a means of denoting the limits within which the balance can be moved to balance the control surface and remain within the tolerance prescribed for the control surface.



Control Surface Balancing Device
Figure 207

D. Balancing Procedures (See Figure 208.)

- (1) Place aileron on balancing device.
- (2) Place a spirit level on the torque tube and level aileron to center level.
- (3) Attach leveling arm to aileron.
- (4) Place spirit level on leveling arm.
- (5) Adjust movable weight to center bubble in level.
- (6) Make sure movable weight is positioned within balance limits.
- (7) If aileron is overbalanced, remove weight from weight assembly by drilling holes in the lead weight until the aileron balances.
- (8) If the aileron is underbalanced, the balance weight assembly must be replaced. New balance weight assemblies are designed to provide a slight overbalance to allow balancing by removal of weight.

7. Aileron Control System Rigging (See Figure 209.)

Aileron rigging should be performed at an ambient temperature that is average for the area in which the aircraft is usually operated. If rigging must be done with the ambient temperature above or below normal, it is recommended that cable tension be measured and adjusted as necessary when temperature returns to normal.

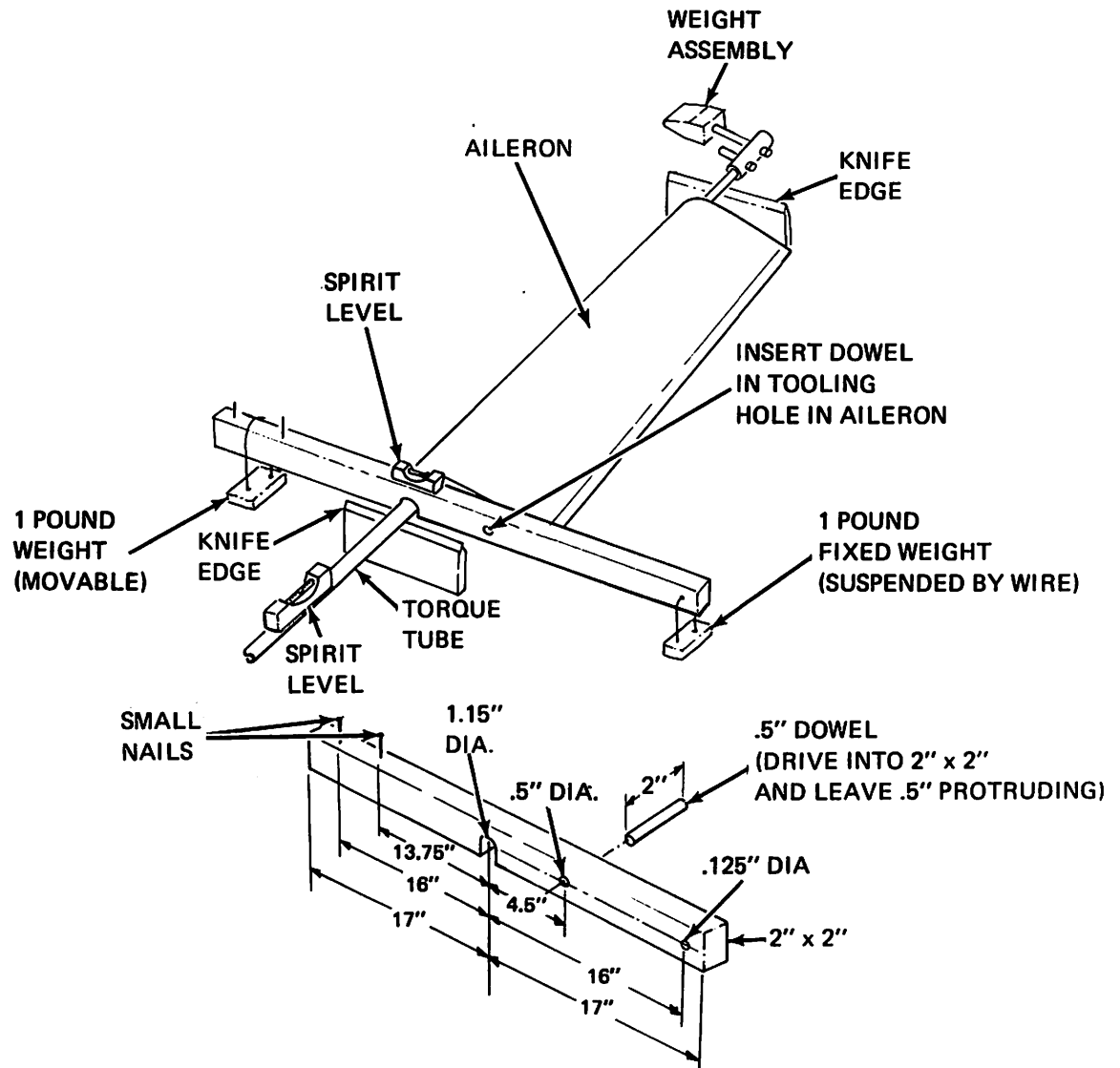
- A. Install control wheel lock in the control wheel shaft. Remove baggage floor covering and access panels as required to gain access to aileron control horns and turnbuckles.**

NOTE: If aileron rigging is being performed after aileron cable replacement, it is recommended that initial cable tension be adjusted with the turnbuckle of the replacement cable.

- B. Adjust tension of cables to 25 ± 5 lb.**
- C. Place aileron rigging fixture on the right wing as shown in Figure 209.**
- D. Adjust turnbuckles at right aileron horn as required to position trailing edge of right aileron at 0° on the rigging fixture.**
- E. Place aileron rigging fixture on left wing as shown in Figure 209.**
- F. Adjust turnbuckles at left aileron horn as required to position trailing edge of left aileron at 0° on rigging fixture.**

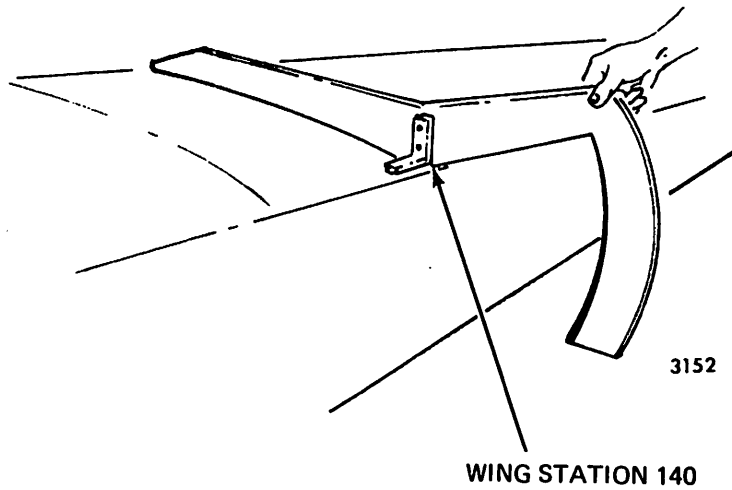
NOTE: Adjust cable tension by alternately tightening or loosening turnbuckles on either side of aileron horns to avoid disturbing rigging.

- G. Measure cable tension and adjust as necessary to obtain 25 ± 5 lb. Make sure both ailerons are still positioned at 0° .**



**Typical Balancing Device
Figure 208**

- H. Install new locking clips on turnbuckles.
- I. Install access panels and baggage floor covering. Remove control wheel lock.
- J. With aileron rigging fixture installed, turn control wheel through full travel in both directions, noting reading at both extremes of travel. Repeat procedure with aileron rigging fixture installed on other wing.
- K. Aileron travel limits are $25 \pm 2^\circ$ up, $20 \pm 2^\circ$ down. If aileron travel is not within tolerances, remove wing tips (Chapter 57) and inspect for damaged or worn aileron stops. Replace aileron stops if required.
- L. Install wing tips in accordance with Chapter 57.



Aileron Rigging Fixture Wing Station 140
Figure 209

8. Cleaning and Painting

CAUTION: PAINTING ANY CONTROL SURFACE MAY CAUSE AN UNDERBALANCED CONDITION. CHECK AILERON BALANCE AFTER PAINTING.

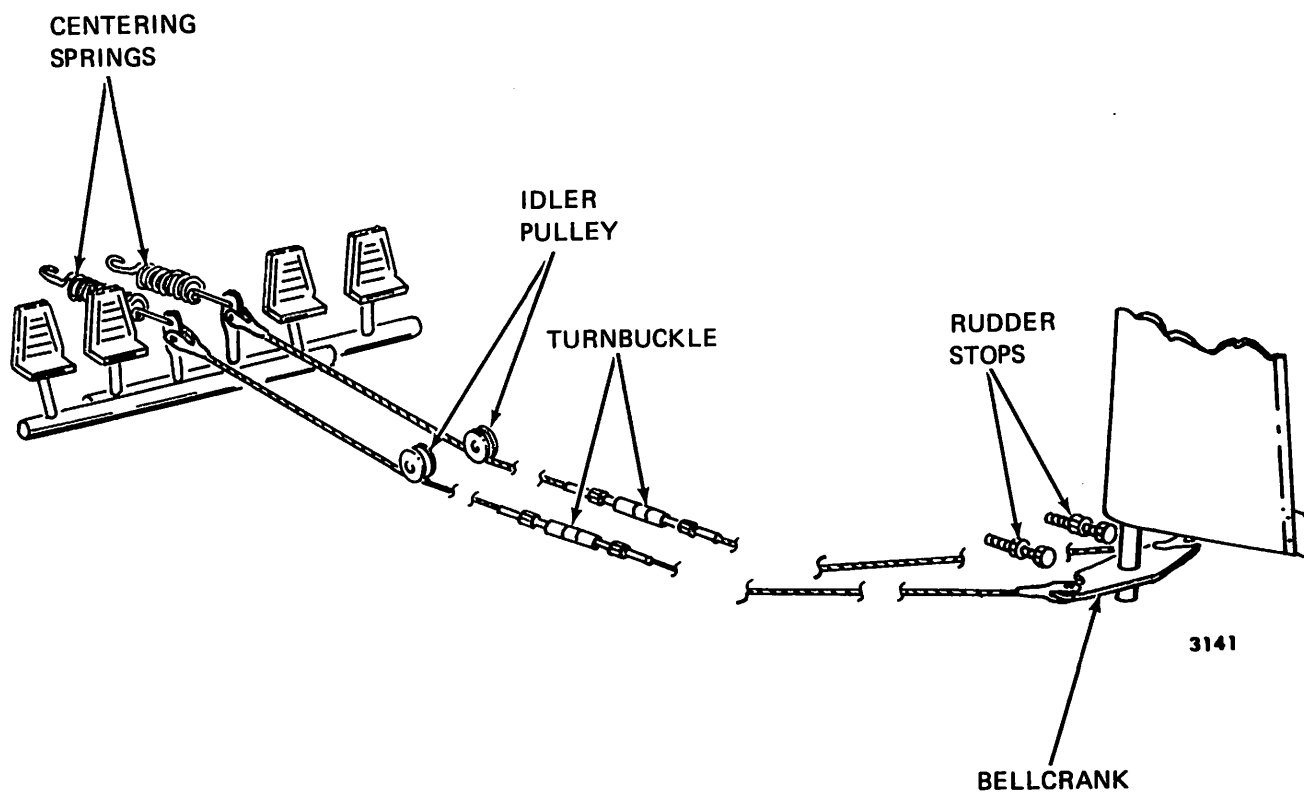
Refer to Chapter 20 for cleaning and painting instructions.

RUDDER & TAB – DESCRIPTION/OPERATION

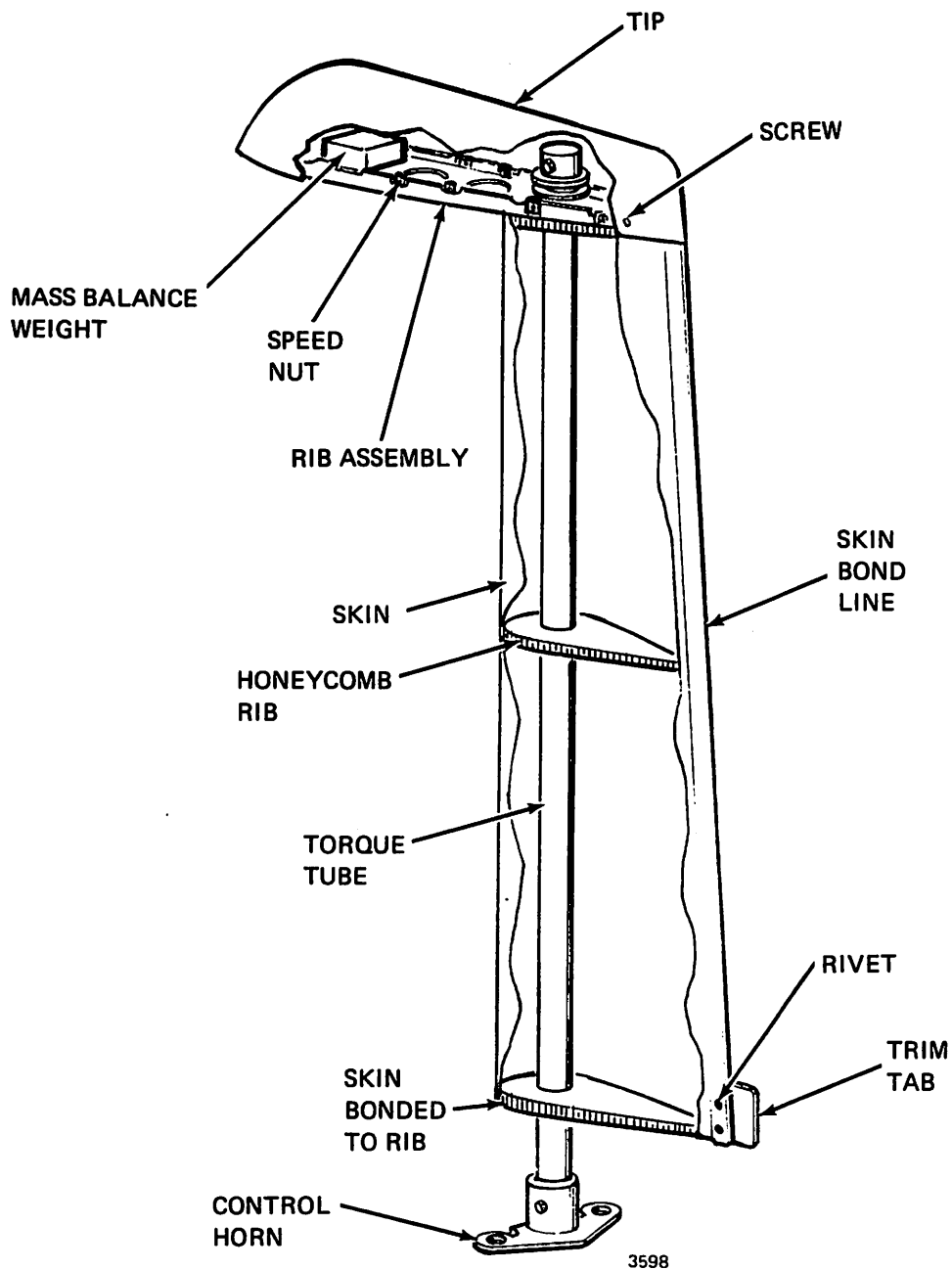
1. General (See Figure 1.)

The rudder system is composed of dual rudder pedals, centering springs, cables which extend from the rudder pedals to the rudder, and a rudder actuated by a bellcrank attached to the cables. Adjustable rudder stops are provided to limit rudder travel to that required for proper control.

The rudder control surface (Figure 2) is a bonded structure composed of a torque tube, three honeycomb ribs, a skin and a tip. The ribs are bonded to both the torque tube and the skin to form a rigid structure that can be positioned by the torque tube. A fixed, ground-adjustable trim tab is riveted to the lower trailing edge of the rudder. The rudder is supported by two bearings, one at the base of the rudder, and the other between the top honeycomb rib and the tip. The rudder tip is supported by a rib assembly that is attached to the torque tube and the top honeycomb rib. This rib assembly provides a mounting point for the rudder mass balance. The plastic rudder tip is attached to the rib by speed nuts and screws. The control horn is attached to the rudder torque tube beneath the bottom hinge.



Rudder System
Figure 1



**Rudder Assembly
Figure 2**

RUDDER & TAB – MAINTENANCE PRACTICES

1. Rudder Removal (See Figure 201.)

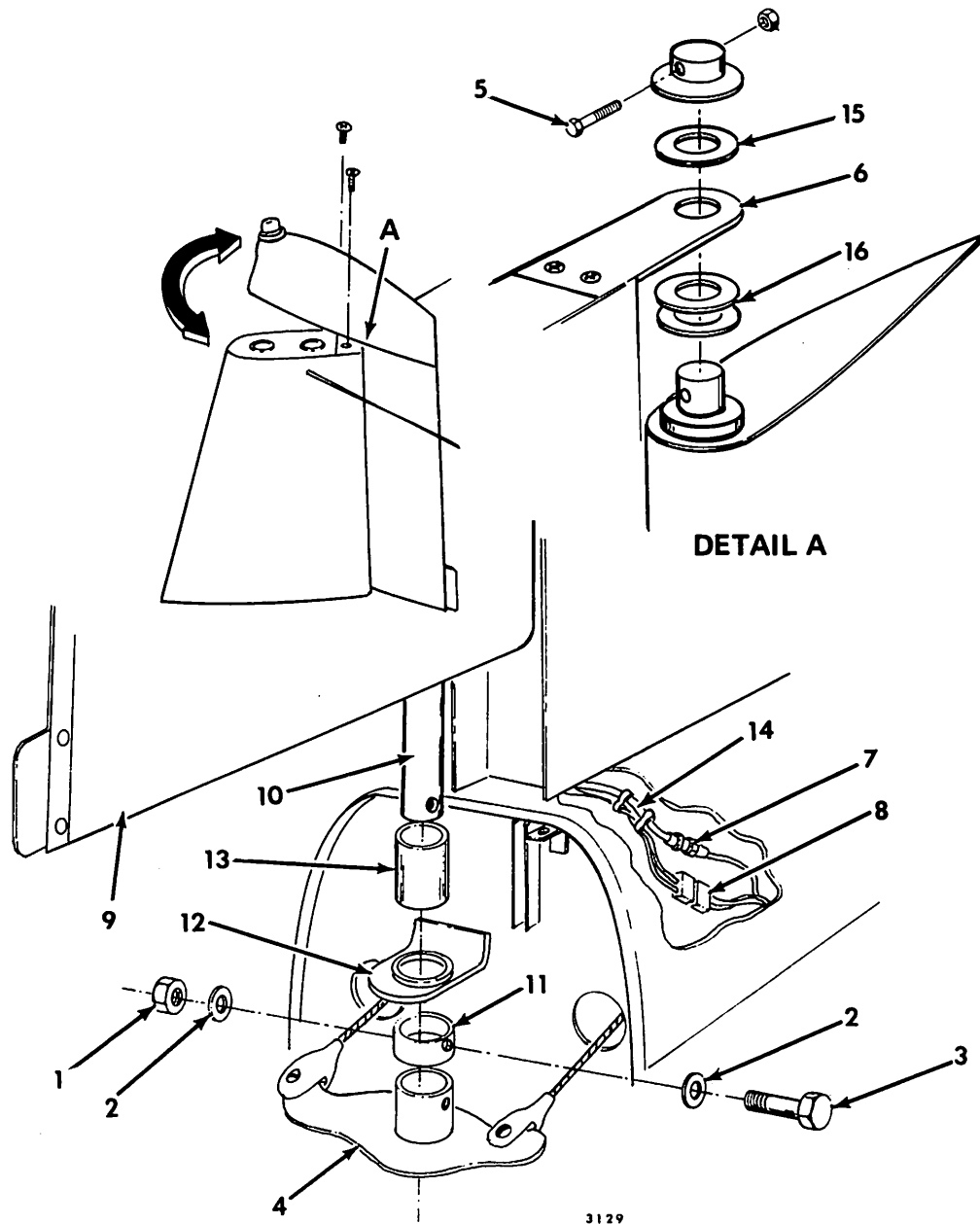
- A. Remove tailcone per Chapter 53.
- B. Remove ELT access panel per Chapter 53.
- C. Remove nut (1), washers (2), and bolt (3) from bellcrank (4).

CAUTION: PROVIDE A MEANS OF SUPPORT FOR SUPPORTING RUDDER (9) IN A VERTICAL POSITION WHEN REMOVING SCREWS (5).

- D. Hold rudder deflected and remove screw (5) from top bearing assembly (6).
- E. Hold rudder deflected in the opposite direction and remove the other screw (5) from top bearing assembly (6).
- F. Disconnect BNC connector (7) by twisting counterclockwise and pulling apart.
- G. Disconnect electrical connector (8) by pulling apart.
- H. Lift rudder (9) until its torque tube (10) clears bottom spacer (11), bellcrank (4), and bottom bearing assembly (12).
- I. Remove top spacer (13) from torque tube (10).
- J. Slowly remove rudder (9) while feeding wire bundle (14) through the vertical fin until it is clear.
- K. Note position and number of shims (16) and spacers (15) for installation.

2. Rudder Installation (See Figure 201.)

- A. Install spacer (13) on torque tube (10) and install torque tube into bottom bearing assembly (12).
- B. Position rudder right or left and feed wire bundle (14) through vertical fin and into fuselage.
- C. Install top bearing assembly (6) into proper position and secure with screws (5).
- D. Measure clearance between rudder tip and vertical fin. If clearance is less than .10 inch, add spacers (15) as required to obtain a minimum .10 inch.
- E. Install bottom spacer (11) and bellcrank (4). Secure with bolt (3) washers (2) and nut (1).
- F. Measure rudder end play. If end play exceeds .030 inch, remove rudder and add shims (16) as required.
- G. Install BNC connector (7) and electrical connector (8).
- H. Check flashing beacon and any radio equipment for proper operation.
- I. Check rudder for proper rigging. Rig as required per Paragraph 11 below.
- J. Install tailcone and ELT access panels per Chapter 53.



- | | |
|-------------------------|-----------------------------|
| 1. Nut | 9. Rudder |
| 2. Washer | 10. Torque Tube |
| 3. Bolt | 11. Bottom Spacer |
| 4. Bellcrank | 12. Bottom Bearing Assembly |
| 5. Screw | 13. Top Spacer |
| 6. Top Bearing Assembly | 14. Wire Bundle |
| 7. BNC Connector | 15. Spacer |
| 8. Electrical Connector | 16. Shim |

**Rudder Removal/Installation
Figure 201**

3. Rudder Bar Assembly Removal (See Figure 202.)

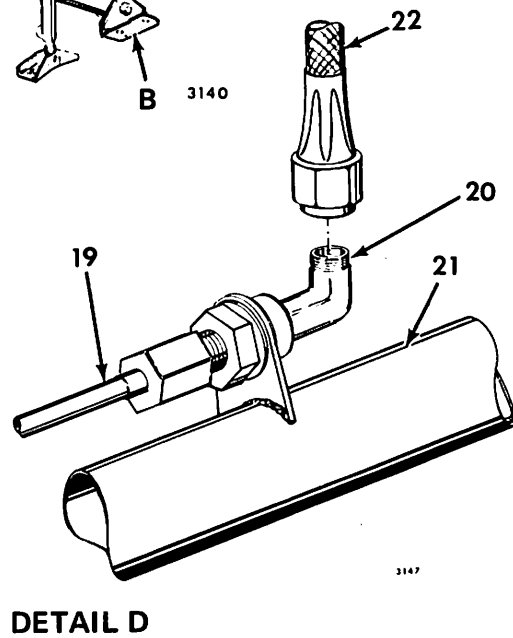
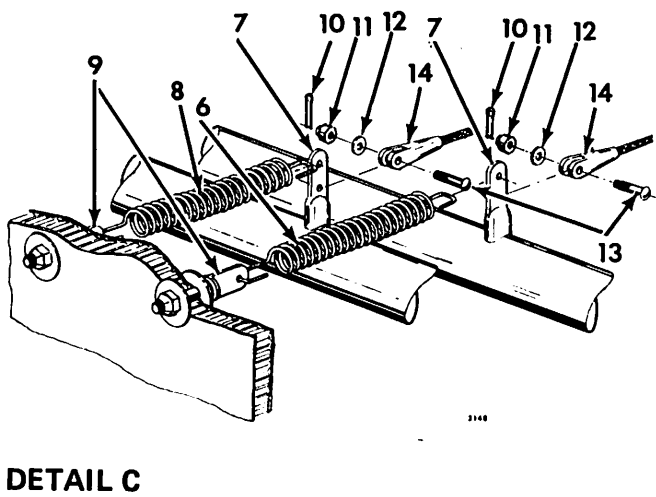
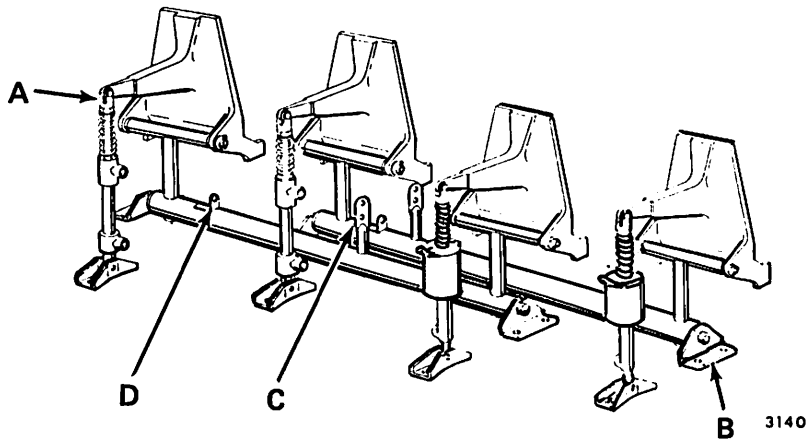
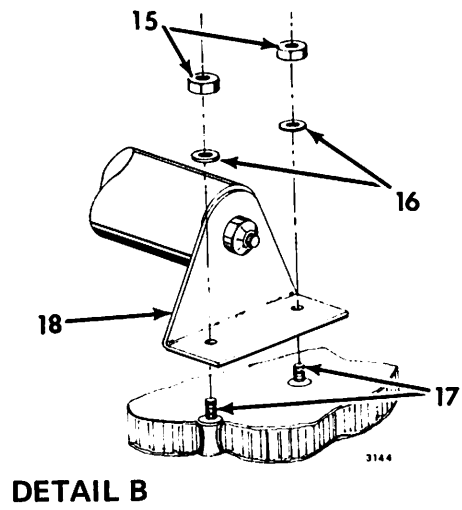
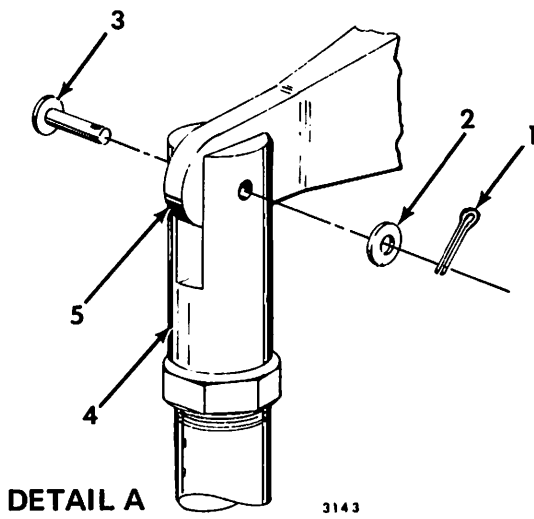
- A. Remove cotter pin (1), washer (2), and clevis pin (3) from brake cylinder clevis (4), and remove rudder pedal link (5) from brake cylinder clevis (4).
- B. Depress left rudder pedal and disconnect left return spring (6) from control horn (7). Slowly release left rudder pedal.
- C. Disconnect right return spring (8) from control horn (7).
- D. Remove return springs (6) and (8) from eye bolts (9).
- E. Remove cotter pins (10), nuts (11), and washers (12) from clevis bolts (13), and remove cables (14) from control horns (7).
- F. Disconnect brake lines (19) from elbow (20) on rudder bar assembly (21) and disconnect flexible lines (22). Cap all open lines.
- G. At left-hand side, remove nuts (15) and washers (16) from mounting studs (17), and lift bearing assembly (18) from studs (17).
- H. Pull the rudder bar assemblies (21) laterally until they clear the bearings (18) on the right side, and remove the rudder bar assemblies (21).

4. Rudder Bar Assembly Installation (See Figure 202.)

- A. Position the rudder bar assemblies (21) so that their open ends slide over the bearings on the right side of the aircraft.
- B. Place the bearing assemblies (18) on the left ends of the rudder bar assemblies (21) and fit over the mounting studs (17) in the floor of the aircraft. Secure with washers (16) and nuts (15), and torque to standard value. (See Chapter 91.)
- C. Connect hydraulic lines (19) and flexible lines (22) to elbow fittings (20) and torque to standard value. (See Chapter 91.)
- D. Position clevis of rudder cable (14) over control horn (7) and secure with clevis bolts (13), washers (12), nuts (11), and cotter pins (10).
- E. Hook return springs (6) and (8) into eye bolts (9).
- F. Depress left rudder pedal and hook left return spring (6) into control horn (7).
- G. Depress right rudder and connect right return spring (8) to control horn (7).
- H. Place rudder pedal brake link (5) in slot in top of brake (4). Secure with clevis pin (3), washer (2), and cotter pin (1).
- I. Bleed brakes per Chapter 32.
- J. Rig rudder controls per Paragraph 11 below.

5. Rudder Cable Removal (See Figure 203.)

- A. Remove tailcone and ELT access panels per Chapter 53. Remove center console per Chapter 25.
- B. Attach a cord or wire to each cable clevis (5) to facilitate installation. Remove cotter pins (1), nuts (2), washers (3), and clevis bolts (4) from cable clevises (5).



**Rudder Pedal Removal/Installation (Sheet 1 of 2)
Figure 202**

- | | |
|--------------------------|-------------------------|
| 1. Cotter Pin | 12. Washer |
| 2. Washer | 13. Clevis Bolt |
| 3. Clevis Pin | 14. Rudder Cable |
| 4. Brake Cylinder Clevis | 15. Nut |
| 5. Link | 16. Washer |
| 6. Left Return Spring | 17. Mounting Stud |
| 7. Control Horn | 18. Bearing Assembly |
| 8. Right Return Spring | 19. Brake Lines |
| 9. Eye Bolt | 20. Elbow |
| 10. Cotter Pin | 21. Rudder Bar Assembly |
| 11. Nut | 22. Flexible Line |

Rudder Pedal Removal/Installation (Sheet 2 of 2)

Figure 202

- C. Remove cable clevises (5) from rudder bellcrank (6) and allow cables (7) to move forward into fuselage.
- D. Remove nuts (8), and washers (9) from studs (10) in aircraft floor (11) and lift pulley group assembly (12) to clear rudder cable assemblies (7).
- E. Pull rudder cable assemblies (7) from under pulley group assembly (12).
- F. Remove cotter pins (13), nuts (14), washers (15), and clevis bolts (16) from cable clevises (17).
- G. Remove clevises (17) from control horns (18). Pull cables (7) forward until cords or wires attached in Step B above are accessible. Remove cords or wires from cables. Remove cables (7).

6. Rudder Cable Installation (See Figure 203.)

NOTE: If new cables are being installed, lubricate pulley contact area of cables with commercial grade paraffin before installation.

- A. Each rudder cable is composed of a short cable (forward cable) and a long cable (aft cable) joined by a turnbuckle (19). Select the clevis end (5) of the long cable and attach it to the pull cord or wire left in place during removal procedure. Pull the cables (7) into position.
- B. Install clevis ends (5) on rudder bellcrank (6). Secure with bolts (4), washer (3), nuts (2), and cotter pins (1).

WARNING: MAKE SURE CABLES ARE ROUTED THROUGH PROPER PULLEYS. SEE FIGURE 203.

- C. While holding cables in the pulleys, install pulley group assembly (12) over studs (10). Secure with washers (9) and nuts (8). Torque to standard values. (See Chapter 91.)
- D. Place cable clevises (17) over control horns (18), align holes, and secure with clevis bolts (16), washers (15), nuts (14), and cotter pins (13).
- E. Rig rudders per Paragraph 7. below.
- F. Install tailcone and ELT access panels per Chapter 53. Install center console per Chapter 25.

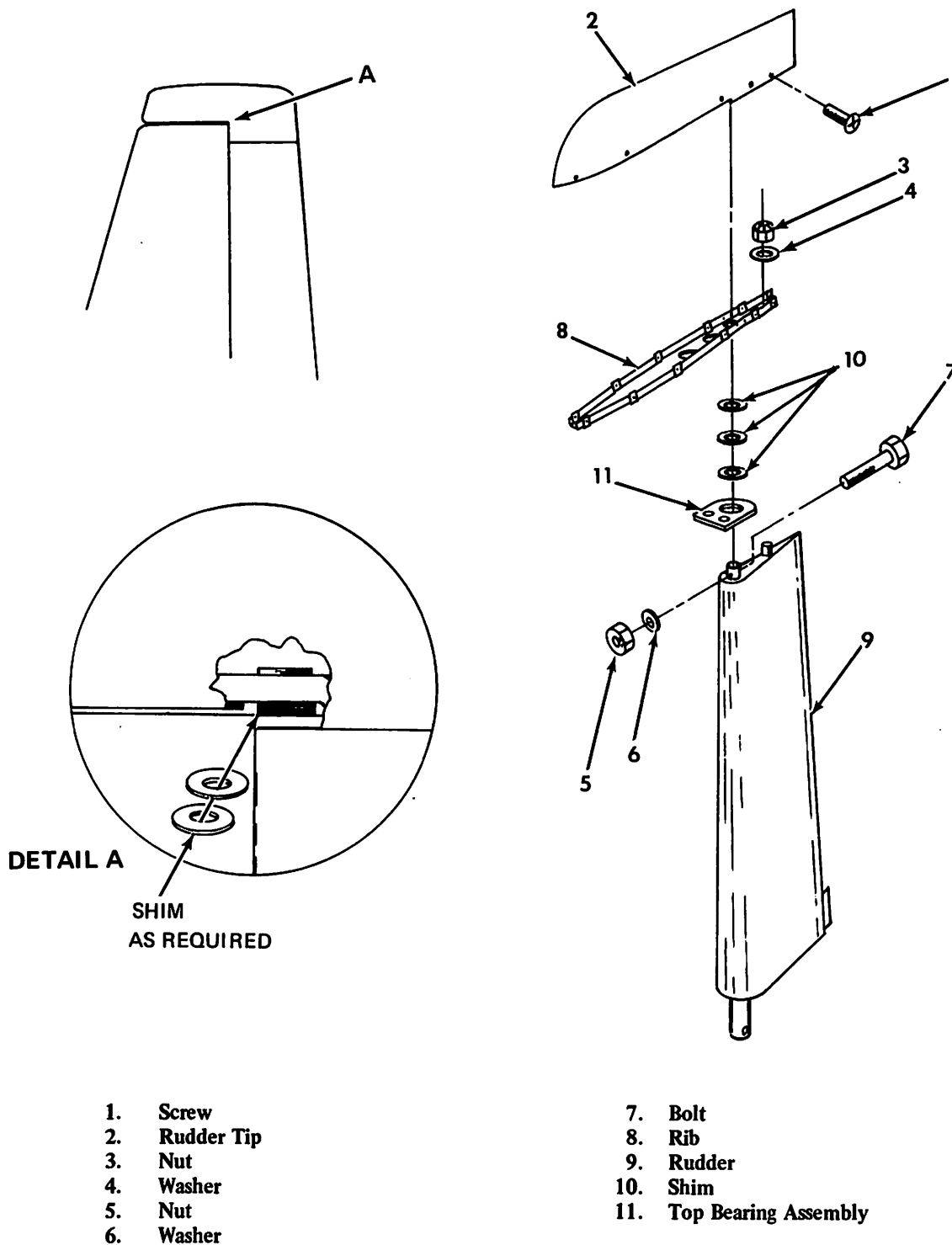
7. Tip-Fin Clearance Adjustment (See Figure 204.)

- A. Inspect rudder for proper clearance (.10 in. minimum) between rudder tip and vertical fin.



- ### Rudder Cable Removal/Installation Figure 203

- B. If insufficient clearance exists, remove rudder per Paragraph 1.**
- C. Remove screws (1, Figure 204) and rudder tip (2).**
- D. Remove nut (3) and washer (4).**
- E. Remove nut (5), washer (6), and bolt (7) from torque tube, and lift rib (8) from rudder (9).**
- F. Place shims (10) on torque tube between hinge (11) and rib (8), to achieve the required clearance.**
- G. Place rib (8) on rudder (9) and secure with washer (4), nut (3), bolt (7), washer (6), and nut (5).**
- H. Place rudder tip (2) on rudder (9) and secure with screws (1).**
- I. Install rudder per Paragraph 2.**



Rudder Tip-Fin Clearance Adjustment
Figure 204

8. Trim Tab Adjustment

The rudder trim tab consists of an adjustable tab riveted to the lower end of the rudder trailing edge. This tab can be bent to provide rudder trim. Bend the tab opposite the direction of rudder correction desired.

NOTE: The aircraft can be rigged to suit individual requirements by adjusting the fixed trim tab on the rudder. Do not exceed 45° as it will not contribute any more toward trim.

9. Rudder Balancing (See Figure 205.)

A. General Information

Refer to Section 27-10-0 for general information and definitions regarding control surface balancing.

B. Control surface tolerance (after painting) -2 to -26 in. oz.

C. Balancing Procedures (See Figure 205.)

- (1) Place rudder on balancing device.
- (2) Place a spirit level on the torque tube and level rudder to center level.
- (3) Attach leveling arm to rudder.
- (4) Place spirit level on leveling arm.
- (5) Adjust movable weight to center bubble in level.
- (6) Make sure movable weight is positioned within balance limits.

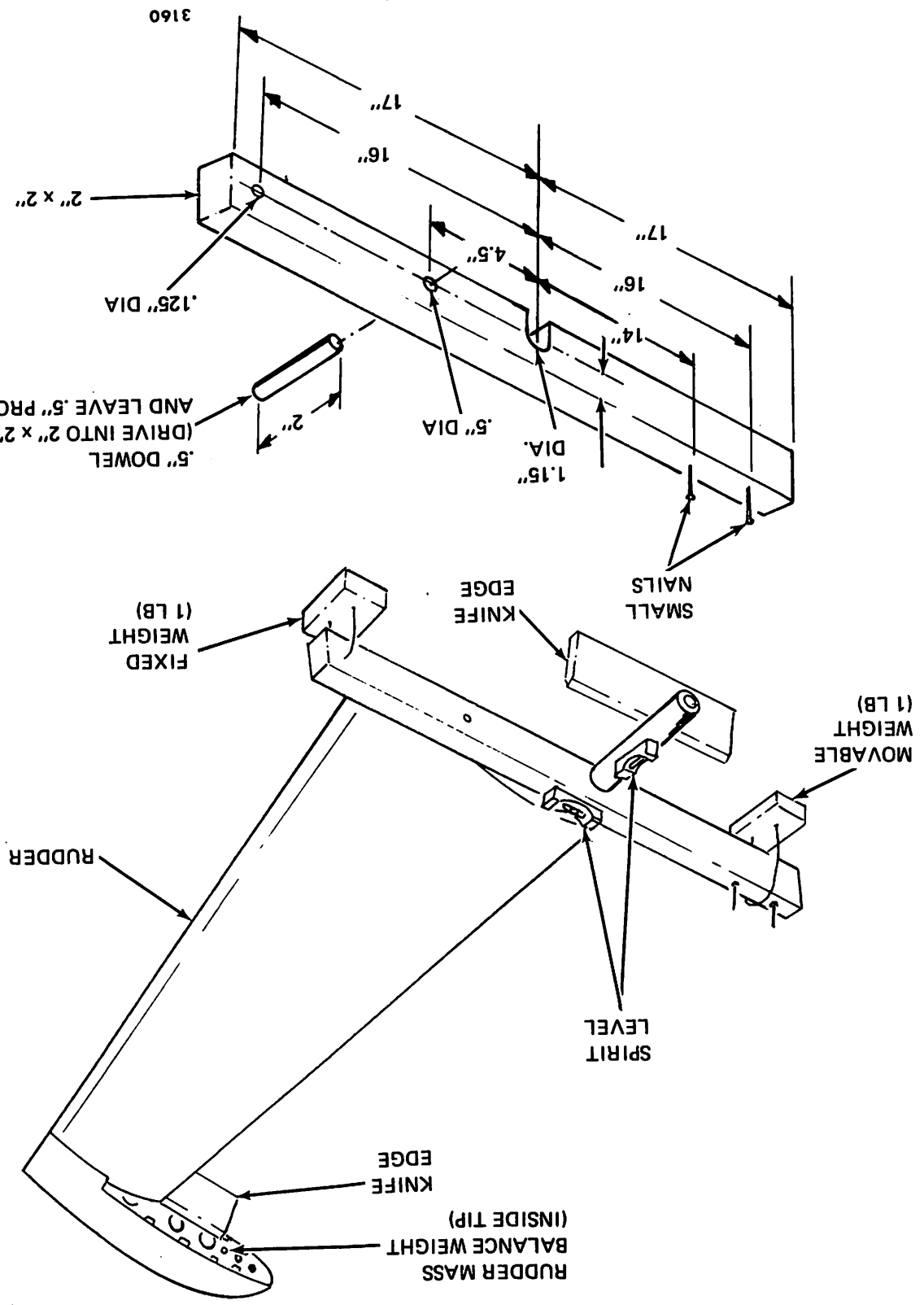
NOTE: If no flashing beacon is installed in the rudder tip cap, follow Steps (7) and (8) below. On aircraft having a flashing beacon installed, follow Steps (9) and (10).

- (7) If rudder is overbalanced, remove weight from mass balance weight by drilling holes or shaving until the rudder balances.
- (8) If rudder is underbalanced, the balance weight must be replaced. This weight is designed to provide a slight overbalance to allow balancing by removal of weight.
- (9) If rudder is overbalanced, remove washer plate weights as required. The weights are secured by the beacon mounting screws.
- (10) If rudder is underbalanced, add washer plate weights as required. The weights are secured by the beacon mounting screws.

10. Bearing and Torque Tube Wear Limits

A. Bearing Support Assembly (Top and Bottom)

Minimum radial wall thickness is .030 in.



Rudder Balancing
Figure 205

Any bearing with a cracked or separated flange must be replaced.

NOTE: Replacement of bearings is the same as for aileron bearings. Refer to Aileron Maintenance Section.

- B. Maximum control surface torque tube wear is .030 in. wall thickness reduction. Wear greater than this requires replacement of the control surface. Service Kit No. SK-121, Control Surface Torque Tube Repair Kit, is available from the Grumman American Supply Operations Department for torque tubes that have not exceeded the maximum wear limits.

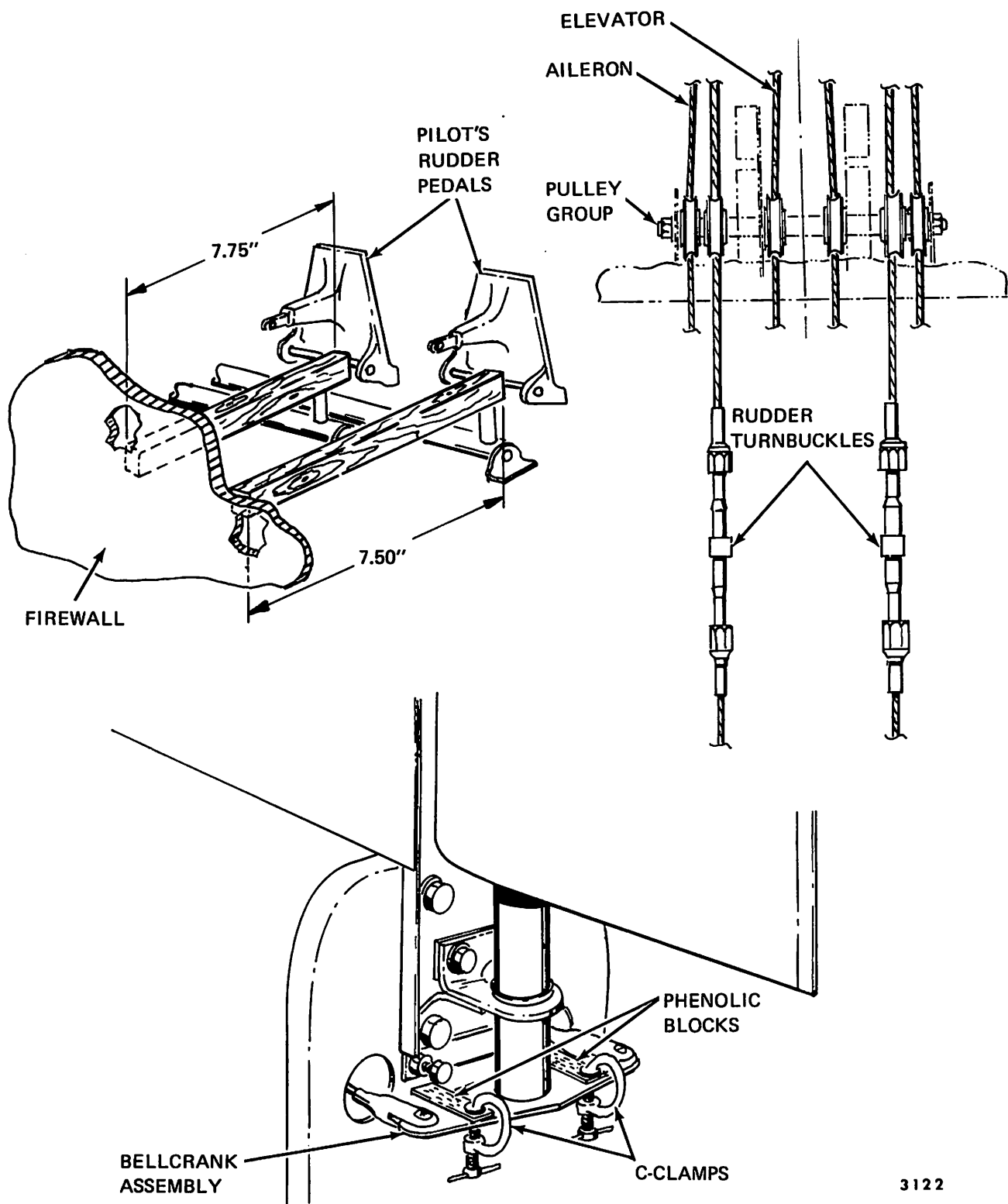
11. Rudder Control System Rigging (See Figure 206.)

- A. Remove tailcone per Chapter 53.
- B. Remove center console panels (Chapter 25) as required to gain access to rudder turnbuckles.
- C. Using the rudder rigging fixture, position the rudder trailing edge 40° right of center. Figure 206 shows one method of securing rudder.
- D. Loosen rudder cable turnbuckles.
- E. Place a 7.50-inch wooden block between the left pilot rudder pedal and the firewall, as shown in Figure 206. Place a 7.75-inch wooden block behind the right rudder pedal and the firewall.
- F. Slowly tighten each rudder turnbuckle until the corresponding wooden block falls from behind the rudder pedal.
- G. Remove clamps and blocks from bellcrank and allow rudder pedal return springs to move rudder to neutral position. Rudder should be at 0° to 5° right rudder (4° optimum).
- H. Safety rudder turnbuckles.
- I. With rudder rigging fixture, check rudder travel limit for $25^\circ \pm 2^\circ$ left and right.
- J. Depress left rudder pedal to its stop, and adjust left control stop (Figure 207) as required until rigging fixture indicates $25^\circ \pm 2^\circ$ rudder deflection to the left.
- K. Hold control stop and tighten lock nut.
- L. Repeat Steps J and K for the right-hand side.
- M. Install tailcone per Chapter 53.

12. Cleaning and Painting

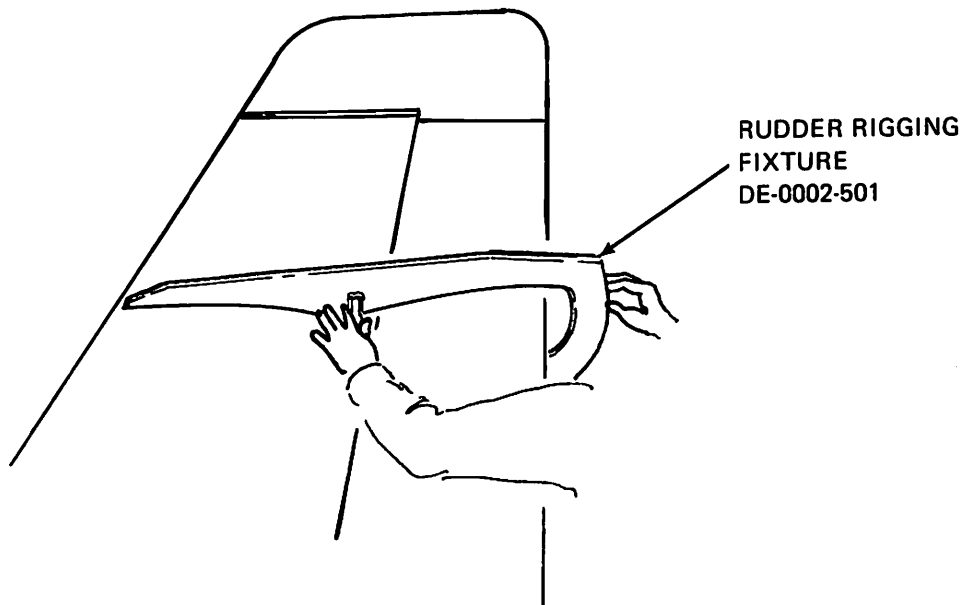
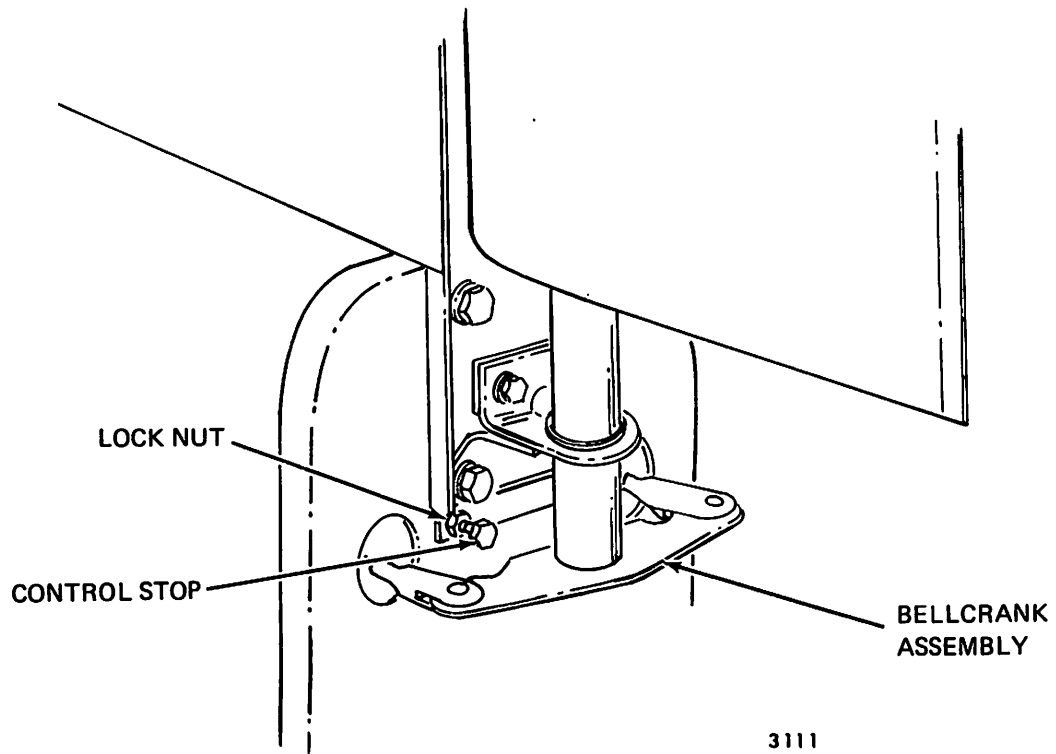
CAUTION: PAINTING ANY CONTROL SURFACE MAY CAUSE AN UNDERBALANCED CONDITION. CHECK RUDDER BALANCE AFTER PAINTING.

Refer to Chapter 20 for cleaning and painting instructions.



3122

Rudder Control System Rigging
Figure 206



**Rudder Travel Adjustment
Figure 207**

ELEVATOR & TAB – DESCRIPTION/OPERATION**1. General (See Figure 1.)**

As the control wheel is moved fore and aft, its displacement is transmitted by cables to the bellcrank on the elevator. Turnbuckles in the elevator control cables enable adjustment of cable tension, and control stops permit adjustment of elevator travel.

2. Elevator Control Surface (See Figure 2.)

The elevator control surface consists of the elevator surface, and the anti-servo tab. The elevator surface is composed of a torque tube to which are bonded honeycomb ribs. The ribs are bonded to an aluminum skin. The one-piece skin is formed around the elevator leading edge, and is bonded to the rear spar. The outboard end of the control surface is capped by a formed plastic tip attached with screws. Contained within the tip is the mass balance weight that provides proper control surface balance.

Attached to the trailing edge of the elevator is the anti-servo tab. This tab is attached to the elevator by a piano hinge. The tab is composed of a formed aluminum skin bonded to internal ribs, and actuated by an arm on its inboard end.

The elevator from the end of the horizontal stabilizer to the outboard rib is covered with aluminum panels. Outboard of the rib is a thermoplastic tip. The tab extends the full length of the elevator.

3. Elevator and Trim Linkage (See Figure 3.)

The elevator control cables are attached to the elevator bellcrank. The bellcrank moves the elevator in response to control column movement. The anti-servo bellcrank is mounted on bearings surrounding the elevator torque tubes. The trim arm, which is positioned by the trim system, establishes the position of the anti-servo bellcrank.

As the elevator is moved upward, a roller attached to the anti-servo bellcrank moves the front end of the trim tab arm downward. Since the trim tab arm is hinged at its center (in line with the trim tab hinge) the trim tab is forced upward by an amount proportional to elevator movement. When the elevator moves downward, movement of the trim tab is also in the downward direction.

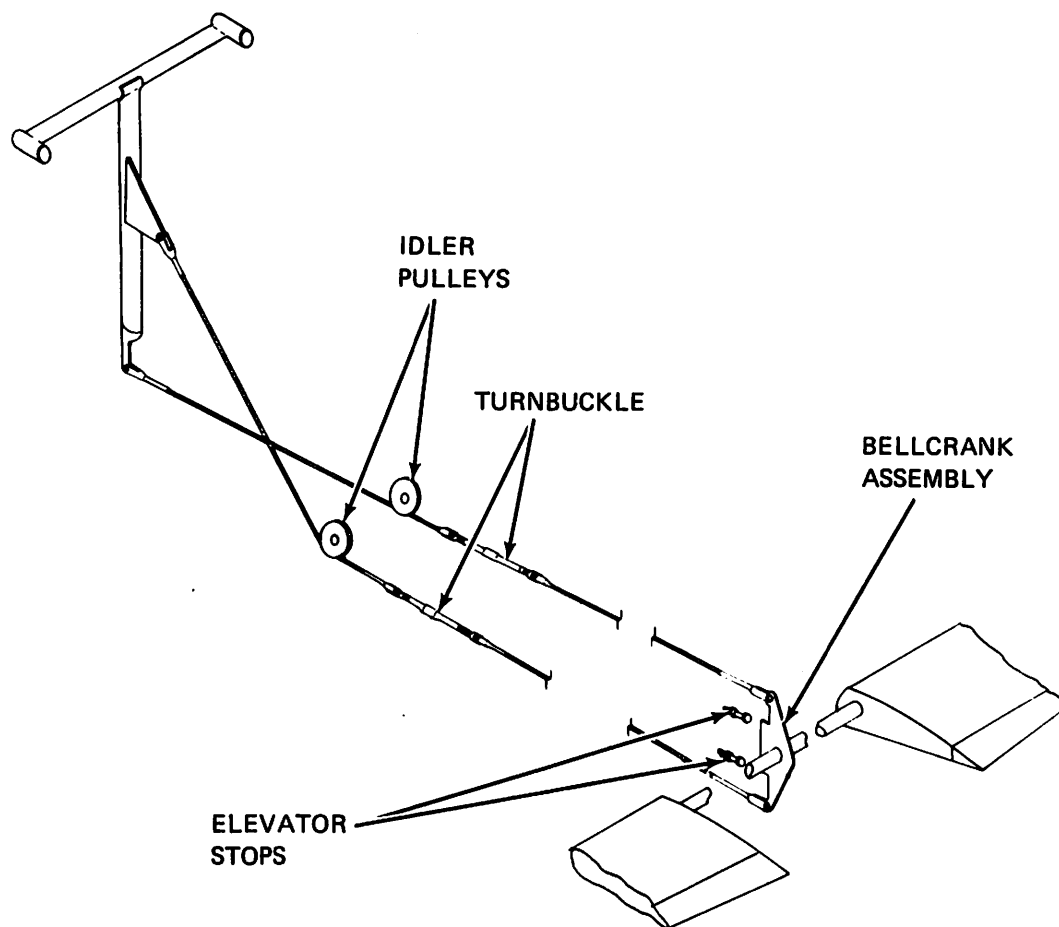
The trim tab provides the proper control "feel" and increases the effectiveness of the elevator.

4. Elevator Trim Control (See Figure 3.)

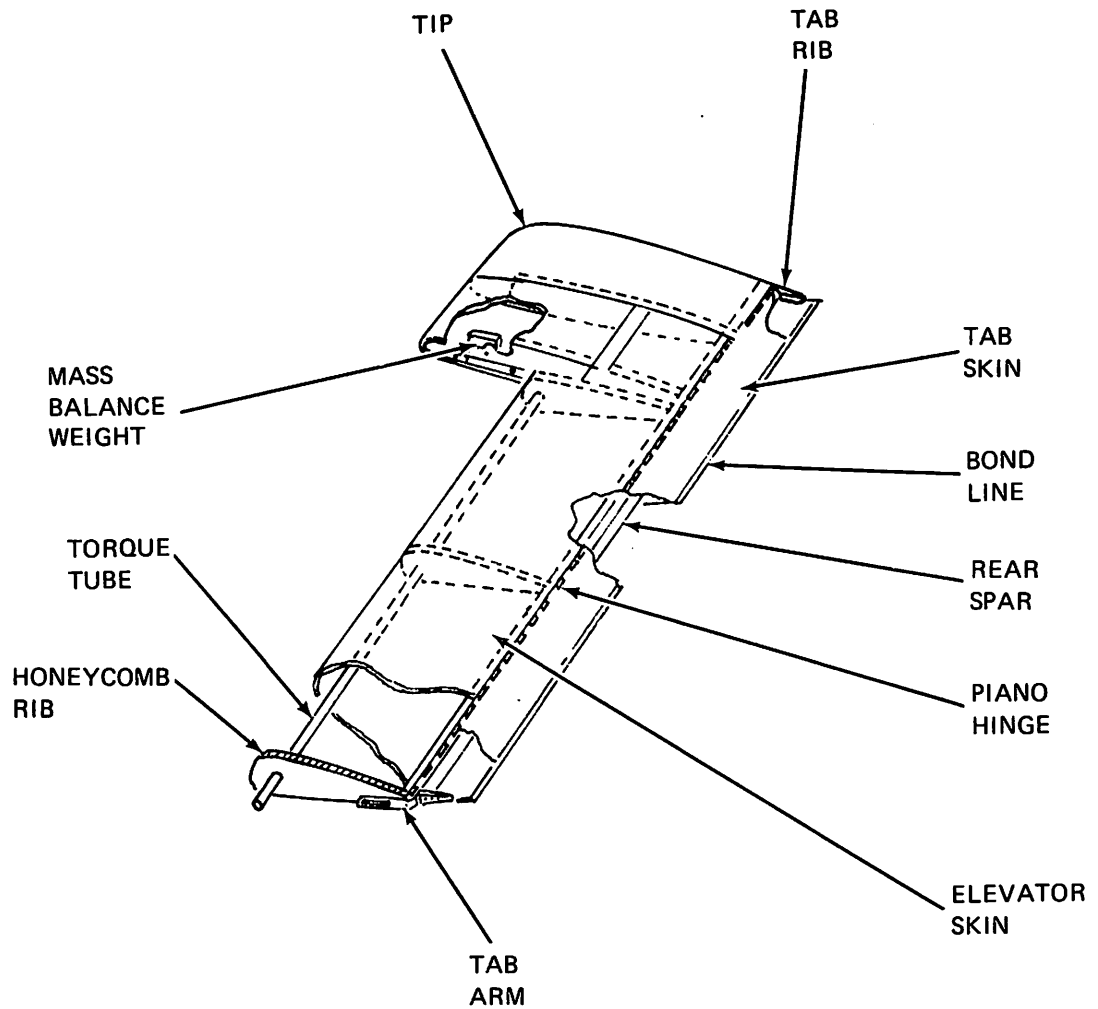
As the trim wheel is rotated, a set of spur gears turn the flexible shaft. The flexible shaft is connected through a linkage to an aluminum shaft that extends to the empennage. The aluminum shaft drives a jackscrew that positions the anti-servo bellcrank.

5. Control Column (See Figure 4)

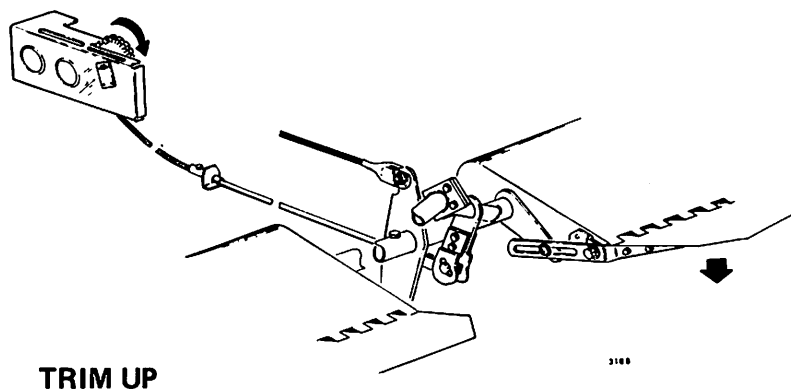
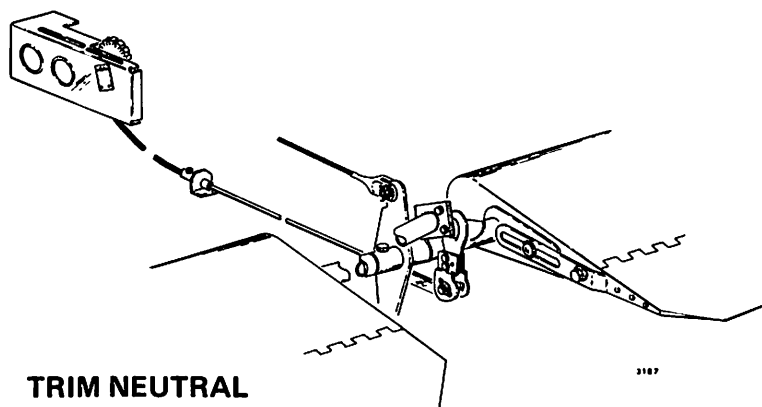
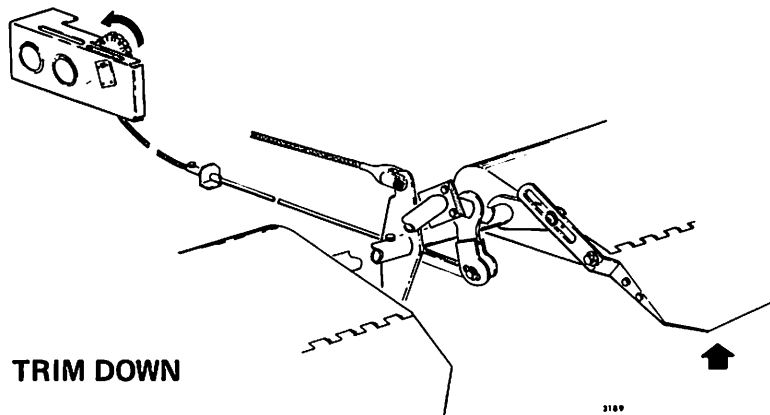
The control column consists of a "T" column, the bottom of which is attached to the aircraft through a needle bearing hinge. The control wheel shafts are connected to bellcranks that actuate pushrods. The pushrods are also attached to a central bellcrank that positions the aileron control cables. The pushrods each have an adjustable rod end that allows for angular adjustment of the control wheels. The shaft of each control wheel is attached through a universal joint to the "T" column. This allows forward and aft movement of the control column (for elevator action), while ensuring that the angular movement of the control wheel is transmitted to the linkage. Needle bearings in the "T" column minimize control system friction.



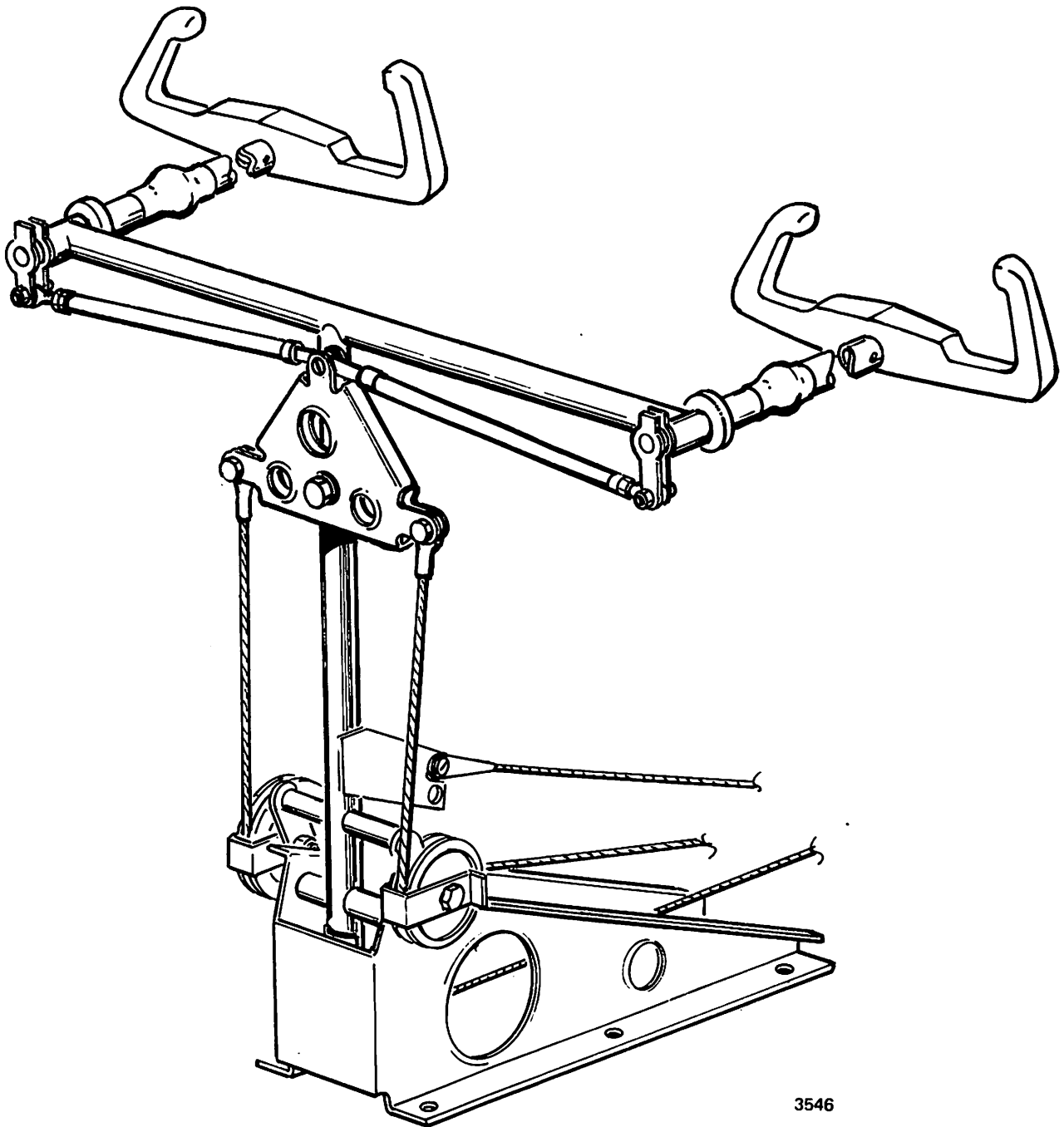
**Elevator Control System
Figure 1**



**Elevator Control Surface
Figure 2**



**Elevator and Trim Linkage
Figure 3**



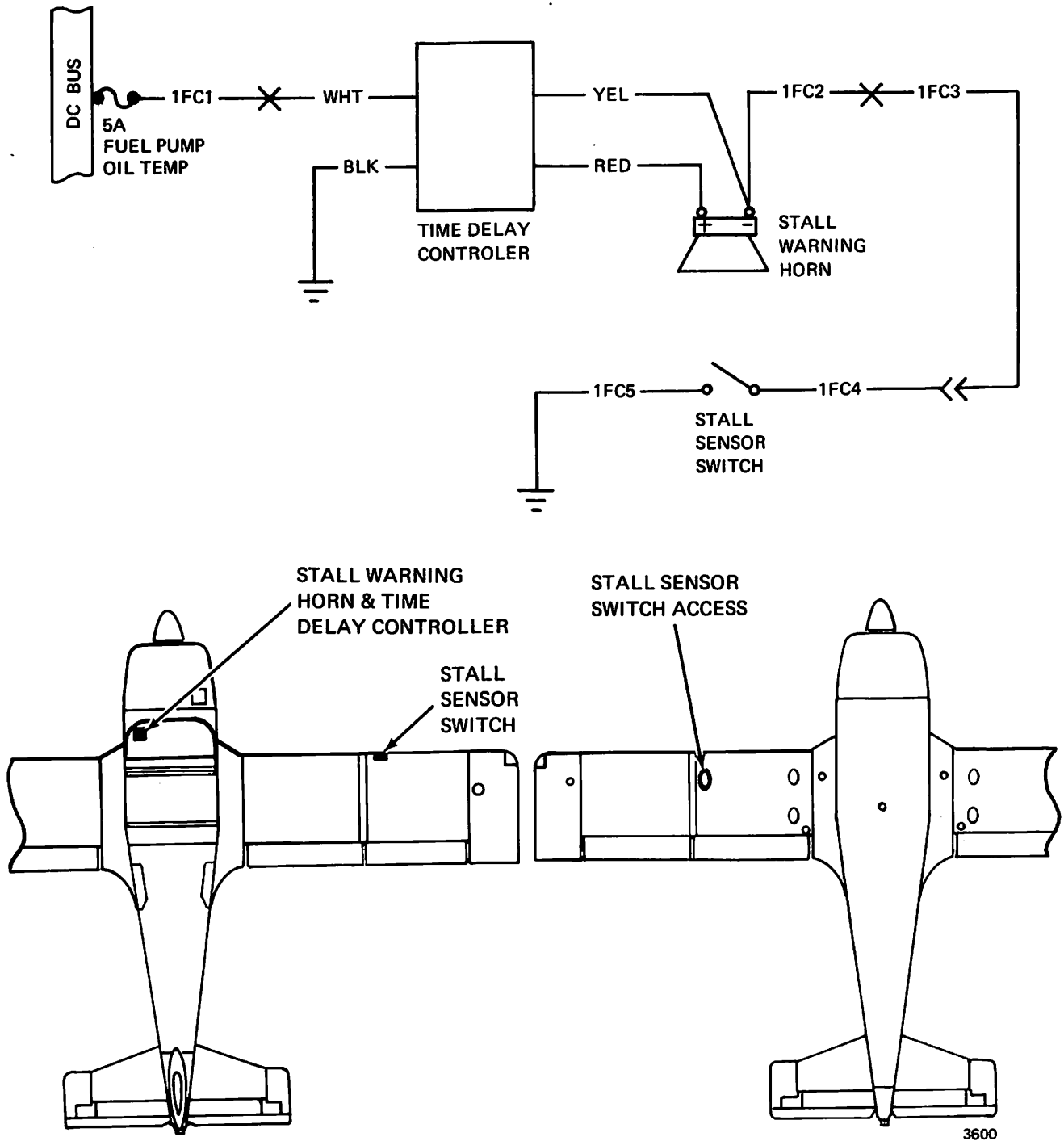
**Control Column
Figure 4**

6. Stall Warning System (See Figure 5.)

The stall warning system is an electrically-operated aural warning that informs the pilot of an impending stall at approximately 4 to 9 knots (4 to 10 mph) above stall speed. The system is composed of a stall sensor switch, a time delay controller, wiring, and a stall warning horn. The time delay controller introduces a time delay into the system to prevent the stall warning system from being activated by turbulence.

DC power from the aircraft bus is applied through a 5-amp fuse to the stall warning system. Input power is applied to the time delay controller. This controller is connected to the stall warning horn, one side of which is connected to the stall sensor switch. When the stall sensor switch is closed due to impending stall, the time delay controller circuit is activated. After a delay of approximately one second (0.9 second), an electronic switch in this circuit applies DC voltage to the stall warning horn through its red lead. Since the yellow lead of the stall warning horn is grounded, the horn sounds as long as the stall sensor switch remains closed. When the stall sensor switch opens, the electronic switch in the time delay controller resets so that a one-second delay is again introduced when the stall sensor switch is closed. If the stall sensor switch is opened during the time delay period, the controller resets and the horn does not sound.

The stall sensor switch is mounted on the leading edge of the right wing. The stall warning horn is mounted on a bracket beneath the left side of the instrument panel. The time delay controller is mounted adjacent to the stall warning horn.



Stall Warning System
Figure 5

TROUBLE SHOOTING1. Trouble Shooting Stall Warning System (See Figures 1 and 201.)

TROUBLE	PROBABLE CAUSE	REMEDY
Horn fails to sound when sensor switch is closed.	Set MASTER switch to ON. Check fuse.	Replace if defective.
	Make sure black lead of time delay controller is grounded.	Establish proper ground.
	Make sure yellow lead of time delay controller is grounded when stall sensor switch is closed.	Check wiring and switch. Repair or replace if defective.
	Make sure 12V is present on red lead of time delay controller within 1 second after stall sensor switch is closed.	If 12V is present, replace stall warning horn. If 12V is not present, replace time delay controller.
Horn remains on when sensor switch is open	Disconnect the stall switch sensor.	If horn stops, replace sensor. If not, reconnect sensor.
	Make sure yellow lead of time delay controller is not grounded.	If not, repair wiring between controller and switch. If yes, replace time delay controller.

ELEVATOR & TAB – MAINTENANCE PRACTICES

1. Elevator Removal (See Figure 201.)

- A. Remove tailcone per Chapter 53.
- B. Remove bolts (1) and washers (2) from trim tab arm (3).
- C. Remove cotter pin (4), nut (5), washers (6), and bolt (7) from bracket (8).
- D. Remove nut (9), washer (10), and bolt (11) from bellcrank (12).
- E. Hold elevator (14) in the full up position, and remove the top screw (15) from hinge (16).
- F. Hold elevator (14) in the full down position and remove bottom screw (17).
- G. Pull elevator (14) outboard and remove from aircraft.

2. Elevator Disassembly (See Figure 202.)

NOTE: Disassembly of the elevator and subsequent repair or replacement of parts requires that the elevator balance be checked prior to installation and rebalanced if required.

A. Trim Tab Removal

- (1) Remove cotter pin (1) from hinge (2).
- (2) Pull hinge pin (3) from hinge (2).
- (3) Remove trim tab (5) from elevator (4).

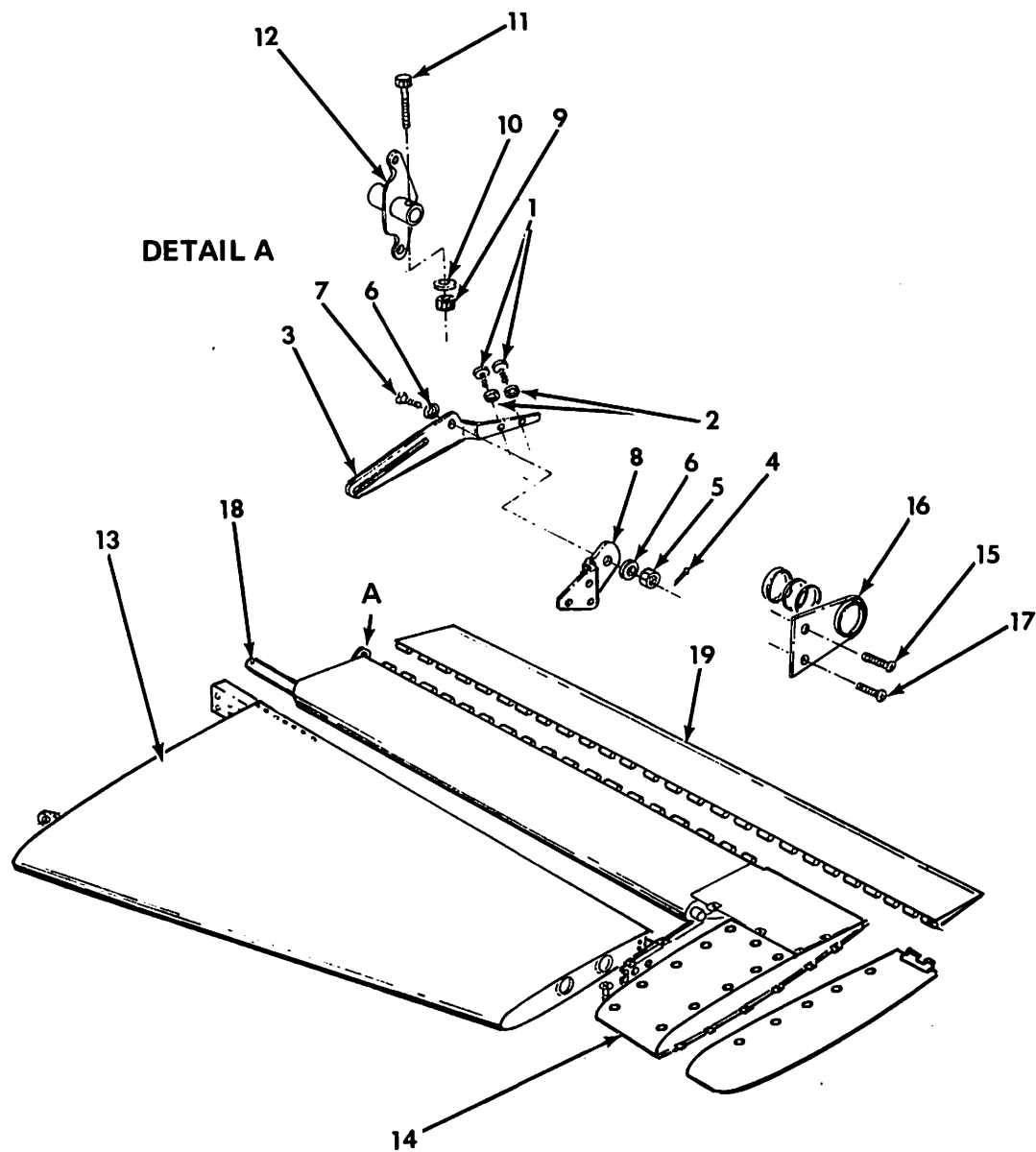
B. Elevator Tip Removal (See Figure 202.)

NOTE: It is not necessary to remove trim tab (5) prior to removing elevator tip (11).

- (1) Remove nuts (6), washers (7), and screws (8) from hinge (9).
- (2) Remove screws (10) from elevator tip (11).
- (3) Pull elevator tip (11) outboard to remove from elevator (12).

C. Elevator Linkage Disassembly (See Figure 202.)

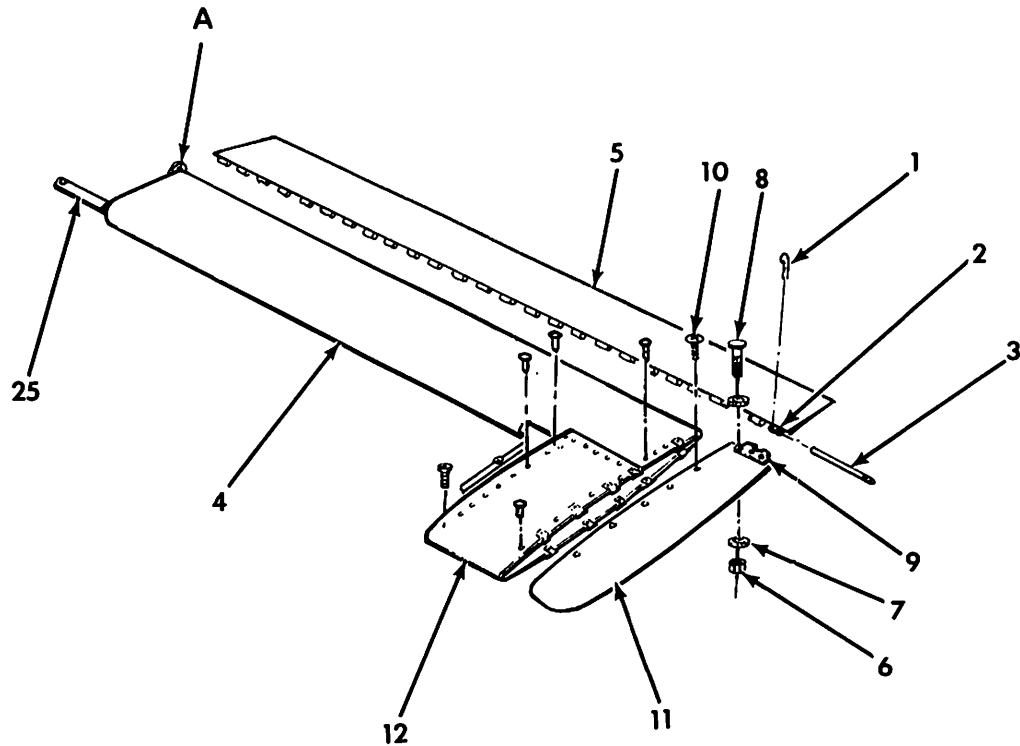
- (1) Remove nut (13), washer (14), and bolt (15) from bellcrank (16).
- (2) Remove bolts (17) and washers (18) from trim tab arm (19).
- (3) Remove cotter pin (20), nut (21), washers (22), and bolt (23) from trim tab arm (19) and bracket (24).
- (4) Pull elevator torque tube (25) from bellcrank (16), and remove bearing (26).
- (5) Pull yoke assembly (27) from torque tube (25).
- (6) Remove bearing (28) and spacers (29) from torque tube (25).



1. Bolt
2. Washer
3. Trim Tab Arm
4. Cotter Pin
5. Nut
6. Washer
7. Bolt
8. Bracket
9. Nut
10. Washer

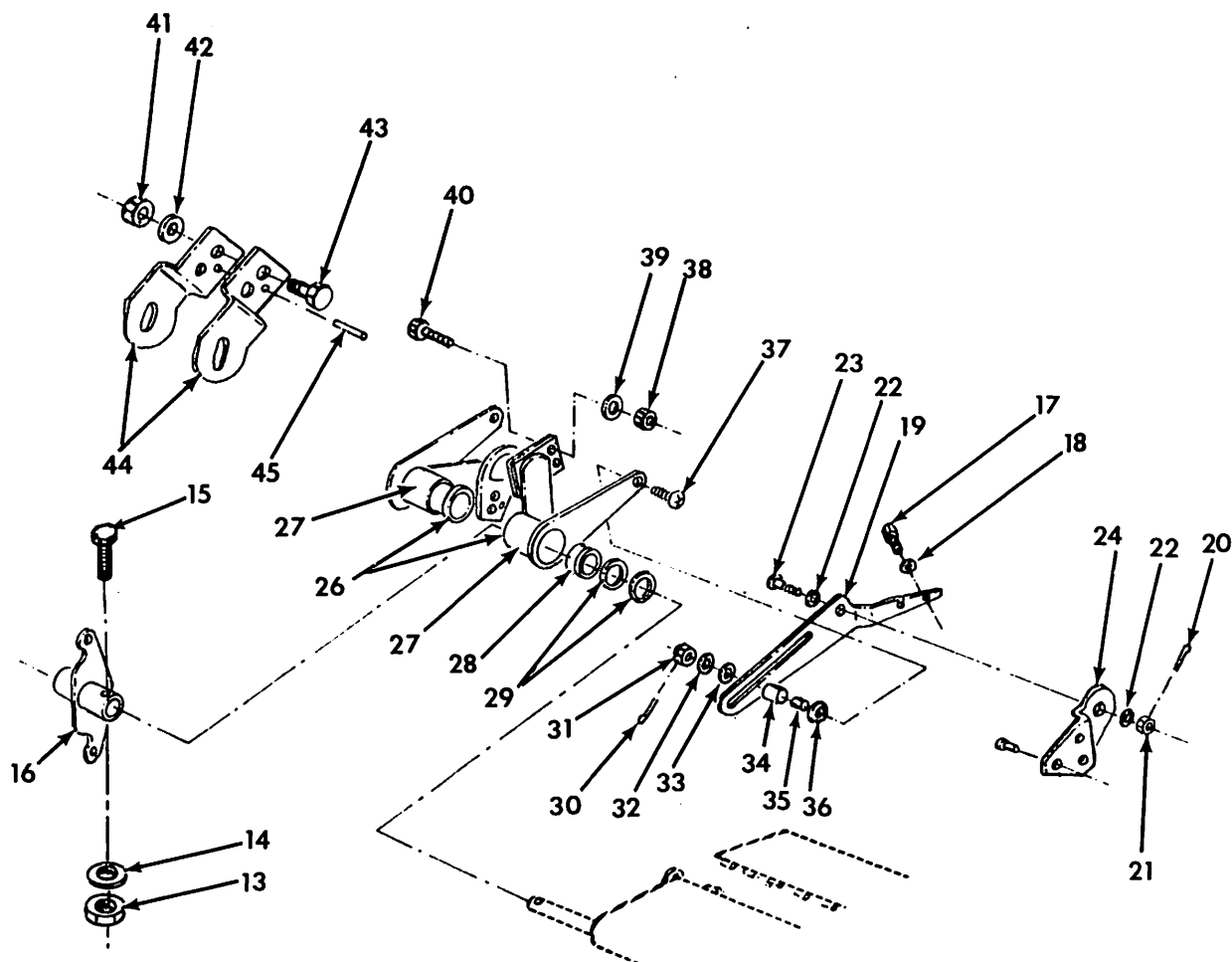
11. Bolt
12. Bellcrank
13. Horizontal Stabilizer
14. Elevator
15. Top Screw
16. Hinge
17. Bottom Screw
18. Torque Tube
19. Trim Tab

**Elevator Removal/Installation
Figure 201**



- | | |
|------------------|-------------------|
| 1. Cotter Pin | 24. Bracket |
| 2. Hinge | 25. Torque Tube |
| 3. Hinge Pin | 26. Bearing |
| 4. Elevator | 27. Yoke Assembly |
| 5. Trim Tab | 28. Bearing |
| 6. Nut | 29. Spacers |
| 7. Washer | 30. Cotter Pin |
| 8. Screw | 31. Nut |
| 9. Hinge | 32. Washer |
| 10. Screw | 33. Washer |
| 11. Elevator Tip | 34. Roller |
| 12. Elevator | 35. Bushing |
| 13. Nut | 36. Washer |
| 14. Washer | 37. Bolt |
| 15. Bolt | 38. Nut |
| 16. Bellcrank | 39. Washer |
| 17. Bolt | 40. Bolt |
| 18. Washer | 41. Nut |
| 19. Trim Tab Arm | 42. Washer |
| 20. Cotter Pin | 43. Bolt |
| 21. Nut | 44. Trim Arm |
| 22. Washer | 45. Roll Pin |
| 23. Bolt | |

**Elevator Disassembly/Assembly (Sheet 1 of 2)
Figure 202**



DETAIL A

**Elevator Disassembly/Assembly (Sheet 2 of 2)
Figure 202**

- (7) Remove cotter pin (30), nut (31), washers (32 and 33), roller (34), bushing (35), washer (36), and bolt (37) from yoke assembly (27) and trim tab arm (19). Remove arm (19) from yoke assembly (27).
- (8) Remove nuts (38), washers (39), and bolts (40) from yoke assembly (27), and remove two halves of yoke assembly (27).
- (9) Remove nuts (41), washers (42), and bolts (43) from trim arm (44).
- (10) Drive roll pin (45) from trim arms (44) and remove them from right half of yoke assembly (27).

3. Elevator Bearing and Torque Tube Wear Limits

A. Bearings

Refer to 27-1-1 for bearing replacement procedures.

The maximum wear limit for the elevator bearings is as follows:

Minimum Radial Wall Thickness – .030 inch

Any bearings that have been worn to the above limits must be replaced. Any bearings with cracked or separated flanges must be replaced.

B. Torque Tube

Maximum control surface torque tube wear is .030-inch wall thickness reduction. Wear greater than this requires replacement of the control surface. Service Kit No. SK-121, Control Surface Torque Tube Repair Kit, is available from the Grumman American Supply Operations Department for worn torque tubes that have not exceeded the maximum wear limits.

4. Elevator Trim Bellcrank Bearing Wear Limits

Refer to 27-1-1 for bearing replacement procedures.

The maximum wear limit for the elevator trim bellcrank bearing is as follows:

Minimum Radial Wall Thickness – .040 inch

Any bearings worn to the above limits must be replaced. Any bearings with cracked or separated flanges must be replaced.

5. Elevator Assembly (See Figure 202.)

A. Elevator Linkage Assembly

- (1) Position trim arms (44) on right yoke (27), and secure with roll pin (45), bolts (43), and nuts (41). Torque to standard value. (See Chapter 91.)
- (2) Assemble two halves of yoke assembly (27) and secure with bolts (40), washers (39), and nuts (38). Torque to standard value. (See Chapter 91.)
- (3) Place spacers (29) and bearing (28) on torque tube (25) and insert torque tube in yoke assembly (27).
- (4) Install bearing (26) on torque tube (25), inside of yoke assembly (27).
- (5) Position bellcrank (16) so that it aligns with end of torque tube (25) and insert end of torque tube in bellcrank so that their holes align. Secure with bolt (15), washer (14), and nut (13). Torque to standard value. (See Chapter 91.)

- (6) Place bolt (37) through hole in arm of yoke assembly (27).
- (7) Install washer (36) and bushing (35) on bolt (37).
- (8) Place roller (34) over bushing (35).
- (9) Place slot in trim tab arm (19) over roller (34).
- (10) Place washers (33 and 32) on bolt (37) and secure with nut (31) and cotter pin (30).
- (11) Attach trim tab arm (19) to trim tab (5) with bolts (17) and washers (18). Torque to standard value. (See Chapter 91.)
- (12) Attach trim tab arm (19) to bracket (24) with bolt (23), washers (22), nut (21), and cotter pin (20).

B. Elevator Tip Installation (See Figure 202.)

- (1) Position elevator tip (11) so that holes in tip and hinge (9) align.
- (2) Secure hinge (9) to elevator tip (11) with screws (8), washers (7), and nuts (6).
- (3) Position elevator tip (11) to align its mounting holes with elevator (12) and secure elevator tip with screws (10).

C. Trim Tab Installation (See Figure 202.)

- (1) Align hinges (2) on trim tab (5) and elevator (4) and install hinge pin (3).
- (2) Secure hinge pin (3) to hinge (2) with cotter pin (1).

6. Elevator Installation (See Figure 201.)

- A. Position elevator so that its torque tube (18) aligns with bellcrank (12). Align holes in torque tube (18) and bellcrank (12) and install bolt (11), washer (10), and nut (9). Torque to standard value. (See Chapter 91.)
- B. Hold elevator (14) in the full up position and align top mounting hole in hinge (16) with hole in horizontal stabilizer (13). Install top screw (15).
- C. Hold elevator (14) in full down position and install bottom screw (17).
- D. Align mounting holes in trim tab arm (3) with holes in trim tab (19) and install bolts (1) with washers (2).
- E. Torque to standard value. (See Chapter 91.)
- F. Install bolt (7) and washers (6) through trim tab arm (3) and secure with nut (5) and cotter pin (4).
- G. Rig elevator per Paragraph 17 below.

7. Elevator Cable Removal (See Figure 203.)

- A. Remove center console panels (Chapter 25) as required to gain access to pulley group assembly (10) and turnbuckles.
- B. Remove tailcone (Chapter 53).
- C. Move control wheel forward until bellcrank (20, Figure 203) contacts elevator down stop (22).

- D. Remove locking clips and release cable tension by loosening turnbuckles (1) equally.
- E. Tie a cord or wire to each elevator cable clevis at bellcrank (20). Remove cotter pins (2), nuts (3), washers (4), and bolts (5). Allow clevis ends of cables (16 and 17) to slide into aircraft interior.
- F. At pulley group assembly (10), remove nuts (6) and washers (7) from studs (8) at mounting brackets (9) on left and right sides.
- G. Remove cotter pins (11), nuts (12), washers (13), and bolts (14) at control column (15).
- H. Pull cables forward until end of cord or wire is obtained. Release end of cord or wire and remove cables from aircraft.

NOTE: Remove cables (16 through 19) from turnbuckles as required.

8. Elevator Cable Installation (See Figure 203.)

NOTE: Original equipment cables are color coded as indicated in Detail A, Figure 203. It is recommended that any replacement cables be compared as to length and proper fittings before installation.

- A. Attach aft cable clevises to cord or wire beneath center console and pull cables aft into position.

NOTE: When attaching cables to control column (15), make sure to use the attach points indicated in Detail A, Figure 203. Failure to comply will result in insufficient elevator travel during rigging procedures.

- B. Attach cables to control column (15) with bolts (14), washers (13), nuts (12), and cotter pins (11).
- C. Route cables beneath pulleys as shown in Detail B, Figure 203. Install pulley group assembly (10) into proper position by installing studs (8) through holes in mounting brackets (9). Secure with washers (7) and nuts (6).
- D. At elevator, install clevises of cables (16 and 17) on bellcrank (20). Secure with bolts (5), washers (4), nuts (3), and cotter pins (2).
- E. Rig elevator in accordance with rigging instructions, Paragraph 17 below.

