

CESSNA™ 310 & Turbo 310 Series

1969 thru 1974 Service Manual

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1969 thru 1974

MODEL 310 AND TURBO 310 SERIES

FOREWORD

This Service Manual contains factory recommended procedures for ground handling, servicing and maintaining the Cessna 310 Series Aircraft. Where reference is made to the 310 Aircraft in this Service Manual, this reference applies to the 310P, 310Q and Turbo 310P and Turbo 310Q certified aircraft. This manual also describes the Cessna 310QII and Turbo 310QII which are the same as the Cessna 310Q and Turbo 310Q with some optional equipment installed as standard. Where there are specific differences, reference will be made to the individual aircraft. Besides serving as a reference for the experienced mechanic, this Service Manual also covers step-by-step procedures for the less experienced mechanic. This Service Manual should be kept in a handy place for ready reference. If properly used, it will better enable the mechanic to maintain the Cessna 310 Series aircraft and thereby, establish a reputation for reliable service.

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

In addition to the information in this Service Manual, a group of vendor publications are available from the Cessna Customer Services 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.

This Service Manual covers the 1969 through 1974 Model 310 and Turbo 310 Series aircraft which are certificated as follows:

1969	1970-1973	1974
310P T310P	310Q T310Q	310Q/310Q II T310Q/T310Q II

THIS REPRINT DATED DECEMBER 1974 OF BASIC SERVICE MANUAL D872-13 DATED DECEMBER 1970 INCORPORATES CHANGE 1 DATED APRIL 1971 CHANGE 2 DATED DECEMBER 1971, CHANGE 3 DATED JUNE 1972, CHANGE 4 DATED OCTOBER 1972, CHANGE 5 DATED JANUARY 1973, CHANGE 6 DATED SEPTEMBER 1973, CHANGE 7 DATED FEBRUARY 1974 AND CHANGE 8 DATED MAY 1974.

SERVICE MANUAL
DECEMBER 1970
REPRINTED DECEMBER 1974

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES

LIST OF EFFECTIVE PAGES

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SERVICE MANUAL CHANGE NOTICE

REFERENCE MANUAL NUMBER: As Noted

DATE: 9-20-74

MANUAL TITLE: All 310, 320, 340 and 400 Series Aircraft

TO: All Zones and Dealers

FROM: CUSTOMER SERVICES DEPARTMENT

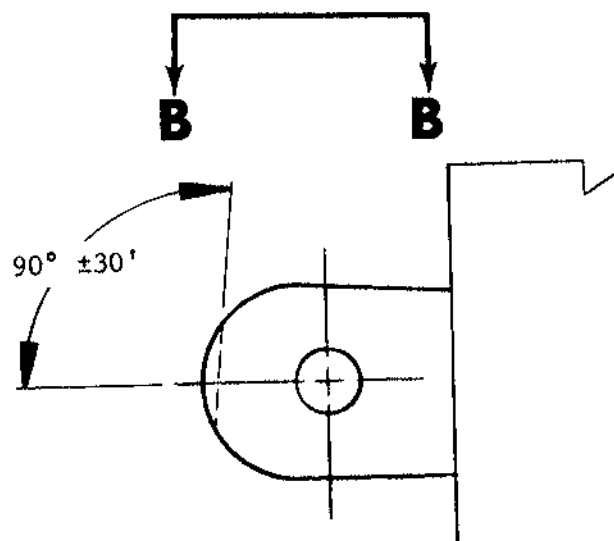
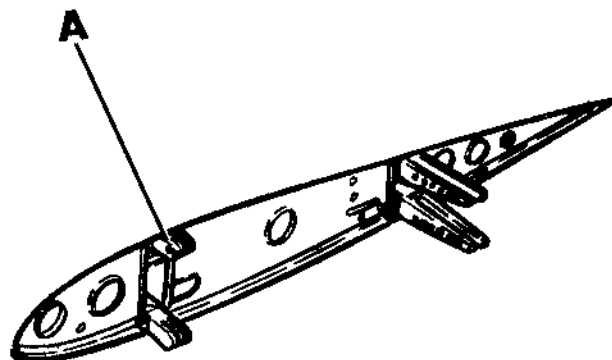
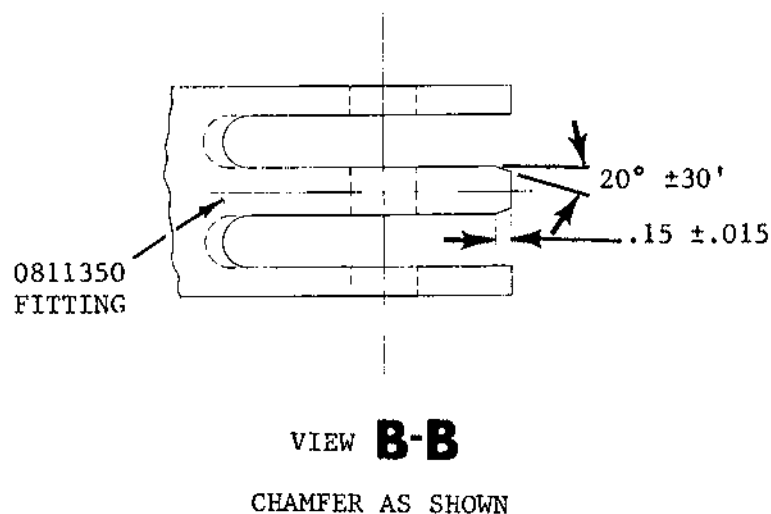
CORRECT YOUR SERVICE MANUAL AS SHOWN BELOW.

SECTION NUMBER	PAGE NUMBER	PARAGRAPH NUMBER	DESCRIPTION OF CHANGES
			To facilitate wing attachment on production aircraft, tooling changes have been made to the front spar attach fitting that affect interchangeability on earlier aircraft; therefore, Service Manuals need to be corrected as follows: Under "Installation of Wing" paragraph, add a note "See Additional Wing Installation Instructions", and incorporate a copy of one of the attached pages opposite the installation information in each of the manuals listed below.
2	2-4	2-7	P150C-13, 310 thru 310D
2	2-5	2-7	D455-13, 310F thru 310K
3	3-25	N/A	D526-13, 310L & 310N
3	3-28	N/A	D872-13, 310P & 310Q
2	2-5	2-7	D247-13, 320/Skyknight, 1962 thru 1965
3	3-28	N/A	D508-13, 320/Skyknight, 1966 thru 1968
3	3-24	N/A	D930-13, 340
3	3-26	N/A	D777-13, 401/402 Series
3	3-18	N/A	D609-13, 411/411A
3	3-20	N/A	D778-13, 414
3	3-21	N/A	D817-13, 421 Series

Additional Wing Installation procedures.

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. Modification Instructions are shown below.



Detail **A**

NOTE:

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.

Fuselage Front Spar Fittings Modification (Typical)



SERVICE MANUAL CHANGE NOTICE

SMCN #76-1

REFERENCE MANUAL NUMBER: Multiengine As Listed Below DATE: 1-5-76

MANUAL TITLE: 310 thru D, 310F thru K, 310L & N, 310P & Q, 320

TO: All Zones and Dealers and 411/411A

FROM: CUSTOMER SERVICES DEPARTMENT

CORRECT YOUR SERVICE MANUAL AS SHOWN BELOW.

Manual Number	Page Number	Model Coverage	DESCRIPTION OF CHANGES
P150C-13	1-12B	310 thru D	The following information is to be incorporated into the Overhaul and Replacement Charts as applicable. LANDING GEAR FORK BOLT Part Number 5243518-3 (0.530" Diameter) Replace every 2000 hours Part Number 5241052-1 (0.750" Diameter) Replace every 5000 hours This change notice corresponds to information in Multi-Engine Service Letter ME75-23 dated 9-19-75.
D455-13	1-17	310F thru K	
D526-13	2-21	310L & N	
D872-13	2-18A/ 2-18B	310P & Q	
D247-13	1-16B	320 1962-65	
D508-13	2-25	320 1966-68	
D609-13	2-14	411/411A	



SERVICE MANUAL CHANGE NOTICE

SMCN #76-6

REFERENCE MANUAL NUMBER: Multi-Engine as Listed Below

DATE: 1-16-76

MANUAL TITLE: 310 thru D, 310F thru K, 310L & N, 320 and 411/411A

TO: All Zones and Dealers

FROM: CUSTOMER SERVICES DEPARTMENT

CORRECT YOUR SERVICE MANUAL AS SHOWN BELOW.

Manual Number	PAGE NUMBER	Model Coverage	DESCRIPTION OF CHANGES																				
			<table><tr><td></td><td>Overhaul</td><td>Replace</td></tr><tr><td>Landing Gear</td><td></td><td></td></tr><tr><td>1. Landing Gear Actuator</td><td>F</td><td></td></tr><tr><td>2. Actuator Motor</td><td>F</td><td></td></tr><tr><td>3. Actuator Reduction Unit</td><td>F</td><td></td></tr><tr><td>F - On Condition</td><td></td><td></td></tr></table>				Overhaul	Replace	Landing Gear			1. Landing Gear Actuator	F		2. Actuator Motor	F		3. Actuator Reduction Unit	F		F - On Condition		
	Overhaul	Replace																					
Landing Gear																							
1. Landing Gear Actuator	F																						
2. Actuator Motor	F																						
3. Actuator Reduction Unit	F																						
F - On Condition																							
			Above is an example of how the landing gear information in the applicable Service Manual Overhaul and Replacement Charts are to be revised to incorporate the following landing gear information.																				
P150C-13	1-12B	310 thru 310D	Delete "B" in REPLACE column Place "F" in OVERHAUL column Add "F- On Condition" to legend																				
D455-13	1-17	310F thru 310K	Delete "B" in REPLACE column Place "E" in OVERHAUL column Add "E- On Condition" to legend																				
D526-13	2-21	310L & 310N	Delete "B" in REPLACE column Place "D" in OVERHAUL column Add "D- On Condition" to legend																				
D247-13	1-16B	320 1962-65	Delete "B" in REPLACE column Place "D" in OVERHAUL column Add "D- On Condition" to legend																				
D508-13	2-25	320 1966-68	Change "C's" in OVERHAUL column to "D's"																				
D609-13	2-14	411/411A	Delete "A" in REPLACE column Place "E" in OVERHAUL column																				

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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	INCORPORATION DATE
Cessna Service Letter ME73-14	8-10-73	Heater Ignition Modification and Troubleshooting	1 Sep 73

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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GENERAL DESCRIPTION.

The 310P and 310Q is an all-metal, low-wing, twin-engine aircraft built by the Cessna Aircraft Company of Wichita, Kansas. The aircraft is powered by two Continental six-cylinder horizontally-opposed, fuel-injection IO-470-VO engines driving constant-speed, all-metal, full-feathering propellers. Flight adjustable trim tabs are located on the right elevator, left aileron and rudder. The split-type wing flaps are electrically operated. The aircraft is equipped with fully retractable, electrically operated, tricycle-type landing gear.

GENERAL DESCRIPTION.

The Turbo 310P and 310Q is an all-metal, low-wing, twin-engine aircraft built by Cessna Aircraft Company of Wichita, Kansas. Power is supplied by two Continental Turbocharged TSIO-520B, fuel injected, six-cylinder engines, driving constant-speed, all-metal, full-feathering propellers. The aircraft has fully retractable, tricycle-type landing gear, which is electrically operated. Flight adjustable trim tabs are located on the right elevator, left aileron and rudder. The split-type wing flaps are electrically operated.

PRINCIPAL DIMENSIONS:

GROSS WEIGHT:

310P	5200 Pounds
310Q	5300 Pounds
Turbo 310P	5400 Pounds
Turbo 310Q	5500 Pounds

LANDING WEIGHT:

310P	5200 Pounds
310Q	5300 Pounds
Turbo 310P	5400 Pounds
Turbo 310Q	5400 Pounds

EMPTY WEIGHT:

310P	3170 Pounds
310Q	3190 Pounds
310Q0601 AND ON	3214 Pounds
310QII0901 AND ON	3392 Pounds
Turbo 310P	3292 Pounds
Turbo 310Q	3292 Pounds
Turbo 310Q0601 AND ON	3293 Pounds
Turbo 310QII0901 AND ON	3471 Pounds

ENGINES:

310P0001 AND ON	Continental IO-470-VO
Turbo 310P0001 AND ON	Continental TSIO-520-B
Spark Plugs	Champion RHB-32E AC 273

PRINCIPAL DIMENSIONS (CONTINUED):

Magnetos (Bendix) LH	S6RN-201
(Bendix) RH	S6RN-205
(See Section 9 for Engine Specifications)	

PROPELLERS:

	(2 Blades Standard)	(3 Blades Optional)
McCauley (310P0001 and On)	D2AF34C71N1/84JF-3	3AF32C87M1/82NC-4
McCauley (Turbo 310P0001 and On)	D2AF34C71N2/84JF-3	3AF32C87M2/82NC-4
Propeller Governor (Woodward)	0750101-69	0750101-69
Diameter	81.00 Inches	78.00 Inches
Blade Angles (See Section 10)		

BATTERIES:	0511319-201

FUEL CAPACITY:

Main Tanks (each wing)	51.0 U. S. Gallons
Usable (each wing)	50.0 U. S. Gallons
Auxiliary Tanks (each wing)	20.50 U. S. Gallons
Usable (each wing)	20.00 U. S. Gallons
Optional Wing Tanks (each wing)	11.50 U. S. Gallons
Usable (each wing)	11.50 U. S. Gallons
Wing Locker Tanks (each wing)	20.30 U. S. Gallons
Usable (each wing)	20.00 U. S. Gallons

CONTROL SURFACE TRAVEL:

Flap	
Down	15° +1° -0°
Down	35° +1° -0°
Aileron	
Up	20° +1° -0°
Down	20° +1° -0°
Aileron Trim Tab	
Up	20° +1° -0°
Down	20° +1° -0°
Rudder (310P0001 AND ON) (Measured perpendicular to hinge line)	
Left	29° +1° -0°
Right	29° +1° -0°
Rudder (Turbo 310P0001 AND ON) (Measured perpendicular to hinge line)	
Left	34° +1° -0°
Right	34° +1° -0°
Rudder Trim Tab (Measured Perpendicular to hinge line)	
Left	25° +1° -0°
Right	20° +1° -0°
Elevator	
Up	16° +1/2° -0°
Down	15° +1° -0°
Elevator Trim Tab	
Up	10° +1° -0°
Down	26° +1° -0°

LANDING GEAR:

Main Wheels and Brakes (twin-piston, disc-type)	
Tire Size	6.50 x 10
Tire Pressure	60 psi
Main Strut Pressure (without load)	320 psi

PRINCIPAL DIMENSIONS (CONTINUED):

Nose Wheel	
Tire Size	6.00 x 6
Tire Pressure	40 psi
Nose Strut Pressure (without load)	48 psi
WING DIHEDRAL:	5°

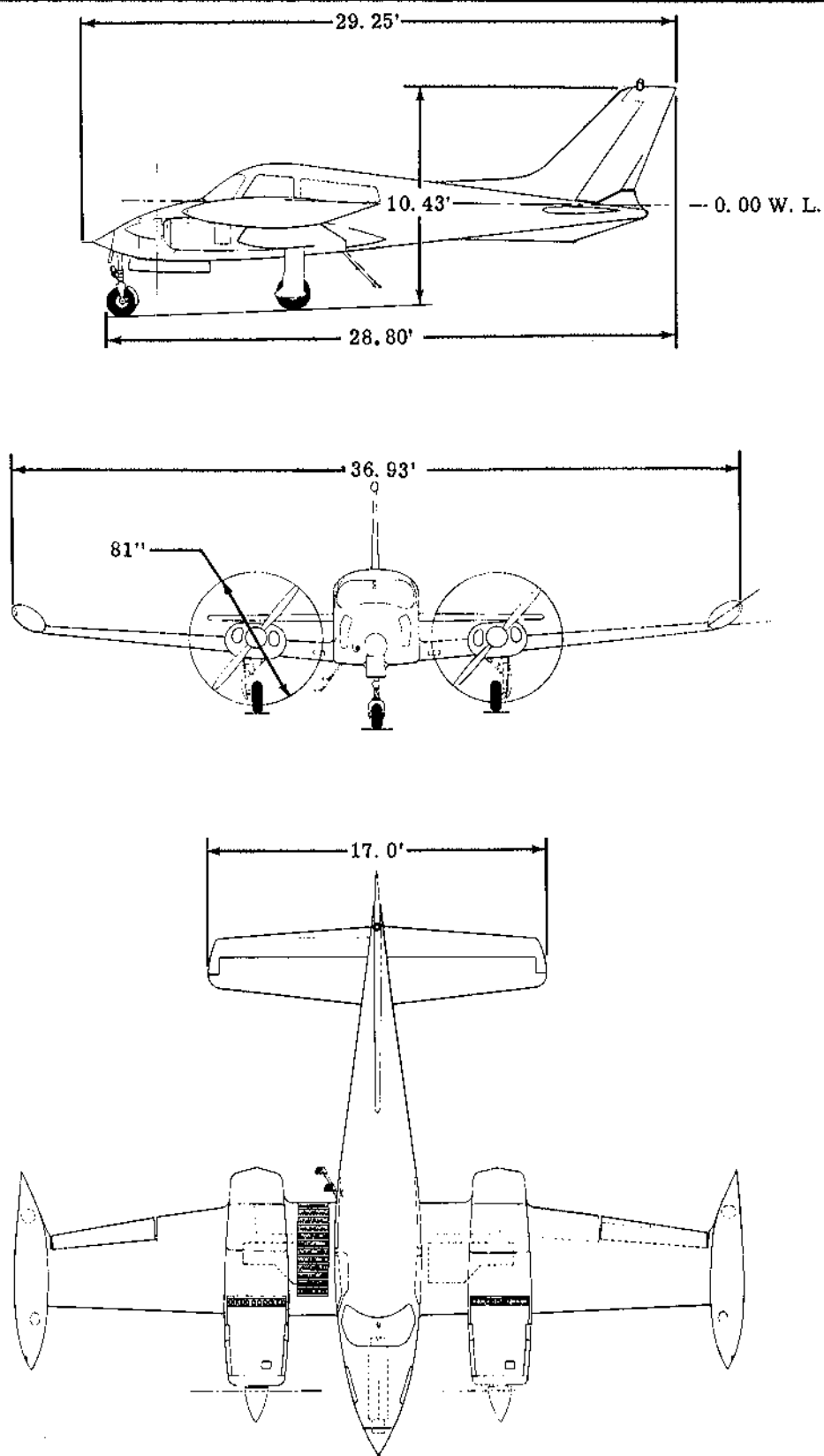
ACCESS AND INSPECTION PROVISIONS.

Access for periodic adjustment, lubrication, or inspection of certain parts of the aircraft is gained by removing access hole covers adjacent to the items affected. Figure 1-3 shows the access hole locations on the aircraft. Access to the interior of aft fuselage is gained through the baggage compartment door. To enter the aft fuselage, remove the rear

baggage compartment upholstery panel by releasing the attaching fasteners.

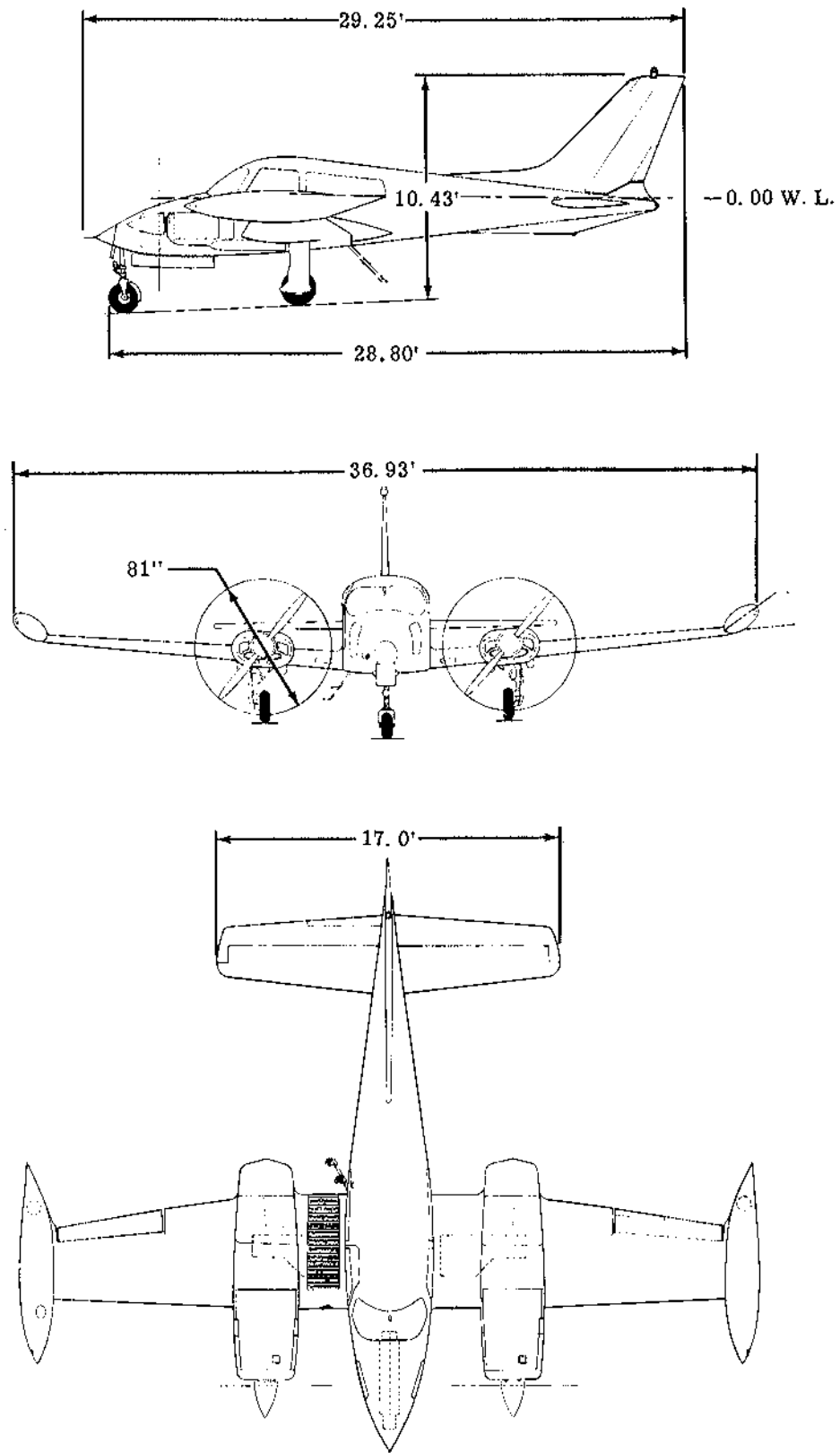
CAUTION

Before entering the aft fuselage, be sure rear section of fuselage is supported. Failure to support aft fuselage may result in the aircraft tipping backward causing damage to the aircraft.



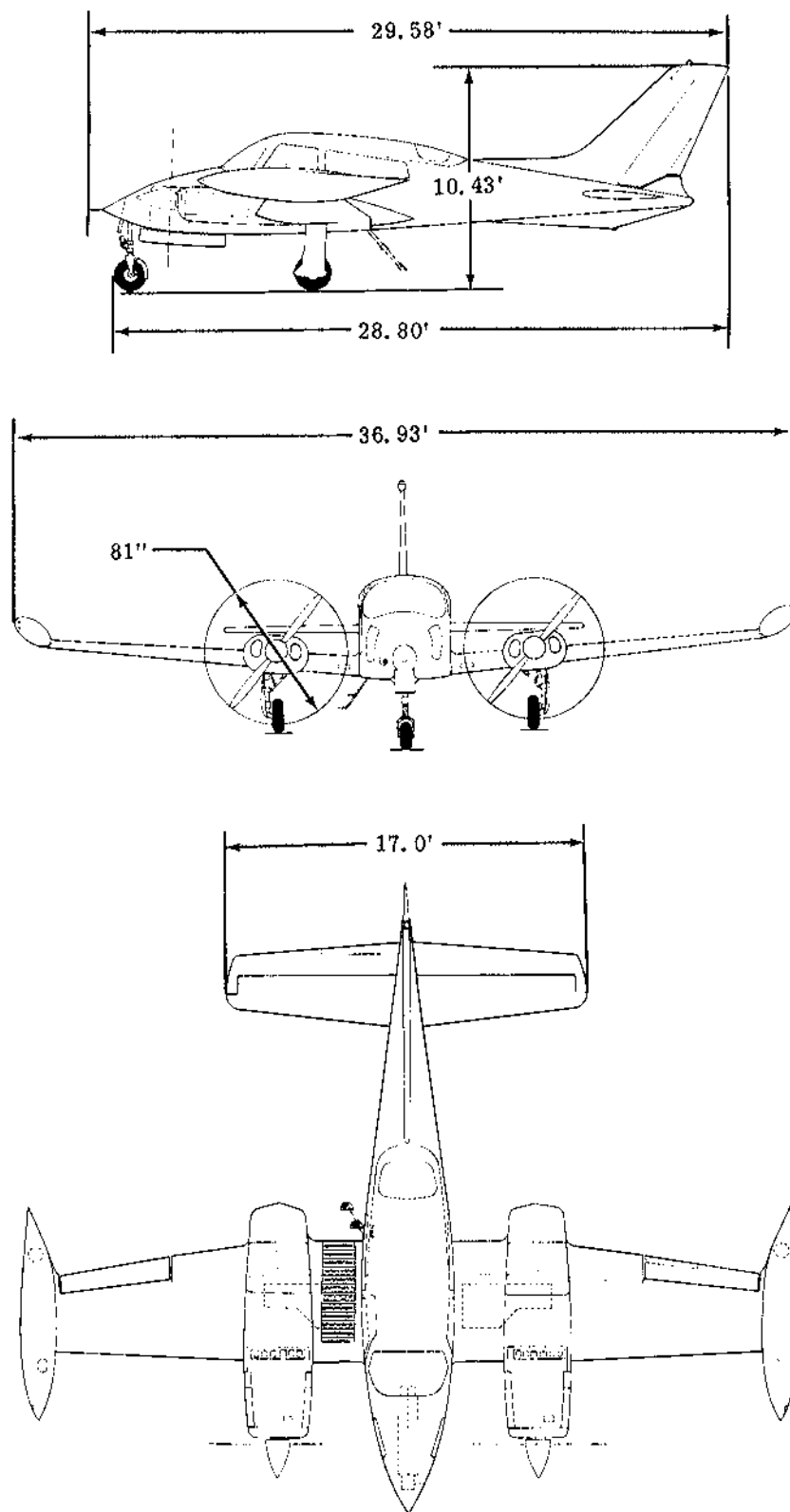
TURBO 310P0001 TO TURBO 310Q0401

Figure 1-1. Three View (Sheet 1)



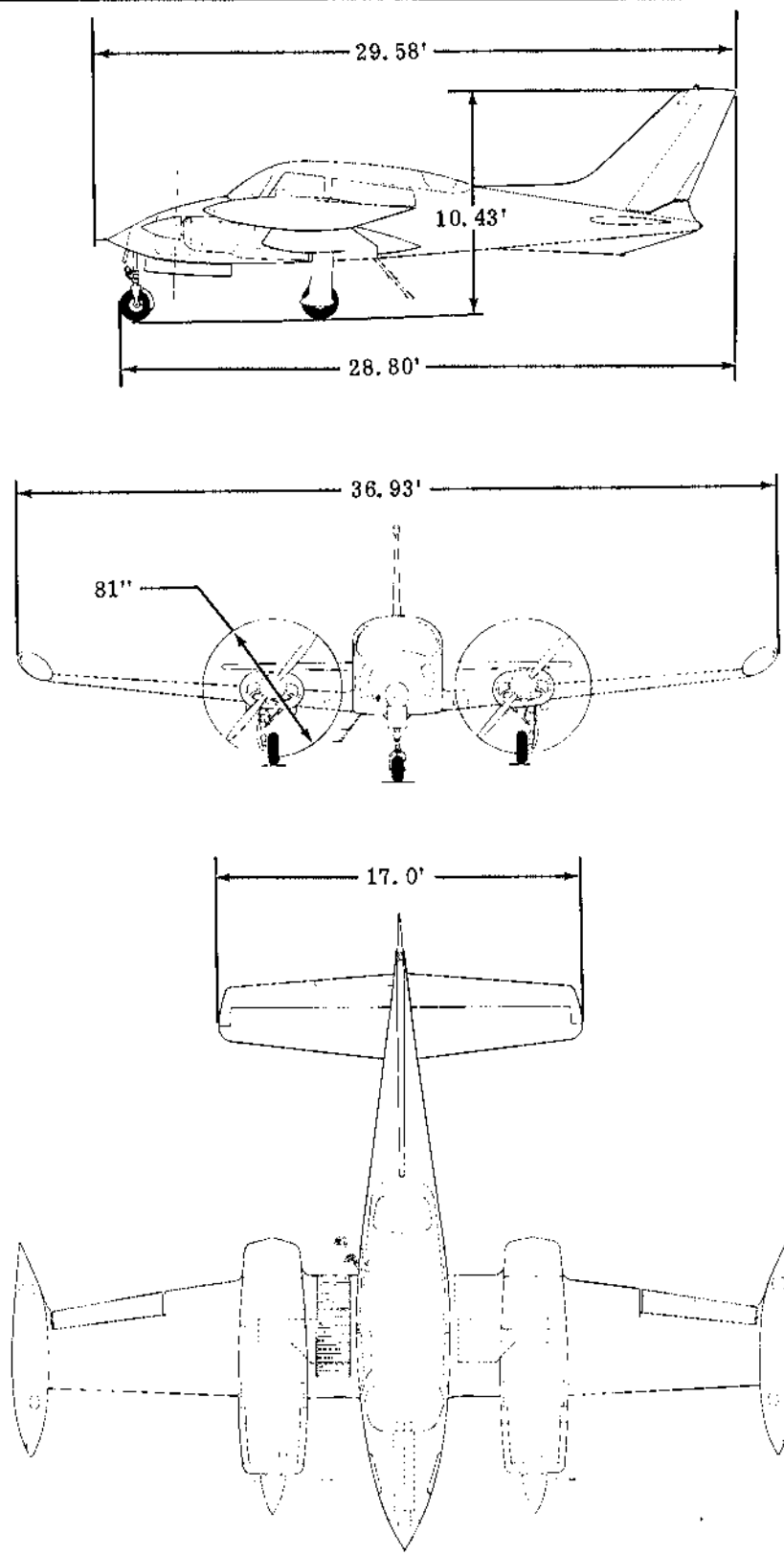
310P0001 TO 310Q0401

Figure 1-1. Three View (Sheet 2)



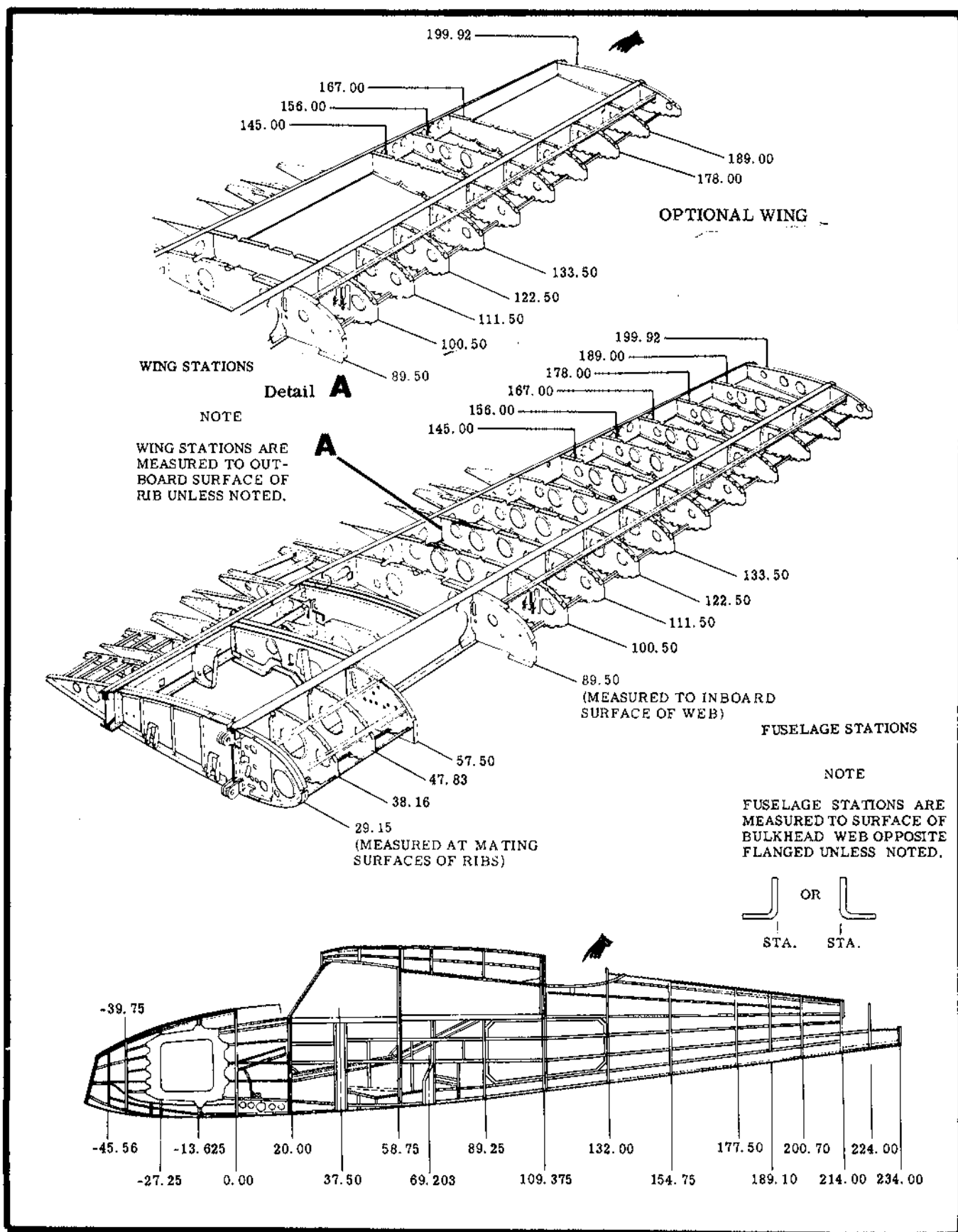
TURBO 310Q0401 AND ON

Figure 1-1. Three View (Sheet 3)



310Q0401 AND ON

Figure 1-1. Three View (Sheet 4)



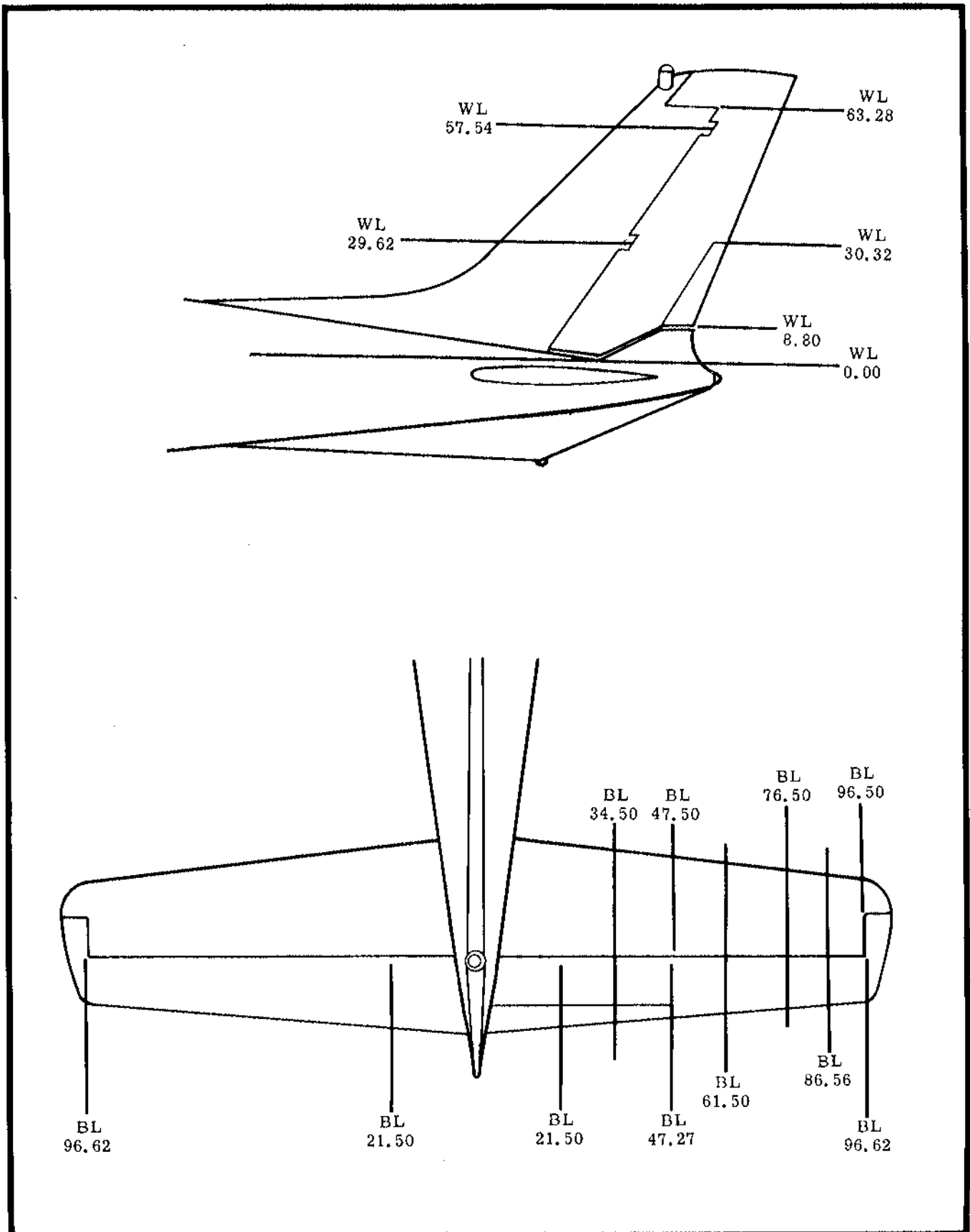
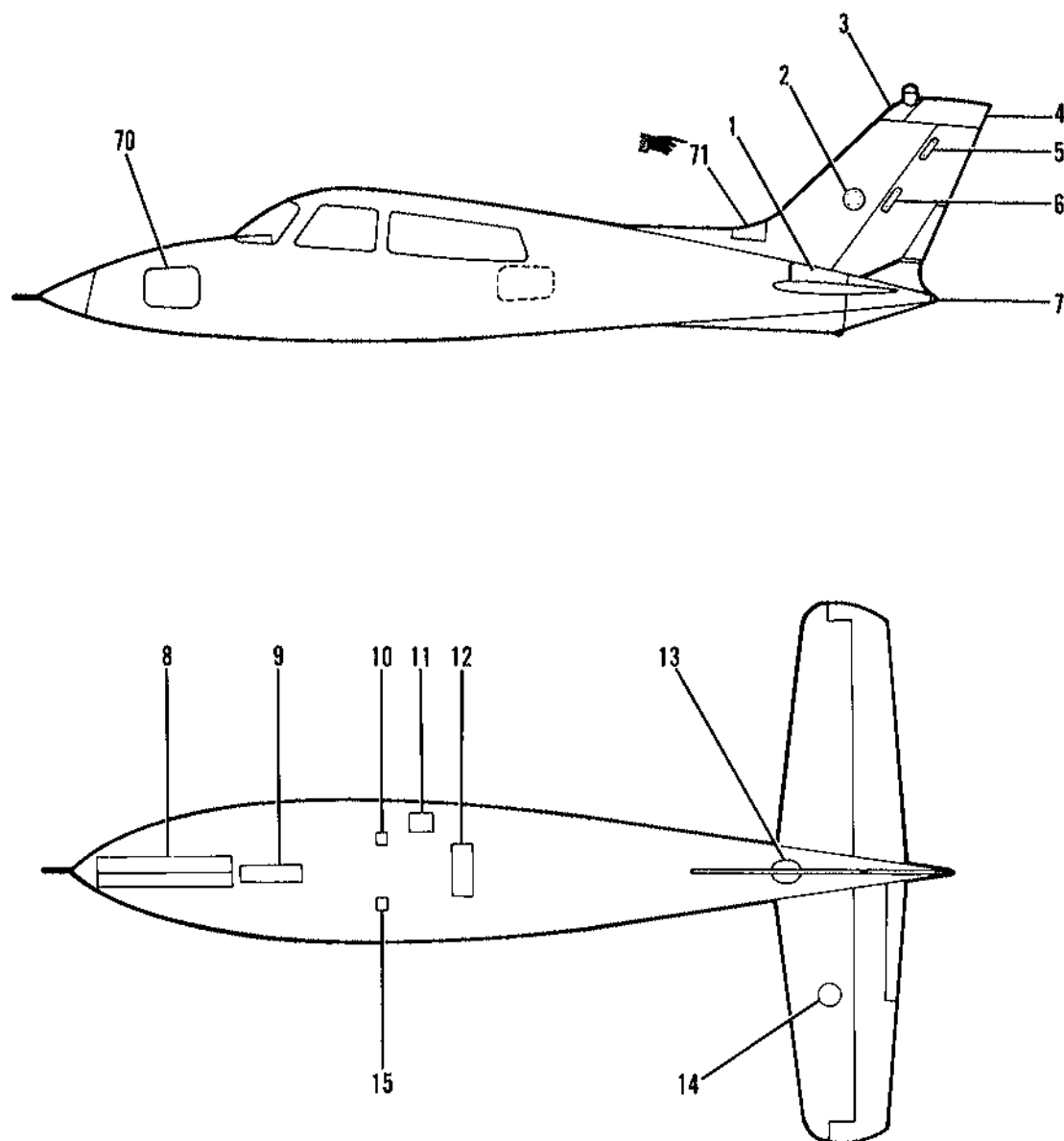
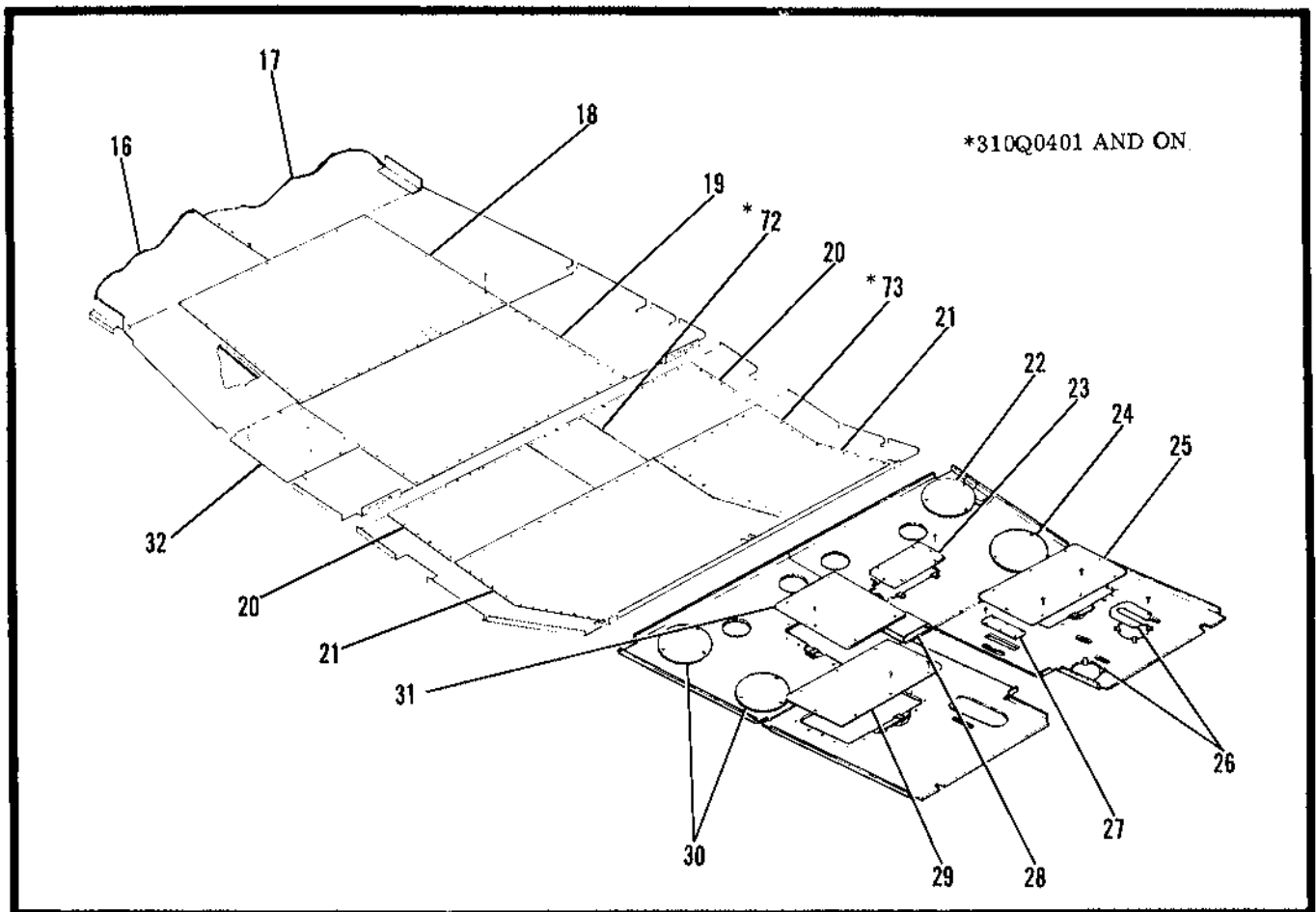


Figure 1-2. Station Diagrams (Sheet 2 of 2)



1. Stabilizer Fairing	11. Nose Gear Bellcrank Access
2. Rudder Trim Access	12. Flap Motor Access
3. Fin Tip	13. Elevator Bellcrank Access
4. Rudder Tip	14. Elevator Trim Access
5. Upper Rudder Access	15. Lower Spar Cap Access (RH)
6. Lower Rudder Access	16. Baggage Floor (RH)
7. Stinger Assembly	17. Baggage Floor (LH)
8. Nose Gear Door	18. Center Floorboard (Aft)
9. Control Cable Access	19. Center Floorboard (Forward)
10. Lower Spar Cap Access (LH)	20. Interspar Floorboard (Aft)

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



21. Interspar Floorboard (Forward)	47. Fuel Line Access
22. Deice Line Access	48. Fuel Line Clamp Access (Inboard)
23. Aileron Cable Access	49. Aileron Bellcrank Access
24. Deice Line Access	50. Fuel Line Clamp Access (Outboard)
25. Brake Line Access	51. Tie Down Ring Access
26. Master Cylinder Access	52. Leading Edge Access
27. Elevator Trim Tab Pulley Access	53. Fuel Line Access
28. Cover (Engine Controls)	54. Main Fuel Tank Access
29. Rudder Cable Access	55. Fuel Vent Line Access
30. Inspection Plate (Selector Valve Control)	56. Rear Spar Access
31. Elevator Bellcrank Access	57. Inboard Wing Access
32. Retractable Step Access	58. Aileron Trim Access
33. Main Tank Filler	59. Plug Button (Aileron Trim)
34. Main Tank Gap Fairing	60. Aileron Trim Pulley Access
35. Aileron Bellcrank Access	61. Plug Button (Outboard Flap)
36. Auxiliary Tank Filler	62. Outboard Flap Access
37. Fuel Selector Valve Access	63. Aileron Cable Stops Access
38. Battery Access	64. Auxiliary Power Plug
39. Wing Locker Tank Filler (Optional)	65. Plug Button (Inboard Flap)
40. Main Gear Door Access	66. Fuel Signal Conditioner Access
41. Engine Controls Access	67. Main Gear Door (Outboard)
42. Heater Pump and Filter Access	68. Waste-Gate Actuator Line Access
43. Vacuum Line Access	69. Main Gear Door (Inboard)
44. Oil Sump Drain Plug	70. Nose Access Door
45. Fuel Line Access	71. Emergency Locator Transmitter Access
46. Fuel Strainer and Selector Valve Access	72. Flap Motor Access
	73. Landing Gear Motor Access
	74. Flap Cable Access

Figure 1-3. Inspection Plates and Access Panels (Sheet 2 of 3)

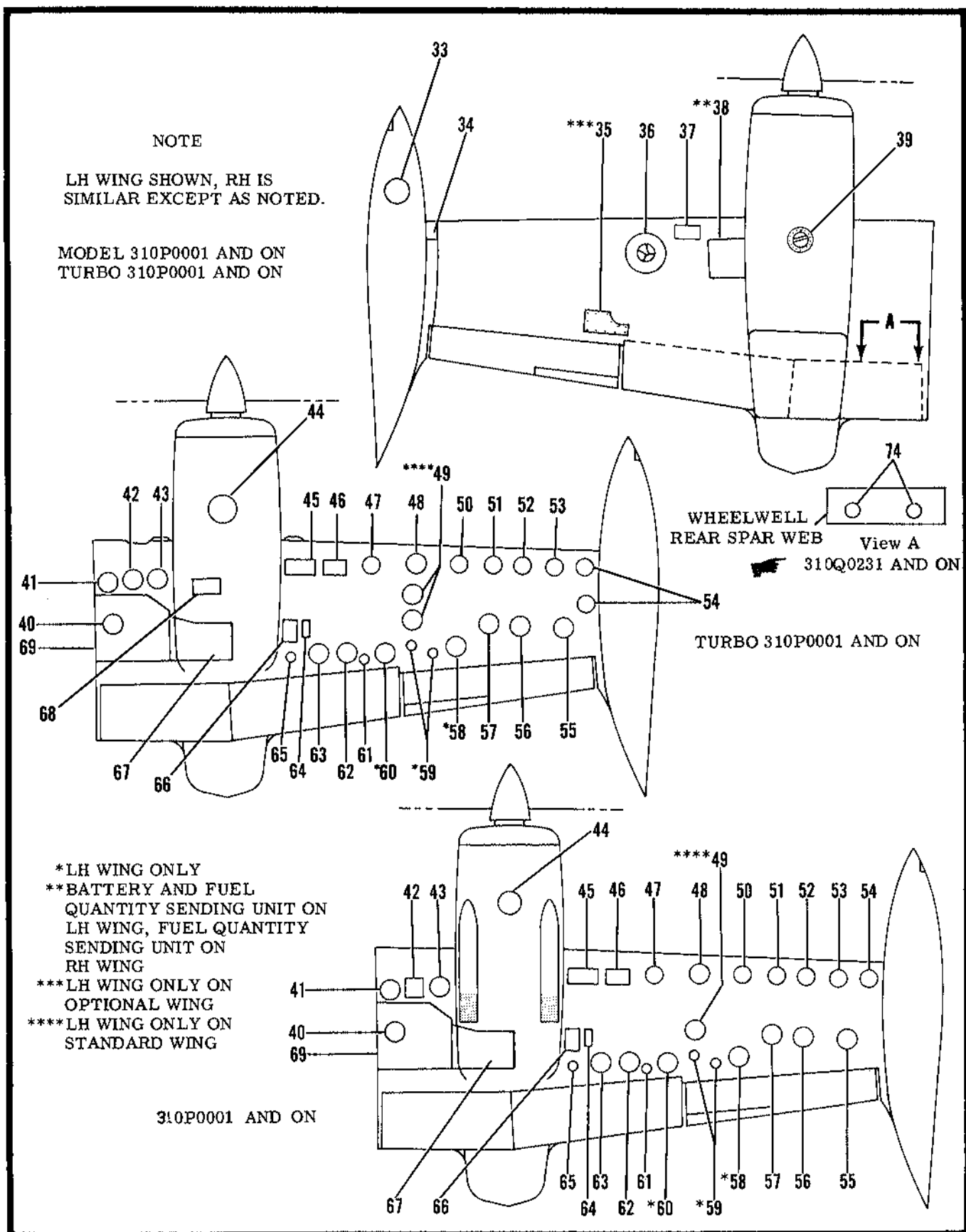


Figure 1-3 Inspection Plates and Access Panels (Sheet 3 of 3)

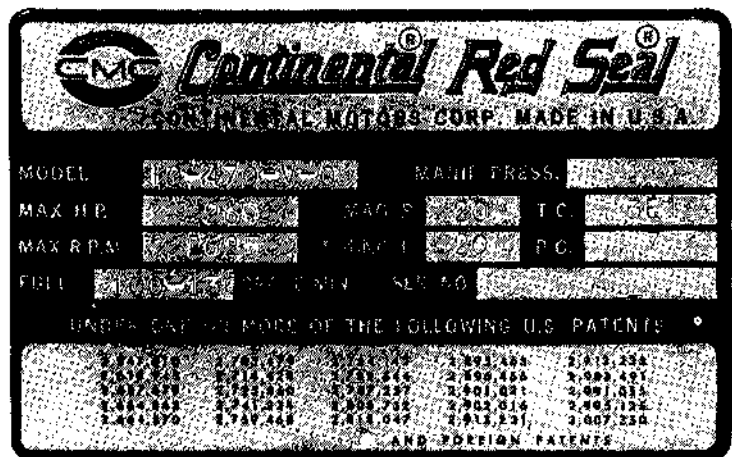
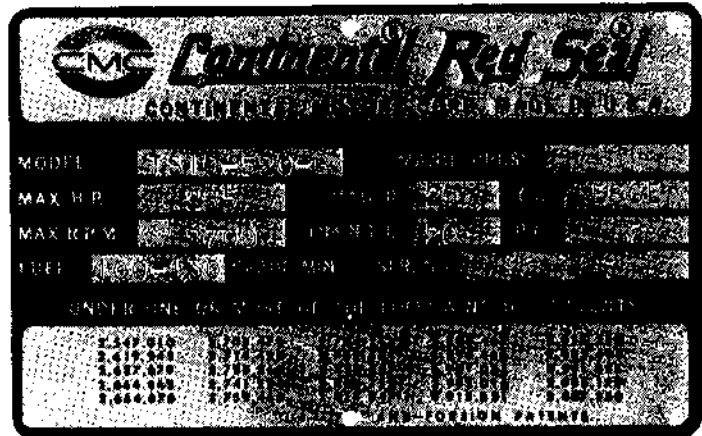
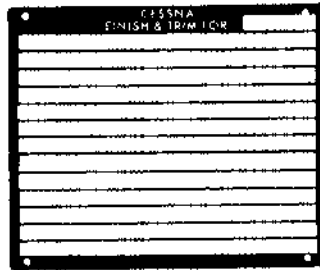


Figure 1-4. Serial Numbers and Identification Plates

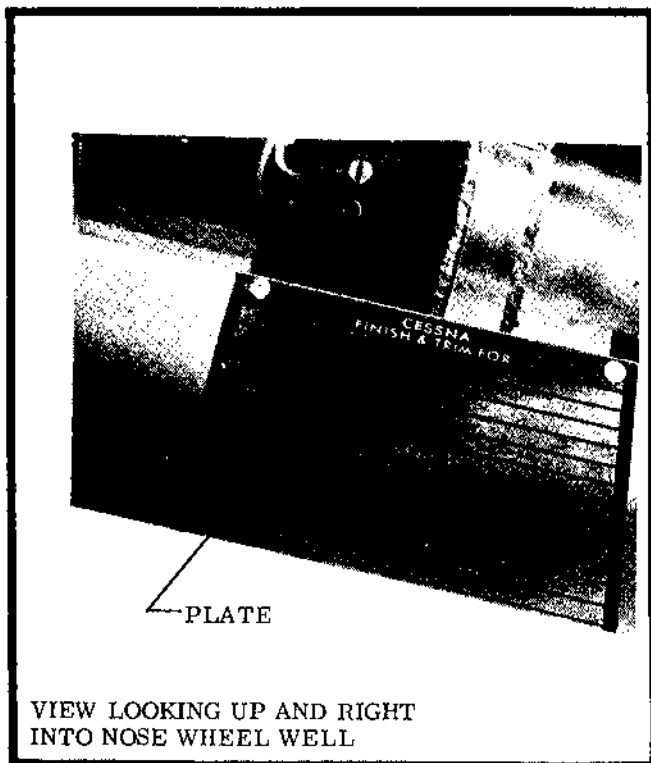


Figure 1-5. Finish and Trim Plate Location

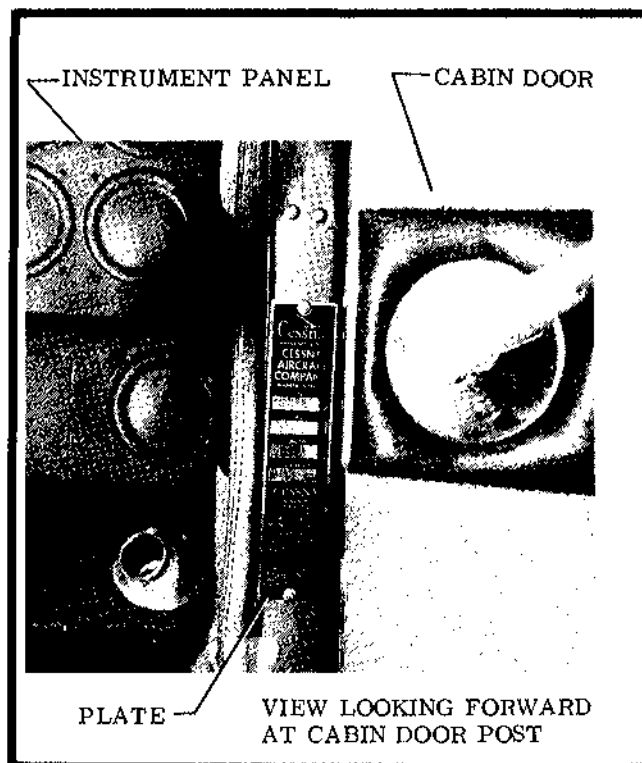


Figure 1-6. MAA Plate Location

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 1-7. Torque Values

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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 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 engines at high RPM.

Towing.

A tow bar, located in the baggage compartment, is provided for ground movement of the aircraft. The tow bar, which engages spacers on the nose gear at the lower torque link, 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 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.

Wing Walk and Wing Walk Areas.

A non skid-surfaced wing walk, located along the in-board side of the right wing, will allow freedom of passage without damaging the wing finish. The entire

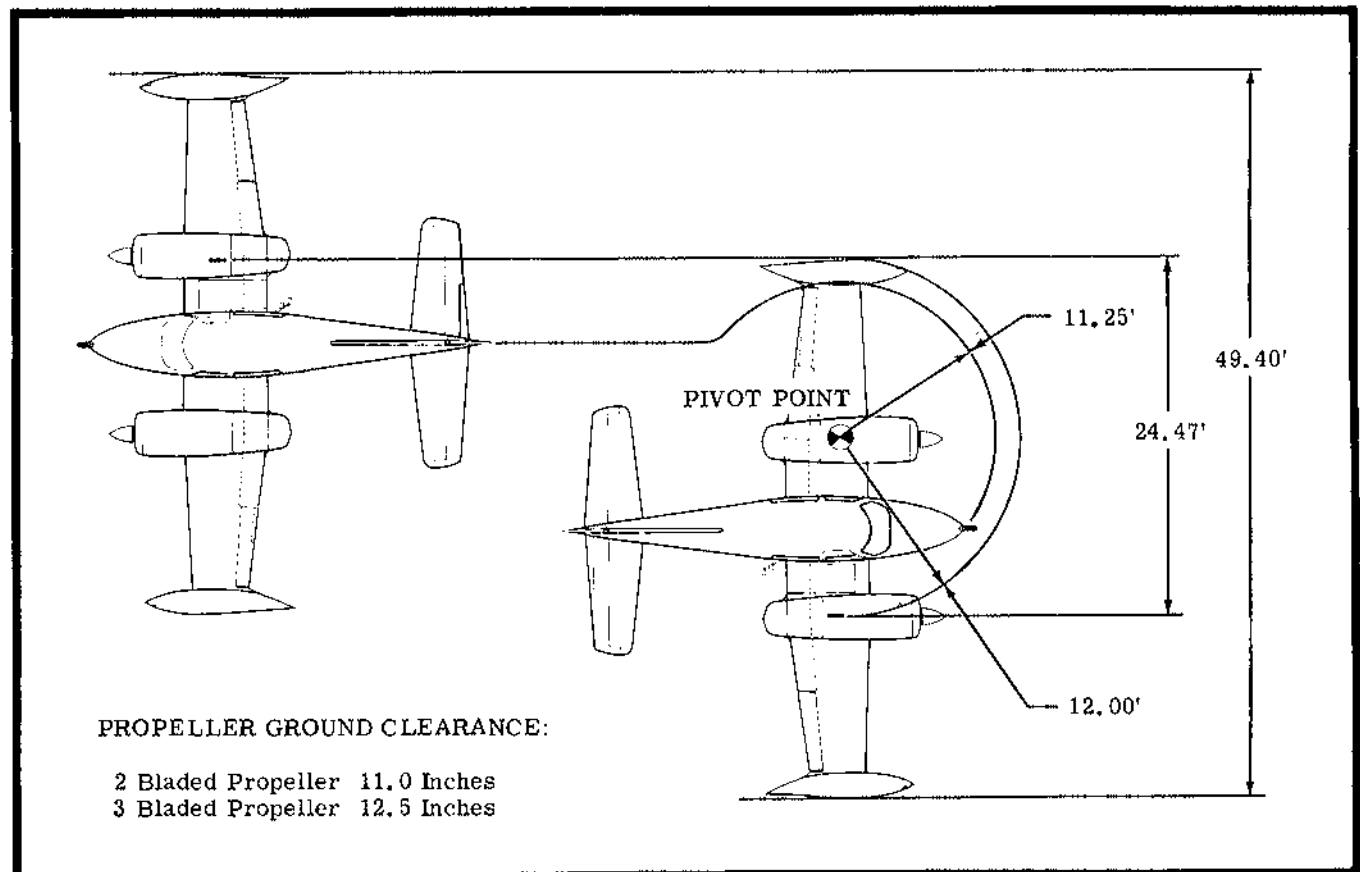


Figure 2-1. Minimum Turning Radius

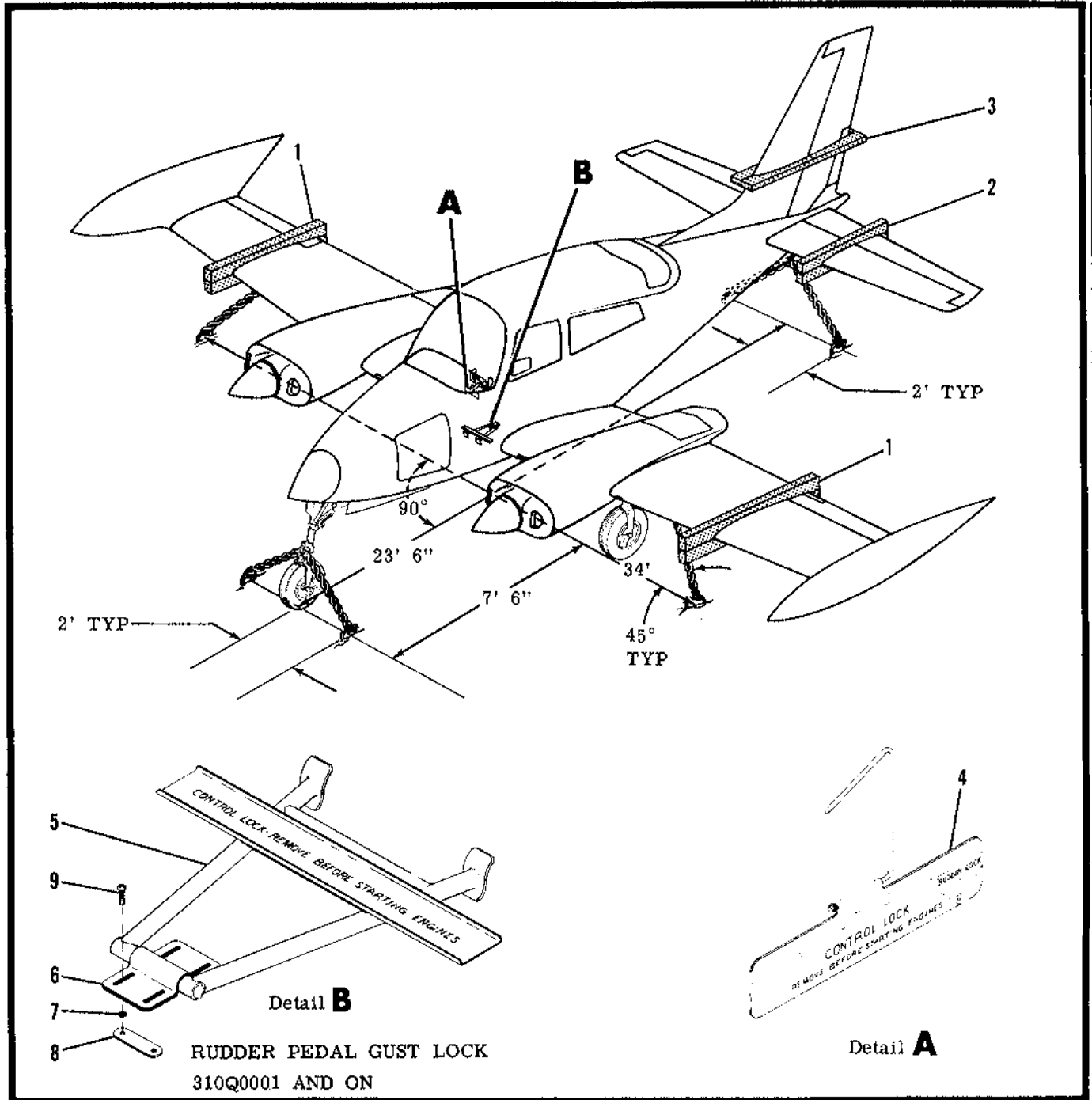
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inboard wing section from the cabin out to the engine nacelle is reinforced to withstand weight pressures up to 500 pounds. The inboard section of the left wing from the cabin out to the left engine is also reinforced, but precautions should be taken if the left inboard edge of the wing must be used for passage. When it is necessary to walk on the left inboard

areas, be sure to cover the surfaces of the wing in order to prevent damaging the wing finish.

Taxiing.

Before attempting to taxi the aircraft, ground person-



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

NOTE

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

CAUTION

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

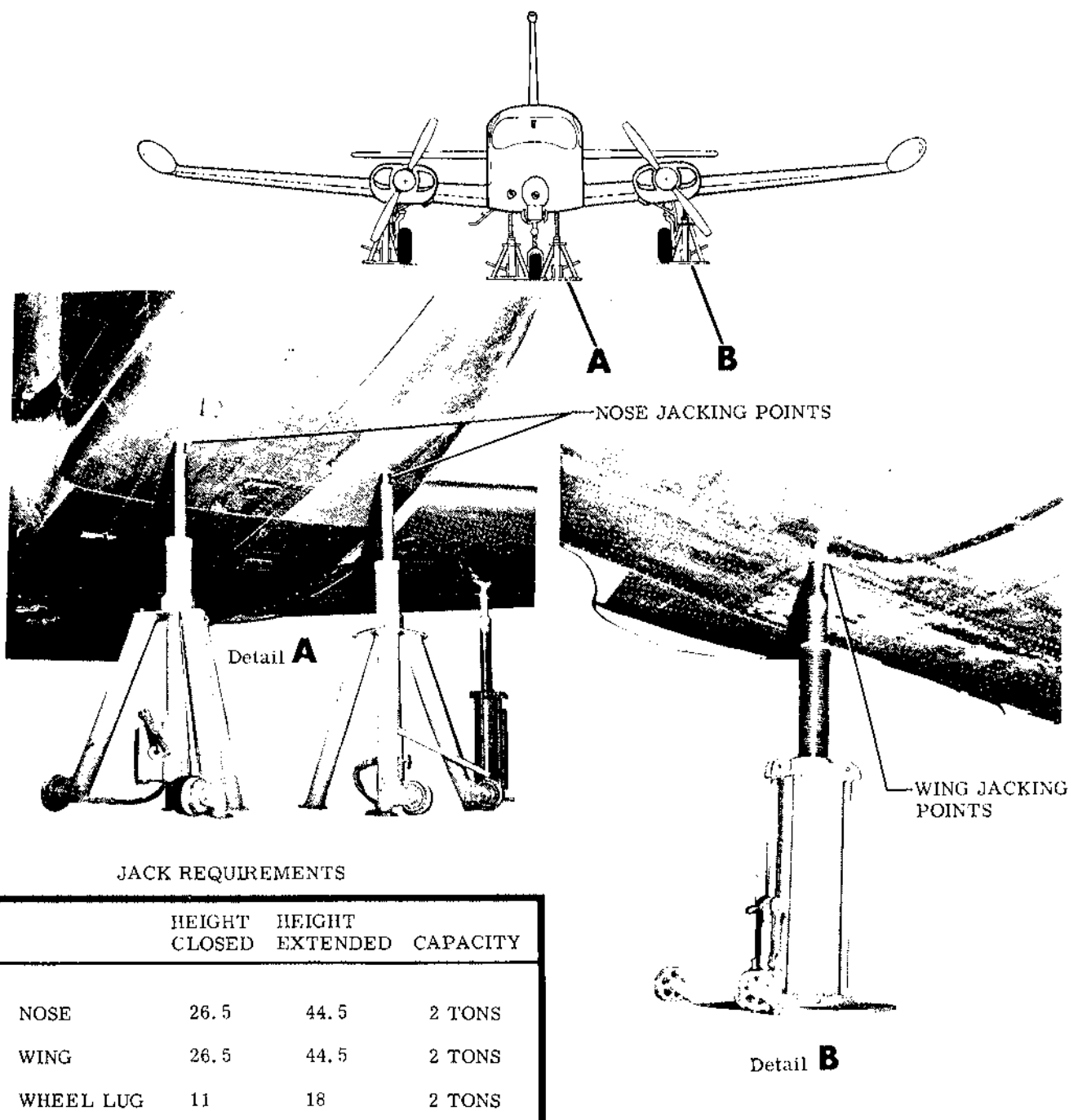


Figure 2-3. Jacking

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

- a. Taxi forward a few feet and apply brakes to determine their effectiveness.
- b. While taxiing, make slight turns to determine the effectiveness of the nose gear steering.
- c. Minimum turning distance must be strictly observed when taxiing the aircraft close to buildings or other stationary objects.
- d. 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 Turning Radius. (See figure 2-1.)

Parking.

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

CAUTION

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

- b. 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. (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 fore and aft for rigging purposes.

NOTE

Rig gust control lock so that both rudder pedals must be pushed forward a minimum of .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.
- 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.

Four jack points, two on underside of the fuselage just aft of the nose wheel well, and one on the lower surface of each wing just aft of the main gear attach points, are provided on the aircraft. One jacking point is provided on each main gear for wheel removal and maintenance. See figure 2-3 for jacking procedures.

NOTE

Special two-ton tripod jacks, ideally suited to the 310, can be supplied by Cessna Service Parts Department. Four jacks are required to raise the aircraft.

Hoisting.

The 310 may be lifted by four hoisting lugs and a sling. These may be fabricated from any suitable material capable of sustaining a 5500 pound load. Each lug may be attached to the upper bolt which secures the front wing spar to the fuselage spar, and the upper bolt at the rear wing spar attaching point. Access to the wing spar bolts is gained by removing the wing fillet between the fuselage and each wing. Each lug may be temporarily attached to the upper bolt on each wing for hoisting purposes only. The forward spar bolts are located directly in line with the aircraft center of gravity, so the sling should be positioned accordingly. Position a man at both the nose gear and the tail cone section of the aircraft to assure that it stays level while hoisting.

NOTE

After removing lugs, torque front spar nuts to 60 ± 5 foot-pounds, and rear spar nuts to 175 ± 15 inch-pounds.

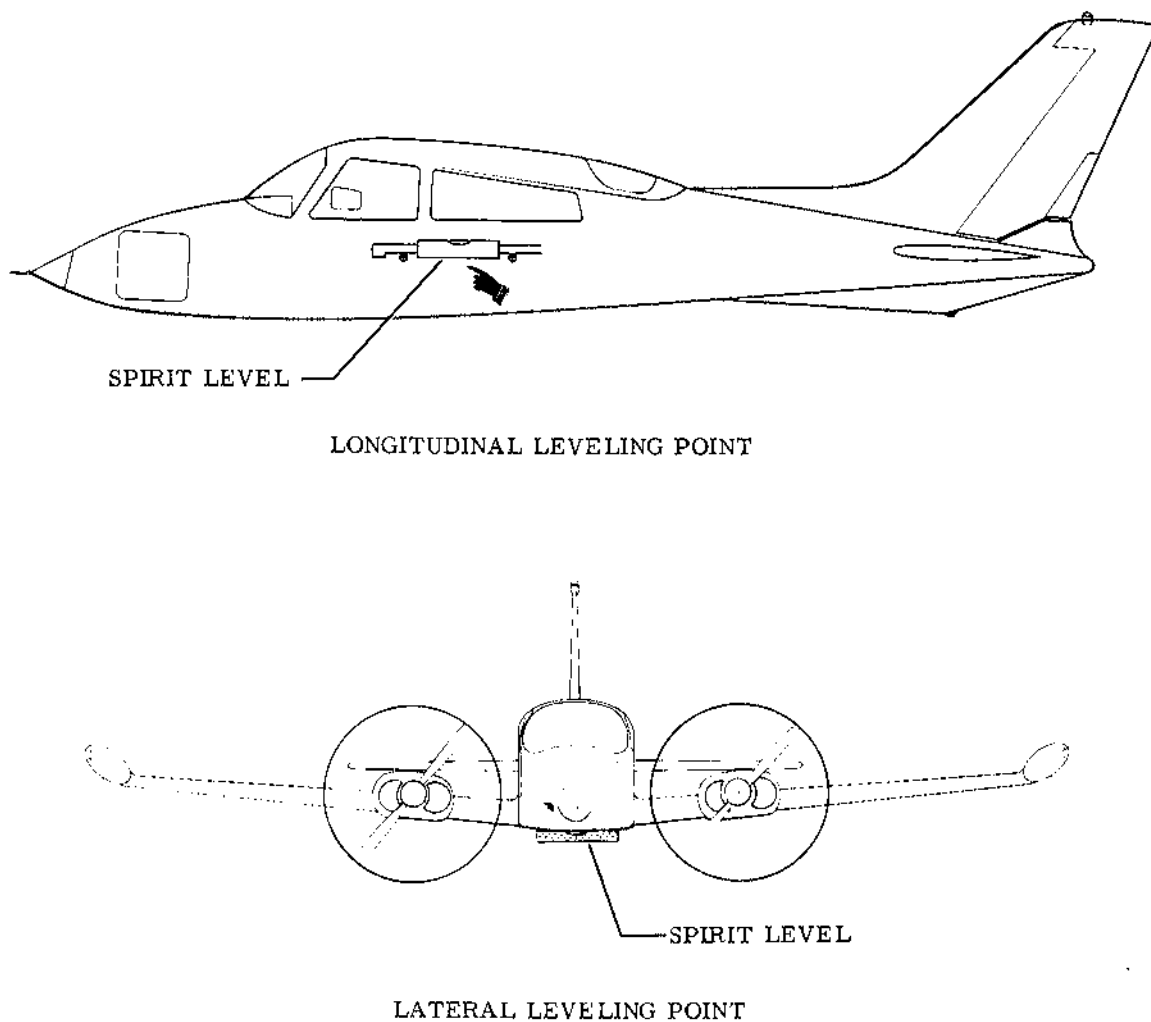


Figure 2-4. Leveling

Leveling. (See figure 2-4.)

To level the aircraft longitudinally and laterally, use the four jacking points provided on the aircraft. Level longitudinally by backing out the two screws at "Level Point" on the left-hand outside fuselage at Stations 89.25 and 58.75, water line -14.05, and placing a spirit level on these screws. To level

laterally, place a spirit level centered on the outside skin along the rear spar, on the under side of the fuselage.

Weighing and Measuring.

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

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, Petroprotect 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 equiv-

alent) 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, re-spray 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 indefinite storage, the aircraft should require the following service.

a. Airframe:

1. Remove all covers from vents and air inlets.
2. Clean aircraft if required.
3. Lubricate the aircraft.
4. Check the brake cylinders, struts and shimmy dampener.

5. Drain a small amount of fuel from all fuel lines and check for water sediment.

6. Check fuel selector valve for evidence of leakage. ■

b. Battery:

1. Check battery, charge if necessary.
2. Install battery.

c. Engines:

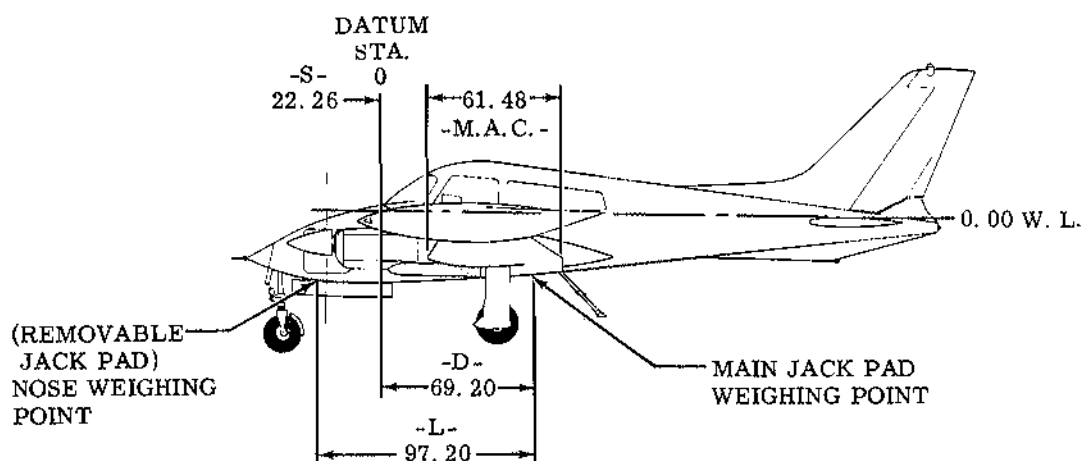
1. Remove all vents and opening covers installed.
2. Remove oil sump drain plugs.
3. Remove plugs from spark plug holes in all cylinders. Rotate engines by hand to remove corrosion preventive oil from cylinders.

CAUTION

Ignition switches must be in the OFF position when rotating the propellers by hand.

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

WEIGHING ON JACK POINTS



REMOVABLE JACK PAD MUST BE LOCATED IN EXTREME FORWARD POSITION WHEN WEIGHING AIRCRAFT.

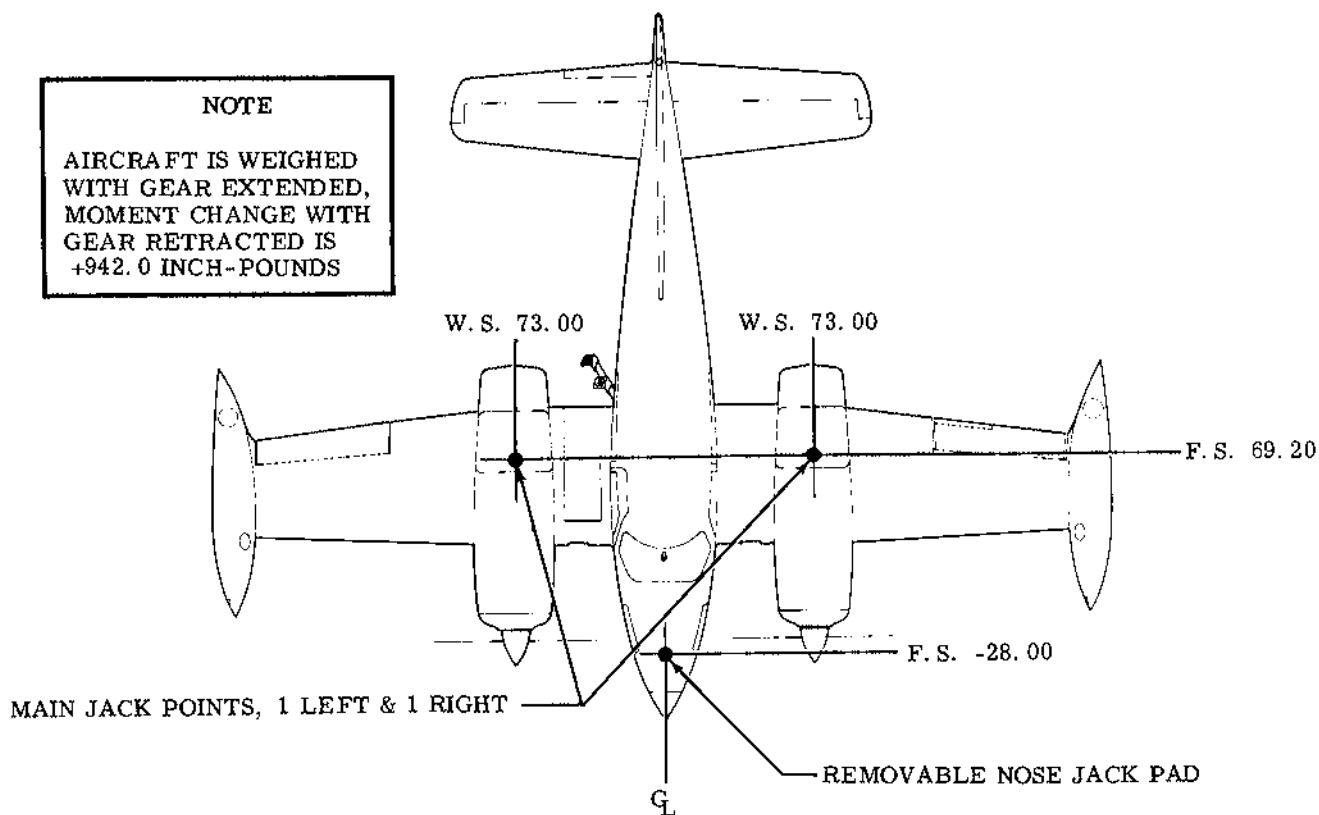
HORIZONTAL CG

$$CG = 69.20 - \frac{W_n (97.20)}{W}$$

$$\%M.A.C. = CG - \frac{22.26}{61.48} (100)$$

NOTE

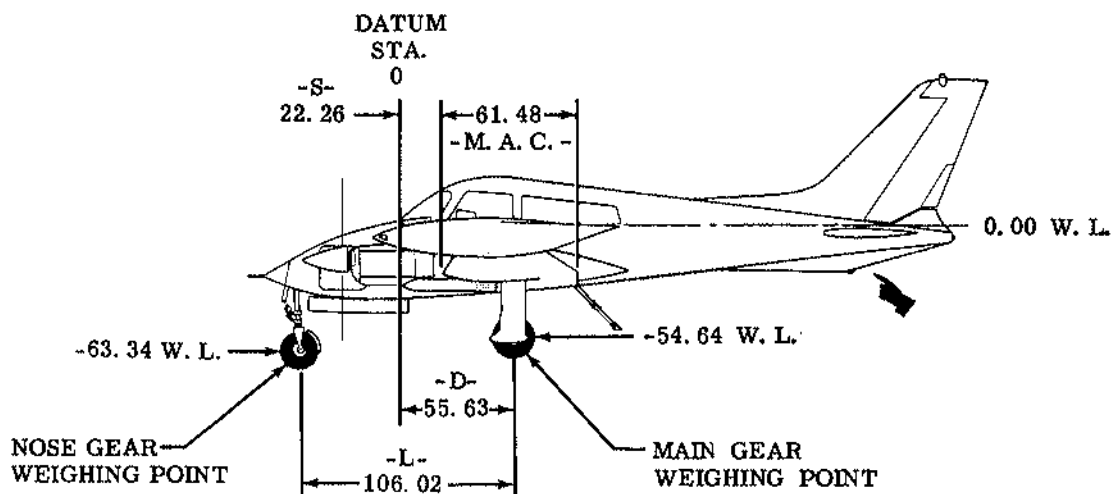
AIRCRAFT IS WEIGHED WITH GEAR EXTENDED, MOMENT CHANGE WITH GEAR RETRACTED IS +942.0 INCH-POUNDS



310P0001 AND ON

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

WEIGHING ON LANDING GEAR



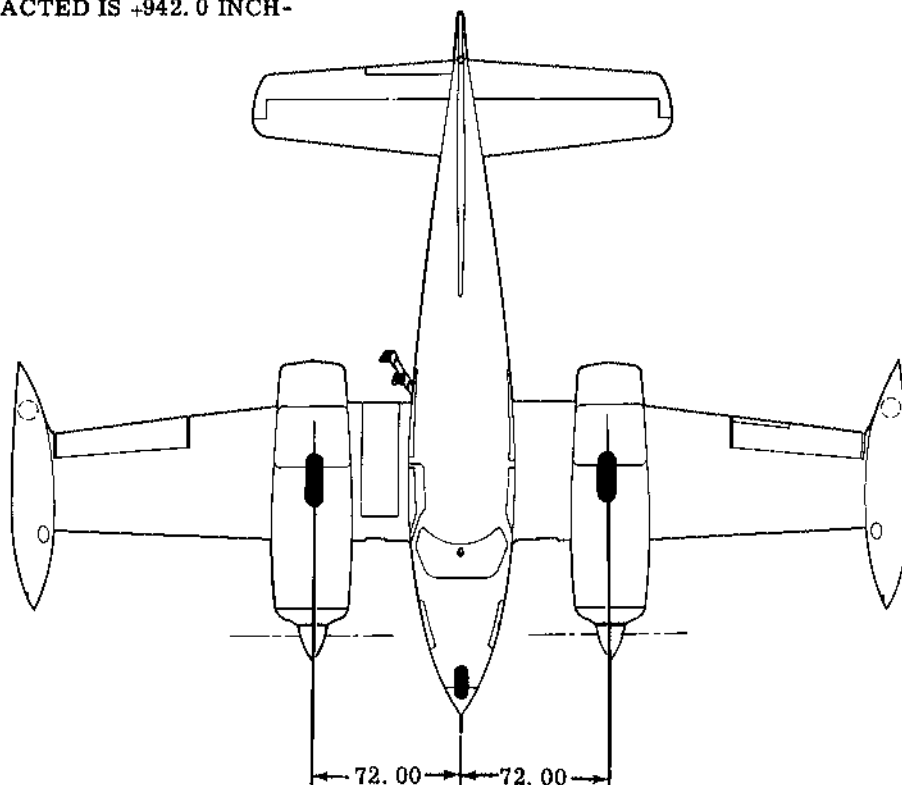
HORIZONTAL CG

$$CG = 55.63 - \frac{W_n (106.02)}{W}$$

$$\%M.A. C. = CG - \frac{22.26}{61.48} (100)$$

NOTE

AIRCRAFT IS WEIGHED WITH GEAR
EXTENDED, MOMENT CHANGE WITH
GEAR RETRACTED IS +942.0 INCH-
POUNDS



310P0001 AND ON

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

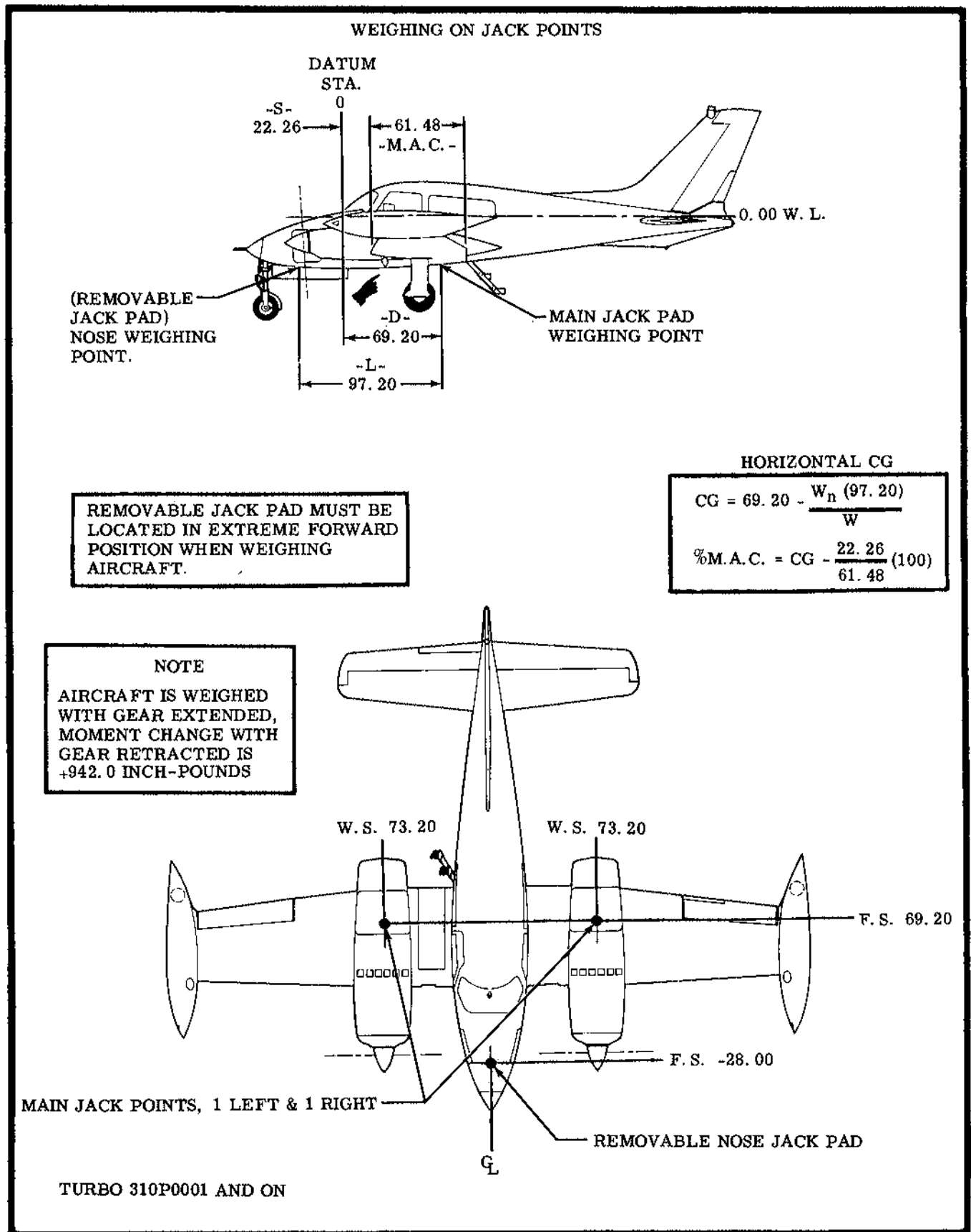
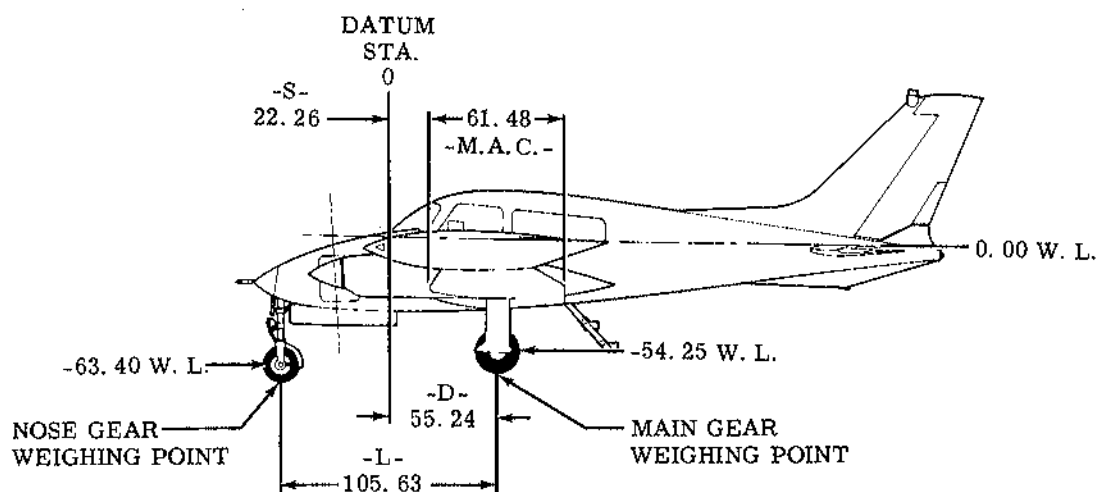


Figure 2-5. Weighing and Measuring (Sheet 3)

WEIGHING ON LANDING GEAR



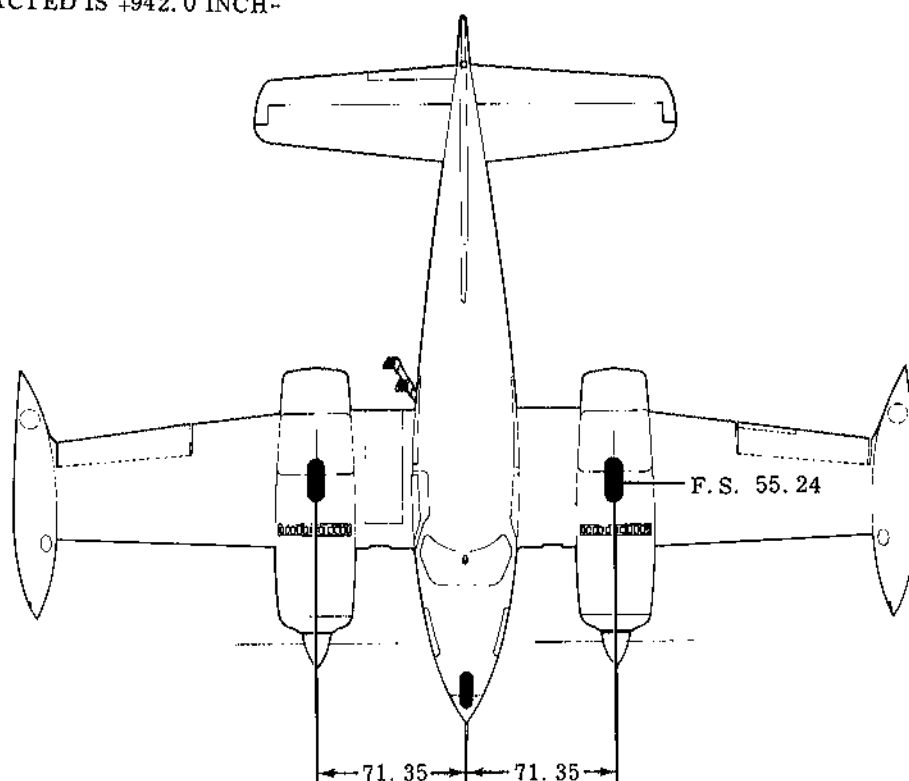
NOTE

AIRCRAFT IS WEIGHED WITH GEAR EXTENDED, MOMENT CHANGE WITH GEAR RETRACTED IS +942.0 INCH-POUNDS

HORIZONTAL CG

$$CG = 55.24 - \frac{W_n (105.63)}{W}$$

$$\%M.A.C. = CG - \frac{22.26}{61.48} (100)$$



TURBO 310P0001 AND ON

Figure 2-5. Weighing and Measuring (Sheet 4)

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 gear or main jack pad weighing points.	W_n	The weight at the nose weighing point.
L	The horizontal distance from the main gear 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.

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

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

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.)

NOTE

Aircraft is weighed with gear extended, moment change with gear retracted is +942.

- 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 5)

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.
 - 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

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.

where corrosion was removed in accordance with manufacturer's instructions.

Finish and Trim.

A finish and trim plate is installed in the nose wheel web. The plate contains finish and trim information for the aircraft. The aircraft and interior parts are painted various colors as coded on the finish trim plate. All paints used on this model aircraft are listed, by finish and trim code on the respective paint color chart, except heat resistant paint and landing gear paint. To read the plate, convert the number codes stamped on the plate to the detailed description given in the Paint Color Chart. To insure matching colors when ordering paint, it is necessary to provide the proper information from the finish and trim plate. Paint must be ordered through the Cessna Dealers' Organization. Use Parts and Accessories Order Form Number P312-12 supplied by Cessna on request.

NOTE

- Since "CODE" numbering or lettering changes with aircraft model changes, it is important that the respective aircraft Model and Serial Number Chart be observed when ordering paint.
- When ordering paint specify CES1054 (3 Digit Dash No.) or CES2800 (4 Digit Dash No.), add letter "P" (for pint), "Q" (for quart), "G" (for gallon) or "S" (for spray can) to the Dash No. Example: CES1054-170G or CES2800-2113G = 1 Gallon of Vestal White.

Primer - Mixture and Application.

NOTE

Mix EX2016G primer only in quantities required for use within six hours and then only in stainless steel bucket provided.

- a. Mix equal parts of EX2016G primer and T6070 diluent and stir thoroughly.
- b. Apply EX2016G primer in a well broken up, wet, even coat. If primer has to be sanded, sand and re-prime. Sanding breaks film, resulting in poor adhesion.

NOTE

On all leading edge surfaces, apply cross coat, wet and even, of EX2016G primer.

- c. Clean equipment immediately after use and under no consideration use EX2016G primer that has been mixed longer than six hours.

Polycarbonate Primer - Mixture and Application.

- a. Surfaces to receive primer shall be solvent

washed with isopropyl alcohol.

b. Primer shall be Lacco 600 SL9953, white - Red Spot Paint and Varnish Company or RV3649, white, Duralac Chemical Corporation. This primer shall be reduced to spray viscosity by thinning with Red Spot SL8381 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 to an approximate cured film thickness of 0.0003 to 0.0004 inch.

d. The sprayed coating shall be allowed to dry a minimum of one hour prior to overcoating.

Epoxy Primer.

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

P-900 Sky spar Surfaces	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 starts to gel, it must be discarded.

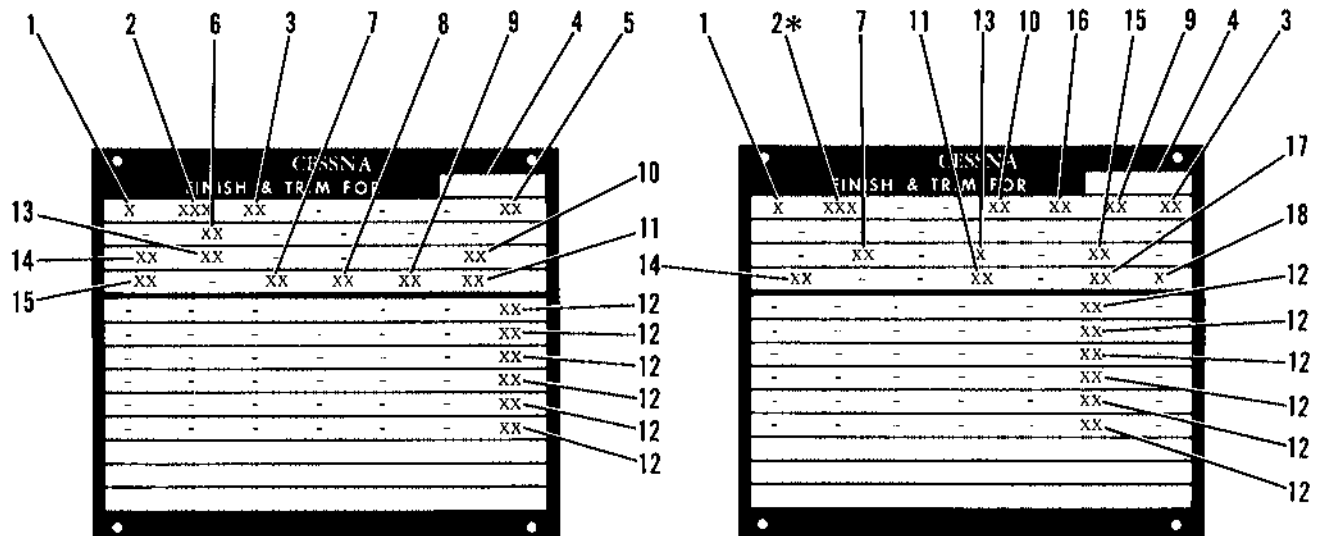
Materials, Description and Mixing Instructions.

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.



310P0001 TO 310Q0001

310Q0001 TO 310Q0201

These diagrams show the sequence and location of the code symbol on the Finish and Trim Plate for exterior and interior paint.

* In the exterior color callout the letter "P" or "V" distinguishes between Polyurethane and Vinyl paint. Example: Pxxx = Polyurethane, Vxxx = Vinyl paint. (See Paint and Color Chart.)

14146001

1. Model Year	10. Heat and Vent Grill, Seat Belt Bracket and Fire Extinguisher Bracket	17. Stationary Shock and Radio Panels and Glove Box Door
2. Exterior Color	11. Standard Interior Paint and Material	18. Circuit Breaker Panel - Silk Screen
3. Control Wheel	12. Exposed Parts - All Seats	19. Escutcheon Individual Lights
4. Aircraft Serial Number	13. Wemac	20. Exposed Parts All Seats - Seat, Seat Track and Armrest Bottom
5. Trim - Circuit Breaker Panel	14. Circuit Breaker Panel	21. Track, Voltage Regulator Cover, Seat Belt Retainer Cover
6. Wire Tunnel	15. Exposed Parts - Baggage and Cabin Door	
7. Cabin Exhaust Vent	16. Seat Track and Armrest Bottom	
8. Track		
9. Seat Support Structure, Emergency Crank Storage Bracket		

Figure 2-6. Finish and Trim Plate (Sheet 1 of 2)

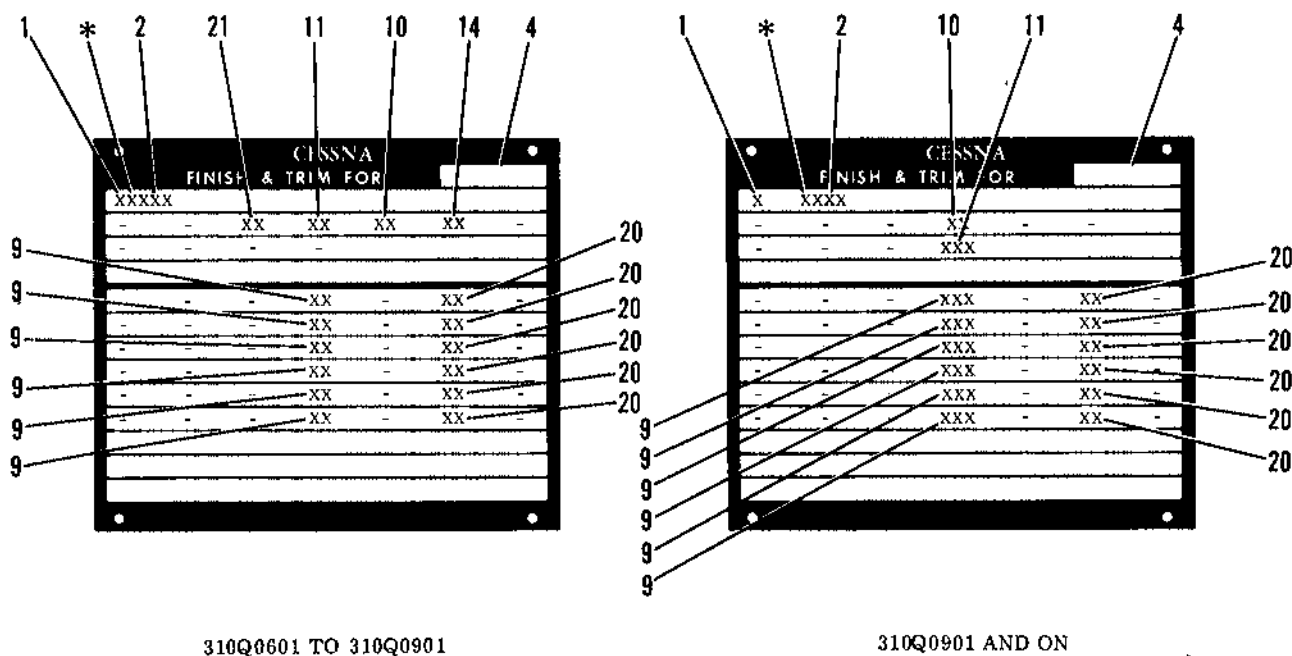
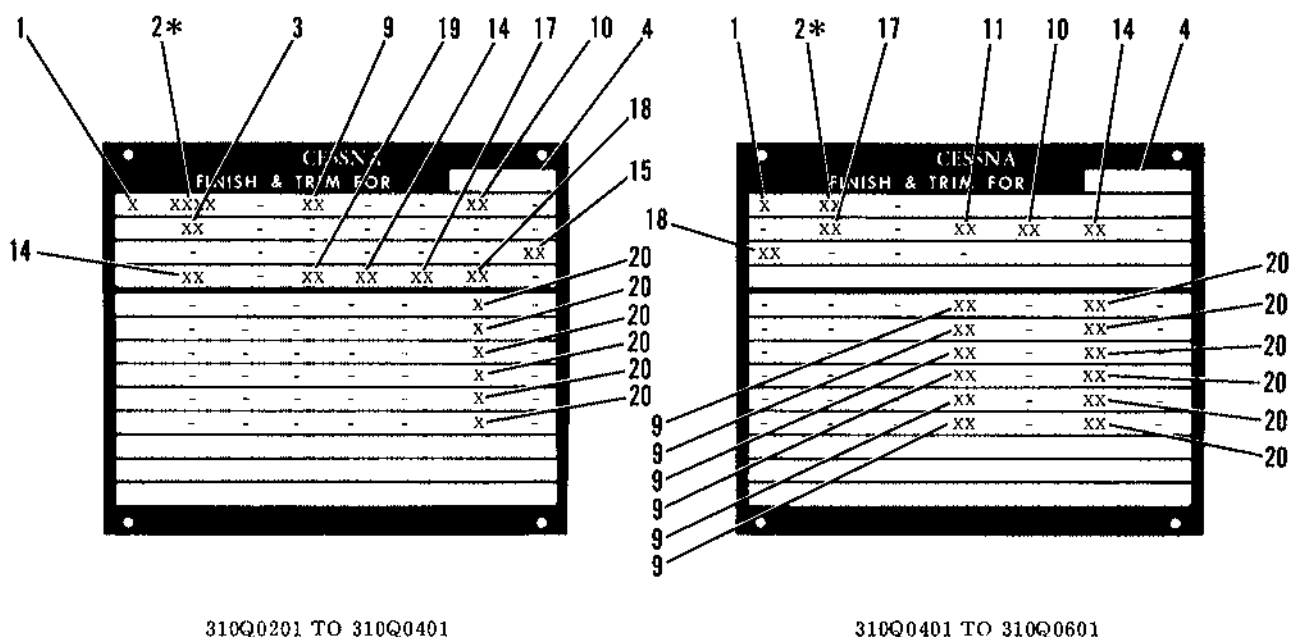


Figure 2-6. Finish and Trim Plate (Sheet 2 of 2)

1969 MODEL 310P0001 TO 310Q0001							
PAINT COLOR CHART							
Finish & Trim Code	EXTERIOR PAINT COLOR	CES 1054	CES 2800	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
A	VESTAL WHITE	-170			EPOXY PAINT		
B	TROPICAL ORANGE	-819		56	SPLENDOR RED	-739	
C	TANGIER BEIGE	-926		57	CLOUD GRAY	-534	
D	SUN YELLOW	-924		58	VELVET BLACK	-308	
E	POLARIS BLUE	-920		59	CANYON TAN	-741	
F	CHAMBRAY GREEN	-941		60	DRAGON RED	-910	
G	BARCELONA BRONZE	-817		61	VELDT GOLD	-912	
H	GOLDENROD	-183		62	ROYAL BLUE	-911	
J	VALOR RED	-417		63	GOLD	-810	
K	BOMBAY BRONZE	-925			LACQUER PAINT		
L	EMPEROR BLUE	-821		64	SPLENDOR RED	-718	
M	PINEHURST GREEN	-728		65	CLOUD GRAY	-531	
N	IMPERIAL BURGUNDY	-818		66	VELVET BLACK	-151	
P	CRANBERRY	-880		67	CANYON TAN	-717	
	EXTERIOR MARKINGS			68	DRAGON RED	-904	
	IMPERIAL GRAY	-754		69	VELDT GOLD	-908	
	WHITE	-262		70	ROYAL BLUE	-906	
	GRAY	-142		71	GOLD	-800	
	BLACK	-171					
SP	SPECIAL COLORS						

INTERIOR TRIM PAINT USAGE •••••

73	CLOUD GRAY LACQUER USED ON: NACELLE BAGGAGE DOOR FRAME EXPOSED PART & INSIDE SURFACE	-857			VELVET BLACK COAT- ING USED ON: DECK SKIN & PANES	-882	
	BLACK SEMI-GLOSS USED ON: BRAKE LINKS & MASTER CYLINDER RUDDER PEDALS CONTROL COLUMN PARKING BRAKE BRACKET QUADRANT-VISIBLE PARTS ON INSIDE	-156			DULL BLACK USED ON: COMPASS DEFROST DUCTS GLOVE BOX DOOR GYRO MOUNTING BRACKETS STATIONARY INSTRUMENT PANEL PRIMARY SHOCK INSTRUMENT PANEL MIKE MOUNTING BRACKETS PEDESTAL ASSY RADIO CONTROL PANELS COMPASS CARD HOLDER & REGISTRATION NO. STATIC PRESSURE PLATE & ALTERNATE SOURCE WINDSHIELDS RETAINER HOOD ASSY - ANTI GEAR SUNVISOR CIRCUIT BREAKER PANELS	-193	
	CLOUD GRAY EPOXY USED ON: END FITTING - CURTAIN TRACK DIVIDER SPEAKER COVER	-534					
	BLACK EPOXY USED ON: QUADRANT COVER TRIM WHEEL	-308					

INTERIOR TRIM PAINT USAGE - CONT.

1969 MODEL 310P0001 TO 310Q0001							
Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
SP	DUSTY PEACH	-535					
	USED ON: BUTTONS-UPHOLSTER SNAP WING LOCKER SPECIAL COLORS						

PAINT COLOR CHART							
1970 MODEL 310Q0001 TO 310Q0201							
Finish & Trim Code	EXTERIOR PAINT COLOR	CES 1054	CES 2800	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
A	VESTAL WHITE	-170			EPOXY PAINT		
B	VELVET BLACK	-171		47	BRONZE	-737	
C	CRANBERRY	-880		48	CLOUD GRAY	-534	
D	CORK BROWN	-464		49	ONYX BLACK	-308	
E	ASCOT YELLOW	-432		50	LIGHT OLIVE	-981	
F	TROPICAL ORANGE	-819		51	MARIGOLD	-983	
G	DEEP MAHOGANY	-285		52	SUN GOLD	-979	
H	EMPRESS BLUE	-605		53	SILVER TEAL BLUE	-982	
J	ARISTO BLUE	-655					
K	PINEHURST GREEN	-728			LACQUER PAINT		
L	VALOR RED	-417		56	CLOUD GRAY	-531	
				57	GLOSS BLACK	-151	
	EXTERIOR MARKINGS			58	DULL BLACK	-193	
				59	LIGHT OLIVE	-971	
	IMPERIAL GRAY	-754		60	MARIGOLD	-973	
	PEARL WHITE	-262		61	SUN GOLD	-960	
	GRAY	-142		62	SILVER TEAL BLUE	-972	
	VELVET BLACK	-171					
SP	SPECIAL COLORS						

INTERIOR TRIM PAINT USAGE •••••

63	BLACK SEMI-GLOSS LACQUER - USED ON BRAKE LINKS & MASTER CYLINDER CONTROL COLUMN PARKING BRAKE BRACKET QUADRANT - VISIBLE PARTS ON INSIDE RUDDER PEDALS	-156			LIGHT COVER PRIMARY SHOCK INSTRU- MENT PANEL STATIONARY INSTRUMENT PANEL PEDESTAL - FRONT & SIDE COVERS CABIN DOOR LATCH HANDLE COVER		
	DULL BLACK LACQUER USED ON: COMPASS DEFROST DUCTS HOOD ASSY - ANTIGLARE PEDESTAL ASSY COMPASS CARD HOLDER & REGISTRATION NO. STATIC PRESSURE PLATE & ALTERNATE SOURCE SUNVISOR WINDSHIELD RETAINERS	-193			DULL WHITE USED ON: ELEVATOR TRIM TAB INDICATOR MARKER	-294	
	DULL BLACK LACQUER USED ON: ENGINE CONTROL COVER FUEL SELECTOR VALVE COVER FUEL SELECTOR VALVE	-279			ONYX BLACK - EPOXY USED ON: QUADRANT COVER & TRIM WHEEL	-308	
					CLOUD GRAY - PLASTIC USED ON: CONSOLE INSTRUMENT LIGHT	-532	
					CLOUD GRAY - EPOXY USED ON: END FITTING - CURTAIN TRACK DIVIDER	-534	

INTERIOR TRIM PAINT USAGE - CONT.

1970 MODEL 310Q0001 TO 310Q0201							
Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
	DUSTY PEACH LACQUER USED ON: BUTTONS - UPHOLSTERY SNAP - WING LOCKER	-535		SP	SPECIAL COLORS CADET GRAY USED ON: INSTRUMENT PANELS WHEN GRAY INSTRU- MENTS ARE INSTALLED		-2106
	CLOUD GRAY LACQUER USED ON: BAGGAGE DOOR - FRAME BAGGAGE DOOR - EXPOSED PARTS ONLY & INSIDE SURFACE NACELLE - EXPOSED PARTS ONLY & INSIDE SURFACE	-857					
	BLACK-SUEDE COATING USED ON: DECK SKINS & PANELS	-882					

1971 MODEL 310Q0201 TO 310Q0401 PAINT COLOR CHART							
Finish & Trim Code	EXTERIOR PAINT COLOR	CES 1054	CES 2800	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
A	VESTAL WHITE	170	2113		EPOXY PAINT		
B	VALOR RED	417	2123	43	CLOUD GRAY	534	
C				44	VELVET BLACK	308	
D	CORK BROWN	464	2116	45	CHAMPAGNE		2127
E	ASCOT YELLOW	432	2117	46	PLATINUM		2128
F	TROPICAL ORANGE	819	2118				
G					LACQUER PAINT		
H	EMPRESS BLUE	605	2120	48	CLOUD GRAY	531	
J	ARISTO BLUE	655	2121	49	VELVET BLACK	151	
K	PINEHURST GREEN	728	2122	50	DULL BLACK	193	
L	CRANBERRY	880	2115	51	CHAMPAGNE		2125
M	DEEP MAHOGANY	285	2119	52	PLATINUM		2126
N	VELVET BLACK	171	2114	53	CADET GRAY		2106

INTERIOR TRIM PAINT USAGE • • • • •

54	BLACK SEMI-GLOSS LACQUER - USED ON: BRAKE LINKS MASTER CYLINDER CONTROL COLUMN PARKING BRAKE BRACKET QUADRANT - VISIBLE PARTS ON INSIDE RUDDER PEDALS	156			CLOUD GRAY - EPOXY USED ON: END FITTING - CURTAIN TRACK DIVIDER	534	
	DULL BLACK LACQUER USED ON: COMPASS DEFROST DUCTS PEDESTAL ASSY COMPASS CARD HOLDER & REGISTRATION NO STATIC PRESSURE PLATE - ALTERNATE SOURCE SUNVISOR WINDSHIELD RETAINER	193			DUSTY PEACH LACQUER USED ON: BUTTONS - UPHOLSTERY SNAPS - WING LOCKER	535	
	ONYX BLACK - EPOXY USED ON: QUADRANT COVER TRIM WHEEL	308		SP	CLOUD GRAY LACQUER USED ON: NACELLE BAGGAGE DOOR FRAME - EXPOSED PARTS ONLY NACELLE BAGGAGE DOOR - INSIDE SURFACE	857	
					BLACK - SUEDE COATING USED ON: DECK SKINS & PANELS	882	
					SPECIAL COLORS		
					CADET GRAY USED ON: INSTRUMENT PANELS WHEN GRAY INSTRU- MENTS ARE INSTALLED		2106

PAINT COLOR CHART

1972 MODEL 310Q0401 TO 310Q0601

Finish & Trim Code	EXTERIOR PAINT COLOR	CES 1054	CES 2800	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
A	VESTAL WHITE	-170	-2113	43	EPOXY PAINT		
B	OLIVE		-2147	44	AVOCADO GREEN		-2162
	OLIVE		-2163	45	CARMEN RED		-2159
C	SUN GLOW RED	-492	-2137	46	MUSTARD GOLD		-2160
D	EMPRESS BLUE	-605	-2120	47	MARINA BLUE		-2158
E	ASCOT YELLOW	-432	-2117	48	VELVET BLACK	-308	
F	GOLDEN OCHRE	-452	-2164	49	BEIGE		-2161
G	CORK BLOWN	-464	-2116		CLOUD GRAY	-534	
H	TROPICAL ORANGE	-819	-2118				
J	DEEP MAHOGANY	-285	-2119	50	LACQUER PAINT		
K	VELVET BLACK	-171	-2114	51	AVOCADO GREEN		-2157
L	CRANBERRY	-880	-2115	52	CARMEN RED		-2154
M	ARISTO BLUE	-655	-2121	53	MUSTARD GOLD		-2155
				54	MARINA BLUE		-2153
	EXTERIOR PROTECTIVE PAINT			55	VELVET BLACK	-151	
	GRAY	-142		56	BEIGE		-2156
SP	SPECIAL COLORS			57	CLOUD GRAY	-531	
				58	DULL BLACK	-193	
					CADET GREY		-2106

INTERIOR TRIM PAINT USAGE

42	BLACK SEMI-GLOSS LACQUER USED ON: BRAKE LINKS MASTER CYLINDER CONTROL COLUMN PARKING BRAKE BKT QUADRANT - VISIBLE PARTS ON INSIDE RUDDER PEDALS	-156			CABIN AND BAGGAGE DOOR - EXPOSED PARTS ESCUTCHEON - INDIVIDUAL LIGHTS		
	DULL BLACK LACQUER USED ON: DEFROST DUCTS PEDESTAL ASSY STATIC PRESS PLATE - ALTERNATE SOURCE WINDSHIELD RETAINERS	-193			DUSTY PEACH LACQUER USED ON: BUTTONS - UPHOLSTERY SNAPS - WING LOCKER	-535	
	VELVET BLACK EPOXY USED ON: QUADRANT COVER TRIM WHEEL	-308			CLOUD GRAY ACRYLIC USED ON: NACELLE BAGGAGE DOOR FRAME - EXPOSED PARTS ONLY & INSIDE SURFACE	-857	
	CLOUD GRAY EPOXY USED ON: END FITTING - CURTAIN TRACK DIVIDER SUNVISOR - EXPOSED PARTS	-534			BLACK - SUEDE COATING USED ON: DECK SKIN & PANELS COMPASS & COMPASS PEDESTAL	-882	

PAINT COLOR CHART							
1973 MODEL 310Q0601 TO 310Q0901							
Finish & Trim Code	EXTERIOR PAINT COLOR	Vinyl	Poly- ure- thane	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
A	VESTAL WHITE	-170	-2113		EPOXY PAINT		
B	GOLDEN OCHRE	-452	-2173	55	AVOCADO GREEN		-2162
C	LAGOON BLUE	-584	-2193	56	CARMEN RED		-2159
D	SUNGLOW RED	-492	-2174	57	MUSTARD GOLD		-2160
E	TROPICAL ORANGE	-819	-2118	58	MARINA BLUE		-2158
F	PALM GREEN	-2196	-2190	59	BEIGE		-2161
G	OLIVE	-2147	-2172	60	VELVET BLACK	-308	
H	ITALIAN GOLD	-517	-2194				
J	ADMIRAL BLUE	-457	-2192		LACQUER PAINT		
K	VELVET BLACK	-171	-2114	61	AVOCADO GREEN		-2157
L	BOMBAY BRONZE	-925	-2191	62	CARMEN RED		-2154
M	GROVE GREEN	-2195	-2189	63	MUSTARD GOLD		-2155
				64	MARINA BLUE		-2153
	EXTERIOR PROTECTIVE PAINT			65	BEIGE		-2156
	GRAY	-142		66	VELVET BLACK	-151	
SP	SPECIAL COLORS						

INTERIOR TRIM PAINT USAGE

54	BLACK SEMI-GLOSS LACQUER - USED ON: BRAKE LINKS MASTER CYLINDER CONTROL COLUMN PARKING BRAKE BRACKET QUADRANT - VISABLE PARTS ON INSIDE RUDDER PEDALS	-156			CLOUD GRAY - EPOXY USED ON: END FITTING - CURTAIN TRACK DIVIDER SUNVISOR - EXPOSED PARTS CABIN & BAGGAGE DOOR - EXPOSED PARTS	-534	
	DULL BLACK - LACQUER USED ON: DEFROST DUCTS COMPASS COMPASS PEDESTAL PEDESTAL ASSY STATIC PRESSURE PLATE - ALT SOURCE WINDSHIELD RETAINERS	-193			DUSTY PEACH - LACQUER USED ON: BUTTONS - UPHOLSTERY SNAP - WING LOCKER	-535	
	ONYX BLACK - EPOXY USED ON: QUADRANT COVER TRIM WHEEL	-308			CLOUD GRAY - LACQUER USED ON: NACELLE BAGGAGE DOOR FRAME - EXPOSED PARTS ONLY NACELLE BAGGAGE DOOR - INSIDE SURFACE	-857	
					BLACK - SUEDE COATING USED ON: DECK SKIN & PANEL	-882	
					CADET GRAY - LACQUER USED ON: INSTRUMENT PANEL CIRCUIT BREAKER PANEL SILKSCREEN		-2106

PAINT COLOR CHART

1974 MODEL 310Q0901 AND ON

Finish & Trim Code	EXTERIOR PAINT COLOR	Vinyl	Poly- ure- thane	Finish & Trim Code	INTERIOR PAINT COLOR	CES 1054	CES 2800
A	VESTAL WHITE	-170	-2113		EPOXY PAINT		
B	VIVID ORANGE	-2244	-2243	89	PALM GREEN		-2233
C	FESTIVAL YELLOW	-2270	-2269	90	CORAL RED		-2232
D	SHADOW BLUE	-2263	-2262	91	TOPAZ GOLD		-2234
E	LIME	-2250	-2249	92	ROYAL BLUE		-2231
F	GRAY	-2266	-2265	93	BEIGE		-2161
G	REBEL RED	-2241	-2240	94	ONYX BLACK	-308	
H	BEIGE	-2257	-2256	95	CLOUD GRAY	-534	
J	BOMBAY BRONZE	-925	-2191				
K	INCA GOLD	-2247	-2246				
L	AWARD BLUE	-2260	-2259		LACQUER PAINT		
M	HUNTER GREEN	-611	-2252	98	PALM GREEN		-2229
N	VELVET BLACK	-171	-2114	99	CORAL RED		-2228
P	EXECUTIVE BROWN	-2254	-2253	100	TOPAZ GOLD		-2230
				101	ROYAL BLUE		-2227
				102	BEIGE		-2156
				103	VELVET BLACK	-151	
	EXTERIOR PROTECTIVE PAINT GRAY	-142					
SP	SPECIAL COLORS						

INTERIOR TRIM PAINT USAGE

116	BLACK SEMI-GLOSS LACQUER - USED ON: BRAKE LINKS MASTER CYLINDER CONTROL COLUMN PRAKING BRAKE BRACKET - QUADRANT - VISABLE PARTS ON INSIDE RUDER PEDEALS	-156		SUNVISOR - EXPOSED PARTS CABIN AND BAGGAGE DOOR - EXPOSED PARTS		
	DULL BLACK - LACQUER USED ON: DEFROST DUCTS COMPASS COMPASS PEDESTAL STATIC PRESSURE PLATE - ALT SOURCE WINDSHIELD RETAINERS REAR VIEW MIRROR BRACKET	-193		DUSTY PEACH - LACQUER USED ON: BUTTONS - UPHOLSTERY SNAP - WING LOCKER	-535	
	ONYX BLACK - EPOXY USED ON: QUADRANT COVER TRIM WHEEL	-308		CLOUD GRAY - ACRYLIC LACQUER USED ON: NACELLE BAGGAGE DOOR FRAME - EXPOSED PARTS ONLY NACELLE BAGGAGE DOOR - INSIDE SURFACE	-857	
	CLOUD GRAY- EPOXY USED ON: END FITTING - CURTAIN TRACK DIVIDER	-534		BLACK SUEDE COATING USED ON: DECK SKIN AND PANEL	-882	
				CADET GRAY - LACQUER USED ON: INSTRUMENT PANEL CIRCUIT BREAKER PNL SILKSCREEN CIRCUIT BREAKER PNL AND PLUG BUTTONS		-2106

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.

g. If the material is to be sprayed, take a portion of the mixed material, thin it further using Component III (T-262 Thinner), until a suitable spray viscosity is obtained. This material is ready for use after thinning.

h. Spray the mixture with the necessary number of coats to cover any brush marks or imperfections in the surface.

NOTE

When applying heavy spray coats, solvent entrapment may occur causing pin holes. To eliminate this, let the part stand for 5 to 10 minutes after it has been sprayed to allow solvent flash off. After 10 minutes, spray one final finish coat and dry.

The part may be force dried at 170°F for a period of 20 to 30 minutes.

Surface Preparation.

- Clean part well by wiping with Isopropyl Alcohol.
- Fill all large holes with putty.
- Using a thinned putty mixture brush material well into surface of material. Do not work back over the surface once it has been completed. Material dries quickly and brush strokes are difficult to sand out.
- Allow to air dry for a period of 2 hours or force dry at 170°F for 30 minutes.
- Sand surface smooth.
- Spray final finish using a thinned mixture and allow to dry same as step d.
- Repeat procedure as necessary to achieve desired results.
- Paint in accordance with painting procedures.

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 Primer. (Type I-M)

- 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.

- 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 Enamel Application.

- 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.
- 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.

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 gage 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.

- Apply first coat even and wet; second and third coats in same manner.
- Check carefully before second and third coats for defects and correct them before final coats.
- 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 T-1411 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 good reflow on vinyl paint.

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

Heat Resistant Enamel

The area aft of the exhaust outlet and waste-gate overboard outlet is painted with heat resistant enamel. When it becomes necessary to repaint the areas the following procedures should be followed:

- a. Mask off the area to be painted and strip off old paint using Delchem E-Z Strip 19B or equivalent then rinse with a clear water spray.
- b. Scuff sand and tack rag area to be sprayed.
- c. Spray coat Red Iron Oxide Primer (Type 1-8) to a cure film thickness of .0002 to .0005 inches to the area to be painted.

NOTE

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

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

NOTE

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

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.

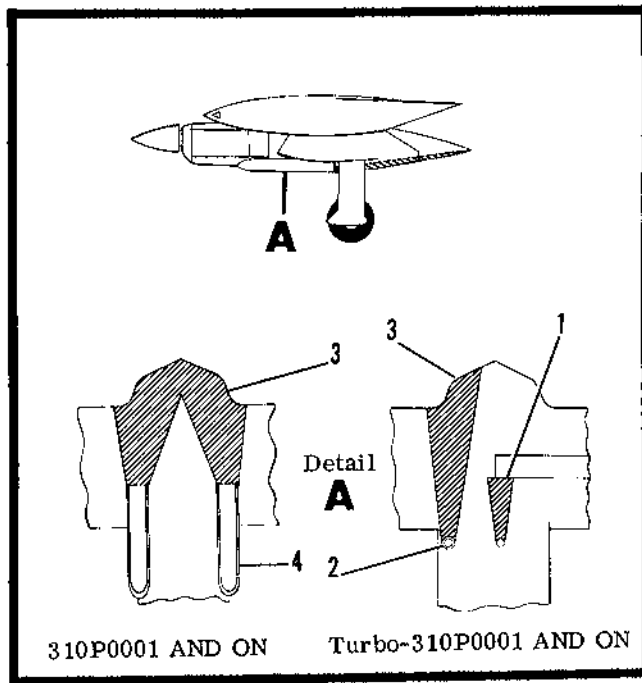
NOTE

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.



1. Waste gate overboard
2. Exhaust
3. Heat resistant enamel
4. Exhaust cover

Figure 2-6A. Heat Resistant Paint Areas

Polyurethane Finish (optional).

