

Cessna

MODELS

MODELS 421, 421A AND 421B GOLDEN EAGLE AND EXECUTIVE COMMUTER

FOREWORD

This Service Manual contains factory recommended procedures and instructions for ground handling, servicing and maintaining the Cessna 421, 421A, 421 Golden Eagle, and 421 Executive Commuter. Where there is a specific difference, reference has been made to the individual model aircraft. Besides serving as a reference for the experienced mechanic, this Service Manual also covers step-by-step procedures for the less experienced mechanic. This Service Manual should be kept in a handy place for ready reference. If properly used, it will better enable the mechanic to maintain the aircraft and, thereby, establish a reputation for reliable service.

The information in this Service Manual is based on data available at the time of publication, and is supplemented and kept current by Service Letters and Service News Letters published by Cessna Aircraft Company. These are sent to all Cessna Dealers so that they have the latest authoritative recommendations for servicing Cessna aircraft. Therefore, it is recommended that Cessna owners utilize the knowledge and experience of the factory-trained Dealer Service Organization.

In addition to the information in this Service Manual, a group of vendor publications are available from the Cessna Customer Service Department which describe complete disassembly, overhaul and parts breakdown of some of the various vendor equipment items. A listing of the available publications is issued periodically in Service Letters.

CHANGE
NOTICE

**LATEST CHANGED PAGES SUPERSEDE
THE SAME PAGES OF PREVIOUS DATE**

Insert changed pages into basic
publication. Destroy superseded pages.

NOTE: This reprint of basic Service Manual D817-13 dated April 1970 incorporates Change 1 dated August 1970, Change 2 dated December 1970, Change 3 dated April 1971, Change 4 dated December 1971, Change 5 dated June 1972, Change 6 dated October 1972, Change 7 dated December 1972, Change 8 dated October 1973, Change 9 dated February 1974, Change 10 dated May 1974, Change 11 dated October 1974 and Change 12 dated February 1975.

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SERVICE MANUAL

APRIL 1970

CHANGED FEBRUARY 1975

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES

LIST OF EFFECTIVE PAGES

NOTE: The portion of the text affected by the current change is indicated by a vertical line in the outer margin of the page.

Dates of issue for original and changed pages are:

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SERVICE LETTERS AND SERVICE KITS

Service Letters and Service Kits (SK's) provide instructions for making modification changes to the aircraft in service.

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

REFERENCE DATA	ISSUE DATE	TITLE	INCORPORATED DATE
Cessna Avionics Service Letter AV74-14	8-30-74	ELT System Improvements	Feb 1975
Cessna Avionics Service Letter AV74-16	9-13-74	ELT Modification	Feb 1975
Cessna Service Letter ME74-13	8-9-74	Voltage Regulator Modification	Feb 1975
Cessna Service Letter ME74-21	12-18-74	Exhaust System Inspection	Feb 1975

CHANGE SYMBOLS

Changes to text and tables in the manual are indicated by a vertical black line in the margin which extends along the entire length of the area affected. Changes to Illustrations, Charts and Tables are indicated by miniature pointing hands. Change Symbols are not shown for:

1. Introductory material, indexes and tabular data.
2. Blank spaces which are the result of text, illustration or table deletion.
3. Correction of minor inaccuracies, such as punctuation, relocation of material, etc., unless such a correction changes the meaning of instructive information and procedures.

SECTION 1

GENERAL INFORMATION

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MODEL NUMBER AND SERIAL			
MODEL	YEAR	BEGINNING	ENDING
421	1968	421-0001	421-0200
421A	1969	421A0001	421A0158
421B	1970	421B0001	421B0056
421B	1971	421B0101	421B0147
421B	1972	421B0201	421B0275
421B	1973	421B0301	421B0486
421B	1974	421B0501	421B0665
421B	1975	421B0801	

GENERAL DESCRIPTION:

The Model 421 is an all-metal, low-wing, pressurized executive aircraft built by Cessna Aircraft Company, Wichita, Kansas. The pressurized cabin permits flights to 24,000 feet on aircraft 421-0001 to 421B0301 and 26,500 feet on aircraft 421B0301 and on, without the use of oxygen. The aircraft is powered by two Continental Turbocharged GTSIO-520-D and GTSIO-520-H, six cylinder, fuel injected 375 horsepower engines. The engines drive, three blade constant-speed, full-feathering 90-inch McCauley propellers. The landing gear on the Model 421 is tricycle-type, fully retractable and electrically operated. Trim tabs located on the right elevator, left aileron, and the rudder are provided to aid in flight adjustment; also provided are split-type electrically-operated wing flaps to aid in landing.

PRINCIPAL DIMENSIONS:

GROSS WEIGHT

421	6800 Pounds
421A	6840 Pounds
421 Golden Eagle (421B0001 to 421B0201)	7250 Pounds
421 Executive Commuter (421-0001 to 421B0001)	7250 Pounds
421 Golden Eagle (421B0201 and On)	7450 Pounds
421 Executive Commuter (421B0201 and On)	7450 Pounds

LANDING WEIGHT

421	6500 Pounds
421A	6500 Pounds
421 Golden Eagle	7200 Pounds
421 Executive Commuter	7200 Pounds

PRINCIPAL DIMENSIONS (CONTINUED):

ENGINES: Continental GTSIO-520-D (421-0001 to 421B0001),
Continental GTSIO-520-H (421B0001 and ON),
Opposed, Fuel Injected, Turbocharged, Wet Sump

HP (maximum)	375	2275 RPM and
Compression Ratio	39.5 Hg.	Manifold Pressure
Fuel	7.5:1	
Oil Capacity Each Engine Sump	Grade 100/130	Minimum
Magnetos	13 Quarts	
Starters	Bendix S6LN-1205	
Alternators	Delco-Remy	
	28V, 50 Amp	
	28V, 100 Amp (Optional)	
	28V, 100 Amp DC; 185 VAC (Optional)	

PROPELLER: McCauley (3AF34C92/90LF-0) Constant-Speed, Three Bladed, Full-Feathering

Diameter	90 Inches

BATTERY (LH Stub Wing)	24V, 24 Amp-Hr

FUEL CAPACITY:

Main Tanks (each wing)	51.0 U.S. Gallons
Usable (each wing)	50.0 U.S. Gallons
Auxiliary Tanks (each wing)	36.5 U.S. Gallons
Usable (each wing)	35.0 U.S. Gallons
Optional Wing Tanks (each wing)	13.5 U.S. Gallons
Usable (each wing)	13.0 U.S. Gallons
Wing Locker Tanks (each wing)	26.3 U.S. Gallons
Usable (each wing)	26.0 U.S. Gallons

CONTROL SURFACE TRAVEL:

Flap	
Down	45° +1° -0°
Aileron	
Up	20° +1° -0°
Down	20° +1° -0°
Aileron Trim Tab	
Up	20° +1° -0°
Down	20° +1° -0°

PRINCIPAL DIMENSIONS (CONTINUED):

Rudder (Measured perpendicular to hinge line)

Left (421-0001 to 421B0801)		25° +1° -0°
Right (421-0001 to 421B0801)		25° +1° -0°
Left (421B0801 and On)		32° +1° -0°
Right (421B0801 and On)		32° +1° -0°

Rudder Trim Tab (Measured perpendicular to hinge line)

Left		16° +1° -0°
Right		11° +1° -0°

Elevator

Up		25° +1° -0°
Down		15° +1° -0°

Elevator Trim Tab

Up (421-0001 to 421B0001)		10° +1° -0°
(421B0001 and On)		12° +1° -0°
Down (421-0001 to 421B0001)		26° +1° -0°
(421B0001 and On)		20° +1° -0°

LANDING GEAR:

Main Wheels and Brakes (Five-Piston, Dual Disc Type)

Tire Size		6.50 x 10 - 8 Ply Rating
Tire Pressure (421-0001 to 421B0001)		65 psi
(421B0001 and On)		70 psi

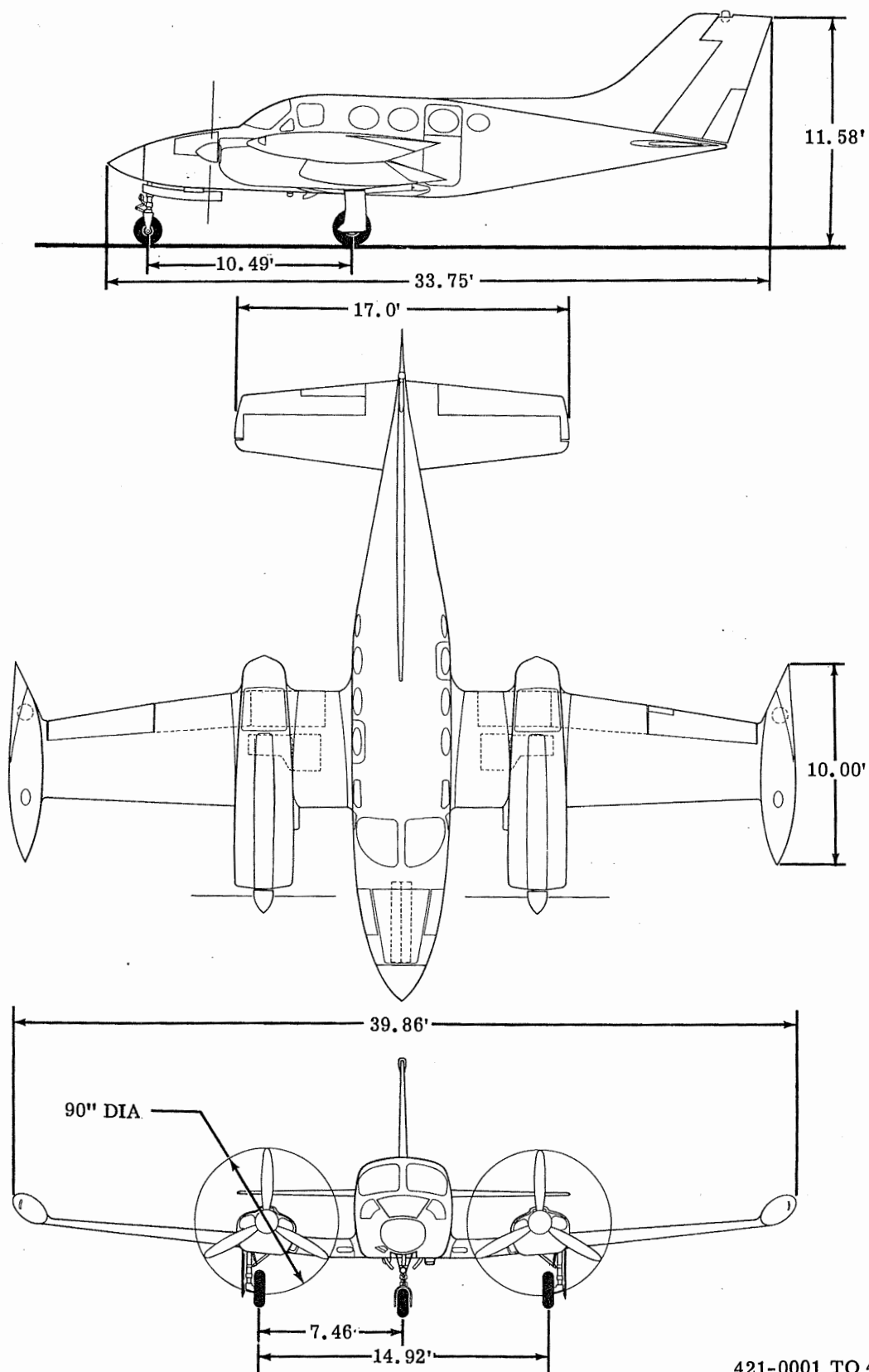
Main Strut Pressure (without load) (421-0001 to 421B0001)	200 psi
(421B0001 and On)	275 psi

Nose Wheel

Tire Size		6.00 x 6 - 6 Ply Rating
Tire Pressure (421-0001 to 421B0001)		32 psi
(421B0001 and On)		35 psi

Nose Strut Pressure (without load)		65 psi

WING DIHEDRAL (Outboard of Wing Fittings)		5.0°



421-0001 TO 421B0001

Figure 1-1. General Dimensions (Sheet 1 of 2)

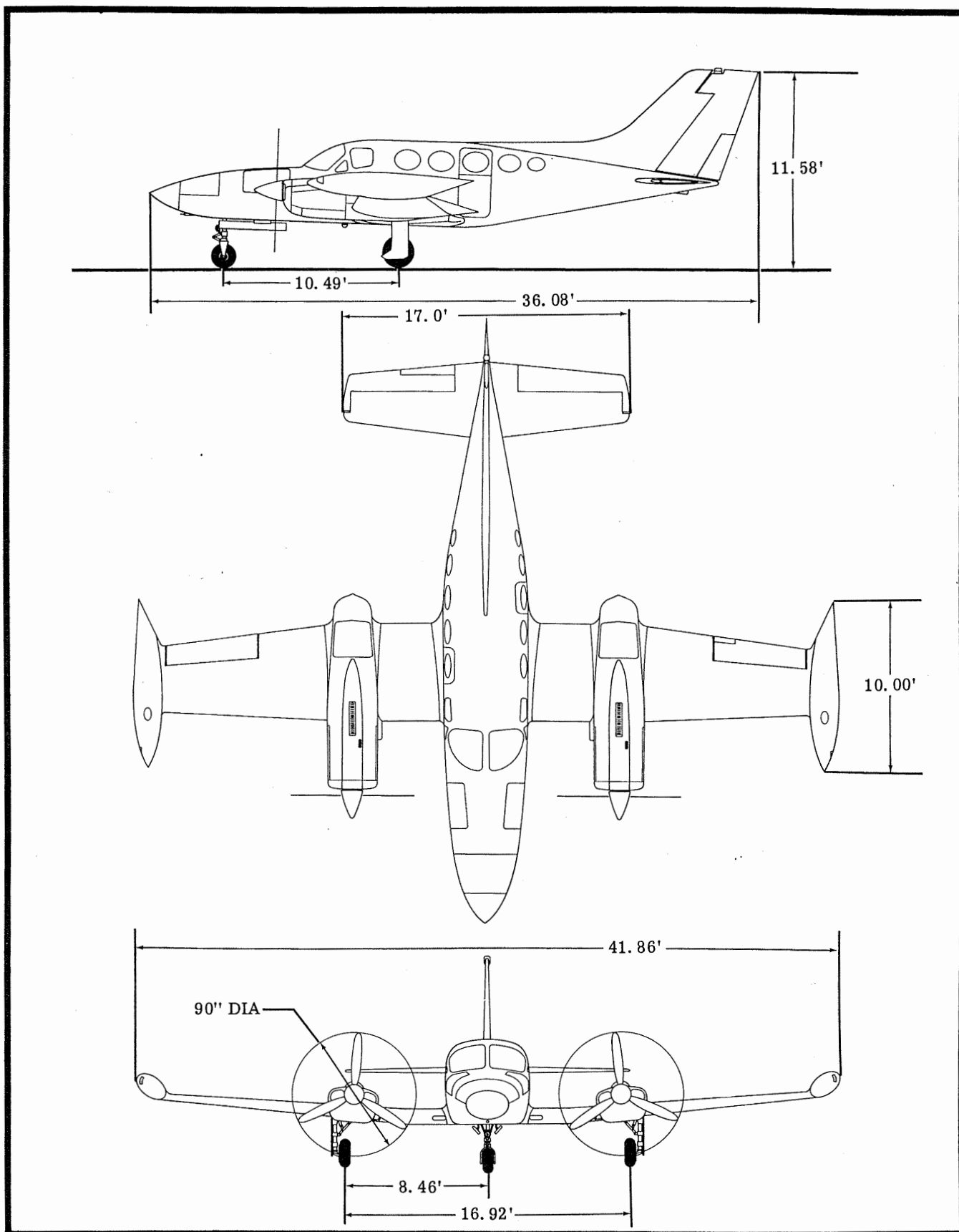


Figure 1-1. General Dimensions (Sheet 2 of 2)

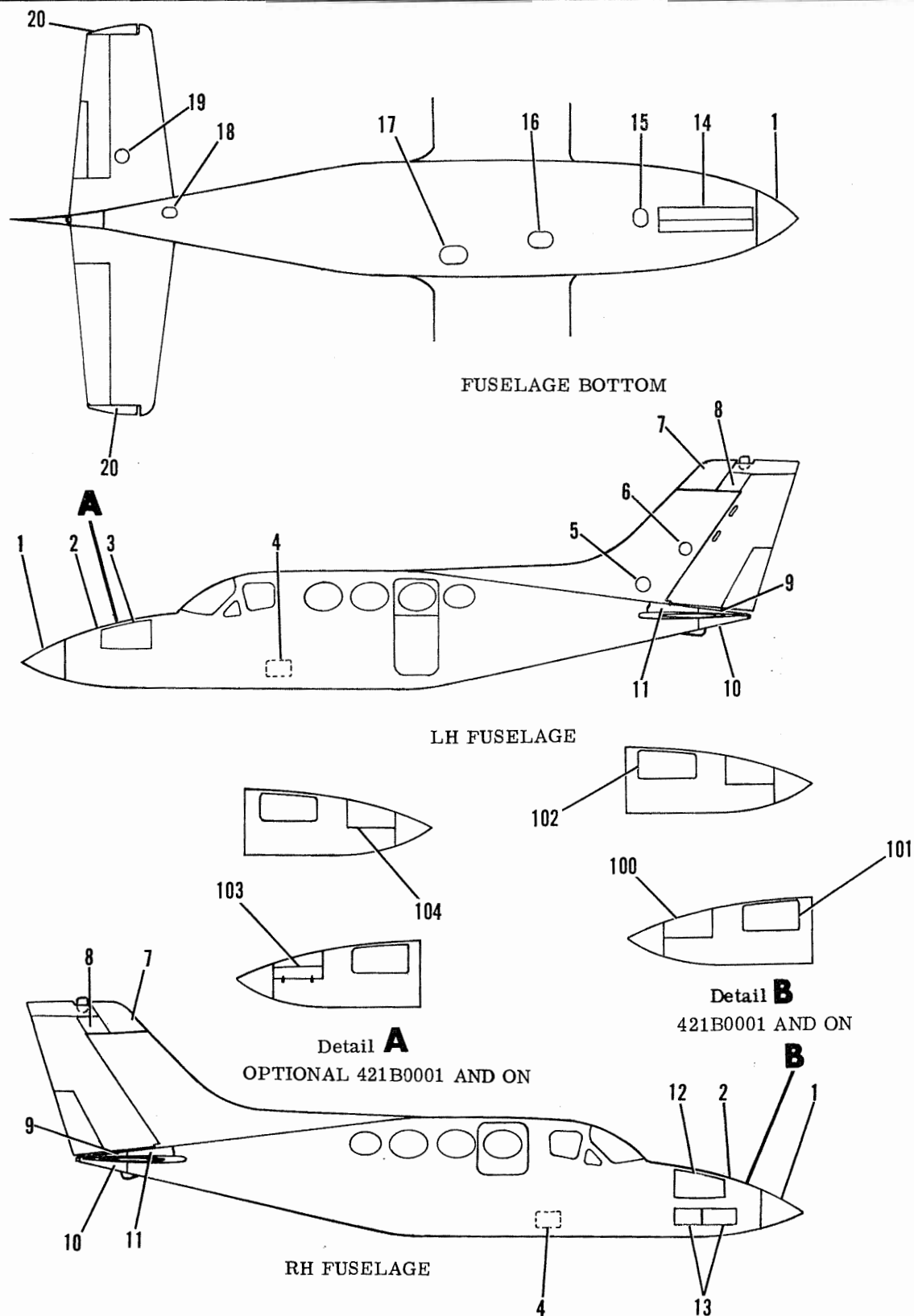


Figure 1-2. Inspection Plates and Access Covers Callouts (Sheet 1 of 7)

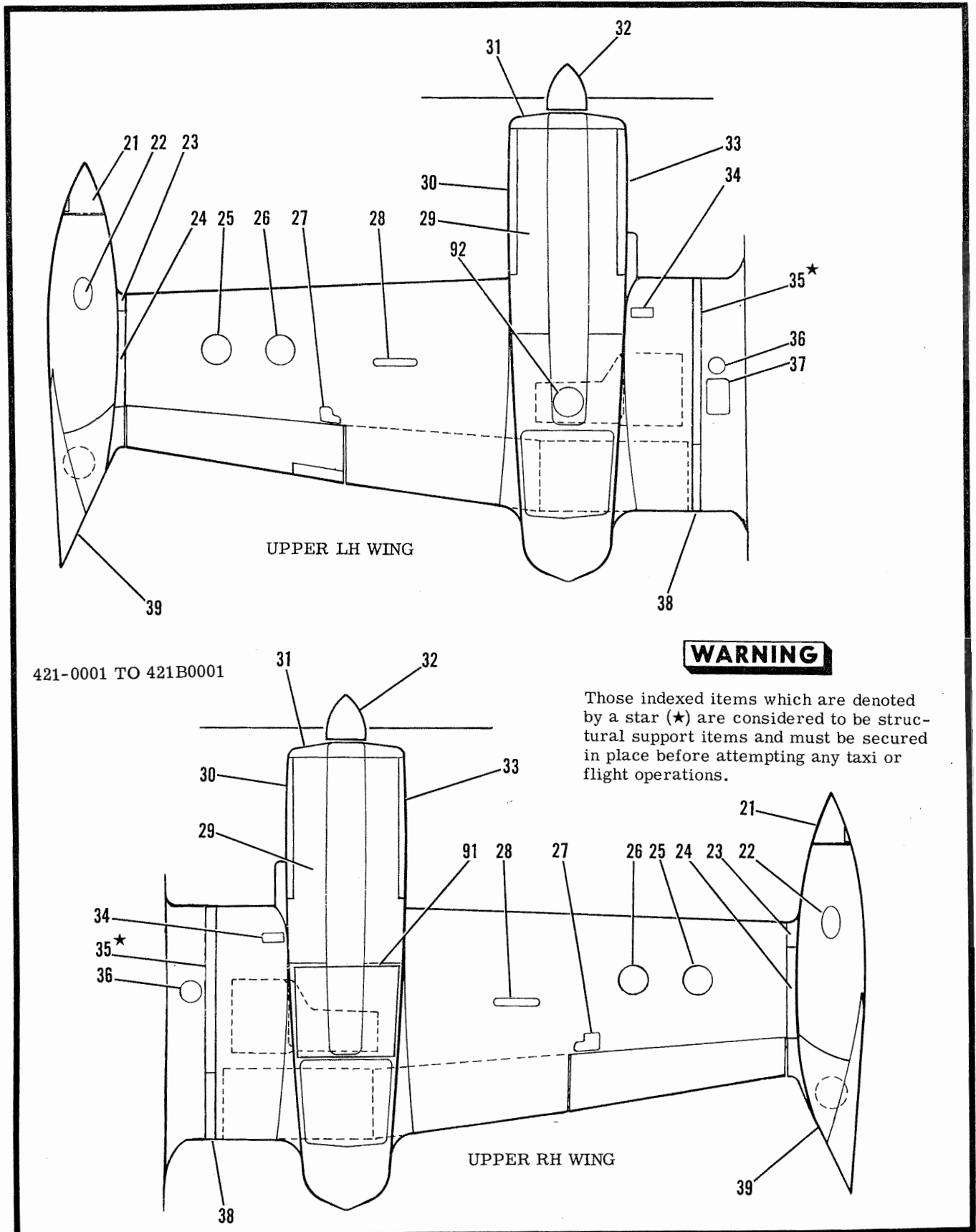
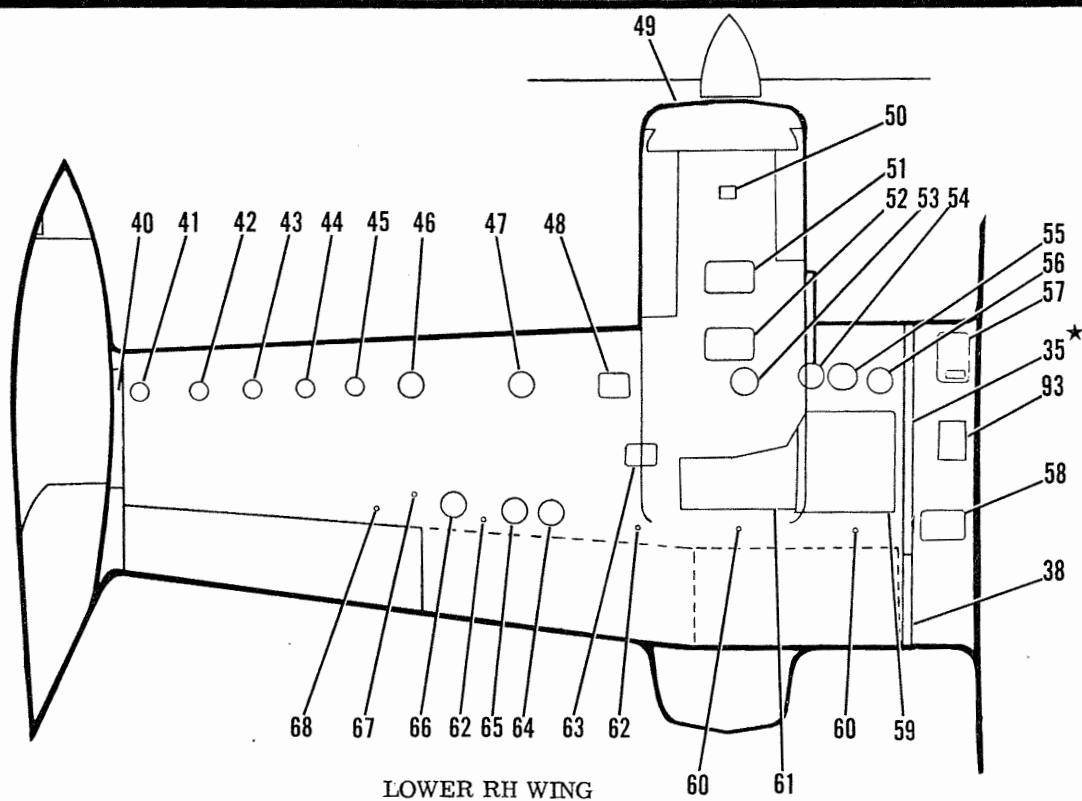


Figure 1-2. Inspection Plates and Access Covers Callouts (Sheet 2 of 7)

**WARNING**

Those indexed items which are denoted by a star (★) are considered to be structural support items and must be secured in place before attempting any taxi or flight operations.

421-0001 TO 421B0001

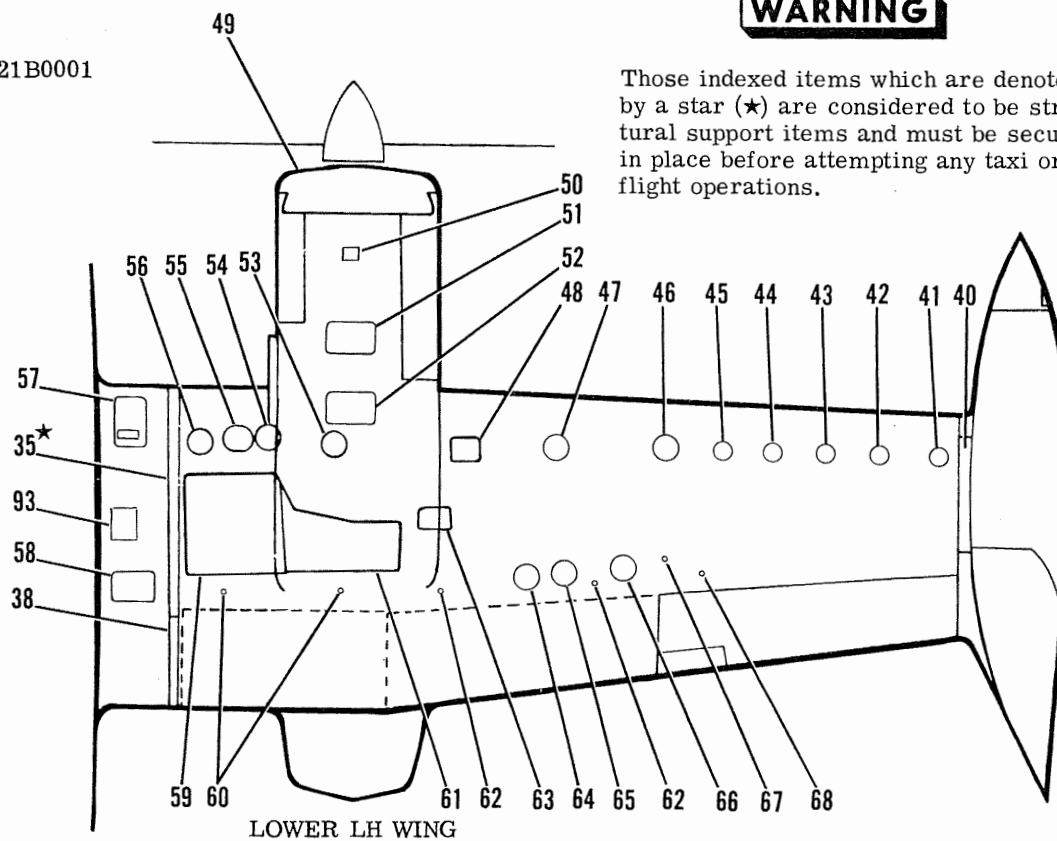


Figure 1-2. Inspection Plates and Access Covers Callouts (Sheet 3 of 7)

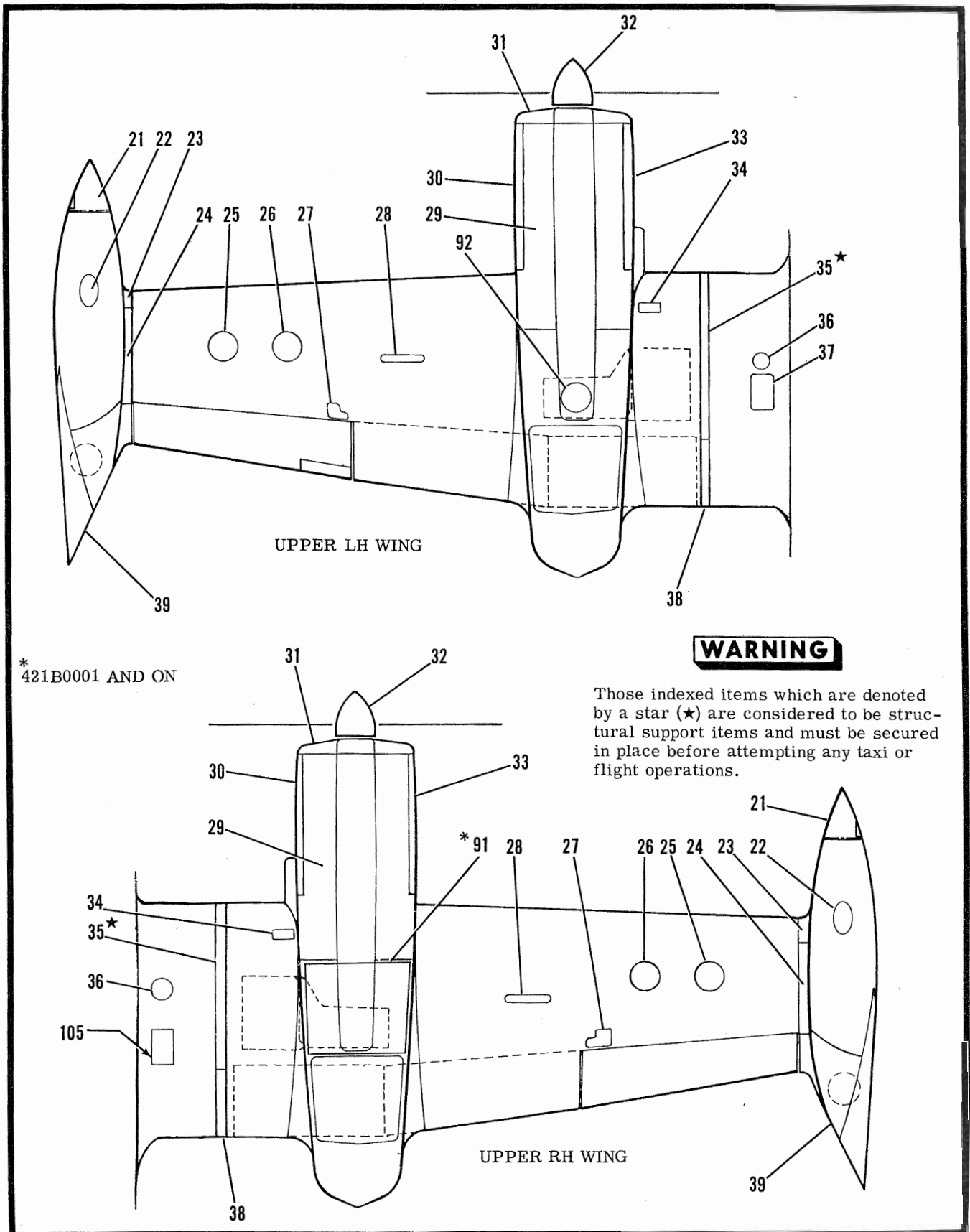


Figure 1-2. Inspection Plates and Access Covers Callouts (Sheet 4 of 7)

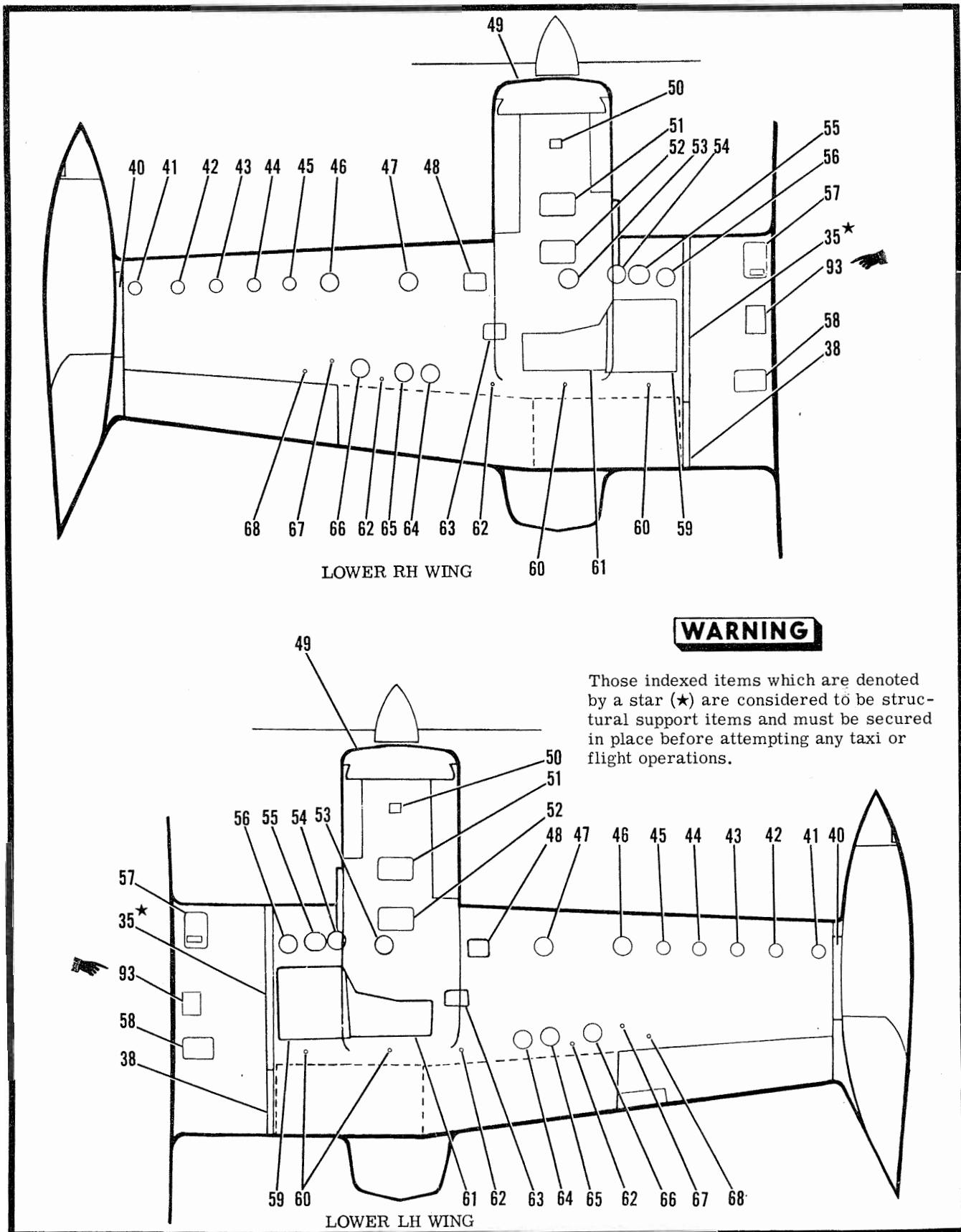


Figure 1-2. Inspection Plates and Access Covers Callouts (Sheet 5 of 7)

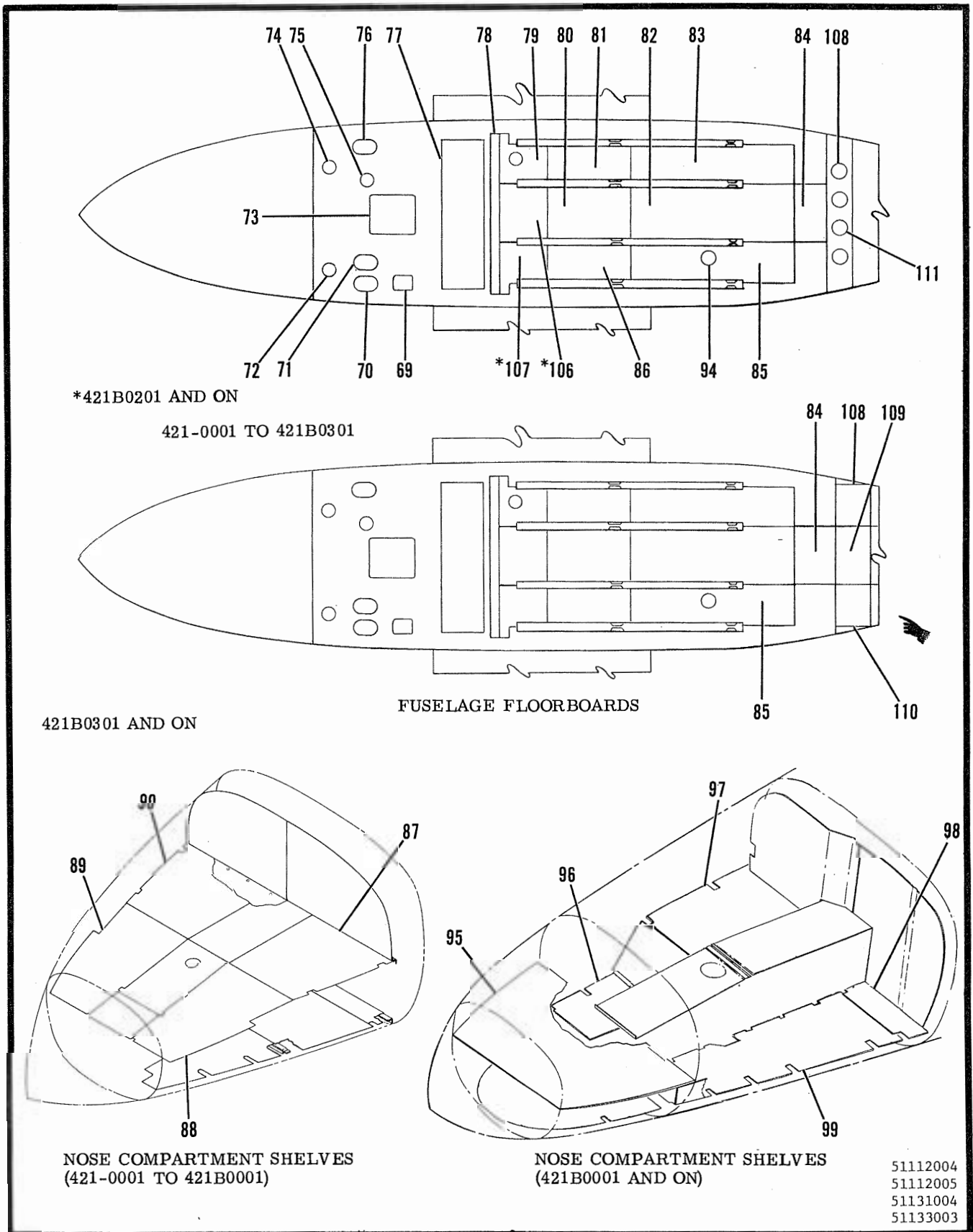


Figure 1-2. Inspection Plates and Access Covers Callouts (Sheet 6)

1. Radome
2. Equipment Access
3. Baggage Door
4. Landing Gear Boot Access
5. Rudder Cable Pulley
6. Rudder Trim Actuator
7. Fin Tip
8. Rudder Balance Weight
9. Upper Stinger
10. Lower Stinger
11. Stabilizer Fairing
12. Baggage Door
13. Heater Access
14. Nose Gear Door
15. Cable Access
16. Nose Gear Bellcrank
17. Aileron Servo Access
18. Elevator Bellcrank Access
19. Elevator Trim Access
20. Elevator Tip
21. Tip Tank Nose
22. Tip Tank Filler Cap
23. Tip Tank Gap Cover
24. Tip Tank Fairing Upper
25. Auxiliary Filler Cap (Optional)
26. Auxiliary Filler Cap (Standard)
27. Aileron Bellcrank Access
28. Fuel Tank Access
29. Upper Nacelle Cowl
30. Left Nacelle Cowl
31. Upper Nose Nacelle Cowl
32. Spinner
33. Right Nacelle Cowl
34. Fuel Selector Access
35. Forward Wing Structural Skin (Wing Gap)
36. Battery Cables Access
37. Battery Access
38. Aft Wing Gap Cover
39. Tip Tank Fairing
40. Tip Tank Fairing Lower
41. Tip Tank Wing Access
42. Optional Fuel Tank Access
43. Outboard L. E. Access
44. Tie-Down Ring Access
45. Auxiliary Fuel Tank Indicator Access
46. Fuel Line Clamping Access
47. Inboard L. E. Access
48. Fuel Vent Check Valve
49. Lower Nose Nacelle Cowl
50. Oil Drain Access
51. Nacelle Louver
52. Lower Nacelle Access
53. Nacelle Fuel Access
54. Air Inlet Access
55. Fuel Selector Access
56. Wing Fitting Access
57. Heat Exchanger Access
58. Battery Drain Access
59. Inboard Main Gear Door
60. Inboard Flap Button
61. Outboard Main Gear Door
62. Outboard Flap Button
63. Auxiliary Fuel Indicator Access
64. Aileron Stop Access
65. Outboard Flap Access
66. Aileron Trim Pulley Access
67. Aileron Bellcrank Button
68. Aileron Pulley Button
69. Left Vacuum Valve Access
70. Pilot's Floor Access
71. Brake Cylinder Access
72. Nose Gear Boot Access
73. Fuel Selector Gear Box Access
74. Heater Hose Access
75. Variable Pressure Control Filter
76. Copilot's Floor Access
77. Front Spar Access
78. Canted Access (421-0001 to 421B0201)
79. Landing Gear Idler Access
80. Center Fwd Floorboard
81. Right Fwd Floorboard
82. Center Aft Floorboard
83. Right Aft Floorboard
84. Aft Cabin Floorboard
85. Left Aft Floorboard
86. Left Fwd Floorboard
87. LH Baggage Web Rear
88. LH Baggage Web Fwd
89. RH Baggage Web Fwd
90. RH Baggage Web Rear
91. Air Conditioning Access Cover
92. Wing Locker Fuel Filler Cap
93. Main L. G. Seal Boot Access
94. Aileron Servo Governor Access
95. Fwd Avionics Bay Baggage
96. Fwd RH Baggage Shelf
97. Aft RH Baggage Shelf
98. Aft LH Baggage Shelf
99. Fwd LH Baggage Shelf
100. Avionics Bay Baggage Access
101. LH Baggage Access
102. RH Baggage Access
103. LH Avionics Bay Baggage Access
104. RH Avionics Bay Baggage Access
105. Heated Windshield Inverter Access
106. Flap Actuator and Limit Switch Access
107. Landing Gear Actuator Access
108. Pressurization Valve Access
109. Center Aft Baggage Floor Access
110. LH Aft Baggage Floor Access
111. Pressure Bulkhead Access

Figure 1-2. Inspection Plates and Access Covers Callouts (Sheet 7 of 7)

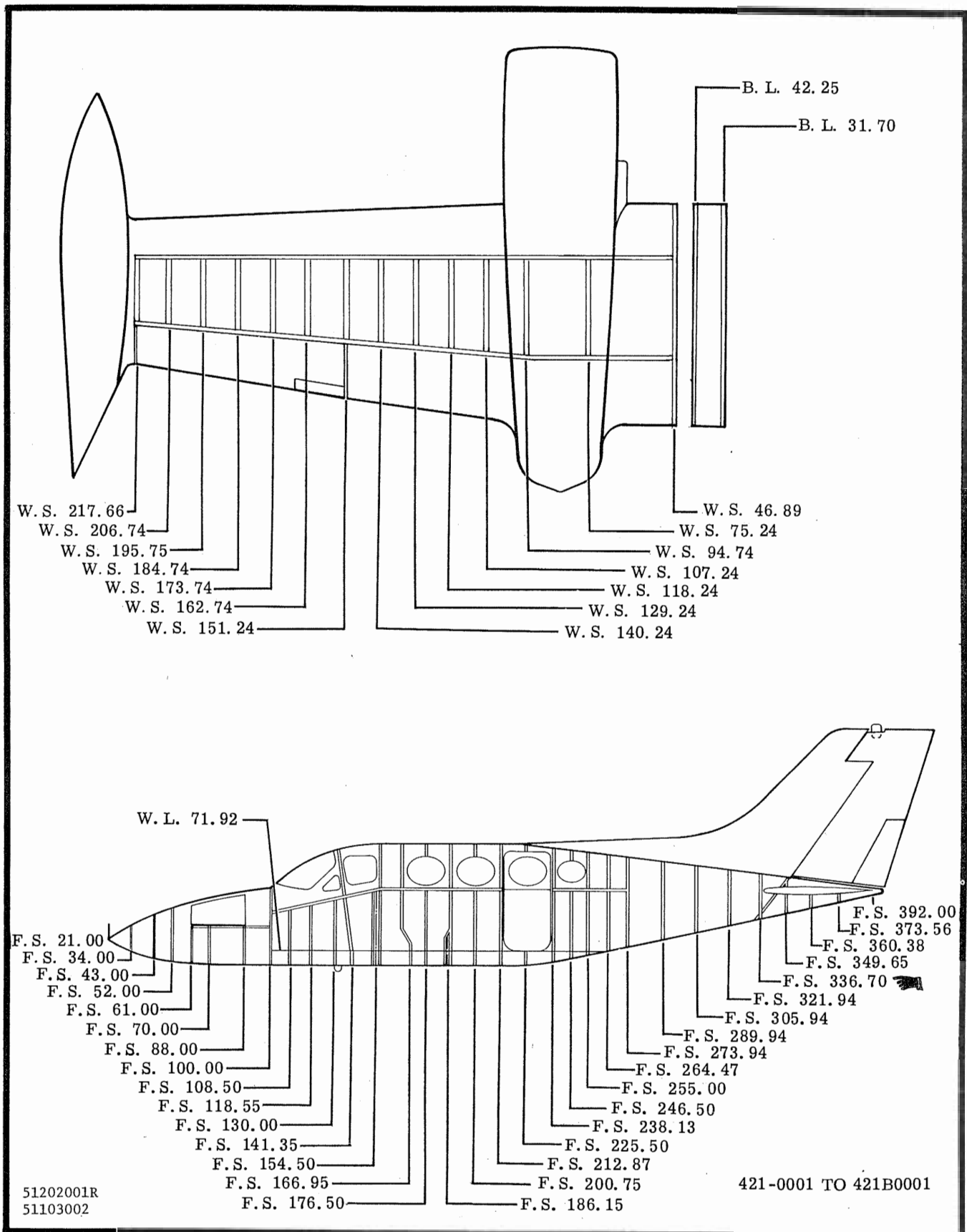


Figure 1-3. Station Diagram (Sheet 1 of 3)

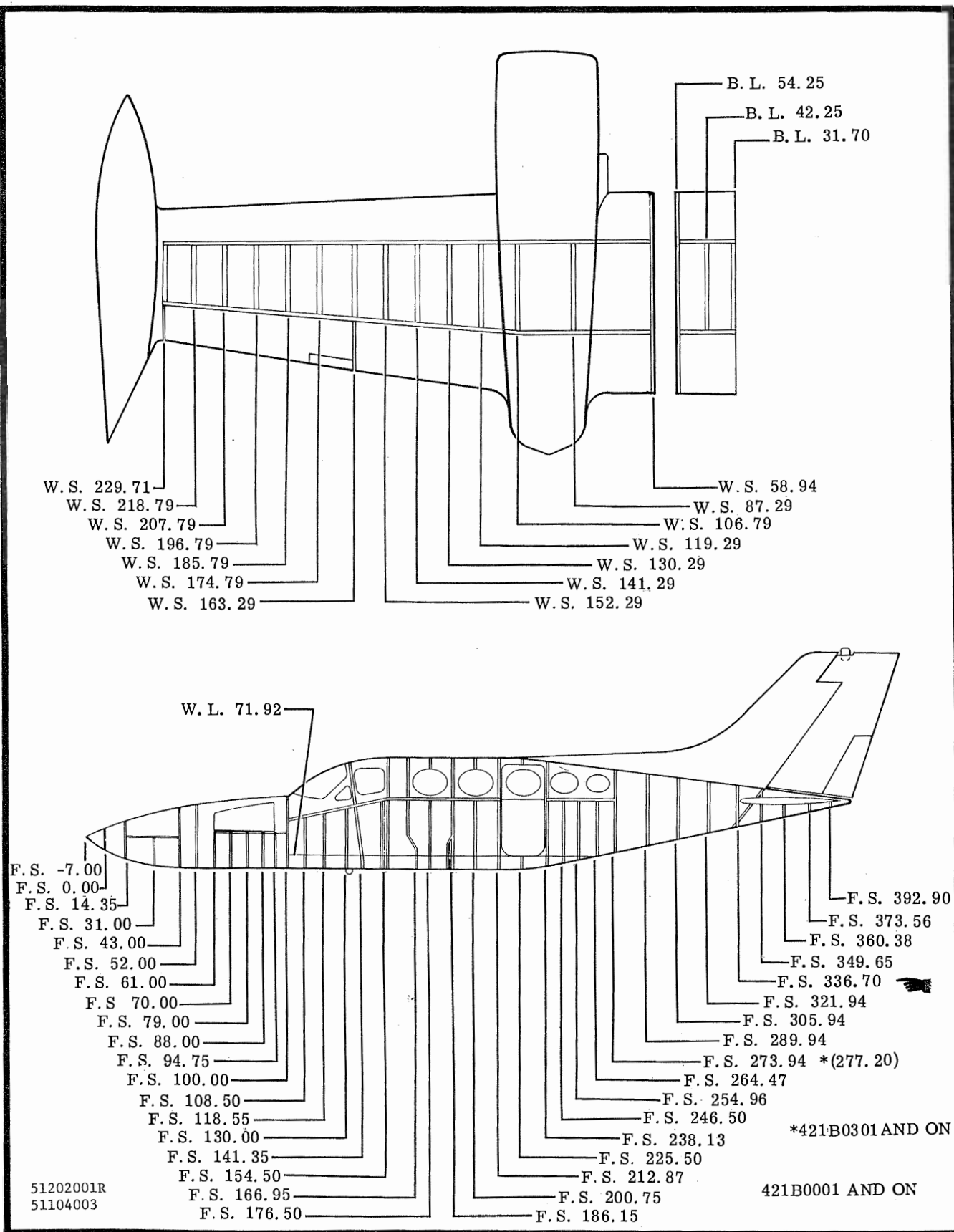


Figure 1-3. Station Diagram (Sheet 2)

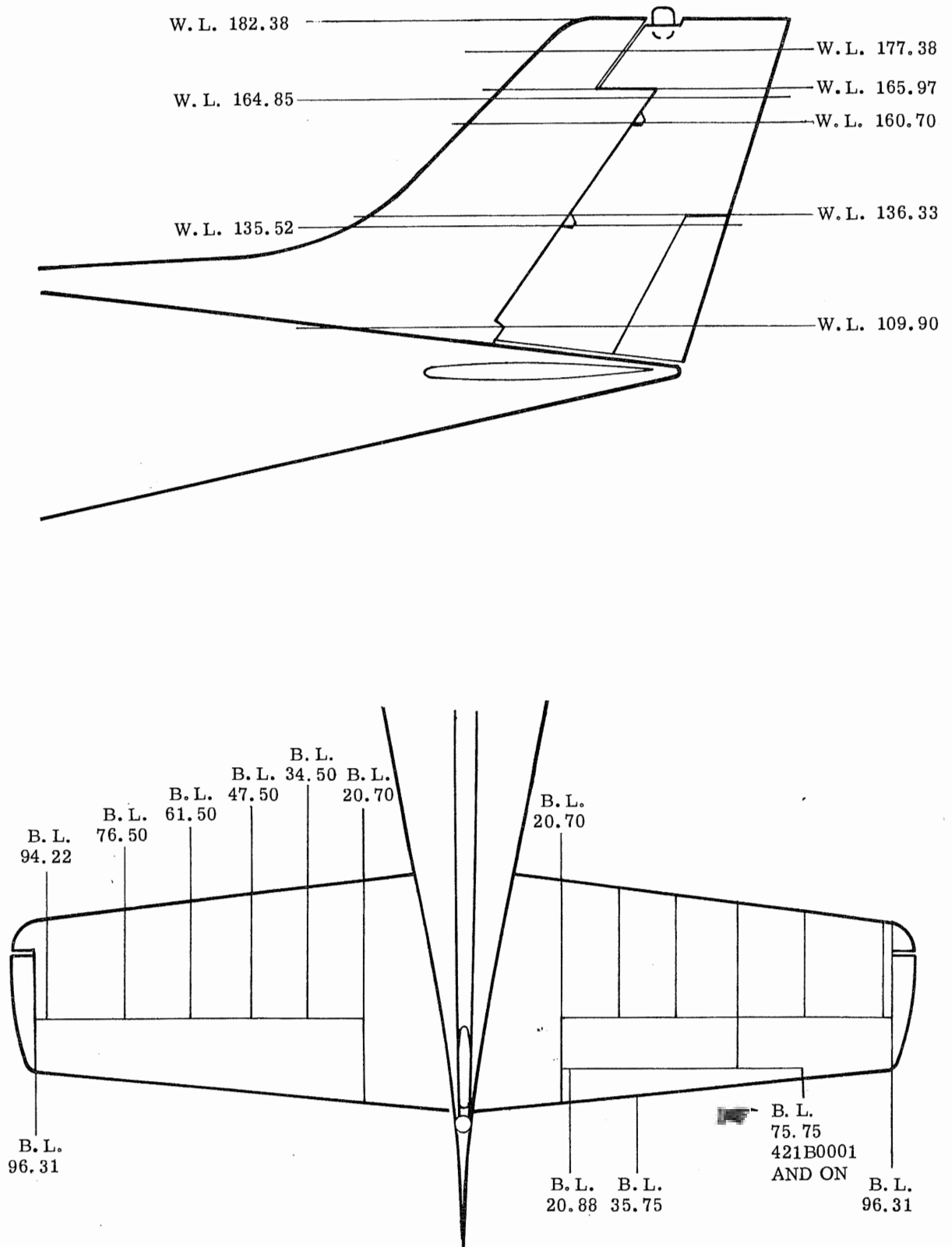


Figure 1-3. Station Diagram (Sheet 3 of 3)

RECOMMENDED NUT TORQUES

THE TORQUE VALUES STATED ARE POUND-INCHES, RELATED ONLY TO STEEL NUTS ON OIL-FREE CADMIUM PLATED THREADS.

FINE THREAD SERIES

TAP SIZE	TENSION NUTS		SHEAR NUTS	
	TORQUE		TORQUE	
	STD (NOTE 1)	ALT (NOTE 2)	STD (NOTE 3)	ALT (NOTE 2)
8-36	12-15		7-9	
10-32	20-25	20-28	12-15	12-19
1/4-28	50-70	50-75	30-40	30-48
5/16-24	100-140	100-150	60-85	60-106
3/8-24	160-190	160-260	95-110	95-170
7/16-20	450-500	450-560	270-300	270-390
1/2-20	480-690	480-730	290-410	290-500
9/16-18	800-1000	800-1070	480-600	480-750
5/8-18	1100-1300	1100-1600	660-780	660-1060
3/4-16	2300-2500	2300-3350	1300-1500	1300-2200
7/8-14	2500-3000	2500-4650	1500-1800	1500-2900
1-14	3700-5500	3700-6650	2200-3300	2200-4400
1-1/8-12	5000-7000	5000-10000	3000-4200	3000-6300
1-1/4-12	9000-11000	9000-16700	5400-6600	5400-10000

COARSE THREAD SERIES

	(NOTE 4)		(NOTE 5)	
8-32	12-15		7-9	
10-24	20-25		12-15	
1/4-20	40-50		25-30	
5/16-18	80-90		48-55	
3/8-16	160-185		95-100	
7/16-14	235-255		140-155	
1/2-13	400-480		240-290	
9/16-12	500-700		300-420	
5/8-11	700-900		420-540	
3/4-10	1150-1600		700-950	
7/8-9	2200-3000		1300-1800	
1-8	3700-5000		2200-3000	
1-1/8-8	5500-6500		3300-4000	
1-1/4-8	6500-8000		4000-5000	

NOTES

1. Covers AN310, AN315, AN345, AN362, AN363, AN366, MS17825, MS20365, MS21044, MS21043, MS21044, MS21045, MS21046, MS21047, MS21048, MS21078 and other fine thread tension nuts.
2. When using AN310, AN320, MS17825 or MS17826 castellated nuts where alignment between the bolt and cotter pin hole is not reached using normal torque values, use alternate torque values or replace the nut.
3. Covers AN316, AN320, AN7502, MS17826, MS20364, MS21043, MS21083, MS21245 and other fine thread shear nuts.
4. Covers MS20341, MS20365, MS21042, MS21043, MS21044, MS21045, MS21046 and other coarse thread tension nuts.
5. Covers AN340, MS20364, MS21083 and other coarse thread shear nuts.

CAUTION

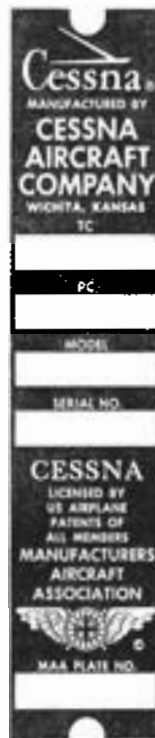
During removal and replacement of component parts, all self-locking nuts and castellated self-locking nuts must be replaced with new nuts.

These torque values are recommended for all procedures contained in this manual except where other values are stipulated. They are not to be used for checking tightness of installed parts during service.

Figure 1-4. Torque Values



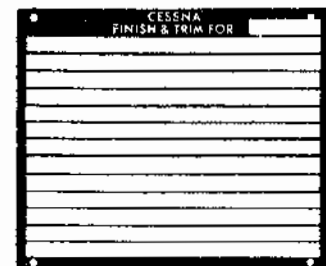
421-0001 TO 421-0118



421-0118 AND ON



421-0001 TO 421-0058



421-0058 AND ON



Figure 1-5. Serial Numbers and Identification Plates

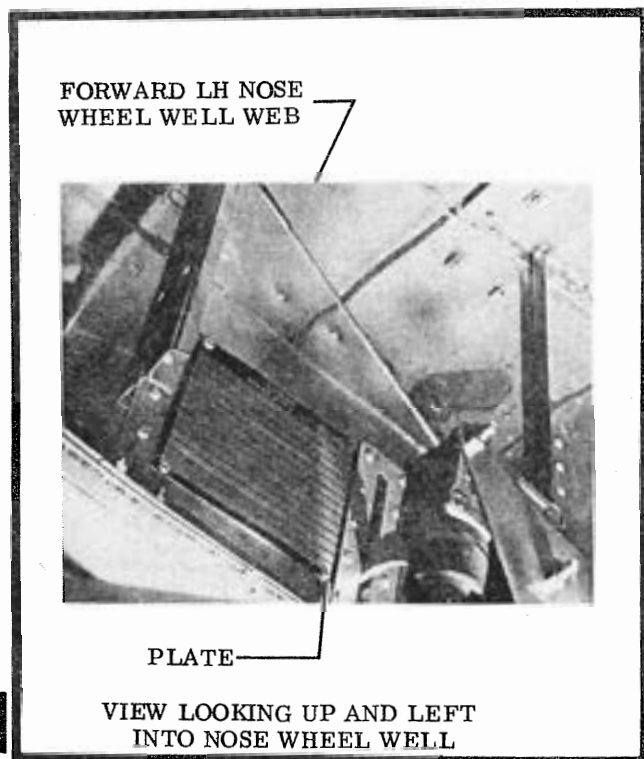


Figure 1-6. Finish and Trim Plate Location

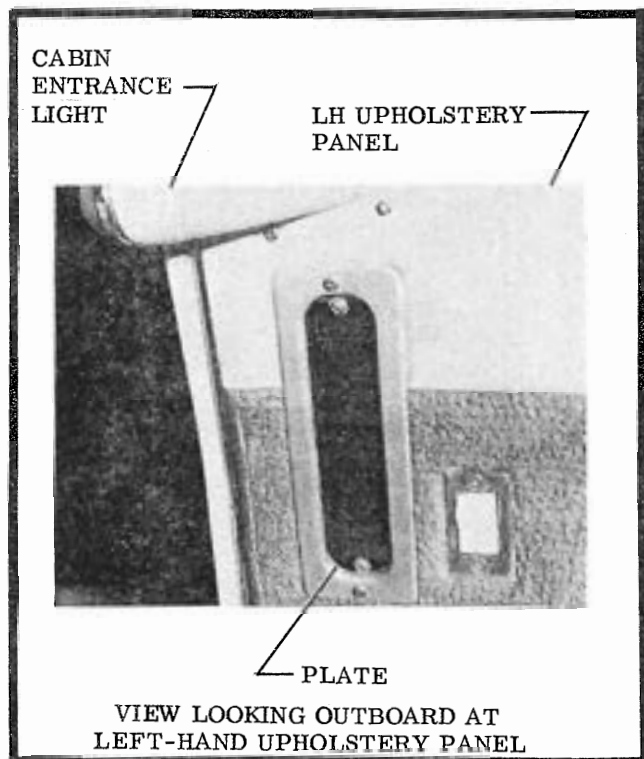


Figure 1-7. MAA Plate Location

SECTION 2

GROUND HANDLING, SERVICING AND INSPECTION

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GENERAL DESCRIPTION.

This section contains routing, servicing and maintenance procedures that are most frequently encountered. Frequent reference to this section will aid maintenance personnel by providing information on ground handling and emergency procedures, daily and periodic servicing procedures and airframe maintenance and lubrication. When any system or unit requires service or maintenance, other than the routine procedures as outlined in this section, refer to the section applicable to that system or unit.

GROUND HANDLING.

The following precautionary measures should be taken when handling the aircraft on the ground:

- a. Control surfaces shall not be locked while towing or taxiing the aircraft.
- b. Do not set parking brake if brakes are overheated.

When operating the engines, observe the following:

- a. Remove all towing equipment.
- b. Head aircraft into wind and chock wheels.
- c. Remove all control locks.
- d. All personnel, work stands, and equipment shall be clear of danger areas.
- e. Parking brake set.
- f. Position nose wheel exactly fore and aft when running engine at high RPM.

Towing.

A steering bar, located in the left nacelle baggage compartment, is provided to aid in ground movement of the aircraft. The steering bar engages spacers on the nose gear lower torque link and is used to guide the aircraft manually. The nose gear will caster a maximum of 55 degrees to either side of center.

CAUTION

- When towing the aircraft, the 55 degree limit shall be strictly observed, as the nose gear and/or steering mechanism will be damaged if turned beyond the 55 degree stops.
- Be sure parking brake is released and the external and internal rudder gust locks are removed before towing as structural damage will be incurred.
- Never push, pull or lift aircraft by the ailerons, elevators, flaps, nacelles or unsupported skin between wing ribs.

Power towing is not recommended. However, aircraft can be power towed to move aircraft over soft or muddy ground or in emergencies by attaching a rope harness to the main landing gear. Do not power tow aircraft with towing vehicle attached to nose gear or the tail skid. When power towing, station a crew member in the aircraft to apply brakes in case of emergency. Use extreme caution to avoid jerky motions, as serious structural damage can result.

Taxiing.

Before attempting to taxi the aircraft, ground personnel should be checked out by qualified pilots or other responsible personnel. When it is determined that the propeller blast area is clear, apply power and start taxi roll and perform the following checks:

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

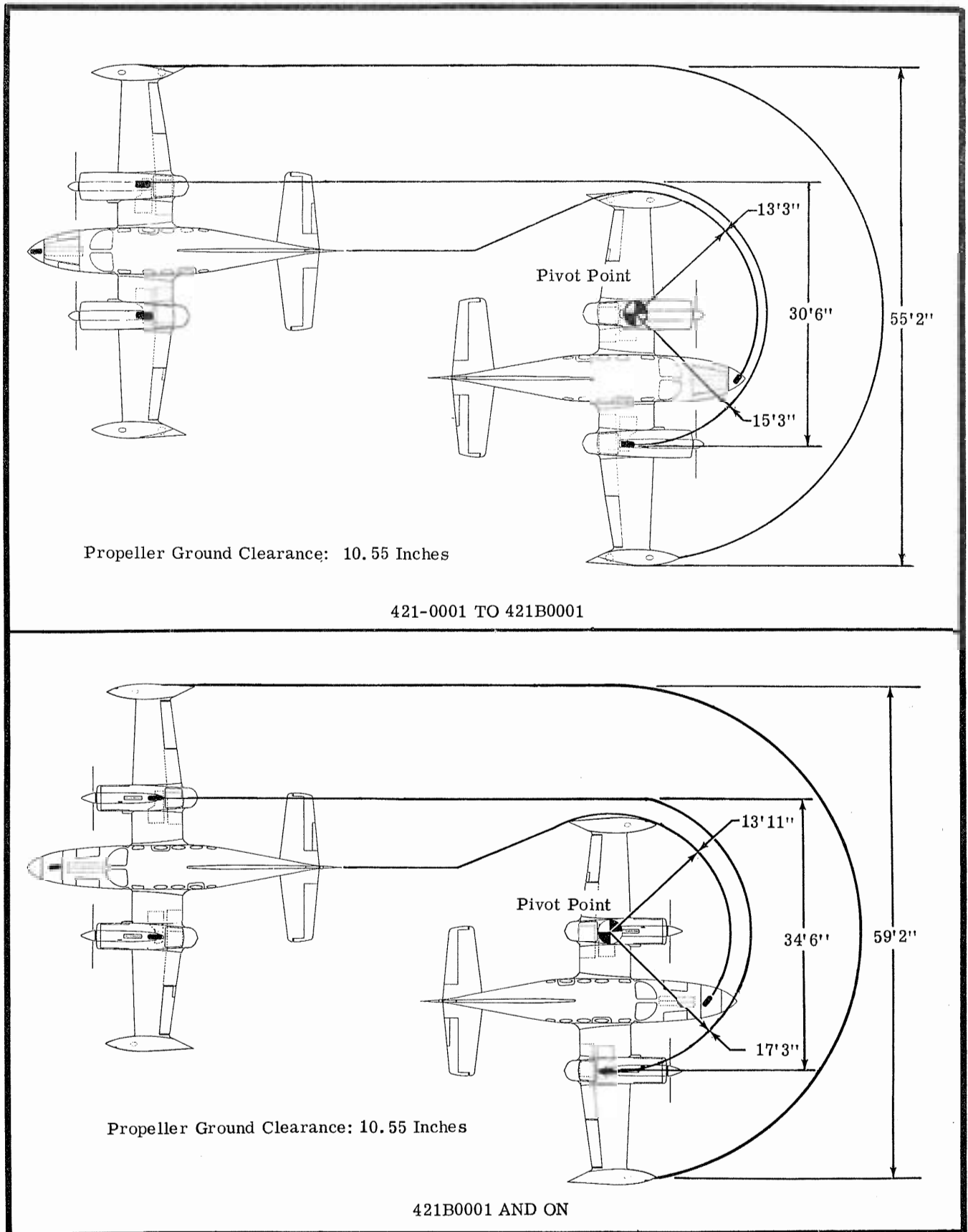


Figure 2-1. Minimum Turning Radius

- b. While taxiing, make slight turns to determine effectiveness of nose gear steering.
- c. Check operation of turn and bank indicator and directional gyro.
- d. Check for sluggish instruments during taxiing. In cold weather, make sure all instruments have warmed sufficiently for normal operation.
- e. Minimum turning distance must be strictly observed when taxiing the aircraft close to buildings or other stationary objects.
- f. Do not operate the engine at high RPM when taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

Minimum Turn Radius.

See figure 2-1 for minimum turning radius.

Parking.

- a. When parking the aircraft, head into the wind and set parking brake.

CAUTION

Do not set parking brakes when the brakes are overheated, or during cold weather when accumulated moisture may freeze the brakes.

- b. Close engine cowl flaps (421-0001 to 421B0001) and install internal control lock. Install pitot tube cover and place chocks under all wheels. In parking the aircraft, it is also important to turn the nose gear to its full limit, either right or left, if external rudder lock is not available. This will place the rudder bellcrank against the stop and hold it there with spring tension from the nose gear steering mechanism.

Rudder Pedals Gust Lock (Optional). (See figure 2-2.)

The rudder pedals gust lock is installed on the left-hand floorboard with a clamp which permits the lock to pivot forward to engage the rudder pedals when in use, and back to the floorboard for stowage when not in use. The lock is adjustable for rigging purposes.

NOTE

Rig gust control lock so that both rudder pedals must be pushed forward a minimum of 0.10 inch to engage lock.

Tie-Down.

Tying-down the aircraft should be accomplished in anticipation of light winds, or anytime the aircraft is to be left outside for lengthy periods, such as overnight. Tie-down as follows:

- a. Head aircraft into the wind, if possible, and close engine cowl flaps.
- b. Set parking brake and install control lock.

CAUTION

Do not set parking brake when the brakes are overheated or during cold weather when accumulated moisture may freeze the brakes.

- c. Set trim tabs to neutral, so tabs fair with control surfaces.
- d. Install external gust locks on rudder, elevator and aileron (one each wing) as shown in figure 2-2.

NOTE

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

- e. (See figure 2-2.) Drive the ground anchor stakes as shown to provide a rope angle of 45° to the ground. Secure chains or manila rope of 700 pounds or more tensile strength to the tie-down fittings under the wings and secure opposite end to the ground anchor stakes.
- f. Tie a manila rope around the nose gear, above torque link, and secure the outer end to a ground anchor.
- g. Tie a manila rope or chain to tailcone bumper and secure other end to a ground anchor.
- h. Install pitot tube cover.

Jacking.

Three jack points are on the underside of the aircraft, one just aft of the nose wheel well, and one on the lower surface of each wing, just aft of the main gear attach points. See figure 2-3 for jacking procedures.

NOTE

Special two-ton jacks, ideally suited to the 421, can be supplied by the Cessna Aircraft Company. Three jacks are required to lift the aircraft.

Leveling.

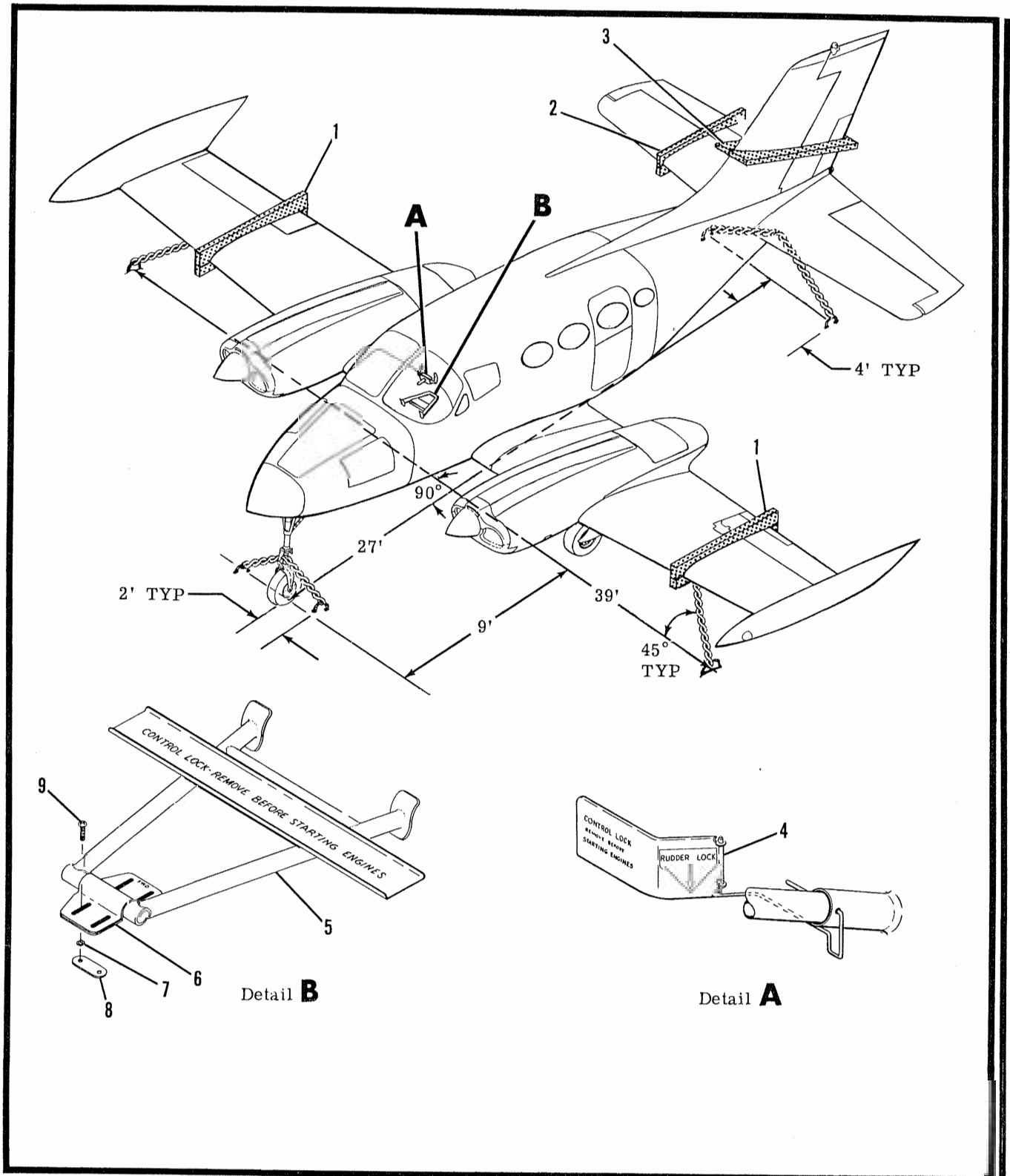
To level the aircraft longitudinally and laterally, use the three jacking points provided on the aircraft. Level longitudinally by backing out the two screws at "Level Point" on the right hand outside fuselage (opposite cabin door) at Stations 214 and 238 and place a spirit level on these screws, then level longitudinally. To level laterally, place a spirit level between the black marks at Station 154.00 (aft of front spar) on the underside of fuselage.

Weighing and Measuring.

For weighing and measuring the aircraft refer to figure 2-5.

NOTE

To prevent the flight hour recorder from recording while the aircraft is on jacks and battery switch is in the ON position, remove fuse located in the left console.



1. Aileron Gust Lock
2. Elevator Gust Lock
3. Rudder Gust Lock

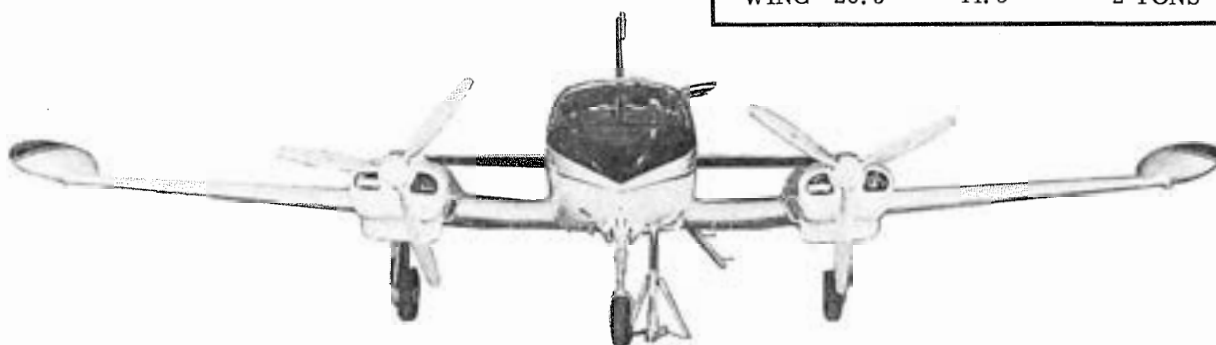
4. Control Lock
5. Rudder Control Lock
6. Clamp

7. Lockwasher
8. Plate
9. Screw

Figure 2-2. Tie-Down and Control Lock

JACKING REQUIREMENTS

	HEIGHT CLOSED	HEIGHT EXTENDED	CAPACITY
NOSE	26.5	44.5	2 TONS
WING	26.5	44.5	2 TONS

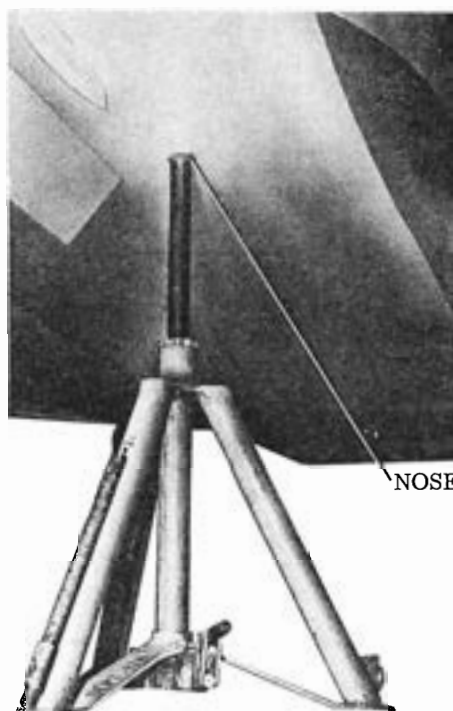


Note

FOR LANDING GEAR REMOVAL AND MAINTENANCE, USE ALL THREE JACK POINTS. FOR REMOVAL OF MAIN WHEELS USE APPROPRIATE WING JACK POINT. FOR REMOVAL OF NOSE WHEEL, USE NOSE JACK POINT.

CAUTION

PLACE WEIGHT IN NOSE SECTION OF FUSELAGE TO PREVENT AIRCRAFT FROM TIPPING BACKWARD WHEN NOSE IS RAISED.



WING JACKING POINT

NOSE JACKING POINT

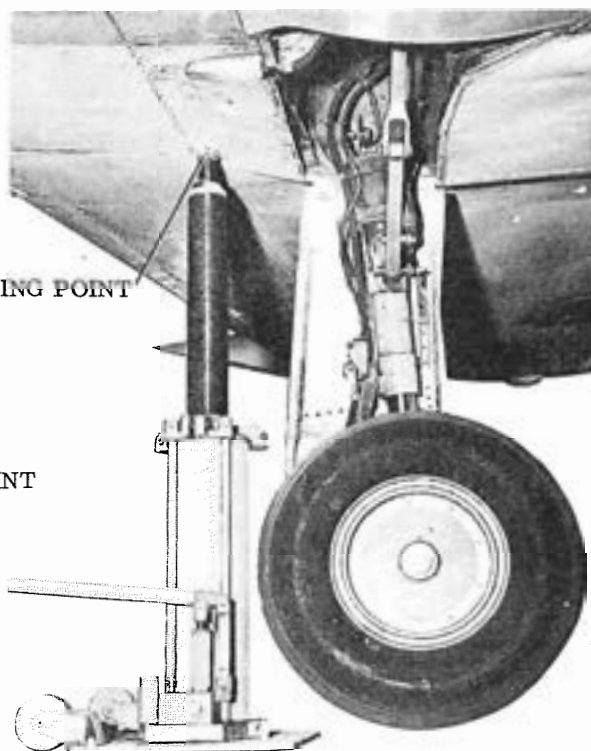


Figure 2-3. Jacking

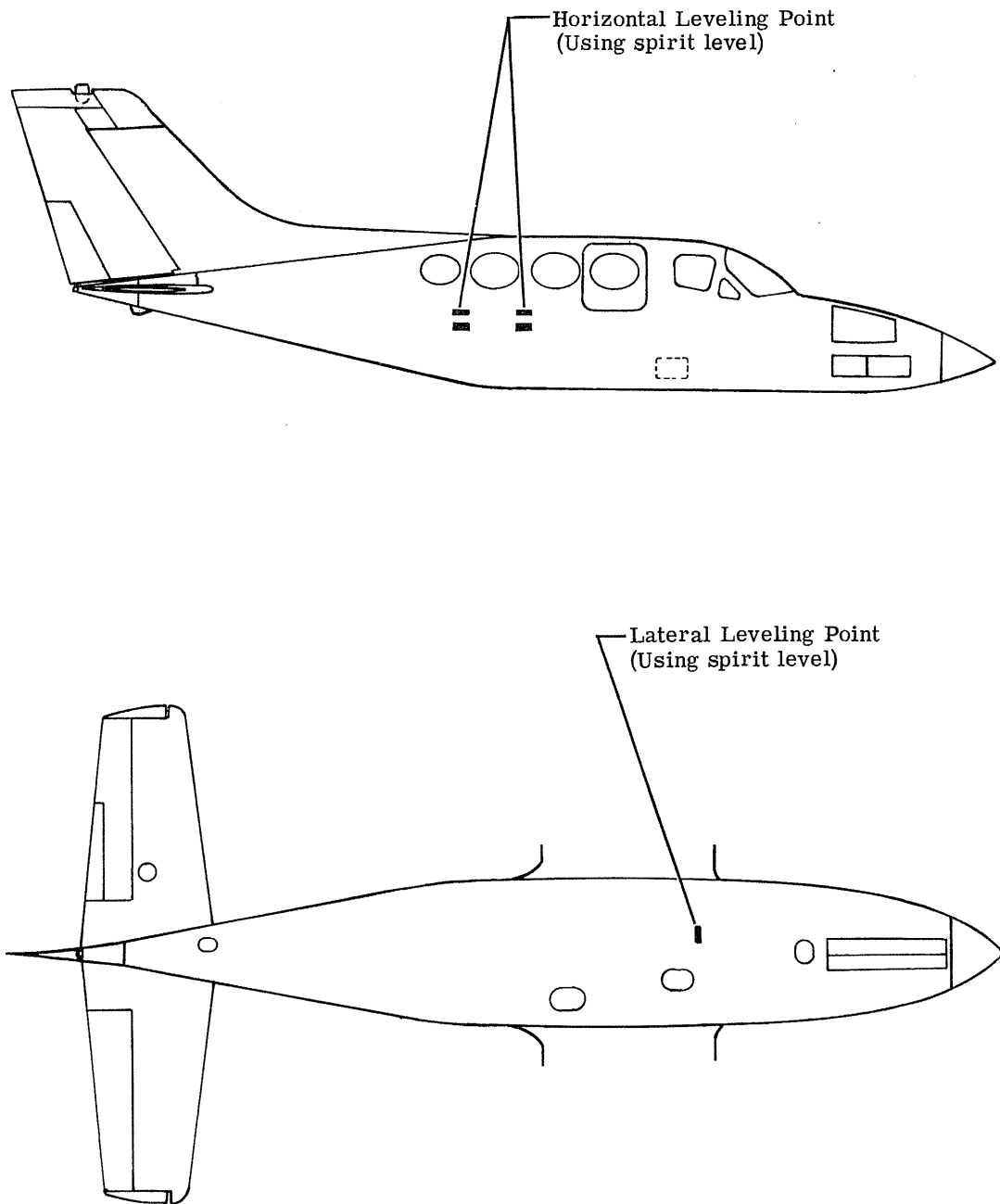
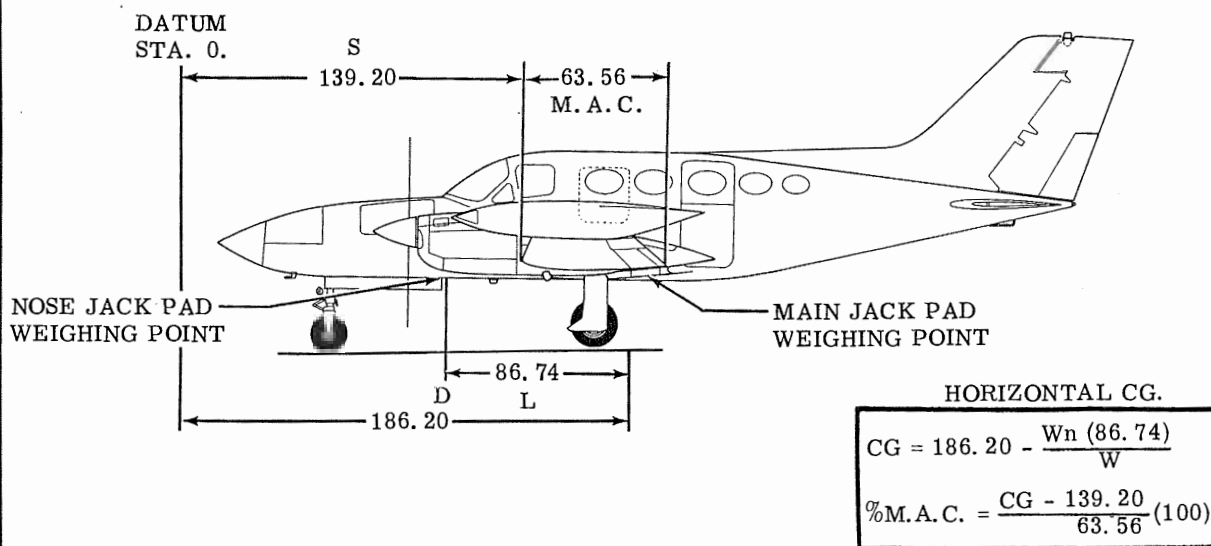


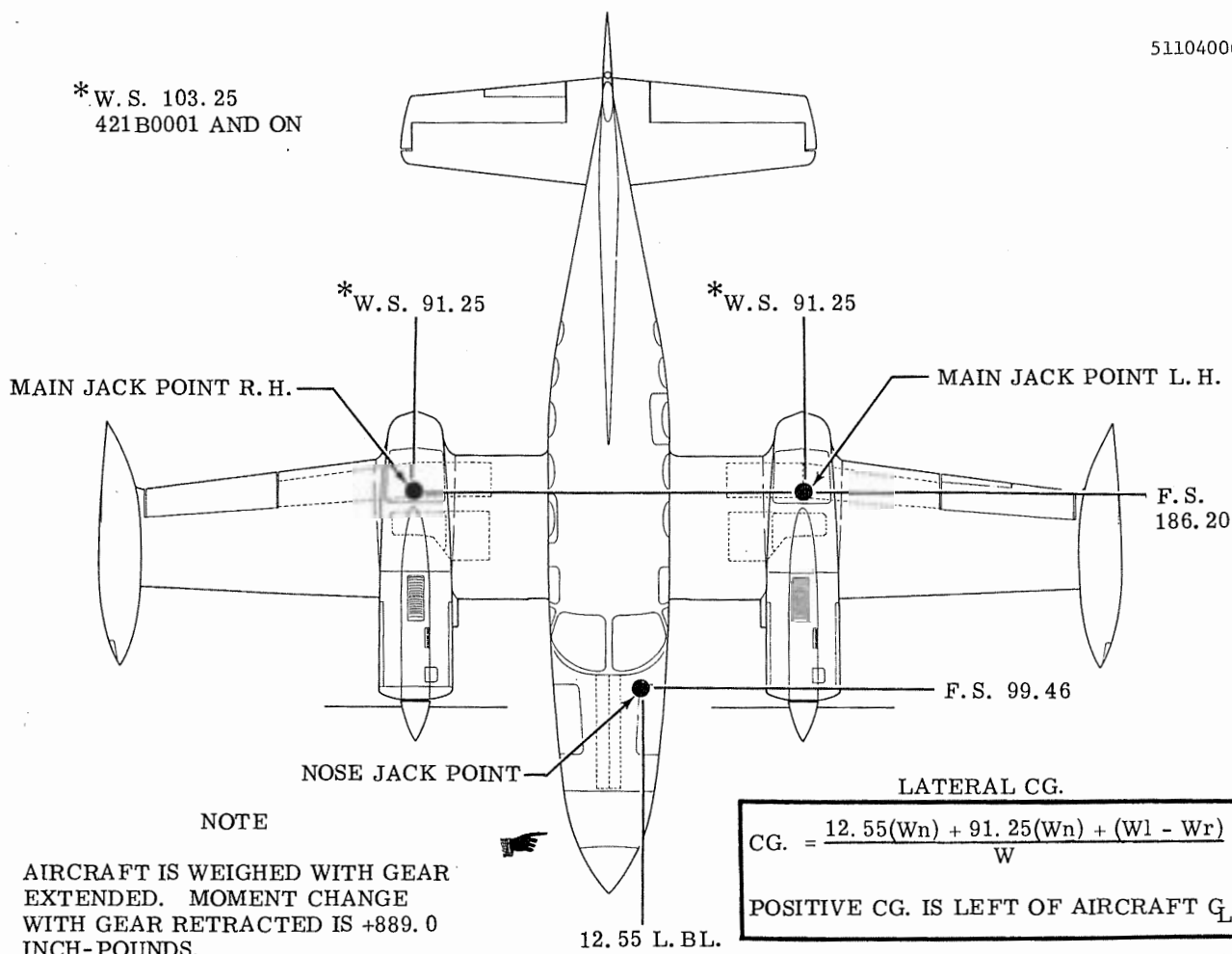
Figure 2-4. Leveling

WEIGHING ON JACK POINTS



51104006

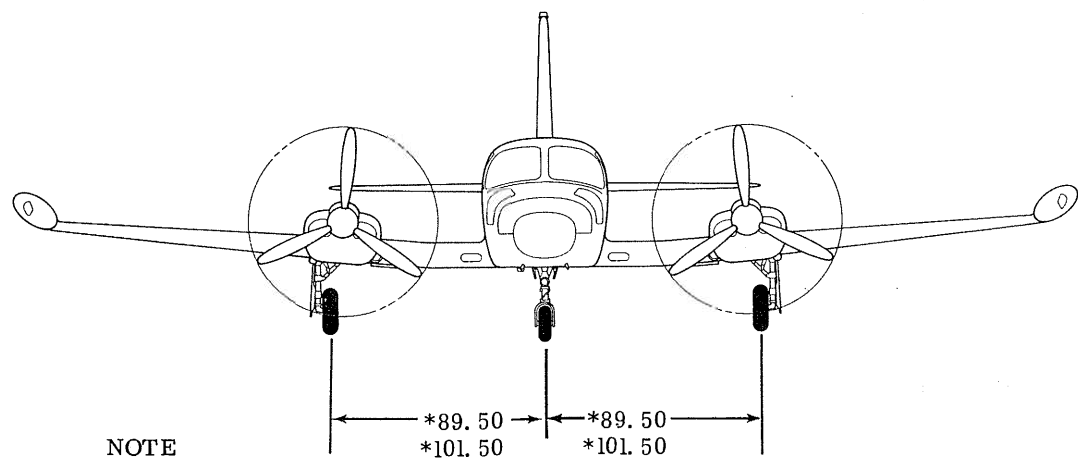
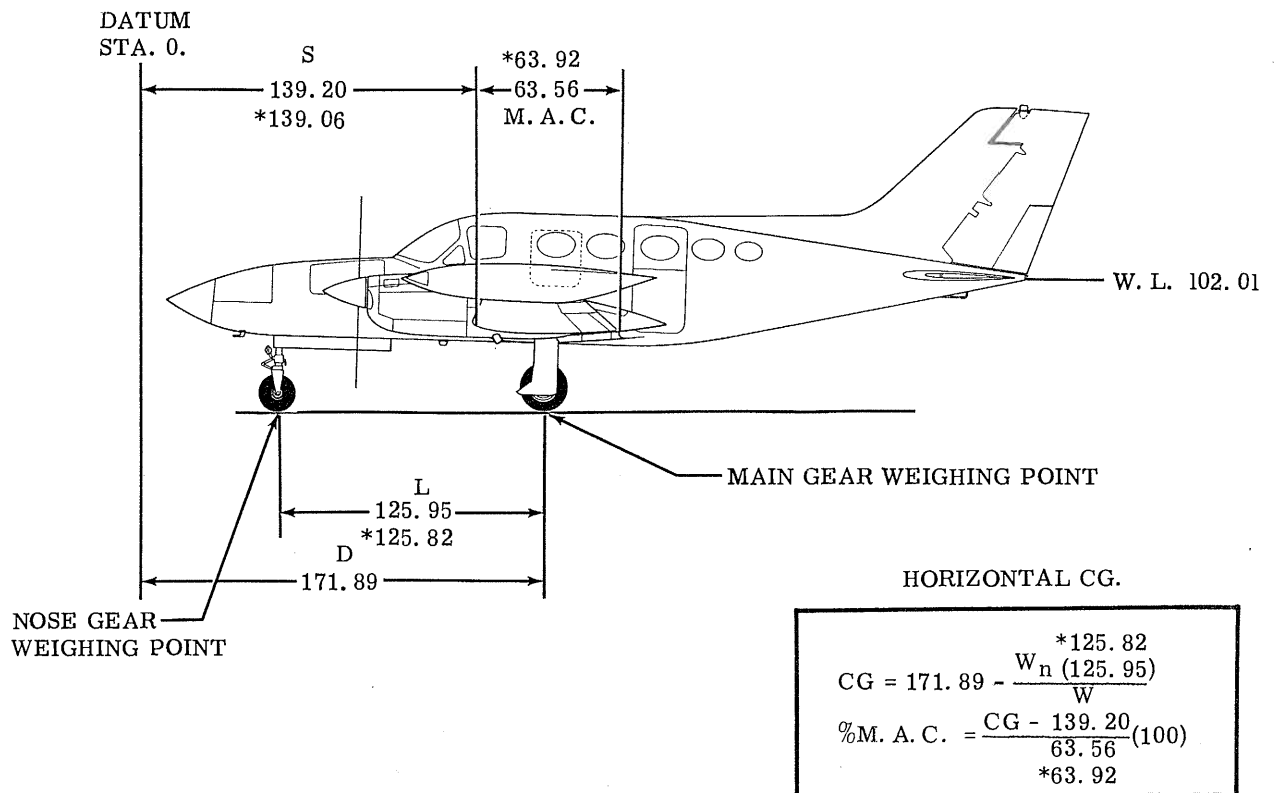
*W.S. 103.25
421B0001 AND ON



51104007

Figure 2-5. Weighing and Measuring (Sheet 1 of 2)

WEIGHING ON LANDING GEAR



NOTE

AIRCRAFT IS WEIGHED WITH GEAR
EXTENDED. MOMENT CHANGE
WITH GEAR RETRACTED IS +889.0
INCH-POUNDS.

*421B0001 AND ON

51104006

Figure 2-5. Weighing and Measuring (Sheet 2)

LEGEND

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

NOTE

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

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

AIRCRAFT IS WEIGHED WITH GEAR EXTENDED. MOMENT CHANGE WITH GEAR RETRACTED IS +889.0 INCH-POUNDS.

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

Table 1.

Preparation for Weighing.

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

NOTE

When weighed with full oil, actual empty

weight equals the actual recorded weight less the weight of the oil in the engines (oil weight = oil capacity in gallons x 7.5 pounds).

- Properly calibrate, zero and use scales in accordance with the scale manufacturer's instructions.
- Place the scales and suitable supports (jacks) under the aircraft jack pads or wheels and record the scale readings. (See table 1.)
- Do not set brakes while taking scale readings.
- Note tare when the aircraft is removed from the scales.

NOTE

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

Figure 2-5. Weighing and Measuring (Sheet 3)

STORAGE OF AIRCRAFT.

There are three recommended categories of storage of the aircraft.

- a. Flyable Storage - Aircraft which will not be flown for an indefinite period of time but which are to be kept ready to fly with the least possible preparation.
- b. Temporary Storage - Aircraft which will be stored for a period of time up to 60 days.
- c. Indefinite Storage - Aircraft which will be stored for an indefinite period of time.

FLYABLE STORAGE

Aircraft which are not in daily flight should have the engine rotated by hand-turning the propeller five (5) revolutions at least once each week. In damp climate and in storage areas where the daily temperature variation can cause condensation, the turning operation should be accomplished more frequently. Rotating the engine an odd number of turns redistributes residual oil on cylinder walls, shaft and gear surfaces and repositions the pistons in the cylinders thus preventing corrosion accumulation.

CAUTION

For maximum safety, accomplish engine rotation as follows. Assure magneto switches are "OFF", throttle position "CLOSED", and mixture control "IDLE CUT-OFF". Do not stand within the arc of the propeller blades while turning the propeller.

- a. Fill fuel tanks full to minimize condensation in the fuel tanks. Keep battery fully charged to prevent the electrolyte from freezing in cold weather. If the aircraft is stored outside, tie-down should be accomplished in anticipation of high winds.
- b. Tie ropes or chains to the wing tie-down fittings located on the underside of each wing. Secure the opposite ends of the ropes or chains to ground anchors.
- c. Secure a rope (no chains or cables) to the upper trunnion of the nose gear and secure opposite end of rope to a ground anchor.
- d. Secure the middle of a rope to tail tie-down ring. Pull each end of rope away at 45-degree angle and secure to ground anchors at each side of tail.
- e. Install surface control locks on ailerons, rudder and elevators and aileron, if available.
- f. Install control lock on pilot control column if available; if control lock is not available, tie pilot control wheel back with front seat belt.
- g. After thirty (30) days, aircraft should be flown for thirty (30) minutes or ground run-up until oil has reached operating temperature.

TEMPORARY STORAGE

- a. Remove top and bottom spark plugs and atomize spray preservative oil (Lubrication Oil - Contact and

Volatile, Corrosion Inhibited, MIL-L-46002, Grade 1) (221°-250°) through upper spark plug hole of each cylinder with the piston in the down position. Rotate crankshaft as each pair of cylinders is sprayed. Stop crankshaft with no piston at top position. If the aircraft is to be stored outside, 2-bladed propeller position should be as nearly horizontal as possible to provide maximum clearance with passing aircraft.

NOTE

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

- b. Respray each cylinder without rotating crank. To thoroughly cover all surfaces of the cylinder interior, move the nozzle or the spray gun from the top to the bottom of the cylinder.
- c. Reinstall spark plugs.
- d. Apply preservative to engine interior by spraying the above specified oil (approximately 2 oz.) through the oil filler tube.
- e. Seal all engine openings exposed to the atmosphere using suitable plugs, or non-hygroscopic tape, and attach red streamers at each point.
- f. Install pitot tube cover, seal static source, install ground locks on retractable gear aircraft and attach red streamers at each location. Close all vents and plug cowl openings to prevent bird nests in the engine compartment.
- g. Engines, with propellers installed, that are preserved for storage in accordance with this section should have a tag affixed to the propeller in a conspicuous place with the following notation on the tag: "DO NOT TURN PROPELLER - ENGINE PRESERVED."
- h. Disconnect or remove the battery from the aircraft. If the battery is disconnected and left in the aircraft, regular servicing will be required to prevent freezing or discharge. Batteries which are removed from the aircraft and stored should be checked regularly for state of charge. Recent production aircraft have the battery serial recorded in the aircraft equipment list. To assure accurate warranty records, batteries should be reinstalled in the same aircraft from which they were removed.
- i. If the aircraft is stored outdoors, place control locks on all movable control surfaces and tie the aircraft down snugly, not tightly, with enough clearance so wind gusts will not shift aircraft into another. Leave no long chains dangling. Release the parking brake to prevent seizing and chock the wheels.

INDEFINITE STORAGE

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

NOTE

Corrosion preventive mixture consists of one part compound MIL-C-6529, Type I, (Esso

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

b. Remove the top spark plug from each cylinder and spray with corrosion preventive mixture (221° to 250° F). To thoroughly cover all surfaces of the cylinder interior, move the nozzle of the spray gun from the top to the bottom of the cylinder. If by accident the propeller is rotated following this spraying, respray the cylinders to insure an unbroken coverage of corrosion preventive mixture on all surfaces.

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

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

e. Seal the cold air inlet to the heater muff with moisture resistant tape to exclude moisture and foreign objects.

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

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

h. Engines, with propellers installed, that are preserved for storage in accordance with this section should have each propeller tagged in a conspicuous place with the following notation of the tag: "DO NOT TURN PROPELLER - ENGINE PRESERVED."

i. After the engine has been prepared for storage, remove the battery from the aircraft, store in a cool dry place and check regularly for state of charge. Note serial number on battery and reinstall in the same aircraft.

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

k. Cover the aircraft with moisture resistant paper and tape as necessary.

NOTE

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

1. Install pitot tube cover, seal static source, install ground locks on retractable gear aircraft and attach red streamers at each location. Close all vents and plug cowl openings to prevent bird nests in the engine compartment.

NOTE

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

m. Aircraft stored in accordance with the indefinite storage procedures should be inspected per the following instructions:

1. Aircraft prepared for indefinite storage shall have the cylinder protex plugs inspected weekly. The plugs should be changed as soon as their color indicates unsafe conditions of storage. If the dehydrator plugs have changed color in one half or more of the cylinders, all desiccant material on the engine should be replaced.

2. The cylinder bores of all engines prepared for indefinite storage should be resprayed with corrosion preventive mixture every 6 months. Before spraying, the engines shall be inspected for corrosion as follows: Inspect the interior of at least one cylinder on each engine through the spark plug hole. Remove at least one rocker box cover from each engine and inspect the valve mechanism.

Restoring Aircraft to Service.

If the proper procedures were followed for extended storage, the aircraft should require the following service:

a. Airframe:

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

b. Battery:

1. Charge and check battery.
2. Install battery.

c. Engines:

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

WARNING

Magneto switches must be in the off position when rotating propellers by hand.

4. Install recommended spark plugs which have been properly cleaned and gapped.
5. Remove, clean and reinstall the oil filter screens.
6. Install the oil sump drain plugs and fill oil sump with recommended oil.
7. Lubricate propellers and check for free operation.
8. Start engine and give aircraft complete ground runup check.
9. Perform flight test.

PAINTING.

Preparation of Surface.

Thoroughly clean all surfaces, beyond area to be painted with Turco 800 or Enmar 3094 thinner. Extreme care should be taken to remove all letters, grease, bugs, etc. Mask off stripe areas to be painted carefully; see that all tapes are firmly adhered to metal to prevent ragged edges. Class "A" wrapping paper and thinner proof masking tape should be used to cover the plexiglas area. This will prevent damage from solvent and thinner vapors. (News-paper will not provide adequate protection.) Extreme care should be taken to assure that no oil seepage occurs from seams, splices, or rivet heads.

CAUTION

- Metallic paper, metal, metal foil or metal of any kind should never be used as a paint spray mask on heated windshields.
- During aircraft painting operations, extreme care must be taken to insure that stripping fluids do not come in contact with fuel cells. Paint stripping fluids can inflict severe damage to cells which is not readily apparent or easily detected. For this reason, the cells should be disconnected from their upper skin covers and hangers and protected with a plastic sheet during stripping operations.

Paint Stripping.

- a. Paint stripping is required to reach paint covered corrosion, repaint an area with paint that is incompatible to paint currently on the part etc.
- b. Before applying paint stripper, windows, areas not being painted, openings, rubber and other non-metallic parts must be masked off. If paint stripper should accidentally get on material, such as plexiglas, flush parts with water immediately.

CAUTION

During paint stripping operations, extreme

care must be taken to insure that stripping fluids do not come in contact with fuel cells. Paint stripping fluids can inflict severe damage to cells which is not readily apparent or easily detected. For this reason, the cells should be disconnected from their upper skin covers and hangers and protected with a plastic sheet during stripping operations.

c. During paint stripping, the following safety precautions should be observed.

1. Have fire extinguisher available.
2. Provide adequate ventilation in working area.
3. Wear goggles, rubber gloves, apron, face shield and head coverings.
- d. Apply paint stripper as follows:
 1. Starting at the top and working down, brush or spray paint stripper on painted surface. Follow paint stripper manufacturer's recommendations regarding use of the stripper.
 2. Rinse area thoroughly and allow to dry.

Corrosion Treatment.

- a. If corrosion occurs, complete removal of corrosion deposits is required to prevent recurrence. Partial removal and covering with paint will not halt continued attack because a small amount of moisture penetrates the surface of all paint and allows corrosion to continue.
- b. If an area of corrosion exists, the area shall be cleaned and the paint stripped. If the area is confined and the use of paint stripper is impractical because of rinsing difficulties paint may be removed with solvent material Federal Specification TT-E-751 or TT-T-266. Apply solvent with a soft bristle brush, allow solvent to remain until paint film is loosened, then wipe clean with a clean damp cloth.
- c. Heavy aluminum parts are susceptible to intergranular corrosion attack. Mechanical corrosion removal may be used in pitted areas or in conjunction with chemical corrosion removal in lightly corroded areas. Use #400 aluminum grit abrasive paper or abrasive mat for mechanical corrosion removal.
- d. Chemical corrosion removal must be used on clad aluminum parts; such as skin. It is also suitable for other areas of light corrosion removal. The surrounding parts and materials shall be protected from damage of the corrosion remover by proper masking or other appropriate methods. Specific CAUTION should be exercised in areas where the corrosion remover could become entrapped or attack an uncorroded area.
- e. For light corrosion and discoloration proceed as follows:
 1. Apply Delchem 810 with brush or cloth.
 2. Agitate with short fiber brush or abrasive mat until all corrosion is removed. Do not leave conditioner in contact with the surface longer than 20 minutes.
 3. Rinse off the corrosion remover with a damp cloth. Rinse the cloth frequently in water.
 4. Repeat cycle as required.
 5. After all corrosion is removed, thoroughly rinse treated area with clean water.

Recommended Materials and Equipment.

NAME	NUMBER	MANUFACTURER	USE
<u>GENERAL CLEANING INCLUDING EXHAUST DEPOSITS</u>			
Delchem Jet Wash	2271	Pennsalt Chemical Corp. 2700 South Eastern Ave. Los Angeles, Calif.	To wash exterior surface of the aircraft.
Aerowash		Wyandotte Chemicals Corp. 8921 Dick Road Los Nietos, Calif.	To wash exterior surface of the aircraft.
<u>PAINT REMOVER</u>			
Delchem E-Z Strip	19B	Pennsalt Chemical Corp. 2700 South Eastern Ave. Los Angeles, Calif.	To strip polyurethane paint.
Paint Remover	Turco 5556A	Turco Products Inc. Box 1055 Wilmington, Calif.	To strip polyurethane paint.
Paint Remover	Turco 5556AF	Turco Products Inc. Box 1055 Wilmington, Calif.	To strip polyurethane paint.
<u>CORROSION REMOVAL</u>			
Delchem	810	Pennsalt Chemical Corp. 2700 South Eastern Ave. Los Angeles, Calif.	To remove light corrosion or discoloration.
Pennsalt	715	Pennsalt Chemical Corp. 2700 South Eastern Ave. Los Angeles, Calif.	To remove moderate corrosion.
<u>DEICING EXTERIOR SURFACES</u>			
Deicing Fluid	WD-20	Jefferson Chemical Corp. Houston, Texas	To remove ice and frost from control surfaces.
<u>PRETREATMENT</u>			
Iridite	14-2	Allied Research Inc.	To prevent aluminum against corrosion.

6. Apply pretreatment (Iridite 14-2) to aluminum where corrosion was removed in accordance with manufacturer's instructions.
- f. For moderate corrosion proceed as follows:
 1. Dilute Pennsalt 715 with an equal volume of water in a plastic lined container.
 2. Apply diluted Pennsalt 715 with a brush or cloth wetting the entire corroded surface thoroughly.
 3. Allow the solution to stand as long as necessary to remove corrosion but no longer than 20 minutes.
 4. Scruff with a short fiber brush just before rinsing with water and damp cloth.
 5. Repeat cycle as necessary.
 6. After all corrosion is removed, rinse the treated area thoroughly with water and dry.
 7. Apply pretreatment (Iridite 14-2) to aluminum where corrosion was removed in accordance with manufacturer's instructions.

Wash Primer (Type I-E) - Mixture and Application.

NOTE

Mix primer only in quantities required for use within six hours and then only in stainless steel bucket provided.

- a. Mix primer EX2016G (Enmar) or 818-012 (Dupont) with diluent T670 (Enmar or Dupont) in a 1 to 1 volume ratio and stir thoroughly.
- b. Apply primer in a well-broken up, wet, even coat. If primer has to be sanded, sand and reprime. Sanding breaks film, resulting in poor adhesion.

NOTE

On all leading edge surfaces, apply cross coat wet and even.

- c. Allow wash primer to air dry a minimum of 30 minutes or a maximum of 4 hours before applying overcoat.
- d. Clean equipment immediately after use and under no consideration use primer that has been mixed longer than six hours.

Polycarbonate Primer (Type I-L) - Mixture and Application.

- a. Surfaces to receive primer shall be solvent washed with isopropyl alcohol.
- b. Primer shall be Lacco 600 SL 9953, White (Red Spot Paint and Varnish Company) or RV 3649, White (Duralac Chemical Corporation). This primer shall be reduced to spray viscosity by thinning with Red Spot SL 8381 or Duralac T901 respectively. Use approximately one volume of thinner for one volume of primer.
- c. The first coat of reduced primer shall be dry sprayed.
- d. The sprayed coating shall be allowed to dry a minimum of one hour prior to overcoating.

Epoxy Primer (Type I-M).

- a. Mix thoroughly by volume one part epoxy primer to one part catalyst. Thin this mixture with T-6487 Thinner to a spray viscosity of 17-19 seconds in a number 2 Zahn cup.
- b. Allow mixture to set for one hour before using.

NOTE

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

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

Epoxy Primer.

Fiberglass parts that have been stripped of their primer should be primed with P-900 Sky Spar Surfacer, consisting of the following:

P-900 Sky Spar Surfacer	Base Component
C-918 Catalyst Concentrate	Component I
C-916 Catalyst Thinner	Component II
T-262 Thinner	Component III

- a. Surfaces to receive Epoxy primer should be sanded lightly so the outer laminated layer is not exposed.
- b. Remove residue by wiping with a cloth dampened with Isopropyl Alcohol.

NOTE

Do not use wood filler, lacquer, putty or aerodynamic smoothers, such as White Streak or Bondtite on fiberglass.

- c. Allow all materials when first mixed with a catalyst, to stand in a closed container for approximately one hour before use.

NOTE

Mixed material has a usable pot life of 8 hours. When the material becomes thick and start to gel, it must be discarded.

Materials, Description and Mixing Instructions.

P-900 Surfaces is an epoxy resin and constitutes the base component of the system. By mixing with the C-918 Catalyst Concentrate and/or the C-916 Catalyst Thinner in varying proportions and thinning with T-262 Thinner, any desired consistency can be obtained, from heavy putty to a spraying viscosity.

- a. Mix 12 parts of the base component with one part of Component I (Catalyst Concentrate). Mix thoroughly then cover the container and allow to stand 1 hour.
- b. The mixture should be a thick, smooth putty and may be applied with a spatula or heavy bristled brush.
- c. The material may be overcoated immediately with P-900 either by brushing or spraying. The material will be dry for sanding when it does not gum up in the sandpaper and sands off in a dry powder. This will occur after air drying for a period of not less than 2 hours or is forced dried at 170° F for 30 minutes.
- d. If the material is to be brushed on, take a portion of the putty material that has been allowed to set for one hour and thin it to a suitable brushing viscosity with Component II (Catalyst Thinner). This material is ready to brush on after thinning.
- e. The mixture should be brushed on the part, working material well into surface and filling all holes.
- f. Allow part to air dry for a period of not less than two hours or force dry at 170° F for 20 minutes before sanding.

Preparation of 82B Series Vinyl Enamel Colors.

Thoroughly mix and stir in original container and make sure all pigments are in solution. Thin required amount of vinyl color with T1866B vinyl thinner in a 1:1 ratio. Mix thoroughly and strain into either a cup or pressure pot.

Application of 82B Series Vinyl Colors.

NOTE

If vinyl is to be applied from pressure pot, do so under the following conditions: pressure of 10 pounds on the pot. Regulate gun pressure at gun with test gauge to 25 pounds, using gun with FX needle and fluid tip, with fan set wide open and yield two turns open. If cups are used, set gun at 30 pounds with EX needle and fluid tip, fan set one turn open and yield wide open.

- a. Apply first coat even and wet; second and third coats in the same manner.
- b. Check carefully before second and third coats for defects and correct before final coats.
- c. On second and third colors, mask off and lightly sand with 400 grit sandpaper the painted surfaces of previous color that is in area to be painted.

NOTE

On all leading edges apply a fourth coat. After finishing each color coat, burn down with T1411 burn down thinner. Remove all masking from painted surfaces after each color application. If you have a Heat Room, turn up the heat and dry paint at temperatures of 125° to 145° F, for at least three hours. Heat will give a very good reflow on vinyl paint.

Epoxy Enamel.

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

Epoxy Enamel Application.

- a. Mix epoxy enamel by adding 1 part by volume of thinner (Enmar 5400) to 1 part by volume of enamel. No additional thinning is necessary.
- b. Allow mixture to set for 1 hour before using.

NOTE

Work life of epoxy enamel is 8 hours.

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

VHT Paint (Very High Temp)

The cowl flaps (421-0001 to 421B0001), are painted with VHT paint. The following instructions apply to the areas where VHT paint is applied.

Priming is not necessary. Area to be refinished must be dry; clean and free of dirt and oil and sanded using a 220 grit or finer abrasive paper.

VHT paint should be thinned for spraying by adding an equal volume of Volveene.

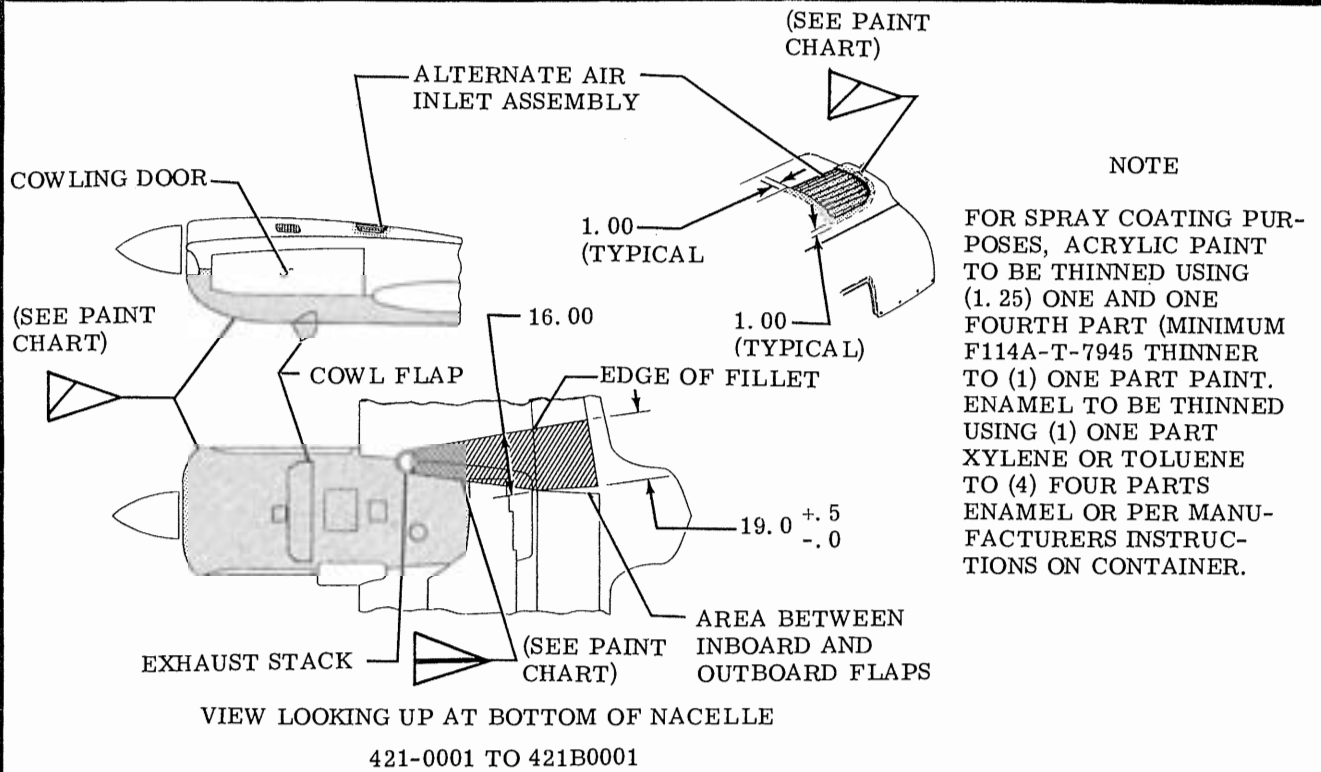
Thinned material should be sprayed on surface to be painted to yield a cured film thickness of .001 inch.

VHT paint shall be allowed to air dry for 30 minutes followed by a 15 minute force dry at 250° F.

Acrylic Lacquer and Heat Resistant Paint. (421B0001 and ON.) (See figure 2-6.)

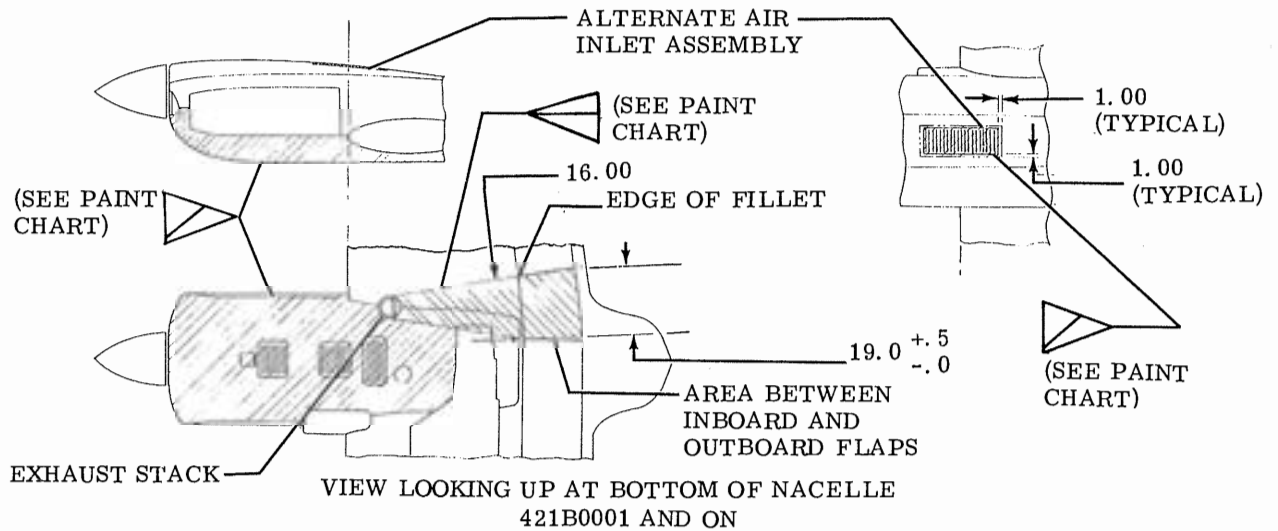
The lower nose cowl, lower nacelle skin and the alternate air inlet are painted with acrylic lacquer. The area aft of the exhaust outlet on the underside of the wing has been painted with heat resistant enamel.

1. When it is necessary to repaint the areas painted with acrylic lacquer or heat resistant enamel the area should be masked off and the area stripped using Delchem E-Z Strip 19B or equivalent, then rinsed clean with a water spray.



NOTE

FOR SPRAY COATING PURPOSES, ACRYLIC PAINT TO BE THINNED USING (1.25) ONE AND ONE FOURTH PART (MINIMUM F114A-T-7945 THINNER TO (1) ONE PART PAINT. ENAMEL TO BE THINNED USING (1) ONE PART XYLENE OR TOLUENE TO (4) FOUR PARTS ENAMEL OR PER MANUFACTURERS INSTRUCTIONS ON CONTAINER.



HEAT RESISTANT - PAINT CHART

LOCATION	CESSNA PART NO.	VENDOR PART NO.	TYPE	COLOR
	CES 2800-2131	PX114A-51070A	ACRYLIC	VESTAL WHITE
	CES1059-918	PX114A-43026	ACRYLIC	SUN YELLOW
	CES 1054-917	PX114A-43029	ACRYLIC	POLARIS BLUE
	CES1054-142	ENMAR 22-11980	ENAMEL	GRAY

Figure 2-6. Acrylic Lacquer and Heat Resistant Paint Chart

2. Scuff sand and tack rag area to be sprayed.
3. Spray coat Red Iron Oxide Primer (Type 1-8) to insure a cure film thickness of 0.002 to 0.005 inches to the area receiving heat resistant enamel.

NOTE

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

4. Spray coat areas receiving acrylic lacquer with wash primer EX2016G Enmar, or 818-012 Dupont wash primer to insure a cured film thickness of .0002 to .0003 inch.

NOTE

Wash primer should be thinned with a one to one ratio with T670 Enmar or Dupont equivalent. The mixed primer must be used within a six hour period after thinning or discarded.

5. Allow primed surface to air dry approximately one hour.
6. Sand primed surface irregularities and reprime.
7. On surfaces to receive acrylic lacquer cross spray coat lacquer to insure a film thickness of .0002 to .0004 inch.

NOTE

Acrylic lacquer should be thinned using (1.25) one and one-fourth part F114A-T-7945 thinner to one part acrylic paint. The acrylic lacquer should be allowed to air dry for a minimum of 24 hours prior to handling.

8. On surfaces to receive heat resistant enamel, spray coat enamel to insure a film thickness of .001 to .0015 inch.

NOTE

Heat resistant enamel should be thinned in a one to one ratio with 1 part Xylene or Toluene to four parts enamel and allowed to air dry for a period of 24 hours.

Touch Up Vinyl.

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

NOTE

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

- a. When touching up vinyl, use EX2016G primer mixed one part primer to one part EX2016A activator. Stir and allow 30 minutes before spraying.

- b. When priming with EX2016G, use a light coat of MIL-P-8585 zinc chromate primer thinned four parts toluol to one part primer applied over the EX2016G.
- c. Fill the feathered areas by spraying on several light coats of Acme 538 dark grey surfaces and allowing 5 to 8 minutes drying time for each coat.
- d. Sand the entire area with #400 sandpaper and apply the top coat.

NOTE

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

Polyurethane Finish (optional).

- a. The surfaces to receive polyurethane paint shall be sanded smooth and solvent cleaned with isopropyl alcohol.
- b. Mix wash primer C-22 Y7277 (U. S. Paint, Lacquer and Chemical Company) in a 1:1 ratio by volume with 66C-7225 so that the viscosity is 17 seconds in a #2 Zahn cup. No induction time is necessary and the pot life is 8 hours.
- c. Apply a light spray coat with a dry film thickness of 0.005 to 0.007 inches and allow to air dry for a period of 30 minutes.
- d. Mix an intermediate primer by mixing two parts AA-92 to one part Y-43 Urethane Zinc Chromate Primer, and then combine these parts of this mixture with two parts 7-888 thinner. This mixture will have a viscosity of 17 seconds in a #2 Zahn cup, and also an induction time of one hour and a pot life of 8 hours.
- e. Apply a spray coat of the intermediate primer over the washed primer surface. Spray the AA-92, Y-43 film to a dry thickness of .0007 to 0.001 and allow to dry one hour at 80°F before overcoating.
- f. Mix AA-92 Urethane Enamel in a 1:1 ratio.

NOTE

For a minimum of orange peel, the material should be thinned to a viscosity of 18 seconds in a #2 Zahn cup. Induction time is 30 minutes and pot life is 8 hours. Induction time is the time required for mixture to set after mixing and before application. At life is the work life after mixing.

- g. Apply urethane enamel to primed surface in two passes such that the dry film thickness is 0.0013 to 0.0017 inches.
- h. Force dry at 140°F for a period of 4 hours before masking for additional painting.

NOTE

Applying a heavy film will cause solvent popping and should be avoided. If anti-cratering solution is used, #92C24 should be added at the rate of not more than 2 ounces per catalyzed gallon.

- i. Apply W102 white for the topcoat if white is specified.

Touch Up of Polyurethane Finish.

- a. Urethane touch up and design should be accomplished within 24 hours after the application of the topcoat. The topcoat must be wiped down with MEK before touch up or painting stripes.
- b. If the touch up or striping is accomplished after the 24 hour limitation the area should be scuff sanded.
- c. Apply touch up in accordance with Polyurethane Finish, steps f thru h.

Metallic Gold Urethane Coating.

A metallic gold urethane coating is applied to painted surface of the vertical stabilizer. Should it become necessary to repaint this area, the following procedure will apply.

NOTE

Touch-up of Polyurethane paint is not recommended. The entire area must be stripped and a new application of Polyurethane applied.

- a. The area to be painted shall be thoroughly cleaned and washed before priming.
- b. Apply a wash primer (EX2016G Enmar, or 818-012 Dupont) mixed with diluent (T670 Enmar or Dupont, respectively) in a 1 to 1 volume ratio.

NOTE

The mixed wash primer must be used within a six-hour period or be discarded.

- c. Apply wash primer by spray coating to insure a film thickness of .0002 to .0003 inch.
- d. Allow primer to air dry for 30 minutes before overcoating.
- e. Wash primer surface irregularities should be sanded and tack-ragged. New primer should be applied to sanded areas to prevent a break in primer film.
- f. Wash primer may be overcoated after air drying a minimum of 30 minutes or a maximum of 4 hours.
- g. Mix a small amount of MEK with the metallic powder until a paste is formed. Continue adding thinner, a little at a time, until gold powder is evenly dispersed with no lumps and volume of MEK added reaches one pint.
- h. Mix the clear urethane C-21C in a 1 to 1 ratio with C-22B catalyst.
- i. Slowly add the thinner-powder mixture. The viscosity will be 15-17 seconds in a #2 Zahn cup. This mixture should be sprayed immediately.
- j. Spray one overlap spray coat and then let flash off. Add one light dry coat to insure uniformity of color.
- k. Allow to air dry for one hour.

CAUTION

Metallic gold is not a finish coat in itself, and must be overcoated. Care should be taken that the surface shall not be touched or wiped, this will cause a discoloration. Overcoat must be applied as soon as possible.

Clear Urethane Top Coat.

- a. Mix the clear urethane C-21C in a 1 to 1 ratio with catalyst C-22B. Mixture may be sprayed at this viscosity or thinned with MEK to a viscosity of no less than 18-20 seconds in a #2 Zahn cup.
- b. Apply the clear coating in three uniform 50% overlap spray coats to an approximate thickness of 2-1/2 to 3 mils dry film thickness.
- c. Allow to air dry 4 to 6 hours or force dry at approximately 135°F for 1 hour.

NOTE

If system is to be recoated, lettered or stenciled in anyway, this will have to be applied within a 36 hour period. Longer times will necessitate a light sanding (remove gloss) before recoating or lettering.

NOTE

All equipment should be cleaned immediately after use. T-732A, Methyl Ethyl Ketone, or Cellosolve Acetate should be used for cleaning equipment.

Touch Up Landing Gear Finish.

- a. The area of the landing gear to receive touch up paint should be masked off, sanded, cleaned and primed in accordance with Priming Procedures using Red Oxide Primer P/N BM 111-35.
- b. Apply enamel touch up paint Gull Gray P/N 52-9375 in accordance with Touch Up Vinyl Enamel Procedures and allow to air dry. On aircraft 421B0501 and On, apply Epoxy White P/N 54E-511 in accordance with Epoxy Finish.

RAIN EROSION COATING APPLICATION.

- a. Refer to Section 16 for preparation and application of rain erosion coating.

I INSPECTION REQUIREMENTS

As required by Federal Aviation Regulations, all civil aircraft of U.S. registry must undergo a complete inspection (ANNUAL) each twelve calendar months. In addition to the required ANNUAL inspection, aircraft operated commercially (for hire) must also have a complete inspection every 100 hours of operation.

In lieu of the above requirements, an aircraft may be inspected in accordance with progressive inspection schedule, which allows the work load to be divided into smaller operations that can be accomplished in shorter time periods.

CESSNA PROGRESSIVE CARE PROGRAM has been developed to provide a modern progressive inspection schedule that satisfies the COMPLETE AIRCRAFT INSPECTION (refer to paragraph II, c., for definition) requirements of both the 100 HOUR and ANNUAL inspection as applicable to Cessna Aircraft.

II INSPECTION CHARTS

The following Inspection Charts show the recommended intervals at which items are to be inspected.

As shown in the charts, there are items to be checked each 50 hours, each 100 hours, each 200 hours, and also Special Inspection Items which require servicing or inspection at intervals other than 50, 100 or 200 hours.

- a. When conducting an inspection at 50 hours, all items marked under EACH 50 HOURS would be inspected, serviced or otherwise accomplished as necessary to insure continuous airworthiness.
- b. At each 100 hours, the 50 hour items would be accomplished in addition to the items marked under EACH 100 HOURS as necessary to insure continuous airworthiness.
- c. At each 200 hours, the 50 hour items and 100 hour items would be accomplished in addition to the items marked under EACH 200 HOURS as necessary to insure continuous airworthiness.
- d. The numbers appearing in the SPECIAL INSPECTION ITEMS column refer to data listed at the end of the inspection charts. These items should be checked at each inspection interval to insure that applicable servicing and inspection requirements are accomplished at the specified intervals.
- e. A COMPLETE AIRCRAFT INSPECTION includes all 50, 100 and 200 hour items plus those Special Inspection Items which are due at the time of the inspection.

III INSPECTION PROGRAM SELECTION

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

1. IF THE AIRCRAFT IS FLOWN LESS THAN 200 HOURS ANNUALLY
 - a. IF FLOWN FOR HIRE

An aircraft operation in this category must have a COMPLETE AIRCRAFT INSPECTION each 100 hours of operation and each 12 calendar months of operation (ANNUAL). A COMPLETE AIRCRAFT INSPECTION consists of all 50, 100, 200 and Special Inspection Items shown in the inspection charts as defined in paragraph II above.
 - b. IF NOT FLOWN FOR HIRE

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

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

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

IV INSPECTION GUIDE LINES

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

NOTE

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

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

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

To be displayed in the aircraft at all times:

- 1. Aircraft Airworthiness Certificate (FAA Form 8100-2).
- 2. Aircraft Registration Certificate (FAA Form 8050-3).
- 3. Aircraft Radio Station License, if transmitter is installed (FCC Form 556).

To be carried in the aircraft at all times:

- 1. Weight and Balance, and associated papers (Latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
- 2. Aircraft Equipment List.

To be made available upon request:

- 1. Aircraft Log Book and Engine Log Book.

- h. ENGINE RUN-UP.

Before beginning the step-by-step inspection, start, run-up and shut down the engine in accordance with instructions in the Owner's Manual. During the run-up; observe the following, making note of any discrepancies or abnormalities:

- 1. Engine temperatures and pressures.
- 2. Static rpm.
- 3. Magneto drop (refer to Owner's Manual).
- 4. Engine response to changes in power.
- 5. Any unusual engine noises.
- 6. Fuel selector and/or shutoff valve; operate engine(s) on each tank (or cell) position and OFF position long enough to ensure shutoff and/or selector valve functions properly.
- 7. Idling speed and mixture; proper idle cut-off.
- 8. Alternator and ammeter.
- 9. Suction gage.
- 10. Fuel flow indicator.

After the inspection has been completed, an engine run-up should again be performed to determine that any discrepancies or abnormalities have been corrected.

INSPECTION FREQUENCY

1 - As required or 500 hours	7 - Every 500 hours
2 - See Table I	8 - Next 10 hours of operation
3 - Check torque first 100 hours then every 100 hours thereafter check for security looseness and working. DO NOT TORQUE	9 - Daily
4 - Every 1200 hours	10 - Every 3 years
5 - First 100 hours and 200 hours thereafter	11 - Every 5 years
6 - Every 50 hours or sooner when dust conditions exist	12 - Every 2 years
	13 - Every 50 hours and at tire replacement
	14 - After rough engine operation
	15 - 400 Hours

IMPORTANT

Read all Inspection Requirements and Paragraphs prior to using this chart.

NOTE

This Inspection Chart should be used in conjunction with the Cleaning Inspection, Repair and Servicing paragraph immediately following the Overhaul and Replacement Chart.

AIRFRAME

	50	100	200	Spl Insp
1. Fuselage			★	1
2. Cabin Pressurization - Check				2
3. Pressure Cabin (Type A Inspection)				2
4. Pressure Cabin (Type B Inspection)				2
5. Pressure Cabin (Type C Inspection)				2
6. Windshield and Windows - Check for condition		★		
7. Cabin Door - Check for condition and operation		★		
8. Cabin Door Seal - Check for cuts, abrasions and excessive wear		★		
9. Door Latch Pin (Upper and Lower) - Check for damage, cracks, wear and rigging		★		
10. Door Latch Pin Guides - Check for damage, cracks and wear		★		
11. Door Latch Pin Receptacles - Check for damage, cracks and wear		★		
12. Baggage Doors - Check for condition and operation		★		
13. Nose Ram Air - Check clamps and hoses to heating and ventilating system for condition and security			★	
14. Heater - Check		★		
15. Seats and Seat Belts - Check condition, security and operation			★	
16. Upholstery and Carpet - Clean			★	
17. Instruments - Check condition and marking		★		
18. Control Quadrant - Check for condition and security			★	
19. Placards and Decals - Check for presence and legibility			★	
20. Empennage			★	
21. Vertical and Horizontal Stabilizers - Check bolts for security			★	
22. Wing - Check for loose rivets, cracks, loose mounting bolts and security - Check for loose rivets, refer to ME73-22	★		★	
23. Wing Wheel Well - Check for damage and sealing		★		
24. Wing Spar Fittings - Check bolts for torque and security				3
25. Wing Locker Doors - Check condition and security			★	
26. Tip Tank Fittings - Check bolts for security			★	
27. Wing and Stub Wing (Type A Inspection)		★		
28. Wing and Stub Wing (Type B Inspection)				4
29. Nacelle Firewall Structure - Check condition and security			★	
30. Emergency Exit Door - Check for condition and security		★		

Figure 2-7. Inspection Chart (Sheet 1 of 6)

	50	100	200	Spl Insp
LANDING GEAR				
1. Main Landing Gear Actuator - Check for condition, security and specification compliance	★			
2. Emergency Extension System - Check for condition, operation and specification compliance			★	
3. Main and Nose Landing Gear Assemblies - Check for condition	★			
4. Rigging - Perform Landing Gear Rigging Inspection in accordance with Figure 2-32			★	
5. Torque Links - Check wear and condition			★	
6. Nose and Main Gear Retracting Linkage - Check for condition			★	
7. Drive Tube Seals - Check for security, position and wear			★	
8. Shock Strut Servicing - Check for proper servicing			★	
9. Nose Gear Shimmy Dampener - Check fluid and condition	★			
10. Nose Wheel Steering System - Check cable tension, travel and gimbal for condition and mounting bolts for proper torque			★	
11. Nose and Main Wheels and Tires - Check wear, condition and tire pressure				13
12. Wheel Bearings - Check and repack				5
13. Brake System Plumbing - Check for leaks, hoses for bulges and deterioration, parking brake for operation			★	
14. Brake Assemblies - Check wear of lining and disc warpage			★	
15. Master Cylinders - Check fluid level		★		
FLIGHT CONTROLS				
1. Control Column - Check for security, looseness, wear and proper rig			★	
2. Aileron - Check hinge, bellcrank, stop bolt for looseness and/or jamb nut for being tight, linkage and bolt for condition, operation and security, and travel			★	
3. Aileron Trim Tab - Check hinge for cracks, wear; bolts for proper safety and tab travel			★	
4. Aileron Trim Tab Actuator - Check travel linkage for condition and security			★	
5. Aileron and Aileron Trim Cables - Check for tension, fraying and turnbuckles for safety - Check pulleys for condition and security			★	
6. Elevator - Check hinges and hinge bolts, bellcranks and push rod connecting bolt and stop bolts for security and condition			★	
7. Elevator Trim Tab - Check hinge for cracks, wear, bolt for proper safety and tab travel			★	
8. Elevator Trim Tab Actuator - Check travel, condition and security			★	
9. Elevator and Elevator Trim Tab Cables - Check tension, fraying and turnbuckles for safety - Check pulleys for condition and security			★	
10. Elevator Trim - Check for security, condition and travel			★	
11. Rudder - Check hinge, bellcrank, stop bolts and jamb nut for looseness, torque tube and connector links for security and safety; check travel			★	
12. Rudder Trim Tab - Check security and condition, linkage and travel			★	
13. Rudder Trim Tab Actuator - Check travel, mountings for security			★	
14. Rudder and Rudder Trim Tab Cables - Check tension, fraying and turnbuckles for safety - Check pulleys for condition and security			★	
15. Flaps - Check linkage, bellcranks, pulleys and cables for condition, tension and security - Check hinges for cracks			★	
16. Flap Motor and Position Indicator - Check for travel, condition and security			★	
17. Flap Actuator Assembly - Check for condition, security, and specification compliance			★	
18. Cable Seals - Check for tears and security			★	
19. Autopilot (Optional Equipment) - Check cables, attachments, pulleys and turnbuckles for tension, condition, operation and security			★	

Figure 2-7. Inspection Chart (Sheet 2)

				Spl Insp
				50
				100
				200
ENGINE GROUP				
CAUTION				
Ground magneto primary circuit before working on the engine.				
1.	Engine - Wash, check for security of accessories	★		
2.	Cowling - Wash, check for cracks, evidence of abrasion and wear		★	
3.	Induction Air Filter - Clean			6
4.	Induction Manifold - Check connections for condition	★		
5.	Engine Oil Pressure System - Check for leaks, bends, cracks and security	★		
6.	Engine Oil Filter - Change oil filter element and inspect adapters.	★		
7.	Engine Oil - Change	★		
8.	Engine Oil Separator - Inspect and clean element. Refer to Service Chart			6
9.	Engine Compartment - Visually check for condition, oil leaks, fuel leaks, etc.	★		
10.	Engine Controls - Check travel and security	★		
11.	Engine Wire Bundle - Check for condition and security	★		
12.	Engine Mounts - Check for condition and security	★		
13.	Engine Compartment Hoses - Fuel, (check fuel lines under pressure) Oil Vacuum, etc. - Check deterioration, leaks, discoloration, bleaching and rubber hoses for stiffness	★	★	
14.	Cylinder Compression - Refer to Manufacturer's Service Bulletin M73-19		★	
15.	Engine Cylinders, Rocker Box Covers and Pushrod Housings - Check for fin damage, cracks, oil leakage, security of attachment and general condition		★	
16.	Crankcase, Oil Sump and Accessory Section - Inspect for cracks and evidence of oil leakage. Check bolts and nuts for looseness and retorquing as necessary			★
17.	Plugs - Clean and rotate (top right to bottom left, top left to bottom right)		★	
18.	Ignition Cables - Check condition and security		★	
19.	Magneto - Check timing, breaker gap and security			14
20.	Alternator - Check brushes, leads, bearings and slip rings		★	7
21.	Starter - Check brushes, commutator and electrical connections		★	
22.	Propeller Governor - Check for oil leaks, condition and security			★
23.	Pumps - Fuel, Vacuum and Autopilot - Check for leaks, condition and security		★	
24.	Turbocharger - Check for condition, bulges, warps and security		★	
25.	Engine Exhaust System - Check for security, cracks, bellows and spring tension	★		
26.	Engine Exhaust System - Check for security, cracks, and spring tension - Visually inspect slip joint seals.	★		
27.	Waste Gate Valve, Variable Absolute Pressure Controller and Rate Controller - Check for condition and security. Visually check springs and linkage			★
28.	Manifold Pressure Relief Valve - Visually check for obstructions, condition, security and proper operation			★
29.	Engine Oil Screen - Check for removal. (Refer to expanded paragraph)	★		
30.	Engine Compartment Fire Extinguisher - Check system pressure, condition and security		★	

Figure 2-7. Inspection Chart (Sheet 3)

	50	100	200	Spl Insp
PROPELLER				
1. Blades - Check for nicks, cracks, scratches and blade angles		★		
2. Propeller Cylinder - Check bolts for security		★		
3. Bulkhead - Check for cracks and security on crankshaft			★	
4. Propeller - Check for oil leaks			★	14
5. Deice System Electrical Leads - Check for condition and security		★		
6. Deice System Brushes - Check for wear and seating (see Section 13)		★		
7. Propeller Spinners - Wash, check for cracks and fractures		★		
8. Propeller Mounting - Check nuts for security		★		14
9. Blades - Check for condition of epoxy and security of retention nut (see Section 2)		★		
10. Deice Slip Ring Mounting Bolts - Check for clearance between propeller hub and slip ring bolt heads (see Section 10)				8
11. Propeller Unfeathering Accumulator - Check for leaks, condition and proper charge		★		
12. Propeller Synchronizer - Check condition and security			★	
FUEL SYSTEM				
1. Metering Unit Filter Screen - Clean		★		
2. Fuel Injection System and Manifold - Inspect for leaking		★		
3. Fuel Discharge Nozzles - Inspect orifices and clean		★		
4. Fuel Selector Valve - Perform operational check, feel for detents through 270°; check linkage, bearings, pins for condition and security		★		
5. Selector Valve - Perform an operational check in accordance with Section 11				7
6. Sediment Bowl - Drain				9
7. Fuel Strainer - Clean		★		9
8. Fuel System Main - Inspect for leaks, and operation				
9. Fuel System Main - Inspect plumbing and component mountings for condition, security, system for leaks		★		
10. Tip Tanks - Inspect mounting bolts for security, tip tank for leaks, cracks, and dents, cracks at welds		★		
11. Boost Pumps (Auxiliary) - Inspect for leaks, operation, vent and overboard drain for obstruction			★	
12. Tip Tank Vents and Nose Cap Drain - Inspect for obstructions				9
13. Auxiliary Tanks - Inspect system for security and operation			★	
14. Heater Fuel Filter - Clean			★	
15. Main Tank Fuel Transfer Pump - Check security and mounting			★	
16. Main Tank Fuel Transfer Pump Filter - Clean			★	
17. Wing Locker Transfer Pump - Check for leaks and security of mounting			★	
18. Auxiliary In-Line Pump - Check for leaks and security			★	
19. Auxiliary In-Line Pump Filter - Inspect and clean element (see Section 11)			★	
OXYGEN SYSTEM				
1. Oxygen System - Check installation, mountings, and pressure			★	
2. Oxygen Regulator - Check pressure and rate of flow			★	
3. Oxygen Masks and Hoses - Check condition and clean			★	
4. Oxygen Cylinder - ICC-3HT/DOT-3HT - Inspect condition and Hydrostatic Test Date				10
5. Oxygen Cylinder - ICC-3AA/DOT-3AA - Inspect condition and Hydrostatic Test Date				11

Figure 2-7. Inspection Chart (Sheet 4)

	50	100	200	Spl Insp
VACUUM SYSTEM				
1. Filter - Clean			★	
2. Relief Valve - Check security and filter for obstruction			★	
3. Hoses - Inspect for hardness, deterioration, looseness and bulging			★	
SURFACE DEICE SYSTEM				
1. Deice System - Check for leaks, condition and operation of controls, lines and clamps for security			★	
2. Deice Boots - Check for abrasions, cuts, nicks and security of mounting			★	
3. Deice Filter - Clean			★	
PITOT STATIC SYSTEM				
1. Sump - Check for cracks, dents, leaks and presence of water			★	
2. System - Leak check			★	
3. Altimeter - Inspect as required by FAR Part 91, paragraph 91.170 in accordance with FAR Part 43, Appendix E, by authorized repair station				12
4. Alternate Static Drain - Check			★	
AIR CONDITION SYSTEM (BELT DRIVEN)				
1. Compressor Drive Belt Tension - Check		★		
2. Compressor Drive Belt - Check condition and security	★			
3. Compressor Lines - Check suction, injection and discharge lines for leaks, cracks, sharp bends and condition		★		
4. Condenser Fan - Check blade for nicks, looseness and security	★			
5. Evaporator Fans - Check blades for nicks, looseness and security		★		
6. Component Mounting - Check condition and security		★		
7. Condenser - Check inlet and outlets for obstruction, check coils for debris, etc.	★			
8. Sight Glass - Check proper charge with engine operating		★		
9. Condenser Fan Motor Brushes - Visually check		★		
AIR CONDITION SYSTEM (HYDRAULIC DRIVEN)				
1. Compressor Lines - Check suction, injection and discharge lines for leaks, cracks, sharp bends, and condition		★		
2. Compressor and Motor - Check condition and security		★		
3. Condensers - Check inlets and outlets for obstruction, check coils for debris, etc.	★			
4. Sight Glass - Check proper charge with engine operating and air conditioner on				
5. Hydraulic Lines - Check for leaks, security and condition		★		
6. Condenser Fan - Check blades for nicks, looseness and security		★		
7. Condenser Fan Motor Brushes - Visually check		★		
8. Evaporator Fan - Check blades for nicks, looseness and security		★		
9. Hydraulic Fluid and Filter - Change fluid and element (P/N 6655567) (refer to expanded paragraph)		★		

Figure 2-7. Inspection Chart (Sheet 5)

	50	100	200	Spl Insp
PRESSURIZATION SYSTEM				
1. Safety Valve - Check for security and operation			★	1
2. Outflow Valve - Check for security and operation			★	
3. Outflow Valve Filter - Clean			★	
4. Safety Valve Filter - Clean			★	
5. Variable Pressure Controller Filter (Optional System) - Check			★	
6. Heat Exchanger - Drain oil. Check for security and air passage obstruction			★	
7. Dump Valves - Check for security and proper operation			★	
8. Door Seals - Check for proper installation, cuts, wear and abrasion			★	
9. Perform Cabin Pressurization Check (refer to Section 13)				
ALCOHOL WINDSHIELD ANTI-ICE SYSTEM				
1. Check reservoir for proper service			★	
2. Check nozzles for security and obstructions			★	
3. Anti-ice System - Check for leaks, condition and operation of controls			★	
4. Pump - Check for leaks, condition and security			★	
ELECTRICAL SYSTEM				
1. Junction Box and Circuit Breaker Panel - Check wiring and terminals for condition and security		★		15
2. Pedestal and Instrument Panel - Check wiring and terminals for condition and security			★	
3. Regulators - Check wiring and terminals for condition and security			★	
4. Switches - Check for security and interference		★		
5. Landing Gear Relay and Limit Switch - Check wiring and terminals for condition and security			★	
6. Flap Limit Switch and Motor - Check wiring and terminals for condition and security			★	
7. Wing and Fuselage - Check wiring bundle for condition and security			★	
8. Battery - Check electrolyte and general condition and security	★			
9. Battery Cables - Check for corrosion, condition and security		★		
10. Battery Box - Check for corrosion, condition and security, clean vent tube	★	★		
11. Instrument and Interior Lights - Check lights for operation		★		
12. Radio and Navigation System - Check for condition and security			★	
13. Check bonding between stationary panel and instrument panel for proper ground - resistance must be 0.010 ohms or less			★	
14. Emergency Locator Transmitter - Check for condition, security, operation and battery pack for proper charge		★		
15. Warning Lamps - Check condition		★		
16. Starter Relay - Inspect Contact Area				
POST INSPECTION				
1. Correct all discrepancies, replace all fairings, doors and access hole covers				
2. Ground check engine, check ignition drop, alternator charging rate, oil pressure and general operation of components				
SERVICE LETTERS				
1. Check that all applicable Cessna Service Letters and Service Bulletins are complied with				
2. Check that all applicable current airworthiness regulations are complied with				

Figure 2-7. Inspection Chart (Sheet 6)

OVERHAUL AND REPLACEMENT CHART

A - Every 500 hours	H - Every 500 hours of heater operation
B - Every 1200 hours	J - Every 12 months
C - Every 1500 hours	K - Every 2500 hours
D - On Condition	L - Every 2400 hours
E - Every 15 years or 4380 cycles whichever occurs first	M - Every 5 years
F - Every 8000 hours	N - At first 5000 hours
G - Every 13,200 hours	P - Every 3 years or 3000 hours

		Overhaul	Replace
AIRFRAME			
1. Oxygen Bottle (ICC or DOT-3HT 1800) (see Section 13)			E
2. Oxygen Regulator	P		
3. Oxygen Pressure Gage			P
4. Oxygen Filler Valve	P		
5. Oxygen Outlets	P		
6. Heater (see Heater and Components Service/Parts Manual)	H		
7. Control Cable Seals			B
8. Safety Valve			K
9. Safety Valve Filter			A
10. Outflow Valve			C
11. Outflow Valve Filter			A
12. Variable Pressure Controller Filter (Optional System)			A
13. Pressurization Dump Valve (see Janitrol Instructions P/N43D57)	B		
14. Ram Air Valve	B		
15. Autopilot Filter P/N AMA201442 (see Cessna Nav-O-Matic 800 Service/Parts Manual)			A
16. Upper Cabin Door Latch Pins and Receptacles (421-0001 to 421B0001)			F
17. Windshield			G
LANDING GEAR			
1. Landing Gear Actuator (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	D		
2. Actuator Motor (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	D		
3. Actuator Reduction Unit	D		
4. Drive Tube Seals			B
5. Shimmy Dampener (see Section 4)	D		
6. Uplock Hooks (421-0001 to 421A0146)			N
FLIGHT CONTROLS			
1. Flap Actuator Gearbox (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	D		
2. Flap Actuator Motor (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	D		
3. Rudder Trim Tab Actuator (see Section 7)	B		
4. Aileron Trim Tab Actuator (see Section 5)	B		
5. Elevator Trim Tab Actuator (see Section 5)	B		
ENGINE GROUP			
1. Engine (see Continental Motors Engine Overhaul Manual)	B		
2. Magneto (see Bendix Magneto Overhaul Manual)	B		
3. Alternator - 50 AMP (see Cessna Alternator Service/Parts Manual)	B		
4. Alternator - 100 AMP (see Westinghouse Service Manual)	B		
5. Turbocharger (see Cessna Turbocharger and Controls Service/Parts Manual)	B		
6. Controllers (see Cessna Turbocharger and Controls Overhaul/Parts Manual)	B		
7. Manifold Pressure Relief Valve (see Cessna Turbocharger and Controls Overhaul/Parts Manual)	B		
8. Waste Gate (see Cessna Turbocharger and Controls Overhaul/Parts Manual)	B		
9. Vacuum Pump (wet) (see Authorized Repair Station)	B		
10. Vacuum Pump (dry) (see Authorized Repair Station)	B		

Figure 2-8. Overhaul and Replacement Chart (Sheet 1 of 2)

		Overhaul	Replace
11.	Vacuum System Hoses		B
12.	Fuel Pump (refer to Manufacturers Overhaul Manual)	B	
13.	Tach Generator (refer to Manufacturers Overhaul Manual)	B	
14.	Starter (Refer to Manufacturers Overhaul Manual)	B	
15.	Engine Compartment Hoses eg. fuel, oil, deice etc. (Rubber)		B
16.	Engine Compartment Fuel and Oil Hoses (Teflon)		L
17.	Induction Air Filter (P/N 9910018-1)		B
18.	Cowl Flap Actuator		B
19.	Engine Compartment Fire Extinguisher Container		M
20.	Engine Compartment Fire Extinguisher Cartridge		M
21.	Vacuum System Filter Element - Standard (P/N C294501-0103)		A
	- Optional (P/N C294501-0203)		A
22.	Engine Mounts		B
PROPELLER			
1.	Propeller (See McCauley Maintenance and Overhaul Manual)	B	
2.	Governor (See Manufacturer's Overhaul Manual)	B	
3.	Accumulator, Unfeathering (See Manufacturer's Overhaul Manual)	B	
4.	Propeller Shaft Oil Seal (See Continental Service Bulletin M70-3)		B

Figure 2-8. Overhaul and Replacement Chart (Sheet 2)

CLEANING, INSPECTION, REPAIR AND SERVICING.

The Cleaning, Inspection, Repair and Servicing Items listed in this section appear in the same sequence as

the Inspection Chart Figure 2-7. These procedures are more detailed and provide expansion of the Inspection items requiring additional attention.

AIRFRAME.

Fuselage.

- a. Cleaning.
 1. Clean the fuselage with mild soap and water. Use Stoddard Solvent to remove grease and tar then wash with soap and water and allow to dry.
 2. The fuselage may be cleaned with any good aircraft cleaner and wax.
- b. Inspection.
 1. Inspect exterior surface for damage and cracks loose rivets and nuts.
 2. Inspect attaching screws, access plates, exterior paint, nose gear door hinge points, for damage and excess wear.
 3. Inspect stiffeners, stringers, doublers, bulkheads and stinger for loose screws, rivets, cracks or damage.
 4. Inspect nose ram air hoses and clamps to heat and vent system for wear and security and leaks.
 5. Inspect heater installation for evidence of fuel leaks, exhaust leaks, combustion air leaks, loose wiring and security to structure.
 6. Inspect instruments for proper marking, broken glass, loose fittings and electrical wiring, and for proper calibration.
 7. Check all placards and decals for security and legibility.
 8. Inspect all fluid lines and hoses for leaks, cracks, dents, kinks, chafing, bleaching or discoloration, proper radius, security, corrosion, deterioration, obstructions and foreign matter.
- c. Repair and Servicing.
 1. If cracks are found in stinger, or fuselage area, refer to Section 16 and repair.
 2. Loose or working rivets must be replaced. Refer to Section 16.

Pressure Cabin.

- a. Cleaning.
 1. Refer to Owner's Manual Section 5 for cleaning pressure cabin windows and painted surfaces.
- b. Inspection.
 1. Any leak at windows or doors, noted during the flight check, should be corrected. If pressurization air dump valve malfunction was detected, the unit should be repaired or replaced (see Janitrol Instructions Part No. 43D57).
 2. Check cabin pressurization ducting fittings in the engine compartment for security, cracks, leaks, loose clamps and deterioration.
 3. Check ram air valve in the nose for operation and possible leakage or blockage due to foreign material.
 4. Check electrical operation of the safety valve by actuating the ram air dump control.
 5. Check main and nose gear actuating pushrod boots for loose clamps, cracks or deterioration.
 6. Check access doors to the cabin for possible seal leaks, check test fittings in forward pressure bulkhead in nose wheel well area.
 7. Check the sealing of any repairs or field electronics installation affecting the cabin pressurized area and the control cable seals for cracks, deterior-

ration, excessive wear and proper installation. Leaks in the cabin structure may be sealed in accordance with Sealing Instructions given in Section 16.

8. Check heater ducting, mounting and sealing forward of pressure bulkhead Station 100.00.

9. On completion of repairs to the cabin pressurization area, a flight or ground check should be performed in accordance with Section 13.

10. To assure a successful fail-safe structure for the pressure cabin, periodic inspections are required. Three types of inspection are outlined for the pressure cabin structure, Types A, B, and C. The aircraft hour intervals and type of inspection to be performed are listed in Table I.

11. Type "A" Inspection.

Type "A" inspection consists of a limited inspection of the cabin structure requiring a very minimum of equipment and upholstery removal for access. The shaded areas to each figure are the critical areas to be inspected. Use the following procedures:

NOTE

In case of any skin cracks or significant rivet damage, upholstery should be removed in the local damage area to inspect internal structure for damage.

TABLE I.

INSPECTION SCHEDULE FOR CABIN STRUCTURE

Type of Inspection	Hours at which Inspections are Required
A	Every 1200 hours.
B	First time at 6000 hours and repeat every 3600 hours thereafter.
C	First time at 13,200 hours and repeat every 3600 hours thereafter.

- (a) Inspect all external pressure cabin structure for cracks and damage.
 - (b) Inspect pressure cabin structure for loose or failed fasteners.
 - (c) Inspect pressure cabin skin and skin splices for cracks, loose rivets or failed fasteners.
 - (d) Inspect windshield, cockpit side windows and cabin windows for looseness, cracks, nicks, deep gouges and scratches.
 - (e) Inspect the cabin door and cabin doorframe for cracks, loose rivets or fasteners.
 - (f) See figure 2-9. Inspect forward cabin pressure bulkhead at Fuselage Station 100.00.
 - (g) See figures 2-22 and 2-23. Inspect aft cabin pressure bulkhead at Fuselage Station 273.94 (421-0001 to 421B0301) Fuselage Station 289.94 (421B0301 and On).
 - (h) See figure 2-10. Inspect stationary instrument panel for cracks at Fuselage Station 118.55, (421-0001 to 421B0301).
12. Type "B" Inspection.
- Type "B" is a visual inspection of the most critical areas of the cabin structure. To conduct this inspection, only partial upholstery and floorboards necessary for these areas must be removed. Inspect all

cabin structure for fatigue cracks and damaged areas for loose and failed rivets or structural fasteners. Shaded areas in each figure are the critical areas to be inspected. Use the following procedures:

(a) See figure 2-13. Inspect entire front spar bulkhead at Fuselage Station 154.5 both left-hand and right-hand, especially around the lightening holes.

(b) See figure 2-14. Inspect front spar carry-thru noting especially the critical points.

(c) See figure 2-15. Inspect entire rear spar bulkhead at Fuselage Station 186.15.

(d) See figure 2-16. Inspect rear spar carry-thru at Fuselage Station 186.15.

(e) See figures 2-22 and 2-23. Inspect aft pressure bulkhead at Fuselage Station 273.94 (421-0001 to 421B0301) Fuselage Station 289.74 (421B0301 and On).

13. Type "C" Inspection.

Type "C" is a complete visual inspection of the cabin structure. Should a crack be detected, the structure must be repaired using the standard structural repair as defined in Section 16 of the Service Manual, with the following exceptions, the windshield, cockpit side windows, cabin windows, door latch pin receptacles, door latch pin guides and lower cabin door pins. Any cracks found in any of these components must be replaced. To conduct this inspection, the floorboards and upholstery must be removed. Shaded areas in each figure are the critical areas to be inspected.

NOTE

On 421-0001 to 421B0001 the upper cabin door latch pins must be replaced at 8000 hours interval. On aircraft 421B0001 and On the latch pin system is fail-safe. The windshield must be replaced at 13,200 hours.

Use the following procedures:

(a) See figure 2-9. Inspect forward pressure bulkhead at especially noted areas at Fuselage Station 100.00.

(b) Inspect windshield, cockpit side windows and cabin windows especially in attaching areas for cracks, nicks, dents, deep gouges, loose rivets or structural fasteners.

CAUTION

When inspecting the critical (shaded) areas, it may be necessary to remove primer and dye check. Removal of sealing is not recommended unless repair is being made.

(c) See figure 2-10. Inspect instrument panel structural fastenings at Fuselage Station 118.55, (421-0001 to 421B0301).

(d) See figure 2-11. Inspect bulkhead structure mountings and skin fasteners at Fuselage Station 141.35, (421-0001 to 421B0301).

(e) See figure 2-12. Inspect bulkhead for structural mounting left-hand and right-hand at Fuselage Station 166.95.

(f) Open escape hatch and inspect frame, seal and operating mechanism.

(g) See figure 2-17. Inspect cabin doorframe at Fuselage Station 225.50.

(h) See figures 2-18 and 2-19. Inspect cabin doorframe supporting bulkheads at Fuselage Stations 211.00, 212.87, 235.50 and 238.13. Note critical areas.

(i) See figure 2-21. Inspect cabin doorframes, hinges, hinge pins, hinge support castings, and support castings attachments.

(j) See figure 2-21. Remove cabin door latch pin receptacles and guides from cabin door and cabin doorframe and inspect for wear, cracks, dents, bends and reinstall.

NOTE

If latch pin receptacles or cabin door latch pins are damaged or worn don't hesitate to reject and install new parts.

(k) See figure 2-20. Inspect entire bulkhead at Fuselage Station 255.00 especially at the left-hand and right-hand mountings as shown.

(l) See figure 2-10A. Inspect entire bulkhead at Fuselage Station 277.20 especially at the critical points.

(m) Inspect skins, skin attaching rivets and skin splices in pressure cabin area.

(n) Inspect all stringers behind upholstery and under the floorboards.

NOTE

It will be necessary to drill out rivets to remove overhead air plenum cover to inspect stringer splices at Fuselage Station 160.50. See Section 16 for sealing and riveting procedures when reinstalling air plenum cover.

Windshield and Windows.

a. Cleaning.

1. Remove dust and dirt from the panels by washing with a solution of mild soap and warm water.

2. Dissolve grease and oil deposits with either kerosene or Aliphatic Naphtha, Specification TT-N-95 (Type II only). Apply this solvent with either a soft, grit-free cloth, chamois, sponge or with bare hands. Bare hands are the most satisfactory applicators, as they are least likely to produce scratches.

CAUTION

Do not use any solvent except those specified in step 2, above, as many chemical solvents will soften or craze the surface of the plastic. Cleaning sprays and other cleaning solutions prepared for use on cellulose-nitrate and cellulose-acetate base plastics often contain ingredients harmful to acrylic plastic, which is the material used in this aircraft. Even a light coat of salt spray or dust should not be wiped off when dry, as small hairline

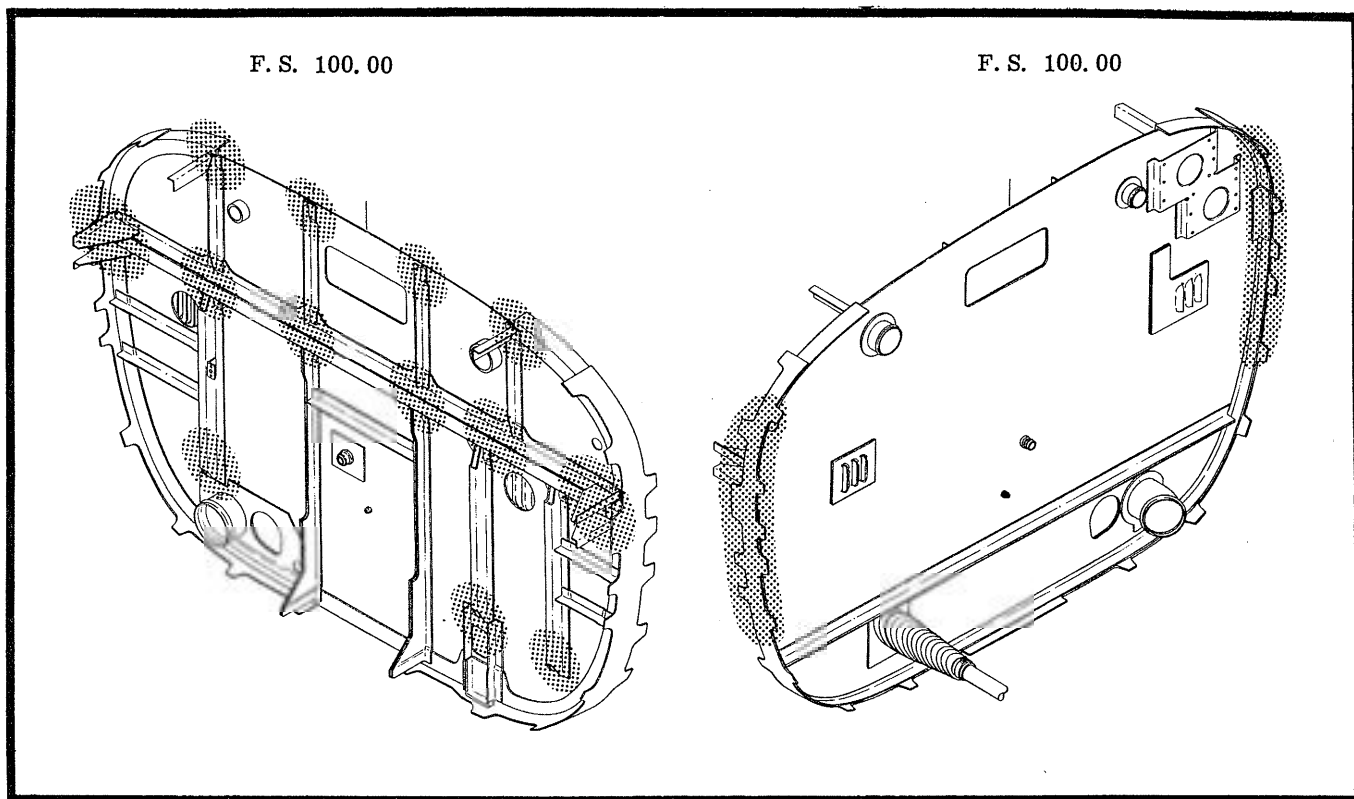


Figure 2-9. Forward Pressure Bulkhead

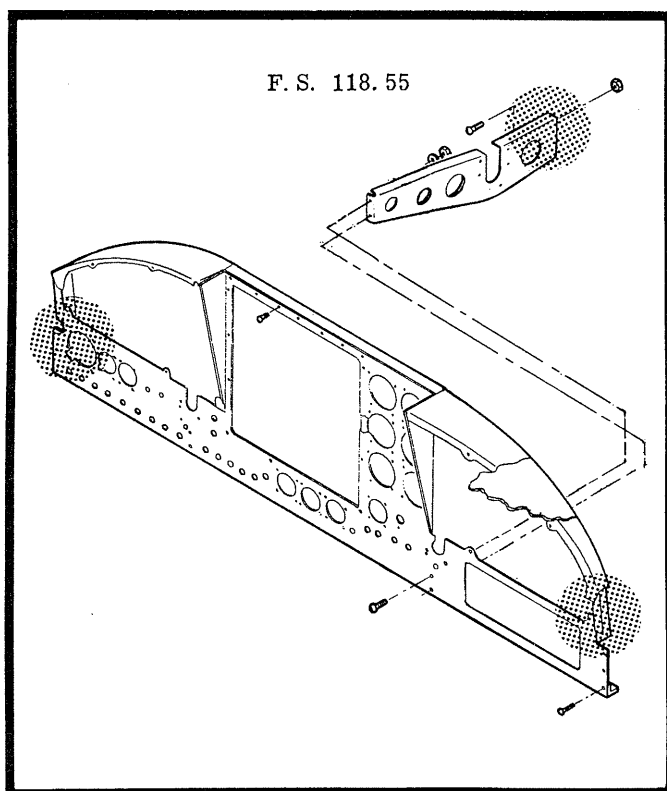


Figure 2-10. Stationary Instrument Panel

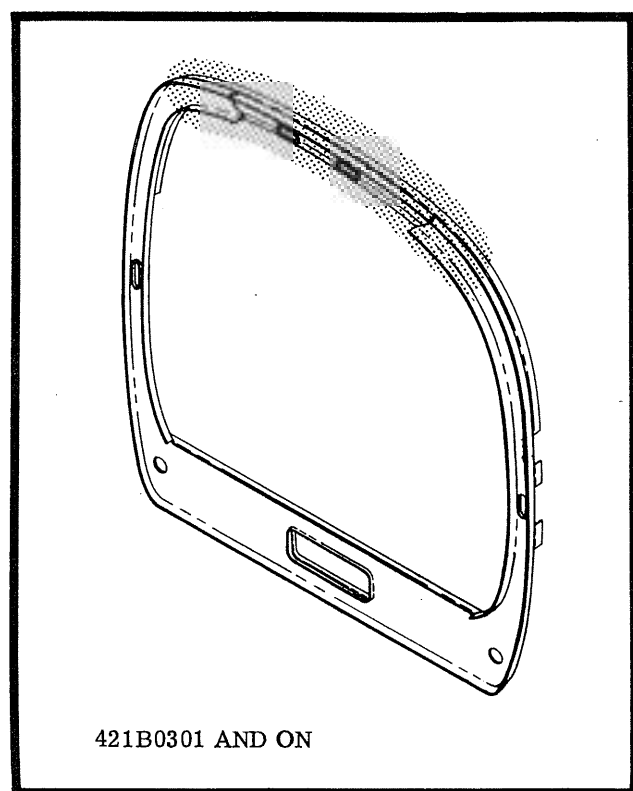


Figure 2-10A. F.S. 277.20 Bulkhead

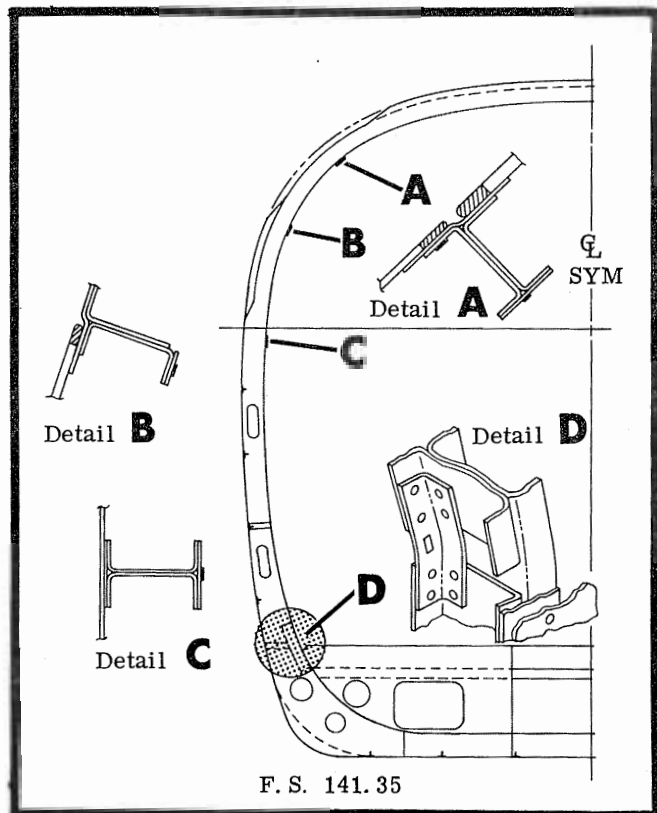


Figure 2-11. Canted Windshield Bulkhead

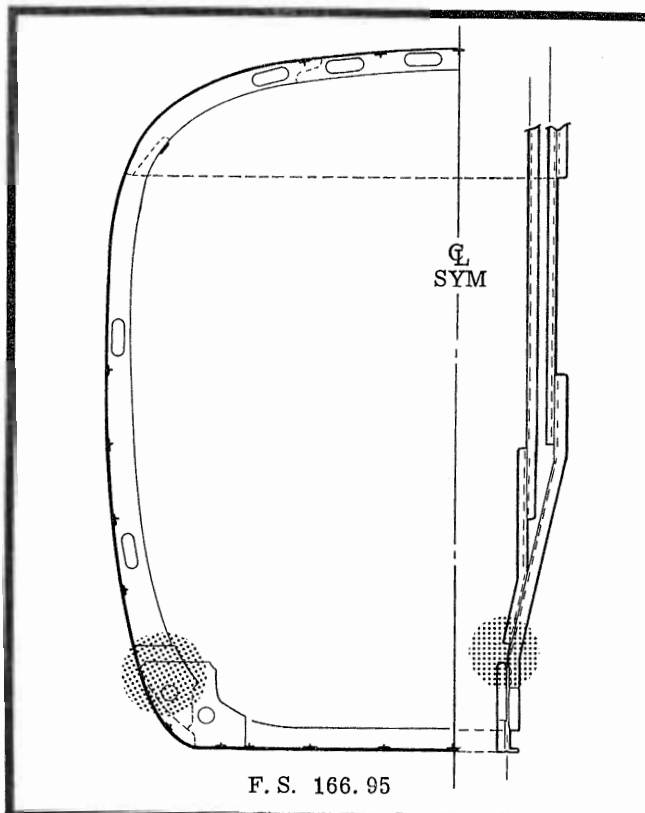


Figure 2-12. Left-Hand Bulkhead

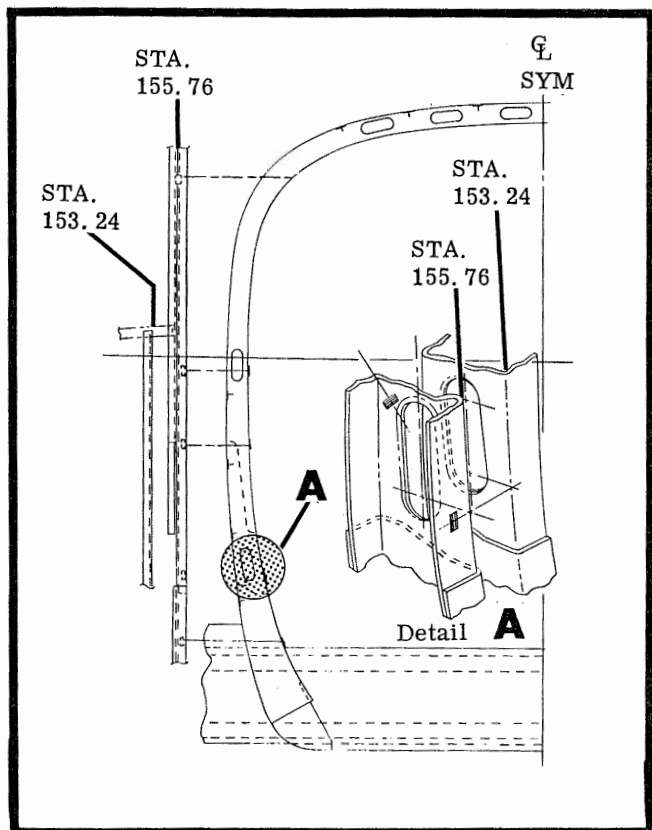


Figure 2-13. Front Spar Bulkhead (Left-Hand)

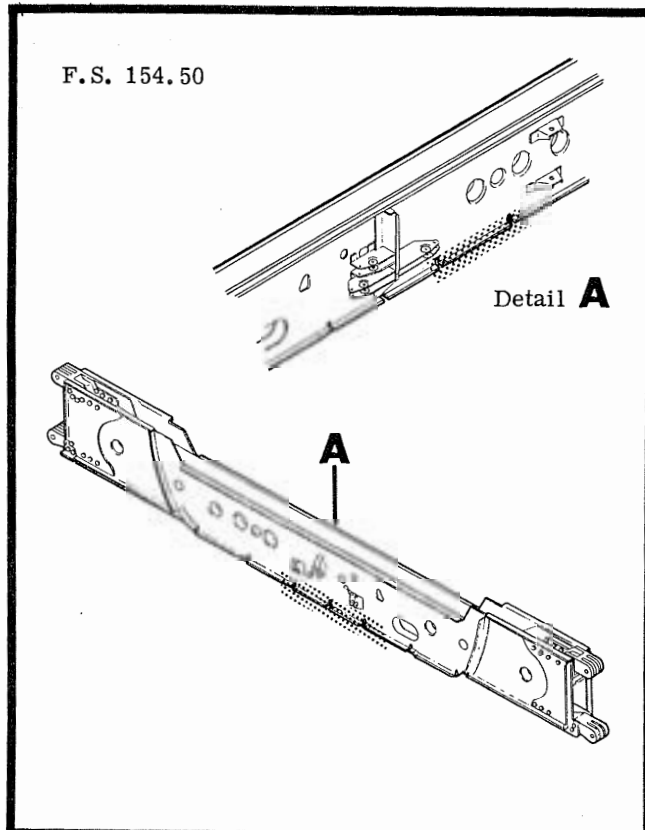


Figure 2-14. Fuselage Front Spar

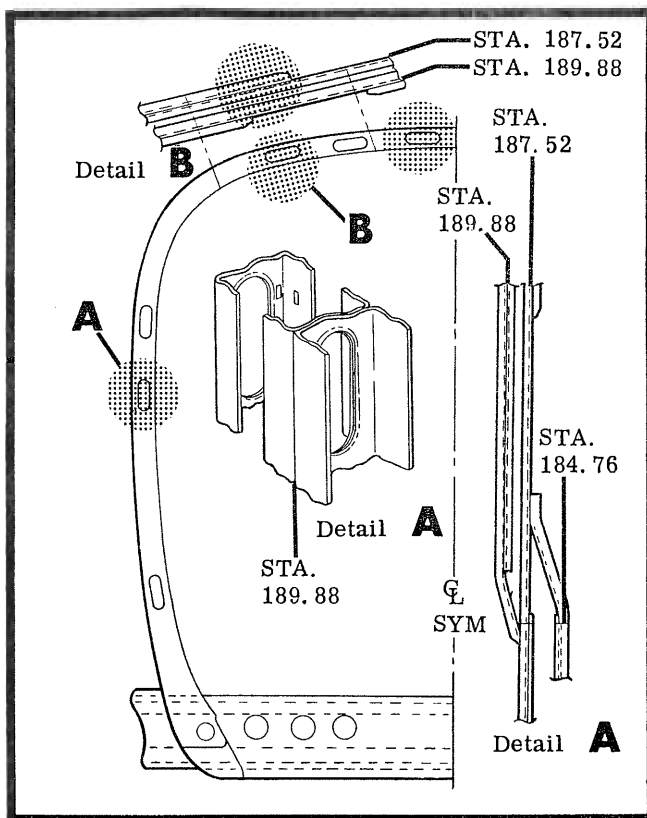


Figure 2-15. Rear Spar Bulkhead (Left-Hand)

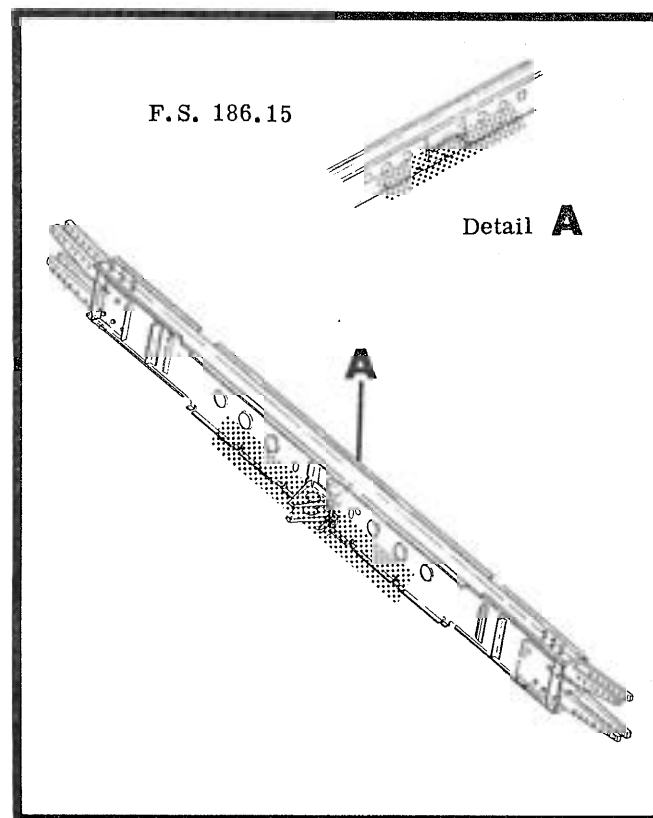


Figure 2-16. Rear Spar Carry-Thru

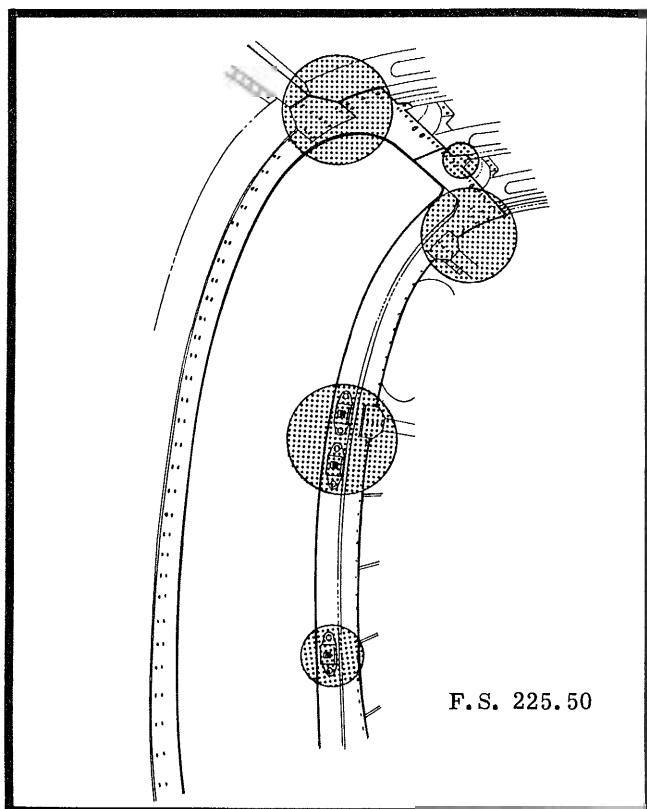


Figure 2-17. Cabin Doorframe

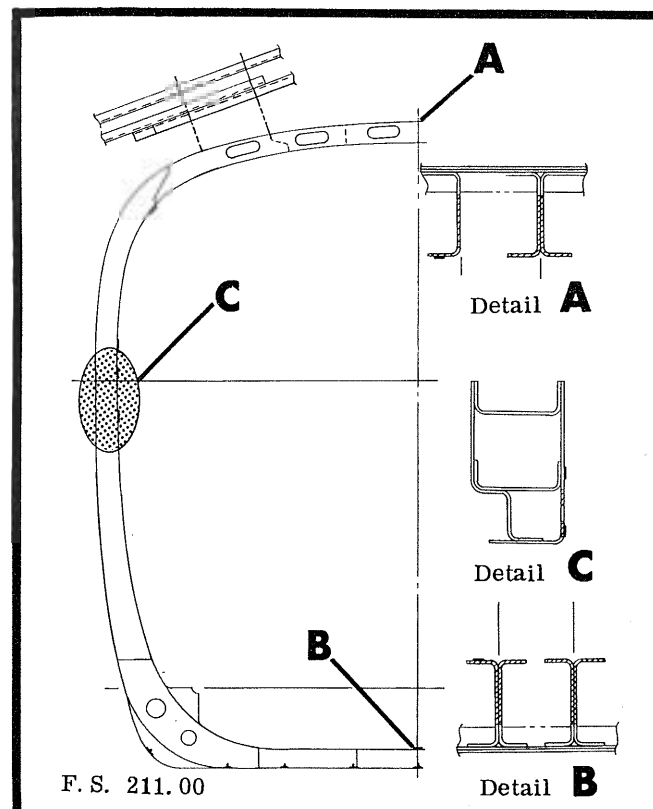


Figure 2-18. Fwd Door Bulkhead

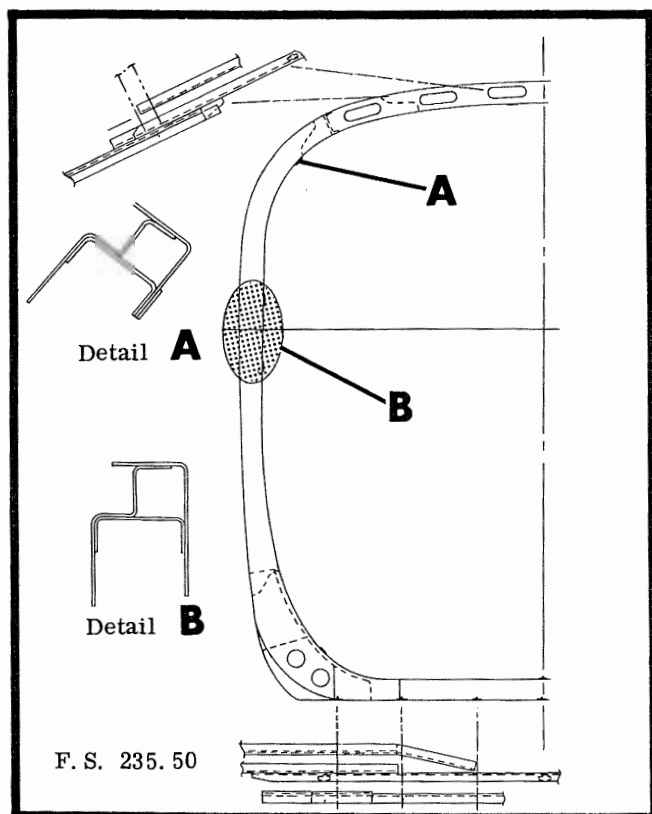


Figure 2-19. Aft Door Bulkhead

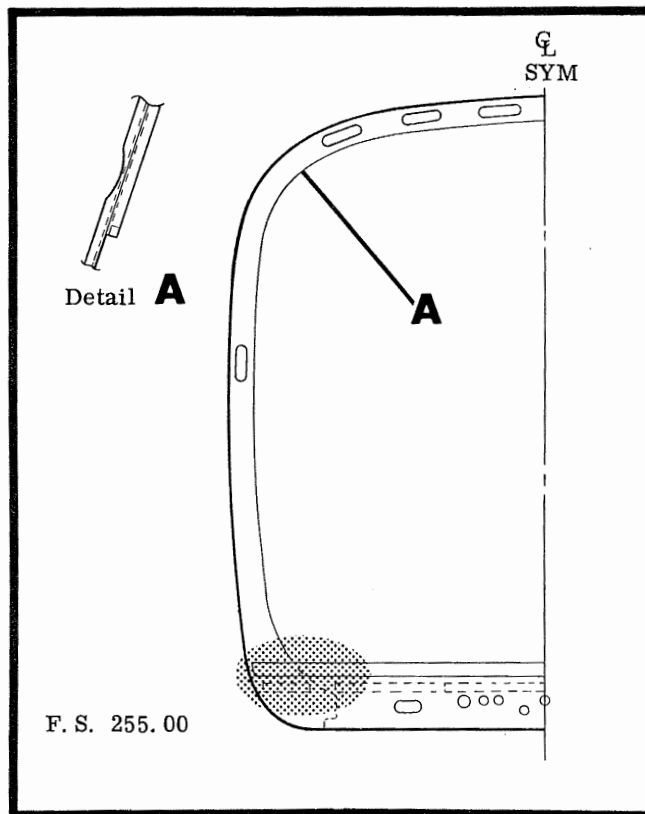


Figure 2-20. Left-Hand Bulkhead

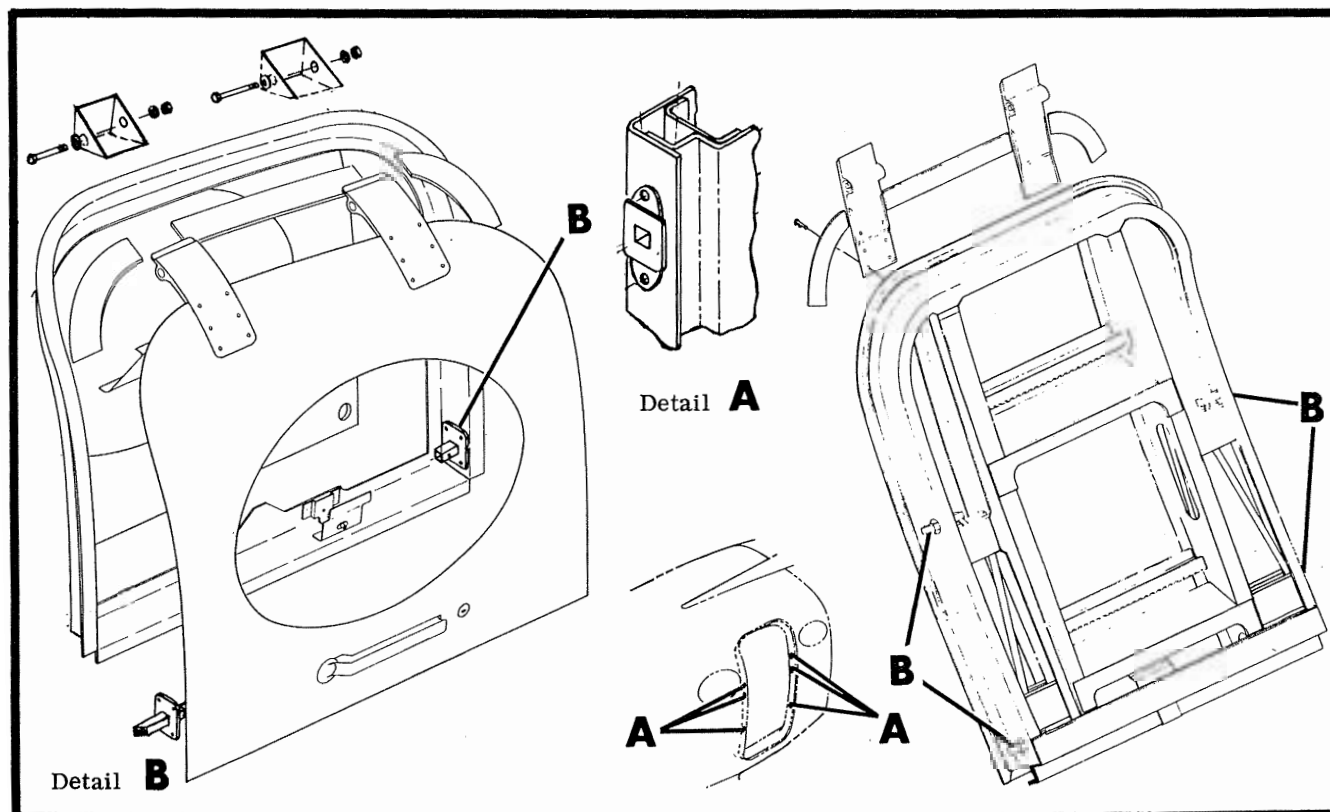


Figure 2-21. Cabin Door Installation

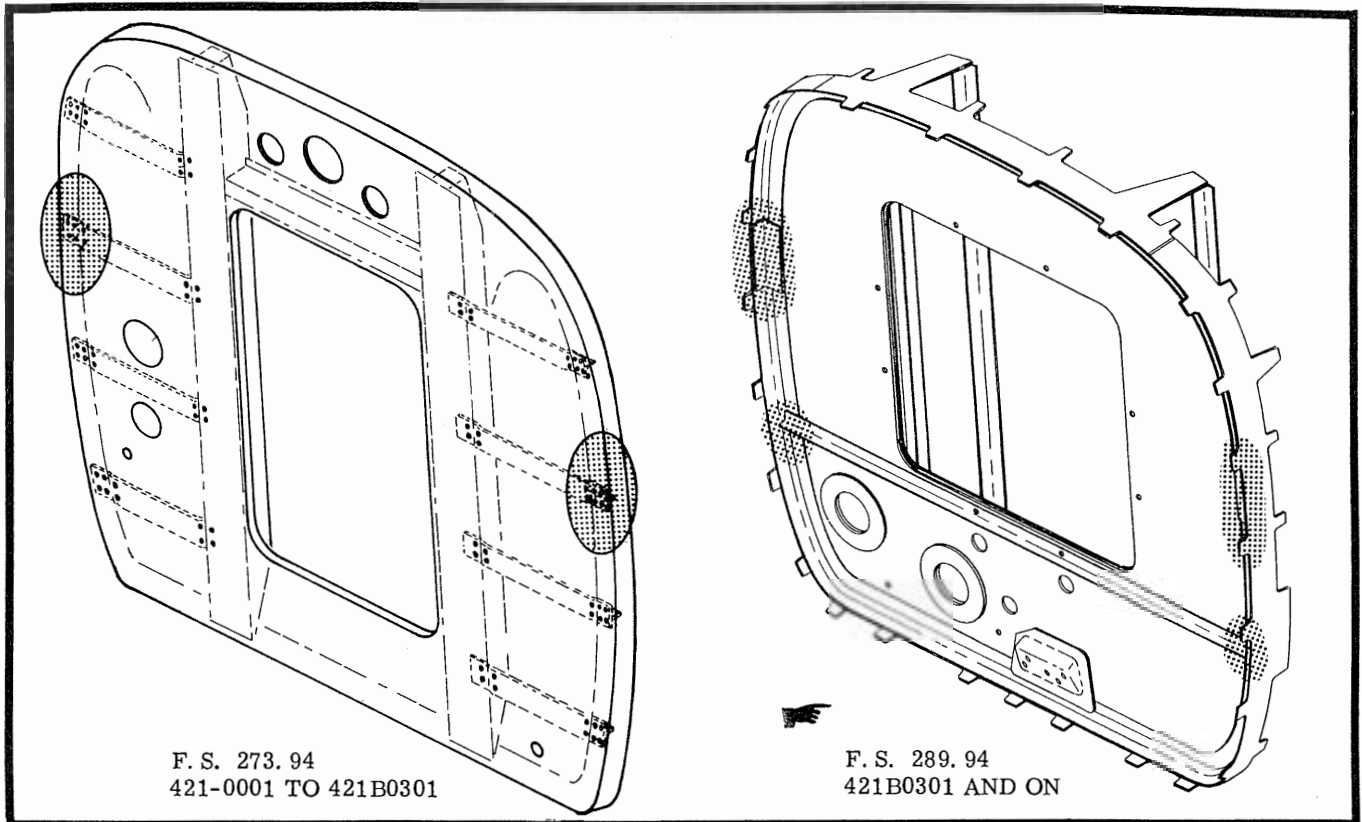


Figure 2-22. Aft Pressure Bulkhead (Fwd Side)

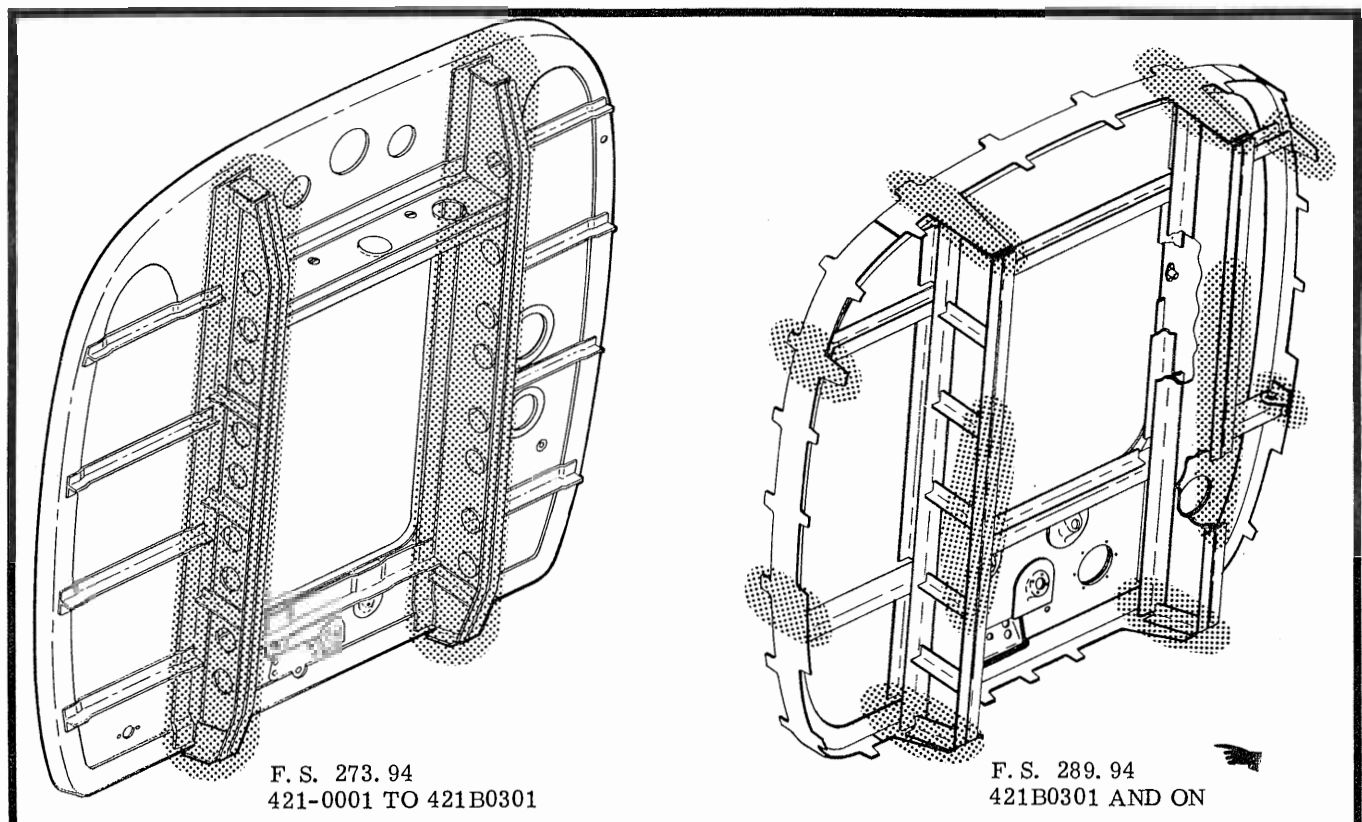


Figure 2-23. Aft Pressure Bulkhead (Aft Side)

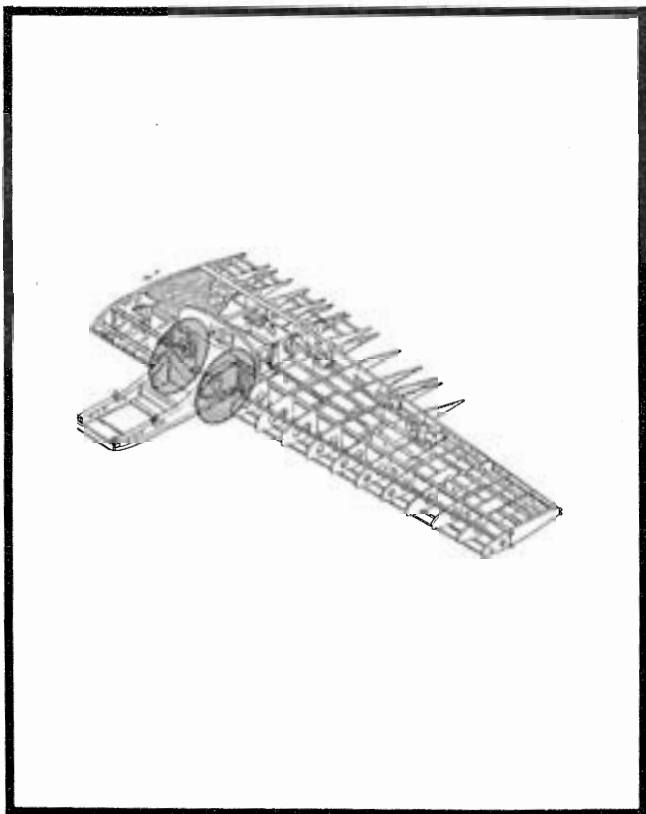


Figure 2-24. Engine Nacelle

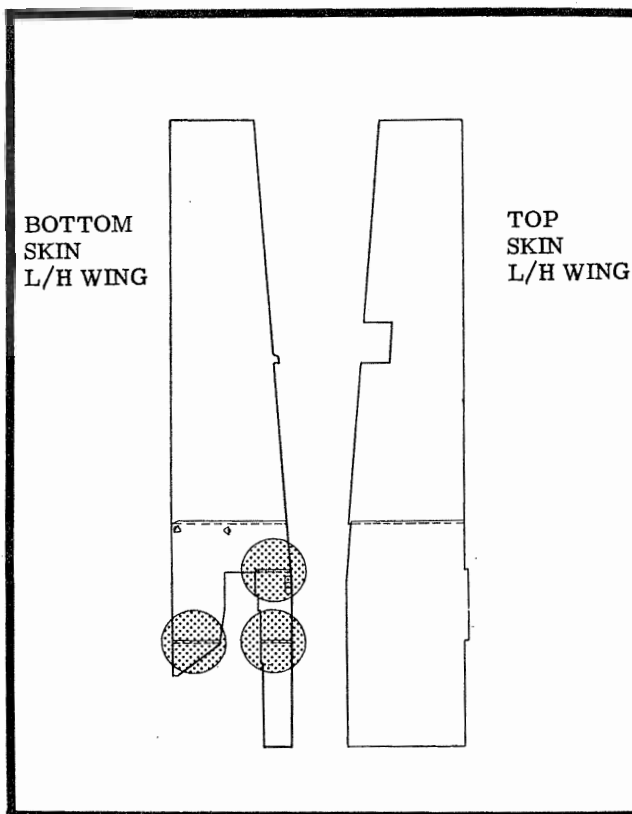


Figure 2-25. Wing Skin and Splices

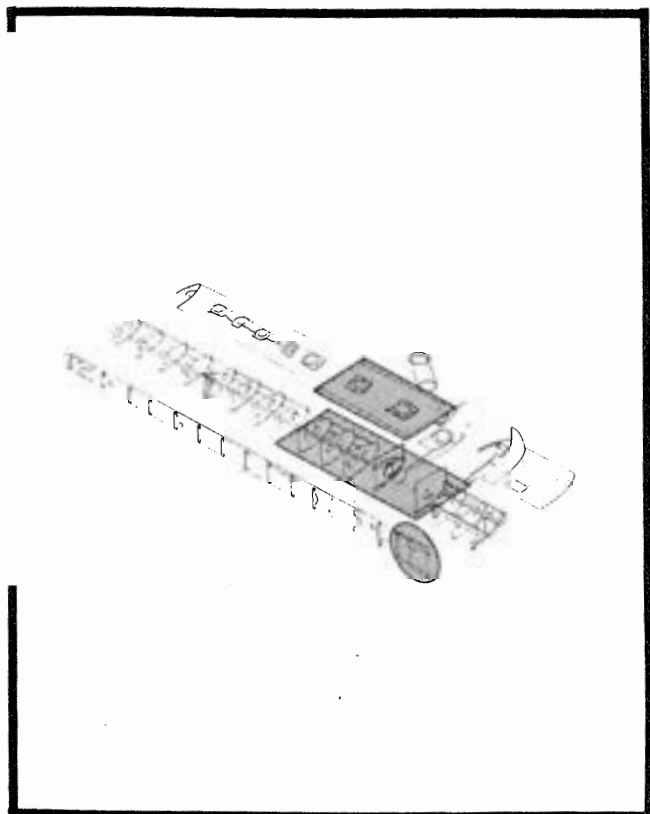


Figure 2-26. Front Spar and Leading Edge Assembly

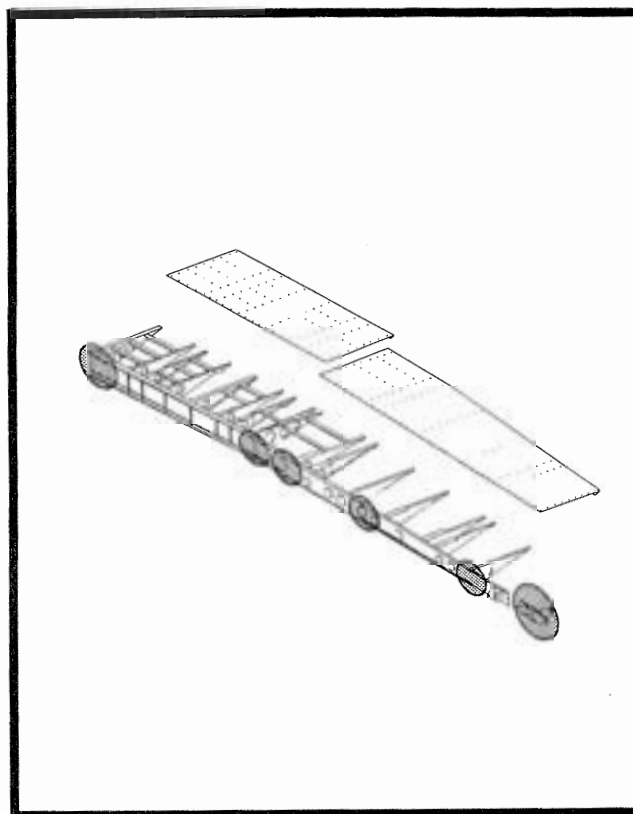


Figure 2-27. Rear Spar

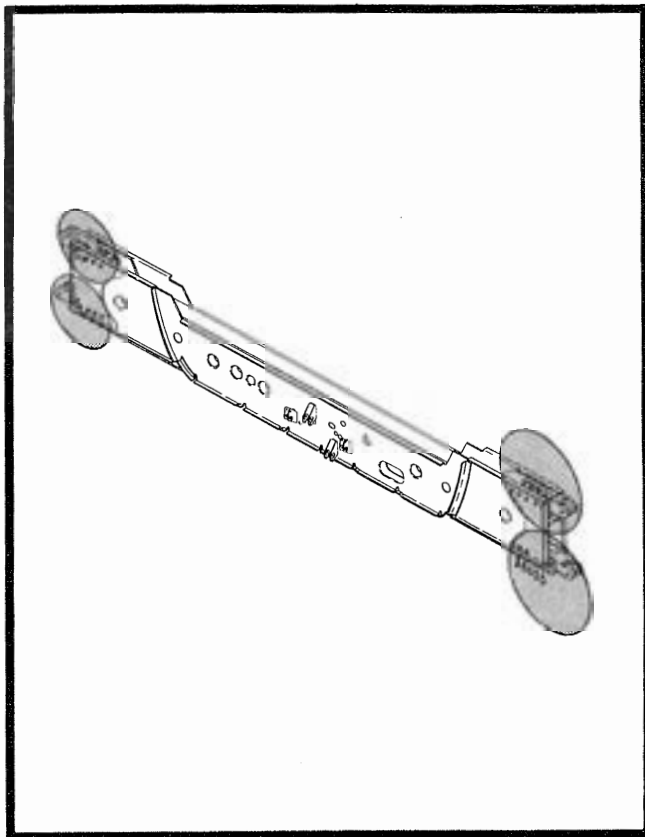


Figure 2-28. Front Spar Carry-Thru Structure

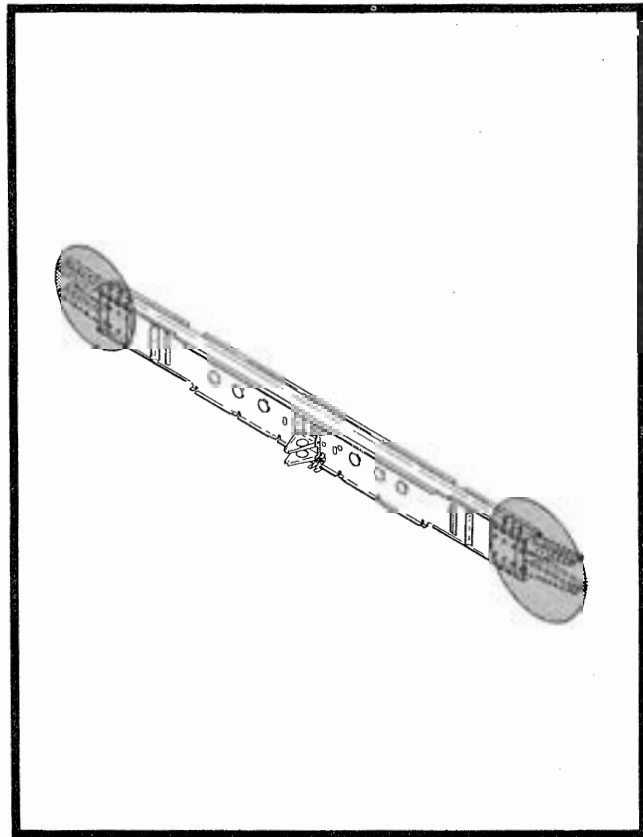


Figure 2-29. Rear Spar Carry-Thru Structure

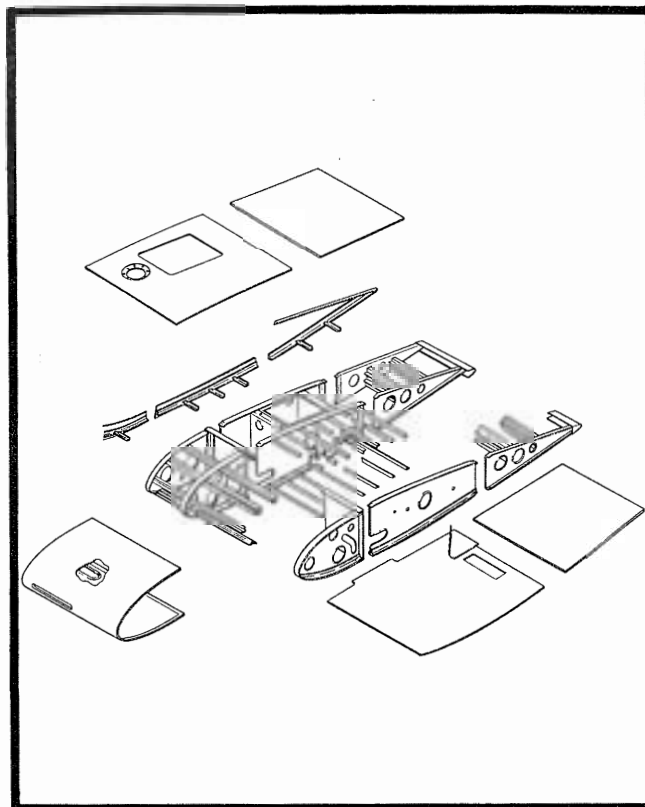


Figure 2-30. Stub Wing

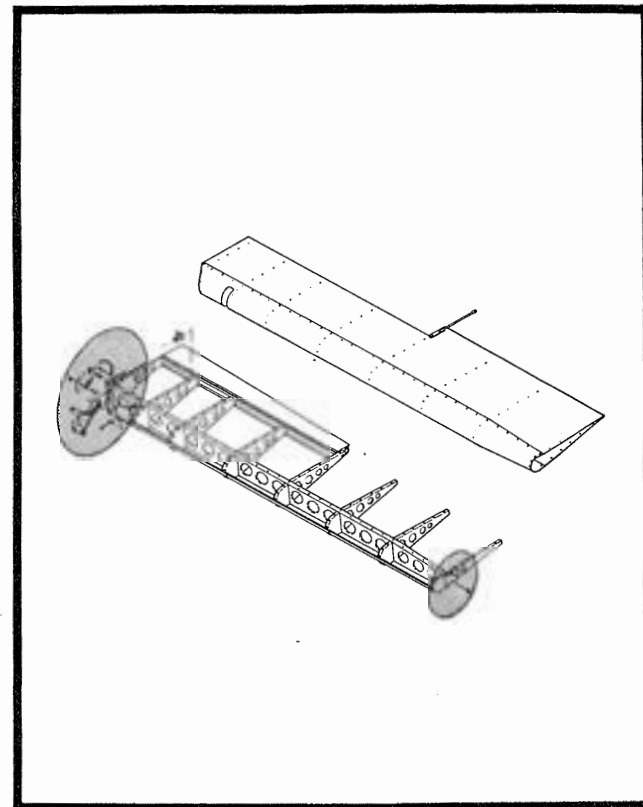


Figure 2-31. Ailerons

scratches will result when gritty particles are rubbed over the surface. Always flush the surface first with clean water or soap solution. Finally, rinse generously with clean water.

b. Inspection.