9. Elevator Balancing (See Figure 204.)

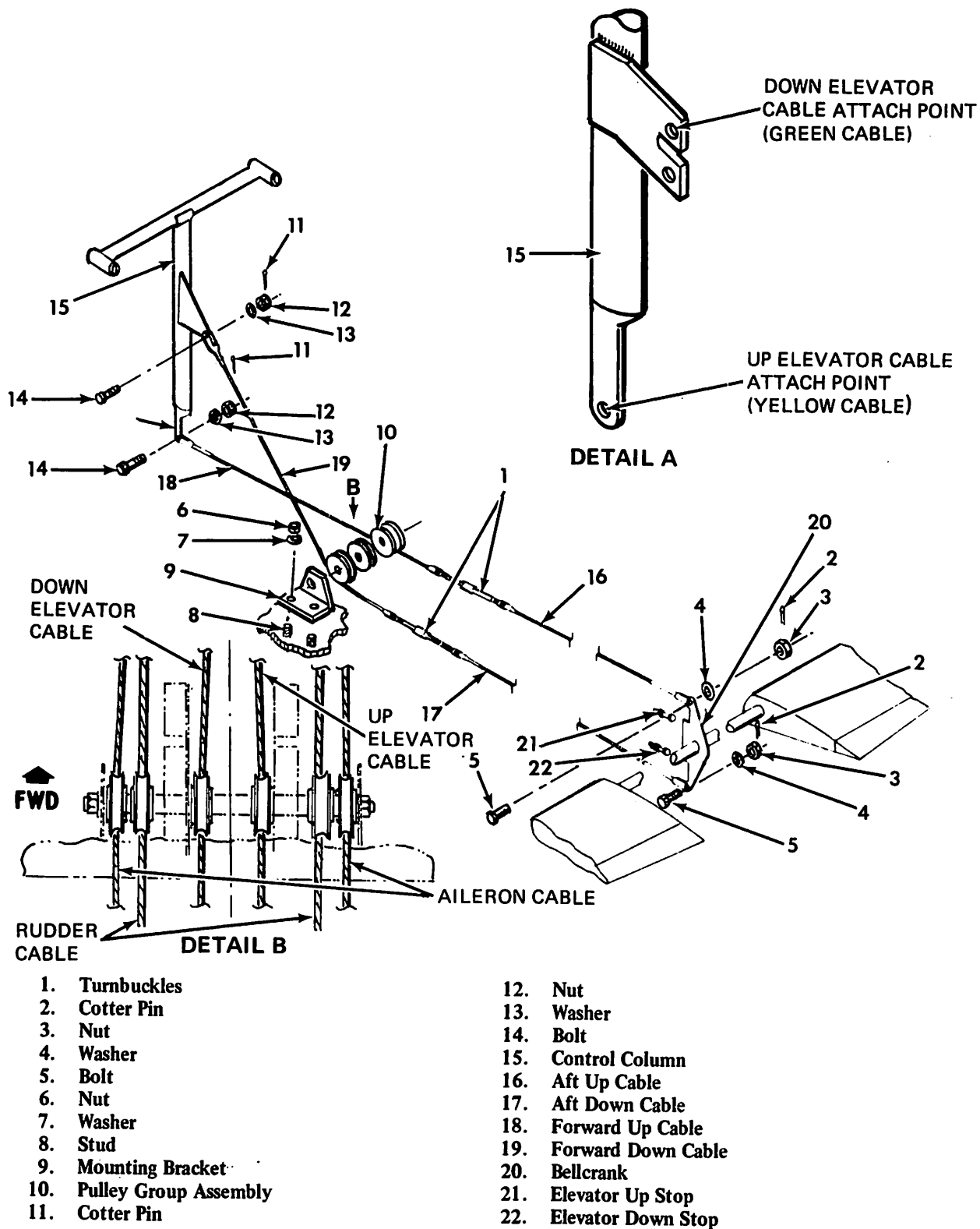
A. General Information

Refer to Section 27-1-1 for general information and definitions regarding control surface balancing.

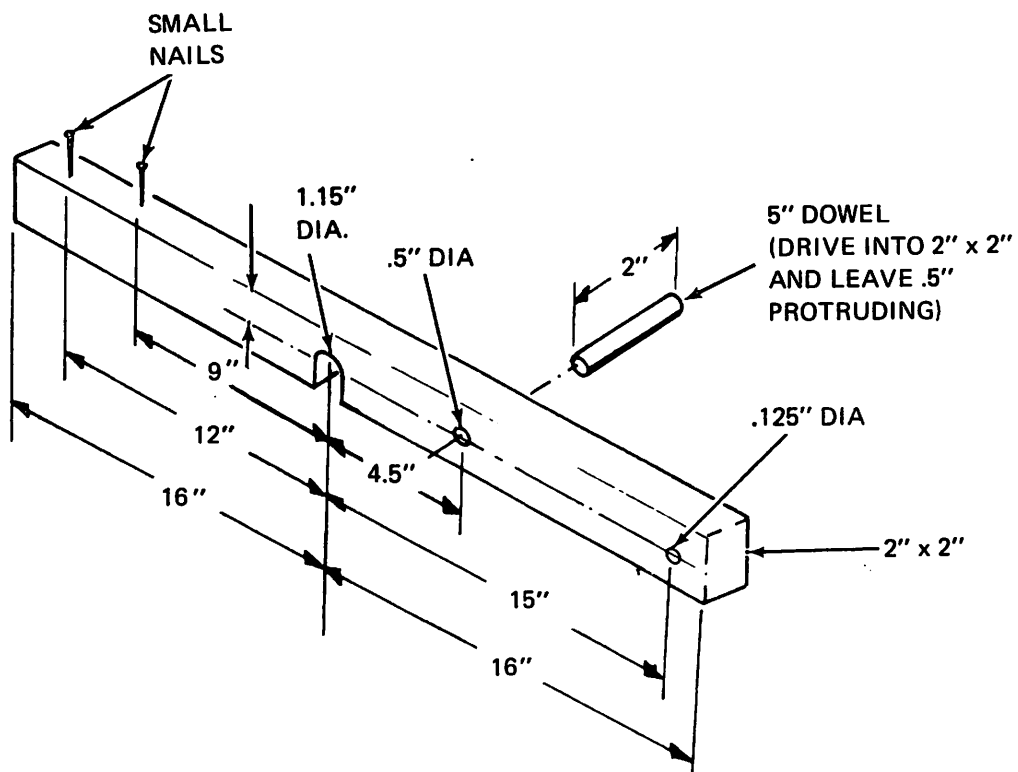
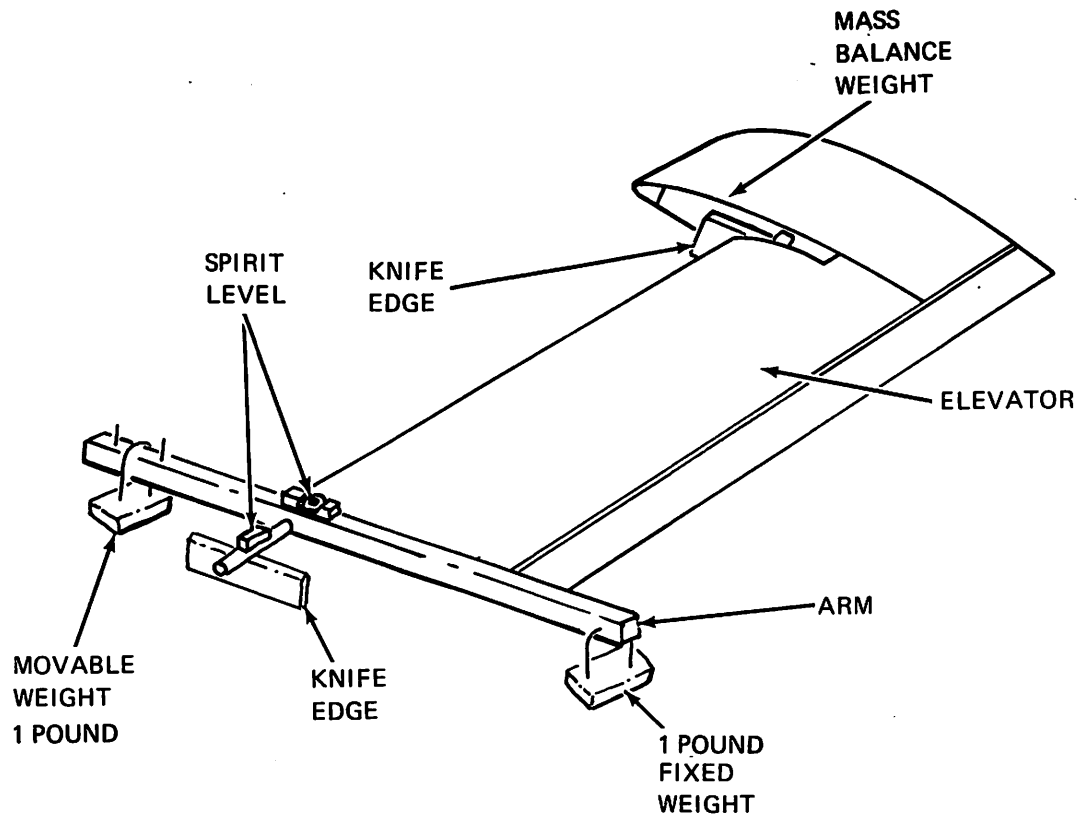
- B. Control surface tolerance (after painting) +48 to +96 in. oz.

C. Balancing Procedures (See Figure 204.)

- (1) Place elevator (balance each side of the elevator separately) on balancing device.
- (2) Place a spirit level on the torque tube and level elevator to center level.
- (3) Attach leveling arm to elevator.
- (4) Place spirit level on leveling arm.
- (5) Move adjustable weight to center bubble in level.
- (6) Check that movable weight is positioned within balance limits.



Elevator Cable Removal and Installation
Figure 203



**Elevator Balancing
Figure 204**

- (7) If elevator is overbalanced, remove weight from mass balance weight by drilling holes in it until elevator balances.
- (8) If elevator is underbalanced, the balance weight must be replaced. New weight is designed to provide a slight overbalance to allow balancing by removal of weight.

10. Trim Tab Control Removal (See Figure 205.)

A. Actuator Removal

- (1) Remove tailcone per Chapter 53.
- (2) Remove nuts (1), washers (2), and bolts (3) from trim arms (4).
- (3) Remove ELT access panel per Chapter 53.
- (4) Remove nut (5), washer (6), and bolt (7) from torque tube (8).
- (5) Pull actuator (9) aft until it clears guide assembly (10).
- (6) Remove bearings (11) and washer (12).
- (7) Remove nuts (13), washers (14), and bolts (15), then remove guide assembly.

B. Torque Tube Removal

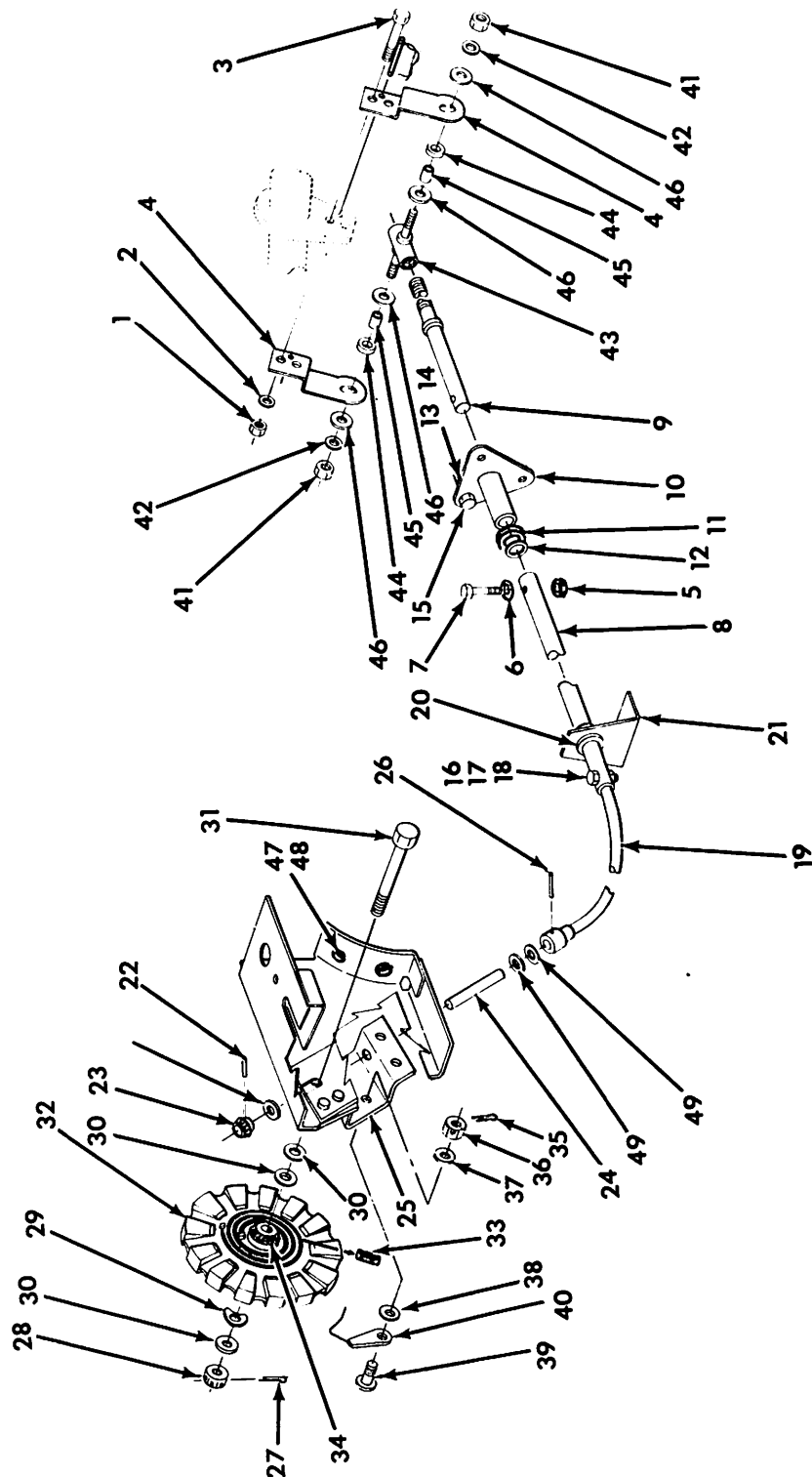
- (1) Remove center console access panels (Chapter 25).
- (2) Remove nut (16), washer (17), and bolt (18) from flexible cable (19), and pull cable (19) from torque tube (8).
- (3) Pull torque tube (8) aft until it clears bushing (20) in front support (21).

C. Trim Wheel Assembly Removal and Disassembly

- (1) Remove center console access panels (Chapter 25).
- (2) Remove screws (47) and washers (48). Remove trim wheel assembly from aircraft.
- (3) Drive roll pin (22) from pinion gear (23) and pull flexible cable (19) from bracket assembly (25).
- (4) Drive roll pin (26) from flexible cable (19) and pull shaft (24) and washers (49) from flexible cable (19). Note number of washers (49) for installation.
- (5) Remove cotter pin (27), nut (28), washers (29 and 30), and bolt (31) from trim wheel (32).
- (6) Drive roll pin (33) from trim wheel (32) and remove pinion gear (34).
- (7) Remove cotter pin (35), nut (36), washers (37 and 38), bolt (39), and indicator bracket (40) from bracket assembly (25).

D. Actuator Disassembly

- (1) Remove nuts (41) and washers (42). Pull trim arms (4) from actuator assembly (43).
- (2) Remove roller (44), bushing (45), and washer (46) from actuator assembly (43).
- (3) Unscrew actuator assembly (43) from actuator (9).



Trim Tab Control Removal/Installation (Sheet 1 of 2)
Figure 205

- | | |
|----------------------|-----------------------|
| 1. Nut | 26. Roll Pin |
| 2. Washer | 27. Cotter Pin |
| 3. Bolt | 28. Nut |
| 4. Trim Arm | 29. Spring Washer |
| 5. Nut | 30. Washer |
| 6. Washer | 31. Bolt |
| 7. Bolt | 32. Trim Wheel |
| 8. Torque Tube | 33. Roll Pin |
| 9. Actuator | 34. Pinion Gear |
| 10. Guide Assembly | 35. Cotter Pin |
| 11. Bearing | 36. Nut |
| 12. Washer | 37. Washer |
| 13. Nut | 38. Washer |
| 14. Washer | 39. Bolt |
| 15. Bolt | 40. Indicator Bracket |
| 16. Nut | 41. Nut |
| 17. Washer | 42. Washer |
| 18. Bolt | 43. Actuator Assembly |
| 19. Cable | 44. Roller |
| 20. Bushing | 45. Bushing |
| 21. Front Support | 46. Washer |
| 22. Roll Pin | 47. Screw |
| 23. Pinion Gear | 48. Washer |
| 24. Shaft | 49. Washer |
| 25. Bracket Assembly | |

Trim Tab Control Removal/Installation (Sheet 2 of 2)
Figure 205

11. Trim Tab Control Installation (See Figure 205.)

A. Actuator Installation

- (1) Screw actuator assembly (43) on to actuator (9).
- (2) Place washers (46) and bushings (45) on actuator assembly (43).
- (3) Place rollers (44) over bushings (45) and place trim arm (4) over rollers (44). Secure with washers (42) and nuts (41). Torque to standard value. (See Chapter 91.)
- (4) Place trim arms (4) on yoke assembly and secure with bolts (3), washers (2), and nuts (1). Torque to standard value. (See Chapter 91.)
- (5) Install tailcone and ELT access panel per Chapter 53.

B. Trim Wheel Assembly Installation

- (1) Insert shaft (24) into cable (19) and secure with roll pin (26).
- (2) Insert shaft (24) through Nyliner bushings in bracket assembly (25).

NOTE: Install washers (49) as required to limit shaft end play from .005 inch to .010 inch.

- (3) Place washers (49), and pinion gear (23) on shaft (24) and secure with roll pin (22).
- (4) Place pinion gear (34) in trim wheel (32). Align holes and secure with roll pin (33).
- (5) Place bolt (39) through indicator bracket (40), washer (38), and bracket assembly (25).

- (6) Secure with washer (37), nut (36), and cotter pin (35).
- (7) Place bolt (31) through bracket assembly (25) and place washers (30) on bolt (31).
- (8) Slide trim wheel (32) on bolt (31) until teeth of pinion gears (34 and 23) engage, and follower pin on trim indicator bracket (40) engages in spiral groove on trim wheel (32).
- (9) Secure trim wheel (32) with spring washers (29), washers (30), nut (28), and cotter pin (27). Adjust nut (28) as required to obtain full mesh of gear teeth.

NOTE: Indicator bracket (40) must be spring loaded by spring washers (29) so that pin contacts bottom of trim wheel groove.

- (10) Install trim wheel assembly on center spar and secure with washers (48) and screws (47).
- (11) Install center console access panels (Chapter 25).

C. Torque Tube Installation

- (1) Slide forward torque tube (8) through front support (21).
- (2) Place end of flexible cable (19) in front end of torque tube (8) and align holes. Secure with bolt (18), washer (17), and nut (16).

D. Actuator Installation

- (1) Place bearings (11) in guide assembly (10), and secure guide assembly to fuselage with bolts (15), washers (14), and nuts (13). Torque to standard value. (See Chapter 91.)
- (2) Slide actuator (9) through guide assembly (10) and place washer (12) on end of actuator (9).
- (3) Insert front end of actuator (9) in aft end of torque tube (8). Align holes and secure with screw (7), washer (6), and nut (5).
- (4) Place trim arms (4) into proper position and secure with bolts (3), washers (2), and nuts (1).
- (5) Rig trim tab control system per Paragraph 18. below.
- (6) Install tailcone and ELT access panels per Chapter 53.

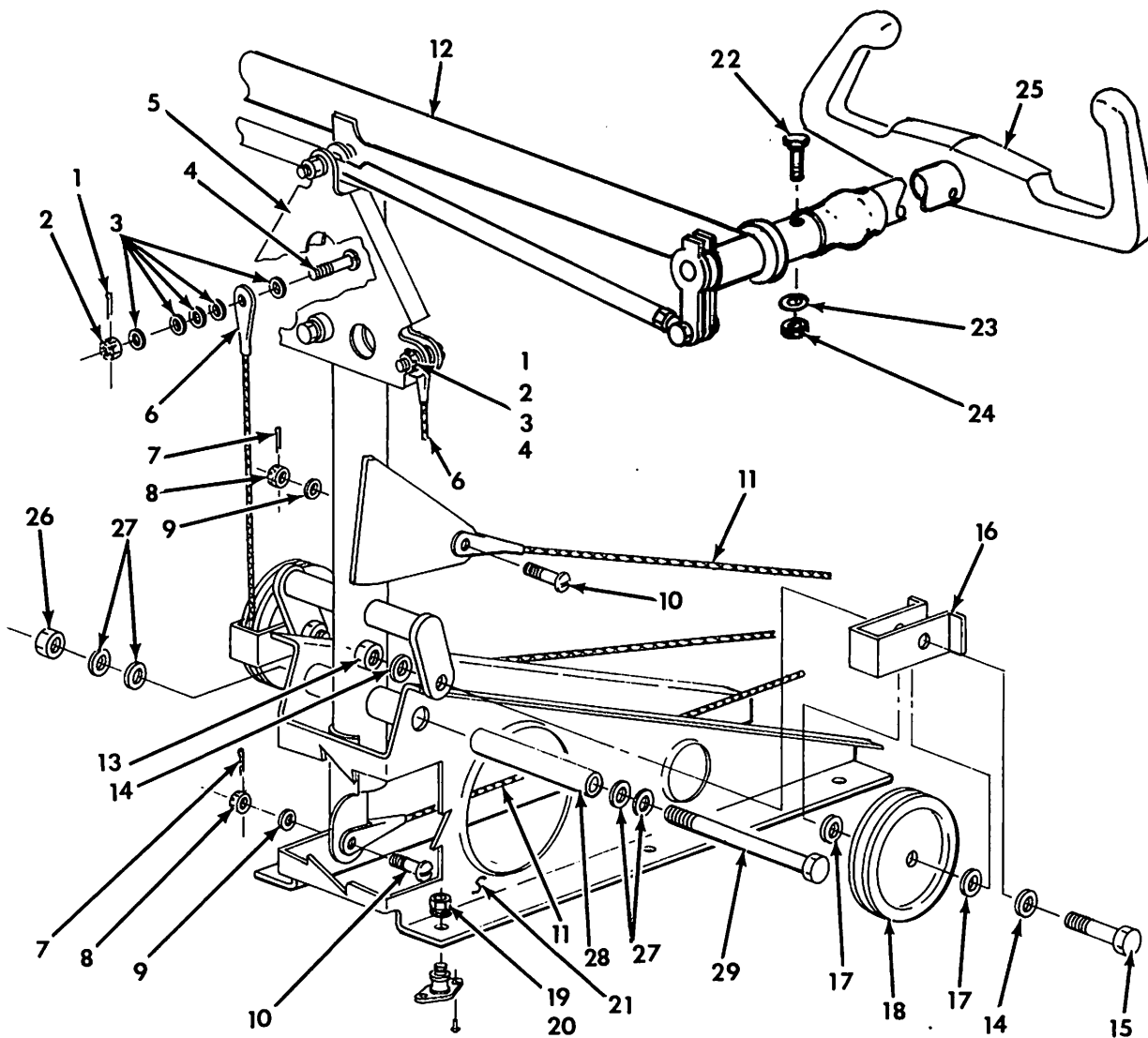
12. Cleaning and Painting

CAUTION: PAINTING ANY CONTROL SURFACE MAY CAUSE AN UNDERBALANCED CONDITION. CHECK ELEVATOR BALANCE AFTER PAINTING.

Refer to Chapter 20 for cleaning and painting instructions.

13. Control Column Removal (See Figure 206.)

- A. Remove center console (Chapter 25). Remove baggage floor covering and access panels as required to gain access to aileron and elevator cable turnbuckles. Relieve tension on cables.
- B. Remove cotter pin (1), nut (2), washers (3), and bolt (4) from bellcrank (5) and pull clevis of aileron cable (6) from bellcrank.
- C. Remove cotter pin (7), nut (8), washer (9), and bolt (10) from clevis of elevator cable (11) and remove clevises from control column (12).



- | | |
|--------------------|----------------------------|
| 1. Cotter Pin | 16. Guard |
| 2. Nut | 17. Washer |
| 3. Washer | 18. Pulley |
| 4. Bolt | 19. Nut |
| 5. Bellcrank | 20. Washer |
| 6. Aileron Cable | 21. Support Assembly |
| 7. Cotter Pin | 22. Bolt |
| 8. Nut | 23. Washer |
| 9. Washer | 24. Nut |
| 10. Bolt | 25. Control Wheel Assembly |
| 11. Elevator Cable | 26. Nut |
| 12. Control Column | 27. Washer |
| 13. Nut | 28. Sleeve |
| 14. Washers | 29. Bolt |
| 15. Bolt | |

**Control Column Removal/Installation
Figure 206**

- D. Remove nut (13), washers (14), bolt (15), guard (16), washers (17), and pulleys (18) from control column (12).
- E. Remove nuts (24), washers (23), bolts (22), and control wheel assemblies (25).
- F. Remove nuts (19) and washers (20) and pull support assembly (21) from mounting studs. Remove control column assembly from aircraft.
- G. Remove nut (26), washers (27), and bolt (29). Remove support assembly (21) from control column assembly. Remove spacer (28).

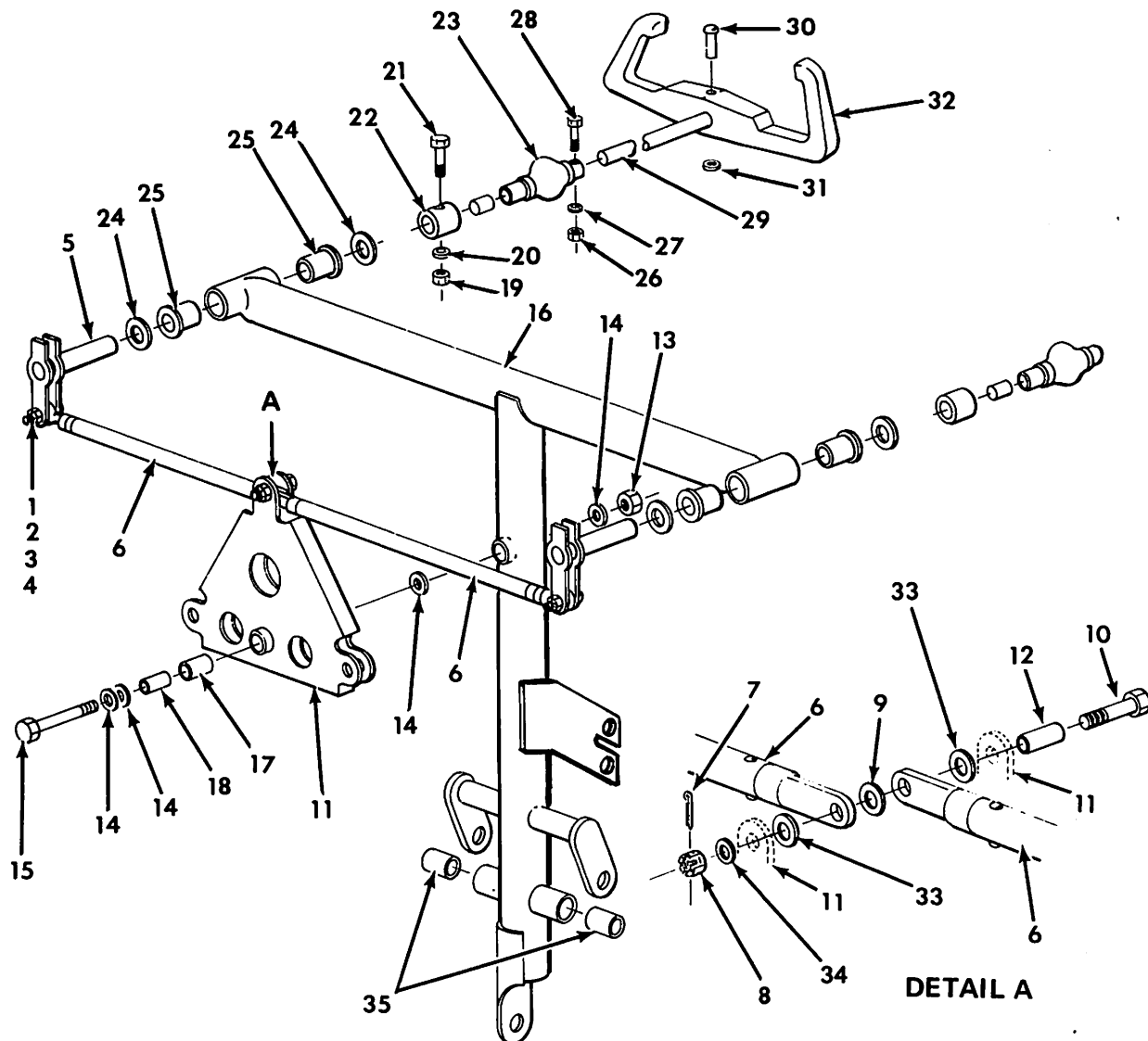
14. Control Column Disassembly (See Figure 207.)

- A. Remove cotter pin (1), nut (2), washer (3), and bolt (4) from horn assembly (5) and pull pushrod assembly (6) from horn assembly.
- B. Remove cotter pin (7), nut (8), washers (9, 33, and 34), and bolt (10). Pull pushrod assemblies (6) from bellcrank assembly (11). Remove bushing (12) from pushrod assemblies.
- C. Remove nut (13), washers (14), and bolt (15) from bellcrank assembly (11) and control column (16).
- D. Remove needle bearing (17) and sleeve (18) from bellcrank assembly.
- E. Pull universal joint (23) from collar (22).
- F. Pull collar (22), from horn assembly (5) and remove washers (24) and horn assembly (5) from control column (16).
- G. Pull bearings (25) from control column (16).
- H. Remove nut (26), washer (27), and bolt (28) from shaft (29), and pull universal joint (23) from shaft (29).
- I. Remove rivet (30) and washer (31) and pull control wheel (32) from shaft (29).

15. Control Column Assembly (See Figure 207.)

- A. Place needle bearings (35) in control column (16).
- B. Place control wheel (32) on shaft (29) and align holes. Secure with rivet (30) and washer (31).
- C. Place shaft (29) on universal joint (23) and align holes. Secure with bolt (28), washer (27), and nut (26).
- D. Install bearings (25) in control column (16).
- E. Place washer (24) on shaft of horn assembly (5) and push shaft through bearings (25). Place washer (24) on end of shaft, and place collar (22) on shaft so that holes align.
- F. Position rod end bearing of pushrod assembly (6) in horn assembly (5) such that holes align. Secure with bolt (4), washer (3), and nut (2). Do not install cotter pin (1) at this time.
- G. Place washers (14), sleeve (18), and needle bearing (17) on bolt (15).
- H. Push bolt (15) and bearing (17) through bearing hole in bellcrank assembly (11). Place washer (14) on bolt (15) and push bolt (15) through mounting hole in control column (16). Secure with washer (14) and nut (13).

NOTE: Refer to Detail A, Figure 207 for proper relationship of parts installed in Steps I through K below.



- | | | |
|------------------------|---------------------|--------------------|
| 1. Cotter Pin | 13. Nut | 25. Bearing |
| 2. Nut | 14. Washer | 26. Nut |
| 3. Washer | 15. Bolt | 27. Washer |
| 4. Bolt | 16. Control Column | 28. Bolt |
| 5. Horn Assembly | 17. Needle Bearing | 29. Shaft |
| 6. Pushrod Assembly | 18. Sleeve | 30. Rivet |
| 7. Cotter Pin | 19. Nut | 31. Washer |
| 8. Nut | 20. Washer | 32. Control Wheel |
| 9. Washer | 21. Bolt | 33. Washer |
| 10. Bolt | 22. Collar | 34. Washer |
| 11. Bellcrank Assembly | 23. Universal Joint | 35. Needle Bearing |
| 12. Bushing | 24. Washer | |

Control Column Disassembly/Assembly
Figure 207

- I. Install thick washer (33), left-hand pushrod assembly (6), thin washer (9), right-hand pushrod assembly (6), and remaining thick washer (33) onto bushing (12).
- J. Install parts assembled above into bellcrank assembly (11).
- K. Install bolt (10) through bellcrank assembly (11) and bushing (12). Secure with nut (8) and cotter pin (7).

NOTE: Proper alignment of control wheels (32) and bellcrank assembly (11) is essential before control column assembly is installed in aircraft.

- L. Position bellcrank assembly (11) so that its bottom edge is parallel with cross member of control column (16). Use a clamp or other suitable means to hold bellcrank assembly in this position.
- M. Observe control wheels (32). The bottom edge of each control wheel should be parallel with cross member of control column (16). If necessary, remove nut (2), washer (3), and bolt (4). Loosen check nut on pushrod assembly (6), and adjust rod end as required to obtain proper alignment of each control wheel. Tighten check nut and install bolt (4), washer (3), and nut (2).
- N. Install cotter pins (1). Remove clamp from bellcrank assembly (11).

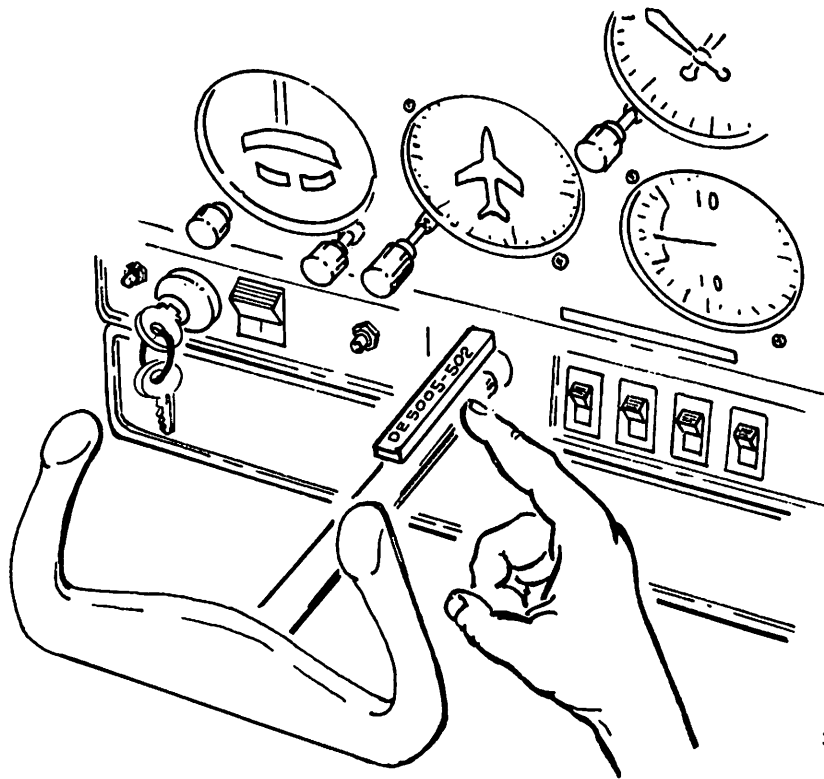
16. Control Column Installation (See Figure 206.)

- A. Install sleeve (28) into control column assembly and install control column assembly into support assembly. Secure with bolt (29), washers (27), and nut (26).
- B. Position control column such that support assembly (21) fits over its six mounting studs. Secure support with washers (20) and nuts (19). Torque to standard value. (See Chapter 91.)
- C. Place clevises of elevator cables (11) on control column horns and secure with bolt (10), washer (9), nut (8), and cotter pin (7).
- D. Place clevises of aileron cable (6) in bellcrank (5). Secure with bolt (4), washers (3), nut (2), and cotter pin (1).
- E. Place aileron cables on pulleys (18). Place guards (16) over pulleys and secure to control column with bolt (15), washers (14), and nut (13). Install control wheel assemblies (25) and secure with nuts (24), washers (23), and bolts (22).
- F. Rig elevators per Paragraph 17 below. Rig ailerons per Section 27-1-1.
- G. Install center console (Chapter 25). Install access covers. Pull floor covering into place and secure with fasteners.

17. Elevator Control System Rigging

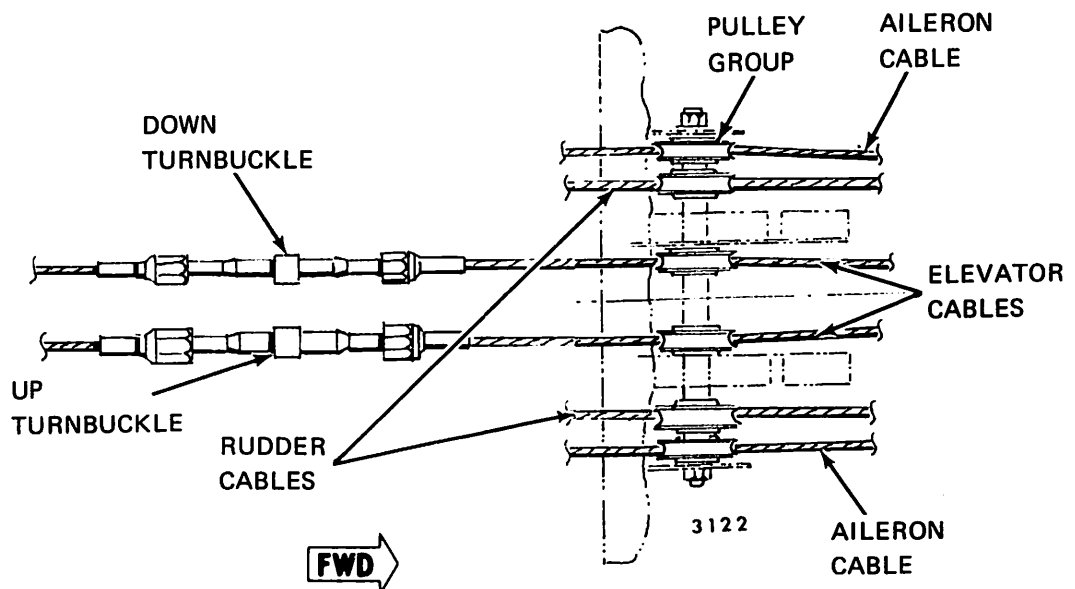
Elevator control system rigging should be performed at an ambient temperature that is average for the area in which the aircraft is normally operated. If rigging must be done at temperature above or below normal, it is recommended that cable tension be measured when temperature returns to normal.

- A. Secure the control wheel in the neutral position by installing rigging fixture as shown in Figure 208. An alternate method is to center control lock hole in control wheel shaft 4.0 inches aft of control lock hole in instrument panel collar and clamp in place.
- B. Remove center console panels (Chapter 25) to provide access to the elevator turnbuckles located under the aft end of the console.
- C. Adjust the elevator turnbuckles (Figure 209) until the elevator is faired with stabilizer.

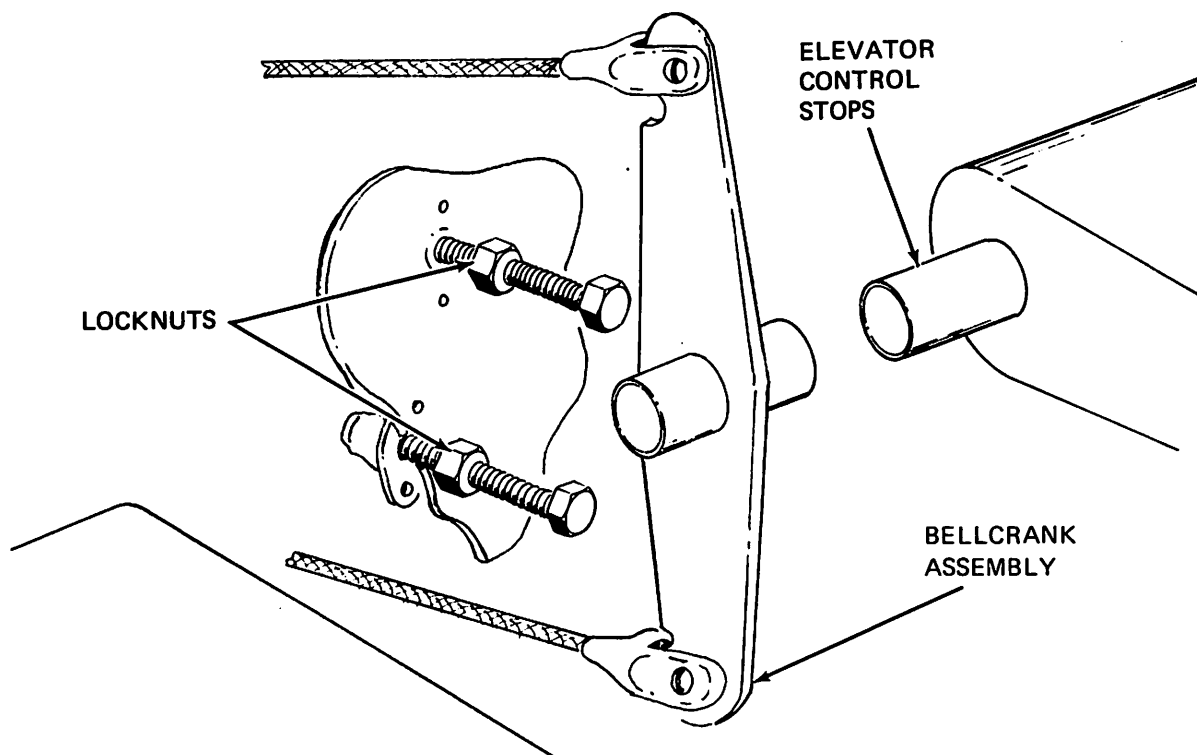


**Elevator Rigging Fixture
Figure 208**

- D. Check the elevator cable tension and adjust the turnbuckles to obtain $35 \pm 0, -5$ lbs tension. Recheck the 0° position of the elevator surface.
- E. Remove rigging fixture.
- F. Remove tailcone per Chapter 53.
- G. Loosen locknuts (Figure 210) on elevator control stops.
- H. Place an inclinometer on the elevator surface forward of the trim tab, and in the center of the elevator.
- I. Hold the elevator faired with horizontal stabilizer and center the bubble. Lock the zero adjustment.
- J. Move the elevator against the up control stop and measure the throw of the control.
- K. Adjust the top elevator stop to obtain $12^\circ \pm 1^\circ$ indication. Tighten control stop locknut.
- L. Move the elevator to its full down position (against the control stop) and measure the throw of the control on the inclinometer.
- M. Adjust the bottom elevator stop to obtain $28^\circ \pm 2^\circ$.
- N. Recheck cable tension and safety turnbuckles with clips.
- O. Check trim tab rigging and rig as required (Paragraph 18).
- P. Install center console panels per Chapter 25.
- Q. Install tailcone per Chapter 53.



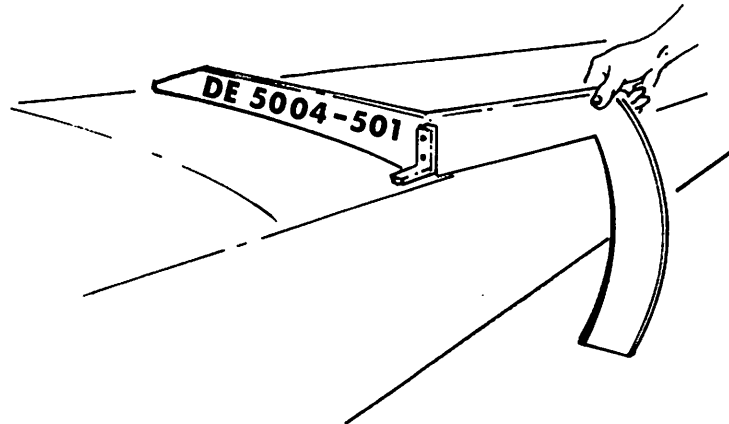
Elevator Turnbuckles
Figure 209



Elevator Control Stops
Figure 210

18. Trim Tab Control System Rigging

- A. Check elevator rigging and rig as required (Paragraph 17).
- B. Run trim wheel to its full nose up position (full aft rotation).
- C. Place trim tab rigging fixture (Figure 211) on the elevator at the center of the trim tab span.
- D. Fair elevator with horizontal stabilizer and note reading on fixture.
- E. Fixture shall indicate $15^\circ \pm 2^\circ$ down throw of trim tab. If tab throw is not within tolerance, adjust rigging as follows:
 - (1) Position the elevator to its neutral ($0^\circ \pm 2^\circ$) position and install rigging fixture (Figure 208).
 - (2) Rotate trim wheel to its full nose up position (full aft rotation).
 - (3) Remove console side panels (Chapter 25) to provide access to trim control mechanism.
 - (4) Remove cotter pin (27, Figure 205), and loosen nut (28).
 - (5) Pull trim wheel (32) out until its pinion gear (34) clears the drive pinion gear (23).



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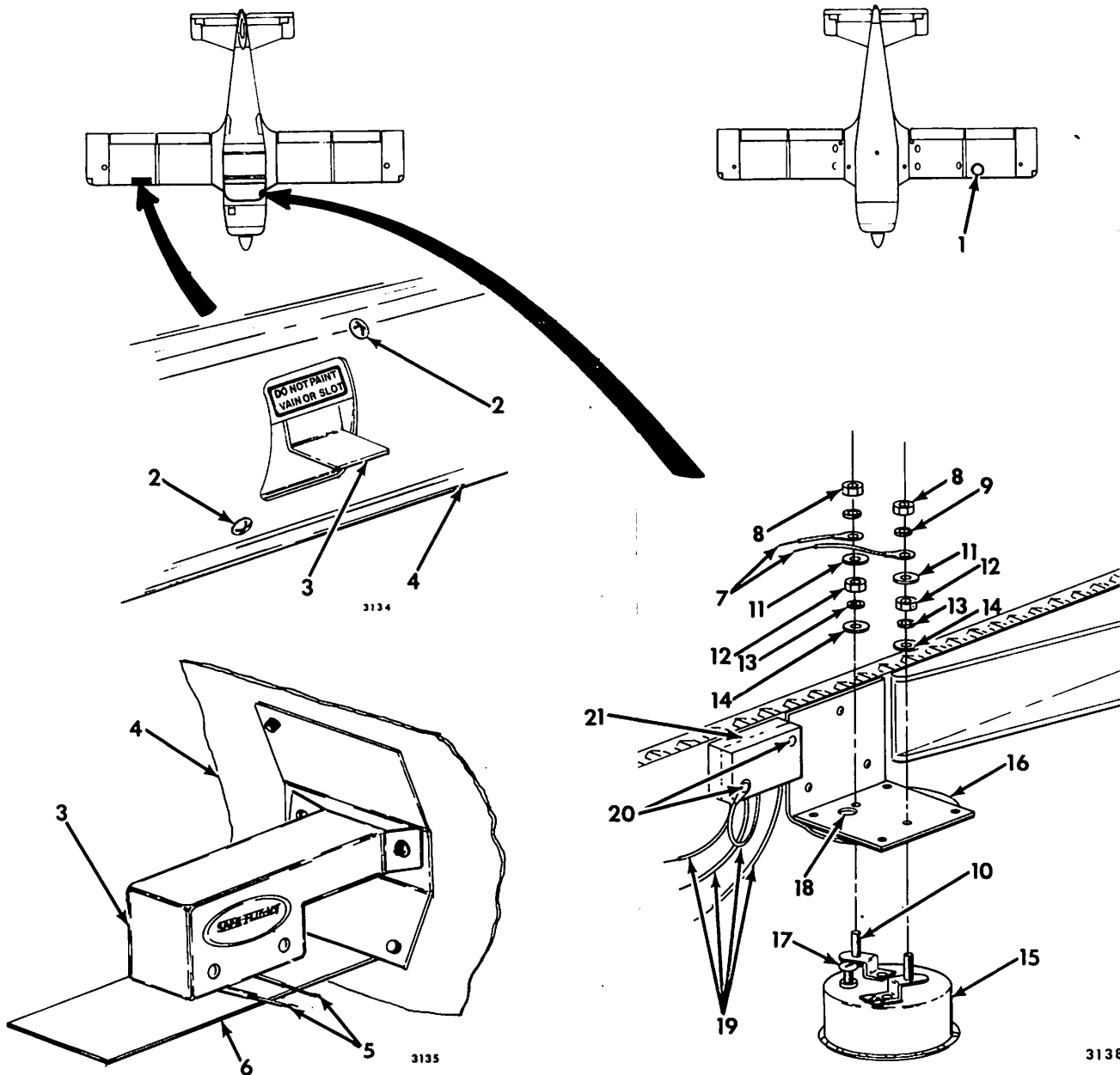
Trim Tab Rigging Fixture
Figure 211

- (6) Rotate flexible cable (19) by hand until the trim tab down throw is $15^{\circ} \pm 2^{\circ}$ down.
- (7) Position trim wheel (32) and follower pin on trim indicator (40) so that the follower pin is engaged in the innermost spiral groove of the trim wheel.
- (8) With trim wheel (32) still disengaged from drive pinion gear (23), rotate trim wheel until follower pin on trim indicator (40) is resting against the stop at the innermost end of the spiral groove. Push trim wheel (32) in to engage pinion gears (23 and 34). Tighten nut (28) sufficiently to compress spring washer (29) as required to seat follower pin firmly at bottom of spiral groove and allow trim wheel to turn freely. Install cotter pin (27).
- (9) Rotate trim wheel (32) until the trim tab is in the neutral (0°) position.
- (10) Bend indicator wire on trim indicator bracket (40) to agree with "T.O." on trim indicator.
- (11) Remove rigging fixture (Figure 211) and control lock or rigging fixture (Figure 205).
- (12) Check trim system for freedom of movement.
- (13) Install center console access panels (Chapter 25).

19. Stall Sensor Switch Removal (See Figure 212.)

NOTE: The use of a template to locate switch is recommended to minimize flight test time after switch removal and installation.

- A. Cut a template from cardboard or other suitable material to fit wing leading edge. Fit the template over the wing adjacent to the stall warning switch vane. Draw a line on the cardboard to indicate the normal position and angle of the stall warning switch vane. Remove access cover (1) from wing.
- B. Remove screws (2) securing sensor switch (3) to wing (4).
- C. Tag and disconnect wires (5), and remove sensor switch (3) from inside of wing (4).
- D. Ensure that insulating strip (6) is not damaged.



1. Access Cover
2. Screw
3. Sensor Switch
4. Wing
5. Wires
6. Insulating Strip
7. Wires
8. Nut
9. Washer
10. Terminals
11. Washer

12. Nut
13. Washer
14. Washer
15. Stall Warning Horn
16. Mounting Bracket
17. Adjustment Screw
18. Access Hole
19. Wires
20. Screws
21. Controller

Stall Warning System Removal/Installation (Sheet 1 of 2)
Figure 212

20. Stall Sensor Switch Installation (See Figure 212.)

- A. Check that insulation strip (6) is in position beneath switch terminal screws.
- B. Connect wires (5) to sensor switch (3).
- C. Position sensor switch (3) inside wing (4) and install screws (2). Fit template over wing leading edge and use as a guide to position stall warning switch vane. Tighten screws (2).
- D. Install access cover (1).
- E. Flight test and adjust stall warning system (Paragraph 25).

21. Stall Warning Horn Removal (See Figure 212.)

- A. Tag wires (7).
- B. Remove nuts (8), washers (9), and wires (7) from stall warning horn terminals (10).
- C. Remove washers (11), nuts (12), and washers (13 and 14) from terminals (10).
- D. Remove stall warning horn (15) from mounting bracket (16).

22. Stall Warning Horn Installation (See Figure 212.)

- A. Position stall warning horn (15) so that its terminals (10) align with holes in mounting bracket (16) and so that adjustment screw (17) aligns with access hole (18) in mounting bracket.
- B. Place washers (14), washers (13), and nuts (12) on terminals (10).
- C. Tighten nuts (12) per Chapter 91.
- D. Place washers (11), wires (7), washers (9) and nuts (8) on terminals (10). Torque to standard value. (See Chapter 91.)

23. Time Delay Controller Removal (See Figure 212.)

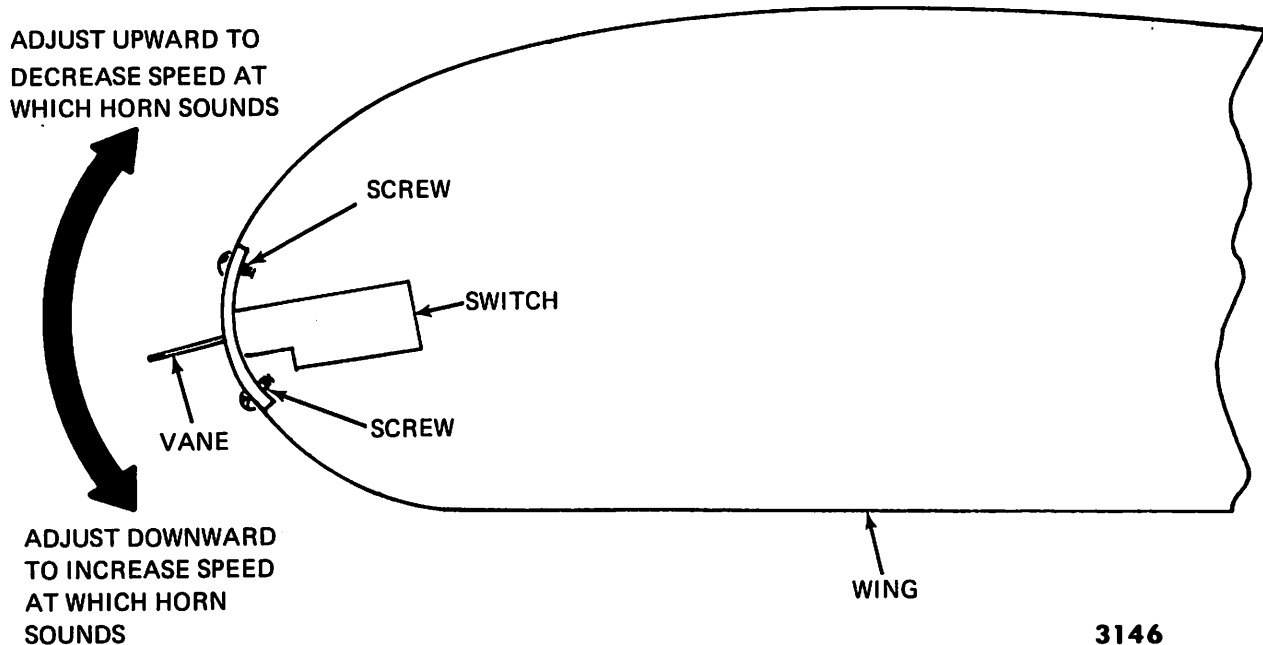
- A. Tag wires (19).
- B. Remove screws (20).
- C. Disconnect wires (19) and remove controller (21) from aircraft.

24. Time Delay Controller Installation (See Figure 212.)

- A. Connect wires (19).
- B. Position controller (21) so that its holes align with mounting holes.
- C. Secure with screws (20).

25. Stall Warning System Adjustment (See Figure 213.)

- A. Flight test aircraft, noting speed at which stall warning system sounds, and speed at which stall occurs. Stall warning horn shall sound at 4 to 9 knots (5 to 10 mph) prior to stall.



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Stall Sensor Switch Adjustment
Figure 213

B. If stall warning occurs at incorrect speed, adjust switch as follows:

- (1) Remove stall sensor switch access panel (1, Figure 212).
- (2) Loosen screws (2) securing sensor switch.
- (3) Position switch upward to decrease speed at which horn sounds, or downward to increase speed.
- (4) Tighten screws (2) and replace access panel (1).
- (5) Repeat Steps A and B as necessary to obtain proper stall warning.

26. Stall Warning System Operational Check

NOTE: The following check gives only a system go, no-go check. It does not test for operation at proper airspeed.

- A. Set master switch to ON.**
- B. Lift and hold vane on stall sensor switch. Stall warning horn shall sound within two seconds.**
- C. Release vane and set master switch to OFF.**

FLAPS – DESCRIPTION/OPERATION

1. General (See Figure 1.)

The flap system consists of a flap on each wing, mounted inboard of the ailerons, an electrically driven actuator, and mechanical linkages to actuate the flaps. The electrical motor is controlled by a toggle switch mounted on the center console. Flap position is indicated by an indicator on the console connected by wire to the flap drive mechanism.

2. Flap Structure (See Figure 2.)

The flap consists of honeycomb ribs and an aluminum skin bonded to the ribs. Each of the ribs contains a hole along its hinge line. These holes contain bearings to accommodate the aileron torque tube, over which the flaps fit. The flap torque tube fits over the aileron torque tube, and actuates the flap by means of a horn bolted to the root flap rib.

3. Flap Drive and Linkage (See Figure 3.)

The flaps are positioned by a reversible DC motor. The motor turns a worm drive gear in the gearbox. The driven gear actuates a screw mechanism to move the push-pull linkage. This linkage is attached to a horn on the center torque tube. As the push-pull linkage moves, the center torque tube rotates. The center torque tube is attached through adjustable linkages and horn assemblies to the flap torque tubes. As the center torque tube rotates, the flap torque tubes rotate the same amount. This arrangement provides a large mechanical advantage for the DC motor so that it can move the flaps against the aerodynamic load imposed in flight. In addition, it is a "one-way" worm-drive mechanism that effectively locks the flaps in position when the motor is stopped.

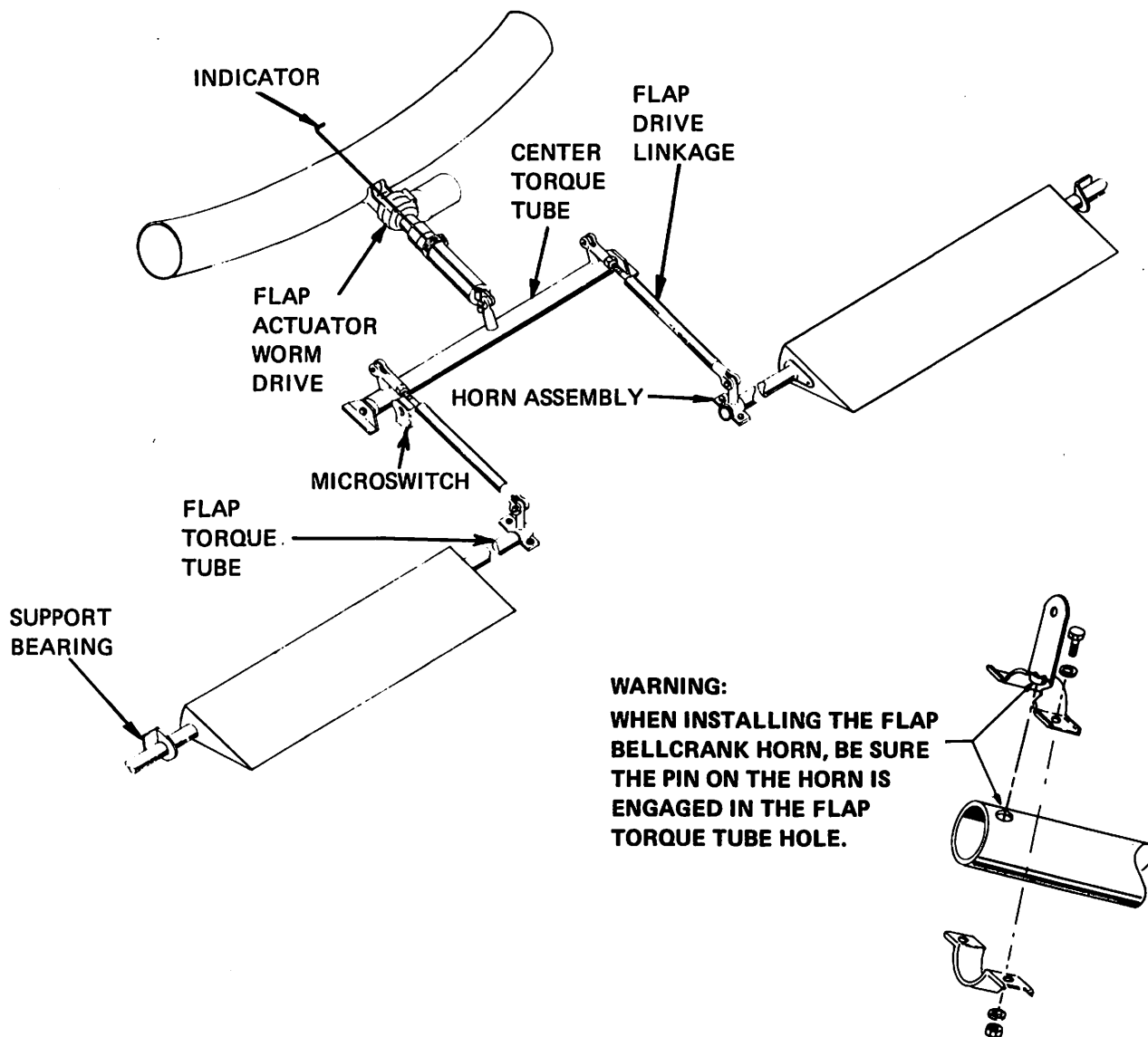
Flap travel in the extended position is limited by a mechanical stop in the flap actuator mechanism. When the flaps are fully extended, the mechanical stop prevents further travel. A friction type clutch on the flap actuator allows the flap motor to continue to rotate so that it is not stalled and damaged.

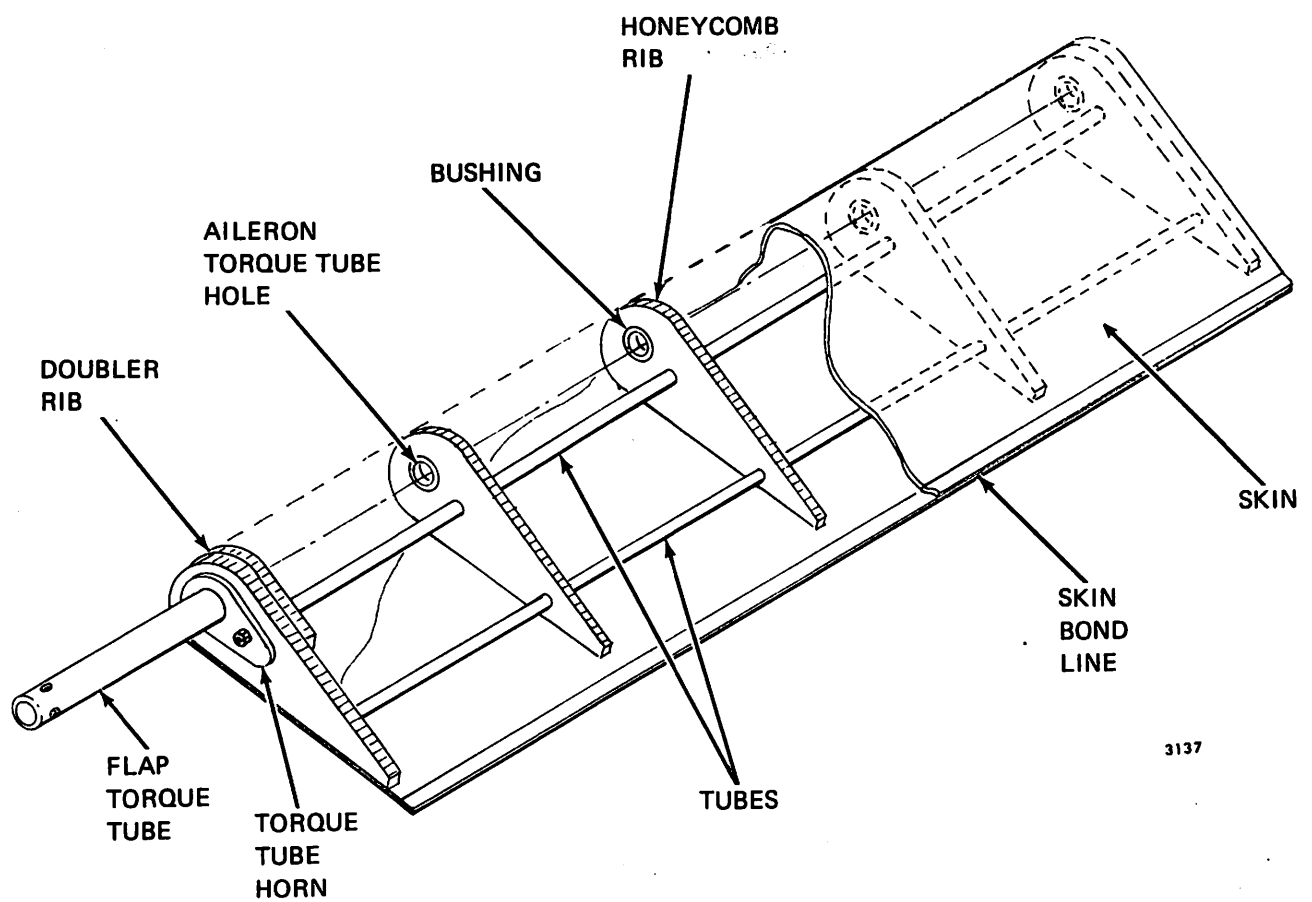
Flap travel in the retracted position is limited by a microswitch located adjacent to the left end of the center torque tube. As the torque tube moves to the up limit of travel, it actuates the microswitch, which interrupts power to the drive motor.

4. Flap Electrical System (See Figure 4.)

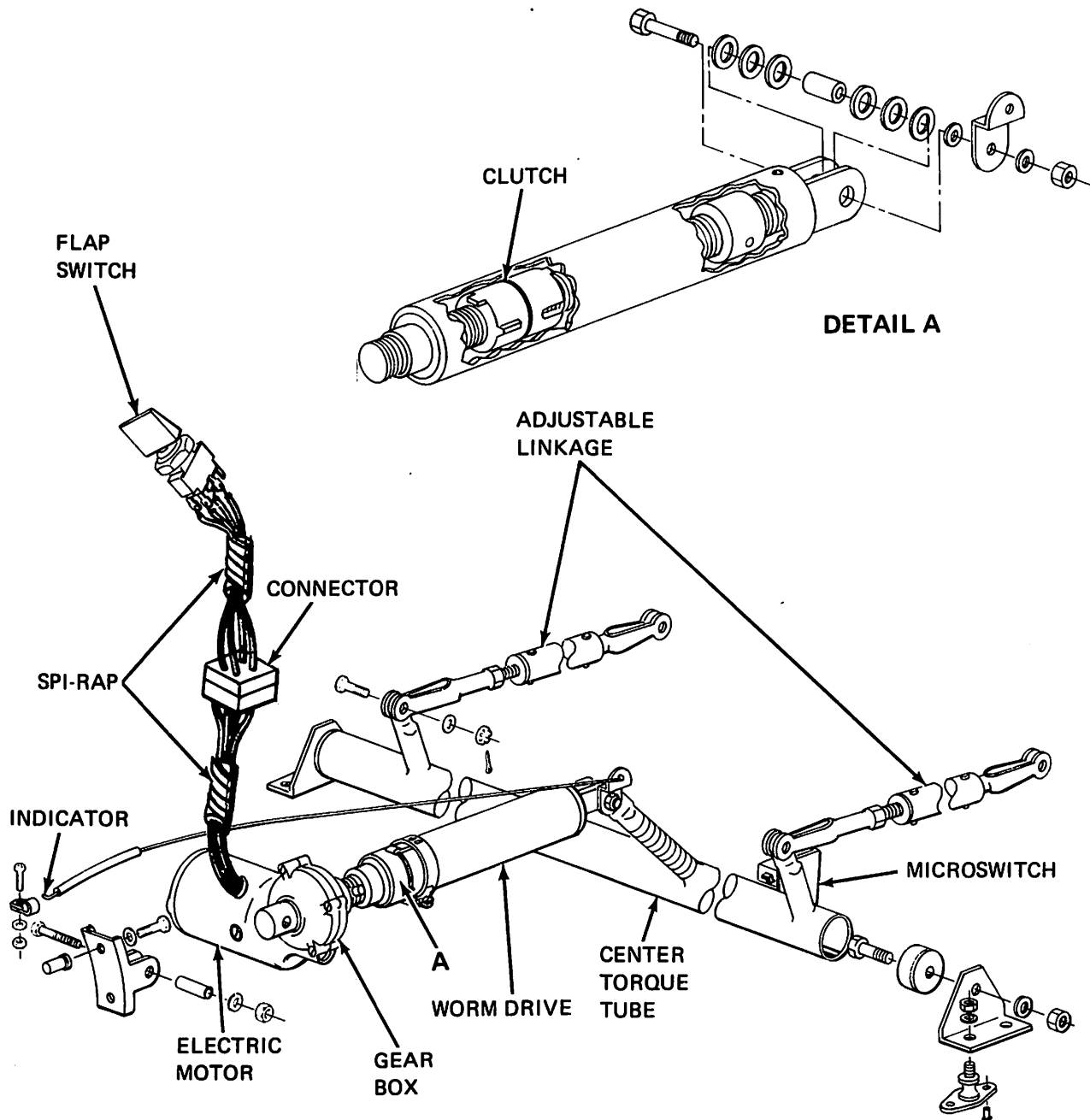
The flap electrical system receives power from the DC bus through a 15-amp fuse. The voltage is applied to the red lead of the flap drive motor. When the flap switch is held in the DOWN (aft) position, the yellow lead of the motor is grounded, and the black and brown leads are connected to each other in the flap switch. This causes the flap drive motor to extend the flaps. If the switch is released when the flaps are partially extended, the motor and flaps stop. If the switch is held in the DOWN position until the flaps are fully deployed, flap travel is stopped by a mechanical stop in the flap actuator. The flap drive motor will continue to run when the stop is reached if the flap switch is held in the DOWN position, and a friction type clutch decouples the motor. Since the flap drive motor operates into a worm gear arrangement, the flap is held secure at any point which the motor stops. The flap switch is spring-loaded so that when it is released it moves from the DOWN position to the neutral position.

When the flap switch is placed in the UP position, the brown lead of the motor is grounded through the limit switch and the flap switch, and the black and yellow leads are connected. This causes the flap drive motor to drive in the reverse direction, retracting the flaps. As the flaps reach their fully retracted position a cam on the center torque tube actuates a microswitch, disabling the motor circuit. The flap switch has a detent in the UP position so that the switch will remain in the UP position until moved.

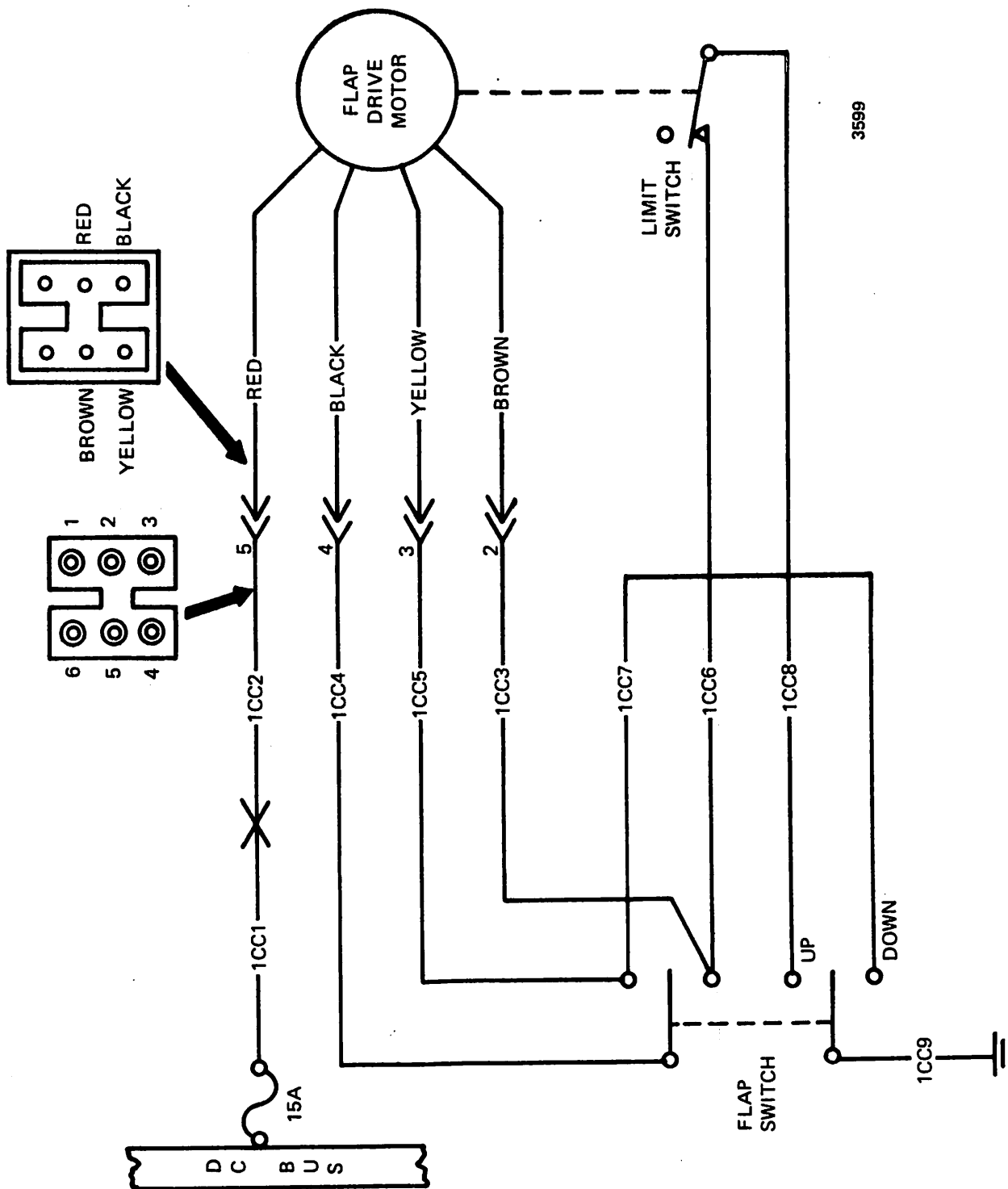
Flap System
Figure 1



Flap Structure
Figure 2



Flap Drive Mechanism
Figure 3



Flap Electrical System Schematic
Figure 4

FLAPS – TROUBLE SHOOTING1. Trouble Shooting Flaps.

TROUBLE	PROBABLE CAUSE	REMEDY
Flaps do not move when switch is actuated.	Set MASTER switch to ON. Check fuse.	Replace fuse if defective.
	Disconnect flap motor connector. Check for 12V at pin 5.	If voltage is not present check wiring. Repair as required.
	Place flap switch in UP position. Check for continuity between pins 3 and 4 of connection.	If continuity is not present, check wiring and switch. Replace or repair as required.
	Check that pin 2 is grounded.	If pin 2 is not grounded check wiring, flap switch and limit switch. Repair or replace as required.
	Reconnect flap motor lead and hold flap switch in DOWN position. Check that motor drives.	If motor does not drive, replace motor. If motor drives but flaps do not extend to down position, replace drive mechanism.
Flaps drive past up limit.	Check limit switch and wiring.	Adjust flap rigging per Paragraph 7, or replace limit switch.
Flaps do not extend fully in flight.	Grease on outer surface of nylon clutch nut.	Remove grease.

FLAPS – MAINTENANCE PRACTICES

1. Flap Removal (See Figure 201.)

- A. Remove aileron per Section 27-10-0.
- B. Remove baggage compartment floor covering and access covers as required (Chapter 25) to expose flap drive mechanism and flap torque tubes.
- C. Remove nut (1, Figure 201), washer (2), and bolt (3) from horn (4).
- D. Remove horn (4) and clamp (5) from flap torque tube (6).
- E. Remove nuts (41), washers (42), and bolts (43). Remove bearing support assembly (7) and shim (44).
- F. Pull the torque tube (6) outboard until it clears the aircraft.

NOTE: If required, flap torque tube may be removed from flap by removing nut and sealant at inboard end of flap. If this is done, be sure to apply new sealant as required to prevent water from reaching the inner walls of the torque tube. Approved sealants are RTV725 (Dow-Corning), EC1239 and EC1674 (3M), 3201 (Chemical Seal Corp.) and 567 (Pro-Seal).

2. Flap Installation (See Figure 201.)

- A. Position flap on wing and slide torque tube (6) through the bearing support assembly (7). Install bolts (43), shim (44), washers (42), and nuts (41). Position bearing support assembly (7) so that flap torque tube is held concentrically around aileron torque tube and tighten securely.

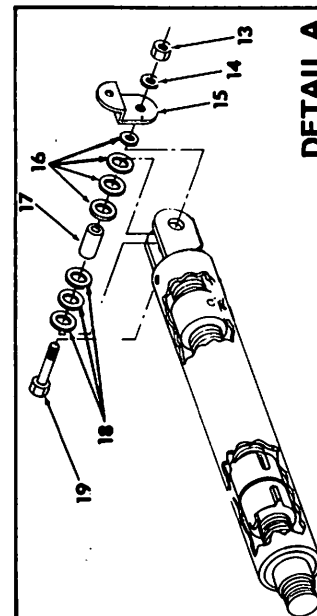
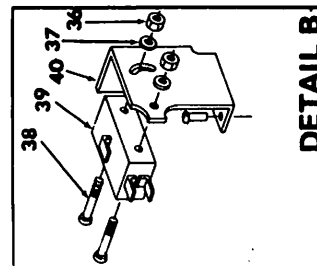
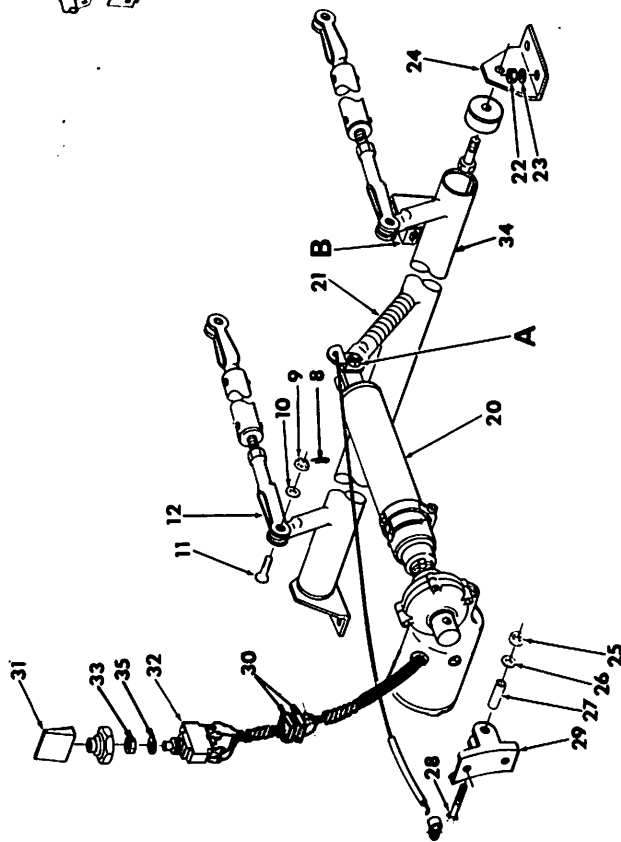
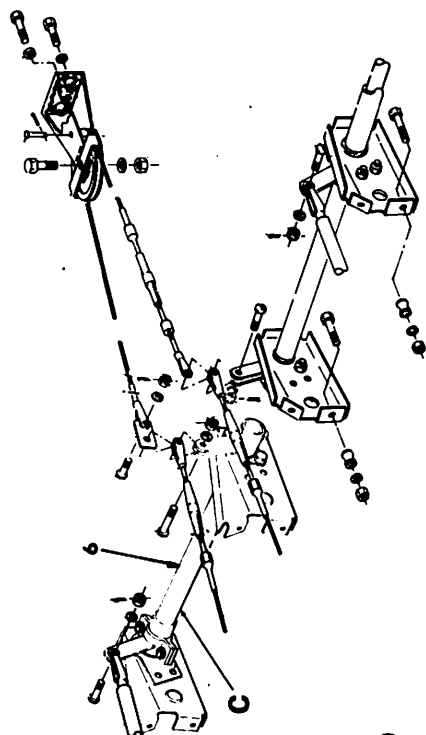
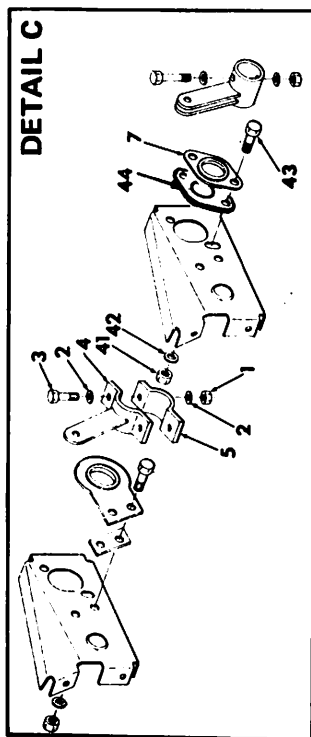
WARNING: WHEN INSTALLING THE FLAP BELLCRANK HORN, BE SURE THAT THE PIN ON THE HORN IS ENGAGED IN THE TORQUE TUBE HOLE.

- B. Install bellcrank horn (4) and clamp (5) on torque tube (6) and secure with bolts (3), washers (2), and nuts (1). Torque to standard value per Chapter 91.
- C. Install aileron per Section 27-1-0.
- D. Install access panels and floor covering (Chapter 25).
- E. Rig flaps per Paragraph 7 below.

3. Flap Drive Removal (See Figure 201.)

- A. Remove aft panels on center console (Chapter 25) to provide access to flap drive. Remove baggage compartment floor covering and access panels as required to provide access to flap torque tubes.
- B. Remove cotter pin (8), nut (9), washer (10) and bolt (11). Pull pushrod assembly (12) from horn.
- C. Remove nut (13), washer (14), bracket (15), washers (16), bushing (17), washers (18), and bolt (19) from flap drive mechanism (20). Pull flap drive mechanism (20) from horn (21).
- D. Remove nut (22) and washer (23). Pull center torque tube and bracket (24) from aircraft.
- E. Remove nut (25), washer (26), bushing (27), and bolt (28) from mounting bracket (29).
- F. Disconnect connector (30) and remove drive mechanism (20) from aircraft.
- G. Remove knob (31) from switch (32). Remove nut (33) and washer (35) and remove switch (32) from aircraft.

WARNING
WHEN INSTALLING THE FLAP
BELLCRANK HORN, BE SURE
THE PIN IS ENGAGED IN THE
FLAP TORQUE TUBE HOLE.
THIS IS ESSENTIAL FOR PROPER
FLAP OPERATION AND RIGGING.



**Flap Removal/Installation (Sheet 1 of 2)
Figure 201**

- | | |
|-----------------------------|-----------------------|
| 1. Nut | 23. Washer |
| 2. Washer | 24. Bracket |
| 3. Bolt | 25. Nut |
| 4. Horn | 26. Washer |
| 5. Clamp | 27. Bushing |
| 6. Flap Torque Tube | 28. Bolt |
| 7. Bearing Support Assembly | 29. Mounting Bracket |
| 8. Cotter Pin | 30. Connector |
| 9. Nut | 31. Knob |
| 10. Washer | 32. Switch |
| 11. Bolt | 33. Nut |
| 12. Pushrod Assembly | 34. Drive Torque Tube |
| 13. Nut | 35. Washer |
| 14. Washer | 36. Nut |
| 15. Bracket | 37. Washer |
| 16. Washers | 38. Screw |
| 17. Bushing | 39. Microswitch |
| 18. Washer | 40. Bracket |
| 19. Bolt | 41. Nut |
| 20. Flap Drive Mechanism | 42. Washer |
| 21. Horn | 43. Bolt |
| 22. Nut | 44. Shim |

Flap Removal/Installation (Sheet 2 of 2)
Figure 201

4. Flap Drive Installation (See Figure 201.)

- A. Position torque tube brackets (24) over their mounting studs and secure with washers (23) and nuts (22). Torque to standard value per Chapter 91.
- B. Place pushrod assemblies (12) over horns on drive torque tube (34) and secure with bolt (11), washer (10), nut (9), and cotter pin (8).

WARNING: MAKE SURE THE PIN ON THE BELLCRANK HORN IS ENGAGED PROPERLY IN THE FLAP TORQUE TUBE HOLE. FAILURE TO COMPLY MAY RESULT IN SLIPPAGE AND AN ASYMMETRICAL FLAP CONDITION.

- C. Place bushing (17) on bolt (19). Push end of bolt (19) through one side of flap drive mechanism (20) mounting hole. Place washer (18) on bolt, then push bolt (19) through hole in horn (21). Place washers (16) on bolt (19) between horn (21) and flap drive mechanism (20). Push bolt (19) through flap drive mechanism (20) and secure with bracket (15), washer (14), and nut (13). Torque to standard value per Chapter 91.
- D. Insert bushing (27) in mounting lug of flap drive mechanism (20). Place mounting lug in mounting bracket (29) so that holes align. Secure with bolt (28), washer (26), and nut (25). Torque to standard value per Chapter 91.
- E. Install switch (32) on console and secure with washer (35) and nut (33). Screw knob (31) on switch (32). Connect connector (30).
- F. Rig flaps per Paragraph 7 below.

- G. Install center console panel (Chapter 25). Install access panels and baggage compartment floor covering.

5. Wiring and Switch Removal (See Figure 201.)

A. Flap Switch Removal

- (1) Place master switch in OFF position.

- (2) Unscrew flap switch knob (31) from flap switch (32).
- (3) Remove center console access panels per Chapter 25.
- (4) Remove mounting nut (33) and washer (35) from flap switch (32) and pull flap switch from console.
- (5) Disconnect power lead. Disconnect connector (30) and remove switch (32).

B. Microswitch Removal

- (1) Remove center console access panels (Chapter 25) to provide access to microswitch.
- (2) Disconnect wires.
- (3) Remove nuts (36), washers (37), and screws (38) from microswitch (39) and remove microswitch from bracket (40).

6. Wiring and Switch Installation (See Figure 201.)

A. Microswitch Installation

- (1) Position microswitch (39) on bracket (40) so that mounting holes align.
- (2) Secure with screws (38), washers (37), and nuts (36). Torque to standard value per Chapter 91.
- (3) Connect wires.
- (4) Rig flaps per Paragraph 7 below.
- (5) Install center console access panels per Chapter 25.

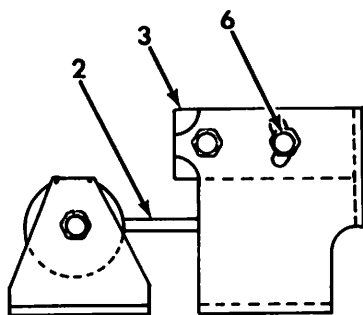
B. Flap Switch Installation

- (1) Connect power lead to switch (32) and plug connector (30) together.
- (2) Insert flap switch (32) from underside of console, positioning locator slot in switch to correspond to tab on console.
- (3) Install mounting nut (33) and washer (35) on switch (32) and tighten nut.
- (4) Install center console access panels (Chapter 25).
- (5) Screw flap knob (31) on flap switch (32).

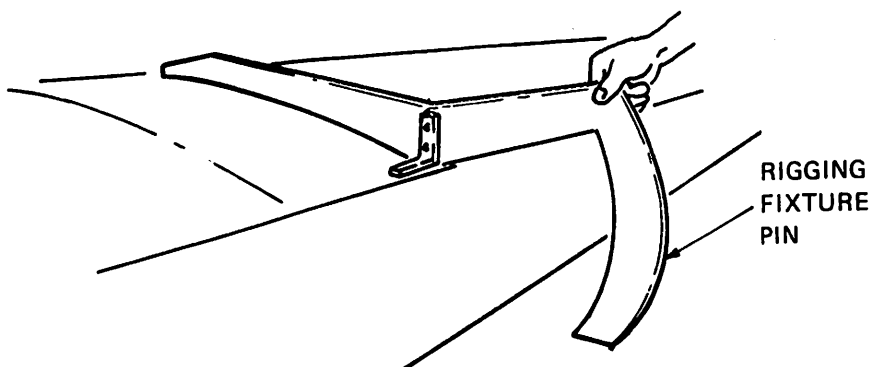
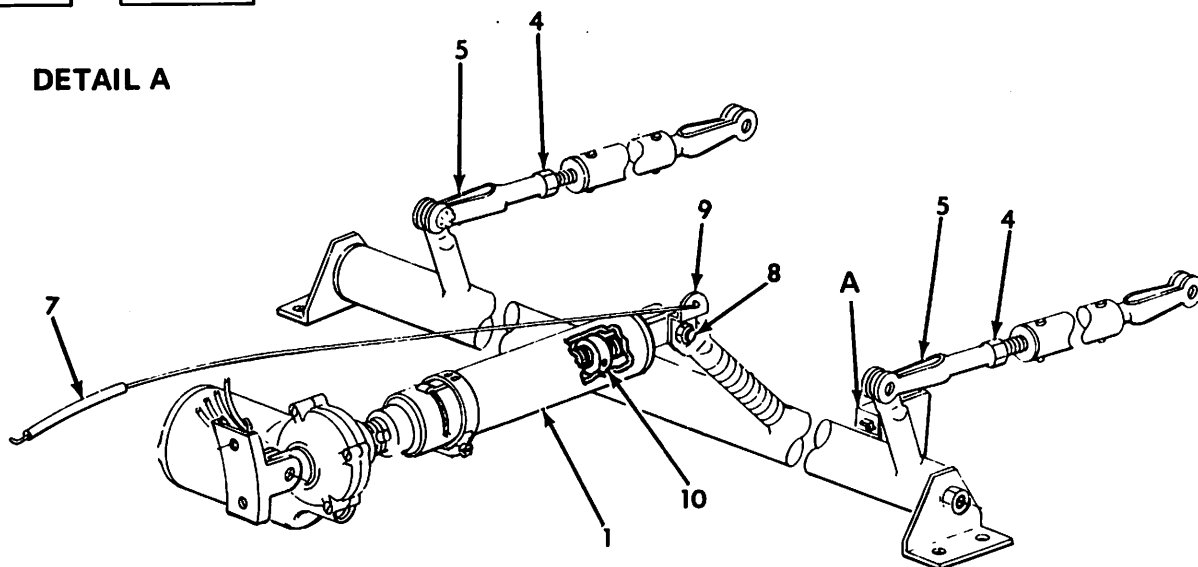
7. Flap Rigging (See Figure 202.)

NOTE: The following procedure requires use of the aircraft electrical system. To avoid unnecessary drain on the battery, turn off all lights, radios, and other electrical loads before rigging the flaps.

- A.** Remove aft panels from center console (Chapter 25) as required to gain access to flap drive assembly.
- B.** Place the master switch in the ON position. Hold the flap switch in the DOWN position until the flaps are fully lowered and the clutch slippage is encountered.
- C.** Install the flap rigging fixture on each wing and note the flap position. Flaps should be at $30^{\circ} \pm 2^{\circ}$ and within 1° of each other.



DETAIL A



- 1. Actuator
- 2. Cam
- 3. Up Limit Switch
- 4. Locknut
- 5. Rod End

- 6. Nut
- 7. Flap Position Indicator
- 8. Bolt
- 9. Bracket
- 10. Up Stop

**Flap Rigging
Figure 202**

- D. If required, loosen locknuts (4) and adjust rod ends (5) to provide proper flap position. Tighten locknuts (4).
- E. Place the flap position switch in the UP position and allow the flaps to raise until the up limit switch (3) stops the drive motor. Return flap position switch to OFF position.
- F. Install the flap rigging fixture on each wing and note the flap position. Flaps should be at $0^\circ \pm 2^\circ$.
- G. If required, loosen nut (6) and adjust position of up limit switch so that the flaps stop at $0^\circ \pm 2^\circ$ when raised. Tighten nut (6) securely.
- H. Cycle the flaps from full up to full down position several times, making sure the flaps stop within the limits given in Steps C and F above. Place the master switch in the OFF position.
- I. After adjustments are complete, set the up stop (10) on the actuator approximately one-half turn beyond the point where the limit switch is actuated.
- J. With the flaps in the up position, loosen bolt (8) and rotate bracket (9) so that flap position indicator (7) is $.08 \pm .06$ inch from forward end of the slot.
- K. Install the aft panels on the center console (Chapter 25).

CHAPTER 28

FUEL SYSTEM

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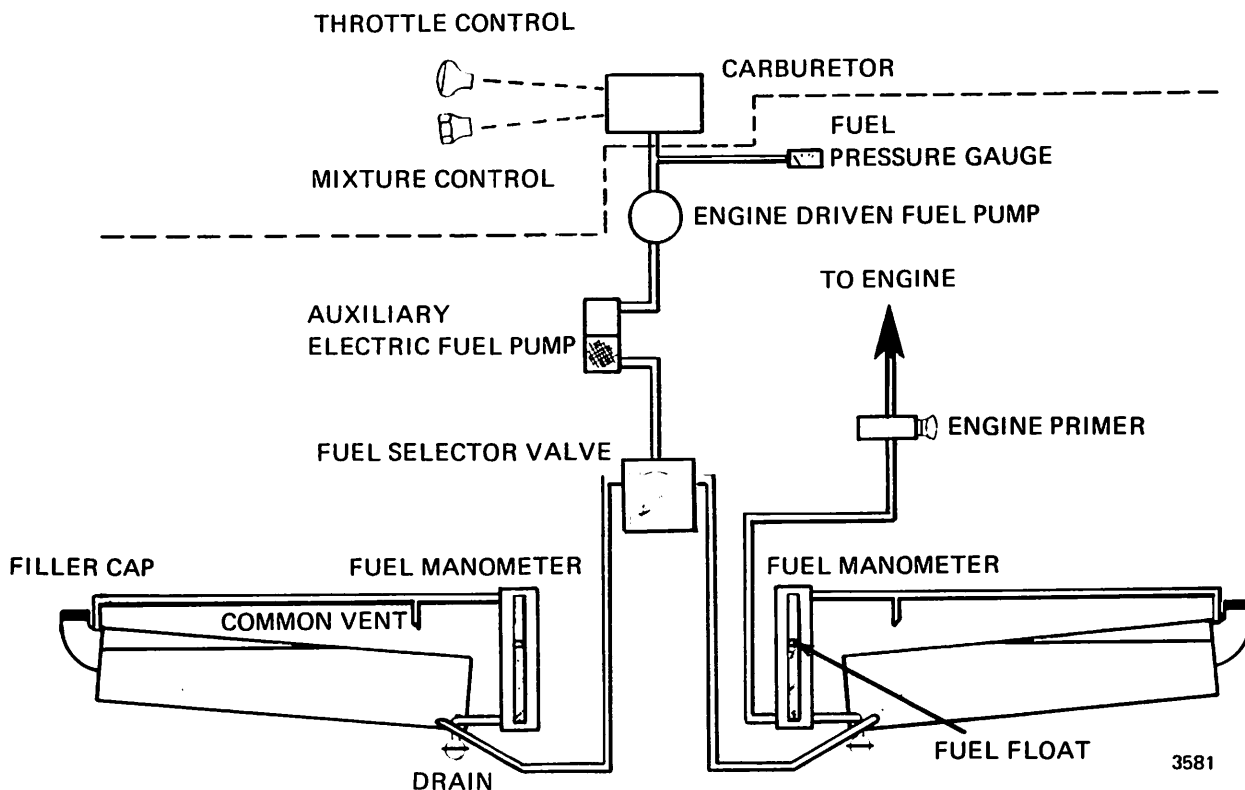
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FUEL SYSTEM – DESCRIPTION/OPERATION1. General (See Figure 1.)

- A. The fuel system consists of two fuel tanks, two fuel tank vents, fuel selector valve, an engine-driven fuel pump, an auxiliary electrically-driven fuel pump, fuel pressure gauge, and two fuel manometers with illuminated vertical sight gauges. The fuel tanks are integral parts of the tubular wing spar and are located inboard of each wing tip. Three baffles inside of each fuel tank serve to retard fuel slosh during uncoordinated maneuvers. Each fuel tank is sealed at each end by a machined casting. This casting has an O-ring and sealant around its entire periphery for sealing purposes.
- B. Fuel is drawn through the mesh finger strainer at the inboard end of the fuel tank, upward through the fuel selector valve mounted on the upper forward console panel, through the electrically-operated fuel pump mounted on the forward side of the firewall, through the engine-driven fuel pump to the carburetor. A tee connector, mounted at the base of the right fuel tank manometer, provides the connection for the fuel primer line. The fuel pressure gauge, mounted on the instrument panel, indicates carburetor fuel pressure. One of the two fuel manometers, mounted on the fuselage interior side panel, is left of the pilot's seat and the other is right of the passenger's seat. The fuel system piping slopes downward to a quick-drain valve located near each wing root. To provide proper operation of the fuel manometers, the fuel tank vents (one located at the bottom of each wing root) are mounted in a manner to maintain a slight pressure in flight.