- a. The surfaces to receive polyurethane paint shall be sanded smooth and solvent cleaned with isopropyl alcohol.
- b. Mix wash primer in a 1:1 ratio by volume so that the viscosity is 17 seconds in #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 0.0005 to 0.0007 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-53 urethane zinc chromate primer, and then combine three parts of this mixture with two parts T-888 thinner. This mixture will have a viscosity of 17 seconds in a #2 Zahn cup, and also an induction time and a pot life of 8 hours.
- e. Apply a spray coat of the intermediate primer over the washed prime surface. Spray the AA-92, Y-53 film to a dry thickness of 0.0007 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. Pot 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.

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 310Q0901 and On, apply Epoxy White P/N 54E-511 in accordance with Epoxy Finish.

RAIN EROSION COATING APPLICATION (RADOME).

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.

- 1 - First 100 hours check torque then every 100 hours check security and for working. DO NOT TORQUE
- 2 - First 100 hours and 200 hours thereafter
- 3 - Every 50 hours or sooner when local dust conditions exist
- 4 - Every 500 hours

- 5 - Daily
- 6 - Every 3 years
- 7 - Every 2 years
- 8 - Every 50 hours and
at tire replacement
- 9 - Every 5 years

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

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

1. Windshield and Windows - Check for cracks, scratches and cleanliness
2. Cabin Door - Check for condition and operation
3. Baggage Door - Check for condition and operation
4. Wing Locker Door - Check for condition and operation
5. Seats and Seat Belts - Check for condition and security
6. Upholstery and carpet - Clean
7. Wing - Check for loose rivets, cracks, loose mounting bolts and security (Ref. ME73-22)
8. Wing Wheel Well - Check root rib and wheel well for fume proofing
9. Wing Spar Fittings - Check bolts for torque and security
10. Empennage
11. Vertical and Horizontal Stabilizers - Check bolts for security
12. Fuselage
13. Exterior and Interior Surfaces - Check paint, damaged skin
14. Nose Ram Air - Check clamps and hose to heat and vent system for security
15. Heater - Check
16. Instruments - Check markings and condition
17. Control Quadrant - Check for condition and security
18. Placards and Decals - Check for presence and legibility
19. Nacelle Firewall - Check for condition and security (Refer to expanded paragraph)

1. Main Landing Gear Actuator - Check for condition, security and proper operating times (Refer to expanded paragraph)
2. Emergency Manual 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 2-8A.
5. Torque Links - Check wear and condition
6. Nose and Main Gear Retracting Linkage - Check for condition
7. Shock Strut Servicing - Check for proper servicing
8. Nose Gear Shimmy Damper - Check fluid and condition
9. Nose Wheel Steering System - Check cable tension, travel and gimbal bolts for condition and torque

Spl Insp	200	100	50
	★ ★ ★ ★ ★	★ ★	
1	★ ★ ★ ★ ★ ★ ★ ★ ★	★	★
	★ ★ ★ ★ ★		★ ★ ★

Change 7

		50	100	200	Spl Insp
LANDING GEAR (CONT.)					
10.	Nose and Main Wheel and Tires - Check wear, pressure and condition				8
11.	Wheel Bearings - Check and repack				2
12.	Brake System Plumbing - Check for leaks, hoses for bulges and deterioration, parking brake for operation			★	
13.	Brake Assemblies - Check wear of lining and disc warpage			★	
14.	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, pulleys, and bolt for condition, operation and security, and travel			★	
3.	Aileron Trim Tab - Check hinge for cracks, wear, bolt 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 security and tension, fraying and turnbuckles for safety			★	
6.	Elevator - Check hinges and hinge bolts, bellcranks and push rod connecting bolt, pulleys 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 security and tension, fraying and turnbuckles for safety			★	
10.	Electric Elevator Trim - Check for security, condition and travel			★	
11.	Rudder - Check hinge, bellcrank, stop bolts and jamb nut for looseness, torque tube, pulleys, 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, security, fraying and turnbuckles for safety			★	
15.	Flaps - Check linkage, bellcranks, pulleys and cables for condition, tension and security			★	
16.	Flap Motor and Position Indicator - Check for travel, condition and security			★	
17.	Flap Actuator Assembly - Check for condition, security, and proper operating times (Refer to expanded paragraph)			★	
18.	Autopilot (Optional Equipment) - Check cables, attachments, pulleys and turnbuckles for tension, condition, operation and security			★	
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				
4.	Induction Manifold - Check connections for condition		★		
5.	Engine Oil Pressure System - Check for leaks, bends, cracks and security		★		
					3

Figure 2-7. Inspection Chart (Sheet 2)

ENGINE GROUP (CONT.)			50	100	200	Spl Insp
6.	Engine Oil - Change (See Service Chart)	310 Turbo 310	★	★		3
7.	Oil Filter - Replace and inspect adapters (Refer to expanded paragraph)		★			
8.	Engine Oil Breather Separator - Clean					
9.	Engine Compartment - Visually check for condition, oil leaks, fuel leaks, etc.			★		4
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 for deterioration, leaks, discoloration, bleaching and rubber hoses for stiffness		★			
14.	Cylinder Compression - Refer to manufacturers operators manual.			★		
15.	Engine Cylinders, Rocker Box Covers and Push-Rod 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			★		
20.	Alternator - Check brushes, leads, bearings and slip rings					
21.	Alternator - Check belt tension, cooling fan for cracks, mounting bolts for safety, security and cleanliness and electrical connectors for security and cleanliness		★			
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, spring tension and perform system leak check (Refer to expanded paragraph)		★			
26.	Engine Exhaust System - Check for security, cracks, slip joint, spring tension and perform system leak check - Visually inspect slip joint seals (Refer to expanded paragraph)				★	
27.	Exhaust Couplings - Check for cracks and deformation		★			
28.	Engine Compartment Fire Extinguisher - Check system, pressure, condition and security			★		
29.	Starter - Check brushes, commutator and electric connections				★	
30.	Waste Gate Valve and Controllers - Check condition and security, visually check springs and linkage				★	
31.	Manifold Pressure Relief Valve - Visually check for obstructions, condition, security and operation				★	
PROPELLERS						
1.	Propeller Spinner - Wash, check for cracks and fractures			★		
2.	Blades - Check for nicks, cracks, scratches and blade angles			★		
3.	Propeller Cylinder - Check allen screws for security			★		
4.	Spinner Bulkhead - Check for cracks and security on crankshaft				★	
5.	Propeller - Check for oil leaks				★	
6.	Propeller Mounting - Check nuts for security			★		
7.	Deice System Electrical Leads - Check for condition and security			★		
8.	Deice System Brushes - Check for wear and seating (See Section 13)			★		
9.	Propeller Unfeathering Accumulator - Check for leaks, condition and proper charge			★		
10.	Propeller Synchronizer - Check for condition and security			★		

Figure 2-7. Inspection Chart (Sheet 3)

	50	100	200	Spl Insp
FUEL SYSTEM				
1. Metering Unit Fuel Screen - Clean		★		
2. Injection and Manifold - Inspect for leaking		★		
3. Fuel Discharge Nozzles - Inspect orifices and clean		★		
4. Fuel Selector Valve - Perform operational check, feel for detents thru 270°, check linkage, bearings, pins for condition and security		★		
5. Selector Valve - Perform an operational check in accordance with Section 11				4
6. Sediment Bowl - Drain				5
7. Fuel Strainer - Clean		★		
8. Fuel System Main - Inspect for leaks, and operation				5
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			★	
11. Boost Pumps (Auxiliary) - Inspect for leaks, operation, vent and over-board drain for obstruction			★	
12. Tip Tank Vent Lines - Inspect for obstruction and security				5
13. Auxiliary Tanks - Inspect system for leaks and security			★	
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			★	
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				6
5. Oxygen Cylinder - ICC-3AA/DOT-3AA - Inspect condition and Hydrostatic Test Date				9
VACUUM SYSTEM				
1. Filter - Clean			★	
2. Relief Valve - Check security and screen for obstruction			★	
3. Hoses - Inspect for hardness, deterioration, looseness and bulging			★	
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				7
4. Alternate Static Drain - Check			★	

Figure 2-7. Inspection Chart (Sheet 4)

	50	100	200	Spl Insp
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 condition and security			★	
ELECTRICAL SYSTEM				
1. Aircraft and Systems Wiring - Check for chafing, broken or loose • terminals and general condition		★		
2. Junction Box - Check terminals for condition and security		★		
3. Circuit Breaker Panel - Check terminals, wiring and mountings		★		
4. Regulators - Check wiring, mounting, condition and wire routing			★	
5. Switches - Check operation, terminals, wiring and mounting		★		
6. Landing Gear Relay and Limit Switch - Check mounting and terminals			★	
7. Wing and Fuselage - Check wiring, routing, security and terminals			★	
8. Battery - Electrolyte specific gravity	★			
9. Battery Cables - Check for corrosion and terminals for security		★		
10. Instruments and Interior Lights - Check for operation and security		★		
11. Radio and Navigation System - Check for operation and condition			★	
12. Instrument Panel and Control Pedestal - Check mountings and terminals for security, check bonding between stationary panel and instrument panel for proper ground - resistance must be 0.010 ohms or less			★	
13. Emergency Locator Transmitter - Check for condition, security and battery pack for proper charge		★		
14. Flap Limit Switch and Motor - Check wiring and terminals for condition and security			★	
15. Warning Lamps - Check condition		★		
POST INSPECTION				
1. Correct all discrepancies, replace all fairings, doors and access 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 5)

A - Every 500 hours
 B - Every 1500 hours (310P0001 AND ON)
 C - Every 12 years or 4380 cycles
 D - Every 1400 hours (Turbo 310P0001 AND ON)
 E - Every 1200 hours
 F - On Condition
 G - Every 3000 hours (310P0001 AND ON)
 H - Every 2800 hours (Turbo 310P0001 AND ON)

I - 1500 hours or 5 years whichever occurs first (310P0001 AND ON)
 J - 1400 hours or 5 years whichever occurs first (Turbo 310P0001 AND ON)
 K - Every 3 years or 3000 hours
 L - Every 12 months
 M - Every 500 hours of heater operation
 N - Every 5 years
 P - At first 5000 hours

	Overhaul	Replace
AIRFRAME		
1. Oxygen Bottle (ICC-3HT/DOT-3HT)		C
2. Oxygen Regulator (Refer to Section 13)	K	K
3. Oxygen Pressure Gage		
4. Oxygen Filler Valve	K	
5. Oxygen Outlet	K	
6. Heater (See Cessna Overhaul/Parts Manual)	M	
7. Autopilot Filter (P/N AMA201442), (See Nav-O-Matic 800 Service/Parts Manual)		A A
8. Vacuum System Filter		
LANDING GEAR		
1. Landing Gear Actuator (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	F	
2. Actuator Motor (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	F	
3. Actuator Reduction Unit (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	F	
4. Shimmy Dampener (see Section 4)	B, D	
5. Uplock Hooks (310-0001 TO 310P0231)		P
FLIGHT CONTROLS		
1. Flap Actuator Gearbox (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	F	
2. Flap Actuator Motor (see Cessna Landing Gear and Flap System Components Overhaul/Parts Manual)	F	
3. Aileron Trim Tab Actuator (see Section 5)	B, D	
4. Elevator Trim Tab Actuator (see Section 5)	B, D	
5. Rudder Trim Tab Actuator (see Section 5)	B, D	
ENGINE GROUP		
1. Engine (see Continental Motors Engine Overhaul Manual)	B, D	
2. Magneto (see Bendix Magneto Overhaul Manual)	B, D	
3. Alternator (see Cessna Alternator Service/Parts Manual)	B, D	
4. *Turbocharger (see Cessna Turbocharger and Controls Overhaul/Parts Manual)	B	
5. *Controllers, Absolute and Pressure Ratio (see Cessna Turbocharger and Controls Overhaul/Parts Manual)	B	
6. *Actuator, Waste-Gate (see Cessna Turbocharger and Controls Overhaul/Parts Manual)	B	
7. *Waste-Gate and Waste-Gate Actuator (see Cessna Turbocharger and Controls Overhaul/Parts Manual)	B, D	
8. Vacuum Pump (Wet) (see manufacturers Overhaul Manual)	B, D	
9. Vacuum Pump (Dry) (see manufacturers Overhaul Manual)	B, D	
10. Fuel Pump (see manufacturers Overhaul Manual)	B, D	
11. Tachometer Generator (see manufacturers Overhaul Manual)	B, D	
12. Starter (see manufacturers Overhaul Manual)	B, D	
13. Governor (see manufacturers Overhaul Manual)	E	
*Turbo 310P0001 AND ON		

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

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		Overhaul	Replace
14.	Engine Compartment Hoses e. g. Fuel, Oil, Deice etc. (Rubber)		I, J
15.	Engine Compartment Fuel and Oil Hoses (Teflon)		G, H
16.	Engine Compartment Fire Extinguisher Container		N
17.	Engine Compartment Fire Extinguisher Cartridge		N
18.	Engine Compartment Pneumatic Hoses		B, D
19.	Induction Air Filter P/N 9910018-2		B, D
20.	Engine Mounts		B, D
PROPELLER			
1.	Propeller (see McCauley Maintenance and Overhaul Manual)	E	
2.	Accumulator, Unfeathering (see manufacturers Overhaul Manual)	E	

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.

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 acrylate 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 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 or 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, figure 2-12, and service components as shown.
 3. To aid the door seal to slip into the groove, lubricate with DC4 compound or equivalent.

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, figure 2-12, and service component parts as shown.

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 rolls 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.

Carpet.

- 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.

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 wing fume proofing materials as follows:

- (a) Fume proofing materials have been incorporated into the wing areas for the purpose of containing carbon monoxide (CO) fumes. Containment of carbon monoxide fumes is accomplished by various sealants, boots, and patches strategically placed within the wing area. Sealants are used throughout the engine nacelle area for both fire proofing and fume proofing. Boots are used to seal the main landing gear door hinges and main landing gear torque tubes. Small patches are used in the corners of the main gear wheel well, over lightening holes in trailing edge of wing at the root rib, along the edges of the wing fittings on the outboard side of root rib, and over the lightening holes just forward of the flaps. Sponge rubber insulation is

placed between corrugated web and wing spars in the wheel well area.

CAUTION

When fume proofing materials, as described above, have been damaged or removed, immediate replacement is required.

3. Inspect all fluid lines and hoses for leaks, cracks, dents, kinks, chafing, bleaching or discoloration, proper radius, security, corrosion, deterioration, obstructions and foreign matter.

4. Inspect wing spar bolts for security and insure they are not working. Torque on spar bolts is 60 ± 5 foot-pounds on the front and 175 ± 15 inch-pounds on the rear spar bolts.

NOTE

When checking torque on spar bolts always loosen nut first then check torque while tightening nut.

5. Inspect firewall access cover screws in accordance with Service Letter ME72-11. (Insure screws are proper length and type to prevent fuel line chafing.)

c. Repair and Servicing.

1. Refer to Lubrication Diagram, figure 2-12, for servicing requirements.

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.

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.

Heater.

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

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, figure 2-12.)

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.

start here

Detail A DISCONNECTING Landing Gear Doors

1. Disconnect nose and main landing gear doors.

CAUTION

When disconnecting the landing gear doors, always pin the landing gear up approximately 20 to 30 degrees and disconnect main gear door by retaining attaching nut from actuator arm. On the nose gear, always disconnect the door link tube from the upper extension to prevent the possibility of connecting lower member to the wrong side of the bellcrank.

— READ THIS — BEFORE STARTING INSPECTION

NOSE AND MAIN LANDING GEAR RIGGING INSPECTION

The nose and main landing gear rigging inspection should be performed indoors with proper jacks, 20 inch power supply, 0 to 150 pound spring scale and an 800001 actuator size tension tool available.

The aircraft should be placed on jacks, the necessary access plates, seals, cable drives, springs, shock absorbers removed, and the landing gear is placed with a suitable actuator prior to inspection. Step by step procedures are provided and each step must be completed before performing the next step.

NOTE

The operational checks and tension measures' secure requirements of this inspection will require the assistance of two people.

CAUTION

- When operating the landing gear always be prepared to stop to prevent damage to the system.
- After removal of retraction linkage, assist springs or component parts for checking, they must be reinstalled before proceeding to the next step.

TABLE 3

Check	Adjustment If Required
Detail A	---
Detail B	---
Detail C	---
Detail D	D-1
Detail E	E-1
Detail F	---
Detail G	H-1
Detail H	H-2
Detail I	H-3
Detail J	H-4
Detail K	H-5
Detail L	H-6
Detail M	H-7
Detail N	H-8
Detail O	H-9
Detail P	H-10
Detail Q	H-11

Detail B CHECKING Up and Down Link Switches

1. Operate landing gear to the up and locked position and turn switch OFF.

2. Engage manual extension crank and note the angular position of the crank handle.

3. Turn handle 100% AFT until the internal up stop is reached.

NOTE

The internal stop should be reached at approximately 3/4 to 1-1/2 turns.

4. If the internal stop is not reached in 3/4 to 1-1/2 turns, run landing gear down and disconnect main drive tube (D-1). Adjust up limit switch until the correct number of turns are obtained.

NOTE

Each time the actuator switches are adjusted the landing gear must be operated approximately half way down then back up before the number of turns required to reach the internal stop.

5. Operate the landing gear to the down and locked position.

6. Engage manual retraction crank and note the angular position of the crank handle.

7. Turn handle 100% FWD until the internal down stop is reached.

NOTE

The internal stop should be reached at approximately 1 to 2 turns.

8. If the internal stop is not reached in 1 to 2 turns the landing gear actuator down limit switch must be adjusted until the proper number of turns are obtained.

CAUTION

During manual extension of the landing gear, never release the manual extension crank, damage could result to personnel and the start of the gear's run.

Detail C CHECKING Drive Tubes, Transmissions, Retraction Linkage, and Wheel Well Area

1. Check the operation of the landing gear. Visually inspect drive tubes, idlers, transmissions, and wheel well area for cracks, dents, bends, loose, wear and other visual damage.

NOTE

If any part of the landing gear system is questionable, do not hesitate to report it.

2. Inspect the landing gear retraction linkage for excessive wear, looseness, dents, cracks, bends, and deep scratches.

3. Check main gear transmission roll pin is pivot shaft for looseness.

Detail D CHECKING Main Gear Door Arm Tension

1. Check main gear door tension as shown 25 to 30 pounds.

NOTE

Check hand crank for number of turns to internal stop after obtaining tension, 3/4 to 1-1/2 turns.

Detail D-1 ADJUSTING Main Gear Door Arm Tension

1. If the main gear door tension is not 25 to 30 pounds, adjust inboard drive tube rod end in half turn increments to obtain proper tension.

2. Shortening rod end will increase door tension (CCW).

3. Lengthening rod end will decrease door tension.

4. After checking door tension with the gear down, run the landing gear up and check the door tension.

5. The tension should be 25 to 30 pounds in the up position and a maximum of 10 pounds difference from the down position. Adjust up limit switch (see Detail B) to obtain proper tension.

NOTE

Check hand crank for number of turns to internal stop after obtaining tension, 3/4 to 1-1/2 turns.

Detail E CHECKING Main Landing Gear Free Fall

1. Check nose gear free fall by breaking nose lock bolts as shown, raise gear approximately 60 inches by hand, then release.

2. If the gear does not free fall to a down and lock position, visually check the following:

- Drive tubes for dents, breaks, trailing and damage.
- Transmission for scoring, binding, alignment and lubrication.
- Lock link trace for alignment, overcenter travel, bending and breaks.
- Side brace for proper overcenter engagement, bolts for proper torque, (refer to Torque Chart, Section I).
- Bolts in wheel well area for binding and interference.

Lengthen rod fitting is 1/2 turn increments until the gear will not free fall down and locked.

3. If the gear does not free fall to a down and lock position, visually check the following:

- Drive tubes for dents, breaks, trailing and damage.
- Transmission for scoring, binding, alignment and lubrication.
- Lock link trace for alignment, overcenter travel, bending and breaks.
- Side brace for proper overcenter engagement, bolts for proper torque, (refer to Torque Chart, Section I).
- Bolts in wheel well area for binding and interference.

Detail E-1 ADJUSTING Main Landing Gear Free Fall

1. Check nose gear free fall by breaking nose lock bolts as shown, raise gear approximately 60 inches by hand, then release.

2. If the gear does not free fall to a down and lock position, visually check the following:

- Drive tubes for dents, breaks, trailing and damage.
- Transmission for scoring, binding, alignment and lubrication.
- Lock link trace for alignment, overcenter travel, bending and breaks.
- Side brace for proper overcenter engagement, bolts for proper torque, (refer to Torque Chart, Section I).
- Bolts in wheel well area for binding and interference.

Lengthen rod fitting is 1/2 turn increments until the gear will not free fall down and locked.

3. If the gear does not free fall to a down and lock position, visually check the following:

- Drive tubes for dents, breaks, trailing and damage.
- Transmission for scoring, binding, alignment and lubrication.
- Lock link trace for alignment, overcenter travel, bending and breaks.
- Side brace for proper overcenter engagement, bolts for proper torque, (refer to Torque Chart, Section I).
- Bolts in wheel well area for binding and interference.

Detail F CHECKING Landing Gear Drop Off

1. (See Detail G-1) Disconnect uplock push-pull tube.

2. Operate landing gear up lock measure drop off as shown.

3. If drop off is not 1/8 to 1/4 inches refer to Detail D-1 and adjust outboard drive tube.

NOTE

Lengthen the outboard drive tube to decrease the amount of drop off. Shorten the outboard drive tube to increase drop off.

4. Reconnect uplock hooks.

Detail G CHECKING Uplock Hooks for Engagement

1. Inspect nose gear uplock hooks for proper engagement, when gear is retracted.

Detail G-1 ADJUSTING Uplock Hook for Engagement

1. If the main gear uplock hooks do not engage properly adjust the uplock hooks until the main gear full contact with the surface of the uplock.

2. Lengthening the uplock push-pull tube (CCW) will move the uplock hooks away from the spacer.

3. Shortening the uplock push-pull tube will pull the uplock hooks in closer to the spacer.

4. After adjustment the uplock hooks must engage and disengage freely with no binding.

Detail H CHECKING Down Lock Tension

1. Inspect main landing gear down lock for proper engagement and tension (40 to 60 pounds).

NOTE

When checking down lock tension always place finger on the down lock switch, pull scales at a right angle to the lock link and read scale at the point where a definite switch activation is felt.

Detail H-1 ADJUSTING Down Lock Tension

1. If the down lock tension is not 40 to 60 pounds, adjust outboard drive tube in one half turn increments until proper tension is obtained. If the down lock tension is in excess of 60 pounds the down lock tension should be rigged 40 to 50 pounds. Lengthening the outboard drive tube (CCW) decreases and shortening the outboard drive tube (CW) increases tension.

NOTE

When shortening or lengthening the outboard drive tube the fork bolt must be lengthened or shortened a corresponding amount of turns so that the combined length of the two parts does not change.

Detail I CHECKING Nose Gear Drive Lock Tension

1. Connect nose push-pull tube. (See Detail L-1.)

2. Inspect nose gear down lock tension (40 to 55 pounds).

3. If the nose gear down lock tension is not 40 to 55 pounds, make sure the nose gear fork bolt is properly adjusted (G-1).

Detail J CHECKING Nose Gear Connector Link for Overcenter Travel

1. If the nose gear connector link is not engaging overcenter properly adjust rod end as shown.

2. Inspect nose gear connector link for proper overcenter adjustment.

Detail J-1 ADJUSTING Nose Gear Connector Link for Overcenter Travel

1. If the nose gear connector link is not engaging overcenter properly adjust rod end as shown.

2. Inspect nose gear connector link for proper overcenter adjustment.

Detail K CHECKING Nose Gear Drive Lock Tension

1. Connect nose push-pull tube. (See Detail L-1.)

2. Inspect nose gear down lock tension (40 to 55 pounds).

3. If the nose gear down lock tension is not 40 to 55 pounds, make sure the nose gear fork bolt is properly adjusted (G-1).

Detail K-1 ADJUSTING Fork Bolt

1. If the nose gear uplock tension is not 100 to 120 pounds, adjust nose push-pull tube in half turn increments.

2. Lengthen the nose push-pull tube (CCW) to decrease the uplock tension.

3. Shorten nose push-pull tube to increase (CW) uplock tension.

Detail L CHECKING Nose Gear Uplock Tension

1. Inspect nose gear uplock tension (100 to 120 pounds).

Detail L-1 ADJUSTING Nose Gear Uplock Tension

1. If the nose gear uplock tension is not 100 to 120 pounds, adjust nose push-pull tube in half turn increments.

2. Lengthen the nose push-pull tube (CCW) to decrease the uplock tension.

3. Shorten nose push-pull tube to increase (CW) uplock tension.

Detail M CHECKING Nose Gear Uplock Engagement

1. Inspect nose gear uplock for proper engagement.

2. Uplock hook must be fully engaged with hook against the nose strut bolt and spacer engages and disengages freely with no binding.

3. Uplock hook must be engaged with .003 to .005 inches clearance between the spacer on the nose strut and surface of the hook.

Detail N CHECKING Gear Down Indicator Light Switches for Proper Adjustment

1. Retract landing gear approximately halfway.

2. Engage manual extension handle (see Detail D). Crank toward the down position and stop when green light comes on. Note the angular position of the manual extension handle.

3. Check applicable gear of illuminated light for being down and locked with the overcenter linkage, overcenter.

4. Rotate crank toward the down position noting the number of turns required to reach the internal stop in the actuator.

5. The number of turns required to reach the internal stop should be less than 8 or more than 14 for the nose gear. Not less than 8 or more than 8 on the main gear.

Detail N-1 ADJUSTING Nose Gear Down Indicator Light Switch

1. Retract landing gear approximately halfway.

2. Engage manual extension handle (see Detail D). Crank toward the down position and stop when green light comes on. Note the angular position of the manual extension handle.

3. Check applicable gear of illuminated light for being down and locked with the overcenter linkage, overcenter.

4. Rotate crank toward the down position noting the number of turns required to reach the internal stop in the actuator.

5. The number of turns required to reach the internal stop should be less than 8 or more than 14 for the nose gear. Not less than 8 or more than 8 on the main gear.

Detail N-2 ADJUSTING Main Landing Gear Down Indicator Light Switch

1. If the indicator lights do not illuminate within the required number of turns or the overcenter linkage is not overcenter when the lights illuminate make the following adjustments:

2. Adjust the nose gear down and locked indicator light switch by adjusting the switch actuating bolt. Turn bolt CCW to actuate switch farther from the internal stop inside the actuator. Turn bolt CW to actuate switch closer to the internal stop inside the actuator.

3. Adjust the main landing gear indicator light switch by repositioning. Loosen mounting screws and move switch toward the bellcrank to actuate switch closer to the internal stop in the actuator. Move the switch away from the bellcrank as actuator is closer to the internal stop in the actuator.

NOTE

After adjusting indicator switches check to see that gear indicator lights do not illuminate before gear is down and locked by overcenter linkage.

Detail O CHECKING Safety Switch Inspection

1. Refer to Section 4 for checking and adjustment of Landing Gear Safety Switch.

NOTE

If adjustments were made, make sure all bolts have been torqued, safety pins installed and doors covered, before installing access plates, fairleads, seals, carpin and cable thimble and releasing aircraft from jacks.

complete

Detail P CHECKING Nose and Main Landing Gear Doors for Proper Fit

1. Operate the landing gear through one complete cycle and check the gear indicator lights and warning horn. Check for operation with gear extended and retracted.

2. Operate the landing gear through one complete cycle and check the gear indicator lights and warning horn. Check for operation with gear extended and retracted.

Detail Q CHECKING Safety Switch Inspection

1. Refer to Section 4 for checking and adjustment of Landing Gear Safety Switch.

NOTE

If adjustments were made, make sure all bolts have been torqued, safety pins installed and doors covered, before installing access plates, fairleads, seals, carpin and cable thimble and releasing aircraft from jacks.

complete

Detail R CHECKING Safety Switch Inspection

1. Refer to Section 4 for checking and adjustment of Landing Gear Safety Switch.

NOTE

If adjustments were made, make sure all bolts have been torqued, safety pins installed and doors covered, before installing access plates, fairleads, seals, carpin and cable thimble and releasing aircraft from jacks.

complete

Figure 2-8A. Nose and Main Landing Gear Rigging Inspection

Change 1

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Check upper and lower bellcranks and splines on the 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 5 to 9 seconds.

(c) If during flight check, the landing gear will not retract and extend within the time limit described in step (b), remove the landing gear motor and perform the following no load test:

- (1) Mount motor securely in a horizontal position.
- (2) Connect motor as shown in Figure 2-8B 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 2-8B 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 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. Servicing.

1. Refer to Lubrication Diagram, figure 2-12, and service components as shown.

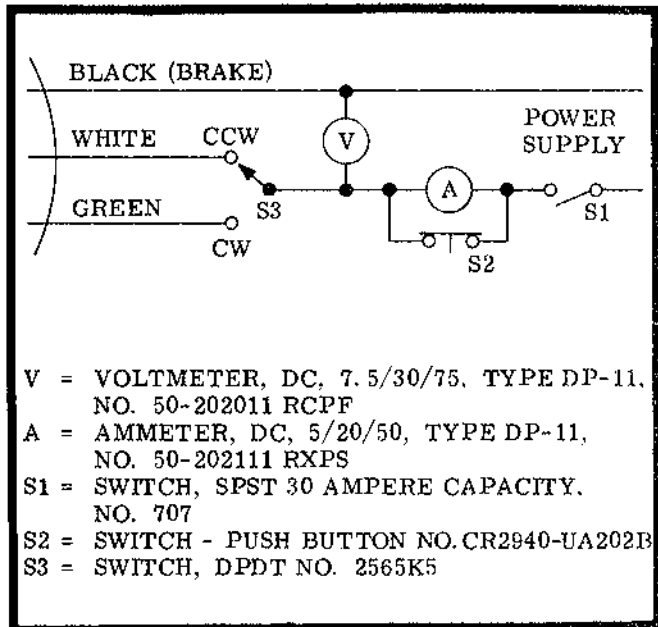


Figure 2-8B. Schematic Test Connection Diagram

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. Fifty-two to fifty-six turns are required to illuminate the lights.
- c. Repair and Servicing.
 1. Refer to Lubrication Diagram, figure 2-12, and service components as shown.

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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.

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, figure 2-12, and service components as shown.

Torque Links.

a. Cleaning.

1. Clean torque link assemblies with a suitable solvent and wipe clean with a clean cloth.

b. 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, figure 2-12, 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. 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. Remove and dye check nose gear uplock torque tube for cracks. If no cracks are visible, replace torque tube.
3. Refer to Lubrication Diagram, figure 2-12, 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 320 PSI with tire clear of ground.
7. When aircraft is on the ground, service strut to approximately 3.00 in. extension until it can be serviced per step 6.
 - b. To fill nose landing gear shock strut, use the following procedure:
 1. To fill the nose gear shock strut follow procedure given above, inflating nose strut to 48 PSI with tire clear of ground.
 2. When aircraft is on the ground, service strut to approximately 1.60 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. Repair of shimmy dampener is limited to replacement of parts, smoothing out of minor nicks, scratches, and dents and repainting of areas where paint has chipped or peeled.
2. Refer to Lubrication Diagram, figure 2-12, 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. Repair and Servicing.
 1. Repair of components in the nose gear steering system is limited to replacement of parts.
 2. Refer to Lubrication Diagram, figure 2-12, 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 keys 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 imbedded 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 tires reliability, don't hesitate to reject it.

- 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, figure 2-12.
 3. Replace damaged keys and tighten loose keys.
 4. Lubricate felt seal with light oil.

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.

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 conducted in compliance with applicable regulations.

2. Service system in accordance with Service Chart, Figure 2-13.

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. Inspect brake disc for "dishing" in excess of .0625 inch or if keyways are worn to a size in excess of 1.188 inches.

3. Inspect disc drive keys for wear, and minimum width of 1.116 inches.

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

c. Repair and Servicing.

1. Replace worn or damaged parts.

2. Polish out minor nicks using 400 grit wet-or-dry sandpaper with system hydraulic fluid.

3. Replace brake lining 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.

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, figure 2-12, and service as shown.

CAUTION

Always release parking brake before servicing master cylinders.

FLIGHT CONTROLS.

Control Column.

a. Cleaning.

1. Use a clean cloth dampened with solvent to remove grease and dirt.

b. Inspection.

1. Inspect control column for security, looseness, and wear.

2. Check rigging between pilot and copilot controls.

3. Check freedom of movement of controls and bob weight.

4. Inspect turnbuckles for proper safety.

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

c. Repair and servicing.

1. Repairs should be made by replacing all worn or damaged parts using the best shop practice and in compliance with applicable regulations.

2. Lubricate control column as shown in Lubrication Diagram, figure 2-12.

Aileron and Aileron Trim Control 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 controls 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.

NOTE

On 310Q0105 and On, check the jamb nut on stop bolts. On aircraft 310P0001 to 310Q0105, if the stop bolts are loose a jamb nut (MS25082-3) should be installed on the near side of the stop bolt. If the rigging of the stop bolts will not permit a jamb nut, the stop bolts may be safety wired instead by drilling a .04 $\pm$.04 diameter hole in the stop bolt bracket.

4. Check travel on aileron up 20° $\pm$ 1° and down 20° $\pm$ 1°
-0°.

5. Check travel on aileron trim tab up $20^{\circ} +1^{\circ}$ and down $20^{\circ} -1^{\circ}$.
6. Check aileron cable tension 25 ± 5 pounds.
7. Check aileron trim tab cable tension 10 ± 3 pounds.
8. Check push-pull tube attaching bolt for safety.
- c. Repair and Servicing.
1. Refer to Section 16 for repair and Figure 2-12 for lubrication of aileron.

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 $16^{\circ} +1/2^{\circ}$, -0° ; down $15^{\circ} +1^{\circ}$, -0° .
8. Check travel on elevator trim tab up $10^{\circ} +1^{\circ}$, -0° ; down $26^{\circ} +1^{\circ}$, -0° .
9. Check elevator cable tension 32 ± 5 pounds.
10. Check elevator trim tab cable tension 16 ± 3 pounds (electric trim cable tension 18 ± 3).
- c. Repair and Servicing.
1. Refer to Section 16 for repair and figure 2-12 for lubrication of elevator.

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 hinges for wear, cracks, excessive looseness and rudder attach bolts for security.

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 (310P0001 and On), left $29^{\circ} +1^{\circ}$, -0° and right $29^{\circ} +1^{\circ}$, -0° ; (Turbo 310P0001 and On), left $34^{\circ} +1^{\circ}$, -0° and right $34^{\circ} +1^{\circ}$, -0° measured perpendicular to hinge line.
8. Check travel on rudder trim tab left $25^{\circ} +1^{\circ}$, -0° ; right $20^{\circ} +1^{\circ}$, -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 2-12 for lubrication of rudder.

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.
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 $15^{\circ} \pm 0^{\circ}$, and $35^{\circ} \pm 2^{\circ}$ at the 35° 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 proper operating times 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), remove the flap actuator motor and perform the following no load test:
 - (1) Mount motor securely in a horizontal position.
 - (2) Connect motor as shown in Figure 2-8B to a variable 30 volt. DC power supply
 - (3) Close switch S3 for either direction.
 - (4) Open switch S2 to read ammeter.

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

NOTE

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

- (7) Read voltmeter when brake releases. Brake must release at or less than 18 volts.
 - (8) Stop motor, close switch S3 for opposite rotation and repeat steps (3) thru (7).
 - (9) Voltage must be within the same limits as previous rotation.
 - (10) If the voltage is not within the same limits, refer to Troubleshooting the Flap Actuator Motor, Section 8.
 - (11) Run motor in each direction as shown connected in Figure 2-8B with 24 volts DC applied.
 - (12) Open switch S2 and read ammeter current. The ammeter should read approximately 3.5 amperes under no load, when the RPM is approximately 1100 RPM.
 - (13) Stop motor, close switch S3 for opposite rotation and repeat step (12).
 - (14) Motor should operate within limits as described in step (12).
 - (15) If the motor does not operate within the limits as described in step (12), refer to Troubleshooting the Flap Actuator Motor, Section 8.
- (c) If the motor will not meet operating requirements, after performing no load test, replace motor and repeat step (a).
- (d) If the flaps still will not meet flight check requirements, check system for binding or interference.
- (e) If no evidence of binding or interference is found, flap actuator must be replaced or overhauled in accordance with Cessna Landing Gear and Flap System Components Overhaul/Parts Manual.

c. Servicing.

1. Refer to Section 16 for repair and figure 2-12 for lubrication of flap.

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,

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loose nuts and studs; baffles for cracks and security, push-rod housings and rocker box covers for leaks, cracks and security, crankcase, oil sump and oil cooler for loose bolts, cracks and leakage. Make necessary corrections and repairs in accordance with best shop practices and in compliance with applicable FAA regulations.

5. Perform a cylinder compression check in accordance with the engine manufacturer's Operations 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.

NOTE

The induction manifold may be inspected for leaks using a vacuum cleaner and applying pressure to the system using the same procedures as the exhaust system leak check.

CAUTION

Make sure the inside of the vacuum cleaner is absolutely clean.

c. Repair and Servicing.

Engine Oil Pressure System.

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. (P/N C294505-0102) (310P0001 and ON) (See figure 2-9.)

a. Installation and Inspection.

1. Inspect filter case by placing a straight edge on the washer seat surface. If any distortion or out-of-flat condition (greater than .010 inch) is observed, replace filter case (8). Replace filter case (8) when conditions indicate that the case may have been dropped, over-pressured or over-torqued.

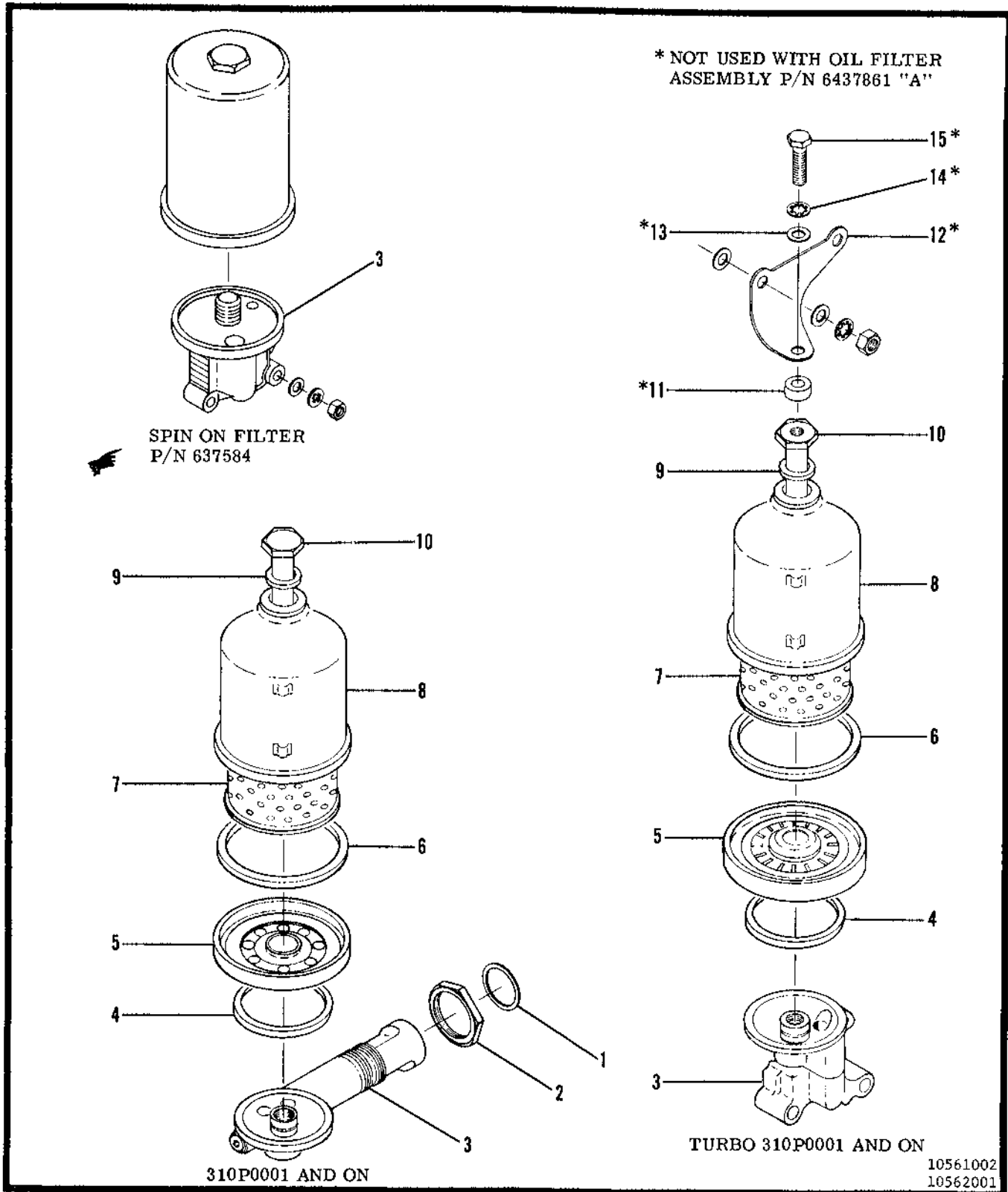
2. Lubricate gasket (6) furnished with filter element kit with a light coat of engine oil or general purpose grease. This procedure will allow the gasket to move freely and seat properly.

NOTE

Install only the .090 inch thick gasket (6).

3. Assemble new cover gasket (4) on cover (5), turn cover (5) so that it is facing downwards. If gasket (4) falls off, replace the gasket and repeat test. If gasket falls from cover (5), replace cover.

4. Assemble bolt (10) and washer (9) through case (8) and filter element (7). Position case (8) so that



1. Packing
2. Adapter Nut
3. Adapter Assembly
4. Gasket (Cover)
5. Cover

6. Gasket
7. Element
8. Case
9. Washer
10. Bolt

11. Spacer
12. Bracket
13. Washer
14. Lockwasher
15. Bolt

Figure 2-9. Oil Filter Assembly

element (7) is facing upwards, then assemble gasket (6) and cover (5) onto bolt (10).

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

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

7. Install the case (8) on adapter (3), but DO NOT allow gasket (4) to make contact with gasket seat. Hold case (8) to prevent it from turning, torque filter bolt (10) 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 (4) snugs against the seat in adapter (3).

8. Refill engine with proper grade and quantity of oil. Start engine and check for leaks after the engine has warmed properly, cycle through at least one high power setting.

9. If gasket (4) protrudes more than twice as much on one side as on the other, the gasket has become unseated during assembly. This condition indicates that either the cover or adapter are faulty and should be replaced.

10. Recheck filter bolt torque and safety wire the filter assembly.

Engine Oil Filter Service. (Turbo 310P0001 and On)
(See figure 2-9.)

a. Installation and Inspection.

1. Inspect bottom surface of filter case (8) by placing a straight edge on the washer seat surface. If any distortion or out-of-flat condition greater than .010 inch is observed, replace filter case (8).

2. Lubricate the gasket (6) 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.

3. Assemble bolt (10), washer (9), through case (8) and filter element (7). Position case (8) so that element (7) is facing upwards, assemble gasket (6) and cover (5) onto bolt (10).

4. Assemble new gasket (4) on cover (5), turn cover (5) so that it is facing downwards. If gasket (4) falls off, replace the gasket and repeat test. Should this gasket fall from cover (5), replace the cover.

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

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

7. Install the cover assembly (5) on the adapter (3) but DO NOT allow the gasket (4) to make contact with the gasket seat. Hold the case assembly to prevent it from turning, torque the filter bolt (10) 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 (4) snugs against the gasket seat.

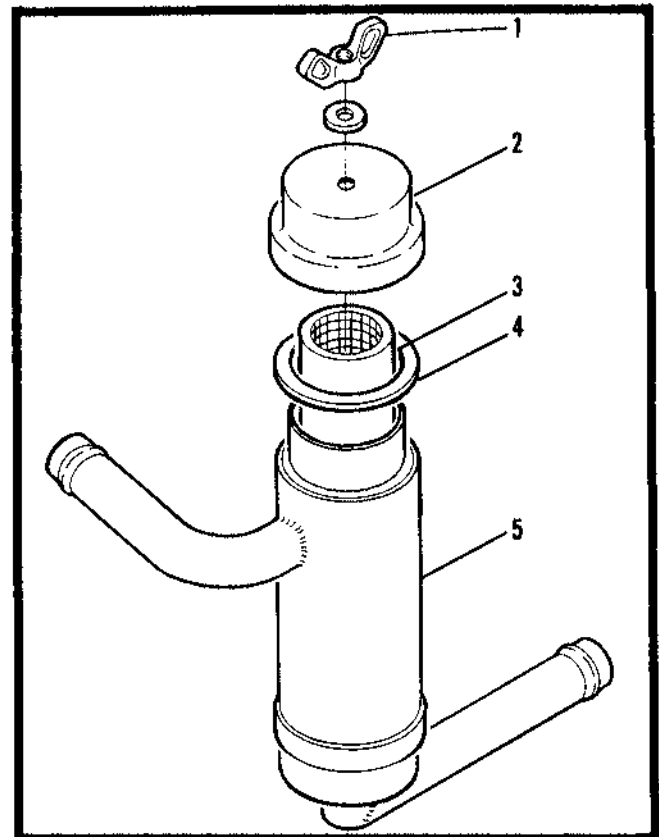
● On Turbo 310 aircraft equipped with oil filter P/N 6437861, secure filter assembly to support bracket (12) with spacer (11), washer (13), lockwasher (14) and bolt (15). The improved oil filter P/N 6437861 identified by a large "A" stamped on the adapter does not require the support bracket.

8. Refill engine with proper grade and quantity of oil. Start engine and check for leaks after the engine has warmed properly, cycle through at least one high power setting.

9. If gasket (4) protrudes more than twice as much on one side as on the other, the gasket has become unseated during assembly. This condition indicates that either the cover or adapter are faulty and should be replaced.

10. Recheck filter bolt torque and safety wire.

11. Aircraft equipped with oil filter P/N 637584; install and torque per instructions on filter. Safety wire filter.



1. Wing Nut
2. Top
3. Element

4. Gasket
5. Body

Figure 2-10. Oil Breather Separator

Oil Breather-Separator. (See figure 2-10.)

- a. Cleaning.
 1. Wash metal parts and element in suitable solvent.
- b. Inspection.
 1. Inspect metal parts for cracks in body and around the welded tubes.
 2. Inspect filter element for clogging and general deterioration.
- c. Repair and Servicing.
 1. Clean oil breather-separator filter at 50 hour interval.

Engine Exhaust System.

- a. Cleaning.
 1. Spray engine exhaust system with a suitable solvent and allow to drain dry.

WARNING

Never use a flammable solvent on engine exhaust system.

2. Wipe dry with a clean cloth.

NOTE

Never use a wire brush or abrasives to clean exhaust system.

- b. Inspection. (310P0001 to 310Q0401 except aircraft incorporating slip joint couplings.)

NOTE

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

1. Remove engine cowling in accordance with removal procedures.
2. Remove shields around the exhaust bellows, couplings at joints, and other items which might hinder the inspection of engine exhaust system.
3. (See figure 9-29.) Inspect the exhaust system for burned areas, cracks and/or looseness. Inspect attaching bolts for proper torque (refer to Section 9).

NOTE

During the inspection, particular attention should be given to flanges at all couplings, to bellows and welded areas along seams and around the bellows.

4. Inspect couplings for cracks and deformation (refer to figure 2-10A). If outer band is deformed beyond 0.062 inch, replace coupling.
5. Inspect springs (17) for correct compression (refer to figure 9-29).

6. An air leak check should be made on the exhaust system to insure optimum performance of the turbocharger. The leak check should be performed when the exhaust system is cool using the following recommended procedures:

- (a) Plug either the waste-gate overboard tube or the turbine overboard tube with a rubber plug.
- (b) Attach the pressure side of an industrial vacuum cleaner to the open overboard tube using a rubber plug to affect a seal as required.

CAUTION

The inside of the vacuum cleaner hose should be free of any contamination that might be blown into the engine exhaust system.

(c) With the vacuum cleaner on, observe the turbocharger inlet couplings and all welds and seams for leaks. The leaks may be detected manually by feel or by using soap solution and watching for bubbles. Small bubbles will appear and are permissible at the waste-gate bearings, ball joints and waste-gate tail-pipe flex joint.

- c. Inspection. (310Q0401 and On and all aircraft incorporating slip joint couplings.)

NOTE

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

1. Remove engine cowling in accordance with removal procedures.

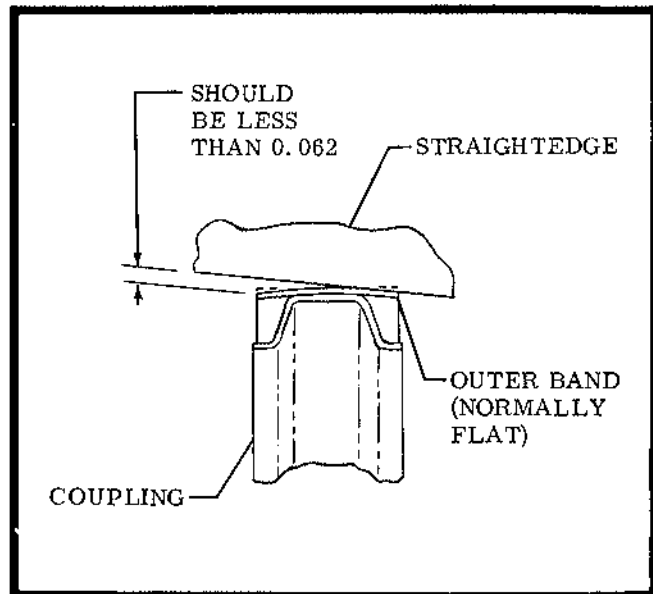


Figure 2-10A. Exhaust Coupling Deformation Limits

2. Remove the heat shields on the turbocharger in accordance with heat shield removal procedures.
3. Remove shields around the exhaust system couplings at joints and other items which might hinder the inspection of engine exhaust system.
4. (See figure 9-29.) Inspect the exhaust system for burned areas, cracks and/or looseness. Inspect attaching bolts for proper torque, refer to Section 9.
5. (See figure 2-10A.) Inspect couplings every 50 hours for cracks and deformation. If outer band is deformed beyond 0.062 inches, the coupling must be replaced.
6. (See figure 9-29.) Inspect springs (17) for correct compression.

CAUTION

Do not check the slip joints seals for air leaks using the procedures outlined in paragraph 7. Use the procedure outlined in paragraph 8 to check the slip joint seals.

CAUTION

Do not allow the soap solution to make contact with the slip joint seals.

7. An air leak check should be made on the turbocharger inlet couplings, all welds, and seams. Leaks may be detected manually by feel or by using a soap solution and watching for bubbles. Small bubbles will appear and are permissible at the waste-gate bearings, balljoints, and waste-gate tailpipe flex joint. This inspection should be performed when the system is cool.

- (a) Plug either the waste-gate overboard tube or the turbine overboard tube with a rubber plug.

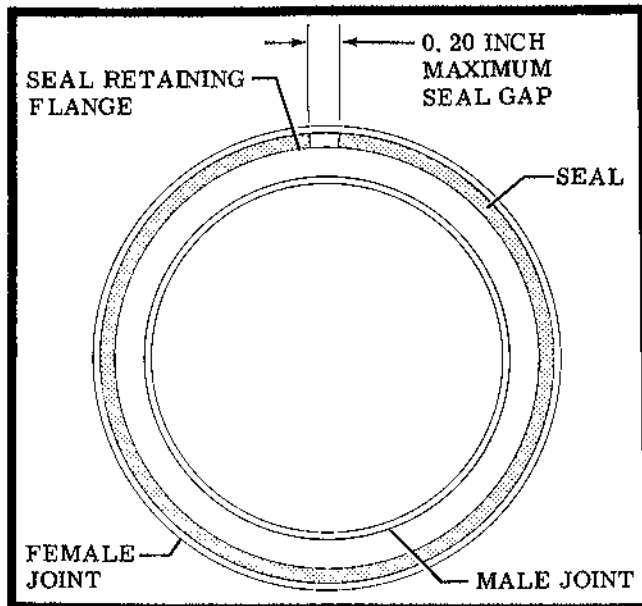


Figure 2-10B. Exhaust Slip Joint Inspection Limit

CAUTION

The inside of the vacuum cleaner hose should be free of any contamination that might be blown into the engine exhaust system.

- (b) Attach the pressure side of an industrial vacuum cleaner to the open overboard tube using a rubber plug to provide a seal as required.
8. Visually inspect each slip joint seal every 50 hours using a mirror and flashlight. Inspect around the entire slip joint. If an open gap or missing portion of the seal in excess of 0.20 inches (see figure 2-10B) is detected between the seal retaining flange and the female joint section, the seal must be replaced.

NOTE

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

9. Repair of exhaust system is limited to replacement of components only. Refer to Section 9 for seal replacement instructions.

Engine Compartment.

- a. Cleaning.
 1. Spray engine compartment with a suitable solvent and allow to drain and air dry.
- b. Inspection.
 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 figure 2-13 for servicing.

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.

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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 engine mounts for security, safetying, looseness, deterioration, cracked fitting, localized burning, blistering, sagging and end separation.
 3. 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.

4. See figure 2-11 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

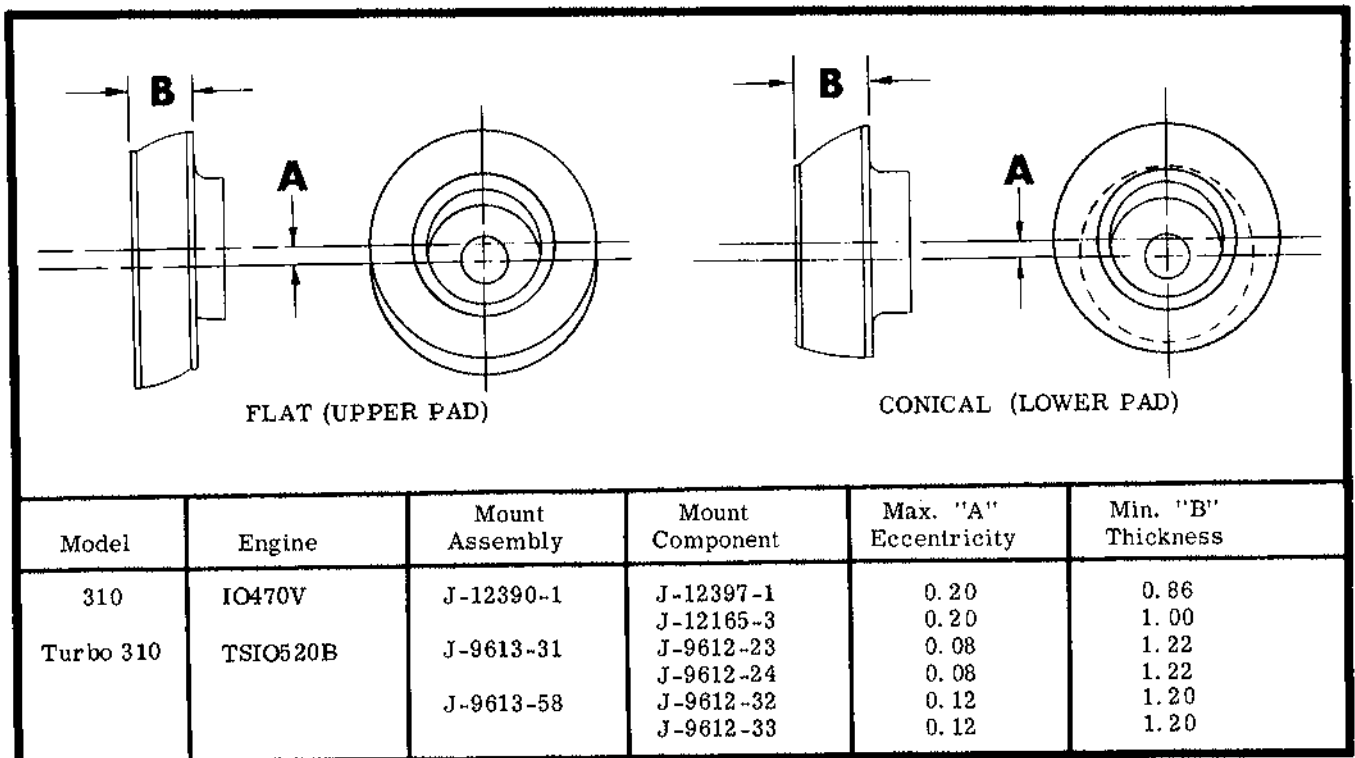


Figure 2-11. Engine Mount Inspection Limits

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 excessive 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.

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. Inspect alternator fan for being bent, having cracks, broken or cracked welds. (See figure 2-11A.)

2. Inspect drive belt for condition and proper tension. Refer to Section 14 for tension adjustment.

3. Check alternator mounting bolts for proper torque. (Refer to Section 14.)

4. Check all electrical connections for cleanliness and security.

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 2-10).

Turbocharger.

a. Cleaning.

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

b. Inspection.

1. Remove turbocharger insulation blanket 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 Control 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 34.5 in. Hg.

- (b) If maximum manifold pressure exceeds 34.5 in. Hg., immediately reduce power and shut down engine. Manifold pressure relief valve is faulty and must be replaced.

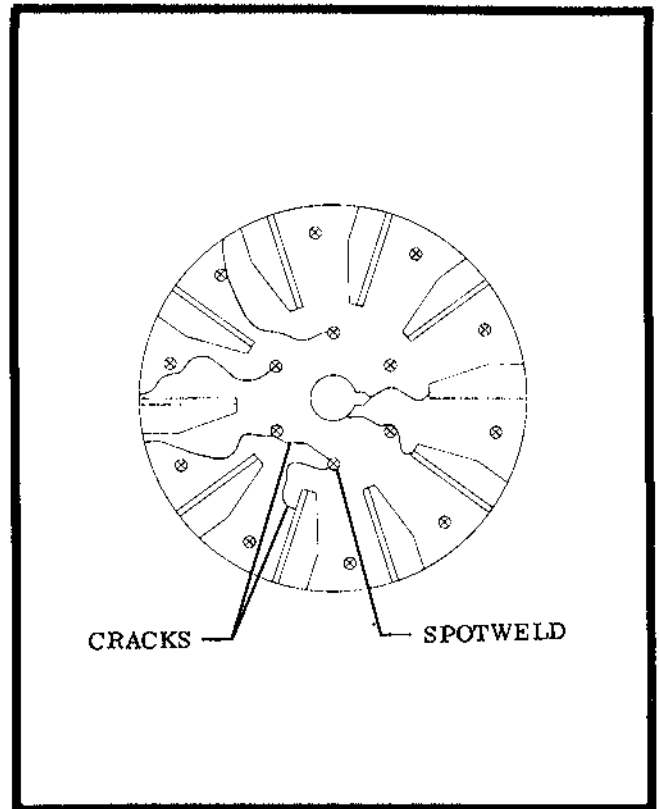


Figure 2-11A. Alternator Fan Inspection

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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 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 (refer to McCauley Industrial Corporation's Service Manual).

b. Inspection.

1. Refer to McCauley Industrial Corporation's Service Manual.

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.

3. Anytime the propeller attachment has been subjected to excessive engine roughness, the propeller should be removed and dowel pins inspected for looseness, cracks and visual damage.

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

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. With a normal amount of friction within the propeller, a range of 125 - 130 psi is acceptable.

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 fuel strainer 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. Hold the top cover down against internal spring until all four attaching screws have been removed,

then gently lift off the cover. Use care not to damage the spring-loaded diaphragm below it.

CAUTION

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

3. 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.

4. Using clean gasoline, flush out the chamber below the screen.
5. 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.
6. Replace flushing plug.
7. Clean the diaphragm valve, top cover and springs in the same manner.
8. Carefully replace diaphragm and valve in manifold body. Check that valve works freely.
9. Place upper spring in position.
10. Align mounting holes in body, diaphragm and top cover locating the small vent hole in the cover to the side. Hold the cover down against the spring while installing and tightening all four attaching screws. Safety the screws.

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 and Strainer.

- a. Cleaning.
 1. Fuel selector valve handles - OFF.
 2. Drain excess fuel from sediment bowl with quick-drain.

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.

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.

Fuel System - Main.

- a. Visually inspect filler cap gasket. If crushed or

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 Section 11 for cleaning and inspection of auxiliary fuel system.

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.

Main Tank Fuel Transfer Pump.

- a. Cleaning.

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

OXYGEN SYSTEM.**Filler Valve.**

- a. Cleaning.
 1. The filler valve should be cleaned with trichlor-

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ethylene 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.

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.

DEICE SYSTEM.

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.

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 air.

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.

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 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 1.250 to 1.280, corrected to temperature.
 - (b) Check that specific gravity of the electrolyte does not vary more than .025 between cells.
 - (c) Should a greater variation exist, battery should be slow charged and retested.

CAUTION

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

Battery Box.

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.

Emergency Locator Transmitter

a. Cleaning.

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

b. Inspection.

1. Perform the following periodic inspections 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 de-activated).

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.

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.
- (h) Mounting security.

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 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 AND WIRE BUNDLES 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 on turbocharged models should be inspected for heat hardness, cracking, flexibility and security during regular engine inspection. (See Inspection Chart for interval.)

FLUID LINES AND HOSES for leaks, cracks, dents, kinks, chafing, proper radius, security, corrosion, deterioration, obstructions and foreign matter.

METAL PARTS 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 in close proximity of exhaust stacks or turbocharger, for heat damage.

BOLTS IN CRITICAL AREA 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 for cleanliness, contamination, and/or replacement at specified intervals.

POST INSPECTION. Post inspections should be made after the last flight of the day. All pilot and operating discrepancies relating to the flight and safety of flight must be corrected before the next flight.

- a. Remove necessary access plates, doors and fairings to gain access to flight controls, engines and electronics equipment only to correct discrepancies.

- b. Make sure all systems are operating properly.
- c. Ground check engine, check ignition drop, alternator charging rate, oil pressure and general operation of components, when post inspection is deemed necessary.

FREQUENCY (HOURS)



50 HOURS



100 HOURS



200 HOURS



500 HOURS



1500 HOURS



ON ASSEMBLY AND
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-5606)
GW	Grease, Wide Temperature Range (MIL-G-81322)
GS	Grease, Medium Consistency (MIL-G-23827)
GSL	Grease, Light Consistency Silicone #33 Dow Corning, Midland, Michigan
DS	Dry Spray, Lubricant Camie No. 1000 Watson Industrial Park, St. Louis, Mo., or Dupont Slip Spray Dry Film Lubricant

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 oftener, if required.

Lubricate door latches with automotive type door latch lubricant, and the latching mechanism with general purpose oil every 1500 hours, or oftener if binding occurs.

Lubricate control surface hinges with general purpose oil (MIL-L-7870) as required.

Lubricate door stop with Sil-Glyde or (MIL-S-8660) or equivalent.

Figure 2-12. Lubrication Diagram (Sheet 1 of 15)

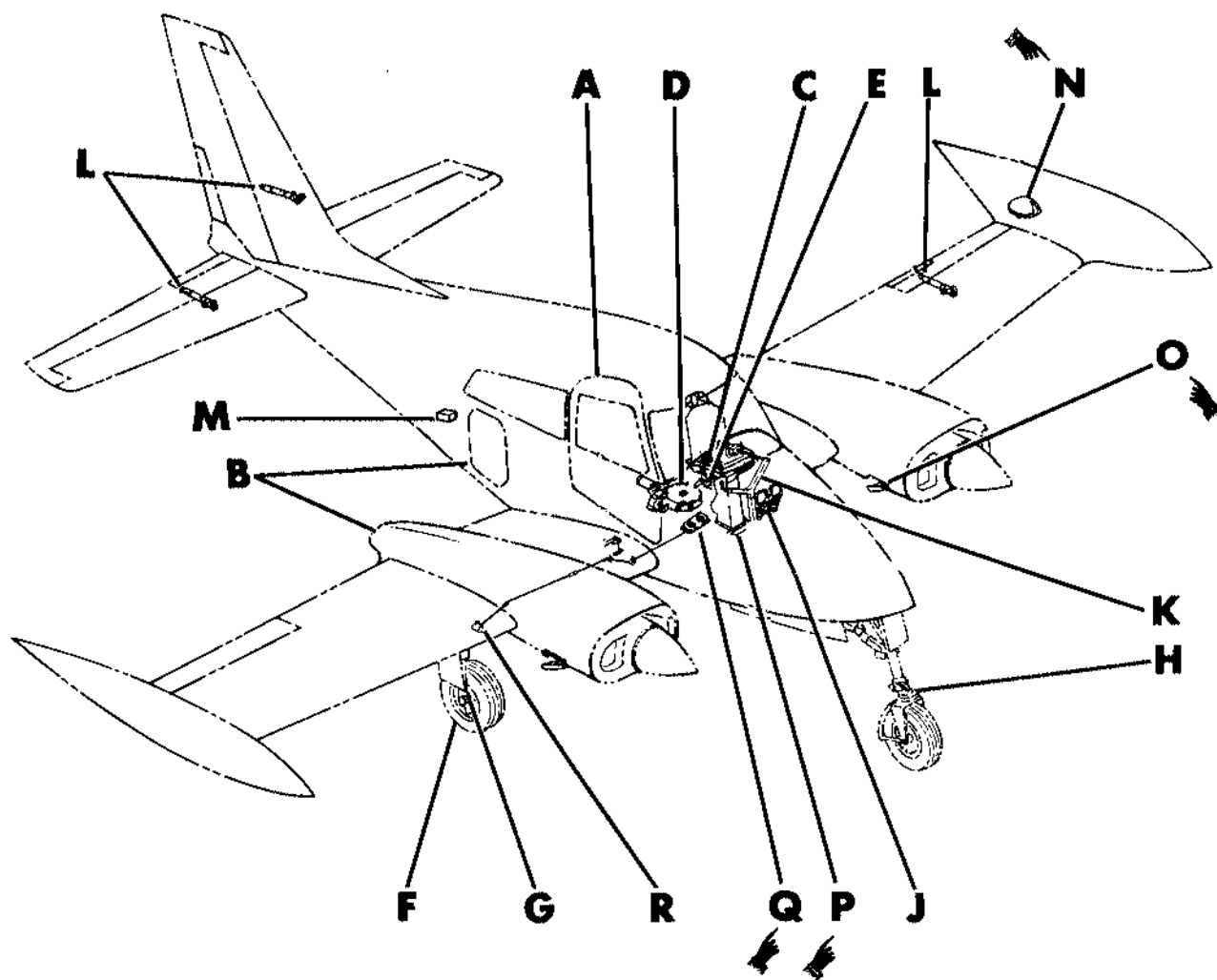


Figure 2-12. Lubrication Diagram (Sheet 2 of 15)

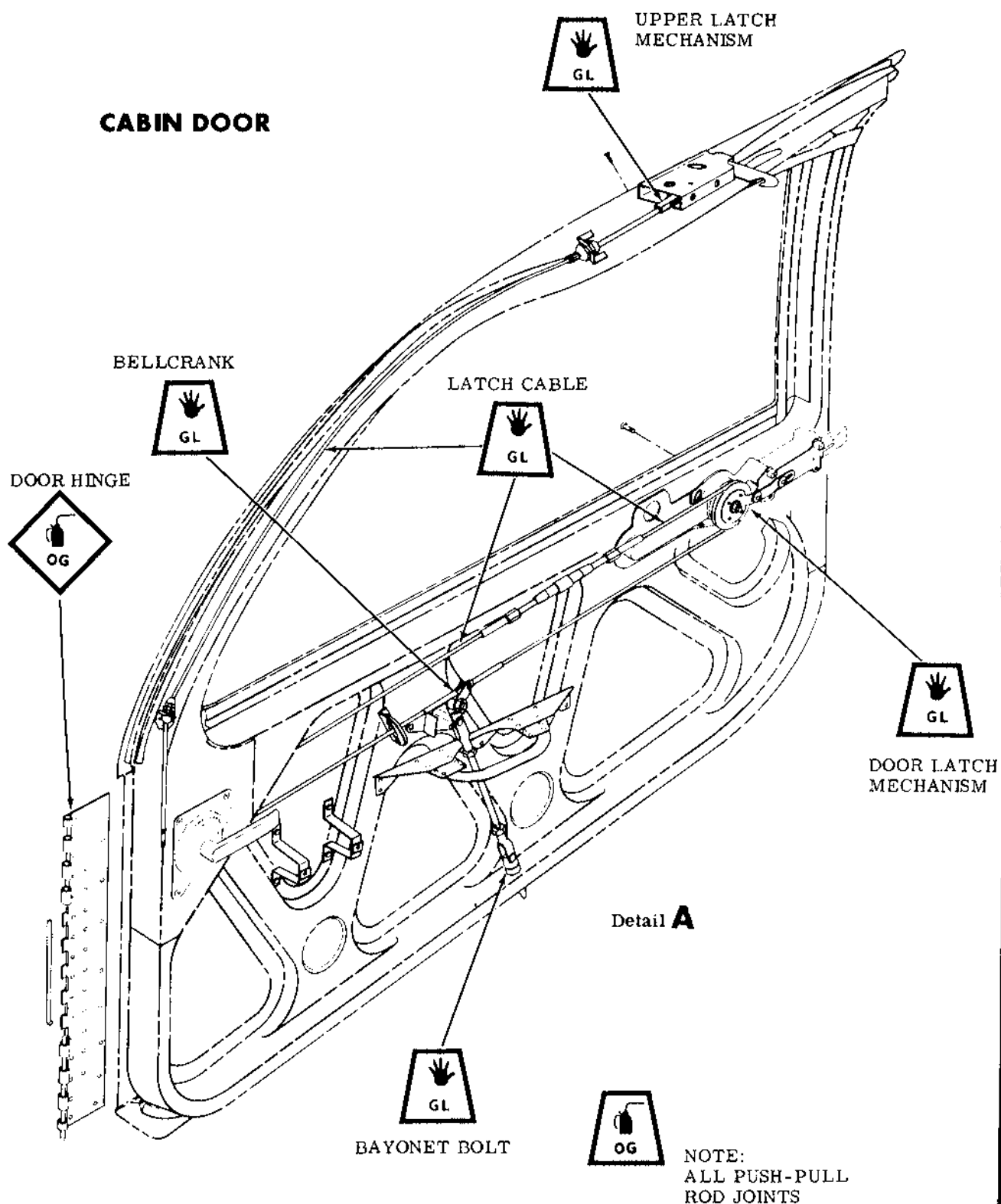


Figure 2-12. Lubrication Diagram (Sheet 3 of 15)

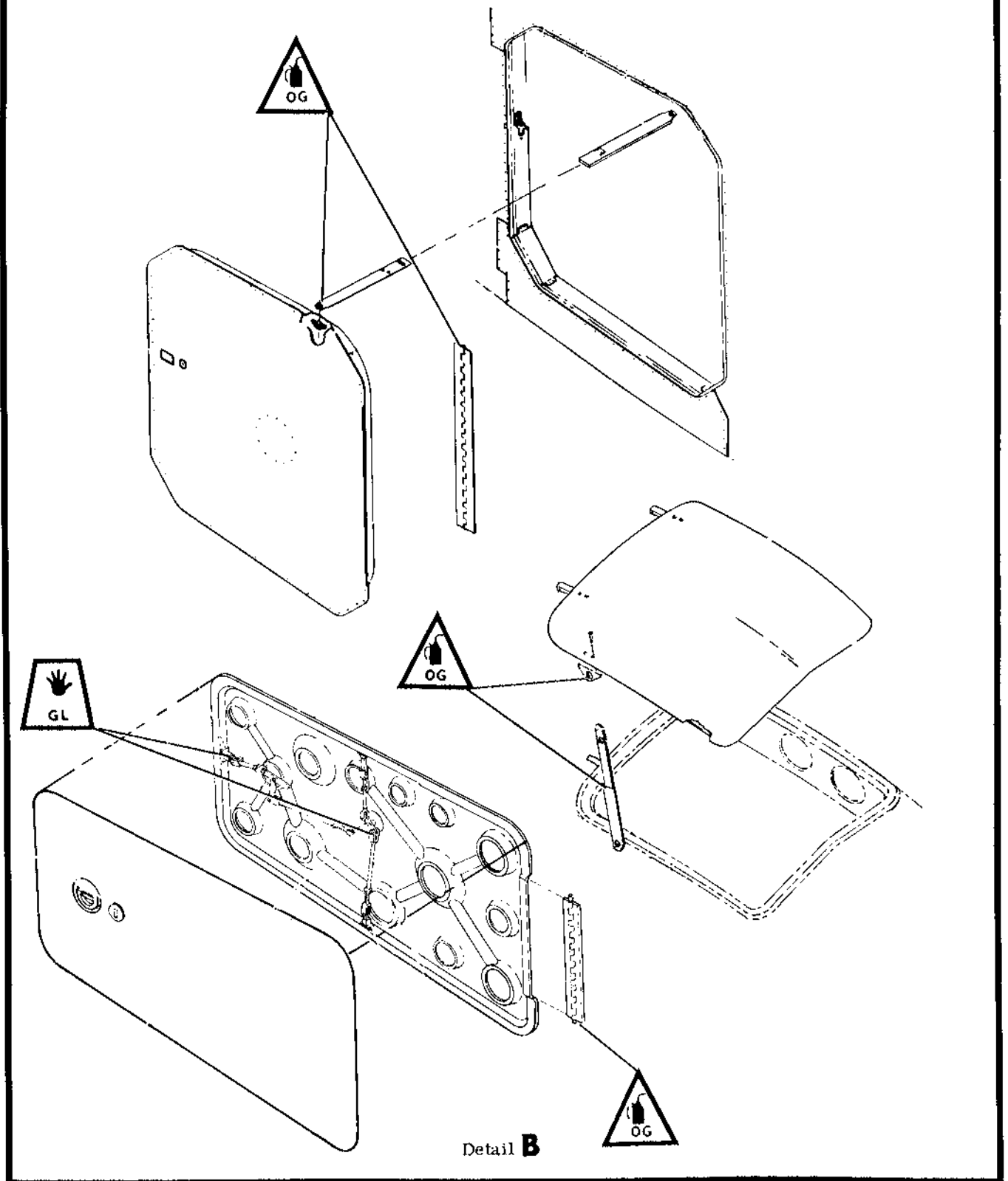
BAGGAGE AND WING LOCKER DOOR

Figure 2-12. Lubrication Diagram (Sheet 4 of 15)

MECHANICAL ADJUSTING SEAT

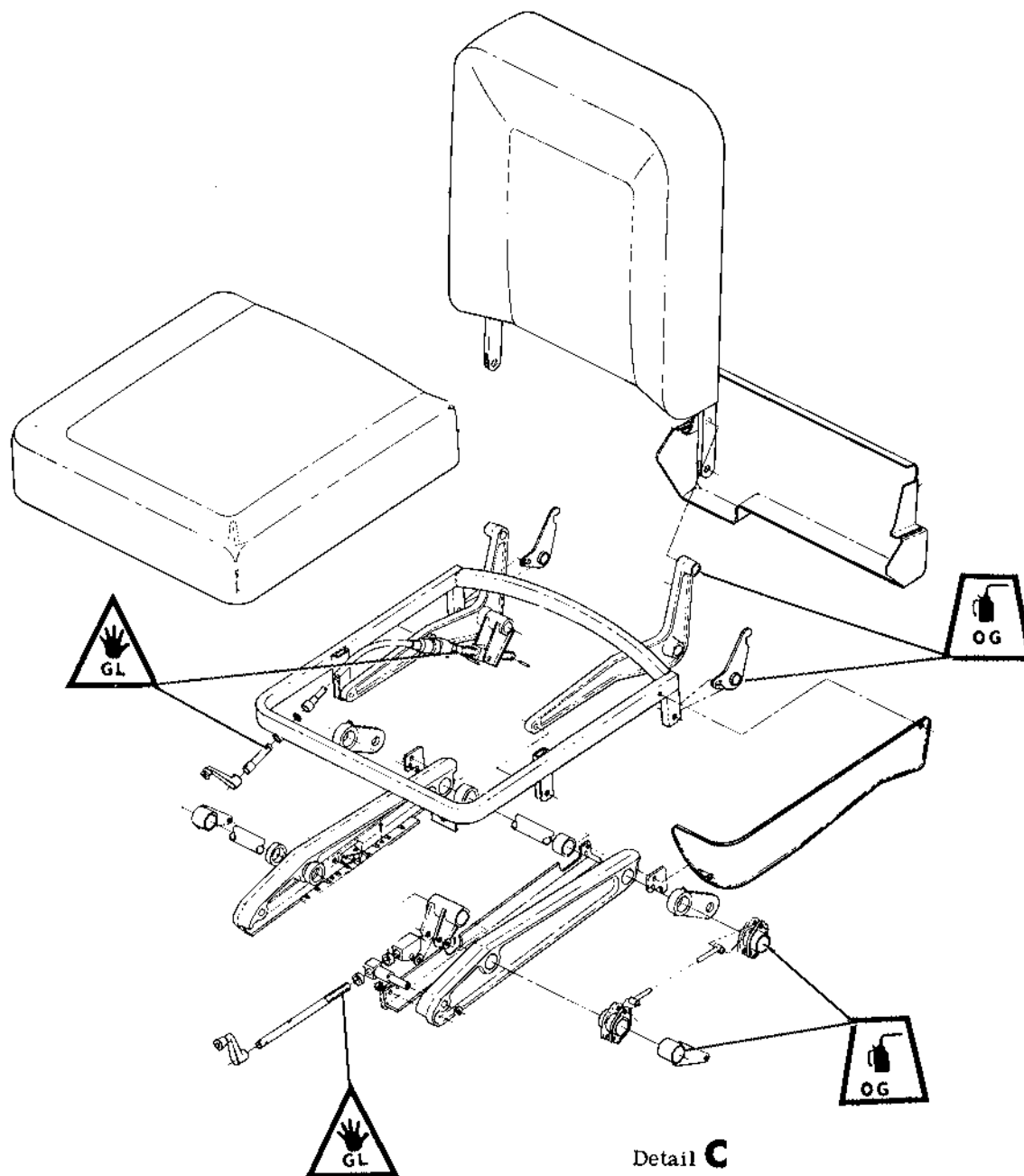


Figure 2-12. Lubrication Diagram (Sheet 5 of 15)

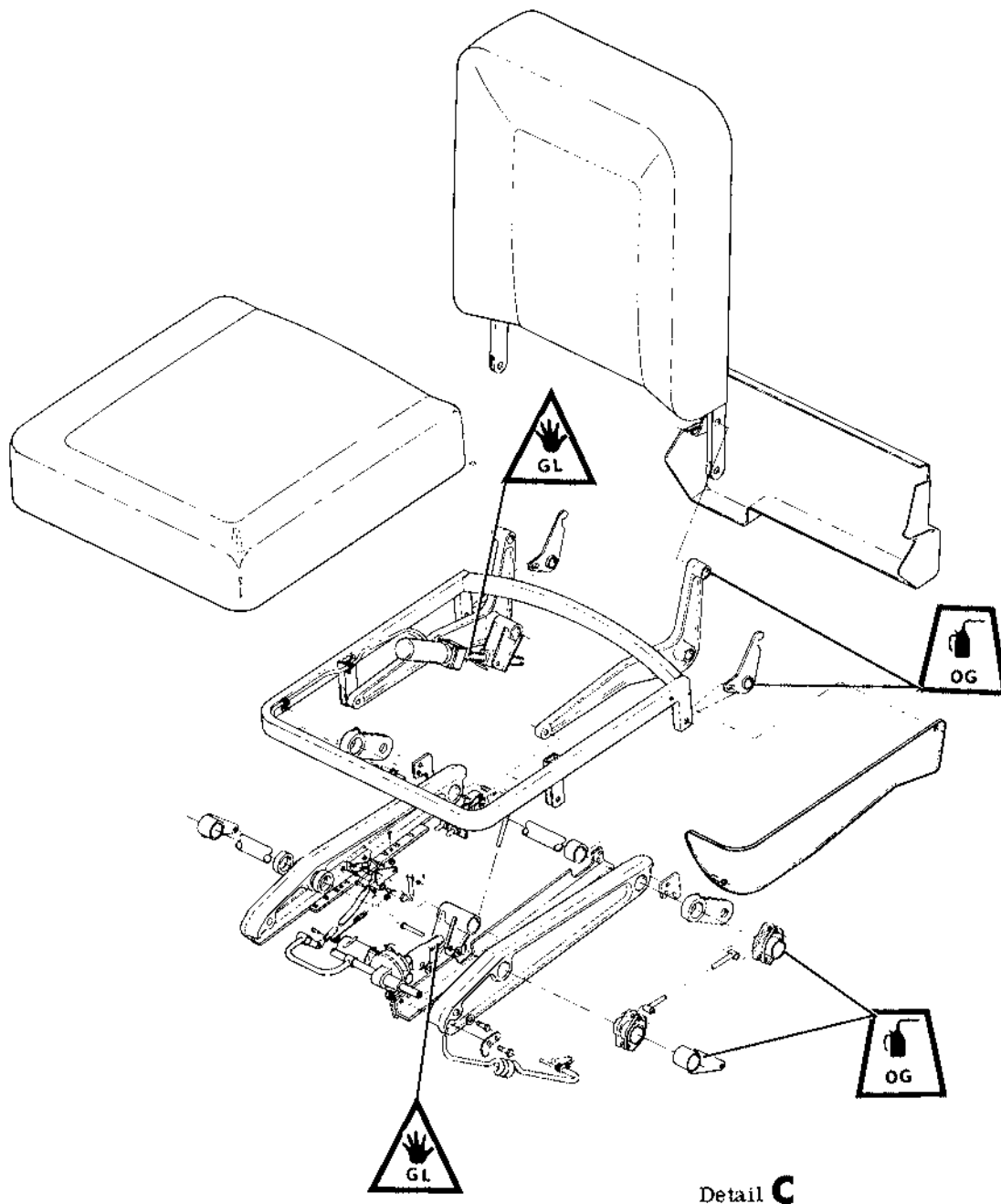
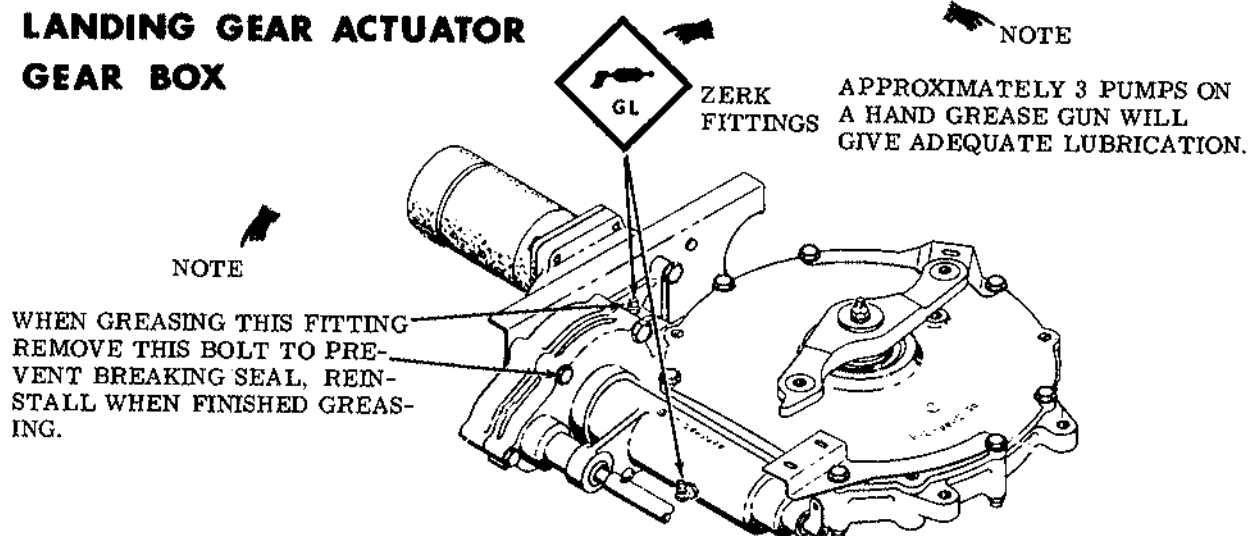
ELECTRICAL ADJUSTING SEAT

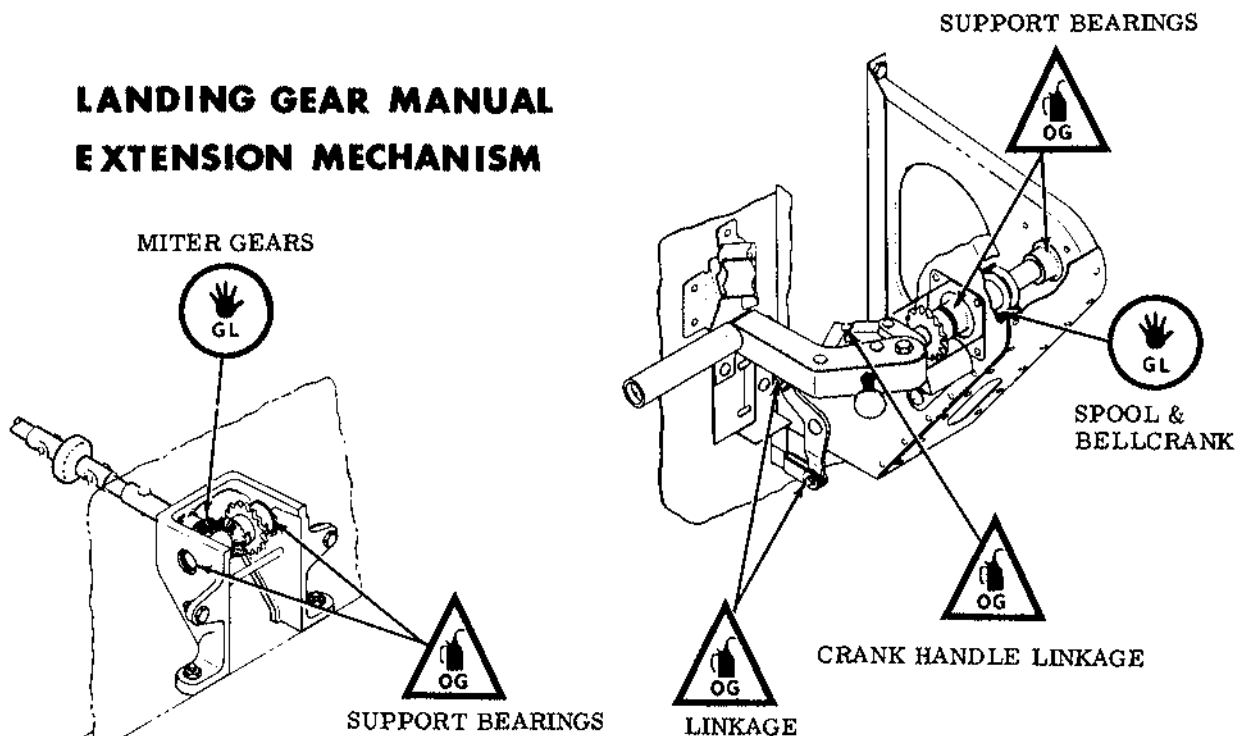
Figure 2-12. Lubrication Diagram (Sheet 6 of 15)

LANDING GEAR ACTUATOR GEAR BOX



Detail **D**

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.

Detail **E**

Figure 2-12. Lubrication Diagram (Sheet 7 of 15)

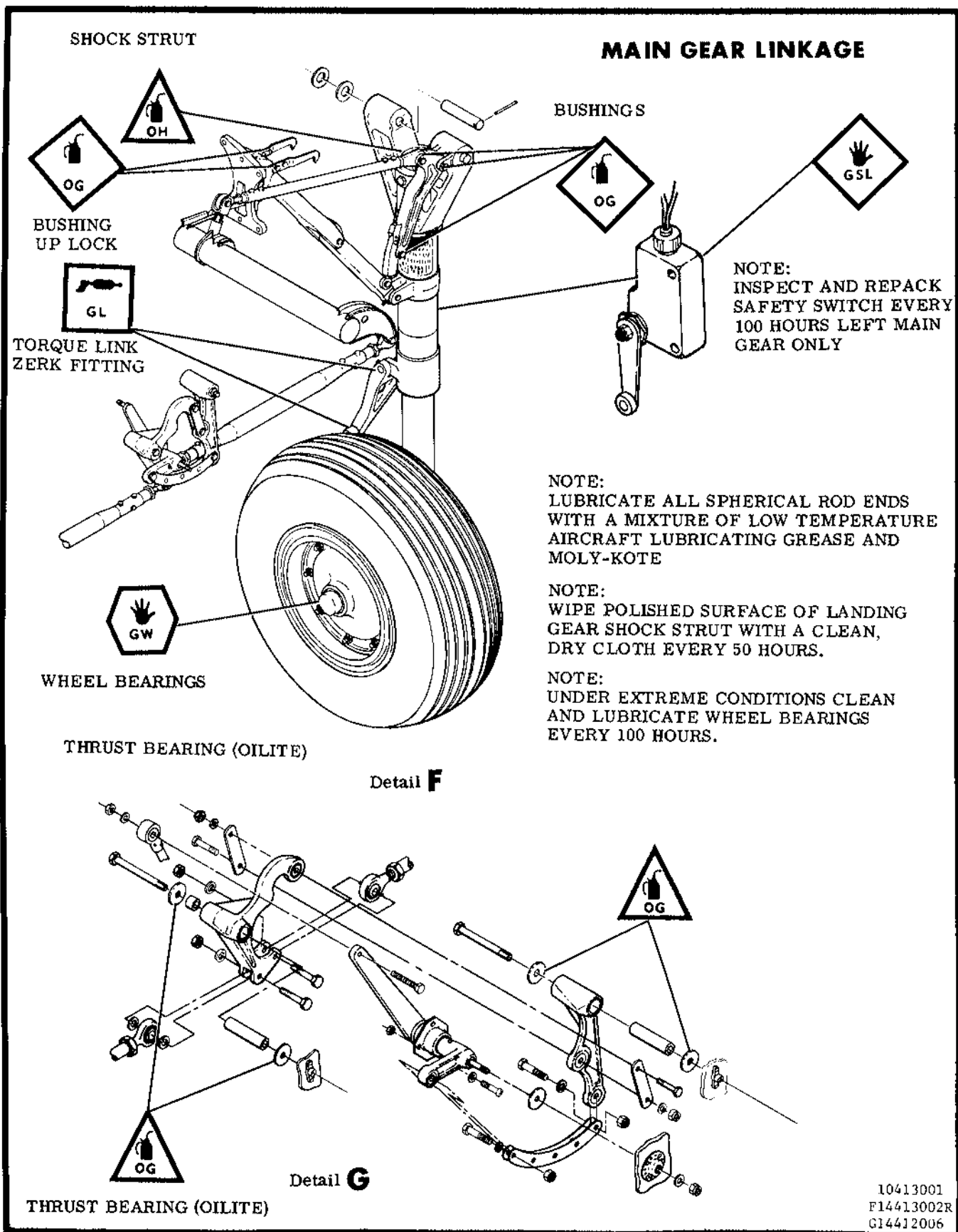


Figure 2-12. Lubrication Diagram (Sheet 8 of 15)

NOSE GEAR LINKAGE

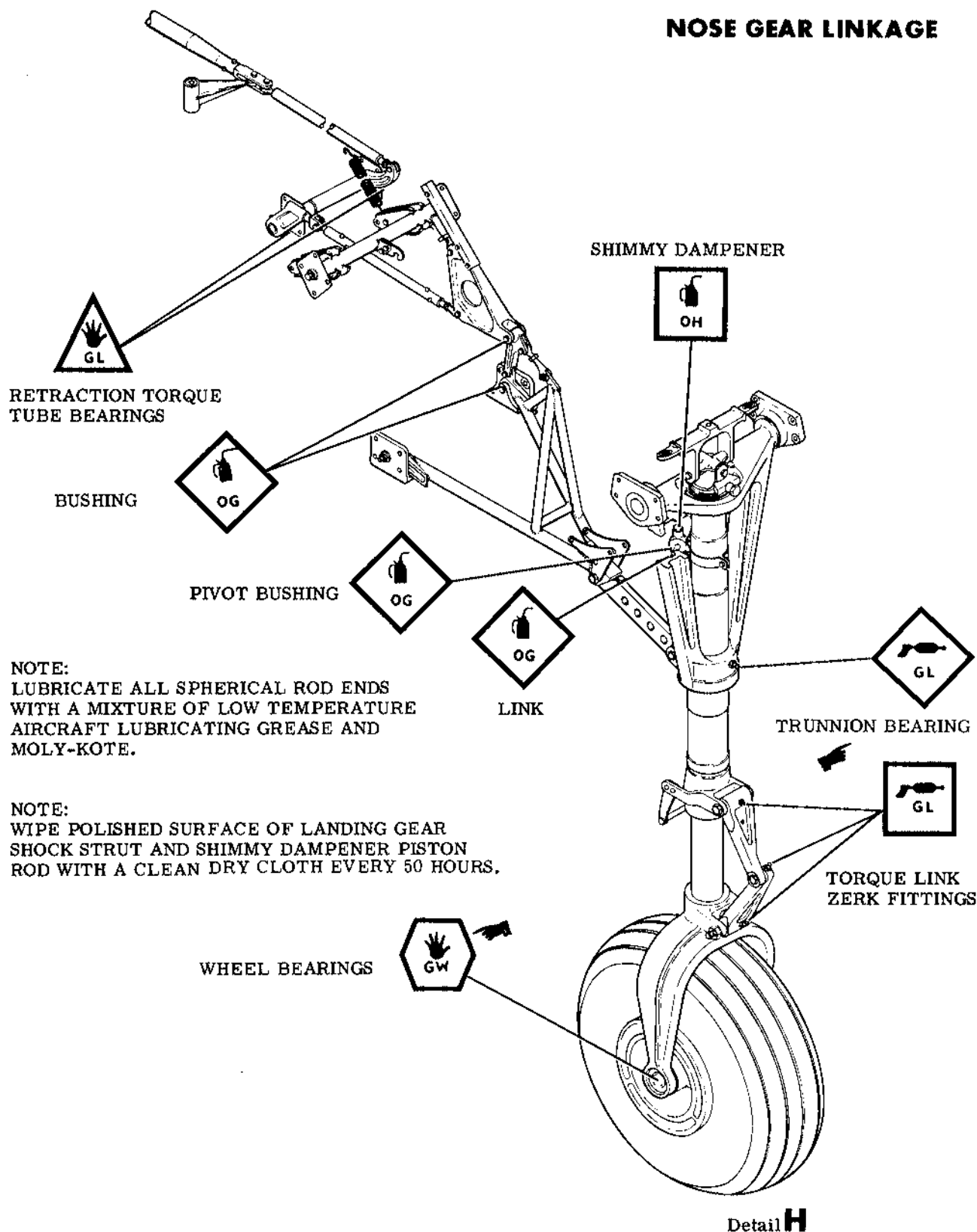


Figure 2-12. Lubrication Diagram (Sheet 9 of 15)

RUDDER PEDAL MECHANISM

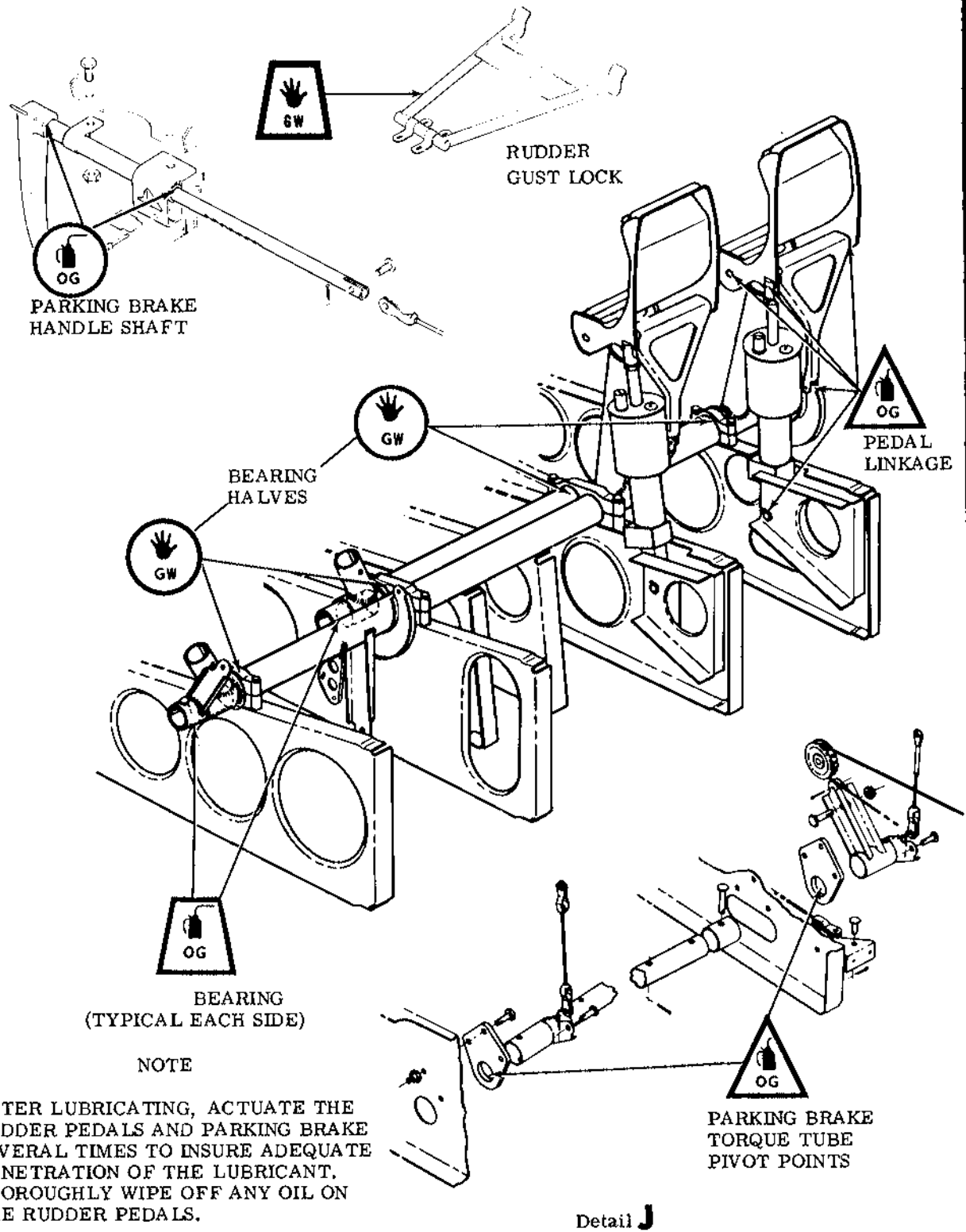
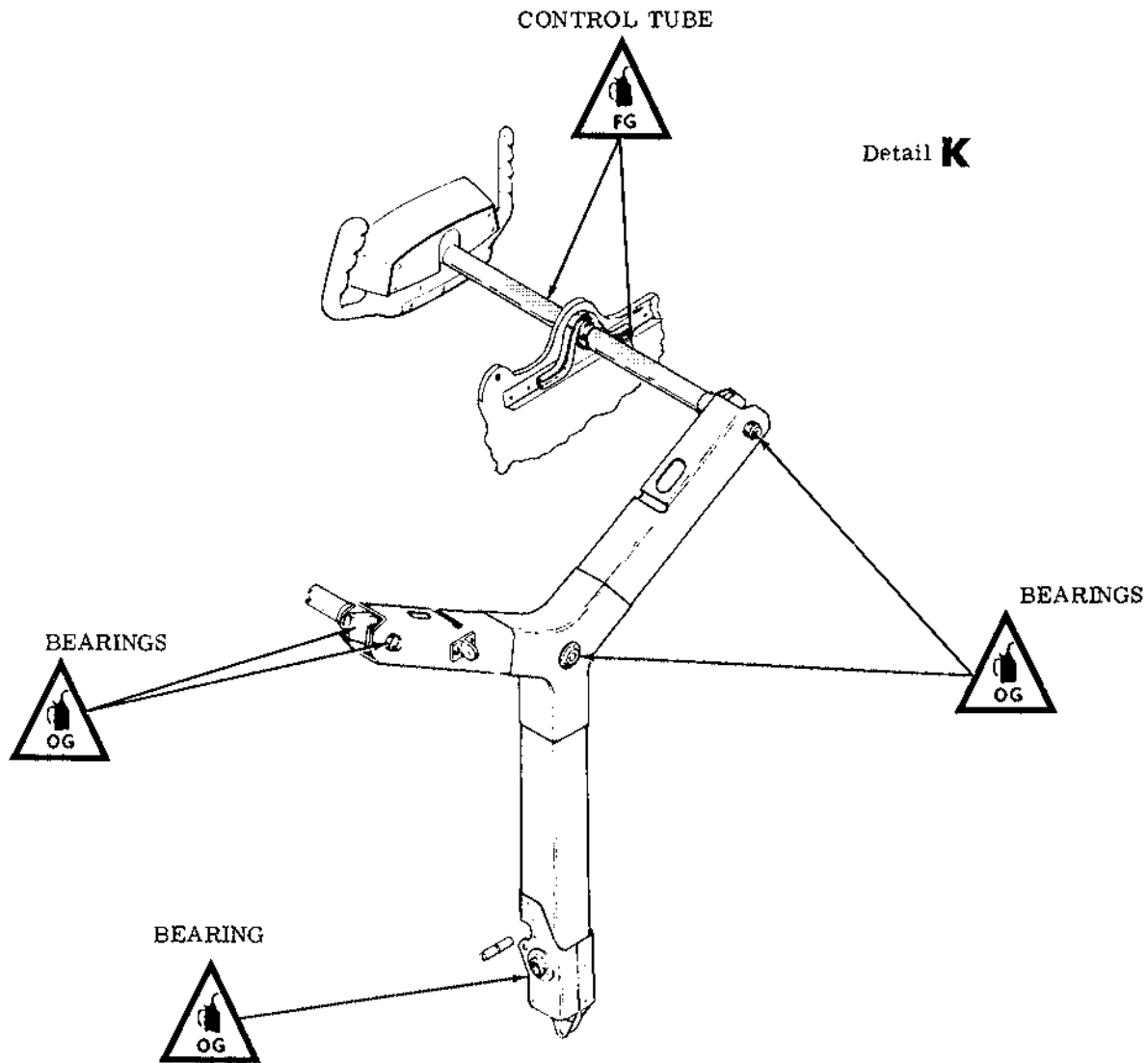


Figure 2-12. Lubrication Diagram (Sheet 10 of 15)

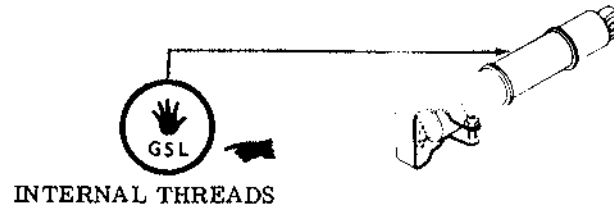
CONTROL COLUMN



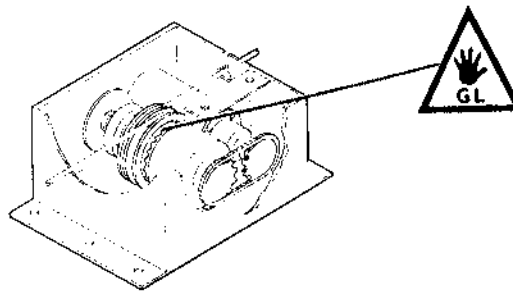
NOTE

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

Figure 2-12. Lubrication Diagram (Sheet 11 of 15)

TRIM TAB ACTUATORSDetail **L****NOTE**

CLEAN AND REPACK AILERON,
ELEVATOR AND RUDDER ACTUATORS

ELECTRIC TRIM TAB ACTUATOR**NOTE**

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

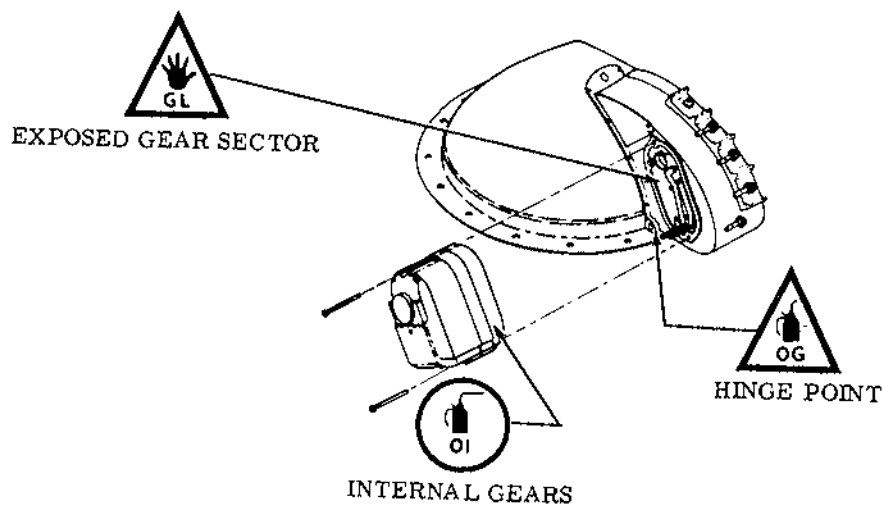
Detail **M**

LANDING LIGHT

NOTES:

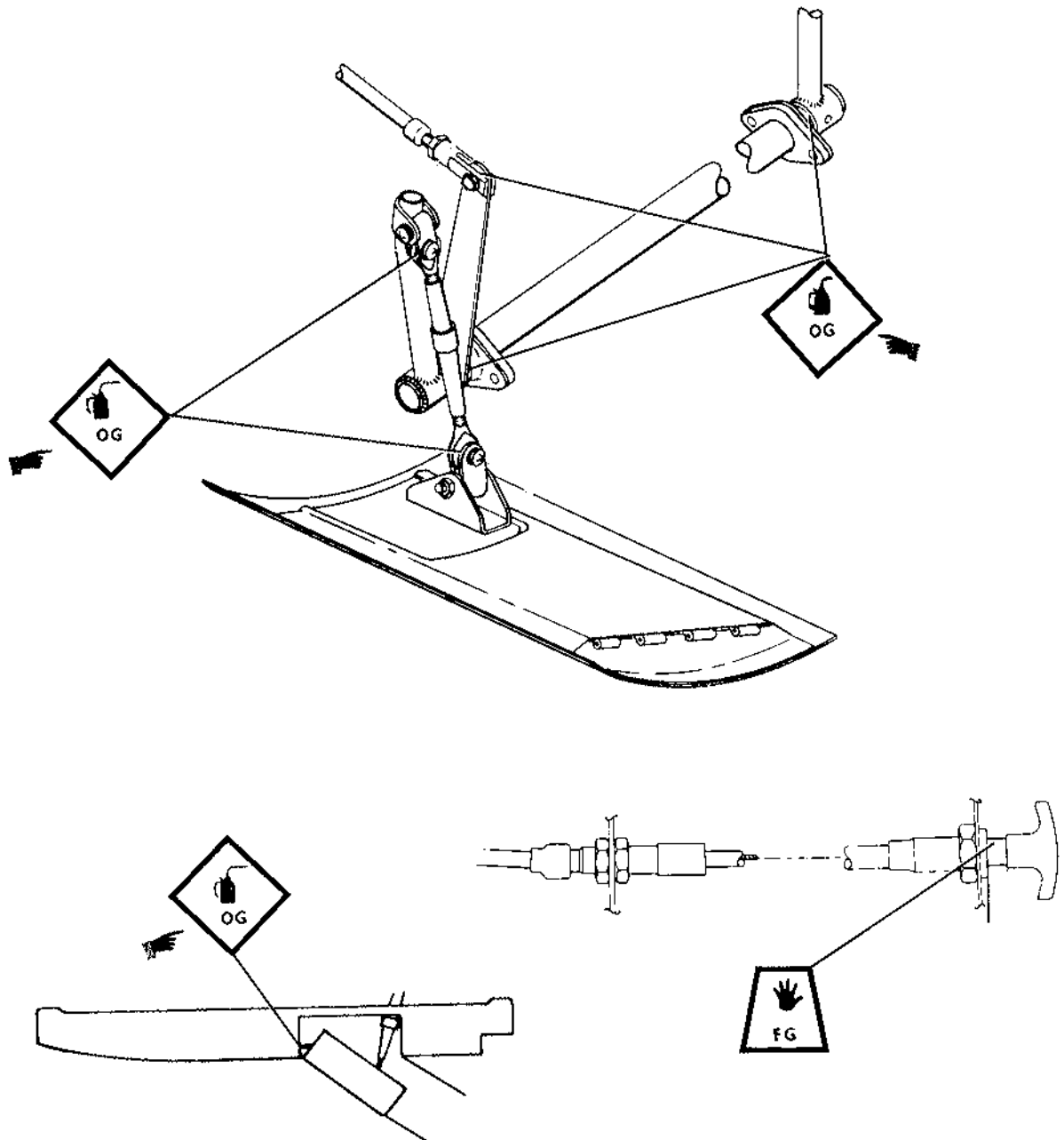
1. THE LIGHT MUST BE EXTENDED TO LUBRICATE THE LARGE SECTOR GEAR. WIPE OFF EXCESS GREASE FROM GEAR SECTOR BEFORE RE-TRACTING THE LIGHT.

2. THE OPTIONAL RIGHT WING LANDING LIGHT, IF INSTALLED, MAY BE LUBRICATED IN THE SAME MANNER.



Detail **N**

Figure 2-12. Lubrication Diagram (Sheet 13 of 15)

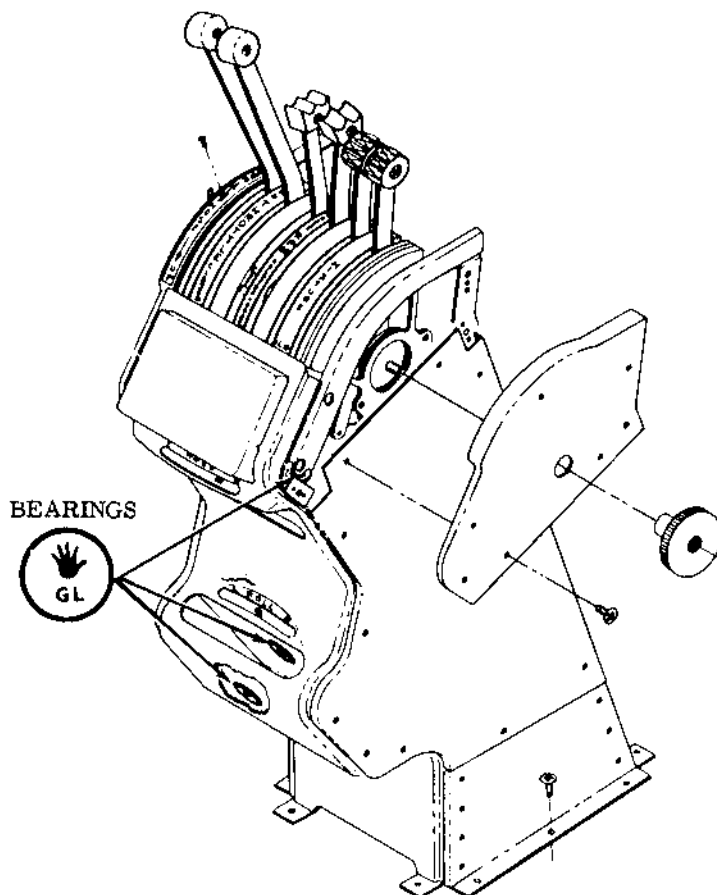
COWL FLAPS

TURBO 310P0001 AND ON

Detail

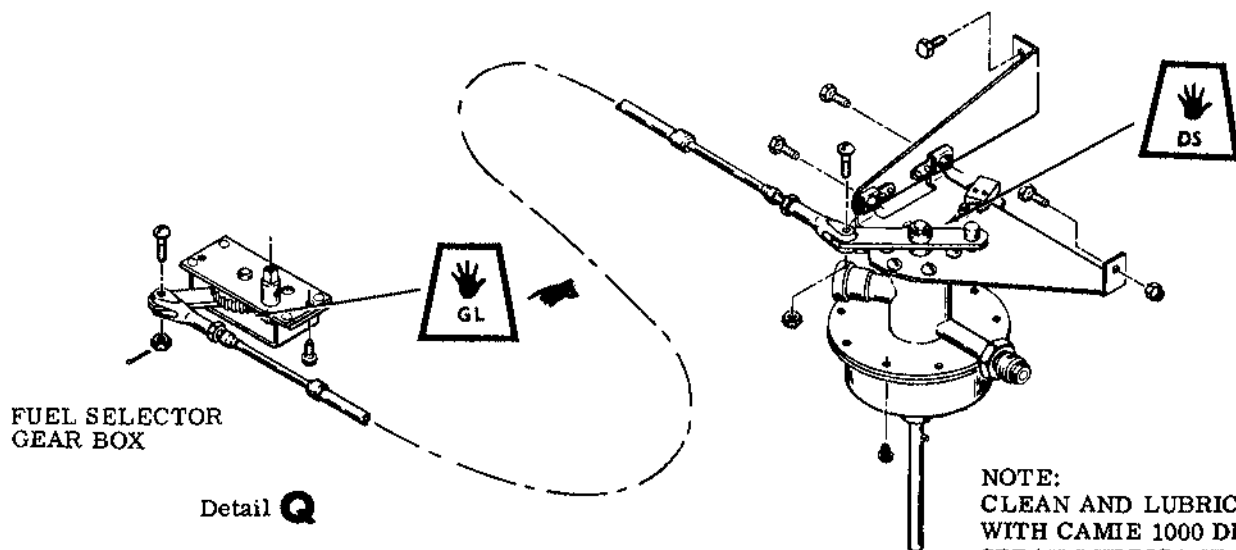
Figure 2-12. Lubrication Diagram (Sheet 14 of 15)

ENGINE CONTROL



Detail **P**

FUEL SELECTOR VALVE

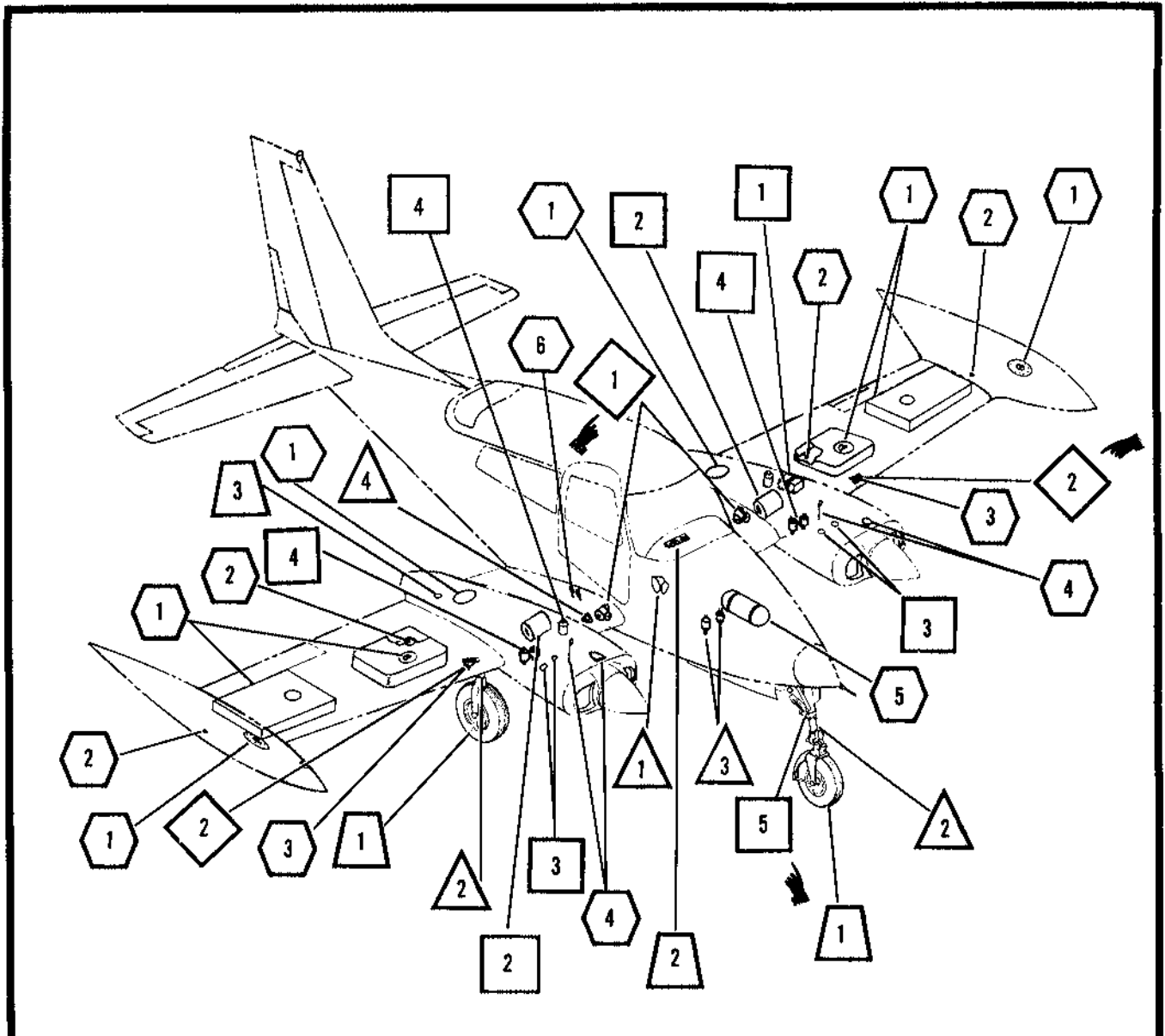


Detail **Q**

Detail **R**

NOTE:
CLEAN AND LUBRICATE
WITH CAMIE 1000 DRY
SPRAY LUBRICANT
EVERY 100 HOURS

Figure 2-12. Lubrication Diagram (Sheet 15 of 15)



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 Chart.

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 2-13. Service Chart (Sheet 1 of 3)

DAILY

- 1 FUEL TANK FILLERS:**
Service after each flight. Keep full to retard condensation in tanks. Service with 100/130 or alternate 115/145 aviation gasoline. Capacity each tip tank: 51 U.S. Gals., 42.5 Imp. Gals., or 193 Liters. Capacity each auxiliary (optional) tank: 20.5 U.S. Gals., 17.1 Imp. Gals., or 77.5 Liters and/or 11.5 U.S. Gals., 9.6 Imp. Gals. or 43.5 Liters. Capacity each wing locker (optional) tank: 20.3 U.S. Gals., 16.8 Imp. Gals., or 76.8 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 tank drain valves.
- 3 FUEL STRAINER DRAIN:**
Drain about 2 ounces of fuel from each fuel strainer before first flight each day and after refueling.
- 4 OIL DIPSTICK AND FILLER CAPS:**
Check on preflight and add oil as necessary. Do not operate on less than 9 U.S. Qts. To minimize loss of oil through breather, fill to 10 U.S. Qts. level for normal flights of less than 3 hours. For extended flights, fill to 12 U.S. Qts. If optional oil filter is installed, one additional U.S. Qt. is required when the filter element is changed. Service with aviation grade SAE 30 below 40° F, SAE 50 above 40° F. Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting, turbocharger and controller operation in cold weather. Detergent or Dispersant oil conforming to Continental Motor Specification MHS-24A must be used after the first 20 to 30 hours of new or overhauled engine operation. The aircraft is delivered from the factory with straight mineral oil. Therefore, it will be necessary during the break-in period or first 20 to 30 hours of engine operation to add straight mineral oil Military Specification (MIL-L-6082).
- 5 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.
- 6 FUEL LINE CROSSOVER DRAINS:**
Drain two (2) ounces of fuel from each valve before first flight each day.

50 HOURS

- 1 BATTERY:**
Check level of electrolyte every 50 hours or at least every 30 days, oftener in hot weather. Maintain level of electrolyte in the filler hole even with the bottom of the vent well by adding distilled water.
- 2 INDUCTION AIR FILTERS:**
Service every 50 hours or oftener when operating in dusty conditions. Under extremely dusty conditions, daily maintenance of the filter is recommended.
- 3 OIL SUMP DRAINS, OIL SCREENS, AND OPTIONAL EXTERNAL OIL FILTERS:**
After break-in oil is removed (mineral oil), change engine oil and replace filter element every 50 hours. If optional oil filter is not installed, change oil and clean screen every 20 to 30 hours. On Turbo 310 engines, replace oil filter element every 50 hours and change oil every 100 hours. Change engine oil at least every four months (turbo engines every six months) even though the above periods have not accumulated. Reduce period for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions. Always change oil and replace filter element whenever oil on dipstick appears dirty. Use caution when installing filter element so as not to overtorque.

Figure 2-13. Service Chart (Sheet 2 of 3)

50 HOURS



OIL SEPARATOR:
Clean oil breather separator.



SHIMMY DAMPER:
Check fluid level and fill as required with hydraulic fluid (Red) MIL-H-5606A.

100 HOURS



SUCTION RELIEF VALVE:
Check suction relief valve screen for dirt or obstructions. If suction gage reading appears high, remove screens and clean with compressed air or wash with Stoddard Solvent.



FUEL SELECTOR VALVE:
Clean and lubricate with Camie 1000, Dry Spray Lubricant.

200 HOURS



VACUUM SYSTEM FILTER:
Clean at 200 hours replace with new filter at 500 hours P/N C294501-0103.



SHOCK STRUTS:
Check and fill to level of filler plug with hydraulic fluid (Red) MIL-H-5606A in the collapsed position.



BRAKE MASTER CYLINDERS:
Check fluid level in reservoirs and fill as needed through plugs on master cylinder head. Fill with hydraulic fluid (Red) MIL-H-5606A.



HEATER FUEL FILTER:
Remove and wash thoroughly with unleaded gasoline.

AS REQUIRED



TIRES:
Nose wheel tire maintain 40 PSI.
Main wheel tire maintain 60 PSI.



FUEL SELECTOR VALVE GEAR BOX:
Clean thoroughly with suitable solvent, allow to air dry and lubricate, by hand, with general purpose grease.



ALCOHOL ANTI-ICE SYSTEM
Check fluid level and fill as required with isopropyl alcohol (MIL-F-5566).

Figure 2-13. Service Chart (Sheet 3)

MISCELLANEOUS SERVICE ITEMS.

Cold Weather Servicing.

If the aircraft is to be used frequently in extremely cold weather, the oil should be drained while the engine is hot and stored in a dry warm place until needed for next flight. If desired, the oil may be heated before it is poured into the engine for the next flight. Refer to Section 9 for Cold Weather Servicing of Oil Pressure Lines.

Draining Oil.

- a. Drain the oil system on each engine 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 Servicing

The standard fuel system is comprised of two main tip tanks. Each main tank has a capacity of 51.0 U.S. gallons of which 50.0 U.S. gallons are usable. Optional fuel systems include two auxiliary fuel tanks with a capacity of 20.5 U.S. gallons each tank of which 20.0 U.S. gallons are usable (310Q0001 to 310Q0601). On aircraft 310Q0601 and ON two optional fuel tanks are available with a capacity of 11.5 U.S. gallons each tank of which 11.5 U.S. gallons are usable. The optional wing locker fuel tanks in each wing have a capacity of 20.5 U.S. gallons each tank of which 20.0 U.S. gallons are usable. This provides a total usable fuel capacity of 203.0 U.S. gallons in both wings.

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. 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 and optional tanks drain valves are located outboard of the nacelle and forward of the rear spar. These drain valves are drained by pushing up on the center plunger.

Defueling.

The defueling procedures given pertain to the right wing. The procedure is the same for the left wing. A standard defueling truck or defueling pump is necessary to defuel the aircraft.

CAUTION

During all defueling, tank purging and tank repair operations, 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.

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

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 gasses 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 explosive 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.

Aircraft File:

There are miscellaneous data, information and licenses that are a part of the aircraft file.

SPECIAL TOOLS AND EQUIPMENT.

The relative simplicity and easy accessibility of 310 components eliminate 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 Service Parts Department.