1. Refer to Section 3 and inspect all windows and windshield in accordance with Plastic Windows Inspection Criteria.

c. Repair and Servicing.

1. After cleaning plastic window surfaces, allow to dry, then wax to give surface a maximum transparency.

2. Minute hairline scratches can often be removed by rubbing with commercial automobile body cleaner. Apply the cleaner with a soft, dry, clean cloth or imitation chamois of flannel.

3. If repair to plastic window surfaces becomes necessary, refer to Section 16 and repair them in accordance with Repair of Plastic Window Surfaces.

Cabin Door.

a. Cleaning.

1. Clean the cabin door and latching mechanisms by wiping with a suitable cloth.

2. Remove accumulations of grease from cabin door parts by using a suitable solvent and wipe clean with a cloth.

b. Inspection.

1. Make a visual inspection of component parts for excessive wear, metal breaks and improper threads.

2. Operate door and observe for proper function of component parts.

c. Repair and Servicing.

1. Refer to Section 3, replace components which show evidence of excessive wear.

2. Refer to Lubrication Diagram, and service components as shown.

3. Lubricate the cabin door seal with Sil-Glide, or equivalent, to aid sealing.

Cabin Door Seal.

a. Cleaning.

1. Remove accumulation of dirt and grease from cabin door seal by using a suitable solvent and wipe clean with a clean cloth.

b. Inspection.

1. Inspect door seal for cuts, abrasions, and excessive wear.

c. Repairing and Servicing.

1. Refer to Section 3 for replacement of door seal if evidence of excessive wear exists.

2. Refer to Lubrication Diagram, and service door seal with proper lubricant.

3. If repair to seals is required refer to Section 16 for repair procedures.

Door Latch Pins (Upper and Lower).

a. Cleaning.

1. Clean the door latch pins with Trichloroethelene or suitable solvent.

b. Inspection.

1. Inspect door latch pins for damage, cracks, and wear.

2. Check for proper rigging in accordance with rigging procedures (See Section 3).

3. Check door latch pin guides for cracks and wear.

4. Check door latch pin receptacles for wear, cracks and visible damage.

c. Repairs and Servicing.

1. Refer to Lubrication Diagram for lubrication of door latch pins.

Nose Baggage and Wing Locker Doors.

a. Cleaning.

1. Clean upholstery panel with a suitable commercial upholstery cleaner.

2. Clean latch assembly, cylinder assembly and door assembly with suitable solvent and wipe dry with cloth.

b. Inspection.

1. Make a visual inspection of latch and cylinder assemblies for excessive wear or binding.

c. Repair and Servicing.

1. Refer to Section 3, replace components which show evidence of excessive wear.

2. Refer to Lubrication Diagram and service component parts as shown.

Heater.

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

Seats.

a. Cleaning.

NOTE

Cleaning fluids used on fabrics having a naphtha base are recommended for use in cleaning fabric covered seats.

CAUTION

Never use anything except a mild soap solution on leather and vinyl covered seats. Solvents and cleaners will damage, discolor and shorten the life of the seats.

1. Clean fabric covered seats as follows:

(a) Carefully brush off and vacuum all loose particles of dirt.

(b) Wet a small, clean cloth with cleaning solution and wring out thoroughly. Then open the cloth and allow a small part of the fluid to evaporate.

(c) Pat the spot lightly with the cloth, but do not rub it. Repeat this procedure several times, using a clean part of the cloth each time.

NOTE

Patting the spot lightly will prevent its spreading and is less likely to leave a ring.

(d) Moisten another piece of cloth and allow to evaporate until barely damp. Now pat the spot lightly, working from the outside in toward the center.

CAUTION

Do not use too much fluid. Seat cushions are padded with foam rubber, and since volatile cleaners attack rubber, these pads may be damaged if the material gets soaked with the cleaner.

(e) Brush again to remove any more particles which have become loosened.

2. Clean vinyl or leather seats as follows:

(a) On vinyl or leather seats, use a mild soap solution and sponge to remove dirt from seats; wipe dry with a clean damp cloth.

b. Inspection.

1. Inspect the front seats for binding on seat rails.

2. Inspect for proper functioning of adjusting handles and tilting mechanism.

3. Seat belts for proper security.

4. If electrically operated seats are installed (optional equipment), actuate switches and observe for smooth operation.

c. Repair and Servicing.

1. Refer to Section 3, replace components which show evidence of excessive wear or binding.

2. Lubricate seat base rollers with oil as required.

3. Wax seat rails with automotive wax to reduce friction between seat rollers and seat rails.

Seat Belts.

a. Cleaning.

NOTE

Seat belts should be removed from the aircraft to clean.

1. Clean seat belts using a suitable solvent or mild soap solution.

CAUTION

Never use thinner or strong solutions on seat belts. See Seat Belt Inspection procedure before reinstalling seat belts in aircraft.

b. Inspection.

1. Inspect webbing material for fraying.

2. Inspect seat belt installation for security.

Upholstery.

a. Cleaning.

1. The upholstery can be cleaned with a noninflam-

mable solvent while installed in the aircraft. Spots or stains can be removed by following the procedure for cleaning the seats (fabric), as outlined in this section.

b. Inspection.

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

Carpets.

a. Cleaning.

1. Use a small whisk broom to loosen dirt; then vacuum the carpet. The more difficult spots or stains can be removed by using a nonflammable dry-cleaning fluid. General care of the carpet is the same as the care of the carpets in your home.

b. Inspection.

1. Inspect carpet for excessive wear and security to the floorboard.

Control Quadrant.

a. Cleaning.

1. Clean all metal parts in a suitable solvent and allow to air dry.

b. Inspection.

1. Inspect all parts for evidence of cracking and excessive wear.

2. Inspect the racks and ratchet stops on the mixture levers for broken teeth and excessive wear.

c. Repair and Servicing.

1. Replace racks, ratchet stops, and ratchet stop springs if worn or too weak to insure positive locking.

2. Lubrication of control quadrant is not recommended; however, the control quadrant pedestal does require lubrication. (Refer to Lubrication Diagram.)

Empennage.

a. Cleaning.

1. Clean the empennage with mild soap and water. Stoddard Solvent may be used to remove grease and tar then washed with soap and water and allowed to dry.

2. The empennage may be cleaned with any good aircraft cleaner and wax.

b. Inspection.

1. Inspect exterior surfaces for damage and cracks, loose rivets and loose nuts.

2. Inspect attaching bolts and hinge attaching points for security.

Wing.

a. Cleaning.

1. Clean the wing as follows:

(a) Use a suitable solvent to remove all grease and dirt from nacelle area and landing gear area.

CAUTION

Never use gasoline, paint thinners, or Ketone to remove grease. These are highly inflammable and fire could result.

(b) After washing area with suitable solvent, wash the remaining solvent off with soap and water and allow to air dry.

(c) The wing can be cleaned with any good aircraft cleaner and wax.

b. Inspection.

1. Inspect wing skins, wing attach fittings, tip tank fittings, flap and aileron attach fittings for cracks and visible damage.

2. Inspect wheel well, fluid lines and hoses for leaks, cracks, dents, kinks, chafing, bleaching or discoloration, proper radius, security, corrosion, deterioration and foreign matter.

3. Inspect wing spar bolts for security and insure they are not working. Torque front spar bolts 60 ± 5 feet-pounds and rear spar bolts 175 ± 15 inch-pounds.

NOTE

When checking torque on spar bolts, always loosen nut first then check torque while tightening nut. Spar bolts are installed in shear position. DO NOT OVERTORQUE. It is possible wing spar bolts will turn if a slight torque is applied to bolt head.

c. Wing and stub wing area inspection.

1. Two types of inspections are required for the wing and stub wing area. These inspection, Type A and Type B, are outlined in the following paragraphs. The aircraft hour intervals and type of inspection to be performed are shown in figure 2-7.

2. Type "A" Inspection.

Type "A" inspection is a limited visual inspection of the wing and stub wing structure.

Use the following procedures:

(a) Inspect all external wing structure for cracks and damaged areas.

(b) Inspect for loose and failed structural fasteners.

(c) Inspect wing skin and splices for cracks, wrinkles, abnormal stresses, dents, etc.

(d) Inspect rivets, especially those common to front spar and skin, for loose or working rivets, stretched rivets, and cracks around dimples.

(e) Inspect gear attach fittings and supporting structure for loose bolts, elongated bolt holes, and structural member damage resulting in secondary damage such as high shear or stretched rivets.

3. Type "B" Inspection.

Type "B" inspection is a complete visual inspection of the wing and stub wing using all available access holes, lightning holes, etc. To conduct this inspection, engine cowls, tip tank fairing, wing stub gap cover, battery box assembly, prop unfeathering accumulator and all access doors and panels are to be removed. Flaps should be fully extended and ailerons free to move for ease in inspection. Shaded areas in each figure are the critical areas to be inspected.

Should a crack be detected, the structure must be repaired using the standard structural repair as defined in Section 16, with the following exceptions: the wing-stub wing spar fittings, tip tank fittings, landing gear and attachment fittings, push-pull tubes, bellcranks, hinges, bolts, rivets, pins bushings and bearings. Any cracks in or failure of these items will require that the item be replaced.

CAUTION

When inspecting the critical (shaded) areas it may be necessary to remove primer and dye check.

(a) Inspect all wing and stub wing structure for cracks and damaged areas.

(b) Inspect for loose and failed structural fasteners.

(c) See figure 2-25. Inspect wing skin and splices.

(d) Inspect rivets, especially those common to front spar and skin.

(e) See figure 2-26. Inspect front spar and leading edge assembly.

(f) See figure 2-28. Inspect front spar carry-thru structure. (For carry-thru structure inside the fuselage, refer to "Pressure Cabin Inspection Requirements.")

(g) See figure 2-27. Inspect rear spar and trailing edge assembly.

(h) See figure 2-29. Inspect rear spar carry-thru structure. (For carry-thru structure inside the fuselage, refer to "Pressure Cabin Inspection Requirements.")

(i) Inspect wheel well, especially gear fittings, ribs and spars.

(j) See figure 2-24. Inspect engine nacelle, especially engine mounts, prop unfeathering accumulator mounting holes and areas shaded.

(k) See figure 2-30. Inspect stub wing.

(l) Inspect flaps, especially the hinge, scissors, and their attachments and push-pull rod connecting the scissor assembly to the bellcrank.

(m) See figure 2-31. Inspect ailerons.

Emergency Exit Door.

a. Cleaning.

1. Clean exit door and latching mechanisms by wiping with a suitable cloth.

b. Inspection.

1. Inspect general condition, fit and security of door.

2. Inspect position of emergency release handle to verify that the release mechanism has not been disturbed.

LANDING GEAR.

Landing Gear Actuator.

a. Cleaning.

1. Clean external parts of landing gear actuator assembly and reduction gear by wiping with a clean

cloth.

2. Dampen cloth with a suitable cleaning solvent to remove oil or grease accumulations.

b. Inspection.

1. Inspect assemblies externally for visible damage such as cracks, nicks, dents and scratches. Check upper and lower bellcranks and splines on protruding portions of sector shaft for visible damage.

2. Check landing gear actuator for proper operating times as follows:

- (a) Flight check for excessive noise and for free, proper operation.

NOTE

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

- (b) Flight check time for full retraction "UP," amber light on 10 to 14 seconds. Time for full extension "DOWN," green lights on 8 to 11 seconds.
- (c) If during flight check, the landing gear will not retract and extend within the time limit described in step (b), remove the landing gear motor and perform the following no load test:
- (1) Mount motor securely in a horizontal position.
 - (2) Connect motor as shown in Figure 2-31A to a variable 30 volt, DC power supply.
 - (3) Connect switch S3 for either direction.
 - (4) Open switch S2 to read ammeter.
 - (5) Close switch S1 to start motor.
 - (6) Gradually increase voltage from zero until the brake releases.

NOTE

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

- (7) Read voltmeter when brake releases. Brake must release at or less than 18 volts.
- (8) Stop motor, close switch S3 for opposite rotation and repeat steps (3) thru (7).
- (9) Voltage must be within the same limits as previous rotation.
- (10) If the voltage is not within the limits as described in step (7), refer to Troubleshooting the Landing Gear Actuator Motor, Section 4.
- (11) Run motor in each direction as shown connected in Figure 2-31A with 24 volts DC applied.
- (12) Open switch S2 and read ammeter current. The ammeter should read approximately 7.5 amperes under no load, when the RPM is approximately 4000 RPM.
- (13) Stop motor, close switch S3 for opposite rotation and repeat step (12).
- (14) Motor should operate within limits as

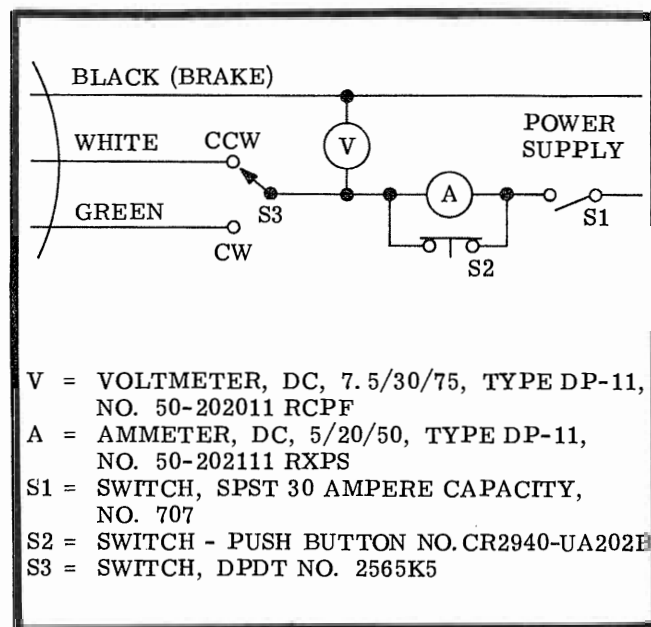


Figure 2-31A. Schematic Test Connection Diagram

described in step (12).

- (15) If the motor does not operate within the limits as described in step (12), refer to Troubleshooting the Landing Gear Actuator Motor, Section 4.
- (d) If the motor will not meet operating requirements, after performing no load check, replace motor and repeat step (b).
- (e) If the gear still will not meet flight check requirements, check all linkage and hinge points for binding or interference.
- (f) If no evidence of binding or interference is found, landing gear actuator must be replaced or overhauled in accordance with Cessna Landing Gear and Flap System Components Overhaul/Parts Manual.
- c. Repair and Servicing.
1. Refer to Lubrication Diagram and service components as shown.
 2. Disassembly of the landing gear actuator assembly or reduction unit for repairs are not recommended.

NOTE

Landing gear actuator may be partially disassembled to lubricate gears.

Emergency Manual Extension System.

- a. Cleaning.
1. Clean all components with suitable solvent.
- b. Inspection.
1. Inspect miter gears and sprocket for visible damage such as chipped or broken teeth, nicks,

dents, cracks or deep scratches.

2. Inspect all bolt and pin holes for elongation.
3. Inspect around all welds for cracks.
4. Check emergency manual extension system for specification compliance as follows:

NOTE

This check must be accomplished during flight.

- (a) Place the landing gear actuator switch in the "OFF" position.
- (b) Manually extend the landing gear, counting the number of turns required to illuminate the green lights. Forty-seven to fifty-four turns are required to illuminate the lights.
- c. Repair and Servicing.
 1. Refer to Lubrication Diagram, and service components as shown.

Main and Nose Landing Gear Assemblies.

- a. Cleaning.
 1. Clean all metal parts with suitable solvent.

CAUTION

If metal parts are not to be assembled immediately, coat with system hydraulic fluid to prevent rusting. Before assembly it will be necessary to again clean with solvent.

2. Clean all O-rings and seals with system hydraulic fluid.
- b. Inspection.
 1. Inspect all components for excessive wear, cracks, dents, nicks and scratches.
 2. Inspect outer barrel of the lower strut assembly for any defects that may damage seals.
 3. Refer to Inspection Chart for additional periodical inspection requirements.
- c. Repair and Servicing.
 1. Repair of main landing gear is limited to replacement of parts, smoothing out of minor scratches, nicks and dents and repainting of areas where paint has chipped or peeled.
 2. Refer to Lubrication Diagram and service components as shown.

Nose and Main Landing Gear Rigging Inspection.

Inspect the nose and main landing gear rigging in accordance with figure 2-32.

Torque Links.

- a. Cleaning.
 1. Clean torque link assemblies with a suitable solvent and wipe clean with a clean cloth.
- b. Inspection.
 1. Refer to Inspection Chart for periodical requirements.

c. Repair and Servicing.

1. Repair of torque link assemblies is limited to replacement of parts, smoothing out of minor scratches, nicks, and dents and repainting of areas where paint has chipped or peeled.
2. Refer to Lubrication Diagram and service components as shown.

Nose and Main Gear Retracting Linkage.

- a. Cleaning.
 1. Clean linkage components with cloth saturated with suitable cleaning solvent.

CAUTION

Do not clean sealed bearings or needle bearings which do not have provisions for lubrication.

- b. Inspection.
 1. Refer to Inspection Chart for periodical inspection requirements.
- c. Repair and Servicing.
 1. Repair of main landing gear retracting linkage is limited to replacement of parts, smoothing out of minor nicks, dents, and scratches and repainting of areas where paint has chipped or peeled.
 2. Refer to Lubrication Diagram and service components as shown.

Shock Strut Servicing.

- a. To fill the main landing gear shock struts, use the following procedures:
 1. Jack aircraft in accordance with Jacking Procedures.
 2. Deflate strut by loosening valve body 2-1/2 turns. (Maximum)
 3. With strut fully compressed, remove valve and fill with hydraulic fluid. (MIL-H-5606)
 4. Stroke strut slowly 3 times. (Minimum)
 5. Top off fluid with strut compressed.
 6. Replace valve and inflate strut to 200 PSI (275 PSI, 421B0001 and ON) with tire clear of ground.
 7. When aircraft is on the ground, service strut to approximately 2.35 inches (2.70 inches, 421B0001 and ON) extension until it can be serviced per step 6.
- b. To fill nose landing gear shock strut, use the following procedures:
 1. To fill the nose gear shock strut follow procedure given above, inflating nose strut to 65 PSI with tire clear of ground.
 2. When aircraft is on the ground, service strut to approximately 1.37 in. extension until it can be serviced per step 1.

Nose Gear Shimmy Dampener.

- a. Cleaning.
 1. Clean all metal parts with suitable solvent.
 2. Clean all O-rings and seals with clean system hydraulic fluid.

CAUTION

If metal parts are not to be assembled immediately, coat with system hydraulic fluid to prevent rusting. Before assembly, it will be necessary to again clean with suitable solvent.

- b. Inspection.
 - 1. Refer to Inspection Chart for periodical inspection requirements.
- c. Repair and Servicing.
 - 1. Repair of shimmy dampener is limited to replacement of parts, smoothing out of minor nicks, scratches, and dents, and repainting areas where paint has chipped or peeled.
 - 2. Refer to Lubrication Diagram and follow this procedure to fill the shimmy dampener.
 - (a) Using the tow bar, turn the nose wheel strut to the extreme left position against the 55-degree stop. This will place the shimmy dampener piston to the rear of the cylinder and eliminate the possibility of entrapped air in the cylinder.
 - (b) Remove the filler plug and fill with hydraulic fluid.
 - (c) Replace filler plug and turn nose wheel strut through its entire travel several times.
 - (d) Return strut to the extreme left position against the 55-degree stop.
 - (e) Remove filler plug and add whatever fluid is needed to fill the cylinder.
 - (f) Replace and safety filler plug.

Nose Wheel Steering System.

- a. Cleaning.
 - 1. Clean metal parts with suitable solvent.
 - 2. Wipe cables and pulleys with a clean dry cloth.
- b. Inspection.
 - 1. Refer to Inspection Chart for periodical inspection requirements.
 - 2. Check gimbal mounting bolts for proper torque 50 to 70 inch-pounds.
- c. Repair and Servicing.
 - 1. Repair of components in the nose gear steering system is limited to replacement of parts.
 - 2. Refer to Lubrication Diagram and service system components as shown.

Nose and Main Wheels and Tires.

- a. Cleaning.
 - 1. Clean all metal parts with suitable solvent.
 - 2. Clean felt seals and bearing cones by washing in suitable solvent and dry thoroughly.
- b. Inspection.
 - 1. Inspect wheel castings for cracks, nicks, dents, scratches and corrosion.

NOTE

Replace castings which show evidence of cracks or heavy corrosion. See step c. for servicing castings which show evidence of light corrosion.

- 2. Inspect disc drive clips for damage, looseness, and excessive wear.
- 3. Inspect bearing cups for visible damage and wear.

NOTE

Do not remove bearing cups unless replacement is required.

- 4. Inspect bearing cones for visible damage and wear.

NOTE

If more than the usual number of takeoffs and landings are made or the aircraft is operated in dusty areas, it is recommended that cleaning and lubrication of wheel bearings be accomplished at each 100-hour inspection.

- 5. Inspect retainers and snap rings for damage and distortion. Straighten or replace as necessary.
- 6. Inspect the tire for breaks, cuts, foreign objects embedded in tread and flat spots and/or exposed cords.

CAUTION

Breaks, flat spots, exposed cords and cuts that damage cords are cause for immediate rejection of tire. Should there be any doubt about a tire's reliability, don't hesitate to reject it.

- 7. Refer to Inspection Chart for periodical inspection requirements.
- c. Repair and servicing.
 - 1. Slightly corroded areas on wheel castings can be repaired as follows:
 - (a) Clean affected area thoroughly.
 - (b) Repaint with two coats of zinc chromate primer on area which has had the protective coating removed.
 - (c) Finish coat casting with two coats of aluminum lacquer.
 - 2. Replace bearing cones with applicable grease as shown in Lubrication Diagram.
 - 3. Replace damaged clips.
 - 4. Lubricate felt seal with light oil.

NOTE

The main wheel tires should be maintained at 65 PSI and nose wheel tires at 32 PSI on aircraft 421-0001 to 421B0001 and at 70 PSI for the main wheel tire and 35 PSI for the nose wheel tire on aircraft 421B0001 and ON. Check and examine tires for wear, cuts and bruises when checking tire pressures.

Brake System Plumbing.

- a. Cleaning.
 - 1. Clean hydraulic components with clean system hydraulic fluid or denatured alcohol.

b. Inspection.

1. Inspect fittings for damaged threads and deformed flares on ends of tubing; lines for cracks, dents, deep scratches, flattened bends and signs of chafing at points of wear; hose for swelling, cracking, abrasions through protective plies and leaks.

2. Refer to Inspection Chart for periodical inspection requirements.

c. Repair and Servicing.

1. Repairs to brake system plumbing should be made in accordance with best shop practice, using standard parts and procedures, and be conducted in compliance with applicable regulations.

2. Service system as shown in Lubrication Diagram.

Brake Assemblies.

a. Cleaning.

1. Wash metal parts in suitable solvent.
2. Wash O-rings with clean system hydraulic fluid or denatured alcohol.

3. If required, clean brake linings with MEK.

b. Inspection.

1. Inspect metal parts for wear and thread damage.
2. See Inspection and Replacement of Brake Linings, Section 4, for wear tolerances.

3. Inspect cylinder walls for corrosion, pitting and scoring.

4. Refer to Inspection Chart for periodical inspection requirements.

c. Repair and Servicing.

CAUTION

Always release parking brake before servicing cylinders.

1. Replace worn or damaged parts.
2. Polish out minor nicks using 400 grit wet-or-dry sandpaper with system hydraulic fluids.
3. Replace brake discs at each engine overhaul or when wear approaches limits described in Section 4, Replacement of Brake Linings.

Master Cylinders.

a. Cleaning.

1. Clean all metal parts in suitable solvent.
2. Clean O-ring seals with clean system hydraulic fluid or denatured alcohol.

b. Inspection.

1. Inspect metal parts for wear and thread damage.
2. Inspect cylinder walls for corrosion, pitting and scores.

3. Inspect O-ring seal and O-ring portion of lock-o-seal for swelling, chipping or other evidence of damage.

4. Refer to Inspection Chart for periodical inspection requirements.

c. Repair and Servicing.

1. Replace master body when damage to cylinder

wall is found.

2. Repairs to master cylinder components are not recommended, only replacement of defective parts.

3. Refer to Lubrication Diagram, and service as shown.

FLIGHT CONTROLS.

Control Column.

a. Cleaning.

1. The control column tube assemblies are chemically treated with a dry lubricant and should be cleaned only with a clean, dry cloth.

2. Clean roller chains and cables with a clean, dry cloth.

b. Inspection.

1. Check all bolt holes for elongation.

2. Check bearings for excessive wear, binding and looseness.

3. Check tube assemblies for cracks and loose rivets.

4. Check for loose or missing bolts, pins, nuts, and rivets on control wheel, aileron sprocket, bearing blocks and tube assemblies.

5. Check control wheel and control locks for condition and operation.

c. Repair and servicing.

1. Repair is limited to replacement of parts and smoothing out minor dents or scratches.

Aileron and Aileron Trim System.

a. Cleaning.

1. Clean ailerons, hinges, pulleys, bellcranks, trim tab actuator and trim tab mechanism with suitable solvent.

2. Remove dirt and grease from cables with a clean dry cloth.

b. Inspection.

1. Inspect aileron and trim system for visible damage such as cracks, dents, nicks, deep gouges and loose balancing weights.

2. Inspect aileron and trim system hinges for freedom of movement, wear and fatigue cracks and attach bolts for security.

3. Inspect aileron and trim control system cables for fraying, proper tension and safeties; fairleads, pulleys and chains for wear and attachment; all gears and sprockets for wear, missing or broken teeth, damage, security of attachment, binding and excessive wear; controls for proper operation, adjustment, travel and security of attach bolts.

4. Inspect linkage, bellcrank and bolt for security, stop bolts for looseness and security.

5. On aircraft 421-0001 to 421B0005, inspect stop bolts on aileron bellcrank stop bracket for looseness, if bolts can be turned by hand, an MS25082-3 lock nut should be installed on the near side of stop bolt. If the existing aileron bellcrank rigging does not allow space for a lock nut, the stop bolt may be safety-wired instead. This requires the drilling of a .04 +.04
-.00 diameter hole in the stop bolt bracket. Safety-wire stop bolt to stop bolt bracket.

6. Check travel on aileron up $20^{\circ} +1^{\circ}$, -0° and down $20^{\circ} +1^{\circ}$, -0° .
7. Check travel on aileron trim tab up $20^{\circ} +1^{\circ}$, -0° and down $20^{\circ} +1^{\circ}$, -0° .
8. Check aileron cable tension 25 ± 5 pounds.
9. Check aileron trim tab cable tension 10 ± 3 pounds.
10. Refer to Lubrication Diagram for lubrication of aileron and trim system.

Elevator and Elevator Trim Tab Control System.

- a. Cleaning.
 1. Use a soap solution and a clear water rinse to remove dirt and grease from the exterior surfaces of the elevator and elevator trim tab. Wipe the hinges and actuator clean using a cloth dampened with suitable solvent.
 2. Clean grease from elevator trim tab actuator with Stoddard Solvent and air dry.
- b. Inspection.
 1. Inspect the elevator and trim tab hinges and attach points for wear, cracked fittings, defective bearings, corrosion, deformation of parts, excessive looseness and attach bolts for security.
 2. Inspect the skin for loose rivets, push rods for wear, binds, cracks and condition.
 3. Inspect linkage, bellcranks, and bolts for looseness and security.
 4. Inspect elevator trim tab, hinge and push rod for security and condition.
 5. Inspect elevator trim tab actuator for wear and condition.
 6. Inspect elevator and elevator trim tab cables for fraying, proper tension and safeties; fairleads, pulleys and chains for wear and attachment; all gears and sprockets for wear, missing or broken teeth, damage, security of attachment, binding, and excessive wear; controls for proper operation, adjustment, travel and security of attach bolts.
 7. Check travel on elevator up $25^{\circ} +1^{\circ}$, -0° ; down $15^{\circ} +1^{\circ}$, -0° .
 8. Check travel on elevator trim tab up $10^{\circ} +1^{\circ}$, -0° 421-0001 to 421B0001, ($12^{\circ} +1^{\circ}$, -0° 421B0001 and On), down $26^{\circ} +1^{\circ}$, -0° 421-0001 to 421B0001 ($20^{\circ} +1^{\circ}$, -0° 421B0001 and On).
 9. Check elevator cable tension 32 ± 5 pounds.
 10. Check elevator trim tab cable tension $10^{\circ} \pm 3$ pounds (electric trim cable tension 18 ± 3).
 11. Inspect ends of elevator torque tubes for rust, if a rust condition exists, the following procedures are recommended:
 - (a) Refer to figure 6-1, remove taper pin (19) and flange fitting.
 - (b) Clean the area and remove any rust with fine emery cloth.

CAUTION

The clean-up should not remove any more material than necessary and still provide a minimum wall thickness of 0.038 on the torque tube ends.

- (c) Apply wet primer to the clean area; reinstall the flange fitting and taper pin.

c. Repair and Servicing.

1. Refer to Section 16 for repair, and Lubrication Diagram, for lubrication of elevator and trim system.

Rudder and Rudder Trim Tab System.

a. Cleaning.

1. Use a soap solution and clear water rinse to remove dirt and grease from the exterior surfaces of the rudder and rudder trim tab. Wipe the hinges and actuator clean using a cloth dampened with a suitable solvent.

2. Clean grease from the rudder trim tab actuator with Stoddard Solvent and air dry.

b. Inspection.

1. Inspect the rudder hinge and attaching points for wear, cracks and excessive looseness.
2. Inspect skin for loose rivets, push rods for wear, bends, cracks and condition.
3. Inspect linkage, bellcranks and bolts for looseness and security.
4. Inspect rudder trim tab hinge and push rod for condition and security.
5. Inspect rudder trim tab actuator for wear and condition.
6. Inspect the rudder and rudder trim cables for proper tension and safeties; fairleads, and pulleys for proper alignment, wear and attachment.

7. Check travel on rudder (421-0001 to 421B0801), left $25^{\circ} +1^{\circ}$, -0° ; right $25^{\circ} +1^{\circ}$, -0° measured perpendicular to hinge line or (421B0801 and On) left $32^{\circ} +1^{\circ}$, -0° , right 32° , $+1^{\circ}$, -0° .

8. Check travel on rudder trim tab, left $16^{\circ} +1^{\circ}$, -0° ; right $11^{\circ} +1^{\circ}$, -0° measured perpendicular to hinge line.

9. Check cable tension on rudder cables 25 ± 5 pounds. (Refer to Rigging of Rudder, Section 7.)

10. Check cable tension on rudder trim tab cables 10 ± 3 pounds.

c. Repair and Servicing.

1. Refer to Section 16 for repair and figure 2-37 for lubrication of rudder.

Rudder Pedal Assembly.

a. Cleaning.

1. Clean component parts with suitable solvent.

b. Inspection.

1. Inspect all components for visible damage such as dents, cracks and broken welds.
2. Inspect all bearings for scoring, binding and excessive wear.
3. Inspect all pin and bolt holes for elongation.

c. Repair and Servicing.

1. Repair rudder pedal assembly by replacing defective parts only.
2. Refer to Lubrication Diagram, and service as shown.

Flap System.

a. Cleaning.

1. Use Stoddard Solvent to remove dirt and grease in the flap scissor area. After solvent is used the entire area should be washed with a mild soap and water solution and rinsed with clear water and allowed to air dry.

b. Inspection.

1. Inspect the external surface of flaps for dents, nicks, cracks and proper flush fit in the up position.
2. Inspect the flap scissors and attaching bolts for wear and security. Check hinge segments for cracks.
3. Inspect bellcranks and push-pull rods for security.
4. Inspect flap cables for fraying, proper tension and safeties; fairleads and pulleys for proper alignment, wear and attachment.
5. Check rigging and travel down at the 15° stop 15° 0°, -2°, and 45° +1°, -0° at the 45° stop.
6. Check cable tension direct cable with flaps down 85 ±10 pounds. Return cables, flaps up 225 ±25 pounds.
7. Check flap operation for specification compliance as follows:
 - (a) Flight check to verify that flaps fully extend in 9 - 13 seconds, and retract in 7 - 10 seconds. Check extension and retraction times at 160 MPH IAS. Check actuation to 15° at 180 MPH IAS.
 - (b) If during flight check, the flaps will not extend and retract within the time limits described in step (a), the flap motor must be replaced.
- c. Repair and Servicing.
 1. Refer to Section 16 for repair of flap.
 2. Lubricate flap hinge as necessary with oil (MIL-L-7870).

Control Cable Seals.

- a. Cleaning.
 1. The control cable seals are packed with a lubricant; therefore, care must be exercised when cleaning to prevent dissolving grease within the seal.
 2. Clean control cables using a clean, dry cloth.
- b. Inspection.
 1. Check seals for cuts or excessive wear.
 2. Check cables and seals for proper lubrication.
- c. Repair and servicing.
 1. Replace worn or damaged seals as required.
 2. Lubricate cables for full length of travel within the seal with MIL-G-81322A lubricant.
 3. Pack seal with MIL-G-81322A lubricant.
 4. Place the seal on the cable on the non pressurized side of bulkhead with the small end of seal toward bulkhead.
 5. Insert seal in the bulkhead hole so that bulkhead metal is seated within the retaining groove of seal and so that the small end of seal is in the pressurized section.
 6. Install proper retaining rings in the grooves on the seal (two on small end and one on large end).

ENGINE GROUP.

- a. Cleaning.
 1. Wash down the engine with Stoddard Solvent and dry with a jet of low pressure air.
- b. Inspection.

NOTE

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

1. Inspect all hoses for evidence of internal swelling, chafing, cuts or breaks.
2. Inspect all fittings for thread damage, damage to chamfered seats and replace fittings as necessary.
3. Inspect oil separators for evidence of restrictions and clean as necessary.
4. Visually inspect the engine cylinders for cracks, loose nuts and studs; baffles and seals for cracks and security; push rod housings and rocker box covers for leaks, cracks and security; crankcase, oil sump and oil cooler for loose bolts, cracks and oil leakage. Make necessary corrections and repairs in accordance with best shop practices and in compliance with applicable FAA regulations.
5. Perform a cylinder compression check in accordance with the engine manufacturers operator's manual.
- c. Repair and servicing.
 1. Refer to Engine Overhaul Manual and Section 9 for repair and servicing.

Engine Cowling.

- a. Cleaning.
 1. Wash cowling with Stoddard Solvent and wipe dry with a clean cloth.

CAUTION

Never use thinners or MEK to clean cowling.

- b. Inspection.
 1. Inspect cowling for cracks, elongated holes, abrasions and wear due to rubbing.
- c. Repair and Servicing.
 1. Refer to Section 16 for repair of engine cowling.

Induction Air Filter.

The induction air filters should be cleaned every 50 hours or more often under dusty conditions and replaced every engine overhaul. Under extremely dusty conditions, daily maintenance of the filter is recommended. One method is to use dry compressed air at not over 100 PSI and blow through the filter. Blow from the inside to outside to remove dirt and dust. At 50 hour intervals clean the filter as follows:

- a. Cleaning.
 1. Remove the filter from the canister.
 2. Slightly rap the filter to remove heavy dirt accumulations.
 3. Wash thoroughly, using a mild detergent, non-sudsing soap and water solution.
 4. Rinse filter with a stream of water until water is clear.
 5. Dry thoroughly using dry compressed air. Air pressure should not exceed 100 PSI.
- b. Inspection.
 1. Check filter for holes, cracks, deterioration and pleats for proper bonding.
 2. Install the filter in the canister and safety.
 3. Refer to Overhaul and Replacement chart for inspection and replacement intervals.

Induction Manifold.

- a. Cleaning.
 - 1. Clean the induction manifold when washing down engine using the same solvent.
- b. Inspection.
 - 1. Inspect the induction manifold for security, loose connections, air leaks and condition.

c. Repair of induction manifold is limited to replacement of components.

Engine Oil Pressure System.

Each engine's oil system has a capacity of 13 U.S. quarts, which includes 1 quart for oil filter. Do not operate on less than 9 U.S. quarts of oil. The filler cap is located on the upper part of the engine or between the first and second left cylinders. The oil dipstick is located outboard of the filler cap and is used to check the quantity of oil. The gear type engine oil pump is located on the lower aft end of the engine and circulates the oil through the oil system.

On aircraft 421-0001 to 421B0001 the oil filter screen, which is located in the oil pump housing, should be removed at the next 50 hour inspection except aircraft modified by SL ME70-8.

a. Cleaning.

1. Clean line assemblies and fittings with suitable solvent.

b. Inspection.

1. Start and run engine for a few moments observing oil pressure gage for fluctuations.

2. Shutdown engine and inspect oil pressure lines and fittings for leaks.

c. Repair and Servicing.

1. Anytime the oil pressure indicating system has been removed or repairs have been made the oil pressure system should be serviced as follows:

(a) With all connections tightened, start engine and allow time for the engine pumps to fill the oil pressure lines.

(b) After a positive indication of oil pressure has been noted, loosen the hose fittings on the rear of the engine gage units and allow a few drops of oil to leak from the fittings. This will bleed the trapped air from the lines and provide an accurate oil pressure indication.

Engine Oil Filter Service. (See figure 2-33.)

a. Installation and inspection.

1. Inspect and replace filter element as follows. (See figure 2-33.)

(a) Remove cowl.

(b) Remove oil filter element from adapter by loosening bolt (8).

(c) Inspect bottom surface of filter case (6) by placing a straight edge on the washer seat surface. If any distortion or out-of-flat condition greater than 0.010 inch is observed, replace filter case (6).

(d) Lubricate the gasket (4) furnished with filter element kit with a light coat of engine oil or general purpose grease which allows the gasket to move freely and seat properly.

(e) Assemble bolt (8), washer (7), through case (6) and filter element (5). Position case (6) so that element (5) is facing upwards. Assemble gasket (4) and cover (3) onto bolt (8).

(f) Assemble new gasket (2) on cover (3), turn cover (3) so that it is facing downwards. If gasket (2) falls off, replace the gasket and repeat test. Should this gasket fall from cover (3), replace the

cover.

(g) Inspect the adapter gasket seat for possible gouges, excessive scratches, wrench marks or other types of mutilation. If defects are found, replace the adapter.

(h) Inspect threaded hole in the center of the adapter gasket seat. If the hole is off center more than .030 inch, replace the adapter.

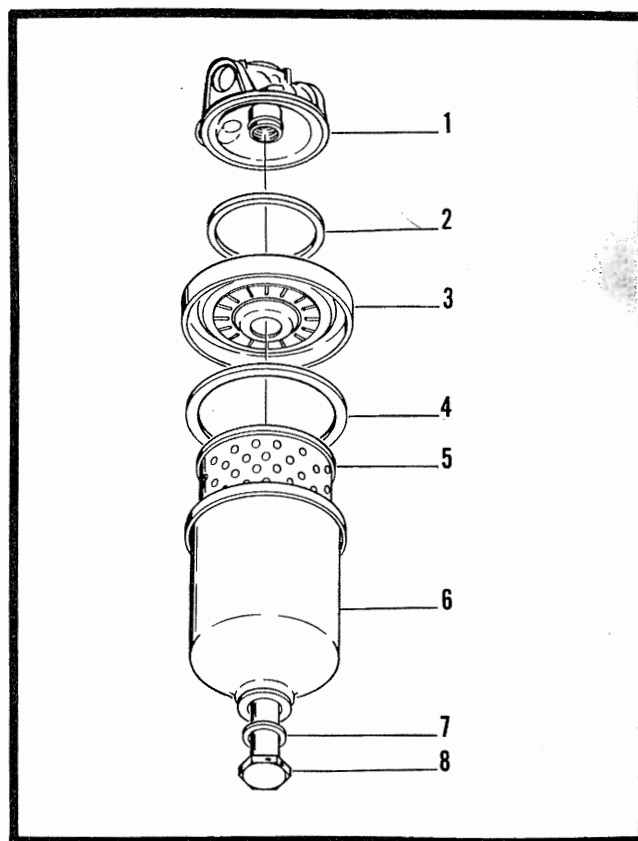
(i) Install the assembled oil filter on the adapter (1) but DO NOT allow the gasket (2) to make contact with the gasket seat. Hold the oil filter assembly to prevent it from turning, torque the filter bolt (8) 15 to 18 foot-pounds (180 to 216 inch-pounds).

NOTE

If torque wrench is not available, tighten bolt 1-3/4 turns after gasket (2) snugs against the gasket seat.

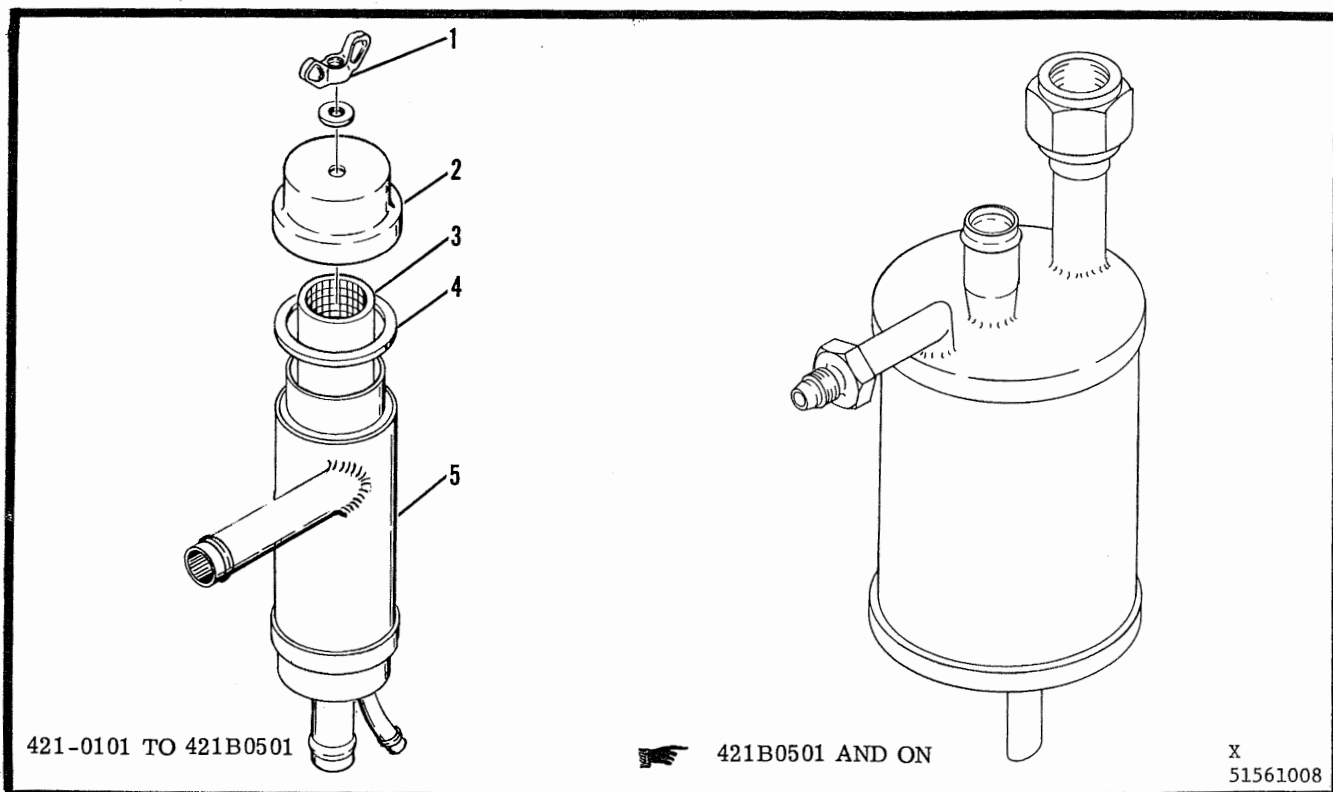
(j) Refill engine with proper grade and quantity of oil. Start engine and run for 5 minutes at 1000 RPM and check for leaks after the engine has warmed properly, cycle through at least one high power setting.

(k) If gasket (2) protrudes more than twice as much on one side as on the other, the gasket has be-



1. Adapter	5. Filter Element
2. Gasket (Cover to Adapter)	6. Filter Case
3. Cover	7. Washer
4. Gasket (Case to Cover)	8. Bolt

Figure 2-33. Oil Filter Assembly



1. Wing Nut	3. Element	4. Gasket
2. Top		5. Body

Figure 2-34. Oil Breather-Separator

come unseated during assembly. This condition indicates that either the cover or adapter are faulty and should be replaced.

(1) Recheck filter bolt torque and safety wire the filter assembly.

Oil Breather-Separator. (See figure 2-34.)

a. Cleaning.

1. Wash metal parts and element in suitable solvent and allow to dry.

b. Inspection.

1. Inspect metal parts for cracks in body and around the welded tubes.

2. Inspect filter element for clogging and general deterioration.

NOTE

If inspection of filter reveals damage or deterioration, replace element with P/N 0850694-5.

Engine Compartment.

a. Cleaning.

1. Spray engine compartment with a suitable solvent and allow to drain and air dry.

b. Inspection.

Change 12

1. Visually inspect the engine compartment for evidence of chafing lines and wires, evidence of fuel leaks, oil leaks, burned spots, parts for excessive wear, loose connections, loose bolts and entire area for cracks, nicks and bends.

c. Repair and Servicing.

1. Refer to Section 16 for repairs.

Engine Compartment Fire Extinguisher.

a. Cleaning.

1. Wipe with a clean dry cloth.

b. Inspection.

1. Inspect the fire extinguisher bottles for proper operating pressure. Replace bottle if pressure is not satisfactory.

NOTE

The pressure-temperature correction table indicates upper and lower pressure limits at a specified ambient temperature.

2. Inspect the extinguisher bottles for security, electrical connections and replacement schedule.

3. Inspect the deployment tubes for security and outlet obstruction.

c. Repair and Servicing.

1. Repair of components is limited to replacement of parts.

2. Refer to Section 13 for servicing the fire extinguisher.

Engine Controls.

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

Engine Wire Bundles.

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

Engine Mounts.

- a. Cleaning.
 - 1. Clean engine mounts with a suitable solvent.

CAUTION

Never use a wire brush or sandpaper to clean engine mounts.

- b. Inspection.
 - 1. Refer to the Inspection Chart for interval.
 - 2. Inspect protective boots for discolored areas or spots.
 - 3. Displace protective boots and inspect engine mounts for security, safetying, looseness, deterioration, cracked fitting, localized burning, blistering, sagging and end separation.

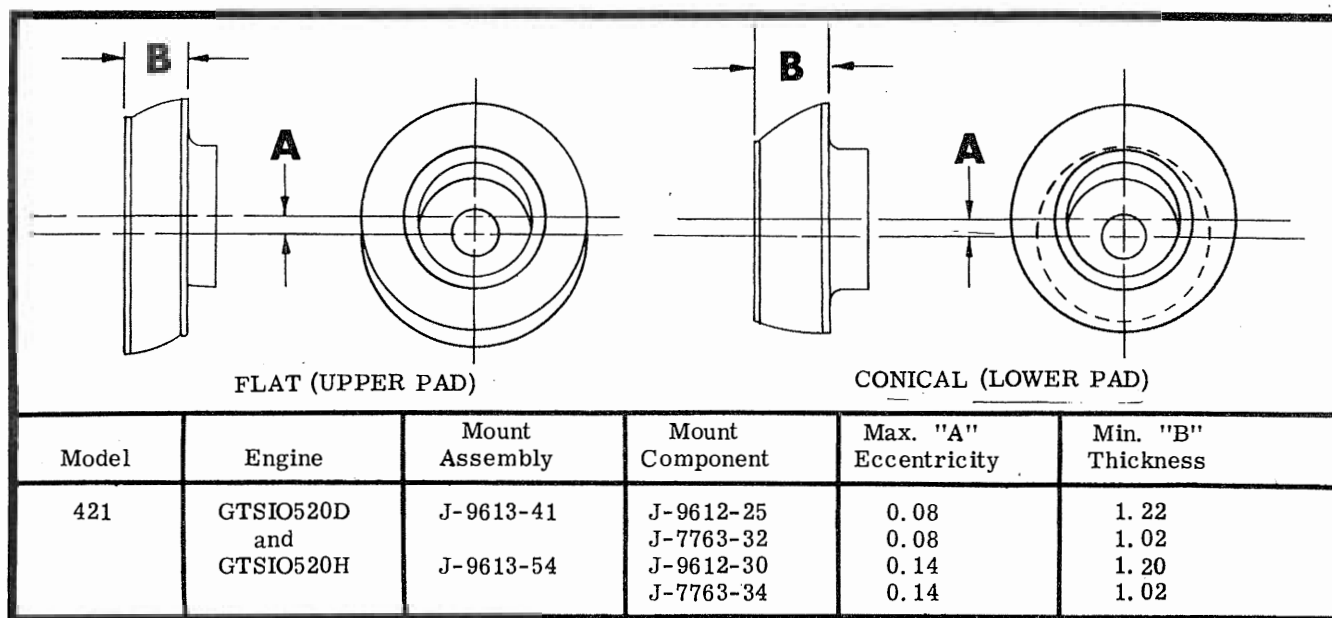


Figure 2-35. Engine Mount Inspection Limits

4. If isolated discolored spots are present on protective boots, rotate the affected area away from the vicinity of the exhaust system.

5. If areas of discoloration or cracks are found in protective boots, replace boots.

6. Check engine mount for sag.

NOTE

If the area between the exhaust riser of number six cylinder and the lower cowl panel does not have a minimum of 0.40 inch clearance, refer to Section 9 and install engine mount shims.

7. See figure 2-35 for inspection requirements.

NOTE

At each engine overhaul period it is recommended that engine mounts be replaced. Engine mounts which have been replaced prior to the normal engine overhaul may be reused providing dimensions are within inspection requirements.

Engine Compartment Hoses.**a. Cleaning.**

1. Clean engine compartment hoses by washing engine compartment down with mineral spirits or a suitable solvent.

CAUTION

Never use inflammable or combustible solvents.

b. Inspection.

1. Inspect all engine compartment hoses for ex-

cessive wear, cracks, nicks, bulges, deterioration, discoloration, bleaching and rubber hoses for hardening.

NOTE

Teflon hose assemblies exhibit considerable stiffness throughout their useful life. Reasonable stiffness is normal and does not indicate that the line should be replaced.

2. Inspect engine compartment fuel hoses under pressure for deformation and leaks as follows:

(a) Make sure throttles are in idle position and mixture controls are in idle cutoff.

(b) Turn prime switch on and assure boost pumps are operating in HI position.

(c) Check hoses for leaks, bulges, deterioration, and deformation.

3. Inspect hoses in the high heat areas such as close proximity of exhaust stacks or turbocharger area for heat deterioration and hardening or cracking due to age.

c. Repair and Servicing.

1. Refer to Overhaul and Replacement Chart for replacement intervals of engine compartment hoses.

Spark Plugs.**a. Cleaning.**

1. Clean the spark plugs with an abrasive type cleaner.

b. Inspection.

1. Inspect spark plugs for proper gap 0.015 to 0.018 inches.

2. Inspect porcelain for cracks and evidence of arcing.

c. Repair and Servicing.

1. Rotate spark plugs top right to bottom left, and top left to bottom right.

Ignition Cables.

a. Cleaning.

1. The ignition cables should be wiped clean using a clean cloth and DC4 Silicone grease.

b. Inspection.

1. Inspect the ignition cable for damaged insulation and the end fitting for evidence of cracks and damage.

c. Repair and Servicing.

1. Refer to Section 9 for maintenance and care of the ignition cables.

Magneto.

a. Cleaning.

1. Clean the magnetos with a suitable solvent such as Stoddard solvent and dry with dry compressed air.

b. Inspection.

1. Inspect the magneto for proper breaker point gap (refer to Section 9), and evidence of moisture and arcing.

2. After rough engine operation, inspect magneto drive couplings. Refer to Section 9.

c. Repair and Servicing.

1. Refer to Section 9 for proper maintenance and care of the magneto.

Alternator.

a. Cleaning.

1. The alternator should be washed down at the time the engine is cleaned using the same cleaning procedure.

b. Inspection.

1. Check wiring for breaks and evidence of wear.

NOTE

For electrical output and operational check, refer to Section 14.

c. Repair and Servicing.

1. Refer to Section 14 and Overhaul and Replacement Chart (figure 2-8).

Pumps.

a. Cleaning.

1. The fuel, vacuum, and autopilot pumps should be washed down at the same time as the engine, using the same solvent.

b. Inspection.

1. Inspect the pumps for evidence of leaking, condition and security.

c. Repair and Servicing.

1. Repair of the engine driven pumps is limited to replacement. Refer to Overhaul and Replacement Chart (figure 2-8).

Turbocharger.

a. Cleaning.

1. Clean outer surface of turbocharger with a suitable solvent.

b. Inspection.

1. Remove turbocharger heat shield from turbine and inspect housing for cracks or bulges.

2. Remove the tail pipe from the turbine and visually inspect the impellers and visible portions of turbine for coking, carbonization, oil deposits, nicks or dents.

c. Repair and Servicing.

1. If cracks or bulges do appear on the turbine housing, replace housing in accordance with the Turbocharger and Controls Overhaul/Parts Manual.

2. For removing coke and carbonized oil deposits, refer to the Turbocharger and Controls Overhaul/Parts Manual.

Manifold Pressure Relief Valve.

a. Cleaning.

1. Clean dirt and debris from valve with a suitable cloth.

b. Inspection.

1. Inspect relief valve vents for obstructions or foreign material.

2. Check for proper operation as follows:

- (a) After adequate engine warm up with oil temperature at the lower third of green arc, accelerate the engine rapidly from idle to maximum RPM.

CAUTION

Discontinue acceleration if manifold pressure exceeds 43.5 in. Hg.

- (b) If maximum manifold pressure exceeds 43.5 in. Hg., immediately reduce power and shut down engine. Manifold pressure relief valve is faulty and must be replaced.

Engine Exhaust System.

a. Cleaning.

NOTE

In order to properly inspect the exhaust system, components must be clean and free of oil, grease, etc. If required, clean as follows:

1. Spray engine exhaust system components with a suitable solvent (such as Stoddard Solvent), allow to drain and then wipe dry with a clean cloth.

WARNING

Never use highly flammable solvents on engine exhaust systems.

Never use a wire brush or abrasives to clean exhaust systems or mark on the system with lead pencils.

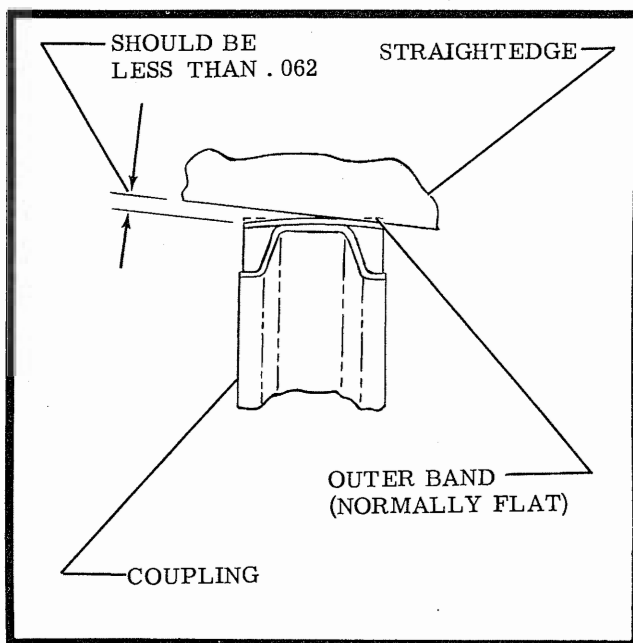


Figure 2-36. Exhaust Coupling Deformation Limits

b. Inspection.

NOTE

This inspection should be conducted when the engine is cool.

1. Remove the heat shields on the turbocharger in accordance with heat shield removal procedures in the service manual.

2. Remove shields around the exhaust bellows or slip joints, multi-segment V-band clamps at joints, and other items which might hinder inspection of the system.

NOTE

Do not remove clamps.

3. Inspect exhaust stacks for burned areas, cracks and looseness. Insure that attach bolts are properly torqued in accordance with the aircraft service manual.

4. Inspect exhaust clamps for cracks, looseness and proper torque. Refer to figure 9-21.

NOTE

During inspection, particular attention should be given to condition of the clamp flanges, bellows or slip joints and welded areas along seams and around the bellows or slip joints.

5. Inspect exhaust joint springs for correct compression only if the joint is disturbed (see figure 9-5).

(a) Before removal of exhaust joint springs,

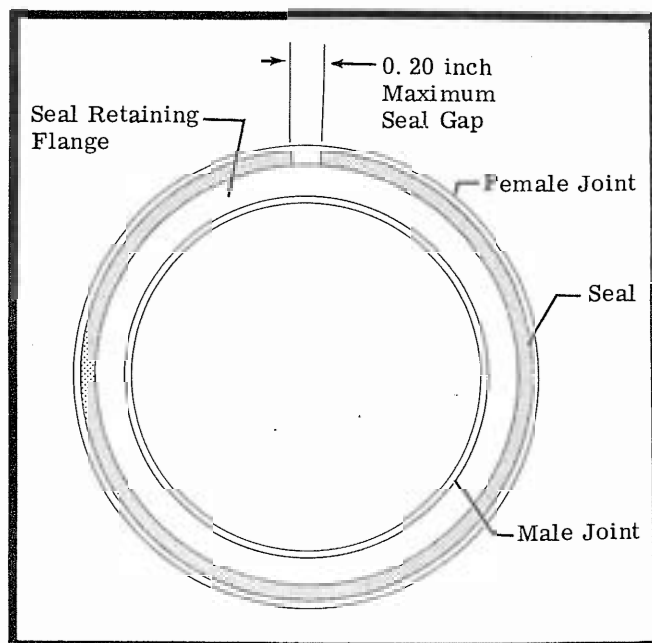


Figure 2-36A. Exhaust Slip Joint Inspection Limit

measure installed length of each spring. Those compressed to less than 0.45 inch must be replaced.

(b) Remove all springs and measure free length. Springs having a free length of less than 0.57 inch must be replaced.

NOTE

Add AN960-10 washers under head of joint bolts as required to obtain correct dimension.

During installation, joint bolts should be tightened gradually and spring length checked frequently to prevent over compression of springs.

(c) Reinstall springs and measure installed length. Length must be $0.51 \pm .00, -.03$ inch.

6. Inspect multi-segment V-band clamp for deformation, looseness and leakage (see figure 2-36).

(a) Inspect installed clamps for deformation by checking the flatness of the outer back-up band, especially within 2 inches of the spot welded tabs which retain the T-bolt fastener. This can be done by placing a straight edge across the flat part of the outer band as shown, then check the gap between the straight edge and band. This gap should be less than 0.062 inch.

(b) If deformation gap exceeds the 0.062 inch limit the clamp must be replaced with a new part. When replacement is required, install the new clamp over the exhaust flange and torque to the correct value. As the band is tightened, lightly tap it circumferentially in a radial direction with a rawhide or soft plastic mallet.

(c) Clamps found in acceptable condition should then be checked for looseness and leakage. Only

clamps which are obviously loose or leaking should be retorqued. If retorquing is required, refer to figure 9-21.

(d) The flexible connection between the waste-gate and overboard duct (when applicable) must be visually inspected for cracks and security.

(e) Any leakage (minor or major) in all other areas of the exhaust system must be corrected.

NOTE

If not previously accomplished, the overboard exhaust stack to turbocharger clamps (multi-segment V-band type) must be replaced with a new one-piece V-clamp.

The remainder of the multi-segment V-band clamp(s) down stream of the aft engine cylinders are "Life Limited" to 400 hours. These clamps must be replaced on or before 400 hours of service and every 400 hours thereafter.

Inspection For Oil Screen. (421-0001 to 421B0001)

- a. Lower the right-hand nacelle cowl to remove the oil screen.
- b. Remove oil filter line from oil discharge port cap.
- c. Remove discharge cap from oil pump housing.
- d. If screen is present, proceed as follows:
 1. Clean all flammable fluids from cap assembly.
 2. Secure cap hexagonal head on a bench vise with screen oriented upwards.
 3. Apply heat with a propane torch on the general area of the screen cap soldered interface, and remove screen by pulling with a wire loop or pliers.

CAUTION

Do not use oxyacetylene equipment since the excessive heat could damage oil discharge cap.

4. Clean and inspect cap for loose solder or screen wire particles.
- e. Install cap on oil pump discharge port and connect hose assembly and fittings.

PROPELLERS.

a. Cleaning.

1. Clean all metal parts in a mixture consisting of 1/3 lubricating oil, Specification MIL-L-6082, Grade 1030, and 2/3 solvent, Federal Specification P-S-661.

Clean small, highly finished parts separately, exercising care not to cause damage, particularly to working surfaces.

NOTE

Inside diameter of counterweight halves and ferrule groove in which they mount, must be free of all oil. Use solvent only - not the mixture - to clean these surfaces. Should cleaning mixture or any other lubricant accidentally come into contact with these surfaces, clean thoroughly prior to reassembly.

2. Clean non-metallic parts (except gaskets, packings and seals) by wiping with a soft, lint-free cloth dampened with cleaning mixture.

3. Heavy and tightly adhering deposits may be removed with a soft brush.

CAUTION

Under no circumstances are any parts to be cleaned with a steel, other metal, or hard bristle brush or tool of any type.

4. After cleaning, allow parts to air dry, or remove excess mixture with a gentle stream of clean, dry compressed air. Keep nozzle well away from parts.

5. Protect parts from collecting dust and dirt during storage and handling for overhaul. It is recommended that small parts be kept in transparent plastic bags.

6. Parts which are to be coated with dry film lubricant are to be cleaned with ethyl acetate immediately prior to application of lubricant.

WARNING

Under no circumstances should engine operation be continued when the presence of a crack in the propeller is suspected.

b. Inspection.

1. Refer to the Inspection Chart, figure 2-7, and McCauley Industrial Corporation's Service Manual.

2. Refer to the Inspection Chart, figure 2-7, for interval, and visually examine the condition of the epoxy sealant by looking through the hole in the spinner. The outboard end of the retention nut to hub connection will appear as a wide, circumferential flat with a narrow, light brown colored groove in the center. The light brown material is epoxy sealant and should be in place without evidence of missing portions. A normal appearance may include several areas with air bubbles on the surface. If in doubt, rock the blades and check for noticeable movement between the nut and hub.

CAUTION

If one propeller is found with missing portions of epoxy sealant and/or loose retention nut, remove and repair both propellers even though the mating propeller appears to be in satisfactory condition.

3. Anytime the propeller attachment has been subjected to excessive engine roughness, inspect in accordance with Rough Engine Operation Inspection, Section 9.

4. Check propeller attachment nuts for 80-85 foot-pounds torque. If torque is less than 80 foot-pounds, replace nuts with new elastic element lock nuts.

c. Repair and Servicing.

1. Any repairs should be made in accordance with best shop practices as outlined in McCauley Industrial Corporation's Service Manual and FAA regulations.

2. Refer to McCauley Industrial Corporation's Service Manual and lubricate only on reassembly.

Propeller Deice System.

a. Cleaning.

1. Clean brushes and slip ring with a suitable non-corrosive solvent.

b. Inspection.

1. Inspect for interference between the propeller hub and deice slip ring mounting bolts on McCauley "K" series propellers. If interference is found, refer to Section 10 for the corrective procedure.

2. Inspect propeller deice brushes for correct length and alignment in accordance with Section 13.

Propeller Unfeathering System.

a. Cleaning.

1. Clean accumulator with suitable solvent.

2. Wipe hoses and accumulator with a clean cloth.

b. Inspection.

1. Inspect hose assemblies for chafing and fittings for tightness.

2. Inspect accumulator for security in mounting brackets.

3. Always inspect filler valve after charging for leaks.

c. Repair and Servicing.

1. Repairs to propeller unfeathering system are limited to replacement of components.

CAUTION

Always release system pressure by placing propeller control in unfeathered position and release accumulator pressure through filler valve, before disconnecting hose between accumulator and governor or removing accumulator.

2. Service accumulator as follows:

(a) Place propeller control in the unfeathered position before charging the accumulator to prevent the possibility of oil under pressure being trapped in the accumulator.

(b) Although the accumulator will function properly when charged with air, dry nitrogen gas is recommended to minimize corrosion.

(c) Either too much pressure or not enough pressure in the accumulator will reduce efficiency of the unfeathering system. Service accumulator to 75-90 psi.

(d) Always check and make sure the filler valve does not leak after charging the accumulator.

Propeller Synchronizer.

a. Cleaning.

1. Clean external parts of propeller synchronizer actuator by wiping with a clean cloth.

b. Inspection.

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

c. Repair and Servicing.

1. Refer to Section 10 for repair and servicing.

FUEL SYSTEM.

Fuel-Air Control.

a. Cleaning.

1. Remove the metering unit filter screen and clean the screen in fresh cleaning solvent. Reinstall and safety.

b. Inspection.

1. Check control connections, levers, and linkage for security of attaching parts, for safetying and lost motion due to wear.

2. Check the air control body for cracks and the fuel-air control unit for overall condition.

Fuel Manifold.

a. Cleaning.

1. Disconnect the overboard vent line from the manifold top cover.

2. Hold the top cover down against internal spring until all four attaching screws have been removed, then gently lift off the cover. Use care not to damage the spring-loaded diaphragm below.

3. Remove the upper spring and lift the diaphragm assembly straight up.

NOTE

If the valve attached to the diaphragm is stuck in the bore of the body, grasp the center nut and rotate and lift at the same time to work gently out of the body.

WARNING

Do not attempt to remove needle or spring from inside valve. Removal of these items from the valve will disturb the 4 PSI factory calibration.

4. Remove the flushing plug located opposite the inlet fitting.

CAUTION

The filter screen is a tight fit and may be damaged if removal is attempted. It should be removed only if a new screen is to be installed.

5. Using clean gasoline, flush out the chamber below the screen.
6. Flush above the screen and inside the center bore making sure that outlet passages are open. Use only a gentle stream of compressed air to remove dust and dirt and to dry.
7. Replace flushing plug.
8. Clean the diaphragm valve, top cover and springs in the same manner.
9. Carefully replace diaphragm and valve in manifold body. Check that valve works freely.
10. Place upper spring in position.
11. Align mounting holes in body, diaphragm and top cover locating the vent fitting hole in the cover to the side. Hold the cover down against the spring while installing and tightening all four attaching screws. Safety the screws.
12. Connect overboard vent line.

Fuel Discharge Nozzles.

- a. Cleaning.
 1. To clean fuel discharge nozzles, immerse in fresh cleaning solvent.

CAUTION

Do not use a wire brush or other sharp metal objects to clean orifices. This will damage orifice.

- b. Inspection.
 1. Inspect the fuel discharge nozzle for damaged orifice, dirt and foreign objects.

Fuel Selector Valve.

- a. Cleaning.
 1. Fuel selector valve handles - OFF.
 2. Drain excess fuel from sediment bowl with quick-drain.
 3. Remove the lower access cover plate.
 4. Remove the eight screws securing sediment bowl to bottom of selector valve and remove bowl and filter assembly.
 5. Clean filter in fresh solvent and air dry.
- b. Inspection.
 1. Inspect quick-drain valve, gasket, filter and fuel selector for nicks, dents, scratches, dirt accumulation and other foreign matter.
 2. Refer to Inspection Chart for interval of inspection.
 3. Refer to Section 11, figure 11-8. Reassemble selector valve. Make sure filter is installed with large hole facing up. Replace gasket with a new gasket.

Fuel Selector Valve Control System.

- a. Cleaning.
 1. Clean the fuel selector valve with a suitable solvent, wipe clean with a dry cloth.
- b. Inspection.
 1. Inspect fuel selector valve control system for

binding of control, travel, proper operation, excessive wear, safetying and detent position.

CAUTION

The fuel selector valve should always stop in a detent position, never intermediate. If the fuel selector stops in an intermediate position, the controls are improperly rigged, and should be rigged in accordance with Section 11.

Fuel System - Main.

- a. Visually inspect filler cap gasket. If crushed or damaged, replace filler gasket.
- b. Remove main tank nose cap (Section 11); visually inspect area for evidence of fuel leakage.
 1. If fuel leakage is evident, defuel the main tank and replace the stat-o-seals and/or panel gaskets as required.

NOTE

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

- c. Purge in accordance with Section 2.
- d. Refer to Section 11 for cleaning and inspection of disassembled main fuel system.

Fuel System - Auxiliary.

Refer to Inspection Chart and Section 11 for cleaning and inspecting of auxiliary fuel system.

Main Tank Fuel Transfer Pump.

- a. Cleaning.
 1. Refer to Section 11, Main Tank Fuel Transfer Pump for cleaning and inspection of main tank transfer pump.

OXYGEN SYSTEM.

Filler Valve.

- a. Cleaning.
 1. The filler valve should be cleaned with trichloroethylene MIL-T-7003.
 2. Clean Freon MIL-C-8638 or Alcohol may be used as an alternate.
- b. Inspection.
 1. Inspect the filler valve for nicks, cracks and deep gouges.
- c. Repair and Servicing.
 1. Repair is limited to the replacement of parts. Refer to Section 13 for servicing oxygen system.

Oxygen Regulator and Cylinder.

- a. Cleaning.
 - 1. Clean regulator and cylinder with a clean cloth.
- b. Inspection.
 - 1. Refer to Section 13 for inspection requirements and criteria.
 - 2. Refer to Section 13 for Hydrostatic Test Date on oxygen cylinder.

c. Repair and Servicing.

- 1. Refer to Section 13 for repair and servicing oxygen cylinders and regulators.

Oxygen Masks and Hoses.

- a. Cleaning.
 - 1. Clean the mask and hoses with a mild solution

of soap and water. Rinse thoroughly with clean water and allow to dry.

NOTE

Make sure all soap is removed by rinsing. Masks may be disinfected with a hospital type antiseptic spray or Zep Aero SBT-12, or denatured alcohol.

CAUTION

Remove microphone from pilot's mask before cleaning.

- b. Inspection.
 1. Inspect mask and hoses for leaks, cracks, and deterioration. Check mask stowage compartment for cleanliness and general condition. Check flow indicator for freedom of movement.
 2. Inspect couplings and adapters for proper insertion.
- c. Repair and Servicing.
 1. Refer to Section 13 for repair and servicing.

VACUUM SYSTEM.

Vacuum System Components.

- a. Cleaning.
 1. The vacuum system components may be cleaned by immersing lines and hoses in dry cleaning solvent, and dried with filtered dry compressed air.
 2. Wipe exterior of lines and hoses with a clean, dry cloth.
 3. Clean vacuum system filter with a jet of clean, dry air and tapping lightly while blowing air over the filter.
 4. Remove the relief valve screen and submerge in suitable solvent. Allow to soak or wash until all foreign particles are dislodged.
 5. Clean relief valve if required by washing in suitable solvent and drying with filtered dry compressed air.
- b. Inspection.
 1. Inspect the vacuum system for scratches, chips, nicks, dents, deformed tubes, sharp bends, dirt, proper operation and correct vacuum indication.

SURFACE DEICE SYSTEM.

Surface Deice System Components.

- a. Cleaning.
 1. The deice system components can be washed down with the engine using Stoddard Solvent.
 2. The deice boots can be cleaned using soap and water.

NOTE

Never use thinners, Ketone or harsh solvents on deice boots.

b. Inspection.

1. Inspect the deice system for leaks, remove filter and clean with Naptha and dry with a jet of dry compressed air.

c. Repair and Servicing.

1. Repair of the deice system components is limited to the replacement of parts.
2. For repair of the deice system boots, refer to Section 13.
3. For replacement of the filter P/N H95888-36, refer to Overhaul and Replacement Chart.

PITOT STATIC SYSTEM.

Pitot Static System Components.

a. Cleaning.

1. Immerse lines in dry cleaning solvent.

NOTE

All pitot static components must be disconnected from instruments and removed from the aircraft when cleaning.

2. Dry lines with filtered compressed air.
 3. Wipe exterior of lines with a clean, dry cloth.
- b. Inspection.
 1. Inspect lines for cracks, chafing and abrasions.
 2. Refer to Section 12 for testing.

NOTE

Make sure alternate static source valve is closed before returning aircraft to service.

AIR CONDITIONING SYSTEM. (Belt Driven)

a. Cleaning.

1. The air conditioning components should be wiped clean with a cloth and a stream of low pressure dry air.

3. Clean and flush condensate valve with water.

b. Inspection.

1. Refer to Section 13, figure 13-27 for 421A0001 to 421B0001 and figure 13-27F for 421B0001 and On, for checking compressor oil level.
2. Remove lint, grease or other debris from evaporator module coils.

3. Clean and flush condensate valve with water.

b. Inspection.

1. Refer to Air Conditioning System Service/Parts Manual for checking compressor oil.
2. Check lines and fittings for evidence of oil seepage around compressor.

CAUTION

If evidence of oil seepage is noted around the compressor shaft or at the system fittings, the compressor seal should be replaced, the fittings tightened, the oil checked for proper servicing and the refrigerant system checked for proper charge.

3. Check compressor drive belt for fraying, looseness, evidence of cuts, nicks, heat deterioration hardness, and alignment of pulleys. Refer to Section 13 for drive belt tension.

NOTE

If the drive belt is out of alignment it will necessitate adding shims to the compressor mounting to properly align belt.

4. Check compressor discharge and suction lines for cracking, fraying or evidence of high temperatures.
 5. Check compressor support bracket bushings for deterioration or wear.
 6. Check condenser fan blade, evaporator motor shaft, condensers, receiver-dryer, condenser fan motor and evaporator modules for looseness and security of mounting.
 7. Check condenser coil inlets and evaporator coil inlets for paper, lint, grease or other debris.
 8. Check freon sight glass for bubbles with air conditioning system in operation, add more freon until bubbles are not indicated in accordance with the Charging Procedures in the Air Conditioning System Service/Parts Manual.
 9. Check brushes on condenser fan motor for proper length. If brush length is 1/4" or less new brushes are required. Refer to Air Conditioning System Service/Parts Manual.
 10. Check condenser fan blade for excessive nicks, cracks or hub looseness.
- c. Repair and Servicing.
1. Repair of the air conditioning system is limited to component replacement. Refer to Section 13 for the removal, replacement and installation of various air conditioning components.

AIR CONDITIONING SYSTEM. (Hydraulic Driven)

- a. Cleaning.
1. The air conditioning components should be wiped clean with a cloth and a stream of low pressure dry air.
 2. Remove lint, grease or other debris from evaporator module coils.
 3. Clean and flush condensate (drain) valve with water.
- b. Inspection.
1. Refer to Air Conditioning System Service/Parts Manual for checking compressor oil level.
 2. Check refrigerant lines and fittings for evidence of oil seepage around compressor.

CAUTION

If evidence of oil seepage is noted around the compressor shaft or at the system fittings, the compressor seal should be replaced, the fittings tightened, the oil level checked for proper level and the refrigerant system checked for proper charge.

3. Check hydraulic lines and fittings for evidence of hydraulic fluid seepage around pump, motor, manifold and valve assembly and reservoir.

NOTE

If evidence of hydraulic fluid seepage is noted, tighten the fittings and check the hydraulic fluid reservoir for proper level.

4. Check compressor discharge, suction and liquid injection lines and hydraulic fluid lines for cracking or evidence of high temperatures.
 5. Check condenser blower fan blade, evaporator motor shaft, condensers, receiver-dryer, condenser fan motor and evaporator modules for looseness and security of mounting.
 6. Check condenser coil inlets and evaporator coil inlets for paper, lint, grease or other debris.
 7. Check freon sight glass for bubbles with air conditioning system in operation, add more freon until bubbles are not indicated in accordance with the charging procedures in Air Conditioning Systems Service/Parts Manual.
 8. Check brushes on condenser fan motor for proper length. If brush length is 1/4 or less new brushes are required. Refer to Replacement of Condenser Blower Motor Brushes in Air Conditioning Systems Service/Parts Manual.
 9. Check condenser fan blade for excessive nicks, cracks or hub looseness.
- c. Repair and servicing.
1. Repair of the air conditioning system is limited to component replacement. Refer to Section 13 for removal, replacement and installation of various air conditioning components.

PRESSURIZATION SYSTEM COMPONENTS.

Safety Valve and Outflow Valve.

a. Cleaning.

1. Clean the safety valve and outflow valve exterior surfaces and valve seat faces with a clean cloth saturated with a suitable solvent such as an 8 to 1 solution of Burlin 815 MS or a sponge soaked with diluted as required solution of NRG No. 678 (National Colloid Corporation, P. O. Box 293, Garden Grove, California 92642). This will remove tars and nicotine deposits from valves and valve seat faces.

CAUTION

- Raise outflow valve with hands as nearly 180° apart as possible. Raising from one side only may damage the outflow valve pilot. Also do not use compressed air in the cleaning of any part of the unit as serious damage to the diaphragms may result.

- Extreme care must be taken to prevent the solution from entering the valves internal cavities. During cleaning of the assembled valves, all sense ports must be protected to prevent solution from entering the internal parts of the valve.

2. Clean outflow valve and safety valve filters by removing and soaking in a mild detergent and rinsing in clear water and allow to air dry.

b. Inspection.

1. Inspect the poppet in the safety valve and outflow valve for freedom of movement.

2. Inspect the fittings and lines for security and condition.

3. Inspect landing gear safety switch to assure actuation of safety valve as described in Adjustment of Landing Gear Safety Switch procedures, Section 4.

c. Repair and Servicing.

1. Repair of the safety valve and outflow valve is limited to the replacement of the valves.

Dump Valve.

a. Cleaning

1. Cleaning the dump valves requires the removal of the valves and cleaning in a suitable solvent (refer to Janitrol instructions P/N 43D57).

b. Inspection.

1. Inspect dump valves for proper operation, security, condition and wear.

c. Repair and Servicing.

1. Refer to Janitrol instructions P/N 43D57 for repair and servicing dump valves.

Door Seals.

a. Cleaning.

1. Clean door seals with a mild detergent solution and dry with a clean cloth.

b. Inspection.

1. Inspect door seals for cuts, breaks, tears and abrasions.

c. Repair and Servicing.

1. Refer to Section 16 for repair of the door seals.
2. Refer to Lubrication Diagram for lubrication of door seals.

ALCOHOL WINDSHIELD ANTI-ICE SYSTEM.

Alcohol Windshield Anti-Ice System Components.

a. Cleaning.

1. Immerse lines in a dry cleaning solvent.

NOTE

Lines not readily removable from aircraft may be flushed with cleaning solvent. Take necessary precautions to protect windshield.

2. Dry lines with filtered compressed.

3. Clean pump filter screen in accordance with Cleaning and Inspection of Main Tank Fuel Transfer Pump Parts (Section 11).

b. Inspection.

1. Inspect lines for cracks, chafing and abrasions.

2. Inspect lines and adjacent areas for evidence of leakage.

3. Inspect pump for security and operation.

ELECTRICAL SYSTEM.

Inspection.

- a. Inspect the electrical system and components for the following:
 1. All aircraft and systems wiring for chafing, terminals for security, and general condition.
 2. Circuit breakers for mounting and condition.
 3. Regulators for mounting, terminals for loose wires.
 4. Switches for loose wiring, proper mounting.
 5. Relays for wiring and mounting.
 6. Motors for proper mounting and wires for clamping.
 7. Battery cables for corrosion and looseness.
 8. Battery for electrolyte level and specific gravity.
 9. Instruments and interior lights for operation and broken glass.
 10. Communications and navigation system for proper installation, security in mounts and proper operation, antenna for damage.
 11. Instrument panel and control pedestal for loose wiring, clamps and terminals for security.
 12. Wing and fuselage wiring for proper wire routing, clamped properly and loose terminals.
 13. External power receptacle for proper door closing, terminals for corrosion and looseness.
 14. Engine compartment wire bundles for proper clamping, evidence of burning, heat hardness, security and chafing.
 15. Stall warning vane and heater for proper operation and security.
 16. Electric heated windshield for operation.

Battery.

NOTE

If excessive corrosion is detected around upper portion of battery box, remove the battery and inspect battery box and surrounding area of wing for corrosion.

a. Cleaning.

1. Clean batteries with a mild solution of bicarbonate of soda (baking soda) and water to remove acid corrosion.

NOTE

Remove batteries from aircraft before cleaning.

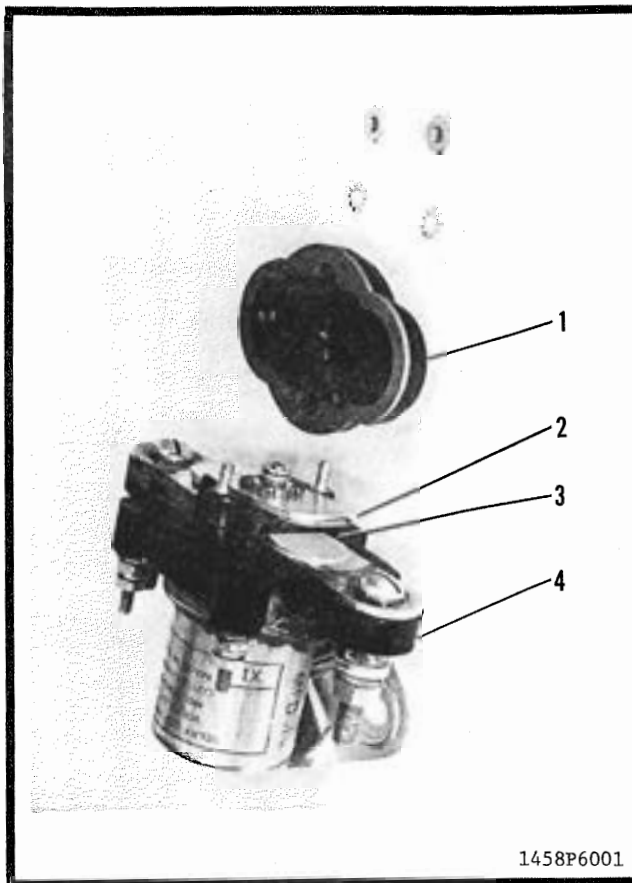
2. Rinse with clear water and sponge off excess water and allow batteries to dry.

CAUTION

Take special precautions to insure that battery cell filler caps are tight before cleaning the battery. Entrance of soda water into battery cells will neutralize the cell electrolyte.

Do not allow acid deposits to come in contact with skin or clothing. Serious acid burns may result unless the affected area is washed immediately with soap and water. Clothing will be ruined upon contact with battery acid.

3. Clean battery terminals as needed with a wire brush to brighten the terminals for good electrical



1. Cover	3. Contact Area
2. Contactor	4. Relay

Figure 2-36B. Starter Relay Inspection

contact. Coat with Petrolatum to prevent corrosion.

b. Inspection.

1. Check battery case for possible cracks and deterioration.
2. Check electrolyte for specific gravity as follows:
 - (a) Using a hydrometer, check specific gravity for a reading of 1.265 to 1.285 corrected to temperature.
 - (b) Check that specific gravity of the electrolyte does not vary more than .020 between cells.
 - (c) Should a greater variation exist, refer to Maintenance of Battery, Section 14.

CAUTION

Remove batteries from aircraft when charging the batteries. Do not use external power generators for charging purposes.

Battery Box.

NOTE

At 100 hours, battery removal is not required if corrosion is not evident around upper portion of box, at 200 hours, the battery must be removed and the battery box thoroughly cleaned and repainted as necessary.

a. Cleaning.

1. Battery lead should be cleaned with a strong solution of bicarbonate of soda (baking soda) and water.
2. Clean hard deposits of spilled acid and corrosion products using a wire brush.
3. When all foreign materials have been removed from the box, flush it thoroughly with clean water.
4. After cleaning battery box, flush surrounding skin with clean water to ensure that all corrosive material has been removed.

CAUTION

Do not allow acid deposits to come in contact with skin or clothing. Serious acid burns may result unless the affected area is washed immediately with soap and water. Clothing will be ruined upon contact with battery acid.

b. Inspection.

1. Inspect the cleaned battery box for physical damage and for areas lacking proper acid proofing. Badly damaged or corroded boxes should be replaced.
2. Inspect surrounding areas of wing adjacent to battery box for damage and corrosion.
- c. Repair.
 1. Boxes requiring acid proofing should be painted inside and out with TT-L-54 Enmar Acid Proof Black lacquer.

NOTE

It is recommended that the bottom of the battery box compartment cover and the battery box supports be painted with acid proof lacquer.

Starter Relay. (See figure 3-36B.)

a. Inspection.

1. Remove starter relay.
2. Remove contact cover.
3. Inspect contact area for burned and pitted area - if 25% of area is burned and pitted, replace relay.

Emergency Locator Transmitter

a. Cleaning.

1. Clean emergency locator transmitter with a clean dry cloth.

b. Inspection.

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

NOTE

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

3. 100 Hours.

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

NOTE

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

- (b) Verify compliance with Cessna Avionics Service Letter AV74-10 and 74-14.

4. 12 Months. Have your dealer check your ELT for the following:

- (a) Power output (refer to Section 13).
- (b) Carrier frequency.
- (c) Modulation.
- (d) Sweep.
- (e) Sweep rate.
- (f) Operation of "g" switch.
- (g) Replacement of battery pack.

MISCELLANEOUS INSPECTION.

To avoid repetition throughout the inspection, general points to be checked are given below. In the inspection, only the items to be checked are listed and details as to how to check, or what to check for, are excluded. Check as applicable:

Movable Parts.

Inspect for lubrication, servicing, security of attachment, binding, excessive wear, safetying, proper operation, proper adjustment, correct travel, cracked fittings, security of hinges, defective bearings, cleanliness, corrosion, deformation, sealing, and tensions.

Engine Compartment Hoses.

Inspect for leaks, cracks, chafing, kinks, deterioration, security, heat hardness, obstructions and foreign matter. The hoses and wire bundles in the heat areas close to the exhaust and turbocharger should be inspected for heat hardness, cracking, flexibility and security during regular engine inspection. (See figure 2-7 for interval.)

Fluid Lines and Hoses.

Inspect for leaks, cracks, dents, kinks, chafing, proper radius, security, corrosion, deterioration, obstructions and foreign matter.

Metal Parts.

Inspect for security of attachment, cracks, metal distortion, broken spot-welds, corrosion, condition of paint and any other apparent damage.

Wiring.

Inspect for security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration and corroded terminals. Inspect wire bundles in high heat areas such as close proximity of exhaust stacks or turbocharger for heat damage.

Bolts in Critical Area.

Inspect for correct torque in accordance with torque values given in the chart in Section 1, when installed or when visual inspection indicates the need for a torque check.

Filters, Screens and Fluids.

Inspect for cleanliness, contamination, and/or replacement at specified intervals.

Aircraft File.

Inspect for miscellaneous data, information and licenses that are a part of the aircraft file. (See Inspection Chart, Figure 2-7.)

EXTREME WEATHER MAINTENANCE.

Cold Weather.

After the last flight of the day, drain engine oil into clean containers so it can be preheated. Cover the engines, including the rear air scoop opening, to prevent ice or snow from collecting inside the cowl-ing. When preparing an engine for operation after using this procedure, preheat the oil. After preheating the oil, gasoline may be mixed with the oil in a ration of one part gasoline to 12 parts oil before pouring the oil in the engines. If free air temperature is below -29°C (-20°F), the engine compartments should also be preheated with a ground heater. Check all engine compartment drain and vent lines for presence of ice. Remove protective covers placed on engines and rear cowl opening. Pull propellers through several revolutions by hand before starting the engines.

WARNING

Preheat oil before diluting with gasoline, and do not heat above 121°C (250°F), to prevent the possibility of a flash fire. Before pulling propellers through by hand, insure the magneto switches are OFF.

CAUTION

Due to the desludging effect of the diluted oil, engine operation should be observed closely during initial warmup of the engines. Engines that have a considerable amount of operational hours accumulated since their last dilution period may be seriously affected by the dilution process. This will be caused by the diluted oil dislodging sludge and carbon deposits within the engines. This residue will collect in the oil sumps and possibly clog the screened inlet to the oil pumps. Small deposits may actually enter the oil pumps and be trapped by the main oil filter screens. Partial, or in some cases, complete loss of engine lubrication may result from either condition. If these conditions are anticipated after oil dilution, the engines should be run for several minutes at normal operating temperatures and then stopped and inspected for evidence of sludge and carbon deposit in the oil sumps, oil coolers, and oil filter screens. Future occurrence of this condition can be prevented by diluting the oil prior to each oil change. This will prevent accumulations of sludge and carbon deposits within the engines.

Hot Weather.

In hot weather, with hot engine, fuel may vaporize at certain points in the fuel system. Vaporized fuel may be purged by setting the mixture control in IDLE CUT-OFF and operating the auxiliary fuel pump on "HI."

Engine mis-starts characterized by weak, intermittent explosions followed by puffs of black smoke from the exhaust are caused by over-priming or flooding. This situation is more apt to develop in hot weather, or when the engine is hot. If it occurs, repeat the starting routine with the throttle approximately one-half OPEN, the mixture control in IDLE CUT-OFF, and the auxiliary fuel pump switch OFF. As the engine fires, move the mixture control to full RICH and decrease the throttle to desired idling speed.

Engine mis-starts characterized by sufficient power to disengage the starter but dying after 3 to 5 revolutions are the result of an excessively lean mixture after the start. This can occur in either warm or cold temperatures. Repeat the starting routine but allow additional priming time with the auxiliary fuel pump switch to "LO" before cranking is started, or place the auxiliary fuel pump switch on "HI" immediately for a richer mixture while cranking.

If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the starter.

Dusty Conditions.

Dust inducted into intake systems is probably the greatest single cause of early engine wear. Under high dust conditions, the induction air filters should be serviced daily.

Seacoast and Humid Areas.

In salt water areas, special care should be taken to keep engines and engine accessories clean to prevent oxidation. Fuel and oil should be checked frequently and drained of condensed moisture in humid areas.

MISCELLANEOUS SERVICE ITEMS.

Cold Weather Servicing.

If the aircraft is to be frequently used in extremely cold weather, the oil should be drained while the engine is hot and stored in a dry warm place until needed for next flight. If desired, the oil may be heated before it is poured into the engine for the next flight

- a. Drain oil system as follows:
 1. Start engine and run until oil temperature is within normal operating limits.
 2. Stop engine and open oil drain access.
 3. Remove drain plug and allow sump to completely drain.
 4. Install drain plug and close oil drain access.

WARNING

When preheating the oil, do not allow the temperature of the heated oil to rise above 121°C

(250°F). Heating the oil above this temperature may cause a flash fire. Just before shutting down the engine in cold weather a quart of gasoline may be added to the oil in the sump to dilute the oil for the next start.

Fuel System.

The fuel system is comprised of two main tanks, holding a total of 51 U. S. gallons each of which 50 gallons are usable, four auxiliary tanks holding a total of 36.5 U. S. gallons in each wing, of which 35 gallons are usable, two optional auxiliary tanks holding a total of 13.5 U. S. gallons each, of which 13.0 gallons are usable. This provides a total usable fuel capacity of 170 U. S. gallons for aircraft without optional auxiliary tanks, or a total usable fuel capacity of 196 U. S. gallons for aircraft with optional auxiliary tanks. The filler caps for the main tanks are located on the top inboard side of the main tanks. The filler caps for the auxiliary or optional tanks are located on the top of the wing just inboard of the main tanks.

NOTE

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

Fuel System Drains.

The fuel system has incorporated eight drain valves which must be drained before the first flight each day to check for water or sediment. Two fuel selector valves and two crossover drain valves are drained by pushing up on the valve stem. The fuel selector valve is located inboard of nacelles and forward of the gear doors in the leading edge, while the crossover drain valves are located in the wing gap area inboard of the fuel selector valves. The main tank drain valves are located in the aft end of the main tanks. To drain the main tank, engage the screwdriver (with shank removed), furnished with the aircraft, and push up. Fuel will flow through the hollow handle of the screwdriver. The auxiliary or optional tanks drain valves are located outboard of the nacelle and forward of flaps. These drain valves are drained by pushing up on the center plunger.

Defueling.

The defueling procedures given pertain to either wing. A standard defueling truck or defueling pump is necessary to defuel the aircraft.

CAUTION

During all defueling, tank purging and tank repairing operation, the aircraft must be located a safe distance from other aircraft and

buildings. Fire fighting equipment must be available. The use of two ground wires from different points on the aircraft to separate approved grounding stakes shall be used to prevent ungrounding of the aircraft due to accidental disconnecting of one ground wire.

- a. Turn off all electrical power.
- b. Turn fuel selector valve handles off.
- c. Remove filler cap and insert defueling tube. Remove as much fuel as possible through the filler.
- d. Cut safety wire and remove drain valves from the bottom side of the wing and drain remaining fuel in a clean open container. Use defueling pump to remove fuel from container.
- e. Drain the crossover lines at the wing gap drain valve.

WARNING

Residual fuel accumulation in the wing is a fire hazard. Use care to prevent the accumulation of such fuel.

Purging Main Fuel Tanks and Auxiliary Fuel Cells.

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

- a. Defuel the aircraft in accordance with defueling procedure.
- b. Insert hose through filler opening into fuel tank or cell.
- c. Attach hose to inert gas container and allow inert gas to flow into the fuel tank or cell until all explosible gas vapors are dissipated.

NOTE

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

SPECIAL TOOLS AND EQUIPMENT.

The relative simplicity of easy accessibility of 421 components eliminates the use of many special tools. In most cases, the well equipped shop will find it necessary to employ only the following special tools which are available through the Cessna Dealers' Organization.

Part No.	Nomenclature
C173001-0101	Towing Bar - Light Duty
P/N 2-170	Jack
SK421-33	Fuel Pressure Test Kit
SE608	Motor Mount Wrench (for use with 0851559 lockwasher)
6090002-1	Tool, Pressure Ratio Controller
SE716	Inclinometer
5090006-9	Propeller Torque Wrench Adapter
SK421-1	Pressurization System Leakage Test Kit
SK310-32	Oxygen Refill Kit
0880002-3	Hook
0880001-1	Actuator Arm Tension Measuring Tool
FT251	Reamer Tool
SK182-43	Cylinder Head Calibration Unit
0880004-1	Ring Pack Support Tool
0880004-2	Ring Pack Support Tool
SK421-40	Exhaust System Seal Replacement Tool Kit
1007254	Seal Replacement Tool Kit
SK150-20	Wheel Balancer Kit
5090005-1	Alternator Hub Wrench
CM3	Screwdriver/Sampler Cup

FREQUENCY (HOURS)



50 HOURS



100 HOURS



200 HOURS



500 HOURS



1200 HOURS



AS REQUIRED

METHOD



HAND



SQUIRT CAN



FILLER CAN



GREASE GUN

NOTE

Specified lubricants will meet requirements for extreme hot or extreme cold temperature operations. Use of substitutes or other lubricants may cause malfunction when operating in extreme temperature conditions, or may cause excessive wear due to improper lubrication.

TYPE OF LUBRICANT

GL		Grease, Low Temperature (MIL-G-21164)
OG		Oil, General Purpose (MIL-L-7870)
FG		Graphite, Lubricating (SS-G-659)
P		Petrolatum or Terminal Grease (VV-P-236) 
OI		Oil, Lubricating, Aircraft Instrument (MIL-O-6085)
OH		Hydraulic Fluid (MIL-H-5606A)
GW		Grease, Wide Temperature Range (MIL-G-81322)
GS		Grease, Medium Consistency Silicone Dow Corning DC4 (MIL-G-23827)
DS		Dry Spray Lubricant, Camie No. 1000 Watson Industrial Pack, St. Louis, Mo., or Dupont Slip Spray Dry Film Lubricant.
GSL		Grease, Light Consistency Silicone Dow Corning, Midland, Michigan

Do not lubricate roller chains or cables except under seacoast conditions. Wipe with a clean, dry cloth.

Lubricate unsealed pulley bearings, rod ends, oilite bearings, pivot end hinge points, and any other friction point obviously needing lubrication, with general purpose oil every 500 hours or more often, if required.

Lubricate door latches with automotive type door latch lubricant, and the latching mechanism with general purpose oil every 1200 hours, or more often if binding occurs. Lubricate door stop with Sil-Glyde.

Figure 2-37. Lubrication Diagram (Sheet 1)

OG

421-0001 TO 421-0104

421-0104 AND ON

* USE ANY AUTOMOTIVE TYPE DOOR LATCH LUBRICANT.

OG

OG

GS

421-0085 AND ON

Change 4

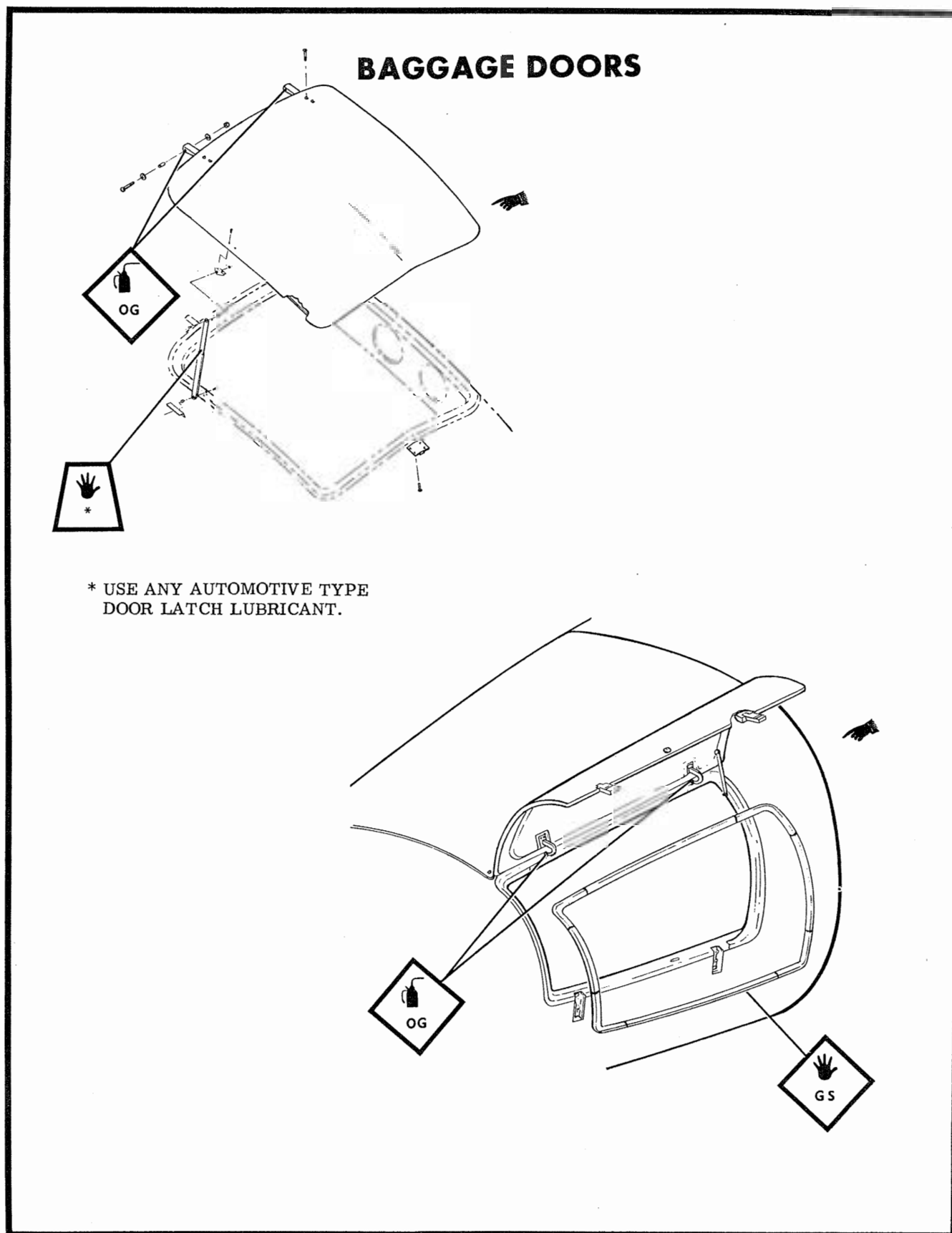


Figure 2-37. Lubrication Diagram (Sheet 3)

ADJUSTING SEATS

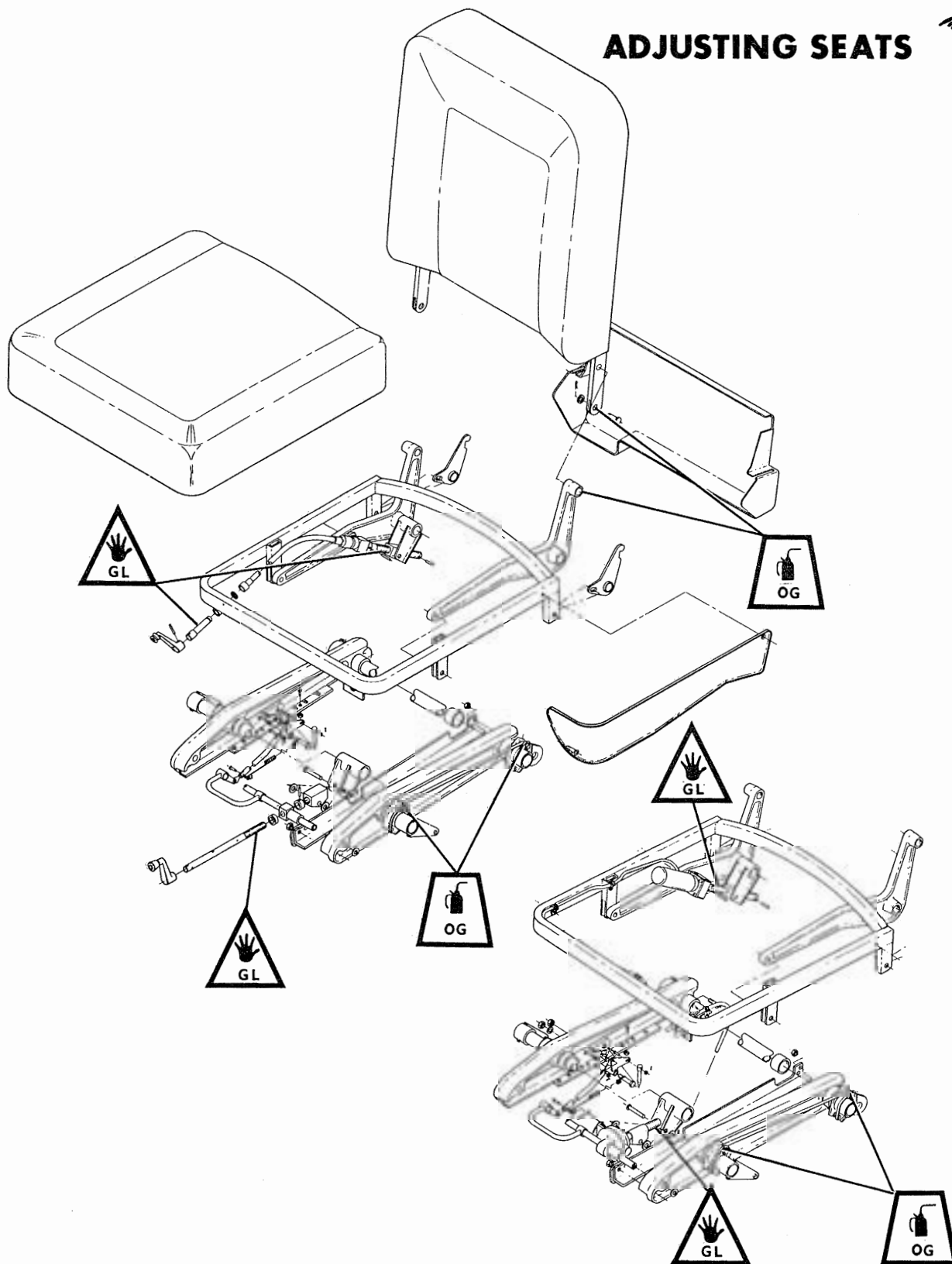


Figure 2-37. Lubrication Diagram (Sheet 4)

LANDING GEAR MANUAL EXTENSION MECHANISM

NOTES:

1. AFTER LUBRICATING, WIPE OFF EXCESS LUBRICANT ADJACENT TO CRANKING HANDLE.
2. DO NOT OIL THE CHAIN; AN OILED CHAIN MAY COLLECT DIRT AND GRIT. WIPE CHAIN WITH A CLEAN DRY CLOTH.

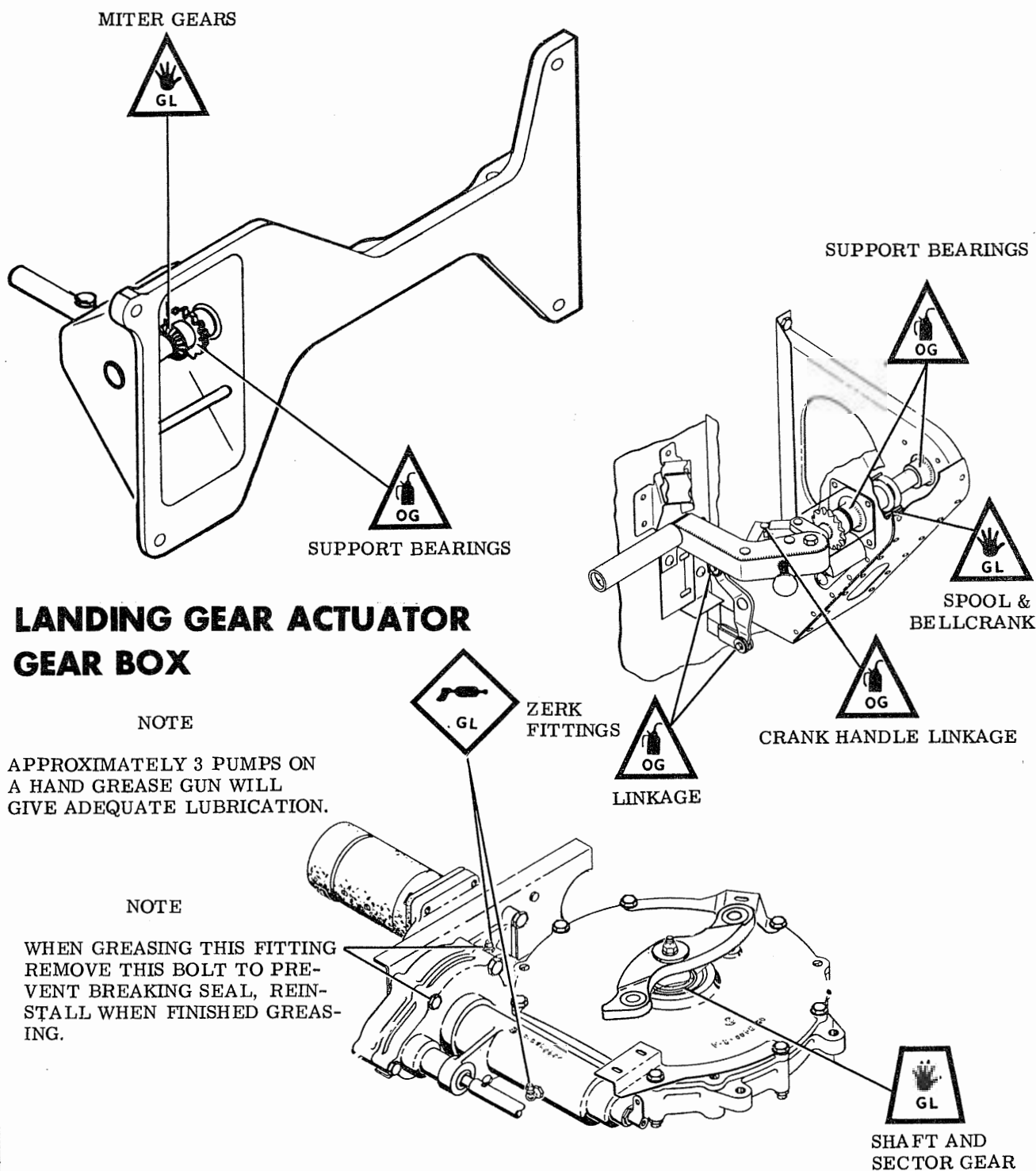


Figure 2-37. Lubrication Diagram (Sheet 5)

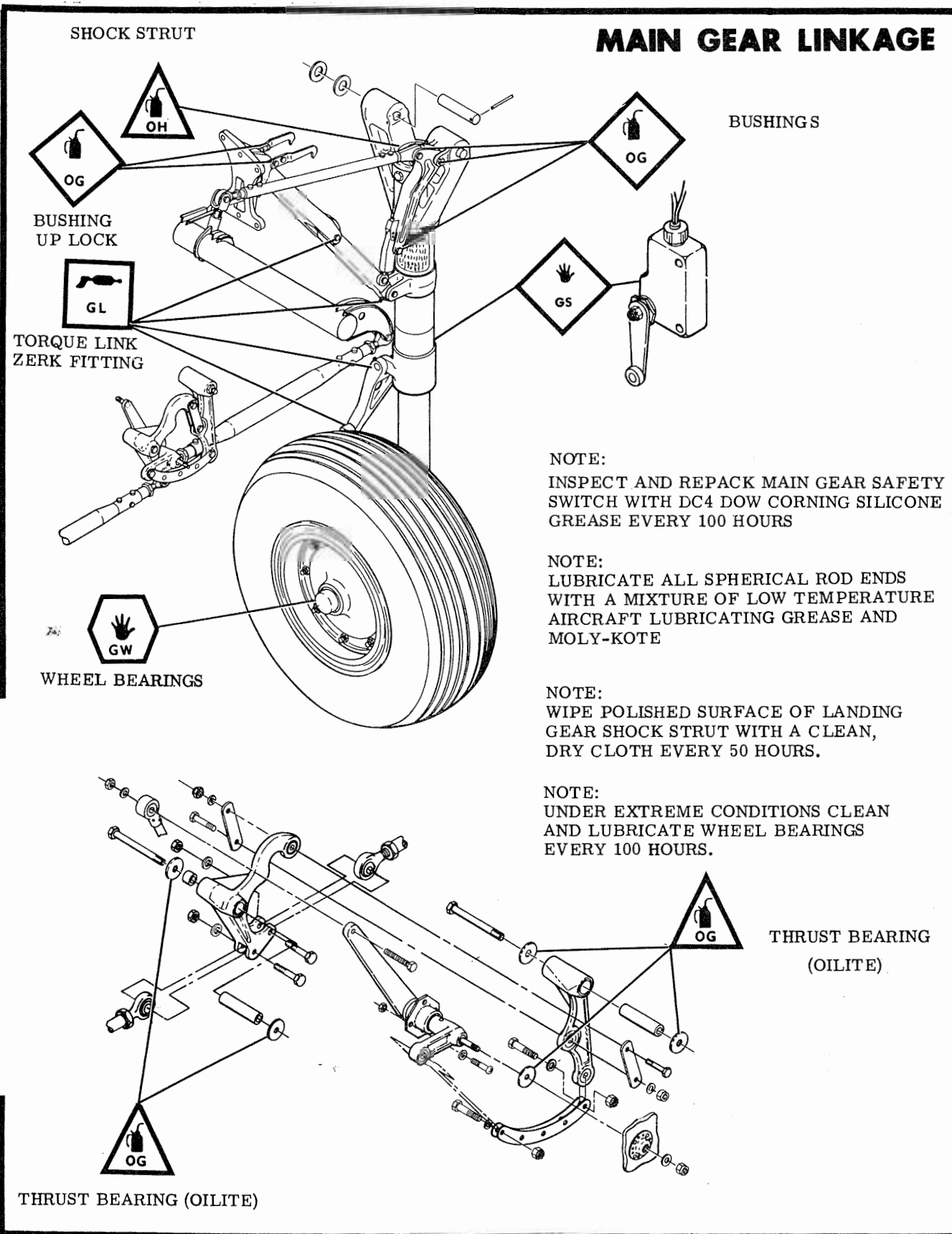


Figure 2-37. Lubrication Diagram (Sheet 6)

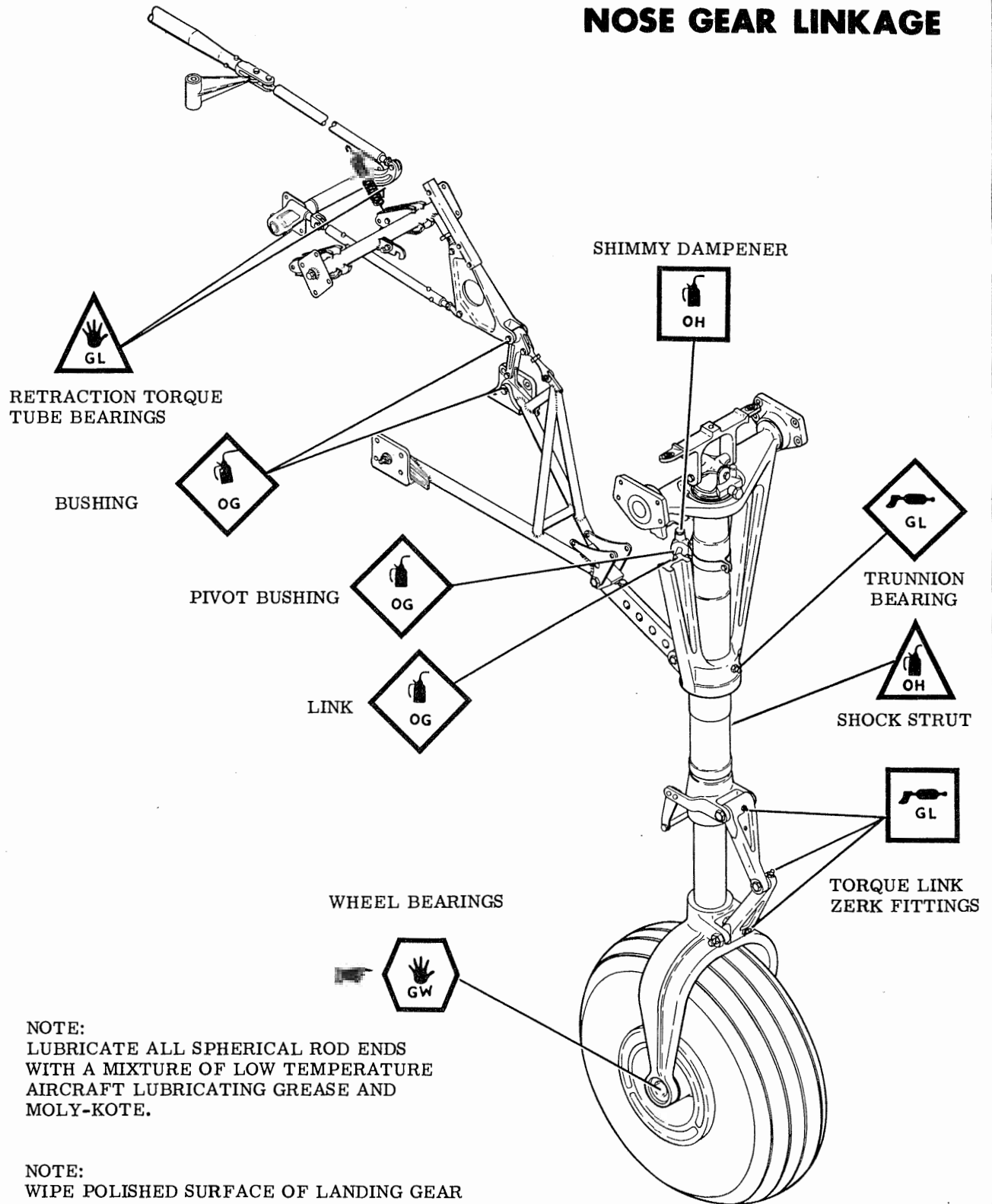
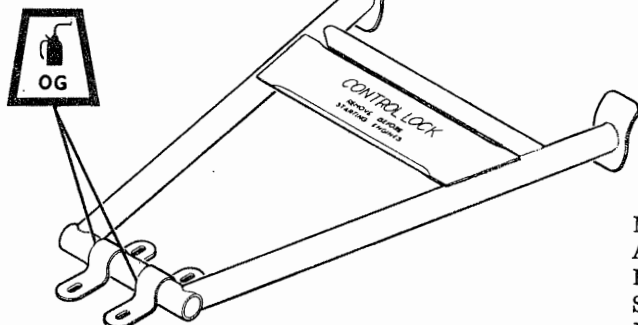
NOSE GEAR LINKAGE

Figure 2-37. Lubrication Diagram (Sheet 7)

RUDDER PEDAL MECHANISM

RUDDER GUST LOCK



NOTE:
AFTER LUBRICATING, ACTUATE THE
RUDDER PEDALS AND PARKING BRAKE
SEVERAL TIMES TO INSURE ADEQUATE
PENETRATION OF THE LUBRICANT.
THOROUGHLY WIPE OFF ANY OIL ON
THE RUDDER PEDALS AND GUST LOCK.

BEARING HALVES

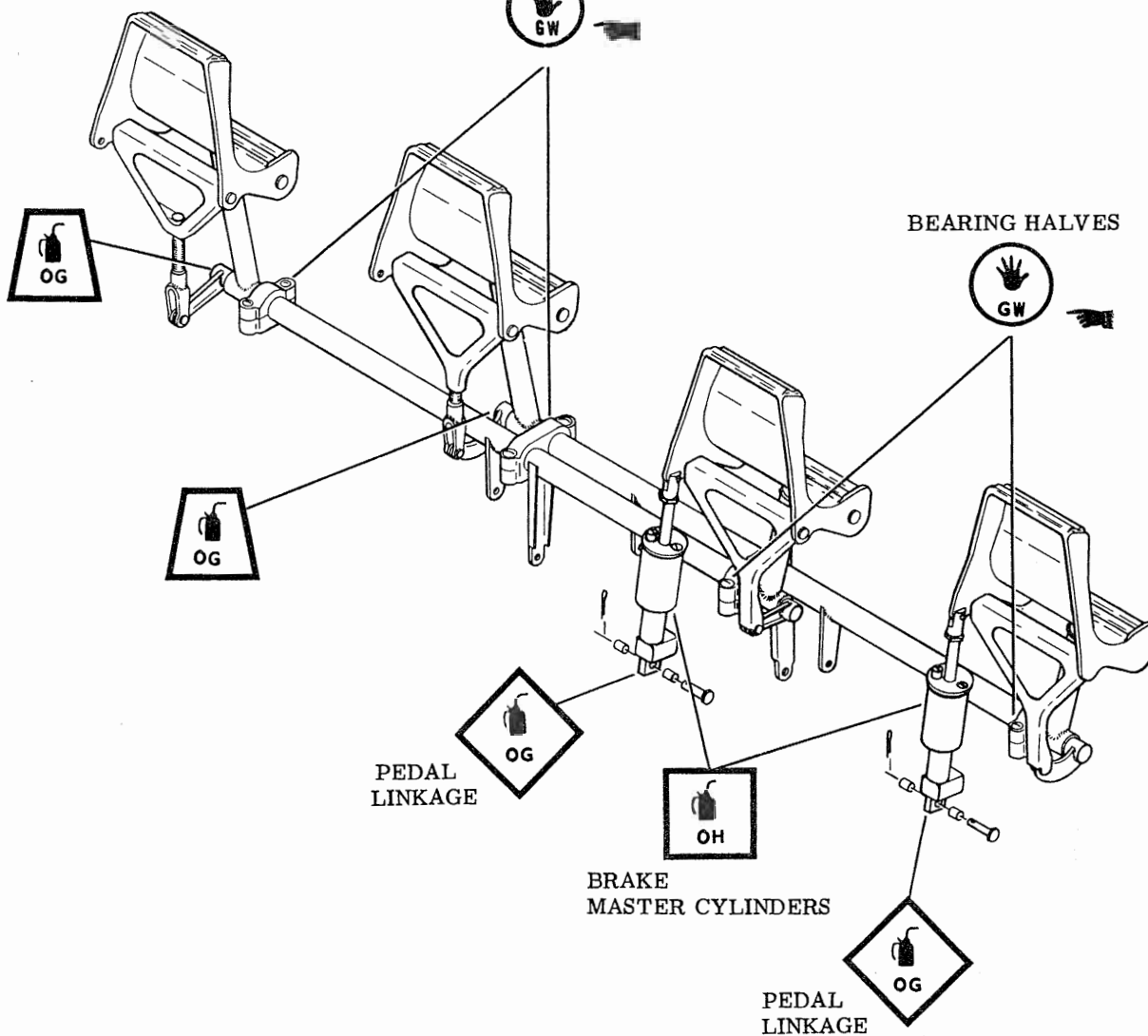


Figure 2-37. Lubrication Diagram (Sheet 8)

TRIM TAB ACTUATORS

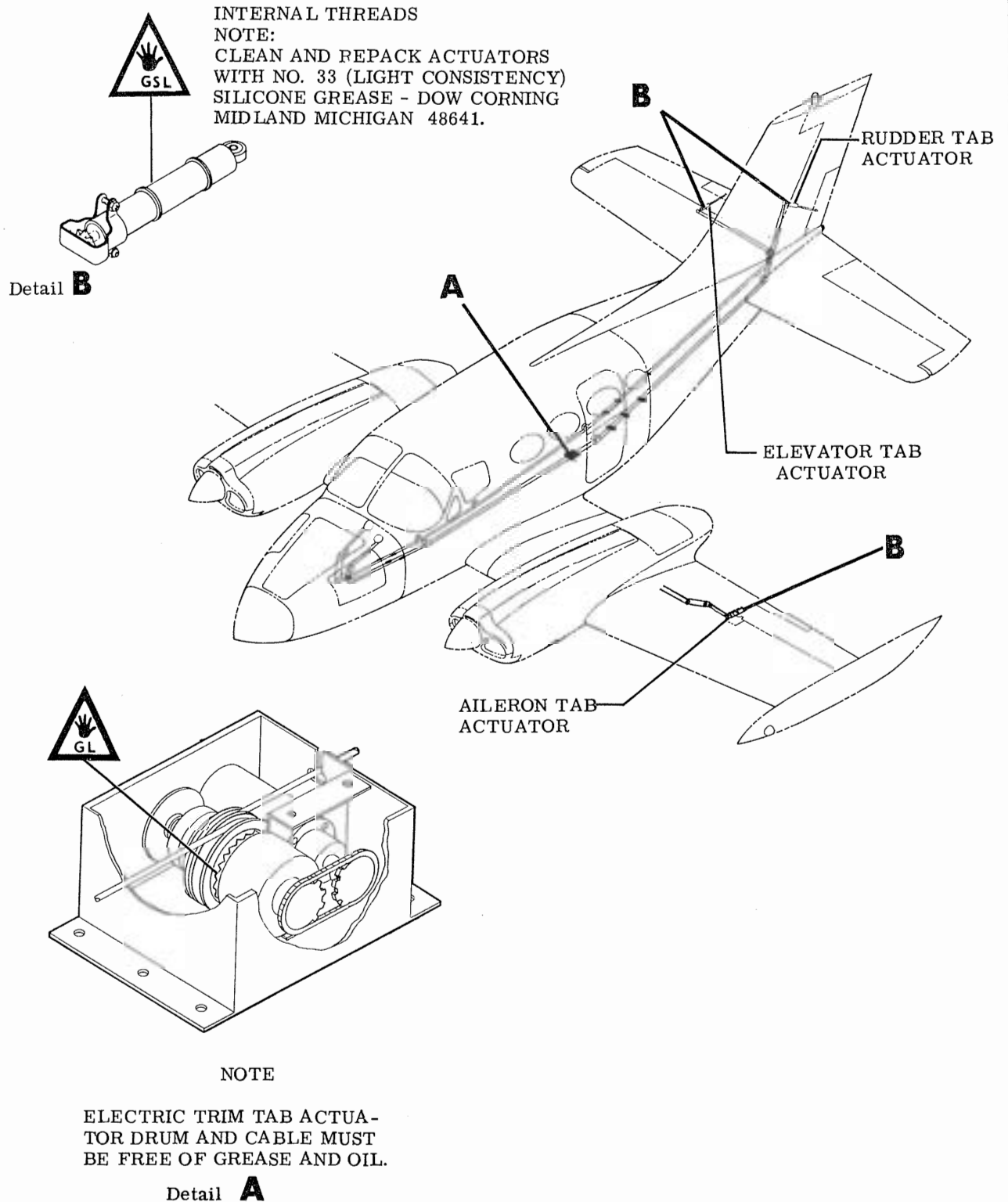
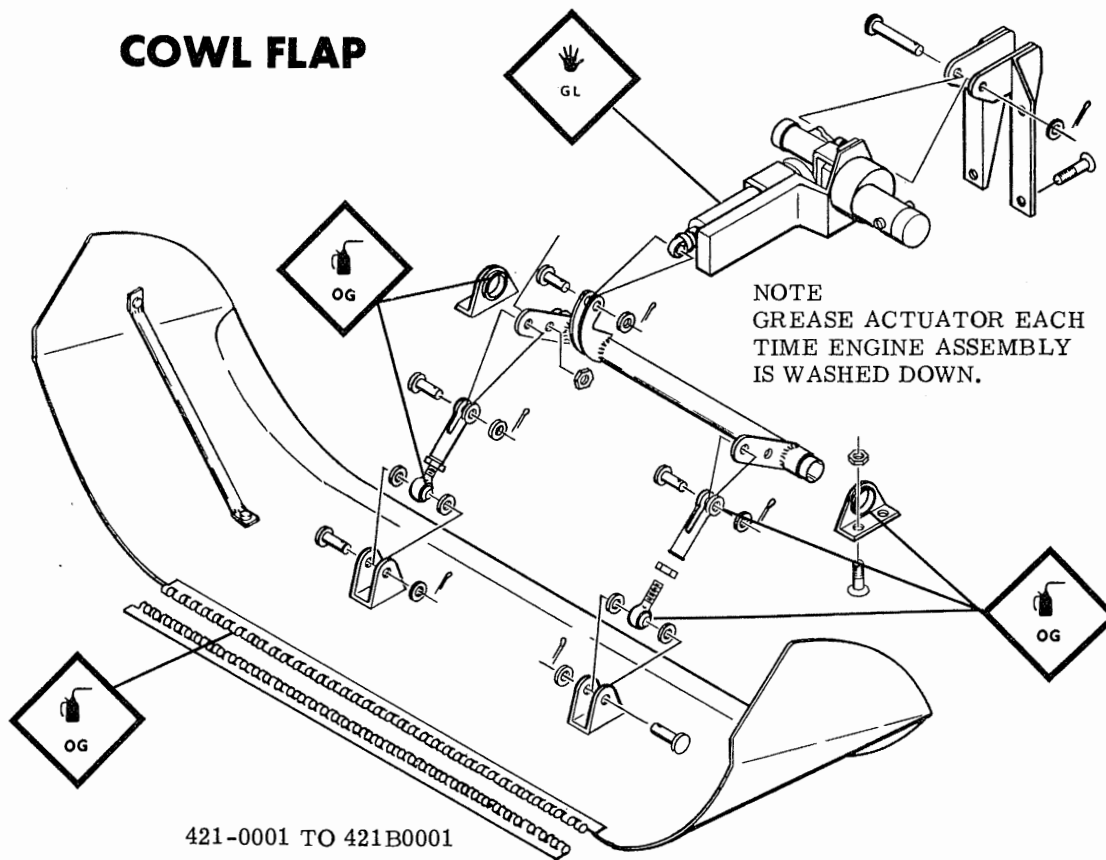


Figure 2-37. Lubrication Diagram (Sheet 9)

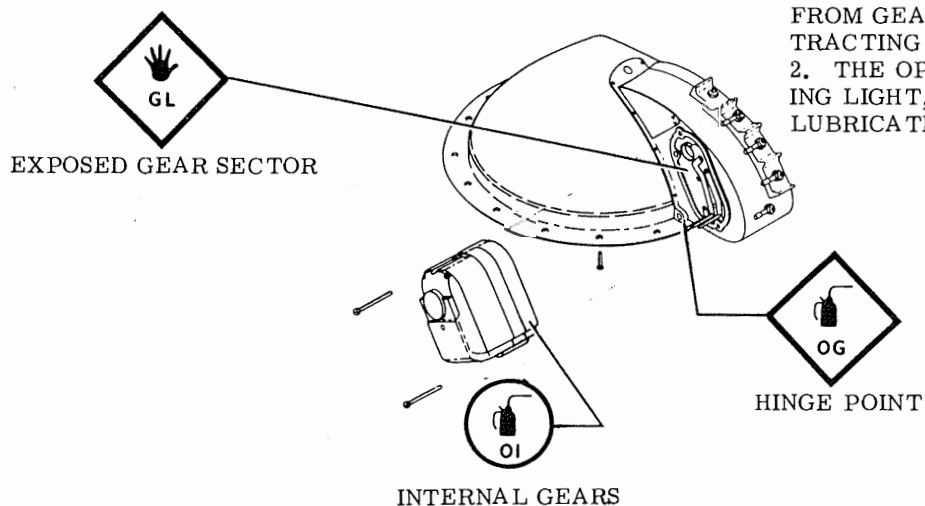
COWL FLAP



LANDING LIGHT

NOTES

1. THE LIGHT MUST BE EXTENDED TO LUBRICATE THE LARGE SECTOR GEAR. WIPE OFF EXCESS GREASE FROM GEAR SECTOR BEFORE RE-TRACTING THE LIGHT.
2. THE OPTIONAL RIGHT WING LANDING LIGHT, IF INSTALLED, MAY BE LUBRICATED IN THE SAME MANNER.



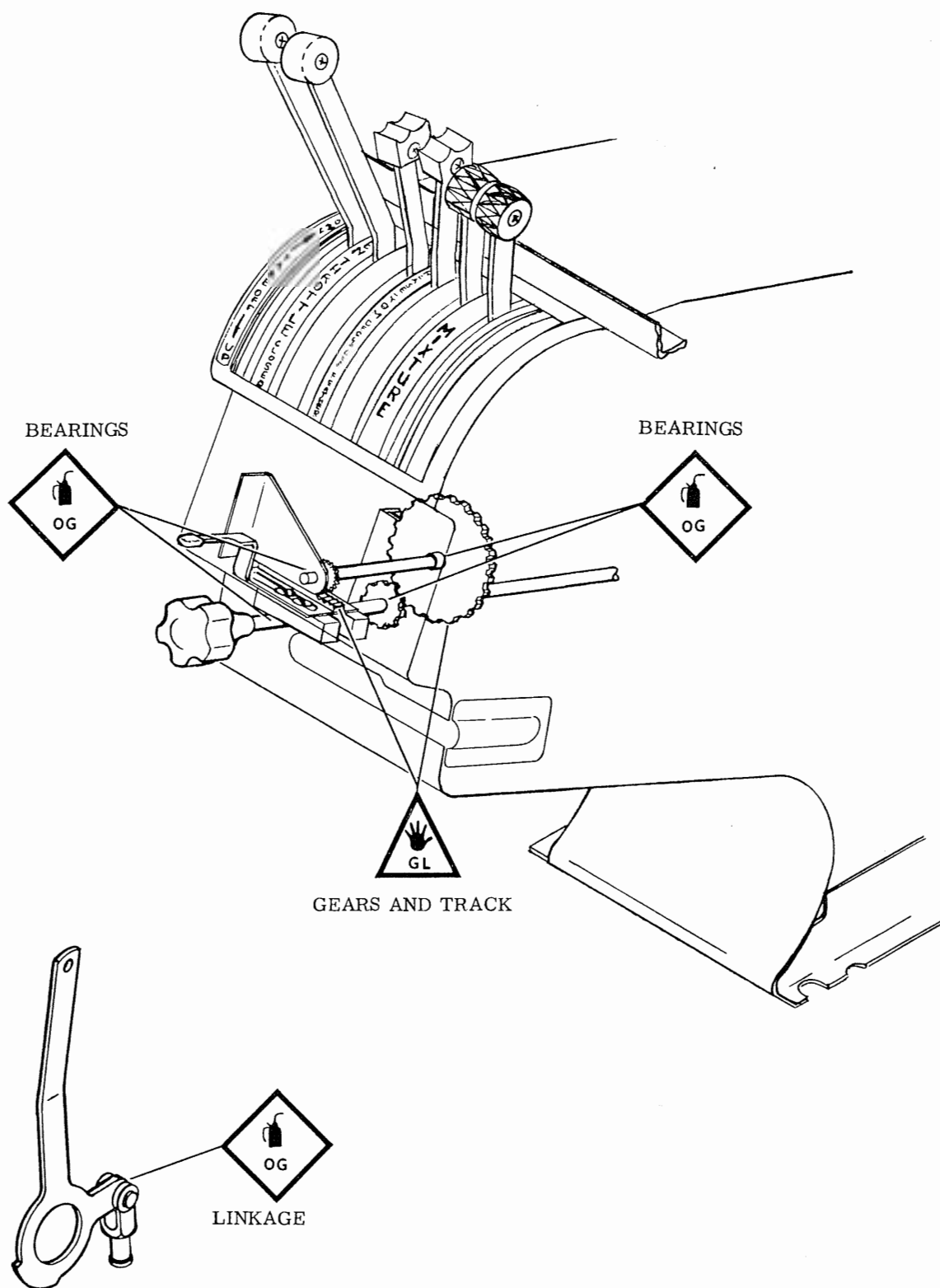
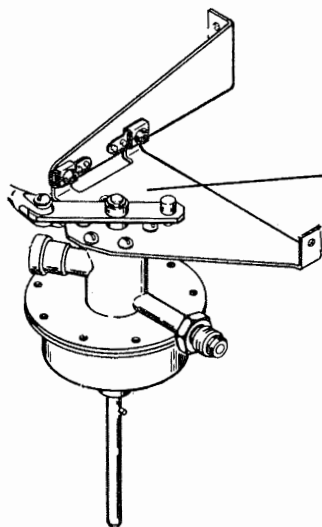
CONTROL MECHANISM

Figure 2-37. Lubrication Diagram (Sheet 11)

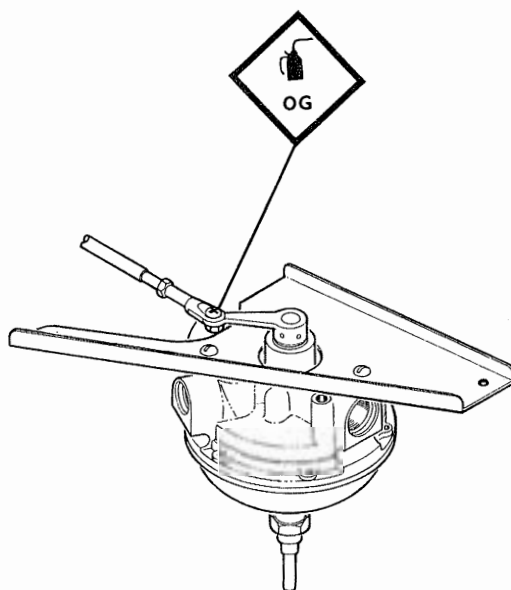
FUEL SELECTOR VALVE

FUEL SELECTOR VALVE



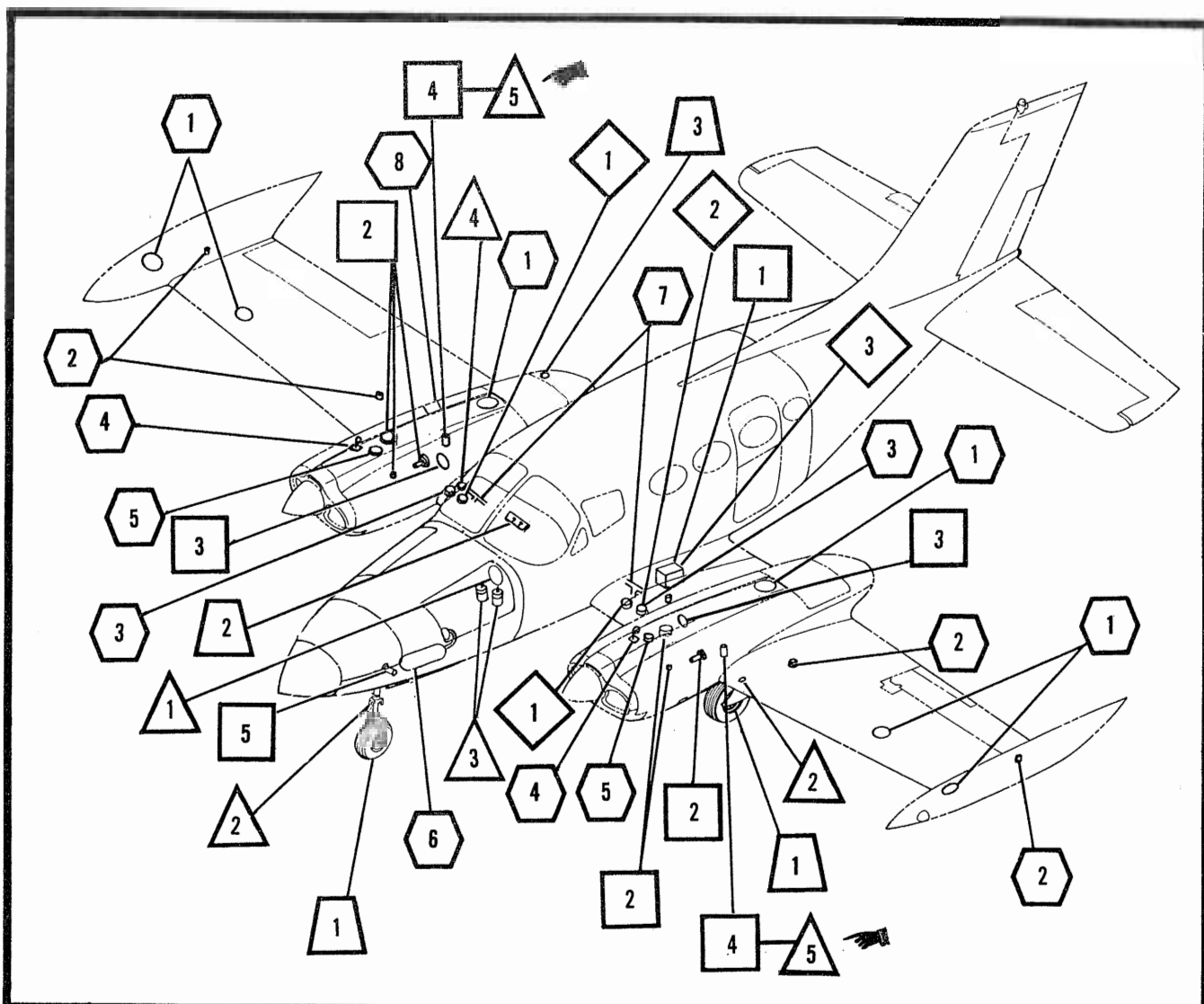
NOTE
CLEAN AND LUBRICATE WITH
CAMIE NO. 1000 DRY SPRAY
LUBRICANT OR DUPONT SLIP
SPRAY DRY FILM LUBRICANT
EVERY 100 HOURS.

421-0001 TO 421A0092



421A0092 AND ON

Figure 2-37. Lubrication Diagram (Sheet 12)



SERVICING PROCEDURES

For convenience, the items listed below are segregated into servicing intervals; that is, all items which must be checked or serviced daily are listed, then items requiring 50 hour service are listed, etc. The numbered symbol at each item refers to the item as shown in the Servicing Diagram.

SERVICING CHART

Symbol denotes servicing interval. Number within symbol refers to item to be serviced.

				
CHECK OR SERVICE DAILY	SERVICE AT 50 HOURS	SERVICE AT 100 HOURS	SERVICE AT 200 HOURS	SERVICE AS REQD.

Figure 2-38. Service Chart (Sheet 1 of 3)

DAILY

1

FUEL TANK FILLERS:

Service after each flight with 100/130 or alternate 115/145 aviation gasoline. The capacity of each main tank is 51 U. S. Gals., 40.7 Imp Gals., or 193.0 Liters and the capacity of the standard auxiliary tanks in each wing without optional auxiliary tank installed is 36.5 U. S. Gals., 28.7 Imp. Gals., or 137.9 Liters. The capacity of the standard auxiliary tanks in each wing and optional auxiliary tank is 50 U. S. Gals., 40.0 Imp. Gals., or 189.3 Liters. The capacity of each optional wing locker fuel tank is 26.3 U. S. Gals., 21.9 Imp. Gals., or 99.5 Liters.

2

FUEL TANK DRAINS:

On the first flight of each day and after each refueling, drain a small amount of fuel from the main and auxiliary tanks drain valves.

3

FUEL SELECTORS:

On the first flight of each day and after each refueling, drain a small amount of fuel from the fuel selector drain valve.

4

OIL DIPSTICKS:

Check oil level before each flight. Capacity for each engine oil sump is 13 U. S. quarts which includes 1 quart for oil filter. (Do not take off on less than 9 quarts.)

5

OIL FILLER CAPS:

Check oil level before each flight. Capacity for each engine oil sump is 13 U. S. quarts, which includes one quart for oil filter. (Do not take off on less than 9 quarts.) When pre-flight shows less than 9 quarts, service with aviation grade engine oil, SAE 30 below 40°F, SAE 50 above 40°F. The aircraft is delivered from the factory with straight mineral oil, therefore it will be necessary during the break in period or first 50 hours of operation to add straight mineral oil. Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting and turbocharger controller operation in cold weather. Ashless dispersant oil, conforming to Continental Motors Specifications MHS-24A must be used after the first 50 hours of new or overhauled engine operation.

6

OXYGEN CYLINDER (OPTIONAL):

Check oxygen pressure gage for anticipated requirements before first flight. Whenever pressure drops below 300 PSI, refill with aviator's breathing oxygen, Military Specification MIL-O-27210. Maximum pressure 1800 PSI.

7

FUEL LINE CROSSOVER DRAINS:

On the first flight of each day, drain two ounces of fuel from each valve.

8

AIR CONDITIONING RESERVOIR:

Check hydraulic fluid level before flight. Service with MIL-H-5606A (Red).

50 HOURS

1

BATTERY:

Check level of electrolyte every 50 hours or at least every 30 days, more often in hot weather. Maintain level of electrolyte in the filler hole even with the bottom of the vent well by adding distilled water. Check battery drain line for corrosion and blockage.

2

OIL SUMP DRAINS AND OIL FILTERS:

Change oil and replace filters. After break-in oil (mineral oil) is removed, change engine oil filter every 100 hours and oil every 100 hours. Change engine oil at least every four months even though less than 100 hours have accumulated. Reduce periods for prolonged operation in dusty areas, cold climates, or where short flights and long idle periods are encountered which cause sludging conditions. Use caution when installing filter element so as not to overtorque.

Figure 2-38. Service Chart (Sheet 2)

50 HOURS (Cont.)

3

INDUCTION AIR FILTERS:

Service every 50 hours or more often when operating in dusty conditions. Under extremely dusty conditions, daily maintenance of the filter is recommended.

4

OIL SEPARATORS:

Remove oil separator element of oil separator (P/N 201957) and clean with Stoddard Solvent, dry with compressed air.

5

SHIMMY DAMPER:

Check fluid level and fill as required with hydraulic fluid, Military Specification MIL-H-5606A (Red).

100 HOURS

1

SUCTION RELIEF VALVE:

Check suction relief valve filter for dirt or obstructions if suction gage reading appears high. Remove, wash with a mild soap and water solution and allow to dry.

2

FUEL SELECTOR VALVE:

Clean and lubricate detents with Camie 1000 dry spray lubricant.

3

BATTERY BOX:

Clean and service with 50 grams of sodium nitride or 50 grams of sodium bicarbonate.

200 HOURS

1

VACUUM SYSTEM FILTER:

Clean at 200 hours replace with new filter at 500 hours (standard) P/N C294501-0103 or (optional) P/N C294501-0203.

2

SHOCK STRUTS:

Check and fill to level of filler plug with hydraulic fluid, Military Specification MIL-H-5606A (Red).

3

BRAKE MASTER CYLINDERS:

Check fluid level in reservoirs and fill as needed through plug on cylinder heads. Fill with hydraulic fluid, Military Specification MIL-H-5606A (Red).

4

HEATER FUEL FILTER:

Remove filter and wash thoroughly with unleaded gasoline.

5

OIL SEPARATORS:

Remove oil separator and flush with Stoddard Solvent, dry with compressed air.

AS REQUIRED

1

TIRES:

Nosewheel tire maintain 32 PSI. Main wheel tire maintain 65 PSI. (421-0001 TO 421B0001.)
Nosewheel tire maintain 35 PSI. Main wheel tire maintain 70 PSI. (421B0001 AND ON.)

2

FUEL SELECTOR VALVE GEAR BOX:

Clean thoroughly with suitable solvent, allow to air dry and lubricate, by hand, with general purpose grease.

3

ALCOHOL WINDSHIELD ANTI-ICE SYSTEM:

Check fluid level and fill as required with isopropyl alcohol (MIL-F-5566)

Figure 2-38. Service Chart (Sheet 3)

COMPONENT	LOCATION
Air Conditioning System (Belt Driven)	
Charging Ports (421A0001 to 421B0001)	RH Wing Locker
Charging Ports (421B0001 and On)	RH Evaporator
Sight Gage (421A0001 to 421B0001)	RH Wing Locker Forward Left Side
Sight Gage (421B0001 and On)	RH Evaporator
Pressure Switch (421B0001 and On)	RH Wing Locker Aft Side
Blower Relay (421B0001 and On)	Outboard Side of RH Evaporator
Circuit Breakers (421A0001 and On)	LH Console
High Pressure Switch (421B0001 and On)	Located off of Freon Liquid Injection Line leading to Air Conditioner Manifold
Low Pressure Switch (421B0001 and On)	Located in Manifold
Solenoid Shutoff Valve (421B0001 and On)	Located in Manifold
Condensate Tank (421-0001 to 421B0001)	Beneath Floorboard Under Evaporator
Expansion Valve (421A0001 to 421B0001)	Right Side of Evaporator
Expansion Valve (421B0001 and On)	Inboard Side of Evaporator
Air Conditioning System (Hydraulic Driven)	
Hydraulic Pump	RH Engine Compartment
Compressor Drive Assembly	RH Wing Locker Compartment
Reservoir (hydraulic fluid)	RH Wing Locker Compartment
Manifold and Valve Assembly	RH Wing Locker Compartment
Condenser Blower Motor	RH Wing Locker Compartment
Condensers	RH Wing Locker Compartment
Drain Valve (hydraulic fluid)	RH Wing Locker Compartment
Low Pressure Switch	RH Wing Locker Compartment
High Temperature Switch	RH Wing Locker Compartment
Receiver-Dryer	RH Wing Locker Compartment
Expansion Valve	On Each Evaporator
Sight Gage	RH Evaporator
Charging Ports	RH Evaporator
Blower Relay	RH Evaporator
Alternate Static Source Valve	Forward Side of Left Console
Alternator System	
Emergency Field Fuse	Left Console Switch Panel
Overvoltage Relay	Inside Left Console
Fail Light Diode	In Wire Bundle approximately 18 inches from Alternator
Fail Module	Mounted on Alternator
Fail Light	In Annunciator Panel
Filter Capacitor	On Alternator
Ammeter	
Shunts	Inside Left Console
Autopilot	
Pressure Switch	Firewall Aft Side of each Engine Compartment
Solenoid Valve	In Left and Right Engine Nacelles
Filter Element	Aft of Rear Cabin Pressure Bulkhead
Barometric Switch	Forward of Instrument Panel
Battery Solenoid	Left Stub Wing Forward of Battery
Cigar Lighter Resistor	Inside Left Console Lower Aft
Deice System Wing	
Timer	Left Console
Control Switch	Left Console
Filter	RH and LH Engine Nacelle
Pressure Switch	Under Floorboards Forward of F. S. 158.00
Deice System (Propeller)	
Timer	Under Copilot Seat

Figure 2-39. Components and Location Chart (Sheet 1 of 3)

COMPONENT	LOCATION
Engine	
Cylinder Head Temperature Bulb	Lower Side of Number 2 Cylinder
EGT Probe	In Exhaust Stack Aft of Engine
Oil Temperature Bulb	Aft Side of Engine in Oil Passage
Tachometer Generator	Accessory Drive Aft Side of Engine
External Power Receptacle	Fuselage Lower Side Forward of Door
Elevator Trim Actuator	In Tailcone Aft of F. S. 273. 94
Flap System	
Position Indicator (421-0001 to 421A0001)	Mounted in Stationary Panel
Position Indicator (421A0001 and On)	Part of Preselect Switch
Limit Switches	Located on Flap Actuator Bracket
400A Autopilot Resistor	Located on Flap Actuator
Flap Actuator	Under Floorboards Aft of Rear Spar
Flight Hour Recorder	
Actuator Switch (421-0001 to 421B0056)	On Belly of Aircraft F. S. 273. 94
Actuator Switch (421B0056 and On)	Connected to LH Main Landing Gear Safety Switch
Fuse	Located in Wire Bundle Inside LH Console
Finish and Trim Plate	Located on Nose Wheel Well Web Forward LH Side
Fuel System	
Drain Valves	Wing Gap Area and Under each Fuel Tank
Selector and Strainer	Outboard of Engine Nacelles in Wing Leading Edge
Boost Pump Relays	Inside LH Console
Transfer Pump (Main Tank)	Aft Side of Main Tank Bulkhead
Pressure Switch	Engine Nacelle Aft Side of Engine
Signal Conditioner	Located on Rib Outboard of each Nacelle
Tank Vent Heaters	End of Vent Lines below Fuel Tanks
Wing Locker Transfer Pump	Outboard of Wing Locker in Wing
In Line Fuel Pump	Wing Area Outboard and Forward of Wing Locker
Heater	
Filter and Solenoid	Right Wing Leading Edge at W. S. 60. 57
Igniter Plug	Located on Heater
Shutoff Valve (Manual)	In RH Wing Leading Edge
Thermostat	Inside Ducting RH Nose
Fuel Pump (421A0001 to 421B0001)	In RH Leading Edge Outboard of Nacelle
Fuel Pump (421B0001 to 421B0149)	RH Stub Wing Leading Edge Inboard of Nacelle
Fuel Pump (421B0149 and On)	Located on Combustion Blower Motor
Junction Box	
Right 1	Left Side in Nose Compartment
Right 15	100. 00 Bulkhead
Landing Gear	
Landing Gear Actuator and Motor	Aft of Front Spar Under Floorboards
Landing Gear Limit Switches	Mounted on Top of Landing Gear Actuator
Landing Gear Safety Switch	Mounted on Torque Link of Left Gear
Landing Gear Down Relays	Inside Left Console (421-0001 to 421A0001)
Landing Gear Down Resistor	Inside Left Console (421-0001 to 421A0001)
Landing Gear Down Resistor	Under Floorboard at F. S. 170. 00 (421A0001 and On)
Landing Gear Relay	Under Floorboard at F. S. 180. 00 (421A0001 and On)
Landing Gear Up Indicator Switches	Mounted on Retracting Linkage in Each Wheel Well
Landing Gear Down Indicator Switches	Mounted on Landing Gear Braces in Each Wheel Well
Landing Gear Diode Assembly	Inside of Pedestal (See Figure 3-11)
Landing Gear Warning Relay	Inside Left Console
Landing Gear Relay	Inside Left Console
Lighting	
Landing	Tip Tank Tail Cap
Strobe Light Power Supply	Located in Tail Cone Aft of F. S. 273. 94
Strobe Light Flasher Unit	Located under Floorboard of LH Aft Passenger Seat
Cabin Entrance	Left Upholstery Panel
Wing Locker Baggage	Wing Locker Baggage Well
Wing Locker Baggage Switch	Aft of Wing Locker Baggage

Figure 2-39. Components and Location Chart (Sheet 2)

COMPONENT	LOCATION
MAA Plate	Left Upholstery Panel Forward of Cabin Door
Outside Air Temperature Bulb	Belly of Aircraft F. S. 151.14 and L. B. L. 17.29
Oxygen Regulator	Mounted on Cylinder in Nose Compartment
Oxygen Warning Barometric Pressure Switch	Forward of Instrument Panel
Pressurization System	
Safety Valve	Mounted on Aft Cabin Pressure Bulkhead
Outflow Valve	Mounted on Aft Cabin Pressure Bulkhead
Dump Valve	Mounted in Leading Edge of Stub Wings
Air Venturi	Mounted in Aft Engine Compartment
Pitot Static System Sump	Mounted on Aft Side of Aft Cabin Pressure Bulkhead
Propeller	
Synchronizer Actuator	Right Engine Compartment
Synchronizer Control Box	Under Glove Compartment Box
Unfeathering Accumulator	Left Side of Engine Mount Beam
Starter	
Solenoid	In Left Stub Wing
Vibrator	Inside Left Console
Stereo	
Resistor	Inside Stereo Cabinet
Relay	Inside Stereo Cabinet
Terminal Blocks	
Refer to Section 14	
Tow Bar	Stowed in LH Wing Locker
Vacuum	
Filter	Mounted on Forward Cabin Bulkhead in Nose Compartment Left Side
Regulator	Wing Gap Area
Variable Pressure Controller	Mounted on Control Pedestal
Variable Pressure Controller Filter	Forward of Station 118.00 Beneath Floorboard
Voltage Regulators	On Right Side of Forward Cabin Bulkhead
Warning Horn	Inside Left Console
Warning Horn Flasher Unit	Under Copilot Seat
Windshield (Heated) Control	Inside Left Console
Windshield (Heated) Relay	Inside Left Console
Wemac Shutoff Valve	Aft of Pilot in Cabin Divider Area
Wemac Blower	In RH Cabin Divider Above Evaporator
Zener Diode (IN3133)	Located Inside Stereo Cabinet

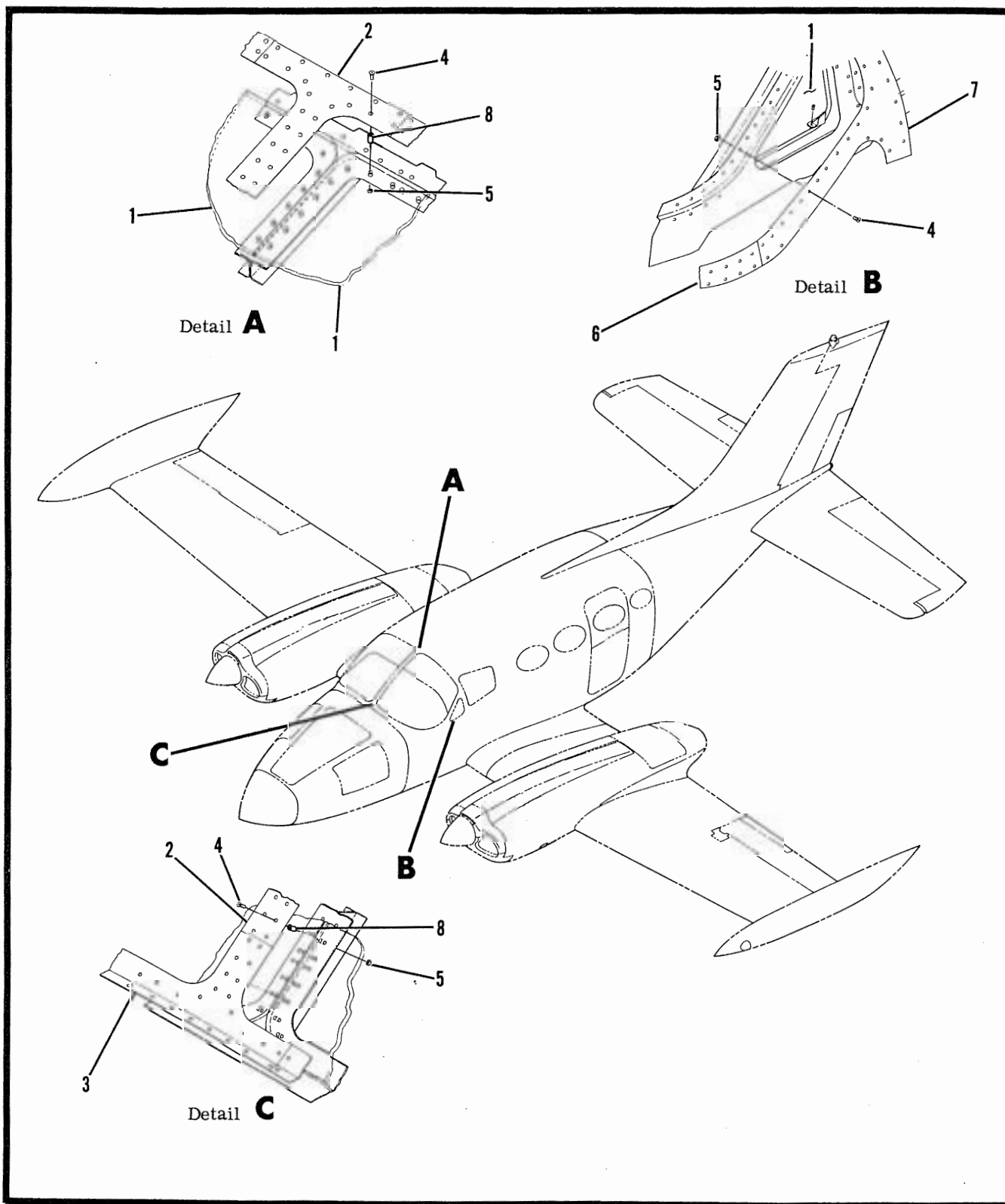
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SECTION 3

AIRFRAME

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- 1. Windshield
- 2. Upper Retainer
- 3. Lower Retainer

- 4. Screw
- 5. Nut

- 6. Lower LH Retainer
- 7. Upper RH Retainer
- 8. Grommet

Figure 3-1. Windshield Installation

FUSELAGE.

The fuselage is of semimonocoque construction, pressurized to the skin between forward pressure bulkhead and aft pressure bulkhead. All skin, bulkhead and structure joints, plumbing, controls, and wiring connections passing through a pressure wall, access doors, windows, control cables, and torque shafts are sealed to minimize air leakage. The wing center section is an integral part of the fuselage. Ten (twelve 421B0301 and on) stretched acrylic plastic windows and a two piece windshield are provided in the fuselage. A pilot's foul weather window, which opens in and forward is provided for pilot and copilot. An emergency exit is provided on the right side of the fuselage at the second window. To provide a convenient stairway for boarding the plane, the cabin entrance door swings down. Individual passenger seats are provided. The fuselage nose section provides baggage space and electronics area.

Windshield. (See figure 3-1.)

The windshield is a two piece stretched acrylic plastic section. It is secured to the fuselage by screw fastened retainers. The retainers and screws are sealed upon installation to adequately maintain pressurization capabilities of the cabin section.

Removal of Windshield. (See figure 3-1.)

a. Disconnect electrical wiring to magnetic compass, remove screw, nut and compass, remove windshield trim.

NOTE

The following instructions are given for the removal of the LH windshield only. The RH windshield is removed in the same manner.

- b. Remove screws and nuts attaching the lower center retainer (3) and remove retainer.
- c. Remove upper center retainer (2), LH upper retainer (7), and LH lower retainer (6) by removing screws and nuts.
- d. Remove windshield from aircraft.

Installation of Windshield. (See figure 3-1.)

- a. Install grommets (8) in each attachment hole of windshield.
- b. Position windshield half in place and temporarily hold in place with a screw at top and one at bottom of glass until installation of retainers.
- c. Fill the void around the edges of glass as described in Section 16.
- d. Fay seal between retainers, windshield and skin with sealant using non-crazing accelerator, in accordance with Section 16. Seal all screws by dabbing countersink or dimpled area with sealant.
- e. Install LH lower retainer (6) but do not tighten screws at this time.
- f. Install LH upper retainer (7) but do not tighten screws at this time.

g. Align holes in windshield half (1) with holes in frame and secure retainer (2) to frame with attaching screws.

h. Install Lower center retainer (3) with attaching screws. Finish securing screws in LH lower retainer (6) and LH upper retainer (7).

i. Install trim strip and magnetic compass with attaching screws and nuts.

Removal and Replacement of Foul Weather Window.

a. The foul weather window assembly is removed by removing four screws securing hinges to the frame at the forward side.

b. Install window assembly by installing the four screws securing the hinges to the frame. Adjust hinge until a good seal is provided at the forward side of the window.

c. Adjust striker by closing window and sliding striker until window latch locks firmly, and a good seal is provided around the window.

Cabin Windows. (See figure 3-2).

The cabin windows are made of one piece stretched acrylic plastic. The pilot and copilot windows are secured to the structure by screw-fastened retainers. The retainers and screws are sealed upon installation to provide adequate pressurization capabilities of the cabin section. The aft cabin windows are secured to the structure by screws, sealing between the window and structure to provide a cabin pressure seal.

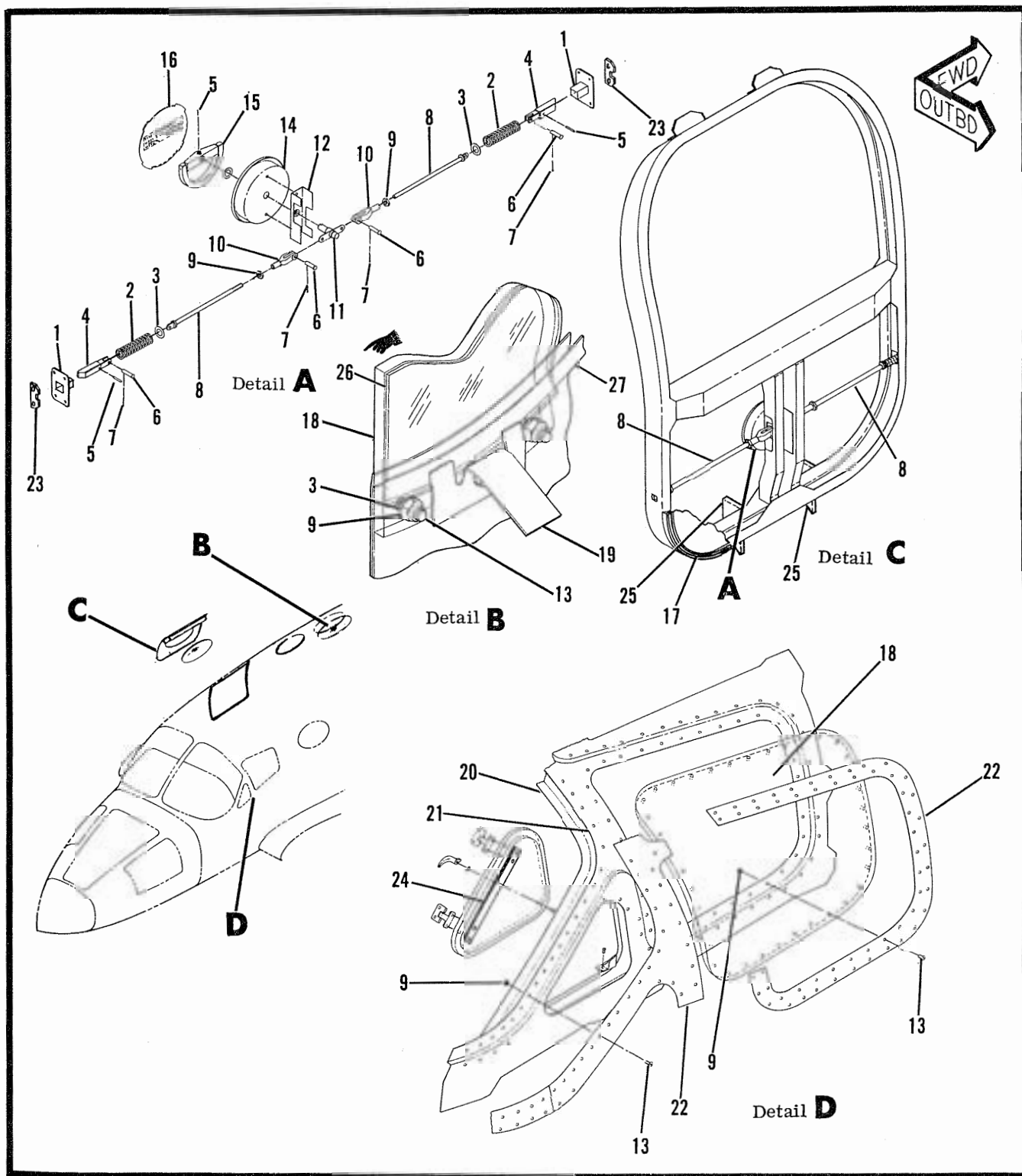
Removal and Replacement of Side Window. (See figure 3-2.)

Remove side window as follows:

- a. Remove side window trim (20).
- b. Remove the seven screws, nuts and washers attaching upper forward retainer to glass.
- c. Remove screws (13), nuts (9) and washers (3) attaching window retainer (22) to glass.
- d. Remove the screws attaching retainer (22) to frame.
- e. Remove retainer (22) and remove window (18).
- f. To install window, place glass in position in frame.
- g. Fay seal between window and retainer and between skin and retainer in accordance with Section 16. Install retainer (22).
- h. Dab sealer in screw holes and attach retainer (22) to frame with screws and attach retainer to glass with screws, nuts and washers.
- i. Install window upholstery trim.

Removal and Installation of Escape Hatch.

- a. Remove plexiglass cover (16) from release pan (14) and turn the handle counterclockwise as far as it will turn, (approximately 1/4 turn).
- b. Remove hatch by pulling inboard on the handle.



1. Guide	8. Link	15. Handle	22. Retainer
2. Spring	9. Nut	16. Cover	23. Striker
3. Washer	10. Clevis	17. Seal	24. Spacer
4. Latch Bolt	11. Bellcrank	18. Window	25. Armrest
5. Roll Pin	12. Channel	19. Clip	Bracket
6. Pin	13. Screw	20. Window Trim	26. Inner Window
7. Cotter Pin	14. Pan	21. Frame	27. Seal Strip

Figure 3-2. Side Window Installation

NOTE

Check seal for cuts or deterioration before installation of hatch. Replace seal if questionable.

- c. To install hatch, position hatch in place and turn handle to locked position.
- d. Install cover (16).

Removal and Installation of Escape Hatch Window.
(See figure 3-2.)

- a. Remove window trim.
- b. Remove screws, nuts and washers securing glass to escape hatch frame and remove glass.
- c. Lay seal between glass and skin when placing the glass in position. See Section 16 for sealing procedures.
- d. Dab sealant in screw holes and secure glass panel with screws, nuts and washers.
- e. Install window trim.

Removal and Installation of Escape Hatch Release Mechanism. (See figure 3-2.)

- a. Remove plexiglass cover (16) from release pan (14) and turn handle counterclockwise.
- b. Remove pan (14) by removing roll pin (5) from handle.
- c. Remove upholstery panel.
- d. Remove pins from links (8) and remove links.
- e. Remove two screws securing channel to frame, lift out channel and bellcrank (11).
- f. Remove latch bolts (4) and springs (2).

g. Lubricate moving parts in accordance with Section 2 before installation.

h. The installation of the release mechanism is the reversal of the removal procedure.

NOTE

The locking mechanism is rigged in such a manner that it has a over-center locking condition.

- 1. To adjust links, install 1/8" rigging pin through the hole provided in the guides (1) and through the 1/8" hole provided in the latch bolts (4).
- j. With the handle turned clockwise until it is against the stop, adjust links to a length whereby the pins (6) can be installed with no binding.
- k. Install pins (6), cotter pins (7), and secure jamb nuts (9).
- l. Remove rig pins.

Removal and Replacement of Cabin Windows. (See figure 3-2, Detail B.)

- a. Remove window trim by removing attaching screws.
- b. Remove nuts securing clips (19). Remove clips and inner window (26).
- c. Remove screws, nuts and washers securing window to structure.
- d. To install window panel, place window in position. Lay seal between window and structure, using a sealant with noncrazing accelerator. Refer to Section 16 for detailed instructions.
- e. Secure window in place with screws, washers

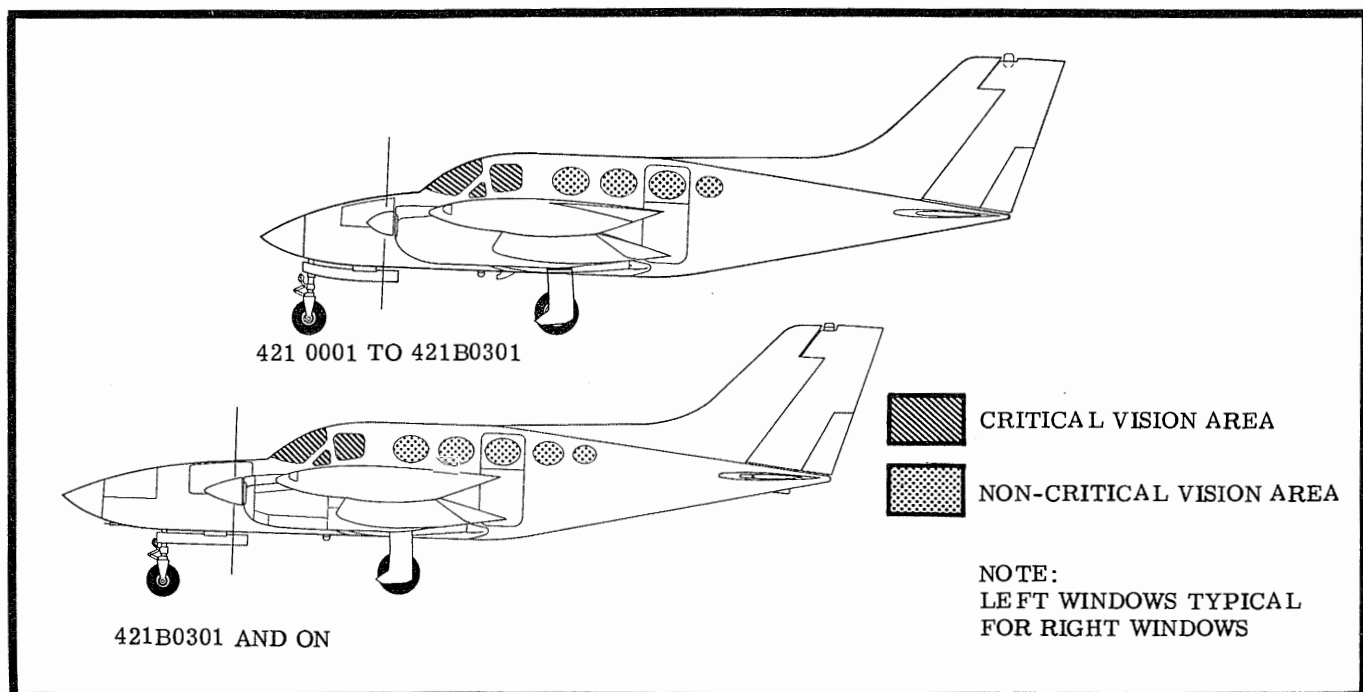


Figure 3-3. Critical Vision Diagram

and nuts. On aircraft 421B0301 and on, an inner retainer is installed next to the glass.

f. Cement new seal strip (27) in position using EC2141 adhesive. Cut seal strip to provide a .40 inch gap at lower side.

g. Position inner window against seal strip and secure in place with four clips (19) and nuts over existing nuts, one each at top, bottom, front and aft sides.

h. Install window trim.

Plastic Windows Inspection Criteria.

DEFECTS			CRITICAL VISION AREA		NON-CRITICAL VISION AREA	
			MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING	MAXIMUM REPAIRABLE	MAXIMUM PERMISSIBLE WITHOUT REPAIRING
NICKS AND DENTS						
Maximum Diameter.	Not repairable.		0.025 inch.		0.250 inch.	0.125 inch.
Depth.	Not repairable.		0.016 inch.		0.060 inch.	0.032 inch.
Frequency.	None		2 per sq. ft.		2 per sq. ft.	1 per sq. ft.
SCRATCHES.						
Length.	12 inches total per area.		12 inches total per area.		24 inches total per area.	24 inches total per area.
Width.	0.020 inch.		0.020 inch.		0.050 inch.	0.020 inch.
Depth.	0.016 inch.		0.008 inch.		0.008 inch.	0.008 inch.
Frequency.	12 inches total per area.		12 inches total per area.		20% of total area.	Total length of scratches equals 3 times longest dimension of area.
CRACKS.						
Length.	Not repairable.		None.		Not repairable.	None.
Frequency.	Not repairable.		None.		Not repairable.	None.
CRAZING.						
Slight.	Not repairable.		Crazing adjacent to the edges of the glass must not extend more than 1 inch into the C.V. area.		Not repairable.	Shall be contained in a 9.00 inch circle.
Severe.	Not repairable.		Crazing adjacent to the edge of the glass must not extend more than 1 inch into C.V. area.		Not repairable.	Shall be contained in a 6.00 inch circle.
DISCOLORATION.						
	Not repairable.		None		Not repairable.	May extend 1 inch from all edges of non-critical areas.

Inspection of Plastic Windshield and Windows.

See Inspection Criteria Chart for allowable defects. Repairable defects after repair are considered permanent repairs. "Not repairable" defects may be repaired and/or used only as a temporary repair.

CAUTION

If temporary repairs are made, aircraft must be operated in unpressurized mode until replacement of window can be made.

Repair of Plastic Windshield and Windows.

See Section 16 for repair of windshield and windows.

Doors.

Removal and Installation of Upper Cabin Door. (See figure 3-5.)

- a. Open cabin doors and carefully pull headliner out of retainer above door to gain access to upper hinge bolts (1).
- b. Remove door stay strap assembly.
- c. With upper door open and supported, remove nuts (3), stat-o-seals (2) and bolts (1).
- d. Remove upper door from aircraft.
- e. Install upper door by reversing removal procedures.

Removal, Installation and Adjustment of Upper Cabin Door Latch. (See figure 3-5.)

- a. Open cabin door and remove handle (17), base (16) and window trim panel by removing screws and pin.
- b. Using Detail C, figure 3-5, disassemble, repair and reassemble door latch as necessary.

NOTE

Refer to Overhaul and Replacement Chart for replacement interval of latch pin (10), figure 3-5.

- c. With the inside handle turned as far as it will go in a clockwise rotation, adjust link (13) to give a positive locking condition of the cam assembly (27).
- d. Adjust links (13) and tube assembly (21) until the pins (11) can be installed with no binding.
- e. Install cotter pins (12) except on pins holding latch pins (10) to link (13) and tube assembly (21).
- f. Secure jamb nut (3) on link (13) holding to cam assembly (27).
- g. Position handle (17) so that the bellcrank (22) is against the housing stop in the open position.
- h. Loosen jamb nuts (3) on tube assembly (21) and link (13) holding latch pins (10), and remove pins (11).
- i. Screw tube assembly (21) and link (13) holding latch pins (10) clockwise or counterclockwise to decrease or increase length of them.

- j. (Refer to figure 3-6A.) Adjust pins to a minimum of 0.77 inch engagement with the receptacles (1) in the locked position and a minimum of 0.05 clearance in the unlocked position and a maximum of 0.21 clearance.

NOTE

If required, one spacer (3) or (4) may be added between the lockplate (2) and the doorframe at each required pin location.

- k. Secure jam nuts (3) and install cotter pins (12) on tube assembly (21) and link (13) holding latch pins (10).

1. Adjust door latch receptacles as follows:
 1. (See figure 3-5.) Remove window trim.
 2. Loosen nut securing receptacle (28) to lock plate (29).
 3. Adjust receptacle (28) in forward door jamb and aft door jam so that when the latch pins (10) are engaged in the receptacles, the door will produce a tight fit.
 4. Secure nuts on receptacle.
- m. Close and fully lock cabin doors. The indicators (31) should indicate a locked condition.
- n. Close and fully lock cabin doors observing the cabin door not-locked light on the stationary instrument panel for a light-out condition. If the light remains illuminated, adjust switch located just forward of doorframe near guide receptacle (28) using the following steps:

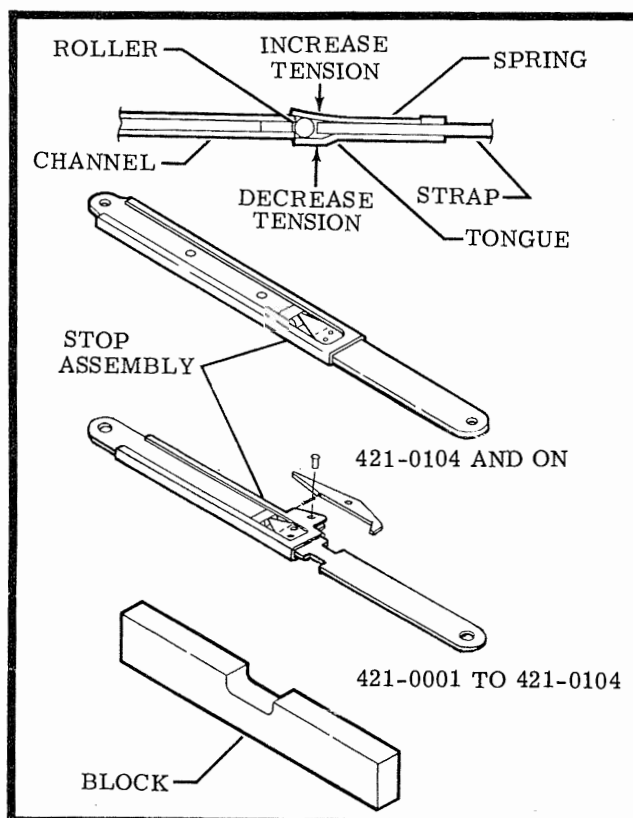
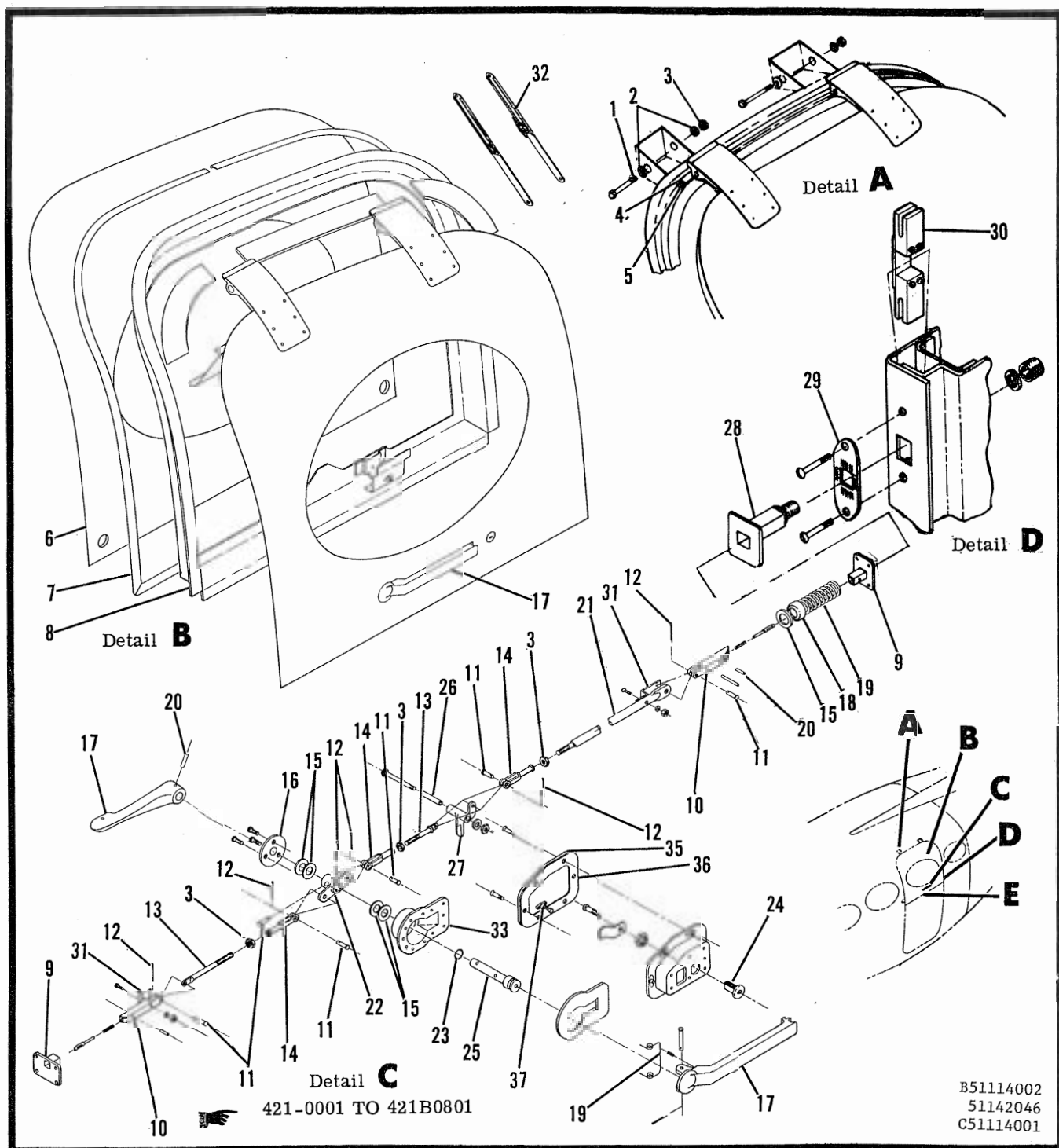
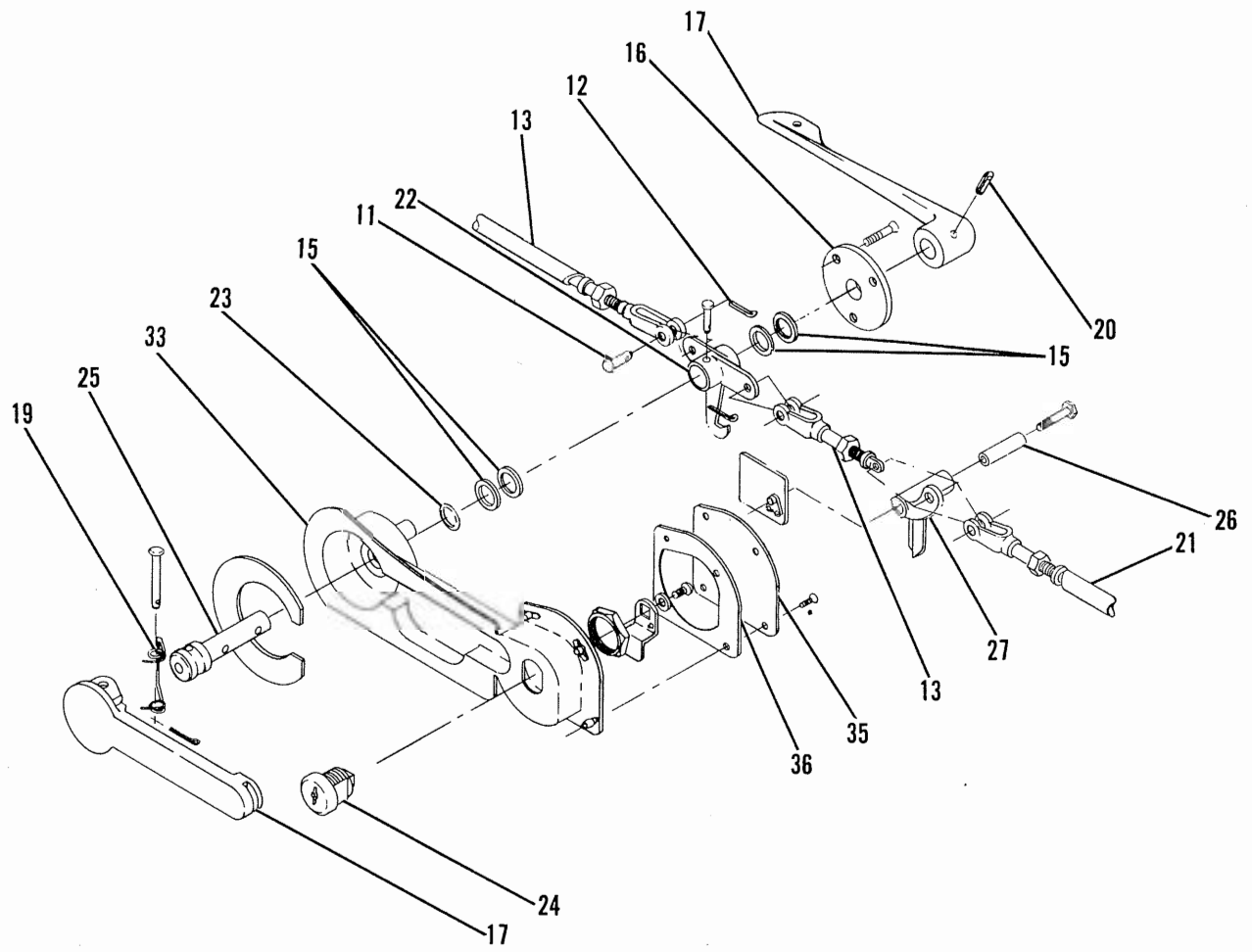


Figure 3-4. Door Stop Adjustment

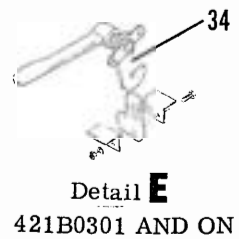


1. Bolt	8. Door Frame	16. Base	24. Lock Assembly	32. Stop
2. Stat-O-Seal	9. Guide	17. Handle	25. Spindle	33. Housing
3. Nut	10. Latch Pin	18. Cup	26. Bearing	34. Catch
4. Seal	11. Pin	19. Spring	27. Cam Assembly	35. Cover
5. Seal Retainer	12. Cotter Pin	20. Roll Pin	28. Receptacle Assembly	36. Gasket
6. Window Trim	13. Link	21. Tube Assembly	29. Lock Plate	37. Stop Bolt
7. Retainer	14. Clevis	22. Bellcrank	30. Spacer	
	15. Washer	23. O-Ring	31. Indicator	

Figure 3-5. Upper Cabin Door Installation (Sheet 1 of 2)



Detail **C**
421B0801 AND ON



Detail **E**
421B0301 AND ON

C14143058
E51141073R

Figure 3-5. Upper Cabin Door Installation (Sheet 2)

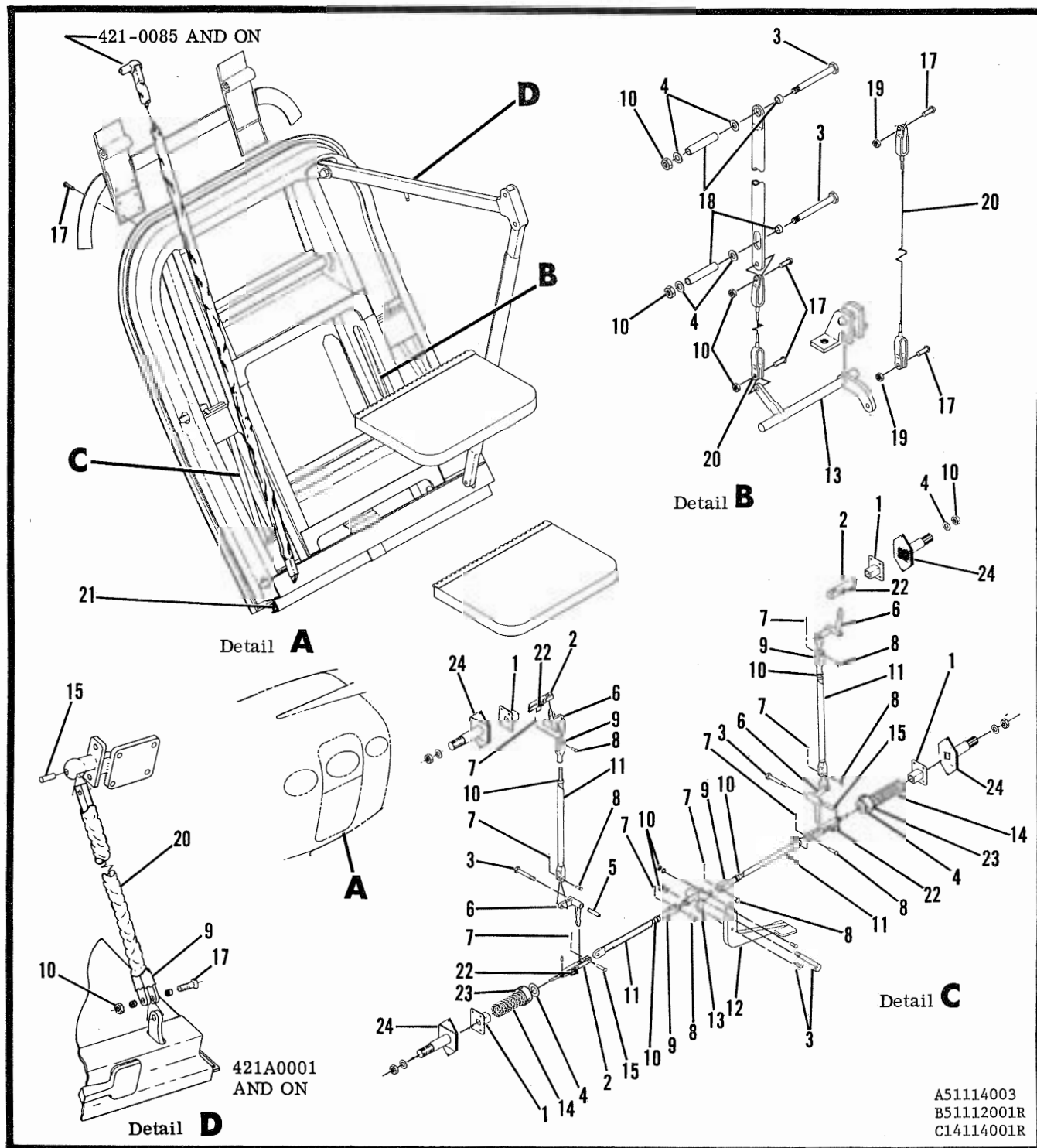


Figure 3-6. Lower Cabin Door Installation

1. Remove window trim just forward of entrance door.
2. Loosen screws securing warning switch to bracket and adjust switch until positive contact with the shaft assembly is made and light on instrument panel is extinguished.
3. Secure switch in this position by tightening screws.
4. Reinstall window trim.

Checking Cabin Door and Locker Door Stop Tension.

- a. Open cabin door until upper cabin door is supported by the cabin door stop.
- b. Install spring scale (0 to 50 pounds) to cabin door handle.
- c. Check for correct tension.

NOTE

When checking tension be sure to pull scales straight and read tension when stop releases door free to close. Tension should be 15 $\pm$ 5 pounds.

- d. If correct tension is not obtained, refer to Adjustment of Cabin Door and Baggage Door Stop Tension.
- e. Check locker door stop tension and adjust in accordance with Adjustment of Cabin Door and Baggage Door Stop Tension procedures. Tension should be 25 $\pm$ 3 pounds as applied directly to the stop assembly.

Adjustment of Cabin Door and Baggage Door Stop Tension. (See Figure 3-4.)

- a. Adjust tension on stop assembly, using a drift punch and hammer as follows:
 1. Position stop assembly on block with stop extended and tongue down.
 2. Using drift punch and hammer, tap on roller to increase tension.
 3. To decrease tension, turn stop assembly over on block and bend tongue down with hammer. Be sure block is inside of the channel to prevent damage to the channel flanges.

Removal and Installation of Lower Cabin Door. (See Figure 3-6.)

- a. With cabin door open and supported, remove nut and screw attaching cable (20) to bellcrank (13).
- b. Remove screws (17) attaching lower hinges to door.
- c. Remove lower door from aircraft.
- d. Install lower door by reversing removal procedures.
- e. (See figure 3-5.) Adjust door latch receptacles as follows:
 1. Remove upholstery side panels.
 2. Loosen nut (3) securing receptacle (28) to lock plate (29).
 3. Adjust receptacles (28), two in forward door jamb and two in aft door jamb so that when the latch pins (10) are engaged in the receptacles, the door will produce a good fit.

4. Secure nuts on receptacles.
5. Install upholstery panels.

Removal and Installation of Cabin Door Seal. (See Figure 3-5 or Figure 3-6.)

- a. Remove door seal from seal retainer being careful not to tear or damage seal. Use a phenolic wedge or plastic tool to help remove door seal.
- b. Install seals by gently edging seal into retainer using a plastic tool. It is permissible to use talcum powder, soapstone or water to facilitate installation of seals.

NOTE

Install upper door seal (4, figure 3-5) with the holes towards the door opening and the lower door seal (21, figure 3-6) with the holes towards the top of the door. Pressurized air from inside the cabin door enters the holes, inflating the seal to form a pressurized seal.

Removal, Installation and Adjustment of Lower Cabin Door Latch. (See Figure 3-6.)

- a. Open lower cabin door and remove necessary upholstery panels to gain access to latch mechanism.
- b. Using Detail C, figure 3-6, disassemble, repair and reassemble door latch as necessary.

NOTE

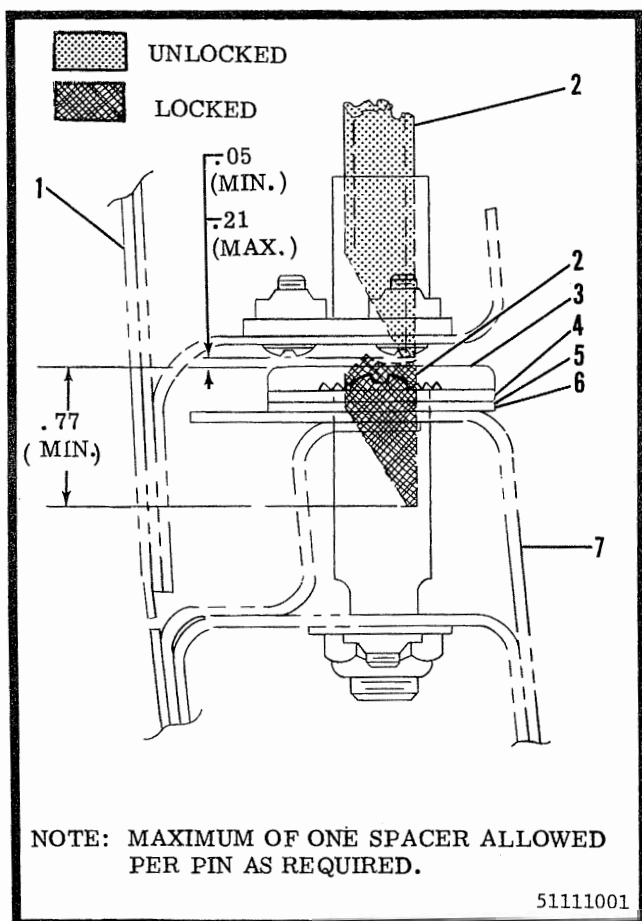
Refer to Overhaul and Replacement Chart for replacement interval of latch pin (2), figure 3-6.

- c. Adjust lower receptacles to outboard position.
- d. Adjust upper receptacles to inboard position to insure that the lower door in the closed position will produce a good fit.
- e. With the handle in the locked position, adjust the tube assemblies (11) to a length whereby the pins (8) can be installed with no binding.
- f. Install cotter pins (7) on clevis (9).
- g. Position handle (12) in the open position.
- h. Loosen jamb nuts (10) on tube assemblies (11) and remove pins (8).
- i. Screw tube assemblies (11) clockwise or counter-clockwise to decrease or increase their length.
- j. (Refer to figure 3-6A.) Adjust the upper latch pins (2) to a minimum of .77 inch engagement with the receptacles (3) in the door locked position and a minimum of .05 clearance in the unlocked position and a maximum of .21 clearance.

NOTE

If required, one spacer (5 or 6) may be added between the lockplate (4) and the doorframe at each required latch pin (2) location.

- k. (Refer to Figure 3-6.) Adjust the lower latch pins for the same engagement and clearance requirements as specified for upper latch pins.
- l. Secure jamb nuts (10) and install cotter pins (7)



1. Door	5. Spacer (P/N 5111565-1)
2. Latch Pin	6. Spacer (P/N 5111565-2)
3. Receptacle	7. Door Jamb
4. Lockplate	

Figure 3-6A. Cabin Door Latch Pin Requirements

on tube assemblies (11).

m. Adjust lower receptacles inboard as far as possible to allow free latch pin movement within the receptacles.

n. Recheck all latch pins for engagement and clearance.

o. Adjust lower door handle stops in the locked and unlocked position to correspond with engagement and clearance requirements.

p. Close doors and check for proper operation, positive locking and observe the door locked indicators (22), which should show a locked condition.

q. Install upholstery panels.

Removal and Installation of Step Mechanism. (See figure 3-6.)

a. Remove upholstery panel from aft side of the step well.

- b. Using Detail B, figure 3-6, disassemble repair and reassemble as necessary.
- c. Reinstall upholstery panel.

Seats.

Removal of Passenger Seats. (See figure 3-8.)

- a. Remove rail stops by removing cotter pin.
- b. Pull up on the left-hand adjusting handle and slide the seat over cutout in rail.
- c. Disengage seat rollers from rail assemblies.
- d. Remove seat from aircraft and disassemble and assemble passenger seat in accordance with figure 3-8.
- e. To remove aft facing seat, lift seat stop (34) and slide seat to cutouts in rail.

Installation of Passenger Seats. (See figure 3-8.)

- a. Engage seat rollers (9) with track assemblies (31) along cutouts in tracks.
- b. Install rail stops (32) on track assemblies (31) and secure in place with cotter pin (33).
- c. Aft facing passenger seats are installed in the same manner as the forward facing seats. Seat position is adjusted by seat stops (34) and the back is adjusted to clear cabin divider or stereo (optional equipment) by adjusting bolt (35).

WARNING

Forward facing seats should never be installed or used as aft facing seats. When installing seats make certain dual roller guide assembly (26) is installed in the aft side of seat on forward facing seats and in the forward side of seat on aft facing seats.