Fuel System
Figure 1

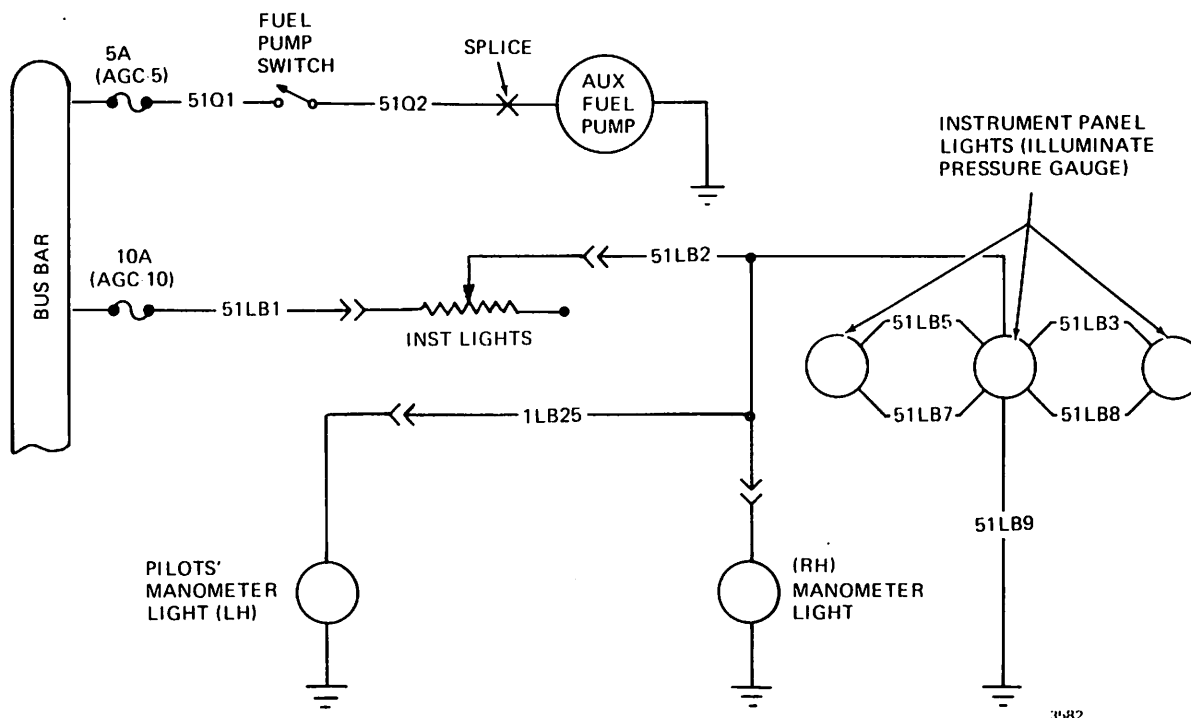
2. Fuel Tanks Capacities

Fuel tanks capacities are as follows:

Capacity (U.S. Gal.)	AA-1C (Std. Tanks)
Left Tank	12.0
Right Tank	12.0
Total	24.0
Unusable Fuel	
Left Tank	1.0
Right Tank	1.0
Total	2.0
Usable Fuel	
Left Tank	11.0
Right Tank	11.0
Total	22.0

3. Fuel System Electrical Circuitry

The electrical wiring, controls, and circuit protective devices that supply electrical power to the auxiliary fuel pump, manometer lights, and instrument panel lighting above the fuel pressure gauge are shown in Figure 2.



Fuel System Electrical Circuits
Figure 2

FUEL SYSTEM TROUBLE SHOOTING

1. Fuel System Trouble Shooting

Trouble shoot the fuel system as follows:

TROUBLE	PROBABLE CAUSE	REMEDY
No fuel pressure (electric fuel pump turned off)	Fuel selector valve in OFF position	Switch to fullest tank.
	Fuel tanks empty	Service with proper grade of fuel.
	Defective engine pump	Remove outlet line, crank engine several times, check for fuel flow from pump. Replace if faulty.
No fuel pressure	Dirty tank strainer	Remove and clean strainer. Flush tank clean prior to reassembly.
	Defective gauge	Replace gauge.
	Obstruction in pressure gauge line	Remove all fittings and lines starting at carburetor inlet and inspect and clean as necessary.
No or low fuel pressure (electric fuel pump turned on)	Partial or no fuel flow from the preceding causes	Use the preceding remedies.
	Blown fuse	Replace with fuse of appropriate rating.
	Faulty switch	Replace switch.
	Defective pump	Remove outlet line from pump. Little or no fuel flow indicates bad pump. Repair or replace pump.
Low Pressure or surging pressure	Obstruction in fuel lines	Starting at carburetor remove, inspect, and clean all fuel lines.
	Fuel valve improperly positioned	Check position.
	Clogged filter in electric pump	Clean filter.
	Defective engine pump	Repair or replace.

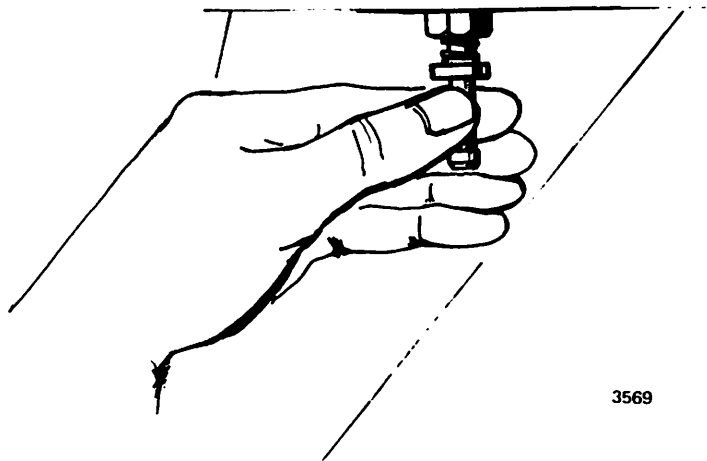
TROUBLE	PROBABLE CAUSE	REMEDY
	Fuel line or connection	Inspect all lines and tighten connection. Use thread sealant as required.
No fuel quantity indication	Leaking O-ring in electric fuel pump	Disassemble, inspect, and replace O-ring or pump.
	Empty fuel tank	Service with proper grade of fuel.
	Obstruction in fuel gauge line	Remove, inspect, and clean line.
	Obstruction at the fuel inlet (bottom)	Disassemble and clean gauge.
	Obstruction in fuel gauge vent line	Remove, inspect, and clean line.
	Obstruction in fuel gauge outlet (top)	Disassemble and clean gauge.
Fuel quantity indicating too high	Aircraft not level	Disregard – fuel will indicate correctly when aircraft is level.
Fuel gauge indicates too low	Aircraft not level	Disregard – fuel will indicate correctly when aircraft is level.
	Obstruction in fuel tank vent line	Remove, inspect, and clean vent line.

FUEL SYSTEM – MAINTENANCE PRACTICES**1. Fuel Tank Quick Drains (See Figure 201 and 202.)**

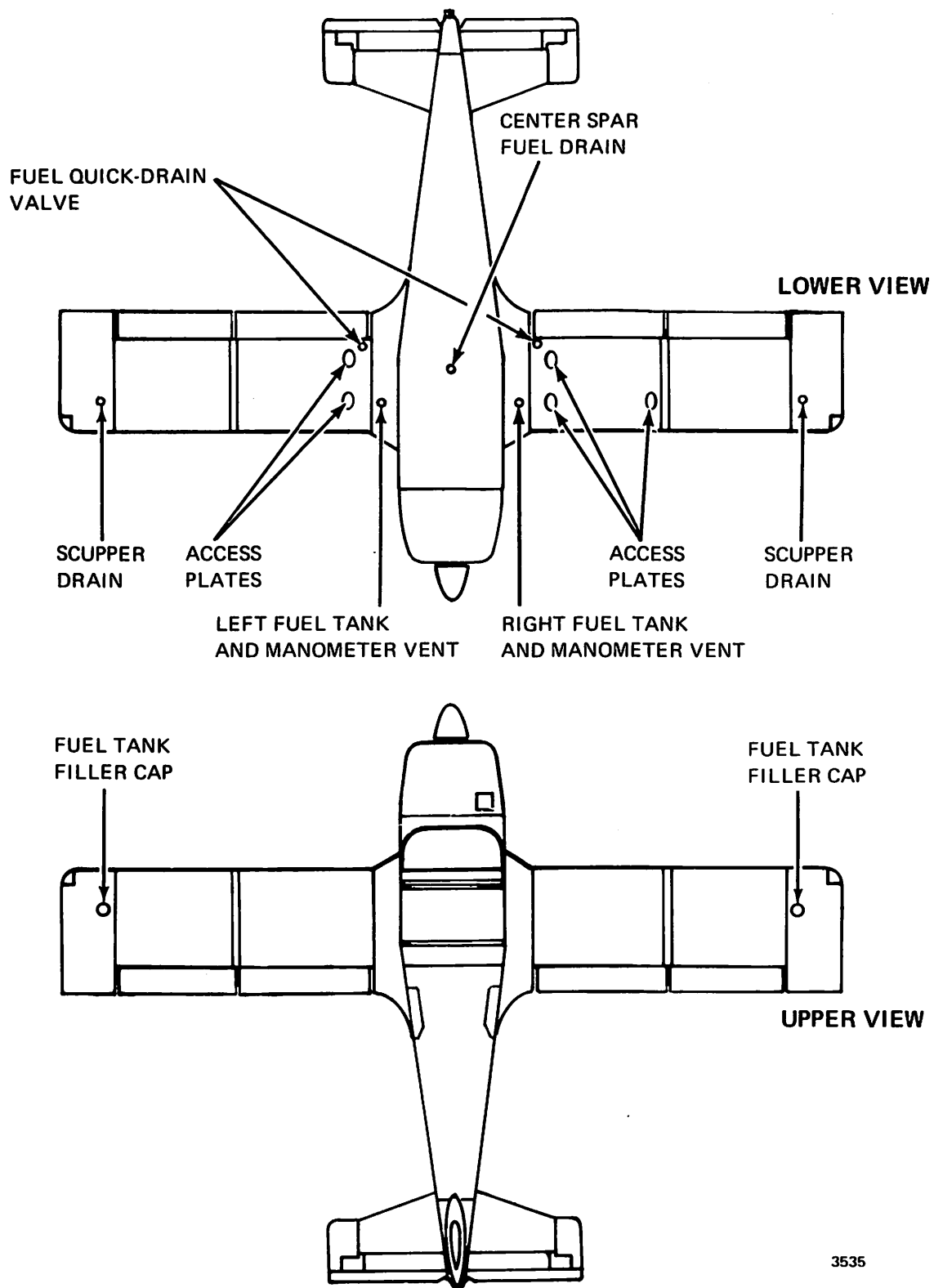
The fuel tank quick drains are located toward the rear and on the bottom of the wings, just outboard of the wing roots. They are spring loaded in the closed position to provide easy preflight draining. These quick drains are connected with a line and a short length of hose to the lowest point in each fuel tank. A sampler cup may be used for preflight fuel check of both wing tanks. The sampler cup is placed under the quick-drain valve and the plunger is pushed upward against the valve, allowing fuel to fill the cup for examination.

2. Refueling/Defueling

Refer to Chapter 12 for detailed refueling/defueling procedures.



**Fuel Tank Quick Drain
Figure 201**



3535

**Fuel System, Filler Drain and Vent Locations
Figure 202**

3. Reduction of Fuel Tank Vapor Hazards

A. General Precautions

During all defueling, ventilation, inerting, or maintenance procedures involving the fuel system, the following general precautions should be observed:

WARNING: WHEN FUEL IS BEING DRAINED, THERE IS LITTLE CONTROL OVER THE RELEASE OF FUEL VAPOR. THIS VAPOR SHOULD BE DISSIPATED AS QUICKLY AS POSSIBLE. COMPRESSED AIR OR EXPLOSION-PROOF BLOWERS MAY BE USED FOR THIS PURPOSE.

- (1) Defueling should be done outdoors with the aircraft at least 100 feet from hangars or other aircraft.
- (2) No smoking should be allowed within 100 feet of the aircraft.
- (3) Suitable fire fighting equipment should be available. Foam or soda type extinguishing agents are recommended.
- (4) The aircraft should be grounded to prevent static electricity from causing sparks. If a ramp ground is available, it should be connected to the exhaust stack. If a ramp ground is not provided, a temporary ground can be obtained by driving a metal rod into the ground and attaching a ground wire between the rod and the aircraft exhaust stack.
- (5) Flame and spark producing equipment should not be operated within 100 feet of the aircraft.
- (6) The aircraft should have its battery removed.
- (7) Only personnel working on the aircraft should be allowed in the immediate area, and no other maintenance should be performed while the tanks are being worked on.
- (8) When a fuel tank is opened for repair, air ventilation or inerting procedures should be started immediately to reduce vapor concentrations.
- (9) When draining fuel, ensure that suitable containers are available and that drained fuel is stored safely. Do not allow fuel to drip to the ground and form pools.
- (10) If it is necessary to ventilate or inert a tank when the aircraft is in a hangar, ensure that vapors do not accumulate to explosive or toxic levels in the hangar.

Before working on fuel tanks, defuel them per Chapter 12. Fuel that cannot be drained by normal defueling must be removed from the tanks by opening all drains.

Two general methods of reducing fuel vapor hazards can be used, ventilating or inerting. The simplest method, ventilation, is done by forcing clean air through the tank until all vapors have been dissipated and flushed out by the air. This method is best when the tank access covers must be removed for work in the tank.

Inerting is another method of reducing vapor hazards. In this method an inert gas, such as nitrogen or carbon dioxide, is forced into the tank to replace the air in the tank. This reduces the oxygen in the tank to a level that will not support combustion. Although inerting may be used to prevent explosion hazards from fuel vapor, it does not prevent toxic levels of vapor in the tank.

B. Air Ventilation

Personnel should be familiar with the general precautions tested in Paragraph A. before attempting the following fuel tank air ventilation procedures:

WARNING: IF FLAMMABLE OR TOXIC CLEANING SOLVENTS ARE ALLOWED IN FUEL TANK, INCREASE AIR CIRCULATION TO DISSIPATE VAPORS. AVOID INHALING VAPORS. KEEP HEAT, OPEN FLAME, OR SPARKS AWAY FROM WORK AREA.

- (1) Completely drain tank(s). (Refer to Chapter 12.)
- (2) Remove tank cap.
- (3) Use compressed air or an explosion-proof blower to blow air into the tank until tank interior is dry and free of vapor.
- (4) Continue ventilation whenever tank is open and being worked on.

C. Pressure Siphoning Inerting

Pressure siphoning inerting is normally used prior to shipment of aircraft by common carrier (ship, truck, aircraft) to ensure the elimination of vapors in the aircraft that can support combustion. It can also be used when an aircraft is to be displayed indoors and susceptible to open flame or sparks.

The following equipment, or its equivalent, is recommended for pressure siphoning inerting:

Differential pressure gauge or manometer.

Nitrogen supply with pressure regulator valve.

Rubber plugs to fit fuel system vent and manometer nipple.

Personnel should be familiar with the general precautions listed in Paragraph A. before attempting the following fuel tank pressure siphoning inerting procedures:

- (1) Set fuel selector valve to OFF.
- (2) Fill left fuel tank to capacity per Chapter 12.
- (3) Insert rubber plug in left wing fuel tank vent.
- (4) Disconnect fuel line at input to auxiliary electric fuel pump forward of firewall.
- (5) Connect dry nitrogen supply and associated pressure regulator valve and indicator (or mercury manometer) to fuel line that was disconnected in Step (4).

CAUTION: WHEN PURGING FUEL TANK, ENSURE THAT PRESSURE APPLIED TO FUEL TANK DOES NOT EXCEED 4.0 PSI.

- (6) Set dry nitrogen supply pressure regulator to 3.5 psi.
- (7) Set fuel selector valve to left tank position.
- (8) Place suitable containers (totaling approximately 12 gallon capacity) under left fuel tank drain.
- (9) Open dry nitrogen supply valve and ensure that pressure regulator indicates 3.5 psi.

CAUTION: WHEN FUEL TANK QUICK-DRAIN VALVE IS REMOVED, FUEL WILL DRAIN RAPIDLY INTO CONTAINER. BE SURE THAT CONTAINER IS PROPERLY POSITIONED TO CATCH FUEL. KEEP ARM ABOVE LOCK NUT TO PREVENT FUEL FLOWING ON BODY.

A CONTINUOUS SUPPLY OF NITROGEN AT 0.6 PSI MUST BE MAINTAINED TO PERMIT SIPHONING AND INERTING OF THE AIR SPACE CREATED BY DEFUELING.

- (10) Remove left wing fuel tank quick-drain valve by rotating lock nut counterclockwise.**
- (11) Drain left wing fuel tank completely and continue to purge tank with dry nitrogen for 15 minutes thereafter before shutting off nitrogen supply.**
- (12) Set fuel selector to OFF.**
- (13) Remove rubber plug from left wing fuel tank vent.**
- (14) Lock Primer in closed position.**
- (15) Repeat Steps (2) through (12) for the right hand side of the fuel system.**
- (16) Disconnect fuel line at input to Primer.**
- (17) Disconnect dry nitrogen supply from fuel line.**
- (18) Reconnect fuel line to input of auxiliary electric fuel pump forward of firewall.**
- (19) Connect dry nitrogen supply and associated pressure regulator and indicator (or mercury manometer) to fuel line that was disconnected in Step (16).**
- (20) Set dry nitrogen supply pressure regulator to 3.5 psi.**
- (21) Open dry nitrogen supply valve and ensure that pressure regulator indicates 3.5 psi.**
- (22) Continue to purge fuel lines with dry nitrogen for 15 minutes then shut off nitrogen supply.**
- (23) Disconnect dry nitrogen supply from fuel line.**
- (24) Reconnect fuel line to Primer.**
- (25) Remove drained fuel from work area.**
- (26) Remove rubber plug from right wing fuel tank vents.**
- (27) Reinstall and lock in place, the two quick-drain valves previously removed in Steps (10) and (15).**

FUEL STORAGE SYSTEM – DESCRIPTION/OPERATION**1. General**

Fuel is stored inside the tubular spar in each wing, inboard of the wing tip. Each spar is sealed at each end by a machined casting with O-rings and sealant around its entire periphery. A three-plate baffle assembly in each tank retards fuel slosh. The outboard casting and baffles are removable and are accessible after removal of the wing tip. (See Chapter 57.)

2. Fuel Tank Caps (See 28-0, Figure 202.)

The fuel tank caps must provide a fuel and air-tight seal with the fuel filler neck. Absence of an air-tight seal may produce erroneous reading in the fuel measurement system. Scupper drains are provided to funnel spilled fuel from around the fuel filler neck and overboard, through the wing drain.

3. Center Spar Fuel Drain (See 28-0, Figure 202.)**A. Description**

The center spar is drilled and equipped with a drain to allow any fuel to escape if the fuel tank end seals should start leaking.

If fuel leakage is noted at the center spar drain, it can be determined which tank is leaking by removing the wing root access covers and inspecting the wing spar and center spar joining surfaces. Normally fuel dye will be evident on the side that is leaking. In the event the wing spar fits tightly enough in the center spar to prevent seepage at that point, inspect the landing gear to spar mounting bolts for similar indications.

FUEL STORAGE SYSTEM – MAINTENANCE PRACTICES**1. Fuel Tank Components Removal/Installation****A. Removal of Fuel Tank Components (See Figure 201.)**

WARNING: FUEL TANK MUST BE EMPTY AND VAPOR FREE BEFORE ATTEMPTING REMOVAL.

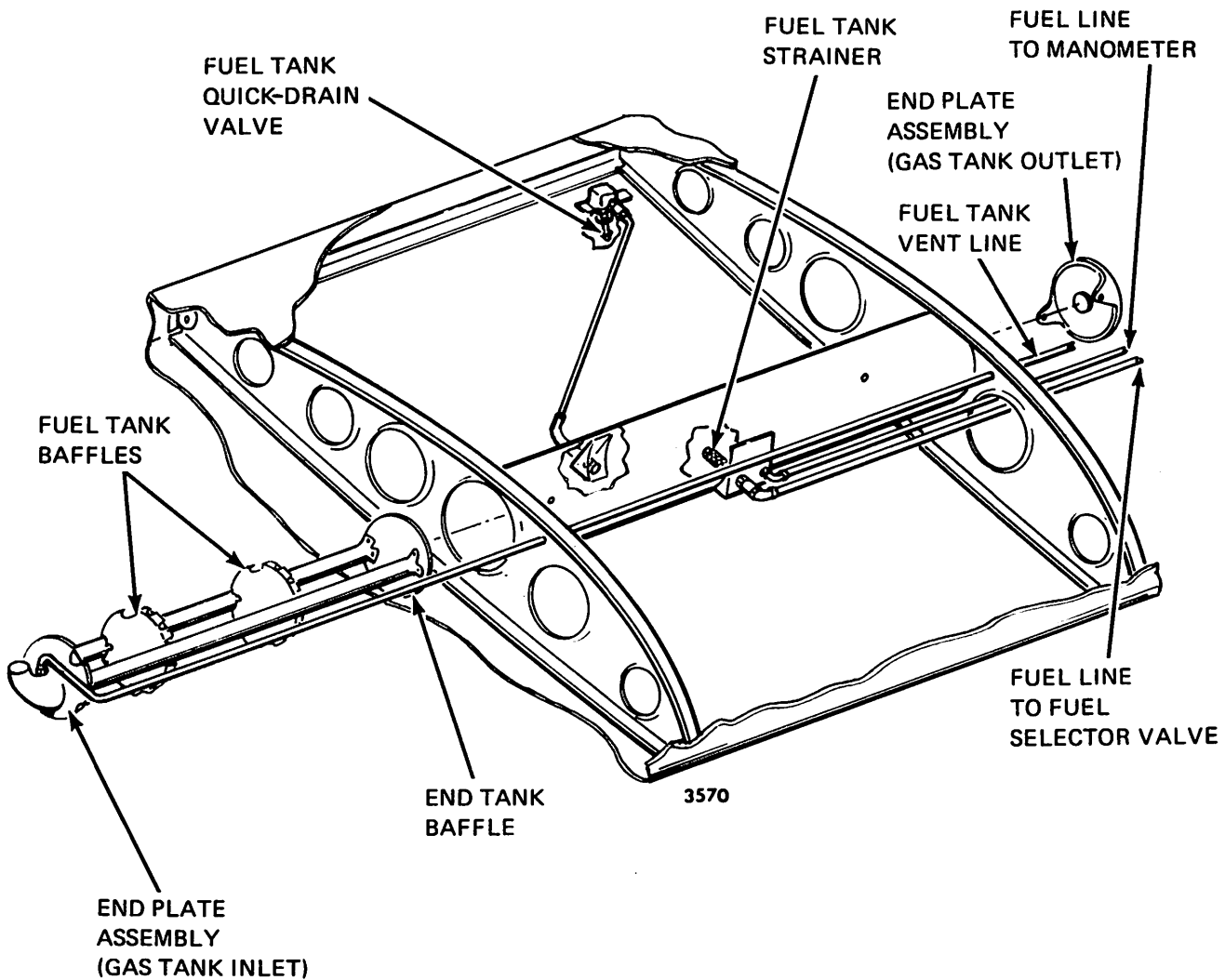
- (1) Remove wing as described in Chapter 57.
- (2) Disconnect fuel tank vent line at outboard end plate assembly. Cap vent line.
- (3) Remove sealant from around outboard end plate assembly and four mounting bolts. A chisel-like tool made of hard fiber or plexiglass is recommended to remove old sealant. (See Figure 202.)
- (4) Remove the four end plate assembly mounting bolts. Retain hardware for reuse.

CAUTION: TAKE CARE NOT TO SCAR INSIDE OF FUEL TANK.

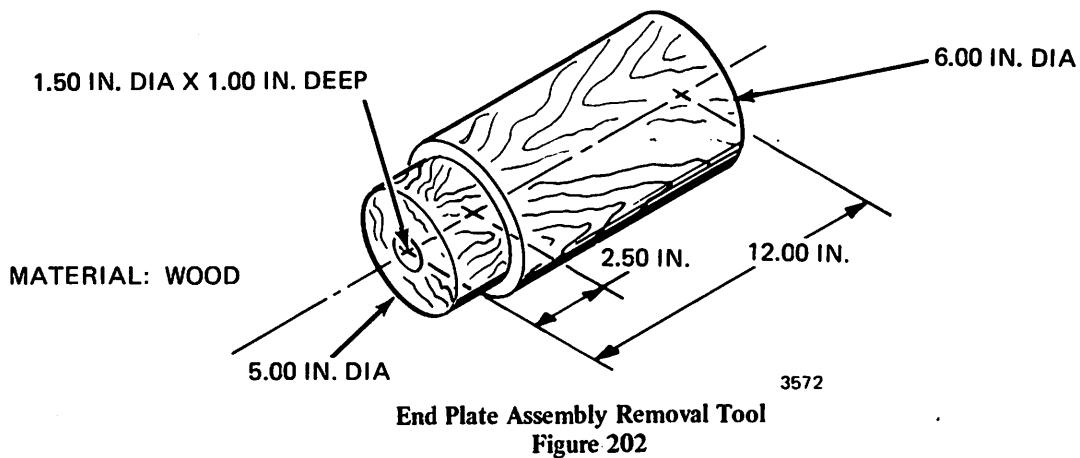
- (5) Slowly withdraw end plate assembly and attached tank baffle components from fuel tank.
- (6) Remove sealant from around inboard end plate assembly and two mounting bolts.
- (7) Remove two end plate mounting bolts.

CAUTION: TAKE CARE NOT TO SCAR INSIDE OF FUEL TANK.

- (8) With a wood or fiber ram (similar to Figure 202) placed in outboard end of wing spar, lightly hammer ram to drive end plate assembly out of spar at inboard end.



**Wing Spar Fuel Tank-Pictorial Diagram
Figure 201**



B. Installation of Fuel Tank Components (See Figure 201.)

- (1) Prior to reinstallation, inspect O-rings for distortion, cuts, or gouges and replace if necessary. Be sure proper O-ring seals are used.
- (2) Remove all loose, chipped, or cracked sealant from end plate assemblies and spar. Use of chisel-like tool made of hard fiber or plexiglass (similar to Figure 202) is recommended to remove sealant.

CAUTION: DO NOT USE STEEL WOOL OR SILICON GRIT ABRASIVES TO REMOVE SEALANT.

- (3) Remove remaining sealant with aluminum wool, 3M ELEKTRO-CIT cloth or aluminum oxide paper.
- (4) Thoroughly clean area using a vacuum or other suitable device.
- (5) To install inboard end plate assembly, position end plate assembly as far into the spar by hand as possible. With a board and hammer, lightly tap around edge, slowly working the end plate assembly into position.
- (6) Install the two inboard end plate assembly mounting bolts, using new stat-o-seals.

WARNING: USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES OR SPARKS.

- (7) Thoroughly clean area to be sealed with MEK (Methyl Ethyl Ketone) or equivalent, apply sealant around entire periphery of end plate assembly and completely over heads of the two mounting bolts. Approved sealants are listed following Step (13).
- (8) Prior to reinstallation of end plate and baffle assembly, repeat Steps (1) through (4).

CAUTION: TAKE CARE NOT TO SCAR INSIDE OF FUEL TANK.

- (9) To reinstall outboard end plate and baffle assembly, slide assembly into spar until mounting lugs are positioned under outer holes in spar.
- (10) Install the four output end plate assembly bolts.

WARNING: USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES OR SPARKS.

- (11) Repeat Step (7).
- (12) Reconnect fuel vent line to nipple on end plate assembly and clamp vent line.
- (13) Reinstall wing as described in Chapter 57.

NOTE: Approved sealants are as follows:
RTV 732 by Dow-Corning
EC 1239 and EC 1675 by 3M Company
3201 by Chemical Seal Corporation of America
567 by Pro-Seal

C. Removal of Fuel Tank Strainer (See Figure 201.)

WARNING: FUEL TANK MUST BE EMPTY AND VAPOR FREE BEFORE ATTEMPTING REMOVAL OF FUEL TANK STRAINER.

- (1) Disconnect fuel line from elbow on outlet fitting. Cap fuel line.

- (2) Loosen B-type lock nut holding elbow to outlet fitting.
- (3) Unscrew elbow from outlet fitting.
- (4) Remove O-ring from elbow. Discard O-ring.
- (5) Pull out fuel strainer from outlet fitting.

D. Installation of Fuel Tank Strainer (See Figure 201.)

WARNING: FUEL TANK MUST BE EMPTY AND VAPOR FREE BEFORE ATTEMPTING INSTALLATION OF FUEL TANK STRAINER.

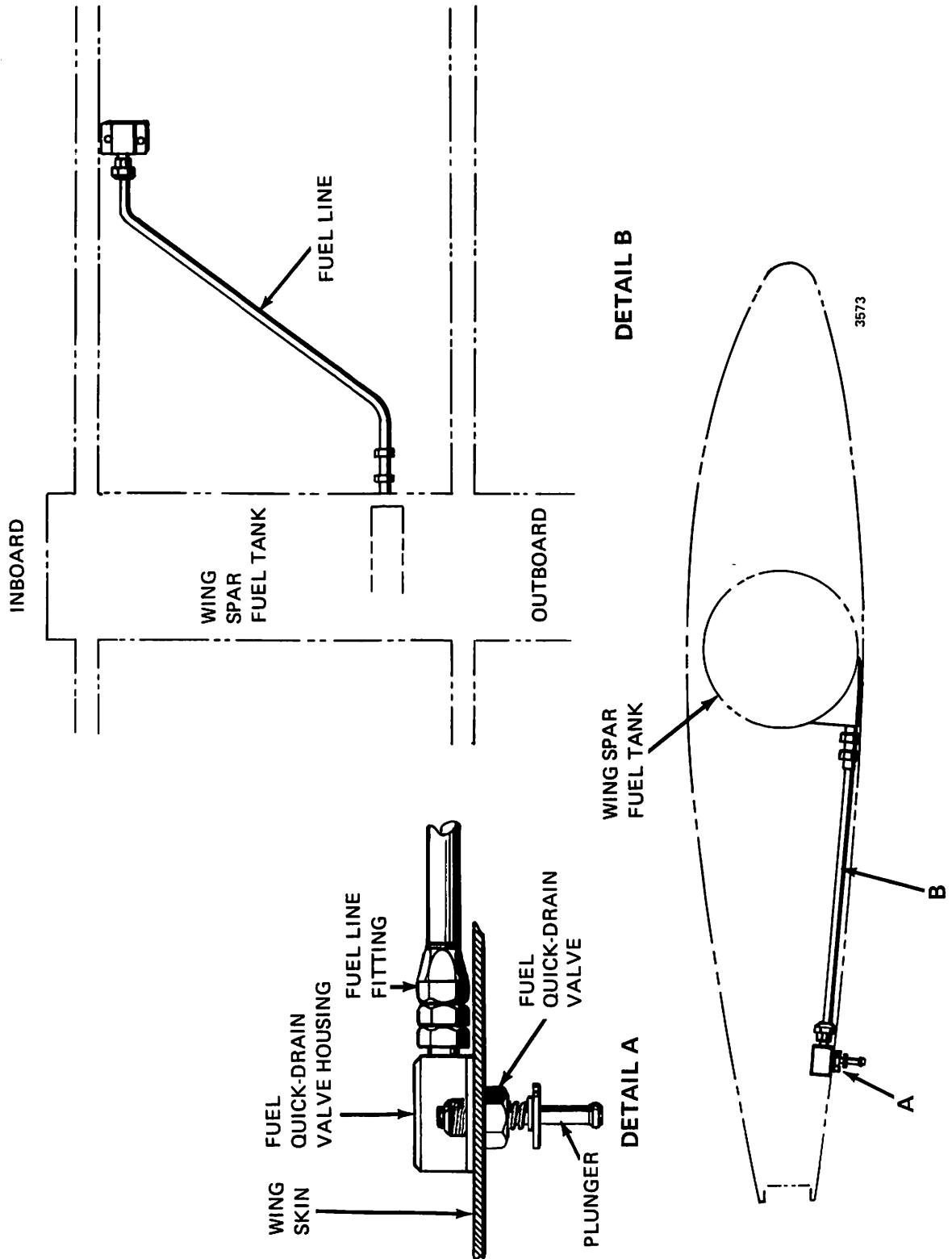
- (1) Insert strainer into outlet fitting.
- (2) Screw elbow, with new O-ring, into outlet fitting behind strainer until tight and aligned with fuel line.
- (3) Tighten B-type lock nut on elbow to secure elbow to outlet fitting.
- (4) Connect fuel line to elbow.
- (5) Check connections for leaks.

E. Removal of Quick-Drain Valve Assembly (See Figure 203.)

The quick-drain valve assembly is comprised of a housing and a quick-drain valve which is screwed into the housing. The housing, which is a casting, normally will not require replacement. To remove quick-drain valve, simply unscrew valve and allow it to drop from housing. Removal of the housing will require removal of the wing. The following procedures are for complete removal of the quick-drain valve assembly (including housing):

WARNING: FUEL TANK MUST BE EMPTY AND VAPOR FREE BEFORE ATTEMPTING REMOVAL OF WING, QUICK-DRAIN VALVE, QUICK-DRAIN HOUSING, OR QUICK-DRAIN VALVE ASSEMBLY.

- (1) Remove wing as described in Chapter 57.
- (2) Disconnect fuel line from quick-drain valve housing inside inboard bottom trailing edge of wing. Cap fuel line.
- (3) Remove quick-drain valve from bottom trailing edge.
- (4) At outside inboard bottom trailing edge of wing, remove two screws securing quick-drain housing to wing.



Fuel Quick-Drain Valve – Removal/Installation
Figure 203

F. Installation of Quick-Drain Valve Assembly

NOTE: Replacement of quick-drain valve can be accomplished simply by inserting threaded end of valve in housing and securing valve to housing. Torque to 100 ± 25 inch-pounds.

The following procedures are for installation of the complete quick-drain valve assembly (including housing):

- (1) At outside inboard bottom trailing edge of wing, secure quick-drain housing to wing with two screws.
- (2) Inside wing, uncap fuel line and connect to quick-drain housing. Torque fuel line fitting nut to 100 ± 25 inch-pounds.
- (3) Insert quick-drain valve in housing and secure to housing.
- (4) Check for leaks (using dry air or nitrogen) as described in this chapter.
- (5) Install wing as described in Chapter 57.
- (6) Repeat Step (4).

WARNING: ENSURE AIRCRAFT IS PROPERLY GROUNDED. AVOID BREATHING FUMES.
KEEP AWAY FROM FLAMES OR SPARKS.

- (7) Fill tank with three gallons of fuel (minimum) and depress valve plunger. Check operation.

FUEL STORAGE SYSTEM – ADJUSTMENT/TEST**1. Fuel Tank Pre-Test Procedures**

WARNING: FUEL TANKS MUST BE EMPTY AND VAPOR FREE BEFORE ATTEMPTING WING REMOVAL.

Remove wing described in Chapter 57, before attempting fuel tank leakage test procedures.

2. Fuel Tank Leakage Test Procedures**A. Test each fuel tank for leakage as follows:**

- (1) Ensure filler cap is installed and secured.
- (2) Plug fuel tank vent line and fuel manometer line at inboard end of wing.
- (3) Attach air pressure gauge (0-10 psi preferred) to fuel line fitting at inboard end of wing.

CAUTION: DO NOT ATTEMPT TO APPLY PRESSURE TO THE FUEL TANK AND ASSOCIATED PLUMBING WITHOUT A GOOD PRESSURE REGULATOR AND A POSITIVE SHUTOFF VALVE IN THE DRY AIR OR NITROGEN SUPPLY LINE. DO NOT PRESSURIZE FUEL TANK AND ASSOCIATED PLUMBING TO MORE THAN 10 PSI OR DAMAGE MAY OCCUR.

- (4) Attach dry air or nitrogen supply to quick-drain valve at inboard end of wing.
- (5) Simultaneously depress quick-drain valve and slowly apply dry air or nitrogen supply until 3.5 psi is reached.
- (6) Allow two minutes for pressure to stabilize.
- (7) Turn off dry air or nitrogen supply.
- (8) Check pressure gauge on fuel line. Fuel tank and associated fuel plumbing in wing is acceptable if there is no pressure loss after two minutes. If no leakage is present, proceed to step (9).
- (9) Repeat Step (5).
- (10) Apply Sherlock 5-Second Leak Detector Liquid or a prepared solution of 50% liquid dish washing detergent and 50% water, successively to all suspect leakage areas of fuel tank and associated plumbing.
- (11) Check for presence of bubbles on outside of tank, end plate assemblies, all plumbing joints, and plugged areas that indicate location of leakage.
- (12) If any leaks are found, replace defective part and/or reseal and retest. (See Fuel Storage System – Approved Repairs or Sealing Procedures, this chapter.)
- (13) Turn off and disconnect dry air or nitrogen supply from quick-drain valve.
- (14) Depress quick-drain valve to bleed wing fuel tank and associated plumbing of dry air or nitrogen.
- (15) Disconnect pressure gauge from fuel line.
- (16) Remove plugs from manometer and fuel vent lines.
- (17) Reinstall wing in accordance with procedures in Chapter 57.

FUEL STORAGE SYSTEM – INSPECTION/CHECK

1. Checking Fuel Tank Leaks (See Figure 204.)

A. Tolerable Fuel Leaks

Fuel leaks which are not considered a flight hazard are stains, seeps, and heavy seeps NOT in an enclosed area. However, all fuel leaks should be repaired as soon as possible.

NOTE: Stains from previously repaired leaks are not considered a flight hazard but must be inspected before each flight to ensure that seepage has not reoccurred to cause a flight hazard.

B. Hazardous Fuel Tank Leaks

Fuel leaks which are a flight hazard are running leaks in any area, seeps, and heavy seeps or stains in enclosed areas such as those surrounding the fuel tanks. These leaks must be repaired before that tank is used for any flight. The wet or stained spot on the wing in the area of the tank is an indication of leak intensity. Fuel leak classifications are shown in Figure 204.

If there are no facilities available to make an acceptable repair of a flight hazardous type leak, it is recommended that the leaking tank be drained and cleared of explosive vapors. By switching the fuel selector valve to the other tank, the aircraft can then be flown to a facility where the fuel leak can be repaired.

2. Checking Fuel Tank Caps (See 28-0, Figure 202.)

The fuel tanks are not vented and should be inspected at every scheduled inspection to ensure that the cap gasket is not deformed or deteriorated. Lubricate cap gasket with grease (MIL-G-6032A) per instructions in Chapter 12.

3. Checking Fuel Tank Quick-Drains (See 28-0, Figure 202.)

The fuel tank quick-drains should be checked at every scheduled inspection to ensure that leakage through the quick-drain valve is not occurring. In addition, the quick-drains should be checked for proper operation.

4. Checking Center Spar Fuel Drain (See 28-0, Figure 202.)

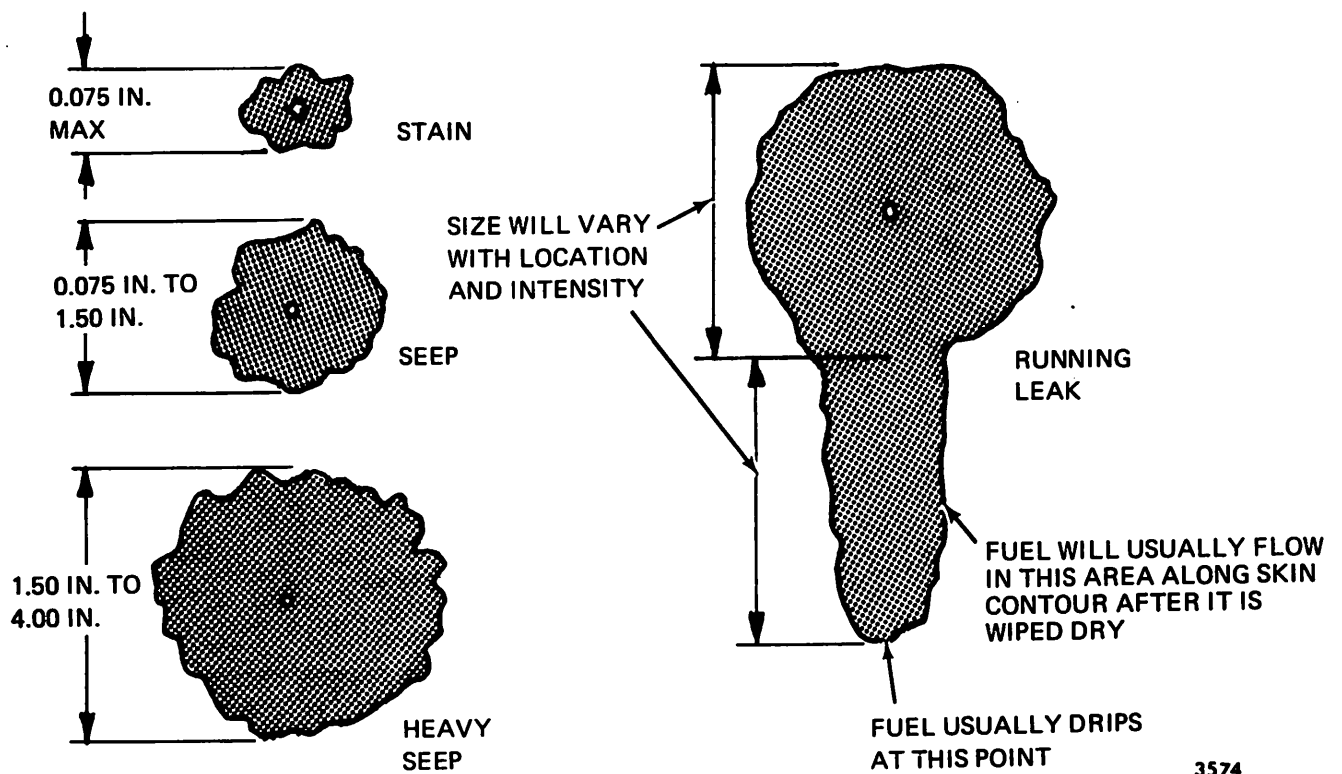
The center spar fuel drain, located at the bottom of the fuselage equidistant between the two wing roots, should be checked before and after every flight to ensure that leakage from fuel tank end seals has not occurred. In addition, the vent should be checked for damage or obstruction by foreign matter.

5. Checking Scupper Drains (See 28-0, Figure 202.)

The scupper drains, located at the bottom of each wing adjacent to the wing tiedown hooks, should be checked at every scheduled inspection to ensure that drains are not obstructed.

6. Checking Fuel Tank Vents (See 28-0, Figure 202.)

The fuel tank vents (one located at the bottom of each wing root) should be checked before each flight to ensure that vents are not obstructed. Damaged or clogged fuel tank vents could cause improper operation of the fuel system and/or cause incorrect fuel measurement indications.

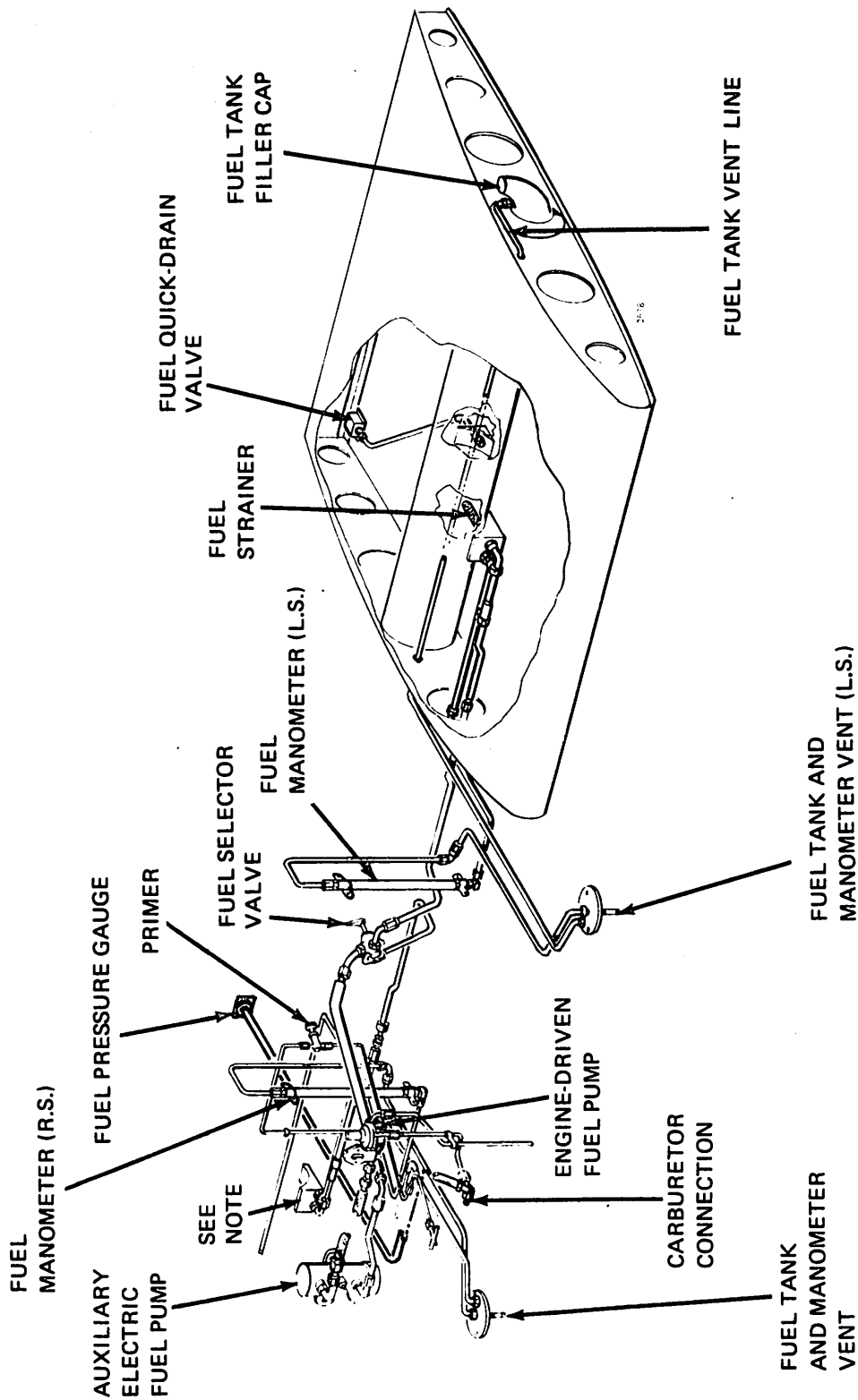


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**Classification of Fuel Leaks
Figure 204**

FUEL DISTRIBUTION SYSTEM – DESCRIPTION/OPERATION**1. General (See Figure 1.)**

The fuel distribution system consists of the two wing spar fuel tanks, fuel selector valve, auxiliary electric fuel pump, engine-driven pump, primer, and associated plumbing. In addition, the electrical circuitry necessary to supply operating power to the electric fuel pump and lighting for the fuel pressure gauge is included in this system.



NOTE: RIGHT WING SPAR
 FUEL TANK NOT SHOWN
 (SIMILAR TO LEFT WING
 FUEL TANK)

Fuel Distribution System Diagram
Figure 1

FUEL DISTRIBUTION SYSTEM – MAINTENANCE PRACTICES

1. Servicing

A. Electric Fuel Pump Filter (See Figure 201.)

A 40 micron filter through which all engine fuel must pass, is incorporated in the electric fuel pump (also called booster or auxiliary pump). This filter must be serviced periodically (every 100 operating hours). The following procedures are recommended for fuel pump filter servicing:

- (1) Remove engine cowl.
- (2) Remove the bottom cover from the fuel pump by cutting the safety wire and turning the bottom cover clockwise with a 5/8 in. wrench.
- (3) Remove the cover gasket, magnet, and filter.

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

- (4) Clean the filter by rinsing in Stoddard solvent or equivalent and blowing out cleansing agent with compressed air. If filter is distorted or damaged, it should be replaced. Refer to the Illustrated Parts Catalog for replacement part number.
- (5) Clean the bottom cover, gasket, and magnet in the same manner as the filter.
- (6) Reinstall filter, magnet, gasket, and bottom cover.
- (7) Turn bottom cover counterclockwise until lugs engage, and safety wire with 0.032 in. wire.

2. Removal/Installation

A. Fuel Selector Valve Description

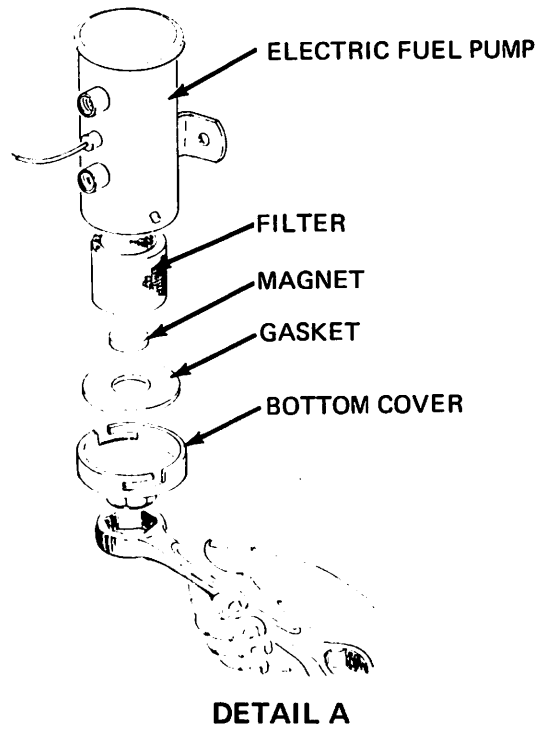
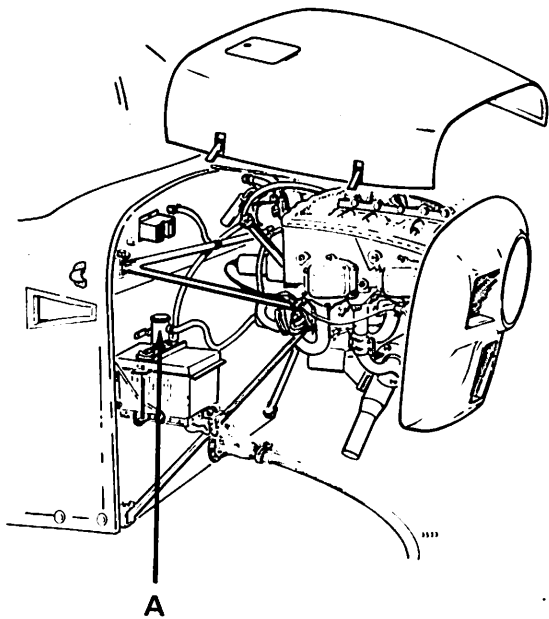
The fuel selector valve, located forward in the console, provides means for fuel tank selection and fuel supply shutoff.

B. Fuel Selector Valve Removal (See Figure 202.)

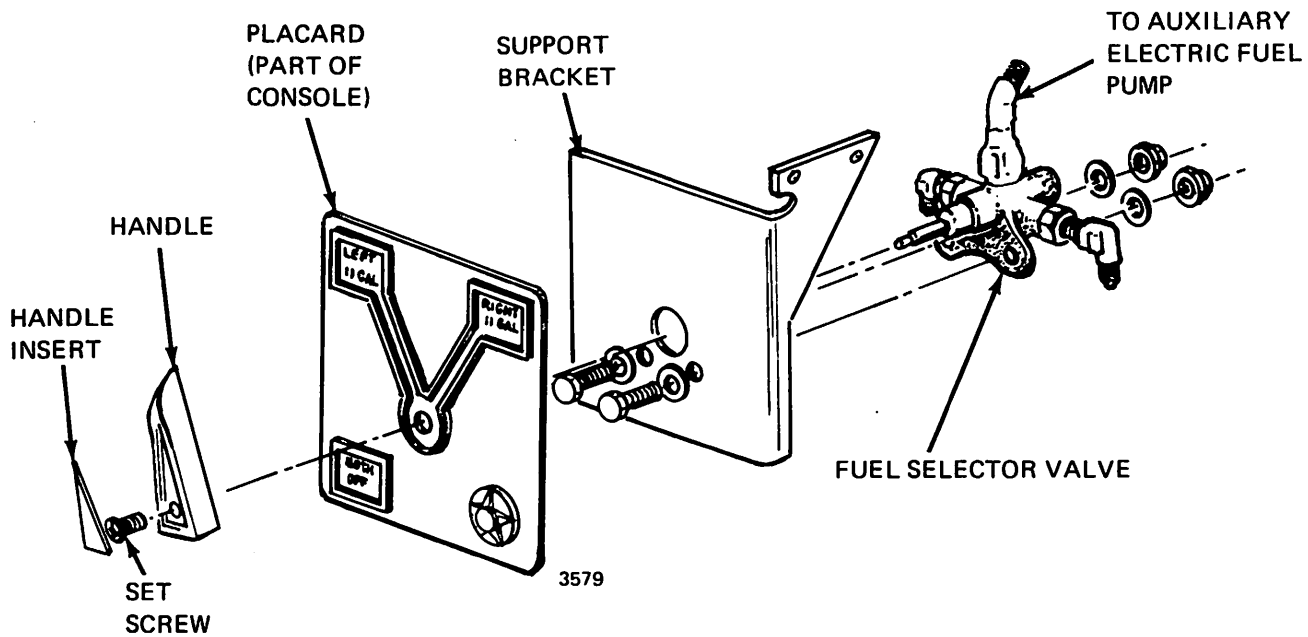
- (1) Lift out handle insert from handle and loosen screw from fuel selector handle.
- (2) Remove console.

WARNING: WHEN FUEL LINES ARE DISCONNECTED, SOME FUEL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT FIRE HAZARD DUE TO SPILLAGE.

- (3) Disconnect fuel lines from three elbows attached to fuel selector valve. Cap open fuel lines.
- (4) Remove two nuts, washers, and bolts securing fuel selector valve to bracket.



Fuel Pump Servicing
Figure 201



Fuel Selector Valve Removal/Installation
Figure 202

- (5) Remove fuel selector valve from bracket.

C. Fuel Selector Valve Installation (See Figure 202.)

- (1) Position fuel selector valve in bracket.
- (2) Install two bolts, two washers, and two nuts through bracket and fuel selector valve.
- (3) Torque nuts per Chapter 91.
- (4) Clean exposed threads on the three elbows.

CAUTION: TO PREVENT CROSS THREADING, USE CARE TO ENSURE FUEL LINES ARE PROPERLY SEATED IN FUEL SELECTOR VALVE BEFORE TIGHTENING NUTS.

- (5) Uncap and reconnect (hand tighten) the three fuel lines to fuel selector valve.
- (6) Torque fuel line fitting nuts to 100 ± 25 in. lb.
- (7) Temporarily install handle onto fuel selector valve stem.
- (8) Fill both fuel tanks.
- (9) Set fuel selector valve alternately to left tank and right tank while observing to ensure that no fuel leakage occurs at connectors or fuel selector valve.
- (10) Remove fuel selector handle.
- (11) Reinstall console.
- (12) Secure handle onto fuel selector valve stem and place handle insert into handle.

D. Fuel System Plumbing Removal

Since the fuel system plumbing is composed of standard aircraft tubing and fittings, its removal is merely the use of standard maintenance practices.

The following precautions should be observed when removing plumbing:

- (1) Cap all open lines and fittings to prevent contamination from entering system.
- (2) When disconnecting lines, first ensure that all residual fuel is drained from the line.
- (3) Exercise the precautions previously mentioned to minimize fire hazards.

E. Fuel System Plumbing Installation

Like removal, the installation of fuel system plumbing follows standard maintenance practices.

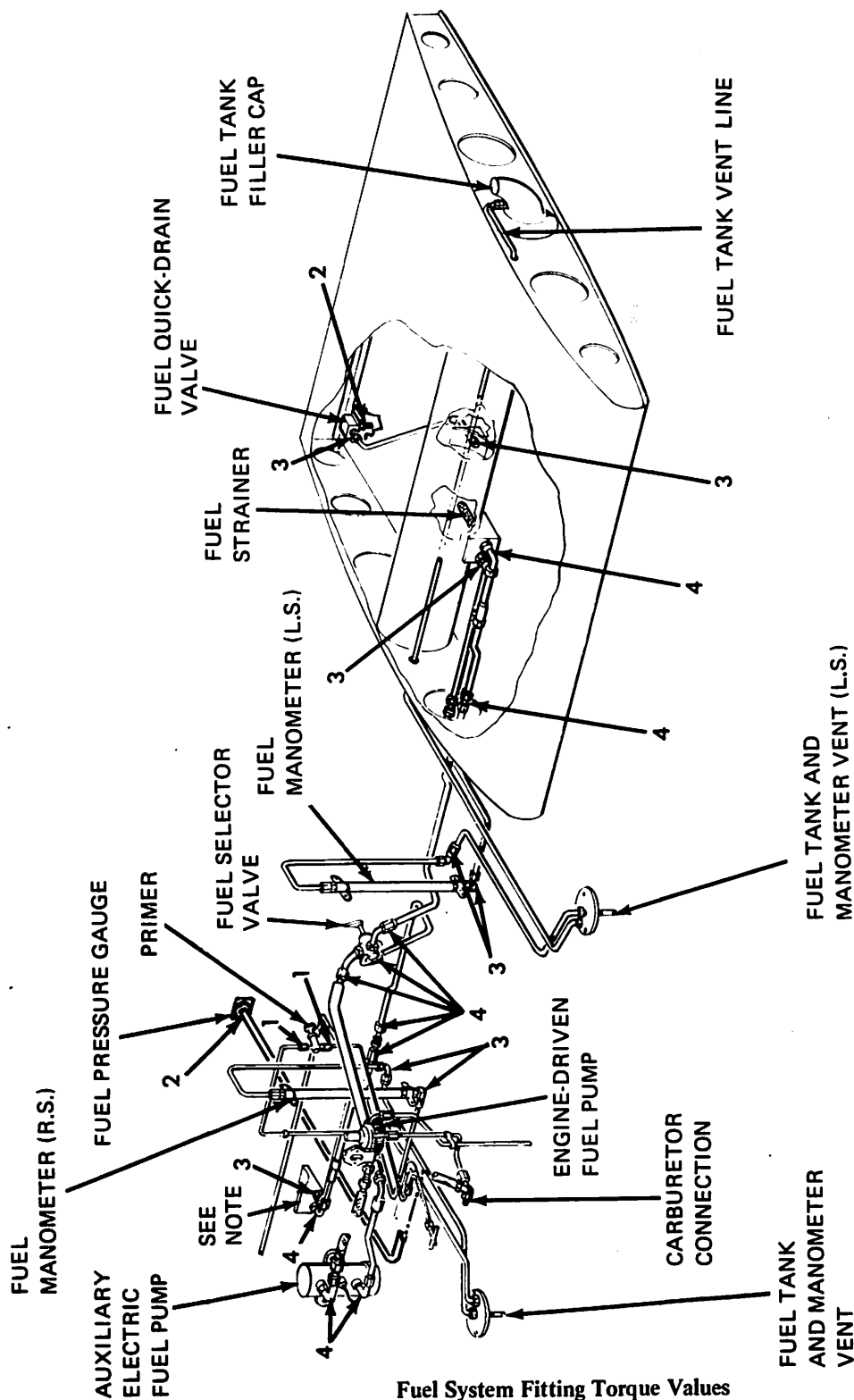
In addition, the following procedures and precautions should be followed during installation:

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

- (1) Prior to installation, all fuel lines and fittings should be cleaned internally (by passing Stoddard solvent through them, then air drying) to prevent contamination from being introduced into the system.

(2) All threaded fittings should be cleaned with a stiff bristle brush before the fitting is tightened.

(3) Threaded fittings should be torqued in accordance with Figure 203.



NOTE: RIGHT WING SPAR
 FUEL TANK NOT SHOWN
 (SIMILAR TO LEFT WING
 FUEL TANK)

Fuel System Fitting Torque Values
Figure 203

FITTINGS	
TORQUE VALUES	
1-PRIMER LINE =	25 TO 30 INCH-POUNDS
2-FUEL PRESSURE GAUGE LINE =	40 TO 65 INCH-POUNDS
3-FUEL MANOMETER LINES =	60 TO 90 INCH-POUNDS
4-ALL OTHER FUEL SYSTEM LINES =	75 TO 125 INCH-POUNDS
UNLESS LISTED OTHERWISE	

F. Electric Fuel Pump Removal (See Figure 204.)

- (1) Disconnect electrical pigtail connector (1) at splice clip.

WARNING: WHEN FUEL LINES ARE DISCONNECTED, SOME FUEL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT FIRE HAZARD DUE TO SPILLAGE.

- (2) Disconnect two fuel lines (2) from the pump and cap fittings.
- (3) Remove nuts (4) and washers (5) securing the pump (3) to the firewall and remove the pump.

G. Electric Fuel Pump Installation (See Figure 204.)

- (1) Position fuel pump (1) on firewall.
- (2) Install washers (5) and nuts (4).
- (3) Torque to 35 ± 5 in. lb.
- (4) Clean exposed threads on fuel pump elbow fittings with a stiff bristle brush.
- (5) Torque fittings to 100 ± 25 in. lb.
- (6) Reconnect electrical pigtail (1) to wire and crimp connector.

H. Engine-Driven Fuel Pump – Removal/Installation

Refer to Avco Lycoming Engine Overhaul Manual for engine-driven fuel pump removal and installation procedures.

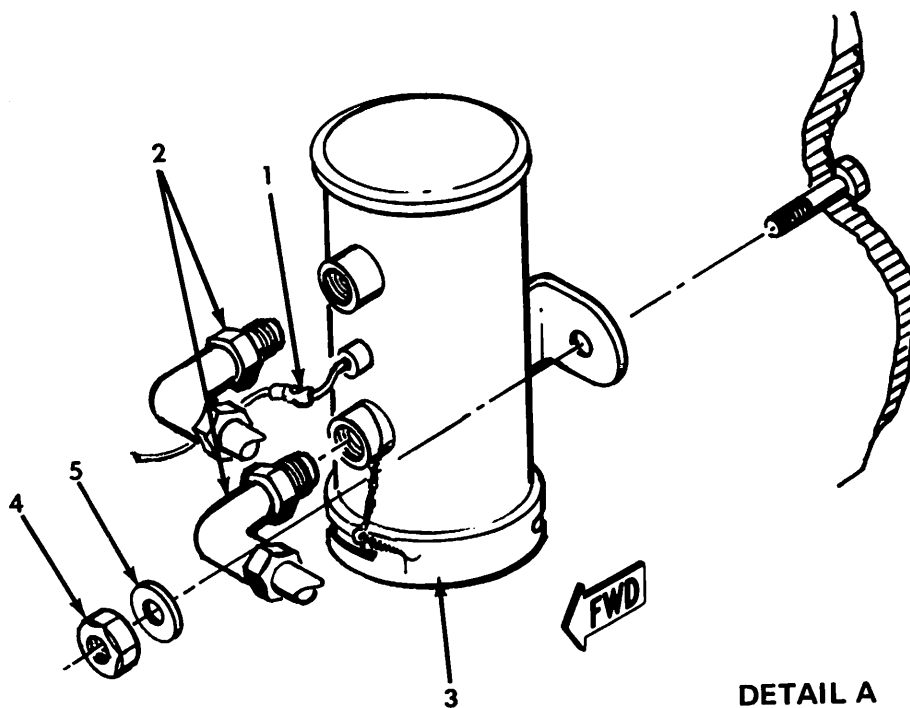
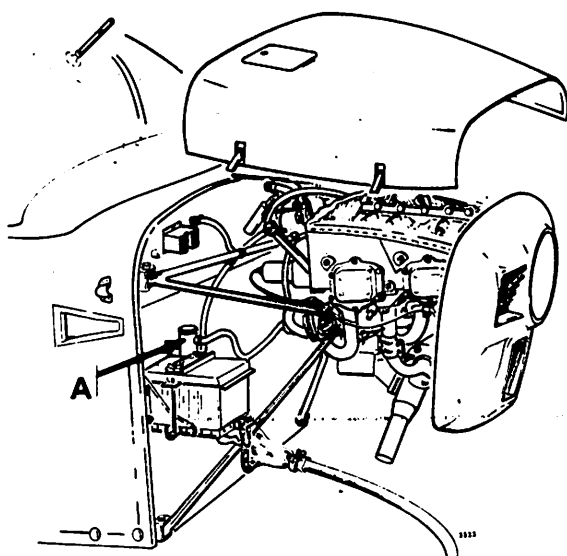
3. Adjustment/Test

A. Fuel System Plumbing Pressure Test

- (1) Pressurize fuel system plumbing by performing procedures in Fuel Storage System – Inspection/Check.
- (2) Prepare a solution of 50% liquid dishwashing detergent and 50% water.
- (3) Apply solution to plumbing at all locations of suspected leakage.
- (4) Check for presence of bubbles to indicate location of leakage.
- (5) If plumbing holds pressure for 15 minutes, with pressure loss not exceeding .05 psi, plumbing is acceptable.
- (6) If leaks are found, repair per Fuel Storage System – Approved Repairs, this chapter.

B. Electric Fuel Pump Operational Check

- (1) Ensure that one fuel tank contains at least three gallons of fuel.
- (2) Set fuel selector valve to the tank containing fuel.
- (3) Set master switch to ON.
- (4) Set auxiliary fuel pump switch to ON.



DETAIL A

**Electric Fuel Pump Removal/Installation
Figure 204**

- (5) Observe fuel pressure gauge. Gauge should indicate 0.5 to 8.0 psi.
- (6) Set auxiliary fuel pump and master switch to OFF.

C. Engine-Driven Fuel Pump Operational Check

It is necessary to operate the aircraft engine in order to check the engine-driven fuel pump.

- (1) Ensure that one fuel tank contains at least 3 gallons of fuel.
- (2) Set mixture to **FULL RICH**.
- (3) Set fuel selector valve to the tank containing fuel.
- (4) Set master switch to **ON**.
- (5) Set auxiliary fuel pump switch to **ON**.
- (6) Observe fuel pressure gauge. Gauge should indicate 0.5 to 8.0 psi.
- (7) If required, prime engine.

WARNING: ENSURE THAT PROPELLER AREA IS CLEAR PRIOR TO STARTING ENGINE.

- (8) Set magneto switch to **LEFT**.
- (9) Press starter button until engine starts.
- (10) Set magneto switch to **BOTH**.
- (11) Check oil pressure gauge. Oil pressure should be indicated within 30 seconds.
- (12) Set auxiliary fuel pump switch to **OFF** while observing fuel pressure gauge. Gauge should indicate 0.5 to 8.0 psi, with auxiliary fuel pump off.
- (13) Run engine at several different power settings and ensure that fuel pressure remains between 0.5 and 8.0 psi.
- (14) Idle engine and set mixture to **IDLE CUTOFF**.
- (15) Set magneto switch to **OFF**.
- (16) Set master switch to **OFF**.

FUEL INDICATING SYSTEM – DESCRIPTION/OPERATION**1. General**

The fuel indicating system consists of a fuel pressure gauge and two fuel manometers with illuminated vertical sight gauges.

A. Fuel Pressure Gauge

The fuel pressure gauge is connected to the main fuel supply line at the carburetor inlet and indicates carburetor fuel pressure. The fuel line which leads from the pickup point to the fuel pressure gauge begins with an 0.040-inch orifice to prevent damaging surges and excess fuel spillage in the event of a line or gauge failure. Normal fuel pressure indication should be approximately 3 psi; however, the operating range is between 0.5 psi and 8.0 psi. The full-scale range of the fuel pressure gauge is 0 to 10 psi.

B. Fuel Manometers

Each of the two fuel manometers is interconnected to a fuel tank by a fuel supply and a vent line. The fuel, tending to seek its own level, will directly indicate the height of fuel in the tank. A floating ball inside the manometer glass tube indicates fuel height. This fuel height indication is translated to fuel capacity indications (1/4, 1/2, 3/4, FULL) by the placarded markings around the manometer tube. Fuel quantity indicated by the manometers will be accurate only when the aircraft is in a level attitude. Each manometer tube is illuminated by an adjacent mounted light. Damaging fuel surges or loss of fuel by siphoning is prevented by a small orifice at each end of the fuel manometer.

MAINTENANCE PRACTICES – REMOVAL/INSTALLATION

1. Removal/Installation

A. Fuel Pressure Gauge Removal (See Figure 201.)

- (1) Ensure that master switch is set to OFF.

WARNING: WHEN FUEL LINES ARE DISCONNECTED SOME FUEL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT FIRE HAZARD DUE TO SPILLAGE.

- (2) At right side of the instrument panel, behind the instrument cluster, disconnect fuel line from fuel pressure gauge. Cap the fuel line.
- (3) At front of the instrument cluster, remove two screws holding the instrument cluster to instrument panel. Retain screws for reuse.
- (4) From front of the instrument panel, push instrument cluster slightly forward and downward to clear instrument panel.
- (5) While holding front of fuel pressure gauge, remove single nut that secures fuel pressure gauge to instrument cluster. Retain nut for reuse.
- (6) Disengage and remove fuel pressure gauge from instrument cluster.

B. Fuel Pressure Gauge Installation (Figure 201.)

- (1) Insert fuel pressure gauge into bottom section of instrument cluster so fitting protrudes through hole in metal support plate.
- (2) Properly align face of fuel pressure gauge in instrument cluster and secure fuel pressure gauge to instrument cluster with nut previously removed.

CAUTION: TO PREVENT CROSS THREADING, USE CARE TO ENSURE FUEL LINES ARE PROPERLY SEATED IN FUEL PRESSURE GAUGE BEFORE TIGHTENING NUT.

- (3) Uncap and reconnect (hand tighten) fuel line to fuel pressure gauge.
- (4) Secure instrument cluster to instrument panel with two screws previously removed.
- (5) Torque fuel line fitting nut at rear of fuel pressure gauge to 52 ± 12 in. lb.

C. Fuel Manometer Removal (See Figure 202.)

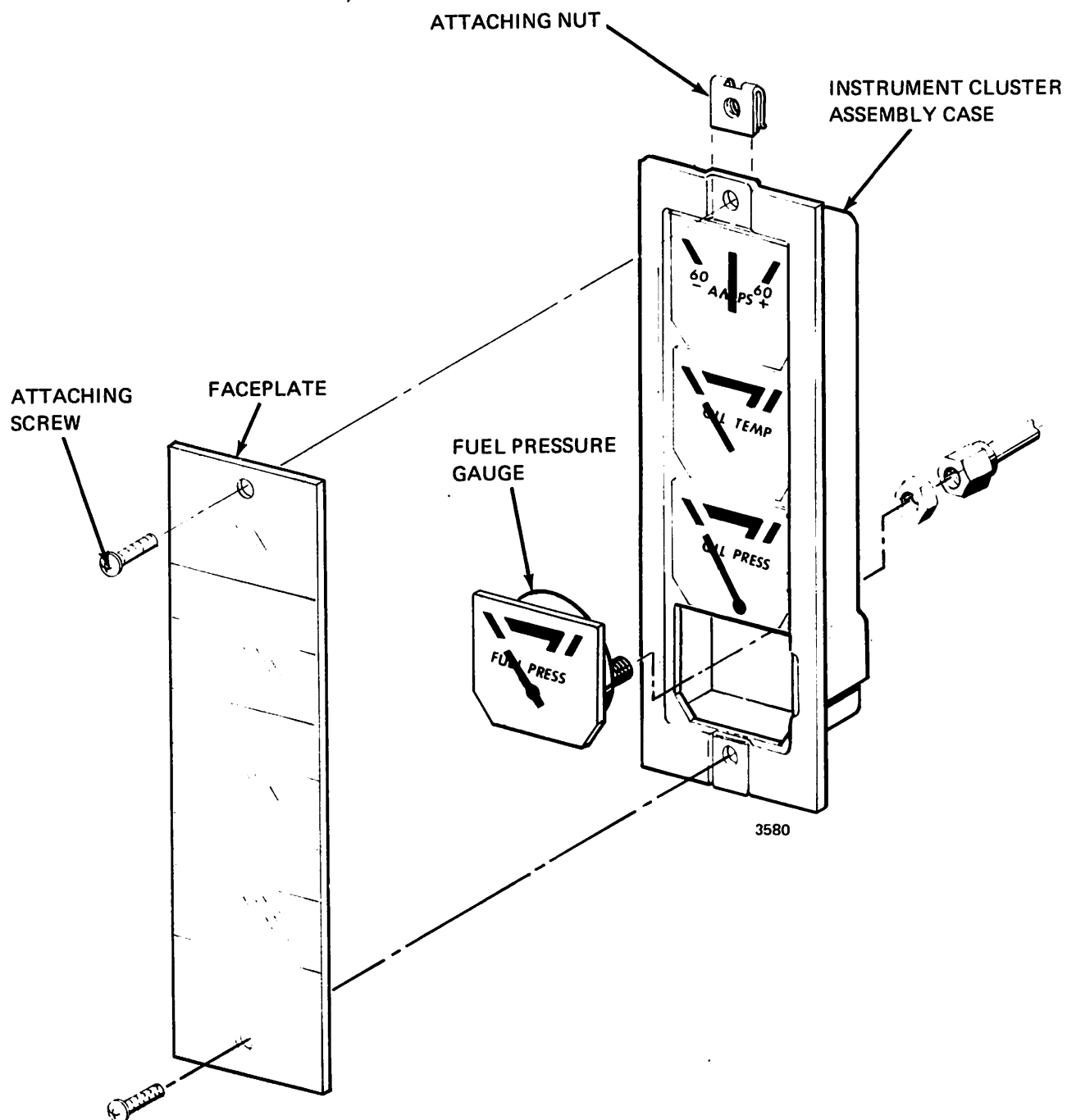
- (1) Remove all interior side panel covers.

WARNING: ENSURE THAT FUEL TANK ASSOCIATED WITH MANOMETER REMOVAL HAS BEEN DRAINED PRIOR TO DISCONNECTING FUEL SUPPLY LINES.

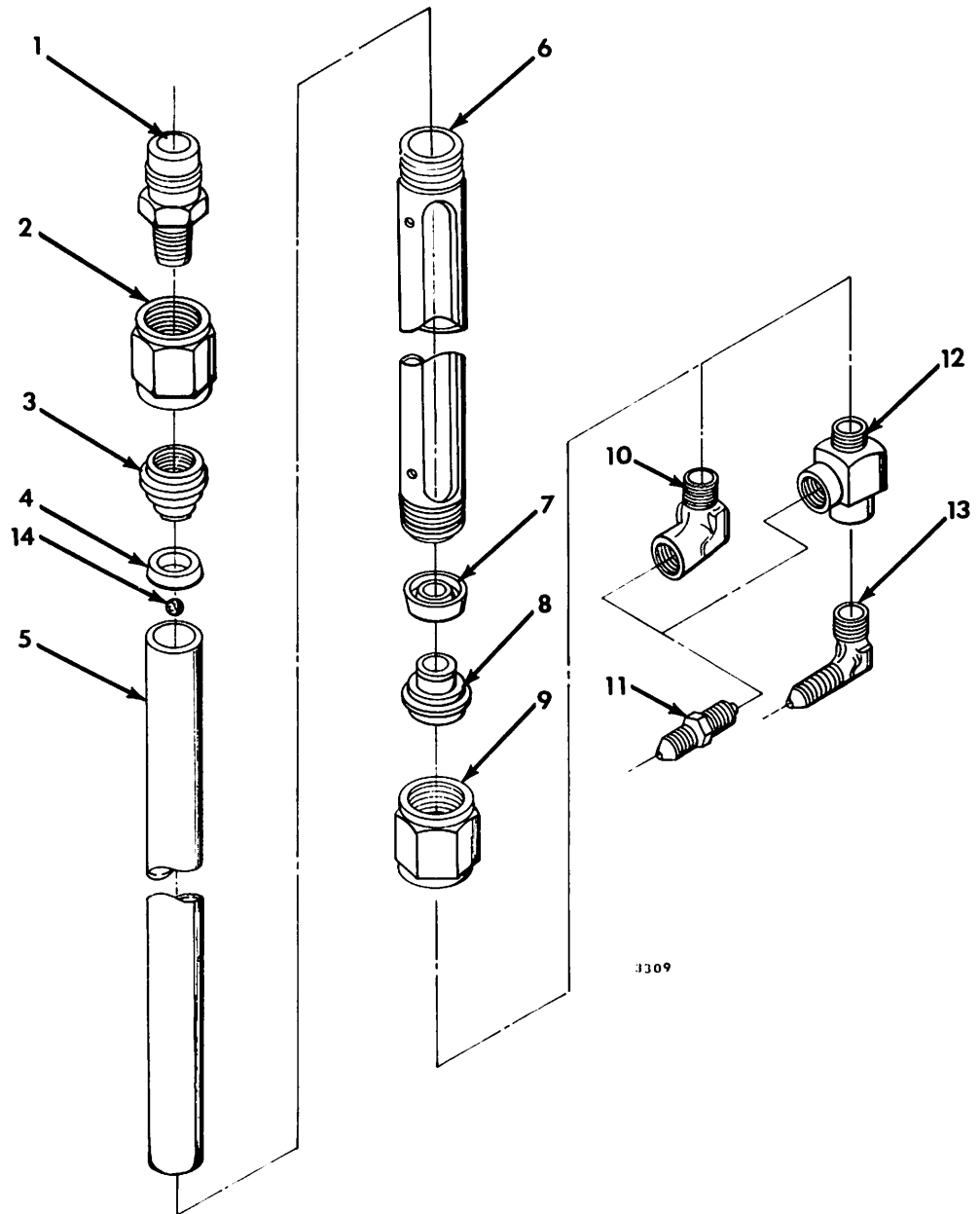
- (2) Disconnect vent line from top of fuel manometer. Cap vent line.

WARNING: WHEN FUEL LINES ARE DISCONNECTED SOME FUEL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT FIRE HAZARD DUE TO SPILLAGE.

- (3) From inside wing root, disconnect fuel manometer fuel supply line. Cap the fuel supply line.



Fuel Pressure Gauge – Removal/Installation
Figure 201



**Fuel Manometer
Figure 202**

NOTE: If removing right-hand manometer, in addition to Step (3), disconnect primer fuel supply line. Cap primer fuel supply line.

- (4) Remove (and retain for future use) two screws in each of the two clamps that secure manometer to side panel.

CAUTION: USE CARE WHEN REMOVING MANOMETER TO PREVENT DAMAGE TO ADJACENT LIGHT FIXTURE.

- (5) Remove manometer from interior side panel.

D. Fuel Manometer Disassembly (Figure 202)

WARNING: KEEP MANOMETER AWAY FROM HEAT, OPEN FLAME, OR SPARKS. FLAMMABLE LIQUID OR EXPLOSIVE VAPOR MAY BE PRESENT.

CAUTION: USE CARE DURING DISASSEMBLY TO PREVENT DAMAGE TO GLASS TUBE.

- (1) Disconnect nipple (1) from top nut (2).
- (2) If left-hand manometer, disconnect elbow (10) from bottom nut (9) and nipple (11) from elbow (10). If right hand-manometer, disconnect "Tee" fitting (12) from bottom nut (9) and elbow (13) from "Tee" fitting (12).
- (3) Remove top nut (2) from case (6).

CAUTION: TO PREVENT LOSS OF FLOAT, DO NOT INVERT MANOMETER WHEN REMOVING CAP VENT AND U-CAP PACKING.

- (4) Remove cap vent (3) and U-cap packing from case (6).
- (5) Cup hand over top of manometer case (6) and invert manometer to catch float (14) and glass tube (5), if glass tube (5) does not release from case (6).
- (6) Remove bottom nut (9), cap inlet (8), and U-cap packing from case (6).
- (7) Inspect all parts for damage, especially the U-cap packings, for distortion, cuts, or gouges. Replace parts as necessary.

E. Fuel Manometer Reassembly (Figure 202)

- (1) Assemble U-cap (4) onto bottom of cap vent (3).
- (2) Assemble U-cap (7) onto top of cap inlet (8).

CAUTION: USE CARE DURING REASSEMBLY TO PREVENT DAMAGE TO GLASS TUBE.

- (4) Press U-cap/cap inlet assembly into bottom of glass tube (5) and upright manometer case.
- (5) Slide float (14) into glass tube (5).
- (6) Press U-cap/cap vent assembly onto top of glass tube (5).
- (7) Continue to press both cap assemblies onto glass tube (5) until they bottom.
- (8) Run nuts (2 and 9) up onto case (6) until contact is made with cap vent (3) and cap inlet (8).

- (9) Tighten nuts (2 and 9) an additional 1/4 turn to complete final assembly.
- (10) If left-hand manometer, connect elbow (10) into bottom nut (9) and nipple (11) into elbow (10). If right-hand manometer, connect "Tee" fitting (12) into bottom nut (9) and elbow (13) into "Tee" fitting (12).
- (11) Connect nipple (1) into top nut (2).

F. Fuel Manometer Installation (Figure 202)

WARNING: KEEP HEAT, OPEN FLAME, OR SPARKS AWAY FROM WORK AREA. FLAMMABLE LIQUID OR EXPLOSIVE VAPORS MAY BE PRESENT.

CAUTION: USE CARE WHEN INSTALLING MANOMETER TO PREVENT DAMAGE TO ADJACENT LIGHT FIXTURE.

- (1) Place manometer on interior side panel. Ensure that all nipples and "Tee" are properly aligned with capped fuel and vent lines.
- (2) Using previously removed two clamps and four screws, secure manometer, at top and bottom, to interior side panel.
- (3) Inside wing root, uncap fuel supply line and connect to nipple at base of manometer. Torque nut to 100 ± 25 in. lb.

NOTE: If installing right-hand manometer, in addition to Step (3), uncap primer fuel supply and connect to elbow at base of manometer. Torque nut to 25-30 in. lb.

- (4) Uncap vent line and connect to top of manometer, Torque nut to 40-64 in. lb.
- (5) Perform fuel system pressure test to ensure fuel system integrity.
- (6) Install all interior side panel covers.
- (7) Fuel manometer installation is now ready for testing. (See Paragraph 2, Adjustment/Test.)

2. Adjustment/Test

A. Fuel Pressure Gauge Calibration/Test

Normally no attempt should be made to calibrate or repair a defective fuel pressure gauge. It should be replaced with a serviceable gauge.

B. Fuel Manometer Calibration/Test

The fuel manometer works on a principle of gravity. The actual aircraft fuel is used to support a float within the manometer glass tube to indicate relative fuel quantity in the fuel tank. No calibration of the manometer is required. No electrical circuitry is used on this system.

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ICE AND RAIN PROTECTION – DESCRIPTION/OPERATION**1. General**

This Chapter includes those units and components which are installed on the AA-1C aircraft, as a means of preventing and disposing of ice formation in the carburetor and pitot system, and the elimination of frost and fog on the windows and windshield.

This Chapter contains the following systems and their related components.

Carburetor Heat System

Pitot Heat System

Windshield Defrosting and Window Defogging System

CARBURETOR HEAT SYSTEM – DESCRIPTION/OPERATION

1. General (See Figures 1 and 2)

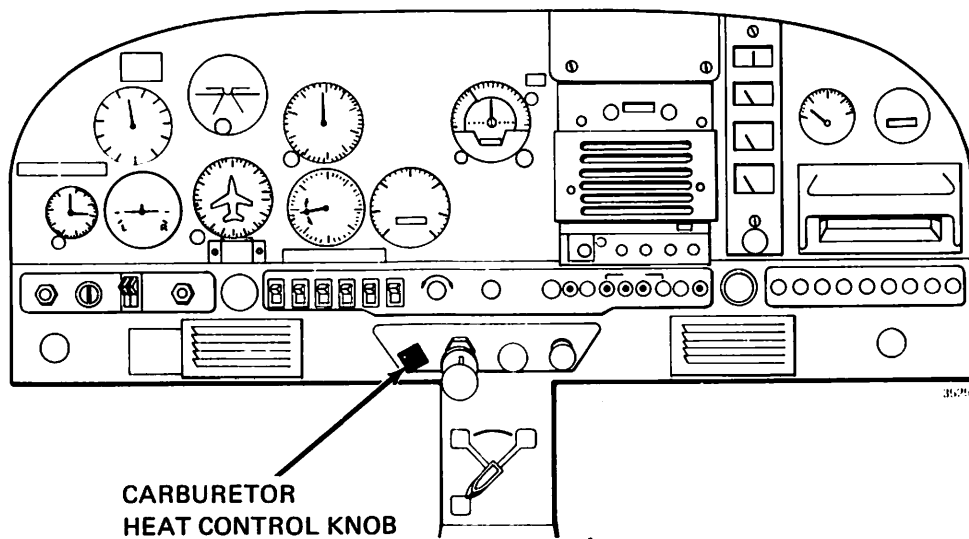
The aircraft engine is equipped with a carburetor heat system which is used when carburetor icing conditions exist. The system provides a source of heated air to the carburetor from an alternate hot air source of the induction system. The system is controlled from the instrument panel by the carburetor heat control which is connected to a shutoff valve on the carburetor air box by a wire linkage. When the carburetor heat control is in the OFF (pushed in) position, filtered air is drawn through ducting into the carburetor. When the carburetor heat control is in the ON (pulled out) position, the shutoff valve shuts off the filtered air source and warm, unfiltered air from a shroud around the exhaust system is directed to the carburetor.

NOTE: On the AA-1C aircraft, limited operation of the carburetor heat system is recommended since no filter is incorporated in the hot air source.

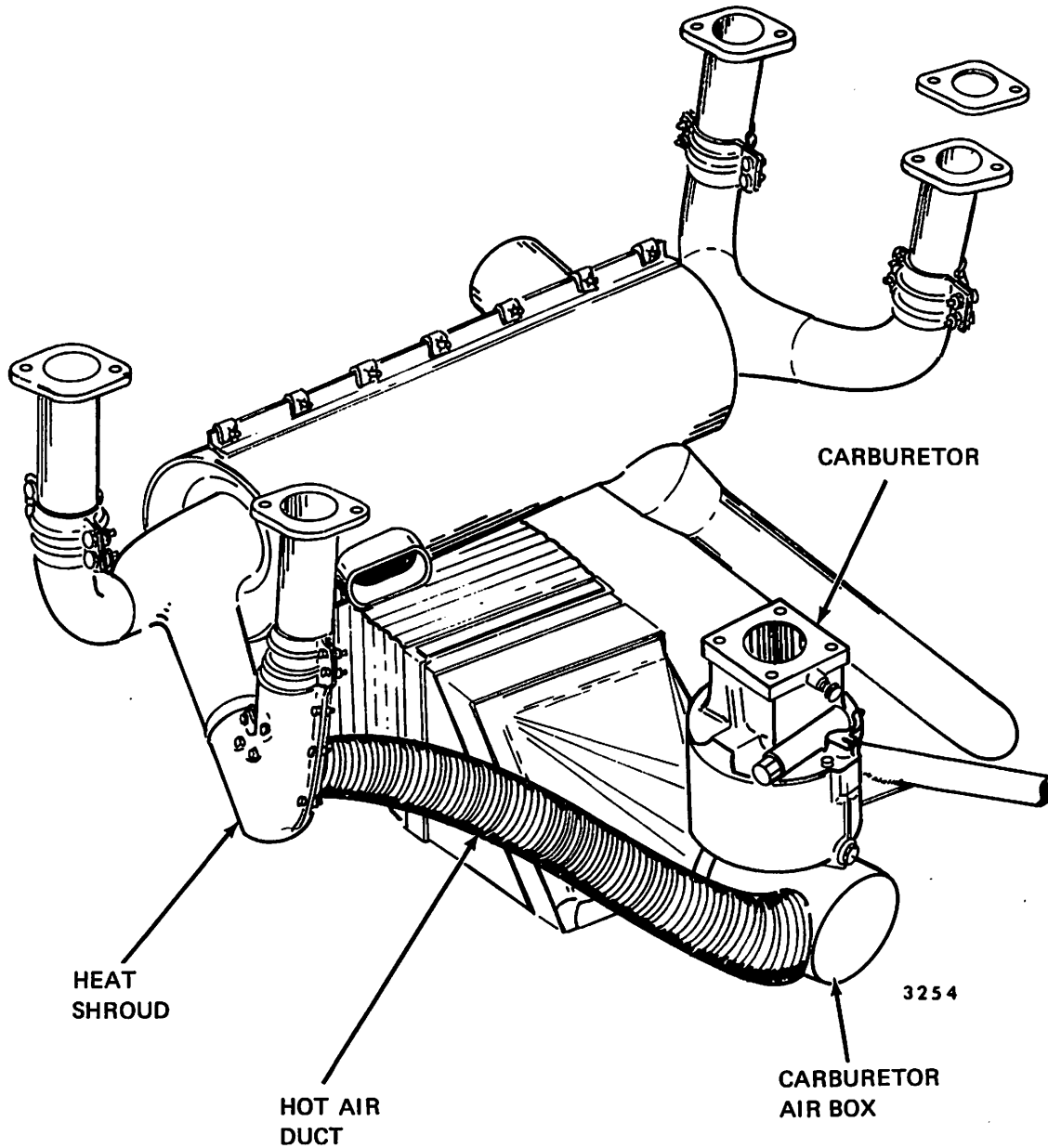
2. Major Components and Their Location

A. Carburetor Heat System

Unit	No. Per Aircraft	Location
Carburetor Heat Control	1	On lower instrument panel to left of throttle.
Carburetor Heat Shutoff Valve	1	In carburetor air box housing.
Carburetor Heat Control Cable (Wire)	1	Runs from control handle on instrument panel to shutoff valve on carburetor air box.



Carburetor Heat Control
Figure 1



**Carburetor Air Box Installation
Figure 2**

CARBURETOR HEAT SYSTEM – MAINTENANCE PRACTICES**1. Carburetor Heat System – Operational Test**

- A. Disconnect the hot air duct at the air box assembly.
- B. Pull the carburetor heat control knob out (ON position) and visually check that the shutoff valve on the carburetor air box is in the fully open position, push heat control knob in (CLOSED position) and visually check that shutoff valve is fully closed. Ensure no binding exists throughout travel of heat control.

NOTE: It is necessary to operate the aircraft engine to operationally test the carburetor heat system.

WARNING: ENSURE THAT PROPELLER AREA IS CLEAR PRIOR TO STARTING ENGINE.

- C. Start and run engine: Refer to Pilot's Operating Handbook.
 - (1) Run engine at 1800 RPM.
 - (2) Pull carburetor heat control out (ON position) and check for positive indication of RPM drop which indicates heat to carburetor.
 - (3) Push carburetor heat control in (CLOSED position) and note increase in RPM.

NOTE: Limited ground operation of the carburetor heat system is recommended since there is no filter incorporated in the hot air source.

- D. Shut down engine: Refer to Pilot's Operating Handbook.

**CARBURETOR HEAT CONTROL – DESCRIPTION/OPERATION****1. General**

The carburetor heat control is used to control the flow of heated air to the carburetor during icing conditions. It consists of a control knob mounted on the lower instrument panel to the left of the throttle. The heat control is connected to a shutoff valve mounted in the carburetor air box by a wire linkage and is a push/pull type control, when it is pulled out the carburetor heat system is ON, pushing it in turns the system to OFF.

CARBURETOR HEAT CONTROL – TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Control will not operate through full travel range	Linkage binding, broken or crimped	Adjust linkage or replace as required
	Control binding in instrument panel	Clean, adjust, lubricate as required
	Air shutoff valve binding or stuck on carburetor air box	Clean, adjust, lubricate or replace valve as required
Control moves through full range of travel but does not fully shut off, or restricts flow of heated air to carburetor	Control and linkage improperly adjusted	Adjust control and linkage; See Section 30-1-1, page 201 of this manual

CARBURETOR HEAT CONTROL – MAINTENANCE PRACTICES

1. Removal

- A. Disconnect the carburetor heat cable from the shutoff valve on carburetor air box by loosening swivel assembly.
- B. Loosen the clamp on the air box assembly and slide the cable from the clamp.
- C. Remove the clamp securing the carburetor heat control cable and the throttle cable to the instrument panel support.
- D. Remove the locknut behind the instrument panel that secures the carburetor heat control.
- E. Remove the control assembly by pulling it through the firewall and instrument panel.

2. Installation

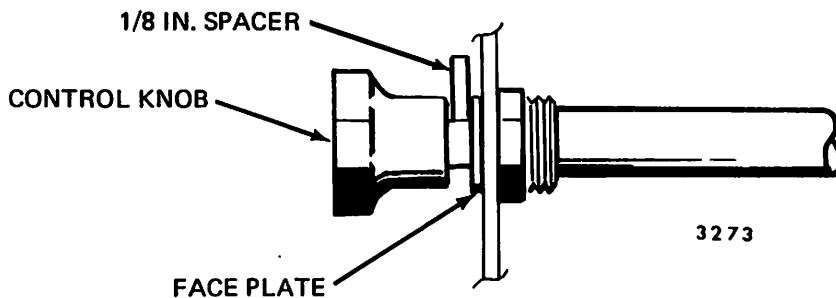
- A. Pass the end of the cable through the instrument panel and install the nut securing cable clamp to the instrument panel.
- B. Slide the cable end through the firewall and the clamp on the side of the air box assembly and connect cable loosely to the air box control arm.
- C. Install the clamps that secure the carburetor heat control cable and throttle cable to the instrument panel support.
- D. Adjust the cable to provide a minimum 4-1/2 in. bend radius and tighten the clamps on the instrument panel brace and the clamp on the air box.

NOTE: The two clamps on the instrument panel brace also secure the throttle cable. Ensure that throttle cable maintains a minimum bend radius of 4-1/2 in.

- E. Seal opening in firewall around carburetor heat control cable with Coast Pro-Seal 700 Firewall Sealant (MIL-S-38249, Type 1) manufactured by Essex Chemical Corp., 19451 Susana Rd., Compton, Calif. 90221.

3. Adjustments

- A. Position the carburetor heat control arm in the completely closed position. Place a 1/8 in. spacer between the control knob and control cable housing. (See Figure 201.)

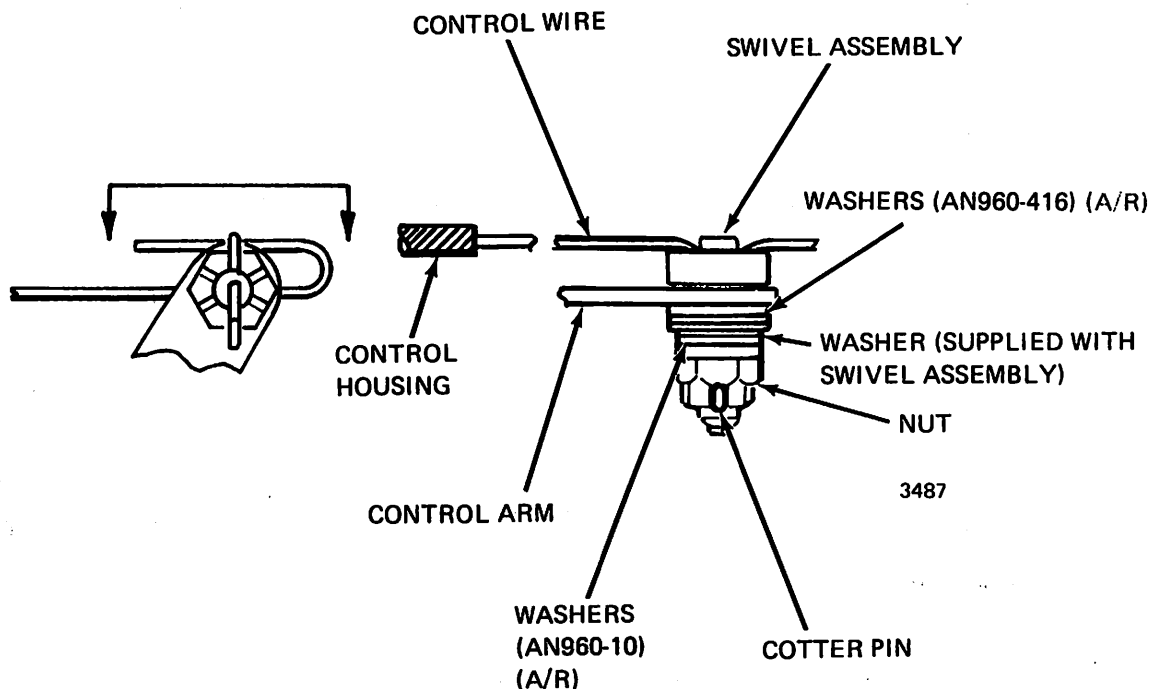


Typical Control Knob Rigging
Figure 201

- B. With the carburetor heat control in the fully closed position, and the control knob against the spacer, tighten the cable clamp on the side of the carburetor air box and the control arm attaching bolt. Remove the spacer from the control knob and check carburetor heat control operation.
- C. Attach and bend the carburetor heat control cable wire (see Figure 202), tighten clamp and install the cotter pin.