Part No.	Nomenclature
0880001-1	Actuator Arm Tension Tool
2-170	Jack
SE709	Filter Adapter Wrench
SE716	Inclinometer
SE608	Motor Mount Wrench (for use with 0851559 lockwasher)
SK320-2	Unmetered Fuel Pressure Test Hookup
SK310-32	Oxygen Refill Kit - Less Bottles
0800020-1	Hoisting Lugs (Optional)
0800007-3	Screwdriver
5090006-9	Propeller Wrench
0880002-1	Cradle
0880002-2	Leveling Block
0880002-3	Hook
FT251	Reamer Tool
SK182-43	Cylinder Head Calibration Unit
0880004-1	Ring Pack Support Tool
0880004-2	Ring Pack Support Tool
1007254-101	Seal Replacement Tool Kit
1007291	Wrench Assembly
5090005-1	Alternator Hub Wrench
SK150-20	Wheel Balancer
5090002-1	Tool, Pressure Ratio Controller

COMPONENT	LOCATION
Alternate Static Source	Mounted on parking brake support bracket
Alternator and Ammeter System	
Emergency Switch	Circuit breaker panel
Emergency Field Fuse	Circuit breaker panel
Overvoltage Relay	Mounted on front spar under copilot's seat
Voltage Regulators	Under copilot's seat
Field Fuse	Circuit breaker panel
Alternator Fail Light Diode	In wire bundle approximately 15 inches from end of bundle
Alternator Filter Capacitor	Mounted on forward or outboard side of alternator
Alternator Fail Module	Mounted on forward or outboard side of alternator
Alternator Fail Light	Stationary instrument panel left of flap position indicator
Ammeter	Stationary instrument panel
Fuse	In each wing root junction box
Shunt	Wing root LH (2), RH (1)
Autopilot	
Pressure Switches	Inboard RH and LH engine nacelle elbow fitting
Solenoid Valve	In aft engine compartment
Filter Element	In pressure line aft of F. S. 132.00
Battery Solenoid	Left engine nacelle firewall
Cigar Lighter Resistor	0.00 Bulkhead forward of instrument panel
Fuse	0.00 Bulkhead forward of instrument panel
Deice System Wing	
Control Box	RH side of fuselage forward of instrument panel
Control Switch	Glare shield switch panel
Filter	In each engine nacelle on firewall
Pressure Switch	Under floorboards aft of front spar LH side of aircraft
Deice Propeller	
Timer	Upper shelf LH nose
Engine	
Cylinder Head Temperature Bulb	Under number three cylinder of each engine
EGT Probe	In exhaust stack aft of risers
Oil Dilution Solenoid	On firewall in RH nacelle
Oil Temperature Bulb	Aft side of engine under oil cooler
Tachometer Generator	Accessory drive aft on engine
External Power Receptacle	Underside of LH wing outboard of nacelle
Elevator Trim Actuator	In tailcone F. S. 154.00
Flap System	
Position Indicator	Stationary panel next to flap switch
Limit Switches	On bracket mounted on flap actuator
400A Autopilot Resistor	On bracket on flap actuator
Flap Actuator	Under floorboard aft of rear spar
Flight Hour Recorder	
Actuator Switch	Belly of aircraft forward of front spar
Fuse	310Q0201 and On landing gear safety switch
Finish and Trim Plate	In wire bundle
Fuel System	
Drain Valves	Forward left side of nose wheel well web
Boost Pump Relays	Wing gap area and under each fuel tank
Transfer Pump	Wing root (LH and RH)
Pressure Switch	Mounted on rib outboard of engine nacelle
Selector and Strainer	Engine nacelle aft side of engine
Signal Conditioner	Outboard of engine nacelles in wing leading edge
310Q0601 and ON	Located in the aft portion of fuel quantity indicator
Tank Vent Heaters	Located outboard of each nacelle in wing
Wing Locker Transfer Pump	End of vent lines below fuel tanks
	Outboard of engine nacelle

Figure 2-14. Components and Location Chart (Sheet 1 of 3)

COMPONENT	LOCATION
Heater	
Filter and Solenoid	Right wing
Igniter Plug	Located in heater combustion chamber
Warning Relay	Right side of nose wheel well next to heater
Shutoff Valve	Right wing gap area
Thermostat	Inside ducting in right nose
Fuel Pump	On fuel pump motor
Inverter	Mounted forward of instrument panel $\mathcal{L}$ of aircraft
Junction Box	
Left	Left side of cabin, floor level, F. S. 100.00 back of upholstery panel
Right	Right side of cabin, floor level, F. S. 100.00 back of upholstery panel
Landing Gear	
Actuator and Motor	Between front and rear spar under floorboard (LH side)
Limit Switch (Down)	Top of landing gear actuator
Limit Switch (Up)	Top of landing gear actuator
Actuator Relays	Aft of actuator under floorboards
Safety Switch	Left landing gear strut
Nose Indicator Switch (Up)	Mounted on up lock torque tube
Nose Indicator Switch (Down)	Mounted on nose gear retracting linkage
Left Indicator Switch (Down)	Mounted on left side brace lock link
Right Indicator Switch (Down)	Mounted on right side brace lock link
Lighting	
Landing	Tip tank tail cap
Strobe Light	Forward tip tank nose and tail cone
Strobe Light - Power Units	In tailcone area
Wing Walkway Light	Right side of fuselage under cabin door
Courtesy Light Switch	Below baggage door stop
Wing Locker Baggage Light	Baggage nacelle wall
MAA Plate	Aft side of forward cabin door post
Propeller	
Synchronizer Actuator	Mounted in aft portion of RH nacelle
Control Box	Mounted on glove box RH side
Unfeathering Accumulator	Mounted on outboard side engine mount
Starter	Aft side of engine
Solenoid	LH engine nacelle
Vibrator	LH panel brace forward of instrument panel
Terminal Blocks	
TB5 (Optional)	Mounted on aft side of stereo
TB14 (Engine Instr. Lts.)	Forward of instrument panel at $\mathcal{L}$ of aircraft
TB15 (Flight & Radio)	Forward of instrument panel left of $\mathcal{L}$ of aircraft
TB16 (Electroluminescent)	Forward of instrument panel at $\mathcal{L}$ of aircraft

Figure 2-14. Components and Location Chart (Sheet 2 of 3)

Tow Bar	.	.	.	.	.	.	.	Stored in RH wing locker
Vacuum System								
Filter	.	.	.	.	.	.	.	Forward 0.00 bulkhead $\frac{1}{2}$ of aircraft
Regulator	.	.	.	.	.	.	.	In wing gap area
Windshield (Heated)								
Relay	.	.	.	.	.	.	.	Upper shelf (LH nose section)
Control	.	.	.	.	.	.	.	Upper shelf (LH nose section)
Warning Horn	.	.	.	.	.	.	.	0.00 Bulkhead forward of instrument panel
Zener Diode (Stereo) (1ZM13T5)	.	.	.	.	.	.	.	Located on glove compartment aft side

Figure 2-14. Components and Location Chart (Sheet 3 of 3)

AIRFRAME

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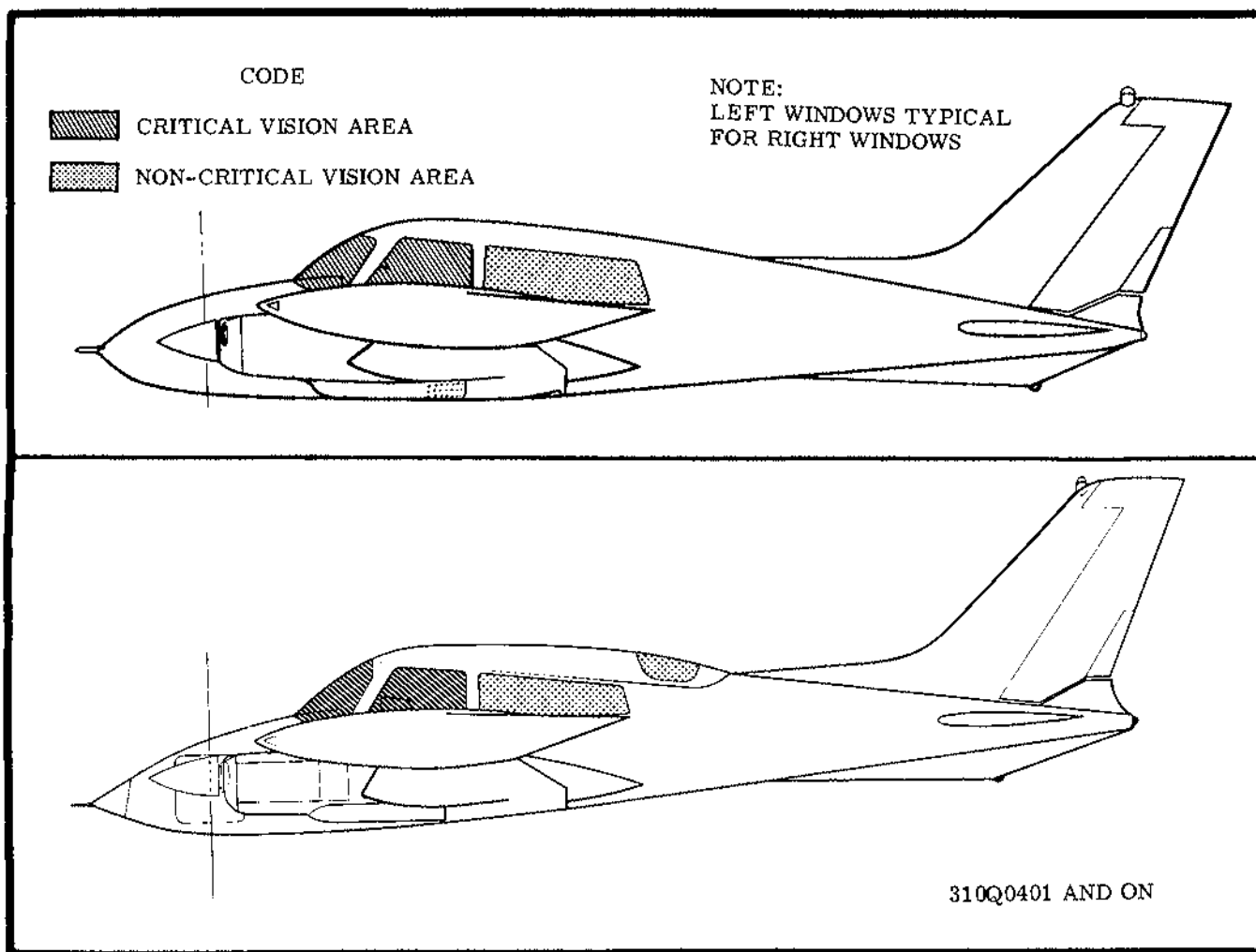


Figure 3-1. Critical Vision Areas

FUSELAGE

Windshield and Windows.

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.	0.076 inch.	0.032 inch.
Frequency.	None.		2 per sq. ft.	2 per sq. ft.	1 per sq. ft.

Plastic Windows Inspection Criteria (Continued).

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 per area.	20% of total area.	Total length of scratches equals 3 times longest dimension of area.
CRACKS.				
Length.	Cracks originating at mounting holes or edge of glass and progressing into C.V. area must not exceed 1 inch.	None.	6.00 inches.	None.
Frequency.	12 inches total per area.	None.	12 inches total per area.	None.
CRAZING.				
Slight.	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 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.

Removal of Windshield. (310P0001 to 310Q0401.)
(See figure 3-2.)

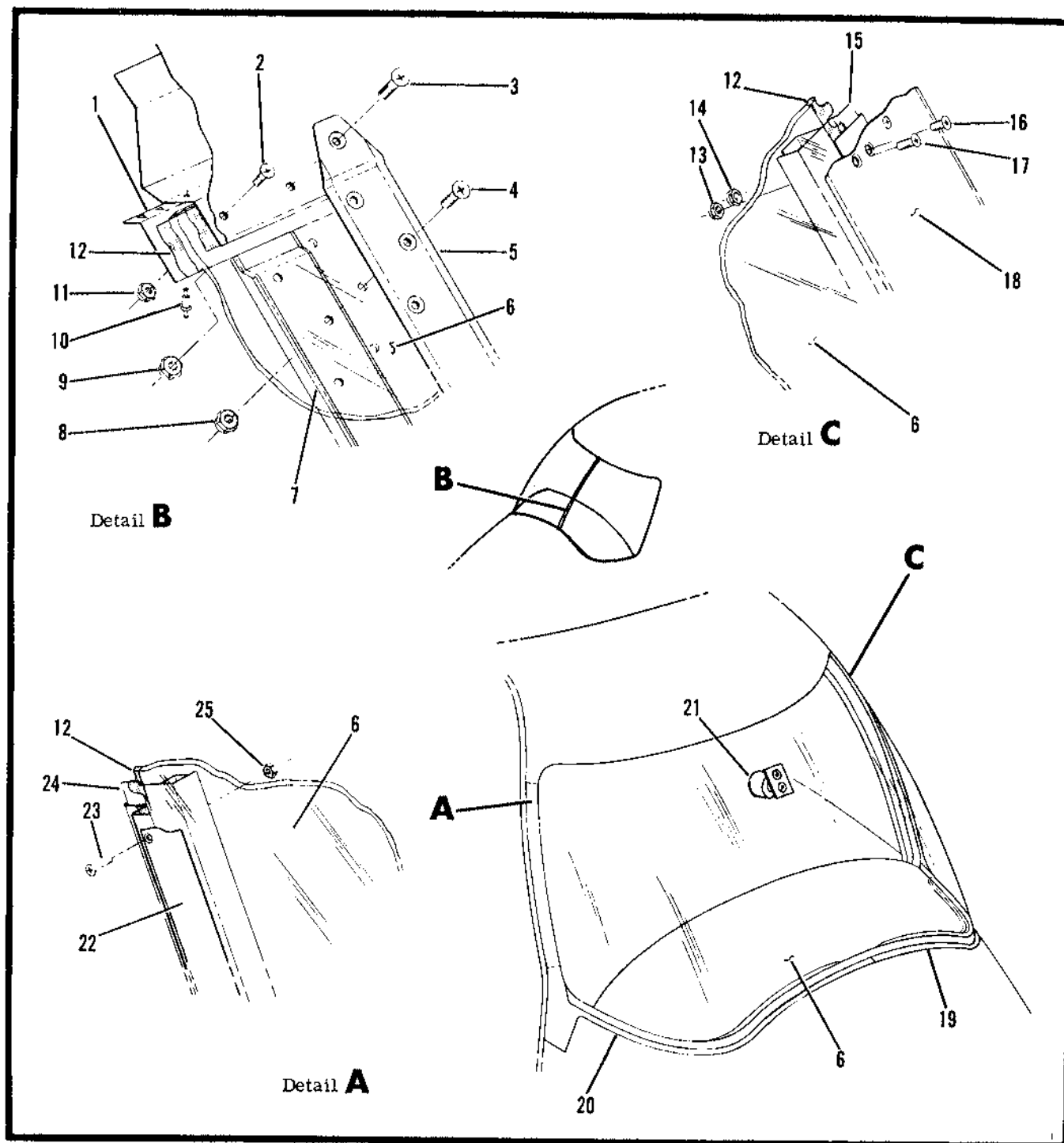
- a. Remove magnetic compass (21).
- b. Remove left, right and upper windshield upholstery trim panels in accordance with upholstery trim removal procedures.
- c. Remove headliner from upper edge of windshield in accordance with upholstery trim removal procedures.
- d. Remove Cherry Rivets (10) and screws (2) from windshield upper retainer.
- e. Remove nuts (11) and screws (2) from windshield upper retainer.
- f. Drill rivets out of left outside retainer (19) and right outside retainer (20).
- g. Remove left skin (18) by removing nuts (13 and 14) and screws (16 and 17).

- h. Remove right skin (22) by removing nuts (25) and screws (23).

- i. Remove windshield (6) from aircraft.
- j. If optional Heated Windshield is installed, follow steps a. through i., plus the removal of nuts (8 and 9), and screws (3 and 4) and windshield center stiffeners (5 and 7).

Installation of Windshield. (310P0001 to 310Q0401.)
(See figure 3-2.)

- a. Place seal tape (12) on windshield edges and apply sealing compound (Presstite Engineering Co., No. 579.6) on all edges of the windshield and retainers.
- b. Position windshield (6) and upper retainer (1). Temporarily fasten in place.

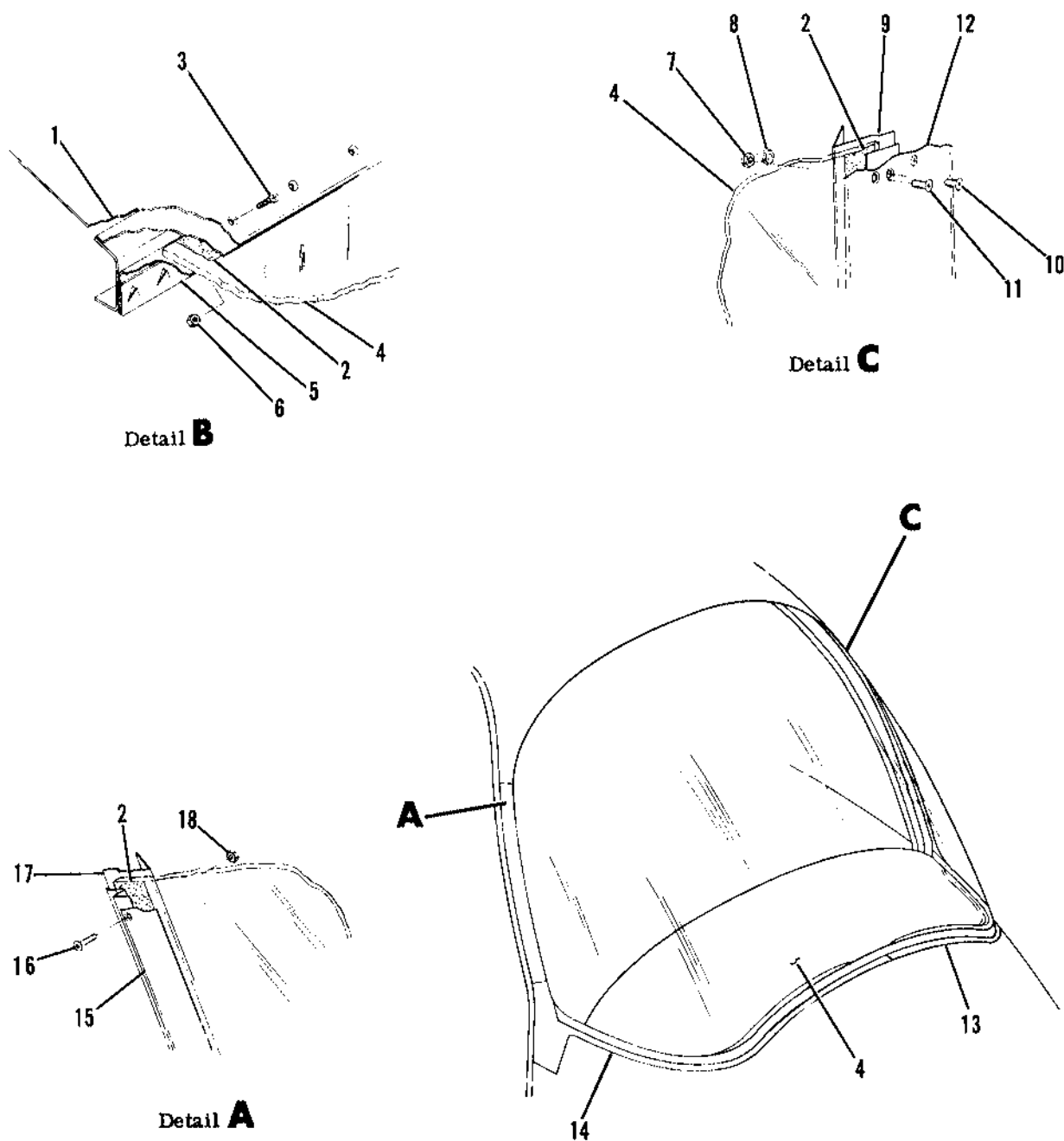


1. Inside Upper Retainer
2. Screw
3. Screw
4. Screw
5. Outside Center Stiffener
6. Windshield Panel
7. Inside Center Stiffener
8. Nut
9. Nut

10. Cherry Rivet
11. Nut
12. Tape
13. Nut
14. Nut
15. Left Inside Retainer
16. Screw
17. Screw

18. Left Skin
19. Left Outside Retainer
20. Right Outside Retainer
21. Magnetic Compass
22. Right Skin
23. Screw
24. Right Inside Retainer
25. Nut

Figure 3-2. Windshield Assembly



310Q0401 AND ON

1. Cabin Skin	7. Nut	13. Left Outside Retainer
2. Seal Tape	8. Nut	14. Right Outside Retainer
3. Screw	9. Left Inside Retainer	15. Right Skin
4. Windshield	10. Screw	16. Screw
5. Upper Retainer	11. Screw	17. Right Inside Retainer
6. Nut	12. Left Skin	18. Nut

Figure 3-2A. Windshield Installation

- c. Position right skin (22) and left skin (18). Temporarily fasten in place.
- d. Install left inside retainer (15) and right inside retainer (24).
- e. Fasten right and left retainers (19 and 20) in place with temporary fasteners. Secure in place with MS20365-4 rivets.

NOTE

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

- f. Secure left skin (18) and right skin (22) with screws (16, 17 and 23) and nuts (13, 14 and 25).
- g. Secure inside upper retainer (1) with screws (2), nuts (11) and cherry rivets (10).
- h. Install magnetic compass.
- i. Install headliner assembly in accordance with installation of upholstery procedures.
- j. Install windshield upholstery trim panels in accordance with installation of upholstery procedures.
- k. If optional Heated Windshield is installed, follow steps a. through f., plus aligning inside (7) and outside (5) metal stiffeners and secure with screws (3 and 4) and nuts (8 and 9). Complete steps h. through i., after installing center stiffeners.

Removal of Windshield. (310Q0401 and On.) (See figure 3-2A.)

- a. Remove left and right windshield upholstery trim in accordance with upholstery trim removal procedures.
- b. Remove nuts (6) and screws (3) from windshield upper retainer.
- c. Drill rivets from left outside retainer (13) and right outside retainer (14).
- d. Remove left inside retainer by removing nuts (7 and 8) and screws (10 and 11).
- e. Remove right retainer (17) by removing nuts (18) and screws (16).
- f. Remove windshield from aircraft.

Installation of Windshield. (310Q0401 and On.) (See figure 3-2A.)

- a. Place seal tape (2) on windshield edges and apply sealing compound (Presstite Engineering Co., No. 579.6) on all edges of the windshield and retainers.
- b. Insert upper edge of windshield between retainer (5) and cabin skin (1) until screw holes are aligned.
- c. Temporarily fasten right skin (15) and left skin (12) in place.

- d. Install right inside retainer (17) and left inside retainer (9).
- e. Secure left skin (12) and right skin (15) with screws (10, 11 and 16) and nuts (7, 8 and 18).
- f. Install screws in upper cabin skin, windshield and inside retainer (5).
- g. Install retainers (13 and 14) and secure with MS20365 rivets.

NOTE

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

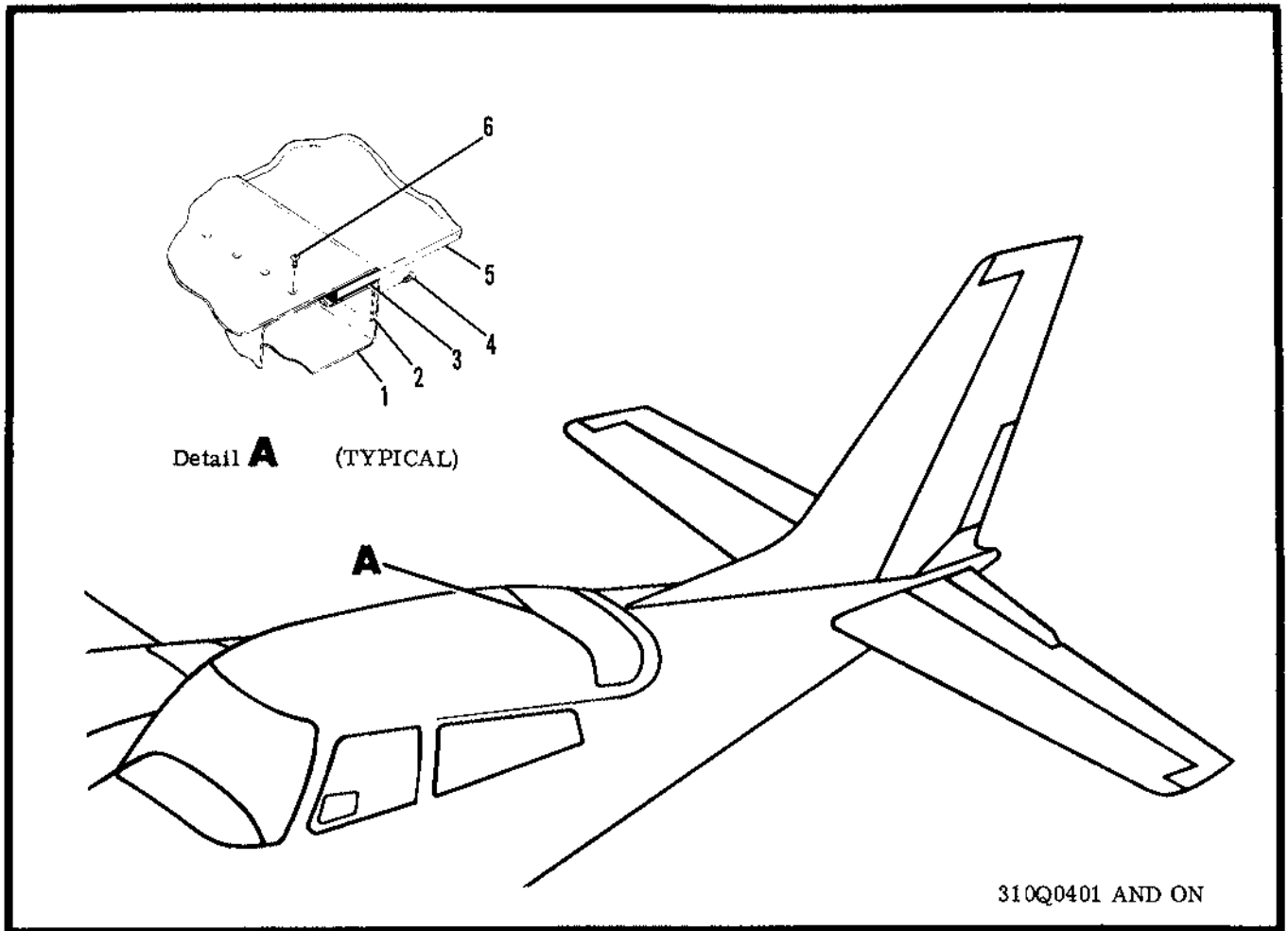
- h. Install interior trim in accordance with upholstery installation procedures.

Removal and Installation of Omni Window. (See figure 3-2B.)

- a. Remove window trim (1) by removing screws (4).
- b. Drill out rivets (6) securing retainer (2) to cabin skin and remove window.
- c. When replacing seal (3), make splice joint at forward center of window (5).
- d. Installation of omni window is reversal of removal procedures.

Heated Windshield.

The electrically heated windshield (optional equipment) is provided to maintain the pilot's windshield at predetermined temperature level. A temperature controller, relay, circuit breakers, switch, light assembly, and necessary wiring make up the electric windshield system. The temperature controller and relay are mounted on the timer shelf in the LH nose section, while the switch and circuit breakers are located on the instrument panel. When the switch is actuated to the ON position, the controller senses the windshield temperature, should the windshield temperature not be within the selected controller temperature setting ($100 \pm 10^\circ\text{F}$), the relay will close and supply power to the heating elements embedded in the windshield. An external adjusting potentiometer on the controller is provided to allow the selection of desired operating temperature. To prevent the rapid on and off cycling during cold operating temperatures, the controller allows the windshield to vary 10 degrees above and below the setting on the potentiometer. When the temperature of the windshield rises to the upper limit of 110°F , the relay will de-energize and power will be removed from the heating element.



- 1. Window Trim
- 2. Retainer

- 3. Seal
- 4. Screw

- 5. Window
- 6. Rivet

Figure 3-2B. Omni Window Installation

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Troubleshooting Heated Windshield.

TROUBLE	PROBABLE CAUSE	CORRECTION
WINDSHIELD WILL NOT HEAT	Open circuit.	Reset circuit breaker.
	Defective relay.	Replace relay.
	Defective temperature controller.	Replace temperature controller.
	Loose or faulty wiring.	Check, tighten or replace wiring.
	Defective switch.	Replace switch.
	Defective windshield sensing element.	Replace windshield.
WINDSHIELD HEATS CONTINUOUSLY	Defective relay.	Replace relay.
	Defective temperature controller.	Replace temperature controller.
	Defective windshield sensing element.	Replace windshield.

Removal of Heated Windshield.

- Disconnect electrical wiring to magnetic compass. Remove screw, nut and compass.
- Tag and disconnect windshield wiring.
- Remove windshield in accordance with removal procedures.

Installation of Heated Windshield.

- Install windshield in accordance with installation procedures.
- Connect wiring and remove tags.
- Install magnetic compass and connect wiring.
- Check operation of heated windshield.

Removal and Installation of Heated Windshield Components. (See figure 3-3.)

- Tag electrical wires, remove temperature controller (1) from timer shelf (2) by removing four attaching screws and nuts.
- Tag electrical wires, remove relay (3) from timer shelf by removing two attaching screws and nuts.
- To install heated windshield components, reverse the above procedures.

Removal and Installation of Picture Windows. (See figure 3-4.)

- Remove window trim panels (6, 7, 10 and 13).
- Remove wire tunnels.
- Remove inboard window panel (3) by removing aft support (8) and removing three attaching screws.

- Remove inboard window panel (3) from supports (5, 11 and 14).

- Remove outboard window (2) by removing upper support (5) and lower support (11) from fuselage structure by removing attaching screws.

- Remove forward support (14) and trim retainer (15) by removing attaching screws and nuts.

- Remove upper and lower retainers (4 and 12) by removing attaching screws.

- Remove aft retainer (9) by removing attaching screws.

- Remove outboard window pane (2) from window frame.

- Install picture windows by reversing procedures outlined in steps a thru i.

Emergency Exit Window.

The emergency exit or pilot's window is a single window located on the left forward side of the cabin. This window consists of a plastic panel with an integrally mounted foul weather window. The emergency exit window is mounted inside a spot-welded and riveted frame assembly. This frame assembly is secured to the main fuselage structure by four catch assemblies and three clips. When the emergency release pull ring is pulled, the cable assemblies release the frame assembly from the fuselage structure, thereby, the frame assembly can be pushed clear of the structure. Operating instructions are contained on a decal located on the window panel.

Removal of Emergency Exit Window. (See figure 3-5.)

- Remove window post trim, lower, upper and forward window trim in accordance with upholstery trim removal procedures.

- b. Remove emergency exit window by removing release cover (20) and actuating release ring (21) thus releasing cable ends (15) from latch assemblies (16).
- c. Supporting emergency exit window, push outwards until pivot pins (8) and clips (10) clear fuselage structure.

Installation of Emergency Exit Window. (See figure 3-5).

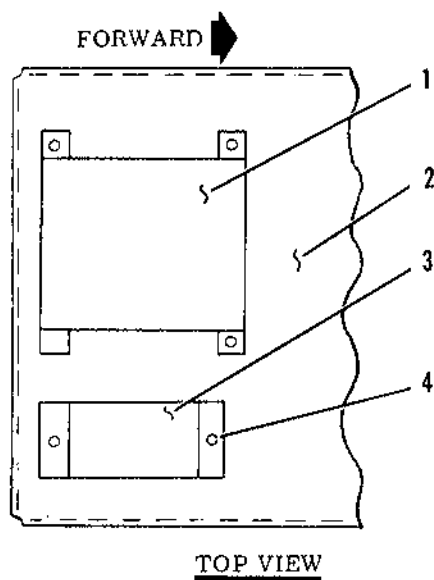
NOTE

Before installing emergency window, replace four clips (10).

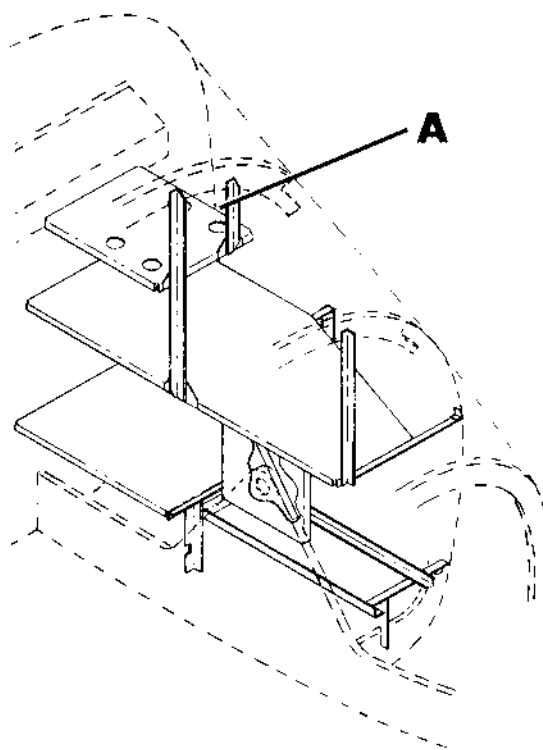
- a. Hold emergency window assembly at a slight angle, engage pivot pins (8) into fuselage structure and position window in fuselage frame.

NOTE

Pivot rings (8) are provided with adjustable mountings. Normally the pivot pins settings are not disturbed during emergency window removal. If pivot pin settings were disturbed, it will become necessary to realign them upon installation. This is accomplished by loosening the four screws in the mounting plate.



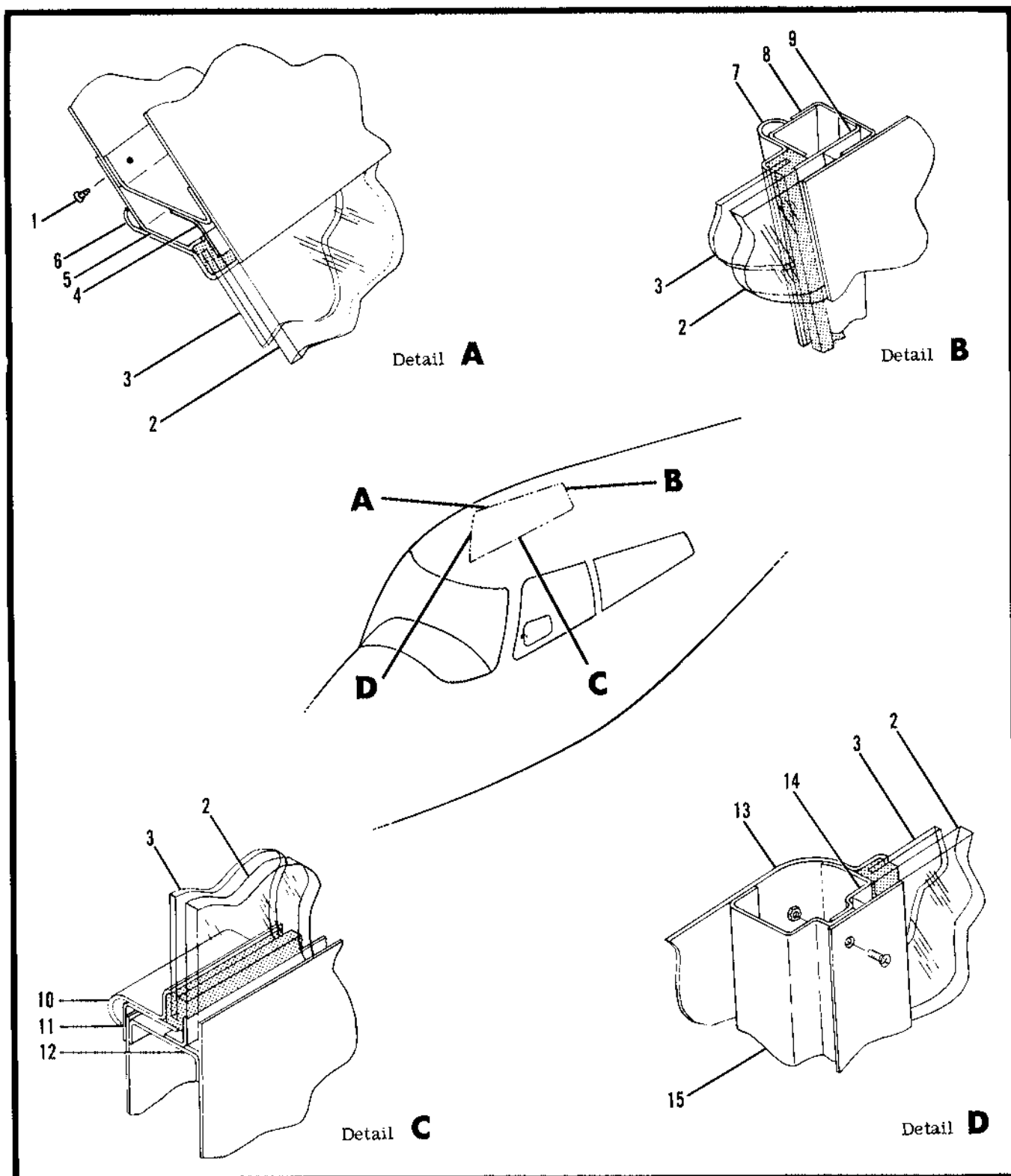
Detail **A**



- 1. Temperature Controller
- 2. Timer Shelf

- 3. Relay
- 4. Screw and Nut

Figure 3-3. Heated Windshield Components Installation

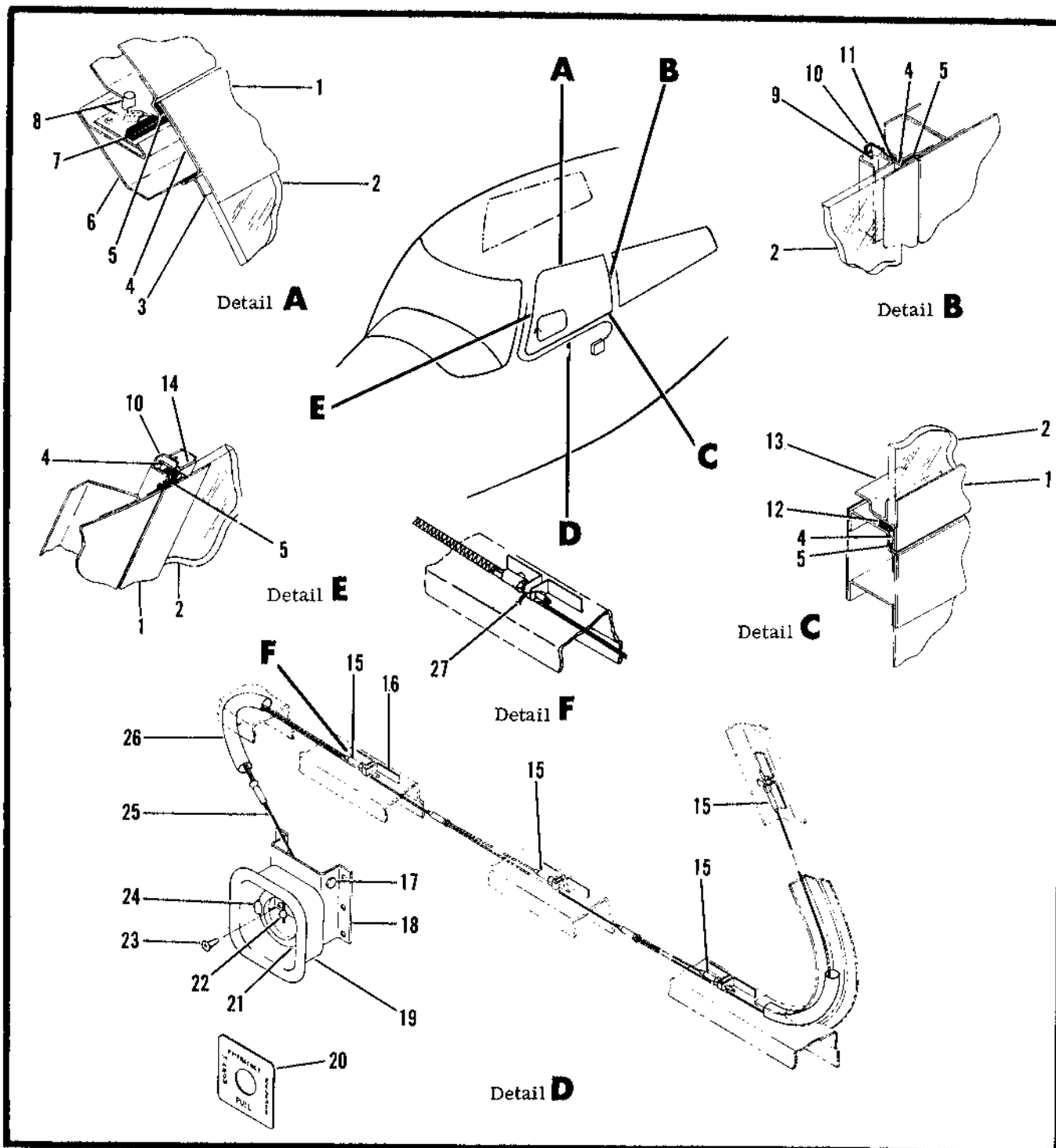


1. Screw
2. Outboard Window Panel
3. Inboard Window Panel
4. Upper Retainer
5. Upper Support

6. Upper Window Trim
7. Aft Window Trim
8. Aft Support
9. Aft Retainer
10. Lower Window Trim

11. Lower Support
12. Lower Retainer
13. Forward Window Trim
14. Window Trim Support
15. Forward Trim Retainer

Figure 3-4. Picture Window Installation



1. Window Skin
2. Pilot's Glass Assembly
3. Retainer (Upper)
4. Support (Glass Assembly)
5. Seal (Outer)
6. Retainer
7. Seal (Upper)
8. Pivot Pin Assembly
9. Retainer (Aft)

10. Clip
11. Seal (Aft)
12. Seal (Lower)
13. Retainer (Lower)
14. Retainer (Forward)
15. Cable Assembly End
16. Latch Assembly
17. Flat Head Pin
18. Hat Section

19. Window Release Pan
20. Window Release Cover
21. Window Release Ring
22. Truloc Ball
23. Screw
24. Ring Clip
25. Cable Assembly
26. Guide Tube
27. Safety Wire

Figure 3-5. Pilot's and Emergency Exit Window Installation

and positioning emergency window in fuselage frame aligning the pivot pin with hole. Scribe an index mark along edge of mounting plate after alignment is achieved. Remove emergency window from fuselage and tighten mounting plate along scribe line with the four attaching screws. Several adjustments may become necessary before positive alignment is achieved.

b. Position a man outside the emergency exit window to apply pressure on the frame at each point while cable end assemblies (15) are being inserted through latch assemblies (16). Safety cable end assemblies (15) in place using .011 copper safety wire. Only a single strand of safety wire should be used.

CAUTION

The barrel on aft emergency window cable end assembly (15) must be housed inside guide tube (26) or serious binding may result.

- c. Using a rubber mallet, bend exposed tab of clip (10) over fuselage window frame.
- d. Install release ring (21) into clip (24) and replace cover (20).
- e. Install forward window trim, upper, lower, and window post trim in accordance with upholstery trim installation procedures.
- f. Using an aerodynamic sealant (579-6 sealer-extruded) pack entire joints of edge of emergency exit window assembly opening trim. Wipe off and remove all excess 579-6 sealer from exterior of emergency exit window assembly and trim. Mix (Bondtite BTC 20 Aerodynamic smoother and apply a light coat on outer perimeter joints of emergency exit window. This smoother should not overlap the joint by more than 1/10 of an inch, nor should it be more than .02 of an inch in depth. After smoother has cured, sand lightly to fair in edges. Repaint all surfaces affected as required.

Emergency Exit Window Release Mechanism.

The emergency release mechanism is located in the left rear upholstery panel, just aft of and below the emergency exit window. A red pull ring is secured in the royalite trim pan assembly, covered and identified by an instructional plastic cover. A finger size center hole in the plastic cover can be quickly grasped to include the pull ring when an emergency condition exists. The cover decal reads: EMERGENCY WINDOW RELEASE, PULL. When the pull ring is pulled, the catch assembly is released and the window then can be pushed free.

Removal and Installation of Emergency Window Release Mechanism. (See figure 3-5.)

- a. Remove window post trim, lower, upper, and forward window trim in accordance with upholstery trim removal procedures.
- b. Remove pilot's seat in accordance with seat

removal instructions.

- c. Remove ash tray and wemac in accordance with upholstery removal procedures.
- d. Remove cover (20) from pan assembly (19).
- e. Remove pull ring (21) by removing ball (22) from cable assembly (25).
- f. If removal of cable assembly (25) is necessary, remove the following items:
 - 1. Remove upholstery side panel in accordance with upholstery removal procedures.
 - 2. Remove safety wire and disengage cable end assemblies (15) from latch assemblies (16).
 - 3. Remove window release pan (19) and ring clip (24) by removing screws (23).
 - 4. Remove flat head pin (17) and route cable assemblies (25) through hat section (18).
- g. Install emergency window release mechanism by reversing procedures a thru f and 1 thru 4.
- h. Safety cable end assemblies (15) using .011 copper safety wire. Only a single strand of safety wire should be used.

NOTE

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

Removal and Installation of Foul Weather Window. (See figure 3-6.)

- a. Tape or mask pilot's window as necessary to protect the plexiglass during removal and installation of hinge pin (7).
- b. Remove nuts (6), washer (10), spring (9), and hinge pin (7) and remove foul weather window (3) from pilot's window (11).

CAUTION

When removing or installing foul weather window, use foul weather window spring tool, Part Number 5090003 to prevent spring from accidentally damaging pilot's window.

- c. Refer to illustration for further disassembly and assembly of the foul weather window.

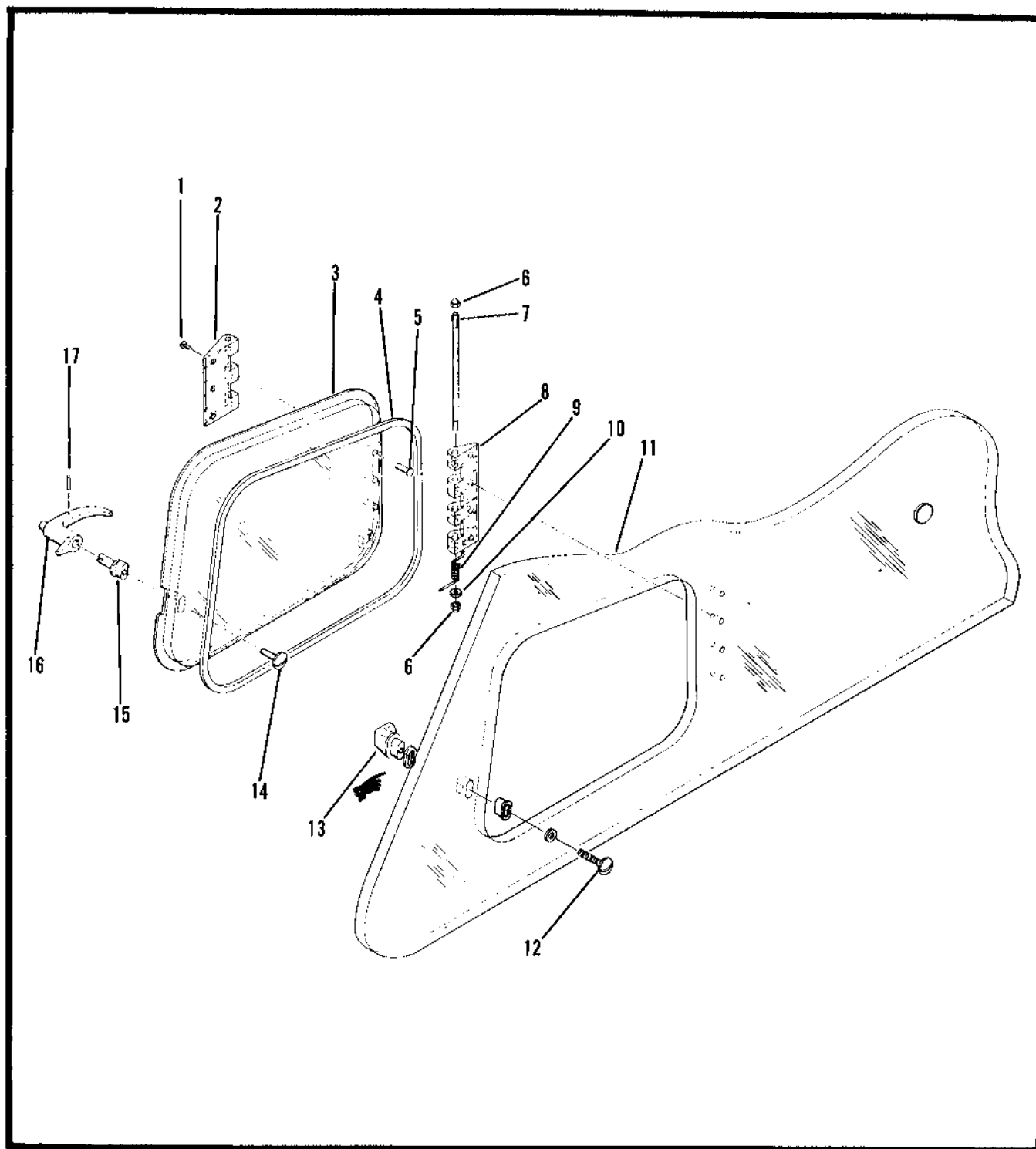
NOTE

If seal (4) is being replaced, bond to foul weather window (3) using Eastman 910 adhesive (Armstrong Cork Company, Lancaster, Pennsylvania, or equivalent).

DOORS.

Removal of Cabin Door. (See figure 3-7.)

- a. With the cabin door open and supported, remove screw, washer, spacer and washer securing door stop strap assembly (12) to fuselage.
- b. Remove cotter pins securing hinge pins (18).
- c. Remove hinge pins (18) by pulling pins through

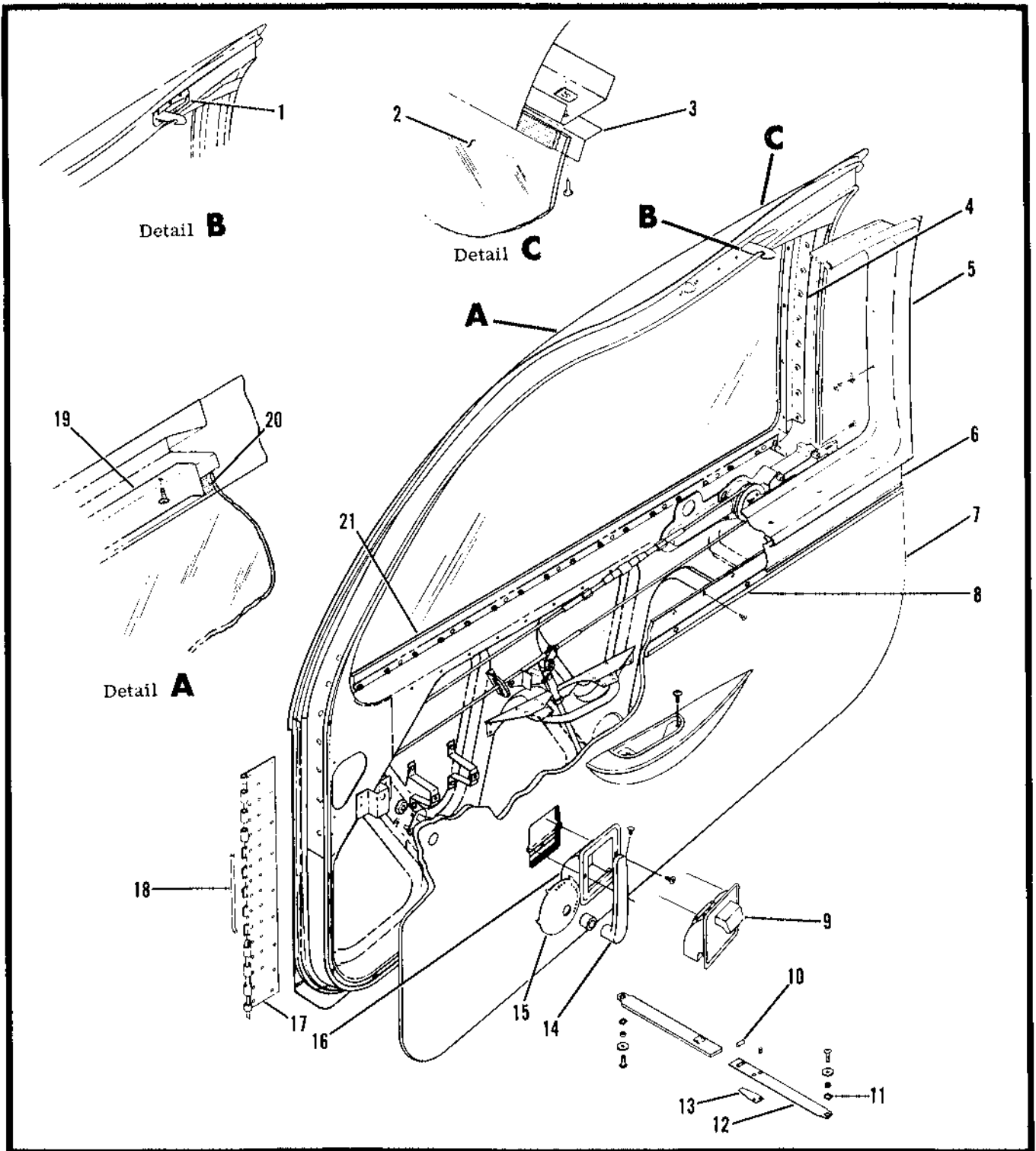


1. Screw
2. Hinge Half
3. Foul Weather Window
4. Seal
5. Screw Post
6. Nut

7. Pin
8. Hinge Half
9. Spring
10. Washer
11. Pilot's Window

12. Screw
13. Hook
14. Screw
15. Stud
16. Handle
17. Roll Pin

Figure 3-6. Foul Weather Window Installation



1. Escutcheon Latch Plate
2. Cabin Door Window Panel
3. Upper Window Retainer
4. Aft Window Retainer
5. Window Trim Panel
6. Trim Pad
7. Upholstery Panel

8. Upholstery Retainer
9. Ash Receiver
10. Door Stop Roller
11. Shake Proof Spring Washer
12. Strap Assembly
13. Spring Clip
14. Handle

15. Escutcheon Plate
16. Ash Receiver Adapter
17. Hinge Half
18. Hinge Pin
19. Window Retainer
20. Tape
21. Lower Retainer

Figure 3-7. Cabin Door Installation

hinge halves (17).

d. Remove the door from the aircraft.

Disassembly of Cabin Door. (See figure 3-7.)

- a. Remove door stop strap assembly from cabin door by removing screws, washers and spacers.
- b. Press escutcheon plate (15) enough to permit removal of setscrew securing door handle (14).
- c. Pull off inside door handle (14) from door and remove escutcheon plate (15).
- d. Remove trim pad (6) and retainer pad (8).
- e. Remove window trim panel (5) by removing screws and washers.
- f. Remove screws securing upholstery panel (7).
- g. Remove window lower retainer (21) by removing attaching screws and nuts.
- h. Remove window lower retainer.

i. Remove window forward retainer (19) by removing attaching screws.

j. Remove window upper retainer (3) by removing attaching screws and remove cabin door window (2).

Assembly of Cabin Door. (See figure 3-7.)

a. To assemble cabin door, reverse disassembly procedures.

Installation of Cabin Door. (See figure 3-7.)

- a. Install cabin door by reversing removal procedures.
- b. If a replacement cabin door is being installed, it may become necessary to carefully trim the edges of the door skin to achieve a good fit.

Troubleshooting Chart of Cabin Door Latch Assemblies.

TROUBLE	PROBABLE CAUSE	CORRECTION
DOOR LATCHES OPERATE TOO TIGHTLY	Tension wrong on linkage rods.	Adjust rods.
	Idler Assembly binding.	If bent, replace.
	Wrong spring.	Replace spring.
	Bayonet assembly binding.	Repair or replace.
	Teleflex clevis too tight.	Adjust clevis gap.
DOOR FAILS TO LATCH PROPERLY	Spring broken.	Replace spring.
	Linkage rod broken.	Replace linkage rod.
	Improper lubrication.	Lubricate.
	Bolt broken	Replace bolt.
	Spring broken.	Replace spring.
CASE AND HANDLE ASSEMBLY FAILS TO OPERATE PROPERLY	Pin broken.	Replace pin.
	Plate loose.	Check screws.
	Broken pin.	Replace pin.
BAYONET ASSEMBLY FAILS TO OPERATE	Linkage too tight.	Adjust linkage.
	Bellcrank broken or bent.	Replace bellcrank.

Removal of Cabin Door Latch Assemblies. (See figure 3-8.)

- a. Remove cabin door in accordance with cabin door removal procedures.
- b. Disassemble cabin door in accordance with disassembly procedures.
- c. Disconnect teleflex cable clevis (16) from upper latch assembly (18) by removing cotter pin, washer (17), and pin (19) attaching clevis to upper latch idler

bellcrank assembly (12).

d. Remove upper latch assembly (18) by removing attaching screws (20).

e. Remove cable assembly (23) from door latch pulley assembly (56).

f. Remove screws (21) from lower latch assembly (22). Remove lower latch assembly (22).

g. Remove cable assembly (23) by removing turn-buckle (63), pin (62), washer and cotter pin.

h. Remove the handle (26) by removing screw (25).

- i. Remove door handle plate (29) and slip cables (60 and 61) from pulley (31). Remove cables.
- j. Remove cotter pin (34) and remove latch cable (15).
- k. Remove nut (36) and slip arm assembly (33) from the door.
- l. Remove cotter pin and nut, slip bayonet assembly (24) from the door.

Disassembly and Assembly of Cabin Door Latch Assemblies. (See figure 3-8.)

- a. If further disassembly of latch assembly is necessary for repairs and/or replacement of components, use figure 3-8 as a guide for disassembly sequence.
- b. Assemble latch assemblies using figure 3-8 as a guide for assembly sequence.

Installation of Cabin Door Latch Assemblies. (See figure 3-8.)

- a. Install cabin door latch assemblies by reversing removal procedures.

Removal of Baggage Door. (See figure 3-9.)

- a. Remove screw attaching door stop (6) to fuselage.
- b. Remove door hinge pin (7) and remove baggage door from aircraft.

Disassembly of Baggage Door. (See figure 3-9.)

- a. Remove screw attaching door stop (6) to baggage door.
- b. Remove upholstery panel (2) by releasing the attaching trimout studs.
- c. If removal of cylinder lock assembly (25) is necessary, proceed as follows: remove screw (4) and washer from cam (26).

NOTE

When cam (26) is removed, the cylinder assembly remains free within the shell. Care should be taken not to lose or disarrange tumblers or the key will not operate the locking mechanism. When cam (26), shell nut (22), and lock-flap stop plate (21) are removed or replaced, tape the lock cylinder to shell, keeping the tumblers intact within the cylinder assembly.

- d. If removal of the baggage door latch (1) is necessary, proceed as follows: drill out rivets attaching latch (1) to baggage door.

Assembly of Baggage Door. (See figure 3-9.)

- a. Install baggage door latch (1) and secure with rivets.
- b. Install lock assembly (25) and secure with screw (4).
- c. Install upholstery panel (2).
- d. Install door stop (6) on baggage door and secure with screw (4).

Installation of Baggage Door. (See figure 3-9.)

- a. Position baggage door on fuselage and install hinge pin (7).
- b. Install door stop (6) on fuselage and secure with screw (4).

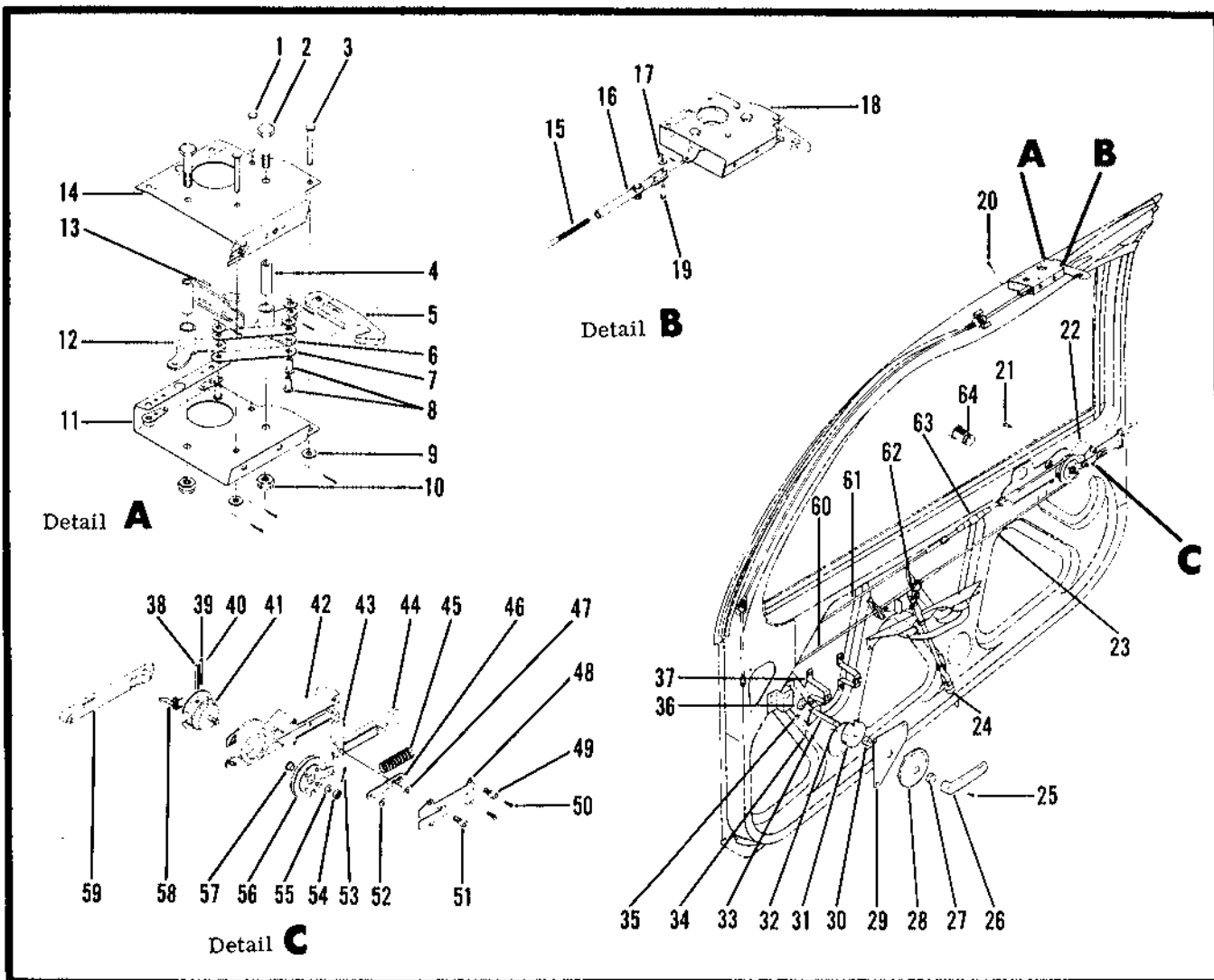
Removal, Installation and Adjustment of Baggage Door and Latch Assembly. (Optional) (See figure 3-9.)

- a. Remove screw (4) attaching door stop (6) to door frame.
- b. Remove door hinge pin (7) and remove baggage door from aircraft.
- c. Remove upholstery panel (2) by removing attaching studs.
- c. If removal of cylinder lock assembly (25) is necessary, proceed as follows: remove screw (4) and washer from arm (26).

NOTE

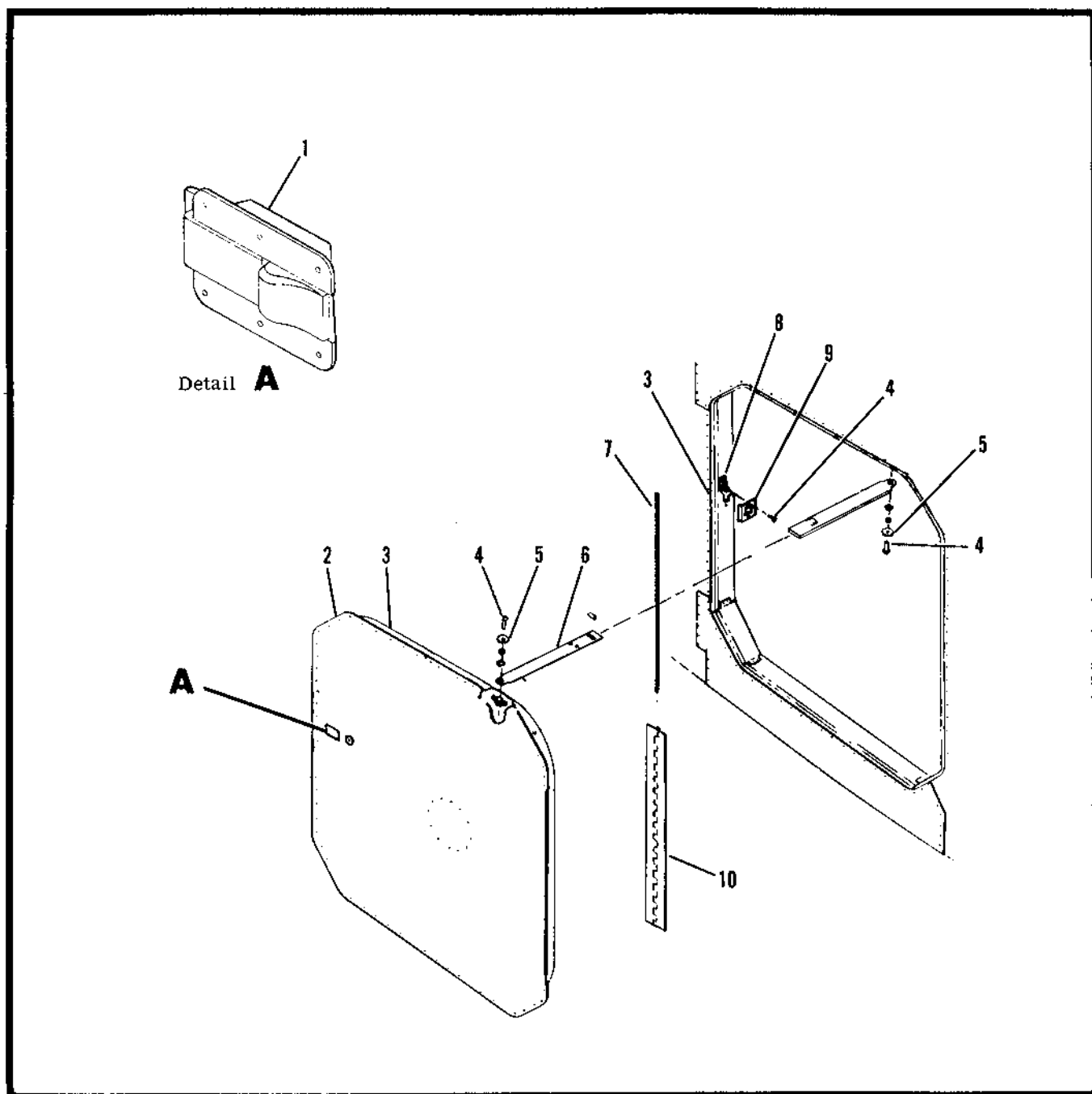
When arm (26) is removed, the cylinder assembly remains free within the shell. Care should be taken not to lose or disarrange tumblers or the key will not operate the locking mechanism. When arm (26), shell nut (22), and lock-flap stop plate (21) are removed or replaced, tape the lock cylinder to shell, keeping the tumblers intact within the cylinder assembly.

- e. Remove cover (27) to gain access to aft latch assembly.
- f. Remove plate (21) by removing retaining screws and bellcrank pivot screw.
- g. Using Detail B, figure 3-9, replace or repair door latch mechanism as necessary.
- h. Install door by reversing the removal procedures.
- i. With handle (15) against the closed position stop, adjust clevis (11) so that the pin assembly (18) has 3/8 inch engagement within the striker plate (9).
- j. Rig pushrods (14) so that latch pins (19) have 3/8 inch engagement within the upper and lower striker plates.
- k. Secure all lock nuts, pins and cotter pins.
- l. Install upholstery panel (2).



1. Pin	23. Cable Assembly	44. Bolt Assembly
2. Bolt	24. Bayonet Assembly	45. Spring
3. Pin	25. Screw	46. Link
4. Bellcrank Spacer	26. Handle	47. Washer
5. Lock Arm	27. Spacer	48. Plate
6. Lock Bellcrank Assembly	28. Escutcheon Plate	49. Stud
7. Upper Latch Link	29. Door Handle Plate	50. Screw
8. Pin	30. Bushing	51. Stud
9. Washer	31. Pulley	52. Washer
10. Nut	32. Pin	53. Cotter Pin
11. Lower Panel Assembly	33. Arm Assembly	54. Nut
12. Idler Bellcrank Assembly	34. Cotter Pin	55. Washer
13. Spring	35. Washer	56. Pulley Assembly
14. Upper Panel Assembly	36. Nut	57. Bearing
15. Latch Cable	37. Cotter Pin	58. Spring
16. Teleflex Cable Clevis	38. Pin	59. Handle Assembly
17. Washer	39. Pin	60. Cable Assembly
18. Upper Latch Assembly	40. Pin	61. Cable Assembly
19. Pin	41. Case	62. Pin
20. Screw	42. Case Assembly	63. Turnbuckle
21. Screw	43. Cotter Pin	64. Lock
22. Lower Latch Assembly		

Figure 3-8. Cabin Door Latch Assemblies



1. Baggage Door Latch
2. Upholstery Panel
3. Seal
4. Screw
5. Washer
6. Door Stop
7. Hinge Pin
8. Esna Nut
9. Striker Plate

10. Hinge Assembly
11. Clevis
12. Spring Washer
13. Bellcrank
14. Push Rod
15. Handle
16. Spring
17. Pin Assembly
18. Roll Pin

19. Latch Pin
20. Guide
21. Plate
22. Nut
23. Spacer
24. Bellcrank
25. Lock Assembly
26. Arm
27. Cover

Figure 3-9. Baggage Door and Latch Assembly Installation (Sheet 1 of 2)

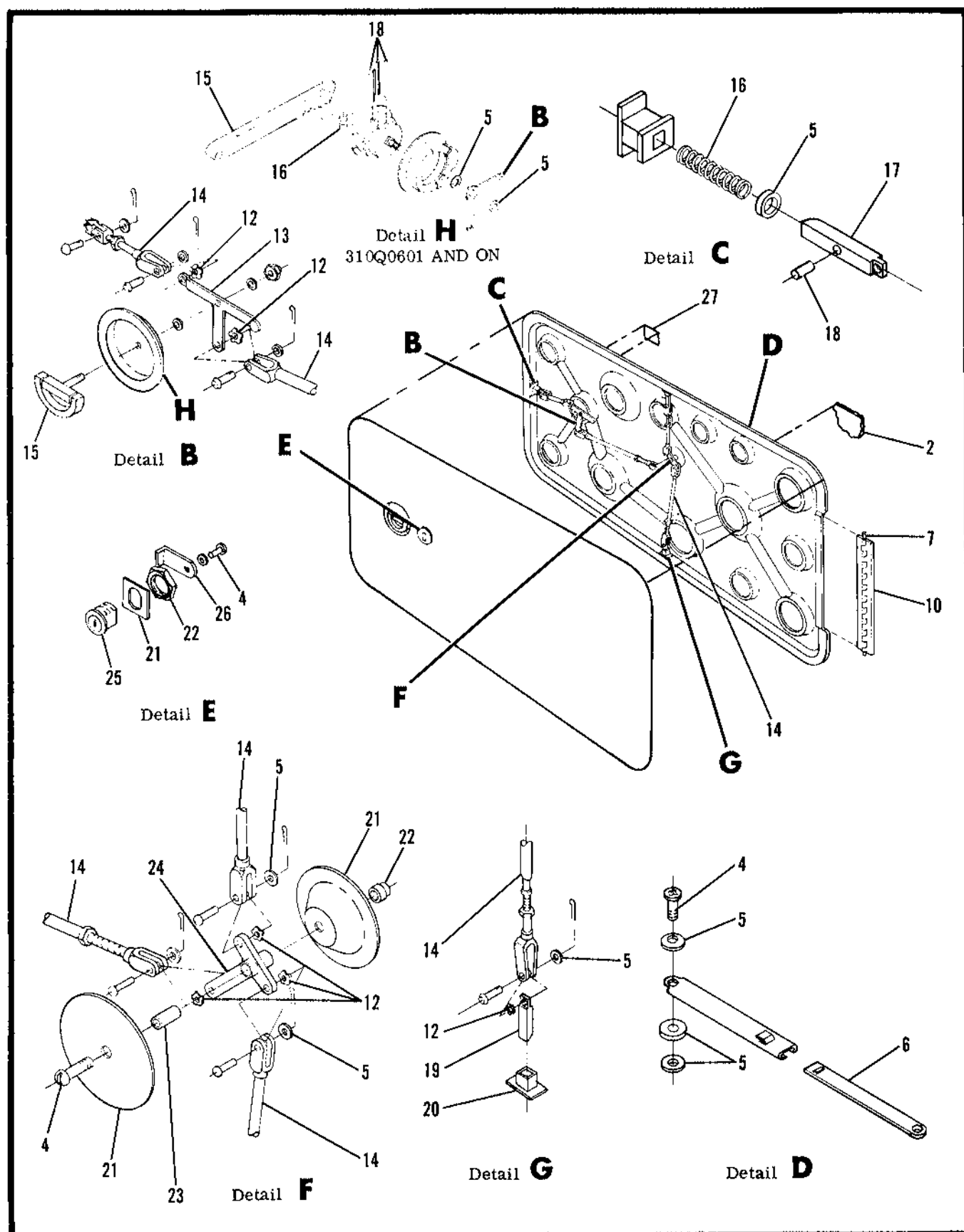


Figure 3-9. Baggage Door and Latch Assembly Installation (Sheet 2 of 2)

m. Adjust striker plates to obtain a tight seal around door.

Adjustment of Wing Locker and Cabin Door and Baggage Door Stop. (See figure 3-10.)

- a. Check tension on stop assembly to obtain 25 ± 3 pounds tension as follows:
- b. Connect a spring scale to upper cabin door or nacelle baggage door stop assembly and read tension required to override the stop in order to close the door.
- c. If adjustment is required, remove stop and adjust as follows:
 1. Remove stop assembly and place on block.

NOTE

Block must be fabricated from wood or similar material.

2. To increase the tension on stop assembly, use a drift punch and hammer and tap on roller.
3. To decrease the tension on stop assembly, turn stop assembly over on block and tap on tongue with hammer.

SEATS.

Troubleshooting the Individual Seat Assemblies.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOCKING MECHANISM FAILS TO ENGAGE IN SEAT SUPPORT	Broken, disconnected or missing spring.	Replace spring.
	Distorted parts.	Repair or replace parts.
SEAT ADJUSTMENT MECHANISM FAILS TO OPERATE	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 of Front Seats. (See figure 3-11.)

- a. Pull on seat right-hand adjusting handle and tilt the seat back as far as possible.
- b. Remove two screws securing the seat stop plates on both sides of the seat pan assembly.
- c. Remove stop plates.
- d. Pull up on the left-hand adjusting handle and slide the seat aft to clear it from the tracks.
- e. Remove the seat from the aircraft and disassemble and assemble front seat in accordance with figure 3-11.

Installation of Front Seats. (See figure 3-11.)

- a. Pull up on seat right-hand adjusting handle and tilt the seat back as far as possible.

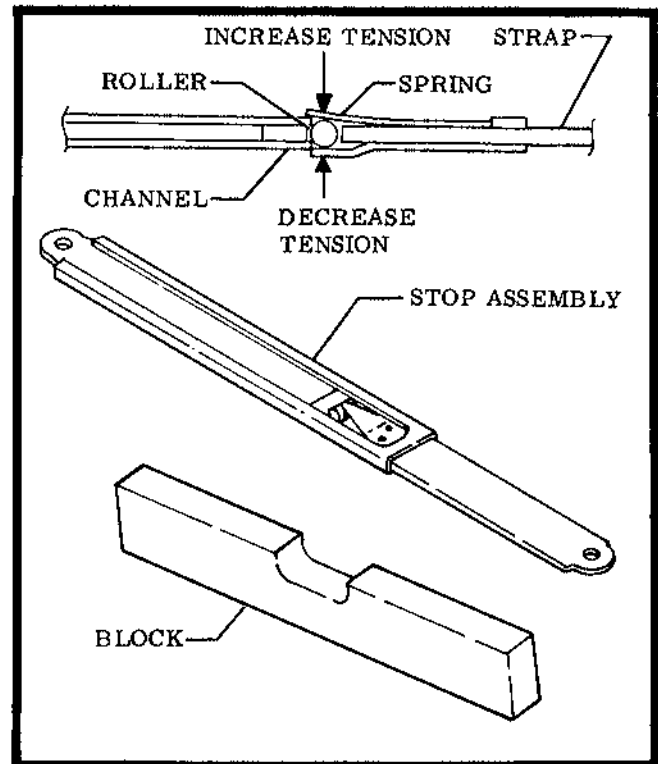


Figure 3-10. Adjustment of Wing Locker, Cabin Door and Baggage Door Stop

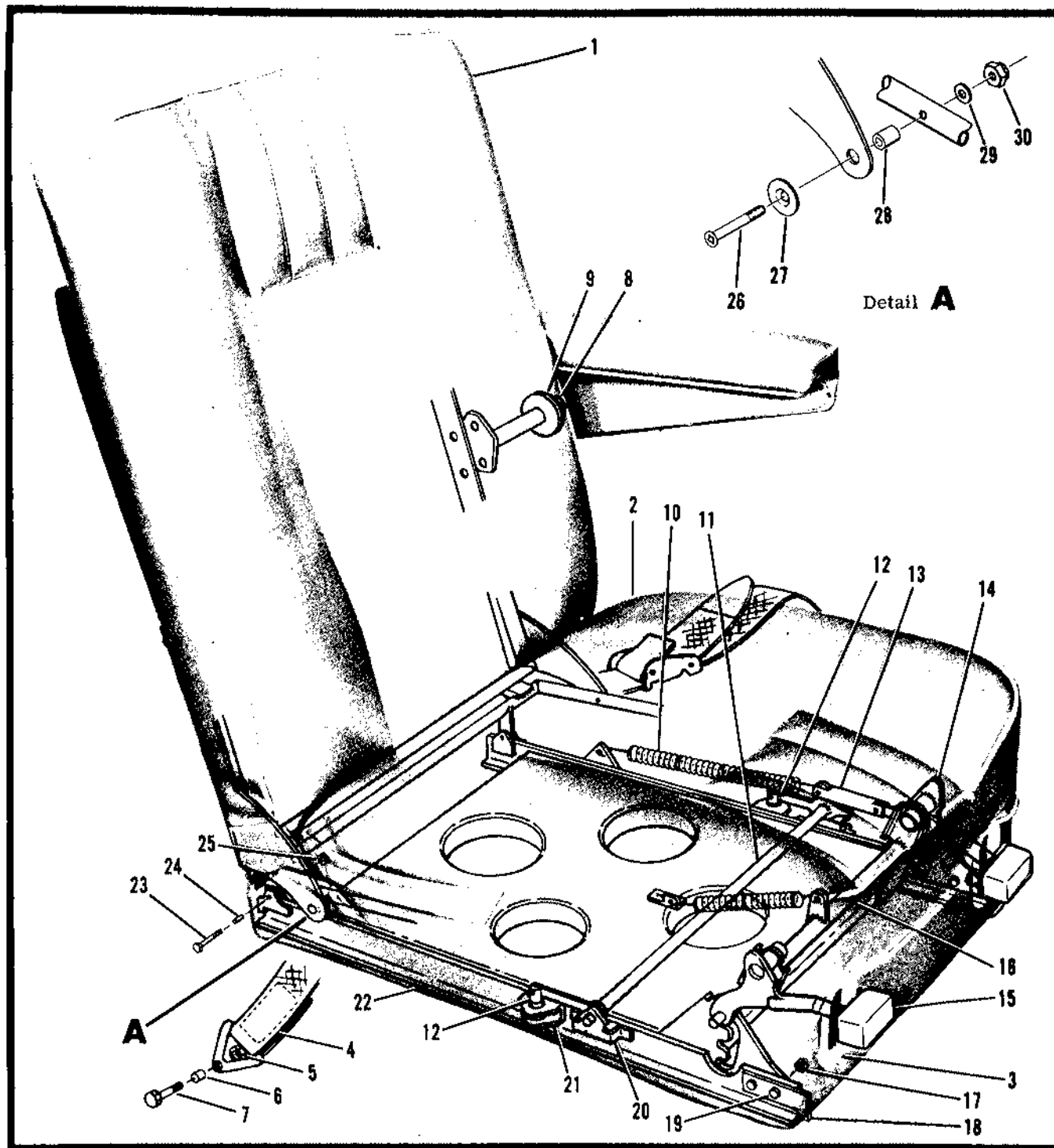
- b. Install seat pan assembly on floorboard seat supports.

- c. Pull up on the left-hand adjusting handle and slide seat forward until the rear seat stops come to rest against the seat supports.

- d. Install the front stop plates on seat pan assembly with attaching screws.

WARNING

After seat has been installed, insure that stop block has been installed properly and that the seat adjustment mechanism functions properly.



1. Front Seat Back Assembly	11. Actuator Assembly	21. Guide
2. Front Seat Bottom Assembly	12. Adjusting Pin	22. Seat Pan Assembly
3. Escutcheon Plate	13. Adjustment Release Tube	23. Bolt
4. Safety Belt	14. Arm Assembly	24. Spacer
5. Nut	15. Handle	25. Nut
6. Spacer	16. Actuator Assembly	26. Screw
7. Bolt	17. Nut	27. Washer
8. Nut	18. Stop	28. Spacer
9. Washer	19. Screw	29. Washer
10. Spring	20. Bracket	30. Nut

Figure 3-11. Front Seat Installation

Removal of Seat Belts. (See figure 3-11.)

- a. Remove escutcheon from floorboard.
- b. Remove nut, washers, spacers and bolt securing seat belts to structure, and remove seat belts.

Installation of Seat Belts. (See figure 3-11.)

- a. Position seat belts in place and install bolt, spacers, washers and nut.
- b. Install escutcheon to floorboard.

NOTE

Make sure seat belts are properly threaded through the seat belt bracket to assure length of seat belts can be adjusted.

■ Removal of Shoulder Harness. (See figure 3-11A.)

- a. Remove mounting bracket cup.
- b. Remove bolt, washer and spacer.

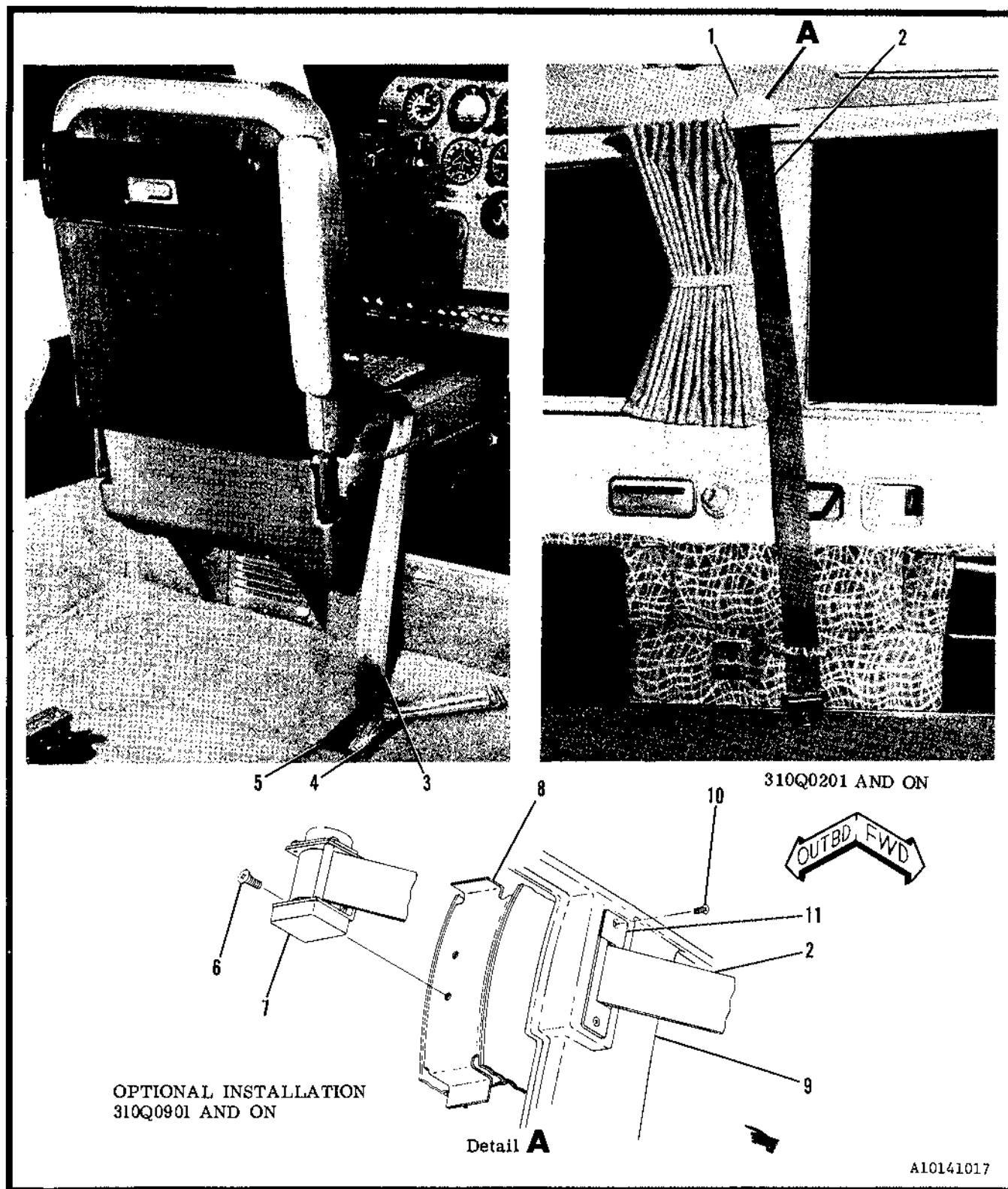
- c. Remove shoulder harness.

Installation of Shoulder Harness. (See figure 3-11A.)

- a. Make sure shoulder harness is properly threaded through bracket.
- b. Install spacer, washer and bolt.
- c. Install mounting bracket cup.

Removal and Installation of Inertia Reel. (See figure 3-11A.) (310Q0901 and On.)

- a. Remove screws, securing guide segments and remove guide segments.
- b. Remove window trim.
- c. Pull out on shoulder harness to gain access to screws, securing inertia reel to bracket, remove inertia reel.
- d. Install inertia reel by reversing removal procedures.



1. Cup
2. Shoulder Harness
3. Seat Belt
4. Retainer

5. Screw
6. Screw
7. Inertia Reel

8. Bracket
9. Window Trim
10. Screw
11. Guide Segments

Figure 3-11A. Seat Belt and Shoulder Harness Installation

Troubleshooting the Reclining Rear Seat.

TROUBLE	PROBABLE CAUSE	CORRECTION
SEATS WILL NOT CHANGE POSITION	Teleflex cable disconnected.	Connect teleflex cable and observe operation.
	Defective stop assembly.	Replace stop assembly.
SEAT HARD TO OPERATE	Seat adjustment tube bent.	Replace seat adjustment tube.
	Teleflex cable improperly rigged.	Rig teleflex cable and observe operation.
	Seat adjustment tube bent.	Replace seat adjustment tube.
	Seat adjustment handle return spring broken, disconnected, or missing.	Replace and/or connect return spring.
	Bolts securing seat adjustment handle too tight.	Loosen bolts securing seat handle enough to permit free operation.
	Seat rollers broken or binding.	Repair or replace seat rollers.

Removal of Reclining Rear Seat. (See figure(3-12.)

a. To remove the reclining rear seat, enter the baggage compartment and proceed as follows:

1. Unfasten snaps securing the upholstery at the bottom of the seat backs.
2. Remove bolts securing seat back to seat frame (4).
3. Tilt the seat back forward and remove the two bolts securing the seat back to the seat bottom.
4. Remove the seat back (1) from the aircraft.
5. Repeat this procedure to remove the other seat back.
6. Remove the two seat belts (12), by removing nuts, washers, spacers and bolts.
7. Tilt the seat bottoms (3) as far forward as possible.
8. Remove the three bolts securing the seat frame to the aircraft structure.
9. Remove the seat frame (4), with seat bottoms (3) attached, from the aircraft.

Disassembly and Assembly of Reclining Rear Seat.

a. Disassemble and assemble the reclining rear seat in accordance with figure 3-12.

Installation of Reclining Rear Seat. (See figure (3-12.)

a. To install the reclining rear seat, reverse the removal procedures.

Removal of Center Single Adjustable Seats (See figure 3-13.)

- a. Pull up on left-hand adjusting handle and move front seat as far forward as possible.
- b. Remove bolt (28) and stop (27) from seat track (26).
- c. Pull up on left-hand adjusting handle and move center seat forward until it clears the support assemblies.
- d. Remove center seat from aircraft through cabin door and disassemble and assemble in accordance with figure 3-13.)

Installation of Center Single Adjustable Seats. (Optional)

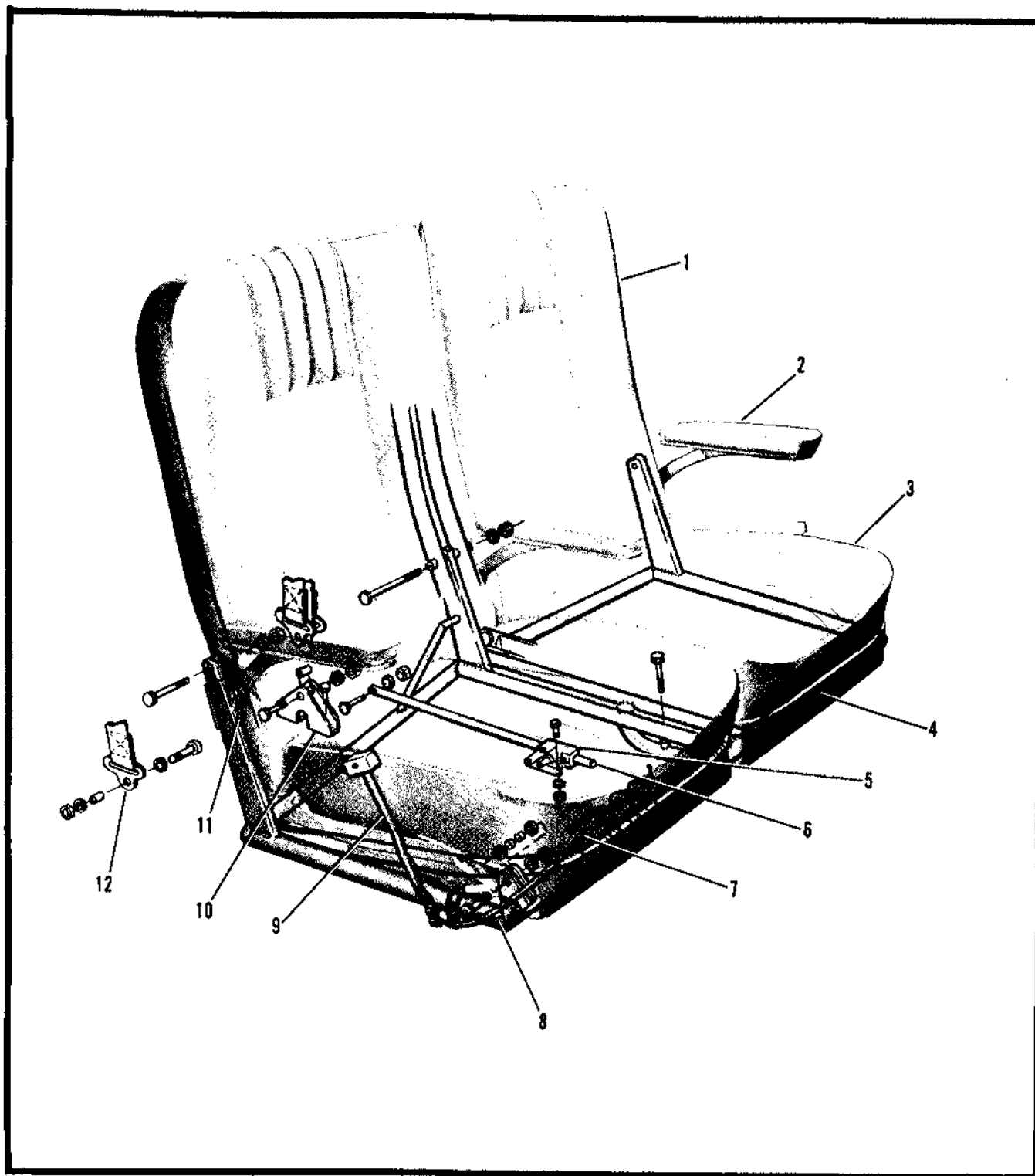
a. To install the center seats, reverse the removal procedures.

Removal and Installation of the Fifth and Sixth Seats. (See figure 3-14.)

- a. Turn slotted screws on fasteners (20) and lift seat from the floor.
- b. To install, align the four round headed studs (14) with the receptacle in the fasteners and apply pressure downward on the seat until the bolts snap into position.

Disassembly and Assembly of Fifth and Sixth Reclining Seats. (Optional)

a. Disassemble and assemble the fifth and sixth seats in accordance with figure 3-14.

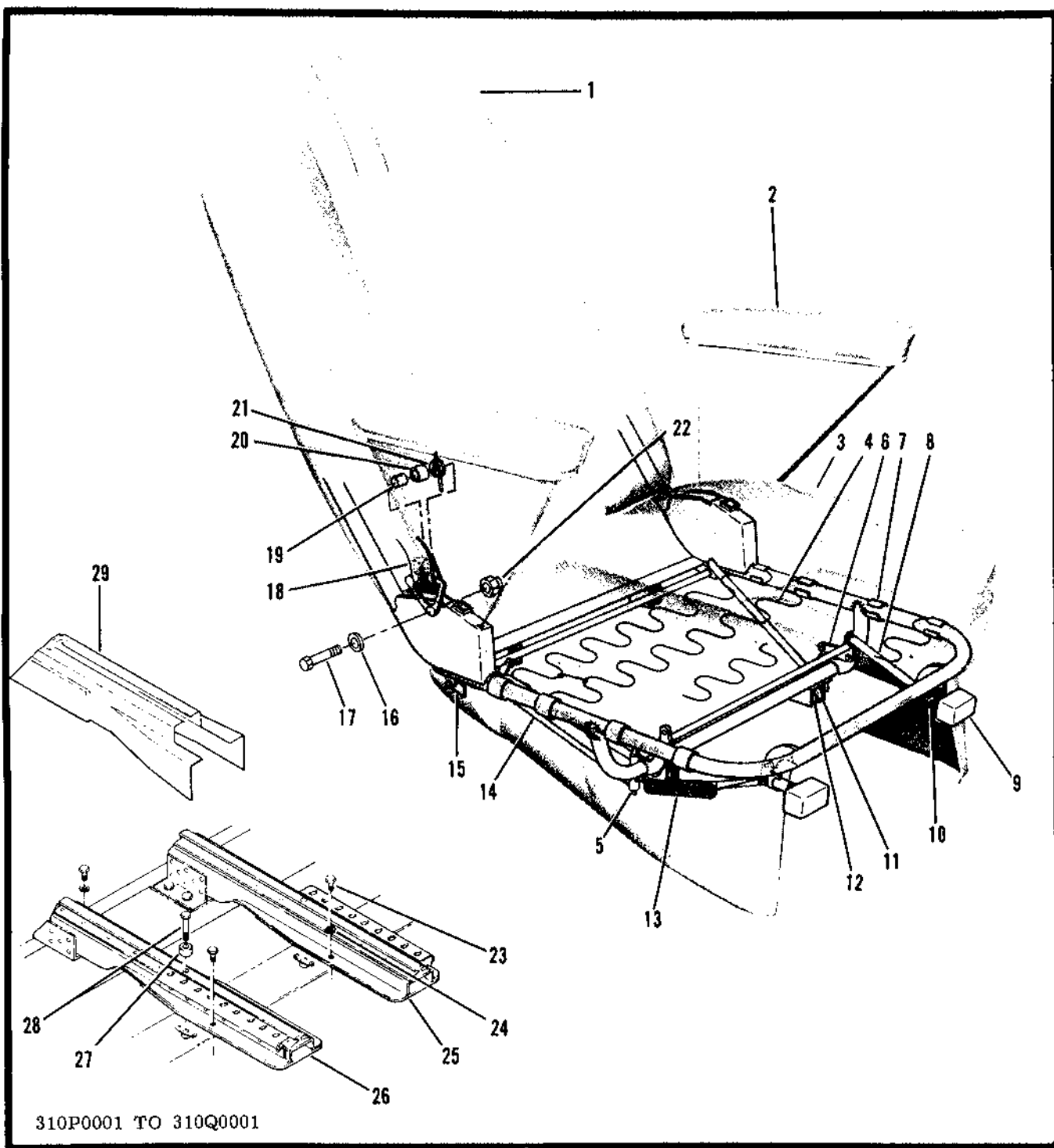


- 1. Seat Back
- 2. Armrest
- 3. Seat Bottom
- 4. Seat Frame

- 5. Stop Assembly
- 6. Adjustment Tube
- 7. Teleflex Cable
- 8. Spring

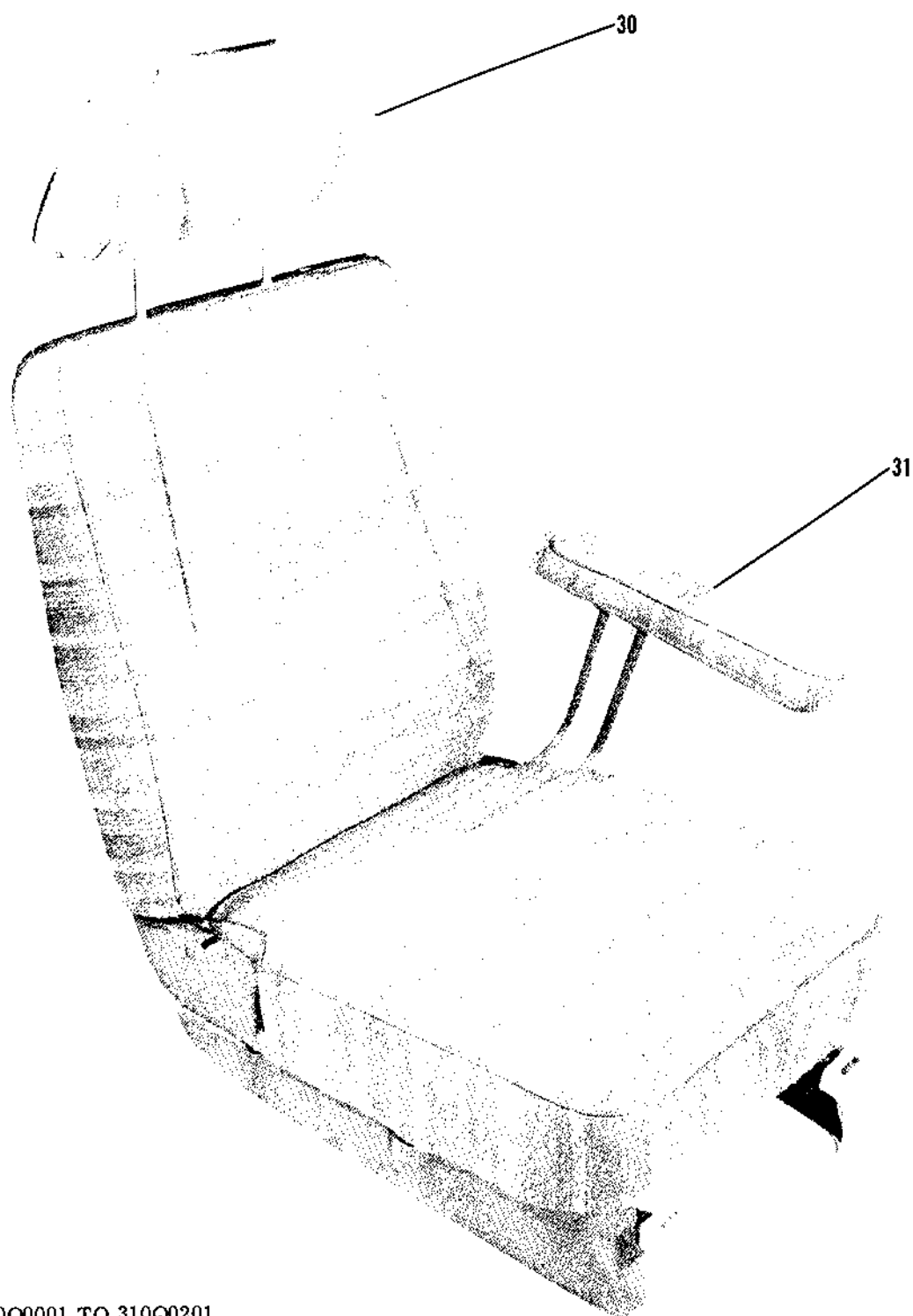
- 9. Seat Adjustment Handle
- 10. Safety Belt Bracket
- 11. Armrest Bracket
- 12. Seat Belt

Figure 3-12. Individual Reclining Rear Seat



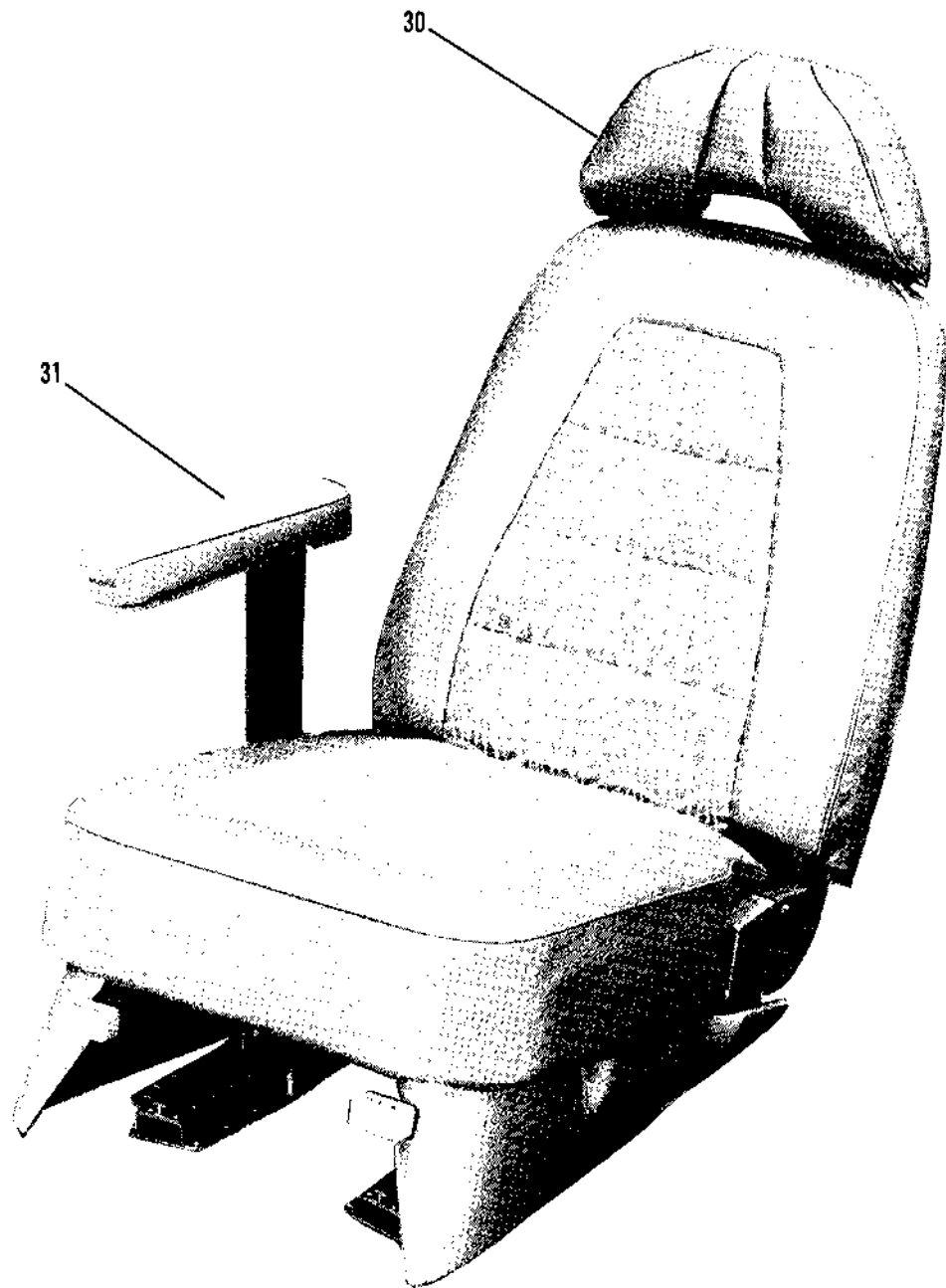
1. Seat Back	12. Roller	22. Nut
2. Armrest Assembly	13. Spring	23. Bolt
3. Seat Bottom	14. Push Rod	24. Washer
4. Seat Spring	15. Torque Tube Assembly	25. LH Inboard Track
5. Stop Pin	16. Washer	26. RH Inboard Track
6. Bellcrank Assembly	17. Bolt	27. Stop
7. Spring Clip	18. Safety Belt	28. Bolt
8. Link	19. Spacer	29. Track Cover
9. Knob	20. Spacer	30. Headrest Assembly
10. Pivot Arm Assembly	21. Spring	31. Removable Armrest Assembly
11. Bushing		

Figure 3-13. Individual Adjusting Center Seat (Sheet 1 of 3)



310Q0001 TO 310Q0201

Figure 3-13. Individual Adjusting Center Seat (Sheet 2 of 3)



310Q0201 AND ON

Figure 3-13. Individual Adjusting Center Seat (Sheet 3 of 3)

UPHOLSTERY.

Removal and Installation of Upholstery and Upholstery Trim. (See figure 3-15.)

- a. Remove seats in accordance with seat removal procedures.
- b. Remove headliner assembly (2) as follows:
 1. Remove overhead console light and cabin lights in accordance with removal procedures outlined in Section 14.
 2. (See figure 3-16.) Remove windshield upper trim (19).
 3. (See figure 3-16.) Remove emergency exit window upper trim (14) and front trim (15).
 4. (See figure 3-16.) Remove curtain stops (2) and curtains (1), and upper curtain track (3).
 5. (See figure 3-16.) Remove picture window trim (5, 6, 8 and 10).
 6. (See figure 3-16.) Remove wire tunnel covers (21, 33, 36 and 37).
 7. Remove rear panel (37), side panel (38 and 39).
 8. Start at the left side of the windshield and remove the headliner from the prong edges of the windshield upper retainer.
 9. Working from left to right and front to rear, remove the headliner assembly by unhooking the headliner supports (1) from headliner hangers (3).
- c. Remove cabin door upholstery as follows:
 1. (See figure 3-16.) Remove door window trim (27).
 2. Remove upper door upholstery panel (27) from retainers (19 and 20).
 3. (See figure 3-16.) Remove door trim pad (29) from retainers (28 and 31).
 4. Remove armrest assembly (22), lower door panel (18), and lower door upholstery panel (21).
- d. Remove rear shelf upholstery as follows:
 1. Remove upholstery panel (42) by rotating fasteners.
 2. Remove cover assembly (41) and shelf assembly (40).
- e. Remove cabin side upholstery as follows:
 1. Remove carpeting in accordance with carpet removal procedures.
 2. (See figure 3-16.) Remove right cover assembly (25) and retainer strip (26).
 3. Remove side panel (10) and upholstered side panel (9).
 4. (See figure 3-16.) Remove wire tunnel cover assemblies (21, 33, 36 and 37) and retainers (23, 35 and 38).

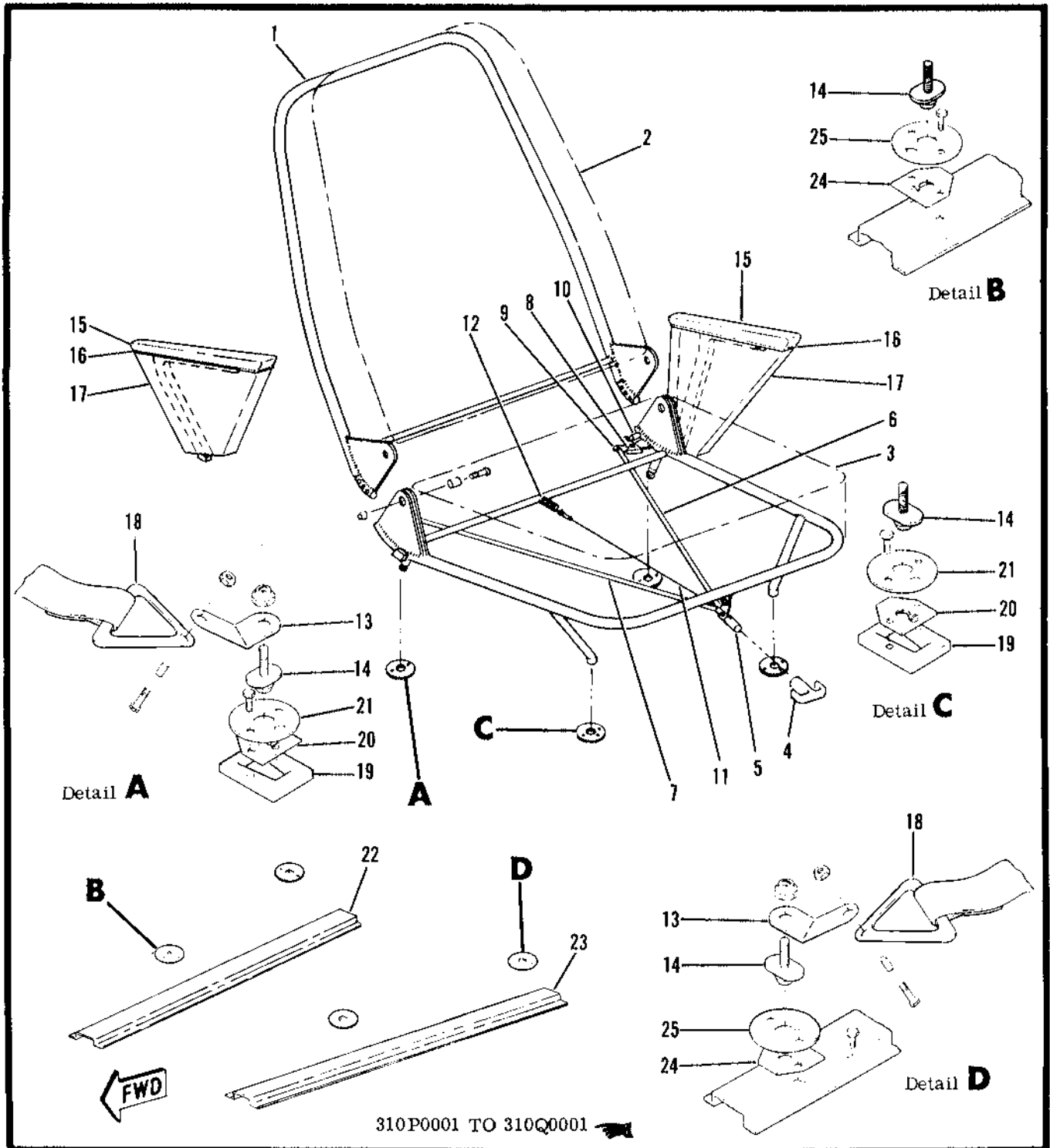
NOTE

Lower portion of window trim (5, 8, and 13) may be loosened for easy access to fasteners in tunnel assemblies and side panels.

5. Remove LH side panels (4, 5, 6, 34 and 35).
6. Remove RH side panels (12, 32, and 33).
- f. If further removal of the upholstery or upholstery trim is necessary, remove in accordance with figures 3-15 and 3-16.
- g. Install upholstery and upholstery trim by reversing the removal procedures outlined in the above steps.

Removal and Installation of the Carpet. (See figure 3-17.)

- a. Remove front and rear seats in accordance with seat removal procedures.
- b. Remove the regulator shield by removing attaching screws. The regulator shield is located underneath the copilot's seat protecting the alternator main and standby voltage regulator terminals.
- c. Remove screws (17) from angles (12 and 16) securing the bulkhead carpet (15). Remove angles (12 and 16) and bulkhead carpet.
- d. Remove left and right cover plates (11 and 18) by removing attaching screws.
- e. Remove the scuff plates by removing the attaching screws.
- f. Remove the control column boot (8) and retainer (7) by removing screws (6).
- g. Remove control column cover (9) by removing attaching screws.
- h. Remove left (10) and right (21) carpets by removing attaching screws, and freeing carpet from glued insulation.
- i. Remove front center spar carpet (4) by loosening and freeing carpet from glued insulation.
- j. Remove the center floorboard carpet (3) by removing attaching screws. The center floorboard carpet has an insulation cover glued to the assembly.
- k. Remove the rear floor cover by removing the lower rear curtain support and the attaching screws.
- l. Install carpet by reversing the removal procedure outlined in the above steps.



1. Seat Back
2. Back Cover Assembly
3. Bottom Cover Assembly
4. Knob
5. Pivot Arm
6. Link LH
7. Link RH
8. Stop
9. Bellcrank

10. Stop Pin
11. Cable Assembly
12. Spring
13. Belt Link LH
14. Stud
15. Armrest Assembly
16. Cover Plate
17. Armrest Support Cover

18. Safety Belt Assembly
19. Spacer
20. Fastener Plate Assembly
21. Seat Attach Cover Plate
22. Outboard Seat Support Assembly
23. Inboard Seat Support Assembly
24. Fastener Plate Assembly
25. Seat Attach Cover Plate

Figure 3-14. Aft Seat Installation

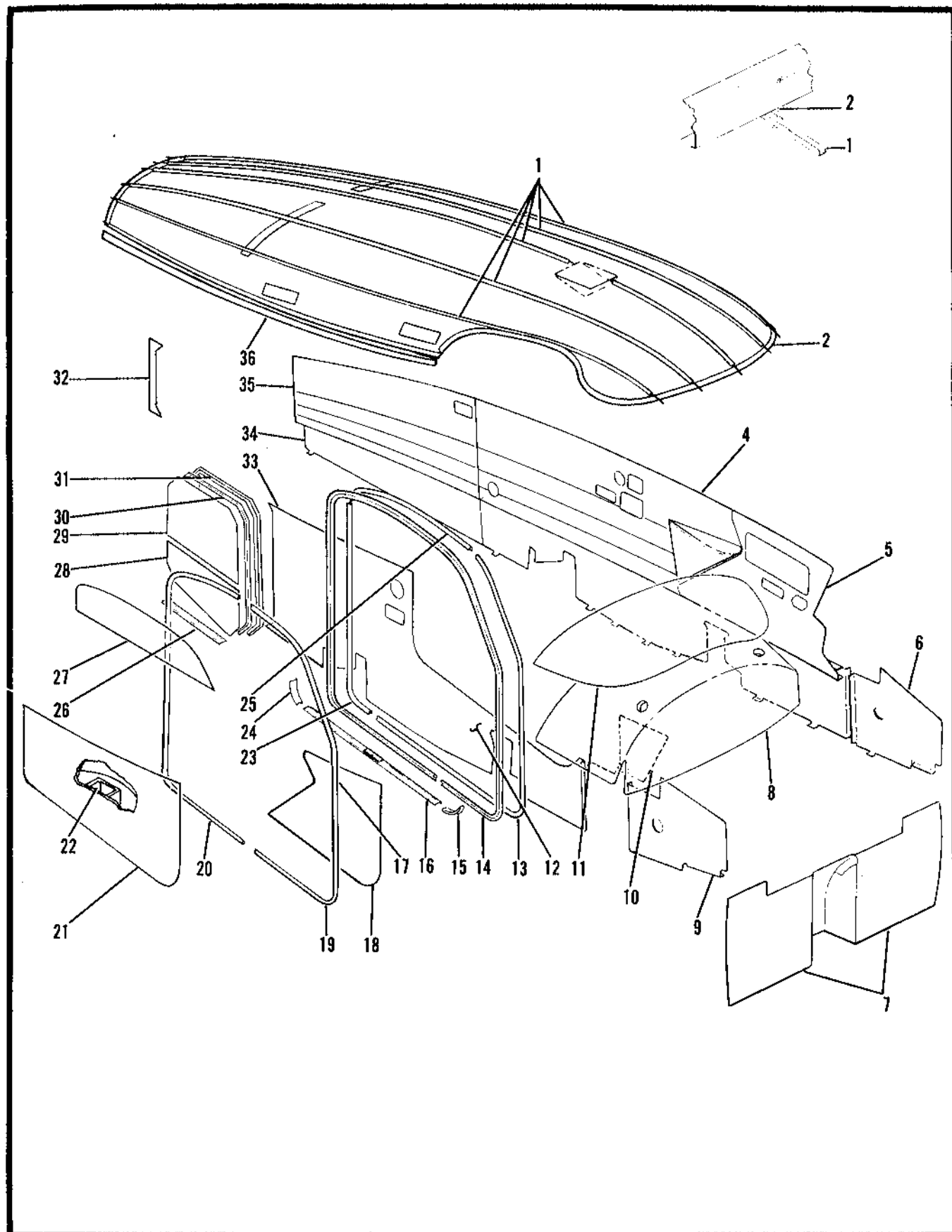
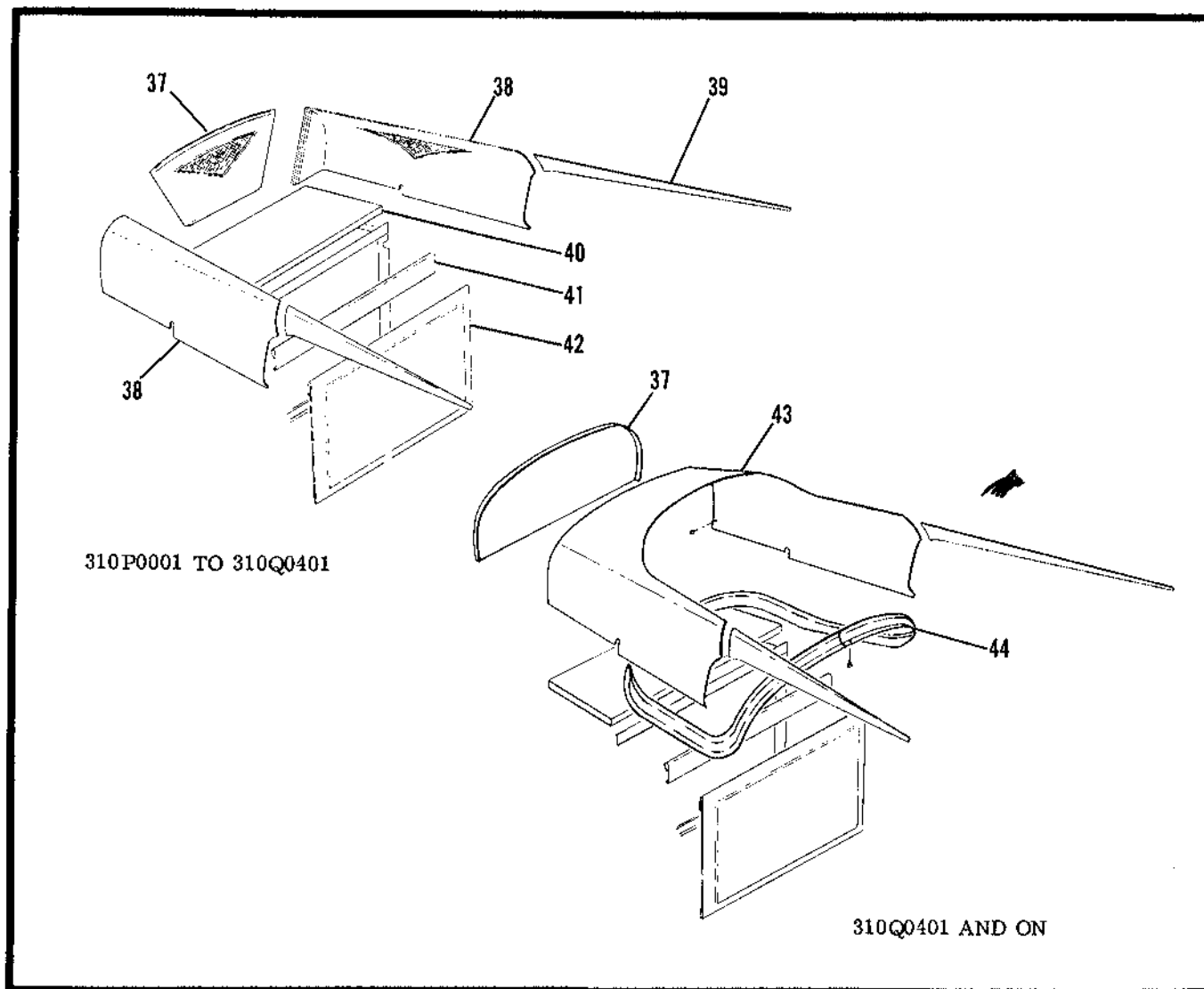
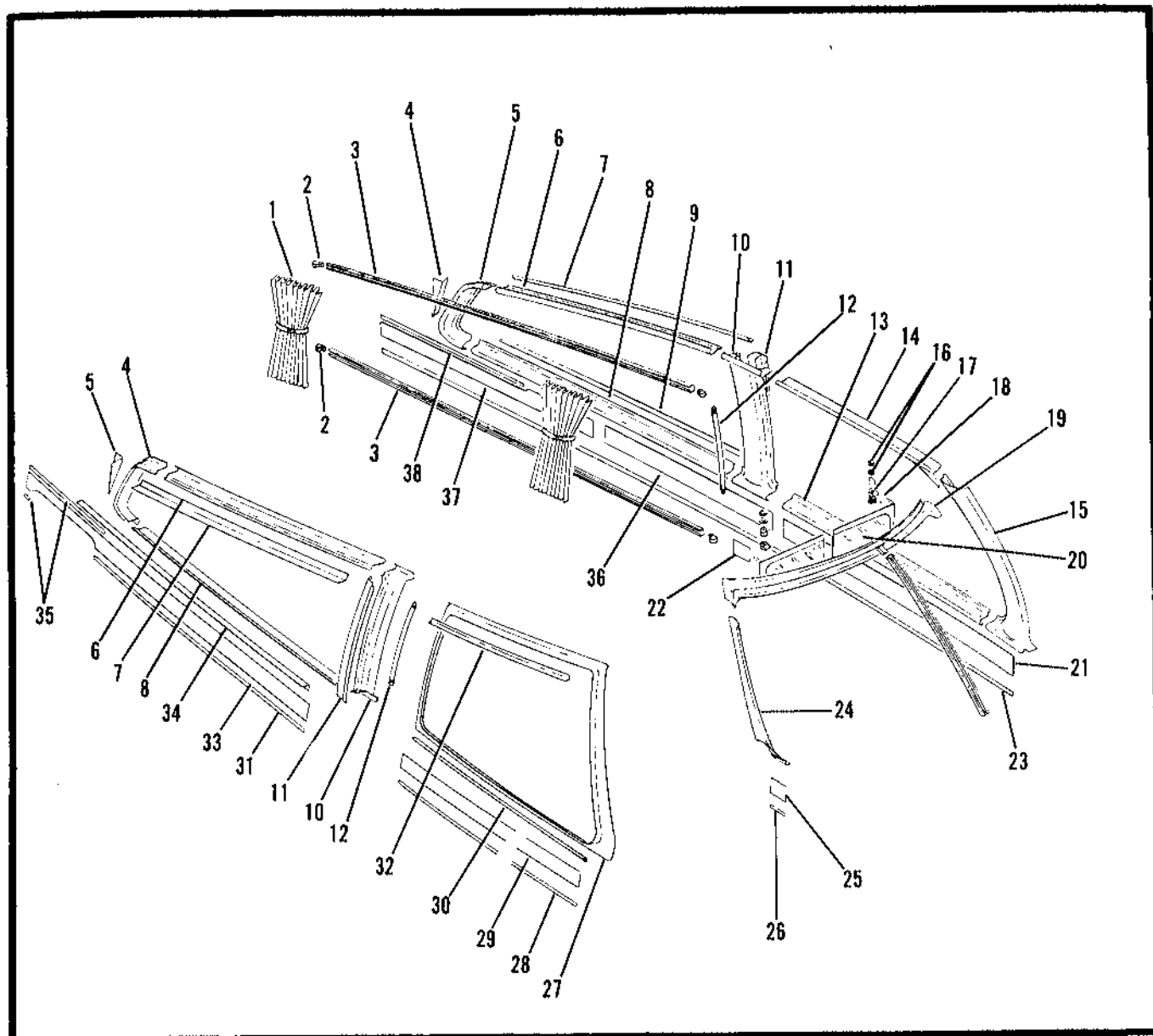


Figure 3-15. Upholstery Installation (Sheet 1 of 2)



1. Headliner Support	23. Retainer Aft Door Jamb
2. Headliner Assembly	24. Aft Door Jamb Fillet
3. Headliner Hanger	25. Clip Upper Door Jamb
4. Left Upholstery Panel	26. Scuff Plate
5. Side Panel (Left upper forward)	27. Upper Door Upholstery Panel
6. Left Upholstered Side Panel (Lower forward)	28. Lower Baggage Door Panel
7. Bulkhead Carpet	29. Upper Baggage Door Panel
8. Cover (Instrument Panel Deck)	30. Windlace
9. Right Upholstered Side Panel (Lower forward)	31. Retainer Baggage Door Opening
10. Side Panel (Right upper forward)	32. Aft Upholstery
11. Glare Shield	33. Upper Center Upholstery Panel
12. Right Upholstered Side Panel (Lower center aft)	34. Lower Aft Upholstery Panel
13. Retainer Forward Door Jamb	35. Upper Aft Upholstery Panel
14. Windlace	36. Retainer (Upper)
15. Forward Door Jamb Fillet	37. Rear Panel
16. Door Jamb Stop	38. Rear Side Panel
17. Retainer (Forward door frame upper)	39. Forward Side Panel
18. Lower Door Panel	40. Shelf Assembly
19. Retainer (Forward door frame lower)	41. Cover Assembly
20. Retainer (Aft door frame)	42. Upholstery Panel Assembly
21. Lower Door Upholstery Panel	43. Upper Rear Panel
22. Armrest Assembly	44. Omni Window Trim

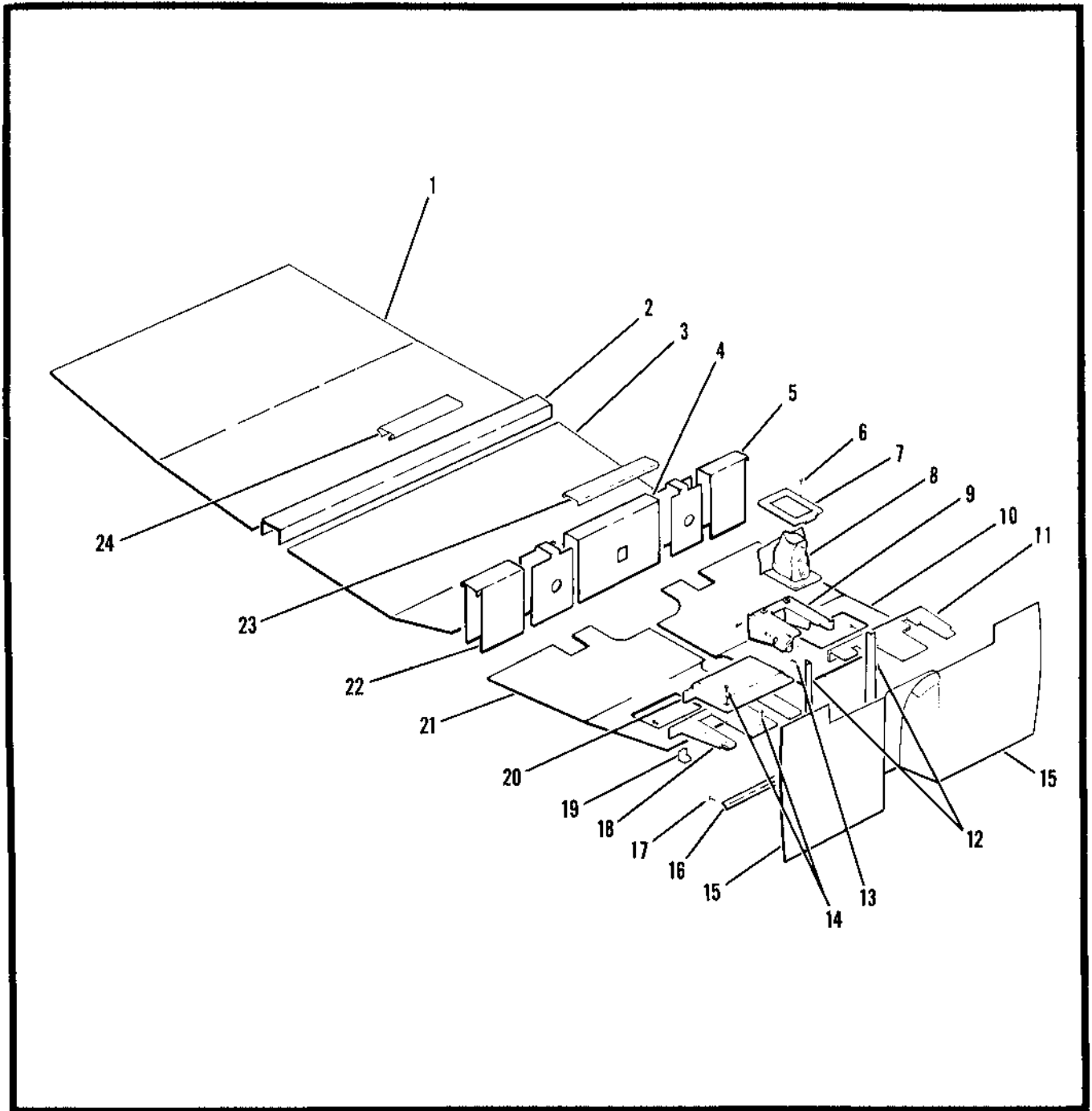
Figure 3-15. Upholstery Installation (Sheet 2 of 2)



1. Curtain
2. Stop
3. Curtain Track
4. Aft Trim Support
5. Aft Picture Window Trim
6. Upper Picture Window Trim
7. Upper Rear Window Trim Support
8. Lower Picture Window Trim
9. Lower Trim Support
10. Window Post Trim
11. Forward Trim Support
12. Assist Strap
13. Lower Left Front Window Trim
14. Upper Left Front Window Trim
15. Forward Left Front Window Trim
16. Washer
17. Visor Mount
18. Bolt
19. Upper Windshield Trim

20. Sun Visors
21. Forward Wire Tunnel (LH)
22. Ash Receiver
23. Retainer
24. Window Post Trim
25. Forward Right Cover
26. Retainer
27. Door Window Trim
28. Retainer
29. Door Trim Pad
30. Lower Trim Support
31. Retainer
32. Upper Trim Support
33. Rear Wire Tunnel (RH)
34. Lower Trim Support
35. Retainer
36. Center Wire Tunnel (LH)
37. Aft Wire Tunnel (LH)
38. Retainer

Figure 3-16. Upholstery Trim Installation



1. Rear Floor Carpet
2. Rear Spar Carpet
3. Center Floor Carpet
4. Front Spar Carpet
5. Front Spar Carpet LH
6. Screw
7. Retainer
8. Boot
9. Cover Assembly
10. Pilot's Floor Carpet LH
11. Cover Plate
12. Angle

13. Screw
14. Screw
15. Bulkhead Carpet
16. Angle
17. Screw
18. Cover Plate
19. Angle
20. Cover Plate
21. Pilot's Floor Carpet RH
22. Front Spar Carpet RH
23. Cover Front Spar
24. Cover Rear Spar

Figure 3-17. Carpet Installation

WING.