WARNING

After the seat has been jointed to rail assemblies (31), insure that rail stops are installed properly and the seat adjustment mechanisms function properly.

Removal of Seventh Seat. (Optional.) (See figure 3-7.)

- a. Pull up on handle (19) and tilt seatback forward as far as possible.
- b. Lift stop pins (11) and slide seat aft to cutouts in seat rails.
- c. Slide seat backward until front guide assemblies (15) disengage from seat rail.
- d. Then slide seat forward until back guide assemblies (15) disengage from seat rail.
- e. Remove seat from aircraft and disassemble and assemble in accordance with figure 3-7.

Installation of Seventh Seat. (Optional.) (See figure 3-7.)

Install seat by reversing removal procedure.

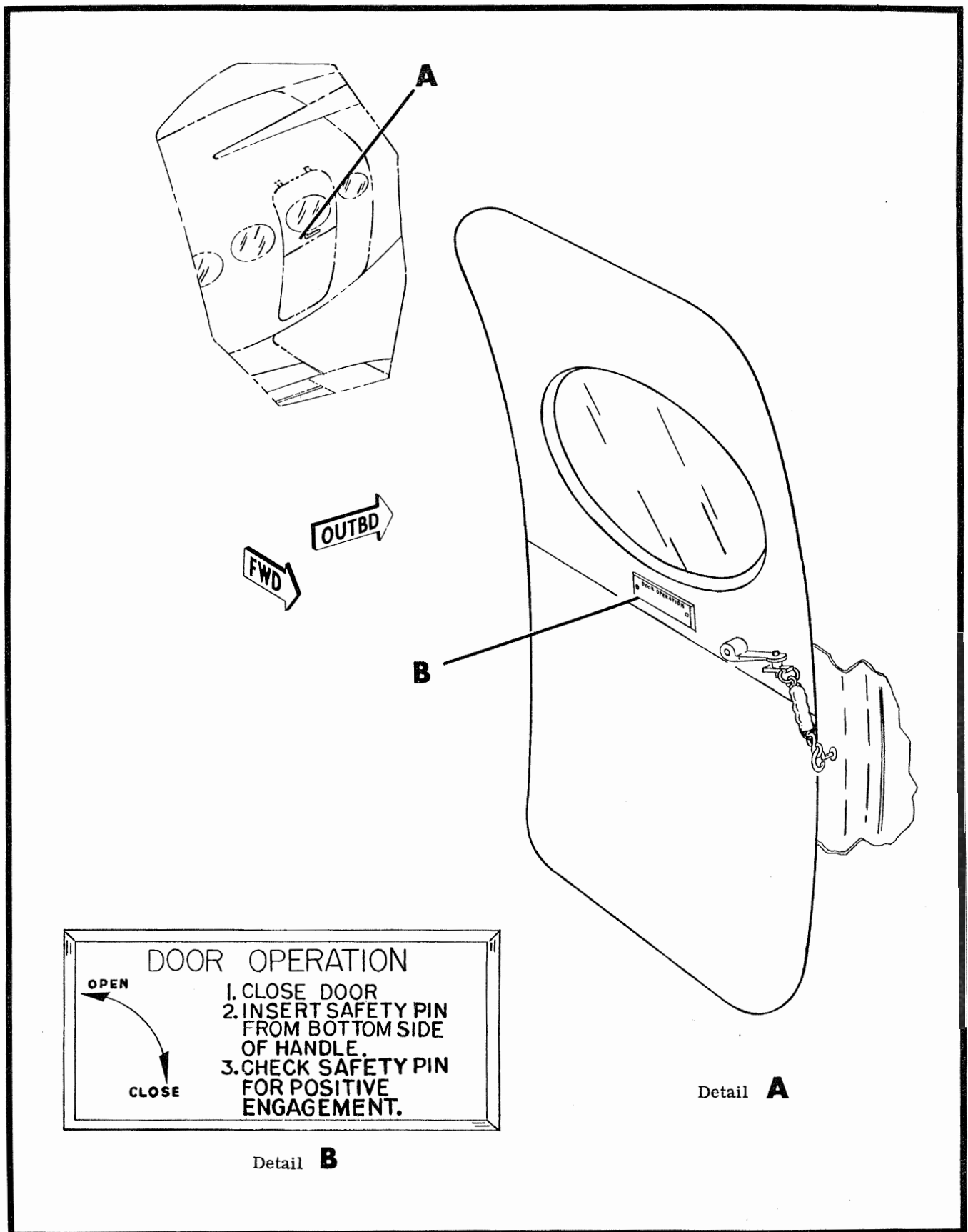
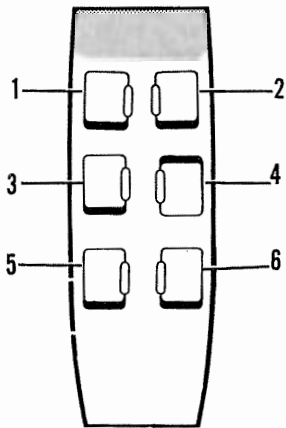
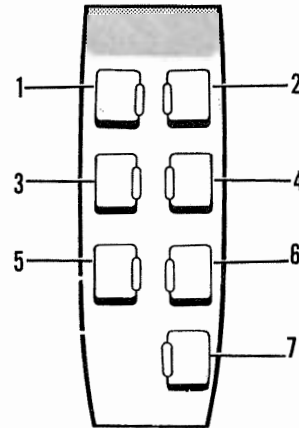


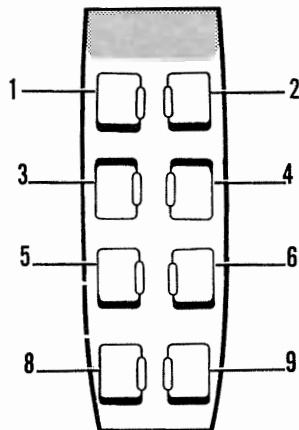
Figure 3-6B. Upper Cabin Door Safety Chain Installation



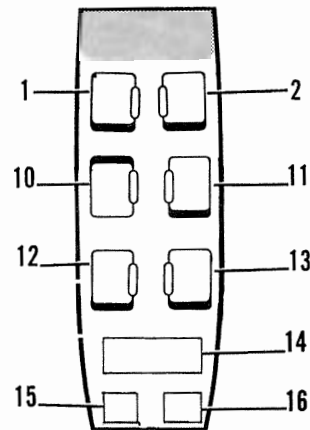
421-0001 TO 421A0001



421A0001 TO 421B0001



421 GOLDEN EAGLE

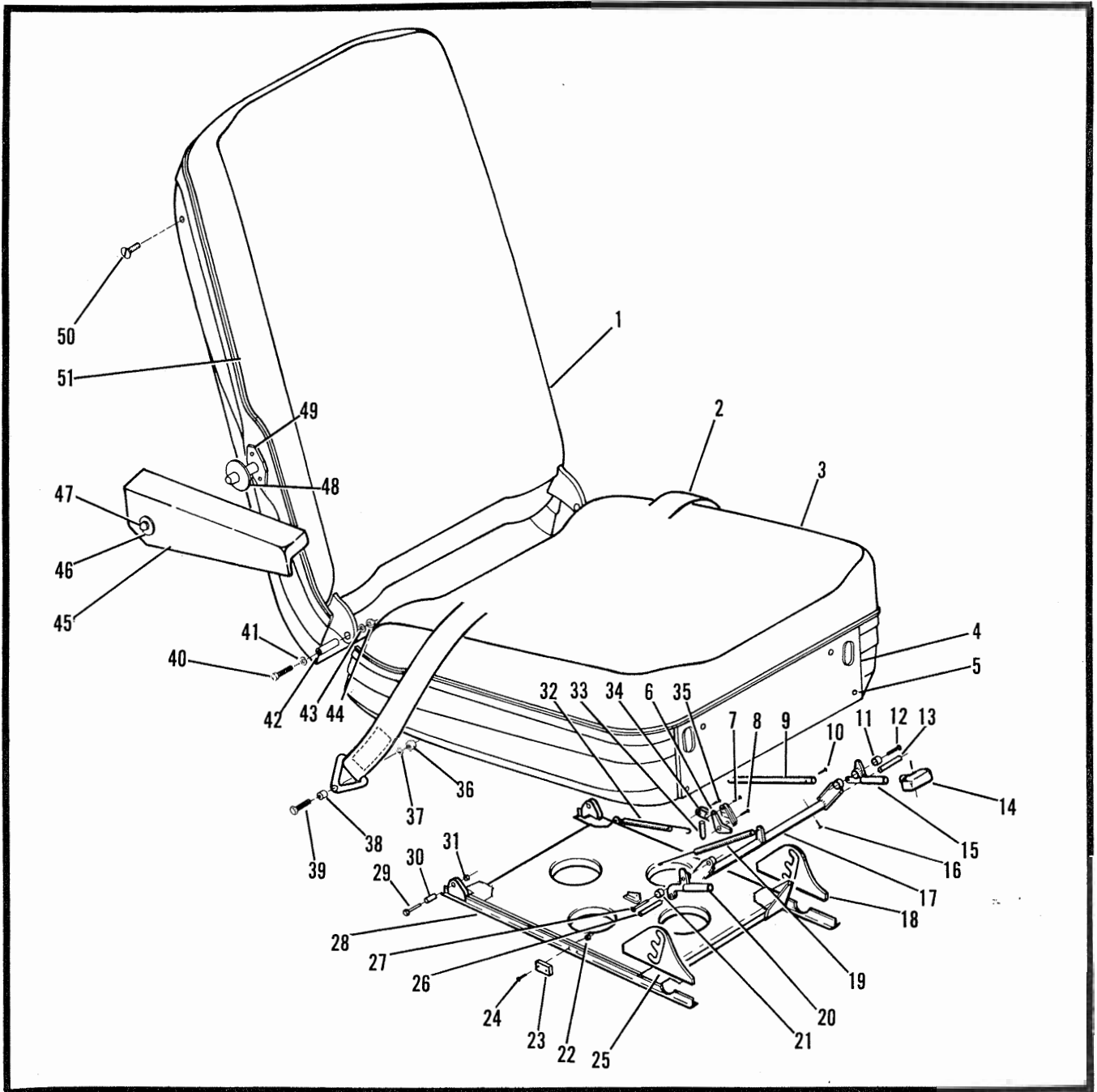


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1. Refer to figure 3-7.
2. Refer to figure 3-7.
3. Refer to figure 3-8.
4. Refer to figure 3-8.
5. Refer to figure 3-8.
6. Refer to figure 3-8.
7. Refer to figure 3-8A.
8. Refer to figure 3-8B.

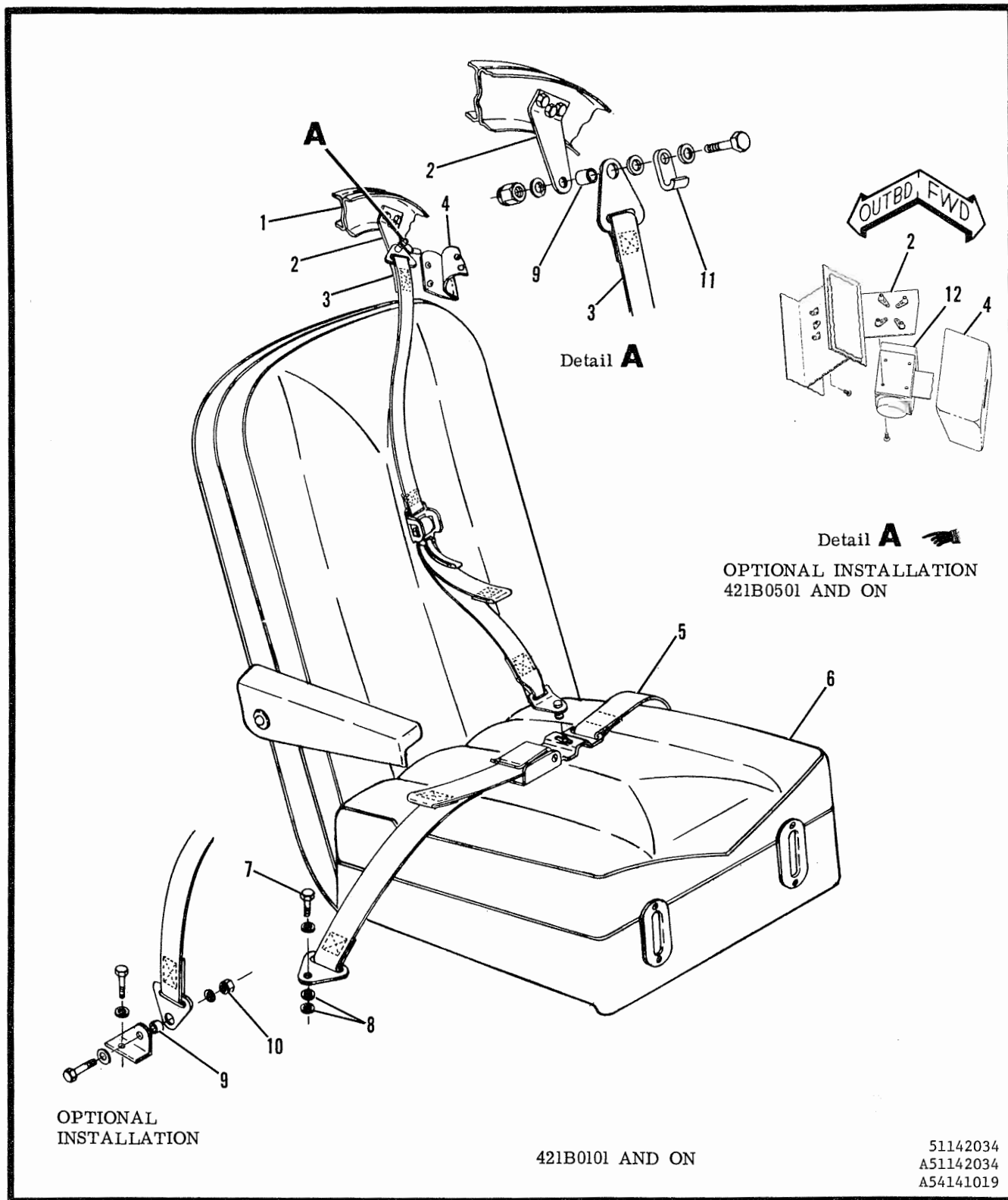
9. Refer to figure 3-8B.
10. Refer to figure 3-8.
11. Refer to figure 3-8.
12. Refer to figure 3-8.
13. Refer to figure 3-8.
14. Refer to figure 3-8C.
15. Refer to figure 3-8D.
16. Refer to figure 3-8D.

Figure 3-6C. Seating Arrangement Schematic



1. Cover Assembly	14. Handle	27. Pin	40. Screw
2. Seat Belt	15. Arm Assembly	28. Pan Assembly	41. Washer
3. Cover Assembly	16. Pin	29. Bolt	42. Spacer
4. Skirt	17. Actuator Assembly	30. Spacer	43. Washer
5. Screw	18. Bracket	31. Nut	44. Nut
6. Stop Pin	19. Spring	32. Spring	45. Cover
7. Pin	20. Arm Assembly	33. Pin	46. Washer
8. Pin	21. Spacer	34. Pivot	47. Nut
9. Tube	22. Nut	35. Pin	48. Stop Assembly
10. Pin	23. Stop	36. Nut	49. Escutcheon Plate
11. Spacer	24. Screw	37. Washer	50. Screw
12. Pin	25. Bracket	38. Spacer	51. Cover
13. Pin	26. Pin	39. Bolt	

Figure 3-7. Front Seat



1. Bulkhead, Station 154.50
2. Bracket
3. Shoulder Harness Assembly
4. Bracket Cover

5. Seat Belt
6. Seat Assembly
7. Bolt
8. Washer

9. Spacer
10. Nut
11. Hook
12. Inertia Reel

Figure 3-7A. Seat Belt and Shoulder Harness Installation

Removal and Installation of Seat Belts. (See figure 2-7A.)

- a. Remove nut, washers, spacer and bolt from seat belt anchor.
- b. Remove seat belt.
- c. Install seat belt by reversing removal procedures

NOTE

Make sure seat belts are installed with the buckle portion of seat belt on the inboard side of the seat.

Removal and Installation of Shoulder Harness. (See figure 3-7A.)

- a. Remove bracket cover (4).
- b. Remove nut, washers, spacer (9), hook (11) and bolt securing shoulder harness to bracket (2).
- c. Install shoulder harness by reversing the removal procedures.

Removal and Installation of Inertia Reel. (See figure 3-7A.)

- a. Remove bracket cover (4) by removing screw and spacer. Retain spacer for reinstallation.
- b. Remove screws securing inertia reel (12) to bracket.
- c. Install inertia reel by reversing the removal procedures.

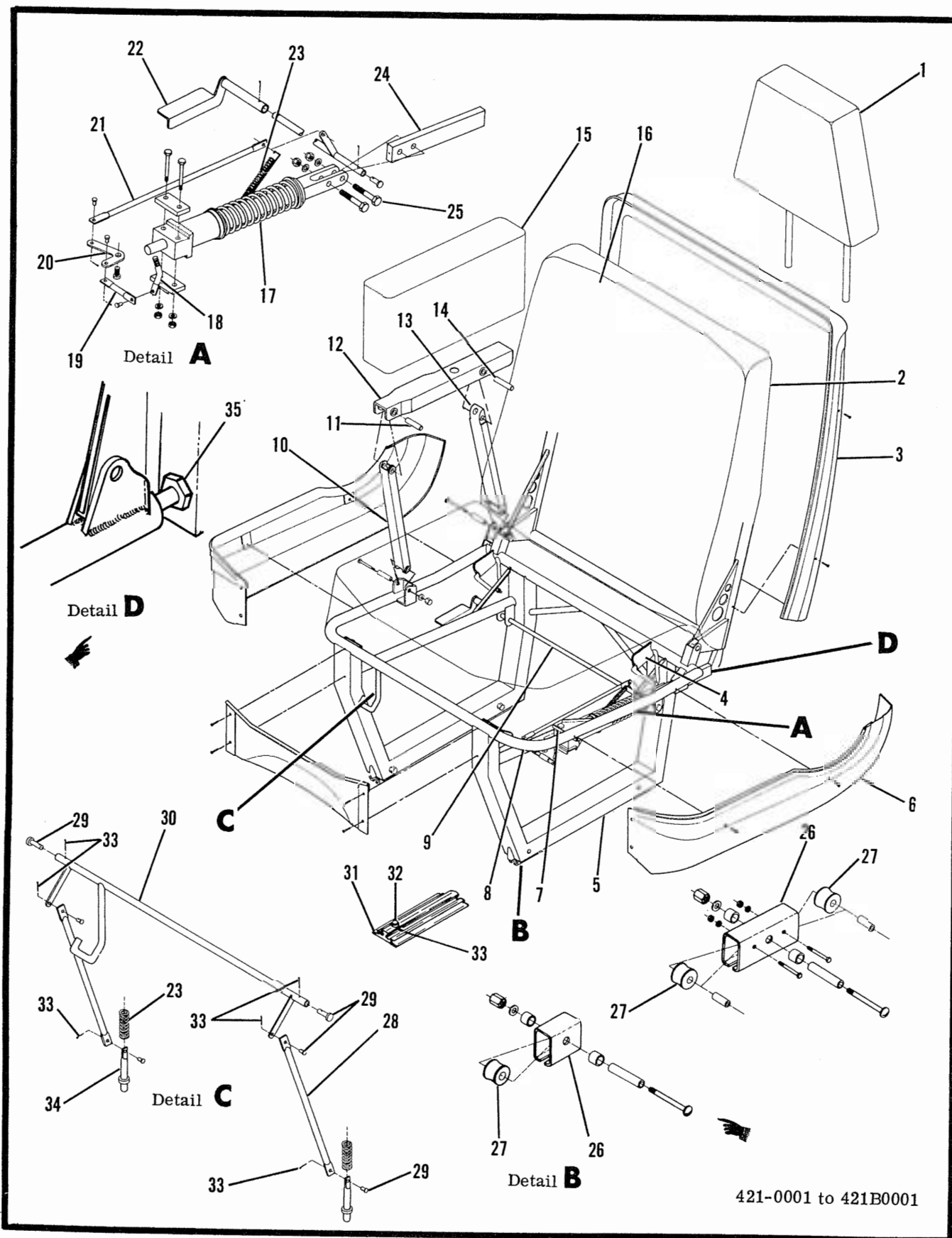


Figure 3-8. Passenger Seat (Sheet 1 of 3)

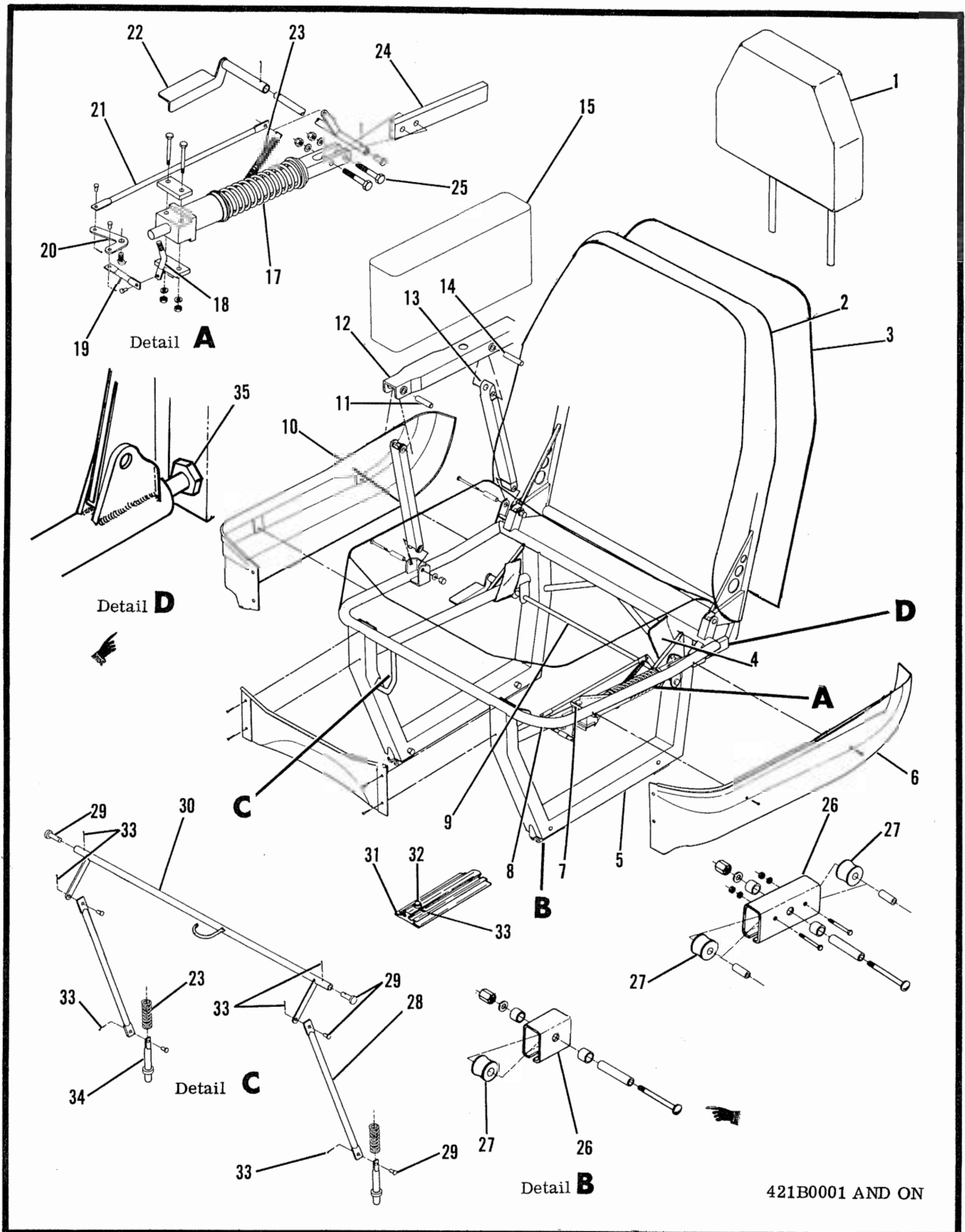
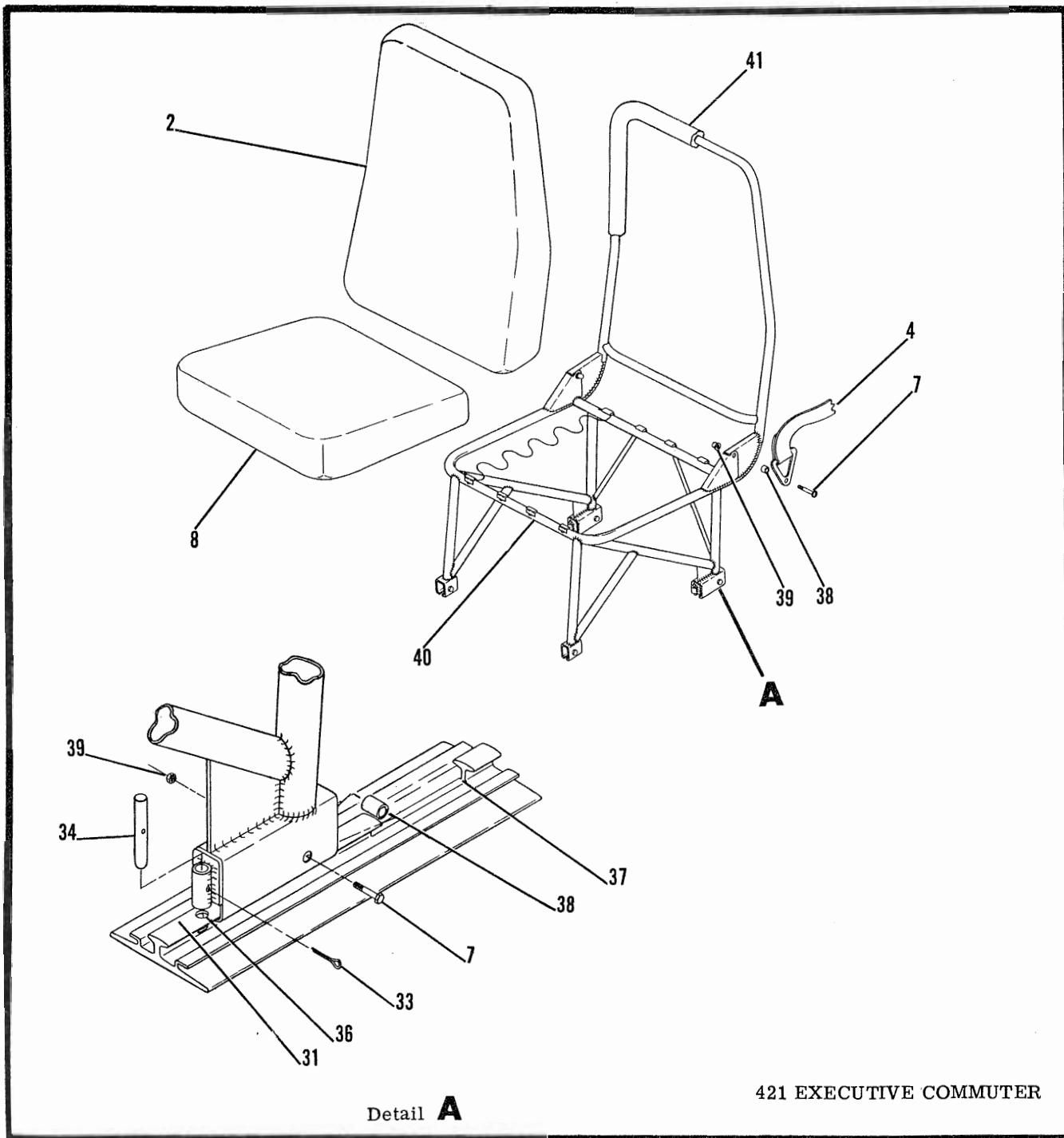
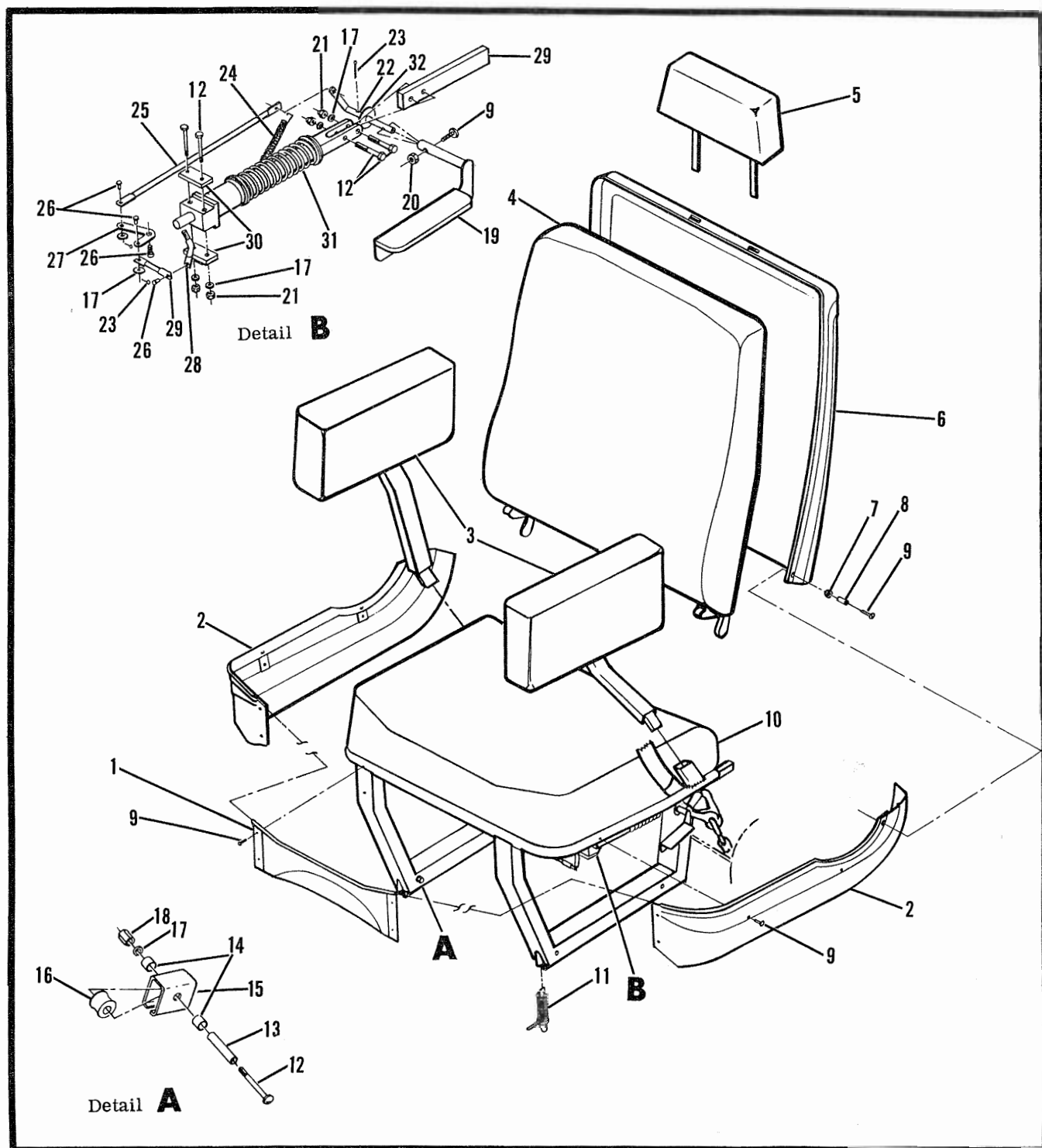


Figure 3-8. Passenger Seat (Sheet 2 of 3)



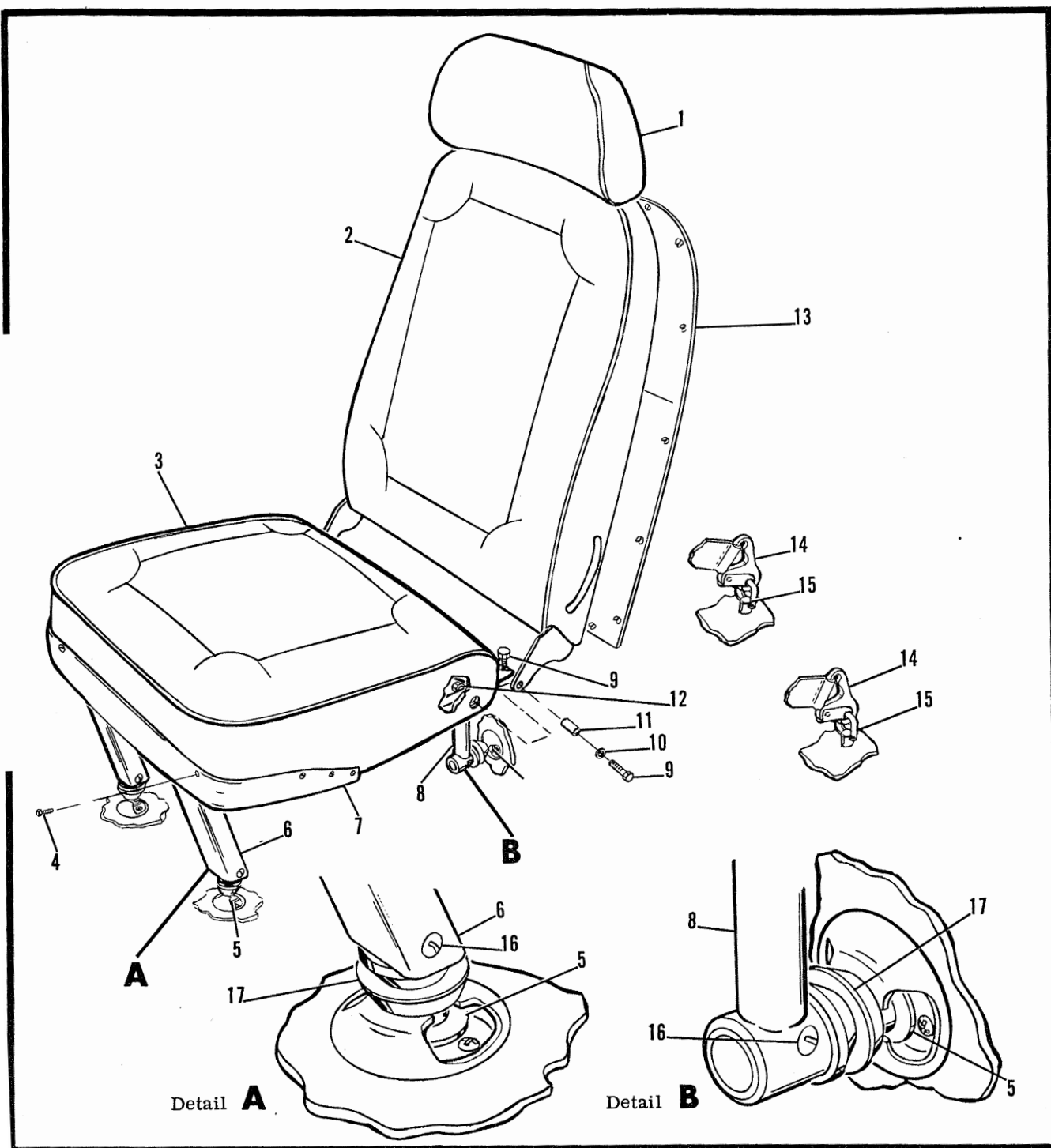
1. Head Rest	9. Bellcrank	17. Actuator Assembly	25. Bolt	33. Cotter Pin
2. Back Assembly	10. Brace	18. Arm	26. Guide	34. Seat Stop
3. Panel	11. Pin	19. Link	27. Roller	35. Bolt
4. Seat Belt	12. Support	20. Bellcrank	28. Link	36. Locating Hole
5. Roller	13. Arm	21. Link	29. Pin	37. Railout
6. Skirt	14. Pin	22. Handle	30. Bellcrank	38. Spacer
7. Bolt	15. Armrest	23. Spring	31. Seat Track	39. Nut
8. Bottom Assembly	16. Seat Cover	24. Stop	32. Rail Stop	40. Seat Frame
				41. Frame Padding

Figure 3-8. Passenger Seat (Sheet 3 of 3)



1. Front Skirt	9. Screw	17. Washer	25. Link
2. Side Skirt	10. Cover - Seat	18. Cap Nut	26. Pin
3. Removable Armrest	11. Track Stop Pin	19. Handle	27. Bellcrank - Forward
4. Cover - Seatback	12. Bolt	20. Nut	28. Actuator Control Arm
5. Headrest	13. Bushing	21. Seat Back Stop	29. Actuator Control Link
6. Cover Assy - Back	14. Spacer	22. Bellcrank - Aft	30. Spacer
7. Grommet	15. Guide	23. Cotter Pin	31. Actuator
8. Spacer	16. Roller	24. Spring	32. Washer

Figure 3-8A. Passenger Seventh Seat



1. Headrest
2. Seat Back
3. Seat Bottom
4. Screw
5. Fastener
6. Forward Leg
7. Seat Bottom Skirt
8. Rear Leg
9. Bolt

10. Washer
11. Spacer
12. Nut
13. Seat Back Cover
14. Seat Belt
15. Seat Belt Attachment
16. Attachment Bolt
17. Stud Fitting

Figure 3-8B. Passenger Seventh and Eighth Seat

Removal and Installation of Seventh and Eighth Seats.
(421B0001 and ON)

- a. Turn fasteners on back legs of chair 1/4 turn and free back legs from anchors.
- b. Turn fasteners on front legs of chair 1/4 turn, free front legs from anchors and remove chair.
- c. Install chair by reversing the removal procedures.

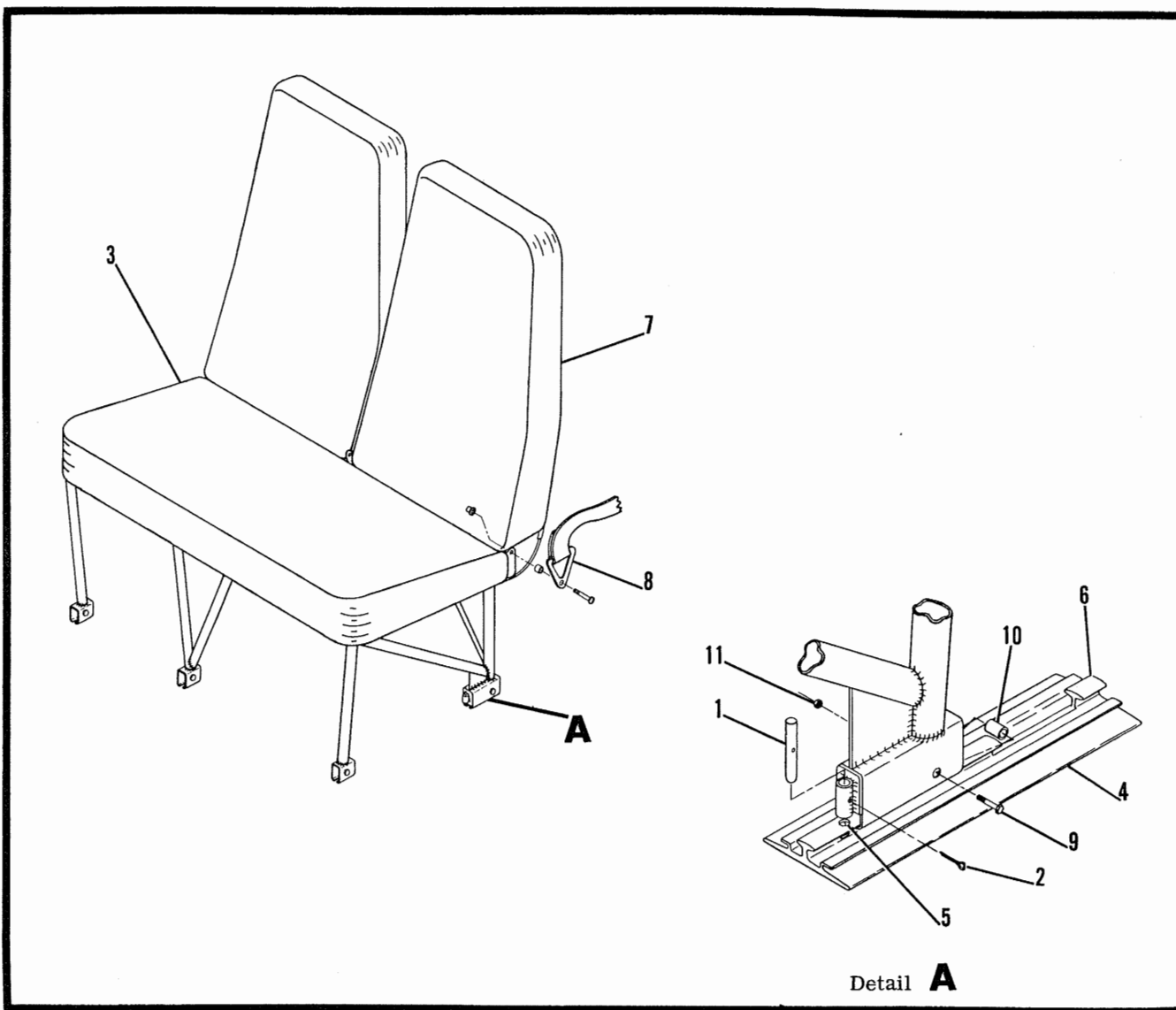
- b. Slide the seat over the cutout in the rail.
- c. Disengage seat rollers from rail assemblies.
- d. Remove seat from aircraft.

Removal and Installation of Passenger Ninth and Tenth Seats. (See figure 3-8D.) (Executive Commuter)

Remove and install ninth and tenth seats in the Executive Commuter in accordance with the Removal and Installation of Seventh and Eighth Seat Procedures.

Removal and Installation of Passenger Bench Seat.
(See figure 3-8C.) (421B0001 and ON)

- a. Remove seat stops by removing cotter pin.

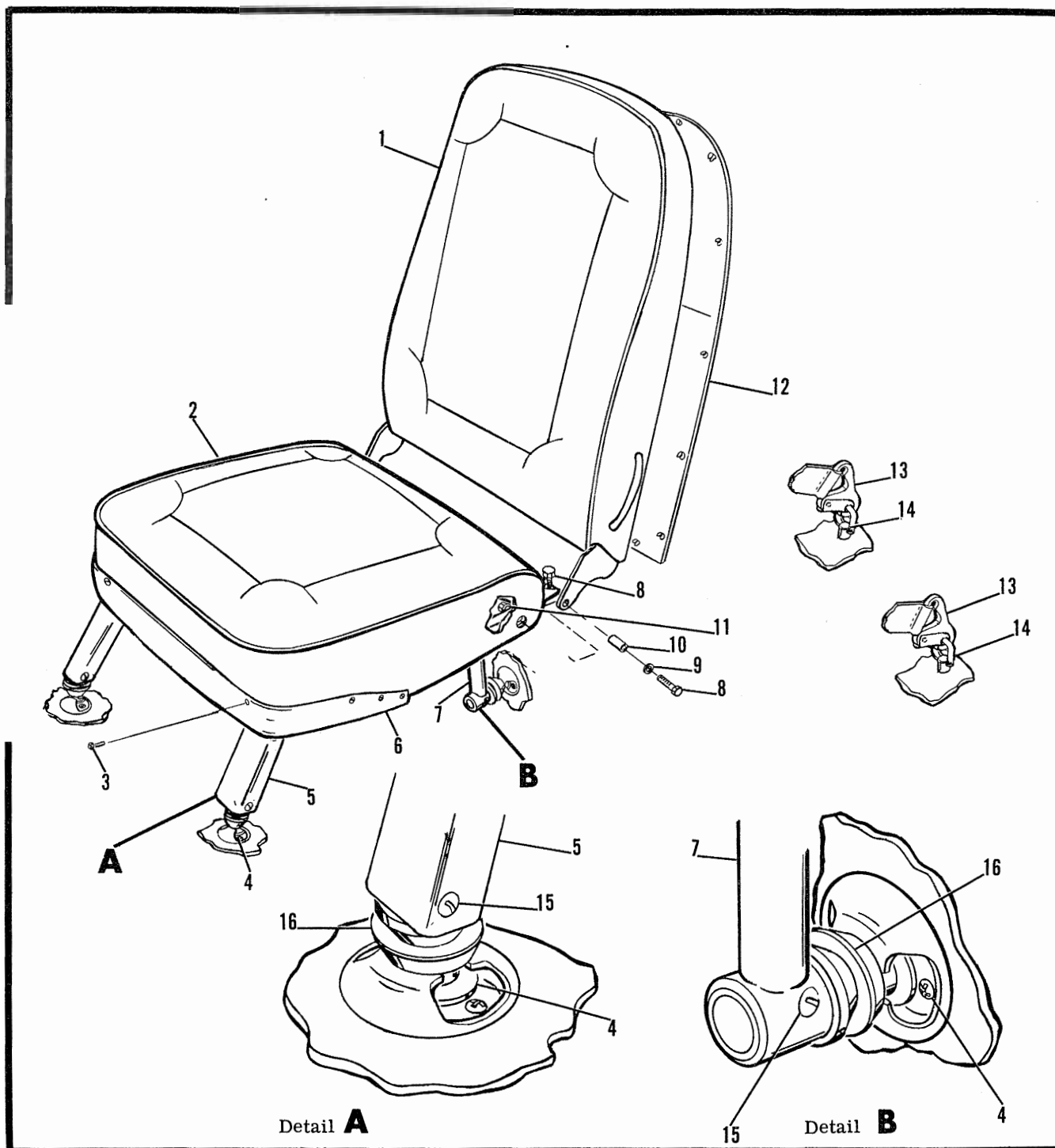


1. Seat Stop
2. Cotter Pin
3. Bottom Cushion
4. Seat Rail

5. Locating Hole
6. Rail Cutout
7. Back Cushion

8. Seat Belt Assembly
9. Bolt
10. Spacer
11. Nut

Figure 3-8C. Passenger Bench Seat



1. Seat Back
2. Seat Bottom
3. Screw
4. Fastener
5. Forward Leg
6. Seat Bottom Skirt
7. Rear Leg
8. Bolt

9. Washer
10. Spacer
11. Nut
12. Seat Back Cover
13. Seat Belt
14. Seat Belt Attachment
15. Attachment Bolt
16. Stud Fitting

Figure 3-8D. Passenger Ninth and Tenth Seat

Removal of Front Seats. (See figure 3-7.)

Removal procedure is the same for either pilot's or copilot's seat.

- a. Pull up on right-hand adjusting handle and tilt the seat back as far as possible.
- b. Remove screws securing front seat stops (23) on left seat rail and pan assembly (28).
- c. Pull up on left-hand adjusting handle and slide seat aft to remove.

NOTE

If (optional) cabin divider is installed, slide seat forward to remove.

- d. Disassemble and assemble front seats in accordance with figure 3-6.

Installation of Front Seats. (See figure 3-7.)

Install front seats by reversing removal procedure.

WARNING

After the front seats have been installed, insure that stops (23) are installed properly and that seat adjustment mechanisms are functioning properly.

Trouble Shooting Individual Seat Assemblies.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOCKING MECHANISM FAILS TO ENGAGE IN SEAT SUPPORT	Broken, disconnected or missing spring.	Replace spring.
SEAT ADJUSTMENT MECHANISM FAILS TO OPERATE	Distorted parts.	Repair or replace parts.
	Broken, disconnected or missing spring.	Replace spring.
	Distorted parts.	Repair or replace parts.
SEAT ASSEMBLY FAILS TO SLIDE FREELY ON SEAT SUPPORT	Improper lubrication	Apply paraffin wax to the seat rails on the pan assembly.
	Parts bent or broken.	Repair or replace parts.

Removal and Installation of Upholstery and Upholstery Trim. (See figure 3-9, sheet 1 of 2.)

- a. Remove front and passenger seats in accordance with seat removal procedures.
- b. Remove headliner as follows:

NOTE

Removal of LH headliner is given, removal of RH headliner is the same.

1. Remove sun visor by removing clamp screws securing clamps to support. Remove supports by screwing counterclockwise out of retainer.
2. Remove cover plate on individual combination light assemblies by removing oxygen outlet port cover, retaining nut and attaching screws.
3. Remove upper windshield trim (22).
4. Remove LH side window trim (39).
5. Starting at the left side of the windshield, remove headliner (13) from prongs of upholstery retainer (18).
6. Remove headliner from side window retainer prongs (17).
7. Remove headliner from overhead plenum by

carefully peeling upholstery from metal.

8. Remove headliner from curtain track (11 and 15) by unsnapping retainer (14 and 10) from curtain track working from front to aft.

9. Carefully remove headliner from pronged retainer (12) above entrance door and at aft cabin bulkhead.

10. Remove headliner by carefully working from left to right and front to rear releasing the headliner wires (16) from support hooks.

11. Remove screws securing retainer (19) to structure and remove headliner.

- c. Remove aft cabin bulkhead upholstery as follows:
 1. The side flaps of the center panel (27) are held by hook and pile. To remove pull sides loose.

2. Raise panel approximately 1/2 inch and pull bottom of panel forward to release upper support from clips. Remove panel.

3. Remove aft cabin bulkhead side upholstery (26 and 28) by carefully peeling the upholstery loose and around the edges.

4. Raise panel approximately 1/2 inch and pull panel forward to release support from clips at top edge.

- d. Remove set screw (6) at the end of curtain tracks and slide curtain from curtain track.

- e. Remove window trim (32, 35 and 36) by remov-

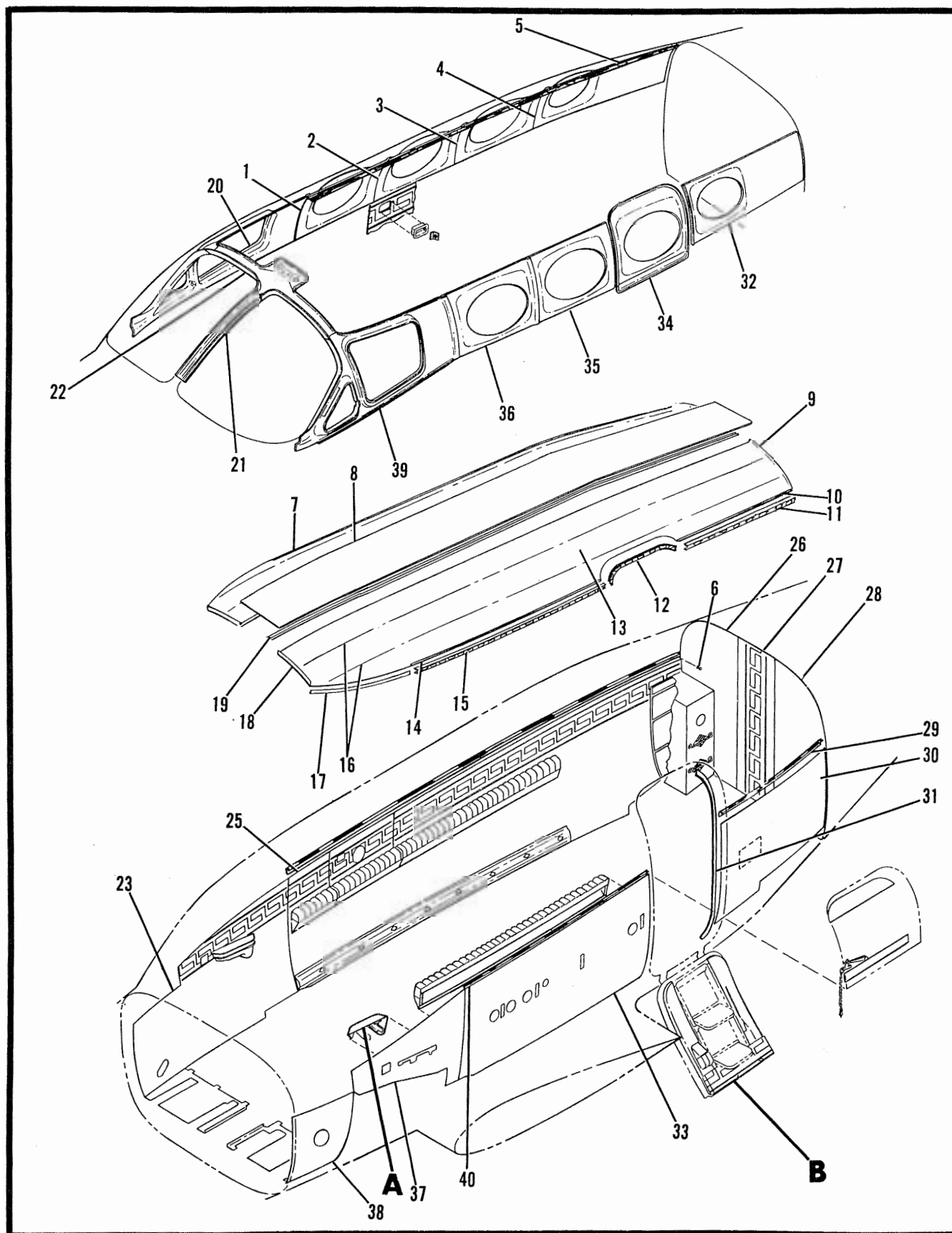
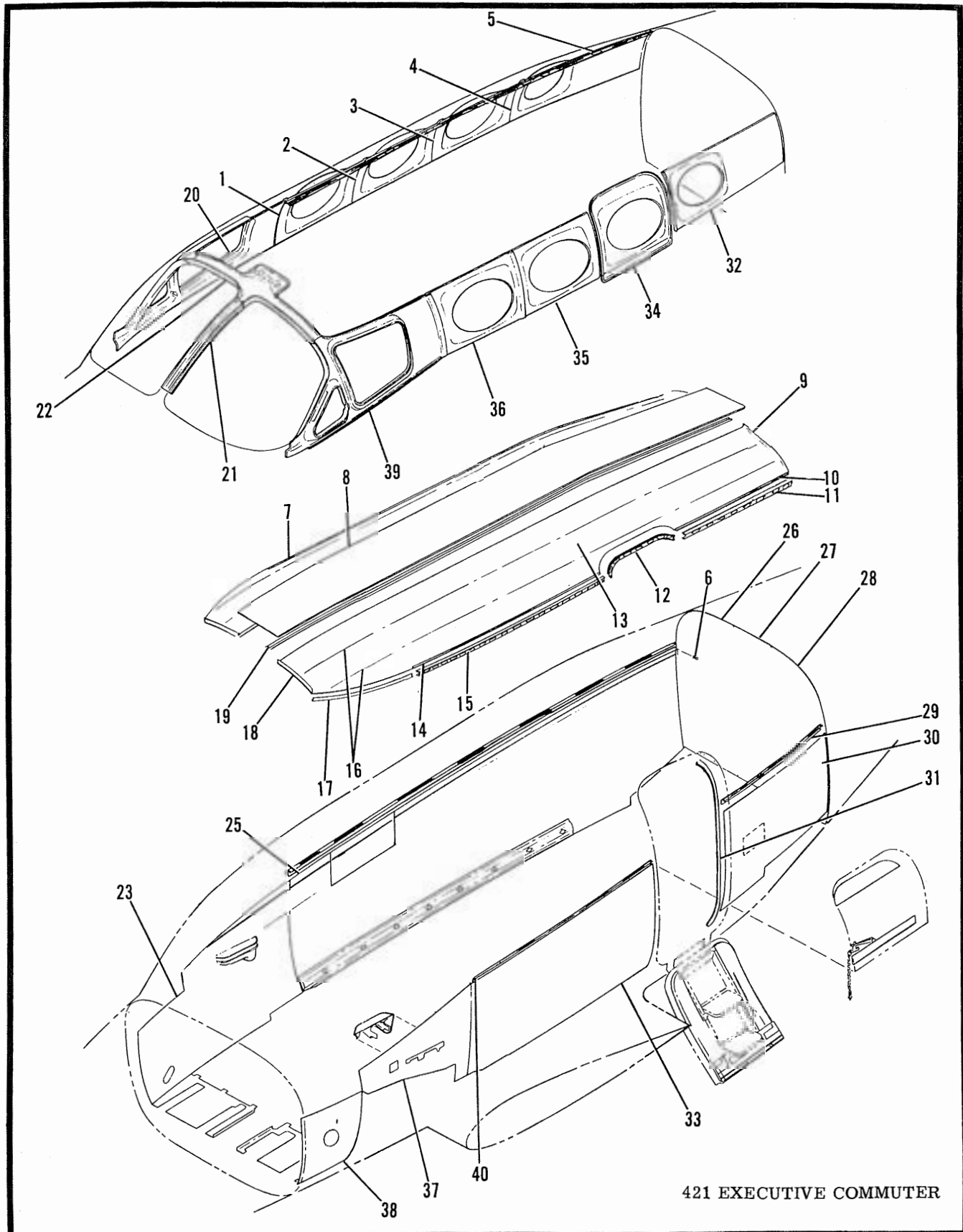


Figure 3-9. Upholstery and Upholstery Trim (Sheet 1 of 4)



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Figure 3-9. Upholstery and Upholstery Trim (Sheet 2 of 4)

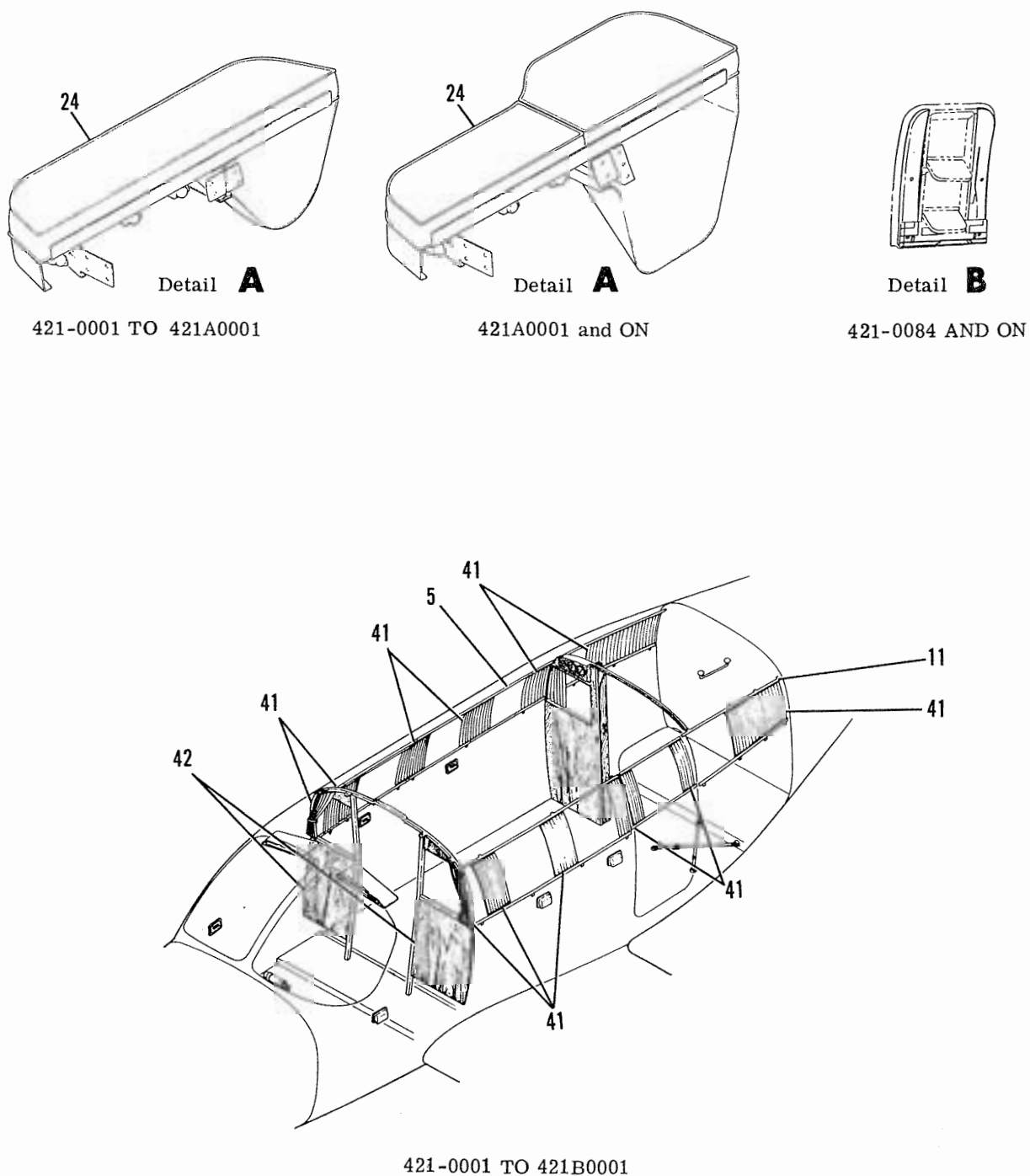
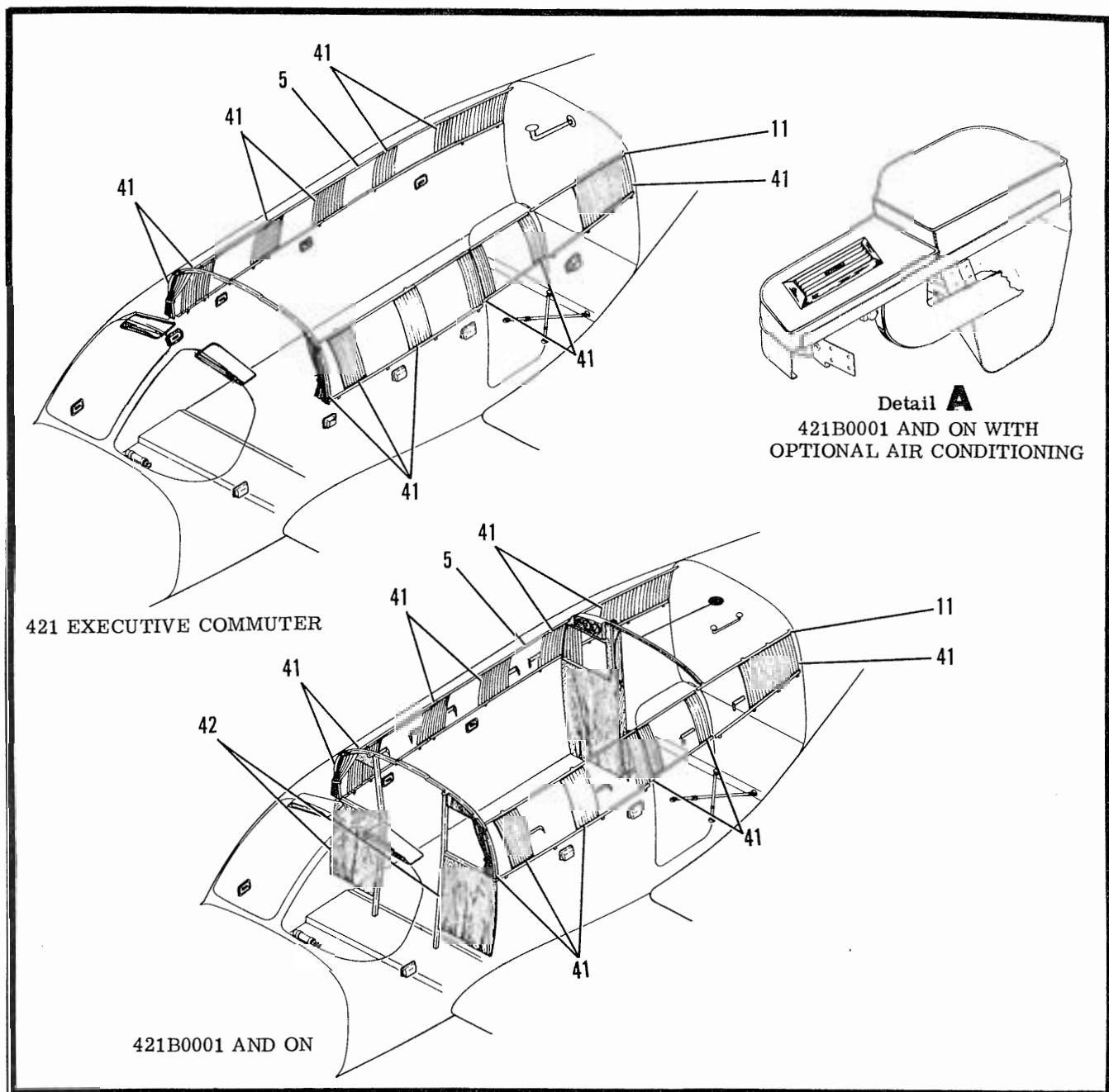
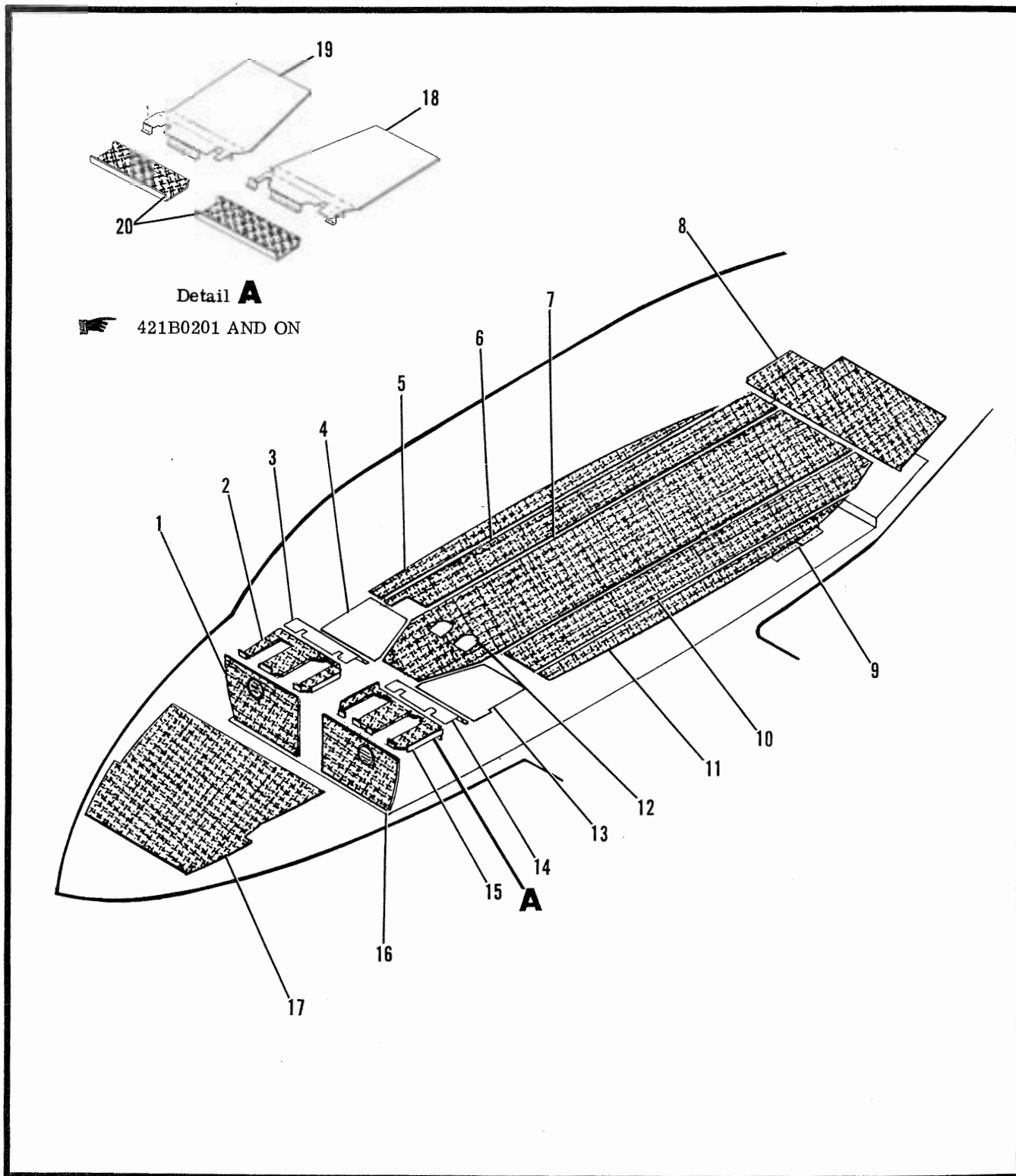


Figure 3-9. Upholstery and Upholstery Trim (Sheet 3 of 4)



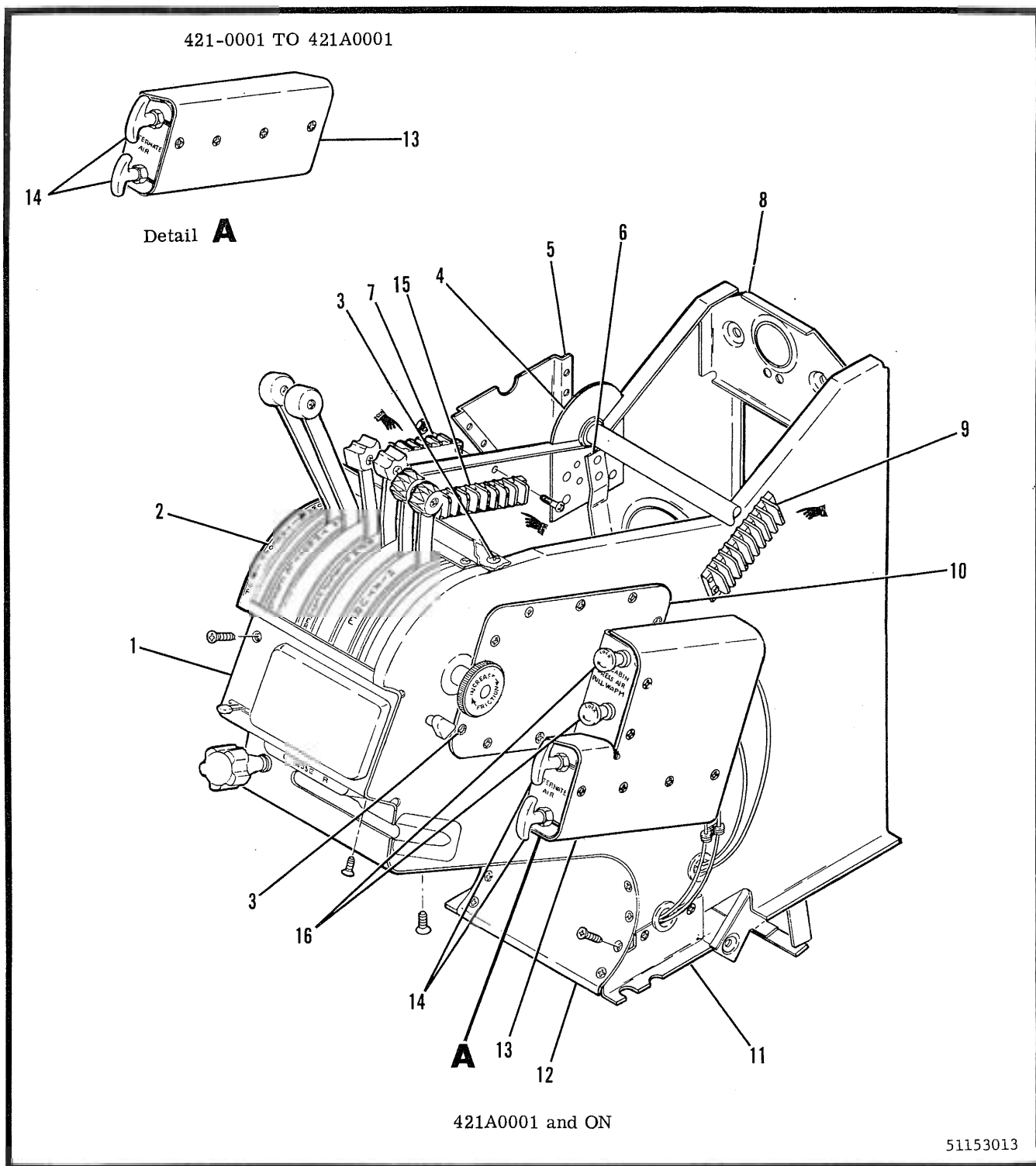
1. Emergency Window Trim	15. LH Forward Curtain Track	29. LH Aft Lower Curtain Track
2. RH Forward Window Trim	16. Headliner Wire	30. LH Aft Side Panel
3. RH Center Window Trim	17. Retainer	31. Retainer
4. RH Aft Window Trim	18. Retainer	32. LH Aft Window Trim
5. RH Upper Curtain Track	19. Retainer	33. LH Center Side Panel
6. Set Screw	20. RH Side Window Trim	34. Upper Cabin Door Trim
7. RH Headliner	21. Center Windshield Trim	35. LH Center Window Trim
8. Center Cover Support	22. Upper Windshield Trim	36. LH Forward Window Trim
9. Aft Headliner Retainer	23. RH Forward Side Panel	37. LH Forward Side Panel
10. Aft Retainer	24. Arm Rest Upholstery	38. LH Forward Panel
11. LH Aft Curtain Track	25. RH Side Upholstery Panel	39. LH Side Window Trim
12. Retainer	26. RH Aft Bulkhead Upholstery	40. LH Forward Lower Curtain Track
13. LH Headliner	27. Center Aft Bulkhead Upholstery	41. Curtain
14. Retainer	28. LH Aft Bulkhead Upholstery	42. Forward Cabin Divider

Figure 3-9. Upholstery and Upholstery Trim (Sheet 4 of 4)



1. Forward Bulkhead Carpet	8. Rear Carpet	14. Kick Plate
2. Cover Plate	9. Step Plate	15. Cover Plate
3. Kick Plate	10. LH Center Carpet	16. Forward Bulkhead Carpet
4. Kick Plate	11. LH Outboard Carpet	17. Baggage Shelf Carpet
5. RH Outboard Carpet	12. Carpet Retainer	18. LH Scuff Plate
6. RH Center Carpet	13. Kick Plate	19. RH Scuff Plate
7. Center Carpet		20. Carpet

Figure 3-10. Carpet Installation



1. Face Plate	6. Bulkhead	12. Cover
2. Quadrant	7. Terminal Block 6	13. Cover
3. Screw	8. Pulley Bracket	14. Alternate Air Controls
4. Bearing Pad	9. Terminal Block 5	15. Diode Assembly
5. Cover	10. Cover Plate	16. Heat Exchange Controls
	11. Filler	

Figure 3-11. Control Pedestal Installation

ing retaining screws and slipping trim out from behind upper and lower curtain tracks.

f. Remove LH and RH forward side panels (23 and 37) as follows:

1. Remove ash receivers and armrest cover assembly by removing attaching screws.
2. Remove bonded armrest upholstery cover and pad by carefully peeling from armrest base.
3. Remove attaching screws and forward panel (38).

g. Remove LH center panel (33) as follows:

1. Remove ash receivers, lighter assembly and safety chain.
2. Remove screws securing panel to structure at forward edge, bottom edge and along center at each bulkhead.

3. Pull panel out of aft retainer and curtain track (40).

4. Disconnect courtesy light and switch wires.
5. Disconnect clamp and hose from air outlet duct and remove panel.

h. Remove RH center panel (25) in a similar manner.

i. Remove LH aft side panel as follows:

1. Remove cabin door cable fitting.
2. Remove screws from aft and lower sides of panel.

3. Pull panel from the forward retainer and from under curtain track and remove panel.

j. Install upholstery panels by reversing removal procedures and bonding affected panels with cement (EC880 Minnesota Mining and Manufacturing Co., or equivalent).

k. Install headliner by reversing removal procedures and bonding affected areas with cement (EC880 Minnesota Mining and Manufacturing Co., or equivalent).

Removal and Installation of Carpet. (See figure 3-10.)

- a. Remove front and passenger seats in accordance with seat removal procedures.
- b. Remove kick plates (3, 4, 13 and 14) by removing attaching screws.
- c. Remove screws attaching cover plates (2 and 15) to floorboards and pedestal installation, remove cover plates.
- d. Remove carpet retainers (12) by removing attaching screws.
- e. Remove carpets (5, 6, 7, 10, 11 and 8) by removing attaching screws.
- f. Remove forward bulkhead carpet (1) by carefully peeling the bonded carpet from metal.
- g. Install carpets by reversing removal procedures and bonding affected carpets using cement (EC880 Minnesota Mining and Manufacturing Co., or equivalent).

Removal and Installation of Control Pedestal. (See figure 3-11.)

NOTE

The control pedestal is riveted to the forward cabin bulkhead and should not be removed unless damaged.

- a. Remove front seats, front carpet and kick

Change 8

plates.

b. Remove cover (5), right and left side filler (11) and cover (12).

c. Remove control quadrant in accordance with Section 9.

d. Remove elevator trim control in accordance with Section 6.

e. Remove rudder trim control in accordance with Section 7.

f. Disconnect aileron trim cable in accordance with Section 5.

g. Route elevator, rudder and trim cables from pedestal.

h. Remove throttle mixture, and propeller controls in accordance with Section 9.

i. Remove alternate air control cover (13) and cover plate (10) in accordance with Section 9, and remove controls from bracket as follows:

1. Remove nut securing controls to bracket.

2. Pull control aft until cable will slip out of slots in bracket.

j. Remove bearing pad (4) by removing screws securing pad to pedestal.

k. Remove terminal blocks (7 and 9) and diode assembly (15).

l. Remove two screws (3) securing pedestal to instrument panel.

m. Remove pedestal side panels by drilling out rivets at floor and forward cabin bulkhead. Drill out rivets securing side panels to bulkhead and pulley brackets.

n. Replace damaged parts and reassemble by reversing the removal procedures.

NOTE

When assembling parts to forward cabin pressure bulkhead, be sure that parts are sealed in accordance with Section 16.

WING.

Removal of Wing. (See figure 3-12.)

a. Drain fuel system at four places: cross feed drain, sediment bowl, main tank and sump drain, and auxiliary tank and sump drain.

NOTE

Wings can be removed with fuel tanks installed. If fuel tank removal is desired, remove in accordance with Section 11.

b. Remove engines in accordance with removal procedures in Section 9.

CAUTION

If one or both engines are removed, the aircraft may become tail heavy. To balance aircraft use weights (such as shot bags or sand bags) in the nose compartment and support the tailcone.

c. Jack aircraft in accordance with jacking procedures in Section 2.

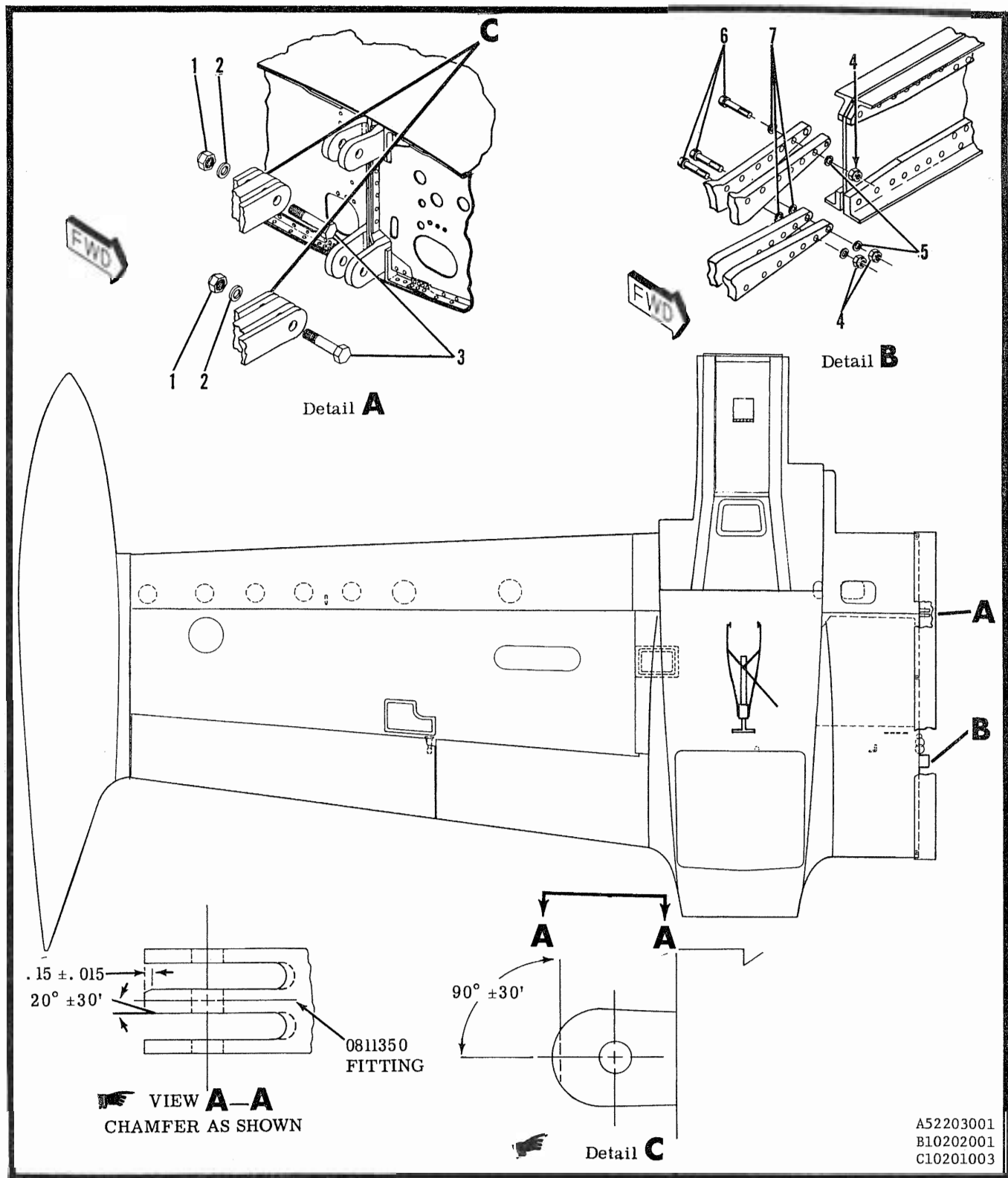


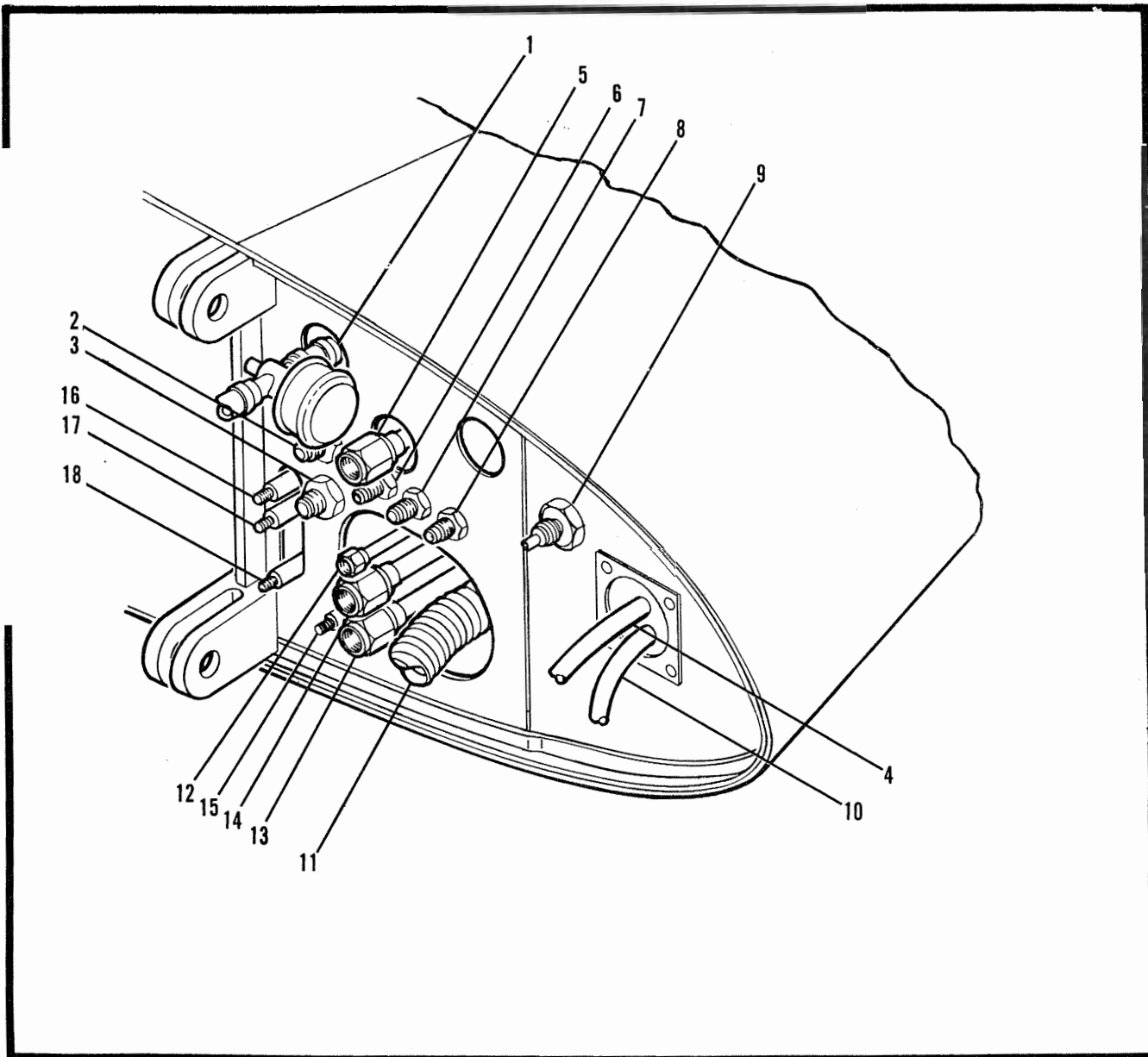
Figure 3-12. Wing Installation

d. Place suitable padded supports (cradles) beneath each stub wing, tailcone, and wing; then remove jacks.

NOTE

To prevent damage to skin and rib sections, place padded supports beneath front and rear

spars 35.50 inches from fuselage centerline on stub wings, beneath tailcone bumper, and wing root, and tip ribs. If both engines were removed and weight was placed in nacelles, remove weight after removing jacks.



1. Vacuum Line	10. Electrical Wire Bundle
2. Brake Line	11. Cabin Pressure Duct
3. Oil Pressure Line	12. Heater Fuel Line (RH wing only)
4. Electrical Wire Bundle	13. Autopilot Supply Line
5. Fuel Line	14. Fuel Line
6. Supercharger Pressure Line	15. Throttle Control
7. Manifold Pressure Line	16. Alternate Air Control
8. Fuel Pressure Line	17. Propeller Control
9. Fuel Selector Control	18. Mixture Control

Figure 3-13. Wing Root Connections

CAUTION

If only one wing is being removed and the engine on the opposite wing remains installed; relieve the engine weight on opposite wing by using engine hoist before removing wing or serious damage, due to tipping, may result.

- e. Remove wing structural skins by removing attaching screws.
- f. Disconnect or remove landing gear drive tube in accordance with removal procedures outlined in Section 4.
- g. Remove flap cables from wing in accordance with Section 8.
- h. Remove aileron cables in accordance with Section 5.
- i. On left wing only, remove aileron trim cables in accordance with Section 5.
- j. Remove engine controls in nacelle in accordance with Section 9.
- k. (See figure 3-13.) Disconnect and tag the following items;
 1. Vacuum line at union (1).
 2. Wing wiring disconnect (4).
 3. Fuel lines (5) and (14).
 4. Brake line at fitting (2).
 5. Oil pressure line at fitting (3).
 6. Supercharger pressure line at fitting (6).
 7. Manifold pressure line at fitting (7).
 8. Fuel pressure line at fitting (8).
 9. Fuel selector control (9).
 10. Electrical disconnect (10).
 11. Cabin pressure line at duct (11).
 12. Heater fuel line (12). Right wing only.
- l. With engine controls (15), (16), (17) and (18) disconnected at engine, route cables through wing toward the fuselage until the wing root is cleared.
- m. If wing de-ice system (optional equipment) is installed, cut nylon line in wing root area.
- n. (See figure 3-11.) From wing attachment fittings, remove nuts (1 and 4), washers (2, 5 and 7), and bolts (3 and 6).

NOTE

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

- o. Move wing and padded supports outboard until wing attachment fittings have disengaged.

Installation of Wing. (See figure 3-12.)

NOTE

If a new wing(s), wing front spar (s), or front spar fitting(s) is being installed on the aircraft, the fuselage front spar fittings may have to be modified in accordance with figure. After performing this modification, all bare surfaces must be color chemical filmed (Irridite 14-2, Allied Research Product) per manufacturer's instructions, then primed with zinc chromate primer.

- a. Route engine control cables (15, 16, 17 and 18, figure 3-13) through proper wing leading edge holes as wing is moved toward fuselage.
- b. Guiding main gear drive tube through wing, move wing toward fuselage until wing fittings engage and attach drive tube in accordance with Section 4.
- c. Guide fuel selector cable (9, figure 3-13) through opening in wing root rib.
- d. Align bolt holes in front and rear spar fittings and install bolts (3), washers (2), and nuts (1) on front spar fittings; and bolts (6), washers (5 and 7), and nuts (4) on rear spar fitting.

NOTE

Install front spar bolts with heads forward and rear spar bolts with heads aft. Place countersunk washers (7) under heads of bolts (6). Torque front spar nuts (1) to 60 $\pm$ 5 foot pounds, and rear spar nuts (4) to 175 $\pm$ 15 inch pounds.

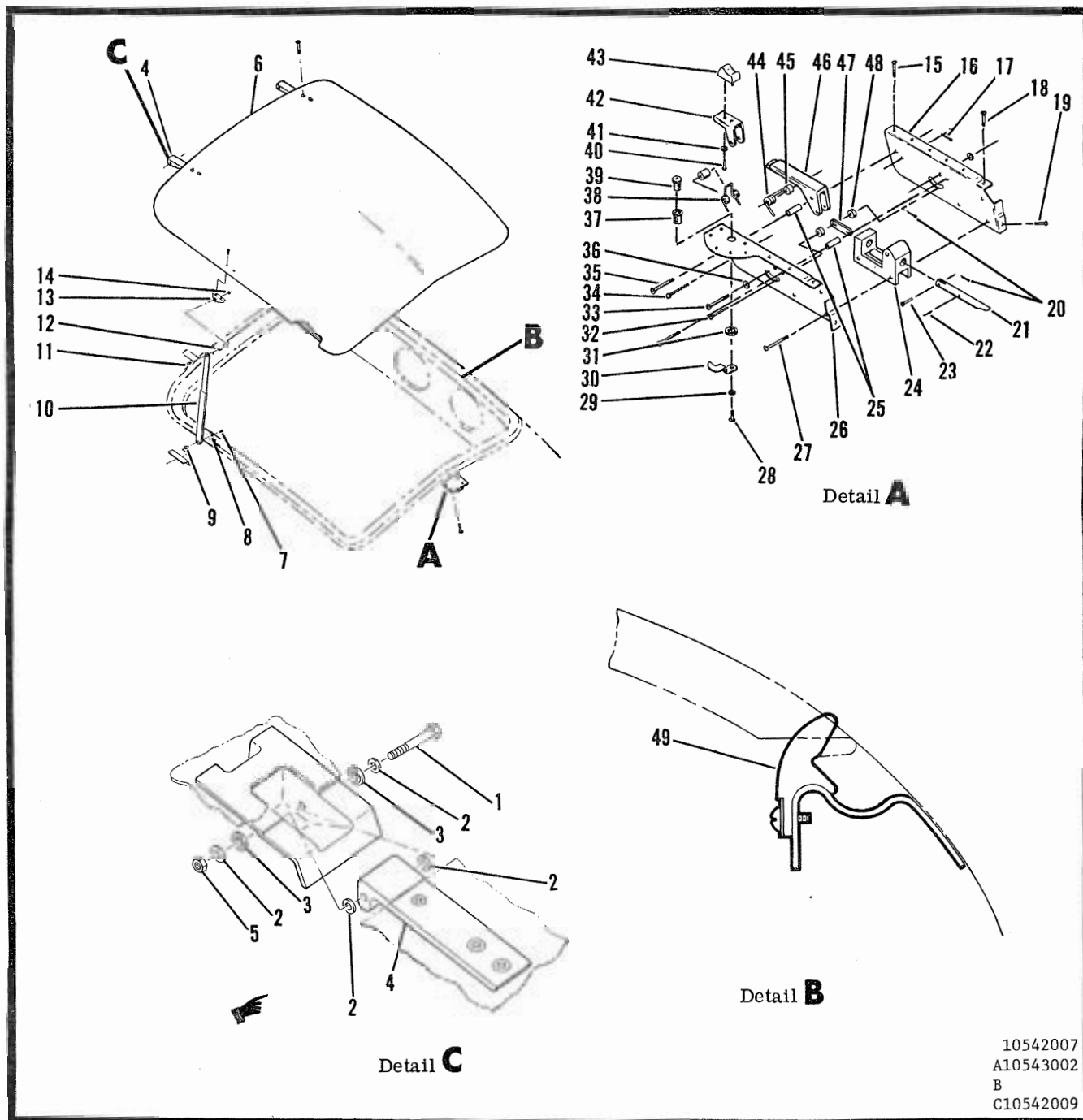
NOTE

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

- e. If wing deice system (optional equipment) is installed, connect the two ends of cut nylon line with two Cessna Part Number S1130-4 Nuts and one S1132-4 Union.
- f. Remove tags and connect the following items:
 1. Vacuum line at fitting (1).
 2. Wing wiring disconnect (4).
 3. Brake line at fitting (2).
 4. Oil pressure line at fitting (3).
 5. Fuel lines (5 and 14).
 6. Supercharger line at fitting (6).
 7. Manifold pressure line at fitting (7).
 8. Fuel pressure line at fitting (8).
 9. Fuel selector control (9).
 10. Electrical disconnect (10).
 11. Cabin pressure duct (11).
 12. Heater fuel line (right wing only) at fitting (12).
- g. On left wing only, route and connect aileron trim cables to trim tab in accordance with Section 5.
- h. Route and connect aileron cables to aileron and rig in accordance with Section 5.
- i. Route and connect flap cables to flap and rig in accordance with Section 8.
- j. Connect landing gear drive tube to landing gear in accordance with Section 4.
- k. Jack aircraft in accordance with procedure outlined in Section 2.

CAUTION

If one or both engines were removed, the aircraft may become tail heavy. To balance aircraft use weights (such as shot bags or sand bags) in the nose compartment and support the tailcone.



1. Bolt	14. Nut	26. Support	38. Spring
2. Washer	15. Screw	27. Screw	39. Cylinder Assembly
3. Stat-o-seal	16. Support	28. Screw	40. Screw
4. Hinge Strap	17. Cotter Pin	29. Lockwasher	41. Lockwasher
5. Nut	18. Screw	30. Lock Arm	42. Latch Handle Retainer
6. Door Assembly	19. Screw	31. Nut	43. Button
7. Screw	20. Cotter Pin	32. Pin	44. Spring
8. Washer	21. Bolt Latch	33. Screw	45. Spacer
9. Spacer	22. Spring	34. Pin	46. Latch Handle
10. Stop Assembly	23. Pin	35. Screw	47. Link
11. Screw	24. Block Guide	36. Washer	48. Spacer
12. Spacer	25. Spacer	37. Shell	49. Seal

Figure 3-14. Wing Locker Installation

- l. Leave tailcone support in place, remove padded supports from beneath fuselage and wings.
- m. Install engines in accordance with installation procedures of Section 9.
- n. Remove tailcone support and jack.
- o. Check for correct cable tensions, proper operation, and correct travel of flaps, ailerons, and aileron trim tabs. Refer to rigging procedures for limits and tolerances.
- p. Service aircraft, then check for fuel leaks at fuel tank and wing root connects.
- q. Install structural skins. Start engines and check operation of electrical equipment and engine controls.

Wing Locker

The wing locker compartments are located just aft of the engine nacelle compartment in each wing nacelle. The wing locker door is located on the aft side of the wing and can be opened by a push type, flush mounted snap latch. The door locks are opened by the same

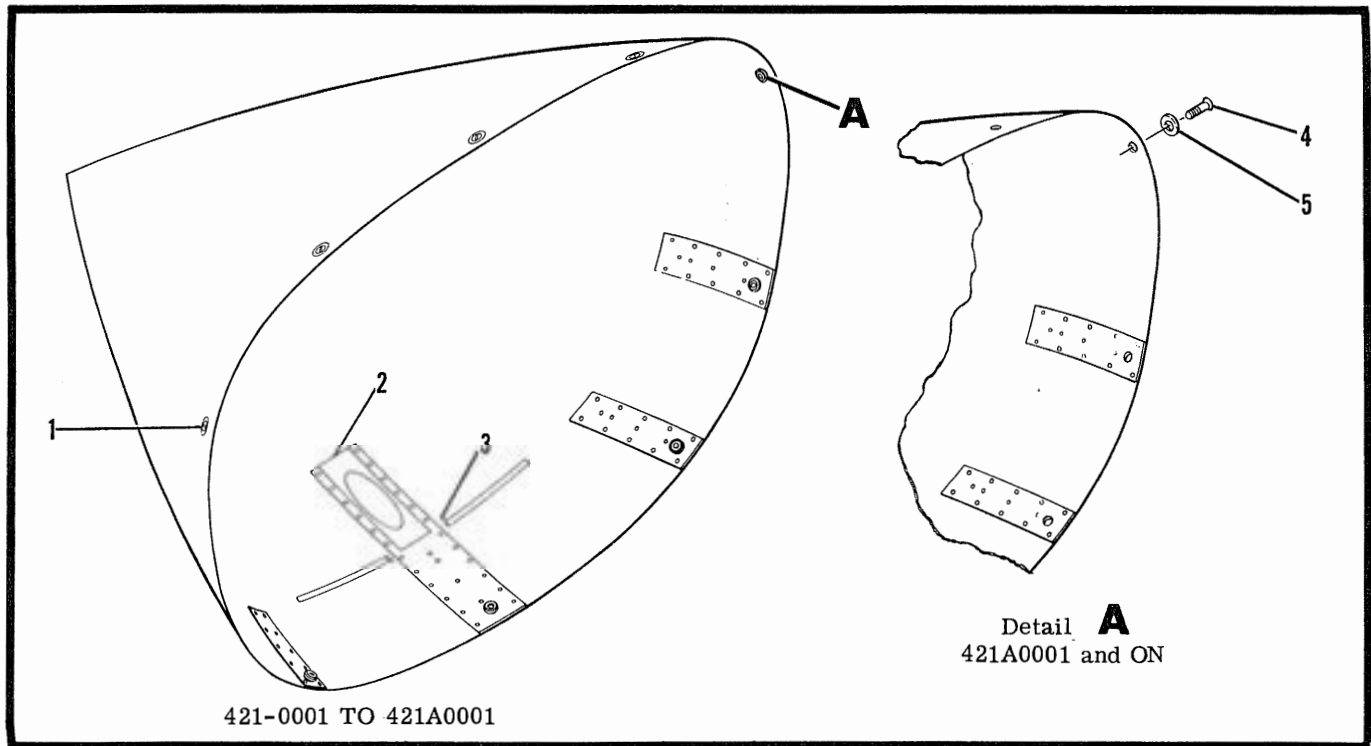
key that operates the cabin door. Door stays are provided to support the door when it is open.

Removal and Installation of Wing Locker Door. (See figure 3-14.)

- a. Open wing locker door.
- b. Remove screw (11), washer (12), and spacer (13) from lower end of stop assembly (10).
- c. Remove nuts (5), washers (2), stat-o-seals (3) and bolts (1) from door hinge (4) and remove door from nacelle.
- d. Install wing locker door by reversing removal procedures.

Removal and Installation of Wing Locker Door Latch.

Removal and installation of wing locker door latch is not recommended unless replacement or repair is



1. Fastener
2. Seal

3. Glide Slope Antenna

4. Screw
5. Washer

Figure 3-15. Radome Installation

necessary. Use figure 3-14 as a guide for removal and installation.

NOSE

The nose section of the fuselage provides a baggage area accessible through two baggage compartment doors. The lower center section of the nose provides a housing for the retractable nose gear with space on the right side for the cabin heater and space on the left side for electronics equipment. The nose cap area may be used for optional electronics equipment and radome installation.

Removal of Nose Baggage Compartment Doors.

- a. The removal of the nose baggage doors is the same for either left or right nose baggage door.
- b. Remove nuts and screws in door hinges and remove door.

NOTE

Do not lose spacers out of door hinges.

Disassembly and Assembly of Nose Baggage Compartment Doors.

No disassembly of nose baggage compartment doors is recommended. If hinges are to be replaced, rivets securing the hinge to door must be drilled out.

Should replacement of the lock assembly be necessary, loosen nut securing the lock assembly to door and remove. Assembly of nose baggage compartment door is the reversal of disassembly procedure.

Installation of Nose Baggage Compartment Doors.

- a. To install nose baggage compartment doors, position door in place and install bolts and nuts through hinges making sure the spacers are in place in the hinges.

NOTE

The installation procedure is the same for either left or right hand nose baggage compartment.

Radome.

The radome is a covering designed to protect the radar antenna from the elements. It is part of the nose section and has certain physical and electrical properties. Physically, the radome must withstand airloads subjected to it and also minimize drag. Electrically, the radome must permit passage of the radar transmitted signals and return echoes with minimum distortion and absorption. In order to do this, it must have a certain electrical thickness and this is related to the physical thickness, operating frequency and type of material and construction. This relationship is defined by a number of complex mathematical equations. These equations show that for given phy-

sical properties a radome will have certain electrical thickness for a narrow range of operating frequencies. This is why C-band radomes will not give optimum performance with X-band radar and vice-versa. Also, a very small variation in physical thickness will cause a sizeable variation in electrical thickness. This can mean the difference between an efficient radome and an inefficient radome that can reduce radar range, distort displays and cause inaccurate directions and false targets.

Removal and Installation of Radome (See figure 3-15.)

NOTE

Installation and removal is the same for standard nose cap or for radome.

- a. Unfasten lock fasteners or screws around the periphery of the radome.
- b. Slide radome forward sufficiently to disconnect glideslope antenna lead.
- c. Reverse this procedure for installation.

Repair of Radome.

Refer to Section 16 for repairs of radome.

STABILIZERS

Removal of Vertical Stabilizer (See figure 3-16.)

- a. (See figure 3-16.) Remove fairings and stinger cap.
- b. (See figure 1-2.) Remove access covers (5, 6 and 18).
- c. Place suitable support under tailcone.
- d. Remove rudder in accordance with Section 7.
- e. Remove rudder cables from vertical stabilizer pulley bracket.
- f. Disconnect elevator cables from elevator bellcrank in accordance with Section 6.
- g. Disconnect elevator downspring from elevator bellcrank.
- h. Remove elevator trim cables in accordance with Section 6.

- i. Remove rudder trim tab actuator cables from vertical stabilizer in accordance with Section 7.
- j. Remove screws securing rudder trim tab cable bracket (10) to vertical stabilizer spar.
- k. Remove screws (3) in dorsal fin.
- l. Remove forward spar nuts (6), washer and bolt (4).
- m. Remove nuts, washers and aft spar bolts (7).
- n. Disconnect antenna lead at fuselage.
- o. Disconnect deice line inside of tailcone if optional deice is installed.
- p. Lift vertical stabilizer vertically until front spar has cleared fuselage and remove from aircraft.

Installation of Vertical Stabilizer.

The installation of the vertical stabilizer is the reversal of the removal procedures.

Removal of Horizontal Stabilizer. (See figure 3-17.)

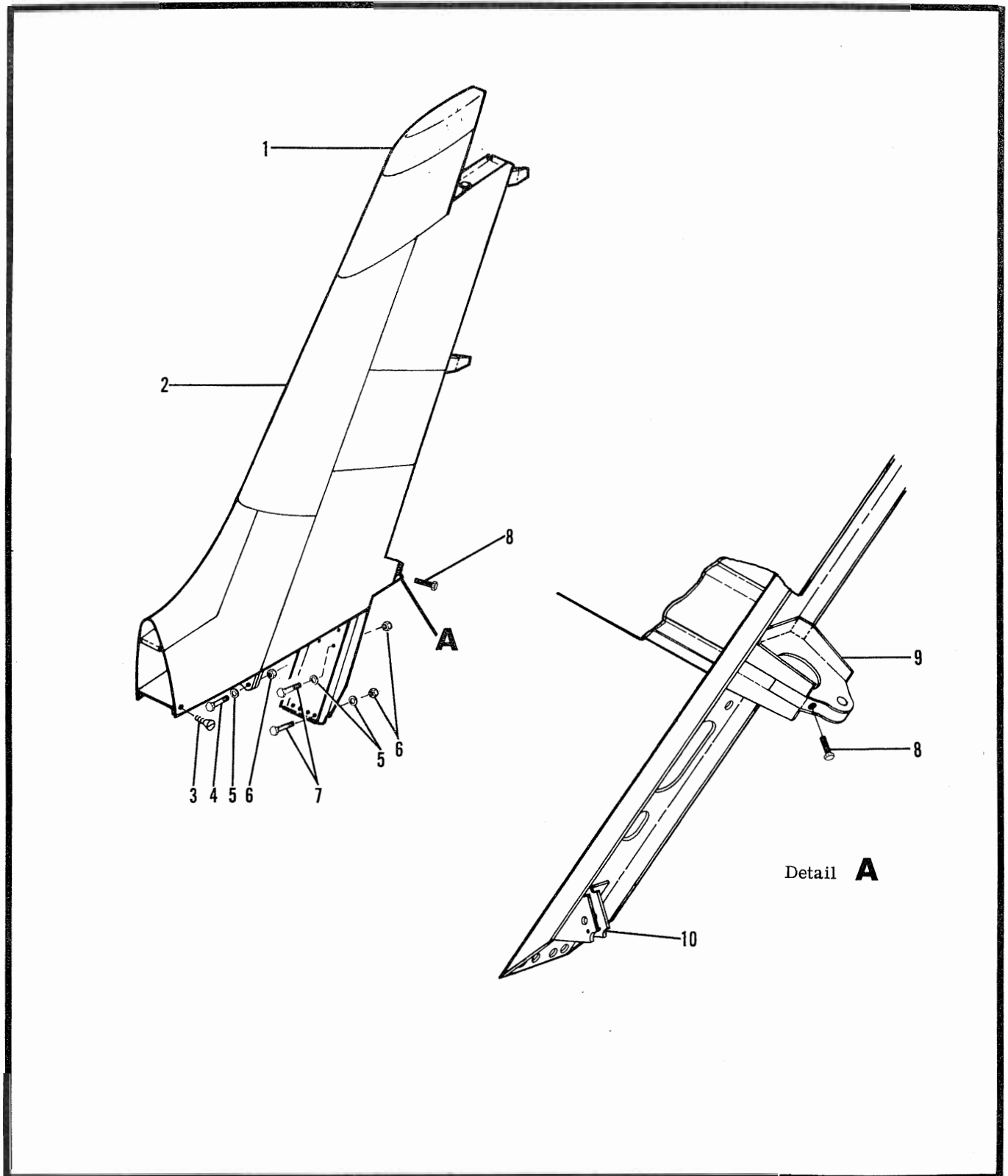
- a. Place a suitable support under tailcone.
- b. Remove rudder in accordance with Section 7.
- c. (See figure 1-2.) Remove access cover (19).
- d. Remove elevator trim tab cables from the stabilizer in accordance with Section 6.
- e. Remove nuts (3), washers (4) and bolts (1) in rear spar cap (2).
- f. Remove nuts (3), washers (4) and bolts (9) in front spar.
- g. Lift rear spar sufficiently to clear trim tab pulley brackets and move horizontal stabilizer aft to remove.

NOTE

Elevators need not be removed to remove stabilizer from empennage. However, if elevators are to be removed, see Section 6 for removal procedures.

Installation of the Horizontal Stabilizer.

The installation of the horizontal stabilizer is the reversal of the removal procedures.

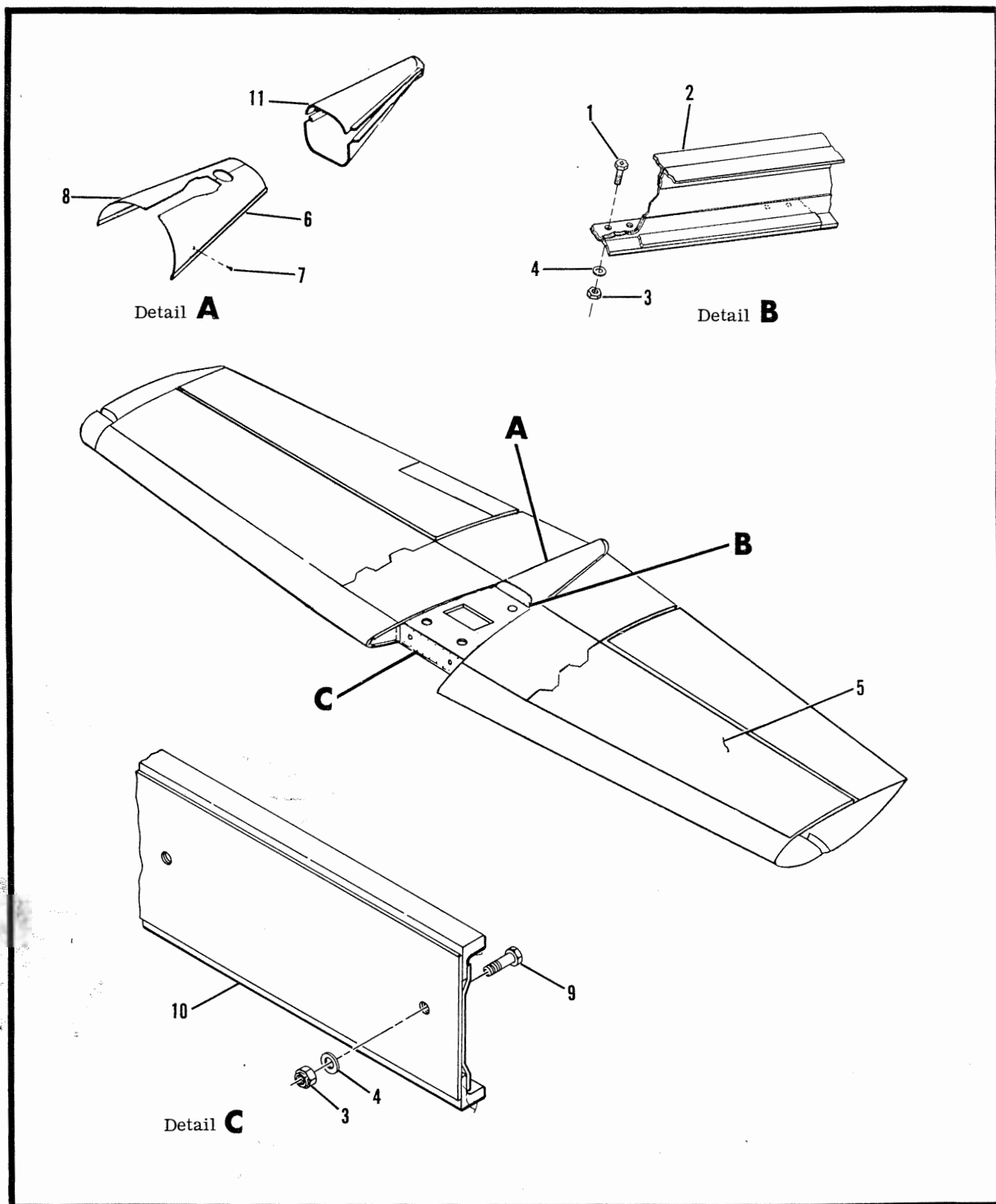


- 1. Fiberglass Tip
- 2. Vertical Stabilizer
- 3. Screw

- 4. Bolt
- 5. Washer
- 6. Nut
- 7. Bolt

- 8. Rudder Bellcrank Stop Bolt
- 9. Lower Hinge Assembly
- 10. Pulley Bracket

Figure 3-16. Vertical Stabilizer Installation



- 1. Bolt
- 2. Stabilizer Rear Spar
- 3. Nut
- 4. Washer

- 5. Horizontal Stabilizer
- 6. Left Stabilizer Fairing
- 7. Screw
- 8. Right Stabilizer Fairing

- 9. Bolt
- 10. Stabilizer Front Spar
- 11. Fuselage Stinger

Figure 3-17. Horizontal Stabilizer Installation

SECTION 4

LANDING GEAR AND BRAKE SYSTEM

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LANDING GEAR.

The landing gear is a fully-retractable tricycle landing gear consisting of a main gear located aft of each engine nacelle, and a nose gear located in the nose section of the fuselage. Each landing gear is connected mechanically to a single gear box driven by an electric motor. In the event of landing gear electrical system failure, the landing gear can be extended by operating the manual extension hand crank located

at the right side of the pilot's seat. Limit switches control the UP and DOWN limits and prevent over-travel by opening the electrical circuits to the motor when the correct amount of travel has been attained. There is a position indicator switch located on each gear to indicate when the landing gear is down and locked. A safety switch prevents accidental retraction on the ground by opening the landing gear electrical circuit while the weight of the aircraft is on the landing gear.

Trouble Shooting the Landing Gear System.

TROUBLE	PROBABLE CAUSE	CORRECTION
LANDING GEAR FAILS TO RETRACT - GEAR MOTOR OPERATES	Manual extension crank improperly stowed.	Stow crank properly.
	Defective landing gear actuator.	Replace actuator.
	Defective reduction unit.	Replace reduction unit.
	Pin sheared on gear motor shaft.	Replace pin.
LANDING GEAR FAILS TO RETRACT - GEAR MOTOR DOES NOT OPERATE	Broken bolts or retracting linkage, or disconnected retracting linkage.	Replace broken parts. Connect linkage if disconnected.
	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Insufficient electrical power.	Recharge batteries. Check voltage regulators.
	Defective UP limit switch.	Replace switch. Adjust in accordance with rigging procedure.
	Defective landing gear safety switch.	Replace switch.
	Incorrectly adjusted landing gear safety switch.	Adjust safety switch.
	Defective landing gear relay.	Replace relay.
	Defective landing gear switch.	Replace switch.
	Defective landing gear motor.	Replace motor.
LANDING GEAR FAILS TO RETRACT COMPLETELY	Defective UP electrical circuit.	Repair circuit.
	Landing gear incorrectly rigged for retracted position.	Rig in accordance with rigging procedure.
	Circuit breaker out, due to overload caused by incorrect landing gear rigging.	Reset circuit breaker and rig in accordance with rigging procedure.
	Circuit breaker out, due to overload caused by defective retracting linkage.	Reset circuit breaker, replace defective linkage, rig in accordance with rigging procedure.
ONE LANDING GEAR FAILS TO RETRACT	UP limit switch incorrectly adjusted.	Adjust in accordance with rigging procedure.
	Retracting linkage to affected gear broken or disconnected.	Replace broken parts. Connect linkage if disconnected. Rig in accordance with rigging procedure.

TROUBLE	PROBABLE CAUSE	CORRECTION
ONE LANDING GEAR FAILS TO RETRACT	Affected landing gear incorrectly rigged for retracted position.	Rig in accordance with rigging procedure.
	Defective retracting linkage to affected landing gear.	Replace defective linkage and rig in accordance with rigging procedure.
LANDING GEAR FAILS TO EXTEND- GEAR MOTOR OPERATES	Manual extension crank improperly stowed.	Stow crank properly.
	Defective landing gear actuator.	Replace actuator.
	Defective reduction unit.	Replace reduction unit.
	Pin sheared on gear motor shaft.	Replace pin.
	Broken bolts or retracting linkage, or disconnected retracting linkage.	Replace broken parts. Connect linkage if disconnected.
LANDING GEAR FAILS TO EXTEND - GEAR MOTOR DOES NOT OPERATE	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Insufficient electrical power.	Recharge batteries. Check voltage regulators.
	Defective DOWN limit switch.	Replace switch. Adjust in accordance with rigging procedure.
	Defective landing gear switch.	Replace switch.
	Defective landing gear motor.	Replace motor.
	Defective DOWN electrical circuit.	Repair circuit.
LANDING GEAR FAILS TO EXTEND COMPLETELY	DOWN limit switch incorrectly adjusted.	Adjust in accordance with rigging procedure.
	Landing gear incorrectly rigged for the DOWN position.	Rig in accordance with rigging procedure.
	Circuit breaker out, due to overload caused by incorrect rigging.	Reset circuit breaker and rig in accordance with rigging procedure.
	Circuit breaker out, due to overload caused by defective retracting linkage.	Reset circuit breaker, replace defective linkage, and rig in accordance with rigging procedure.
ONE LANDING GEAR FAILS TO EXTEND	Retracting linkage to affected gear broken or disconnected.	Replace broken parts. Connect linkage if disconnected. Rig in accordance with rigging procedure.
ONE LANDING GEAR FAILS TO EXTEND COMPLETELY	Affected landing gear incorrectly rigged for the DOWN position.	Rig in accordance with rigging procedure.
	Defective retracting linkage to affected gear.	Replace defective linkage and rig in accordance with rigging procedure.
MANUAL EXTENSION SYSTEM FAILS TO EXTEND LANDING GEAR	Manual extension crank not fully engaged.	Engage crank fully.
	Incorrect adjustment of manual extension linkage.	Adjust linkage in accordance with rigging procedure.
	Defective manual extension linkage.	Replace defective linkage.

TROUBLE	PROBABLE CAUSE	CORRECTION
MANUAL EXTENSION SYSTEM FAILS TO EXTEND LANDING GEAR (CONT.)	Defective landing gear retracting linkage or actuator.	Replace defective linkage or actuator.
	Landing gear improperly rigged.	Rig landing gear in accordance with rigging procedure.
GEAR UP (AMBER) LIGHT FAILS TO LIGHT*	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
*421-0001 to 421B0201	Lamp burned out.	Replace lamp.
	Lamp loose.	Repair or replace receptacle.
	Defective electrical circuit.	Repair circuit.
	Landing gear not fully retracted.	Retract fully.
	Defective or incorrectly adjusted UP limit switch.	Replace and/or adjust switch in accordance with rigging procedure.
GEAR UP (AMBER) LIGHT REMAINS ON WHEN GEAR IS DOWN*	Defective UP limit switch.	Replace switch and adjust in accordance with rigging procedure.
	Circuit shorted to another system.	Locate and repair.
LEFT GEAR DOWN (GREEN) RIGHT GEAR DOWN (GREEN) NOSE GEAR DOWN (GREEN) LIGHTS FAIL TO LIGHT	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker or electrical circuit.	Replace circuit breaker. Replace defective electrical circuit.
	Lamps burned out.	Replace lamps.
	Lamps loose.	Repair or replace receptacle.
	Landing gear not fully extended.	Extend fully.
	One or more DOWN indicator switches defective or incorrectly adjusted.	Replace defective switches and/or adjust in accordance with rigging procedure.
LEFT GEAR DOWN (GREEN) RIGHT GEAR DOWN (GREEN) NOSE GEAR DOWN (GREEN) LIGHT REMAINS ON WHEN GEAR IS UP	Circuit shorted to another system.	Locate and repair.
	Defective switch.	Locate and repair or replace.
LEFT GEAR DOWN (GREEN) RIGHT GEAR DOWN (GREEN) NOSE GEAR DOWN (GREEN) LIGHT FLICKERS WHEN GEAR IS DOWN	One or more DOWN indicator switches defective or incorrectly adjusted.	Replace defective switches and/or adjust in accordance with rigging procedure.
	Loose lamp.	Repair or replace receptacle.
GEAR WARNING HORN SOUNDS IN FLIGHT WHEN LANDING GEAR IS DOWN AND THROTTLES ARE RETARDED	Defective gear DOWN indicator switch.	Replace defective switch and adjust in accordance with rigging procedure.
GEAR WARNING HORN SOUNDS IN FLIGHT WHEN LANDING GEAR IS UP AND THROTTLES ARE NOT RETARDED	Defective throttle microswitch.	Replace switch and adjust in accordance with rigging procedure.
	Incorrectly adjusted throttle microswitch.	Adjust in accordance with rigging procedure.

TROUBLE	PROBABLE CAUSE	CORRECTION
GEAR WARNING HORN SOUNDS ON THE GROUND WHILE LANDING GEAR SWITCH IS DOWN	Incorrectly adjusted gear DOWN indicator switches.	Replace switch and adjust in accordance with rigging procedure.
	Defective gear DOWN indicator switches.	Replace switch and adjust in accordance with rigging procedure.
GEAR WARNING HORN SOUNDS WHEN BATTERY SWITCH IS TURNED ON, OR SOUNDS WHEN AN UNRELATED SYSTEM IS TURNED ON	Circuit shorted to another system.	Locate and repair.
	incorrectly adjusted gear DOWN indicator switches.	Adjust switch in accordance with rigging procedure.
	Defective gear DOWN indicator switches.	Replace switch and adjust in accordance with rigging procedure.
GEAR WARNING HORN FAILS TO SOUND WHEN LANDING GEAR SWITCH IS PLACED UP WHILE ON THE GROUND	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Landing gear safety switch incorrectly adjusted.	Adjust in accordance with rigging procedure.
	Defective landing gear safety switch.	Replace switch and adjust in accordance with rigging procedure.
	Defective electrical circuit.	Repair circuit.
	Defective warning horn or flasher unit.	Replace horn or flasher unit.
GEAR WARNING HORN FAILS TO SOUND IN FLIGHT WHEN LANDING GEAR IS UP AND THROTTLES ARE RETARDED	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Defective gear DOWN indicator switches.	Replace switch and adjust in accordance with rigging procedure.
	Defective electrical circuit.	Repair circuit.
	Defective warning horn.	Replace horn.
	Throttle microswitch incorrectly adjusted.	Adjust in accordance with rigging procedure.
	Defective throttle microswitch.	Replace switch and adjust in accordance with rigging procedure.
LANDING GEAR DOORS FAIL TO OPERATE PROPERLY	Doors incorrectly rigged.	Rig doors in accordance with rigging procedure.
	Defective door operating linkage.	Replace defective linkage.
LANDING GEAR SHIMMIES DURING FAST TAXI, TAKEOFF, OR LANDING	Insufficient fluid in shimmy dampener.	Service shimmy dampener in accordance with Section 2.
	Internal leakage in shimmy dampener.	Replace defective seals and/or piston.
	Roll pin attaching piston to piston rod sheared.	Replace roll pin.
	Shimmy dampener loose at mounting.	Replace worn housing and/or attaching bolt.
	Tires out of balance.	Replace tires when tread is worn unevenly or has flat spots.

TROUBLE	PROBABLE CAUSE	CORRECTION
LANDING GEAR SHIMMIES DURING FAST TAXI, TAKEOFF, OR LANDING (CONTINUED)	Worn or loose wheel bearings.	Replace and/or adjust bearings.
	Excessive clearance between upper and lower torque links.	Adjust clearance in accordance with alignment procedure.
	Worn torque link bushings.	Replace bushings.
EXCESSIVE OR UNEVEN WEAR ON TIRES	Incorrect operating pressure.	Inflate to correct pressure.
	Incorrect wheel alignment.	Align in accordance with alignment procedure.
	Wear resulting from shimmy.	See the preceding corrections for shimmy.
NOSE GEAR FAILS TO STEER PROPERLY	Incorrect rigging of nose gear steering system.	Rig in accordance with nose gear steering procedure.
	One brake dragging.	Determine cause and correct.
	Defective nose gear steering springs.	Replace springs.
NOSE GEAR FAILS TO STRAIGHTEN WHEN LANDING GEAR EXTENDS	Gimbal broken or damaged at the top of the nose strut.	Replace defective gimbal.
	Incorrect rigging of nose gear steering system.	Rig in accordance with nose gear steering procedure.
NOSE GEAR FAILS TO STRAIGHTEN WHEN LANDING GEAR RETRACTS	Gimbal broken or damaged on top of the nose strut.	Replace defective gimbal.
ATTITUDE OF AIRCRAFT ON GROUND IS INCORRECT	Landing gear struts incorrectly inflated.	Inflate struts correctly.
STRUT BOTTOMS ON NORMAL LANDING OR TAXIING ON ROUGH GROUND	Insufficient air and/or fluid in strut.	Service strut with proper amount of fluid and air.
	Defective internal parts in strut.	Replace defective parts.
STRUT DEFLATED WITH EVIDENCE OF FLUID LEAKAGE	Defective O-rings.	Determine which O-rings are defective and replace.

Landing Gear Actuator.

The landing gear actuator consists of an electric motor, a reduction unit, and a worm-and-sector assembly. The actuator is normally operated by the electric motor; however linkage is provided to disengage the motor-driven reduction unit and engage the manual extension system, which is linked directly to the

actuator worm gear. The bellcrank that operates the main landing gear drive tubes is attached to the upper end of the sector shaft, which extends vertically through the actuator assembly, and the bellcrank that operates the nose gear drive tube is attached to the lower end of the sector shaft. Adjustable limit switches are provided so that correct landing gear travel can be obtained.

Troubleshooting the Landing Gear Actuator Motor.

TROUBLE	PROBABLE CAUSE	CORRECTION
BRAKE DOES NOT RESPOND AS REQUIRED	Loosen or open connections or circuits. Improper assembly.	Check test connections; if all right, test motor circuits for proper resistance, check for proper brake air gap. Adjust or replace defective parts.

Troubleshooting the Landing Gear Actuator Motor (Continued).

TROUBLE	PROBABLE CAUSE	CORRECTION
SPEED IS TOO LOW OR CURRENT IS TOO HIGH	Incorrect end play, shorted armature circuit, excessive bearing friction.	Check motor for correct end play. If all right, test motor circuits for shorts. Replace defective parts.
MOTOR WILL NOT RUN	Circuit breaker out.	Reset breaker; if breaker will not remain set, check for shorted wiring in field circuit. If field circuit is shorted, refer to Landing Gear and Flap System Components Overhaul/Parts Manual and repair or replace motor.
MOTOR NOISY	Faulty bearings or armature dragging.	Refer to Landing Gear and Flap System Components Overhaul/Parts Manual and repair or replace motor.

Removal of Landing Gear Actuator. (See figure 4-1.)

- a. Jack the aircraft in accordance with Section 2.
- b. Remove the rear seats and carpet.
- c. Remove cabin floor above landing gear actuator and access hole cover from underside of fuselage beneath landing gear actuator.
- d. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- e. Disconnect both main landing gear drive tubes from idler bellcranks.
- f. Remove nut (5), washer (6), caps (7 and 40) and bolt (39) securing upper and lower bellcranks to the sector shaft.
- g. Lift upper bellcrank (12) enough to allow main gear drive tubes to be disconnected. Remove nuts, washers, and bolts attaching main gear drive tubes (10 and 48) to upper bellcrank (12) and slide both tubes outboard so they will not interfere with removal of actuator.
- h. Lower bellcrank (41) enough to allow nose gear drive tube (37) to be disconnected. Remove nut and bolt attaching nose gear drive tube to bellcrank.
- i. Temporarily reinstall bolt (39), caps, washers and nuts to prevent loss of bellcranks and spacers (13 and 42).
- j. Disconnect manual extension disengage rod by removing cotter pin and clevis pin.
- k. Disconnect the manual extension drive tubes by removing the three clevis pins, washers, and cotter pins; then slide outer shaft aft and inner shaft forward to disconnect. On 421-0182 and ON aircraft slide torque shaft and universal joint forward to disconnect.
- l. Remove safetywire from bolts to be removed; then remove the four bolts and washers attaching reduction unit and actuator assembly to the aft bulkhead.

NOTE

When removing the motor, disconnect and tag all electrical wires at the quick-disconnects provided.

- m. Remove switch brackets from actuator assembly. Do not disturb switch adjustments except to replace switches or brackets.

NOTE

If switches are to be replaced, tag wires before disconnecting.

- n. Remove the two bolts, washers, and nuts attaching actuator assembly to forward bracket.
- o. Lift actuator assembly vertically and remove from aircraft.

Installation of Landing Gear Actuator. (See figure 4-1.)

- a. Install lower bellcrank on lower end of sector shaft.

NOTE

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

- b. Position actuator assembly in position, aligning manual extension outer and inner shaft so they will mate.

NOTE

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



- c. Install the two bolts attaching the actuator to the forward mounting bracket and bolt, washers and nut securing actuator to side support.
- d. Install the four bolts and washers attaching actuator assembly and reduction unit to bulkhead.

NOTE

Shim as required between reduction unit (3) and bulkhead (4) to align reduction unit gear with the drive gear in the actuator.

CAUTION

Use of bolts of improper length may cause damage or binding.

- e. If motor was removed, connect the electrical wires at the quick-disconnect provided.
- f. Install switch brackets with bolts, washers, and nuts.

CAUTION

Check switches thoroughly for proper operation. A faulty switch may cause damage to the landing gear actuator.

- g. Tighten all nuts and bolts which were installed but not tightened.
- h. Safetywire bolts attaching actuator to the bulkhead.
- i. Connect manual extension drive tubes with clevis pins and washers, and safety with cotter pins. On 421-0182 and ON aircraft connect torque shaft and universal joint with clevis pins and washers, and safety with cotter pins.
- j. Connect the manual extension disengage rod with clevis pin and safety with cotter pin.
- k. Position upper bellcrank above actuator assembly, slide main gear drive tubes inboard and attach to bellcrank with bolts, washers, and nuts. Install bolts with their threaded ends UP.

NOTE

Main gear drive tubes must be installed with half-round side of end fitting upwards.

- l. Place spacer and upper bellcrank on sector shaft.

NOTE

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

- m. Attach nose gear drive tube to lower bellcrank with bolt, washer, and nut.
- n. Insure that lower bellcrank and spacers are correctly in position and install bolt, caps, washers, and nut.
- o. Connect main landing gear drive tubes to idler bellcranks with bolts, spacers, and nuts.
- p. Connect forward push-pull tube to fork bolt with bolt and nut.
- q. Perform an operational check of landing gear, check especially that limit switches are correctly adjusted and landing gear is correctly rigged.
- r. Install cabin floor panel and access hole cover on underside of fuselage beneath landing gear actuator.
- s. Install rear carpet and seats removed for removal of actuator.
- t. After making sure landing gear is DOWN and locked, remove aircraft from jacks.

Manual Extension System.

The manual extension system consists of a hand crank, which is connected to the landing gear actuator by an arrangement of chain and sprockets, bellcranks, miter gears, and push-pull rods. The hand crank, located at the right of the pilot's seat, is provided with a spring-loaded release button which unlocks the hand crank so that it can be folded into the stowed position. When the hand crank is folded, it disengages the manual extension system; when unfolded, into its operating position, the hand crank disengages the normal landing gear operating system.

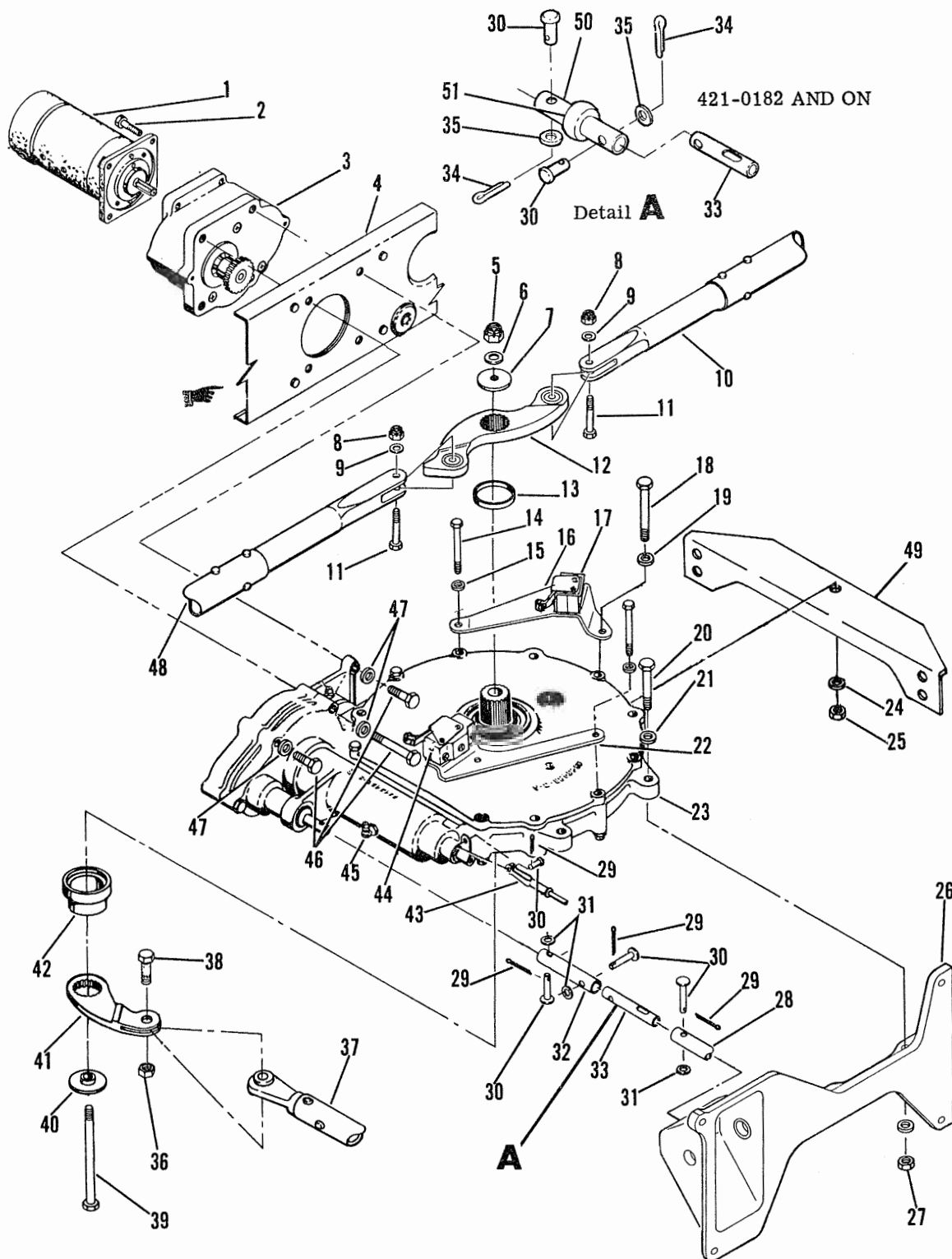


Figure 4-1. Landing Gear Actuator Installation

Figure 4-1. Landing Gear Actuator Installation Callouts

1. Landing Gear Motor	19. Washer	37. Nose Gear Drive Tube
2. Bolt	20. Bolt	38. Bolt
3. Reduction Unit	21. Washer	39. Bolt
4. Bulkhead	22. Switch Bracket	40. Cap
5. Nut	23. Actuator Assembly	41. Lower Bellcrank
6. Washer	24. Washer	42. Spacer
7. Cap	25. Nut	43. Manual Extension
8. Nut	26. Mounting Bracket	Disengage Rod
9. Washer	27. Nut	44. Down Limit Switch
10. Main Landing Gear Drive Tube	28. Gear Shaft	45. Grease Fitting
11. Bolt	29. Cotter Pin	46. Bolt
12. Upper Bellcrank	30. Pin	47. Washer
13. Spacer	31. Washer	48. Main Gear Drive Tube
14. Bolt	32. Outer Shaft	49. Support
15. Washer	33. Inner Shaft	50. Torque Shaft
16. Switch Bracket	34. Cotter Pin	51. U-Joint
17. Up Limit Switch	35. Washer	
18. Bolt	36. Nut	

Removal of Manual Extension System. (See figure 4-2.)

- a. Remove pilot's seat.
- b. Remove left rear seats and carpet to gain access to cover over extension system.
- c. Remove access hole cover from cabin floor above the landing gear actuator.
- d. Remove chain guards by removing the three attaching screws.
- e. Remove chain by disconnecting at the master link.
- f. Remove crank handle and shaft assembly as follows:
 1. Remove roll pin and washer from shaft.
 2. Remove cotter pin and clevis pin from spool.
 3. Pull crank handle and shaft from supports, removing spool as shaft is pulled through it.
- g. Remove upper rod assembly by removing cotter pins, washers, and clevis pins attaching rod assembly to the bellcranks.
- h. Remove upper bellcrank by removing nut, washer, and bolt; then remove bushing from bellcrank.
- i. Remove lower rod assembly by removing cotter pins, washer, and clevis pins attaching rod assembly to lower bellcrank and landing gear actuator.
- j. Remove lower bellcrank by removing nut, washer, spacer, and bolt.
- k. Remove chain tighteners by removing attaching screws and washers, then remove the adjusting screw, washers, and nut.
- l. If support bracket is to be disassembled further, proceed as follows:
 1. Remove roll pins from sprocket and miter gear and slide shaft out of bracket and remove sprocket and miter gear.
 2. Disconnect drive tube from actuator by removing cotter pin, washer, and clevis pin. On 421-0182 and ON aircraft disconnect universal joint from actuator by removing cotter pin, washer, and clevis pin.
 3. Slide shaft with other miter aft and remove roll pin; then remove the other miter gear.

NOTE

If bushings in the support bracket are to be

replaced, the landing gear actuator must be removed; then the support bracket removed from front spar. The oilite bearings in which the gear shafts rotate are a press fit, and should be removed only for replacement.

Cleaning, Inspection, and Lubrication of Manual Extension System. (See Section 2.)

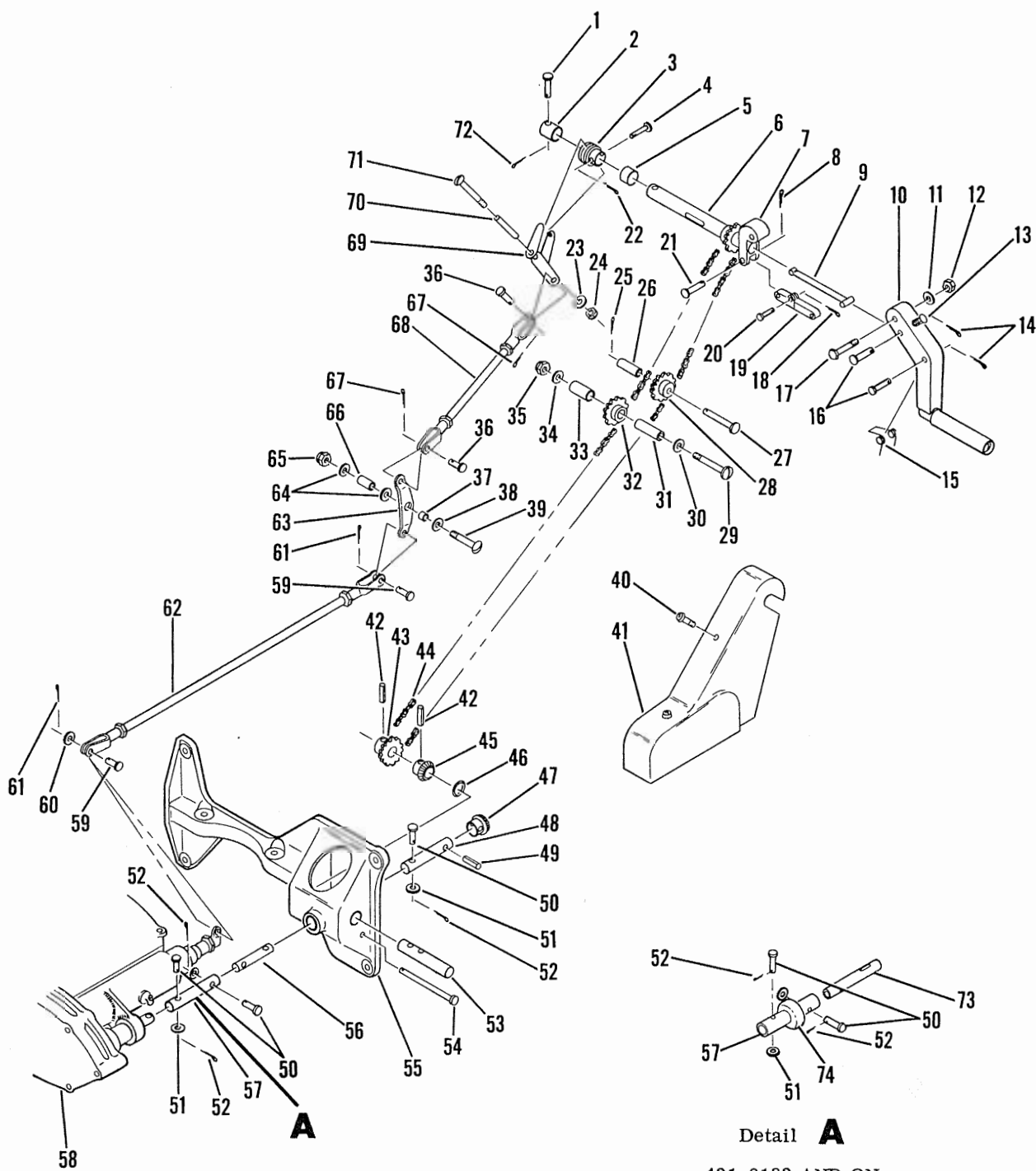
Installation of Manual Extension System. (See Figure 4-2.)

- a. If the support bracket has been disassembled without removing the landing gear actuator, assemble as follows:
 1. Insert actuator drive tube thru the aft bushing; then install miter gear on shaft and insert roll pin.
 2. Holding sprocket and other miter gear in position, slide the shaft thru the gear and sprocket, then insert the two roll pins.
- b. Connect drive tubes from landing gear actuator. On 421-0182 and ON aircraft connect universal joint and torque shaft.

NOTE

AN3-6A bolt and MS428C nut with AN960-10 washers may be installed in lieu of clevis pin (50), washer (51) and cotter pin (52) on universal joint if clevis pins are excessively loose.

- c. Install chain tighteners with attaching screws and washers; then install adjusting screw, washers, and nut, but do not tighten at this time.
- d. Install lower bellcrank with bolt, spacer, washer and nut.
- e. Insert bushing into upper bellcrank then install bellcrank with bolts, washers, and nuts.
- f. If disassembled, reassemble crank handle and shaft with pins, cotter pins, nut and bolt.
- g. Install crank handle and shaft assembly as follows:
 1. Insert crank handle and shaft through inboard support, spool, and the outboard support.
 2. Engage upper bellcrank with spool, align spool attaching holes, and install pin and cotter pin.



Detail **A**
421-0182 AND ON

421-0001 TO 421-0182

Figure 4-2. Manual Extension System Installation

Figure 4-2. Manual Extension System Installation Callouts

1. Clevis Pin	20. Clevis Pin	39. Screw	58. Actuator Assembly
2. Spacer	21. Clevis Pin	40. Screw	59. Clevis Pin
3. Spool	22. Cotter Pin	41. Chain Guard	60. Washer
4. Clevis Pin	23. Washer	42. Roll Pin	61. Cotter Pin
5. Spacer	24. Nut	43. Sprocket	62. Manual Extension
6. Shaft Assembly	25. Cotter Pin	44. Chain	Disengage
7. Lug	26. Spacer	45. Gear	Rod
8. Cotter Pin	27. Clevis Pin	46. Ring	63. Bellcrank
9. Apool	28. Sprocket	47. Gear	64. Washer
10. Crank Assembly	29. Screw	48. Gear Shaft	65. Nut
11. Washer	30. Washer	49. Roll Pin	66. Spacer
12. Nut	31. Spacer	50. Clevis Pin	67. Cotter Pin
13. Pin Lock	32. Sprocket	51. Washer	68. Rod
14. Cotter Pin	33. Spacer	52. Cotter Pin	69. Bellcrank
15. Spring	34. Washer	53. Shaft	70. Bushing
16. Clevis Pin	35. Nut	54. Clevis Pin	71. Screw
17. Bolt	36. Clevis Pin	55. Mounting Bracket	72. Cotter Pin
18. Cotter Pin	37. Spacer	56. Inner Shaft	73. Torque Shaft
19. Link	38. Washer	57. Outer Shaft	74. U-Joint

3. Place washer and collar on the shaft and install roll pin and safety. This washer is to remove end play.

h. Install chain on sprockets and connect with master link. Adjust chain tighteners and tighten adjusting screw and nut.

i. Attach the lower rod assembly to the lower bellcrank and landing gear actuator with pins and washers and safety with cotter pins.

j. Attach upper rod assembly to bellcranks with pins, washers, and cotter pins.

k. If the length of the upper or lower rod has been changed, adjust as follows:

1. Place crank in operating position.

2. Adjust lower rod assembly to a length of approximately 18.10 inches, measured between the rod end bolt holes, and install.

3. Pull lower rod assembly forward until internal gear, in landing gear actuator, reaches the end of its travel; adjust upper rod assembly so that rod and bolt holes align with holes in upper and lower bellcranks.

4. Lengthen upper rod assembly one-half turn and install.

m. Install chain guards with attaching screws.

n. Install access hole cover on cabin floor above the landing gear actuator.

o. Install rear carpet and seats.

Main Landing Gear.

Each main landing gear consists of a wheel and tire assembly, brake assembly, lower piston assembly, cantilever axle, upper cylinder assembly, and torque links. The Air-oleo shock strut contains an orifice and tapered metering pin which vary the resistance to shock according to its severity. During extension and retraction, the landing gear pivots on heavy-duty needle bearings by means of trunnion shafts attached to the upper cylinder assembly.

Removal of Main Landing Gear. (See figure 4-3.)

a. Jack the aircraft in accordance with Section 2.

b. Drain brake system by loosening bleeder plug.

c. Disconnect brake hose at forward wheel well bulkhead union. Plug hose and cap fittings to prevent entry of foreign matter.

d. Remove safety switch and down indicator switch by removing attaching screws and nuts.

e. Remove wire clamps and tie switches where they will not interfere with gear removal.

f. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.

g. Disconnect the main landing gear doors.

h. Disconnect retracting linkage as follows:

1. Disconnect outboard push-pull tube from bellcrank by removing nuts, washers, and bolts.

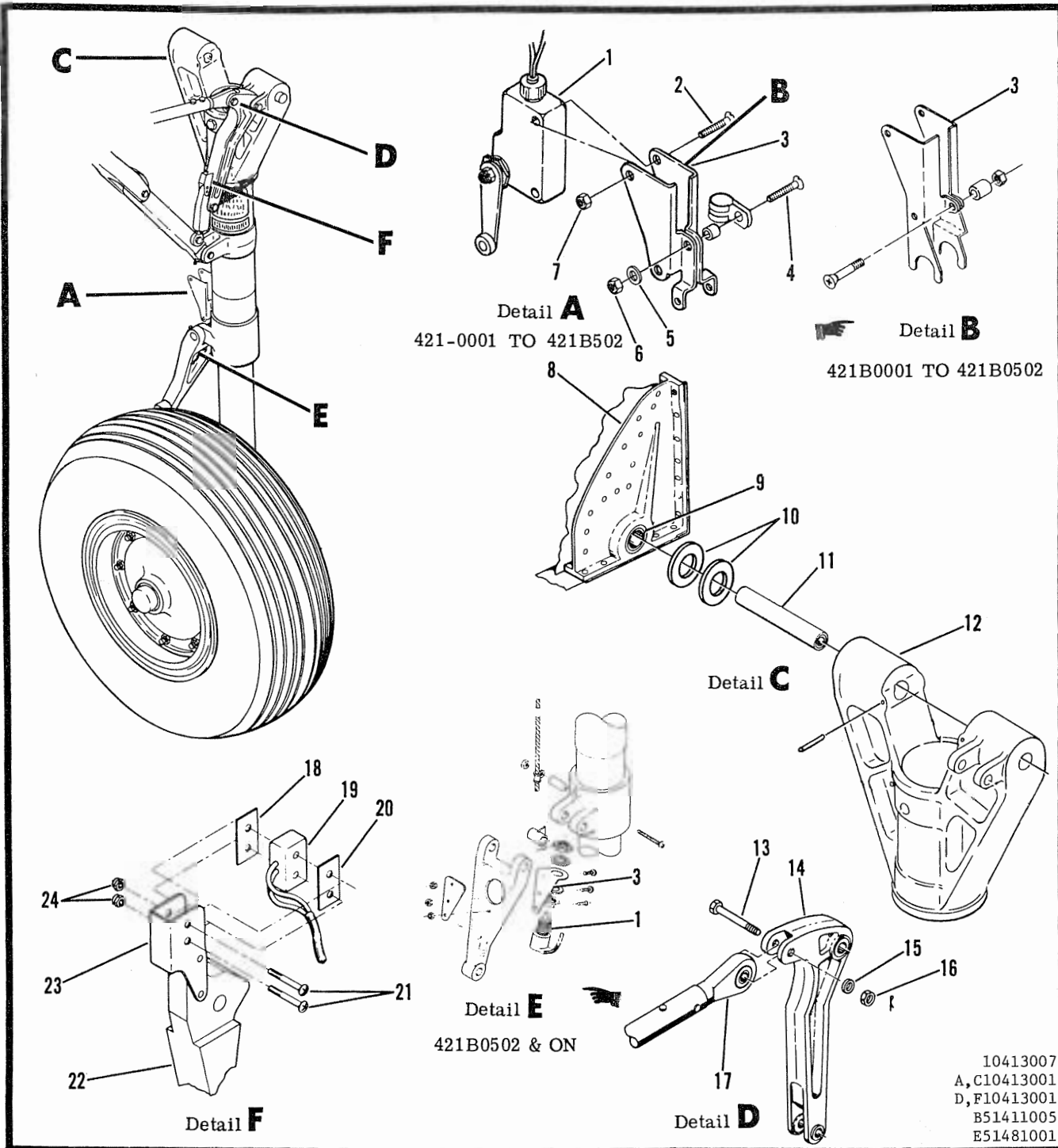
NOTE

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

1. Perform an operational check to see that manual extension functions properly.

CAUTION

Do not use the manual extension system to fully retract the landing gear, except when manually pushing upward on all landing gears to relieve strain on manual extension system.



1. Landing Gear Safety Switch
2. Screw
3. Bracket
4. Screw
5. Washer
6. Nut
7. Nut
8. Landing Gear Support

9. Bearing
10. Washer
11. Attaching Shaft
12. Truss Assembly
13. Bolt
14. Bellcrank
15. Washer
16. Nut

17. Outboard Push-Pull Tube
18. Spacer
19. Down Indicator Switch
20. Spacer
21. Screw
22. Side Lock Link
23. Bracket
24. Nut

Figure 4-3. Main Landing Gear Installation

2. Disconnect upper side link from lower side link by removing nuts, washers, and bolts.

i. Remove roll pins from attaching shafts, and insert AN6 bolt or puller tool.

j. Support gear and pull attaching shafts.

NOTE

Needle bearings, in which the attaching shafts pivot, are a press fit and should be removed

only for replacement. Bearings must be removed by driving them toward the wheel well.

CAUTION

NOTE the amount of thickness of washers removed. These washers should be installed exactly as they were located before removal to insure proper alignment of side link assembly.

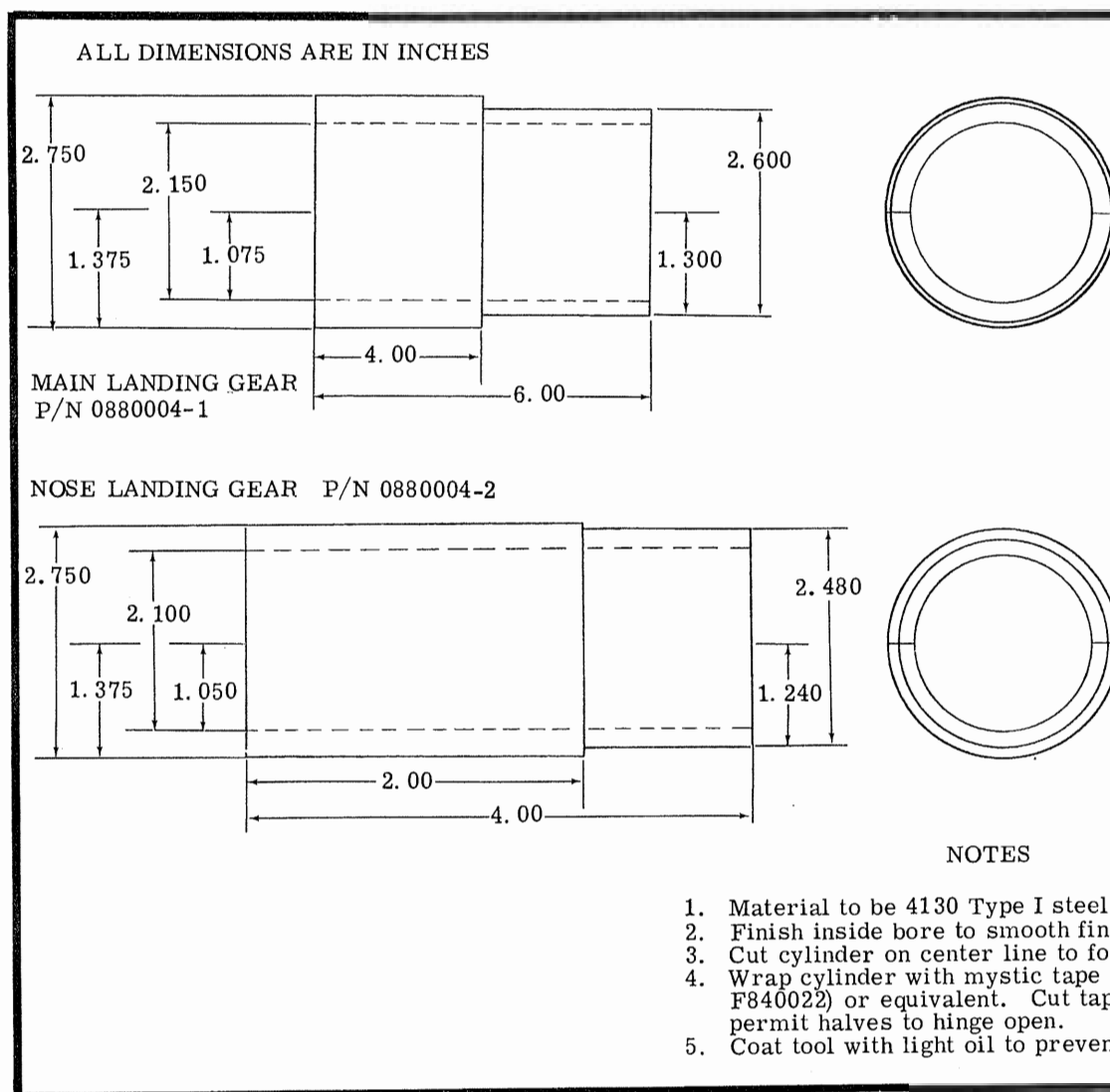


Figure 4-3A. Landing Gear Ring Pack Support Tool

Disassembly of Main Landing Gear. (See figure 4-4.)

- a. Completely deflate strut, and after all the air has been expelled, remove the valve body and drain fluid.
- b. Remove lower strut assembly from upper truss assembly as follows:
 1. Disconnect brake hose from brake at elbow and remove hose.
 2. Remove wheel and tire assembly and brake assembly from axle fitting.
 3. Disconnect torque links (14) by removing cotter pin, nut (20), washer (21), spacer (19), clamp and bolt (15).
 4. Remove lock ring (27), scraper ring (28), and internal lock ring (29).
 5. Pull piston assembly (10) from upper trunnion assembly (46).

NOTE

Lower piston barrel and axle fittings are a press fit and drilled on assembly. Disassembly is not recommended.

CAUTION

Removal and handling of the lower strut should be done with care to prevent the possibility of damage to exposed parts.

- c. (See figure 4-4) Disassemble upper trunnion assembly as follows:

1. Remove bolts (48), washers (47), and nut (54).
2. Remove metering tube (4) from trunnion assembly (46) by pulling straight out.

CAUTION

If the metering pin and seal support are to be reinstalled, use extreme caution during removal.

3. See Section 2 for cleaning and inspection of main landing gear.

Assembly of Main Landing Gear. (See figure 4-4.)

NOTE

Before each component of the main landing gear shock strut is assembled, assure that it is thoroughly clean, then lubricate with system hydraulic fluid.

- a. Assemble landing gear as follows:
 1. Carefully work O-ring (6) over threads of metering pin (5) and install in seal support (7) with nut (9).
 2. Install O-ring (8) in groove on outside of seal support (7).
 3. Insert seal support (7), with metering pin assembled, into lower piston barrel (10).

NOTE

On 421B0001 and On add shims (61) and/or washers (62) as required between metering pin (5) and seal support (7) to maintain .112 $\pm$.005 inch between top of pin (5) and opening of orifice.

4. Slide lock ring (27), scraper ring (28), and internal lock ring (29) on piston barrel (10).

5. Install poly-pak seal (63) inside ring pack support (34); then work O-ring (30) on the outside into groove on ring pack support (34) and slide onto piston barrel (10).

CAUTION

Install poly-pak seal with wide lip up (toward pressure area).

6. Install spacer (35) on piston barrel (10).
7. Install inner bearing (36) on piston barrel (10) and secure with external lock ring (37).

NOTE

Install inner bearing with chamfered end up in order to seat against external lock ring.

8. Carefully work O-ring (3) into groove in orifice tube (4) and insert into trunnion assembly (46) from the bottom, taking care to align holes.

9. Align holes and install two bolts (48), washers (47), and nuts (54).

10. Carefully work piston barrel into trunnion assembly (46) and slide ring pack support (34), internal lock ring (29), scraper ring (28), and lock ring (27) into trunnion assembly and secure.

NOTE

To prevent damage to piston barrel and ring pack support during installation, a ring pack support tool P/N 0880004-1 available from your Cessna Dealers' Organization should be used. (See Figure 4-3A.)

- b. Assemble torque links (14), if removed, to strut assembly in accordance with installation of main gear torque link procedures.

- c. Install brake assembly, wheel and tire assembly; then connect hoses and clamp.

- d. Service strut with hydraulic fluid in accordance with Section 2. Do not fill with air at this time.

- e. Install new O-ring (2) on valve body (1) and install in top of orifice tube (4).

- f. Install side braces removed with bolts, washers, and nuts.

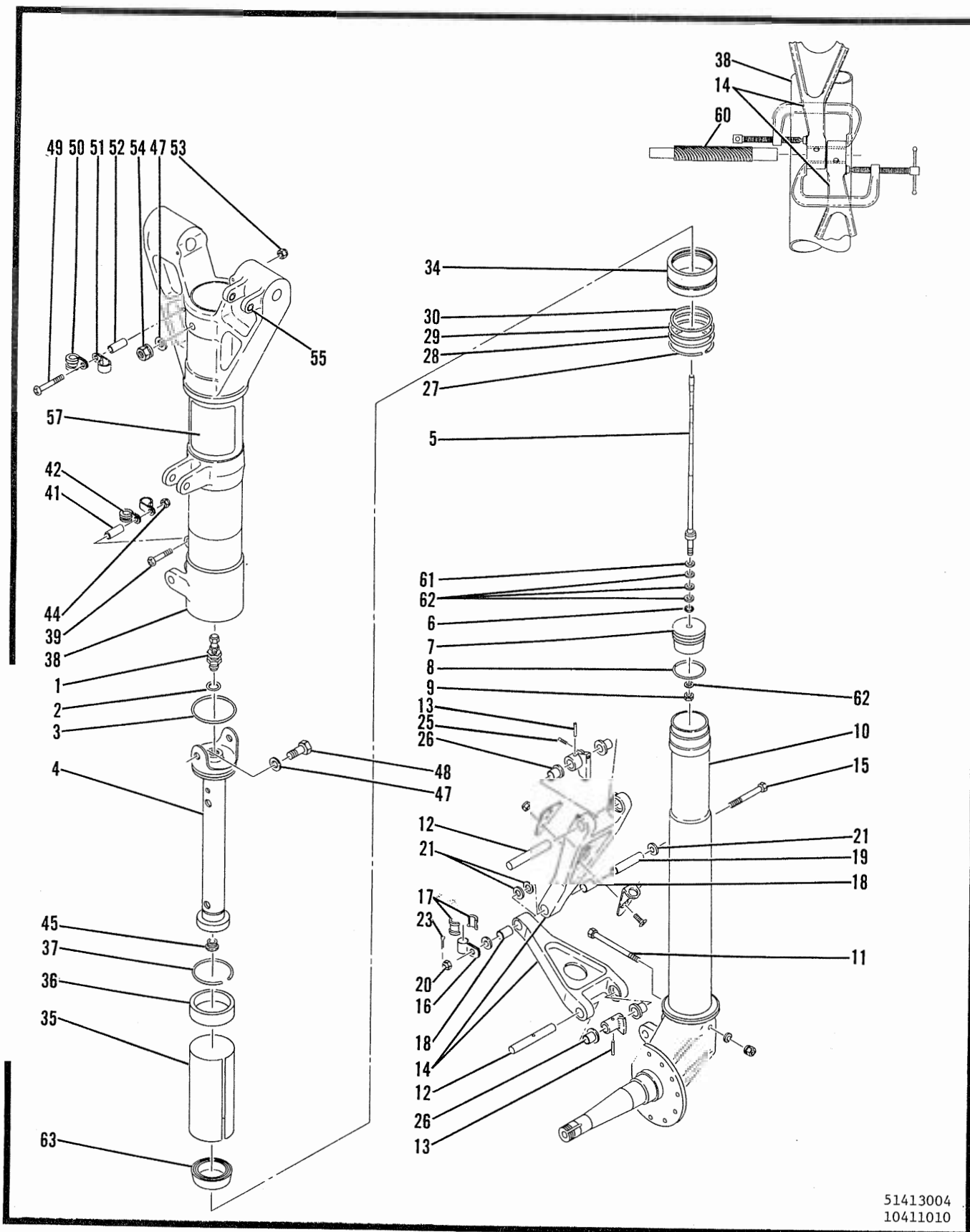


Figure 4-4. Main Landing Gear Strut

Figure 4-4. Main Landing Gear Strut Callouts

1. Valve Body	17. Bushing	33. Deleted	49. Screw
2. Packing	18. Bushing	34. Ring Pack Support	50. Clamp
3. "O" Ring	19. Spacer	35. Spacer	51. Clamp
4. Metering Tube	20. Nut	36. Inner Bearing	52. Spacer
5. Metering Pin	21. Washer	37. External Lock Ring	53. Nut
6. "O" Ring	22. Deleted	38. Deleted	54. Nut
7. Seal Support	23. Cotter Pin	39. Screw	55. Bushing
8. "O" Ring	24. Deleted	40. Deleted	56. Deleted
9. Nut	25. Set Screw	41. Spacer	57. Placard
10. Barrel Piston	26. Bushing	42. Clamp	58. Spacer
11. Bolt	27. Lock Ring	43. Deleted	59. Spacer
12. Shaft	28. Scraper Ring	44. Nut	60. Reamer Tool
13. Roll Pin	29. Internal Lock Ring	45. Orifice	61. Shim
14. Torque Link	30. "O" Ring	46. Trunnion	62. Washer
15. Bolt	31. Deleted	47. Washer	63. Poly Pak Seal
16. Clamp	32. Deleted	48. Bolt	

Installation of Main Landing Gear.

- a. If needle bearings were removed, install as follows:
 1. Press needle bearings into landing gear supports. Bearings must seat against shoulders provided in supports.
 - b. Position gear in place; then install washers between supports and trunnion and align holes.
 - c. Install attaching shafts into gear trunnion and align gear trunnion, washer, and bearing in the landing gear supports, then work the shafts into position, using care to align holes in shaft and trunnion for the installation of roll pin.

NOTE

The attaching shafts are a slip fit and should be lubricated with light oil to aid in the installation of the shafts.

- d. Remove AN6 bolt used in removal and installation of attaching shafts and install roll pin.
- e. Connect side brace and push-pull tubes and gear door using bolts, washers, and nuts.
- f. Install safety switch and down indicator switch with screws and nuts and adjust in accordance with Rigging of Main Landing Gear.

NOTE

Make sure landing gear limit switches have all holes in switch housing plugged and packed with DC-4 Silicone Compound to prevent moisture entering limit switches.

- g. Remove plug and caps and connect brake hose to union at bulkhead at forward wheel well. Use suitable lubricant on threads.
- h. Install clamps securing switch wire bundle and brake hose.
- i. Service and bleed brake system in accordance with Servicing Instructions, Section 4.
- j. Perform operational check on landing gear.

- k. Service strut in accordance with Servicing Instructions in Section 2, then remove jacks.

1. Check landing gear alignment in accordance with Main Wheel Alignment and Figure 4-5.

Main Wheel Alignment. (See figure 4-5.)

Correct alignment of the main landing wheels is necessary to minimize tire wear. If the tires are wearing excessively or unevenly, the wheel alignment should be checked and corrected in accordance with the following procedure:

- a. Position the aircraft with the main wheels resting on grease plates.

NOTE

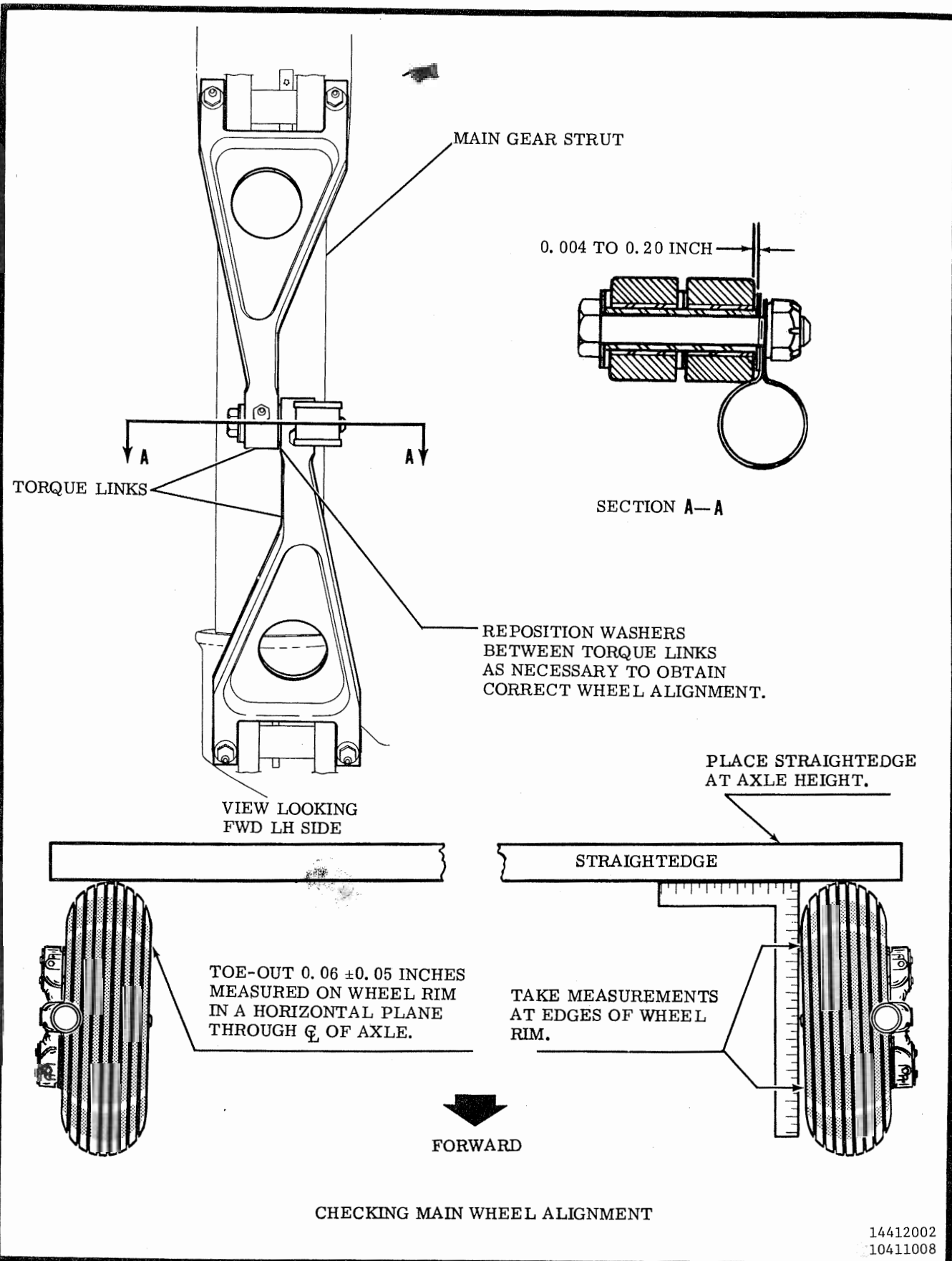
For each set of grease plates, use two aluminum sheets approximately 18 inches square with sufficient grease spread between them to permit the top plates to slide freely on the bottom plates.

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

NOTE

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

- d. Add washers between torque links to correct for excessive toe-in. Wheel alignment after adjustment must be within limits prescribed in step "c".



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NOTE

(See Figure 4-5) AN960-716 and AN960-716L washers are used as shims between the upper and lower torque links. Combinations of thick and thin washers can be used between the torque links to obtain the correct wheel alignment. Washers that are added or removed between the torque links must also be removed or added to the outside end of the spacer to maintain an .004 to .020 side play of the torque links. Be sure that the spacer washers are centered on the spacer as the nut is being torqued up to proper value (refer to Figure 1-4).

Removal of Main Gear Torque Links. (See figure 4-4.)

The removal procedures are the same for either left or right main landing gear torque links.

- a. Check alignment of main landing gear wheels in accordance with alignment procedures.
- b. With main landing gear wheels aligned and jacks removed, mark the relative position of each main landing gear piston and axle assembly, and trunnion assembly to facilitate aligning of parts for installation.

NOTE

Use a grease pencil for marking.

- c. Mark extension of landing gear strut.
- d. Jack the aircraft in accordance with Section 2.

NOTE

Make sure jack is positioned to allow removal of wheel and brake assembly.

- e. Remove brake, wheel and tire assembly in accordance with Section 4.
- f. Deflate strut in accordance with Section 2.
- g. Disconnect landing gear door and tie out of way.
- h. Disconnect torque link braces by removing cotter pins (23), nut (20), bolt (15), washers (21) and spacer (19).

NOTE

Washers located between torque link braces control toe-out, and must be retained and replaced in removal order, for proper wheel and torque link brace alignment.

- i. Remove roll pin (13) using a suitable drift punch.
- j. Remove shaft (12) using a suitable drift punch.
- k. Remove torque links (14).

Disassembly of Main Gear Torque Links. (See figure 4-4.)

Bushings (18 and 26) are press fit and should be removed only for replacement. When replacement becomes necessary proceed as follows:

- a. Remove grease fittings.
- b. Using a bench vise, wood blocks and proper size shaft or punch, press out bushings (18 and 26).

CAUTION

Take precaution when removing bushings to prevent damage to torque link.

Assembly of Main Gear Torque Links. (See figure 4-4.)

- a. Press in bushings (18 and 26) using bench vise, with necessary wood block and proper size punch.

NOTE

Bushings (18 and 26) must be pressed in wet using MIL-P-8585 zinc chromate primer or equivalent, and lube fitting holes of bushings aligned with torque brace lube fitting holes.

- b. Mill and finish installed bushings (18 and 26) flush with outside edge of torque link brace (14), break sharp edges 0.005 radius minimum. Bushings must not extend past edge of torque link brace.

NOTE

Mill an equal amount on each bushing (26) using a flat mill file to provide a slip fit between lugs on the torque link and the lugs on the trunnion and/or the lugs on the axle.

- c. Insure lube fitting holes are clean and install lube fittings.

Installation of Main Gear Torque Links. (See figure 4-4.)

- a. Install upper torque link brace (14) on barrel assembly (38), with shaft (12), spacer (59) and the necessary shims to align pin hole in shaft with pin hole in spacer.

CAUTION

It may be necessary to remove the finish from shaft (12). DO NOT FORCE. If stop welds on the inside of spacer interfere, smooth welds with file.

NOTE

Adjust set screw (25) against strut to prevent spacer (59) from pivoting, then stake set screw.

- b. Install pin (13) and safety wire in place by routing wire through roll pin and around the bushing.
- c. Install lower torque link brace (14) on barrel assembly (38) using same procedures as the upper torque link.
- d. Align main landing gear barrel piston (10) and axle assembly in position as previously marked.
- e. Block landing gear strut up using wood blocks to previously marked extension to facilitate aligning torque link braces.
- f. Align upper and lower torque link braces (14) using same number of retained washers positioned between braces in the same order they were removed.
- g. Use a .4300 diameter pilot (bolt or rod) to align torque link braces and washers.
- h. Clamp torque link braces in position using two small "C" clamps.

- i. Using a standard 29/64 (.4531) reamer, having a 0.75 length, 0.430 diameter pilot or Cessna Special Tool FT251 reamer, ream bushings, to insure a straight true hole in both parts.

CAUTION

Turn reamer by hand, using a "T" handle.
Do not use power tools.

- j. Remove clamps and clean torque link braces with suitable solvent.
- k. Install retained lube fitting in torque link braces and flush grease to insure bushings are free of dirt and remove grease.
- l. Position brake hose and clamp on bolt (15) and connect upper and lower torque link at hinge point using bolt (15), spacer (19), washers (21) and nut (20).

NOTE

Make sure all new and existing washers at torque link hinge point are in place and free in movement, tighten bolt and nut to insure a side play of 0.004 to 0.020 is maintained between torque link braces. It may be necessary to position the washers in a different location to maintain alignment and side play simultaneous.

- m. Insure brake line is clear of all structure and secure.
- n. Safety bolt (15) and nut (20) with cotter pin (23).
- o. Install wheel and brake assembly in accordance with installation procedures.
- p. Torque all nuts properly, and safety.
- q. Lubricate upper and lower torque link fittings.
- r. Inflate landing gear strut in accordance with Section 2.
- s. Connect landing gear door and cycle landing gear to make sure door fits properly and all lines are clear.
- t. Remove aircraft from jacks.

Main Landing Gear Doors.

The main landing gear is equipped with wheel well doors and strut doors. Each strut door, pivoting on a continuous hinge located at its outboard end, is operated by a push-pull rod attached to the main landing gear strut. Each wheel well door, pivoting on forged aluminum hinges located at its inboard end, is operated by a bellcrank and push-pull tube, which is connected to the landing gear retracting linkage. The operating mechanism is so arranged that the wheel well door is closed when the main gear is either fully retracted or fully extended.

Removal of Main Landing Gear Doors. (See figure 4-6.)

- a. Remove strut door as follows:
 - 1. Disconnect door link rod from strut by removing nut and bolt.
 - 2. Remove screws securing door to structure; remove door.

- b. Remove wheel well door as follows:
 - 1. Jack aircraft and engage manual extension, and release tension on gear retraction system.
 - 2. Remove access hole covers from wheel well door.
 - 3. Disconnect the door link tube from actuator arm.
 - 4. Remove wheel well door by removing nuts, washers, and bolts attaching hinge arms to door.
 - c. If desired, remove hinge arms as follows:
 - 1. Remove lower wing root fillet and hinge covers by removing attaching screws.
 - 2. Remove hinge arms from brackets by removing nuts, washers, spacers, and bolts.

Installation of Main Landing Gear Door. (See figure 4-6.)

- a. If hinge arms were removed, attach to brackets with bolts, spacers, washers, and nuts. Install hinge covers and lower wing root fillet with attaching screws.
- b. Install wheel well door as follows:
 - 1. Jack aircraft and engage manual extension to release tension on gear retraction system.
 - 2. Place wheel well door in position, align mounting holes, and attach to hinge arms with bolts, washers, and nuts.
 - 3. Attach door link tube to actuator arm with bolt and nut.

NOTE

If length of door link tube has been changed, or new door components are being installed, rig in accordance with Rigging Procedures of Main Landing Gear Doors.

- 4. Install access hole cover on wheel well door.
- c. Install strut door as follows:
 - 1. Place door in position and secure in place with nine screws.
 - 2. Attach door link rod to strut with bolt and nut.

NOTE

If length of door link rod has been changed or new door components are being installed, rig in accordance with Rigging Procedures of Main Landing Gear Doors.

Rigging Main Landing Gear Door. (See figure 4-6.)

- a. Jack aircraft in accordance with Section 2.
- b. Disconnect wheel well door by removing nut (14), attaching door link tube (15) to actuator arm (16).
- c. Disconnect strut door by removing nut (27) attaching door link rod (28) to strut.
- d. Using the normal landing gear retraction system, operate gear to the UP position.

NOTE

The use of an external power source is recommended for operation of electrical units while engines are not being operated. Low voltage could cause low downlock tension readings.

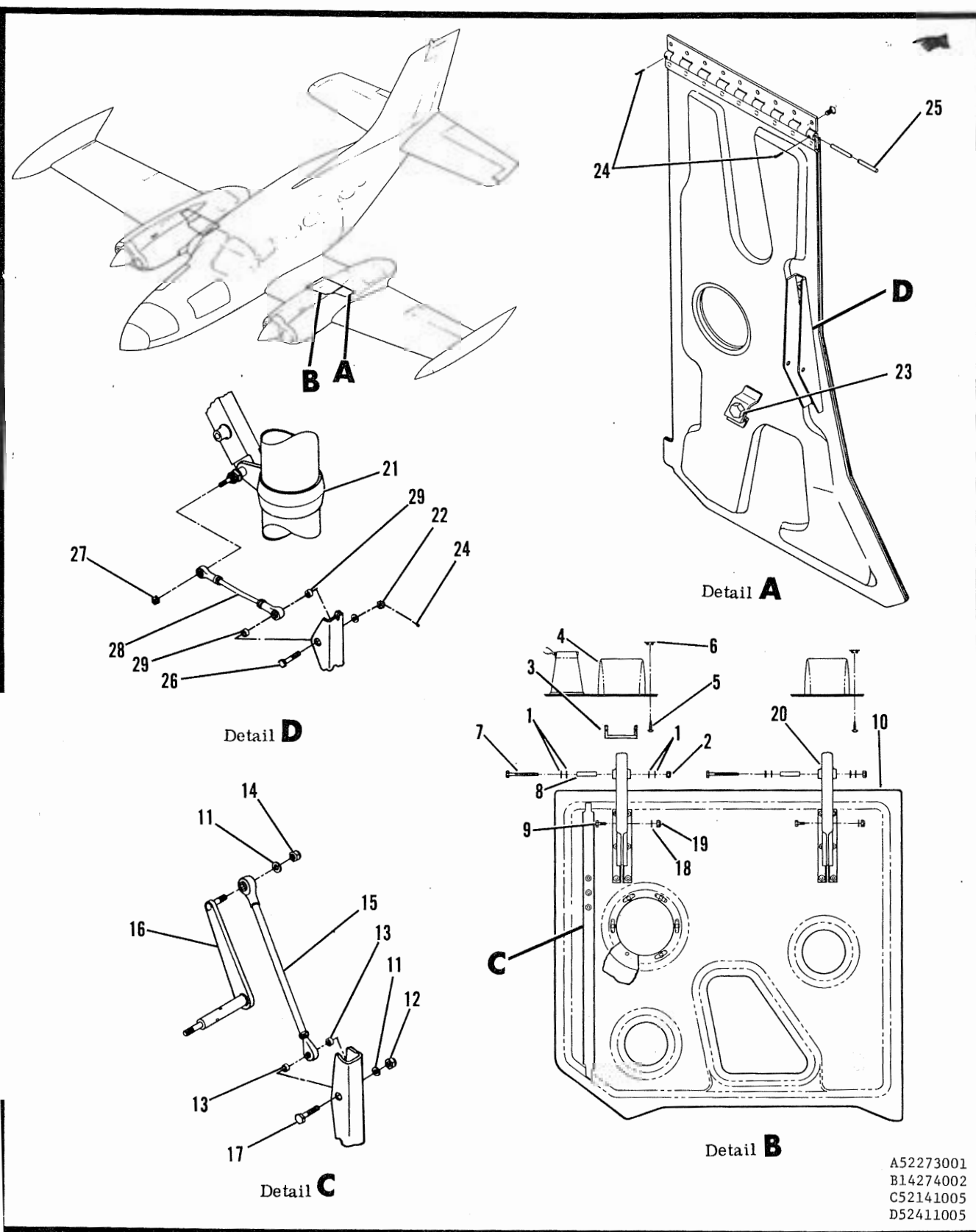


Figure 4-6. Main Landing Gear Door Installation

Figure 4-6. Main Landing Gear Door Installation Callouts

1. Washer	11. Washer	20. Hinge
2. Nut	12. Nut	21. Main Landing Gear
3. Bracket	13. Spacer	22. Nut
4. Hinge Cover	14. Nut	23. Snubber
5. Screw	15. Door Link Tube	24. Cotter Pin
6. Nut	16. Door Actuator Arm	25. Hinge Pin
7. Bolt	17. Bolt	26. Bolt
8. Spacer	18. Washer	27. Nut
9. Bolt	19. Nut	28. Door Link Rod
10. Main Wheel Well Door		29. Spacer

- e. Close strut door and adjust door link rod (28) so that door fits flush.
- f. Adjust snubber (23) so there is 0 to 0.06 inches clearance between door and main gear torque link.
- g. Operate gear to the DOWN position.
- h. Close wheel well door and adjust door link tube (15) so that door just fits flush.
1. Adjust rod end on door link tube one-half turn shorter and connect.

NOTE

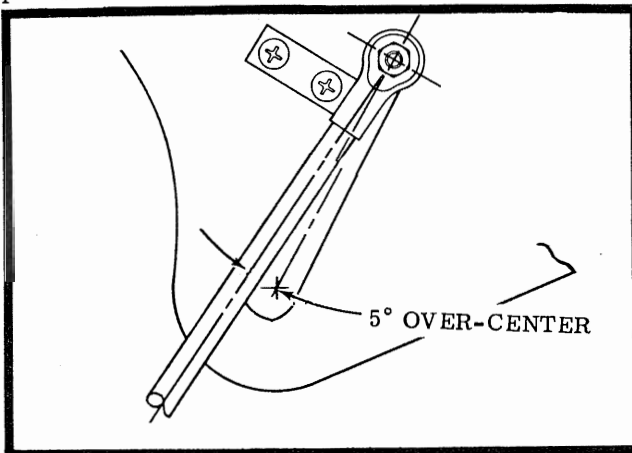
Make sure door link tube adjustment does not cause deformation of door.

- i. Operate gear to the UP position.

CAUTION

When retracting gear while rigging door, be prepared to stop before damage can occur.

- j. If necessary, readjust door link tube (15) so that door fits flush.
- k. Repeat steps "d" thru "j" as necessary to obtain proper fit of doors, checking that wheel well door clears tire and wheel.
- l. The door push-pull tube is to be 5 degrees over-center with the door actuator arm against its stop, as shown in figure 4-6A, in both gear Up and gear Down position.

Figure 4-6A. Door Actuator Arm
Overcenter Adjustment**CAUTION**

If the door actuator arm stop is moved, re-

rigging of the main landing gear system will be necessary.

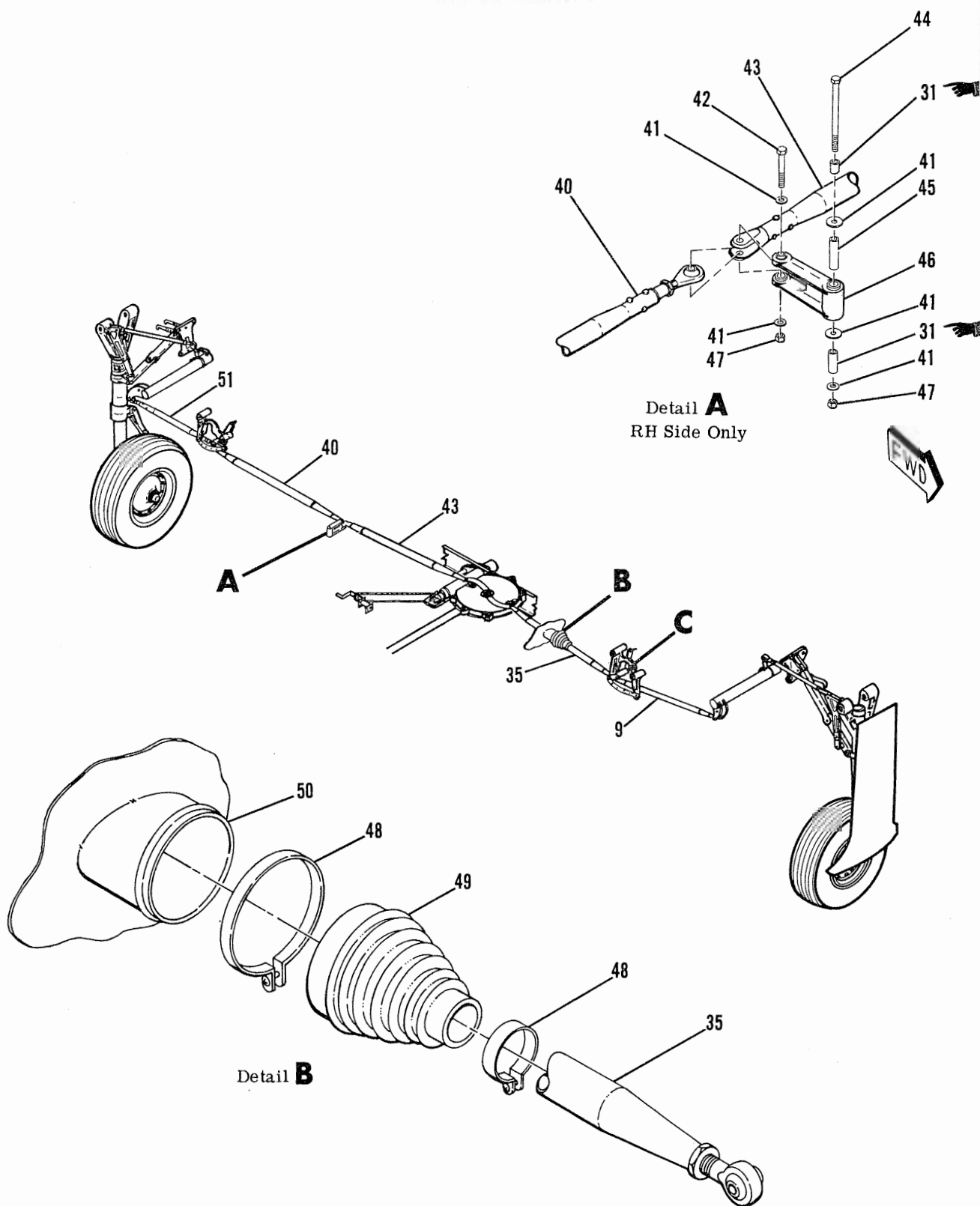
- m. Install access hole cover on wheel well door.
- n. Insure that the landing gear is DOWN and locked, remove jacks.

Main Landing Gear Retracting Linkage.

The main landing gear retracting linkage consists of push-pull tubes, bellcranks, torque tubes, braces, and links interconnected between the landing gear actuator and the main landing gear. A positive downlock is obtained by rigging the main side links to an over-center position. The link assemblies which hold the main side links in an over-center position are also rigged over-center. Downlock springs, which apply spring tension to the over-center position of the link assemblies, are provided as an added safety feature. Hook-type mechanical locks are provided to lock the landing gear in its retracted position. The main landing gear retracting linkage also operates the main landing gear door operating mechanism.

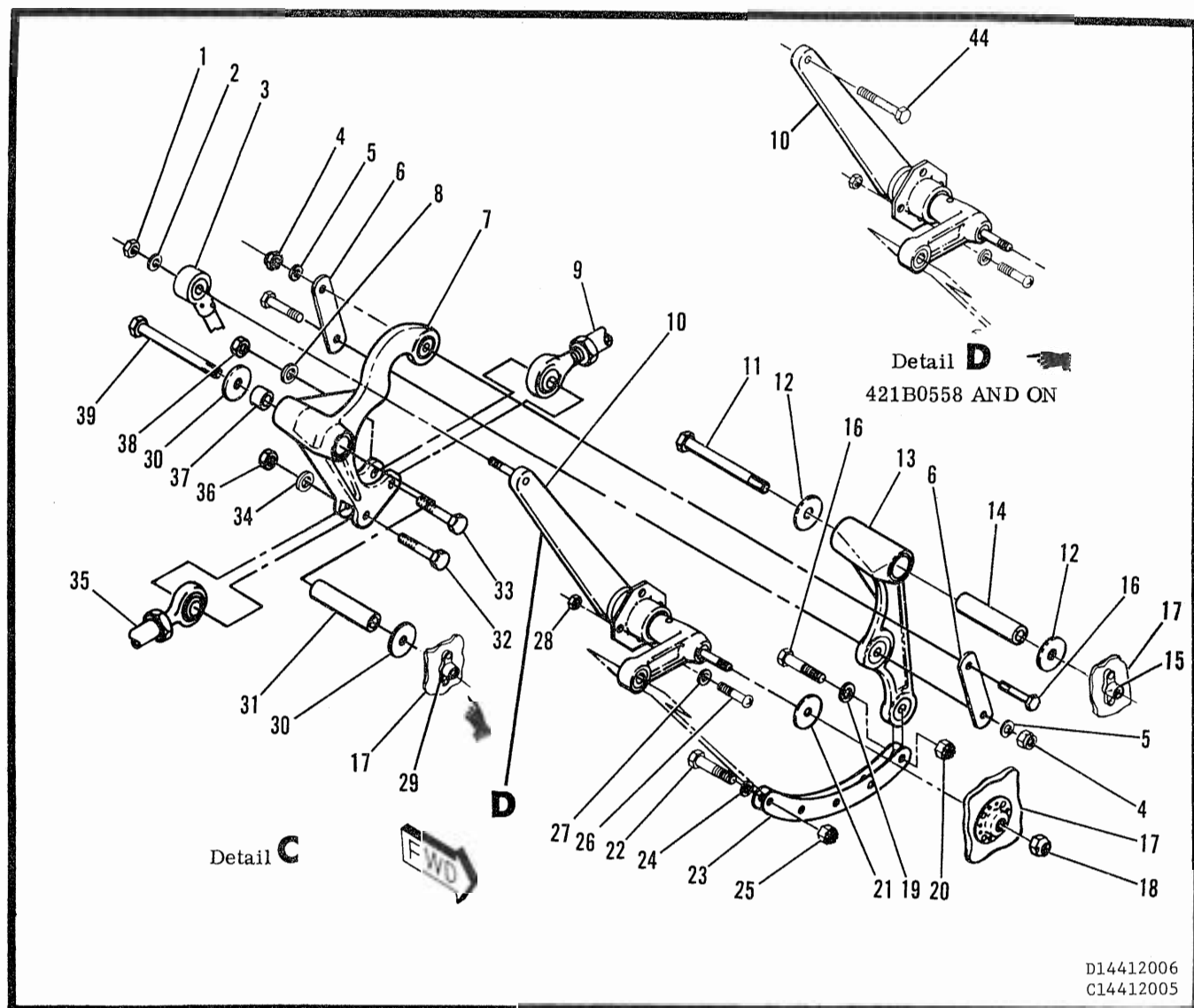
Removal of Main Landing Gear Retracting Linkage.
(See figures 4-7 and 4-8.)

- a. Jack the aircraft in accordance with Section 2.
- b. Disconnect main landing gear doors.
- c. Release tension on retracting linkage by engaging hand crank and operating a few turns toward the UP position.
- d. (See figure 1-2.) Remove access covers (56, 36, 16 and 4).
- e. Remove rear seats, carpet and floorboard to gain access to the landing gear actuator.
- f. Remove inboard drive tube (35) as follows: (See figure 4-7.)
 1. Disconnect drive tube from landing gear actuator bellcrank.
 2. Disconnect drive tube from idler bellcrank (7) by removing nut (36), washer (34) and bolt (32).
 3. Remove clamp (48) securing seal boot (49) to drive tube; then remove drive tube by pulling tube into cabin area.
- g. Remove seal boot as follows: (See figure 4-7.)
 1. The following procedures are given for the left side. The right side procedures are the same.
 2. Remove the landing gear drive tube in accordance with the preceding instructions.
 3. (See figure 1-2.) Remove cover plates (36 and 4).
 4. Remove clamps (48) and remove boot.



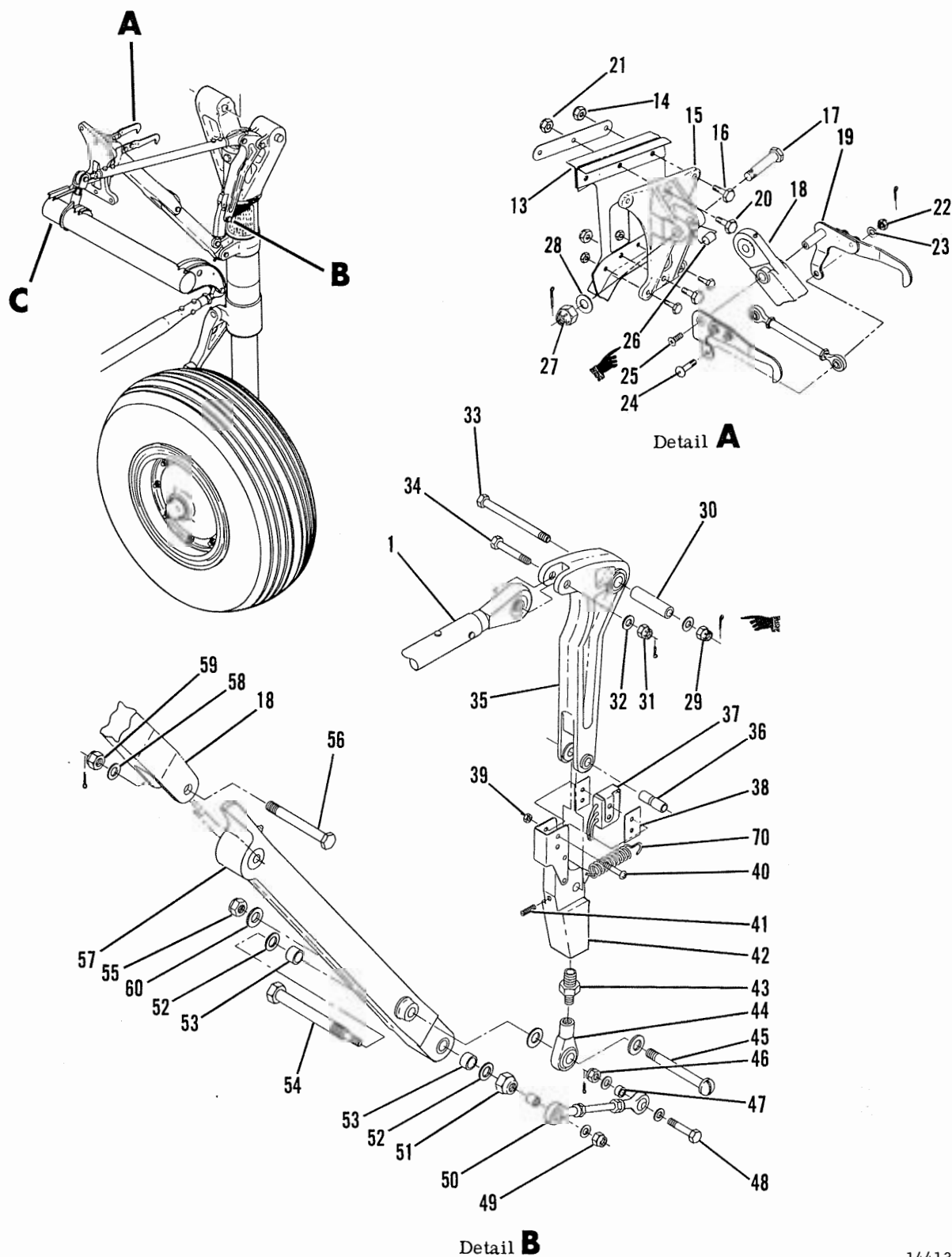
A51411004
14403001R
B14412007

Figure 4-7. Main Landing Gear Retracting Linkage-Inboard Components (Sheet 1 of 2).

D14412006
C14412005

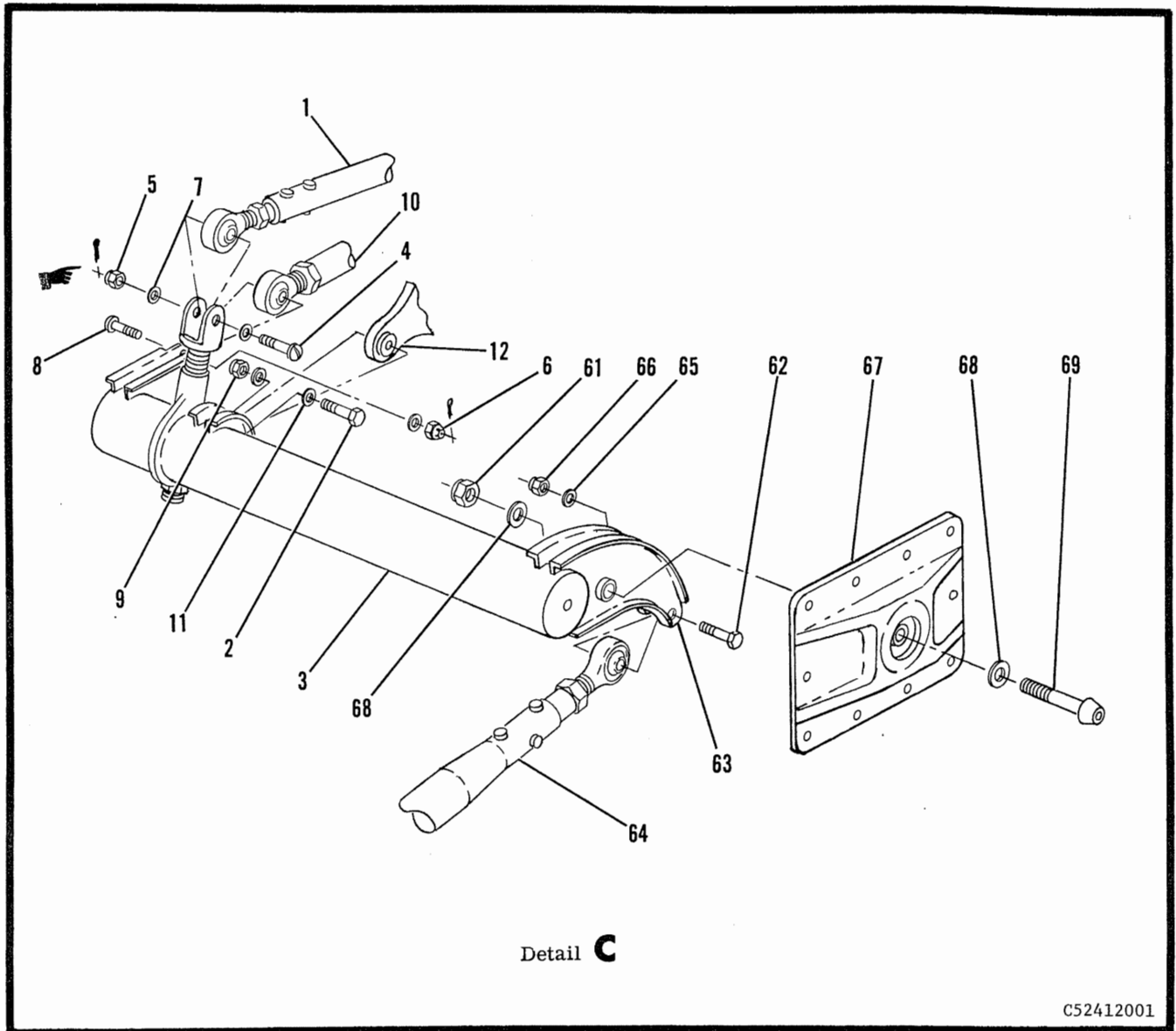
1. Nut	18. Nut	35. LH Inboard Drive Tube
2. Washer	19. Washer	36. Nut
3. Door Link Tube	20. Nut	37. Bearing
4. Nut	21. Thrust Bearing Washer	38. Nut
5. Washer	22. Bolt	39. Bolt
6. Upper Connecting Link	23. Rocker Arm Lower Link	40. Intermediate Drive Tube
7. Idler Bellcrank	24. Washer	41. Washer
8. Washer	25. Nut	42. Bolt
9. LH Outboard Drive Tube	26. Screw	43. RH Inboard Drive Tube
10. Door Actuator Assembly	27. Washer	44. Bolt
11. Bolt	28. Nut	45. Bushing
12. Thrust Bearing Washer	29. Nutplate	46. Idler Bellcrank
13. Bellcrank Rocker Arm	30. Thrust Bearing Washer	47. Nut
14. Spacer	31. Spacer	48. Clamp
15. Nutplate	32. Bolt	49. Seal Boot
16. Bolt	33. Bolt	50. Adapter
17. Spar	34. Washer	51. RH Outboard Drive Tube

Figure 4-7. Main Landing Gear Retracting Linkage - Inboard Components (Sheet 2)



14413002R
A14411001
B14413003

Figure 4-8. Main Gear Retracting Linkage - Outboard Components (Sheet 1 of 2)



1. LH Push-Pull Tube	18. Upper Side Link	36. Pin	54. Bolt
2. Bolt	19. Uplock Assembly	37. Down Indicator Switch	55. Nut
3. Torque Tube	20. Bolt	38. Spacer	56. Bolt
4. Bolt	21. Nut	39. Nut	57. Lower Side Link
5. Nut	22. Nut	40. Screw	58. Washer
6. Nut	23. Washer	41. Setscrew	59. Nut
7. Washer	24. Bolt	42. Side Brace Lock Link	60. Washer
8. Bolt	25. Screw	43. Adjusting Screw	61. Nut
9. Nut	26. Spacer	44. End Fitting	62. Bolt
10. Uplock Push-Pull Tube	27. Nut	45. Bolt	63. Torque Tube
11. Washer	28. Washer	46. Nut	64. LH Outboard Drive Tube
12. Mounting Bracket	29. Nut	47. Spacer	65. Washer
13. Rib Assembly	30. Spacer	48. Bolt	66. Nut
14. Nut	31. Nut	49. Nut	67. Torque Tube Support
15. Support	32. Washer	50. Door Link Rod	68. Washer
16. Bolt	33. Bolt	51. Nut	69. Bolt
17. Bolt	34. Bolt	52. Washer	70. Spring
	35. Bellcrank	53. Spacer	

Figure 4-8. Main Gear Retracting Linkage-Outboard Components (Sheet 2)

5. Installation of seal boot is the reversal of the removal procedures.

NOTE

Clamp seal boot to drive tube with gear down and with boot extended approximately 11". Install clamps with the clamp body aft to clear the rib when gear retracts. Install boot so that the majority of folds in the boot, when compressed, are in the aft position. Check neoprene gasket for cuts or tears before reinstalling cover plate (4).

g. Remove idler bellcrank (7) and door operating linkage as follows:

1. Remove nut (25) and bolt (22) and four screws attaching bearing housing to web.
2. Remove nut (18) and thrust bearing washer (21) then pull door actuator arm (10) thru web.

NOTE

Door actuator arm assembly (10) is a matched set. Disassembly is not recommended.

3. Remove bolt (39) and thrust bearing washers (30), attaching idler bellcrank (7) to front spar and support web.
4. Remove bolt (11) and thrust bearing washers (12), attaching bellcrank rocker arm (13) to front spar and support web.
5. Pull bellcranks and attached linkage from between front spar and support web.
6. Remove the spacers (14 and 31) from the idler bellcrank (7) and bellcrank rocker arm (13).
7. Remove upper connecting links (6) by removing nuts (4), washers (2), and bolts (16).
8. Remove rocker arm lower link (23) by removing nuts (20 and 25), washers (19 and 24), and bolts (22 and 16).

NOTE

See figure 4-8 for the following steps.

- h. Remove LH push-pull tube (1) as follows:
 1. Disconnect the push-pull tube from the bellcrank (35) by removing cotter pin, nut (31), washer (32) and bolt (34).
 2. Disconnect push-pull tube from torque tube (3) by removing cotter pin, nut (5), washers and bolt (4).
- i. Remove bellcrank (35) and side brace (42) lock link as follows:
 1. Disconnect DOWN indicator switch (37) by removing nuts (39) and screws (40).
 2. Remove downlock spring.
 3. Disconnect side brace lock link from lower side link (57) by removing nut (55), washer (60), and bolt (45).
 4. Disconnect bellcrank (35) from the upper barrel by removing cotter pin, nut (29), spacer (30), and bolt (33).
 5. Remove the side brace lock link (42) from the bellcrank (35) by removing setscrew (41) and pin (36).