4. Operational Test

Check operation of the carburetor heat control. Control should have 1/8 in. travel remaining with the control arm in fully closed position. Control cable should have 4-1/2 in. minimum bend radius.



Carburetor Heat Control Wire Installation
Figure 202

CARBURETOR HEAT SHUTOFF VALVE – DESCRIPTION/OPERATION

1. General

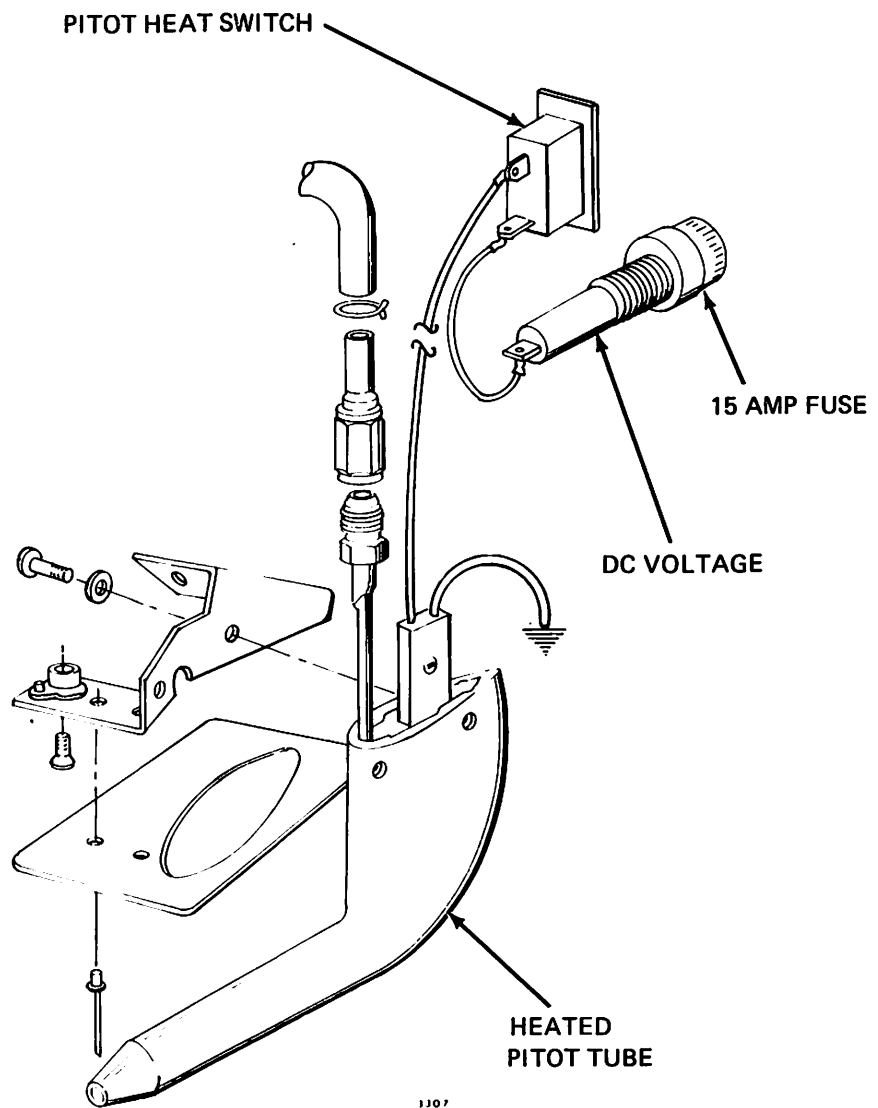
The carburetor heat shutoff valve is an integral part of the carburetor air box. The valve control arm is located on the exterior section of the carburetor air box and is connected to the carburetor heat control lever by a control wire assembly. When the shutoff valve is open, heated air is diverted to the carburetor air intake. Carburetor heat is shut off when the valve is closed.

Since the carburetor heat shutoff valve is an integral part of the carburetor air box, removal or replacement of the valve requires removal of carburetor air box. (Refer to Chapter 73 of this manual).

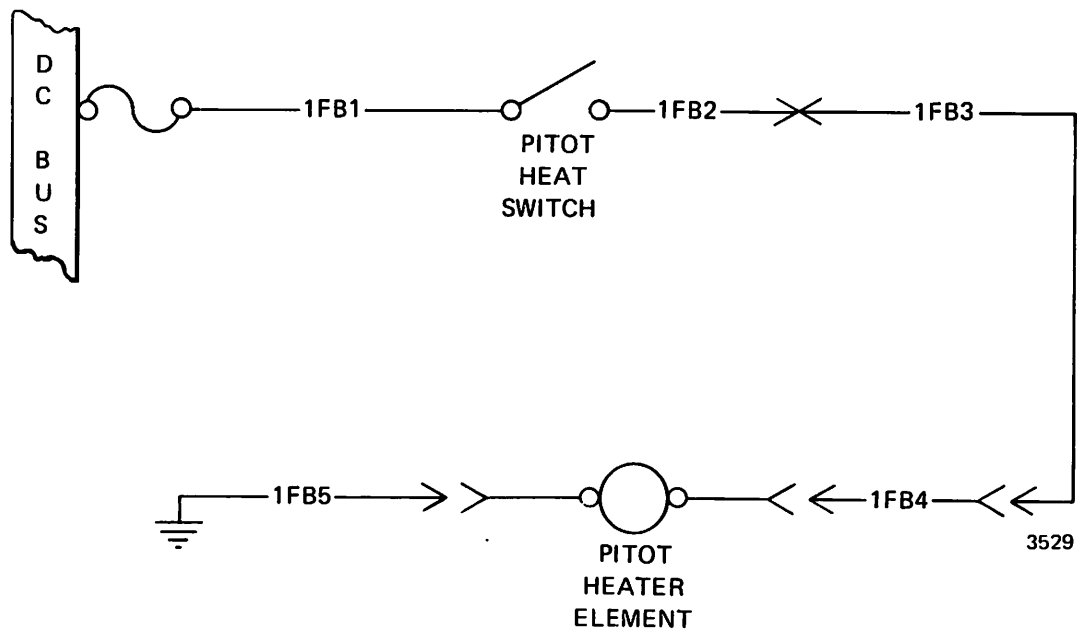
To perform an operational test on the carburetor heat shutoff valve, refer to 30-1-0, this chapter.

PITOT HEATER – DESCRIPTION/OPERATION1. General

The pitot heating system (see Figure 1) consists of an electric heating element which is an integral part of the pitot tube, a receptacle for connection to the element, a fuse and fuse holder, an OFF-ON switch and associated wiring. The switch and fuse holder are of plastic construction and are mounted on the lower part of the instrument panel. The heater uses a 15-amp fuse (see Figure 2). The purpose of the pitot heater is to prevent or eliminate the formation of ice inside the pitot tube during aircraft flight. The heated pitot tube is an optional item.



Pitot Heater System
Figure 1



**Pitot Heater Circuit
Figure 2**

PITOT HEATER – TROUBLE SHOOTING**1. Trouble Shooting Pitot Heater System**

TROUBLE	PROBABLE CAUSE	REMEDY
Pitot tube fails to heat	Blown fuse	Replace with properly rated fuse
	Defective wiring	Check with ohmmeter and repair as necessary
	Heater element burned out	Replace pitot tube

PITOT HEATER – MAINTENANCE PRACTICES

1. Removal/Installation of Pitot Heater

When the pitot heater becomes inoperative, the pitot tube assembly must be replaced. For removal/installation procedures, refer to Chapter 34.

2. Removal/Installation of Pitot Heater Switch

A. Remove Pitot Heater Switch

- (1) Ensure that master switch is in OFF position.
- (2) Reach behind instrument panel and disconnect switch wiring.
- (3) Push switch unit out through the face of the panel.

B. Install Pitot Heater Switch

- (1) Ensure that master switch is in OFF position.
- (2) Position switch in place on instrument panel and push switch into mounting hole until switch snaps into panel.
- (3) Connect wiring to switch terminals.

3. Operational Test of Pitot Heater

A. Test Pitot Heater

WARNING: WHEN THE PITOT HEATER IS OPERATING, THE PITOT TUBE BECOMES HOT. PHYSICAL CONTACT COULD RESULT IN A BURN.

- (1) Place master switch to ON position.
- (2) Place pitot heater switch to ON position. Within two or three seconds pitot tube will begin to get warm.
- (3) Lightly feel the pitot tube immediately after the pitot heater switch has been placed in ON position.

NOTE: Ground operation of the pitot heater should be held to a minimum during operational checks.

- (4) Place pitot heater switch and master switch to OFF position.

WINDSHIELD DEFROSTER – DESCRIPTION/OPERATION**1. General**

To provide for windshield defrosting, flexible ducts are connected to the plenum assembly of the heating system and terminated just below the sliding doors located on the forward panel deck. Operation of the defroster is accomplished by pulling the push-pull cabin heat control out and opening the sliding doors on the defroster outlets.

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LANDING GEAR
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LANDING GEAR – DESCRIPTION/OPERATION

1. General

The AA-1C aircraft utilizes a non-retractable, tricycle type landing gear. The main landing gear consists of fiberglass struts attached to forged brackets which mount to the carry-through spar. Forgings, attached to the lower end of each main landing gear strut, serve as the wheel axles and as an attaching base for the brake torque plate assembly. The nose gear is the castering type and consists of a tubular strut with shock absorbers, attached to torque tubes mounted in the fuselage. The aircraft is furnished, at the customers option, with wheel fairings for the three wheels. The fairings are equipped with an adjustable scraper which prevents mud and slush from entering the fairing cavity. Aircraft operation on rough fields, with tires out of balance, or in snow, ice, or mud can be detrimental to the life of the wheel fairings and should be avoided.

**MAIN LANDING GEAR – DESCRIPTION/OPERATION****1. General**

The main landing gear consists of the right and left hand gear assemblies. Each assembly consists of a wheel assembly, laminated fiberglass strut, forged wheel axle, attaching brackets, and attaching hardware. Wheel fairings are a customer option.

MAIN LANDING GEAR – MAINTENANCE PRACTICES

1. Removal/Installation of Main Landing Gear Assembly

A. Remove Main Landing Gear Assembly (See Figure 201.)

- (1) Support the aircraft on jacks (refer to Chapter 7).
- (2) Remove the wing and wing root (refer to Chapter 57).
- (3) Bleed the fluid from the brake system and disconnect the brake line at the wheel brake assembly fitting.
- (4) Remove main landing gear wheel assembly (refer to 32-4-1).
- (5) Support the main gear strut assembly and remove bolts (3) and washers (4) that secure the spar mounting bracket (5) and remove the landing gear assembly.
- (6) Disassemble the landing gear strut assembly as follows:
 - (a) Remove bracket assembly (5) by removing nuts (6), bolts (7) and washers (8).
 - (b) Remove nuts (10), bolts (11), washers (12), and separate brackets (13, 14, and 15), shims (16, 17, and 18), spacer (19), and spring plate (20) from strut (21).
 - (c) Remove nuts (22), bolts (23), washers (24), and separate axle (25), bracket (26), reinforcement plate (27), and shims (28) from strut (21).
 - (d) Remove nuts (29), bolts (30), and washers (31) to remove torque plate assembly (7, Figure 201, 32-4-1).

B. Install Main Landing Gear Assembly (See Figure 201.)

- (1) When installing the main landing gear, observe the following torque values:

BOLT DIA. (IN.)	TORQUE (IN. LBS)
1/2	650 – 750
3/8	250 – 300
5/16	200 – 225

- (2) Check shims for excessive wear or hole elongation and replace if necessary. Shims must ensure a tight fit.

NOTE: Install shims in same order and position as prior to disassembly.

- (3) Assemble the main gear strut assembly as follows:

- (a) Position torque plate assembly (7, Figure 201, 32-4-1) in place on axle (25, Figure 201) and install bolts (30), washer (31), and nuts (29).
- (b) Assemble shims (28), axle (25), reinforcement plate (27), and bracket (26) in place on strut (21) and install bolts (23), washers (24), and nuts (22).
- (c) Assemble shims (18, 17, and 16), spring plate (20), spacer (19), brackets (15, 14, and 13) in place on strut (21) and install bolts (11), washers (12), and nuts (10).
- (d) Install shims (9) and bracket assembly (5) on brackets (14) and (15).

(4) Install main landing gear on carry-through spar as follows:

- (a) Apply a solid film lubricant to the mating surfaces of the carry through spar and the spar mounting bracket.

Approved Solid Film Lubricants:

McLube 1708 by McGee Chemicals Co., Inc.
Lube-Lok 5396 by Allen Aircraft Products Inc.

- (b) Align holes in the spar mounting bracket (5) with holes in carry-through spar and retainer assemblies.

- (c) Install bolts (3) and washers (4).

2. Visual Inspection of Main Landing Gear Assembly

A visual inspection of the main landing gear strut and attach brackets should be made at each 100 hour inspection and after any hard or overweight landing. Inspect the laminated fiberglass main gear struts for evidence of nicks, cracks, delamination, and deterioration of the protective paint coating. Refer to Chapter 5 for scope of inspections and detailed procedures.

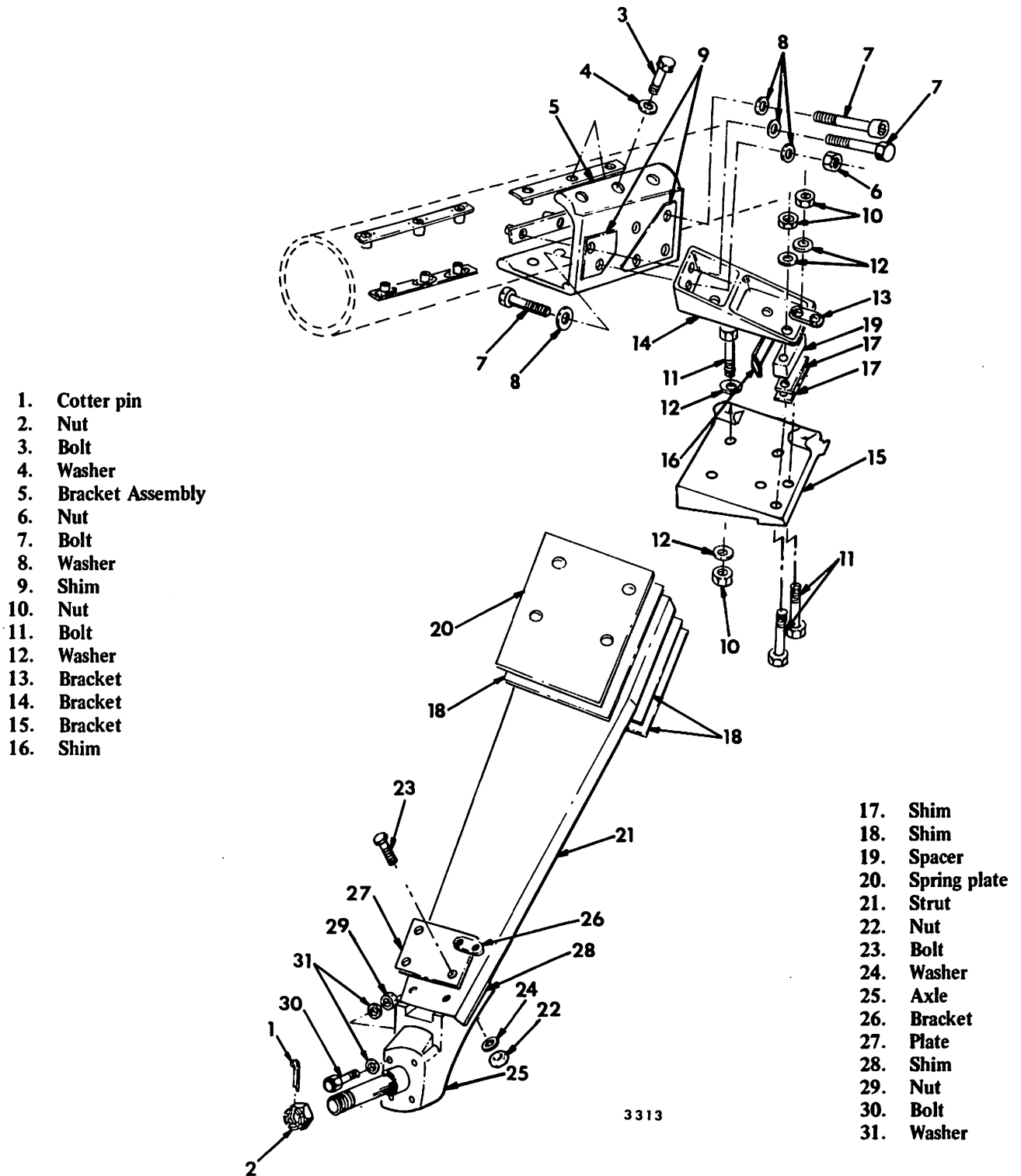
3. Repair of Main Landing Gear Strut

NOTE: (1) Minor surface delaminations are acceptable providing they do not extend more than one ply into the surface of the strut. Corner delaminations (slivers) are acceptable if they are smaller than 1/16 x 1/16 in. in size throughout their length. If airworthiness of a damaged strut is in question, close-up photographs of the damaged area may be submitted to Grumman American Aviation Corporation for analysis and recommendations.

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

Corrective Action — Remove delaminated material. Smooth out minor paint chips or stone bruises with No. 150 Tri-Mite. Clean unpainted areas thoroughly with Methyl Ethyl Ketone. Seal minor surface or corner delaminations with a two-part epoxy adhesive to seal out moisture from the damaged area. Clean strut with wax and grease remover and prime with two light coats of zinc chromate primer per MIL-P-8585 (see Chapter 12) and paint to match aircraft color.

NOTE: (2) Epoxy adhesive is available from Grumman American Supply Operations or may be purchased locally.



**Main Landing Gear Assembly
Figure 201**

NOSE LANDING GEAR – DESCRIPTION/OPERATION**1. General**

The nose landing gear consists of a fuselage mounted torque tube and yoke assembly connected to a non-steerable strut with a castoring nose wheel mounted on the forward end. Normal servicing of the nose wheel strut includes the application of grease to the nose fork swivel and adjustment of the disc springs. The aircraft has two shock absorbers installed on the nose gear as standard equipment.

NOSE LANDING GEAR – MAINTENANCE PRACTICES**1. Removal/Installation of Nose Landing Gear****A. Remove Nose Landing Gear Strut Assembly (See Figure 201.)**

- (1) Remove weight from the nose gear by either tying down the tail or placing a suitable support under forward fuselage. Remove shock absorbers as described in Part A of paragraph 3.
- (2) Remove bolt (1, Figure 201) and spacer (2) from fork assembly (15).
- (3) Remove cotter pin (3), nuts (4), washers (5), and withdraw axle rod (6) from nose wheel.
- (4) Remove plugs (7), spacers (8), and axle (9).

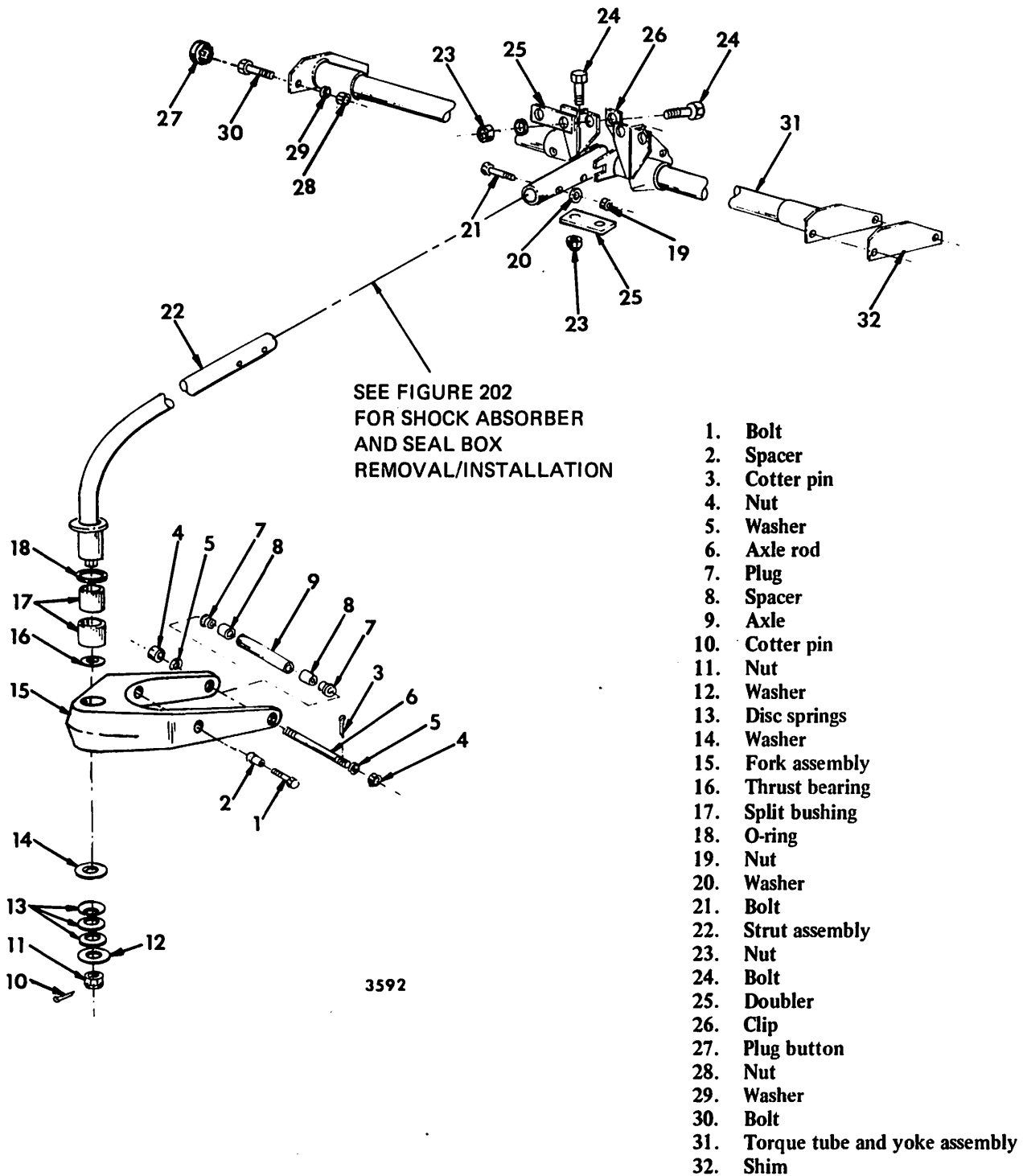
NOTE: Some aircraft have nose wheel fairing installed as an optional item.

- (5) Remove cotter pin (10), nut (11), washer (12), springs (13), washer (14), fork assembly (15) with fairing attached, thrust bearing (16), bushings (17), and O-ring (18). Remove two attaching bolts and remove fairing from fork assembly (15).
- (6) Remove nut (19), washer (20), bolt (21), and slide strut (22) from the torque tube and yoke assembly.

B. Remove Nose Landing Gear Torque Tube and Yoke Assembly

NOTE: The torque tube and yoke assembly is located in the forward end of the fuselage. To gain access to the torque tube and yoke assembly some items of equipment must be removed from the cockpit area.

- (1) Remove the seats (refer to Chapter 25).
- (2) Remove left and right-hand forward console panels. The panels may be easily removed by grasping the forward edge at the firewall and bending the panels out 90 degrees and parallel with the firewall. Slide the panels forward far enough so that they slip out from behind the aft portion of the console.
- (3) Remove the fresh air box assembly from the left side.
- (4) Remove the upholstery side panels and fiberglass insulating material from the left and right-hand forward side panels.
- (5) Remove the lower cowling (refer to Chapter 71).
- (6) Disconnect the rudder return springs by unbolting the eye bolts from the forward face of the firewall. Note that additional washers are used under the left-hand eye bolt for proper rudder pedal centering and rudder trim.
- (7) Remove the nuts that secure the right forward rudder bar attach bracket to the floor. Lift the rudder bar up and aft to provide clearance for removing left brake cylinder attach bracket on co-pilot's side.
- (8) Remove the nuts that attach the brake cylinder brackets to the floor. Lift brake cylinders free from the floor and allow pedals to rotate aft.
- (9) Remove clevis pins from left and right brake cylinder attachments to rudder pedals on pilot's side.



**Nose Landing Gear Assembly
Figure 201**

- (10) Disconnect one end of the parking brake chain by cutting the wire which attached it to the link on the master cylinder (pilot's side).
- (11) Move the left and right master cylinders on the pilot's side up as high as possible and against the firewall and secure them temporarily in this position.
- (12) Remove the screws and nuts which attach the throttle cable clamps to the instrument panel brace.
- (13) Remove the nuts that attach the T-column support to the floor. Lift the T-column and support assembly from the studs which protrude through the floor and allow the assembly to come as far aft as possible.
- (14) Remove nuts (23), bolts (24), doublers (25), and clips (26) that secure the center torque tube and yoke bearing supports to the floor and firewall.
- (15) Remove the four plug buttons (27) on the lower forward fuselage and the four nuts (28), washers (29) and bolts (30) which secure the ends of the torque tube and yoke assembly (31) to the fuselage side panels.

CAUTION: CARE SHOULD BE TAKEN NOT TO WEDGE THE TORQUE TUBE ASSEMBLY INTO THE FUSELAGE PANELS AS DAMAGE TO THE HONEYCOMB SKIN MAY RESULT.

- (16) Remove the torque tube and yoke assembly (31) from the fuselage by working the assembly up and aft, left end first, so that the assembly is withdrawn from under the pilot's side of the instrument panel.
- (17) Remove shims (32).

C. Install Nose Landing Gear Torque Tube and Yoke Assembly

- (1) Carefully position the torque tube and yoke assembly (31, Figure 201) in place and install clips (26), doublers (25), bolts (24) and nuts (23) that secure the center torque tube and yoke assembly bearing supports to the firewall and the floor, but do not tighten nuts (23).
- (2) Check the clearance between the ends of the torque tube and yoke assembly (31) and the inside of the lower engine mount extrusions, and install the proper thickness shims (32) to obtain a minimum clearance between the ends of the torque tube and yoke assembly and the inside of the lower engine mount extrusions.
- (3) Install bolts (30), washers (29), and nuts (28).
- (4) Torque the center torque tube bearing support bolts (24) at the firewall and the cabin floor to 185-195 in. lb and torque the bolts (30) that attach the ends of the torque tube assembly to the fuselage sides to 300-350 in. lb.
- (5) Install plug buttons (27).
- (6) Position the T-column and support assembly in place and install nuts (refer to Chapter 27).
- (7) Position throttle cable in place on instrument panel brace and install cable clamps, screws, and nuts.
- (8) Position brake master cylinders on co-pilot's side in place and install washers and nuts to secure attach brackets to the floor.
- (9) Position right-hand rudder bar in place and install washers and nuts on attach brackets.

- (10) Attach the left and right brake master cylinders, on the pilot's side to the floor. Attach the parking brake chain to the parking brake link on the master cylinder. Use 0.032 in. stainless steel safety wire and make double loop through the link and through the chain. Install the two clevis pins which attach the left and right rudder pedals on the pilot's side to the master cylinders.
- (11) Install rudder return spring eye bolts in firewall using same number of washers as were removed.
- (12) Where upholstery side panels and fiberglass insulation have been removed from the forward cabin area, the fiberglass insulation may be recemented to the fuselage side skin with Uniroyal 6306 adhesive or equivalent.
- (13) Install left and right-hand forward console panels.
- (14) Install left side fresh air box assembly.
- (15) Install the seats (refer to Chapter 25).

D. Install Nose Landing Gear Strut Assembly

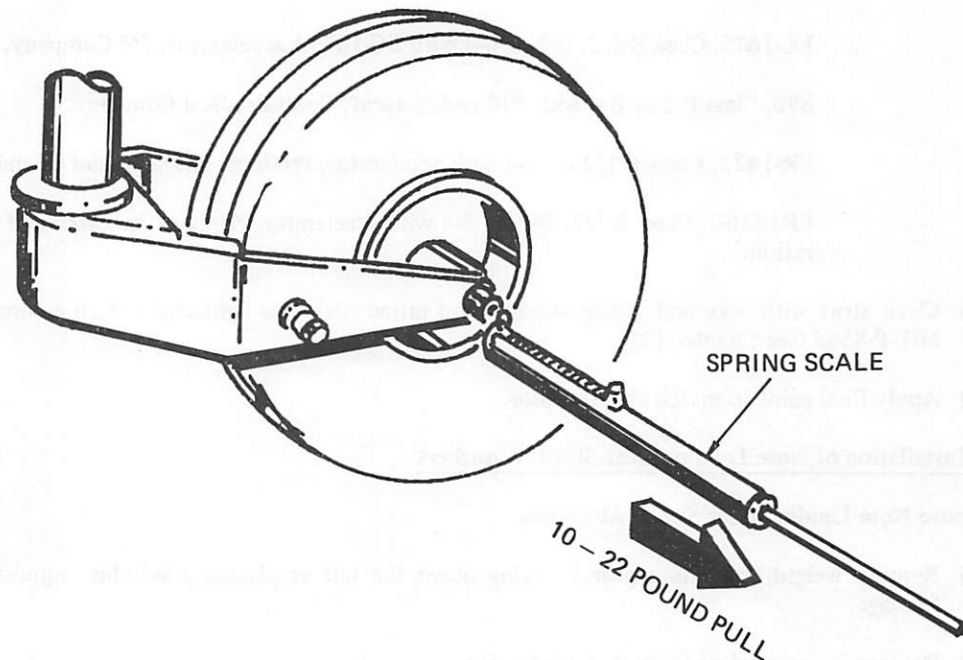
- (1) Position strut into torque tube and yoke assembly (31) and install attaching bolts (21), washers (20), and nuts (19). Torque bolts (21) to 95-110 in. lbs.
- (2) Apply sealant, RTV 102 by General Electric or RTV 732 by Dow Corning, to strut-to-torque tube connection and to bolt heads (21) and nuts (19).
- (3) If nose wheel fairing was removed, position strut (22) through cutout in fairing.
- (4) Assemble O-ring (18), bushings (17), thrust bearing (16), and fork assembly (15) in place on strut (22).

NOTE: Proper installation of nose gear strut and fork assembly is essential to prevent nose wheel shimmy. Refer to Figure 201 for proper installation of disc springs (13).

- (5) Install washers (14), springs (13), washer (12) and nut (11).
- (6) Install two attaching bolts that secure nose wheel fairing to fork assembly (15).
- (7) Assemble axle (9), spacers (8), and plugs (7), in nose wheel. Position nose wheel in fork assembly (15), and insert axle rod (6) through fork and wheel, and through fairing mount brackets.
- (8) Install washers (5), nuts (4), and tighten until a very slight drag is evident when the wheel is rotated. Install cotter pin (3).
- (9) Install spacer (2) and bolt (1).
- (10) Install shock absorbers and seal box assembly as described in part B of paragraph 3.
- (11) Install lower cowl.

2. Adjustment/Test of Nose Landing Gear Fork

Proper fork friction is attained by adjustment of torque on nut (11). Tighten nut (11) until a 10-22 lb. drag is attained at the axle centerline when the fork is rotated. See Figure 202 for proper nose fork friction measurement. The cotter pin (10, Figure 201) must be in place for this measurement.



Nose Fork Friction Measurement
Figure 202

3. Inspection and Minor Repair of Nose Landing Gear

A. Visually Inspect Nose Landing Gear

- (1) Inspect the steel tube nose gear strut for nicks, rust, or damage to protective coating.
- (2) Perform a thorough inspection of the nose landing gear at each 100-hour inspection and after any hard or overweight landing. Refer to Chapter 5 for scope of inspections and detailed procedures.

B. Repair Nose Landing Gear Strut Minor Damage

- (1) Smooth out minor nicks with fine sandpaper.
- (2) Use 150 Trimate sandpaper to remove all rust and smooth out damaged paint.
- (3) Inspect the nose fork bearing cup-to-strut fillet for the following conditions: cracks; corrosion; deterioration; damage (see Area D, Figure 203, Chapter 5). If any discrepancies are found, place a 150 ft. lb torque load on cup, suitably protecting the bearing surface. Any detectable rotation is reason for strut replacement. After testing, replace fillet as follows:
 - (a) Remove cup-to-strut fillet with hand abrasive. Remove rust and paint from strut, 1.5 in. minimum, upward from cup stop plate.
 - (b) Apply Loctite 290 Adhesive/Sealant (Loctite Corporation) to any cracks remaining in cup-to-strut bondline.

- (c) Apply a uniform 0.12 in. radius fillet of sealant* to replace fillet removed. Also apply sealant on strut, 1.5 in. minimum, upward from cup stop plate.

*Approved Sealants (PR-1422, Class B-1/2 is available through the Grumman American Supply Operations):

EC-1675, Class B-1/2, B-2 or B-4 with EC-1675A accelerator, 3M Company.

890, Class B-2 or B-4 with 890 curing agent, Coast Pro-Seal Company.

PR-1422, Class B-1/2 or B-2 with accelerator, Products Research and Chemical Corporation.

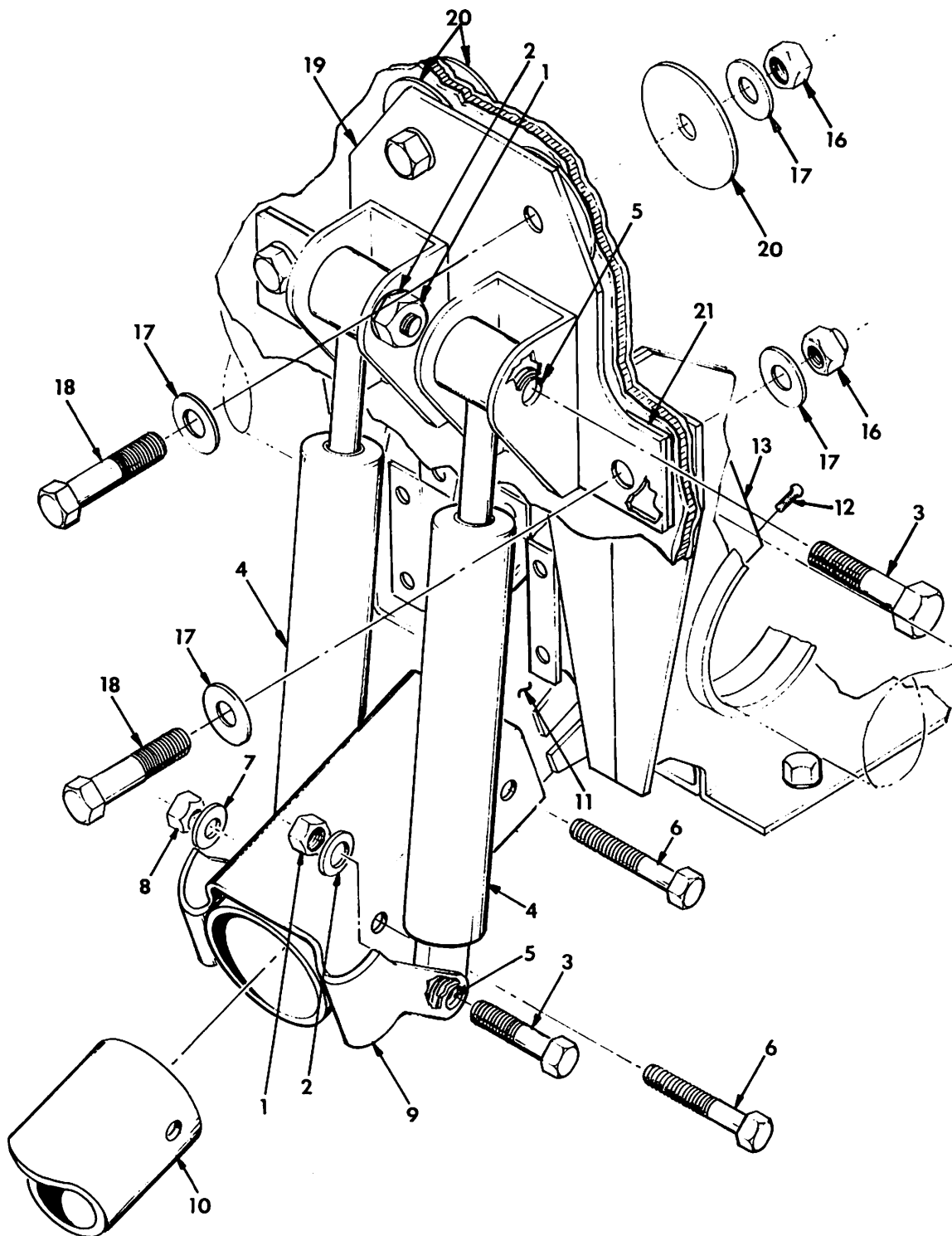
PR1436G, Class B-1/2, B-2 or B-4 with accelerator, Products Research and Chemical Corporation.

- (4) Clean strut with wax and grease remover and prime with two light coats of zinc chromate primer per MIL-P-8585 (see Chapter 12).
- (5) Apply final paint to match aircraft color.

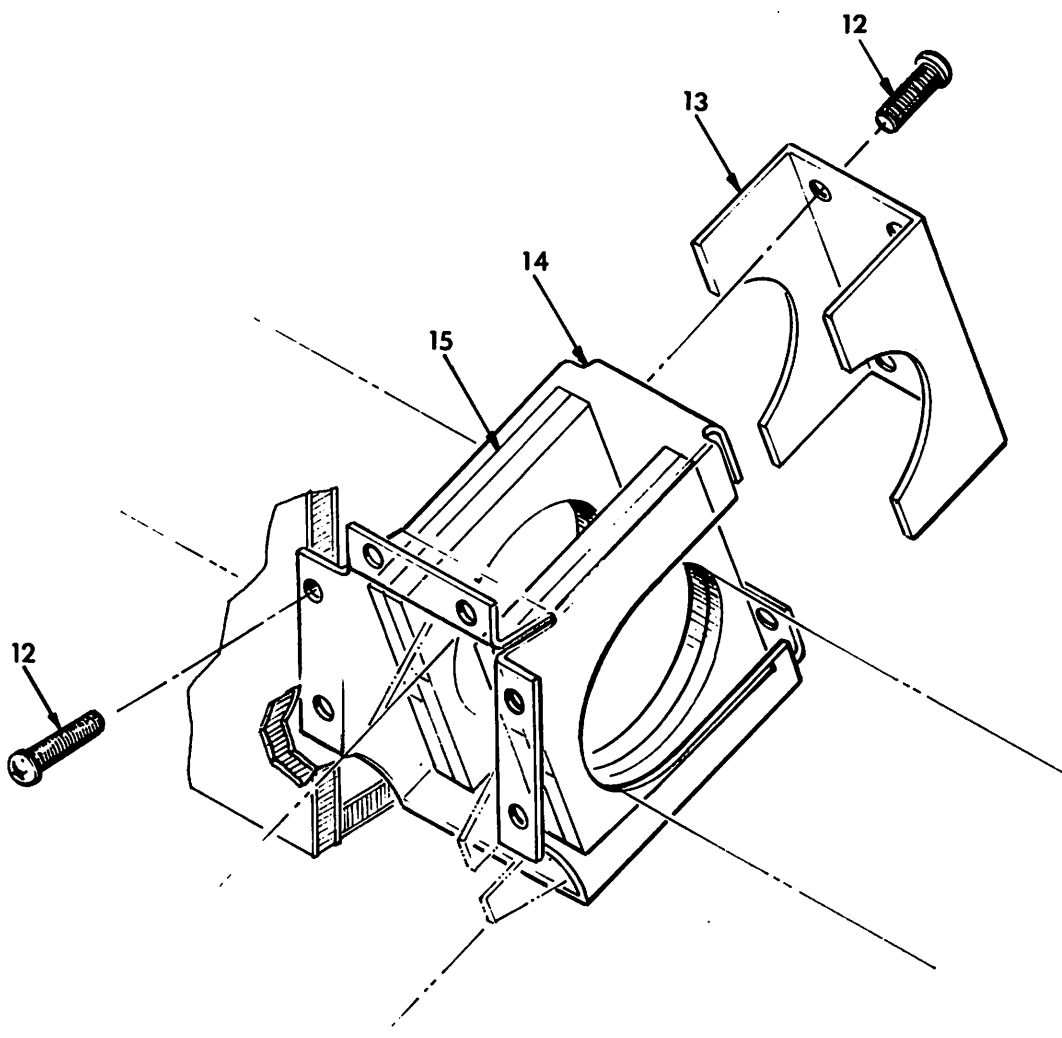
4. Removal/Installation of Nose Landing Gear Shock Absorbers

A. Remove Nose Landing Gear Shock Absorbers

- (1) Remove weight from nose gear by tying down the tail or placing a suitable support under front of fuselage.
- (2) Remove lower cowling (refer to Chapter 71).
- (3) Remove nuts (1, Figure 203), washers (2), bolts (3), and remove shock absorbers (4). Remove bushings (5) from each end of shock absorbers (4).
- (4) Remove nuts (8), washers (7), bolts (6), and remove bracket (9) from strut (10) and torque tube and yoke assembly (11).
- (5) Remove screws (12) from firewall seal box assembly and remove box cover (13) and box (14) from torque tube and yoke assembly (11).
- (6) Remove seals (15) from torque tube and yoke assembly (11).
- (7) Remove nuts (16), washers (17), bolts (18), bracket (19), washers (20), and doublers (21).



**Nose Landing Gear Shock Absorber Installation (Sheet 1 of 2)
Figure 203**



3517

- | | |
|-----------------------------------|---------------|
| 1. Nut | 12. Screw |
| 2. Washer | 13. Box Cover |
| 3. Bolt | 14. Box |
| 4. Shock Absorber | 15. Seal |
| 5. Bushing | 16. Nut |
| 6. Bolt | 17. Washer |
| 7. Washer | 18. Bolt |
| 8. Nut | 19. Bracket |
| 9. Bracket | 20. Washer |
| 10. Strut | 21. Doubler |
| 11. Torque Tube and Yoke Assembly | |

**Nose Landing Gear Shock Absorber Installation (Sheet 2 of 2)
Figure 203**

B. Install Nose Landing Gear Shock Absorbers (See Figure 203.)

- (1) Assemble washers (20) on bolts (18) and install bolts through firewall.
- (2) Install doublers (21) on the four lower bolts and washers (20) on the two upper bolts.
- (3) Slide bracket (19) on bolts (18), and install washers (17) and nuts (16). Torque the two upper bolts to 120 ± 20 in. lb and the four lower bolts to 175 ± 15 in. lb.

WARNING: **CLEANING SOLVENT (STODDARD) IS TOXIC AND FLAMMABLE. USE IN A WELL VENTILATED AREA. DO NOT BREATHE FUMES AND KEEP AWAY FROM FLAMES.**

- (4) Use Stoddard solvent or equivalent to clean firewall area around nose gear torque tube and flanges of firewall seal box assembly.
- (5) Install seals (15) on torque tube and yoke assembly (11) with thin edge of seal up and the thin seal outboard.
- (6) Coat aft side of box (14) flanges with firewall sealant, Pro-Seal 700, and position box in place against firewall. Ensure that seals (15) are inside of box and secure box (14) to firewall with screws (12).
- (7) Ensure that seals (15) remain in place and install box cover (13). Secure box cover (13) with screws (12).
- (8) Seal any opening between box (14) and box cover (13) with firewall sealant so that the box forms an airtight seal around the torque tube.
- (9) Insert bushings (5) in lower mounting holes of shock absorbers (4), position shock absorbers in place on bracket (9) and install attaching bolts (3), washers (2), and nuts (1). Torque bolts to 60 ± 10 in. lb.
- (10) Slide nose gear strut (10) into torque tube and yoke assembly (11), position bracket (9) in place on torque tube and yoke assembly (11) and install bolts (6), washers (7), and nuts (8). Torque bolts (6) to 175 ± 15 in. lb.
- (11) Insert bushings (5) in top mounting holes in shock absorbers (4), align holes in shock absorbers (4) with holes in bracket (19), and install bolts (3), washers (2), and nuts (1). Torque bolts (3) to 175 ± 15 in. lb.
- (12) Install lower cowling (refer to Chapter 71).
- (13) Remove support from under forward fuselage.

WHEELS AND TIRES – DESCRIPTION/OPERATION**1. General**

AA-1C aircraft are equipped with 4-ply, 5.00 x 5 tube type tires on the nose landing gear. The main landing gear tires are tube type, size 6.00 x 6. Tires should be rotated periodically to obtain maximum tire life. All wheels are of the split-wheel design for each servicing and each main wheel has an independent disc-type hydraulic brake system. Refer to 32-4-2 for information on the brake system. All wheels and tires are balanced to within 5 in.-ounces at the factory. It is recommended that replacement tires be balanced to this specification to prevent excessive vibrations in the landing gear assemblies. Balancing is accomplished with a static bubble balancer.

LANDING GEAR WHEEL ASSEMBLIES – MAINTENANCE PRACTICES**1. Removal/Installation of Main Gear Wheel Assemblies****A. Remove Main Gear Wheel Assembly**

- (1) Support the aircraft on jacks (refer to Chapter 7).
- (2) Remove main gear wheel fairing if installed (refer to Paragraph 5, Section 32-4-1).
- (3) Remove bolts (1, Figure 201) and washers (2) which attach the brake pressure plate (4) and backplate (3) to the brake cylinder assembly (5).
- (4) Remove cotter pin (1, Figure 201, Section 32-1-1), nut (2) and remove wheel assembly from axle (25).

B. Install Main Gear Wheel Assembly

- (1) Position wheel on axle (25, Figure 201, Section 32-1-1).
- (2) Check brake anchor bolts (6, Figure 201, Section 32-4-1) for freedom of movement in torque plate assembly (7) and for adequate lubrication.
- (3) Install axle nut (2, Figure 201, Section 32-1-1) and tighten until a slight drag is evident when wheel is rotated. Back off the nut to the next castellation and install cotter pin (1).
- (4) Position brake backplate assembly (3, Figure 201, Section 32-4-1) in place and install washers (2) and bolts (1). Torque bolt (1) to 90 in. lb.
- (5) Install wheel fairing if applicable (refer to Paragraph 5A, Section 32-4-1).
- (6) Remove jacks.

2. Disassembly/Reassembly of Main Landing Gear Wheel Assembly**A. Disassemble Main Landing Gear Wheel Assembly**

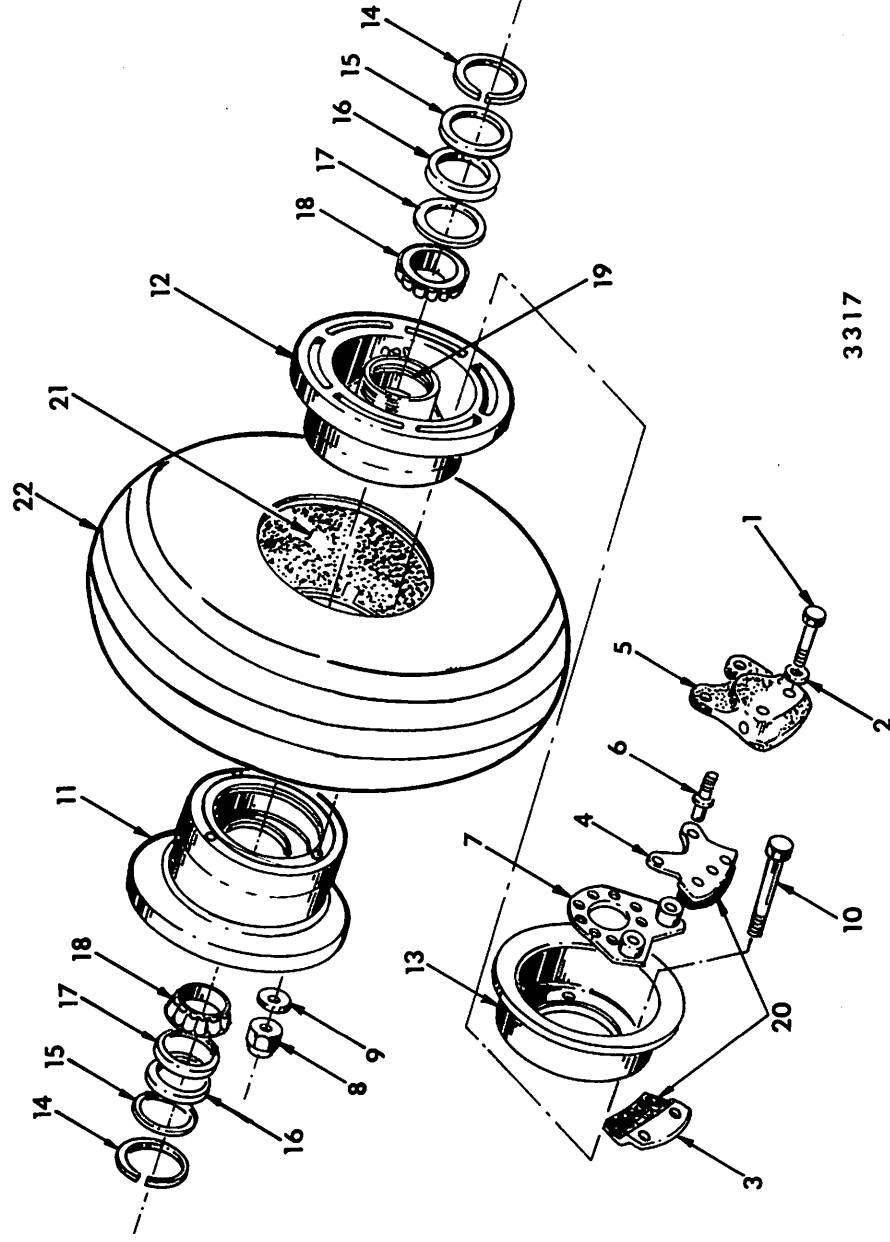
- (1) Remove main landing gear wheel assembly (refer to Paragraph 1A.).
- (2) Match-mark wheel halves and brake discs prior to disassembly to expedite reassembly in the same relative positions.

WARNING: DO NOT ATTEMPT TO SEPARATE WHEEL HALVES WHILE TIRE IS UNDER PRESSURE. SERIOUS INJURY COULD RESULT.

- (3) Deflate tire by removing valve core.
- (4) Break tire bead loose from wheel half assemblies.

NOTE: Care should be taken to prevent damage to wheel halves when breaking the beads loose.

- (5) Remove nuts (8, Figure 201, Section 32-4-1), washers (9), bolts (10), and separate wheel halves (11 and 12) and disc assembly (13).
- (6) Remove snap rings (14), grease seal rings (15), felt grease seals (16), grease seal rings (17) and cone bearings (18) from both wheel halves (11 and 12).



1. Bolt
2. Washer
3. Backplate Assembly
4. Pressure Plate Assembly
5. Cylinder Assembly
6. Anchor Bolt
7. Torque Plate Assembly
8. Nut
9. Washer
10. Bolt
11. Outer Wheel Half Assembly

12. Inner Wheel Half Assembly
13. Brake Disc Assembly
14. Snap Ring
15. Grease Seal Ring
16. Felt Grease Seal
17. Grease Seal Ring
18. Cone Bearing
19. Bearing Cup
20. Brake Lining
21. Tube
22. Tire

Main Landing Gear Wheel Assembly
Figure 201

- (7) Inspect the bearing cups (19) for nicks and discoloration, and replace if damaged.

NOTE: To remove bearing cups (19), heat wheel halves for 15 minutes in boiling water. Press out damaged bearing cup with an arbor press and press in new cup while wheel half is still hot.

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

- (8) Clean bearings (18), rings (15 and 17) and seals (16) with cleaning solvent and dry thoroughly with clean air blasts from an air hose. Inspect bearings for pitting, wear or discoloration. Repack bearings with grease per Lubrication Chart (refer to Chapter 12).
- (9) Inspect wheel halves (11 and 12) for nicks, cracks, scoring, distortion and corrosion. Replace wheel halves found cracked.
- (10) Repair minor damage by sanding damaged area with fine sandpaper, cleaning thoroughly, applying zinc chromate primer, and painting with aluminum lacquer.
- (11) Inspect brake disc (13) and linings (20) for excessive wear or scoring and replace if necessary. Minor scratches may be sanded smooth.
- (12) Remove tube (21) from tire (22).

B. Reassemble Main Landing Gear Wheel Assembly

- (1) Position tube (21, Figure 201, Section 32-4-1) inside tire (22) and align the red dot on tire with index mark on tube. If there is no mark on tube, align red dot on tire with tube seam. If there is no seam on tube, align red dot on tire with valve stem of tube.
- (2) Place outboard wheel half (11) in tire (22) and position valve stem through hole in outer wheel half.
- (3) Position inner wheel half (12) and brake disc (13) in tire (22) and install bolts (10), washers (9), and nuts (8).

NOTE: Care must be taken not to pinch tube between wheel halves.

CAUTION: IMPROPER TORQUE OF BOLTS (10) MAY RESULT IN WHEEL FAILURE.

- (4) Torque bolts (10) to 150 in. lb. Torque value may be indicated on wheel.
- (5) Install bearings (18), grease seal rings (17), felt grease seals (16), grease seal rings (15), and snap rings (14).
- (6) Inflate tire to prescribed pressure (refer to Chapter 6, SPECIFICATIONS paragraph).
- (7) If new tire is installed, balance in accordance with Section 32-4-1, GENERAL paragraph.

3. Removal/Installation of Nose Wheel Assembly

A. Remove Nose Wheel Assembly

- (1) Support aircraft on jacks (refer to Chapter 7).
- (2) Remove cotter pin (3, Figure 201, Section 32-2-1), nuts (4), and washers (5).

(3) Withdraw axle rod (6) and remove nose wheel assembly from nose fork assembly (15).

(4) Remove plugs (7), spacers (8), and axle (9) from nose wheel assembly.

B. Install Nose Wheel Assembly

(1) Assemble axle (9, Figure 201, Section 32-2-1), spacers (8), and plugs (7) in nose wheel.

(2) Position nose wheel in nose fork (15) and insert axle rod (6).

(3) Install washers (5), nuts (4), and tighten until a very slight drag is evident when the wheel is rotated. Install cotter pin (3).

(4) Install nose wheel fairing, if applicable (refer to Paragraph 6,B.).

(5) Remove jacks.

4. Disassembly/Reassembly of Nose Wheel Assembly

A. Disassemble Nose Wheel Assembly (See Figure 202.)

(1) Remove nose wheel assembly (refer to Paragraph 3,A.).

WARNING: DO NOT ATTEMPT TO SEPARATE WHEEL HALVES WITH THE TIRE UNDER PRESSURE. SERIOUS INJURY COULD RESULT.

(2) Deflate tire by removing valve core.

(3) Break tire beads loose from wheel halves.

NOTE: Care should be taken to prevent damage to wheel halves when breaking beads loose.

(4) Remove nuts (1, Figure 202), washers (2 and 4) and bolts (3), and separate wheel halves (5 and 6).

(5) Remove snap rings (7), grease seal rings (8), felt grease seals (9), grease seal rings (10), and cone bearings (11).

(6) Inspect bearing cups (12) for nicks and discoloration and replace if damaged.

NOTE: To remove bearing cups, heat wheel halves in boiling water for 15 minutes. Using an arbor press, press out damaged bearing cups and press in new bearing cups while the wheel halves are still hot.

(7) Remove tube (13) from tire (14).

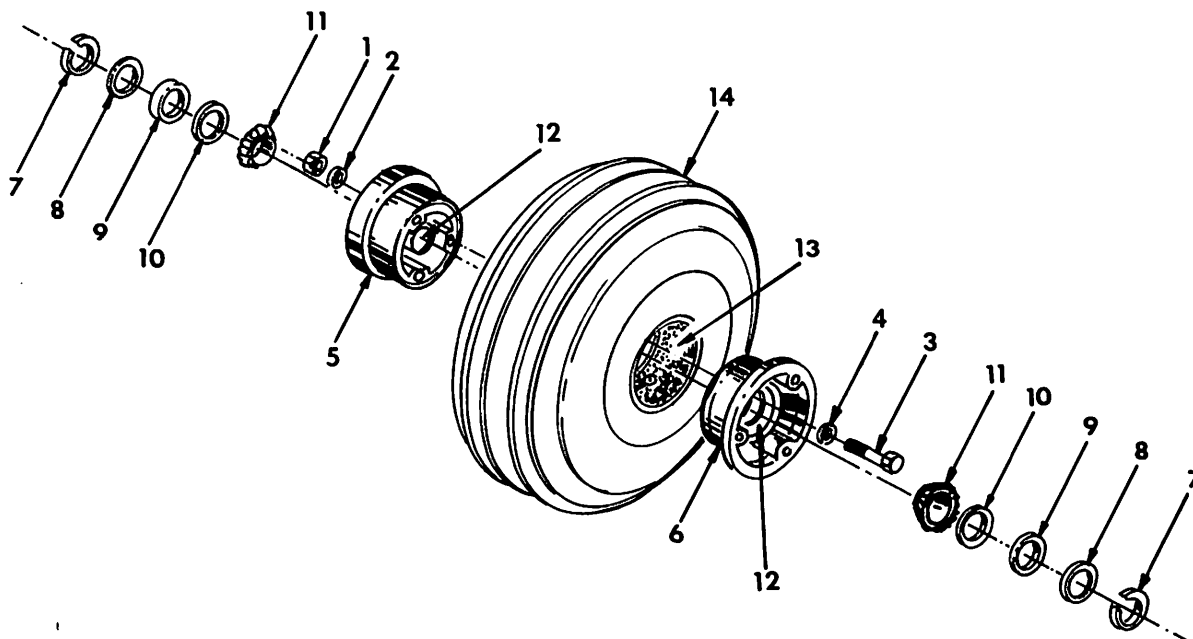
WARNING: USE SOLVENT IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

(8) Clean bearings (11), grease seal rings (8 and 10), felt grease seals (9) with cleaning solvent and dry thoroughly with clean air blasts from an air hose.

(9) Inspect wheel halves (5 and 6) for nicks, cracks, gouges, scratches or corrosion. Replace cracked wheel halves.

(10) Repair minor damage by sanding area with fine sandpaper, cleaning thoroughly, applying zinc chromate primer, and painting with aluminum lacquer.

- (11) Examine bearings (11) for damage or discoloration. Replace damaged bearings. Repack bearings (11) with grease specified in Lubrication Chart in Chapter 12.



3316

- | | |
|------------------------------|----------------------|
| 1. Nut | 8. Grease Seal Ring |
| 2. Washer | 9. Felt Grease Seal |
| 3. Bolt | 10. Grease Seal Ring |
| 4. Washer | 11. Cone Bearing |
| 5. Inner Wheel Half Assembly | 12. Bearing Cup |
| 6. Outer Wheel Half Assembly | 13. Tube |
| 7. Snap Ring | 14. Tire |

Nose Wheel Assembly
Figure 202

B. Reassemble Nose Wheel Assembly

- (1) Position tube (13) in tire (14). Align red dot on tire with index mark on tube. If there is no mark on tube, align red dot on tire with tube seam. If there is no seam or index mark on tube, align red dot on tire with valve stem on tube.
 - (2) Position tire and tube on wheel half (6) and insert valve stem through hole.
 - (3) Position inner wheel half (5) in tire (14) and install washers (4), bolts (3), washers (2), and nuts (1).
- NOTE:** Care should be taken not to pinch the tube between the wheel halves.
- (4) If a new tire is installed, balance in accordance with 32-4-1, GENERAL paragraph.

CAUTION: IMPROPER TORQUE OF BOLTS (3) MAY RESULT IN WHEEL FAILURE.

- (5) Torque bolts (3) to 90 in. lb. Torque value may be indicated on wheel.
- (6) Install bearings (11), grease seal rings (10), felt grease seal (9), grease seal rings (8), and snap ring (7).
- (7) Inflate tire to pressure prescribed in Chapter 6 SPECIFICATIONS paragraph.
- (8) Install nose wheel assembly (refer to Paragraph 3.B.).
- (9) Remove jacks.

5. Removal/Installation of Main Gear Wheel Fairing**A. Remove Main Gear Wheel Fairing (See Figure 203.)**

- (1) Remove plug button (1), bolts (2), washers (3), and bearing (4).
- (2) Remove bolts (5), washers (6), and tile fairing up so that bracket (7) will clear flex bolt (8), and remove fairing shell assembly (9).

B. Install Main Gear Wheel Fairing (See Figure 203.)

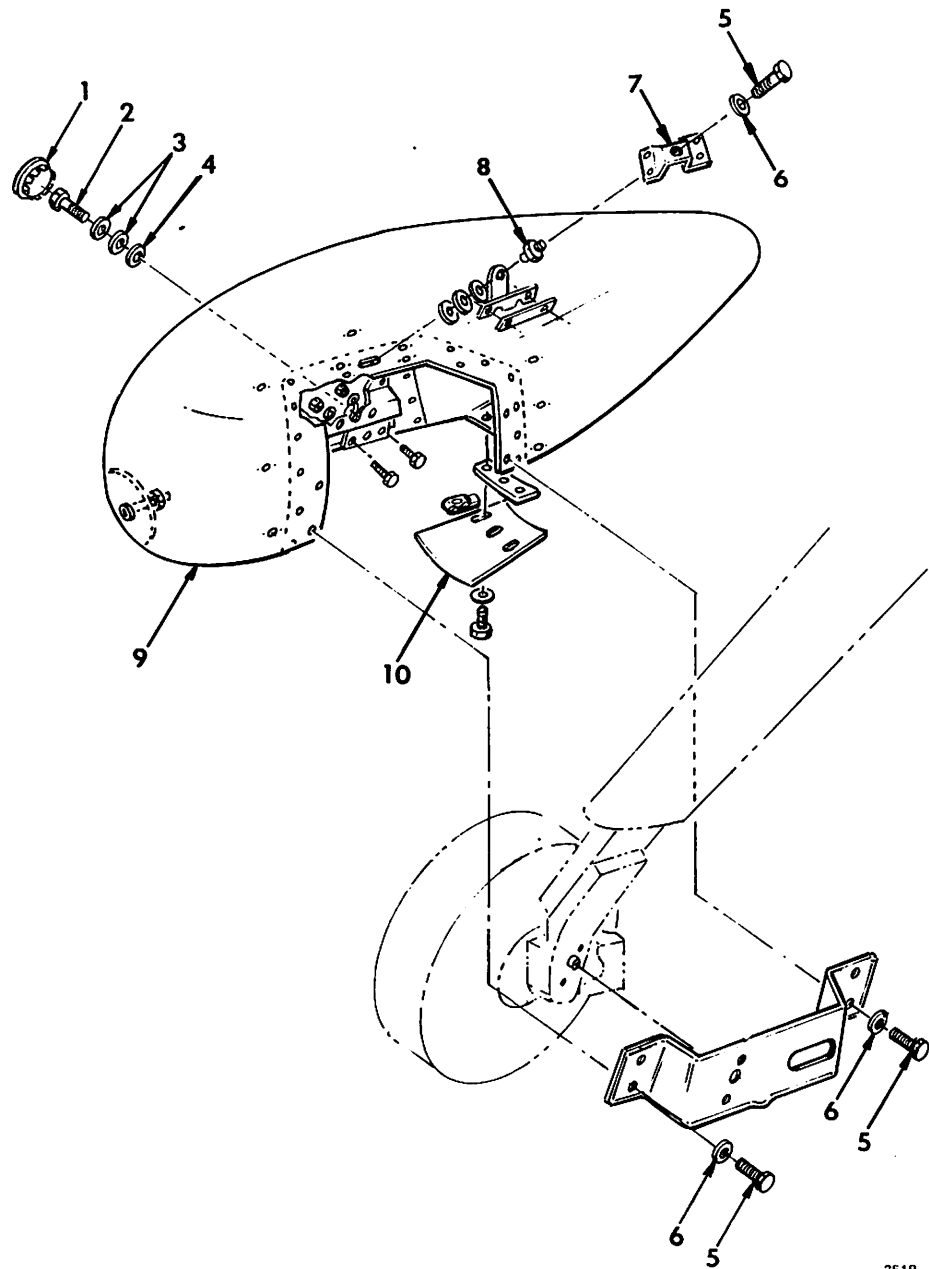
- (1) Position fairing shell assembly (9) in place on wheel with flex bolt (8) in bracket (7) and install washers (6) and bolts (5).
- (2) Install bearing (4), washers (3), bolts (2), and plug button (1).
- (3) Check position of scraper (10) in relation to tire. If necessary, adjust scraper for 1/2 inch clearance from tire.

6. Removal/Installation of Nose Wheel Fairing**A. Remove Nose Wheel Fairing (See Figure 204.)**

- (1) Remove plug button (1) from both sides of nose wheel fairing.
- (2) Remove tow bar bolts and spacers.
- (3) Remove nose gear wheel and fork assembly (refer to Paragraph 3.A.).
- (4) Remove bolts (2, Figure 204), washers (3), and fairing (4).

B. Install Nose Wheel Fairing (See Figure 204.)

- (1) Position fairing (4) on nose strut.
- (2) Install nose gear fork and wheel assembly (refer to Paragraph 3.B.).
- (3) Position fairing in place and install washers (3) and bolts (2).
- (4) Install tow bar bolts and spacers.
- (5) Install plug buttons (1) on both sides of fairing.
- (6) Check position of scraper (5) in relation to tire, and if necessary adjust scraper for 1/2 inch clearance from tire.

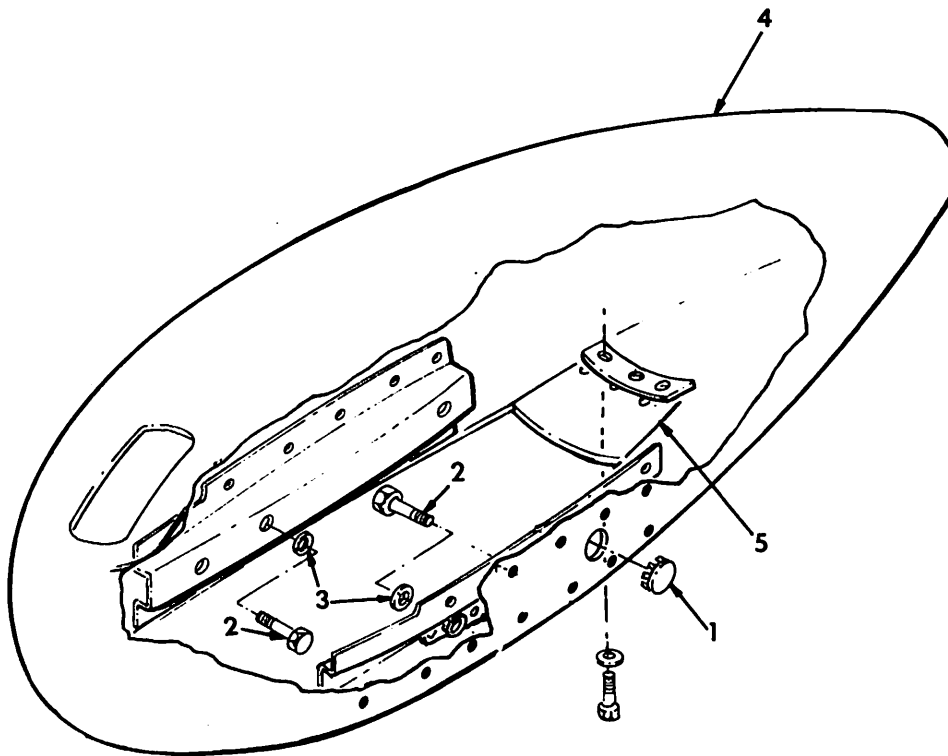


3518

- 1. Plug button
- 2. Bolt
- 3. Washer
- 4. Bearing
- 5. Bolt

- 6. Washer
- 7. Bracket
- 8. Flex bolt
- 9. Fairing
- 10. Scraper

**Main Wheel Fairing Assembly
Figure 203**



3319

- 1. Plug Button
- 2. Bolt
- 3. Washer
- 4. Fairing
- 5. Scraper

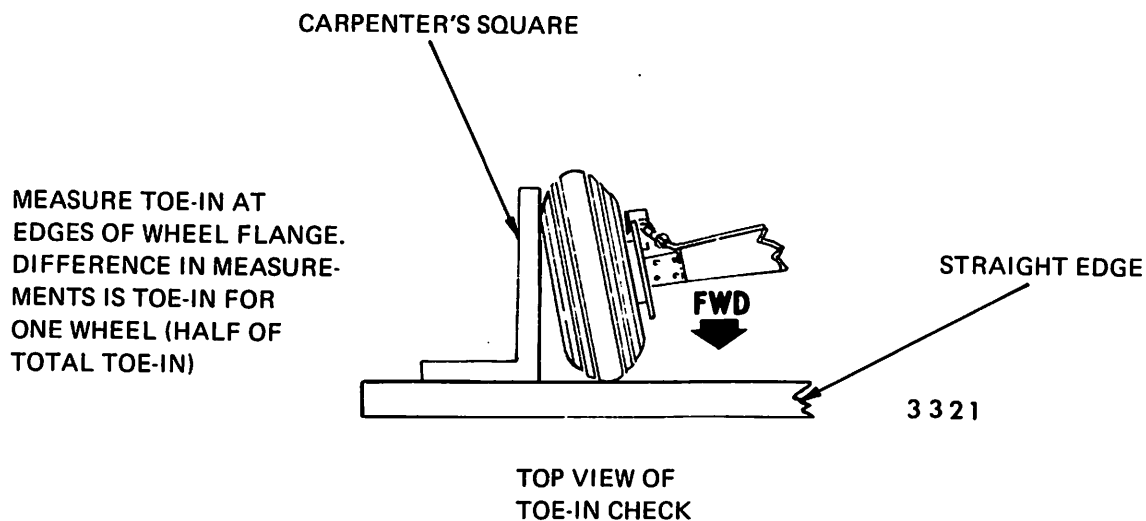
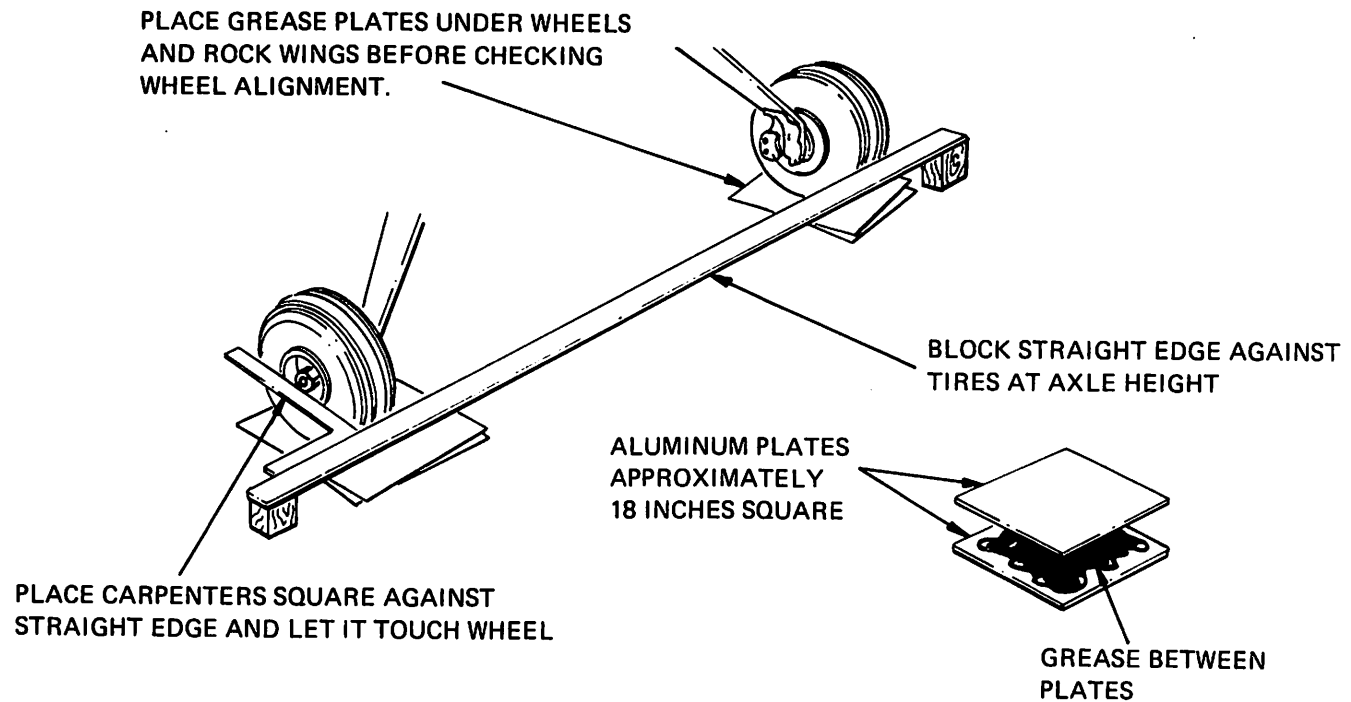
**Nose Wheel Fairing
Figure 204**

7. Main Landing Gear Wheel Alignment

Toe-in adjustments are made at the factory within the tolerances specified in Figure 205 and the toe-in adjustment should be checked periodically to ensure the wheels are properly aligned. Setting toe-in within the specified tolerances while the cabin and fuel tanks are empty will give approximately zero toe-in at gross weight. Ideal setting is zero toe-in at normal operating weight. Therefore, if normally operated at less than gross weight, and abnormal tire wear occurs, the wheel alignment should be adjusted to obtain the ideal setting for the load conditions under which the aircraft normally operates. The desired procedure during wheel alignment is to use the least number of shims possible to obtain the specified tolerances. Shims are available from the factory under the following part numbers.

PART NUMBER	SHIM ANGLE	AMOUNT OF TOE-IN/OUT CHANGE
701068-1	0° – 30 Min. Ref.	15 Minutes
701068-2	0° – 45 Min. Ref.	23 Minutes
701068-3	1° – 0 Min. Ref.	30 Minutes

NOTE: The use of toe-in adjustment shims requires the replacement of two AN6-22A bolts with longer AN6-23A bolts on the thick side of the shim.



TOE-IN/OUT LIMITS (EACH WHEEL) $\pm$ 30 MINUTES
MAXIMUM DIFFERENCE BETWEEN WHEELS = 30 MINUTES

Main Landing Gear Wheel Alignment Procedure
Figure 205

BRAKES – DESCRIPTION/OPERATION

1. General

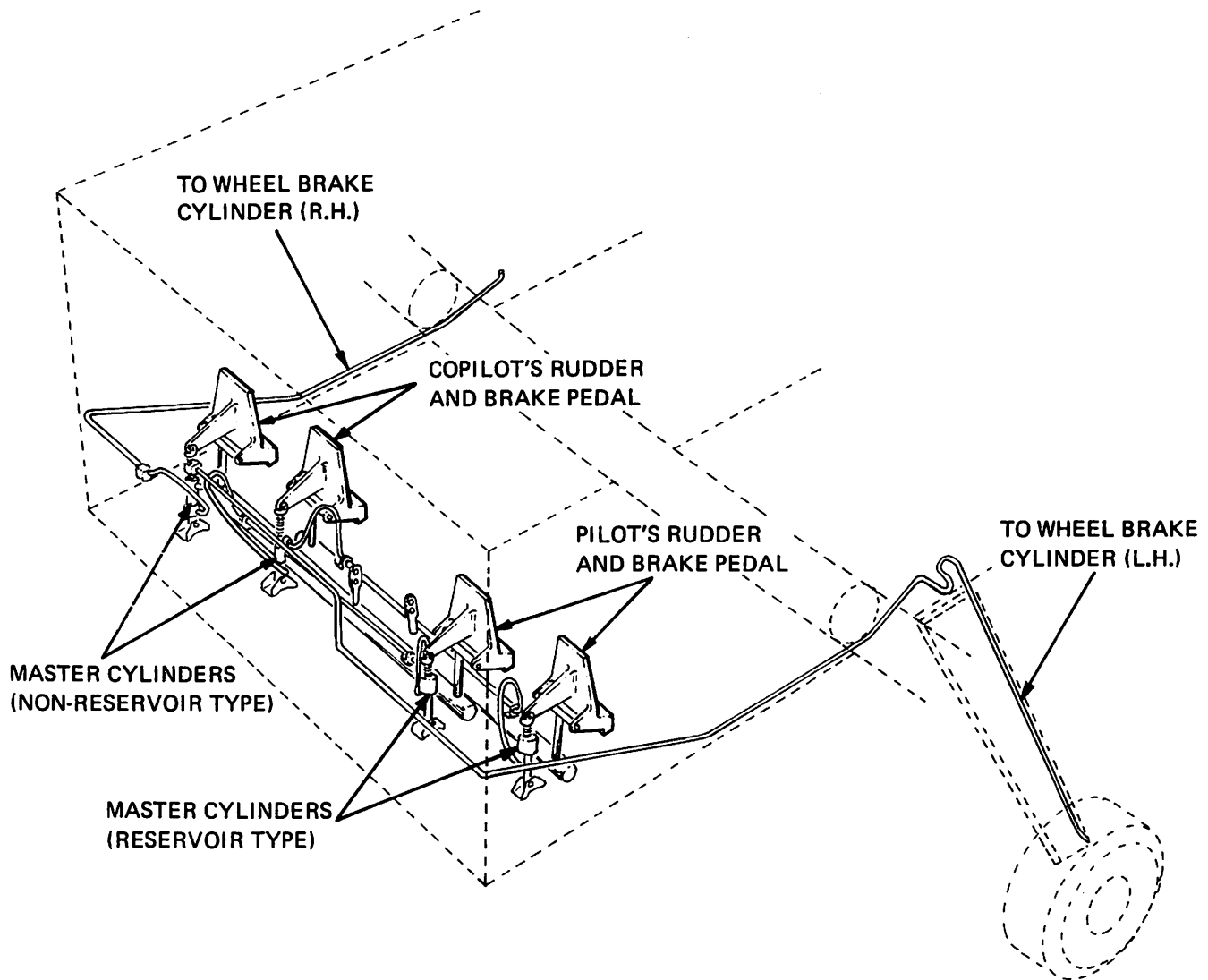
The AA-1C aircraft utilizes a dual hydraulic brake system (Figure 1) consisting of master cylinders, brake pedals, brake cylinders, and brake disc. Four master cylinders are used in the system, one cylinder for each of the brake pedals. The two master cylinders on the pilot's side of aircraft are reservoir type cylinders and the cylinders on co-pilot's side are non-reservoir type cylinders. When brake pedals on co-pilot's side are in neutral position, the ports in the two cylinders on co-pilot's side are open allowing direct flow of fluid from the two cylinders on the pilot's side.

The aircraft is also equipped with a parking brake. The parking brake operates by depressing the top of the brake pedals and pulling out the parking brake control which locks the master cylinder shaft, by mechanical linkage, in a brakes on position. Depressing the top of brake pedal and pushing in parking brake control releases the brakes.

2. Special Tools

Special type pliers are required to remove the Truarc snap ring from the hydraulic brake master cylinders. Different size pliers are needed for non-reservoir and reservoir type master cylinders. Pliers may be purchased locally or ordered from Waldes Kohinoor, Inc., Long Island City, New York. The types of pliers required are:

Truarc Snap Ring Pliers No. 3
Truarc Snap Ring Pliers No. 1120



3323

**Hydraulic Brake System
Figure 1**

BRAKES – MAINTENANCE PRACTICES

1. Removal/Installation of Master Cylinder

A. Remove Master Cylinder

- (1) Bleed fluid from brake system by removing the bleeder valve from the bottom of brake assembly.
- (2) Disconnect flexible hose assembly at master cylinder connection.
- (3) Remove cotter pin and withdraw clevis pin which connects the clevis on the master cylinder to the rudder pedal.
- (4) Remove cotter pin and withdraw clevis pin which attaches the mounting lug of the master cylinder to the mounting bracket.
- (5) Disconnect parking brake chain from lever on master cylinder by cutting safety wire at chain-to-lever connection.

B. Install Master Cylinder

- (1) Position master cylinder on mounting bracket and install clevis pin and cotter pin.
- (2) Position master cylinder clevis to rudder pedal connection and install clevis pin and cotter pin.
- (3) Connect flexible hose assembly to master cylinder connection.
- (4) Connect parking brake chain to parking brake lever on master cylinder with 0.032 in. stainless steel safety wire.
- (5) Service hydraulic brake system with an approved hydraulic fluid conforming to MIL-H-5606. (Refer to Chapter 12.)

2. Disassembly/Reassembly of Master Cylinder Assembly – Non-Reservoir Type

A. Disassemble Master Cylinder Assembly (See Figure 201.)

- (1) Remove fittings from cylinder inlet and outlet ports.

NOTE: Note distance from mounting hole in clevis (1) and mounting hole in brake cylinder housing (16) before removing clevis (1). This distance must be maintained upon reassembly.

- (2) Remove clevis (1) and check nut (2) from shaft (3).
- (3) Remove snap ring (4) using special pliers, Truarc No. 1120.
- (4) Remove O-ring (5) and end cap (6).
- (5) Remove piston and shaft assembly from housing (16).
- (6) Remove O-ring (7), snap ring (8) and spacer (9).

NOTE: Do not attempt to remove the thrust collar from shaft (3). These parts are pressed together. If either part is damaged, replace both.

- (7) Remove snap ring (10), spring (11), piston (12) and O-rings (13 and 14).
- (8) Remove spring (15) from housing (16).

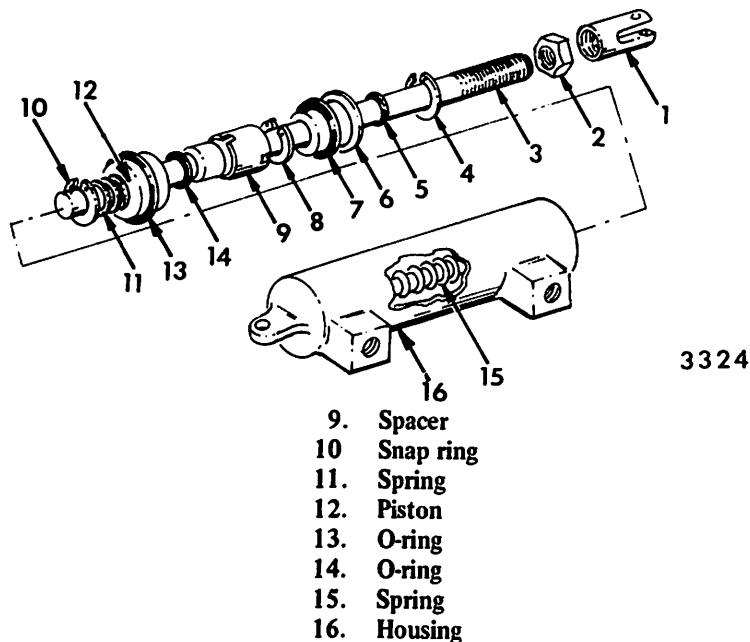
B. Reassemble Master Cylinder Assembly (See Figure 201.)

NOTE: Use new O-rings at reassembly of master cylinder.

- (1) Immediately before reassembly, immerse all seals in hydraulic brake fluid (MIL-H-5606) and apply a coating of brake fluid to bore of cylinder housing (16).
- (2) Assemble spacer (9), O-rings (13 and 14) and spring (11) on shaft (3) and lock in place with snap rings (8 and 10).
- (3) Assemble O-rings (5 and 7) and end cap (6) on shaft (3).
- (4) Engage bottom of shaft and piston assembly into small diameter of springs (15) and install in housing (16). Use caution when installing in housing to prevent damage to O-ring seals.
- (5) Depress shaft into housing and lock in position with snap ring (4).
- (6) Install check nut (2) and clevis (1). Adjust to dimensions noted before disassembly.

CAUTION: DO NOT OVERTIGHTEN FITTINGS IN MASTER CYLINDER PORTS. OVERTIGHTENING COULD CRACK THE CASTING.

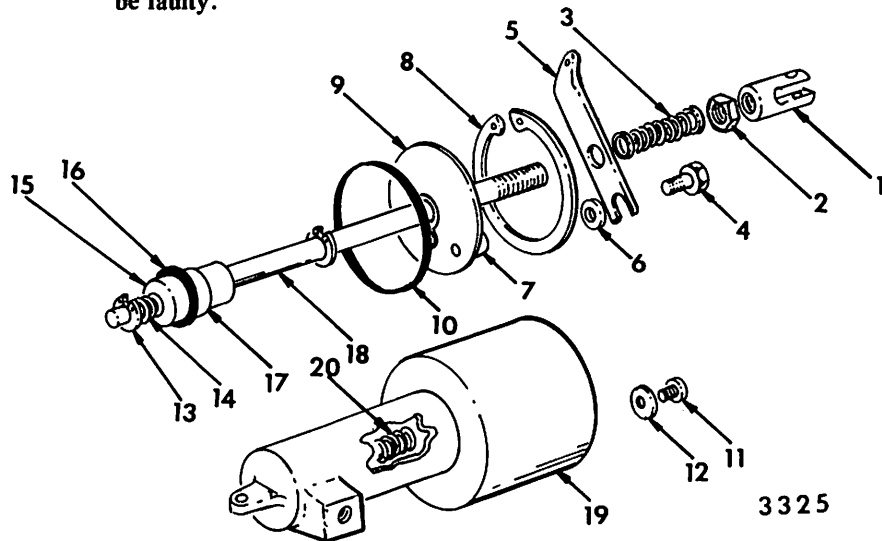
- (7) Install fittings in inlet and outlet ports.

Master Brake Cylinder
Figure 201

3. Disassembly/Reassembly of Master Cylinder Assembly – Reservoir TypeA. Disassemble Master Cylinder Assembly (See Figure 202.)

- (1) Remove fitting from cylinder housing outlet port.
- (2) Remove clevis (1), check nut (2), and spring (3) from shaft (18). Note distance from mounting hole in clevis (1) and mounting hole in brake cylinder housing (19) before removing clevis. This distance must be maintained upon reassembly.
- (3) Remove bolt (4), parking brake lever (5), and spacer (6).
- (4) Remove filler plug (7).
- (5) Remove snap ring (8), using special pliers, Truarc No. 3, and remove cover plate (9) and seal (10).
- (6) Using a 1/8-in. allen wrench, remove screw (11) and washer (12).
- (7) Remove shaft assembly from housing (19) and remove snap ring (13), spring (14), piston (15), and O-rings (16 and 17) from shaft (18).

NOTE: Do not attempt to remove the thrust collar from shaft (18). These parts are pressed together. If either part is faulty, replace both. Also, do not attempt to remove the bushing from cover plate (9). These parts are swaged together and should be ordered together should either part be faulty.



- | | |
|-------------------------|----------------------|
| 1. Clevis | 11. Screw |
| 2. Check Nut | 12. Washer |
| 3. Spring | 13. Snap Ring |
| 4. Bolt | 14. Spring |
| 5. Parking Brake Lever | 15. Piston |
| 6. Spacer | 16. O-ring |
| 7. Filler Plug | 17. O-ring |
| 8. Snap Ring | 18. Shaft |
| 9. Cover Plate Assembly | 19. Cylinder Housing |
| 10. Rubber Seal | 20. Spring |

Master Brake Cylinder – Reservoir Type
Figure 202

B. Reassemble Master Cylinder Assembly

NOTE: Use new O-rings at reassembly of master cylinder.

- (1) Immediately before reassembly, immerse all seals except seal (10) in hydraulic fluid (MIL-H-5606, see Chapter 12) and apply a coating of hydraulic fluid to the bore of the cylinder housing (19).
- (2) Assemble O-rings (17 and 16), piston (15), spring (14), on shaft (18), and lock in place with snap ring (13).
- (3) Engage bottom of shaft and piston assembly into small diameter of spring (20), and install assembly into housing (19).

NOTE: Use a new screw (11) and washer (12) and snap ring (8) at reassembly.

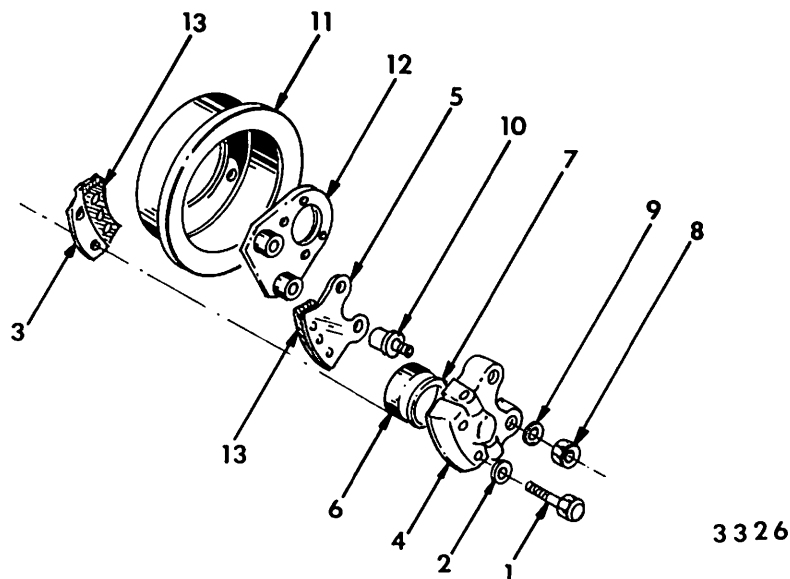
- (4) Depress shaft assembly into housing (19) and lock in position with screw (11) and washer (12).
- (5) Install rubber seal (10), cover plate (9), and lock in place with snap ring (8).
- (6) Install filler plug (7).
- (7) Slide parking brake lever (5) onto shaft (18) and position spacer (6) in place under lever, and secure with bolt (4).
- (8) Install spring (3), nut (2), and clevis (1) on shaft (18). Adjust clevis (1) to dimension noted before disassembly.
- (9) Install fitting in cylinder housing outlet port.

4. Removal/Installation of Wheel Brake Assemblies

A. Remove Wheel Brake Assembly (See Figure 203.)

NOTE: Brake disc (11) is removed after wheel disassembly. Torque plate assembly (12) can be removed after wheel has been removed. Refer to 32-4-1 for wheel removal.

- (1) Disconnect hydraulic line at wheel brake assembly fitting.
- (2) Remove bolts (1), washers (2), and remove backplate (3).
- (3) Pull anchor bolts (10) out of torque plate assembly (12) and remove brake cylinder assembly (4).
- (4) Slide pressure plate (5) off anchor bolts.
- (5) Blow lightly with compressed air into hydraulic line fitting to force piston (6) from cylinder (4). Slide O-ring (7) off piston (6).
- (6) Anchor nut (10) is pressed into torque plate (12). Smooth nicks with sandpaper. If removal is necessary, remove nuts (8), washers (9), and press out anchor bolts (10).



1. Bolt
2. Washer
3. Backplate
4. Cylinder
5. Pressure Plate
6. Piston
7. O-ring

8. Nut
9. Washer
10. Anchor bolt
11. Brake Disc
12. Torque Plate
13. Lining

Wheel Brake Assembly
Figure 203

B. Install Wheel Brake Assembly

NOTE: Keep brake lining (13) dry and completely free from hydraulic fluid. Install new O-ring (7) at reassembly.

- (1) Lubricate piston (6), cylinder bore, and O-ring (7) with clean hydraulic fluid.
- (2) If removed assemble anchor bolts (10) into cylinder (4) by driving bolts in with a soft mallet. Install washers (9) and nut (8).
- (3) Assemble O-ring (7) on piston (6) and install in cylinder (4). Hold piston in cylinder until pressure plate (5) is installed.
- (4) Slide pressure plate (5) onto anchor bolts (10).
- (5) Insert anchor bolts (10) into torque plate assembly (12), and install washers (2), bolts (1), and backplate (3). Torque bolts (1) to 75-90 in. lb.

5. Bleeding Hydraulic Brake System

NOTE: When servicing the hydraulic brake system, use an approved hydraulic fluid conforming to MIL-H-5606. (see Chapter 12.)

- (1) Remove vent plugs from master cylinders on pilot's side (Figure 1, Section 32-4-2) and replace with overflow lines. Immerse the free ends of the overflow lines in a can containing enough hydraulic fluid to cover the ends of the lines.
- (2) Connect a clean hydraulic source to the brake assembly bleeder valve (11, Figure 202).
- (3) Fill the system until the overflow line in the master cylinder being filled shows no more air bubbles. Remove the overflow lines.
- (4) Remove the source of fluid and pressure and allow the fluid to drain back through the system until the fluid level is approximately 1/4-inch from the top of the reservoir in the master cylinder.
- (5) Secure the bleeder valve and replace vent plugs.

NOTE: Do not fill the reservoir higher than 1/4-inch from top as this will result in spillage. Spilled fluid can be removed with imperial cleaner.

6. Cleaning Brake System Parts

WARNING: CLEANING SOLVENT (PS-661 OR EQUIVALENT) IS TOXIC AND FLAMMABLE. USE IN A WELL VENTILATED AREA. AVOID BREATHING FUMES AND KEEP AWAY FROM FLAMES.

Clean all parts with cleaning solvent, Federal Specification No. PS-661 or equivalent (See Chapter 12). Thorough cleaning is important to prevent brake malfunction.

7. Inspection of Brake System

A. Inspect Brake Cylinders

NOTE: Any part, damaged or worn beyond minor repair, must be replaced.

- (1) After disassembly of brake cylinder, inspect all parts for wear, cracks, damage, or distortion.
- (2) Inspect piston for deep scratches.
- (3) Inspect bore of cylinder housing for deep scratches.
- (4) Check valve spring (11, Figure 201) for a free length of 3/8 to 7/16-in.
- (5) Check return spring (15, Figure 201) for a free length of 2-5/16 to 3-1/16-in.
- (6) Check valve spring (14, Figure 202) for a free length of 3/8 to 7/16-in.
- (7) Check return spring (20, Figure 202) for a free length of 2-3/8 to 2-1/2-in.
- (8) Inspect brake linings for damage, deterioration, and excessive wear. New brake linings should be installed when linings are worn to less than 1/10-in.
- (9) Inspect anchor bolts on wheel brake assembly for nicks or damage and sand nicks smooth with fine sandpaper.
- (10) Inspect wheel brake disc for a minimum thickness of 0.205-in. If brake disc is below minimum thickness, install a new brake disc.

8. Testing Brake Master Cylinders

A. Test Brake Master Cylinder — Non-Reservoir Type

- (1) After complete assembly, check operation of cylinder valve by blowing air through bottom port hole in cylinder housing and checking top port hole for air passing through. This assures that the valve is opening. With air still flowing through the cylinder, depress the piston shaft approximately 1/16 in. The valve should close and cut off the flow of air through the cylinder.