Removal of Wing.

- a. Remove batteries in accordance with Section 14.
- b. Drain fuel system at three places: wing tip tank, fuel strainer just forward of front spar and adjacent to nacelle, and auxiliary fuel cell just forward of rear spar and adjacent to nacelle.

NOTE

Wings can be removed with all fuel tanks and cells installed. If fuel tank and cell removal is desired, remove in accordance with Section 11.

- c. Remove engine in accordance with removal procedures in Section 9.

CAUTION

If one or both engines are removed, the aircraft may become tail heavy. Therefore, to balance the aircraft, place equivalent weight (shot bags or sand bags) in the engine nacelles and support the tailcone with padded support.

- d. Jack aircraft in accordance with jacking procedures in Section 2.
- e. Place suitable padded supports beneath cabin section and wings; then remove jacks.

NOTE

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

CAUTION

If only one wing is being removed and the engine on the opposite wing remains installed; relieve the engine weight on opposite wing by using engine hoist before removing wing or serious damage may occur due to an over-balance tipping condition.

- f. Remove wing root fillets by removing attaching screws.
- g. Disconnect or remove landing gear drive tube in accordance with removal procedures in Section 4.

NOTE

Wings can be removed with main landing gear installed. If gear removal is desired, remove in accordance with removal procedures in Section 4.

- h. Remove flap cables from wing in accordance with removal procedures in Section 8.
- i. Remove aileron cables from wing in accordance with removal procedures in Section 5.

- j. On left wing only, remove aileron trim cables in accordance with removal procedures in Section 5.
- k. Disconnect engine controls in engine nacelle in accordance with Section 9.

- l. Remove upholstery panels in cabin as necessary to gain access to junction box located on side of aircraft from which wing is to be removed.

- m. At the junction box, disconnect and tag each wire to affected engine and route wire from fuselage.

NOTE

Some wires in each junction box have solenoid connections which must be unsoldered.

- n. (See figure 3-19.) Disconnect, tag or route the following items in the wing root area:

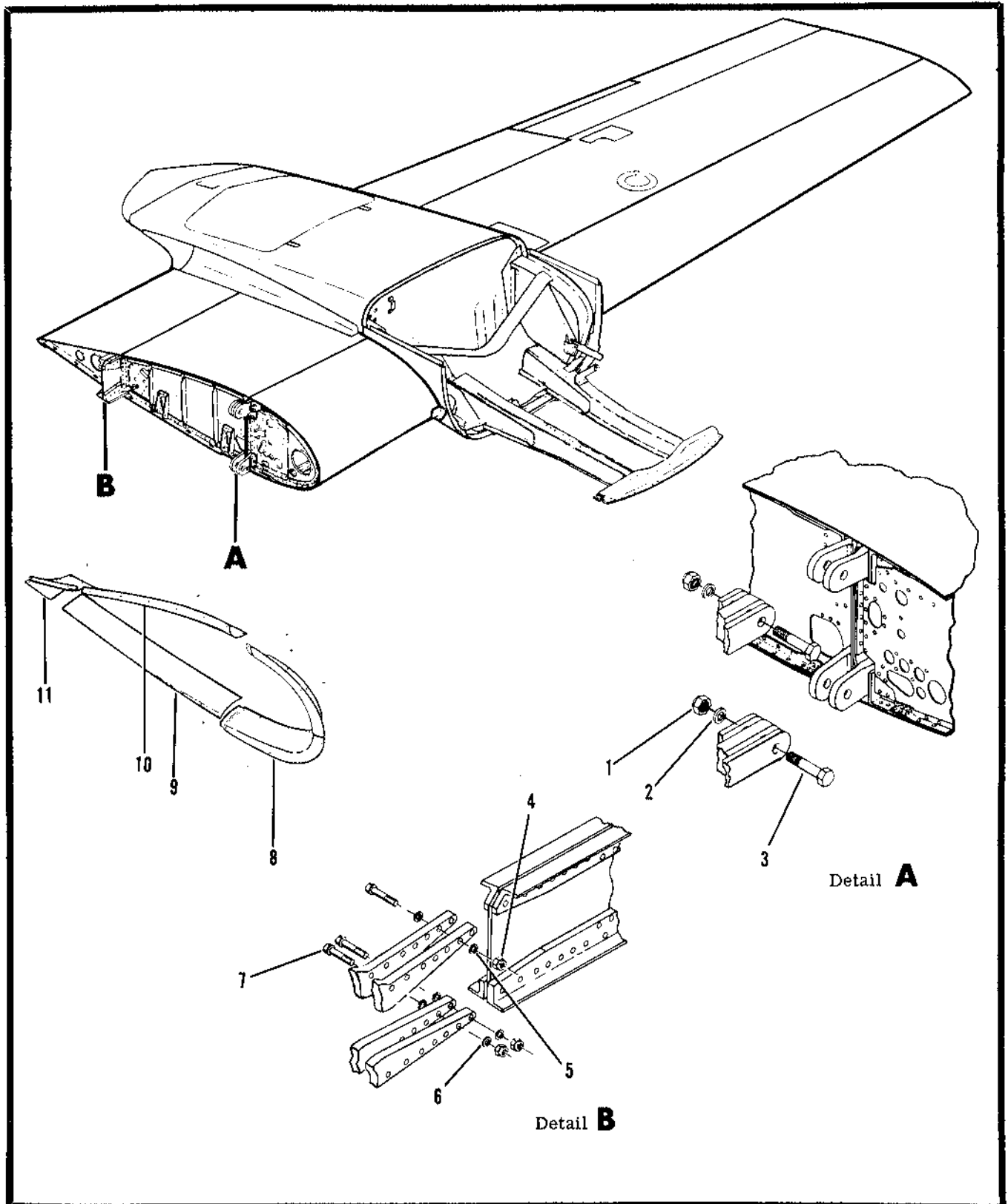
1. Route engine flex cables (14, 15 and 16) to fuselage.
2. Disconnect magneto wires at electrical connector (5).
3. Route starter cable (19) to fuselage.
4. Disconnect fuel lines (2 and 3).
5. Disconnect manifold pressure line at fitting (7).
6. Disconnect oil pressure line at fitting (10).
7. Disconnect fuel pressure line at fitting (9).
8. Disconnect vacuum hose at pressure relief valve (8).
9. Disconnect brake line at fitting (11).
10. Route fuel selector flex cable (12) to fuselage.
11. If installed, disconnect deice line at fitting (13).
12. If installed, disconnect auxiliary fuel tank plug at electrical connector (1).
13. Route wing wiring bundle (4) from fuselage.
14. Disconnect heater fuel line at fitting (6).
15. If Nav-O-Matic Autopilot is installed, disconnect line at fitting.
- o. (See figure 3-18.) Remove nuts (1 and 4), washers (2, 5 and 6) and bolts (3 and 7) from wing attachment fittings.
- p. Move wing and padded wing supports outboard until wing attachment fittings have disengaged.

NOTE

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

Installation of Wing. (See figure 3-19.)

- a. Position wing approximately one foot from fuselage.
- b. (Refer to Section 2.) Clean and/or lubricate engine flex cables fittings, electrical wiring and all other items relating to the wing needing servicing.
- c. Route flex cables (14, 15 and 16) through root rib towards engine nacelle. Do not secure cables to structure at this time.
- d. Route fuel selector valve flex cable (12) through root rib towards engine nacelle.
- e. Move the wing toward fuselage until wing attachment fittings begin to engage, guide landing gear drive tube through opening in root rib.
- f. (See figure 3-18.) Align bolt holes in wing attachment fittings and install bolt (3), washer (2), and nut (1) on front attach fitting; install bolt (7), washer (6),

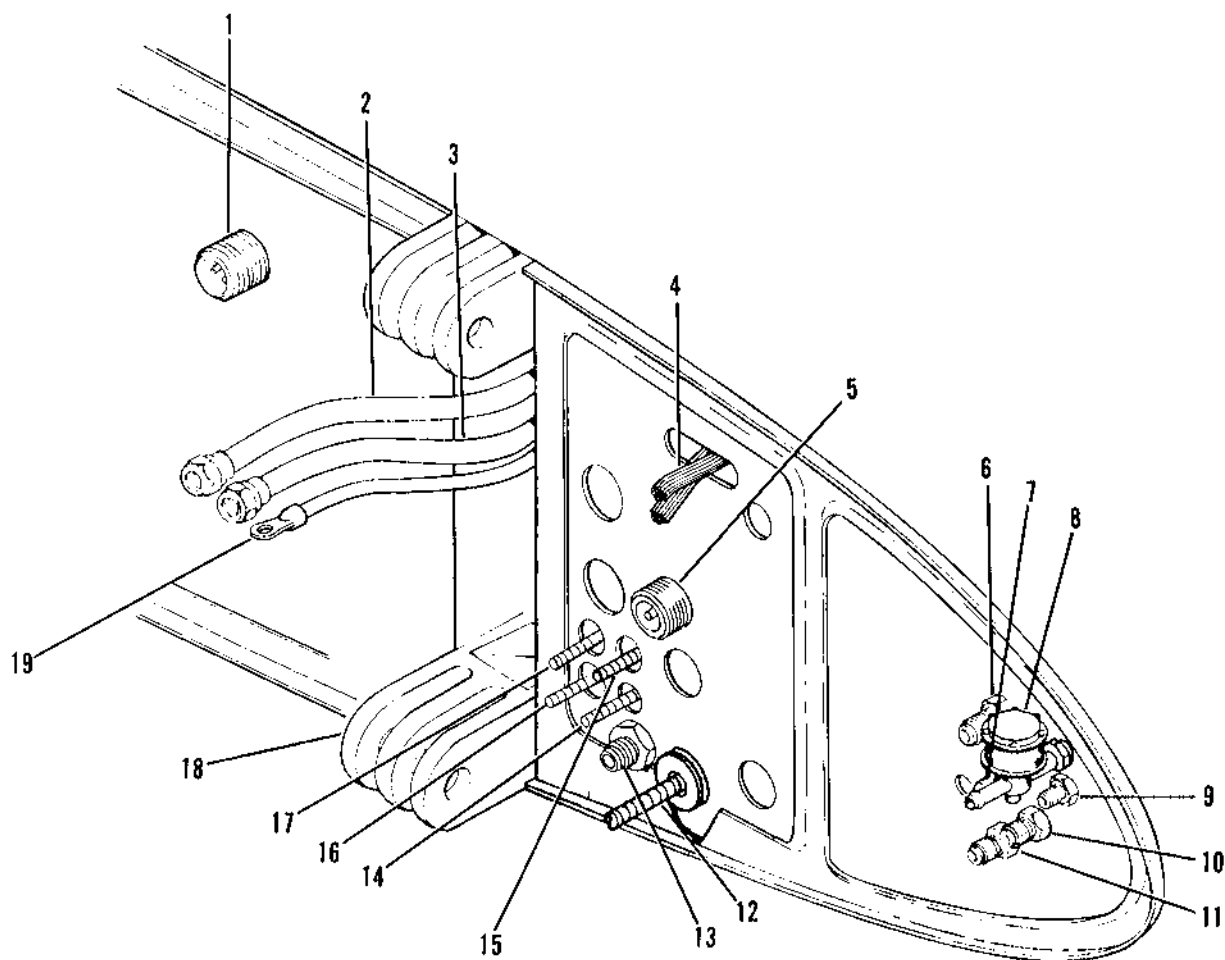


1. Nut
2. Washer
3. Bolt
4. Nut

5. Washer
6. Countersunk Washer
7. Bolt

8. Forward Fillet
9. Lower Fillet
10. Upper Fillet
11. Aft Fillet

Figure 3-18. Wing Installation



RH WING ROOT

1. Electrical Connector (Auxiliary Fuel)	11. Fitting (Brake Line)
2. Fuel Line (Crossover)	12. Flex Cable (Fuel Selector Valve)
3. Fuel Line (Crossover)	13. Fitting (Deice Line)
4. Wire Bundle	14. Flex Cable (Mixture Control)
5. Electrical Connector (Magnetos)	15. Flex Cable (Alternate Air Control)
6. Fitting (Heater Fuel Line)	16. Flex Cable (Throttle Control)
7. Fitting (Manifold Pressure Line)	17. Flex Cable (Propeller Control)
8. Pressure Relief Valve	18. Fuselage Front Spar Fitting
9. Fitting (Fuel Pressure Line)	19. Starter Cable
10. Fitting (Oil Pressure Line)	

Figure 3-19. Wing Connections

washer (5), and nut (4) on rear attach fitting.

NOTE

Refer to figure 3-18, install front spar bolts with heads facing forward and rear spar bolts with heads facing aft. On rear spar bolts, place countersunk washers (6) under heads of bolts (7). 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 shear positions, **DO NOT OVERTORQUE**. It is possible wing spar bolts will turn if a slight torque is applied to bolt head.

g. Connect any of the following items of optional equipment which were disconnected during wing removal:

1. Connect deice line to fitting (13).
2. Connect auxiliary fuel tank electrical plug to electrical connector (1).
3. Connect Nav-O-Matic autopilot line to fitting.

NOTE

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

h. Connect the following items at the wing root area and remove tags:

1. Connect heater fuel line to fitting (6).
2. Route wing wiring bundle (4) through fuselage.
3. Connect brake line to fitting (11).
4. Connect vacuum hose to pressure relief valve (8).
5. Connect fuel pressure line to fitting (9).
6. Connect oil pressure line to fitting (10).
7. Connect manifold pressure line to fitting (7).
8. Connect fuel lines (2 and 3).
9. Route starter cable (19) to wing.
10. Connect magnet wires to electrical connector (5).
- i. Connect electrical wires to proper terminals in junction box and remove tags. Solder wires which require soldering.
- j. Refer to Section 8, install flap cables in wing and rig in accordance with rigging procedures.
- k. Refer to Section 5, install aileron cables in wing and rig in accordance with rigging procedures.
- l. If left wing was removed, install and rig aileron trim cables.
- m. If wing tip fuel tank was removed, install in accordance with Section 11. Do not install lower fairing at this time.
- n. Refer to Section 2, jack aircraft in accordance with jacking procedures.

CAUTION

If both engines were removed, the aircraft is tail heavy. To balance the aircraft, place weight (such as shot bags or sand bags) in engine nacelles prior to jacking.

- o. Remove padded supports from beneath cabin section, tail section, and wings.
- p. Place tailcone support beneath tailcone bumper.
- q. If landing gear was removed, refer to Section 4 and install and rig landing gear.

NOTE

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

- r. Refer to Section 9, install engine in accordance with installation procedures and connect flex cables (14, 15 and 16) to engine.

NOTE

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

- s. Remove support from beneath tailcone bumper.
- t. Remove aircraft jacks.
- u. Refer to Section 14, install batteries in accordance with installation procedures.
- v. Check control cables for proper operation and correct directional travel.
- w. Service aircraft and check for fuel leaks, especially at the fuel tank and wing connections.
- x. Install wing root and fuel tank fairings.
- y. Refer to Section 9, perform an engine operation check and observe engine controls and electrical equipment for proper operation.

Removal of Wing Locker Door. (See figure 3-20.)

- a. Open wing locker door.
- b. Remove screw (11), spacer (12) and bracket (13) from lower end of stop assembly (10).
- c. Remove nuts (5), washers (2), spacers (3), and screws (1) from door hinge (4) and remove door (6) from nacelle.

Installation of Wing Locker Door. (See figure 3-20.)

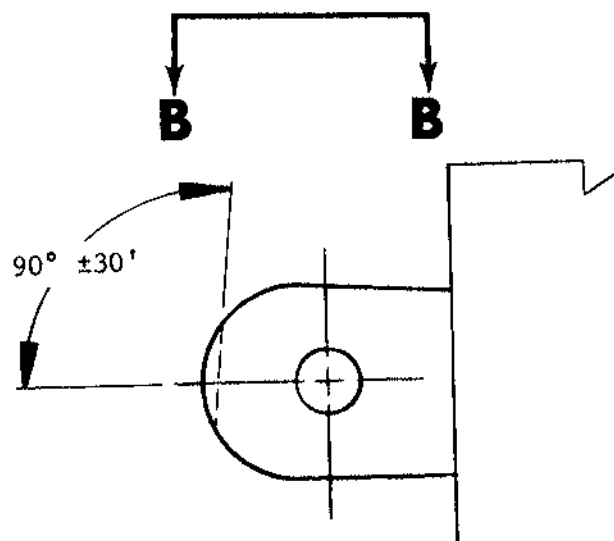
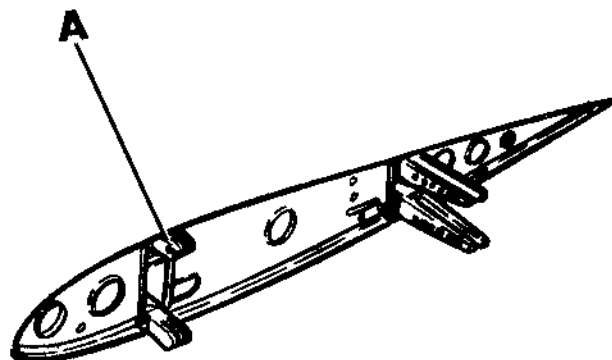
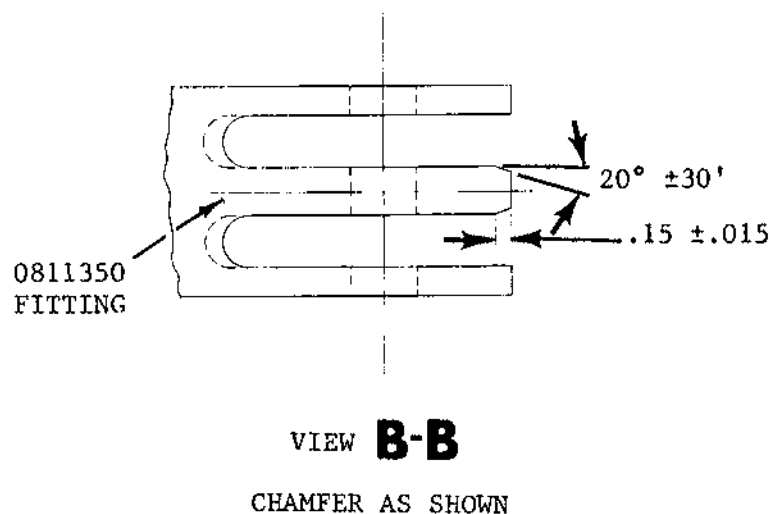
Install wing locker door by reversing removal procedures.

See additional wing installation instructions on the next page.
These additional instructions were added by Service Manual Change Notice dated 9-20-1974.

Additional Wing Installation procedures.

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. Modification Instructions are shown below.



Detail **A**

NOTE:

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.

Fuselage Front Spar Fittings Modification (Typical)

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Removal and Installation of Wing Locker Door Latch.

Removal and installation of wing locker door latch is not recommended unless replacement or repair is necessary. Use figure 3-20 as a guide for removal and installation.

Checking Baggage and Wing Locker Door Stop Tension (See figure 3-10.)

- Remove stop assembly from aircraft and set in a vice.
- Using a spring scale (0 to 50 pounds), measure the tension required to close the stop. Read tension when stop releases to close the stop. Tension should read 25 ± 3 pounds.
- If correct tension is not obtained, refer to Baggage Door Stop Adjustment procedures.

FUSELAGE STINGER.**Removal of Fuselage Stinger. (See figure 3-21.)**

- Remove attaching screws and move stinger assembly aft slightly.
- Disconnect electrical wires to the navigation light.
- If a reel antenna (optional equipment) has been installed, disconnect the reel antenna lead wires.
- Remove stinger assembly (1) from tailcone.

Installation of Fuselage Stinger. (See figure 3-21.)

- If removed, install tail navigation light with attaching screws, washers and nuts.
- Place stinger assembly (1) near tailcone.
- If antenna reel (optional equipment) is installed, connect reel and lead wires.
- Connect electrical wire.
- Secure stinger assembly (1) to tailcone with screws.

STABILIZERS.**Removal of Horizontal Stabilizer. (See figure 3-22.)**

- Refer to Section 6, remove elevator in accordance with removal procedures.
- Disconnect elevator trim tab push-pull tube from actuator by removing attaching nut, washer and bolt.
- Remove vertical fin and rudder in accordance with removal procedures.
- Refer to Section 6, remove elevator and trim control cables from stabilizer.
- Remove tail navigation light wires by removing screws from attaching clamps and wire terminal.
- If deice system (optional equipment) is installed, disconnect and tag hoses at tee located on support bracket just forward of center bulkhead in tailcone.
- Remove four nuts, washers and bolts attaching rear spar to tailcone bulkhead.
- Remove two bolts and washers attaching front spar to fuselage bulkhead.

- Lift the rear spar until the stabilizer is at an angle of approximately 45 degrees, then remove from the aircraft by lifting vertically.

Installation of Horizontal Stabilizer. (See figure 3-22.)

- Position horizontal stabilizer on tailcone and align mounting holes.
- Attach stabilizer front spar to fuselage bulkhead with two bolts and washers. Torque bolts to 175 ± 15 pound-inches.
- Attach stabilizer rear spar to tailcone bulkhead with four bolts, washers and nuts. Torque bolts to 120 ± 20 pound-inches.
- If deice system (optional equipment) is installed, connect hoses to tee located on support bracket forward of center bulkhead in tailcone.
- Install tail navigation light wires by installing screws in attaching clamps and wire terminal.
- Refer to Section 6, install elevator in accordance with installation procedures.
- Install vertical fin and rudder in accordance with installation procedures.
- Connect the elevator trim tab push-pull tube to the actuator by installing attaching bolt, washer and nut.

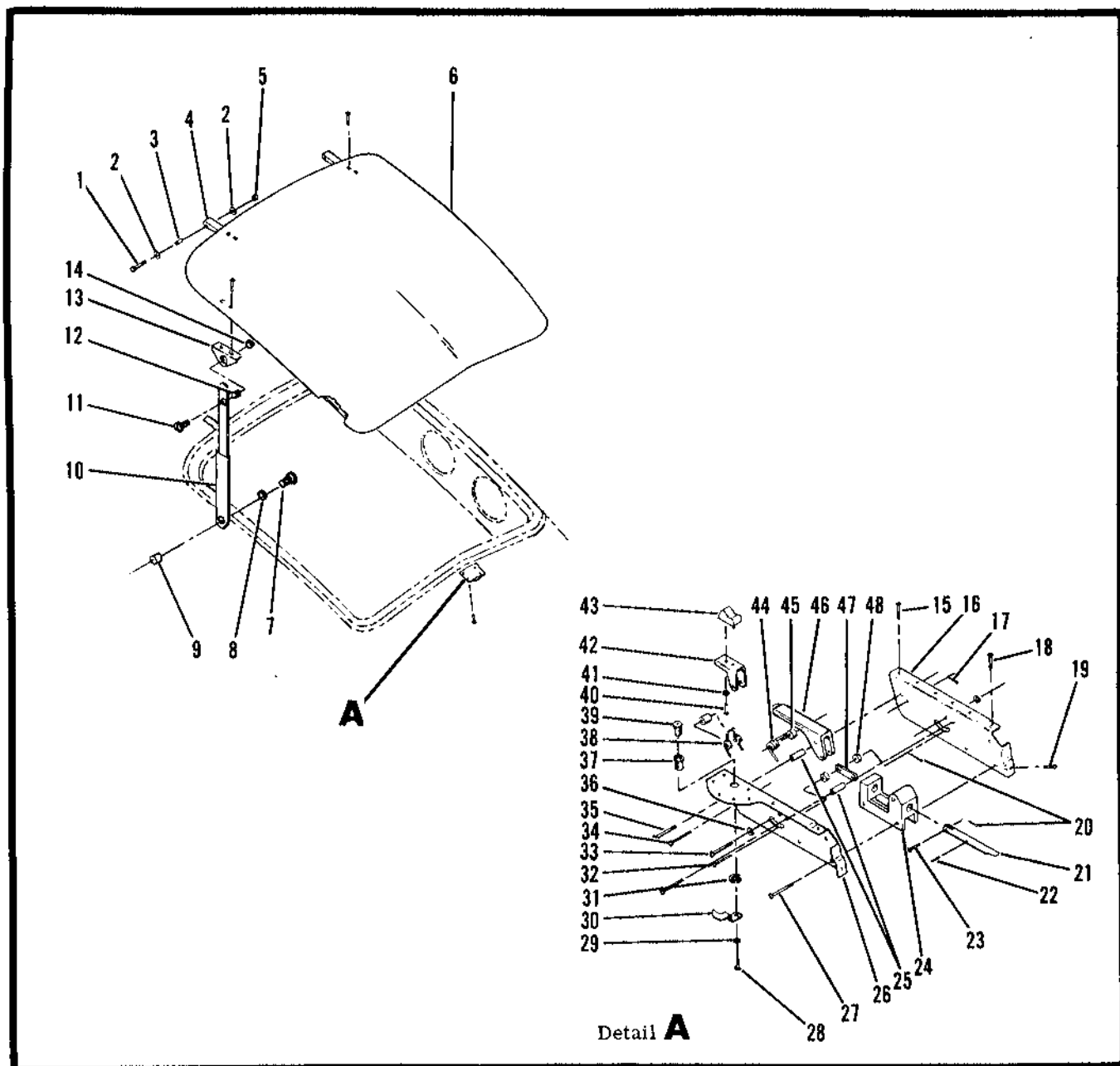
Removal of Vertical Stabilizer. (See figure 3-23.)

- Place suitable support beneath tail section.
- (See figure 3-22.) Remove horizontal stabilizer fairings (6 and 8).
- If omni-antenna (optional equipment) is installed, disconnect the coaxial cable in the aft fuselage.

NOTE

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

- If rotating beacon (optional equipment) is installed, two quick disconnects must be unhooked and the ground wire disconnected at the bulkhead in the aft fuselage.
- Refer to Section 7, remove rudder in accordance with removal procedures.
- Remove four screws attaching forward dorsal skin to fuselage.
- Remove nut, washer and eyebolt attaching elevator down spring to vertical fin rear spar.
- Refer to Section 7, remove rudder and trim control cables.
- Refer to Section 6, remove elevator push-pull tube in accordance with removal procedures.
- Remove two nuts and bolts attaching front spar to fuselage.
- Remove four bolts and washers attaching rear spar to fuselage.
- Lift fin vertically until front spar has cleared fuselage and remove from aircraft.



1. Screw	17. Cotter Pin	33. Screw
2. Washer	18. Screw	34. Pin
3. Spacer	19. Screw	35. Screw
4. Hinge Strap	20. Cotter Pin	36. Washer
5. Nut	21. Bolt Latch	37. Shell
6. Door Assembly	22. Spring	38. Spring
7. Screw	23. Pin	39. Cylinder Assembly
8. Washer	24. Block Guide	40. Screw
9. Spacer	25. Spacer	41. Lockwasher
10. Stop Assembly	26. Support	42. Latch Handle Retainer
11. Screw	27. Screw	43. Button
12. Spacer	28. Screw	44. Spring
13. Bracket	29. Lockwasher	45. Spacer
14. Nut	30. Lock Arm	46. Latch Handle
15. Screw	31. Nut	47. Link
16. Support	32. Pin	48. Spacer

Figure 3-20. Wing Locker Installation

Installation of Vertical Stabilizer. (See figure 3-23.)

- a. Place vertical fin in position on fuselage and align mounting holes.
- b. Attach vertical fin rear spar to tailcone bulkhead with four bolts and washers.

NOTE

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

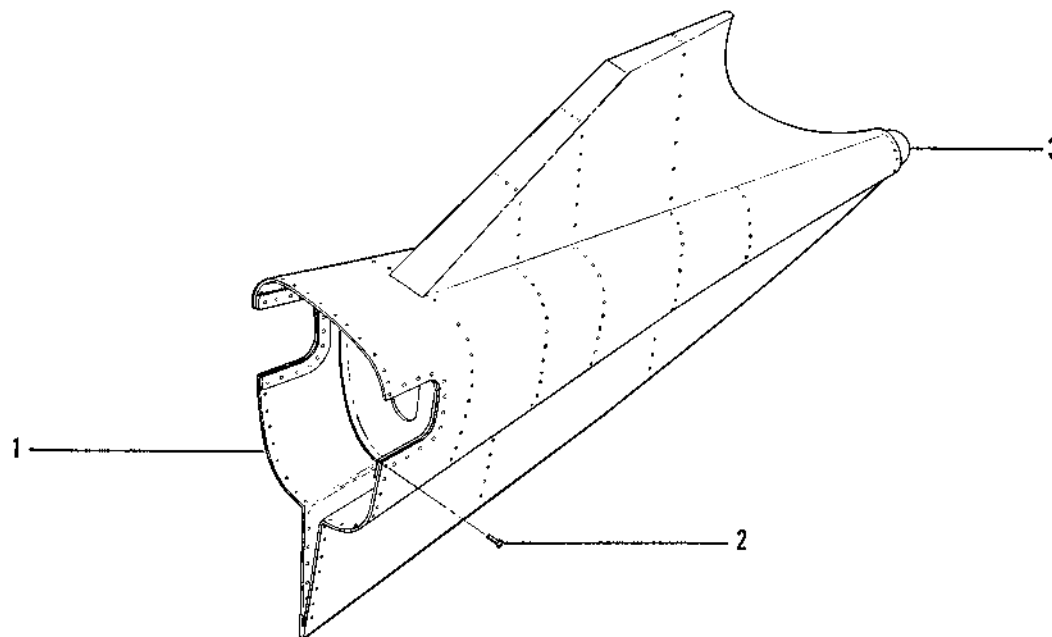
- c. Attach forward dorsal skin to fuselage with four screws.
- d. Attach vertical fin front spar to fuselage with two bolts and nuts.
- e. Refer to Section 6, install elevator push-pull tube in accordance with installation procedures.
- f. Install elevator down spring with eyebolt, washer and nut.
- g. Refer to Section 7, install rudder to vertical stabilizer and connect rudder and trim control cables.
- h. If omni-antenna (optional equipment) is installed, connect the coaxial cable in the aft fuselage.
- i. If rotating beacon (optional equipment) is installed, fasten the two disconnects and attach the ground wire to the bulkhead in the aft fuselage.
- j. Remove support from beneath tail section and install stabilizer fairings.

CONTROL PEDESTAL.

The control pedestal is located in the cabin, between the pilot's and copilot's positions, just below and aft of the instrument panel. This pedestal contains the engine control quadrant, elevator trim, aileron trim and rudder trim control wheels and indicators. Provision is made for installation of an automatic pilot control head in the upper part of the control pedestal, immediately aft of the control quadrant.

Removal of Control Pedestal. (See figure 3-24.)

- a. Refer to Section 3, remove the front seats, front carpet and kick plates.
- b. Remove engine controls cover (21).
- c. Remove elevator trim control wheel (3) by removing four screws and washers.
- d. Remove top panel (7) and side panels (11 and 12) from both sides of control pedestal by removing attaching screws.
- e. Refer to Section 6, remove elevator trim control sprocket (2) in accordance with removal procedures.
- f. Disconnect rudder trim control torque tube (16) by removing roll pin.
- g. Disconnect upper aileron trim control chain (15) at master link.

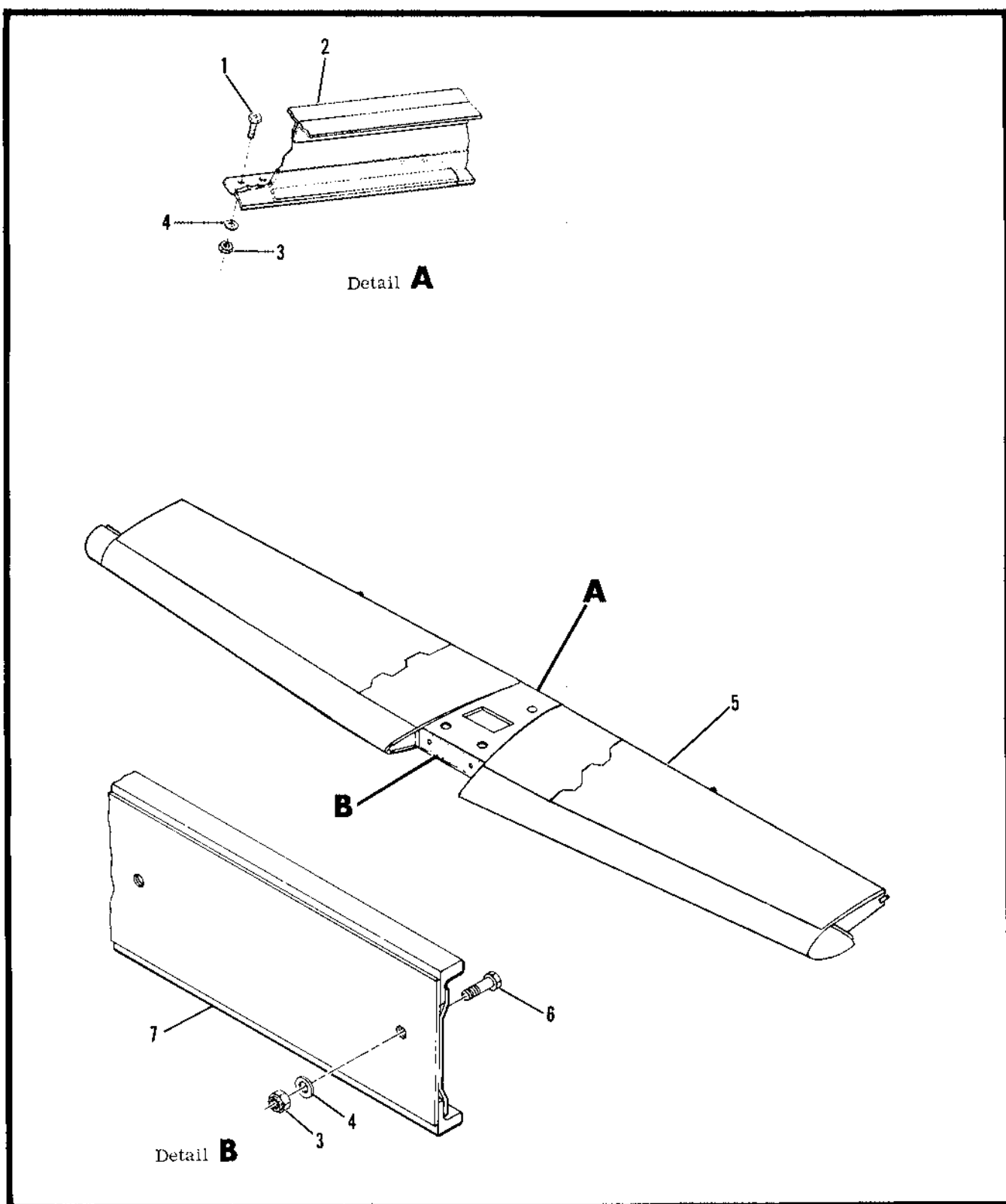


1. Fuselage Stinger

2. Screw

3. Tail Light Assembly

Figure 3-21. Fuselage Stinger

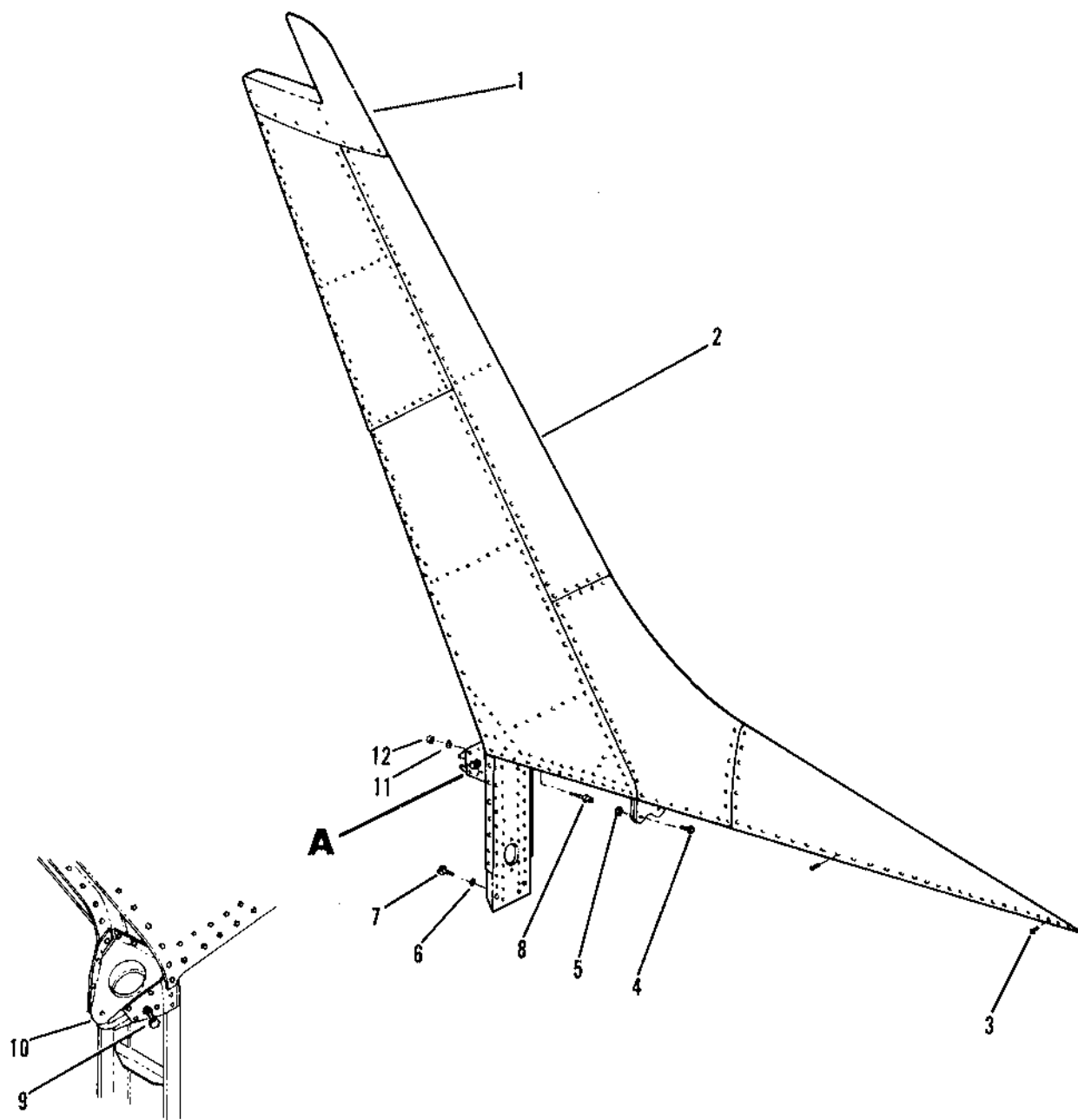


- 1. Bolt
- 2. Stabilizer Rear Spar
- 3. Nut

- 4. Washer
- 5. Horizontal Stabilizer

- 6. Bolt
- 7. Stabilizer Front Spar

Figure 3-22. Horizontal Stabilizer Installation

Detail **A**

1. Fiberglass Tip	5. Nut	9. Rudder Bellcrank Stop Bolt
2. Vertical Fin	6. Washer	10. Lower Hinge Assembly
3. Screw	7. Bolt	11. Washer
4. Bolt	8. Eyebolt	12. Nut

Figure 3-23. Vertical Fin Installation

- h. Route aileron, elevator, and rudder trim control cables from pedestal.
- i. Disconnect throttle, propeller and mixture control cables by loosening the coupling nuts.

NOTE

If autopilot (optional equipment) is installed, disconnect wire bundle from rear of control unit box.

- j. Remove alternate air control bracket (10) from control pedestal (9) by removing attaching rivets.
- k. Remove two screws fastening upper part of control pedestal to stationary instrument panel (8).
- l. Remove ten screws which fasten control pedestal to floor.
- m. Carefully lift control pedestal upward to disengage the rudder trim control torque tube (16) from the torque tube shaft (17). Tilt the control pedestal aft, work it free of all units, and remove from cabin.

Disassembly of Control Pedestal. (See figure 3-24.)

This disassembly procedure will deal only with those parts which could normally be expected to be removed without disassembling the basic (riveted) structure. If further disassembly is required, standard shop procedure should be used. For disassembly of removed components, refer to the appropriate paragraph in this manual.

- a. Remove control quadrant (22) and linkage.
- b. Remove control swivel connectors (5) and push-pull unit (4).
- c. Remove rudder trim control chain (19) by disconnecting at master link. Remove sprocket (18) and shaft (17). Remove bearing plate by removing screws and nuts. Removal of remaining rudder trim control components is not recommended.

Assembly of Control Pedestal. (See figure 3-24.)

Assembly of control pedestal should be accomplished by reversing the disassembly procedures.

Installation of Control Pedestal. (See figure 3-24.)

- a. Work control pedestal carefully into position over control cable (6) and rudder trim control torque tube (16). Lower into place to align holes in pedestal flanges with nutplates in floor, so that torque tube shaft (17) enters into upper end of torque tube (16).
- b. Fasten control pedestal to floor with ten screws and to stationary instrument panel (8) with two screws.
- c. Insert roll pin through rudder trim control torque tube (16) and shaft (17), and safety wire in place.

NOTE

If rudder trim tab position or cable tension has been disturbed while the torque tube was disconnected, it may be necessary to adjust the rigging of the rudder trim control system in accordance with Section 7.

- d. Install upper aileron trim control chain (15) and fasten at master link.

NOTE

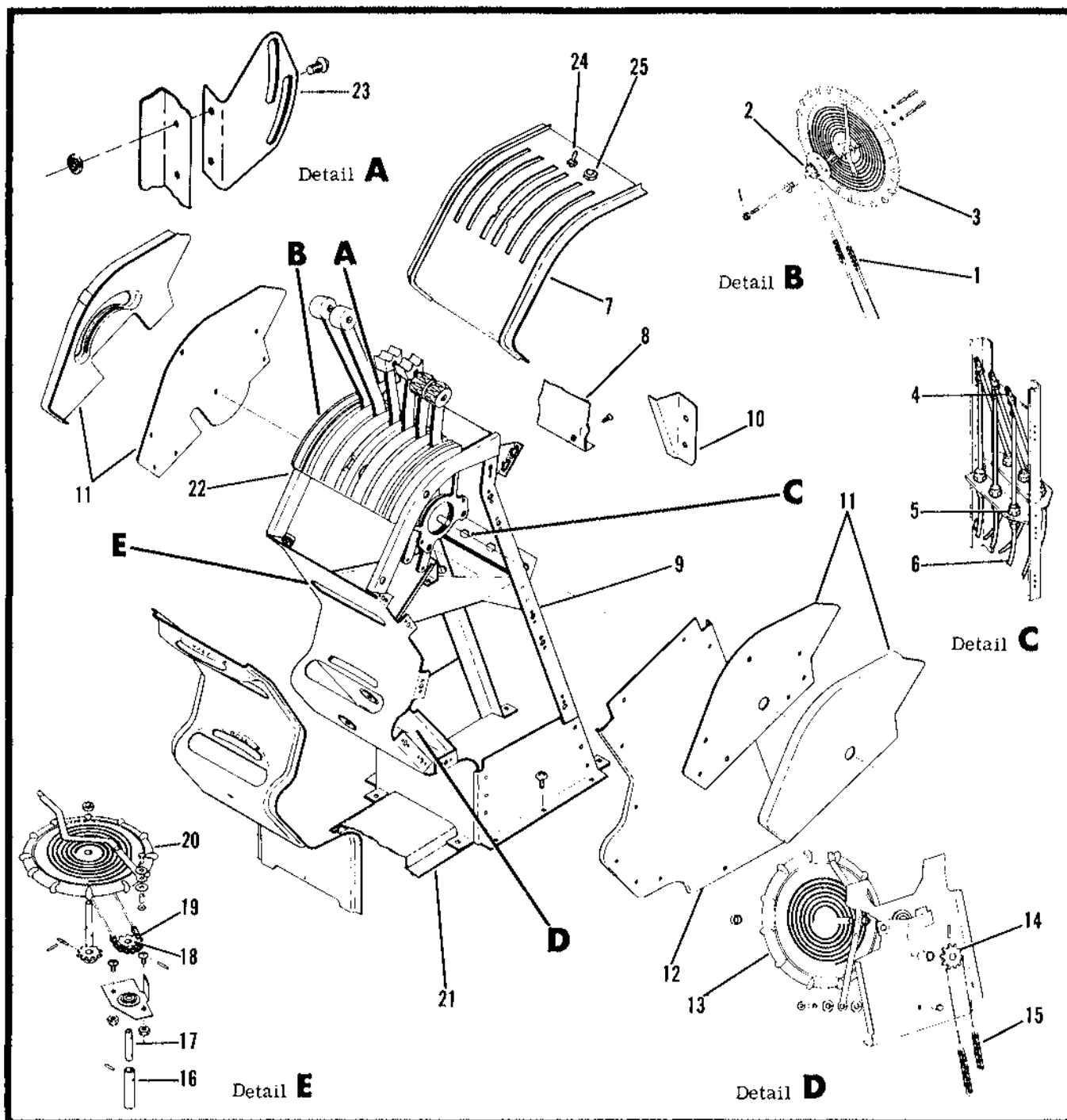
If aileron trim tab position or cable tension has been disturbed while chain was disconnected, it may be necessary to adjust the rigging of the aileron trim control system in accordance with Section 5.

- e. Install elevator trim control sprocket (2), chain (1), left upper side panel (11) and left center side panel (12).

NOTE

If elevator trim tab position or cable tension has been disturbed while chain was disconnected, it may be necessary to adjust the rigging of the elevator trim control system in accordance with Section 6.

- f. Attach cables (6) in place by tightening the coupling nuts. (Use a suitable thread lubricant on the male threads of all connectors.)
- g. Attach all engine controls in accordance with Section 9.
- h. Rig all engine controls in accordance with Section 9.
- i. Install the right center side panel (12), the right upper side panels (11), and the top panel (7).
- j. Fasten carpet and floor covering in place and replace control cover (21).
- k. Install front seats.



1. Elevator Trim Control Chain
2. Elevator Trim Control Sprocket
3. Elevator Trim Control Wheel
4. Control Push-pull Unit
5. Swivel
6. Control Cable
7. Top Panel
8. Stationary Instrument Panel
9. Control Pedestal
10. Alternate Air Control Bracket
11. Upper Side Panel
12. Center Side Panel
13. Aileron Trim Control Wheel

14. Aileron Trim Control Sprocket
15. Aileron Trim Control Chain
16. Torque Tube
17. Torque Tube Shaft
18. Rudder Trim Control Sprocket
19. Rudder Trim Control Chain
20. Rudder Trim Control Wheel
21. Control Cover
22. Control Quadrant
23. Switch Bracket
24. Synchronizer Switch
25. Indicator Light

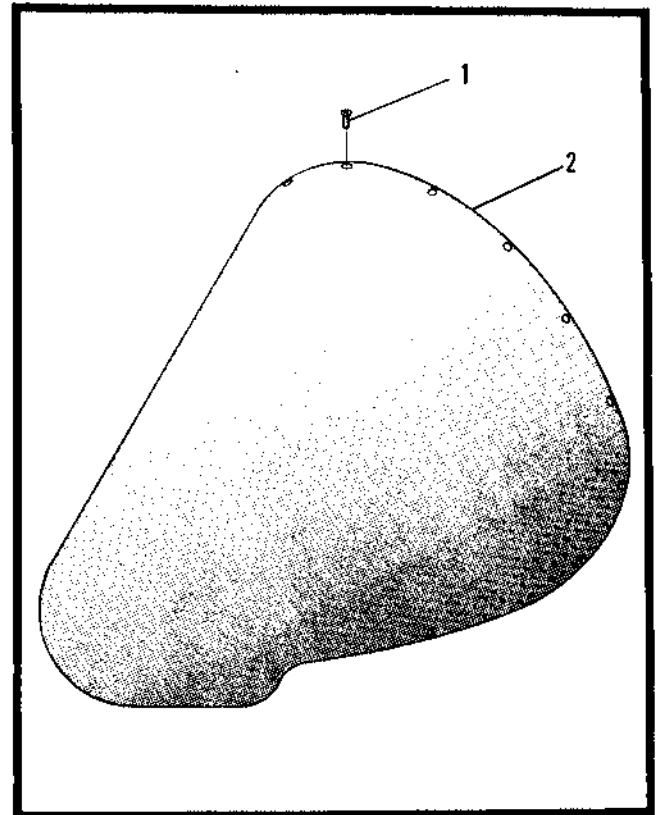
Figure 3-24. Pedestal Installation

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 physical 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 3-25.)

- a. Remove screws securing radome to nose structure.
- b. Move radome forward in order to disconnect the glide slope quick-disconnect antenna lead and remove radome from aircraft.
- c. Reverse this procedure for installation.



1. Screw

2. Radome

Figure 3-25. Radome Installation

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SECTION 4

LANDING GEAR AND BRAKE SYSTEM

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LANDING GEAR SYSTEM.

The fully-retractable tricycle landing gear consists of a main gear located aft of each engine nacelle and a nose gear located near the forward end of the fuselage. Each landing gear is mechanically connected to a single gearbox, which is normally driven by an electric motor. In the event of landing gear electrical system failure, the landing gear can

be extended by operating a hand crank, located at the right side of the pilot's seat. Landing gear over-travel during operation is prevented by limit switches which open the electrical circuit to the motor when the correct amount of travel has been attained. 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.

Troubleshooting Landing Gear and Cabin Step.

TROUBLE	PROBABLE CAUSE	CORRECTION
LANDING GEAR FAILS TO RETRACT - GEAR MOTOR OPERATES	Manual extension crank improperly stowed. Defective landing gear actuator. Defective reduction unit. Pin sheared on gear motor shaft.	Stow crank properly. Replace actuator. Replace reduction unit. Replace pin.
LANDING GEAR FAILS TO RETRACT - GEAR MOTOR DOES NOT OPERATE	Broken bolts or retracting linkage, or disconnected retracting linkage. Circuit breaker out. Defective circuit breaker. Insufficient electrical power. Defective UP limit switch. Defective landing gear safety switch. Incorrectly adjusted landing gear safety switch. Defective landing gear relay. Defective landing gear switch. Defective landing gear motor. Defective UP electrical circuit.	Replace broken parts. Connect linkage if disconnected. Reset circuit breaker. Replace circuit breaker. Recharge batteries. Check voltage regulators. Replace switch. Adjust in accordance with rigging procedures. Replace switch. Adjust safety switch. Replace relay. Replace switch. Replace motor. Repair circuit.
LANDING GEAR FAILS TO RETRACT COMPLETELY	Landing gear incorrectly rigged for retracted position. Circuit breaker out, due to overload caused by incorrect landing gear rigging. Circuit breaker out, due to overload caused by defective retracting linkage. UP limit switch incorrectly adjusted.	Rig in accordance with rigging procedures. Reset circuit breaker and rig in accordance with rigging procedures. Reset circuit breaker, replace defective linkage, and rig in accordance with rigging procedures. Adjust in accordance with rigging procedures.
LANDING GEAR FAILS TO RETRACT	Retracting linkage to affected gear broken or disconnected.	Replace broken parts. Connect linkage if disconnected. Rig in accordance with rigging procedures.
ONE LANDING GEAR FAILS TO RETRACT COMPLETELY	Affected landing gear incorrectly rigged for retracted position. Defective retracting linkage to affected landing gear.	Rig in accordance with rigging procedures. Replace defective linkage and rig in accordance with rigging procedures.
LANDING GEAR FAILS TO EXTEND- GEAR MOTOR OPERATES	Manual extension crank improperly stowed.	Stow crank properly.

TROUBLE	PROBABLE CAUSE	CORRECTION
LANDING GEAR FAILS TO EXTEND - GEAR MOTOR OPERATES (CONT)	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 procedures.
	Defective landing gear switch.	Replace switch.
	Defective landing gear motor.	Replace motor.
LANDING GEAR FAILS TO EXTEND COMPLETELY	Defective DOWN electrical circuit.	Repair circuit.
	DOWN limit switch incorrectly adjusted.	Adjust in accordance with rigging procedures.
	Landing gear incorrectly rigged for the DOWN position.	Rig in accordance with rigging procedures.
	Circuit breaker out, due to overload caused by incorrect rigging.	Reset circuit breaker and rig in accordance with rigging procedures.
	Circuit breaker out, due to overload caused by defective retracting linkage.	Reset circuit breaker, replace defective linkage, and rig in accordance with rigging procedures.
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 procedures.
ONE LANDING GEAR FAILS TO EXTEND COMPLETELY	Affected landing gear incorrectly rigged for the DOWN position.	Rig in accordance with rigging procedures.
	Defective retracting linkage to affected gear.	Replace defective linkage and rig in accordance with rigging procedures.
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 procedures.
	Defective manual extension linkage.	Replace defective linkage.
	Defective landing gear retracting linkage or actuator.	Replace defective linkage or actuator.
	Landing gear improperly rigged.	Rig landing gear in accordance with rigging procedures.
GEAR UP (RED) LIGHT FAILS TO LIGHT	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.

TROUBLE	PROBABLE CAUSE	CORRECTION
GEAR UP (RED) LIGHT FAILS TO LIGHT (CONT)	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 ac- cordance with rigging procedures.
GEAR UP (RED) LIGHT REMAINS ON WHEN GEAR IS DOWN	Defective UP limit switch.	Replace switch and adjust in accord- ance with rigging procedures.
	Circuit shorted to another system.	Locate and repair.
GEAR DOWN (GREEN) LIGHT FAILS TO LIGHT	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker or el- ectrical circuit.	Replace circuit breaker. Repair de- fective electrical circuit.
	Lamp burned out.	Replace lamp.
	Lamp loose.	Repair or replace receptacle.
	Landing gear not fully extended.	Extend fully.
	One or more DOWN indicator switch- es defective or incorrectly adjusted.	Replace defective switches and/or adjust in accordance with rigging procedures.
	Circuit shorted to another system.	Locate and repair.
GEAR DOWN (GREEN) LIGHTS REMAIN ON WHEN GEAR IS UP		
GEAR DOWN (GREEN) LIGHTS FLICKER WHEN GEAR IS DOWN	One or more DOWN indicator switch- es defective or incorrectly adjusted.	Replace defective switches and/or adjust in accordance with rigging pro- cedures.
	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 proced- ures.
GEAR WARNING HORN SOUNDS IN FLIGHT WHEN LANDING GEAR IS UP AND THROTTLES ARE NOT RETARDED	Defective throttle microswitch.	Replace switch and adjust in accord- ance with rigging procedures.
	Incorrectly adjusted throttle micro- switch.	Adjust in accordance with rigging procedures.
GEAR WARNING HORN SOUNDS ON THE GROUND WHILE LANDING GEAR SWITCH IS DOWN	Incorrectly adjusted gear DOWN in- dicator switch.	Adjust switch in accordance with rig- ging procedures.
	Defective gear DOWN indicator switch.	Replace switch and adjust in accord- ance with rigging procedures.
	Circuit shorted to another system.	Locate and repair.
GEAR WARNING HORN SOUNDS WHEN BATTERY SWITCH IS TURNED ON, OR SOUNDS WHEN AN UNRELATED SYSTEM IS TURNED ON	Incorrectly adjusted gear DOWN in- dicator switch.	Adjust switch in accordance with rigging procedures.

TROUBLE	PROBABLE CAUSE	CORRECTION
GEAR WARNING HORN SOUNDS WHEN BATTERY SWITCH IS TURNED ON, OR SOUNDS WHEN AN UNRELATED SYSTEM IS TURNED ON (CONT)	Defective gear DOWN indicator switch.	Replace switch and adjust in accordance with rigging procedures.
GEAR WARNING HORN FAILS TO SOUND WHEN LANDING GEAR SWITCH IS PLACED UP WHILE ON THE GROUND	Circuit breaker out. Defective circuit breaker. Landing gear safety switch incorrectly adjusted. Defective landing gear safety switch. Defective electrical circuit. Defective warning horn and flasher unit.	Reset circuit breaker. Replace circuit breaker. Adjust safety switch. Replace switch and adjust safety switch. Repair circuit. Replace horn and flasher unit.
GEAR WARNING HORN FAILS TO SOUND IN FLIGHT WHEN LANDING GEAR IS UP AND THROTTLES ARE RETARDED	Circuit breaker out. Defective circuit breaker. Defective gear DOWN indicator switch. Defective electrical circuit. Defective warning horn. Throttle microswitch incorrectly adjusted. Defective throttle microswitch.	Reset circuit breaker. Replace circuit breaker. Replace switch and adjust in accordance with rigging procedures. Repair circuit. Replace horn. Adjust in accordance with rigging procedures. Replace switch and adjust in accordance with rigging procedures.
LANDING GEAR DOORS FAIL TO OPERATE PROPERLY	Doors incorrectly rigged. Defective door operating linkage.	Rig doors in accordance with rigging procedures. Replace defective linkage.
LANDING GEAR SHIMMIES DURING FAST TAXI, TAKE-OFF, OR LANDING	Insufficient fluid in shimmy dampener. Internal leakage in shimmy dampener. Roll pin attaching piston to piston rod sheared. Shimmy dampener loose at mounting. Tires out of balance. Worn or loose wheel bearings. Excessive clearance between upper and lower torque links.	Service shimmy dampeners in accordance with Section 2. Replace defective seats and/or piston. Replace roll pin. Replace worn housing and/or attaching bolt. Replace tires with tread worn unevenly or flat spots. Replace and/or adjust wheel bearings. Adjust clearance in accordance with alignment procedure.

TROUBLE	PROBABLE CAUSE	CORRECTION
LANDING GEAR SHIMMIES DURING FAST TAXI, TAKEOFF OR LANDING (CONT)	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 at the 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.
CABIN STEP DOES NOT RETRACT	Broken cable.	Replace cable.
	Cable off pulley at landing gear actuator.	Place cable in pulley track. Check operation.
	Cable disconnected.	Connect and check cable as described in installation of cabin step system.
CABIN STEP DOES NOT EXTEND	Cable off pulley track and binding.	Place cable in pulley track. Check pulley for freedom of operation. Check that pulley cable retaining pin is installed.
	Step assembly binding.	Retract and extend cabin step by hand to locate source of binding.
CABIN STEP DOES NOT FULLY RETRACT	Improperly rigged.	Rig in accordance with installation of cabin step system.

TROUBLE	PROBABLE CAUSE	CORRECTION
CABIN STEP DOES NOT FULLY RETRACT (CONT)	Cable off pulley track.	Place cable in pulley track. Check pulley for freedom of operation. Check that pulley cable retaining pin is installed.
CABIN STEP DOES NOT FULLY EXTEND	Improperly rigged.	Rig in accordance with installation of cabin step system.

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 direct-

ly 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.
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 Actuator System Components Overhaul/Parts Manual and repair or replace motor.

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Removal of Landing Gear Actuator. (See figure 4-1.)

- a. Jack the aircraft in accordance with Section 2.
- b. Remove the carpet in accordance with Section 3.
- c. Remove the floorboards between front and rear spar, and access hole cover from underside of fuselage beneath landing gear actuator.

NOTE

Disconnect aircraft battery terminals to prevent accidental electrical operation of gear during disassembly procedures.

- d. (See figure 4-6.) Engage manual extension crank and operate toward the UP position until the main gear doors open sufficiently to disconnect link (3) from door (6) by removing nut, washer, spacers and bolt.
- e. (See figure 4-7.) Disconnect the inboard LH drive tube (35) and the intermediate drive tube (40) from idler bellcranks (7) by removing nuts, spacers and bolts. For ease of bolt removal, support the wheel by hand to remove shear load from bolt. After bolt is removed, gently lower gear to its free fall or extended position.
- f. Engage manual extension crank and operate toward the UP position until nose gear drive tube attaching bolt (43) is accessible through lower access hole. Support nose gear while removing cotter pin, nut, washer and bolt (43). Gently lower nose gear to its free fall or extended position.
- g. Engage manual extension crank and operate toward the DOWN position until the upper bellcrank is in approximately a lateral position.
- h. Remove nut, washer, caps (6 and 47) and bolt attaching upper and lower bellcrank to the sector shaft.
- i. (See figure 4-7.) Disconnect RH inboard drive tube (43) from idler (46) by removing nut, washer, spacers and bolt.
- j. Lift upper bellcrank (5) enough to clear sector shaft. Remove upper bellcrank, RH inboard drive tube (54) and LH inboard drive tube (11) as a unit by pulling inboard until LH tube clears fuselage skin.

- k. Remove lower bellcrank (50) and pulley (44) as a unit from sector shaft, leaving step connected.
- l. Disconnect manual extension disengage rod (32) by removing cotter pin and pin.
- m. Disconnect manual extension drive tubes by removing three cotter pins, washers and pins. To disconnect, slide universal joint (31) aft and inner shaft (30) forward.
- n. Remove safety wire from all bolts which must be removed.
- o. Remove four bolts and washers attaching reduction unit (3) and actuator assembly (18) to bulkhead (4).

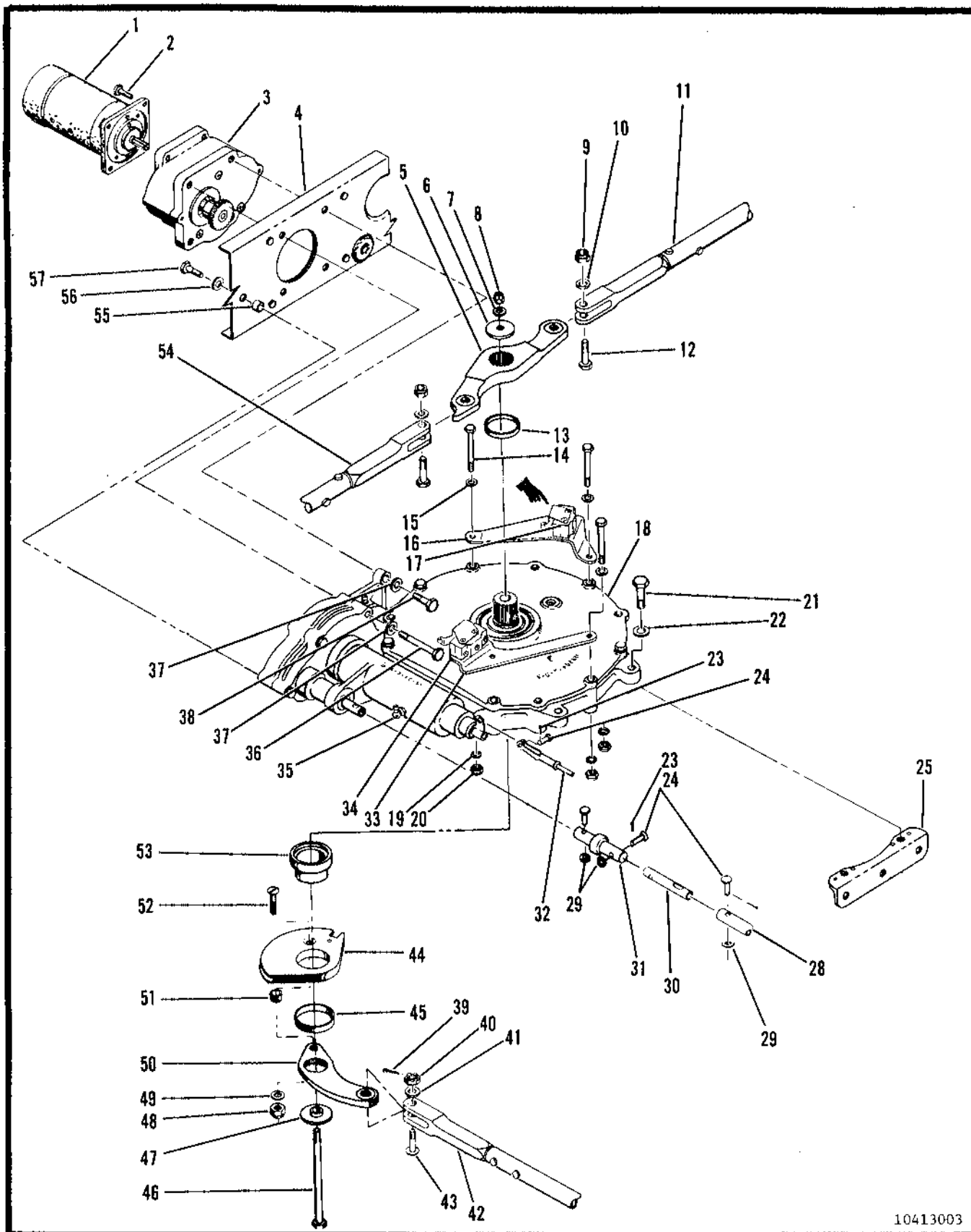
NOTE

To remove reduction unit (3) or motor (1) from aircraft, remove four bolts. When removing motor, disconnect and tag the electrical wires at the relays to insure proper placement on reinstallation.

- p. Remove four nuts, washers and bolts attaching switch brackets (16 and 33) to actuator assembly. Do not disturb switch adjustment except to replace switches or brackets.
- q. Remove remaining nuts, washers and bolts attaching actuator assembly (18) to mounting channel.
- r. Remove bolts and washers attaching actuator assembly (18) to forward mounting bracket (25).
- s. Remove bolts, washers and spacer (55) attaching actuator assembly (18) to bulkhead (4).
- t. Lift actuator assembly (18) vertically and remove from aircraft.

Installation of Landing Gear Actuator. (See figure 4-1.)

- a. Position actuator assembly being sure that lower bellcrank (50) and pulley (44) is positioned so as not to cause damage to lower skin. Install spacer (53) and lower bellcrank (50) on lower end of sector shaft. Universal joint (31) and inner shaft (30) must be in place before positioning actuator.



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Figure 4-1. Landing Gear Actuator

Figure 4-1. Landing Gear Actuator Callouts

1. Landing Gear Motor	20. Nut	39. Cotter Pin
2. Bolt	21. Bolt	40. Nut
3. Reduction Unit	22. Washer	41. Washer
4. Bulkhead	23. Cotter Pin	42. Nose Gear Drive Tube
5. Upper Bellcrank	24. Pin	43. Bolt
6. Cap	25. Mounting Bracket	44. Pulley
7. Washer	26. Deleted	45. Spacer
8. Nut	27. Deleted	46. Bolt
9. Nut	28. Gear Shaft	47. Cap
10. Washer	29. Washer	48. Nut
11. LH Inboard Drive Tube	30. Inner Shaft	49. Washer
12. Bolt	31. Universal Joint	50. Lower Bellcrank
13. Spacer	32. Manual Extension Disengage Rod	51. Spacer
14. Bolt	33. Switch Bracket	52. Screw
15. Washer	34. Down Limit Switch	53. Spacer
16. Switch Bracket	35. Grease Fitting	54. RH Inboard Drive Tube
17. Up Limit Switch	36. Bolt	55. Spacer
18. Actuator Assembly	37. Washer	56. Washer
19. Washer	38. Bolt	57. Bolt

NOTE

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

- b. Install spacer (55), washer and bolt attaching actuator assembly (18) to bulkhead (4).

NOTE

To facilitate installation, install all actuator assembly (18) attaching bolts before any are tightened.

- c. Install two bolts and washers attaching actuator assembly (18) to forward mounting bracket (25).
d. Install switch bracket (16 and 33) with bolts, nuts and washers.

CAUTION

Check switches thoroughly for proper operation. A faulty switch may cause damage to landing gear actuator.

- e. Install bolt, washer and nut attaching actuator assembly (18) to mounting channel.

NOTE

Use AN960-10L washers to shim as required between actuator and two mounting channels.

- f. Install four bolts and washers attaching actuator assembly (18) and reduction unit (3) to bulkhead (4).

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.

- g. If removed, install four bolts attaching motor (1) to reduction unit (3).
h. If motor was removed, connect the electrical wires at the appropriate relay as previously marked.
i. Tighten all nuts and bolts which were installed but not tightened.
j. Safety bolts attaching motor (1) to reduction unit (3).
k. Safety bolts attaching actuator to bulkhead (4).
l. Connect manual extension drive tubes with pins, washers and cotter pins.
m. Connect manual extension disengage rod (32) with pin and cotter pin.
n. Insert LH inboard drive tube (11) through opening in fuselage skin until upper bellcrank (5) is in position to be installed on sector shaft with the threaded portion of bolts (12) in the UP position.

NOTE

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

- o. Place spacer (13) and upper bellcrank (5) on sector shaft.

NOTE

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

- p. Insure that lower bellcrank (50) and spacer (45) are correctly in place and install bolt, caps (6 and 47), washer and nut.
q. (See figure 4-7.) Connect RH inboard drive tube (43) and intermediate drive tube (40) to idler (46) by installing spacers, bolts washer and nut.
r. (See figure 4-7.) Connect LH inboard drive

tube (35) and intermediate drive tube (40) to idler bellcranks (7) with bolts, spacers and nuts.

s. Connect forward push-pull tube (42) to lower bellcrank (50) with bolt, washer, nut and cotter pin.

t. (See figure 4-6.) Connect main gear doors (6) to links (3) with bolt, spacer, washer and nut.

u. Connect battery terminals.

v. Perform an operational check of landing gear, checking especially that limit switches are correctly adjusted and landing gear is correctly rigged. Refer to landing gear rigging procedures.

w. Install access hole covers on cabin floor and underside of fuselage, beneath landing gear actuator.

x. Install the carpet in accordance with Section 3.

y. Insure that landing gear is DOWN, then remove jacks.

CABIN STEP SYSTEM.

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

Removal of Cabin Step System. (See figure 4-2.)

a. Remove the rear seats and center and rear carpet in accordance with Section 3.

b. Remove the two access covers between the front and rear spars, also the three access covers aft of the rear spar, in accordance with Section 1.

c. Remove skin access cover from below landing gear actuator.

d. Disconnect cable at turnbuckle (36).

e. Disconnect cable from spring bail (35) by removing spring bail.

f. Remove cable (13) from pulley by removing cotter pin, washer, pin and clamp.

g. Remove cable (13) from aircraft.

h. Disconnect cable (31) from arm (22) by removing cotter pin and pin.

i. Remove cable (31) from aircraft.

j. Remove cabin step assembly from aircraft, being careful to disengage spring (23) from step support (32) when bolt, washer and nut are removed.

k. Location and parts necessary for disassembly or assembly of the cabin step assembly and pulley are clearly shown in figure 4-2.

1. For removal of pulley track (12) from landing gear actuator, refer to "Removal of Landing Gear Actuator."

Installation of Cabin Step System. (See figure 4-2.)

a. Place bail at end of cable (13) just outside of the pulley track (12) and with the cable (13) in the pulley, install clip and secure with pin, washer and cotter pin.

b. Route cable (13) aft through pulley (3) and attach spring bail (35).

c. Make certain that cotter pins are installed in

pulley bracket (4) to prevent the cable from leaving the pulley track.

d. Attach the short cable between the turnbuckle (36) and the spring bail (35).

e. Attach the cable (31) to arm (22) by installing pin and cotter pin.

f. Before installing step assembly, make certain that spacer (24) is installed.

g. Install spring (23) on step assembly. Preload spring 160°.

h. Place step assembly, with spring (23) installed into step support (32) and install bolt, washer and nut.

i. Route cable (31) through pulley (16).

j. Make certain that cotter pins are installed in pulley bracket (17) to prevent the cable from leaving the pulley track.

k. Raise the cabin step by hand and note that the spring (23) returns the cabin step to the extended position.

l. Raise the cabin step by hand to provide slack in cable (31) and install turnbuckle (36).

m. After turnbuckle (36) is installed, then return step to its extended position.

n. Adjust the turnbuckle (36) to place tension on the cable until just a small amount of light may be seen between the step assembly and step stop.

o. Check the cabin step installation as follows:

1. Jack aircraft in accordance with Section 2.
2. Raise the cabin step into the fuselage well by hand to make certain there are no obstructions.
3. Retract landing gear using normal retraction system

NOTE

Use of an external power source is advisable to prevent draining battery power.

4. Note that the cabin step retracts fully into the step well.

5. Using a spring scale, it should require approximately 4 to 6 pounds pressure to move the cabin step downward a short distance.

6. Safety turnbuckle.

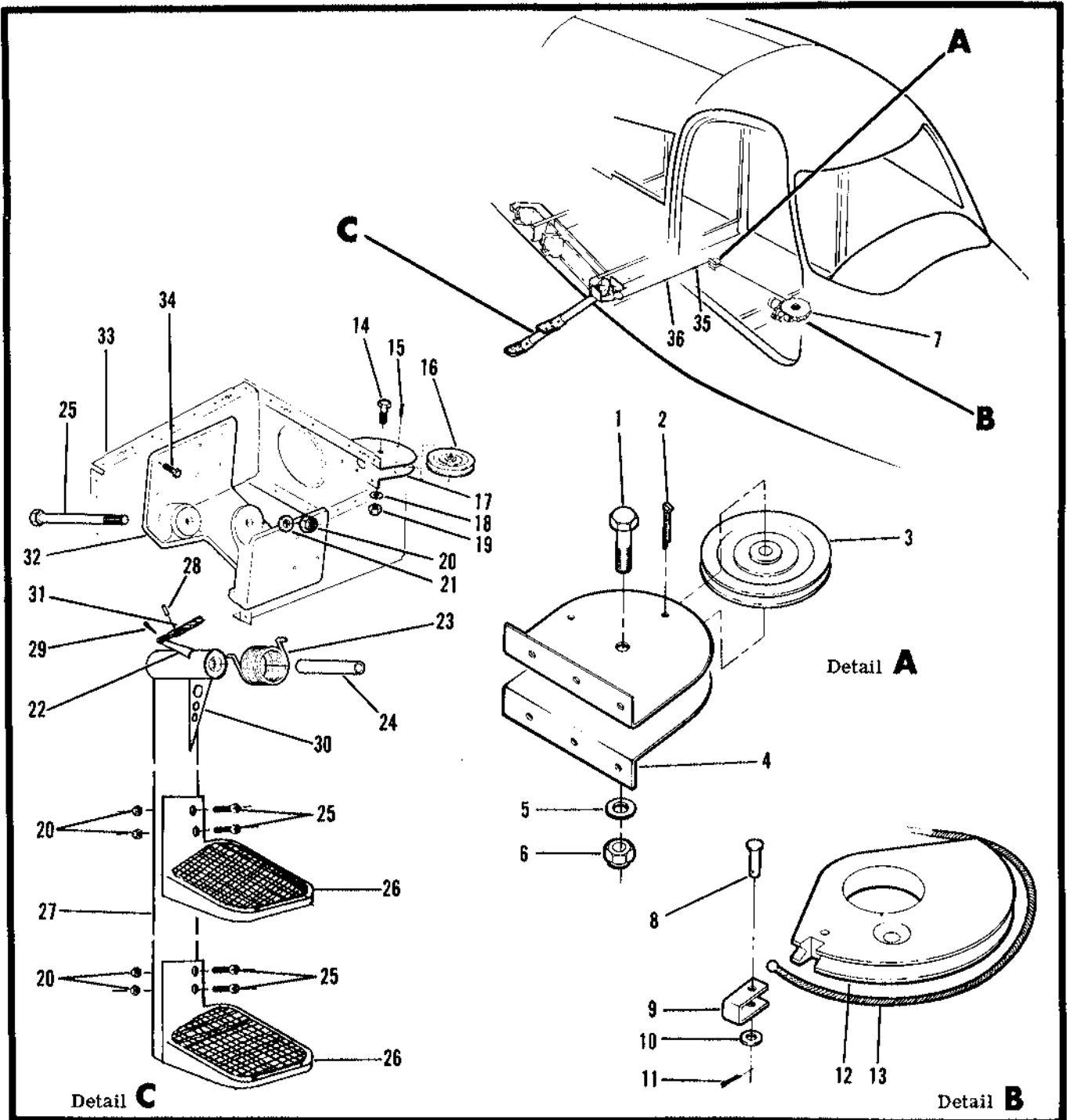
7. Insure that landing gear is DOWN and remove jacks.

p. Install the floorboard access covers and skin access cover in accordance with Section 1.

q. Install the center and rear carpets and the rear seats in accordance with Section 3.

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, bellcrank, miter gears, and push-pull rods. The hand crank located at the right of the pilot's seat is normally in a stowed position. When unfolded into its operation position the hand crank disengages the normal landing gear operating system, and allows the gear to be operated manually. A spring loaded release button is provided to unlock the hand crank so that it may be unfolded and stowed.



1. Bolt	10. Washer	19. Nut	28. Pin
2. Cotter Pin	11. Cotter Pin	20. Nut	29. Cotter Pin
3. Pulley	12. Pulley Track	21. Washer	30. Web
4. Pulley Bracket	13. Cable	22. Arm	31. Cable
5. Washer	14. Bolt	23. Spring	32. Step Support
6. Nut	15. Cotter Pin	24. Spacer	33. Fuselage Structure
7. Landing Gear Actuator	16. Pulley	25. Bolt	34. Bolt
8. Pin	17. Pulley Bracket	26. Step	35. Spring Bail
9. Clamp	18. Washer	27. Tube	36. Turnbuckle

Figure 4-2. Cabin Step System

Removal of Manual Extension System. (See figure 4-3.)

- a. Remove pilot's seat and center carpet in accordance with Section 3.
- b. Remove floorboards between front and rear spar, above landing gear actuator.
- c. Remove chain guards by removing attaching screws.
- d. Remove chain (12) by disconnecting at the master link.
- e. Remove crank handle and shaft assembly as follows:
 1. Remove roll pin, collar (1) and washer (2) from shaft (6).
 2. Remove cotter pin and pin attaching spool (4) to shaft (6).
 3. Pull crank handle and shaft from supports, removing spool (4) as shaft is pulled through it.
 - f. If desired, disassemble crank handle and shaft by removing nut, bolt, cotter pins and pins.
 - g. Remove upper rod assembly (16) by removing cotter pins, washers and pins attaching rod assembly to bellcranks (15 and 17).
 - h. Remove upper bellcrank (15) by removing nut, washers and bolt. Remove bushing (14) from bellcrank.
 - i. Remove lower rod assembly (18) by removing cotter pins, washer and pins attaching rod assembly to lower bellcrank and landing gear actuator.
 - j. Remove lower bellcrank (17) by removing nut, washer, spacer and bolt.
 - k. Remove chain tightener (11) by removing attaching screw and washer, and adjusting screw, washers and nut.
- l. Remove gear support bracket (21) as follows:
 1. Disconnect shafts (27 and 28) and universal joint (29) by removing the three cotter pins, washers and pins.
 2. Slide universal joint (29) aft and inner shaft (28) forward to disconnect.
 3. Remove two bolts and nuts attaching gear support bracket to front spar.
 4. Remove two screws, washers and nuts attaching gear support bracket to bottom of fuselage.
- m. If desired, disassemble gear support bracket as follows:
 1. Remove three roll pins attaching sprocket (23) and gears (24 and 26) to gear shafts (22 and 27).
 2. Remove snap ring (25) from gear shaft (22).
 3. Remove gear shaft (22) through the left side of the bracket, removing sprocket (23) and gear (24) as shaft is removed.
 4. Remove gear (26) and shaft (27) from gear sup-

port bracket.

NOTE

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

Installation of Manual Extension System. (See figure 4-3.)

- a. If disassembled, assemble gear support bracket (21) as follows:
 1. If removed, press bearings into gear support bracket.
 2. Assemble gear (26) to shaft (27) with attaching roll pin, and insert into position in gear support bracket.
 3. Insert shaft (22) through the left side of gear support bracket, through sprocket (23) and gear (24). Install two roll pins attaching sprocket and gear to shaft, and safety all three roll pins.
 4. Install snap ring (25) on gear shaft (22).
- b. Install gear support bracket (21) as follows:
 1. Place universal joint (29) on actuator shaft (30) and slide aft.
 2. Insert inner shaft (28) into gear shaft (27) and slide forward.
 3. Position gear support bracket in aircraft and attach to fuselage bottom with two screws, washers and nuts.
 4. Install two bolts and nuts attaching gear support bracket to front spar.
 5. Align the holes in the shafts connecting miter gear assembly to landing gear actuator, and install pins, washers and cotter pins.
- c. Install chain tightener (11) with attaching screw and washer. Install adjusting screw, washers and nut, but do not tighten at this time.
- d. Install lower bellcrank (17) with bolt, spacer (20), washer and nut.
- e. Insert bushing (14) into upper bellcrank (15) and install bellcrank with bolt, washers and nut.
- 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 (5), spool (4), and outboard support (3).
 2. Engage upper bellcrank (15) with spool (4), align spool attaching holes, and install pin and cotter pin.
 3. Place washer (2) and collar (1) on shaft (6), in-

Figure 4-3. Manual Extension System Callouts

1. Collar	11. Chain Tightener	21. Gear Support Bracket
2. Washer	12. Chain	22. Gear Shaft
3. Outboard Support	13. Bracket	23. Sprocket
4. Spool	14. Bushing	24. Gear
5. Inboard Support	15. Upper Bellcrank	25. Snap Ring
6. Shaft	16. Upper Rod Assembly	26. Gear
7. Sprocket	17. Lower Bellcrank	27. Gear Shaft
8. Spool Link	18. Lower Rod Assembly	28. Inner Shaft
9. Crank Link	19. Landing Gear Actuator	29. Universal Joint
10. Crank	20. Spacer	30. Actuator Shaft

stall roll pin and safety.

NOTE

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

- h. Install chain (12) on sprockets (7 and 23) and connect with master link. Adjust chain tightener (11), and tighten adjusting screw and nut.
- i. Attach lower rod assembly (18) to lower bellcrank (17) and landing gear actuator (19) with pins, washers and cotter pins.
- j. Attach upper rod assembly (16) to bellcranks (15 and 17) with pins, washers and cotter pins.
- k. If length of upper or lower rod assembly has been changed, adjust as follows:
 1. Place hand crank in operating position.
 2. Adjust lower rod assembly (18) to a length of approximately 4.80 inches, measured between the center lines of rod end bolt holes, and install.
 3. Pull lower rod assembly forward until internal gear in landing gear actuator reaches the end of its travel, and adjust upper rod assembly (16) so that rod end bolt holes align with holes in upper and lower bellcranks (15 and 17).
 4. Lengthen upper rod assembly (16) one-half turn and install.

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 step "3 and 4".

- l. Perform an operational check to see that manual extension system functions properly.

CAUTION

Do not use the manual extension system to fully retract the landing gear, except when manually pushing upward on all landing gear to relieve strain on manual extension system.

- m. Install chain guards with attaching screws.
- n. Install access covers on cabin floor above landing gear actuator.

- o. Install center carpet and pilot's seat in accordance with Section 3.

MAIN LANDING GEAR.

Removal of Main Landing Gear. (See figure 4-4.)

- a. Jack the aircraft in accordance with Section 2.
- b. Drain brake system by removing bleeder plug.
- c. Disconnect brake hose at forward wheel well bulkhead union. Plug hose and cap fitting to prevent entry of foreign matter.
- d. Remove safety switch (1) and down indicator switch (20) by removing attaching nuts and screws.
- e. Remove 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 main landing gear doors.
- h. Disconnect retracting linkage as follows:
 1. Disconnect outboard push-pull tube (18) from bellcrank (15) by removing nut, washers and bolt.
 2. Disconnect upper side link from lower side link by removing nut, washer and bolt.
- i. Remove roll pins (13) from attaching shafts (11), and insert AN6 bolt or puller tool.
- j. Support gear and pull attaching shafts (11).

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.

Disassembly of Main Landing Gear. (See figure 4-5.)

- a. Completely deflate strut, and after all the air has

Figure 4-4. Main Landing Gear Installation Callouts

1. Landing Gear Safety Switch	14. Bolt
2. Screw	15. Bellcrank
3. Bracket	16. Washer
4. Screw	17. Nut
5. Washer	18. Outboard Push-Pull Tube
6. Nut	19. Spacer
7. Nut	20. Down Indicator Switch
8. Landing Gear Support	21. Spacer
9. Bearing	22. Screw
10. Washer	23. Side Lock Link
11. Attaching Shaft	24. Bracket
12. Truss Assembly	25. Nut
13. Roll Pin	26. Plate

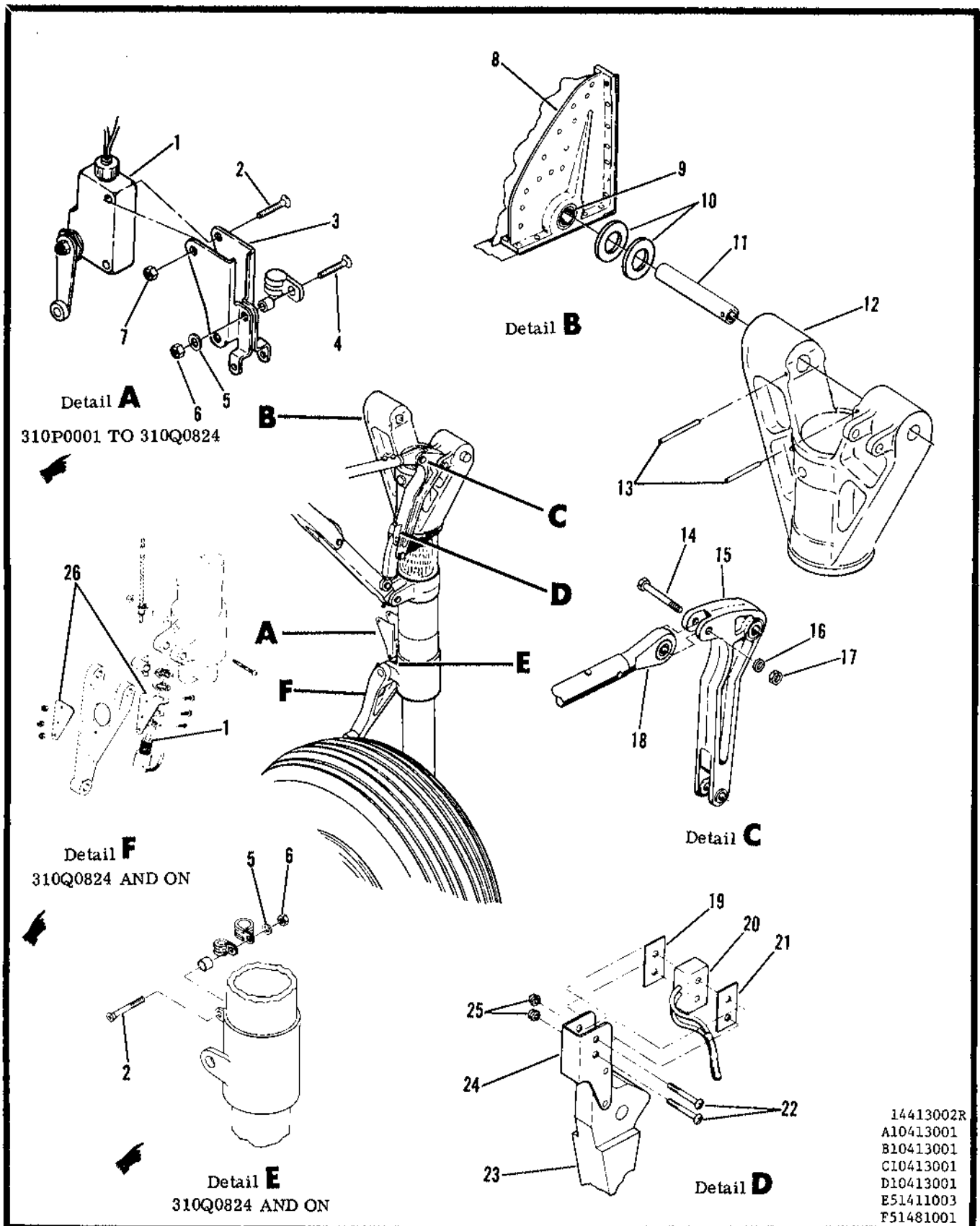
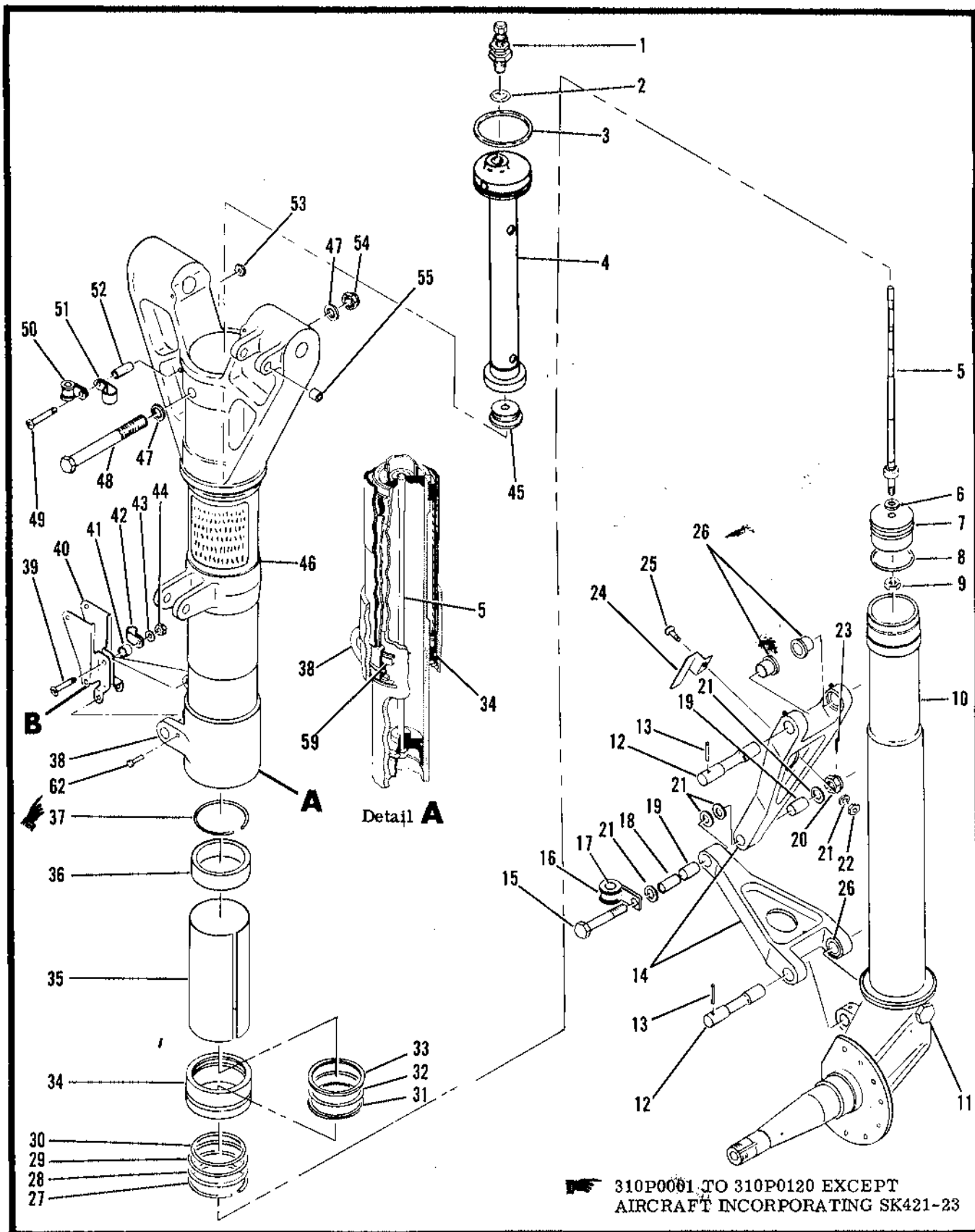


Figure 4-4. Main Landing Gear Installation



310P0001 TO 310P0120 EXCEPT
AIRCRAFT INCORPORATING SK421-23

Figure 4-5. Main Landing Gear Strut (Sheet 1 of 2)

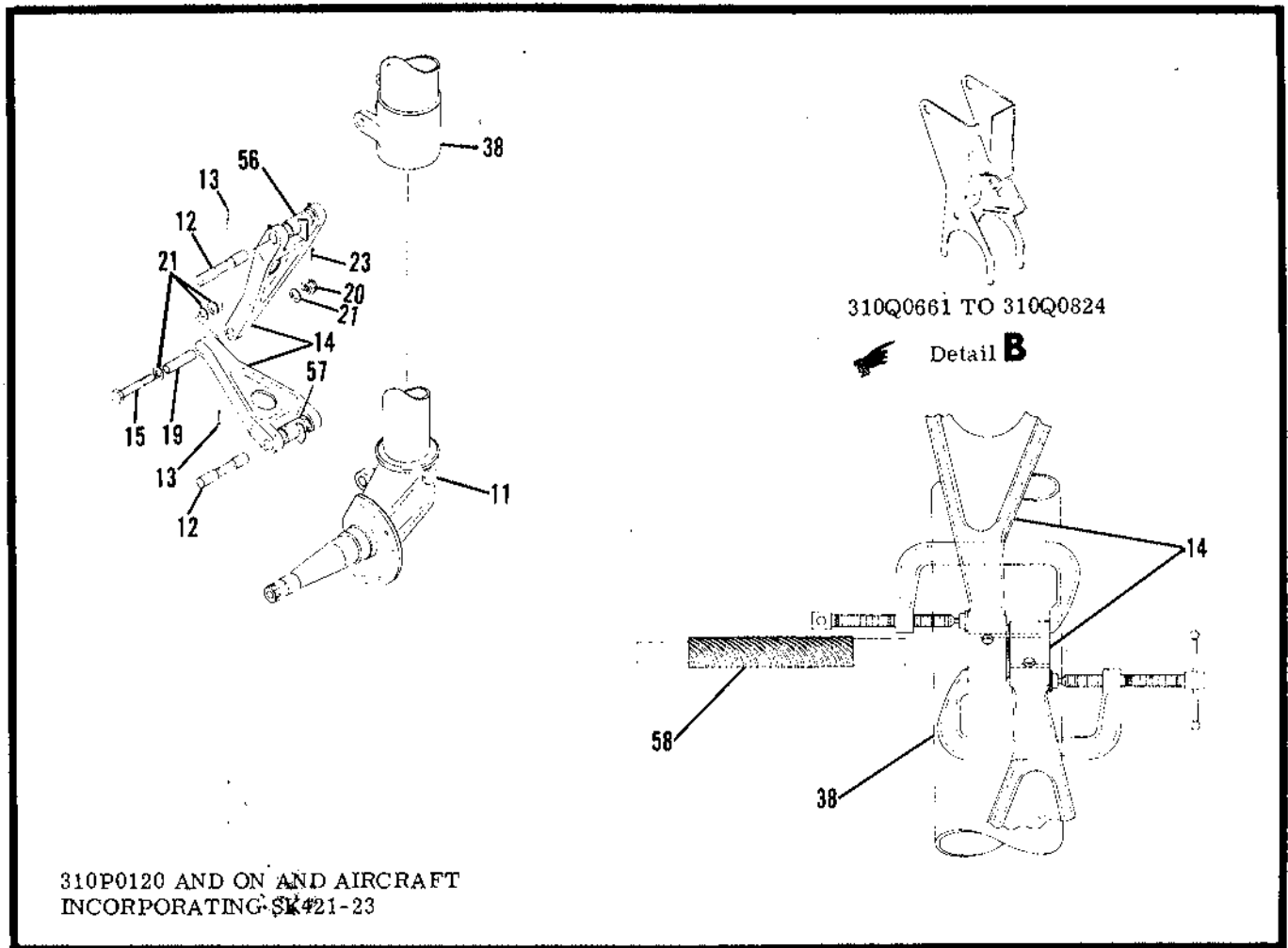
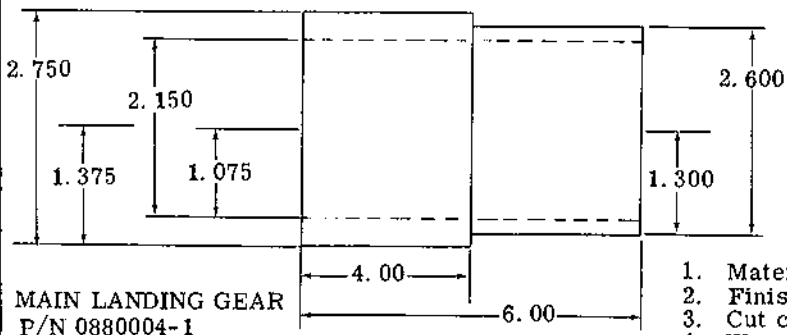


Figure 4-5. Main Landing Gear Strut (Sheet 2 of 2)

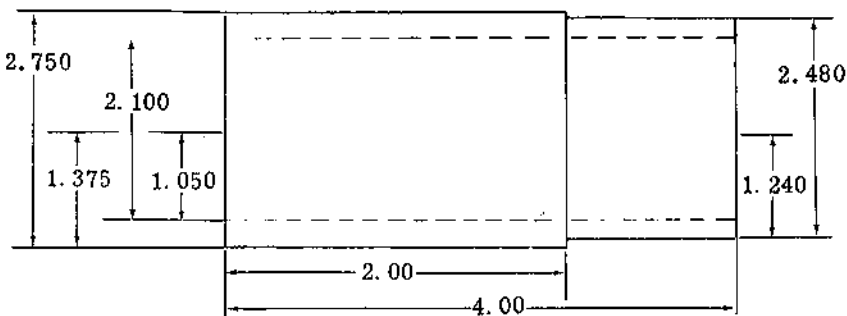
1. Valve Body	21. Washer	41. Spacer
2. Packing	22. Nut	42. Clamp
3. "O" Ring	23. Cotter Pin	43. Washer
4. Orifice Tube Assembly	24. Striker Plate	44. Nut
5. Metering Pin	25. Screw	45. Orifice
6. "O" Ring	26. Bushing	46. Trunnion
7. Seal Support	27. Lock Ring	47. Washer
8. "O" Ring	28. Scraper Ring	48. Bolt
9. Nut	29. Internal Lock Ring	49. Screw
10. Barrel Piston	30. "O" Ring	50. Clamp
11. Bolt	31. Backup Ring	51. Clamp
12. Shaft	32. "O" Ring	52. Spacer
13. Roll Pin	33. Backup Ring	53. Nut
14. Torque Link	34. Ring Pack Support	54. Nut
15. Bolt	35. Spacer	55. Bushing
16. Clamp	36. Inner Bearing	56. Spacer
17. Bushing	37. External Lock Ring	57. Spacer
18. Spacer	38. Barrel Assembly	58. Reamer Tool
19. Bushing	39. Screw	59. Poly Pak Seal
20. Nut	40. Switch Bracket	60. Rivet

ALL DIMENSIONS ARE IN INCHES



MAIN LANDING GEAR
P/N 0880004-1

NOSE LANDING GEAR P/N 0880004-2



NOTES

1. Material to be 4130 Type I steel.
2. Finish inside bore to smooth finish.
3. Cut cylinder on center line to form two halves.
4. Wrap cylinder with mystic tape 5812 (Stock Code F840022) or equivalent. Cut tape on one side to permit halves to hinge open.
5. Coat tool with light oil to prevent rust.

Figure 4-5A. Landing Gear Ring Pack Support Tool

has been expelled, remove the valve body and drain fluid.

b. Remove lower strut assembly from upper trunnion assembly as follows:

1. Disconnect the torque link, brake hose clamps, bushings, and safety switch bracket by removing the cotter pins, nuts, washers and bolts.
2. Disconnect brake hose from brake at elbow and remove hose.
3. Remove wheel and tire assembly and brake assembly from axle fitting.

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 4-5.) Disassemble upper cylinder assembly as follows:

1. Remove bolt (48), washers (47) and nut (54) from trunnion (46).
2. Remove orifice tube (4) from upper barrel assembly by pulling straight out.

CAUTION

If the metering pin and seal support are to be reinstalled, use extreme caution during removal.

3. Disconnect torque link (14) by removing nut (20), washer (21), bushing (19), clamp (16) and bolt (15).
4. Remove lock ring (27), scraper ring (28), and internal lock ring (29).
5. Pull piston assembly (10) from barrel assembly (38).

NOTE

Lower piston barrel and axle fittings are a press fit and drilled on assembly. Disassembly is not recommended.

6. See Section 2 for cleaning and inspection of main landing gear.

Assembly of Main Landing Gear. (See figure 4-5.)

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).

4. Slide lock ring (27), scraper ring (28), and internal lock ring (29) on piston barrel (10).

5. Install backup ring (33), O-ring (32), and backup ring (31) or poly-pak seal (59), 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 side).

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 piston barrel into barrel assembly (38) and slide ring pack support (34), internal lock ring (29), scraper ring (28), and lock ring (27) into barrel assembly (38) and secure.

NOTE

To prevent damage to piston barrel and ring pack support during installation, a ring pack support tool P/N 0380004-1, available from your Cessna Dealers' Organization, should be used. See figure 4-5A.

9. Carefully work O-ring (3) into groove in orifice tube (4) and insert into barrel assembly (38) taking care to align holes.

10. Align holes and install bolt (48), washers (47), and nut (54).

b. Assemble torque link (14), if removed, then connect with bolt (15), washers (21), bushing (19), washers (21) and nut (20).

c. (Aircraft 310P0001 to 310Q0824.) Install switch striker plate (24) and switch bracket assembly (40).

d. (Aircraft 310Q0824 and ON.) Install plates (26) and secure with nuts and screws.

e. Install brake assembly, wheel and tire assembly; then connect hoses and clamp.

f. Service strut with hydraulic fluid in accordance with Section 2. Do not fill with air at this time.

g. Install new O-ring (3) on valve body (1) and install in top of orifice tube (4).

h. Install side braces with bolts, washers, and nuts.

Installation of Main Landing Gear.

a. If needle bearings were removed, install as follows:

1. Press needle bearings into landing gear supports. Bearing 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 2.
- j. Perform operational check on landing gear.
- k. Remove jacks and inflate strut in accordance with Section 2.
- l. Check landing gear alignment in accordance with Main Wheel Alignment and figure 4-29.

Removal of Main Gear Torque Links. (See figure 4-5.)

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.

Change 7

- 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 (18).

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 4-5.)

Bushings (19 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 (19 and 26).

CAUTION

Take precaution when removing bushings to prevent damage to torque link.

Assembly of Main Gear Torque Links. (See figure 4-5.)

- a. Press in bushings (19 and 26) using bench vise, with necessary wood block and proper size punch.

NOTE

Bushings (19 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 (19 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.
- c. Insure lube fitting holes are clean and install lube fittings.

NOTE

Mill an equal amount on each bushing (26) using a flat mill file to provide a slip fit between the lugs on the torque link and the lugs on the trunnion and/or the lugs on the axle.

Installation of Main Gear Torque Links. (See figure 4-5.)

a. Install upper torque link brace (14) on barrel assembly (38), with shaft (12), spacer (57) 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 inside of spacer interfere, smooth welds with file.

NOTE

Stop plate on spacer assembly (57) must be positioned toward landing gear barrel assembly, when installed.

- b. Install shaft (12) 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 .75 length, .4300 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 all grease is removed.

l. Position brake hose and clamp on bolt (15) and connect upper and lower torque link at hinge point using bolt (15), spacer (18), 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 .004 to .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 simultaneously.

- 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.

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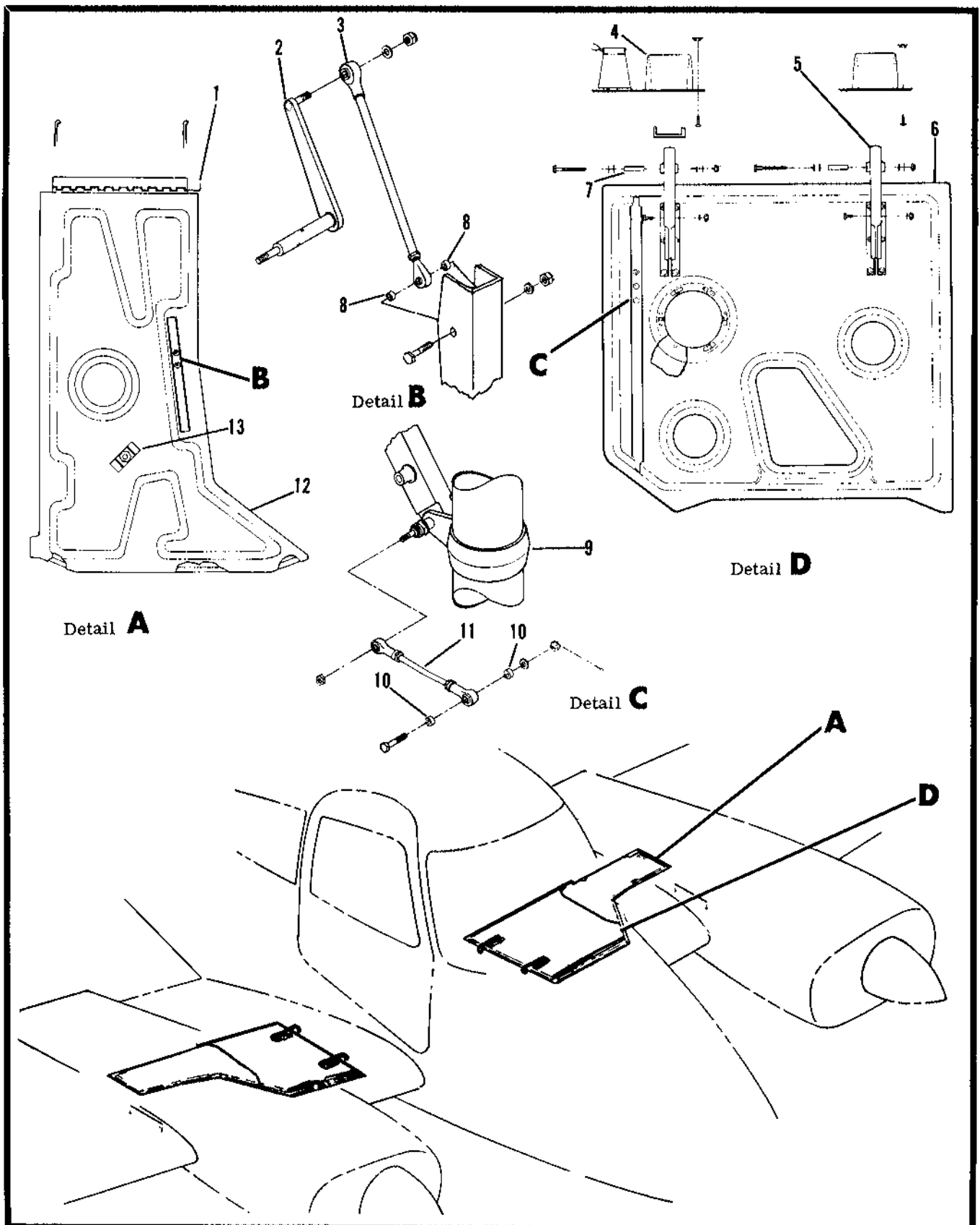


Figure 4-6. Main Landing Gear Door Installation

Figure 4-6. Main Landing Gear Door Installation Callouts

1. Hinge Pin	5. Hinge	10. Spacer
2. Door Actuator Arm	6. Main Wheel Well Door	11. Door Link Rod
3. Door Link Tube	7. Spacer	12. Strut Door
4. Hinge Cover	8. Spacer	13. Snubber
	9. Main Landing Gear	

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 cotter pins in the ends of hinge pin; then remove the hinge pin and outboard door.
- b. Remove wheel well door as follows:
 1. Jack aircraft, engage manual extension crank and operate toward the UP position until the main gear doors open sufficiently to disconnect link (3) from door (6) by removing nut, washer, spacers and bolt.
 2. 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 door with bolt, spacers, washer 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.

- d. Install strut door as follows:
 1. Place strut door in position and install hinge pin. Install cotter pins in each end of hinge pin to safety.
 2. Attach door link rod to strut with 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 attaching door link tube (3) to actuator arm (2).
- c. Disconnect strut door by removing nut attaching door link rod (11) 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.

- e. Close strut door and adjust door link rod (11) so that door fits flush.
- f. Adjust snubber (13) so there is 0 to 0.06 inch 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 (3) 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 (3) so that door fits flush.
- k. Repeat steps "d" thru "i" as necessary to obtain proper fit of doors, checking that wheel well door clears tire and wheel.
1. The door push-pull tube is to be 5 degrees over-center with the door actuator arm against its stop in both gear UP and gear DOWN position.
- m. Install access hole cover on wheel well door.
- n. Insure that the landing gear is DOWN, 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

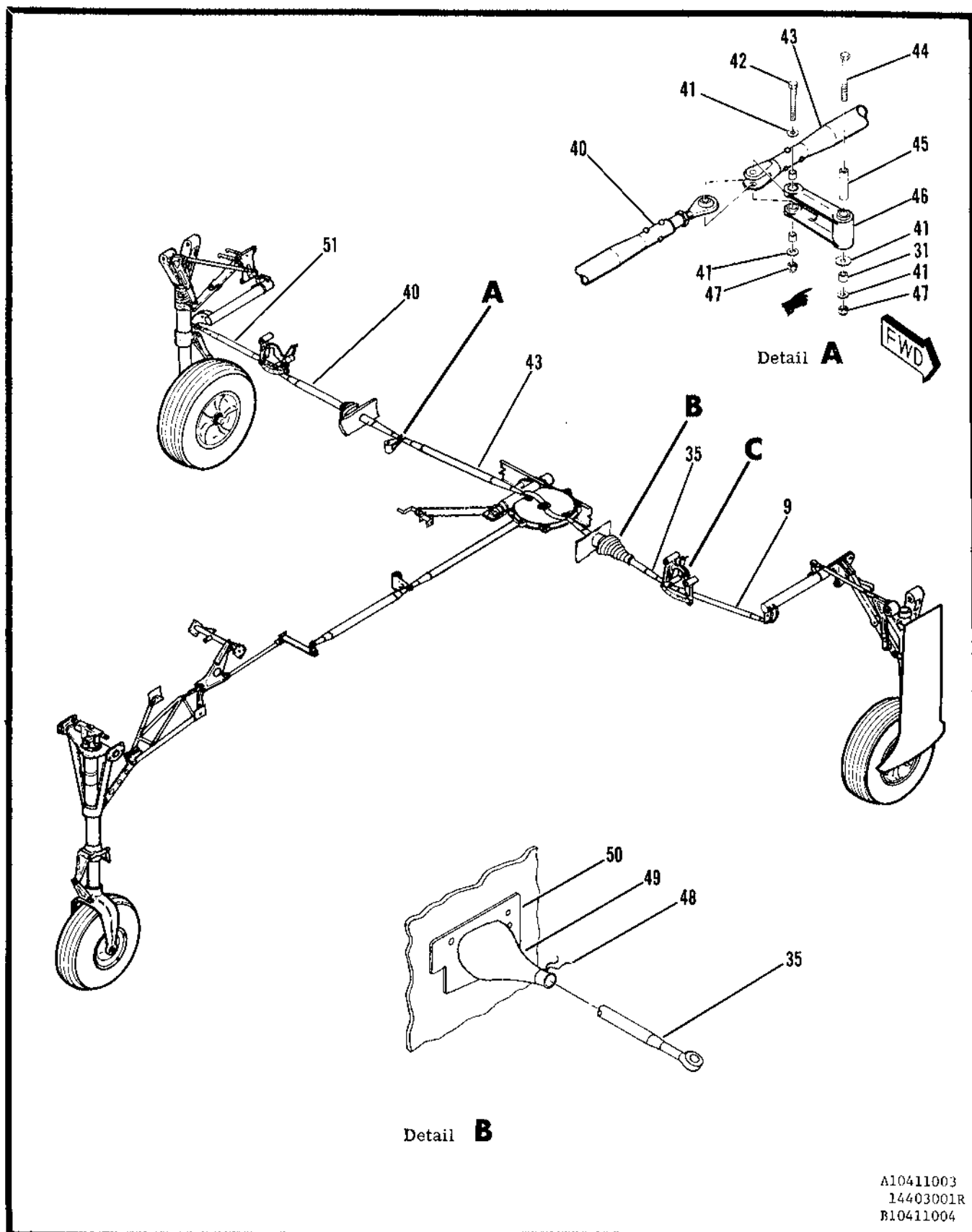
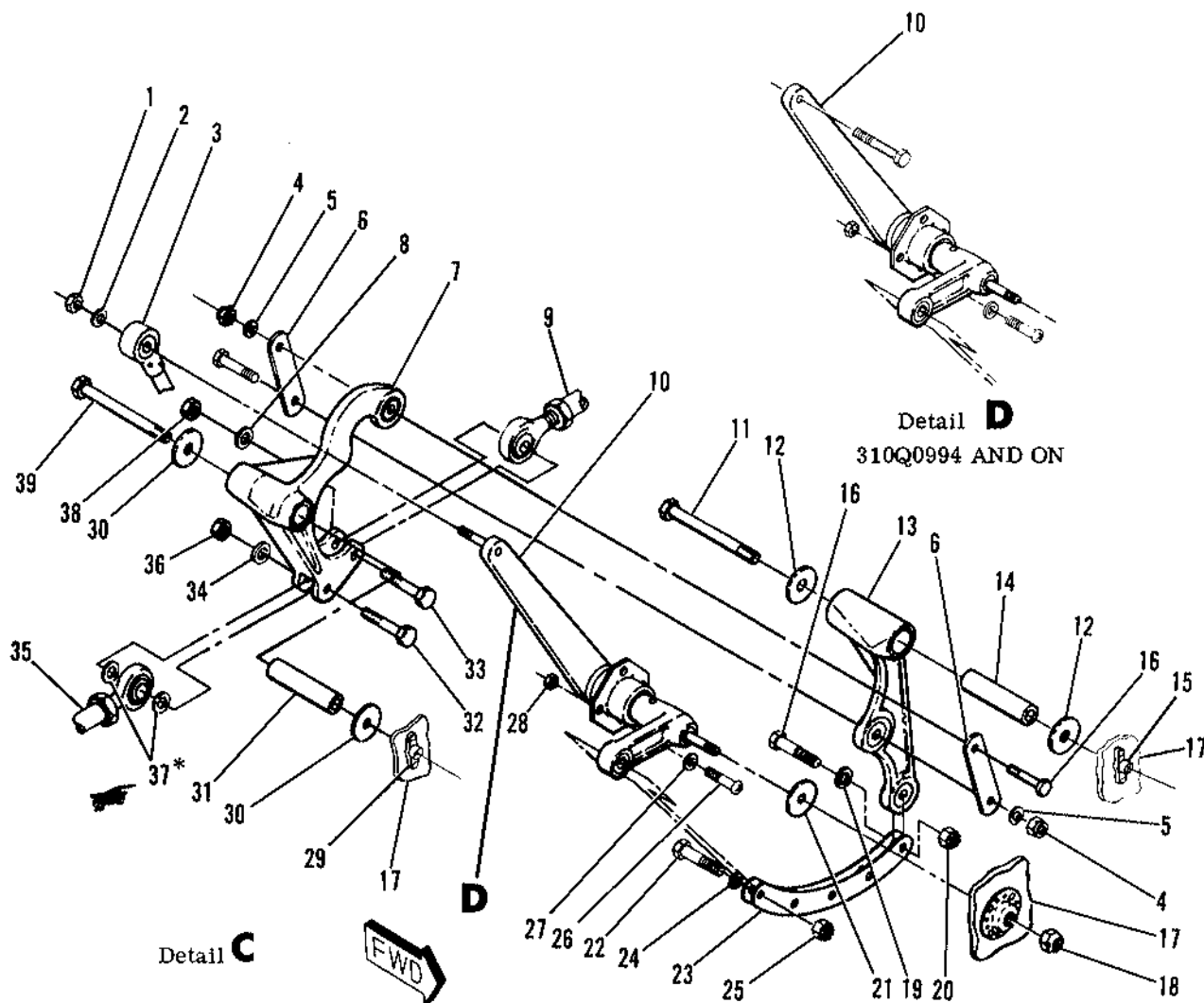


Figure 4-7. Main Landing Gear Retracting Linkage - Inboard Components (Sheet 1 of 2)



*USED ON LH SIDE ONLY

D14412006
C14412005

Figure 4-7. Main Landing Gear Retracting Linkage - Inboard Components (Sheet 2)

Figure 4-7. Main Landing Gear Retracting Linkage - Inboard Components Callouts

1. Nut	18. Nut	35. LH Inboard Drive Tube
2. Washer	19. Washer	36. Nut
3. Door Link Tube	20. Nut	37. Spacer
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
13. Bellcrank Rocker Arm	30. Thrust Bearing Washer	47. Nut
14. Spacer	31. Spacer	48. Drawstring
15. Nutplate	32. Bolt	49. Seal Boot
16. Bolt	33. Bolt	50. Doubler
17. Spar Web	34. Washer	51. RH Outboard Drive Tube

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 figure 4-7.)

- Jack the aircraft in accordance with Section 2.
- Disconnect main landing gear doors.
- Release tension on retracting linkage by engaging hand crank and operating a few turns toward the UP position.
- Remove access hole cover from underside of wing, forward of wheel well.
- Remove center seats, carpet and floorboard to gain access to the landing gear actuator.
- Remove the outboard drive tubes (9 and 51) as follows:
 - Disconnect drive tubes from landing gear actuator bellcrank in accordance with actuator removal procedures.
 - Disconnect drive tube from idler bellcrank (7) by removing nut, washer and bolt; then remove drive tube by pulling into the fuselage area.
- Remove idler bellcrank (7) and door operating linkage as follows:
 - Remove nut (25) and bolt (22) and four screws attaching bearing housing to web.
 - Remove nut (18) and thrust bearing washer (21) then pull door actuator arm assembly (10) through web.

NOTE

Door actuator arm assembly (10) is a matched set, and disassembly is not recommended.

- Remove bolt (39) and thrust bearing washers (30) attaching idler bellcrank (7) to front spar and support web.
- Remove bolt (11) and thrust bearing washers (12) attaching bellcrank rocker arm (13) to front spar and support web.

front spar and support web.

- Pull bellcranks and attached linkage from between front spar and support web.

- Remove the spacers (14 and 31) from the idler bellcrank (7) and bellcrank rocker arm (13).

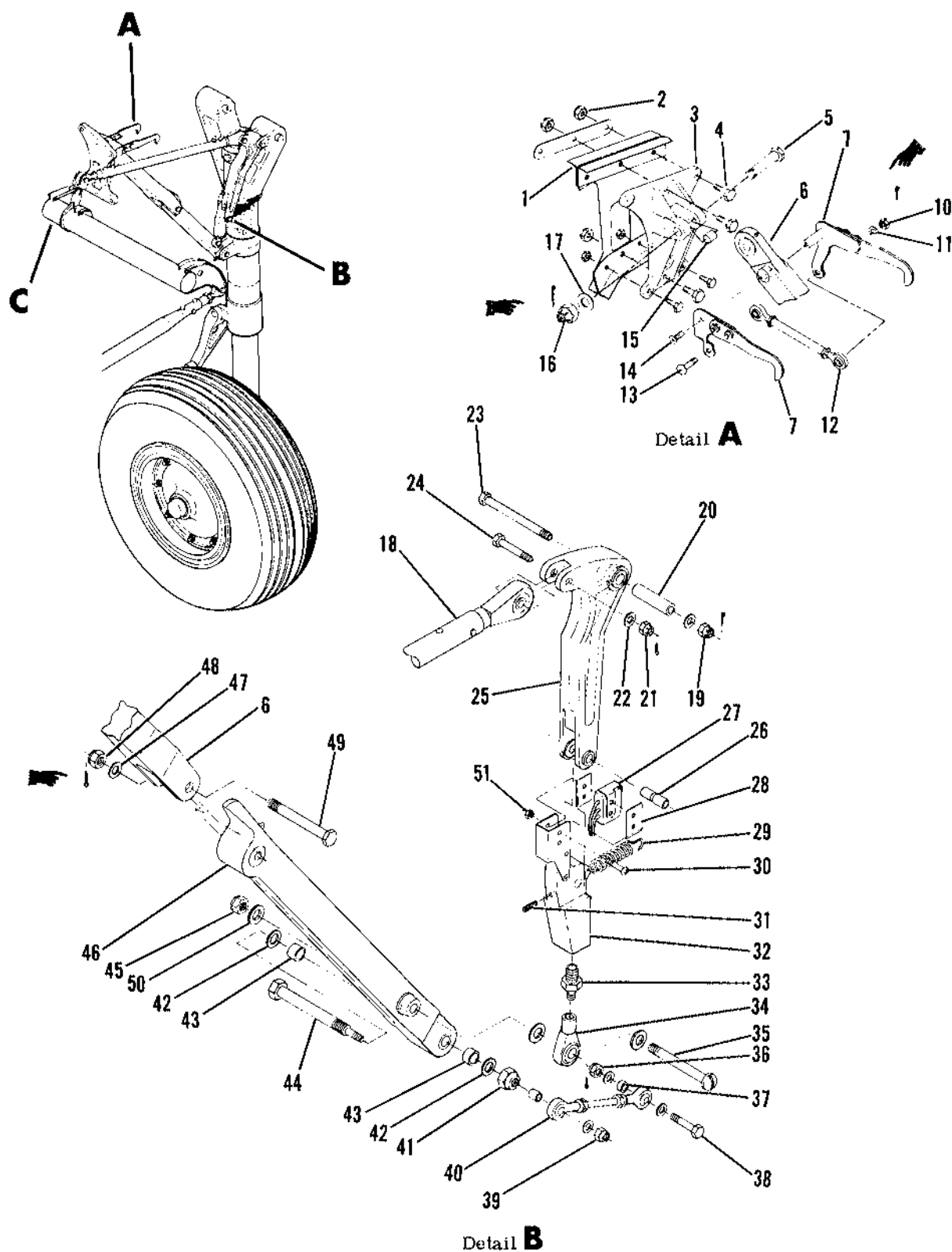
- Remove upper connecting links (6) by removing nuts (4), washers (2) and bolts (16).

- Remove rocker arm lower link (23) by removing nuts (20 and 25), washers (19 and 24) and bolts (16 and 22).

NOTE

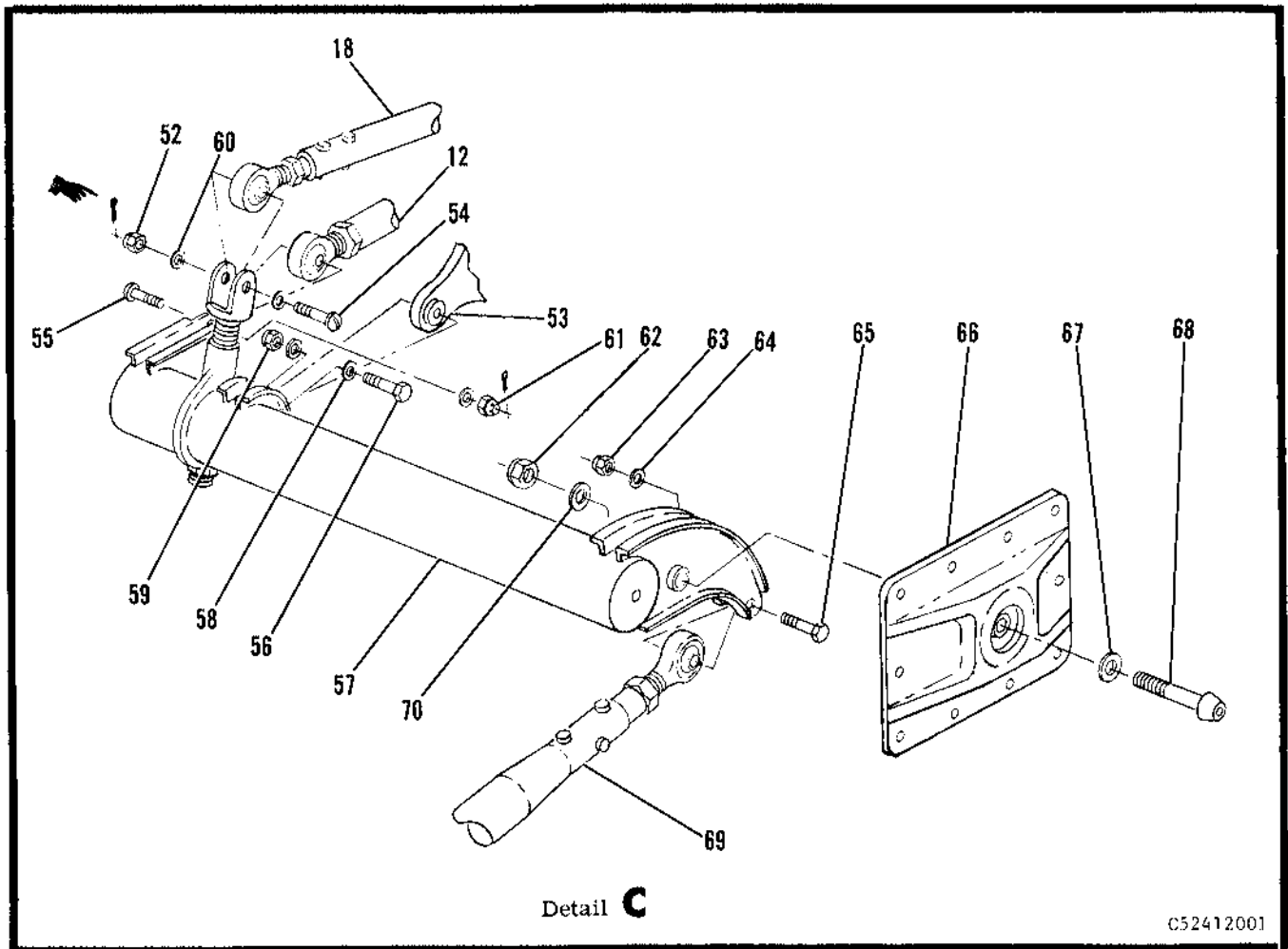
See figure 4-8 for the following steps:

- Remove outboard push-pull tube (18) as follows:
 - Disconnect the push-pull tube from the bellcrank (25) by removing cotter pin, nut (21), washer (22) and bolt (24).
 - Disconnect push-pull tube from torque tube (57) by removing cotter pin, nut (52) and bolt (54).
- Remove bellcrank (25) and side brace lock link (32) as follows:
 - Disconnect DOWN indicator switch (27) by removing nuts (51) and screws (30).
 - Remove downlock spring (29).
 - Disconnect side brace lock link from lower side link (46) by removing nut (45), washer (50) and bolt (35).
 - Disconnect bellcrank (25) from the upper barrel by removing cotter pin, nut (19), spacer (20) and bolt (23).
 - Remove the side brace lock link (32) from the bellcrank (25) by removing setscrew (31) and pin (26).
- Remove uplock assembly as follows:
 - Disconnect uplock push-pull tube (12) from uplock assembly by removing cotter pin, nut (10), washer (11) and bolt (13).
 - Remove screw (14) attaching uplock assembly to side link (6).
- Remove side links (6 and 46) as follows:
 - Disconnect lower side link (46) from upper barrel by removing nut (39), door link rod (40), nut (41), washers (42), spacers (43) and bolt (44).
 - Disconnect lower side link (46) from upper side link (6) by removing cotter pin, bolt (49), washer and nut.
 - Disconnect upper side link (6) from support (3) by removing cotter pin, bolt (5), washer and nut.



14413002R
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B14413003

Figure 4-8. Main Gear Retracting Linkage - Outboard Components (Sheet 1 of 2)



1. Rib Assembly	24. Bolt	48. Nut
2. Nut	25. Bellcrank	49. Bolt
3. Support	26. Pin	50. Washer
4. Bolt	27. Down Indicator Switch	51. Nut
5. Bolt	28. Spacer	52. Nut
6. Upper Side Link	29. Spring	53. Mounting Bracket
7. Uplock Assembly	30. Screw	54. Bolt
8. Deleted	31. Setscrew	55. Bolt
9. Deleted	32. Side Brace Lock Link	56. Bolt
10. Nut	33. Adjusting Screw	57. Torque Tube
11. Washer	34. End Fitting	58. Washer
12. Uplock Push-Pull Tube	35. Bolt	59. Nut
13. Bolt	36. Nut	60. Washer
14. Bolt	37. Spacer	61. Nut
15. Spacer	38. Bolt	62. Nut
16. Nut	39. Nut	63. Nut
17. Washer	40. Door Link Rod	64. Washer
18. Outboard Push-Pull Tube	41. Nut	65. Bolt
19. Nut	42. Washer	66. Torque Tube Support
20. Spacer	43. Spacer	67. Washer
21. Nut	44. Bolt	68. Bolt
22. Washer	45. Nut	69. Outboard Drive Tube
23. Bolt	46. Lower Side Link	70. Washer
	47. Washer	

Figure 4-8. Main Gear Retracting Linkage - Outboard Components (Sheet 2 of 2)

1. Remove torque tube (57) as follows:

1. Disconnect uplock push-pull tube (12) from torque tube by removing cotter pin, nut (61), washer (60) and bolt (55).
2. Remove nut (59), washer (58) and bolt (56) attaching torque tube to torque tube support (66).
3. Remove nut (62), washers (67 and 70) and bolt (68) attaching torque tube to torque tube support (66).