- j. Remove uplock assembly as follows:
 1. Disconnect uplock push-pull tube (10) from uplock assembly by removing cotter pin, nut (22), washer (23), and bolt (24).
 2. Remove screw (25) attaching uplock assembly to side link (18).
- k. Remove side links (18 and 57) as follows:
 1. Disconnect lower side link (57) from upper barrel by removing nut (49), door link rod (50), nut (51), washers (52), spacers (53) and bolt (54).
 2. Disconnect lower side link from upper side link by removing cotter pin, nut, washer and bolt (56).
 3. Disconnect upper side link (18) from support (15) by removing cotter pin, nut, washer and bolt (17).
- l. Remove torque tube (3) as follows:
 1. Disconnect uplock push-pull tube (10) from torque tube by removing cotter pin, nut (6), washer (7), and bolt (8).
 2. Remove nut (9), washer (11), bolt (2) attaching torque tube to rib mounting bracket.
 3. Remove nut (61), washer (68), and bolt (69) attaching torque tube to torque tube support (67).

Installation of Main Landing Gear Retracting Linkage. (See figure 4-8.)

- a. Install torque tube as follows:
 1. Attach torque tube (3) to torque tube support (67) with bolt (69), washer (68), and nut (61).
 2. Attach torque tube (3) to rib mounting bracket (12) with bolt (2), washer (11) and nut (9).
 3. Connect uplock push-pull tube (10) to torque tube (3) with bolt (8), washer (7), nut (6), and cotter pin.
- b. Install side links (18 and 57) as follows:
 1. Attach upper side link (18) to lower side link (57) with bolt (56), washer (58), and nut (59). Torque nut to 110 ± 5 inch-pounds. Install cotter pin.
 2. Attach upper side link (18) to support with bolt (17), washer (28), and nut (27). Torque nut (27) to 200 ± 25 inch-pounds. Install cotter pin.
 3. Attach lower side link (57) to upper barrel with bolts (54), washers (52), spacers (53), and nut (51). Torque nut (51) to 110 ± 5 inch-pounds. Install door link rod (50) on bolt (54) with nut (49).
- c. Install uplock assembly as follows:
 1. Insert uplock hook (19) into upper side link (18) and secure uplock assembly with screw (25).
 2. Attach uplock push-pull tube (10) to uplock assembly with bolt (24), washer (23), nut (22) and cotter pin.
- d. Install bellcrank (35) and side brace lock link (42) as follows:
 1. Attach side brace lock link (42) to bellcrank (35) with pin (36). Secure set screw (41) and stake. Do not stake over existing stakes.

NOTE

Ensure arrow (indicating flat surface) located on end of pin (36) is aligned towards set screw (41).

2. Attach bellcrank (35) to upper barrel with bolt (33), spacer (30), nut (29) and cotter pin.
3. Attach side brace lock link (42) to lower side link (57) with bolt (45), washer (60), and nut (55).
4. Install down lock spring (70).
5. Install DOWN indicator switch (37) with attaching screws and nuts.
- e. Install LH push-pull tube (1) as follows:
 1. Attach push-pull tube to bellcrank (35) with bolt

(34), washer (32), nut (31) and cotter pin.

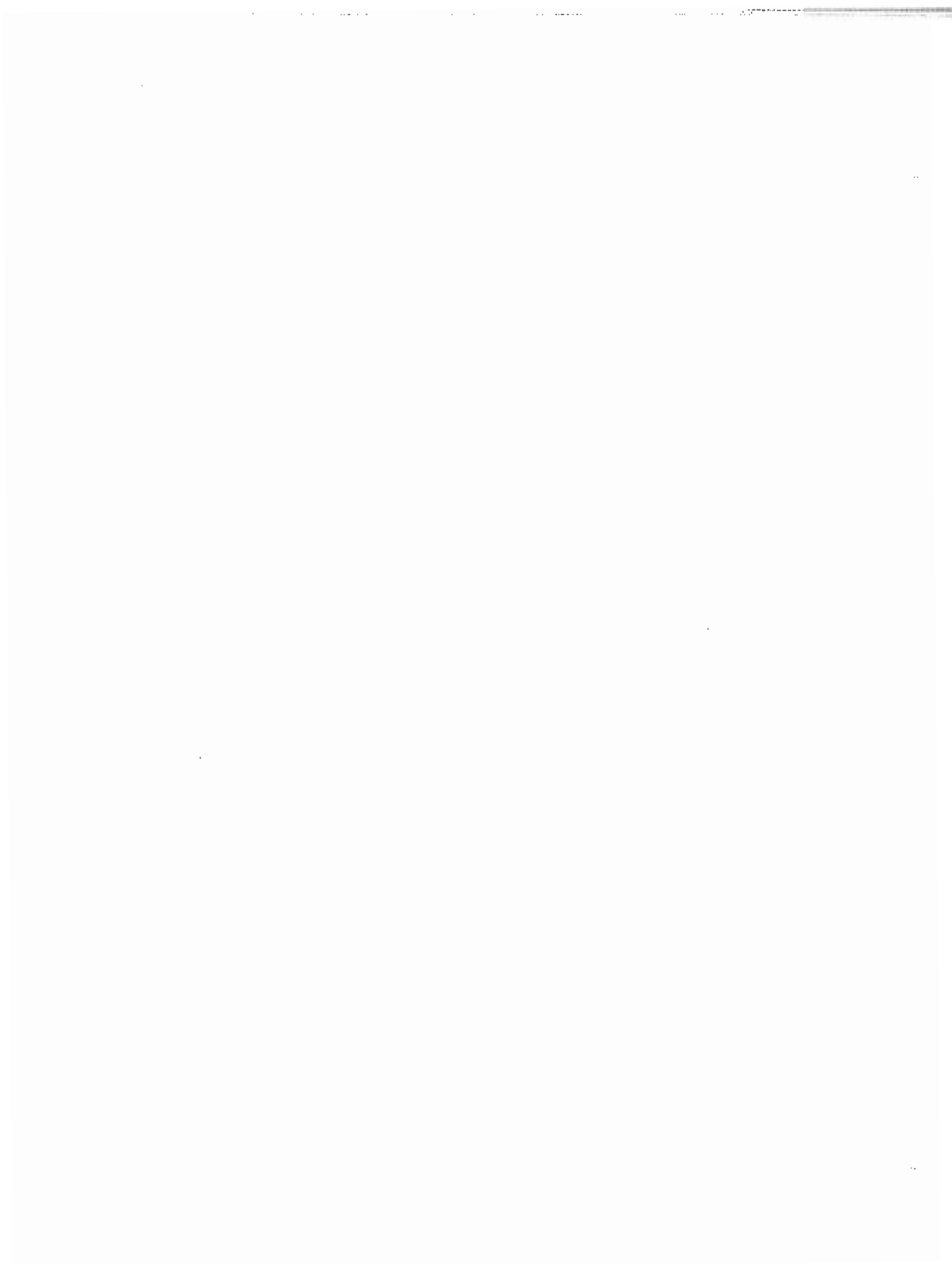
2. Attach push-pull tube to torque tube (3) with bolt (4), nut (5) and cotter pin.

3. Insert push-pull tube and verify that the heads of the three in-line rivets are facing down.

NOTE

See figure 4-7 for the following steps.

- f. Install idler bellcrank (7) and door operating linkage as follows:



1. Attach rocker arm lower link (23) to bellcrank rocker arm (13) and bellcrank (10) with bolts (16 and 22), washers (19 and 24), and nuts (20 and 24).
2. Attach upper connecting links (6) to bellcrank rocker arm (13) and idler bellcrank (7) with bolts (16), washers (2), and nuts (4).
3. Install spacers (14 and 31) in idler bellcrank (7) and bellcrank rocker arm (13).
4. Place bellcranks and attached linkage in position between front spar and support web.
5. Install bellcrank rocker arm (13) with bolt (11), and thrust bearing washers (12).
6. Install idler bellcrank (7) with bolt (39) and thrust bearing washers (30).
7. Insert door actuating arm assembly (10) thru web; then install thrust bearing washer (21) and nut (18).
8. Install four screws attaching bearing housing to web and bolt (22) and nut (25). Safety with locktite sealant.
- g. Install landing gear drive tube (35) as follows:
 1. Insert drive tube into position from the cabin area and attach to idler bellcrank (7) with bolt (32), washer (34), and nut (36).
 2. Attach drive tube to landing gear actuator bellcrank.
- h. (See figure 4-8) Install outboard drive tube (64) as follows:
 1. Attach drive tube to torque tube (63) with bolt (62), washer (65), and nut (66).
 2. (See figure 4-7) Attach drive tube to idler bellcrank (7) with bolt (33), washer (8), and nut (38).
- i. Rig main landing gear in accordance with rigging procedure.
- j. Install access hole covers on underside of wing forward of wheel well.
- k. Install floorboard and rear carpet.
- l. Connect landing gear doors and rig per Main Landing Gear Door Rigging Procedure.
- m. Insure that landing gear is DOWN and locked, then remove aircraft from jacks.
- n. Install rear seats.

Rigging of Main Landing and Nose Gear. (See figure 4-9.)

The following landing gear rigging procedure is designed specifically for the Model 421. A faithful following of this procedure will result in a proper rigged and efficient operating system. Before starting the rigging the "toe-out" should be checked in accordance with main wheel alignment procedures, the tires inflated to proper pressures and main gear door link tube should be checked for proper overcenter adjustment, in accordance with main landing gear door rigging procedures.

- a. Jack aircraft using the three provided jack points. One point is located on the underside of the fuselage, just aft of the nose wheel well, and one point is located on the lower surface of each wing on the wing rear spar, just aft of the main gear attach points. Position jacks to clear movement of main gear strut door.
- b. Remove carpet and floorboards covering and necessary access plates to gain access to the gear box

and idler in the fuselage.

CAUTION

Anytime the floorboards are removed a temporary protective cover should always be used to prevent damage and improper settings of the landing gear actuator limit switches.

- c. Release compression on retracting linkage by engaging manual extension crank and operating a sufficient number of turns toward the up position to open the inboard main gear door 20° - 30°.

NOTE

Prior to any operation of the landing gear by the manual extension crank, assure the landing gear switch is in the neutral position and circuit breaker is pulled.

- d. (See figure 4-6.) Disconnect main wheel well door link tube (15) by removing nut (14) and washer (11) from the door actuators. (See figure 4-16.) Disconnect door link tubes (3 and 15) by removing nuts and bolts.

NOTE

Always disconnect nose gear door link tubes from the upper connection to prevent the possibility of connecting the lower connection to the wrong side of the hinge.

- e. (See figure 4-10.) Disconnect nose gear retracting linkage in the nose gear wheel well by removing nuts and bolts attaching nose push-pull tube (7) to fork bolt (8) and connector link (3) and removing push-pull tube (7).
- f. Disconnect the inboard end of both outboard drive tubes (15) by removing nut, spacers and bolt.
- g. Disconnect LH inboard drive tube (21) and RH inboard drive tube (17) at door actuator bellcranks (16).

CAUTION

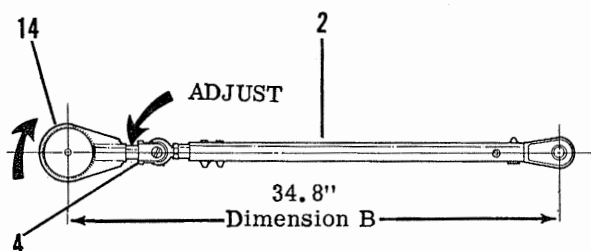
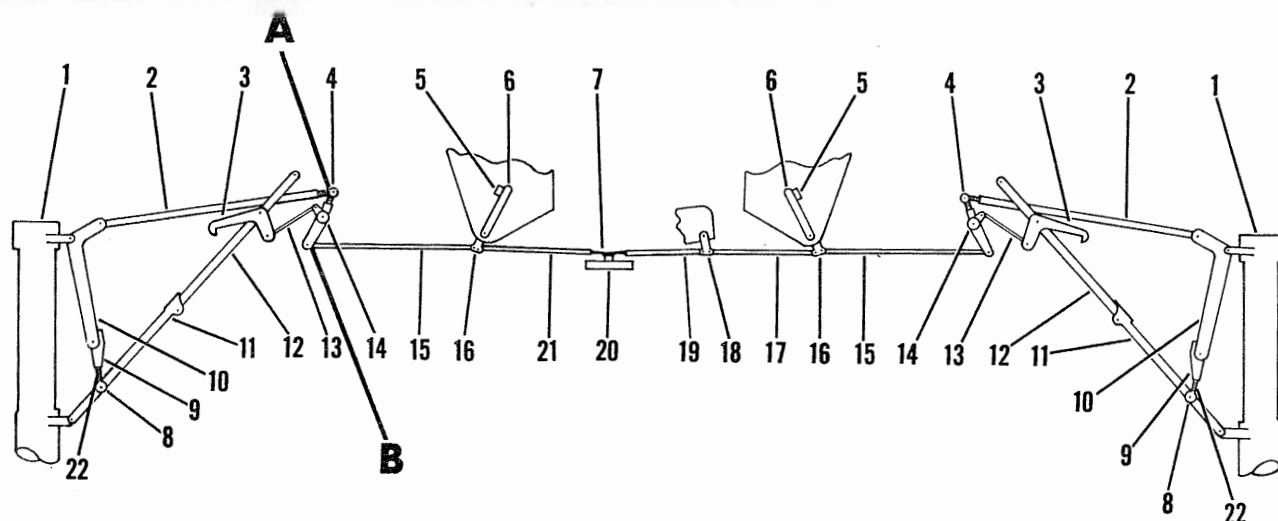
During operation of landing gear actuator be prepared to stop to prevent any possible damage.

CAUTION

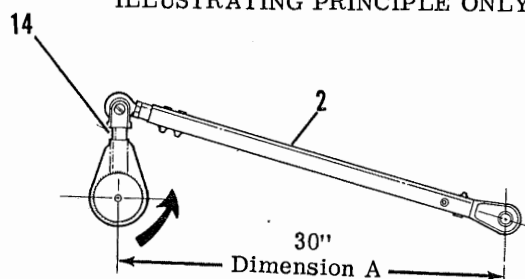
It is recommended that the inboard drive tubes be held during actuation to prevent damage to the structure. It may be necessary to install a length of safety-wire in the drive tube ends to help hold tubes in position during operation.

- h. (See figure 4-1.) Adjust the UP and DOWN limit switches (17 and 44) on the landing gear actuator as follows:

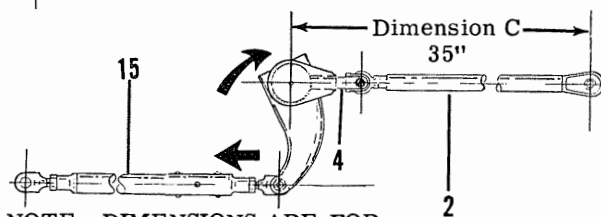
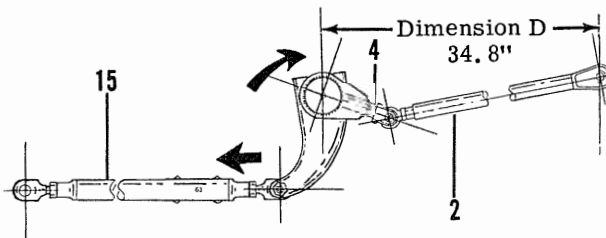
1. Adjust both limit switches to the end of their adjusting slots in a direction which will permit maximum bellcrank travel.



NOTE: DIMENSIONS ARE FOR
ILLUSTRATING PRINCIPLE ONLY.



Detail **A**

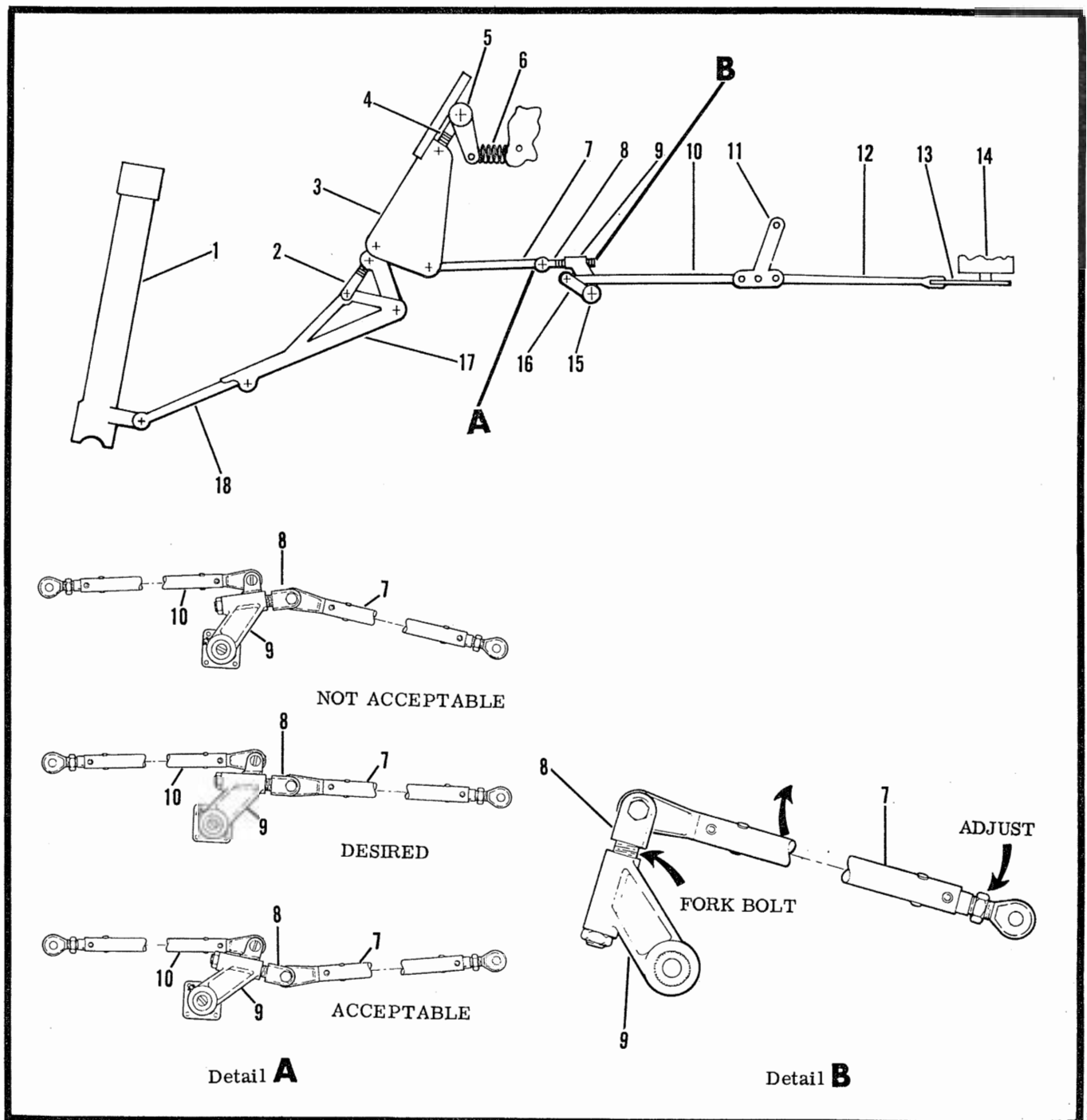


NOTE: DIMENSIONS ARE FOR
ILLUSTRATING PRINCIPLE ONLY.

Detail **B**

1. Main Landing Gear Strut	8. Lock Link End Fitting	16. Door Actuator Bellcrank
2. Push-Pull Tube	9. Side Brace Lock Link	17. RH Inboard Drive Tube
3. Uplock	10. Bellcrank	18. Bellcrank
4. Fork Bolt	11. Lower Side Link	19. Intermediate Drive Tube
5. Door Actuator Arm Stop	12. Upper Side Link	20. Landing Gear Actuator
6. Door Actuator Arm	13. Uplock Push-Pull Tube	21. LH Inboard Drive Tube
7. Bellcrank	14. Torque Tube	22. Adjusting Screw
	15. Outboard Drive Tube	

Figure 4-9. Schematic of Main Gear Retracting Linkage



1. Nose Gear Strut
2. Adjusting Fork
3. Connector Link
4. Adjusting Rod End
5. Uplock Torque Tube
6. Spring
7. Nose Push-Pull Tube
8. Fork Bolt
9. Adjusting Bellcrank

10. Forward Drive Tube
11. Idler Bellcrank
12. Aft Drive Tube
13. Actuator Bellcrank
14. Landing Gear Actuator
15. Torque Tube Assembly
16. Outboard Bellcrank
17. Truss Assembly
18. Drag Brace

Figure 4-10. Schematic of Nose Gear Retracting Linkage

NOTE

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

2. Engage manual extension crank and operate toward the up position until the internal stop in the actuator is reached. To prevent possible damage to the actuator, do not force against the internal stop.

3. (See figure 4-1.) Note the angular position of the crank when internal stop is reached, back crank off toward the down position 2 turns of the hand crank, then advance crank 1/2 turn toward the up position. Adjust the up limit switch (17) so that it is just actuated at this point.

4. Engage manual extension crank and operate toward the down position until the internal stop in the actuator is reached. Do not force against the internal stop.

5. (See figure 4-1.) Note the angular position of the crank when internal stop is reached, back crank off toward the up position 2 turns of the hand crank, adjust the down limit switch (44) so that it is just actuated at this point.

6. After these preliminary adjustments to the limit switches have been made, stow the manual extension crank and operate the actuator electrically to the up position until the up limit switch is actuated.

CAUTION

Caution must be observed during actuation to insure that no damage is incurred by the disconnected ends of the main drive tubes.

NOTE

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

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

8. Stow the manual extension crank and operate the actuator electrically to the down position until the down limit switch is actuated.

9. Engage the manual extension crank and note the position of the crank. Operate crank toward the down position and note the number of turns required to reach the internal stop in the actuator. The minimum number of turns required in the down position is one and the maximum (and desired) number of turns is

two turns. If necessary, adjust the down limit switch to meet this requirement.

10. Actuate gear electrically to the down position. Manually place the door actuator arm (6) against its stop. Adjust RH and LH inboard drive tubes (17 and 21) to align with hole in bellcrank door actuator (16); then lengthen the rod ends on the drive tubes (17 and 21) two turns. Actuate gear electrically toward the up position as required to install bolts, washers and nuts.

CAUTION

Bolt (32, figure 4-7) must be installed with head of bolt forward.

11. (See figure 4-11.) Actuate gear electrically to the DOWN position and check the pull force required to move the door actuator arms from their stops as illustrated.

NOTE

The pull required to move door actuator arm from stop must be measured at a right angle to the arm. The tool illustrated in figure 4-11 can be made to facilitate this measurement.

12. Adjust the length of both inboard drive tubes (17 and 21) as necessary to obtain a force of 25 ±10 pounds required to move door actuator arms (6) from stops (5) in the down position.

13. Actuate gear electrically to the UP position and adjust the up limit switch as necessary to obtain a force of 25 ±10 pounds and a maximum difference of 10 pounds from the down position required to move the door actuator arms (6) from stop (5) in the up position.

NOTE

If the up limit switch is readjusted recheck the minimum turn requirement in Step 7.

i. Adjust side brace lock links (9) as follows:

1. With landing gear in the down position, adjust end fitting (8) so that lower side link (11) and upper side link (12) are held firmly in overcenter position when side brace lock link (9) is firmly overcenter.

2. During retraction check for clearance between bellcrank (10) and push-pull tube (2). It may be necessary to add or subtract washers to provide clearance.

3. Manually "Break" the lock link from its overcenter position and move the landing gear to a position five to six inches inboard from the down and locked position, then release. The landing gear must free fall and lock when released from this position.

NOTE

Lengthen side brace lock link end fitting (8) in 1/2 turn increments until the gear will not free fall down and locked.

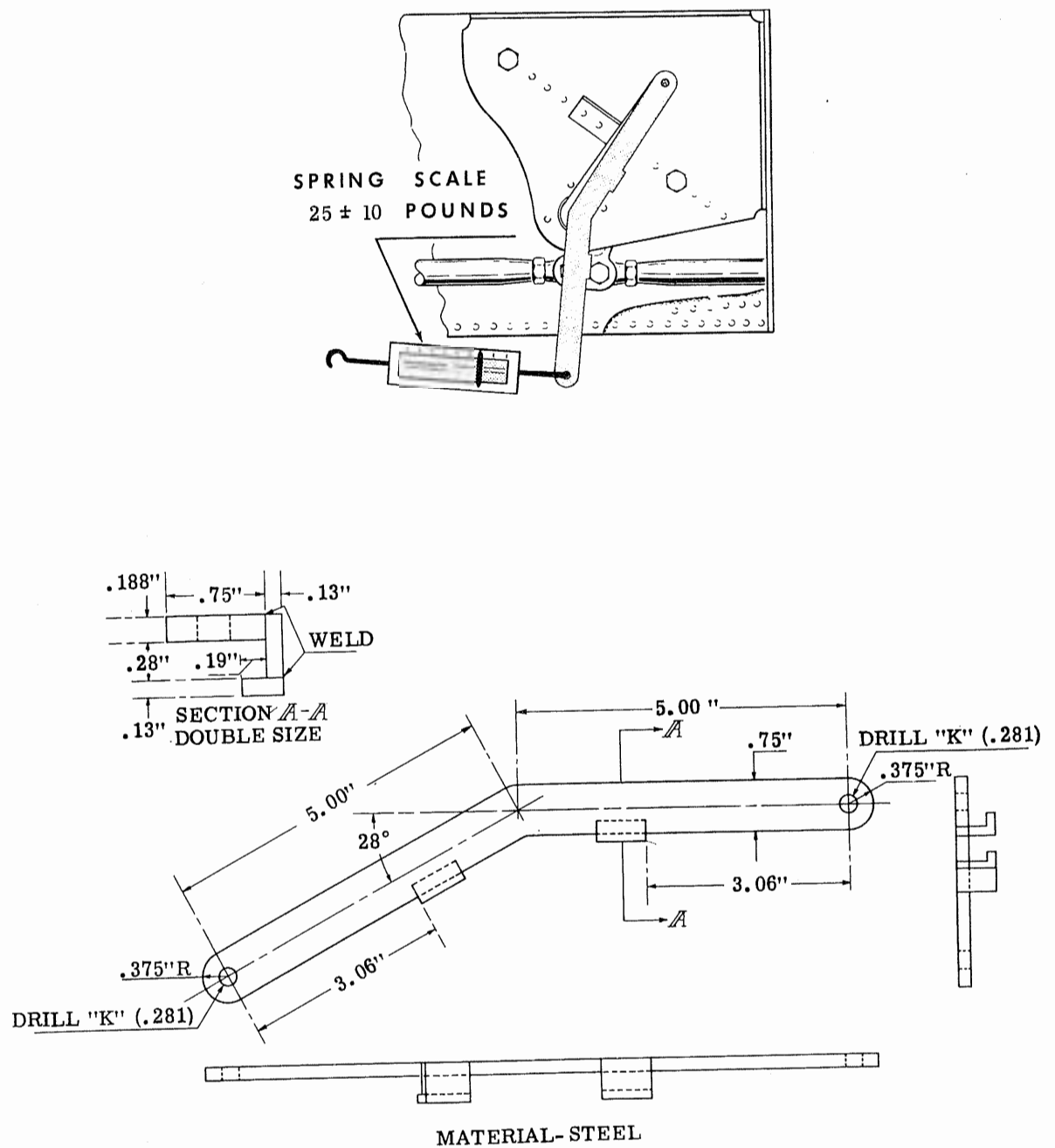


Figure 4-11. Fabrication and Usage of Tool for Measuring Door Actuator Arm Tension

4. On aircraft 421-0001 to 421A0070 shorten lock link end fitting (8) in 1/2 turn increments until gear will free fall down and locked.
5. On aircraft 421A0070 and On shorten adjusting screw (22) in small increments until the gear will free fall down and locked. Double safety wire screw in adjusted position.
6. Adjust both main landing gear side brace lock links in this manner.

NOTE

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

- j. Make the following preliminary preparations:
 1. Remove uplocks (3) and uplock push-pull tubes (13) by removing attaching bolts.
 2. Adjust the length of outboard drive tubes (15) to 1/4 inch from as short as possible and install.

NOTE

Bolt (33, figure 4-7) must be installed with head of bolt forward.

3. Disconnect push-pull tube (2) from fork bolt (4).
4. Screw fork bolts (4) into torque tubes (14) as far as possible.
5. Operate landing gear actuator to DOWN position.
6. With landing gear DOWN, adjust length of push-pull tubes (2) so that rod end holes align with the holes in fork bolts (4), then shorten one turn. Operate landing gear actuator toward the UP position far enough to permit installation and install push-pull tubes (2). INSTALL WITH THE COLLAR-END OF THE HI-SHEAR RIVETS POINTING UPWARD FOR CLEARANCE.

CAUTION

The bolt installing push-pull tube (2) to the fork bolt (4), must be installed with the bolt head forward.

NOTE

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

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

NOTE

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

2. The axle dust cover should make light contact with the corrugated reinforcement at the top of wheel well, then drop down a specified distance (drop-off). Refer to step "m."

m. Adjust the amount of drop-off as follows:

1. Determine whether drop-off is too little or too much. The minimum and desired amount of drop-off, measured at the center of the wheel, is 1/8 inch. The maximum is 1/4 inch.
2. If drop-off is too much, lengthen outboard drive tube (15) in half-turn increments until drop-off is correct.
3. If drop-off is too little, shorten outboard drive tube (15) in half-turn increments until drop-off is correct.
4. Adjust the amount of drop-off for both main landing gears in this manner.

NOTE

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

- n. Adjust the down lock tension as follows:
 1. (See figure 4-12.) Operate the landing gear to the DOWN position. The main landing gear down lock tension should be 40 to 50 pounds.
 2. If down lock tension is too high, lengthen push-pull tube (2) until the correct down lock tension is obtained.
 3. If down lock tension is too low shorten push-pull tube (2) until the correct down lock tension is obtained.

NOTE

Since the highest position during retraction is controlled by the combined length of the push-pull tube (2) and the fork bolt (4), this combined length must remain unchanged to maintain the correct highest position. When adjusting the push-pull tube to obtain the specified down lock tension, the fork bolt must be readjusted a corresponding amount in the direction that will not change the combined length of the push-pull tube and fork bolt.

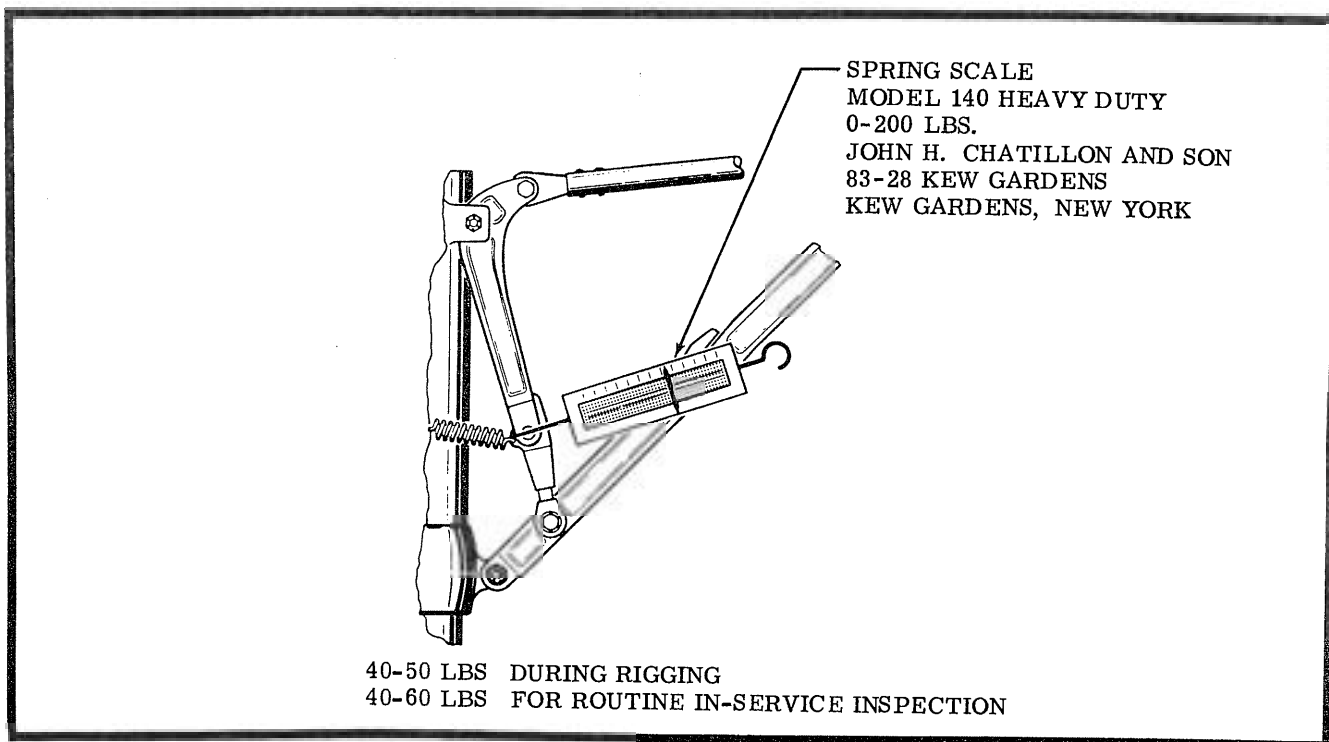


Figure 4-12. Main Landing Gear Down Lock Requirements

4. Adjust the down lock tension for both main landing gear in this manner.

o. Install and adjust uplocks as follows:

1. Connect uplock push-pull tubes (13) to uplock assemblies with bolts, washers and nuts.

2. (See figure 4-8.) Position uplock assemblies in place and attach to upper side links with screws (25). Do not tighten attachment.

3. Adjust uplock push-pull tubes (13) to a preliminary length of 5.15 inches and attach to torque tube (14) with bolts, washers and nuts.

4. Operate landing gear to the UP position.

CAUTION

Use caution when landing gear nears the UP position before adjustment of uplock push-pull tubes has been completed. If necessary, readjust the push-pull tube and/or uplock hooks to prevent damage.

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

NOTE

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

6. Operate the landing gear several times, observing uplock assemblies. Uplock hooks must engage fully with the spacers provided on the gear, and

must engage and disengage freely and smoothly with no indication of binding.

7. VISUALLY CHECK THE ALIGNMENT OF ALL ROD ENDS TO INSURE THAT THEY ALIGN WITH THEIR ATTACH FITTINGS.

p. Refer to figure 4-10 for the following steps q. thru z. for rigging the nose gear.

q. Disconnect downlock assist spring (6) in nose gear wheel well.

NOTE

Because the aft drive tube (12) is a fixed length, the idler bellcrank (11) is correctly positioned to the actuator bellcrank (13).

r. Operate the actuator to the DOWN position, then adjust the length of the forward drive tube (10) as follows:

1. Disconnect forward drive tube (10) from outboard bellcrank (16).

2. Adjust the length of forward drive tube (10) so that fork bolt (8) is parallel with the upper flange of the wheel well former adjacent to the fork bolt. The forward end of the fork bolt will point downward any amount caused by less than one turn of the threaded end of the forward drive tube (10). Detail "A" illustrates three possible conditions. The straight configuration is most desired. The fork bolt must never point up.

NOTE

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

- s. Make the following preliminary adjustments:
 1. Screw fork bolt (8) into adjusting bellcrank (9) as far as possible.
 2. Screw adjusting rod end (4) into uplock torque tube (5) as far as possible.
 3. Shorten adjusting fork (2) as much as possible.
 4. (See figure 4-17.) Adjust uplock hook (52) to the end of its adjusting slots in the direction that will prevent hook from fully engaging.
- t. Adjust connector link (3) as follows:
 1. With nose gear DOWN, check the over-center position of connector link (3).

NOTE

A slight force should be required to snap connector link into its over-center position.

2. Lengthen adjusting rod end (4) in half-turn increments to increase the force required to snap connector link over-center; shorten to decrease.
3. Manually place nose gear UP, push upward on door actuator arm to lock connector link over-center, and check the retracted position.

NOTE

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

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

NOTE

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

- u. Adjust uplock and downlock tensions as follows:
 1. Lengthen nose push-pull tube (7) as much as possible. Insure rod end is visible through the inspection hole for thread engagement.
 2. Temporarily install nose push-pull tube (7).
 3. Retract landing gear electrically.

NOTE

If the auxiliary switch described in paragraph h., step 6., of Rigging of Main Landing Gear, is not being used to rig the landing gear, use the normal retraction system. The use of an external power source is recommended for operation of electrical units while engines are not being operated.

4. Check the uplock tension at the nose gear door actuator arm, as illustrated in figure 4-13. The force required to move the connector link from its position against uplock torque tube must be 75 ± 10 , -15 pounds.
5. Shorten nose push-pull tube (7) in half-turn increments to increase uplock tension; lengthen to decrease.
6. Operate landing gear to the DOWN position and check the downlock tension in the same manner. The force required to move the connector link from its position against the uplock torque tube must be 25 ± 10 pounds.
7. Lengthen fork bolt (8) in half-turn increments to increase downlock tension; shorten to decrease. DO NOT adjust nose push-pull tube (7).

NOTE

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

8. Operate landing gear to the UP position and recheck the uplock tension. If necessary, readjust nose push-pull tube (7) in accordance with step 5.

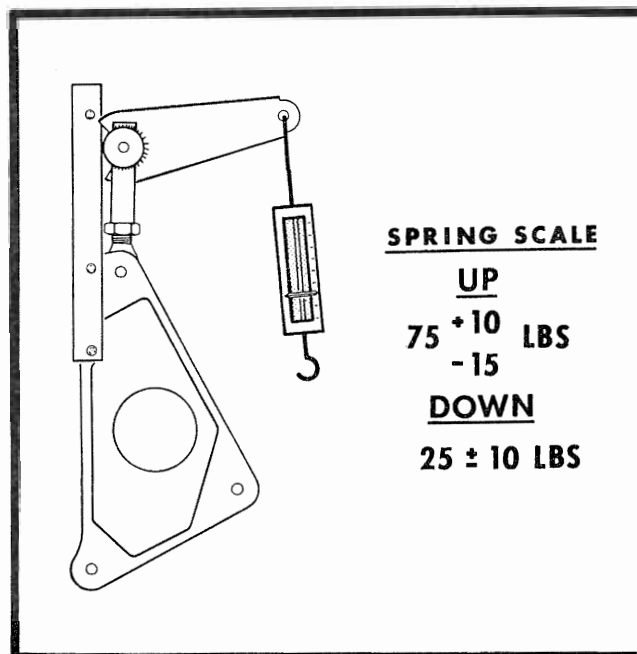


Figure 4-13. Nose Gear Tension Requirements

NOTE

Since the combined length of fork bolt (8) and nose push-pull tube (7) determines the downlock tension, this combined length must remain unchanged. When changing the length of the nose push-pull tube to obtain the correct uplock tension, change the length of the fork bolt to a corresponding amount in the direction that will not change their combined length.

v. Adjust the uplock hook as follows:

1. With landing gear in the UP position, check the clearance between uplock hook and the spacer on the strut with which the hook engages.

NOTE

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

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

NOTE

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

3. Operate landing gear several times to observe the uplock hook. The hook must engage and disengage freely, with no indication of binding between the hook and the spacer.

w. Connect downlock assist spring and cycle landing gear. The spring must cause no interference with gear operation.

x. (See figure 4-16.) Connect door link tubes (3 and 15) with bolts and nuts and rig nose gear doors in accordance with Nose Gear Door Rigging Procedures.

y. (See figure 4-6.) Connect main wheel well door link tubes (15) with washer (11) and nut (14). Rig doors in accordance with Main Gear Landing Doors Rigging Procedure.

z. Reinstall floorboards, seats, carpet and access covers. Insure that landing gear is DOWN and locked, then remove jacks.

Adjustment of Landing Gear Safety Switch. (See figure 4-13A.)

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

- a. Jack aircraft in accordance with Section 2.
- b. Place landing gear switch in the DOWN position.

c. Insure that battery switch is OFF.

d. (Aircraft 421-0001 to 421B0502.) Adjust safety switch as follows:

1. With left main landing gear strut fully extended, adjust arm of landing gear safety switch so that switch is actuated when the arm is raised to a position of 0.30 +.05, -.00 inches. Assure pressurization portion of the landing gear safety switch provides an open circuit to pressurization safety valve. Movement of the landing gear safety switch arm should provide an audible actuation of the safety valve solenoid. If either the landing gear safety switch portion or pressurization safety valve portion does not operate within the prescribed limits, the switch must be replaced.

NOTE

The arm is adjusted by removing the cotter pin and nut which attach the arm to the switch, repositioning the arm, and reinstalling the nut and cotter pin.

e. (Aircraft 421-0001 to 421B0472.) Check the adjustment of the landing gear safety switch as follows:

WARNING

Since landing gear may retract if adjustment of safety switch is incorrect, insure that all wheel well areas are clear while performing the following checks.

1. If available, connect an external power source; if not available, turn battery switch ON.
2. Raise the switch arm to the position adjusted in step d. While holding the switch arm in this position, have an assistant place the landing gear switch in the UP position. Landing gear should NOT retract.
3. Continue to raise the switch arm upward to the end of its travel. Landing gear should NOT retract.
4. Release the switch arm. Landing gear SHOULD retract.
5. Operate landing gear through several cycles, checking landing gear for proper operation.
- f. (Aircraft 421B0472 and On.) Adjust safety switch as follows:
 1. Adjust the landing gear safety switch to operate on the centerline of the stop plate.
 2. Remove bottom left-hand wing gap fairing.
 3. Place jack under axle and raise strut to 0.75 +0.75, -0.12 from full extended position. Cut safety wire and adjust the switch to actuate at this position.

NOTE

To ensure switch is actuating at position described above, refer to Section 14 and make a continuity check of safety switch.

4. Tighten jam nuts at safety switch and safety wire nuts.
5. Remove jack from under axle.

6. If available connect external power source; if not available, turn battery switch ON.

WARNING

Since landing gear may retract if adjustment of safety switch is incorrect, insure that all wheel well areas are clear while performing operational check.

7. Place the landing gear switch in the UP position. Landing gear SHOULD retract.
8. Operate landing gear through several cycles, check landing gear for proper operation.
9. Reinstall bottom left-hand wing gap fairing.
- g. Insure that landing gear switch and landing gear are DOWN and battery switch is OFF, then remove jacks.

Adjustment of Landing Gear Warning System.

- a. Adjust the throttle microswitch as follows:

NOTE

To properly adjust the throttle microswitch, it is necessary to fly the aircraft. As a preliminary adjustment before flight, adjust microswitch to actuate when the aft edges of the throttle levers are approximately 3/4 inch from the fully closed position.

1. Obtain a pressure altitude of 2500 feet.
2. Adjust propeller pitch levers to obtain 2300 rpm on both engines.
3. Place mixture levers in FULL RICH.
4. Retard throttle levers to obtain 12 to 14 inches of manifold pressure.

NOTE

If throttle levers are retarded below the specified manifold pressure, advance them and repeat the retarding procedure.

5. Using a pencil, tape, or other suitable means of marking, index the position of the throttle levers in the control quadrant.

NOTE

The remainder of the adjusting procedure must be accomplished with the aircraft on the ground.

6. With engines not being operated, place mixture levers in FULL RICH.

WARNING

Insure that fuel selector valve handles and fuel boost pump switches are in the OFF position.

7. Jack aircraft in accordance with Section 2.
8. Fully advance throttle levers, then retard to

the position marked on the control quadrant during flight.

9. Adjust the throttle microswitch to actuate at this position. Turn battery switch ON and check that warning horn sounds as throttle levers are retarded to this position, then turn battery switch OFF.

NOTE

Elongated slots are provided for vertical adjustment and an adjusting screw positions the microswitch horizontally.

- b. On aircraft 421B0201 and On, adjust flap gear warning as follows:

1. Fully advance throttle levers.
2. Position flap preselect lever to $16^{\circ} +2^{\circ}$ -0° .
3. Turn off electrical power.
4. (See figure 8-3.) Loosen screws (39) and adjust switch (38) to operate at this position. A definite click should be felt when switch actuates.
5. (See figure 8-3.) Tighten screws (39) and turn electrical power on.
6. Operate the landing gear to full up position.
7. Operate flaps to full down position and note flap position when warning horn sounds.

NOTE

Anytime the flap preselect lever is placed below the 15° detent, the landing gear warning horn should sound when the flaps reach $16^{\circ} +2^{\circ}$ -0° travel.

8. It may be necessary to repeat steps 4 through 7 to properly adjust the landing gear warning system.
9. After microswitch adjustment is completed, place throttle levers in the CLOSED position and the mixture levers in IDLE CUT-OFF.
- c. Adjust DOWN indicator switches as follows:
 1. (See figure 4-6) Disconnect main wheel door link tubes (15) from main wheel well door (10).
 2. (See figure 4-16) Disconnect nose gear door link tube (15) from nose gear door hinge (21).
 3. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
 4. (See figure 4-17) Disconnect nose gear nose push-pull tube (37) from fork bolt (39) by removing nut and bolt.
 5. (See figure 4-7) Disconnect main gear LH outboard drive tube (9) from idler bellcrank (7) by removing nut, spacers and bolt.
 6. Adjust all three DOWN indicator switches so that they are not actuated until landing gear is DOWN and locked by the over-center linkage. Adjust the main landing gear switches by repositioning. Adjust the nose gear switch by adjusting the switch actuating bolt.
 7. Attach the push-pull tubes disconnected in steps "4" and "5."
 8. Using the normal landing gear retraction system, operate landing gear to the UP position.
 9. Place landing gear switch in a neutral position, engage the manual extension crank, and lower the

landing gear. Stop cranking immediately when the green light illuminates, and note the exact angular position of the crank.

10. Check that both main gear and nose gear are DOWN and locked in the over-center position.

11. Resume cranking toward the DOWN position noting the number of turns required, until the internal stop in the landing gear actuator is reached. The number of turns required should not be less than four, nor more than eight for the main landing gears. The number of turns should not be less than eight nor more than fourteen for the nose gear.

12. If necessary, readjust DOWN indicator switches as required to meet the conditions of steps "6" and "11."

13. Connect nose gear nose push-pull tube (7) to fork bolt (8).

14. (See figure 4-7) Connect main gear LH outboard drive tube (9) to idler bellcrank (7).

15. Insure that landing gear is DOWN, then remove jacks.

sembly, torque links, and shimmy dampener. The Air-oleo shock strut contains an orifice and tapered metering pin which vary the resistance to shock according to its severity. During extension and retraction, the nose gear pivots on heavy-duty needle bearings by means of sleeved lugs on the trunnion assembly. A wheel straightener and steering mechanism are provided so that the nose wheel turns while taxiing, but is straightened during retraction.

Removal of Nose Gear. (See figure 4-14.)

- a. Jack aircraft in accordance with Section 2.
- b. Remove taxi light (if installed, optional).
- c. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- d. Disconnect nose gear doors.
- e. Disconnect retracting linkage as follows:
 1. Remove nut (20), washer (19), and bolt (22) attaching drag brace (23) to strut.

NOSE GEAR.

The nose gear consists of a wheel and tire assembly, yoke, axle, lower strut, upper strut, trunnion as-

NOTE

To facilitate installation, note the number and position of attaching clamps and the routing of electrical wires.

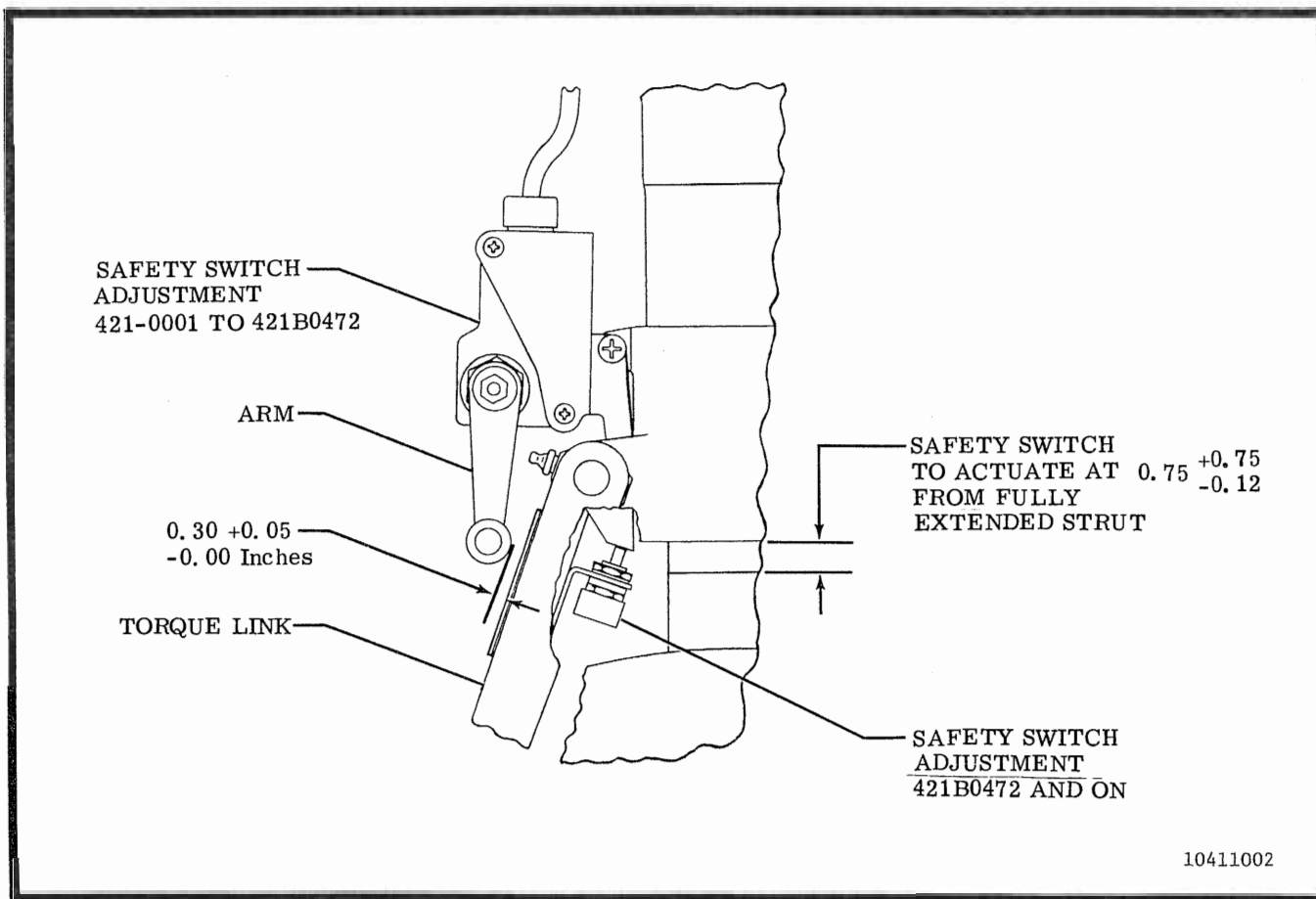


Figure 4-13A. Adjustment of Landing Gear Safety Switch

2. Remove bolts (25 and 29), washers (26 and 30), and spacers (27 and 28).

3. Remove four nuts (17), washers (16), and bolts (14) on both left and right side of wheel well; then turn nose gear and slide retainer and gear aft to remove gear.

NOTE

To facilitate removal, wax or paraffin was applied to retainer (13) upon installation.

Disassembly of Nose Gear. (See figure 4-15.)

WARNING

Deflate the nose gear strut before removing or disconnecting nose gear torque links.

- a. Remove fender (if installed, optional).
- b. Remove wheel and tire assembly.
- c. Remove retainers from trunnion assembly.

NOTE

Needle bearings are a press fit and should be removed only for replacement.

- d. Remove shimmy dampener by removing nuts, washers, and bolts.
- e. Completely deflate strut and after all air has been expelled remove valve assembly and drain fluid.
- f. Remove snap ring (28) and stop (34) then pull trunnion (30) from upper barrel (59).
- g. Remove ball bearing (33) and packing (32) from trunnion (30).
- h. Remove cotter pin (35), washer (36), and pin (60) from upper barrel (59).
- i. Remove cotter pin (42), nut (43), washers (44 and 50), and bolt (49). Then disconnect torque links (46 and 51).
- j. Pull inner tube and fork assembly (5) and upper barrel (59) far enough apart to remove lock ring (27); then remove lock ring (27) and separate upper barrel (59) and inner tube (5).
- k. Pull orifice tube (14) from inner tube and fork (5), then unscrew orifice (15) from orifice tube (14).
- l. Remove lock ring (16) from inner tube and fork (5) and remove bearing (17).
- m. Slide spacer (18), shim (19), ring pack support (21), scraper ring (25), and ring pack retainer (26) up and off of inner tube and fork (5).
- n. Remove metering pin as follows:
 1. Remove nut (12) and bolt (9) from wheel fork.
 2. Pull metering pin from inner tube and wheel fork.
 3. Remove nut and disassemble metering pin as shown.
- o. Remove back up ring (22), O-ring (23), and back up ring (24) from ring pack support (21).

NOTE

Inner tube and fork are a press fit and drilled on assembly. Disassembly is not recommended.

Cleaning, Inspection, and Repair of Nose Gear.

The instructions for cleaning, inspection, and repair of the main landing gear also applies to the nose gear.

Assembly of Nose Gear. (See figure 4-15.)

Before each component of the nose gear shock strut is assembled, assure that it is thoroughly clean, then lubricate with system hydraulic fluid.

a. If metering pin was disassembled, assemble as follows:

1. Install O-rings (2) as shown and install pin (1) in pin plug base (3) and install nut (4).
2. Install metering pin in inner tube and fork (5). Align holes and install bolt (9), washer, and nut (12).

NOTE

On 421B0001 and On add shims (65) and/or washers (66) as required between metering pin (1) and plug pin base (3) to maintain .486 $\pm$.005 inch between top of pin (1) and opening of orifice.

- b. Slide lock ring (27), ring pack retainer (26), and scraper ring (25) on inner tube and fork (5).
- c. Install back up ring (22), O-ring (23), and back up ring (24) or poly-pak seal (67) inside ring pack support (21); and O-ring (20) in the groove on the outside of ring pack support (21).

CAUTION

Install poly-pak seal with wide lip up (toward pressure side).

- d. Slide ring pack support on inner tube and fork (5) then install shim (19) and spacer (18).
- e. Install bearing (17) on inner tube and fork (5) and install lock ring (16).

NOTE

Install bearing with chamfered end up in order to seat against external lock ring.

- f. Screw orifice (15) in bottom of orifice tube (14) and install O-ring (13) in groove in orifice tube (14).
- g. Insert assembled orifice tube (14) into upper barrel (59); align holes and install pin (60), washer (36), and safety with cotter pin (35).

NOTE

Lubricate O-ring (13) or tape sharp edges of lower strut to prevent O-ring damage.

- h. Install assembled inner tube and fork (5) into upper barrel (59). Carefully work scraper ring (25) and retainer ring (26) into place and install lock ring (27).

NOTE

Lubricate O-ring (20) or tape sharp edges of lower strut to prevent O-ring damage.

NOTE

To prevent damage to piston barrel and ring pack support during installation, a ring pack support tool P/N 0880004-2, available from your Cessna Dealers' Organization, should be used. (See Figure 4-3A.)

- i. Connect torque links (46 and 51) together with bolt (49), washer (50), bushing (52), washer (53), spacer (54), washer (53), bushing (55), washers (44), nut (43), and cotter pin (42).
- j. Install packing (32) and ball bearing (33) into trunnion (30) and lubricate.

CAUTION

Do not use high pressure grease gun on fitting (31). Damage may result to trunnion (30).

- k. Install ball bearing (29) in top of trunnion (30) and fit trunnion on upper barrel.
- l. Install stop (34) and snap ring (28).
- m. Press needle bearings into place on trunnion (30).
- n. Install shimmy dampener in accordance with installation procedure.
- o. Install fender (if required, optional).
- p. Install wheel and tire assembly.
- q. With strut completely deflated, fill with hydraulic fluid as specified in Section 2 and install valve body. Do not inflate strut at this time.

Installation of Nose Gear. (See figure 4-14.)

- a. Make sure bearings (12) are in place, then install retainers (13) and shims on trunnion (11).

NOTE

Shim as required to center nosegear and to limit side play to not exceed 0.020.

- b. Place nose gear in wheel well and turn into position for installation. Force nose gear forward and align mounting holes.

NOTE

To facilitate installation, rub wax or paraffin on the wheel well bulkheads against which the retainers must slide; and move forward evenly.

- c. Install eight bolts (14), washers (16), and nuts (17) attaching retainers to airframe. Torque heads of bolts to 85 ± 15 inch-pounds.
- d. Align Gimbal fitting on nose gear steering unit and install spacers (27 and 28), washers (26 and 30), and bolts (25 and 29). Torque bolts 50 to 70 inch-pounds.

Removal and Disassembly of Nose Gear Torque Link Assemblies.

- a. Nose Gear (see figure 4-15).

WARNING

If the aircraft is on jacks, it is advisable to deflate struts before removing torque links to avoid possible damage.

- 1. Remove cotter pins (11, 37 and 42).
- 2. Remove nuts (10, 38 and 43).
- 3. Remove washers (7, 39 and 44).
- 4. Remove spacers (8, 48 and 57).
- 5. Remove bolts (6, 49 and 56) attaching links to strut and attaching the upper torque links to the lower torque links.

NOTE

Observe the number of washers (53) installed to facilitate reinstallation.

- 6. Remove nose gear torque links by pulling forward.

NOTE

The bushings and spacers in the torque links are a press fit and should be removed only for replacement.

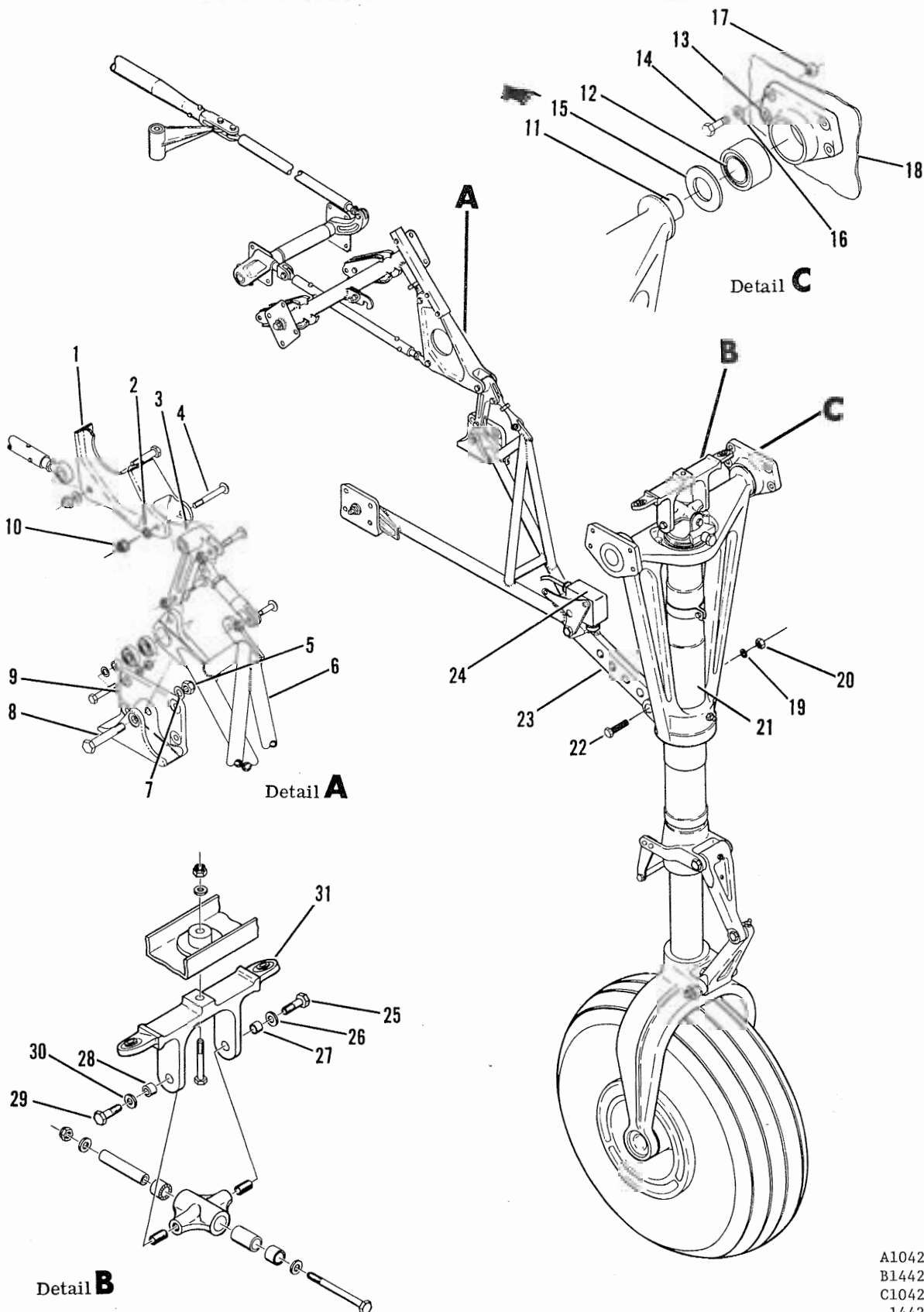
- b. Remove grease fittings from torque links.

Assembly and Installation of Nose Gear Torque Link Assemblies.

- a. Nose Gear (see figure 4-15).
 - 1. Install grease fitting in torque link.
 - 2. If removed, install bushings (40, 45, 47, 52, 55 and 58).

NOTE

- Mill an equal amount on each bushing (40, 45, 47 and 58) using a flat mill file to provide a slip fit between the lugs on the torque link and the trunnion and/or lugs on the axle.
- Make sure holes in spacers (52 and 55) are aligned with grease fittings.
- 3. Install spacers (8, 48 and 57).
- 4. Insert nose gear torque links (51 and 46) into position and install washers (7 and 39) and bolts (6



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Figure 4-14. Nose Gear Installation

Figure 4-14. Nose Gear Installation Callouts

1. Connector Link	12. Bearing	22. Bolt
2. Washer	13. Retainer	23. Drag Brace
3. Retracting Arm	14. Bolt	24. Nose Gear Down Indicator Switch
4. Bolt	15. Shim	25. Bolt
5. Nut	16. Washer	26. Washer
6. Truss Assembly	17. Nut	27. Spacer
7. Washer	18. Web	28. Spacer
8. Bolt	19. Washer	29. Bolt
9. Retainer	20. Nut	30. Washer
10. Nut	21. Trunnion	31. Nose Gear Steering Assembly
11. Trunnion		

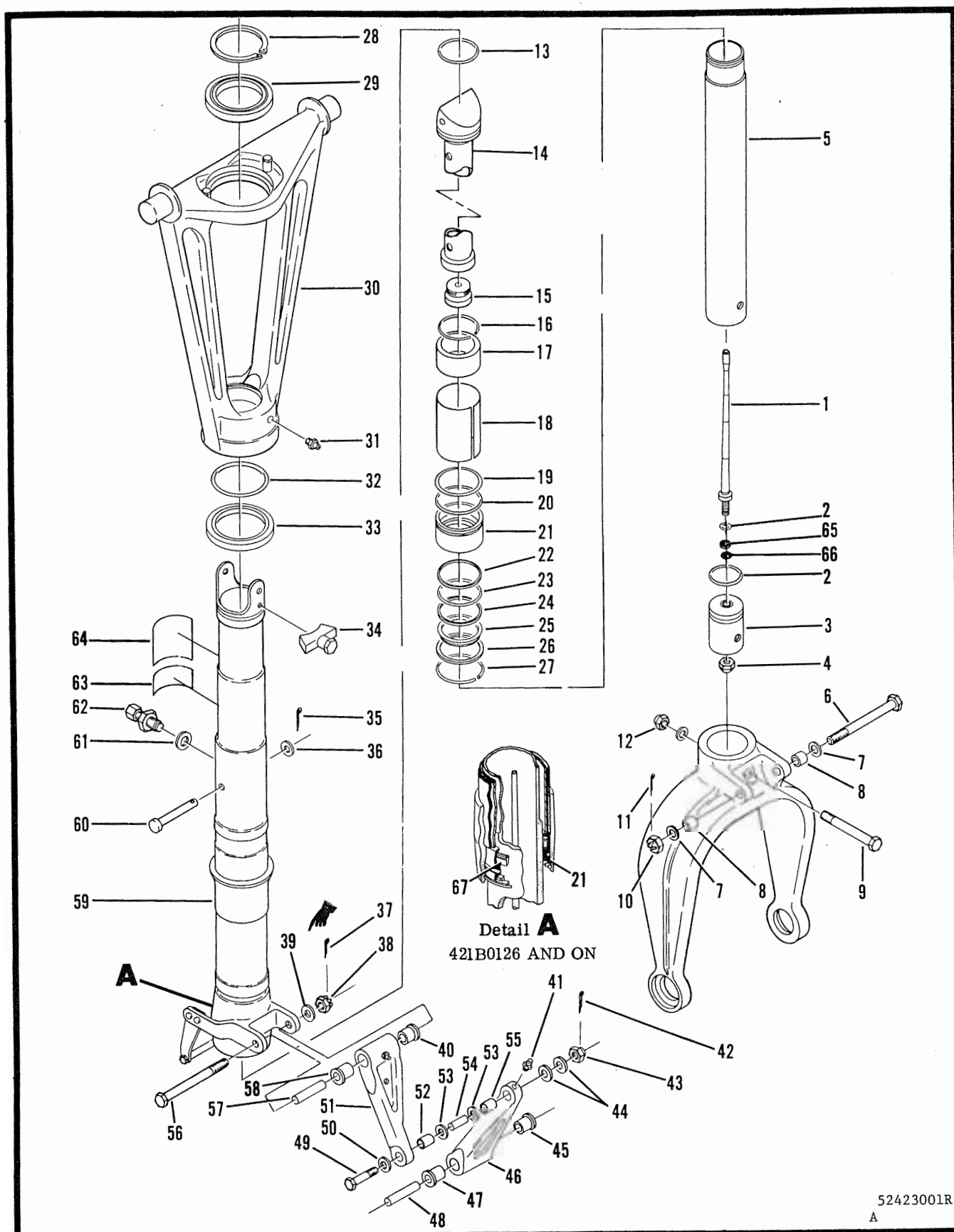


Figure 4-15. Nose Gear Strut

and 56).

5. Install nuts (10 and 38) and safety with cotter pins (11 and 37).

6. Install correct number of washers (53) previously removed.

7. Install bolt (49), washers (44), nut (43) and safety with cotter pin (42).

NOTE

Washers should be installed in the same position from which they were removed. If new components are being installed, align landing gear in accordance with Main Wheel Alignment Procedures.

b. If aircraft was placed on jacks, insure the gear is DOWN and locked and remove aircraft from jacks.

c. Inflate struts in accordance with Section 2.

d. Lubricate torque links in accordance with Lubrication Chart.

Nose Gear Doors.

Right and left main doors are used to enclose the nose gear in its retracted position. The doors are connected to the nose gear retracting linkage and hinged at their outboard ends, pivoting downward during nose gear extension and remaining down while the nose gear is down.

Removal of Nose Gear Doors. (See figure 4-16.)

a. Remove nut, washers, and bolt from door link tubes (3 and 15).

b. Remove the three nuts and bolts from four hinge brackets and doors; then remove doors.

c. Remove nose gear door hinges as follows:

1. Remove necessary radio equipment and shelves to gain access to hinge bolts.

2. Remove nuts, spacers, washers, and bolts from hinge brackets and remove hinges.

Installation of Nose Gear Doors.

a. If nose gear door hinges were removed, install as follows:

1. Install hinges in brackets using bolts, washers, spacers, and nuts.

2. Replace radio shelves and equipment removed previously.

b. Install nose gear doors at the four hinges with the three bolts and nuts.

c. Connect door link tubes with bolt, washers, and nut to the forward side of hinge (21).

d. Rig nose gear doors in accordance with rigging procedure.

CAUTION

Damage will result if door link tube is not connected on the proper side of hinge (21).

Rigging Nose Gear Door. (See figure 4-16.)

a. Jack aircraft in accordance with Section 2.

b. Disconnect main door link tubes (3 and 15) from center hinges (8 and 21) by removing cotter pins, nuts, washers, and bolts.

c. Using the normal landing gear retraction system, operate gear to the UP position.

NOTE

The use of an external power source is recommended for operation of electrical units while engines are not being operated.

CAUTION

When operating gear before door rigging is completed, be prepared to stop before damage can occur. On new doors, operation by hand is necessary to make sure of clearance between fuselage skin and door.

d. Connect and adjust main door link tubes (3 and 15) until main doors close snugly when gear is in the UP position.

Figure 4-15. Nose Gear Strut Callouts

1. Metering Pin	19. Shim	37. Cotter Pin	
2. O-Ring	20. O-Ring	38. Nut	55. Bushing
3. Plug Pin Base	21. Ring Pack Support	39. Washer	56. Bolt
4. Nut	22. Back Up Ring	40. Bushing	57. Spacer
5. Inner Tube and Fork	23. O-Ring	41. Lube Fitting	58. Bushing
6. Bolt	24. Back Up Ring	42. Cotter Pin	59. Upper Barrel Assembly
7. Washer	25. Scraper Ring	43. Nut	60. Pin
8. Spacer	26. Ring Pack Retainer	44. Washer	61. Gasket
9. Bolt	27. Lock Ring	45. Bushing	62. Valve Assembly
10. Nut	28. Snap Ring	46. Torque Link	63. Placard
11. Cotter Pin	29. Bearing Ball	47. Bushing	64. Placard
12. Nut	30. Trunnion	48. Spacer	65. Shim
13. O-Ring	31. Lube Fitting	49. Bolt	66. Washer
14. Orifice Tube Assembly	32. Packing	50. Washer	67. Poly Pak Seal
15. Orifice	33. Bearing Ball	51. Torque Link	
16. Lock Ring	34. Stop Assembly	52. Bushing	
17. Bearing	35. Cotter Pin	53. Washer	
18. Spacer	36. Washer	54. Spacer	

- e. Extend and retract gear, check for clearance between nose tire and doors, and readjust door link tubes (3 and 15) as necessary to obtain clearance.
- f. Insure that landing gear is DOWN and locked, then remove jacks.

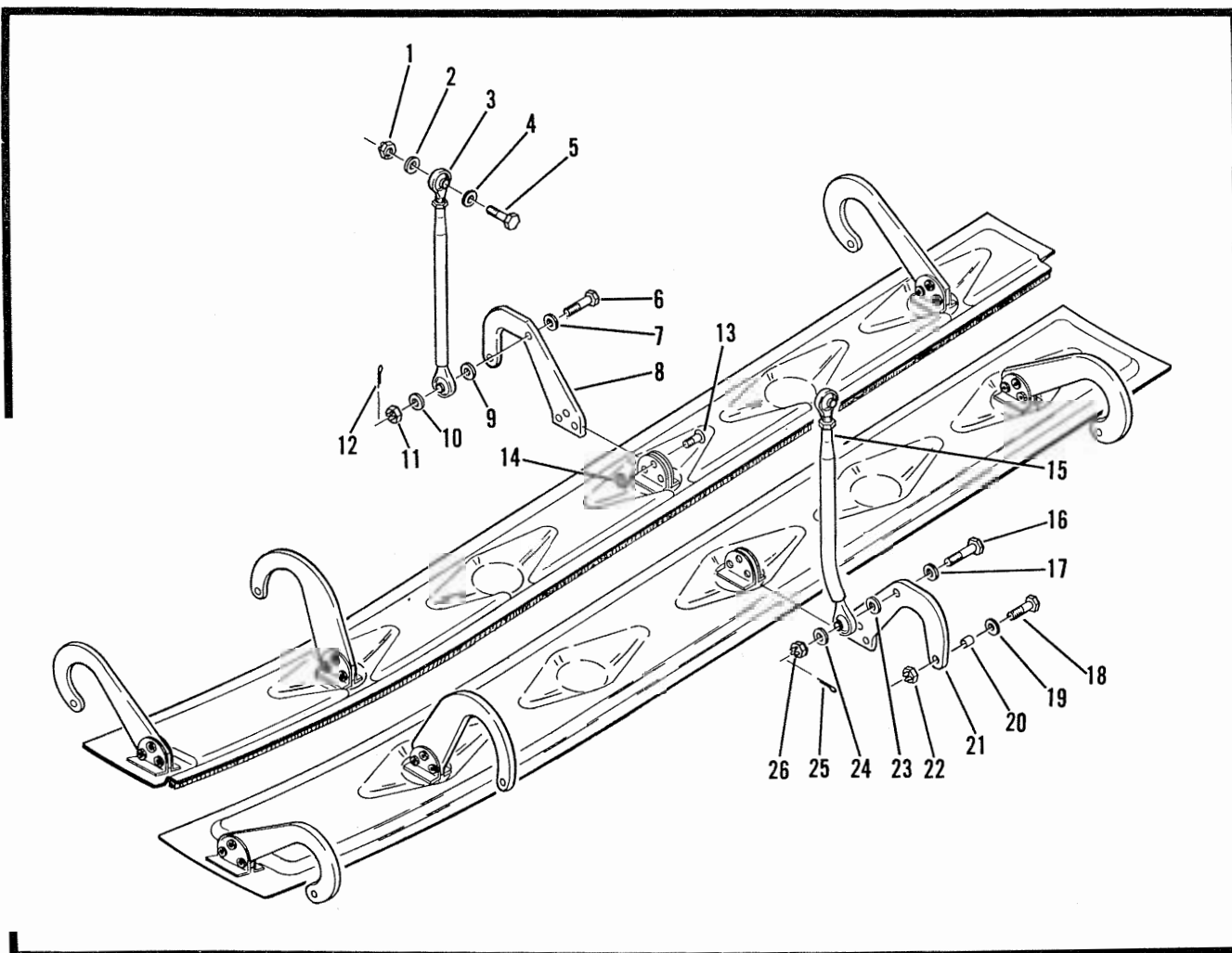
center position is also rigged over-center. A hook-type mechanical lock is provided to lock the nose gear in its retracted position. The nose gear retracting linkage also operates the main nose gear doors.

Nose Gear Retracting Linkage.

The nose gear retracting linkage consists of a drag brace, truss assembly, bellcranks, torque tubes, push-pull tubes and drive tubes interconnected between the landing gear actuator and the nose gear. A positive down lock is obtained by rigging the drag brace to an overcenter position. The connector link assembly which holds the drag brace in an over-

Removal of Nose Gear Retracting Linkage. (See figure 4-17.)

- a. Jack the aircraft in accordance with Section 2.
- b. Remove pilot's seat and front carpet.
- c. Remove covers from access holes from underside of fuselage and left front cabin floor.



1. Nut	8. Hinge	14. Nut	20. Spacer
2. Washer	9. Washer	15. Door Link Tube	21. Hinge
3. Door Link Tube	10. Washer	16. Bolt	22. Nut
4. Washer	11. Nut	17. Washer	23. Washer
5. Bolt	12. Cotter Pin	18. Bolt	24. Washer
6. Bolt	13. Bolt	19. Washer	25. Cotter Pin
7. Washer			26. Nut

Figure 4-16. Nose Gear Doors Installation

- d. Disconnect main nose gear doors.
- e. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- f. Remove nose push-pull tube (37) as follows:
 - 1. Remove nut and bolt attaching nose push-pull tube to fork bolt.
 - 2. Remove nut, washer, and bolt attaching nose push-pull tube to connector link.

NOTE

During removal of nose gear linkage, manually move gear as required for access to attaching bolts and nuts.

- g. Remove aft drive tube (1) as follows:
 - 1. Disconnect aft drive tube from actuator in accordance with Removal of Landing Gear Actuator, steps f and h.
 - 2. Move aft drive tube (1) forward as far as possible to gain access to idler bellcrank attachment point, and remove nut, washer, spacers, and bolt.
- h. Remove forward drive tube (8) as follows:
 - 1. Remove nut, washer, spacers, and bolt attaching forward drive tube to idler bellcrank.
 - 2. Remove nut and bolt attaching forward drive tube to outboard bellcrank.
- i. Remove idler bellcrank by removing bolt and washers. Then remove spacer from idler bellcrank.

NOTE

Access to bolt (3) is provided by a hole in the cabin floor above the bolt head.

- j. Remove torque tube (25) as follows:
 - 1. Remove adjusting bellcrank (18) by removing cotter pin (40) and pin (16). If desired, the fork bolt (39) can be removed from adjusting bellcrank.
 - 2. Remove inboard support bearing (20) by removing four nuts (21) and bolts (19). Then remove washer (22).
 - 3. Pull torque tube (25) inboard until it clears outboard support bearing (30), then tilt the outboard end upward and remove from nose section. Then remove washer (33).
 - 4. If desired, outboard support bearing (30) can be removed by removing attaching nuts (31) and bolts (32).
 - 5. Remove stop collar (24) from torque tube by removing cotter pin (35) and pin (23).

NOTE

Removal of collar (26) and outboard bellcrank (28) from torque tube (25) is not recommended. These are matched parts and collar (26) is a press fit.

- k. Remove connector link assembly (48) as follows:
 - 1. Remove nut (79) and bolt (65) attaching connector link assembly to retracting arm (78).
 - 2. Remove nut (50), washer (49), and bolt (47) attaching connector link assembly to adjusting rod end (51).

NOTE

Access to bolt (47) is provided by a hole in the adjacent structure. Rotate connector link assembly to align hole.

- l. Remove drag brace (61) as follows:
 - 1. Remove nut (58), washer (59), and bolt (62) attaching drag brace to truss assembly (55).
 - 2. Remove nut and bolt attaching drag brace to strut.
- m. Remove up lock torque tube (41) as follows:
 - 1. Remove nut (44) and washer (45) from each end of assembly, then unhook spring (82).

NOTE

Up lock torque tube (41) must be removed with bearing assemblies in place.

- 2. Remove the bearing assemblies (46) by removing attaching nuts (43) and bolts (42).

NOTE

Bearings are a press fit, and should be removed from supports only for replacement.

- 3. If desired, up lock hook (52) and adjusting rod end (51) can be removed from up lock torque tube.
- n. Remove truss assembly (55), retracting arm (78), and adjusting fork (68) as an assembly as follows:
 - 1. Remove nut (63) and bolt (56) attaching switch bracket (57) to truss assembly.
 - 2. Remove clamps attaching switch wires to retracting linkage and tilt switch where it will not interfere with linkage removal.
 - 3. Remove nuts (70), washers (71), and bolts (73) attaching truss assembly to retainers (72).
 - 4. Pull truss assembly forward and remove from aircraft.
 - 5. If desired, retracting arm (78) and adjusting fork (68) can be removed from truss assembly by removing attaching nuts and bolts.
 - 6. If desired, retainers (72) can be removed from aircraft by removing nuts (76), washers (75), and bolts (74).

Installation of Nose Gear Retracting Linkage. (See figure 4-17.)

- a. Install truss assembly (55) as follows:
 - 1. If removed, install retracting arm (78) and adjusting fork (68) on truss assembly.

NOTE

Lower retracting arm bolt (67) is inaccessible after truss assembly is installed.

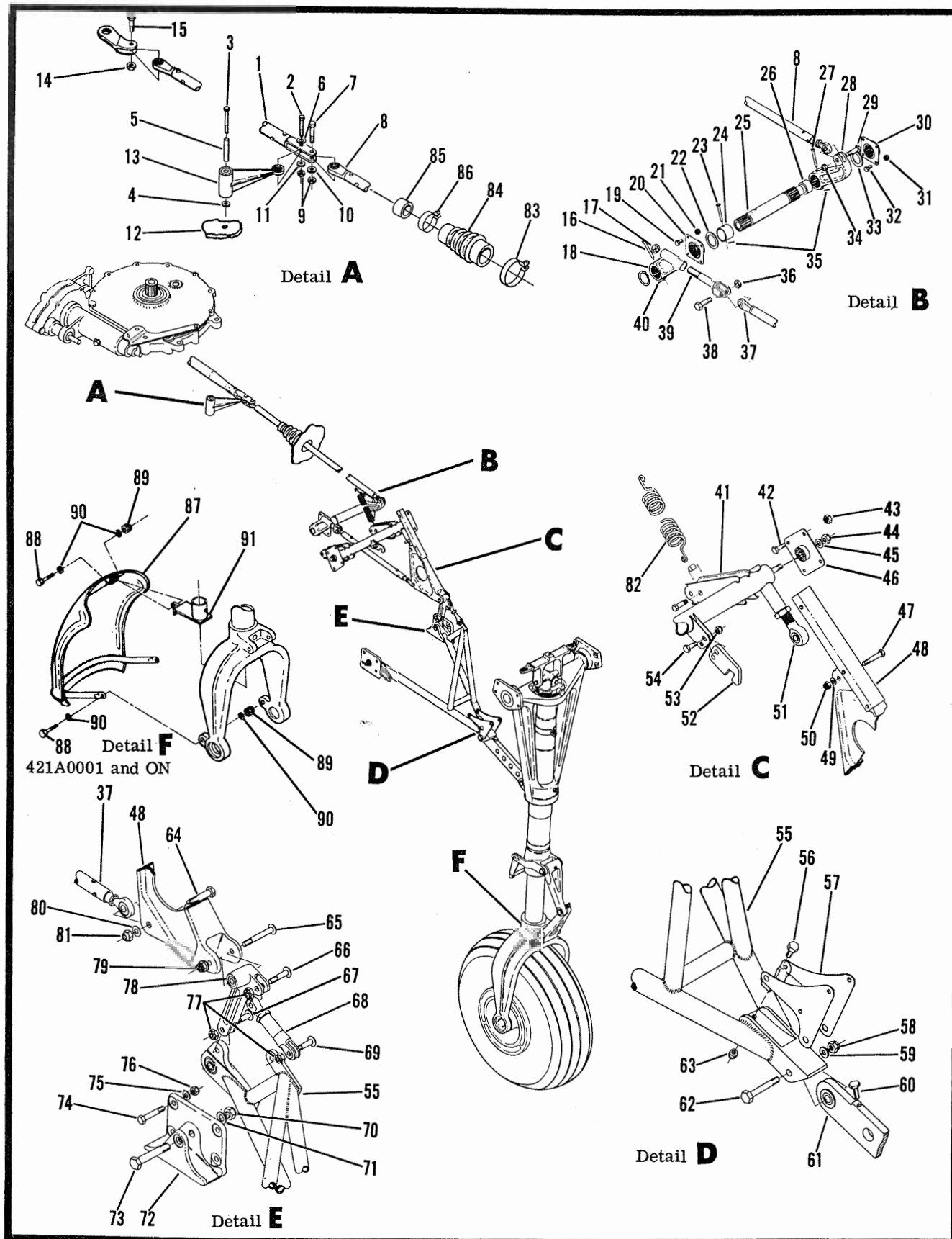


Figure 4-17. Nose Gear Retracting Linkage

2. If removed, install retainers (72) with bolts (74), washers (75), and nuts (76).

3. Place truss assembly in position and attach to retainers with bolts (73), washers (71), and nuts (70).

4. Install clamps attaching switch wires to retracting linkage and attach switch bracket (57) to truss assembly with bolt (56) and nut (63).

b. Install up lock torque tube assembly (41) as follows:

1. If removed, attach up lock hook (52) and adjusting rod end (51) to up lock torque tube.

2. Install bearing assemblies (46) with bolts (42) and nuts (43).

3. Install washer (45) and nut (44) on each end of up lock torque tube assembly.

c. Install drag brace (61) as follows:

1. Attach drag brace to truss assembly (55) with bolt (62), washer (59), and nut (58).

NOTE

When installing bolt (62), insure that down indicator switch bracket (57) is properly in place.

2. Connect drag brace to strut with attaching bolt and nuts.

d. Install connector link assembly (48) as follows:

1. Attach connector link assembly to retracting arm (78) with bolt (65) and nut (79).

2. Attach connector link assembly to adjusting rod end (51) with bolt (47), washer (49), and nut (50).

NOTE

Access to bolt (47) is provided by a hole in the adjacent structure. Rotate connector link assembly to align hole.

e. Install torque tube (25) as follows:

1. Install stop collar (24) on torque tube with pin (23) and safety with cotter pin (35).

2. If removed, install outboard support bearing (30) with bolts (32) and nuts (31).

NOTE

Torque the nuts attaching inboard and outboard support bearings to 13.5 ±1.5 inch-pounds.

3. Install outboard washer (33) on torque tube and place in position.

NOTE

Insert inboard end of torque tube through the inboard mounting hole from the left, pull into wheel well area until outboard end of torque tube can be inserted into outboard support bearing.

4. Place inboard washer (22), then inboard support bearing (20), on inboard end of torque tube. Install support bearing with bolts (19) and nuts (21).

5. If removed, install fork bolt (39) in adjusting bellcrank (18).

Figure 4-17. Nose Gear Retracting Linkage Callouts

1. Aft Drive Tube	31. Nut	62. Bolt
2. Bolt	32. Bolt	63. Nut
3. Bolt	33. Washer	64. Bolt
4. Washer	34. Nut	65. Bolt
5. Spacer	35. Cotter Pin	66. Bolt
6. Washer	36. Nut	67. Bolt
7. Bolt	37. Nose Push-Pull Tube	68. Adjusting Fork
8. Forward Drive Tube	38. Bolt	69. Bolt
9. Nut	39. Fork Bolt	70. Nut
10. Washer	40. Cotter Pin	71. Washer
11. Washer	41. Uplock Torque Tube	72. Retainer
12. Bracket	42. Bolt	73. Bolt
13. Idler Bellcrank	43. Nut	74. Bolt
14. Nut	44. Nut	75. Washer
15. Bolt	45. Washer	76. Nut
16. Pin	46. Bearing Assembly	77. Nut
17. Nut	47. Bolt	78. Retracting Arm
18. Adjusting Bellcrank	48. Connector Link Assembly	79. Nut
19. Bolt	49. Washer	80. Washer
20. Inboard Support Bearing	50. Nut	81. Nut
21. Nut	51. Adjusting Rod End	82. Spring
22. Washer	52. Uplock Hook	83. Clamp
23. Pin	53. Nut	84. Seal Boot
24. Collar	54. Bolt	85. Spacer
25. Torque Tube	55. Truss Assembly	86. Clamp
26. Collar	56. Bolt	87. Fender
27. Pin	57. Switch Bracket	88. Bolt
28. Outboard Bellcrank	58. Nut	89. Nut
29. Bolt	59. Washer	90. Washer
30. Outboard Support Bearing	60. Adjusting Bolt	91. Bracket Assembly
	61. Drag Brace	

6. Install adjusting bellcrank (18) on torque tube with pin (16) and safety with cotter pin (40).

NOTE

Splines must align so that pin (16) can be installed and bellcranks (18 and 28) both extend forward from torque tube.

- f. Insert spacer (5) into idler bellcrank (13), place bellcrank in position and install with bolt (3) and washers (4 and 6).

- g. Install forward drive tube (8) as follows:

1. Attach forward drive tube (8) to outboard bellcrank (28) with bolt (29) and nut (34).
2. Attach forward drive tube (8) to idler bellcrank (13) with bolt (7), washer (10), and nut (9).

NOTE

To gain access to idler bellcrank attachment points, rotate bellcrank forward as far as possible.

3. If seal boot (84) was removed; install boot but do not clamp to forward drive tube (8) at this time.

NOTE

After gear is rigged, cement rubber spacer (85) to forward drive tube (8) and clamp boot to spacer at a position approximately 5 inches from the Station 100.00 bulkhead while gear is in the down position.

- h. Install aft drive tube (1) as follows:

1. Attach aft drive tube (1) to idler bellcrank (13) with bolt (2), washer (6), washers (11), and nut (9).
2. Attach aft drive tube (1) to landing gear acuator lower bellcrank with bolt. Refer to removal and installation of landing gear actuator.

NOTE

Access to lower bellcrank is gained through an access hole on underside of fuselage.

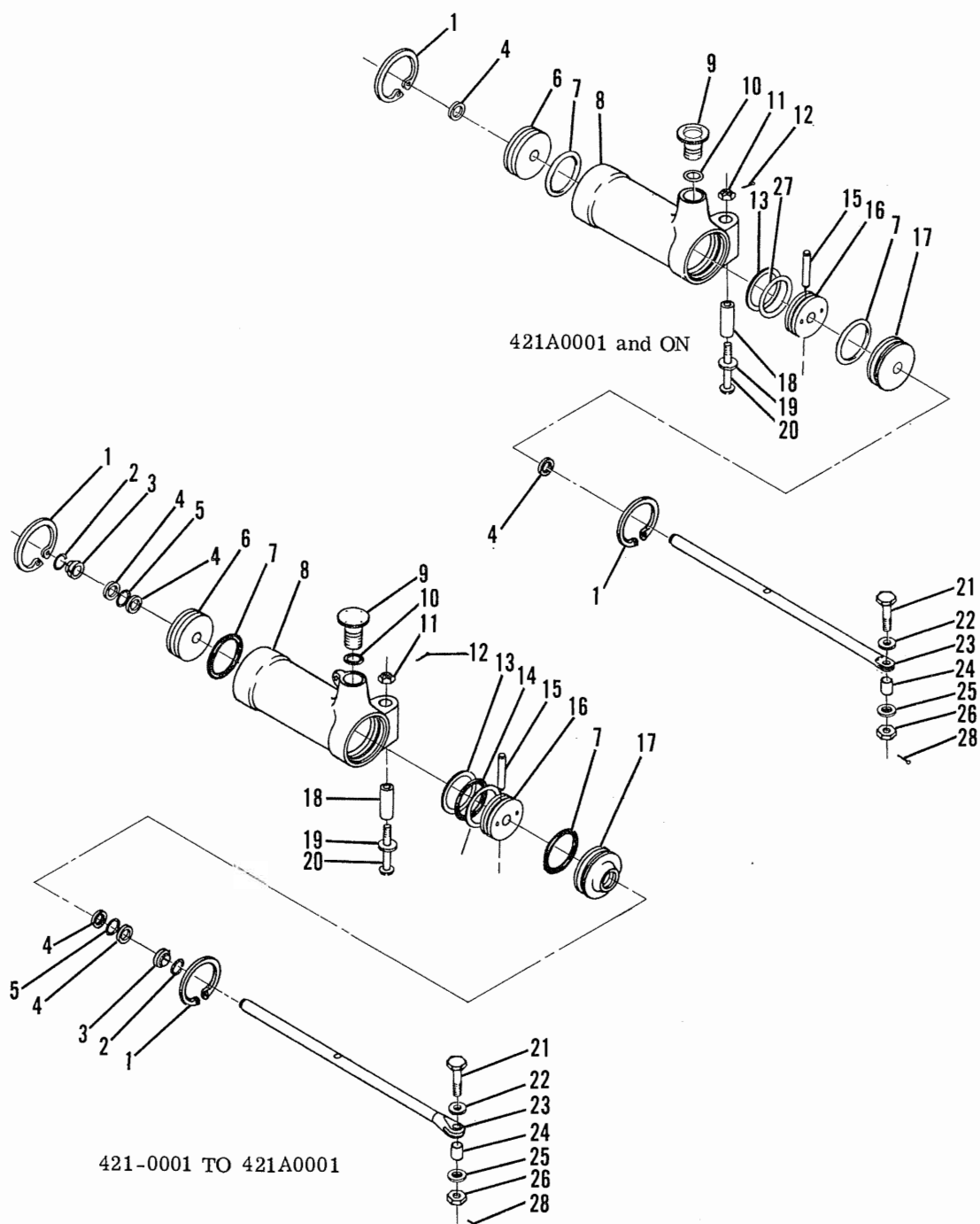
- i. Install nose push-pull tube (37) as follows:
 1. Using the manual extension system, operate the landing gear to the DOWN position, then crank a few turns toward the UP position.
 2. Attach nose push-pull tube (37) to connector link assembly (48) with bolts, washers, and nuts.
 3. Attach nose push-pull tube (37) to fork bolt (39) with bolt and nut.
 - j. Rig nose gear retracting linkage in accordance with rigging procedure.
 - k. Connect nose gear doors and rig nose gear doors in accordance with rigging procedure.
 - l. Install access hole covers and carpet.
 - m. Install pilot's seat, insure that landing gear is DOWN and locked; then remove aircraft from jacks.

Nose Gear Shimmy Dampener.

The shimmy dampener provided for the nose gear offers resistance to shimmy by forcing hydraulic fluid through small orifices in the piston. The outer housing is attached to the upper nose strut and moves as the strut turns, while the piston and piston rod are attached to the trunnion assembly which does not turn, thus causing motion between the housing and the piston.

Removal of Nose Gear Shimmy Dampener. (See figure 4-18.)

- a. Disconnect piston rod (23) from trunnion assembly by removing nut (26), washer (25), spacer (24), washer (22), bolt (21), and cotter pin (28).
- b. Remove shimmy dampener by removing nut (11), bushing (18), washer (19) and bolt (20).



1. Lock Ring
2. Internal Retaining Ring
3. Wiper Ring
4. Backup Ring
5. O-Ring
6. Bearing Head
7. O-Ring
8. Barrel
9. Filler Plug

10. O-Ring
11. Nut
12. Cotter Pin
13. Backup Ring
14. O-Ring
15. Roll Pin
16. Piston
17. Bearing Head
18. Bushing

19. Washer
20. Bolt
21. Bolt
22. Washer
23. Piston Rod
24. Spacer
25. Washer
26. Nut
27. Retainer
28. Cotter Pin

Figure 4-18. Shimmy Dampener

Disassembly of Nose Gear Shimmy Dampener. (See figure 4-18.)

- a. Push piston rod (23) into shimmy dampener, remove filler plug (9) and O-ring (10), and drain fluid.
- b. Remove lock ring (1) from forward end of shimmy dampener and pull piston and rod assembly from barrel (8).

CAUTION

Remove bearing heads and piston assemblies with care to prevent damage to O-rings.

- c. Remove O-rings, backup ring and retainer, as applicable, from piston (16).
- d. Remove roll pin (15) and remove piston (16) from piston rod (23).
- e. Remove bearing head (17) from piston rod (23).
- f. Remove lock ring (1) from aft end of shimmy dampener and pull bearing head (6) from barrel (8).
- g. Remove outer O-rings (7) from bearing heads (6 and 17).
- h. Remove internal retaining rings, wiper rings, backup rings and O-rings, as applicable, from bearing heads (6 and 17).

Assembly of Nose Gear Shimmy Dampener. (See figure 4-18.)

Before each component of the shimmy dampener is assembled, assure that it is thoroughly clean, then lubricate with system hydraulic fluid.

- a. Install internal retaining rings, wiper rings, backup rings and O-rings, as applicable, inside bearing heads (6 and 17).
- b. Install outer O-rings (7) on bearing heads (6 and 17).
- c. Install bearing head (6) in barrel (8) and secure with aft lock ring (1).
- d. Position bearing head (17) on piston rod (23), then assemble piston (16) to piston rod (23) with roll pin (15).
- e. Install O-rings, backup ring and retainer, as applicable, on piston (16).
- f. Insert piston and piston rod assembly into barrel (8), slide bearing head (17) into position, and secure with forward lock ring (1).

CAUTION

Insert piston and bearing heads with care to prevent damage to O-rings.

- g. Completely fill shimmy dampener with hydraulic fluid, as specified in Section 2, and install filler plug (9) and O-ring (10).

NOTE

For proper operation, shimmy dampener must be completely full of hydraulic fluid, with no trapped air present. Push piston rod into the shimmy dampener to the limit of its travel, then fill with hydraulic fluid. If desired, shimmy dampener can be serviced after installation in accordance with Section 2.

Installation of Nose Gear Shimmy Dampener. (See figure 4-18.)

- a. Place bushing (18) in barrel (8), align mounting holes and install bolt (20), washer (19) and nut (11).

NOTE

Lubricate bushing (18) with light oil during installation.

- b. Connect the piston rod (23) to the trunnion assembly with bolt (21), washer (22), spacer (24), washer (25), nut (26), and cotter pin (28).
- c. If not filled with hydraulic fluid during assembly, service shimmy dampener in accordance with Section 2.

Nose Gear Steering System.

The nose gear steering system permits nose gear steering with the rudder pedals, for angles up to 18 degrees, either right or left of center. Spring loaded nose gear steering cables permit continued resisted turning action of the nose gear for steering angles greater than 18 degrees, up to a maximum of 55 degrees. Steering arms, welded to the rudder torque tubes, are connected by the steering cables, to a steering gimbal, which pivots in a support mounted directly above the nose gear trunnion assembly. The gimbal allows nose gear steering when the gear is down. When gear is retracted, the gimbal serves as an idler, permitting free wheeling of the nose gear steering.

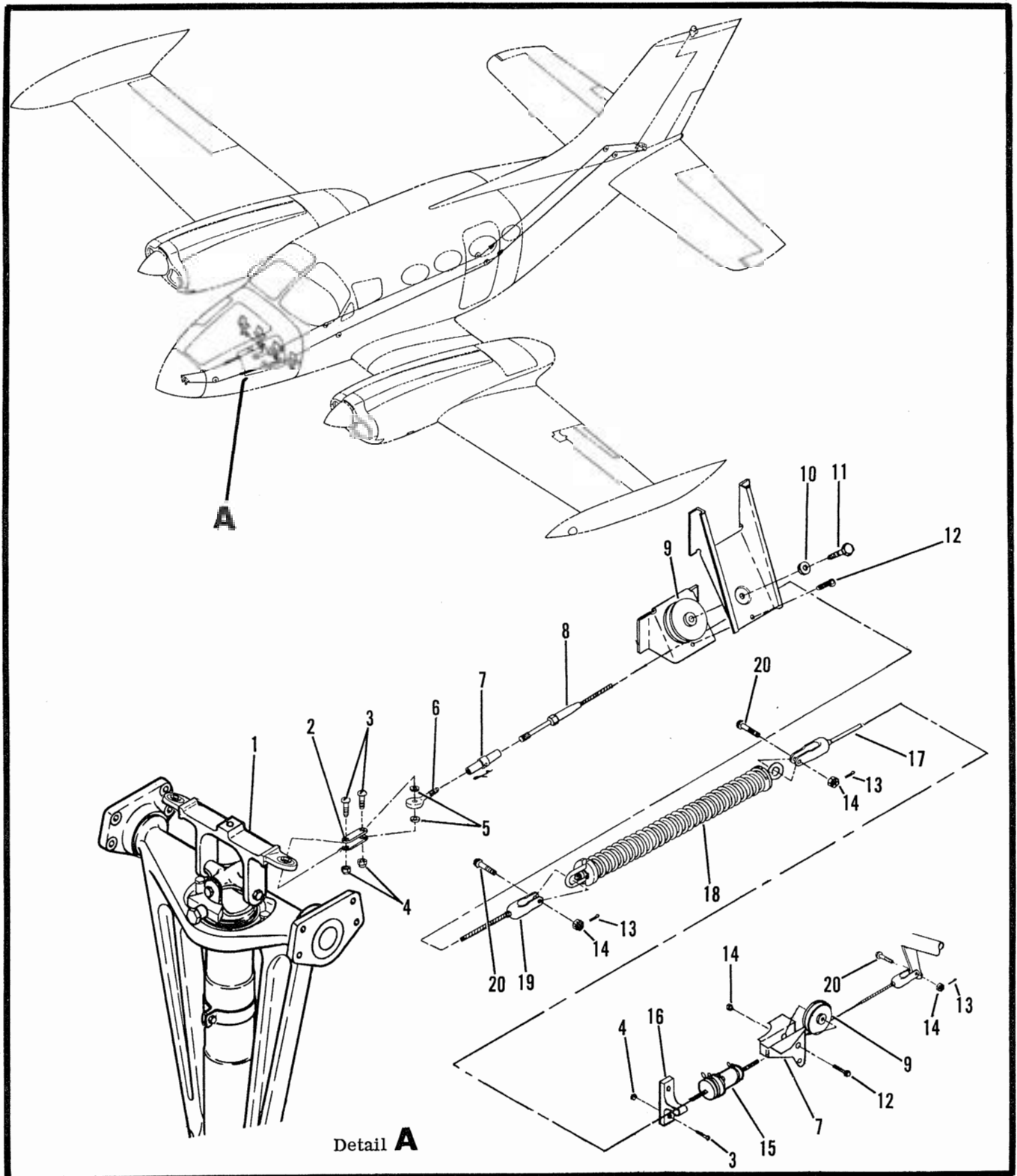
Removal of Nose Gear Steering System. (See figure 4-19.)

- a. Remove pilot's and copilot's seats.
- b. Remove scuff plates from front carpet by removing attaching screws, then remove carpet and access panels on pilot's and copilot's side of aircraft.
- c. Remove cable access panel from underside of aircraft.
- d. Disconnect the nose gear steering cables at the forward bellcrank in the nose wheel well by loosening the turnbuckles.

CAUTION

Do not remove clevis pin from nose gear steering bellcrank without first releasing tension on the nose gear steering cables.

- e. Remove necessary radio shelving to gain access to nose gear steering cable pulleys and remove cable guard pins.
- f. Disconnect nose gear steering cable from rudder torque tube by removing cotter pin, nut, and bolt.
- g. Remove seals (15) from forward cabin pressure bulkhead.
- h. Pull forward cable through wheel well web into nose section then pull cable forward and remove from aircraft.
- i. Disassemble cables from spring by removing



1. Nose Gear Steering Bellcrank
2. Link
3. Screw
4. Nut
5. Spacer

6. Eye
7. Turnbuckle Assembly
8. Cable Assembly
9. Pulley
10. Washer

11. Bolt
12. Cable Pin
13. Cotter Pin
14. Nut
15. Seal Assembly

16. Guide
17. Cable Assembly
18. Spring
19. Cable Assembly
20. Bolt

Figure 4-19. Nose Gear Steering System

cotter pins, nuts and bolts.

j. If desired, remove nose gear steering bellcrank as follows:

1. Remove the two bolts in the gimbal.
2. Remove the nut, washer and bolt in bellcrank and remove bellcrank.

Installation of Nose Gear Steering System. (See figure 4-19.)

a. If removed, install nose gear steering bellcrank as follows:

1. Position bellcrank in place and install the two washers and bolts in gimbal and torque 50 to 70 inch-pounds.
2. Align upper hole in bellcrank with hole in structure and install bolt, washer and nut.
 - b. Attach forward end of turnbuckles to bellcrank with screws, washers and nuts.
 - c. Assemble forward and aft cables to spring with bolts, nuts and safety with cotter pins.
 - d. Route the aft cable through the spring housing to the rudder torque tube and connect with bolt and nut and safety with cotter pin.
 - e. Route the forward cable through nose wheel well web.
- f. Install cable seals (15) as follows:
 1. Insure that the cables are lubricated for the full length of its travel within the seals.
 2. Pack the seals with MIL-G-7187 lubricant.
 3. Place seals on cable on the non-pressurized side of bulkhead with small end of seal toward bulkhead.
 4. Insert seal in bulkhead hole so that bulkhead metal is seated within the retaining groove of seals and so that the small end of the seal is on the pressurized side of the bulkhead.
 5. Install proper retaining rings in the grooves on the seals (two on small end and one on large end).
 - g. Install cable guard pins and replace radio equipment shelves removed during removal.
 - h. Connect nose steering cables to turnbuckles and tighten. Rig cable tension in accordance with Rigging of Rudder Control System (Section 7). Re-safety turnbuckles.
 - i. Install carpet, scuff plates, pilot and copilot seats.

NOTE

Nose steering springs are pre-set at the factory to 85 pounds.

Rigging the Nose Gear Steering System.

Rig nose gear steering system in accordance with Section 7.

Nose Wheel and Tire Assembly.

The nose wheel is a two-piece, magnesium alloy casting. Two halves of the wheel, which are bolted together, can be separated to install the tire. Each wheel half contains a tapered roller bearing, which

seats in hardened steel cups. The nose wheel rotates around a tubular axle attached to the nose strut fork.

Removal of Nose Wheel and Tire Assembly. (See figure 4-20.)

- a. Jack the aircraft in accordance with Section 2.
- b. Remove cotter pin (2), nut (3) and bolt (7).
- c. Remove axle bolt buckets (4). After removal of buckets, the wheel and tire assembly can be removed from fork (1).
- d. Remove spacers (5) and axle tube (6) from wheel.

Disassembly and Assembly of Nose Wheel and Tire Assembly.

Instructions for the disassembly and reassembly of the main wheel and tire assembly also applies to the nose wheel and tire assembly.

Installation of Nose Wheel and Tire Assembly. (See figure 4-20.)

- a. Insert axle tube (6) in wheel and place spacers (5) on ends of axle tube.
- b. Place wheel and tire assembly in position, align with mounting holes in fork (1), and install axle bolt buckets (4).
- c. Install bolt (7) and nut (3).

NOTE

Tighten nut (3) until a slight bearing drag is felt as wheel is rotated. Loosen nut to the nearest slot that will align cotter pin hole.

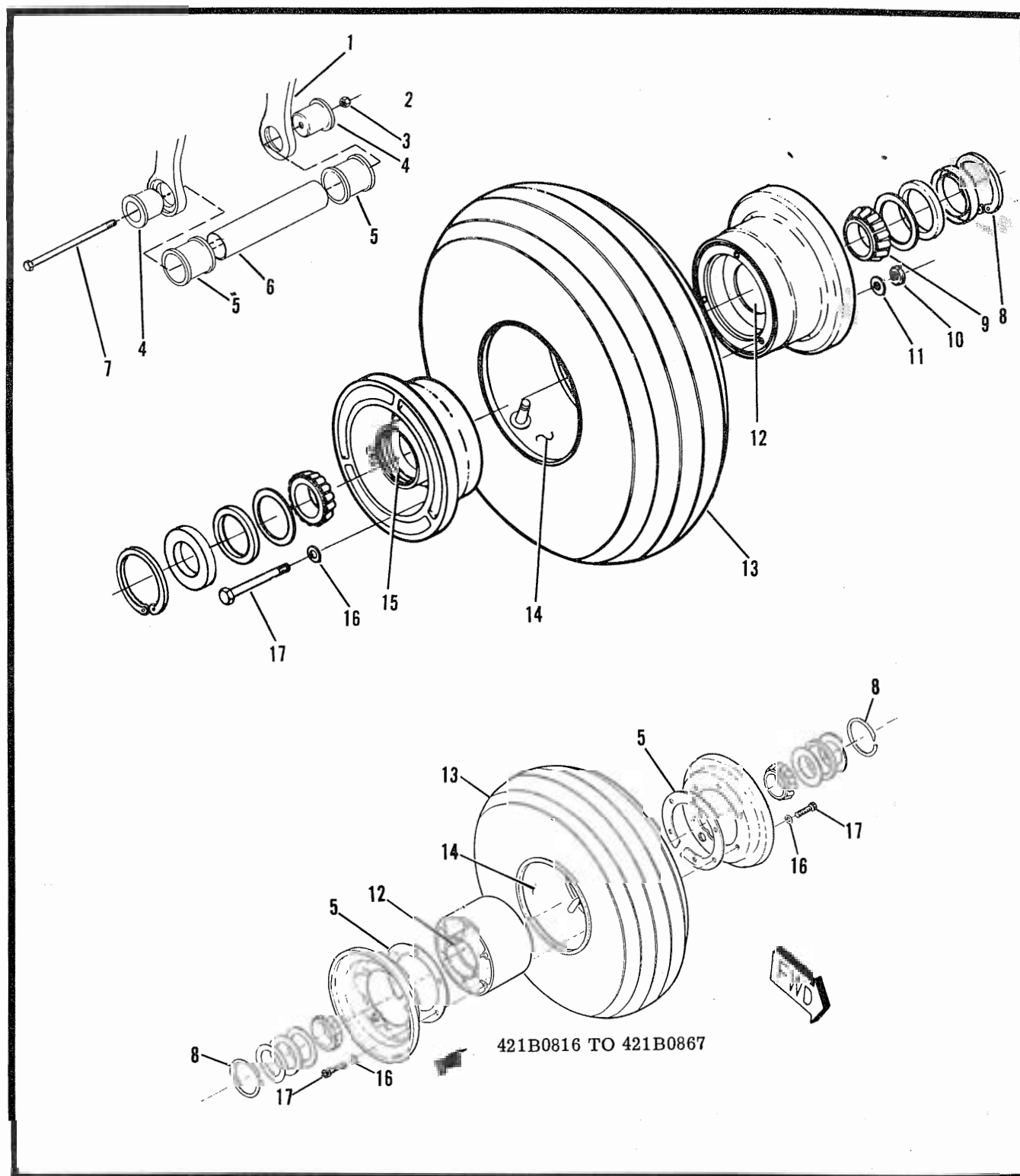
- d. Install cotter pin (2).
- e. Insure gear is DOWN and locked, then remove aircraft from jacks.

Main Wheel and Tire Assembly.

The main wheel is a two-piece magnesium alloy casting. The two halves of the wheel can be separated to install the tube and tire. Tapered roller bearings, seated in hardened steel cups, are provided in each wheel half. The brake side of the main wheel is equipped with steel drive keys and provisions to accommodate a dual disc type brake.

Removal of Main Wheel and Tire Assembly. (See figure 4-21.)

- a. Jack aircraft in accordance with Section 2.
- b. Remove snap ring (1), bearing cap (2), cotter pin (3), nut (4) and washer from axle.
- c. Remove wheel and tire assembly from axle using caution to prevent damage to axle threads and to keep bearings clean.
- d. Remove outer bearing cone (6) from wheel to prevent it from dropping out of wheel after wheel removal.



1. Nose Wheel Fork
2. Cotter Pin
3. Nut
4. Axle Bolt Bucket
5. Spacer
6. Axle Tube

7. Bolt
8. Retainer
9. Bearing Cone
10. Nut
11. Washer

12. Inner Wheel Half
13. Tire
14. Tube
15. Outer Wheel Half
16. Washer
17. Bolt

Figure 4-20. Nose Wheel and Tire Assembly

Disassembly of Main Wheel and Tire Assembly.
(See figure 4-21.)

- a. Remove tire (11) as follows:
 1. Deflate tire by removing valve core from tube.

WARNING

Always deflate tire before separating wheel halves.

2. Remove nuts (7), washers (8) and bolts (16) and separate wheel halves (9 and 12).
3. Remove each wheel half from tire and remove tire and tube.
 - b. Remove snap ring (20), felt retainers (18), felt seal (19) and bearing cone (17) from wheel half (12).
 - c. Bearing cups (10 and 13) are a shrink fit and should be removed only for replacement.
 - d. Keyway liners (14) are attached with rivets and should not be removed unless replacement is required.

CAUTION

During disassembly be careful not to gouge, nick or scratch the rim in the tire bead seat area, this could cause wheel rim to crack.

Cleaning and Inspection of Main Wheel Assembly.

- a. Remove dirt and grease as specified in the following procedures:

WARNING

Dry-cleaning solutions are toxic and volatile. Use in a well-ventilated area. Avoid contact with skin or clothing. Do not inhale vapors.

1. Clean all metal parts with dry-cleaning solution, Federal Specification P-D-680. A soft bristle brush may be used to remove hardened grease, dust, or dirt.

CAUTION

Clean bearing cones in a separate container of clean solvent.

2. Dry bearing cones thoroughly, using filtered and dried compressed air.

CAUTION

Do not spin bearings with compressed air.

3. Inspect and repack bearing cones and coat bearing cups with clean bearing grease, Specification MIL-G-81322.

4. Wash inboard bearing seal in denatured alcohol and dry with a clean, soft cloth.

- b. Make the following inspection as specified in the following procedures:

1. Inspect all parts of wheel for cracks, nicks, corrosion, or other damage. Replace all cracked or severely damaged parts.

2. Inspect inboard bearing seal for wear of damage to sealing lip or to metal reinforcing ring. Replace if damaged or deformed.

3. Visually inspect bearing cones for nicks, scratches, water staining, spalling, heat discoloration, roller wear, cage damage, cracks, or distortion. Replace if defective or worn.

4. Inspect wheel halves for cracks, corrosion, and other damage. Areas having suspected cracks should be inspected by Zyglo or other dye-penetrant method. Cracked or badly corroded castings should be replaced. Small nicks, scratches, or pits in the castings should be blended out with fine (400 grit) wet-or-dry sandpaper.

5. Inspect bearing cups for looseness, scratches, pitting, corrosion, or evidence of overheating. If evidence of any defect exists, replace cup as explained in the Replacement of Bearing Cup Procedures.

6. Inspect valve hole of outboard wheel half for cracks or corrosion. Replace cracked wheels. Pits or nicks may be polished out with fine (400 grit) wet-or-dry sandpaper.

7. Inspect wheel bolts. Carefully check for cracks in radius under bolt head and in the threads adjacent to the bolt shank. Replace cracked bolts.

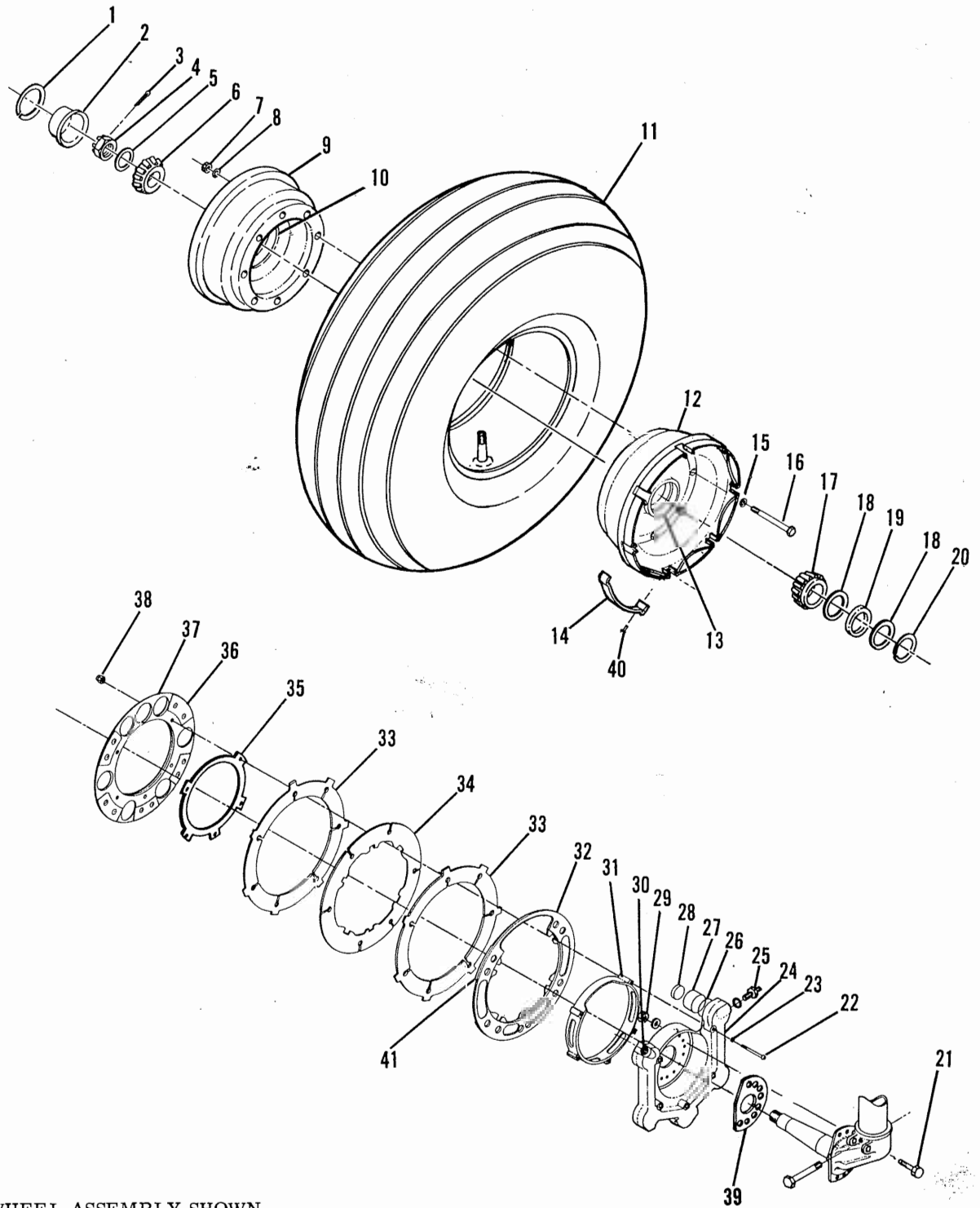
NOTE

No reworking of bolts is permissible.

8. Inspect self-locking nuts for self-locking feature. Replace if nut can be turned onto bolt with the fingers past the nut's locking section.

Figure 4-21. Main Wheel, Tire and Brake Assembly Callouts

1. Lock Ring	14. Keyway Liner	28. Piston Insulator
2. Cap	15. Countersunk Washer	29. Nut
3. Cotter Pin	16. Bolt	30. Bleeder Plug
4. Nut	17. Bearing Cone	31. Torque Tube
5. Washer	18. Grease Seal Ring	32. Pressure Plate
6. Bearing Cone	19. Grease Seal Felt	33. Rotating Disc
7. Nut	20. Snap Ring	34. Stationary Disc
8. Washer	21. Bolt	35. Spacer
9. Wheel Half	22. Bolt	36. Wear Pad
10. Bearing Cup	23. Countersunk Washer	37. Back Plate
11. Tire and Tube Assembly	24. Housing	38. Nut
12. Wheel Half	25. Union	39. Spacer
13. Bearing Cup	26. "O" Ring	40. Rivet
	27. Piston	41. Wear Pad



RH WHEEL ASSEMBLY SHOWN

Figure 4-21. Main Wheel, Tire and Brake Assembly

9. Inspect keyway liners on inboard wheel half for wear. If distance between surfaces of liners across any tang slot of inboard wheel half exceeds 0.680 inch, replace liners as explained in the Replacement of Keyway Liners Procedures in Section 4.

10. Inspect keyway liners for tightness. If loose, either tighten or replace rivets.

NOTE

Replace all parts of brake assembly which are cracked, unrepairable, or otherwise unserviceable.

Replacement of Bearing Cup. (See figure 4-21.)

a. Heat wheel half in boiling water for one hour, or in an oven not exceeding 250° F (121°C) for 30 minutes.

b. Remove wheel half from source of heat and remove bearing cup.

NOTE

After heating wheel half, bearing cup should be loose enough to fall out of bearing bore when inverted. If cup does not drop out, tap evenly from bore with a fiber drift pin.

c. Place wheel half (9 or 12) in boiling water for one hour, or in an oven not exceeding 250° F (121°C) for 30 minutes. Chill bearing cup on dry ice.

d. Remove wheel half from source of heat.

e. Dry chilled bearing cup thoroughly and coat contacting surfaces of cup with zinc chromate primer or paste.

f. Install chilled bearing cup in heated wheel half and tap into place evenly with a fiber drift pin.

NOTE

Bearing cup should be installed while primer or paste is still wet.

Replacement of Keyway Liner. (See figure 4-21.)

a. Grind off rivet head.

b. Punch out rivet and remove keyway liner (14).

CAUTION

Support flange solidly when punching out rivets. Be careful not to enlarge rivet holes.

c. Inspect area under keyway liners for corrosion. Blend out corrosion pits to 0.010 inch deep and re-treat and repaint reworked areas in accordance with the Retreating and Repainting Procedures.

d. Position new liner (14) on inboard wheel half with tab extension on ends of liner toward the centerline of the wheel. The outer edge of the liner should be flush with the outer edge of the wheel.

e. Install rivet (40) through wheel flange and keyway liner (14).

CAUTION

Peened head of rivet must be on outside of keyway liner. Chamfered head of rivet must be installed in countersink in wheel flange.

Retreating and Repainting of Main Wheel Repaired Surfaces.

a. Thoroughly clean repaired surfaces and areas of the wheel from which paint has been removed.

b. Treat cleaned surfaces with Dow No. 1 solution, Specification MIL-M-3171, and paint with two coats of zinc chromate primer, Specification MIL-P-8585A, and two coats of aluminum lacquer, Specification TT-L-32.

CAUTION

Never paint working surfaces of bearing cups. Wheel register surfaces and bolt bosses should receive one mist coat of zinc chromate primer only.

NOTE

Wheel halves between bead flanges should be kept painted with zinc chromate primer and aluminum lacquer. This will help to prevent corrosion.

Assembly of Main Wheel and Tire Assembly. (See figure 4-21.)

a. If removed, replace bearing cups (10 and 13).

b. Install tube, yellow stripe on base of tube aligned with red dot on tire to obtain proper balance in tire, and leave deflated.

c. Place wheel halves (9 and 12) in position on tire.

d. Install bolts (16), countersunk washers (15), washers (8) and nuts (7). The countersink of washers (15) must be facing the bolt head. Torque bolts to 120 inch-pounds.

CAUTION

Tighten nuts evenly and torque correctly in a criss cross pattern to lessen the possibility of bolt failure. Make sure at least one full thread is through nut.

e. Inflate tire enough to seat the beads on the wheels, deflate completely, then reinflate to approximately one-half operating pressure.

f. Install bearing cone (17), felt seal (19), grease seal rings (18) and snap ring (20).

CAUTION

Insure that bearing cones (6 and 17) are properly greased before installing.

g. Check wheel balance using Service Kit SK150-20.

Installation of Main Wheel and Tire Assembly. (See figure 4-21.)

a. Place the wheel and tire assembly in position on the axle, aligning brake discs with disc drive slots in wheel.

NOTE

Ascertain that the seven keyway liners (14) are properly installed in the wheel flange.

b. Install outer bearing cone (6), washer (5) and nut (4).

NOTE

Tighten wheel bearing nut (4) to 40 pound-inches while rotating wheel, back off nut and retighten to 20 pound-inches while rotating wheel, continue to first locking position and install cotter pin.

c. Install cotter pin (3), bearing cap (2) and lock ring (1).

d. Check that wheel rotates freely, then remove jack and inflate tire to correct operating pressure.

BRAKE SYSTEM - MAIN AND PARKING.

The aircraft has a hydraulically actuated braking system. A hydraulic master cylinder is attached to each pilot's rudder pedal with lines routed to the brake assemblies on each main gear. The brakes are dual-disc, non-adjustable type with five actuating cylinders in each brake assembly. The brakes may be operated from either pilot's or copilot's pedals. The parking brake system consists of a manually operated handle assembly connected to the parking brake valves located in each main brake line. When pressure is applied to the brake system and the parking brake handle is pulled, the valve holds pressure on the brake assemblies until released. To release parking brakes, push parking brake handle in. It is not necessary to depress rudder pedals when releasing parking brakes.

Trouble Shooting the Brake System.

TROUBLE	PROBABLE CAUSE	CORRECTION
BRAKE PEDAL BOT-TOMS	Insufficient brake fluid in system.	Bleed and fill system in accordance with Section 2.
	Brake disc warped, causing excessive clearance.	Replace disc.
	Loose bleeder screw, faulty bleeder screw washer, or adapter not tight.	Tighten bleeder screw. Replace washer. Tighten adapter.
	Leaking connections or broken lines or hoses.	Tighten connections. Replace or repair lines or hoses.
	Rudder pedals not connected to master cylinders.	Connect pilot's rudder pedals to master cylinders.
	Damaged O-ring seal in master cylinder or in brake actuating cylinder.	Replace O-ring seal.
"SPONGY" BRAKES	Damaged Lock-o-seal in master cylinder.	Replace Lock-o-seal.
	Air trapped in system.	Bleed system.
BRAKES DRAG	Swollen hose.	Replace hose.
	Binding brake pedal linkage.	Free linkage to prevent binding.
	Brake disc badly dished or warped.	Replace brake disc.
	Internally swollen hoses and/or swollen O-ring seals due to improper hydraulic fluid in system.	Replace hoses and/or O-ring seals. Flush system with denatured alcohol. Bleed and fill system in accordance with Section 2.

Trouble Shooting the Brake System Cont'd.

TROUBLE	PROBABLE CAUSE	CORRECTION
BRAKES FAIL TO HOLD	Brake discs worn out.	Replace discs in accordance with Section 2.
	New discs just installed.	Taxi aircraft and apply brakes several times to condition discs.
	Air in system.	Bleed and fill system in accordance with Section 4.
	Oil, grease, or other foreign material on discs.	Clean and flush with carbon tetrachloride, then taxi the aircraft slowly, apply the brakes several times to condition the discs.
	Rudder pedals positioned so that brakes cannot be fully applied.	Reposition pedals.
	Brakes too hot from extensive use.	Allow time for brakes to cool.

Removal of Brake System. (See figure 4-22.)

- a. Drain fluid from system by removing bleeder screw.
- b. Remove pilot's and copilot's seats in accordance with Section 3.
- c. Remove front carpet and scuff plates from front floorboards.
- d. Remove the access panels in front floorboard area and on bottom of fuselage.
- e. Remove covers from around rudder pedals.
- f. Disconnect master cylinders (29) from rudder pedals and rudder torque tube by removing cotter pins and clevis pins.
- g. Remove hoses (1 and 2) from master cylinders and parking brake valve.
- h. On aircraft 421-0001 to 421B0001 disconnect link (11), cable (31), and stop (10), and lines (12 and 13) from parking brake valves (5). Remove parking brake valves (5) by removing nuts, washers, and screws attaching valves to bulkhead.
- i. On aircraft 421B0001 and ON disconnect cable (31) and lines (12 and 13) from parking brake valve (5). Remove parking brake valve (5) by removing nuts, washers, and screws attaching valve to bracket (32).
- j. Remove clamps from lines (12 and 13) then disconnect lines from elbow (14) and union (15) and remove line.

NOTE

Removal of brake lines is not recommended except for replacement.

- k. Remove access panels on lower side of inboard leading edge, wing gap covers, left and right wings.
- l. Remove clamps from lines (16 and 17) then disconnect at wing gap from unions (15 and 19) and pull

line from stub wing section.

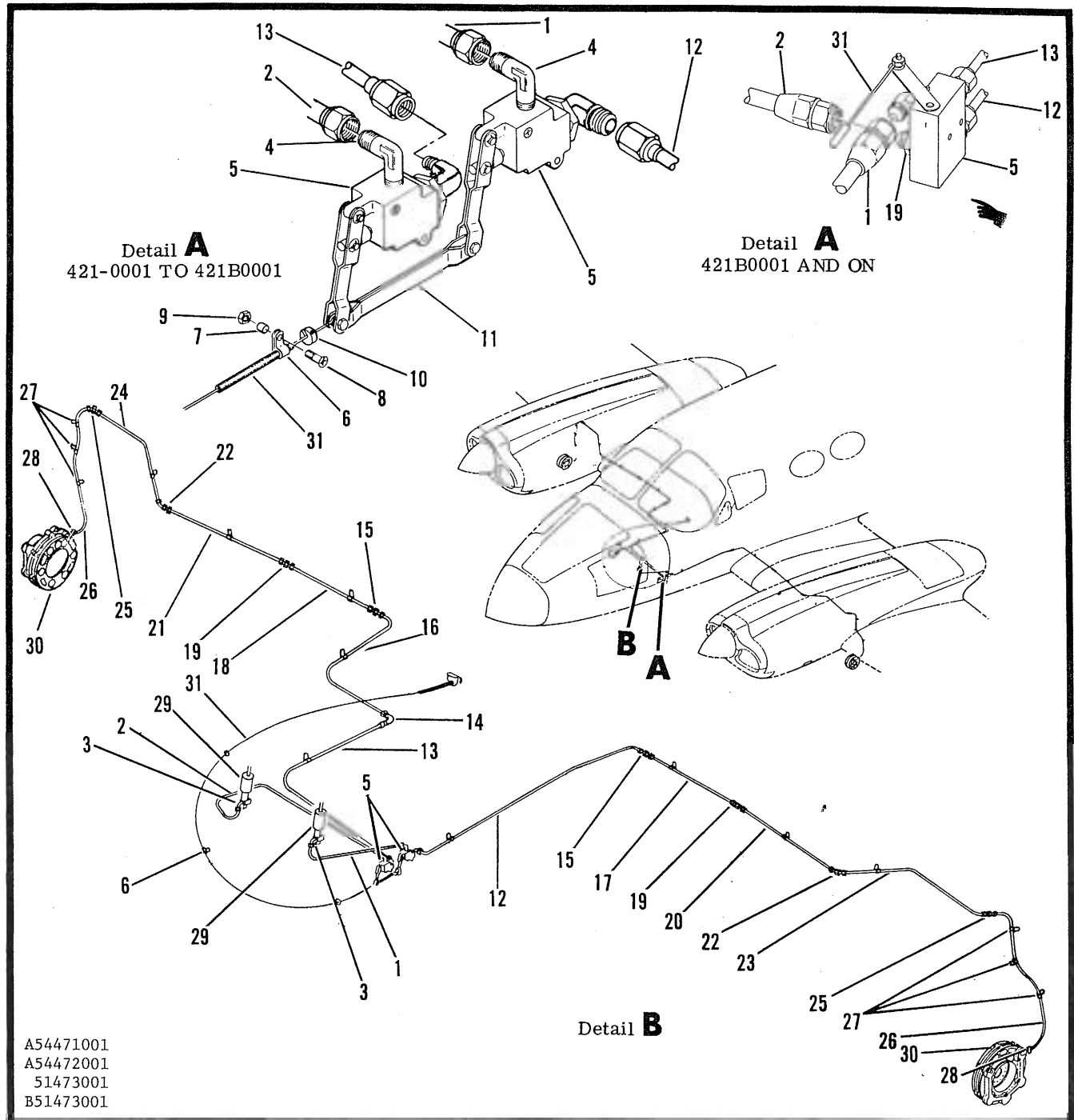
- m. Remove clamps from lines (18 and 20) then disconnect union (19) and elbow (22) and remove lines thru access holes in wing.
- n. Remove clamps from lines (21 and 23) then disconnect at elbows (22 and 25) and remove into wheel well area.
- o. Remove clamps from line (24) on right wing and disconnect at elbow (25).
- p. Remove elbow (25) from structure of wing by removing the nut and washer and disconnecting hoses (26).
- q. Remove clamps (27) from main gear strut and disconnect hose at brake unit, then remove hose.
- r. Remove brake units by removing the six bolts securing unit to strut and remove union (28).
- s. If removal of parking brake control is desired, remove as follows:
 1. Remove clamps (6) by removing nut (9), spacer (7), and screw (8).
 2. Remove stop (10) from cable.
 3. Remove nut securing cable (31) in panel bracket and pull cable (31) aft out into cabin area.

Installation of Brake System. (See figure 4-22.)

- a. If removed, install parking brake control as follows:
 1. Route cable (31) thru panel bracket, forward thru grommet, and around down and aft into parking brake valve area. Then clamp to brackets with clamps (6), spacers (7), screw (8), and nut (9).

CAUTION

Do not bend cable in too sharp a radius to prevent binding in cable action.



1. Hose LH (To Master Cylinder)	12. Line LH	22. Elbow
2. Hose RH (To Master Cylinder)	13. Line RH	23. Line Assy. LH Brake
3. Elbow	14. Elbow	24. Line Assy. RH Brake
4. Elbow	15. Union	25. Elbow
5. Valve Parking Brake	16. Line Assy. RH Brake	26. Hose
6. Clamp	17. Line Assy. LH Brake	27. Clamp
7. Spacer	18. Line Assy. RH Brake	28. Union
8. Screw	19. Union	29. Master Cylinder
9. Nut	20. Line Assy. LH Brake	30. Brake Assembly Main Wheel
10. Stop	21. Line Assy. RH Brake	31. Cable
11. Link		

Figure 4-22. Brake System Plumbing Installation

2. Install stop (10) with screw and nut, and tighten only snug at this time.
- b. Install brake units on main strut with six bolts and nuts and install elbow (28) in brake unit.
- c. Install hose (26) and clamp to strut with clamps (27).
- d. Install elbow (25) in bulkhead with washer and nut.
- e. Connect hose (26) to brake unit and elbow (25).
- f. Route lines (23 and 24) in position. Connect to elbow (25) and clamp.
- g. Install elbow (22) on lines (21 and 20). Route in place and connect to lines (23 and 24) and clamp in place.
- h. Install unions (19) on lines (17 and 21) then route in wing and clamp in place.
- i. Install unions (15) on lines (12 and 16) and route in wing position and connect to line (17) and clamp as required.
- j. Install line (13) to elbow (14) and connect to line (16) then clamp.

NOTE

When installing lines, it may be necessary to bend lines to work into position. However, excessive bending should be avoided.

- k. Assemble parking brake valves (5).
- l. On aircraft 421-0001 to 421B0001 perform the following procedures:
 1. Install fittings (4) and valve link (11).
 2. Install valves (5) in place with screws and nuts.
 3. Connect valve link (11) with bolt, and connect cable (31) to link bolt at time of installation.
 4. Rig stop (10) so the valve link (11) movement is stopped, in forward direction, approximately 1/16 inch before it reaches the full forward direction of the valve arms. Loosen stop to set, then tighten stop screw.
- m. On aircraft 421B0001 and ON perform the following procedures:
 1. Install fitting (4) to valve.
 2. Install valve (5) to bracket (32) with screws and nuts.
 3. Connect cable (31) to valve assembly.
- n. Connect lines (12 and 13) and install hoses (1 and 2).
- o. Assemble master cylinders and place in position and connect hoses (1 and 2).
- p. Install lower end of master cylinders with spacers, clevis pins, and safety with cotter pins.
- q. Connect top end of master cylinders with clevis pins and safety with cotter pins.
- r. Fill master cylinders and bleed in accordance with the bleeding procedure. Check system for leaks.
- s. Replace all access covers, forward wing structural skin, floorboard covers and carpet.
- t. Replace pilot's and copilot's seats.

Checking of the Wearing of Brake Discs.

Brake disc wear can be determined while brake is on aircraft as follows:

- a. Apply and release brakes twice.

Change 8

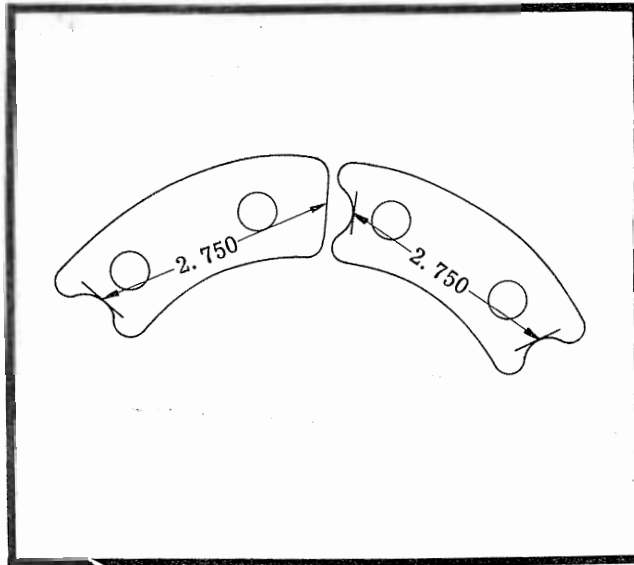


Figure 4-22A. Wear Pad Wear Limits

- b. Apply 600 psi pressure to the brake and hold.
- c. Measure distance between inside face of brake housing and pressure plate. If this distance measures 0.234 inch or greater, remove brake for inspection.

Removal and Disassembly of Main Wheel Brake Assembly. (See figure 4-21.)

To remove either brake assembly, proceed as follows:

- a. Remove wheel and tire assembly.
- b. Disconnect brake line from union (25).
- c. Remove brake assembly from axle by removing eight nuts (29), washers and bolts (21).
- d. Lay brake assembly on a clean flat surface and remove nuts (38), bolts (22) and countersunk washers (23) releasing back plate (37).
- e. Remove rotating disc (33), stationary disc (34), second rotating disc (33) and pressure plate (32).
- f. Remove spacer (35).
- g. Remove piston insulators (28) and pistons (27) from housing (24), then remove O-ring seals (26) from brake housing.

Cleaning of Brake Assembly Parts.

- a. Clean all metal parts of brake assembly, except rotating discs, in dry-cleaning solution, Federal Specification P-D-680, and dry with filtered compressed air. A soft bristle brush may be used where necessary.

WARNING

Dry-cleaning solvents are toxic and volatile. Use in a well-ventilated area. Do not inhale solvent vapors or allow solvent to contact skin or clothing.

- b. Clean rotating discs with compressed air and a soft wire or stiff bristle brush.
- c. Clean piston insulators with denatured alcohol. Dry with compressed air or a clean cloth.

NOTE

It is recommended that new O-ring packings be installed at each overhaul. If packings must be reused, they should be cleaned with denatured alcohol and dried with a clean, soft cloth. Reinstall packings in same location from which they were removed.

Inspection of Brake Assembly Parts. (See figure 4-21.)

Inspect all parts for cracks, nicks, scratches, damaged threads, or other damage. Discard all cracked parts and all parts having damaged threads.

- a. Inspect rotating discs (33) as follows:
 - 1. Inspect relief slot terminal holes and drive tang radii for cracks. Discard cracked discs.
 - 2. Inspect disc for wear. Discard disc when minimum thickness across unchipped mix becomes 0.143 inch or less or if mix is worn to 0.015 inch thick at any location on either face of disc.

NOTE

As much as 25 percent of mix may be lost through chipping, provided mix loss is scattered.

- 3. Inspect discs for dishing. Discs can be dished a maximum of 0.015 inch if they are to be used with other dished discs.

- 4. Discard discs that are 0.125 inch or more out of round.

- 5. Inspect disc tangs for battering. Discard disc when one or more tangs becomes less than 0.615 inch in width.

- 6. Inspect disc for shrinkage. Discard discs that have shrunk to an inside diameter of 7.750 inches or less.

- b. Inspect stationary disc (34) as follows:

- 1. Inspect relief slot terminal holes and key slot corners for cracks. Discard cracked discs.

- 2. Inspect disc for wear. Discard disc when worn to a thickness of 0.146 inches or less on aircraft 421-0001 to 421B0001 or when worn to a thickness of 0.170 inches or less on aircraft 421B0001 and On.

- 3. Inspect for dishing. Disc can be dished a maximum of 0.015 inch if it will be used with other dished discs.

- 4. Check inside diameter of disc for size by ascertaining that it can be installed on the torque tube without interference.

- 5. Check key slots for wear and battering. Discard disc with keyslots less than 0.590 inch or greater than 0.640 inch in width.

- 6. Inspect disc for shrinkage. Discard disc if shrunk to an inside diameter of 7.10 inches or less measured between ends of key slot tangs.

- c. Inspect pressure plate subassembly (32) as follows:

- 1. Inspect pressure plate subassembly for cracks in corners of keyslots. Discard if cracked.

- 2. Inspect subassembly for thickness. Replace if worn to 0.225 inch or less in thickness measured between wear pad rivets.

- 3. Inspect wear pads (41) for thickness. Replace all pads if any rivet is sheared, any pad is cracked, or if one or more pads are worn to a width of 2.75 inches or less, as shown in Figure 4-22A. Install new pads in accordance with applicable instructions.

- 4. Discard if key slot width is less than 0.615 or greater than 0.640 inch.

- 5. Inspect for dishing. Replace pressure plate dished in excess of 0.015 inch.

- 6. Discard pressure plate which is 0.120 inch or more out-of-round.

- d. Inspect back plate subassembly (37) as follows:

- 1. Inspect for cracks. Pay particular attention to relief slot terminal holes. Discard cracked back plate.

- 2. Inspect wear pads (36) for thickness. Replace all pads if one or more pads are worn to 0.090 inch or less in thickness when measured from face of pad to surface of back plate, or if pad width is less than 2.75 inches, as shown in Figure 4-22A. Install new pads in accordance with applicable instructions.

- 3. Inspect for dishing. Replace back plate if dished 0.015 inch or more.

- e. Inspect the torque tube (31) as follows:

- 1. Inspect for cracks. Discard cracked torque tube.

- 2. Inspect for key width. Discard torque tube if key is worn to a width of 0.550 inch or less at any point on any key.

- f. Inspect the brake housing (24) as follows:

- 1. Inspect housing for cracks. Discard cracked housing.

- 2. Discard housing having stripped or badly damaged threads in inlet and bleeder bosses.

- 3. Inspect piston cavities for wear. Discard housing if any cavity exceeds 1.386 inches in diameter.

- 4. Inspect for nicks, scratches, and corrosion. Rework in accordance with applicable instructions.

- g. Inspect the pistons (27) as follows:

- 1. Inspect pistons for wear. Measure diameter of pistons at three places around circumference. Discard any piston if diameter at any location measures 1.362 inches or less.

- 2. Inspect pistons for burrs, scratches, or nicks. Discard any piston having damage greater than 0.003 inch deep on seal contacting surfaces. Repair pistons with damage less than 0.003 inch deep.

- h. Inspect the piston insulators (28) as follows:

- 1. Inspect piston insulators for deterioration or wear. Discard insulators worn to 0.215 inch or less in thickness.

- 2. Remove blisters and raised areas not exceeding 0.010 inch from insulators with a file or by grinding, making certain a minimum thickness of 0.215 inch is maintained, and that both faces are parallel.

- i. Carefully inspect brake bolts for thread damage and cracks under head and in threads adjacent to bolt

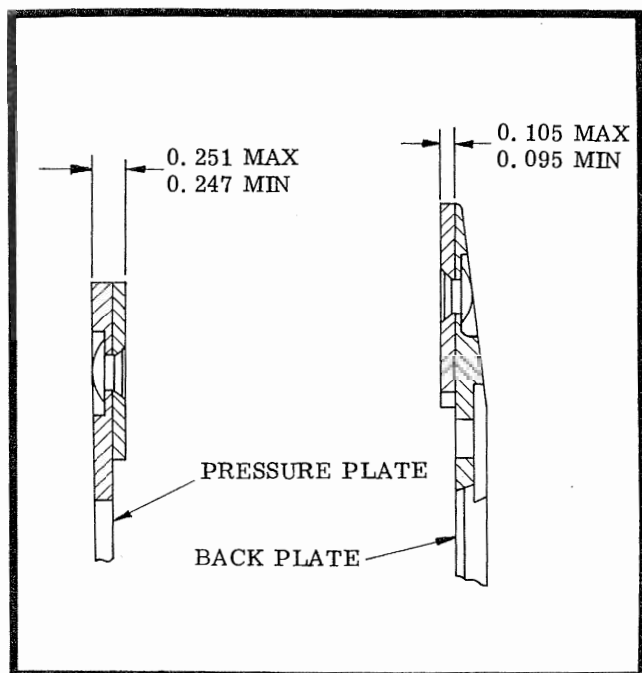


Figure 4-22B. Limits For Repadded Pressure and Back Plates

shank. Discard bent or cracked bolts or ones with thread damage. No refinishing of these parts is permissible.

j. Inspect self-locking nuts for self-locking feature. Replace if nut can be spun onto brake bolt with the fingers past the nut's locking section.

Replacement of Wear Pads on Pressure Plate and Back Plate. (See figure 4-21.)

a. Using a 7/32 (0.218) inch drill, remove wear pads (36 or 41) from back plate or pressure plate by drilling out shop heads of old rivets and punching out rivets.

CAUTION

Exercise care to avoid damaging or enlarging rivet holes.

b. Inspect base plate of pressure plate or back plate for cracks, using Magnaflux or equivalent method. Discard cracked base plates or base plates dished 0.015 inch or more.

c. Using the proper rivets, install new wear pads and rivets. Rivets shall be installed by the compression method so that formed head or rivet is flush with or below the surface of the wear pad.

NOTE

When installation is complete, rivets must be snug. A slight movement of wear pads is desirable. It should be determined that a force of not less than 2 pounds or more than 100 pounds is required to cause move-

ment of the wear pads. A maximum of one crack is permitted in the shop head of a tubular rivet, but it must not extend into the rivet shank. To check rivets that appear unseated, insert a 0.0015 inch feeler gage between the disc and the pad. It should not slide past the rivet.

d. After repadding, grind the wear-padded subassembly to the thickness as shown in Figure 4-22B.

NOTE

Wear pads must be ground flat to each other with assurance that the minimum dimensions shown in Figure 4-22B are held. No more than 25 percent of the rivet head shall be removed by grinding as shown in Figure 4-22C.

Applying Protective Coating.

Treat newly ground back and pressure plates which are not to be put immediately into service as follows:

- Degrease discs in a vapor degreaser to remove all oil and grinding residue.
- Immerse disc in Houghton's Rust Veto 377 or equivalent. Use in the "as-received" condition without dilution. Let discs drip and air dry for five minutes or more. Clean, compressed air may be used to speed drying.

WARNING

Rust Veto is highly flammable. Observe all fire precautions during its use.

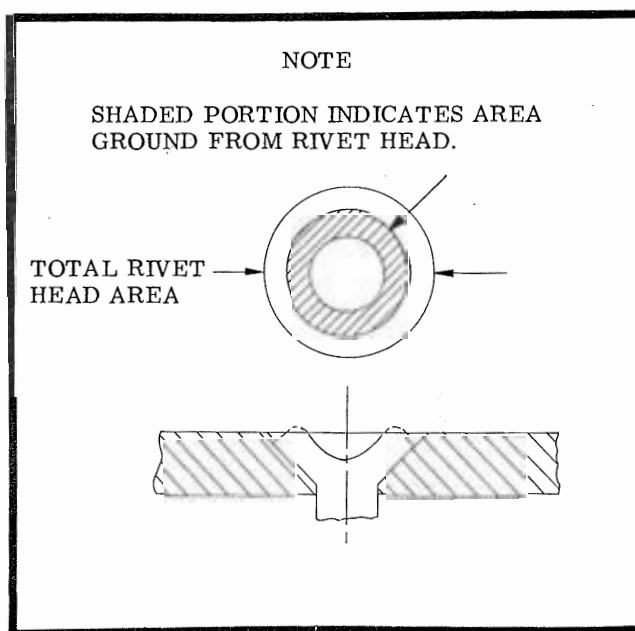


Figure 4-22C. Rivet Head Grinding Limits

Repairing Torque Tube.

- a. Repair worn disc drive keys which have not worn to 0.550 inch or less by blending out indentations in keys.

Repairing the Housing.

- a. Blend out and polish burrs, nicks, and scratches to 0.030 inch deep on outside of housing with 280 grit (wet-or-dry) sandpaper.
- b. Blend and polish out scratches in piston cavities not exceeding 0.003 inch deep with fine 400 grit (wet-or-dry) sandpaper. Remove burrs and rough edges from seal grooves to a 0.010 to 0.015 inch radius with 400 grit (wet-or-dry) sandpaper. Avoid heavy localized polishing as this can promote leakage.

Repairing the Piston.

- a. Blend out and polish scratches, nicks, and burrs on edges and seal contacting surfaces of piston to 0.003 inch deep.
- b. Blend repairs to avoid local indentation of piston seal surfaces. Discard pistons damaged deeper than 0.003 inch.
- c. Retreat reworked areas with Dow No. 1 Solution, MIL-M-3171, Type I.

Retreating and Repainting Brake Housing.

- a. Rinse reworked areas with hot water and dry thoroughly with filtered, dried compressed air.
- b. Retreat reworked areas with Dow No. 1 Solution, MIL-M-3171, Type I.
- c. Repaint reworked areas with two coats of zinc chromate primer, Specification MIL-P-8585, and two coats of aluminum lacquer, Specification TT-L-32.

Installation and Assembly of Main Wheel Brake.
(See figure 4-21.)

- a. Assemble main wheel brake as follows:
 - 1. Lubricate o-rings (26) with hydraulic oil and install in the groove of each cylinder of housing (24).
 - 2. Install pistons (27) in brake housing (24). Lubricate pistons with MIL-G-7711 Grease.
 - 3. Install on piston insulator (28) in recess of each piston (27).
 - 4. Position torque tube (31), scalloped side toward brake housing and align the bolt holes.
 - 5. Install pressure plate (32), wear pads facing away from and directly over the pistons.

CAUTION

Be sure the five key ways of the pressure plate and stationary disc engage the five keys of the torque plate.

- 6. Install one rotating disc (33), one stationary disc (34) and a second rotating disc in sequence.
- 7. Position back plate (37) on torque tube spacer (35) aligning the bolt holes and position on torque

tube (31).

- 8. Install five bolts (22), countersunk washers (23) and nuts (38) securing the assembly as a unit. Draw up bolts evenly and torque to 120 inch-pounds.

CAUTION

Countersunk washers (23) must be installed under the bolt heads with the countersink facing the bolt head.

- b. Place brake assembly on axle with bleeder ports at top and secure to axle flange with eight bolts (21), washers and nuts (31). Draw up nuts evenly and torque to 100-120 inch-pounds.
- c. Connect hydraulic brake line to elbow (25).
- d. Fill and bleed brake system in accordance with bleeding procedure.

Bleeding the Brake System. (See figure 4-21.)

In order to assure proper brake action, it is necessary to have positive transfer of hydraulic pressure through the system. Any air trapped in the system must be removed. This is accomplished by bleeding, which can be done in any one of several different ways. The following procedure is bleeding by pressure with a bleeder pump:

- a. Fill reservoir of bleeder pump with clean system hydraulic fluid. (See Section 2 for hydraulic fluid specifications.)
- b. Remove filler plug from master cylinder.

NOTE

When bleeding the brake system, it is advisable to wrap the master cylinder with rags to prevent fluid from spilling or leaking on the carpet.

- c. Remove bleeder screw and open bleeder plug and allow hydraulic fluid to drain from the system into a suitable container.
- d. Connect the hose to the bleeder pump to the bleeder valve on top of brake unit.
- e. Pump slowly until fluid in master cylinder reservoir is within 1/2 inch of the top.
- f. Close bleeder plug (30) and detach bleeder pump hose connection.
- g. Check brake operation.

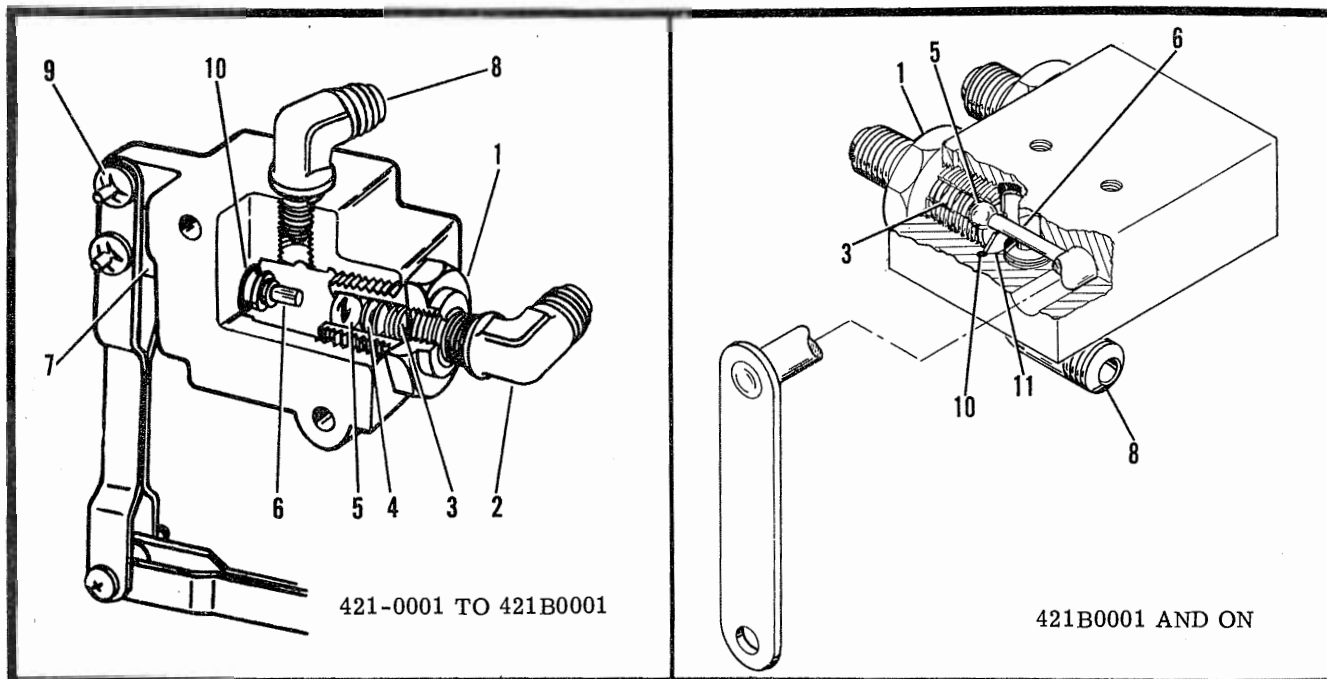
NOTE

If brakes are "spongy" and do not have a solid feel in the pedals, repeat the above procedure.

- h. Install bleeder screw in brake unit and replace filler plug in master cylinder.

Parking Brake Valves.

The removal and installation of the parking brake valves is included in the Removal and Installation of the Brake System.



1. Valve Seat	4. Washer	7. Spacer	10. O-ring
2. Elbow	5. Ball	8. Elbow	11. Seal
3. Spring	6. Plunger	9. Lockwasher	

Figure 4-23. Parking Brake Valve

Master Cylinder. (See figure 4-24.)

Each vertical mounting type master cylinder used on the aircraft incorporates a fluid reservoir and cylinder within the same body (11). A plastic filler plug (3) is used to close the filler opening in the cover (5), which is threaded into the body. The filler plug is vented, as sufficient ventilation is not provided by clearance between the piston rod (6) and piston rod passage through the cover (5). With the exception of the piston return spring (12), all internal operating parts are assembled onto the piston rod; piston (17), piston spring (15), lock-o-seal (19), and compensating sleeve (20). A seal between the piston (17) and the cylinder walls is provided by a packing O-ring (16) installed in a groove around the piston. As pressure is applied to advance the piston rod into the cylinder, the piston remains stationary until the lock-o-seal is seated on the piston (.030 to .040 inch movement). Proper operation of the master cylinder depends upon this seating action. When the lock-o-seal is seated, fluid cannot get past the piston and with continued movement of the piston rod forcing the piston farther into the cylinder, pressure in the cylinder is increased. At any time during the stroke that pressure on the piston is eased, the piston spring will tend to keep the piston seated against the lock-o-seal, maintaining pressure in advance of the piston. As the pressure is further eased, allowing the piston return spring to force the piston to retreat, the upper end of the compensating sleeve will contact the cover boss, forcing the piston to unseat itself from the lock-o-seal. This will allow additional fluid from the re-

servoir to enter the cylinder. This positive unseating also allows unrestricted passage of fluid from cylinder to reservoir while the piston is in the static position. This is to compensate for any excess fluid which may be present in the system due to pumping or from thermal expansion. The effective stroke of the piston is 1.437 inches with maximum displacement of .5327 cubic inch. Reservoir capacity is approximately 3.391 cubic inches.

Removal of Master Cylinder. (See figure 4-24.)

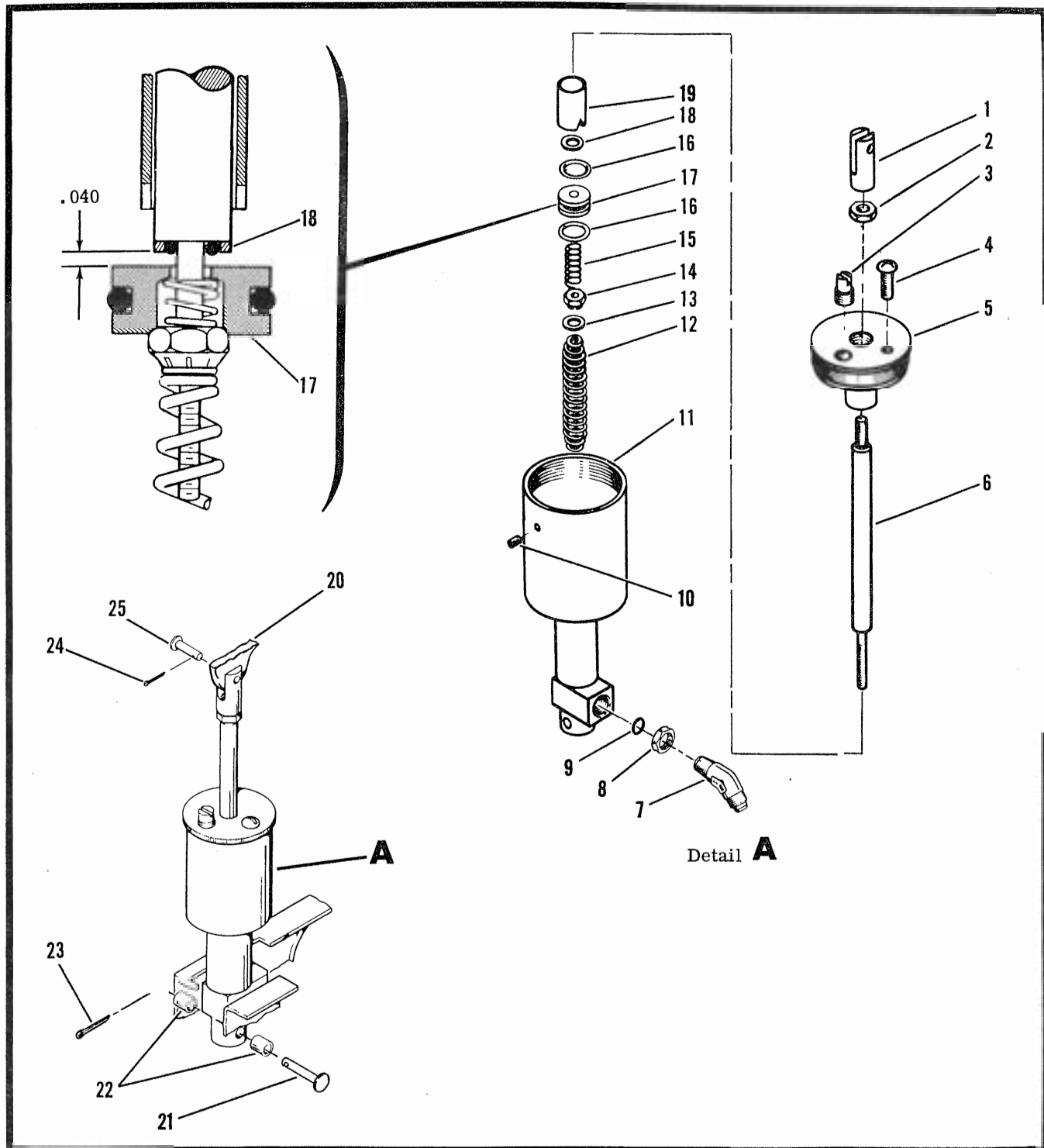
Removal of either master cylinder can be accomplished as follows:

- Remove pilot's seat in accordance with Section 2.
- Remove carpet, left scuff plate, and left access hole cover.
- Drain hydraulic fluid from master cylinder by removing the line at the main wheel, then connect the line after draining fluid to prevent entry of foreign material into brake.

NOTE

When making connections on hydraulic lines, use only system fluid as a lubricant.

- Disconnect clevis (1) from rudder pedal (21) by removing cotter pin (24) and pin (25).
- Disconnect lower end of master cylinder by removing cotter pin (23), pin (21), and spacers (22).
- Disconnect hose from fitting (7) in base of master



1. Clevis	10. Setscrew	18. Lock-O-Seal
2. Jamb Nut	11. Body	19. Compensating Sleeve
3. Filler Plug	12. Piston Return Spring	20. Pilot's Rudder Pedal
4. Screw	13. Washer	21. Pin
5. Cover	14. Nut	22. Spacer
6. Piston Rod	15. Piston Spring	23. Cotter Pin
7. Elbow	16. O-Ring	24. Cotter Pin
8. Nut	17. Piston	25. Pin
9. O-Ring		26. O-Ring

Figure 4-24. Brake Master Cylinder Installation

cylinder body (11) by lifting master cylinder enough to allow removal of hose.

g. Remove master cylinder and cap hose to prevent entry of foreign material into system.

Disassembly of Master Cylinder. (See figure 4-24.)

Disassembly of either master cylinder can be accomplished as follows:

a. Remove filler plug (3) and drain residual hydraulic fluid from reservoir portion of master cylinder. Screw (4) serves no purpose in this assembly except as a plug for the threaded hole in the cover, and need not be removed.

b. Remove setscrew (10) and unscrew cover (5) to remove cover and piston rod (6) along with the other illustrated parts which are attached to the piston rod. The piston return spring (12) will remain inside the body (11); to remove, lift from position.

c. Remove nut (14) from piston rod (6), to remove piston spring (15), piston (17), lock-o-seal (18), and compensating sleeve (19).

d. Back off jamb nut (2) from its locking position against base of clevis (1) and remove both parts from piston rod (6).

e. Remove O-ring (16) from piston (17).

f. Remove elbow (7) from body (11), if required.

NOTE

Clean all metal parts with a suitable solvent. O-ring seals should be washed in clean system hydraulic fluid or denatured alcohol. Inspect metal parts for wear and thread damage. Inspect cylinder walls for corrosion, pitting and scores. Damaged cylinder walls require replacement of the body (11). Inspect O-ring seal (16) and O-ring portion of lock-o-seal (18) for swelling, chipping, or other evidence of damage. Replace as necessary. Repairs to master cylinder components are not recommended. Damaged or defective parts should be replaced.

Assembly of Master Cylinder. (See figure 4-24.)

Assemble either master cylinder as follows:

a. Install lock-o-seal (18) on shank of piston rod (6).

CAUTION

Lubricate O-ring portion of lock-o-seal with system hydraulic fluid and install carefully prevent damage from the threaded portion of the piston rod shank.

b. Slip O-ring (16) into groove in piston (17) as illustrated, using clean system hydraulic fluid as a lubricant.

CAUTION

Install O-ring carefully to prevent chipping on sharp corner of piston.

c. Install piston (17), piston spring (15), and nut (14) on piston rod (6) as illustrated. Tighten nut (14) and with piston spring (15) compressed to seat piston

(17) against nut, adjust clearance between piston and lock-o-seal (18) to 0.040 inch as illustrated, using feeler gage or 0.040 to check measurement.

CAUTION

Be careful, when inserting feeler gage or wire, not to damage lock-o-seal.

NOTE

The 0.030 to 0.040 inch dimension between the lock-o-seal and the piston determines the relationship between piston rod travel and seating of the lock-o-seal to the piston. Proper master cylinder operation depends upon this dimension being set correctly.

d. Place piston return spring (12) into cylinder section of body (11).

NOTE

On aircraft 421-0001 to 421A0005 make sure piston return spring (12) is installed correctly with broad base down.

e. Lubricate cylinder walls and piston (17) with clean system hydraulic fluid and insert nut (14) against piston return spring.

f. Place compensating sleeve (19) notched end toward piston, over piston rod (6). Slide cover (5) over piston rod, and tighten into body. Install setscrew (10) and tighten to prevent movement of cover (5).

g. Screw jamb nut (2) and clevis (1) onto piston rod end.

h. Install filler plug (3), and elbow (7), if removed during disassembly.

NOTE

If elbow is being installed, use a suitable lubricant on O-ring (9) and threads before screwing into master cylinder.

Installation of Master Cylinder. (See figure 4-24.)

Install either master cylinder as follows:

a. Lift hose end and connect to lower elbow (7).

NOTE

Use only system hydraulic fluid for lubricant when making this connection.

b. Insert pin (21) through master cylinder mounting brackets and hole in body of master cylinder (11) with spacers (22) in place as illustrated. Secure pin (21) with cotter pin (23).

c. Connect clevis (1) to rudder pedal (20) with pin (25). Adjust clevis (1) to align tips of rudder pedals (20) with rudder pedals in a neutral position. Secure pin (25) with cotter pin (24), and secure clevis with jamb nut (2).

d. Install access hole cover, carpet, and scuff plates.

e. Fill master cylinder and bleed brakes in accordance with bleeding procedure in Section 4.

f. Install pilot's seat.

SECTION 5

CONTROL COLUMN, AILERON AND TRIM CONTROL SYSTEMS

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CAUTION

Primary and secondary flight control cables, push pull tubes, bellcranks and mountings on late model aircraft use dual locking fasteners. The lock nuts for these fasteners incorporate a fiber lock, and are castellated for safetying with a cotter pin. When any of these areas are disconnected on any aircraft, new dual locking fasteners should be installed. See the Aircraft Parts Catalog for part numbers and location of these fasteners.

CONTROL COLUMN.

The control column assembly consists of two telescopic tube assemblies which rotate within each other. The control column incorporates the use of roller-bearings for the purpose of easing the forward and aft motions of the tube assemblies. Each control column is attached to the forward cabin bulkhead and is supported by a bearing block. A roller-bearing block assembly supports the control column at the stationary instrument panel. The control column assemblies are physically coupled by an interconnect assembly located at the forward cabin bulkhead.

Removal of Control Column. (See figure 5-1.)

- Remove secondary instrument shock panel in accordance with Section 12.
- Position front seats to the most aft position.
- Disconnect electrical wiring to control wheels and remove control wheel (1) from tube assembly (10) by removing nuts and bolts.
- Remove nut (15) from control column sprocket shaft.

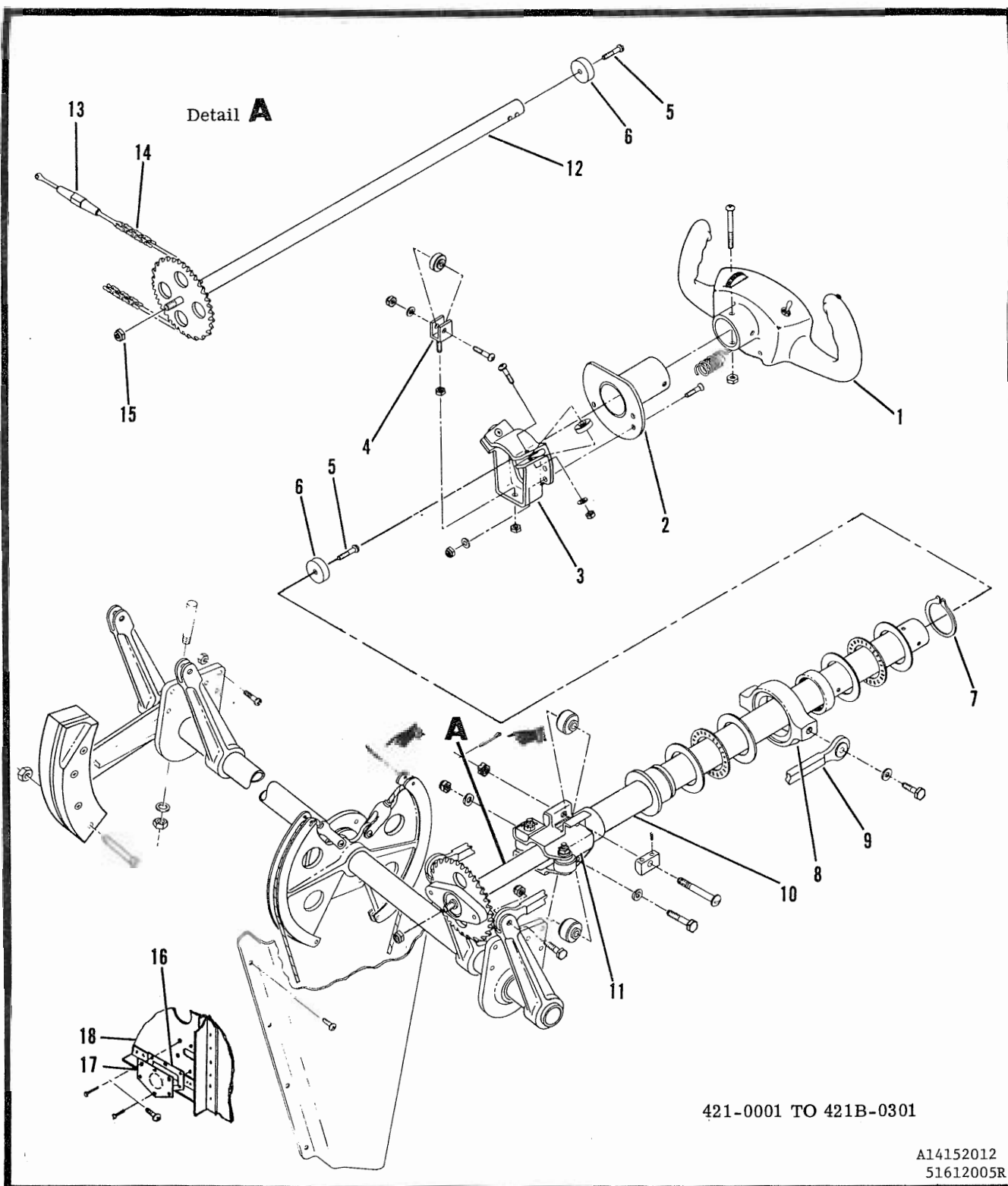
NOTE

To remove nut (15), remove cover (17) and gasket (16) from the forward side of forward cabin pressure bulkhead (18).

- Remove safety and loosen turnbuckle (13) to relieve tension on rigging chain (14) and disengage chain from sprocket.
- Disconnect push rods (9) from bearing sleeve (8) by removing bolt and washer.
- Remove screws, washers and nuts retaining the control column support block (3) and cover (2) to instrument panel.
- Compress control column and remove by lifting upwards and to the rear until the stationary instrument panel is cleared.

Disassembly of Control Column. (See figure 5-1.)

- Remove control column from stationary panel.

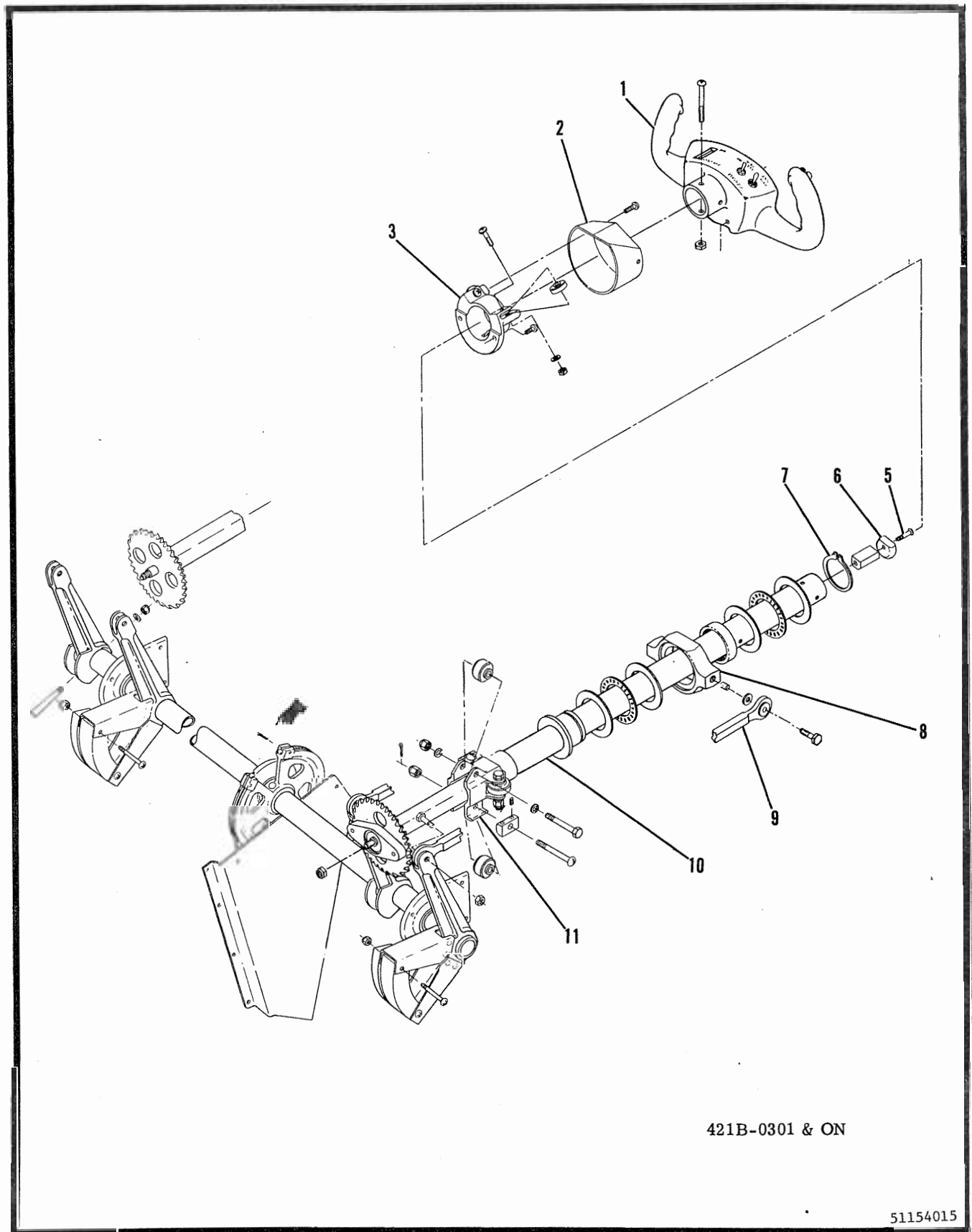


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1. Control Wheel	6. Slide	10. Tube Assembly	14. Chain
2. Cover	7. External Retainer	11. Roller Support	15. Nut
3. Support Block	8. Bearing Sleeve	12. Tube Assembly	16. Gasket
4. Clevis Assembly	9. Push Rod	13. Turnbuckle	17. Cover
5. Screw			18. Bulkhead

Figure 5-1. Control Column (Sheet 1 of 2)



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Figure 5-1. Control Column (Sheet 2)

NOTE

Disassembly and repair of control column is limited to the replacement of worn or defective shafts, bearings, bushings, rollers or other replaceable components.

- b. Loosen clevis assembly (4) on control support block (3) and remove column support block from tube

assembly (10).

- c. Compress tube assembly (10) and (12) together and remove screw (5) and slide (6).

- d. Remove tube assembly (12) from inside tube assembly (10) by pulling apart.

- e. Expand external retainer (7) and remove bearing sleeve (8) and retainer from tube assembly (10).

- f. Remove roller support (11) by drilling out the

four rivets attaching roller support to the sleeve on tube assembly (10).

NOTE

Do not remove roller support (11) from tube assembly (10) except when replacement of roller support is required.

Assembly of Control Column. (See figure 5-1.)

- a. Assemble component parts of the control column by reversing disassembly procedures.

NOTE

When assembling the control support block (3) to the column tube assembly (10), set the adjustable lower bearing to provide .008 clearance with the two upper bearings in direct contact with tube assembly.

Installation of Control Column. (See figure 5-1.)

- a. Compress control column together and insert into slot provided in the stationary instrument panel.
- b. Align holes in cover (2) and support block (3) with stationary instrument panel and attach with screws, washers and nuts.
- c. Extend control column, align aileron sprocket with bearing block attached to bulkhead and secure with nut (15).
- d. Install gasket (16) and cover (17) with six attaching screws.
- e. Connect push rods (9) to bearing sleeve (8) with bolts and washers.
- f. Place chain (14) on sprocket and rig interconnect assembly in accordance with rigging procedure.
- g. Secure turnbuckle (13) by safetying.

Rigging Control Column. (See figure 5-3.)

- a. (See figure 5-2.) Align interconnect assembly (3) as shown.

NOTE

Check and/or adjust length of interconnect assembly to provide 16.10 inches span, measuring from center to center of clevis holes. If adjustment is made to interconnect assembly, recheck aileron cable tensions.

- b. With interconnect assembly centered, check pilot's and copilot's control wheels for the neutral position. If control wheels do not assume the neutral position, or are not aligned together, proceed with the following steps:

1. Loosen turnbuckle (43) on chain (45) and remove chain from control column sprockets.
2. Rotate pilot's control wheel to the neutral position and install control column lock.
3. Visually align copilot's control wheel with pilot's control wheel.

4. Align interconnect assembly with sprockets as shown in figure 5-2, and engage chain on sprockets.
5. Tighten turnbuckle and install safety wire.

NOTE

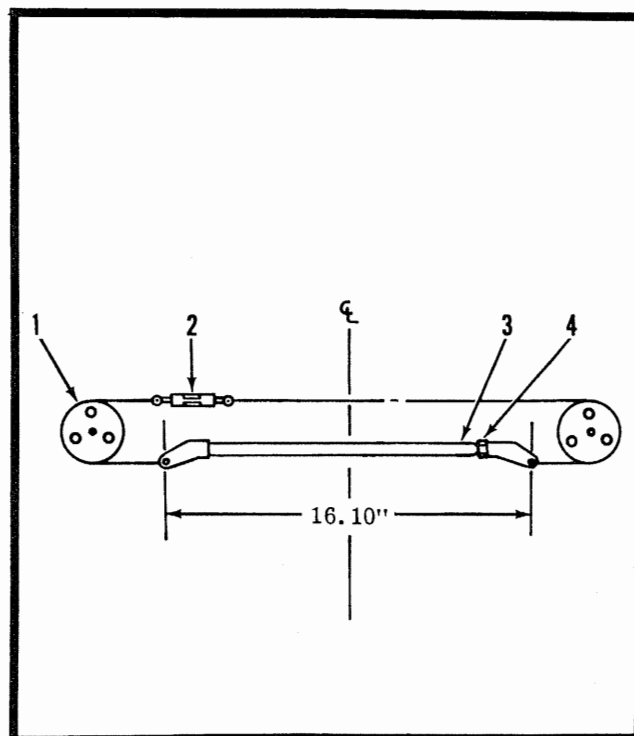
When tightening turnbuckles, chain tension should not exceed the minimum necessary to remove excess slack.

AILERONS.

The all metal ailerons attach to the rear spar of each wing at two hinge points, each hinge point is bolted to the rear spar and incorporates a sealed bearing. The aileron trim tab actuator fastens to the left aileron by a full length hinge and operates from a push-pull tube. The ailerons are 100% static balanced at the time of installation.

Removal of Aileron. (See figure 5-4.)

- a. When the left aileron assembly is being removed, move aileron trim tab to the extreme UP position and remove cotter pin, nut, bolt and spacer from aileron trim tab push-pull tube (6).
- b. Lower flaps and disconnect aileron push-pull rod assembly (10) by removing bolt and washer.
- c. Disconnect bonding strap from aileron by removing attaching screw.
- d. Remove bolt attaching aileron to hinge assembly.



1. Sprocket	3. Interconnect Assembly
2. Turnbuckle	4. Lock Nut

Figure 5-2. Interconnect Assembly Adjustment

e. To remove aileron, move aileron to the rear, clearing hinge assembly, and slightly inboard until outboard hinge pin (9) is free of bearing.

Installation of Aileron.

NOTE

If rigging was correct prior to aileron removal and aileron push-pull rod end adjustment was not disturbed, it should not be necessary to rerig the aileron control system. If the push-pull rod end adjustment was disturbed, adjust rod ends to provide 9.65 inches span measuring from center to center of rod end attach holes.

a. Installation of Ailerons is the reversal of the removal procedures.

NOTE

After installation of ailerons, check the travel and alignment and rerig if necessary.

AILERON TRIM TAB.

The all metal aileron trim tab is attached to the left aileron by a single hinge extending the entire length of the trim tab. The trim tab must be installed when static balancing the left aileron.

Removal of Aileron Trim Tab. (See figure 5-4.)

a. Position aileron trim tab to full DOWN and dis-

Trouble Shooting Aileron Control System.

connect bonding strap by removing screw.

b. Remove cotter pin, nut and bolt attaching aileron trim tab push-pull tube (6) to aileron trim tab.

c. Remove cotter pins in hinge half and remove hinge pin.

d. Remove aileron trim tab from aileron.

Installation of Aileron Trim Tab. (See figure 5-4.)

a. Install aileron trim tab by reversing removal procedures.

NOTE

Check aileron trim tab travel, alignment and rerig, if necessary, in accordance with rigging procedure.

AILERON CONTROL SYSTEM.

The ailerons are actuated by the rotational movement of either control wheel. The actuation of ailerons is accomplished by cable assemblies which are attached to the control column interconnect assembly and routed through the fuselage to the fuselage bellcrank located just forward of the rear spar. From the fuselage bellcrank, cable assemblies are then routed through each wing to a wing bellcrank assembly where a push-pull tube is connected to the aileron. An aileron trim system is provided and is routed directly through the fuselage and left hand wing to the aileron trim tab actuator. An aileron trim control knob is provided on the control pedestal.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN CONTROL WHEEL AND AILERON	Cable tension too low.	Adjust cable tension in accordance with rigging procedures.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys or wing bellcranks.	Install cables correctly. Check cable guards.
RESISTANCE TO CONTROL WHEEL ROTATION	Cable tension too high.	Adjust cable tension in accordance with rigging procedures.
	Wing bellcrank bolts over-torqued.	Loosen bolts.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Clevis assembly in control column support block adjusted too close to control tube assembly.	Provide proper clearance between bearing and control tube assembly.

TROUBLE	PROBABLE CAUSE	CORRECTION
RESISTANCE TO CONTROL WHEEL ROTATION (CONT.)	Control column crossover chains too tight.	Adjust in accordance with control column rigging procedures.
	Cables not in place on pulleys or wing bellcrank.	Install cables correctly.
	Bent aileron.	Repair or replace aileron.
CONTROL WHEELS NOT SYNCHRONIZED	Incorrect control column rigging.	Rig in accordance with control column rigging procedures.
	Aileron system tension greater than control column crossover tension.	Adjust tensions in accordance with rigging procedures.
CONTROL WHEELS NOT HORIZONTAL WHEN AILERONS ARE NEUTRAL	Incorrect aileron system rigging.	Rig in accordance with rigging procedures.
INCORRECT AILERON TRAVEL	Aileron quadrant stops incorrectly adjusted.	Adjust in accordance with rigging procedures.
CORRECT AILERON TRAVEL CANNOT BE OBTAINED BY ADJUSTING WING BELLCRANK STOPS	Incorrect rigging of quadrant cables, compensated for by incorrect adjustment of push-pull rods.	Rig in accordance with rigging procedures.
	Incorrect rigging of aileron bellcranks.	Rig in accordance with rigging procedures.

Removal of Aileron Control Cables. (See figure 5-3.)

NOTE

See figure 1-2 and remove floorboard access panels (80, 81 and 86), fuselage panel (15), and wing access panels (64, 65 and 66).

- a. Remove cable guard pins from fuselage and/or wing aileron pulley brackets.
- b. Relieve aileron cable tension by loosening cable turnbuckles at the fuselage bellcrank assembly (6).

NOTE

The following procedure is for removing aileron cables with turnbuckle forks remaining attached to the fuselage bellcrank.

- c. Remove turnbuckle barrels connecting turnbuckle forks to cable terminals and attach guide wire to cable terminals.
- d. Disconnect forward aileron cables from interconnect assembly (54) by removing cotter pin, nut and bolt.
- e. Remove fuselage aileron cables from aircraft through cabin forward access panel.
- f. Disconnect wing aileron cables at the wing bellcrank assembly (26) by removing cotter pin, nut and bolt.
- g. Remove cable guard pins, washers and cotter pins from wing bellcrank assembly (26).

- h. Remove pulley (30) from pulley bracket.
- i. Remove cable seals (56).
- j. Remove wing aileron cables from aircraft through wing access panel.

NOTE

Leave the guide wires in the aircraft to serve as a guide for cable reinstallation.

Installation of Aileron Cables. (See figure 5-3.)

- a. Attach guide wires to wing aileron and/or fuselage aileron cable terminals and route cable through aircraft toward fuselage bellcrank (6).
- b. Secure wing aileron cables to wing bellcrank assembly (26) with bolts, nuts and cotter pins.
- c. Install cable guard pins, washers and cotter pins on wing bellcrank assembly (26).
- d. Install pulley (30) in pulley bracket.

CAUTION

Be sure spacer (31) is correctly installed beneath pulley (30) or cable will misalign with wing bellcrank and damage may occur.

- e. Connect fuselage aileron cables to the interconnect assembly (54) with bolts, nuts and cotter pins.
- f. Assemble turnbuckle barrels to aileron cable terminals and forks on fuselage bellcrank assembly (6).

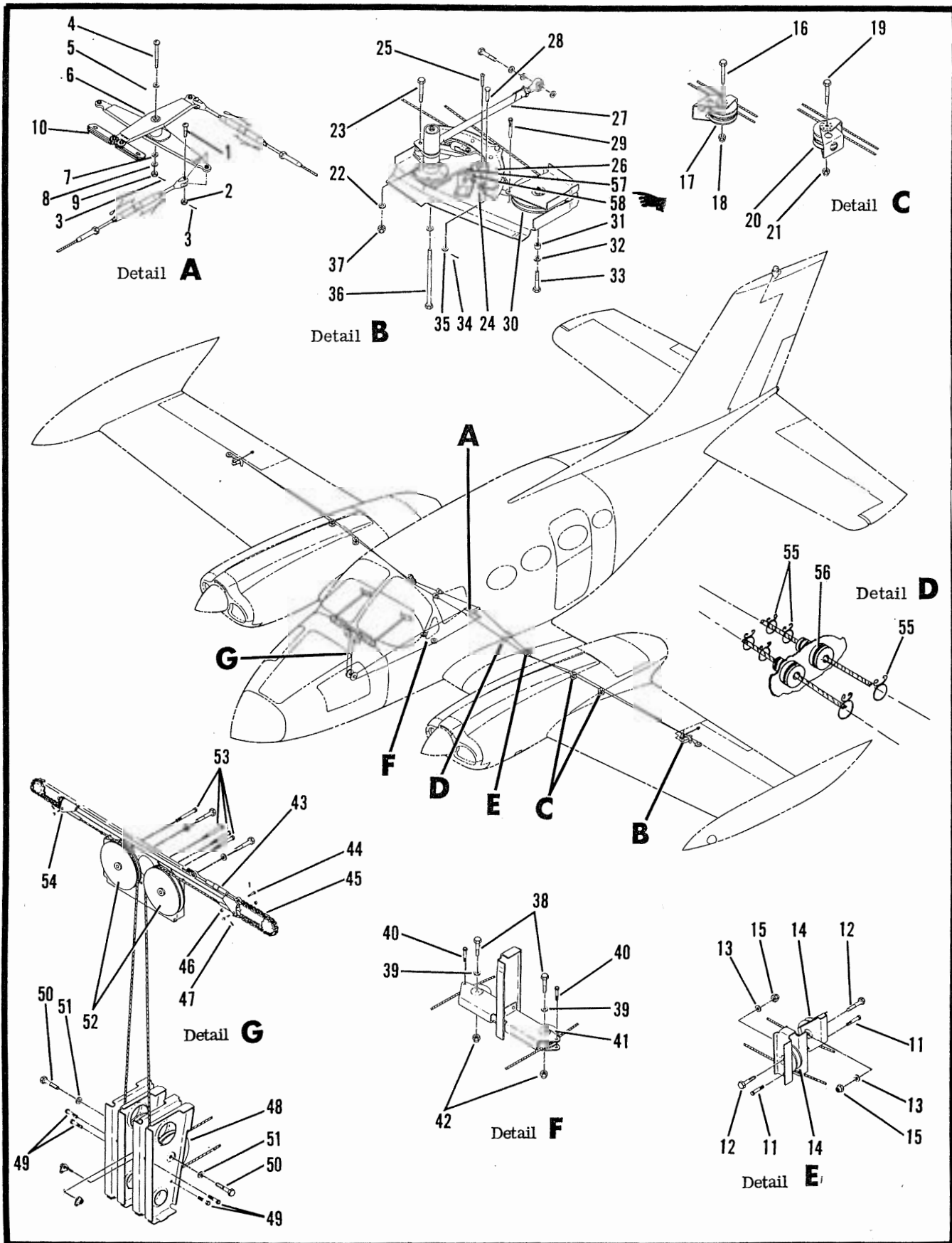


Figure 5-3. Aileron Control System

Figure 5-3. Aileron Control System Callouts

1. Bolt	16. Bolt	29. Cable Guard Pin	44. Bolt
2. Nut	17. Pulley	30. Pulley	45. Chain
3. Cotter Pin	18. Nut	31. Spacer	46. Nut
4. Pivot Bolt	19. Bolt	32. Washer	47. Cotter Pin
5. Washer	20. Pulley	33. Bolt	48. Pulley
6. Fuselage Bellcrank	21. Nut	34. Cotter Pin	49. Cable Guard Pin
7. Washer	22. Washer	35. Washer	50. Bolt
8. Washer	23. Bolt	36. Pivot Bolt	51. Washer
9. Nut	24. Nut	37. Nut	52. Pulley
10. Link	25. Screw	38. Bolt	53. Cable Guard Pin
11. Cable Pin	26. Wing Bellcrank	39. Washer	54. Interconnect Assembly
12. Bolt	Assembly	40. Cable Guard Pin	55. Retaining Ring
13. Washer	27. Aileron	41. Pulley	56. Cable Seal
14. Pulley	Push-pull Tube	42. Nut	57. Stop Bolt
15. Nut	28. Pin	43. Turnbuckle	58. Safety Wire

- g. Install cable guard pins in pulley brackets.
- h. Install cable seals (56) as follows:
 - 1. Insure that the cables are lubricated for the full length of its travel within the seals.
 - 2. Pack the seals with MIL-G-81322A lubricant.
 - 3. Place the seals on cable on nonpressurized side of bulkhead with small end of seal toward bulkhead.
 - 4. Insert seal in the bulkhead hole so that bulkhead metal is seated within the retaining groove of seals and so that the small end of seal is in the pressurized section.
 - 5. Install proper retaining rings in the grooves on the seal (two on small end and one on large end).
 - i. Rig aileron control system in accordance with rigging procedure.
 - j. Install safety on turnbuckles.
 - k. Reinstall all access panels.

Removal of Aileron Fuselage Bellcrank. (See figure 5-3.)

NOTE

See figure 1-2 and remove floorboard access panel (80).

- a. Relieve tension on aileron control system by removing turnbuckle clips and loosening the aileron cable turnbuckles.
- b. Disconnect turnbuckle forks from bellcrank by removing nuts, washers and bolts.
- c. Remove pivot bolt (4) and work bellcrank through floorboard access hole.

NOTE

Repair of aileron fuselage bellcrank is limited to replacement of defective bearings and spacers.

Installation of Aileron Fuselage Bellcrank. (See figure 5-3.)

- a. Installation of aileron fuselage bellcrank is the

- reversal of the removal procedures.
- b. Rig aileron control system in accordance with rigging procedures.
- c. Safety turnbuckles by installing clips.
- d. Install access panel.

WARNING

Make sure ailerons move in the correct direction when operated by the control wheel.

Removal of Aileron Wing Bellcrank. (See figure 5-3.)

NOTE

See figure 1-2 and remove floorboard access panel (80), wing plug buttons (67 and 68) and wing access panel (27).

- a. Relieve tension on aileron control system by loosening the aileron control cable turnbuckles at the fuselage bellcrank assembly (6).
- b. Disconnect wing aileron cables from wing bellcrank assembly (26) by removing the cable guard pins, washers and cotter pins and attaching screws and nuts.
- c. Disconnect aileron push-pull tube (27) from wing bellcrank assembly (26) by removing attaching nut, washer and bolt.
- d. Remove pivot bolt (36) from wing bellcrank assembly (26) and work bellcrank through wing access hole.

NOTE

Repair of aileron wing bellcrank is limited to replacement of defective bearings and spacers.

Installation of Aileron Wing Bellcrank. (See figure 5-3.)

- a. Installation of wing bellcrank is the reversal of the removal procedures.

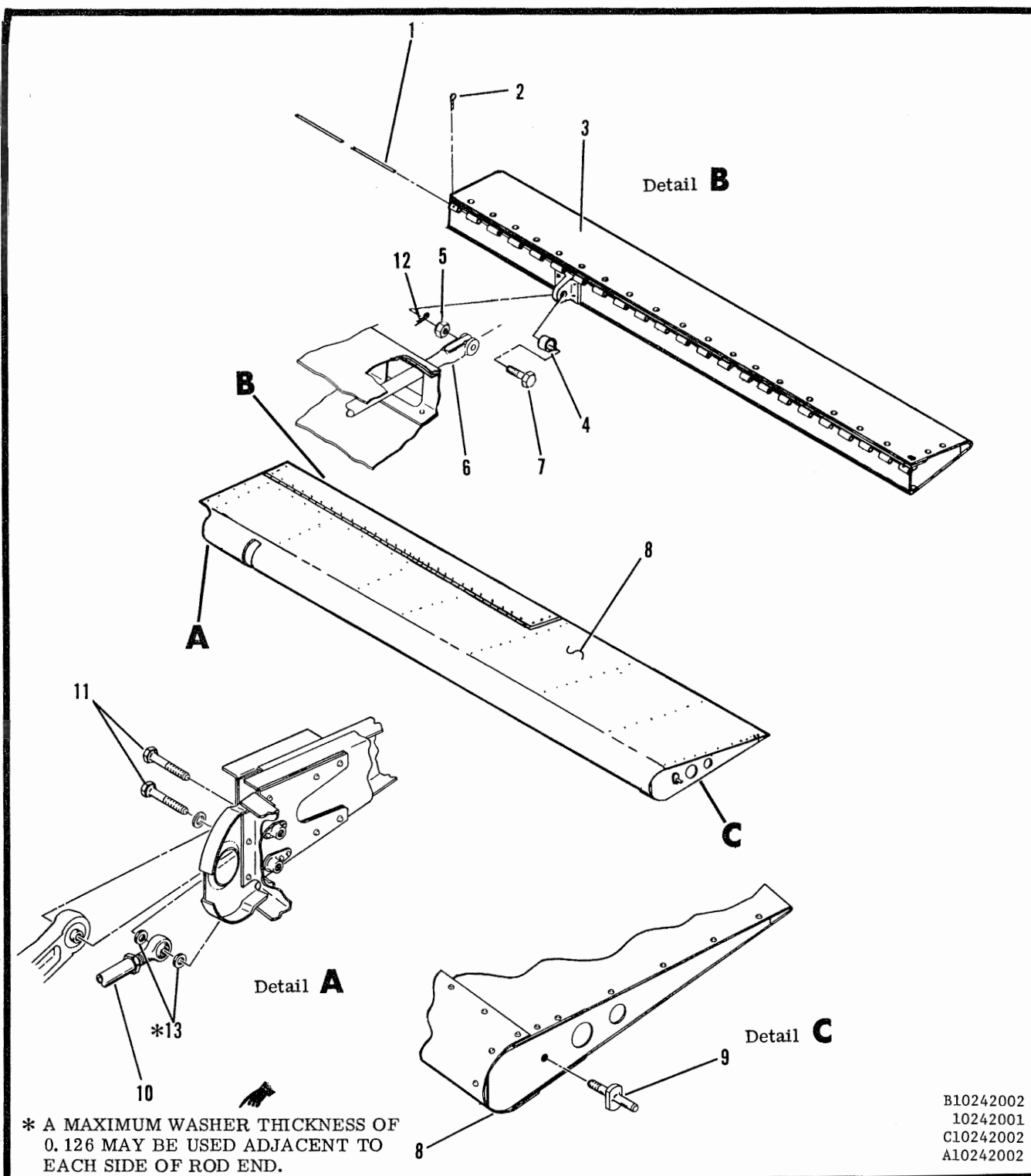


Figure 5-4. Aileron and Aileron Trim Tab Installation

CAUTION

Do not over-torque pivot bolt (36) or serious binding may result.

- b. Rig aileron control system in accordance with rigging procedures.
- c. Safety turnbuckles by installing clips.
- d. Install fuselage and wing access panels.

WARNING

Make sure ailerons move in the correct direction when operated by the control wheel.

Rigging Aileron Control System. (See figure 5-3.)

NOTE

See figure 1-2 and remove center floorboard access panel (80), fuselage access panel (15) and wing access panel (27).

- a. Place pilot's control wheel in neutral position and install control column gust lock.

NOTE

The next steps may be omitted if copilot's wheel is aligned in neutral with pilot's control wheel.

- 1. Loosen turnbuckle on crossover chain and adjust copilot's control column sprocket to provide the neutral position. Chain tension should be the minimum necessary to remove slack from chain.
- 2. Align interconnect assembly as shown in figure 5-2.

AILERON TRIM CONTROL SYSTEM.

Trouble Shooting Aileron Trim Control System.

- b. Loosen fuselage and wing aileron cable turnbuckles to provide free swivel of fuselage bellcrank assembly (6).
- c. Adjust fuselage aileron cables as necessary to bring fuselage bellcrank to neutral position.
- d. Rig fuselage aileron cables to provide 25 ± 5 pounds tension.
- e. Retain control column gust lock in place; streamline trailing edge of aileron with edge of flap and secure aileron in place with a temporary locking device.

NOTE

Rig each wing aileron separately.

- f. Remove excess slack in wing aileron cables by tightening turnbuckles.
- g. Rig wing aileron cables to 25 ± 5 pounds tension.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of 4 hours.

- h. Remove control column gust lock and temporary aileron locking device and check aileron for the neutral position.
- i. Adjust wing aileron bellcrank stop bolts (57) to provide 20° up and down travel with a plus one and minus zero tolerance.
- j. Tighten jam nuts, safety turnbuckles and bellcrank stop bolts (57) and check for obstructed travel.
- k. Check all pulleys for cable guard pins in place.

WARNING

Insure that ailerons move in the proper direction when operated by the control wheel.

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE	Cable tension too high.	Adjust tension in accordance with rigging procedure.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Cables not in place on pulleys during installation.	Install cables on pulleys correctly.
	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB	Cable tension too low.	Adjust tension in accordance with rigging procedures.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cable on pulleys correctly and check cable guards.
	Worn trim tab actuator.	Repair or replace actuator.

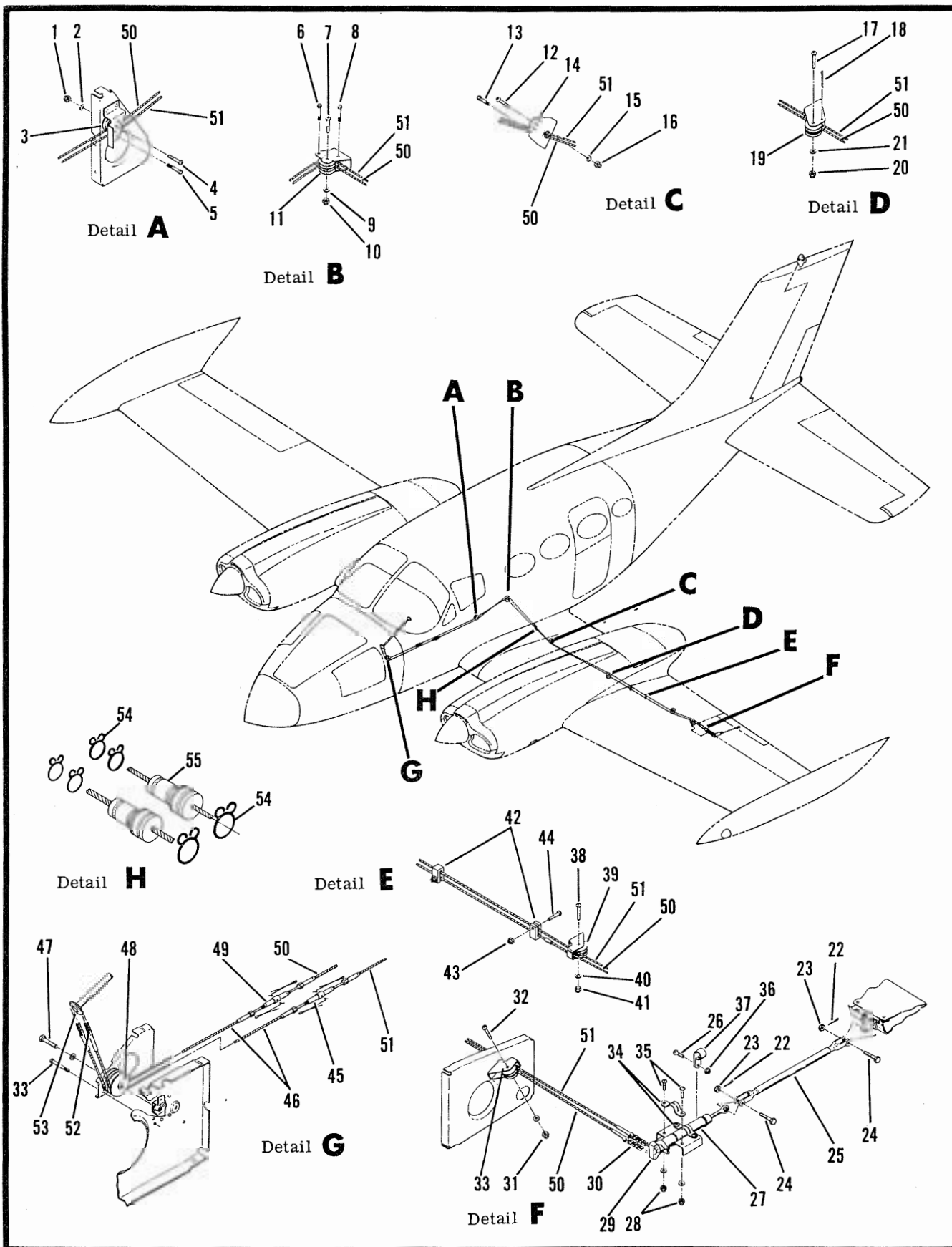


Figure 5-5. Aileron Trim Control System

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM INDICATOR FAILS TO INDICATE CORRECT TRIM POSITION	Indicator incorrectly engaged with wheel track.	Engage indicator on track.
INCORRECT TRIM TAB TRAVEL	Travel stop blocks loose or incorrectly adjusted.	Adjust stop blocks in accordance with rigging procedures.
CORRECT TRAVEL CANNOT BE OBTAINED BY ADJUSTING STOP BLOCKS	Actuator screw incorrectly adjusted.	Adjust in accordance with rigging procedures.

1. Install access panels in aircraft.

NOTE

An Inclinometer for measuring control surface travel is available from Cessna Service Parts Center. (See figure 5-8.)

Removal of Aileron Trim Control Cables and Chains.
(See figure 5-5.)

NOTE

See figure 1-2 and remove fuselage access panel (15), floorboard access panels (80 and 86) and left wing panels (27, 64 and 66).

- a. Remove RH access cover on pedestal.
- b. Disconnect turnbuckles (45 and 49) and remove forward fuselage aileron trim cable and chain (46) from aircraft through fuselage cable access.
- c. Remove cable guard pins from fuselage and wing aileron trim pulley brackets.
- d. Remove chain guard (29) from trim tab actuator (27).
- e. Remove cable seals (55).

- f. Remove stop blocks (42) from main aileron trim cables in LH wing.

- g. Connect guide wires to main aileron trim cable terminals in fuselage area and remove aileron trim cable from aircraft through wing access panel.

NOTE

Leave guide wires in aircraft to serve as a guide for cable reinstallation.

Installation of Aileron Trim Control Cables and Chains. (See figure 5-5.)