NOTE: The following function and proof test should be conducted with hydraulic brake fluid (MIL-H-5606) only.

- (2) Bleed all air from system and pressurize cylinder to 1500 psi. Allow 2 minutes for stabilization and check for external leaks.
- (3) Lower pressure to 1000 psi and after a 2-minute period check for pressure drop. Pressure should remain steady. A 40 psi drop in a 2-minute period is acceptable.
- (4) If cylinder fails the pressure test, recycle and test again. If cylinder fails the second test, disassemble the master cylinder and check O-ring seal (13) for cuts or scratches which might have occurred during assembly. Also check other O-rings for dirt or contamination.

B. Test Brake Master Cylinder — Reservoir Type

- (1) After complete assembly, check operation of cylinder valve by blowing air through port hole in cylinder housing (19, Figure 202) and checking vent in filler plug (7) for air passing through. This ensures that cylinder valve is opening. With air still flowing through cylinder, depress piston shaft approximately 1/16-in. This should cut off air passing through the assembly and show that the valve is closing and sealing properly.

NOTE: The following function and proof test should be conducted with hydraulic brake fluid (MIL-H-5606) only.

- (2) Bleed all air from system and pressurize cylinder to 1500 psi. Allow 2 minutes for stabilization then check for external leaks.
- (3) Lower pressure to 1000 psi and after a 2-minute period, check for pressure drop. Pressure should remain steady. A 40 psi drop in a 2-minute period is acceptable.
- (4) If cylinder fails pressure leak test, recycle and test again. If the cylinder fails the second test, disassemble cylinder assembly and check O-ring (16) for cuts or scratches which may have occurred during re-assembly. Also check for dirt or contamination around O-rings (16 and 17).

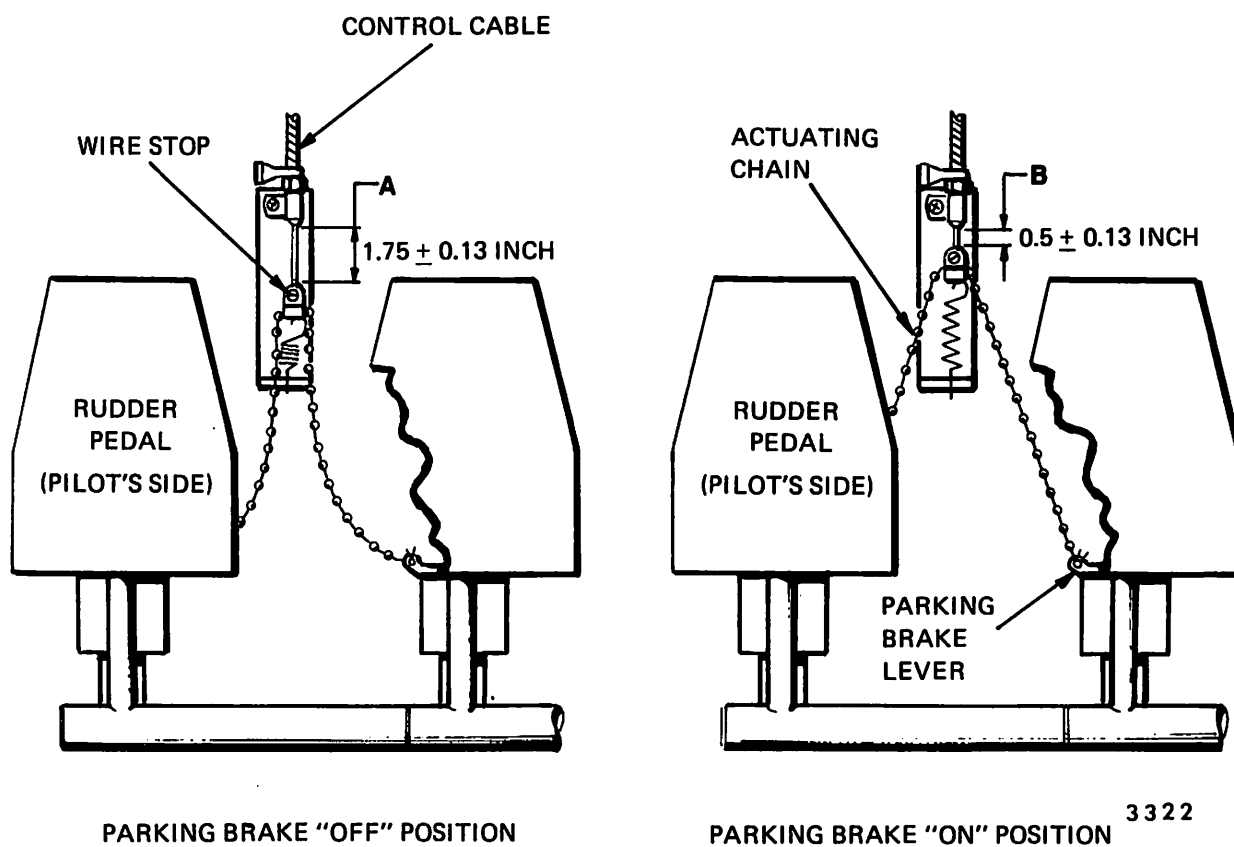
9. Rigging the Parking Brake

A. Rig Parking Brake (See Figure 204.)

- (1) Place the parking brake control in OFF position (full in) and measure the dimensions at A. This dimension should be 1.75 ± 0.13 inches. If necessary, adjust the wire stop to obtain this dimension.
- (2) The actuating chain should exert a straight pull on the parking brake levers. The master cylinder cover plate and lever may be rotated to achieve this condition.
- (3) Allow the rudder pedals to center, then begin pulling out the parking brake control until all slack is removed from the actuating chain.

NOTE: Do not permit either master cylinder parking brake lever to lift.

- (4) Measure the dimension at B. If this dimension is less than specified, remove enough chain to obtain 0.5 ± 0.13 inch. If the dimension B is more than specified, the chain length will have to be increased.
- (5) Check parking brake for proper operation. After disengaging, apply full rudder pedal deflection in both directions and confirm that neither master cylinder parking brake lever is lifting.



Parking Brake Rigging
Figure 204

10. Relining Brakes

A. Reline Brakes (See Figure 203.)

- (1) Remove wheel brake assembly (refer to Paragraph 4).
- (2) Place backplate (3) on a table with lining side down flat. Center a 9/64-inch (or slightly smaller) punch in the rolled rivet and strike the punch sharply with a hammer. Punch out all rivets securing the linings to the backplate and pressure plate (5) in the same manner.
- (3) Clamp the flat side of the anvil in a vise.
- (4) Align new lining on backplate and plate rivet in hole with rivet head in the lining. Place the rivet head against the anvil.
- (5) Center the rivet setting punch on the lips of the rivet and while holding the backplate down firmly against the lining, strike the punch with a hammer to set the rivet. Repeat blows to the punch until the lining is firmly against the backplate.
- (6) Realign the lining on the backplate and install rivets in the remaining holes.
- (7) Install new lining on pressure plate in the same manner.

11. Landing Gear Wheel Vibration

Most wheel vibration is caused by tire out of roundness, tire out of balance, loose bearings, loose gear attachment, loose fairing attachment, disc springs out of adjustment or any combination of these. Normal good maintenance practices will eliminate most causes of wheel vibration or shimmy.

A. Nose Wheel Vibration and Shimmy

Typical nose wheel vibrations can be placed in two categories as described below:

- (1) True shimmy, which is a side-to-side motion of the nose wheel and fork assembly, is caused by improper adjustment of the shimmy dampener Belleville washers, located at the strut/fork attach point. The fork attaching nut should be tightened until a 10-22 pound friction drag is attained when the fork is rotated (Figure 202). The friction measuring device should always be applied along the axle centerline.
- (2) Vertical bounce or vertical tramping, which can feel like shimmy in the cockpit, but is actually an up and down motion of the nose wheel and tire assembly. This is caused by either nose tire out-of-round or tire and wheel assembly out-of-balance. The tire and wheel assemblies are all balanced to within 5-inch ounces at the factory and this balance should be maintained on in-service aircraft.

Additional checks should be made on aircraft that have experienced nose wheel vibration/shimmy to determine that the nose gear torque tube attach plates, center bearing support attach brackets and nose gear strut attach points are tight. Looseness at any of these connections can contribute to wheel vibration or shimmy.

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LIGHTING – DESCRIPTION

1. General

To simplify this chapter, it has been divided into two sections. The first section will cover the interior lights, and the second section will cover the exterior lights.

The interior lights consist of instrument lights, dome light and radio lights. The exterior lights consist of landing light, navigation lights, flashing beacon and strobe lights.

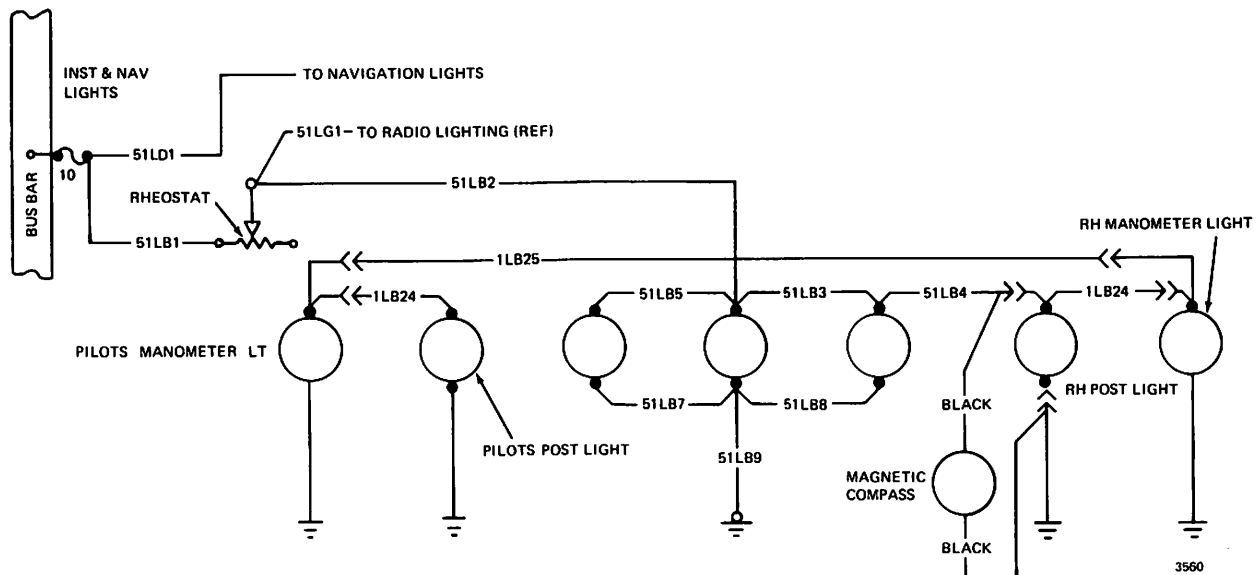
BULB CHART

Interior Lights		
Quantity	Type Light	Bulb Part Number
5	Instrument Lights	1816 (G.E.)
1	Dome Light	1816 (G.E.)
2	Manometer Lights	1816 (G.E.)
N/A	Radio Lights	N/A
Exterior Lights		
Quantity	Type Light	Bulb Part Number
1	Landing Light	4509 (G.E. or Westinghouse)
2	Navigation Lights – (Wing Tips)	1512 (Grimes)
1	Navigation Light – (Tail Cone)	1777 (Grimes)
1	Flashing Beacon	40-5A (Aero-Flash)
2	Strobe Lights	73-152 (Aero Flash)

INTERIOR LIGHTS – DESCRIPTION/OPERATION

1. Instrument Lights (Figure 1)

The total instrument lighting system consists of three lights mounted in the glareshield, two manometer lights and two lights mounted forward of the windshield bow. All seven lights are identical in components and receive power through the INST LTS dimming rheostat located on the instrument panel. The rheostat receives its power from the bus through a 10 amp fuse (Inst. & Nav. Lights). Turning the control knob on the rheostat will vary the brightness of these lights.



Instrument Lights – Wiring Diagram
Figure 1

2. Dome Light (Figure 2)

The dome light and switch are contained in the speaker housing located above and behind the pilot. Electrical power is supplied directly to the switch from the battery in order to make use of the light without first activating the airplane's electrical system. The dome light is protected by a fuse (H-METER, Dome) mounted on the battery box tray.

3. Radio and Compass Dial Lights (Figure 1)

The radio and compass dial lights are built into the individual units. These lights are controlled by the INST LTS dimming rheostat located on the instrument panel.

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INTERIOR LIGHTS – MAINTENANCE PRACTICES

1. Replacement of Instrument Lights

A. Glareshield Instrument Lights Replacement

- (1) Removal of the screws from the glareshield lower lip will separate the two halves and expose the light assembly.
- (2) Remove the bulb and replace as required.
- (3) Install lower lip and attaching hardware.
- (4) Perform operational check (see Interior Lights - Operational Check).

B. Replacement of Lights Mounted Forward of the Windshield Bow

- (1) Remove the thermoplastic cover.
- (2) The light assembly is attached to the back of this cover. Remove bulb and replace as required.
- (3) Install the thermoplastic cover.
- (4) Perform operational check (see Interior Lights – Operational Check).

C. Fuel Measurement Gauge Light Replacement

- (1) Remove the thermoplastic fuel measurement gauge cover.
- (2) Remove the screw which mounts the lamp socket to the fuselage side panel.
- (3) Remove the bulb and replace as required.
- (4) Install the lamp socket to the fuselage side panel with attaching screw.
- (5) Install the thermoplastic fuel measurement gauge cover.
- (6) Perform operational check (see Interior Lights – Operational Check).

2. Replacement of Dome Lights (Figure 2)

- A. Remove the screw which attaches the thermoplastic speaker and dome light housing to the forward turtleback bulkhead.
- B. Remove the bulb and replace as required.

NOTE: The dome light is protected by a fuse mounted on the battery box tray.

- C. Install thermoplastic speaker and dome light housing and attaching hardware.
- D. Perform operational check (see Interior Lights – Operational Check).

INTERIOR LIGHTS – OPERATIONAL CHECK

1. Instrument Lights

NOTE: Ensure fuses are operational before performing check.

- A. Place MASTER switch to the ON position.
- B. Turn INST LTS control knob of rheostat from DIM to BRIGHT. While turning control knob, the instrument lights should become brighter.
- C. Turn INST LTS control knob on rheostat to OFF position. Lights should go out.
- D. Place MASTER switch to OFF position.

2. Dome Light

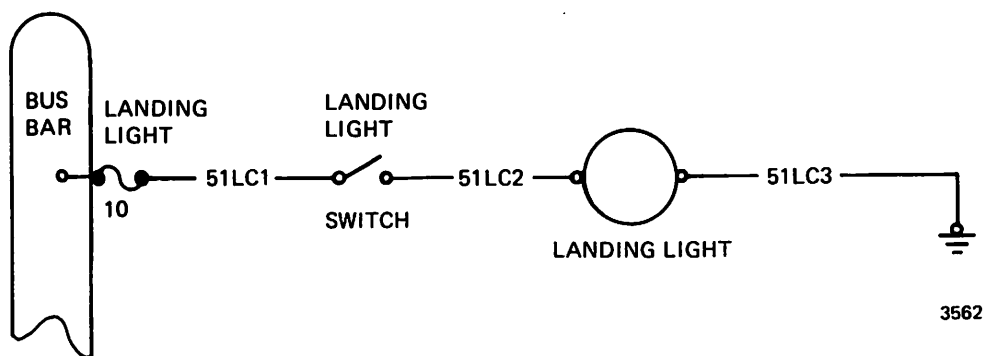
NOTE: Ensure fuses are operational before performing check.

- A. Place dome light switch to ON position. The dome light should come on.
- B. Place dome light switch to the OFF position. The light should go out.

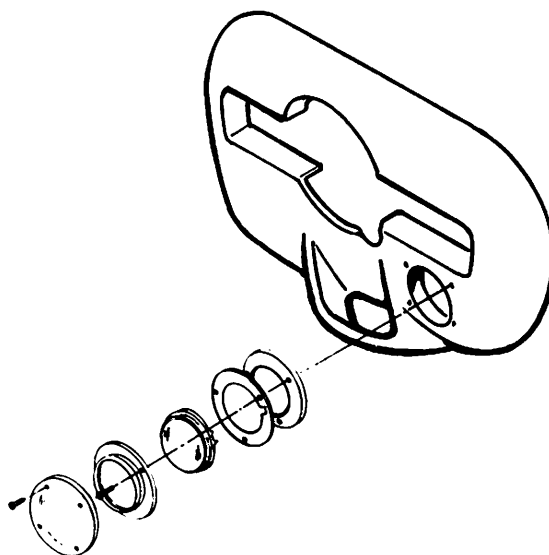
EXTERIOR LIGHTS – DESCRIPTION/OPERATION1. Landing Light (Optional)

The landing light serves the dual purpose of landing light and taxi light. The light is located on the left lower corner of the forward engine cowl. The lamp is protected by a clear plastic shield. Adjustments can be made after removing the plastic shield.

The landing light is operated by a switch located to the left of the instrument lights rheostat on the instrument panel. The switch receives power from the bus through a 10 amp fuse (Landing Light).



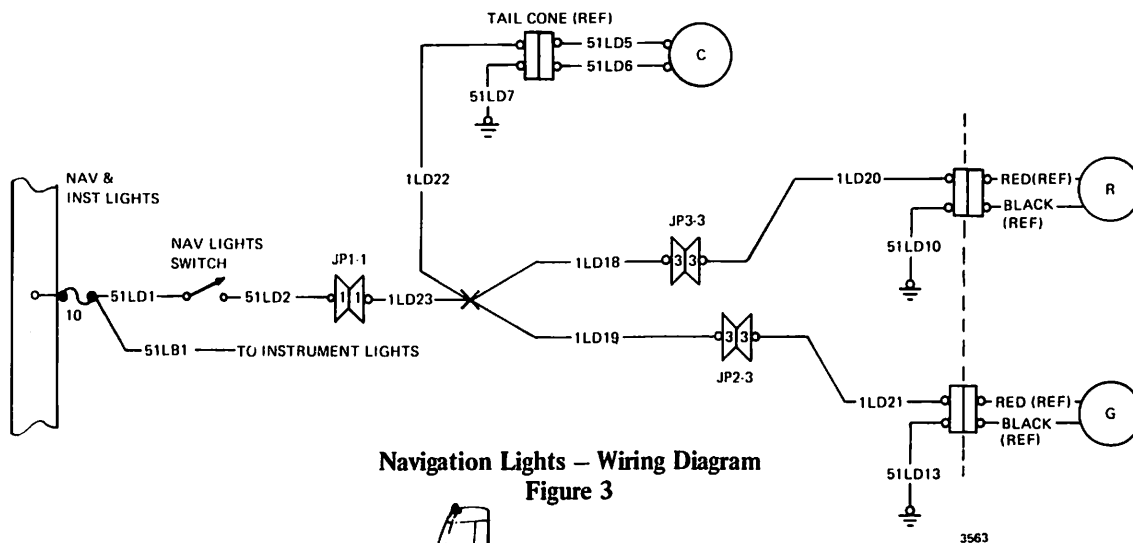
Landing Light – Wiring Diagram
Figure 1



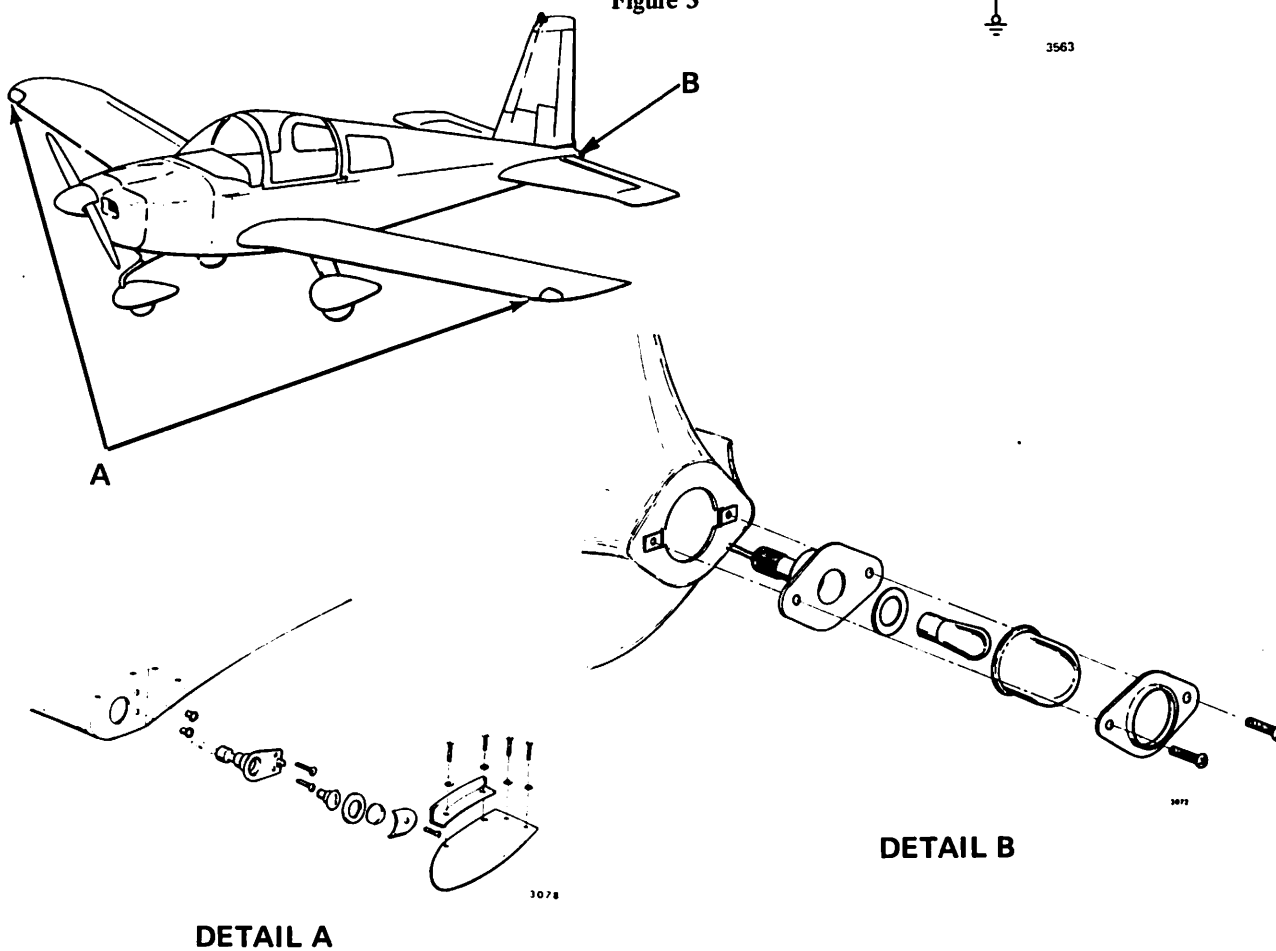
Landing Light – Exploded View
Figure 2

2. Navigation Lights (See Figures 3 and 4)

The navigation lights consist of the two wing-tip lights, and the tail light mounted in the tail cone. The lights are controlled by a switch located on the instrument panel. Power for the lights is provided by the bus through a 10 amp fuse (Inst. & Nav. Lights).



Navigation Lights - Wiring Diagram
Figure 3

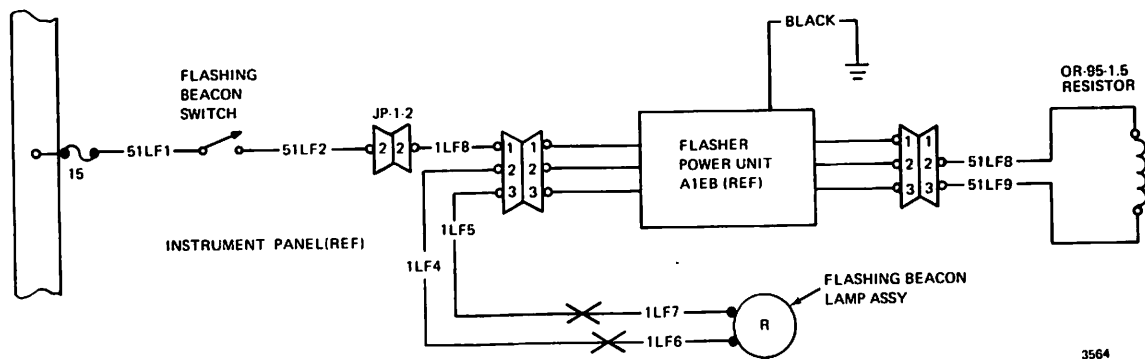


Navigation Lights-Exploded View
Figure 4

3. Flashing Beacon (Optional) (See Figures 5 and 6)

The flashing beacon consists of the light assembly mounted on top of the vertical fin, and the slave unit (transistorized flasher unit) which is accessible through the right side tail inspection panel. The flashing beacon is an iodine vapor lamp electrically switched by the transistorized flasher unit.

The slave unit receives power from a switch located on the instrument panel. This switch receives power from the bus through a 15 amp fuse (Flash Bcn).

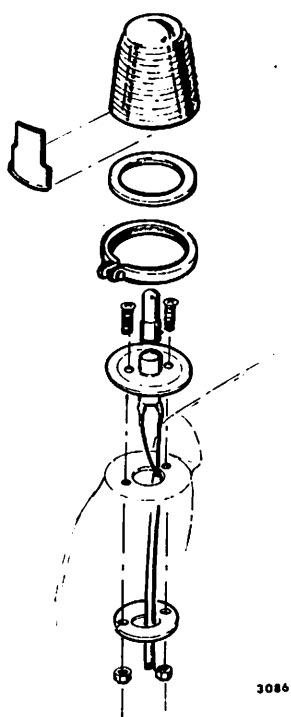
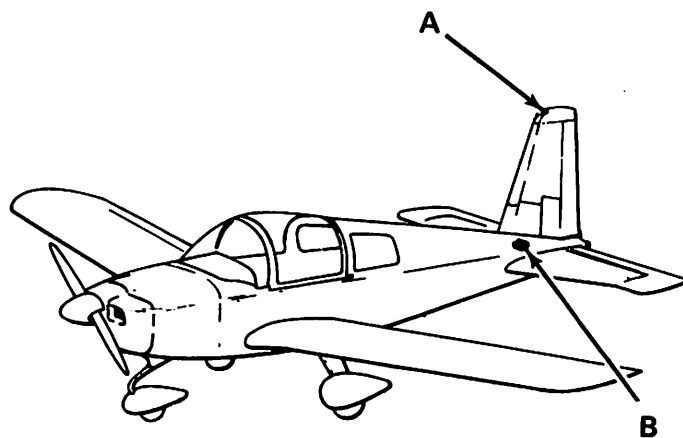


Flashing Beacon – Wiring Diagram
Figure 5

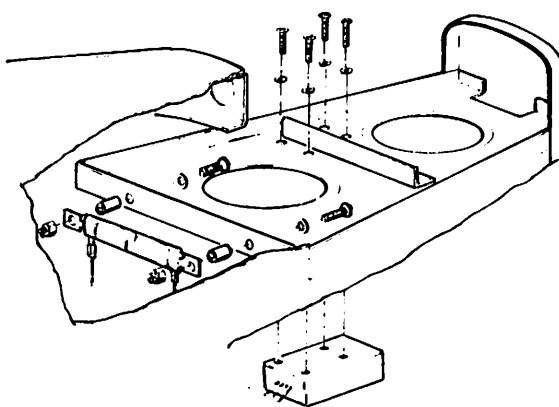
4. Strobe Lights (Optional) (See Figures 7 and 8)

The strobe light system consists of two flashers (power supplies) and two slaves (strobe assemblies). The flasher is a solid state encapsulated electronic device. A flasher is mounted on each outer wing rib. The slave unit contains a lamp socket to hold the iodine quartz lamp and an outer covering glass dome. The slaves are mounted to the wing tip cutouts on the wing tips. They are located above and behind the navigation lights. Clear plastic lens are mounted over the lights to protect them from the weather.

Power is provided by the bus through a 5 amp fuse (fuel pump and strobe) located on the fuse panel. Operation of the strobe lights is controlled by a rocker switch located on the instrument panel.

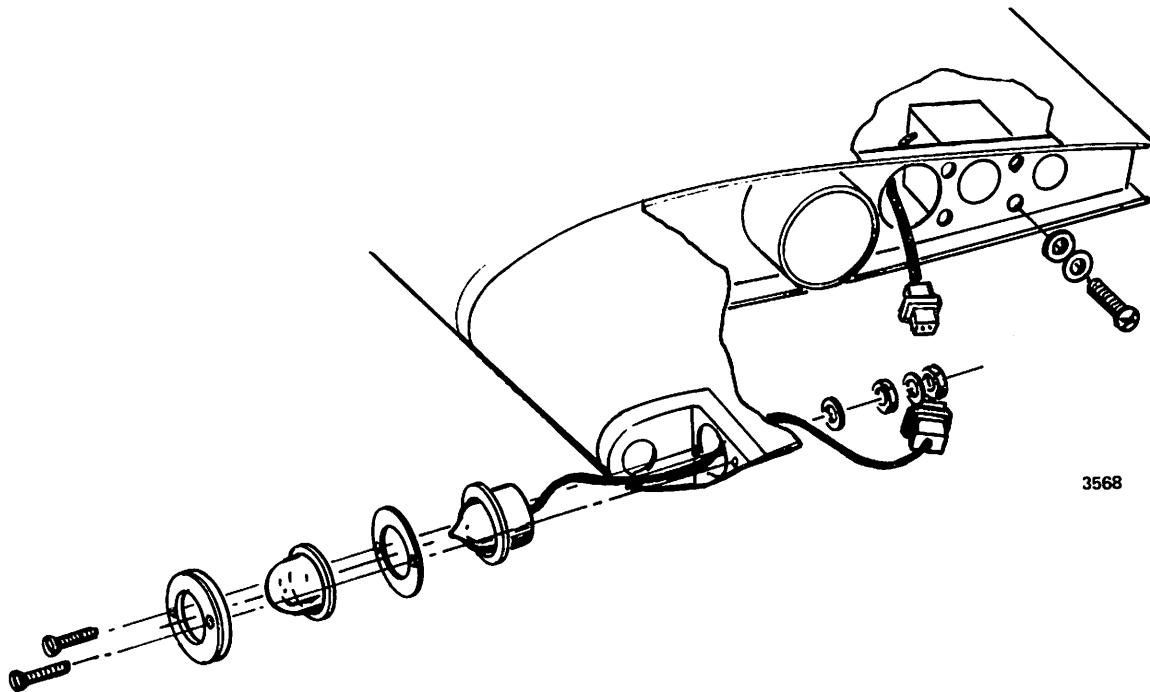


DETAIL A

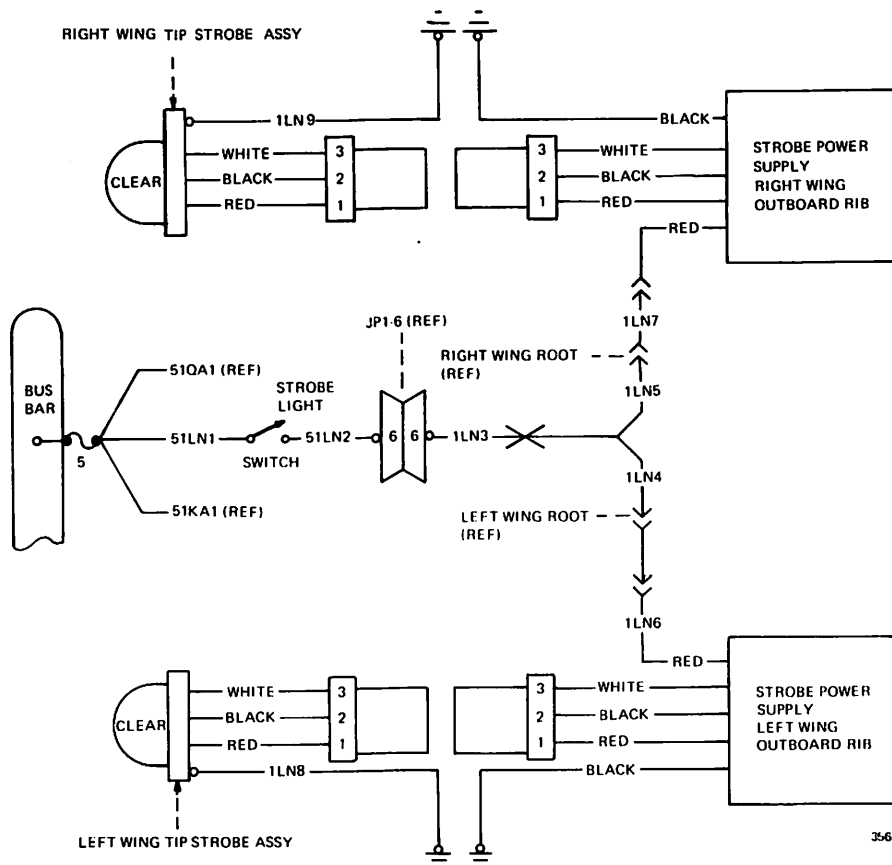


DETAIL B

**Flashing Beacon System – Exploded View
Figure 6**



Strobe Light and Power Supply – Exploded View
Figure 7



Strobe Light – Wiring Diagram
Figure 8

EXTERIOR LIGHTS – TROUBLE SHOOTING

1. Flashing Beacon System

TROUBLE	PROBABLE CAUSE	REMEDY
Flashing beacon fails to operate	Blown fuse	Check and replace if required.
	Defective switch or wiring	Check flasher unit input voltage by placing positive lead of voltmeter to red lead and the black lead to ground. A reading of 12 to 14 volts DC should be coming in. If no voltage is present, repair or replace switch and wiring as required.
	Defective flasher unit	Check the output voltage of the flasher unit by taking the positive lead from voltmeter and putting it into the output lead of the lamp socket No. 2 or No. 3. Ground the black lead to the airframe or the black lead of the flasher unit. A pulsating movement on the meter from 0 to 12 or 14 volts should be present. If this type of reading is not found, the flasher unit is defective and should be replaced.
	Lamp burned out	If flasher unit is operative, check lamp and replace if required.

2. Strobe Light System

TROUBLE	PROBABLE CAUSE	REMEDY
Both flash tubes fail to flash	Blown fuse	Check and replace if required.
	Defective switch	Check and replace if required.
	Defective wiring	Check wiring from bus to power supply (flasher power unit)
Only one side fails to flash	Defective flash tube	Replace flash tube with known good flash tube (opposite wing). If operation is normal, replace defective flash tube.
	Shorted or open circuit to flash tube	Check wiring from power supply (flasher power unit) to the flash tube.
	Defective power supply unit because of reversed polarity of the input power.	Replace power supply

EXTERIOR LIGHTS – MAINTENANCE PRACTICES

1. Replacement of Landing Light (Figure 2)

- A. Gain access to the landing light by removing the lamp shield.
- B. Remove the three mounting screws and withdraw the lamp and bracket.
- C. Disconnect wires at the light terminals.
- D. Remove light and replace as required.
- E. Connect wires at the light terminal.
- F. Place lamp in mounting bracket and install hardware.
- G. Install lamp shield.
- H. Perform operational check (see Exterior Lights – Operational Check).

2. Replacement of Navigation Lights (Figure 4)

A. Wing Tip Light Replacement

- (1) Remove the screws which attach the protective lens to the wing tip.
- (2) Remove the one screw which holds the lamp shield.
- (3) Remove the lamp and replace if necessary.
- (4) Install lamp shield and securing screw.
- (5) Install protective lens and attaching hardware to the wing tip.
- (6) Perform operational check (see Exterior Lights – Operational Check).

B. Tail Light Replacement

- (1) Remove the two screws which hold the lamp retainer to the tailcone.
- (2) Withdraw the retainer and lens.
- (3) Remove the lamp and replace as required.
- (4) Install lens and retainer to the tailcone.
- (5) Perform operational check (see Exterior Lights – Operational Check).

3. Flashing Beacon (Figure 6)

A. Light Replacement

- (1) Remove the clamp securing lens.
- (2) Withdraw the lens, shield and lamp.

CAUTION: DO NOT HANDLE LAMP BY GLASS. INSERT INTO SOCKET BY BASE. ALWAYS WIPE LAMP OFF WITH TISSUE AROUND LAMP.

- (3) Remove lamp and replace as required.
- (4) Install lamp, shield and lens.
- (5) Install clamp.
- (6) Perform operational check (see Exterior Lights – Operational Check)

B. Flasher Unit Removal

- (1) Remove the tail inspection covers (ELT inspection covers).
- (2) Disconnect the wires.
- (3) Remove the four screws which attach the unit beneath the horizontal bulkhead.

C. Flasher Unit Installation

- (1) Place unit beneath the horizontal bulkhead and install attaching hardware and ground wire.
- (2) Connect the remaining wires.
- (3) Install the tail inspection covers.
- (4) Perform operational check (see Exterior Lights – Operational Check)

4. Strobe Light (Optional) (Figure 7)

A. Light Assembly Replacement

WARNING: REMOVE POWER FOR 5 MINUTES BEFORE SERVICING SYSTEM.

- (1) Remove hardware attaching wing tip to the wing.
- (2) Disconnect wires going to navigation and strobe lights.
- (3) Remove wing tip.
- (4) Remove protective shield and supporting hardware from wing tip.
- (5) Remove hardware supporting light assembly to wing tip.
- (6) Remove light assembly and replace as required.
- (7) Install hardware supporting light assembly to wing tip.
- (8) Install protective shield and hardware.
- (9) Connect wires going to navigation and strobe lights.
- (10) Install wing tip and attaching hardware.
- (11) Perform operational check (see Exterior Lights – Operational Check).

B. Strobe Power Supply Assembly – Removal

WARNING: REMOVE POWER FOR 5 MINUTES BEFORE SERVICING SYSTEM.

- (1) Remove hardware attaching wing tip to the wing.
- (2) Disconnect wires going to navigation and strobe lights.
- (3) Remove wing tip from wing.
- (4) Disconnect wires going to strobe power supply.
- (5) Remove hardware supporting strobe power supply to wing rib.
- (6) Remove strobe power supply from wing rib.

C. Strobe Power Supply Assembly – Installation

- (1) Install Strobe power supply, ground wire and supporting hardware.

CAUTION: THIS UNIT IS POLARITY SENSITIVE. THE WHITE OR RED LEAD IS POSITIVE AND THE BLACK LEAD AND OR CASE IS NEGATIVE.

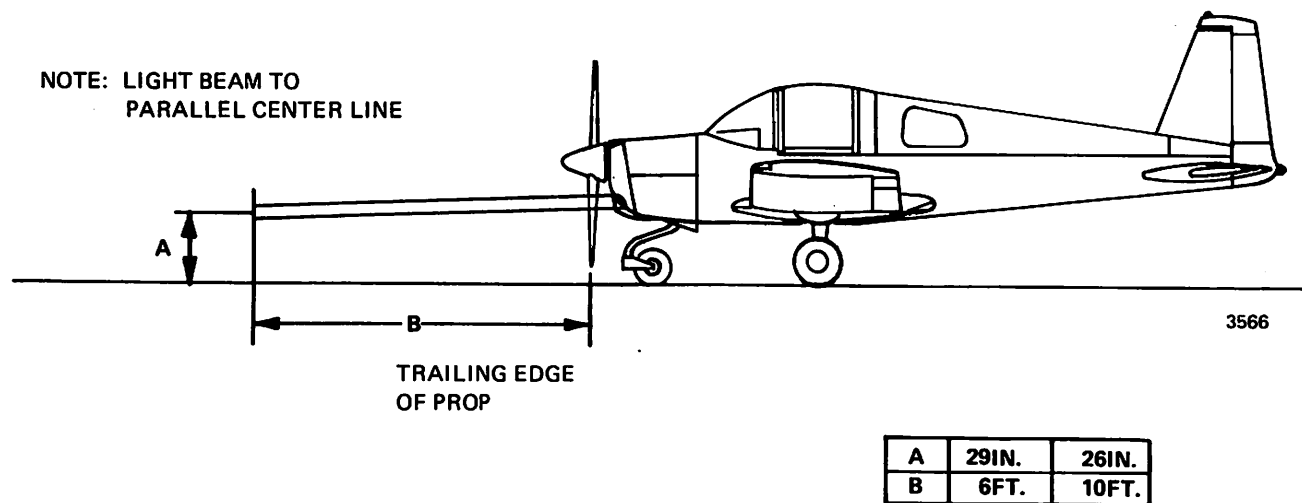
- (2) Connect wires going to strobe power supply.
- (3) Connect wires going to navigation and strobe lights.
- (4) Install wing tips to wing and attaching hardware.
- (5) Perform operational check (see Exterior Lights – Operational Check).

LANDING LIGHT – MAINTENANCE PRACTICES/ADJUSTMENT

NOTE: Before adjusting light, ensure tires are properly inflated.

1. Landing Light Adjustment

- A. Position aircraft on flat surface.**
- B. Remove the lamp shield to gain access to the adjusting screws.**
- C. Adjust light in accordance with Figure 201.**
- D. Install the lamp shield.**



**Landing Light Adjustment
Figure 201**

EXTERIOR LIGHTS – OPERATIONAL CHECK**1. Landing Light (Optional)**

- A. Place MASTER switch to ON position.
- B. Place LDG LT switch to ON position. Landing light should come on. (For adjusting landing light, see Maintenance Practices – Landing Light Adjustment, Page 202).
- C. Place LDG LT switch to OFF position. Light should go out.
- D. Place MASTER switch to OFF position.

2. Navigation Lights

- A. Place MASTER switch to ON position.
- B. Place NAV LTS switch to ON position. The two lights mounted on each wing tip and the one light mounted on the tail cone should come on.
- C. Place NAV LTS switch to OFF position. Navigation lights should go out.
- D. Place MASTER switch to OFF position.

3. Flashing Beacon (Optional)

- A. Place MASTER switch to ON position.
- B. Place FLASH BCN switch to ON position. Flashing beacon should start flashing.
- C. Place FLASH BCN switch to OFF position. Lamp should stop flashing.
- D. Place MASTER switch to OFF position.

4. Strobe Lights (Optional)

- A. Place MASTER switch to ON position.
- B. Place STROBE light switch to ON position. Strobe lights should start flashing.
- C. Place STROBE light switch to OFF position. Strobe lights should stop flashing.
- D. Place MASTER switch to the OFF position.

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NAVIGATION SYSTEMS – DESCRIPTION/OPERATION**1. General**

Not all AA-1C aircraft will have identical navigational equipment installed. The basic items that provide minimum requirements to comply with FAA regulations are available on all aircraft. More diverse navigational items are installed as a customer option. It is the intent of this chapter to present procedures and instructions adequate for minor inspection and flight line maintenance of all navigation equipment that may be installed on the aircraft including the optional items. Overhaul or shop maintenance of the navigation equipment must be performed in accordance with the individual manufacturer's data. An appropriately rated and qualified technician is required to perform maintenance on the navigation equipment.

PITOT AND STATIC PRESSURE SYSTEMS – DESCRIPTION/OPERATION

1. General

The pitot and static pressure systems supply impact (pitot) and atmospheric (static) pressure to various instruments. Some of these instruments require static pressure only; others require both static and pitot pressure for operation (see Figure 1). Both systems operate independently of each other.

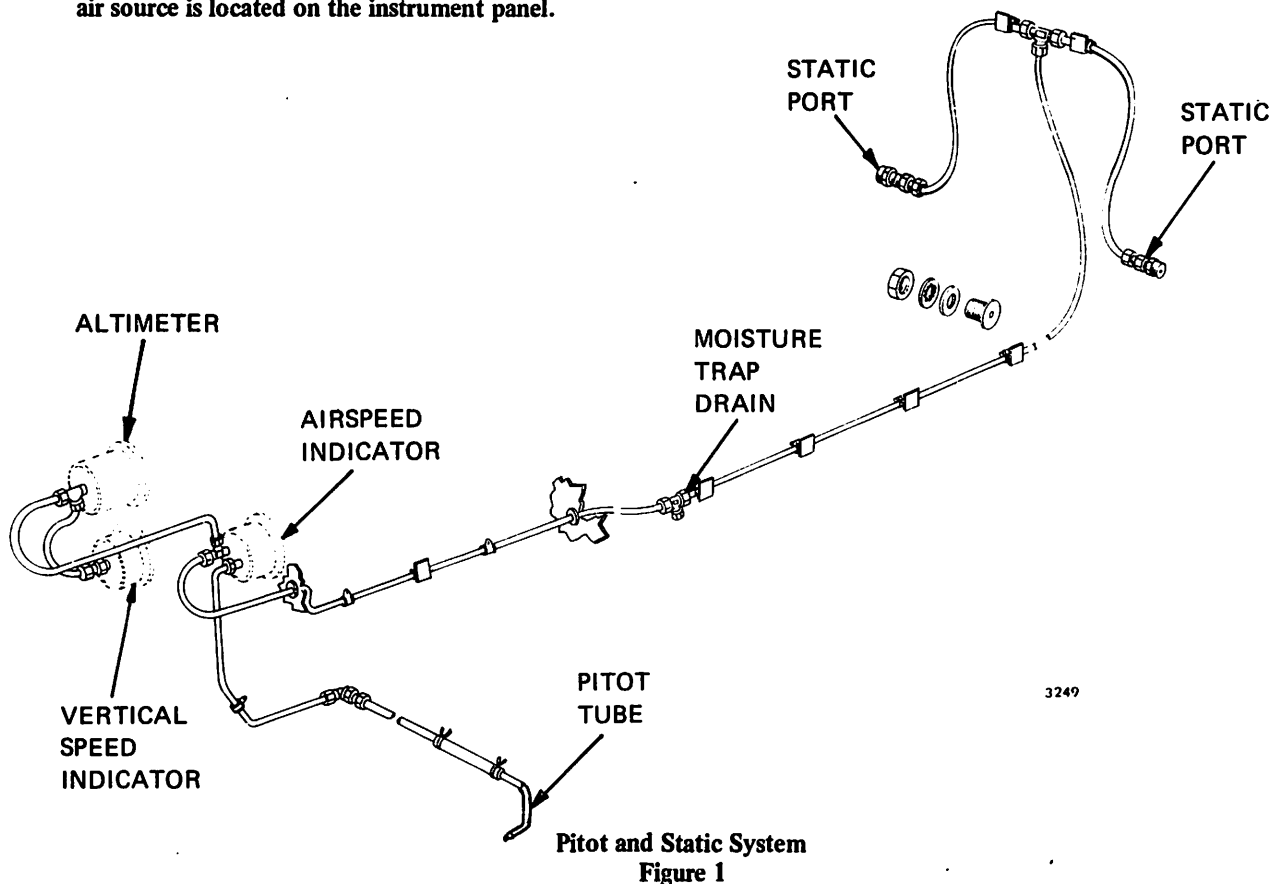
The pitot and static systems consist of metal and plastic tubing which convey ram air pressure and atmospheric pressure to the airspeed indicator, vertical speed indicator, and altimeter.

Ram air pressure is picked up by the pitot tube located under the left wing tip. From the pitot tube, a line runs along the trailing edge of the wing to the wing root and then to the instruments.

At the 100-hour inspection or when the airspeed indicator fails to operate properly the pitot line should be disconnected at the elbow or the plastic connection located inside the wing root in order to drain any moisture accumulation.

The static system, consisting of a static port on each side of the aft fuselage, conducts atmospheric pressure to the instruments. The line which runs from the ports to the instruments incorporates a moisture trap located behind the left rear seat upholstery side panel. It is recommended that the moisture trap drain be serviced at each static system test, or more often if fluctuations are observed in instruments connected to the static system, or if moisture is noted inside the glass cover of the airspeed indicator.

As an optional item the pitot tube is equipped with an electrical heating element for icing protection. The switch that controls the heating element is located on the instrument panel. Refer to Chapter 30 for complete details on pitot heat system. Also offered as an option is an alternate static air source. The control knob for the alternate static air source is located on the instrument panel.



PITOT AND STATIC PRESSURE SYSTEMS – TROUBLE SHOOTING**1. Trouble Shooting Pitot and Static Pressure Systems**

TROUBLE	PROBABLE CAUSE	REMEDY
Airspeed indicator fails to indicate	Static buttons blocked or obstruction in pitot or static lines.	Check all lines and fittings for obstruction and clean as necessary.
	Water in static system	Drain static system.
	Pitot line kinked or disconnected	Check all pitot lines and repair as required.
Airspeed indicator fluctuates or indicates incorrectly	Leak in pitot or static systems	Tighten all connections and test system until no leakage is evident.
	Defective instrument	Replace instrument.
	Instrument leakage	Test instrument individually and replace if necessary.
Altimeter fails to operate	Clogged static line	Check all lines and fittings and blow out as required.
	Defective instrument	Replace instrument.
Altimeter fluctuates	Instrument leakage	Test instrument individually and replace if necessary.
	Defective instrument	Replace instrument.
	Leak in static system	Tighten all connections and test system until no leakage is evident.
Vertical speed indicator fails to operate, fluctuates or reads incorrectly	Obstruction in static lines	Remove, inspect and clean all static lines.
	Defective instrument	Replace instrument.
	Instrument leakage	Test instrument individually and replace if necessary.

PITOT AND STATIC PRESSURE SYSTEMS – MAINTENANCE PRACTICES**1. Removal/Installation of Pitot and Static Pressure System Components (See Figure 201.)****A. Remove Pitot Tube**

- (1) Remove left wing tip to gain access to pitot tube attaching hardware.
- (2) Disconnect pitot tube air inlet line and wiring.
- (3) Remove hardware supporting pitot tube mount to wing spar and wing rib.
- (4) Remove pitot tube assembly.

B. Install Pitot Tube Assembly

- (1) Place pitot tube assembly in position and install attaching hardware.
- (2) Connect pitot tube air inlet line and wiring.
- (3) Replace wing tip.

2. Pitot and Static Pressure System Leakage Test**A. Test the Pitot System**

CAUTION: NEVER APPLY SUCTION TO THE PITOT TUBE UNLESS THE AIRSPEED INDICATOR IS DISCONNECTED.

- (1) Insert a surgical type rubber hose, approximately 24 inches long over the pitot tube.
- (2) Apply pressure by closing the opposite end of the tube and slowly roll up rubber hose until the airspeed indicator registers between 120-150 mph.
- (3) Secure the rolled-up end of the hose to prevent it from unrolling.
- (4) After two or three minutes, recheck the airspeed indicator. Any leakage in the system will result in a lower airspeed indication. If the reading has decreased more than 1 mph per minute, an undesirable leak exists somewhere in the system.

NOTE: Be sure the hose is not losing pressure.

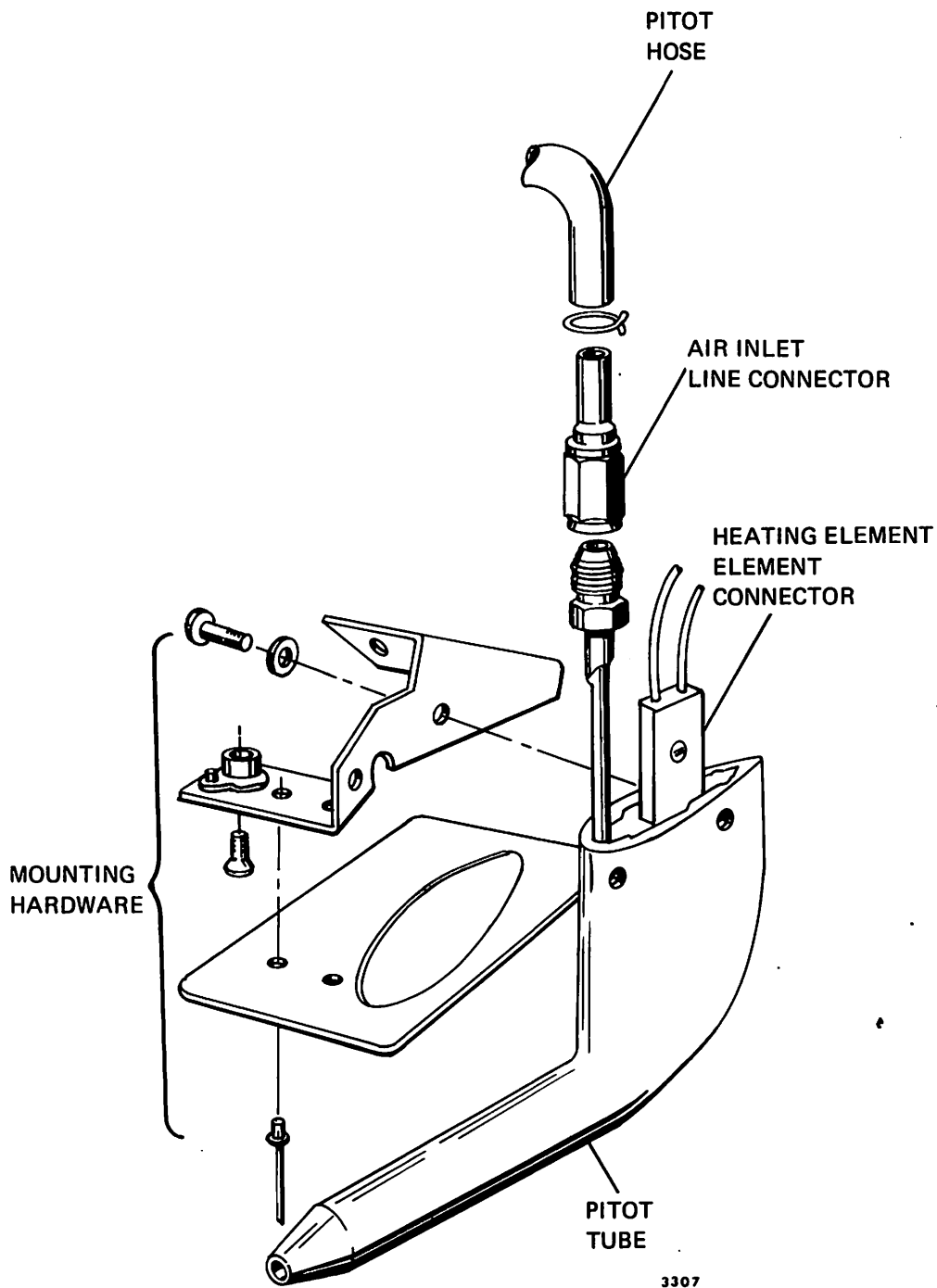
- (5) To eliminate the leak, check all connections and tighten all fittings in the system as necessary and apply thread sealant sparingly as required. Inspect the pitot line in the wing root and replace the hose if it appears deteriorated.

- (6) Repeat steps (1) through (4).

B. Test the Static System

CAUTION: NEVER APPLY POSITIVE PRESSURE TO THE STATIC SYSTEM UNLESS ALL INSTRUMENTS ARE DISCONNECTED.

FAR 91.170 requires that static systems and altimeters be checked every 24 months for IFR. The most common method of testing static systems is covered in FAR 43, Appendix E, "Altimeter System Test and Inspection". Additional information may be found in FAA Advisory Circular No. AC 43-203A. An approved alternate method specifically for the AA-1C is listed below. Perform testing as follows:



**Pitot Tube Installation
Figure 201**

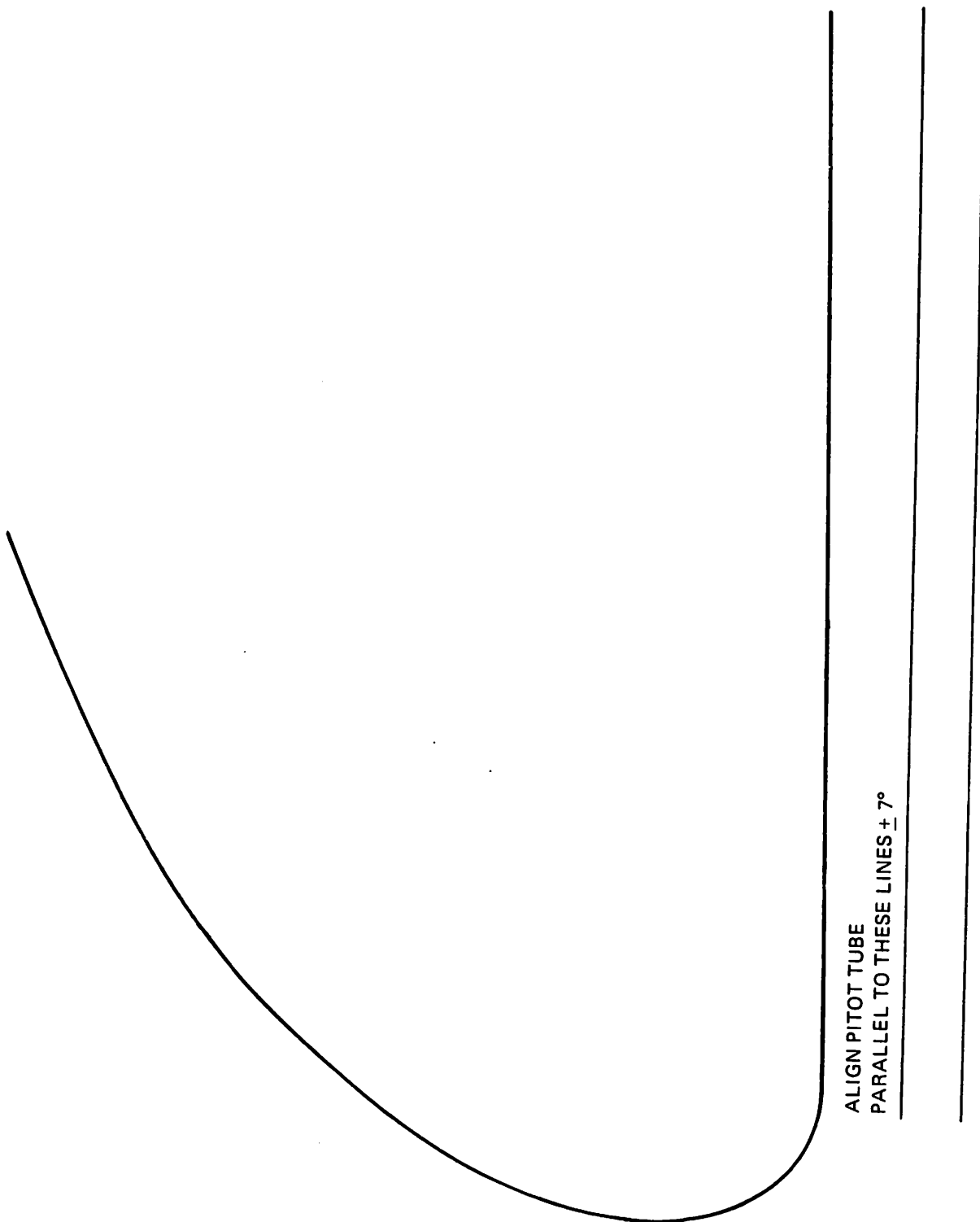
- (1) Ensure that altimeter has been tested and approved by an appropriately rated facility per FAR Part 43, Appendix E, prior to aircraft system test.
- (2) Seal off one static port opening with plastic tape. This must provide an air tight seal.
- (3) Attach a source of suction to the remaining static port. If an alternate static source is installed, ensure that control is in OFF position.

NOTE: One method of applying suction is to insert a hypodermic syringe into the static port and slowly withdraw the plunger of the syringe. Ensure the syringe does not leak and an airtight seal is maintained during test.

- (4) Slowly apply suction until the altimeter indicates a 1000-foot increase in altitude.
- (5) Secure the suction source to maintain a closed system. Leakage shall not exceed a decrease of 100 feet of altitude per minute, as indicated on the altimeter.
- (6) If the leakage rate exceeds 100 feet per minute, check and retighten all connections and fittings.
- (7) Repeat steps (1) through (6).
- (8) If the leakage rate is still too high, disconnect the static lines from the individual instruments.
- (9) Proceeding one at a time, and using suitable fittings, connect the lines together so that the altimeter is the only instrument still connected to the static pressure system.
- (10) Repeat the leakage test to determine whether the static pressure system or the instruments disconnected from the system are the cause of leakage. If the instruments are at fault, they must be repaired by an appropriately rated repair station or replaced. If the static pressure system is at fault, repeat the procedure given in step (6).

3. Pitot Tube Alignment

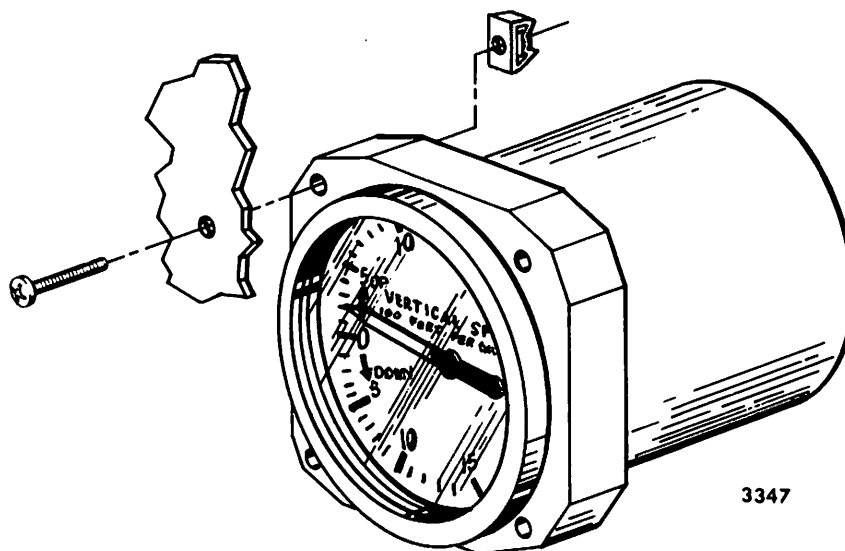
Figure 202 shows an outline of the wing contour and a series of parallel lines. To check the proper alignment of the pitot tube, make a template conforming to the lines shown in Figure 202. If the pitot tube is properly aligned, it should parallel one of the lines.



Pitot Tube Alignment Template
Figure 202

VERTICAL SPEED INDICATOR – DESCRIPTION/OPERATION1. General

The vertical speed indicator (Figure 1), located on the instrument panel, measures the rate of change in static pressure when the aircraft is climbing or descending. By means of a pointer and dial this instrument will indicate the rate of ascent or descent of the aircraft in feet per minute. But due to the lag of the instrument, the aircraft will be climbing or descending before the instrument starts to change and the instrument will continue to change after the aircraft has assumed level flight. In rough air the lag of the instrument should not be considered a malfunction.



Vertical Speed Indicator
Figure 1

VERTICAL SPEED INDICATOR – TROUBLE SHOOTING**1. Trouble Shooting Vertical Speed Indicator**

TROUBLE	PROBABLE CAUSE	REMEDY
Pointer fails to respond.	Obstruction in static line.	Disconnect all instruments connected to the static line. Inspect and clear all static lines.
Pointer oscillates.	Leaks in static lines or instrument.	Disconnect all instruments connected to the static line. Check individual instruments for leaks. Replace if necessary. Check lines and connections for leaks. (Refer to 34-1-1.)
	Defective mechanism.	Replace instrument.
Rate of climb indicates when aircraft is banked.	Water in static line.	Remove cap at low place in static line and drain line.
Pointer has to be set before every flight.	Temperature compensator Inoperative.	Replace instrument.
Pointer cannot be reset to zero.	Diaphragm distorted.	Replace instrument.
Instrument reads very low during climb or descent.	Instrument case broken or leaking.	Replace instrument.

VERTICAL SPEED INDICATOR – MAINTENANCE PRACTICES**1. Removal/Installation of Vertical Speed Indicator****A. Remove Vertical Speed Indicator**

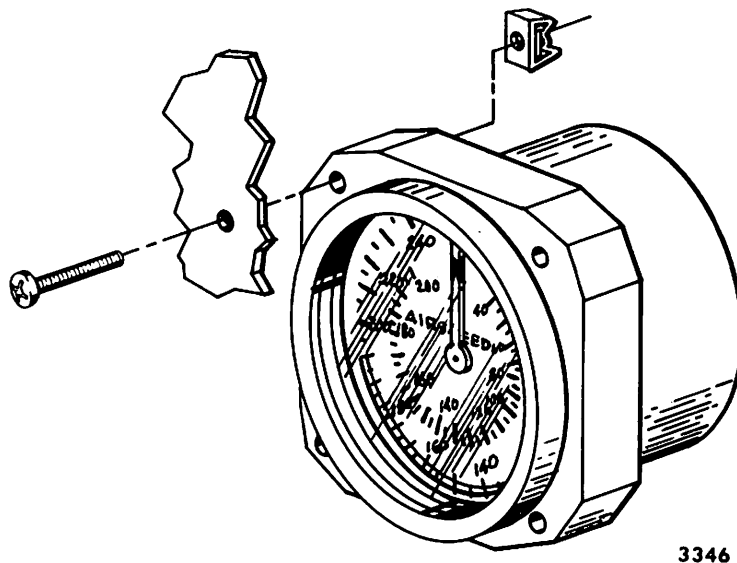
- (1) Remove screws securing deck assembly to instrument panel.
- (2) Raise deck assembly and tape to windshield.
- (3) Locate vertical speed indicator on instrument panel and loosen fitting to disconnect tubing from rear of indicator.
- (4) Remove three screws and nuts mounting vertical speed indicator to instrument panel and remove indicator.

B. Install Vertical Speed Indicator

- (1) Position vertical speed indicator in place on instrument panel and install three screws and nuts securing vertical speed indicator to instrument panel.
- (2) Connect tubing to back of indicator. Secure by tightening fitting.
- (3) Position deck assembly in place and install screws securing deck assembly to instrument panel.
- (4) Perform test of vertical speed indicator system. (Refer to manufacturer's manual for test procedure.)

AIRSPEED INDICATOR – DESCRIPTION/OPERATION1. General

The airspeed indicator (Figure 1), located on the instrument panel, provides a means of indicating the speed of the aircraft passing through the air. The airspeed indication is derived from the differential pressure between pitot air pressure and static air pressure. This instrument has its diaphragm vented to the pitot air source and its case vented to the static air system. As the aircraft increases speed, the pitot air pressure increases, causing the diaphragm to expand. A mechanical linkage picks up this motion and moves the instrument pointer to the indicated speed. The instrument dial is calibrated in knots and miles per hour, and also has the necessary operating range markings for safe operation of the aircraft.



Airspeed Indicator
Figure 1

AIRSPPEED INDICATOR – TROUBLE SHOOTING**1. Trouble Shooting Airspeed Indicator**

TROUBLE	PROBABLE CAUSE	REMEDY
Pointer of airspeed indicator does not indicate properly.	Leak in instrument case or in pitot lines.	Check for leak and seal. (Refer to 34-1-1.)
Pointer of airspeed indicator oscillates.	Defective mechanism.	Replace instrument.
Instrument reads high.	Pointer not on zero.	Replace instrument.
	Leaking static system.	Find leak and correct. (Refer to 34-1-1.)
Instrument reads low.	Pointer not on zero.	Replace instrument.
	Leaking static system.	Find leak and correct. (Refer to 34-1-1.)
	Pitot tube not aligned correctly.	Realign pitot tube. (Refer to 34-1-1.)
Airspeed changes as aircraft is banked.	Water in pitot line.	Disconnect pitot line from airspeed indicator. Blow out pitot line from cockpit to pitot tube.

AIRSPPEED INDICATOR – MAINTENANCE PRACTICES**1. Removal/Installation of Airspeed Indicator****A. Remove Airspeed Indicator**

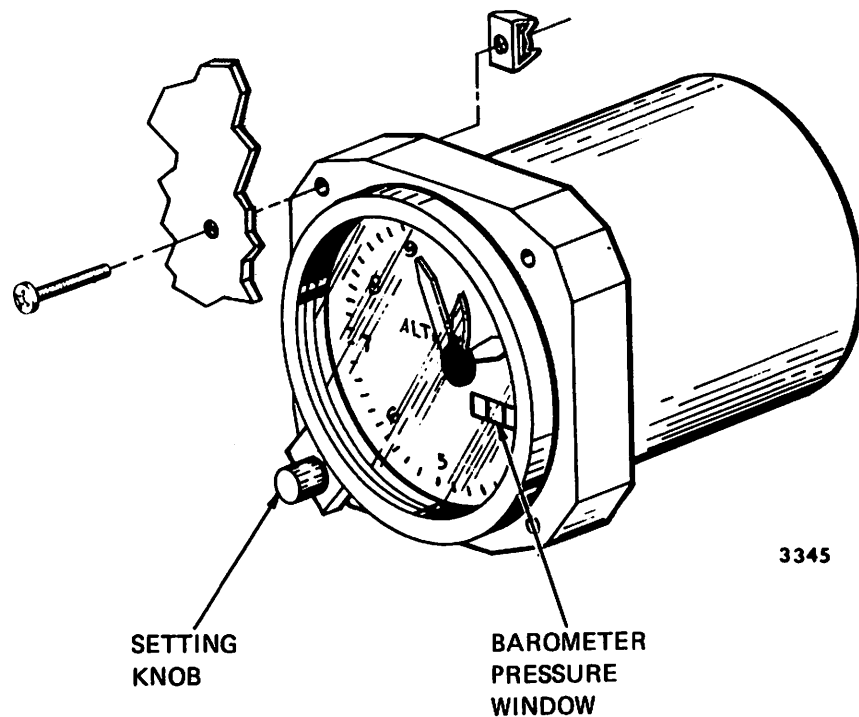
- (1) Remove screws securing deck assembly to instrument panel.
- (2) Raise deck assembly and tape to windshield.
- (3) Locate airspeed indicator on instrument panel and loosen fittings to disconnect tubing from the connections on back of indicator.
- (4) Remove four mounting screws securing airspeed indicator to instrument panel and remove indicator.

B. Install Airspeed Indicator

- (1) Position airspeed indicator in place on instrument panel and install four screws securing airspeed indicator to instrument panel.
- (2) Connect tubing to connections on back of indicator.
- (3) Place deck assembly in position and install screws securing deck assembly to instrument panel.
- (4) Perform test of airspeed indicating system. (Refer to 34-1-1.)

ALTIMETER – DESCRIPTION/OPERATION1. General

The altimeter (Figure 1), located on the instrument panel, indicates pressure in feet above sea level. The indicator has three pointers and a dial scale; the long pointer is read in hundreds of feet, the middle pointer in thousands of feet and the short pointer in ten thousands of feet. A barometric pressure window is located on the right side of the indicator dial. The barometric pressure indication is set by the knob located on the lower left corner of the instrument. The altimeter consists of a sealed diaphragm that is connected to the pointers through a mechanical linkage. The instrument case is vented to the static air system, and as static air pressure changes the diaphragm changes causing the pointers to move through the mechanical linkage.



Altimeter
Figure 1

ALTIMETER – TROUBLE SHOOTING

1. Trouble Shooting the Altimeter

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Defective mechanism.	Replace instrument.
High or low reading.	Improper venting.	Eliminate leak in static pressure system. (Refer to 34-1-1.)
Setting knob is hard to turn.	Wrong lubrication or lack of lubrication.	Replace instrument.
Inner reference marker fails to move when setting knob is rotated.	Out of engagement.	Replace instrument.
Setting knob setscrew loose or missing.	Not tight when altimeter was reset.	Tighten instrument screw, if loose. Replace instrument, if screw is missing.
Cracked or loose cover glass.	Case gasket hardened.	Replace instrument.
Dull or discolored markings.	Age.	Replace markings.
Barometric scale and reference markers out of synchronism.	Slippage of mating parts.	Replace instrument.
Barometric scale and reference markers out of synchronism with pointers.	Drift in mechanism.	Reset pointers, per AC 43.13-1 Chapter 7 dated June 12, 1969.
Altimeter sticks at altitude or does not change with change of altitude.	Water or restriction in static line.	Remove static lines from all instruments, and blow line clear from cockpit to static ports.
Altimeter changes reading as aircraft is banked.	Water in static line.	Remove drain cap from static line and drain water from line.
Altimeter requires resetting frequently.	Temperature compensator inoperative.	Replace instrument.

ALTIMETER – MAINTENANCE PRACTICES

1. Removal/Installation of Altimeter

A. Remove Altimeter

- (1) Remove screws securing deck assembly to instrument panel.
- (2) Raise deck assembly and tape to windshield.
- (3) Locate altimeter on instrument panel and loosen fittings to disconnect tubing from tee connection on back of instrument.
- (4) Remove three screws securing altimeter to instrument panel and remove altimeter.

B. Install Altimeter

- (1) Position altimeter in place on instrument panel and install three mounting screws securing altimeter to instrument panel.
- (2) Connect tubing to tee connection on back of altimeter.
- (3) Place deck assembly in position and install screws securing deck assembly to instrument panel.
- (4) Perform test and recertify altimeter. (Refer to 34-1-1.)

AIR TEMPERATURE GAUGE – DESCRIPTION/OPERATION**1. General**

The outside air temperature gauge is located on the upper center of the windshield. The gauge is a mechanically operated instrument actuated by expansion of a metallic element to give the temperature indication on the face of the instrument. The range of temperature readings is from 144°F(64°C) to -64°F(-54°C).

AIR TEMPERATURE GAUGE – MAINTENANCE PRACTICES1. Removal/Installation of Air Temperature Gauge (See Figure 201.)

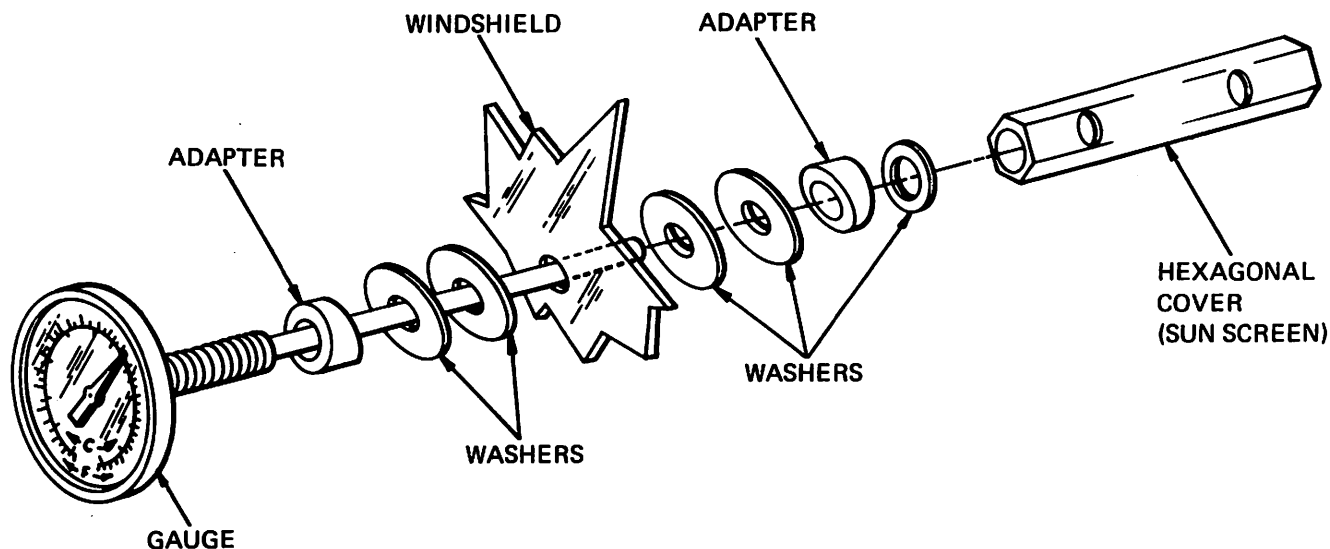
A. Remove Air Temperature Gauge

- (1) Hold the gauge on the inside of the windshield.
- (2) From outside the aircraft, unscrew and remove hexagonal (sun screen) gauge cover.
- (3) Remove washers and tube adapter from outside of windshield.
- (4) Remove gauge, tube adapter, and washers from inside of windshield.

B. Install Air Temperature Gauge

- (1) Assemble tube adapter and washers on gauge stem (Figure 201).
- (2) Apply one or two drops of Loctite sealant, grade EV to the gauge stem threads.
- (3) Insert gauge stem through mounting hole from inside the windshield.
- (4) Assemble tube adapter and washers on gauge stem on outside of windshield (see Figure 201).
- (5) Apply a small bead of Presstite soft putty around gauge stem between rubber washer and metal washer on outside of windshield.

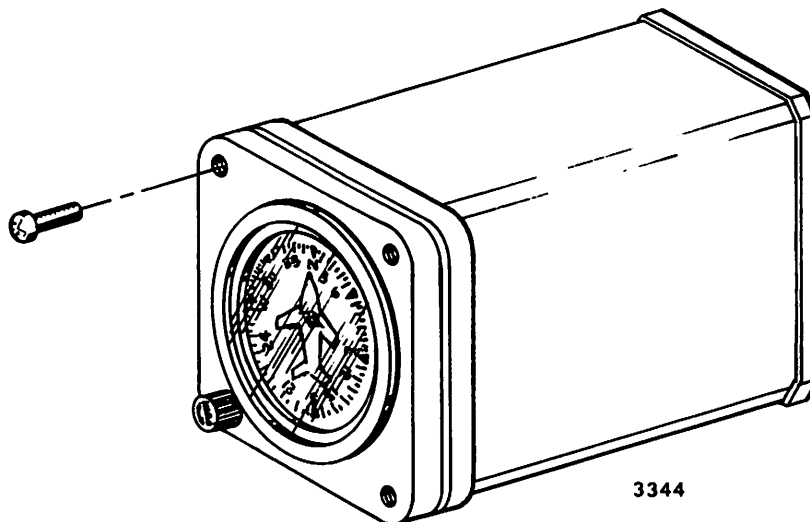
CAUTION: DO NOT OVERTIGHTEN OR STEM THREADS WILL SEPARATE FROM GAUGE CASE.



Air Temperature Gauge Installation
Figure 201

DIRECTIONAL GYRO – DESCRIPTION/OPERATION1. General

The directional gyro (Figure 1) located on the instrument panel, is a flight instrument incorporating an air driven gyro stabilized in the vertical plane. This instrument operates off the vacuum system (see Chapter 37). The gyro is rotated at high speed by lowering the pressure in the airtight case and simultaneously allowing atmospheric air pressure to enter the instrument against the gyro buckets. Due to gyroscopic inertia, the spin axis continues to point in the same direction even though the aircraft yaws to the right or left. This relative motion between the gyro and the instrument case is shown on the instrument dial which is similar to a compass card. The dial, when set to agree with the aircraft magnetic compass, provides a positive indication free from swing and turning error. Due to internal friction, spin axis error, and air turbulence, the gyro should be set at least every 15 minutes for accurate operation.



Directional Gyro
Figure 1

DIRECTIONAL GYRO – TROUBLE SHOOTING

1. Trouble Shooting Directional Gyro

TROUBLE	PROBABLE CAUSE	REMEDY
Excess drift in either direction.	Setting error.	Reset gyro.
	Defective instrument.	Replace instrument.
	High or low vacuum. If vacuum is not correct check for the following:	
	a. Relief valve improperly adjusted.	a. Adjust relief valve. (Refer to 37-1-1.)
	b. Incorrect gauge reading.	b. Replace gauge. (Refer to 37-1-1.)
	c. Pump failure.	c. Repair or replace pump. (Refer to 37-1-1.)
	d. Vacuum line kinked or leaking.	d. Check and repair. Check for collapsed inner wall of hose.
	e. Dirty filters.	e. Replace filters. (Refer to 37-1-1.)
Dial spins during turn.	Limits (55° bank) or gimbal exceeded.	Recage gyro in level flight.
Dial spins continuously.	Defective mechanism.	Replace instrument.

DIRECTIONAL GYRO – MAINTENANCE PRACTICES

1. Removal/Installation of Directional Gyro

A. Remove Directional Gyro

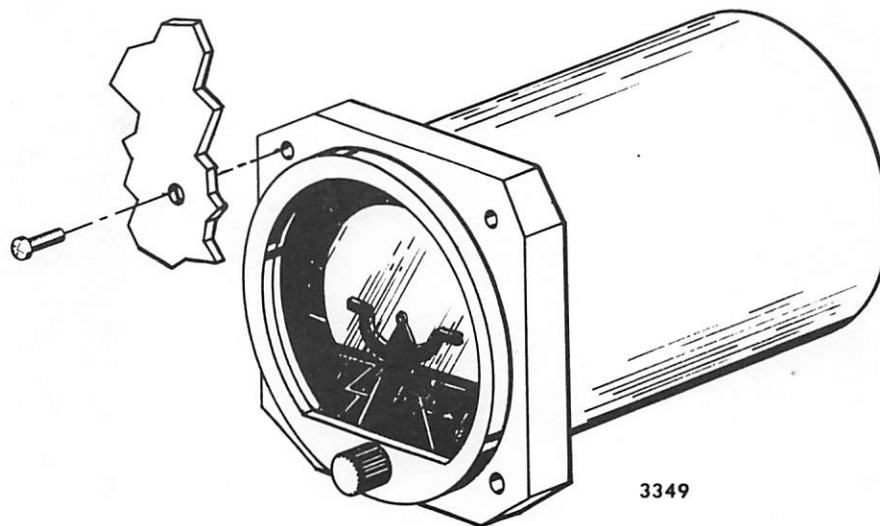
- (1) Remove screws securing deck assembly to instrument panel.**
- (2) Raise deck assembly and tape to windshield.**
- (3) Disconnect lines from fittings on back of gyro.**
- (4) Remove reset knob.**
- (5) Remove three mounting screws and slide gyro backward out of instrument panel.**

B. Install Directional Gyro

- (1) Position directional gyro in place on instrument panel and install three mounting screws.**
- (2) Install reset knob.**
- (3) Connect lines to fitting on back of gyro.**
- (4) Position deck assembly in place and install screws securing deck assembly to instrument panel.**

ATTITUDE GYRO – DESCRIPTION/OPERATION1. General

The attitude gyro (Figure 1), located on the instrument panel, is essentially an air driven gyroscope rotating in a horizontal plane and is operated on the same principal as the directional gyro. Due to the 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 pitch and roll axis. A bar across the face of the indicator represents the horizon and aligning the miniature aircraft to the horizon bar simulates the alignment of the aircraft to the actual horizon. Any deviation simulates the deviation of the aircraft from the true horizon. The attitude gyro is marked for different degrees of bank.



Attitude Gyro
Figure 1.

ATTITUDE GYRO – TROUBLE SHOOTING

1. Trouble Shooting the Attitude Gyro

TROUBLE	PROBABLE CAUSE	REMEDY
Bar fails to respond.	Insufficient vacuum.	Check pump and tubing.
	Filters dirty.	Replace filter. (Refer to 37-1-1.)
Bar does not settle.	Insufficient vacuum.	Check line and pump. Adjust valve. (Refer to 37-1-1.)
	Defective instrument.	Replace instrument.
Bar oscillates or shimmies continuously.	Instrument loose in panel.	Tighten mounting screws.
	Vacuum too high.	Adjust valve. (Refer to 37-1-1.)
	Defective mechanism.	Replace instrument.
Instrument does not indicate level flight.	Instrument not level in panel.	Loosen screws and level instrument.
	Aircraft out of trim.	Trim aircraft.
Instrument tumbles in flight.	Low vacuum.	Reset regulator. (Refer to 37-1-1.)
	Dirty filters.	Replace filters. (Refer to 37-1-1.)
	Line to filter restricted.	Replace line.
	Plug missing or loose in instrument.	Replace or tighten plug.

ATTITUDE GYRO – MAINTENANCE PRACTICES

1. Removal/Installation of Gyro

A. Remove Attitude Gyro

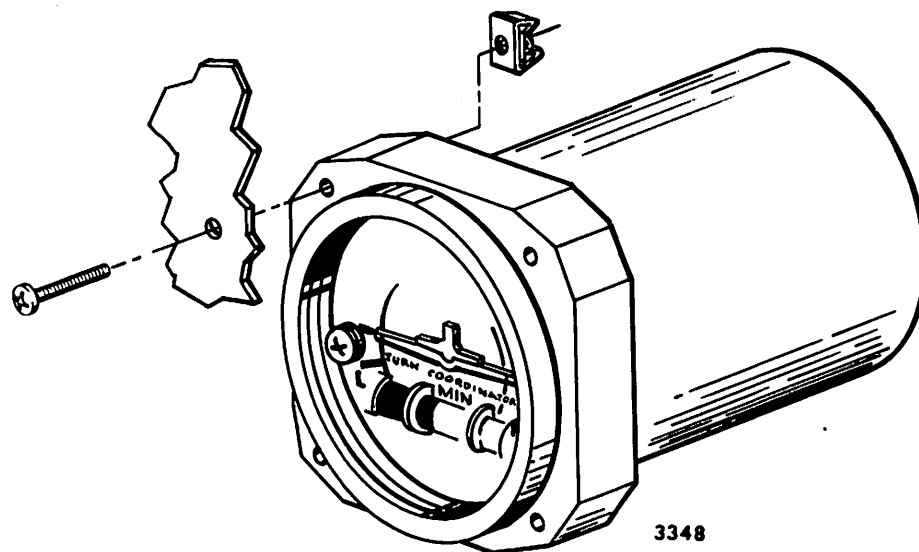
- (1) Remove screws securing deck assembly to instrument panel.**
- (2) Raise deck assembly and tape to windshield.**
- (3) Loosen clamps and disconnect lines from gyro.**
- (4) Remove the four mounting screws that secure gyro to instrument panel and remove gyro.**

B. Install Attitude Gyro

- (1) Position attitude gyro in place on instrument panel and install four mounting screws.**
- (2) Connect lines and install clamps in place at back of gyro.**
- (3) Position deck assembly in place and install screws securing deck assembly to instrument panel.**

TURN AND BANK INDICATOR/TURN COORDINATOR – DESCRIPTION/OPERATION**1. General**

The turn and bank indicator or turn coordinator is one of the most important instruments in instrument flight. The instruments are electrically driven; therefore they will operate only when the master switch is on. The sensitive element in the instrument is a gyro. The turn and bank indicator consists of a needle to indicate a left or right turn and an inclinometer (ball sealed in a curved glass with damping fluid) to indicate if the aircraft is slipping while in a turn. The turn coordinator (Figure 1) consists of a small aircraft silhouette that will indicate whenever the aircraft is rotating about either the yaw or roll axis and an inclinometer (ball sealed in a curved glass with damping fluid) to indicate if the aircraft is slipping while in a turn. During a standard rate turn or any turn where the aircraft controls are properly coordinated the ball in the inclinometer will remain in the center.



**Turn Coordinator
Figure 1**

TURN AND BANK INDICATOR/TURN COORDINATOR – TROUBLE SHOOTING**1. Trouble Shooting Turn and Bank Indicator/Turn Coordinator**

TROUBLE	PROBABLE CAUSE	REMEDY
Pointer or aircraft silhouette fails to respond.	Foreign matter lodged in instrument.	Replace instrument.
	Master switch OFF.	Place master switch ON.
	Blown fuse.	Replace fuse.
Incorrect sensitivity.	Out of calibration.	Replace instrument.
Incorrect turn rate.	Out of calibration.	Replace instrument.
	Aircraft not in coordinated turn.	Center ball in turn.
Ball sticky.	Flat spot on ball.	Replace instrument.
Ball not in center when aircraft is correctly trimmed.	Instrument not level in panel.	Level instrument.

TURN AND BANK INDICATOR/TURN COORDINATOR – MAINTENANCE PRACTICES**1. Removal/Installation of Turn and Bank Indicator/Turn Coordinator****A. Remove Turn and Bank Indicator/Turn Coordinator**

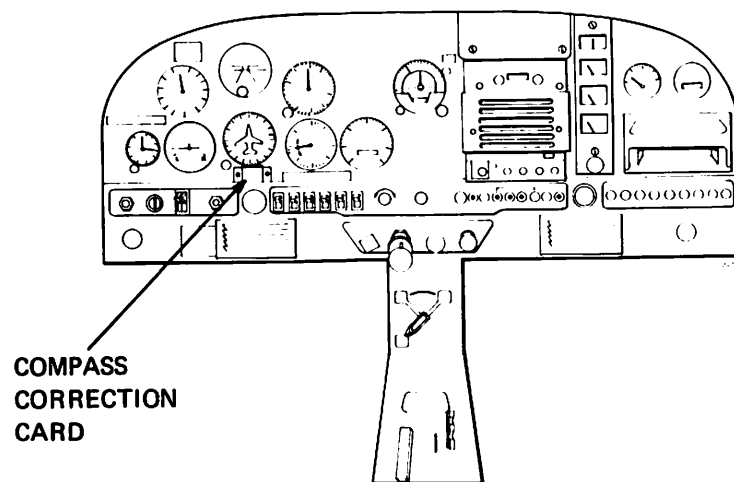
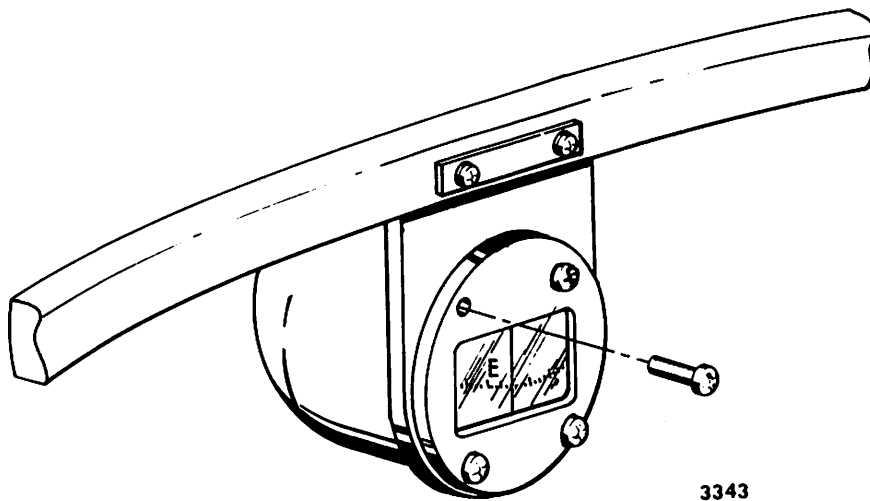
- (1) Remove screws securing deck assembly to instrument panel.
- (2) Raise deck assembly and tape to windshield.
- (3) Disconnect electrical plug from indicator.
- (4) Remove the four mounting screws and nuts that secure indicator to instrument panel and remove indicator.

B. Install Turn and Bank Indicator/Turn Coordinator

- (1) Position instrument in place on instrument panel and install the four mounting screws and nuts.
- (2) Connect electrical lead to rear of indicator.
- (3) Position deck assembly in place and install screws securing deck assembly to instrument panel.

MAGNETIC COMPASS – DESCRIPTION/OPERATION1. General

The magnetic compass (Figure 1), located on the top center of the windshield frame, is the liquid filled, compensating type, incorporating two adjustable magnets. No maintenance is required for the magnetic compass except to swing it on a compass rose. Adjustments may be made to the instrument by the two screws located on the front face using a non-magnetic screwdriver of brass, aluminum, or non-magnetic stainless steel. The compass correction card is located on lower left center of the instrument panel (see Figure 1).



Magnetic Compass
Figure 1

MAGNETIC COMPASS – TROUBLE SHOOTING**1. Trouble Shooting the Magnetic Compass**

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive card error.	Compass not properly compensated.	Compensate instrument.
	External magnetic interference.	Locate magnetic interference and eliminate if possible.
Excessive card oscillation.	Insufficient liquid.	Replace instrument.
Card sluggish.	Weak card magnet.	Replace instrument.
	Excessive pivot friction or broken jewel.	Replace instrument.
Liquid leakage.	Loose bezel screws.	Replace instrument.
	Broken cover glass.	Replace instrument.
	Defective sealing gaskets.	Replace instrument.
Discolored markings.	Age.	Replace instrument.
Defective light.	Burned out lamp or broken circuit.	Check lamp or continuity of wiring.
Card does not move when compensating screws are turned.	The gears that turn compensating magnets are stripped.	Replace instrument.

MAGNETIC COMPASS – MAINTENANCE PRACTICES

1. Removal/Installation of Magnetic Compass

A. Remove Magnetic Compass

- (1) Remove two mounting screws and nuts.**
- (2) Disconnect electrical lead and remove compass.**

B. Install Magnetic Compass

- (1) Connect electrical lead to magnetic compass.**
- (2) Position magnetic compass in place and install mounting screws and nuts.**
- (3) Perform compass swing. (Refer to FAA AC 43.13-1.)**

TRANSPONDER – DESCRIPTION/OPERATION

1. General

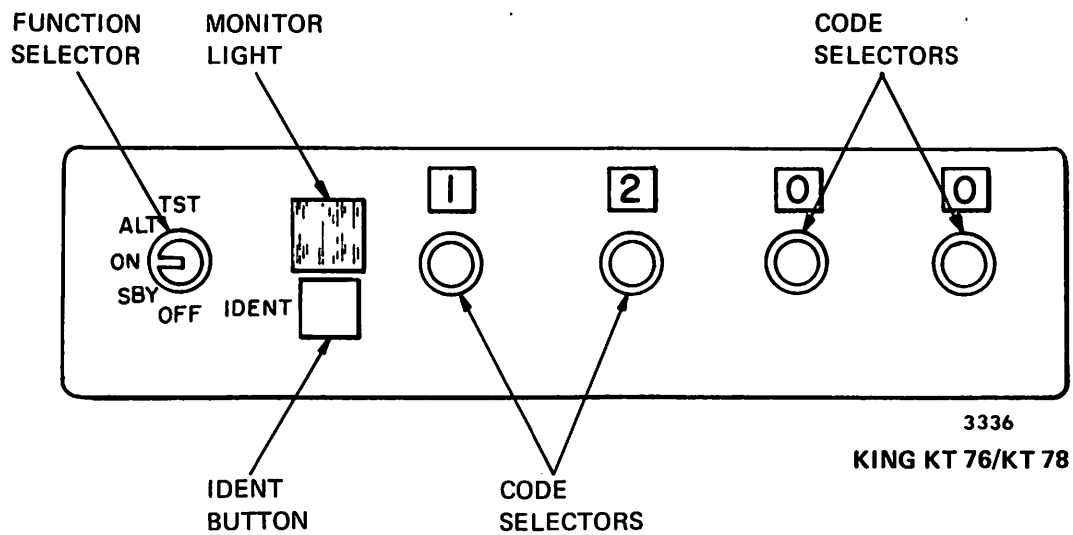
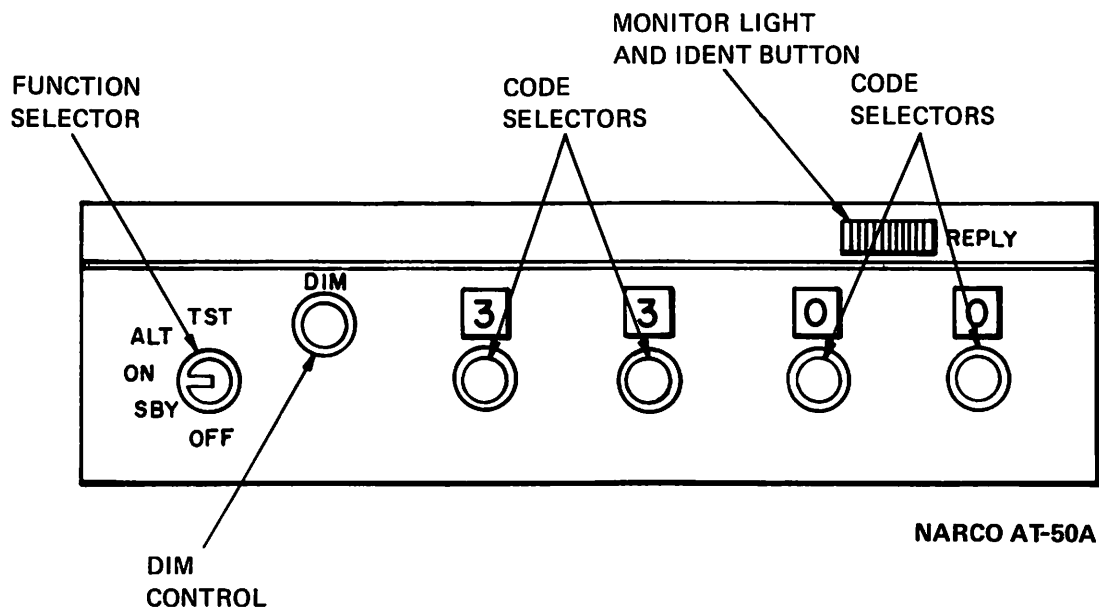
The transponder is radar beacon equipment designed to fulfill the role of the airborne beacon under the requirements of the Air Traffic Control Radar Beacon System (ATCRBS).