Installation of Main Landing Gear Retracting Linkage.
(See figure 4-8.)

a. Install torque tube as follows:

1. Attach torque tube (57) to torque tube support (66) with bolt (68), washer (70) and nut (62).
2. Attach torque tube (57) to rib mounting bracket (53) with bolt (56), washer (58) and nut (59).
3. Connect uplock push-pull tube (12) to torque tube (57) with bolt (55), washer (60), nut (61) and cotter pin.

b. Install side links (6 and 46) as follows:

1. Attach upper side link (6) to lower side link (46) with bolt (49), washer (47) and nut (48). Torque nut to 110 $\pm$ 5 inch-pounds.
2. Attach upper side link (6) to support with bolt (5), washer (17) and nut (16). Torque nut (16) to 200 $\pm$ 25 inch-pounds. Install cotter pin.
3. Attach lower side link (46) to upper barrel with bolt (44), washers (42), spacers (43) and nut (41). Torque nut (41) to 110 $\pm$ 5 inch-pounds. Install door link rod (40) on bolt (44) with nut (39).

c. Install uplock assembly as follows:

1. Insert uplock hook (7) into upper side link (6) and secure uplock assembly with screw (14).
2. Attach uplock push-pull tube (12) to uplock assembly with bolt (13), washer (11), nut (10) and cotter pin.

d. Install bellcrank (25) and side brace lock link (32) as follows:

1. Attach side brace lock link (32) to bellcrank (25) with pin (26) and setscrew (31).
2. Attach bellcrank (25) to upper barrel with bolt (23), spacer (20), nut (19) and cotter pin.
3. Attach side brace lock link (32) to lower side link (46) with bolt (35), washer (50) and nut (45).
4. Install downlock spring.
5. Install DOWN indicator switch (27) with attaching screws and nuts.

e. Install outboard push-pull tube (18) as follows:

1. Attach push-pull tube to bellcrank (25) with bolt (24), washer (22), nut (21) and cotter pin.
2. Attach push-pull tube to torque tube (57) with bolt (54), washer (60), nut (52) 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) with bolt (16), washer (19) and nut (20).
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 actuator arm assembly (10) through bracket, thrust bearing washer (21) and spar web (17). Then install nut (18).

8. Install four screws attaching bearing housing to bracket and safety with loctite sealant.

9. Attach rocker arm lower link (23) to door actuator arm assembly (10) with bolt (22), washer (24), and nut (25).

g. Install inboard drive tube (35) as follows:

1. Insert drive tube into position from the fuselage area and attach to idler bellcrank (7) with bolt (32), washer (34) and nut (36).

2. Attach drive tube to landing gear actuator bellcrank in accordance with landing gear actuator installation procedures.

h. (See figure 4-8.) Install outboard drive tube (69) as follows:

1. (See figure 4-8.) Attach outboard drive tube to torque tube (57) with bolt (65), washer (64) and nut (63).

2. Attach outboard drive tube to idler bellcrank (7) with bolt (33), spacers (8) and nut (38).

i. Rig main landing gear in accordance with rigging procedures.

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 center seats.

Rigging of Main Landing and Nose Gear. (See figure 4-9 and 4-10.)

The following landing gear rigging procedure is designed specifically for the Model 310. A faithful following of this procedure will result in a proper rigged and efficient operating system. Before starting the rigging the "toe-out" should be checked in accordance with main 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 four jack points provided. Two points are 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 (3) by removing nut and washer from the door actuators. (See figure 4-15.) Disconnect door link tubes (20) 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 (6) to fork bolt (7) and connector link (3) and removing push-pull tube (6).

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 34) 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

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 (34) 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.

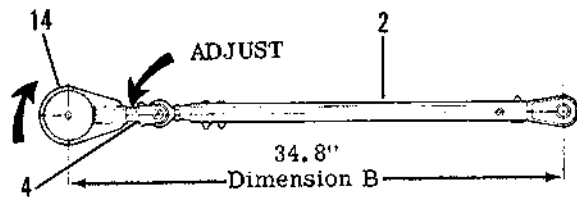
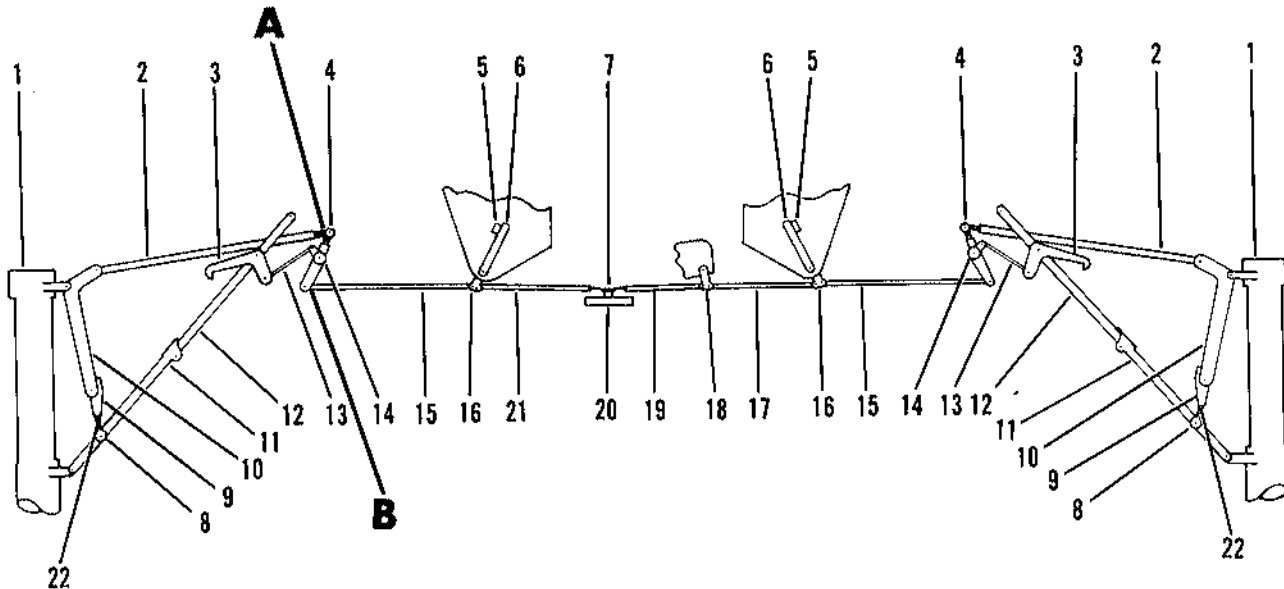
NOTE

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.

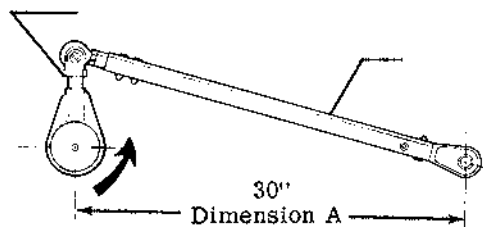
7. Engage the manual extension crank and note the angular position of the crank. Operate crank toward the up position noting the number of turns required to reach the internal stop in the actuator. The minimum number of turns required in the up position is three-fourths of one turn. The desired is 1-1/2 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.

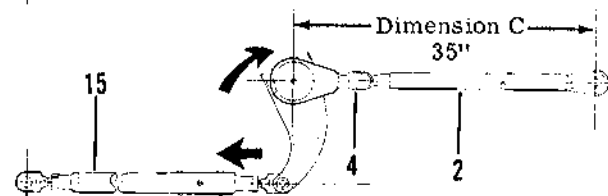
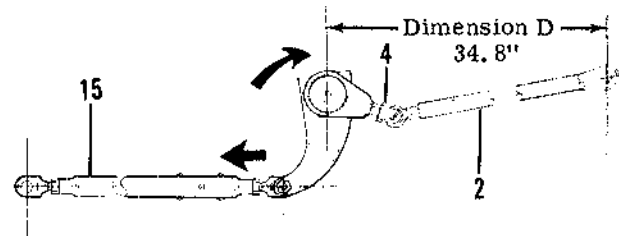
9. Engage the manual extension crank and note the position of the crank. Operate crank toward the down position and note the number of turns required to reach the internal stop in the actuator. The minimum number of turns required in the down position is one and the maximum (and desired) number of turns is two turns. If necessary, adjust the down limit switch to meet this requirement.



NOTE: DIMENSIONS ARE FOR
ILLUSTRATING PRINCIPLE ONLY.



Detail **A**

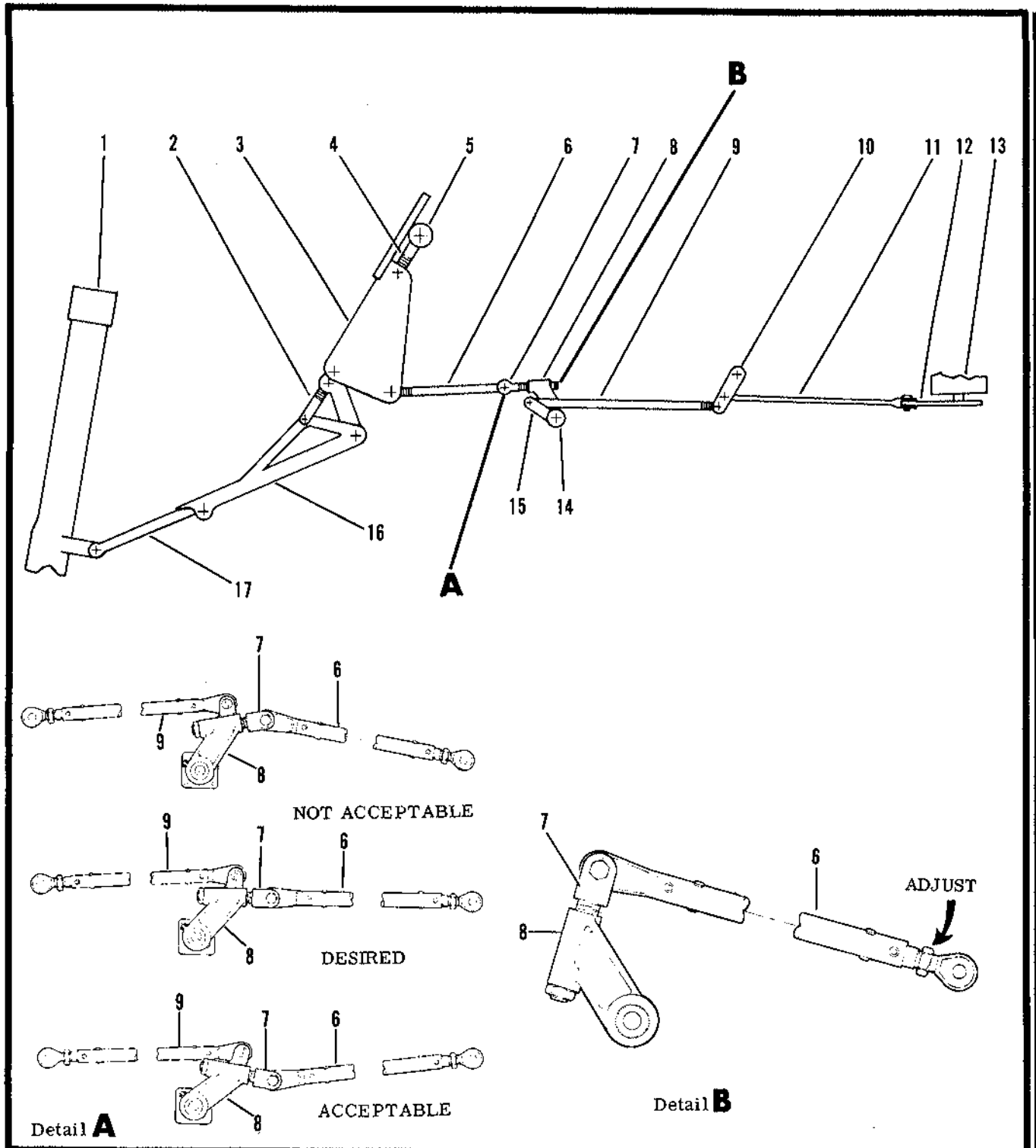


NOTE: DIMENSIONS ARE FOR
ILLUSTRATING PRINCIPLE ONLY.

Detail **B**

1. Main Landing Gear Strut	8. Lock Link End Fitting	16. Idler Bellcrank
2. Outboard Push-Pull Tube	9. Side Brace Lock Link	17. Intermediate Drive Tube
3. Uplock	10. Bellcrank	18. Idler
4. Fork Bolt	11. Lower Side Link	19. RH Inboard 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 Landing Gear Retracting Linkage



1. Nose Gear Strut
2. Adjusting Fork
3. Connector Link
4. Adjusting Rod End
5. Uplock Torque Tube
6. Nose Push-Pull Tube

7. Fork Bolt
8. Adjusting Bellcrank
9. Forward Drive Tube
10. Idler Bellcrank
11. Aft Drive Tube

12. Actuator Bellcrank
13. Landing Gear Actuator
14. Torque Tube Assembly
15. Outboard Bellcrank
16. Truss Assembly
17. Drag Brace

Figure 4-10. Schematic of Nose Gear Retracting Linkage

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 door actuator bellcrank (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.

4. On aircraft 310P0001 to 310P0113 shorten lock link end fitting (8) in 1/2 turn increments until gear

will free fall down and locked.

5. On aircraft 310P0113 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.

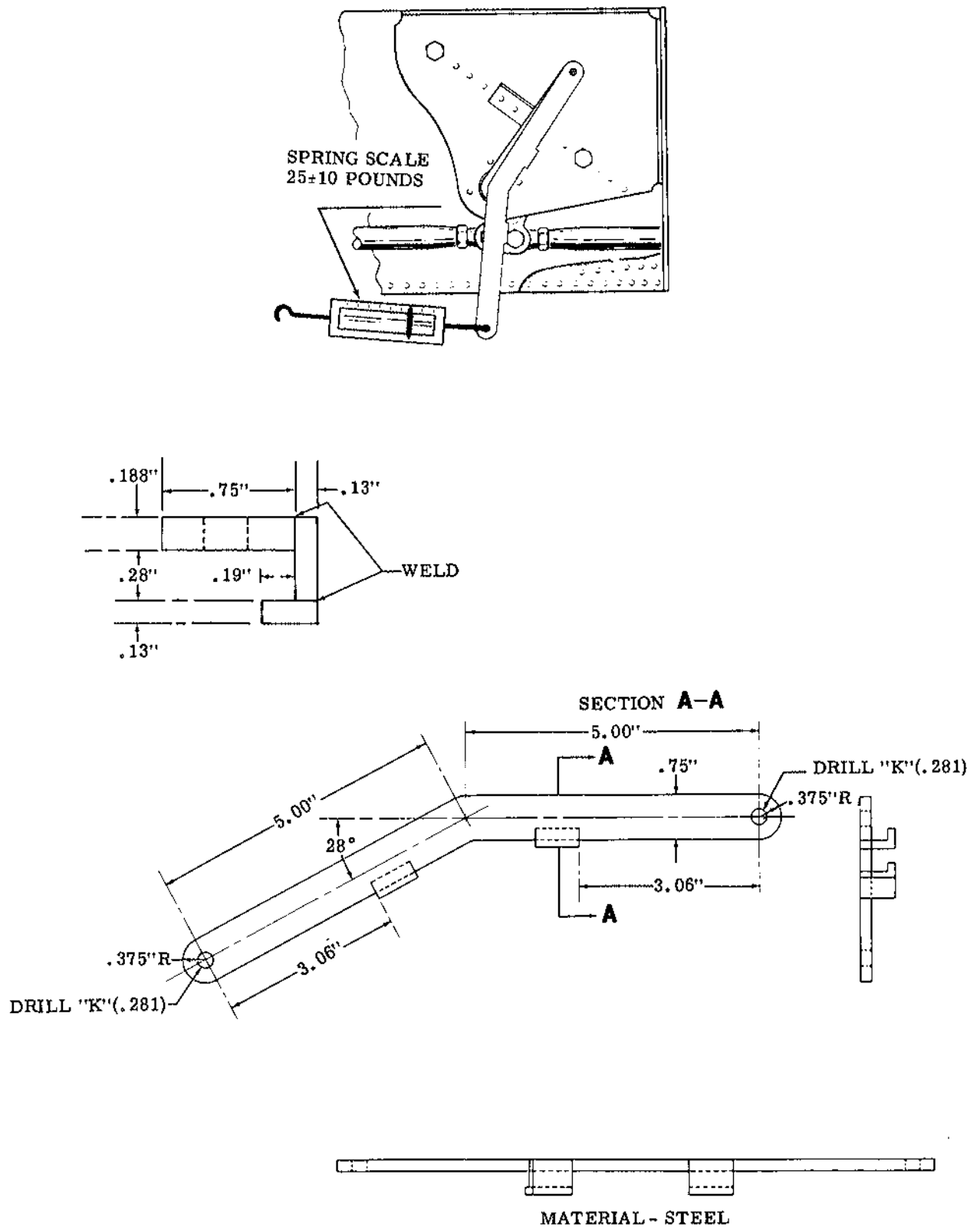
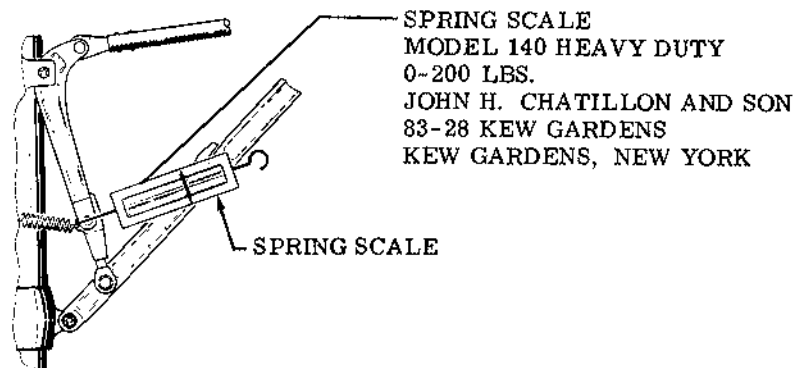


Figure 4-11. Fabrication and Usage of Tool for Measuring Door Actuator Arm Tension



40-50 LBS. DURING RIGGING

40-60 LBS. FOR ROUTINE IN-SERVICE INSPECTION

Figure 4-12. Main Landing Gear Down Lock Requirements

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 posi-

tion 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 downlock 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 downlock tension is too high, lengthen push-pull tube (2) until the correct downlock tension is obtained.

3. If downlock tension is too low shorten push-pull tube (2) until the correct downlock 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 downlock 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.

4. Adjust the downlock tension for both main landing gears 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 (14). 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 y. for rigging the nose gear.

NOTE

Because the aft drive tube (11) is a fixed length, the idler bellcrank (10) is correctly positioned to the actuator bellcrank (13).

- q. Operate the actuator to the DOWN position, then adjust the length of the forward drive tube (9) as follows:

1. Disconnect forward drive tube (9) from outboard bellcrank (15).
2. Adjust the length of forward drive tube (9) so that fork bolt (7) is parallel with the upper flange of the wheel well former adjacent to the fork bolt. The forward end of the fork bolt will point downward any amount caused by less than one turn of the threaded end of the forward drive tube (9). Detail "A" illustrates three possible conditions. The straight configuration is most desired. The fork bolt must never point up.

NOTE

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

- r. Make the following preliminary adjustments:
1. Screw fork bolt (7) into adjusting bellcrank (8) 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 (23) to the end of its adjusting slots in the direction that will prevent hook from fully engaging.
- s. Adjust connector link (3) as follows:
 1. With nose gear DOWN, check the overcenter position of connector link (3).

NOTE

A slight force should be required to snap connector link into its overcenter position.

2. Lengthen adjusting rod end (4) in half-turn increments to increase the force required to snap connector link overcenter; shorten to decrease.
3. Manually place nose gear UP, push upward on door actuator arm to lock connector link overcenter, 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.

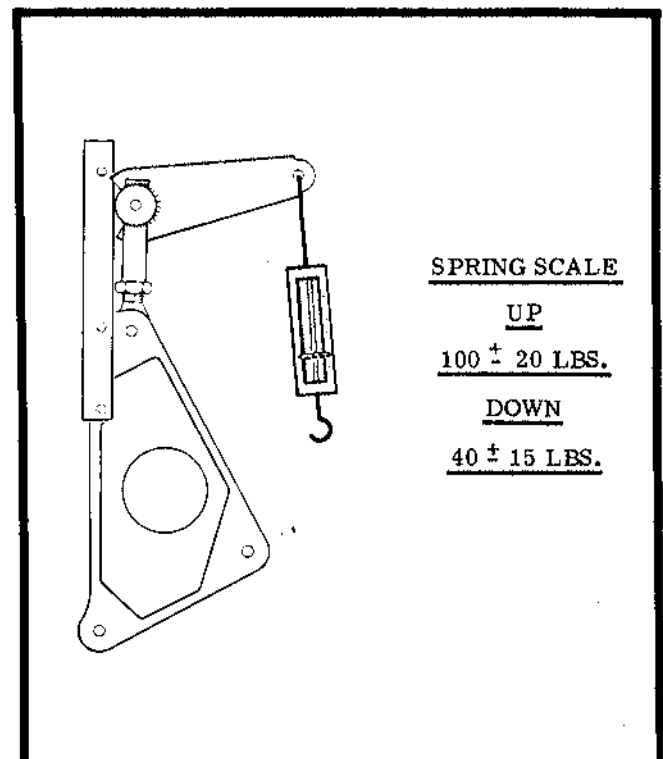


Figure 4-13. Nose Gear Tension Requirements

NOTE

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

- t. Adjust uplock and downlock tensions as follows:
 1. Lengthen nose push-pull tube (6) as much as possible. Insure rod end is visible through the inspection hole for thread engagement.
 2. Temporarily install nose push-pull tube (6).
 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 100 $\pm$ 20 pounds.
5. Shorten nose push-pull tube (6) 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 40 $\pm$ 15 pounds.
7. Lengthen fork bolt (7) in half-turn increments to increase downlock tension; shorten to decrease. DO NOT adjust nose push-pull tube (6).

NOTE

Detail "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 (6) in accordance with step 5.

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.

- u. 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 engaged 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.
- v. Connect downlock assist spring and cycle landing gear. The spring must cause no interference with gear operation.
- w. (See figure 4-16.) Connect door link tubes (20) with bolts and nuts and rig nose gear doors in accordance with Nose Gear Door Rigging Procedures.
- x. (See figure 4-6. Connect main wheel well door link tubes (3) with washer and nut. Rig doors in accordance with Main Gear Landing Doors Rigging Procedure.
- y. 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 310P0001 to 310Q0824.) 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 which is approximately 0.30 $\pm$.05, $\pm$.00 inch from torque link.

NOTE

The arm is adjusted by removing the cotter pin and nut which attach the arm to the switch, repositioning the arm, and reinstall the nut and cotter pin.

e. (Aircraft 310P0001 to 310Q0824.) 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.
- f. (Aircraft 310Q0824 and ON.) Adjust safety switch as follows:
 1. Adjust the landing gear safety switch to operate on the center line of the stop plate.
 2. Place jack under the axle and raise strut to 0.75 ± 0.05 , -0.12 from full extended position. Cut safety

wire and adjust the safety 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.

3. Tighten jam nuts at safety switch and safety wire nuts.
4. Remove jack from under axle.
5. If available, connect an 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.

6. Place the landing gear switch in the UP position. Landing gear should retract.
- g. Operate landing gear through several cycles, checking landing gear for proper operation.
- h. Insure that landing gear switch and landing gear are DOWN and battery switch is OFF, then remove jacks.

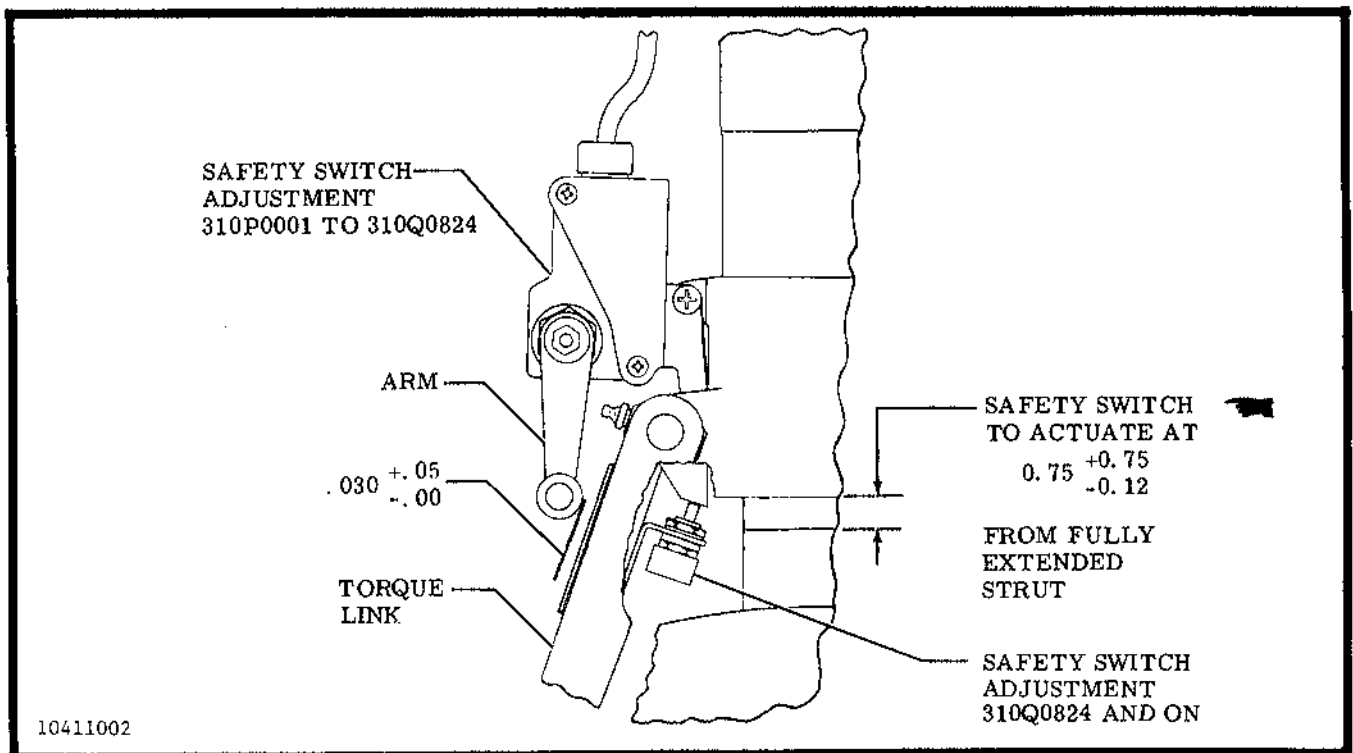


Figure 4-13A. Adjustment of Landing Gear Safety Switch

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- i. If used, disconnect the external power source.

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 3/16 inch aft of the word "THROTTLE" on the control quadrant.

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 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.

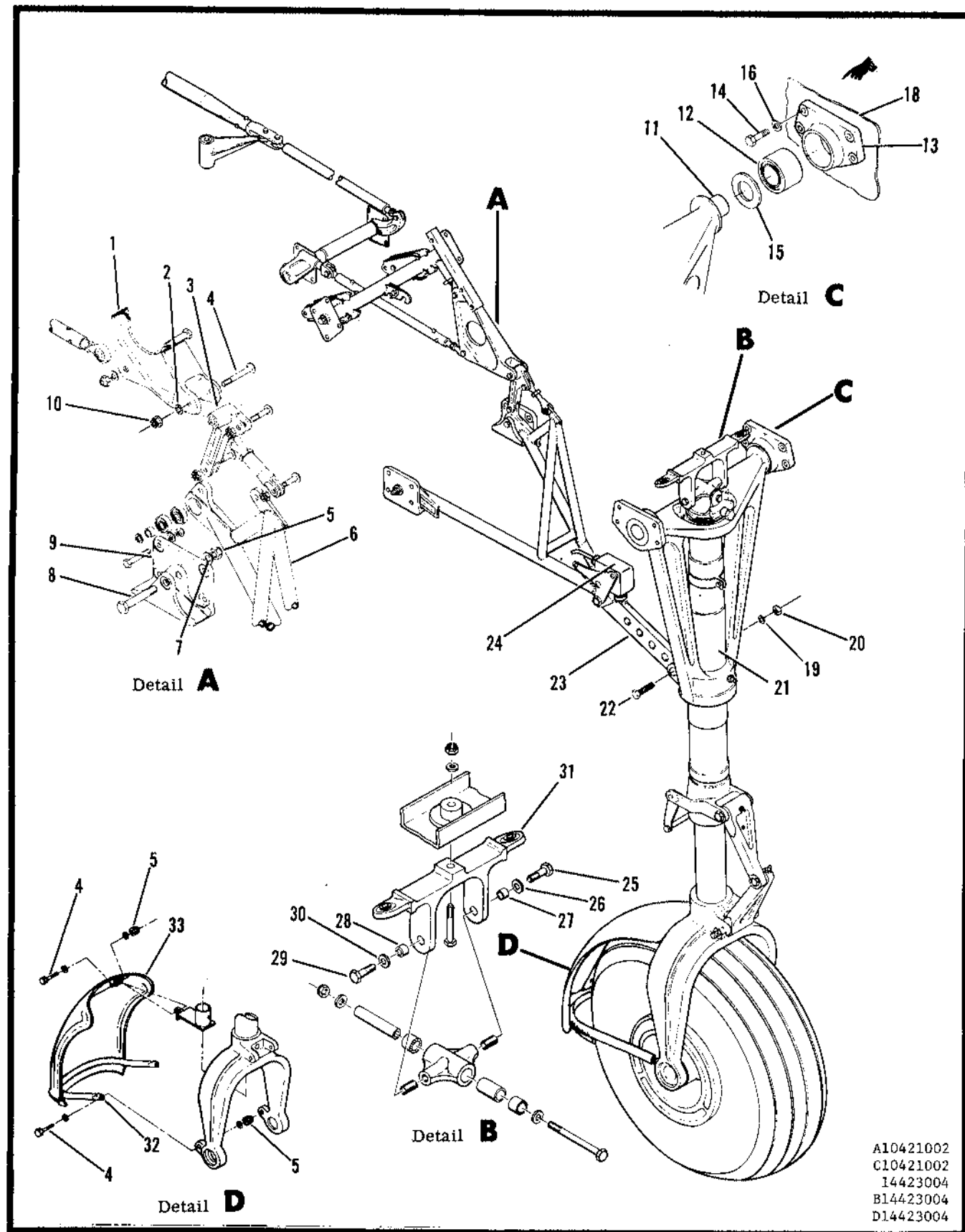
- b. On aircraft 310Q0401 and on, adjust flap-gear warning as follows:

1. Fully advance throttle levers.
2. Position flap preselect lever to 15° detent.
3. Turn off electrical power.
4. (See figure 8-1.) Loosen screws (62) and adjust switch (61) to actuate at .04 to .08 inch below the 15° detent. A definite click should be felt when switch actuates.
5. Tighten screws (62) 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 15° detent, the landing gear warning horn should sound.

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 (17) from fork bolt (18) 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 overcenter 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 overcenter 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.



A10421002
C10421002
14423004
B14423004
D14423004

Figure 4-14. Nose Gear Installation

Figure 4-14. Nose Gear Installation Callouts

1. Connector Link	12. Bearing	23. Drag Brace
2. Washer	13. Retainer	24. Nose Gear Down Indicator Switch
3. Retracting Arm	14. Bolt	25. Bolt
4. Bolt	15. Shim	26. Washer
5. Nut	16. Washer	27. Spacer
6. Truss Assembly	17. Deleted	28. Spacer
7. Washer	18. Web	29. Bolt
8. Bolt	19. Washer	30. Washer
9. Retainer	20. Nut	31. Nose Gear Steering Assembly
10. Nut	21. Trunnion	32. Brace
11. Trunnion	22. Bolt	33. Mud Guard and Scraper Assembly

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.

NOSE GEAR.

The nose gear consists of a wheel and tire assembly, yoke, axle, lower strut, upper strut, trunnion assembly, 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.)

- Jack aircraft in accordance with Section 2.
- Remove taxi light (if installed, optional).
- Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- Disconnect nose gear doors.
- Disconnect retracting linkage as follows:
 - Remove nut (20), washer (19), and bolt (22) attaching drag brace (23) to strut.

NOTE

To facilitate installation, note the number and position of attaching clamps and the routing of electrical wires.

- Remove bolts (25 and 29), washers (26 and 30), and spacers (27 and 28).
- Remove bolts (14) and washers (16) on both left and right side of wheel well; then slide retainer and gear aft to remove gear.

NOTE

To facilitate removal, wax or paraffin was applied to retainer pad (15) upon installation.

Disassembly of Nose Gear. (See figure 4-15.)

WARNING

Deflate the nose gear strut before removing or disconnecting nose gear torque links.

- Remove wheel and tire assembly.
- Remove retainers from trunnion assembly.

NOTE

Needle bearings are a press fit and should be removed only for replacement.

- Remove shimmy dampener by removing nuts, washers, and bolts.
- Completely deflate strut and after all air has been expelled, remove valve assembly and drain fluid.
- Remove snap ring (28) and stop (34) then pull trunnion (30) from upper barrel (59).
- Remove bearing ball (33) and packing (32) from trunnion (30).
- Remove cotter pin (35), washer (36), and pin (60) from upper barrel (59).
- Remove cotter pin (42), nut (43), washers (44 and 50), and bolt (49). Then disconnect torque links (46 and 51).
- 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).
- Pull orifice tube (14) from inner tube and fork (5), then unscrew orifice (15) from orifice tube (14).
- Remove lock ring (16) from inner tube and fork (5) and remove bearing (17).
- 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).
- Remove metering pin as follows:
 - Remove nut (12) and bolt (9) from wheel fork.
 - Pull metering pin from inner tube and wheel fork.
- Remove nut and disassemble metering pin as shown.
- 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).

b. Slide lock ring (27), ring pack retainer (26), and scraper ring (25) on inner tube and fork (5).

c. Install backup ring (22), O-ring (23), and back-up ring (24) or poly-pak seal (63) 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 (towards the 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. 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 4-5A.

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 bearing ball (33) into trunnion (30) and lubricate.

CAUTION

Do not use high pressure grease gun on fit-

Figure 4-15. Nose Gear Strut Callouts

1. Metering Pin	22. Back Up Ring	43. Nut
2. O-Ring	23. O-Ring	44. Washer
3. Plug Pin Base	24. Back Up Ring	45. Bushing
4. Nut	25. Scraper Ring	46. Torque Link
5. Inner Tube and Fork	26. Ring Pack Retainer	47. Bushing
6. Bolt	27. Lock Ring	48. Spacer
7. Washer	28. Snap Ring	49. Bolt
8. Spacer	29. Bearing Ball	50. Washer
9. Bolt	30. Trunnion	51. Torque Link
10. Nut	31. Lube Fitting	52. Bushing
11. Cotter Pin	32. Packing	53. Washer
12. Nut	33. Bearing Ball	54. Spacer
13. O-Ring	34. Stop Assembly	55. Bushing
14. Orifice Tube Assembly	35. Cotter Pin	56. Bolt
15. Orifice	36. Washer	57. Spacer
16. Lock Ring	37. Cotter Pin	58. Bushing
17. Bearing	38. Nut	59. Upper Barrel Assembly
18. Spacer	39. Washer	60. Pin
19. Shim	40. Bushing	61. Gasket
20. O-Ring	41. Lube Fitting	62. Valve Assembly
21. Ring Pack Support	42. Cotter Pin	63. Poly Pak Seal

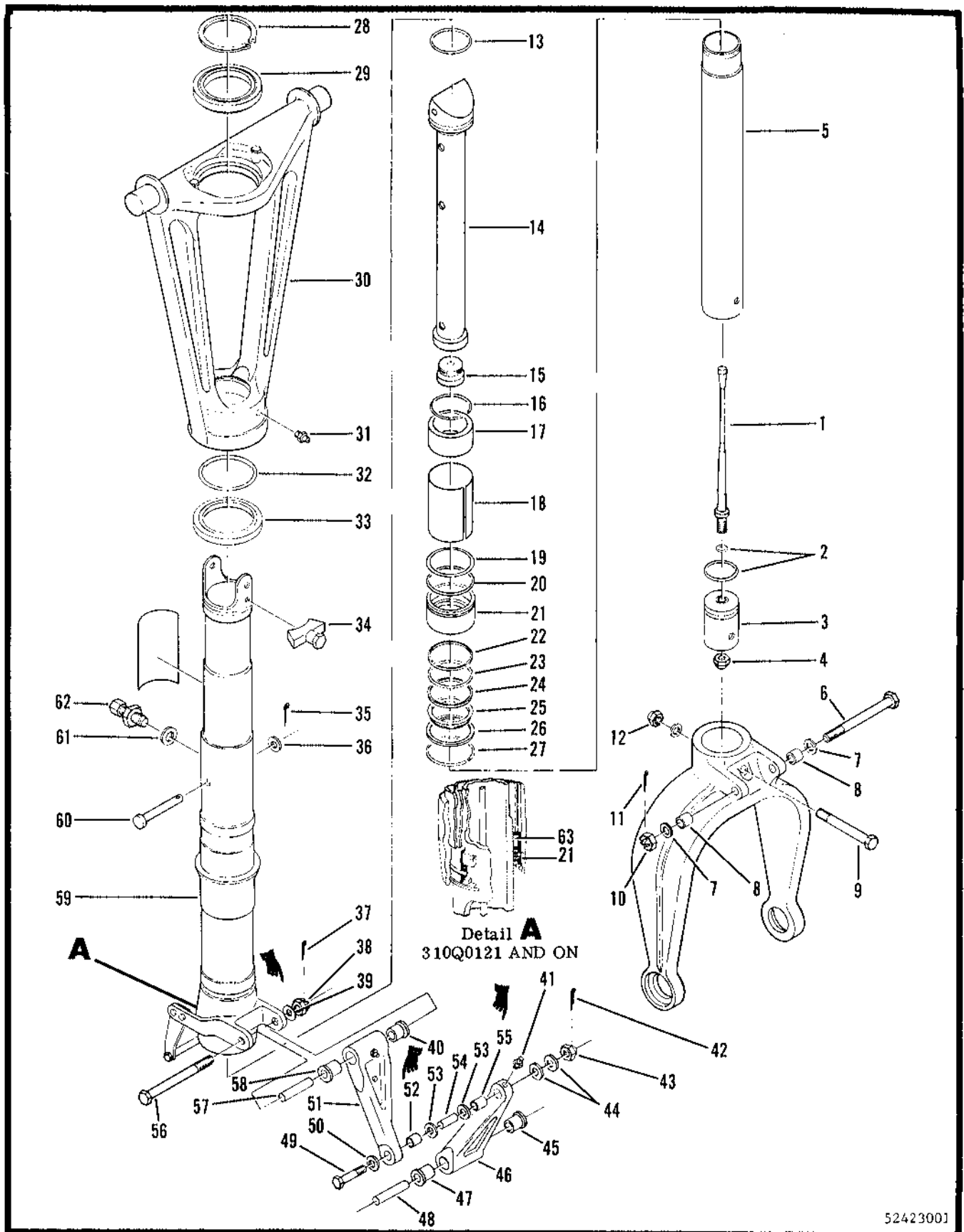


Figure 4-15. Nose Gear Strut

ting (31). Damage may result to trunnion (30).

- k. Install bearing ball (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 wheel and tire assembly.
- p. 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) and shims (15) as required to limit maximum side play to 0.020 are in place, then insert retainer (13) in place.
- 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) and washers (16) 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 (25 and 29) 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).
 3. Install spacers (8, 48 and 57).

NOTE

- Make sure holes in spacers are aligned with grease fittings.
- 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 fork.

4. Insert nose gear torque links (51 and 46) into position and install washers (7 and 39) and bolts (6 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).

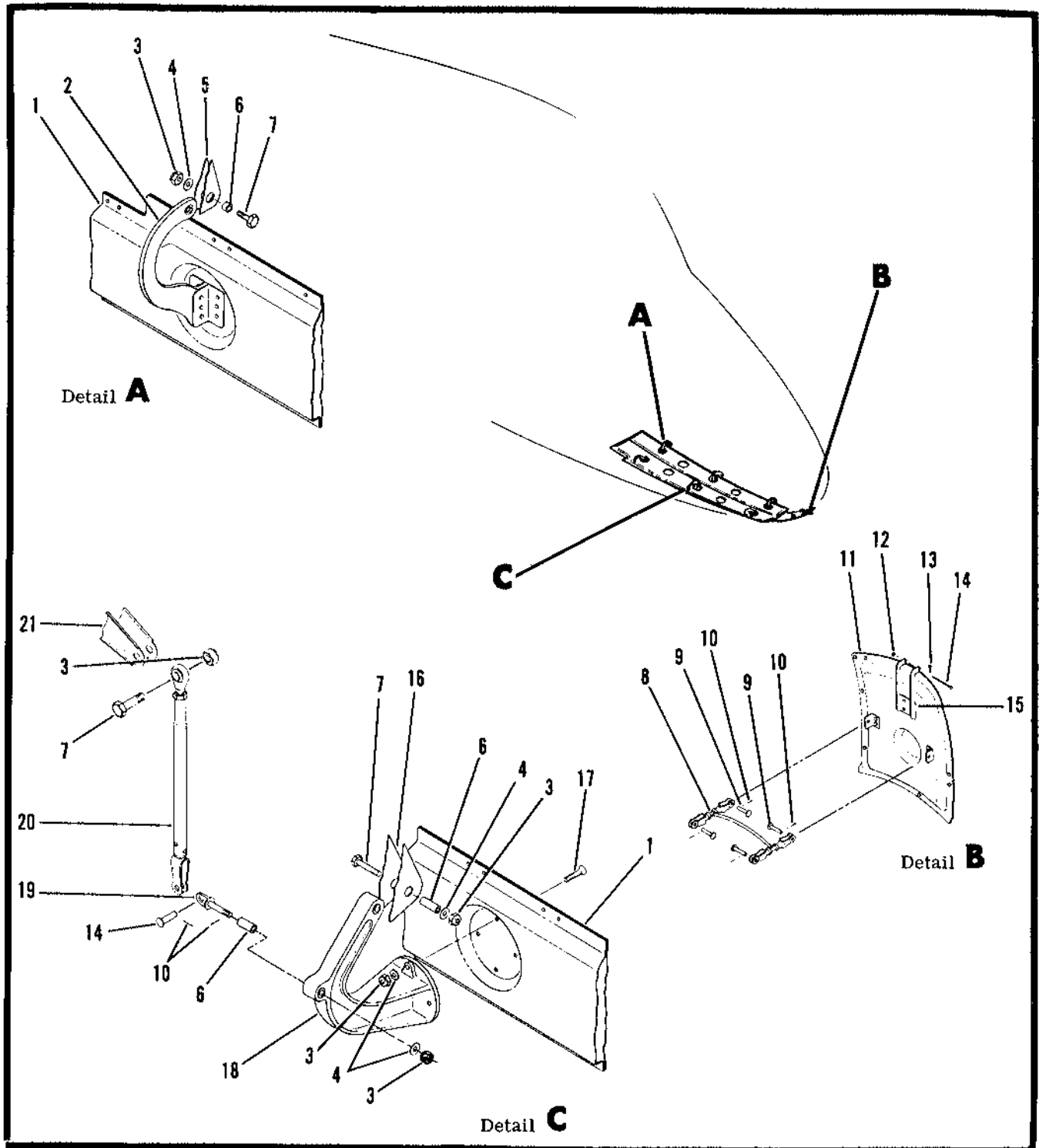
NOTE

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.

Removal of Nose Gear Doors. (See figure 4-16.)

- a. Remove forward nose gear door (11) as follows:
 1. Disconnect door (11) from strut by removing cotter pins and pins.
 2. Remove door (11) by removing cotter pin, washer and pin.
- b. Remove either main nose gear door (1) as follows:
 1. Disconnect door link tube (20) from hinge (18) by removing cotter pin and pin.
 2. Remove door by removing nuts, washers, spacers and bolts attaching hinges (2 and 18) to hinge brackets (16 and 5).
 3. If desired, center hinge (18) can be removed from door by removing four nuts, washers and screws.



1. Nose Gear Main Door
2. Hinge
3. Nut
4. Washer
5. Bracket
6. Spacer
7. Bolt

8. Tie Rod Assembly
9. Pin
10. Cotter Pin
11. Nose Gear Forward Door
12. Washer
13. Cotter Pin
14. Pin

15. Hinge
16. Bracket
17. Screw
18. Hinge
19. Eye Bolt
20. Door Link Tube
21. Door Actuator Arm

Figure 4-16. Nose Gear Doors Installation

Installation of Nose Gear Doors. (See figure 4-16.)

- a. Install either main nose gear door (1) as follows:
 1. If removed, install center hinge (18) with four screws, washers and nuts.
 2. Place door in position and attach hinges (2 and 18) to hinge brackets (5 and 16) with bolts, spacers, washers and nuts.
 3. Attach door link tube (20) to aft side of hinge (18) with pin and cotter pin.

CAUTION

Damage will result if door link tube (20) is not connected on the proper side of hinge (18).

- b. Install forward nose gear door (11) as follows:
 1. Place door (11) in position and install pin, washer, and cotter pin.
 2. Attach door to strut with pins and cotter pins.
- e. If new components have been installed, or connecting linkage adjustments have been changed, rig nose gear doors.

Rigging of Nose Gear Doors. (See figure 4-16.)

- a. Jack aircraft in accordance with Section 2.
- b. Disconnect main door link tubes (20) from center hinges (18) by removing cotter pins and pins.
- 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.

- d. Adjust ends of tie rod assembly (8) until forward door closes snugly when gear is in the UP position.
- e. Connect and adjust main door link tubes (20) until main doors close snugly when gear is in the UP position.

CAUTION

Damage will result if the door link tube (20) is not connected on the proper side of hinge (18).

- f. Extend and retract gear, check for clearance between nose tire and doors, and readjust door link tubes (20) as necessary to obtain clearance.
- g. Insure that landing gear is Down and locked then remove aircraft from jacks.

Removal of Nose Gear Retracting Linkage. (See figure 4-17.)

- a. Jack aircraft in accordance with Section 2.
- b. Remove pilot's seat and carpet in accordance with Section 3.
- c. Remove access hole covers from left cabin floor and underside of fuselage beneath landing gear actuator.
- d. Disconnect nose gear main doors.
- e. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.

NOTE

Prior to any operation of the gear by the manual extension crank, assure that there is no electrical power on the aircraft; or that the landing gear switch is in the neutral position.

- f. Remove forward push-pull tube (17) as follows:
 1. Remove nut and bolt attaching push-pull tube (17) to fork bolt (18).
 2. Remove nut, washer and bolt attaching push-pull tube (17) to connector link (21).

NOTE

During removal of nose gear linkage, manually move gear as required for access to attaching bolts and nuts.

- g. Remove nose gear drive tube (1) as follows:
 1. (See figure 4-1.) Using the normal landing gear retraction system, operate landing gear to the UP position. From underside of fuselage, remove cotter pin, nut, washer and bolt attaching drive tube (42) to landing gear actuator lower bellcrank (50).

NOTE

The use of an external power source is recommended for operation of electrical units while engines are not being operated.

2. Move drive tube (1) forward as far as possible to gain access to idler bellcrank (7) attachment point and remove nut, washer, spacers and bolt.
- h. Remove intermediate push-pull tube (5) as follows:

Figure 4-17. Nose Gear Retracting Linkage Callouts

1. Nose Gear Drive Tube	11. Collar	21. Connector Link Assembly
2. Spacer	12. Drive Tube	22. Adjusting Rod End
3. Bolt	13. Idler	23. Uplock Hook
4. Washer	14. Inboard Bellcrank	24. Truss Assembly
5. Intermediate Push-Pull Tube	15. Inboard Support Bearing	25. Switch Bracket
6. Nut	16. Cotter Pin	26. Drag Brace
7. Idler Bellcrank	17. Forward Push-Pull Tube	27. Adjusting Fork
8. Pin	18. Fork Bolt	28. Retainer
9. Adjusting Bellcrank	19. Uplock Torque Tube	29. Retracting Arm
10. Inboard Support Bearing	20. Bearing Assembly	

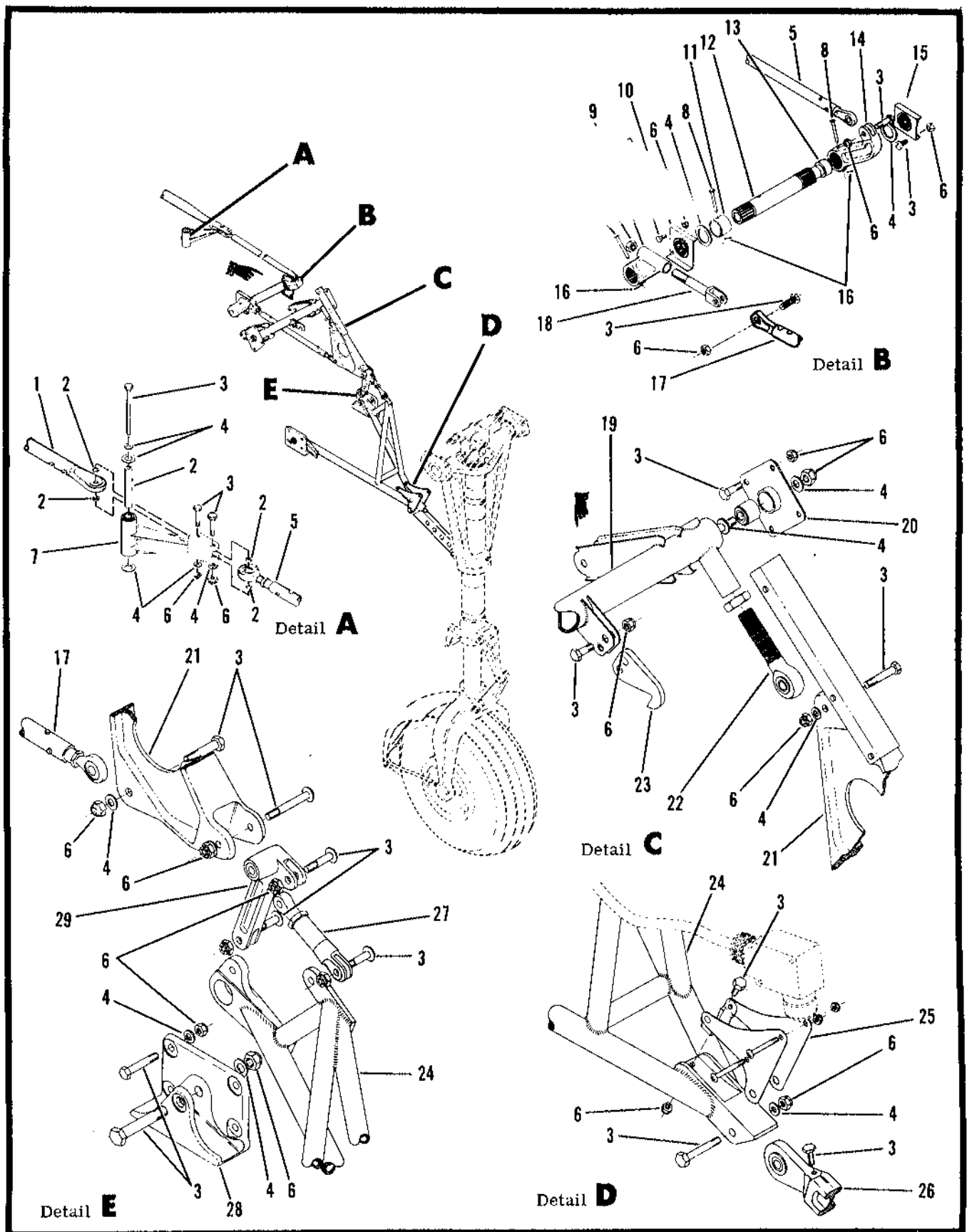


Figure 4-17. Nose Gear Retracting Linkage

1. Remove nut, washer, spacers and bolt attaching push-pull tube (5) to idler bellcrank (7).
2. Remove nut and bolt attaching push-pull tube (5) to outboard bellcrank (14).
 - i. Remove idler bellcrank (7) by removing bolt and washers. Remove spacer from idler bellcrank.

NOTE

Access to bolt for removal at idler bellcrank (7) is provided by a hole in the cabin floor above the bolt head.

- j. Remove torque tube (12) as follows:
 1. Remove adjusting bellcrank (9) by removing cotter pin and pin. If desired, fork bolt (18) can be removed from adjusting bellcrank.
 2. Remove inboard support bearing (10) by removing four nuts and bolts. Remove washer (4).
 3. Pull torque tube (12) inboard until it clears outboard support bearing (15), then tilt the outboard end upward and remove from nose section. Remove washer (4).
 4. If desired, outboard support bearing (15) can be removed by removing attaching nuts and bolts.
 5. Remove stop collar (11) from torque tube by removing cotter pin and pin

NOTE

Removal of collar (13) and outboard bellcrank (14) from torque tube (12) is not recommended. These are matched parts and collar (13) is a press fit.

- k. Remove connector link assembly (21) as follows:
 1. Remove bolt and nut attaching connector link assembly (21) to retracting arm (29).
 2. Remove nut, washer and bolt attaching connector link assembly (21) to adjusting rod end (22).

NOTE

Access to bolt for removal at adjusting rod end (22) is provided by a hole in the adjacent structure. Rotate connector link assembly to align hole.

1. Remove drag brace (26) as follows:
 1. Remove nut, washer, and bolt attaching drag brace (26) to truss assembly (24).
 2. Remove nut and bolt attaching drag brace to strut.
- m. Remove uplock torque tube (19) as follows:
 1. Remove nut and washer from each end of torque tube.

NOTE

Uplock torque tube (19) can be removed with left bearing assembly in place.

2. Remove bearing assemblies (20) by removing attaching nuts and bolts.

NOTE

Bearings are a press fit, and should be removed from supports only for replacement.

3. If desired, uplock hook (23) and adjusting rod end (22) can be removed from uplock torque tube.
 - n. Remove truss assembly (24), retracting arm (29), and adjusting fork (27) as an assembly as follows:

1. Remove nut and bolt attaching switch bracket (25) to truss assembly (24).
2. Remove clamps attaching wires to retracting linkage and tie switch where it will not interfere with linkage removal.
3. Remove nuts, washers and bolts attaching truss assembly (24) to retainers (28).
4. Pull truss assembly (24) forward and remove from the aircraft.
5. If desired, retracting arm (29) and adjusting fork (27) can be removed from truss assembly by removing attaching nuts and bolts.
6. If desired, retainers (28) can be removed from aircraft by removing nuts, washers and bolts.

Installation of Nose Gear Retracting Linkage. (See figure 4-17.)

- a. Install truss assembly (24) as follows:
 1. If removed, install retracting arm (29) and adjusting fork (27) on truss assembly.

NOTE

Lower retracting arm (29) bolt is inaccessible after truss assembly is installed.

2. If removed, install retainers (28) with bolts, washers and nuts.
3. Place truss assembly (24) in position and attach to retainers with bolts, washers and nuts.
4. Install clamps attaching wires to retracting linkage and attach switch bracket (25) to truss assembly with bolt and nut.
- b. Install uplock torque tube assembly (19) as follows:
 1. If removed, attach uplock hook (23) and adjusting rod end (22) to uplock torque tube.
 2. Install left bearing assembly, then place uplock torque tube in position and install right bearing assembly. Install bearing assemblies (20) with bolts and nuts.
 3. Install washer and nut on each end of uplock torque tube assembly.
- c. Install drag brace (26) as follows:
 1. Attach drag brace (26) to truss assembly (24) with bolt, washer and nut.

NOTE

When installing bolt, insure that down indicator switch bracket (25) is properly in place.

2. Connect drag brace (26) to strut with attaching bolt and nuts.
- d. Install connector link assembly (21) as follows:
 1. Attach connector link assembly (21) to retracting arm (29) with bolt and nut.
 2. Attach connector link assembly (21) to adjusting

rod end (22) with bolt, washer and nut.

NOTE

Access to bolt for installation of adjusting rod end (22) is provided by a hole in the adjacent structure. Rotate connector link assembly to align hole.

e. Install torque tube (12) as follows:

1. Install stop collar (11) on torque tube with pin and cotter pin.

NOTE

Bellcrank (14) and collar (13), located at the outboard end of torque tube (12), are mated to the torque tube and drilled on assembly. These three parts must be assembled before installation.

2. If removed, install outboard support bearing (15) with bolts and nuts.

NOTE

Torque the nuts attaching inboard and outboard support bearings to 13.5 ± 1.5 pound-inches.

3. Install outboard washer on torque tube and place in position.

NOTE

Insert inboard end of torque tube through the inboard mounting hole from the left, pull into wheel well area until outboard end of torque tube can be inserted into outboard support bearing.

4. Place inboard washer, then inboard support bearing (10) on inboard end of torque tube. Install support bearing with bolts and nuts.
5. If removed, install fork bolt (18) in adjusting bellcrank (9).
6. Install adjusting bellcrank (9) on torque tube with pin and cotter pin.

NOTE

Splines must align so that pin can be installed, and bellcranks (9 and 14) both extend forward from torque tube.

- f. Insert spacer into idler bellcrank (7), place bellcrank in position, and install with bolt and washers.
- g. Install intermediate push-pull tube (5) as follows:
 1. Attach push-pull tube (5) to outboard bellcrank (14) with bolt and nut.

NOTE

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

2. Attach push-pull tube (5) to idler bellcrank (7) with bolt, washer, spacers and nut.

NOTE

To gain access to idler bellcrank attachment points, rotate bellcrank forward as far as possible.

- h. Attach gear drive tube (1) as follows:
 1. Attach tube to idler bellcrank (7) with bolt, washers and nut.
 2. Attach drive tube (42) to landing gear actuator lower bellcrank (50) with bolt, washer, nut and cotter pin.

NOTE

Access to lower bellcrank is gained through an access hole on underside of fuselage.

- i. Install forward push-pull tube (17) as follows:
 1. Using the manual extension system, operate landing gear to the DOWN position, then crank a few turns toward the UP position.
 2. Attach push-pull tube (17) to connector link assembly (21) with bolt, washer and nut.
 3. Attach push-pull tube (17) to fork bolt (18) 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 floorboards on cabin floor and access hole covers on underside of fuselage beneath landing gear actuator.
- m. Install carpet and seats in accordance with Section 3.
- n. 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 (16) from trunnion assembly by removing cotter pin (17), nut (18), washers (19) and bolt (20).
- b. Remove shimmy dampener from strut by removing cotter pin (25), nut (24), washer (22), bushing (23) and bolt (21).

Disassembly of Nose Gear Shimmy Dampener. (See figure 4-18.)

- a. Push piston rod (16) into shimmy dampener, remove filler plug (1) and O-ring (2) and drain fluid.
- b. Remove lock ring (15) from forward end of shimmy dampener and pull piston and rod assembly from barrel (3).
- c. Remove piston (8) from piston rod (16) by removing O-ring (11), retainer (10) and roll pin (9).
- d. Remove lock ring (7) from aft end of shimmy dampener and pull bearing head (6) from barrel (3).
- e. Remove O-rings (4, 14, 5 and 12) from bearing heads (6 and 13).

hydraulic fluid.

- a. Install O-rings (4, 14, 5 and 12) on bearing heads (6 and 13).
- b. Install bearing head (6) and lock ring (7) on aft end of barrel (3).
- c. Install piston (8) on piston rod (16) and insert roll pin (9) through piston (8) and piston rod (16).
- d. Install retainer (10) and O-ring (11) on piston (8).
- e. Insert piston and piston rod assembly into barrel (3), slide bearing head (13) into position and install lock ring (15).

CAUTION

Insert piston and bearing heads with care to prevent damage to O-ring.

Assembly of Nose Gear Shimmy Dampener. (See figure 4-18.)

Before shimmy dampener is assembled, thoroughly clean each component, then lubricate with system

- f. Completely fill shimmy dampener with MIL-H-

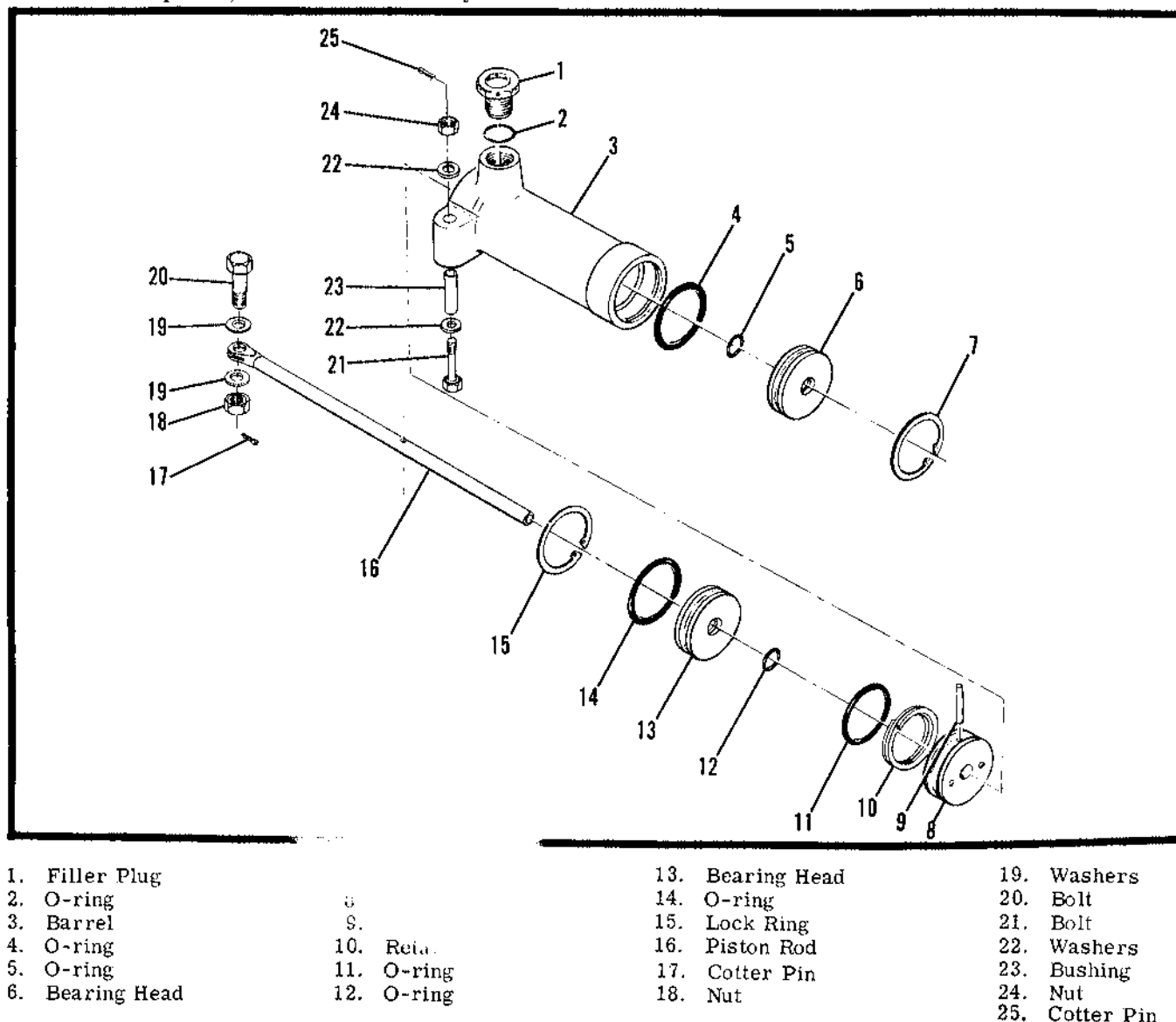


Figure 4-18. Shimmy Dampener

5606A hydraulic fluid, and install O-ring (2) and filler plug (1).

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 (23) in barrel (3) align mounting holes, and install bolt (21), washer (22), nut (24) and cotter pin (25).

NOTE

Lubricate bushing (23) with light oil during installation.

- b. Connect piston rod (16) to trunnion assembly with bolt (20), washers (19), nut (18) and cotter pin (17).

NOSE GEAR STEERING.

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. (See figure 4-19.)

- a. Remove pilot's and copilot's seats and front carpet in accordance with Section 3.
- b. Remove access hole covers from cabin floor as necessary to gain access to steering cables.
- c. 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.

- d. Remove necessary radio shelving to gain access to nose gear steering cable pulleys and remove cable

guard pins.

- e. Disconnect nose gear steering cable from rudder torque tube by removing cotter pin, nut, and bolt.
- f. Pull forward cable thru wheel well web into nose section then pull cable forward and remove from aircraft.

g. Remove cables from spring by removing cotter pins, and bolts.

h. 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 the bellcrank, refer to Installation of Nose Gear for torque values.

2. Align outer 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 thru nose wheel well web.

- f. Install cable guard pins and replace radio equipment shelves removed during removal.

- g. Connect nose gear steering cables to turnbuckles and tighten. Rig cable tension in accordance with Rigging of Rudder Control System (Section 7). Re-safety turnbuckles.

- h. Install access cover plates on underside of fuselage and under pilot's and copilot's scuff plates.

- i. Install carpet, scuff plates, pilot's and copilot's seats.

NOTE

Nose steering springs are pre-set at the factory to 85 pounds.

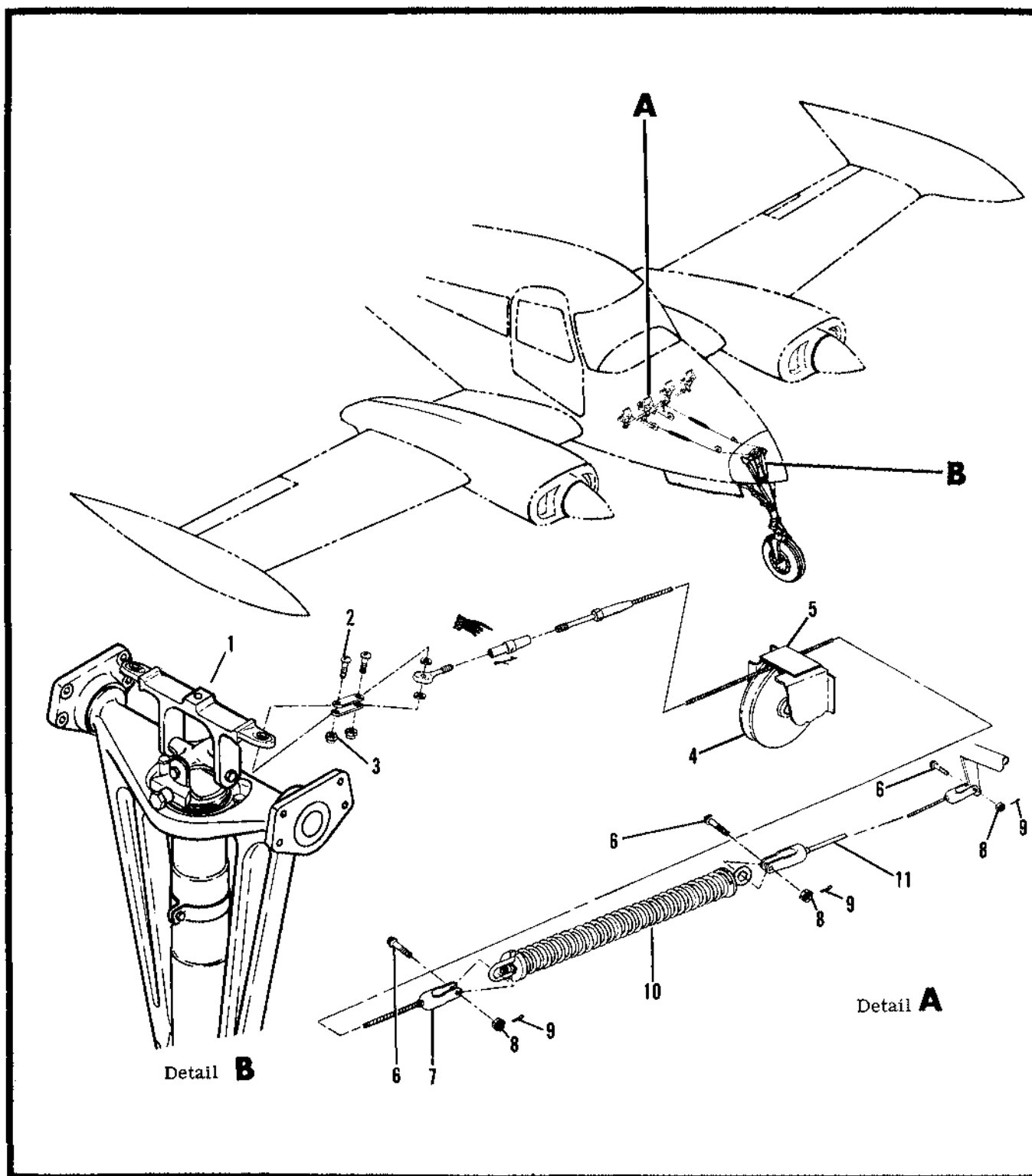
Rigging the Nose Gear Steering System.

Rig nose gear steering system in accordance with Section 7.

NOSE WHEEL AND TIRE.

Removal and Disassembly of Nose Wheel and Tire. (See figure 4-20.)

- a. Jack 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 nose wheel fork (1).
- d. Remove spacers (5) and axle tube (6) from wheel.



1. Nose Gear Steering Bellcrank
2. Screw
3. Nut
4. Pulley

5. Bracket
6. Bolt
7. Cable Assembly

8. Nut
9. Cotter Pin
10. Spring
11. Cable Assembly

Figure 4-19. Nose Gear Steering System

- e. Remove retainers (8) and bearing cones (9) from wheel.
- f. Remove tire (13) and tube (14) as follows:
 - 1. Deflate tire and tube by removing valve core.

WARNING

Always deflate tire and tube before separating wheel halves.

- 2. Remove nuts, washers and bolts and separate wheel halves (12 and 15).
- 3. Remove each wheel half from tire and tube and remove tube from tire.
- g. Bearing cups are a shrink fit and should be removed only for replacement.

NOTE

If removal of bearing cups is necessary, place wheel half in boiling water for at least 30 minutes, then remove bearing cup by tapping cup evenly from the inner side.

Assembly and Installation of Nose Wheel and Tire.
(See figure 4-20.)

- a. If removed, replace bearing cups.

NOTE

Bearing cups are a shrink fit in wheel. To install, place wheel in boiling water for at least 30 minutes, chill bearing cups with dry ice, and tap lightly into position to insure proper seating.

- b. Place wheel halves (12 and 15) in position on tire (13) and tube (14).
- c. Install bolts, washers and nuts. Torque nut to value marked on wheel half.

CAUTION

Tighten nuts evenly and torque correctly to lessen the possibility of bolt failure.

- d. Inflate tire enough to seat the beads on the wheels, deflate completely, then reinflate to approximately one-half operating pressure.
- e. Install bearing cones (9) and retainers (8) in the wheel halves (12 and 15).

CAUTION

Insure that bearing cones (9) are properly greased before installing.

- f. Insert axle tube (6) in wheel and place spacers (5) on end of axle tube.
- g. Place wheel and tire assembly in position, align with mounting holes in fork (1) and install axle bolt

buckets (4).

- h. 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.

- i. Install cotter pin.

MAIN WHEEL AND TIRE.

Removal and Disassembly of Main Wheel and Tire.
(See figure 4-21.)

- a. Jack aircraft in accordance with Section 2.
- b. Remove snap ring (12), bearing cap (11), cotter pin (13), nut (14) and washer (10) from axle.
- c. Remove brake disc clips from brake side of the wheel as follows:
 - 1. Turn wheel until a disc clip is opposite the brake unit.
 - 2. Move brake disc to outer edge of wheel and insert a thin screwdriver, or other suitable tool, between disc clip and wheel.
 - 3. Pry the inner edge of disc clip out of groove inside the wheel, and pull disc clip out.
 - 4. Repeat this procedure until all clips are removed.
- d. Remove wheel and tire assembly from axle, using caution to prevent damage to axle threads and to keep bearings clean.
- e. Remove seal (1) and bearing cones (2 and 9) from wheel to prevent them from dropping out of wheel after wheel removal.
- f. Remove tire (18) as follows:

WARNING

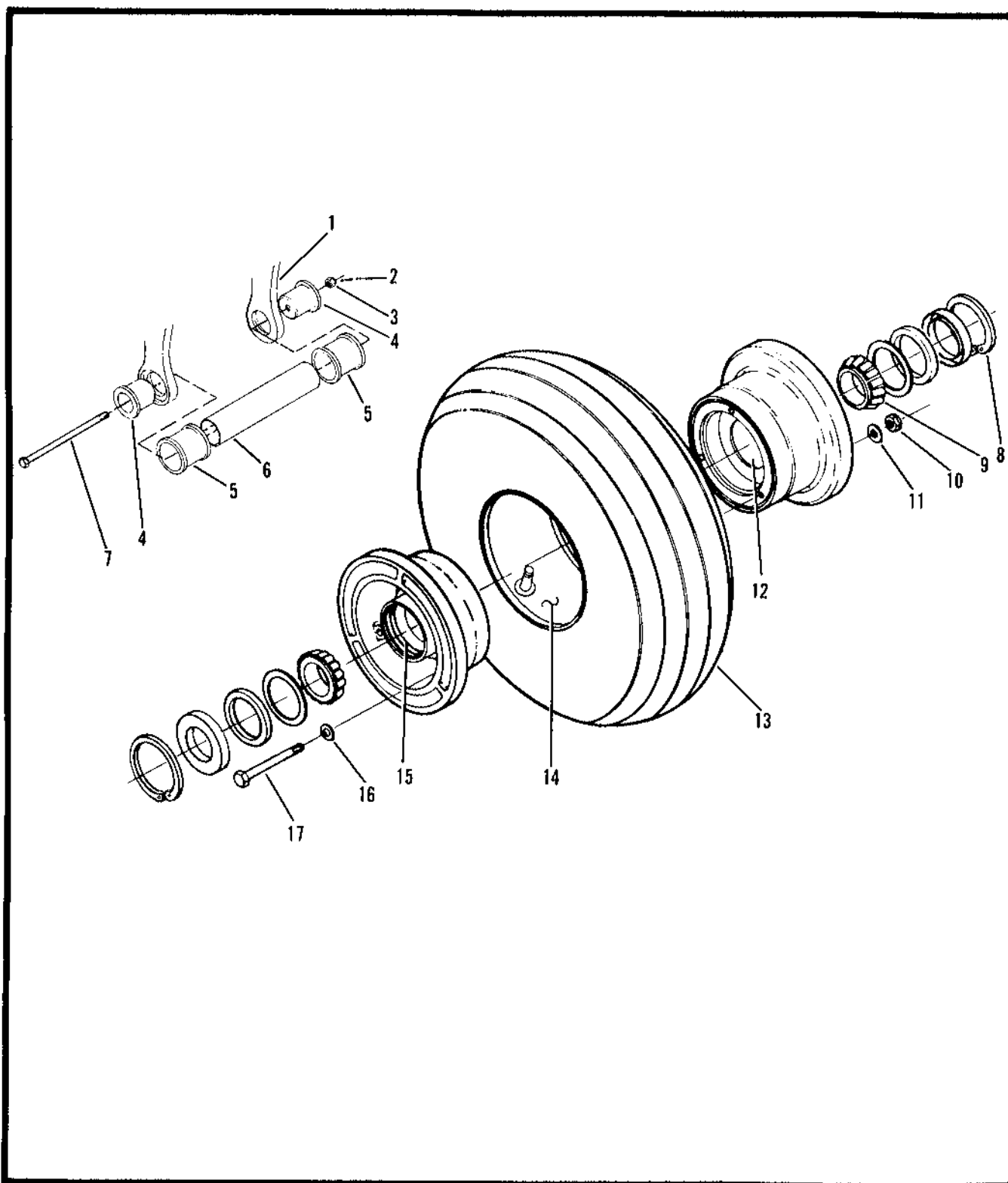
Always deflate tire before separating wheel halves.

- 1. Deflate tire by removing the valve core with a suitable tool.
- 2. Remove nuts, washers and bolts and separate wheel halves (4 and 17).
- 3. Remove each wheel half from tire and remove tire.
- 4. Remove tube (7) from tire (18).
- 5. Bearing cups (3 and 8) are a shrink fit and should be removed for replacement only.

NOTE

If removal is necessary, place wheel half in boiling water for at least 30 minutes, then remove bearing cup by tapping cup evenly from the inner side.

- g. Remove drive keys (5) if worn to a minimum width of 1.116 inches by removing screws (6).

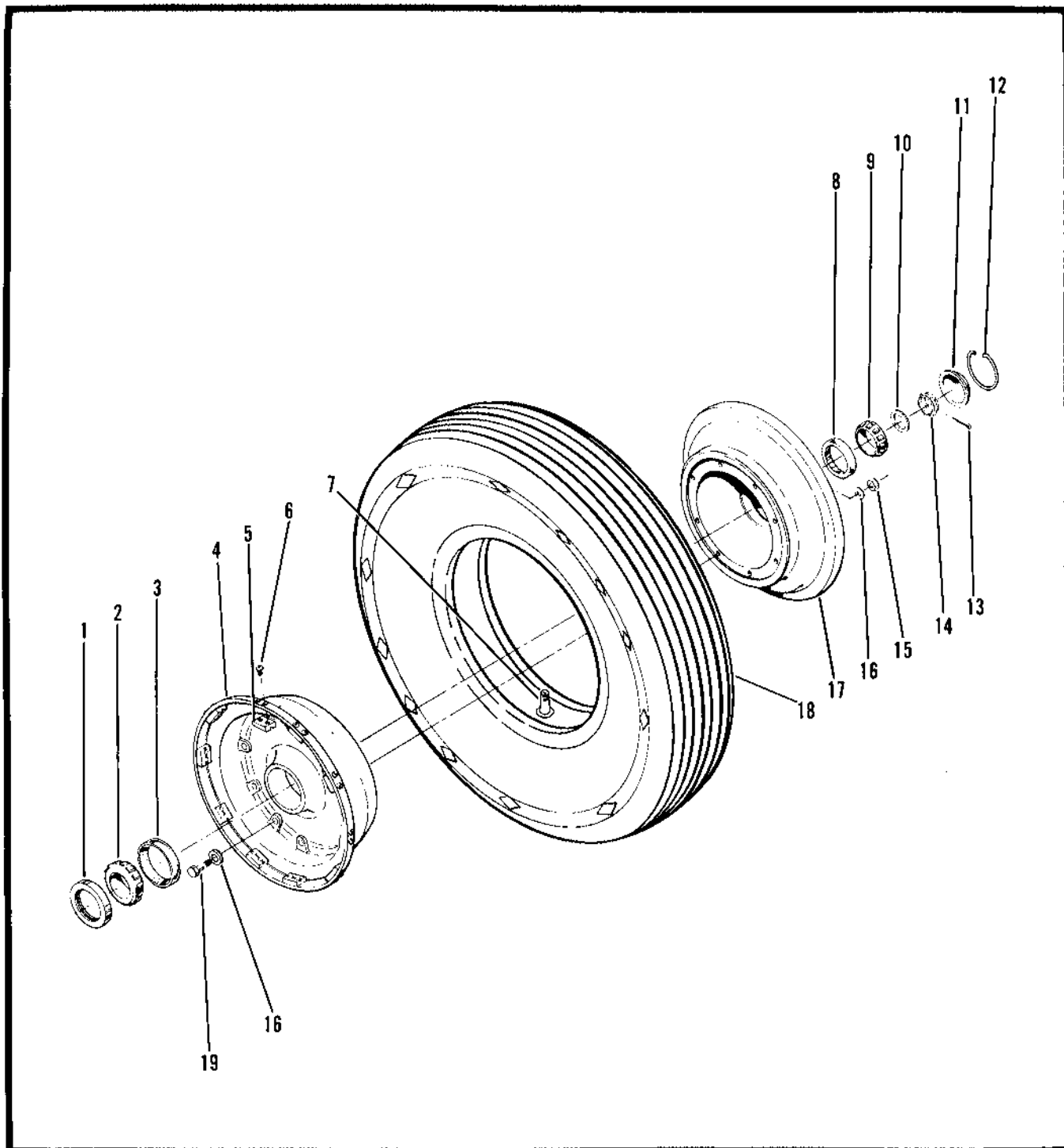


1. Nose Wheel Fork
2. Cotter Pin
3. Nut
4. Axle Bolt Bucket
5. Spacer
6. Axle Tube

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



1. Seal	7. Tube	14. Nut
2. Bearing Cone	8. Bearing Cup	15. Nut
3. Bearing Cup	9. Bearing Conc	16. Washer
4. Brake Wheel Half	10. Washer	17. No-Brake Wheel Half
5. Drive Key	11. Bearing Cap	18. Tire
6. Screw	12. Snap Ring	19. Bolt
	13. Cotter Pin	

Figure 4-21. Main Wheel and Tire Assembly

NOTE

Screws (6) are staked to the drive keys (5) and should be removed only for replacement.

Assembly and Installation of Main Wheel and Tire.
(See figure 4-21.)

- a. If removed, replace disc drive keys (5) and install retaining screws (6).

NOTE

When replacing drive keys, prime the contact surfaces, torque retaining screws to 60 ±10 pound-inches, and stake.

- b. If removed, replace bearing cups (3 and 8).

NOTE

Bearing cups are a shrink fit in wheel. To install, place wheel in boiling water for at least 30 minutes, chill bearing cups with dry ice, and tap lightly into position to insure proper seating.

- c. Install tube (7) in tire (18).
- d. Place wheel halves (4 and 17) in position on the tire.
- e. Install bolts, washers and nut. Torque nut to value marked on wheel half.

CAUTION

Tighten nuts evenly and torque correctly to lessen the possibility of bolt failure.

- f. Inflate tire enough to seat the beads on the wheels, deflate completely, then reinflate to approximately one-half operating pressure.
- g. Install bearing cone (2) and seal (1) in wheel half (4).
- h. Check wheel balance using Service Kit SK150-20.

CAUTION

Insure that bearing cones (2 and 9) are properly greased before installing.

- i. Place the wheel and tire assembly in position on the axle, aligning brake disc with disc drive keys in wheel.
- j. Install outer bearing cone (9), washer (10) and nut (14).

NOTE

Tighten wheel bearing nut (14) to 40 inch-pounds while rotating wheel, then back off nut and retighten to 20 inch-pounds while rotating wheel. If the nut is not positioned to allow installation of the cotter pin at the 20-inch pound torque, continue tightening to the next locking position that will align

the cotter pin hole.

- k. Install cotter pin (13), bearing cap (11) and snap ring (12).

- l. Install brake disc clip as follows:

- 1. Starting opposite the brake unit, insert disc clip between disc and wheel, and between any two adjacent drive keys.

- 2. Install disc clip so that ends of clip contact the disc, and the smaller of the two bent center flanges is inserted first.

- 3. Press the disc clip into the wheel until the small bent flange seats in the groove provided inside the wheel.

- 4. Rotate wheel, omit the next space between the drive keys, and repeat the above procedure until all five disc clips are installed.

- m. Check that all disc clips are properly installed and that wheel rotates freely, remove jack and inflate tire to correct operating pressure.

Main Wheel Alignment. (See figure 4-22.)

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 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. Jack the aircraft in accordance with Section 2.

- d. Add washers between torque links to correct for excessive toe-in. Wheel alignment after adjustment must be within limits prescribed in step "c."

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 added or removed to the outside end of the spacer to maintain an .004 to .020 inch side-play of the torque link. Torque the bolt to one castellation beyond firm. Insure that washers are centered on spacer.

BRAKE SYSTEM- MAIN AND PARKING.

The aircraft has a hydraulically actuated main brake system. A hydraulic master cylinder is attached to each pilot's rudder pedal, and hydraulic lines and hoses are routed from these cylinders through the cabin, through the wing, and to the brake assemblies on each main landing gear. The brakes are Good-year single-disc, nonself-adjusting type, with two actuating cylinders in each brake assembly. No manual adjustment is required on these brakes. The brake can be operated by applying pressure to either the pilot's or copilot's rudder pedals. The parking brake system consists of a manually operated handle assembly connected to the parking brake torque tube. The parking brake torque tube is connected to the pilot's rudder pedal brake links by two short cables. The parking brake is set by applying pressure to both rudder pedals and then setting parking brake handle.

Troubleshooting Brake System.

TROUBLE	PROBABLE CAUSE	CORRECTION
BRAKE PEDAL BOTTOMS	Insufficient brake fluid in system.	Bleed and fill system in accordance with bleeding procedure.
	Brake disc warped, causing excessive clearance.	Replace disc.
	Disc clips missing.	Replace disc clips.
	Loose bleeder screw, faulty bleeder screw washer, or adaptor not tight.	Tighten bleeder screw. Replace washer. Tighten adaptor.
BRAKE PEDAL BOTTOMS (CONT)	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.
	Damaged Lock-o-seal in master cylinder.	Replace Lock-o-seal.
"SPONGY" BRAKES	Air trapped in system.	Bleed system.
	Expanded hose.	Replace hose.
BRAKES DRAG	Weak or broken piston return spring in master cylinder.	Replace piston return spring.
	Binding brake pedal linkage.	Free linkage to prevent binding.
	Brake disc badly dished.	Replace brake disc.
	Brake disc coming out of wheel due to loss of disc clips.	Replace disc clips.
	Internally swollen hoses and/or swollen O-ring seals due to improper hydraulic fluid in system.	Replace hoses and/or O-ring seats. Flush system with denatured alcohol. Bleed and fill system in accordance with bleeding procedure.

TROUBLE	PROBABLE CAUSE	CORRECTION
BRAKES FAIL TO HOLD	Brake linings worn out.	Replace lining in accordance with replacement of brake lining procedure.
	New linings just installed.	Taxi aircraft and apply brakes several times to condition linings.
	Air in system.	Bleed and fill system in accordance with bleeding procedure.
	Oil, grease or other foreign material on disc or brake linings.	Clean and flush with Trichloroethelene, then taxi the aircraft slowly, apply the brakes several times to condition the lining.
	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 4-23.)

- Remove pilot's and copilot's seats in accordance with Section 3.
- Remove front carpets and scuff plates in accordance with Section 3.
- Remove upholstery side panels in accordance with Section 3.
- Remove control column access cover from underside of fuselage by removing attaching screws.
- Remove the rectangular access hole cover from right floorboard adjacent to the aft part of control pedestal.
- Drain system fluid by removing bleeder screw from both main wheel brake assemblies.
- Remove brake master cylinders.
- Disconnect left master cylinder hose (22) from elbow in web of pilot's left rudder pedal bracket, and remove through access hole.
- Remove left cabin brake line (20) as follows:

NOTE

As removal of this line requires its destruction, it is not recommended that it be removed except as required for replacement. Replacement of the factory installed line (20) will require two separate lines (1 and 3) joined with a union (2) just above the floorboard on the forward side of the bulkhead. These parts can be ordered as spares.

- Cut line at riser portion forward of bulkhead and as close to the floorboard as practical.
- Loosen coupling nuts from elbows and remove each section of line.
- To remove right master cylinder hose:
 - Disconnect cabin crossover brake line (24) from elbow in web of pilot's right rudder pedal bracket.
 - Remove attaching nut and washer from elbow to allow its removal from web or rudder pedal

bracket. Remove hose (25), with elbow attached, through master cylinder mounting position.

- Detach hose from elbow.
- Disconnect cabin crossover brake line (24) from elbow in right side of control column well and remove through access hole in left floorboard.
- Remove intermediate cabin brake line (26) as follows:

NOTE

Due to difficulty of access, it is recommended that this line be removed only as necessary for replacement.

- Remove attaching nut and washers from elbow in right side of control column well to allow its withdrawal from position.
- Disconnect line (26) from aft elbow.

NOTE

Access to the aft coupling nut on this line is through the forward rectangular access hole in the right floorboard and through the lightening hole in the web of the copilot's left rudder pedal bracket. A 9/16 inch crowfoot wrench and extension can be manipulated through this opening to loosen the coupling nut.

- Remove line through lightening hole, with elbow still attached, by manipulating forward end outboard and forward, to allow aft end to clear edge of lightening hole.
- Detach line (26) from elbow.
- Disconnect right cabin brake line (29) from elbows. Carefully work line from its position beneath the floorboards, and remove through access hole.

CAUTION

It may be necessary to flex this line slightly

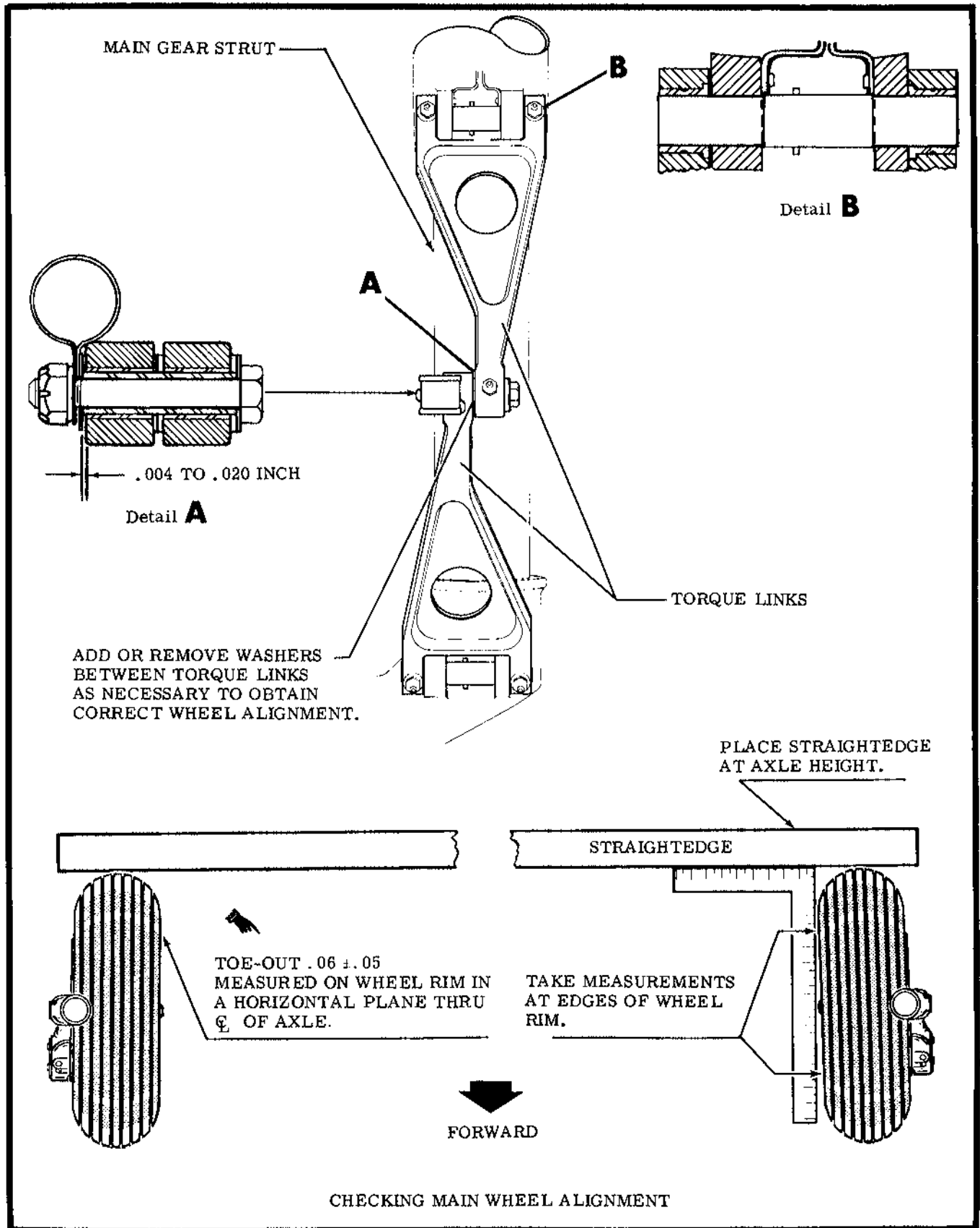


Figure 4-22. Main Wheel Alignment

to facilitate removal. However, excessive bending should be avoided to prevent deformation or other damage to the line.

n. Remove forward wing root fillets, and the two inboard access hole covers from underside of each wing leading edge.

o. To remove right and left wing inboard brake lines (19 and 30), disconnect each one from fittings at both ends, and carefully work them free of adjacent lines inside the wings so that they can be removed through the rectangular access holes.

p. Disconnect right and left wing outboard brake lines (17 and 31) from fittings at both ends, remove clamps and remove lines through main wheel wells.

q. Disconnect right and left brake hoses (4 and 32) from elbows at their upper ends and detach right and left brake hoses (4 and 22) at lower ends of hoses. Remove two upper hose clamps. To release hoses, remove hose clamps by removing nuts from bolts in main gear torque links. Replace nuts and secure with cotter pins after hose clamps have been removed.

r. Remove brake hoses (4 and 32) by detaching coupling nuts from fittings in main brake assemblies. Install temporary caps over brake assembly fittings to prevent entry of foreign material.

Installation of Brake System. (See figure 4-23.)

NOTE

Use clean system hydraulic fluid only as a lubricant for all hydraulic fittings.

a. Remove temporary caps from fittings in brake assemblies and attach brake hoses (4 and 32) to fittings.

b. Attach upper hose ends to elbows. Fasten hoses (4 and 32) in position illustrated. Secure clamps to torque link bolts with nuts. Secure nuts with cotter pins. Attach clamps to upper portion of hoses.

c. Working through main wheel wells, place right and left wing outboard brake lines (17 and 31) in position and attach ends to elbows as illustrated. Attach clamps.

d. Working through wing access holes, carefully work right and left wing inboard brake lines (19 and

30) into position and attach ends to elbows as illustrated.

CAUTION

Some flexing of the lines may be necessary to work them into position. However, excessive bending should be avoided.

e. Replace access hole covers and wing root fillets.
f. Working through aft, right rectangular floorboard access hole, carefully work right cabin brake line (29) into position beneath the floorboard, with outboard end extending upward through routing hole in floorboard. Attach ends to elbows.

CAUTION

Some flexing of this line will be required to work it into position. However, excessive bending should be avoided.

g. Install intermediate cabin brake line (26) as follows:

1. Attach elbow to forward end of line and set washer in place over elbow.

2. Working through forward right floorboard access hole, and through lightening hole in web of copilot's left rudder pedal bracket, work line (26) into position, with elbow extending through routing hole in right side of control column well.

NOTE

Do not allow washer to drop from elbow while working line into position.

3. Using a 9/16 inch crowfoot wrench with extension, attach aft coupling nut on line (26) to elbow.

4. Secure elbow in place at right side of control column well with washer and attaching nut.

h. Working through left floorboard access hole, position U-shaped cabin crossover brake line (24) beneath left floorboard, with longer leg extending through routing hole in left side of control column well. Attach coupling nut to elbow in right side of control column well.

i. To install right master cylinder hose (25):

1. Connect elbow to hose end.

2. Place washer over elbow, and working aft

Figure 4-23. Brake System Plumbing Callouts

1. Left Bulkhead Brake Line	13. Bolt	24. Cabin Crossover Brake Line
2. Union	14. Clamp	25. Right Master Cylinder Hose
3. Left Floorboard Brake Line	15. Lower Torque Link	26. Intermediate Cabin Brake Line
4. Left Brake Hose	16. Elbow	27. Nut
5. Upper Torque Link	17. Left Wing Outboard Brake Line	28. Bulkhead Web
6. Nut	18. Elbow	29. Right Cabin Brake Line
7. Washer	19. Left Wing Inboard Brake Line	30. Right Wing Inboard Brake Line
8. Bushing	20. Left Cabin Brake Line	31. Right Wing Outboard Brake Line
9. Barrel Piston	21. Left Master Cylinder	32. Right Brake Hose
10. Main Gear Axle Assembly	22. Left Master Cylinder Hose	33. Parking Brake Handle
11. Shaft	23. Right Master Cylinder	34. Spacer
12. Roll Pin		

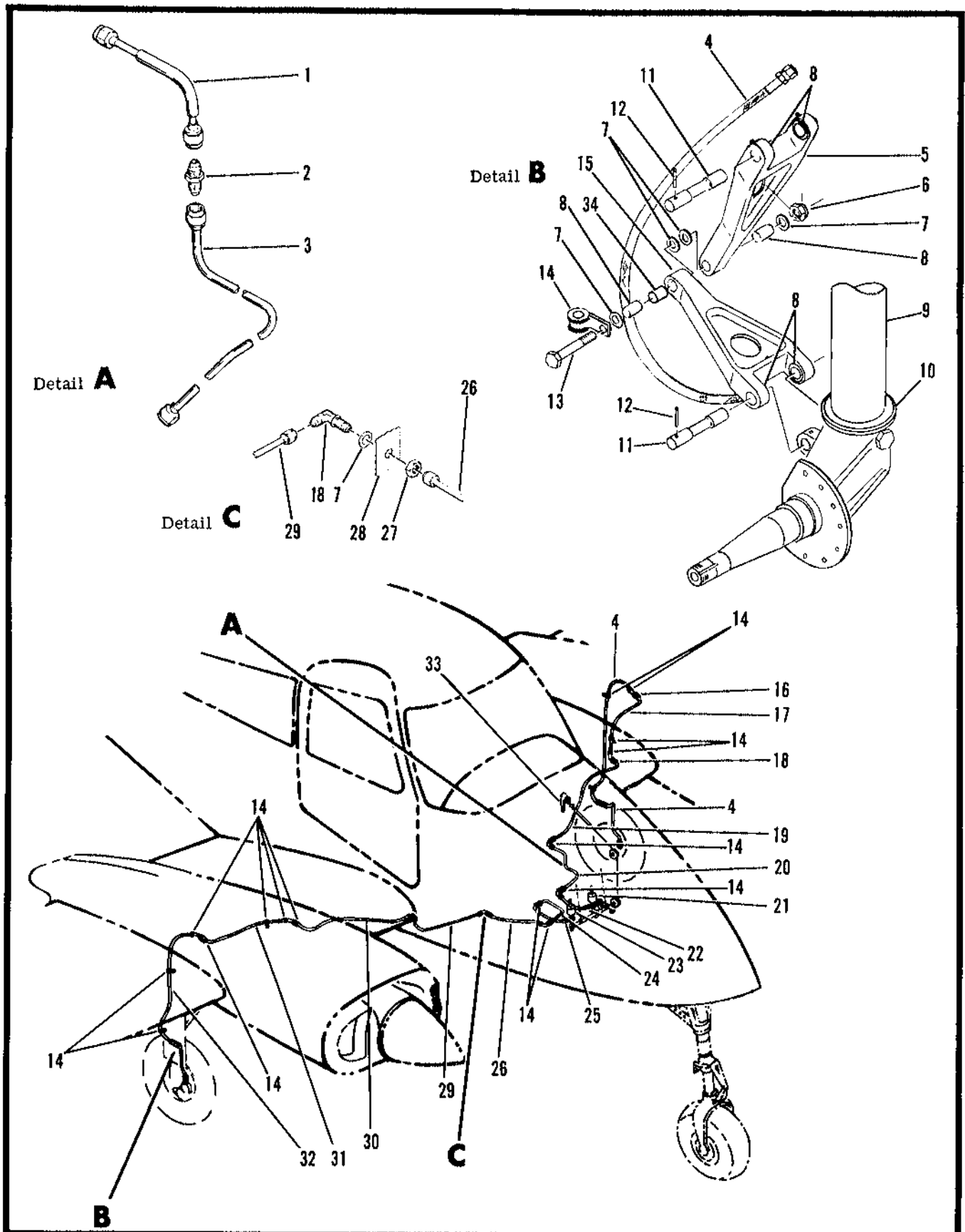


Figure 4-23. Brake System Plumbing Callouts

through right master cylinder mounting position, place elbow with hose attached, into position in routing hole through web of pilot's right rudder pedal bracket.

NOTE

Do not allow washer to drop from elbow, while working elbow into position.

3. Secure elbow with washer and nut.
4. Attach coupling nut on cabin crossover line (24) to elbow.
- j. To install left cabin brake line (20):

NOTE

If left cabin brake line (20) was removed, three parts which can be ordered as spares are required to replace it. This spares assembly consists of a left floorboard brake line (3), a union (2), and a left bulkhead brake line (1).

1. Join union (2) to short end of left floorboard brake line (3).
2. Position left floorboard brake line beneath left floorboard so that end with union attached extends upward through routing hole in floorboard. Attach coupling nut to elbow.
3. Position left bulkhead brake line (1) through routing hole in bulkhead, and attach coupling nuts to elbow and union (2).
- k. Attach coupling nut on left master cylinder hose (22) to elbow in web of pilot's left rudder pedal bracket.
- l. Replace brake master cylinders (21 and 23).
- m. Fill and bleed brake system in accordance with bleeding procedure.
- n. Replace all access covers removed.
- o. Replace upholstery, carpets and seats in accordance with Section 3.

Removal and Disassembly of Main Wheel Brake. (See figure 4-24.)

To remove either brake assembly, proceed as follows:

- a. Remove wheel and tire assembly.
- b. Disconnect brake line from union (9) and drain hydraulic fluid into a suitable container. Drain remaining fluid from brake housing (5) by removing bleeder screw (15) and unscrewing plug bleeder (13) until fluid flows from hole in plug bleeder (13). Tighten plug bleeder (13) when housing is drained.
- c. Remove brake housing (5) and brake disc (4) by removing five bolts and nuts.
- d. Remove brake disc (4) and linings (11 and 16) from brake housing (5).
- e. Use snap ring pliers and remove cylinder heads (19).
- f. Push pistons (17) from cylinders.
- g. Remove O-ring seals (18) from pistons (17) and cylinder heads (19).
- h. Remove plug bleeder (13), bleeder adapter (12) and O-ring (10).

- i. Remove union (9) and O-ring (10).

Assembly and Installation of Main Wheel Brake. (See figure 4-24.)

Reassemble either brake assembly as follows:

- a. Install union (9) and O-ring (10) in upper inlet port of housing (5).
- b. Install bleeder adapter (12), plug bleeder (13) and O-ring (10) into lower inlet port of housing (5), as illustrated.
- c. Using clean system hydraulic fluid as a lubricant, set new serviceable O-rings (18) in place on cylinder heads (19) and pistons (17).
- d. Lubricate cylinder walls and pistons (17) with clean system hydraulic fluid and insert pistons into cylinders.
- e. Install cylinder heads (19) in place, and replace retaining rings (20).
- f. Install new or serviceable brake linings (11) and 16), setting piston lining (16) in piston side, with smooth sides of linings facing each other.
- g. Set brake disc (4) in place between linings.
- h. Position brake housing (5) over axle (6), against axle torque flange (7) so that uppermost hole in the uppermost side of the brake housing (5). Install five bolts and nuts and torque to 100 pound-inches. Tolerance is plus zero and minus 10 pound-inches.
- i. Install wheel and tire assembly.
- j. Attach brake line coupling nut to union (9).
- k. Fill and bleed brake system in accordance with bleeding procedure.
- l. Insure that landing gear is Down and locked then remove aircraft from jacks.

Inspection and Replacement of Brake Linings and Brake Disc. (See figure 4-24.)

NOTE

Brake linings should be replaced at overhaul periods and at such time as they become worn beyond limits.

- a. Check brake lining wear.
 1. Check the brake lining wear limit as follows:
 - (a) Set parking brake to force brake disc (4) against the anvil lining (11).
 - (b) Check clearance between outboard surface at brake disc (4) and flat surface of brake housing (5).
 - (c) Replace linings if clearance measures 3/8 (0.375) inch or greater.
 - b. Checking brake disc wear limits.
 1. Check brake disc wear limits as follows:
 - (a) Inspect disc for wear, discard disc when worn to a thickness of 0.225 or less.
 - (b) Inspect disc for dishing. Disc must be replaced if dishing exceeds 1/16 (0.625) inch.
 - (c) Inspect disc keyways for wear and evidence of damage. Replace disc if keyway width exceeds 1.188 inches.
 - c. Check drive keys for wear.
 1. Check drive keys for wear as follows:
 - (a) If drive keys are worn to a minimum width

of 1.116 inches, the drive keys must be replaced.

NOTE

Drive keys must be replaced as a set.

d. Replacement of brake linings.

1. Remove wheel and tire assembly.
2. Remove brake disc (4) from slot in brake hous-

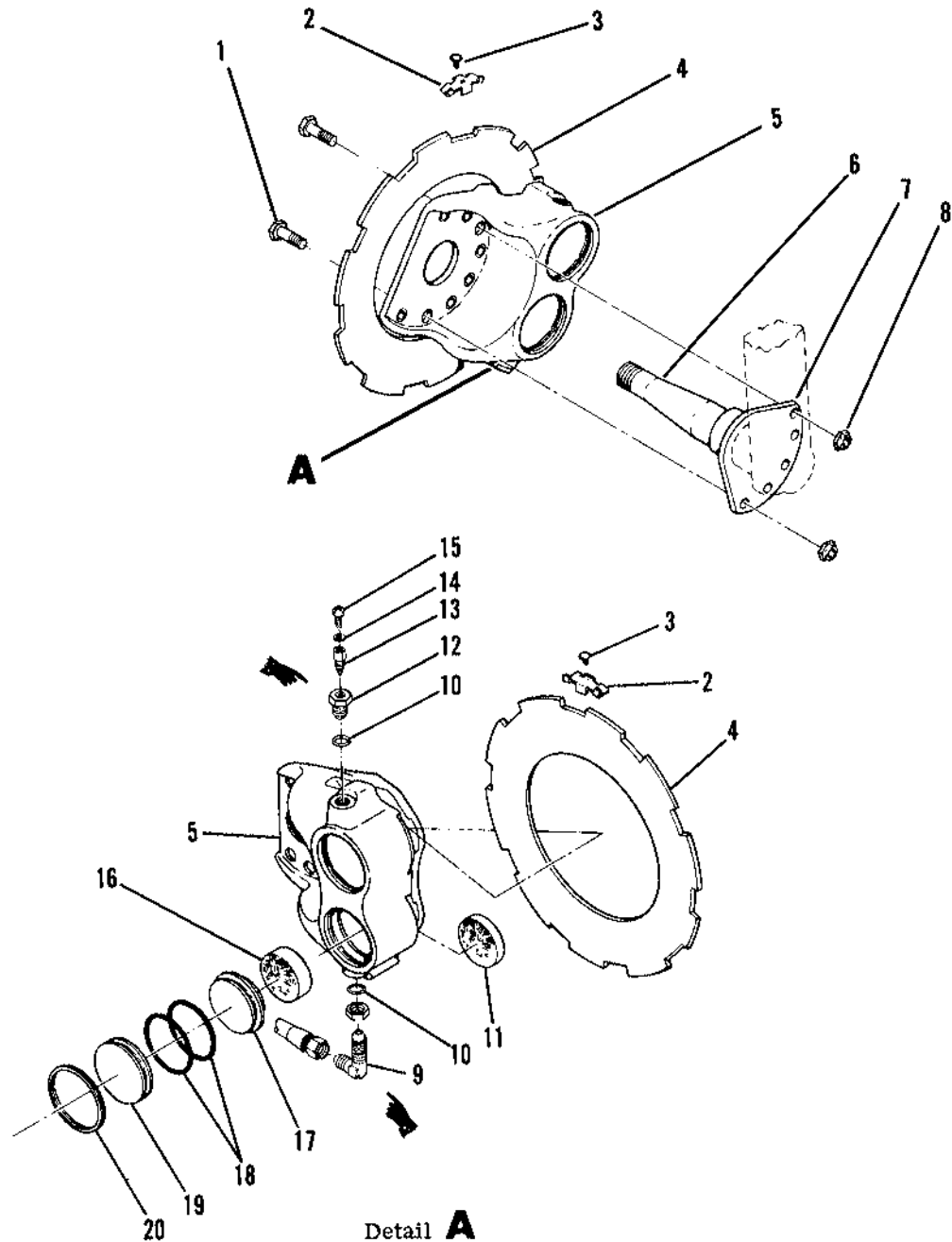
ing (5) and remove worn linings (11 and 16).

3. Install new linings (11 and 16) with the thicker piston lining (16) in piston side of housing (5) and the thinner anvil lining (11) in anvil side of housing. Smooth sides of the linings should face to contact brake disc (4).

4. Position brake disc (4) between linings in brake housing (5).

5. Install wheel and tire assembly.

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1. Bolt
2. Disc Clip
3. Fastener
4. Brake Disc
5. Brake Housing
6. Axle
7. Axle Torque Flange

8. Nut
9. Elbow
10. O-Ring
11. Anvil Lining
12. Bleeder Adapter
13. Plug Bleeder

14. Washer
15. Bleeder Screw
16. Piston Lining
17. Piston
18. O-Ring
19. Cylinder Head
20. Retaining Ring

Figure 4-24. Main Wheel Brakes

NOTE

Before removing jacks, spin wheels to make certain they will turn freely. Apply brakes and check to see that they do not drag when released.

Bleeding the Brake System. (See figure 4-24.)

In order to have proper brake action, it is necessary to have positive transfer of hydraulic pressure through the system. To insure proper brake action, 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 specification).
- b. Remove filler plug from master cylinder.
- c. Remove bleeder screw (15) and unscrew plug bleeder (13) to allow hydraulic fluid to drain from the system into a suitable container.
- d. Connect the hose on the bleeder pump to the bleeder valve in the brake housing.
- e. Pump slowly until fluid in master cylinder reservoir is within 1/2 inch of the top.
- f. Close plug bleeder and detach bleeder pump hose connection.
- g. Replace bleeder screw and washer in master cylinder and check brake operation.

PARKING BRAKE SYSTEM

Removal of Parking Brake System. (See figure 4-25.)

- a. Remove pilot's seat, copilot's seat, rudder scuff plate and carpet in accordance with Section 3.
- b. To obtain working room beneath the left floorboard, remove left warm air duct in accordance with Section 13.
- c. Detach left and right brake cables (15 and 24) from brake links (25) by removing cotter pins, pins and bushings.
- d. Disconnect parking brake cable (8) at its upper end by removing cotter pin and pin.
- e. Remove handle assembly parts (1, 2, 6 and 11) by removing nuts and bolts. Slide housing assembly (11) and spring (10) from parking brake tube (6), and

remove spring from housing. Remove roll pin (1) and handle (2) from parking brake tube (6).

- f. Working through nose wheel well, remove nuts, bolts, cable guards and pulleys (12 and 13) from pulley brackets on forward left side of forward cabin bulkhead.

NOTE

In some configurations, optional radio equipment is installed on a shelf adjacent to these pulleys. This equipment must be removed to permit access to the pulleys.

- g. To remove parking brake torque tube (21) and attached components, proceed as follows:

NOTE

Because of difficulty of access removal of parking brake torque tube and attached components is not recommended, except as required for replacement.

1. Remove cotter pin and pin attaching left parking brake coupling (16) to parking brake torque tube (21) and remove from torque tube.

NOTE

Due to close tolerances between left parking brake coupling and parking brake torque tube, some difficulty may be encountered in separating these two parts.

Work parking brake coupling (16) aft, clear of the floorboard, with parking brake cable (8) still in place around pulley (14). Remove cotter pins, nut, bolt and pulley (14) to free coupling from parking brake cable (8).

2. Remove three nuts and bolts attaching left torque tube support (17) to left rudder pedal bracket (19) and remove.

3. Slide torque tube (21), with attached components, outboard to clear hole in right torque tube support (17) then work forward to clear the floorboards.

4. Remove three nuts and bolts to remove right torque tube support (17).

5. Further disassembly of removed components can be accomplished as shown in figure 4-32.

- h. To remove parking brake cable (8), detach from cable bracket (18) by removing cotter pin and pin,

Figure 4-25. Parking Brake System Callouts

1. Roll Pin	10. Spring	20. Collar
2. Parking Brake Handle	11. Housing Assembly	21. Parking Brake Torque Tube
3. Bolt	12. Upper Pulley	22. Right Parking Brake Coupling
4. Mounting Bracket	13. Lower Pulley	23. Right Rudder Pedal Bracket
5. Nut	14. Pulley	24. Right Brake Cable
6. Parking Bracket Tube	15. Left Brake Cable	25. Brake Link
7. Pin	16. Left Parking Brake Coupling	26. Brake Torque Tube Coupling
8. Parking Brake Cable	17. Torque Tube Support	27. Brake Master Cylinder
9. Cotter Pin	18. Cable Bracket	28. Rudder Pedal
	19. Left Rudder Pedal Bracket	

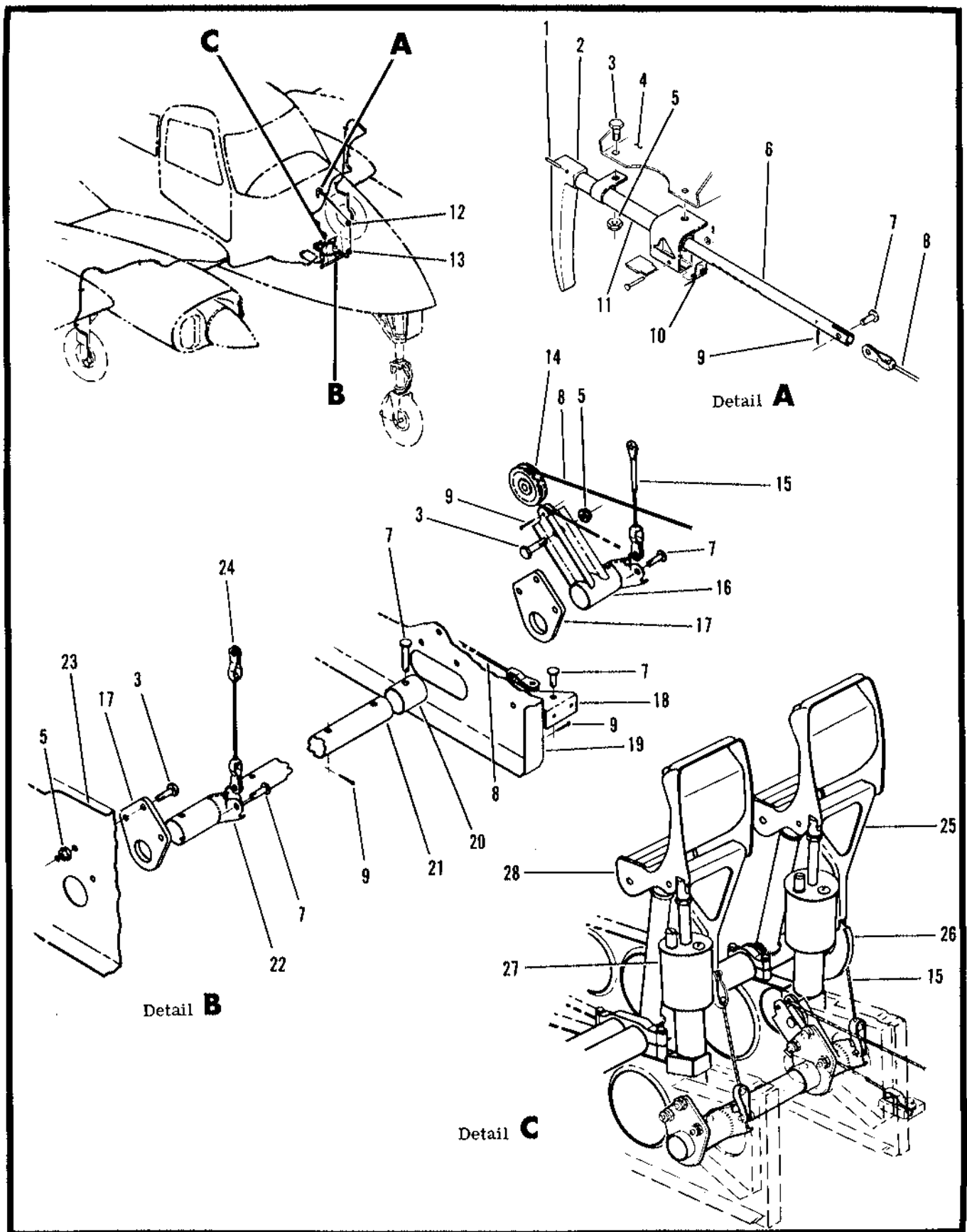


Figure 4-25. Parking Brake System

and work free of routing holes in forward cabin bulkhead.

i. Inspect all components for excessive wear, cracks or deformation which could cause failure, and cables for wear or broken strands. Replace defective parts.

Installation of Parking Brake System. (See figure 4-25.)

- a. Assemble right parking brake coupling (22) and collar (20) to parking brake torque tube (21) and attach right brake cable (24) as illustrated.
- b. Attach right torque tube support (17) to right rudder pedal bracket (23), in position illustrated, using three bolts and nuts.
- c. Attach end of parking brake cable (8) to cable bracket (18) with pin and cotter pin. Route other end of cable through lower routing hole in forward cabin bulkhead, leaving a loop of cable accessible through floorboard access hole.
- d. Assemble pulley (14) to left parking brake coupling (16) with bolt and nut. Loop of parking brake cable (8) should be in place around pulley (14) as illustrated. Insert cable guard cotter pins, and attach left brake cable (15) as illustrated.
- e. Position parking brake torque tube (21) between left and right rudder pedal brackets (19 and 23) with inboard end through hole in right torque tube support (17). Position left torque tube support (17) over outboard end of torque tube (21) as illustrated, and fasten to left rudder pedal bracket (19) with three attaching bolts and nuts.
- f. Position left parking brake coupling (16) over end of parking brake torque tube (21) as illustrated, and secure with attaching pin and cotter pin.
- g. Pull free end of parking brake cable (8) through upper routing hole in forward cabin bulkhead. Attach pulleys (12 and 13) and cable guards to mounting brackets on forward side of forward cabin bulkhead, with parking brake cable (8) routed around pulleys as illustrated.

NOTE

Replace any radio equipment it may have been necessary to remove to gain access to these pulleys.

- h. Assemble components of parking brake handle assembly (parts 1, 2, 6 and 11) as illustrated, and attach handle assembly to mounting bracket (4) with bolts and nuts.
- i. Connect free end of parking brake cable (8) to parking brake tube (6) with pin and cotter pin.
- j. Retrieve free ends of left and right brake cables (15 and 24) through routing holes in floorboards and attach to brake links (25) as illustrated.
- k. Replace left warm air duct in accordance with Section 13.
- l. Check operation of parking brake system. There should be no binding in the system or interference from the left warm air duct. Brake master cylinders (27) should be positively actuated when parking brake handle (2) is pulled. Parking position of handle (2)

should be maintained by action of spring (10) in notches of parking brake tube (6).

m. Replace left carpet, left scuff plate, and left rudder bar shield in accordance with Section 3.

n. Replace pilot's and copilot's seats in accordance with Section 3.

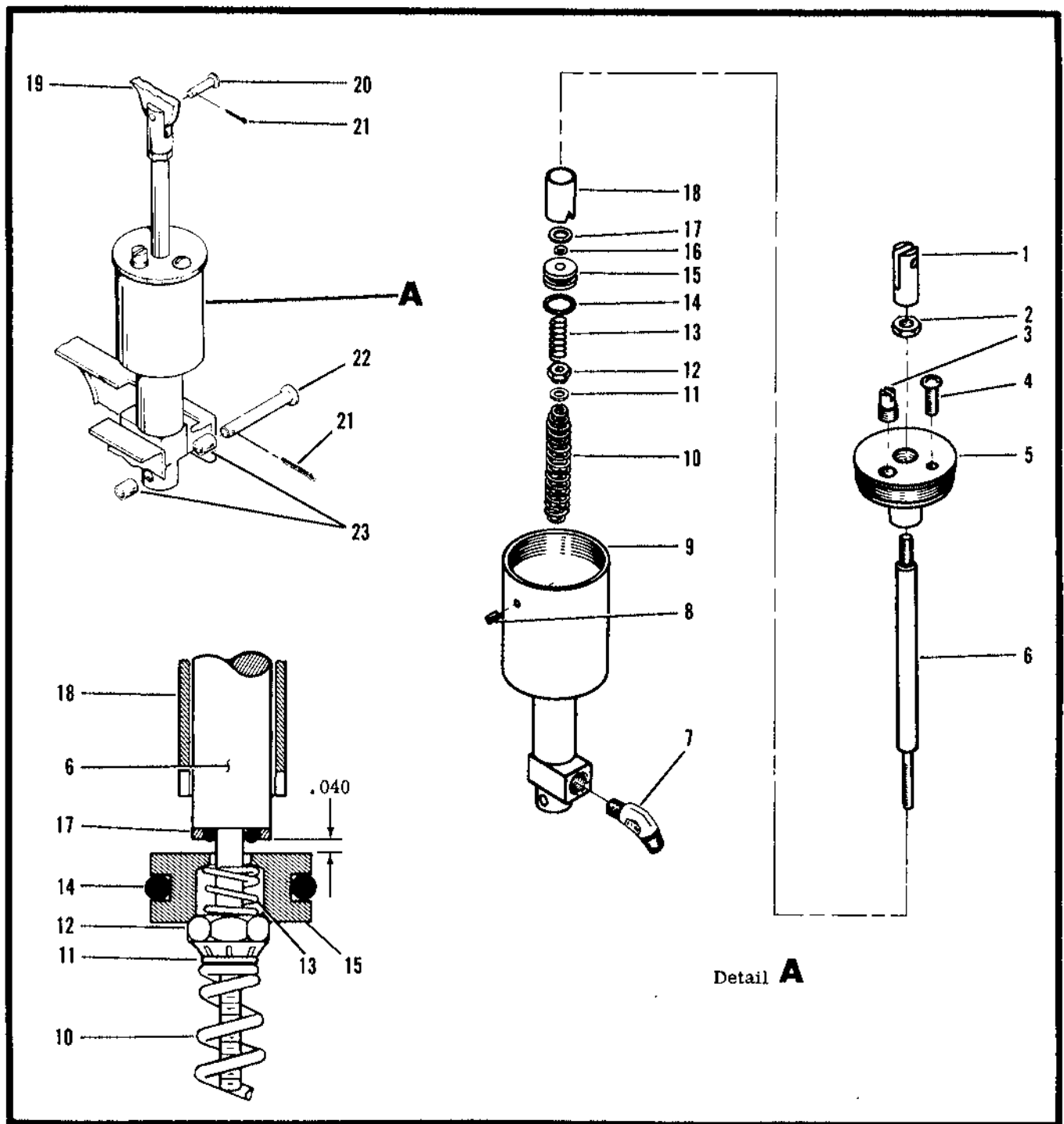
Master Cylinder. (See figure 4-26.)

Each vertical mounting type master cylinder used on the aircraft incorporates a fluid reservoir and cylinder within the same body. 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 boss. With the exception of the piston return spring (10), all internal operating parts are assembled onto the piston rod (6), piston (15), piston spring (13), lock-o-seal (17), O-ring (16) and compensating sleeve (18). A seal between the piston (15) and the cylinder walls is provided by an O-ring (14) installed in 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 (.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 reservoir 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 .633 cubic inch. Reservoir capacity is approximately 3.391 cubic inches.

Removal of Master Cylinder. (See figure 4-26.)

Removal of either master cylinder can be accomplished as follows:

- a. Remove pilot's seat, left rudder bar shield, left scuff plate and carpet in accordance with Section 3.
- b. Remove the cover plate from around the master cylinder by removing the four screws with which it is fastened.
- c. Drain the hydraulic fluid from the master cylinder and lines by disconnecting the line at the main wheel brake assembly. Connect the line again after fluid has been drained, to prevent the entry of foreign



1. Clevis
2. Jamb Nut
3. Filler Plug
4. Screw
5. Cover
6. Piston Rod
7. Elbow
8. Setscrew

9. Body
10. Piston Return Spring
11. Washer
12. Nut
13. Piston Spring
14. O-Ring
15. Piston

16. O-Ring
17. Lock-O-Seal
18. Compensating Sleeve
19. Pilot's Rudder Pedals
20. Pin
21. Cotter Pin
22. Pin
23. Spacer

Figure 4-26. Brake Master Cylinder

material into the brake.

NOTE

When making connections on hydraulic lines, use only system fluid as a lubricant.

- d. Disconnect clevis (1) from rudder pedal (19) by removing cotter pin and pin.
- e. Disconnect lower end of body (9), by removing cotter pin, pin and spacers.
- f. Disconnect hose from elbow (7) in base of body (9), by lifting master cylinder enough to allow the coupling nut on the hose to be disconnected.
- g. Remove body (9) and install a suitable cap on the end of the hose to prevent the entry of foreign material.

Disassembly of Master Cylinder. (See figure 4-26.)

Disassembly of either master cylinder can be accomplished as follows:

- a. Remove filler plug (3) and drain residual hydraulic fluid from reservoir portion of body (9). 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 (8) 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 (10) will remain inside body (9); to remove, lift from position.
- c. Remove nut (12) from piston rod (6), to remove piston spring (13), piston (15), O-ring (16), lock-o-seal (17) and compensating sleeve (18).
- 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 (14) from piston (15).
- f. Remove elbow (7) from body (9), if required.

Assembly of Master Cylinder. (See figure 4-26.)

Assemble either master cylinder as follows:

- a. Install lock-o-seal (17) and O-ring (16) on shank of piston rod (6).

CAUTION

Lubricate O-ring portion of lock-o-seal with system hydraulic fluid and install carefully to prevent damage from the threaded portion of the piston rod shank.

- O-ring (16) portion of lock-o-seal (17) should be installed first, then set retainer in place around O-ring and against piston rod shank base as illustrated.
- b. Slip O-ring (14) into groove in piston (15) 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 (15), piston spring (13) and nut (12) on piston rod (6) as illustrated. Tighten nut (12) and with piston spring (13) compressed to seat piston (15) against nut, adjust clearance between piston and lock-o-seal (17) to .040 inch as illustrated, using feeler gage or .040 wire to check measurement.

CAUTION

Be careful, when inserting feeler gage or wire, not to damage lock-o-seal.

NOTE

The .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 (10) into cylinder section of body (9), broad base down, as illustrated.

NOTE

If piston return spring (10) is installed incorrectly, brake dragging can occur.

- e. Lubricate cylinder walls and piston (15) with clean system hydraulic fluid and insert nut (12) against piston return spring (10).
- f. Place compensating sleeve (18) notched end toward piston, over piston rod (6). Slide cover (5) over piston rod, and tighten into body. Install setscrew (8) and tighten to prevent movement of cover (5).
- g. Screw jamb nut (2) and clevis (1) into piston rod end.
- h. Install filler plug (3) and elbow (7), if removed during disassembly.

NOTE

If elbow is being installed, use a suitable thread lubricant on tapered threads before screwing into master cylinder. Do not allow lubricant to enter master cylinder or elbow passages.

Installation of Master Cylinder. (See figure 4-26.)

Install either master cylinder as follows:

- a. Lift hose end from its position between master cylinder mounting brackets and remove temporary cap. Attach hose to elbow (7) at base of master cylinder and tighten coupling nut.

NOTE

Use only system hydraulic fluid for lubricant when making this connection.

b. Insert pin (22) through master cylinder mounting brackets and hole in base of body (9), with spacers (23) in place as illustrated. Secure pin (22) with cotter pin.

c. Connect clevis (1) to rudder pedal (19) with pin (20). Adjust clevis (1) to align tips of rudder pedals (19) with rudder pedals in a neutral position. Secure

pin (20) with cotter pin, and secure clevis with jamb nut (2).

d. Attach cover plate to floor around master cylinder with four screws.

e. Fill and bleed brake system in accordance with bleeding procedure.

f. Replace carpet, left scuff plate, left rudder bar and pilot's seat in accordance with Section 3.