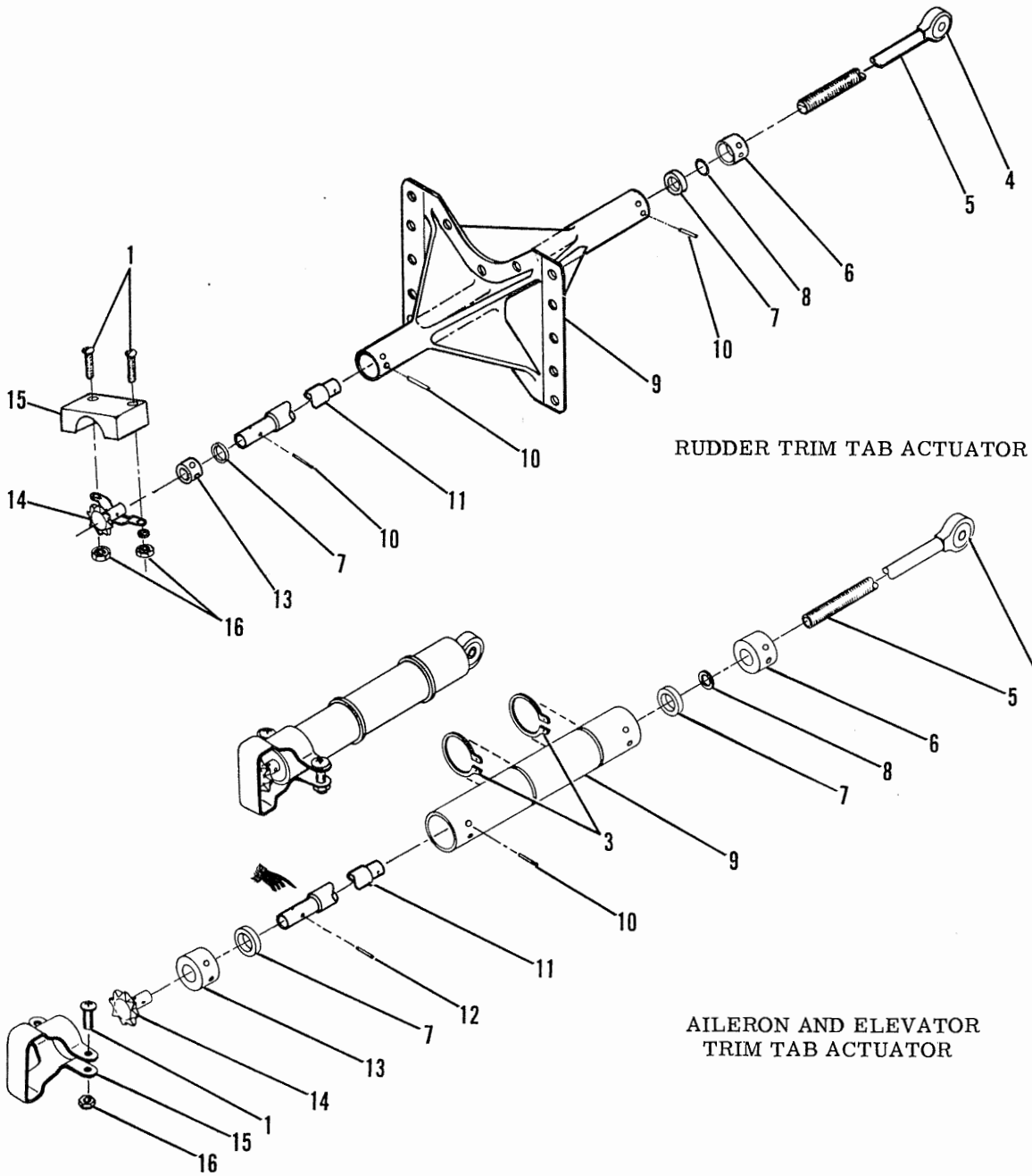
- a. Install aileron trim cables by reversing removal procedures and rig in accordance with aileron trim rigging procedure.
- b. Install aileron trim cable seals (55) in accordance with aileron cable seal installation procedures.

Removal of Aileron Trim Tab Actuator. (See figure 5-5.)

- a. Remove LH aileron in accordance with aileron removal procedure.
- b. Disconnect turnbuckles on aileron trim cables.

Figure 5-5. Aileron Trim Control System Callouts

1. Nut	19. Pulley	37. Clamp
2. Washer	20. Nut	38. Bolt
3. Pulley	21. Washer	39. Pulley
4. Bolt	22. Cotter Pin	40. Washer
5. Cable Pin	23. Nut	41. Nut
6. Cable Pin	24. Bolt	42. Stop Block
7. Bolt	25. Push-pull Tube	43. Nut
8. Cable Pin	26. Screw	44. Bolt
9. Washer	27. Trim Tab Actuator	45. Turnbuckle
10. Nut	28. Nut	46. Forward Aileron Trim Cable
11. Pulley	29. Chain Guard	47. Bolt
12. Bolt	30. Chain	48. Pulley
13. Cable Pin	31. Nut	49. Turnbuckle
14. Pulley	32. Bolt	50. RH Aileron Trim Cable
15. Washer	33. Cable Guard	51. LH Aileron Trim Cable
16. Nut	34. Clip	52. Chain
17. Bolt	35. Screw	53. Sprocket
18. Cotter Pin	36. Nut	54. Retaining Ring
		55. Cable Seal



1. Screw	6. Bearing	12. Groov-Pin
2. Deleted	7. Collar	13. Bearing
3. Retaining Ring	8. O-ring Packing	14. Sprocket
4. Bearing	9. Housing	15. Chain Guard
5. Screw	10. Groov-Pin	16. Nut
	11. Screw	

Figure 5-6. Trim Tab Actuators

- c. Relieve tension on aileron trim control system by disconnecting turnbuckles in forward cabin section.
- d. At the aileron trim tab actuator assembly, remove chain guard (29) and disengage chain (30) from sprocket.
- e. Remove cotter pin, nut, washer and bolt attaching push-pull tube (25) to aileron trim actuator (27).
- f. On forward side of rear spar, remove nuts, bolts, and clips (34).
- g. On aft side of rear spar, remove nut, bolt and clamp (37).
- h. (See figure 5-6.) Remove forward retaining ring (3) from housing (9).
- i. Remove aileron trim tab actuator (27) from aircraft through rear spar.

Disassembly, Overhaul and Assembly of Trim Tab Actuators (See figure 5-6.)

- a. Disassemble aileron trim tab actuator assembly in accordance with exploded view, figure 5-6. This view clearly illustrates the proper relationship of all component parts.
- b. Do not remove bearing (4) from screw (5) unless replacement of parts is required.
- c. Clean all component parts, except bearing (4), by washing in suitable solvent. Do not clean sealed bearing (4).
- d. Inspect all component parts for obvious indications of damage such as stripped threads, cracks, deep nicks and dents.
- e. Check bearings (6 and 13) and screws (5 and 11) for excessive wear and scoring. Dimensions of parts shall be as follows:

Front bearing (13) ID	.....	0.373 in. min.
	.....	0.380 in. max.
Rear bearing (6):		
Small hole ID	.....	0.248 in. min.
	.....	0.253 in. max.
Large hole ID	.....	0.373 in. min.
	.....	0.380 in. max.
Screw (5) OD (Shank)	.....	0.242 in. min.
	.....	0.246 in. max.
Screw (11) OD	.....	0.367 in. min.
	.....	0.370 in. max.

NOTE

Relative linear movement between internal threaded screw (11) and bearing (6) should be 0.008 to 0.012 inch on rudder trim tab actuator when set at room temperature.

NOTE

Relative linear movement between internal threaded screw (11) and bearing (6) should be 0.004 to 0.010 on aileron and elevator trim tab actuator when set at room temperature.

- f. Examine screws (5 and 11) for damaged threads or dirt particles that may impair smooth operation.
- g. Check sprocket (14) for broken, chipped and/or worn teeth.
- h. Check bearing (4) for smoothness of operation.
- i. Do not attempt to repair damaged or worn parts of the actuator assembly. Discard all defective items and install new parts during reassembly.
- j. Always discard the following items and install new parts during reassembly: nuts (16), groov-pins (10 and 12) and O-ring packing (8).
- k. During reassembly, lubricate collars (7) and screw (11) with general purpose lubricating grease.
- l. Reassemble actuator in accordance with the following:
 - m. Slip bearing (13) and collar (7) on screw (11).
 - n. Press sprocket (14) into hollow end of screw (11), making sure pin holes are aligned. Press two new groov-pins (12) into pin holes.
 - o. Insert screw (11), with assembled parts, into housing (9).

NOTE

Locate sprocket (14) at the end of housing (9) which is farthest from the groove for retaining ring (3).

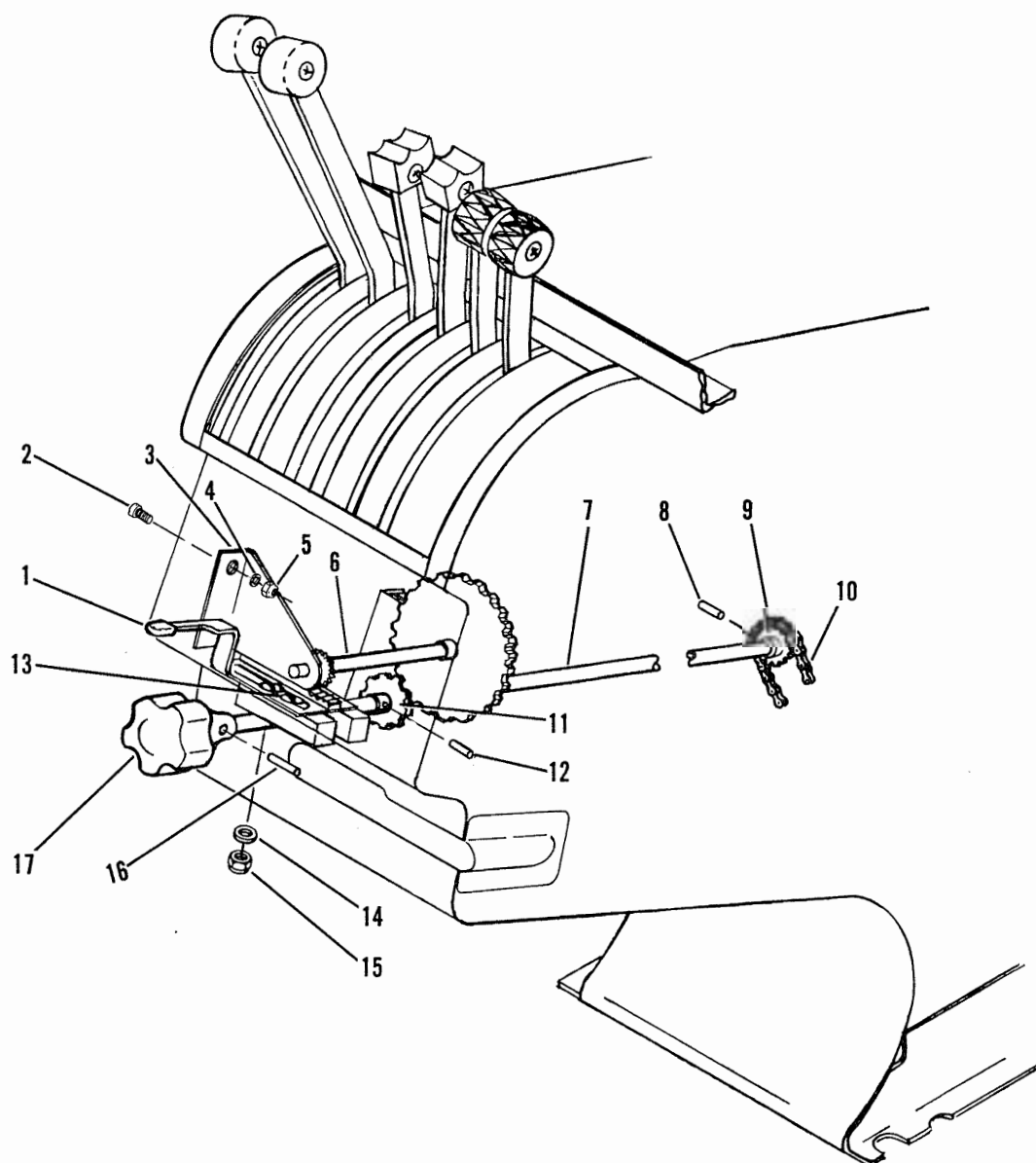
- p. Align pin holes in bearing (13) and housing (9). Press new groov-pin (10) into pin holes.
- q. Insert collar (7), new O-ring (8) and bearing (6) into end of housing (9). Align pin holes in bearing and housing and install new groov-pin (10).
- r. If new parts are required, press bearing (4) into boss at end of screw (5). Be sure force bears against outer race of bearing. Install screw (5) in housing (9) and screw (11).
- s. Install retaining rings (3) in grooves provided on outside of housing (9).
- t. Test actuator assembly by rotating sprocket (14) with fingers while holding bearing end of screw (5). Screw (5) should travel in and out of housing (9) smoothly, with no indication of binding.

NOTE

Relative end movement between screw (5) and collar (7) should be 0.008 to 0.012 inch when set a room temperature.

Installation of Aileron Trim Tab Actuator. (See figure 5-5.)

- a. Secure aileron trim tab actuator (27) in position with clamp (37) and clips (34).
- b. Engage chain (30) on sprocket and install chain guard (29) with screws and nuts.
- c. Reconnect forward and main aileron trim cables with turnbuckles (45 and 49) and tighten cables to 10 ±3 pounds tension and safety turnbuckle.



- 1. Pointer
- 2. Screw
- 3. Bracket
- 4. Washer
- 5. Nut
- 6. Gear Assembly

- 7. Shaft
- 8. Roll Pin
- 9. Sprocket
- 10. Chain
- 11. Gear

- 12. Roll Pin
- 13. Screw
- 14. Washer
- 15. Nut
- 16. Roll Pin
- 17. Knob

Figure 5-7. Aileron Trim Control Knob and Pointer Assembly.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of 4 hours.

- d. Connect aileron trim tab push-pull tube (25) to actuator (27) with bolt, washer, nut and cotter pin.
- e. Install left aileron in accordance with installation and rigging procedures.
- f. Rotate aileron trim control knob to the neutral position and align aileron with the trailing edge of wing.
- g. Position the trailing edge of trim tab with aileron trailing edge.
- h. Align push-pull tube (25) with trim tab horn and secure with bolt and nut.
- i. Check aileron trim tab for proper operation, correct travel and rigging.
- j. Install access covers.

Removal of Aileron Trim Control Knob and Pointer Assembly. (See figure 5-7.)

- a. Remove pedestal access covers.
- b. Remove gear assembly (6) and bracket (3) from pedestal assembly.

- c. Remove pointer assembly (1) by removing four attaching screws (13).
- d. Relieve tension on aileron trim control system by loosening turnbuckles.
- e. Disengage roller chain (10) from sprocket (9) and slide sprocket from shaft (7).
- f. Remove roll pin (12) from gear (11) and slide shaft (7) from pedestal assembly.

Installation of Aileron Trim Control Knob and Pointer Assembly (See figure 5-7.)

- a. Installation of trim control knob and pointer is the reversal of the removal procedure.
- b. Check rigging and rig, if necessary, in accordance with Rigging of Aileron Trim Control System.

Rigging of Aileron Trim Control System. (See figure 5-5.)

NOTE

See figure 1-2 and remove cable access panel (15), floorboard access panels (80 and 83) and wing access panels (27, 65 and 66).

- a. Remove safety from turnbuckles (45 and 49) and adjust cable tension to 10 ± 3 pounds.

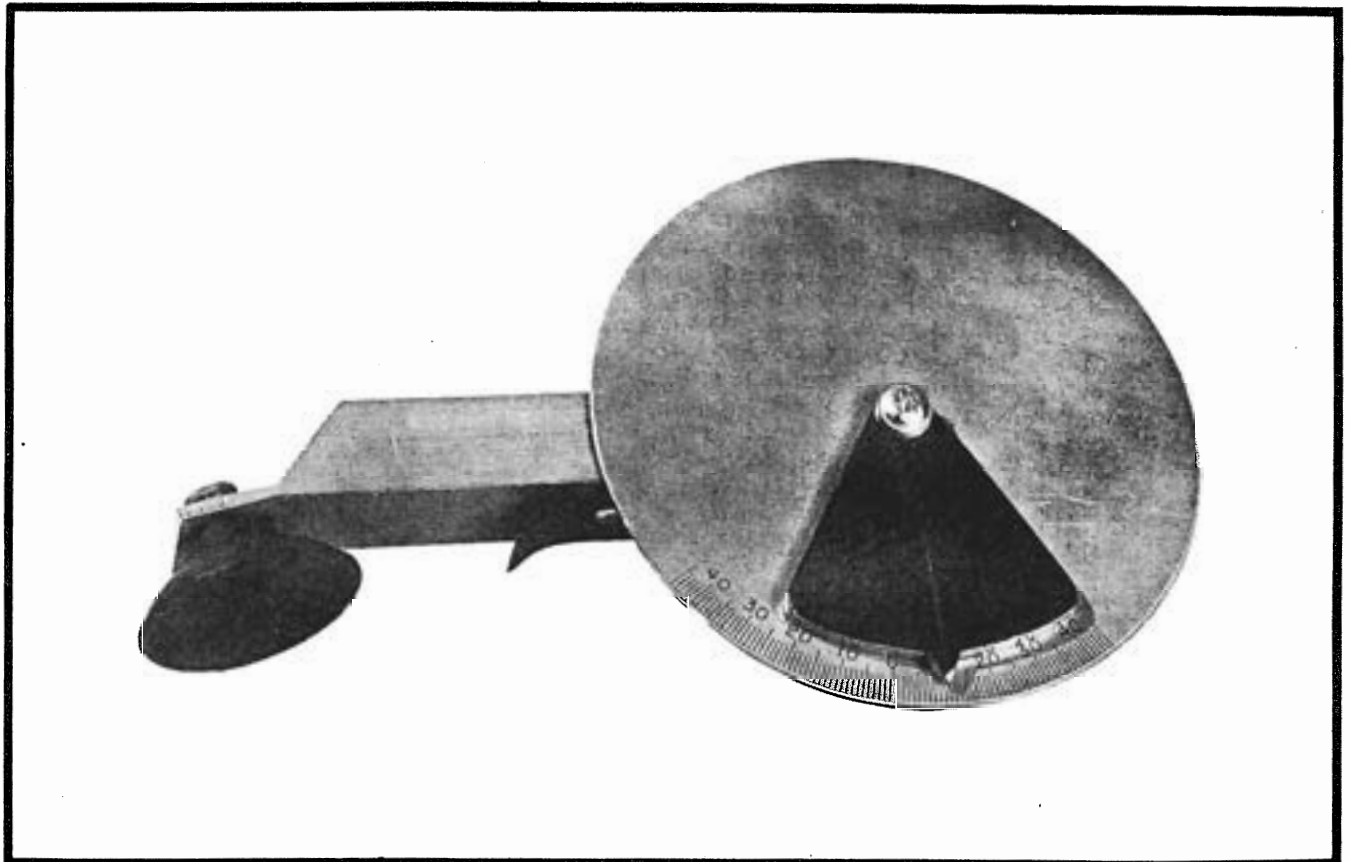


Figure 5-8. Inclinator SE716 for Measuring Control Surface Travel

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of 4 hours.

- b. Move aileron trim control system to neutral by rotating control knob.
- c. Check to make sure ends of chain (30) are equal in length from sprocket on actuator (27) and ends of chain (52) are equal in length from sprocket (53).
- d. (See figure 5-7.) Adjust aileron trim indicator to neutral by removing screw and raising bracket (3) to allow pointer (1) to move to the center.
- e. (See Figure 5-5.) Remove cotter pin (22), nut (23) and bolt (24) attaching push-pull tube (25) to aileron trim tab.
- f. Align aileron with trailing edge of wing and place trim tab in neutral.
- g. (See figure 5-5.) Adjust screw of trim tab actuator (27) so that hole in push-pull tube (25) is in line with hole in trim tab horn.
- h. (See figure 5-5.) Install bolt (24), nut (23) and cotter pin (22).

- i. Loosen stop blocks (42), move trim tab to 20 plus one, minus zero degrees DOWN, slide outboard stop block against outboard rib assembly at station 129.24 and tighten stop block.

NOTE

Stop blocks (42) should be installed so that bottom cable passes through bushing and top cable is clamped by stop blocks.

- j. Move trim tab to 20 plus one, minus zero degrees UP, slide inboard stop block against inboard rib assembly at station 118.24 and tighten stop block.

WARNING

Insure that aileron moves in the proper direction when operated by trim knob.

- k. Install all access panels.

SECTION 6

ELEVATOR AND TRIM CONTROL SYSTEMS

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CAUTION

Primary and secondary flight control cables, push pull tubes, bellcranks and mountings on late model aircraft use dual locking fasteners. The lock nuts for these fasteners incorporate a fiber lock, and are castellated for safetying with a cotter pin. When any of these areas are disconnected on any aircraft, new dual locking fasteners should be installed. See the Aircraft Parts Catalog for part numbers and location of these fasteners.

ELEVATORS.

The elevator control surfaces consist of two elevator assemblies connected by a torque tube, and an elevator trim tab located at the trailing edge of the right elevator. Each elevator is attached to the rear spar of the horizontal stabilizer at two hinge points. Each hinge has a sealed bearing. The elevators are operated by an arm to which the elevator torque tubes are bolted. Each elevator is 100% static balanced with the elevator trim tab and elevator arm attached, at the time of installation.

Removal of Elevators. (See figure 6-1.)

- Refer to Section 3 (Removal of Horizontal Stabilizer) and remove stinger and access covers.
- (See figure 6-2.) Disconnect elevator trim tab push-pull tube (19) by removing cotter pin, nut, washer and bolt.

- (See figure 6-2.) Remove push-pull tube (19) by unscrewing from actuator.
- Disconnect bonding strap (16) by removing attaching screws.
- Remove fiberglass tip (15) by removing attaching screws.
- Remove nut (21), washer (22) and remove pin (19) by installing washers and nut on the opposite end of pin and tighten nut as required to free pin.
- Remove nuts (47) and screws (48) securing elevator collar to elevator arm.
- Remove elevator hinge by removing cotter pins, nuts (27), washers (26) and bolts (25).
- Remove collar (46) from torque tube.

CAUTION

The elevator collar (46) and elevator torque tube (45) are drilled and taper reamed as a matched set and must be replaced as a matched set.

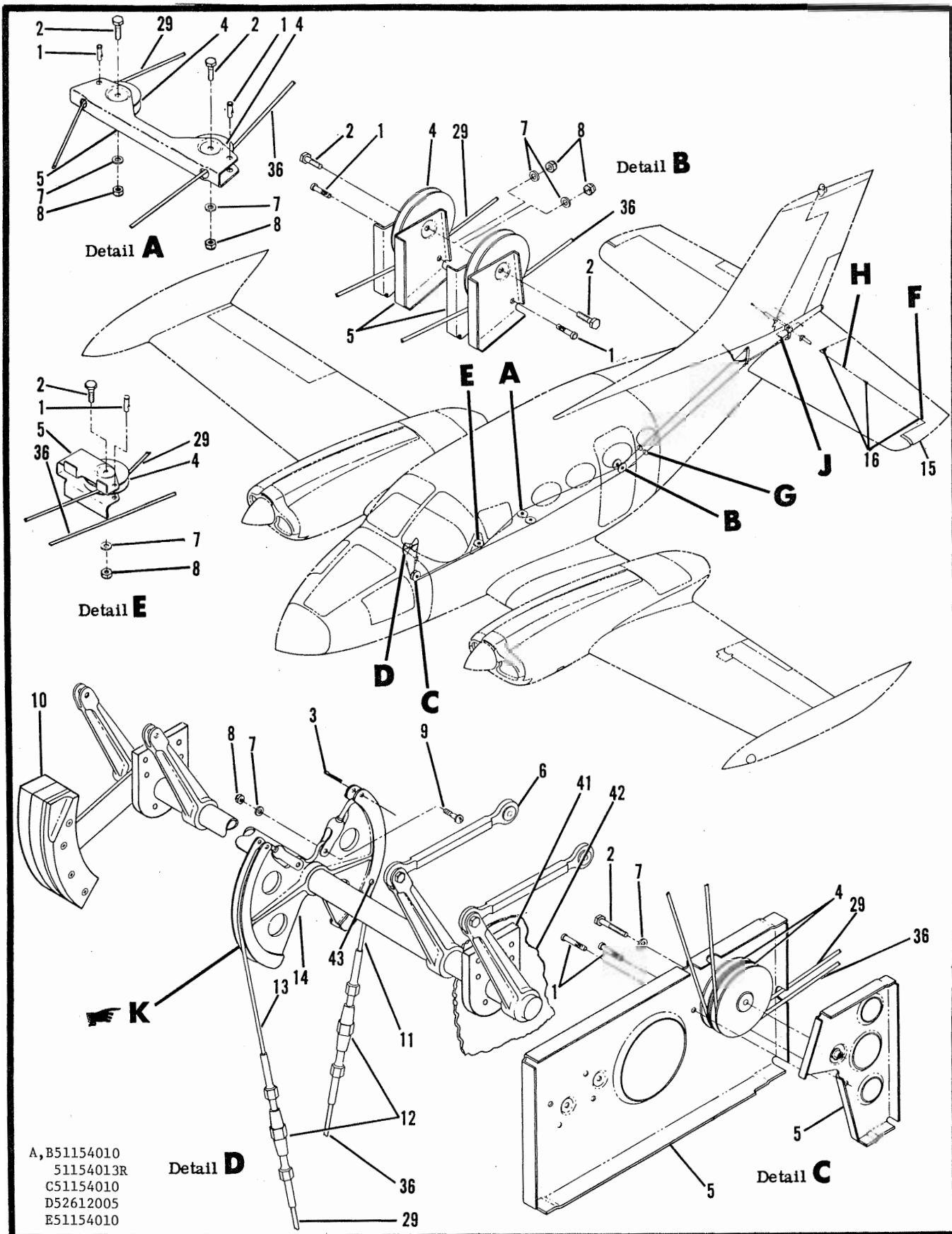
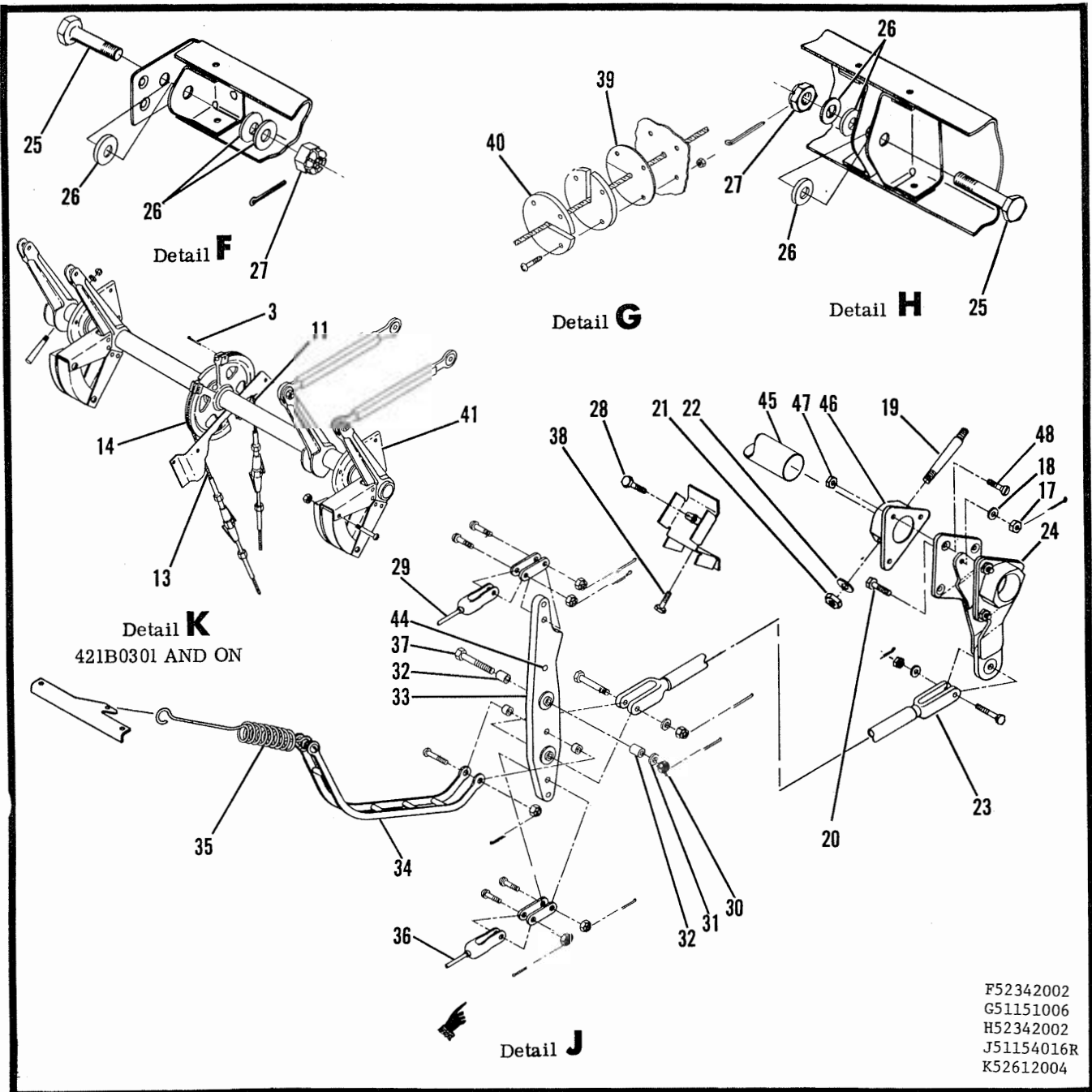


Figure 6-1. Elevator and Elevator Bellcrank (Sheet 1 of 2)



F52342002
G51151006
H52342002
J51154016R
K52612004

1. Cable Guard Pin	13. Right Forward Cable	25. Bolt	37. Bolt
2. Bolt	14. Quadrant	26. Washer	38. Up Stop Bolt
3. Cotter Pin	15. Fiberglass Tip	27. Nut	39. Gasket
4. Pulley	16. Bonding Strap	28. Down Stop Bolt	40. Seal
5. Pulley Bracket	17. Nut	29. Right Aft Cable	41. Bearing Pad
6. Push Rod	18. Washer	30. Nut	42. Support
7. Washer	19. Pin	31. Washer	43. Rigging Pin Hole
8. Nut	20. Bolt	32. Spacer	44. Rigging Pin Hole
9. Screw	21. Nut	33. Elevator Bellcrank	45. Torque Tube
10. Bob Weight	22. Washer	34. Down Spring Arm	46. Collar
11. Left Forward Cable	23. Push-pull Tube	35. Down Spring	47. Nut
12. Turnbuckles	24. Elevator Arm	36. Left Aft Cable	48. Screw

Figure 6-1. Elevator and Elevator Bellcrank (Sheet 2)

j. Remove the elevator by pulling aft and outboard while guiding the torque tube through the horizontal stabilizer ribs.

NOTE

Counterweights are located in the forward outboard elevator tips. Support the elevator tips during removal to prevent damage to elevator during removal.

Installation of Elevators. (See figure 6-1.)

a. Reverse the elevator removal procedure.

NOTE

Install pin (19) with wet primer and tighten nut (21) to 50 +10, -10 inch-pound torque.

b. If a new collar is being installed on an original elevator, proceed as follows:

1. Install elevator on aircraft with new collar in place. Install screws securing collar (46) to elevator arm (24).

NOTE

The replacement collar will be 1.85 inch long. Make sure of identification of part because right and left hand parts are not interchangeable.

2. Using external control locks, lock elevators in a neutral position.

3. Using the pilot holes in the collar, drill a 1/8" (.125) hole through elevator torque tube.

4. Enlarge hole in stages until small end of a Number 4 B&S taper reamer will enter the hole.

5. Line ream hole with number 4 reamer to a diameter which will permit taper pin to extend not more than 1/16 inch above surface of collar.

6. Install taper pin (19) with wet primer, position AN975-5 washer (22) over pin and secure with nut (21). Tighten nut to 50 +10, -10 inch-pound torque. Do not over-torque nut.

c. Check elevator and elevator trim tab for proper operation and correct travel.

ELEVATOR TORQUE TUBE.

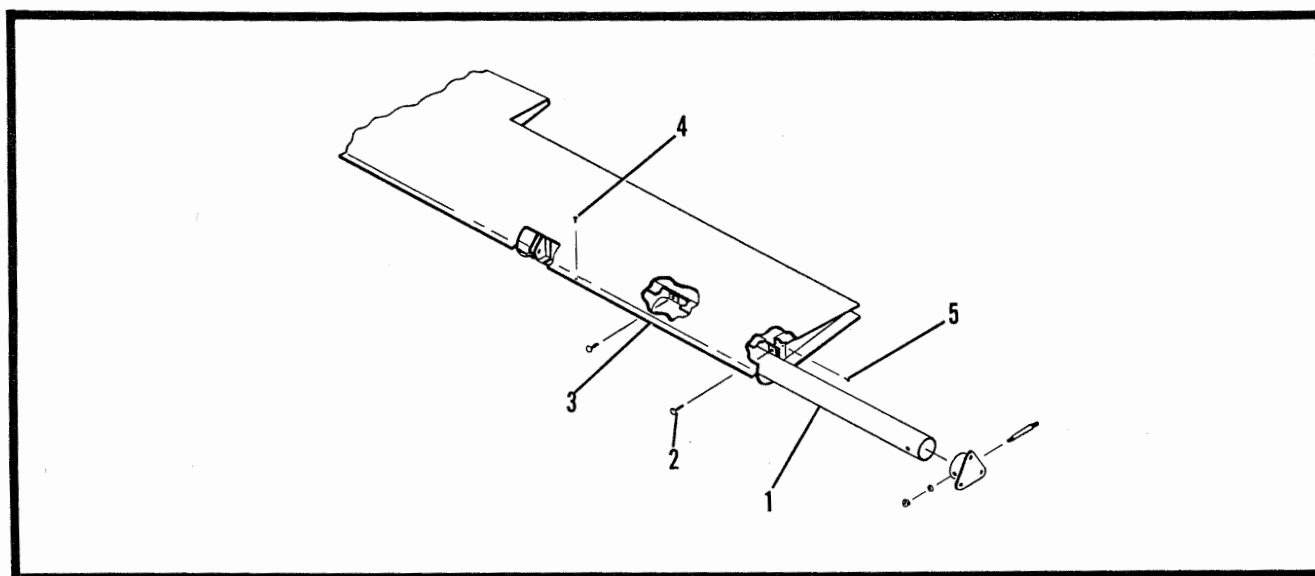
Removal of Elevator Torque Tube. (See figure 6-1A.)

a. Remove elevator from aircraft in accordance with elevator removal procedures.

b. Drill out rivets (4) from leading edge of elevator to gain access to torque tube (1) by spreading leading edge skins (3).

CAUTION

During all drilling operations, take precautions to prevent enlarging holes or damaging existing structure.



1. Torque Tube
2. Screw

3. Leading Edge Skin

4. Rivet
5. Rivet

Figure 6-1A. Elevator Torque Tube

- c. Drill out rivets (5) securing torque tube to rib.
- d. Remove four screws (2) and withdraw torque tube.

Installation of Elevator Torque Tube. (See figure 6-1A.)

- a. Install torque tube in position and secure with four screws (2).

NOTE

To facilitate installation of torque tube, drill out attaching rivets at rib and spar as required to gain access for bucking rivets.

- b. Drill holes through torque tube flange to match drilled out rivet holes in elevator assembly rib.
- c. Secure torque tube flange to rib using same size and type rivets removed.
- d. Resecure elevator skin using the same size and type rivets as that removed.

ELEVATOR TRIM TAB.

Removal of Elevator Trim Tab. (See figure 6-2.)

- a. Disconnect the elevator trim tab push-pull tube (19) by removing cotter pin, nut, washer and bolt.
- b. Remove cotter pin (17) from each end of hinge pin (18).
- c. Remove trim tab by removing hinge pin (18).

Disassembly and Assembly of Elevator Trim Tab.

Disassembly and assembly of the trim tab is limited to removal and installation of trim tab horn. To remove the elevator trim tab horn, proceed as follows:

- a. Remove nuts, washers and screws securing trim tab horn to trim tab.
- b. To install trim tab horn, install screws through horn and secure with washers and nuts.

Installation of Elevator Trim Tab. (See figure 6-2.)

- a. Reverse the elevator trim tab removal procedures.
- b. Check the elevator trim tab for proper operation and travel in accordance with the rigging of elevator trim tab control system.

Troubleshooting Elevator Control

ELEVATOR CONTROL SYSTEM.

The elevators are operated by the fore and aft movement of the control column. The quadrant assembly is attached to the control column by links which are attached to a swivel bearing on the control column. The elevator cable assemblies and adjustable turn-buckles are attached to the quadrant assembly and then routed down under the floor panel and through the fuselage by pulleys to the elevator bellcrank in the tail section. A push-pull tube connects the bellcrank to the elevator arm which is attached to the elevator torque tube. The elevator travel stops, consisting of bolts mounted in a bracket just aft of the bellcrank, are provided for the recommended adjustment. The elevator bob weight is attached to the quadrant assembly torque tube and is provided to stabilize the aircraft in flight. The elevator down spring is attached to the bellcrank and is provided for better elevator balance during flight.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN CONTROL WHEEL AND ELEVATORS	Cable tension too low.	Adjust cable tension in accordance with elevator rigging instructions.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Aft push-pull tube disconnected.	Connect push-pull tube.
RESISTANCE TO ELEVATOR CONTROL MOVEMENT	Cable disconnected.	Connect cables.
	Cable tension too high.	Adjust cable tension in accordance with elevator rigging instructions.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Cable not in place on pulleys.	Install cable correctly.
	Bent elevator or hinge.	Repair or replace elevator or hinge.
INCORRECT ELEVATOR TRAVEL	Defective bearing or bushing in control column or interconnect assembly.	Replace defective bearing or bushing.
	Elevator bellcrank stops incorrectly adjusted.	Adjust in accordance with elevator rigging instructions.
	Elevator cables incorrectly rigged.	Rig cables in accordance with elevator rigging instructions.
	Control wheel is not rigged in the neutral position.	Rig cables in accordance with elevator rigging procedures.
CORRECT ELEVATOR TRAVEL CANNOT BE OBTAINED BY ADJUSTING BELLCRANK STOPS	Bob weights contacting or rubbing.	Provide clearance if rubbing or contacting other equipment.

Removal of Elevator Control Cables. (See figure 6-1.)

- a. Remove seat, cabin divider (optional equipment), refreshment bar (optional equipment), toilet (optional equipment), carpet, tailcone access and pedestal left access in accordance with Section 3.
- b. (See figure 1-2.) Remove floorboards access (73, 77, 80, 82, and 84) and cable access (15).
- c. Unsafety turnbuckles (12) and remove; disconnect elevator cables (11 and 13) from quadrant (14) by removing nuts (8), washers (7) and screw (9).
- d. Disconnect elevator cables (29 and 36) from elevator bellcrank (33) by removing cotter pins, nuts, and bolts.
- e. Remove cable seal (40) and gasket (39).
- f. Tie guide wires to forward ends of elevator cables (29 and 36), remove cables by pulling them out aft of cabin compartment, and disconnect guide wires.

NOTE

When removing or installing the elevator cable (29), check the correct routing through the down spring arm (34).

Removal of Elevator Control Quadrant. (See figure 6-1.)

- a. Remove pilot's and copilot's seats in accordance with Section 3.
- b. Remove elevator cables cover by removing screws.
- c. Disconnect cables (29 and 36) at turnbuckles (12).
- d. Disconnect push rods (6) by removing nuts from each control column assembly.
- e. Disconnect bearing pad (41) from supports (42) and the center pedestal structure by removing nuts and bolts.
- f. Remove the elevator control quadrant by tilting the right side up and working the quadrant assembly out on the left hand side of the aircraft.

Installation of Elevator Control Quadrant. (See figure 6-1.)

- a. Installation of elevator control quadrant is the reversal of the removal procedure.
- b. Check rigging in accordance with rigging procedures.

Installation of Elevator Control Cables. (See figure 6-1.)

- a. Reverse the elevator control cable removal procedure except the installation of seats, cabin dividers (optional equipment), refreshment bar (optional equipment), toilet (optional equipment), carpet and cabin tailcone access door.
- b. Rig elevator control system in accordance with rigging the elevator control surface.

Removal of Elevator Bellcrank. (See figure 6-1.)

- a. Remove cabin tailcone access door.
- b. Remove left access cover from pedestal.
- c. Unsafety and loosen either turnbuckle (12) (to release tension on elevator cables).
- d. Disconnect elevator cables (29 and 36) from elevator bellcrank (33) by removing cotter pins, nuts and bolts.

NOTE

If an autopilot (optional equipment) is installed, disconnect from elevator bellcrank.

- e. Disconnect elevator push-pull tube (23) from elevator bellcrank (33) by removing cotter pin, nut, washer and bolt.
- f. Disconnect elevator down spring (35) from bracket and remove cotter pin, nut and bolt from down spring arm (34) at the bellcrank (33).
- g. Remove elevator bellcrank (33) by removing nut (30), washer (31), bolt (37) and spacers (32).

Installation of Elevator Bellcrank. (See figure 6-1.)

- a. Reverse the removal of elevator bellcrank procedures, except the installation of the access door and panel.
- b. Rig the elevator control system in accordance with rigging of elevator control system.

Removal of Elevator Arm. (See figure 6-1.)

- a. Remove stinger in accordance with Section 3.
- b. Remove elevators in accordance with the removal of elevator procedure.
- c. Disconnect elevator push-pull tube (23) from elevator arm (24) by removing cotter pin, nut, washer and bolt.
- d. Remove elevator arm by removing nuts (17), washers (18) and bolts (20) from hinge bracket.

Installation of Elevator Arm. (See figure 6-1.)

- a. Reverse the removal of elevator arm procedures.
- b. Check elevator for proper operation and correct travel.

Removal and Installation of Elevator Down Spring. (See figure 6-1.)

- a. Refer to Section 3, remove rear upholstery panel to tailcone.
- b. Remove cotter pin, nut and screw from down spring arm (34).
- c. Remove down spring (35) by unhooking from structure.
- d. Installation of the elevator down spring is the reversal of the above procedure.

Removal and Installation of Aft Elevator Push-Pull Tube. (See figure 6-1.)

- a. Refer to Section 3, remove rear upholstery panel

to tailcone and stinger.

b. Remove cotter pin, nut, washer and bolt attaching push-pull tube (23) to elevator bellcrank (33).

c. Remove cotter pin, nut, washer and bolt attaching push-pull tube (23) to elevator arm (24) and remove push-pull tube.

d. To install aft elevator push-pull tube, reverse the above procedure.

Rigging of Elevator Control System. (See figure 6-1.)

a. Remove access cover from pedestal, tailcone access door and necessary covers to gain access to elevator push-pull tube.

b. Place a suitable support under tailcone at F. S. 305.94.

NOTE

Cable tension should be measured aft of F. S. 255.00 in tailcone. Cable tension should be adjusted when ambient temperature is 60°F. Allow aircraft temperature to stabilize for a period of four hours.

An inclinometer for measuring control surface travel is available from the Cessna Dealers' Organization. (See figure 5-8.)

c. On aircraft 421-0001 to 421-0050 rig controls as follows:

1. Adjust elevator bellcrank up stop (38) so that elevator travel is 25 +1, -0 degrees up.

2. Adjust elevator bellcrank down stop (28) so that elevator travel is 15 +1, -0 degrees down.

3. Adjust turnbuckles (12) until tension on elevator cables (29 and 36) is 32 ±5 pounds with 5/32" diameter rig pins installed in rigging pin holes (43 and 44).

4. Safetywire turnbuckles (12) and remove rigging pins.

d. On aircraft 421-0050 and On, rig controls as follows:

1. Disconnect elevator push-pull tube (23) from elevator arm (24), by removing cotter pin, nut washer and bolt.

2. Install external control locks between elevator horns and the horizontal stabilizer.

NOTE

On aircraft with a royalite cover over the control column, remove cover and slide aft to facilitate installation of holding tool.

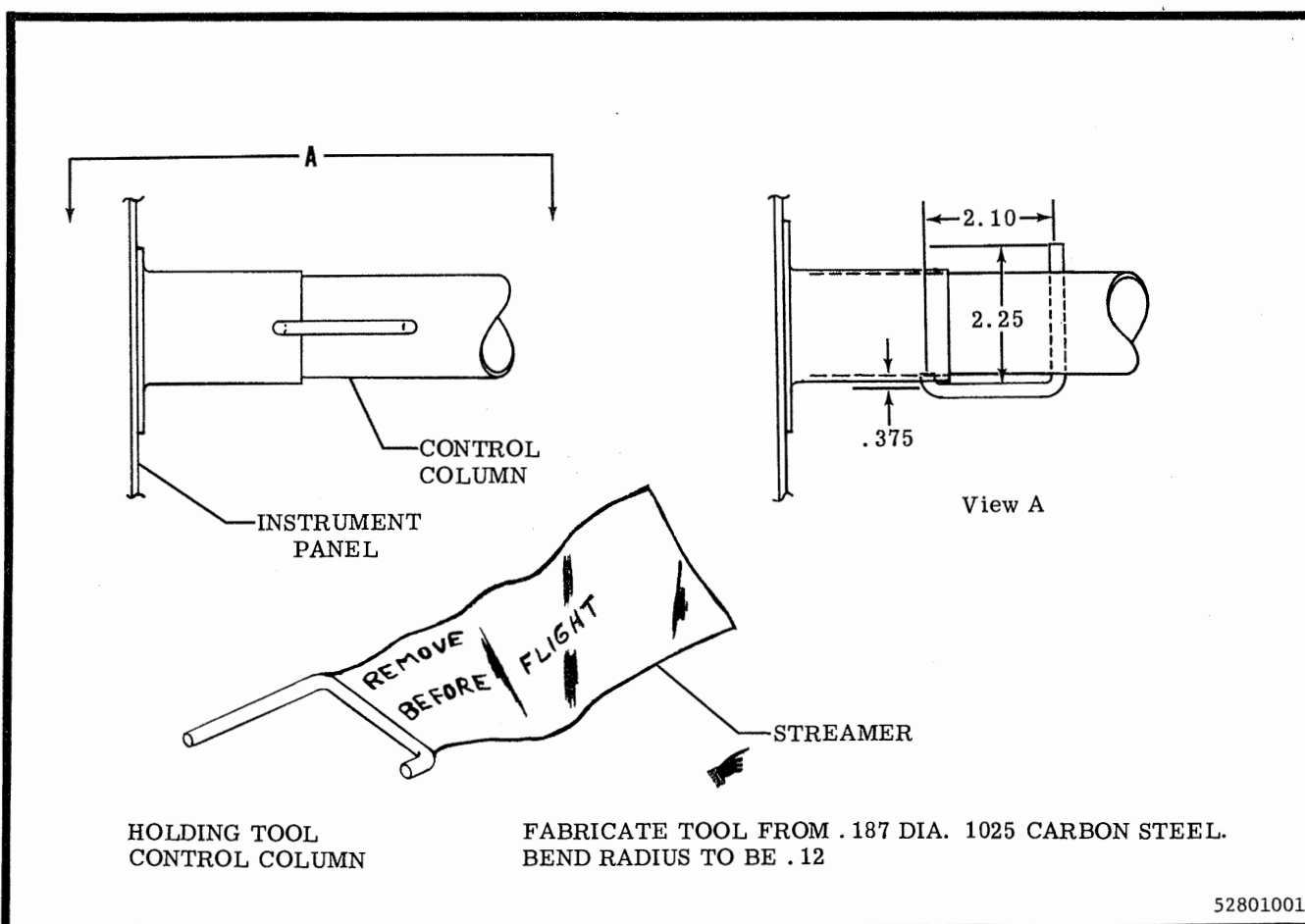


Figure 6-1B. Control Column Holding Tool

3. Fabricate and install a control column holding tool (see figure 6-1B) to secure control column in position.

NOTE

Elevator down spring must be disconnected when adjusting cable tension.

4. Adjust turnbuckles (12) connecting cables (13 to 29) and (11 to 36) until elevator bellcrank (33) is vertical (cable attachment holes equal distance from bulkhead) and cable tension on cables (29 and 36) is 32 $\pm$ 5 pounds.
5. Adjust push-pull tube length to obtain slip fit of push-pull tube attachment bolt and secure to elevator with bolt, washer, nut and cotter pin.
6. Remove external elevator locks.
7. Remove control column holding tool. (Refer to step 6.)

CAUTION

Do not operate elevator from the tips, damage could result.

8. Adjust elevator bellcrank up stop to provide an up travel of 25 $\pm$ 1°, -0°.
9. Adjust elevator bellcrank down stop to provide a down travel of 15 $\pm$ 1°, -0°.

CAUTION

Make sure elevator bellcrank is striking stops and is not limited by other structural interference.

10. Safety turnbuckles and secure all bolts and nuts. Safety nuts with cotter pins.
 - e. Install access covers, center pedestal cover, tailcone access panels, seats and upholstery.

WARNING

Insure that elevator controls have freedom of movement and elevator moves in proper direction when operated by the control wheel. Make sure aileron controls have freedom of movement at the extreme positions of the elevator control.

ELEVATOR TRIM TAB CONTROL SYSTEM.

The elevator trim tab is operated by a control wheel mounted on the left side of the pedestal. The control wheel is attached to a sprocket which drives a chain and cables. The chain and cables are routed to pulleys, forward and down through the pedestal under the floor and aft to the tailcone of the aircraft. In the tailcone, the cables are routed aft to pulleys just forward of the horizontal stabilizer rear spar, then up and through the right horizontal stabilizer to a chain which operates the trim tab actuator. The trim tab push rod connects the trim tab actuator to the elevator trim tab which is mounted to the right elevator by a continuous hinge. The adjustable turnbuckles are located in the forward inspection panel for cable tension adjustment. The stop blocks are located in the tailcone for the adjustment of the elevator trim tab travel.

Troubleshooting Elevator Trim Tab Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB	Cable tension too low.	Adjust cables in accordance with elevator trim control rigging instructions.
	Broken pulley.	Replace pulley.
	Cables not in place on pulley.	Install cables correctly. Check cable guards.
	Worn trim tab actuator.	Repair or replace actuator.
RESISTANCE TO CONTROL WHEEL MOVEMENT	Cable tension too high.	Adjust cable in accordance with elevator trim control rigging instructions.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Cable not in place on pulleys.	Install cable correctly.
	Trim tab actuator defective.	Repair or replace actuator.
INCORRECT ELEVATOR TRIM TAB TRAVEL	Stop block loose or incorrectly adjusted or control wheel not indexed properly on chain.	Adjust stop block or chain in accordance with elevator trim control rigging instructions.

TROUBLE	PROBABLE CAUSE	CORRECTION
CORRECT ELEVATOR TRIM TAB TRAVEL CANNOT BE OBTAINED BY ADJUSTING STOP BLOCK	Actuator screw incorrectly adjusted.	Adjust in accordance with elevator trim control rigging instructions.
INDICATOR DOES NOT INDICATE THE CORRECT TRIM POSITION	Indicator incorrectly engaged with wheel track.	Adjust in accordance with elevator trim control rigging instructions.

Removal of Elevator Trim Control Cables and Chains. (See figure 6-2.)

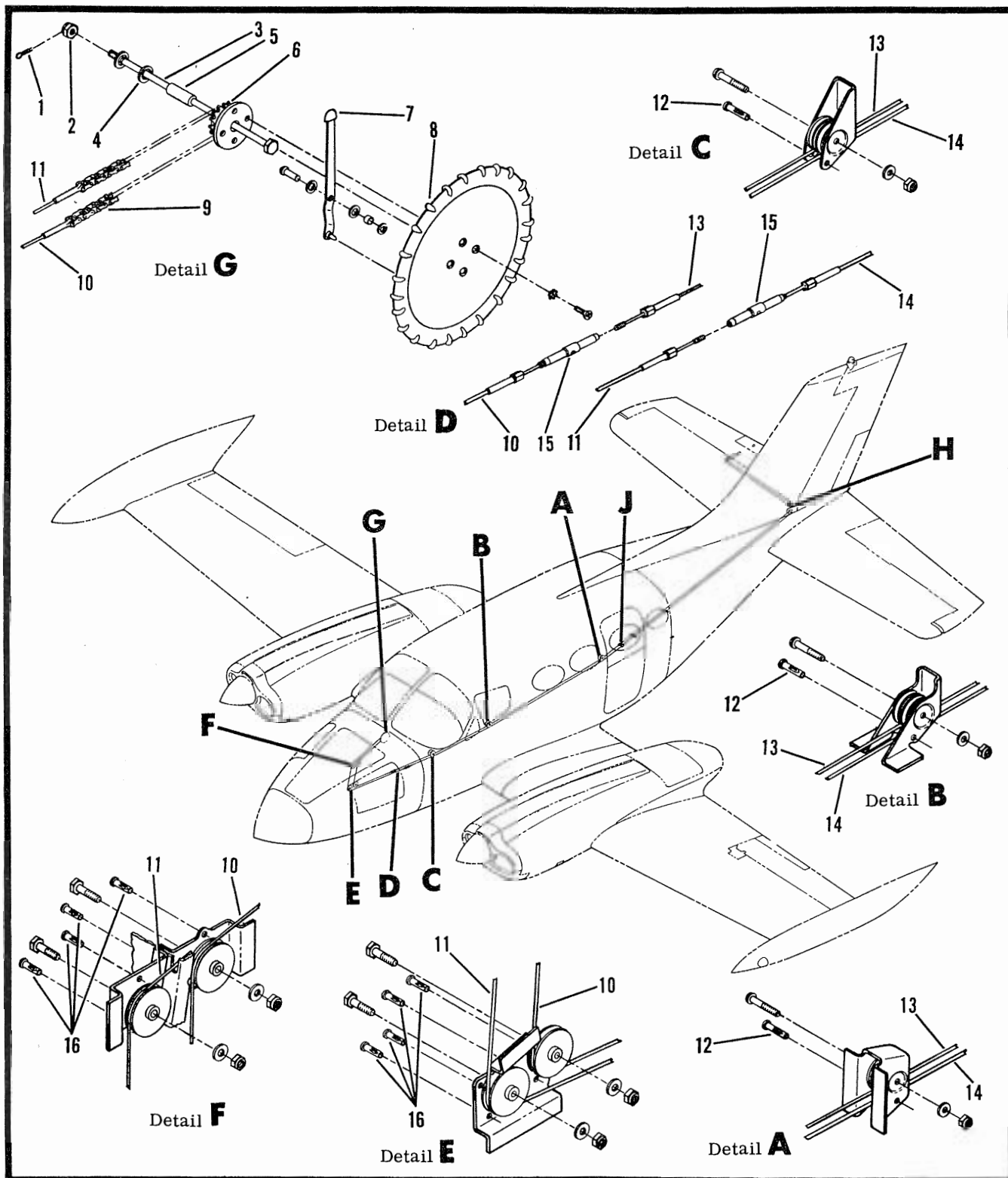
- a. Remove seats, cabin dividers (optional equipment), refreshment bar (optional equipment), toilet (optional equipment), carpet, tailcone access and pedestal aft and right access in accordance with Section 3.
- b. (See Figure 1-2.) Remove floorboard access (77, 80, 82, and 84), fuel selector gearbox access (73) and cable access (15).
- c. (See figure 1-2.) Remove stabilizer fairing (11), stinger (10) and elevator trim tab actuator access panel (19).
- d. Remove elevator trim stop blocks (29) and bushings (30) by removing nut, washer and screw.
- e. Unsafety turnbuckles (15) and disconnect cables by removing turnbuckles.
- f. Remove chain guard (25) from elevator trim actuator (26) by removing nuts and screw.
- g. Remove elevator push-pull tube (23, figure 6-1) to gain access to guard pin at pulley (28).
- h. Remove pulley (27) by removing nut, washer, bolt and cable guard pins at pulleys (27 and 28).
- i. Disengage chain (22) from actuator sprocket (24), attach a guide wire to the chain, and remove cables and chain from stabilizer by pulling out through opening in tailcone.
- j. Remove three cable guard pins (12) and two seals (31) and disengage cables from rub block (34).
- k. Attach guide wire to aft cables (13 and 14) at fuel selector valve access and remove by pulling out through opening in tailcone.
- l. Remove eight cable guard pins (16).
- m. Attach guide wires to forward cables (10 and 11) at fuel selector valve access and remove by pulling out through opening in pedestal.

Installation of Elevator Trim Control Cables and Chains. (See figure 6-2.)

- a. Tie guide wires at pedestal to turnbuckle end of cables (10 and 11), pull into position, and remove guide wires.
- b. Engage chain (9) with trim control wheel sprocket (6) and install eight cable guard pins (16).
- c. Attach chain (22) to guide wire in tailcone and pull into position and remove guide wire.
- d. Engage chain (22) with actuator sprocket (24) and install chain guard (25) with screws and nuts.

- e. Install cable pulley (27) by installing bolt, washer, nut and cable guard pins at pulleys (27 and 28).
 - f. Attach guide wire to turnbuckle ends of cables (20 and 21) in the tailcone and pull into position and remove guide wires. Engage cables in rub block (34).
 - g. Connect the left cables (11 and 14) and right cables (10 and 13) using turnbuckles (15).
 - h. Install cable guard pins (12) and two seals (31).
 - i. Install seals (31) as follows:
 1. Insure that cables are lubricated for the full length of travel within the seals.
 2. Pack the seals with MIL-G-81322A lubricant.
 3. Place seals on cable on non-pressurized side of bulkhead with small end toward bulkhead.
 4. Insert seal in the bulkhead hole so that bulkhead metal is seated within the retaining groove with the small end of the seal in the pressurized section.
 5. Install proper retaining rings in the grooves of the seal (two on small end and one on large end).
 - j. Install stop block (29) and bushings (30) with screws, nuts and washers. Do not tighten at this time.
 - k. Rig elevator trim control in accordance with rigging of elevator trim control system.
 - l. Install elevator push-pull tube (23, figure 6-1) with bolt, washer and nut. Safety nuts with cotter pins.
 - m. Install stabilizer fairings, stinger, and elevator actuator access panel.
 - n. Install access cover on pedestal, floorboard fuel selector gearbox access, and cable access door.
 - o. Install tailcone access door, carpet, seats, cabin divider (optional equipment), refreshment bar (optional equipment), and toilet (optional equipment).
- Removal of Elevator Trim Tab Actuator. (See figure 6-2.)

- a. (See Figure 1-2.) Remove fuel selector gearbox access (73) and elevator trim access panel (19).
- b. Unsafety and loosen turnbuckles (15) to release tension on elevator trim control cables.
- c. Remove right elevator in accordance with removal of elevator procedures.
- d. Disconnect the elevator trim tab push-pull tube (19) by removing cotter pin, nut, washer and bolt.
- e. Remove chain guard (25) from elevator trim tab actuator (26) by removing nuts and screw; disengage chain from sprocket.
- f. Remove clamps (23) by removing nut, washer and screw and remove elevator trim tab actuator.



1. Cotter Pin
2. Nut
3. Bolt
4. Washer
5. Bearing
6. Sprocket

7. Trim Indicator
8. Control Wheel
9. Chain
10. Forward Right Cable
11. Forward Left Cable

12. Cable Guard Pin
13. Aft Right Cable
14. Aft Left Cable
15. Turnbuckle
16. Cable Guard Pin

Figure 6-2 Elevator Trim Control System (Sheet 1 of 2)

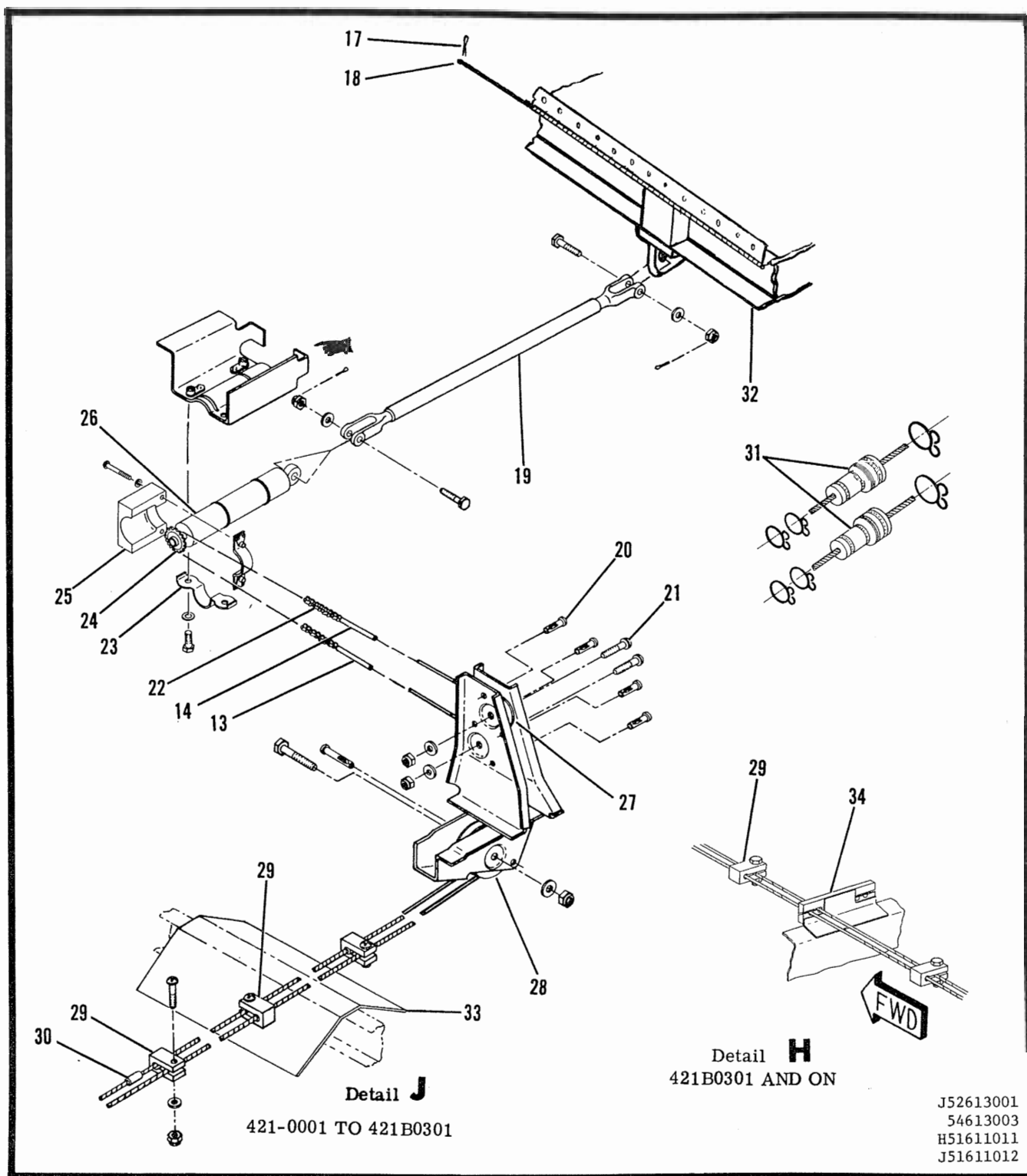


Figure 6-2. Elevator Trim Control System (Sheet 2 of 2)

Disassembly of Elevator Trim Tab Actuator.

For elevator trim tab actuator disassembly, overhaul, and reassembly procedure, see Section 5, Disassembly, Overhaul and Reassembly of Trim Tab Actuator.

Installation of Elevator Trim Tab Actuator. (See figure 6-2.)

a. Reverse the elevator trim tab actuator removal procedure except installation of inspection panel and trim actuator access panel.

b. Rig the elevator trim control system in accordance with rigging of the elevator trim control system.

Removal of Elevator Trim Control Wheel, Sprocket, and Indicator Assembly. (See figure 6-2.)

a. (See Figure 1-2.) Remove fuel selector gearbox access (73).

b. Unsafety and loosen turnbuckles (15) to release tension on elevator trim control system.

c. Remove elevator trim control wheel by removing four screws and washers.

d. Remove the quadrant cover, right side panel and forward panel from control pedestal.

NOTE

To remove the elevator trim indicator assembly, the rivet, around which the indicator pivots, must be removed.

e. Disengage chain (9) from sprocket (6) and remove sprocket (6) by removing cotter pin (1), nut (2), washer (4), bearing (5) and bolt (3).

Installation of Elevator Trim Control Wheel, Sprocket, and Indicator Assembly. (See figure 6-2.)

a. Reverse the elevator trim control wheel, sprocket, and indicator assembly removal procedures except the installation of the inspection panel.

b. Rig elevator trim control system in accordance with rigging of the elevator trim control system.

Rigging of Elevator Trim Control System. (See figure 6-2.)

a. Remove the tailcone door and RH pedestal cover.

b. (See Figure 1-2.) Remove fuel selector gearbox access (73) and elevator trim access (19).

c. Loosen stop blocks (29) by loosening attaching nuts and bolts.

d. Check and adjust the cable tension on the elevator trim control cables to 10 ± 3 pounds.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of 4 hours.

NOTE

If the Nav-O-Matic 800 autopilot is installed, adjust tension on elevator trim control cables to 16 ± 3 pounds. If the 400A Nav-O-Matic is installed, adjust tension to 19 ± 3 pounds.

NOTE

If an electric elevator trim control is installed, in addition to the autopilot, adjust tension on elevator trim control cables to 18 ± 3 pounds for the Nav-O-Matic 800 or 22 ± 2 pounds for the 400A Nav-O-Matic.

e. Disconnect elevator trim push-pull tube (19) from elevator trim tab by removing attaching cotter pin, nut, washer and bolt.

f. Rotate elevator trim control wheel (8) forward (nose down) until forward chain (9) and aft chain (22) have approximately two links clearing the sprockets.

NOTE

If the elevator trim indicator (7) reaches its extreme travel during rigging, it can be re-located by removing elevator trim control wheel, moving the indicator, and reinstalling wheel. (See figure 6-2.)

g. With the elevator in neutral (elevator horns aligned with stabilizer) and the chains in the above position, adjust trim actuator (26) by rotating push-pull tube (19) so that the push-pull tube hole and the elevator trim tab attaching holes align with the trim tab positioned approximately 12° up from neutral (neutral position is alignment of the outboard trailing edge of the trim tab with the elevator trailing edge). Connect push-pull tube to the elevator trim tab with attaching bolt, washer, nut and cotter pin.

h. Rotate elevator trim control wheel so elevator tab is $10^{\circ} + 1^{\circ}$, -0° up on 421-0001 to 421B0001, $12^{\circ} + 1^{\circ}$, -0° up on 421B0001 and On. On aircraft 421-0001 to 421B0301, locate center stop (29) approximately three inches forward of Fuselage Station 305.94 and tighten. Slide the forward stop block (29) aft against center stop block and tighten. On aircraft 421B0301 and On, slide aft stop block forward against rub block (34) and tighten.

i. Rotate elevator trim control wheel so elevator trim tab is $26^{\circ} + 1^{\circ}$, -0° down on 421-0001 to 421B0001 $20^{\circ} + 1^{\circ}$, -0° down on 421B0001 and On. On aircraft 421-0001 to 421B0301, slide aft stop block (29) forward against center stop block and tighten. On aircraft 421B0301 and On, slide forward stop block against rub block (34) and tighten.

WARNING

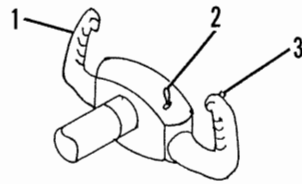
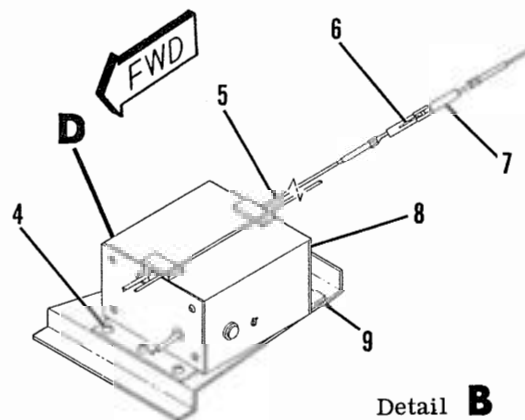
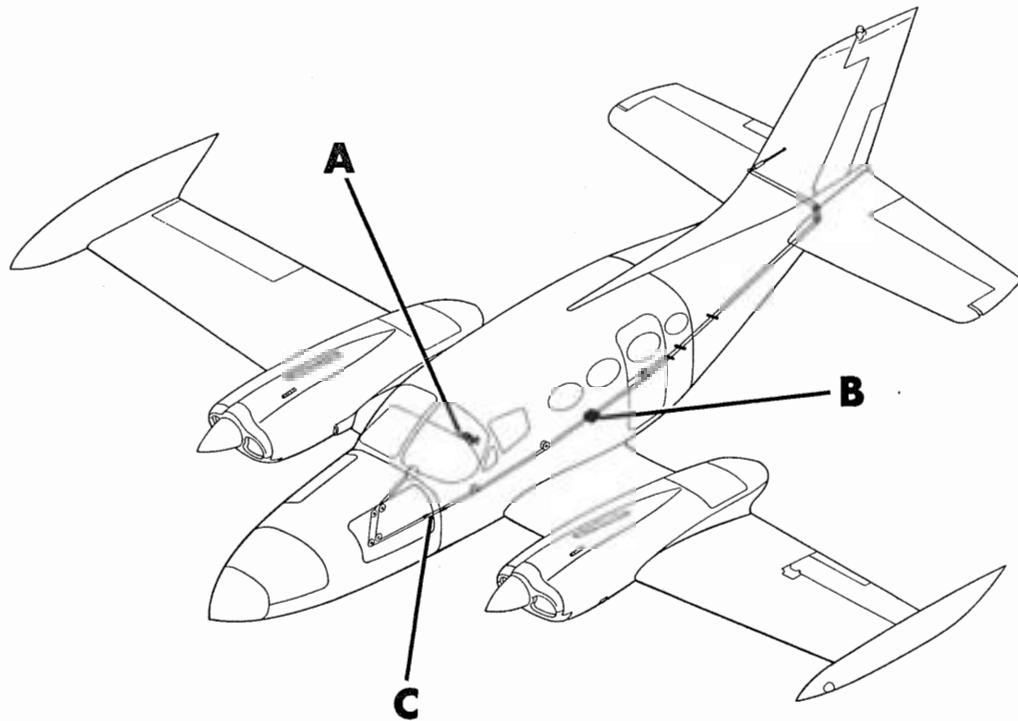
Insure that elevator trim tab moves in the proper direction when operated by the trim control wheel.

j. (See figure 1-2.) Install fuel selector gearbox access (73) and elevator trim access (19).

k. Install tailcone door and RH pedestal cover.

ELECTRIC ELEVATOR TRIM CONTROL. (Optional 421A0001 and ON.)

The electric elevator trim control system is comprised of a single pole, single throw switch and a slider switch mounted in the pilot's control wheel; an actuator assembly mounted on a support under

Detail **A**Detail **B**

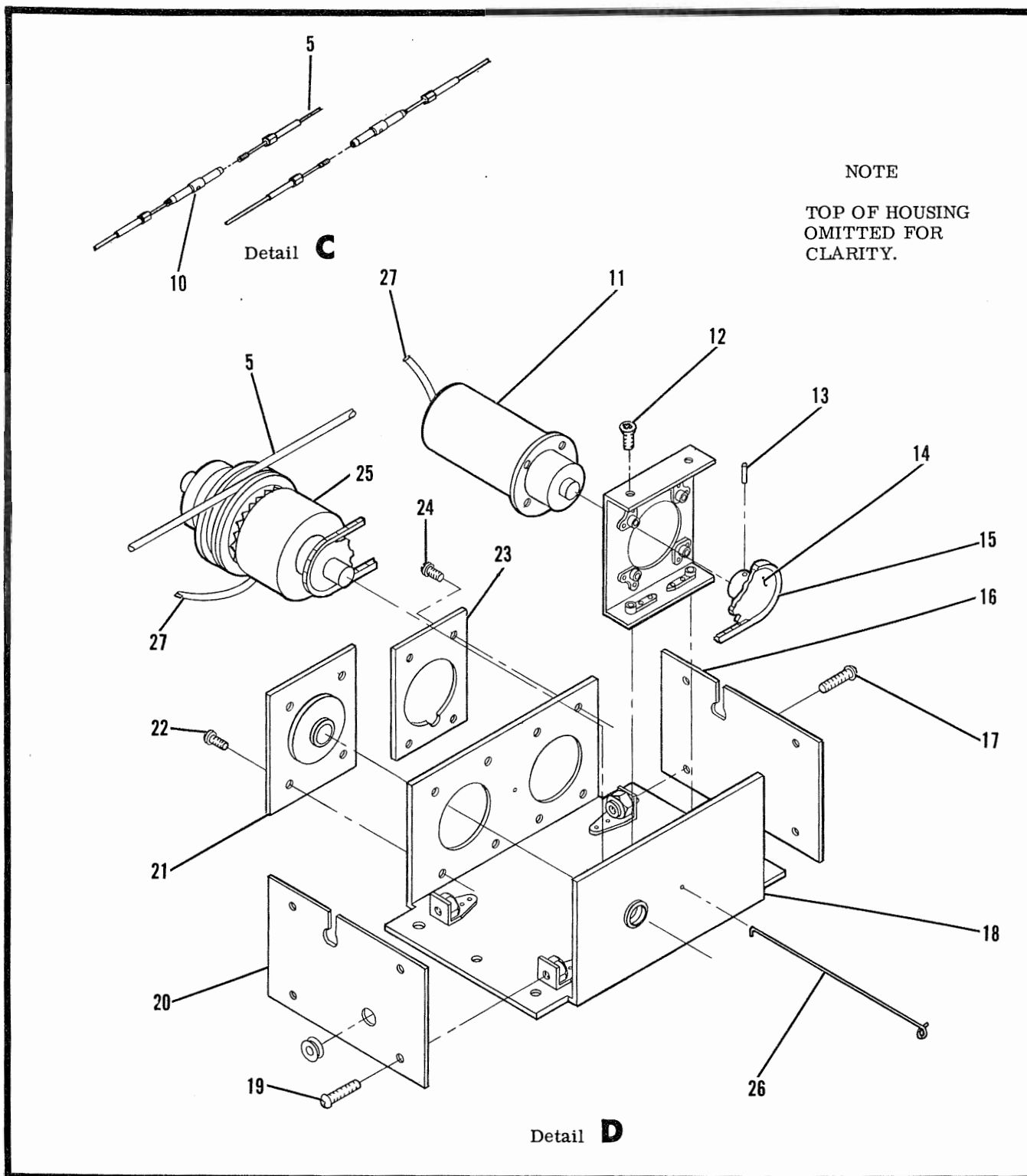
421A0001 and ON

1. Control Wheel
2. Switch
3. Switch

4. Screw
5. Control Cable
6. Locking Clip

7. Turnbuckle
8. Actuator Assembly
9. Support

Figure 6-3. Electric Elevator Trim Control System (Sheet 1 of 2)



10. Turnbuckle	16. Cover	22. Screw
11. Motor Assembly	17. Screw	23. Cover Assembly
12. Screw	18. Housing	24. Screw
13. Pin	19. Screw	25. Clutch Assembly
14. Sprocket	20. Cover	26. Cable Guard
15. Chain Assembly	21. Cover Assembly	27. Electrical Wire

Figure 6-3. Electric Elevator Trim Control System (Sheet 2 of 2)

the cabin floorboard at Station 225.50; a control cable attached to the elevator trim control cable and routed around the actuator clutch assembly cable drum; and associated electrical wiring. The electric elevator trim control system is energized when the single pole, single throw switch is placed in the ENGAGE position and the slider switch is moved to the forward (DOWN) or aft (UP) position. The actuator motor drives the clutch assembly, which moves the elevator trim control cable and places the elevator trim tab in the corresponding UP or DOWN position. Manual override is accomplished by operating the elevator trim control wheel mounted on the left side of the pedestal.

Removal of Elevator Trim Actuator Assembly. (See figure 6-3).

- a. Remove seats and center carpets in accordance with Section 3.
- b. (See figure 1-2.) Remove floorboard center access panels, as necessary, to gain access to the elevator trim control cable turnbuckles.
- d. Loosen and disconnect turnbuckles (7 and 10) from the control cable.
- e. Remove screws (4) attaching actuator assembly (8) to support (9) and disconnect electrical wiring (27).
- f. Remove actuator assembly (8) and control cable (5).

Disassembly and Assembly of Elevator Trim Actuator Assembly.

- a. Loosen screws (12, 17 and 19) and remove top and side covers (16 and 20).
- b. Loosen screws (22 and 24) and remove cover assembly (21), support assembly (23) and cable guard (26).
- c. Slide clutch assembly (25) from housing (18) and remove chain assembly (15) from clutch assembly sprocket and sprocket (14).
- d. Remove control cable (5) from clutch assembly (25).
- e. Remove motor assembly (11) from housing (18).
- f. Clean component parts by wiping with a clean cloth saturated with a suitable solvent.
- g. Check clutch assembly sprocket and sprocket (14) for broken, chipped and worn teeth.
- h. Do not attempt to repair damaged or worn parts of the actuator assembly. Discard all defective parts and install new parts during reassembly.
- i. Adjust clutch assembly (25) to slip at 25 ± 3 inch-pounds.

- j. (See figure 2-9.) During reassembly, lubricate clutch assembly (25).
- k. Install motor assembly (11) in housing (18).
- l. Install control cable (5) on clutch assembly (25).

NOTE

Clutch assembly cable drum and control cable must be free of grease and oil and control cable must make 3 full wraps around the cable drum.

- m. Install chain assembly (15) on sprocket (14) and clutch assembly sprocket and slide clutch assembly into housing (18).
- n. Install support assembly (23), cover assembly (21) and secure with screws (22 and 24).
- o. Install cable guard (26) in housing (18).
- p. Install top and side covers (16 and 20) and secure with screws (12, 17 and 19).

Installation of Elevator Trim Actuator Assembly (See figure 6-3).

- a. Install actuator assembly (8) on support (9) and secure with screws (4).
- b. Connect electrical wiring (27).
- c. Connect turnbuckles (7 and 10) to elevator trim control cable.
- d. Install locking clips (6) in turnbuckles.
- e. Rig elevator trim control system in accordance with the Elevator Trim Control System Rigging Procedures, except cable tension should be 18 ± 3 pounds.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of 4 hours.

- f. (See figure 1-2.) Install removed floorboard access panels.
- g. Install carpets and seats in accordance with Section 3.

SECTION 7

RUDDER AND TRIM CONTROL SYSTEMS

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CAUTION

Primary and secondary flight control cables, push pull tubes, bellcranks and mountings on late model aircraft use dual locking fasteners. The lock nuts for these fasteners incorporate a fiber lock, and are castellated for safetying with a cotter pin. When any of these areas are disconnected on any aircraft, new dual locking fasteners should be installed. See the Aircraft Parts Catalog for part numbers and location of these fasteners.

RUDDER.

The all metal rudder has a fiberglass tip which encloses a rotating beacon. The rudder is 100% static balanced by means of lead weight enclosed in leading edge at the time of installation. The rudder trim tab, located at the trailing edge of the rudder, is actuated by a push-pull rod which is routed through the rudder to an actuator in the vertical stabilizer. The rudder, attached to the vertical stabilizer with three hinges, is operated by cables attached to a bellcrank at the bottom of the rudder.

Removal of Rudder. (See figure 7-1.)

- (See figure 1-2.) Remove stabilizer fairings (9, 10 and 11).
- (See figure 7-3.) Disconnect the push rod (17) from the rudder trim tab (14) by removing cotter pin, nut, washer and bolt.
- Disconnect the bonding strap (11) by removing nut, washer and screw.
- Disconnect cable links (16) from bellcrank (13) by removing screw and nut.

- Disconnect rotating beacon light wire at upper hinge.
- Support the rudder and remove the three hinge cotter pins, nuts, washers and bolts.
- Remove rudder by pulling aft while guiding rudder trim tab push rod out through the rudder.

Installation of Rudder. (See figure 7-1.)

- Reverse the rudder removal procedure except the installation of the stabilizer fairing.

NOTE

Washers may be required between rudder hinge brackets and hinge bearings to prevent deformation of hinge brackets.

- Check rudder and rudder trim tab for proper operation and travel in accordance with rigging of the rudder control system and rigging of the rudder trim control system.
- Install the stabilizer fairings.

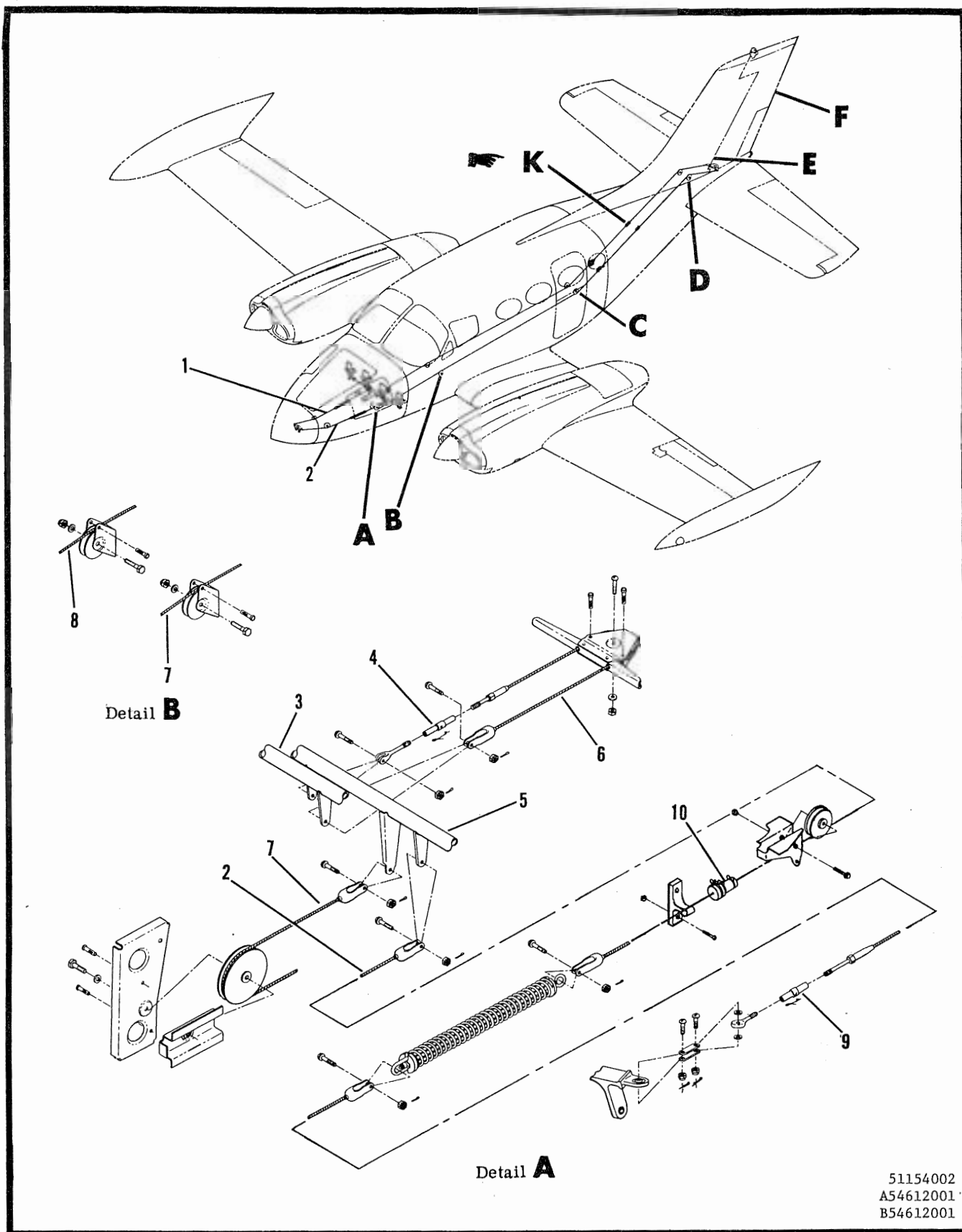
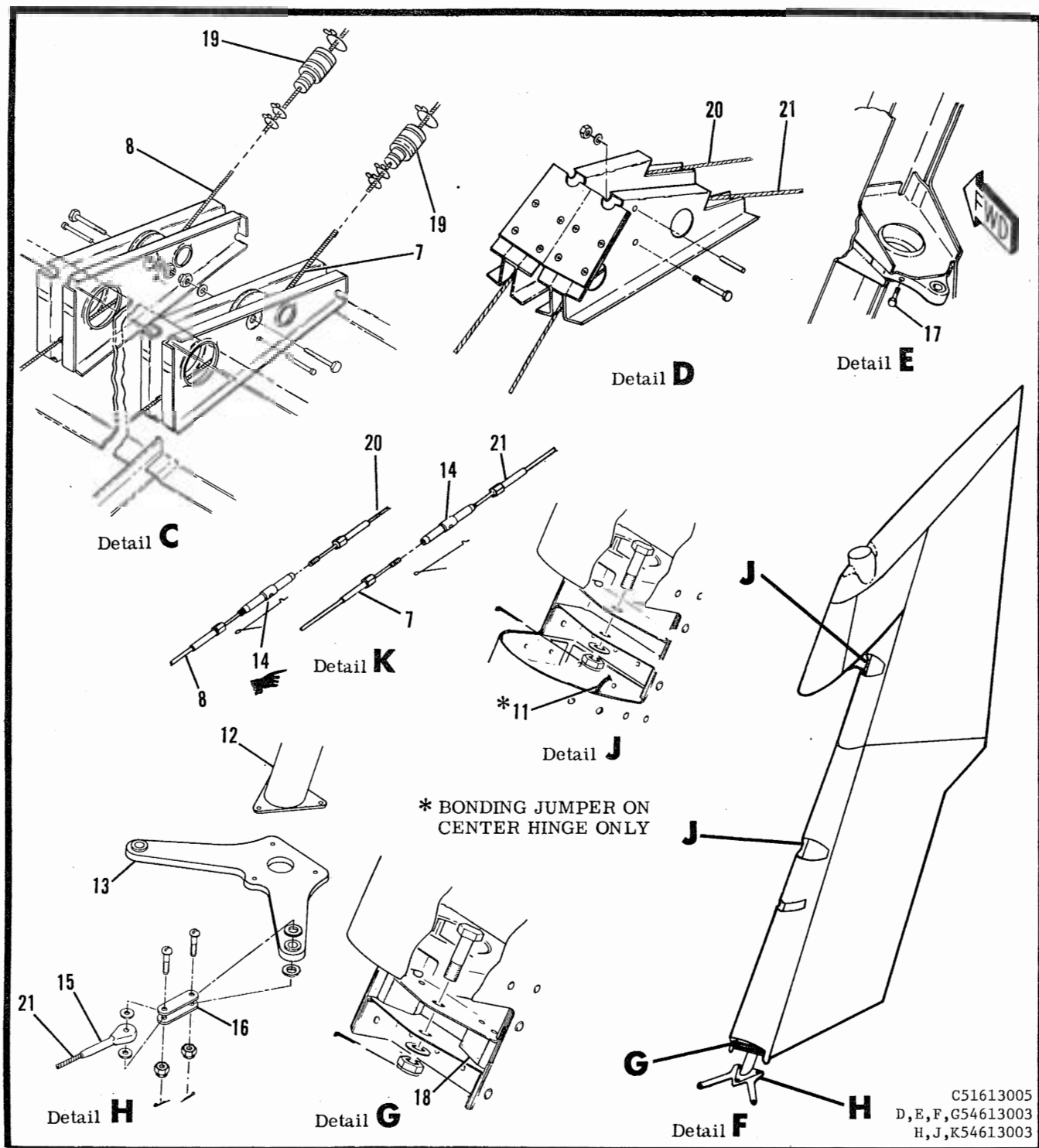


Figure 7-1. Rudder and Rudder Control (Sheet 1 of 2)



1. Right Steering Cable
2. Left Steering Cable
3. Right Torque Tube
4. Turnbuckle
5. Left Torque Tube
6. Position Cable
7. Left Rudder Cable (Fwd)

8. Right Rudder Cable (Fwd)
9. Turnbuckle
10. Seal
11. Bonding Strap
12. Rudder Torque Tube
13. Rudder Bellcrank
14. Turnbuckle

15. Terminal
16. Link
17. Stop Bolt
18. Stop Block
19. Seal
20. Right Rudder Cable (Aft)
21. Left Rudder Cable (Aft)

Figure 7-1. Rudder and Rudder Control System (Sheet 2)

RUDDER TRIM TAB. (See figure 7-3.)

The all-metal rudder trim tab is operated by a push-pull tube extending through the rudder and attached to an actuator in the vertical fin. The tab is attached to the lower trailing edge of the rudder by a continuous hinge and is adjustable in flight.

Removal of Rudder Trim Tab. (See figure 7-3.)

- a. Disconnect the rudder trim tab push rod (17) by removing cotter pin, nut, washer and bolt.
- b. Remove cotter pin from each end of hinge pin (16).
- c. Remove trim tab by removing hinge pin (16).

Installation of Rudder Trim Tab. (See figure 7-3.)

- a. Reverse the rudder trim tab removal procedures.
- b. Check the rudder trim tab for proper operation and travel in accordance with the rigging of rudder trim tab control system.

RUDDER CONTROL SYSTEM.

The rudder is operated by the movement of the right and left pilot's or copilot's rudder pedals. The pedals are connected to torque tubes which have link arms for the attachment of the rudder cables. The rudder cables are attached to the torque link arms and routed forward over pulleys, then aft under the floorboards through pulleys to turnbuckles in the tailcone, then routed over pulleys to the rudder bellcrank. The bellcrank is attached directly to the rudder torque tube. The rudder travel stops, consisting of bolts mounted in brackets attached to the lower hinge bracket, are provided for the recommended travel adjustment. The position cable is attached to the left rudder pedal torque tube and is routed aft around a pulley and then forward to right rudder pedal torque tube to complete the rudder control cable system. The nose gear steering cables are attached to the right and left rudder pedal torque tubes; routed forward to springs and then to the nose gear steering yoke.

Troubleshooting Rudder Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN RUDDER PEDAL AND RUDDER	Cable Tension too low.	Adjust cable tension in accordance with rudder rigging instructions.
	Broken pulley.	Replace pulley.
	Bolts attaching rudder bellcrank	Tighten bellcrank bolts.
RESISTANCE TO RUDDER CONTROL MOVEMENT	Cable tension too high.	Adjust cable tension in accordance with rudder rigging instructions.
	Pulley binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Cable not in place on pulley.	Install cables correctly.
	Bent hinges or faulty hinge bearings.	Replace hinges and/or bearings.
	Bent rudder.	Repair and/or replace rudder.
CORRECT RUDDER TRAVEL CANNOT BE OBTAINED BY ADJUSTING BELL- CRANK STOPS	Rudder cables incorrectly rigged.	Rig cables in accordance with rudder rigging instructions.
	Rudder pedals contacting fuselage bulkhead.	Rig position cables, nose wheel steering cables, and rudder cables in accordance with rudder rigging instructions.
RUDDER PEDALS NOT NEUTRAL WHEN RUDDER IS STREAMLINED	Aft rudder cables incorrectly rigged.	Rig in accordance with rudder rigging instructions.

Removal of Rudder Control Cables. (See figure 7-1.)

a. Remove seats, cabin dividers (optional) refreshment bar (optional), carpet, LH and RH rudder cover plates and tailcone access in accordance with Section 3.

b. (See figure 1-2.) Remove cables access (15), front spar access (77), center control access (79), front pilot's floor access (70), brake cylinder access (71), floorboards (80, 82, 84) and stabilizer fairing (11).

NOTE

If an autopilot (optional equipment) is installed, disconnect from rudder bellcrank when removing cables (20 and 21).

c. Remove turnbuckle clip and turnbuckles (14) and disconnect cables (20 and 21) from bellcrank (13) by removing cotter pins, nuts and bolts.

d. Disconnect rudder cables (7 and 8) from pedal torque tubes (3 and 5) by removing cotter pins, nuts and bolts.

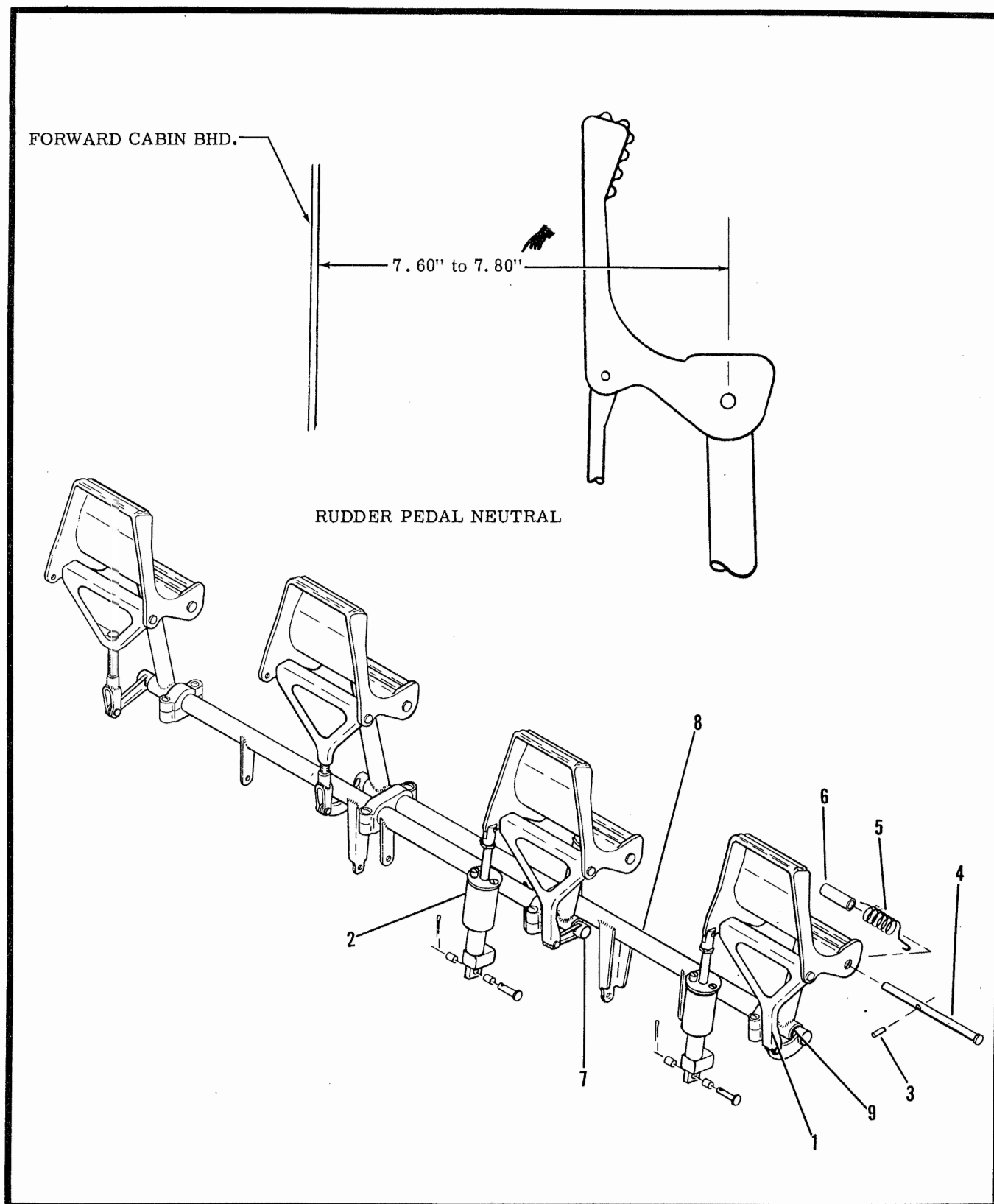
e. Remove seals (19).

f. Remove cable guard pins; attach guide wires to cables (7, 8, 20 and 21) and withdraw cables. Disconnect guide wires and leave in place until ready to reinstall cables.

CAUTION

Tension on nose wheel steering cables must be released before rudder position cable (6) is disconnected.

g. Remove turnbuckle clip and turnbuckle (4), from position cable (6); remove cotter pin, nut and screw securing cable to torque tube (3).



- 1. Brake Link
- 2. Brake Master Cylinder
- 3. Roll Pins

- 4. Pin
- 5. Spring
- 6. Spacer

- 7. Brake Torque Tube
- 8. Rudder Torque Tube
- 9. Bearing

Figure 7-2. Rudder Pedal Assembly

- h. Remove cable guard pins from pulley bracket and route cable from aircraft.

Installation of Rudder Control Cables. (See figure 7-1.)

- a. Reverse the rudder control cables removal procedures except the installation of seats, cabin dividers (optional), refreshment bar (optional), carpet, access panels, rudder cover plates, floorboards and stabilizer fairings.
- b. Install seals (10) on steering cables and seals (19) on rudder cables as follows:
 - 1. Insure that cables are lubricated for the full length of its travel within the seals.
 - 2. Pack the seals with MIL-G-81322A lubricant.
 - 3. Place seals on cable on non-pressurized side of bulkhead with small end toward bulkhead.
 - 4. Insert seal in the bulkhead hole so that bulkhead metal is seated within the retaining groove of seals and the small end of seal is in the pressurized section.
 - 5. Install proper retaining rings in the grooves of the seal (two on small end and one on large end).
- c. Rig rudder control system in accordance with rigging of the rudder control system.

Removal of Rudder Bellcrank. (See figure 7-1.)

- a. (See figure 1-2.) Remove stabilizer fairings (11).
- b. Remove turnbuckle clips and loosen either turnbuckle (4) (to release tension on rudder cables).
- c. Disconnect rudder cables (20 and 21) from rudder bellcrank (13) by removing cotter pins, nuts, washers and bolts.
- d. Remove nut, washer and bolt from rudder bellcrank hinge.
- e. Remove rudder bellcrank (13) from the rudder torque tube by removing nut, washer and bolt.

Installation of Rudder Bellcrank. (See figure 7-1.)

- a. Reverse the rudder bellcrank removal procedures except the installation of the stabilizer fairings.
- b. Rig rudder control system in accordance with rigging of rudder control system.

Removal of Rudder Pedal Assembly. (See figure 7-2.)

- a. Remove pilot's seat and copilot's seat, cabin divider (optional), cover plates, kick plates, carpet and pedestal filler in accordance with Section 3.
- b. (See figure 1-2.) Remove pilot's floor access (70), copilot's floor access (76), and brake cylinder access (71).
- c. Release tension on nose wheel steering cables, rudder cables and rudder position cable.
- d. Remove five cables from rudder torque tubes (8) by removing cotter pins, nuts, washers and bolts.
- e. Disconnect brake master cylinders (2) from the pilot's rudder pedals by removing cotter pins and pins.
- f. Remove four brake links (1) from rudder pedal

torque tubes by removing cotter pins, spacers and pins.

- g. Remove rudder pedal assemblies by removing eight bolts, four upper and four lower bearing halves.

NOTE

The upper and lower halves of each bearing are matched parts and should be tagged and kept in pairs.

Disassembly of Rudder Pedal Assembly. (See figure 7-2.)

- a. Remove brake links (1) by removing cotter pins and pins.
- b. Remove pilot's and copilot's rudder pedals by driving out roll pins (3) and removing pins (4), springs (5) and spacers (6).

NOTE

Copilot's rudder pedals do not have springs (5) and spacers (6) installed.

- c. Remove brake torque tubes (7) from rudder pedal torque tubes (8) by removing cotter pins, pins and couplers.
- d. Bearing (9) in rudder pedal torque tube and torque arm are a press fit and should be removed only, if during an inspection, it is determined that the bearings need to be replaced.

Assembly of Rudder Pedal Assembly. (See figure 7-2.)

- a. Insert brake torque tubes (7) into rudder pedal torque tubes (8) and install couplings using pins and cotter pins.
- b. Install rudder pedals on rudder pedal torque tube arms using spacers (6), springs (5), pins (4), and roll pins (3).

NOTE

Copilot's rudder pedals do not have springs (5) and spacers (6) installed.

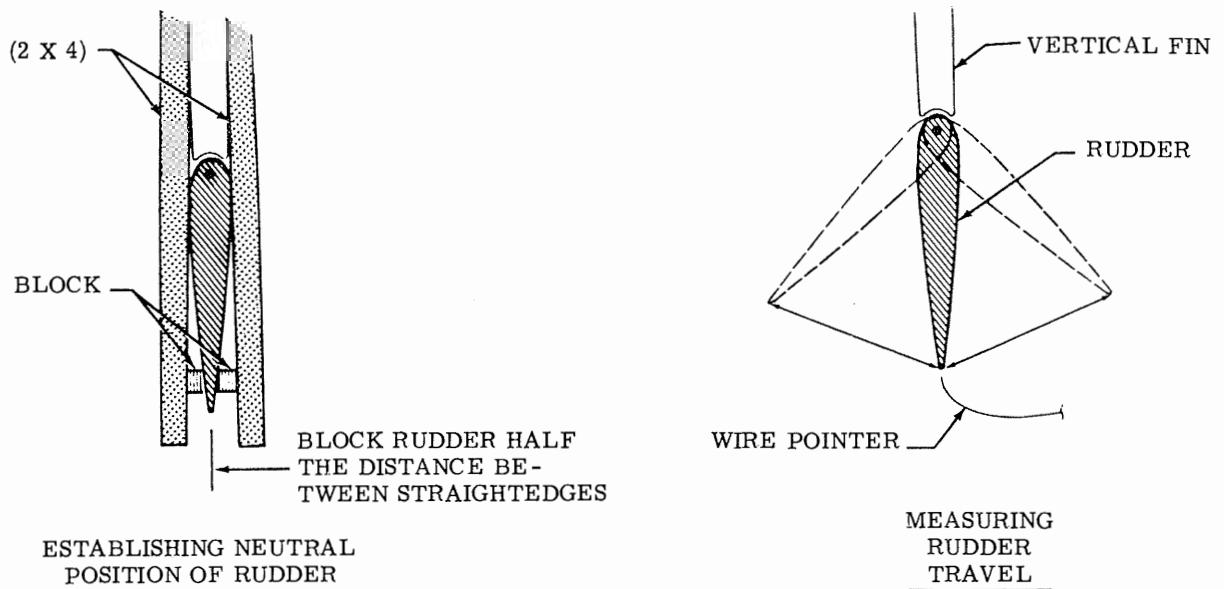
- c. Install brake links (1) using pins and cotter pins.

Installation of Rudder Pedal Assembly. (See figure 7-2.)

- a. Install the rudder pedal assembly by placing the lower half of each bearing over attached nutplates and locate the rudder pedal assembly in the bearing, then placing the upper bearing half and installing the screws.

NOTE

During the installation of rudder pedal assemblies, lubricate in accordance with Section 2. Rudder pedal torque tubes must rotate freely



1. Establish neutral position of rudder by clamping straightedge (such as wooden 2 x 4) on each side of fin and rudder and blocking trailing edge of rudder half the distance between straightedges as shown.
2. Tape a length of soft wire to the stinger in such a manner that it can be bent to index at the lower corner of the rudder trailing edge.
3. Using soft lead pencil, mark rudder at point corresponding to soft wire indexing point (neutral).
4. Remove straightedges and blocks.
5. Hold rudder against right, then left, rudder stop. Measure distance from pointer to pencil mark on rudder in each direction of travel. Distance should be between 14.25" and 14.87" (421-0001 to 421B0801) or 15.90 to 16.52 (421B0801 and On).

Figure 7-2A. Checking Rudder Travel

in bearings.

- b. Connect brake links (1) to rudder pedal torque tubes (8) with pins, spacers and cotter pins.
- c. Connect brake master cylinders (2) to pilot's rudder pedals with pins and cotter pins.
- d. Attach rudder cables, nose wheel steering cable and position cable to rudder pedal torque tube with bolts, washers, nuts and cotter pins.
- e. Rig rudder control system in accordance with rigging of the rudder control system.
- f. Install pilot's floor access, copilot's floor access and brake cylinder access.
- g. Install pedestal filler, carpet, kick plate, cover plate, cabin divider (optional), and pilot's and copilot's seats.

Rigging of Rudder Control System. (See figure 7-1.)

- a. Remove seats, cabin dividers (optional), cover plates, kick plates and carpet in accordance with Section 3.
- b. (See figure 1-2.) Remove cable access (15), stabilizer fairings (11) and fuel selector gear box access (73).
- c. Remove turnbuckle clips from the rudder system turnbuckles (14).
- d. Adjust the position cable (6), which is a "balance" cable, used to close the rudder system. The position cable turnbuckle (4) should be adjusted so that the pivot point of the rudder pedals are 7.60 to 7.80 inches from the forward cabin bulkhead (see figure 7-2).
- e. With the nose wheel and rudder pedals in neutral position, adjust the nose wheel steering cables tension to 20 ± 5 pounds.
- f. With the nose wheel, rudder pedals and rudder in neutral position, adjust the rudder cable turnbuckles so that the cable tension is 25 ± 5 pounds.

NOTE

The tension on the nose wheel steering cables and the aft rudder cables operate in the same direction. If either cables are adjusted, it will be necessary to recheck the tension on the cables which were not adjusted.

Troubleshooting Rudder Trim Control System.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of 4 hours.

- g. Adjust the rudder bellcrank stop bolts (17) so that the rudder travel is (421-0001 to 421B0801) $25^{\circ} +1^{\circ}$, -0° left and $25^{\circ} +1^{\circ}$, -0° right (measured perpendicular to the rudder hinge line) or (421B0801 and On) $32^{\circ} +1^{\circ}$, -0° left and $32^{\circ} +1^{\circ}$, -0° right. See figure 7-2A for alternate method of measuring rudder travel.
- h. Resafety stop bolts (17) and install turnbuckle clip on all turnbuckles.
- i. Check the tips of the pilot's rudder pedals for alignment and if needed, adjust clevis rod ends (2) on brakes master cylinders. Check and adjust the copilot's rudder pedals for alignment. (See figure 7-2.)

WARNING

Insure that rudder moves the proper direction when operated by the rudder pedals.

- j. Install cable access, stabilizer fairings and fuel selector valve access.
- k. Install seats, cabin dividers (optional), cover plates, kick plates and carpet.

RUDDER TRIM CONTROL SYSTEM.

The rudder trim tab is operated by a control wheel mounted on the aft side of the pedestal. The control wheel is attached to a sprocket which drives a chain and cables. The chain and cables are routed by pulleys, forward and down through the pedestal under the floor and aft to the tailcone of the aircraft. In the tailcone, the cables are routed aft to pulleys mounted on the aft side of the vertical stabilizer rear spar, then up and through the vertical stabilizer, to a chain which operates the trim tab actuator. The trim tab push rod connects the trim actuator to the rudder trim tab which is mounted to the rudder by a continuous hinge. The adjustable turnbuckles, for cable tension adjustment, are located under the fuel selector gear box access panel. The stop blocks are located in the tailcone for adjustment of the rudder trim tab travel.

TROUBLE	PROBABLE CAUSE	CORRECTION
RESISTANCE TO CONTROL WHEEL MOVEMENT	Cable tension too high.	Adjust cables in accordance with rudder trim control rigging instructions.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Cable not in place on pulleys.	Install cable correctly.
	Trim tab actuator defective.	Repair or replace actuator.
	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.

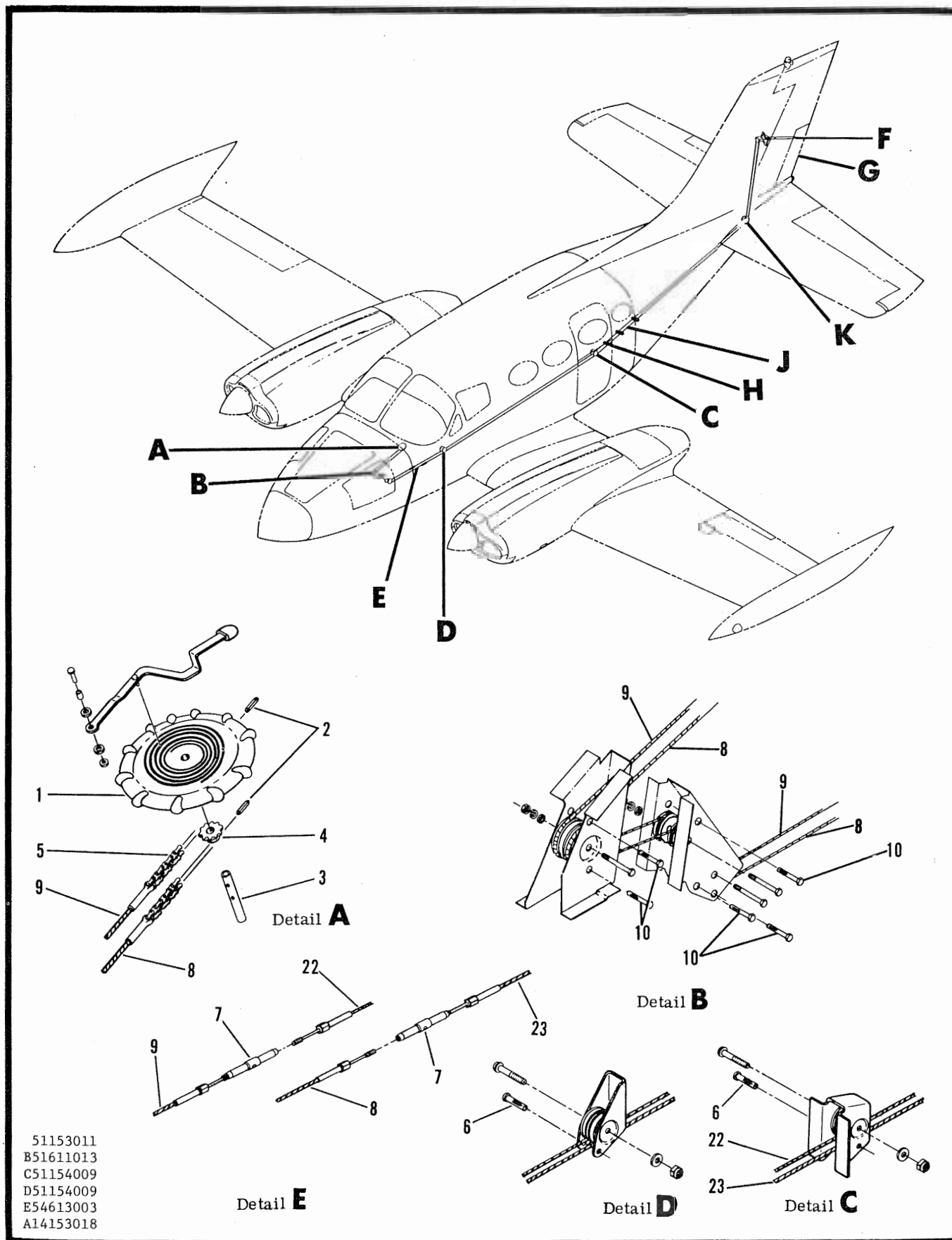
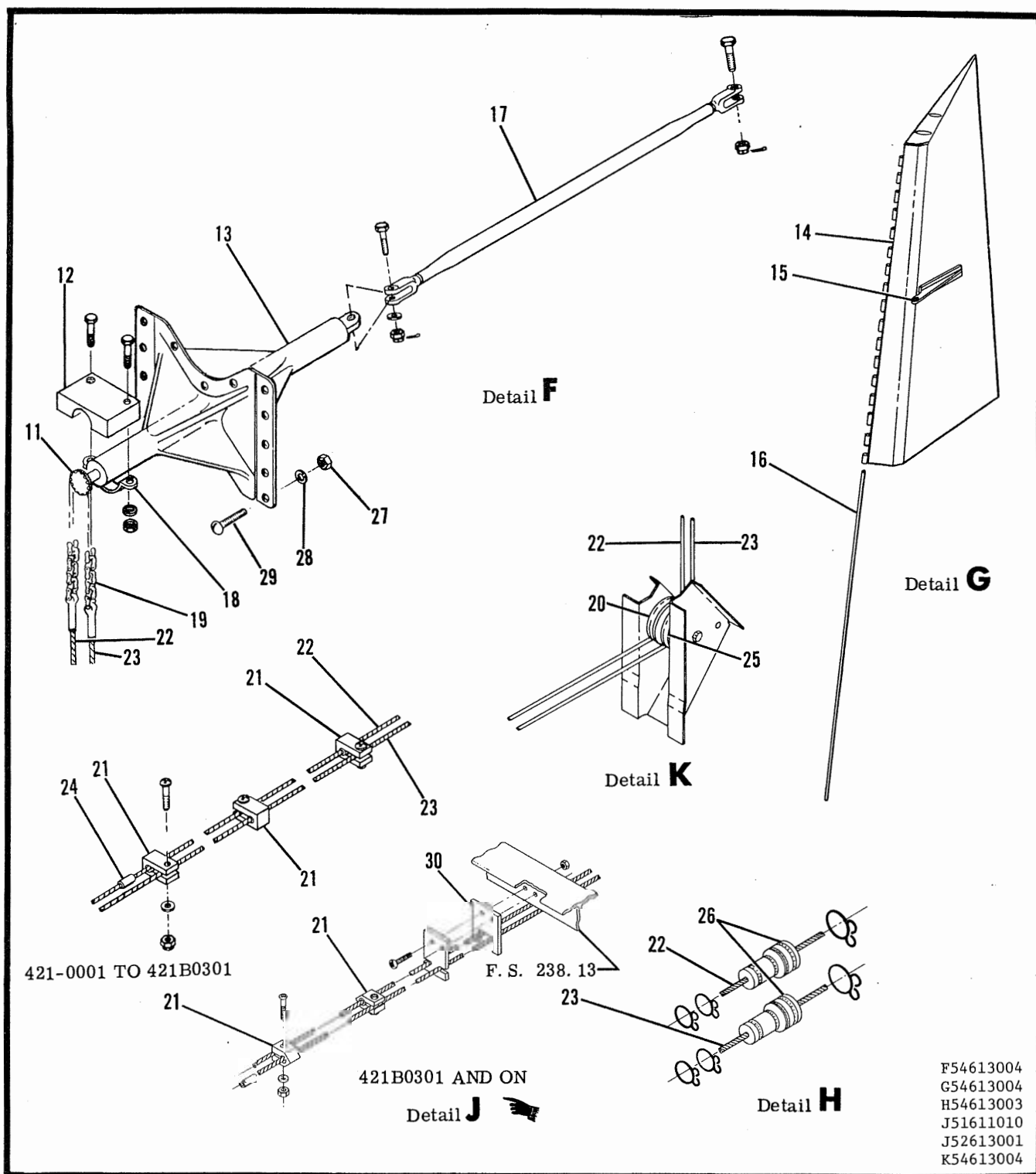


Figure 7-3. Rudder Trim Control System (Sheet 1 of 2)



1. Control Wheel	9. Right Cable (Fwd)	16. Hinge Pin	23. Left Cable (Aft)
2. Pin	10. Guard Pin	17. Push Rod	24. Bushing
3. Shaft	11. Sprocket	18. Clamp	25. Pulley
4. Sprocket	12. Chain Guard	19. Chain	26. Seal
5. Chain	13. Trim Actuator	20. Pulley	27. Nut
6. Guard Pin	14. Trim Tab	21. Stop Block	28. Washer
7. Turnbuckle	15. Trim Tab Horn	22. Right Cable (Aft)	29. Screw
8. Left Cable (Fwd)			30. Cable Stop

Figure 7-3. Rudder Trim Control System (Sheet 2)

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB	Cable tension too low.	Adjust cables in accordance with rudder trim control rigging instructions.
	Broken pulley.	Replace pulley.
	Worn trim tab actuator.	Repair or replace actuator.
INCORRECT TRIM TAB TRAVEL	Stop block loose or incorrectly adjusted.	Adjust stop block in accordance with rudder trim control rigging instructions.
CORRECT RUDDER TRIM TAB TRAVEL CANNOT BE OBTAINED BY ADJUSTING STOP BLOCK	Actuator screw incorrectly adjusted.	Adjust in accordance with rudder trim control rigging instructions.
INDICATOR DOES NOT INDICATE THE CORRECT TRIM POSITION	Indicator incorrectly engaged with control wheel.	Adjust in accordance with rudder trim control rigging instructions.

Removal of Rudder Trim Control Cables and Chains. (See figure 7-3.)

- Remove seats, cabin dividers (optional), refreshment bar (optional), carpet, pedestal cover and tailcone access door in accordance with Section 3.
- (See figure 1-2.) Remove fuel selector gear box access (73), center control access (79), center floorboards (80, 82, and 84) and cable access (15) to gain access to forward cables, pulleys and attachment points.
- (See figure 1-2.) Remove stabilizer fairing (11), vertical stabilizer access (6) and tailcone access (18).
- Remove rudder trim stop blocks (21) and bushings (24) by removing nut, washer, and screw.
- Remove cable stop (30) by removing screws and nuts.
- Unsafety turnbuckles (7) and disconnect cables by removing turnbuckles.
- Remove chain guard (12) from rudder trim actuator (13) by removing nuts, washers and screws.
- Remove pulleys (20 and 25) by removing nuts, washers, bolts and cable guard pins.
- Disengage chain (19) from actuator sprocket (11), attach a guide wire to the chain and remove cables and chain from vertical stabilizer by pulling out through opening in tailcone.
- Remove seals (26).
- Remove two cable guard pins (6).
- Attach guide wire to aft cables (22 and 23) at fuel selector gear box access and remove by pulling out through opening in tailcone.
- Remove forward cables by removing five cable guard pins (10) and remove chain (5) from sprocket (4).
- Attach guide wires to forward cables (8 and 9) at cable access (15, figure 1-2) and remove by pulling out through pedestal.

Installation of Rudder Trim Control Cables and Chains. (See figure 7-3.)

- Tie guide wires at pedestal to turnbuckle end of cables (8 and 9), pull into position and remove guide wires.
- Engage chain (5) with trim control wheel sprocket and install five cable guard pins (10).
- Attach chain (19) to guide wire in vertical stabilizer and pull into position and remove guide wire.
- Engage chain (19) with actuator sprocket (11) and install chain guard (12) with screws, washers and nuts.
- Install cables pulleys (20 and 25) by installing bolts, washers, nuts and cable guard pins.
- Attach guide wire to turnbuckle end of cables (22 and 23) in tailcone, pull into position and remove guide wires.
- Connect the left cables (8 and 23) and right cables (9 and 22) using turnbuckles (7).
- Install stop block (21) and bushing (24) with screws, nuts and washers. Do not tighten at this time.
- Install cable stop (30) with screws and nuts.
- Install seals (26) in accordance with instructions for installing rudder seals.
- Rig rudder trim control in accordance with rigging of rudder trim control system.
- Install stabilizer fairing and rudder actuator access panel.
- Install access cover on pedestal, floor, and fuel selector valve access.
- Install tailcone access door, seats, cabin divider (optional), refreshment bar (optional), carpet, and pedestal cover.

Removal of Rudder Trim Tab Actuator. (See figure 7-3.)

- (See figure 1-2.) Remove fuel selector gear box access (73) and rudder trim access (6).
- Unsafety and loosen turnbuckles (7) to release tension on rudder trim control cables.

- c. Disconnect the rudder trim tab push rod (17) by removing the cotter pin, nut, washer and bolt.
- d. Remove cable guard from rudder trim tab actuator (13) by removing nuts, washers and screws, and disengage chain from sprocket.
- e. Remove nuts (27), washers (28), and screws (29) and remove actuator through access hole.

Disassembly, Overhaul and Assembly of Rudder Trim Tab Actuator.

The instructions for disassembly, overhaul and assembly of the aileron trim tab actuator, given in Section 5, also applies to the rudder trim tab actuator.

Installation of Rudder Trim Tab Actuator. (See figure 7-3.)

- a. Reverse the rudder trim tab actuator removal procedure except installation of fuel selector gear box access and rudder trim access.
- b. Rig the rudder control system in accordance with rigging of rudder trim control system.

Removal of Rudder Trim Control Wheel, Sprocket, and Indicator Assembly. (See figure 7-3.)

- a. Remove from the pedestal lower access cover, right access cover, and autopilot cover to autopilot panel (optional).
- b. Remove fuel selector gear box access and loosen turnbuckles (7) to release tension on rudder trim control system.
- c. Disengage chain and drive out pins (2) from control wheel (1) and sprocket (4).
- d. Remove the control wheel and sprocket by removing shaft (3).

NOTE

To remove the rudder trim indicator assembly, the rivet, around which the indicator pivots, must be removed.

Installation of Rudder Trim Control Wheel, Sprocket, and Indicator Assembly. (See figure 7-3.)

- a. Reverse the rudder trim control wheel, sprocket and indicator assembly removal procedure except the installation of the access cover and panels.
- b. Rig rudder trim control system in accordance with rigging of the rudder trim control system.

Rigging of Rudder Trim Control System. (See figure 7-3.)

- a. (See figure 1-2.) Remove tailcone access door, fuel selector gear box access (73), pedestal access, and rudder trim access (6).
- b. Loosen stop block (21) by loosening attaching nuts and screws.
- c. Check and adjust the cable tension on the rudder trim control cables to 10 ± 3 pounds.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of 4 hours.

- d. Move rudder trim control system to neutral by rotating trim control wheel so that the ends of the chains are equal length from actuator and control wheel sprocket.
- e. Check the rudder trim indicator to indicate neutral position and if requiring adjustment, insert a screwdriver beneath the indicator and prying out of track in the trim control wheel, moving the indicator to neutral, and re-engaging with the track.
- f. Disconnect rudder trim tab push rod (17) from rudder trim tab (14) by removing attaching cotter pin, nut, washer and bolt.
- g. With the control wheel (1), rudder and rudder trim tab (14) in neutral, adjust the trim actuator (13) so that the hole in the push-pull tube (17) is aligned with the hole in the trim tab horn (15); attach with bolt, washer, nut and cotter pin.
- h. Rotate rudder trim control wheel (1) so rudder trim tab (14) is $11^{\circ} +1^{\circ}$, -0° right (measured perpendicular to rudder hinge line). On aircraft 421-0001 to 421B0301 locate center stop block (21) approximately 24 inches aft of cabin bulkhead and tighten. Slide forward stop block (21) against center stop block (21) and tighten. On aircraft 421B0301 and On, slide aft stop block (21) against cable stop (30) and tighten.
- i. Rotate rudder trim control wheel (1) so rudder trim tab (14) is $16^{\circ} +1^{\circ}$, -0° left (measured perpendicular to rudder hinge line). On aircraft 421-0001 to 421B0301, slide aft stop block (21) against center stop block and tighten. On aircraft 421B0301 and On, slide forward stop block against cable stop (30) and tighten.

WARNING

Insure that rudder trim tab moves in the proper direction when operated by the trim control wheel.

- j. Install the tailcone access door, fuel selector valve access, pedestal access, and rudder trim access.

SECTION 8

FLAP CONTROL SYSTEM

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CAUTION

Primary and secondary flight control cables, push pull tubes, bellcranks and mountings on late model aircraft use dual locking fasteners. The lock nuts for these fasteners incorporate a fiber lock, and are castellated for safetying with a cotter pin. When any of these areas are disconnected on any aircraft, new dual locking fasteners should be installed. See the Aircraft Parts Catalog for part numbers and location of these fasteners.

FLAP CONTROL SYSTEM.

The flap control system is operated by an electric motor which drives a gear reduction unit. Two sprockets, connected in tandem to the reduction unit output shaft by special rivets, drive four chain-connected cables which actuates the flap bellcranks. The four bellcranks in each wing are interconnected by push-pull tubes. A cam, driven by a gear attached to the aft output shaft of the reduction unit, operates two limit switches. On aircraft 421A0001 and ON, a flap preselect system is provided. The flap preselect system is comprised of a preselect lever assembly, mounted on the instrument panel; a flap preselect control cable, attached to the preselect

lever assembly and routed aft under the cabin floor-board and attached to the flap control cable, and associated electrical wiring. When the preselect lever assembly is placed in the 0° (UP) or 15°, 30° or 45° (DOWN) position, the preselect lever assembly microswitches are energized and actuates the flap motor, which drives the flaps until the corresponding flap position is reached. As the flaps reach the preselected position, the preselect lever assembly microswitches are de-energized. On aircraft 421B0201 and ON, a warning switch is mounted on the flap preselect mounting bracket to provide an aural warning when the flap preselect handle is lowered past the 15° position with the landing gear not down and locked.

Troubleshooting Flap Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
FLAP FAILS TO EXTEND OR RETRACT	Battery switch OFF.	Turn switch ON.
	Circuit breaker out.	Reset circuit breaker.
	Defective flap switch and/or limit switches.	Replace flap switch and/or limit switches.
	Defective flap motor.	Replace flap motor.
	Stripped or broken drive gear on flap motor.	Replace flap motor.
	Stripped or broken gears in reduction unit.	Replace reduction unit.
	Drive sprockets not secured to reduction unit output shaft.	Replace special rivets and/or sprockets.
FLAPS FAIL TO RETRACT	Up limit switch incorrectly adjusted.	Adjust in accordance with rigging procedures.
	Incorrect rigging of flap cables, compensated for by incorrect adjustment of push-pull rods.	Rig in accordance with rigging procedures.
FLAPS FAIL TO EXTEND COMPLETELY	DOWN limit switch incorrectly adjusted.	Adjust in accordance with rigging procedures.
	Incorrect rigging of flap cables, compensated for by incorrect adjustment of push-pull rods.	Rig in accordance with rigging procedures.
	Incorrect adjustment of push-pull rods.	Rig in accordance with rigging procedure.
FLAPS NOT SYNCHRONIZED OR FAIL TO FIT EVENLY WHEN RETRACTED	Incorrect adjustment of push-pull rods.	Adjust in accordance with rigging procedure.
	Bent push-pull rods.	Straighten or replace.
	Incorrect adjustment of bellcrank interconnecting push-pull tubes.	Adjust in accordance with rigging procedure.
	Incorrect rigging of cables and chains.	Rig in accordance with rigging procedures.
	Bent flap.	Repair or replace flap.
FLAPS ON ONE SIDE FAIL TO OPERATE	Drive sprocket for inoperative side not secured to reduction unit output shaft.	Replace special rivets and/or sprocket.
	Broken chain, cable or attaching pin.	Replace broken parts.

Removal of Flaps. (See figure 8-1.)

The following is a removal procedure for the left in-board flap. Remove the other flaps in a similar manner.

- a. Extend flaps.
- b. (See figure 1-2.) Remove access cover (38).
- c. Disconnect lower scissors link assemblies (10) from flap structure by removing nuts (15), washers (14), spacers (12 and 13) and bolts (9).
- d. Remove safety wire from bent end of hinge pin (24), and detach flap by removing hinge pin.

NOTE

If difficulty is encountered in removing outboard flap hinge pin, it may be necessary to remove aileron to gain better access to hinge pin.

Installation of Flaps. (See figure 8-1.)

- a. Attach flap to wing with hinge pin (24). Safety wire bent end of hinge pin.

NOTE

To facilitate hinge pin installation, check hinges and pin for distortion, lubricate hinge pin, and taper end of hinge pin.

- b. Connect lower scissors link assemblies (10) to flap structure by installing bolts (9), spacers (12 and 13), washers (14) and nuts (15).
- c. (See figure 1-2) Replace wing access cover (38).

- d. Check flap for proper operation and correct travel. If adjustment is necessary, refer to rigging procedure.

Removal of Flap Control Cables and Chains. (See figure 8-1.)

- a. Remove cabin seats and carpet on LH and RH sides of aircraft in accordance with Section 3.
- b. (See figure 1-2) Remove floorboard access panels (80, 81 and 86).
- c. (See figure 1-2) Remove wing structural skin (35) and access plates (58, 64, 65, and 66).
- d. Remove four inspection plates on forward side of rear spars adjacent to wheel well.
- e. Lower flaps several degrees to decrease tension on cables, remove safety and disconnect the turn-buckles.
- f. Disengage chains from sprockets.
- g. Disconnect flap extend cable (25) and return cable (27) from cable attachment links (26) by removing cotter pins, screws and nuts.
- h. Remove outboard pulley (28) by removing nut and bolt.

NOTE

Outboard pulley cable guard cotter pins are quite difficult to remove and install and should be removed only for replacement.

- i. Remove pulleys (29 and 30) located on wing stub by removing nuts and bolts.
- j. Remove pulleys (31 and 32) located under floor-

board access panel by removing bolts.

k. Remove seal assemblies (42) through access holes (58).

l. Disconnect chain (33) from extend cable (25) and return cable (27) by removing cotter pins, nuts, washers and bolts.

m. Tie guide wires to flap cables and pull out through fuselage.

n. Untie guide wires and remove cables from aircraft.

o. Removal procedures are for LH wing only. Remove right cables and chain in a similar manner.

Installation of Flap Control Cables and Chains. (See figure 8-1.)

a. Tie cables (25 and 27) to guide wire and route into position through the fuselage and wing.

b. Attach flap extend cable (25) and return cable (27) to links (26) on bellcrank (17) with screws, washers, nuts and cotter pins.

c. Place return cables (27) in position on pulleys (28, 29, and 31) and install pulleys with bolts and nuts.

d. Place extend cables (25) in position on pulleys (32 and 30) and install pulleys with bolts and nuts.

e. With turnbuckle ends attached to extend cable (25) and return cable (27), secure cables to chain (33) with screws, washers, nuts and cotter pins.

f. Engage chains (33) on reduction unit sprocket and rig cables in accordance with flap rigging procedures.

g. Install seal assemblies (42) as follows:

1. Insure that cables are lubricated for the full length of its travel within the seals.

2. Pack the seals with MIL-G-81322A lubricant.

3. Place seals on cable on non-pressurized side of bulkhead with small end toward bulkhead.

4. Insert seal in the bulkhead hole so that bulkhead metal is seated within the retaining groove with the small end of seal in the pressurized section.

5. Install proper retaining rings in the grooves of the seal (two on small end and one on large end).

h. Install inspection plates, wing access panels, wing gap skin, floorboard access panels, carpet and seats.

i. Installation procedures are for LH wing only. Install RH cables and chain in a similar manner.

Removal of Flap Bellcrank. (See figure 8-1.)

NOTE

Eight bellcranks are used to operate the flaps. The following procedure is used for removing the inboard bellcrank on the inboard flaps. Removal of the remaining bellcranks may be accomplished in a similar manner.

a. Remove cabin seats and carpet in accordance with Section 3.

b. (See figure 1-2.) Remove floorboard access panels (80, 81 and 86).

c. (See figure 1-2) Remove plug button (60) and rear spar access cover adjacent to bellcrank.

d. Lower flaps several degrees to decrease tension on return cable (27), remove safety and loosen turnbuckles to release tension on cables.

e. Disconnect extend cable (25) and return cable

(27) from cable attachment links (26) by removing cotter pins, screws and nuts.

NOTE

The above steps apply only to removal of the inboard bellcrank for the inboard flaps. To remove other bellcranks, remove access hole covers from rear spar adjacent to affected bellcrank.

f. Disconnect push-pull rod (11) from bellcrank (17) by removing cotter pin, nut, spacers and bolt.

g. Disconnect interconnecting push-pull tube (19) from bellcrank (17) by removing cotter pin, nut, spacers and bolts.

h. Unsafety bolt (22) retaining bellcrank (17) and remove bolt by gaining access through plug button from the underside of wing beneath bolt.

i. Remove bellcrank through rear spar access panels taking care that bushing (21) does not fall from bellcrank during removal.

Installation of Flap Bellcrank. (See figure 8-1.)

a. Insert bellcrank through access hole and install with washers (23) and bolt (22). Safety bolt and install plug button on underside of wing beneath bolt.

NOTE

Washers (23) and bushing (21) must be in place before installing bolt (22).

b. Attach interconnecting push-pull tube (19) to bellcrank with attaching bolt, spacers, nut and cotter pin.

c. Connect push-pull rod (11) to bellcrank (17) with attaching bolt, spacers, nut and cotter pin.

d. On bellcrank (17) connect flap extend cable (25) and return cable (27) to cable attachment links (26) by installing screws, nuts and cotter pins.

e. Rig flaps in accordance with rigging procedure.

f. Reinstall access hole covers, carpets and seats as necessary.

Removal and Installation of Flap Scissors Assembly. (See figure 8-1.)

a. Removal of flap scissors as follows:

1. Extend flaps.

2. Disconnect upper and lower scissors links (3 and 10) by removing cotter pins, nuts, washers, spacers and bolts.

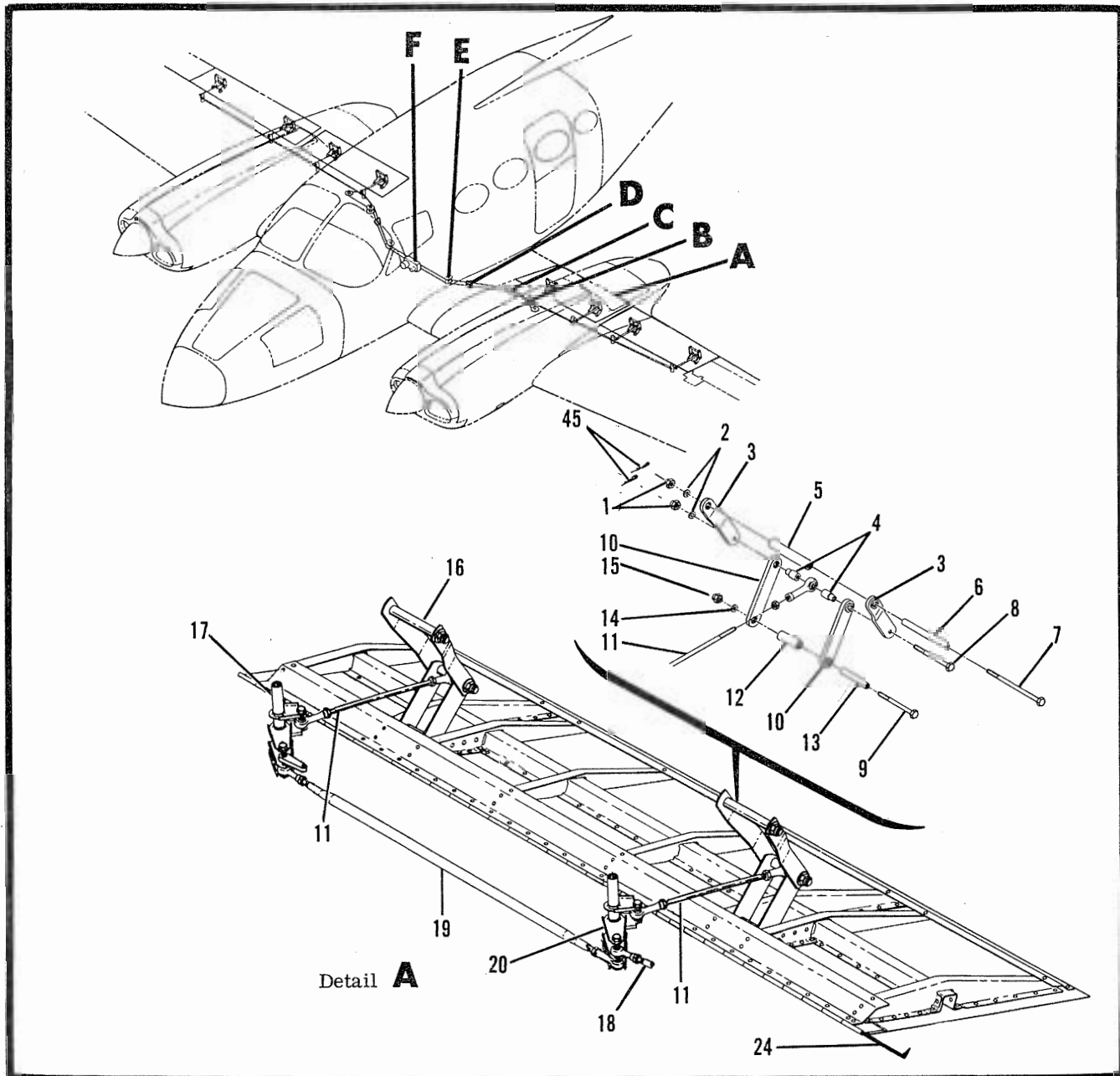
3. Disconnect push-pull rod (11) by removing cotter pin, nut, washer, spacers and bolts attaching push-pull rod to scissors.

b. Install flap scissors as follows:

1. Attach scissor links (3 and 10) to push-pull rod using bolt, spacers, washer, nut and cotter pin.

2. Connect upper and lower scissor links (3 and 10) using bolts, spacers, washers, nuts and cotter pins.

3. Check flaps for proper operation and correct travel. See Rigging of Flap Control System for limits and tolerances.



1. Nut	16. Scissors Assembly	31. Upper Inboard Pulley LH
2. Washer	17. Bellcrank	32. Lower Inboard Pulley LH
3. Upper Link Assembly	18. Center Interconnecting Push-pull Tube	33. Flap Chain LH
4. Spacer	19. Inboard Interconnecting Push-pull Tube	34. Extend Cable RH
5. Spacer	20. Outboard Bellcrank	35. Return Cable RH
6. Spacer	21. Bushing	36. Flap Chain RH
7. Bolt	22. Bolt	37. Lower Inboard Pulley RH
8. Bolt	23. Washer	38. Upper Inboard Pulley RH
9. Bolt	24. Hinge Pin	39. Lower Center Pulley LH
10. Lower Link Assembly	25. LH Extend Cable	40. Upper Center Pulley LH
11. Push-pull Rod	26. Cable Attachment Link	41. Flap Actuator
12. Spacer	27. LH Return Cable	42. Seal Assembly
13. Spacer	28. Outboard Pulley LH	43. Bellcrank RH
14. Washer	29. Upper Center Pulley LH	44. Outboard Pulley RH
15. Nut	30. Lower Center Pulley LH	45. Cotter Pin

Figure 8-1. Flap Control System (Sheet 1 of 2)

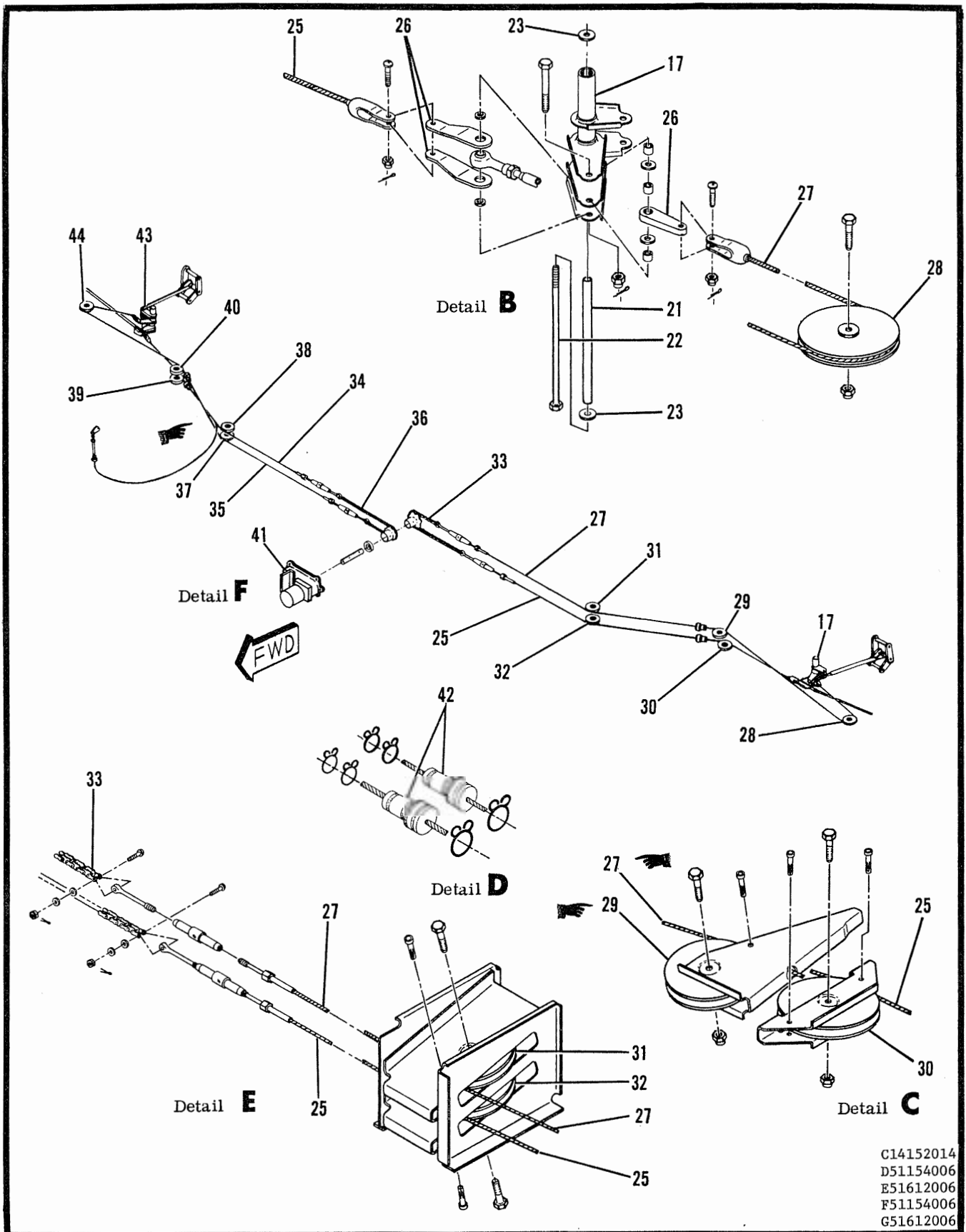


Figure 8-1. Flap Control System (Sheet 2 of 2)

Troubleshooting the Flap Actuator Motor.

TROUBLE	PROBABLE CAUSE	CORRECTION
BRAKE DOES NOT RESPOND AS REQUIRED	Loosen or open connections or circuits. Improper assembly.	Check test connections; if all right, test motor circuits for proper resistance, check for proper brake air gap. Adjust or replace defective parts.
SPEED IS TOO LOW OR CURRENT IS TOO HIGH	Incorrect end play, shorted armature circuit, excessive bearing friction.	Check motor for correct end play. If all right, test motor circuits for shorts. Replace defective parts.
MOTOR WILL NOT RUN	Circuit breaker out.	Reset breaker, if breaker will not remain set, check for shorted wiring in field circuit. If field circuit is shorted, refer to Landing Gear and Flap System Components Overhaul/Parts Manual and repair or replace motor.
MOTOR NOISY	Faulty bearings or armature dragging.	Refer to Landing Gear and Flap System Components Overhaul/Parts Manual and repair or replace motor.

Removal of Flap Actuator Assembly. (See figure 8-2.)

- a. Flap motor and/or position transmitter (421-0001 to 421A0001) can be removed without removing reduction unit; however, due to limited working space it is desirable to remove reduction unit, flap motor, and transmitter as an assembly.
- b. (See Section 3) Remove cabin seats and carpet on LH side of aircraft.
- c. (See figure 1-2) Remove floorboard access panels (80, 81 and 86).
- d. Lower flaps several degrees to release tension on return cables, remove safety from turnbuckles and loosen turnbuckles enough to disengage chains from sprockets.
- e. On aircraft 421-0001 to 421A0001, disconnect electrical connector from position transmitter (25).
- f. Remove nuts and screws attaching reduction unit to fuselage rear spar.
- g. Move complete actuator assembly forward until it clears the rear spar, tilt assembly slightly and remove through floorboard access hole.

Care should be exercised when working flap actuator assembly through control cables.

- h. Disconnect and tag wires leading from wire bundle to limit switches (21).

NOTE

If optional 400A Nav-O-Matic autopilot flap actuator is installed, tag and disconnect wires from resistor (28).

Removal of Limit Switch Bracket. (See figure 8-2.)

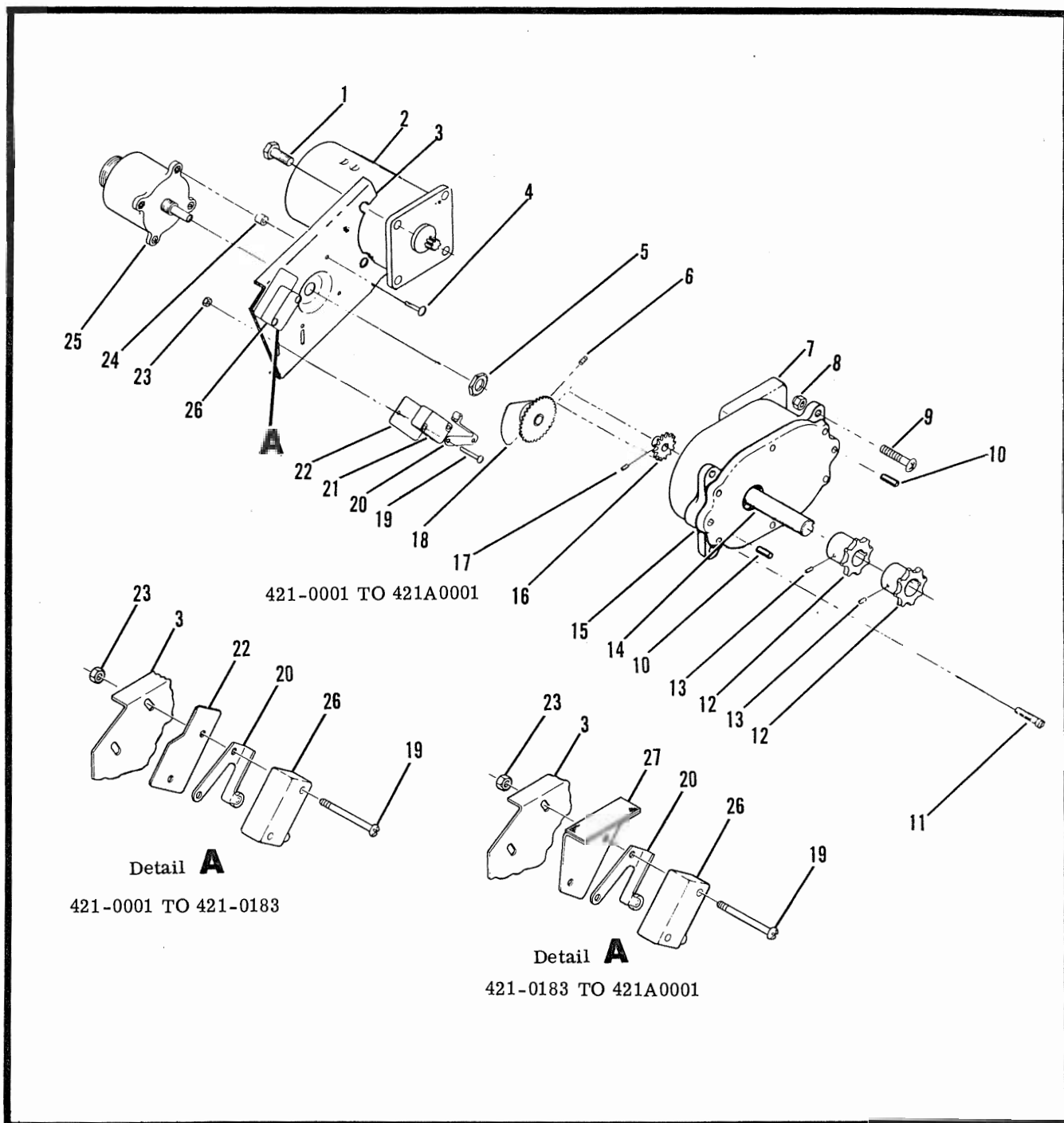
- a. Disconnect and tag electrical wires and route from bracket.
- b. Remove safety wire from bolts (1).
- c. Remove screw (38) and bolt (1). The lower bolt only needs to be loosened. Bracket hole is slotted for removal.
- d. Remove bracket (3) and switch assembly.

Installation of Limit Switch Bracket. (See figure 8-2.)

- a. Position bracket (3) and switch assembly to motor (2) and secure with bolts (1), screw (38) and lockwasher (39). Safety wire bolts (1).
- b. Route electrical wires through bracket and grommet. Connect wires and remove tags.
- c. Check that the reduction unit output shaft (14) does not turn when 800 pound-inches torque is applied.
- d. Adjust setscrew (33) to provide 0.005 maximum transfer shaft movement and secure with locknuts (34).

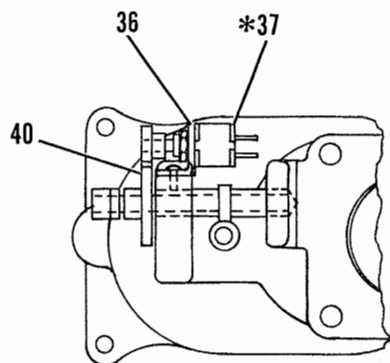
NOTE

Shaft movement measurement should be measured between miter gear (30) and miter gear (32).



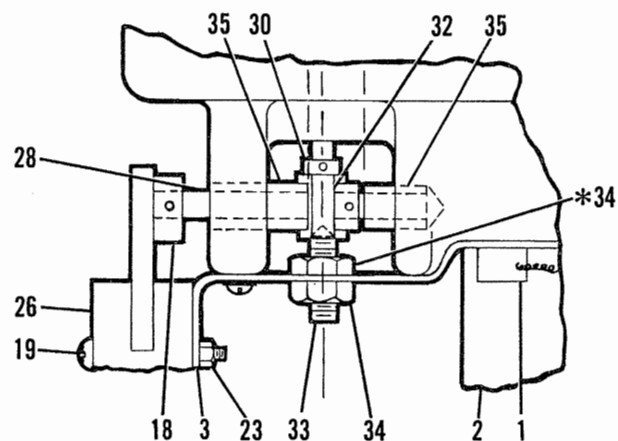
1. Bolt	11. Screw	20. Limit Switch Actuator	30. Miter Gear
2. Flap Motor	12. Sprocket	21. Limit Switch (Down)	31. Roll Pin
3. Bracket	13. Pin	22. Spacer	32. Miter Gear
4. Screw	14. Output Shaft	23. Nut	33. Setscrew
5. Nut	15. Reduction Unit	24. Spacer	34. Locknut
6. Setscrew	16. Pinion Gear	25. Position Transmitter	35. Spacer Bushing
7. Reduction Unit	17. Roll Pin	26. Limit Switch (Up)	36. Resistor Bracket
8. Nut	18. Cam	27. Guard Assembly	37. Resistor
9. Screw	19. Screw	28. Shaft	38. Screw
10. Dowel Pin		29. Spacer	39. Lockwasher
			40. Gear

Figure 8-2. Flap Actuator Assembly (Sheet 1 of 2)

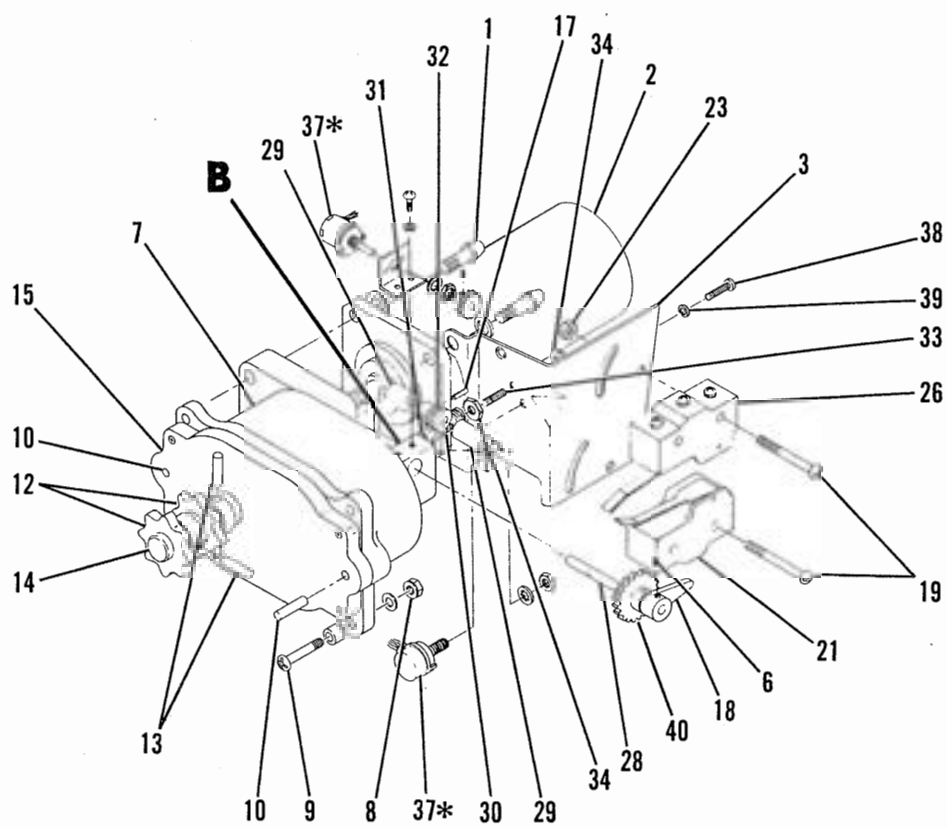


NOTE

*USED WITH 400A
NAV-O-MATIC
AUTOPILOT ONLY



Detail **B**
421A0067 AND ON



14152019
B
51152007

421A0001 AND ON

Figure 8-2. Flap Actuator Assembly (Sheet 2)

Installation of Flap Actuator Assembly. (See figure 8-2.)

- a. Place flap actuator assembly near floorboard access hole and attach wires from wire bundle to respective limit switch and remove tags.

NOTE

Insure that terminals of the limit switches are covered with insulated sleeving and wiring is secure and clear of all control cables and moving parts.

- b. Insert actuator assembly through floorboard access hole and install with screws and nuts.
- c. On aircraft 421-0001 to 421A0001 connect the electrical connector to the position transmitter (25).
- d. Engage chains with sprockets (12) and rig flap control system in accordance with rigging procedure.
- e. Install fuselage and floorboard access panels.
- f. Install carpets and cabin seats in accordance with Section 3.

Rigging of Flap Control System. (See figure 8-1.)

The flap control system should be rigged using a 24 volt external power source, with a two-position momentary switch, attached to the flap motor wires so the flaps may be observed while being operated during rigging.

CAUTION

Use caution while operating flaps with an external power source, as the limit switches are inoperative.

- a. Remove center seats and center carpet in accordance with Section 3.
- b. (See figure 1-2) Remove floorboard access panels (80, 81 and 86).
- c. Remove four inspection plates on the forward side of rear spar adjacent to wheel well.
- d. Check length of inboard push-pull rod (11) on each inboard flap and adjust to 10.45 inches.

NOTE

Length of push-pull rods is measured between the centerlines of rod end bolt holes.

- e. Check length of interconnecting push-pull tubes and adjust, if necessary, to the following dimensions:

Outboard interconnecting
push-pull tubes 33.35 inches

Center interconnecting
push-pull tubes 23.80 inches

Inboard interconnecting

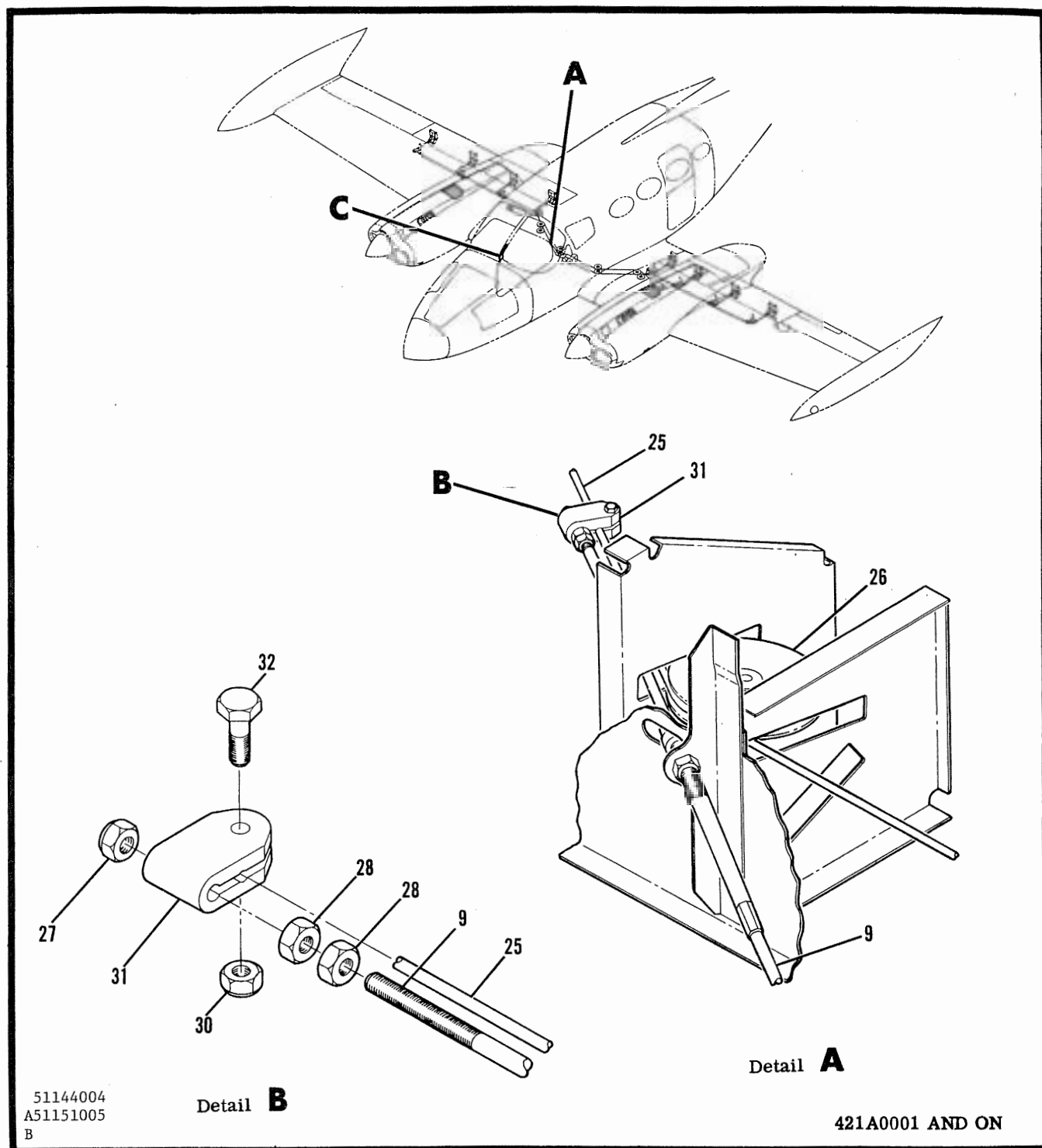
push-pull tubes 23.80 inches

- f. Adjust remaining push-pull rods from bellcranks to scissors so flaps fit evenly when in the UP position.
- g. (See figure 8-2) Adjust limit switches as follows:
 1. Loosen limit switches (21 and 26) and position them where they will be activated by the cam (18).
 2. With the flaps in the UP position on 421-0001 to 421A0001 aircraft, flex flap switch bracket (3) aft to disengage cam (18) from pinion gear (16). Rotate cam to a point where it actuates the UP limit switch (26), (upper switch) and re-engage cam with pinion gear by releasing tension on bracket (3).
 3. With the flaps in the UP position on 421A0001 and ON aircraft, loosen setscrew (6), rotate cam (18) to a point where it actuates the UP limit switch (26), and then tighten setscrew (6).
 - h. (See figure 8-1) With flaps in the UP position, check for correct positioning of the flap chains on sprockets and, if necessary, adjust as follows:
 1. Engage right chain (36) with forward sprocket so that approximately 2-1/2 links extend around bottom side of sprocket.
 2. Engage left chain with aft sprocket so that 3 links extend around the top side of sprocket.
 3. Connect RH extend cable (34) to the long end of chain (top side of forward sprocket) and route over pulleys (38 and 39) to bellcrank (43).
 4. Connect RH return cable (35) to the short end of chain (bottom side of forward sprocket) and route over pulleys (37 and 40) around outboard pulley (44) and back to bellcrank (43).
 5. Connect LH extend cable (25) to the long end of chain (bottom side of aft sprocket) and route over pulleys (30 and 32) to bellcrank (17).
 6. Connect return cable (27) to the short end of chain (top side of aft sprocket) and route over pulleys (29 and 31) around outboard pulley (28) and back to bellcrank (17).
 7. With flaps secured in UP position tighten turnbuckles until all slack is out of cables. Temporarily rig both return cables (27 and 35) with 185 lbs. tension. Final tension on return cables should be 200 to 250 lbs. with flaps in the UP position. The differential tension between left and right should not exceed 25 lbs.

NOTE

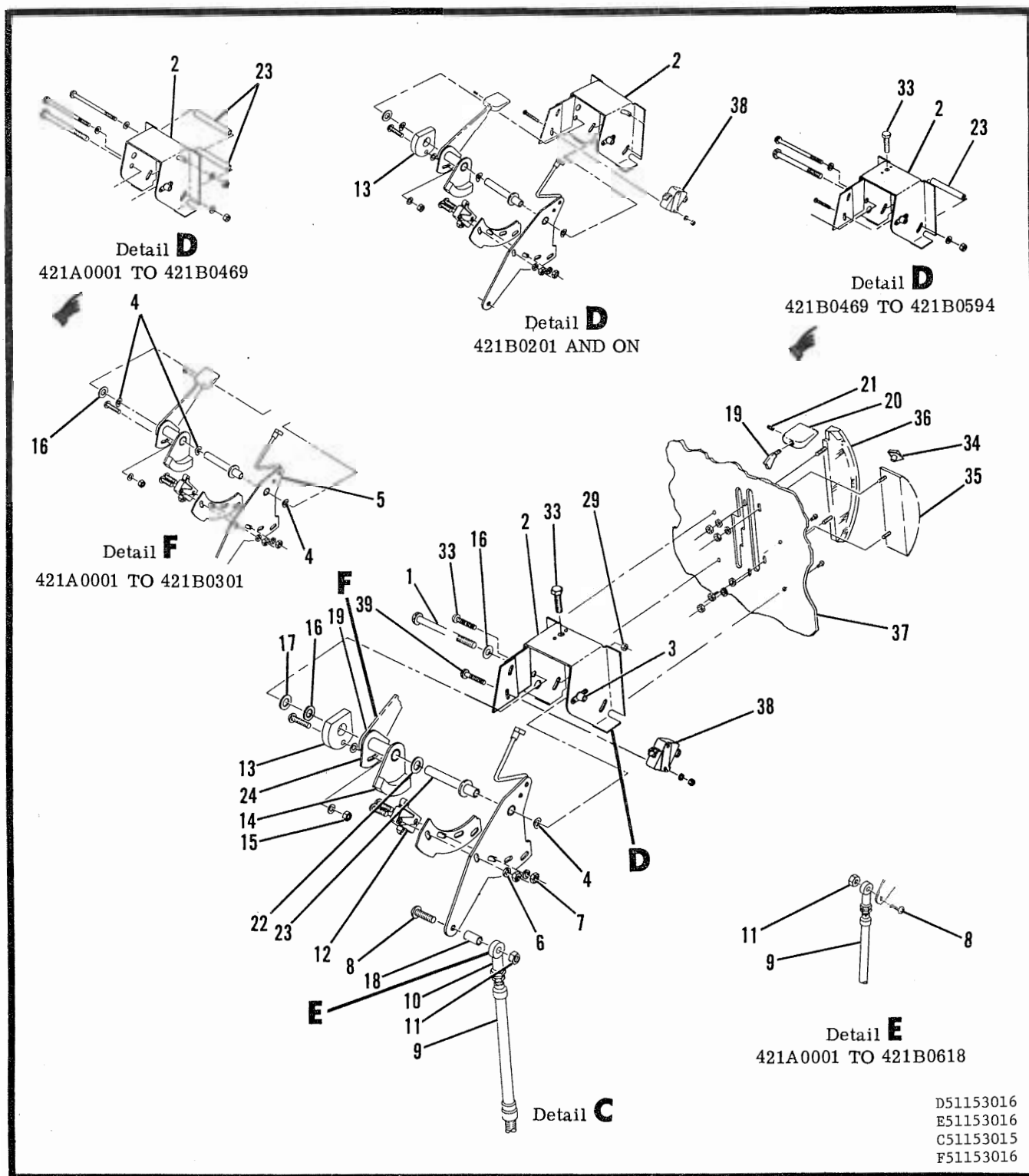
At this point, recheck flap position as to being in proper position with respect to wing trailing edge. Should further adjustment of push rods be necessary, this must be accomplished before final setting of cable tension.

8. Remove tape or other means of securing flaps in the UP position and lower flaps a few degrees at a time, observing for any unusual tension build-up in the cables or binding of the push-pull tubes and push rods, until flaps reach their bottom position as



1. Bolt	9. Control Cable	17. Phenolic Washer
2. Bracket Assembly	10. Rod End	18. Spacer
3. Nutplate	11. Nut	19. Flap Preselect Lever
4. Spring Washer	12. Limit Switches	20. Knob
5. Arm Assembly	13. Cam	21. Set Screw
6. Washer	14. Cam	22. Teflon Washer
7. Nut	15. Nut	23. Spacer
8. Screw	16. Washer	24. Pivot Bellcrank

Figure 8-3. Flap Preselect Installation (Sheet 1 of 2)



- 25. Flap Cable (Extend)
- 26. Flap Cable Pulley
- 27. Nut
- 28. Nut
- 29. Nut

- 30. Nut
- 31. Clamp
- 32. Bolt
- 33. Stop Bolt
- 34. Pointer

- 35. Indicator Block
- 36. Guard Block
- 37. Instrument Panel
- 38. Warning Switch
- 39. Screw

Figure 8-3. Flap Preselect Installation (Sheet 2)

measured with a protractor. Tolerance for flap travel is plus one degree, minus zero degrees.

9. Rig both extend cables (25 and 34) with 85 lbs. of tension. (Final tension of extend cables, with flaps down should be 75 to 95 lbs., with the differential tension between left and right not exceeding 25 lbs.)

10. Raise flaps and make final tension check of return cables (27 and 35) when stopped by the limit switch. (200 to 250 lbs.)

NOTE

If the return cable tension is readjusted at this time, it will be necessary to recheck the extend cable tension with the flaps in the down position and adjust as required. It will always be necessary to make the last tension adjustment on the extend cables with flaps down.

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of 4 hours.

11. (See figure 8-2) Lower flaps to 45 degrees and adjust down limit switch (21) to actuate and stop flap travel at this point. Safety turnbuckles.

NOTE

On aircraft 421A0001 and On, adjust limit switches and cable tension in accordance with Flap Preselect Rigging Procedures.

- i. If used, disconnect the switch and outside power source which were wired into the flap circuit.
- j. Replace access hole covers.
- k. Install rear carpet in accordance with Section 3.
- l. Install rear seat in accordance with Section 3.

Operational Flight Check.

The operational flight check of the flaps consists of flying the aircraft at 165 MPH CAS and operating the flaps down, noting the extension time. The flaps should extend in 10 to 14 seconds. Operate the flaps up and note the retraction time. The flaps should retract in 6 to 10 seconds.

NOTE

If the flaps will not extend or retract within the correct time, it will be necessary to replace the flap motor.

Removal of Flap Preselect Lever Assembly. (See figure 8-3.) 421A0001 and ON

- a. Loosen set screw (21) and remove knob (20) from lever assembly (19).
- b. Loosen nut (11) and remove screw (8) from rod end (10).
- c. Remove bolt (1) from nutplate (3).
- d. Remove flap preselect lever assembly from bracket assembly (2).

NOTE

Install knob with a minimum clearance of 0.12 from instrument panel structure.

- e. Rig flap preselect system in accordance with rigging procedure.

NOTE

When removing flap preselect lever assembly from bracket assembly, make sure spring washers do not fall into center console.

Disassembly and Assembly of Flap Preselect Lever Assembly. (See figure 8-3.) 421A0001 and ON

- a. Disassemble lever assembly in accordance to the applicable detail in figure 8-3.

NOTE

To facilitate assembly of preselect lever (19) and cam (14), mark position of assemblies before loosening nut (15).

- b. Assemble flap preselect lever assembly by reversing disassembly procedure.

Installation of Flap Preselect Lever Assembly. (See figure 8-3.) 421A0001 and ON

- a. Place flap preselect lever assembly into position in bracket assembly (2).
- b. Install bolt (11) to nutplate (3).
- c. Align holes in rod end (10) and arm assembly (5), install screw (8) and secure with nut (11).
- d. Install knob (20) on lever assembly (19) and secure with set screw (21).

Removal of Flap Preselect Control Cable. (See figure 8-3.) 421A0001 and ON

- a. Remove pilot's, copilot's and forward passenger seats in accordance with Section 3.
- b. Remove center carpets and floorboard in accordance with Section 3 to gain access to flap preselect control cable.
- c. Loosen nut (11) and remove screw (8).
- d. Loosen nut (30) and remove bolt (32) and clamp (31) from flap cable (25) and control cable (9).
- e. Remove clamps securing control cable (9) to bulkheads.
- f. Remove control cable (9) from aircraft.

Installation of Flap Preselect Control Cable. (See figure 8-3.) 421A0001 and ON

- a. Install flap preselect control cable by reversing removal procedure and rig in accordance with rigging procedure.

Rigging Flap Preselect System. (See figure 8-3.)
421A0001 and On

- a. Remove passenger seats and center carpets in accordance with Section 3 to gain access to the right-hand forward floorboard.
- b. Remove right-hand floorboard.
- c. Loosen nut (30) and remove bolt (32) from clamp (31).
- d. Remove clamp (31) from flap cable (25) and control cable (9).
- e. Connect a 24 volt external power source.

NOTE

To facilitate rigging of the flap preselect system, a two position momentary switch with suitable lengths of electrical wires can be connected to the flap actuator limit switches in such a manner that the flaps can be observed while being operated during rigging.

- f. On aircraft 421A0001 to 421B0469, adjust flap motor limit switches to provide 0° (UP) position and 45°, +1°, -0° position flap travel in accordance with the adjusting procedures.
- g. On aircraft 421B0469 and On, adjust flap motor limit switches to provide 0° (UP) with cable tension of 280 ± 20 pounds and 46° (DOWN) with cable tension of 85 ± 10 pounds.
- h. Operate flaps full down and retract control cable (9) to full in position at aft end.
- i. Move control cable (9) out .10 inch and install clamp (31) to flap cable (25) with bolt (32) and secure with nut (30). Clamping block to be located .50 ± .25 inch from edge of flap pulley (26). Use conduit and/or cable end thread adjustment to attain .50 inch dimension. Operate flaps to full up position.
- j. Adjust limit switch (12) rollers snug against cam (14) at the flap preselect control.
- k. Adjust tension on flap control bolt (1) to prevent flap preselect lever (19) from moving when limit switch roller falls off cam (14).
- l. Attach rod end (10) to preselect arm (5) and adjust rod end (10) and/or cable housing to locate preselect arm (5) to the dimension shown in figure 8-4.
- m. Move flap preselect lever (19) to 15° position detent. Loosen adjustment screw (17) between the flap preselect lever (19) and pivot bellcrank (24). Measure flap control surface and move cam (14) as required to provide a flap surface position of 15° ± 0°. Tighten adjustment screw (17) at flap preselect lever (19) and pivot bellcrank (24).

NOTE

When the preselect lever assembly is placed in the 15° (DOWN) position, the flap angular travel must be 15° ± 0°.

- n. Adjust pointer (34) to center on 15° mark on indicator block (35) by bending wire.
- o. Place preselect lever assembly (19) in the 30°

(DOWN) position.

- p. Operate flap motor until flaps are in the 30° ± 0° (DOWN) position.

- q. Check preselect limit switches (12) for proper adjustment, to ensure limit switches are de-energized when the flaps reach the 30° (DOWN) position.

NOTE

When the preselect lever assembly is placed in the 30° (DOWN) position, the flap angular travel must be 30° ± 2°.

- r. Match pointer arc with indicator block (35) and guard block (36) by adjusting blocks vertically. (Slotted holes provided.)
- s. On aircraft 421A0001 to 421B0469, adjust flap handle stop bolts (33) so that switch rollers are still on cam (14) when 0° and 45° flap motor limit switches are actuated. This will take .12 inch to .16 inch handle travel measured at the intersection of the panel slot.
- t. On aircraft 421B0469 and On, adjust flap preselect lever up stop (33) to limit 0° flap setting with 225 ± 25 pounds return cable tension.
- u. Adjust flap preselect lever down stop to limit flap travel to 45°, +1°, -0°.
- v. Check flap surface travel tolerances at the following locations: 15° ± 0° DOWN; 30° ± 2° DOWN; 45°, +1°, -0° DOWN; 15°, +0°, -2° from DOWN to UP.
- w. Disconnect the 24 volt external power source from flap motor wiring.
- x. Perform operational check out of flap and preselect system, using the aircraft power system, to ensure that proper operation of limit switches, preselect switches and flap angular movements are within specified tolerances.
- y. Install right-hand floorboard.
- z. Install center carpets and center seats in accordance with Section 3.

Adjustment of Flap-Gear Warning System. (421B0201 and On)

Refer to Adjustment of Landing Gear Warning System, Section 4.

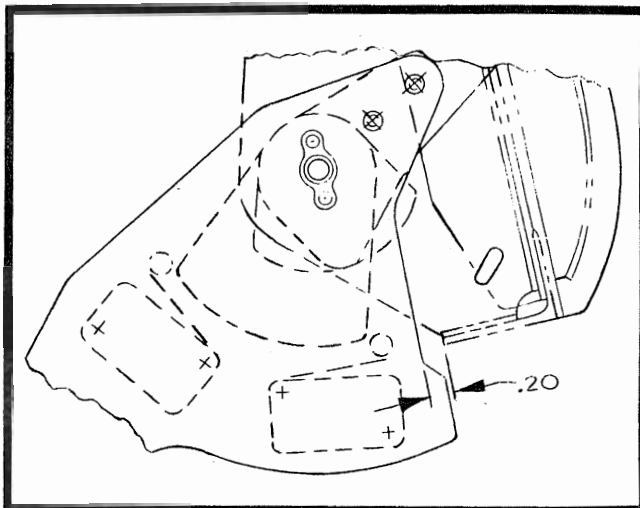


Figure 8-4. Flap Preselect Dimension Requirement

SECTION 9

ENGINE

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GENERAL INFORMATION.

Two Continental GTSIO-520D (421-0001 to 421B0001) or GTSIO-520H (421B0001 and ON) engines are mounted on the aircraft. The engine is geared, turbocharged, six-cylinder, fuel injected, horizontally opposed and develops 375 horsepower at 2275 propeller RPM. Installed on each engine are two magnetos, twelve spark plugs, ignition harness and wiring, primer distribution lines and fittings, engine-driven fuel pump, low pressure, multi-nozzle, continuous flow fuel injection system, pressure type intake manifold piping, integral oil pump and externally mounted oil cooler, intake air intercooler, starter

and various adapters, clamps and brackets for mounting these items on the engine. Each engine drives an all-metal, three-bladed, constant-speed full-feathering propeller. In addition to the propeller and the above mentioned engine accessories, the complete engine assembly consists of the following Cessna installed items: propeller governor, engine baffles, induction air filter, vacuum pump, oil filter, turbocharger with pressurization bleed off, controllers, waste-gate actuator, alternators, exhaust stack assemblies, cylinder head temperature bulb, oil temperature bulb, cowl flap assembly, crankcase breather line and various other lines, hoses, fittings and brackets necessary for the proper assembly and operation of the engine.

Detail Engine Specifications.

Model (421-0001 to 421B0001)	GTSIO-520D
(421B0001 and On)	GTSIO-520H
Propeller Drive Ratio	.667:1
Propeller Shaft Rotation (Looking Forward)	Clockwise*
Propeller Attachment (Flange)	APR 502 Type I
Bore, Inches	5.250
Stroke, Inches	4.000
Displacement, Cubic Inches	520
Compression Ratio	7.5:1
Turbosupercharged (Maximum RPM)	75,000
Oil SAE Number Above 40°F	SAE #50
Below 40°F	10W30 Multi-Viscosity or SAE #30
Oil Sump Capacity	13 Qts.
Fuel, Aviation Grade, Octane (Minimum) (Low Lead Fuels are approved for use)	100/130
Fuel System	Continental Fuel Injection
Fuel Injector	Continental Fuel Injection
Magneto Drive, Ratio to Crankshaft	1.5:1
Magnetos (1) Bendix S6LN-1201 (Left Magneto on LH and RH Engines)	Clockwise*
(1) Bendix S6LN-1205 (Right Magneto on LH and RH Engines)	Clockwise*
Tachometer Drive, Ratio to Crankshaft	.5:1
Rotation	Clockwise*

*Direction of rotation facing engine drive pad.

Detail Engine Specifications (Cont.)

Starter Drive, Ratio to Crankshaft		32:1
Rotation		Counterclockwise*
Alternator Drive, Ratio to Crankshaft		3:1
Rotation		Counterclockwise*
Vacuum Pump Drive, Ratio to Crankshaft		1.14: 1
Rotation		Counterclockwise*
Vacuum Pump Drive, (Deice)		1.14: 1
Rotation		Counterclockwise*
Vacuum Pump Drive, (Autopilot)		1.14: 1
Rotation		Counterclockwise*
Propeller Governor Drive, Ratio to Crankshaft		.809:1
Rotation		Clockwise*
Spark Plug Type, AC		AC 273
Breaker Point Setting (Both Magnetos)		20° BTC
Spark Plug Gap		0.017-0.018
Firing Order		1-4-5-2-3-6
Fuel Pressure (Lbs. Per Sq. Inch) Unmetered @ 450 Propeller RPM		6.0 PSI
Auxiliary Pump Resistor @ 450 Propeller RPM		5.5 ± .25 PSI
Maximum Metered Fuel Pressure @ 39.5" Hg MP & 2275 Propeller RPM		16.0 - 17.0 PSI
Metered Fuel Pressure Shown Here is Referenced to Compressor Discharge Pressure		
Minimum Auxiliary Pump Pressure Switch @ 450 Propeller RPM		4.0 ± .25 PSI
Oil Pressure (Lbs. Per Sq. Inch)		
Normal		30 to 60
Maximum		100
Idling (Minimum)		10
Oil Temperature (°F)		
Normal		170°
Maximum		240°
Cylinder Head Temperature (°F)		
Maximum		460°
Minimum (Takeoff)		200°
Standard Engine Dry Weight (Lbs.)		550.39

* Direction of rotation facing engine drive pad.

Troubleshooting the Engine.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START	Fuel tank empty. Improper starting procedure. Cylinder overprimed.	Fill with correct grade of fuel. Refer to Pilot's Checklist for starting procedure and check for performance of each item. With auxiliary fuel pump switch OFF, allow manifold to drain at least 5 minutes or until fuel ceases to flow out of the drain under the nacelle. If circumstances do not allow natural draining periods recommended above, with the auxiliary pump switch OFF, magneto switches OFF, mixture idle cut-off and throttle full open, turn engine with starter and/or by unfeathering for a minimum of 15 revolutions.
CAUTION If the primer switch is activated for excessive periods of time with the engine inoperative on the ground or during flight, damage may be incurred to the engine and/or aircraft due to fuel accumulation in the induction system. Similar conditions may develop when the engine is shutdown with the auxiliary pump switch in the ON position.		
ENGINE WILL NOT START (CONT.)	Manifold valve sticking closed. Induction system leak. Excessive starter slippage. Fuel system malfunction. Ignition system malfunction. Intercooler and risers system leak.	Repair or replace manifold valve. Tighten or replace loose or damaged hose connections. Replace starter adapter. Isolate cause and correct. (See Engine Maintenance and Overhaul Manual.) Isolate cause and correct. (See Engine Maintenance and Overhaul Manual.) Tighten or replace clamps or faulty hose connections.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT RUN AT AT IDLING SPEED	Propeller levers set in high pitch (DECREASE RPM) position.	Use low pitch (INCREASE RPM) position for all ground operations.
	Fuel injection system improperly adjusted.	See Section 11.
	Air leak in intake manifold.	Tighten loose connection or replace damaged part.
	Spark plugs fouled by oil escaping past piston rings.	Top overhaul.
	Intercooler and risers system leak.	Tighten or replace clamps or faulty hose connections.
ROUGH IDLING	Fuel injection system improperly adjusted.	See Section 11.
	Mixture levers set for lean mix- ture.	Use FULL RICH position for all ground operation.
	Fouled spark plugs.	Remove and clean. Adjust gaps.
	Discharge nozzle air vent mani- fold restricted or defective.	Set fuel control in FULL RICH position, turn auxiliary pump ON, check to be sure feed lines and filters are not re- stricted. Clean or replace defective components.
	Hydraulic lifters fouled.	Remove and clean lifters. In- spect and clean oil filter at more frequent intervals.
	Burned or warped exhaust valves, worn seats, scored valve guides.	Top overhaul.
ENGINE RUNS TOO LEAN AT CRUISING POWER	Improper manual leaning proce- dure.	Operate in FULL RICH position below 5000 feet. Above 5000 feet retard mixture levers un- til a slight drop in RPM is noted, then advance levers ap- proximately one inch toward FULL RICH position.
	Turbine pressurization air leak at controlling venturi inlet coupling or at variable absolute pressure con- troller mounting flange.	Tighten or replace faulty components.
	Turbocompressor discharge air leak at throttle body coupling.	Tighten or replace faulty components.
	Fuel injection malfunction.	See Fuel Injection System.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE RUNS TOO RICH AT CRUISING POWER	Fuel flow too low.	Check fuel strainer for clogging. Clean screen.
	Restrictions in air intake passages.	Check passages and remove restrictions.
	Intercooler or induction system leak.	Tighten or replace clamps or faulty hose connections.
ENGINE RUNS TOO LEAN OR TOO RICH AT THROTTLE SETTINGS OTHER THAN CRUISE	Fuel injection malfunction.	See Fuel Injection System.
CONTINUOUS FOULING SPARK PLUGS	Piston rings excessively worn or broken.	Replace rings. Replace cylinder if damaged.
	Oil leakage from turbocharger into intake system.	Check turbocharger oil drain lines, separator and scavenger oil pump. If positive identification is made of this type of malfunction, it is important to thoroughly clean the pressurization air ducts, intercooler and heater system.
	Piston rings inverted or not seated.	Install with side marked TOP toward piston head. Allow approximately 25 hours for new rings to wear in.
	Cold cylinder operation.	Check cylinder baffles.
ENGINE RUNS ROUGH AT HIGH SPEED	Loose mounting bolts or damaged mount pads.	Tighten mounting bolts. Replace mount pads.
	Plugged nozzle.	Clean.
	Propeller out of balance.	Remove and repair.
	Ignition system malfunction.	See Ignition Trouble Shooting Chart.
CAUTION After rough engine operation, inspect in accordance with Rough or Malfunctioning Engine Operation Inspection.		
REGULAR MISSING AT HIGH SPEED	Broken valve spring.	Replace.
	Plugged nozzle.	Clean.
	Spark plugs fouled.	Clean or replace.
	Burned or warped valve.	Top overhaul.
	Hydraulic tappet dirty or worn.	Remove and clean or replace.
SLUGGISH OPERATION AND LOW POWER	Throttle not opening wide.	Check and adjust linkage.
	Exhaust system leakage.	Locate and correct.
	Restriction in air intake passages.	Check passages; remove restrictions.
	Turbocharger wheels rubbing.	Replace turbocharger.
	Ignition system malfunction.	See Ignition Trouble Shooting Chart.

TROUBLE	PROBABLE CAUSE	CORRECTION
SLUGGISH OPERATION AND LOW POWER (CONT.)	Fuel injection malfunction.	See Fuel Injection System.
	Valve seats worn and leaking. Piston rings worn or stuck in grooves.	Top overhaul.
	Bypass valve stuck open or controllers and actuators inoperative.	Repair or replace faulty components.
	Variable absolute pressure controller low setting improperly adjusted.	Adjust low pressure setting of variable absolute pressure controller.
HIGH CYLINDER HEAD TEMPERATURE	Low octane fuel.	Drain tanks and replace with correct grade of fuel.
	Lean fuel/air mixture due to improper manual leaning procedure.	See CORRECTION under Engine Runs too Lean at Cruising Power.
	Dirt between cylinder fins.	Clean thoroughly.
	Excessive carbon deposits in cylinder head and on pistons.	Top overhaul.
	Exhaust system gas leakage.	Locate and adjust.
	Exhaust valves leaking.	Top overhaul.
	Improper magneto timing.	See installation and timing of magnetos.
	Improper seating of bypass valve in closed position.	Repair or replace valve or actuator system.
OIL LEAKS	At front of engine; damaged crankshaft oil seal.	Replace.
	At top of engine; discontinuity on crankcase breather system.	Repair or replace lines or hose connections.
	Around push-rod housings; damaged push-rod housing packing.	Replace.
	At aft engine compartment: exhaust valve controllers or actuators.	Tighten or replace faulty seals, lines or fittings.
	Around propeller mounting flange; damaged hub O-ring seal.	Replace.
	Around plugs, fittings and gaskets due to looseness or damage.	Tighten or replace.
	Around oil temperature bulb.	Remove crush washer from oil temperature and install MS28774-4 packing.
EXCESSIVE OIL DIS- CHARGE OVERBOARD	Faulty vacuum pumps or breather oil separators: restricted oil return line.	Repair or replace faulty components.
	Crankcase breather line; stuck rings due to prolonged operation at low power.	High power engine operation to clear rings with close monitoring of cylinder temperatures.
LOW COMPRESSION	Piston rings excessively worn. Valve faces and seats worn.	Top overhaul.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOW COMPRESSION (CONT.)	Excessively worn cylinder walls.	Replace cylinders and piston rings.
ENGINE WILL NOT ACCELERATE PROPERLY	Unmetered fuel pressure too high.	See Unmetered Fuel Pressure Adjustment.
	Waste-gate does not close properly.	Replace waste-gate and actuator.
	Manifold pressure relief valve sluggish or stuck open.	Replace manifold pressure relief valve.
	Leak in turbocharger discharge pressure system. (See Note.)	Inspect turbocharger installation.
NOTE Leak in turbocharger discharge system is characterized by the engine leaning out at idle, but when acceleration is attempted, it will not accelerate because of an over-rich mixture. However, when the mixture control is leaned the maximum RPM will be low and the engine will be very rough.		
SLOW ENGINE ACCELERATION ON A HOT DAY	Variable absolute pressure controller improperly adjusted.	Adjust cam on variable controller as to advance point of contact with valve plunger.
	Premature opening of waste-gate: hydraulic system obstruction or oversensitive rate controller adjustment.	Check and clear all lines: desensitize rate controller up to the over-boost limits under rapid acceleration.
ROUGH IDLE AT AIRFIELDS WITH GROUND ELEVATION OF 3500 FEET OR HIGHER	Mixture too rich.	Momentarily pull mixture control back until engine acceleration picks up, then move mixture control to full forward again.
SLOW ENGINE ACCELERATION AT AIRFIELDS WITH A GROUND ELEVATION OF 3500 FEET OR HIGHER	Mixture too rich.	Pull mixture control back to where the engine operates the smoothest at IDLE RPM.
MANIFOLD PRESSURE OVERSHOOT ON ENGINE ACCELERATION	Mixture too rich.	Pull mixture control back to where engine operates at IDLE RPM. Engine should accelerate normally.
ERRATIC ENGINE OPERATION, WITH UNASSISTED POWER CHANGES	Engine acceleration too rapid from idle to full power.	Open throttles about half-way. Let engines accelerate to 30" Hg. and peak. Move throttles to full open position.
	Manifold pressure relief valve stuck closed.	Replace manifold pressure relief valve.
	Rate controller improperly adjusted.	Adjust rate controller.
	Loose or failed compressor discharge to throttle body coupling, affecting throttle and mixture control lever positions.	Tighten or replace coupling. Re-rigging of throttle and mixture may be necessary.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE MANIFOLD PRESSURE TOO HIGH	Variable absolute pressure controller improperly adjusted.	Adjust variable pressure controller.
	Manifold pressure relief valve stuck closed.	Replace manifold pressure relief valve.
LOW CRITICAL ALTITUDES AT CORRESPONDING ENGINE POWER	Induction, pressurization air, and/or exhaust systems leaking.	Conduct air leak check and tighten or replace faulty components.
ENGINE DOES NOT DEVELOP MAXIMUM POWER	Variable absolute pressure controller high setting improperly adjusted.	Adjust high pressure setting on variable absolute pressure controller.
	Loose or failed compressor discharge to throttle body coupling.	Tighten or replace coupling.
ENGINE WILL NOT STOP AT IDLE CUT-OFF	Fuel manifold valve not seating tightly.	Repair or replace manifold valve.
ENGINE WILL NOT START	Fuel manifold valve sticking closed.	Repair or replace manifold valve.
HIGH FUEL PRESSURE AT ENGINE IDLE IMPOSSIBLE TO OBTAIN	Fuel manifold valve sticking closed.	Repair or replace manifold valve.
ERRATIC ENGINE OPERATION	Fuel manifold valve sticking part-way, or not free.	Repair or replace manifold valve.
MANIFOLD PRESSURE VARIES WITH AIRSPEED. INCREASE WHEN AIRSPEED INCREASED, DECREASE WHEN AIRSPEED DECREASED	Ram air pressure changes with air-speed while RPM remains constant.	Normal turbocharged engines characteristics.

NOTE

The left engine manifold pressure will normally increase or decrease more than right engine because of location of left engine air intake duct.

MANIFOLD PRESSURE VARIES WITH ENGINE RPM	Waste-gate OPEN, RPM increase, manifold pressure slight decrease. RPM decrease, manifold pressure slight increase.	Normal turbocharged engines characteristics.
	Waste-gate CLOSED, RPM increase, manifold pressure slight increase. RPM decrease, manifold pressure slight decrease.	Normal turbocharged engines characteristics.
MANIFOLD PRESSURE VARIES WITH INCREASING OR DECREASING FUEL FLOW	Waste-gate CLOSED, fuel flow increased, turbine turns faster more induction air furnished engine resulting in manifold pressure increase.	Normal turbocharged engines characteristics.

TROUBLE	PROBABLE CAUSE	CORRECTION
INDICATED FUEL FLOW HESITATES OR LAGS OVER THREE SECONDS AFTER THROTTLE IS ADVANCED TO FULL OPEN POSITION	Compressor discharge air pressure line to fuel flow gage obstructed with oil.	Flush and clear lines. Rework air reference pressure lines in conformance with provisions defined on SK421-6.
FUEL FLOW FLUCTUATES WITHIN A RANGE OF ± 1.0 GALLONS/HR. IN FLIGHT WITH ENGINE OPERATING ON MAIN TANK, AND WITH AUXILIARY PUMP SWITCH IN THE LOW POSITION	Low pressure output from auxiliary pump.	Reset low boost adjustment in conformance with the adjustment procedures defined in Section 11. Adjustment must be performed with the opposite engine operating at 1000 rpm to insure correct electrical power supply.
FUEL FLOW FLUCTUATES OVER A RANGE OF ± 3.0 GALLONS/HR. IN FLIGHT WITH ENGINE OPERATING ON MAIN TANK AND WITH AUXILIARY PUMP SWITCH IN THE ON POSITION	Defective fuel pressure switch.	To isolate malfunction reset auxiliary pump switch to LOW position. If fuel flow fluctuations are arrested, replace fuel pressure switch installed on unmet-tered fuel line to metering unit.
FUEL FLOW FLUCTUATIONS EXCEEDING A RANGE OF ± 1.0 GALLONS/HR. IN FLIGHT WITH ENGINE OPERATING ON MAIN TANK, AND WITH AUXILIARY PUMP SWITCH IN THE LOW POSITION	Very low pressure output from auxiliary pump or complete auxiliary pump failure.	To isolate malfunction alternatively activate and deactivate auxiliary pump for not less than 40 seconds in each mode and observe fuel flow changes: 1. If fluctuations decrease with auxiliary pump "ON", the auxiliary pump requires readjustment in conformance with the adjustment procedures defined in Section 11. Adjustment must be performed with the opposite engine operating at 100 rpm to insure correct electrical power supply. 2. In the event that no change is detected in fuel flow fluctuations with or without auxiliary pump "ON", the auxiliary pump and/or the associated electrical system is malfunctioning. Refer to Section 11.
FUEL FLOW FLUCTUATIONS EXCEEDING ± 3.0 GALLONS/HR. OR POWER LOSS IN FLIGHT WITH ENGINE OPERATING ON AUXILIARY TANKS, AND WITH AUXILIARY PUMP SWITCH IN THE "LOW" POSITION	Auxiliary tank pump failure.	To isolate malfunction alternatively move the auxiliary pump switch from "OFF" to "LOW" for not less than 40 seconds in each mode and observe fuel flow changes. If no change takes place, select main tank with auxiliary pump switch in "LOW". In the event that power is regained or fluctuations are eliminated by this operations, the auxiliary tank in-line pump must be replaced.

TROUBLE	PROBABLE CAUSE	CORRECTION
EXCESSIVE FUEL FLOW INDICATION AND/OR CIRCUIT BREAKER OPENS WITH ENGINE OPERATING FROM AUXILIARY TANK WITH PUMP SWITCH ON "LOW"	Pressure relief provisions on auxiliary tank pump out of calibration.	To verify malfunction observe mixture control positions between both engines at comparable power settings and fuel flows. If severe lean out is required on the affected engine when auxiliary tanks are selected with pump switch on "LOW", the auxiliary tank in-line pump must be replaced. Refer to SK421-14.
ENGINE FAILS AFTER LANDING AND/OR TAXIING WITH AUXILIARY PUMP ON "ON"	Auxiliary pump failure or incorrect boost pressure output.	Replace pump or adjust low boost pressure in conformance with adjustment procedures defined in Section 11. Adjustment must be performed with the opposite engine operating at 1000 rpm in insure correct electrical power supply.
SEVERE FUEL FLOW CALIBRATION CHANGES AT MAXIMUM POWER AND FULL RICH CONDITIONS, DURING OPERATION FROM HIGH ALTITUDE FIELDS OR HIGH AMBIENT TEMPERATURES	Inherent fuel injection system characteristics.	Adjust engine driven fuel injection pump to obtain fuel flows within the prescribed gage white arc during take-off, under the average operating ambient conditions. The following procedure is suggested in order to facilitate pump high pressure adjustment during ground static maximum power run-ups. 1. For operation from field altitudes below 2000 feet and ambient temperatures below 60° F, adjust ground static maximum power fuel flow to 40-42 gals/hour. 2. For operation from field altitudes above 2000 ft., reduce an additional 1 gal/hour for each 1000 ft. 3. For operation at ambient temperatures above 60° F, reduce an additional 1 gal/hour for each 10° F.

ENGINE COWLING. (See figure 9-1.)

Removal of Engine Cowling.

NOTE

This procedure is the same for either engine.

- a. Release cowl door fasteners to open cowl doors (2 and 7).
- b. Release upper cowl section fasteners and remove upper cowl section (1).
- c. Remove screws on cowl doors (2 and 7) and re-

move doors.

d. Remove nose cowl by removing the screws in the lower nose cowl (5) and then removing screws (4) that attach upper nose cowl (6) and lower nose cowl (5) together.

e. Remove clamp from cooling air duct.

Installation of Engine Cowling. (See figure 9-1.)

NOTE

This procedure is the same for either engine.

- a. Install the upper and lower nose cowl (5 and 6) together and to nacelle structure using screws (4).
- b. Install the upper cowl section (1) in place and fasten to nose cowl (6) and nacelle structure.
- c. Install doors (2 and 7) with screws and fasteners.

COWL FLAPS. (421-0001 to 421B0001)

Removal of Cowl Flap and Actuator. (See figure 9-2.)

- a. Release cowl doors (2 and 7) fasteners and open doors. (See figure 9-1.)
- b. Turn battery switch ON and open cowl flap (Full Open). Turn battery switch OFF.
- c. Remove cotter pins, washers, and pins attaching adjustable push-rods (5) to cowl flaps (8).

d. To remove cowl flap (8) remove pin (7) from cowl flap hinge (6).

e. To remove actuator (3), disconnect the electrical leads and remove cotter pin, washer and pin.

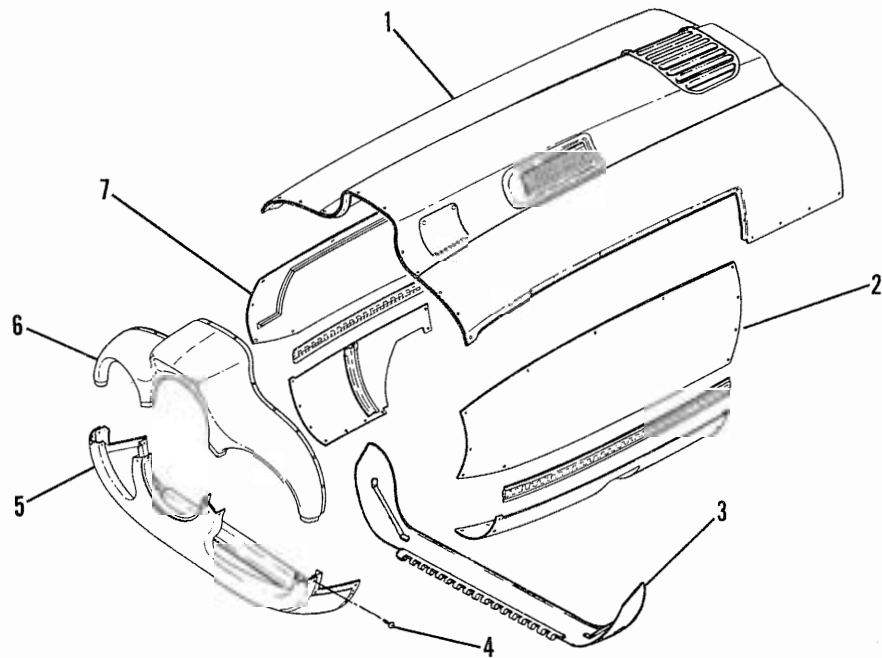
f. To remove torque tube (2), remove nuts and screws from bearing block (1), and disconnect the cowl flap transmitter arm.

Installation of Cowl Flap and Actuator. (See figure 9-2.)

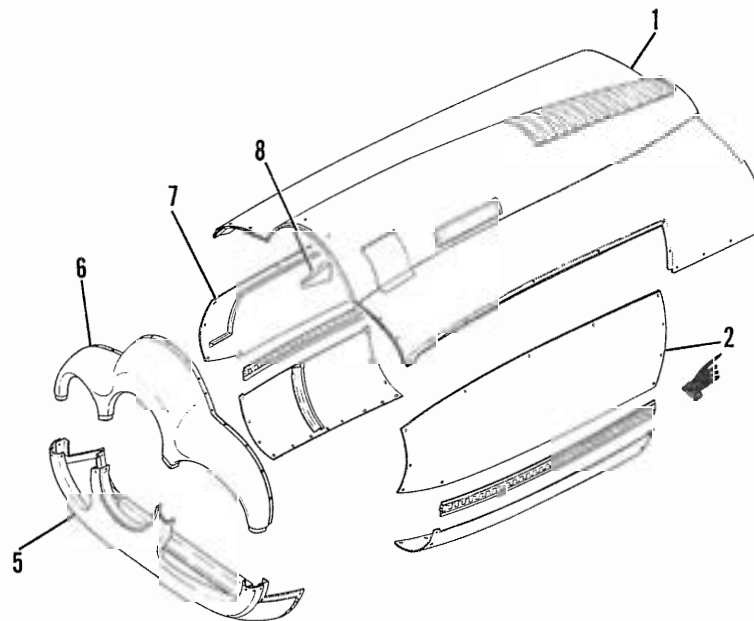
- a. Reverse the cowl flap and actuator removal procedure.
- b. Rig the cowl flap and actuator assembly in accordance with the rigging procedure.

Rigging the Cowl Flap. (See figure 9-2.)

- a. Extend cowl flap to the full DOWN position.
- b. Attach an inclineometer to cowl flap and check for 40 degrees down travel.
- c. If adjustment is necessary, proceed as follows:
 1. Remove pins, washers, and cotter pins attaching push-pull rods (5) to torque tube (2).
 2. Lengthen or shorten push-pull rods as necessary.
 3. Install pins, washers and cotter pins attaching push-pull rods (5) to torque tube (2).
- d. Remove inclineometer and actuate cowl flaps to full UP position.



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421B0001 AND ON

- 1. Upper Cowl Section
- 2. Left Cowl Door
- 3. Cowl Flap Assembly

- 4. Screw
- 5. Lower Nose Cowl

- 6. Upper Nose Cowl
- 7. Right Cowl Door
- 8. Cooling Scoop

Figure 9-1. Engine Cowling

ENGINE.

NOTE

Engine Removal. (See figure 9-3.)

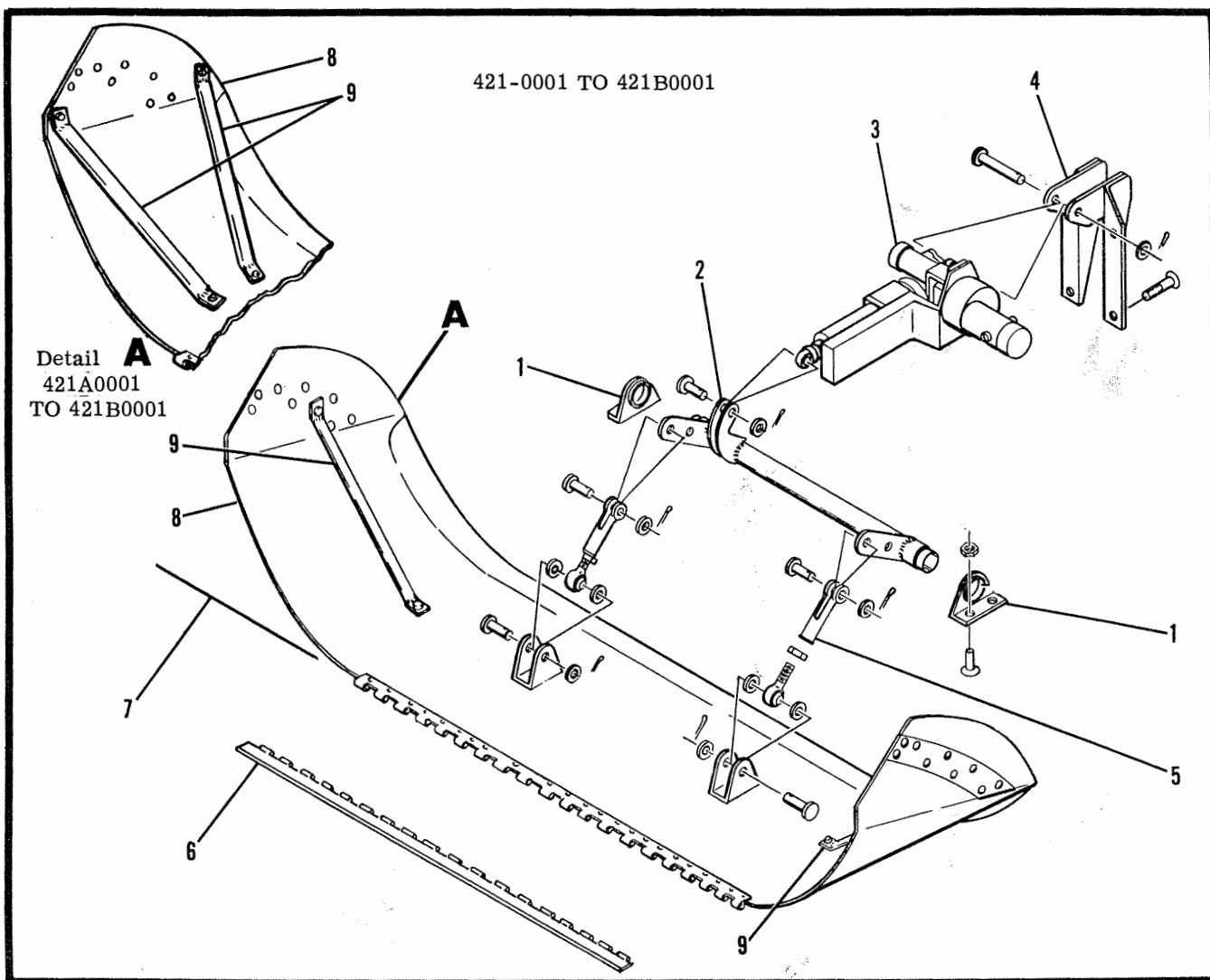
The removal procedure is the same for either engine. Although the routing of wire bundles, cables, lines, hoses and conduit varies between engines, the following description will be typical for either engine. Identify each item as it is disconnected to aid in re-installation. Cover the open ends of all lines and hoses to prevent entry of foreign materials.

NOTE

If engine being removed is to be placed in storage, proper preparatory steps should be taken prior to beginning the removal procedure.

Plug or cap all disconnected lines and hoses.

- a. Turn all cockpit switches and the fuel selector valves OFF.
- b. Open the battery circuit by disconnecting the ground cable.
- c. Remove engine cowl (29, 30, 31 and 33). (See figure 1-2.)
- d. Disconnect magneto ground wires at the magnetos (21) alternator cables at the alternator (20), and withdraw wire bundle aft through the rear engine baffle (5).
- e. If installed, disconnect connector and ground wire to optional propeller de-ice.
- f. Drain the oil in accordance with Section 2. Replace the drain plug.
- g. Remove the propeller in accordance with Section 10.



1. Bearing Block
2. Torque Tube
3. Actuator

4. Structure Attachment
5. Adjustable Push-rod
6. Hinge

7. Hinge Pin
8. Cowl Flap
9. Brace

Figure 9-2. Cowl Flap Control System

h. Disconnect the propeller control (18) at the governor (19) by removing nut, washer and bolt. Remove the propeller control bracket (16) from the engine sump by removing the two bolts and washers.

i. Disconnect wires and cables as follows:

1. Disconnect starter cable at starter.
2. Disconnect electrical connector at tachometer.
3. Disconnect oil temperature electrical connector (12) located directly below the oil cooler (13) and the ground terminal.