The use of the transponder enables the air traffic controller to identify the aircraft and therefore provides more positive control. Range and azimuth are established by the return from the transponder's pulsed transmitter in reply to a routing interrogation from the ground radar site.

The transponder reply is a set of pulses, selected in number, and positioned in time, one with respect to the other. Information is conveyed to the ground in this manner. An identity code number, selected at the front panel by the pilot is transmitted as a Mode A reply. Mode C, altitude reporting, is an additional capability designed into the transponder. However, in order to convey altitude information, the transponder must be used in conjunction with an encoding altimeter and be operated in "ALT" mode.

An additional feature of the transponder and beacon system is the S.P.I. (Special Pulse, Identification). After pressing the ident button the transponder, when interrogated, will reply with a special pulse that will cause the associated pip on the controllers display to "bloom" effecting immediate recognition.

All operating controls for the transponder are mounted on its front panel. Many AA-1C aircraft are equipped with either a NARCO AT-50A or King KT76/KT78 transponder. Operating controls for both models are shown in Figure 1.



**Transponders
Figure 1**

TRANSPONDER – MAINTENANCE PRACTICES**1. Removal/Installation of Transponder****A. Remove Transponder**

- (1) Ensure that master power switch is in the OFF position.
- (2) Locate transponder in avionics panel on the instrument panel.
- (3) Turn locking screw (allen) clockwise to release transponder unit from its mounting case. Use 5/64 in. hex wrench (allen).

CAUTION: DO NOT PULL TRANSPONDER FREE OF MOUNT BY GRASPING THE CONTROL KNOBS.

- (4) Grasp the body of the transponder and carefully slide transponder from avionics panel mount. A slight left to right movement might help in disconnecting unit from connector plug.

B. Install Transponder

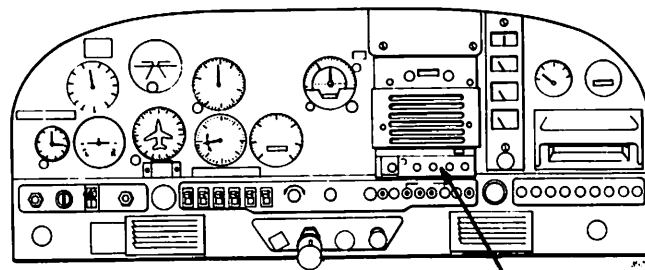
- (1) Ensure that master power switch is in the OFF position.
- (2) Grasp the transponder by the sides and carefully slide transponder into avionics panel mount until plug connection is fully engaged.
- (3) Turn locking screw (allen) counterclockwise to secure transponder unit to its mounting case. Use 5/64 in. hex wrench (allen).

2. Removal/Installation of Transponder Antenna (See Figure 201.)**A. Remove Transponder Antenna**

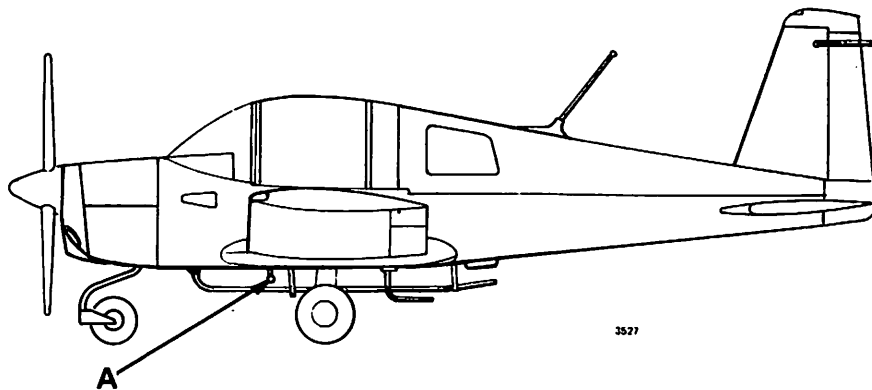
- (1) Ensure that master power switch is in the off position.
- (2) Locate transponder antenna forward of center spar (station 90).
- (3) Disconnect coax cable from antenna.
- (4) With phenolic scraper, remove sealant from around nut which secures antenna to fuselage.
- (5) Loosen nut and remove antenna.

B. Install Transponder Antenna

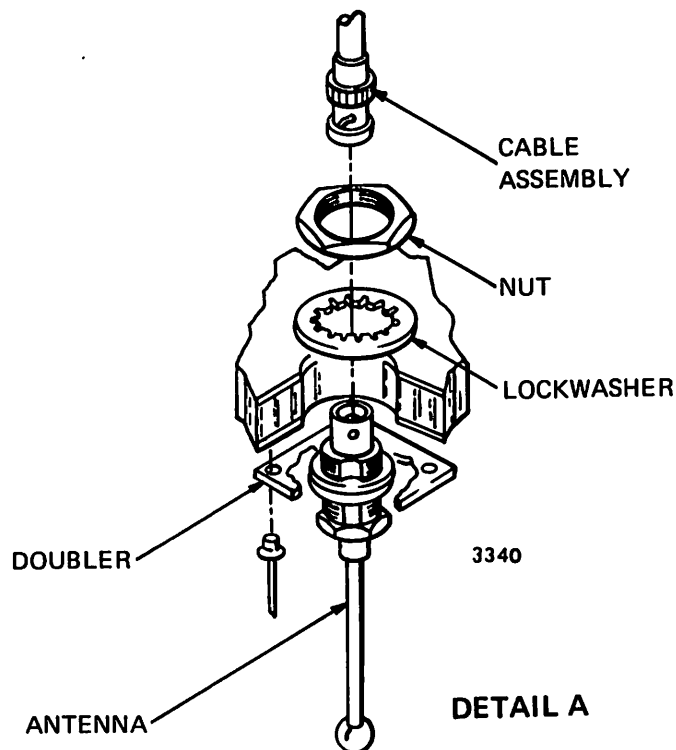
- (1) Ensure Master switch is OFF.
- (2) Position transponder antenna into mounting hole located at fuselage station 90.
- (3) Install nut securing antenna to the fuselage.
- (4) Apply Presstite putty sealant around attaching nut.
- (5) Connect coax cable to antenna.



TRANSPONDER



3527



DETAIL A

**Transponder Antenna Installation
Figure 201**

ADF SYSTEM – DESCRIPTION/OPERATION1. General

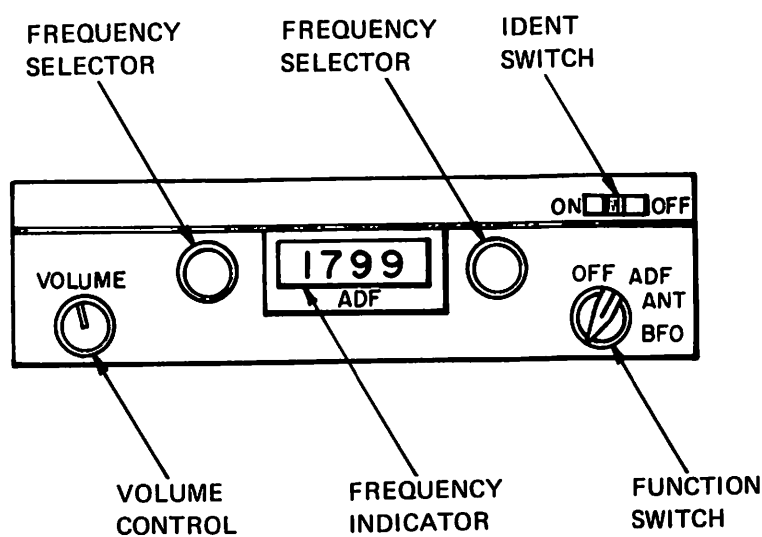
The automatic direction finder (ADF) system consists of a receiver, an indicator, R.F.I. filter, antennas, related cables, and associated wiring. The receiver and the indicator is located on the instrument panel. All operating controls for the ADF are located on the front of the receiver and the indicator.

Several different models of ADF equipment are available for installation in the aircraft. Two different models are described in this section.

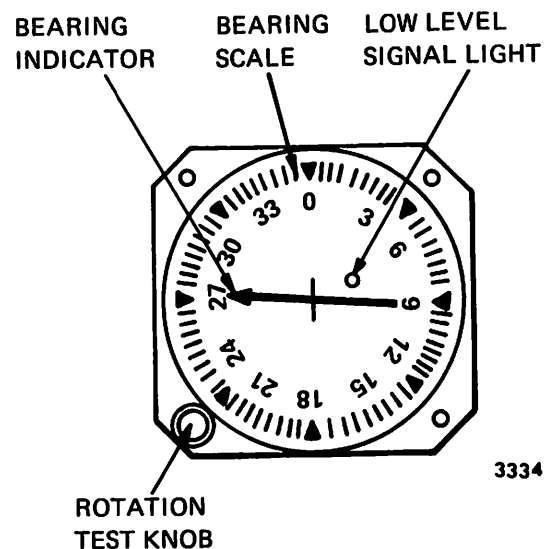
2. NARCO ADF 140/ADF #101 Automatic Direction Finder

The NARCO ADF 140/ADF 101 automatic direction finder, Figure 1, is an airborne radio receiver that indicates the relative direction to the station to which it is tuned. The ADF 140 receives and detects the radio signal, and the bearing information is displayed on the ADF 101 indicator.

The ADF receives signals in the frequency range of 200-1799 KHz with individual frequencies tuned in increments of 1 KHz.



ADF 140 RECEIVER

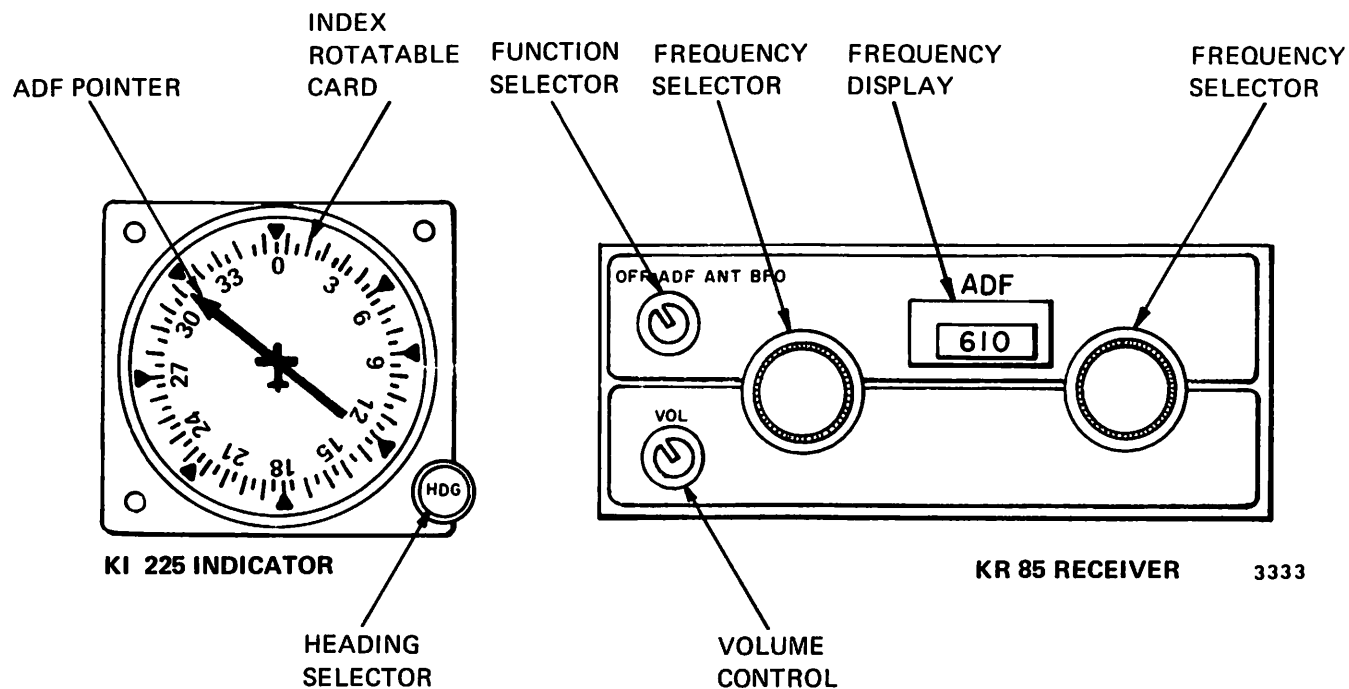


ADF 101 INDICATOR

NARCO ADF 140/ADF 101 Automatic Direction Finder
Figure 1

3. King KR 85/KI 225 Automatic Direction Finder

The King KR 85 Automatic Direction Finder (Figure 2) is a digitally tuned solid state receiver which provides aural reception and bearing information capability within the frequency range of 200 KHz to 1699 KHz. The channels may be selected in 1 KHz increments. The KR 85 is capable of automatic needle stowage. This is, when the function selector is turned to the "ANT" function the needle automatically seeks the 90° position and then turns off the servo system so that all pointing functions are discontinued.



King KR 85/KI 225 Automatic Direction Finder
Figure 2

ADF SYSTEM – MAINTENANCE PRACTICES

1. Removal/Installation of ADF Indicator

A. Remove Instrument Panel Mounted Indicator

- (1) Remove screws securing deck assembly to instrument panel.
- (2) Raise deck assembly and tape to windshield.
- (3) Disconnect electrical wiring from rear of ADF indicator to instrument panel and remove indicator.

B. Install Instrument Panel Mounted Indicator

- (1) Position indicator in place on instrument panel and install three mounting screws.
- (2) Connect electrical wiring to rear of indicator.
- (3) Position deck assembly in place and install screws securing deck assembly to instrument panel.

2. Removal/Installation of ADF Receiver

A. Remove Receiver

- (1) Ensure that master power switch is in the OFF position.
- (2) Locate ADF receiver in avionics panel on the instrument panel.
- (3) Loosen ADF receiver unit by turning locking screw (allen) clockwise. Use 5/64 in. hex wrench (allen).

CAUTION: DO NOT PULL ADF RECEIVER FREE FROM INSTRUMENT PANEL BY GRASPING THE CONTROL KNOBS.

- (4) Pull the ADF receiver unit straight forward. Be extremely careful not to bend connector pins. A slight left to right movement might help to release unit from connector plug.

B. Install Receiver

- (1) Ensure that master power switch is OFF.
- (2) Slide ADF receiver unit into mounting position on instrument panel. Be extremely careful not to bend connector pins.
- (3) Secure ADF receiver unit to mounting case by turning locking screw (allen) counterclockwise. Use 5/64 in. hex wrench (allen).

3. Removal/Installation of ADF Sensor Loop Antenna (See Figure 201.)

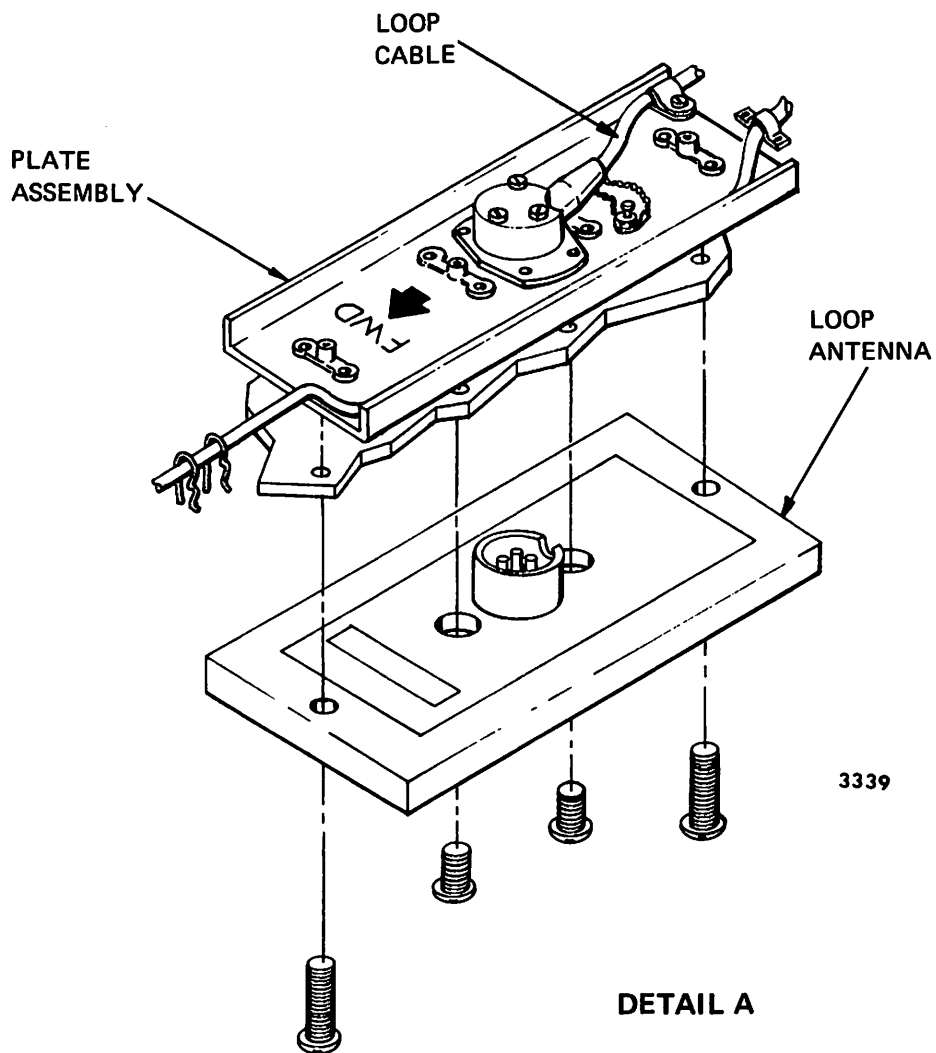
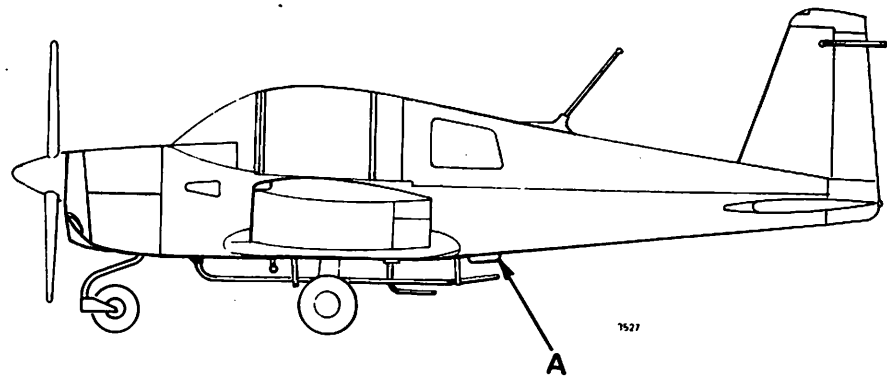
A. Remove ADF Loop Antenna

NOTE: This procedure is typical for ADF equipment furnished by either NARCO or King.

- (1) Ensure master power switch is OFF.
- (2) Locate ADF loop antenna on bottom of fuselage at station 147.1.
- (3) Remove two screws attaching loop antenna to fuselage and loop cable and plate assembly.
- (4) Disconnect loop antenna from loop cable.
- (5) Remove two screws attaching loop cable and plate assembly to fuselage.
- (6) Remove carpet and access cover on baggage compartment floor.
- (7) Through access opening, remove loop cable and plate assembly.

B. Install ADF Loop Antenna

- (1) Ensure that master power switch is in the OFF position.
- (2) Through access hole in baggage compartment floor, align loop cable and plate assembly with holes in fuselage floor at station 147.1. Make sure arrow on plate points to the forward end of the aircraft.
- (3) On outside of fuselage, install two screws attaching loop cable and plate assembly to fuselage.
- (4) Making sure arrow on loop antenna points to the forward end of the aircraft, plug loop antenna into loop cable receptacle.
- (5) Install two screws attaching loop antenna to fuselage and plate assembly.
- (6) Install access cover to baggage compartment floor and secure carpet to floor.



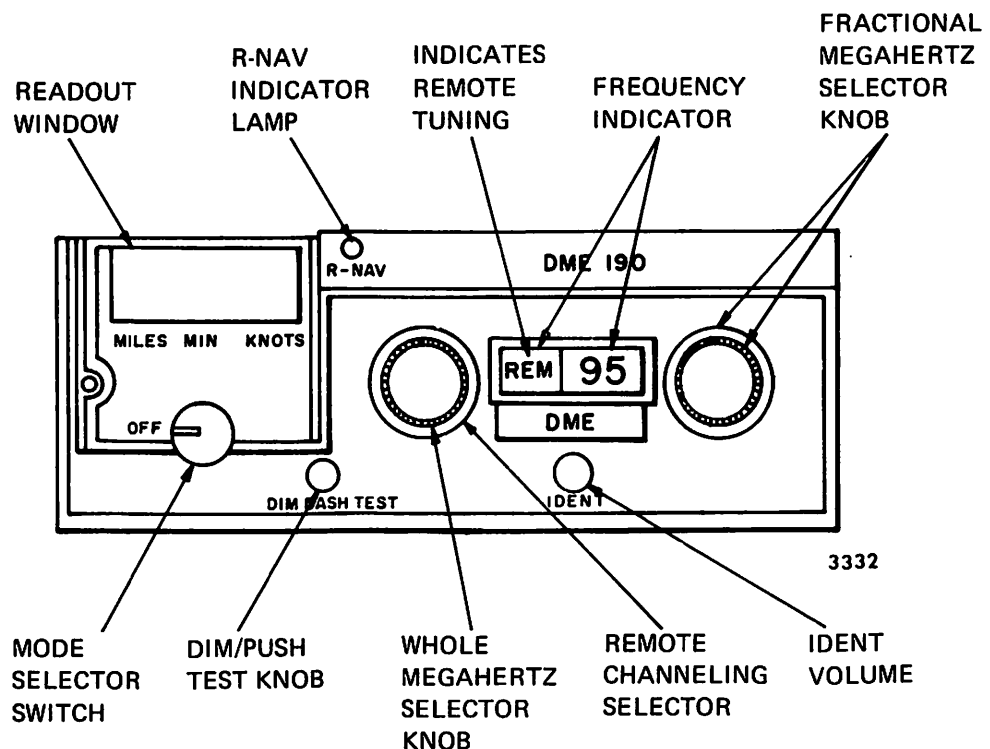
**ADF Sensor Antenna Installation
Figure 201**

DME SYSTEM – DESCRIPTION/OPERATION

1. General

A typical Distance Measuring Equipment (DME) system consists of a panel mounted 200 channel UHF transmitter-receiver and an externally mounted antenna. The transceiver has a single selector knob that changes the DME's mode of operation to provide the pilot with: distance-to-station, time-to-station, or ground speeds up to 250 knots and has a maximum slant range of 199.9 nautical miles. Depending upon type of equipment installed it is possible to channel DME system from a remote location.

All operating controls for the DME are mounted on its front panel. The DME 190 shown in Figure 1 depicts a typical installation.



NARCO DME 190 Distance Measuring Equipment
Figure 1

DME SYSTEM – MAINTENANCE PRACTICES**1. Removal/Installation of DME Transmitter-Receiver****A. Remove DME Transmitter-Receiver**

- (1) Locate DME transmitter-receiver in instrument panel.
- (2) Ensure that master power switch is OFF.
- (3) Turn locking screw (allen) clockwise to release DME unit from its mounting case. Use 5/64 inch hex wrench (allen).

CAUTION: DO NOT PULL DME TRANSMITTER-RECEIVER FREE OF MOUNT BY GRASPING THE CONTROL KNOBS.

- (4) Grasp the body of the transmitter-receiver and with a slight rocking motion while pulling outward, free receiver from connector plug and slide receiver from instrument panel mount.

B. Install DME Transmitter-Receiver

- (1) Ensure that master power switch is OFF.
- (2) Grasp the transmitter-receiver by the sides and carefully slide transmitter-receiver into instrument panel mount until connector plug is fully engaged.
- (3) Turn locking screw (allen) counterclockwise to secure DME unit to its mounting case. Use 5/64 inch hex wrench (allen).

VOR SYSTEM – DESCRIPTION/OPERATION1. General

The primary and most widely used system of navigation in the United States today is the very high frequency omni directional range (VOR). The VOR System consists of both ground stations and airborne radio equipment. This chapter defines and discusses the airborne portion of the system only. A more detailed coverage of the use and procedures applicable to the VOR system is presented in the manufacturer's technical data.

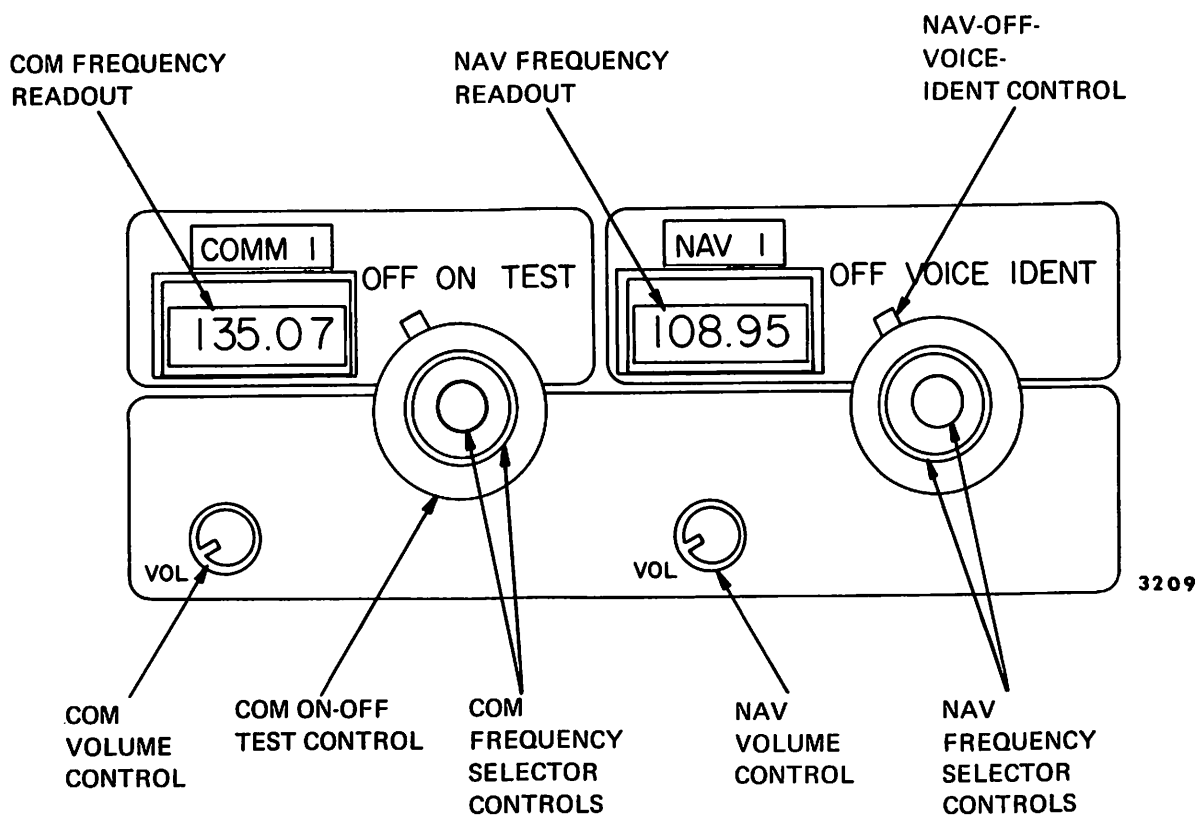
The VOR receivers exist in a variety of forms. One type now in use is the NAV/COM set which combines both the communication and navigation functions. One part of this set is a radio transceiver, the other a navigation receiver with a separate VOR indicator.

Other sets in use incorporate a receiver with an indicator built into the control panel as an integral part of the set. Another widely used unit is the combination VOR receiver and indicator. The AA-1C uses equipment distributed by different manufacturers. The NARCO and King VOR receivers and indicators are described in this section.

2. King KX 170B/175B NAV/COM Transceiver

The King KX 170B/KX 175B NAV/COM combines, in a single panel mounted unit, a 720 channel VHF COM transceiver and an independent 200 channel VHF NAV receiver. The NAV receiver supplies VOR/LOC information to navigational converters and provides frequency selection for remote mounted distance measuring equipment and glideslope receivers.

All operating controls for the transceiver are mounted on its front panel and identified in Figure 1.



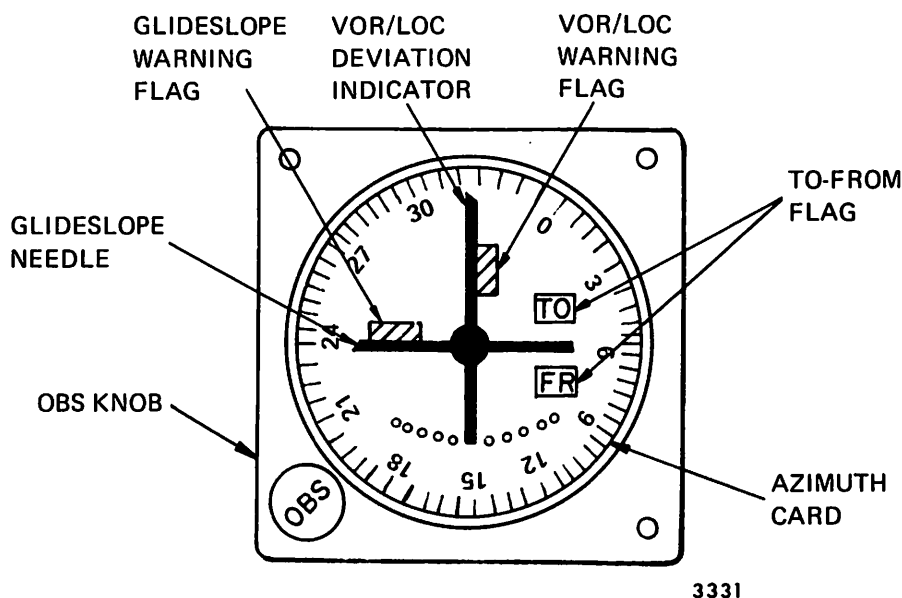
King KX 170B/KX 175B NAV/COM Transceiver
Figure 1.

3. King KI 201C/211C/214C VOR/LOC-GS Indicator

The King KI 201C/211C VOR indicator is designed to operate with VHF navigational equipment such as the KX 170A/B or KX 175B to provide OMNI (VOR) or LOCALIZER (LOC) information. The VHF navigational receiver receives and detects the OMNI or LOCALIZER information. The KI 201C converts this information to DC signals which drive the LEFT-RIGHT needle and the TO-OFF-FROM flag of the visual indicator.

The KI 214 ILS indicator performs the same functions as the KI 201C. In addition, it contains a 40 channel glideslope receiver and the visual indicators include an UP-DOWN glideslope needle with an OFF warning flag.

All operating controls for the indicator are mounted on its front panel and are identified in Figure 2.



King KI 201C/211C/214C VOR/LOC-GS Indicator
 Figure 2

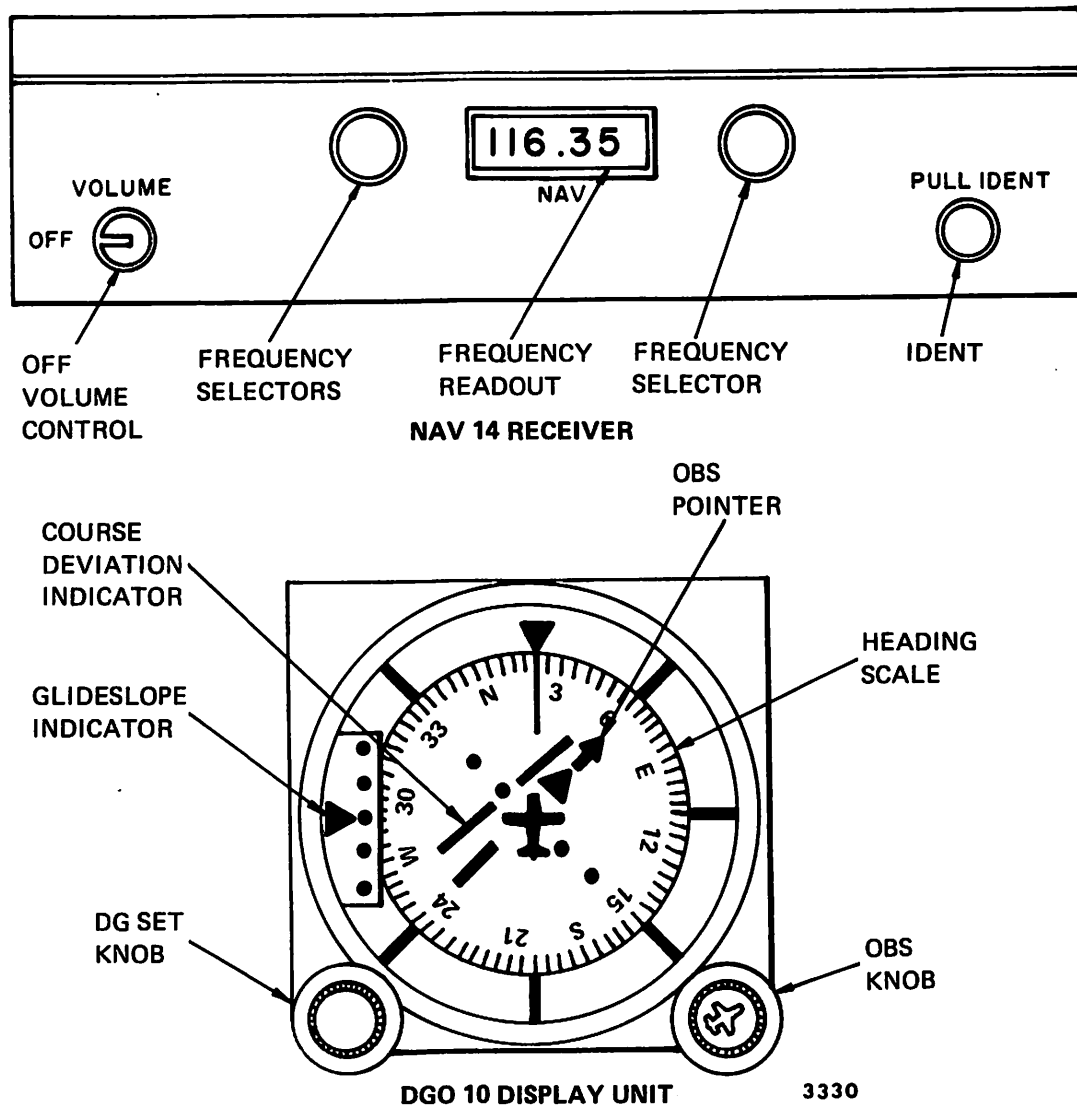
4. NARCO NAV 14 Navigation Receiver and DGO 10 Display Unit

The NARCO NAV 14 is a fully independent NAV receiver designed to drive the DGO 10 pictorial navigation display.

The NAV 14 and DGO 10 provide the following:

- A. 200 channel navigation receiver (108.00 to 117.95 MHz).
- B. 160 channel backup communication receiver (118.00 to 125.95 MHz).
- C. Remote DME channeling capability.
- D. VOR/LOC presentation.

All operating controls for the NAV 14 and DGO 10 are mounted on their front panels and are identified in Figure 3.



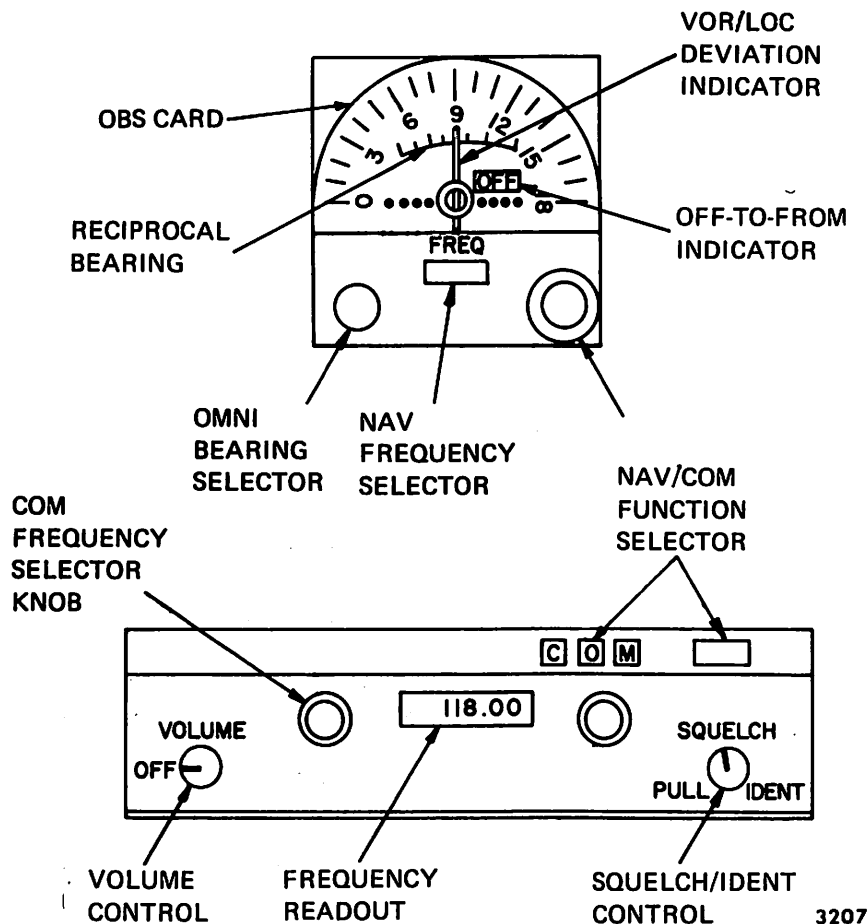
NARCO NAV 14 Navigation Receiver and DGO 10 Display Unit
Figure 3

5. NARCO NAV 10/COM 10 () System

The NARCO NAV 10/COM 10 () system consists of two separate panel mounted units. These units are treated as a system because the NAV 10 is dependent upon the COM 10 () for receiver circuitry. The mode of operation is determined by the function selector switch located on the COM 10 () unit. This section describes the operation of the navigation portion only, see Chapter 23 for description of the VHF communication section.

The system is capable of receiving 200 VHF navigation channels from 108.00 MHz through 117.95 and for localizer information between 108.10 MHz and 111.95 MHz. When localizer channel (frequency) is selected, the indicator needle shows left or right deviation from runway centerline.

All operating controls for the system are located on the front panels and are identified in Figure 4.



NARCO NAV 10/COM 10 () Units
Figure 4

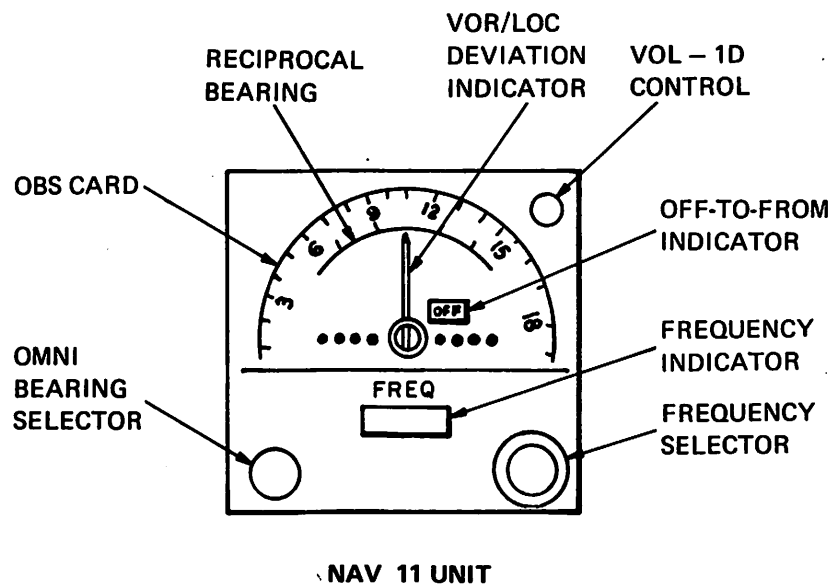
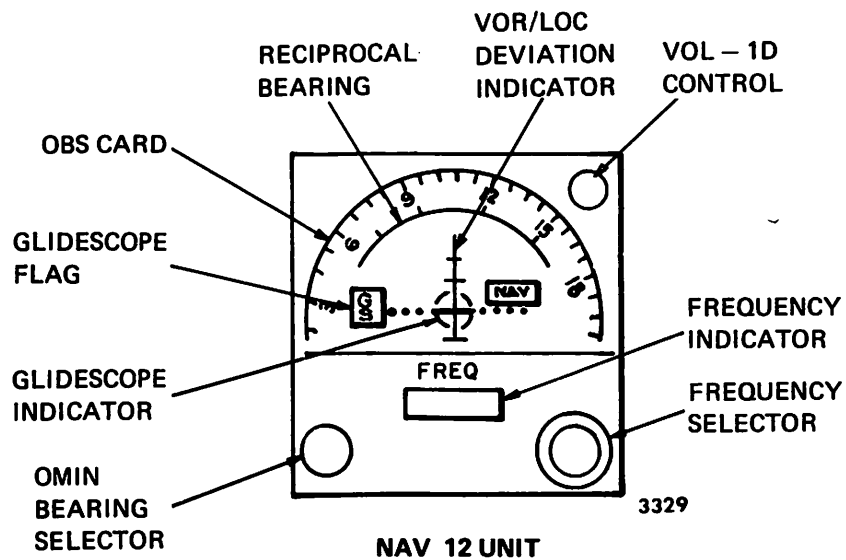
6. NARCO NAV 11-NAV 12 Navigation System Unit

The NARCO NAV 11-NAV 12 navigation system consists of a panel-mounted unit that provides navigational information. The NAV 11 and NAV 12 systems are similar with regard to VOR reception. The NAV 12 system has the added capability of receiving and displaying glideslope information to enable full ILS approaches rather than the localizer only approaches possible with the NAV 11.

The NAV 11 system receives and displays VOR stations as follows: Even tenths between 108.00 and 111.85 MHz and all channels 112.00 through 117.95 MHz. In addition, it receives and displays localizer channels (odd tenths, 108.10 through 111.95 MHz).

The NAV 12 system receives and displays the same VOR and ILS localizer signals as the NAV 11 system. In addition, the NAV 12 system receives and displays the UHF glideslope signals to provide full ILS approach display.

All operating controls for the navigation system are located on its front panel and are identified in Figure 5.



**NARCO NAV 11 NAV 12 Navigation System Units
Figure 5**

NAVIGATION (VOR) SYSTEM – MAINTENANCE PRACTICES

1. Removal/Installation of Navigation (VOR) System Units

NOTE: When removing or installing avionics equipment always ensure that the Master power switch is OFF.

A. Removal of Navigation Transceiver Unit

- (1) Locate, on the instrument panel, the transceiver used for navigation.
- (2) Turn locking screw (allen) clockwise to release transceiver unit from its mounting case. Use 5/64 hex wrench (allen).
- (3) Pull unit straight out. Be extremely careful not to bend connector pins. A slight left to right movement might help to release unit from connector plug.

NOTE: Do not use front panel controls as handles in removing unit from instrument panels.

B. Installation of Navigation Transceiver Unit

- (1) Slide the transceiver unit straight forward into its mounting case. Ensure connector plug is fully engaged. Be extremely careful not to bend connector pins.
- (2) Turn locking screw (allen) counterclockwise to secure transceiver unit to its mounting case. Use 5/64 inch hex wrench (allen).

C. Removal of Navigation (OMNI Head) Unit

- (1) Remove screws securing deck assembly to instrument panel.
- (2) Raise deck assembly and tape to windshield.
- (3) Disconnect electrical plug from rear of navigation unit that is to be removed.
- (4) Remove the mounting hardware securing navigation unit to instrument panel.
- (5) Remove navigation unit.

D. Installation of Navigation (OMNI Head) Unit

- (1) Position navigation unit in place on instrument panel and install mounting hardware securing unit to instrument panel.
- (2) Connect electrical plug to rear of navigation unit.
- (3) Position deck assembly in place and install screws securing deck assembly to instrument panel.

2. Removal/Installation of NAV Antenna (See Figure 201.)

A. Removal of NAV Antenna

- (1) Ensure the master power switch is OFF.
- (2) Remove rudder tip, to gain access to NAV antenna connections.

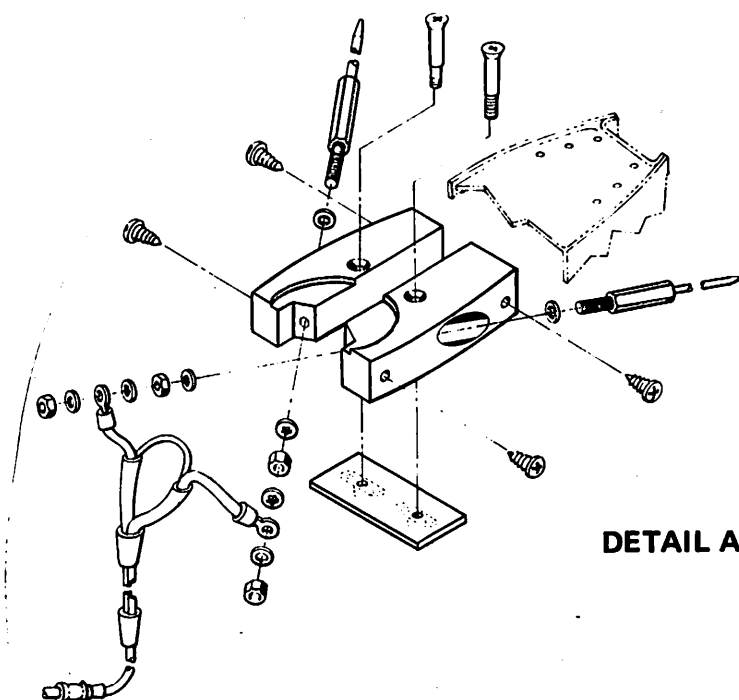
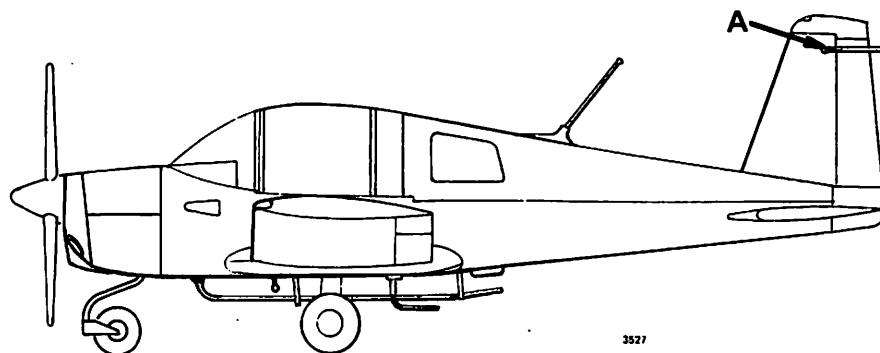
NOTE: Be careful not to damage flashing beacon assembly.

- (3) Locate NAV antenna at top of vertical stabilizer.
- (4) Disconnect cable assembly from antenna rods and remove antenna rods.

NOTE: Do not allow cable assembly to drop down inside vertical stabilizer.

B. Installation of NAV Antenna

- (1) Ensure the master power switch is OFF.
- (2) Insert antenna rod ends into mounting block.
- (3) Connect cable assembly to antenna rods.
- (4) Replace rudder tip.



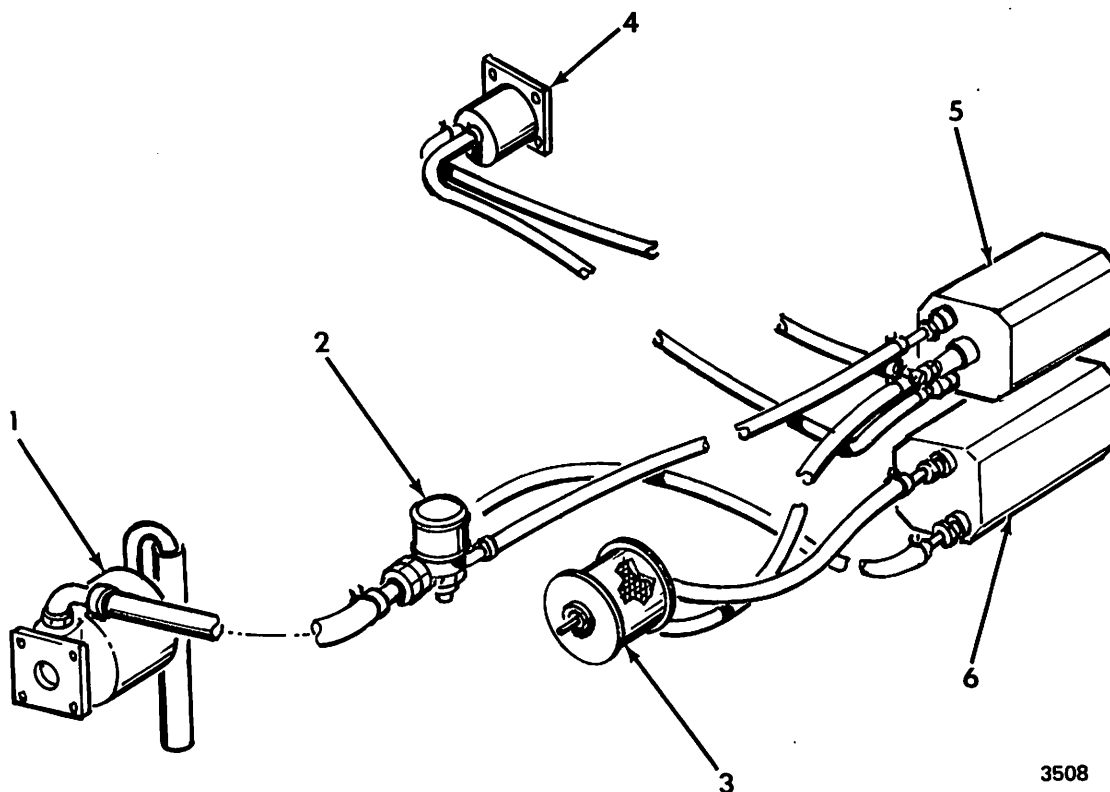
NAV Antenna Installation
Figure 201

CHAPTER 37**VACUUM SYSTEM****TABLE OF CONTENTS**

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General	1
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VACUUM SYSTEM – DESCRIPTION/OPERATION1. General (See Figure 1.)

The vacuum system consists of an engine driven vacuum pump, vacuum regulator, filter, directional gyro, horizon gyro and a suction gauge, plus necessary tubing and fittings. Since the vacuum pump is of the dry type, no oil separator is required.



1. Engine Driven Vacuum Pump
2. Vacuum Regulator
3. Vacuum Filter

4. Suction Gauge
5. Horizon Gyro
6. Directional Gyro

Vacuum System
Figure 1

VACUUM SYSTEM – TROUBLE SHOOTING**1. Vacuum System Trouble Shooting**

Trouble shoot the vacuum system as follows:

TROUBLE	PROBABLE CAUSE	REMEDY
No Vacuum	Pump Inoperative Gauge Inoperative Totally Plugged Central Filter Collapsed Suction Hose	Replace Replace Replace Replace
Low Vacuum	Partially Plugged Central Filter Partially Collapsed Suction Hose Improperly Set Regulator	Replace Replace Adjust
Erratic Vacuum	Oil in Pump Engine Oil Seal Defective	Replace Replace
High Vacuum Gyro Gauge Follows Engine RPM	Improperly Set Regulator Foreign Material on Regulator Seat	Adjust Release Tension on Regulator, Adjust Screw, Remove Material, Reset.
	Regulator Inoperative	Replace
Gauge Reading O.K. Gyros won't Erect	Gyro(s) Inoperative	Replace Gyro(s)
Gauge Reading O.K. Gyros Tumble/Precess	Gyro(s) Defective	Replace Gyro(s)
Gyro Gauge Indicates Frequent Need for Regulator Adjustment	Central Filters Nearly Plugged	Replace Filters Readjust Regulator
Frequent Pump Replacement	Partially Restricted Pump Discharge or Restricted (Kinked) Suction Hose.	Replace Hose
	Incorrect Pump for Engine or System	Replace with correct pump
Pump Oily	Defective Engine Drive Seal	Replace Seal
No Vacuum at Low RPM Vacuum O.K. High RPM	Oil in Pump Suction Hose Cut (Crimped)	Replace Pump Replace Hose

VACUUM SYSTEM – MAINTENANCE PRACTICES**1. Adjustment/Test****A. Operational Test**

NOTE: It is necessary to operate the aircraft engine in order to operationally test the vacuum system.

WARNING: ENSURE THAT PROPELLER AREA IS CLEAR PRIOR TO STARTING ENGINE.

- (1) Start engine in accordance with Pilot's Operating Handbook.
- (2) Set engine speed to 2100 RPM.
- (3) Check that suction gauge indicates between 4.6 and 5.4 in. Hg., and that vacuum-driven gyro instruments (directional gyro and artificial horizon) operate properly.
- (4) Vary engine speed between 2100 and 2400 RPM.
- (5) Check that suction gauge indicates between 4.6 and 5.4 in. Hg. for all power settings.
- (6) Shut down engine in accordance with Pilot's Operating Handbook.

DISTRIBUTION SYSTEM – DESCRIPTION/OPERATION

1. General

The distribution system consists of the engine driven vacuum pump, the vacuum regulator, the vacuum filter, and the lines necessary to route the vacuum to the instruments being driven.

- A. When installing a dry air pump, fitting installation or removal should be accomplished with a few good mechanical practices:
- (1) Always be sure lines (and hoses) are clean and free of any debris, oils or solvents.
 - (2) Replace any hard or brittle hose, particularly on the pump inlet, as sections of the inner layers may come off and cause a pump failure.
 - (3) If anti-seize is used on fittings, always omit the first two lead threads. A recommended compound is spray silicone or Moly-Lube.
 - (4) Never over-torque the fittings while installing. Install fittings hand tight, then with a box wrench tighten to the desired position. A maximum of 1-1/2 turns beyond hand tight.
 - (5) Never place the pump directly in a vise to install or remove fittings. Place pump, with drive coupling down, in a jaw protected vise. Place clamps across the mounting flange only. Clamping across the center housing will cause an internal failure of the carbon rotor.
- B. When installing a dry air pump, always use a new mounting gasket. Always torque the four pump mounting nuts to 40-50 in. lbs even if it means removing an adjacent appliance. Never use a pump that has been dropped.
- C. Always verify that the pump is the correct one for the engine and/or system. Consult the airframe manufacturer's current parts manual, Airborne Applications List and the PMA label on the pump box. If improper application is suspected or questions arise, check with the Dealer's Service Department.
- D. Never attempt modifications to system components. Unauthorized alterations may cause additional problems and does void any warranty.
- E. Do not add items in a pneumatic system unless it is an approved change.
- F. Consult service instructions for specific settings or adjustments.

DISTRIBUTION SYSTEM – MAINTENANCE PRACTICES

1. Servicing

A. Regulator Filter

Refer to Chapter 12 for regulator filter servicing.

B. System Filter

Refer to Chapter 12 for system filter servicing.

2. Removal/Installation

A. Pump Removal (See Figure 201.)

- (1) Using a clamp removal tool, remove spring clamp from vacuum line at pump.
- (2) Remove vacuum line from pump.
- (3) Remove the four nuts and washers securing pump to engine accessory pad.
- (4) Pull pump from engine.
- (5) Remove gasket and discard.
- (6) Cover opening in accessory pad to prevent foreign material from entering engine.

B. Pump Installation

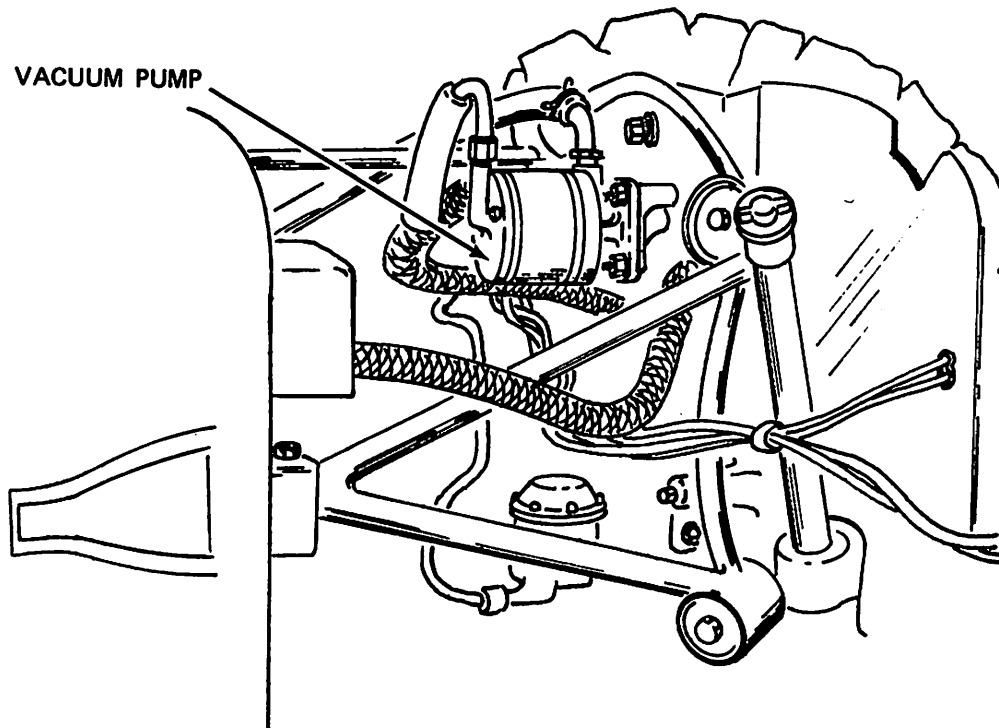
- (1) Position pump and new gasket on engine accessory pad as shown in Figure 201. Rotate pump slightly so that its splined shaft mates with female spline in engine.
- (2) Slide pump onto its mounting studs on engine accessory pad. Secure pump to engine with the four nuts and washers. Torque to 40-50 in. lbs.
- (3) Install line on vacuum pump and secure with hose clamp.

C. Regulator Removal (See Figure 202.)

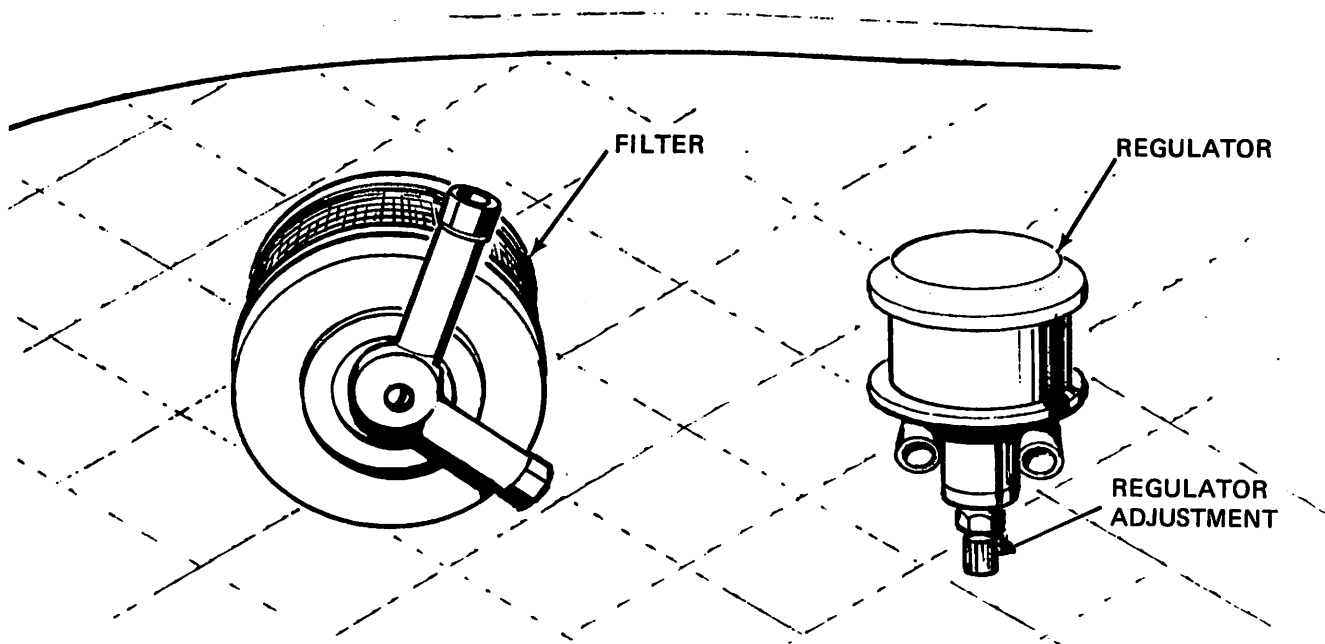
- (1) Using a clamp removal tool, remove spring clamps from three hoses on regulator.
- (2) Remove hoses from regulator.
- (3) While holding regulator to prevent it from turning, use a one inch open end wrench to remove nut securing regulator on firewall.
- (4) Remove regulator from inside aircraft.

D. Regulator Installation

- (1) Position regulator as shown in Figure 202.



**Vacuum Pump Removal/Installation
Figure 201**



**Regulator and Filter Removal and Installation
Figure 202**

(2) Install nut on firewall side and torque to standard value. Refer to Chapter 91.

(3) Install the three hoses and secure with spring clamps.

E. Filter Assembly Removal (See Figure 202.)

(1) Using a clamp removal tool, remove spring clamps from two hoses on filter assembly.

(2) Remove hoses from the filter assembly.

(3) While holding filter to prevent its turning, use a 7/16 in. wrench to remove nut securing filter to firewall.

(4) Remove filter assembly from inside aircraft.

F. Filter Assembly Installation

(1) Position filter assembly as shown in Figure 202.

(2) While holding filter to prevent its turning install nut and washers on bolt securing it to firewall. Torque nut to standard value. Refer to Chapter 91.

(3) Install hoses on filter assembly and secure with clamps.

3. Adjustment/Test

A. Regulator Adjustment

NOTE: It is necessary to operate the aircraft engine in order to adjust the regulator.

WARNING: ENSURE THAT PROPELLER AREA IS CLEAR PRIOR TO STARTING ENGINE.

(1) Start engine in accordance with Pilot's Operating Handbook.

(2) Adjust engine speed to 2200 RPM.

(3) Adjust regulator adjustment (Figure 202) for an indication of 5.0 in. Hg. on suction gauge.

(4) Vary engine speed from 2100 RPM to 2400 RPM and ensure that suction gauge indication remains between 4.6 and 5.4 in. Hg. If necessary, readjust regulator adjustment to ensure that proper range of vacuum is obtained.

(5) Bend locking tabs or safety wire to secure regulator adjustment.

(6) Shut down engine in accordance with Pilot's Operating Handbook.

**INDICATING SYSTEM – DESCRIPTION/OPERATION****1. General**

The indicating system consists of the suction gauge and the lines attaching it to the other vacuum system components.

INDICATING SYSTEM – MAINTENANCE PRACTICES**1. Removal/Installation****A. Suction Gauge Removal**

- (1) Remove glareshield/deck as described in Chapter 25.
- (2) Using a clamp removal tool, remove spring clamp from vacuum line(s) attached to suction gauge.
- (3) Remove two Phillips screws securing suction gauge.
- (4) Remove suction gauge from aircraft.
- (5) Cap all open lines.

B. Suction Gauge Installation

- (1) Install gauge in instrument panel and secure with two Phillips screws.
- (2) Install hose(s) on rear of suction gauge, and secure with spring clamp(s).
- (3) Reinstall glareshield/deck as described in Chapter 25.
- (4) Perform Operational Check per Section 37-0, this Chapter.

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Painting Metal Surfaces

208



DOORS – DESCRIPTION/OPERATION

1. General

The doors covered in this chapter consist of a sliding canopy that provides access to the pilot and passenger seats.

**CANOPY – DESCRIPTION/OPERATION****1. General**

The canopy consists of a formed plexiglass structure, mounted on tracks extending along the sides of the fuselage. When positioned in its aft limit of travel the canopy opening provides an entry opening approximately 27 inches in area. This allows entry into both front seats of the airplane. The canopy is held in the closed (forward) position by a latch mechanism that can be actuated by handles from either inside or outside the airplane. A key actuated lock is provided to lock the canopy from outside the aircraft.

CANOPY – MAINTENANCE PRACTICES

1. Servicing

A. Rail Lubrication

WARNING: USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

- (1) Use isopropyl alcohol and a small brush to clean the teflon runners inside the canopy outer tracks. Ensure that the tracks are clean and free of residue.
- (2) Inject a small amount of non oil base spray lubricant (E-Z-Free by XIM Products, Inc., 1169 Bassett Rd., Westlake, Ohio 44145, or equivalent) into the sliding surfaces.
- (3) Open and close the canopy several times to distribute the lubricant.

B. Latch Lubrication

Lubricate latch in accordance with Chapter 12.

2. Removal/Installation

A. Canopy Removal (See Figure 201.)

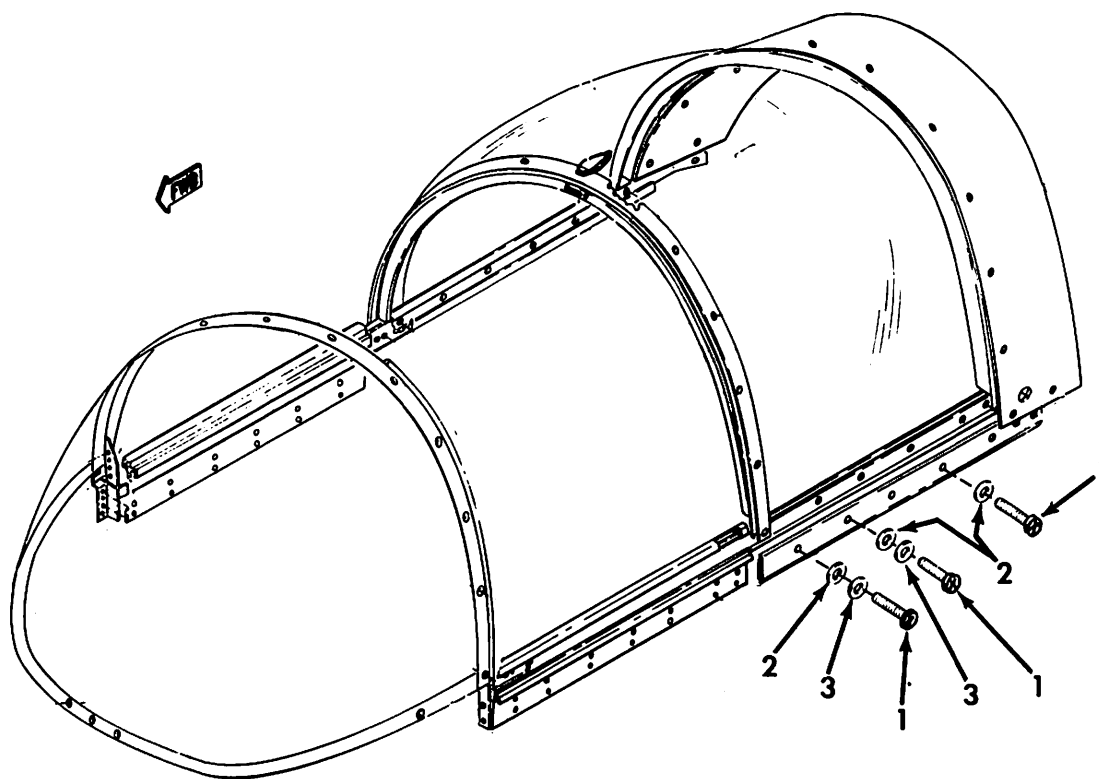
- (1) Remove row of Phillips screws (1) and washers (2 and 3) on each side of canopy.
- (2) Lift canopy straight up and remove from aircraft.

B. Canopy Installation (See Figure 201.)

- (1) Lower canopy straight down and align holes in canopy with holes in rails.
- (2) Install row of Phillips screws (1) and washers (2 and 3) through canopy into track and tighten to 10 ± 2 inch-pounds.

C. Canopy Latch Removal (See Figure 202.)

- (1) Remove roll pin (1) and pull handle (2) from handle assembly (3) shaft.
- (2) Pull bearing (4) from shaft.
- (3) Remove screws (5) from canopy and pull latch assembly from canopy.
- (4) Remove screws (6) and separate halves of block assembly (7).
- (5) Pull handle assembly (3) from block assembly (7) and remove bearings (8) from block assemblies (7).
- (6) Remove screws (9), nuts (10), and washers (11).
- (7) Remove shim (12) and bearing block (13) from windshield bow.

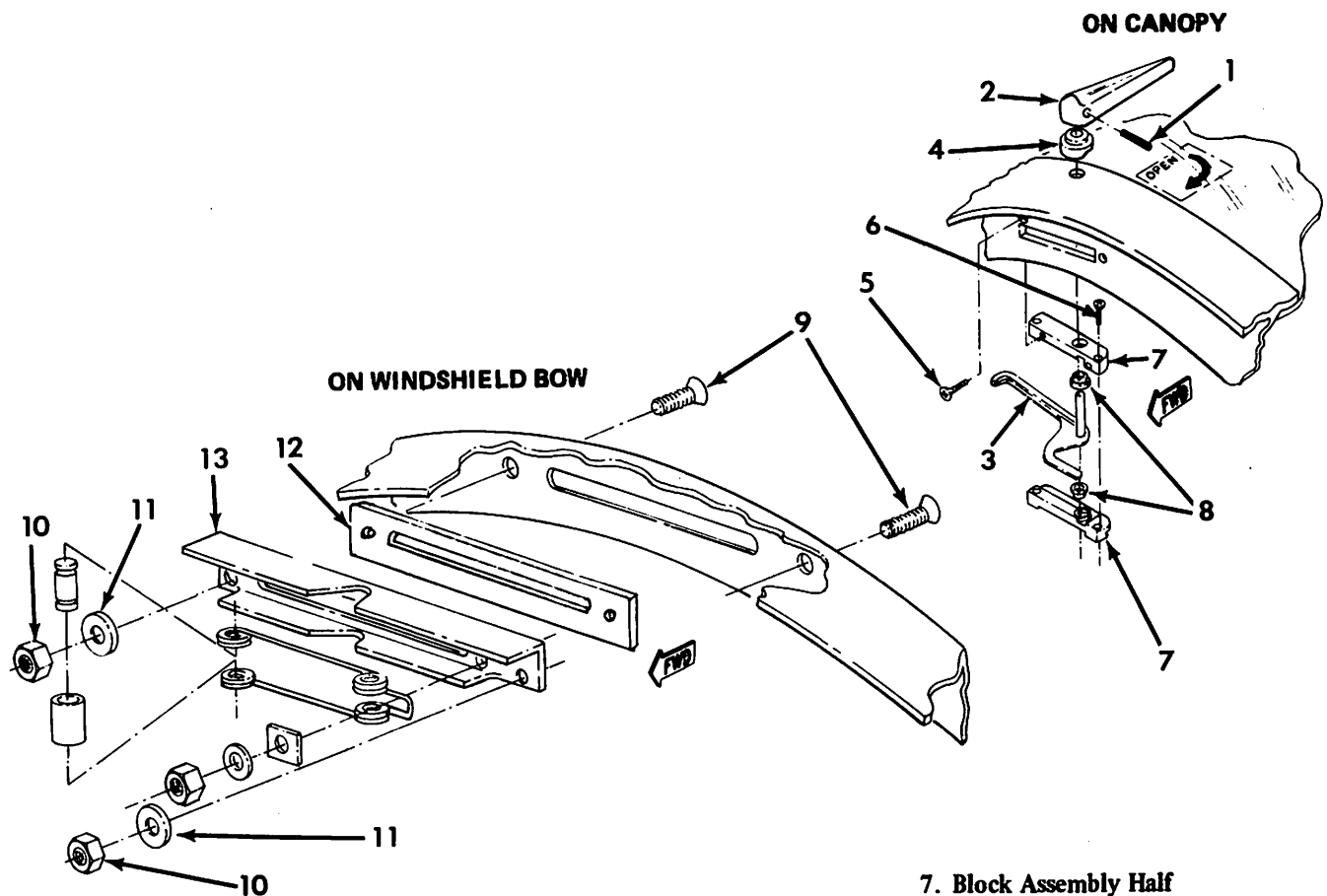


1. Screw

2. Washer

3. Washer

**Canopy Removal/Installation
Figure 201**



- 1. Roll pin
- 2. Handle
- 3. Handle Assembly
- 4. Bearing
- 5. Screw
- 6. Screw

- 7. Block Assembly Half
- 8. Bearing
- 9. Screw
- 10. Nut
- 11. Washer
- 12. Shim
- 13. Bearing Block

**Canopy Latch Removal/Installation
Figure 202**

D. Canopy Latch Installation (See Figure 202.)

- (1) Position bearing block (13) and shim (12) so that their mounting holes align with those in windshield bow. Secure with screws (9), washers (11), and nuts (10).
- (2) Place bearings (8) in block assemblies (7).
- (3) Place ends of handle assembly (3) shaft in block assemblies (7) and secure block assemblies (7) together with screws (6).
- (4) Insert shaft of handle assembly (3) through access hole in canopy and place bearing (4) on shaft.
- (5) Place handle (2) on shaft and secure with roll pin (1).

E. Rear Seal Removal/Installation

WARNING: USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

NOTE: Methyl Ethyl Ketone (MEK) will attack the paint on the surfaces to which the seal is cemented. After removal of the seal, it will be necessary to repaint this area prior to installation of a new seal.

- (1) Use a cloth moistened with Methyl Ethyl Ketone to soften cement holding the seal to the canopy.
- (2) Use a fiber scraper to lift the seal as the cement softens and slowly peel the seal from canopy.
- (3) Use the moistened cloth to remove remaining cement from canopy.
- (4) Clean and repaint area of seal on canopy. Refer to Chapter 20. Allow paint to dry thoroughly prior to installing a new seal.
- (5) Cement new seal (Part No. 1803-4) to canopy with A851-B adhesive, B.F. Goodrich Inc., (or equivalent).

F. Front Seal Removal/Installation

- (1) Remove attaching hardware securing retainer to windshield bow.
- (2) Remove retainer.

WARNING: USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

NOTE: Methyl Ethyl Ketone (MEK) will attack the paint on the surfaces to which seal is cemented. After removal of the seal, it will be necessary to repaint this area prior to installation of a new seal.

- (3) Use a cloth moistened with Methyl Ethyl Ketone to soften cement holding seal.
- (4) Use a fiber scraper to lift seal as the cement softens and slowly remove seal.
- (5) Use the moistened cloth to remove remainder of cement.

- (6) Clean and repaint area of seal and allow to thoroughly dry prior to installing new seal.
- (7) Cement new seal to windshield bow using EC-180 or EC-847 from 3-M Company, or equivalent.
- (8) Install retainer using retained attaching hardware.
- (9) Adjust canopy latch (refer to Paragraph 3C, this Chapter) as required for proper seal.

G. Canopy Cable/Pulley System Removal (See Figure 203.)

- (1) Remove canopy per step 2A.
- (2) Remove screw (1) and washer (2).
- (3) Pull cables (3) from pulleys and remove cables from aircraft.
- (4) Remove nuts (4), washers (5), spacers (6), washer (7), and bolts (8) securing pulleys (9) and remove pulleys (9) from aircraft.

H. Canopy Cable/Pulley System Installation (See Figure 203.)

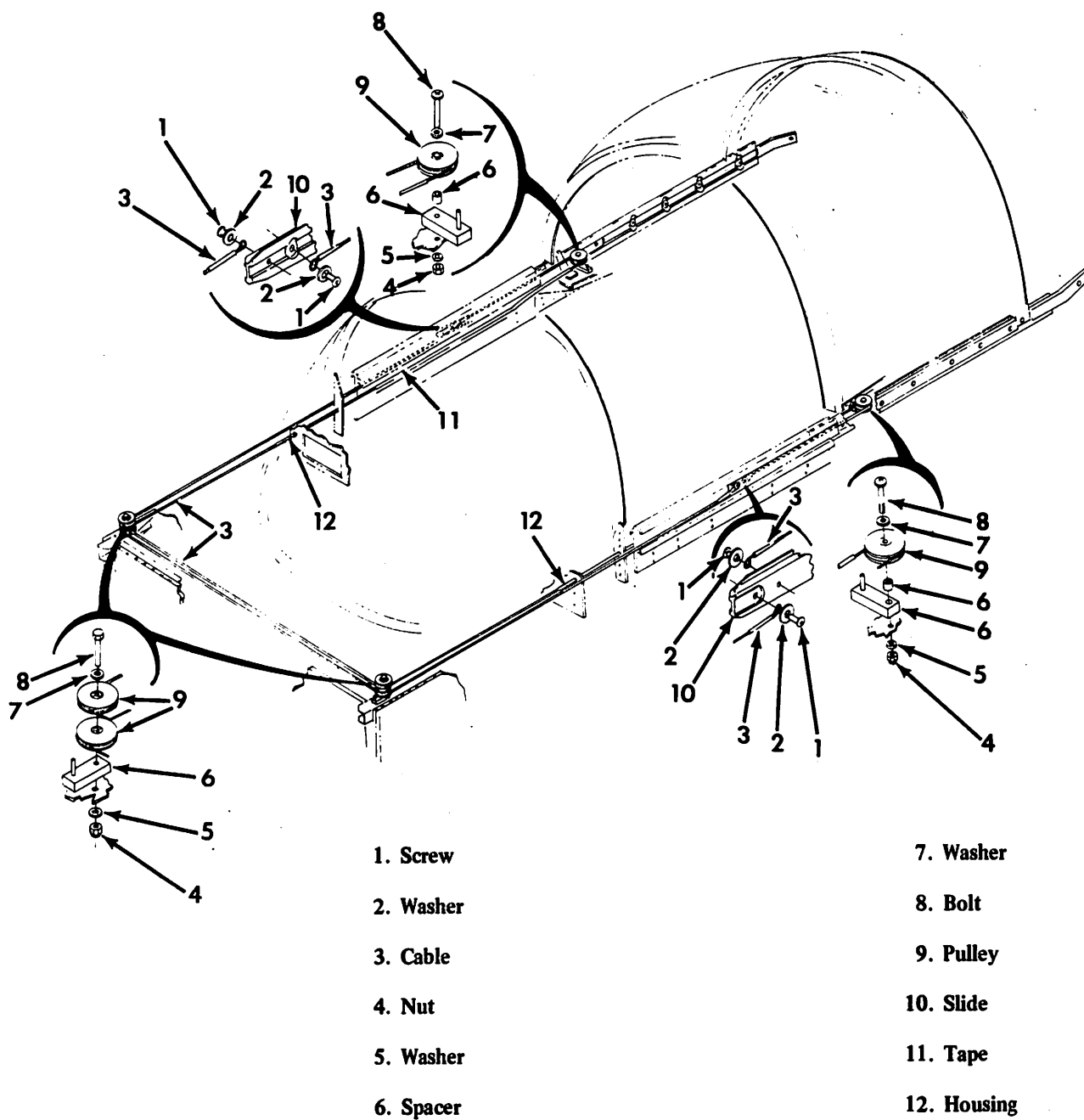
- (1) Place washer (7) on bolt (8), then place pulley (9) on bolt (8).
- (2) Place spacers (6) on bolt (8), and install bolt (8) in its attachment point.
- (3) Secure bolt (8) with washer (5) and nut (4).
- (4) Route cables (3) around pulleys (9) per Figure 203. Secure cables (3) to slides (10) with washers (2) and screws (1).
- (5) Place a piece of duct tape (11) over cable (3) on slide (10) as shown in Figure 203.
- (6) Install canopy per step 2B.
- (7) Adjust canopy per step 3B.

3. Adjustment/Test

A. Track Adjustment

Field experience has shown that after extended operation, the canopy may become difficult to open and close. The following suggestions are provided to aid in maintaining satisfactory freedom of operation of the canopy.

- (1) DO NOT use the canopy as a hand hold during entry to and exit from the aircraft as bending of the inner tracks can result.
- (2) The inner canopy tracks must be perfectly straight. If the tracks are bent, they should be straightened or replaced.



**Canopy Cable/Pulley System Removal/Installation
Figure 203**

- (3) The sliding surfaces of the canopy inner tracks and the teflon runners in the canopy outer tracks must be kept clean and lightly lubricated. Smoother operation may be achieved by cleaning the sliding surfaces with isopropyl alcohol and a small brush and then injecting a small amount of spray lubricant into the sliding surfaces. Production aircraft canopy tracks are lubricated with E-Z Free lubricant which is available in six or 16 ounce spray cans from Grumman American Supply Operations or from XIM Products, Inc. 1169 Bassett Road, Westlake, Ohio 44145.
- (4) If external cleaning and lubricating does not satisfactorily eliminate canopy sticking or binding, the canopy should be removed from the tracks and the tracks slid completely out of the aircraft. All sliding surfaces should then be carefully cleaned with isopropyl alcohol and relubricated with a very thin film of lubricant. If the teflon runners are galled or severely worn, they should be replaced. The teflon runners are secured in the outer tracks with roll pins, Esna Part Number 52-062-0500, inserted at the forward end of each channel.
- (5) A canopy track sizing tool, Part No. ST-1064, is available which may be used to resize the teflon runners when the tracks are removed for cleaning or when the teflon runners are replaced in the field. This tool is simply inserted into the outer track in place of the sliding inner track and forced through the entire length of the outer track to force the teflon runners tightly into the retaining channels. Properly installed teflon runners allow a 1/32 in. to 1/16 in. vertical clearance between the inner canopy track and the runners. This clearance can be checked with the canopy installed by moving it up and down and measuring the inner track movement. Clean lubricated teflon runners installed with the correct clearance are essential for smooth, free canopy operation.

B. Cable/Pulley System Adjustment (See Figure 203.)

The canopy cable/pulley system provides interconnecting cables and pulleys which force both sides of the canopy to move together, thus eliminating binding due to racking.

NOTE: Cable tension must be maintained to allow smooth operation of the canopy. Adjust cable tension by locating lower ends of canopy bow at an equal distance from lower ends of windshield bow and removing all slack from system at both outboard cable attach screws (1). If a cable is removed, install cable and rerig system as follows:

- (1) Wrap cable counterclockwise around inboard cable attach screw (1) and tighten screw. Looped end of cable to be approximately 2.25 inches from screw. Secure end with shrink tubing.
- (2) Install inner canopy track (11) and route cable aft around pulley, then forward through housing (12). If cable is being routed through left housing, position cable around upper forward pulleys; if cable is being routed through right housing, position cable around lower forward pulleys.
- (3) Install canopy.
- (4) Wrap cable counterclockwise around outboard cable attach screw (1) and tighten screw after removing all slack from system and ensuring squareness of canopy to windshield. Looped end of cable to be approximately 2.25 inches from screw. Secure end with shrink tubing.

C. Latch Adjustment

The canopy latch assembly can be adjusted for a tighter seal between the canopy and windshield by installing additional shims (12, Figure 202), as required.

4. Cleaning/Painting**A. Plexiglass Cleaning**

CAUTION: NEVER USE GASOLINE, BENZINE, ALCOHOL, ACETONE, CARBON TETRACHLORIDE, FIRE EXTINGUISHER FLUID, ANTI-ICE FLUID, LACQUER THINNER, OR GLASS CLEANER TO CLEAN PLASTIC. THESE MATERIALS WILL DAMAGE THE PLASTIC AND MAY CAUSE SEVERE CRAZING.

- (1) If large deposits of mud and/or dirt have accumulated on the plexiglass, flush with clean water. Rubbing with your hand is recommended to dislodge excess dirt and mud without scratching the plexiglass.
- (2) Wash with soap and water. Use a sponge or heavy wadding of a soft cloth. DO NOT rub, as the abrasive action in the dirt and mud residue will cause fine scratches in the surface.
- (3) Grease and oil spots may be removed with a soft cloth soaked in kerosene.
- (4) After cleaning, wax the plexiglass surface with a thin coat of hard polish-wax. Buff with a soft cloth.
- (5) If a severe scratch or marring occurs, jeweler's rouge is recommended. Follow directions, rub out scratch, smooth, apply wax and buff.

B. Painting Metal Surfaces

Refer to Chapter 20 for metal cleaning and painting procedures.

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FUSELAGE – DESCRIPTION/OPERATION**1. General**

The main fuselage structure (Figure 1) is a one piece bonded aluminum assembly using one-half inch thick light-weight aluminum honeycomb panels to form the cabin area. The aft section of the fuselage from the cabin area rearward is composed of sheet aluminum panels bonded together with high strength adhesive and formed to aluminum stiffeners and bulkheads. Bulkheads inside the cabin compartment provide support for the floor panels and attaching provisions for other equipment. The engine support mounts and support mount doublers are bonded to the front end of the main fuselage structure.

Most fuselage maintenance requirements will consist of removal and replacement of detachable components or structural repair as detailed in Chapter 20.

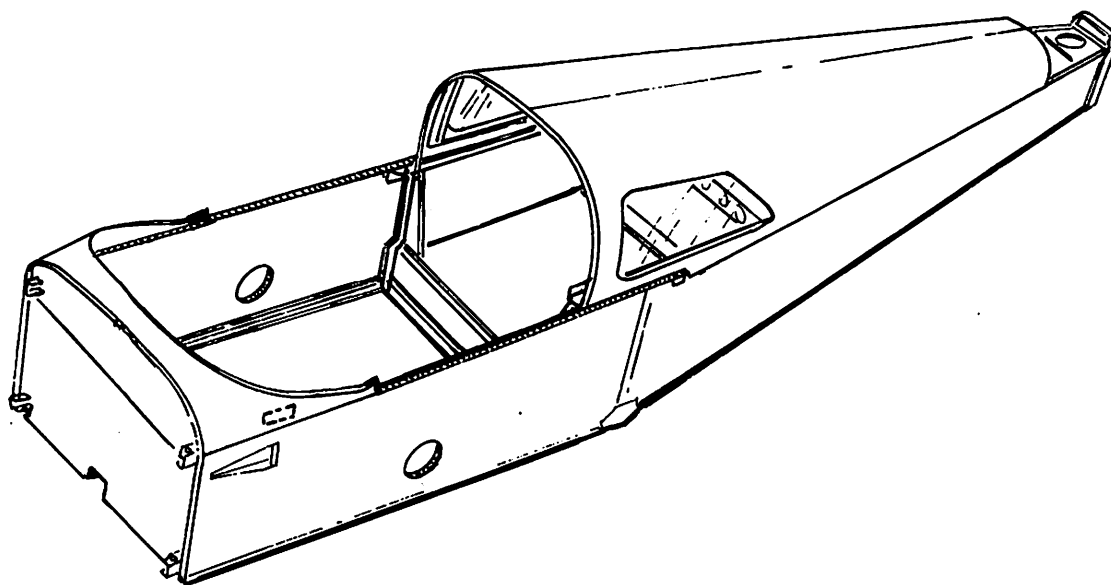
2. Fuselage Assembly Components

The fuselage assembly consists of the main fuselage structure, the inboard carry through spar, horizontal stabilizer fairing, horizontal stabilizer fillet, tailcone, aft fuselage access covers, and attach fittings and brackets for other equipment. These items are detachable and may be removed and replaced when necessary. The tubular inboard carry through spar extends through the main fuselage structure beneath the pilot and co-pilot's seats, and provides attach points for the wings and the main landing gear. The spar is attached to the fuselage structure with four support attach brackets. Two brackets are located above the spar on the inside of the fuselage and two are located beneath the spar on the outside of the fuselage structure. The removable attach fittings, fairings, fins, fillets, tailcone, and access covers are secured to the fuselage with screws.

The tailcone is made of thermo-plastic and consists of an upper and a lower half. Either half can be removed separately. The tail light is mounted in the rearmost part of the tailcone. The tailcone houses the rudder and elevator bellcrank assemblies.

The horizontal stabilizer fillets are made of sheet aluminum and attached to the fuselage structure with screws.

The access covers on the aft section of the fuselage are made of aluminum and attached with screws.



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**Fuselage Assembly AA-1C
Figure 1**

FUSELAGE – MAINTENANCE PRACTICES

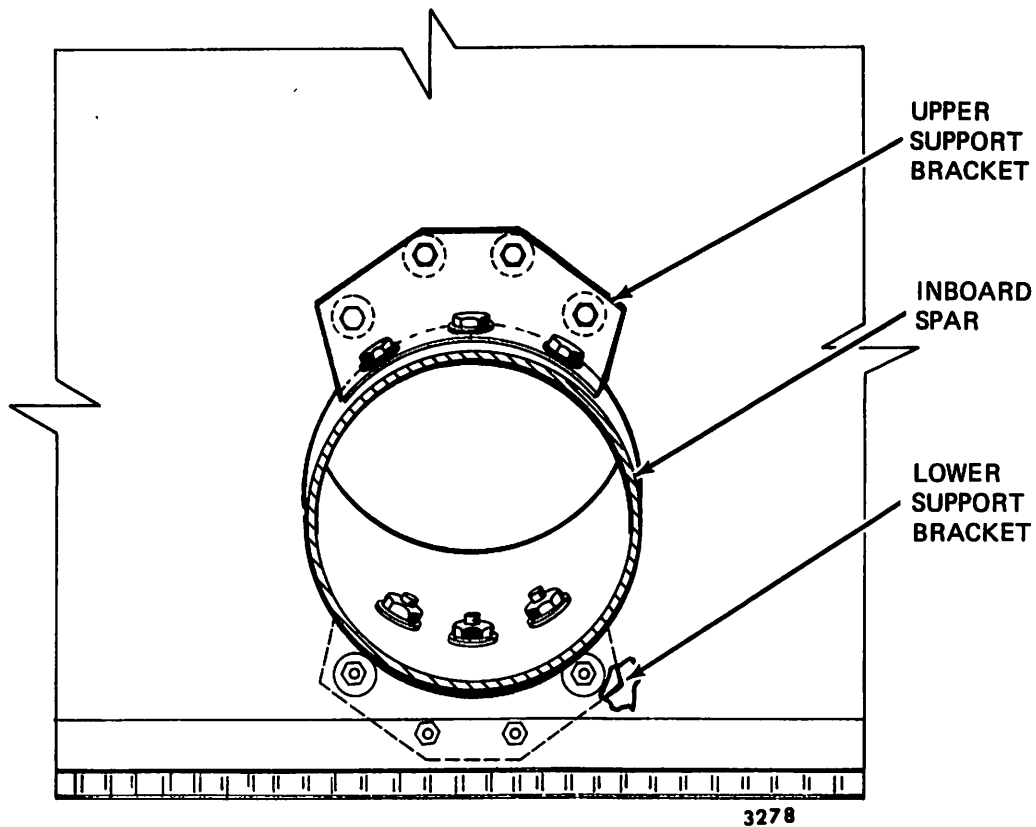
1. Removal/Installation of Fuselage Detachable Components.

A. Remove Inboard Spar (See Figure 201.)

- (1) Remove wings and wing roots. (Refer to Chapter 57.)
- (2) Remove main landing gear. (Refer to Chapter 32.)
- (3) Remove seats and upholstery as necessary to gain access to support brackets. (Refer to Chapter 15.)
- (4) Remove trim console attach screw from inboard spar.
- (5) Remove sealant from around spar at fuselage structure.
- (6) Remove bolts that attach support brackets to spar on outside of fuselage structure.
- (7) Remove bolts that attach support brackets to spar and that attach support brackets to fuselage, on inside of fuselage structure and remove support brackets.
- (8) Slide inboard spar out of main fuselage structure.

B. Install Inboard Spar

- (1) Slide inboard spar through main fuselage structure and line up bolt holes with bolt holes in lower support brackets.
- (2) Install bolts, washers, and nuts that attach lower support brackets to inboard spar but do not tighten nuts.
- (3) Position upper support brackets in place and secure to fuselage structure with bolts, screws, washers and nuts. Torque nuts to 60-70 in. lbs.
- (4) Align holes in spar with holes in support bracket and install shims as required, bolts, washers and nuts. Torque all spar attaching bolts to 340-360 in. lbs.
- (5) Apply presstite soft putty sealant around spar on outside of fuselage structure.
- (6) Install seats and upholstery removed at spar removal. (Refer to Chapter 25.)
- (7) Install main landing gear. (Refer to Chapter 32.)
- (8) Install wing roots and wings. (Refer to Chapter 57.)



Inboard Spar Installation — Inside View
Figure 201

C. Remove Horizontal Stabilizer Fillet (See Figure 202.)

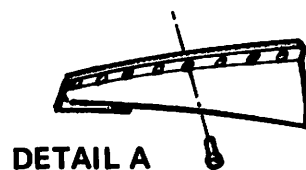
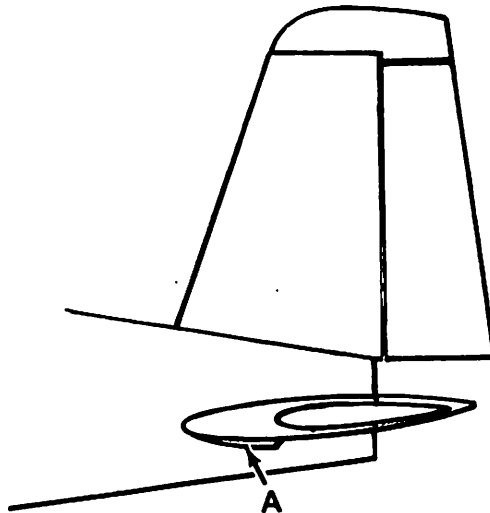
- (1) Punch out mandrel in center of rivets with a small drift punch, then drill out rivet with a No. 30 drill.
- (2) Remove fillet.

D. Install Horizontal Stabilizer Fillet

- (1) Position fillet in place on fuselage.
- (2) Install rivets.

E. Remove Tailcone (See Figure 203.)

- (1) Remove screws that secure tailcone to aft fuselage.
- (2) Slide tailcone back, disconnect tail light wires, and remove tailcone.



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**Horizontal Stabilizer Fairings – Removal/Installation
Figure 202****F. Install Tailcone**

- (1) Connect tail light wires at aft fuselage bulkhead.
- (2) Perform functional check of tail light.
- (3) Position tailcone to fuselage and install attaching screws.