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SECTION 5

CONTROL COLUMN, AILERON AND TRIM CONTROL SYSTEMS

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		Rigging	5-15

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 "Y" assembly internally houses the forward aileron control system cables, chains and sprockets. Externally attached to the control column "Y" assembly, is the elevator forward push-pull tube and bob-weight assemblies. The pilot's and copilot's (optional) control wheels are attached to individual tubes which extend through the instrument panel and connect to a universal joint on the control column "Y" assembly.

Removal of Control Column Assembly. (See figure 5-1.)

- Refer to Section 3, remove the following items in accordance with removal procedures:
 - Front and rear seats (middle individual optional).
 - Bulkhead, pilot's floor and center carpets.
 - Boot, retainer and cover from lower control column.

- Refer to Section 12, remove shock-mounted instrument panel in accordance with removal procedures.
- Drill out rivets and remove upper and lower instrument panel braces on RH side only.
- Remove access covers just forward of rear spar and just aft of nose wheel well on underside of fuselage.
- (See figure 5-3.) Remove safety wire and loosen turnbuckles on aileron cables (17) to relieve tension on aileron control system.
- Refer to Section 6, disconnect bob-weight assembly and push-pull tube from control column assembly.
- Remove control wheels (1) from control column assembly by removing nuts, bushings and bolts attaching control tube (2) to universal joint (5).

NOTE

If automatic pilot is installed, disconnect electrical wires from control tube assembly at the quick-disconnects.

- h. Disconnect chain assembly (26) from aileron control cables (37) by removing cotter pins and clevis pins.
- i. Remove nut, washer, spacers and bolt attaching control column assembly to fuselage structure.
- j. Carefully work control column assembly from beneath RH side of stationary instrument panel.

Disassembly of Control Column Assembly. (See figure 5-1.)

- a. On lower control column assembly, remove spacers, washers, bearings and sprockets by removing attaching nut, washer and bolt.
- b. Disengage chain assembly (26) from sprocket assembly and remove chain assembly from control column assembly.
- c. Remove triple sprocket assembly from control column assembly by removing nut, washers and bolt.
- d. Disconnect chain assembly (21) by removing turnbuckle (22) and routing chain assembly over sprockets.
- e. Remove cotter pin (15) and nut (16) from shaft (13).
- f. Remove nuts (17) from bolts (6 and 12) and remove bolts from adapter (7) and sprocket (11).
- g. Remove shaft (13), bearing (8), adapter (7) and universal joint (5) from control column assembly.

NOTE

Safety wire shaft (13), adapter (7) and universal joint (5) to each other so that they may be retained together as a matched set.

- h. Refer to figure 5-1 for further disassembly of control column components, as necessary.

Assembly of Control Column. (See figure 5-1.)

- a. Place control column assembly in a suitable padded fixture (such as a vise) facing bob-weight bracket away from the assembler.

NOTE

The following procedure is given for aircraft with dual control wheels installed; single control wheel aircraft need only install upper LH chain (21) and lower chain assembly (26).

- b. Install washer (38) and triple sprocket assembly (23) inside control column assembly using a long, thin bolt or heavy gauge wire to support components temporarily.
- c. If disassembled, assemble the long (twenty link) chains and the short (fourteen link) chains into chain assemblies (21) using attaching turnbuckles (22). Observe that the terminal ends are equal in length after turnbuckles are installed.

NOTE

If the assembly of long and short chains into chain assembly (21) was correct, the index link (red) on the long chain should be nine links from the now open end of the chain assembly (21) with all bolt heads facing in the same direction.

- d. Attach guide wires to each end of chain assembly (21) and route the long chain under the center sprocket on triple sprocket assembly (23) to LH leg of control column assembly.
- e. Assemble into LH leg of control column the following components:
 - 1. Insert sprocket shaft (13) into universal joint (5) and secure with roll pin (18).
 - 2. Place adapter (7) over universal joint (5) and sprocket shaft (13).

NOTE

Adapter (7), universal joint (5) and sprocket shaft (13) are drilled as a matched set and cannot be interchanged with other like components.

- 3. Place bearing (8) over adapter (7) and position adapter, universal joint, sprocket shaft, and sprocket (11) into LH leg of control column assembly with universal joint facing aft.

NOTE

Install sprocket (11) with collar of sprocket facing away from adapter (7).

- 4. Align holes and install long bolt (6) through adapter (7) and sprocket shaft (13); secure with nut.
- 5. Align holes and install short bolt (12) through sprocket (11) and sprocket shaft (13); secure with nut.
- 6. Place bearing (8) on sprocket shaft (13); secure sprocket shaft to control column assembly with washers, nut and cotter pin.
- f. Route the short chain of chain assembly (21) over the top of upper sprocket (11) and align index mark (red) on sprocket with index link (red) on chain.
- g. Secure chain assembly (21) together with turnbuckle and tighten just enough to take up slack. Observe that the terminals on chain are equal in length after turnbuckles are installed.
- h. Assemble and install components in leg of RH control column assembly as described in steps "e" through "g", except position collar on sprocket (11) butted against adapter (7).
- i. Install lower chain and cable assembly (26) on aft sprocket of triple sprocket assembly (23) and align index mark (red) on chain link with index mark (red) tooth of sprocket.
- j. Replace temporary bolt or heavy gauge wire which was used to support triple sprocket (23) during assembly with attaching bolt (20), washer and nut.

NOTE

Care should be taken to insure that the washer between triple sprocket assembly and wall of control column "Y" remains in place when attaching bolt is installed.

k. Using a bolt or pin as a rigging pin, insert through tube assembly attachment holes in universal joints (5) and tighten turnbuckles (22) on upper chain assemblies (21) until bolts or pins are parallel with

vertical leg of control column "Y".

NOTE

After rigging upper chain assemblies (21), safety wire last link on lower chain assemblies (26) to control column "Y", thus preventing chain assemblies from accidentally moving off index tooth on sprocket during installation of control column "Y" in aircraft.

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1. Insert bolt through lower control column "Y" tab and assemble component parts as shown in figure 5-1; secure with washer and nut.

Installation of Control Column Assembly. (See figure 5-1.)

- a. Carefully work control column assembly into position from the RH side of instrument panel.
- b. Secure control column assembly to fuselage structure with attaching bolt, spacers, washers and nut.
- c. Connect chain assembly (26) to aileron control cables (37) with attaching clevis pins and cotter pins.
- d. Install control wheel (1) and control tube (2) on control column assembly with attaching bolts, bushings and nuts.

NOTE

If automatic pilot is installed, connect electrical wires to control tube assembly with quick-disconnects.

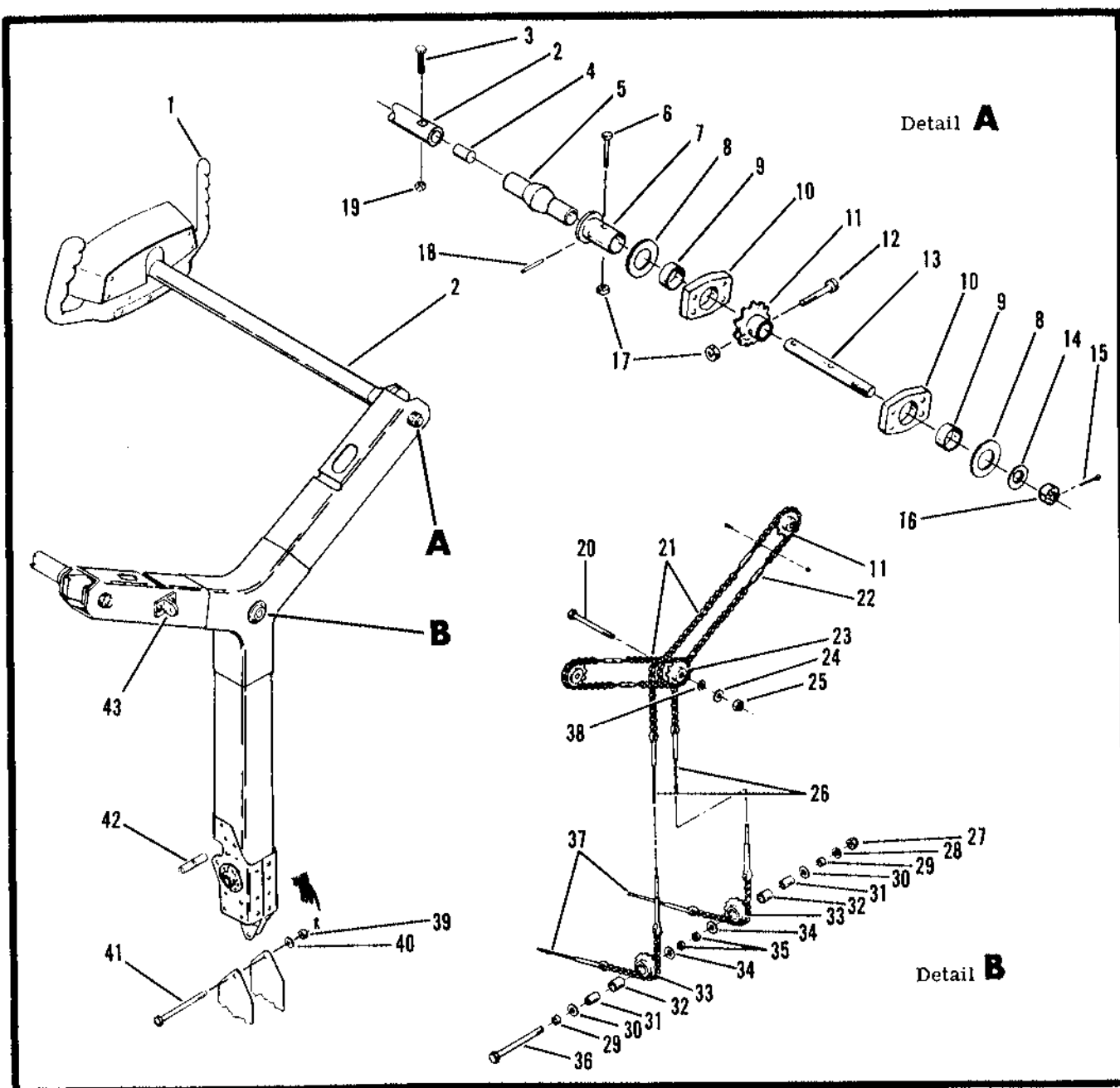
- e. Refer to Section 6, connect bob-weight assembly and push-pull tube to bracket on RH leg of control column assembly.
- f. Install upper and lower instrument panel braces using rivets.
- g. Refer to Section 12, and install shock-mounted instrument panel in accordance with installation procedures.
- h. Rig aileron control cables in accordance with rigging tolerances and safety turnbuckles.
- i. Replace access covers.
- j. Refer to Section 3 and install the following items:
 1. Control column assembly boot, retainer and cover.
 2. Center, pilot's floor and bulkhead carpets.
 3. Front and rear seats (middle individual optional).

AILERON CONTROL SYSTEM

The aileron control system is interconnected through a series of cables, chains, turnbuckles, push-pull rods, bellcranks and quadrants. This system, as described herein, extends from the cable to chain connections at the lower end of the control column to terminal point at the aileron itself.

Troubleshooting Aileron Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN CONTROL WHEEL AND AILERON	Cable tension too low.	Adjust cable tension in accordance with aileron rigging procedures.
	Chain tension too low in control column assembly.	Adjust chain tension in accordance with assembly of control column.
	Broken pulley.	Replace pulley.
RESISTANCE TO CONTROL WHEEL ROTATION	Cables not in place on pulleys or quadrants.	Install cables correctly. Check cable guards.
	Cable tension too high.	Adjust cable tension in accordance with aileron rigging procedures.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Chain tension too high in control column assembly.	Adjust chain tension in accordance with assembly of control column.
	Cables not in place on pulleys or quadrants.	Install cables correctly.
CONTROL WHEELS NOT SYNCHRONIZED	Bent aileron.	Repair or replace aileron.
	Unequal tensions on control column upper chain assemblies.	Adjust chain tensions in accordance with assembly of control column.
	Chain not indexed on sprockets properly.	Re-index chains and adjust chain tensions in accordance with assembly of control column.



1. Control Wheel
2. Tube Assembly
3. Bolt
4. Bushing
5. Universal Joint
6. Bolt (Long)
7. Adapter
8. Bearing
9. Bearing
10. Bearing Block
11. Sprocket (Upper)
12. Bolt (Short)
13. Sprocket Shaft
14. Washer
15. Cotter Pin

16. Nut
17. Nut
18. Roll Pin
19. Nut
20. Bolt
21. Chain Assembly (Upper)
22. Turnbuckle
23. Triple Sprocket Assembly
24. Washer
25. Nut
26. Chain Assembly (Lower)
27. Nut
28. Washer
29. Spacer (Thick)

30. Washer
31. Race Bearing
32. Bearing
33. Sprocket (Lower)
34. Washer
35. Spacer
36. Bolt
37. Cable Assembly (Aileron)
38. Washer
39. Nut
40. Washer
41. Bolt
42. Spacer
43. Bob-Weight Bracket

Figure 5-1. Control Column

TROUBLE	PROBABLE CAUSE	CORRECTION
CONTROL WHEELS NOT HORIZONTAL WHEN AILERONS ARE NEUTRAL	Incorrect aileron system rigging.	Rig in accordance with aileron rigging procedures.
	Lower chain assembly not indexed on triple sprocket properly.	Re-index lower chain on triple sprocket in accordance with assembly of control column.
INCORRECT AILERON TRAVEL	Aileron quadrant stops incorrectly adjusted.	Adjust in accordance with aileron rigging procedures.
CORRECT AILERON TRAVEL CANNOT BE OBTAINED BY ADJUSTING QUADRANT STOPS	Incorrect rigging of quadrant cables, compensated for by incorrect adjustment of push-pull rods.	Rig in accordance with aileron rigging procedures.
	Incorrect rigging of aileron bellcranks.	Rig in accordance with aileron rigging procedures.

Removal of Aileron. (See figure 5-2.)

- If the left aileron 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).
- Lower flap and disconnect aileron push-pull rod (10) by removing attaching bolt.
- Disconnect bonding strap from aileron by removing screw and washer.
- Remove aileron from wing by removing attaching bolts.

NOTE

If left aileron is being removed, carefully guide aileron trim tab push-pull tube (6) through opening on aileron during removal.

Installation of Aileron. (See figure 5-2.)

- Install aileron by reversing removal procedures.

NOTE

When installing the left aileron, guide aileron trim tab push-pull tube (6) through opening in aileron.

- Check aileron and trim tab for proper operation and correct travel. If necessary, rig in accordance with aileron control system rigging procedures.

Removal of Aileron Trim Tab. (See figure 5-2.)

- Move aileron trim tab to extreme UP position and remove nut, bolt and spacer disconnecting push-pull tube from trim tab.
- Remove aileron trim tab from aileron by removing cotter pins and attaching hinge pin.

Installation of Aileron Trim Tab. (See figure 5-2.)

- Install aileron trim tab by reversing removal procedures.
- Check trim tab for proper operation.

Removal of Aileron Control Cables. (See figure 5-3.)

NOTE

The following procedure is for removing the aileron cables with turnbuckles attached to the cables and pulley cable guard cotter pins removed. If desired, turnbuckle barrels may be unscrewed to leave the turnbuckle forks attached to the fuselage bellcrank.

- Refer to Section 3 and remove the following items from the aircraft:
 - Front seats and rear reclining seat; or middle individual and aft fifth-sixth seats (optional equipment).
 - Front, center and rear carpets.
 - Rear upholstery panel if autopilot (optional equipment) is installed.
- Remove boot, retainer and cover from lower control column.
- Refer to Section 1 and remove floorboard and access covers, access panel located on rear spar adjacent to aft wheel well, lower aft wing root fillets, and aileron quadrant access cover.
- Remove safety wire and disconnect turnbuckle (2) to right- and left-hand return cables (1).
- Remove cable guard cotter pin on fuselage return cable pulley.
- Relieve tension on aileron direct cables (15 and 17) by loosening turnbuckles at the fuselage bellcrank (16).
- At the fuselage bellcrank (16), disconnect aileron direct cables (15 and 17) by removing attaching cotter pins, nuts and bolts.
- Disconnect aileron cables (17) from lower control column chain (18) by removing attaching cotter pins, washers and clevis pins.

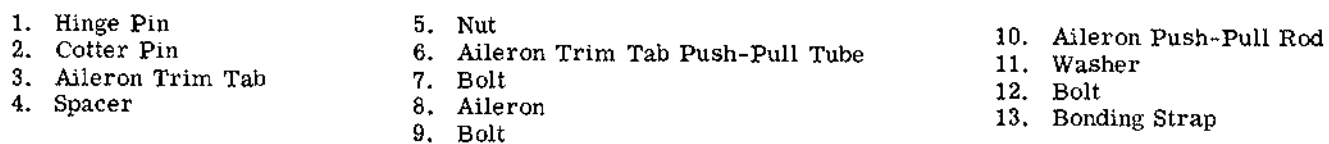


Figure 5-2. Aileron and Aileron Trim Tab Installation

- i. If an autopilot (optional equipment) is installed, disconnect autopilot cables from aileron direct cables (15) by removing attaching cable clamps.
- j. Remove aileron pulley (outboard of aileron quadrant) by removing cable guard pins, attaching bolt and washer.
- k. Disconnect aileron push-pull tube (8) from aileron quadrant (14) by removing cotter pin, nut, washer and bolt.
- l. Remove two sets of pulleys aft of the wheel well and one set in each wing root by removing cable guard cotter pins and attaching nuts and bolts.

NOTE

When removing control cables, tie safety wire to ends of cables before removal.

- m. Remove bolt and washer attaching aileron quadrant (14) to wing structure.
- n. With aileron return and direct cables (1 and 15) attached to aileron quadrant, remove quadrant and cables from wing using aileron quadrant access hole.
- o. Route fuselage direct cables (17) aft to bellcrank (16) and remove from aircraft.

NOTE

Leave guide wires in wing and fuselage to facilitate installation.

Installation of Aileron Control Cables. (See figure 5-3.)

- a. Secure aileron cables (17) to guide wires and route cable from bellcrank (16) to lower control column chain (18).
- b. Remove guide wires from cables.
- c. Secure aileron cables (17) to chain (18) with attaching clevis, cotter pin, and install pulleys.

NOTE

Insure that fuselage direct cables (17) are not crossed and routed on the underneath side of pulley.

- d. Secure aileron cable (17) to bellcrank (16) with attaching bolt, nut and cotter pin.
- e. Install cable guard cotter pin on fuselage pulleys.
- f. Secure aileron cables (1 and 15) to guide wires and route cables and quadrant into position.
- g. Remove guide wire from cables.
- h. Install quadrant (14) in wing and secure with washer and bolt.

CAUTION

Be sure bushing (11) is installed with quadrant or serious binding will occur during rigging.

- i. Install two sets of pulleys on pulley brackets aft of the wheel well and secure with attaching bolts and nuts.

- j. Install one set of pulleys on lower aft wing root pulley brackets and secure with attaching bolt and nuts.
- k. Position aileron direct cables (15) on lower pulleys and aileron return cables (1) on upper pulleys and install cable guard cotter pins.

NOTE

Aileron cables (1 and 15) must be routed on aft side wing pulleys.

- l. Secure aileron cables (1 and 15) to fuselage bellcrank with attaching bolts, nuts and cotter pins.

CAUTION

Insure that aileron cables are in place on aileron quadrants and pulleys in both wings before rigging tension on aileron system. Wing structure can be damaged by the aileron cables if tension is rigged on the cables while not properly in place on aileron quadrants or pulleys.

- m. If an autopilot (optional equipment) is installed, attach to the aileron cables and rig in accordance with rigging procedures.
- n. Install lower aft wing root fillets, fuselage floorboard access covers, aft underside wing access covers, and quadrant access cover.
- o. Install boot, retainer and cover on lower control column.
- p. Refer to Section 3 and install the following items:
 - 1. Rear upholstery panel, if autopilot (optional equipment) is installed.
 - 2. Front, center and rear carpets.
 - 3. Front seats and rear reclining seat, or middle individual and aft fifth and sixth seats (optional equipment).

Removal of Aileron Quadrant. (See figure 5-3.)

- a. Refer to Section 3 and remove the following items:
 - 1. Rear reclining seat or middle, fifth and sixth seats (optional equipment).
 - 2. Rear carpet.
 - 3. Rear upholstery panel, if autopilot (optional equipment) is installed.
- b. Refer to Section 1 and remove aft floorboard access covers and wing access cover above quadrant.
- c. If autopilot (optional equipment) is installed, disconnect autopilot cables from aileron cables.
- d. Remove safety wire from turnbuckles (2) on cables (1 and 15) and disconnect cables at bellcrank.
- e. Remove aileron pulley outboard of aileron quadrant by removing cable guard pins, attaching bolt and washer.
- f. Attach safety wires to cables (1 and 15) to be used as guides on installation.
- g. Disconnect aileron push-pull tube (8) from aileron quadrant (14) by removing attaching cotter pin, nut, washer and bolt.
- h. Remove bolt and washer attaching aileron quadrant (14) to wing structure.

- i. Remove aileron quadrant (14) from wing by working quadrant and cables through wing access hole.

NOTE

To prevent routing cables (1 and 15) through entire wing, disconnect cable ends from quadrant as near to the wing access hole as working room will permit. Care also should be taken to prevent bushing (11) from falling during removal.

- j. Disconnect aileron cables from quadrant by removing cotter pins, cable guard, nut, washer and bolt.

Installation of Aileron Quadrant. (See figure 5-3.)

- a. Place aileron quadrant (14) near aft wing access hole and connect aileron cables (1 and 15) to quadrant using attaching bolt, washer and nut; secure cables in position with cable guard and cotter pins.

NOTE

Position return cable (1) on bottom groove of quadrant and direct cable (15) on upper groove of quadrant.

- b. Install quadrant (14) in wing and secure with washer, bolt, and safety wire to pulley bracket.

CAUTION

Be sure bushing (11) is reinstalled with quadrant or serious binding will occur during rigging.

- c. Connect aileron push-pull tube (8) to quadrant with attaching bolt, washer, nut and cotter pin.
- d. Install pulley (outboard of aileron quadrant) with attaching bolt, washer and cable guard cotter pin.
- e. Route aileron cable (15) to bellcrank (16), connect cable to turnbuckle fork with turnbuckle.
- f. Route return cable (1) to center fuselage and connect with turnbuckle.
- g. Rig aileron control system in accordance with rigging procedures.

CAUTION

Insure that aileron cables are in place on aileron quadrants and pulleys in both wings before rigging tension on aileron system. Wing structure can be damaged by the aileron cables if tension is rigged on the cables while not properly in place on aileron quadrants or pulleys.

- h. If autopilot (optional equipment) is installed, connect autopilot cables to aileron cables with attaching clamps.

- i. Install wing access covers and floorboard access covers.
- j. Install removed carpets and seats.

Removal of Aileron Bellcrank. (See figure 5-3.)

- a. Refer to Section 3. Remove rear seats and carpets.
- b. Remove floorboard access cover just in front of rear spar.
- c. Remove safety wire from turnbuckle (2) and loosen tension on aileron return cable (1).
- d. Disconnect aileron direct cables (15 and 17) from bellcrank (16) by removing cotter pins, nuts and bolts.
- e. Remove bellcrank (16) by removing attaching bolts.

Installation of Aileron Bellcrank. (See figure 5-3.)

- a. Reverse removal procedures and rig in accordance with rigging procedures.

CAUTION

Insure that aileron cables are in place on aileron quadrants and pulleys in both wings before rigging tension on aileron system. Wing structure can be damaged by the aileron cables if tension is rigged on the cables while not properly in place on aileron quadrants or pulleys.

Rigging of Aileron Control System. (See figure 5-3.)

- a. Refer to Section 3, and remove rear seats and rear carpet.
- b. Remove floorboard access covers forward of rear spar.
- c. Remove wing access covers above aileron quadrant.
- d. Align control wheels horizontal and tape a straightedge to lower edge of both control wheels to insure alignment during rigging.

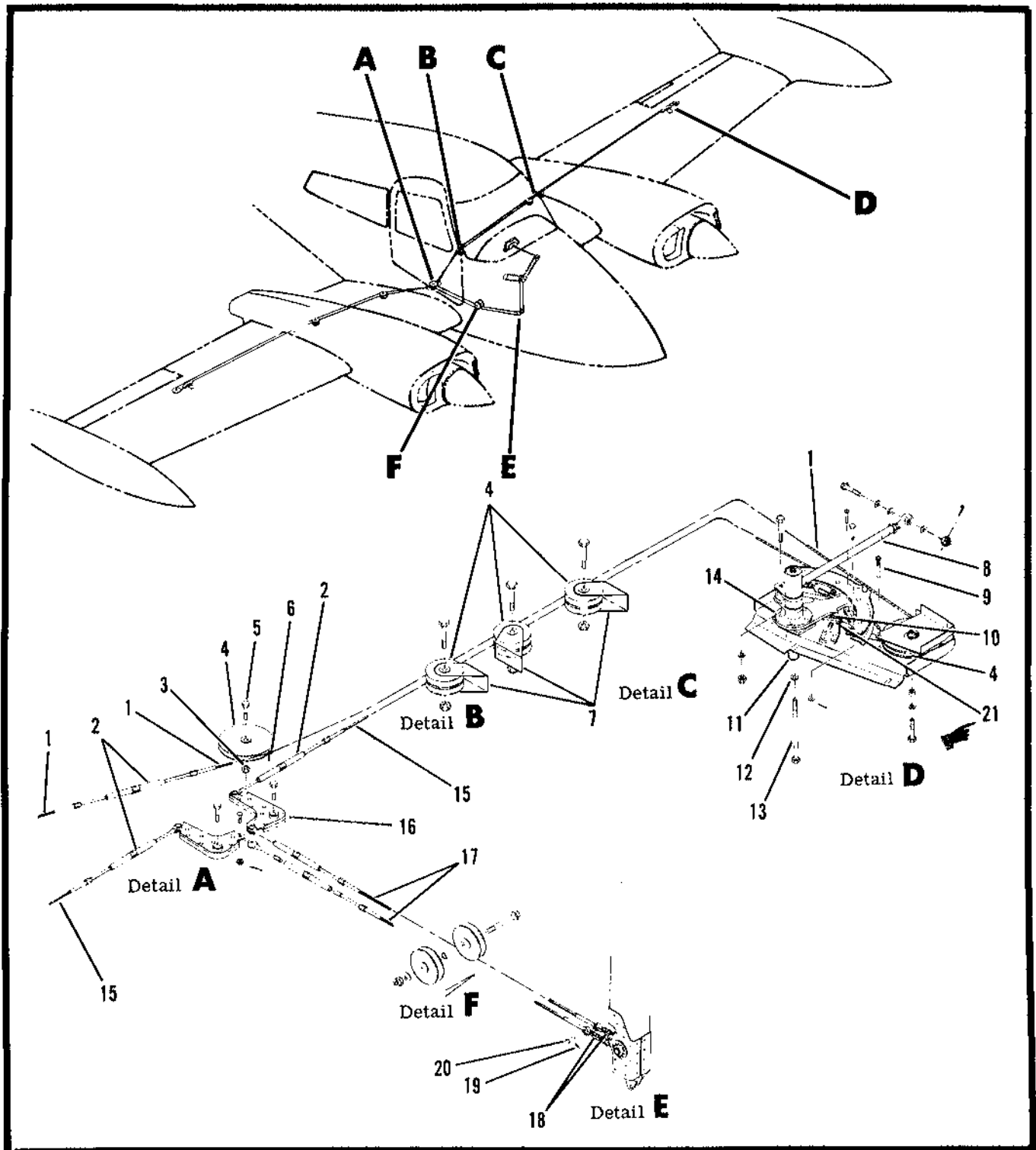
NOTE

- e. Dual control wheels are optional equipment, if only one control wheel is installed, it must be kept in the horizontal position during rigging.

- f. Remove safety wire from all turnbuckles at the fuselage bellcrank.
- g. Adjust turnbuckles on aileron cables (15 and 17) so that both halves of bellcrank (16) are aligned in the same relative position in respect to each other.

NOTE

During all aileron rigging adjustments, maintain 25 ± 5 pounds tension on both the wing and fuselage forward cables.



1. Aileron Cable	8. Push-Pull Tube	15. Aileron Cable (Wing Direct)
2. Turnbuckle	9. Cable Guard Pin	16. Bellcrank
3. Nut	10. Quadrant Stop Bolt	17. Aileron Cable (Fuselage Direct)
4. Pulley	11. Bushing	18. Control Column Chain (Lower)
5. Bolt	12. Washer	19. Cotter Pin
6. Cable Guard Cotter Pin	13. Bolt	20. Clevis Bolt
7. Pulley Bracket	14. Aileron Quadrant	21. Safety Wire

Figure 5-3. Aileron Control System

g. Adjust turnbuckles connecting wing direct cables (15) to bellcrank and turnbuckle connecting return cables (1) so that the ailerons align with the trailing edges of the wings.

h. Resafety turnbuckles from which safety wire was removed, and remove straightedge which was taped to control wheels during rigging.

i. Adjust quadrant stop bolts (10) so that aileron travel is 20 +1, -0 degrees up and 20 +1, -0 degrees down. Safety wire stop bolts after adjustment.

NOTE

If length of aileron push-pull tube (8) has been changed, or new push-pull rods are being installed, adjust rod ends so that push-pull rod is as short as possible, prior to alignment of ailerons with trailing edge of wings.

WARNING

Insure that ailerons move in the proper direction when operated by the control wheel.

j. Install access covers on wing and in fuselage.
k. Refer to Section 3, and install center carpet and seats.

Troubleshooting Aileron Trim Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE	Cable tension too high.	Adjust cable tension in accordance with rigging procedures.
	Defective miter gear assembly.	Repair or replace miter gear assembly.
	Defective trim tab actuator.	Repair or replace actuator.
	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 pulleys correctly.
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.
	Cable tension too low.	Adjust cable tension in accordance with rigging procedures.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install pulleys correctly. Check cable guards.
	Excessive backlash on miter gear assembly.	Repair or replace miter gear assembly.
TRIM INDICATOR FAILS TO INDICATE CORRECT TRIM POSITION	Worn trim tab actuator.	Repair or replace actuator.
	Indicator incorrectly engaged with wheel track.	Engage in accordance with rigging procedures.
	Travel stop blocks loose or incorrectly adjusted.	Adjust stop blocks in accordance with rigging procedures.
	Actuator screw incorrectly adjusted.	Adjust in accordance with rigging procedures.

AILERON TRIM CONTROL SYSTEM.

The aileron trim control system is interconnected by chains, cables, sprockets, turnbuckles, miter gears, an actuator, and a push-pull tube. The aileron trim control wheel, mounted on the aft side of the control pedestal, incorporates a track in which the indicator rides.

Removal of Aileron Trim Control Cables and Chains. (See figure 5-4.)

- a. Refer to Section 3, and remove the following items:
 1. Front seats, middle and rear seats.
 2. Front and rear carpets.
- b. Remove side panels from control pedestal.
- c. Remove floorboard access covers, bottom fuselage access cover aft of nose wheel well, aileron quadrant access cover on left wing, and aft left wing root fillet.
- d. In the fuselage, remove safety wire and disconnect turnbuckle (11) connecting the top cables together.
- e. In the fuselage, remove nut and bolt attaching bottom cable ends (8) together.
- f. Remove four sets of pulleys (6) in wing and two sets of pulleys (6) in fuselage by removing nuts, bolts, and cable guard cotter pins.
- g. Remove chain guard (3) from actuator (2) by removing nuts and screws. Remove chain (4).
- h. Remove stop blocks (7) and bushings (10) by removing nuts and bolts.
- i. Remove cables from wing by pulling out through aileron quadrant access hole in wing.

NOTE

When removing cables, tie safety wire to ends of cables before removal. Leave the wires in the aircraft to facilitate installation.

- j. Remove chain guard (12) by removing attaching screws and washers, and pull fuselage cables (8 and 9) out through access hole.
- k. Remove chain (4) from around sprockets on gear support (15) and trim wheel (22) by disconnecting at master link.

NOTE

If, during removal or installation of chain, the indicator reaches its extreme travel, it can be disengaged from trim control wheel track by inserting a screwdriver beneath indicator and prying out of track. This permits indicator to be moved to a different position or wheel to be turned, before indicator is re-engaged with track.

Installation of Aileron Trim Control Cables and Chains. (See figure 5-4.)

- a. Install chain (4) around sprockets on gear support (15) and trim wheel (22) by connecting chain ends with master link.

- b. Secure fuselage cables (8 and 9) to guide wires and pull aft into position, then remove guide wires.
- c. Rotate trim control wheel to center indicator, engage lower chain with sprocket (13) so that ends of chain are equal in length and install chain guard (12) with screws and washers.
- d. Secure wing cables (8 and 9) to guide wires and route from actuator to fuselage connections, then remove guide wires.
- e. Align aileron with trailing edge of wing; then rotate sprocket on actuator to move trim tab to neutral. Engage chain with sprocket so that ends of chain are equal in length, and install chain guard (3) with attaching screws and nuts.
- f. Install four sets of pulleys (6) in wing and two sets of pulleys in fuselage with bolts and nuts.
- g. Connect fuselage and wing bottom cables (8) with attaching bolt and nut.
- h. Connect fuselage and wing top cables (9) with turnbuckle (11), rig in accordance with rigging procedures, and safety turnbuckle.
- i. Install stop blocks (7) and bushings (10) on cables (8 and 9) between ribs at wing stations 100.5 and 111.5 with bolts and nuts and rig in accordance with rigging procedures.
- j. Check trim tab for proper operation.
- k. Install aft wing root fillet, and access hole covers on underside of fuselage aft of nose wheel well, aft underside of left wing, and cabin floor.
- l. Install side panels on control pedestal.
- m. Install front and rear carpets in accordance with Section 3.
- n. Install front seats in accordance with Section 3.

Removal of Aileron Trim Tab Actuator. (See figure 5-4.)

- a. Refer to Section 3, remove rear seats and rear carpet in accordance with removal procedures.
- b. Remove floorboard access covers above landing gear actuator and from aileron quadrant access cover on left wing.
- c. Remove safety wire from turnbuckle (11) and disconnect.
- d. Remove left aileron in accordance with removal procedures.
- e. Remove aileron trim tab push-pull tube from actuator (2) by removing attaching nut and bolt.
- f. Remove chain guard (3) from actuator by removing nuts and screws.
- g. Disengage chain from sprocket.
- h. Remove clamp (1) and clamps (5) by removing attaching bolts, screws and nuts.
- i. Remove actuator from wing.

Disassembly, Overhaul and Assembly of Aileron Trim Tab Actuator. (See figure 5-5.)

- a. Disassemble aileron trim tab actuator assembly in accordance with figure 5-5. This view clearly illustrates the proper relationship of all component parts.
- b. Do not remove bearing (4) from screw (5) unless replacement parts are 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. Dimension of parts shall be as follows:

Front bearing (13) ID	0.373 in. min. 0.380 in. max.
Rear bearing (6):	
Small hole ID	0.248 in. min. 0.253 in. max.
Large hole ID	0.373 in. min. 0.380 in. max.
Screw (5) OD (shank)	0.242 in. min. 0.246 in. max.
Screw (11) OD	0.367 in. min. 0.370 in. max.

NOTE

(See figure 5-5.) Relative linear movement between internal threaded screw (11) and bearing (6) should be 0.004 to 0.010 inches on aileron and elevator trim tab actuator when set at room temperature.

NOTE

Relative linear movement between internal threaded screw (11) and bearing (6) should be 0.008 to 0.012 inch on rudder trim tab actuator when set at room temperature.

- Examine screws (5 and 11) for damaged threads or dirt particles that may impair smooth operation.
- Check sprocket (14) for broken, chipped, and/or worn teeth.
- Check bearing (4) for smoothness of operation.
- Do not attempt to repair damaged or worn parts of the actuator assembly. Discard all defective items and install new parts during reassembly.
- Always discard the following items and install new parts during reassembly: nuts (16), groov-pins (10 and 12), and O-ring packing (8).
- During reassembly, lubricate collars (7) and screw (11) with general purpose lubricating grease.
- Reassemble actuator in accordance with the following:
 - Press sprocket (14) into hollow end of screw (11), making sure pin holes are aligned. Press two new groov-pins (10 and 12) into pin holes.
 - Slip bearing (13) and collar (7) on screw (11) and slide down against sprocket (14). Install retaining rings (2) in the grooves of screw (11).
 - 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).

4. Align pin holes in bearing (13) and housing (9). Press new groov-pin (10) into pin holes.

5. 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).

6. 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).

7. Install retaining rings (3) in grooves provided on outside of housing (9).

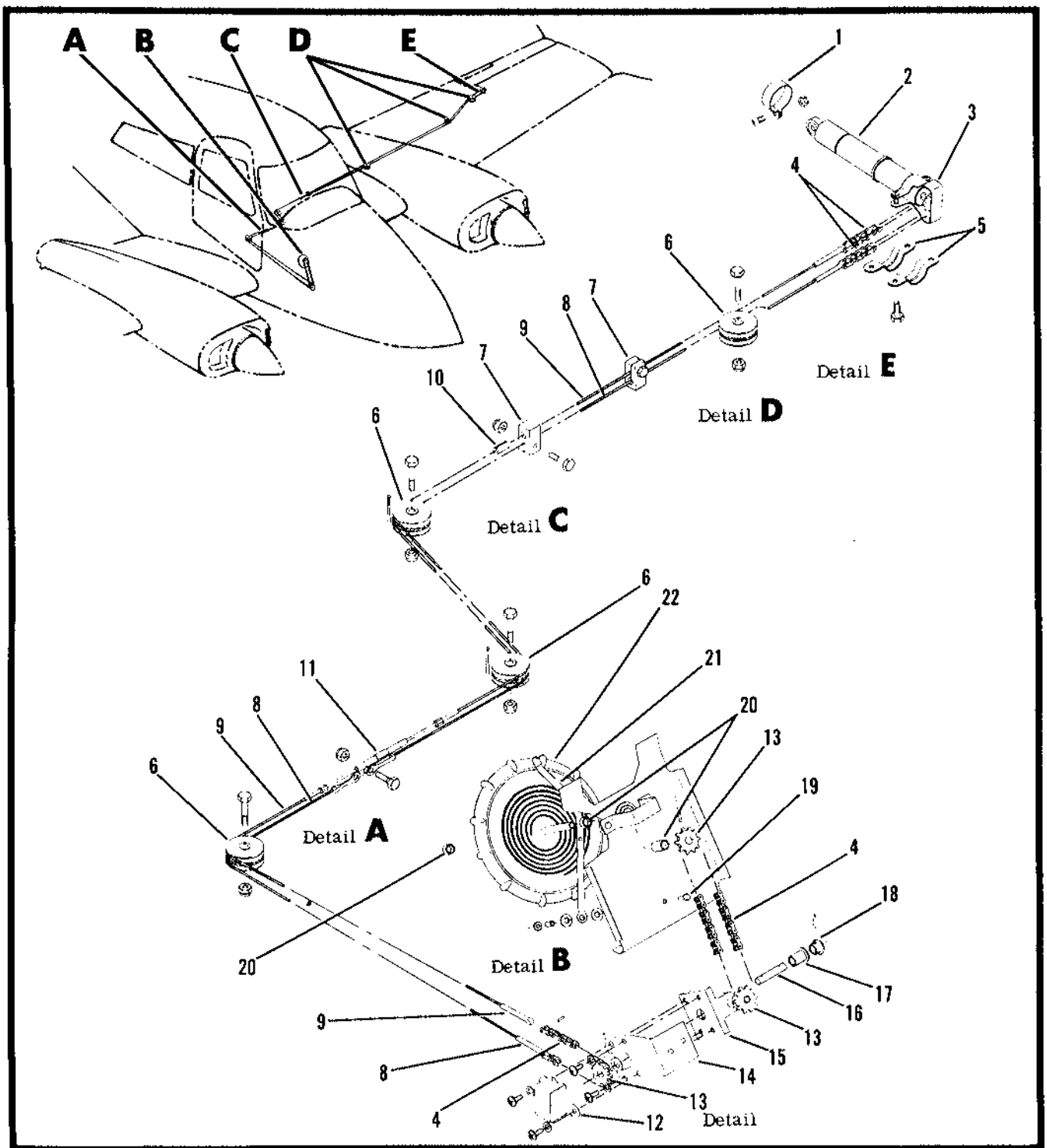
m. Test actuator assembly by rotating sprocket (14) with fingers while holding bearing end of screw (5). Screw (5) should travel in and out of housing (9) smoothly, with no indication of binding.

Installation of Aileron Trim Tab Actuator. (See figure 5-4.)

- Place actuator in position, install clamps (5) and clamp (1) with attaching bolt, screws and nuts.
- Engage chain on sprocket and install chain guard (3) with attaching screws and nuts.
- Connect turnbuckle (11) to fuselage and wing cables (9), tighten cables to 10 ± 3 pounds tension, and safety turnbuckle.
- Connect aileron trim push-pull tube to actuator (2) with attaching bolt and nut.
- Install left aileron in accordance with installation procedures.
- Rotate aileron trim control knob to the neutral position and align aileron with trailing edge of wing.
- With trim tab in neutral, adjust actuator screw so that push-pull tube is aligned with hole in trim tab horn; install attaching bolt, spacer and nut.
- Check aileron trim tab for proper operation, correct travel and rigging.
- Install access covers, carpet and seats.

Removal of Aileron Trim Gear Assembly. (See figure 5-4.)

- Refer to Section 3 and remove front seats and left front carpet.
- Remove access hole covers from forward cabin floor, aft cabin floor above the landing gear actuator, and underside of fuselage just aft of the nose wheel well.
- Remove safety wire from turnbuckle (11) and disconnect.
- Remove chain guard (12) by removing two screws and washers, and disengage chain from sprocket (13).
- Remove sprocket (13) from shaft by removing roll pin.
- Remove two screws and washers attaching gear assembly support (15) and support guard (14) in fuselage.
- Rotate forward side of gear assembly support upward, disengage upper chain from sprocket, and remove support guard and gear assembly support through access hole in cabin floor.



1. Aft Actuator Clamp
2. Aileron Trim Tab Actuator
3. Chain Guard
4. Chain
5. Aft Clamp
6. Aileron Trim Pulley
7. Stop Block

8. Bottom Cable
9. Top Cable
10. Stop Block Bushing
11. Turnbuckle
12. Chain Guard
13. Sprocket
14. Support Guard
15. Gear Support

16. Gear Shaft
17. Shaft Bearing
18. Miter Gear
19. Rivet
20. Spacer
21. Aileron Trim Indicator
22. Aileron Trim Wheel

Figure 5-4. Aileron Trim Control System

Disassembly, Overhaul, and Reassembly of Aileron Trim Gear Assembly. (See figure 5-4.)

- a. Remove miter gears (18) and sprocket (13) from shafts by driving out roll pins. Remove shafts (16) from gear assembly support (15).
- b. Remove press-fit bearings (17) only to replace.
- c. Clean components with suitable solvent, inspect for visible damage and excessive wear, and replace all defective parts.
- d. To reassemble, reverse disassembly procedures.

Installation of Aileron Trim Gear Assembly. (See figure 5-4.)

- a. Insert gear assembly support (15) and support guard (14) through access hole in cabin floor, and engage upper chain with sprocket.
- b. With support guard in position, align mounting holes in gear assembly support and install with two screws and washers. Use the two mounting holes that are not utilized to attach chain guard (12).
- c. Attach sprocket to shaft by installing roll pin.
- d. Engage chain (4) with sprocket (13) and install chain guard (12) with two screws and washers.
- e. Connect trim control cables with turnbuckle (11), tighten cables to 10 $\pm$ 3 pounds tension, and safety turnbuckle.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for four hours.

- f. Move aileron trim tab to neutral and adjust indicator to neutral.

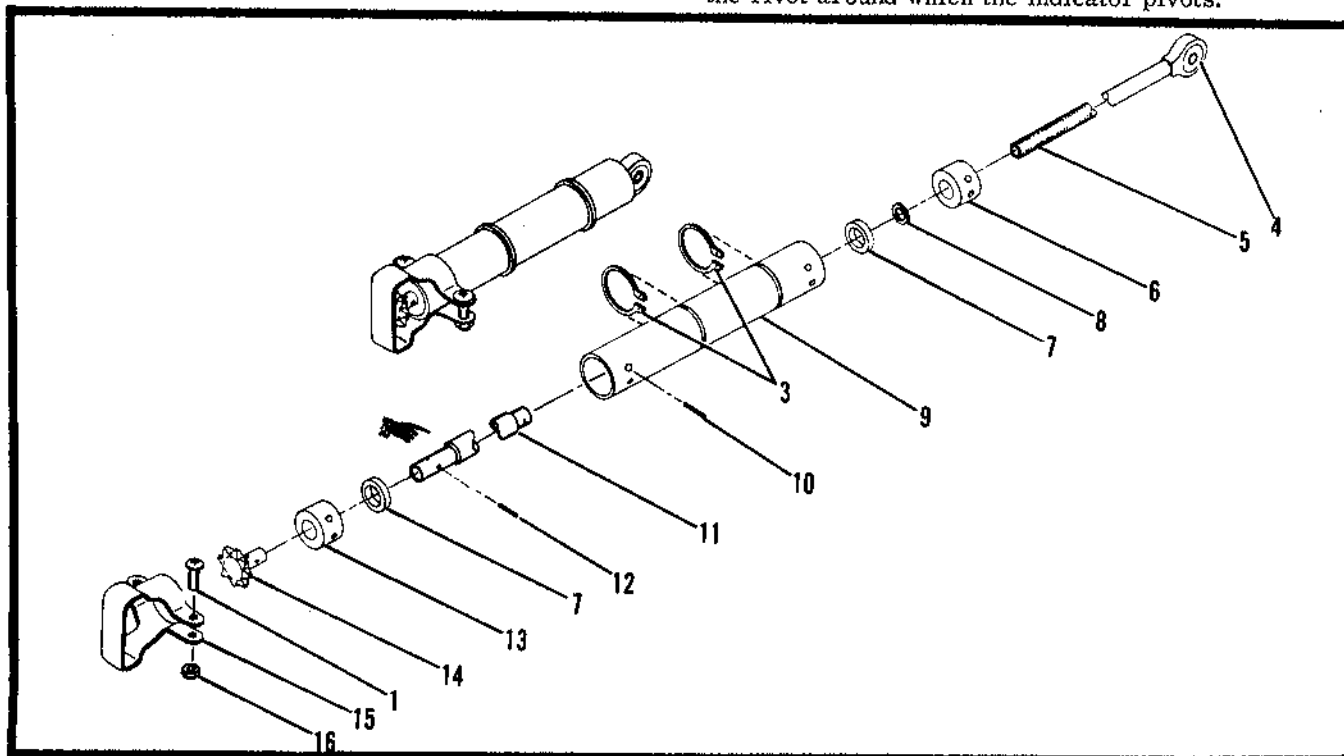
NOTE

To disengage indicator from trim control wheel track, insert a screwdriver beneath indicator and pry out of track. This permits indicator to be moved to a neutral position and re-engaged with track.

- g. Check aileron trim tab for proper operation, correct travel and rigging.
- h. Install access hole covers on forward cabin floor, aft cabin floor and underside of fuselage aft of nose wheel well.
- i. Install carpets and front seats.

Removal and Installation of Aileron Trim Wheel and Indicator Assemblies. (See figure 5-4.)

Removal of aileron trim wheel and indicator assemblies is not recommended. However, removal can be accomplished by drilling out the rivets which attach the wheel bracket to the control pedestal, and the rivet around which the indicator pivots.



1. Screw	5. Screw	9. Housing	13. Bearing
2. Deleted	6. Bearing	10. Groov-Pin	14. Sprocket
3. Retaining Ring	7. Collar	11. Screw	15. Chain Guard
4. Bearing	8. O-Ring Packing	12. Groov-Pin	16. Nut

Figure 5-5. Trim Tab Actuators

Rigging of Aileron Trim Control System. (See figure 5-4.)

- a. Refer to Section 3 and remove the following items:
 1. Front seats, middle and rear seats.
 2. Front and center carpets.
- b. Remove access cover from underside of the fuselage just aft of the nose wheel well, the fuselage floorboards above the landing gear actuator, the spar access covers aft of main wheel wells, and the access cover above aileron quadrant.
- c. Remove safety wire from turnbuckle (11) connection aileron trim control cables, adjust to 10 ± 3 pounds tension, and resafety turnbuckle.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for four hours.

- d. Move aileron trim control system to neutral by rotating trim control wheel so that the chain on actuator sprocket is equal in length, and the chain on gear support sprocket (13) is equal in length.
- e. Adjust aileron trim indicator (21) to neutral by inserting a screwdriver beneath indicator and prying out of track in trim control wheel, moving the indicator to neutral, and re-engaging with track.
- f. Remove nut, bolt and spacer attaching push-pull tube to aileron trim tab.

- g. Align aileron with trailing edge of wing and place trim tab in neutral.
- h. (See figure 5-5.) Adjust actuator screw (5) so that aft hole in push-pull tube is aligned with hole in trim tab horn; attach push-pull tube to trim tab horn with bolt, spacer and nut.

- i. Loosen stop blocks (7), move trim tab to 20 degrees DOWN, slide outboard stop block against outboard rib (wing station 111.5), and tighten stop block.

NOTE

Stop blocks (7) should be installed so that bottom cable (8) passes through bushings (10), and top cable is clamped by stop blocks.

- j. Move trim tab to 20 degrees UP, slide inboard stop block against inboard rib (wing station 100.5), and tighten stop block.
- k. Tolerance for aileron trim tab travel is plus one degree and minus zero degrees.

WARNING

Insure that aileron trim tab moves in the proper direction when operated by the trim control wheel.

- l. Install access covers, carpets and seats.

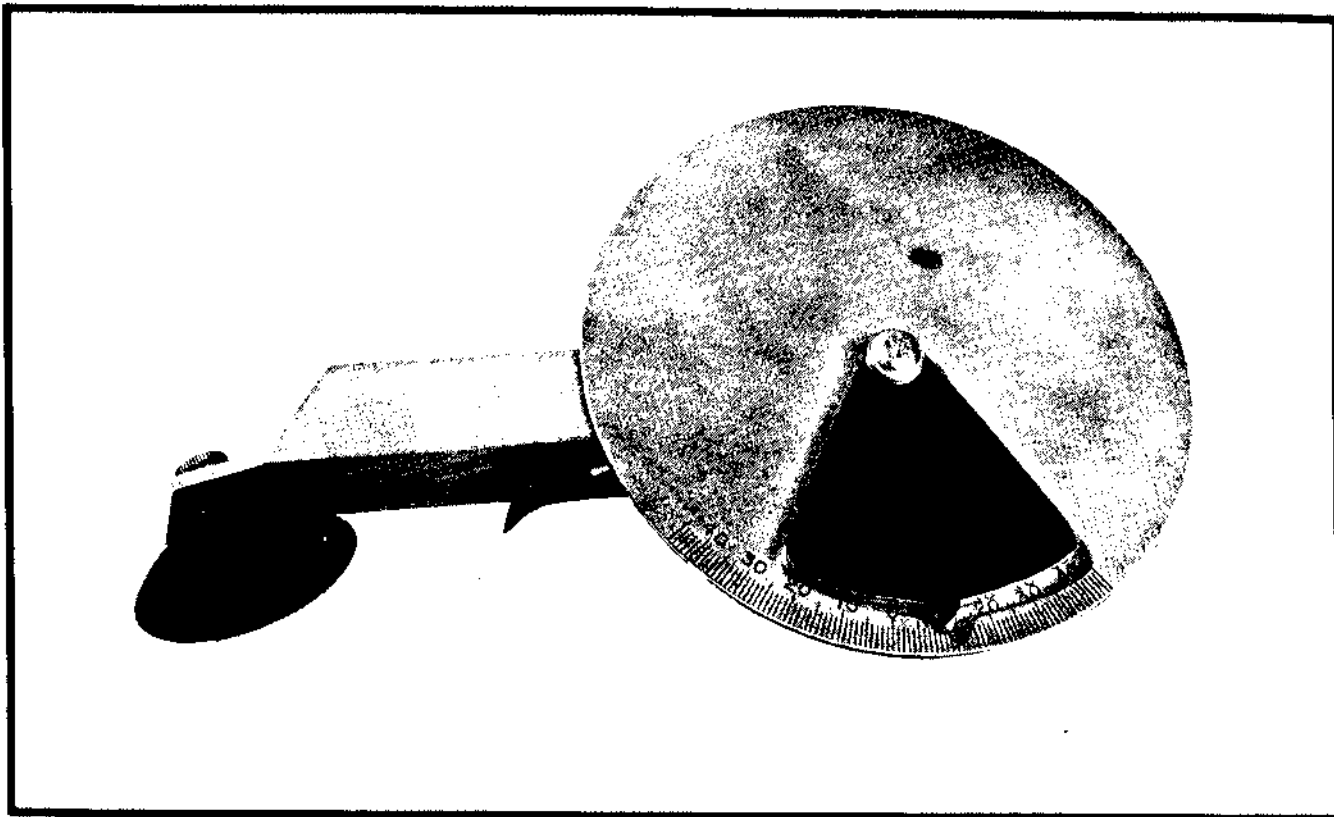


Figure 5-6. SE716 Inclinometer for Measuring Control Surface Travel

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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 with two hinges. The elevators are operated by a pylon to which the elevator torque tubes are bolted.

Removal of Elevators. (See figure 6-1.)

- Refer to Section 3 and remove stinger in accordance with removal procedures.
- Disconnect elevator trim tab push-pull tube (3) by removing cotter pin, nut, washer and bolt.
- Disconnect elevator torque tubes from the ele-

vator pylon (14) by removing nuts and bolts.

- Disconnect bonding straps (8) by removing attaching screws.
- Remove fiberglass tips (6) by removing attaching screws.
- Remove each elevator by removing nuts (12), washers (11), and bolts (10).
- When removing right elevator, guide elevator trim tab push-pull tube (3) out through elevator.

Installation of Elevators. (See figure 6-1.)

- Place elevators in position, guiding elevator trim tab push-pull tube (3) through opening in right elevator, and align mounting holes.
- Attach each elevator to horizontal stabilizer with bolts (10), washers (11) and nuts (12).
- Attach elevator torque tubes to elevator pylon

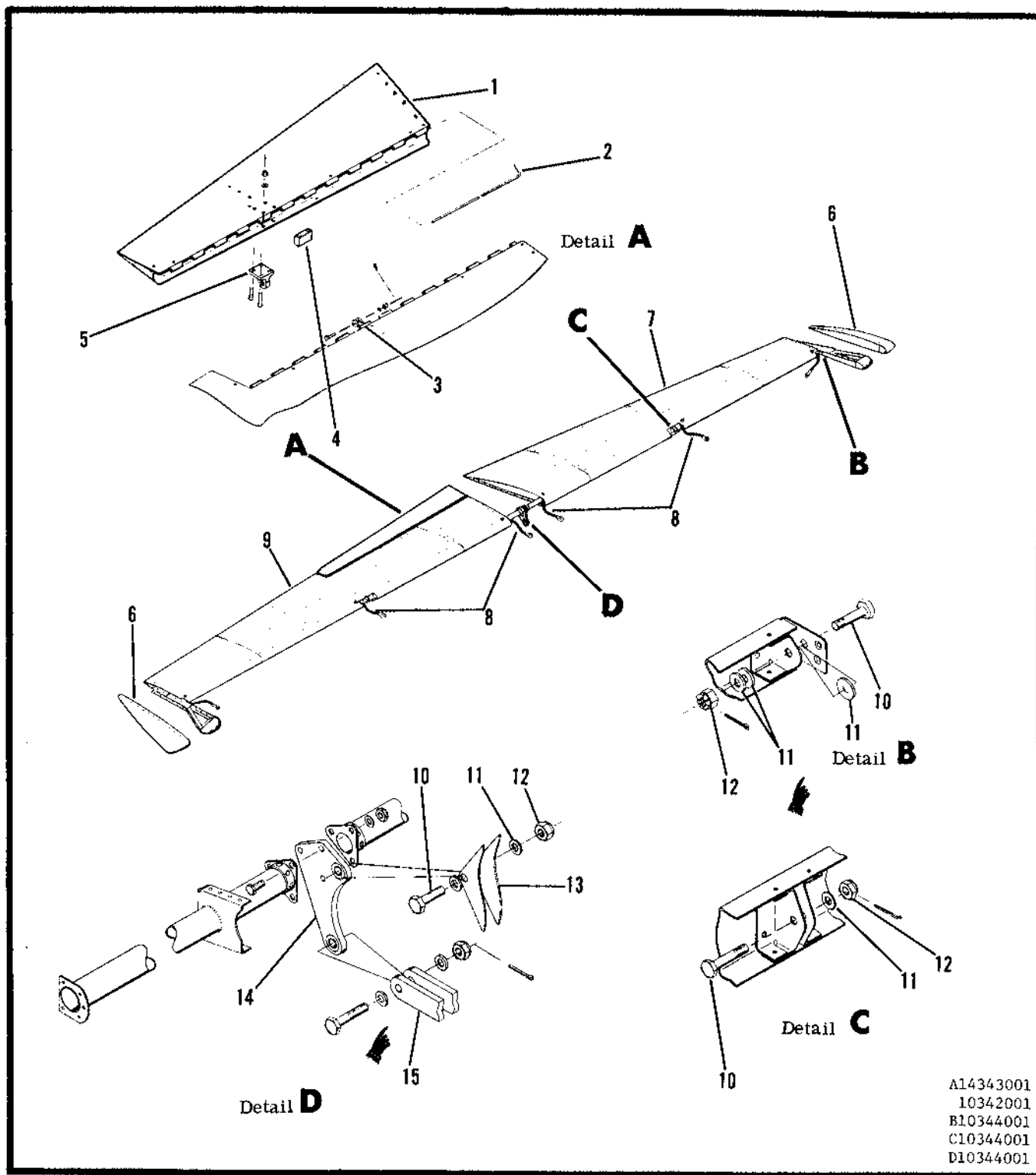


Figure 6-1. Elevator and Trim Tab Installation

- (14) by installing bolts, washers and nuts.
- d. Attach bonding straps (8) with attaching screws.
- e. Install fiberglass tips (6) with attaching screw.
- f. Attach elevator trim tab push-pull tube (3) to trim tab with bolt, washer, nut and cotter pin.
- g. Refer to rigging procedures and check elevators and elevator trim tab for proper operation and travel.
- h. Refer to Section 3 and install stinger in accordance with installation procedures.

ELEVATOR TRIM TAB.

Removal of Elevator Trim Tab. (See figure 6-1.)

- a. Disconnect elevator trim tab push-pull tube (3) by removing nut, washer and bolt.

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b. Remove cotter pins from hinge pin (2), and detach trim tab from elevator by removing hinge pin.

Disassembly and Assembly of Elevator Trim Tab. (See figure 6-1.)

- a. Remove elevator trim tab horn (5) and spacer (4) by removing nuts, washers and screws.
- b. To assemble, reverse the above procedure.

Installation of Elevator Trim Tab. (See figure 6-1.)

- a. Attach trim tab to elevator with hinge pin (2) and safety in place with cotter pins.

b. Connect elevator trim tab push-pull tube (3) to trim tab horn (5) with bolt, washer, nut and cotter pin.

c. Refer to elevator trim control system rigging procedures, checking elevator trim tab for proper operation and correct travel.

ELEVATOR CONTROL SYSTEM.

The elevator control system consists of cables, turnbuckles, bellcranks, an elevator down spring, adjustable bellcrank stops and push-pull tubes. This system, as described herein, extends from the lower control column attachment point to the pylon which operates the elevators.

Troubleshooting the Elevator Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN CONTROL WHEEL AND ELEVATORS	Cable tension too low.	Adjust cable tension in accordance with elevator rigging procedures.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Excessive end play in aileron sprocket shaft on control column assembly.	Tighten sprocket shaft nut in accordance with control column assembly procedures (Section 5).
RESISTANCE TO ELEVATOR CONTROL MOVEMENT	Cable tension too high.	Adjust cable tension in accordance with elevator rigging procedures.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Cable not in place on pulleys during installation.	Install pulleys correctly.
	Instrument panel ball and socket needs lubricating.	Lubricate in accordance with Section 2.
	Binding control column pivot bearings.	Lubricate in accordance with Section 2.
	Bent elevator or hinge.	Repair or replace elevator hinge.
	Elevator bellcrank stops incorrectly adjusted.	Adjust in accordance with elevator rigging procedures.
INCORRECT ELEVATOR TRAVEL	Elevator cables incorrectly rigged.	Rig cables in accordance with elevator rigging procedures.
CORRECT ELEVATOR TRAVEL CANNOT BE OBTAINED BY ADJUSTING BELLCRANK STOPS	Control column contacting fuselage bulkhead or instrument panel.	Adjust length of forward elevator push-pull tubes in accordance with elevator rigging procedures.
	Incorrect positioning of forward elevator bellcrank.	Rig elevator cables in accordance with elevator rigging procedures.

Removal of Elevator Control Cables. (See figure 6-2.)

- a. Refer to Section 3 and remove the following items:
 1. Front and rear seats or; middle and aft rear seats (optional equipment).
 2. Front, center and rear carpets.
 3. Rear upholstery panel to tailcone.
- b. Remove access hole covers from floor as necessary to gain access to cables, pulleys, and attachment points.
- c. Unsafety turnbuckles (18) and disconnect elevator cables (6 and 7) from forward elevator bellcrank (17) by removing turnbuckles.
- d. Remove four pulleys (19) by removing nuts, bolts and cable guards (20).
- e. Remove fairleads through which elevator cables pass at fuselage rear spar.
- f. Disconnect elevator cables (6 and 7) from aft elevator bellcrank (9) by removing cotter pins, nuts, washers and bolts.
- g. Tie guide wires to forward ends of elevator cables (6 and 7), remove cables by pulling them out aft of baggage compartment, and disconnect guide wires.

Installation of Elevator Control Cables. (See figure 6-2.)

- a. Tie elevator cables (6 and 7) to guide wires, pull into position, and remove guide wires.
- b. Install fairleads through which elevator cables pass at fuselage rear spar.
- c. Install four pulleys (19) with bolts, cable guards (20) and nuts, insuring that cables are correctly in place as pulleys are installed.
- d. Attach elevator cables (6 and 7) to aft elevator bellcrank (9) with bolts, washers, nuts and cotter pins.
- e. Connect elevator cables (6 and 7) to forward elevator bellcrank (17) with turnbuckles (18), and rig elevator control system in accordance with rigging procedures.
- f. Install removed access panels.
- g. Refer to Section 3 and install the necessary upholstery panels, carpets and seats.

Removal of Aft Elevator Bellcrank. (See figure 6-2.)

- a. Refer to Section 3 and remove the following items:
 1. Front seats.
 2. Front carpet.
 3. Rear upholstery panel to tailcone.
- b. Remove access hole covers from cabin floor above forward elevator bellcrank (17).
- c. Unsafety and loosen either turnbuckle (18) to release tension on elevator cables.
- d. Disconnect elevator cables (6 and 7) from aft elevator bellcrank (9) by removing cotter pins, nuts and bolts.

NOTE

If an automatic pilot (optional equipment) is installed, disconnect from aft elevator bellcrank.

- e. Disconnect aft elevator push-pull tube (1) from elevator bellcrank (9) by removing nut and bolt.
- f. Release tension on elevator down spring cables (5) by either disconnecting elevator down spring (2) or blocking elevator down spring channel assembly (3) forward.
- g. Disconnect elevator down spring cables (5) from elevator bellcrank (9) by removing cotter pin, nut, washers, spacer and bolt.
- h. Remove aft elevator bellcrank (9) by removing nut, spacers and bolt.

Installation of Aft Elevator Bellcrank. (See figure 6-2.)

- a. Place aft elevator bellcrank (9) in position, and install with bolt, spacers and nut.
- b. Connect elevator down spring cables (5) to elevator bellcrank (9) with bolt, spacer, washers, nuts and cotter pin.
- c. Connect elevator down spring (2) or remove block aft of elevator down spring channel assembly (3) in accordance with the method used to release tension on elevator down spring cables.
- d. Attach aft elevator push-pull tube (1) to elevator bellcrank (9) with bolt, nut, and cotter pin.
- e. Attach elevator cables (6 and 7) to elevator bellcrank (9) with bolts, nuts, and cotter pins.

NOTE

If an automatic pilot (optional equipment) is installed, connect to aft elevator bellcrank.

- f. Rig elevator control system in accordance with rigging procedures.
- g. Install access cover above forward elevator bellcrank.
- h. Refer to Section 3 and install rear upholstery panel, front carpet and front seats.

Removal and Installation of Elevator Pylon. (See figure 6-1.)

- a. Refer to Section 3 and remove stinger in accordance with removal procedures.
- b. Disconnect aft elevator push-pull tube (15) by removing nut and bolt.
- c. Remove three nuts, washers and bolts attaching elevators to elevator pylon (14). Remove nut, washer and bolt attaching elevator pylon (14) to hinge bracket (13) and remove by sliding aft.
- d. To install elevator pylon, reverse the above procedure.

Removal and Installation of Elevator Down Spring and Channel Assembly. (See figure 6-2.)

- a. Refer to Section 3, remove rear upholstery panel to tailcone and stabilizer fairings.
- b. Stretch elevator down spring (2) aft and unhook from eyebolt.
- c. Remove elevator down spring (2) from elevator down spring channel assembly by removing cotter pin, nut, washers, spacers and bolt.
- d. Disconnect elevator down spring cables (5) by removing cotter pin, nut, spacer and bolt.
- e. Remove elevator down spring channel assembly (3) by removing nut, spacer and bolt.
- f. To install elevator down spring and channel assembly, reverse the above procedure.

Removal and Installation of Aft Elevator Push-Pull Tube. (See figure 6-2.)

- a. Refer to Section 3, remove rear upholstery panel to tailcone and stinger.
- b. Remove cotter pin, nut, and bolt attaching push-pull tube (1) to aft elevator bellcrank (9).
- c. Remove cotter pin, nut and bolt attaching push-pull tube (1) to elevator pylon and remove push-pull tube by pulling aft.
- d. To install aft elevator push-pull tube, reverse the above procedures.

Removal of Forward Elevator Bellcrank. (See figure 6-2.)

- a. Refer to Section 3, remove the front seats and front carpet in accordance with removal procedures.
- b. Remove access covers from cabin floor above forward elevator bellcrank.
- c. Unsafety and loosen either turnbuckle (18) to release tension on elevator cables (6 and 7).
- d. Disconnect elevator cables (6 and 7) from forward elevator bellcrank (17) by removing cotter pins, nuts and bolts.
- e. Disconnect forward elevator push-pull tube (16) from elevator bellcrank (17) by removing cotter pin, nut, washer and bolt.
- f. Remove elevator bellcrank (17) by removing bolt.

Installation of Forward Elevator Bellcrank. (See figure 6-2.)

- a. Place forward elevator bellcrank (17) in position, and install with bolt.
- b. Attach forward elevator push-pull tube (16) to elevator bellcrank (17) with bolt, washer, nut and cotter pin.
- c. Attach elevator cables (6 and 7) to elevator bellcrank (17) with bolts, nuts and cotter pins.
- d. Rig elevator control system in accordance with rigging procedures.
- e. Install access covers on cabin floor.
- f. Refer to Section 3, install front carpet and front seats.

Removal and Installation of Forward Elevator Push-Pull Tube. (See figure 6-2.)

- a. Refer to Section 3, remove front seats and front carpet in accordance with removal procedures.
- b. Remove access covers from cabin floor above forward elevator bellcrank (17) and from underside of the fuselage aft of nose wheel well.
- c. Disconnect forward elevator push-pull tube (16) from elevator bellcrank (17) by removing nut, washer and bolt.
- d. Disconnect forward elevator push-pull tube (16) from control column by removing nut, spacers and bolt.
- e. To install forward elevator push-pull tube (16), reverse the above procedures.

NOTE

If length of forward elevator push-pull tube (16) has been changed or a new push-pull tube is being installed, adjust length to approximately 12 inches, measured between centerlines of the rod end bolt holes.

Rigging of Elevator Control System. (See figure 6-2.)

- a. Refer to Section 3, remove the following items:
 1. Front seats.
 2. Front carpet.
 3. Rear upholstery panel to tailcone.
- b. Remove access covers from cabin floor above forward elevator bellcrank (17) and tailcone access cover below aft push-pull tube (1).
- c. Install an inclinometer on trailing edge of the elevator and adjust elevator bellcrank stops (10) so that the elevator travel is $16 \pm 1/2$, -0 degrees UP and 15 ± 1 , -0 degrees DOWN.

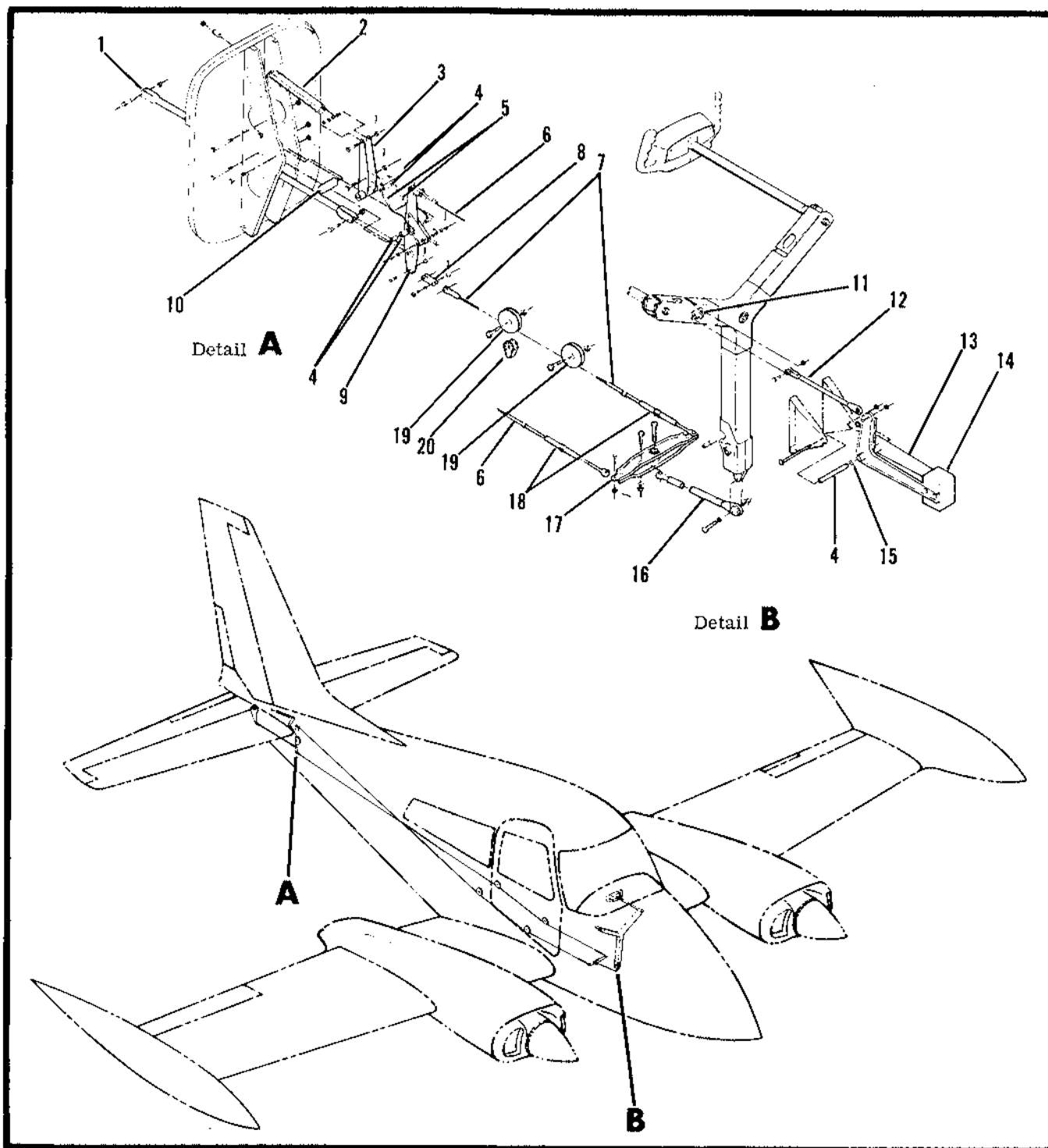
CAUTION

When checking elevator travel, do not operate elevator from the elevator tip or serious damage to the elevator may result.

NOTE

The hole through the elevator bellcrank stop (10) is drilled off-center to provide a positive means of adjusting the elevator travel. At the extreme elevator travel limits ($16 \pm 1/2$, -0 degrees UP and 15 ± 1 , -0 degrees DOWN), the bellcrank (9) should be tangent with the flat surface of stop (10). Adjustments (0 and $1/2$ degree) are accomplished by rotating stop (10) approximately 60 degrees or until another side of the stop is encountered and tangent with bellcrank surface.

- d. Unsafety turnbuckles (18) and adjust so that tension on elevator cables (6 and 7) is 32 $\pm$ 5 pounds, insuring that forward elevator bellcrank (17) does not contact the bulkhead located just forward of the bellcrank. When elevators are in either extreme posi-



1. Elevator Push-pull Tube (Aft)	8. Link	14. Bob-Weight
2. Elevator Down Spring	9. Elevator Bellcrank (Aft)	15. Bearing
3. Down Spring Channel Assembly	10. Bellcrank Stop	16. Elevator Push-pull Tube (Forward)
4. Spacer	11. Bob-Weight Bracket	17. Elevator Bellcrank (Forward)
5. Down Spring Cable	12. Push-pull tube	18. Turnbuckle
6. Right Elevator Control Cable	13. Bob-Weight Bellcrank	19. Pulley
7. Left Elevator Control Cable		20. Cable Guard

Figure 6-2. Elevator Control System

tion, the bellcrank should clear the bulkhead by approximately 1/4 inch.

NOTE

Cable tension readings should be taken just aft of rear cabin bulkhead (fuselage Station 132.00) with bob-weight push-pull tube (12) disconnected from control column. Check tension when ambient temperature is 60°F to 90°F after temperature has stabilized for a period of four hours.

- e. Resafety turnbuckles (18).

WARNING

Insure that elevator moves in the proper direction when operated by the control wheel.

- f. Adjust length of forward elevator push-pull tube

(16) so that control column clears instruments in aft position and fuselage bulkhead in forward position.

NOTE

When elevator system is correctly rigged, the length of forward elevator push-pull tube (16) should be approximately 12 inches, measured between centerlines of the rod end bolt holes.

- g. Install access covers.
h. Install rear upholstery panel, carpets and front seats.

ELEVATOR TRIM CONTROL SYSTEM.

The elevator trim control system is interconnected by chains, cables, sprockets, pulleys, miter gears, an actuator, and a push-pull tube. The elevator trim control wheel, mounted on the left side of the control pedestal, incorporates a track in which the indicator rides.

Troubleshooting the Elevator Trim Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE	Cable tension too high.	Adjust tension in accordance with rigging procedures.
	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 correctly.
	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.
	Defective trim tab actuator.	Repair or replace actuator.
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 cables correctly. Check cable guards.
	Worn trim tab actuator.	Repair or replace actuator.
TRIM INDICATOR FAILS TO INDICATE CORRECT TRIM POSITION	Indicator incorrectly engaged with wheel track.	Engage in accordance with rigging procedures.
INCORRECT TRIM TAB 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.

Removal of Elevator Trim Control Cables and Chains.
(See figure 6-3.)

- a. Refer to Section 3, remove the following items:
 1. Front and rear seats or; middle and individual rear seats (optional equipment).
 2. Front, center and rear carpet.
 3. Rear upholstery panel to tailcone.
 4. Stinger and stabilizer fairings.
- b. Remove access covers on floorboard as necessary to gain access to cables and access covers from underside of fuselage, aft of nose wheel well and stabilizer.
- c. Unsafety turnbuckle (10) and disconnect aft cables (7 and 8) by removing turnbuckle, cotter pin and pin.
- d. Remove aft pulleys (6) by removing nuts, bolts and cable guard cotter pins.
- e. Remove chain guard from elevator trim tab actuator (2) by removing nuts and screws.
- f. Disengage chain (5) from sprocket (4), attach a guide wire to the chain, and remove cables and chain by pulling out through opening in tailcone. Disconnect guide wire and leave in horizontal stabilizer to facilitate installation.
- g. Remove stop blocks (12) by removing nuts, bolts and bushings (13).
- h. Remove three sets of pulleys (6) as illustrated in figure 6-3.
- i. Remove elevator trim control wheel (14) by removing four screws and washers.
- j. Remove upper left side panel from control pedestal.
- k. Remove four cable guard pins.
- l. Tie guide wires to aft ends of cables (9 and 11) and pull chain and cables out through control pedestal. Disconnect guide wires and leave in position to facilitate installation.

NOTE

Pulleys (6) are difficult to reinstall and should be removed only for replacement.

Installation of Elevator Trim Control Cables and Chains. (See figure 6-3.)

- a. Tie aft ends of cables (9 and 11) to guide wires, pull into position, and remove guide wires.
- b. Engage chain (15) with sprocket (20) and install upper left side panel on control pedestal.
- c. Install four cable guard pins.
- d. Install three sets of pulleys (6) as illustrated in figure 6-3.
- e. Tie aft chain (5) to the guide wire, pull into position, and remove guide wire.
- f. Engage aft chain (5) with actuator sprocket (4) and install chain guard with screws and nuts.
- g. Install aft pulleys (6) with bolts, nuts and cable guard cotter pins, insuring that the cables are correctly in place.
- h. Connect forward left cable (9) to aft left cable (8) with pin and cotter pin, and forward right cable (11) to aft right cable (7) with turnbuckle (10).
- i. Install stop blocks (12) and bushings (13) with bolts and nuts. Do not tighten at this time.

- j. Install elevator trim control wheel (14) with washers and screws, and rig elevator trim control system in accordance with rigging procedures.
- k. Install access covers.
 1. Refer to Section 3, install the following items:
 1. Stinger and stabilizer fairings.
 2. Rear upholstery panel to tailcone.
 3. Front, center and rear carpet.
 4. Front and rear seats or; middle and aft seats (optional equipment).

Removal of Trim Tab Actuator. (See figure 6-3.)

- a. Refer to Section 3, remove rear upholstery panel to tailcone.
- b. Remove access hole cover from underside of the horizontal stabilizer beneath elevator trim tab actuator.
- c. Unsafety and loosen turnbuckle (10) to release tension on elevator trim control cables.
- d. Remove chain guard from elevator trim tab actuator (2) by removing nuts and screws, and disengage chain from sprocket (4).
- e. Remove right elevator in accordance with elevator removal procedures.
- f. Remove elevator trim tab push-pull tube from the elevator trim tab actuator screw (1) by removing cotter pin, nut, washer and bolt.
- g. Remove clamps (3) by removing bolts, and remove elevator trim tab actuator.

Disassembly of Elevator Trim Tab Actuator. (See figure 5-5.)

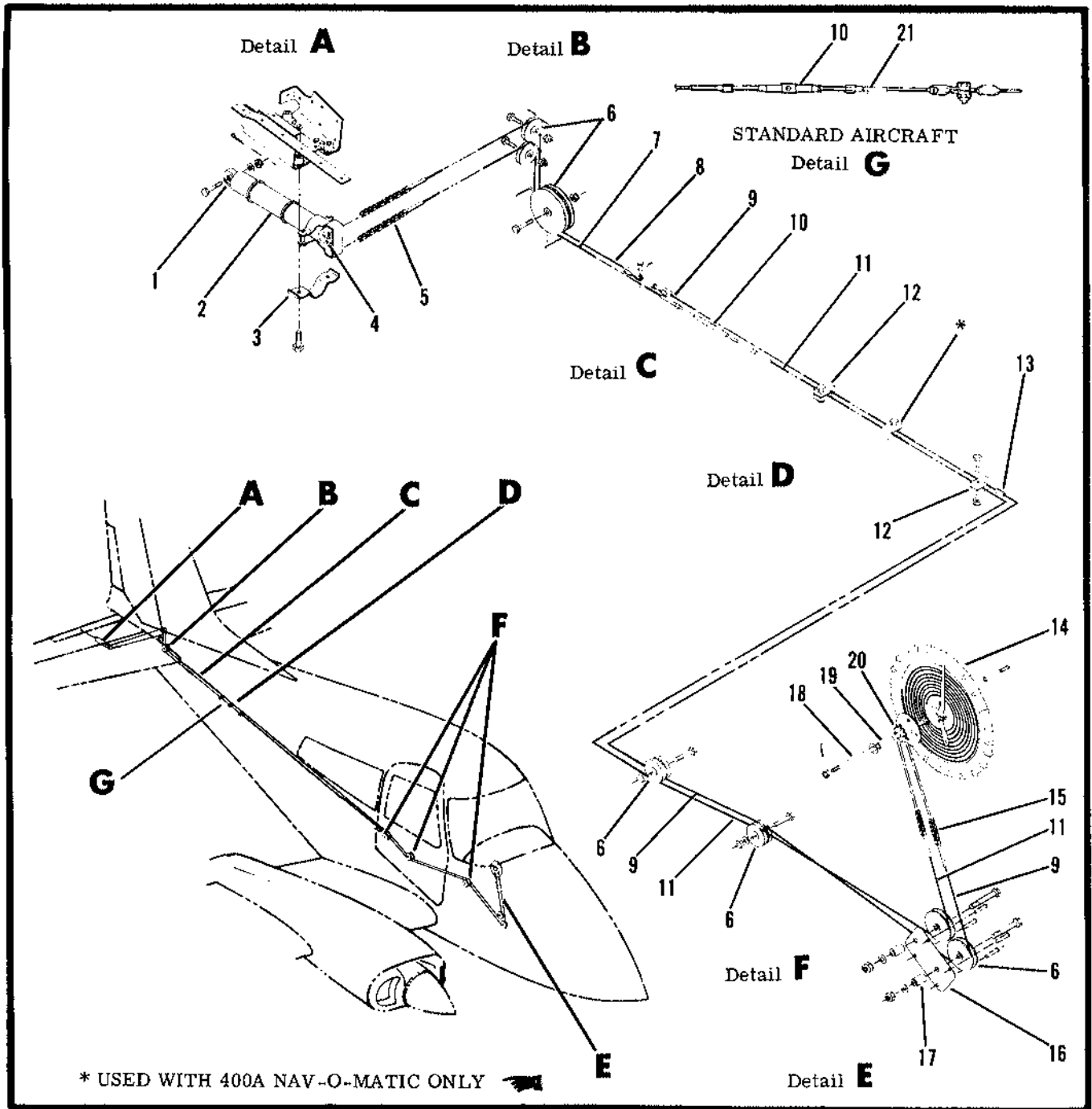
The instructions for disassembly, overhaul and reassembly of the aileron trim tab actuator, given in Section 5, also applies to the elevator trim tab actuator.

Installation of Elevator Trim Tab Actuator. (See figure 6-3.)

- a. Insert elevator trim tab actuator through access hole, place in position, and install clamps (3) with bolts.
- b. Attach elevator trim tab push-pull tube to elevator trim tab actuator screw (1) with bolt, washer, nut and cotter pin.
- c. Install right elevator in accordance with installation procedures.
- d. Engage chain (5) with sprocket (4), and install the chain guard with screws and nuts.
- e. Rig elevator trim control system in accordance with rigging procedures.
- f. Install access hole cover on underside of horizontal stabilizer.
- g. Refer to Section 3, install rear upholstery panel to tailcone.

Removal of Elevator Trim Control Wheel, Sprocket, and Indicator Assembly. (See figure 6-3.)

- a. Remove rear curtain from baggage compartment.



1. Actuator Screw	12. Stop Block
2. Actuator	13. Bushing
3. Clamp	14. Elevator Trim Control Wheel
4. Actuator Sprocket	15. Chain
5. Chain	16. Cable Guard Bracket
6. Pulley	17. Spacer
7. Right Elevator Trim Control Cable (Aft)	18. Bolt
8. Left Elevator Trim Control Cable (Aft)	19. Spacer
9. Left Elevator Trim Control Cable (Forward)	20. Sprocket
10. Turnbuckle	21. Elevator Trim Extension Cable
11. Right Elevator Trim Control Cable (Forward)	

Figure 6-3. Elevator Trim Control System

- b. Unsafety and loosen turnbuckle (10) to release tension on elevator trim control system.
- c. Remove elevator trim control wheel (14) by removing four screws and washers.
- d. Remove upper left side panel from control pedestal.

NOTE

To remove the elevator trim indicator assembly, the rivets around which the indicator pivots must be removed.

- e. Disengage chain (15) from sprocket (20), remove upper right side panel from control pedestal, and remove sprocket (20) by removing cotter pin, nut, washer, spacer (19) and bolt (18).

Installation of Elevator Trim Control Wheel, Sprocket, and Indicator Assembly. (See figure 6-3.)

- a. Install sprocket (20) with bolt (18), spacer (19), washer, nut and cotter pin.
- b. Install upper right side panel on control pedestal.
- c. Engage chain (15) with sprocket (20) and install upper left side panel on control pedestal.
- d. Rig the elevator trim control system in accordance with rigging procedure, and install the elevator trim control wheel (14) with four washers and screws.
- e. Install rear upholstery panel to tailcone.

Rigging of Elevator Trim Control System. (See figure 6-3.)

- a. Remove the rear curtain from the baggage compartment.
- b. Loosen stop blocks (12) by loosening nuts.
- c. Unsafety turnbuckle (10), adjust so that tension on the elevator trim control cables is 10 ± 3 pounds, and resafety turnbuckle.

NOTE

If an automatic pilot (optional equipment) is installed, adjust tension on elevator trim control cables to 19 ± 3 pounds.

Cable tension should be adjusted when ambient temperature is 60°F to 90°F . Allow aircraft temperature to stabilize for a period of four hours.

- d. (See figure 6-1.) Disconnect elevator trim tab push-pull tube (3) from elevator trim tab horn (5) by removing attaching nut, washer and bolt.
- e. Rotate elevator trim control wheel (14) forward (nose down) until aft chain (5) and forward chain (15) have approximately two links clearing the sprockets.

NOTE

If the elevator trim indicator reaches its extreme travel during rigging, it can be relocated by removing elevator trim control wheel, moving the indicator, and re-

installing wheel.

- f. With the chains in the above position and the elevators in neutral (elevator horns aligned with stabilizer), adjust actuator screw (1) by rotating push-pull tube so that aft bolt hole in push-pull tube aligns with bolt hole in the trim tab horn when the elevator trim tab is approximately 10° up.

- g. (See figure 6-1.) Connect push-pull tube (3) to elevator trim tab horn (5) with attaching bolt, washer and nut.

NOTE

The threaded end of bolt attaching the elevator trim tab push-pull tube to actuator screw must be inboard; therefore, exact travel adjustment is not made by this means.

- h. Rotate elevator trim control wheel (14) so that elevator trim tab is $10^{\circ} +1^{\circ}$, -0° up, locate aft stop block (12) adjacent to cable terminal, and tighten. Slide the center stop block against aft stop block and tighten.

NOTE

If an automatic pilot (optional equipment) is installed, refer to Section 13 for rigging of stop blocks.

- i. Rotate elevator trim control wheel (14) so that the elevator trim tab is $26^{\circ} +1^{\circ}$, -0° down. Slide forward stop block against the center stop block and tighten.

- j. When the elevator trim control system is in either extreme position, the elevator trim indicator should be in the same relative position to the NOSE UP and NOSE DOWN positions on the decal. To adjust the indicator, use the following procedure:

- 1. Rotate elevator trim control wheel (14) so that elevator trim control system is in the extreme NOSE DOWN position.

- 2. Remove elevator trim control wheel (14) by removing four screws and washers, and place the elevator trim indicator at the NOSE DOWN position on the decal.

- 3. While the elevator trim indicator is in this position, install the elevator trim control wheel (14) with four washers and screws.

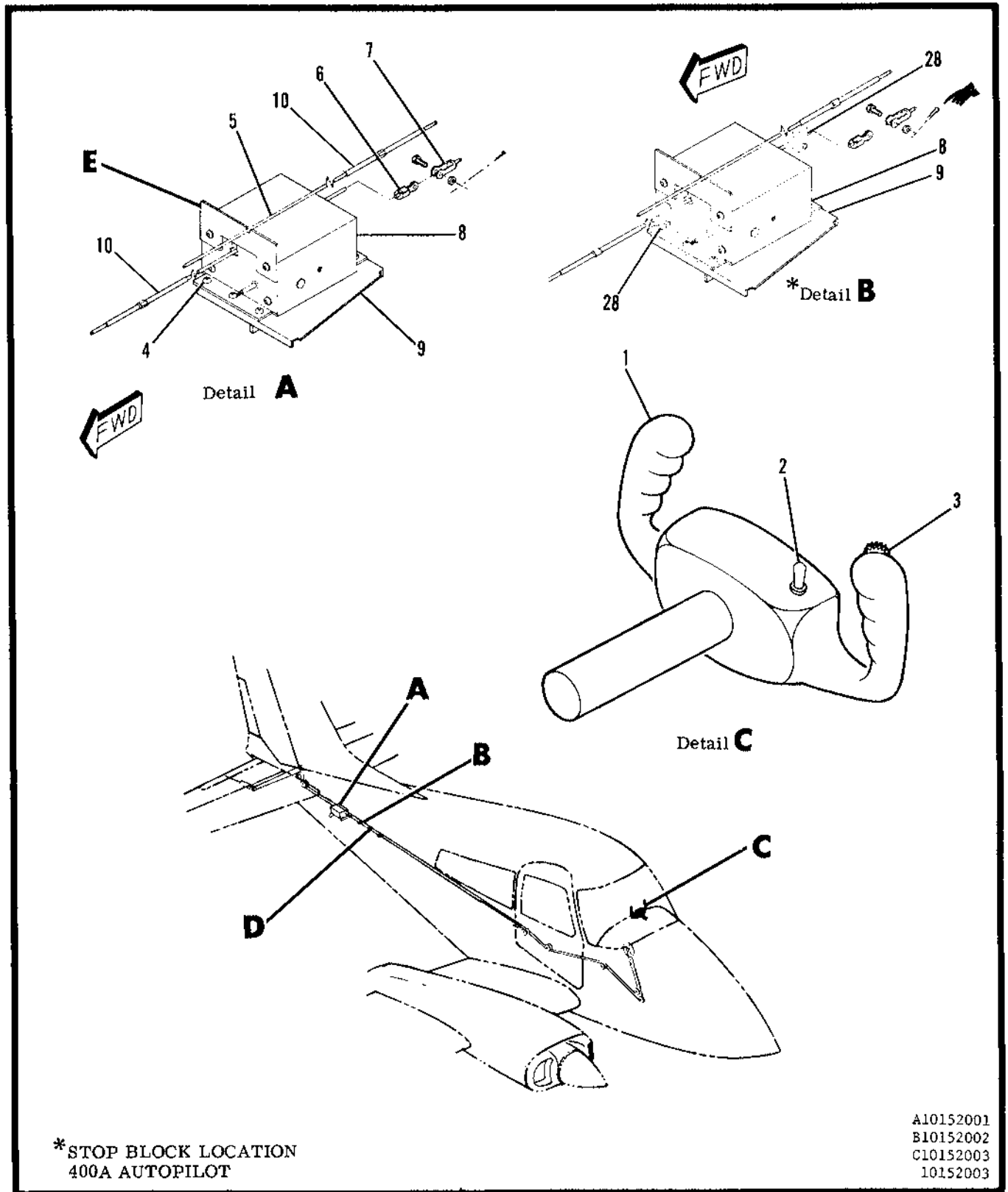
NOTE

The elevator trim control wheel (14) can be installed in any one of four positions. Select the position which causes the least indicator movement as it engages with the wheel track.

WARNING

Insure that elevator trim tab moves in the proper direction when operated by the trim control wheel.

- k. Refer to Section 3, install rear upholstery panel to tailcone.

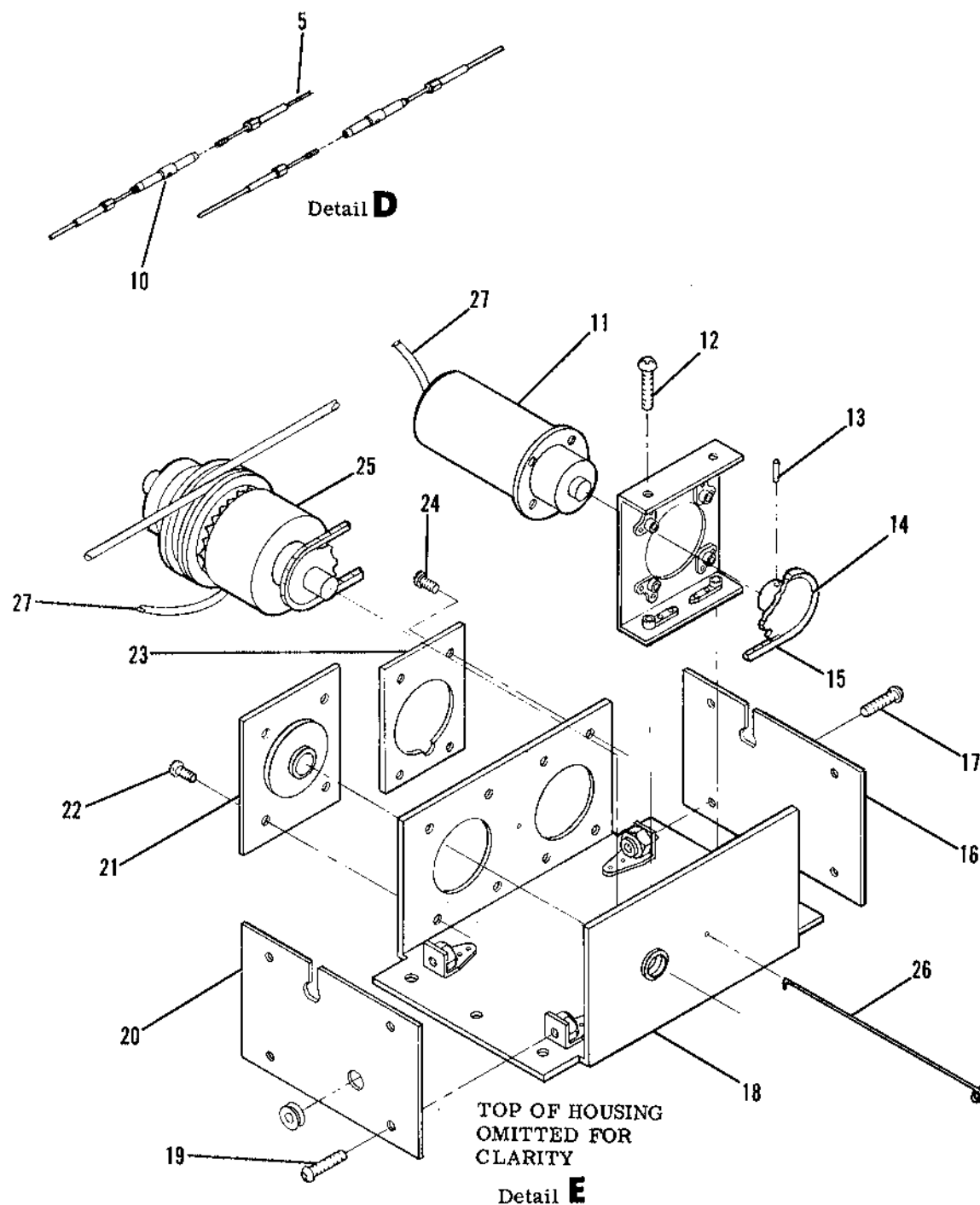


1. Control Wheel
2. Switch
3. Switch

4. Screw
5. Control Cable
6. Locking Clip

7. Turnbuckle
8. Actuator Assembly
9. Support

Figure 6-4. Electric Elevator Trim Control System (Sheet 1 of 2)



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10. Turnbuckle	17. Screw	22. Screw
11. Motor Assembly	18. Housing	23. Support Assembly
12. Screw	19. Screw	24. Screw
13. Pin	20. Cover	25. Clutch Assembly
14. Sprocket	21. Cover Assembly	26. Cable Guard
15. Chain Assembly		27. Electrical Wire
16. Cover		28. Stopblock

Figure 6-4. Electric Elevator Trim Control System (Sheet 2 of 2)

**ELECTRIC ELEVATOR TRIM CONTROL
SYSTEM (OPTIONAL)**

The electric elevator trim control system is composed of a single pole single throw switch, slider switch and actuator assembly. The switches are mounted in the pilot's control wheel; the actuator assembly is mounted in the tailcone at Station 192.70. The elevator trim control cable is attached to the actuator cable which is routed around the cable drum on the actuator clutch. The electric elevator trim control system is energized when the single pole single throw switch is engaged and the slider switch is moved to the forward (DOWN) or aft (UP) position. The actuator motor drives the clutch, which moves the elevator trim control cable and places the 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 Electric Elevator Trim Actuator Assembly. (See figure 6-4.)

- a. Refer to Section 3, remove rear upholstery panel from tailcone.
- b. Remove locking clips (6) from turnbuckles.
- c. Loosen and disconnect turnbuckles (7 and 10) from the control cable.
- d. Remove screws (4) attaching actuator assembly (8) to support (9) disconnect electrical wiring (27) and remove actuator assembly.

Disassembly and Assembly of Electric 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 (25) 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 $\pm$ 3 inch-pounds.
- j. (See figure 2-12.) 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 Electric Elevator Trim Actuator Assembly. (See figure 6-4.)

- 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 Rigging Procedures, except cable tension should be 19 $\pm$ 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. Install rear upholstery panel to tailcone.

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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 lead weight used for static balance. The rotating beacon is installed in the fiberglass tip. The rudder trim tab, located at the trailing edge of the rudder, is actuated by a push-pull tube which is routed through the rudder to an actuator in the vertical fin. The rudder, attached to the vertical fin with three hinges, is operated by cables attached to a bellcrank to the lower hinge.

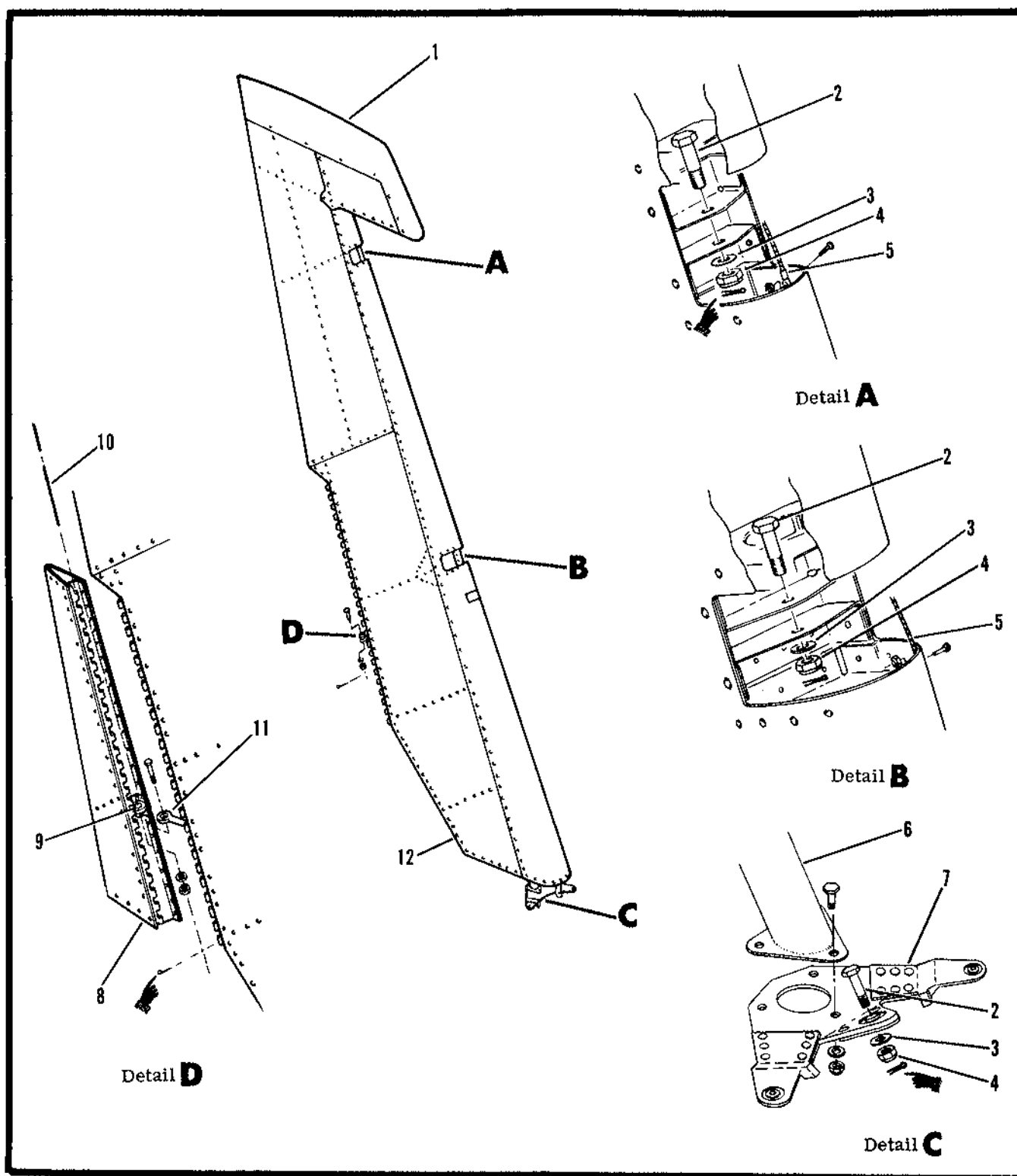
Removal of Rudder. (See figure 7-1.)

- Place a suitable support beneath the tailcone at station 132.00.
- Refer to Section 3 and remove stinger in accordance with removal procedures.
- Remove cotter pin, nut, washer and bolt from rudder trim tab push-pull tube (11).
- Remove three cotter pins, nuts, washers and bolts attaching rudder torque tube (6) to bellcrank (7).
- Disconnect bonding straps (5) from vertical stabilizer.
- Support rudder and remove nuts (4), washers (3) and bolts (2) from center and upper hinges.

- Remove rudder from vertical stabilizer by pulling aft and guiding rudder trim tab push-pull tube (11) through rudder.

Installation of Rudder. (See figure 7-1.)

- Place rudder into position, guide rudder trim tab push-pull tube (11) through rudder and align mounting holes on upper and center hinges with vertical stabilizer.
- Attach rudder to vertical stabilizer at the upper and center hinges with bolts (2), washers (3) and nuts (4).
- Attach rudder torque tube (6) to bellcrank (7) with three bolts, washers, nuts and cotter pins.
- Connect rudder trim tab push-pull tube (11) to trim tab horn (9) with bolt, washer, nut and cotter pin.
- Remove support from beneath tailcone and check rudder and rudder trim tab for proper operation and correct travel. If rigging is necessary, rig in accordance with rigging procedures.
- Refer to Section 3 and install stinger in accordance with installation procedures.



1. Fiberglass Tip	5. Bonding Strap	9. Trim Tab Horn
2. Bolt	6. Torque Tube	10. Hinge Pin
3. Washer	7. Bellcrank	11. Push Pull Tube
4. Nut	8. Trim Tab	12. Rudder

Figure 7-1. Rudder and Rudder Trim Tab Installation

RUDDER TRIM TAB.

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 7-1.)

- a. Turn rudder trim control wheel on pedestal until indicator is pointing to full right position.
- b. Disconnect rudder trim tab push-pull tube (11) by removing cotter pin, nut, washer and bolt.
- c. Remove trim tab from rudder by removing cotter pins and hinge pin (10).

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NOTE

Any further disassembly or assembly of the rudder trim tab is not advisable.

Installation of Rudder Trim Tab. (See figure 7-1.)

- a. Attach rudder trim tab to rudder with hinge pin (10) and cotter pins.
- b. Connect rudder trim tab push-pull tube (11) to trim tab with bolt, washer and nut.
- c. Check rudder trim tab for proper operation and correct travel. If necessary, rig in accordance with rigging procedures.

RUDDER CONTROL SYSTEM.

The rudder is operated by the movement of the pilot's rudder pedals (copilot's optional equipment). 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 a pulley and then aft under the floorboards and through the tailcone by pulleys to the adjustable turnbuckles which are attached to the rudder bellcrank. The bellcrank is attached directly to the rudder torque tube and also provides the lower hinge for the rudder. 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 torque tube and is routed aft around a pulley and then forward to right rudder torque tube to complete the rudder control cable system. The nose gear steering cables are attached to the right and left rudder torque tubes; routed forward to springs and then to the nose gear steering bellcrank.

Removal of Rudder Control Cables. (See figure 7-2.)

- a. Refer to Section 3 and remove the following items in accordance with removal procedures:

Trouble Shooting Rudder Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN RUDDER PEDALS AND RUDDER	Cable tension too low.	Adjust in accordance with rigging procedures.
	Broken pulley.	Replace pulley.
	Bolts attaching rudder to bellcrank are loose.	Tighten bellcrank bolts.
EXCESSIVE RESISTANCE TO RUDDER PEDAL MOVEMENT	Cable tension too high.	Adjust in accordance with rigging procedures.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Rudder binding because of faulty bearings or bent hinges.	Replace bearings and/or hinges.
	Rudder pedal torque tube bearings misaligned or need lubrication.	Loosen bearing halves, lubricate and retighten. Refer to Section 2 for lubrication requirements.
	Cables not in place on pulleys during installation.	Install cables correctly.
	Bent rudder.	Repair or replace rudder.
	Aft rudder cables incorrectly rigged.	Rig in accordance with rigging procedures.
RUDDER PEDALS NOT NEUTRAL WHEN RUDDER IS STREAMLINED		
INCORRECT RUDDER TRAVEL	Rudder bellcrank stop incorrectly adjusted.	Adjust in accordance with rigging procedures.
CORRECT RUDDER TRAVEL CANNOT BE OBTAINED	Rudder pedals contacting fuselage bulkhead.	Rig position cable, nose wheel, steering cables, and rudder cables in accordance with rigging procedures.

1. Front and rear seats or; middle and aft seats (optional equipment).
2. Front, center and rear carpet.
3. Rear upholstery panel to tailcone.
4. Stabilizer fairings.
- b. Remove access covers on cabin floor as necessary to gain access to rudder cables, pulleys and attachment points.
- c. Disconnect rudder cables (5 and 6) from bellcrank (2) by unsafetying and disconnecting turnbuckles (3).
- d. Remove pulleys (4, 9 and 15) by removing attaching nuts, washers, spacers and bolts.

NOTE

Attaching nut and bolt for pulleys (15) must be removed from inside nose wheel well.

- e. Remove fairleads through which rudder cables pass at fuselage rear spar and fuselage station 132.00.
- f. Disconnect rudder centering springs (8) from cable clamps (7) by removing nuts, spacers, washers and bolts.
- g. Remove cable clamps (7) by removing attaching nuts and bolts.
- h. Disconnect rudder cables (5 and 6) from rudder pedal torque tubes (11 and 16) by removing cotter pins, nuts and bolts.
- i. Tie guide wires to forward ends of rudder cables (5 and 6) and remove cables from aircraft by routing them out through stabilizer fairing.

NOTE

If an automatic pilot (optional equipment) is installed, disconnect from rudder cables by removing attaching clamps.

- j. Release tension on nose wheel steering cables (12 and 14) as follows:
 1. Manually turn nose wheel to an extreme right or left position to release tension on spring (13).
 2. Disconnect nose wheel steering cables (12 and 14) by either separating nose wheel steering spring components or removing cotter pins, washers and pins.

CAUTION

Tension on nose wheel steering cables must be released before rudder position cable (10) is disconnected.

- k. Disconnect rudder position cable (10) from rudder pedal torque tube (11) by removing cotter pins and pins.
 1. Remove pulley (17) by removing nut and bolt.
- m. Tie guide wire on position cable (10) and route from underneath floorboard.

Installation of Rudder Control Cables. (See figure 7-2.)

- a. If removed, place rudder position cable (10) and install pulley (17) with pins and cotter pins.

- b. Connect rudder position cable to rudder pedal torque tube (11) with pins and cotter pins.

NOTE

The right nose wheel steering cable (14) must be connected to the rudder pedal torque tube at this time, because one pin is used to attach both steering cable and position cable at this point.

- c. Connect nose wheel steering cables (12 and 14) and springs (13) in accordance with the method used to release tension.
- d. Tie rudder cables (5 and 6) to guide wires, pull into position, and remove guide wires.
- e. Install forward pulleys (15) with bolt, spacers and nut.

NOTE

When installing pulleys (15), the pulleys and spacers must be aligned and held in position from inside the cabin while attaching bolt and nut are installed from inside the nose wheel well.

- f. Connect rudder cables (5 and 6) to rudder pedal torque tubes (11 and 16) and secure with bolt, nuts and cotter pin.
- g. Install pulleys (4 and 9) in fuselage and tailcone and secure with bolts, spacers and nuts.
- h. Connect rudder cables (5 and 6) to bellcrank (2) by installing turnbuckle on terminals and cables.
- i. Install fairleads through which rudder cables pass at fuselage station 132.00 and rear spar.
- j. Install cable clamps (7), attach centering springs (8), and rig springs in accordance with rigging procedures.
- k. Rig rudder cables in accordance with rigging procedures.

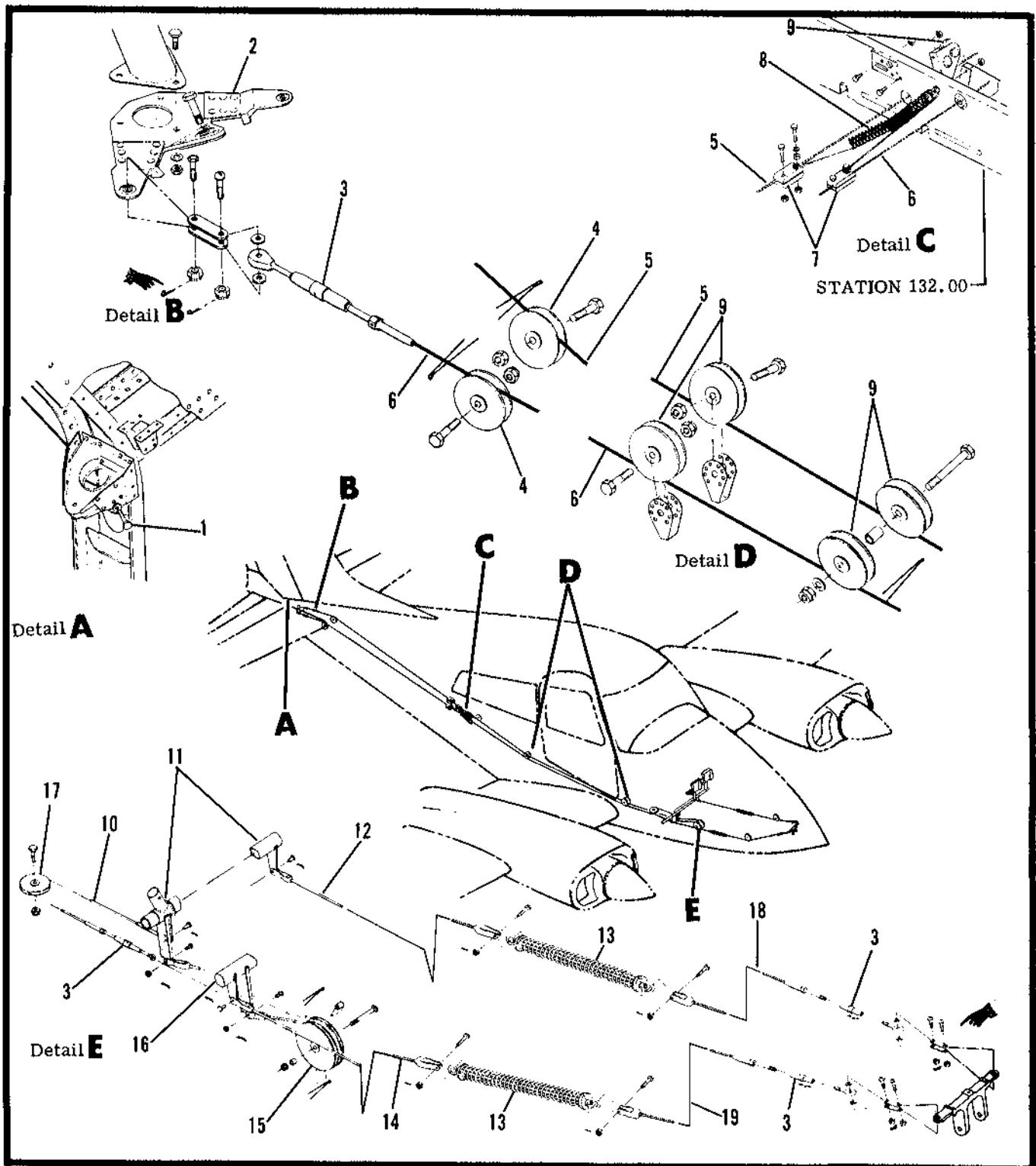
NOTE

If an automatic pilot (optional equipment) is installed, the automatic pilot cables must be connected to the rudder cables.

1. Install access covers.
 - m. Refer to Section 3 and install the following items in accordance with installation procedures:
 1. Stabilizer fairings.
 2. Rear upholstery panel.
 3. Front, center and rear carpets.
 4. Seats.

Removal of Rudder Pedal Assembly. (See figure 7-2.)

- a. Refer to Section 3 and remove front seats and front carpet in accordance with removal procedures.
- b. Remove boot, retainer and covers from lower control column.
- c. Remove access covers from forward cabin floorboards.
- d. Release tension on nose wheel steering cables as



1. Stop	7. Cable Clamps	14. Aft Right Steering Cable
2. Rudder Bellcrank	8. Rudder Centering Spring	15. Forward Fuselage Pulley
3. Turnbuckle	9. Center Fuselage Pulley	16. Torque Tube (RH, forward)
4. Aft Fuselage Pulley	10. Position Cable	17. Position Cable Pulley
5. Left Cable	11. Torque Tube (LH, aft)	18. Forward Left Steering Cable
6. Right Cable	12. Aft Left Steering Cable	19. Forward Right Steering Cable
	13. Nose Gear Steering Spring	

Figure 7-2. Rudder Control System

described in Removal of Rudder Control Cables procedures.

- e. Disconnect rudder position cable (10) and right nose wheel steering cable (14) from torque tubes (11) by removing cotter pins and pins.
- f. Disconnect left nose wheel steering cable (12) from rudder pedal torque tube (11) by removing cotter pin and pin.
- g. Disconnect rudder cables (5 and 6) from rudder pedal torque tubes (11 and 16) by removing cotter pins, nuts and bolts.
- h. (See figure 7-3.) Accomplish the following steps:
 1. Disconnect brake master cylinders (24) from the pilot's rudder pedals by removing cotter pins (5) and pins (3).
 2. Disconnect two parking brake cables (17) and four brake links (8) from rudder pedal torque tubes (22 and 23) by removing cotter pins (15), spacers (18) and pins (16).
 3. Remove copilot's rudder pedals by removing nuts (20) and bolts (21).
 4. Remove upper and lower bearing halves (26 and 27) by removing eight bolts (25). Remove rudder pedal assembly from aircraft.

NOTE

The upper and lower halves of each bearing are matched parts and should be tagged and kept in pairs.

Disassembly of Rudder Pedal Assembly. (See figure 7-3.)

- a. Remove brake links (8) from rudder pedals (4) by removing cotter pins (1), washers (9) and pins (2).
- b. Remove rudder pedals by driving out roll pins (7) and removing springs (13), spacers (12) and pins (14).

NOTE

Springs (13) and spacers (12) are not used on copilot's rudder pedals.

- c. Remove couplings (28 and 29) from brake torque tubes by removing attaching cotter pins and pins.
- d. Remove brake torque tubes from rudder pedal torque tubes (22 and 23).

NOTE

Bearings (31) in rudder pedal torque tubes (23 and 22) and bearings (11) in rudder pedal torque tube arms (10) are a press fit and should be removed for replacement only.

Assembly of Rudder Pedal Assembly. (See figure 7-3.)

- a. Insert brake torque tubes into rudder pedal torque tubes (22 and 23).
- b. Install couplings (28 and 29) on ends of brake torque tubes with attaching pins and cotter pins.
- c. Install rudder pedals on rudder pedal torque

arms (10) with spacers (12), springs (13) and pins (14). Secure with roll pins (7).

NOTE

Springs (13) and spacers (12) are not used on copilot's rudder pedals.

- d. Attach brake links (8) to rudder pedals (4) with pins (2), washers (9) and cotter pins (1).

NOTE

To facilitate installation, do not attach copilot's rudder pedal assemblies to rudder pedal torque tubes prior to installation.

Installation of Rudder Pedal Assembly. (See figure 7-3.)

- a. Place rudder pedal assembly in position, remove identification tags from bearing halves (26 and 27), and install with eight bolts (25).

NOTE

When installing bearing halves, lubricate in accordance with Section 2. Rudder pedal torque tubes must rotate freely in bearings.

- b. Install copilot's rudder pedal assemblies on rudder pedal torque tubes (22 and 23) with bolts (21) and nuts (20).

- c. Connect two parking brake cables (17) and four brake links (8) to rudder pedal torque tubes (22 and 23) with pins (16), spacers (18) and cotter pins (15).

- d. Attach brake master cylinders (24) to pilot's rudder pedals with pins (3) and cotter pins (5).

- e. (See figure 7-2.) Accomplish the following steps:

1. Attach rudder cables (5 and 6) to rudder torque tubes (11 and 16) and secure with bolts, nuts and cotter pins.

2. Attach left nose wheel steering cable (12) to rudder pedal torque tube (11) and secure with pin and cotter pin.

3. Attach right nose wheel steering cable (14) and rudder position cable (10) to rudder torque tube (11) with pins and cotter pins.

4. Connect nose wheel steering cables (12 and 14) and springs (13) in accordance with the method used to release tension.

- f. Rig rudder control system in accordance with rigging procedures.

- g. Install access covers.

- h. Install boot, retainer and cover on lower control column.

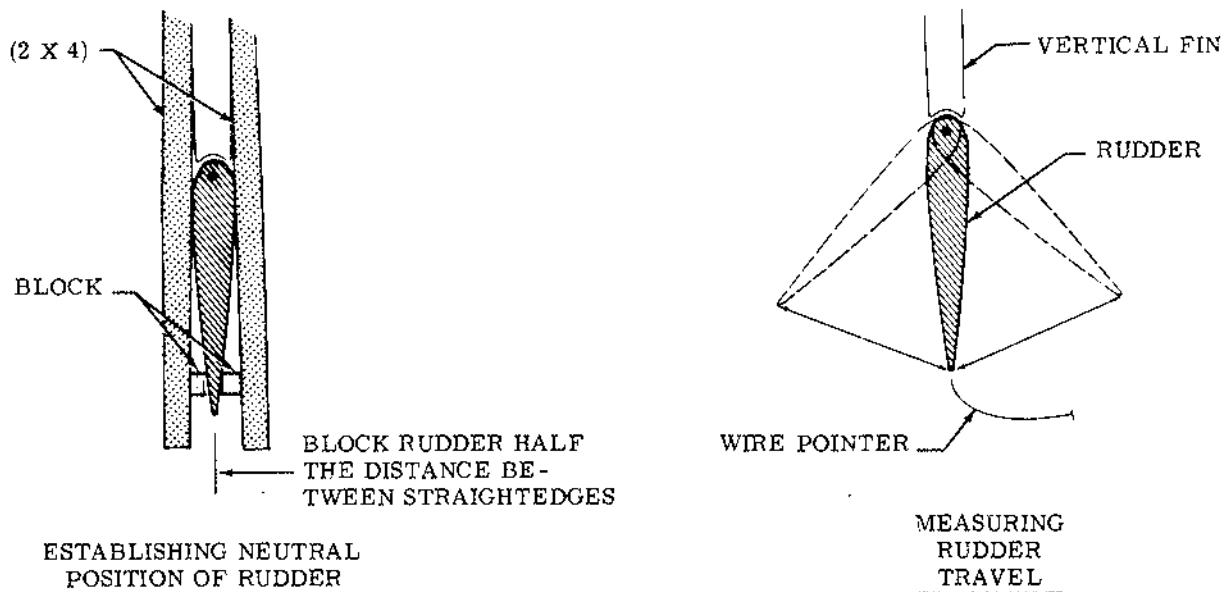
- i. Refer to Section 3 and install front seats and front carpets in accordance with installation procedures.

Rigging of Rudder Control System. (See figure 7-2.)

- a. Refer to Section 3 and remove the front seats, front carpet and stabilizer fairings.

- b. Remove access covers on floorboard.

- c. Remove safety wire from any turnbuckle which



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 12.00" and 13.00" for 310 and 13.75" and 14.25" for Turbo 310.

Figure 7-2A. Checking Rudder Travel

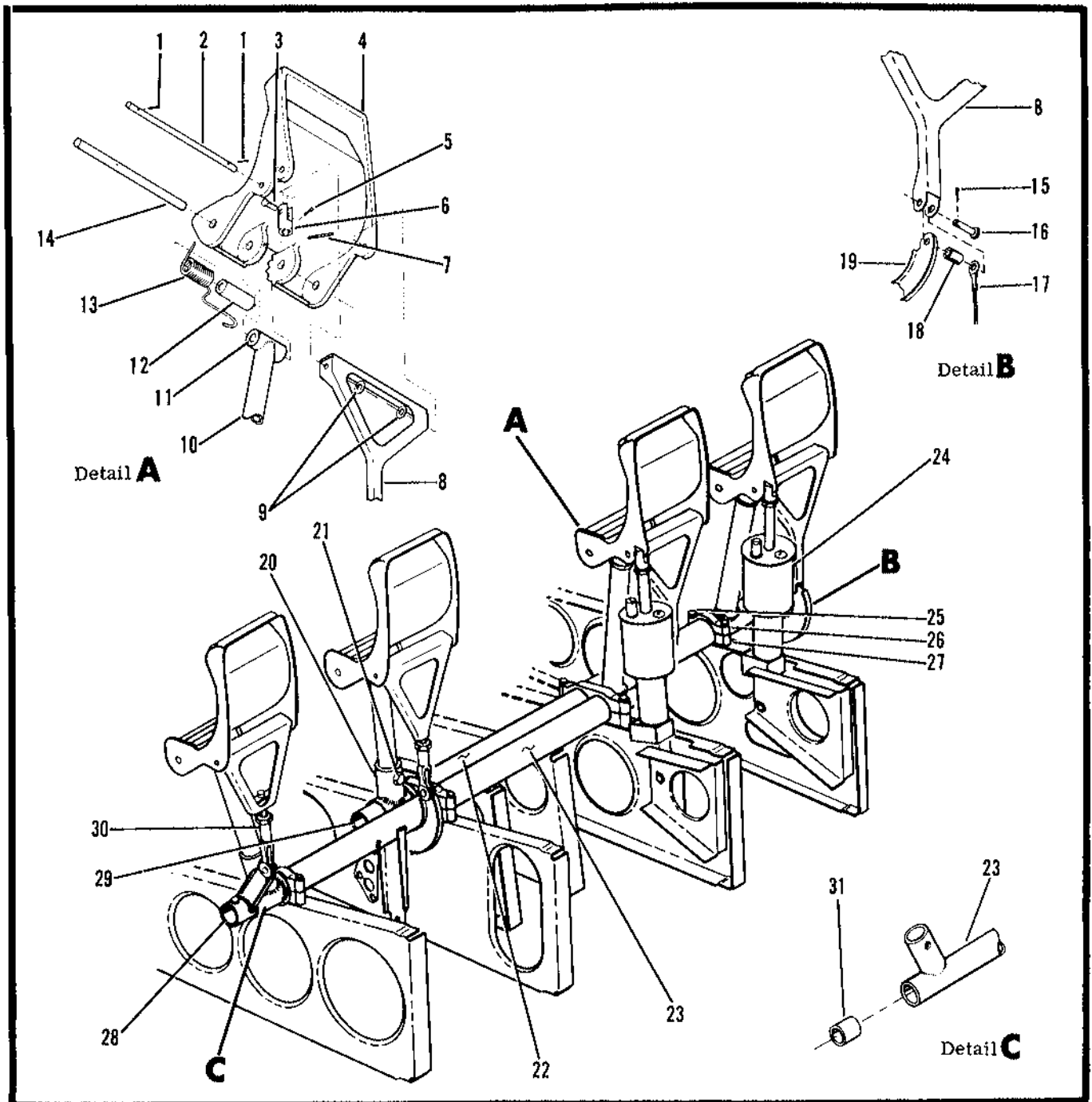
must be adjusted during rigging.

d. Position cable (10) is a "balance" cable, used to close the rudder system. Turnbuckle (3) should be adjusted so that the remaining cables can be correctly rigged and turnbuckles properly safetied.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of four hours.

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1. Cotter Pin	11. Bearing	22. Left Rudder Torque Tube
2. Pin	12. Spacer	23. Right Rudder Torque Tube
3. Pin	13. Spring	24. Brake Master Cylinder
4. Rudder Pedal	14. Pin	25. Bolt
5. Cotter Pin	15. Cotter Pin	26. Upper Bearing Half
6. Clevis Rod End	16. Pin	27. Lower Bearing Half
7. Roll Pin	17. Parking Brake Cable	28. Torque Tube Coupling
8. Brake Link	18. Spacer	29. Torque Tube Coupling
9. Washer	19. Torque Tube Coupling	30. Tie Rod
10. Torque Tube Arm	20. Nut	31. Bearing
	21. Bolt	

Figure 7-3. Rudder Pedal Assembly

NOTE

To facilitate rigging of the rudder system, adjust turnbuckle (3) so that approximately 5/8 inch of cable terminal is exposed between the terminal safety hole and the end of the turnbuckle barrel. This dimension may be varied as necessary to accomplish the desired result.

e. Place nose wheel in the neutral position and adjust nose wheel steering cable turnbuckles so that rudder pedals are in neutral and tension on nose wheel steering cables (12 and 14) is 20 ±5 pounds.

f. With nose wheel and rudder pedals in neutral, adjust aft rudder cable turnbuckles so that rudder is in neutral (streamlined) and tension on rudder cables is 25 ±5 pounds, measured forward of centering springs at fuselage station 132 or 45 ±5 pounds aft of centering springs. With rudder in neutral, each centering spring should be extended 2 ±.10 inches, and clamped to rudder cables.

NOTE

The tension on the nose wheel steering cables and the aft rudder cables operates in the same direction. If either cables are adjusted, it will be necessary to recheck the tension on the cables which were not adjusted.

g. On aircraft 310P0001 and on, adjust rudder bellcrank stop bolts (1) so that rudder travel is 29° +1°, -0° left and 29° +1°, -0° right (measured perpendicular to hinge line). Resafety bolts. On aircraft Turbo 310P0001 and on, adjust rudder bellcrank stop bolts (1) so that rudder travel is 34° +1°, -0° left and 34° +1°, -0° right (measured perpendicular to hinge line). Resafety bolts. See figure 7-2A for alternate method of measuring travel.

h. Safety all turnbuckles from which safety wire was removed.

i. (See figure 7-3.) Adjust clevis rod ends (6) on brake master cylinders (24) so the tips of the pilot's rudder pedals are aligned. Adjust right brake link tie rods (30) so that tips of copilot's rudder pedals are aligned.

WARNING

Insure that rudder moves in the proper direction when operated by the rudder pedals.

j. Install access covers.

k. Refer to Section 3 and install stabilizer fairings, carpets, and front seats in accordance with installation procedures.

RUDDER TRIM CONTROL SYSTEM.