4. Disconnect the electrical leads from the cylinder head temperature bulb located on the lower side of No. 2 cylinder.

5. Remove all clamps attaching wires and cables to the engine assembly. Locate wire to clear engine for removal.

6. Remove ground strap from oil sump bolt aft of No. 5 cylinder.

j. Disconnect lines and hoses as follows:

1. Disconnect oil separator overboard drain hose from oil separator.

WARNING

Fuel and oil draining from lines and hoses is a fire hazard. Prevent fuel and oil from collecting in the engine nacelle.

2. Disconnect vacuum pump to firewall hose from vacuum pump.

NOTE

If surface deice system is installed, an additional oil separator exists and more hoses must be disconnected.

3. Disconnect the fuel flow gage line (1) at the aft side of engine rear baffle (5).
4. Disconnect the controller to air injection manifold hose (25) at the manifold.
5. Disconnect the ram air tube (14) at the engine rear baffle (5).
6. Disconnect the manifold pressure gage hose (3) at the aft side of engine baffle (5).
7. Disconnect the controller oil return hose (7) from the aft end of engine crankcase.
8. Disconnect the vapor return hose (29) from the fuel pump.
9. Disconnect fuel bypass to fuel pump hose (30) at the fuel pump.
10. Disconnect fuel pump to mixture control hose (26) at the fuel pump.
11. Disconnect firewall to fuel pump hose (28) at the fuel pump.
12. Disconnect oil filter to oil pump screen hose at the oil pump screen.
13. Disconnect turbocharger oil return hose (37) from scavenger oil pump.
14. Disconnect oil filter to oil cooler hose (10) at the oil cooler (13).
15. Disconnect fuel pump drain hose from fuel pump.
16. Disconnect oil pressure hose (39) and turbocharger oil supply hose (38) at "tee" fitting.

NOTE

If the aircraft has the optional propeller unfeathering system installed, check the accumulator for pressure and disconnect hose at the governor after all pressure has been released. (Refer to Section 10 for unfeathering procedures.)

17. Disconnect cylinder head drain cross to overboard outlet hoses (35) at the cross (36).

18. Remove hose and clamps which connect intake air duct (6) to the throttle body (24).

k. Disconnect exhaust stack ball joints at forward end of exhaust stack bellows (11).

1. Attach a hoist to the lifting eyes of the engine crankcase. Lift the engine just enough to relieve the weight from the engine mounts.

CAUTION

Place a stand under the aircraft tailcone bumper before removing engine. The loss of engine weight may allow the tail to drop.

- m. Remove the engine as follows: (See figure 9-4.)

1. Remove engine mount bolt (11).
2. Hoist engine out of the nacelle and clear of the aircraft.

NOTE

Determine location and number of spacers, boots, and bolt lengths used on each forward engine mount so that proper reinstallation may be attained.

CAUTION

Hoist engine slowly and make certain that all wires, lines and hoses have been disconnected.

Engine Disassembly and Assembly.

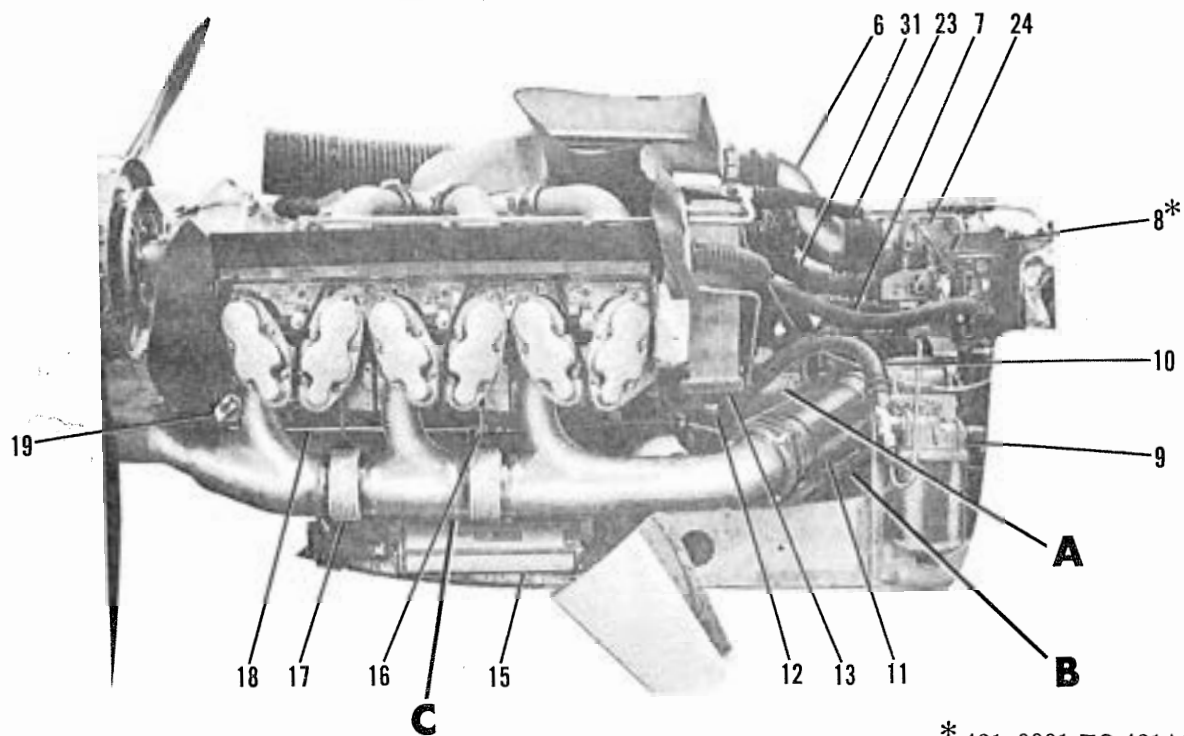
a. The disassembly procedure is the same for either engine and is intended to cover only those items which could normally be expected to require removal or are not covered by Continental Motor Corporation Engine Maintenance and Overhaul Manual.

1. Hoist engine assembly to a convenient working height.

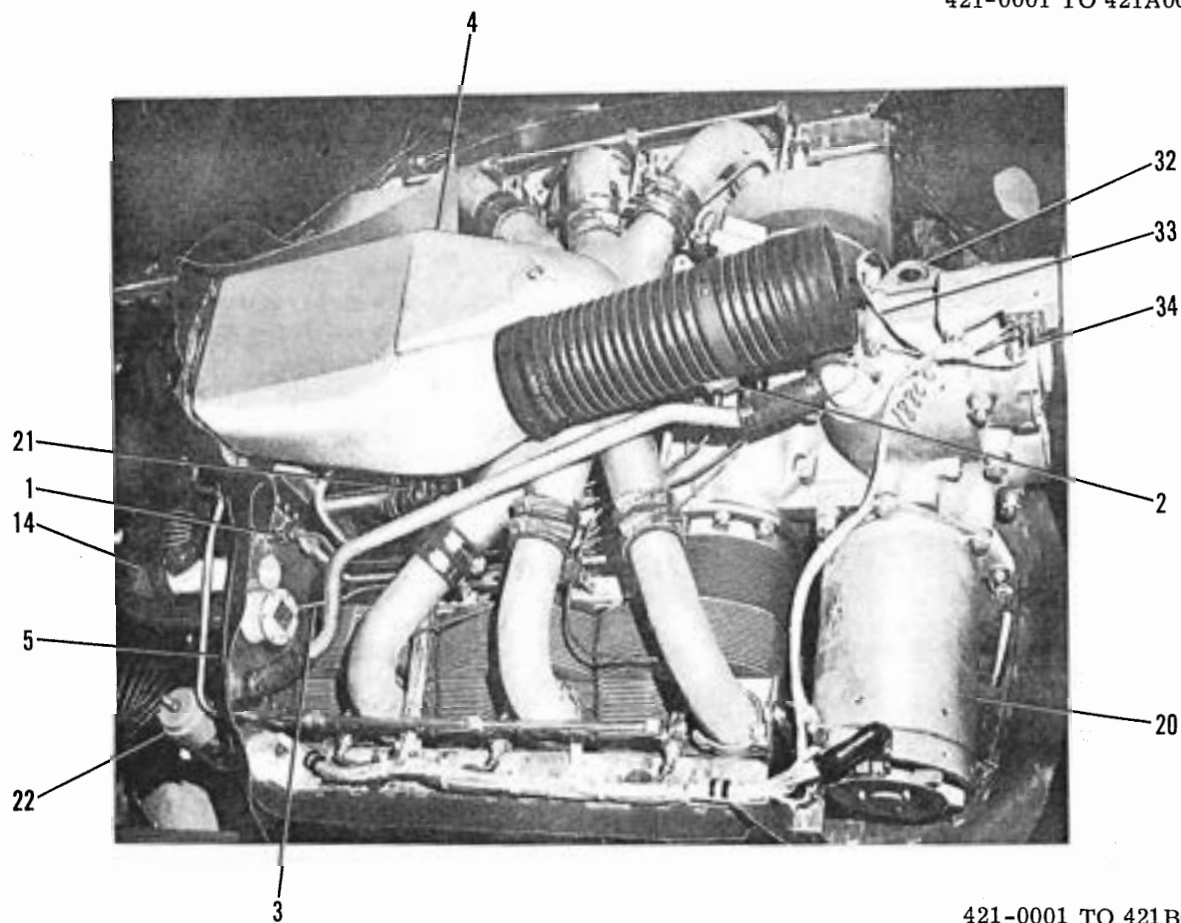
2. Spray engine assembly with suitable solvent to clean off any dirt accumulation and allow to drain. Blow off residual dirt and solvent with compressed air.

CAUTION

Particular care should be given to electrical components and bearings before cleaning. Solvents should not be allowed to enter magnetos, starters, alternators, compressor idler pulley bearings, and any lubricated control. These items must be protected with



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Figure 9-3. Engine Installation (Sheet 1 of 3)

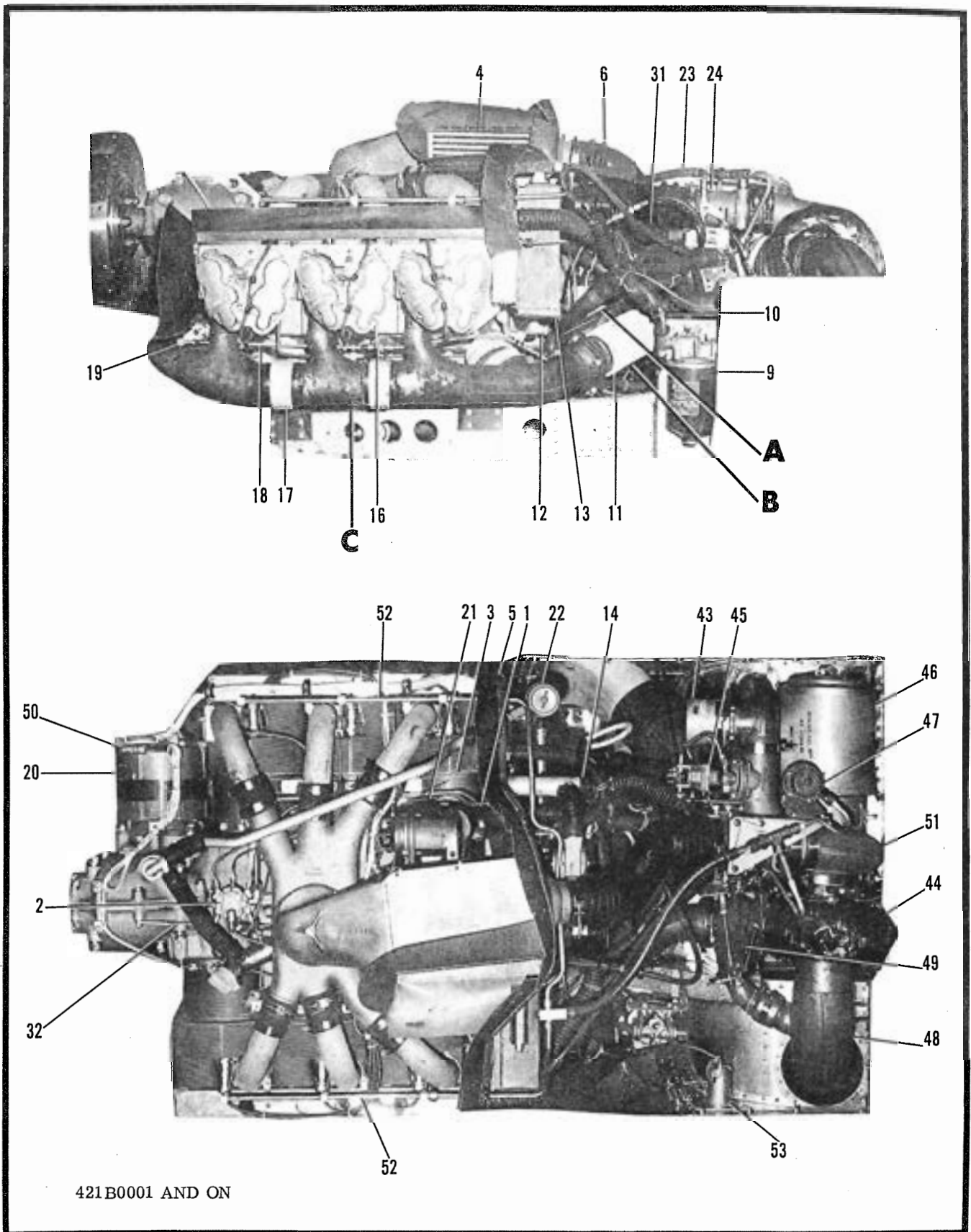
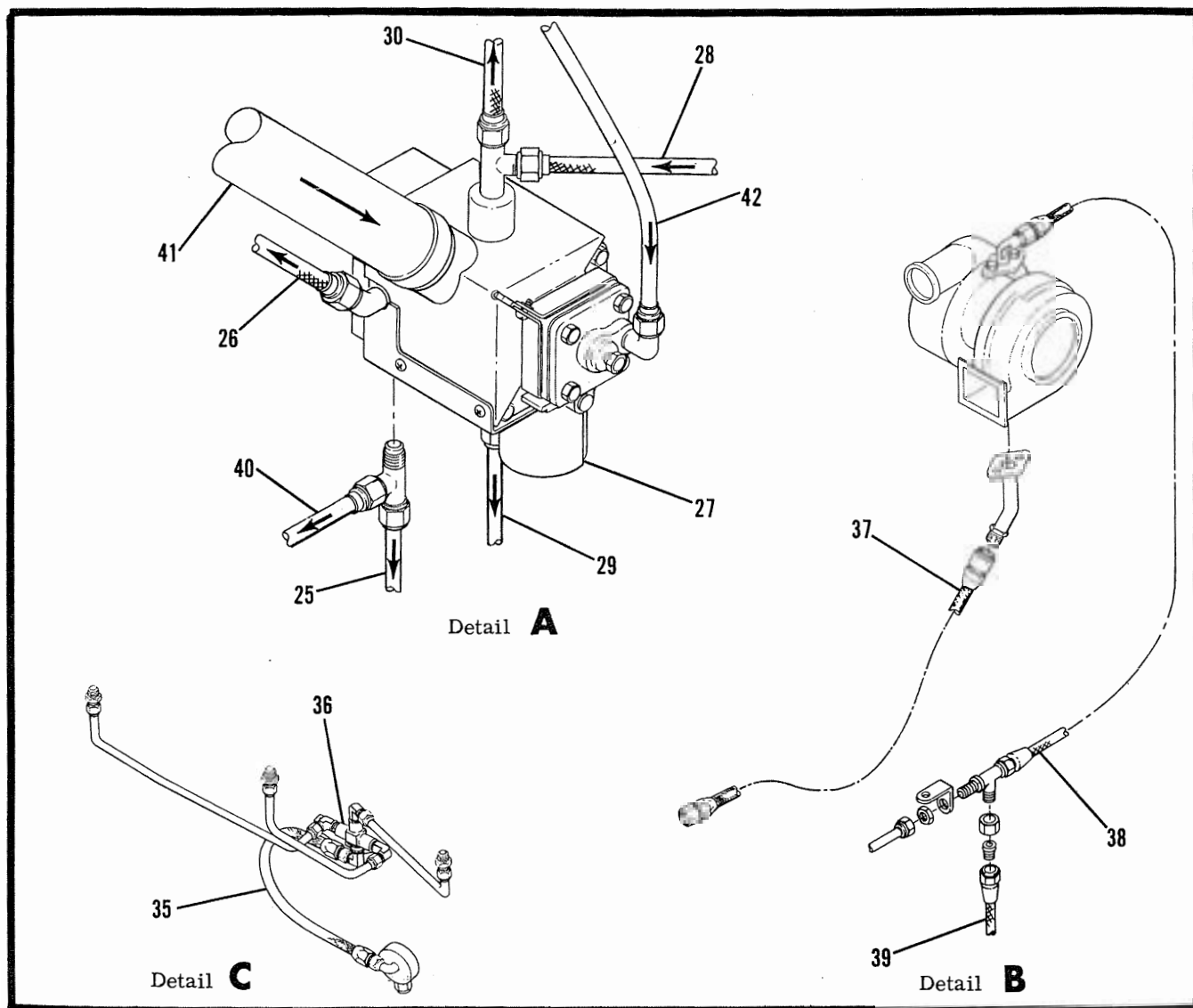


Figure 9-3. Engine Installation (Sheet 2)



1. Fuel Flow Gage Line	19. Governor	37. Turbocharger to Scavenger Pump Line
2. Manifold Valve	20. Alternator	38. Turbocharger Oil Supply Line
3. Manifold Pressure Line	21. Magneto	39. Oil Pressure Line
4. Intercooler	22. Oil Separator	40. Fuel to Metering Unit Line
5. Rear Engine Baffle	23. Air Injection Manifold Hose	41. Cooling Duct
6. Intake Air Duct	24. Throttle Body	42. Air Inlet
7. Oil Line (Controller to Crankcase)	25. Fuel Manifold and Pump Drain Line	43. Manifold Pressure Relief Valve
8. Rate of Change Controller	26. Mixture Control to Fuel Pump Hose	44. Turbocharger (Turbine)
9. Oil Filter	27. Fuel Pump	45. Variable Absolute Pressure Controller
10. Oil Line (Filter to Crankcase)	28. Fuel Inlet	46. Air Canister
11. Exhaust Stack Bellows	29. Vapor Return Line	47. Fuel Pressure Regulator
12. Oil Temperature Connector	30. Fuel Return	48. Exhaust Pipe
13. Oil Cooler	31. Vacuum Pump Inlet Hose	49. Waste-Gate Actuator
14. Ram Air Tube	32. Hoisting Lug	50. Alternator Fail Indicator Module
15. Accumulator	33. Prop Synchronizer Lead	51. Turbocharger (Compressor)
16. Prop Control Bracket	34. Prop Deice Lead	52. Nozzle Pressurization Line
17. Accumulator Hose	35. Cylinder Head Drain Line	53. Wing Deice Light
18. Prop Control Cable	36. Cross	

Figure 9-3. Engine Installation (Sheet 3)

cover before saturating the engine with solvent. Any oil, fuel, and air openings on the engine accessories should be covered before washing down the engine with solvent. Caustic cleaning solutions should be used cautiously and should always be properly neutralized after their use.

NOTE

As each item is removed from the engine, place a temporary cover over the hole left by the removal of the item. This will prevent the accidental entry of foreign material which could cause engine damage or lead to engine malfunction.

3. Remove engine exhaust system in accordance with removal of exhaust system.

4. Remove cylinder head drain lines by disconnecting at cylinder heads and removing clamp at cross.

5. Remove engine baffles in accordance with removal of engine baffle.

6. Remove the vacuum pump in accordance with Section 12.

7. Remove the tachometer generator by removing four nuts and pulling it free of the tachometer generator drive adapter.

8. Remove oil temperature bulb.

NOTE

When reinstalling oil temperature bulb, remove crush washer and install MS28778-4 packing.

b. To assemble the engine, reverse the engine disassembly procedure.

Inspection of Engine. (See Section 2.)

Installation of Engine. (See figures 9-3 and 9-4.)

The installation procedure is the same for either engine. Although there is some difference in the routing of wire bundles, lines, hoses and conduit. This procedure is typical for installation of either engine.

- a. Hoist engine to a point just above the nacelle.
- b. Install engine on engine mounts as follows (see figure 9-4):

1. On aircraft 421-0001 to 421B0201, temporarily install mount pads (4 and 7), spacer (5), boot (8), retainer (9), to all four engine mounts (1) using bolts (11) and lockwashers (10). Ascertain that the mounting pad (7) will locate over pin (12) in the lower surface of mount bracket (6) and lockwasher (10) fits in hole in retainer (9) and mount pad (7).

- (a) On aircraft 421B0201 and On, temporarily install mount pads (4 and 7), spacer (5) and shield (13) to all four engine mounts (1) using bolts (11) and lockwashers (10). Ascertain that the mounting pad (7) will locate over pin (12) in the lower surface of mount bracket (6) and lockwasher (10) fits in hole in retainer (9) and mount pad (7).

2. Be certain that the propeller control conduit and bracket is outside of engine mounts.

3. On aircraft 421-0001 to 421B0201, with upper mount pads (4) located on mount brackets (6) and boot (2) installed on engine mount (1), lower engine onto mount pads (4) and install lower pads (7) by locating hole in pads over pin (12) then install boot (8), retainer (9), lockwashers (10) and bolts (11). Be sure lockwasher extends through retainer into hole in lower pad.

- (a) On aircraft 421B0201 and On, with the upper mount pads located on mount brackets (6) and spacers (3) as required in place, lower engine onto mount pads (4) and install lower pads (7) by locating hole in pads over pin (12) then install shield (13), lockwashers (10) and bolts (11). Be sure lockwasher extends through retainer into hole in lower pad.

4. Torque bolts (11) to 300, +50, -00 inch-pounds and bend tab on lockwasher (10) over bolt head.

NOTE

Locate spacers (3) between upper mount pads (4) and engine on the forward mounts only as required to align propeller spinner with cowling. Be sure proper length bolts are used on each mount.

5. (See figure 9-3.) Connect exhaust stack ball joint to exhaust bellows (11) in accordance with exhaust system installation.

- c. (See figure 9-3.) Install lines and hoses as follows:

1. Install hose and clamps which connect intake air duct (6) to throttle body (24).

2. Connect cylinder head drain hose (35) to cross (36).

NOTE

If aircraft has the optional propeller unfeathering system installed, connect hose (17) from accumulator (15) to governor (19).

3. Connect oil pressure hose (39) and turbocharger oil supply hose (38) at "tee" fitting.

4. Connect oil filter to oil cooler hose (10) at oil cooler (13).

5. Connect fuel pump drain hose to fuel pump (27).

6. Connect turbocharger oil return hose (37) to scavenger oil pump.

7. Connect filter to oil pump hose to oil pump.

8. Connect firewall to fuel pump hose (28) to fuel pump (27).

9. With ram air tube installed and pushed aft, connect the mixture control to fuel pump hose (26).

10. Connect the fuel pump to mixture control hose (26).

11. Connect fuel pump to firewall vapor return line (29) at fuel pump (27).

12. Connect the controller to crankcase oil return hose (7) to the crankcase.

13. Connect the baffle to firewall fuel flow gage hose (33).

14. With the aft end of the ram air tube (14) installed, and tube clamped. Connect ram air tube (14) to baffle.

15. Connect the firewall to engine baffle manifold pressure gage hose (3) to the baffle fitting.

16. Connect vacuum pump inlet hose (31) to vacuum pump.

NOTE

If surface deice system is installed, an additional oil separator exists and more hoses must be connected.

17. Connect oil separator overboard drain hose to oil separator (22).

- d. Fasten engine ground strap to the sump bolt aft of No. 5 cylinder.

NOTE

Use a multimeter to assure proper bond between engine and aircraft structure. Resistance should be 0.00 ohms.

- e. Install the propeller control cable bracket (16) using the two engine sump washers and bolts.

- f. Connect propeller control cable (18) at the governor by installing bolt, washer and nut.

- g. Connect wires and cables as follows:

1. Route starter cable forward and attach to starter terminal.

2. Route magneto grounding and alternator wires forward through aft engine baffle (5) and clamps. Attach alternator wires to alternator.

3. Route the tachometer wire to the tachometer and connect.

4. Route the oil temperature wire to oil temperature bulb, locate directly below oil cooler (13) and safety. Connect ground wire to engine baffle (5).
5. Route the cylinder head temperature wire forward along right side of engine to the number 2 cylinder.
- h. Install the propeller in accordance with Section 10.
- i. Connect the battery cables in accordance with Section 14.
- j. Inspect installation for safeties, loose connections, missing bolts, clamps, screws or nuts; proper routing of cables, hoses and lines, and for correct connection.
- k. Make a magneto switch ground-out and continuity check. Connect magneto ground wires to the magnetos.
- l. Service the engine in accordance with Section 2.
- m. Install the engine cowling in accordance with installation of engine cowling.

Installation Inspection. (See figure 9-3.)

The following check may be used as a guide for inspecting the installation of either engine.

- a. Propeller mounting nuts torqued.
- b. Engine mounts secure.
- c. Oil temperature bulb electrical connector secure and safetied, ground wire connection tight.
- d. Oil pressure relief valve plug safetied.
- e. Tachometer generator electrical connector secure and safetied.
- f. Starter cable connection secure and insulating boot in place.
- g. Cylinder head temperature bulb installed and ground wire connection bonded properly.
- h. Alternator cable connection secure and case ground wire installed (100 Amp alternator only).
- i. All wiring securely clamped in place.
- j. Fuel pump connection tight.
- k. Manifold pressure hose connections tight.
- l. Oil pressure connections clamped and tight.
- m. Fuel injection nozzles tight.
- n. Fuel pressurization line tight.
- o. Fuel injection lines clamped and tight.
- p. Fuel manifold secure.
- q. Turbocharger oil supply line tight.
- r. Oil filter lines tight.
- s. Controller lines secure and tight.
- t. All flexible tubing in place and clamped.
- u. Crankcase breather line connections secure.
- v. Air-oil separator exhaust and return hoses secure.

NOTE

On aircraft 421B0001 to 421B0501, make certain oil separator return line check valves are installed horizontally with the word "HINGE" stamped on the hex flat in UP position and the flow arrow pointing toward the scavenge pump.

- w. Turbocharger assembly secure.
- x. Vacuum line and vacuum pump outlet hose and connection secure.
- y. Engine controls properly rigged.
- z. Oil drain plugs tight and safetied.
- aa. Oil quantity check (see Section 2).
- ab. Hose and lines secure at firewall.
- ac. Fuel air control unit secure.
- ad. Shrouds installed on engine-driven fuel pump, and fuel-air control unit. Ram air tube installed and clamped.
- ae. Air leak check should be made on the induction system to insure optimum performance from the turbocharger. The following procedure is recommended:
 1. Remove the flexible duct between the air induction filter and the air inlet scoop, then by use of an adapter plug, attach the pressure side of an industrial vacuum cleaner to the air filter inlet.
 2. Fabricate a baffle plate and install between fuel control body and pressurization venturi to block the flow of air to cabin.

CAUTION

The inside of the vacuum cleaner should be free of any contamination that might be blown into the engine induction system.

3. With the vacuum cleaner on, all joints may be checked for leaks by using a soap solution and watching for bubbles. All joints should be free of air leaks with the exception that some small bubbles will appear at the joint of the turbocharger compressor and bearing housing.

NOTE

The manifold pressure indicator should indicate two to three inches of pressure above atmospheric pressure, when the vacuum cleaner is on.

- af. Exhaust system secure. Conduct air leak check in accordance with Inspection of Exhaust System procedures.
- ag. Spark plugs tight. Ignition harness connections tight and harness properly clamped.
- ah. Magneto ground wires connected.
- ai. Engine nacelle for loose objects (tools, nuts, rag, etc.).
- aj. Cowl flaps free.
- ak. Cowling and access doors for security.

Rough or Malfunctioning Engine Operation Inspection.

The purpose of the tachometer yellow arc and associated placard is to minimize the possibility of operation with a rough or malfunctioning engine at these RPM's. The GTSIO-520 engine has no restrictions

or critical vibration characteristics when operating normally (e. g. all cylinders firing equally); however, certain malfunctions within the engine cause torsional vibrations to be excited in the crankshaft and drive system. These vibrations, when forced at certain levels and frequencies, will damage numerous components of the engine and possibly the propeller and its attachment. This condition may be characterized as a roughness such as that resulting from a misfiring or dead cylinder caused by one or more of the following malfunctions:

- a. Both spark plugs of a cylinder fouled or shorted.
- b. Broken valve spring.
- c. Burned valve guide.
- d. Sticking or broken valve.
- e. Broken rocker arm or pushrod.
- f. Loose cylinder
- g. Cracked cylinder head.

Specific items which show early damage from these torsional vibrations are: the magneto rubbers, alternator drives, starter adapter gears, tachometer drive shaft, and quill shaft.

If it is necessary to keep a rough engine in operation, the speed of least destructive resonance is 1800 RPM; however, it is recommended that a rough engine be shutdown whenever possible.

In addition to the normal troubleshooting required to determine cause and correct engine roughness, the following inspection must be conducted.

- a. Check magneto rubber drive couplings for backlash, and possible damage or tearing.

1. Drive coupling backlash may be inspected by removing the timing inspection plug from each magneto and moving the distributor gear with a flat blade screwdriver. Total backlash should not exceed 1-3/4 teeth with a 3 pound load each direction on the screwdriver. Backlash exceeding 1-3/4 teeth requires removal of both magnetos for visual drive rubber inspection.

- b. If magneto rubbers are in good serviceable condition, accomplish the following propeller inspection:

1. Check torque of propeller attach nuts to determine if they are loose. If any nuts are found excessively loose (70 foot-pounds or less), remove propeller and check dowel pins and mounting studs for possible damage. If damage is found, the affected parts should be replaced by an approved propeller overhaul shop.

NOTE

When reinstalling the propellers, new A1639-2 (MS21044-N8) attach nuts are to be used. Do not reuse old nuts.

- c. If magneto rubbers show severe distress, the following additional items must be inspected:

1. Alternator couplings, starter adapter drive gear, and tachometer drive for galling, pitting, distortion or heavy wear distress. Items found to be unserviceable must be replaced.

2. Remove propeller and inspect quill shaft for evidence of blueing or discoloration from heat. If discoloration is found, the quill shaft must be replaced and also the propeller dowels and studs must be replaced.

NOTE

To inspect quill shaft, remove cover plate located on the crankcase below the propeller shaft. (Refer to Continental Overhaul Manual, Figure 4-12) Remove retaining ring (16), and pull shaft out for inspection.

CAUTION

Failure of the valve actuating mechanism for one valve in any cylinder will usually cause the other valve pushrod in the same cylinder to bend or twist and finally fail since it is operating beyond capacity in trying to open the valve against full compression pressure. It is therefore necessary to fully inspect both valve trains in any cylinder which has experienced lifter, pushrod, rocker arm or rocker shaft failure.

Engine Operational Check.

CAUTION

Ground operation time should be held to a minimum to prevent overheating the engine. At no time should the engine temperatures be allowed to exceed their maximum limits. Do not operate the engine with cowling removed.

- a. Park aircraft with nose headed into prevailing wind and clear an area directly in front and to the rear of all objects that may be affected by the propeller and propeller slipstream.

CAUTION

Avoid engine run-up with aircraft parked in a loose gravel area. The propeller will pick up small stones which can damage propeller blades.

- b. Install wheel chocks and position a fire extinguisher for easy access in the event of engine fire.
- c. Release parking brake if previously set, and test-operate brakes. Take note of any sponginess or

excessive pedal travel. Reset parking brake after completion of test

CAUTION

If parking brake action is not normal do not perform engine run-up until corrective action is accomplished on the brake system.

d. Refer to Model 421 Owner's Manual and perform "Before Starting Engine" and "Starting Engines" procedures.

e. Warm-up engines as follows:

Throttles - 750 to 900 RPM.

1. Leave cowl flap to full OPEN position. (421-0001 to 421B0001)

2. Perform magneto ground-out check as follows:

(a) Throttle engine back to idle RPM.

(b) Momentarily switch both magnetos OFF.

RESULT: The tachometer will indicate a sudden RPM drop when magnetos cease firing.

CAUTION

If magneto switches are left OFF for a prolonged period, after firing may occur when they are switched back on. If the engine continues to run with switches OFF, stop engine by placing control in IDLE CUT-OFF and check magneto ground.

3. Advance throttle to 1500 RPM and perform a magneto check as follows:

(a) Place right magneto switch to OFF position and note RPM drop. Return switch to ON position. Repeat check with left magneto switch.

RESULT: Engine speed drop of 100 RPM maximum or if the drop in RPM between the left and right magneto differs by 50 RPM maximum.

4. With engine at 1700 RPM, exercise the propeller.

(a) Retard the propeller pitch lever to obtain a 1000 RPM tachometer indication.

RESULT: Exercise propeller and watch for any indication of sluggish or erratic operation.

5. Make a mixture control check by slowly moving the mixture lever toward IDLE CUT-OFF.

RESULT: When a slight drop in RPM is noted, immediately return mixture lever to FULL RICH position.

6. Stop engine by placing the mixture lever in IDLE CUT-OFF. As soon as propeller has stopped turning, place ignition switches OFF. Turn all switches OFF.

CAUTION

After extended periods of ground engine operation above 1600 rpm or when the cylinder head temperature indicator shows values within the upper half of the green operating arc, reduce power to speeds between 600 and 800 rpm for a period not less than 2 to 3 minutes prior to engine shutdown. This expedient is intended to reduce internal turbocharger temperatures and preclude the possibility of premature accumulation of carbon on the turbine shaft seals.

ENGINE MOUNTS.

The engine is mounted to the nacelle structure by four engine mounts. Each mount incorporates two rubber pads capable of sustaining operational loads and provide absorption for engine vibrations. On aircraft 421-0001 to 421B0201, these mounts are covered by an elastomeric rubber boot to provide a shield for the rubber mounting pads against heat. On aircraft 421B0201 and On, a metal heat shield is provided.

Removal of Engine Mounts. (See Figure 9-4.)

NOTE

Engine must be supported before removal is attempted. If engine is going to be removed, see Removal of Engine for the attaching parts to be disconnected.

a. Bend ears down on locking washers (10) and remove bolts (11) locking washers (10), retainers (9), boots (8), lower mount pads (7) and spacers (5).

b. Lift the engine just enough to relieve the weight from engine mounts (1).

c. Remove upper mount pads (4) and on forward engine mounts, remove spacer washers (3).

Shimming the Engine Mounts. (See Figure 9-4.)

Although engine mount sag is normal and occurs over a period of time in-service, it can be corrected by shimming the mount back to its original position with special spacers.

Engine mount sag which has resulted in a loss of clearance between engine, mount and or cowl components should be corrected by shimming. If the area between the exhaust riser of number six cylinder and the lower cowl panel does not have sufficient clearance, (0.40 inch minimum) install shims to obtain proper clearance.

a. Hoist engine and support as required to insert spacers.

NOTE

Spacers may be obtained from the Cessna Dealers' Organization. Refer to Table I for part number and thickness. If a total thickness of spacers on any mount exceeds 0.312 inch the mount must be removed and inspected in accordance with Section 2.

ENGINE MOUNT SPACER SPECIFICATIONS

PART NUMBER	DESCRIPTION	THICKNESS
5056010-1	Spacer	0.125 inch
5056010-2	Spacer	0.188 inch
5056010-3	Spacer	0.250 inch

TABLE I

b. Insert spacers between the engine mount bracket (1) and the upper pad (4) as required to obtain 0.40 inch minimum clearance.

CAUTION

For each 0.125 inch of spacer thickness added it will be necessary to add the next size longer length engine mount bolt.

- c. Secure engine mount in place and safety in accordance with engine mount installation procedures.
- d. Recheck all clearances, especially in the exhaust stack area.

Installation of Engine Mounts. (See Figure 9-4.)

- a. Install the upper mount pads (4) on mount brackets (6) and on forward engine mounts install spacer washers (3).
- b. Lower engine slowly into place on mount pads (4) and spacer washer (3), forward engine mounts only.
- c. Install spacers (5) and lower mount pads (7) with hole located over pin (12) in mount brackets (6).
- d. Install boots (8), retainers (9), lockwashers (10) and bolts (11). On aircraft 421B0201 and On, install shield (13), lockwashers (10) and bolts (11).
- e. Torque bolts (11) 300, +50, -00 pound-inches.

NOTE

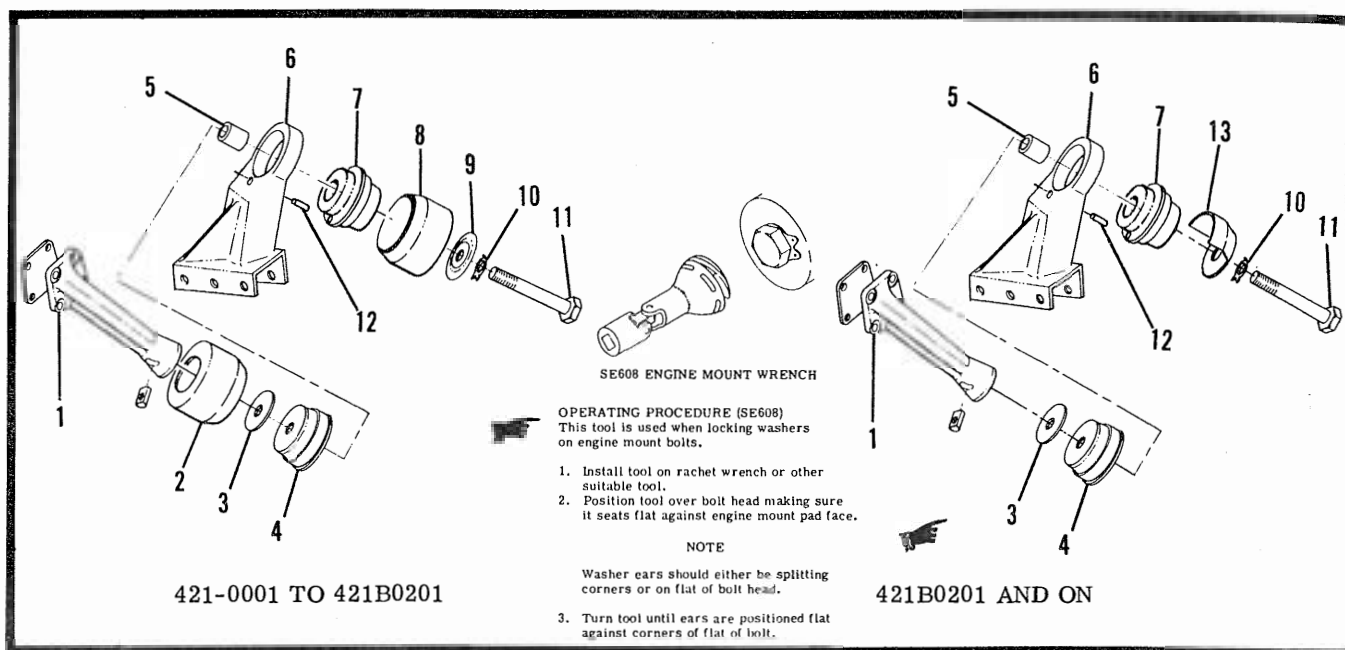
Lock washers (10) with a break tool. This break tool is available from Cessna Dealers' Organization (Tool No. SE608).

Engine Exhaust System.

The exhaust system consists of a riser pipe attached to the exhaust port of each cylinder. The three risers at each bank of cylinders are joined together into a common pipe to form a stack assembly. The in-board stack assembly is joined by a forward crossover pipe to the outboard stack. The outboard stack assembly is routed aft through a flexible bellows to a bypass valve assembly which is mounted to the turbine side of the turbocharger. From the exhaust port of the turbine, the tailpipe routes the exhaust out of the aircraft through the lower nacelle. The exhaust port of the waste-gate assembly is teed into the tailpipe for the exhaust to be expelled from the system when not required at the turbine. The waste-gate is automatically controlled by the turbo control system.

Removal of Exhaust System. (See figure 9-5.)

- a. Remove engine cowling in accordance with removal procedures.
- b. Remove cotter pin, washer and pin from the forward support brackets.
- c. Remove cotter pins, nuts, washers, springs, and bolts from the crossover (3) and elbow (2).
- d. Remove crossover (3) and elbow (2) from engine.
- e. Remove cotter pins, nuts, washers, springs and bolts from heat shield (5) and bellows (12).
- f. Remove the exhaust stacks by removing the four nuts securing each riser to its cylinder.
- g. Work riser down and free of cylinder studs and remove stacks from engine.

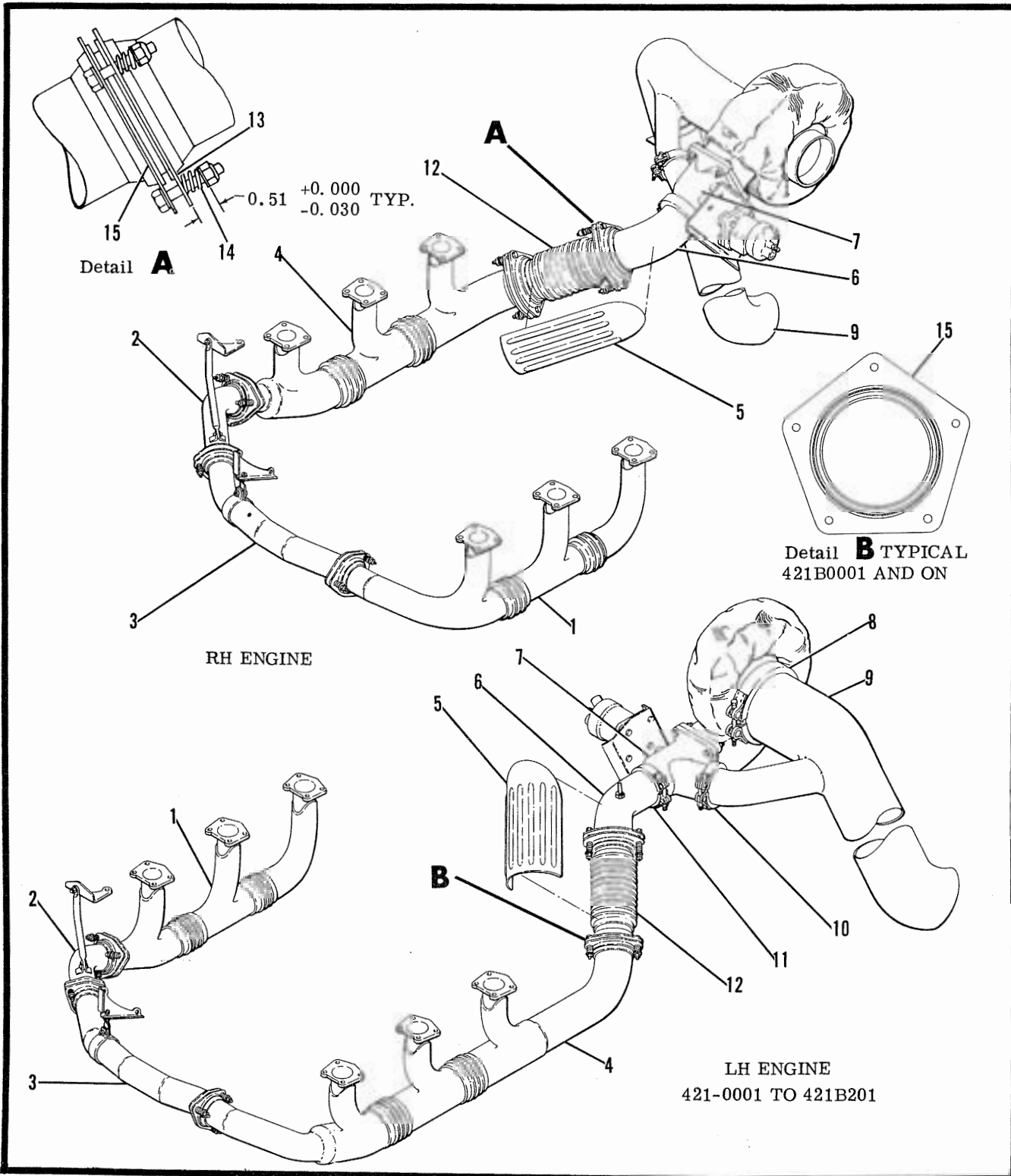


1. Engine Mount
2. Boot
3. Spacer
(Front Mount only)
4. Upper Pad

5. Spacer
6. Mount Bracket
7. Lower Pad
8. Boot

9. Retainer
10. Lockwasher
11. Bolt
12. Pin
13. Shield

Figure 9-4. Typical Engine Mount Installation



1. Stack Assembly	7. Waste-gate Valve Assembly	12. Bellows	17. Clamp
2. Elbow	8. Coupling	13. Coupling	18. Flex Joint
3. Crossover	9. Tailpipe	14. Spring	19. Expansion Ring
4. Stack Assembly	10. Coupling	15. Joint Flange	20. Seal
5. Heat Shield	11. Coupling	16. Slip Joint	21. Clamp
6. Elbow			22. Retention Bracket

Figure 9-5. Engine Exhaust Stack Assemblies (Sheet 1 of 2)

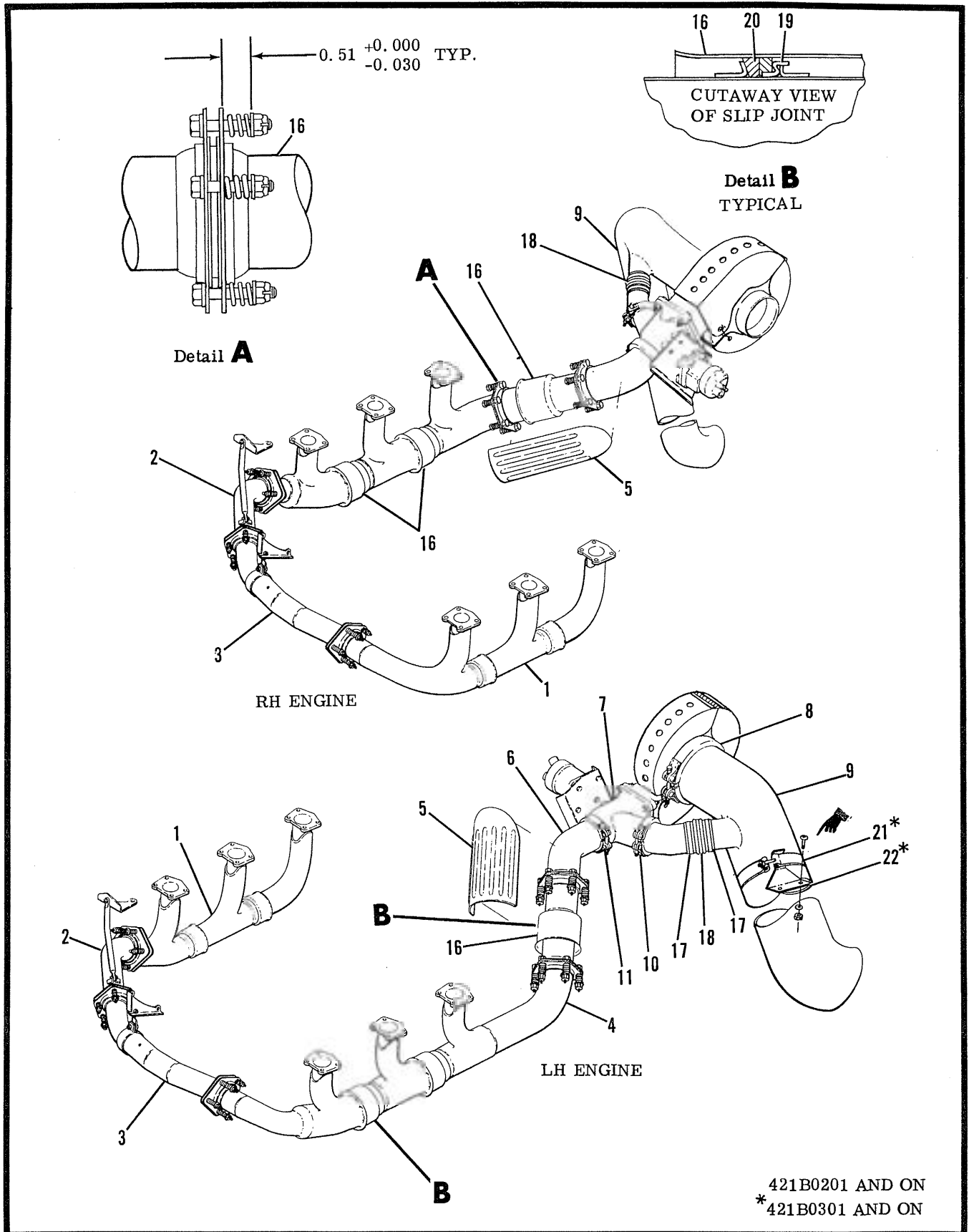


Figure 9-5. Exhaust Stack Assemblies (Sheet 2)

NOTE

Discard metallic gaskets at risers and engine mounting pads and replace with new gaskets.

- h. Remove coupling (11) connecting elbow (6) to waste-gate (7) and remove elbow.
- i. On aircraft 421-0001 to 421B0201, remove coupling (10) connecting waste-gate (7) to tailpipe (9) and coupling (8) connecting tailpipe to turbine to remove tailpipe.
- j. On aircraft 421B0201 and On, remove coupling (8) and clamps (17) to remove tailpipe (9) and flex joint (18).

Removal and Installation of Exhaust Slip Joint Seals and Expansion Ring. (See figure 9-5.)

- a. Remove exhaust system in accordance with removal procedures.
- b. Remove seal and expansion rings.
- c. Install new expansion ring and seal in accordance with SK421-40.

CAUTION

Do not bend or flex exhaust system after replacing seals. This could cause leakage.

Installation of Exhaust System. (See Figure 9-5.)

- a. Install new spirotallic gaskets between each riser and its mounting pad then work riser up on cylinder studs.
- b. Install nuts and torque to 100 - 110 inch-pounds.

NOTE

Apply Fel-Pro C-5 or equivalent (Felt Products Manufacturing Company, Chicago 7, Illinois) high temperature anti-seize compound to attaching nuts and bolts in extreme high heat areas of the exhaust system.

- c. Install crossover (3) securing it with bolts, springs, and washers.

NOTE

Check free length of exhaust springs before installation. If the free length is less than 0.57 inch, the springs must be replaced. Compress springs to a length of 0.51 +0.000, -0.030 inch by adding or removing washers during installation.

- d. Secure elbow (6) to waste-gate (7) with couplings (11), aligning elbow with bellows (12).

- e. Install bellows (12) securing it with bolts, springs, and washers. The heat shield will be supported by two of the aft bolts.
- f. On aircraft 421-0001 to 421B0201, install tailpipe (9) securing it at the waste-gate (7) and to the turbine with couplings (8) and (10).
- g. On aircraft 421B0201 and On, install flex joint (18) and tailpipe securing tailpipe to turbine with coupling (8) and flex joint with clamps (17).
- h. Torque coupling bolts to torque values given in Figure 9-21.

ENGINE BAFFLES.

Removal of Engine Baffles. (See Figure 9-6.)

- a. Remove engine cowl in accordance with cowl removal procedures.
- b. Remove baffles (9 and 17) as follows:
 - 1. Remove nuts attaching upper straps to intake manifold (2 places).
 - 2. Remove screws attaching lower straps to engine rocker arm assemblies (3 places).
 - 3. Remove screws attaching baffle (9) to baffle (7).
 - 4. Remove screws attaching baffle (17) to baffle (1).
 - 5. Remove screws attaching baffles (9 and 17) to baffles (15 and 16).
 - 6. Remove baffles (9 and 17) from engine.
- c. Remove bolts (19) connecting supports (18) to baffle assemblies (11) and remove supports from engine.
- d. Remove screws attaching baffle bases (10), to baffle assemblies and remove baffle assemblies from engine.
- e. Reaching in between the engine cylinders, retrieve baffle bases (10 and 11).
- f. Remove shield (14) from baffle (15) by removing screws and washers.
- g. Remove exhaust support (13) by removing attaching screws.
- h. Remove baffles (15 and 12) from engine by removing attaching screws and washers on baffle (15).
- i. Remove screws fastening baffle (12) to baffle (15) if baffle (12) is being replaced.
- j. Remove baffle (16) as follows:
 - 1. Disconnect and remove exhaust manifold supports at the exhaust manifold, engine body, and alternator bracket.
 - 2. Remove bolts and washers attaching baffle (16) to front engine body.
 - 3. Remove baffle (16) by lifting slightly upwards, clearing tab on exhaust manifold and remove baffle from front of engine.
- k. Remove baffle (1) as follows:
 - 1. Disconnect oil breather line hoses at the oil separator and tee assembly, route breather line through engine baffle.
 - 2. Tag and disconnect the following wires:
 - (a) Alternator wires.
 - (b) Propeller deice wires (Optional).
 - (c) Magneto wires.
 - 3. Route engine wire bundle aft through baffle.

- 4. Remove air injection line at air injection manifold and at nozzle.
- 5. Disconnect manifold pressure line at baffle and cap lines to prevent entry of dirt or foreign objects.
- 6. Disconnect cooling shrouds from baffle adapter and disconnect fuel line at distributor valve and route aft through baffle adapter.
- 7. Remove screws attaching baffle (1) to support (3).
- 8. Remove lower RH nut on vacuum pump and remove baffle (1).
 - 1. Remove support (3) from engine by removing bolt from aft engine body.
- m. Remove baffle (2) by removing induction air coupling and removing five screws attaching baffle to inter cooler.
- n. Remove baffle (6) as follows:
 - 1. Remove ram air hose from baffle to fuel pump housing at the baffle.
 - 2. Remove air injection line at air injection manifold and at nozzle.
 - 3. Remove screws attaching baffle (6) to oil cooler.
 - 4. Remove screws attaching baffle (6) to baffle (7).
- o. Remove baffle (7) by removing attaching screws from baffle (9) and baffle (20).
- p. Remove baffle (20) and support (5) together by removing attaching screws.
- q. Remove baffle (4) from baffle (8) by removing attaching screws and pulling aft clearing rear cylinder.
- r. Remove baffle (8) by pulling down and aft clearing tab on baffle from cooling fins and index fin to facilitate installation.

Installation of Engine Baffles. (See Figure 9-6.)

NOTE

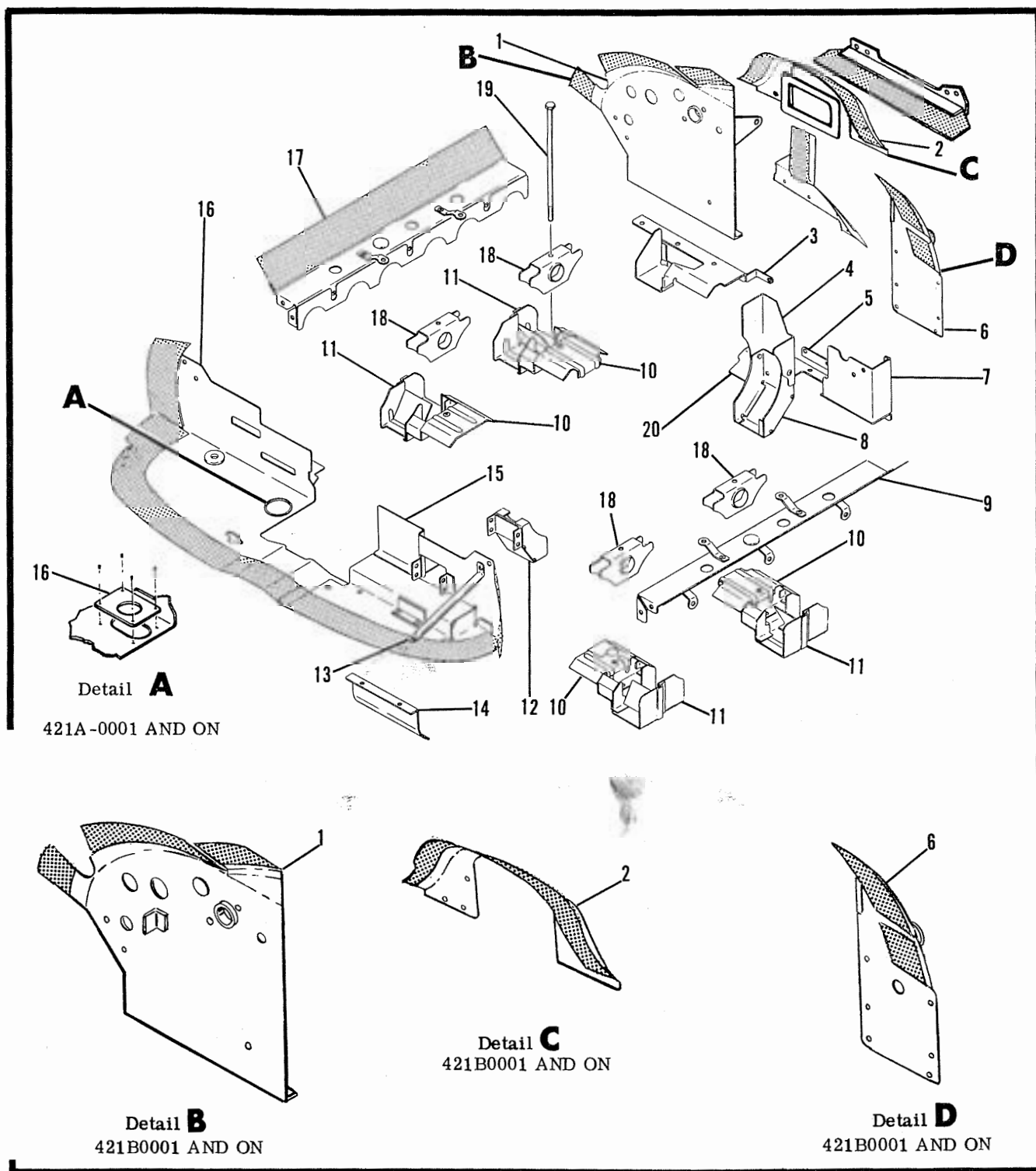
Seal all holes left in baffles due to bend reliefs with Sealant EC801 (Minnesota Mining and Manufacturing Co., or equivalent).

- a. Align baffle (8) on index mark made on removal and guide baffle into position aft of No. 2 cylinder.
- b. Mount baffle (5) with baffle (8) using attaching screws.
- c. With baffle (20) and support (5) affixed together, guide into position aligning holes in baffle (8) with support (5) and secure with attaching screws.
- d. Secure baffle (7) to baffle (20) with attaching screws.
- e. Install baffle (6) as follows:
 - 1. Secure baffle (6) to baffle (7) and engine oil cooler using attaching screws.
 - 2. Install air injection line through baffle and secure to air injection manifold and to nozzle.
 - 3. Install ram air to fuel pump hose.

NOTE

Make sure that seal is installed properly between oil cooler and engine.

- f. Install baffle (2) by securing to intercooler with



1. Baffle Assembly
2. Baffle Assembly
3. #1 Cylinder Baffle
4. Upper Baffle
5. Angle
6. Baffle Assembly
7. Baffle Assembly

8. #2 Cylinder Baffle
9. Baffle Assembly
10. Base
11. Baffle Assembly
12. Baffle Assembly
13. Support

14. Shield
15. Baffle Assembly
16. Baffle Assembly
17. Baffle Assembly
18. Support
19. Bolt
20. Baffle Assembly

Figure 9-6. Engine Baffles

three screws and to baffle (1) with two screws. Connect induction air coupling.

g. Install support (3) using existing bolt on aft engine body.

h. Install baffle (1) as follows:

1. Position baffle (1) in position and secure to baffle (3) with screws.

2. Secure baffle (1) to lower RH nut of vacuum pump using existing nut.

3. Route engine wire bundle through baffle.

4. Connect and remove tags on the following wires:

(a) Magneto wires.

(b) Propeller deice wires (Optional).

(c) Alternator wires.

5. Route breather line through engine baffle and connect to oil separator and tee assembly using existing clamps.

6. Route air injection line through baffle and connect to air injection manifold and at nozzle.

7. Connect manifold pressure line.

8. Route fuel line through baffle to distributor valve, then secure cooling shrouds to baffle adapter using existing clamps.

i. Install baffle (16) as follows:

1. Position baffle (16) on front of engine by lifting upwards slightly to clear tab on exhaust manifold.

2. Secure baffle (16) to front engine body using existing nuts and washers.

3. Install exhaust manifold brackets and supports.

j. Install baffle (12) on baffle (15) and secure with screws, if removed, from baffle (15).

k. Install baffles (15 and 12) on engine and secure with washers and screw.

l. Install exhaust support (13) and secure with screws.

m. Install shield (14) on baffle (15) and secure with screws.

n. Position baffle bases (10) between engine cylinders.

o. Secure baffle assemblies (11) to bases (10) with screws.

p. Position supports (18) on engine cylinders with inner leg between #13 and #14 fins from engine crankcase and secure to baffle assemblies (11) with bolts (19). Make sure baffle (11) is mounted to proper cylinders.

q. Install baffles (9 and 17) as follows:

1. Position baffles (9 and 17) on engine and secure to rocker arm assemblies with screws (3 places) and to intake manifold with washers and nuts (2 places).

2. Secure baffles (9 and 17) to front baffles (15 and 16) with screws.

3. Secure baffle (9) to rear baffle (7) with screws.

4. Secure baffle (17) to rear baffle (1) with screws.

r. Install engine cowling in accordance with installation procedures.

s. Start engine and check for intake manifold leaks by observing manifold pressure gage on instrument panel.

ENGINE CONTROLS.

Removal and Installation of Engine Controls. (See Figure 9-8.)

a. Remove pilot and copilot seats, cabin divider (optional equipment), carpet and pedestal access covers in accordance with Section 3.

- b. (See Figure 1-2.) Remove access panels (73 and 77).
- c. (See Figure 1-2.) Remove engine cowls (29, 30 and 33) and wing access panels (54, 55, 56 and 57).
- d. Disconnect the throttle, propeller and mixture controls from quadrant levers. Note the direction that each pin is installed and position of each housing, so they may be reinstalled in the same position.
- e. Disconnect each control from its respective engine component, and remove rod ends and jam nuts from each end of controls.
- f. Disconnect cable housings from brackets at each end of controls, and remove washers and nuts.
- g. Remove block assembly (1) from the housings.
- h. Loosen the shield (16) through which the engine controls pass at the engine firewall.
- i. Remove seal assembly (17) as follows:
 1. Remove nuts and screws securing seal assembly to cabin skin.
 2. Carefully remove seal assembly from cabin skin and separate seal halves to remove from controls.
- j. Remove the controls from clamps under the floorboards and from clamps securing the controls along their routing to the engine compartment.
- k. Pull the controls into the cabin and remove.

CAUTION

Due to the design of the throttle control, extreme care should be exercised to prevent damage to the control during removal. See Throttle Control Installation.

- l. Reverse this procedure to install the controls, then rig each control.
- m. Install seal halves and seal in accordance with Section 16 sealing procedures.

CAUTION

Safety wire all ball joints and locknuts.

Throttle Control Installation.

The throttle control cable is an anti-friction bearing type control having a center blade or ribbon suspended and guided by balls which are separated by ball separators. Due to the geometry of the ribbon and balls, care should be exercised in handling, removing and installing the control to prevent damage. To make bends in different planes it is necessary to helix or twist the control so that the axis of the two planes are separated by one inch per ten degrees of angular difference in the two planes.

NOTE

Minimum bend radius can not be less than eight inches. Do not coil the cable as a rope or force into position when storing but fold cable in a lazy figure eight.

a. Install cable as follows:

1. Lay cable out on floor with arrow at control end facing up (fixed race up).
2. Straighten ribbon by establishing a bend or hump in the control and carrying the hump from one end of control to the other.
3. Start cable into wing through nacelle firewall and route cable to the control pedestal, exercising extreme care to prevent damage to the control.
4. Check control for freedom of movement before securing cable.
5. Secure each end of cable housing to control brackets.
6. Secure control to quadrant control lever and fuel control lever making sure the control cannot be bottomed.

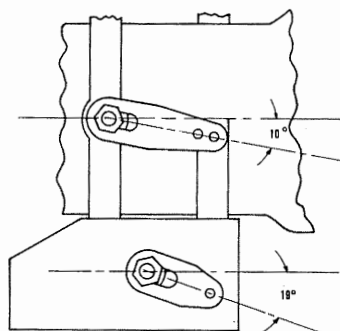
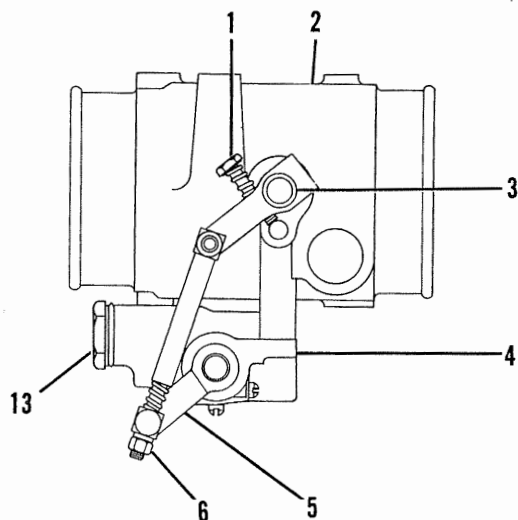
Rigging Mixture and Throttle Controls. (See Figure 9-7.)

- a. Adjustment of the idle mixture is accomplished by the use of locknut (6) which is attached to mixture control lever (5) on the mixture control (4). Tightening locknut (6) to shorten the interconnecting linkage provides a leaner mixture. Adjust to obtain a slight and momentary gain in idle speed as the mixture control is slowly moved toward IDLE CUT-OFF (if set too lean, idle speed will drop under the same condition). Mixture control levers in the cabin should end their travels approximately 1/4 of an inch before reaching the quadrant stops. At the same time, the mixture levers on the engines should rest against the corresponding stops.
- b. Mixture levers should be uniform within 1/2 of a knob through the cruising range. This can be checked by adjusting both flow meter readings to an identical value at uniform RPM and manifold pressure on both engines.
- c. Adjust the throttle control levers in the cabin so that their travel ends 1/4 of an inch before reaching the quadrant stops. At the same time the throttle levers on the engines should rest against the corresponding stops.
- d. Throttle control levers should be uniform within 1/8 of an inch of the knobs through the entire travel. The rigging procedures chart provides corrective instructions in order to meet the above control requirements.
- e. Rig control cables on throttle valve and mixture control as follows:
 1. Find the neutral position on shafts (3 and 8) and scribe an index mark on body of throttle valve (2) and mixture control (4).
 2. Align serrated spacer (9) on shafts (3 and 8) so that serration lines on the face of the spacer are perpendicular to the neutral position of the shafts.

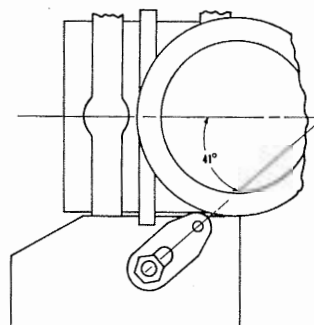
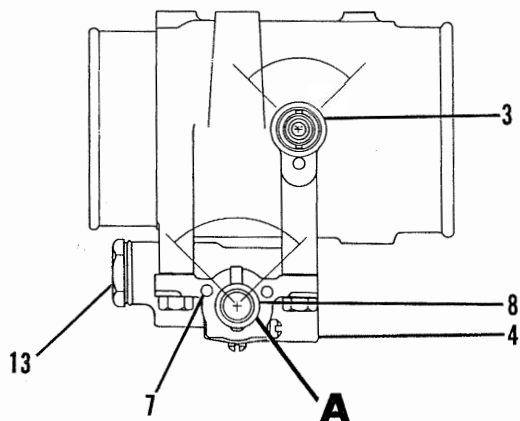
CAUTION

Care should be exercised in order to maintain original factory setting of serrated spacer (9) on shafts (3 and 8).

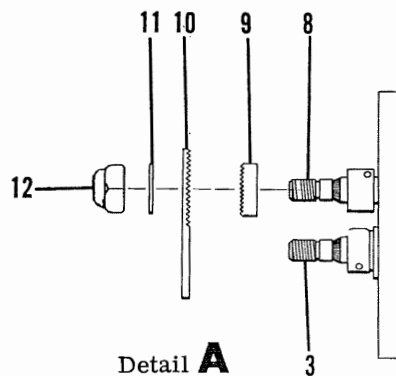
3. Install lever (10) on shafts (3 and 8) aligning the serration marks on spacer (9).
4. Install washer (11) and nut (12) on shafts (3 and 8).



L H ENGINE (Closed Position)



R H ENGINE (Closed Position)



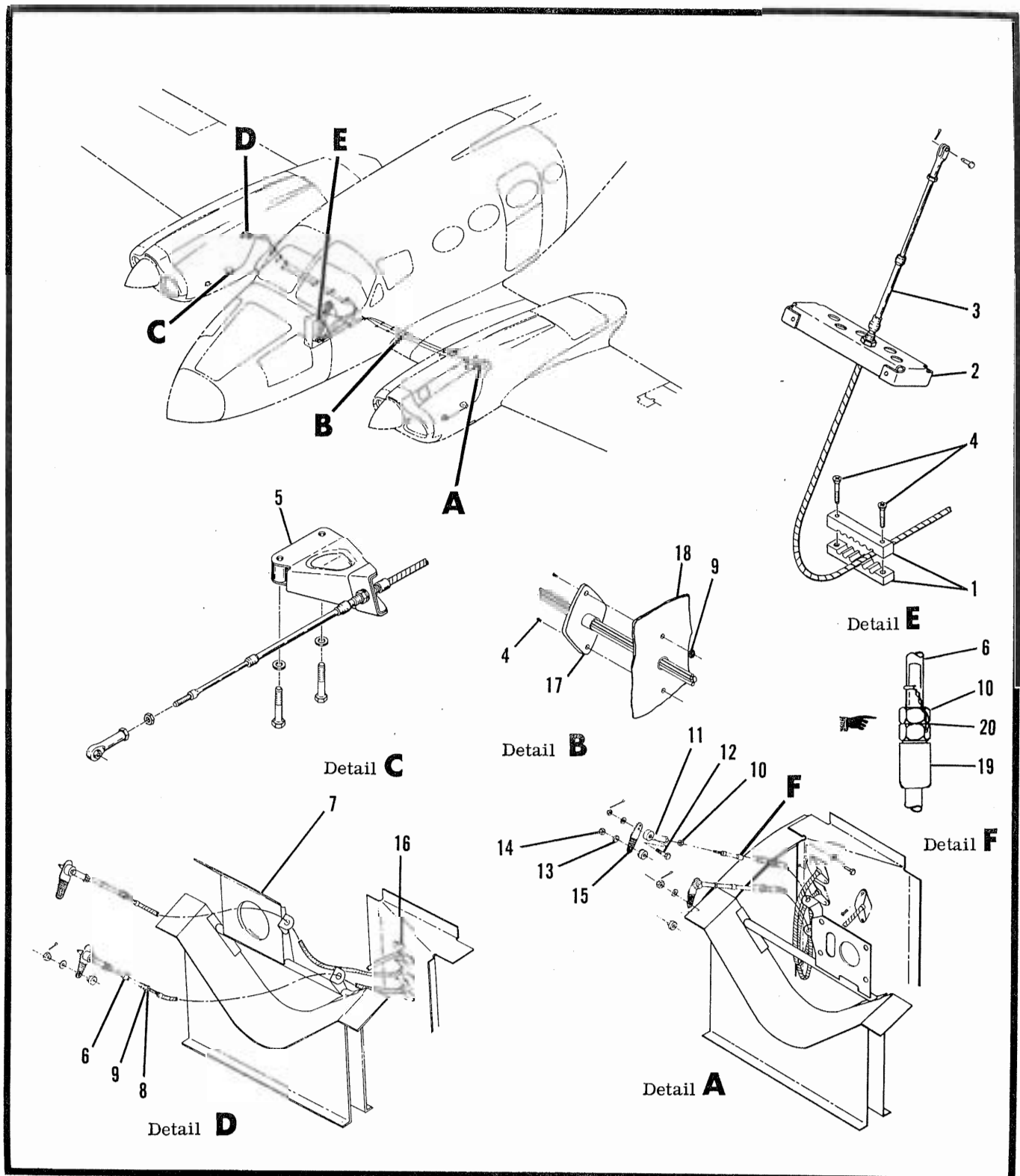
Detail A

1. Idle Speed Adjustment
2. Throttle Valve
3. Throttle Shaft
4. Mixture Control
5. Mixture Control Lever

6. Idle Mixture Adjustment Nut
7. Stop Pin
8. Mixture Control Shaft
9. Serrated Spacer

10. Lever
11. Washer
12. Nut
13. Metering Unit Filter

Figure 9-7. Engine Controls



1. Block Assembly	6. Control Cable	11. Rod End	16. Shield
2. Pedestal Bracket	7. Housing Bracket	12. Bolt	17. Seal Assembly
3. Control Housing	8. Washer	13. Washer	18. Cabin Skin
4. Screw	9. Nut	14. Nut	19. Ball Joint
5. Clamp	10. Jam Nut	15. Lever	20. Safety Wire

Figure 9-8. Engine Control Cables

5. On the control quadrant place the throttle and mixture controls at the mid-point between stops.

6. With shafts (3 and 8) in the NEUTRAL position and the controls on quadrant set at the mid-point, adjust control cables ends so that when attached to levers (10) a 90 degree angle is formed between centerline of lever (10) and centerline of control cables.

NOTE

If throttle and mixture controls at the quad-

rant were not set at a true mid-point as described in step 5 above, the 1/4 inch tolerance as noted in steps a. and c. will not be available. Readjustment for 1/4 inch travel will be necessary and should be made at the control quadrant.

NOTE

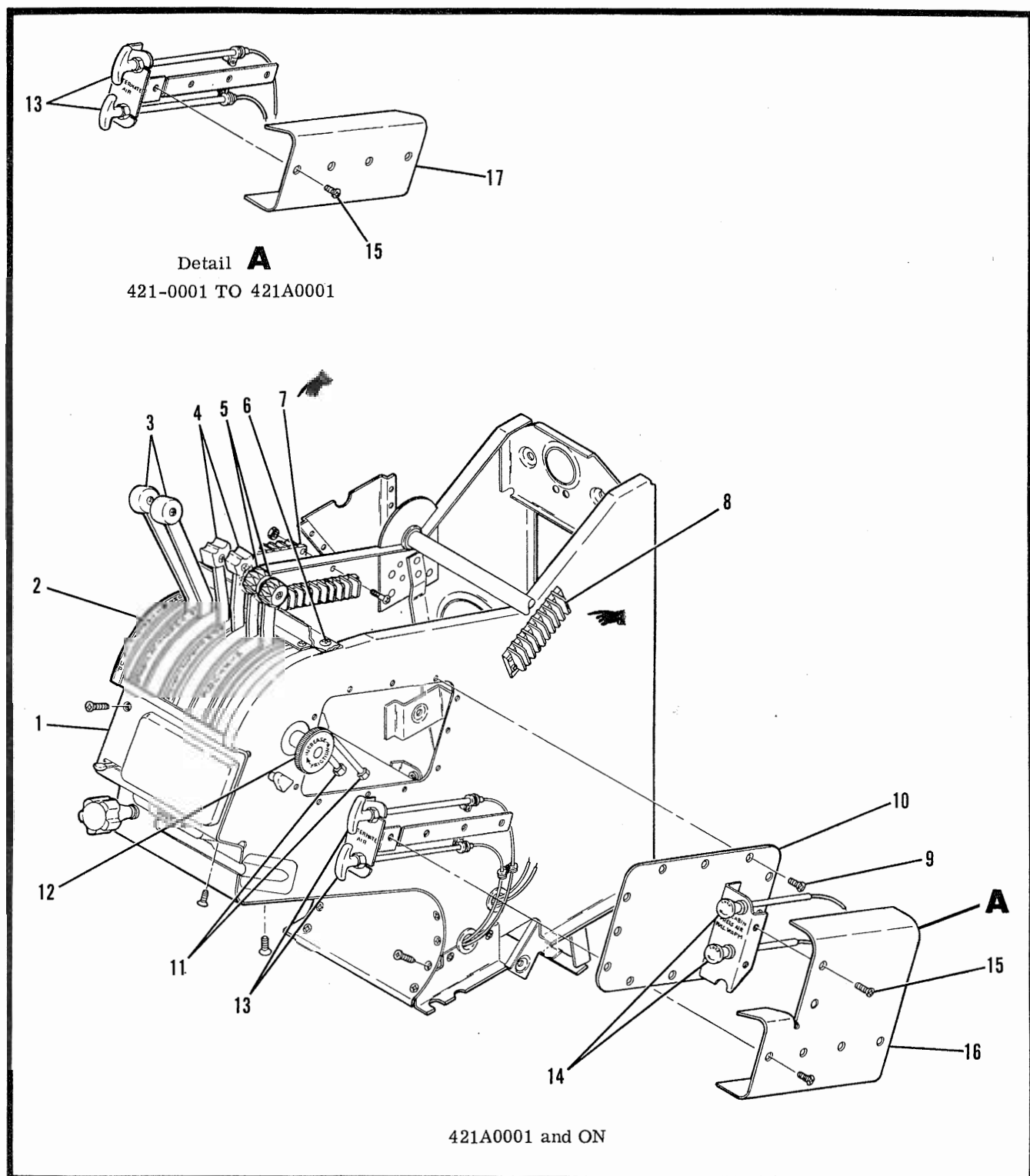
Control actions must be corrected in the order presented in Rigging Chart. Start at the top of the chart and work toward the bottom.

Rigging Procedures Chart for Throttle and Mixture Controls. (See Figures 9-7 and 9-8.)

TROUBLE	PROBABLE CAUSE	CORRECTION
MIXTURE CONTROL LEVER REACHES QUADRANT BEFORE COVERING FULL TRAVEL	Insufficient mixture control lever travel on fuel-air control unit.	(See Figure 9-7.) Shorten travel of serrated lever (10) by resetting lever lower on serrated spacer (9).
MIXTURE CONTROL LEVER STOPS SHORT AT BOTH ENDS OF QUADRANT	Excessive mixture control lever travel on fuel-air control unit.	(See Figure 9-7.) Lengthen travel of serrated lever (10) by resetting lever higher on serrated spacer (9).
MIXTURE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	(See Figure 9-8.) Reset control cable travel by removing bolt (12), washer (13), nut (14) and loosening nut (10) and turning rod end (11) to achieve desired adjustment.
UNEVEN MIXTURE RESPONSE BETWEEN ENGINES (MORE THAN HALF KNOB DIFFERENCE AT BALANCED FLOW METER READINGS. RPM AND MANIFOLD PRESSURE	Different mixture control sensitivities.	Refer to Rigging Mixture and Throttle Controls.
THROTTLE CONTROL LEVER REACHES QUADRANT BEFORE COVERING FULL TRAVEL	Insufficient throttle control lever travel on fuel-air control unit.	(See Figure 9-7.) Shorten travel of serrated lever (10) by resetting lever lower on serrated spacer (9).
THROTTLE CONTROL LEVER STOPS SHORT AT BOTH END OF QUADRANT	Excessive throttle control lever travel on fuel-air control.	(See Figure 9-7.) Lengthen travel of serrated lever by resetting lever higher on serrated spacer.
THROTTLE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES THE QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	(See Figure 9-8.) Reset control cable travel by removing bolts (12) washer (13), nut (14) and loosening nut (10) and turning rod and (11) to achieve desired adjustment.
UNEVEN THROTTLE SETTING RESPONSE BETWEEN ENGINES, MORE THAN 1/8 INCH DIFFERENCE BETWEEN KNOBS (AT SAME FLOW METER MANIFOLD PRESSURE AND RPM READINGS)	Different throttle control sensitivities.	Refer to Rigging Mixture and Throttle Controls.

NOTE

If described corrective measures do not provide adequate throttle control operation, check throttle body, control valve operation and air intake system for leaks.

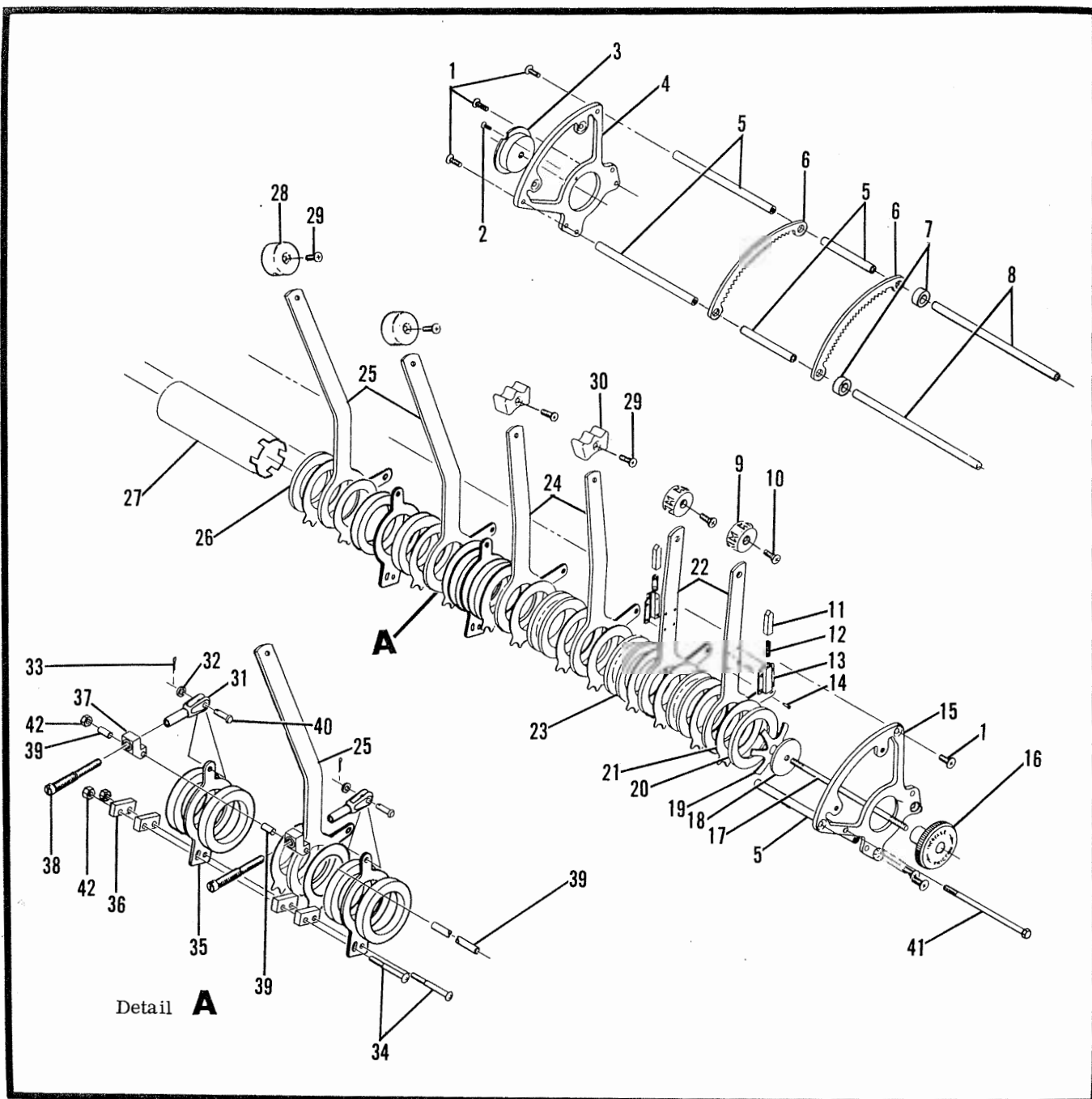


1. Control Pedestal
2. Metalcal
3. Throttle Levers
4. Propeller Levers
5. Mixture Levers
6. Screw

7. Terminal Block 6
8. Terminal Block 5
9. Screw
10. Cover Plate
11. Control Cable Assembly

12. Friction Knob
13. Alternate Air Controls
14. Heat Exchange Controls
15. Screw
16. Cover Plate
17. Cover Plate

Figure 9-9. Control Quadrant



1. Screw	15. Right Mounting Plate	29. Screw
2. Lockscrew	16. Friction Knob	30. Pitch Lever Knob
3. Retainer	17. Center Stud	31. Terminal
4. Left Mounting Plate	18. Washer	32. Washer
5. Spacer	19. Spring	33. Cotter Pin
6. Rack	20. Spacer	34. Screw
7. Spacer	21. Friction Disc	35. Spacer
8. Guide Rod	22. Mixture Lever	36. Switch
9. Mixture Lever Knob	23. Spacer	37. Lug
10. Screw	24. Propeller Pitch Lever	38. Screw
11. Ratchet Stop	25. Throttle Lever	39. Spacer
12. Spring	26. Spacer	40. Pin
13. Housing	27. Hub	41. Bolt
14. Screw	28. Throttle Lever Knob	42. Nut

Figure 9-10. Control Quadrant Disassembly

Removal, Installation and Rigging of Propeller Controls.

For removal, installation and rigging of propeller controls see Section 10.

ENGINE CONTROL QUADRANT.

Removal of Control Quadrant. (See Figure 9-9.)

- a. Remove elevator trim control wheel and sprocket in accordance with Section 6.
- b. Remove cover plate (10) and unscrew friction knob (12) from right hand side of control pedestal (1).
- c. Remove cotter pins and pins which connect the cable assemblies (11) to the control levers (3, 4 and 5).
- d. Disconnect the wires from the gear warning switches and tag.
- e. Remove control quadrant by removing screws (6) which attach the control quadrant to the pedestal (1).

Disassembly of Control Quadrant. (See Figure 9-10.)

- a. Remove the three screws (1) attaching right mounting plate (15) to guide rods (8).
- b. Remove cotter pins (33), washers (32) and pins (40) from terminal (31).
- c. Remove nut (42), spacers (39), lugs (37) and bolt (41) from right and left mounting plates (4 and 15).
- d. Remove washer (18) and spring (19) from end of center stud (17).
- e. Remove spacer (7), rack (6) and spacers (7) from guide rods, then remove spacer (20), friction disc (21) and control lever (22) from hub (27). Follow this sequence and remove the remaining parts assembled on the guide rods and hub.

NOTE

The spacers are of different thickness.

- f. Remove three screws (1) attaching guide rods to the left mounting plate (4) and remove guide rods.

CAUTION

Hold the ratchet stop (11) on the mixture levers (22) down when removing the racks to prevent them from springing out of their housings.

- g. Remove lockscrew (2) from left mounting plate (4) and remove hub (27) from mounting plate.
- h. Unscrew retainer (3) from hub (27) and center stud (17) from retainer, to complete disassembly.
- i. To remove stall warning switches (36) from spacer (35), remove nut (42), spacer (35), and screws (34).

Assembly of Control Quadrant. (See Figure 9-10.)

- a. Install gear warning switch using bolts, spacers and nuts as illustrated.
- b. Screw center stud (17) into retainer (3).
- c. Screw retainer (3) into hub (27) and install hub in left mounting plate with lockscrew (2).

NOTE

Prick punch edge of lockscrew after installing to prevent it from becoming loose and dropping out.

- d. Install three guide rods on left mounting plate (4) with three attaching screws (1).
- e. Assemble control levers, spacers, guides, etc. on hub and guide rods as illustrated.

NOTE

Do not lubricate the parts to be assembled on the hub. These parts must remain dry for proper operation of the control friction lock.

- f. Install right mounting plate (15) with three screws (1), attaching mounting plate to guide rods (8).
- g. Install the two lugs (37) with the spacers (39), bolts (41) and nuts (42).
- h. Install screws (38) in lugs (37) and terminals (31) on screws (38), then with terminals (31) located on spacer lugs, install pins (40), washers (32), and cotter pins (33).
- i. Adjust forward screw (34) on the gear warning switches (36) so that when the throttle levers (25) are CLOSED, the switches (36) are closed.

Installation of Control Quadrant. (See Figure 9-8.)

Reverse the removal of control quadrant procedure.

FUEL INJECTION SYSTEM.

The fuel injection system is a simple, low pressure system of injecting fuel into the intake valve port in the cylinder head. It is a multi-nozzle, continuous flow type system which controls fuel flow to match engine airflow. Any change in throttle position, engine speed, or a combination of both, causes changes in fuel flow in correct relation to the engine airflow. A manual mixture control and a flow gage, indicating metered fuel pressure, are provided for precise leaning at any combination of altitude and power setting. The continuous flow system uses a typical rotary vane fuel pump. There are no running parts in this system except for the engine-driven fuel injection pump.

Trouble Shooting The Fuel Injection System.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START --- WITH NO FUEL FLOW GAGE INDICATION	No fuel to engine.	Check tank fuel level.
	Mixture control improperly rigged.	Check mixture control for proper rigging.
	Engine not primed.	Auxiliary pump switch in PRIME position.
	Selector valve in wrong position.	Position selector valve to MAIN TANK position.
ENGINE WILL NOT START --- WITH FUEL FLOW GAGE INDICATION	Engine flooded.	Open throttle, close mixture, clear engine of excess fuel, try another start.
	No fuel to engine.	Loosen one line at nozzle. If no fuel flow shows, with fuel flow on gage, replace fuel manifold valve.
ROUGH IDLE	Nozzle restricted.	Remove nozzles and clean.
	Improper idle mixture.	Adjust mixture per Engine Operational Check.
POOR ACCELERATION	Idle mixture incorrect.	Adjust mixture as required. See Engine Operational Check.
	Unmetered fuel pressure too high.	Lower unmetered fuel pressure.
	Worn linkage.	Replace worn elements of linkage.
ENGINE RUNS ROUGH	Restricted nozzle.	Remove and clean all nozzles. Check adjustment of fuel pump, if unable to adjust properly replace fuel pump.
	Improper mixture.	
LOW FUEL FLOW GAGE INDICATION	Restricted flow to metering valve.	Check mixture control for full travel. Check for clogged fuel filters.
	Inadequate flow from pump.	Adjust engine-driven fuel pump.
	Altitude compensator stuck.	Repair or replace engine-driven fuel pump.
	Distribution valve stuck open.	Repair or replace distribution valve.
HIGH FUEL FLOW GAGE INDICATION	Restricted flow beyond metering valve.	Check for restricted nozzles or fuel manifold valve. Clean or replace as required.
	Air in gage line.	Loosen line to remove trapped air.
	Restricted recirculation passage in pump.	Replace engine-driven fuel pump.
FLUCTUATING OR ERRONEOUS FUEL FLOW INDICATIONS	Vapor in system, excess fuel temperature.	If not cleared with auxiliary pump, check for clogged ejector jet in vapor separator cover. Clean only with solvent, no wires.

TROUBLE	PROBABLE CAUSE	CORRECTION
FLUCTUATING OR ERRONEOUS FUEL FLOW INDICATIONS (CONT.)	Aneroid in pump stuck.	Repair or replace injection fuel pump.
	Distribution valve stuck closed.	Repair or replace distribution valve.
	Air in fuel flow gage line. Leak at gage connection.	Repair leak and purge line.
ERRATIC IDLE FUEL PRESSURE	(Not associated with vapor) Dirty Relief Valve.	Clean relief valve. Refer to Continental M73-22.
POOR IDLE CUTOFF	Engine getting fuel.	Check mixture control in full IDLE CUT-OFF. Check auxiliary pump is OFF. If neither, replace manifold valve.
UNMETERED FUEL PRESSURE RAISE	Internal orifices plugged.	Clean internal orifices in engine-driven fuel pump. Set aneroid.
UNMETERED FUEL PRESSURE DROP	Relief valve stuck open.	Replace engine-driven fuel pump. Check supercharger discharge pressure.
VERY HIGH IDLE AND FULL THROTTLE FUEL PRESSURE PRESENT	Relief valve stuck closed.	Replace engine-driven fuel pump.
FUEL DISCHARGED INTO ENGINE COMPARTMENT AND RELIEF VALVE WILL NOT PROPERLY OPEN	Leaking diaphragm.	Replace engine-driven fuel pump.
LOW FUEL PRESSURE AT HIGH POWER	No turbocharger discharge pressure.	Check turbocharger lines and fittings. Check discharge pressure.
NO FUEL PRESSURE	Check valve stuck open.	Replace engine-driven fuel pump.

FUEL-AIR CONTROL UNIT.

The function of the fuel-air control unit is to control engine air intake and to set the metered fuel pressure for proper fuel-air ratio. There are three control elements in this unit, one for air, and two for fuel; one of which is for fuel mixture and the other for fuel metering.

Main fuel enters the control unit through a strainer and passes to the metering valve. The position of the metering valve controls the fuel passed to the manifold valve and nozzles. A linkage connecting the metering valve to the air throttle proportions air-flow to fuel-flow. The position of the mixture valve determines the amount of fuel returned to the fuel pump. The fuel control portions of the fuel-air control unit is enclosed in a shroud and is blast air cooled to help prevent vapor lock. A fuel pressure switch, connected to the fuel control unit, actuates to cause the auxiliary fuel pump to operate at a high speed if the engine-driven pump pressure drops below 5 PSI. The auxiliary fuel pump switch must be ON for the fuel pressure switch to operate.

Removal of Fuel-Air Control Unit.

- Place the fuel selector valve handle in OFF position.
- Remove the engine cowling.

NOTE

Plug or cap all open lines, hoses and fittings.

- Loosen clamps securing flexible ducts to the bottom of the fuel control unit shroud and slide ducting down. Disconnect the three fuel lines.
- Disconnect the fuel pressure switch wiring.
- Remove fuel-air control cover.
- Remove bolts securing fuel-air control to throttle body.
- Remove the fuel-air control unit.

Installation of Fuel-Air Control Unit.

- Place the fuel-air control in position on the throttle body.

NOTE

When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

- b. Install bolts securing fuel-air control to the throttle body.
- c. Install fuel-air control lever.
- d. Before connecting the three fuel lines, which run between the fuel control unit and the fuel pump and engine, make certain that the three flexible ducts are installed on these lines. Connect these three lines at the fuel-air control unit. Install the flexible ducts on the air tubes located at the bottom of the fuel-air control shroud and secure with clamps.
- e. Connect electrical wiring at fuel pressure switch.
- f. Rig engine controls in accordance with rigging instructions.
- g. Check the operation of mechanical linkage and ground run as required for adjustments.
- h. Install engine cowling.

Adjustment of Fuel-Air Control Unit. (See Figure 9-11.)

The idle speed adjustment is a conventional spring-loaded screw located in the air throttle lever. Adjust idle speed adjustment screw to obtain 450 to 500 RPM. Turn screw CW to increase RPM; CCW to decrease RPM. The idle mixture adjustment is the locknut at the metering valve end of the linkage. Tightening the nut, to shorten the linkage, provides a leaner mixture. A richer mixture is obtained by backing off the nut to lengthen the linkage. Adjust to obtain a slight and momentary gain in idle speed as the mixture control is slowly moved toward IDLE CUT-OFF. If set too lean, idle speed will drop under the same conditions.

FUEL MANIFOLD.

From the fuel control unit, fuel is delivered to the fuel manifold which provides a central point for dividing fuel to the individual cylinders.

In the fuel manifold, a diaphragm and plunger valve raises or lowers, by fuel pressure, to open or close the individual cylinder fuel supply ports simultaneously. A piston type check valve serves to insure that the plunger fully opens the outlet ports before fuel flow starts. Thus, there is no unbalance restrictions to fuel flow in the fuel manifold. A fine mesh screen is included in the fuel manifold as additional protection of the injection nozzles against dirt or foreign matter.

Removal of Fuel Manifold.

NOTE

Plug or cap all disconnected lines, hoses and fittings.

- a. Disconnect fuel supply line and fuel flow gage line at the fuel manifold.
- b. Disconnect the six fuel injection lines at the fuel manifold.
- c. Disconnect the manifold overboard vent line.
- d. Remove the fuel manifold by removing the crankcase bolts which secures it.

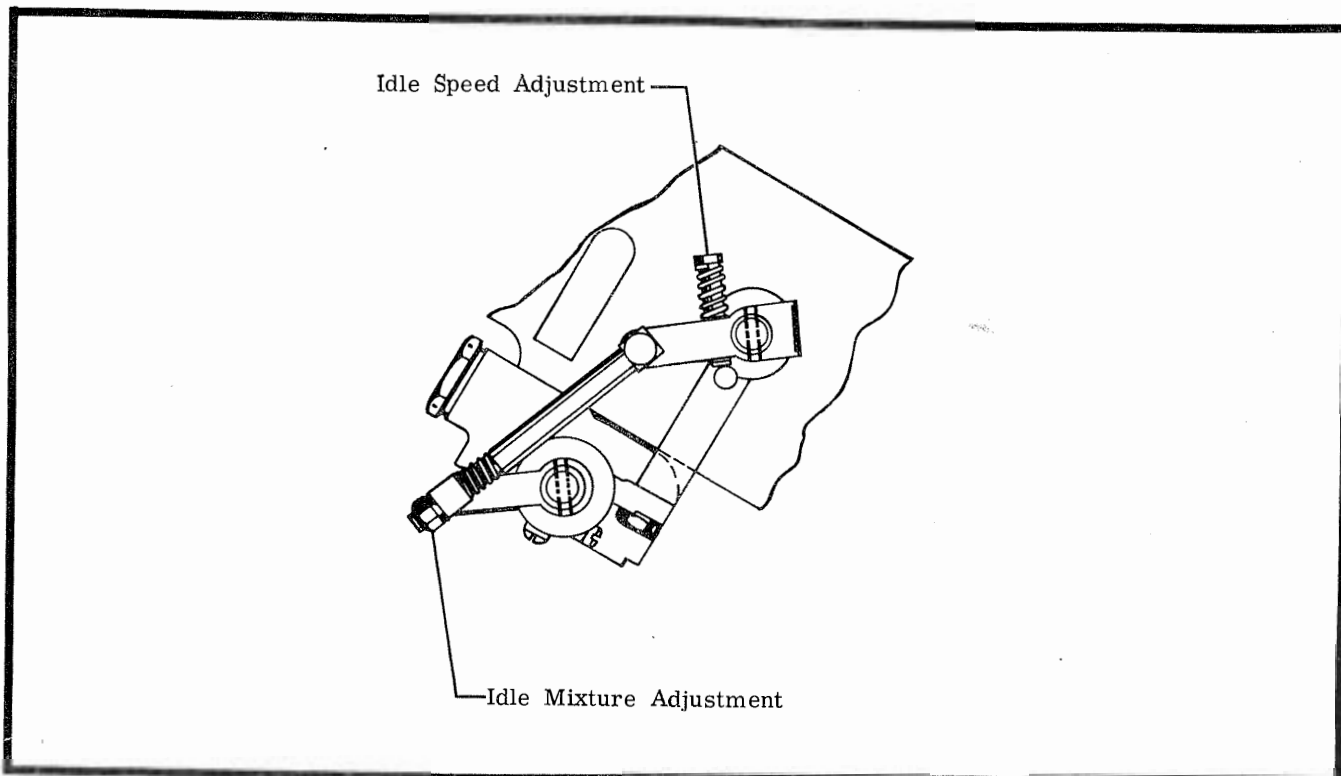
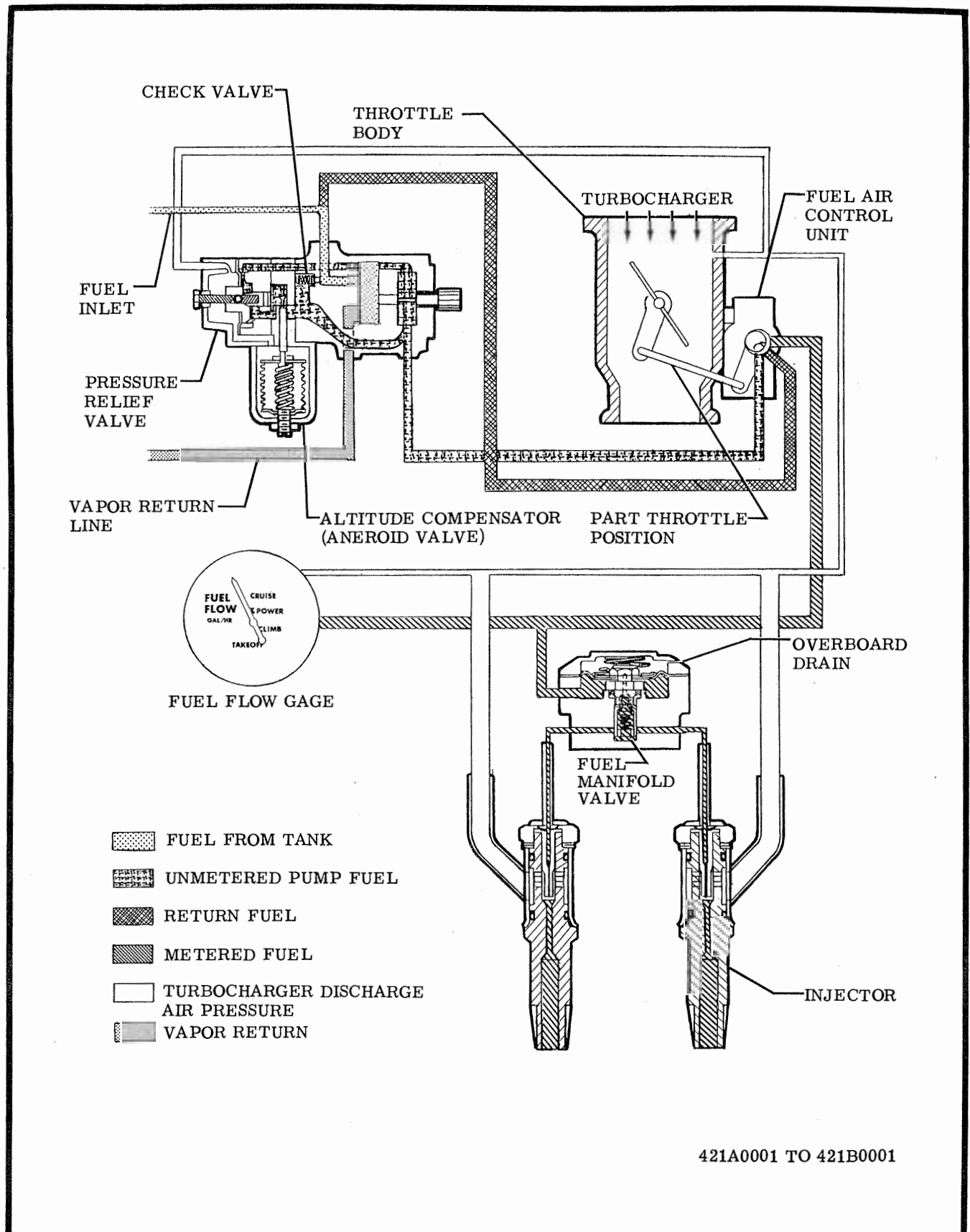
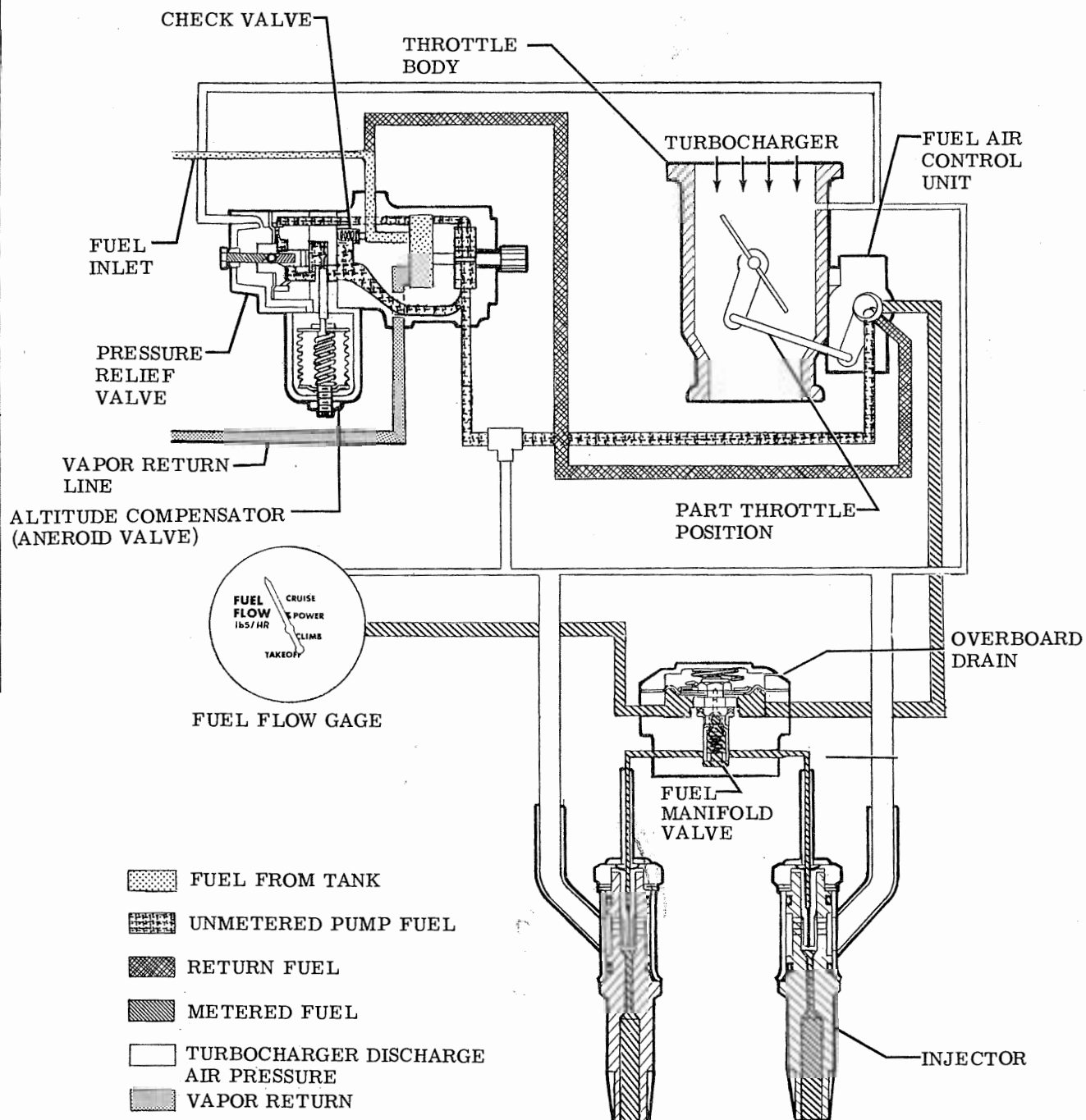


Figure 9-11. Fuel Air Control Unit Adjustment



421A0001 TO 421B0001

Figure 9-12. Fuel Injection System Schematic (Sheet 1 of 2)



421B0001 AND ON

Figure 9-12. Fuel Injection System Schematic (Sheet 2 of 2)

Cleaning and Inspection of Fuel Manifold. Refer to Section 2.

Installation of Fuel Manifold.

NOTE

When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on the thread fittings. **DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.**

- a. Install the fuel manifold using crankcase bolts.
- b. Connect fuel supply line and fuel flow gage line.
- c. Connect the manifold overboard vent line.
- d. Connect the six fuel injection lines at the fuel manifold.
- e. Check for leaks and proper operation.

FUEL DISCHARGE NOZZLES.

From the fuel manifold, individual fuel lines carry the metered fuel to the fuel discharge nozzles, one for each cylinder. These nozzles are installed in the cylinder heads outside each intake valve. An air bleed and nozzle pressurization arrangement supplies pressurized air to the nozzle. The air bleed arrangement aids in vaporization of fuel and by breaking the high vacuum at idle, maintains the fuel lines solidly filled and ready for instant acceleration of the engine. Nozzles are stamped with a letter on the hex of the nozzle body. Replacement nozzles must match, but a matched set of another letter may be used.

Removal of Fuel Discharge Nozzles.

- a. Disconnect the fuel injection lines at the fuel discharge nozzles.

NOTE

Plug or cap all disconnected lines and fittings.

- b. Disconnect nozzle pressurization hose.
- c. Remove the fuel discharge nozzles from the cylinders.

Installation of Fuel Discharge Nozzles.

NOTE

When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on the fitting threads. **DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.**

- a. Install the fuel discharge nozzles in the cylinders.
- b. Connect fuel injection lines at the fuel discharge nozzles.

- c. Connect nozzle pressurization hose at the fuel discharge nozzle.
- d. Check installation for crimped lines and loose fittings.

FUEL INJECTION PUMP.

The fuel pump is a single rotor pump incorporating a splined shaft for connection to the accessory unit. Since the pump is engine-driven, changes in engine speed affect total pump flow proportionally. The pump supplies more fuel than is required by the engines. Therefore, a relief valve is provided to maintain a constant fuel pump pressure. A check valve is provided so that the auxiliary pump pressure can bypass the engine-driven fuel injection pump for starting. In case of engine-driven fuel injection pump failure, the auxiliary fuel pump will operate automatically when the auxiliary fuel pump switch is ON. Incorporated on the fuel injection pump is a variable orifice controlled by an aneroid on the pump. The aneroid is controlled by the supercharger discharge pressure.

Removal of Fuel Injection Pump.

- a. Place fuel selector valve handles in the OFF position.
- b. Remove the engine cowl.
- c. Remove necessary lines and hoses for accessibility to pump.

NOTE

Plug or cap and tag for identification all lines, hoses and fittings.

- d. Remove the shroud surrounding the fuel pump.
- e. Remove the four nuts and washers attaching the pump to the engine.
- f. Remove fuel pump and gasket.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent the accumulation of such fuel when lines or hoses are disconnected.

- g. If a replacement pump is not being installed immediately, a temporary cover should be installed on the fuel pump mount pad.

Installation of Fuel Injection Pump.

- a. Position a new gasket and fuel pump on four mounting studs with the fuel pump inlet to the left.
- b. Secure pump to engine with four plain washers, four internal tooth lockwashers and nuts.

NOTE

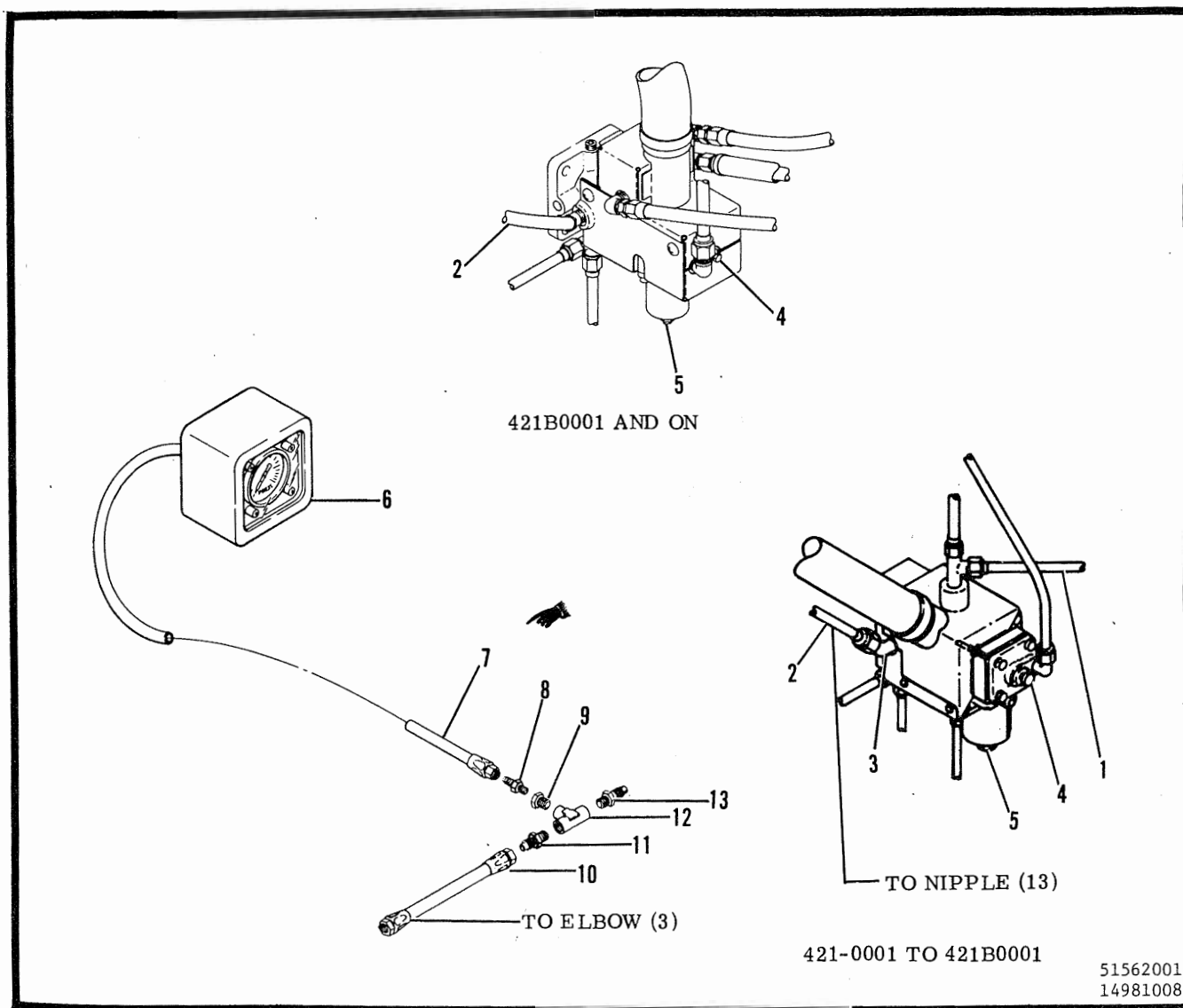
When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

- c. Install the cooling shroud on the fuel pump.
- d. Install all fittings and connect all lines as tagged at removal.
- e. Run operational check and adjust as required.
- f. Replace the engine cowling.

Fuel Mixture Check.

a. Perform a fuel mixture check as follows:

1. Warm-up engine, move throttle back to idle position (450 RPM).
2. Place mixture control to full rich and propeller control full forward.
3. Position auxiliary fuel pump to LOW, advance throttle to 1000 RPM and slowly reduce mixture control, if both the fuel mixture control unit and fuel injection pumps are set properly, RPM should decrease when the mixture control is gradually moved towards IDLE CUT-OFF.



1. Hose (fuel inlet from tank)
2. Hose (fuel pump to metering unit)
3. Elbow
4. Low Unmetered Pressure Adjusting Screw

5. Compensator Valve Adjusting Screw
6. Gage
7. Hose
8. Nipple
9. Reducer

10. Hose
11. Nipple
12. Tee
13. Nipple

Figure 9-13. Fuel Injection Pump Adjustment

NOTE

If RPM increases when mixture is reduced, fuel mixture is too rich; conversely, if RPM diminishes rapidly when mixture is reduced, fuel mixture is too lean.

- b. If fuel mixture check indicates a too rich or too lean idle condition, refer to Fuel-Air Control Unit Adjustments paragraph and adjust as necessary.

Unmetered Fuel Injection Pump Test Hook-Up, Check and Adjustment. (See figure 9-13.)

a. Test procedures are the same for left and right fuel pumps. Connect test gage to pump as follows:

1. Install fitting in pressure port of gage (6) and connect hose (7).
2. Install nipples (11 and 13) and reducer (9) and nipple (8) in tee (12).
3. Connect hose (10) to nipple (11) and hose (7) to nipple (8).
4. Disconnect hose (2) (engine-driven pump to metering unit) from fuel pump elbow (3) and connect hose (10) to elbow (3). Connect hose (2) to nipple (13).

b. Adjust compensator valve (aneroid) and pressure relief valve to obtain the following:

1. Low unmetered pressure adjustment: Allow engine warm-up, then idle engine at idle RPM. Pressure should indicate 5.5 to 6.5 PSI on test hook-up pressure gage. If the indicated pressure is not within prescribed tolerances, turn adjusting screw (4) on pressure relief valve (turn IN to increase fuel pressure or turn OUT to decrease fuel pressure) until proper fuel pressure is obtained. Position auxiliary pump to LOW, observe that unmetered fuel pressure does not exceed 6.5 PSI.

2. Maximum fuel flow adjustment (421-0001 to 421B0001): Allow engine oil to reach a temperature indication in the upper 1/3 of green arc on the oil temperature indicator. With the engine power setting at maximum RPM and 39.5 in. Hg manifold pressure, reading from the aircraft's fuel flow indicator set the fuel flow to 42.6 to 44.3 GPH with auxiliary fuel pumps in the OFF position. Position auxiliary fuel pumps to ON, check that fuel flow does not exceed 44.8 GPH. If the indicated GPH is not within prescribed tolerance, loosen locknut and turn adjustment screw (5) on altitude compensator valve (turn OUT to increase or turn IN to decrease) until proper GPH is obtained.

NOTE

Adjustments made to either the pressure relief valve or the altitude compensator will affect the pressure setting of the other valve. Therefore, recheck low and high RPM indica-

tions and readjust each pressure valve until the proper balance and pressure settings are achieved.

3. Maximum fuel flow adjustment (see figures 9-3 and 9-13) (421B0001 and ON and aircraft incorporating SK421-38).

NOTE

Propeller and manifold pressure adjustments must be accomplished before fuel flow adjustments.

(a) Disconnect hose from return center port of pressure regulator and plug the end of detached hose and cap center port on regulator.

(b) Allow engine oil to reach a temperature indication in the upper 1/3 of green arc on temperature indicator.

CAUTION

Do not disconnect or plug line connected to inlet (side) port of pressure regulator. Complete failure of pressure regulator could occur.

(c) With throttle full open, mixture full rich, low boost and propeller control retarded to maintain 2100 RPM reading aircrafts fuel flow gage, set high pressure adjustment to obtain a fuel flow gage reading of 233 to 238 pounds per hour.

NOTE

The above adjustment is accomplished by loosening locknut and turning adjustment screw (5) on altitude compensator (turn OUT to increase or turn IN to decrease).

(d) Shutdown engine, remove plug and connect hose to return (center) port of pressure regulator.

(e) Start engine and allow to warm up.

(f) Adjust top screw of pressure regulator to obtain aircraft fuel flow gage reading of 255 to 260 pounds per hour with throttle full open, mixture full rich, auxiliary boost pumps on low, and maximum static RPM settings.

NOTE

This setting will override the setting made at the engine-driven fuel pump. Therefore, it is important to follow these procedures correctly to assure proper fuel flow.

(g) Turn the auxiliary boost pump ON and check that fuel flow does not exceed (260 lbs/hr) on instrument panel gage. If fuel flow exceeds (260 lbs/hr) with auxiliary boost pumps ON, the fuel pressure relief valve is malfunctioning or the auxiliary boost pump pressure is set too high. (See Section 11 for auxiliary boost pump adjustment.)

NOTE

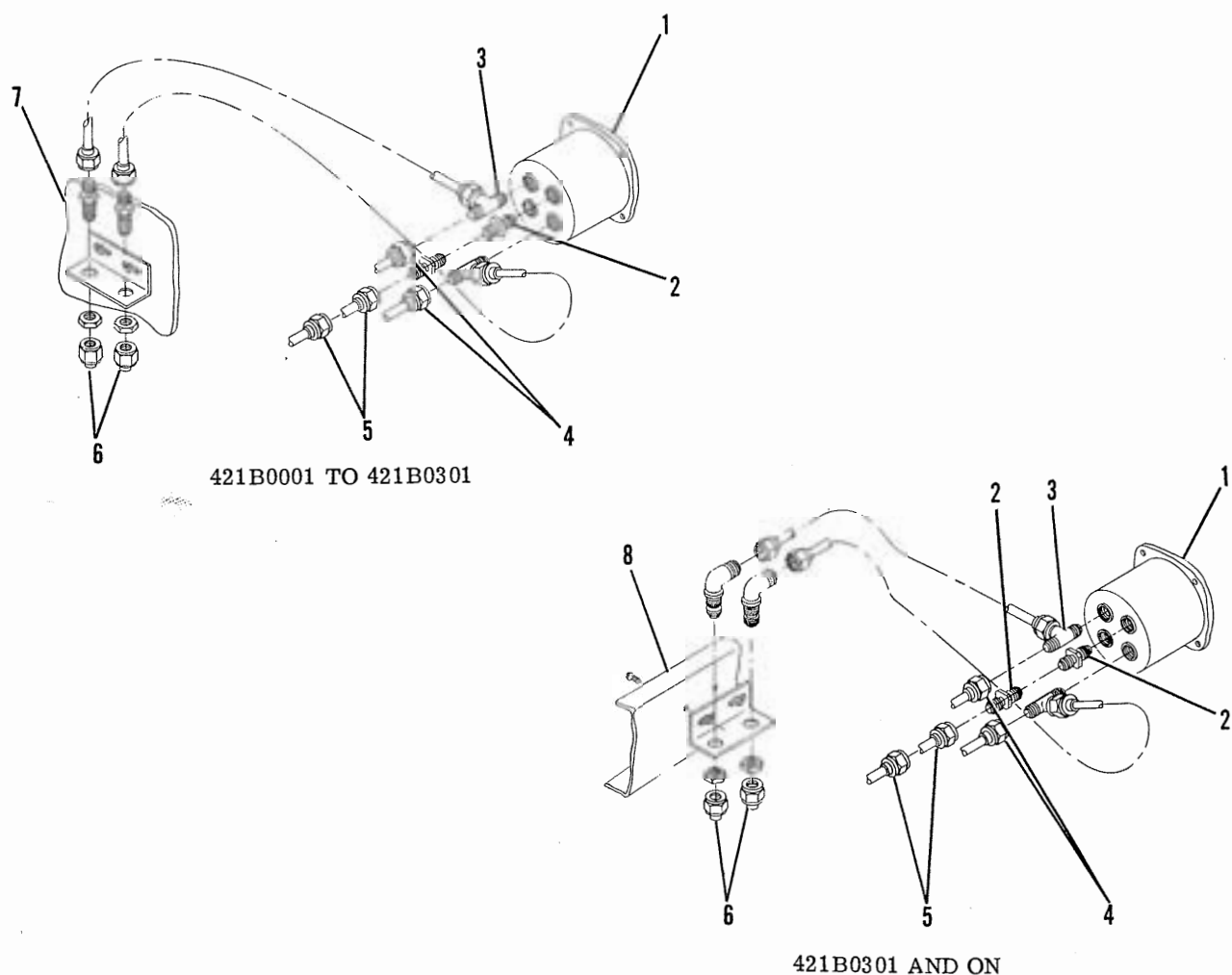
Adjustments made to either the pressure relief valve (4) or the altitude compensator (5)

will affect the pressure setting of the other valve. Therefore, recheck low and high RPM indications and readjust each pressure valve until the proper balance and pressure settings are achieved.

4. After adjusting the low unmetered fuel pressure and the maximum fuel flow, check idle RPM and idle mixture in accordance with the FUEL MIXTURE CHECK.

5. Remove test hook-up.

6. After completion of unmetered fuel adjustments with test equipment removed and fuel lines connected in normal position, it may be necessary to purge air from the fuel lines to prevent indicator needle fluctuations or erroneous readings.



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1. Fuel Flow Gage	4. Fuel Pressure Line	7. Glove Compartment
2. Snubber	5. Turbocharger Discharge Line	8. Elevator Torque Tube
3. Snubber Tee	6. Cap	Support

Figure 9-13A. Purging Fuel Pressure Lines

Purging Fuel Pressure Lines. (See figure 9-13A.)

NOTE

WARNING

Considerable fuel will run from the intake drain under each nacelle during purging procedures. An appropriate receptacle should be provided to prevent a pool of raw fuel from accumulating under each nacelle.

- a. Place throttle in full open position and mixture to full rich.
- b. Remove caps (6) from fuel pressure lines and operate auxiliary fuel pump until at least one pint of fuel has discharged from each pressure line.

On aircraft 421-0001 to 421B0001, the lines will have to be disconnected at the fuel flow gage.

- c. Reinstall caps (6) or lines, tightening finger tight then backing off one-half turn.
- d. Operate auxiliary pump until solid fuel is discharged from the cap connection. Tighten cap with pump still operating then turn pump off.

NOTE

Verify that snubbers (2) and snubber tees (3) are properly installed if excessive fuel flow fluctuations are encountered.

Trouble Shooting the Ignition System.

ENGINE IGNITION SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE FAILS TO START DUE TO IGNITION TROUBLE	Ignition switch OFF or grounded switch wires.	Flip switch ON, check for grounded wires.
	Spark plugs fouled, improperly gapped, or loose.	Remove and clean, adjust to proper gap. Tighten to specified torque.
	Magnetos improperly timed to engine.	See Ignition Timing.
	Shorted condenser.	Replace condenser.
ROUGH IDLING	Magneto internal timing incorrect or timed for opposite rotation.	Install correctly timed magneto.
	Spark plugs fouled or improperly gapped.	Clean spark plugs. Adjust spark plug gap.
ROUGH AT SPEEDS ABOVE IDLE	Weak condenser.	Replace condenser.
	Loose or improperly gapped spark plugs.	Tighten to specified torque. Adjust to proper gap.
	High tension leak in ignition harness.	Check for faulty insulation.
	Weak or burned out condenser as evidenced by burned or pitted breaker points.	Replace points and condenser.
SLUGGISH OPERATION AND/OR EXCESSIVE RPM DROP	Fouled or dead spark plugs.	Clean spark plugs. Replace dead spark plugs.
	Improperly gapped spark plugs.	Adjust to proper gap.
	Magnetos out of time with engine.	See Installation of Magnetos and Ignition Timing.
	Damaged magneto breaker points or condenser.	See Installation of Magnetos and Ignition Timing.
HIGH CYLINDER HEAD TEMPERATURE	Improper magneto timing.	See Installation of Magnetos and Ignition Timing.

MAGNETOS.

Engine ignition for the aircraft is provided by two Bendix-Scintilla magnetos mounted on each engine. Each magneto has a ground wire to a two position switch mounted on the console panel. The left magneto has a retard contact assembly which is so positioned that its points open at a predetermined number of degrees after the main contact points open. A battery operated starting vibrator used with this magneto provides retarded ignition for starting. The vibrator is electrically actuated by the starter switch mounted on the left console. Routed from the left magneto are six shielded, high tension cables, with three to the upper spark plugs on the left bank of cylinders and the other three routed to the lower spark plugs on the right bank of cylinders. The right magneto and wiring harness fires the remaining spark plugs on that engine.

Removal of Magnetos. (See Figure 9-3.)

NOTE

The magneto removal procedures are identical for removing either magneto from either engine.

- a. Remove the engine cowl.
- b. Remove induction air intercooler as follows:
 1. Remove clamp from induction air coupling at aft end of intercooler.
 2. Remove clamp from coupling at forward end of cooling air plenum.
 3. Disconnect manifold pressure line.
 4. Loosen clamps and slide hoses of intake manifold tubes off of intake air plenum.
 5. Remove intercooler assembly.
- c. Remove magneto ground wire from magneto.

WARNING

The magneto is in a switch ON position when the switch ground wire is disconnected.

NOTE

When both magnetos are being removed, tag each ground wire for identification.

- d. Detach the high tension outlet plate from the magneto to be removed.
- e. Remove the two magneto flange clamp nuts, washers and clamps. Pull the magneto forward from the crankcase mounting pad.

NOTE

As the magneto flange clears the crankcase accessory hole, watch the rubber drive bush-

ing and steel retainer in the gear hub to make sure they will not drop out.

Inspection of Magnetos

NOTE

Anytime the engine and propeller have been subjected to excessive roughness the magnetos should be removed for a drive coupling inspection.

- a. Inspect the rubber drive bushings in the drive gear hub for deformation and damage.

NOTE

If magneto rubber shows severe distress, inspect the quill shaft, alternator couplings, starter adapter drive gear and tachometer drive for galling, pitting, or heavy wear distress.

Replace with new parts if they will not fit the magneto coupling lugs closely.

- b. Remove the magneto breaker cover plate and inspect the points. They should have a gray, frosty appearance. If burning or pitting is apparent, determine the cause and correct it before replacing the points. If the breaker points are oily, they can be cleaned with clear unleaded gasoline. Avoid getting any gasoline on the breaker felt as this will wash away the lubricant. Breaker point gap is $.016 \pm .003$.

Internal Timing. (See Figure 9-25.)

- a. On each side of the breaker compartment there are five timing marks. The marks on the left-hand side, viewed from the breaker compartment, are for clockwise rotation viewed from the drive end. The marks on the right-hand side are for counterclockwise rotation. The timing marks indicate "O" position, "E" gap, and various degrees of magneto retard. (See Figure 9-25.) The point in the center of the "E" gap boss indicates the exact "E" gap position. The width of the boss on either side of the point is the allowable tolerance of $\pm 4^\circ$. In addition to these marks, the cam has an indented line across its end for locating neutral position. The number of degrees retard for a particular magneto is stamped at the bottom of the breaker compartment.

NOTE

When 25° retard is required, advance pointer until it is over the 20° mark. Then turn rotor until pointer is over the 45° mark. This will give a total of 25° retard.

b. Turn rotor in direction of rotation until painted chamfered tooth of distributor gear is just becoming visible in timing window. Continue turning rotor of magneto until line on end of cam is aligned with neutral mark in housing.

c. Fabricate a timing pointer from a piece of wire (approximately 2-1/2 inches) as follows:

1. Remove the cam screw and flat washer from cam.
2. Bend one end of wire around the threads of the screw, loose enough to allow wire to be rotated.
3. At the outside diameter of the large washer, bend wire straight up parallel to the screw.
4. Install assembly on cam shaft and tighten screw just enough to hold wire in position and yet allowing it to be rotated.
5. At a height sufficient to clear breaker housing, make a right angle bend in the wire.

NOTE

Pointer should be over timing marks, but not touching the housing.

d. On the retard breaker magnetos, it is necessary to set the retard breaker to open a predetermined number of degrees after the main breaker opens within $+2^\circ$, -0° . The number of degrees retard for a particular magneto is stamped at the bottom of the breaker compartment. After main breaker has been set to open a "E" gap $15^\circ \pm 2^\circ$ move pointer back until it is over the zero mark without moving rotor from its position where main breaker just opened. Turn rotor until pointer is over correct retard mark. Us-

ing a timing light, adjust retard breaker contacts to open at this point. A tolerance of 1/16 inch past the point can be used to get proper contact clearance. Continue rotating rotor until cam follower is on the high point of the lobe. Measure contact clearance. It should be 0.016 ± 0.003 . If not, readjust breaker and recheck to be sure that contacts will open within retard degree tolerance. Replace breaker assembly if retard degree tolerance and contact clearance cannot be obtained.

NOTE

Extreme care must be taken not to move the rotor from the main breaker opening position when returning the pointer back to the zero mark.

Installation and Timing of Magnetos. (See Figure 9-15.)

- a. Check magneto to see that it is internally timed for left hand drive rotation as viewed from the drive end.

NOTE

The magneto installation procedure is identical for installing either magneto on either engine.

- b. (See Figure 9-15.) Remove the timing inspection plug located on the side of the crankcase and forward of No. 6 cylinder.

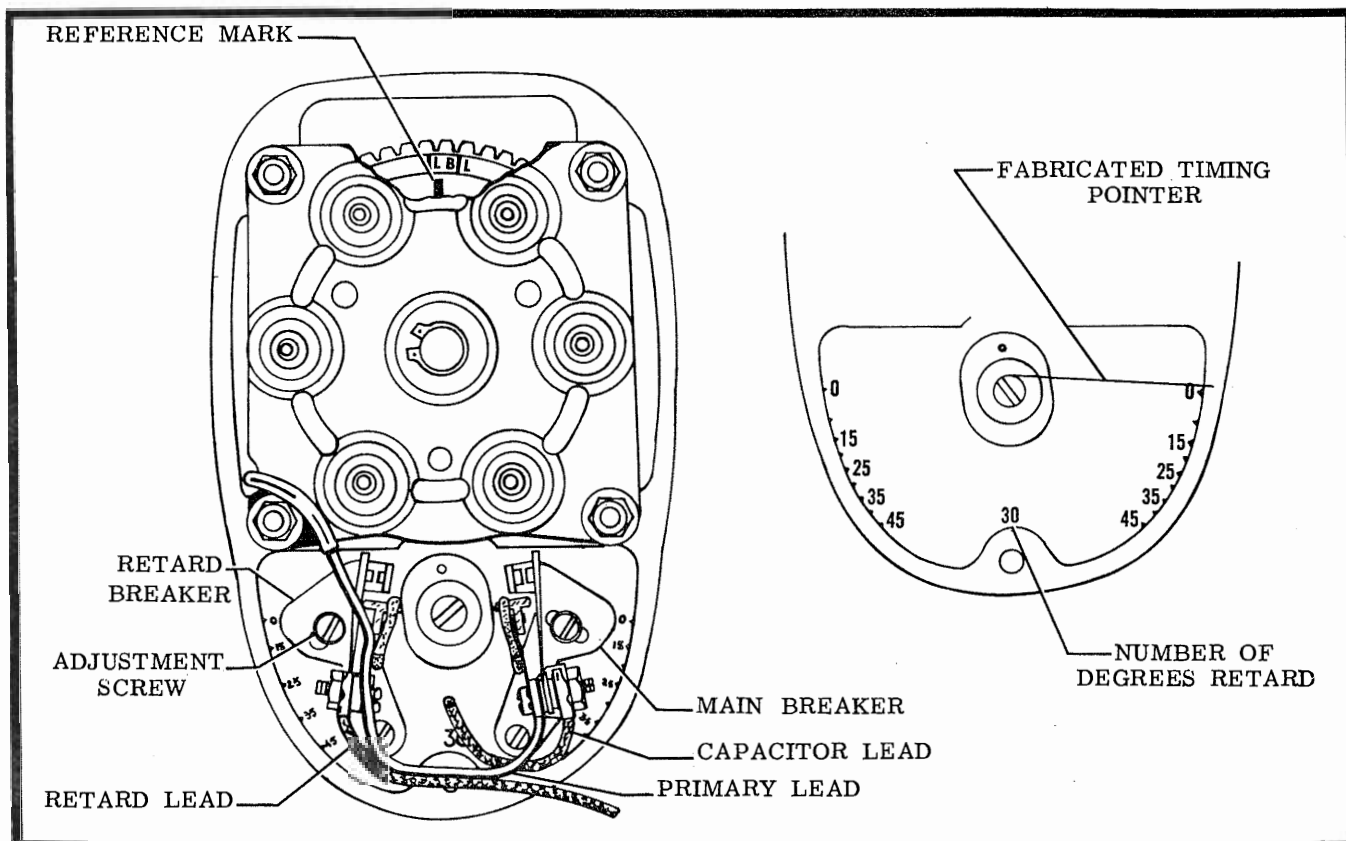
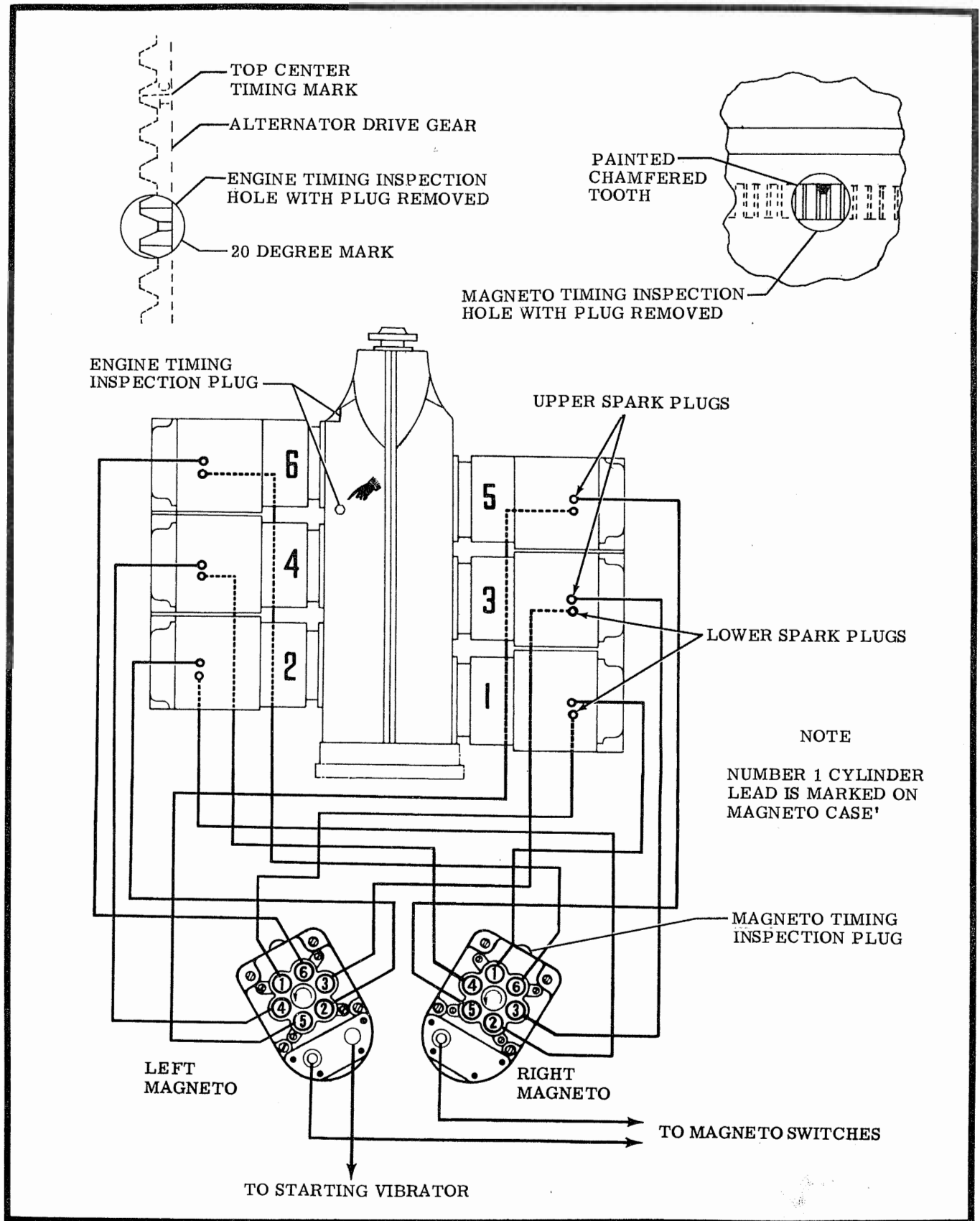


Figure 9-14. Magneto Timing Adjustment



9-15. Magneto and Cable Numbering

- c. Remove the upper No. 1 cylinder spark plug.
- d. Rotate the propeller by hand until the No. 1 cylinder is on the compression stroke and the timing mark on the ring gear is visible through the crankcase timing inspection hole.
- e. Turn magneto coupling until the painted chamfered tooth on the distributor gear is centered in the inspection hole and hold magneto in its approximate position while installing.
- f. Set the magneto in place on the crankcase accessory mounting pad.
- g. Attach a timing light to the magneto in accordance with the timing light manufacturer's instructions.
- h. If timing light is extinguished, rotate magneto housing in direction of its magneto rotation a few degrees beyond point where light illuminates. Slowly rotate magneto in opposite direction until light is extinguished.
- i. Tighten magneto clamp nuts to prevent any further movement of the magneto.

CAUTION

Do not adjust breaker points to compensate for ignition timing. Breaker point adjustment is for internal magneto timing only. This adjustment of magneto breaker points to compensate for ignition timing will ultimately produce a weak ignition spark and reduce engine performance.

- j. Rotate propeller in opposite direction of normal rotation for a few degrees after light illuminates.
- k. Rotate propeller in direction of normal rotation until light extinguishes. If timing mark is visible, through the crankcase timing inspection hole, when light extinguishes, the magneto is correctly timed to the engine.
- l. Repeat timing procedure for other magneto, if applicable.
- m. When ignition timing has been checked (breaker points open on both magnetos at 20° BTC) retighten magneto clamp nuts to prevent movement of the magnetos.
- n. Remove timing light from the magneto and engine.
- o. Replace magneto timing inspection hole plug and attach high tension outlet plate to magneto.

WARNING

The magneto is in a switch ON position when the switch wire is disconnected.

- p. Install timing inspection plug.
- q. Attach the magneto ground wire to magneto.
- r. Replace the removed spark plug.
- s. Install the engine cowling.

IGNITION CABLES

Removal of Ignition Cables. (See Figure 9-15.)

- a. Remove the engine cowling in accordance with engine cowling removal procedure.
- b. To remove any ignition cable:
 1. Remove the cable from the spark plug and withdraw the contactor from the spark plug barrel.
 2. Loosen attaching clamps.
 3. Remove screws which secure high tension plate to magnetos.

4. Remove the slotted-head screw and brass washer from plate grommet base which is in line with cable to be detached.
5. Withdraw cable.

Installation of Ignition Cables. (See Figure 9-15.)

- a. All cables can be installed in the same manner. If a new cable is being installed, check it for correct length by comparing it with the cable which is being replaced.
- b. To install ignition cable:
 1. Connect cable to high tension outlet by inserting cable end, with ferrule and coupling nut in place, through high tension cable outlet plate and into proper hole in outlet plate grommet.
 2. Fasten cable in place with cable piercing screw and brass washer.

CAUTION

Do not over-tighten screws.

3. Attach high tension outlet plate, with cables in place, to magneto with four attaching screws.
4. Replace cable on proper spark plug.
5. Install the engine cowling removed.
- c. By using good ignition maintenance practices in addition to the Do's and Don'ts listed herein, the normal life expectancy of the harness can be reached. Avoid sloppy installation and maintenance to gain full harness service life. Don't let poor practices reduce reliability.

Do - Use the Bendix 11-8950 High-Tension Lead Tester to avoid unnecessary handling and replacement of leads.

Do - Route leads to avoid all contact with engine, engine components, oil lines, airframes, etc.

Don't - Allow leads to chafe on engine, engine components, oil lines, airframes, etc.

Do - Make necessary bends as gradual as possible. Keep leads stright wherever possible. Use an elbow clamp P/N 10-320283, screw P/N 10-35936-6 and nut P/N 10-90404-4 where a bend at the spark plug is required.

Don't - Make sharp bends or stretch leads.

Do - Torque spark plug coupling nuts accurately: 90-95 inch-pound for 5/8"-24 nut and 110-120 inch-pound for the 3/4"-20 coupling nut.

CAUTION

Don't over-torque or under-torque spark plug coupling nuts. Always use a torque wrench.

Do - Hold the hex-shaped crimped portion of the spark plug terminal ferrule with a crescent wrench. This will prevent the ferrule from turning and twist-

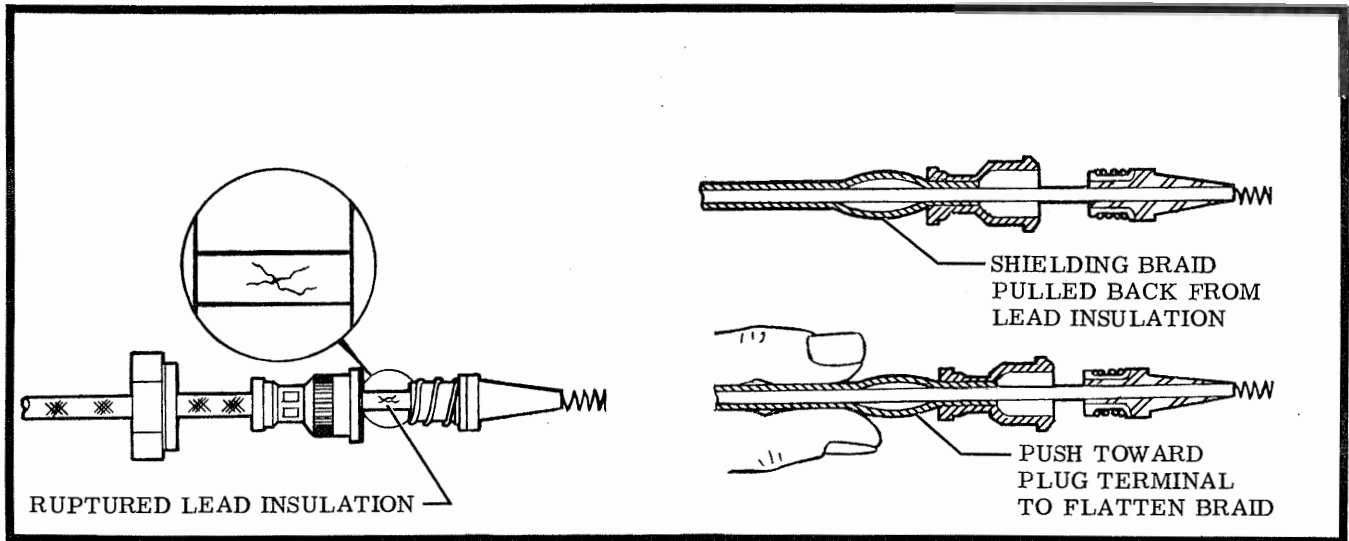


Figure 9-15A. Ignition Harness

ing the lead while tightening or loosening the coupling nut. A four-inch crescent-type wrench is about the right size.

Don't - Allow the leads to twist while coupling. Twisting leads may rupture the insulating material.

Do - Use as many clamps and wire bundle ties as necessary. When in doubt, use another clamp or tie.

Do - Redress harnesses when engines are mounted in their nacelles to prevent chafing against airframe components, etc. Change nylon ties or clamps if they will hold better in a new position. Check harnesses, ties and clamps when other checks are being made on the engine.

Don't - Allow leads and wire bundles to hang loosely from their clamps. Don't allow leads to come near the exhaust manifold - keep them as far away as possible. Retighten or reposition clamps or ties if they are loosened for any reason.

Do - Check lead terminals, especially bottom cylinder plug terminals (which seem to run the hottest). The heat may cause the insulating sleeve of the plug terminal to stick in the barrel of the spark plug. If stuck, the insulating sleeve should be removed from the spark plug in such a manner as to protect the silicone insulating on the lead as much as possible. The insulating sleeve, which is readily replaceable, will receive most of any damage incurred during removal.

Don't - Bend and twist the spark plug lead until the insulation is damaged or cut by the edge of the terminal ferrule. Do not damage the 5mm high-tension wire by allowing a screwdriver blade or other sharp tool to pierce it.

Do - Remember to clean the spark plug well ceramic and terminal insulating sleeve. Clean with a cloth dampened in alcohol.

Don't - Touch the terminal insulating sleeve after washing.

Do - Use a high-temperature mold (MS-122 Fluorocarbon Spray, Miller-Stepenson Chemical Co., Inc., 16 Sugar Hollow Rd., Danbury, Connecticut), release on terminal sleeves and on grommets at the magneto cable outlet plates. This will help prevent the hotter running plug insulating sleeves from sticking.

Don't - Apply mold release to dirty plugs or insulating sleeves.

d. During maintenance check, carefully inspect the silicone lead insulating between the braided conduit and insulating sleeve. Remove the elbow clamp, if installed, to facilitate this inspection. Any lead that is torn or cut must be replaced. A longitudinal or cross-shaped tear may be caused by spark plug leakage. This leakage usually causes a gray or black discoloration of the lead at the torn area.

CAUTION

Avoid bending the lead over the edge of the harness ferrule; this may result in cutting the lead.

e. Whenever a 3/4-20 spark plug is used, insure that the compression spring is fully seated in the ferrule counterbore. If this precautions is not observed, a "Z" or "S" shaped bend can occur in the lead when assembled to the plug and the conductor may eventually puncture the silicone lead insulation. As shown in Figure 9-15A, the braided

conduit should always be pushed along the lead to its original position before assembling the lead to the spark plug.

SPARK PLUGS.

a. There are two 18mm short-reach type spark plugs for each cylinder. The spark plugs are screwed into a heli-coil insert in each cylinder. The spark plugs have an internal resistor to provide longer gap life and are shielded to prevent radio interference. An average life of 200 hours can be expected, however, this time will vary with operating conditions. The spark plugs are installed in the engine at a torque of 330 ± 30 pound-inches. The correct gap setting is .016 to .018 inch.

ENGINE OIL SYSTEM.

The engines installed in the aircraft have wet pump pressure lubrication system. Oil temperature in each is controlled by a thermally operated valve which either bypasses the oil around the externally mounted cooler or routes it through the cooler passages for cooling. Drilled and cored internal passages route the oil to all moving engine parts which require lubrication. Oil furnished to the propeller governor for propeller operation is also routed through internal passages. Engine oil is used externally for lubrication

purpose on the engine turbocharger and for controlling purposes at the waste gate. Engine oil is filtered through an internally mounted outlet filter screen in the oil pump and an externally mounted oil filter. A bypass valve will route the oil around the oil filter if it should become clogged. Oil pressure is maintained by a spring-loaded pressure relief valve. The oil temperature bulb is located directly below the oil cooler. The bulbs are heat variable resistor type and are attached to the oil temperature gage by a single electrical wire.

Oil Pressure Adjustment.

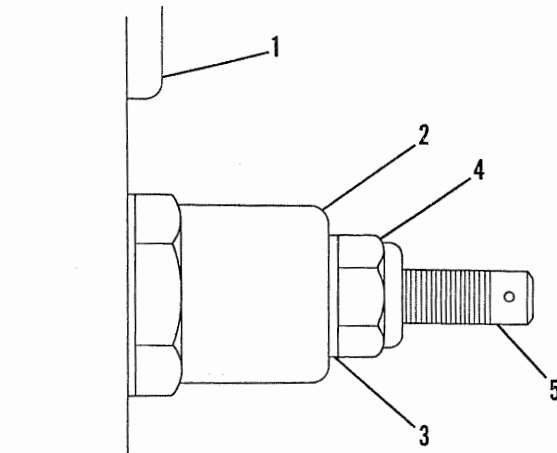
The oil pressure relief valve, located on the oil pump is adjustable to increase or decrease oil pressure. Refer to figure 9-15B and adjust oil pressure to 30 to 60 psi.

Removal of Oil Pressure Lines. (See Figure 9-17.)

- a. Remove engine cowling.
- b. Remove oil filter element and drain oil filter.

NOTE

Cap all hose and line openings on removal.



1. Oil Pump
2. Housing

3. Washer (Copper)

4. Locknut
5. Adjusting Screw

Figure 9-15B. Oil Pressure Adjustment

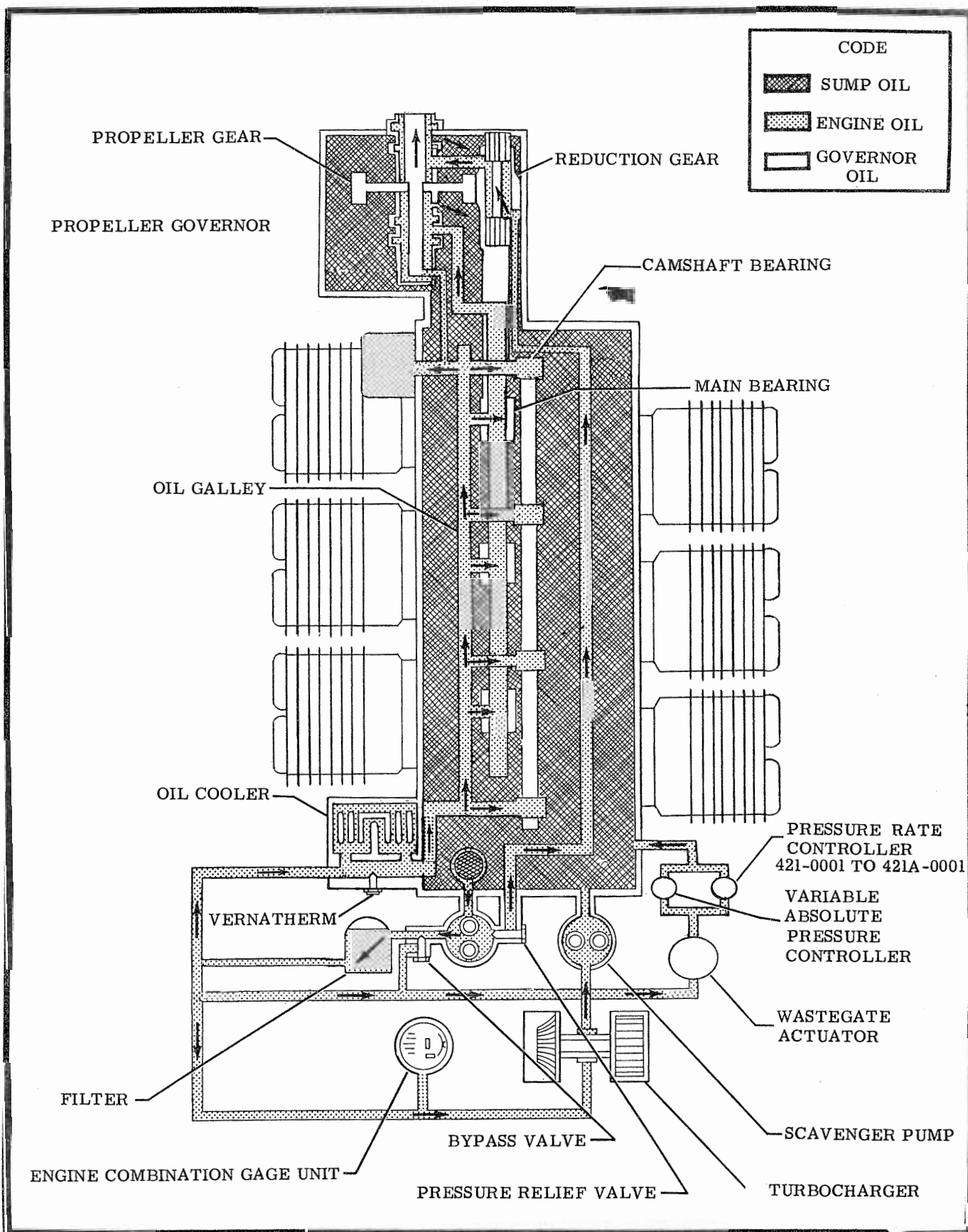


Figure 9-16. Engine Oil Schematic

Trouble Shooting Engine Oil System

TROUBLE	PROBABLE CAUSE	CORRECTION
HIGH OIL TEMPERATURE INDICATION	Low oil supply.	Replenish.
	Cooler air passages clogged.	Clean thoroughly.
	Cooler core plugged.	Remove cooler and flush thoroughly.
	Thermostat damaged or held open by solid matter.	Remove, clean valve and seat. If still inoperative, replace.
	Oil viscosity too high.	Drain and refill with correct seasonal weight. (See Section 2.)
	Prolonged ground operation.	Limit ground operation to a minimum.
	Malfunctioning gage or bulb unit.	Check wiring. Check bulb unit. Check gage. Replace defective parts.
LOW OIL PRESSURE INDICATION	Low oil supply.	Replenish.
	Oil viscosity too low.	Drain and refill with correct seasonal weight. (See Section 2.)
	Foam in oil due to presence of alkaline solids in system.	Drain and refill with fresh oil. (It may be necessary to flush cooler core if presence of alkaline solids is due to a previous cleaning with alkaline materials.)
	Defective pressure pump.	Replace pump.
	Malfunctioning pressure gage.	Check gage. Clean plumbing. Replace if required.
	Weak or broken oil pressure relief valve spring.	Replace spring. Adjust pressure to 30-60 PSI by adjusting screw.
	Clogged oil filter.	Replace oil filter.

c. Disconnect hose (9) from turbocharger (27) and tee at engine mounting bracket.

d. Disconnect hose (10) from turbocharger (27) to scavenger pump and remove.

e. Disconnect hose (7) from tee to firewall fitting and remove.

f. To remove line (6) from between firewall and wing gap, remove wing access (34, 54, 55, and 56, figure 1-2).

g. To remove line (5) from between fuselage skin and wing gap, remove heat exchanger in accordance with removal procedures, Section 13. Disconnect line at each end, using caution to prevent breaking seal at cabin bulkhead fitting, and remove line.

h. To remove line (4) from between support bracket and fuselage union, remove upholstery side panel in accordance with Section 3, pilot's seat, carpet and front spar access (78, figure 1-2). Disconnect line at each end and remove through access (78).

i. Disconnect hoses (2 and 3) from between engine gage and support bracket and remove.

j. Disconnect line (12) and hoses (11) and (13) from oil filter, let all excess oil drain from hoses.

k. Disconnect hose (11) from engine oil screen and

remove.

l. Disconnect hose (13) from oil cooler and remove.

m. Disconnect line (12) from actuator and remove.

n. Disconnect hose (26) and lines (16) and (23) from rate controller (17).

o. Disconnect hose (26) from engine and remove.

p. Disconnect line (14) from waste-gate actuator (19) and variable pressure controller (15) and remove.

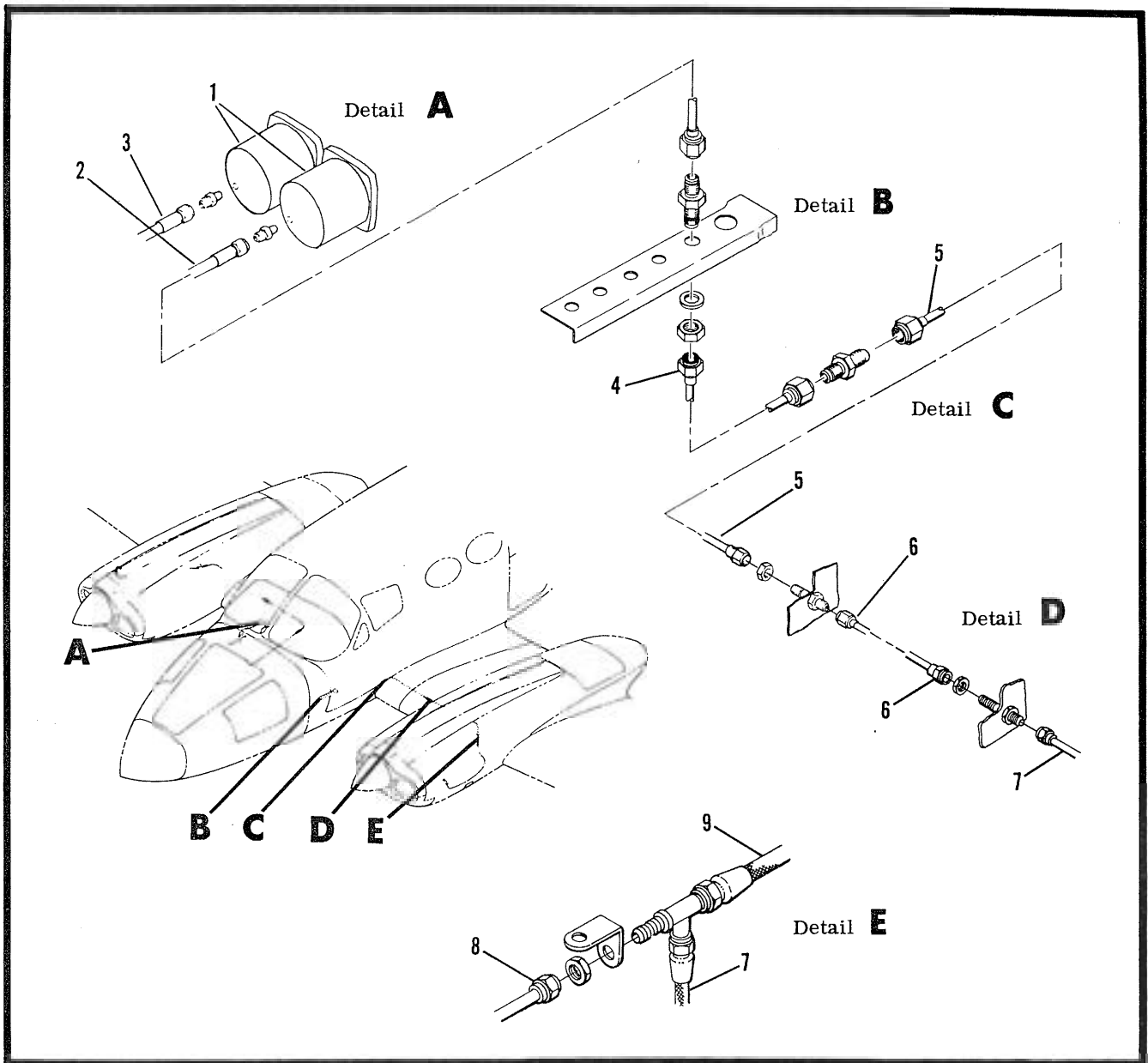
q. Disconnect (23) and (16) from variable pressure controller and remove.

r. Disconnect hose (18) from variable pressure controller (15) and engine, and remove.

s. Disconnect line (24) from variable pressure controller (15) and tee, and remove.

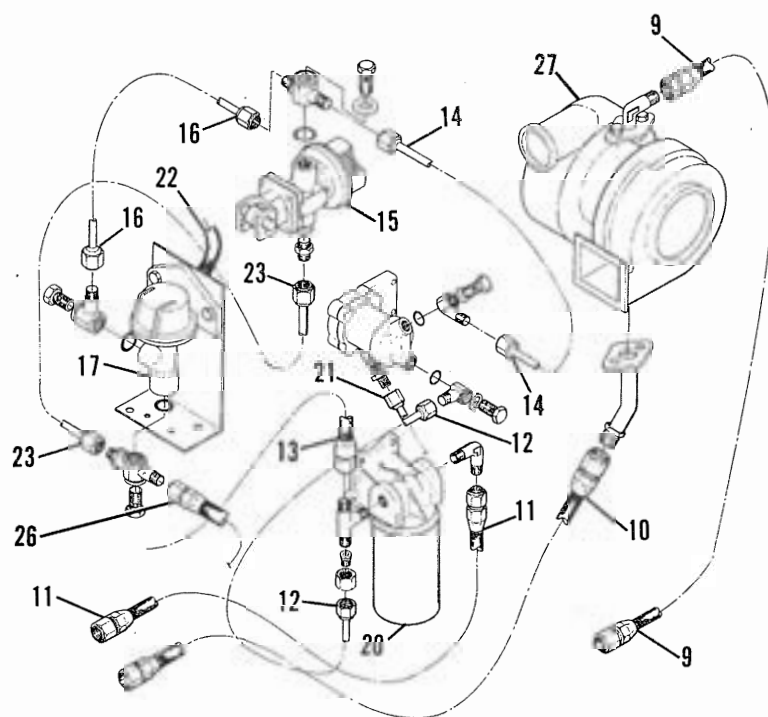
Installation of Oil Pressure Lines. (See Figure 9-17.)

a. Reverse the oil pressure line removal procedures.

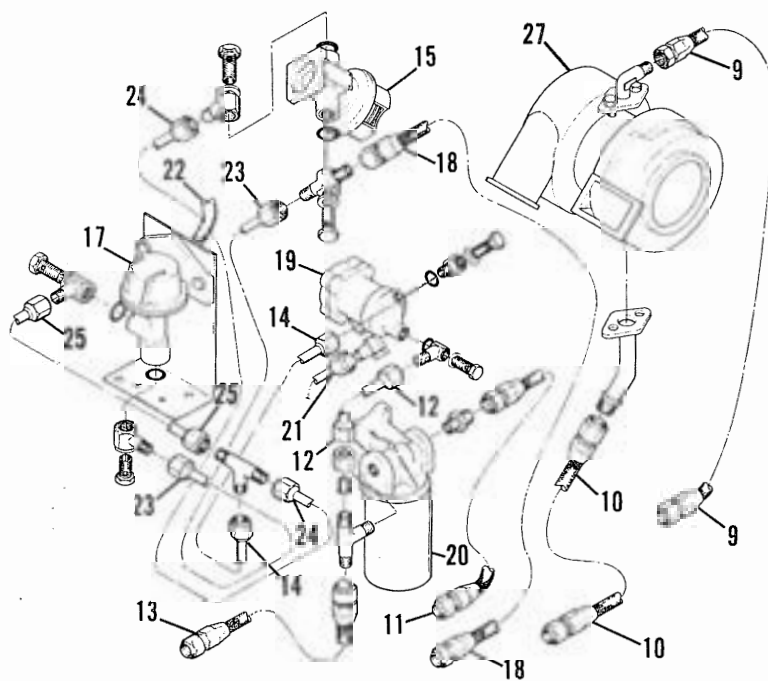


1. Engine Gage	16. Line (Variable Pressure Controller to Rate Controller)
2. Left Oil Pressure Hose	17. Rate Controller
3. Right Oil Pressure Hose	18. Hose (Variable Pressure Controller to Sump)
4. Cabin Oil Pressure Line	19. Actuator
5. Stub Wing Oil Pressure Line	20. Oil Filter
6. Wing Oil Pressure Line	21. Actuator Drain Line
7. Nacelle Oil Pressure Hose	22. Hose (Turbocharger Manifold to Rate Controller)
8. Engine Oil Pressure Line	23. Oil Line (Variable Pressure Controller to Rate Controller)
9. Hose (Turbocharger to Oil Supply)	24. Line (Variable Pressure Controller to Tee)
10. Hose (Turbocharger to Oil Pump)	25. Line (Tee to Rate Controller)
11. Hose (Oil Screen to Filter)	26. Hose (Rate Controller to Sump)
12. Line (Oil Filter to Actuator)	27. Turbocharger
13. Hose (Oil Filter to Oil Cooler)	28. Oil Separator
14. Line (Actuator to Variable Pressure Controller)	29. Line (Separator to Crankcase)
15. Variable Pressure Controller	

Figure 9-17. Engine Oil Pressure System (Sheet 1 of 3)



LH ENGINE



RH ENGINE

421-0001 TO 421AC001

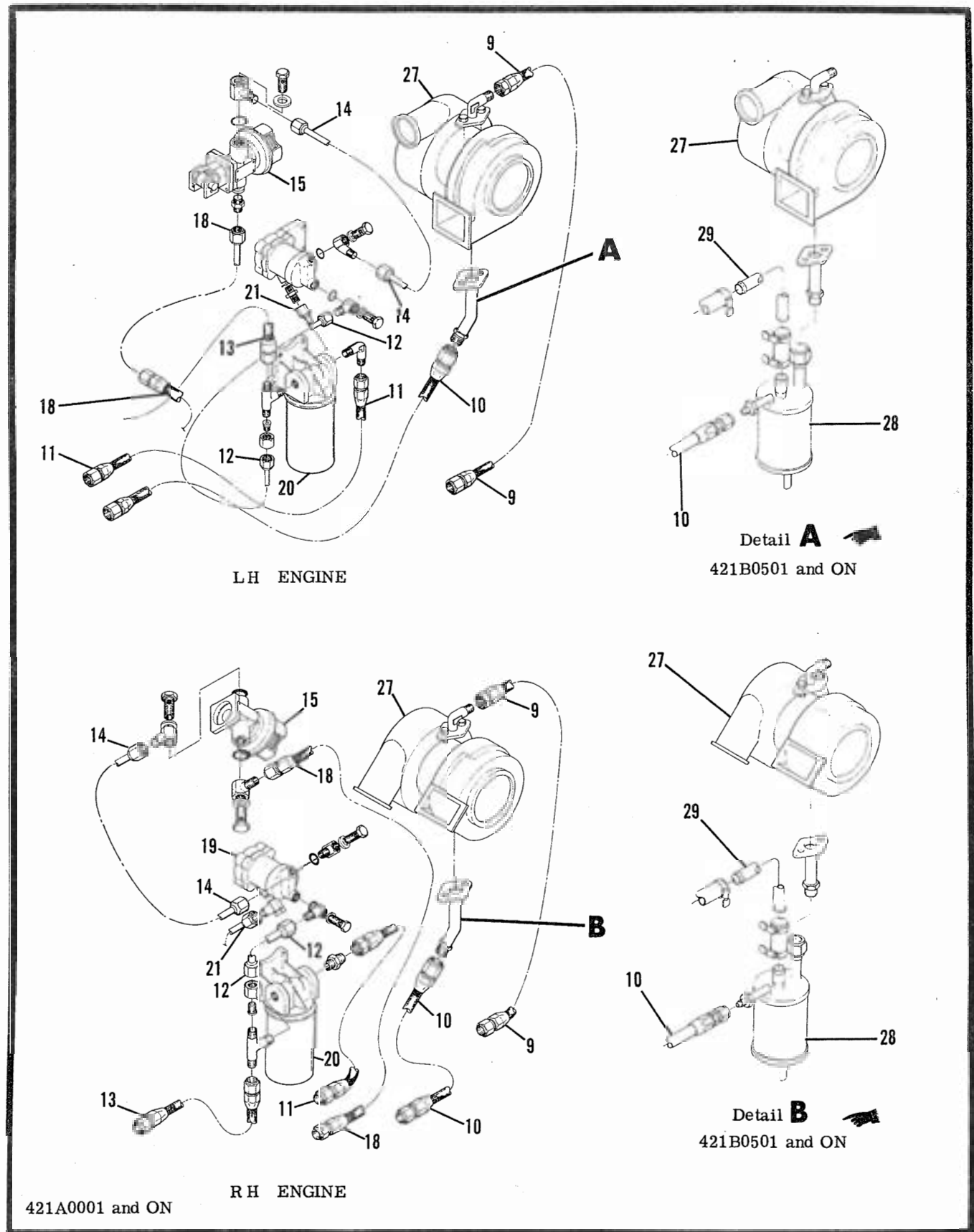
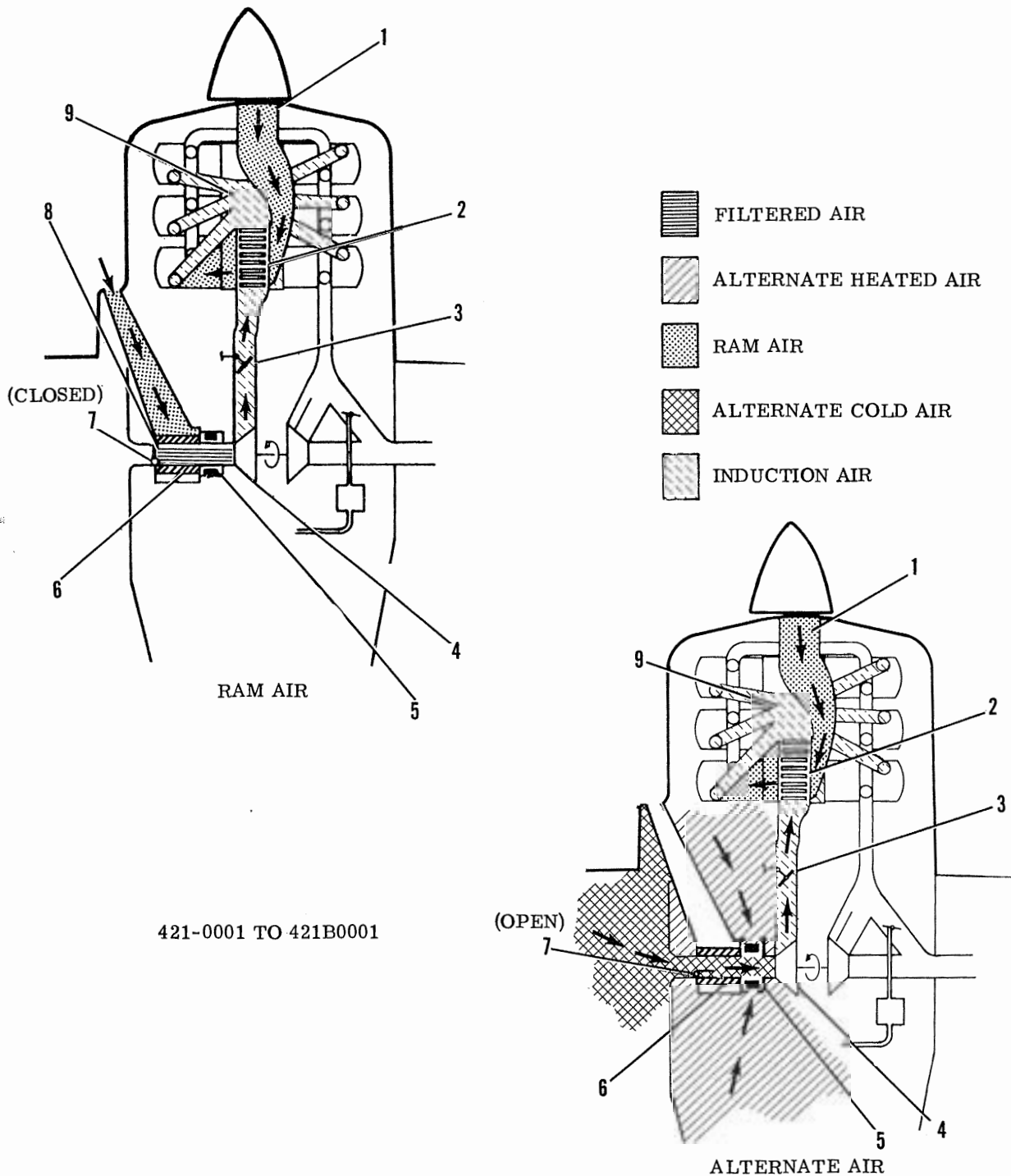


Figure 9-17. Engine Oil Pressure System (Sheet 3 of 3)



1. Ram Air
2. Intercooler
3. Throttle Body
4. Turbocharger

5. Manually Controlled Alternate Heated Air
6. Filter

7. Magnetically Controlled Alternate Air Door
8. Filtered Air
9. Induction Air

Figure 9-18. Induction Air System Schematic (Sheet 1 of 2)

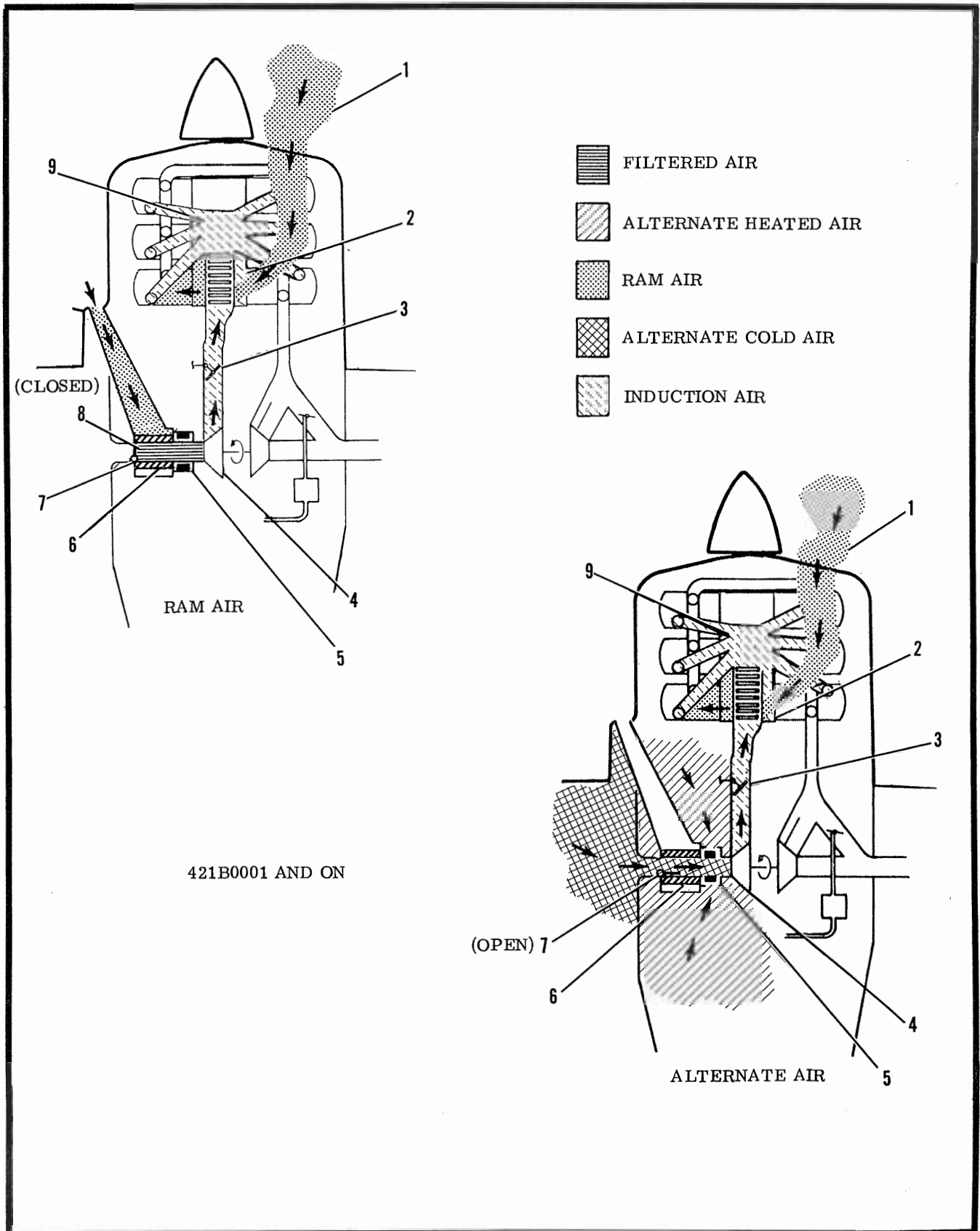


Figure 9-18. Induction Air System Schematic (Sheet 2 of 2)

NOTE

When installing oil pressure hoses and lines, coat threads of fittings with a suitable thread lubricant to facilitate installation.

- b. Start engines and observe for oil leaks while bringing engines up to operating temperatures.
- c. Install all access covers, upholstery panels, seats, carpet and engine cowling.

AIR INDUCTION SYSTEM

Induction air enters the system through a ram air duct located on the inboard side of each nacelle and is directed through a filter mounted to the turbocharger-compressor air inlet. A magnetically controlled alternate air door incorporated in the air filter permits compressor suction to open the door and admit alternate air if the air induction system becomes obstructed. A manually controlled alternate air door within the nacelle permits the pilot to open it to admit alternate (heated engine compartment air) if the air induction system should become obstructed and the automatic system failed to operate. An exhaust driven turbocharger is automatically controlled by controllers to maintain a manifold pressure at 39.5 inches Hg. from sea level to a critical altitude (16,000 feet) regardless of temperature. The turbocharger is completely automatic requiring no pilot action to critical altitude.

Removal and Installation of Induction Air Filter. (See figure 9-19).

- a. Remove cowling in accordance with removal procedures.
- b. Unlock and disconnect air filter clamp.
- c. Remove air filter from cannister.
- d. Installation of induction air filter is the reversal of the above procedure.

NOTE

Before installing the induction air filter, the filter should be cleaned in accordance with Cleaning Procedures, Section 2.

Rigging of Alternate Air Canister Control Door (See figure 9-18A.)

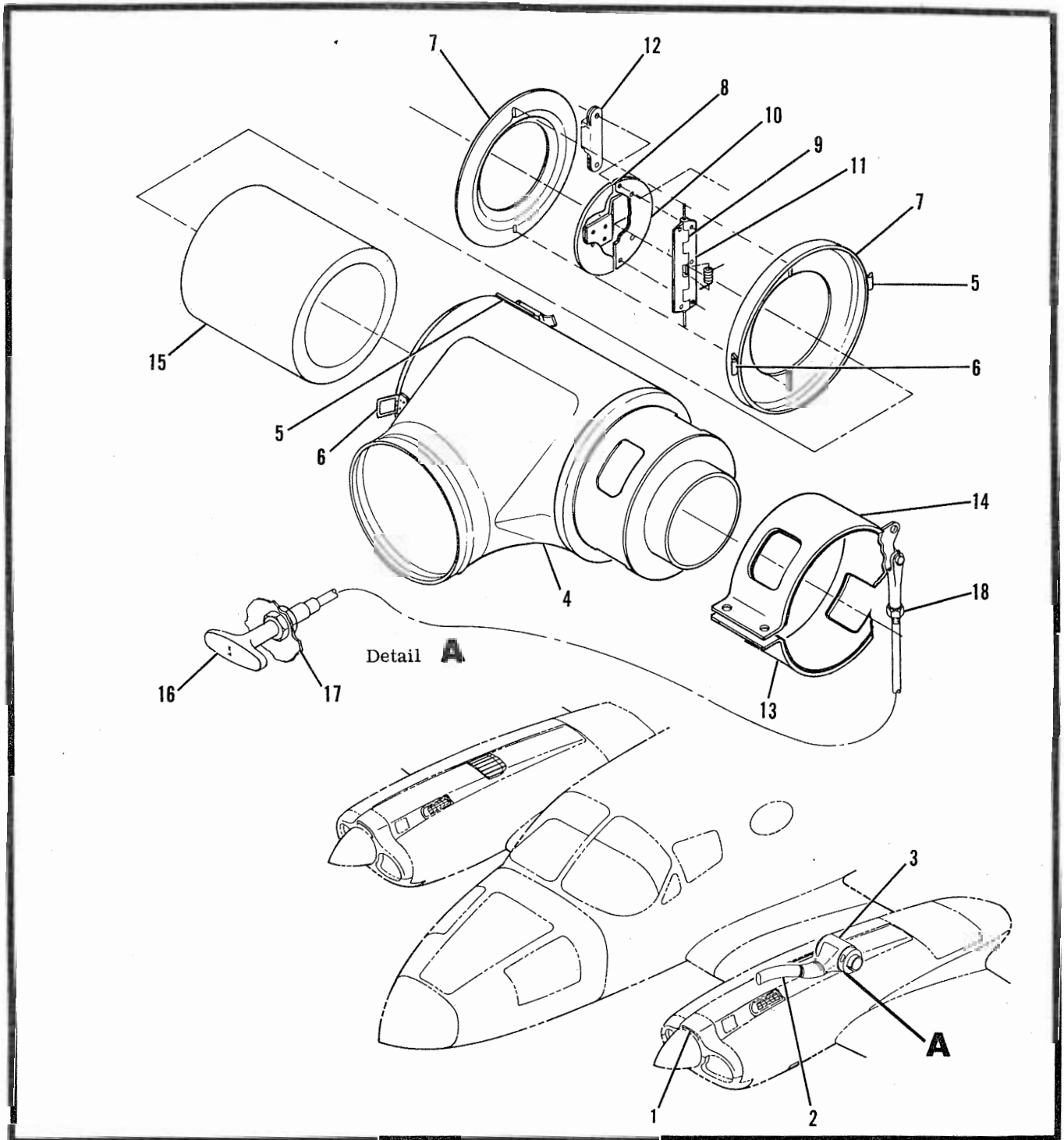
- a. Position door to CLOSE.
- b. Adjust travel of alternate air control door by loosening nut (18) to increase or decrease length of cable.
- c. Position door to OPEN.
- d. Check the extension of control handle for not more than 3.00 inches of travel from control pedestal.

WASTE-GATE ACTUATOR, CONTROLLERS AND TURBOCHARGER.

Turbocharger Control System Functions and Operations.

a. Functions. The turbocharger is driven by exhaust gases to provide engine induction air and cabin pressurization air. An actuator controls the position of the waste gate which allows exhaust gases to bypass the turbocharger when less pressure is required as determined by the controllers. A variable absolute pressure controller is mounted integrally with the throttle body and its sensing head is exposed to the pressurization airflow. The variable absolute pressure controller automatically maintains a pre-selected compressor discharge pressure at levels that exceed the engine manifold pressures, determined by the position of the throttle lever. On 421-0001 to 421A0001 aircraft, a rate-of-change controller controls the rate of which the turbocharger compressor discharge will increase under rapid or moderate movements of the throttle by governing the flow of oil to the waste-gate actuator. On 421A0001 and ON aircraft, a manifold pressure relief valve is mounted on the venturi which provides protection to the engine from excessive intake manifold pressure by assuming the function of rate control.

b. Operation. The waste-gate actuator is spring loaded to position the waste-gate to the normally open position when there is not adequate oil pressure in the actuator power cylinder during engine shut down. When the engine is started, oil pressure is fed into the actuator power cylinder through a capillary tube which restricts the flow and dampens any sudden changes of the position of the waste-gate. As the actuator cylinder and lines leading to the controllers are filled, the controllers will block the flow of oil by normally closed metering and/or poppet valves. As the oil pressure builds up in the actuator cylinder, it overcomes the force of the actuator open spring, closing the waste-gate. When the waste-gate begins to close, the exhaust gases are routed through the turbocharger turbine. As the engine increases its power and speed, the increase of temperature and pressure of the exhaust causes the turbocharger to rotate faster, raising the turbocharger compressor outlet pressure. As the compressor outlet pressure rises, the aneroid bellows in the variable absolute pressure controller senses the increase in

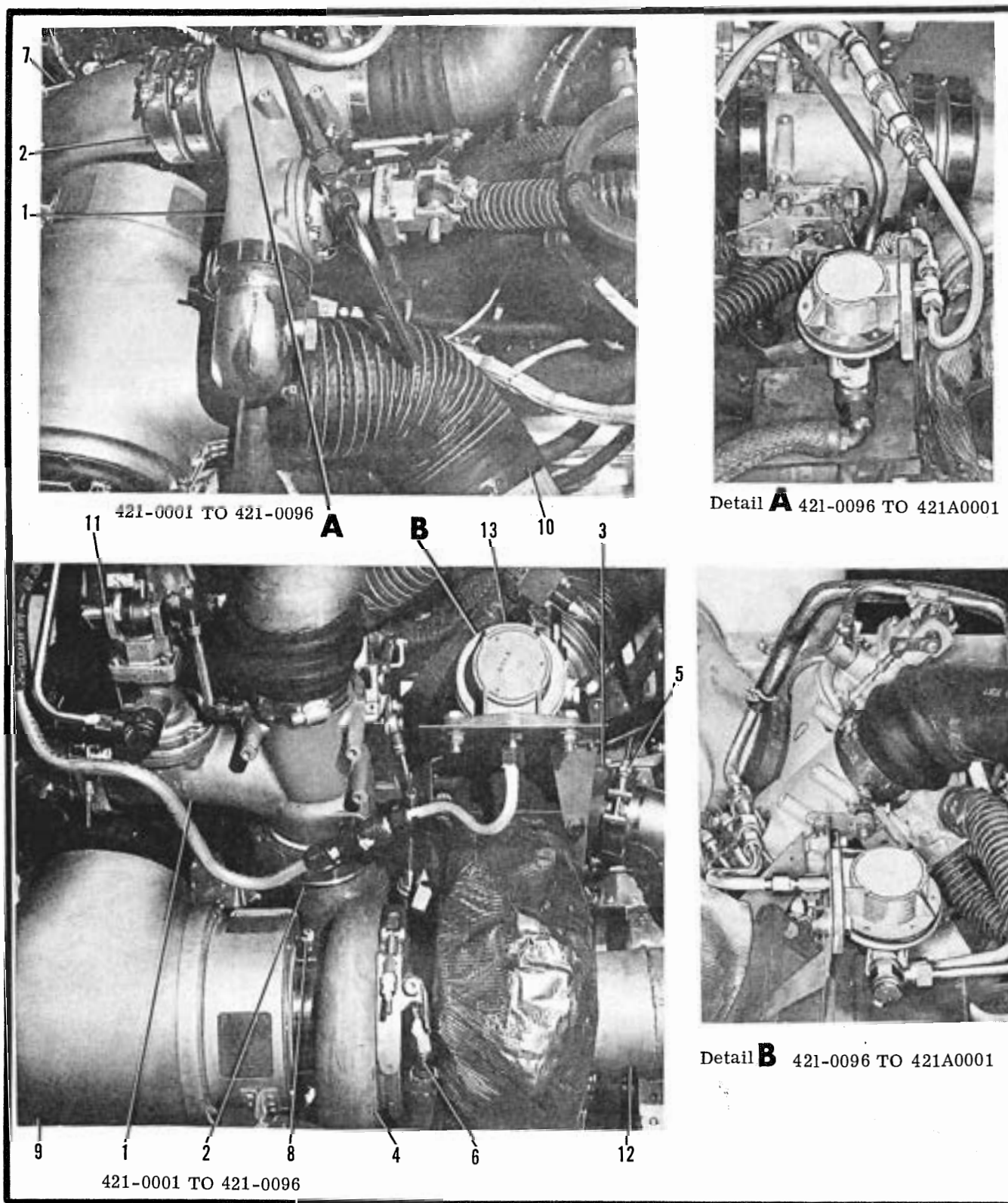


1. Air Inlet Scoop
2. Duct
3. Canister
4. Container
5. Latch
6. Latch

7. End Cap
8. Door
9. Hinge-Half
10. Door
11. Hinge-Half
12. Hinge-Half

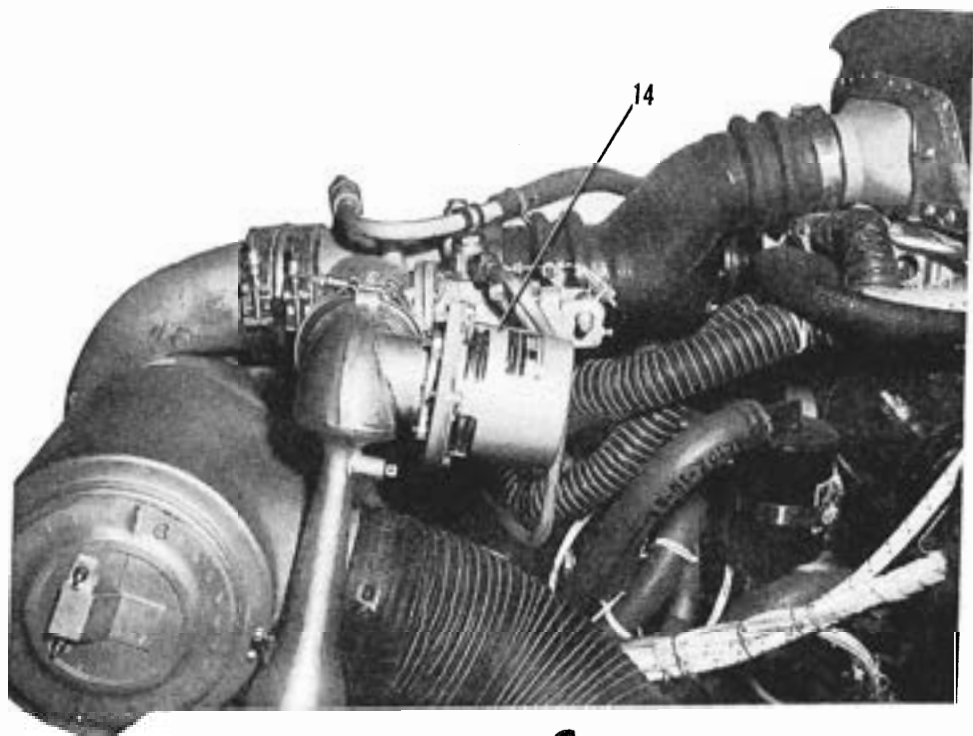
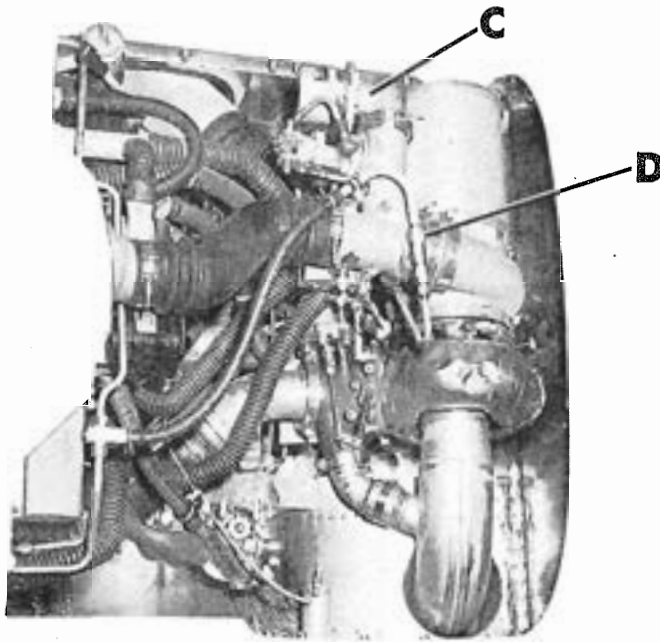
13. Valve
14. Seal
15. Dry Air Filter
16. Alternate Air Control
17. Bracket-Control Pedestal
18. Nut

Figure 9-18A. Turbocharger Induction Air Components



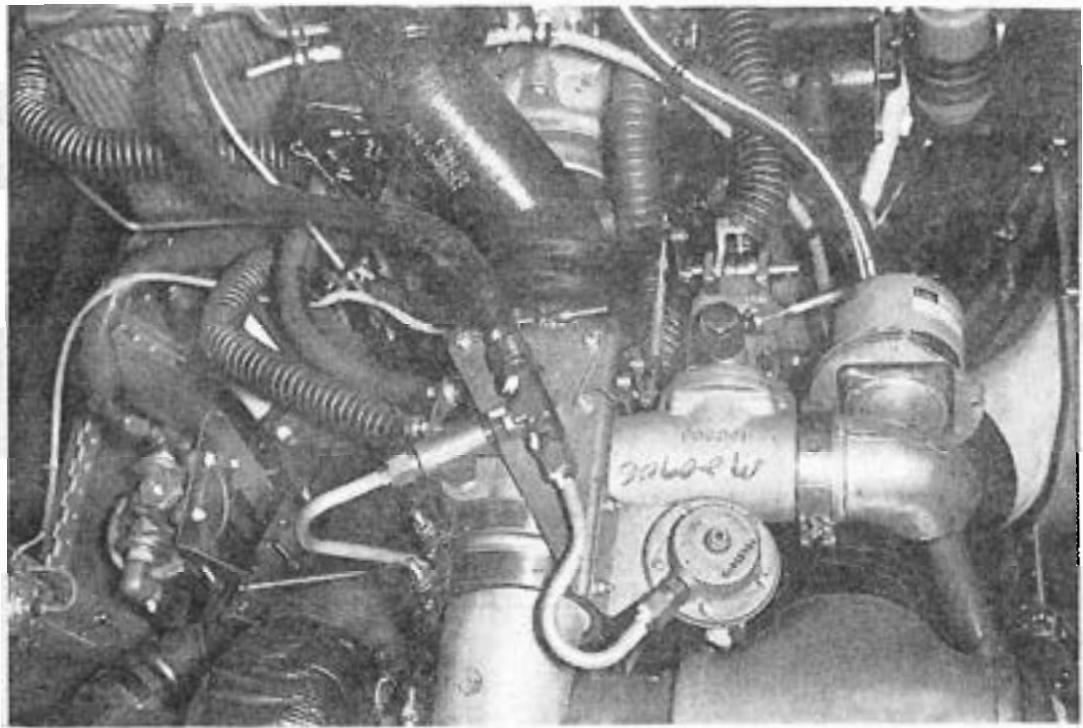
1. Throttle Valve	6. Oil Pressure Line	11. Variable Absolute Pressure Controller
2. Coupling	7. Bracket	12. Tail Pipe
3. Bypass Valve Assembly	8. Clamp	13. Rate Controller
4. Compressor	9. Air Filter Assembly	14. Manifold Pressure Relief Valve
5. Coupling	10. Air Intake Duct	

Figure 9-19. Turbocharger and Induction System (Sheet 1)

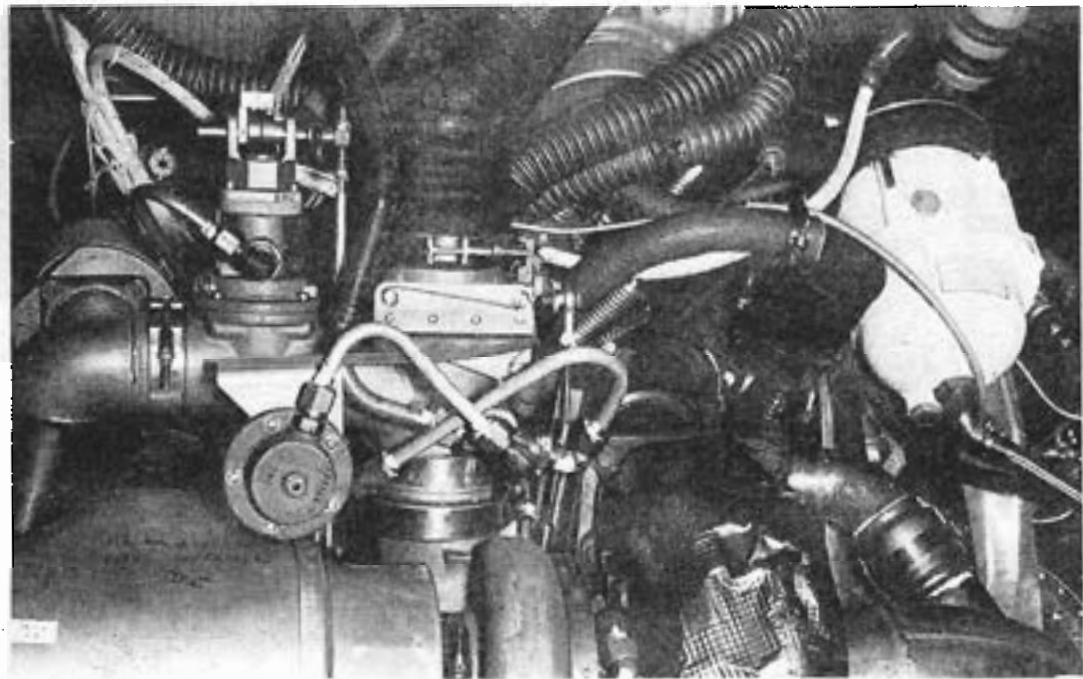
Detail **C**

421A0001 TO 421B0001

Figure 9-19. Turbocharger & Induction System (Sheet 2)



LEFT ENGINE (421B0001 AND ON)



RIGHT ENGINE (421B0001 AND ON)

Detail **D**

Figure 9-19. Turbocharger & Induction System (Sheet 3)

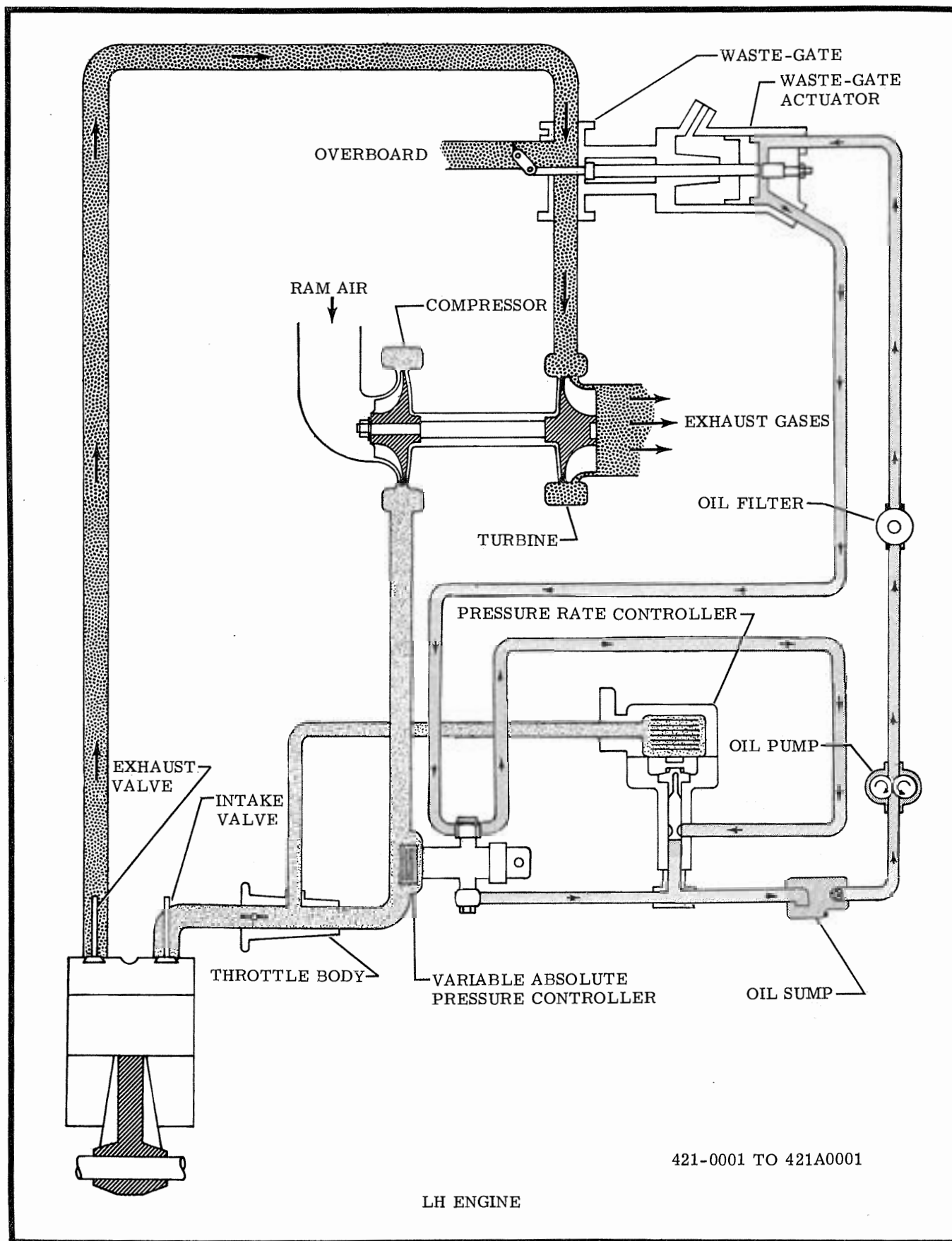


Figure 9-20. Turbocharger, Controllers and Waste-Gate Actuator System Schematic (Sheet 1 of 4)

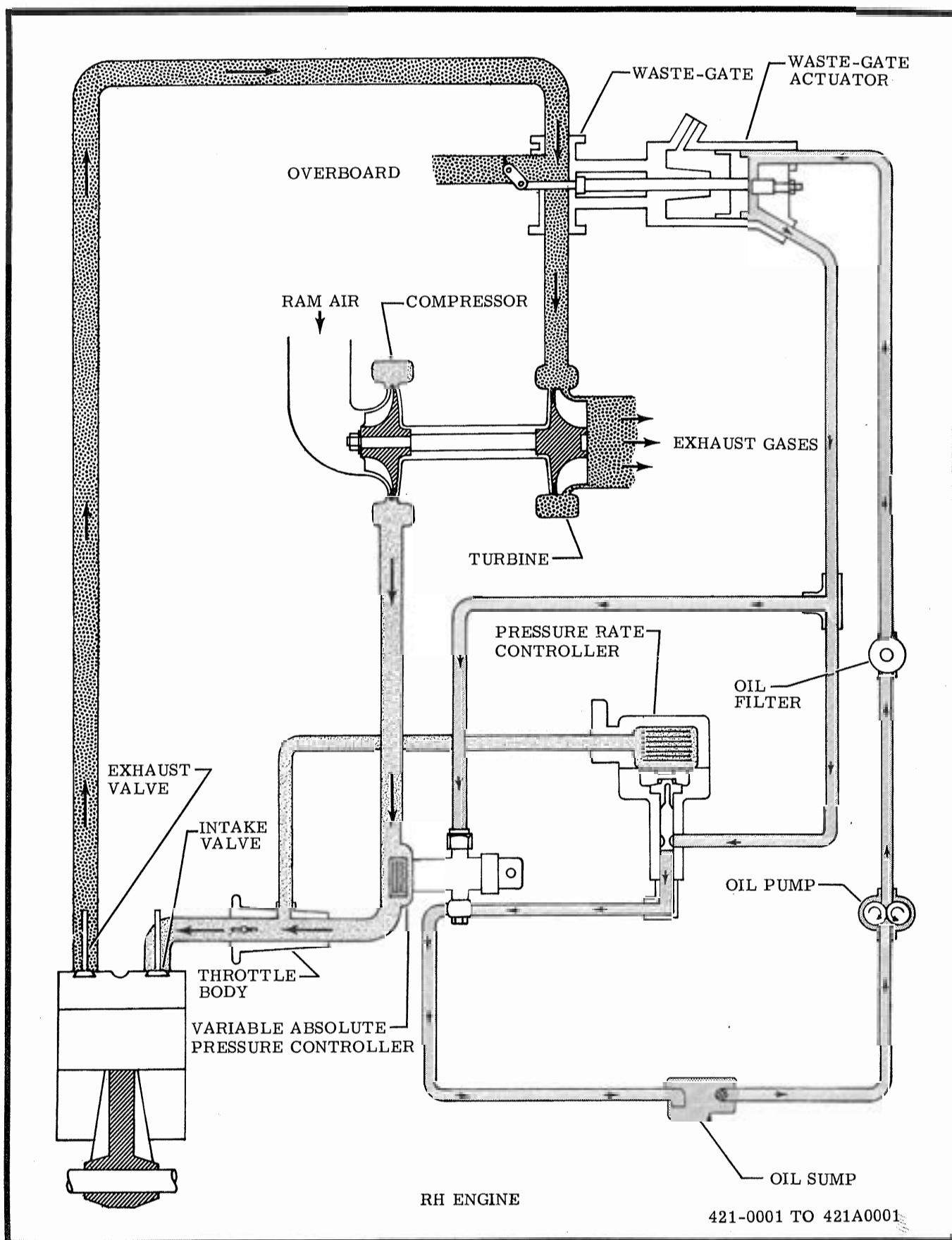


Figure 9-20. Turbocharger, Controllers and Waste-Gate Actuator System Schematic (Sheet 2 of 4)

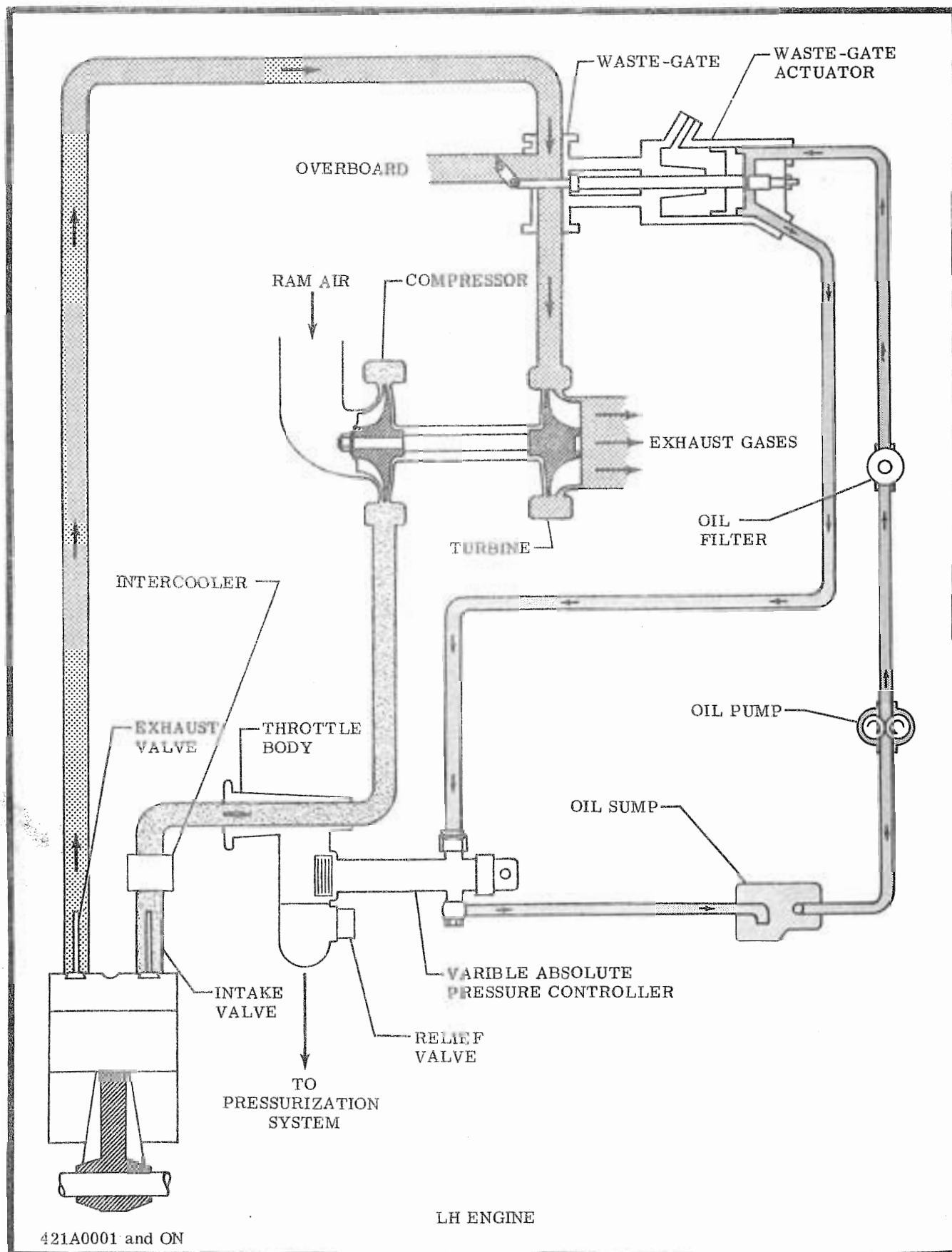


Figure 9-20. Turbocharger, Controllers and Waste-Gate Actuator System Schematic (Sheet 3 of 4)

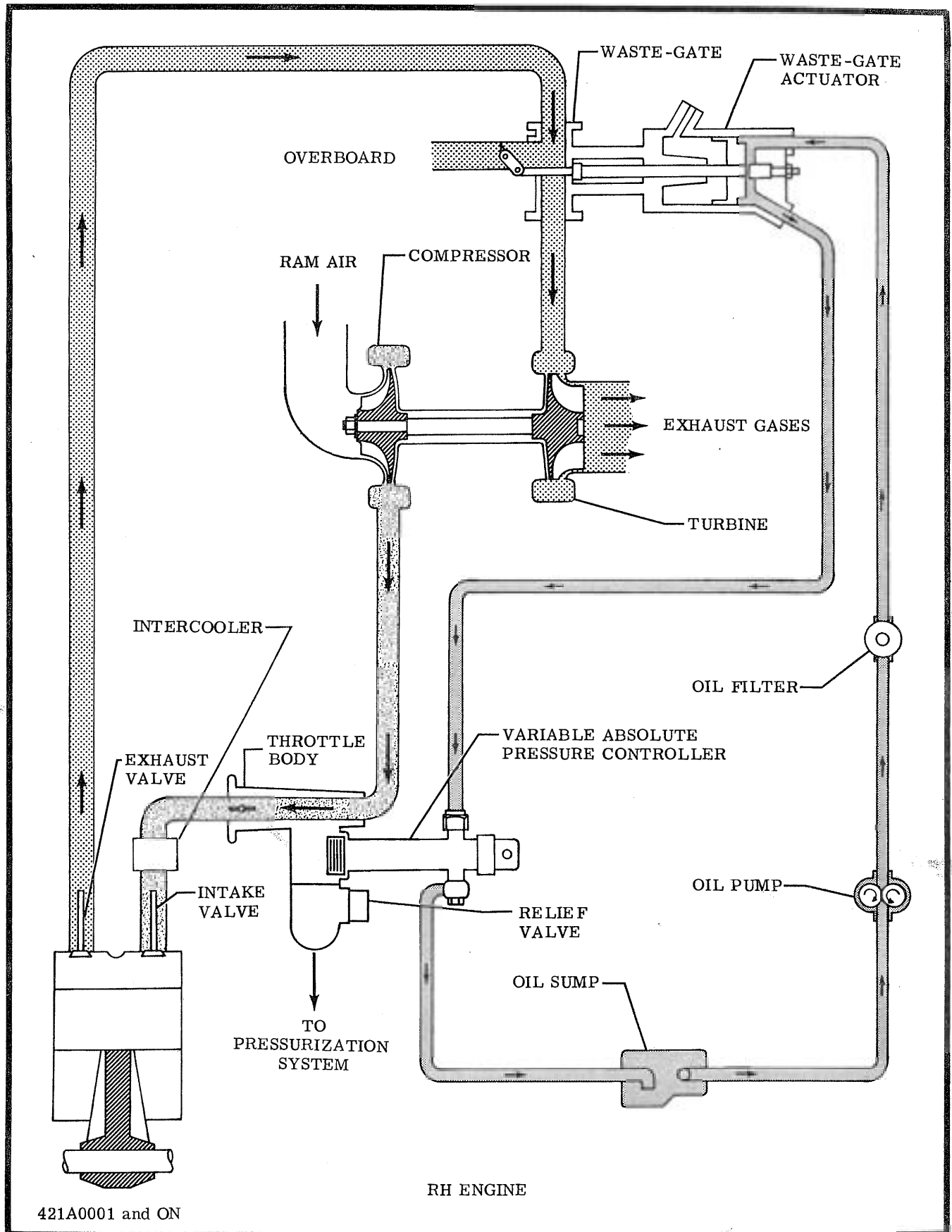


Figure 9-20. Turbocharger, Controllers and Waste-Gate Actuator System Schematic (Sheet 4 of 4)

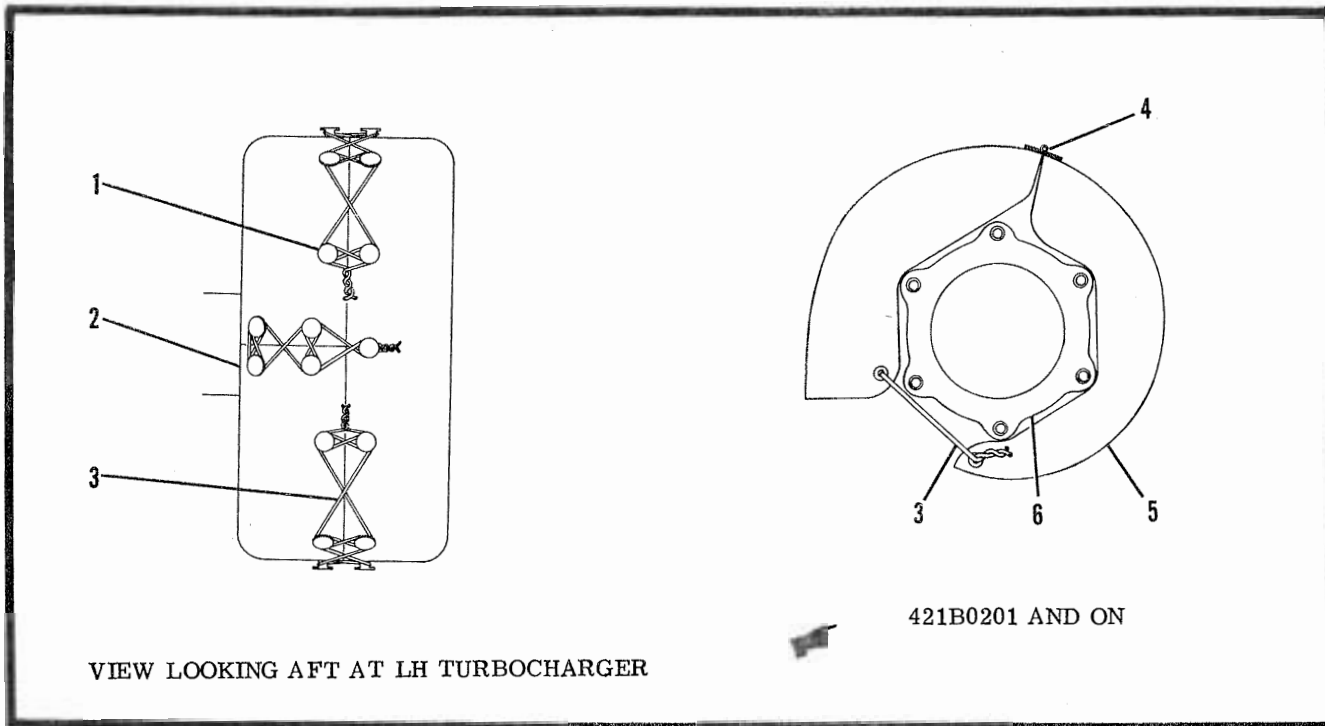
Troubleshooting Controllers, Waste-gate Actuator, and Turbocharger.