G. Remove Access Covers on Aft Fuselage (see Figure 1).

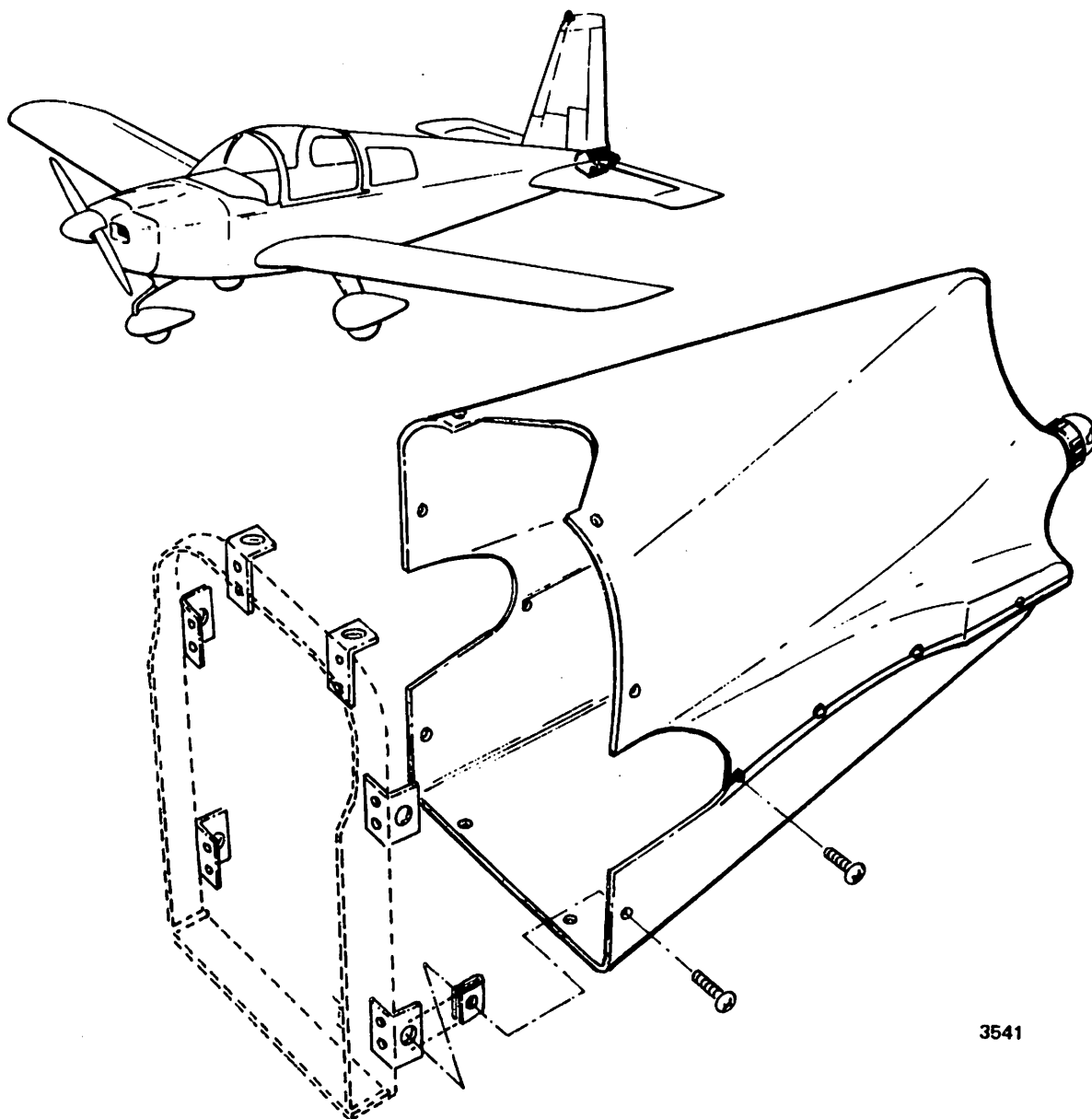
- (1) Remove attaching screws that secure access covers to fuselage and remove covers.

H. Install Access Covers on Aft Fuselage

- (1) Position covers in place on fuselage and install attaching screws.

I. Brackets, Supports and Attach Fittings

Various brackets, supports, and attach fittings are considered components of the fuselage assembly. The battery support bracket mounted on the lower firewall, the instrument panel support bracket, and the shoulder harness and baggage tie down attach fittings are secured to the fuselage structure with either screws or bolts. Removal and replacement of these items require only a simple procedure of removing screws or bolts to detach the bracket or attach fitting and then reinstall by positioning bracket or fitting in place and installing attaching bolts or screws.



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**Tailcone – Removal/Installation
Figure 203**

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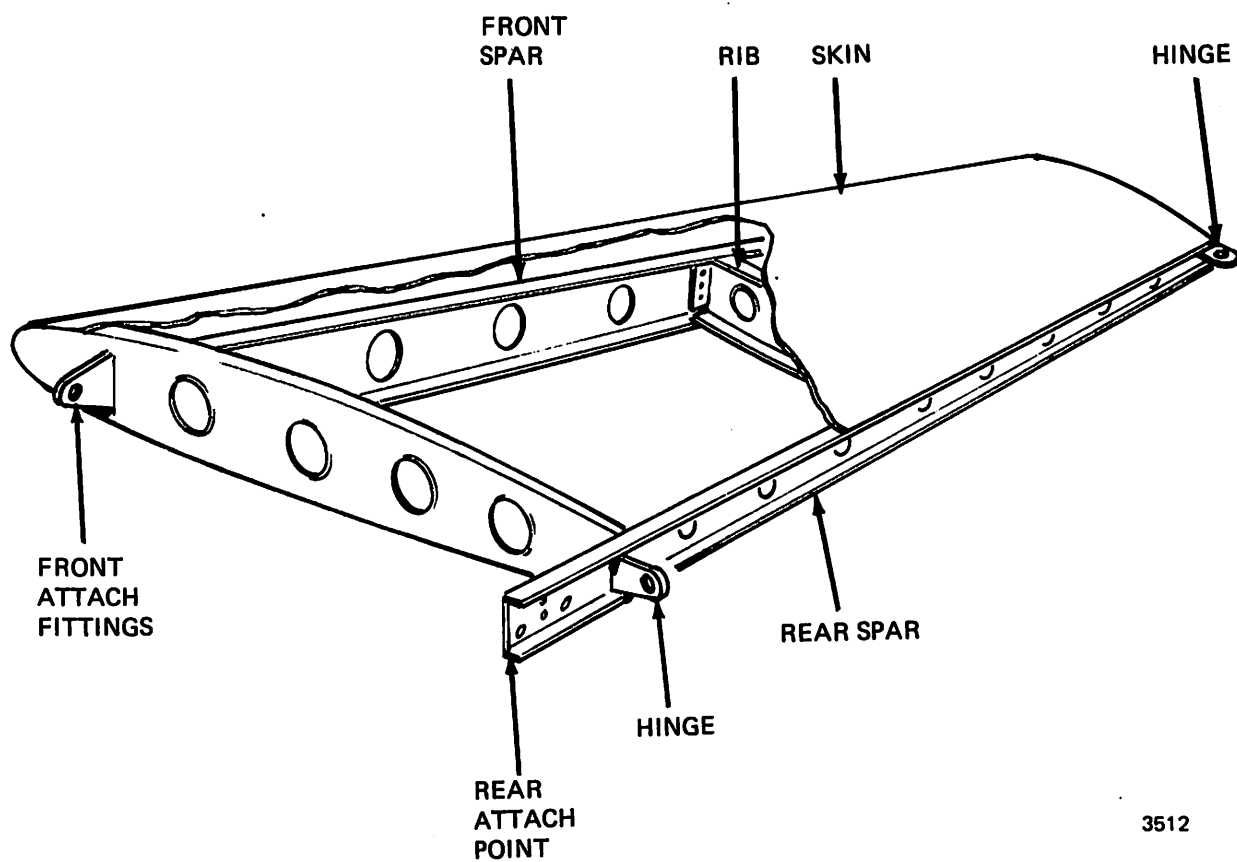
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STABILIZERS – DESCRIPTION/OPERATION**1. General**

The horizontal and vertical stabilizers are the fixed empennage structures to which the elevators and rudders are connected. In addition to providing attachment points for the control surfaces, the stabilizers assist in ensuring directional and longitudinal stability of the aircraft.

HORIZONTAL STABILIZERS – DESCRIPTION/OPERATION**1. General (See Figure 1.)**

The horizontal stabilizers are of conventional dual spar and rib structure, with the skin bonded to the ribs and spars. On the AA-1C aircraft, the horizontal stabilizer has a tapered chord, wider at the root than the tip.



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Horizontal Stabilizer
Figure 1

HORIZONTAL STABILIZERS – MAINTENANCE PRACTICES

1. Removal/Installation

A. Horizontal Stabilizer Assembly Removal (See Figure 201.)

NOTE: The horizontal stabilizer can be removed as an assembly with trim tabs and elevator intact, or by a disassembly procedure, whichever is required. If the trim tabs or elevators are being replaced, this can be accomplished without removing the stabilizer. However, if the right or left stabilizer half is being replaced, it may be advantageous to remove the stabilizer as an assembly. For complete stabilizer assembly removal, the following procedure may be used:

- (1) Remove tailcone and aft fuselage inspection covers below vertical fin. Refer to Chapter 53.
- (2) Disconnect elevator control cables and trim lever. Refer to Chapter 27.
- (3) Remove nuts (1), washers (2), and bolts (3) securing bearing (4).
- (4) Loosen lock nuts (5) and remove elevator stop bolts (6).

NOTE: Before removing horizontal stabilizer mounting bolts place stands beneath horizontal stabilizer to prevent its falling.

- (5) Remove forward attachment bolt (7) and washer (8).
- (6) Remove rear attachment bolts (9) and washers (10).
- (7) When stabilizer is removed, note position of shim (11) and spacers (12), in relation to spar stiffener flange (13).
- (8) Spread stabilizer assembly apart at forward edge, just enough to free forward attaching lugs from fuselage and remove assembly from rear of aircraft.

B. Horizontal Stabilizer (Partial) Removal

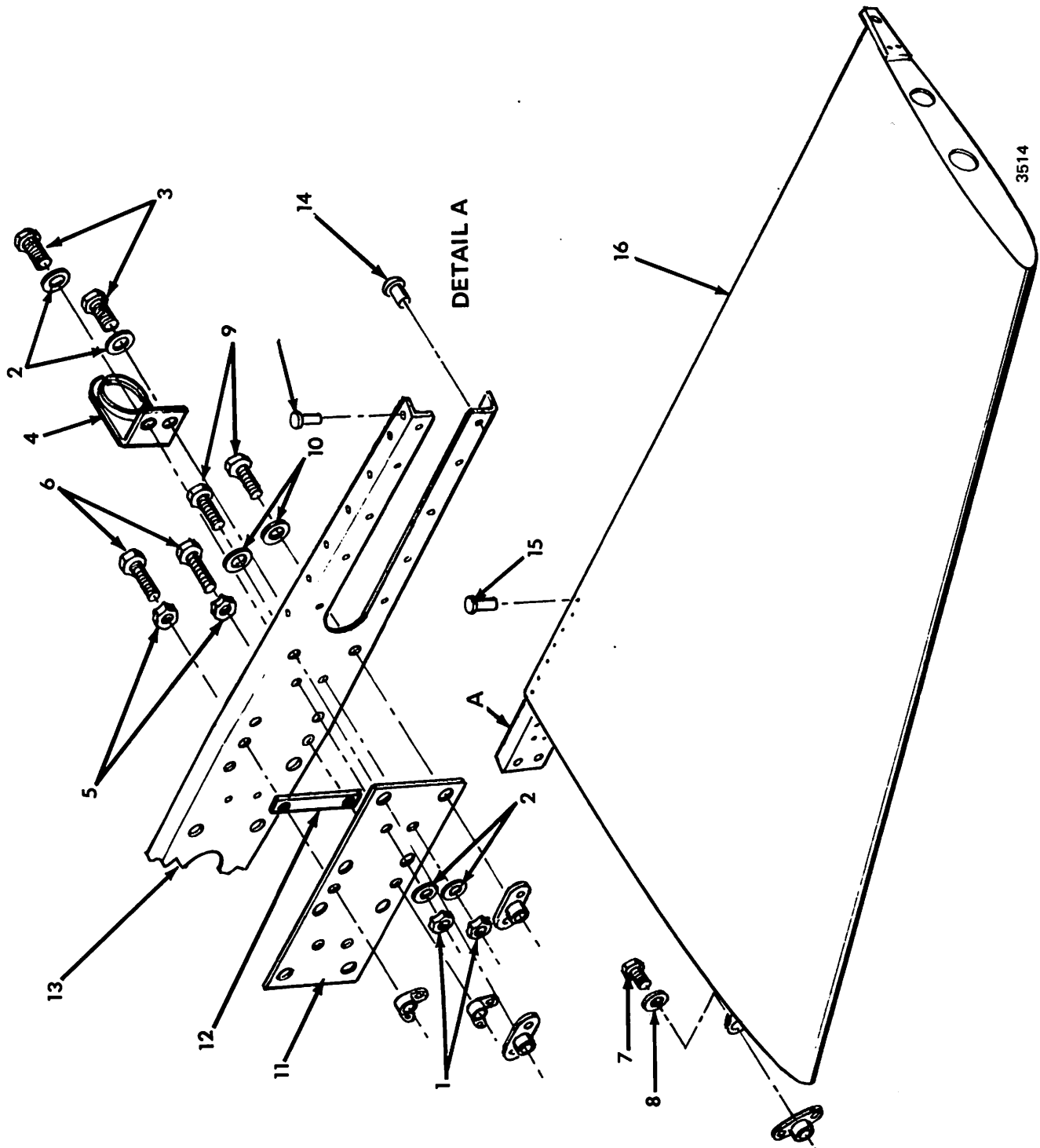
NOTE: If only one side of the horizontal stabilizer is to be removed, proceed as follows.

- (1) Remove appropriate elevator. Refer to Chapter 27.
- (2) Remove appropriate aft fuselage inspection cover below vertical fin. Refer to Chapter 53.
- (3) Remove forward attach bolt (7, Figure 201) and washer (8).
- (4) Use a Number 30 drill to drill out the ten rivets (14) and fourteen rivets (15) securing spar stiffener flange (13) to horizontal stabilizer (16).
- (5) Pull stabilizer (16) from aircraft.

C. Horizontal Stabilizer Assembly Installation (See Figure 201.)

NOTE: The horizontal stabilizer can be installed as an assembly with trim tabs and elevator intact, or by build-up, whichever is required. If the right or left stabilizer half is being replaced, it may be advantageous to install the stabilizer as an assembly. For complete stabilizer assembly installation, the following procedure may be used.

- (1) Position stabilizer in its installed location and spread assembly apart at forward edge enough to allow forward attaching lugs to enter access openings in fuselage.



**Horizontal Stabilizer Removal/Installation
Figure 201**

- (2) Secure forward attaching lugs to fuselage with bolts (7) and washers (8). Torque to standard value. (Refer to Chapter 91.)
- (3) Position shim (11) and spacers (12) between spar stiffener flange (13) and fuselage aft bulkhead.
- (4) Align bolt holes and secure with bolts (9) and washers (10). Torque to standard value. (Refer to Chapter 91.)
- (5) Screw locknuts (5) on bolts (6) and install bolts (6). Do not tighten bolts.
- (6) Align bearing (4) mounting holes with holes in spar stiffener flange (13). Secure with bolts (3), washers (2), and nuts (1). Torque to standard value. (Refer to Chapter 91.)
- (7) Connect elevator and trim controls and rig. Refer to Chapter 27.
- (8) Install aft fuselage inspection covers and tailcone. Refer to Chapter 53.

D. Horizontal Stabilizer (Partial) Installation

NOTE: If only one side of the horizontal stabilizer is to be replaced, proceed as follows:

- (1) Position horizontal stabilizer on spar stiffener flange and secure with ten rivets (14, Figure 201) (Part Number MS20470AD4-5) and fourteen rivets (15) (Part Number MS20426AD4-5).
- (2) Secure attaching lug to fuselage with bolt (7) and washer (8). Torque to standard value. (Refer to Chapter 91.)
- (3) Connect elevator controls and rig. Refer to Chapter 27.
- (4) Install aft fuselage inspection covers and tailcone. Refer to Chapter 53.

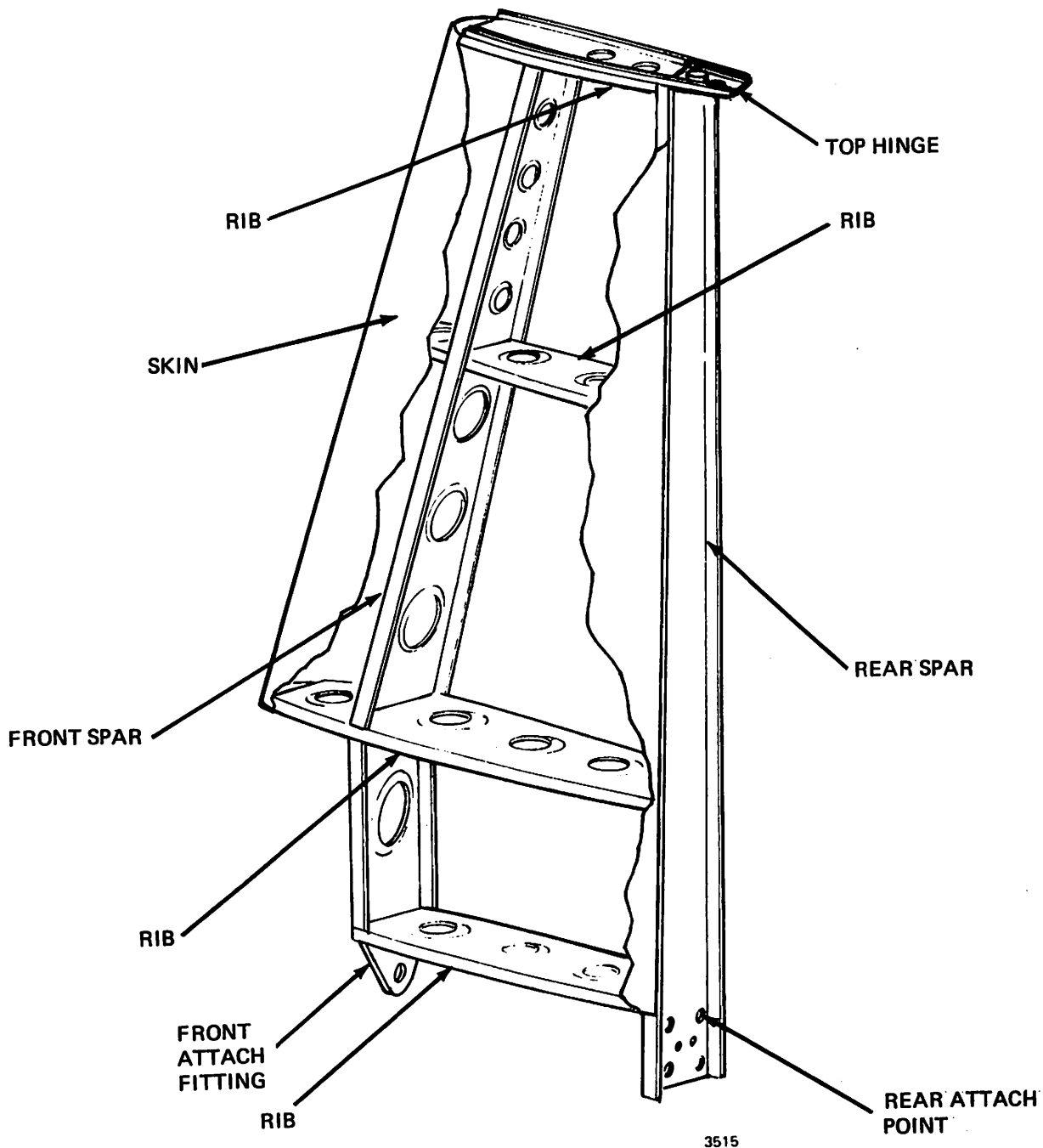
2. Cleaning/Painting

Clean and paint horizontal stabilizer. Refer to Chapter 20.

VERTICAL STABILIZER – DESCRIPTION/OPERATION

1. General (See Figure 1.)

The vertical stabilizer is of conventional dual spar and rib construction, with its skin bonded to the ribs and spars. It has a tapered chord, with its maximum chord at the root, and its minimum chord at the tip.



**Vertical Stabilizer
Figure 1**

VERTICAL STABILIZER – MAINTENANCE PRACTICES

1. Removal/Installation

A. Vertical Stabilizer Removal (See Figure 201.)

NOTE: The vertical stabilizer can be removed as an assembly with rudder intact, or by a disassembly procedure, whichever is required. If the rudder is being replaced, this can be accomplished without removing the vertical stabilizer. (Refer to Chapter 27 for Rudder Removal.) For stabilizer and rudder removal as an assembly, proceed as follows:

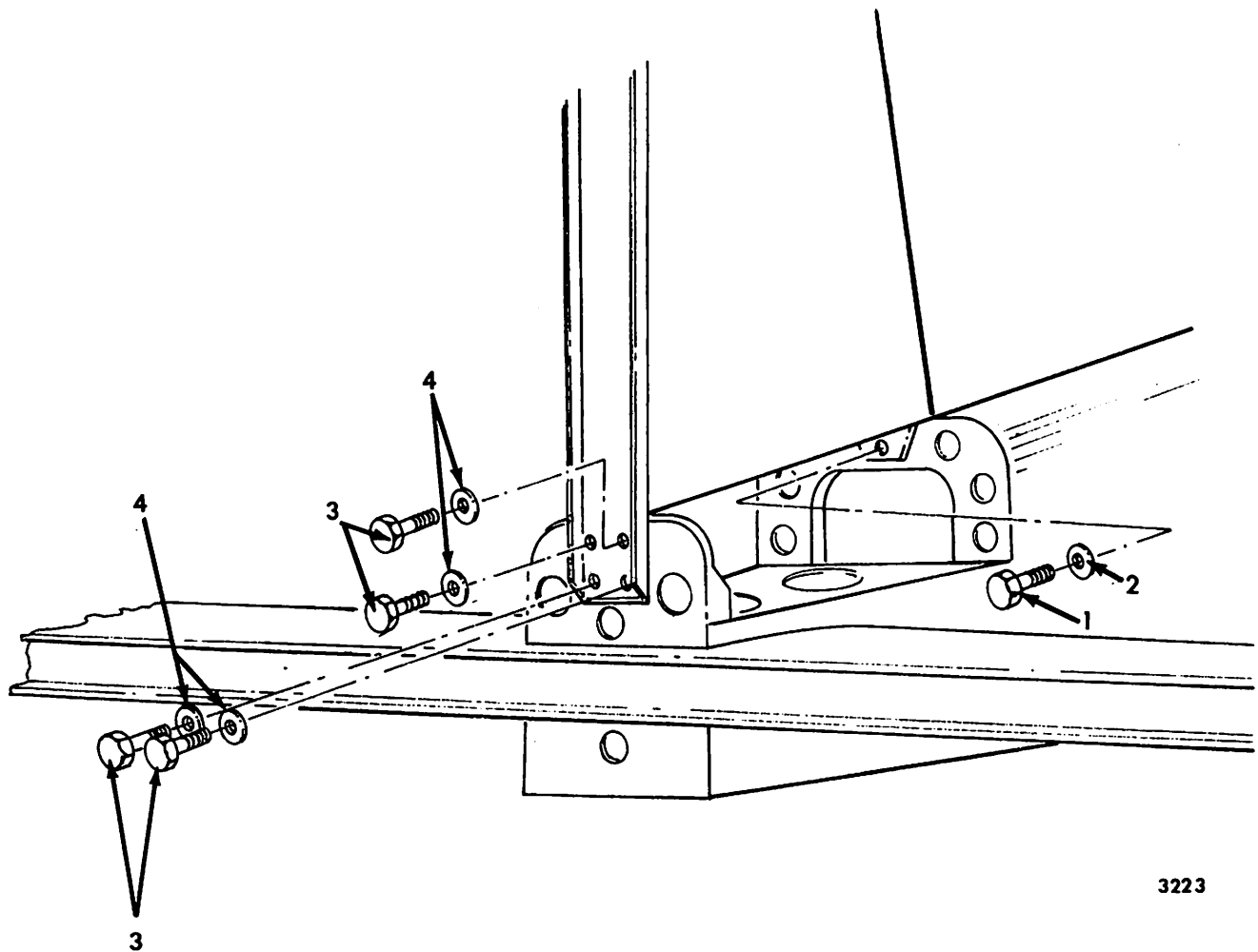
- (1) Remove tailcone and aft fuselage inspection covers. Refer to Chapter 53.
- (2) Disconnect rudder cables. Refer to Chapter 27.
- (3) Remove front attachment bolt (1) and washer (2).
- (4) Remove aft attachment bolts (3) and washers (4).
- (5) Remove lower rudder bearing support bolts.
- (6) Disconnect antenna and rotating beacon wiring. Refer to Chapter 27.
- (7) Remove vertical stabilizer and rudder from aircraft.

B. Vertical Stabilizer Installation (See Figure 201.)

- (1) Position vertical stabilizer and rudder on aircraft so that its rear mounting holes are aligned with those in fuselage. Secure with rear mounting bolts (3) and washers (4). Torque to standard value. (Refer to Chapter 91.)
- (2) Align hole in forward mount with hole in fuselage. Secure with bolt (1) and washer (2). Torque to standard value. (Refer to Chapter 91.)
- (3) Connect antenna and rotating beacon wiring. Refer to Chapter 27.
- (4) Install lower rudder bearing support bolts.
- (5) Connect rudder cables and rig rudder. Refer to Chapter 27.
- (6) Install tailcone and aft inspection covers. Refer to Chapter 53.

2. Cleaning/Painting

Clean and paint vertical stabilizer. Refer to Chapter 20.



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Vertical Stabilizer Removal/Installation
Figure 201

WINDOWS – DESCRIPTION**1. General**

The rear windows and the canopy are constructed of plexiglas with a 1/8 in. thickness. The windshield is constructed of plexiglas with a 1/4 in. thickness. Tinted plexiglas for all windows is optional. (See Chapter 52, Doors, for maintenance practices involving the canopy assembly.)

2. Windshield

The plexiglas windshield and bow are bonded together and serviced as a single assembly. The lower edge of the windshield is sealed and bolted into the upper forward fuselage windshield lip. The windshield is heated by means of a defroster vent located on the deck assembly.

3. Rear Cabin Windows

The rear cabin windows are held in position by top, bottom, forward, and aft retainers. Sealing of the windows consists of a sealing compound used along with a felt seal around the window edges.

CHAPTER 56

WINDOWS

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WINDOWS – MAINTENANCE PRACTICES

1. Windshield Removal

NOTE: Numbers in parentheses refer to Figure 201.

- A. Remove glareshield and deck assemblies. (See Chapter 25.)
- B. Remove the forward trim panels. (See Chapter 25.)
- C. Remove the screws (5), washers (3) and nuts (4) securing the windshield to the forward fuselage.
- D. Remove the screws (6), washers (3), and nuts (4) where windshield bow is secured to the fuselage assembly.
- E. Remove the nuts (4), washers (3), and bolts (2) which attach the windshield bow support (8) to the bracket (10) on the fuselage and remove the windshield from the aircraft.
- F. Remove old seal from bottom of windshield.

WARNING: WHEN USING TRICHLORETHYLENE OR MEK, ENSURE THAT THE WORKING AREA IS WELL-VENTILATED AND THAT PROTECTIVE EQUIPMENT (GLOVES, EYE PROTECTION) IS WORN. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

CAUTION: AVOID ALLOWING TRICHLORETHYLENE OR MEK TO CONTACT PAINTED SURFACES. THESE SOLVENTS HAVE A CORROSIVE EFFECT UPON PAINTED SURFACES.

- G. Remove old seal. Remove adhesive residue from upper forward fuselage assembly with trichlorethylene or MEK. Wipe the surface with a clean dry cloth before the solvent evaporates.

2. Windshield Installation

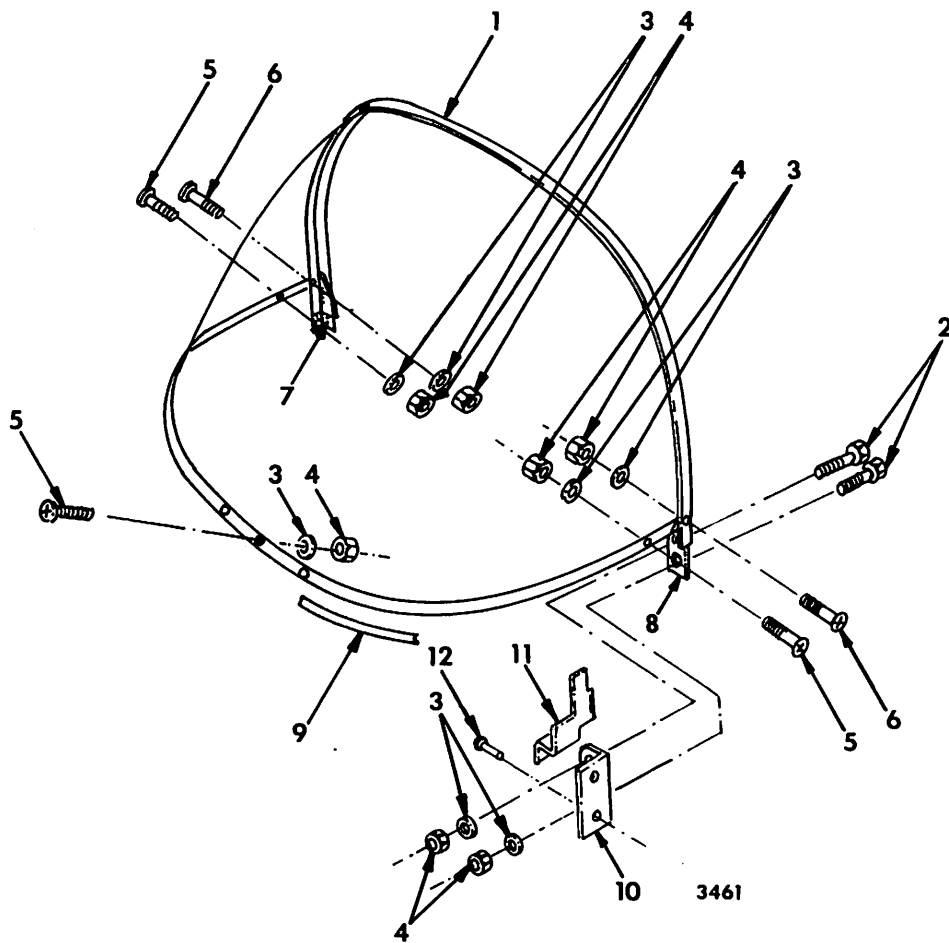
NOTE: Numbers called out in the following procedures refer to Figure 201.

- A. Make sure faying surfaces of windshield and upper forward fuselage assembly are clean and dry.
 - (1) The plexiglass faying surface may be cleaned with a cloth moistened with aliphatic naptha.
 - (2) For preparation of upper forward fuselage faying surface, see Step G. in Paragraph 1 above. Observe warning and caution.
- B. With faying surface of plexiglass clean and dry, press adhesive surface of 522 vinyl foam tape to lower edge of plexiglas.
- C. With faying surface of upper forward fuselage assembly clean and dry, apply sealant (Presstite) to faying surface. Apply sealant by hand. If sealant flows out after joint is mated, the excess may be wiped off.
- D. Align hole at bottom of windshield bow support with hole in bracket (10). Install bolts (2), washers (3), and nuts (4) which attach the windshield bow support (8) to the bracket (10).

NOTE: For new windshields, position windshield bow vertically parallel with forward canopy bow in alignment with canopy contour and carefully drill mounting holes.

CAUTION: WHEN DRILLING HOLES THROUGH PLEXIGLAS, EXERCISE CARE TO PREVENT CRACKING WINDSHIELD OR ELONGATING MOUNTING HOLES.

- E. Install screws (6), washers (3), and nuts (4) when windshield bow is secured to fuselage assembly.



- 1. Windshield Assembly
- 2. Bolt
- 3. Washer
- 4. Nut
- 5. Screw
- 6. Screw

- 7. Rivet
- 8. Support
- 9. Tape (Vinyl Foam)
- 10. Bracket
- 11. Retainer
- 12. Rivet

**Windshield Assembly
Figure 201**

- F. Install screws (5), washers (3), and nuts (4) securing the windshield to the forward fuselage and torque 8-12 inch pounds.

3. Rear Cabin Window Removal

- A. Remove window moulding. (See Chapter 25.)
- B. Remove screws from the retainer strips mounted around the edge of the window and remove window. (See Figure 202.) There are four screws securing the top and bottom retainer strips to the fuselage and three screws securing the aft and forward retainer strips to the fuselage.
- C. Remove old felt seal from edges of windows.
- D. Remove Presstite sealant from fuselage area where window was mated.

4. Rear Cabin Window Installation

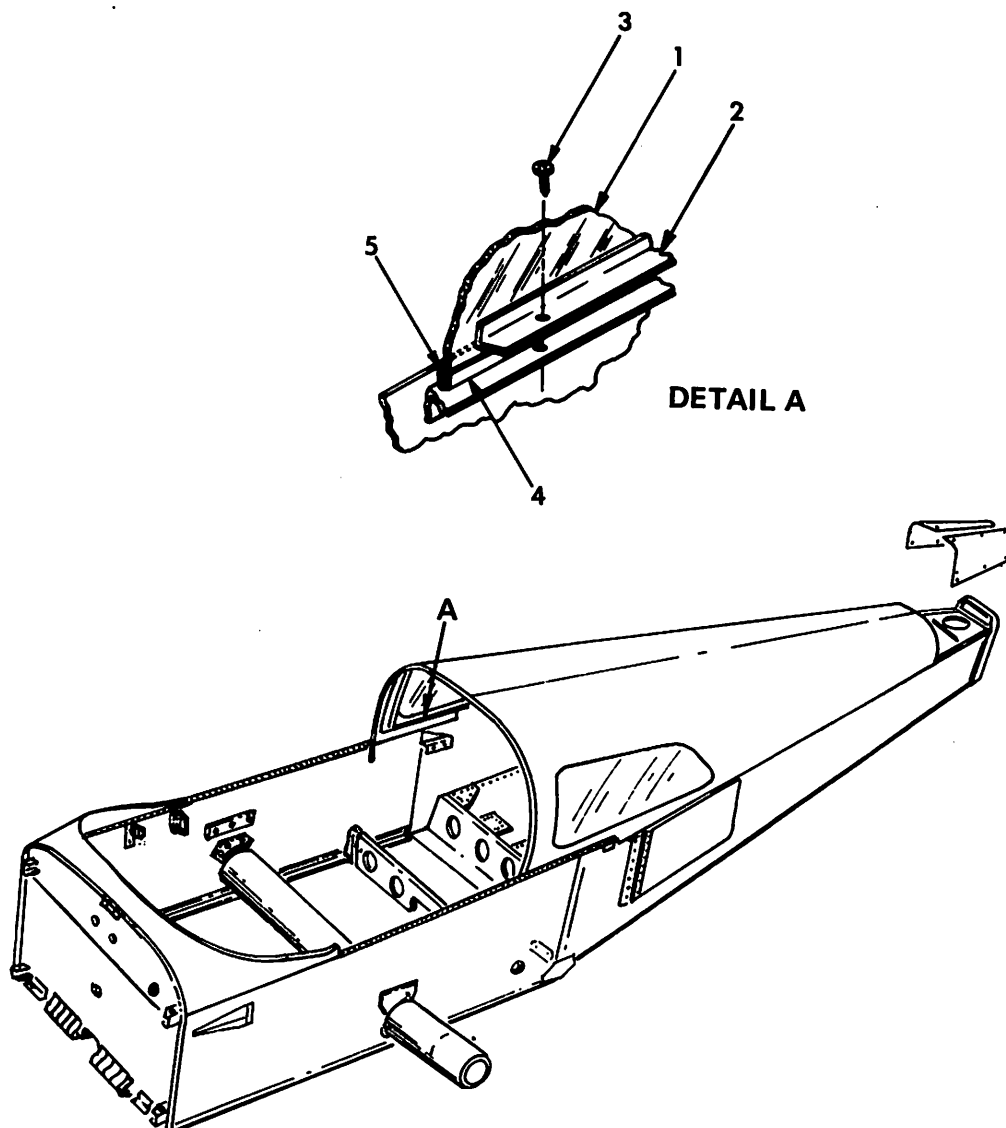
- A. Clean area around edges of window where adhesive tape seal is to be placed. Use cloth moistened with aliphatic naphtha.
- B. Apply felt seal around edges of window.
- C. Apply Presstite sealant by hand to fuselage area where window is to be mated.
- D. Place window to fuselage mating surface and install top, bottom, forward, and aft retainer strips around edges of window. If sealant flows out after joint is mated, the excess should be wiped off.
- E. Install window moulding. (See Chapter 25.)

5. Windshield and Window Cleaning

It is recommended that plexiglas in the canopy, windshield, and cabin windows be kept clean and unscratched. The following procedures are recommended:

CAUTION: DO NOT USE GASOLINE, ALCOHOL, BENZINE, ACETONE, CARBON TETRACHLORIDE, OR GLASS WINDOW CLEANER. THESE FLUIDS CAN DAMAGE THE PLEXIGLAS.

- A. If large deposits of mud and/or dirt have accumulated on the plexiglas, flush with clean water. Rubbing with your hand is recommended to dislodge excess dirt and mud without scratching the plexiglas.
- B. Wash with soap and water. Use a sponge or heavy wadding of a soft cloth. DO NOT rub, as the abrasive action in the dirt and mud residue will cause fine scratches in the surface.
- C. Grease and oil spots may be removed with a soft cloth soaked in kerosene.
- D. After cleaning, wax the plexiglas surface with a thin coat of hard polish-wax. Buff with a soft cloth.
- E. If a severe scratch or marring occurs, jeweler's rouge is recommended. Follow directions, rub out scratch, smooth, apply wax and buff.



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- 1. Window
- 2. Retainer Strip
- 3. Screw

- 4. Felt Seal
- 5. Sealant

**Window Installation
Figure 202**

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WINGS – DESCRIPTION**1. General**

The AA-1C wing construction is a one piece bonded assembly utilizing a tubular main wing spar and a formed U-channel rear wing spar. Aluminum ribs are bonded directly to both spars with the wing skin bonded directly to the wing ribs and rear spar. The wings incorporate the ailerons, flaps, fuel tanks, wing tip assemblies and navigation lights. The AA-1C model has a wing span of 24 feet and 5 inches.

The tubular main wing spar also serves as a fuel tank utilizing aluminum castings at the inboard and outboard ends of the spar. The inboard fuel tank casting is located just outboard of the wing attach joint. The outboard casting, which incorporates the filler neck, is located at the outboard end of the main wing spar. A fuel tank baffle system is bolted to the outboard casting and spans the length of the tank.

2. Wing Root

The fiberglass wing root is located between the wing and the fuselage and provides a smooth fusing of the wing assembly to the fuselage. The wing root encloses the upper main landing gear attaching brackets and lines from the fuel tanks.

3. Wing Tip

The wing tips are the outermost part of the wing assembly. They are constructed of fiberglass and blend the wing leading edge and trailing edge into a single unit. The wing tips house the aileron balance weight assemblies, contain the navigation lights and the fuel tank filler assembly.

4. Wing Interchangeability

Model AA-1C wings are identical to and interchangeable with Model AA-1B wings. Model AA-1C and Model AA-1B wings are identical to Model AA-1A wings except that a stronger spar material is utilized in the AA-1C and AA-1B wings. AA-1C and AA-1B have a heavier gross weight and are all utility category aircraft. AA-1C and AA-1B wings can be used on the Model AA-1A aircraft, but AA-1A wings cannot be used on AA-1C and AA-1B aircraft.

WINGS – MAINTENANCE PRACTICES

1. Wing Tip Removal

NOTE: Numbers in parentheses refer to callouts in Figure 201.

- A. Remove the four mounting screws (1) which hold the scupper assembly (2) to the wing tip (3).
- B. Remove the 23 screws (4) which attach the wing tip to the wing.
- C. Place the aileron in the neutral or down position to clear the balance weight (5).
- D. Drop the tip a few inches away from the wing in order to reach inside and disconnect the navigation light wires.

2. Wing Tip Installation

NOTE: Numbers in parentheses refer to callouts in Figure 201.

NOTE: Before installing wing tip, check condition and location of all clip nuts (6).

- A. Align wing tip (3) with outboard edge of wing and connect navigation light wires.

NOTE: Ensure that there is positive clearance of the aileron balance weight.

- B. Secure wing tip to outside edge of wing with 23 screws (4).
- C. Install the four mounting screws (1) securing the scupper assembly (2) to the wing tip.

3. Wing Removal

NOTE: Numbers in parentheses refer to callouts in figures.

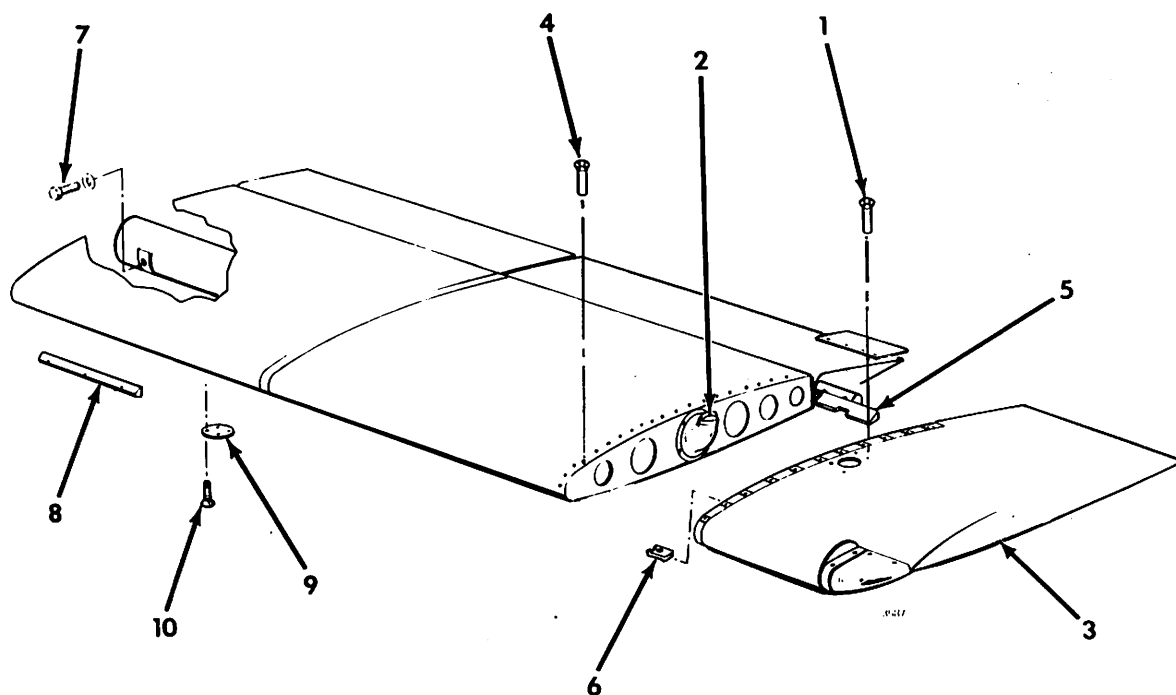
- A. Remove 13 screws (1, Figure 202) securing inspection cover (2) to wing root (3).
- B. Disconnect the airspeed pitot line located in the left wing root.

CAUTION: ENSURE THAT FUEL TANK HAS BEEN COMPLETELY DRAINED BEFORE ATTEMPTING TO DISCONNECT THE FUEL LINES. (SEE CHAPTER 28.)

- C. Disconnect the main fuel line and the fuel measurement gauge line located in the wing root.
- D. Disconnect all wiring in the wing root.
- E. Raise the carpet on the baggage compartment floor and remove inspection plate from the compartment floor.

CAUTION: DO NOT DISTURB THE CABLE TURNBUCKLES OR CONTROL SURFACE RIGGING.

- F. Remove the nut and bolt securing the aileron bellcrank to the torque tube and remove the bellcrank from the torque tube by rotating and sliding it from the end of the tube.
- G. Remove the two bolts securing the flap bellcrank to the flap torque tube and rotate bellcrank out of way.
- H. Through the wing root inspection cover, remove the two wing lock bolts (7, Figure 201).



1. Screws
2. Scupper Assembly
3. Wing Tip
4. Screws
5. Balance Weight

6. Clip Nuts
7. Wing Lock Bolts
8. Stall Strip
9. Access Cover
10. Screw

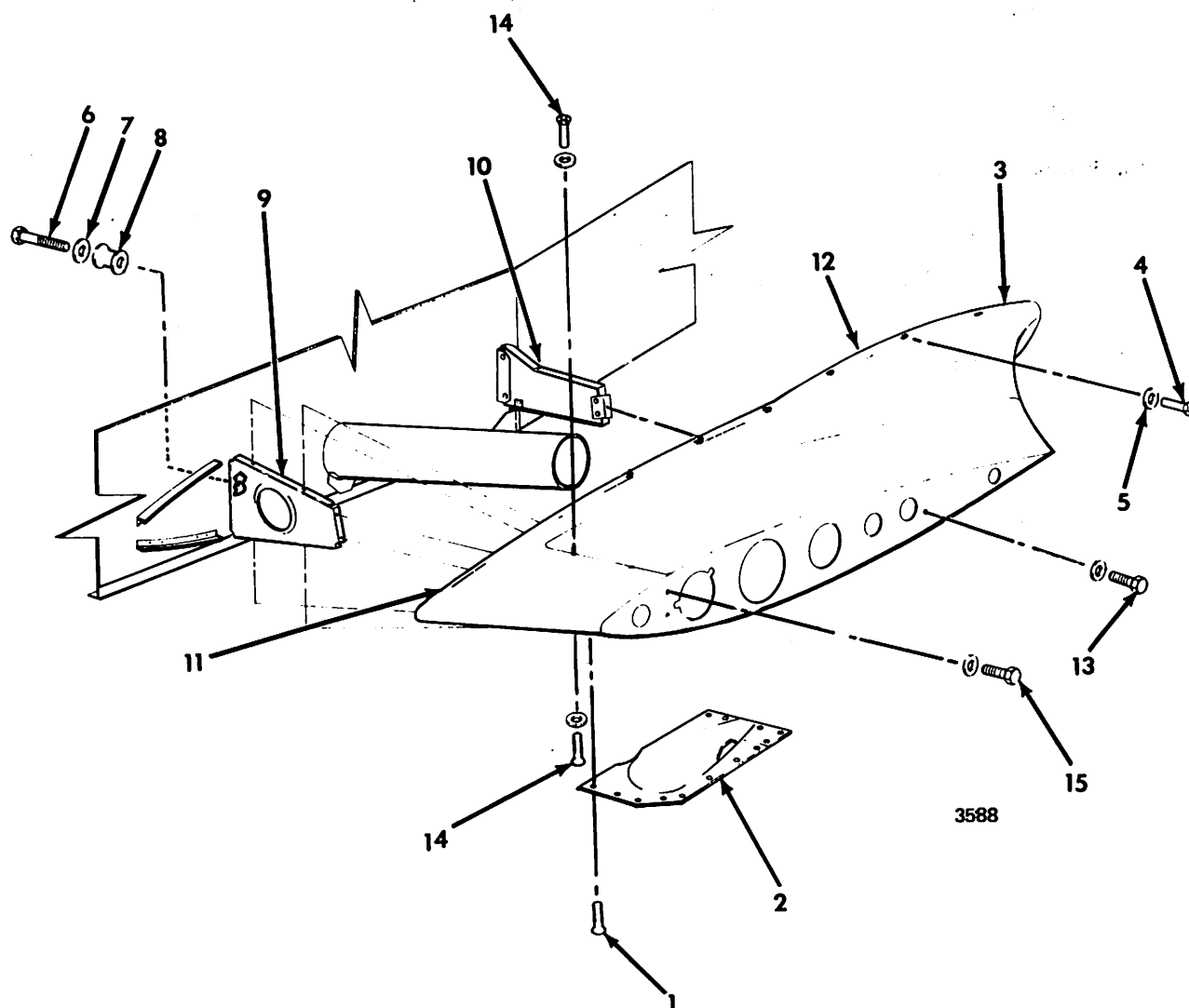
Wing Assembly and Installation
Figure 201

CAUTION: EXERCISE CARE TO PREVENT FLAP "OVERTRAVEL" WHICH MAY RESULT IN THE SCRATCHING OF PAINT OR SKINS.

- I. Place one man at the wing tip to support wing weight and to be ready to pull wing out.
- J. Place one man inside the aircraft to make sure torque tubes do not bind.
- K. Place one man at the inboard leading edge and another man at inboard trailing edge and rotate the wing slightly clockwise and counterclockwise until the wing is free of the spar. Pull wing outboard from the fuselage.

4. Wing Installation

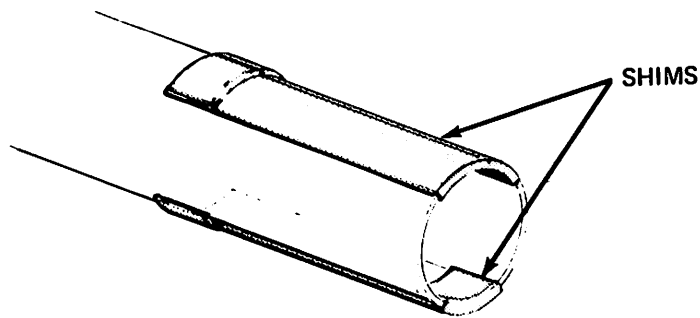
- A. Spray the spar mating surfaces with a solid film lubricant and rub general purpose lubricating oil over the fuselage carry-through spar. Approved solid film lubricants are McLube 1708 by McGee Chemicals Co., Inc. and Lube-Lok 5396 by Allen Aircraft Products, Inc.
- B. Place one man inside the aircraft to adjust the aileron and flap tube assemblies when inserted through the wing root and fuselage.
- C. Place one man at the wing tip to support the wing weight, one man at the inboard leading edge, and another man at the inboard trailing edge.
- D. With all three men lifting, lift the wing and align the center spar with the wing spar and align the torque tube assembly with aft hole in the wing root.
- E. Carefully install wing spar to center spar, with man stationed in aircraft aligning flap tube through support and aligning aileron tube through support and aileron bellcrank.
- F. Prior to installation of shoulder bolts, shake wing vertically and horizontally to check for looseness. If looseness is noted at the wing tip proceed with the following steps:
 - (1) Apply a 25 lb. down load at the wing tip and measure gap at top of spar, between center spar and wing spar, using a wire type feeler gauge. If gap exceeds .016 in., shim to reduce gap to not more than .008 in. (unshimmed gap less shim thickness) as described in Steps (a) through (d) below. See Figure 203.
 - (a) Sand edges of the shim (shims) down to remove sharp corners.
 - (b) Place the shim (shims) on the top and/or bottom of the inboard spar as required.
 - (c) Bend approximately 1.25 in. of the outboard end of the shim (shims) over the end and inside the inboard spar.
 - (d) Bend over the inboard end (ends) of the shim (shims) so that this portion will wrap over the end of the outboard (wing) spar when the wing is fully installed.
 - (2) Inspect the wing lock bolt holes in the wing spar for any signs of elongation or wear. Maximum hole diameter is .377 in. If the hole diameter is larger than this, it must be reamed to a larger diameter and a steel bushing installed.
 - (3) Before wing installation, coat surfaces of shim (shims) with McLube 1708 solid film lubricant or equivalent and lubricate spar mating surfaces as described in 4A above.



1. Screws
2. Inspection Cover
3. Wing Root
4. Screws
5. Washers
6. Bolts
7. Washers
8. Spacers

9. Support Bracket (Forward)
10. Support Bracket (Rear)
11. Rubber Seal
12. Chafe Tape
13. Screw
14. Screws
15. Screws

**Wing Root Assembly and Installation
Figure 202**



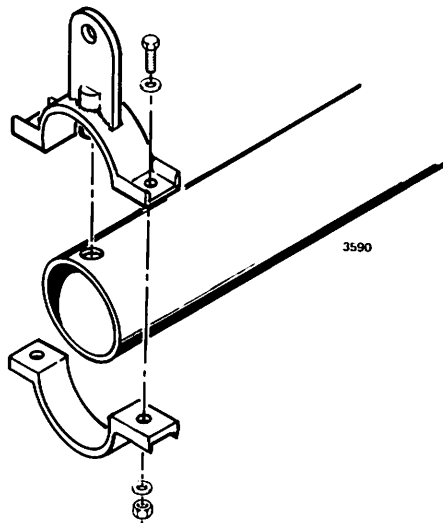
Shim Installation
Figure 203

NOTE: Numbers in parentheses refer to callouts in figures.

- G. Through the wing root inspection cover, install the two wing lock bolts (7, Figure 201). Torque the wing attaching bolts 60-85 inch pounds.

CAUTION: WHEN INSTALLING THE FLAP BELLCRANK HORN, BE SURE THE PIN IS ENGAGED IN THE FLAP TORQUE TUBE HOLE. THIS IS ESSENTIAL FOR PROPER FLAP OPERATION AND RIGGING.

- H. Position pin of flap bellcrank horn into the flap torque tube hole and install the two bolts securing the flap bellcrank to the flap torque tube. (See Figure 204.)



Flap Bellcrank Horn Installation
Figure 204

- I. Install the nut and bolt securing the aileron bellcrank to the torque tube. Ensure that ailerons and flaps are properly rigged. (See Chapter 27.)
- J. Install inspection plate to the baggage compartment floor and replace carpet.
- K. Connect all wiring in the wing root.
- L. Connect the main fuel line and the fuel measurement gauge line located in the wing root.
- M. Connect the airspeed pitot line located in the left wing root.
- N. Install 13 screws (1, Figure 202) securing inspection cover (2) to wing root (3).

NOTE: If the original wing is replaced by a new wing, the stall strip (8, Figure 201) should be taped in place (see Figure 205) and the aircraft test flown to "fine tune" the wing. Perform a series of stalls at half throttle and move the stall strip slightly up or down (1/8 inch maximum), as required to obtain a straight ahead stall and rivet in place.

5. Wing Root Removal

NOTE: Numbers in parentheses refer to callouts in Figure 202.

- A. Remove 13 screws (1) securing inspection cover (2) to wing root (3).
- B. Remove the wing as described in Paragraph 3 above.
- C. From inside the wing root, disconnect the flexible line connecting the fuel gauge vent line.

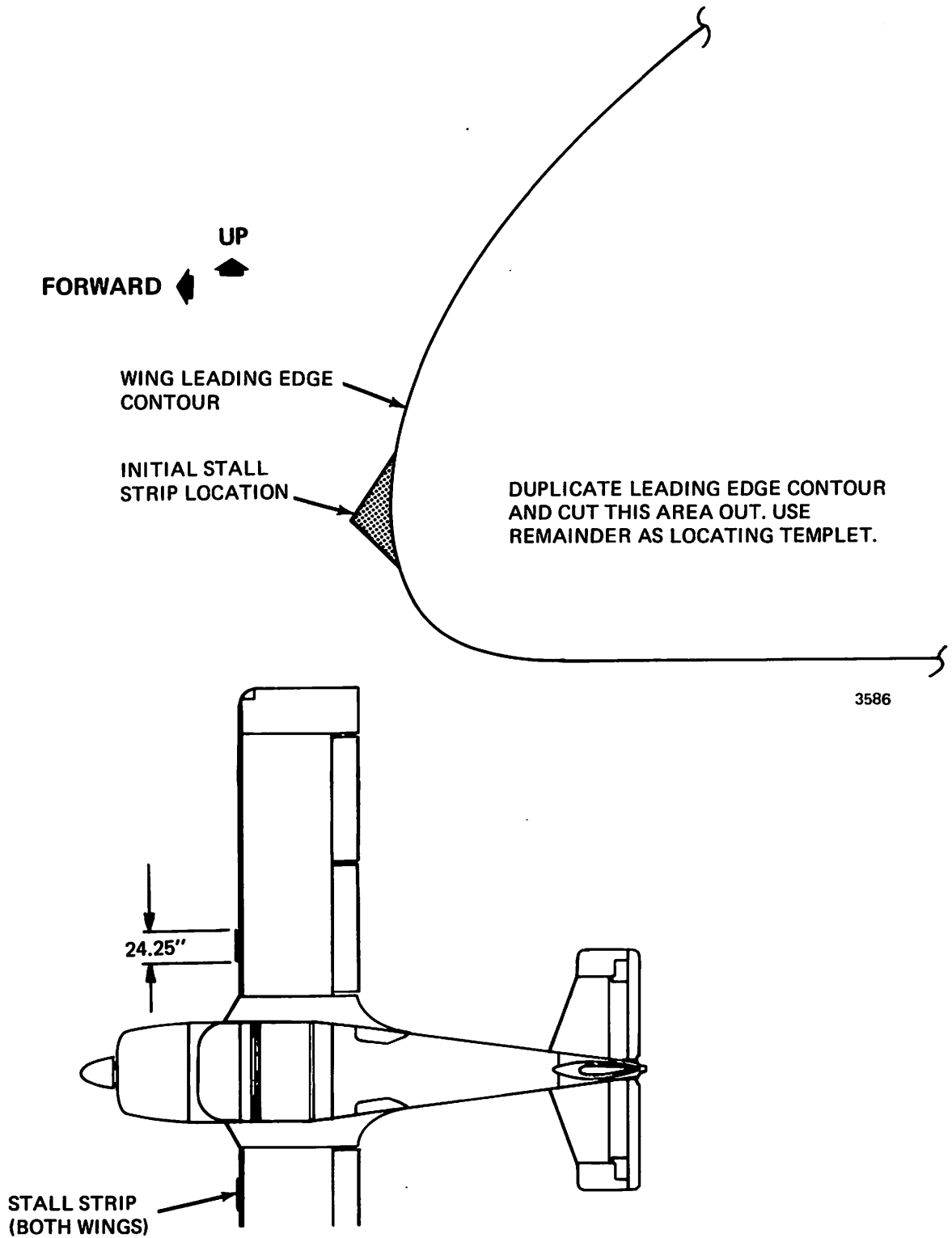
NOTE: If wing root is to be removed with support brackets attached to root structure follow Steps D through F below. If wing root is to be removed with support brackets remaining attached to fuselage structure, follow Steps G through H below.

- D. Remove center trim panel. (See Chapter 25.)
- E. Remove the eight screws (4) and washers (5) which attach the wing root to the fuselage.
- F. From within the fuselage, remove the bolts (6), washers (7) and spacers (8) securing the support brackets (9) and (10) to the fuselage. Remove the wing root with brackets attached.
- G. Remove the two screws which attach the wing root to the rear rib. One screw is located under the wing root, aft of the inspection cover. The other screw (2) is located on the outboard side of the wing root.
- H. Remove the six screws which attach the wing root to the front rib. Two screws (14) are located on the top side of the wing root, two screws (14) are located on the underneath side of the wing root, and two screws (15) are located on the outboard side of the wing root. Remove the wing root with brackets remaining attached to fuselage.

6. Wing Root Installation

NOTE: Numbers in parentheses refer to callouts in Figure 202.

- A. Place rubber seal (11) into position along leading edge of wing root.
- B. Place chafe tape (12) and an application of Pro Seal 711 along mating surface of aft end of wing root.



**Initial Stall Strip Location
Figure 205**

NOTE: Steps C through F refer to installation of wing root with support brackets already attached to root. Steps G through L refer to installation of wing root with support brackets already attached to fuselage.

- C. Align holes in support brackets (9) and (10) installed in the root and align holes in the inboard edge of the wing root with holes in the fuselage side.
- D. Install the bolts (6), the washer (7) and spacers (8) to secure the support brackets with root attached to the fuselage side.
- E. Install screws (4) and washers (5) securing the inboard edge of the wing root to the fuselage side.
- F. Install center trim panel. (See Chapter 25.) Proceed with Step J below.
- G. Align holes in wing root with holes in support brackets (9) and (10) and align holes in the inboard edge of the wing root with holes in the fuselage side.
- H. Install the six screws which attach the wing root to the front rib. Two screws (14) are located on the top side of the wing root, two screws (14) are located on the underneath side of the wing root, and two screws (15) are located on the outboard side of the wing root.
- I. Install the two screws which attach the wing root to the rear rib. One screw is located under the wing root, aft of the inspection cover. The other screw (13) is located on the outboard side of the wing root.
- J. From inside the wing root, connect the flexible line connecting the fuel gauge vent line.
- K. Install the wing as described in Paragraph 4 above.
- L. Install 13 screws (1) securing inspection cover (2) to wing root (3).

CHAPTER 61

PROPELLER

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PROPELLER – DESCRIPTION/OPERATION**1. General**

The AA-1C aircraft are equipped with a two-blade, fixed-pitch, aluminum alloy propeller manufactured by Sensenich.

The AA-1C aircraft are normally equipped with a Sensenich Model 72CK-0-56 propeller; however, an optional Sensenich Model 72CK-0-52 propeller may be installed.

PROPELLER ASSEMBLY – DESCRIPTION/OPERATION**1. General**

The propeller assembly consists of the propeller, the spinner assembly, and attaching hardware. The spinner assembly consists of a formed aluminum spinner with an aluminum centering bulkhead and an aluminum backplate assembly to which it is secured by screws.

CAUTION: DO NOT MOVE THE AIRCRAFT ON THE GROUND BY PUSHING ON THE SPINNER.

STORE THE AIRCRAFT WITH THE PROPELLER IN THE VERTICAL POSITION TO PREVENT WATER ACCUMULATION IN THE SPINNER AND SUBSEQUENTLY FREEZING IN COLD WEATHER.

DO NOT OPERATE THE ENGINE WITH ICE IN THE SPINNER.

PROPELLER ASSEMBLY – MAINTENANCE PRACTICES

1. Servicing

The propeller should be wiped occasionally with an oily cloth to remove stains. This will also aid in corrosion-proofing the propeller. In coastal regions, the propeller should be wiped with an oily cloth more often.

2. Removal/Installation

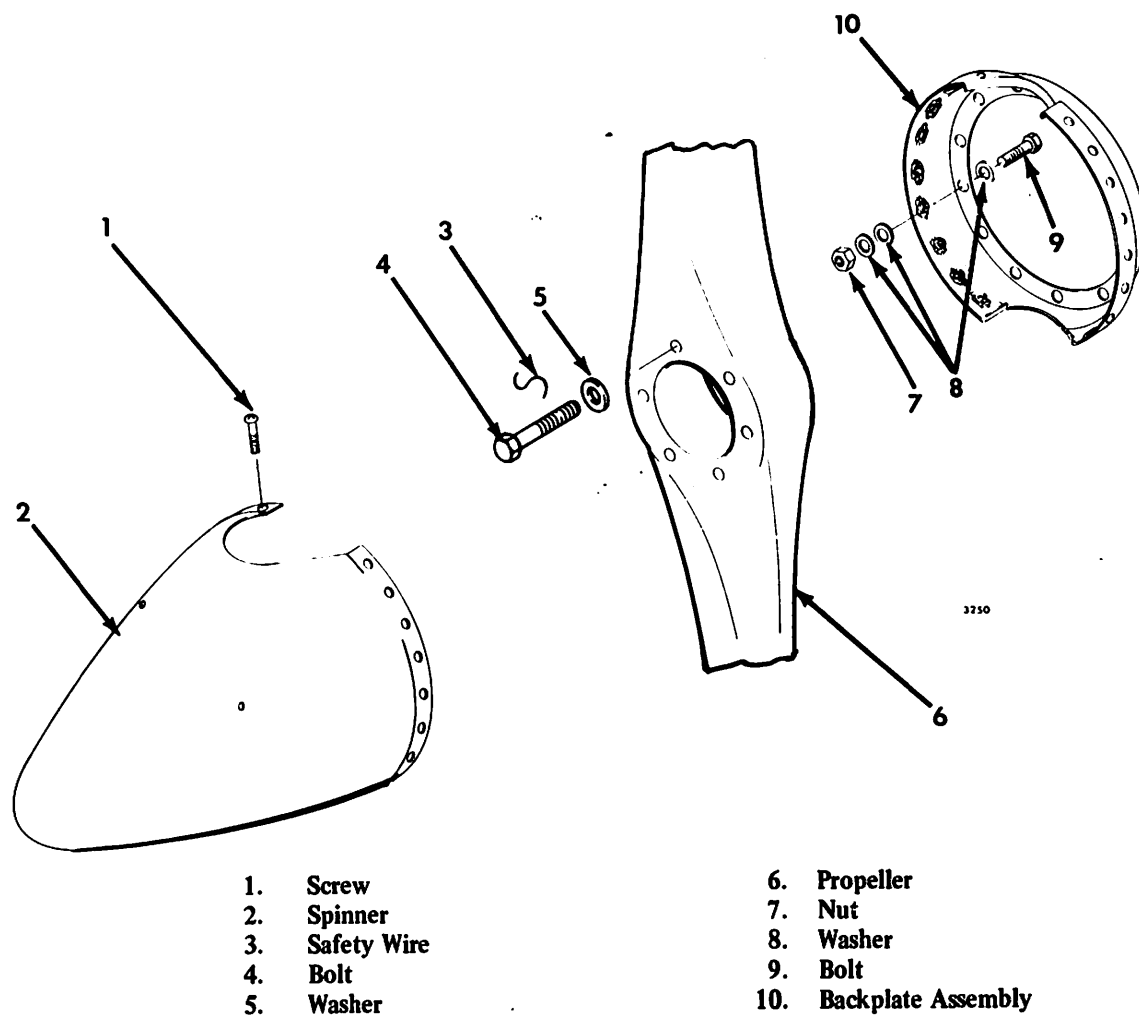
A. Propeller Removal (See Figure 201.)

- (1) Remove screws (1) from spinner (2) and slide spinner forward off of propeller.
- (2) Cut safety wire (3). Remove bolts (4) and washers (5).
- (3) Pull propeller (6) forward to remove from aircraft.
- (4) Note indexing of backplate to starter gear and remove nuts (7), washers (8), and bolts (9) and pull backplate (10) from starter gear of engine.

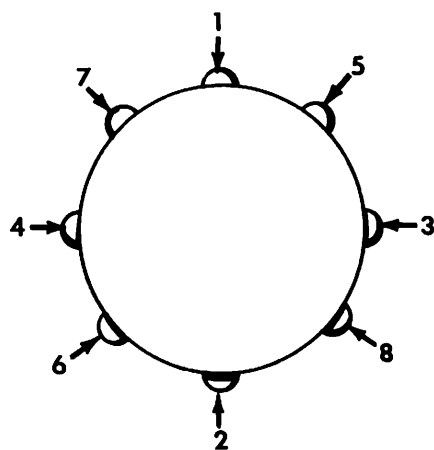
B. Propeller Installation (See Figure 201.)

WARNING: **ENSURE THAT THE MAGNETO SWITCH IS SET TO OFF AND THE MIXTURE IS SET TO IDLE CUTOFF PRIOR TO ROTATING THE CRANKSHAFT.**

- (1) Rotate the engine crankshaft until the TC mark on the starter gear is aligned with the parting line on the engine crankcase.
- (2) Position backplate assembly (10) on engine starter gear such that the propeller cutouts are indexed in the same position as removed.
- (3) Align bolt holes and secure backplate to starter gear with bolts (9), washers (8), and nuts (7). Torque to standard value. (See Chapter 91.)
- (4) Position propeller (6) on backplate (10) such that propeller fits in cutouts and its mounting holes align with holes in engine crankshaft.
- (5) Secure propeller (6) with washers (5) and bolts (4). Torque to 300 in. lb and secure bolts in pairs with .041 safety wire (3).
- (6) Place spinner (2) on propeller and check spinner bulkhead fit in propeller. Add plastic electrical tape as required to ensure a snug fit.
- (7) Center spinner carefully on the propeller axis. Align holes in spinner and backplate (10) and secure spinner to backplate with screws (1). Tighten screws in sequence shown in Figure 202.
- (8) Spinner runout after installation must be less than 1/16 in. when measured at the forward end of the spinner. Spinner attach screws may be loosened, and spinner shifted to correct alignment. Retighten screws.



Propeller Removal/Installation
Figure 201.



Spinner Screw Tightening Sequence
Figure 202

3. Inspection/Check**A. Propeller Inspection**

- (1) The propeller should be included in every preflight inspection and should receive special attention during 25, 50, and 100 hour inspections. Visually inspect the entire propeller for damage or defects. Any necessary repair should strictly adhere to AC43.13-1, Aircraft Inspection and Repair Manual, or manual and bulletins published by the propeller manufacturer.

Remove the spinner at each 100 hour inspection and visually inspect the spinner and backplate for cracks. When the spinner is reinstalled at the 100 hour inspection, run out must be corrected if more than 1/16 in.

Types of damage and defects which may be observed on parts of this assembly are defined as follows:

Burr —	A small, thin section of metal extending beyond a regular surface, usually located at a corner or on the edge of a bore or hole.
Corrosion —	Loss of metal from surface by chemical or electrochemical action. The corrosion products generally are easily removed by mechanical means. Iron rust is an example of corrosion.
Crack —	A physical separation of two adjacent portions of metal, evidenced by a fine or thin line across the surface, caused by excessive stress at that point. It may extend inward from the surface from a few thousandths inch to completely through the section thickness.
Cut —	Loss of metal, usually to an appreciable depth over a relatively long and narrow area, by mechanical means, as would occur with the use of a saw blade, chisel or sharp-edged stone striking a glancing blow.
Dent —	Indentation in a metal surface produced by an object striking with force. The surface surrounding the indentation will usually be slightly upset.
Erosion —	Loss of metal from the surface by mechanical action of foreign objects, such as grit or fine sand. The eroded area will be rough and may be lined in the direction in which the foreign material moved relative to the surface.
Fretting —	Breakdown or deterioration of metal surface by vibratory or "chattering" action. Usually no loss of metal or cracking of surface but generally showing similar appearance.
Gouge —	Grooves in, or breakdown of, metal surface from contact of foreign material under heavy pressure. Usually indicates metal loss but may be largely displacement of material.
Inclusion —	Presence of foreign or extraneous material wholly within a portion of metal. Such material is introduced during the manufacture of rod, bar, or tubing by rolling or forging.
Nick —	Local break or notch on edge. Usually displacement of metal rather than loss.
Pitting —	Sharp, localized breakdown (small, deep cavity) on metal surface, usually with defined edges.
Scratch —	Slight tear or break in metal surface from light, momentary contact by foreign material.

Score — Deeper (than scratch) tear or break in metal surface from contact under pressure. May show discoloration from temperature produced by friction.

Stain — A change in color, locally, causing a noticeably different appearance from the surrounding area.

- (2) Visually inspect all parts for damage or defects. Check all bolt threads for rough edges and irregularities. Check that surface finish (anodizing or plating) is not broken, chipped, or peeled (if peeled, look for corrosion). Staining and slight surface markings (not perceptible to fingernail) are normal and not alone cause for rejection or replacement.
- (3) If scratches or suspected cracks are found, determine their extent by use of the penetrant inspection method, Military Specification MIL-I-6866. The fluorescent method, "Zyglo" (Magnaflux Corp., Chicago, Ill.), is preferred; however, a non-fluorescent method, "Dycheck" (Turco Products Co., Los Angeles, Calif.), may also be used.

B. Spinner Inspection

- (1) Inspect the spinner for loose attaching hardware.
- (2) Check that the spinner is not dented or damaged.
- (3) Inspect centering bulkhead for cracks and damage.
- (4) Check area of spinner and backplate that is cut out for propeller (flanged area) for cracks, nicks, etc. Nicks should be polished out. Cracks may be repaired by welding

4. Cleaning/Painting

A. Propeller Cleaning/Painting

WARNING: USE SOLVENT IN A WELL VENTILATED AREA. DO NOT BREATHE FUMES. KEEP AWAY FROM FLAMES.

CAUTION: DO NOT USE STEEL, METAL, OR HARD BRISTLE BRUSH, OR A TOOL OF ANY TYPE TO REMOVE DEPOSITS.

- (1) Clean propeller and all attaching parts in a mixture consisting of 1/3 lubricating oil, Specification MIL-L-6082, (refer to Chapter 12) Grade 1065, and 2/3 solvent, Federal Specification PS 661 or equivalent. Remove heavy and tightly adhering deposits with a soft bristle brush.
- (2) After cleaning, allow parts to air dry, or use a gentle stream of clean, dry, compressed air to remove excess mixture.
- (3) Refer to manufacturer's (Sensenich) operating instructions for painting procedures.

B. Spinner Cleaning/Painting

Refer to Chapter 20 for spinner cleaning and painting procedures.

5. Approved Repairs

A. Propeller Repair

Repair the propeller in accordance with AC43.13-1, Aircraft Inspection and Repair Manual or manual and bulletins published by the propeller manufacturer.

B. Spinner Assembly Repair

Spinner and backplate repair consists of replacement of missing or loose attachment hardware (rivets, screws, and nutplates). If the spinner is warped or dented, it should be replaced. Minor nicks or scratches can be polished out. Cracks can be repaired by welding.

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POWER PLANT – DESCRIPTION/OPERATION

1. General

The AA-1C aircraft is powered by a 115 H.P. Lycoming, four-cylinder, horizontally opposed, air-cooled engine. The engine turns a Sensenich fixed pitch propeller, model number 72CK-0-56 or 72CK-0-52.

The power plant is enclosed by a three-segment cowl assembly consisting of an upper, lower, and forward cowl assembly.

The engine is attached to the engine mount assembly at four places using vibration isolator type shock mounts. After complete engine build-up the power plant is attached to the fuselage at the four engine mount support locations.

The engine is cooled by ram air pressure that is forced over and around the cylinders by the use of baffles. The air is then exhausted to the atmosphere through exit ducts located in the bottom of the lower cowl.

2. Engine Data

Engine	0-235-L2C
Rated horsepower	115
Rated speed RPM	2700
Bore, inches	4.375
Stroke, inches	3.875
Displacement, cubic inches	233.3
Compression Ratio	8.5:1
Firing order	1-3-2-4
*Spark plug gap	0.017 to 0.021
Valve rocker clearance (cold)	0.007 to 0.009
Propeller drive ratio	1:1
Propeller drive rotation (viewed from rear)	Clockwise

*See latest revision of Lycoming Service
Instruction Number 1042 for gap on specific
plug being used.

3. Engine Operation

Refer to Avco Lycoming Operator's Manual, Avco Lycoming Service Instructions, and the Aircraft Pilot's Operating Handbook for proper operation of engine.

POWER PLANT – TROUBLE SHOOTING1. Trouble Shooting the Power Plant

TROUBLE	PROBABLE CAUSE	REMEDY
Engine fails to start	Lack of fuel	Open fuel selector valve. Service fuel tanks. Push mixture control to full rich position.
	Flooded, or overprimed	Open the throttle and unload engine by cranking.
	Underprimed	Prime with two to three strokes.
	Incorrect throttle setting	Set throttle to closed position.
	Defective spark plugs	Clean and regap, or replace.
	Dead or weak battery	Recharge or replace.
	Defective ignition wire	Check with electric tester, and replace any defective wires.
	Water in carburetor	Drain carburetor and lines.
	Internal failure	Check oil sump for metal particles. If found, complete overhaul is indicated.
Engine not idling properly	Incorrect carburetor idle adjustment	Adjust throttle stop to obtain correct idle.
	Idle mixture	Adjust mixture.
	Open primer	Lock primer in closed position.
	Leak in the induction system	Tighten all connections and replace defective parts.
	Uneven cylinder compression	Check condition of rings and valve seats and then check cylinder compression.
	Insufficient fuel pressure	Check fuel pumps and filters.
	Faulty ignition system	Check ignition leads, plugs and magnetos.
Low power and uneven running	Mixture too rich	Readjustment of carburetor by authorized personnel.
	Mixture too lean	Readjustment of carburetor by authorized personnel.

TROUBLE	PROBABLE CAUSE	REMEDY
Low power and uneven running (Continued)	Leaks in induction system	Tighten all connections and replace defective parts.
	Defective spark plugs	Clean and gap or replace spark plugs.
	Magnetos not properly timed	Check for proper timing and synchronization.
	Defective spark plug terminal connectors	Replace connectors on spark plug wire.
	Improper grade of fuel	Empty tank and fill with proper grade fuel.
Failure of engine to develop full power	Throttle not properly adjusted	Adjust throttle lever.
	Leak in the induction system	Tighten all connections and replace defective parts.
	Dirty air filter	Clean or replace filter.
	Restriction in air scoop	Remove restriction.
	Improper grade of fuel	Empty tank and fill with proper grade fuel.
	Faulty ignition system	Check ignition leads, plugs and magnetos.
Rough running engine	Lead deposit on spark plugs	Clean and regap or replace spark plugs.
	Unbalanced propeller	Remove propeller and check for balance.
	Worn mounting bushings	Install new mounting bushings.
	Uneven compression	Check compression.
	Magneto not properly timed	Check magneto timing (Refer to Chapter 74).
Low oil pressure	Insufficient oil	Check oil supply and fill as recommended.
	Defective pressure gauge	Replace gauge.
	Dirty oil strainer	Remove and clean oil strainer.
	Air or dirt in relief valve	Remove and clean oil pressure relief valve.
	Leak in pressure or suction lines	Check gasket between accessory housing and crankcase.

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TROUBLE	PROBABLE CAUSE	REMEDY
Low oil pressure (Continued)	Stoppage in oil pump intake passage	Check line for obstruction and clean strainer.
	High oil temperature	See "High oil temperature" in "Trouble" column.
High oil temperature	Insufficient oil supply	Check oil supply and fill as recommended.
	Insufficient cooling air	Check cowl inlet and outlet for obstructions. Check baffles.
	Low grade of oil	Replace with oil conforming to specifications (Refer to Chapter 12).
	Clogged oil cooler, lines or strainers	Remove and clean oil cooler, lines, and strainers.
	Defective gauge	Replace gauge (See Chapter 79).
	Defective probe	Replace probe.
	Excessive blow-by	Usually caused by worn or stuck rings. Complete overhaul required.
Excessive oil consumption	Bearing failure	Examine sump for metal particles. If found, complete overhaul required.
	Worn piston rings	Install new rings.
	Incorrect installation of piston rings	Install new rings.
	Low grade of oil	Replace with proper grade of oil.
	External leakage	Check engine carefully for leaking gaskets and O-rings.
	Failure of rings to seat (new nitrided cylinders)	Use mineral base oil, climb to cruise altitude at full power and operate above 75% cruise power setting until oil consumption stabilizes.
Engine does not stop	Mixture control not correctly adjusted	Adjust mixture control.
	Faulty ignition system	Check ground wires.
Cold weather difficulties	Cold oil	Heat oil.

TROUBLE	PROBABLE CAUSE	REMEDY
Cold weather difficulties (Continued)	Weak battery	Recharge or replace.
	High oil pressure	In extreme cold weather, readings up to approximately 100 psi do not necessarily indicate malfunctioning.
	Overpriming	Open throttle, put mixture control in idle cut-off position. Crank engine until it starts. Immediately return mixture control to full rich position and close throttle as required.

POWER PLANT – MAINTENANCE PRACTICES

1. General

Prior to performing maintenance on the power plant, ensure that all safety precautions (such as switches in OFF position, fire extinguishers available, and NO SMOKING rules) are enforced. The complete power plant should be inspected for cleanliness and general condition. More detailed and up-to-date maintenance information can be obtained from the Avco Lycoming Operator's Manual, Service Letters, Bulletins, and Service Instructions.

2. Cleaning Power Plant

WARNING: USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.

Cleaning of the power plant can be accomplished with a suitable solvent and drying thoroughly. (Stoddard Solvent or equivalent).

NOTE: Use extreme care to prevent solvent entering the magnetos, alternators, starters, vacuum pump, and openings in the engine. Keep the amount of solvent contacting wiring to a minimum.

3. Removal/Installation of Power Plant

A. Remove Power Plant

CAUTION: PRIOR TO REMOVAL OF THE ENGINE, PLACE A SUPPORT UNDER THE TAIL OF THE AIRCRAFT TO PREVENT DAMAGE TO THE EMPENNAGE. TAG OR LABEL ALL WIRING AND CABLES PRIOR TO REMOVAL OF THE ENGINE FOR REFERENCE ON INSTALLATION.

- (1) Remove the propeller and spinner (refer to Chapter 61).
- (2) Remove the cowling (refer to 71-1-1).
- (3) Disconnect the throttle, mixture, and carburetor heat controls.
- (4) Disconnect the fuel and oil pressure lines.
- (5) Disconnect the main fuel line at the inlet to the engine driven fuel pump.
- (6) Disconnect the tachometer cable.
- (7) Disconnect the vacuum pump hose at the pump.
- (8) Disconnect the fuel primer lines.
- (9) Disconnect bonding strap from engine.
- (10) Disconnect all wiring from the engine.
- (11) Disconnect the heater duct at the muffler.
- (12) Disconnect oil cooler lines.
- (13) Attach a suitable lifting device to engine and remove the engine mounting bolts.

B. Install Power Plant

NOTE: Inspect the engine rubber mounting bushings for wear and deterioration. Replace as required.

- (1) Position the engine to the engine mount and install the mounting bolts. Torque mounting bolts to 200-250 in. lb.
- (2) Connect the heater duct to the muffler.
- (3) Connect all wiring to the engine.
- (4) Connect the fuel primer lines.
- (5) Connect the vacuum pump hose at the pump.
- (6) Connect the tachometer cable.
- (7) Connect the main fuel line at the inlet to the engine driven fuel pump.
- (8) Connect the fuel and oil pressure lines.
- (9) Connect the throttle, mixture, and carburetor heat controls.
- (10) Connect the oil cooler lines.
- (11) Connect bonding strap at top of engine.

NOTE: Refer to Chapter 73 for proper installation of the carburetor throttle control.

NOTE: Maintain a minimum 4-1/2 in. bend radius on all carburetor controls.

- (12) Install the cowling (refer to 71-1-1).
- (13) Install the propeller (refer to Chapter 61).

POWER PLANT COWLING – DESCRIPTION/OPERATION**1. General**

The power plant is enclosed by a three-piece cowl assembly. The upper cowl assembly is located above the engine between the fuselage and forward cowl. The upper cowl is latched to the lower cowl on each side and secured to the forward cowl with 1/4 turn fasteners. The upper cowl can be raised to gain access to the engine for inspection, service, or minor repair. The lower cowl assembly encloses the lower engine components and must be removed to gain access to the carburetor, exhaust system, air induction system and other lower engine components. The forward cowl covers the front of the engine and encloses the starter, flywheel, and alternator. The landing light is mounted in the forward cowl.

POWER PLANT COWLING – MAINTENANCE PRACTICES

1. Removal/Installation of Cowling

A. Remove Cowling

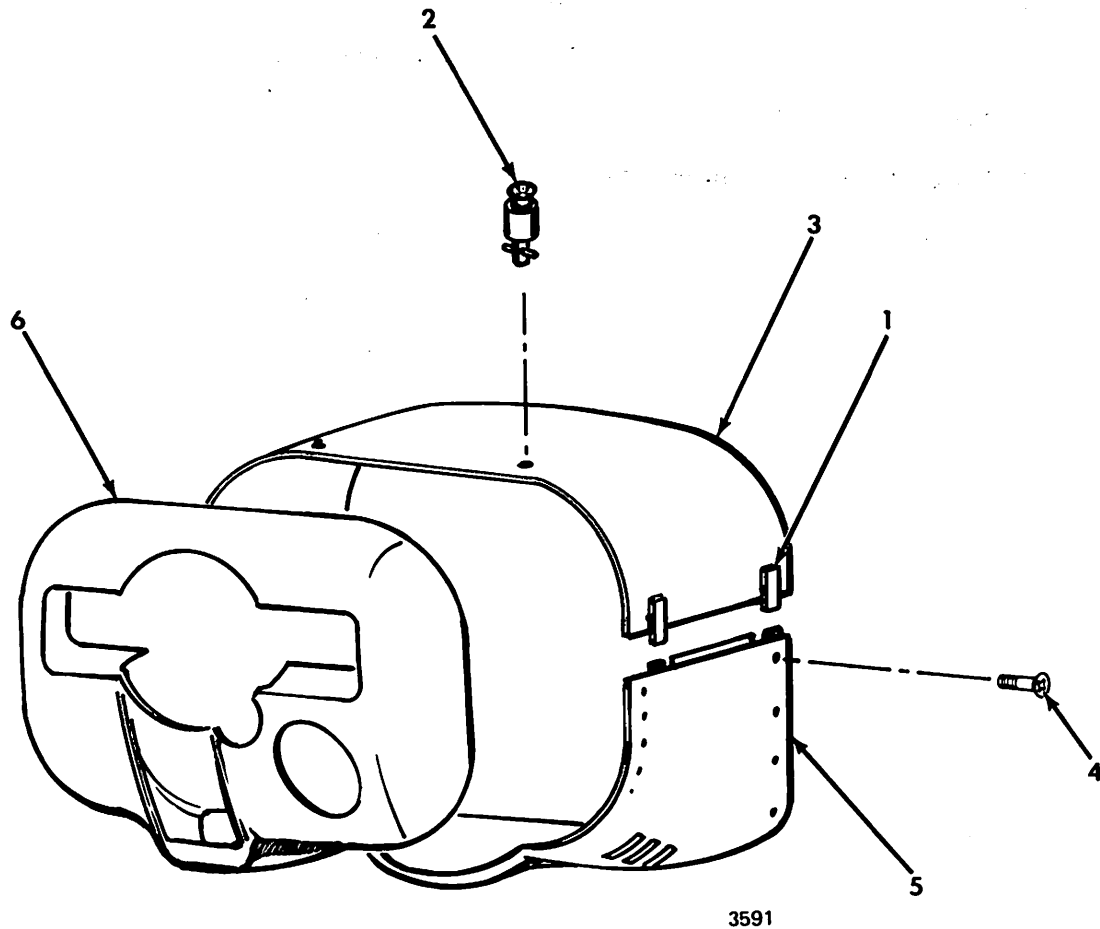
- (1) Unfasten the latches (1, Figure 201) on each side of the cowl.
- (2) Disconnect Camloc fasteners (2) and lift off the upper cowl assembly (3).
- (3) Remove the screws (4).
- (4) Remove the lower cowl assembly (5).
- (5) Remove the propeller spinner and propeller, (refer to Chapter 61).
- (6) Disconnect landing light wires and remove forward cowl assembly (6).

NOTE: For removal, installation, and adjustment of the landing light assembly, refer to Chapter 33.

B. Install Cowling

CAUTION: WHEN ADJUSTING COWL LATCHES AT INSTALLATION, PROVIDE ONLY ENOUGH TENSION TO HOLD UPPER COWL SECURELY. OVER-TIGHTENING WILL CREATE EXCESSIVE STRESS AND CAUSE CRACKING OF COWL SKIN IN THE LATCH AREA.

- (1) Position forward cowl assembly (6) on front of engine and connect landing and light wires.
- (2) Install propeller and propeller spinner (refer to Chapter 61).
- (3) Position lower cowl assembly (5) in place on engine and install screws (4).
- (4) Position upper cowl assembly (3) in place on engine and install Camloc fasteners (2).
- (5) Fasten latches (1) on each side of the cowl.



1. Cowl Latch
2. Camloc Fastener
3. Upper Cowl Assembly
4. Screw
5. Lower Cowl Assembly
6. Forward Cowl Assembly

**Cowl Assembly Removal/Installation
Figure 201**

**ENGINE MOUNT – DESCRIPTION****1. General**

The engine mount is composed of sections of tubing, formed and welded together. The purpose of the engine mount is to support the engine and attach the engine to the airframe. The engine is attached to the mount at four places using vibration isolator type shock mount assemblies, bolts, and self-locking type nuts. The engine mount is attached to the airframe at four places using bolts, washers, and nuts safetied with cotter pins.

ENGINE MOUNT – MAINTENANCE PRACTICES

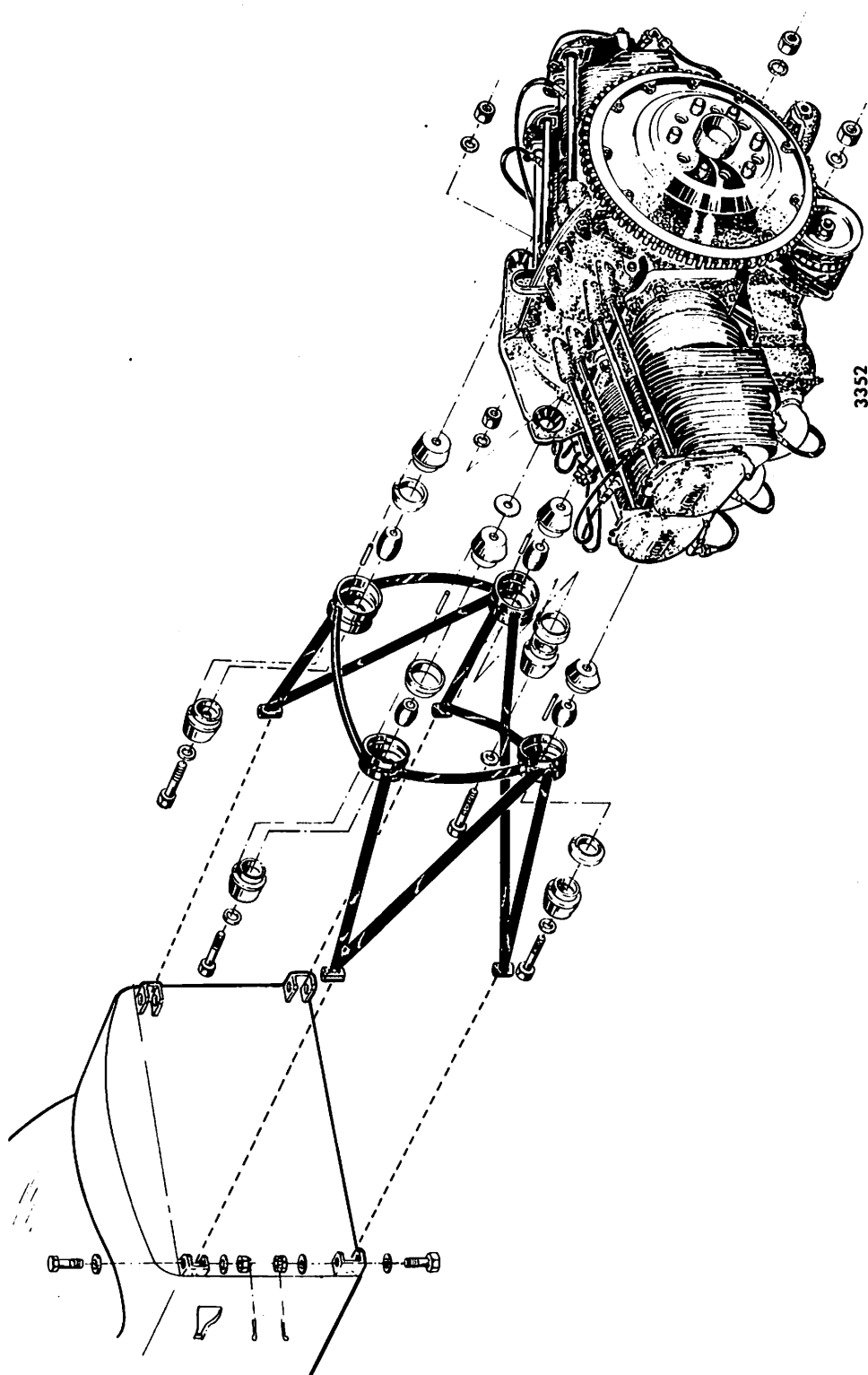
1. Removal/Installation of Engine Mount

A. Remove Engine Mount (See Figure 201.)

- (1) Remove power plant (refer to subsection 71-0, Power Plant Removal).**
- (2) Disconnect all wiring, ties, and clamps attached to engine mount.**
- (3) Remove nuts, washers, and bolts securing mount to engine mount supports, and remove mount.**

B. Install Engine Mount (See Figure 201.)

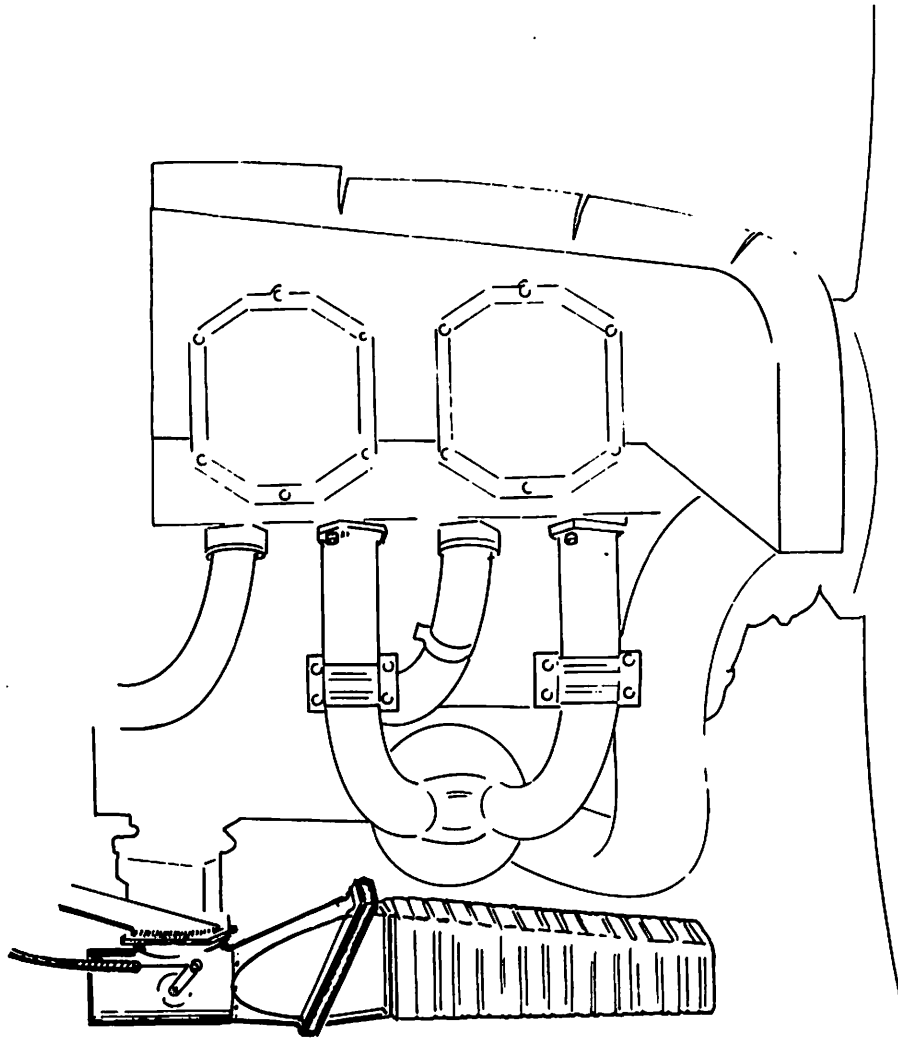
- (1) Position engine mount to engine mount supports and install mounting bolts, washers, and nuts.**
- (2) Connect clamps and ties to mount.**
- (3) Install power plant as outlined in subsection 71-0.**



**Engine Mount Installation
Figure 201**

AIR INTAKES – DESCRIPTION/OPERATION1. General (See Figure 1.)

Openings in the forward cowl provide for entry of ram air to the engine. An opening in the lower front of the forward cowl provides ram air directly to the carburetor air filter and then to the carburetor.