The rudder trim control system is interconnected by chains, cables, sprockets, pulleys, miter gears, a

Troubleshooting Rudder Trim Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE	Cable tension too high.	Adjust tension in accordance with rigging procedures.
	Defective miter gear assembly.	Repair or replace miter gear assembly.
	Defective trim tab actuator.	Repair or replace actuator.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.
	Bent rudder trim torque tube in control pedestal.	Replace torque tube.
	Cables not in place on pulleys during installation.	Install cables correctly.
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB	Cable tension too low.	Adjust tension in accordance with rigging procedures.
	Broken pulley.	Replace pulley.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB (CONT)	Excessive back lash in miter gear assembly.	Repair or replace miter gear assembly.
	Worn trim tab actuator.	Repair or replace actuator.
	Worn universal joint in rudder trim torque tube in control pedestal.	Replace universal joint.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
TRIM INDICATOR FAILS TO INDICATE CORRECT TRIM POSITION	Indicator incorrectly engaged with wheel track.	Engage in accordance with rigging procedures.
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.

torque tube, an actuator, and push-pull tube. The rudder trim control wheel, mounted on the aft side of the control pedestal, incorporates a track in which the indicator rides.

Removal of Rudder Trim Control Cables and Chains. (See figure 7-4.)

- a. Refer to Section 3 and remove the following items:
 1. Front seats.
 2. Front, center and rear carpets.
 3. Rear upholstery panel to tailcone.
 4. Right side panel from control pedestal.
 5. Stabilizer fairings.
- b. Remove access covers from vertical stabilizer adjacent to rudder trim tab actuator and floorboards.
- c. Unsafety turnbuckle and disconnect aft cables (6 and 7) from forward cables (9 and 11) by removing turnbuckle, cotter pin and pin.
- d. Remove aft pulleys (8) by removing nut, bolt and cable guard cotter pins. Pull cables aft into tailcone.
- e. Remove chain guard from rudder trim tab actuator (2) by removing nuts and screws.
- f. Disengage chain (5) from sprocket (4), attach a guide wire to the chain, and remove cables and chain from vertical fin. Disconnect guide wire and leave in vertical fin to facilitate installation.
- g. Remove stop blocks (12) by removing nuts, bolts and bushings (13).
- h. Remove three sets of pulleys (14) from forward cables (9 and 11) by removing nuts, washers and bolts.
- i. Disengage forward chain (15) from sprocket (16).

NOTE

Chain guards (18) are flexible enough to allow chain to be disengaged without removing chain guards.

- j. Remove forward cables (9 and 11) by pulling out through access hole in forward cabin floor.

NOTE

To facilitate installation, tie guide wires to aft ends of cables and leave guide wires in the fuselage.

- k. Remove upper chain (24) by disconnecting master link.

NOTE

If, during the removal or installation of the chain, the indicator reaches its extreme travel, disengage from the trim control wheel track by inserting a screwdriver beneath the indicator and prying out of track. This permits the indicator to be moved, or wheel to be turned, before indicator is re-engaged with track.

1. The above procedure does not include removal of rudder trim control wheel, indicator, torque tube or miter gear assembly, because their removal is not recommended. However, removal of these components is possible by the following methods:

1. Trim control wheel (27) and indicator (28) can be removed by drilling out the rivets which attach the wheel bracket to the control pedestal and the rivet around which the indicator pivots.
2. Torque tube (20) can be removed by removing upper roll pin and lower roll pin.

NOTE

To gain access to the lower roll pin, it may be necessary to remove the control pedestal, or to drill out the rivets which attach the lower right side panel.

3. Sprocket (23) and sprocket shaft (21) can be removed by removing the roll pin. Chain guard (22) can be removed by removing nuts and screws.

4. Miter gear assembly can be removed by removing the control pedestal and drilling out enough attaching rivets to allow the section of the floor above the miter gear assembly to be lifted for access.

Installation of Rudder Trim Control Cables and Chains. (See figure 7-4.)

- a. Install upper chain (24) on sprockets (23 and 25) and connect with master link.
- b. Tie ends of cables (9 and 11) to the guide wires, pull into position, and remove guide wires.
- c. Rotate rudder trim control wheel (27) to center indicator (28), and engage forward chain (15) with sprocket (16) so that the ends of the chain are equal in length from the sprocket.
- d. Install three sets of pulleys (14) with bolts, washers and nuts, insuring that the cables are correctly in place as pulleys are installed.
- e. Tie the aft chain (5) to the guide wire, pull into position in the vertical fin, and remove the guide wire.
- f. Rotate actuator sprocket (4) so that rudder trim tab is in neutral, and engage chain (5) with sprocket (4) so that the ends of the chain are equal in length from the sprocket.
- g. Install the chain guard with screws and nuts.
- h. Install aft pulleys (8) with bolts, nut and cable guard cotter pins.
- i. Connect aft left cable (7) to forward left cable (9) with pin and cotter pin. Connect aft right cable (6) to forward right cable (11) with turnbuckle (10).
- j. Install the stop blocks (12) with bushings (13), bolts and nuts, and rig the rudder trim control system in accordance with rigging procedures.
- k. Install access covers on vertical fin and cabin floor.

1. Refer to Section 3 and install the following items:
 1. Stabilizer Fairings.
 2. Right side panel on control pedestal.
 3. Rear upholstery panel to tailcone.
 4. Front, center, and rear carpets.
 5. Front seats.

Removal of Rudder Trim Tab Actuator. (See figure 7-4.)

- a. Refer to Section 3 and remove rear upholstery panel to tailcone.
- b. Remove access hole cover from vertical stabilizer adjacent to rudder trim tab actuator (2).
- c. Unsafety turnbuckle (10) and disconnect aft cables (6 and 7) from forward cables (9 and 11) by removing turnbuckle (10), cotter pin and pin.
- d. Remove chain guard by removing nuts and screws.
- e. Disengage chain (5) from sprocket (4) and tie chain to screw hole in vertical fin.
- f. Disconnect rudder trim tab push-pull tube from the actuator screw (1) by removing nut, washer and bolt.
- g. Remove clamps (3) by removing bolts and washers, and remove the rudder trim tab actuator (2).

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 7-4.)

- a. Insert the rudder trim tab actuator (2) into position in vertical stabilizer, and install clamps (3) with bolts and washers.
- b. Attach the rudder trim tab push-pull tube to the actuator screw (1) with bolt, washer and nut.
- c. Rotate actuator sprocket (4) so that rudder trim tab is in the neutral position, and engage chain (5) with sprocket (4) so that the ends of the chain are equal in length from the sprocket.
- d. Install the chain guard with screws and nuts.
- e. Connect the aft left cable (7) to forward left cable (9) with pin and cotter pin. Connect aft right cable (6) to forward right cable (11) with turnbuckle (10).
- f. Rig rudder trim control system in accordance with rigging procedures.
- g. Refer to Section 3 and install rear upholstery panel to tailcone.
- h. Install access hole cover on vertical stabilizer.

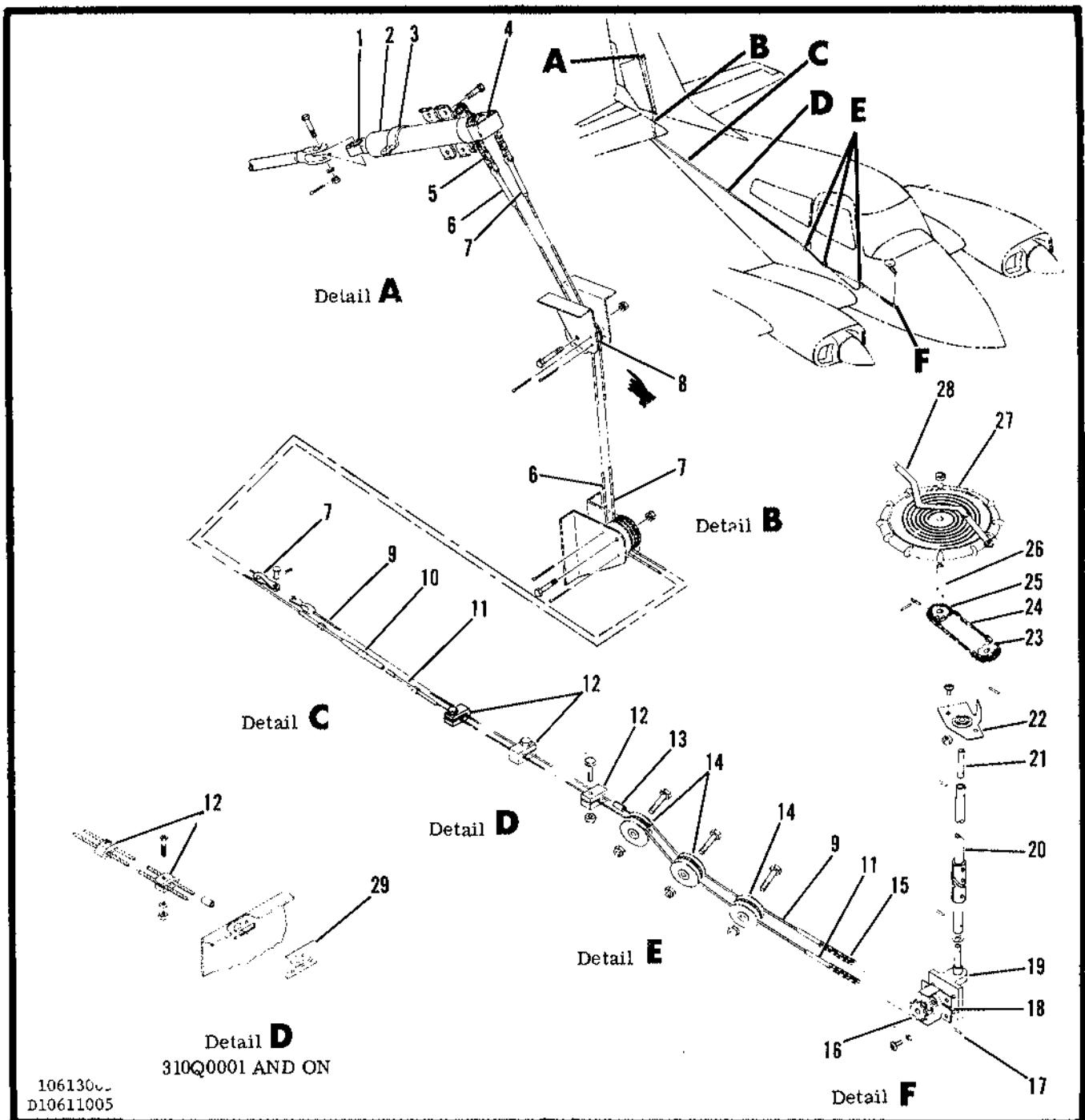
Rigging the Rudder Trim Control System. (See figure 7-4.)

- a. Refer to Section 3 and remove the following items:
 1. Front Seats.
 2. Front, center and rear carpets.
 3. Rear upholstery panel to tailcone.
- b. Remove floorboard access covers and cover from vertical stabilizer adjacent to rudder trim tab actuator.
- c. Remove access hole cover from vertical fin adjacent to rudder trim tab actuator.
- d. Remove safety wire from turnbuckle (10) connecting rudder trim control cables, adjust to 10 $\pm$ 3 pounds tension, and resafety turnbuckle.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for four hours.

- e. Move rudder trim control system to neutral by rotating trim control wheel so that the ends of the chain (5) are equal in length from actuator sprocket (4), and the ends of chain (15) are equal in length from sprocket (16).
- f. Adjust the rudder trim indicator (28) to the neutral position by inserting 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.
- g. Remove nut, washer and bolt attaching push-pull tube to the rudder trim tab.



1. Actuator Screw	10. Turnbuckle	20. Torque Tube
2. Rudder Trim Tab Actuator	11. Right Forward Cable	21. Sprocket Shaft
3. Clamp	12. Stop Block	22. Upper Chain Guard
4. Actuator Sprocket	13. Bushing	23. Forward Sprocket (Upper)
5. Aft Chain	14. Forward Pulley	24. Upper Chain
6. Right Aft Cable	15. Forward Chain	25. Control Wheel Sprocket
7. Left Aft Cable	16. Forward Sprocket (Lower)	26. Sprocket Shaft
8. Aft Pulley	17. Roll Pin	27. Rudder Trim Control Wheel
9. Left Forward Cable	18. Lower Chain Guard	28. Indicator Arm
	19. Gear Assembly	29. Rub Block

Figure 7-4. Rudder Trim Control System

- h. Place the rudder and the rudder trim tab in neutral. Adjust actuator screw (1) so that the aft hole in the push-pull tube is aligned with the hole in the trim tab horn, attach with bolt, washer and nut.
- i. Loosen stop blocks (12) and move the rudder trim tab to $20^{\circ} +1^{\circ}$, -0° right (measured perpendicular to hinge line. Locate aft stop block adjacent to cable (11) terminal and tighten. Slide center stop block against aft stop block and tighten.
- j. Move the rudder trim tab to $25^{\circ} +1^{\circ}$, -0° left (measured perpendicular to hinge line. Slide forward stop block against center stop block and tighten.
- k. Install floorboard access covers and cover on

vertical stabilizer adjacent to trim tab actuator.

- 1. Refer to Section 3 and install the following items:
 - 1. Rear upholstery panel to tailcone.
 - 2. Rear, center and front carpets.
 - 3. Front seats.
- m. Tolerance for rudder trim tab travel is plus one degree and minus zero degrees.

WARNING

Insure that the rudder trim moves in proper direction when operated by the trim control wheel.

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 consists of the flap preselect assembly and flap actuator assembly. The actuator assembly is an electric motor which drives a gear reduction unit, two sprockets connected in tandem to the reduction unit output shaft by special rivets. The sprockets, drive two chain cables which actuates four bellcranks in each wing which are interconnected by push-pull tubes. The flap preselect assembly consists of a preselect lever assembly mounted on the instrument panel, flap preselect control cable attached to the preselect lever assembly and routed

aft under the floorboard and attached to the flap control cable. When the preselect lever assembly is placed in the 0° (UP), 15° or 35° (DOWN) positions, 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 310Q0401 and on, a warning switch is mounted on the flap preselect mounting bracket to provide an aural warning anytime the flap preselect handle is lowered past the 15° position with the landing gear not extended and locked.

Troubleshooting Flap Control System.

TROUBLE	PROBABLE CAUSE	CORRECTION
FLAPS FAIL 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.

TROUBLE	PROBABLE CAUSE	CORRECTION
FLAPS FAIL TO EXTEND OR RETRACT (CONT.)	Defective flap motor.	Replace flap motor.
	Defective electrical circuit.	Replace defective wires.
	Stripped or broken drive gear or 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 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.
FLAPS NOT SYNCHRONIZED OR FAIL TO FIT EVENLY WHEN RETRACTED	Incorrect adjustment of push-pull rods.	Adjust in accordance with rigging procedures.
	Bent push-pull rods.	Straighten or replace.
	Incorrect adjustment of bellcrank interconnecting push-pull tubes.	Adjust in accordance with rigging procedures.
	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 rivets and/or sprocket.
	Broken chain, cable or attaching pin.	Replace broken parts.

Removal of Flap. (See figure 8-1.)

The following is a removal procedure for the left inboard flap. Remove the other flaps in a similar manner.

- a. Extend flaps.
- b. If inboard flap is being removed, remove lower aft wing fillet.
- c. Disconnect lower scissors link assemblies (17) by removing nuts, washers, spacers and bolts.
- d. Remove the safety from the bent end of the hinge pin (12) 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 Flap. (See figure 8-1.)

- a. Attach flap to wing with hinge pin (12). Safety bent end of hinge pin (12).

NOTE

To facilitate hinge pin installation, check the hinges and pin for distortion, lubricate hinge pin and taper end of hinge pin.

- b. Connect lower scissors link assemblies (17) to flap by installing bolts, spacers, washers and nuts.
- c. If lower aft wing fillet was removed, install with attaching screws.
- d. Check flap for proper operation and correct travel. See Rigging of Flap Control System for limits and tolerances.

Removal of Flap Control Cables and Chains. (See figure 8-1.)

- a. Remove center seats and center carpet in accordance with Section 3.
- b. Remove access covers above and below flap motor.
- c. Remove aft wing root fillet and aft wheel wells access cover.
- d. Lower flaps several degrees to decrease tension on return cables, remove safety from four turn-

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buckles (27), and disconnect turnbuckles.

e. Disconnect flap extend and return cables from bellcranks (20) by removing cotter pins, nuts and bolts.

f. Remove outboard pulleys (22) by removing nuts and bolts.

NOTE

Cable guard cotter pins are quite difficult to install and should be removed only for replacement.

g. Remove pulleys (19) and cable guards (24) by removing nuts and bolts.

h. Remove pulleys (25 and 26) by removing nuts, bolts and cable guard cotter pins.

i. Tie guide wires to flap cables, pull out through access hole in cabin floor, and disconnect guide wires.

j. (See figure 8-2.) Unsafety and remove four screws, remove chain guard (7), and disengage chains from sprockets (13).

Installation of Flap Control Cables and Chains. (See figure 8-1.)

a. Tie flap cables to guide wires and pull into position.

b. Attach flap extend and return cables (18, 21, 30 and 31) to links of bellcranks (20 and 35) with bolts, nuts and cotter pins.

c. Place return cables in position on pulleys (22 and 36) and install with bolts and nuts.

d. Install pulleys (19 and 34) and cable guards (24) with bolts and nuts.

e. Install pulleys (25, 26, 32 and 34) with bolts, nuts and cable guard cotter pins.

f. Engage chains (28 and 29) with reduction unit sprockets, connect to the cables with four turnbuckles (27), and rig in accordance with flap rigging procedures.

g. Install aft wing root fillet and aft wheel wells access cover.

h. Install access covers above and below flap actuator.

i. Install carpet and seats in accordance with Section 3.

Removal of Flap Bellcrank. (See figure 8-1.)

Eight bellcranks are used to operate the flaps. The following is a removal procedure for the left inboard bellcrank of the left inboard flap. Remove the other bellcranks in a similar manner.

a. Remove center seats and center carpet in accordance with Section 3.

b. Remove access cover from above flap actuator and aft wheel well.

c. Lower flaps several degrees to decrease tension on return cables, remove safety from turnbuckles (27), and loosen turnbuckles to release tension on cables which route to affected bellcrank only.

d. Disconnect flap cables (18 and 21) from bellcrank by removing cotter pins and pins.

NOTE

Steps "a" through "d" apply only to removal of the inboard bellcrank of each inboard flap. To remove any other bellcrank, remove access hole covers from underside of wing adjacent to affected bellcrank.

e. Disconnect push-pull rod (2) from bellcrank by removing attaching nut, spacers and bolt.

f. Disconnect interconnecting push-pull tube (7) from bellcrank by removing attaching nut and bolt.

g. Remove bellcrank by removing safety wire from bolt and removing bolt and washers, taking care that bushing (9) does not fall from bellcrank during removal.

NOTE

Access to bolt is gained by removing a plug button from the underside of the wing beneath the bolt.

Installation of Flap Bellcrank. (See figure 8-1.)

a. Insert bellcrank through access hole and install with washers and bolts. Safety bolts and install plug button on underside of wing beneath bolt.

NOTE

Washers and bushing (9) must be in place before installing bolt.

b. Attach interconnecting push-pull tube (7) to bellcrank with attaching bolt and nut.

c. Connect push-pull rod (2) to bellcrank with attaching bolt, spacers and nut.

d. Connect flap cables (18 and 21) to bellcrank (8) with bolts, nuts and cotter pins.

e. Rig flaps in accordance with rigging procedures.

f. Reinstall access covers.

g. Install carpet and seats in accordance with Section 3.

Removal and Installation of Flap Scissors Assembly. (See figure 8-1.)

a. Removal of flap scissors is as follows:

1. Extend flaps.

2. Disconnect upper and lower scissors links (14 and 17) by removing nuts, washers, spacers and bolts.

3. Remove scissor by removing nut, washers, spacers and bolts which attach scissor to push-pull rod.

b. Install flap scissors as follows:

1. Attach scissor links (14 and 17) to push-pull rod using bolt, spacers, washer and nut.

2. Connect upper and lower scissor links (14 and 17) using bolts, spacers, washers, and nuts.

3. Check flaps for proper operation and correct travel. See Rigging of Flap Control System for limits and tolerances.

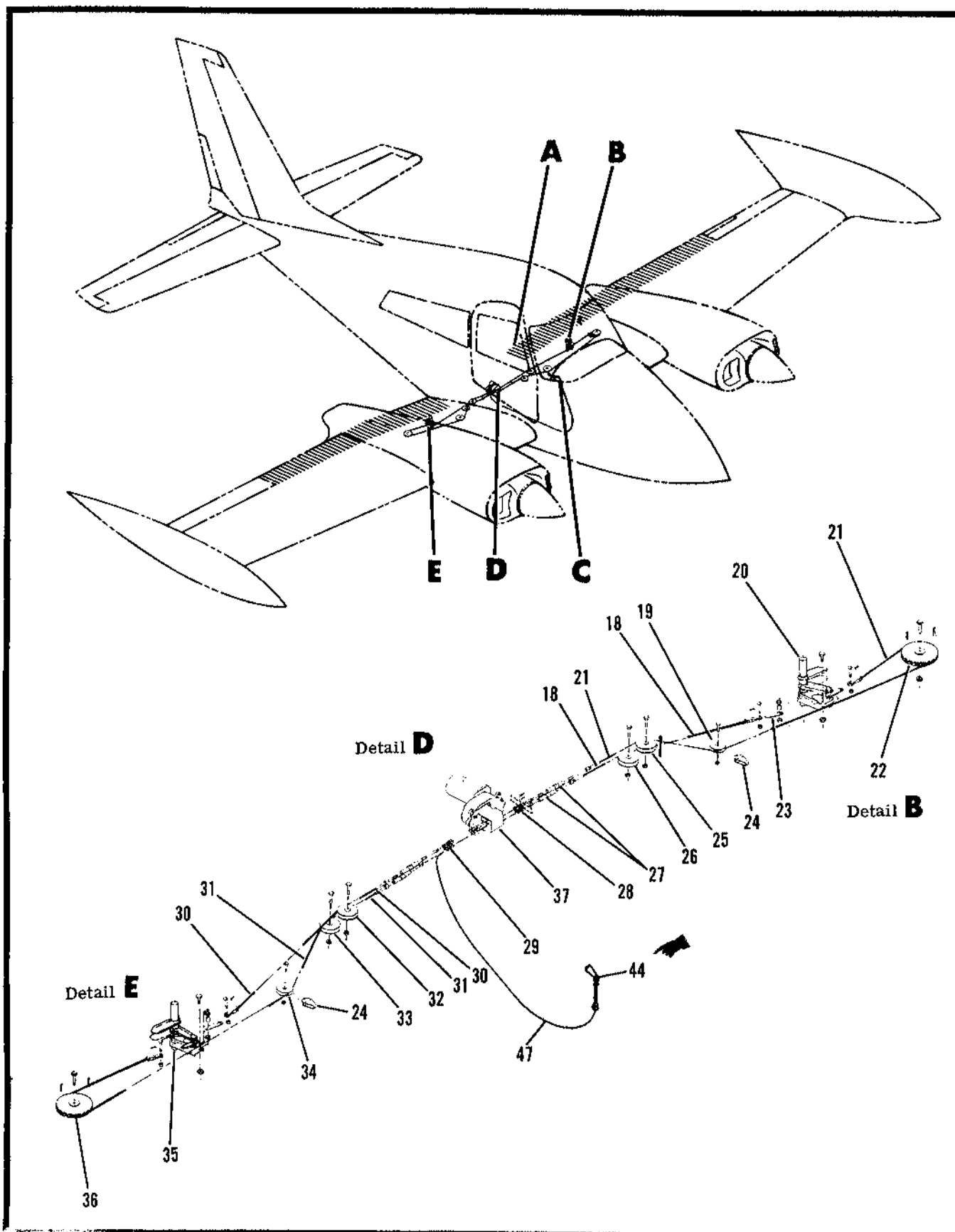
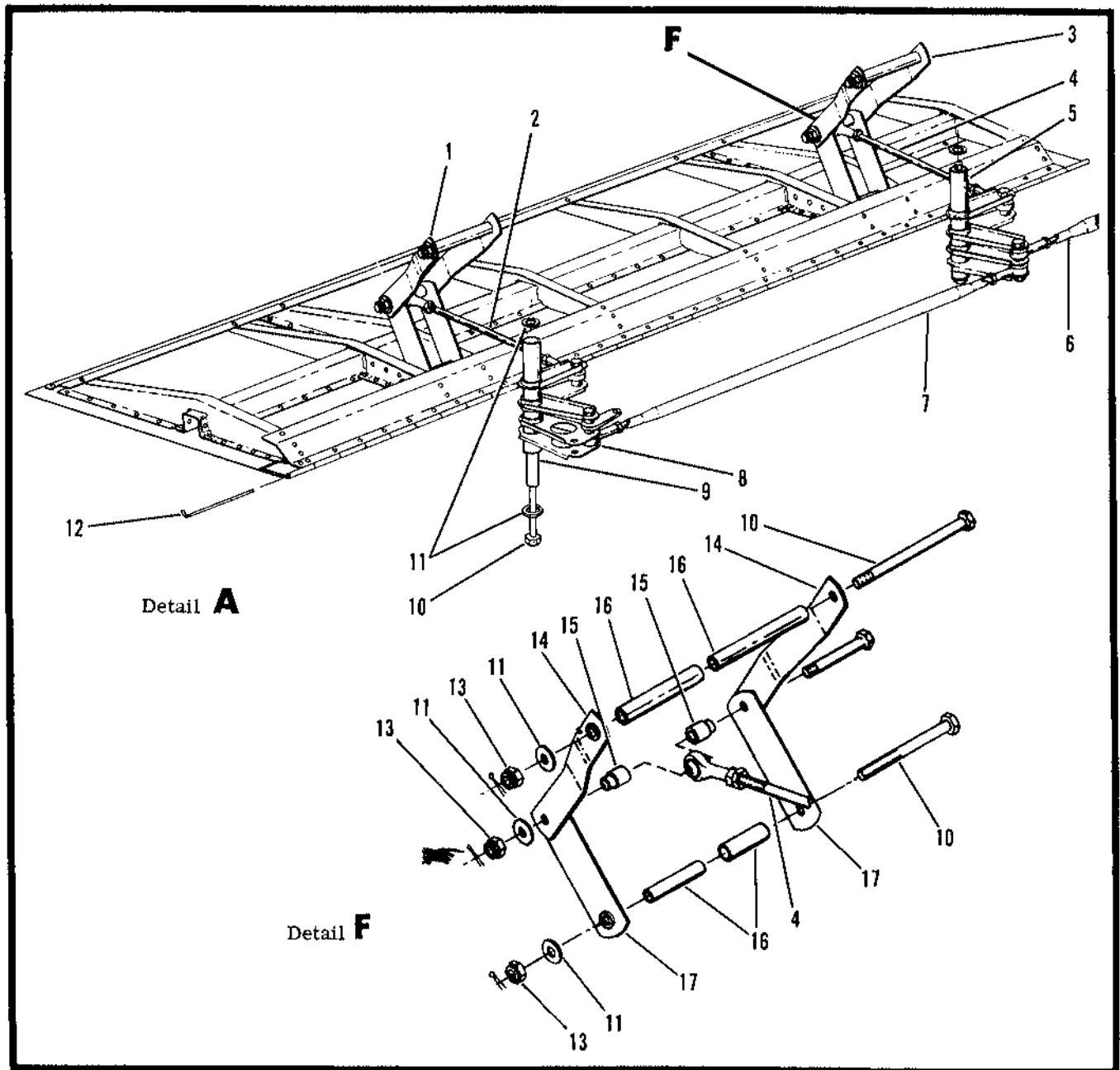
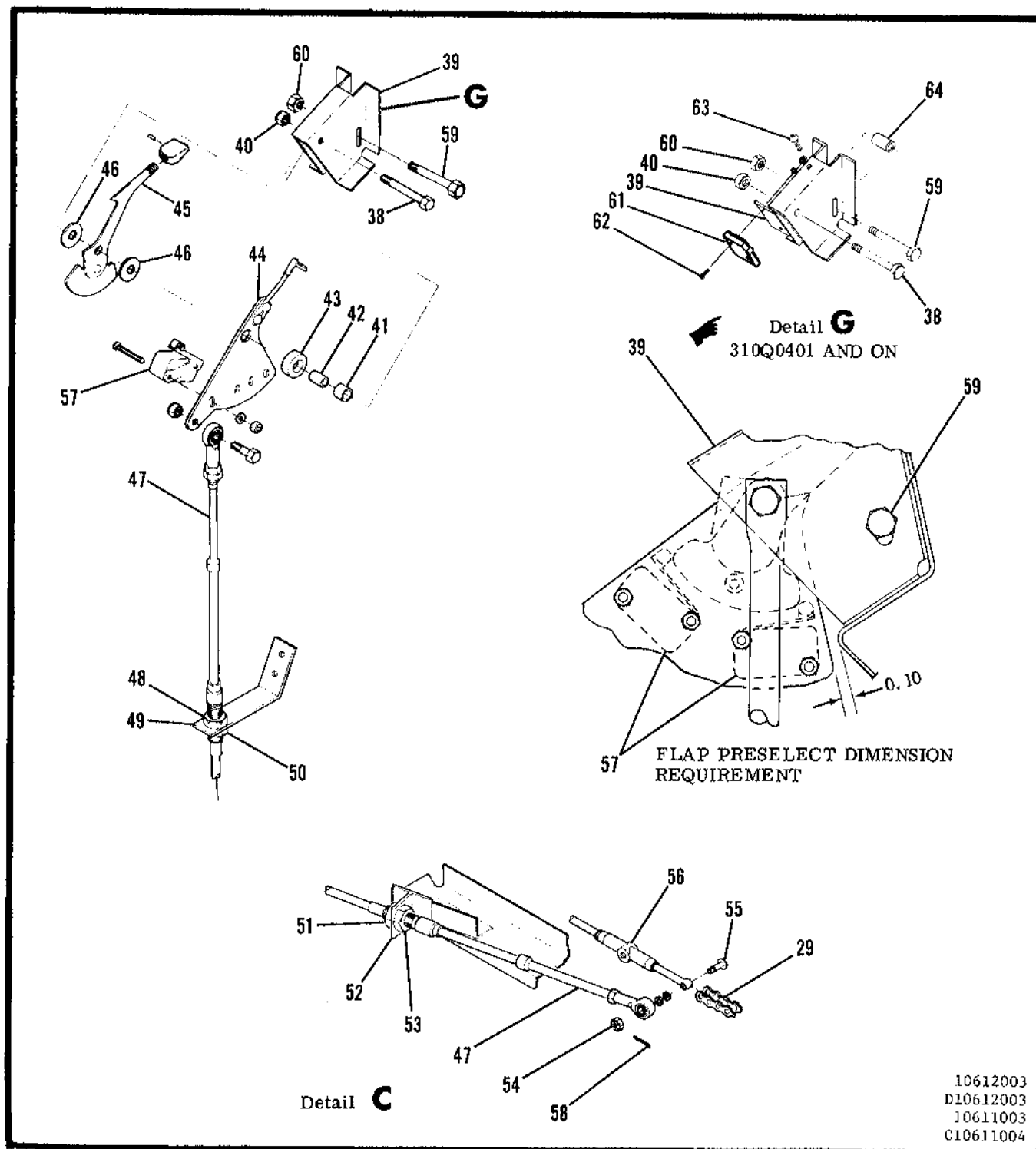


Figure 8-1. Flap Installation and Control System (Sheet 1 of 3)



1. Inboard Scissor Assembly	14. Upper Link Assembly	26. Pulley
2. Inboard Push-Pull Rod	15. Spacer	27. Turnbuckles
3. Outboard Scissor Assembly	16. Spacer	28. Left Flap Chain
4. Outboard Push-Pull Rod	17. Lower Link Assembly	29. Right Flap Chain
5. Outboard Bellcrank	18. Left Extend Cable	30. Right Extend Cable
6. Center Interconnecting Push-Pull Tube	19. Pulley	31. Right Return Cable
7. Inboard Interconnecting Push-Pull Tube	20. Inboard Left Bellcrank	32. Pulley
8. Inboard Bellcrank	21. Left Return Cable	33. Pulley
9. Bushing	22. Pulley	34. Pulley
10. Bolt	23. Cable Attachment Link	35. Inboard Right Bellcrank
11. Washer	24. Cable Guard	36. Pulley
12. Hinge Pin	25. Pulley	37. Chain Guard
13. Nut		

Figure 8-1. Flap Installation and Control System (Sheet 2 of 3)



38. Bolt	44. Arm	51. Nut	58. Cotter Pin
39. Bracket	45. Lever	52. Bracket	59. Stop Bolt
40. Nut	46. Washer	53. Nut	60. Nut
41. Bushing	47. Control Cable	54. Nut	61. Warning Switch
42. Bushing	48. Nut	55. Bolt	62. Screw
43. Washer	49. Bracket	56. Turnbuckle	63. Screw (Stop)
	50. Nut	57. Preselect Switch	64. Bushing

Figure 8-1. Flap Installation and Control System (Sheet 3 of 3)

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.)

Flap motor can be removed without removing reduction unit; however, due to limited working space, it is desirable to remove reduction unit.

- Remove center seats and center carpet in accordance with Section 3.
- Remove access cover above flap actuator and underside at fuselage beneath flap motor.
- Lower flaps several degrees to release tension on return cables, remove safety wire from turn-buckles (27, figure 8-1), and loosen enough to disengage chains.
- Disconnect electrical wire from flap motor (2).
- If optional Nav-O-Matic 400A Autopilot is installed remove two screws (25) securing bracket (23) to reduction unit (3).
- Unsafety and remove four screws (8), remove chain guard (7) and disengage chains from sprockets (9).
- Remove four nuts (4) and screws (5) attaching reduction unit to fuselage rear spar.
- Pull complete actuator assembly aft, tilt it, and remove through access hole.

NOTE

If an automatic pilot (optional equipment) is installed, disconnect automatic pilot cables from clamps attaching them to aileron cables, and separate beneath flap actuator to remove actuator from aircraft.

Removal of Limit Switch Bracket. (See figure 8-2.)

- Disconnect and tag electrical wires and route from bracket.
- Remove safety wire from bolts (1).
- Remove screw (26) and bolt (1). The lower bolt only needs to be loosened. Bracket hole is slotted for removal.
- Remove bracket (14) and switch assembly.

Installation of Limit Switch Bracket. (See figure 8-2.)

- Position bracket (14) and switch assembly to motor (2) and secure with bolts (1), screw (26) and lockwasher (27). Safety wire bolts (1).
- Route electrical wires through bracket and grommet. Connect wires and remove tags.
- Check that the reduction unit output shaft (11) does not turn when 800 pound-inches torque is applied.
- Adjust setscrew (20) to provide 0.005 maximum transfer shaft movement and secure with locknuts (21).

NOTE

Shaft movement measurement should be measured between miter gear (15) and miter gear (16).

- e. Connect 24 volt power supply and operate each direction to check limit switches.
- f. Assure limit switches operate properly and remove 24 volt power supply.

Installation of Flap Actuator Assembly. (See figure 8-2.)

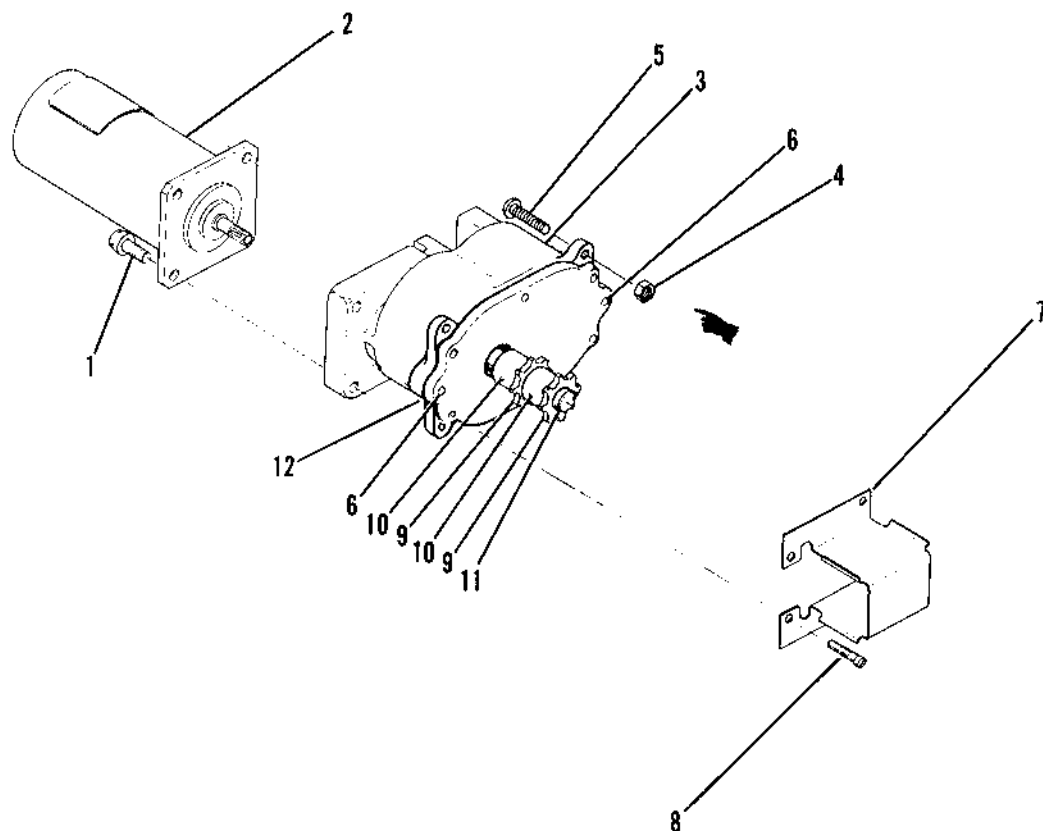
- a. Adjust limit switches at the end of the adjusting slot which is farthest from cam (18) to allow for travel when rigging.
- b. Attach wires from motor to limit switches and from motor to ground at their respective connections, and remove tags.
- c. Place flap actuator assembly near access hole in underside of the fuselage, attach electrical wiring to flap motor.

- d. Insert actuator assembly through access hole and install with four screws and nuts.

NOTE

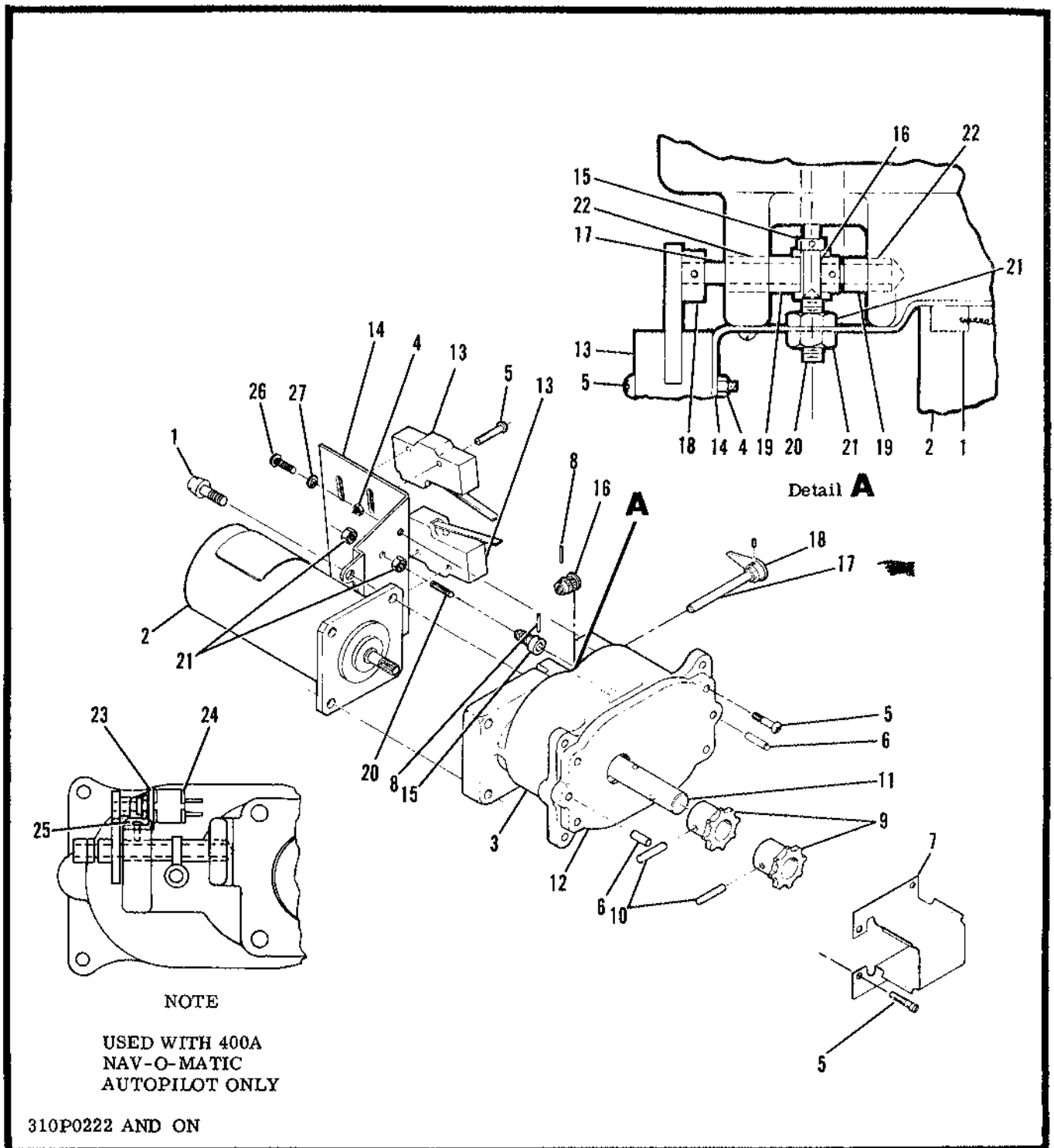
If an automatic pilot (optional equipment) is installed, connect the automatic pilot cables to the clamps which attach them to the aileron cables.

- e. Engage chains with sprockets (9) and rig flap control system in accordance with rigging procedures.
- f. Install access covers above and below flap actuator.
- g. Install carpet and seats in accordance with Section 3.



310P0001 TO 310P0222

Figure 8-2. Flap Actuator Assembly (Sheet 1 of 2)



1. Bolt	8. Roll Pin	15. Miter Gear	22. Spacer Bushing
2. Flap Motor	9. Sprocket	16. Miter Gear	23. Resistor Bracket
3. Reduction Unit	10. Roll Pin	17. Shaft	24. Resistor
4. Nut	11. Output Shaft	18. Cam	25. Screw
5. Screw	12. Reduction Unit Cover Plate	19. Spacer	26. Screw
6. Dowel Pin	13. Limit Switches	20. Set Screw	27. Lockwasher
7. Chain Guard	14. Limit Switch Bracket	21. Locknut	

Figure 8-2. Flap Actuator Assembly (Sheet 2)

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Removal of Flap Preselect Assembly. (See figure 8-1.)

- a. Remove knob from lever (45).
- b. Disconnect control cable (47) from arm (44).
- c. Remove nut (40), bolt (38) and flap preselect lever assembly from bracket (39).

Disassembly and Assembly of Flap Preselect Lever Assembly. (See figure 8-1.)

- a. Remove washers (46).
- b. Remove bushing (41 and 42) and washer (43) from arm (44).
- c. Remove microswitches (57) from arm (44).
- d. Assembly of flap preselect is accomplished by reversing disassembly procedure.

Installation of Flap Preselect Assembly.

- a. Position flap preselect in bracket (39) and install bolt (38) and secure with nut (40).
- b. Connect control cable (47) to arm (44).
- c. Install knob on lever (45).

Removal of Flap Preselect Control Cable. (See figure 8-1.)

- a. Remove necessary carpets and floorboards in accordance with Section 3 to gain access to flap preselect control cable.
- b. Disconnect control cable (47) from arm (44) and remove rod end from control cable (47).
- c. Remove control cable (47) from bracket (49) by removing nut (48).
- d. Disconnect control cable (47) from turnbuckle (56) and remove rod end from control cable (47).
- e. Remove control cable (47) from bracket (52) by removing nut (53).
- f. Remove clamps securing control cable (47) to bulkheads.

Installation of Flap Preselect Control Cable. (See figure 8-1.)

Installation of flap preselect control cable is accomplished by reversing removal procedure; rig in accordance with rigging procedure.

Rigging Flap Control System. (See figure 8-1.)

- a. Remove center seats, carpet and floorboards in accordance with Section 3.
- b. Check length of inboard push-pull rod (2) on each inboard flap and adjust to 10.45 inches.

- c. Check length of interconnected 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

- d. Adjust remaining push-pull rods from bellcranks to scissors so that flaps fit evenly when in the UP position.
- e. Connect 24 volt external power source, using a two-position momentary switch, to the flap motor wires so the flap may be observed while being operated during rigging.

CAUTION

Use caution while operating flaps with an external power source, as the microswitches are inoperative.

- f. (See figure 8-2.) With flaps in the UP position, check flap chains on sprockets and if necessary, adjust as follows:

1. Tape flaps in the UP position.
2. Unsafety and loosen turnbuckles.
3. Remove chain guard (7) and disengage chain from sprockets (9).
4. (See figure 8-2.) Engage right chain with aft sprocket (9) so that approximately $3\frac{1}{2}$ links extend around bottom side of sprocket.
5. (See figure 8-2.) Engage left chain with forward sprocket (9) so that 3 links extend around the top side of sprocket.
6. Install chain guard (7) with four screws and safety.
7. (See figure 8-1.) Connect RH extend cable (30) to long end of chain (top side of aft sprocket) and route over pulley (32) to bellcrank (35).
8. Connect RH return (31) to the short end of chain (bottom side of aft sprocket) and route over pulleys (33 and 34) around outboard pulley (36) and back to bellcrank (35).
9. Connect LH extend cable (18) to long end of chain (bottom side forward sprocket) and route over pulley (26) to bellcrank (20).
10. Connect LH return cable (21) to short end of chain (top side of forward sprocket) and route over pulleys (25 and 19) around outboard pulley (22) and back to bellcrank (20).
11. With flaps secured in UP position, tighten turnbuckles until all slack is out of cable. Temporarily rig both return cables (21 and 31) with 185 pounds tension. Final tension on return cables should be 225 +25 pounds with flaps in the UP position. The differential tension between left and right cable should not exceed 25 pounds.

NOTE

Length of push-pull rods are measured between centerline of rod and bolt holes.

NOTE

At this point, recheck flap position as to being in proper position with respect to wing

trailing edge. Should further adjustment of push-pull rods be necessary, this must be accomplished before final setting of cable tension.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of four hours.

12. Remove tape and lower flaps a few degrees at a time, observing for any unusual tension build-up in the cables or binding of push-pull tubes and bell-cranks, until flaps reach 35° +1° -0°.

13. Rig both extend cables (18 and 30) with 85 pounds of tension. Final tension of extend cables, with flaps DOWN should be 85 ± 10 pounds, differential tension between right and left should not exceed 25 pounds.

Rigging Flap Preselect System. (See figure 8-1.)

The following procedure is applicable to 310P0222 and On.

- a. Remove center seats and center carpets in accordance with Section 3.
- b. Remove floorboards.
- c. Connect 24 volt external power source to external power receptacle.

NOTE

To facilitate rigging of the flap preselect system, a two position momentary switch with suitable length 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.

- d. Loosen nuts (48, 50, 51 and 53) to allow freedom of movement of cable (47).
- e. Adjust flap motor limit switches to provide 0° and 37° +1°, -0° flap travel. Adjust return cable tension to 280 lbs. ± 20 lbs. with flaps retracted and extend cable tension to 85 lbs. ± 10 lbs. with flaps extended.
- f. Center control cable (47) in brackets (49 and 52) and tighten nuts (48, 50, 51 and 53) with flaps retracted.
- g. At flap preselect assembly adjust limit switches rollers snug against cam ends.
- h. Tighten bolt (38) to obtain a 2 lb. ± .5 lb. friction load measured at end of preselect lever with lever between 0° and 15° settings.
- i. Adjust control cable (47) rod end and/or cable housing such that 15° flap selection results in 15° ± 0° flap travel.
- j. Check for .10 minimum clearance between flap arm (44) and stationary panel.
- k. Adjust pointer (bend wire) on arm (44) to center on 15° mark.
- l. Adjust flap preselect lever upper stop to limit 0° flap setting with 225 lbs. ± 25 lbs. return cable ten-

sion. Flap angular travel must be 0° retracted.

m. Position flap preselect lever to 35° (DOWN) adjust stop bolt (59) to limit flap travel to 35° +1°, -0°.

NOTE

When preselect lever assembly is placed in the 35° (DOWN) position, the angular travel must be 35° +1°, -0°.

n. Aircraft 310Q0401 and On, adjust flap/landing gear warning switch (61). Refer to Adjustment of Landing Gear Warning System, Section 4.

o. Check flap surface travel tolerances at the following locations: 15° ± 0° DOWN; 35° +1°, -0° DOWN; 15° +0°, -2° from DOWN to UP.

p. Check the extension and retraction time. The flaps should extend in 6.5 to 9.5 seconds and retract in 6.5 to 9.5 seconds.

NOTE

If the flaps will not extend or retract in 6.5 to 9.5 seconds, the flap motor should be replaced.

q. Disconnect the 24 volt external power source from flap motor wiring.

r. Perform operational checkout of flap and preselect system, using the aircrafts power system, to ensure that proper operation of limit switches, preselect switches and flap angular movements are within specified tolerances.

s. Safety wire all turnbuckles and install floorboards.

t. Install center carpets and center seats 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.

Section 9

ENGINE

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GENERAL INFORMATION

The 310P and 310Q aircraft incorporate two Continental six-cylinder, horizontally-opposed engines. The detail specification lists the engine specifications for the individual 310P, 310Q and the Turbo 310P, 310Q. Installed on each engine are two magnetos, twelve spark plugs, ignition harness and wiring, primer distribution lines and fittings, engine-driven fuel pump, continuous flow fuel injection system, pressure type intake manifold piping, integral oil pump and externally mounted oil cooler, starter, and various adapters, clamps and brackets for mounting these items on the engine. Each engine drives an

all-metal, two bladed propeller (standard equipment) or three bladed propeller (optional equipment), 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, exhaust stack assemblies, cylinder head temperature, oil temperature bulb, cowl flap assembly (Turbo 310P and 310Q), crankcase breather line and various other lines, hoses, fittings and brackets necessary for the proper assembly and operation of the engine.

Detail Engine Specifications (310P0001 AND ON)

Model	IO-470-VO
Propeller Drive Ratio	Direct
Propeller Shaft Rotation (Looking Forward)	Clockwise
Bore, Inches	5.00
Stroke, Inches	4.00
Displacement, Cubic Inches	471
Compression Ratio	8.6:1
Oil SAE Number Above 40°F	SAE #50
Below 40°F	SAE 10W30 Multi-Viscosity or SAE #30
Oil Sump Capacity (Without Filter)	12 Qts.
Fuel, Aviation Grade, Octane (Minimum) (Low Lead Fuels are Approved for Use)	100/130
Fuel System	Continental Fuel Injection
Fuel Injector	Continental Fuel Injection
Magneto Drive, Ratio to Crankshaft	1.5:1

Magnetos (See Section 1)	Counterclockwise*
Tachometer Drive, Ratio to Crankshaft Rotation	0.5:1 Counterclockwise*
Starter Drive, Ratio to Crankshaft Rotation	32:1 Counterclockwise*
Alternator Drive, Ratio to Crankshaft Rotation	3.5:1 Counterclockwise*
Vacuum Pump Drive, Ratio to Crankshaft Rotation	1.5:1 Clockwise*
Propeller Governor Drive, Ratio to Crankshaft Rotation	1:1 Clockwise*
Spark Plug Type	SL300A
Spark Occurs (Degrees BTC) Both Magnetos	20°
Spark Plug Gap	0.016-0.018
Firing Order	1-6-3-2-5-4
Oil Pressure (Lbs. Per Sq. Inch)	
Normal	30 to 60
Maximum	100
Idling (Minimum)	10
Oil Temperature (°F)	
Normal	170°
Maximum	225°
Cylinder Head Temperature (°F)	
Maximum	460°
Cruise	380°
Minimum (Takeoff)	200°
Standard Engine Dry Weight (Lbs.)	461

*Direction of rotation facing engine drive pad.

Detail Engine Specifications (Turbo 310P0001 AND ON)

Model	TSIO-520-B
Propeller Drive Ratio	Direct
Propeller Shaft Rotation (Looking Forward)	Clockwise
Bore, Inches	5.25
Stroke, Inches	4.00
Displacement, Cubic Inches	520
Compression Ratio	7.5:1

Oil SAE Number	Above 40°F	SAE #50
	Below 40°F	SAE #30
Oil Sump Capacity (Without Filter)		12 Qts.
Fuel, Aviation Grade, Octane (Minimum)		100/130
Fuel System		Continental Fuel Injection
Fuel Injector		Continental Fuel Injection
Magneto Drive, Ratio to Crankshaft		1.5:1
Magnetos (See Section 1)		Counterclockwise*
Tachometer Drive, Ratio to Crankshaft		5:1
Rotation		Counterclockwise*
Starter Drive, Ratio to Crankshaft		48:1
Rotation		Counterclockwise*
Alternator Drive, Ratio to Crankshaft		3:1
Rotation		Clockwise*
Vacuum Pump Drive, Ratio to Crankshaft		1.5:1
Rotation		Clockwise*
Propeller Governor Drive, Ratio to Crankshaft		1:1
Rotation		Clockwise*
Spark Plug Type		See Section 1
Spark Occurs (Degrees BTC) Both Magnetos		20°
Spark Plug Gap		0.016-0.018
Firing Order		1-6-3-2-5-4
Oil Pressure (Lbs. Per Sq. Inch)		
Normal		30 to 60
Maximum		100
Idling (Minimum)		10
Oil Temperature (°F)		
Normal		170°
Maximum		240°
Cylinder Head Temperature (°F)		
Maximum		460°
Cruise		380°
Minimum (Takeoff)		200°
Standard Engine Dry Weight (Lbs.)		
(With Turbocharger Accessories)		477.50

*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 procedures 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 RUN AT IDLING	Induction system leak. Excessive starter slippage. Fuel system malfunction. Ignition system malfunction. Propeller levers set in high pitch (DECREASE RPM). Fuel injection system improperly adjusted. Air leak in intake manifold. Spark plugs fouled by oil escaping past piston rings. Fuel injection system improperly adjusted. Mixtures levers set for lean mixture. Fouled spark plugs. Discharge nozzle air vent manifold restricted or defective. Hydraulic lifters fouled. Burned or warped exhaust valves, worn seats, scored valve guides.	Tighten or replace loose or damaged hose connections. Replace starter adapter. Isolate cause and correct. (See Troubleshooting the Fuel Injection System and refer to Section 11 for Troubleshooting the Fuel System.) Isolate cause and correct. (See Troubleshooting the Ignition System.) Use low pitch (INCREASE RPM) position for all ground operations. See Troubleshooting the Fuel Injection System. Tighten loose connection or replace damaged part. Top overhaul. See Troubleshooting the Fuel Injection System. Use FULL RICH position for all ground operation. Remove and clean. Adjust gaps. Set fuel control on FULL RICH position, turn auxiliary pump ON, check to be sure feed lines and filters are not restricted. Clean or replace defective components. Remove and clean lifters. Inspect and clean oil filter at more frequent intervals. Top overhaul.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE RUNS TOO LEAN AT CRUISING POWER	Improper manual leaning procedure.	Operate in FULL RICH position below 5000 feet. Above 5000 feet, retard mixture levers until a slight drop in rpm is noted, then advance levers approximately one inch toward FULL RICH position.
	Fuel flow reading too low.	Check fuel strainer for clogging. Clean screen. (Refer to Section 11.)
	Fuel injection malfunction.	See Troubleshooting the Fuel Injection System.
ENGINE RUNS TOO RICH AT CRUISING POWER	Restrictions in air intake passages.	Check passages and remove restrictions.
ENGINE RUNS TOO LEAN OR TOO RICH AT THROTTLE SETTINGS OTHER THAN CRUISE	Fuel injection malfunction.	See Troubleshooting the Fuel Injection System.
CONTINUOUS FOULING OF SPARK PLUGS	Piston rings excessively worn or broken.	Replace rings. Replace cylinder if damaged.
	Oil leakage from turbocharger into intake system. (Turbo 310P0001 AND ON.)	Check turbocharger oil drain lines, separator and scavenger oil pump.
	Piston rings inverted or not seated.	Install with side marked "TOP" toward piston head. Allow approximately 25 hours for new rings to "wear in."
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 Troubleshooting the Ignition System.
REGULAR MISSING AT HIGH SPEED	Broken valve spring.	Replace.
	Plugged Nozzle.	Clean.
	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. (See Rigging of Mixture and Throttle Controls.)
	Exhaust system leakage.	Locate and correct.
	Restrictions in air intake passages.	Check passages and remove restrictions.
	Turbocharger wheels rubbing (Turbo 310P.)	Replace turbocharger.
	Ignition system malfunction.	See Troubleshooting the Ignition System.

TROUBLE	PROBABLE CAUSE	CORRECTION
SLUGGISH OPERATION AND LOW POWER (Continued)	Fuel injection malfunction.	See Troubleshooting the Fuel Injection System.
	Valve seats worn and leaking. Piston rings worn or stuck in grooves.	Top overhaul.
HIGH CYLINDER HEAD TEMPERATURE	Low octane fuel.	Drain tanks and replace with correct grade of fuel. (Refer to Section 2.)
	Lean fuel/air mixture due to improper manual leaning procedure.	See "CORRECTION" under "Engine runs too lean at cruising power."
	Cylinder baffles loose or bent.	Check and correct.
	Dirt between cylinder fins.	Clean thoroughly.
	Excessive carbon deposits in cylinder head and on pistons.	Top overhaul.
	Exhaust system gas leakage.	Locate and correct.
	Exhaust valves leaking.	Top overhaul.
OIL LEAKS	At front of engine: damaged crankshaft oil seal.	Replace
	Around push rod housings: damaged push rod housing packing.	Replace.
	Around propeller mounting flange: damaged hub O-ring seal.	Replace. (Refer to Section 10.)
	Around plugs, fittings and gaskets due to looseness or damage.	Tighten or replace.
LOW COMPRESSION	Piston rings excessively worn.	Top overhaul.
	Valve faces and seats worn.	Top overhaul.
	Excessively worn cylinder walls.	Replace cylinders and piston rings.
ENGINE WILL NOT ACCELERATE PROPERLY	Unmetered fuel pressure too high.	See Unmetered Fuel Pressure and Mixture Checkout and Adjustment.
	Waste-gate does not close properly.	See Waste-Gate Check and Adjustment.
	Leak in turbocharger discharge pressure system. (See Note.)	See Inspection of Engine and 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.

TROUBLE	PROBABLE CAUSE	CORRECTION
SLOW ENGINE ACCELERATION ON A HOT DAY	Mixture too rich.	Momentarily pull mixture control back until engine acceleration picks up, then move mixture control to full forward again.
ROUGH IDLE AT AIRFIELDS WITH GROUND ELEVATION OF 3500 FEET OR HIGHER	Mixture too rich.	Pull mixture control back to where the engine operates the smoothest at IDLE RPM.
SLOW ENGINE ACCELERATION AT AIRFIELDS WITH A GROUND ELEVATION OF 3500 FEET OR HIGHER	Mixture too rich.	Pull mixture control back to where engine operates at IDLE RPM. Engine should accelerate normally.
MANIFOLD PRESSURE OVERSHOOT ON ENGINE ACCELERATION	Engine acceleration too rapid from idle to full power.	Open throttles about half-way. Let engines accelerate to 29 inches Hg. and peak. Move throttles to full open position.
ENGINE WILL NOT STOP AT IDLE CUT-OFF	Manifold valve not seating tightly.	Repair or replace manifold valve.
ENGINE WILL NOT START	Manifold valve sticking closed.	Repair or replace manifold valve.
HIGH ENGINE IDLE PRESSURE IMPOSSIBLE TO OBTAIN	Manifold valve sticking closed.	Repair or replace manifold valve.
ERRATIC ENGINE OPERATION	Manifold valve sticking part-way, or not free.	Repair or replace manifold valve.
CLIMBING TO ALTITUDES ABOVE 12,000 FEET, ENGINE QUITS WHEN POWER REDUCED	Fuel vaporization.	Turn boost pumps ON when climbing 12,000 feet, when climb completed continue with boost pumps ON until vaporization possibility is eliminated. Lean mixture during climb to proper fuel flow for power being used. Engines may quit when throttles are brought back for power adjustment after leveling off. If this occurs, lean mixture and engines will pick up again.
MANIFOLD PRESSURE BETWEEN ENGINES VARIES WITH ALTITUDE	1000 feet critical altitude tolerance between engines.	Advance one throttle in front of the other to keep manifold pressure the same.
MANIFOLD PRESSURE VARIES WITH AIRSPEED. INCREASE WHEN AIRSPEED INCREASED, DECREASE WHEN AIRSPEED DECREASED	Waste-gate stuck or closed.	Adjust throttles after airspeed has increased from climb speed.

NOTE

The left engine manifold pressure will not normally increase or decrease more than right engine because of location of left engine air intake duct.

TROUBLE	PROBABLE CAUSE	CORRECTION
MANIFOLD PRESSURE VARIES WITH ENGINE RPM	Waste-gate OPEN, RPM increase manifold pressure slight decrease. RPM decrease manifold pressure slight increase.	Normal turbocharged engines characteristic.
	Waste-gate CLOSED, RPM increase, manifold pressure slight increase. RPM decrease, manifold pressure slight decrease.	Normal turbocharged engines characteristic.
MANIFOLD PRESSURE VARIES WITH INCREASING OR DECREASING FUEL FLOW	Waste-gates CLOSED.	Fuel flow increase the mass flow of exhaust increased, turbine turns faster more induction air furnished engine resulting in manifold pressure increase.

ENGINE COWLS.

Removal and Installation of Engine Cowls. (See figure 9-1.)

NOTE

This removal procedure is for the RH engine cowling, LH engine cowling is removed in a similar manner.

- Release fasteners retaining cowl doors (6 and 7) to upper cowl assembly (3).
- Release fasteners retaining upper cowl assembly (3) to engine nacelle structure and nose caps and remove upper cowl assembly (3) from aircraft.
- Remove screws attaching lower portion of cowls (8) to engine beam assembly.
- Release fasteners retaining nose cap assemblies (10 and 11) to forward engine beam assembly.
- Remove screws securing nose cap assemblies (10 and 11) together and remove nose cap assemblies.

NOTE

To remove oil filler door (5) from upper cowl section, pull hinge pin (4).

- Install engine cowling by reversing removal procedures.

COWL FLAPS. (TURBO 310P0001 AND ON).

Removal and Installation of Cowl Flaps. (See figure 9-2.)

- Position cowl flaps to OPEN.
- Disconnect lower link (8) from bracket (9) on door assembly (10) by removing attaching nut and bolt.
- Remove hinge pin (11) from hinge halves and remove door assembly (10) from engine nacelle.
- Install door assembly (10) by reversing removal procedures.

NOTE

Secure hinge pin (11) with cotter pins upon installation.

Removal and Installation of Torque Tube Assembly. (See figure 9-2.)

- Position cowl flap to OPEN.
- Disconnect turnbuckle (7) from inboard bellcrank assembly (2) by removing nut, bushing, washers and screws attaching upper link (12) to bellcrank assembly (2).
- Disconnect control cable (1) from bellcrank (2) by removing nut, bushing, washers and bolt.
- Unsafety and remove roll pin securing outboard bellcrank (5) to torque tube assembly (3).
- Route torque tube assembly (3) from engine nacelle through the inboard cowl flap opening.
- Install torque tube assembly (3) by reversing removal procedures.

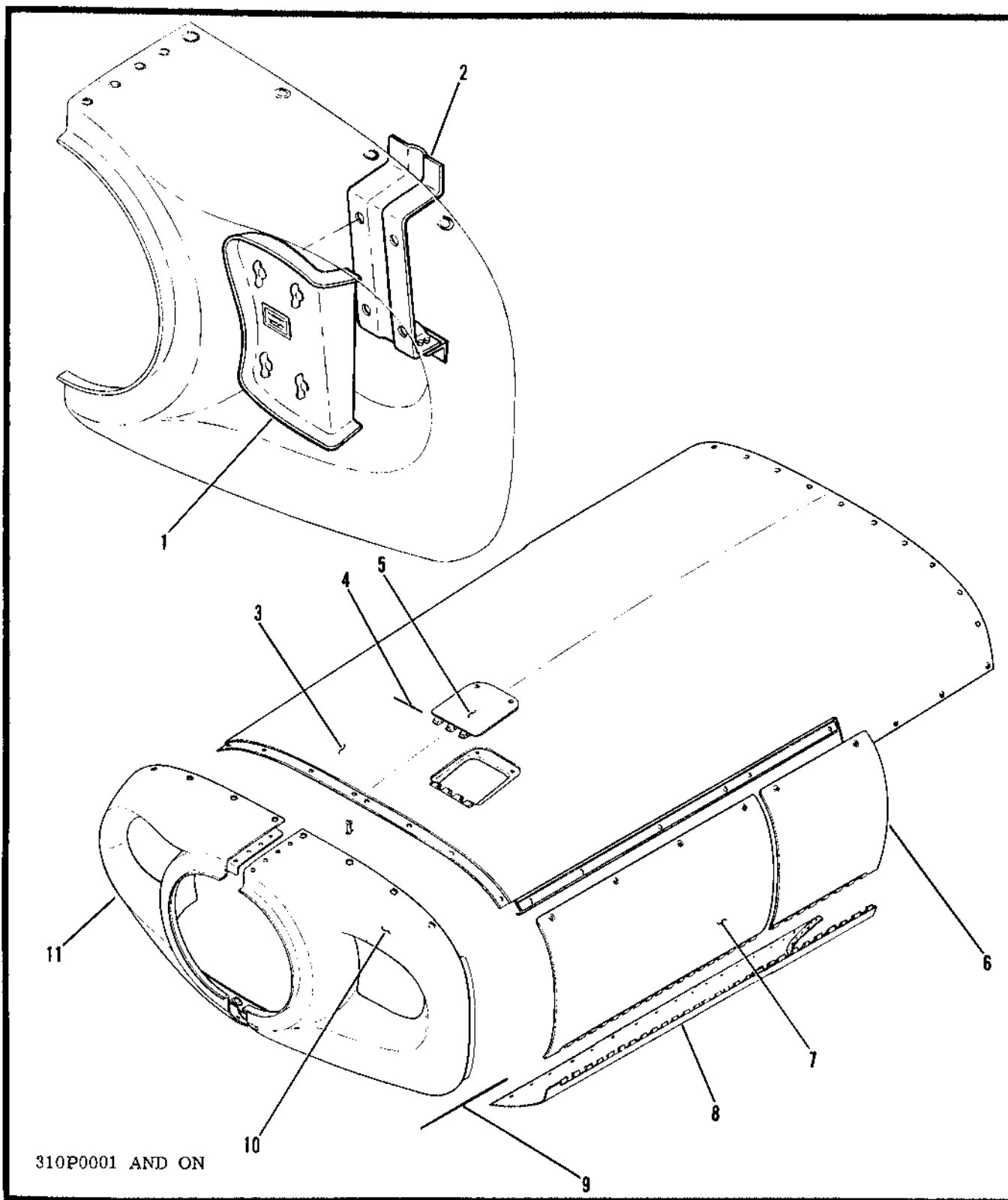
NOTE

On installation, safety wire roll pin (6) to bellcrank assembly (5).

- Check rigging in accordance with rigging procedures.

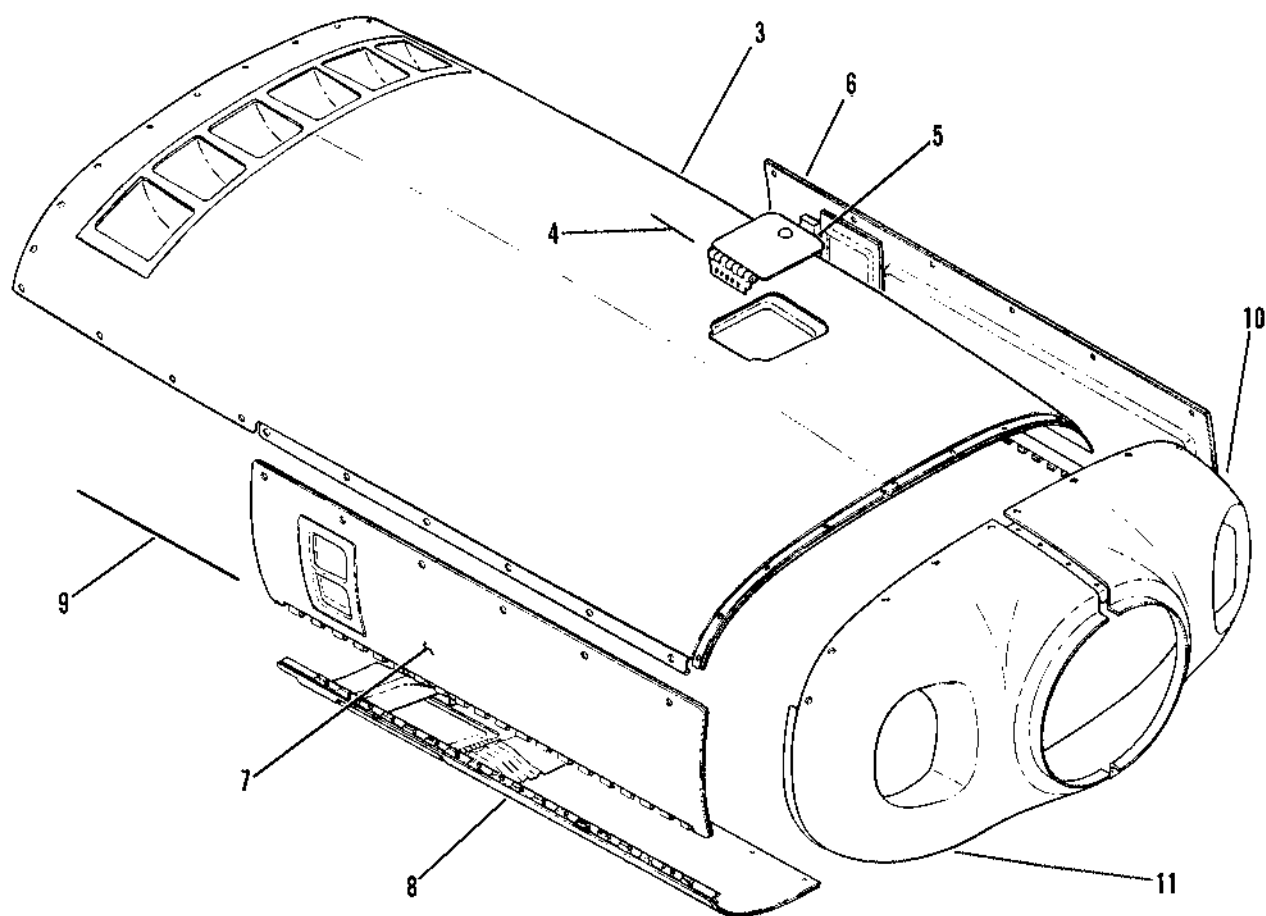
Removal and Installation of Control Cable. (See figure 9-2.)

- Remove engine cowling.
- (Refer to Section 3, Control Pedestal Installation) Remove center side panel and control cover from control pedestal.
- Position cowl flaps to OPEN.
- Disconnect clevis end of control cable (1) from inboard bellcrank (2) by removing attaching nut, bushing, washers and bolt.
- Remove nuts retaining control cable (1) to nacelle bracket.
- Loosen nut retaining control cable (1) to pedestal.



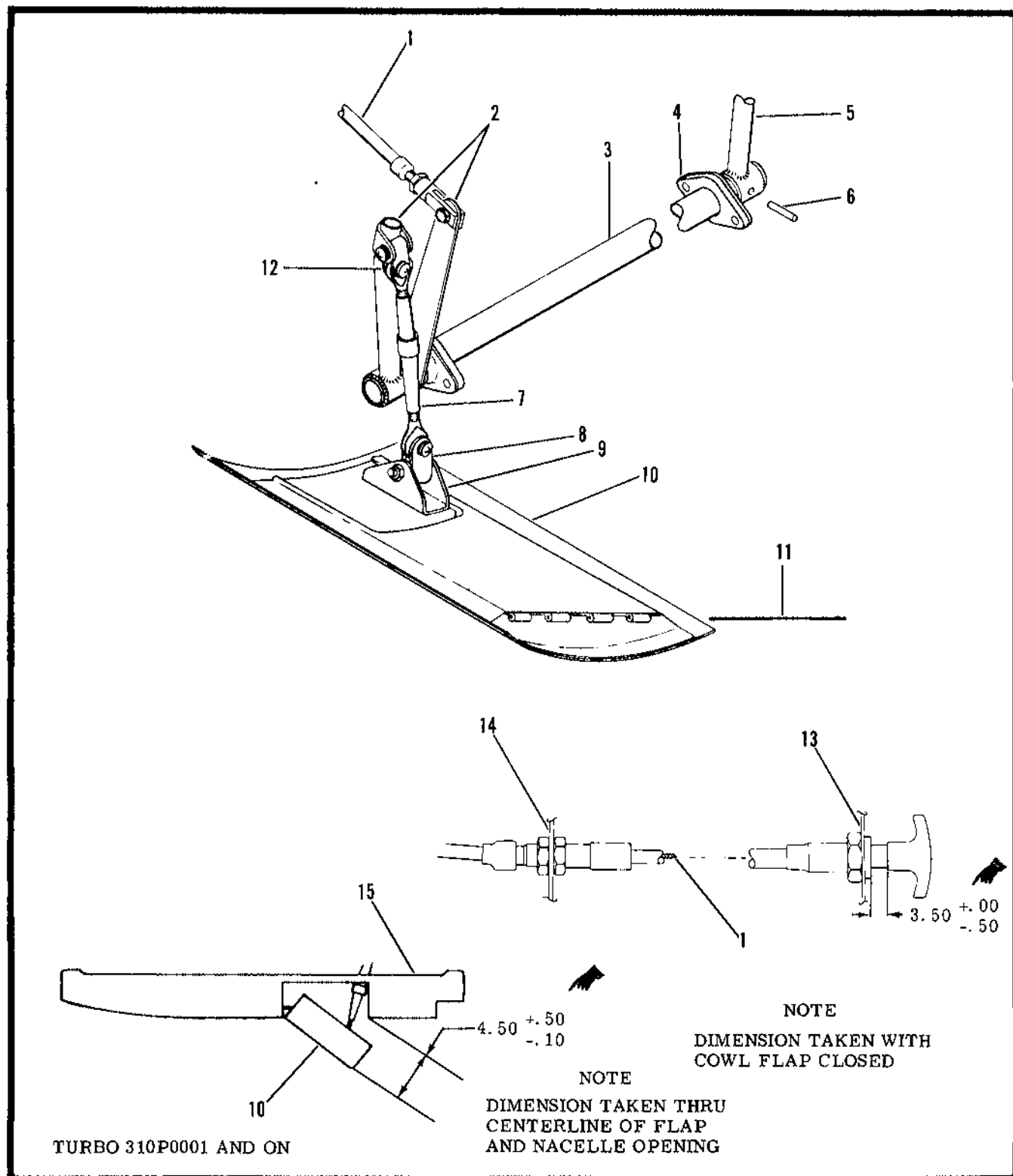
1. Winterization Baffle	5. Oil Filler Door	8. Lower Cowl Assembly LH
2. Attaching Bracket	6. Aft Cowl Door	9. Hinge Pin
3. Upper Cowl Assembly	7. Cowl Door	10. Nose Cap Assembly - Left Half
4. Hinge Pin		11. Nose Cap Assembly - Right Half

Figure 9-1. Engine Cowling (Sheet 1 of 2)



TURBO 310P0001 AND ON

Figure 9-1. Engine Cowling (Sheet 2 of 2)



1. Control Cable
2. Inboard Bellcrank Assembly
3. Torque Tube Assembly
4. Bearing Block
5. Outboard Bellcrank

6. Roll Pin
7. Turnbuckle
8. Lower Link
9. Bracket
10. Door Assembly

11. Hinge Pin
12. Upper Link
13. Pedestal
14. Engine Nacelle Bracket
15. Lower Nacelle

Figure 9-2. Cowl Flap Installation

- g. Tie guide wire to control cable (1) and route from wing to control pedestal.
- h. Install control cable (1) by reversing removal procedures and rig in accordance with rigging procedures.

Rigging of Cowl Flaps. (See figure 9-2.)

- a. Position cowl flaps to OPEN.
- b. Locate the centerline of cowl flap door (10) and nacelle opening. Measure the distance of travel for 4.50 $\pm$.50, $\pm$.10 inches.
- c. Adjust travel of flap doors by increasing or decreasing the length of clevis end on control cable (1).
- d. Position cowl flaps to CLOSE.
- e. Check the extension of control handle for not more than 3.50 $\pm$.00, $\pm$.50 inches of travel from control pedestal.

ENGINE.

Engine Removal Procedures (310P0001 and On). (See figure 9-3.)

The removal procedures given apply to either engine on the 310P, 310Q and the Turbo 310P, 310Q aircraft although the routing of wire bundles, cables, lines, hoses and conduit varies between engines; the following description will be typical for each specified aircraft. Identify each item as it is disconnected to aid in reinstalling. Cover the open ends of all lines and hoses to prevent entry of foreign materials.

CAUTION

Before removing engine, place a suitable padded support under fuselage bulkhead at approximately FS132:00 to prevent aircraft from tipping backwards.

NOTE

If engine is being removed to be placed in storage, proper preparatory steps as outlined in Section 2, "Extended Storage," must be observed. In addition to the above mentioned procedures, cover all engine and accessory vents and other openings, including the crankcase breather, with other vapor-proof material.

- a. Turn all cockpit switches and fuel selector valves OFF.
- b. Open the battery circuit by disconnecting the battery ground cable.
- c. Remove engine cowling in accordance with removal procedures.
- d. Disconnect magneto ground wires (32) at the magnetos and withdraw them aft through the right rear engine baffle (17).

WARNING

These magnetos DO NOT have internal grounding springs. Ground the magnetos to the crankcase to prevent accidental firing.

- e. Drain the oil in accordance with Section 2. Replace the drain plug.
- f. Remove the propeller in accordance with Section 10.
- g. Disconnect the engine controls as follows:
 - 1. Disconnect the induction air control (3), the mixture control (24), and the throttle control.
 - 2. Disconnect the propeller control (30) at the governor (26). Remove the propeller control bracket (31) from the intake manifold (20) by loosening the bracket clamps.
- h. (Refer to Section 10.) If installed, remove propeller unfeathering system hose at the governors.

CAUTION

The propeller unfeathering accumulator is normally pressurized, therefore, release accumulator pressure by referring to Section 10 before attempting to disconnect hose from governor.

- i. Disconnect wires and cables as follows:
 - 1. Disconnect oil temperature electrical connector (12) located directly below the oil cooler (14). Disconnect oil temperature ground wire.
 - 2. Disconnect tachometer generator (21) electrical connector.
 - 3. Disconnect starter cable (19).
 - 4. Remove the cylinder head temperature bulb (9).
 - 5. Disconnect alternator cables (51) and cable shielding ground.
 - 6. Disconnect fuel pressure switch (40) wiring.
 - 7. Disconnect wiring at radio noise filter (51).
 - 8. Remove all clamps attaching wires or cables to the engine. Pull all wires and cables aft to clear the engine assembly.
- j. Remove engine ground strap from engine mount assembly by removing existing bolt.
- k. Disconnect lines and hoses as follows:
 - 1. Separate crankcase breather line (33) at hose connector just aft of right rear engine baffle (17).
 - 2. Disconnect vacuum line (37) from vacuum pump (22).
 - 3. Disconnect fuel vapor return line (39) from the outboard nacelle rib.
 - 4. Disconnect the fuel pressure gage line (41) from the right rear engine baffle.
 - 5. Disconnect the manifold pressure hose (25) from the intake tube at the right rear of the engine.
 - 6. Disconnect oil pressure hose (45) at the inboard nacelle rib and remove the clamp which fastens it to the canted bulkhead. Pull the hose free of the canted bulkhead.
 - 7. Disconnect fuel pump supply line (43) at the fuel pump (49).

WARNING

Fuel and oil draining from lines and hoses is a fire hazard. Prevent fuel and oil from collecting in the engine nacelle.

8. Disconnect the two manifold drain hoses (23 and 44) from rear intake elbows.

NOTE

If oil dilution system is installed, disconnect oil dilution hose at crankcase fitting just below the fuel pump.

1. Disconnect exhaust stacks (38) from each cylinder by removing attaching nuts.
- m. Attach a hoist to the lifting eye at the top center of the engine crankcase. Lift the engine just enough to relieve its weight from the engine mounts.

CAUTION

Place a stand under the aircraft tailcone bumper before removing an engine. The loss of engine weight may allow the tail to drop.

- n. Remove engines as follows: (See figure 9-5.)
1. Remove bolts (8).
2. Hoist engine out of the nacelle and clear of the aircraft.

CAUTION

Hoist engine slowly and make certain that all wires, lines, and hoses have been disconnected.

3. Remove mount pads (3 and 6) and spacers (5) from engine mount bracket (4).

Engine Removal Procedures (Turbo 310P and 310Q). (See figure 9-4.)

- a. Turn all cockpit switches and fuel selector valves OFF.
- b. Open the battery circuit by disconnecting the battery ground cable.
- c. Remove engine cowling in accordance with removal procedures.
- d. Disconnect starter cable (39) from starter (38).
- e. Tag and disconnect the engine wiring bundle (27) from the following components:
 1. Magnetos (1).
 2. Alternator (32).
 3. Propeller deice brush holder assembly (31) (optional equipment).
 4. Starter (38).
 5. Tachometer (11).
 6. Oil temperature bulb (located on lower portion of oil cooler).
 7. Cylinder head temperature bulb (34).

f. Remove all clamps attaching engine wire bundle (27) to engine components and route clear of engine assembly.

g. Remove engine ground strap (33) from engine beam assembly by removing existing bolt.

h. Drain engine oil in accordance with Section 2. Replace drain plug and tighten.

i. (Refer to Section 13.) If installed, remove propeller unfeathering system hose at the governors.

WARNING

The propeller unfeathering accumulator is normally pressurized, therefore, release accumulator pressure by referring to Section 10 before attempting to disconnect hose from governor.

j. Remove propeller in accordance with Section 10.

k. Disconnect propeller control rod end (24) at the governor (25) by removing nuts, spacer and bolt.

l. (See figure 9-6.) Disconnect propeller control support bracket (7) from engine intake manifold by removing clamps.

m. Disconnect the following lines and hoses from engine assembly:

1. Vacuum hose (6) from vacuum pump (5).
2. Turbocharger air pressure hose (3) from manifold fitting (4).
3. Aft air intake manifold drain hose (37) from manifold fitting (36).
4. Slide shrouds (48, 49 and 50) clear of fittings on hose assemblies (16, 18 and 21), disconnect line and hose assemblies (16, 18, 19, 20 and 21) from fuel pump (17).
5. Remove clamp and metered fuel hose shroud (42) from rear baffle (35).
6. Metered fuel hose (28) from fuel manifold valve assembly (30).

NOTE

Route metered fuel hose (28) through engine baffle.

7. Oil cooler hose assembly (8) from oil cooler (2).
8. Turbocharger oil return hose assembly (41) from scavenger pump (40).
9. Oil return hose assembly (7) at the crankcase.
10. Remove fuel pressure hose (43) from baffle fitting.
- n. Disconnect drain line (26) from intake manifold crossover (23).
- o. Disconnect exhaust stacks (22) at ball joint at the end of bellows.
- p. Loosen clamp and disconnect hose (13) from the throttle body (12).
- q. Disconnect oil separator drain line (9) from oil separator (10).
- r. Attach engine hoist to the engine hoisting lug (29) and lift the engine just enough to relieve weight from the engine mounts.

CAUTION

Place a suitable stand under the aircraft tailcone bumper before removing engine. The loss of engine weight may cause the tail to drop.

- s. (See figure 9-5.) Remove the engine mounts and engine as follows:
 1. Remove heat shield (17) from fitting assembly (11) by removing screw.
 2. Remove bolt (8) and lock washer (7) from engine mount (2).
 3. Hoist engine out of nacelle and clear of aircraft.

Disassembly and Assembly of Engine.

NOTE

The disassembly procedure is the same for either engine and is intended to cover only those items which could normally be expected to require removal or are not noted by Continental Motors Corporation "Engine Maintenance and Overhaul" manual for engine specified.

- a. Hoist engine assembly to a convenient working height.
- b. Clean engine assembly as prescribed by aforementioned engine maintenance and overhaul manual.

CAUTION

Particular care should be given to electrical components before cleaning. Solvents should not be allowed to enter magnetos, starters, alternators, and any lubricated controls. These items must be protected with 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 of the following items is removed from the engine, place a temporary cover over the hole left by the removal of the item. This procedure should prevent the accidental entry of foreign material which could cause engine damage or lead to a serious engine malfunction.

- c. Refer to Section 12, remove vacuum pump in accordance with removal procedures.
- d. Remove engine baffles in accordance with removal procedures.
- e. Remove the tachometer generator by removing four nuts and lifting tachometer generator free of drive adapter.
- f. Refer to Section 10, remove propeller governor in accordance with removal procedures.
- g. Remove all other fittings, hoses, lines and attaching parts necessary to facilitate maintenance of engine.
- h. To assemble the engine, reverse the engine disassembly procedures.

Inspection of Engine Assembly.

Refer to Section 2 Cleaning, Inspection, Servicing and Repair, for inspection of engine.

Engine Installation Procedures (310P0001 AND ON).
(See figure 9-3.)

NOTE

The installation procedure is the same for either engine. Although there is some difference in the routing of wire bundles, lines, hoses and conduit, the following procedure is typical for installation of either engine.

- a. Hoist engine to a point just above the nacelle.
- b. (See figure 9-5.) Install the engine mounts and engine as follows:
 1. Position upper mount (3) on engine mount bracket (4).
 2. Using a shop punch, or like instrument, as an aligning tool, guide engine on upper mount (3) and engine mount bracket (4).

NOTE

Align exhaust stack assemblies with engine studs as engine is being lowered on mounts.

3. Assemble lock washer (7), lower mount (6) and bonded spacer (5) on bolt (8). Position these items on the engine mount bracket (4) and index lower mount (6) with aligning pin to notch in engine mount bracket.
4. Torque bolt (8) to 50 +0, -5 foot-pounds.
5. Safety bolt (8) by crimping the ears on lock washer over the flat surfaces of the bolt head.

- c. Fasten engine ground strap to the left aft engine mount bracket.
- d. Connect wires and cables as follows:
 - 1. Attach wire bundle (1) to right manifold intake pipe with two clamps, and alternator cables to left intake manifold pipe with two clamps.
 - 2. Route oil temperature wires forward along right side of engine, below cylinders and behind intake manifold pipe. Use a sump attachment bolt to attach a clip to the engine crankcase. Fasten the oil temperature wires to this clip with a wire clamp. Attach connector (12) to oil temperature bulb, located directly below oil cooler (14), and safety. Connect ground wire to nacelle, just below forward right engine mount bracket.
 - 3. Route magneto ground wires (32) forward through the right rear engine baffle (17).

WARNING

These magnetos DO NOT have internal grounding springs. Ground the magnetos to the crankcase to prevent accidental firing. DO NOT connect the aircraft ground wires to the magnetos at this time.

- 4. Connect starter cable (19) to starter (18).
- 5. Attach the tachometer generator electrical connector to the tachometer generator (21) and safety.
- 6. Route the cylinder head temperature bulb wires forward along left side of engine, below the cylinders and behind the intake manifold pipe. Install cylinder head temperature bulb (9) in No 3 cylinder of RH and LH engine. Attach cylinder head temperature bulb ground wire to nacelle just below left aft engine mount bracket.
- 7. Attach alternator cables (51) to alternator (52), and attach ground wire and cable shielding to ground.
- 8. Attach wiring at the fuel pressure switch (40).
- e. Connect lines and hoses as follows:
 - 1. Connect crankcase breather line (33).
 - 2. Connect vacuum line (37) to vacuum pump (22).
 - 3. Connect fuel vapor return line (39) and fuel pressure gage line (41).
 - 4. Connect the manifold pressure hose (25) and the two manifold drain lines (23 and 44).
 - 5. Route oil pressure hose (45) aft through lightening hole in canted bulkhead and attach to oil pressure fitting at inboard nacelle rib. Fasten oil pressure hose to canted bulkhead with a clamp.
 - 6. Connect fuel pump supply line (43) at fuel pump (49).

NOTE

If oil dilution system is installed, connect the oil dilution hose at the crankcase fitting just below the fuel pump.

- f. Attach propeller control bracket (31) with two clamps. Connect the propeller control (30) at the governor. Rig the propeller control in accordance with rigging procedures.
- g. Connect the induction air control (3), the mixture control (24) and the throttle control. Rig these controls in accordance with rigging procedures.

- h. Install the exhaust stacks and torque nuts to 60 +10 inch-pounds.
- i. Install the propeller in accordance with Section 10.
- j. Connect the battery ground cable in accordance with Section 14.
- k. Inspect installation for safeties, loose connections, missing bolts, clamps, screws, or nuts; proper routing of cables, hoses and lines, and for correct connection.
- l. Make a magneto switch ground-out and continuity check. Connect the magneto ground wires to the magnetos.
- m. Service the engine in accordance with Section 2.
- n. Install the engine cowling in accordance with installation procedures.

Engine Installation Procedures (Turbo 310P0001 AND ON). (See figure 9-4.)

NOTE

The installation procedure is the same for either engine. Although there is some difference in the routing of wire bundles, lines, hoses and conduit the following procedure is typical for installation of either engine.

- a. Hoist engine to a point just above the nacelle.
- b. (See figure 9-5.) Install the engine mounts and engine as follows:
 - 1. Position upper mount (10) on fitting assembly (11).
 - 2. Using a shop punch or like instrument as an aligning tool, guide engine on upper mount (10) and fitting assembly (11).

NOTE

Align exhaust stack assemblies with engine studs as engine is being lowered on mounts.

- 3. Assemble lock washer (15), lower mount (14) and bonded spacer (13) on bolt (16). Position these items on fitting assembly (11) and index lower mount (14) with roll pin (12).
- 4. Torque bolt (16) to 300 +50, -0 inch-pounds.
- 5. Safety bolt (16) by crimping the ears on lock washer over the flat surfaces of the bolt head.
- 6. Install heat shields (17) on fitting assembly (11) and secure with two screws. Safety wire screws. Heat shields on aircraft Turbo 310Q0401 and On are not required.
- c. Connect oil separator drain line (9) to oil separator (10).
- d. Connect intake manifold hose (13) to throttle body (12) and secure with clamp.
- e. Secure exhaust stacks (22) to each cylinder with attaching washers and nuts.
- f. Connect drain line (26) to intake manifold crossover tube (23).

NOTE

Remove all protective covers, plugs, caps and identification tags as each item is connected or installed.

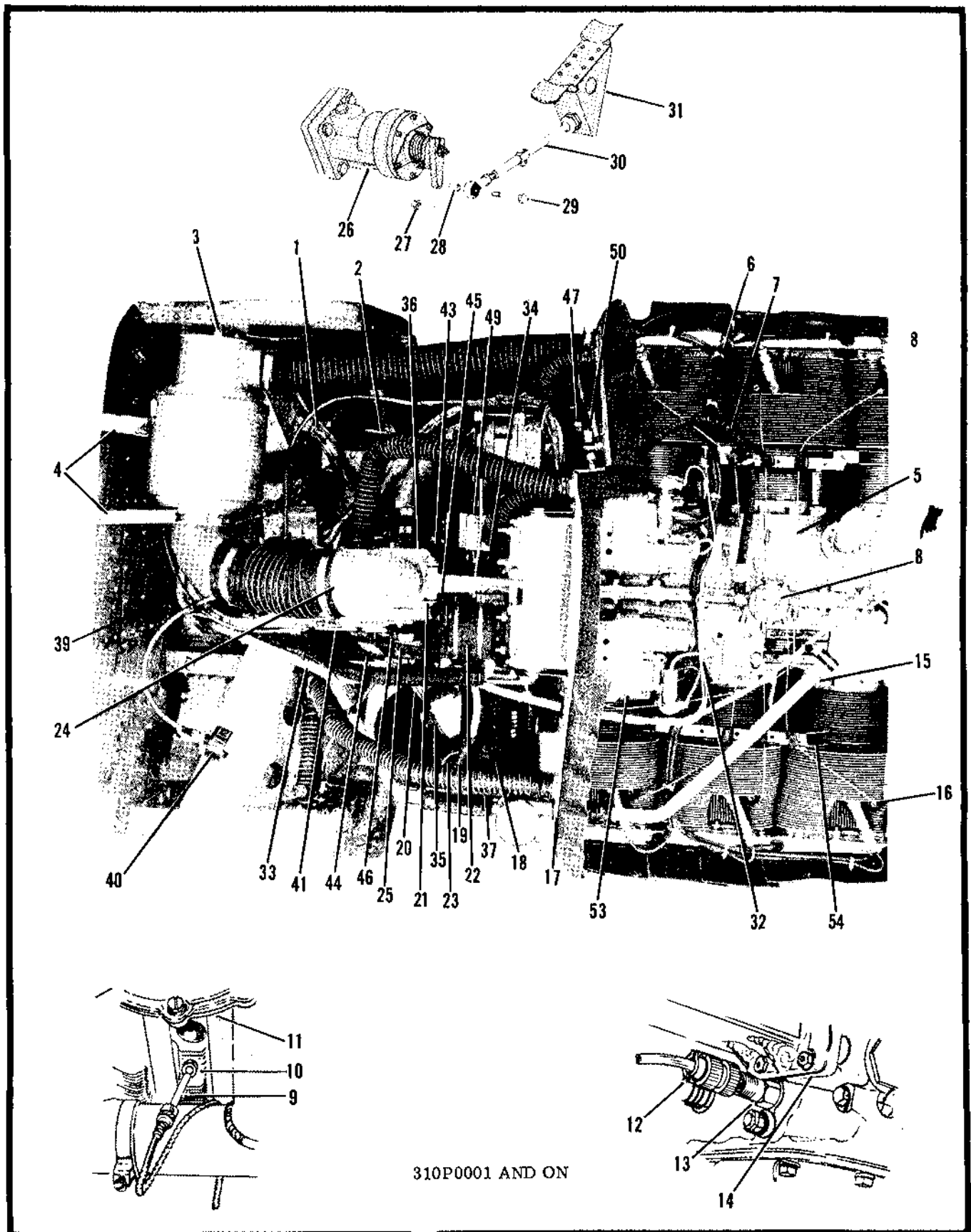
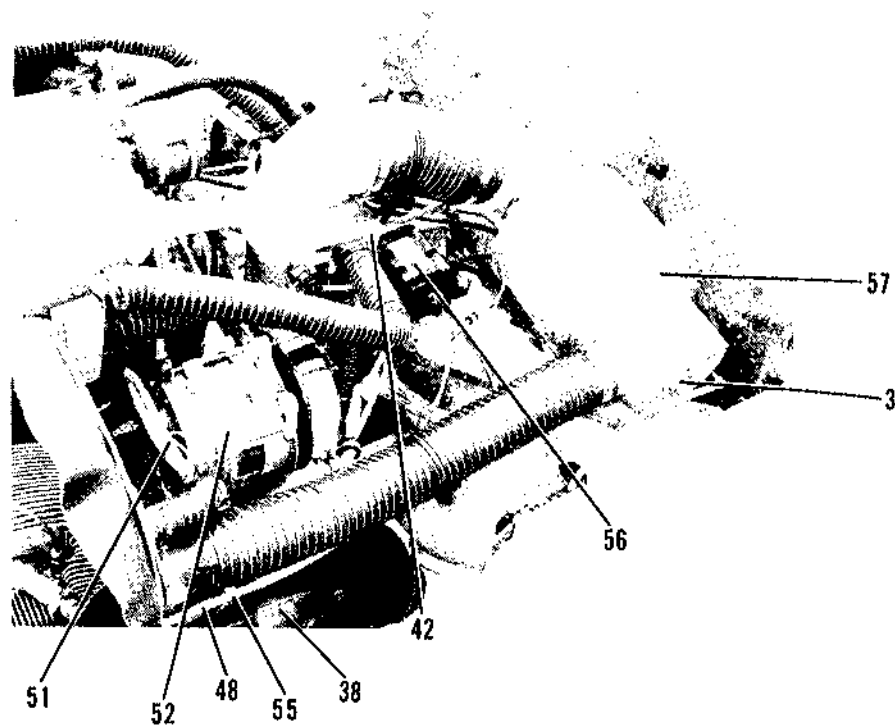


Figure 9-3. Engine Removal (Sheet 1 of 2)



310P0001 AND ON

1. Wire Bundle	17. Right Rear Engine Baffle	37. Vacuum Line
2. Fuel Pump Ram Air Tube	18. Starter	38. Exhaust Stack
3. Induction Air Control	19. Starter Cable	39. Fuel Vapor Return Line
4. Air Canister Brackets	20. Intake Manifold	40. Fuel Pressure Switch
5. Fuel Pressure Gage Line (Forward)	21. Tachometer Generator	41. Fuel Pressure Gage Line (Aft)
6. Ignition Cable	22. Vacuum Pump	42. Fuel Control Unit
7. Fuel Line (Fuel Control to Fuel Manifold)	23. Manifold Drain Line	43. Fuel Line (Strainer to Pump)
8. Fuel Manifold	24. Mixture Control	44. Manifold Drain Line
9. Cylinder Head Temperature Bulb	25. Manifold Pressure Hose	45. Oil Pressure Line
10. Cylinder Head Temperature Bulb Adapter	26. Propeller Governor	46. Clamp
11. No. 4 Cylinder	27. Nut	47. Clamp
12. Oil Temperature Electrical Connector	28. Spacer	48. Propeller Control Conduit
13. Oil Temperature Bulb	29. Bolt	49. Fuel Pump
14. Oil Cooler	30. Propeller Control Sliding End	50. Radio Noise Filter
15. Fuel Injection Line	31. Propeller Control Bracket	51. Alternator Cable
16. Fuel Injection Nozzle	32. Magneto Ground Wires	52. Alternator
	33. Crankcase Breather Line	53. Magneto
	34. Fuel-Air Control Unit Support	54. Bracket
	35. Oil Filter	55. Engine Ground Strap
	36. Fuel-Air Control Unit	56. Propeller Sync Control Unit
		57. Air Intake Canister

Figure 9-3. Engine Removal (Sheet 2 of 2)

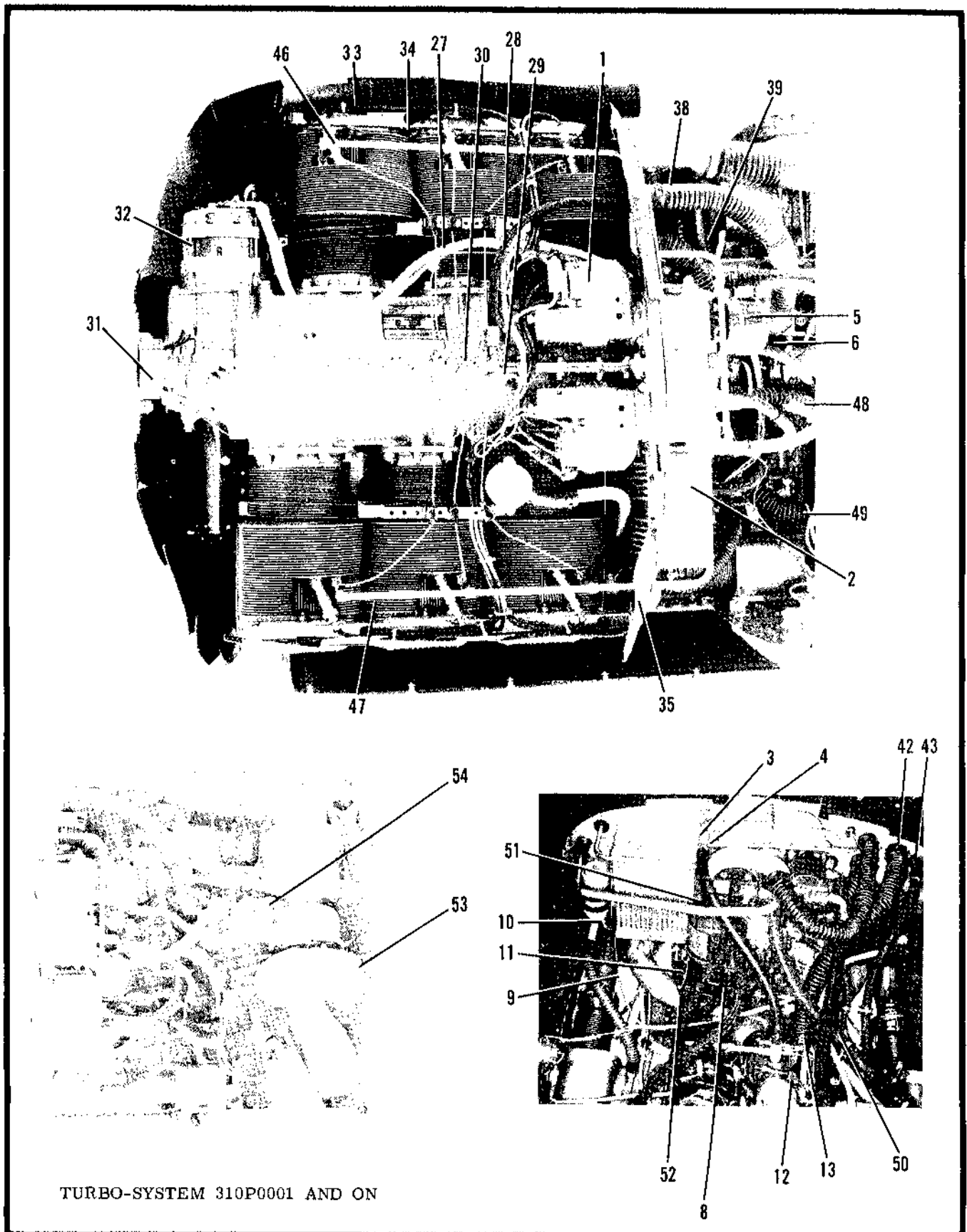
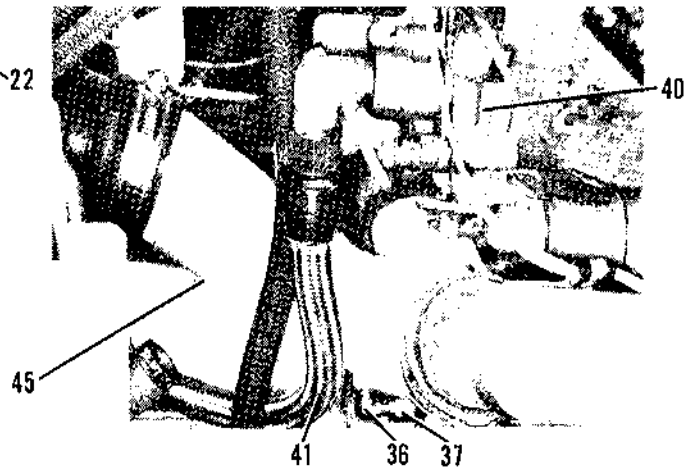
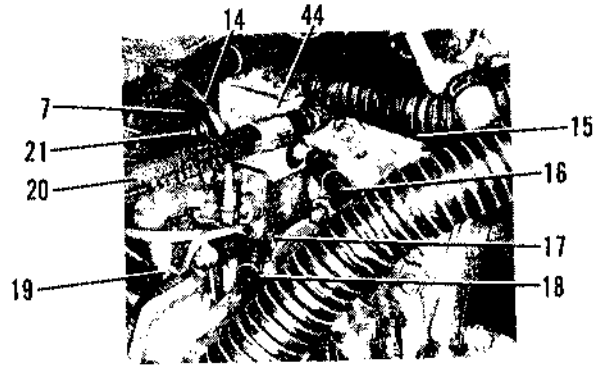
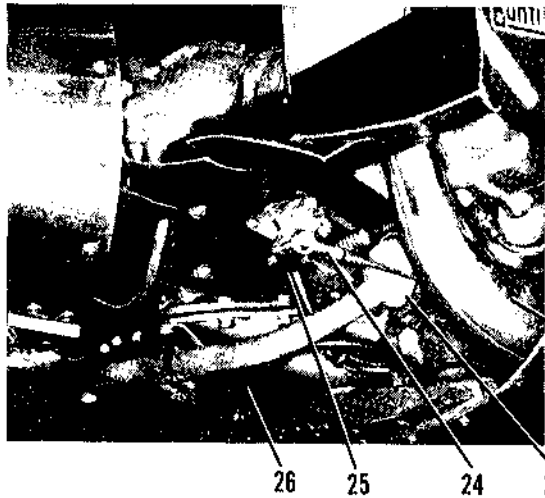


Figure 9-4. Engine Installation (Sheet 1 of 2)



TURBO-SYSTEM 310P0001 AND ON

1. Magnetos	29. Hose Assembly
2. Oil Cooler	(Metering valve to fuel manifold valve)
3. Hose (Throttle body to manifold fitting)	30. Fuel Manifold Valve Assembly
4. Manifold Fitting	31. Brush Holder Assembly (Propeller deice)
5. Vacuum Pump	32. Alternator
6. Hose (Vacuum pump)	33. Ground
7. Hose Assembly (Controller to crankcase)	34. Temperature Bulb (Cylinder head)
8. Hose Assembly (Cooler to waste-gate actuator)	35. Rear Engine Baffle
9. Drain Line (Oil separator to overboard)	36. Fitting (Drain line)
10. Oil Separator	37. Hose Assembly (Aft air intake manifold)
11. Tachometer	38. Starter
12. Throttle Body	39. Starter Cable
13. Hose (Throttle body to intake manifold)	40. Scavenger Pump
14. Line Assembly (Turbocharger discharge)	41. Hose Assembly (Oil return, turbocharger
15. Tube (Ram air to fuel pump)	to scavenger pump)
16. Hose Assembly (Return, metering valve to fuel pump)	42. Shroud Hose (Metering valve hose)
17. Fuel Pump	43. Line Assembly (Fuel pressure)
18. Hose Assembly (Supply, fuel pump to metering valve)	44. Fuel Pump Shroud
19. Line Assembly (Fuel pump drain)	45. Air Intake Manifold
20. Hose Assembly (Vapor return to fuel tank)	46. Line Assembly (RH, nozzle pressurization)
21. Hose Assembly (Supply, nacelle fitting to fuel pump)	47. Line Assembly (LH, nozzle pressurization)
22. Exhaust Stack	48. Duct (Fuel supply from tee)
23. Manifold Crossover (Air intake)	49. Duct (Fuel return line to pump)
24. Rod End (Propeller control)	50. Duct (Fuel supply from pump)
25. Governor	51. Shroud (Metering valve)
26. Hose Assembly (Forward air intake drain)	52. Hose Assembly (Collar to turbocharger)
27. Wire Bundle (Engine)	53. Turbocharger
28. Hoisting Lug	54. Manifold Pressure Relief Valve

Figure 9-4. Engine Installation (Sheet 2 of 2)

g. Connect the following lines and hoses to the engine assembly:

1. Oil return hose (7) at the crankcase fitting.
2. Turbocharger oil return hose (41) to scavenger pump (40).
3. Oil cooler hose (8) from oil cooler (2).
4. Route metered fuel hose (28) through baffle and connect to manifold valve assembly (30).
5. Shroud (42) housing metered fuel hose (28) to baffle (35) by securing with clamps.
6. Line and hose assemblies (16, 18, 19, 20 and 21) to fuel pump (17) and slide shrouds (48, 49 and 50) over hose assemblies (16, 18 and 21).
7. Aft air intake manifold drain hose (37) to intake manifold fitting (36).
8. Air intake manifold pressure hose (3) to manifold fitting (4).
9. Fuel pressure hose (43) to baffle fitting.
- h. (See figure 9-6.) Position and secure propeller control mounting bracket (16) to engine intake manifold with clamps.
- i. Connect propeller control rod end (24) to the governor (25) with attaching bolt, spacer and nuts.
- j. Install propeller in accordance with Section 10.
- k. Connect engine ground strap (33) to engine beam assembly with existing bolt.
- l. Connect engine wire bundle (27) to the following components and remove tags:
 1. Cylinder head temperature bulb (34) to adapter in No. 3 cylinder of RH engine and No. 2 cylinder of LH engine.
 2. Oil temperature bulb (located on lower oil cooler).
 3. Tachometer (11).
 4. Starter (38).
 5. Propeller deice brush holder assembly (31).
 6. Alternator (32).
 7. Magnetos (1).
- m. Connect starter cable (39) to starter (38).
- n. Inspect engine installation in accordance with installation inspection procedures.
- o. Rig engine controls in accordance with rigging procedures.
- p. Make a magneto switch ground-out and continuity check. Connect magneto ground wires to the magnetos.
- q. Service the engine with oil in accordance with Section 2.
- r. Close battery circuit by connecting the battery ground cable.
- s. Install engine cowling in accordance with installation procedures.
- t. Perform an engine operational check.

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 Cessna 310P AND 310Q Owners Manual and perform "Before Starting Engines" and "Starting Engines" procedures.

e. Warm-up engines as follows:
Throttles - 750 to 900 RPM.

1. Leave cowl flap in full OPEN position.
 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 mixture control in IDLE CUT-OFF and check for magneto ground.

3. Advance throttle to 1700 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 should drop no more than a maximum of 150 RPM, with a maximum differential between right and left magnetos of 50 RPM with no appreciable roughness.

4. With engine at 1700 RPM, exercise the propeller:

(a) Retard the propeller pitch lever to obtain a 1200 RPM tachometer indication.

(b) Return propeller pitch lever to HIGH RPM position.

RESULT: During exercise watch for any indication of sluggish or erratic operation.

5. Make a mixture control check at 100 RPM 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

Idle engines before shutting down engine to allow turbine bearings to cool. A minimum of five minutes idling should be allowed after full power run-ups or two to three minutes on run-ups of 1500 to 2000 RPM.

ENGINE SHOCK MOUNTS

The bonded rubber and metal shock mounts are designed to reduce the transmission of engine vibrations to the airframe. This provides smoother aircraft operation and reduces the possibility of structural failure from vibration fatigue.

Removal and Installation of Engine Shock Mounts (310P0001 AND ON). (See figure 9-5.)

NOTE

The engine must be supported with an engine hoist before attempting removal of shock mounts. If engine is going to be removed from aircraft, see Removal of Engine for the attaching parts to be disconnected.

- Remove necessary engine cowling in accordance with removal procedures.
- Place suitable support beneath tailcone.
- Remove bolt (8) and lock washer (7) from shock mounts (6 and 3).
- Disconnect fuel pump drain line.
- Hoist engine slowly to a height of 2 to 3 inches above normal mounting position.

NOTE

Care should be taken not to introduce adverse stresses on other items attached to engine while hoisting engine.

- Remove upper mount (3), spacer (5) and lower mount (6) from engine mount bracket (4).
- Install engine shock mounts by reversing procedure steps above.

NOTE

Torque bolts (8) to 50 +0, -5 foot-pounds.

Removal of Engine Shock Mounts (Turbo 310P0001 AND ON). (See figure 9-5.)

NOTE

The engine must be supported with an engine hoist before attempting removal of engine mount. If engine is going to be removed from aircraft, see Removal of Engine for the attaching parts to be disconnected.

- Remove necessary engine cowling in accordance with removal procedures.
- Place suitable support beneath tailcone.
- Remove heat shield (17) from fitting assembly (11) by removing screws.
- Remove bolt (16) and lock washer (15) from engine mount.
- Disconnect the following components on the engine:
 - Hose between throttle body and engine air intake manifold.
 - Oil separator drain hose from overboard drain tube.
 - Air intake manifold drain line from manifold.
- Hoist engine slowly to a height of 2 to 3 inches above normal mounting position.

NOTE

Care should be taken not to introduce adverse stresses on other items attached to engine while hoisting engine.

- Remove upper mount (10), spacer (13), and lower mount (14) from fitting assembly (11).

Installation of Engine Shock Mounts (Turbo 310P0001 AND ON). (See figure 9-5.)

- Install engine mounts by reversing removal procedures.
- Torque bolt (16) to 300 +50, -0 inch-pounds.

Shimming the Engine Mount. (See figure 9-5.)

Although engine mount sag is normal and occurs over 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 the engine mount and/or cowling 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.

- Hoist engine and support as required to insert spacers (18).

NOTE

Spacers may be obtained from the Cessna Dealers' Organization. Refer to Table I for part number and thickness desired. If the total thickness of spacers installed on any mount exceeds 0.312 inch, the mount must be removed and inspected in accordance with Section 2.

TABLE I.

Part Number	Description	Thickness
5056010-1	Spacer	0.125 Inch
5056010-2	Spacer	0.188 Inch
5056010-3	Spacer	0.250 Inch

b. Insert spacers between the engine fitting assembly (9) and upper mount (10) as required to obtain 0.40 inch minimum clearance.

NOTE

Align propeller spinner with cowling nose cap contours, to assist in determining correct engine mount position.

CAUTION

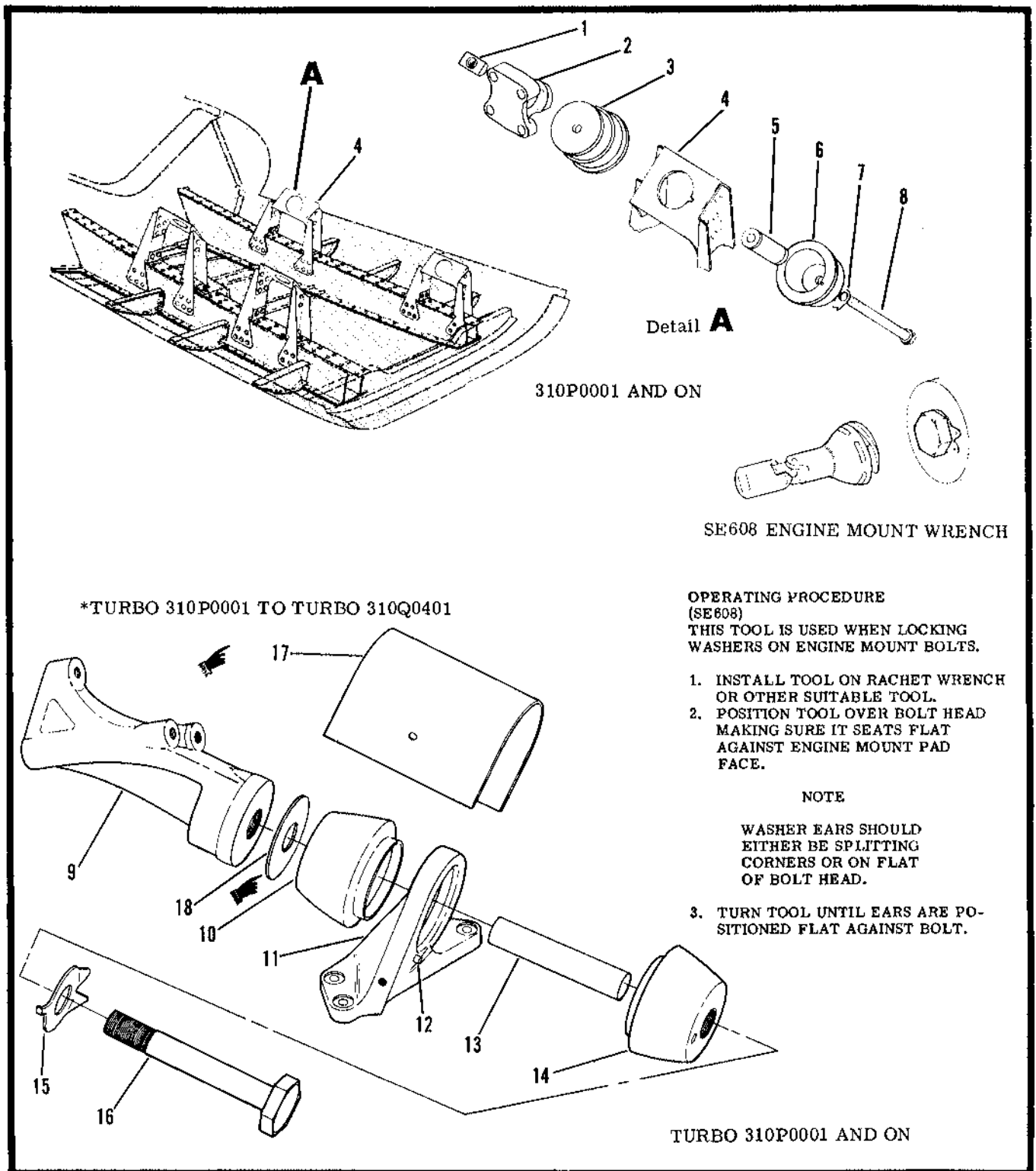
For each 0.125 inch of spacer thickness added, it will be necessary to add the next length longer bolt in engine mount.

c. Secure engine mount in place and safety in accordance with engine mount installation procedures.
d. Recheck all clearances, especially in the exhaust stack.

NOTE

Lock washers (15) with a break tool. This break tool is available from Cessna Dealers' Organization (Tool No. SE 608).

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1. Barrel Nut
2. Engine Mount
3. Mount Pad (Upper)
4. Engine Mount Bracket
5. Spacer
6. Mount Pad (Lower)

7. Washer
8. Bolt
9. Engine Mount
10. Upper Mount
11. Fitting Assembly

13. Bonded Spacer
14. Lower Mount
15. Lock Washer
16. Bolt
17. Heat Shield
18. Spacer

Figure 9-5. Typical Engine Mount Installation

ENGINE CONTROL CABLES.

Removal of Engine Control Cables. (See figure 9-6.)

- a. (Refer to Control Pedestal Installation in Section 3.) Remove elevator trim control wheel, cover plate, friction knob, upper RH panel and RH side panel.
- b. Disconnect throttle, propeller and mixture control cables from quadrant control levers by removing attaching clevis pins.
- c. Unthread bulkhead locknuts (6) from control cables at the control pedestal support bracket and nacelle firewall rib (10).
- d. Unthread and remove bulkhead locknuts (6) from propeller control cable on propeller control cable mounting bracket (16) and disconnect rod end (15) from governor (14) by removing nut, spacer and bolt. Remove rod end (15) from propeller cable.
- e. Remove clamps securing throttle and mixture control cables to aft firewall.
- f. Disconnect rod ends (15) from serrated levers (17) on mixture and throttle control cables by removing attaching nuts, washers and bolts.
- g. Remove rod ends (15) from control cables.
- h. Remove locknuts from throttle and mixture control cables at mounting bracket (16).
- i. Attach guide wires to control cables.
- j. Disconnect control cables from guide wires.

NOTE

To facilitate installation, leave guide wire in aircraft.

Installation of Engine Control Cables. (See figure 9-6.)

- a. Attach guide wires to the ends of control cables.
- b. Route the propeller, throttle, and mixture control cables to their proper location in the engine nacelle and the control pedestal.
- c. Remove guide wires from control cables.
- d. Install rod ends (15) on mixture and throttle control cables.

NOTE

Do not connect rod ends (15) to serrated levers (17) at this time.

- e. Secure control cables to nacelle firewall (10) and control pedestal support bracket with bulkhead locknut (6).
- f. Connect control cables clevis ends to quadrant control levers with attaching clevis pins and safety in place with cotter pin.
- g. Route propeller cable through bracket (7) and secure with bulkhead locknuts (6).
- h. Secure rod end (15) to propeller cable and connect rod end to propeller governor (19) with bolt, spacer and nut.

Change 4

NOTE

On 310P0001 and On, secure governor control to the outboard hole of the control arm.
On Turbo 310P0001 and On, secure governor control to the inboard hole of the control arm.

- i. (Refer to Section 10.) Rig propeller control in accordance with rigging procedures.
- j. Connect mixture and throttle rod ends (15) to serrated levers (17) with attaching bolts, washers, spacers and nuts. Rig in accordance with rigging procedures.

Rigging Mixture and Throttle Controls. (See figure 9-6.)

- a. Rig control cables on throttle valve and metering unit as follows:

1. Find the neutral position of the throttle shaft by rotating the throttle shaft clockwise and then counterclockwise until the shaft comes to rest on the internal stops. Scribe an index mark on shaft and throttle body at these positions. Rotate throttle shaft to the midpoint between the marks and scribe a neutral position mark. The neutral position on the metering unit can be determined by visually positioning the pin on the metering unit shaft at the midpoint between the two stop pins. Position both the throttle and metering unit shafts to neutral.

2. Align serrated spacers on throttle and metering unit shafts so that serration lines on the face of the spacer are perpendicular to the neutral position of the shafts.

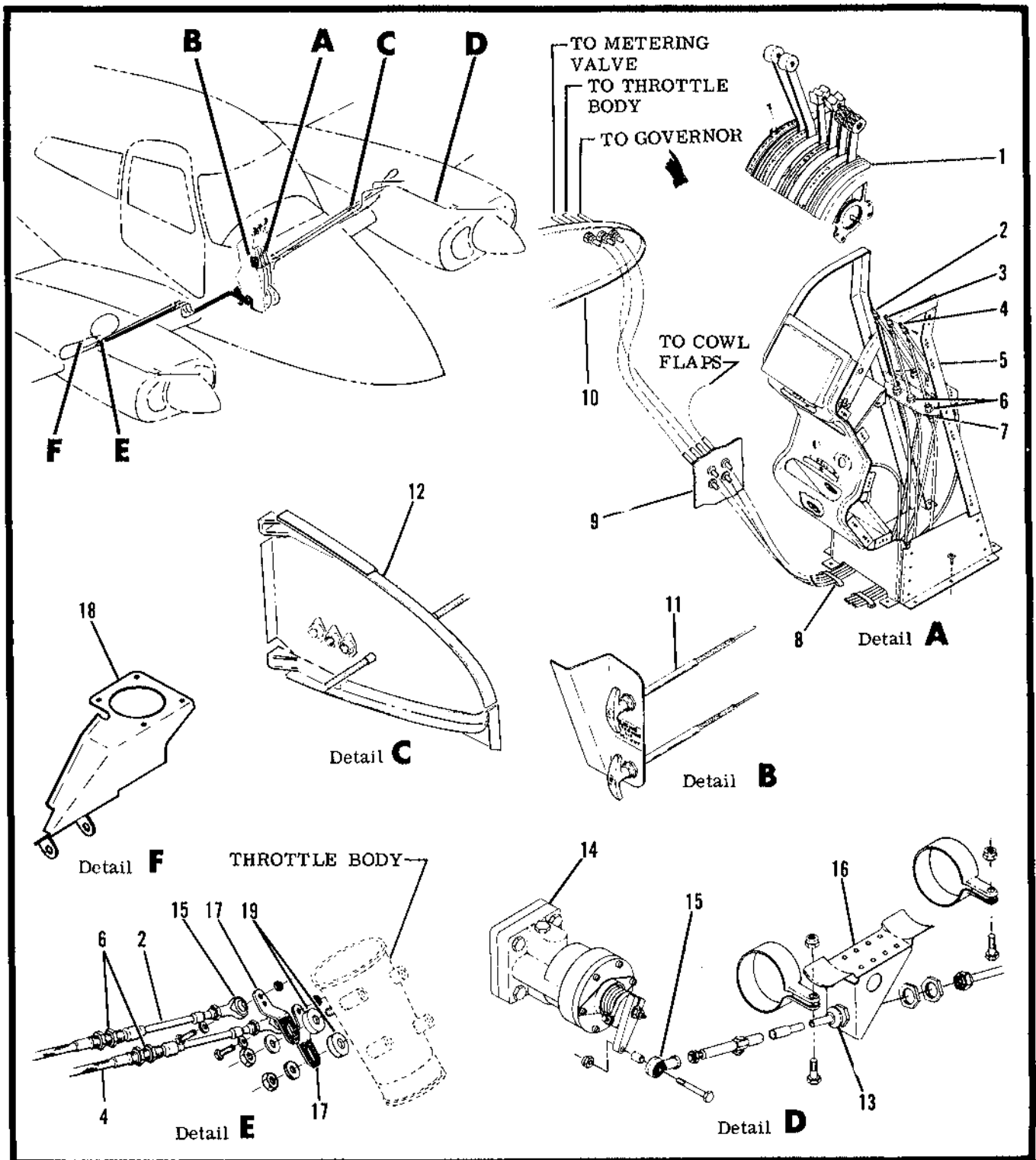
CAUTION

Care should be exercised in order to maintain original factory setting of serrated spacers on shafts.

3. Install levers (17) on spacers (19) aligning the serrations.
4. Secure levers (17) and spacers (19) to throttle and metering unit shafts with washers and nuts.
5. On the control quadrant, place throttle and mixture control levers at the midpoint between stops.
6. With the throttle and metering unit shafts in the NEUTRAL position and the throttle and mixture control levers on quadrant set at the midpoint, adjust control cables rod ends (15) so that when attached to levers (17), a 90 degree angle is formed between centerline of lever (17) and centerline of control cables.

NOTE

If throttle and mixture controls on the quadrant were not set at a true midpoint as described in step 5 above, the 1/4 inch tolerance as noted in following steps b and d will not be available. Readjustment for 1/4 inch travel (cushion) will be necessary and should be made as specified in Rigging Procedures Chart.