TROUBLE	PROBABLE CAUSE	CORRECTION
UNABLE TO GET RATED POWER BECAUSE MANIFOLD PRESSURE IS LOW	Controller not getting enough oil pressure to close the waste-gate.	Check pump outlet pressure, oil filter, and external lines for obstructions.
	Chips under metering and/or poppet valves in controllers holding them open.	Flush chips out of controller. Replace controller if necessary.
	Capillary tube in actuator plugged.	Remove actuator and clean capillary.
	Actuator piston seal failed and leaking oil excessively.	Replace actuator.
ENGINE SURGES OR SMOKES	Leak in exhaust system.	Replace defective exhaust components.
	Metering valve stem seal broken in one of the controllers, leaking oil into manifold.	Replace controller.
	Actuator waste-gate linkage binding.	Correct cause of binding.
	Turbine seal leaking.	Replace seal (see Turbocharger and Controls Overhaul/Parts Manual.
TURBOCHARGER NOISY, POWER ADEQUATE	Turbocharger overspeeding, controllers not opening, aneroid bellows leaking or not properly adjusted.	Adjust or replace controller assemblies and turbocharger.
	Waste-gate sticking closed.	Replace waste-gate, waste-gate actuator, or correct binding linkage.
ENGINE POWER INCREASES SLOWLY, OR SEVERE FLUCTUATIONS OF MANIFOLD PRESSURE ON RAPID THROTTLE ADVANCE	421-0001 to 421A0001	
	Controller drain line obstructed.	Clean or replace line.
	Capillary tube plugged in rate of change controller.	Replace absolute pressure and rate-of-change controller.
	Rate-of-change controller out of calibration.	Calibrate or replace absolute pressure and rate-of-change controller.
	Waste-gate operation is sluggish.	Replace waste-gate, waste-gate actuator or correct binding linkage.
	421A0001 and ON	
	Controller drain line obstructed.	Clean or replace line.
	Waste-gate operation is sluggish.	Replace waste-gate, waste-gate actuator, or correct binding linkage.
	Manifold Pressure relief valve is popping open too soon.	Check or replace valve.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE POWER INCREASES RAPIDLY AND MANIFOLD PRESSURE OVERBOOSTS ON RAPID THROTTLE ADVANCE	Allow engine to warm up.	Oil temperature low.
	421-0001 to 421A0001	
	Rate-of-change controller out of calibration.	Calibrate or replace absolute pressure and rate-of-change controller.
	Waste-gate operation is sluggish.	Replace waste-gate, waste-gate actuator or correct binding linkage.
MANIFOLD PRESSURE OVERBOOSTS DURING FLIGHT	421A0001 and ON	
	Waste-gate operation is sluggish.	Replace waste-gate, waste-gate actuator or correct binding linkage.
	Manifold pressure relief valve stuck closed.	Check or replace valve.
	Manifold pressure relief valve stuck closed.	Repair or replace relief valve.
SLUGGISH OR LOW POWER ENGINE OPERATION	Waste-gate actuator sluggish.	Repair or replace waste-gate.
	Waste-gate butterfly clearances set improperly.	Reference Turbocharger and Controls Overhaul/Parts Manual and set butterfly valve clearances properly.
	Rust deposits in seal ring area.	Soak or spray the area behind turbine wheel with *KANO Aerokroil penetrating oil.
		*KANO LABORATORY INC. 1000 South Thompson Lane Nashville, Tennessee 37211

pressure. When at high engine speed and load and the proper absolute pressure is reached as determined by the throttle position, the force on the aneroid bellows opens the normally closed metering valve in the controller. When the oil pressure in the actuator is lowered sufficiently, the actuator open spring forces the mechanical linkage to open the waste-gate. A portion of the exhaust gases then bypasses the turbocharger turbine, thus preventing further increase of turbocharger speed and holding the compressor discharge absolute pressure to the desired value. Conversely at engine idle, the turbocharger runs slowly with low compressor pressure output; therefore, low pressure applied to aneroid bellows is not sufficient to affect the unseating of the normally closed metering valve. Consequently, engine oil pressure keeps the waste-gate closed. On 421-0001 to 421A0001 aircraft, a rate-of-change controller

senses the compressor outlet pressure in the upper chamber and through an internal capillary restrictor tube in the lower chamber. When the compressor discharge pressure increases more rapidly than approximately 6.5 inches of mercury per second, a pressure differential exists between the upper and lower chambers of the diaphragm. As the pressure in the upper chamber becomes greater than that of the lower chamber, the diaphragm between the upper and lower chamber is forced downwards causing the poppet valve to open and lowers the oil pressure in the actuator power cylinder causing the waste-gate to open. This prevents the turbocharger from increasing at too fast a rate and prevents overboosting the engine. On 421A0001 and ON, a manifold pressure relief valve protects the engine from overboosting by actuating if the intake manifold pressure exceeds 43.5 in. Hg.



1. Wrap Button
2. Insulation Blanket

3. 0.032 Monel Wire
4. Hinge

5. Shield
6. Turbine

Figure 9-20A. Turbocharger Insulation Installation

TURBOCHARGER INSULATION.

On aircraft 421-0001 to 421B0201, the turbocharger insulation installation consists of three individual blankets which are wrapped around the turbocharger turbine and held in place with Monel wire. Each blanket is made from material which consists of high temperature insulation sandwiched between two thin jackets of quilted stainless steel. Small holes are provided on the inside of each blanket to provide the necessary breathing. These blankets, when installed, will contain the high temperatures which are emitted by the turbocharger turbine.

Removal and Installation of Turbocharger Insulation Blankets. (See figure 9-20A.)

CAUTION

Extreme care should be taken when removing, installing, or working near the turbocharger blankets to prevent puncturing the stainless steel jackets.

- a. Cut and unlace the Monel wire securing the turbocharger insulation blankets in place.
- b. Carefully remove the three insulation blankets from the turbocharger turbine.
- c. Install insulation blankets by placing the large blanket on turbocharger turbine. Position each of the two smaller blankets over the large blanket and turbine.

- d. Lace insulation blankets together with number 0.032 Monel wire.

NOTE

When lacing, wrap Monel wire tightly around buttons on the insulation blankets.

On aircraft 421B0201 and On, the turbocharger is insulated by a shield, the shield consists of two shield halves hinged together which are fitted around the turbocharger turbine and held in place with Monel wire.

Removal and Installation of Turbocharger Shield. (See figure 9-20A.)

- a. Cut safety wire securing the turbocharger shield in place.
- b. Open shield assembly and remove from turbocharger.
- c. Install shield assembly by placing the shield around the turbocharger turbine with the hinge at the top.
- d. Lace the shield halves together on each side with 0.032 Monel wire.

Checking Turbine Shaft Drag.

Excessive turbine shaft drag can be verified by manually rotating the compressor wheel through the air filter opening. This shaft drag is caused by the for-

mation of rust deposits in the area of the turbine shaft piston ring area as a result of water vapor accumulation. Though not detrimental to the integrity of the turbocharger, these deposits may momentarily restrict or impede rotation of the turbine assembly, resulting in sluggish or low-power engine operation. Where this condition exists, the turbine shaft can be freed by the method described below.

- a. Remove the overboard exhaust stack and liberally spray the area behind the turbine wheel with the following approved or equivalent penetrating oil: Kano Aerokroi (Kano Laboratories, 1000 S. Thompson Lane, Nashville, Tennessee 37211).
- b. After a soaking period of not less than 10 minutes, turn the turbine by hand. Lightly tapping the shaft end with a soft mallet may be required to free the shaft in the most severe cases.
- c. Once the shaft is free, reinstall the overboard

exhaust stack and conduct an engine power check to confirm proper turbocharger output.

NOTE

The above turbine shaft drag problem concerns only formation of rust deposits in new or low-time turbochargers, those in which combustion product have not yet formed a protective coating on seal surfaces. This problem should not be confused with turbine shaft binding caused by excessive internal coking, which can occur on high-time turbochargers. Units which are binding after a long time in-service must be removed for cleaning or replacement. Turbocharger coke removal procedures are given in the Cessna Turbocharger and Controls Overhaul/Parts Manual.

CAUTION

The variable absolute pressure and rate-of-change, controllers are set at the factory and should not be tampered with except for prescribed minor adjustments to obtain rated manifold pressure.

Removal of Turbocharger. (See Figure 9-19.)

- a. Remove air induction filter assembly (9) by removing clamps (8) at air compressor (4) and at air intake duct (10).
- b. Remove coupling (2) which attaches throttle body to compressor (4).
- c. Remove couplings securing tail pipe (12) to turbine outlet and bypass valve assembly.
- d. Disconnect turbine assembly from bypass valve assembly by removing four nuts, washers and bolts.
- e. Disconnect oil pressure line (6) and oil return line from turbocharger.
- f. Remove two bolts at aft side of turbine assembly attaching turbine to bracket (7).

pressor air openings to prevent the entry of foreign materials.

Installation of Turbocharger. (See Figure 9-19.)

- a. Remove covers or seals from turbine and induction air openings.
- b. Lower turbine-compressor assembly into place and install bolts and nuts securing turbine to bracket (7).
- c. Install four bolts, washers, and nuts securing turbine to support bracket and waste-gate assembly.

NOTE

Cap and plug oil lines and seal turbine-com-

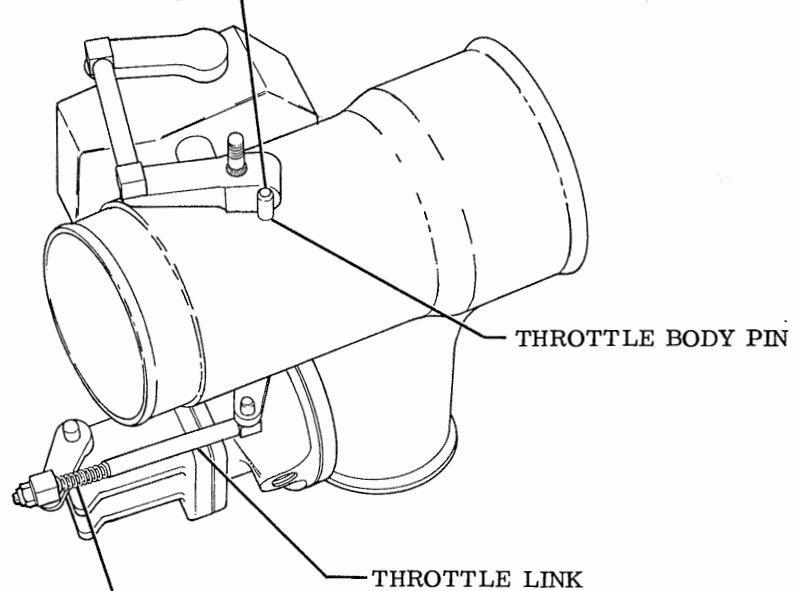
NOTE

Apply Fel-Pro C-5 or equivalent (Felt Products Manufacturing Company, Chicago 7,

ENGINE TORQUE VALUES IN POUND INCHES	
Engine Mount Bolts	300-350
Turbine Flange Bolts	150-160
Compressor Housing Coupling Bolt	40-60
Turbine to Center Housing Bolts	160-190
Compressor Discharge to Throttle Body Coupling Bolts	70-75
Turbine Exhaust to Tailpipe Clamp	40
Tailpipe Duct to Waste-gate Assembly	65-70
Venturi Inlet to Throttle Body Coupling Bolt	45-50
Intercooler Outlet to Riser Coupling Bolt	45-50
Air Filter to Compressor Inlet Clamp	70-75
Exhaust Elbow to Waste-gate Inlet Clamp	70-90
Exhaust Riser to Cylinder Studs	100-110

Figure 9-21. Engine Torque Values

THROTTLE VALVE SHAFT STOP



SPRING FORCE OF 8
TO 10 LBS IS ADEQUATE
TO MAINTAIN CONTROLLER
AGAINST HIGH STOP

INCREASE

DECREASE

HIGH PRESSURE
SETTING ADJUSTMENTLOW PRESSURE
SETTING ADJUSTMENT

INCREASE

LOW PRESSURE SETTING
REFERENCE MARKINGSRATE OF CHANGE
CONTROLLER
421-0001 TO 421A0001

LOCK NUT

CAM NEEDLE BEARING

VARIABLE ABSOLUTE
PRESSURE CONTROLLERFLAT BLADED
SCREWDRIVER

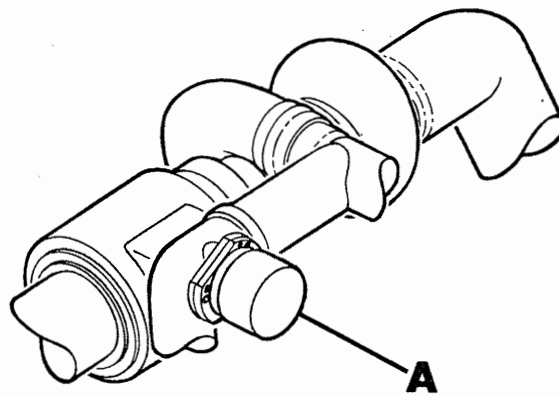
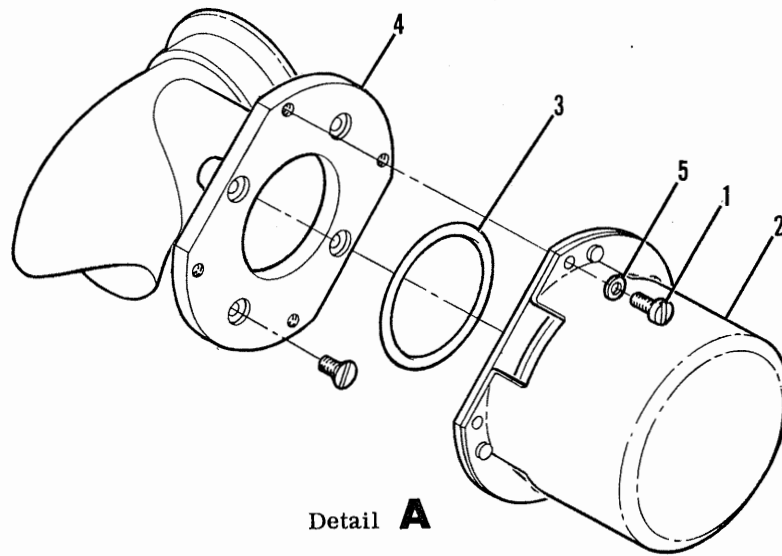
INLET PORT

5090002-1 TOOL

BELLOWS
ASSEMBLY BOOT

DRAIN PORT

Figure 9-22. Controller Adjustments



421A0001 AND ON
AND AIRCRAFT
MODIFIED BY
SK421-22

- 1. Screw
- 2. Relief Valve
- 3. O-ring

- 4. Adapter Pad
- 5. Washer

Figure 9-22A. Manifold Pressure Relief Valve

Illinois) high temperature anti-seize compound to attaching nuts and bolts when installing turbocharger to bypass assembly.

- d. Connect oil pressure line and oil return line to turbocharger.

CAUTION

If oil inlet adapter was removed, do not over-torque inlet fitting or adapter mounting bolts on installation.

- e. Install tailpipe and secure with couplings at turbine and waste-gate assembly.
- f. Install air filter and secure with clamp (8) at turbine.

NOTE

For bolt torque and coupling torque values see figure 9-21.

Removal and Installation of Rate of Change Controller. (See Figure 9-17.) 421-0001 TO 421A0001

- a. Disconnect oil line assemblies and discharge air line assembly from controller.

NOTE

Cap all lines and fittings to prevent entry of foreign materials.

- b. Remove two nuts and bolts attaching controller to mounting bracket.

Rate of Change Controller Adjustment. (See figure 9-22.) 421-0001 TO 421A0001

- a. Remove rate of change controller in accordance with removal procedures.
- b. Remove ambient air plug from low pressure port. Remove oil line assembly from drain port.

- c. Insert tool 5090002-1 into drain port. Insert small bladed screwdriver into low pressure port. Rotate poppet assembly until screwdriver blade engages slot provided in bellows assembly boot.
- d. Holding bellows assembly boot, rotate poppet assembly (1/16th of one full turn changes manifold pressure 1 inch Hg.), clockwise to increase, counter-clockwise to decrease.
- e. Install ambient air plug and oil line assembly.
- f. Install rate of change controller and connect lines.
- g. Install engine cowling in accordance with installation procedures.
- h. Check operation in accordance with controller operation flight check procedures.

Removal and Installation of Variable Absolute Pressure Controller. (See Figure 9-20.)

- a. Remove engine cowling in accordance with removal procedures.
- b. Disconnect oil line assemblies.
- c. Disconnect throttle link at throttle lever.
- d. Remove screws securing controller to throttle body and lift of controller out.
- e. Install controller by reversing removal procedures.

NOTE

If controller is being replaced, use existing fittings with new packings. The use of Teflon tape is permissible on all controller fittings to provide sealing.

Variable Absolute Pressure Controller Adjustment.

The variable absolute pressure controller may be adjusted as much as 2" Hg. increase or decrease in the high pressure setting by the following procedure and not change the low stop setting more than 1" Hg. from its nominal setting while maintaining the $30 \pm 2^\circ$ alpha angle.

NOTE

The alpha angle is the degree of travel of the cam starting with the cam arm against the high setting stop pin to where cam disengages the cam follower.

- a. Remove engine cowling in accordance with removal procedures.
- b. (See figure 9-22.) Adjust linkage as follows:
 - 1. Make sure controller mounting screw, fittings and lines are torqued properly.
 - 2. With the corresponding throttle lever against the full open cushion force, verify that the throttle valve shaft stop rests solidly against the pin on the throttle body.
 - 3. The throttle linkage adjustment nut must be adjusted to provide a clearance of .015 to .025 between the nut and the link rod end with the cam arm in solid contact against the high setting controller stop.

NOTE

The above settings must be carried out with the throttle lever in contact with the quadrant full open stop against the cushion force.

High Pressure Settings.

- a. After adequate engine warm up with oil temperature at upper third of green arc, accelerate the engine gradually to maximum RPM. Manifold pressure at maximum RPM should be $39.5 \pm .5$ in. Hg.

CAUTION

Discontinue acceleration if manifold pressure exceeds 40.0 in. Hg.

- b. If maximum manifold pressure does not conform with the limits defined above, reduce power to idle and loosen the high setting screw lock nut. Hold the screw while loosening the lock nut to prevent change of setting.
- c. When adjusting, the fork and pin arrangement should be turned in the direction of the markings stamped at the edge of the cam arm, UP to increase manifold pressure and DN to decrease manifold pressure. Approximately one turn of the adjusting screw should provide a 1-inch Hg. variation of manifold pressure.
- d. Repeat adjustments as required to obtain a setting within the limits specified in step "c" with the high setting screw lock nut properly tightened. Shut down engine.

Low Pressure Setting.

- a. Align the index marks on the side of the cam arm and edge of cast bearing support by moving the engine throttle lever. Tighten the control quadrant friction knob to prevent control movement.
- b. Loosen the low pressure setting screw lock nut and adjust the screw so that the cam needle bearing just starts to contact the cam follower. This can best be determined by rotating the needle bearing with the fingers to detect the point of initial drag. Tighten the low setting screw lock nut.

Low Pressure Setting and Cam Angle Verification Procedure.

In order to establish an adequate low pressure adjustment, the following concurrent ground and flight tests must be conducted.

- a. Ground Test.
After completion of the adjustment defined by the high pressure setting and low pressure setting, connect a standard dual manifold pressure gauge to the test ports provided at the corresponding compressor discharge connections of the fuel flow gauge. This test gauge provides compressor discharge pressure readings required on the following verification tests:

1. Start the engine and after adequate warm up, adjust the propeller control to maintain a constant 1800 RPM during the following verification.

2. With the manifold pressure setting at 29.0 inches Hg. the compressor discharge pressure should read 31.3 ± 6 inches Hg.

3. With the manifold pressure setting at 26.0 inches Hg. the compressor discharge pressure should read 30.7 ± 6 inches Hg.

NOTE

To attain the above manifold pressure settings it will be necessary to adjust the throttle control along with the propeller control.

4. (See figure 9-22.) To increase compressor discharge pressure loosen the low pressure setting screw lock nut and turn screw clockwise as shown. To decrease compressor discharge pressure, the reverse process should be adopted. Tighten lock nut holding adjusting screw stationary after adjustment.

b. Flight Check.

1. The dual pressure test gauge must be connected to the right hand and left hand compressor discharge pressure connections at the fuel flow gauge test ports during the flight tests.

2. Flight verification for the low pressure adjustment to be conducted at a pressure altitude of 12,000 feet and at 1950 RPM. Adjust the throttle to a manifold pressure of 23.0 inches Hg. and the corresponding compressor discharge pressure should be 31.0 ± 3 inches Hg.

3. After low setting flight verification is complete, remove compressor discharge pressure test gauge and reinstall caps.

Waste-gate and Actuator.

Removal of waste-gate and Actuator.

NOTE

The waste-gate and actuator are considered as a matched set and must be removed and replaced as sets.

a. Remove upper cowl in accordance with removal procedures.

b. (See Figure 9-17.) Disconnect actuator drain line.

c. Disconnect oil inlet and oil outlet lines from actuator and plug open lines.

d. Remove three bolts securing waste-gate to controller bracket.

e. Remove four nuts, washers and bolts securing waste-gate to turbocharger.

f. Remove couplings from waste-gate valve to exhaust tailpipe and from exhaust elbow to waste-gate.

g. Remove the waste-gate and actuator combination from the aircraft.

Installation of Waste-gate and Actuator.

a. Before installation of waste-gate and a actuator assembly check adjustments in accordance with adjustment procedures.

b. Attach waste-gate assembly to turbine with four bolts, washers and nuts.

NOTE

Install new gaskets between waste-gate, support and turbine. Apply Fel-Pro C-5 or equivalent on all bolts in extreme high heat area.

c. Install tailpipe and bypass duct and secure with couplings. Torque couplings to values shown in figure 9-21.

d. Connect exhaust elbow to waste-gate with coupling. See torque chart figure 9-21.

e. Connect actuator drain line.

f. Connect oil inlet and oil outlet lines to actuator.

g. Install upper cowl.

h. Start engine in accordance with operational procedure to check for oil leaks and proper operation.

Adjustment of Waste-gate and Actuator.

a. See Turbocharger and Controls Overhaul/Parts Manual.

Turbocharger Operational Flight Check Procedure.

The flight check procedure details the method of checking the turbocharger, variable absolute pressure and rate-of-change controllers. This procedure is to be used for aircraft suspected of improper turbocharger operation in order for the discrepancy to be correctly diagnosed. To aid in recording the necessary flight readings, a sample form, as shown in figure 9-24, is provided. This sample form, or one with similar content, should be used in conjunction with the flight check procedure. To determine at which conditions bootstrapping is most likely to occur, refer to the Bootstrapping Tolerance Chart in figure 9-23.

1. TAKEOFF - VARIABLE ABSOLUTE CONTROLLER

a. Cowl flaps - open (421-0001 to 421B0001)

b. Airspeed - 120 MPH IAS

c. Oil temperature - upper 1/3 of green arc

d. RPM - 2275 ± 25 RPM

e. Fuel flow - full rich

f. Full throttle M. P. - 39.5 ± 5 in. Hg.

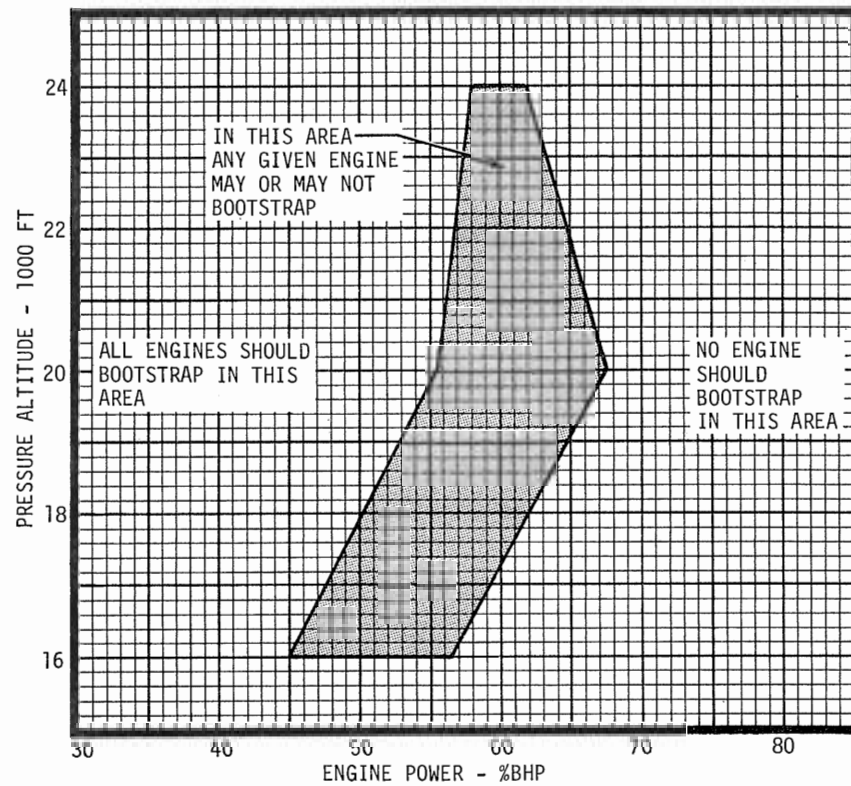
2. CLIMB - VARIABLE ABSOLUTE CONTROLLER

a. Cowl flaps - open (421-0001 to 421B0001)

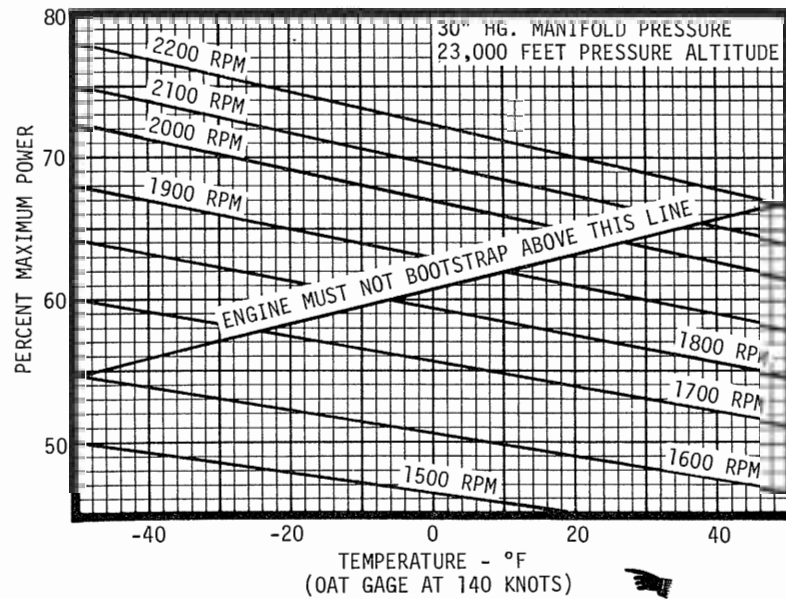
b. Airspeed - 120 MPH IAS

c. Pressure altitude - 16,000 ft.

d. RPM - 2275 ± 25 RPM



421-0001 TO 421B0001



421B0001 AND ON

51986002
51986003

Figure 9-23. Bootstrapping Tolerance Chart

- e. Fuel flow - full rich
- f. Full throttle M. P. - 39.5 ± 5 in. Hg.
- 3. CRUISE - RATE-OF-CHANGE CONTROLLER
 - a. Cowl flaps - closed (421-0001 to 421B0001)
 - b. Airspeed - level flight
 - c. Pressure altitude - 16,000 ft.
 - d. RPM - $2275 \pm 5^\circ$ RPM
 - e. Fuel flow - full rich
 - f. Throttle (one engine at a time)
 - (1) Idle until M. P. stabilizes
 - (2) Rapidly advance to full throttle
 - (3) Obtain time for M. P. to increase from 20 to 30 in. Hg.
 - (a) Should require between 1.25 and 2 seconds (5 to 8 in. Hg./sec.)
- 4. CRUISE - MANIFOLD PRESSURE RELIEF VALVE (421A0001 and ON.)
- 5. CRUISE - BOOTSTRAPPING DETERMINATION (421-0001 to 421B0001)
 - a. Cowl flaps - closed
 - b. Airspeed - level flight
 - c. Pressure altitude - 20,000 ft.
 - d. RPM - 2100 RPM
 - e. Fuel flow - lean
 - f. Throttle - 26 in. Hg.
 - g. Prop control (one engine at a time)
 - (1) Slowly decrease RPM until M. P. drop indicates waste-gate is closed
 - (2) The M. P., RPM, OAT, and H_p at the instant of waste-gate closing should be recorded
 - (3) The actual power being developed should be less than 60% power
 - h. RPM - Increase 50 RPM
 - i. Mixture - normal lean
 - j. Engine should not boot-strap

- 6. CRUISE - BOOTSTRAPPING DETERMINATION (421B0001 and ON.)
 - a. Airspeed - level flight
 - b. Pressure altitude 23,000 ft.
 - c. RPM - 2200 RPM
 - d. Fuel flow - lean
 - e. Throttle - 30 in. Hg.
 - f. Prop control (one engine at a time)
 - (1) Slowly decrease RPM until M. P. drop indicates waste-gate is closed
 - (2) The M. P. RPM, and OAT at the instant of waste-gate closing should be recorded
 - (3) The actual power being developed should be less than 60% power
 - g. RPM - increase 50 RPM
 - h. Mixture - normal lean
 - i. Engine should not bootstrap

MANIFOLD PRESSURE RELIEF VALVE.

A manifold pressure relief valve, mounted on the venturi adapter plate, is provided on aircraft 421A-0001 and ON to prevent engine damage from excessive intake manifold pressure. The non-adjustable manifold pressure relief valve will be actuated if the manifold pressure exceeds 43.5 in. Hg.

Removal and Installation of Manifold Pressure Relief Valve. (See figure 9-22A.) 421A0001 and ON

Removal and installation procedures of the manifold pressure relief valve is the same on either engine.

- a. (See figure 9-1.) Remove engine cowlings in accordance with removal procedure.
- b. Remove screws (1) and washers (5) attaching manifold pressure relief valve (2) to venturi adapter pad (4) and remove manifold pressure relief valve with O-ring (3).
- c. Install manifold pressure relief valve by reversing removal procedure.

CAUTION

Be sure that O-ring remains in groove on relief valve when installing to adapter plate.

6 LEVEL OFF <u>20,000 FT</u> COWL FLAPS - CLOSED 421-0001 to 421B0001	1. Perform Controller Operation Flight Check Procedure step 4.
5 CLIMB <u>20,000 FT</u> SET THROTTLE MAX RPM MIXTURE-LEAN (COWL FLAPS-OPEN) (421-0001 TO 421B0001) CLIMB SPEED-120 MPH IAS CAUTION SEE M P OPERATIONS LIMITATIONS PLACARD	<u>READINGS AT 20,000 FT.</u> OAT _____ M. P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Gal/Hr M. P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Gal/Hr
4 CLIMB <u>16,000 FT</u> M. P. 39.5 ±0.5 IN. HG. FULL RPM MIXTURE - RICH (COWL FLAPS - OPEN) (421-0001 TO 421B0001) CLIMB SPEED - 120 MPH IAS	1. Observe manifold pressure at approx. 16,000 ft. If 39.5 ±0.5 in. Hg. is available, absolute pressure controller is functioning properly. } 421-0001 TO 421A0001 2. If 39.5 ±0.5 in. Hg. is not available, perform Controller Operation Flight Check, step 3. 3. Observe manifold pressure at 16,000 ft. If 39.5 ±0.5 in. Hg. is available, absolute pres- sure controller is functioning properly. } 421A0001 AND ON 4. If 39.5 ±0.5 in. Hg. is not available, the man- ifold pressure relief valve is popping open too soon. <u>READINGS AT 16,000 FT.</u> OAT _____ M. P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Gal/Hr M. P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Gal/Hr
3 CLIMB <u>14,000 FT.</u> M. P. 32.5 ±.5 IN. HG. RPM 2100 MIXTURE - RICH (COWL FLAPS - OPEN) (421-0001 TO 421B0001) CLIMB SPEED - 120 MPH IAS	<u>READINGS AT 14,000 FT.</u> OAT _____ M. P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Gal/Hr M. P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Gal/Hr
2 TAKEOFF M. P. 39.5 ±0.5 IN. HG. FULL RPM MIXTURE - RICH OIL TEMPERATURE - UPPER 1/3 GREEN ARC	1. Observe and record altitude where, manifold pressure (M. P.) falls off. If altitude is unusually low (below 8,000 or 9,000 ft. on a hot day) suspect exhaust system leak. <u>ALTITUDE READINGS AT M. P. FALL OFF</u> Altitude Number 1 _____ Ft Altitude Number 2 _____ Ft <u>READINGS AT TAKEOFF</u> OAT _____ M. P. Number 1 _____ In. RPM Number 1 _____ Fuel Flow _____ Gal/Hr M. P. Number 2 _____ In. RPM Number 2 _____ Fuel Flow _____ Gal/Hr
1 SET ALTIMETER 29.92 IN. HG	

Figure 9-24. Turbocharger System Operational Check Chart

SECTION 10

PROPELLER SYSTEM

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PROPELLER.

The Model 421 is equipped with all metal, three bladed, constant-speed, full-feathering, single-acting, and governor regulated propellers. Each propeller utilizes hydraulic pressure which opposes the forces of springs and counterweights to obtain the correct pitch for engine load. Hydraulic pressure from the engine-mounted governor urges blades toward low pitch (increasing rpm) while the springs and counterweights urge blades toward high pitch (decreasing rpm). The source of hydraulic pressure for propeller operation is furnished by the engine oil system, boosted in pressure by the governor gear

pump, and supplied to the propeller hub through engine shaft flange. When the engine is not in operation, the high pitch latch mechanism prevents the propeller blades from moving into the feathered position. To feather the propeller blades, the propeller control levers on the control pedestal must be placed in the feathered position. Unfeathering the propeller is accomplished by positioning the propeller control levers to increase rpm position and rotating the blades to the low pitch position, or by starting the engines. If installed, the optional unfeathering system uses accumulator air and oil to force the propeller to the low pitch condition.

Troubleshooting the Propellers.

TROUBLE	PROBABLE CAUSE	CORRECTION
PROPELLER DOES NOT RESPOND TO MOVEMENT OF PROPELLER PITCH LEVER OR FAILS TO CHANGE PITCH	Control linkage disconnected.	Check visually, connect or replace control linkage.
	Governor not correct for propeller.	Check that correct governor is installed.
	Governor speeder spring broken.	Overhaul or replace governor.
	Screen in governor mounting gasket clogged.	Remove governor and replace gasket.
	Governor drive shaft sheared.	Overhaul or replace governor.
	Defective pitch changing mechanism or excessive blade friction.	Check propeller manually, repair or replace parts as required.

TROUBLE	PROBABLE CAUSE	CORRECTION
FAILURE TO CHANGE PITCH FULLY	Improper rigging of governor control.	Check that arm on governor has full travel and rig correctly.
	Defective governor.	Overhaul or replace governor.
SLUGGISH PROPELLER MOVEMENT TO EITHER HIGH OR LOW PITCH	Excessive propeller blade friction.	Overhaul propeller.
ENGINE SPEED WILL NOT STABILIZE	Governor relief valve sticking.	Overhaul or replace governor.
	Excessive clearance in pilot valve.	Overhaul or replace governor.
	Air trapped in propeller actuating cylinder.	Trapped air should be purged by exercising the propeller several times prior to takeoff, after the propeller has been reinstalled or has been idle for an extended period.
	Excessive friction in pitch changing mechanism or excessive blade friction.	Check propeller manually, repair or replace parts as required.
	Excessive governor oil pump clearance.	Overhaul or replace governor.
EXCESSIVE RPM CHANGES WITH AIR-SPEED OR POWER CHANGES	Sludge in governor.	Remove and clean governor. Drain engine oil, clean oil filter, service engine with new oil.
FAILURE OF PROPELLER TO GO TO FULL LOW PITCH (HIGH RPM)	Improper rigging of governor control system.	Refer to Operational Check of Propellers.
	Governor arm reaches stop before maximum RPM is obtained.	Adjust in accordance with Operational Check of Propellers.
	Defective governor.	Overhaul or replace governor.
STATIC RPM TOO HIGH	Incorrect propeller or incorrect low pitch blade angle.	Install correct propeller, with correct blade angle.
STATIC RPM TOO LOW	Governor high RPM stop set too low.	See Note 1 at the end of this chart and rig.
	Defective governor.	See Note 2 at the end of this chart.
	Incorrect propeller or incorrect low pitch blade angle.	Install correct propeller with correct blade angle.
PROPELLER FEATHERS DURING ENGINE SHUT-DOWN	Latching mechanism does not engage.	Due to unusual circumstances, a propeller may occasionally feather during engine shutdown. If this occurs repeatedly, the latching mechanism is defective. Propeller repair or replacement is required.
FAILURE TO FEATHER	Defective governor.	See Note 2 at the end of this chart.
	Defective pitch changing mechanism or excessive blade friction.	Check propeller manually, repair or replace parts as required.

TROUBLE	PROBABLE CAUSE	CORRECTION
FAILURE TO FEATHER (CONTINUED)	Incorrect rigging of governor control.	Check that arm on governor has full travel and rig.
	Defective latching mechanism inside propeller.	Propeller repair or replacement is required.
	Attempting to feather from too low an engine RPM.	Increase RPM and attempt to feather again. (See feathering procedures.)
	Feathering spring weak or broken.	Overhaul propeller.
OIL LEAKAGE AT MOUNTING FLANGE	Damaged O-ring seal between engine and propeller.	Check visually for oil leakage and replace O-ring seal.
	Foreign material between engine and propeller mating surfaces or nuts not tight.	Check visually for oil leakage and clean propeller and engine mating and tighten nuts properly.
OIL OR GREASE LEAKAGE AT ANY OTHER PLACE	Defective seals, gaskets, etc., or incorrect assembly.	Check visually for oil or grease leakage, repair or replace propeller as required.
NOTE 1. It is possible for either the propeller low pitch (high RPM) stop or the governor high RPM stop to be the high RPM limiting factor. It is desirable for the governor stop to limit the high RPM at the maximum rated RPM. Due to climatic conditions, field elevation, low pitch blade angle, and other considerations, an engine should not reach rated RPM on the ground. It may be necessary to readjust the governor stop after test flying to obtain maximum rated RPM when airborne. NOTE 2. When trouble shooting a propeller-governor combination, it is recommended that a governor known to be in good condition be installed to check whether the propeller or the governor is at fault. Removal and replacement, high-speed stop adjustment, desludging, and replacement of the mounting gasket are not major repairs and may be accomplished in the field. Repairs to governors are classed as propeller major repairs in Federal Aviation Regulations, which also defines who may accomplish such repairs.		

Removal of Propellers. (See Figure 10-1.)

The removal procedure is the same for either propeller. It is not necessary to feather the propeller for removal or installation but if blade angles are to be changed, which would require removal of the dome, it is then necessary to feather the propeller. Blade angles may be changed without removing the propeller.

- a. Feather the propeller by the following procedure:
 1. Start engine in accordance with "Pilot's Checklist."
 2. Operate engine at normal idle (470 RPM).
 3. Place propeller pitch lever in the FEATHER position and at the same time place the mixture lever in the IDLE CUT-OFF position.

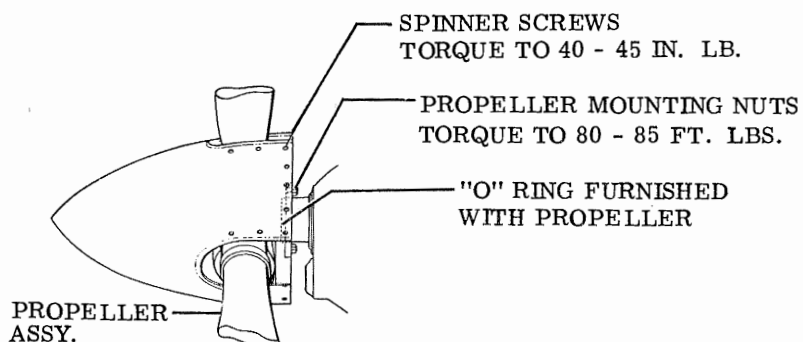
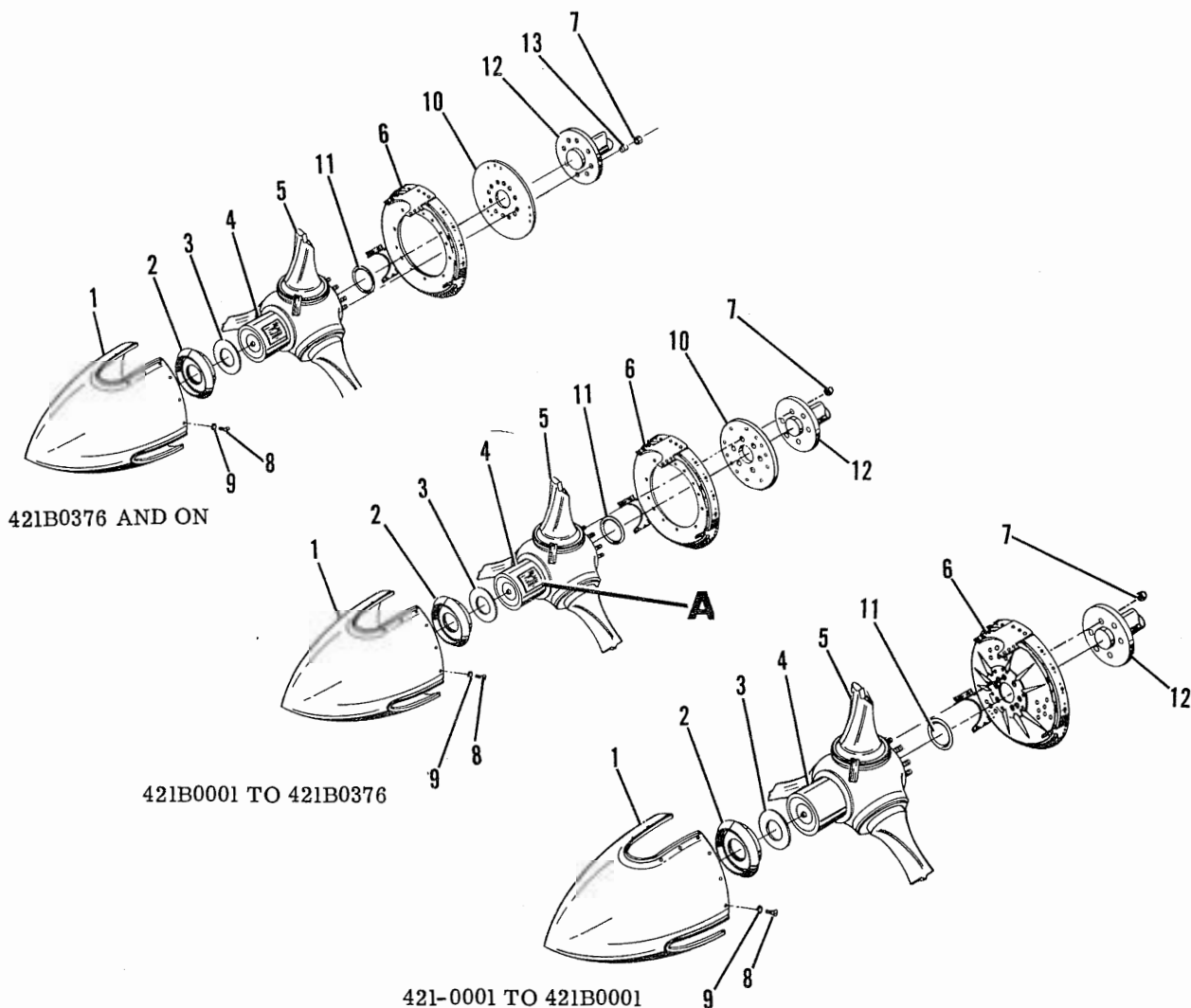
CAUTION

Do not feather from a high RPM as this will cause excessive manifold pressure and possible damage to the engine. If the propeller

fails to feather at idling (470 RPM), increase the RPM slightly and attempt to feather again.

If the Optional Unfeathering System is Installed:

1. After the propeller has been feathered and the engine shutdown, move the propeller control out of FEATHER position until blades start to unfeather, then quickly pull the control back into FEATHER. This procedure is known as "milking" the pressure out of the unfeathering system. This procedure should be continued until the propeller will no longer move, which may require 15 to 20 movements of the propeller control.
2. Do not allow propeller blades to rotate far enough to let high-pitch latches engage or engine must be restarted, propeller feathered again, and the procedure repeated.
- b. Remove the nose cap cowling and spinner.
- c. Remove the six attaching nuts securing propeller to crankshaft mounting flange. On aircraft 421B0376 and On, remove eight nuts and eight spacers. Retain spacers for installation.
- d. Remove propeller from engine crankshaft.
- e. If optional propeller deice system is installed,



Cessna	PART NUMBER
	0850334-23
BLADE ANGLES	
LOW	$16.9^{\circ} \pm 0.2^{\circ}$
FEATHER	$84.5^{\circ} \pm 0.3^{\circ}$
APPROVED FOR CESSNA AIRCRAFT MODEL NUMBER(S)	
421	

Detail **A** 51502003
A51501004
14502004

1. Spinner	4. Cylinder	8. Screw	12. Crankshaft
2. Support	5. Propeller	9. Washer	13. A-4472
3. Shim	6. Bulkhead	10. Adapter	Spacer
	7. Nut	11. O-Ring	

Figure 10-1. Propeller Installation

remove wiring at terminal block then remove the slip rings and spinner bulkhead from propeller hub.

NOTE

Refer to McCauley Service/Parts Manual for maintenance, overhaul and repair of propeller.

Installation of Propeller. (See figure 10-1.)

The installation procedure is the same for either propeller.

- a. Position spinner bulkhead over propeller hub attach studs.
- b. Wipe all dust and foreign particles from the propeller hub flange, the propeller hub oil passage, the crankshaft flange and the crankshaft oil passage with a clean cloth.
- c. Install or check "O"-ring seal in the propeller hub and lubricate lightly with engine oil.
- d. Position propeller and spinner bulkhead on the crankshaft.
- e. Secure propeller to crankshaft with six new nuts. On aircraft 421B0376 and On, secure propeller to crankshaft with eight A-4472 spacers and eight new elastic element locknuts.

WARNING

Do not use all steel locknuts. Use only new elastic element locknuts when installing propeller.

- f. Torque nuts to 80 to 85 foot-pounds.
- g. (See figure 10-2.) On McCauley "K" series propellers (421-0001 to 421B0001), if optional deice system is installed, check for interference between propeller hub (8) and deice slip ring mounting bolts (7). If clearance is not sufficient (0.001 inches), proceed with the following steps:
 1. Remove propeller.
 2. Remove bolts (7), one at a time to eliminate aligning of holes of spinner bulkhead (1), spacer (2), and slip ring (3).
 3. Grind the head of each bolt (7), as shown in Section A-A of figure 10-2, to assure positive clearance of (.001 shim or cigarette paper) between head of bolt and the hub forging (8) of the propeller when the propeller is fully torqued in place.
 4. Blend out any nicks or gouges in propeller hub caused by bolt interference.
 5. Paint chamfered metal of bolt heads and propeller hub using zinc chromate primer (MIL-P-8585) for corrosion protection.
 6. Secure locknuts (6) on bolts (7) making sure that ground side of head of bolts are positioned toward the hub forging of the propeller.

NOTE

(See figure 13-30.) Replace star lockwasher (16) and locknuts (21) when making reinstallation.

NOTE

Insure that all washers are reinstalled properly. Slip rings should run in a true plane relative to brush block. Total deviation not to exceed .005 true indicator reading, with no more than .002 deviation within any 4.00 inch interval. Approximately, .012 inch adjustment may be made by varying torque on attach bolts (maintain as near 65 inch-pounds as possible). Shims may be used between slip ring and spinner bulkhead under mounting bolts.

7. Reinstall propeller.
- h. Install spinner: (See figure 10-1.)
 1. Install shims (3) and support (2).
 2. Lightly press spinner (1) to hold snug against support and check alignment of spinner holes with bulkhead (6).
 3. Alignment lack of 3/64 is approximate fit: add or remove shims to produce this condition.
 4. Pushing hard on the shell, install screws (8) and washers (9). Remove shims, if necessary, until just possible to install screws.
 - i. Replace nose cap cowl and check propeller for operation in accordance with the operational check procedure.

Operational Check of Propellers.

Anytime the propellers or propeller governors have been removed, the following check should be performed after reinstallation, this will insure that the engine-propeller-governor combination is in good operating adjustment and will give maximum performance.

- a. Start engines and perform normal ground runup.

CAUTION

Avoid running up engines where loose stones or cinders can be sucked up by inflow of air and damage the propeller blades.

- b. Check tachometer indication during power check. Static RPM should be approximately 2225 RPM.
 1. If static RPM is too high, reduce by adjusting governor stop screw (12). Turn clockwise one revolution for each 17 RPM decrease. This reduction prevents possible overspeeding at takeoff.
 2. If static RPM is too low, it is possible that either the governor stop or the propeller low pitch stop is the limiting factor. Increase the engine RPM and move the propeller pitch lever back and forth. If the maximum obtainable RPM is reached at the same time as the governor stop is reached, the gov-

ernor is the limiting factor. Correct by adjusting the governor stop screw (12). Turn counterclockwise one revolution for each 17 RPM increase. If the maximum obtainable RPM is reached before the governor stop is reached, the propeller low pitch stop is the limiting factor. This would require an adjustment of the propeller blades to decrease the low pitch angle. This adjustment should be made only by an authorized propeller overhaul station.

CAUTION

Do not allow engine temperatures to exceed operating limits while these checks are being performed.

NOTE

To avoid propeller surging on takeoff, it is desirable for the governor stop to limit the high static RPM, with the propeller stop reached at 50 to 100 RPM beyond.

3. Anytime the propeller attachment has been subjected to excessive engine roughness the propeller should be removed and the dowel pin inspected for looseness, cracks, and visual damage as part of the Rough Engine Operation Inspection defined in Section 9.

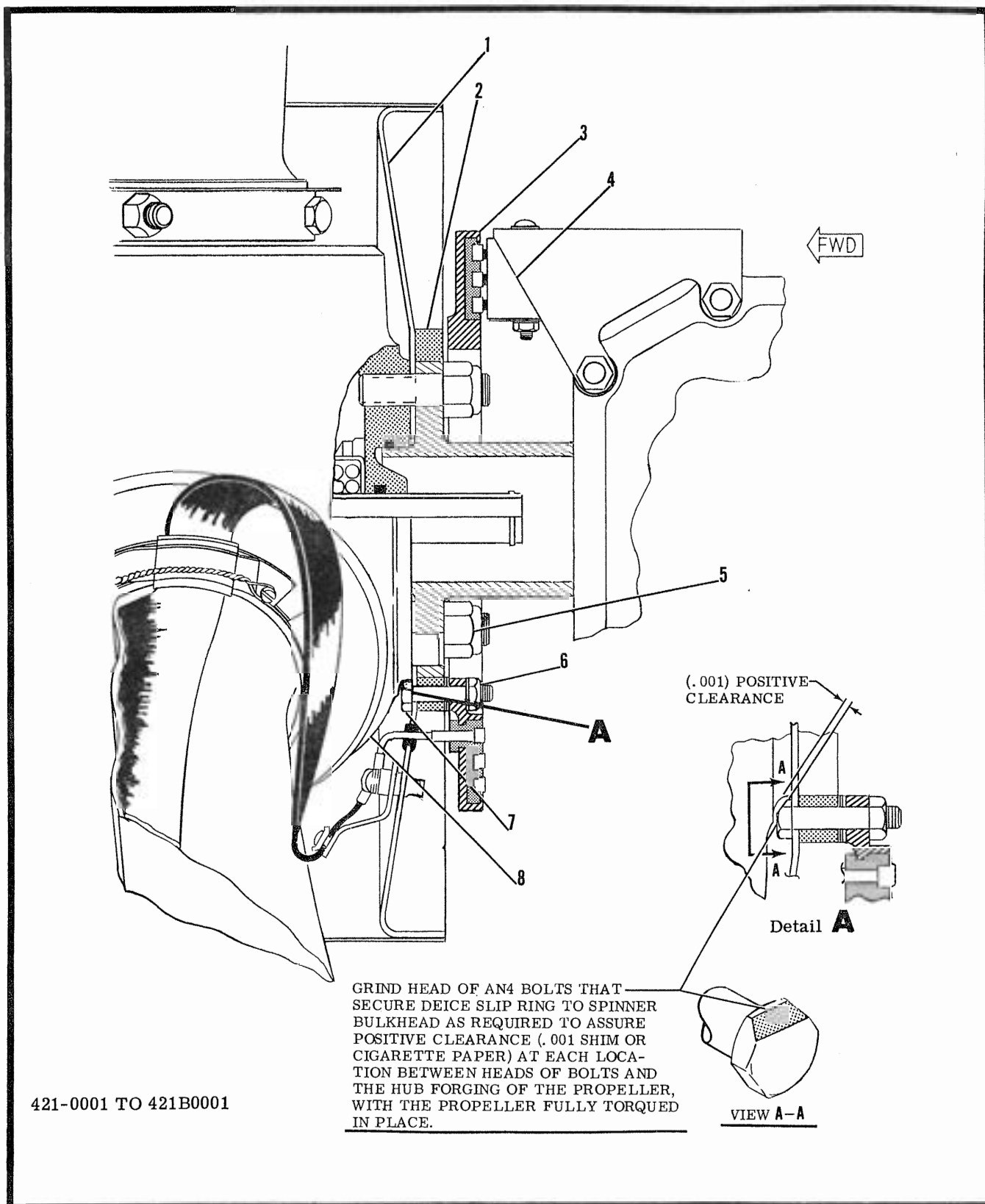
PROPELLER GOVERNORS.

One base-mounted, centrifugal, single-acting governor is installed on each engine to control propeller pitch. The governors are engine-driven and are mounted on the left side of each crankcase just below and forward of the most forward cylinder. A gear type pump and relief valve are incorporated in each governor to boost engine oil pressure to the pressure required to actuate the propeller piston, (approximately 275 psi). Internal flyweights are attached to the pilot valve which directs high pressure oil to the propeller piston or allows oil to drain from the piston. Pitch changing links connect the propeller piston to the propeller blades. The position of the piston determines the propeller blade angle which is either increased or decreased by the governor as flight conditions vary, to maintain a constant RPM.

Removal of Propeller Governors. (See figure 10-3.)

The removal procedure is the same for either propeller governor.

- a. Remove the engine cowling.



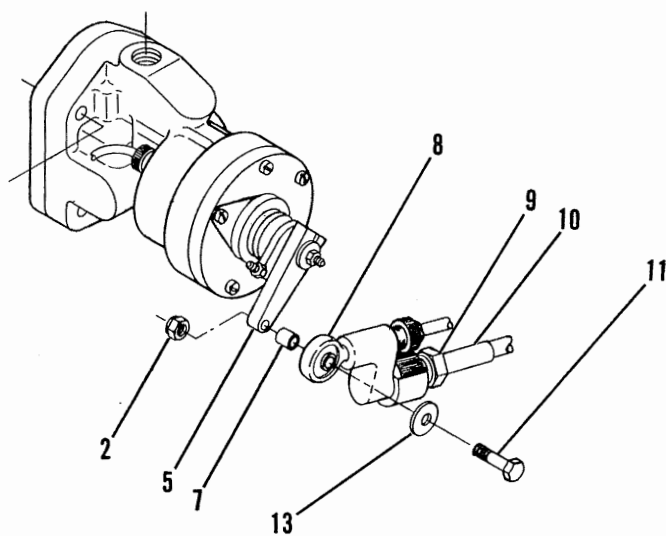
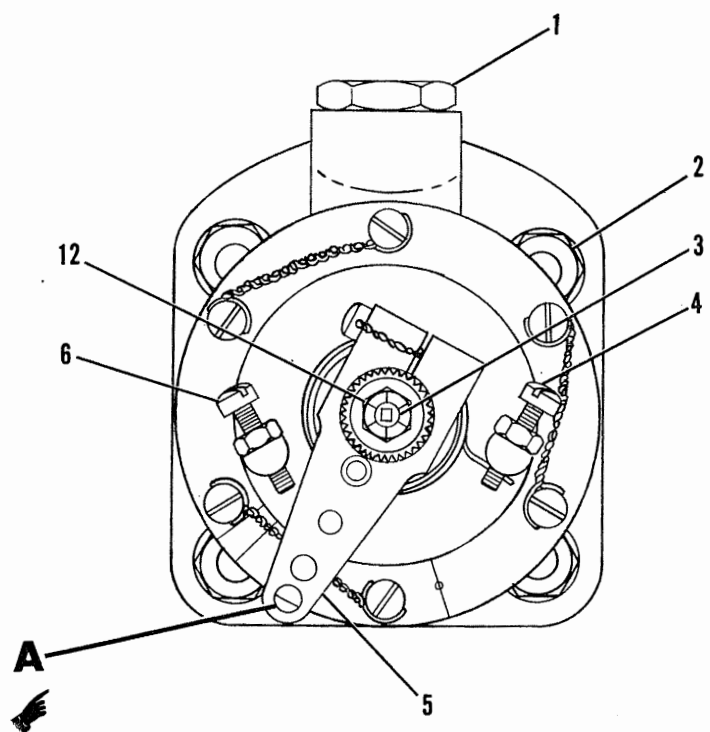
1. Spinner Bulkhead
2. Spacer Ring

3. Deice Slip Ring
4. Deice Brush Block

5. Nut
6. Locknut

7. Bolt
8. Propeller Hub

Figure 10-2. Checking of Propeller Hub Clearance



Detail A

54551001
A10551007

1. Plug
2. Nut
3. Screw Adjustment
4. Feather Stop

5. Control Arm
6. High RPM Stop
7. Spacer
8. Rod End
9. Locknut

10. Control Cable
11. Bolt
12. Locknut
13. Washer

Figure 10-3. Propeller Governor

- b. Remove the left forward engine baffle and heat shield.
- c. Disconnect propeller control from governor control arm.
- d. If optional unfeathering system is installed, disconnect the accumulator hose from the governor.

CAUTION

Make sure all pressure is removed from the accumulator before disconnecting hose. Refer to alternate unfeathering method.

- e. Remove governor and mounting gasket by removing the four nuts, lockwashers, and plain washers.

Installation of Propeller Governor. (See figure 10-3.)

- a. Place the mounting gasket over the governor mount studs with the raised surface of gasket screen facing away from the engine.

NOTE

Do not use sealing compound of any kind on the mounting gasket.

- b. Align the splines on the governor shaft with the engine drive and slide the governor into position.
- c. Secure the governor in place with the four plain washers, lockwashers and nuts on the governor mount studs.
- d. Connect accumulator hose to governor if optional unfeathering system is installed.

unfeathering system is installed.

- e. Rig the propeller governor in accordance with the propeller governor rigging procedure.
- f. Replace governor heat shield and forward engine baffle.
- g. Replace the engine cowling and make Operational Check as described in Operational Check of Propellers.

Rigging of Propeller Governor Control.

- a. Disconnect the propeller control at the propeller governor arm.
- b. Place propeller pitch lever in the control pedestal in the FULL INCREASE RPM position against the forward stop. Retard the lever approximately 1/4 inch from stop and lock lever in this position by tightening the friction knob on the control quadrant.
- c. Place governor arm with the full forward position against the stop (FULL INCREASE RPM).
- d. Loosen locknut on propeller control and adjust the position of the control rod end by screwing in or out until the bolt can be inserted through the rod end and governor arm without binding.

NOTE

Do not allow propeller pitch lever or propeller governor arm to move from position during adjustment of the control rod end.

- e. Install the bolt, washer, spacer and nut with spacer between the rod end and governor arm. Tighten nut then tighten locknut.
- f. Unlock propeller pitch lever in the control pedestal. Move the pitch lever to the FEATHER position (full aft). Check to see that the propeller governor arm is against its stop in the full aft position. With the governor arm against either stop, the pitch lever should be approximately 1/4 inch from the quadrant stop. This unused travel provides the necessary cushion to assure full travel of the governor arm.

SECTION 11

FUEL SYSTEM

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FUEL SYSTEM.

The aircraft standard fuel system consists of an integrally sealed (wet) tank mounted to each wing tip and two interconnected auxiliary tanks (synthetic rubber cell) mounted within each wing. Optional wing fuel tanks are provided to increase fuel capacity and are interconnected to the auxiliary tanks. Optional wing locker fuel tanks are also provided, located in the forward section of the wing locker. Fuel capacities for each system are given in Section 1. On air-

craft 421A0112 and ON and all aircraft modified by SK421-26A there are two electrically operated fuel pumps mounted in each main tip tank, the auxiliary fuel pump and the fuel transfer pump. The auxiliary fuel pump, mounted in the bottom of the main tank, provides fuel pressure for priming during engine starting and supplies fuel to the engine in an emergency. The fuel transfer pump is mounted on the aft side of the tip tank rear bulkhead and transfers fuel from the nose section of the main tank to the center baffle area, where it is picked up and routed to the

* 421A0112 AND ON
AND ALL AIRCRAFT
MODIFIED BY SK421-26A

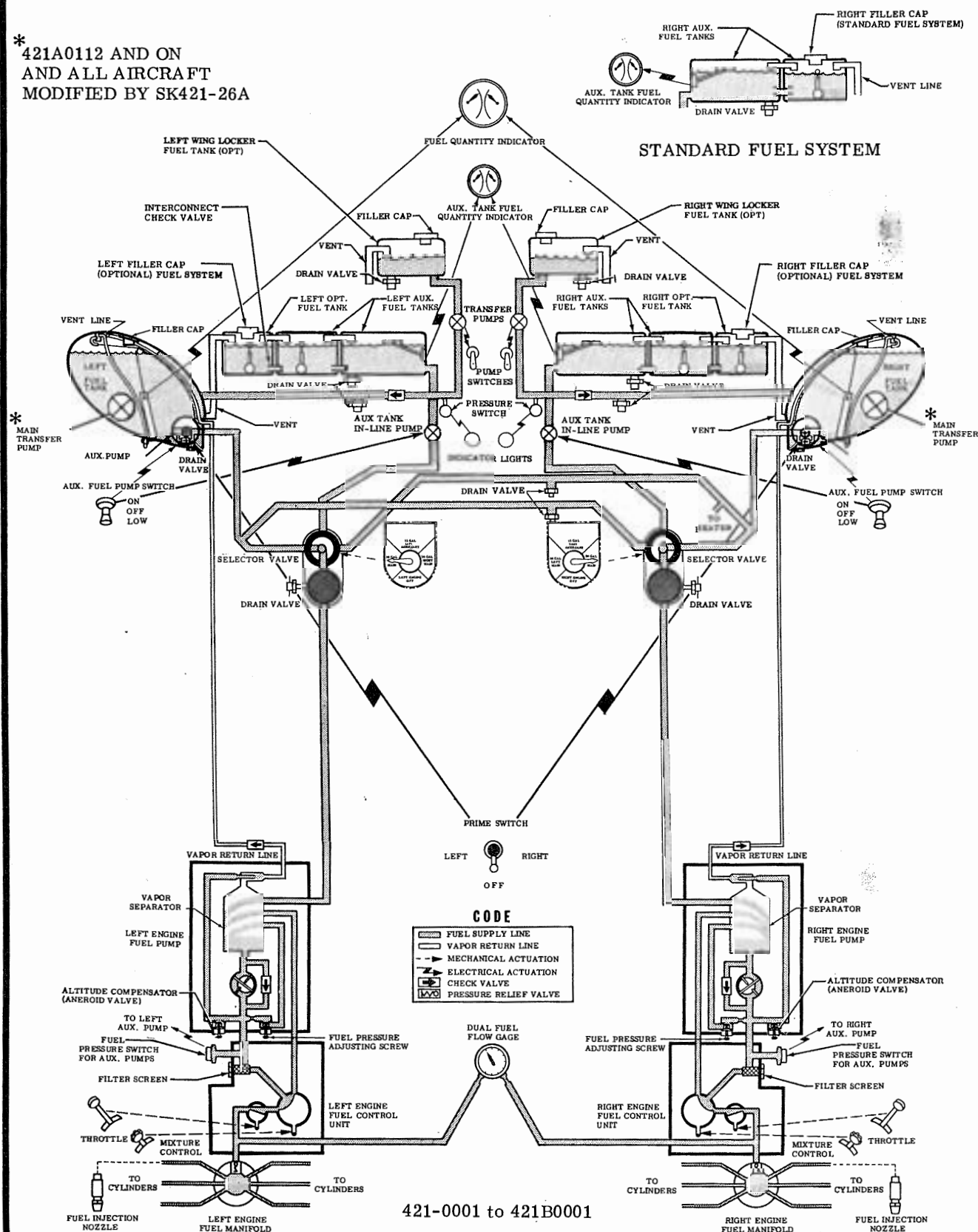


Figure 11-1. Fuel System Schematic (Sheet 1 of 2)

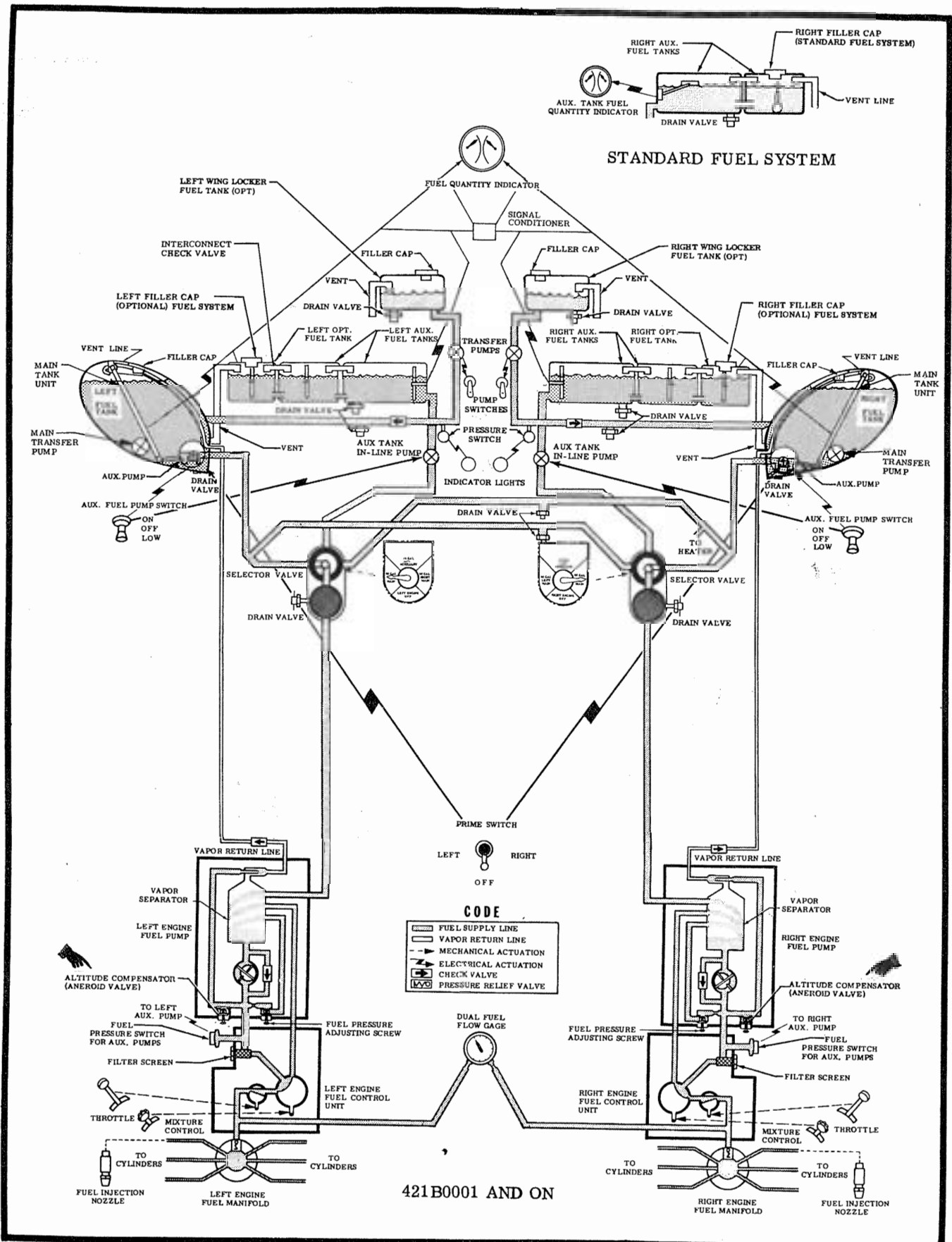


Figure 11-1. Fuel System Schematic (Sheet 2 of 2)

engine by, either the engine-driven or the auxiliary fuel pump. The fuel transfer pump prevents the possibility of fuel starvation to the engine during steep angles of descent and a low quantity of fuel. An electrically operated auxiliary fuel pump feeds fuel to the selector valve, located outboard of each engine nacelle and in turn routes fuel to the engine-driven fuel pumps on each engine. A vapor return line is installed from the engine-driven fuel pump to the main tank to return unused fuel. A line is installed from each auxiliary fuel cell to the respective fuel selector. The auxiliary fuel cells are equipped with an in-line fuel pump for vapor clearing, there is no vapor return line to the auxiliary tanks. When fuel is used from the main tanks, the fuel vapor from the fuel pump is returned to the main tank. Fuel from the optional wing tanks is gravity fed into the auxiliary tanks. The wing locker fuel system is equipped with a transfer pump mounted outboard of the wing locker on the rib. These pumps transfer fuel from the wing

locker to the main tanks. Fuel is routed from the wing locker tank to each respective tank through lines routed in the leading edge of the wing. There are no return lines in the wing locker system, therefore, it is necessary the aircraft be flown with the fuel selector on MAIN for at least sixty minutes or until thirty gallons of fuel remain in the main tanks before transferring fuel from the wing locker tanks. A pressure switch is installed in the fuel line to operate a pilot indicator light mounted on the lower left side of the instrument panel. Quick-drain valves are provided in the bottom of each main auxiliary and wing locker tanks, in addition to a drain valve located in the crossover drain line and fuel selector sediment bowl to drain trapped moisture and sediment. The fuel system is vented to a common vent located on the underside of each tip tank and incorporates a heater to prevent icing. A snuffle valve located aft of the filler cap, provides a secondary vent for the main tank.

Trouble Shooting the Fuel System.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO FUEL QUANTITY INDICATION	Fuel tank empty.	Fill tank with correct grade of fuel.
	Fuel quantity indicator circuit breaker open.	Reset circuit breaker.
	Broken or loose wiring.	Check circuit with multimeter.
	Loose connection or open circuit.	Tighten connections and check wiring.
	Defective signal conditioner. (421B0001 and on)	Replace signal conditioner.
	Defective fuel quantity indicator.	Replace fuel quantity indicator.
	Defective fuel quantity sending unit.	Replace fuel quantity sending unit.
FUEL DRIPS FROM OVERBOARD DRAIN TUBE IN NACELLE	Defective fuel tank unit. (421B0001 and on)	Verify tank unit is defective using Field Calibration Unit Test Box.
	Mixture lever not in IDLE CUT-OFF.	Place mixture lever in IDLE CUT-OFF.
	Mixture lever not in IDLE CUT-OFF due to improper rigging.	Rig mixture control in accordance with rigging procedure.
	Distribution valve is leaking.	Repair or replace.
AUXILIARY FUEL PUMP INOPERATIVE	Broken fuel line or loose fitting.	Check fuel lines and fittings.
	Master switch OFF.	Turn master switch ON.
	Circuit breaker open.	Reset circuit breaker.
	Open circuit or loose connection.	Check circuit and repair.
	Defective fuel pump.	Replace fuel pump.

TROUBLE	PROBABLE CAUSE	CORRECTION
AUXILIARY FUEL PUMP RUNS AT HIGH SPEED WITH AUXILIARY FUEL PUMP SWITCH IN "ON" POSITION WITH ENGINE RUNNING	Defective fuel pressure switch.	Replace fuel pressure switch.
	Prime switch has been actuated momentarily.	Move auxiliary pump switch to the OFF position.
AUXILIARY FUEL PUMP RUNS AT SLOW SPEED WITH AUXILIARY FUEL PUMP SWITCH "ON" AND ENGINE NOT RUNNING	Defective auxiliary fuel pump.	Replace auxiliary fuel pump.
ENGINES WILL NOT START OR CONTINUE TO RUN AFTER STARTING	Fuel tank empty.	Fill tank with correct grade of fuel.
	Fuel selector valve in OFF position.	Move fuel selector valve to desired tank.
	Mixture in IDLE CUT-OFF.	Set mixture to FULL RICH.
	Engine overprimed.	Place mixture control in IDLE CUT-OFF, turn engine over several revolutions with throttle WIDE OPEN.
	Fuel strainer in fuel control unit dirty.	Clean fuel control unit strainer.
	Auxiliary fuel pump switch not in PRIME position.	Place auxiliary fuel pump switch in PRIME position.
	Plugged fuel cap vent.	Clean vent.
	Bypass valve in engine-driven fuel pump stuck.	Replace engine-driven fuel pump.
HIGH FUEL FLOW INDICATION AT FULL THROTTLE AFTER RAPID ENGINE ACCELERATION ON GROUND	Gage vent line plugged or leaking.	Clean, tighten or replace vent line.
LOW FUEL FLOW	Mixture control lever does not contact the full-rich stop.	Rig mixture control in accordance with Section 9, Rigging Mixture Throttle Controls.
	No turbocharger discharge pressure to fuel pump.	Check turbocharger and fuel pump aneroid.
ROUGH AND ERRATIC ENGINE SHUTDOWN	Fuel mixture control lever does not contact idle cut-off stops firmly.	Rig mixture control in accordance with Section 9. Rigging Mixture and Throttle Controls.
FUEL SHUTOFF INCOMPLETE	Misaligned linkage or fuel control levers hitting stops too hard.	Align linkage or re-rig mixture control.
	Distribution valve stuck.	Repair or replace.
FUEL FLOW INCREASES, ENGINE DIES	Pressure switch set too high.	Reset fuel pressure switch to actuate between 4 to 5 PSI
	Pressure switch stuck.	Replace pressure switch.

TROUBLE	PROBABLE CAUSE	CORRECTION
AUXILIARY PUMP WILL NOT SWITCH TO HIGH SPEED	Pressure switch stuck.	Replace pressure switch.
AUXILIARY WING LOCKER FUEL PUMP INOPERATIVE	Circuit breaker open.	Reset circuit breaker.
	Open circuit or loose connections.	Check circuit and repair.
	Defective fuel pump.	Replace pump.
AUXILIARY WING LOCKER FUEL TRANSFER LIGHTS INOPERATIVE	Open circuit or loose connection.	Check circuit and repair.
	Defective pressure switch.	Replace pressure switch.

MAIN FUEL TANKS.

Each main tank is attached to the outboard end of both spars and is streamlined to the wing by fairing strips. A flush-type filler cap is incorporated for servicing. The tanks are integrally sealed (wet) tanks and have an electrically operated fuel boost pump installed in the bottom of each tank. On aircraft 421A0112 and ON, and all aircraft modified by SK421-26A an electrically operated fuel transfer pump is located on the aft side of the main tank rear bulkhead. On aircraft 421-0001 to aircraft 421B0001 a sending unit operated by a float arm inside the main tank is also installed. On aircraft 421B0001 and ON, a fuel capacitance sending unit is mounted in the upright position to provide fuel quantity measurements. Access to the auxiliary fuel pump is gained by removing upper and lower fairing strips. Access to the fuel transfer pump is made by removing tail cap assemblies from the wing main fuel tanks. Access to the fuel capacitance tank unit is gained by removing the main tank filler cap. Access to the fuel quantity sending unit is gained by removing the main fuel tank tail cap. A quick drain valve is incorporated in the bottom of each fuel tank for draining moisture and sediment.

Removal of Main Fuel Tank. (See figure 11-2.)

The removal procedure is the same for either main tank.

- Selector valve handles - OFF.

CAUTION

Make sure handle is in detent in the OFF position to prevent fuel leakage.

- Defuel main tank in accordance with Section 2.
- Remove wing fairings and tail cap.
- Disconnect electrical wiring.
- Disconnect fuel lines, fittings and vent lines.
- Remove mounting nuts, washers and bolts.
- Remove main tank.

Disassembly of Main Fuel Tank.

Disassemble main fuel tank in accordance with figure 11-2 and figure 11-3.

CAUTION

If drain cock has been removed, replace existing seal with aluminum crush washer (P/N AN960-616D) in order to prevent leakage from overtightening drain cock when installing it.

Inspection and Repair of Main Fuel Tanks.

- Inspect filler cap gasket. If crushed or damaged, replace filler gasket. On integrally sealed (wet) tanks, inspect sealing gasket, loose rivets, cracks or dents for leaks and attaching mounts.
- Purge in accordance with Section 2.
- Repair in accordance with Section 16.

Assembly of Main Fuel Tanks.

Assemble main fuel tank in accordance with figure 11-2 and figure 11-3.

NOTE

When replacing fuel lines, use only a fuel soluble lubricant (such as engine oil) on the thread fittings. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

All access openings must be sealed and checked on assembly. Seal and check as follows:

- Clean all surfaces to be sealed with a low moisture solvent using a lintless cloth for solvent application.

NOTE

Do not allow cleaning solvent to evaporate; wipe dry.

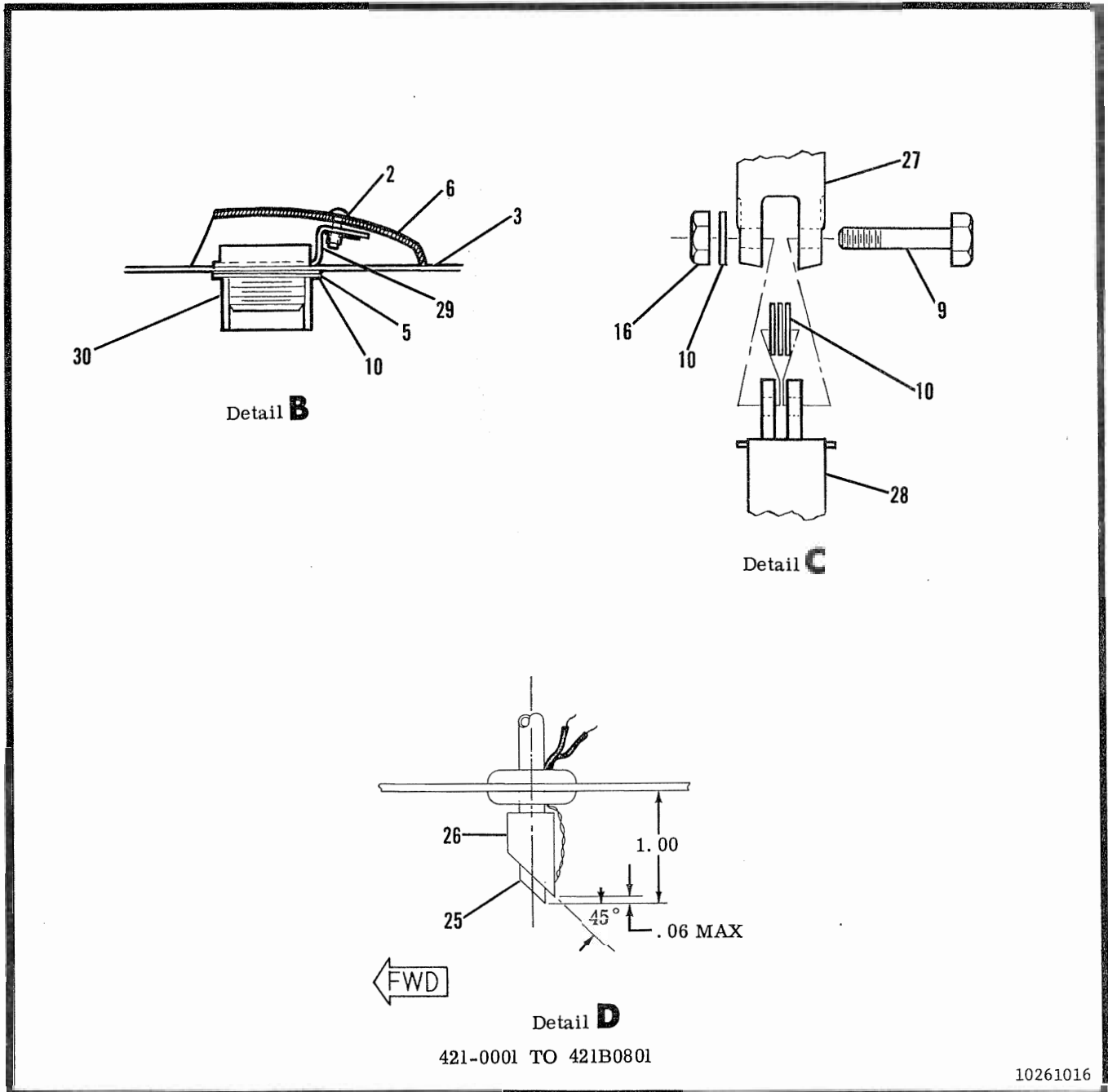


Figure 11-2. Main Fuel Tank Installation (Sheet 2)

b. Mix Sealant MIL-S-8802 per manufacturer's instructions and apply with a spatula over all seams, rivets, fittings and possible leak areas.

c. Inspect tank as follows:

1. Seal off all access holes in tanks. Close vent hole by covering inside with tape.
2. Saturate a clean rag with 25 cubic centimeters of household ammonia. Insert rag in fuel tank and close filler cap.
3. Pressurize fuel tank to a maximum of 2 psi.
4. Saturate a large clean cloth with indicated solution (1/2 gallon distilled water, 1/2 gallon denatured alcohol, and 1/2 ounce of phenolphthalein crystals or powder) and spread smoothly on surface of tank.
5. A leak will appear as a pink spot on the cloth. Repair all leaks and repeat testing until entire tank surface has been tested.

WARNING

Remove tape from filler cap, rag from inside fuel tank, and allow fuel tank to air out before using.

Installation of Main Fuel Tank. (See figure 11-2.)

The installation procedure is the same for either main fuel tank. For installation of main fuel tanks, reverse removal procedure.

CAUTION

If vent scoop is installed; lower fairing, tail cap and drip fence must be sealed with Pro-Seal 890 to prevent entry of fuel to wing structure.

NOTE

Torque main tank mounting bolts to 50 ± 10 inch-pounds.

SNIFFLE VALVE (See figure 11-2.)

The snuffle valve is located in the top of each main tank aft of the filler cap. This valve will vent the main tank should the overboard vent become clogged or obstructed.

Removal Snuffle Valve. (See figure 11-2.)

The removal procedures given pertain to either main tank.

CAUTION

Care should be taken to guard against foreign matter entering the tank.

- a. Defuel main tip tank in accordance with defueling procedures.
- b. Remove screw securing cover.
- c. Remove tip tank filler cap in accordance with removal procedure.
- d. Holding top half of valve, remove bottom of

- valve, washer and gasket.
- e. Remove snuffle valve.

Installation of Snuffle Valve. (See figure 11-2.)

The installation procedure of the snuffle valve is the reversal of the removal procedures.

MAIN TANK FUEL TRANSFER PUMP.
(421B0001 and ON)

One main tank fuel transfer pump is mounted on the aft side of each main tank rear bulkhead. The function of these pumps is to transfer fuel from the forward end of the main tanks to the center baffle area, where it is picked up and routed to the engine by either the engine-driven pump or the auxiliary fuel pump.

Removal of the Main Tank Fuel Transfer Pump.
(See figure 11-3.)

The removal procedure is the same for either main tank fuel transfer pump.

- a. Make sure fuel selector handles are OFF.
- b. Defuel main tank in accordance with Section 2.
- c. Remove tail cap assemblies from wing main fuel tanks by removing attaching screws.
- d. Disconnect electrical wiring.
- e. Disconnect fuel lines from pump.
- f. Remove two nuts attaching pump to bulkhead and remove pump from aft end of main tank.

Disassembly of Main Tank Fuel Transfer Pump.
(See figure 11-2A.)

NOTE

The interrupter end of the main tank fuel transfer pump is sealed with air removed and an atmosphere of a special dry gas injected. Should any of the electrical components become inoperative, the fuel pump must be replaced. The gas seal is located in the center of the mounting bracket and no attempt should be made to break this seal, as it would render the pump useless.

- a. Hold the pump body securely in one hand and release the bottom cover from the bayonet fittings by rotating it counterclockwise with a 5/8 inch wrench.
- b. Remove the gasket from the cover.
- c. Carefully remove the filter screen.
- d. Remove the three screws that hold the plunger spring cup to the pump body.
- e. Remove the gasket and plunger spring.
- f. Carefully withdraw the plunger from the pump body. Do not drop or mutilate the plunger.

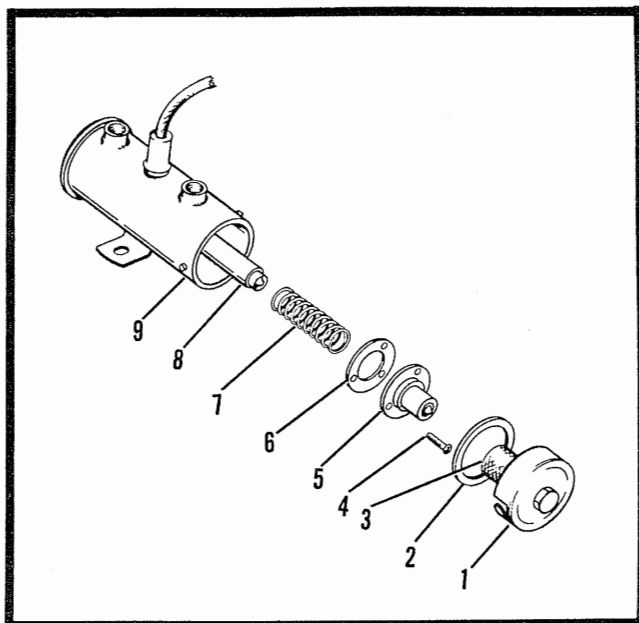
Cleaning and Inspection of Main Tank Fuel Transfer Pump Parts.

- a. Wash the plunger assembly in Stoddard Solvent or gasoline. If it fails to become thoroughly clean or

if any rough spots are present, dress the surface carefully with crocus cloth. Rinse thoroughly to remove all foreign material.

b. Dip the pump body in clean solvent, shake it lightly, then remove it and dry with compressed air.

c. Blow out the plunger tube with compressed air and check for any rough spots, deposits or foreign material. If not smooth, wrap a piece of cloth around a wood dowel, dip the cloth in Stoddard Solvent (Federal Specification P-D-680), and swab the plunger tube until clean.



1. Bottom Cover	6. Gasket
2. Cover Gasket	7. Plunger Spring
3. Filter Screen	8. Plunger
4. Screw	9. Pump Body
5. Plunger Spring Cup	

Figure 11-2A. Main Transfer Pump

d. Rinse remaining parts in the solvent and dry with compressed air. Exercise care when drying the screen (3) to prevent damage.

e. Inspect all parts visually for damage.

f. Inspect the fuel pump electrical resistance by connecting an ohmmeter between the connector terminal and ground on the pump housing. Resistance should be between 19.0 and 19.5 ohms. If the resistance is not within limits, replace the pump assembly.

Assembly of Main Tank Fuel Transfer Pump.

a. Insert the plunger assembly (8) in the tube with the buffer-spring end first. Check for proper fit by slowly raising and lowering the plunger in the tube; it should move freely without any tendency of sticking. A click should be heard each time the plunger approaches the top of the tube. If this click cannot be heard, the interrupter assembly in the sealed portion of the pump is not functioning properly, and the pump assembly must be replaced.

b. Install the plunger spring (7).

c. Place the spring cup gasket (6) in position on the plunger spring cup (5) and carefully attach this assembly to the pump body (9), with the three screws (4). Tighten screws securely.

d. Carefully install the screen (3), place cover gasket (2) in position in cover (1) and attach the cover to the pump body (9).

e. Hold the pump body securely with one hand and tighten the cover (1) into place on the pump body bayonets with a 5/8 inch open-end wrench or box socket.

Installation of Main Tank Fuel Transfer Pump. (See figure 11-3.)

The installation procedure is the same for either main tank fuel transfer pump.

- Install pump to bulkhead.
- Connect fuel lines to pump.

CAUTION

Observe "IN" and "OUT" markings on pump relative to lines being connected for correct installation. Outlet port of pump must be to the top of pump.

- Connect electrical wiring.
- Perform following operational check of transfer pump:
 - Pour approximately 5 gallons of fuel into main tank.
 - Turn master switch ON.
 - Observe that pump is functioning properly.

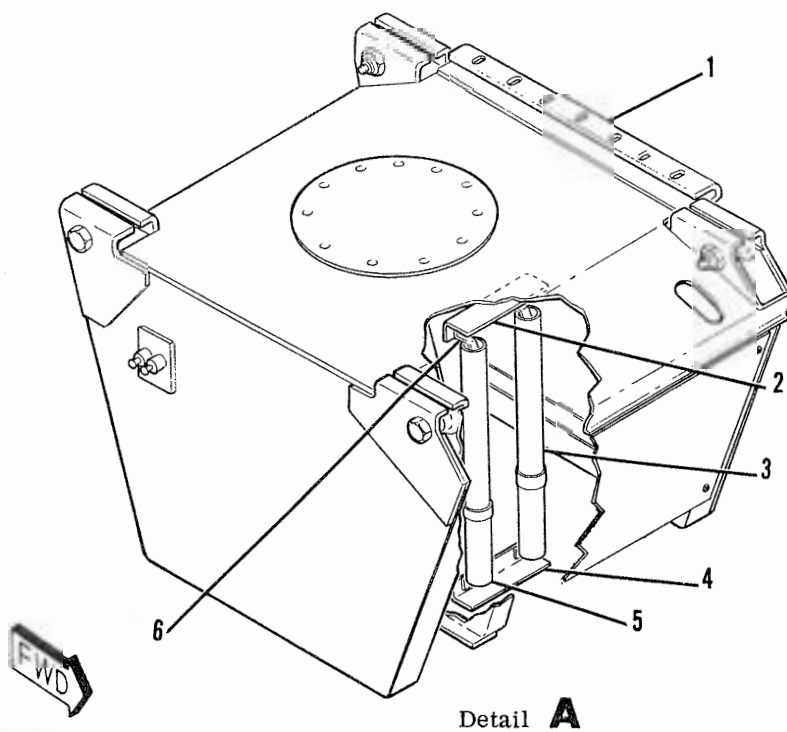
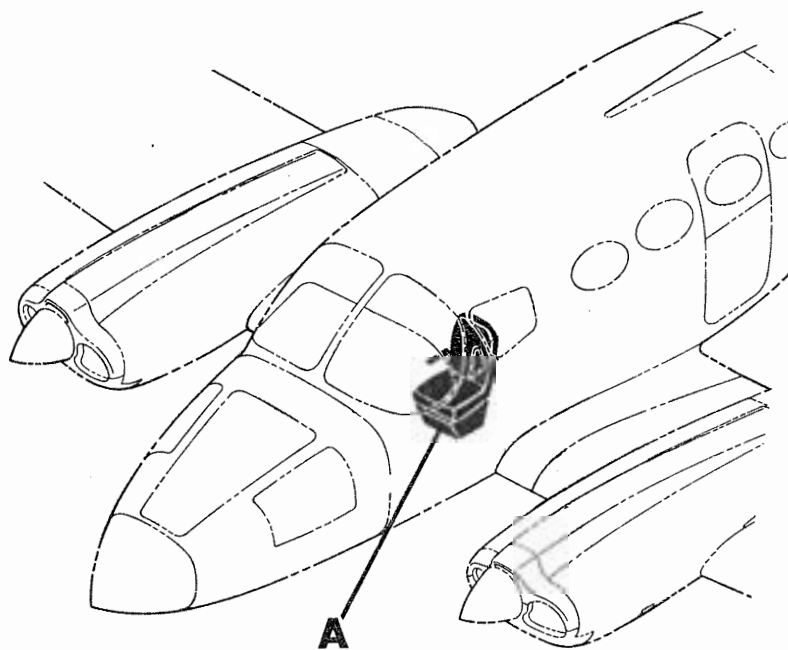
NOTE

Transfer pump must be pumping from forward section of main tank to center baffle area.

- Install tail cap assemblies to main fuel tank.
- Refuel aircraft.

AUXILIARY FUEL PUMP.

One auxiliary fuel pump is installed in the bottom of each main tank. These pumps are submerged, electrically controlled by three switches. The prime



421A0001 AND ON

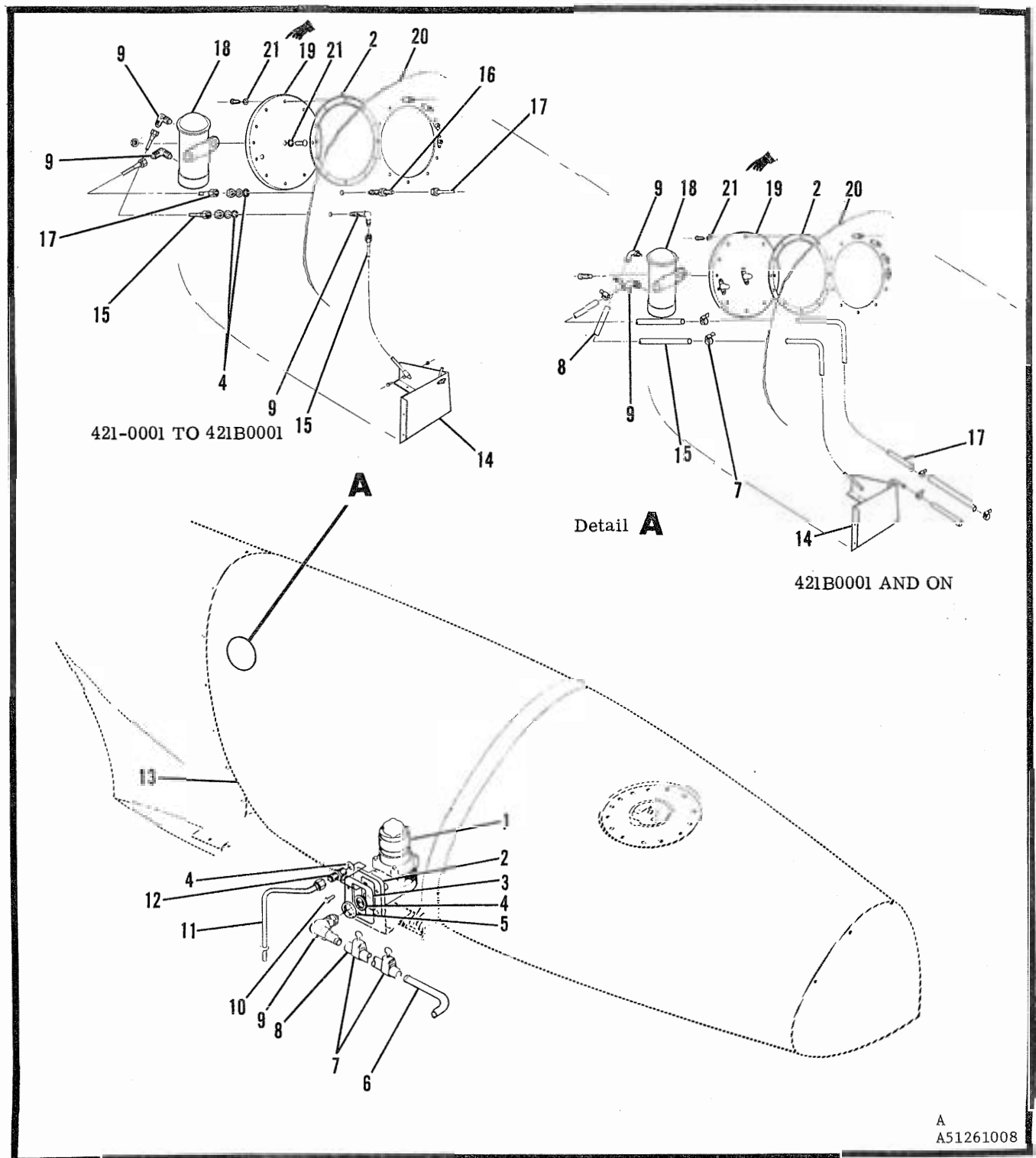
Detail **A**

- 1. Seat Support
- 2. Clip Assembly

- 3. Resistor
- 4. Clip Assembly

- 5. Resistor
- 6. Mounting Bracket

Figure 11-2B. Auxiliary Fuel Pump Resistors



1. Auxiliary Fuel Pump	8. Hose	15. Fuel Line (Transfer Outlet)
2. Gasket	9. Elbow	16. Union
3. Doubler	10. Bolt	17. Fuel Line (Transfer Inlet)
4. O-ring	11. Fuel Pump Drain Line	18. Main Fuel Transfer Pump
5. Nut	12. Nipple	19. Access Plate
6. Fuel Supply Line	13. Fuel Tank	20. Aft Bulkhead
7. Clamp	14. Baffle	21. Stat-O-Seal

Figure 11-3. Auxiliary Fuel and Transfer Pumps Installation

switch is a momentary on, center off switch. When the prime switch is placed in the left position, the left auxiliary pump provides priming for the left engine. When the prime switch is placed in the right position, the right auxiliary pump provides priming for the right engine. During the priming operation, the auxiliary pumps operate at high speed. The auxiliary pump switches are a two-position center off switch. When placed in the LOW position, the auxiliary pump and also the auxiliary tank in-line fuel pump provides pressure for purging. When the auxiliary pump switch is placed in the ON position, the auxiliary pump operates at low speed. In case of an engine-driven fuel pump failure, the auxiliary pump will automatically operate at high-speed. Prior to switching to auxiliary tanks, place the auxiliary pump switch in the LOW position. During take-off and landing, the auxiliary pump switch is placed in the ON position.

Removal of Auxiliary Fuel Pump. (See figure 11-3.)

The removal procedure is the same for either auxiliary fuel pump.

- Make sure fuel selector handles are OFF.
- Defuel main tank in accordance with Section 2.
- Remove wing fairings.
- Disconnect electrical wiring.
- Remove fittings, lines, and hoses required.
- Remove tail cap, rear access plate and gasket.
- Remove the four auxiliary pump mounting bolts, and remove pump from inside the fuel tank.

Installation of Auxiliary Fuel Pump.

The installation procedure is the same for either auxiliary fuel pump. For installation of auxiliary fuel pump, reverse removal procedures as outlined in preceding paragraph.

NOTE

Anytime the auxiliary fuel pump has been replaced or altered the auxiliary fuel pump low adjustment must be performed.

Auxiliary Fuel Pump Low Adjustment.

- Fill main tank with proper grade of fuel (see Section 2).
- Install a calibrated fuel pressure gage in the engine-driven fuel pump inlet line by use of a tee, hose and unions.
- Place fuel selector valve handles to main tanks.
- Start both engines and allow to warm-up.
- Set engine being adjusted to 450 rpm and the opposite engine to 1250 rpm with all electrical equipment turned off to insure maximum bus voltage.
- Position auxiliary fuel pump to LOW position for engine being checked. The fuel pressure gage should indicate $5.5 \pm .25$ psi.
- If fuel auxiliary fuel pump pressure is not $5.5 \pm .25$ psi, adjust as follows:
 - Remove pilot's seat.

- On aircraft 421A0001 and On, adjust resistor until required auxiliary fuel pump pressure is obtained (see figure 11-2B).

NOTE

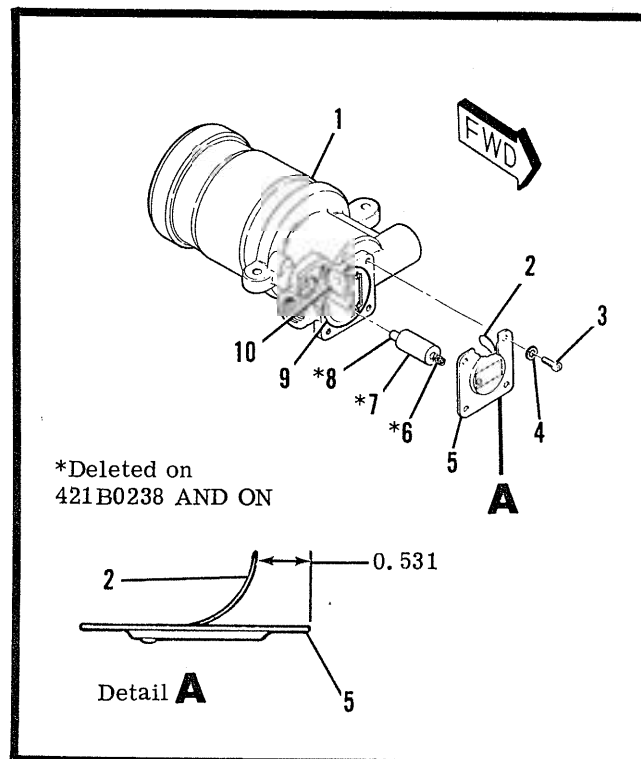
The left resistor is for the left auxiliary fuel pump and the right resistor is for the right auxiliary fuel pump.

- On aircraft 421-0001 to 421A0001, remove left console panel and adjust resistor until required auxiliary fuel pump pressure is obtained (see figure 14-2).

NOTE

The upper resistor is for the left auxiliary fuel pump and the lower resistor is for the right auxiliary fuel pump.

- Turn all switches OFF, place fuel selector valve handle to OFF position.
- Replace left console side cover and install pilot's seat.
- Remove test pressure gage.



1. In-line Fuel Pump	5. Spring
2. Leaf Spring	7. Filter
3. Screw	8. Pilot
4. Lockwasher	9. Seal Ring
5. Relief Valve Cover	10. Bypass Valve

Figure 11-3A. Auxiliary Tank In-Line Fuel Pump Filter Installation

AUXILIARY WING CELLS

The auxiliary fuel system consists of two wing cells in each wing on standard aircraft. These cells are synthetic rubber, interconnected fuel cells located outboard of the nacelle in each wing, having a combined capacity of 36.5 U. S. gallons. On the optional fuel system, there is another fuel cell installed just outboard of the standard auxiliary cells and in interconnected to provide a combined capacity of 50 U. S. gallons in each wing. When the optional tank is installed, the fuel filler is located outboard allowing a greater fuel capacity in each wing. A finger strainer is provided at the fuel outlet. Fuel is fed to the selector valve through an auxiliary tank in-line fuel pump. The auxiliary fuel system has a separate fuel quantity indicating system and each cell has a sending unit calibrated for either a standard fuel system or a optional system. Located on the bottom of each inboard wing cell, there is a drain valve for draining moisture and sediment.

Removal of Auxiliary Wing Cells. (See figure 11-4.)

Removal procedure is the same for either wing outboard and center cells.

- a. Fuel selector valve handles - OFF.
- b. Defuel main tank in accordance with Section 2.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent the accumulation of such fuel.

- c. Remove top access covers on the upper surface of the wing and the bottom access covers to gain access to fuel outlet connection and fuel quantity sending units.

NOTE

It may be necessary to drill off the access hole doublers to gain access to the fuel lines.

- d. On inboard fuel cells, remove safety wire and bolts from the inner bar, closing the fuel cells and interconnects, clamps and lines.
- e. Disconnect outlet line and remove finger strainer from cell.
- f. Remove and tag fuel quantity sending units wires.
- g. On the inboard fuel cell, remove the five bolts securing the sending units to the inboard wing rib and remove the fuel quantity sending unit.
- h. Remove two screws securing drain valve adapter, then thru the top access holes, disconnect the bayonet fasteners and carefully remove the fuel tank, using care not to puncture or tear the bladder.

CAUTION

During all defueling, tank purging, and tank repairing operations, two ground wires, from different points on the aircraft to separate approved grounding stakes, shall be used to prevent ungrounding of the aircraft due to accidental disconnecting of one ground wire.

- i. On the two outboard fuel cells, thru the bottom access in the leading edge, remove the fuel quantity sending unit wires, then remove the fuel quantity sending unit. Refer to "Removal of Fuel Quantity Sending Unit Wing Cell" paragraph.
- j. Remove top access cover and filler cap assembly.
- k. Disconnect interconnects and clamps.
- l. Disconnect bayonet fasteners and carefully remove the fuel cell thru the top access hole, using care not to puncture or tear bladder.

NOTE

Retain sending unit gaskets for replacement if they are not damaged.

Inspection and Repair of Auxiliary Wing Fuel Cells.

- a. Inspect filler cap gasket. If crushed or damaged, replace filler gasket. Inspect fuel cell for cuts, tears, abrasions and deterioration.
- b. Purge in accordance with Section 2.
- c. Repair in accordance with repair procedures, Section 16.

Inspection of Fuel Cell Cavity Following Fuel Cell Removal.

- a. Inspect carefully the interior of the fuel cell cavity and cell bulkheads or supports for possible damage or corrosion.
- b. All internal rivets and protrusions must be protected by the proper type of tape.

Installation of Wing Cells. (See figure 11-4.)

Installation procedure is the same for either wing.

- a. Make sure the cell cavities are free from dirt, rough edges, and rivets.
- b. On the inboard fuel cell, carefully work the tank thru the access hole and position in place. Then fasten the bayonet fasteners.
- c. Install fuel quantity sending unit as shown in figure 11-5.
- d. Install finger strainer, connect outlet lines and install drain valve.
- e. On the outboard wing cells, carefully work the tanks thru access hole and into position.
- f. Pull the fuel cell aft far enough to install the fuel quantity sending unit.
- g. Install the fuel quantity sending unit in cell, as shown in figure 11-5, with five screws; then position gasket between spar and cell unit and secure sending unit to front spar; connect the fuel quantity sending unit wires.
- h. Install bayonets in position, and install interconnects and clamps in each cell. Then install the two screws in drain valve adapter on the underside of the wing.
- i. Install filler cap and adapter assembly on outboard fuel cells.
- j. Close inboard fuel cells as shown. Torque bolts (12) 75 to 85 inch-pounds. Safetywire bolts and install covers.

AUXILIARY TANK IN-LINE FUEL PUMP

The auxiliary tank in-line fuel pump supplies fuel from the auxiliary tank to the fuel injection pump and

prevents vapor from forming in the auxiliary fuel lines. The auxiliary tank in-line fuel pump operates simultaneous with the auxiliary fuel pump when the auxiliary fuel pump switch is placed in the "LOW" position. The fuel pressure setting is preset at 5 PSI and cannot be adjusted.

Removal of Auxiliary Tank In-Line Fuel Pump. (See figure 11-6.)

The removal procedure is the same for either auxiliary tank in-line fuel pump.

- a. Place fuel selector valve handles in the OFF position.
- b. Defuel auxiliary tanks in accordance with Section 2.
- c. (See figure 1-2.) Remove access plates 47, 48, and 63.
- d. Tag and disconnect electrical wiring.
- e. Disconnect fuel lines (7) and (42) and drain line (48).
- f. Loosen nut on band clamp securing pump to pump mounting bracket.
- g. Slip fuel pump from band clamp.

Installation of Auxiliary Tank In-Line Fuel Pump.

The installation procedure is the same for either auxiliary tank in-line fuel pump. For installation of auxiliary tank in-line fuel pump, reverse removal procedures as outlined in preceding paragraph.

Removal of Auxiliary Tank In-Line Fuel Pump Filter. (421-0001 to 421B0238) (See figure 11-3A.)

The removal procedure is the same for either auxiliary tank in-line fuel pump filter.

- a. Place fuel selector valve handles in the OFF position.
- b. Defuel auxiliary tanks in accordance with Section 2.
- c. (See figure 1-2.) Remove access plates 47, 48, and 63.

NOTE

Mark or scribe a line on applicable in-line fuel pump relief cover (5) and pump housing to insure original position for reinstallation of relief valve cover.

- d. Loosen screws (3) attaching relief valve cover to pump (1).

CAUTION

Be sure to loosen all four screws before removal thus to prevent damage to leaf spring (2) attached to relief valve cover (5).

- e. Remove screws (3), lockwashers (4), and relief valve cover (5) by pulling cover gently forward and inboard until clear of pump housing to prevent damage to leaf spring (2).

Cleaning and Inspection of Auxiliary Tank In-Line Fuel Pump Filter (421-0001 to 421B0238) (See figure 11-3A.)

- a. Cleaning.

1. Clean filter (7) with a suitable solvent and jet of low pressure dry air not to exceed 10 PSI.

- b. Inspection.

1. Inspect filter for any damage to main filter body, pilot (8), and spring (6).

NOTE

If there is any damage to any portion of filter (7), replace filter.

2. Inspect leaf spring (2) for a dimension not to exceed 0.531 inch as shown in illustration or less than 0.500 inch. The leaf spring may be bent slightly to meet the requirement when necessary.

3. Inspect seal ring (9) for damage, replace if necessary.

Installation of Auxiliary Tank In-Line Fuel Pump Filter (421-0001 to 421B0238) (See figure 11-3A.)

The installation procedure is the same for either auxiliary tank in-line fuel pump filters.

- a. Align marked lines of relief valve cover (5) and in-line fuel pump housing to insure original position of cover.
- b. Position relief valve cover (5) on face of pump housing, aligned with coil spring (6) of installed filter and leaf spring (2) of cover in contact with bypass valve (10) of pump.
- c. Secure relief valve (5) with screws (3) and lockwashers (4).

NOTE

Tighten screws (3) finger-tight before using screwdriver. Tighten screws (3) to approximately 15 inch-pounds torque.

- d. Refuel auxiliary tanks partially.
- e. Place fuel selector valve handles in the ON position and inspect relief valve cover plate (5) on in-line fuel pump for leaks while pump is operating.
- f. Complete refueling if no leaks occur.
- g. If leaks occur, place fuel selector in OFF position, defuel in accordance with Section 2, remove cover plate (5) and check that filter (7) is in proper position, and also that seal ring (9) is properly installed.
- h. Reinstall cover plate (5), refuel aircraft, and place fuel selector valve in ON position.
- i. (See figure 1-2.) Install access plates 47, 48, and 63.

FUEL INDICATOR SYSTEM.

On aircraft 421-0001 to 421B0001 the main and auxiliary fuel systems have individual indicators and each fuel tank has an individual sending unit. The two systems are float arm actuated, variable resistor type sending units, powered by the aircraft electrical system, which sends an electrical signal to the fuel quantity indicators in the cabin. On aircraft 421B0001 and ON, a capacitance type fuel quantity indicating system, that is compensated for specific gravity and reads in both pounds and gallons, is in-

stalled. The system components include an indicator, a fuel indicator selector switch mounted on the instrument panel, a signal conditioner mounted on a rib just outboard of each engine nacelle and six tank units mounted in each main tank and each auxiliary fuel cell. Each tank unit consists of two concentric electrodes. The inner electrode consists of a main body of insulating material with two conducting surfaces, separately insulated around the outside face of the tank unit. One conducting surface is grounded and the other surface is connected to the signal conditioner input bridge circuit. The outer electrode is an aluminum tube coated with insulating material on the outside. Openings in the unit allow fuel to flow between electrodes to the same level as that in the tank. Fuel between the electrodes is the variable dielectric factor of the capacitor. Capacitance of

the tank units which are part of the system bridge circuit, provide a continuous signal to the signal conditioner and is amplified to the indicator. The indicator is a dual indicator providing a left and right hand indication for the main fuel tanks as well as left and right hand indication for the auxiliary fuel cells. When the fuel selector handle is placed in the main position, the fuel quantity indicator will indicate fuel in the main tanks. When the fuel selector handle is placed in the auxiliary position, an indicator light located under the indicator will be turned on, indicating that the selector valve is in the auxiliary position and the fuel quantity indicator will indicate auxiliary fuel. An override switch is provided for monitoring the fuel quantity in the opposite system. When the fuel selector handles are placed in the main position and the override switch is pressed, the indicator

Troubleshooting the Fuel Quantity Indicator System. (The troubleshooting chart is the same for either system.)

TROUBLE	PROBABLE CAUSE	CORRECTION
INCORRECT QUANTITY INDICATION	Defective wiring. Defective sending unit.	Replace or repair defective wiring. Remove wires at the sending unit and attach an ohmmeter to unit terminals. Operate float by hand. If the unit is good, the meter should read approximately 15 ohms when empty and 180 ohms when full.
NO INDICATION ON GAGE AND TANK IS FULL	Circuit breaker out. Defective circuit breaker. 421B0001 AND ON	Reset circuit breaker. Replace circuit breaker.
POWER SWITCH ON POINTER BELOW 0	No power. Defective indicator. Open wiring in harness or probe. Defective probe.	Use a voltmeter to check that power is being applied to the system. Substitute a known good indicator. If proper indication is obtained, original indicator is defective. Use an ohmmeter to check continuity. Verify probe is defective using Field Calibration Unit Test Box.
POWER SWITCH ON POINTER ABOVE 310 LBS. (INTO STOP)	Open HiZ line to probe. Open HiZ to compensator. Defective tank unit. Defective indication. Defective tank fuel valve switch and/or selector switch relays.	Use an ohmmeter to check for open. Use an ohmmeter to check for open. Check for defective probe. Check for defective indicator. Check switch and relays with ohmmeter.

TROUBLE	PROBABLE CAUSE	CORRECTION
INACCURATE FUEL	Defective indicator.	Check for defective indicator.
	Contaminated probe.	Check for defective probe.
	Capacitance leakage in wiring.	Refer to wiring manual. Check all connections, shields and components.
POWER ON AND BOTH POINTERS AT MID SCALE REGARDLESS OF FUEL LEVEL	LoZ to ground short.	Use ohmmeter to check for short on LoZ leads.
	Defective indicator.	Check for defective indicator.
POWER ON AND POINTER READS APPROXIMATELY 80 TO 100 LB HIGH	Defective fuel valve switch.	Use ohmmeter to check switch.
	Defective selector switch relay.	Use ohmmeter to check relay.
POWER ON AND POINTERS CHANGE READING WHEN OTHER AVIONICS ARE OPERATED	HiZ shield shorted to ground.	Use ohmmeter to check for short between HiZ and shield (with indicator disconnected).
	Defective indicator.	Check for defective indicator.
POWER ON AND POINTER POSITION SENSITIVE TO BATTERY VOLTAGE	Defective indicator.	Check for defective indicator.
	Battery voltage too low.	Check battery voltage.
ERRATIC INDICATOR READINGS	Defective indicator.	Check for defective indicator.
	Defective harness.	Check all grounds.
	Defective probe.	Check for defective probe.
STICKY POINTER	Defective tank selector.	Check switch with ohmmeter.
	Defective indicator.	Replace indicator.

lights will light along with the indicator reading auxiliary fuel quantity. When the fuel selector handles are placed in the auxiliary position and the override switch is pressed the indicator will read main fuel quantity.

NOTE

Fuel quantity system is solid state. There are no moving parts.

Removal of Fuel Quantity Sending Unit. Wing Cells. (421-0001 to 421B0001)

The removal of the optional fuel cell (extreme outboard) fuel quantity sending unit is the same for either wing; likewise, the removal of the inboard and auxiliary cells fuel quantity sending units are the same for either wing.

- a. Fuel shutoff valves handles - OFF.
- b. Defuel main tank in accordance with Section 2.

CAUTION

During all defueling, tank purging and tank repairing operations, two ground wires, from different points on the aircraft to separate approved grounding stakes, shall be used to prevent ungrounding of the aircraft due to accidental disconnecting of one ground wire.

- c. On the inboard fuel cells, remove lower access.
- d. Disconnect fuel quantity sending unit wiring.
- e. Remove the five bolts securing the sending unit to the wing rib and remove sending unit.

WARNING

Residual fuel draining from fuel cells is a fire hazard. Use care to prevent the accumulation of such fuel.

- f. To remove the fuel quantity sending unit on the auxiliary fuel cell, remove lower access covers.
- g. Remove and tag fuel quantity sending unit wires.
- h. Remove the five bolts securing the fuel quantity sending unit to the front spar.
- i. Remove the clamps on the main fuel and vent lines if necessary and remove fuel quantity sending unit from cell.
- j. When removing the fuel quantity sending units on the optional fuel cells (extreme outboard, removal of the fuel quantity sending unit is accomplished as follows:
 1. Remove top access hole cover and filler.

2. Remove interconnects, clamps and bayonet fittings as necessary to pull the fuel cell aft far enough to remove sending unit.
3. Remove the five bolts securing fuel quantity sending unit to front spar.
4. Remove fuel quantity sending unit aft thru upper access panel.

Installation of Fuel Quantity Sending Unit. Wing Cells. (421-0001 to 421B0001)

The installation of the optional fuel cells fuel quantity sending units is the same for either wing; likewise, the installation of the auxiliary and inboard wing cell fuel quantity sending unit is the same for either wing.

- a. On the optional fuel cells, make sure wing cavity is free from dirt, rough edges, and protruding rivets; pull cell aft sufficiently to install fuel quantity sending unit.
- b. Install fuel quantity sending unit as shown in figure 11-5, Detail C.
- c. Install gasket and sending unit in position thru the front spar and secure with five bolts provided.
- d. Connect wires.
- e. Install bayonet fittings, interconnects and clamps, filler cap and adapter assembly.
- f. When installing the auxiliary fuel cell fuel quantity sending unit, place gasket on the sending unit and position unit in place forward of front spar.

NOTE

When installing fuel quantity sending unit, it may be necessary to loosen clamp on the main fuel lines in the leading edge of the wing.

- g. Secure fuel quantity sending unit to fuel cell through spar with five bolts, making sure bonding strap is placed under one of the bolts for sufficient ground.
- h. Connect wires.
- i. On the inboard fuel cell, place gasket and sending unit in position securing to wing rib with five bolts, making sure bonding strap is placed under one of the bolts for sufficient ground.
- j. Connect wires.

NOTE

After the removal and installation of fuel quantity sending units, the fuel cells should be checked for leaks. Service aircraft in accordance with Section 2 and allow to remain for a long enough period of time to insure cells are not leaking.

Removal of Fuel Quantity Sending Units - Main Tank. (421-0001 to 421B0001)

Either fuel quantity sending unit can be removed by the following procedure:

- a. Fuel shutoff valve handles - OFF.
- b. Drain fuel from main tank.
- c. Remove tail caps.
- d. Remove wires and tag.
- e. Remove fuel quantity sending unit.

Installation of Fuel Quantity Sending Unit - Main Tank (421-0001 to 421B0001)

Either fuel quantity sending unit can be installed by the following procedure:

- a. Install new gasket and sending unit; secure with five bolts.
- b. Connect wires.
- c. Install tail cap.

Fuel Quantity Sending Units Operational Check. (421-0001 to 421B0001)

- a. With the fuel tanks completely drained, place the quick-drain valves in the closed position.
- b. Turn battery switch to the ON position.
- c. Add 1 gallon of fuel to each tank (the amount determined as unusable fuel) and the fuel quantity indicator should read empty (E).
- d. Add fuel in five gallon increments until a total of 50 gallons has been added to each tank. Check fuel quantity indicator reading for each five gallons of fuel added.

Removal of Outboard, Auxiliary, and Inboard Fuel Cell Tank Units. (See figure 11-5.) 421B0001 and ON

The removal of the optional fuel cell (extreme outboard) fuel quantity tank unit is the same for either wing; likewise, the removal of the inboard and auxiliary cells fuel quantity tank units are the same for either wing.

- a. Defuel aircraft in accordance with Section 2.

CAUTION

During all defueling, tank purging and tank repairing operations, two ground wires, from different points on the aircraft to separate approved grounding stakes, shall be used to prevent ungrounding of the aircraft due to accidental disconnecting of one ground wire.

- b. (See figure 11-4.) On the extreme outboard optional cell, remove filler cap (1) and adapter assembly (2) from fuel cell.
- c. Tag and disconnect electrical bundles (17) from tank unit (18).
- d. Remove tank unit from clip.
- e. Working through filler cap access opening care-

fully remove tank unit (18) from fuel cell (6).

f. (See figure 11-4.) On the auxiliary fuel cell, if optional outboard cell is not installed, remove filler cap (1) and adapter assembly (2) from fuel cell. If optional outboard cell is installed, remove access cover (18) from auxiliary fuel cell.

g. Tag and disconnect electrical bundles (17) from tank unit (18).

h. Remove tank unit from clip.

i. Working through filler cap opening or access cover opening carefully remove tank unit (18) from auxiliary fuel cell (6).

j. (See figure 11-4.) On the inboard fuel cell, remove cover (7), support (10), outer bar (9), and inner bar (8) from inboard fuel cell.

k. Tag and disconnect electrical bundles (17) from tank unit (18).

l. Remove tank unit from clip.

m. Working through access opening carefully remove tank unit (18) from inboard fuel cell (6).

Installation of Outboard, Auxiliary, and Inboard Fuel Cell Tank Units. (See figure 11-5.) 421B0001 and ON

The installation of the optional fuel cell (extreme outboard) fuel quantity tank unit is the same for either wing; likewise, the installation of the auxiliary and inboard wing cell quantity tank units are the same for either wing.

- a. Reverse the removal procedures for installing tank units.
- b. Service fuel cell in accordance with fueling procedures and check for leaks.
- c. Perform the operational and calibration check in accordance with the Fuel Quantity System Operational Check and Calibration Procedure.

Removal of Main Fuel Tank Unit. (See figure 11-5.) (421B0001 and ON)

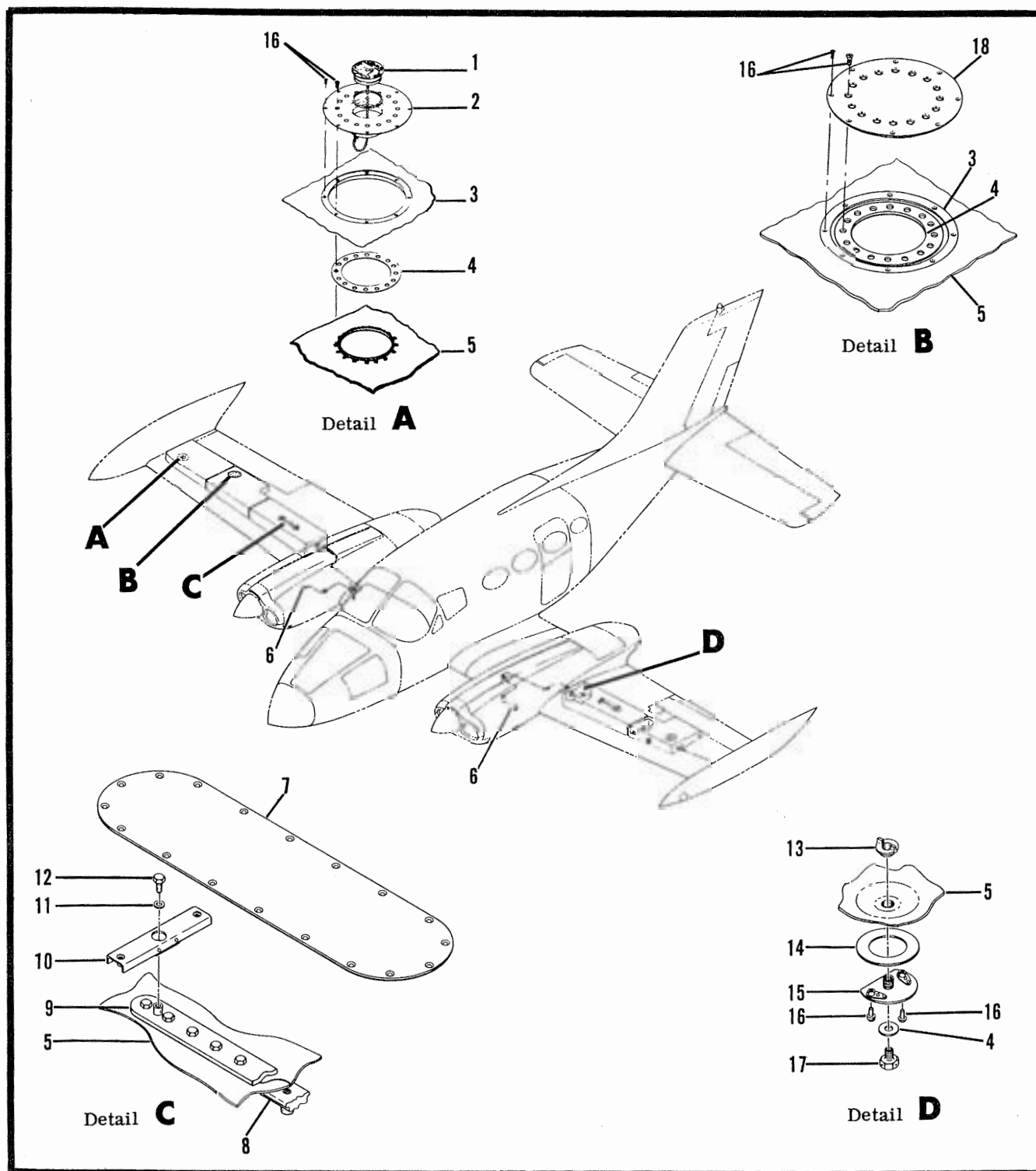
The removal procedure is the same for either main fuel quantity sending unit.

- a. Defuel aircraft in accordance with section 2.

CAUTION

During all defueling, tank purging and tank repairing operations, two ground wires from different points on the aircraft to separate approved grounding stakes shall be used to prevent ungrounding of the aircraft due to accidental disconnection of one ground wire.

- b. (See figure 11-2.) Remove filler cap (4) and gasket (5) from main fuel tank.
- c. Tag and disconnect electrical bundle (17) from tank unit (18).
- d. Remove four bolts attaching brackets (19) to bulkhead.
- e. Working through filler cap access opening, carefully remove tank unit (18) from fuel cell (6).

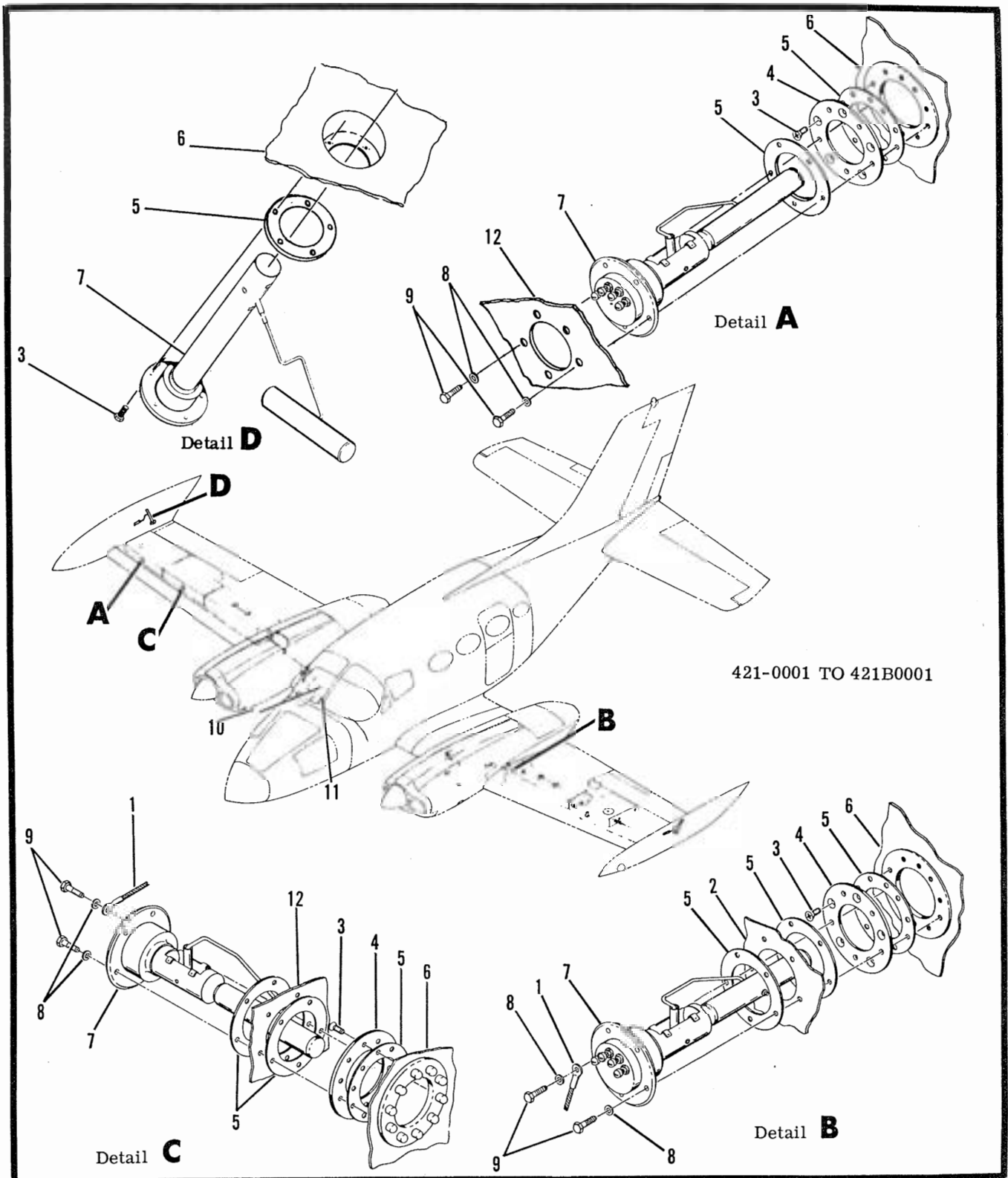


1. Filler Cap
2. Adapter Assembly
3. Wing Skin
4. Gasket
5. Fuel Cell
6. Fuel Injection Pump

7. Cover
8. Inner Bar
9. Outer Bar
10. Support
11. Washer
12. Bolt

13. Sleeve
14. Shield
15. Adapter
16. Screw
17. Drain Cock
18. Access Cover

Figure 11-4. Wing Fuel Cells

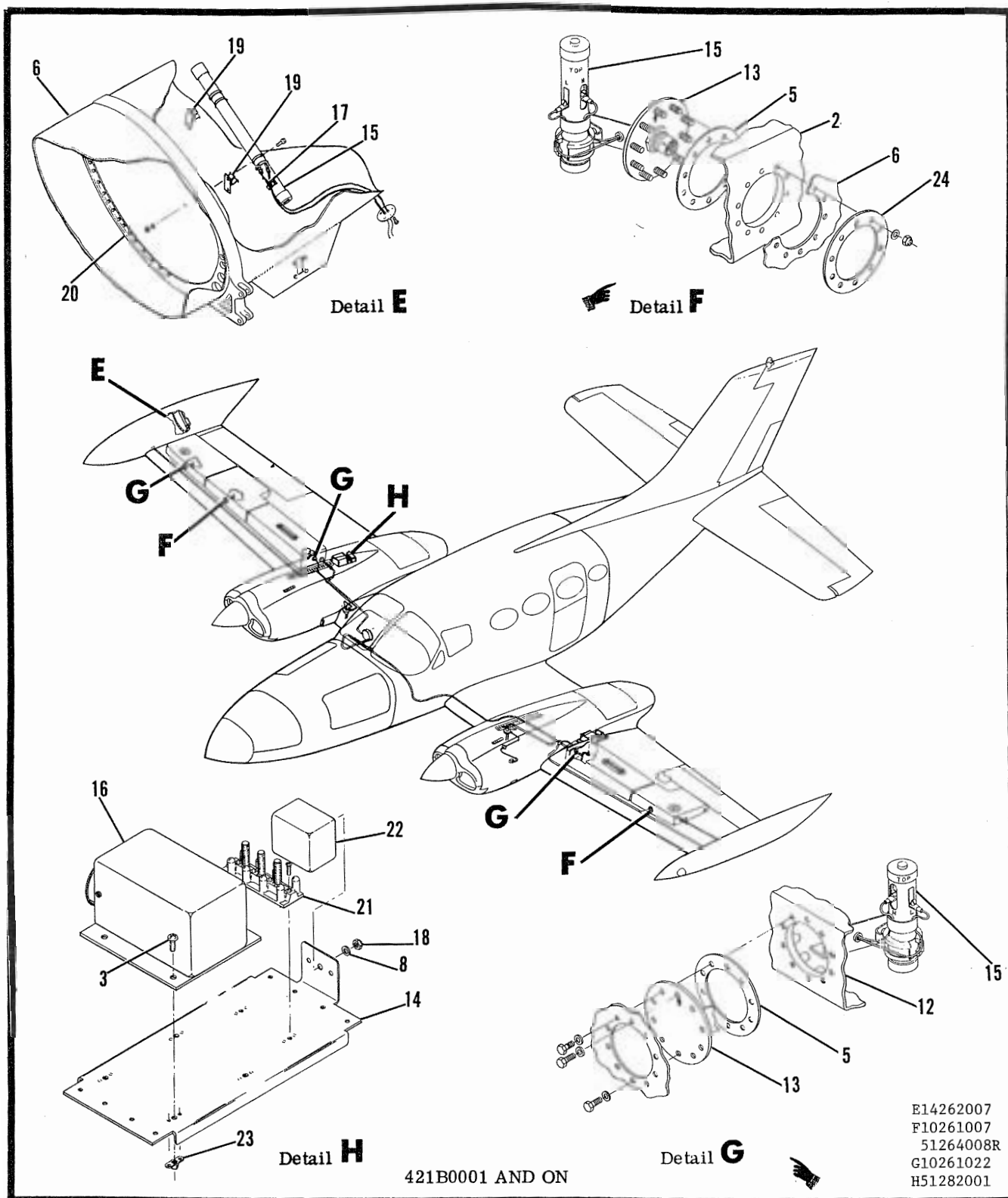


1. Bonding Cable
2. Wing Rib
3. Screw
4. Adapter Assembly

5. Gasket
6. Fuel Cell
7. Fuel Quantity Sending Unit
8. Washer

9. Bolt
10. Auxiliary Fuel Gage
11. Main Fuel Gage
12. Front Spar

Figure 11-5. Fuel Indicator System (Sheet 1 of 2)

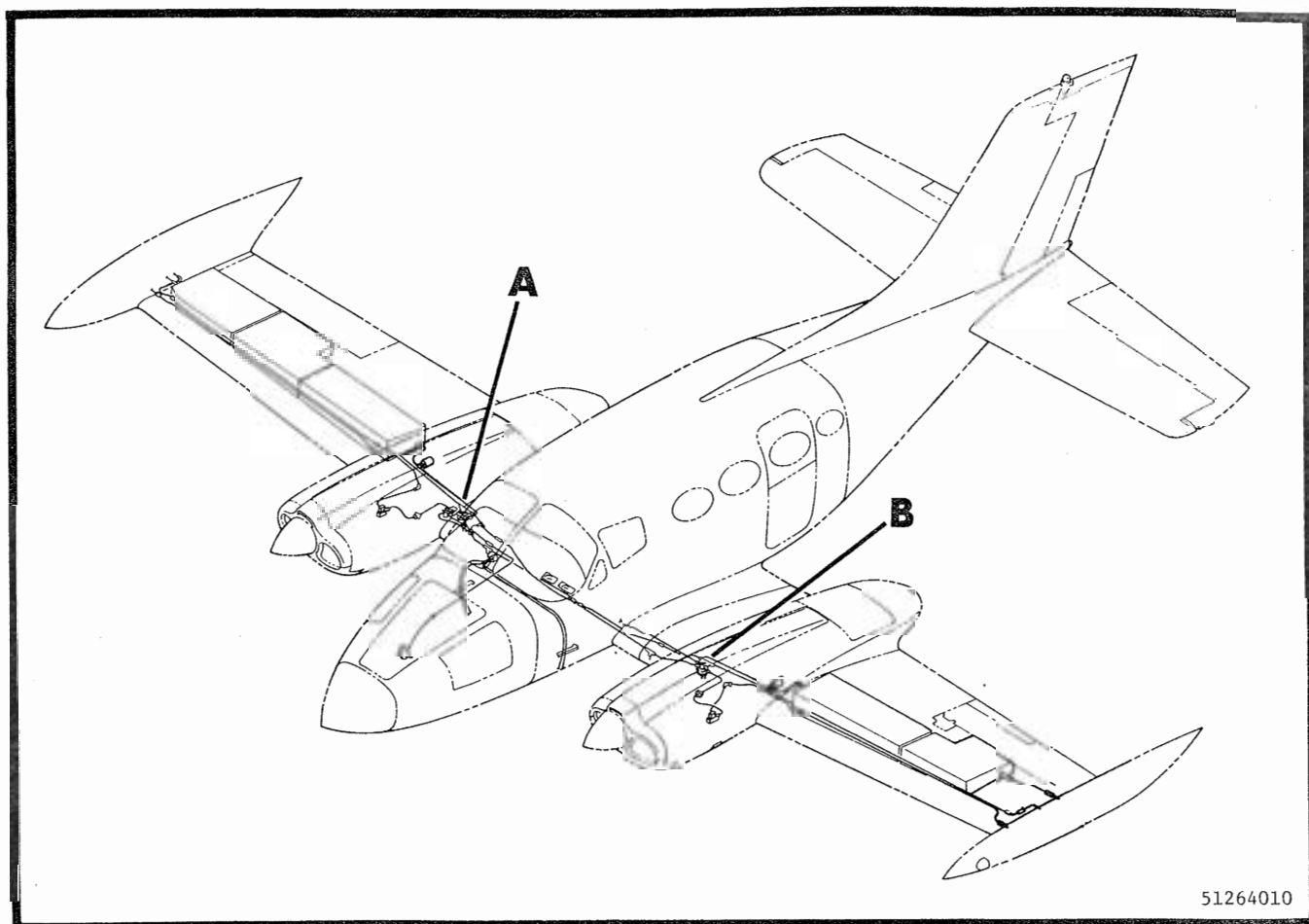


- 13. Bracket Assembly
- 14. Bracket
- 15. Sensor Unit
- 16. Signal Conditioner

- 17. Electrical Bundle
- 18. Nut
- 19. Tank Unit Bracket
- 20. Access Plate

- 21. Terminal Board
- 22. Relay
- 23. Nutplate
- 24. Doubler

Figure 11-5. Fuel Indicator System (Sheet 2 of 2)



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1. Line (crossover, selector valve to union) RH	21. Line (main fuel, selector valve to firewall) LH
2. Line (crossover, selector valve to union) LH	22. Line (main fuel, selector valve to firewall) RH
3. Line (crossover, selector valve to drain valve) LH	23. Line (heater fuel, tee to shutoff valve)
4. Line (crossover, selector valve to tee) RH	24. Line (heater fuel, shutoff valve to pump)
5. Line (auxiliary, selector valve to bulkhead elbow) LH	25. Line (heater fuel, pump to filter)
6. Line (auxiliary, selector valve to bulkhead elbow) RH	26. Line (heater fuel, filter to solenoid)
7. Line (auxiliary, bulkhead elbow to fuel pump) LH	27. Line (heater fuel, solenoid valve to heater)
8. Line (auxiliary, bulkhead elbow to fuel pump) RH	28. Shutoff Valve
9. Line (auxiliary vent, auxiliary tank to main tank) LH	29. Heater Fuel Pump
10. Line (auxiliary vent, auxiliary tank to main tank) RH	30. Fuel Filter
11. Line (vapor return, check valve to main tank) LH	31. Solenoid Valve
12. Line (vapor return, check valve to main tank) RH	32. Check Valve
13. Line (vapor return, firewall to check valve) LH	33. Selector Valve LH
14. Line (vapor return, firewall to check valve) RH	34. Selector Valve RH
15. Line (main fuel, main tank to union) LH	35. Tee
16. Line (main fuel, main tank to union) RH	36. Elbow
17. Line (main fuel, union to union) LH	37. Union
18. Line (main fuel, union to union) RH	38. Hose
19. Line (main fuel, union to selector valve) LH	39. Drain Valve
20. Line (main fuel, union to selector valve) RH	40. Strainer Assembly
	41. Auxiliary Tank In-Line Fuel Pump
	42. Line (auxiliary, pump to elbow) LH
	43. Line (auxiliary, pump to elbow) RH
	44. Line (crossover, tee to union) RH
	45. Line (crossover, union to union) RH
	46. Line (crossover, union to union) LH
	47. Line (heater fuel, pump to solenoid)
	48. Line (pump drain)

Figure 11-6. Fuel System Plumbing (Sheet 1 of 3)

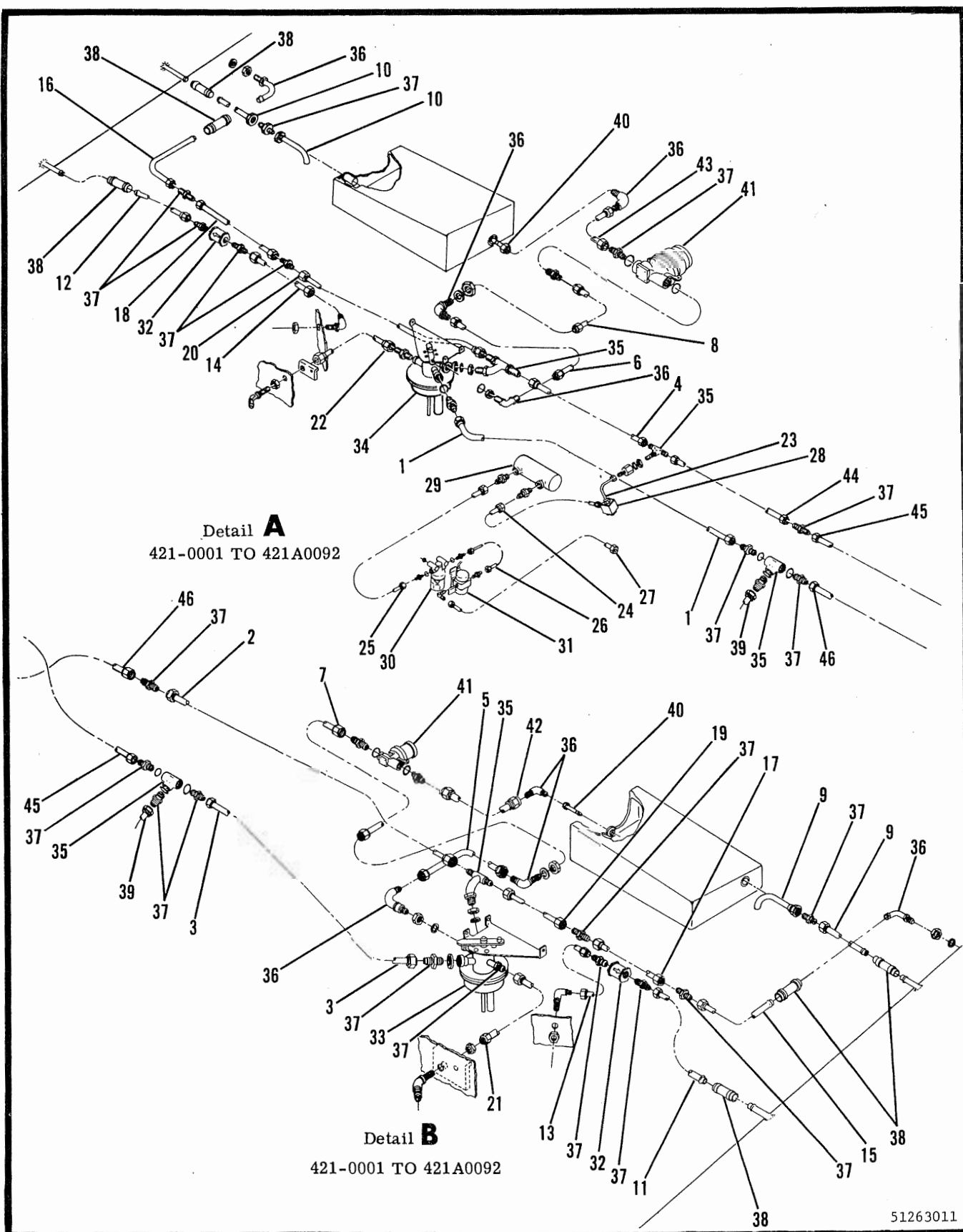


Figure 11-6. Fuel System Plumbing (Sheet 2)

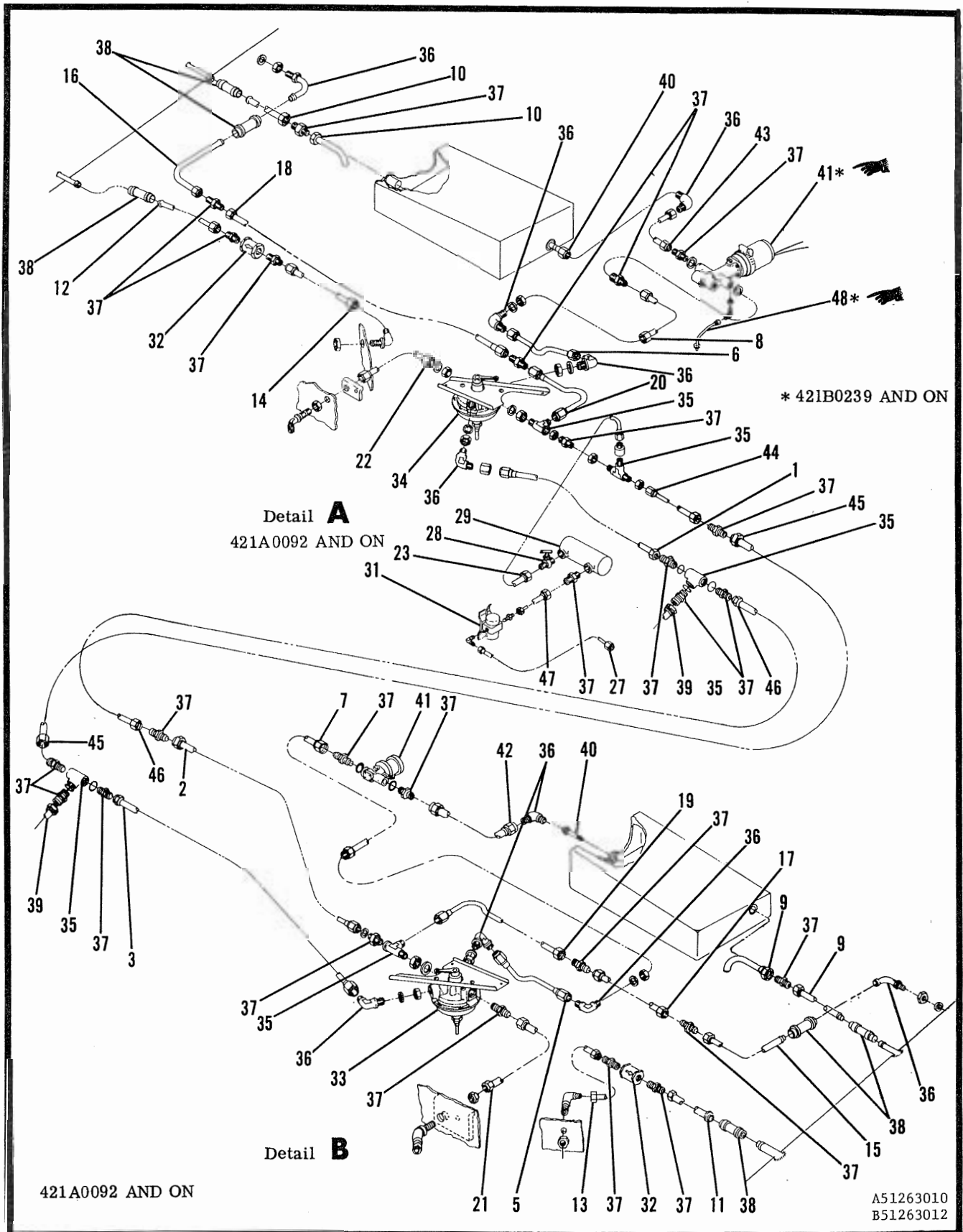


Figure 11-6. Fuel System Plumbing (Sheet 3)

Installation of Main Fuel Tank Unit. (See figure 11-5.) (421B0001 and ON)

The installation procedure is the same for either main tank unit.

- a. Install main fuel tank unit (17) in position and secure with brackets (19) and bracket bolts.
- b. Position electrical connector in main tank and secure with nut.
- c. Connect electrical plug to connector.
- d. (See figure 11-2.) Install filler cap (3) and gasket (5) to main fuel tank.
- e. Refuel main tanks
- f. Check for leaks.
- g. Check operation of fuel quantity indicating system.
- h. Check calibration in accordance with calibration procedures.

Removal and Installation of Signal Conditioner. (See figure 11-5.) (421B0001 and ON)

- a. Remove access plate (46, figure 1-2) to remove signal conditioner (16).
- b. Remove four screws and washers attaching the signal conditioner to bracket (14).
- c. Remove signal conditioner through access hole (48, figure 1-2).
- d. Install the signal conditioner by reversing the removal procedures.

Removal of Auxiliary Fuel Quantity Tank Units. (See figure 11-5.) (421B0001 and ON)

The removal procedure for the auxiliary fuel tank units is the same for either side.

- a. Remove the access cover located just outboard of the engine nacelle on the upper surface of the wing.
- b. Defuel aircraft in accordance with section 2.

CAUTION

During all defueling, tank purging and tank repairing operations, two ground wires from different points on the aircraft to separate approved grounding stakes shall be used to prevent ungrounding of the aircraft due to accidental disconnecting of one ground wire.

- c. Tag and disconnect electrical wires.
- d. Remove bolts securing the auxiliary fuel tank unit and carefully remove the unit from the aircraft.

WARNING

Residual fuel accumulation in the wing is a fire hazard. Use care to prevent the accumulation of such fuel.

Installation of Auxiliary Fuel Quantity Tank Unit. (See figure 11-5.) (421B0001 and ON)

The installation procedure for the auxiliary fuel
Change 6

quantity tank unit is the same for either left or right auxiliary fuel cell.

- a. Carefully position auxiliary fuel tank unit into cell and secure into place with bolts. Torque bolts to 50 ±5 inch-pounds.
- b. Connect electrical wires.
- c. Service fuel cell in accordance with fueling procedures and check for leaks.
- d. Replace cover plates and perform operational and calibration check.

Fuel Quantity System Calibration (421B0001 and On).

Two methods of calibrating the fuel quantity system are given. Dry Calibration and Alternate Calibration.

Dry Calibration is the preferred method, being the most accurate. Dry Calibration uses the actual tank units for Zero Calibration, this compensates for the tank unit and wiring harness tolerances. A fixed capacitance is added in parallel with the actual dry tank unit to represent the fuel in the tank to provide for calibration in the full condition.

To calibrate the fuel system with the Dry method, it will be necessary to fabricate a capacitance test box in accordance with Figure 11-6A or use the Field Calibration Unit Test Box. The parts for fabricating the capacitance test box may be purchased locally or through your Cessna Dealers' Organization. The Field Calibration Unit Test Box is designed for complete maintenance, troubleshooting and calibration, enabling the technician to measure capacitance of system, individual components, harness insulation breakdown, resistance of system components and substitute capacitance to simulate the tank sensors or actual fuel in the tank.

The Alternate method of calibrating the fuel quantity system may be accomplished without the capacitance test box. This method checks fuel temperature and density versus total capacitance of fuel. The Alternate method of calibration has a greater chance for error than the Dry Fuel System Calibration.

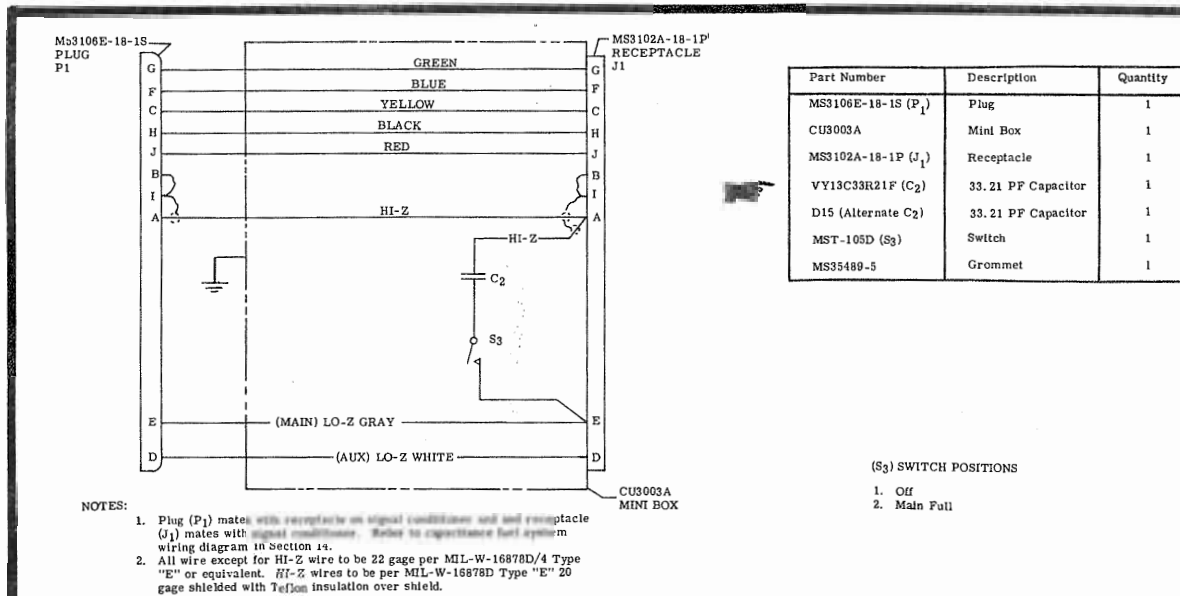
Dry Calibration.

- a. Defuel aircraft in accordance with Defueling Procedures in Section 2.

CAUTION

During all defueling and tank calibration, the aircraft must be located a safe distance from other aircraft and buildings. Fire fighting equipment must be available. Two ground wires from different points on the aircraft to separate approved grounding stakes shall be used to prevent accidental disconnecting of one ground wire.

- b. Apply electrical power - If battery is used be

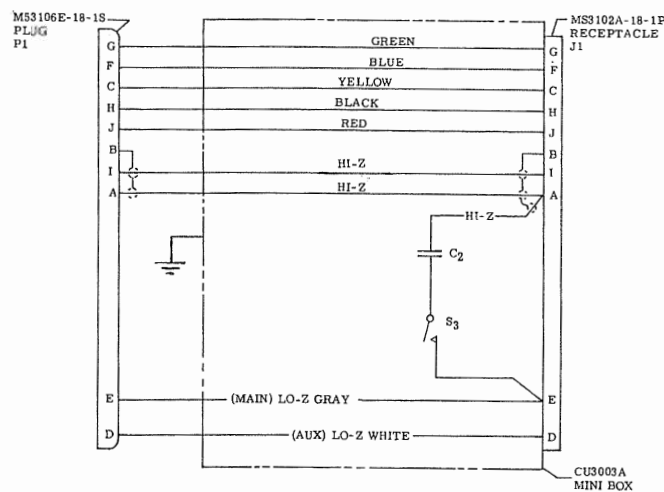


Part Number	Description	Quantity
MS3106E-18-1S (P ₁)	Plug	1
CU3003A	Mini Box	1
MS3102A-18-1P (J ₁)	Receptacle	1
VY13C33R21F (C ₂)	33.21 PF Capacitor	1
D15 (Alternate C ₂)	33.21 PF Capacitor	1
MST-105D (S ₃)	Switch	1
MS35489-5	Grommet	1

(S₃) SWITCH POSITIONS

1. Off
2. Main Full

421B0001 TO 421B0301



Part Number	Description	Quantity
MS3106E-18-1S (P ₁)	Plug	1
CU3003A	Mini Box	1
MS3102A-18-1P (J ₁)	Receptacle	1
VY13C32R6F (C ₂)	32.6 PF Capacitor	1
D15 (Alternate C ₂)	32.6 PF Capacitor	1
MST-105D (S ₃)	Switch	1
MS35489-5	Grommet	1

(S₃) SWITCH POSITIONS

1. Off
2. Main Full

421B0301 AND ON

Figure 11-6A. Fabrication of Fuel Quantity Test Box

sure voltage is not less than 22 volts.

- c. Place fuel selector handle to "Main" position.
- d. Adjust the "Main Empty" potentiometer on signal conditioner to read exact zero pounds indication on fuel quantity indicator.

NOTE

Tap the indicator slightly when reading indicator, this will help overcome friction of the needle when the indicator is in a static condition.

- e. Interconnect capacitance test box in accordance with Figure 11-6A.

NOTE

Fabricate test box in accordance with Figure 11-6A.

- f. Position selector switch on capacitance test box to "Main Full".
- g. Adjust the "Main Full" potentiometer on the signal conditioner to read 50 gallons on the indicator.

NOTE

Tap indicator when reading indicator.

- h. Position selector switch on the capacitance test box to "Off" and recheck zero indication.

NOTE

If the zero indication has changed readjust zero and full indications until no change is evident by the adjustment setting of the other.

- i. Turn off power and return aircraft to original configuration and remove capacitance test box.
- j. Turn power on and recheck main zero indication.

NOTE

This will assure that calibration of the main tank was good and not affected by a defective test box.

- k. Place fuel selector valve to "Aux" position.
- l. Adjust the "Empty Auxiliary" potentiometer on the signal conditioner, to read exact zero on the indicator.
- m. With power on the aircraft place fuel selector handles to "Main" position and check "Main Empty" potentiometer setting.

NOTE

It may be necessary to readjust main and auxiliary empty potentiometers by switching back and forth the main and auxiliary positions respectively until NO deviation reading is evident.

- n. Turn power Off.
- o. Interconnect capacitance test box in accordance with Figure 11-6A, and recheck "Main Full" indication.
- p. If calibration has changed repeat steps c thru l until a full indication without change in both main and auxiliary zero indication is obtained.
- q. After both LH and RH systems have been restored to their original configurations, read indication on auxiliary tank by actuating the override switch located below the fuel quantity indicator and verify that auxiliary zero corresponds to that of main.
- r. Turn off electrical power and service fuel systems in accordance with Section 2.

Alternate Method.

The Alternate method of calibrating the fuel system should be used only as a temporary calibration until the preferred method of calibration can be accomplished. The alternate method of calibration will require a thermometer with a scale reading of -30°F to 150°F.

- a. Defuel aircraft in accordance with Defueling Procedures in Section 2.

CAUTION

During all defueling and tank calibration the aircraft must be located a safe distance from other aircraft and buildings. Fire fighting equipment must be available. Two ground wires from different points on the aircraft to separate approved grounding stakes shall be used to prevent accidental disconnecting of one ground wire.

- b. Turn on electrical power.
- c. Place fuel selector control valve to "Main" position.
- d. Adjust the "Main Empty" potentiometer on the signal conditioner to exact zero on the fuel quantity indicator.

NOTE

Tap the indicator lightly when reading indicator. This will overcome friction of the needle when the indicator is in a static condition.

- e. Position fuel selector valve handles to "Auxiliary" and adjust the "Auxiliary Empty" potentiometer exact zero on the fuel indicator.
- f. Using a thermometer measure the temperature of the fuel and determine density of the fuel from Figure 11-6B, Temperature Conversion Chart.
- g. Fuel the system or tank being calibrated in accordance with Fueling Procedures, Section 2.
- h. Record the total number of gallons in the tank.

i. Multiply the density of the fuel as determined in step f by the total number gallons of fuel in the tank to obtain total pounds of fuel.

NOTE

This should be the exact number of pounds of fuel as indicated on the fuel quantity indicator.

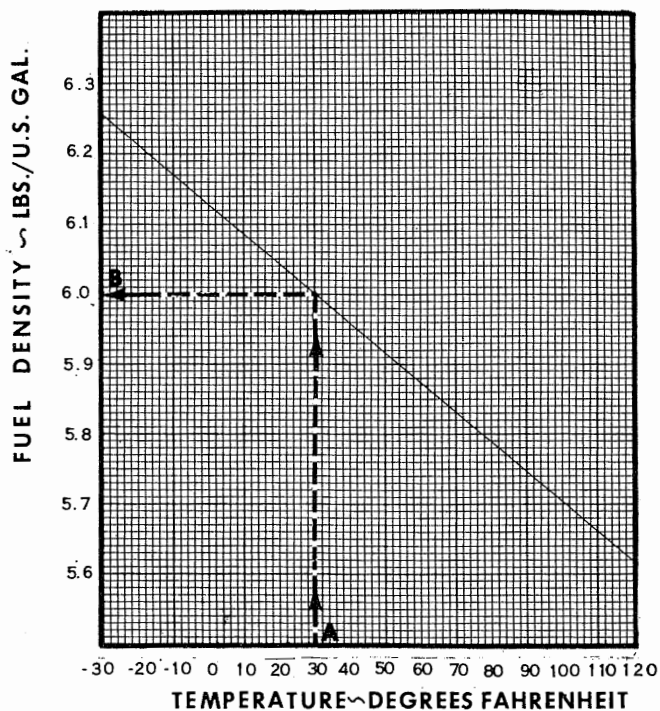
j. If the total pounds of fuel as indicated on the fuel quantity indicator is other than the total number pounds of fuel as determined in step h, adjust the "Main Full" potentiometer on the signal conditioner to the correct number of pounds.

k. Place fuel selector valve to "Auxiliary" position and check fuel quantity gage.

l. Determine total pounds of fuel from Figure 11-6B using same procedure as for the main tank.

WARNING

When using the Alternate Method of calibration allow 10% error in total quantity pounds of fuel.



EXAMPLE: A - Temperature, 30°
B - Density, 6.0 Pounds Per Gallon

TOTAL FUEL IN TANK	51.0 gal
FUEL DENSITY	6.00 lbs/gal
TOTAL POUNDS IN TANK	306.00 lbs
MINUS UNMEASURED FUEL	6.00 lbs =
	1 gal $\pm$ 0.5 gal
APPROXIMATE GAUGED FUEL	300 lbs

Figure 11-6B. Temperature Conversion Chart

FUEL LINES AND VENTS. (See figure 11-6.)

Fuel from either main tank may be routed to either engine. Fuel vapor from the vapor separator, located in the engine-driven fuel pump, is returned to the fuel tank through a vapor return line. The main supply line and vapor return line are routed through the wing forward of the main spar. The cross feed lines between the selector valves are routed aft of the firewall and forward of the main spar to the fuselage. A fuel line drain valve, located at each wing root, is installed in the low point of each cross feed line. These drain valves are accessible by removing the wing gap covers. It is not necessary to remove the wing gap covers to drain the valves. The main fuel tanks are vented through an overboard vent line and the auxiliary fuel cells are vented into the main tank.

Removal of Fuel Lines. (See figure 11-6.)

Removal procedure is given for the right wing. Removal of the left wing fuel lines is the same except the heater fuel lines which are installed in the right wing only.

- a. (See figure 1-2.) Remove access panels (41, 42, 43, 46, 47, 48, 53, 63, 54, 55, 56 and 34).
- b. (See figure 1-2.) Remove forward wing gap skin (35).
- c. Remove tip tank fairing.
- d. Defuel main tank in accordance with Section 2.

WARNING

Residual fuel draining from lines is a fire hazard. Use care to prevent accumulation of such fuel when lines and hoses are being disconnected.

- e. Disconnect right main fuel lines (16, 18, and 20) at hose (38), unions (37), and tee (35).
- f. Remove clamps securing line and remove lines.

NOTE

It will be necessary to remove tip tank to withdraw the main fuel line, vapor return line and vent line.

- g. Disconnect vapor return line at hose (38) and check valve (32) and remove through tip rib.
- h. Disconnect vapor return line (14) from firewall fitting and remove through access hole.
- i. Disconnect auxiliary fuel line (6) from selector valve (34) and elbow mounted through spar web. Then remove through fuel selector access hole.

NOTE

It will be necessary to remove turbocharger and remove access plate behind turbocharger to gain access to the elbow fitting.

- j. Disconnect auxiliary fuel line (8) from elbow (36) and strainer (40) and remove through access hole (63, see figure 1-2).

- k. Disconnect auxiliary vent line (10) and remove through wing tip rib.
- l. Loosen clamp which secures auxiliary vent line (42) in fuel cell and remove through access hole.

NOTE

It will be necessary to open the outboard auxiliary fuel cell to gain access to the clamp that secures the vent line.

- m. Disconnect crossover line (1) at selector valve and union at wing gap and remove through selector valve access.

- n. Disconnect crossover line (4) at selector valve and unions and remove through selector access.

- o. Remove heater lines (23, 24, 25 and 26) through access holes in lower side of wing.

Installation of Fuel Lines. (See figure 11-6.)

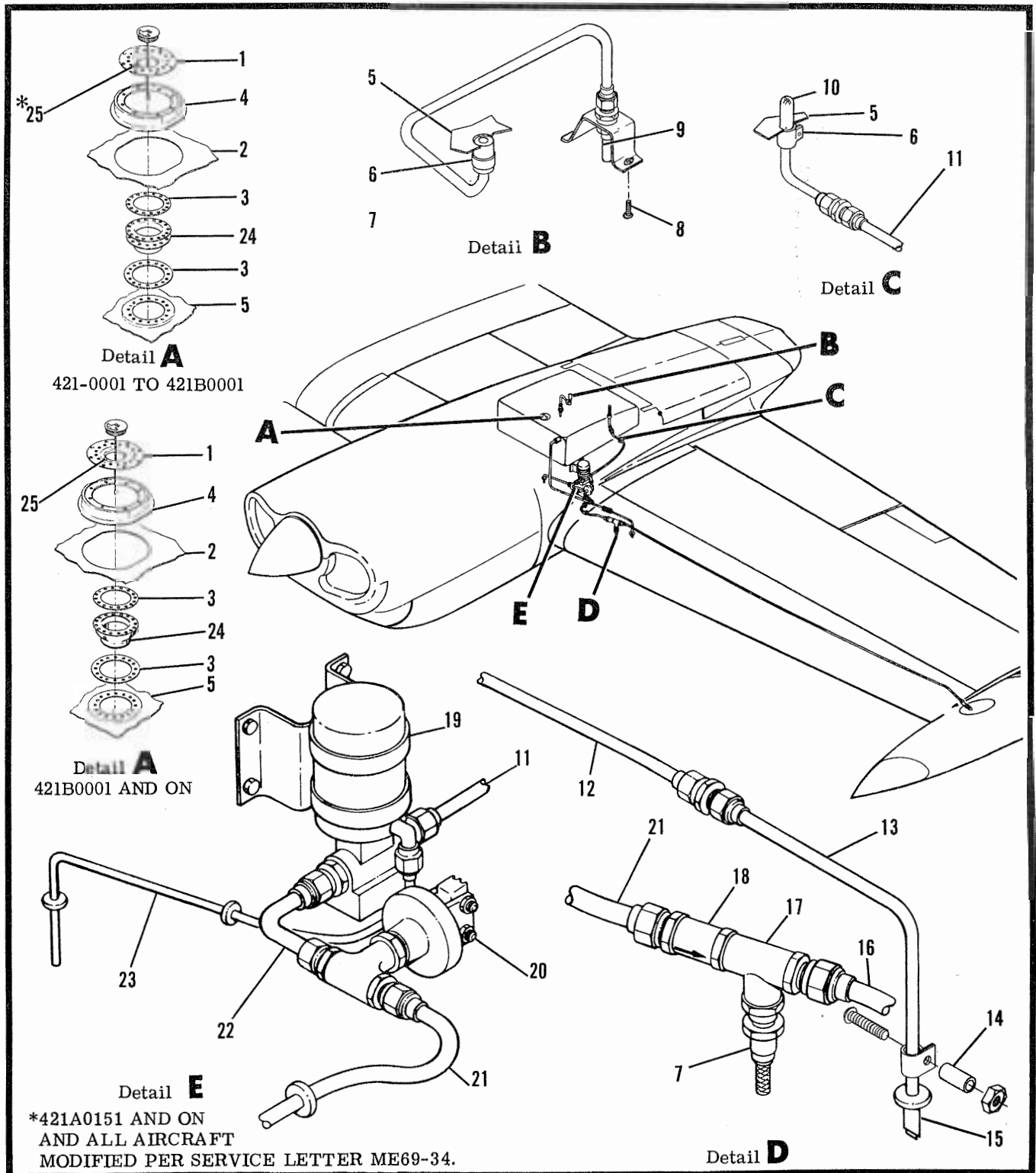
To install fuel lines, reverse removal procedure.

NOTE

Use a suitable thread lubricant on the male threads of all fittings. Fuel soluble lubricant only should be used. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

WING LOCKER FUEL. (Optional)

Optional wing locker fuel consists of a fuel cell (26.0 U.S. gallons usable each wing) mounted in the forward portion of each wing locker, an electrical operated, manually controlled fuel pump, a pressure switch to control the panel warning lights and necessary plumbing. There are no separate fuel selector controls or fuel quantity gages for the optional wing locker fuel tanks. Optional fuel is pumped directly into the main fuel tanks with independent fuel transfer pumps. Switches are provided on the panel to control each pump. Indicator lights mounted directly above the switches are illuminated by pressure switches to indicate fuel has been transferred. There is no fuel quantity indicating system in the wing locker fuel tanks.



1. Adapter Assembly	7. Drain Line	13. Vent Line	19. Wing Locker Fuel Transfer Pump
2. Nacelle Skin	8. Screw	14. Spacer	20. Pressure Switch
3. Gasket	9. Drain Valve	15. Heater	21. Fuel Line
4. Support	10. Strainer	16. Fuel Line	22. Fuel Line
5. Fuel Cell	11. Fuel Line	17. Tee Assembly	23. Drain Line
6. Clamp	12. Vent Line	18. Check Valve	24. Filler Neck
			25. Vent Hole

Figure 11-7. Wing Locker Fuel Installation (Optional)

Trouble Shooting the Wing Locker Fuel System.

TROUBLE	PROBABLE CAUSE	CORRECTION
WING LOCKER FUEL PUMP INOPERATIVE (OPTIONAL FUEL)	Circuit breaker open.	Reset circuit breaker.
	Open circuit or loose connections.	Check circuit and repair.
	Defective fuel pump.	Replace pump.
INDICATOR LIGHTS WILL NOT LIGHT (OPTIONAL FUEL)	Open circuit or loose connections.	Check circuit and repair.
	Defective pressure switch.	Replace pressure switch.

Removal of Wing Locker Fuel Cell. (Optional) (See figure 11-7.)

- Refer to Section 2 and defuel aircraft.
- Remove screws attaching adapter assembly (1) to nacelle skin and to support (4).
- Remove screws attaching support (4) to fuel cell (5).
- Reaching through filler opening, remove the clamp securing vent line (12) to the fuel cell (5).
- In the wheel well area, remove clamp securing drain line (7) to fuel cell.
- Disconnect strainer (10) from fuel line (11), remove clamp securing strainer (10) to fuel cell and remove strainer.
- Carefully fold fuel cell and remove through opening vacated by the support and adapter assembly.

Installation of Wing Locker Fuel Cell. (Optional) (See figure 11-7.)

- Carefully insert fuel cell through the filler opening and arrange the cell in the correct position.
- Insert strainer (10) into fuel cell and secure with clamp (6).
- Insert drain line (7) into fuel cell and secure with clamp (6).
- Insert vent line (12) into fuel cell and secure to cell with clamp.
- Install a new gasket (3) between support (4) and fuel cell (5) and secure with screws.
- Install a new gasket (3) between support (4) and adapter assembly (1) and secure with screws.
- Attach adapter assembly (1) to nacelle skin with screws.

Removal of Wing Locker Fuel Plumbing. (Optional) (See figure 11-7.)

- Refer to Section 2 and defuel aircraft.

NOTE

Removal procedure is the same for either wing locker fuel plumbing.

- (See figure 1-3.) Remove wing access covers (40, 41, 42, 43, 44, 45, 46, 47, 48 and 63). Remove applicable cover plates in wheel well area.
- (See Removal of Wing Locker Fuel Cell.) Accomplish steps b, c, d, e and f.

- Remove nut, spacer (14) and screw securing vent line (13) to structure, disconnect heater wires to vent heater (15), remove through lower access opening.
- Disconnect drain line (7) from drain valve and remove.
- Remove two screws securing drain valve (9) and bracket assembly and remove drain valve through wheel well access.
- Disconnect fuel line (11), fuel line (22) and drain line (23) from fuel pump (19). Disconnect electrical wires to fuel pump. Remove four nuts, washers and bolts securing pump to structure and remove pump.
- Disconnect fuel line (21) from tee. Disconnect electrical wires from pressure switch (20) and remove line (22) and pressure switch (20) as an assembly.
- Disconnect fuel line (21) from check valve (18) and remove through wing leading edge access opening.
- Remove clamps securing fuel line (16) in wing leading edge. Disconnect fuel line (16) from tee (17) and at main fuel tank. Remove line through outboard wing leading edge rib.

Installation of Wing Locker Fuel Plumbing. (Optional) (See figure 11-7.)

- Install wing locker fuel plumbing by reversing the removal procedure.
- Connect all electrical wires.
- Service fuel system with proper grade of fuel and check for leaks.
- Check vent heater for proper operation.

VENT HEATERS

Vent heaters are installed on the fuel tank vent tubes to prevent freezing of vapors. Care must be exercised in removing and installing the vent tubes to prevent damage to the heaters and electrical leads.

- Replace heaters in accordance with following procedures:

- Clean vent tube surface in area where heater is to be installed with 280 grit sandpaper and ketone (MEK).

- Install in accordance with detail A, figure 11-2, and bond vent heater to vent tube using epoxy cement Epon 834 with curing agent TTA in accordance with the manufacturers instructions.

- Pot the heater wires to protect them from damage using EC2273 or Hysol EA9309, mixed in accordance with the manufacturer's instructions.

SELECTOR VALVES.

One fuel selector valve is located in each wing just forward of the main spar, between the fuselage and nacelle. Each valve is cam operated from the cabin thru flex cables. Each valve has four positions which allows fuel to flow to the respective engine from the left tank, the right tank, the auxiliary tank, or stops all fuel flow thru the valve. Each fuel selector valve has a fuel strainer located on the bottom of the valve and a quick-drain is provided to remove moisture and sediment.

Removal of Fuel Selector Valves. (See figure 11-9.)

The removal of the fuel selector valves is essentially the same for either valve; however, there are left and right brackets which mount the valve into position.

- a. Defuel main tank in accordance with Section 2.
- b. Remove upper and lower access cover plates.
- c. Disconnect lines and fittings.

CAUTION

Plug or cap all open lines or fittings.

- d. Disconnect selector linkage at valve arm.
- e. Remove the three bolts securing valve and remove the valve from wing.

Installation of Fuel Selector Valves.

The installation of the fuel selector valves is essentially the same for either valve; however, there are left and right brackets which mount the valve into position.

- a. Install fittings in valve and clock to correct position.

NOTE

It is permissible to use teflon tape to improve sealing ability of fittings used in fuel selector valve. Lay end of tape on male threads of fitting leaving one and one half threads exposed, wrap around once, stretching tightly so that the threads show through the tape. Overlap end of tape approximately 3/8" and cut tape. Assemble joint.

- b. Install valve, securing in position with three bolts, then connect lines.
- c. Connect selector linkage and safety.

WARNING

Residual fuel draining from the lines and hoses is a fire hazard. Care should be exercised in disposal of such fuel when lines or hoses are disconnected to prevent its accumulation in the wing.

FUEL SELECTOR CONTROL SYSTEM.

The fuel selector valve controls are located between the front seats on the cabin floor. The valve control on the right controls fuel flow to the right engine and the valve control on the left controls the fuel flow to the left engine. The handles are of rotary-type and are operated mechanically 270° with a flex cable to the fuel selector valve assemblies mounted between the nacelles and the fuselage in the leading edge of the wing. The four valve positions which are marked on the "metalcals" are: LEFT MAIN, RIGHT MAIN, LEFT AUXILIARY, and OFF; RIGHT MAIN, LEFT MAIN, RIGHT AUXILIARY, and OFF. The fuel selector valve handles indicate the position of the fuel selector valves. The valve handles are protected by a guard to prevent the possibility of switching or movement by pilot's or copilot's feet.

Removal of Fuel Selector Control System. (See figure 11-9.)

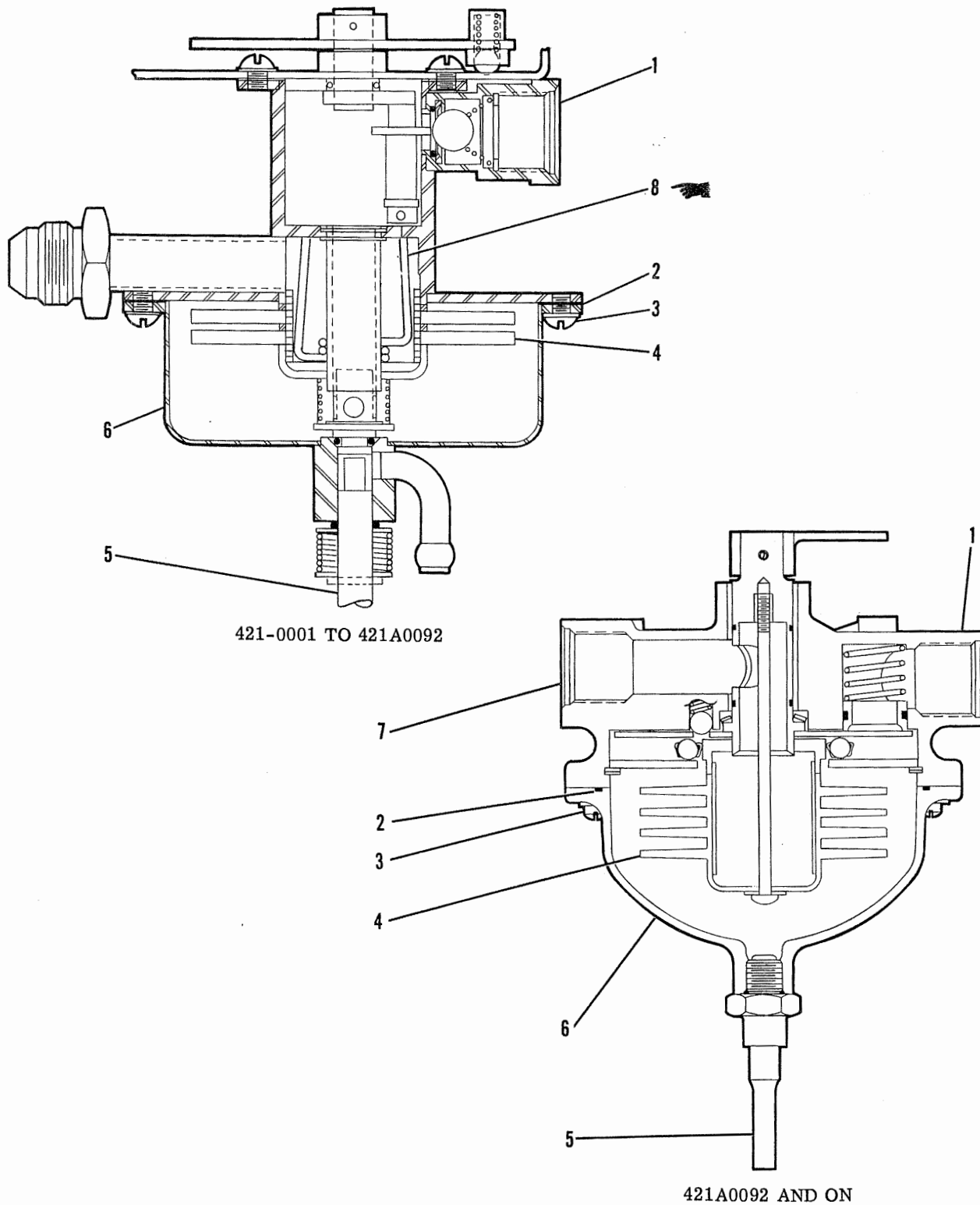
Removal of fuel selector control system is the same for either selector.

- a. Fuel selector valve handles - OFF.
- b. Remove pilot and copilot seats.
- c. (See figure 1-2.) Remove carpet as required and remove access covers (73 and 77).
- d. (See figure 1-2.) Remove access covers (34, 35, 56 and 57).
- e. Remove fuel selector handle.
- f. (See figure 11-9.) Disconnect cable (7) by removing cotter pin, nut and bolt.
- g. Remove two screws attaching gear box to bracket and remove gear box.
- h. Disconnect cable from selector valve in wing by removing cotter pin, nut and screw.
- i. Remove cable terminals, jam nuts, clamps and pressure seal assembly.

NOTE

To remove pressure seal at fuselage skin and to facilitate routing of cable, remove the heat exchanger in accordance with Section 13.

- j. Remove cable through heat exchanger access opening.



1. Fuel Inlet	4. Filter	6. Bowl Assembly
2. Gasket	5. Drain Valve Push-Rod	7. Fuel Outlet
3. Screw		8. Spring

Figure 11-8. Fuel Selector Valve and Strainer

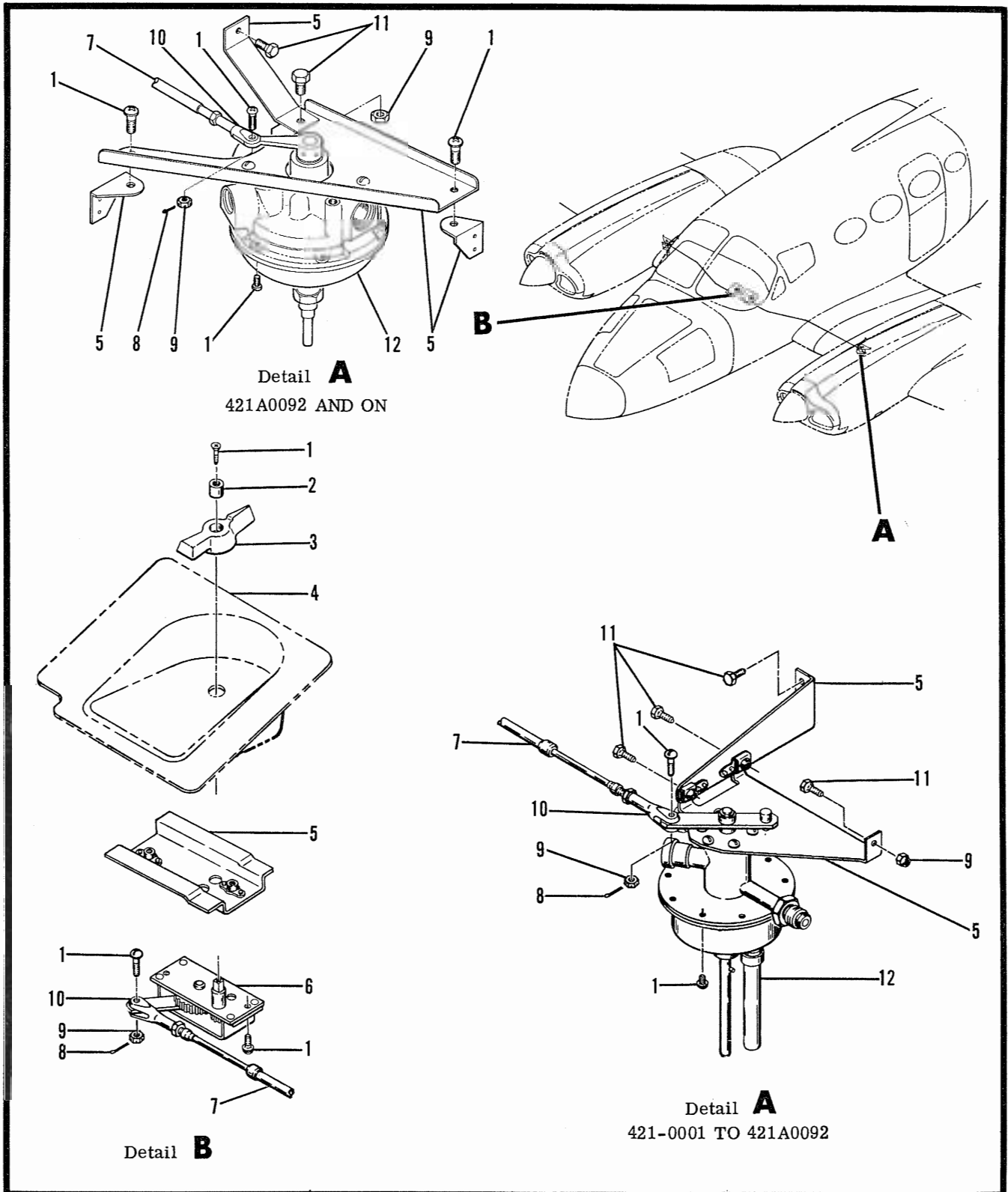
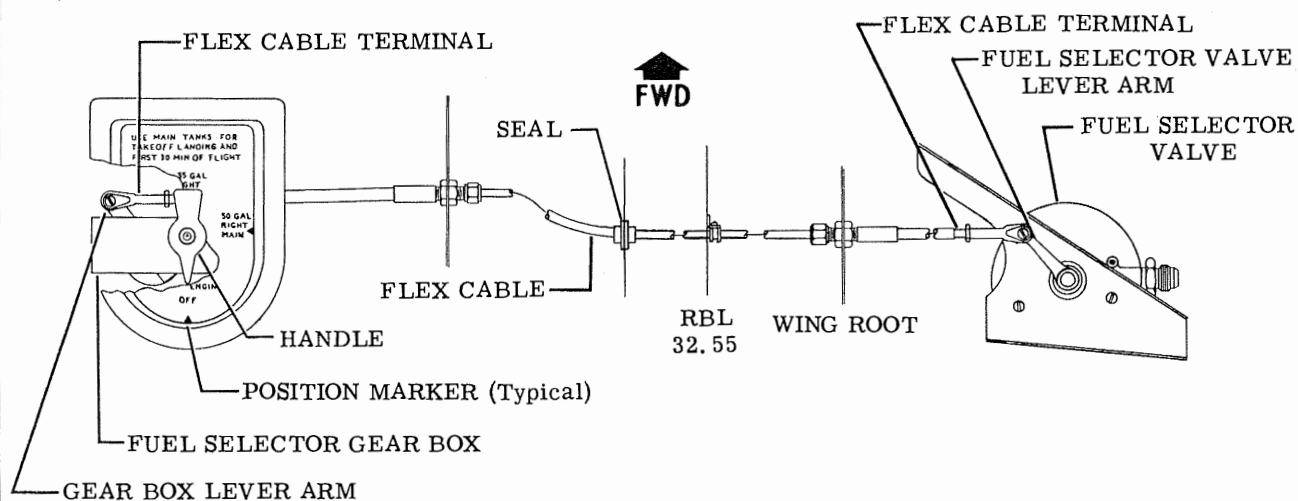
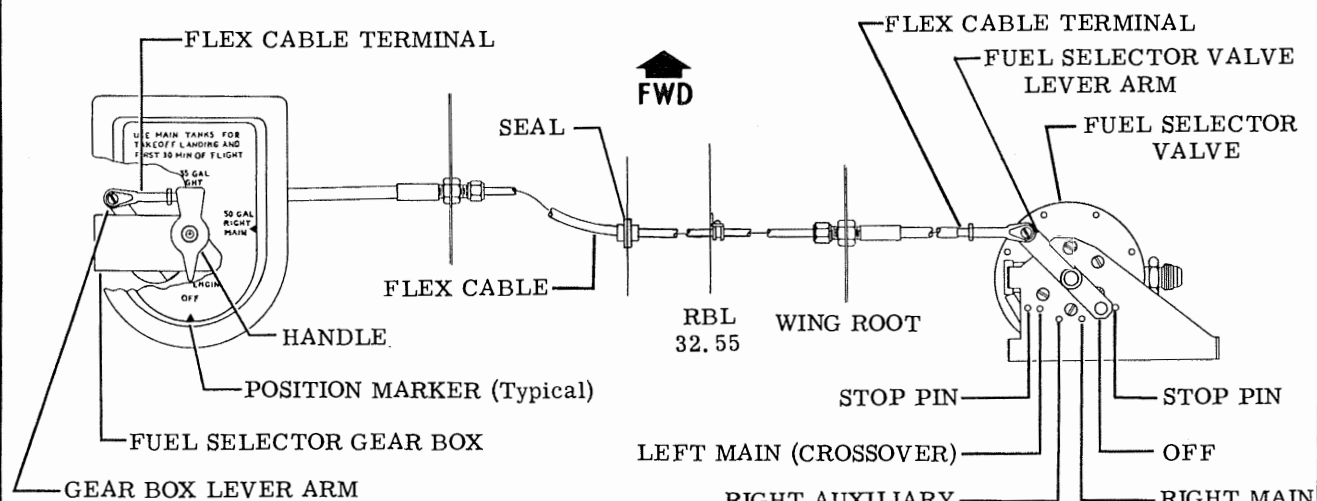


Figure 11-9. Fuel Selector Control Handle



421A0092 AND ON



421-0001 TO 421A0092

Figure 11-10. Fuel Selector Rigging Schematic

Installation of Fuel Selector Control System. (See figure 11-9.)

- a. Place gear box in position and secure to bracket (5) with two screws.
- b. Install selector handle (3) with spacer and screw.
- c. Route cable through heat exchanger access opening into cabin and into wing root rib. (The shortest telescoping unit into fuselage.)
- d. Secure cable housing to wing root rib with jamb nuts and to bracket under floor with jamb nuts.
- e. Install jamb nuts and terminals to cable ends and secure terminals to gear box and selector valve.
- f. Install and seal pressure seal assembly in accordance with sealing procedures in Section 16.
- g. Check operation for binding and smooth actuation.
- h. Check for proper rigging.
- i. Install heat exchanger in accordance with Section 13.

NOTE

Support and security of the fuel selector cables is most essential to provide the optimum fuel selector valve operation. Inspect the fuel selector cable support points for adequate tightness and security.

Rigging the Fuel Selector Valve. (See figure 11-10.)

- a. (See figure 3-9.) Remove scuff plates and fold back carpet (9) just enough to remove floorboard access plate (73, figure 1-2).
- b. (See figure 1-2.) Remove wing access plates (34 and 35).
- c. Position lever arm on fuel selector valve in wing to the most inboard position.

NOTE

Observe that the attachment hole in lever arm is pointing inboard.

- d. Connect terminal on flex cable to the fuel selector valve lever arm with attaching bolt, nut and cotter pin.
- e. On the cabin floorboard, rotate (counterclockwise for LH and clockwise for RH) the handle on the gear box until lever arm comes to rest against gear box bracket.
- f. Rotate handle (clockwise for LH and counterclockwise for RH) approximately 5° until a pointer on handle is aligned with the OFF position marker.

CAUTION

Observe that the handle is parallel with the centerline of aircraft and pointer on handle is indexed to the OFF position (aft).

- g. With the handles in the position described in step f. above, adjust terminal and flex cable until attach holes on gear box lever arm and terminal are aligned.
- h. Connect terminal to gear box lever arm with attaching screw, nut and cotter pin.
- i. Start from the OFF position and rotate (clockwise for LH and counterclockwise for RH) the han-

dles to the LEFT MAIN and RIGHT MAIN positions respectively.

j. Observe that the pointer end of handle nearly aligns with marker on placard after traveling approximately 90° from the OFF position and the fuel selector valve lever arm seats in the respective main tank detent on the fuel selector valve.

k. If the fuel selector valve lever arm has not seated in proper detent after handle has been rotated 90° from the OFF position, lengthen or shorten terminals and/or flex cables as necessary to achieve proper rigging.

l. Continue from the LEFT MAIN and RIGHT MAIN position, rotate handles to the LEFT AUXILIARY and RIGHT AUXILIARY positions respectively.

m. Observe that the pointer end of handle nearly aligns with marker on placard after traveling approximately 180° from the OFF position and the fuel selector valve lever arm seats in the respective auxiliary tank detent on the fuel selector valve.

n. If the fuel selector valve lever arm has not seated in proper detent after handle has been rotated 180° from the OFF position, lengthen or shorten terminals and/or flex cable as necessary to achieve proper rigging.

o. Continue from the LEFT AUXILIARY and RIGHT AUXILIARY position, rotate LH handle to the RIGHT MAIN (crossover) and RH handle to the LEFT MAIN (crossover).

p. Observe that the pointer end of handle nearly aligns with marker on placard after traveling approximately 270° from the OFF position and the fuel selector valve lever arm seats in the respective inboard crossover tank detent on the fuel selector valve.

q. If the fuel selector valve lever arm has not seated in proper detent after handle has been rotated 270° from the OFF position, lengthen or shorten terminals and/or flex cable as necessary to achieve proper rigging.

NOTE

If terminal and/or flex cable adjustments have been made at any one of the fuel selector positions, repeat steps i, j, l, m, o and p to verify correct rigging and make further adjustments as necessary.

Operational Check.