3555

Engine Air Intake System
Figure 1

**ENGINE BAFFLES – DESCRIPTION/OPERATION****1. General**

The engine baffles are made from sheet aluminum with rubber-asbestos composition seal at points of contact with the engine cowling. The baffles are attached to the engine and direct the cooling air around the engine to provide optimum engine cooling. The complete baffles are composed of several segments which provides for easy removal and replacement of any single segment. The engine baffles should be inspected thoroughly at each periodic inspection for condition and security of mounting. Any loose or damaged baffles should be repaired or replaced.

ENGINE BAFFLES – MAINTENANCE PRACTICES

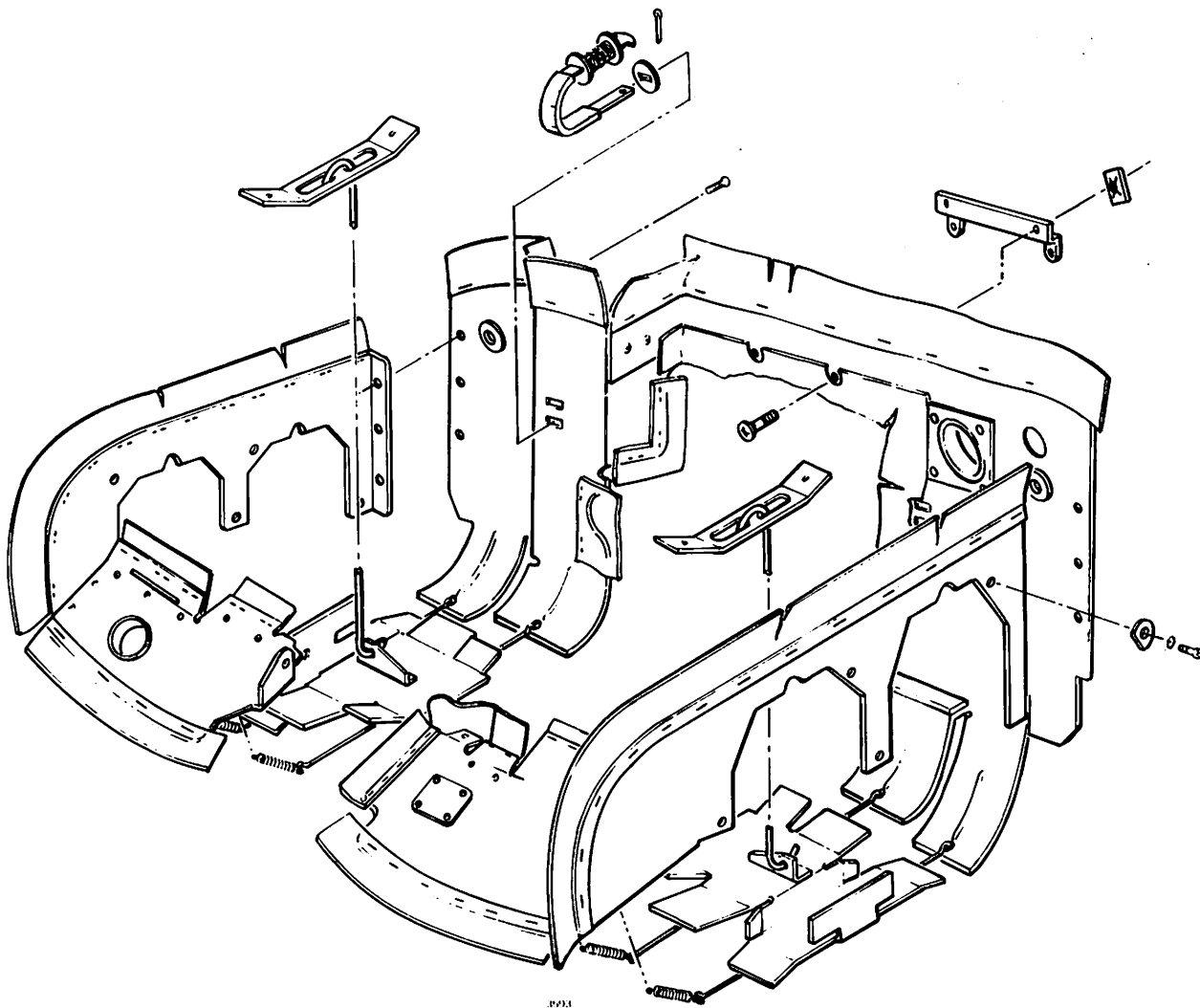
1. Removal/Installation of Engine Baffles

A. Remove Engine Baffles (See Figure 201.)

- (1) Remove cowling as necessary to gain access. (Refer to Section 71-1-1.)
- (2) Disconnect baffle springs on underside of engine.
- (3) Disconnect upper spark plug leads and pull lead ends through hole in rear baffles.
- (4) Disconnect air inlet flexible duct from front baffle.
- (5) Remove attaching screws and bolts that secure baffles to engine.
- (6) Remove screws that secure baffle segments together where necessary to remove individual segments and remove baffles.

B. Install Engine Baffles (See Figure 201.)

- (1) Assemble individual baffle segments in position on the engine and secure together with screws.
- (2) Install attaching screws and bolts that secure baffles to engine.
- (3) Connect baffle springs on underside of engine.
- (4) Connect baffle-to-exhaust clamp braces on front baffle.
- (5) Connect air inlet flexible ducts to front baffle.
- (6) Pull spark plug leads through holes in rear baffle, install grommets in holes, and connect spark plug leads.
- (7) Install cowling. (Refer to Section 71-1-1.)



**Engine Baffles
Figure 201**

ENGINE DRAINS – DESCRIPTION

1. General

All drain lines are routed overboard through openings in the bottom of the lower cowl.

The engine breather line is a flexible line attached at the breather vent port in the top of the engine. The breather prevents an excessive pressure buildup inside the crankcase. The flexible line is extended by a piece of aluminum tubing attached to the flexible line with a spring clamp.

The fuel pump drain line may be either a clear plastic line attached to the pump vent by a spring type clamp or an aluminum line connected to a nipple vent by a nut. The battery box drain line is a short length of clear plastic tubing attached to the battery box drain with a spring type clamp.

CHAPTER 73

ENGINE FUEL AND CONTROL

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ENGINE FUEL AND CONTROL – DESCRIPTION/OPERATION**1. General**

The engine fuel and control system consists of the units and components which deliver metered fuel and air to the engine. The fuel portion includes the carburetor and associated controls, fuel primer, and fuel pressure indicator. The air portion includes the air induction system and associated controls. The fuel controls consist of the throttle and mixture control. The controls are located on the lower instrument panel.

Fuel induction system components that are an integral part of the engine are described in the Avco Lycoming Operator's Manual.

**AIR INDUCTION SYSTEM – DESCRIPTION/OPERATION****1. General**

The induction system consists of an air inlet housing and filter assembly. The inlet housing aligns with an opening in the nose cowl which permits filtered outside air to enter the carburetor through an oil saturated filter located in the induction inlet duct.

The induction system includes an alternate hot air source, which is controlled from the instrument panel. When carburetor icing conditions exist, the carburetor heat control can be pulled out to provide hot air to the carburetor intake.

NOTE: Limited operation of the carburetor heat control is recommended since no filter is incorporated in the hot air source.

AIR INDUCTION SYSTEM – MAINTENANCE PRACTICES1. Removal/Installation of Air Induction System

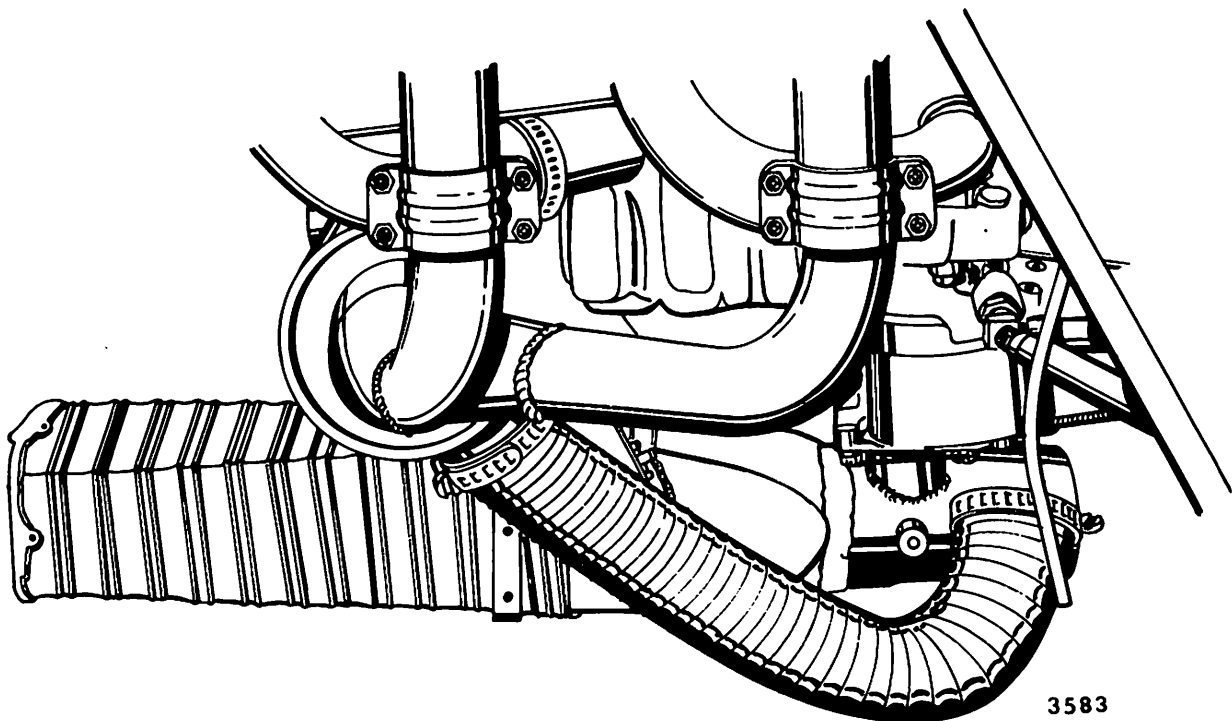
A. Remove Induction System (See Figure 201.)

- (1) Remove the lower cowl assembly (refer to Chapter 71).
- (2) Loosen the clamp and disconnect the carburetor heat hose from the air box assembly.
- (3) Disconnect the carburetor heat control from the air box assembly. (Refer to Chapter 30)
- (4) Remove the bolts and lower the air box assembly from the carburetor.

B. Install Induction System (See Figure 201.)

- (1) Position the air box assembly to the carburetor and forward cowl and install the bolts.
- (2) Connect the carburetor heat control to the air box assembly. (Refer to Chapter 30.)
- (3) Install the carburetor heat inlet hose and clamp to the air box assembly.
- (4) Install the lower cowl.

NOTE: Make sure the air duct is properly fitted over the scoop in the forward cowl. Failure to do this could result in an inadequate air supply to the carburetor.



Air Induction System
Figure 201

2. Filter Servicing

A. Remove, Service, and Install Filter

- (1) Remove lower cowl. (Refer to Chapter 71.)**
- (2) Remove the screws attaching the adapter assembly, air filter and air box assembly together.**
- (3) Thoroughly wash the filter in petroleum solvent. Make certain all dirt is removed and filter is in serviceable condition. If filter has flocking worn from screen wire, replace.**
- (4) Dry the filter at room temperature. Filter must be completely dry before proceeding with next step. If the filter is not dry, the solvent will prevent oil from adhering to the filter, thereby reducing the filter efficiency.**
- (5) Immerse the filter in the grade oil called for on the filter. If none is called out, use engine preservative oil MIL-L-21260 (Socony's "Avrex 901" or Esso's "Rust-Ban 626"). Refer to Table of Lubricants, Chapter 12.**
- (6) After removing the filter from the oil, allow it to drain thoroughly before installing in the aircraft.**
- (7) Inspect the gasket between the air filter and air box; if damaged or otherwise defective, replace with a new gasket.**
- (8) Position the air box assembly, filter, and adapter together and install the screws.**
- (9) Install lower cowl. (Refer to Chapter 71.)**

**CARBURETOR – DESCRIPTION/OPERATION****1. General**

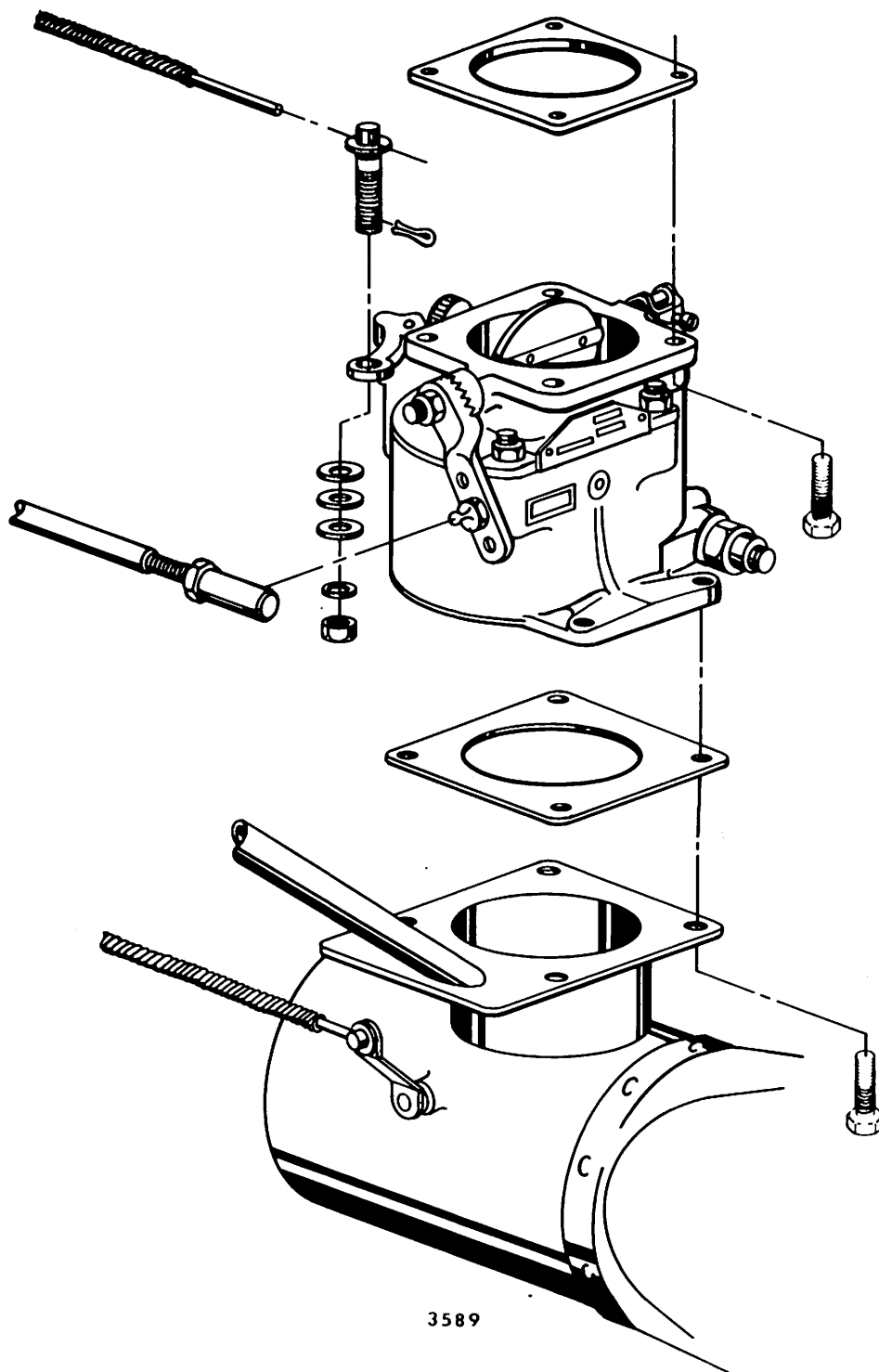
The engine is equipped with a single barrel, float-type carburetor, which incorporates an idle cut-off mechanism and a manual mixture control. The carburetor is mounted on the bottom of the engine.

CARBURETOR – MAINTENANCE PRACTICES**1. Removal/Installation of Carburetor****A. Remove Carburetor**

- (1) Place fuel shut-off valve in OFF position.
- (2) Remove induction system (refer to 73-1-1).
- (3) Remove throttle control. (Refer to 73-2-1.)
- (4) Remove mixture control. (Refer to 73-2-2.)
- (5) Remove throttle control support bracket.
- (6) Disconnect fuel inlet and fuel pressure lines at carburetor and cap lines and fittings.
- (7) Remove four nuts and washers and remove carburetor.

B. Install Carburetor

- (1) Using a new gasket, position carburetor to engine and install washers, nuts, and Pal nuts.
- (2) Use a new gasket and install gasket and throttle support bracket.
- (3) Connect fuel inlet and fuel pressure lines at carburetor.
- (4) Install carburetor with four bolts, nuts, and washers.
- (5) Install throttle control. (Refer to 73-2-1.)
- (6) Install mixture control. (Refer to 73-2-2.)
- (7) Place fuel shut-off valve to ON position.
- (8) Place auxiliary fuel boost pump switch to ON position to pressurize the system and check connections for leaks.
- (9) Install induction system (refer to 73-1-1).



**Carburetor Removal/Installation
Figure 201**

**ENGINE PRIMER SYSTEM – DESCRIPTION/OPERATION****1. General**

The engine is equipped with a four cylinder priming system. Fuel is injected directly into the cylinder intake system by a plunger in the primer body located on the instrument panel. Fuel to the primer is obtained from a connection in the bottom of the right fuel measurement gauge. The primer knob can be locked in the closed position by pushing fully in and rotating either left or right until the knob cannot be pulled out. If a manifold pressure gauge is desirable, the priming system can be converted to a three cylinder system, and number three or number four cylinder used for the manifold pressure gauge connection.

ENGINE PRIMER SYSTEM – MAINTENANCE PRACTICES

1. Removal/Installation of Primer System

A. Remove Primer System

- (1) Remove the lower cowl.
- (2) Remove the line between the tee at rear of engine and the primer.
- (3) Remove the clamps securing the primer lines to the engine and the engine intake pipes and remove the primer lines from the engine.

NOTE: Do not disconnect the line from the tee connection at the right tank gauge unless line is damaged. If the line must be removed for repair or replacement, drain the right fuel tank.

- (4) Remove the knurled nut on the front of the instrument panel securing the primer.
- (5) Remove primer knob, plunger, spacer, and knurled nut as an assembly from the front of the instrument panel.
- (6) Remove primer body from rear of instrument panel.

B. Install Primer System

- (1) Assemble primer body, spacer, plunger, primer knob, and knurled nut on instrument panel and tighten nut.
- (2) Connect line between tee at rear of engine and primer.
- (3) Install primer lines to individual cylinders.
- (4) Connect primer line from firewall to tee connection.
- (5) Install clamps and secure primer lines to engine intake pipes and to engine.
- (6) Operate engine primer and check lines and connections for leaks.
- (7) After operating primer and checking system, allow sufficient time for excess fuel to drain overboard from the engine manifold before attempting an engine start.
- (8) Install lower cowl.

THROTTLE CONTROL – DESCRIPTION/OPERATION**1. General**

The throttle setting regulates the power output of the engine by controlling the amount of the fuel/air mixture that moves into the engine cylinders. The throttle control is on the lower center of the instrument panel and is connected to the carburetor throttle valve by a flexible cable. The engine manifold pressure is controlled by the throttle settings.

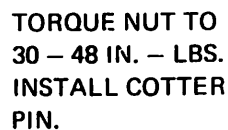
THROTTLE CONTROL – MAINTENANCE PRACTICES**1. Removal/Installation of Throttle Control****A. Remove Throttle Control as Follows:**

- (1) Remove cowl to gain access (refer to Chapter 71).
- (2) Disconnect the ball joint (1, Figure 201) from the carburetor throttle arm (2).
- (3) Remove the nut (3), bolt (4), and lock plate (5) which secure the throttle plunger sleeve (6) to the support bracket (7).
- (4) Remove plunger sleeve (6) from support bracket (7).
- (5) Remove the clamps which secure the throttle cable and carburetor heat control cable to the instrument panel support (located between instrument panel and firewall).
- (6) Remove the throttle housing retainer nut (8) from behind the instrument panel and carefully pull the throttle cable (9) through the firewall and instrument panel.

B. Install Throttle Control as Follows:

- (1) Pass the end of the throttle control cable (9, Figure 201) through the instrument panel and slide the housing retainer nut (8) over the end of the cable.
- (2) Route cable through the firewall to the carburetor.
- (3) Install and tighten the nut (8) on the throttle housing behind the instrument panel.
- (4) Position the throttle plunger sleeve (6) in the slot in the support bracket (7) and secure the lock plate (5) with bolt (4) and nut (3).
- (5) Position the throttle cable (9) to provide a minimum 4-1/2 in. bend radii and install the clamps.
- (6) Install the ball joint (1) loosely on the throttle arm (2).
- (7) When carburetor throttle arm has been removed, install as follows:
 - (a) Check carburetor throttle arm (2) with arm against full open stop. Arm should be $55^{\circ} \pm 2^{\circ}$ forward of vertical as shown on Figure 201.
 - (b) Torque throttle arm screw to 30-48 in. lbs.
- (8) Turn throttle knob (10) and jam nut (11) completely down, then tighten jam nut against throttle knob.
- (9) Place a 1/8 inch spacer between the throttle knob jam nut (11) and the friction lock (12) (friction lock partially loose).
- (10) Adjust the threaded ball joint (1) to position the carburetor throttle arm (2) against the full open stop. Check through the inspection hole in ball joint (1) that there is a minimum of 3/16 in. plunger rod engagement in the ball joint. Secure with jam nut (13).
- (11) If thread engagement in step (10) above is less than 3/16 in., the throttle knob (10) may be threaded out to 3/16 in. minimum thread engagement and step (10) above repeated.
- (12) Space between throttle knob jam nut (11) and friction lock (12) with throttle fully open (friction lock partially loose) must be 1/8 - 1/4 in. maximum.

-



View of Carburetor Throttle Arm (Serrated Clamp Design)

Engine Throttle Control Removal/Installation

Figure 201

MIXTURE CONTROL – DESCRIPTION/OPERATION**1. General**

The mixture control is located on the lower center of the instrument panel adjacent to the throttle control. The mixture control meters the amount of fuel that passes through the carburetor main jet, and is used to regulate fuel economy at various power settings and cruising altitudes.

MIXTURE CONTROL – MAINTENANCE PRACTICES1. Removal/Installation of Mixture Control

A. Remove Mixture Control (See Figures 201 and 202.)

- (1) Remove cowl to gain access (refer to Chapter 71).
- (2) Disconnect mixture control at carburetor by removing cotter pin (1), nut (2), washers (3), bearing (4), and bolt (5) from mixture control arm (6).
- (3) Straighten mixture control wire (7) and remove wire from swivel assembly.
- (4) Loosen the clamp at the firewall and instrument panel brace sufficiently to allow the cable to slide through.
- (5) Remove the nut (8) securing the mixture control housing (9) to the instrument panel and pull the mixture control cable through the firewall and instrument panel.

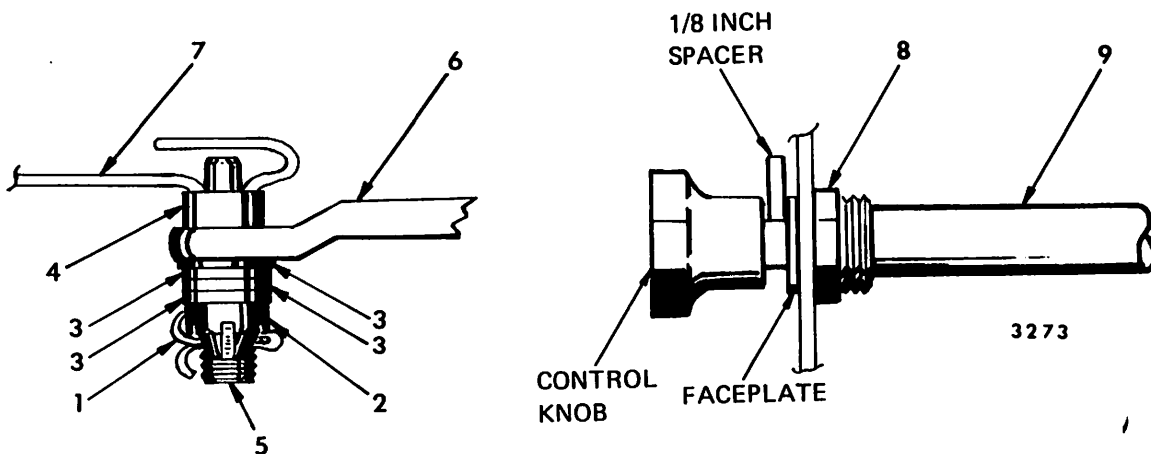
B. Install Mixture Control

CAUTION: DO NOT BEND OR KINK MIXTURE CONTROL CABLE DURING INSTALLATION.

- (1) Pass the end of the control cable through the instrument panel opening and slide the nut (8) over the end of the cable and secure housing (9) to instrument panel.
- (2) Continue the cable through the firewall, being sure it passes through the tie-wraps on the wiring and cable bundle and the clamps on the instrument panel brace and on the forward side of the firewall.
- (3) Pass the end of the cable through the bushing in the support bracket.
- (4) Assemble the bolt (5), bearing (4), washers (3), and nut (2) loosely on the carburetor mixture control (6). Thread the wire (7) through the hole in the swivel assembly.

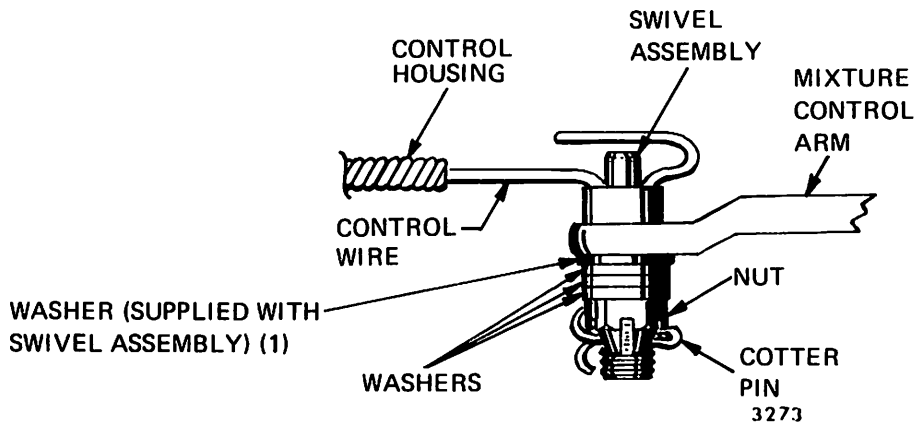
NOTE: Do not bend wire or tighten bolt at this time.

- (5) Position the mixture control arm completely against the full rich stop. Place a 1/8-in. spacer between mixture control knob and control cable housing as shown in Figure 201.



Typical Control Knob Rigging
Figure 201

- (6) With the mixture control arm against the full rich stop, and the control knob against the spacer, tighten the swivel assembly nut and the cable clamps at the firewall and the instrument panel brace. Remove the spacer from control knob and check mixture control operation.
- (7) Bend mixture control cable wire as shown on Figure 202 and install the cotter pin.
- (8) Check operation of mixture control. Control should have 1/8 in. travel remaining with mixture control arm in full rich position. Control cable should have 4-1/2 in. minimum bend radius.
- (9) Install cowl (refer to Chapter 71).



Mixture Control Wire Installation
Figure 202

2. Idle Speed and Mixture Adjustment

A. Adjust Idle Speed and Mixture Setting

- (1) Perform a normal engine warm up until oil temperature has stabilized.
- (2) With engine operating at 1800 rpm, check for normal magneto rpm drop (175 rpm maximum drop with no more than 50 rpm difference between magnetos).
- (3) Set the throttle stop idle speed adjustment screw on the carburetor so that the engine idles at 600-650 rpm.
- (4) With a smooth and steady motion, pull the cockpit mixture control towards the idle cut-off position and observe the tachometer for any change. Return the control to the full rich position prior to the engine cutting out. An increase of more than 50 rpm while "leaning out" indicates an excessively rich idle mixture. An immediate decrease in rpm indicates the idle mixture is too lean.
- (5) If the procedure in step (4) indicates the fuel mixture is too rich or too lean, turn the idle mixture screw in the carburetor to obtain the necessary correction, and repeat step (4).
- (6) Each time the idle adjustment is changed, run the engine up to 2000 rpm before proceeding with the next rpm check.
- (7) Check engine idle speed and if necessary, make final adjustments to obtain correct idle speed.

3. Mixture Control Wires Inspection

NOTE: All mixture control wires are to be removed from service after they have accumulated a total time in service of 500 hours. Mixture control wires with more than 500 hours time in service, must be replaced within 50 hours; thereafter, at 500 hour intervals.

- A. Cycle the control knob between the full rich and idle cutoff position, and observe the control housing for a "snaking" movement. Movement of the housing indicates that the control wire is kinked and must be replaced.
- B. Place the control knob in the idle cutoff position, grasp the mixture control arm and move arm to the full rich position. Measure the additional travel (sponge) remaining between the faceplate and control knob. Replace mixture control wire, if the additional travel remaining exceeds 1/8 inch.

NOTE: When obtaining the above measurements, the carburetor mixture control arm must be in the full rich position. If the arm is not in the full rich position with control knob against the faceplate, loosen cable clamps and rerig for 1/8 inch maximum sponge.

- C. The control housing minimum bend radius is 4-1/2 inches throughout its entire routing. If necessary, adjust housing and replace mixture control wire, if the minimum bend radius is less than 4-1/2 inches.
- D. The firewall cable clamp must direct the control housing at the right angles to the firewall. If necessary, adjust to achieve this condition.
- E. Perform a final check of the mixture control for proper travel, security, operating condition and control cushion (sponge).

FUEL PRESSURE GAUGE – DESCRIPTION/OPERATION**1. General**

The fuel pressure gauge is the lower gauge in the instrument cluster assembly. The cluster assembly is located on the right-hand side of the instrument panel. The gauge is connected to the fuel inlet on the carburetor by an aluminum tube from the gauge to the firewall and a flexible pressure line from the firewall to the fuel inlet on the carburetor.

FUEL PRESSURE GAUGE – MAINTENANCE PRACTICES

1. Fuel Pressure Gauge Removal/Installation

A. Remove Fuel Pressure Gauge (See Figure 201.)

WARNING: BE SURE THAT MASTER SWITCH IS IN OFF POSITION.

CAUTION: WHEN LINE IS DISCONNECTED, SOME FUEL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT HAZARD DUE TO SPILLAGE.

NOTE: To remove the fuel pressure gauge, the instrument cluster assembly must first be detached from the instrument panel.

- (1) Place container under instrument cluster and disconnect tubing from fuel pressure gauge at back of instrument cluster. Cap disconnected tubing.
- (2) Remove two screws securing instrument cluster to instrument panel.
- (3) Carefully push instrument cluster inward approximately one inch and slide plastic face plate downward to remove from instrument cluster.
- (4) Remove lock nut securing fuel pressure gauge to case and remove fuel pressure gauge from case.

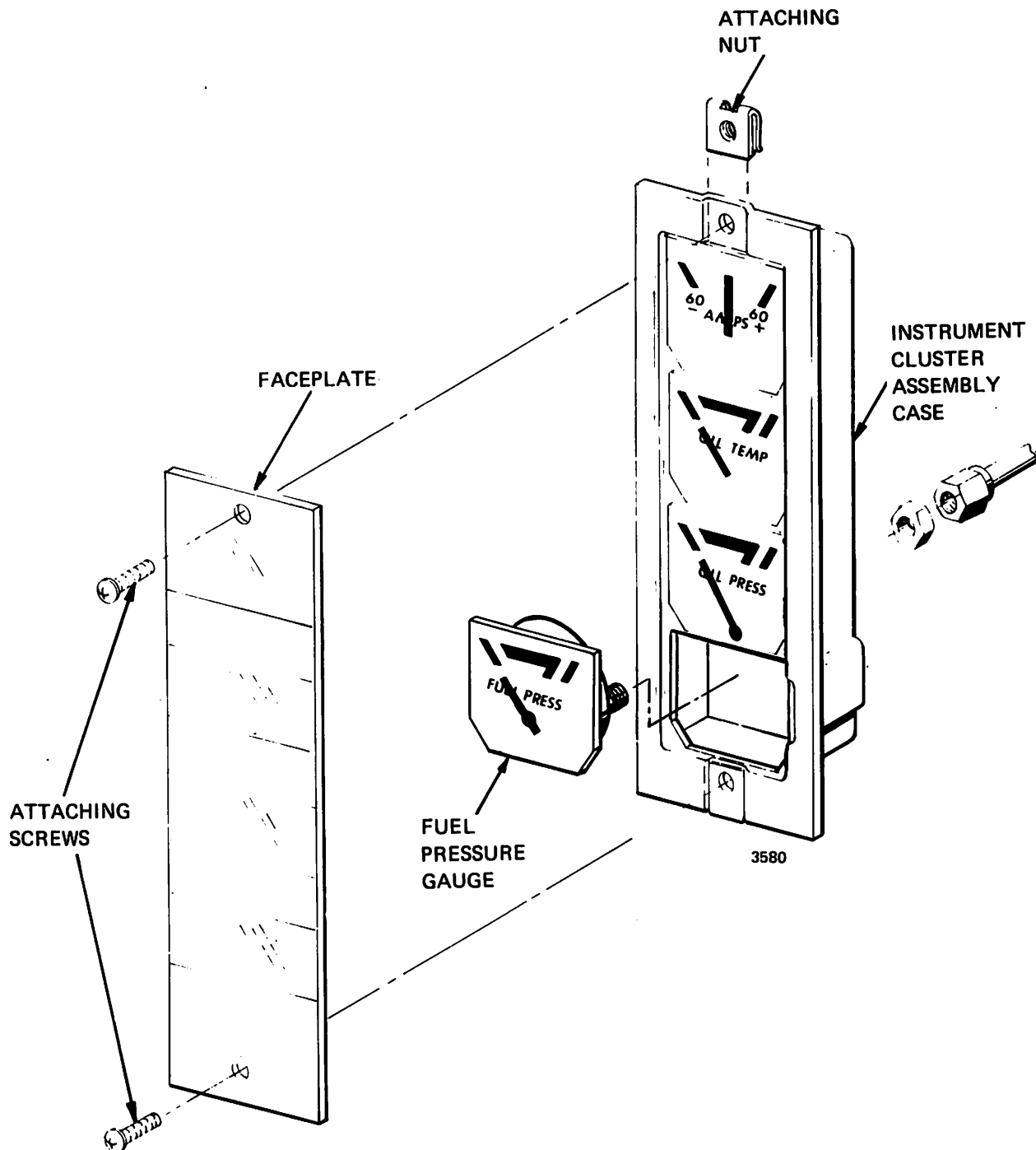
B. Install Fuel Pressure Gauge (See Figure 201.)

WARNING: BE SURE THAT MASTER SWITCH IS IN OFF POSITION.

- (1) Position fuel pressure gauge in instrument cluster assembly case and install nut on gauge nipple. Torque nut to 25-30 in. lb.
- (2) Position plastic face plate on instrument cluster assembly case and carefully push case upward to position in instrument panel.
- (3) Secure instrument cluster assembly to instrument panel with attaching screws.

CAUTION: WHEN LINE IS UNCAPPED, SOME FUEL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT HAZARD DUE TO SPILLAGE.

- (4) Operate engine for three minutes while observing fuel pressure for normal indications.
- (5) Shut down engine. Check fuel pressure gauge connection for signs of leakage.



Fuel Pressure Gauge Installation
Figure 201

CHAPTER 74

IGNITION

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**IGNITION SYSTEM – DESCRIPTION/OPERATION****1. General**

The ignition system components generate, control, and distribute an electrical current to ignite the fuel-air mixture in the cylinders. The engine dual ignition system consists of the magnetos, shielded harness, spark plugs and the ignition switch. The magnetos are a sealed, lightweight type requiring no internal adjustments. Timing the magneto to the engine at installation is the only adjustment required. Each lead of the ignition harness can be removed separately. The ignition switch is located on the lower left-hand side of the instrument panel.

IGNITION SYSTEM – MAINTENANCE PRACTICES

1. Inspection of Ignition System Components

- A. Check magneto harness for security of mounting clamps, tight connections, and frayed shielding.

WARNING: **USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES.**

- B. Examine spark plug lead shielding, compression springs, and ceramics for corrosion and deposits. If this condition exists, clean the leads and ceramics with a clean cloth moistened with methyl-ethyl-ketone.

NOTE: If lead has been disassembled, see Figure 201 for correct arrangement at reassembly.

- C. Remove and check spark plugs for proper gap and evidence of fouling. Clean and regap plugs if necessary. (See latest revision of Lycoming Service Instruction No. 1042). Plugs should be rotated upper-to-lower every 100 hours of plug service, or sooner if lead fouling occurs.

- D. Check magnetos to engine timing. If necessary, time the magnetos to the engine. The magneto to engine timing check should be made every 100 hours.

2. Removal/Installation of Ignition System Components

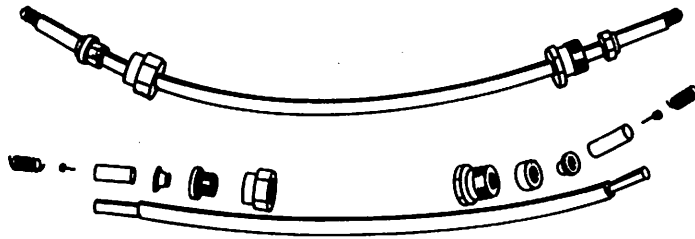
- A. Remove Ignition Harness.

- (1) Remove cowl as necessary to gain access.
- (2) Tag or identify each lead for reference at installation.
- (3) Disconnect harness leads at spark plugs.
- (4) Remove clamps securing the harness to the cylinder head.
- (5) Remove harness ties to engine mount.
- (6) Remove plastic ties as necessary to separate harness leads.
- (7) Remove attaching screws from magneto caps.
- (8) Remove the magneto caps and harness as an assembly.

- B. Install Ignition Harness.

- (1) Route ignition harness leads as shown in Figure 202. (For alternate ignition lead routing, see Lycoming Service Instruction No. 1294.)
- (2) Install ignition harness leads and magneto caps on magnetos.
- (3) Connect ignition harness leads to spark plugs. Tighten nut finger tight plus one-fourth turn.
- (4) Install plastic ties on harness as necessary.
- (5) Install clamps securing ignition leads to cylinder heads as necessary.
- (6) Secure ignition harness to engine mount as necessary.
- (7) Remove identification tags installed prior to removal.

(8) Install cowl.



3204

NOTE: Refer to Slick Electro, Inc. pamphlet (Form No. 1009-5M-8-68) for assembly instructions and tool requirements. Slick Electro Inc., 530 Blackhawk Park Avenue, Rockford, Ill. 61101

Magneto Lead Disassembly/Assembly
Figure 201

C. Remove Spark Plugs.

- (1) Remove cowl as necessary to gain access.
- (2) Disconnect ignition harness leads from spark plugs.
- (3) Remove spark plugs.

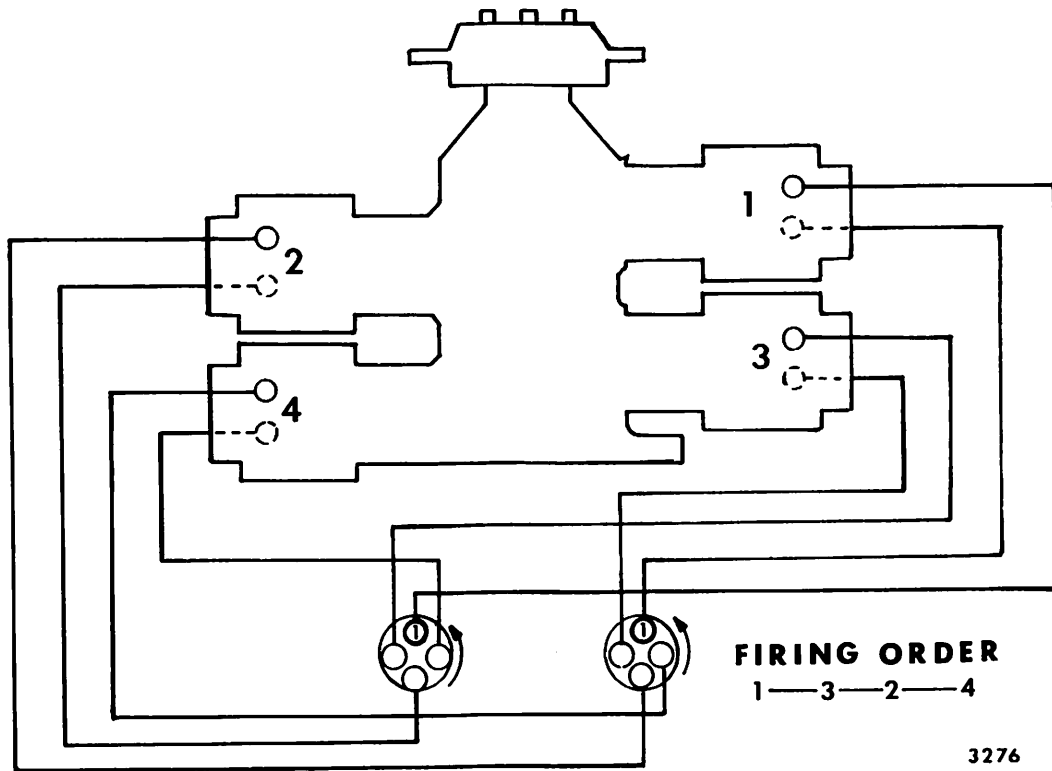
D. Install Spark Plugs.

- (1) Apply anti-seize compound on all but first two threads of the spark plug.
- (2) Install spark plugs and torque to 360-420 inch pounds.
- (3) Install ignition harness leads to spark plugs. Tighten nut finger tight plus one-fourth turn.
- (4) Install cowl.

E. Remove Magneto.

WARNING: DURING ALL MAGNETO MAINTENANCE, TAKE PROPER PRECAUTIONS TO MAKE SURE THE ENGINE CANNOT FIRE OR START WHEN THE PROPELLER IS MOVED.

- (1) Remove cowl as necessary to gain access.
- (2) Disconnect the magneto ground wire ("P" lead) and shielding terminal.



Ignition System Schematic
Figure 202

- (3) Remove the distributor cap assembly.
- (4) Remove the mounting lugs and withdraw the magneto.

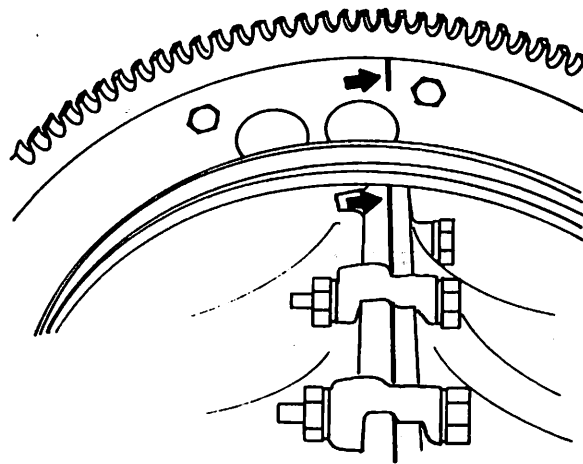
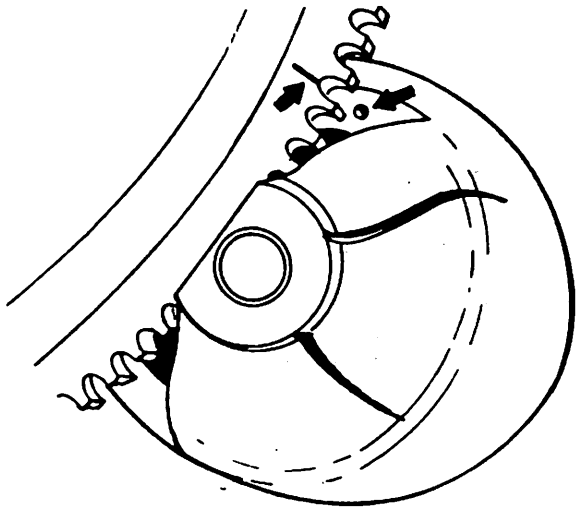
NOTE: Make a note of the approximate angle the magneto makes with the engine centerline as an aid in its subsequent installation.

F. Install Magneto

- (1) Rotate the propeller in the normal direction of rotation until No. 1 cylinder enters its compression cycle.

NOTE: To determine if the No. 1 cylinder is in the compression cycle, remove the top plug from the No. 1 cylinder and place thumb over the port. As the piston approaches the end of the compression stroke, a positive pressure will try to force the thumb off the port.

- (2) Continue turning the propeller in the normal direction of rotation until the 25° advanced timing mark on the forward face of the flywheel becomes aligned with the small hole drilled in the head of the starter casing. Alternate method is to align the 25° advance mark on the back of the flywheel with the crankcase parting line. At this point, the engine is ready to receive the magnetos. (See Figure 203.)



3203

Advance Timing Alignment
Figure 203

- (3) Remove the plug from the bottom of the magneto. (See Figure 204.)

NOTE: In order to rotate the magneto incorporating on impulse coupling, depress the pawl on the impulse coupling with the finger.

- (4) Rotate the magneto shaft until a spark occurs from number one lead (hold screwdriver close to No. 1 lead while turning the shaft). As soon as the spark occurs, slowly reverse direction until the timing hole in the rotor is centered in the plug opening. (See Figure 204.)

NOTE: Failure to spark check the number one position leaves the possibility of the magneto being 180° out of phase. The timing hole appears in the plug opening twice for every complete firing cycle.

- (5) Insert a pin (0.093" diameter) into the timing hole in order to keep the rotor in the timed position.
- (6) Position the magneto into the crankcase at the approximate angle noted on removal. Be sure gasket is installed behind the magneto mounting flange.
- (7) Install the attach clip over the magneto mounting flange and tighten the nut finger-tight.

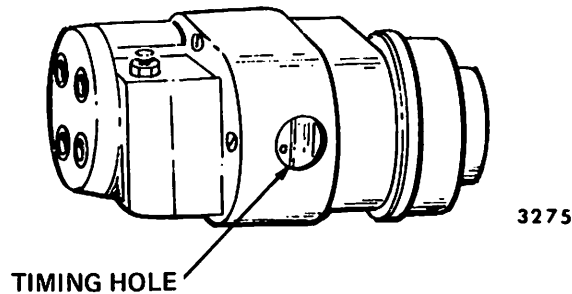
NOTE: Install the magneto with the impulse coupling on the left side.

- (8) Install the second magneto in the same manner as described in steps (3) through (7) above.

CAUTION: DO NOT ROTATE THE PROPELLER WITH THE PIN STILL INSTALLED IN THE MAGNETO TIMING HOLE.

- (9) Final timing should be accomplished with a timing light. Using a battery powered timing light, attach the positive leads to the magneto ground terminal, and the negative leads to any unpainted portion of the engine.
- (10) Remove the pins from the magnetos.
- (11) Rotate the magneto in its mounting flange until the light comes on. Slowly turn the magneto in the opposite direction until the light goes off. Bring the magneto back slowly until the light just comes on.

NOTE: Some timing lights operate in the reverse manner as described above. The lights come on when the breaker points open. Check timing light instructions.



**Magneto Timing Hole
Figure 204**

- (12) Repeat this process for the other magneto.
- (13) Upon timing both magnetos, check to ascertain that both magnetos will fire simultaneously.

NOTE: To check the simultaneous firing of both magnetos, back off on the propeller a few degrees (timing light should go out). Bring the propeller back slowly in the direction of normal rotation until the 25° advanced timing mark aligns with the hole in the starter casing. At this point, both lights should go on simultaneously. When timing the magneto to the engine, a maximum tolerance of $\pm 2^\circ$ is allowable.

- (14) Tighten the magneto mounting nut and torque to 150 inch-pounds and install magneto ground wire and shielding terminal.
- (15) When the magneto shows an excessive rpm loss or has reached a total of 900 hours, whichever comes first, the magneto should be returned to the magneto manufacturer for exchange. No attempt should be made to repair the magneto in the field since disassembly of the magneto will void its warranty.

NOTE: If the driveshaft nut has been removed from the magneto incorporating the impulse coupling, care should be exercised when reassembling, not to over tighten. The recommended torque is 156 inch-pounds. Torque may be increased to line up hole with slot in nut.

CHAPTER 77

ENGINE INDICATING

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**ENGINE INDICATING SYSTEM – DESCRIPTION/OPERATION****1. General**

Because of the simplicity of the engine installed in the AA-1C aircraft, a limited number of engine indicating instruments are required. Most of the engine indicating instruments are discussed in their specifically related system chapter. This chapter covers only the tachometer.

TACHOMETER – DESCRIPTION/OPERATION

1. General

The tachometer is a mechanical indicator mounted on the lower center of the instrument panel and driven by a flexible shaft. It measures the rate at which the crankshaft revolves in revolutions per minute (rpm), and is calibrated in hundreds of rpm. The instrument also incorporates a recording mechanism to keep an accurate record of engine hours.

The tachometer provides the pilot with throttle control information necessary in making required power settings and adjustments for takeoff, climb, cruise, and descent. The tachometer is also used when making magneto checks and for maintenance checks of the engine. The formation of carburetor ice is indicated by a drop in engine rpm.

The tachometer is color coded for easy interpretation. A green arc on the face of the instrument indicates the normal, safe operating range. The red line is the maximum allowable rpm.

TACHOMETER – MAINTENANCE PRACTICES

1. Removal/Installation of Tachometer and Tachometer Cable

A. Remove Tachometer (See Figure 201)

- (1) Disconnect tachometer flexible cable at rear of instrument panel.
- (2) Remove four mounting screws and remove tachometer.
- (3) Install plastic cover or masking tape over nipple on tachometer.

B. Install Tachometer

- (1) Connect flexible cable to tachometer. Ensure that cable is seated in driveshaft.
- (2) Position tachometer on rear of instrument panel and install the four mounting screws.

C. Remove Tachometer Cable and Housing

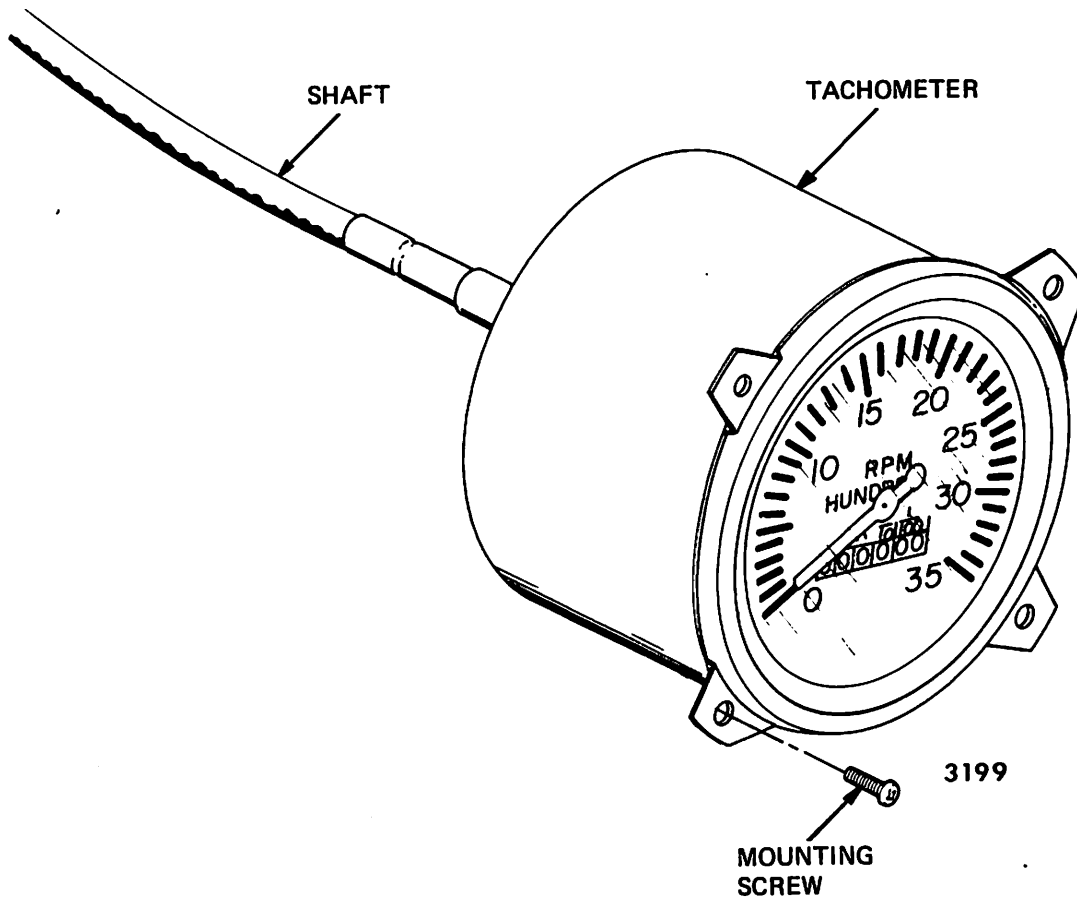
- (1) Remove upper cowl to gain access (refer to Chapter 71).

NOTE: If cable only needs removing, disconnect cable at tachometer and pull cable out of housing.

- (2) Cut plastic clamps both forward and aft of firewall, and free wiring from flexible cable.
- (3) Disconnect cable from tachometer and from engine.
- (4) Cover connections on engine and tachometer with masking tape or plastic caps.
- (5) Pull cable and housing through firewall.
- (6) Pull cable out of housing.

D. Install Tachometer Cable and Housing

- (1) If cable only has been removed, apply approved graphite base lubricant to cable and insert in housing as far as it will go and rotate slowly to make sure cable is seated in engine fitting. Connect cable to tachometer.
- (2) Check cable and housing for dents, kinks, or evidence of damage.
- (3) Apply approved graphite base lubricant to cable and insert into the housing.
- (4) Insert cable assembly through firewall and connect to engine and tachometer. Ensure that cable ends are properly seated.
- (5) Using plastic clamps, secure wiring to cable housing as necessary both forward and aft of firewall.
- (6) Start engine and check tachometer for proper operation.
- (7) If tachometer is erratic or noisy, check for loose connections or sharp bends in cable. No bend radius should be less than 6 inches.
- (8) Install cowl (refer to Chapter 71).



**Tachometer
Figure 201**

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**ENGINE EXHAUST SYSTEM – DESCRIPTION/OPERATION****1. General**

The exhaust system consists of an integral muffler and exhaust pipe, clamp assemblies, risers, and gaskets. The muffler is enclosed by a metal shroud which is connected by flexible tubing to the plenum assembly in the cabin and furnishes warm air for cabin heating. Inlet air is picked up through an opening in the front of the shroud.

The carburetor heat hose is attached to a shroud around the exhaust pipe from No. 4 cylinder and supplies heat to the carburetor when the carburetor heat control is opened.

ENGINE EXHAUST SYSTEM – MAINTENANCE PRACTICES

1. Removal/Installation of Engine Exhaust System

A. Remove Exhaust System (See Figure 201)

- (1) Remove the upper and lower cowl (refer to Chapter 71).
- (2) Remove the carburetor air induction system (refer to Chapter 73).
- (3) Loosen clamps and disconnect cabin heater and fresh air inlet flexible ducts from the muffler shroud assembly.
- (4) Loosen clamp and disconnect carburetor heat flexible duct from shell assembly around No. 4 exhaust pipe.
- (5) Remove nuts securing the exhaust risers to cylinders and remove muffler assembly from engine.
- (6) If further disassembly is required, remove nuts, bolts, and bead clamps and remove risers.

B. Install Exhaust System

- (1) Install risers onto muffler with bead clamps, bolts, and nuts and support braces.
- (2) Using new gaskets, position muffler onto engine and install exhaust flange nuts using new lock washers.
- (3) Torque exhaust flange nuts to 110-130 in. lb and ensure bead clamp bolts are tightened.
- (4) Install cabin heater and fresh air inlet flexible ducts to muffler shroud assembly and tighten clamps.
- (5) Install carburetor heat flexible duct to shell assembly around No. 4 exhaust pipe and tighten clamp.
- (6) Install carburetor air induction system (refer to Chapter 73).
- (7) Install upper and lower cowl (refer to Chapter 71).

2. Inspection of Exhaust System

Exhaust systems are subject to burning, cracking, and general deterioration from alternate thermal stresses and vibration. Consequently, it is extremely important that the system be inspected every 100 hours or at any time exhaust fumes or carbon monoxide are detected in the cabin. To properly inspect the exhaust system, the components must be clean and free from oil, grease, or dirt. Stoddard solvent may be used to clean exhaust system components.

A. Inspect Exhaust System

WARNING: USE SOLVENTS IN A WELL VENTILATED AREA. AVOID BREATHING FUMES. KEEP AWAY FROM FLAMES. DO NOT USE HIGHLY FLAMMABLE SOLVENTS ON ENGINE EXHAUST SYSTEM. NEVER USE A WIRE BRUSH OR ABRASIVES TO CLEAN EXHAUST SYSTEM OR MARK THE SYSTEM WITH LEAD PENCILS.

- (1) Clean exhaust system components using a suitable solvent.
- (2) Allow components to drain and then wipe dry with a clean cloth.
- (3) Inspect core through tailpipe opening and shake the muffler to determine if baffles are loose.

- (4) Tap muffler lightly with a rubber mallet and check for scale and rust from interior of muffler. Large flakes of scale and rust from the interior of the muffler are an indication of deterioration and the muffler should be replaced.

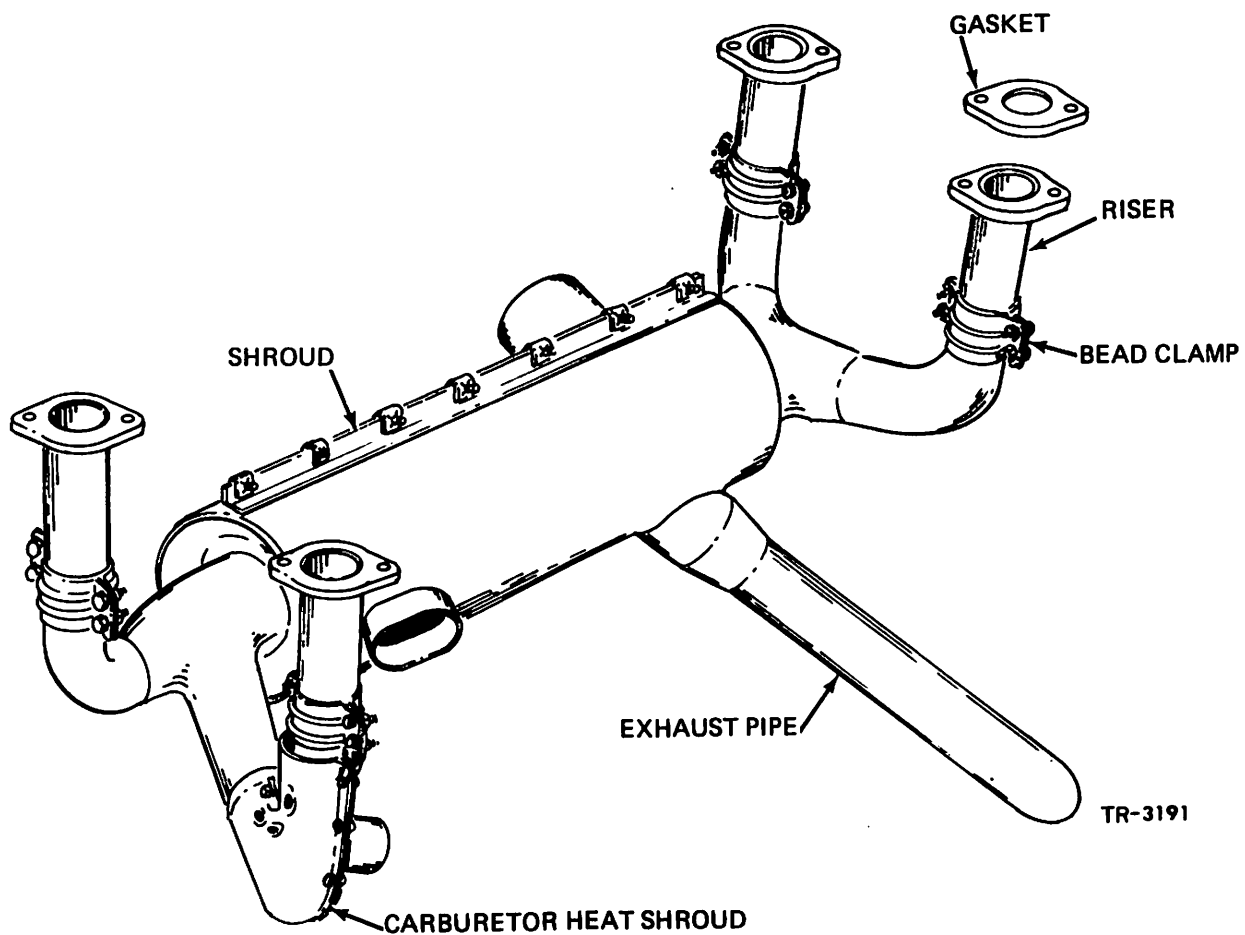
NOTE: Especially check the area adjacent to welds. Look for exhaust gas deposits in surrounding areas, indicating that exhaust gasses are escaping through a crack or hole. If thorough inspection is not possible, pressure test for leaks in accordance with AC43.13-1, Chapter 14, Section 3, Paragraph 387B. If cracks are found in the muffler or tailpipe, repairs must be in accordance with AC43.13-1, Chapter 14, Section 3, Paragraph 388.

- (5) Inspect the engine exhaust flanges for smooth seating surfaces. Check the header flanges for warpage.
- (6) Check fit of risers to muffler pipes. If loose, swage out the risers for tight fit.
- (7) Perform exhaust system air leak test as follows:

- (a) Plug all openings in the muffler and attach the pressure side of an industrial vacuum cleaner (capable of producing a pressure rise of at least 2 in. Hg., above atmospheric pressure) to the tailpipe opening, using a rubber plug or other suitable means of effecting a suitable seal.

NOTE: The inside of the vacuum cleaner hose should be free of any contamination that might be blown into the system.

- (b) With the vacuum cleaner operating, the complete muffler assembly can be checked for leaks by applying a soapy water solution to all areas and watching for air bubbles.
- (8) All leakage must be corrected.



**Exhaust System Assembly
Figure 201**

CHAPTER 79

OIL

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ENGINE OIL SYSTEM – DESCRIPTION/OPERATION

1. General

This chapter describes only those units and components of the oil system that are external to the engine. These components include: oil cooler, oil pressure gauge, oil temperature gauge, pressure relief valve, breather vent and associated wiring and tubing.

The engine oil system is of the pressure wet sump type with a 5-bay oil cooler. The oil sump capacity is 6 U.S. quarts. Minimum safe quantity in sump should be no less than 2 U.S. quarts.

The oil cooler is mounted on a support assembly off the left firewall and is connected to the engine accessory housing by flexible lines. Air to the oil cooler is picked up directly from the left rear engine baffle. A thermostatic pressure valve located in the engine accessory housing controls oil flow to the cooler.

The oil pressure gauge and oil temperature gauge are mounted in the instrument cluster assembly at the upper right-hand side of the instrument panel. The line attaching the oil pressure gauge to the engine incorporates a .040 orifice to prevent a large oil loss due to line or gauge failure.

A pressure relief valve, located behind the oil filler neck in the engine, maintains oil pressure within prescribed limits (60-90 psi normal, 25 psi at idle speed). This valve is not adjustable, however, the oil pressure can be controlled at other values by the addition of washers (Refer to Lycoming Engine Manual for details).

The engine is also equipped with a breather vent to prevent excessive pressure build-up in the crankcase. The vent tube should be inspected periodically for obstructions.

Periodic maintenance of the engine oil system should include an oil change and removal and inspection of the oil suction and oil pressure screens. The visible presence of metal particles on the oil screws is indicative of internal engine failure.

The following are recommended oil viscosities to be used in the aircraft oil system. Refer to the latest revision of Lycoming Service Instruction No. 1014 for more complete details.

<u>Average Ambient Air Temperature</u>	<u>Straight Mineral Grade</u>	<u>Ashless Dispersant</u>
Above 60°F (16°C)	SAE 50	SAE 40 or SAE 50
30° (-1°C) to 90°F (32°C)	SAE 40	SAE 40
0° (-18°C) to 70°F (21°C)	SAE 30	SAE 40 or SAE 20W-30
Below 10°F (-12°C)	SAE 20	SAE 20W-30

NOTE: During the initial 50 hours operation of a new or overhauled engine, use straight mineral oil (non-detergent). Detergent or additive oils should only be used after consulting Lycoming Service Instruction No. 1014.

ENGINE OIL SYSTEM – TROUBLE SHOOTING**1. Oil Cooler Trouble Shooting**

TROUBLE	PROBABLE CAUSE	REMEDY
High temperature indication	Obstructions in oil cooler air passages	Inspect oil cooler core for dirt or obstructions and clean as necessary.
Low or no oil pressure indication	Loose fittings or leaking oil cooler	Inspect oil cooler and leakage. Repair fittings or replace oil cooler.

2. Oil Pressure Gauge Trouble Shooting

TROUBLE	PROBABLE CAUSE	REMEDY
No indication	Insufficient oil	Check oil supply and fill as recommended.
		Starting at engine, inspect oil cooler, all fittings and lines for leaks. Repair or replace as necessary.
	Obstruction in pressure line	Remove all fittings and lines, starting at engine and inspect and clean as required.
	Defective gauge	Replace gauge
High or low indication	Defective gauge	Replace gauge.
	Oil pressure relief valve out of adjustment	Check engine pressure with a calibrated gauge and correct pressure setting as required.
Low indication	Loose fittings, defective line or leaking oil cooler	Inspect oil cooler, fittings and lines for leaks. Repair or replace as necessary.

3. Oil Temperature Gauge Trouble Shooting

TROUBLE	PROBABLE CAUSE	REMEDY
No indication	Blown fuse	Replace with properly rated fuse
No indication, high or low indication	Gauge not grounded	Check gauge ground connection and perform necessary repairs.
	Defective wiring	Check system with ohm-meter and perform necessary repairs.

TROUBLE	PROBABLE CAUSE	REMEDY
	Defective gauge	Replace gauge
	Defective thermistor	Replace oil temperature thermistor.
	Defective gauge	Temporarily substitute a 28.5 ohm resistance for the oil temperature thermistor. If gauge does not indicate 245°F (Red Line), replace gauge.
Low indication	Low aircraft supply voltage	Check aircraft supply voltage and adjust, repair or replace accordingly.

ENGINE OIL SYSTEM – MAINTENANCE PRACTICES**1. Oil Cooler – Removal/Installation****A. Remove Oil Cooler (See Figure 201.)**

- (1) Remove upper cowl assembly.

CAUTION: BEFORE ATTEMPTING OIL COOLER REMOVAL, ENSURE THAT OIL COOLER IS COOL TO THE TOUCH WHEN LINES ARE DISCONNECTED SOME OIL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT HAZARD DUE TO SPILLAGE.

- (2) Place container under oil cooler and disconnect flexible lines at oil cooler inlet and outlet fittings.
- (3) Cap flexible lines to prevent oil system contamination.
- (4) Cut safety wire from two mounting bolts and remove bolts, spacers, and washers.
- (5) Remove two bolts and washers securing oil cooler to support assembly and remove reinforcing doublers, gasket and oil cooler. Retain all hardware for reuse.

B. Install Oil Cooler (See Figure 201.)

- (1) Position reinforcing doublers, gasket and oil cooler in place on support assembly at left firewall and install gasket, spacers, washers and bolts.
- (2) Install safety wire in drilled bolt heads.

CAUTION: WHEN LINES ARE UNCAPPED, SOME OIL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT HAZARD DUE TO SPILLAGE.

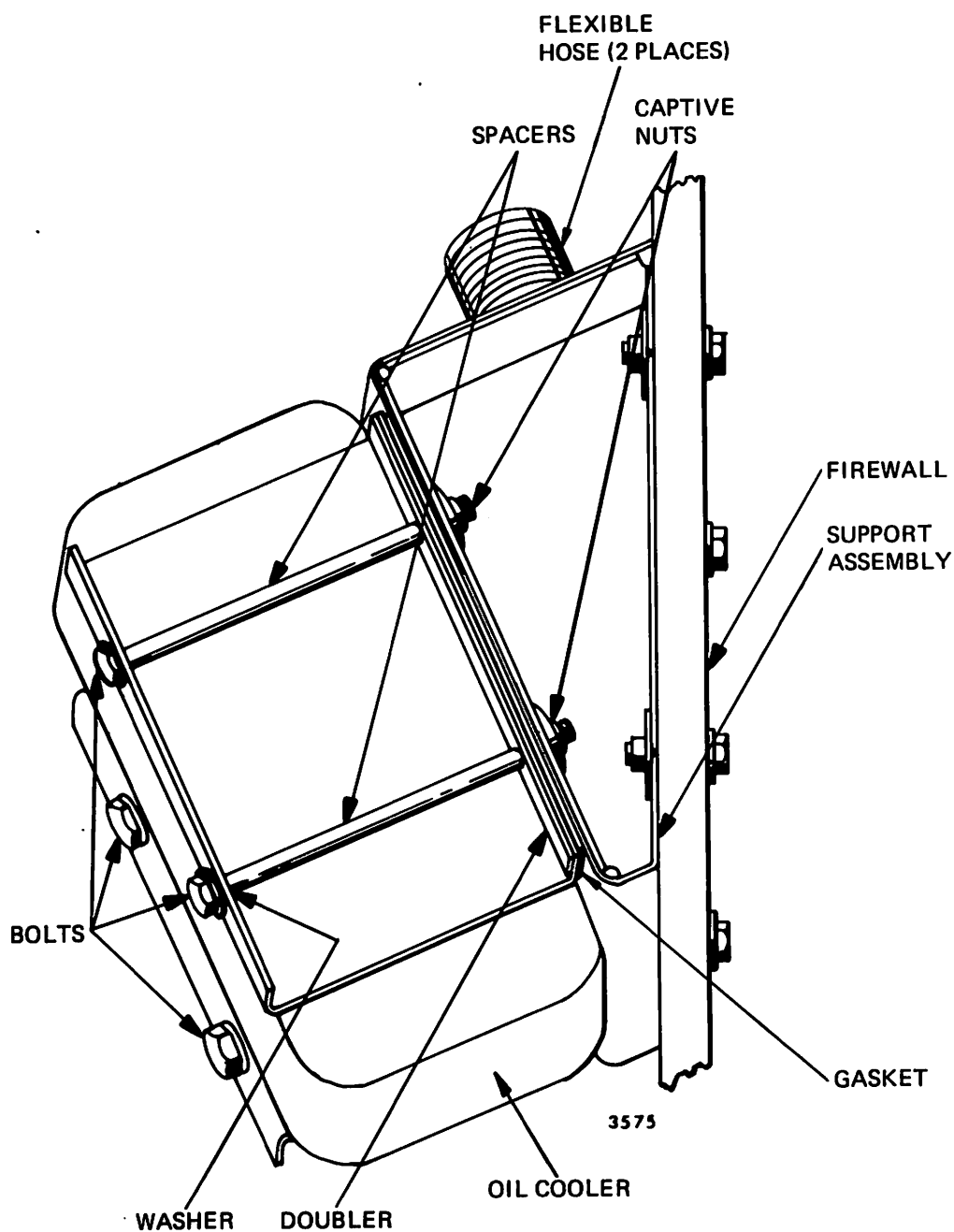
- (3) Uncap flexible lines and connect to oil cooler inlet and outlet fittings. Torque fittings to 70-80 in. lb.
- (4) Operate engine for three (3) minutes, while observing oil pressure and oil temperature gauges for normal indications.
- (5) Shut down engine. Check oil cooler, flexible lines and all connections for signs of leakage.
- (6) Install upper cowl assembly.

2. Oil Cooler Inspection**A. Inspect Oil Cooler**

- (1) Inspect oil cooler air passages for dirt and obstructions.
- (2) Inspect oil cooler core for cracks, damage and evidence of leakage.
- (3) Check flexible lines for worn or damaged areas and signs of leakage as per Paragraph 7, Inspection and Maintenance of Flexible Hoses.

CAUTION: DO NOT APPLY MORE THAN 100 PSI MAXIMUM TO OIL COOLER WHEN PERFORMING A SUBMERGED LEAK TEST.

- (4) If necessary, subject oil cooler to submerged leak test.



Oil Cooler Installation
Figure 201

3. Oil Pressure Gauge Removal/Installation

A. Remove Oil Pressure Gauge (See Figure 202.)

CAUTION: WHEN LINE IS DISCONNECTED, SOME OIL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT HAZARD DUE TO SPILLAGE.

NOTE: To remove the oil pressure gauge, the instrument cluster assembly must first be detached from the instrument panel.

- (1) Place container under instrument cluster and disconnect tubing from oil pressure gauge at back of instrument cluster. Cap disconnected tubing.
- (2) Remove two screws securing instrument cluster to instrument panel.
- (3) Carefully push instrument cluster inward approximately one inch and slide plastic face plate downward to remove from instrument cluster.
- (4) Remove lock nut securing oil pressure gauge to case and remove oil pressure gauge from case.

B. Install Oil Pressure Gauge (See Figure 202.)

- (1) Position oil pressure gauge in instrument cluster assembly case and install nut on gauge nipple. Torque nut to 25-30 in. lb.
- (2) Position plastic face plate on instrument cluster assembly case and carefully push case upward to position in instrument panel.
- (3) Secure instrument cluster assembly to instrument panel with attaching screws.

CAUTION: WHEN LINE IS UNCAPPED, SOME OIL SPILLAGE MAY OCCUR. TAKE PROPER PRECAUTIONS TO PREVENT HAZARD DUE TO SPILLAGE.

- (4) Operate engine for three minutes while observing oil pressure and oil temperature gauges for normal indications.
- (5) Shut down engine. Check oil pressure gauge connection for signs of leakage.

4. Oil Pressure Gauge Adjustment/Test

A. Oil Pressure Gauge Calibration/Testing

No attempt should be made to calibrate or repair a defective oil pressure gauge. It should be replaced with a serviceable gauge.

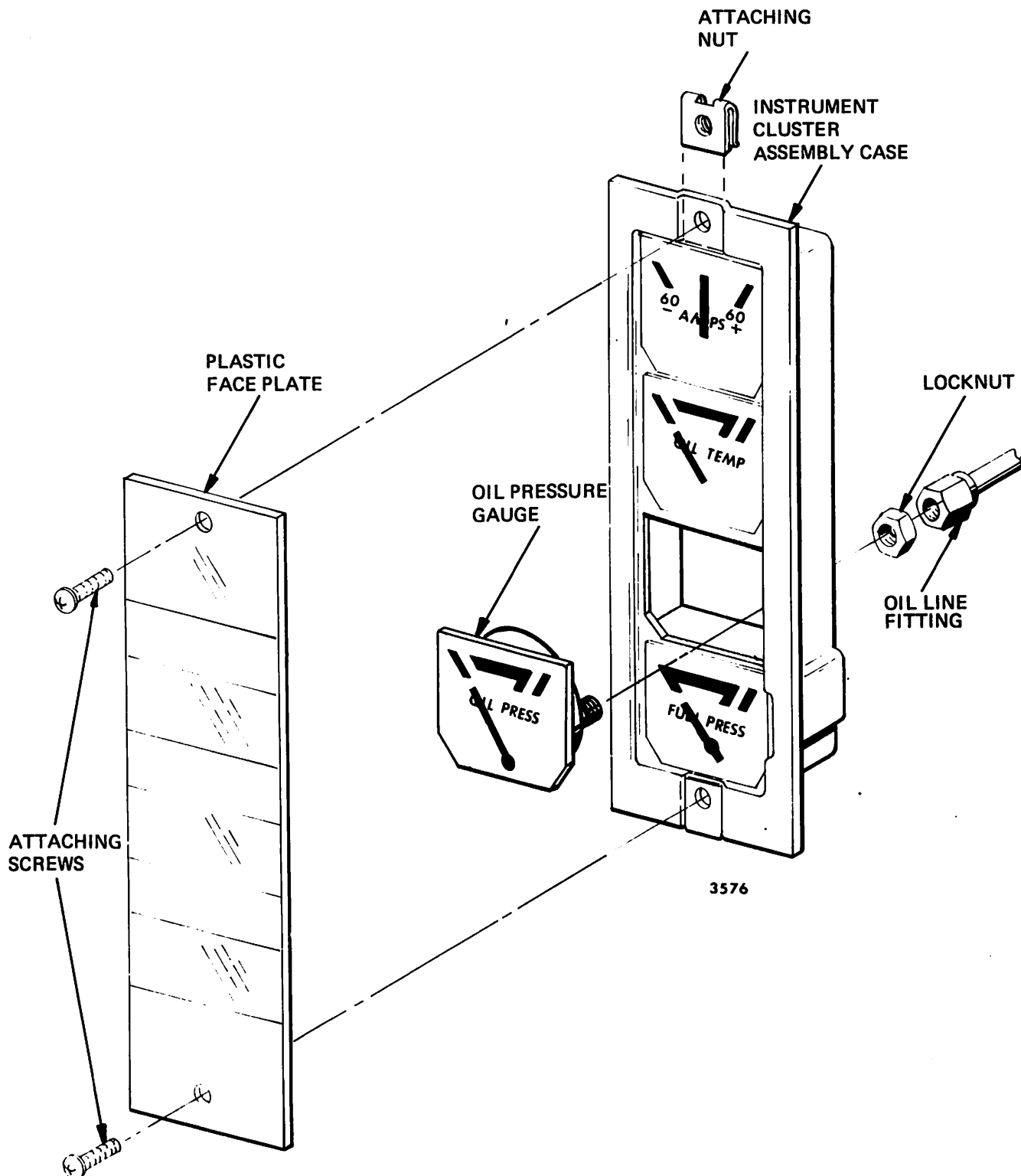
5. Oil Temperature Gauge Removal/Installation

A. Remove Oil Temperature Gauge (See Figure 203.)

WARNING: ENSURE MASTER SWITCH IS IN OFF POSITION.

NOTE: To remove the oil temperature gauge, the instrument cluster assembly must first be detached from the instrument panel.

- (1) Disconnect wiring from oil temperature gauge at back of instrument cluster assembly. Tag leads to aid in future reconnection of gauge.



**Oil Pressure Gauge Removal/Installation
Figure 202**

- (2) Remove two screws securing instrument cluster to instrument panel.
- (3) Carefully push instrument cluster inward approximately one inch and slide plastic face plate downward to remove from instrument cluster.
- (4) Remove nuts, lock washers and spacers securing oil temperature gauge to case and remove gauge from case.

B. Install Oil Temperature Gauge (See Figure 203.)

- (1) Position oil temperature gauge in instrument cluster assembly case and secure gauge to case with two spacers, two lockwashers and two nuts.
- (2) Connect wiring to oil temperature gauge at back of instrument cluster assembly case.
- (3) Position plastic face plate on instrument cluster assembly case and carefully push case upward to position in instrument panel.
- (4) Secure instrument cluster assembly to instrument panel with attaching screws.
- (5) If ambient temperature is above 32 degrees Fahrenheit (F) operate engine approximately three minutes while observing oil temperature and oil pressure gauges for normal indications. If ambient temperature is 32°F or below, operate engine for approximately ten minutes while observing oil temperature and oil pressure gauges for normal indications.
- (6) Shut down engine.

6. Oil Temperature Gauge Adjustment/Test

A. Oil Temperature Gauge Calibration/Testing (Refer to Paragraph 3 of Trouble Shooting Chart, this chapter).

If gauge is determined to be defective by using the procedures in the above paragraph, gauge should be replaced with a serviceable gauge.

7. Inspection and Maintenance of Oil System Flexible Hoses

A. Inspect Oil System Flexible Hoses

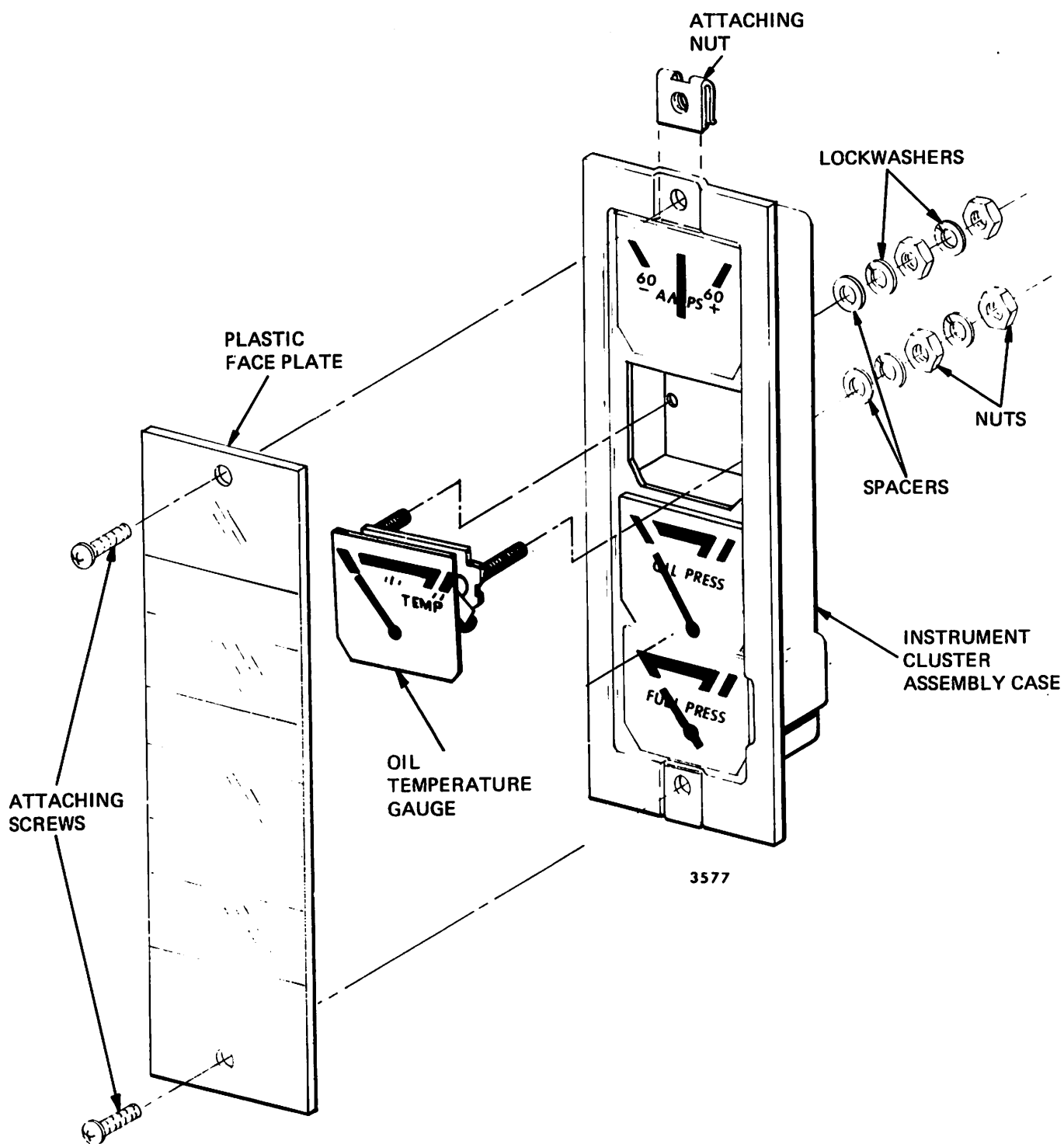
- (1) Inspect flexible hoses at each 50-hour inspection.
- (2) Examine flexible hose exterior for evidence of leakage or wetness.

CAUTION: AVOID EXCESSIVE FLEXING AND SHARP BENDS WHEN EXAMINING HOSES FOR STIFFNESS.

- (3) Check flexible hoses for evidence of stiffness.
- (4) Examine flexible hoses for evidence of rubbing or chafing.
- (5) Inspect for color bleaching of the end fittings or severe discoloration of hoses.

B. Recommended Maintenance Procedures for Oil System Flexible Hoses

- (1) Replace all flexible fluid carrying hoses in the engine compartment at engine overhaul or every five years, whichever occurs first.
- (2) Replace all flexible hoses that show evidence of leakage or stiffness.



Oil Temperature Gauge, Removal/Installation
Figure 203



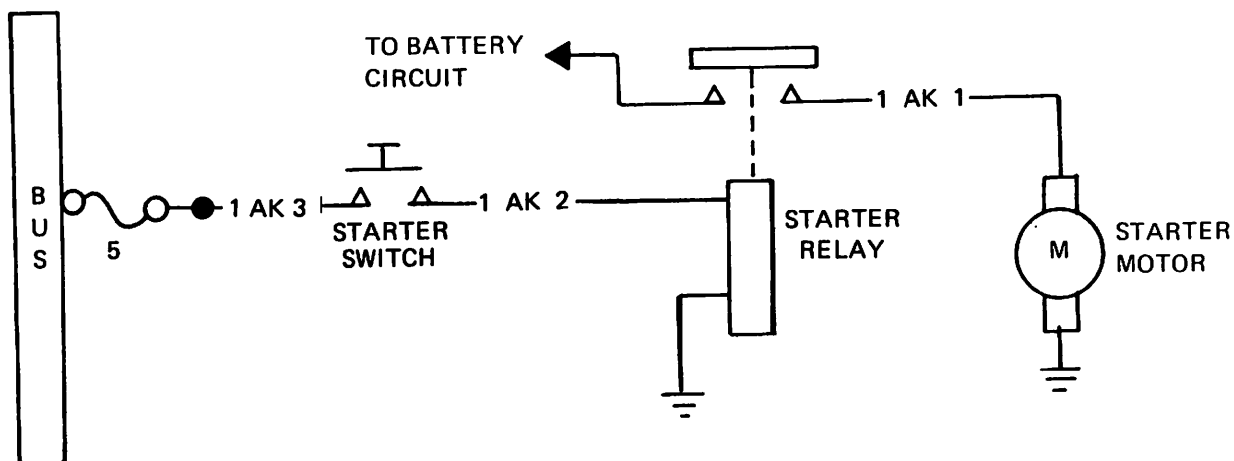
- (3) Avoid twisting the flexible hose at installation.
- (4) Provide as large a bend radius as possible during installation.
- (5) During removal, do not attempt to straighten a flexible hose that has taken a permanent set during extended use in service.
- (6) During reinstallation of flexible hose, be sure that hose is returned to original position.
- (7) Route hoses as far as possible from areas of intense heat.
- (8) Refer to AC 43.13-1, Chapter 10, for additional procedures regarding flexible hose installation.

CHAPTER 80**STARTING****TABLE OF CONTENTS**

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ENGINE STARTING – DESCRIPTION/OPERATION1. General

The starting system consists of the starter switch, starter relay, starter, a 5-amp fuse, and associated wiring necessary to effect the required connections. The starter switch is a pushbutton type switch located on the lower left-hand side of the instrument panel. The 5-amp fuse that protects the starter circuit is located at the extreme right-hand corner of the instrument panel. The same fuse also protects two other circuits and is decalcd: FUEL PUMP, STROBE, STARTER. The starter relay is located on the front of the firewall and is connected directly to the starter switch (see Figure 1). The starter is mounted on the front of the engine and is secured with one mounting bolt and three mounting studs, nuts, and washers. When power is supplied to the starter, the starter Bendix gears engage the starter ring gear mounted on the front end of the crankshaft and turn the engine for starting. Power for starting is supplied from a 12-volt, 25-ampere hour, dry-charge type battery.



Starter Circuit
Figure 1

STARTING SYSTEM – TROUBLE SHOOTING

1. Trouble Shooting the Starter

TROUBLE	PROBABLE CAUSE	REMEDY
Starter will not operate	Low Battery	Recharge or replace
	Blown fuse	Replace fuse
	Defective wiring	Check wiring with ohmmeter and repair as required.
	Defective Starter Relay	Replace relay
	Defective Starter Switch	With master switch off, conduct continuity test across starter switch. If circuit is open when button is depressed, replace switch.
	Defective Starter Motor	Repair or replace
Starter motor sluggish	Low Battery Dirty contacts on starter switch or starter relay	Recharge or replace Replace
	Defective Starter	Repair or replace
	Dirty commutator	Clean and turn down as required.
Starter noisy	Worn starter drive gear	Inspect starter drive gear and replace if necessary
	Worn or broken teeth on crankshaft ring gear	Inspect crankshaft, ring gear and replace if necessary.

STARTING SYSTEM – MAINTENANCE PRACTICES

1. Removal/Installation of Starting System Components

A. Remove Starter (See Figure 201.)

NOTE: Ensure that master switch is in OFF position.

- (1) Remove cowl as necessary to gain access to starter (refer to Chapter 71).
- (2) Disconnect starter cable and landing light ground wire.
- (3) Remove bolt securing brace to alternator mount.
- (4) Remove mounting bolt and three nuts on starter mounting studs and remove starter.

B. Install Starter

- (1) Position starter on mounting studs and install nuts and mounting bolt.
- (2) Position brace from alternator mount in place and install mounting bolt.
- (3) Connect starter, cable and landing light ground wire.
- (4) Install cowl.

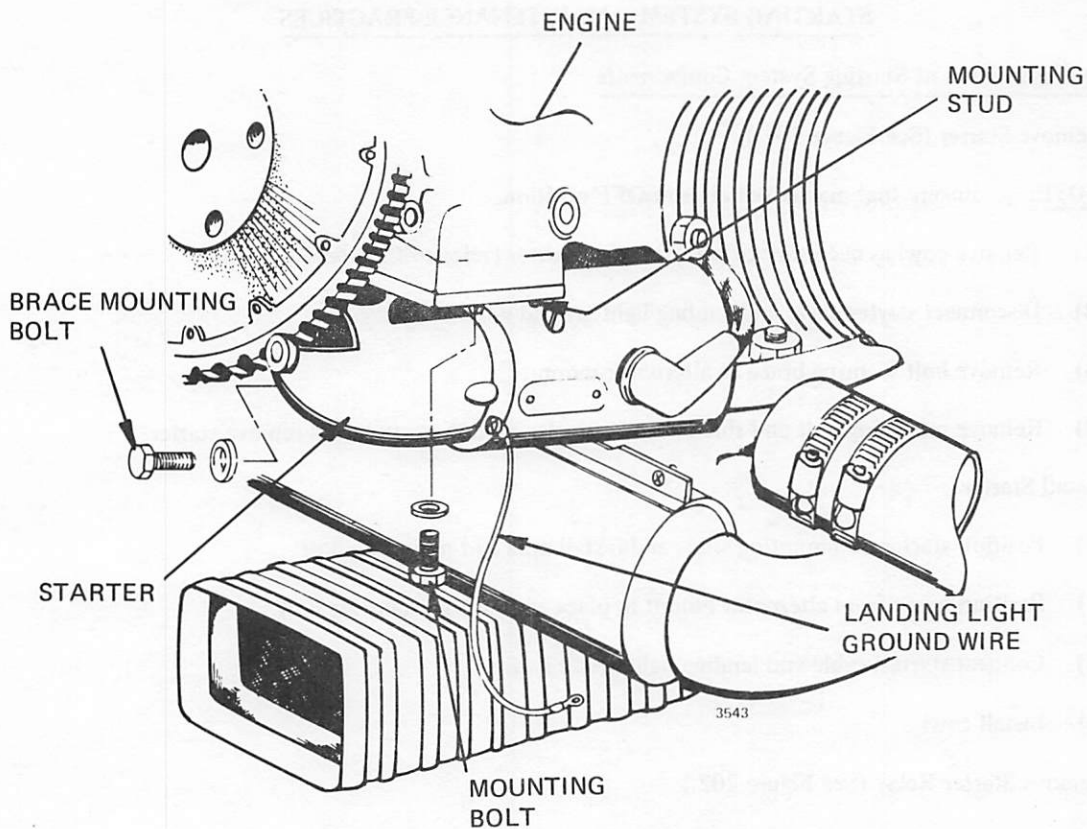
C. Remove Starter Relay (See Figure 202.)

NOTE: Ensure that master switch is in OFF position.

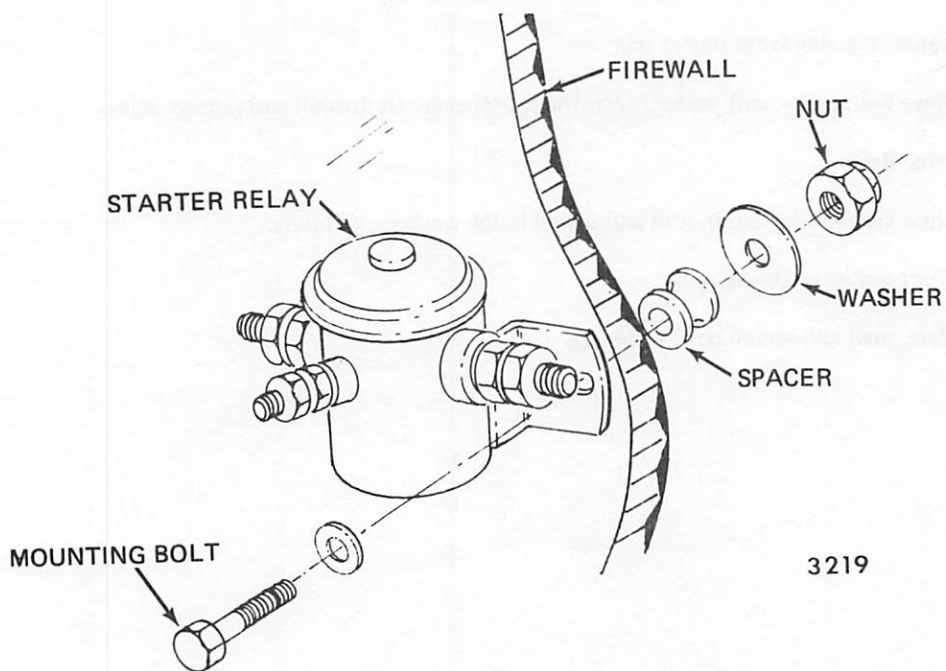
- (1) Remove upper cowl to gain access.
- (2) Disconnect wiring from starter relay.
- (3) Remove bolts, nuts, and washers securing starter relay to firewall and remove relay.

D. Install Starter Relay

- (1) Position starter relay to firewall and install bolts, washers, and nuts.
- (2) Connect wiring to starter relay.
- (3) Replace cowl and secure cowl fasteners.



Starter Removal/Installation
Figure 201



Starter Relay
Figure 202

CHAPTER 91

CHARTS

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91-0 CHARTS

Recommended Nut Torques

1

RECOMMENDED NUT TORQUES

NOTE: The Torque Values stated are inch-pounds, related only to oil-free cadmium plated threads. All torque values given throughout this service manual are for oil-free threads unless otherwise noted.

TAP SIZE	FINE THREAD SERIES			
	TYPE OF NUT			
	TENSION		SHEAR	
	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	

- NOTE:**
1. Covers AN310, AN315, AN345, AN363, AN366, MS20365, "1452", "EB", "UWN", "Z1200", and other self-locking nuts.
 2. When using AN310 or AN320 castellated nuts where alignment between bolts and cotter pin is not reached using normal torque values, use alternate torque values or replace nut.
 3. Covers AN316, AN320, AN7502 and MS20364.
 4. Covers AN310, AN340, AN366, MS20365, and other self-locking anchor nuts.

5. Covers AN316, AN320 and MS20364.

The above values are recommended for all installation 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.