- a. Place left selector valve in the left position. Place right selector valve in the right position and start both engines.
- b. When the engines are sufficiently warmed, advance the throttles to 1500 RPM. Observe the fuel flow gage to assure there are no radical fluctuations and that fuel flows at proper pressure. Observe the engine for a proper short continuous run.
- c. Place both selector valves in RIGHT position. Make observations given in step b.
- d. Place both selector valves in AUXILIARY position. Make observations given in step b.
- e. Place both selector valves in LEFT position. Make observations given in step b.
- f. Place left selector valve in OFF position with engine at idle RPM. Engine should run momentarily, then fail.
- g. Place right selector valve in OFF position with engine at idle RPM. Engine should run momentarily, then fail.

SECTION 12

INSTRUMENTS AND RELATED SYSTEMS

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GENERAL.

All instruments, except the magnetic compass which is mounted on the windshield centerstrip, are located on the shock-mounted instrument panel or the stationary panel. Specific locations are illustrated in figure 12-1. For ease of maintenance, each instrument may be removed individually or the shock-mounted panel with instruments attached may be removed. The instruments are positioned in back of and attached to the instrument panel by three or four attaching bolts and nuts. Since all instruments are mounted in a similar manner, a description of a typical removal

and installation is provided as a guide for the removal and installation of all instruments. The instruments are grouped and listed according to systems: the vacuum system and the pitot static system. The remainder of the instruments are listed under engine or miscellaneous instruments.

NOTE

Disassembly or overhaul of instruments should be performed only in approved ships by authorized personnel.

INSTRUMENTS.

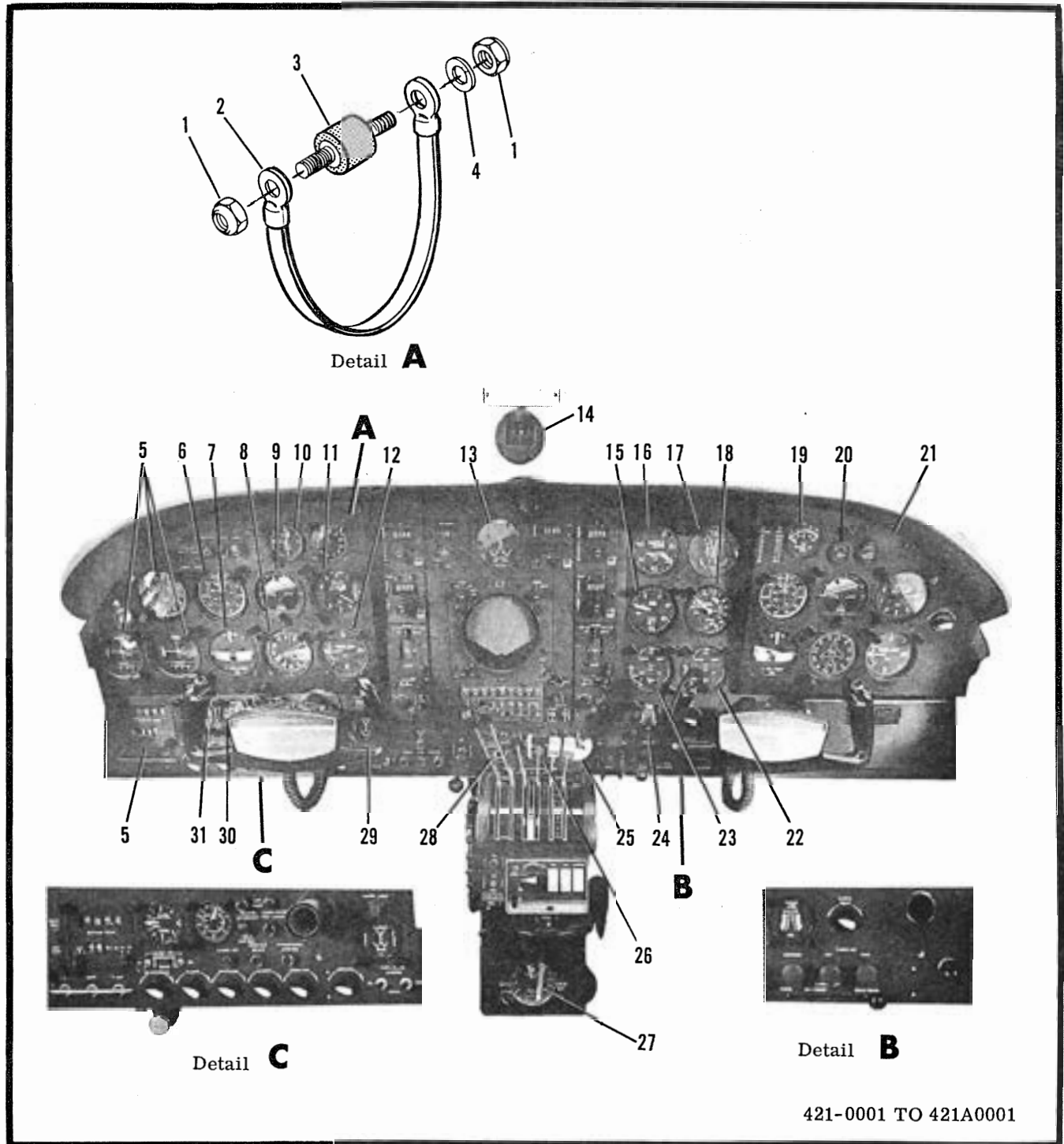
Troubleshooting the Instruments.

TROUBLE	PROBABLE CAUSE	CORRECTION
	VACUUM SYSTEM INSTRUMENTS	
BOTH VACUUM INSTRUMENTS MALFUNCTIONING	Dirty filter element. Restricted airflow or improper adjustment.	Clean and replace filter. Adjust vacuum relief valve.
ONE VACUUM INSTRUMENT MALFUNCTIONING, OTHER VACUUM INSTRUMENT OPERATING NORMAL	Defective instrument.	Replace instrument.
DIRECTIONAL GYRO PRECESSES AND/OR SPINS	Insufficient suction.	Repair or replace vacuum pump and/ or check system.
	Filter element dirty.	Replace filter element.
	Excessive vibration of instrument panel.	Replace instrument panel shock mounts.
	Operational limits exceeded.	Replace or overhaul directional gyro.
GYRO HORIZON WILL NOT ERECT, TUMBLES, AND IS SLUGGISH IN OPERATION	Insufficient suction.	Repair or replace vacuum pump and/or check system.
	Filter element dirty.	Replace filter element.
	Excessive vibration of instrument panel.	Replace instrument panel shock mounts.
	Operational limits exceeded.	Replace or overhaul gyro horizon.
	SENSITIVE ALTIMETER	
INDICATING POINTERS FAIL TO RESPOND	Static line obstructed.	Disconnect static line from all in- struments and altitude hold on auto- pilot computer, and blow out line with dry compressed air.
EXCESSIVE POINTER VIBRATION	Excessive vibration of static line or hose.	Secure to aircraft structure or com- ponents.
ERRONEOUS INDICATIONS	Water or foreign matter in static line.	Disconnect static line from all in- struments and altitude hold on auto- pilot computer, and blow out line with dry low pressure air.
	Loose static line connection.	Test and repair in accordance with testing static pressure system.
	Defective instrument.	Replace instrument.
	AIRSPEED INDICATOR	
POINTER FAILS TO RESPOND	Clogged pitot line.	Disconnect pitot line and altitude hold on autopilot computer from in- strument and blow out line with dry compressed air.
ERRONEOUS INDICATIONS	Water or restriction in pitot and/ or static line.	Disconnect tube from all pitot static system instruments and altitude hold on autopilot computer and blow out lines with dry compressed air.

TROUBLE	PROBABLE CAUSE	CORRECTION
ERRONEOUS INDICATIONS	Leak in pitot and/or static line.	Test and repair in accordance with testing of pitot pressure system.
	Pitot and/or static line improperly connected.	Connect lines as illustrated in figure 12-9.
	VERTICAL SPEED INDICATOR	
POINTER FAILS TO RESPOND	Water or restriction in static line.	Disconnect static line from all pitot static system instruments and altitude hold on autopilot computer and blow out with dry compressed air.
	Defective instrument.	Replace instrument.
	TURN-AND-BANK INDICATOR	
NOTE To operate any of the electrical instruments, the battery switch must be in the ON position.		
BALL OFF CENTER	Incorrectly mounted.	Mount correctly.
	Defective instrument.	Replace instrument.
TURN INDICATED	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective instrument.	Replace instrument.
	DUAL TACHOMETER	
ERRONEOUS INDICATION OR INDICATOR INOPERATIVE	Defective circuit.	Check and repair circuit.
	Defective instrument.	Replace instrument.
	Defective tachometer generator.	Replace tachometer generator.
	DUAL FUEL QUANTITY INDICATOR	
NO INDICATION	Sunken float. (421-0001 to 421B0001)	Replace float.
	Defective tank unit. (421B0001 and on)	Repair or replace tank unit.
	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective fuel quantity sending unit. (421-0001 to 421B0001)	Replace fuel quantity sending unit.
	Defective fuel quantity signal conditioner (421B0001 and on)	Replace fuel quantity signal conditioner.
	Defective indicator.	Replace indicator.
ERRONEOUS INDICATOR	Damaged float. (421-0001 to 421B0001)	Replace float.
	Defective fuel tank unit. (421B0001 and on)	Repair or replace tank unit.

TROUBLE	PROBABLE CAUSE	CORRECTION
ERRONEOUS INDICATOR	Defective circuit. Malfunctioning fuel quantity sending unit. (421-0001 to 421B0001) Malfunctioning fuel quantity signal conditioner. (421B0001 and on) Defective indicator. Improper calibration.	Check and repair circuit. Check in accordance with Section 11. Replace if necessary. Check in accordance with Section 11. Replace if necessary. Replace indicator. Calibrate in accordance with calibration procedures.
NO INDICATION WITH FLAPS DOWN	FLAP POSITION INDICATOR Open circuit. Defective indicator. Defective transmitter.	Reset circuit breaker. Check and repair circuit. Replace indicator. Replace transmitter.
ERRONEOUS INDICATION WITH FLAPS DOWN	Improper engagement of transmitter cam with pinion gear. Defective circuit. Defective indicator. Defective transmitter.	Rig in accordance with Section 8. Check and repair circuit. Replace indicator. Replace transmitter.
POINTER FAILS TO RESPOND	OUTSIDE AIR TEMPERATURE INDICATOR Open circuit.	Reset circuit breaker. Check and repair circuit.
ERRONEOUS INDICATION	Defective circuit. Defective air temperature bulb. Defective indicator.	Check and repair circuit. Replace air temperature bulb. Replace indicator.
HORN FAILS TO OPERATE	STALL WARNING INDICATOR Open circuit. Defective transmitter. Defective horn.	Reset circuit breaker. Check and repair circuit. Replace transmitter. Replace horn.
NO INDICATION ON OIL TEMPERATURE GAGE	COMBINATION GAGES Open circuit. Defective oil temperature bulb. Defective instrument.	Reset circuit breaker. Check and repair circuit. Replace oil temperature bulb. Replace instrument.

TROUBLE	PROBABLE CAUSE	CORRECTION
ERRONEOUS INDICATION OF CYLINDER TEMPERATURE GAGE	Defective circuit.	Check and repair circuit.
	Defective cylinder head tempera- ture bulb.	Replace cylinder head temperature bulb.
	Defective instrument.	Replace instrument.
HIGH CYLINDER HEAD TEMPERATURE INDICATOR	Improper ground.	Remove ground wire and door bonding area. Replace bonding wire.
ERRONEOUS OIL PRES- SURE INDICATION	Defective instrument.	Replace instrument.
	Broken or restricted oil pres- sure line.	Repair or replace oil pressure line.
	Defective oil pressure relief valve.	Repair or replace relief valve.
	MANIFOLD PRESSURE GAGE	
SLUGGISH POINTER OPERATION	Damaged or restricted lines.	Remove line and blow out restriction. Replace line or hoses as necessary.
	Defective instrument.	Replace instrument.
	MAGNETIC COMPASS	
EXCESSIVE COMPASS ERROR	Improper compensation.	Compensate the compass.
	External magnetic interference.	Locate the interference and elimi- nate if possible.
FAILURE TO RESPOND TO COMPENSATION	Compensating magnets de- magnetized.	Replace instrument.
	FUEL FLOW GAGE	
ERRONEOUS FUEL PRES- SURE INDICATION	Clogged or restricted fuel lines.	Clean fuel lines and fuel strainer.
	Broken or restricted fuel flow lines.	Replace fuel flow lines.
	Defective fuel pump.	Replace fuel pump.
	Defective instrument.	Replace instrument.
	VOLTAMMETER	
NO INDICATION ON VOLT- AMMETER	Defective voltammeter.	Check/replace voltammeter.
	Defective voltammeter leads.	Check/repair or replace.

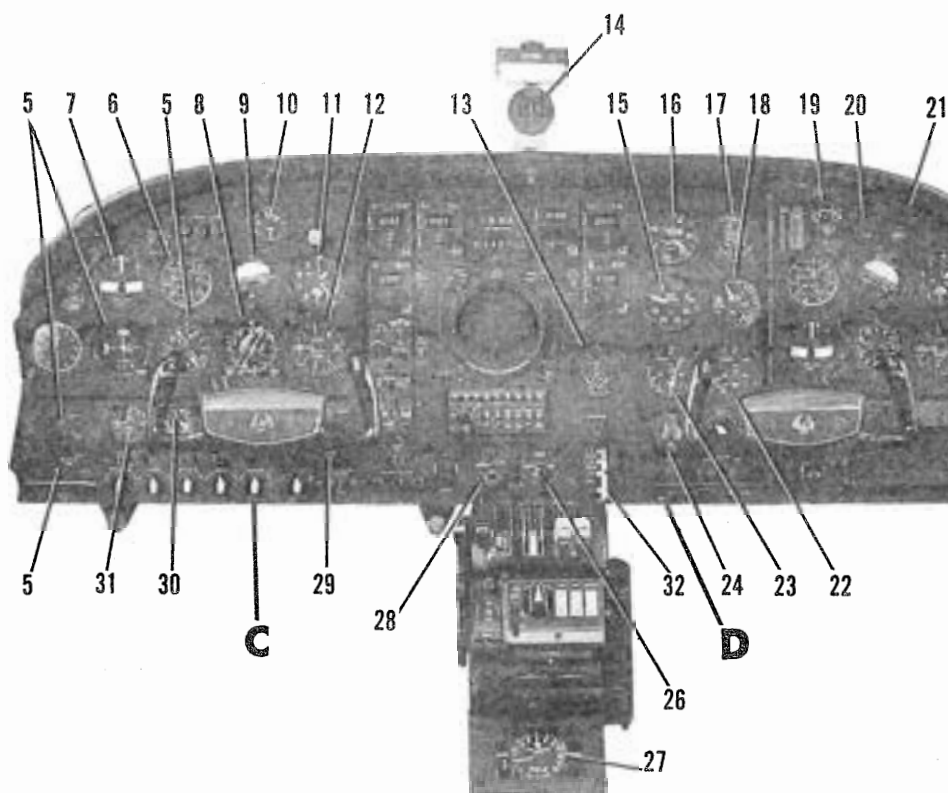


1. Nut
2. Bonding Strap
3. Shock Mount
4. Washer
5. Optional Instrument
6. Airspeed Indicator
7. Turn and Bank Indicator
8. Directional Gyro
9. Horizontal Gyro

10. Clock
11. Altimeter
12. Vertical Speed Indicator
13. Economy Mixture Indicator
14. Compass
15. Tachometer
16. Manifold Pressure
17. Fuel Gage

18. Fuel Flow Gage
19. Outside Air Temperature Gage
20. Prop Deice Ammeter
21. Optional Right Panel
22. Right Engine Combination Gage
23. Left Engine Combination Gage
24. Auxiliary Fuel Gage
25. Flap Position Indicator
26. Oxygen Gage

Figure 12-1. Instrument Panel (Sheet 1 of 3)



Detail C



Detail D

421A0001 TO 421B0001

27. Variable Cabin Pressure Rate Controller (Optional)	31. Cabin Rate of Climb Indicator	36. Pressurization Controls
28. Suction Gage	32. Flap Preselect Indicator	37. Light Dimming Controls
29. Cowl Flap Position Indicator	33. Annunciator Panel	38. Gyro Slaving Ammeter
30. Cabin Differential Pressure Gage	34. Radio Panel	39. Cabin Heat Controls
	35. Screw	40. Cigar Lighter (Optional)

Figure 12-1. Instrument Panel (Sheet 2 of 3)

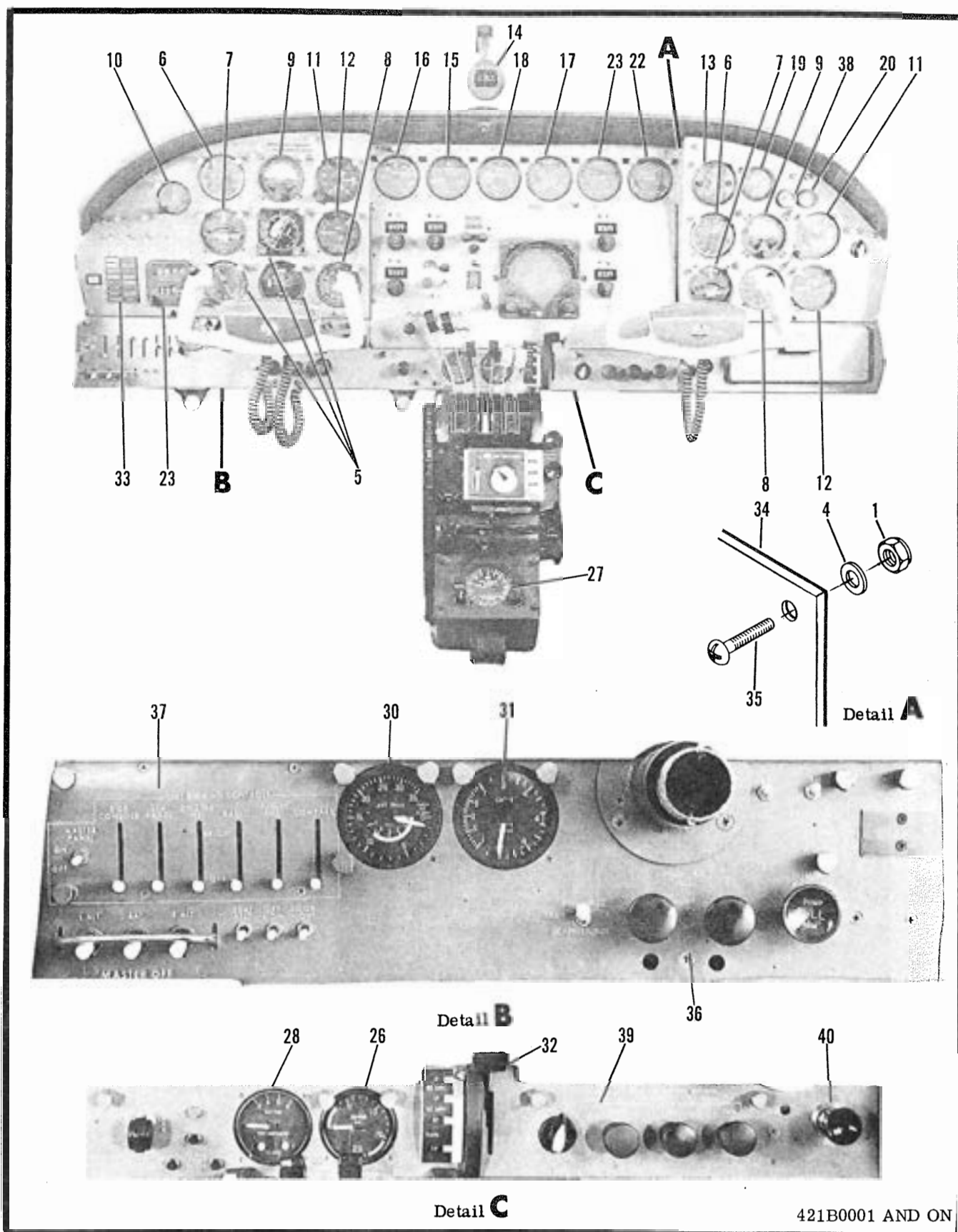


Figure 12-1. Instrument Panel (Sheet 3 of 3)

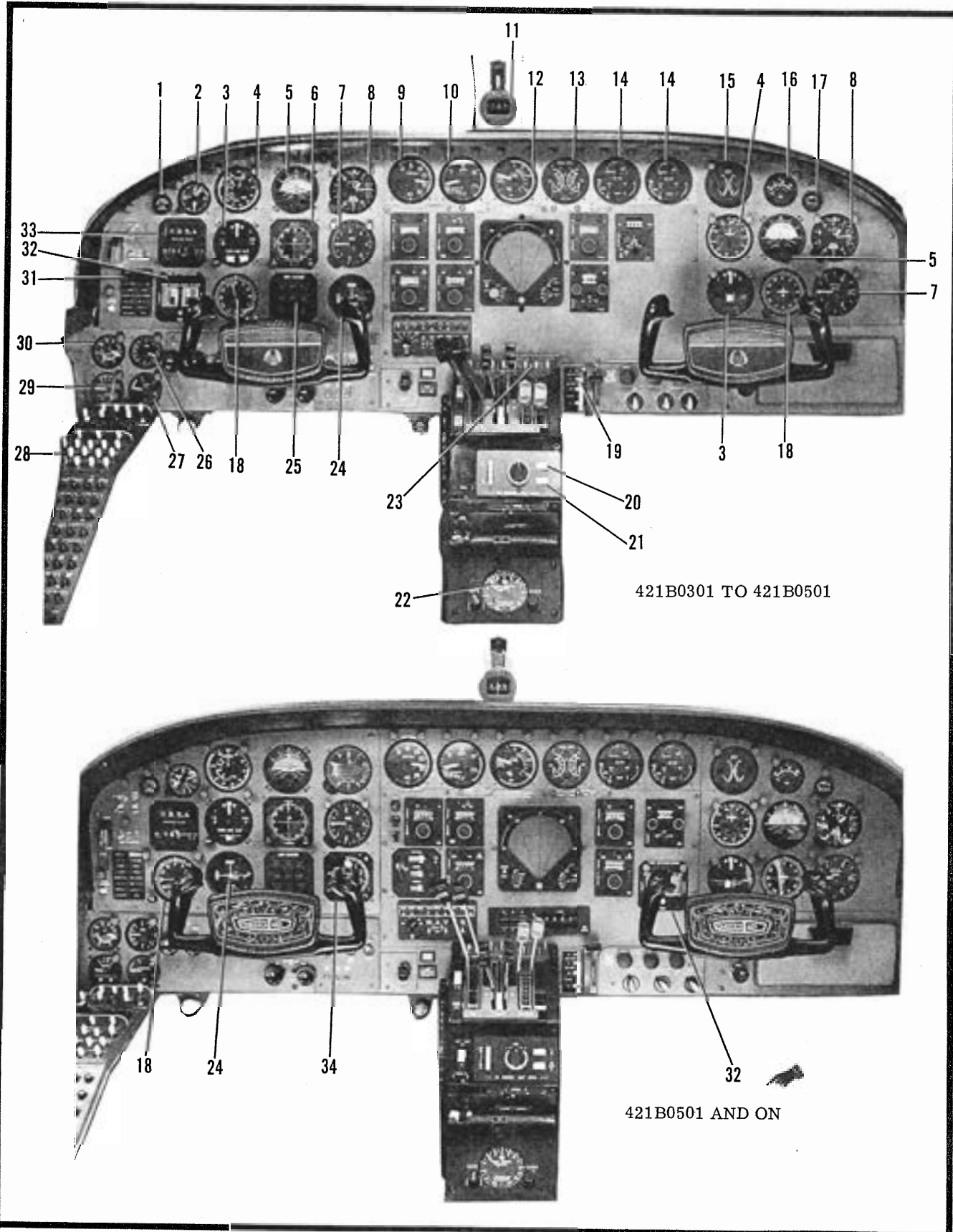
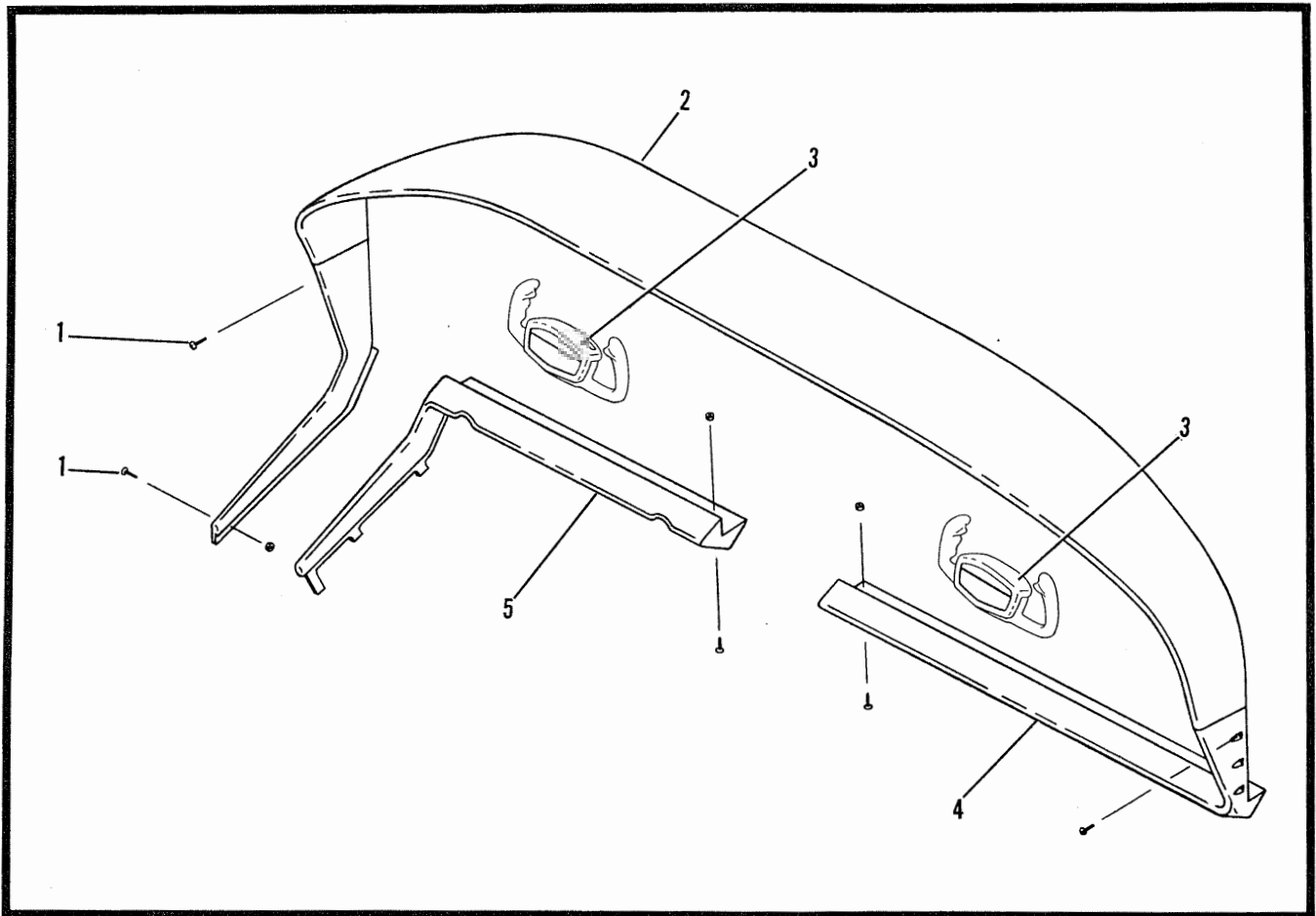


Figure 12-1A. Instrument Panel

Figure 12-1A. Instrument Panel Callouts

1. Slaving Meter	18. ADF Ind.
2. Clock	19. Flap Position Ind.
3. Turn and Slip Ind.	20. Autopilot Controller
4. Airspeed Ind.	21. Yaw Damper Switch
5. ADI Attitude Director Ind.	22. Variable Cabin Pressure Controller
6. HSI Horizontal Situation Ind.	23. Dimming Control
7. Vertical Speed Ind.	24. OBS Ind.
8. Altimeter	25. Mode Selector
9. Manifold Pressure Ind.	26. Cabin Rate-of-Climb
10. Tachometer	27. Oxygen Pressure Ind.
11. Magnetic Compass	28. Circuit Breakers
12. Fuel Flow Ind.	29. Suction Gage
13. Fuel Quantity Ind.	30. Differential Pressure Gage
14. Engine Combination Gage	31. Annunciator Panel
15. EGT Ind.	32. Fire Detect Panels
16. Outside Air Temperature Ind.	33. DME Indicator
17. Propeller Deice Ammeter	34. Radar Altimeter



1. Screw	3. Padded Control Wheel	5. LH Stationary Panel Padding
2. Padded Glareshield	4. RH Stationary Panel Padding	

Figure 12-1B. Padded Glareshield and Stationary Panel

TROUBLE	PROBABLE CAUSE	CORRECTION
ERRONEOUS INDICATIONS	CABIN DIFFERENTIAL PRESSURE GAGE	
	Static line obstructed.	Disconnect static line from all instrument and altitude hold on autopilot computer, and blow out line with dry compressed air.
POINTER FAILS TO RESPOND	Defective instrument.	Replace instrument.
	CABIN RATE OF CLIMB INDICATOR	
NO INDICATION ON AMMETER	Static ports obstructed.	Remove obstructions.
	Defective instrument.	Replace instrument.
	PROPELLER DEICE AMMETER	
	Defective ammeter.	Check/replace ammeter.
	Defective ammeter leads.	Check/repair ammeter.

Vacuum System Instruments.

a. The Directional Gyro. A flight instrument incorporating an air-driven gyro stabilized in the vertical plane. The gyro is rotated at high speed by lowering the pressure in the airtight case with the engine-driven vacuum pumps and simultaneously allowing air at atmospheric pressure to enter against the gyro buckets. Due to gyroscopic inertia, the spin axis continues to point in the same direction, even though the aircraft yaws to the left or right. This relative motion between the gyro and the instrument case is shown on the instrument dial which is similar to a compass card. The dial, when set to agree with the aircraft's magnetic compass, provides a "dead beat" azimuth indicator that is free from "swing."

b. The Slaved Directional Gyro includes a single, synchro-driven pointer and in some gyros, a dual pointer for use with ADF/VOR inputs to provide continuous indication of the bearing to specific ground stations. The slaved directional gyro operates with a slaving meter and a flux detector, to produce input to the electronic compass circuit in the gyro. The flux detector is remotely located in the tailcone of the aircraft. Refer to Compass Alignment procedure for compensating the slaved directional gyro.

c. The Horizontal Gyro is essentially an air-driven gyroscope rotating in a horizontal plane, operated by the same supply of vacuum as the directional gyro. Due to gyroscopic inertia, the spin axis continues to point in the vertical direction providing a constant visual reference to the attitude of the aircraft relative to its pitch and roll axis. A bar across the face of the indicator represents the horizon and a miniature adjustable aircraft is mounted to the case. Aligning the miniature aircraft to the horizon bar simulates the alignment of the aircraft to the actual horizon and any deviation simulates the deviation of the aircraft

from the true horizon. The indicator is marked from zero to 90 degrees.

d. Directional and Attitude Gyro Precession. Acceptable limits for gyro drift is 4° in either direction from a heading during a ten minute period. Excessive gyro precession can be caused by low vacuum system pressure; therefore, the following items should specifically be checked prior to gyro removal and/or replacement:

1. Vacuum system lines for kinks or leaks.
 2. Central air filter or instrument filter for dirt. The filter should be cleaned and/or replaced.
 3. Suction gage for proper operation.
 4. Vacuum relief valve for proper adjustment.
- Adjustment instructions are outlined in "Adjustment of Vacuum Relief Valve."

NOTE

A gage reading of 5.0 inches of mercury is desirable for gyro instruments; however, a range of 4.75 to 5.25 inches of mercury is acceptable.

e. The Suction Gage is calibrated in inches of mercury and indicates the amount of vacuum created by the engine-driven vacuum pumps. The suction gage has four connecting lines. The upper outboard line is routed directly to the directional gyro to monitor vacuum. The lower lines are attached to the vacuum system manifold for the purpose of monitoring vacuum pump function. The upper inboard line is routed to static air.

Pitot-Static Instruments.

a. The Sensitive Altimeter is a pressure instrument that measures the change in static pressure and by means of an indicator, translates this change into altitude above sea level. A barometric scale is in-

corporated in the instrument. The barometric pressure scale is calibrated in inches of mercury and is set manually by a knob on the lower left-hand corner of the altimeter case. Three pointers on the dial of the instrument indicate altitude in units of 100 feet, 1000 and 10,000 feet.

b. The Airspeed Indicator measures the differential between ram, or impact air pressure taken at the pitot tube, and static air pressure. The instrument dial is calibrated in both knots and miles per hour. Should airspeed indicator require maintenance and recalibration, recalibrate in accordance with FAA TSO-2C.

c. The Vertical Velocity Indicator measures the rate of change in static pressure when the aircraft is climbing or descending. By means of a pointer and dial it indicates the rate of ascent and descent of the aircraft in feet per minute.

d. The Cabin Altitude and Differential Pressure instrument is a dual purpose instrument which indicates cabin altitude in feet. It also indicates differential pressure between cabin pressure and atmospheric pressure. This function is given in PSI.

e. The Cabin Altitude Rate of Change indicates the rate in feet per minute at which the cabin pressure is changing. The instrument dial is calibrated in 100 feet increments. The cabin altitude rate of change is similar in function to the vertical velocity indicator except the cabin altitude rate of change indicator is referenced to cabin pressure instead of static air pressure.

Engine Instruments.

a. A Fuel Quantity Indicator with two pointers on the dial, one for each wing tip tank, is located in the upper right-hand portion of the instrument panel. The fuel quantity indicator receives electrical signals from the variable resistor type fuel quantity sending units located inside the wing tip tanks and indicates, in gallons, the amount of remaining usable fuel. An auxiliary fuel quantity indicator with two pointers on the dial, one for each wing tank, is located in the lower right-hand portion of the instrument panel indicating the amount of remaining usable fuel in the auxiliary tanks.

b. The Dual Fuel Flow Gage senses the pressure at which fuel is delivered to the fuel injection nozzles. The gage is marked as a flowmeter. Two pointers indicate the fuel-flow for the left and right engines. The gage is a direct reading pressure gage.

c. The Manifold Pressure Gage is a direct reading gage used to indicate the pressure of the induction air in the engine intake system. Two pointers indicate the manifold pressure in inches of mercury absolute.

d. The Engine Combination Gages, (Cylinder Head Temperature, Oil Temperature and Oil Pressure), one for each engine, are remote electrical indicators. Each gage is connected electrically to a cylinder head temperature bulb located underneath the number two cylinder of the respective engine. As the temperature of the bulb changes, the combination gage measures the change and the pointer indicates the tempera-

ture in degrees Fahrenheit. The oil temperature is electrically received from the oil temperature bulb, located in the engine oil passage and calibrated in degrees Fahrenheit. Oil pressure is taken directly from the pressurized engine oil passage. It is routed through small lines and hoses to the combination gage which calibrates the pressure to pounds per square inch.

e. The Dual Tachometer is a remote electrical instrument that is connected by electrical leads to a tachometer generator on each engine. The tachometer calibrates electrical current from the tachometer generator to revolutions per minute. The pointers, one marked for each engine, are concentrically mounted so that the engines may be synchronized visually by over-lapping the pointers.

Miscellaneous Instruments.

a. The Turn-and-Bank Indicator is a combination instrument. The turn indicator is an electrically-driven gyro mounted in a horizontal gimbal that is attached to a pointer which indicates the rate of turn. The slip indicator consists of a curved, liquid-filled glass tube in which an inclinometer ball, moving with dampened motion, changes positions according to the gravitational and centrifugal force acting upon the aircraft.

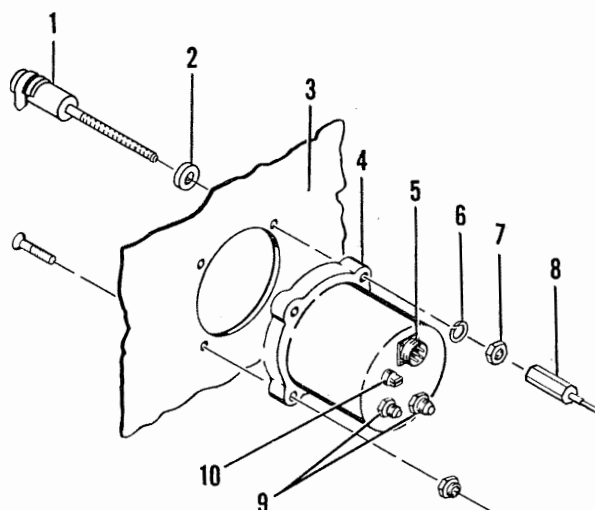
b. The Voltammeter, located on the left console, measures the current received from each alternator, individually or simultaneous, the battery drain or the battery bus voltage, whichever is desired, using the Voltammeter Selector Switch.

c. The Magnetic Compass is located on the windshield centerstrip. It consists of a pair of parallel magnetic bars surrounded by a circular calibrated compass card visible through a window in the compass case. The compass case is a metal bowl filled with liquid to dampen dial oscillation. Lighting is integral and controlled by a rheostat on the switch panel. The compass has two adjusting set screws, one for N-S headings and one for E-W headings. These set screws are located on lower face of compass behind the metal disc.

d. The Stall Warning Unit is mounted in the left console. A stall warning transmitter, mounted on the leading edge of the left wing, energizes the electrical circuit when the aircraft approaches a stall and causes the horn to operate. The stall warning transmitter incorporates a heater element, operated by the pitot heater switch, to prevent ice from hampering its operation.

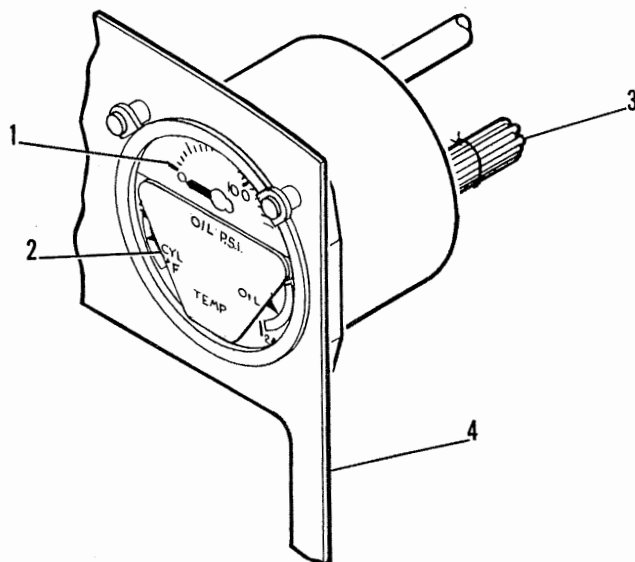
e. The Outside Air Temperature Gage is calibrated in degrees Fahrenheit and operated electrically from a free air temperature bulb located in the heat exchanger ram air duct, in the right stub wing.

f. (421-0001 to 421A0001) The flap position indicator is electrically operated and indicates the position of the flaps from zero to 45 degrees. The indicator operates in conjunction with a flap position transmitter located just aft of the fuselage spar. Refer to Section 8 for flap position transmitter removal and installation procedures.



1. Lighting Fixture	4. Instrument	8. Connector
2. Spacer	5. Electrical Connector	9. Hose Fittings
3. Instrument Panel	6. Lockwasher	10. Vent Plug
	7. Nut	

Figure 12-2. Typical Instrument Installation



1. Oil Pressure Line	3. Cylinder Head Wiring Bundle
2. Oil Temperature	4. Instrument Panel

Figure 12-3. Engine Combination Gauge

g. (421A0001 and On) The flap position is indicated by the flap preselect system pointer on the stationary instrument panel.

h. The cowl flap position indicator (421-0001 to 421B0001), mounted on the stationary panel in front of the pilot, is an electrically operated instrument using a transmitter connected to the cowl flap actuator for indicating degrees of travel.

i. The clock is a standard eight-day aircraft clock with a sweep second hand. A winding stem is provided in the lower left hand portion of the case.

Typical Instrument Removal. (See figure 12-2.)

- a. If instrument is not accessible, remove instrument panel in accordance with procedures for instrument panel removal.
- b. Disconnect and tag electrical wires, hoses or tubes from back of instrument being removed.
- c. Plug all hoses and cap fittings to prevent the entry of foreign matter.
- d. Remove the connector (8), nut (7), washer (6), and spacer (2) from the lighting fixture (1) if installed on instrument.
- e. Remove instrument (4) from panel (3) by removing nuts and screws.

NOTE

If the instrument is to be replaced, remove the hose or tube fittings and install the replacement unit.

Typical Instrument Installation. (See figure 12-2.)

NOTE

Lubricate straight threads with specification petrolatum; tapered threads with specification anti-seize compound. Apply lubricant to male threads only, omitting the first two threads.

- a. Position instrument (4) on back of instrument panel (3) and secure with attaching screws and nuts.

NOTE

Steps "b" and "c" should be omitted if no lighting fixtures are used to attach instrument.

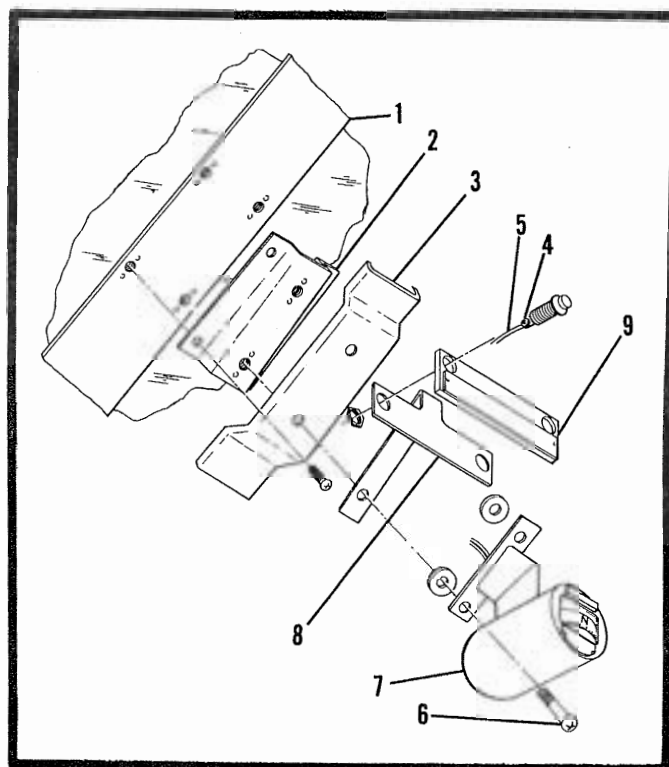
- b. Install lighting fixtures using spacers (2), washers (6) and nuts (7).
- c. Attach connectors (8) to lighting fixtures (1).
- d. Connect hoses, tubing and electrical wires as tagged at removal.
- e. Reinstall panel if removed.

Removal of Magnetic Compass. (See figure 12-4.)

- a. Remove screw (4) securing compass light wire to compass card light.
- b. Remove two mounting screws (6) securing compass to mounting bracket (2).
- c. Retain the compass card bracket for reassembly.

Installation of Magnetic Compass. (See figure 12-4.)

- a. Position compass (7) and compass card bracket on windshield centerstrip and secure with two screws (6).
- b. Connect compass light wire to compass card light terminal with screw (4).



1. Windshield Centerstrip	6. Mounting Screw
2. Mounting Bracket	7. Compass
3. Centerstrip Trim	8. Compass Card Bracket
4. Terminal Screw	9. Compass Card
5. Compass Light Wire	

Figure 12-4. Magnetic Compass

Compass Alignment Procedure.

The following procedures pertain to alignment of the magnetic (standby) compass and the flux detector on the slaved directional gyro. A calibrated compass rose must be used to accomplish the alignment procedures.

- a. Insure compensator adjustments are set to a neutral position. The compensators are located on flux detector or gyro, depending on system.
- b. Using a hand held magnetic compass, check all ferrous material parts for magnetism near the magnetic compass and flux detector.

- c. Degauss any parts within two feet which cause greater than 10° deflection of the magnetic compass, and any part within four feet which cause greater than 90° deflection of the magnetic compass.
- d. Insure that each of the applicable systems are controlled from the proper circuit breakers, and the corresponding "HDG" flag appears when the circuit breaker is disengaged.
- e. Insure slave meter is operative.
- f. Insure the systems fast slaving circuitry is operational.
- g. Insure all electrical instruments for the aircraft are installed and operative.
- h. Insure other aircraft and vehicles are a safe out of the way distance.
- i. Position aircraft on the 270° heading of the compass rose.
- j. With both engines running 1000 RPM, turn on the following:
 1. All circuit breakers.
 2. Inverters.
 3. All lights except landing lights and reading lights.
 4. All avionics systems.
 5. All electrical systems except pitot heat, stall and static heaters.
 6. Allow slaved gyro system to stabilize (stabilization speed may be increased by using fast slave).
 7. Record the slaved gyro system error in degrees and direction with the slave meter nulled.
 8. Record the standby compass error in degrees and direction.

NOTE

High readings are positive errors, low readings are negative errors.

9. Position aircraft on the 360° heading of the compass rose and repeat steps 1 thru 8.
10. Position aircraft on the 90° heading of the compass rose and repeat steps 1 thru 8.
11. Position aircraft on the 180° heading of the compass rose and repeat steps 1 thru 8.

Index Error Alignment.

This alignment should insure that the compass systems flux detector is positioned for minimum index error.

- a. Algebraically sum the four cardinal heading errors obtained in preceding paragraph, steps 1 thru 8.
- b. Divide the sum obtained by four. This result is the index error correction and direction of rotation of the flux detector.
- c. Rotate flux detector the direction and amount as calculated in steps a and b. CCW rotation of the flux detector is required to correct a positive error.

NOTE

Approximately five degrees rotation equals approximately 1/8 inch distance measured on the outer circumference of the flux detector.

- d. Repeat compass alignment procedure step j, 1 thru 8.

e. The remaining error at the cardinal headings as received in step d should equal the difference between the initial cardinal heading errors obtained originally in compass alignment procedure step j, 1 thru 8.

- f. Recalculate error and assure the remaining error is 0 ± 0.5 degrees.

Compensator Adjustments.

a. If the corrected error as calculated in index error alignment paragraph step a is greater than $\pm 2^\circ$ the compensators must be adjusted. The index corrected errors are used to calculate the required amount of degrees of compensation required for the remote compass. The errors obtained in the compass alignment procedure step j, 1 thru 8, for the standby compass will be used to determine the required amount and degree of compensation for the standby compass.

Compensation Calculations.

- a. Using cardinal heading errors calculated in index error alignment, step e for remote compass system and compass alignment procedure for the standby compass, algebraically sum the north and south errors, divide this sum by two and change the sign of the result. The resulting number is the amount and direction of north/south compensator adjustment.
- b. Repeat step a for east/west errors.

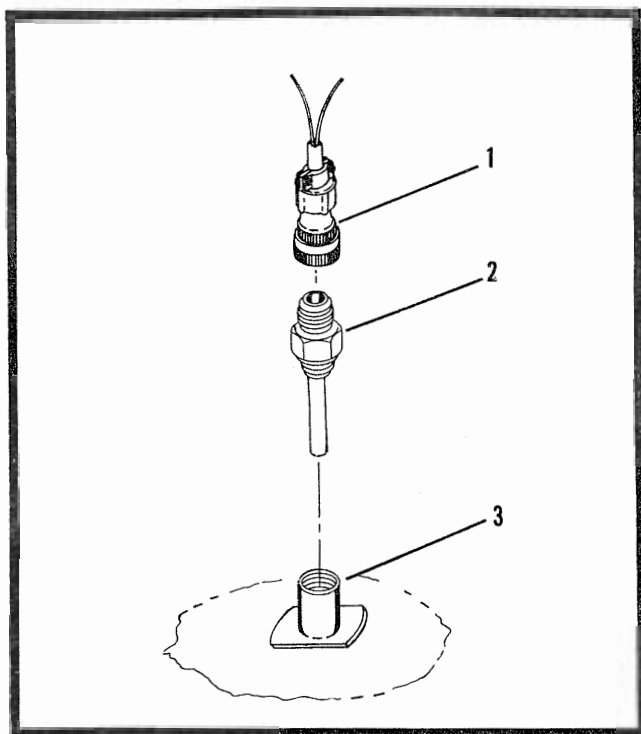
Compass Compensation.

- a. At one cardinal heading, adjust the appropriate compensator the amount calculated in the compensation calculations paragraph step a.
- b. Rotate the aircraft 90° and adjust the appropriate compensator the amount calculated.
- c. Rotate the aircraft to the next two cardinal headings and insure that no errors greater than two degrees for slaved gyro systems or five degrees for the standby compass are present.
- d. With normal aircraft power, all electrical systems on, rotate the aircraft to 30° headings (including cardinals). Stop on each reading long enough to allow the gyros to stabilize and the slave meter to null.
- e. Observe and record the headings indicated by the slaved gyro system.
- f. Record the headings indicated by the standby compass at the 30° positions.
- g. No error greater than $\pm 5^\circ$ shall be indicated by the standby compass.

NOTE

The errors determined in step f shall be recorded on the compass correction card.

- h. Turn off all electronic systems and shut down engines.



1. Electrical Connector 2. Bulb 3. Flange

Figure 12-5. Indicator Bulb

Typical Bulb Removal and Installation. (See figure 12-5.)

- a. Tag and disconnect electrical connector (1).
- b. Remove bulb (2).
- c. Install bulb by reversing removal procedures.

INSTRUMENT PANELS.

The stationary instrument panel is a part of the fuselage structure and is not ordinarily considered removable. (421-0001 to 421B0301 and 421B0801 and On), the pilot's and copilot's panels contain the flight instruments and are removable. (421B0301 to 421B0801), the pilot's and copilot's panels are hinged for easier access to instruments and fittings. The radio or radio panel is directly attached to the stationary panel depending upon the optional radio equipment installed. The removal of these panels will depend upon the individual or group of instruments required to be removed.

Removal of Instrument Panels. (See figure 12-1.)

- a. (421-0001 to 421B0301 and 421B0801 and On), remove the shock-mounted instrument panels as follows:
 1. Disconnect tubing lines to instruments and tag.
 2. Remove nuts (1) from shock mounts (3) on instrument panel and pull panel aft enough to disconnect instrument hoses and electrical leads. Tag all hoses and electrical leads.

b. (421B0301 to 421B0801), remove the hinged instrument panels as follows:

1. Remove the two holdown screws at aft end of glareshield. Lift shield up and pull aft. Remove from aircraft.
2. Remove two screws from Royalite cover over steering column and lift cover away from column.
3. Remove two screws from block holding steering column in place against instrument panel structure.
4. Remove two screws holding instrument panel to structure, swing panel out and down.
5. Disconnect tubing and electrical leads, tag and stow. Cap and plug hose connections.
6. Remove six mount screws from hinge at base of panel assembly.
7. Remove panel from aircraft.

c. Remove the instrument panels not shock-mounted as follows:

1. Remove screws, nuts, and washers from instrument panel and pull panel aft enough to disconnect instruments electrical leads.
2. Tag all electrical leads and remove panel.

Installation of Instrument Panels. (See figure 12-1.)

a. (421-0001 to 421B0301 and 421B0801 and On), install the shock-mounted instrument panels as follows:

CAUTION

Clean bonding area between stationary panel and instrument panel before starting to install instrument panel.

NOTE

Inspect rubber shock-mounts (3) and bonding strap (2) for deterioration and cracks. If either is damaged, replace before installing instrument panel.

1. Position instrument panel, to attach hoses and electrical leads as tagged at removal.

NOTE

Lubricate straight threads with specification petrolatum; tapered threads with specification anti-seize compound. Apply lubricant to male threads only, omitting the first two threads.

2. Position instrument panel on shock mounts (3) and install nuts (1).
3. Connect tubing lines to instruments.
 - b. Install the instrument panel not shock-mounted as follows:
 1. Position the instrument panel, to attach electrical leads as tagged at removal.
 2. Locate instrument panel and install screws, washers, and nuts.

c. (421B0301 to 421B0801), install the hinge mounted instrument panels as follows:

1. Position panel to align hinge assembly with structure. Secure panel to structure with six attaching screws.
2. Check condition of hoses, connectors, and wire bundles.
3. Attach hoses and electrical leads as tagged at removal.
4. Swing panel up taking care not to allow hoses or wires to kink or bind. Secure in place with two screws.
5. Reinstall block, cover, and glareshield.

VACUUM SYSTEM.

A dry vacuum pump, which requires no lubrication of any kind, is located on the aft right accessory mount pad of each engine. The pump outlets are exhausted into the engine nacelle. The vacuum line plumbing is routed from the vacuum pumps through the nacelles to the relief valves mounted in the wing root area. From the relief valves, the lines are routed through the stub wing, through the cabin to the vacuum manifold located on the left side of the forward cabin bulkhead. The manifold has check valves included to prevent reverse flow, in the event of failure of either vacuum pump. Hoses are routed from the manifold to the directional gyro, horizontal gyro, and suction gage. Other hoses connect the gyros to a vacuum air filter located on the forward side of the forward cabin pres-

sure bulkhead and to the suction gage. The suction gage is vented to ambient air through a fitting mounted in the forward cabin bulkhead. The suction gage indicates amount of vacuum present in the system; also provided are operational indicator buttons for each pump. The vacuum air filter is provided to remove dust particles and vapor from the air, providing dry, clean air for the instruments. Vacuum air is routed to a vacuum operated dump valve located on the aft cabin pressure bulkhead. The dump function of this valve is governed by an electric solenoid which opens the vacuum line to open the dump valve and closes the vacuum line to close the dump valve.

NOTE

All flexible and fixed line fittings, clamps, relief valves, and filters must be cleaned and suitably protected by caps or bags until installed in aircraft. The vacuum system shall not be open while awaiting the remaining parts to be installed. Prior to running of the vacuum pumps, the lines shall be flushed with air to approximately seven (7) cubic feet per minute while alternately closing off the ends of the lines. This will create pressure pulses to dislodge and eject foreign particles.

Trouble Shooting the Vacuum System.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO SUCTION INDICATED AT ONE SOURCE	Defective vacuum pump.	Check suction at pump. Replace pump.
	Disconnected, broken or plugged lines or hoses.	Check suction through lines and hoses. Clean or replace lines and hoses.
	Defective relief valve.	Check suction to and from relief valve. Replace relief valve.
	Defective suction gage.	Check suction at applicable line to test indicator buttons. Replace suction gage.
NO SUCTION INDICATED, BUT GYROS OPERATE NORMALLY	Defective suction gage.	Check suction to gage. Replace gage.
LOW SUCTION	Defective vacuum pump.	Check suction at pump. Replace pump.
	Leaking or restricted lines or hoses.	Clean or replace lines and hoses. Check suction through lines and hoses.
	Defective or improperly adjusted relief valves.	Check suction to relief valves. Adjust relief valve in accordance with adjusting procedures. Replace if defective.
	Defective check valves.	Check operation of check valves. Replace manifold assembly.
HIGH SUCTION	Relief valve air filters dirty.	Check operation with filters removed. Clean or replace filters.
	Defective or improperly adjusted relief valves.	Check suction to relief valves. Adjust relief valves in accordance with adjusting procedures. Replace if defective.
SUCTION GAGE FLUCTUATES	Excessive vibration.	Visually check for panel, gage or plumbing vibration. Determine cause of vibration and correct.
	Defective suction gage.	Check for fluctuating suction to gage. Replace gage.

Removal of Vacuum Pumps. (See figure 12-6.)

- a. Remove upper nacelle cowl.
- b. Loosen the two hose clamps securing hoses (1 and 3) to the vacuum pump (2).
- c. Remove vacuum pump (2) by removing four attaching nuts and washers.

NOTE

Do not clean vacuum pump (2) in solvent.
Clean by wiping with a clean cloth.

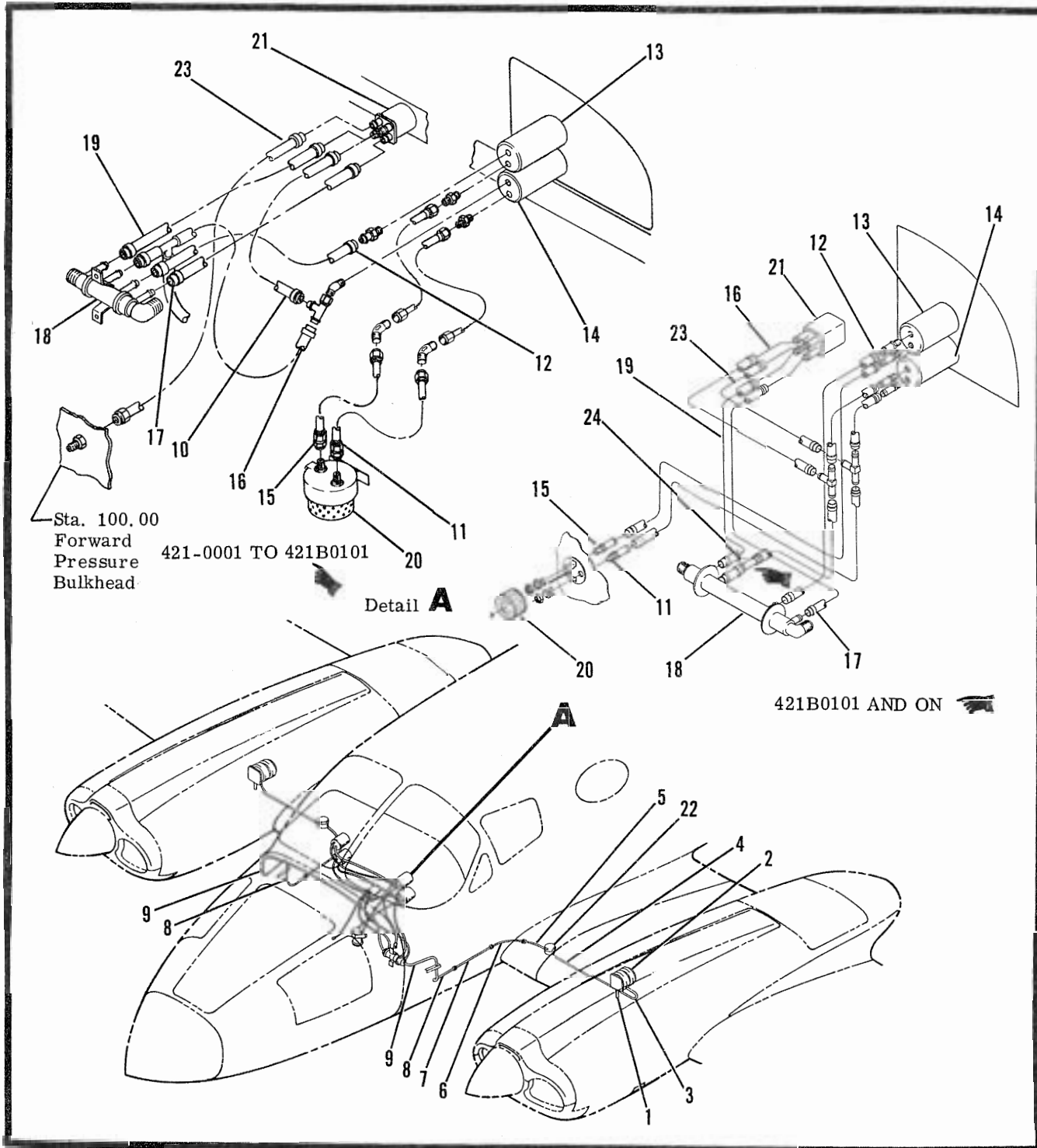


Figure 12-6. Vacuum System

Installation of Vacuum Pumps. (See figure 12-6.)

NOTE

If a new vacuum pump is being installed, remove the serviceable fittings from the old pump and install the fittings on the new pump. Use no oil of any sort, no thread lubricant of any description on any fitting used on the inlet side of the vacuum pumps. Make sure inlet fitting on the dry vacuum pump has an inlet screen.

- Align splines on the vacuum pump drive (2) with splines on the engine drive and slide vacuum pump into position so the ports are facing to the right.
- Secure vacuum pump (2) to the engine with four washers and nuts.
- Slide vacuum line hose (3) and clamp onto the in port of the vacuum pump and secure clamp.
- Slide vacuum pump outlet hose (1) and clamp onto the out port of the vacuum pump and secure clamp.
- Install upper nacelle cowl.

Removal of Vacuum Air Filter. (See figure 12-6.)

- Disconnect filter hoses (11 and 15) from filter fittings.
- Remove vacuum air filter (20) from forward side of the left hand cabin bulkhead by removing two screws.

Replacement of Vacuum Air Filter Element.

NOTE

It is not required to remove air filter to replace the element.

- Remove wing nut from the bottom of the vacuum air filter (20).
- Remove vacuum air filter element.
- Install new vacuum air filter element.
- Fasten element in place using wing nut.

Installation of Vacuum Air Filter. (See figure 12-6.)

Reverse the vacuum air filter removal procedures.

Removal of Vacuum Relief Valve. (See figure 12-6.)

- Remove wing gap skin (35). (See figure 1-2.)
- Remove relief valve (7) by loosening hose clamps, then slide hoses off of valve.
- Remove valve (7).

Installation of Vacuum Relief Valve. (See figure 12-6.)

Reverse the vacuum relief valve removal procedures.

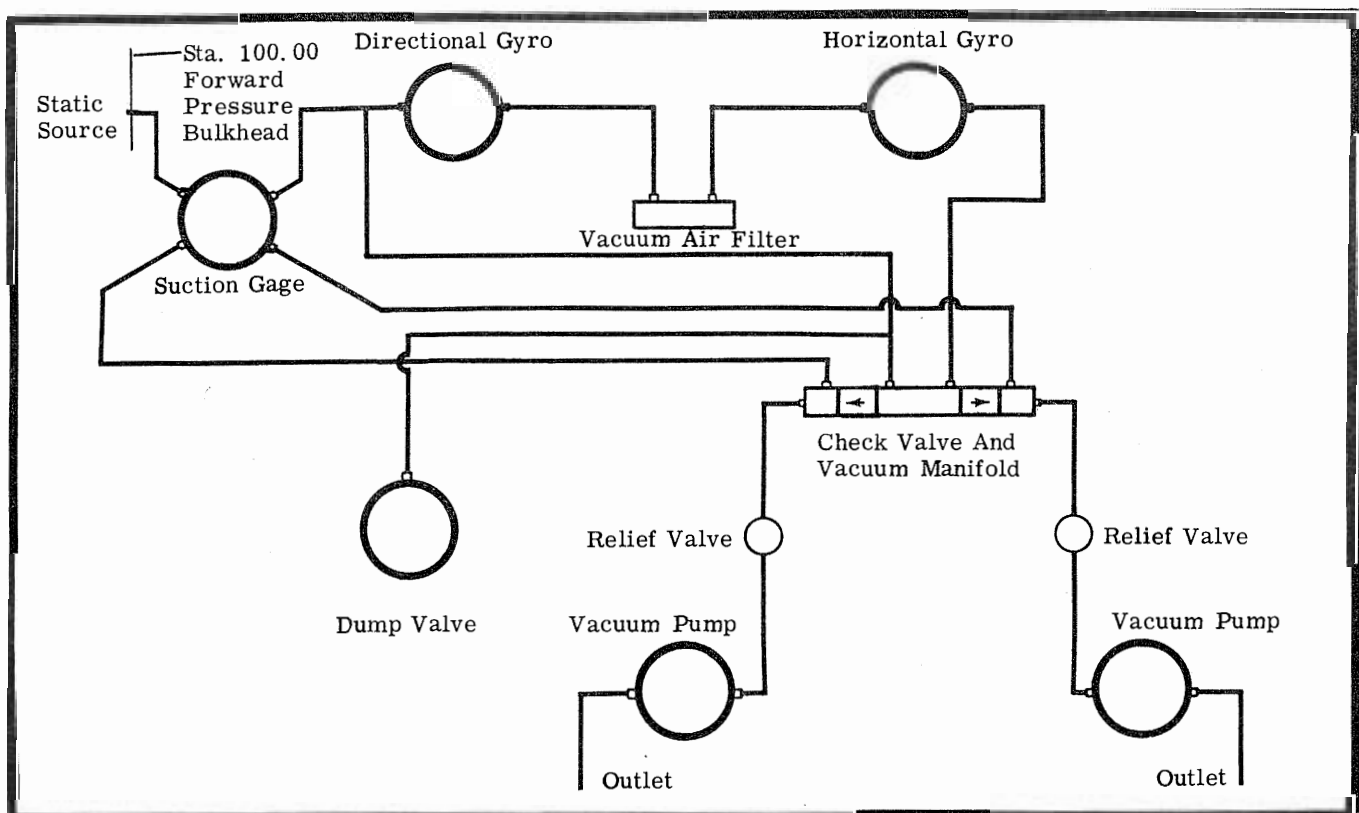


Figure 12-7. Vacuum System Schematic

Adjustment of Vacuum Relief Valve.

Since a relief valve is used for each vacuum source, each relief valve must be adjusted separately.

- a. Remove wing gap skin (35). (See figure 1-2.)
- b. Remove safety wire from adjusting screw locknut.
- c. Start the engines and idle the right engine.
- d. With left engine operating and tachometer reading 1700 RPM, the suction gage should read 4.80 inches of mercury.
- e. Adjust the left relief valve by loosening the knurled screw locknut and adjusting to obtain the desired vacuum reading, clockwise rotation of the adjusting screw increases the vacuum.
- f. Idle the left engine and operate the right engine so tachometer reads 1700 RPM.
- g. Adjust the right relief valve by loosening the knurled screw locknut and adjusting to obtain the desired vacuum reading. Clockwise rotation of the adjusting screw increases the vacuum.
- h. With both engines operating at tachometer RPM of 1700, the suction gage should read $5.00 \pm .25$ inches of mercury. If the gage reading is not within these limits, the relief valves should be readjusted to these limits.
- i. Shutdown both engines and check that the locknuts on the knurled adjusting screw are tight.

Removal of Vacuum System Plumbing. (See figure 12-6.)

NOTE

Removal procedure will be given for left engine installation only. Removal of right engine installation is basically the same.

- a. (See figure 1-2.) Remove engine nacelle cowls (29, 30 and 33).
- b. Remove hose (1) by loosening clamp and removing.
- c. Remove hose (3) by loosening clamp at vacuum pump and detaching from union at wing rib.
- d. Removal of line (4) is not recommended except as required for replacement. The replacement of the line with a hose to facilitate installation is permissible.
- e. Remove pilot's seat, copilot's seat, cabin divider (optional) kick plates and carpet in accordance with Section 3.
- f. Remove line (5) by detaching at the fuselage skin union and relief valve. Remove through wing gap.
- g. Remove aft cabin vacuum line (6) by disconnecting at fuselage skin union and intermediate line union.
- h. Remove intermediate line (7) by disconnecting at aft line union and forward line union.
- i. Remove left upholstery side panel in accordance with Section 3.
- j. Remove forward vacuum line (8) by disconnecting from intermediate line union, and from union at support bracket.
- k. Remove manifold line (9) by disconnecting from union at support bracket and from union at manifold (18).

- l. Remove manifold (18) by disconnecting all hoses from manifold and removing two screws.
- m. Remove hose from manifold (18) to instrument and instrument to filter by removing clamps at manifold and disconnecting hoses at instrument.

Installation of Vacuum System Plumbing. (See figure 12-6.)

NOTE

Slight bending of the vacuum line may be required to facilitate installation, however, excessive bending should be avoided. Use no oil of any sort, no thread lubricant of any description on any fitting used on the inlet side of the vacuum pumps.

- a. Reverse the vacuum system plumbing removal procedure except installation of the upholstery panel, wing panels, access panels, carpet, kick plates, pilot's seat, copilot's seat and cabin divider (optional).
- b. Check vacuum system and adjust the relief valves if system vacuum gage indication is not within the specified limits.
- c. Install the upholstery panel, wing panels, access panels, carpet, kick plates, pilot's seat, copilot's seat, cabin divider (optional) and nacelle cowls.

PITOT STATIC SYSTEM.

The pitot tube mounted in the nose of the fuselage and connected with plastic tubing to the airspeed indicator provides it with ram air pressure. An electrical heating element is installed within the pitot tube to prevent ice from obstructing the pitot tube opening during severe weather conditions. The static pressure is provided by two holes mounted on opposite sides of the fuselage, aft of the cabin compartment. These are connected with plastic tubing and routed forward through the right side of the fuselage to a tee. The static drain valve is forward of the tee and is accessible through the copilot's side pocket. The static pressure line is routed from the tee up the right side and across to the altimeter, vertical speed indicator and airspeed indicator. The alternate static source valve which substitutes an alternate ambient air pressure for atmospheric air pressure in emergencies is located forward of the left hand switch and circuit breaker console. The valve is attached by plastic tubing to the airspeed indicator.

Removal of Pitot and Static Lines. (See figure 12-9.)

The location of all pitot and static lines are shown in figure 12-9. All lines are standard nylon or aluminum tubing and fittings. (All of the lines are equipped with conventional fittings and may be removed when necessary.) Lines and fittings may be cleaned by immersing in denatured alcohol or tri-ethyl alcohol and dry with filtered compressed air.

Installation of Pitot and Static Lines. (See figure 12-9.)

- a. Install lines as illustrated in figure 12-9.

NOTE

Apply a small amount of suitable thread lubricant to male threads of all metal fittings before installation.

Testing Static Pressure System. (See figure 12-9.)

When testing the static pressure system, it will be necessary to evacuate the system using a vacuum source capable of 9 inches Hg. to provide an instrument altitude indication of 9550 feet. See figure 12-11 for test equipment and connection schematic.

NOTE

If autopilot is installed turn off all electrical power.

- a. Set all altimeters to zero.
- b. Close static drain valve (15).
- c. Alternate static system valve (16) must be closed.
- d. Carefully seal static ports (11) in tail cone with masking tape.
- e. Connect vacuum source to the alternate static system bulkhead fitting (12) at station 100.00 lower left side of nose compartment.
- f. Disconnect pitot line at aft cabin airspeed indicator.
- g. Attach vacuum line to airspeed pitot tube. This is to equalize pressure within the cockpit airspeed instruments to prevent damage when vacuum is applied to the static system.

NOTE

Do not use positive pressure in the static system with the instruments connected. When applying or releasing vacuum from the static system, care should be taken not to exceed the range of the rate of climb indicator as instrument damage could result.

- h. Close pitot control valve to protect airspeed indicators during the test in step (i).
- i. With the alternate static valve (16) closed apply vacuum to the line between the vacuum source attachment and the alternate static valve (16) until 9550 feet is indicated on the altimeter. Lock pressure in the line by closing the vacuum control valve and immediately check leak down rate for one minute. The indicated altitude loss should not exceed 190 feet per minute. Tap indicator lightly during leak down check.
- j. Release vacuum slowly and change alternate static valve (16) to the open position.
- k. Apply vacuum to the static system until altimeters indicate approximately 3500. Slowly open pitot control valve to apply enough vacuum to equalize pressure and stabilize the airspeed indicators.

NOTE

Care must be taken during evacuation of the static system above 3500 feet indicated altitude to prevent damaging airspeed indicators. This can be done by metering vacuum to the pitot system through the pitot control valve, to keep from exceeding instrument range.

- l. Continue to evacuate the static system until 9550 feet is indicated on the altimeters. Lock pressure in the static and pitot systems by closing both test control valves and immediately check leak down rate for one minute, tap altimeter lightly during leak down check.

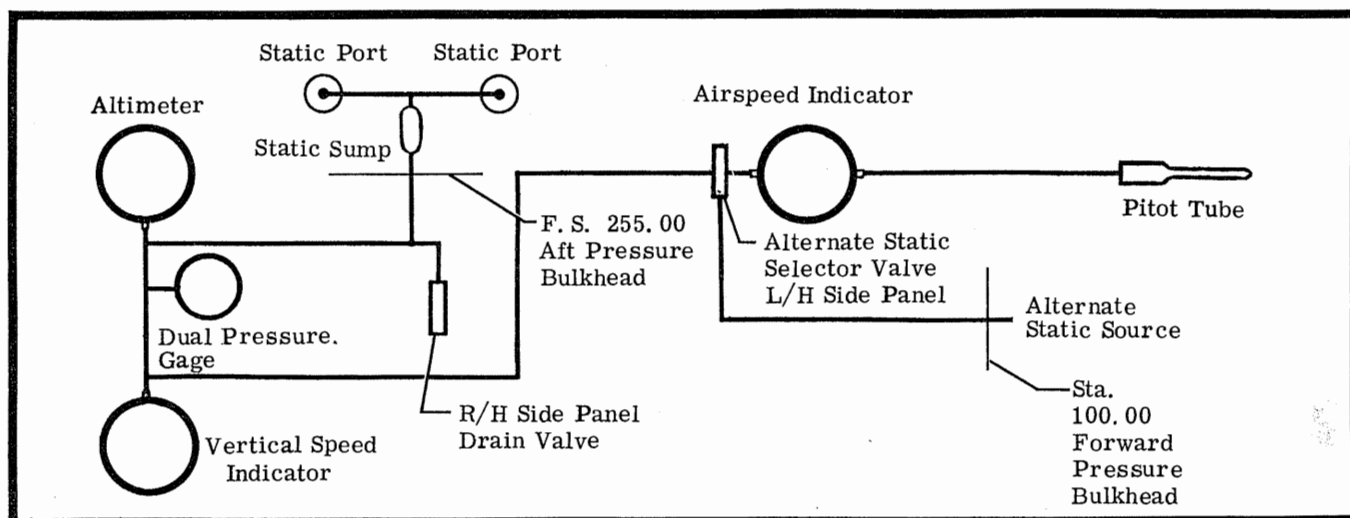
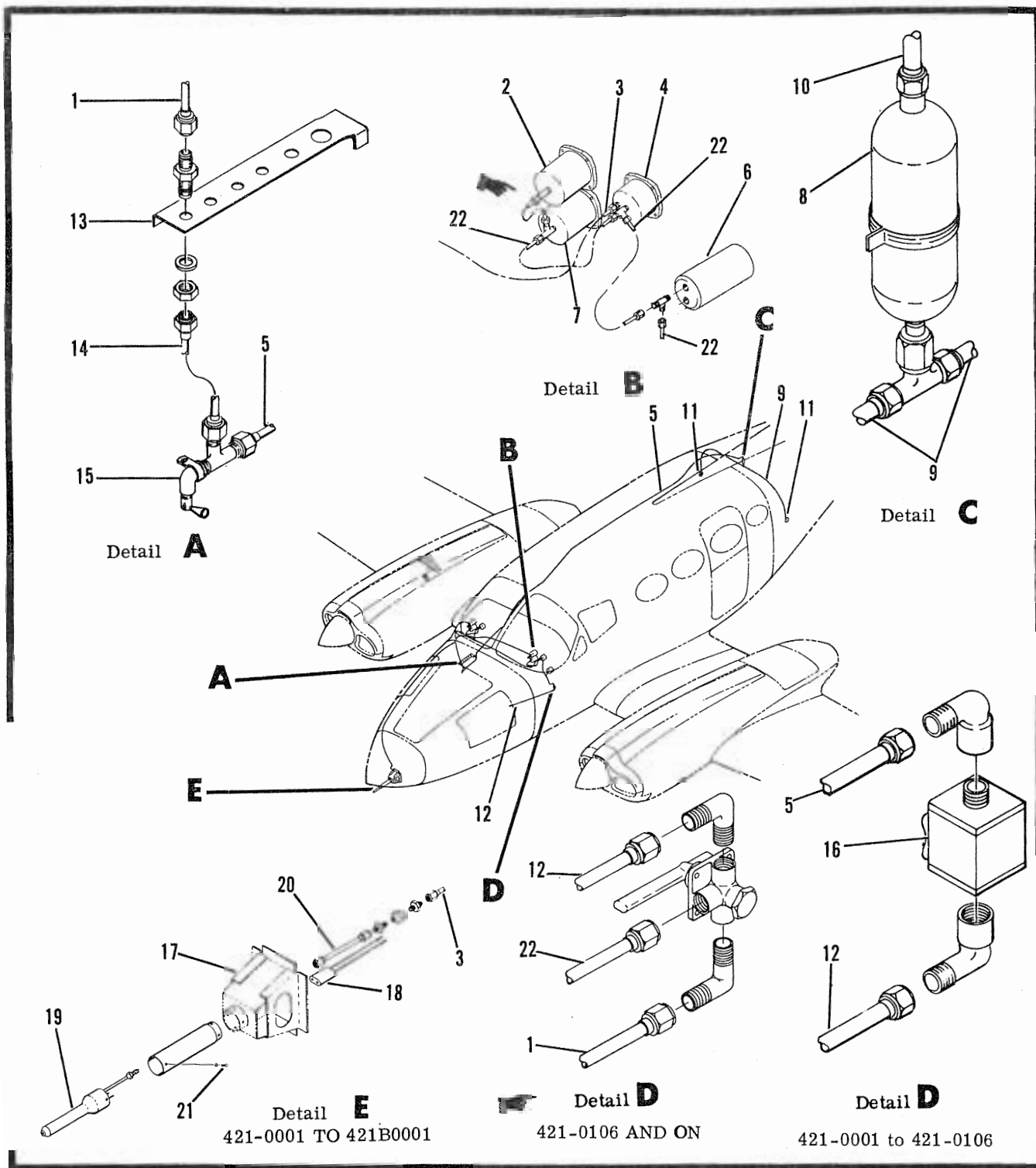


Figure 12-8. Pitot Static System Schematic



1. Forward Static Line
2. Altimeter
3. Pitot Pressure Line
4. Airspeed Indicator
5. Static Source Line
6. Dual Pressure Gauge
7. Vertical Speed Indicator

8. Sump
9. Static Crossover Line
10. Aft Static Line
11. Static Port
12. Alternate Static Line
13. Support Bracket
14. Static Line
15. Drain Valve

16. Selector Valve
17. Pitot Tube Bracket
18. Receptacle
19. Pitot Tube
20. Pitot Line
21. Screw
22. Instrument Static Line

Figure 12-9. Pitot Static System (Sheet 1 of 2)

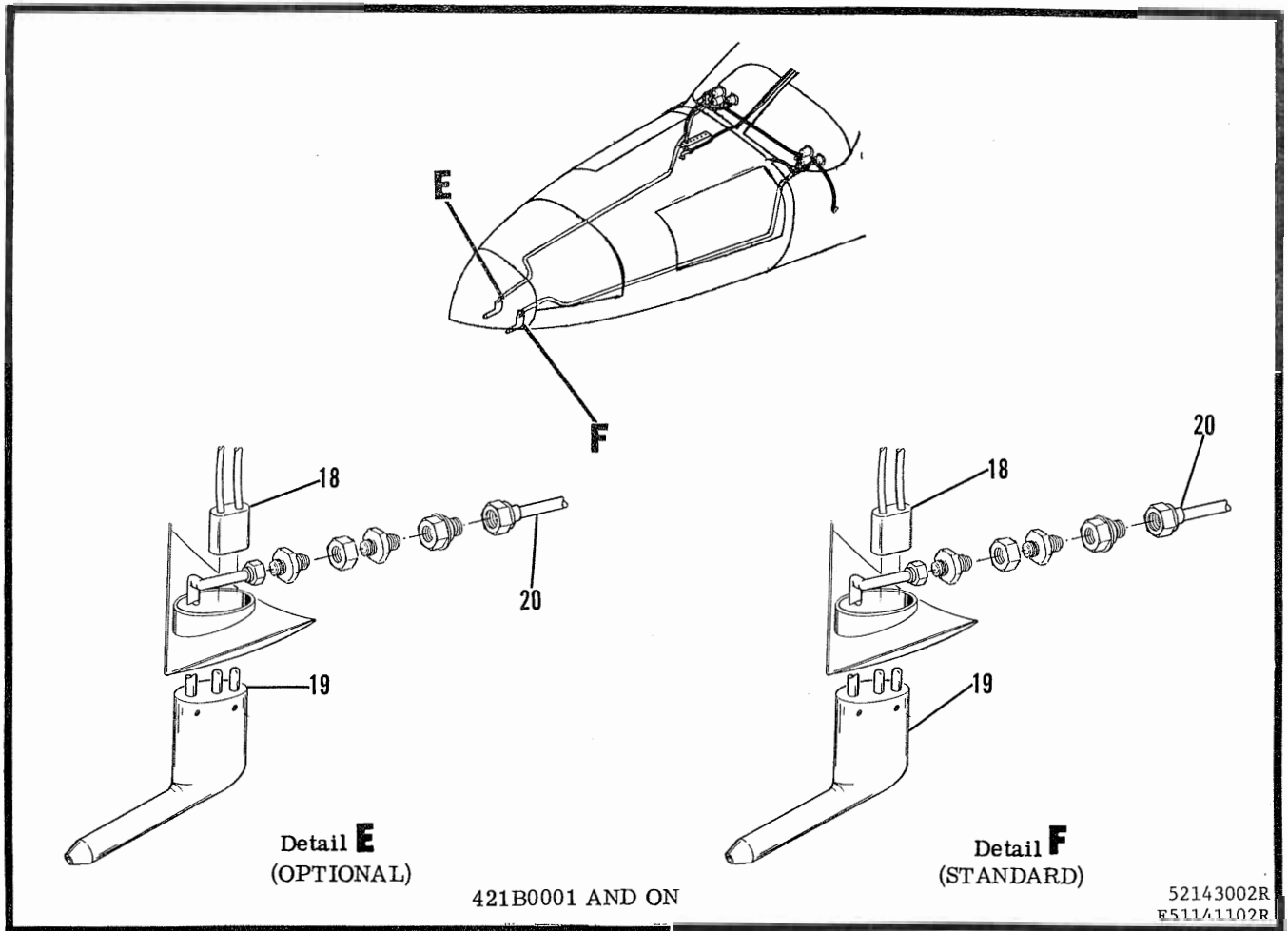


Figure 12-9. Pitot Static System (Sheet 2)

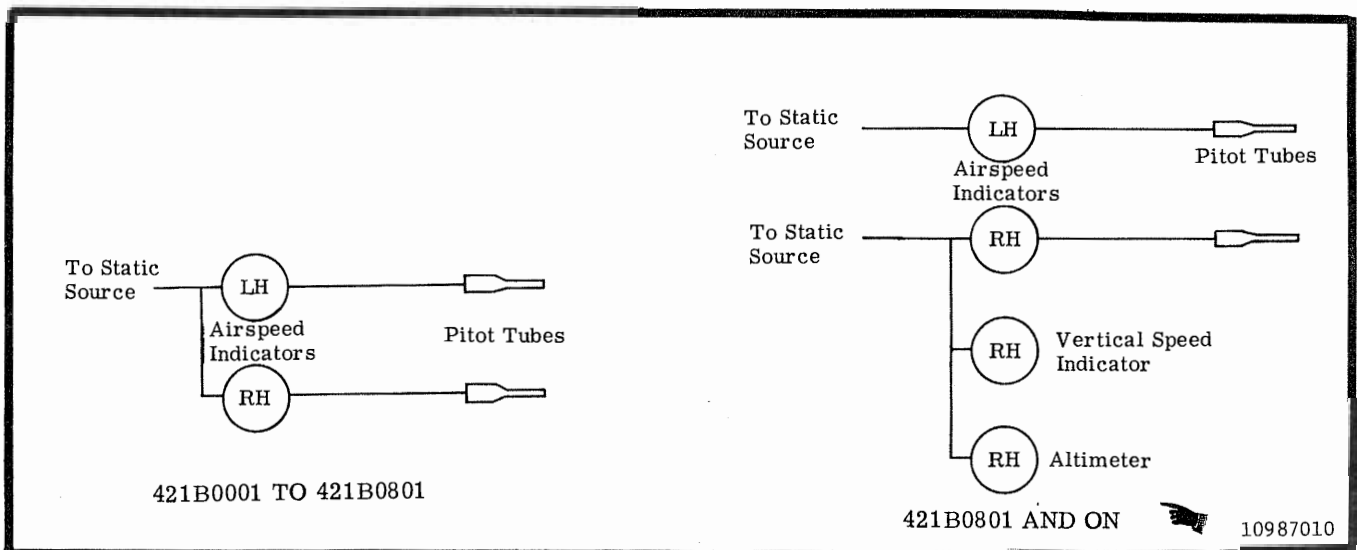


Figure 12-9A. Dual Pitot System Schematic

Dual Pitot and Static System. (See figure 12-9A.)

On aircraft 421B0001 and On, an optional pitot system is provided for the copilot's airspeed indicator. It is independent of the pilot's airspeed indicator but uses a common static air source.

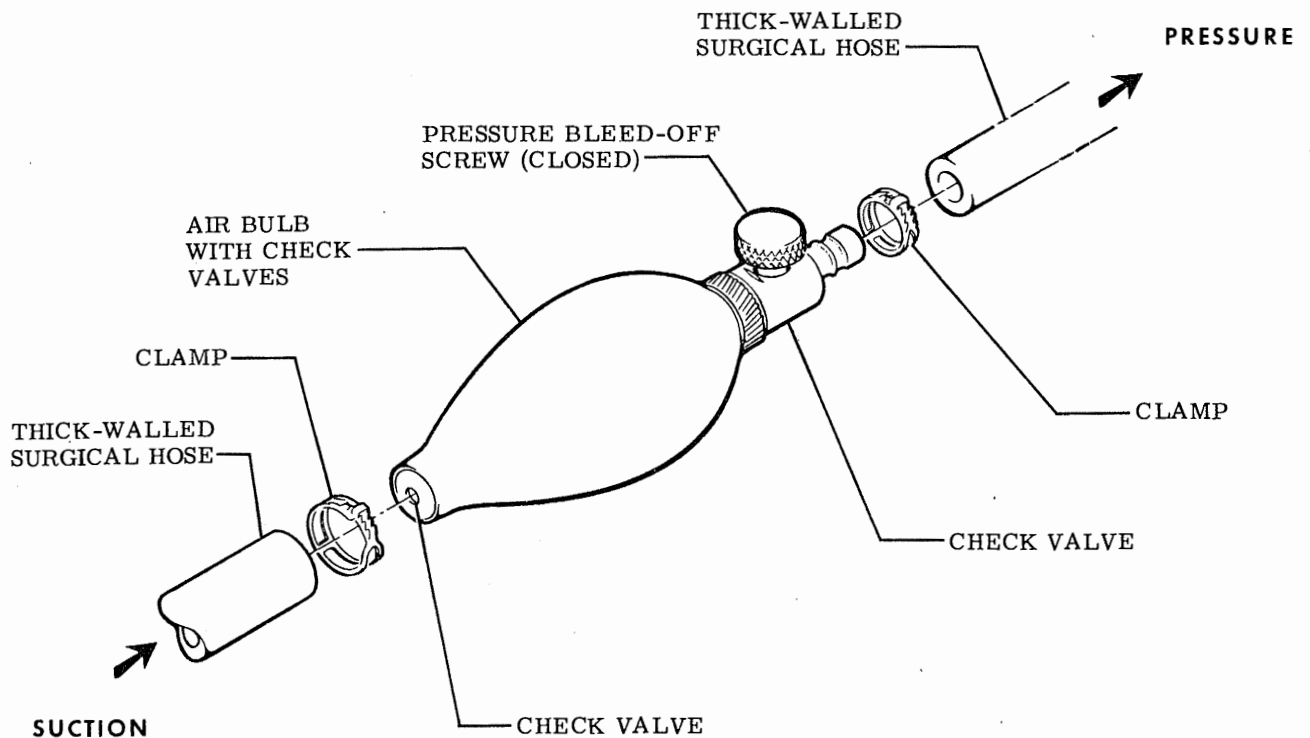
On aircraft 421B0801 and On, an optional static air

source is provided for the copilot's flight instruments. It is identical to but independent of the pilot's flight instruments static system.

For maintenance and servicing of the dual pitot and static systems, refer to procedures for removal, installation, testing and purging of the standard systems.

NOTE

Air bulb with check valves may be obtained locally from a surgical supply company. This is the type used in measuring blood pressure.



TO TEST PITOT PRESSURE SYSTEM

1. Connect pressure hose to pitot tube.
2. Slowly squeeze air bulb to apply desired pressure to pitot system. Desired pressure may be maintained by repeatedly squeezing bulb to replace any air escaping through leaks.
3. Release pressure by slowly opening pressure bleed-off screw, then remove test equipment.

Figure 12-10. Pitot System Test Equipment

m. A leak down rate of 190 feet per minute or less indicates the static system is within the allowable tolerance and has satisfactorily completed the test.

n. Slowly release the vacuum from the pitot and static systems, remove the test equipment, close the alternate static valve (16) and remove tape from static buttons (11) in tail cone. Reconnect aft cabin airspeed indicator if installed to return aircraft to service.

Isolation of Excessive Static System Leakage.

If the system leak down rate exceeds 190 feet per minute, the leakage must be located and corrected. Possible sources are the static port assemblies, system connections and fittings, selector and drain valves and instrument case leakage.

NOTE

All system connections require plastic line inserts (P/N S-1131-1) to seal properly, any connection without inserts must have them installed before resealing.

When checking for excessive leakage proceed as follows:

a. Remove the static line from one of the tail cone static ports (11) and plug the line. Apply vacuum to the system and leak check for one minute as described above. Check the leakage rate. Repeat the above test with the other static port disconnected from the system. If system leak down rate is improved with static ports out of the system, either or both ports are leaking and should be resealed or replaced as follows:

1. Remove static port by drilling out four rivets. Install a tube in the static port, seal the vent hole securely, apply positive pressure while static port is immersed in water to detect leakage. If the static port is leaking replace it.

2. If the static port assembly does not leak it should be reinstalled and sealed using PR1422 (MIL-S-8802).

NOTE

Insert a wire through the vent hole to prevent sealant from plugging hole. Do not apply vacuum to port, for a period of 4 hours after resealing to allow sealant to set. Remove wire after sealant has set.

b. Connect static port lines together and apply vacuum to 9,550 feet altitude and check leak down rate for one minute.

c. If static system leak down rate is still in excess of 190 feet per minute, slowly remove the vacuum source, disconnect and plug cockpit instrument static line at the instrument side of the drain valve (located at the copilots side pocket). This isolates the cockpit instruments from the remainder of the system.

d. Slowly apply vacuum to the static and pitot systems of the cockpit instruments as described previously (monitor pitot vacuum above 3,500 feet) until 9,550 feet altitude is indicated. Lock pressure in

the system and conduct leak check for one minute.

e. A leak rate of less than 190 feet per minute indicates cockpit instrument system is satisfactory and excessive system leakage is isolated to the remainder of the system in the fuselage.

1. Remove line fittings at static system drain valve, aft cabin bulkhead and tail cone sump and make sure fitting line inserts (P/N S-1130-1) are installed and that fittings are not cracked. Reinstall fittings using a light coating of Parker thread lube or equivalent for sealant.

NOTE

Care must be used when installing and tightening nylon line connection nuts to prevent damage due to over-torque.

2. Reconnect the cockpit instrument system and the fuselage system at the static drain valve. Apply vacuum to the test altitude to check leak down rate. If leakage is less than 190 feet per minute the system is satisfactory.

f. A leak down rate in excess of 190 feet per minute while testing cockpit instruments, as described in item (d) above, requires that the leakage be isolated and corrected.

1. Release vacuum from the cockpit instrument system and remove the glove box for easier access to lines behind the instrument panel.

2. Disconnect and plug pitot and static lines between pilot and copilot instrument group (copilot optional instruments) behind the copilots instrument panel.

3. With pilots instruments isolated, apply vacuum to the pitot and static systems (monitor airspeed pitot vacuum above 3,500 feet) until 9,550 feet altitude is reached and conduct leak check for one minute.

4. If leak rate for the pilots instrument group is less than 190 feet per minute, release vacuum slowly from the system, reconnect pilot and static lines between pilot and copilot instrument groups coupling the cockpit instruments together again.

5. The above test indicated excess leakage in the copilot instrument group. Check for leak as follows:

(a) Isolate copilot instruments in the following order, one at a time - airspeed rate of climb indicator and altimeter. Disconnect and plug the static line at the instrument (both pitot and static lines for airspeed) and apply vacuum to the remainder of the system, until a 9,550 foot altitude is reached and conduct leak down check for one minute.

(b) After each instrument is tested by removing it from the system, lines should be reconnected to each acceptable instrument before proceeding. The results of these tests will show the source of leakage.

(c) Instruments found to be leaking excessively should be replaced.

6. If the test of the pilots instruments (f. 4. above) indicates a leak rate over 190 feet per minute, the following isolation procedure is required:

(a) Release vacuum from the system and isolate instruments in the following order, one at a time - airspeed, rate of climb, cabin differ-

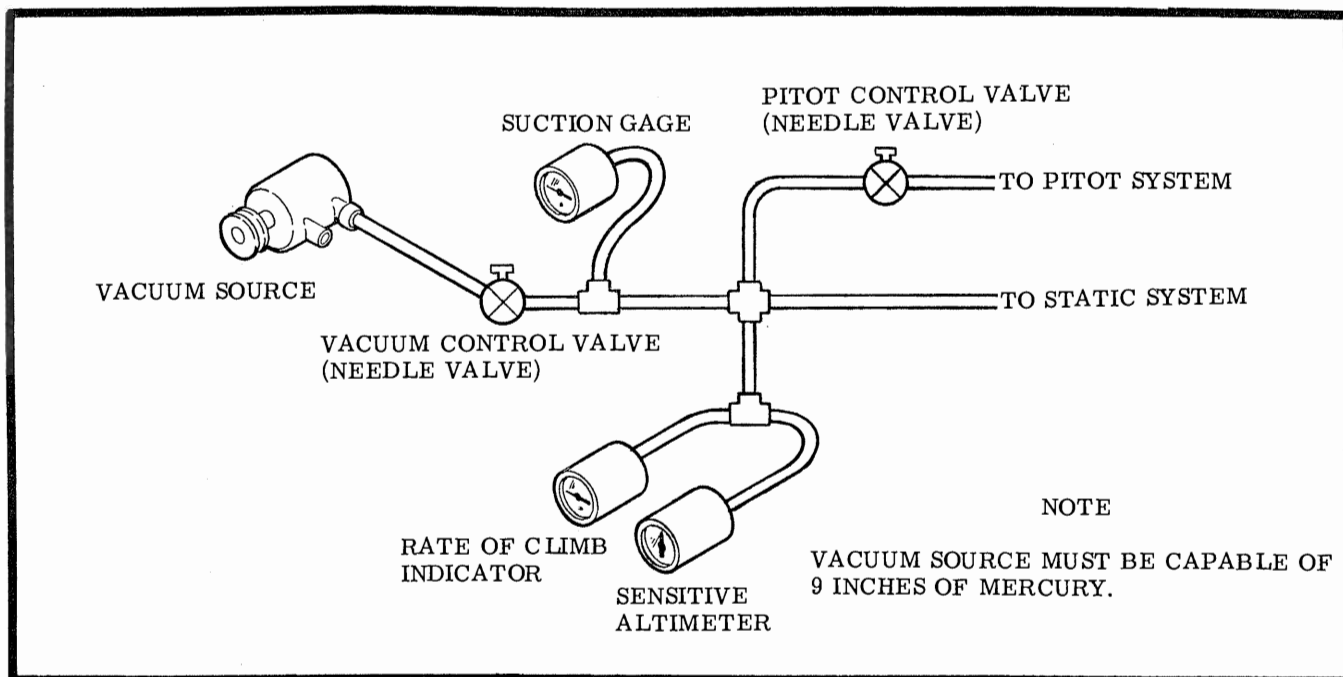


Figure 12-11. Typical Static System Test Equipment

ential pressure gage and altimeter. Disconnect and plug the static line at the instrument (both pitot and static lines for airspeed). Apply vacuum to the remainder of the system until the test altitude is reached and check leak down rate for one minute.

- (b) Reconnect each acceptable instrument to the static system before proceeding. If instruments leak replace instruments.

NOTE

If leakage is indicated at a point other than the pilots instruments, be sure to test the static line to the autopilot computer.

7. With leakage isolated and corrected in the cockpit instrument system and in the fuselage system, reconnect lines to the tail cone static ports (11). Check security of connections of static lines at the drain valve.

8. Apply vacuum to the complete system (monitor airspeed pitot vacuum above 3,500 feet) until 9,550 feet is indicated on the altimeters. Lock pressure in the static and pitot systems and check leak down rate for one minute. The altitude loss should not exceed 190 feet per minute.

9. Replace glove box, remove test equipment, reconnect pitot line at the aft cabin airspeed, close alternate static valve and replace access openings to return the aircraft to service.

CAUTION

If static drain valve is left open during flight, damage to instruments can occur.

Testing Pitot Pressure Lines. (See figure 12-9.)

- a. Connect a pressure source to opening in pitot tube assembly (19).
- b. Apply pressure slowly until airspeed indicator reads 150 MPH; shut off pressure, seal opening and wait one minute.

CAUTION

The amount of pressure required for a 150 MPH indication is less than 1/2 PSI. Avoid high pressures as instrument damage will result.

- c. If airspeed indicator (4) drops more than 10 MPH in one minute, disconnect hose from airspeed indicator (4).
- d. Plug hose and apply pressure.
- e. Coat lines and connections with a solution of soap and water to locate leak.
- f. Tighten or repair faulty connections or replace lines. Connect hose to instrument and repeat step "b" to be certain connections and lines do not leak.

CAUTION

Do not apply suction to pitot pressure system unless static system is being tested.

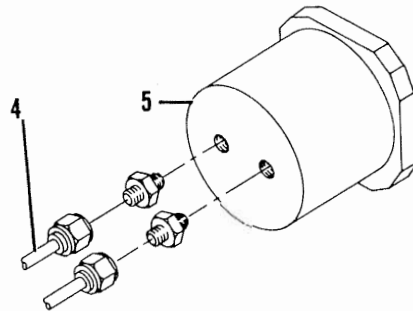
Purging Pitot or Static Lines.

Although the pitot system is designed to drain down to the pitot tube opening, condensation may collect at other points in the system and produce a partial obstruction. To clear the line, disconnect it at the airspeed indicator and, using low pressure air, blow from the indicator end of the line toward the pitot tube.

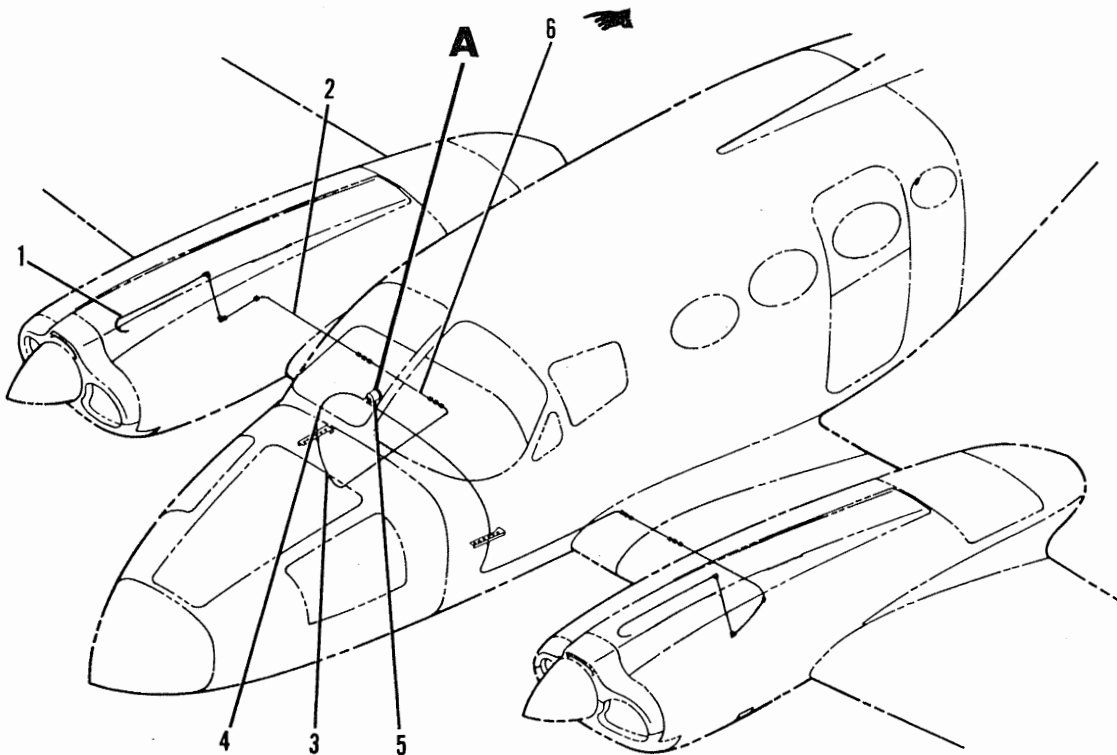
CAUTION

Never blow through the pitot lines toward the instruments. Doing so may damage them. If autopilot is installed with altitude hold, disconnect the static line from the computer before purging static lines.

Like the pitot lines, the static pressure lines must be kept clear and the connections tight. The system has static source sumps that collect moisture and keep the system clear. However, when necessary, purge the system as follows:



Detail **A**



- 1. Manifold Line
- 2. Wing Line
- 3. Cabin Line

- 4. Gage Line
- 5. Manifold Pressure Gage
- 6. Stub Wing Line

Figure 12-12. Manifold Pressure System

- a. On aircraft 421-0001 to 421-0107:
 1. Disconnect static line to instruments from the static line drain valve tee.
 2. Cap or plug open end of tee.
 3. Open static source drain valve.
 4. Plug one static port.
 5. Purge the system from the drain valve with clean moisture free air for a period of at least two minutes.
 6. Plug opposite static port and repeat step 5.
 7. Remove cap or plug from static line drain valve tee.
 8. Connect static line to instruments to the static line drain valve tee.
 9. Leak check static system in accordance with testing procedures.
- b. On aircraft 421-0107 and On:
 1. Turn static source selector valve to "Alternate Source."
 2. Open static source line drain valve.
 3. Plug one static port.
 4. Purge system from the drain valve with clean moisture free air for a period of at least two minutes.
 5. Plug opposite static port and repeat step 4.
 6. Close static line drain valve and turn static source selector valve to main system.

Removal of Pitot Tube. (See figure 12-9.)

- a. Remove screw (21) and pull pitot tube (19) forward.
- b. Disconnect heat element receptacle (18).
- c. Disconnect line (20) from pitot tube (19).
- d. Use denatured alcohol or tri-ethyl alcohol for cleaning the pitot tube.
- e. Dry all parts with filtered compressed air.

Installation of Pitot Tube. (See figure 12-9.)

- a. Connect line (20) to pitot tube assembly (19).
- b. Connect heat element receptacle (18).
- c. Position pitot tube (19) into sleeve and install screws (21).

MANIFOLD PRESSURE SYSTEM.

The manifold pressure system consists of a dual manifold pressure gage mounted in the instrument panel. The manifold pressure lines are routed from the intake manifold of each engine to separate connections at the back of the gage. The gage is calibrated in inches of mercury, it indicates the absolute pressure in the intake manifold of each engine.

Removal of Manifold Pressure Plumbing. (See figure 12-12.)

NOTE

Removal procedure will be given for left engine installation only. Removal of right engine is basically the same.

- a. (See figure 1-2.) Remove engine nacelle cowls (29, 30 and 33).
- b. Remove cabin divider (optional), pilot's seat, copilot's seat, kick plates, carpet, and left forward upholstery side panel in accordance with Section 3.
- c. (See figure 1-2.) Remove forward wing structural skin (35), heat exchanger access (57), air inlet access (54), fuel selector access (55), wing fitting access (56), access (69) and front spar access (77).
- d. Remove manifold line (1) by disconnecting at rear baffle and firewall bulkhead.
- e. Remove wing line (2) by disconnecting from union at firewall bulkhead and from wing splice union.

NOTE

It may be necessary to bend the line slightly to facilitate removal, however, excessive bending should be avoided to prevent possible damage to the lines.

- f. Remove stub wing line (6) by disconnecting at unions.
- g. Remove cabin line (3) by disconnecting from union at wing splice and at support angle remove clamps then remove line.
- h. Remove gage line (4) by disconnecting from union at support angle and from elbow at manifold gage (5).

Installation of Manifold Pressure Plumbing. (See figure 12-12.)

Reverse the Manifold Pressure Plumbing procedures.

NOTE

Apply a small amount of suitable thread lubricant to male threads of all fittings before installation. Slight bending of the manifold pressure lines may be required to facilitate installation, however, excessive bending should be avoided.

SECTION 13

UTILITY AND OPTIONAL SYSTEMS

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HEATING, VENTILATING AND DEFROSTING SYSTEM. (See figure 13-1.)

The heating and ventilating system provides air for cabin heating, cooling, ventilation, defrosting, and also provides an air source for cabin pressurization. Air enters the cabin through controllable outlets. Two outlets are located at the base of the windshield for defrosting purposes, two are located on the forward cabin pressure bulkhead just forward of each set of rudder pedals and one is mounted on each side of the cabin. There are also seven overhead wemac valves.

During unpressurized ground operation, fresh air enters a ram air scoop located in the nose of the aircraft and is forced through the cabin outlets by use of the cabin heater fan acting as a ventilating fan. The cabin heater controls the temperature of the ventilating air. The ventilating fan is operated by the use of either the cabin fan switch or the cabin heat switch. During unpressurized flight operation, air also enters the ventilation system through a duct located underneath the fuselage and is routed through ducts to individual adjustable overhead wemac valves.

During pressurized flight, ventilating air is ducted from the turbine compressor, through a heat exchanger which cools the air, into the cabin ventilating system. Fresh air continually enters the cabin and is exhausted through a cabin pressure regulating valve located on the aft pressure bulkhead.

Description of Heater and Basic Components.

The heater is a gasoline combustion type and is mounted in the right side of the nose section. On aircraft 421-0001 thru 421B0229, fuel is routed from a tee in the fuel crossfeed line through a filter and pulsating pump to the solenoid valve-regulator which regulates the fuel pressure to 7.5 ± 0.5 psi. On aircraft 421B0229 and on the fuel pump is mounted in the combustion blower. Fuel from the solenoid valve-regulator is routed through the fuel line assembly to the heater. The heater fuel line assembly fitting, at the heater, is enclosed in a metal housing. The housing is vented and drained as a precaution against fire in the event of a fitting leakage. Fuel routed through the fuel line assembly enters the heater solenoid valve which allows fuel to pass through the combustion chamber spray nozzle. Electrical current is supplied to the combustion air blower, combustion air pressure switch and ignition coil when the heater switch is placed in the HEAT position.

As the combustion air flow increases, the combustion air pressure switch closes and actuates the ignition coil and heater solenoid valve. Fuel then flows through the heater solenoid valve into the combustion chamber spray nozzle which injects a conical shaped spray cone of fuel into the combustion chamber where the spark plug is already sparking, thus combustion occurs. As the heated air flowing from the heater to the cabin exceeds the thermostat setting, the thermostat automatically closes the solenoid valve, stopping fuel flow into the heater. As the heater cools, the thermostat opens the solenoid valve, allowing fuel to flow and combustion takes place since the spark plug is continually sparking. By cycling on and off the heater maintains an even air temperature in the cabin. The heater combustion chamber is completely separate from the ventilating system to prevent any exhaust gases from contaminating the cabin air. All exhaust gases are vented overboard through an exhaust tube directly beneath the heater.

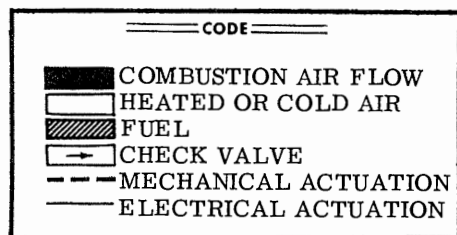
Operating Procedure.

- a. Place the CABIN HEAT switch in the ON position. The heater should fire and continue to operate.

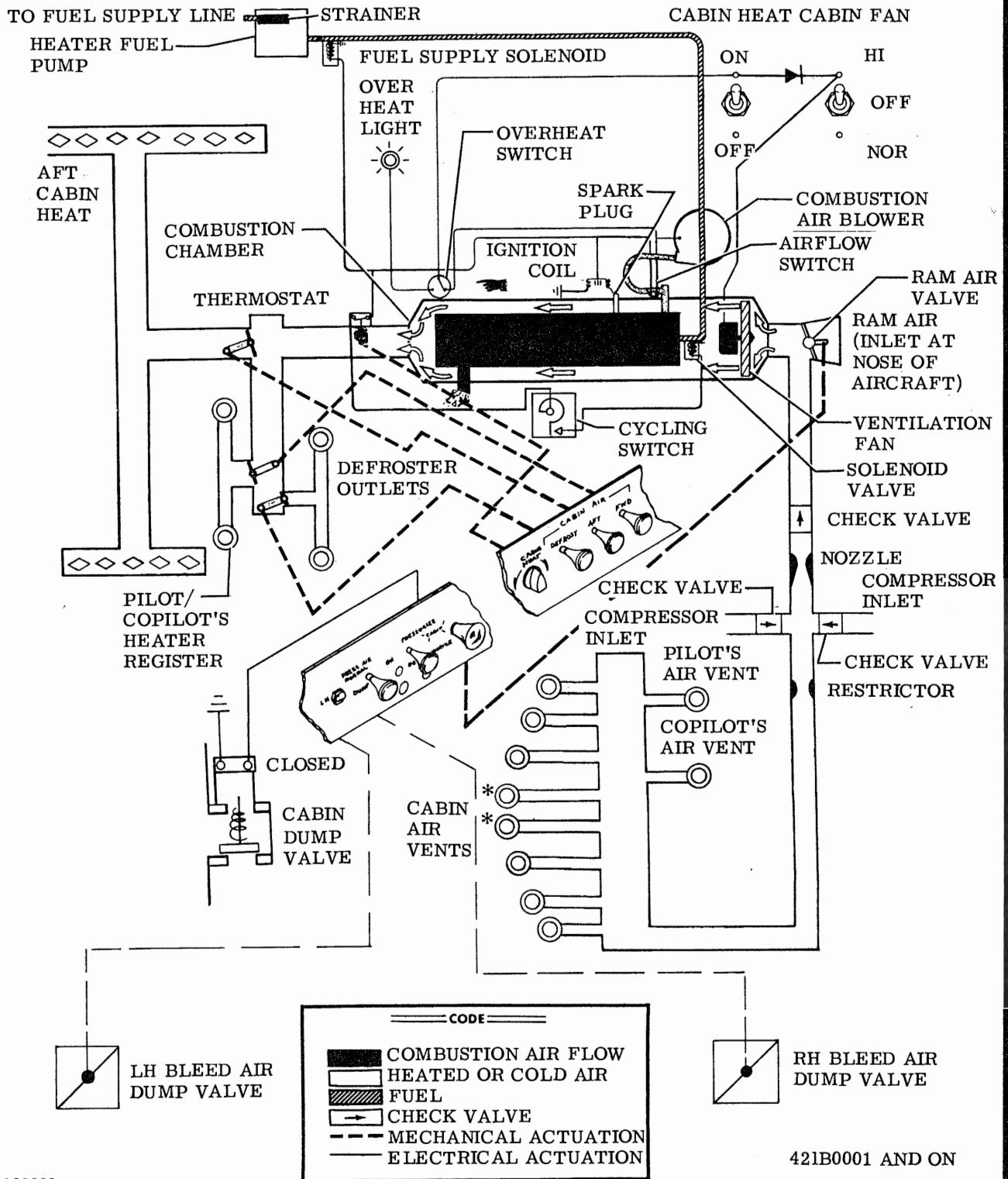
NOTE

A short time lag, not more than 10 seconds, unless fuel line has been drained, may be required for the fuel pump to purge the fuel line of air bubbles.

- b. Open cabin heat vents.
- c. The cabin air temperature control knob, labeled CABIN HEAT, can be set to regulate the cabin temperature for desired comfort level. If this switch is set for ground operating comfort, it may be necessary to reset it after airborne, since ram air will increase the ventilating air flow and heater output.



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Troubleshooting the Heater. (421-0001 To 421B0229)

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER FAILS TO LIGHT	Heater switch or circuit breaker open. Low voltage. No fuel to system. Insufficient fuel pressure caused by faulty fuel pump or no pump current. Fuel pump operating but not building up sufficient pressure. Fuel nozzle clogged in heater. Fuel solenoid valves not operating. Fuel lines clogged or broken. Fuel filter clogged. Ignition vibrator defective. Manual reset overheating switch open. Combustion air flow switch open. Cycle switch open. Thermostat switch open.	Position heater switch to HEAT or close circuit breaker. Connect to auxiliary power supply. Turn on fuel shutoff valve. Correct faulty fuel pump wiring or repair or replace fuel pump. Remove and repair or replace fuel pump. Remove the nozzle and clean or replace it. Remove and check solenoid. Replace it if faulty. Inspect all lines and connections. It may be necessary to disconnect lines at various points to determine where the restriction is located. Clean fuel filter element. Replace Press reset button and recheck to determine reason for switch opening. Check for low blower output and correct it. If switch is defective, replace it. Replace if defective. Operate control to see if switch will come on. Replace switch if defective.

TROUBLE	PROBABLE CAUSE	CORRECTION
VENTILATING AIR BLOWER FAILS TO RUN	Heater switch OFF. Broken or loose wiring to motor.	Turn heater switch to FAN. Check and re- pair wiring.
	Circuit breaker out.	Close circuit breaker.
	Worn motor brushes.	Replace motor brushes.
	Blower fan jammed.	Remove and repair the ventilating-air blower.
	Motor burned out.	Remove blower assembly and replace defec- tive motor.
	Defective radio-noise capacitor.	Replace capacitor.
COMBUSTION AIR BLOWER FAILS TO RUN	Faulty wiring to motor.	Inspect and replace faulty wiring.
	Poor ground connection.	Tighten ground screw.
	Worn motor brushes.	Replace motor brushes.
	Blower wheel jammed. (Usually in- dicated by hot motor housing.)	Overhaul the combustion-air blower.
	Short-circuited radio-noise capacitor.	Replace capacitor.
	Faulty or burned-out motor.	Remove combustion air blower for overhaul or replacement.
HEATER FIRES BUT BURNS UNSTEADILY	Insufficient fuel supply.	Inspect fuel supply to heater, including shut- off valve, solenoid valve, fuel filter, fuel pump and fuel lines. Make necessary repairs.
	Spark plug partially fouled.	Replace spark plug.
	Loose primary connection at ignition assembly.	Tighten connection.
	Faulty vibrator.	Replace vibrator.
	Combustion-air blower speed fluctu- ates. (Can be caused by low fluctua- ting voltage, loose blower wheel, worn brushes or defective motor.)	Remove and overhaul the combustion-air blower assembly as required.
	Insufficient combustion-air supply.	Seal by use of Arno Ductape No. C-506 or equivalent and clamps, as required.
	High voltage leak in lead between ignition assembly and spark plug.	Replace ignition assembly.
	Defective ignition assembly.	Replace ignition assembly.
	Restriction in fuel nozzle orifice.	Remove nozzle for cleaning or replacement.
	Nozzle loose in retainer or protruding improper spray angle.	Tighten or replace the nozzle as required.
	Lack of fuel at heater.	Check fuel supply through all components from the tank to the heater. Make necessary corrections.
	Defective combustion-air pressure switch.	Replace switch assembly.

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER STARTS THEN GOES OUT (CONT.)	Damaged overheat switch.	Replace the switch.
	Damaged cycling switch.	Adjust or replace the switch.
	Fouled spark plug.	Replace spark plug.
HEATER FAILS TO SHUTOFF	Fuel solenoid valve in heater stuck open.	Remove and replace solenoid assembly.
	Defective heater switch.	Replace the heater switch.
COLD HEATER OUTPUT AT HIGH AIR SPEEDS	Combustion air supply is low.	Perform functional check of air pressure switch with voltmeter.
	Defective thermostat.	Perform functional check of thermostat.
	Defective pressure switch.	Replace pressure switch.
INSUFFICIENT HEATER OUTPUT AT HIGH AIR SPEEDS	Malfunction in heater fuel supply.	Perform checks in accordance with functional check of heater fuel supply and heater fuel nozzle. Replace components as necessary.

Troubleshooting the Heater. (421B0229 AND ON)

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER WILL NOT START, BLOWERS DO NOT RUN	Open circuit breaker.	Reset circuit breaker.
	Defective heater switch or wiring.	Replace switch or wiring as necessary.
VENT AIR BLOWER RUNS BUT COMBUSTION AIR BLOWER DOES NOT START	Overheat switch tripped.	Reset switch and find cause of overheating.
	Defective combustion air blower.	Replace blower assembly.
BOTH BLOWERS RUN BUT HEATER FAILS TO START	Ignition vibrator defective.	Replace vibrator.
	Defective spark plug.	Replace plug.
	Defective airvane switch.	Replace switch assembly.
	Obstruction in combustion air passage.	Remove obstruction.
	Defective ignition coil.	Replace coil.
	Open circuit in thermostat.	Replace thermostat.
	Defective solenoid or obstructed nozzle.	Replace nozzle solenoid assembly.
	Open circuit in duct limit switch.	Replace switch.
	Defective fuel pump.	Replace blower assembly.
	Defective supply solenoid.	Replace solenoid.

TROUBLE	PROBABLE CAUSE	REMEDY
BOTH BLOWERS RUN BUT HEATER FAILS TO START (CONT.) HEATER OPERATES ON GROUND, BUT NOT IN FLIGHT	Airflow switch open.	Recalibrate switch or correct cause of low combustion air flow.
	Insufficient combustion air.	Check ducts for obstruction Check blower motor for proper speed. Check fan blades for damage and freedom of rotation.
	Weak ignition.	Check spark plug. A good ignition system check may be performed by using a long reach automotive spark plug opened up to a 3/32 inch gap. If the ignition system is operating properly the spark in this gap will ignite a business card or a manila tag. NOTE Heater spark plug will not work for this check, due to the annular spark gap. Check ignition unit.
	Lack of fuel.	Check power to heater solenoid terminal (#8). If no voltage is present, check thermostat calibration, air flow switch, and cycling switch. Check fuel pressure between fuel pump and heater. Refer to Cessna Heater and Components Overhaul/Parts Manual. Check fuel supply to pump (remote solenoid, filter manual valves, etc.). Refer to Cessna Heater and Components Overhaul/Parts Manual and perform Fuel Nozzle and Solenoid test.
HEATER OPERATES IN FLIGHT, OUTPUT IS LOW	Poor thermostat operation.	Check thermostat calibration and freedom of movement.
	Poor fuel atomization in burner.	Check fuel pressure to heater. Refer to Cessna Heater and Components Overhaul/Parts Manual and perform Fuel Nozzle and Solenoid test.
HEATER BURNS BUT THERMOSTAT WILL NOT CONTROL TEMPERATURE OUTLET AIR TEMPERATURE TOO HIGH	Defective thermostat.	Replace thermostat.
	Defective fuel solenoid.	Replace solenoid.
	Insufficient vent air.	Increase vent air flow.
	Defective thermostat.	Replace or adjust thermostat.

TROUBLE	PROBABLE CAUSE	CORRECTION
OUTLET AIR TEMPERATURE TOO LOW	Excessive vent air flow.	Reduce vent air flow.
	Defective thermostat.	Replace thermostat.
	Defective duct limit switch.	Replace switch.
	Low fuel pressure.	Repair or replace pump.
	Dirty fuel nozzle.	Replace nozzle.
	Defective solenoid valve.	Replace solenoid valve.
HEATER TRIPS OVER-HEAT SWITCH	Defective overheat switch.	Replace switch.
	Insufficient vent air plus defective duct limit switch.	Replace duct limit switch and increase air rate.
SMOKING HEATER EXHAUST	Defective nozzle.	Replace nozzle.
	Slow combustion blower.	Replace combustion blower.
	Leaking solenoid valve.	Replace valve.
HEATER POPS OR BANGS WHEN STARTING OR CYCLING	Leaking solenoid valve.	Replace valve.
	Delayed ignition caused by intermittent spark.	Replace spark plug or coil as necessary.
	Defective fuel nozzle.	Replace nozzle.
RUMBLE OR COMBUSTION NOISE IN HEATER	Loose burner assembly mounting screws.	Tighten mounting screws.
	Defective nozzle.	Replace nozzle.

Electrical Continuity Checks.

For electrical continuity checks, refer to Section 14 and to the Heater and Components Service/Parts Manual.

Functional Check of Heater Fuel Supply

- a. Heater Fuel Supply. Install a pressure gage in the heater fuel supply line (between the heater solenoid valve and heater). Start the heater and observe pressure gage, on aircraft 421-0001 to 421B0229 it should indicate 7 to 8 psi, on aircraft 421B0001 and On it should indicate 18 to 24 psi. If this pressure is low, check:
 1. Heater Fuel Shutoff Valve (Located in right wing leading edge at station 60.57 - Check that valve is open.
 2. Heater Fuel Pump - with a supply source to the pump (inlet hose in a container of fuel), pump outlet pressure should be 7 to 8 psi on aircraft 421-0001 to 421B0229, on aircraft 421B0229 and On it should indicate 18 to 24 psi. Replace fuel pump if defective.
 3. Heater Solenoid Valve (Remote valve in wing right-hand leading edge) - Check that solenoid valve is open. Replace valve if defective.
 4. Fuel Strainer and Lines - Clean filter and check lines for obstructions.

Removal and Installation of Heater Assembly. 421-0001 to 421B0229. (See Figure 13-2.)

- a. (See Figure 1-2.) Remove baggage shelf (90) located in the right nose section.
- b. Close heater fuel shutoff valve located in the right leading edge at wing station 60.57.
- c. Tag and disconnect all electrical wires from heater terminal strip necessary for removal of heater.
- d. Loosen clamps and slide hoses from fuel inlet shroud (23).
- e. Loosen clamp attaching fuel inlet shroud to heater; separate shroud halves by removing two attaching screws.
- f. Disconnect fuel line (16) from the heater and remove.

CAUTION

A small amount of fuel will drain from fuel line. Do not permit accumulation of fuel in the area.

- g. Disconnect combustion air blower outlet tube (13) from heater elbow by removing attaching nut and bolt.
- h. Disconnect drain line (15).
- i. Remove mounting clamps (11) at front and rear of heater.
- j. Loosen clamps (17 and 24) to gain clearance, then lift out heater.

NOTE

For disassembly and inspection of heater and heater components, see Cessna Heater and Components Overhaul/Parts Manual.

- k. Install heater by reversing removal procedures.
- l. Turn fuel valve on and perform functional check for proper operation.

Removal and Installation of Heater Assembly. 421B0229 and on. (See Figure 13-2A.)

- a. Remove necessary access plates, radio and radio shelves to gain access to heater.
- b. Remove RH engine control access cover. Un-safety knob on shutoff valve and turn heater fuel valve off.
- c. Tag and disconnect all electrical wires from the combustion blower motor and heater terminal strip.
- d. Remove hose clamp from fuel lines (3 and 7) from fuel pump housing and fuel inlet shroud.
- e. Remove fuel pump housing vent line.
- f. Disconnect vent line (7), and fuel inlet shroud vent lines from shroud on air flow switch (12).
- g. Remove clamp from heater at plenum (1).
- h. Remove clamp from forward inlet valve (10) and remove clamp (11) from ram air tube.
- i. Remove mounting clamps and lift heater out.

WARNING

Fuel accumulation in the nose is a fire hazard. Use caution when removing heater to prevent residual fuel from draining.

- j. Cap all fuel lines to prevent dirt accumulation or contamination of fuel.
- k. Install the heater by reversing the removal procedures.
- l. Turn fuel shutoff valve on and safety in the ON position.

Ventilating Air Blower. (See Figure 13-2.)

The ventilating air blower is attached to the inlet end of the heater assembly to provide a source of ventilating air through the heater and ram air from the ventilating-air intake scoop.

Removal and Installation of Ventilating Blower. 421-0001 to 421B0229. (See Figure 13-2.)

- a. (See Figure 1-2.) Remove baggage shelf (90) located in right nose section.
- b. Remove electrical connector.
- c. Remove clamps (17, 11 and 4).
- d. Slide sleeve (19) forward, then lift blower out as a unit, independent of the heater.
- e. Installation of the blower is the reversal of the removal procedures.

Removal and Installation of Ventilating Blower. 421B0229 and on. (See Figure 11-2A.)

- a. Remove necessary access plates, radio and radio shelves to gain access to heater.
- b. Remove ventilating blower clamp, duct assembly (10), and clamp (11) from heater.
- c. Tag and disconnect wires.
- d. Route shutoff valve and duct assembly (10) out of the way enough to remove ventilating blower.
- e. Install ventilating blower by reversing the removal procedures.

Combustion Air Blower. (See Figure 13-2.)

The combustion air blower is a centrifugal type blower, located above the heater assembly, that supplies combustion air to the combustion chamber in the heater.

Removal and Installation of Combustion Air Blower.
421-0001 to 421B0229. (See Figure 13-2.)

- a. (See Figure 1-2.) Remove baggage shelf (90) located in the right nose section.
- b. Disconnect electrical wire.
- c. Remove tubes (12 and 13) from blower assembly by removing nuts and bolts securing tubes to adapter.
- d. Remove clamps (7) securing blower assembly to support (8).

NOTE

Check combustion air supply joints for leakage, seal by the use of Arno Ductape No. C-506 or equivalent and clamps as required.

- e. Installation of the combustion air blower is the reversal of the removal procedure.

Removal and Installation of Combustion Blower.
421B0229 and on. (See Figure 11-2A.)

- a. Remove necessary access covers, radios and radio shelves to gain access to the combustion blower.
- b. Tag and disconnect wiring.
- c. Remove right engine control access cover and unsafety heater fuel shutoff valve and turn shutoff valve off.
- d. Disconnect inlet air duct (17) and combustion air duct (15).
- e. Disconnect heater fuel pump drain line, inlet fuel line and vent lines by removing hose connections.

WARNING

Fuel accumulation in the nose is a fire hazard. Use caution when removing heater to prevent residual fuel from draining.

- f. Remove mounting screws from bracket and remove combustion blower from aircraft.
- g. Install the combustion blower by reversing the removal procedures.

Spark Plug.

- a. Removal and Installation.
 1. Remove high voltage lead connector at spark plug and grommet.
 2. Remove spark plug with a 7/8-inch deep socket. Make sure spark plug gasket is removed with plug.

NOTE

On aircraft 421B0229 and On it will be necessary to remove the ignition unit before removing spark plug.

3. Install spark plug by reversing above procedure.

NOTE

A new spark plug gasket should be installed on the spark plug. Torque plug to 28 foot-pounds. Torque nut on high voltage lead to 20 foot-pounds.

Vibrator Assembly.

- a. Remove the necessary access panels to reach the ignition unit on the heater assembly.
- b. Measure the distance the vibrator protrudes out of the ignition assembly to determine when the new unit is inserted properly. Grasp the vibrator and with slight back and forth movement, pull it straight out of the ignition unit. (For a friction grip, it may be necessary to use a piece of masking or friction tape around the exposed portion of vibrator.)
- c. Carefully rotate the new vibrator until the index marks are aligned and the connector pins on the vibrator can be felt entering the pin sockets in the ignition unit socket, then press the vibrator fully and firmly into position.
- d. Check the heater for operation and close all access openings.

Thermostat.

The thermostat is located in the plenum at the aft end of the heater. It senses the ventilating air outlet temperature. To select the desired cabin air temperature, the thermostat may be manually controlled through a temperature range of 200°F, down to 70°F.

Removal and Installation of Thermostat.

- a. Disconnect electrical wires from terminals.
- b. Loosen screw securing control wire to thermostat actuating arm.
- c. Remove four screws securing thermostat to plenum duct then carefully remove thermostat and gasket.
- d. Installation is the reversal of the removal procedures.
- e. Adjust control wire in thermostat actuating arm for proper operation.

Fuel Solenoid Valve.

A fuel solenoid valve is located in the RH leading edge wing (421-0001 to 421B0001) and in the RH leading edge stub wing (421B0001 and On). It is electrically operated and controls the fuel supply and regulates fuel pressure to the heater. The pressure regulator function of the solenoid valve is adjusted to control fuel pressures to 6.5 to 7 psi.

Removal and Installation of Fuel Solenoid Valve.

- a. Remove access hole cover from lower leading edge at RH wing or RH stub wing area.

- b. Shut off fuel at fuel shutoff valve located in wing leading edge adjacent to the fuel pump.
- c. Disconnect electrical leads and disconnect fuel lines.
- d. Remove screws securing solenoid valve to rib.
- e. Install valve by reversing removal procedures.
- f. Turn fuel shutoff valve on and check for leaks.

Heater Fuel Pump.

The heater fuel pump is an electrically operated fuel pump, located in the RH leading edge wing (421-0001 to 421B0001) and in the RH leading edge stub wing (421B0001 to 421B0229). On 421B0229 and on the heater fuel pump is mounted on the combustion air blower.

Removal and Installation of Heater Fuel Pump. 421-0001 to 421B0229.

- a. Remove access hole cover from lower leading edge at RH wing or RH stub wing area.
- b. Shut off fuel at fuel valve located adjacent to the fuel pump.
- c. Disconnect electrical lead and fuel lines. Tag fuel lines so proper reinstallation can be attained and remove pump.

NOTE

Do not lose insulator in the electrical connector.

- d. Installation is the reversal of the removal procedures.

Removal and Installation of Heater Fuel Pump. 421B0229 and on. (See Figure 13-2A.)

- a. Remove necessary access plates, radio and radio shelves to gain access to combustion blower.
- b. Remove combustion air blower in accordance with removal procedures.
- c. Refer to Heater and Components Overhaul/Parts Manual for disassembly of heater fuel pump.

Heater Fuel Filter.

On aircraft 421-0001 to 421A0092 the fuel filter is located in the right wing leading edge at wing station 65.57 in the fuel line between the heater, fuel pump and heater shutoff solenoid. Refer to figure 2-34, Inspection Chart, for inspection and cleaning interval.

Removal, Cleaning and Installation of Heater Fuel Filter. 421-0001 to 421A0092.

WARNING

Residual fuel accumulation in the wing is a fire hazard. Use care to prevent the accumulation of such fuel.

- a. (See figure 1-2.) Remove access cover (55) from lower right leading edge at wing station 70.57.
- b. Shut off fuel at fuel valve located adjacent to the fuel pump.
- c. Disconnect fuel lines and remove screw securing filter to rib.
- d. Clean filter with unleaded gas and a jet of low-pressure air.
- e. Install filter by reversing the removal procedures.

On aircraft 421A0092 to 421B0229 the heater fuel

filter is located in the heater fuel pump, which is located in the right wing leading edge at wing station 60.57. Refer to figure 2-34, Inspection Chart, for inspection and cleaning interval.

Removal, Cleaning and Installation of Fuel Filter. 421A0092 to 421B0229.

WARNING

Residual fuel accumulation in the wing is a fire hazard. Use care to prevent the accumulation of such fuel.

- a. (See figure 1-2.) Remove access plate (55) from lower right leading edge.
- b. Remove bottom cover of heater fuel pump and remove filter screen.
- c. Clean filter screen with unleaded gas and a jet of low-pressure air.
- d. Install filter by reversing the removal procedure.

Removal, Cleaning and Installation of Fuel Filter. 421B0229 and on.

On aircraft 421B0229 and on the heater fuel filter is located in the leading edge of the RH stub wing. The removal, cleaning and installation of fuel filter (421-0001 to 421A0092) procedures apply to 421B0229 and on, except the fuel filter is located in the stub wing.

Cabin Heat Switch.

The cabin heater is controlled by a two position toggle switch labeled CABIN HEAT located on the left console. Switch positions are ON and OFF. Placing the switch in the ON position starts and maintains heater operation and also turns the cabin fan on low.

Cabin Fan Switch.

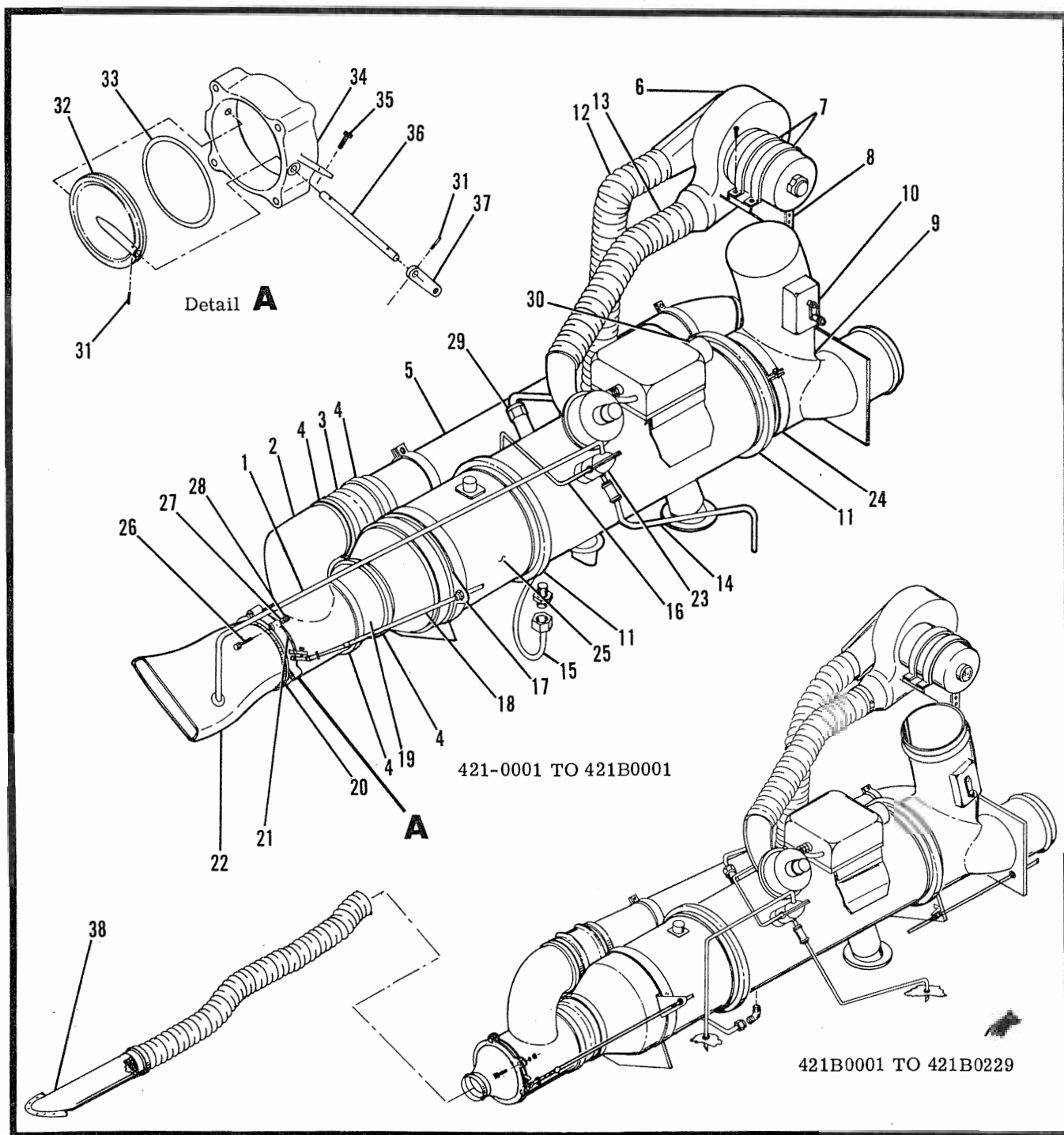
The ventilating fan which is integrated into the heater assembly is controlled by a three position switch labeled CABIN FAN located on the left console. Switch positions are NORMAL, OFF, and HIGH. Placing the switch in either the normal or high position operates the ventilating fan.

Removal and Installation of Cabin Heat Switch and Cabin Fan Switch.

- a. Remove and replace switches in accordance with Section 14.

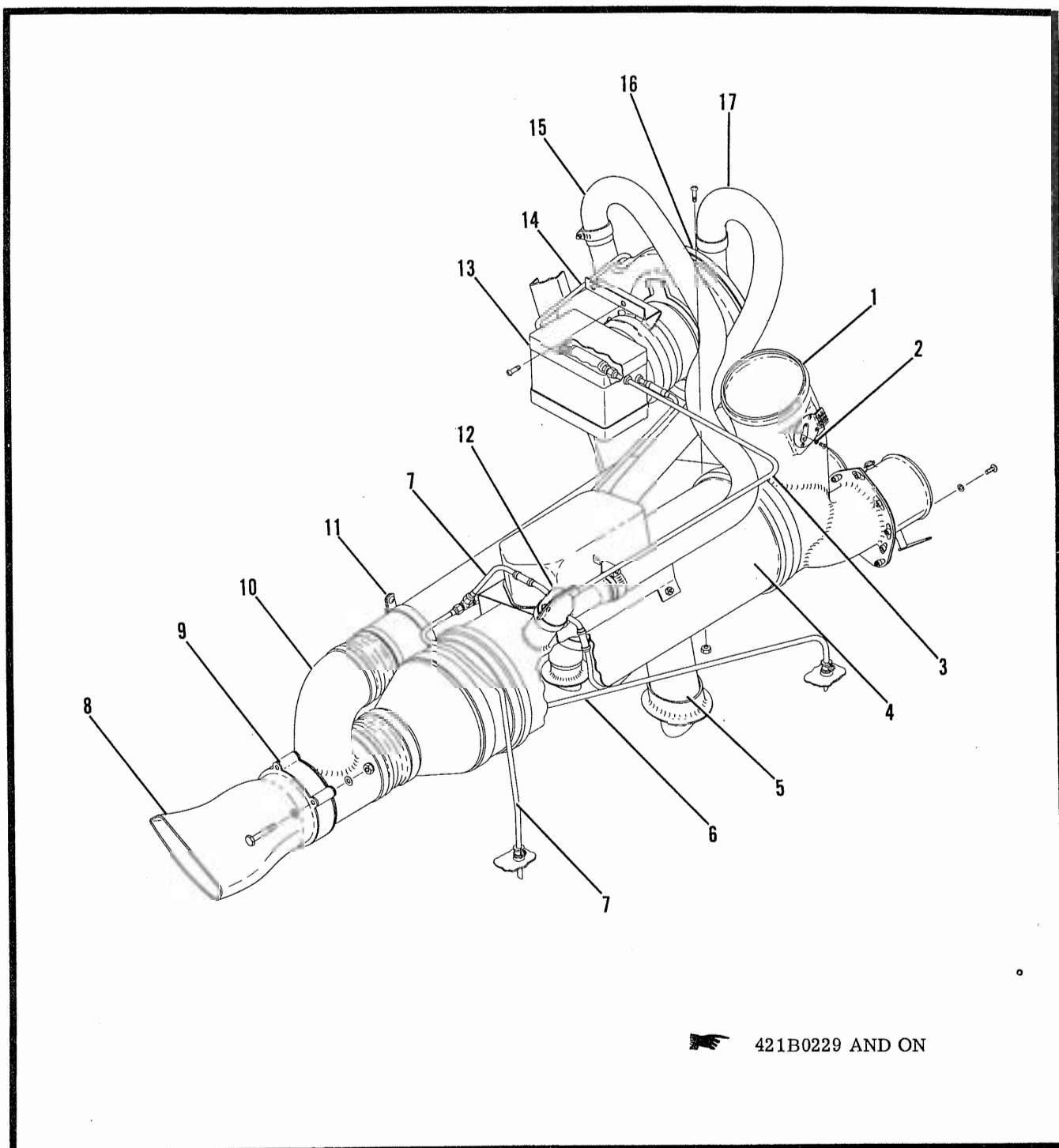
Temperature Control.

The temperature control is located below and slightly to the left of the right control column. It is a rotary type knob and is labeled CABIN HEAT. Clockwise rotation of the temperature control knob increases cabin temperature and counterclockwise rotation decreases it. This knob mechanically controls the setting of a thermostat located within the outlet adapter just aft of the heater. The thermostat in turn cycles the heater to maintain the cabin temperature setting selected with the control knob.



1. Vent Air Inlet Line	10. Thermostat Control	19. Sleeve	29. Spark Plug
2. Duct Assembly	11. Clamp	20. Valve Assembly	30. Vibrator
3. Sleeve	12. Blower Inlet Tube	21. Gasket	31. Pin
4. Clamp	13. Blower Outlet Tube	22. Adapter	32. Disc
5. Duct	14. Vent Air Outlet Line	23. Inlet Fuel Shroud	33. O-ring
6. Combustion Air Blower Assembly	15. Drain Line	24. Clamp	34. Housing
7. Clamps	16. Fuel Line	25. Blower Housing	35. Stop Bolt
8. Support	17. Clamp Assembly	26. Bolt	36. Shaft
9. Plenum Assembly	18. Ram Air Control	27. Washer	37. Arm
		28. Nut	38. Scoop

Figure 13-2. Heater Installation



421B0229 AND ON

1. Plenum Assembly	10. Duct Assembly
2. Thermostat Control	11. Clamp
3. Fuel Supply Line	12. Airflow Switch
4. Combustion Chamber	13. Fuel Pump
5. Exhaust Outlet	14. Fuel Supply Line
6. Fuel Drain Line	15. Combustion Air Duct
7. Vent Line	16. Combustion Fan
8. Ram Air Duct	17. Inlet Air Duct
9. Valve Assembly	

Figure 13-2A. Heater Installation

Removal of Temperature Control.

- a. Loosen screw securing control wire to thermostat actuating arm.
- b. Remove clamp securing coil wire housing to the plenum.
- c. Remove control knob by removing knob set screw.
- d. Remove nut securing temperature control assembly to the stationary instrument panel. Slide temperature control assembly forward until free of stationary instrument panel and then aft beneath stationary panel until coiled wire housing is removed from forward cabin bulkhead.

Installation of Temperature Control.

- a. Route temperature control wire housing through forward cabin bulkhead and attach to plenum with attaching clamp.
- b. Insert temperature control assembly through hole in stationary instrument panel and secure with nut.
- c. Place control knob on temperature control assembly and secure with set screws.
- d. With control knob turned to the LOW position and the thermostat arm forward, secure arm to the control wire by tightening clamp screw.
- e. Seal control cable at forward cabin bulkhead in accordance with instructions given in Section 16 for sealing continuous wire bundles.

Airflow Controls.

Removal of Airflow Controls.

- a. Loosen clamp and nuts securing control wires to the cabin air defroster valve arms.
- b. Work cabin air control coiled wire housing from seal assembly.
- c. Work defroster control coiled wire housing from seal assembly supporting it at forward cabin bulkhead.
- d. Loosen nuts securing control assemblies to lower instrument panel and slide assemblies aft through mounting holes.

Installation of Airflow Controls.

- a. Insert control assemblies through mounting holes in lower instrument panel.
- b. Slide lockwashers and nuts over coiled wire housings and secure control assemblies to lower instrument panel by tightening nuts onto threaded fittings on control ends.
- c. Route defroster control through seal assembly at forward cabin bulkhead, and cabin air control through seal assembly.
- d. With control knobs locked in the closed position and plenum chamber valves closed, insert the con-

trol wires through the valve actuating arm clamps and secure by tightening clamp nuts.

- e. Seal control cables at forward cabin bulkhead in accordance with instructions given in Section 16 for sealing continuous wire bundles.

Removal and Installation of Ram Air Valve Assembly. (See figure 13-2.)

- a. (See figure 1-2.) Remove baggage shelf (90) located in right nose section.
- b. Remove screws securing radio shelf located just forward of heater and raise it to gain access to bolts (26).
- c. Disconnect control (18) from valve by removing cotter key, nut and screw.
- d. Remove nuts (28), washers (27) and bolts (26).
- e. It is possible to lift valve out but for convenience in reinstallation, remove duct assembly (2) by removing clamps (4) and sliding flex ducts aft. Retain gasket (21) for reinstallation if not torn or mutilated.
- f. Installation of the ram air valve is the reversal of the removal procedures.

Removal and Installation of Ram Air Control.

- a. Remove nut and bolt securing control to valve.
- b. Remove clevis, jam nuts, and control housing retaining nuts, remove from support bracket.
- c. Remove cotter key, nut and screw securing control to control lever located just forward of the switch panel.
- d. Remove clevis, jam nut, and control housing retaining nuts, then remove from support bracket.
- e. Remove clamps securing control located under the forward cabin floor.
- f. Slide control through the seal at forward cabin bulkhead.
- g. Install control by reversing removal procedure.
- h. Seal control cable at forward bulkhead in accordance with instructions given in Section 16 for sealing continuous wire bundles.
- i. Check control adjustment for positive sealing of the inlet duct when in the closed position.

Removal and Installation of Plenum Ducts. (See figure 13-3.)

- a. To remove lower plenum duct (9), remove heater in accordance with procedures for removing heater.
- b. Remove temperature control from thermostat (8) and aft cabin control cable from valve (13).
- c. Remove clamps (1) and remove flex duct (7).
- d. Remove clamp (15) securing duct to support.
- e. Remove screws (12) securing duct assembly to forward cabin bulkhead (11).
- f. Remove duct by pulling forward and up.
- g. To remove upper plenum duct (2), disconnect forward cabin air control from valve lever and defrost control from defrost valve.
- h. Remove clamps (3) securing defrost ducts (4) to

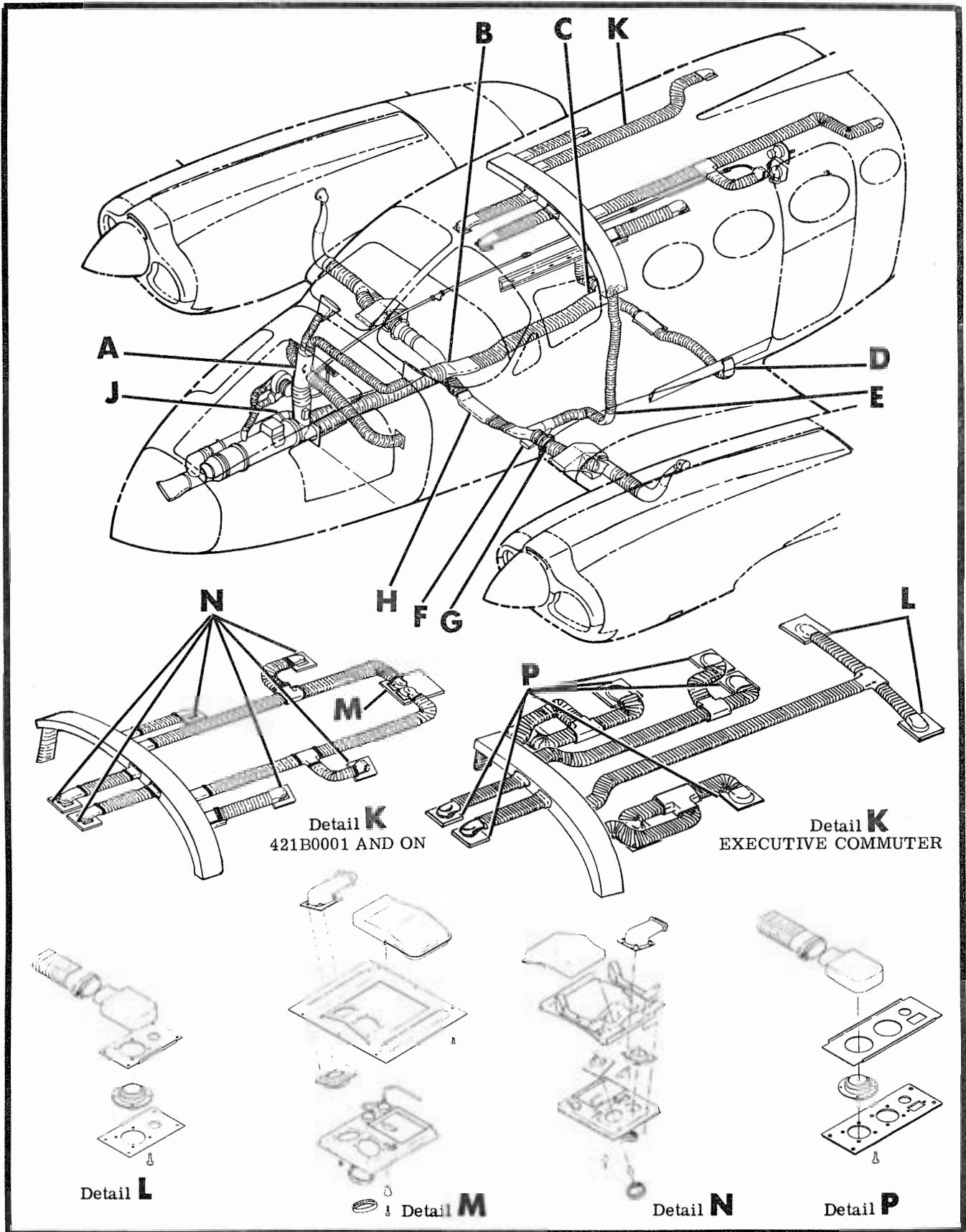


Figure 13-3. Air Distribution System (Sheet 1 of 3)

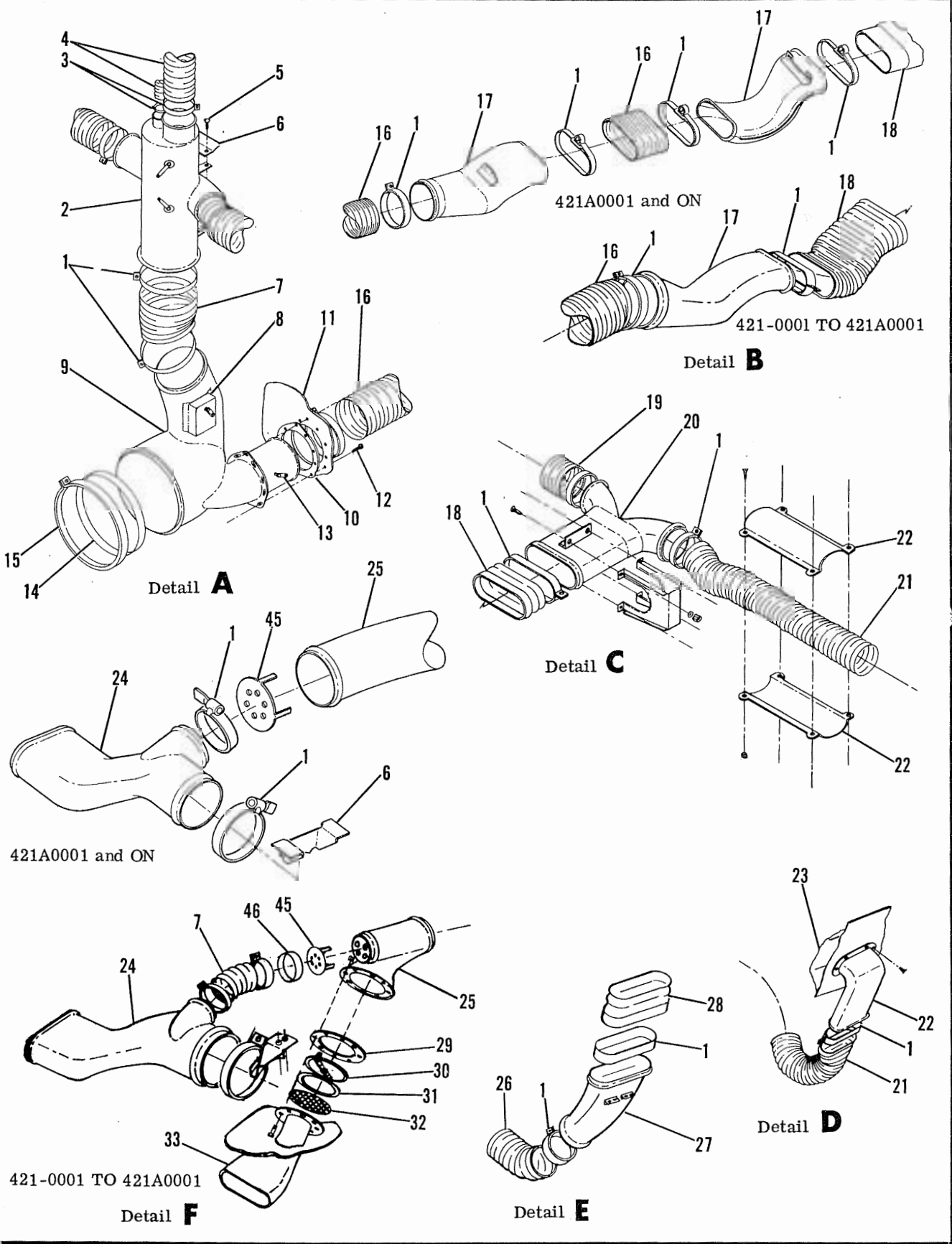
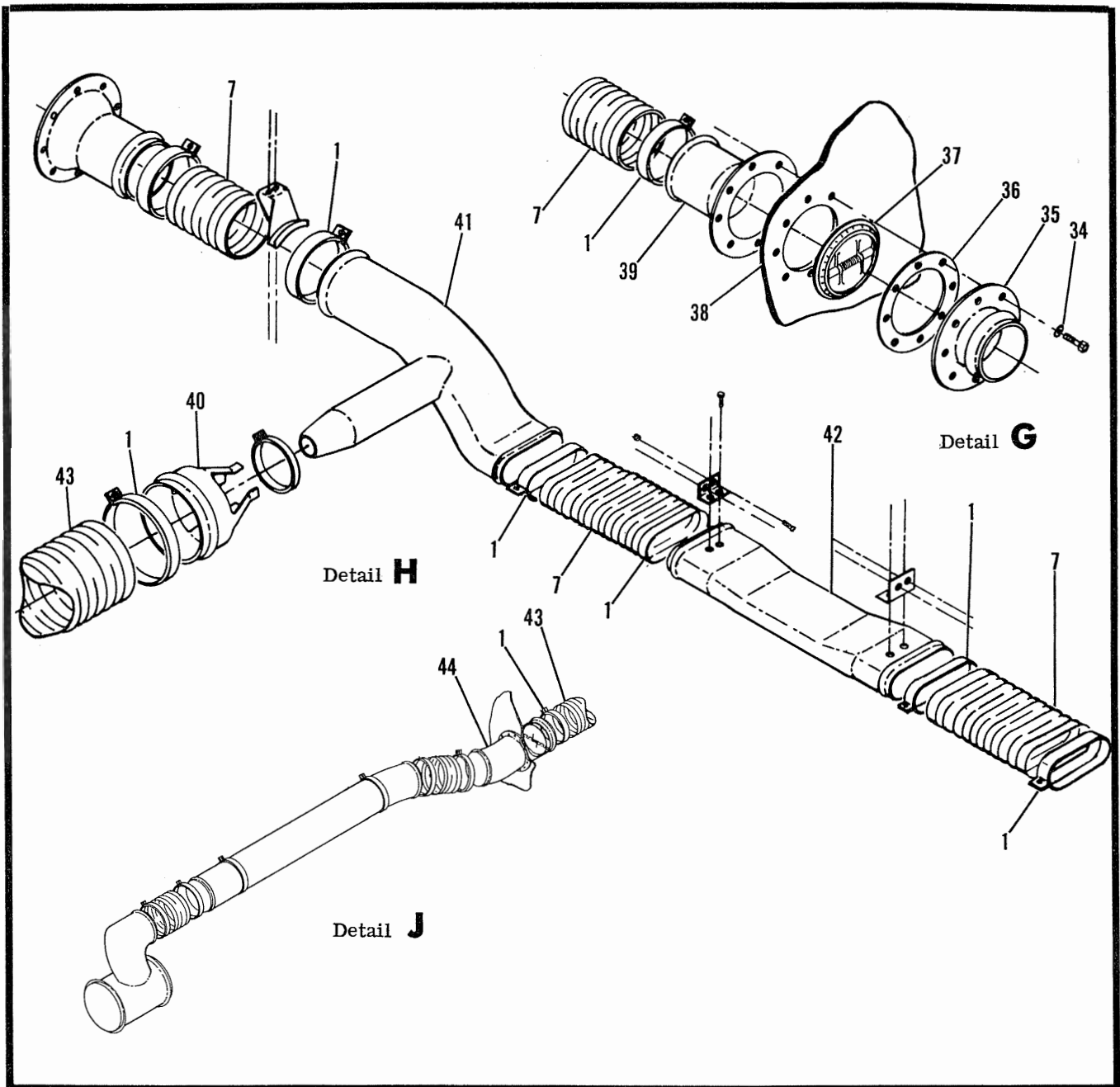


Figure 13-3. Air Distribution System (Sheet 2 of 3)



1. Clamp	16. Forward Cabin Duct	31. Gasket
2. Upper Plenum	17. Adapter	32. Screen
3. Clamp	18. Center Cabin Duct	33. Scoop
4. Defrost Duct	19. Right Cabin Duct	34. Stat-O-Seal
5. Screw	20. Duct Assembly	35. Coupling
6. Bracket	21. Left Cabin Duct	36. Gasket
7. Duct	22. Clamp Assembly	37. Check Valve
8. Thermostat	23. Upholstery Panel	38. Fuselage Skin
9. Plenum	24. Left Pressure Duct	39. Adapter
10. Gasket	25. Adapter	40. Nozzle Adapter
11. Forward Cabin Bulkhead	26. Vent Duct	41. Nozzle Assembly
12. Screw	27. Adapter	42. Center Pressure Duct
13. Aft Cabin Air Control	28. Upper Vent Duct	43. Forward Pressure Duct
14. Insulation Strip	29. Retainer	44. Check Valve Assembly
15. Clamp	30. Check Valve	45. Baffle Plate
		46. Seal

Figure 13-3. Air Distribution System (Sheet 3 of 3)

plenum (2) and slide tubes off.

- i. Remove screws (5) securing top of plenum to support.
- j. Remove screws (5) securing bottom bracket (6) to structure.
- k. Install plenum by reversing removal procedure.

NOTE

Install new gaskets as necessary to insure a good seal.

Cabin Warm Air Vents and Ducting.

The cabin is heated by six warm air vents. The warm air is routed from the heater through warm air ducting and expelled through heat outlets, along the sides of the aft cabin near the floor, defrost outlets, and the forward cabin direct outlets. The outlets are controlled by controls located on the right-hand switch panel.

Removal and Installation of Warm Air Ducting. (See figure 13-3.)

- a. (See figure 1-2.) Remove all seats, carpeting, floorboards (78, 79, 80, 81, 82, 83, 85 and 86) and access plates (73, 74 and 72).
- b. Remove forward duct (16) by removing clamps at plenum (9) and adapter (17) through floorboard access holes.
- c. Remove duct (18) by removing clamps at adapter (17) and duct (20).
- d. Remove duct (19) by removing clamps at duct (20). It will be necessary to remove lower upholstery panel (23) to gain access to the adapter on right and left sides.
- e. Remove duct (21) by removing clamps at duct (20) and left side adapter (22). Remove adapter (22) by removing four nuts, washers and screws.
- f. Remove adapter (17) and duct (20) by removing screws attaching them to the structure.
- g. Install ducting by reversal of removal procedures.

Cabin Fresh Air Vents and Ducting.

Fresh air is supplied to the cabin when in unpressurized mode, by ram air taken in at the nose and routed through the heater and enters the cabin as either heated or cool air. In addition, secondary ram air is supplied to the cabin by a scoop mounted on the bottom of the fuselage. Air is taken in through the bottom scoop, routed through ducting and enters the cabin through overhead outlets.

Removal and Installation of Fresh Air Ducting. (See figure 13-3.)

- a. Remove seats, carpet, floorboards (77, 79 and 86) and left side upholstery panel. (See figure 1-2.)
- b. Remove clamps securing duct (7) to adapter (24), restrictor duct (25) and remove duct (7)
- c. Remove clamps securing duct (26) to restrictor duct (25) and adapter (27) and remove duct.

- d. Remove clamps securing duct (28) to overhead plenum and adapter (27).
- e. Remove adapter (27) by removing four nuts, washers and screws.
- f. Remove restrictor duct (25), retainer (29), check valve (20), gasket (21) and screen (32) by removing eight nuts, washers and screws.
- g. Remove screws securing scoop (33) to skin, break seal carefully and remove scoop.
- h. Remove the ducts from the overhead plenum to the individual wemacs by removing the headliner as necessary to gain access to the clamps and ducts.
- i. Install ducting by reversing removal procedures.

NOTE

Fay seal scoop (33) in accordance with instructions given in Section 16.

Cabin Pressurized Air Ducting.

The cabin pressurization system utilizes the aircraft's air distribution system through which the cabin is pressurized. Pressurized air enters the cabin through a system of check valves and ducts to the heater inlet. The ram air inlet being closed, the air enters the normal ventilation system. Pressurized air is also ducted to the overhead outlets through a restrictor which is an integral part of one of the ducts.

Removal and Installation of the Cabin Pressurized Air Ducting. (See figure 13-3.)

- a. Remove forward cabin carpet and access plates (77, 73, 74, 76 and 69). (See figure 1-2.)
- b. Remove duct (43) by removing clamps at forward check valve assembly (44) and adapter (40).
- c. Remove nozzle assembly (41) by removing clamps securing the nozzle to the structure.
- d. To remove center pressure duct (42), remove clamps, slide the flex ducts off, then remove nuts, washers and screws that secure the duct to the structure.
- e. Remove adapter (24) by disconnecting clamps and slide off flex ducts.
- f. Remove coupling (35), check valve (37) and adapter (39) by removing eight nuts, washers, stat-o-seals and screws.
- g. Install by reversing removal procedures.

NOTE

Install all butterfly type check valves with the hinge line in a vertical plane. Be sure air will flow in the proper direction.

PRESSURIZATION SYSTEM.

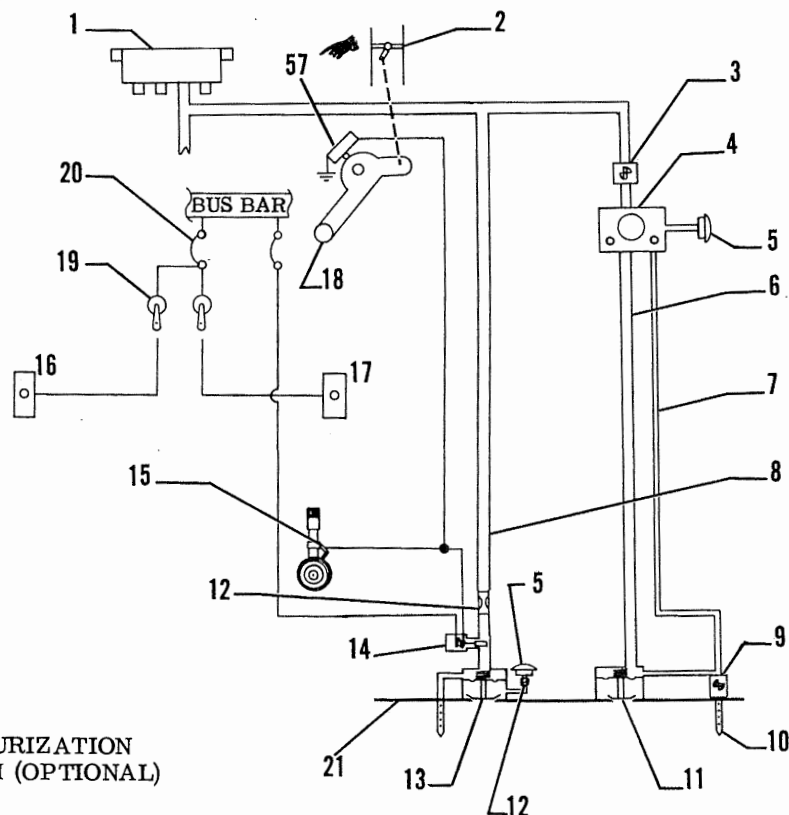
The pressurization system provides a constant 8000 foot cabin altitude from 8000 to the altitude at which nominal differential pressure is reached. No pressurization is provided below 8000 feet with the standard system. Above 20,180 feet a nominal differential

pressure of $4.2 \pm .10$ is maintained on aircraft 421-0001 to 421B0201. On aircraft 421B0201 to 421B0301 a nominal differential pressure of $4.4 \pm .10$ psig is maintained above 20,860 feet. On aircraft 421B0301 and On a nominal differential pressure of $5.0 \pm .10$ psig is maintained above 23,120 feet. Pressurization of the cabin is developed by the use of the engine-driven turbocharger which provides compressed air for engine induction air and for cabin pressurization. One compressor is mounted in each engine nacelle, either of which will supply adequate pressurization in the event of failure of one. Ram air is taken through a scoop on the side of the nacelle, compressed by the turbocharger and directed through a sonic venturi type flow limiter to a ram air heat exchanger mounted in the leading edge of the stub wing, which reduces the temperature of the pressurized air entering the cabin. From the heat exchanger, air is routed through check valves which are provided to prevent back flow of air in the event of failure of either compressor or single engine operation, into the cabin air system. The pressurized air is routed through the air distribution system and enters the cabin through the overhead fresh air wemacs and heater outlets at a controlled temperature. In the unpressurized, conventional mode of operation, the pressurized air is dumped overboard by means of two pressurization air dump valves located in each stub wing, adjacent to the heat exchangers. On aircraft 421-0001 to 421B0001 the pressurization air dump valves are solenoid actuated and may be actuated independently by switches mounted on the control panel. On aircraft 421B0001 and On the dump valves are manually actuated and may be actuated independently by push pull controls on the control panel. A cabin pressure regulator valve is located in the aft

cabin pressure bulkhead which controls cabin air outflow and is automatic in operation. A combination safety and cabin air dump valve is located on the aft cabin pressure bulkhead. The dump function of the valve is solenoid operated, vacuum actuated, and controlled by the pilot by means of a switch lever mounted on the control panel. An override switch interlocked with the gear squat switch insures decompression when the aircraft is on the ground. Two small restrictor valves are installed in the dump valve sensing lines to provide a controlled opening and closing rate. This reduces the "pressure bump" to a minimum when making the transition from the unpressurized mode to the pressurized mode and vice versa. Upon actuation it should take approximately 30 seconds for the valve to open and approximately 20 seconds for it to close. A pressure control panel is located on the stationary panel consisting of a combination cabin altitude and cabin ambient differential pressure gage, cabin altitude rate-of-change instrument, left and right pressurization air dump valve switches, a cabin altitude warning light, and a manual ram air shutoff valve control located to the right side of the panel. The cabin altitude and differential pressure instrument indicates cabin altitude in feet and also indicates differential pressure between cabin and atmosphere. The cabin altitude rate-of-change instrument tells the pilot the rate in feet per minute at which the cabin altitude is changing. It is calibrated in 100-foot increments to 6000 feet in both up and down directions. A cabin altitude light is provided to warn the pilot of an oxygen requirement. This light is connected to a barometric pressure switch which is set to come on at cabin altitude of $10,000 \pm 350$ feet and go off at 9000 feet minimum. The ram air shutoff valve control is located

Troubleshooting the Pressurization System.

TROUBLE	PROBABLE CAUSE	CORRECTION
CABIN WILL NOT PRESSURIZE	Dump valves open.	Check electrical circuit.
	Outflow valve defective.	Replace outflow valve.
	Inadequate air supply to cabin.	Repair or adjust air supply equipment.
	Safety valve defective.	Replace safety valve.
	Foreign object between safety valve or outflow valve.	Clean safety or outflow valve seat.
	Defective landing gear squat switch.	Replace switch.
	Filter clogged.	Clean or replace filter.
	Defective electrical circuits.	Check electrical circuit.
	Inadequate vacuum supply to altitude and rate of change controllers.	Adjust vacuum supply to $4.2 \pm .10$ in. Hg. less than cabin pressure.



VARIABLE PRESSURIZATION
CONTROL SYSTEM (OPTIONAL)

421-0001 TO 421-0013, 421-0014 TO
421-0025 AND 421-0026 TO 421-0029

1. Vacuum Manifold	29. Variable Controller
2. Ram Air Valve	30. Turbocharger
3. Vacuum Shutoff Valve	31. Waste-Gate Actuator
4. Variable Pressure Outflow Controller	32. Rate Controller
5. Filter	33. Alternate Air Door
6. Outflow Valve Vacuum Line	34. Pressurization Air Dump Valve
7. Static Pressure Line	35. Heat Exchanger
8. Safety Valve Vacuum Line	36. Check Valve
9. Static Shutoff Valve	37. Passenger Air Outlets
10. Static Line	38. Safety Valve
11. Outflow Valve	39. Tailcone
12. Restrictor	40. Aft Cabin Pressure Bulkhead
13. Safety Valve	41. Static Pressure Reference
14. Safety Valve Solenoid	42. Outflow Valve
15. Left Gear Safety Switch	43. Cabin Outlets
16. Left Dump Valve	44. Ram Air Inlet and Check Valve
17. Right Dump Valve	45. Pilot and Crew Air Outlet
18. Ram Air Control Lever	46. Windshield Defog Outlets
19. Switch	47. Forward Cabin Heating Outlets
20. Circuit Breaker	48. Forward Cabin Pressure Bulkhead
21. Aft Cabin Pressure Bulkhead	49. Windshield Defog Control Valve
22. Ram Air Inlet	50. Forward Cabin Heat and Ventilation Valve
23. Ram Air Shutoff Valve	51. Recirculating Air Duct
24. Ventilating Air Blower	52. Inlet
25. Combustion Air Blower	53. Exhaust
26. Nacelle Ram Air Valve	54. Inlet Air Valve
27. Intercooler	55. Manifold Pressure Relief Valve
28. Throttle Air Valve	56. Left-Hand Pressure Check Valve Open

Figure 13-4. Pressurization Schematic (Sheet 1 of 6)

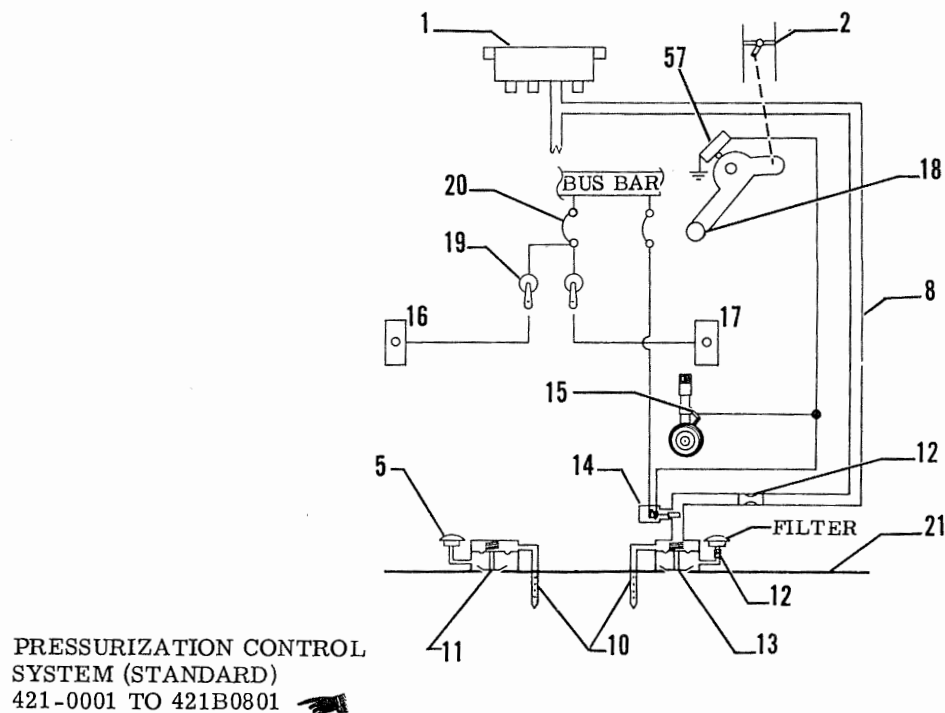
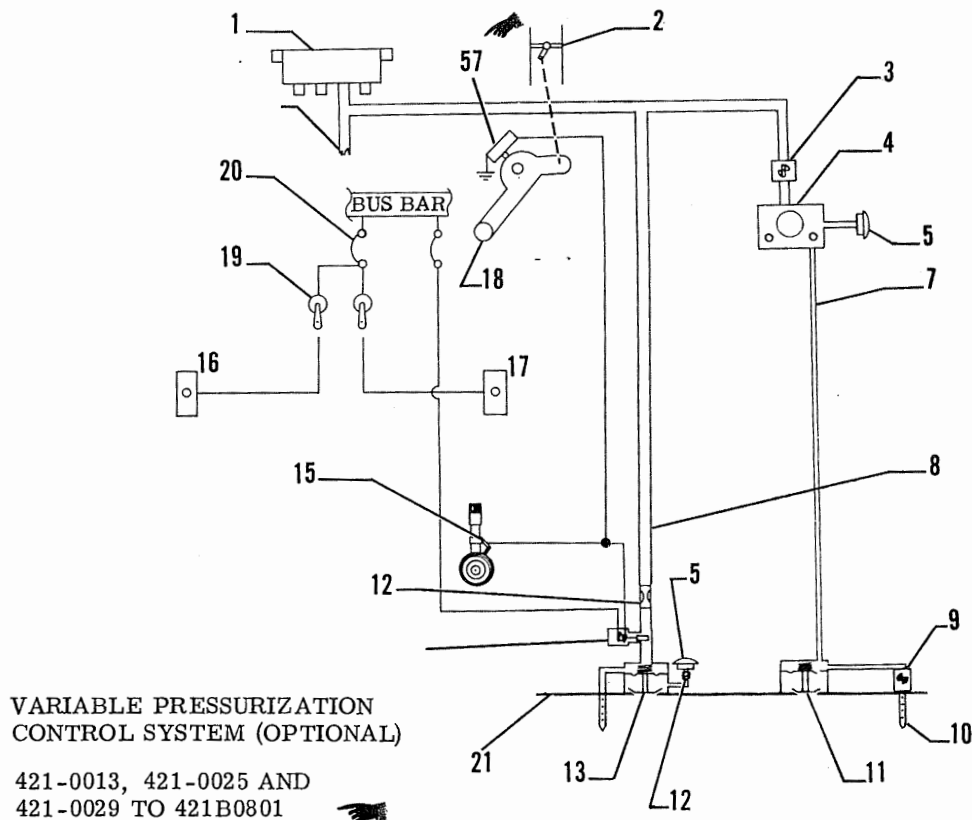
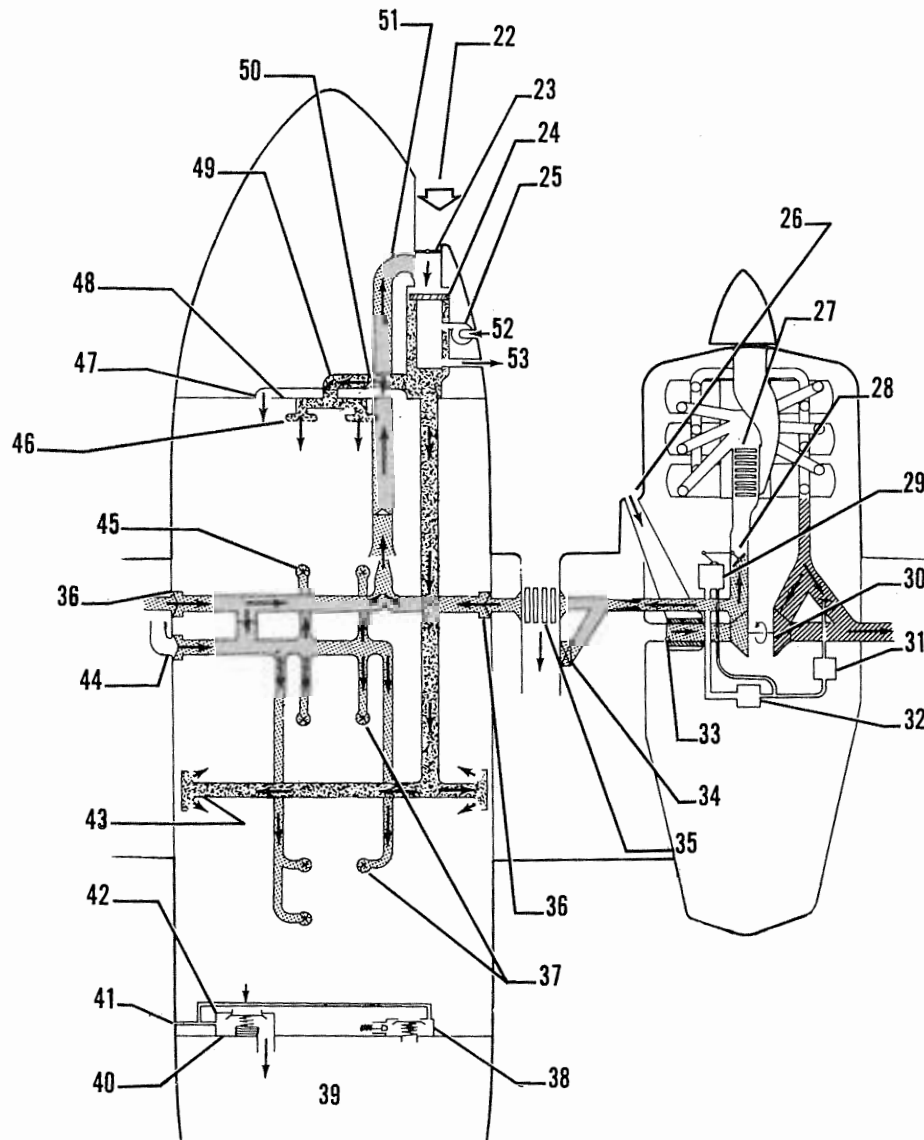


Figure 13-4. Pressurization Schematic (Sheet 2)



421-0001 TO 421A0001

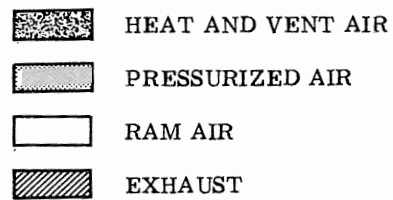
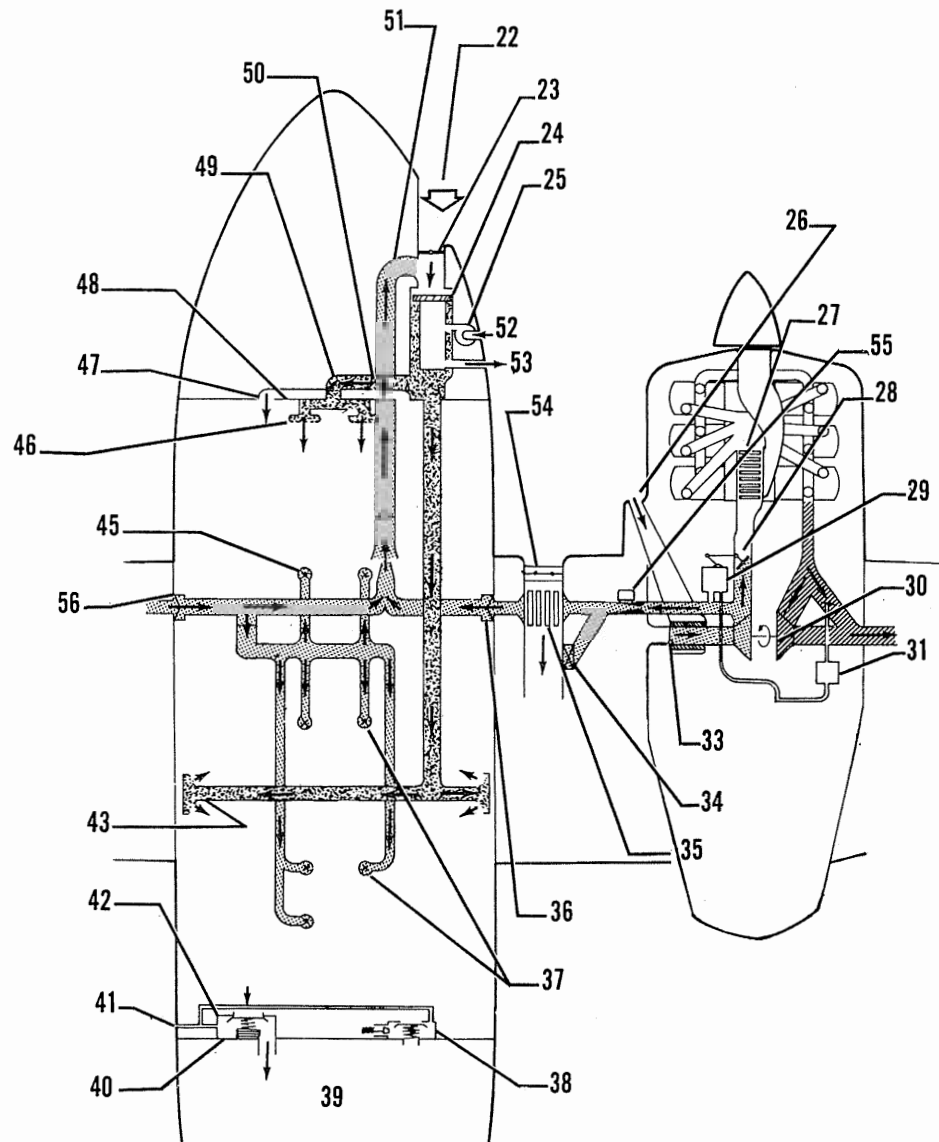


Figure 13-4. Pressurization Schematic (Sheet 3)



421A0001 TO 421B0001

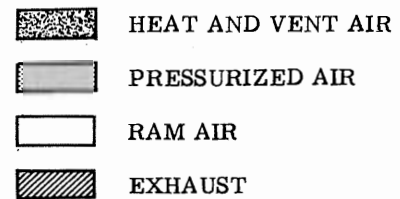


Figure 13-4. Pressurization Schematic (Sheet 4)

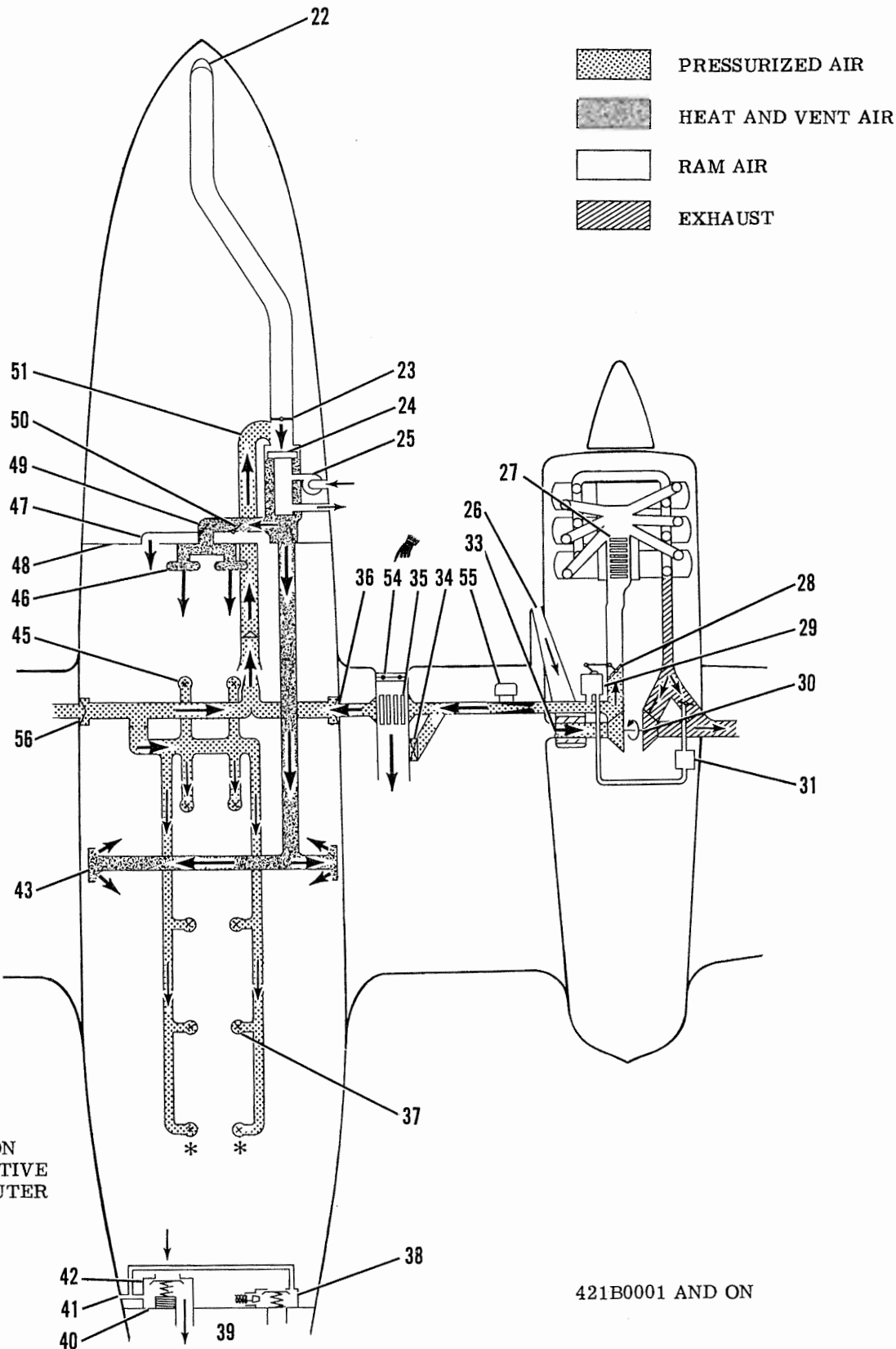
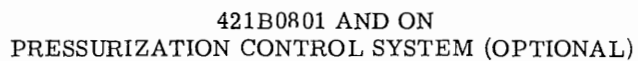
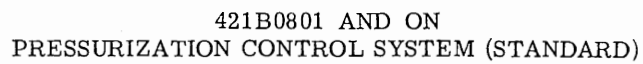


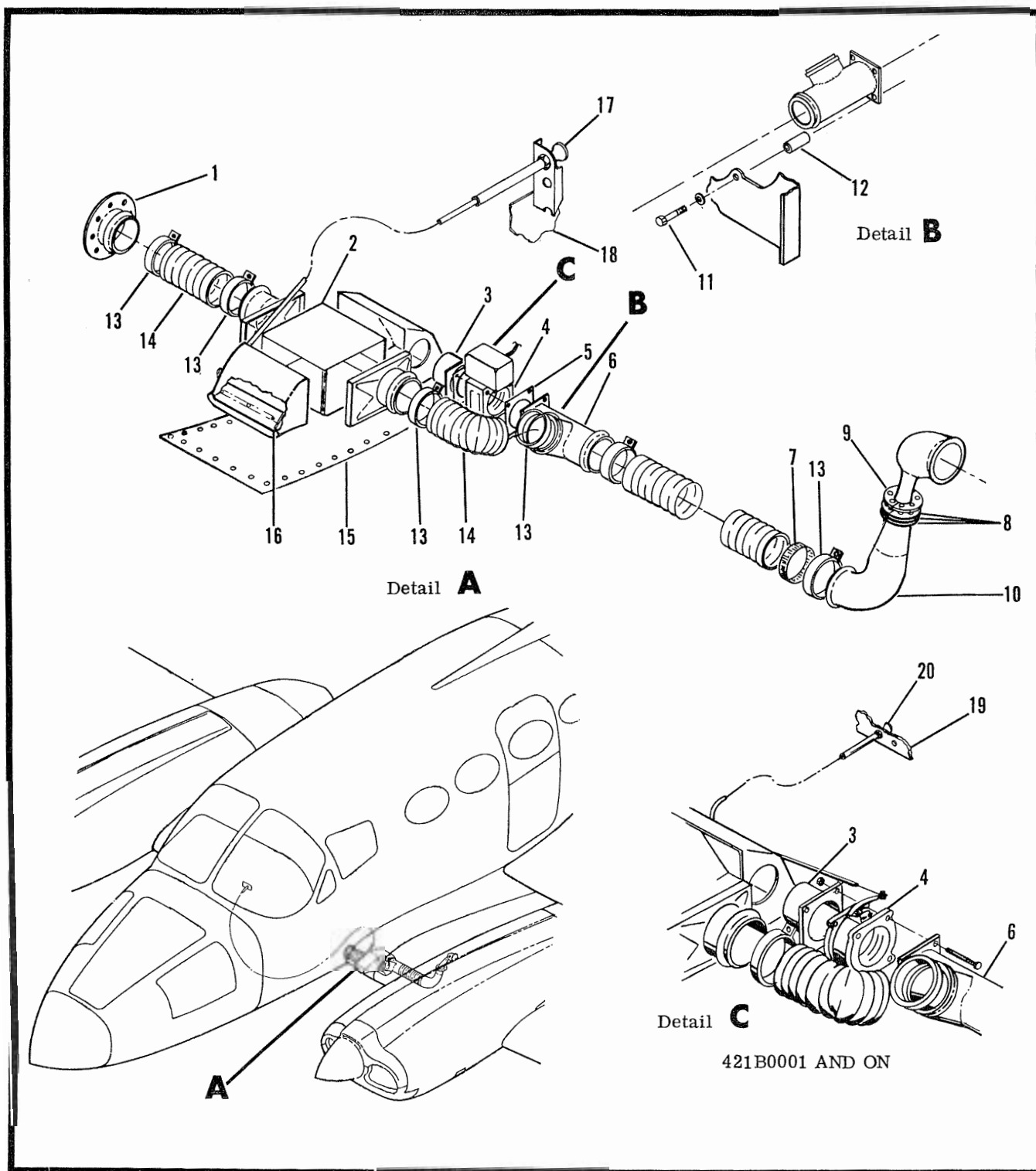
Figure 13-4. Pressurization Schematic (Sheet 5)



59. Rate-of-Change Selector
60. Volume Tank

Change 11

TROUBLE	PROBABLE CAUSE	CORRECTION
CABIN WILL NOT PRESSURIZE	Excessive cabin leakage.	Locate and repair.
	Control knob on altitude controller improperly set.	Turn control knob of altitude controller to desired setting.
	Defective pressure controller. (Optional system.)	Replace controller.
CABIN PRESSURE EXCESSIVELY HIGH	Defective outflow valve.	Replace valve.
	Shutoff valve or valves closed.	Open shutoff valve or valves.
	Defective safety valve.	Replace valve.
	Outflow valve static line loose or restricted.	Tighten line or clear obstruction.
	Ground test valve in TEST ONLY-ALL OFF position.	Place valve in FLIGHT position.
	Defective rate of change controller.	Replace rate of change controller.
	Defective rate of change selector.	Replace rate of change selector.
OUTFLOW OR SAFETY VALVE FAILS TO OPEN DURING VACUUM RELIEF CYCLE	Defective safety or outflow valve.	Replace safety or outflow valve.
CABIN AIR PRESSURE RATE OF CHANGE DOES NOT RESPOND TO RATE OF CHANGE SELECTOR	Loose or damaged pneumatic fittings on rate of change controller or selector.	Repair or replace fittings.
	Defective rate of change controller	Replace rate of change controller.
	Pressure ports of rate of change controller clogged with foreign matter.	Remove connections and clean ports.
CABIN PRESSURIZES IMMEDIATELY TO MAXIMUM DIFFERENTIAL	Shutoff valve in vacuum line is closed.	Open valve and safety.
	Shutoff valve in static line is closed.	Open valve and safety.
CABIN PRESSURE WILL NOT DUMP WHEN SAFETY VALVE SWITCH IS SET TO OPEN	Defective safety valve.	Replace safety valve.
	Defective electrical circuit.	Check circuitry.
	Safety valve vacuum line restricted.	Clean or replace restrictor.
	Safety valve vacuum line loose or disconnected.	Tighten vacuum line.
	Vacuum control filter restricted.	Clean or replace filter.
	Leak in deice flow valves.	Refer to deice system troubleshooting. Remove deice flow valves and clean.



1. Coupling	8. Gasket	14. Duct
2. Heat Exchanger	9. Retainer	15. Door
3. Adapter	10. Venturi	16. Inlet Air Valve
4. Dump Valve	11. Bolt	17. Heat Exchanger Control
5. Gasket	12. Spacer	18. Control Pedestal
6. Duct	13. Clamp	19. Instrument Panel
7. Sleeve		20. Dump Valve Control

Figure 13-5. Heat Exchanger Installation

below the heater controls. This control is mechanically linked to a butterfly valve located in the nose inlet scoop just forward of the heater. It is electrically linked to the cabin pressure safety valve. As the ram air control is moved to the DEPRESSURIZED position, the cabin dump valve is actuated to the open position. When the control is moved to the PRESSURIZED position, the cabin dump valve is actuated closed provided the gear is in extended position. When the control lever is moved to the RAM (dump) position the butterfly valve in the nose is opened and ram air is allowed to enter the cabin.

Heat Exchanger and Pressurization Air Dump Valve.

A heat exchanger is located in each stub wing leading edge. Pressurized air passing through the heat exchanger is cooled to within 10 degrees of ambient temperature by ram air entering the wing leading edge air intake and passing through the heat exchanger. On aircraft 421-0001 to 421A0001 the dump valve is solenoid operated. On aircraft 421B0001 and On the dump valve is manually controlled. The dump valves may be individually controlled by the pilot. In case of noxious fumes or contamination entering the cabin, either dump valve may be opened to allow fumes to be dumped overboard and still maintain pressurization from the opposite side.

Removal and Installation of Heat Exchanger Dump Valve and Pressurization Air Venturi. (See figure 13-5.)

Removal and installation is given for left-hand side; right-hand side is similar. Remove heat exchanger as follows:

- a. Remove access plates (54, 55, 56, 57 and 35). (See figure 1-2.)
- b. Remove door (15) and overboard drain tube.
- c. Remove clamps securing ducts to heat exchanger.
- d. Remove bolt (11) and spacer (12), then slide dump valve assembly outboard to disengage adapter (3) from heat exchanger.
- e. Remove screws securing heat exchanger to structure at forward side and lower heat exchanger from stub wing.
- f. Remove the remaining bolts securing the dump valve to adapter to remove dump valve.
- g. Ducting is then removed by removing clamps (13) and sleeve (7).
- h. Remove screws securing retainer (9) and three gaskets (8), then remove venturi (10) through firewall into nacelle area.

- i. Install heat exchanger and dump valve by reversing removal procedures.

Outflow and Safety Valves.

An outflow valve is located on the aft cabin pressure bulkhead. It is completely automatic in operation, set to maintain a nominal cabin pressure altitude of 8000 feet to 20,180 feet and a nominal pressure differential of 4.1 to 4.3 psi above 30,180 feet on aircraft 421-0001 to 421B0201. On aircraft 421B0201 to 421B0301 a nominal pressure differential of 4.3 to 4.5 psi is maintained above 20,860 feet. On aircraft 421B0301 and On a nominal pressure differential of 4.9 to 5.1 psi is maintained above 23,120 feet. There is no adjustment of the outflow valve. A combination cabin safety and dump valve is also located on the aft cabin pressure bulkhead. This valve is provided for cabin depressurization and as a safety backup for the outflow valve. On aircraft 421-0001 to 421B0201 the safety valve pressure relief is factory set at 4.2 to 4.4 psi and should not be reset. On aircraft 421B0201 to 421B0301 the safety valve pressure relief is factory set at 4.5 to 4.6 psi and should not be reset. On 421B0301 and On the safety valve pressure is factory set at 5.2 to 5.4 psi and should not be reset. The safety valve also incorporates a dump function which is solenoid operated, vacuum actuated and controlled by the pilot.

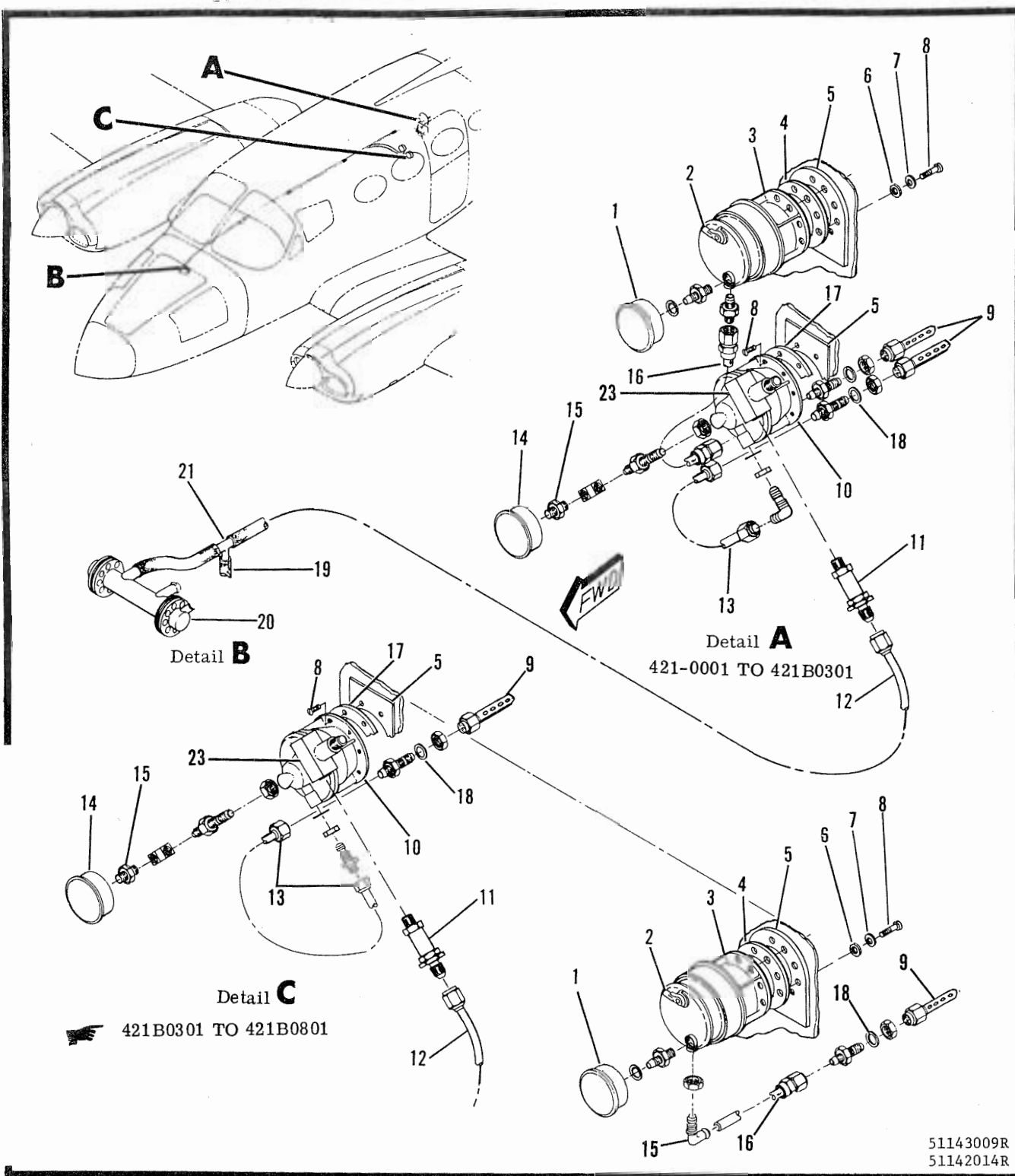
Removal and Installation of Outflow Valve and Safety Valve. (See figure 13-5A.)

- a. Remove tailcone access door.
- b. Disconnect static line (13), vacuum line (12) and electrical connection at safety valve (10).
- c. Remove screws (8) securing valve to aft cabin bulkhead (5).
- d. Disconnect static pressure line (16) from outflow valve (3).
- e. From aft side of cabin bulkhead, remove screws (8), washers (7) and stat-o-seals (6) while holding valve to prevent damage from falling.

NOTE

On aircraft 421-0801 and On, discard removed gaskets and seal valves to bulkhead with approximately 1/8" diameter bead of RTV-106 sealant. Torque attaching screws to 4-6 inch-pound in a diametrically opposed sequence. Safetywire screws in accordance with standard procedures.

- f. Installation is a reversal of removal procedures.



1. Filter	7. Washer	13. Static Line	19. Vacuum Hose
2. Lever	8. Screw	14. Filter	20. Manifold
3. Outflow Valve	9. Static Ports	15. Restrictor	21. Tee
4. Gasket	10. Safety Valve	16. Static Line	22. Doubler
5. Aft Cabin Bulkhead	11. Restrictor	17. Gasket	23. Solenoid Valve
6. Stat-O-Seal	12. Vacuum Line	18. Lock-O-Seal	24. Controller

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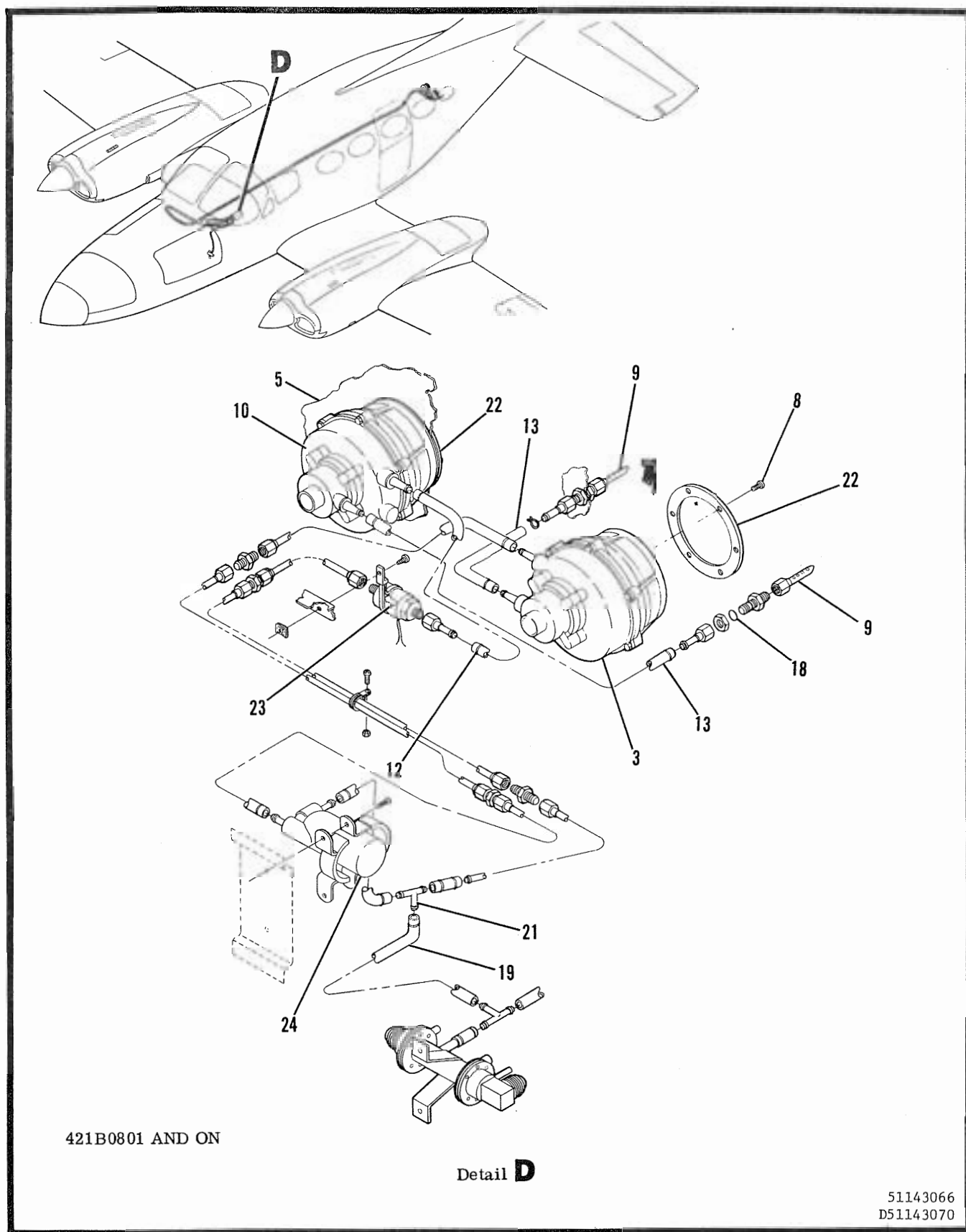


Figure 13-5A. Cabin Outflow Valve and Safety Valve Installation (Sheet 2)