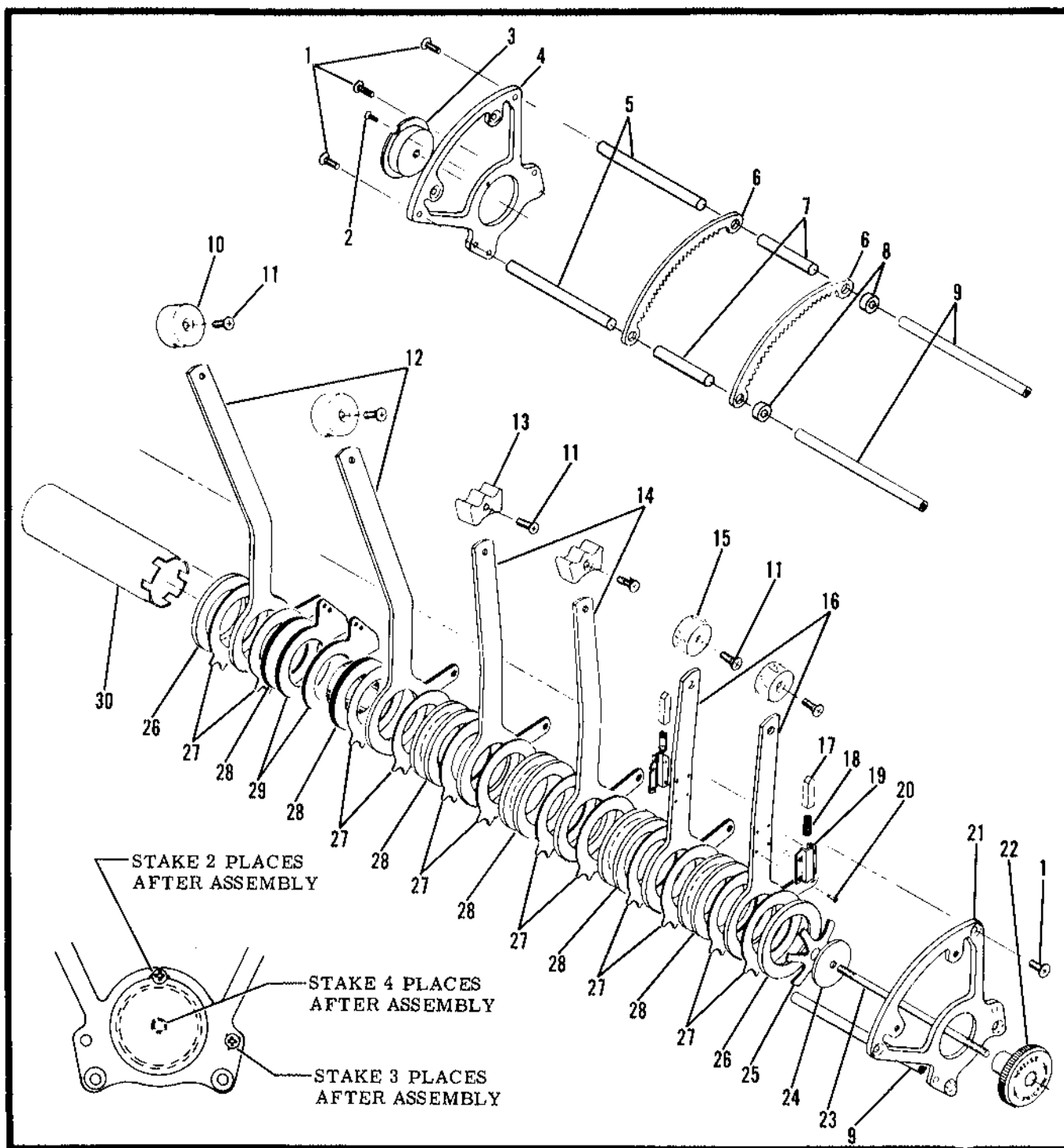


1. Control Quadrant
2. Throttle Control Cable
3. Propeller Control Cable
4. Mixture Control Cable
5. Control Pedestal
6. Locknut (Bulkhead)

7. Support Bracket
8. Cable Clamp
9. Fuselage Skin
10. Nacelle Fire Wall Rib
11. Alternate Air Control
12. Inboard Nacelle Rib
13. Swivel Connector

14. Propeller Governor
15. Rod End
16. Mounting Bracket
17. Serrated Lever
18. Mounting Bracket
19. Serrated Spacers

Figure 9-6. Engine Controls



1. Screw	11. Screw	21. Mounting Plate (Right)
2. Lock Screw	12. Lever (Throttle Control)	22. Friction Knob
3. Retainer	13. Knob (Pitch Lever)	23. Stud
4. Mounting Plate (Left)	14. Lever (Pitch Control)	24. Washer
5. Spacer	15. Knob (Mixture Lever)	25. Spring
6. Rack (Mixture Control)	16. Lever (Mixture Control)	26. Spacer
7. Spacer	17. Ratchet Stop	27. Friction Disc
8. Spacer	18. Spring	28. Spacer
9. Guide Rods	19. Housing	29. Cam
10. Knob (Throttle Lever)	20. Screw	30. Hub

Figure 9-7. Control Quadrant Disassembly

b. Adjustment of the idle mixture is accomplished by the use of a locknut which is attached to the metering unit lever on the metering unit. Tightening locknut, to shorten the interconnecting linkage, provides a richer mixture. Adjust to obtain a slight and momentary gain in idle speed as the mixture control is moved toward IDLE CUT-OFF (if set too lean, idle speed will drop under the same condition). Mixture control levers in the cabin should end their travels approximately 1/4 of an inch before reaching the quadrant stops. At the same time, the metering unit levers on the engines should rest against the corresponding stops.

c. Metering unit levers should be uniform within

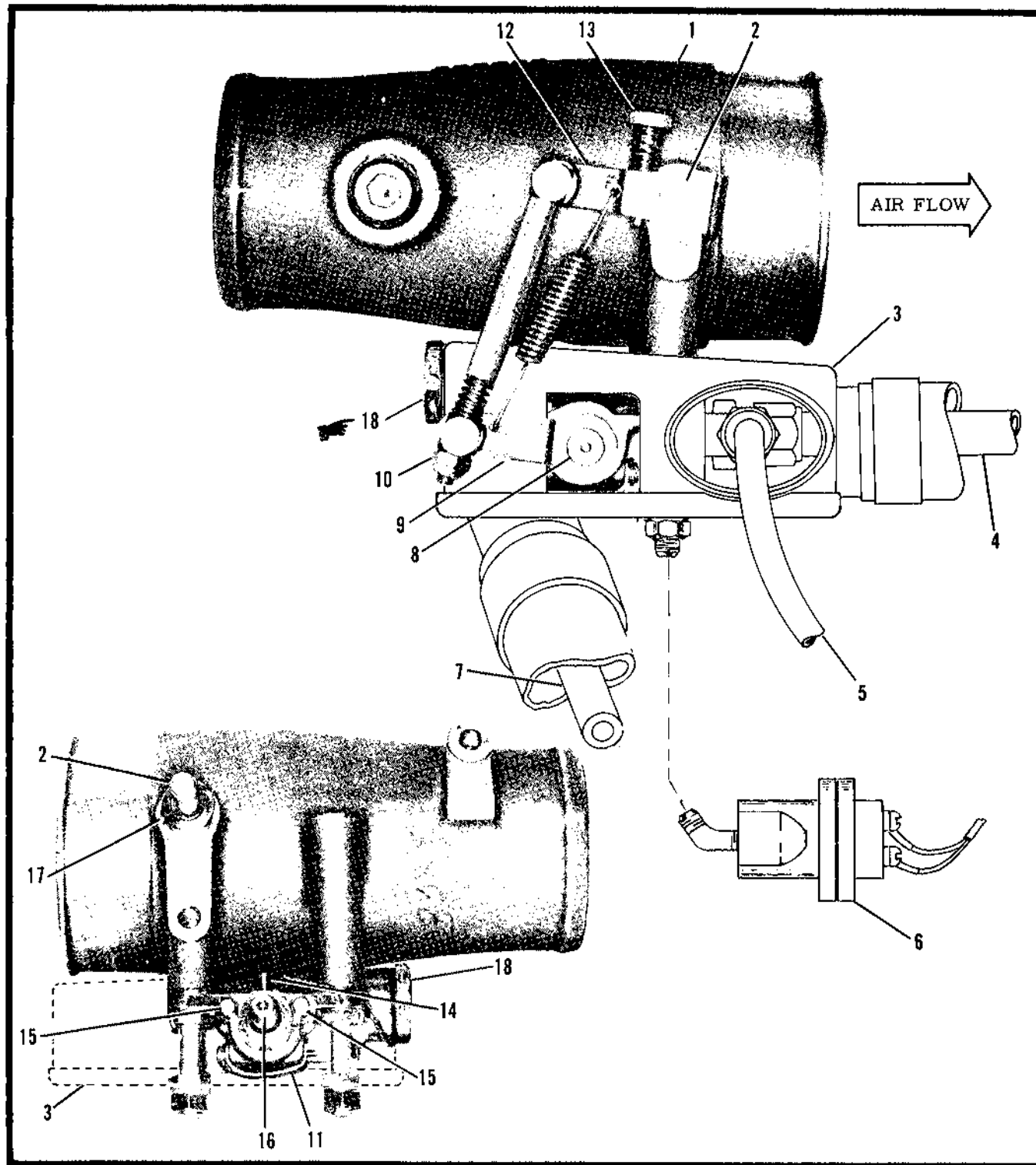
1/2 of a knob through the cruising range. This can be checked by adjusting both flow meter readings to an identical value at uniform RPM and manifold pressure on both engines.

d. Adjust the throttle control levers in the cabin so that their travel ends 1/4 of an inch before reaching the quadrant stops. At the same time the throttle levers on the engines should rest against the corresponding stops.

e. Throttle control levers should be uniform within 1/8 of an inch of the knobs through the entire travel. The rigging procedures chart provides corrective instructions in order to meet the above control requirements.

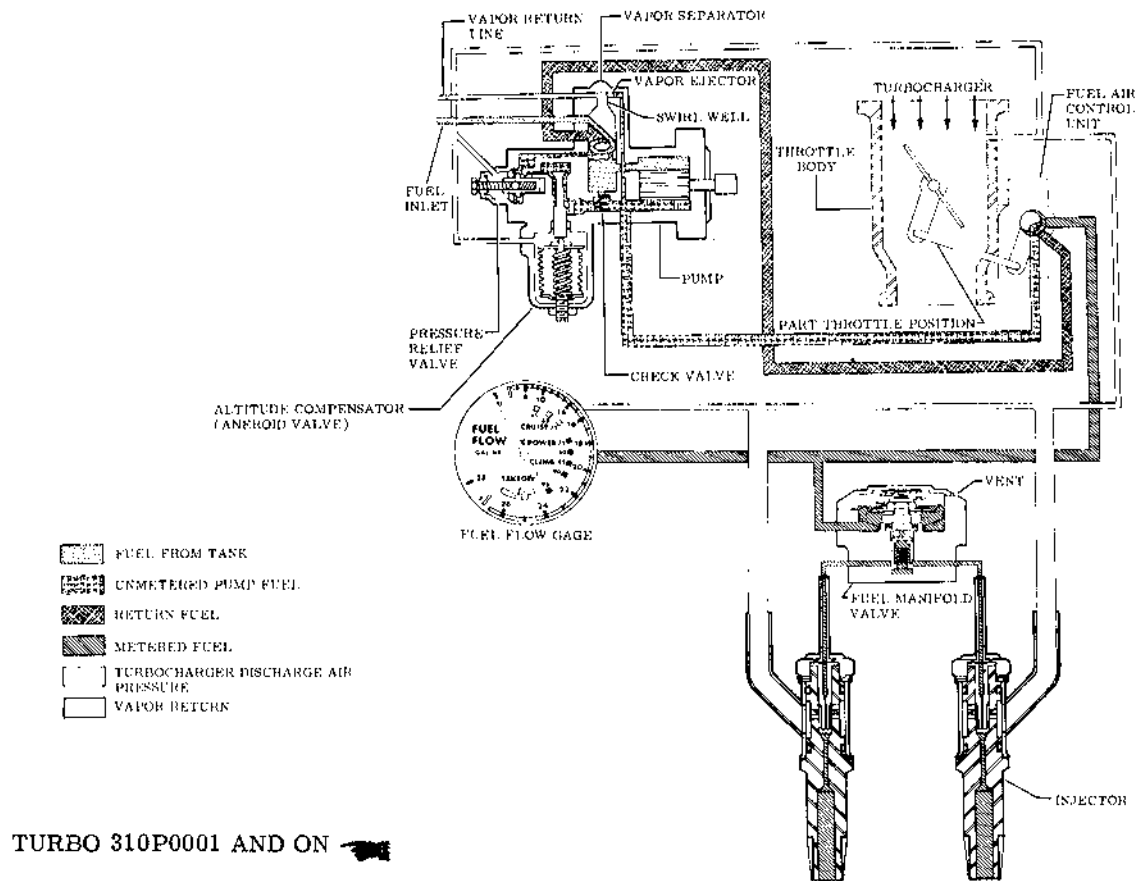
Rigging Procedures Chart for Mixture and Throttle Controls. (See figure 9-6.)

TROUBLE	PROBABLE CAUSE	CORRECTION
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.		
MIXTURE CONTROL LEVER REACHES QUADRANT BEFORE COVERING FULL TRAVEL	Insufficient control travel.	(See figure 9-6.) Shorten travel of serrated lever (17) by resetting lever higher on serrated spacer.
MIXTURE CONTROL LEVER STOPS SHORT AT BOTH ENDS OF QUADRANT	Excessive control travel.	(See figure 9-6.) Lengthen travel of serrated lever (17) by resetting lever lower on serrated spacer.
MIXTURE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES THE QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	(See figure 9-6.) Disconnect rod end (15) from lever (17) and turn rod end until desired adjustment is achieved. Connect rod end to lever.
UNEVEN MIXTURE RESPONSE BETWEEN ENGINES (MORE THAN HALF KNOB DIFFERENCE AT BALANCED FLOW METER READINGS, RPM AND MANIFOLD PRESSURE)	Different mixture control sensitivities.	Refer to Rigging Mixture and Throttle Controls.
THROTTLE CONTROL LEVER REACHES QUADRANT STOPS BEFORE COVERING FULL TRAVEL	Insufficient control travel.	(See figure 9-6.) Shorten travel of serrated lever (17) by resetting lever higher on serrated spacer.
THROTTLE CONTROL LEVER STOPS SHORT AT BOTH ENDS OF QUADRANT	Excessive control travel.	(See figure 9-6.) Lengthen travel of serrated lever (17) by resetting lever lower on serrated spacer.
THROTTLE CONTROL LEVER STOPS SHORT AT ONE END OF TRAVEL AND STRIKES THE QUADRANT STOP AT THE OTHER END	Uneven control travel adjustment.	(See figure 9-6.) Disconnect rod end (15) from lever (17) and turn rod end until desired adjustment is achieved. Connect rod end to lever.

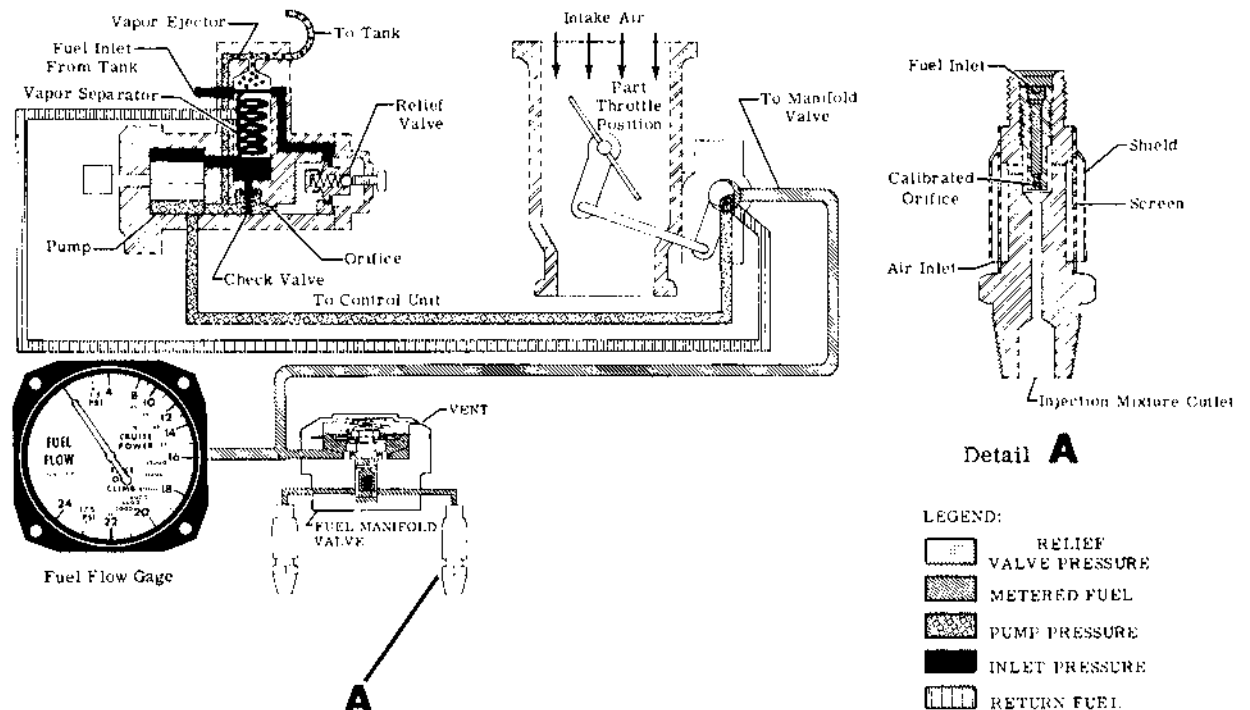


1. Throttle Body	7. Fuel Return	14. Approximate Neutral Position
2. Throttle Shaft	8. Metering Unit Shaft	15. Pin Stop
3. Metering Unit Cooling Shroud	9. Metering Unit Lever	16. Fuel Air Control Unit Shaft
4. Metering Fuel to Manifold	10. Idle Mixture Locknut	17. Roll Pin Indexed to Approximate Neutral Position
5. Fuel Supply	11. Metering Unit	18. Filter Screen
6. Fuel Pressure Switch	12. Throttle Lever	
	13. Idle Adjust	

Figure 9-8. Fuel-Air Control Unit



TURBO 310P0001 AND ON



310P0001 AND ON

Figure 9-9. Fuel Injection Schematic

Rigging Procedures Chart for Mixture and Throttle Controls. (Continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
UNEVEN THROTTLE SETTING RESPONSE BETWEEN ENGINES. MORE THAN 1/8 INCH DIFFER- ENCE 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.		

ENGINE CONTROL QUADRANT.

The engine control quadrant, mounted in the control pedestal, contains the throttle levers, propeller pitch levers, and mixture levers. The control quadrant components are fastened together in a manner which allows a friction control knob at the right side of the control quadrant to vary the amount of friction on the various control levers. This provides a means of locking the control levers in the desired position.

Removal and Installation of Engine Control Quadrant.
(See figure 9-7.)

- a. (Refer to Section 3, Control Pedestal Installation.) Remove elevator trim control wheel, cover plate, friction knob, upper panel and side panel.
- b. Remove cover box or autopilot control unit (optional equipment) from upper face of control pedestal by removing screws from support angles.
- c. Disconnect control cables from quadrant control levers by removing the clevis pins. The clevis pins are safetied with cotter pins.
- d. Remove control quadrant from control pedestal by removing attaching screws.
- e. Install control quadrant by reversing steps a. through d. , above.

Disassembly of Control Quadrant. (See figure 9-7.)

- a. Remove three screws (1) attaching right mounting plate (21) to guide rods (9).
- b. Remove washer (24) and spring (25) from end of center stud (23).
- c. Remove rack (6) and spacers (8) from guide rods, then remove spacer (26), friction disc (27) and control lever (16) from hub (30). Follow this sequence and remove the remaining parts assembled on the guide rods and hub.

NOTE

The spacers are of different thicknesses.

- d. Remove three screws (1) attaching rods to left mounting plate (4) and remove guide rods.

CAUTION

Hold the ratchet stop (17) on the mixture levers (16) down when removing the racks to prevent them from springing out of their housings.

- e. Remove lock screw (2) from left mounting plate (4) and remove hub (30) from mounting plate.
- f. Unscrew retainer (3) from hub (30) and center stud (23) from retainer, to complete disassembly.

Assembly of Control Quadrant. (See figure 9-7.)

- a. Screw center stud (23) into retainer (3).
- b. Screw retainer into hub (30) and install hub in left mounting plate (4). Secure hub to mounting plate with lock screw (2).

NOTE

Prick punch edge of lock screw after installing to prevent it from becoming loose and dropping out.

- c. Install three guide rods (9) on left mounting plate (4) with three attaching screws (1).
- d. 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.

- e. Install right mounting plate (21) with three screws (1), attaching mounting plate to guide rods (9).

FUEL INJECTION SYSTEM.

The fuel injection 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 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

the correct relation to 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 pump.

Troubleshooting the Fuel Injection System.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START AND 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.
ENGINE WILL NOT START WITH FUEL FLOW GAGE INDICATION	Selector valve in wrong position.	Position selector valve to MAIN TANK position.
	Engine flooded.	Reset Throttle, clear engine of excess fuel, try another start.
	No fuel to engine.	Loosen one line at nozzle. If no fuel shows, with fuel flow on gage, replace fuel manifold valve.
ROUGH IDLE	Nozzle restricted.	Remove nozzles and clean.
	Improper idle mixture.	Adjust fuel-air control unit in accordance with adjustment procedures.
POOR ACCELERATION	Idle mixture incorrect.	Adjust fuel-air control unit in accordance with adjustment procedures.
	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.
	Improper mixture.	Improper pump pressure, replace.
LOW FUEL FLOW GAGE INDICATION	Restricted flow to metering valve.	Check mixture control for full travel. Check for clogged fuel filters.
	Inadequate flow from fuel pump.	Adjust engine-driven fuel pump.
HIGH FUEL FLOW GAGE INDICATION	Altitude compensator (aneroid valve) stuck Turbo-System 310P AND 310Q.	Repair or replace engine driven fuel pump.
	Restricted flow beyond metering valve.	Check for restricted nozzles or fuel manifold valve. Clean or replace as required.
	Restricted recirculation passage in	Replace engine-driven fuel pump.

TROUBLE	PROBABLE CAUSE	CORRECTION
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.
	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 CUT-OFF	Engine getting fuel.	Check mixture control is 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 injector pump.
UNMETERED FUEL PRESSURE DROP	Relief valve stuck open.	Repair or replace injector pump.
VERY HIGH IDLE AND FULL THROTTLE FUEL PRESSURE PRESENT	Relief valve stuck closed.	Repair or replace injector pump.
FUEL DISCHARGING INTO ENGINE COMPARTMENT AND RELIEF VALVE WILL PROBABLY NOT OPERATE (TURBO-310P0001 AND ON)	Leaking diaphragm.	Repair or replace injector pump.
LOW FUEL PRESSURE AT HIGH POWER (TURBO 310P0001 AND ON)	No turbocharger discharger discharge pressure	Check turbocharger lines and fittings.
	Check valve stuck open.	Repair or replace injector pump.
NO FUEL PRESSURE	Check valve stuck open.	Repair or replace injector pump.

FUEL-AIR CONTROL UNIT.

The fuel-air control unit consists of the throttle body and the metering body. This unit occupies the position ordinarily used for a carburetor at the intake manifold inlet. The function of this unit is to control engine air intake and to set the metered fuel pressure for proper fuel-air ratio. There are three control elements in this unit, one for air and two for fuel, one of which is for fuel mixture and the other for fuel metering. Main fuel enters the control unit through a strainer and passes to the metering valve. The position of the metering valve controls the fuel passed to the manifold valve and nozzles. A linkage connecting the metering valve to the air throttle proportions airflow to fuel flow. The position of the mixture valve determines the amount of fuel returned to the fuel pump. The fuel control portion of the fuel-air control is enclosed in a shroud and is blast air cooled

to help prevent vapor lock. A fuel pressure switch, connected to fuel control unit, actuates to cause the auxiliary fuel pump to operate at a high speed if the engine-driven fuel pump pressure drops below 4 to 5 psi. The auxiliary fuel pump switch must be ON for the fuel pressure switch to operate.

Removal of Fuel-Air Control Unit.

- Remove the engine cowling.
- Place the fuel selector valve handles OFF.
- Loosen clamp on ram air tube at the metering body and slide tube clear of hose connection.
- Remove sheet metal screws retaining cover on metering body cooling shroud.
- Disconnect hose to the fuel pressure switch.
- Slide cooling shroud cover aft and down to expose the three hose connections at the metering

body. These hoses are to be disconnected at this time.

NOTE

Plug or cap all open lines, hoses and fittings.

- g. Loosen the clamps which secure the throttle body to both the right and left intake manifold.
- h. Remove the air intake box in accordance with removal procedures.
- i. Remove two forward bolts attaching throttle body to upper support.
- j. Remove two nuts attaching throttle body to the lower support braces.
- k. Disconnect the throttle and mixture controls.
- l. Remove fuel-air control unit.

NOTE

The metering body may be removed from the throttle body by removing the three special bolts which are safetied with tang washers.

Installation of Fuel-Air Control Unit.

- a. Place the fuel-air control unit in position on the engine.
- b. Temporarily install upper support bolts to obtain the correct position for the fuel-air control unit.
- c. Install two lower support braces and install lock-washers and nuts.
- d. Install hose connectors and clamps which secure the unit to the intake manifold.
- e. Install the air intake box in accordance with installation procedures.

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.

- f. Attach the unmetered fuel hose, the metered fuel hose, and the vapor return hose to the metering body.
- g. Slide cooling shroud cover into place and attach with sheet metal screws.
- h. Connect hose from fuel pressure switch.
- i. Slide ram air tube onto metering body cooling shroud and secure with clamp.
- j. Connect throttle and mixture controls.
- k. Inspect completed installation.
- l. Rig the engine controls in accordance with rigging procedure.
- m. Install engine cowling.

Fuel-Air Control Unit Adjustments.

The idle speed adjustment is a conventional spring-loaded screw located in the air throttle lever. The idle mixture adjustment is accomplished by the lock-nut at the metering valve end of the linkage. Tightening the nut to shorten the linkage provides a richer

mixture. A leaner mixture is obtained by backing off the nut to lengthen the linkage. With engine running at 1000 RPM and auxiliary pumps set to the LOW position, adjust idle mixture as rich as possible without obtaining an increase in engine RPM when mixture control is slowly moved toward IDLE CUT-OFF. Check idle mixture with auxiliary pumps off to assure that idle mixture has not changed.

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 port simultaneously. A fine mesh screen is included in the fuel manifold as additional protection of the injection nozzles against dirt or foreign matter. The fuel manifold is calibrated to operate at 4 PSI.

Removal of Fuel Manifold. (See figure 9-3.)

NOTE

Plug or cap all disconnected lines, hoses and fittings.

- a. Disconnect fuel hose (8) at the fuel manifold (9).
- b. Disconnect the six fuel injection lines at the fuel manifold.
- c. Disconnect fuel pressure line (6).
- d. Remove the fuel manifold (9) by removing the crankcase bolts which secure it.

Installation of Fuel Manifold. (See figure 9-3.)

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.

- a. Install the fuel manifold (9).
- b. Connect fuel pressure line (6).
- c. Connect fuel line (8) at the fuel manifold (9).
- d. Connect the six fuel injection lines at the fuel manifold.
- e. Inspect the completed installation.

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 arrangement is incorporated in each 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 engine. Nozzles are stamped with a letter on the hex of the nozzles body. Each engine has matched (same letter) nozzles. Replacement nozzles must match but a matched set of another letter may be used.

Removal of Fuel Discharge Nozzles. (See figure 9-3.)

- a. Disconnect the fuel injection lines at the fuel discharge nozzles.

NOTE

Plug or cap all disconnected lines and fittings.

- b. Remove fuel discharge nozzles from cylinders.

Installation of Fuel Discharge Nozzles. (See figure 9-3.)

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. Check installation for crimped lines and loose fittings.

FUEL INJECTION PUMP.

The fuel pump is a positive-displacement, rotating vane type. It has a splined shaft for connection to the accessory drive section of the engine. Fuel enters the pump at the swirl well of the vapor separator. Here, vapor is separated by a swirling motion so that only liquid fuel is fed to the pump. The vapor is drawn from the top center of the swirl well by a small pressure jet of fuel and is fed into the vapor return line and returned to the fuel tank. Since the pump is engine-driven, changes in engine speed affect total pump flow proportionally. The pump supplies more fuel than is required by the engine, therefore, a relief valve is provided to maintain a constant fuel pump pressure. On Turbo 310P, 310Q, a recirculation path within the pump is provided by an arrangement of a calibrated variable orifice (aneroid valve) and relief valve to maintain proper delivery pressure relative to altitude. A check valve is provided so that auxiliary pump pressure can bypass the engine-driven pump for starting. In case of engine-driven fuel pump failure, the auxiliary fuel pump will operate automatically when the auxiliary fuel pump switch is ON.

Removal of Fuel Injection Pump. (See figure 9-3.)

- a. Place fuel selector valve handles OFF.
- b. Remove the engine cowling
- c. Remove the alternator (53) drive belt (310P, 310Q).
- d. Tag and disconnect all lines and fittings attached to the fuel pump (50).

NOTE

Plug or cap all disconnected lines, hoses and fittings.

- e. Remove the shroud surrounding the fuel pump (50).
- f. Remove the four nuts and washers attaching the pump to the engine.
- g. 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.

- h. 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. (See figure 9-3.)

- a. Position a new gasket and fuel pump (50) on the 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.

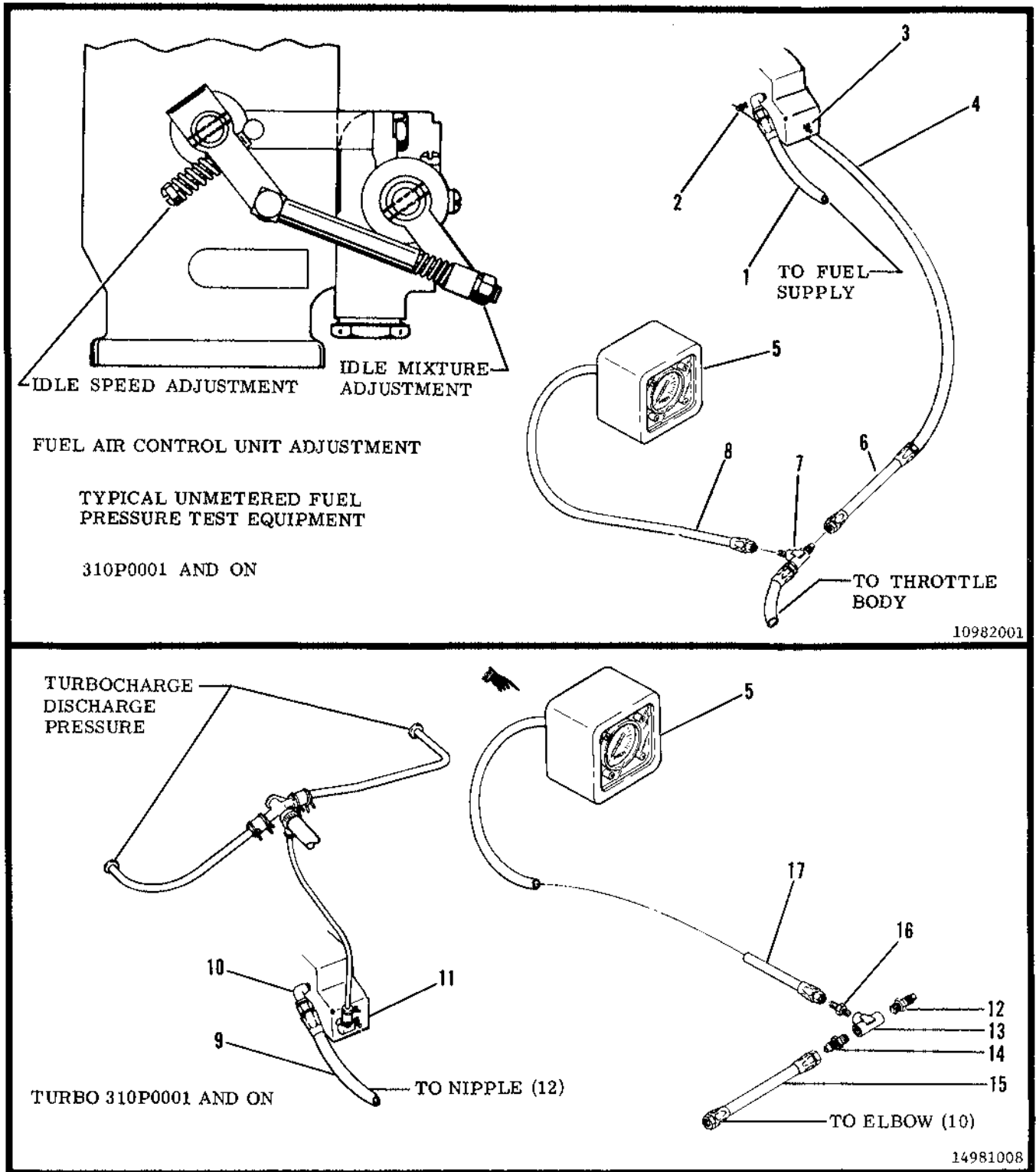
NOTE

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. Replace the alternator (53) drive belt and tighten the bolt on the adjusting arm so that the belt is tight, then safety bolt.
- f. Replace the engine cowling.
- g. Check unmetered fuel pressure in accordance with Unmetered Fuel Test Hook-up, Check and Adjustment paragraph.

Fuel Mixture Check.

- a. Perform a fuel mixture check as follows:
 1. Warm-up engine, move throttle back to idle position (600 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, NO RPM rise will occur when the mixture control is gradually moved towards IDLE CUT-OFF.
 4. Using the above procedure set throttle to 1300 RPM and reduce mixture control slowly. If mixture



1. Fuel Inlet Hose	7. Tee	12. Nipple
2. Adjusting Screw (High setting)	8. Gage Hose	13. Tee
3. Adjusting Screw (Low setting)	9. Hose (Fuel Pump to metering unit)	14. Nipple
4. Unmetered Fuel Pressure Hose	10. Elbow	15. Hose
5. Gage	11. Adjusting Screw	16. Nipple
6. Test Hose		17. Hose

Figure 9-10. Fuel Injection Pump Adjustment

control and fuel injection pumps are properly set, RPM should increase 10 RPM when mixture control is gradually moved towards IDLE CUT-OFF.

NOTE

If RPM increases when mixture is reduced, fuel mixture is too rich; conversely, if RPM diminishes rapidly when mixture is reduced, fuel mixture is too lean.

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 Test Hook-Up, Check and Adjustment (310P0001 AND ON). (See figure 9-10.)

The following procedures for checking and adjusting the unmetered fuel pressure are factory recommended and must be followed to insure the engines are properly adjusted.

CAUTION

Excessive leaning is difficult to detect unless these procedures are followed.

- a. Connect test gage to fuel pump as follows:
 1. Place fuel selector valves in the OFF position.
 2. Attach hose (8) to aft side of gage (5).
 3. Install tee (7) in line (8).
 4. Attach test hose (6) to tee (7).
 5. Disconnect unmetered fuel pressure hose (4) from the fuel pump fitting located at the rear underside of pump.
 6. Connect the unmetered fuel pressure hose (4) to tee (7).
 7. Connect test hose (6) to the fuel pump fitting located at the rear underside of pump.
- b. Adjust unmetered fuel pressure as follows:
 1. Allow engine to warm-up, then set idle RPM to 600 and check unmetered fuel pressure. Pressure should indicate 7.0 PSI on test hook-up pressure gage.

NOTE

The test gage should be placed as near the same level as the fuel pump as possible or erroneous readings will result.

If pressure does not indicate 7.0 PSI, the high end setting must be turned in 1-1/2 to 3 turns and the low setting must be adjusted to 7.0 PSI. After correct unmetered fuel pressure is obtained, position auxiliary fuel pump to LOW, observe that fuel pressure does not exceed 7.2 PSI. If fuel pressure exceeds 7.2 PSI, the auxiliary fuel pump may require adjusting. See Section 11 for Adjusting Procedures.

2. Maximum fuel flow adjustment:

Allow oil temperature to reach an indication in the upper 1/3 of the green arc of the oil temperature indicator, run engine at full throttle (2600 to 2625) and check fuel flow gage on instrument for a

reading of 130 to 137 PPH, or a metered fuel pressure reading of 18.6 to 20.0 PSI. If these readings are not in prescribed tolerance, turn high setting adjusting screw located on the lower left side of fuel pump (turn IN to increase pressure or turn OUT to decrease fuel pressure) until proper fuel pressure is obtained.

3. The engines, when well warmed, should respond to a rapid throttle acceleration without hesitation with boost pump off and on and mixture full rich.

4. After adjusting unmetered fuel pressure, check idle RPM and idle mixture in accordance with Fuel Mixture Check.

5. After completion of unmetered fuel adjustments, with test equipment removed and fuel lines connected in normal position, it may be necessary to purge air from the fuel pressure lines to prevent indicator needle fluctuations or erroneous readings.

6. Purge air from fuel pressure hoses in the following manner:

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 to full open position and mixture to full rich.

(b) Disconnect fuel pressure hoses at fuel flow gage, operate auxiliary fuel pump (primer switch) until at least one (1) pint of fuel has discharged from each pressure hose.

(c) Reconnect hoses to flow gage, tightening "finger tight" then backing off one-half (1/2) turn.

(d) Operate auxiliary pump (primer switch) until solid fuel is discharged from gage connection. Tighten connection, with pump still operating, then turn pump off.

Unmetered Fuel Test Hook-Up, Check and Adjustment (Turbo 310P0001 and On). (See figure 9-10.)

a. Test procedures are the same for left and right fuel pumps. Connect test gage to pump as follows:

1. Attach hose (17) to aft side of gage (5).
2. Install nipple (16) in hose (17) and install tee (13) on nipple (16). Install nipples (12 and 14) to tee (13) and attach hose (15).

3. Disconnect hose (9) (hose from engine-driven pump to metering unit) from fuel pump elbow (10) and connect hose (15) to elbow (10). Connect hose (9) to nipple (12).

b. Adjust compensator valve (aneroid) and pressure relief valve to obtain the following:

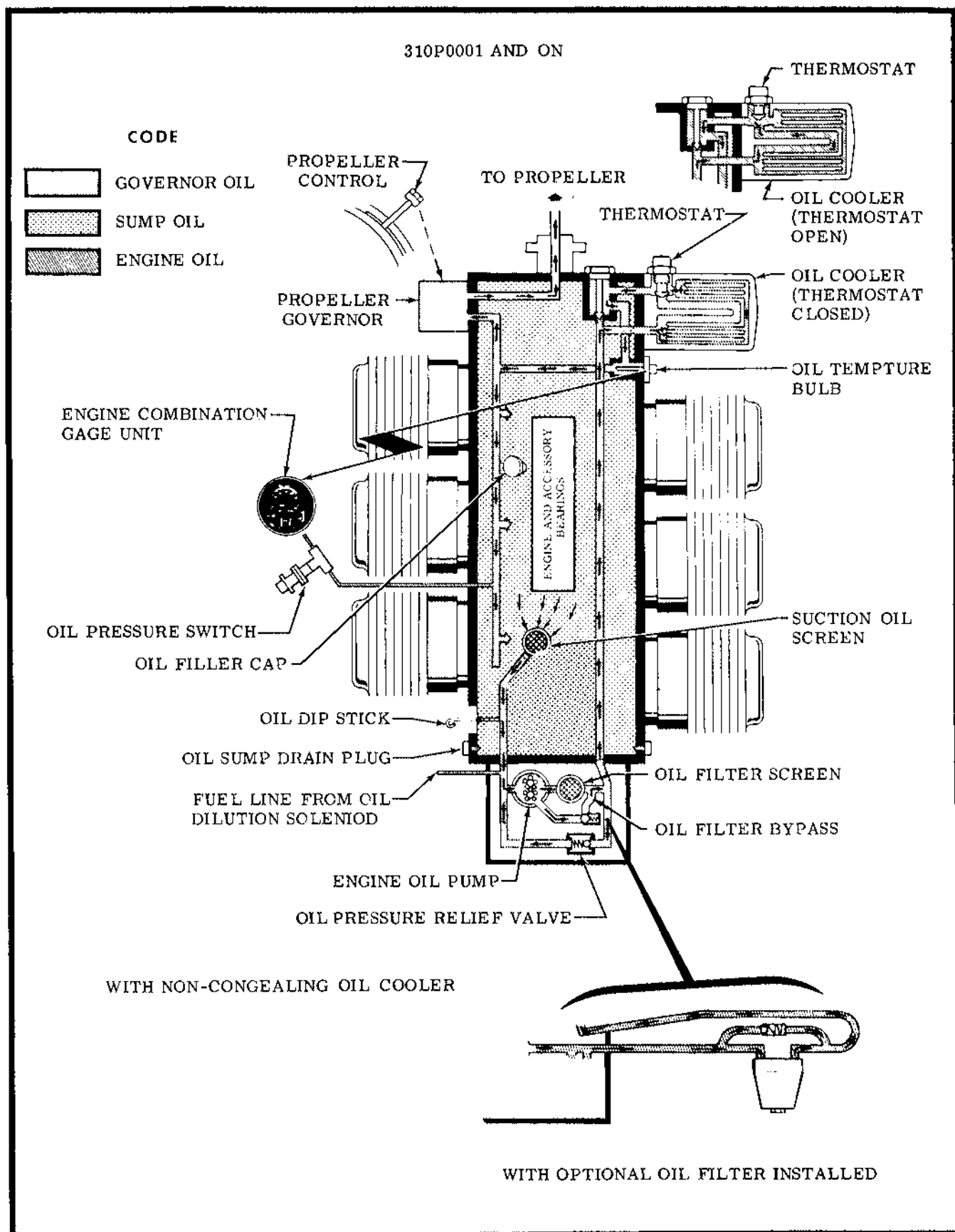


Figure 9-11. Engine Oil Systems Schematic (Sheet 1 of 2)

TURBO 310P0001 AND ON

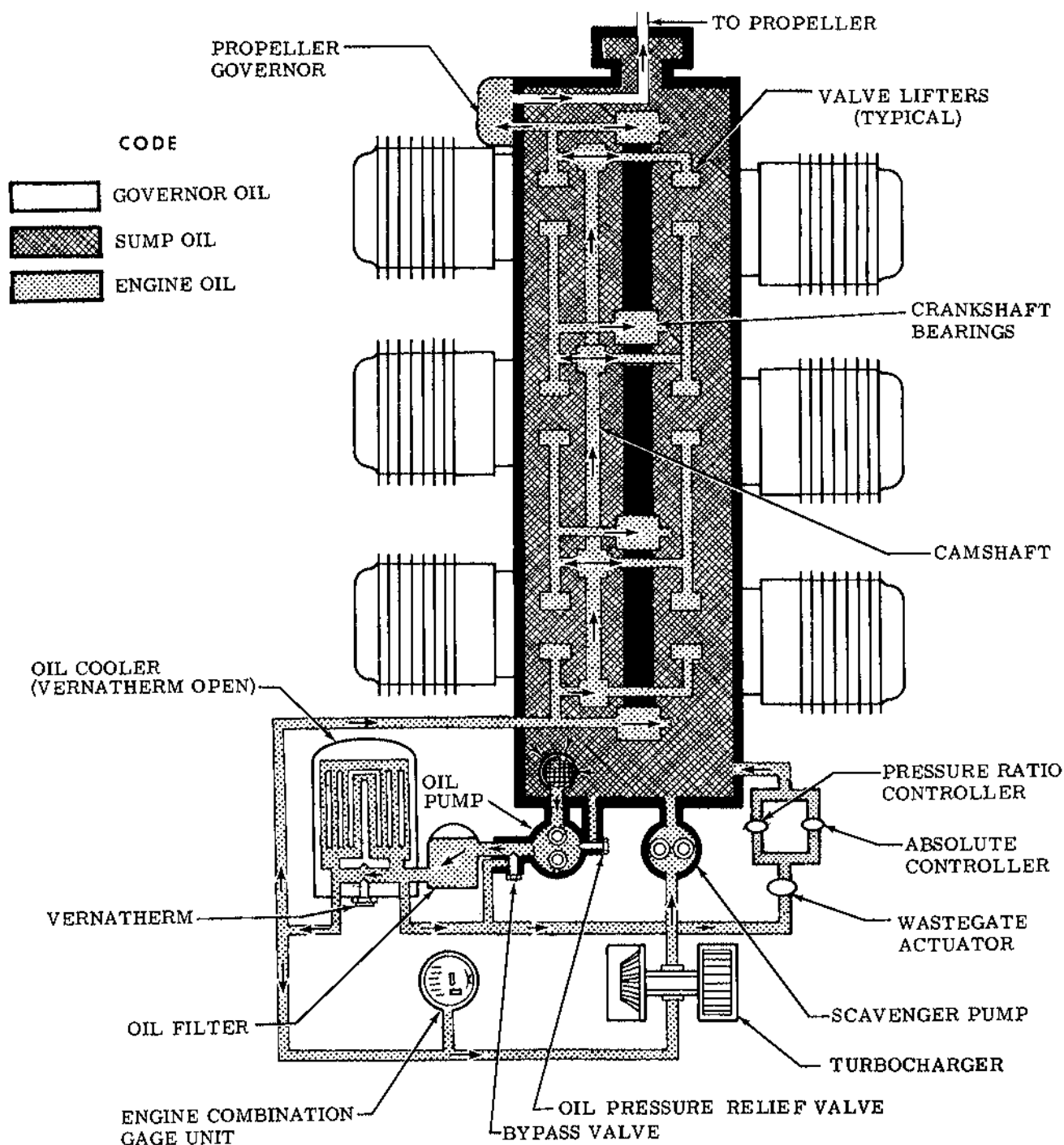


Figure 9-11. Engine Oil Systems Schematic (Sheet 2 of 2)

1. Low Unmetered Pressure Adjustment: Allow engine to warm-up, then idle engine at 600 RPM. Unmetered fuel pressure should indicate 7.0 PSI on test hookup pressure gage. If the indicated pressure does not indicate 7.0 PSI, turn adjusting screw 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 7.2 PSI.

2. Maximum Fuel Flow Adjustment: Allow engine oil to reach a temperature indication in the upper 1/3 of green arc on oil temperature indicator. With the engine power setting at maximum RPM and 32 ± 0.5 Hg, reading from the aircraft's fuel flow indicator and the auxiliary fuel pumps OFF, set fuel flow to 29.2 GPH (175.2 PPH). Position auxiliary fuel pumps to ON, check that fuel flow does not exceed 31.0 PSI (186.0 PPH). If the GPH (PPH) is not within the prescribed tolerance, loosen lock nut and turn adjusting screw on altitude compensator (turn OUT to increase and turn IN to decrease) until 27.5 to 29.2 GPH (165 to 175 PPH) is obtained.

ENGINE OIL SYSTEM. (See figure 9-11.)

The Continental engines installed in the aircraft have wet sump, pressure lubrication systems. Oil tem-

perature in each engine 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. This complete internal oil system eliminates all difficulties associated with external oil lines. Engine oil is routed externally for use in actuating the turbocharger wastegate and turbocharger lubrication on the Turbo 310P0001 and On. Engine oil is filtered through an internally mounted screen filter or externally mounted oil filter. A bypass valve will rotate the oil around the filter if it should become clogged. Oil pressure is maintained by a spring-loaded pressure relief valve which is adjustable.

Oil temperature is sensed through a heat variable resistor type temperature bulb which is located in the main oil passage of the crankcase directly below the cooler. Changes in oil temperatures are transmitted from the oil temperature bulb to the oil temperature gage through a single electrical wire.

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.

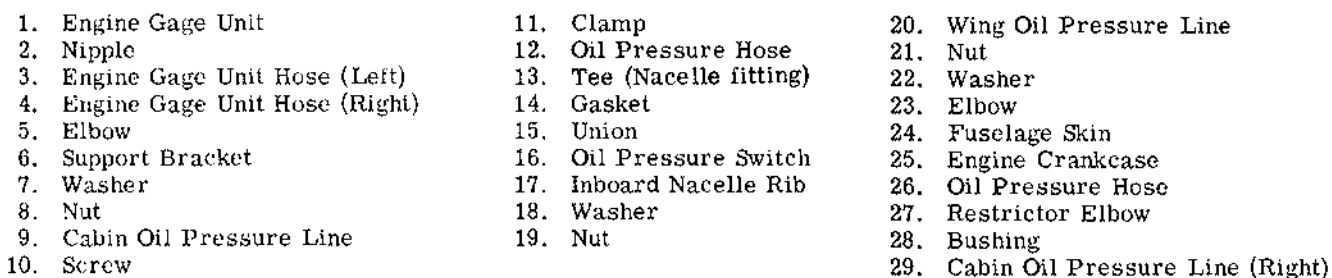
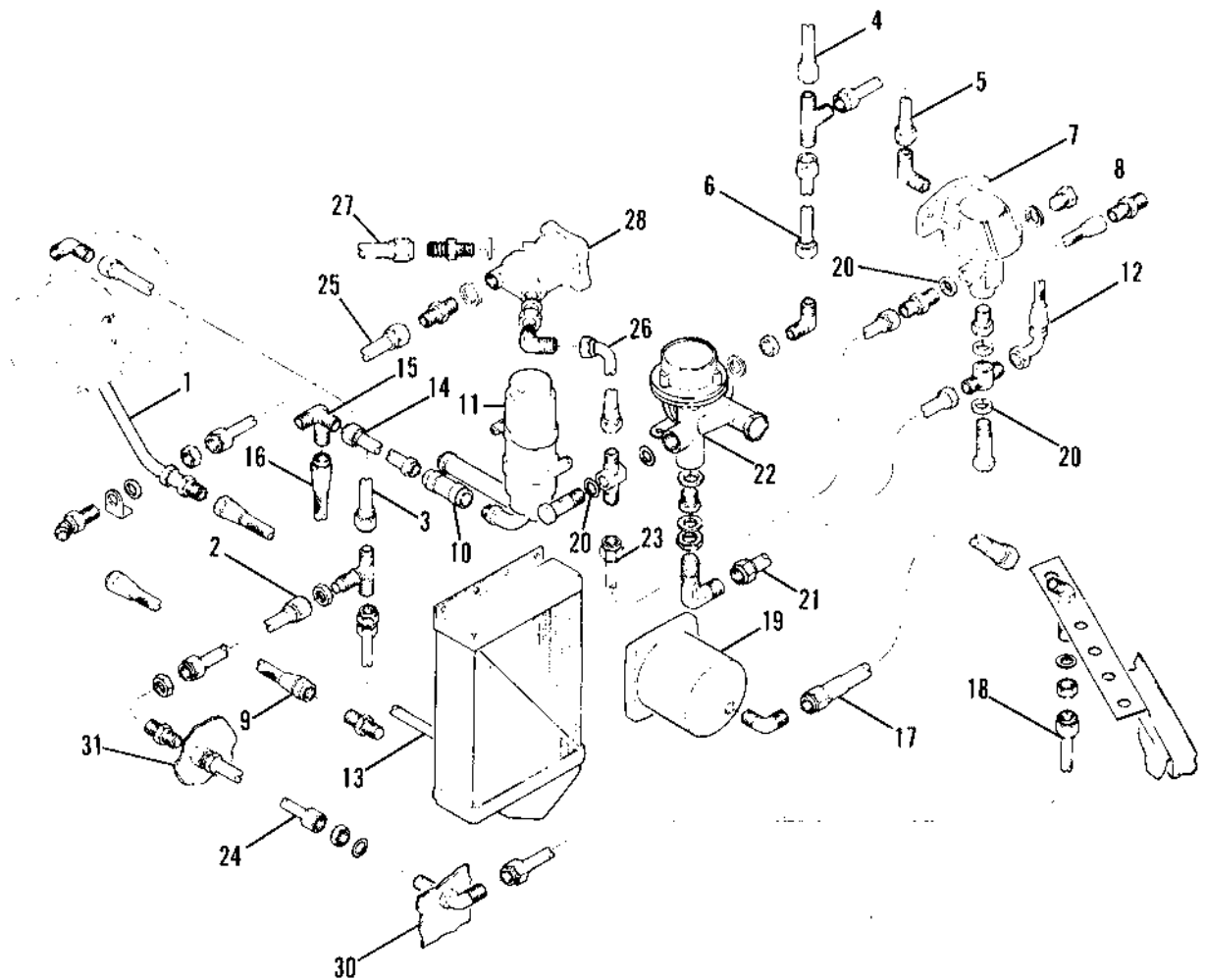


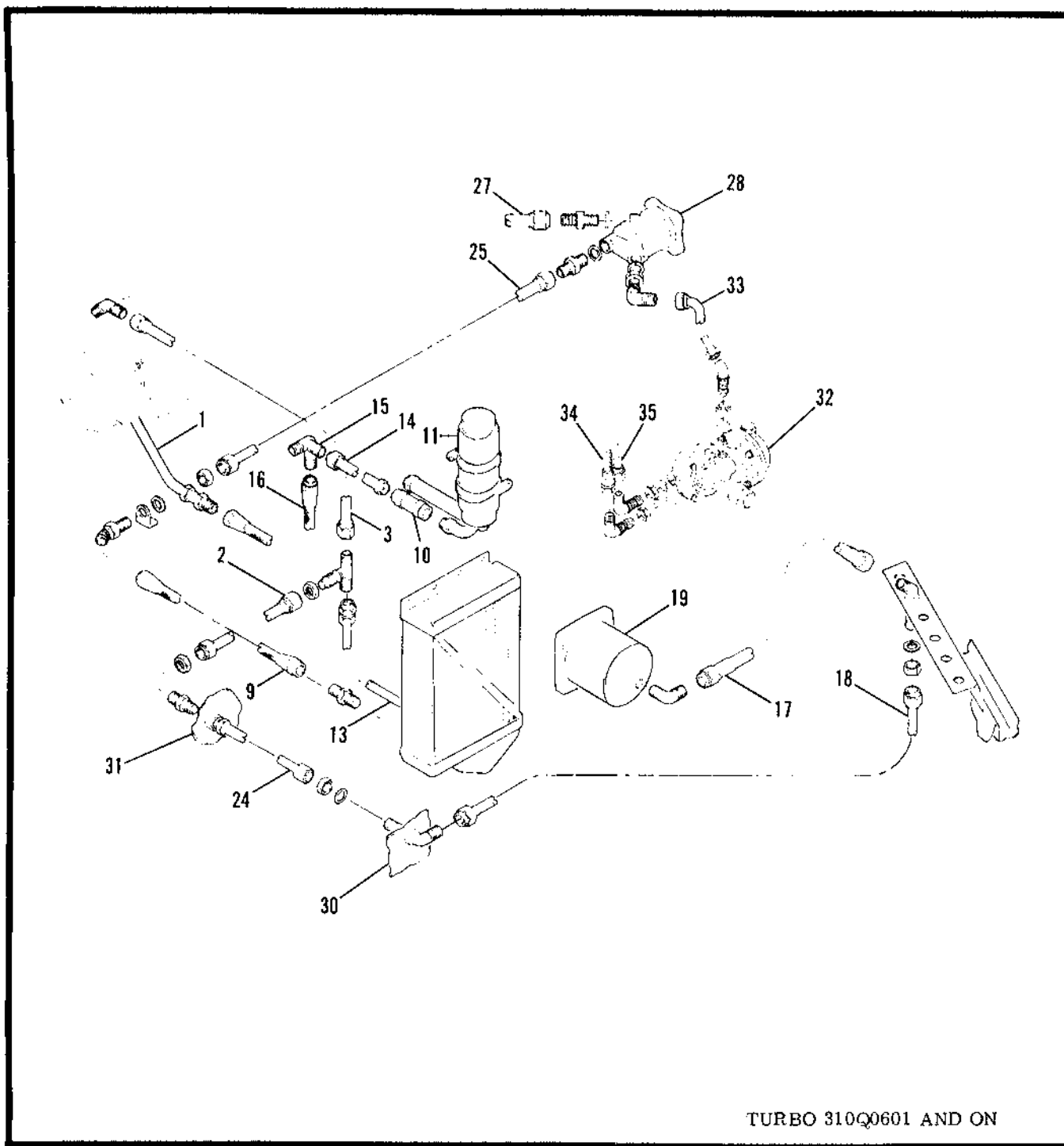
Figure 9-12. Oil Pressure System



TURBO 310P0001 TO 310Q0601

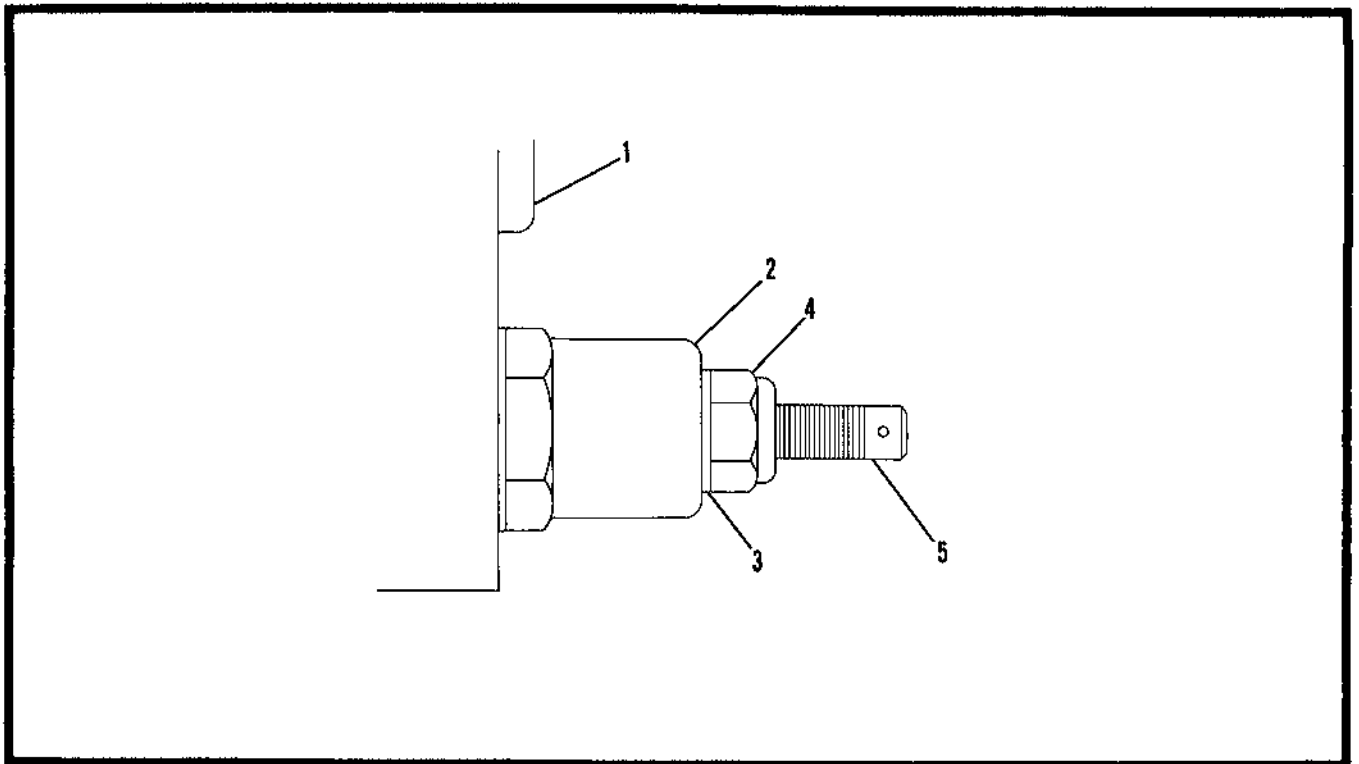
1. Turbocharger Drain Line	10. Hose (Line Assembly to Separator)
2. Line Assembly (Tee to Nacelle Rib)	11. Oil Separator
3. Line Assembly (Turbocharger to Tee)	12. Hose Assembly (Tee to Scavenger Pump)
4. Line Assembly (Tee to Throttle Body)	13. Hose Assembly (Tee to Oil Cooler)
5. Line Assembly (Tee to Ratio Controller)	14. Line Assembly
6. Line Assembly (Tee to Absolute Controller)	15. Fitting (Crankcase)
7. Pressure Ratio Controller	16. Hose Assembly (Crankcase Fitting to Turbocharger Line)
8. Ambient Air Plug	17. Hose Assembly (Bracket to Gage)
9. Hose Assembly (Oil Cooler to Elbow)	

Figure 9-13. Oil System Lines and Components Installation (Sheet 1 of 2)



18. Line Assembly (Fuselage to Bracket)	27. Drain Line
19. Oil Pressure Gage	28. Waste-gate Actuator
20. Packing	29. Absolute Pressure Controller Adjustment Plug
21. Line Assembly (Absolute Controller to Tee)	30. Fuselage Skin
22. Absolute Pressure and Rate of Change Controller	31. Nacelle Rib
23. Line Assembly (Ratio Controller to Tee)	32. Controller Assembly
24. Line Assembly (Fuselage to Nacelle Rib)	33. Line Assembly (Controller to Waste-gate)
25. Line Assembly (Actuator to Elbow)	34. Hose Assembly (Controller to Scavenger Pump)
26. Line Assembly (Actuator to Tee)	35. Line Assembly (Controller to Throttle Body)

Figure 9-13. Oil System Lines and Components Installation (Sheet 2)



- 1. Oil Pump
- 2. Housing

- 3. Washer (Copper)

- 4. Locknut
- 5. Adjusting Screw

Figure 9-13A. Oil Pressure Adjustment

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Oil Pressure System.

The oil pressure system consists of plumbing that attaches to the lower left portion of each engine crankcase between No. 2 and No. 4 cylinders. The plumbing is routed through the wings, into the cabin, and to the forward side of the instrument panel. Here it connects to a separate engine gage unit for each engine. A restrictor is incorporated in the elbow of the engine fittings to protect the gages from pressure surges and to limit the loss of engine oil in case of a plumbing failure.

Removal and Installation of Oil Pressure Lines and Hoses (310P0001 AND ON). (See figure 9-12.)

NOTE

Cap all openings and lines on removal.

- a. Disconnect oil pressure hoses (12 and 26) at inboard nacelle ribs (17) and allow all fluid to drain from oil pressure lines.

NOTE

It may be necessary to loosen both hoses (3 and 4) at back of engine gage units (1) to facilitate complete draining of oil pressure lines.

- b. To remove hoses (3 and 4) from between engine gage units (1) and support brackets (6), disconnect hoses at each end and remove from behind instrument panel.
- c. To remove lines (9 and 29) from between support brackets (6) and fuselage skin (24), remove upholstery side panels below instrument panel and back to main wing spar in accordance with upholstery removal procedures. Disconnect lines at both ends and push lower sections forward through routing holes in bulkhead until ends of lines are free of routing holes, then remove them from under instrument panel.
- d. To remove lines (20) from between fuselage skin (24) and inboard nacelle ribs (17) remove forward wing fillets and three access hole covers located on underside of each wing leading edge between fuselage and engine nacelle. Disconnect lines at each end and remove them through access hole nearest to each engine nacelle.

NOTE

It may be necessary to bend the lines slightly to facilitate removal, however, excessive bending should be avoided.

- e. To remove hoses (12 and 26) from between inboard nacelle ribs (17) and each engine crankcase (25), remove left exhaust stack assemblies from the engines. Disconnect hoses at each end.

NOTE

The left exhaust stack assemblies are removed to provide access to the crankcase oil pressure connections.

- f. Install oil pressure lines and hoses by reversing removal procedures.

CAUTION

Make certain that the oil pressure hoses are connected to the proper fittings at the engine gage units.

Removal and Installation of Oil Pressure Lines and Hoses (Turbo 310P0001 AND ON). (See figure 9-13.)

NOTE

Cap all openings and lines on removal.

- a. Disconnect and remove line assembly (3) from tee and elbow on turbocharger.
- b. Disconnect and remove hose assembly (13) from tee and oil cooler.
- c. Disconnect and remove line assembly (2) from tee and nacelle rib union.

NOTE

If line assembly (24) needs to be removed, refer to Section 3 and remove wing. Removal of line (24) is not recommended unless replacement is required.

- d. Disconnect line assembly (24) from nacelle rib union and remove from wing by routing through wing root rib.
- e. Refer to Section 3 and remove upholstery side panels. Disconnect and remove line assembly (18) from elbows on fuselage skin and bracket.
- f. Disconnect and remove hose assembly (17) from elbow and oil pressure gage (19).
- g. Install oil pressure lines and hoses by reversing removal procedures.

Removal and Installation of Waste-gate Actuator Oil Control System Lines and Hoses (Turbo 310P0001 AND ON). (See figure 9-13.)

- a. Disconnect and remove hose assembly (12) from ratio controller (7) and scavenger pump.
- b. Disconnect and remove line assemblies (21 and 23) from ratio controller (7) and absolute controller (22).
- c. Disconnect and remove line assembly (26) from absolute controller (22) and waste-gate actuator (28).

- d. On aircraft Turbo 310Q0601 and On, disconnect hose assembly (34), from controller and scavenge pump, line assembly (33) from controller and waste-gate, and line assembly (35) from controller to throttle body.
- e. Disconnect and remove line assembly (25) from waste-gate actuator (28) and elbow.
- f. Disconnect and remove hose assembly (9) from oil cooler and elbow.
- g. Install lines and hoses by reversing removal procedures.

Removal and Installation of Turbocharger Return Oil Lines and Hose (Turbo 310P0001 AND ON). (See figure 9-13.)

- a. Disconnect and remove hose assembly (16) from crankcase fitting (15) and drain line (1) by removing two bolts attaching drain line to turbocharger. Remove clamp and route from engine nacelle.
- b. Install drain line (1) and hose assembly (16) by reversing removal procedures.

Oil Pressure Adjustment.

The oil pressure relief valve, located on the oil pump is adjustable to increase or decrease oil pressure. Refer to figure 9-13A and adjust oil pressure to 30 to 60 psi.

Servicing Oil Pressure Lines.

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

Cold Weather Servicing of Oil Pressure Lines. (See figure 9-12.)

Disconnect engine hoses (12 and 26) at inboard nacelle ribs (17) and loosen connections at rear of engine gage units (1). Allow time for the oil lines to completely drain.

NOTE

To facilitate draining in cold weather, the airplane should either be stored in a heated hangar or the engines operated before the lines are disconnected.

Attach a small hand pump filled with kerosene or instrument oil to a nacelle fitting (13) and force the fluid through the oil pressure line until a few drops leak around the engine gage fitting. Tighten the hose at the gage fitting, remove pump and attach engine hose to inboard nacelle rib fitting. Repeat procedure for other engine.

OIL FILTER ADAPTER(310P0001 AND ON).

Removal of Oil Filter Adapter.

- a. Remove safety wire from case.
- b. Loosen bolt and disassemble case, element, cover, and gaskets from adapter.
- c. Unsafety and loosen adapter nut on adapter; remove adapter and packing from engine assembly.

Installation of Oil Filter Adapter.

- a. Assemble packing and adapter nut on adapter. Install adapter on engine assembly and torque adapter nut to 50 to 60 foot-pounds.

NOTE

After adapter nut has been properly torqued, check adapter for looseness (easily moved by hand). If loose, further checking of the adapter and case threads for deformation is recommended.

WARNING

Undertorque of the adapter nut can lead to improper sealing of packing, resulting in an oil leak. Destruction of the engine case threads due to adapter movement can result from undertorque.

- b. Safety adapter nut to engine assembly.
- c. Install oil filter assembly in accordance with installation procedures.

ENGINE BAFFLES.

The sheet metal baffles installed on each engine direct the flow of air around the cylinders and other engine components. These baffles incorporate rubber-asbestos composition seals at points of contact with the engine nacelle to help confine and direct the airflow to the desired area. It is very important to engine cooling that the baffles are installed correctly.

Removal of Engine Baffles (310P0001 AND ON). (See figure 9-15.)

- a. Remove engine cowling in accordance with removal procedures.
- b. To remove right and left baffles (3, 4, 5, 19, 20, and 21), remove the upper rocket box cover screws and nuts with which they are attached.
- c. To remove the oil cooler baffles (1 and 25) remove the four attaching screws and nuts and the two oil cooler mounting bolts which hold them in place.
- d. To remove the left front baffle (23), remove the three attaching screws and bolts.
- e. To remove the right and left forward intercylinder baffles (27) and the right and left intercylinder baffle supports (26 and 29), remove bolts (6 and 28).

- f. To remove the right and left rear intercyylinder baffles (30) and the rear intercyylinder baffle supports (31), remove bolts (7).

NOTE

The cylinder fuel lines and spark plug leads are attached to support brackets which are secured to the engine by bolts (6 and 7). It is not necessary to remove these lines, leads, or brackets to remove the baffles.

- g. Remove upper rear baffle (15) by removing screws (13) and five screws attaching baffle (15) to baffle (18).
- h. To remove the lower left rear baffle (18):
1. Remove the alternator in accordance with removal procedures.
 2. Disconnect the left rear baffle fasteners (8 and 9) and work the lower fastener free of the cylinder.
 3. Remove fuel supply line.
 4. Loosen clamps and remove ram air fuel control and fuel strainer hoses.
 5. Remove the two rocker box cover screws and remove the lower left rear baffle (18).
 - i. To remove the rear center baffle (32) remove the screws from support brackets (12 and 14).
 - j. To remove the right rear baffle (10):
 1. Disconnect the magneto ground wires and withdraw them aft, through the baffle.
 2. Loosen the clamps on crankcase breather line hose connectors and remove the crankcase breather line.
 3. Disconnect ram air fuel strainer hose.
 4. Loosen air-oil separator.
 5. Remove engine breather air-oil separator.
 6. Disconnect the starter cable and remove the starter by removing the two mounting nuts and wash-

ers and pulling the starter straight out.

7. Disconnect the right rear baffle fasteners (8 and 9) and work the lower fastener free of the cylinder.

8. Remove the right rear baffle.

k. Support brackets (2 and 22) may be removed by removing the rocker box cover screws which attach them. After removing support bracket (2) also remove No. 5 cylinder head baffle (33).

1. To remove the rear baffle support brackets (12 and 14) and aft support, crankcase thru-bolt must be removed.

NOTE

In removing the upper crankcase thru-bolt, use care to prevent damaging the O-ring seals installed on the bolt.

1. To remove the forward center baffle (34) remove the four pan bolts.

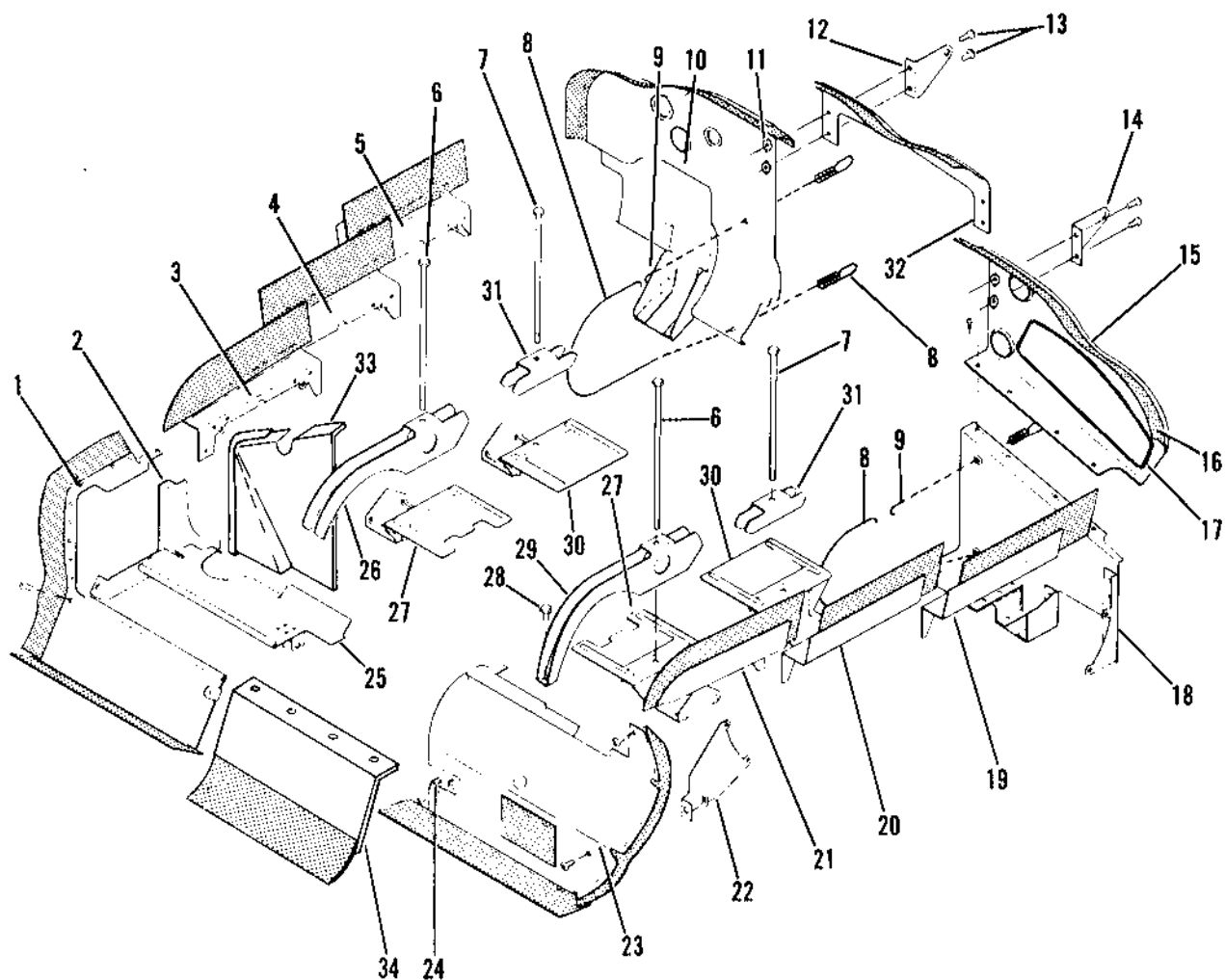
Cleaning and Inspection of Engine Baffles.

The engine baffles should be cleaned with a suitable solvent to remove oil and dirt.

NOTE

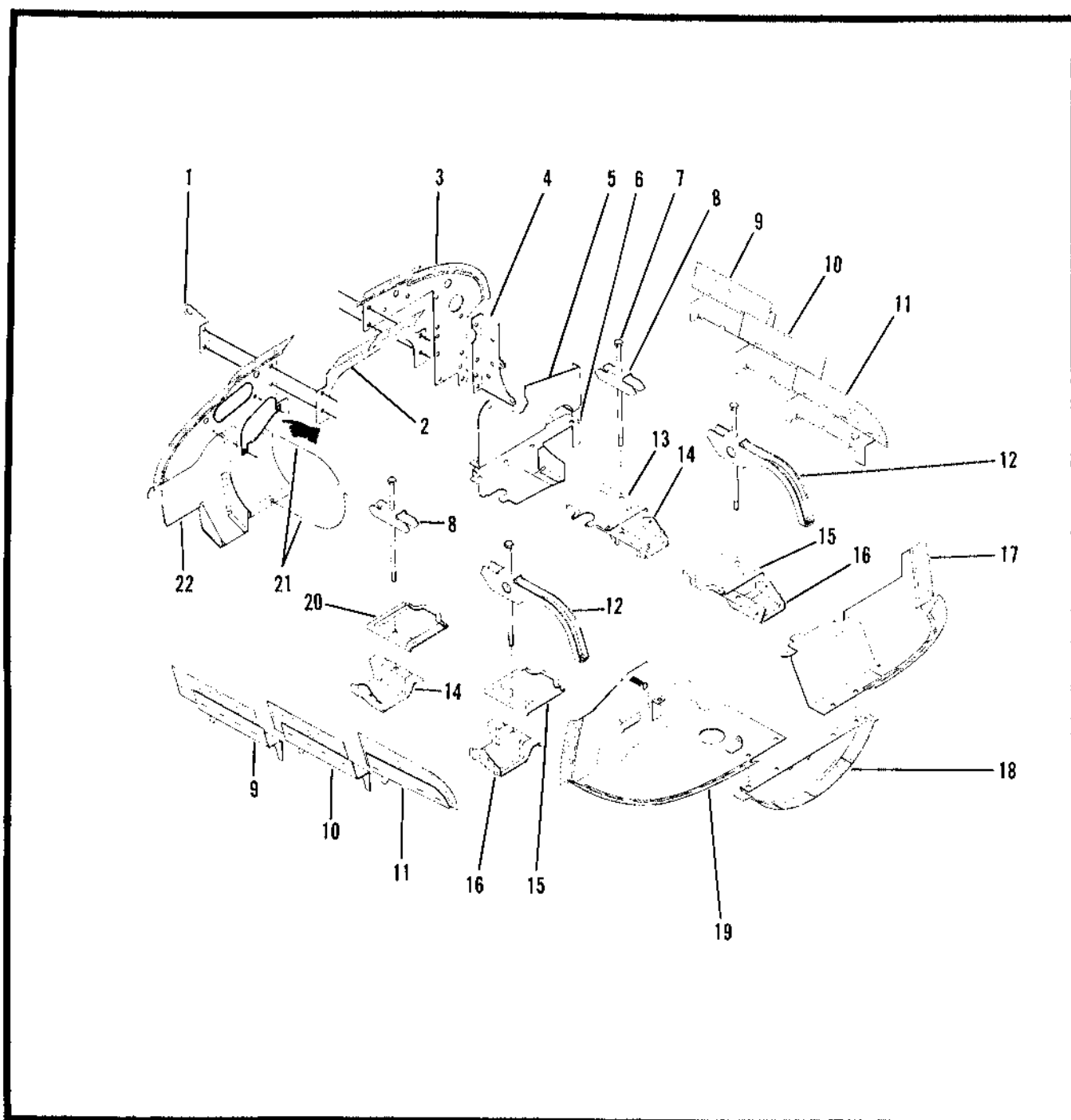
The rubber asbestos seals are oil and grease resistant but should not be soaked in solvents for long periods.

Inspect for cracks in the metal and for loose and/or torn seals. Replace defective parts.



1. Forward Oil Cooler Baffle	13. Screws	25. Aft Oil Cooler Baffle
2. Support Bracket	14. Support Bracket	26. Forward Right Intercylinder Baffle Support
3. Forward Right Baffle	15. Upper Rear Baffle	27. Forward Intercylinder Baffle Assembly
4. Center Right Baffle	16. Seal	28. Bolt
5. Aft Right Baffle	17. Stiffener	29. Forward Left Intercylinder Baffle Support
6. Bolt	18. Lower Rear Baffle	30. Aft Intercylinder Baffle Assembly
7. Bolt	19. Left Aft Baffle	31. Aft Intercylinder Baffle Support
8. Rear Baffle Fastener (lower)	20. Center Left Baffle	32. Rear Center Baffle
9. Rear Baffle Fastener (upper)	21. Forward Left Baffle	33. No. 5 Cylinder Head Baffle
10. Right Rear Engine Baffle	22. Support Bracket	34. Forward Center Baffle
11. Nut	23. Forward Left Engine Baffle	
12. Support Brackets	24. Support Tab	

Figure 9-15. Engine Baffle Installation 310P0001 AND ON.



1. Support Assembly (Aft, baffle)	12. Support (Intercylinder baffles, fwd)
2. Baffle Assembly (Aft, center)	13. Baffle Assembly (Intercylinder inboard aft, LH)
3. Baffle Assembly (Aft, LH)	14. Baffle Assembly (Intercylinder outboard aft)
4. Bracket Assembly (Aft, baffle)	15. Baffle Assembly (Intercylinder inboard fwd)
5. Baffle Assembly (Aft, baffle)	16. Baffle Assembly (Intercylinder outboard fwd)
6. Channel Assembly (Aft, baffle)	17. Baffle Assembly (Fwd, LH)
7. Bolt	18. Baffle Assembly (Fwd, center)
8. Support (Intercylinder baffles, aft)	19. Baffle Assembly (Fwd, RH)
9. Baffle Assembly (Aft, side)	20. Baffle Assembly (Intercylinder inboard aft, RH)
10. Baffle Assembly (Center, side)	21. Fastener (Baffle aft, RH)
11. Baffle Assembly (Forward, side)	22. Baffle Assembly (Aft, RH)

Figure 9-16. Engine Baffle Installation - Turbo 310P0001 and On

Installation of Engine Baffles (310P0001 AND ON).
(See figure 9-15.)

- a. Install engine baffles by reversing removal procedures.

Removal of Engine Baffles (Turbo 310P0001 AND ON).
(See figure 9-16.)

Removal of Engine Baffles. (See figure 9-16.)

- a. Remove engine cowling in accordance with removal procedures.

- b. Remove screws attaching baffle (2) to support (1), baffles (3 and 22). Remove baffle (2) from engine nacelle.

- c. Disconnect and remove the following items from baffle (3):

1. Disconnect oil filler breather hose from oil separator by loosening attaching clamps.

2. (See figure 9-13.) Remove oil separator (11) from baffle by removing two clamps and attaching screws.

3. (See figure 9-4.) Disconnect LH nozzle pressurization line (47) from fuel injection nozzles and route line through baffle (3) by removing grommet.

4. Remove the remaining screws attaching baffle (3) to oil cooler and baffle (4).

5. Remove baffle (3) from engine nacelle.

- d. On both LH and RH sides of engine, remove baffles (9, 10, and 11) by removing existing screws in rocker covers and screws attaching baffles (11) to baffles (17 and 19). Remove baffles from engine nacelle.

- e. Remove baffle (5) by removing four screws attaching baffle (5) to baffle (6). Remove baffle (5) from engine nacelle.

- f. Remove baffle (6) by removing screws attaching baffle (6) to rocker cover. Remove baffle from engine nacelle.

- g. Remove supports (8 and 12) from between engine cylinders by removing bolts (7). Remove supports from engine nacelle.

- h. Remove baffles (13, 14, 15, 16 and 20) from engine as follows:

1. (See figure 9-4.) Disconnect air intake manifold (45) from throttle body (12) by loosening hose (13).

2. Remove attaching nuts and washers and lower air intake manifold until it comes to rest upon the engine support mounts.

3. Route baffles (13, 14, 15, 16 and 20) from beneath engine cylinder heads.

4. Remove baffles from engine nacelle.

- i. Remove baffle (17) from engine as follows:

1. (Refer to Section 10.) If propeller synchronizer is installed, disconnect electrical impulse pick-up from governor and route through baffle.

2. Remove two screws attaching baffle (17) to baffle (18).

3. Remove baffle from engine nacelle.

- j. Remove baffle (19) from the engine as follows:

1. Remove radio noise filter from baffle (19) by removing attaching screws.

2. Remove lower forward bolt which attaches alternator and baffle (19) to crankcase.

3. Remove two screws attaching baffle (19) to baffle (18).

4. Release spring and remove baffle (19) from engine nacelle.

- k. Remove baffle (18) as follows:

1. (Refer to Section 10.) Remove propeller spinner in accordance with removal procedures.

2. Remove two nuts and four washers attaching baffle (18) to engine crankcase.

3. Remove baffle from engine nacelle.

- l. Remove baffle (22) as follows:

1. (See figure 9-4.) Disconnect from baffle the following items:

- (a) Ram air tube (15).

- (b) Shroud tube (42) and metering fuel line (28).

- (c) Disconnect and route wire bundle (27) through baffle.

- (d) If autopilot is installed, disconnect ram air tube from baffle.

2. Disconnect spring (21) and remaining attaching screws and route baffle (22) from engine nacelle.

Installation of Engine Baffles (Turbo 310P0001 AND ON). (See figure 9-16.)

- a. Install engine baffles by reversing removal procedures.

NOTE

If induction air intake manifold was lowered to remove baffles (13, 14, 15, 16 and 20), replace gaskets upon installation.

TURBOCHARGER INSULATION.

On aircraft Turbo 310P0001 to 310Q0401, 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. On aircraft Turbo 310Q0401 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 Insulation Blankets. (See figure 9-17.)

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 .032 Monel wire.

NOTE

When lacing, wrap Monel wire tightly around buttons on the insulation blankets.

Removal and Installation of Turbocharger Shield. (See figure 9-17.)

- 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 .032 Monel wire.

TURBOCHARGER.

Removal of Turbocharger (Turbo 310P0001 AND ON).

- a. Remove upper engine cowl in accordance with removal procedure.
- b. (See figure 9-13.) Remove drain line (1) and line assembly (3) from turbocharger.
- c. Remove clamps securing turbocharger air compressor to throttle body and canister assembly.
- d. Remove clamp securing turbocharger turbine to exhaust pipe.
- e. Remove the four nuts and bolts securing turbocharger assembly to support bracket and manifold header assembly.
- f. Lift turbocharger and remove from engine nacelle.

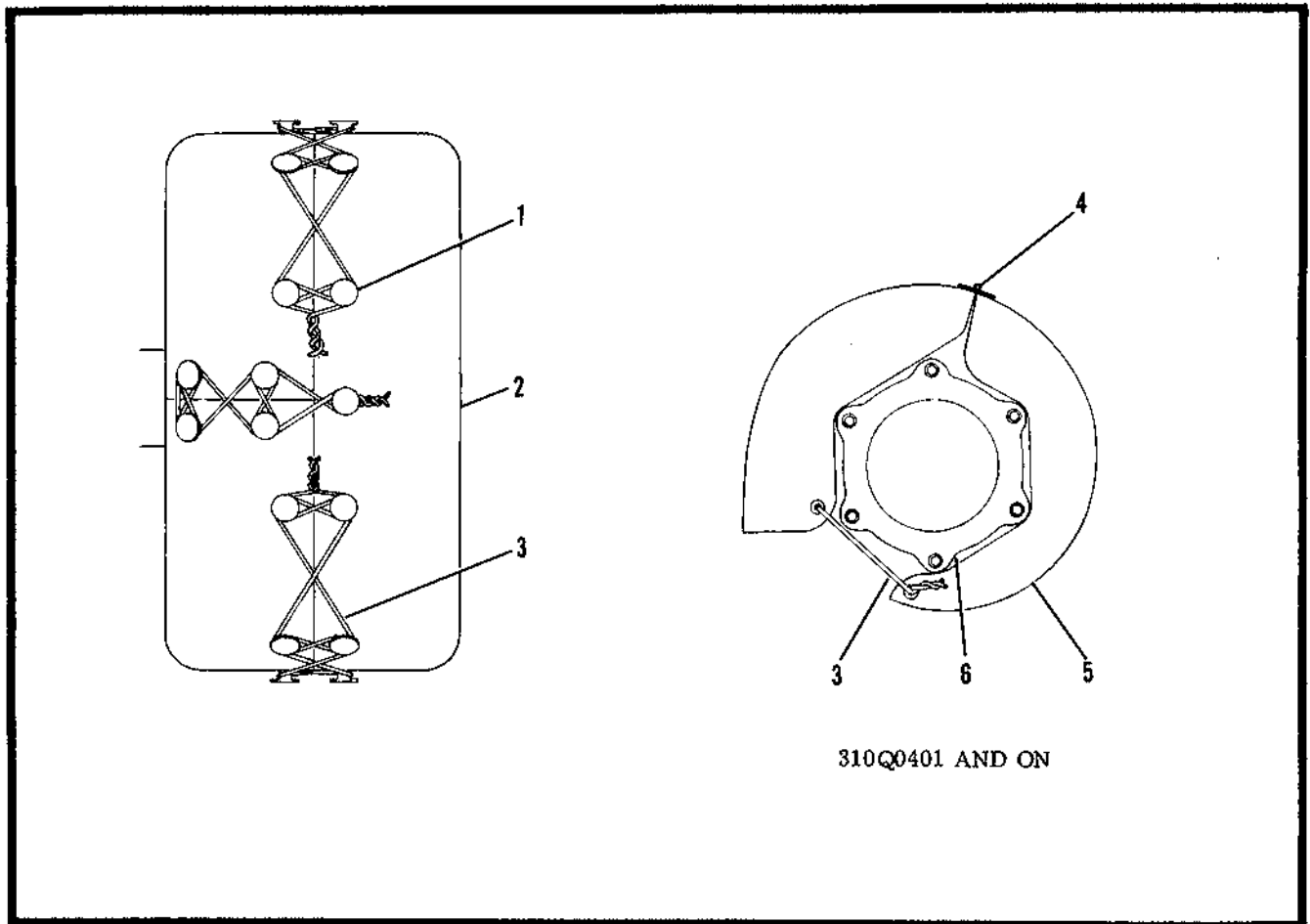
NOTE

Cap and plug oil lines and seal turbine compressor air openings to prevent the entry of foreign materials.

Installation of Turbocharger (Turbo 310P0001 AND ON).

- 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.
- c. Install four bolts, washers, and nuts securing turbocharger assembly to support bracket and manifold header assembly.
- d. Install clamp securing turbocharger turbine to exhaust pipe.

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1. Wrap Button
2. Insulation Blanket

3. 0.032 Monel Wire
4. Hinge

5. Shield
6. Turbine

Figure 9-17. Turbocharger Insulation and Lacing Diagram

ENGINE TORQUE VALUES IN POUND INCHES	
Engine Mounts	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 (P/N MVT68637-375-M)	70-75
Turbine Exhaust to Tailpipe Clamp (P/N V37A4234)	40
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 Assembly Bolts	70-90
Exhaust Riser to Cylinder Studs	50-70

Figure 9-17A. Engine Torque Values

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 when installing turbocharger to bypass assembly.

- e. Install clamps and secure turbocharger air compressor to throttle body and canister assembly.
- f. Install drain line (1) and line assembly (3) to turbocharger. (See figure 9-13.)
- g. Safety wire bolts to support bracket.

NOTE

For bolt torque and coupling torque values, see figure 9-17A.

- h. Perform operation checkout in accordance with operational procedures.

AIR INDUCTION SYSTEM

Ram air enters through the leading edge of the wing and is routed through the Canister Filter Assembly before entering the throttle body. On the Turbo 310P and 310Q, air is routed from the leading edge of the wing through the canister to the compression section of the turbocharger. A manually controlled alternate air valve located on the end of the canister assembly is provided to admit alternate air (heated engine compartment air) should the air induction filter become clogged or if a requirement for heated air is needed. Air filter maintenance service, particularly in areas where dust is prevalent is very important to the life of the engine and turbocharger.

Removal and Installation of Induction Air Canister Assembly (see figure 9-18).

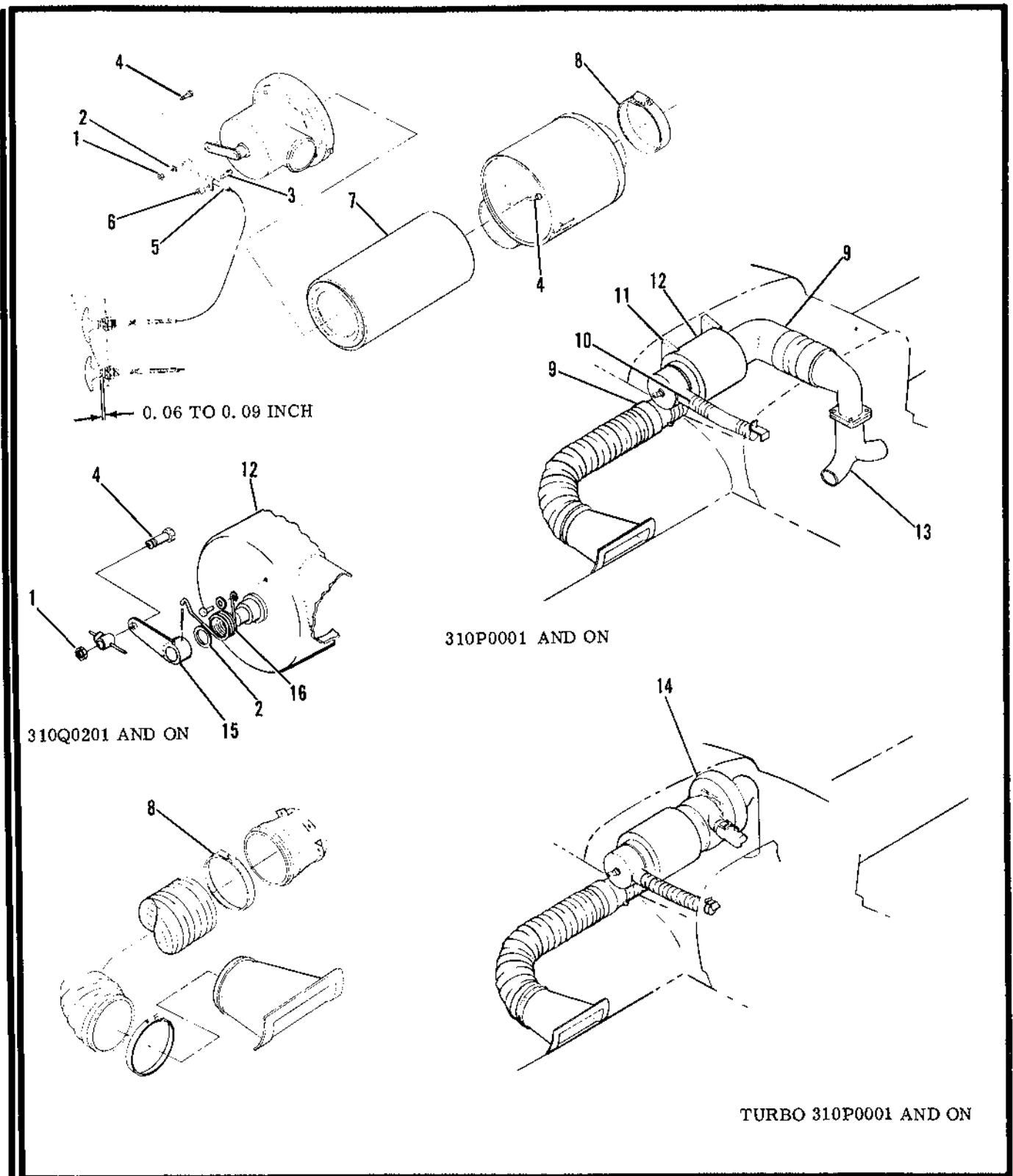
- a. Remove engine cowling in accordance with removal procedures.
- b. Disconnect control cable (5) from canister assembly (12) by loosening nut on bolt (4) and routing end of cable from bolt. Disconnect cable assembly from bracket by removing nut and screw.
- c. Disconnect induction air ducts (9) and alternate air duct (10) by removing clamps securing hoses to canister.
- d. Remove valve end of canister to remove filter (7), remove three bolts (4) securing canister to support (11).
- e. Remove clamp (8) securing canister to support and remove canister assembly from aircraft.
- f. Install induction air canister assembly by reversing the removal procedures.
- g. Add or remove washers (2) to spacer (6) as necessary to align cable assembly with control arm.
- h. Clamp cable assembly (5) so that the cable housing is 3.50 ± .125 inches from the control arm when in the closed position. Clamp cable assembly to bolt (7) so that the control handle is .06 to .09 inch from panel.
- i. Check control cable (5) for proper operation.

CONTROLLERS AND WASTE-GATE ACTUATOR.

Turbocharger Control System Functions and Operations. (See figure 9-20.)

a. Functions. The waste-gate actuator and controllers use engine oil for power supply. The turbocharger is controlled by the waste-gate and waste-gate actuator, absolute pressure and above critical altitudes by the pressure ratio controller. The waste-gate bypasses the engine exhaust gases around the turbocharger turbine inlet. The waste-gate actuator, which is physically connected to the waste-gate by mechanical linkage, controls the position of the waste-gate butterfly valve. The manifold pressure relief valve will open and prevent engine overboost should the engine manifold pressure exceed 34.5 inches of mercury. The absolute pressure controller controls the maximum turbocharger compressor discharge pressure (32 ± 0.5 in. Hg. to critical altitude, approximately 16,000 feet). The pressure ratio controller begins to function at approximately critical altitude and controls the maximum turbocharger compressor discharge pressure at a ratio of 2.2 times nacelle ambient pressure.

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 waste-gate actuator power cylinder during engine shut down. When the engine is started, oil pressure is fed into the waste-gate actuator power cylinder through the capillary tube. This automatically fills the waste-gate actuator power cylinder and lines leading to the controllers, blocking the flow of oil by normally closed metering and/or poppet valves. As the oil pressure builds up in the waste-gate actuator power cylinder, it overcomes the force of the waste-gate open spring, closing the waste-gate. When the waste-gate begins to close, the exhaust gases are routed through the turbocharger turbine. As the engine increases its power and speed, the increase of temperature and pressure of the exhaust gases causes the turbocharger to rotate faster, raising the turbocharger compressor outlet pressure. As the compressor outlet pressure rises, the aneroid bellows in the absolute pressure controller sense the increase in pressure. When at high engine speed and load and the proper absolute pressure is reached, the force on the aneroid bellows opens the normally closed metering valve. When the oil pressure in the waste-gate actuator power cylinder is lowered sufficiently, the waste-gate actuator open spring forces the mechanical linkage to open the waste-gate. A portion of the exhaust gases then bypasses the turbocharger turbine, thus preventing further increase of turbocharger speed and holding the compressor discharge absolute pressure to the desired value. Conversely at engine idle, the turbocharger runs slowly with low compressor pressure output, therefore, low pressure applied to aneroid bellow is not sufficient to affect the unseating of the normally closed metering valve. Consequently, engine oil pressure keeps the waste-gate closed. After critical altitude is reached (approximately 16,000 feet), the absolute pressure controller is unable to maintain 32 ± 0.5 inches of manifold pressure.



1. Nut	5. Cable Assembly	9. Induction Air Duct	13. Throttle Body
2. Washer	6. Spacer	10. Alternate Air Duct	14. Turbocharger
3. Bolt (Clamping)	7. Filter	11. Support	15. Arm
4. Bolt	8. Clamp	12. Canister Assembly	16. Spring

Figure 9-18. Induction Air Canister

ENGINE AIR INDUCTION SYSTEM SCHEMATIC

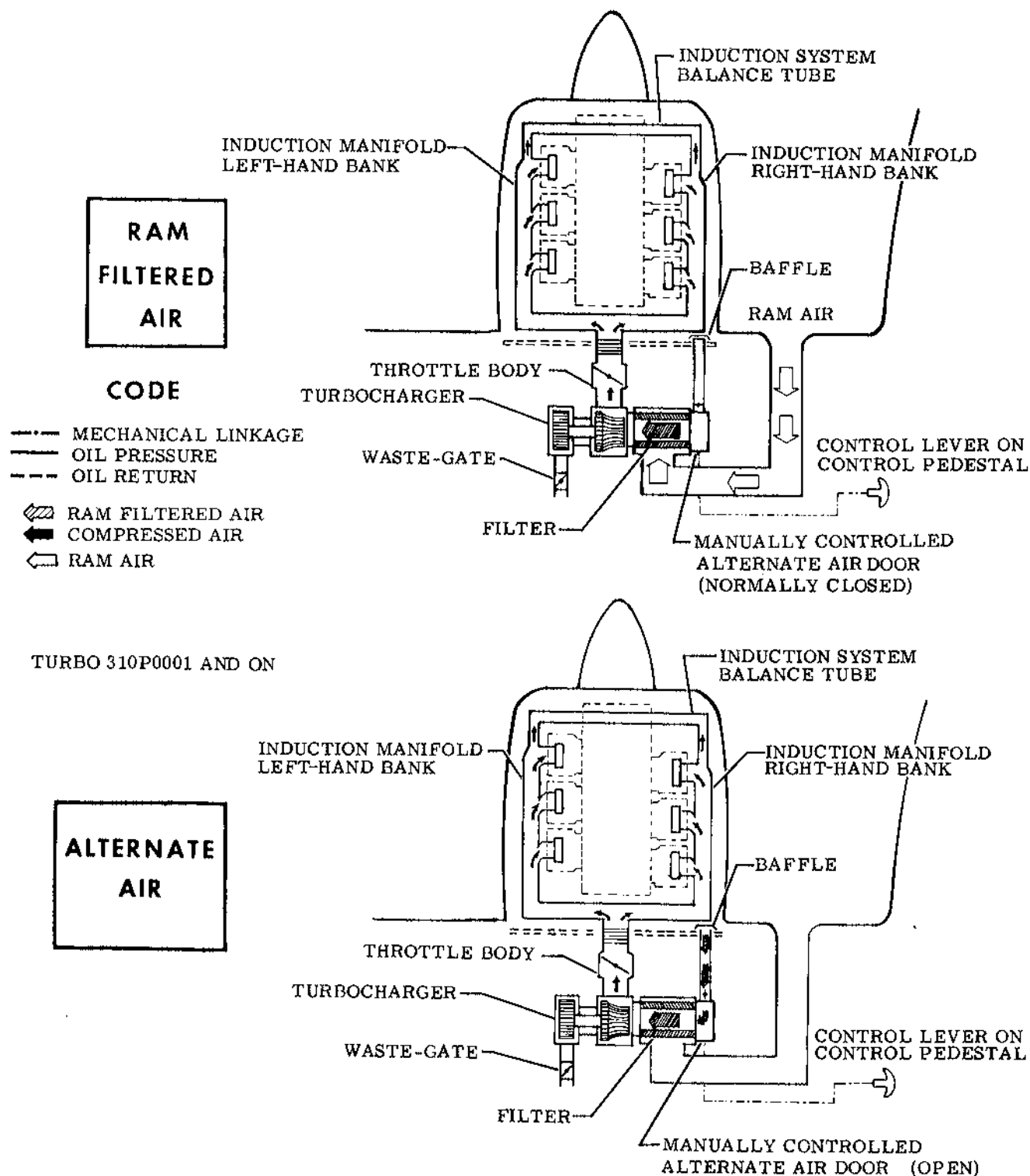


Figure 9-19. Air Induction Schematic

The pressure ratio controller, which senses both nacelle ambient pressure and discharge pressure, begins the function of controlling turbocharger discharge pressure at a ratio of 2.2 times ambient pressure.

When the proper discharge pressure is reached inside the pressure ratio controller, the force on the aneroid bellows opens the poppet valve and lowers the oil pressure in the waste-gate actuator power cylinder.

Troubleshooting Controllers and Waste-Gate Actuator.

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.
	Pressure ratio controller set too low and cutting in at altitude below 16,000 feet.	Adjust pressure ratio controller.
	Leak in exhaust system.	Replace defective exhaust components.
	Manifold pressure relief valve stuck open.	Replace manifold pressure relief valve.
	Leak in induction air system.	Repair or replace. (Refer to Leak Checking Air Induction System.)
	Leak in induction air system.	Replace or repair in accordance with Induction Air Leak Check Procedures.
	Leak in exhaust system.	Replace or repair in accordance with Exhaust Leak Check Procedures.
LOW POWER OR INSUFFICIENT MANIFOLD PRESSURE	Improper alignment of air inlet ducts, canister and filter elements.	Align ducts, clean or replace filter.
	Hot nacelle air leaking into induction system. Improperly rigged alternate air door.	Rig alternate induction air door.
	Obstructions in air inlet system or filter.	Clean or replace filter, remove obstruction.
	Waste-gate not closing properly.	Refer to Turbocharger and Controls Overhaul/Parts Manual and check rigging of waste-gate actuator.
	Wrong manifold pressure relief valve installed.	Replace with proper manifold pressure relief valve.
	Waste-gate actuator leaking oil.	Replace waste-gate and actuator.

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Troubleshooting Controllers and Waste-Gate Actuator. (Continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
LOW POWER OR INSUFFICIENT MANIFOLD PRESSURE	Low engine oil pressure in flight.	Verify that engine oil pressure remains in the upper half of green arc during cruise.
Note This verification can be made on the ground but must be reasserted in flight with oil temperatures in the normal limits. Adjust pressure relief valve if necessary to obtain proper oil pressure.		
CAUTION If low oil pressure is encountered during flight check, reduce power to minimum cruise and allow oil to cool to the lower sector of the green arc. Open cowl flaps to aid in cooling the oil temperatures. Upon attainment of the cooler oil temperature, apply power and recheck the bootstrapping power level. If a marked improvement is attained, correct oil pressure or isolate the overheating cause.		
ENGINE SURGES OR SMOKES	Metering valve stem seal broken in one of the controllers, leaking oil into manifold.	Replace or repair controller in accordance with Turbocharger and Controls Overhaul/Parts Manual.
	Actuator bypass valve linkage binding.	Correct cause of binding.
TURBOCHARGER NOISY, PLENTY OF POWER	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.
	Controller drain line obstructed.	Clean or replace line.
ENGINE POWER INCREASES SLOWLY, OR SEVERE FLUCTUATIONS OF MANIFOLD PRESSURE ON RAPID THROTTLE ADVANCE	Capillary tube plugged in rate of change controller.	Replace absolute pressure and rate of change controller.
	Sluggish manifold pressure relief valve.	Replace manifold pressure relief valve.
	Waste-gate operation is sluggish.	Replace waste-gate, waste-gate actuator, or correct binding linkage.
ENGINE POWER INCREASES RAPIDLY AND MANIFOLD PRESSURE OVERBOOSTS ON RAPID THROTTLE ADVANCE	Manifold pressure relief valve stuck.	Replace manifold pressure relief valve.
	Waste-gate operation is sluggish.	Replace waste-gate, waste-gate actuator, or correct binding linkage.
MANIFOLD PRESSURE OVERBOOST DURING FLIGHT	Manifold pressure relief valve stuck closed	Repair or replace relief valve
	Waste-gate actuator sluggish	Repair or replace waste-gate.
	Waste-gate butterfly clearance improperly set	Refer to Turbocharger and Controls Overhaul/Parts Manual and set butterfly valve clearance properly.
CAUTION The absolute pressure, manifold pressure relief valve, and pressure ratio controllers are set at the factory and should not be tampered with except for prescribed minor adjustment to obtain rated manifold pressure.		

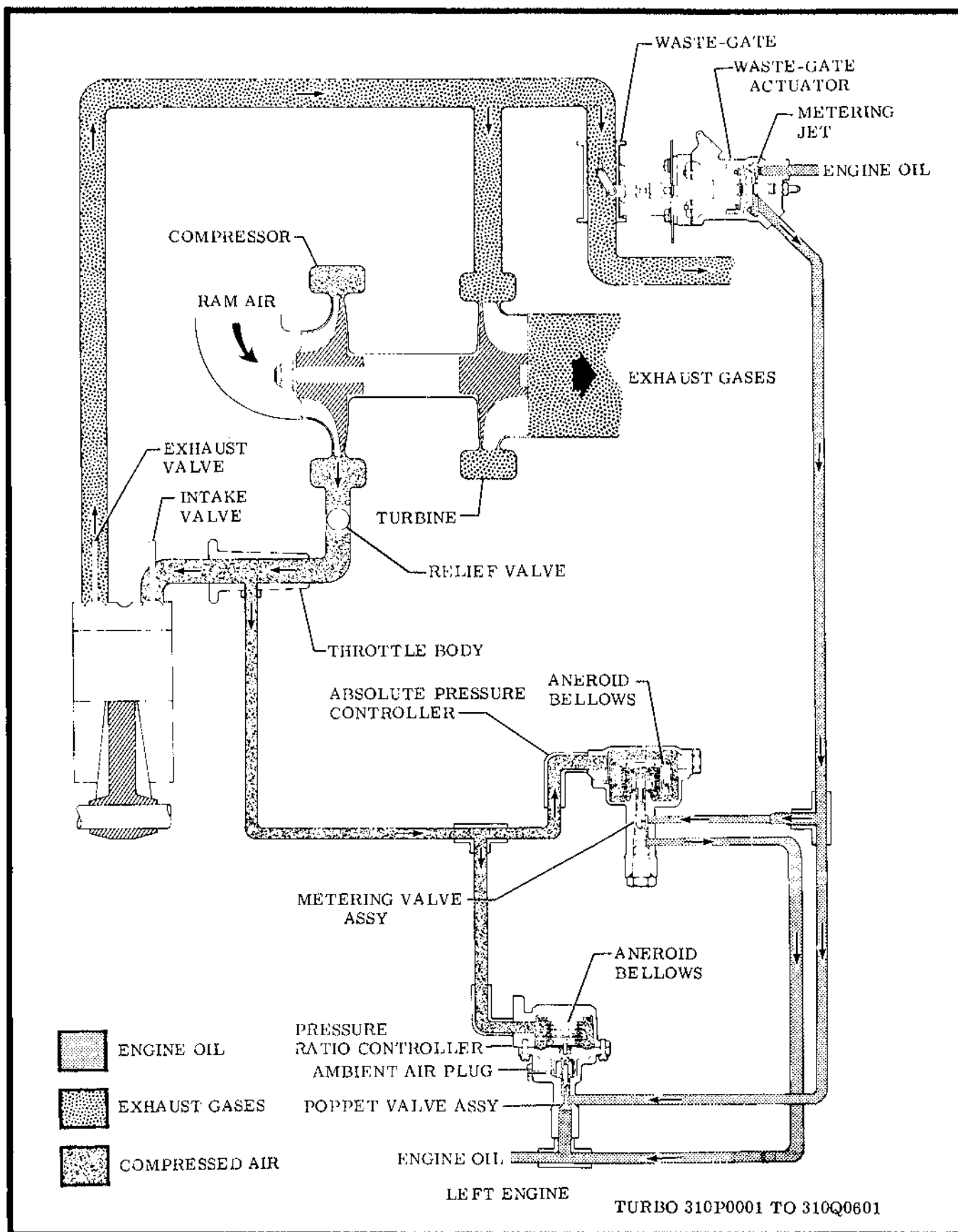
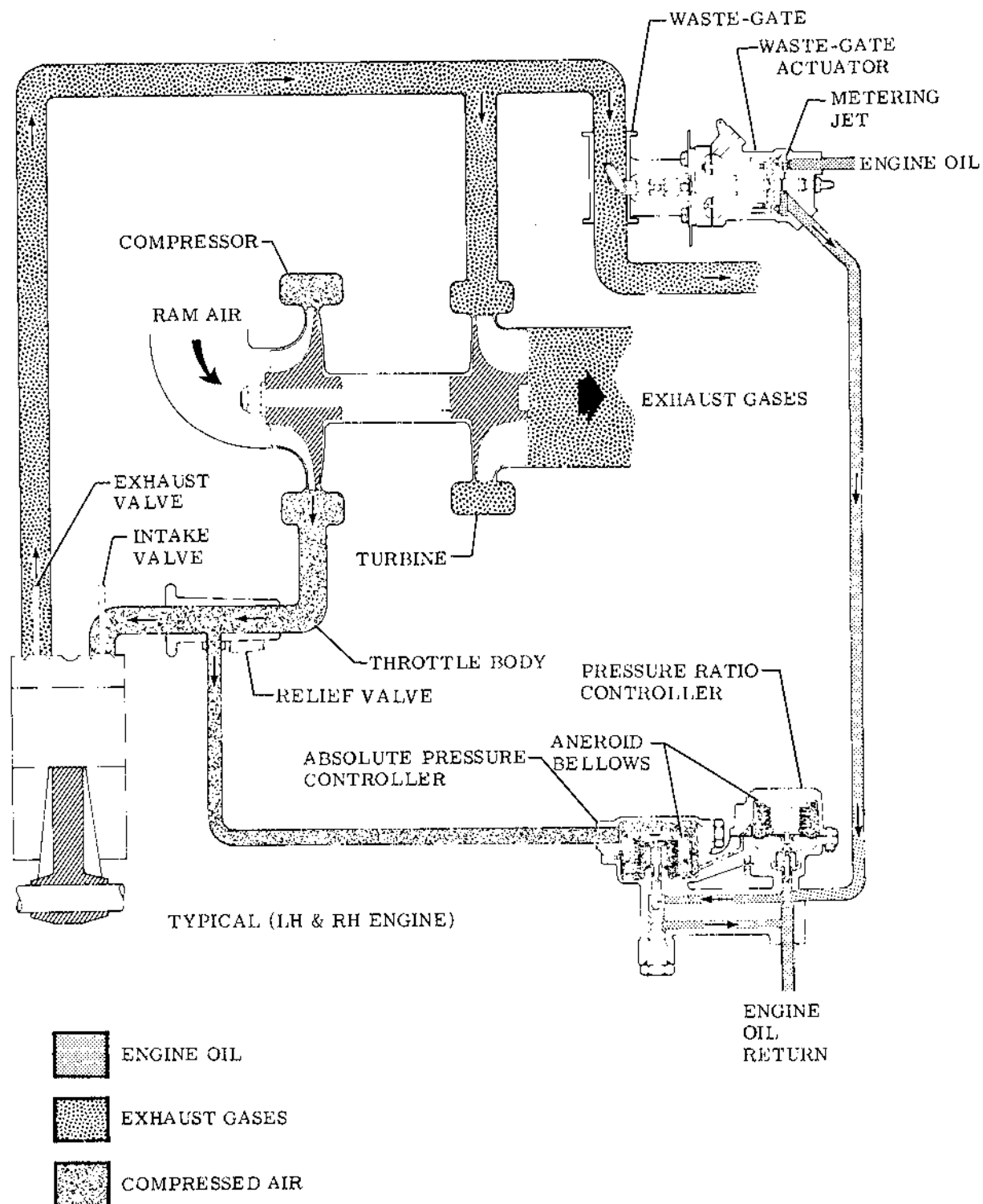


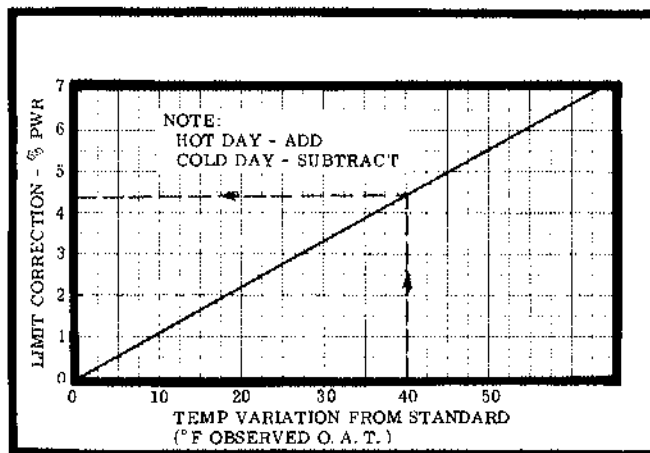
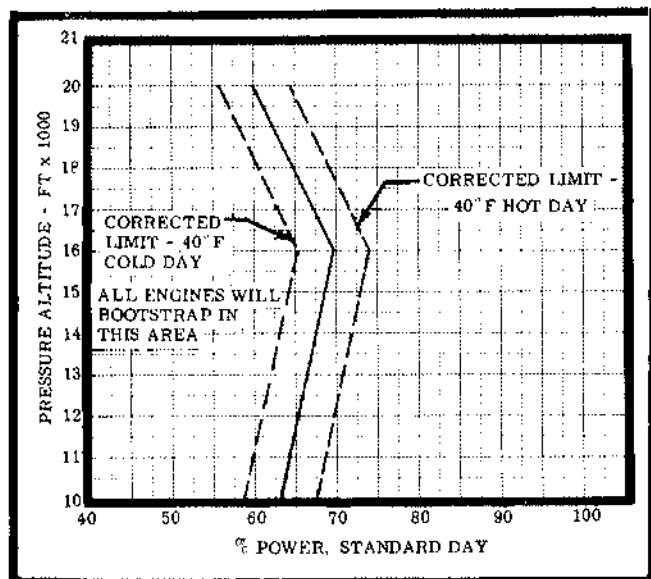
Figure 9-20. Turbocharger, Controllers and Waste-Gate Actuator System Schematic (Sheet 1 of 2)



TURBO 310Q0601 AND ON

Figure 9-20. Turbocharger, Controllers and Waste-Gate Actuator System Schematic (Sheet 2)

BOOTSTRAP LIMITS - TSIO 520B ENGINE, TE0659 1.58 A/R TURBINE



BOOTSTRAP LIMITS - TSIO 520B ENGINE WITH TE0659 1.83 A/R TURBINE

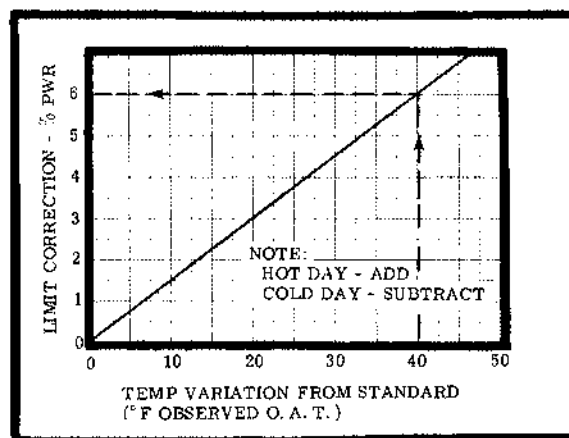
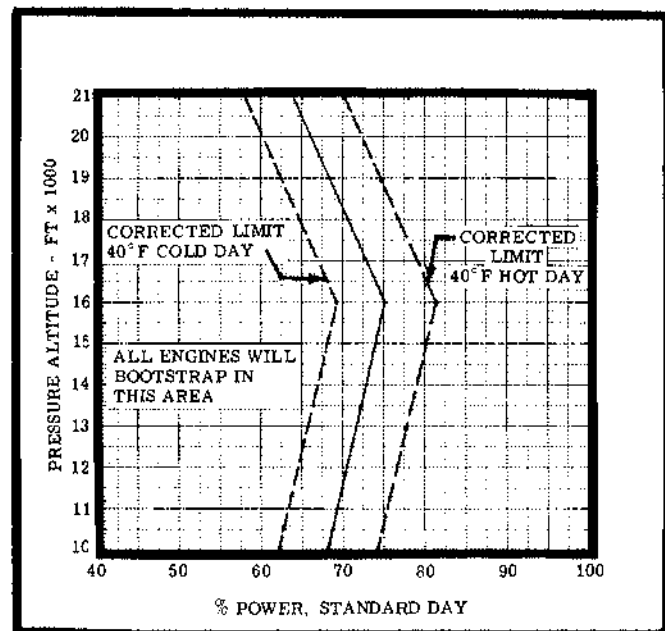


Figure 9-21. Bootstrapping Tolerance Chart

Controller Operation Flight Check Procedure.

The flight check procedure details the method of checking the operation of the absolute pressure, rate of change, and pressure ratio controllers. This procedure is to be used for aircraft suspected of improper controller operation in order for the discrepancy to be correctly diagnosed. To aid in recording the necessary flight readings, sample form, as shown in figure 9-23, 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 9-21.

1. TAKEOFF - ABSOLUTE CONTROLLER
 - a. Cowl flaps - open
 - b. Airspeed - 105 MPH IAS
 - c. Oil temperature - upper 1/3 of green arc
 - d. Engine speed - 2700 $\pm$ 25 RPM
 - e. Fuel flow - 27.5 to 29.2 GPH
 - f. Full throttle M. P. - 32 $\pm$.5 in. Hg.
2. CLIMB - ABSOLUTE CONTROLLER
 - a. Cowl flaps - open
 - b. Airspeed - 120 MPH IAS
 - c. Pressure altitude - 16,000 ft.
 - d. Engine speed - 2700 $\pm$ 25 RPM
 - e. Fuel flow - 29.0 PSI to 31.0 PSI.
 - f. Full throttle M. P. - 32 $\pm$.5 in. Hg.
3. CLIMB - MANIFOLD PRESSURE RELIEF VALVE
 - a. Cowl flaps - open.
 - b. Airspeed - 120 IAS
 - c. Pressure altitude - below 16,000 ft.
 - d. Engine speed - 2700 $\pm$ 25 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
 - (a) If at full throttle maximum manifold pressure is not reached 32 $\pm$ 0.5 inches of Hg. manifold pressure relief valve is operating improperly.
4. CRUISE - BOOTSTRAPPING DETERMINATION
 - a. Cowl flaps - closed
 - b. Airspeed - level flight
 - c. Pressure altitude - 16,000 feet
 - d. Engine speed - 2700 RPM
 - e. Manifold pressure - 28 in. Hg.
 - f. Fuel flow - full rich
 - g. Prop controls (one engine at a time)
 - (1) Slowly decrease RPM until M. P. drop indicates waste-gate is closed
 - (2) The manifold pressure, RPM, outside air temperature and pressure altitude at the instant of waste-gate closing should be recorded.
 - (3) The actual power being developed when the waste-gate closed should be less than 77. % power.
 - h. Engine speed - increase 50 RPM
 - i. Mixture - normal lean
 - j. Engine should not boot-strap
5. CLIMB - PRESSURE RATIO CONTROLLER
 - a. Cowl flaps - open

- b. Airspeed - 120 MPH
- c. Pressure altitude - 20,000 feet
- d. Engine speed - 2700 $\pm$ 25 RPM
- e. Fuel flow - full rich
- f. Full throttle M. P. - 29 $\pm$.5 in. Hg.
6. CRUISE - BOOTSTRAPPING DETERMINATION
 - a. Cowl flaps - closed
 - b. Airspeed - level flight
 - c. Pressure altitude - 20,000 feet
 - d. Engine speed - 2700 RPM
 - e. Fuel flow - full rich
 - f. Throttle - full throttle
 - 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 Hp at the instant of waste-gate closing should be recorded.
 - (3) The actual power being developed should be less than 67.5% power
 - h. Engine speed - increase 50 RPM
 - i. Mixture - normal lean
 - j. Engine should not boot-strap.

Absolute Pressure Controller.

Removal and Installation of Absolute Pressure Controller. (See figure 9-13.)

NOTE

On aircraft Turbo 310P0001 to Turbo 310Q0601, the absolute pressure controller and rate of change controller is an integrated unit. On aircraft Turbo 310Q0601 and On, the absolute pressure controller and pressure ratio controller is an integrated unit and the rate of change controller is not required. Removal and installation procedures and controller adjustments are typical for both installations.

- a. Disconnect oil line assemblies (21, 23 and 26) and discharge air line assembly (6) from controller (22).

NOTE

Cap all lines and fittings to prevent entry of foreign materials.

- b. Remove two nuts and bolts attaching controller (22) to mounting bracket.
- c. Route controller (22) from engine nacelle.
- d. Install controller (22) by reversing removal procedures.

NOTE

If controller (22) is being replaced, use existing fittings with new packing (20).

6 <u>LEVEL OFF</u> <u>20,000 FT</u> COWL FLAPS - CLOSED	1. Perform Controller Operation Flight Check Procedure step 6.
5 <u>CLIMB</u> <u>20,000 FT</u> FULL THROTTLE FULL RPM MIXTURE - LEAN COWL FLAPS - OPEN CLIMB SPEED - 120 MPH IAS	1. Observe manifold pressure at 20,000 ft. If 29 ± 0.5 in. Hg is available, pressure ratio controller is functioning properly. 2. If 29 ± 0.5 in. Hg. is not available, perform Controller Operation Flight Check, step 5.
	<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 <u>CLIMB UP TO 16,000 FT</u> M. P. 32 ± 0.5 IN. HG. FULL RPM MIXTURE - RICH COWL FLAPS - OPEN CLIMB SPEED - 120 MPH IAS	1. Observe manifold pressure up to 16,000 ft. If 32 ± 0.5 in. Hg. is available, absolute pressure controller is functioning properly. 2. If 32 ± 0.5 in. Hg. is not available, perform Controller Operation Flight Check, step 3.
	<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 <u>CLIMB</u> <u>14,000 FT.</u> M. P. 29 ± 0.5 IN. HG. RPM 2350 MIXTURE - RICH COWL FLAPS - OPEN CLIMB SPEED - 120 MPH IAS	<u>READINGS AT 14,000 FT.</u> 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 <u>TAKEOFF</u> M. P. 32 ± 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 6,000 or 7,000 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 <u>SET ALTIMETER</u> 29.92	

Figure 9-22. Turbocharger System Operational Check Chart

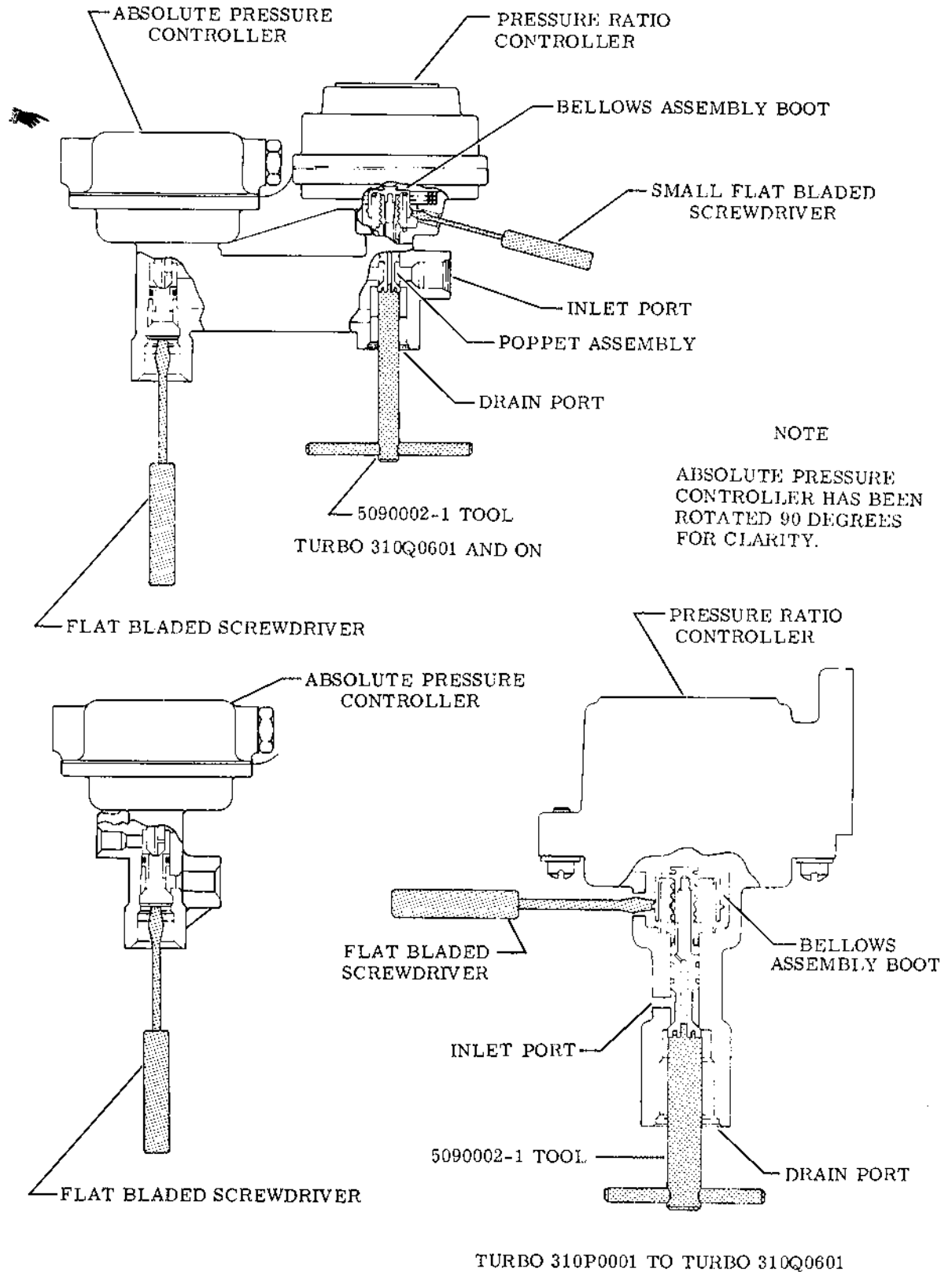


Figure 9-23. Controller Adjustments

Absolute Pressure Controller Adjustment. (See figure 9-23.)

- a. Remove engine cowling in accordance with removal procedures.
- b. (See figure 9-13.) Remove adjustment plug from absolute pressure controller.
- c. Using a flat bladed screwdriver, rotate metering valve seat (1/16th of one full turn changes manifold pressure 1 inch Hg.), clockwise to increase or counterclockwise to decrease.
- d. (See figure 9-13.) Install absolute pressure controller adjustment plug.
- e. Install engine cowling in accordance with installation procedures.
- f. Start engine, allow engine oil to reach operating temperature (upper 1/3 of green arc), ground check manifold pressure for 32 ± 0.5 inches Hg. at 2700 RPM.

NOTE

Several adjustments and checks may be necessary to achieve correct manifold pressure.

Manifold Pressure Relief Valve (Turbo 310P0001 AND ON).

The manifold pressure relief valve is mounted on the turbocharger compressor adapter plate, and is provided to prevent engine damage from excessive intake manifold pressure. The non-adjustable manifold pressure relief valve will be actuated if the manifold pressure exceeds 36.5 in. Hg. If the relief valve is defective or malfunctions it must be replaced.

Removal and Installation of Manifold Pressure Relief Valve. (See figure 9-30.)

- a. Remove and install LH engine manifold pressure relief valve as follows:
 1. (See figure 9-1.) Remove engine cowling in accordance with removal procedure.
 2. Remove screws (1) attaching manifold pressure relief valve (2) to turbocharger compressor adapter pad (4) and remove manifold pressure relief valve.
 3. Install manifold pressure relief valve by reversing removal procedure.
- b. Remove and install RH engine manifold pressure relief valve as follows:
 1. (See figure 9-1.) Remove engine cowling in accordance with removal procedure.
 2. (See figure 9-18.) Remove alternate air canister in accordance with removal procedure.
 3. Loosen and remove clamp attaching overboard exhaust tube to turbine body.
 4. Loosen nuts and remove four bolts attaching turbocharger to nacelle bracket.

NOTE

Support turbocharger when removing attaching bolts to prevent damage to turbocharger and nacelle structure.

5. Remove turbocharger from engine nacelle.
6. Repeat substeps 2. and 3. of step a.

Pressure Ratio Controller.

Removal and Installation of Pressure Ratio Controller. (See figure 9-13.)

- a. Disconnect oil line assemblies (12, 21 and 23) and discharge air line (5) from controller (7).

NOTE

Cap all lines and fittings to prevent entry of foreign materials.

- b. Remove two nuts and bolts attaching controller (7) to bracket.
- c. Route controller (7) from engine nacelle.
- d. Install controller (7) by reversing removal procedures.

NOTE

If controller (22) is being replaced, use existing fittings with new packing (20).

Pressure Ratio Controller Adjustment. (See figure 9-23.)

- a. Remove engine cowling in accordance with removal procedures.
- b. Remove pressure ratio controller in accordance with removal procedures.
- c. (See figure 9-13.) Remove ambient air plug (8) from low pressure port. Remove tee and reducer from drain port.

NOTE

Protect all fittings and lines to prevent entry of foreign materials.

- d. Insert tool 5090002-1 into drain port. Insert small bladed screwdriver into low pressure port. Rotate poppet assembly until screwdriver blade engages slot provided in bellows assembly boot.
- e. Holding bellows assembly boot, rotate poppet assembly (1/16 of one full turn changes manifold pressure 1 inch Hg.), clockwise to increase, counterclockwise to decrease.
- f. (See figure 9-13.) Install ambient air plug (8) reducer and tee.
- g. Install pressure ratio controller.
- h. Install engine cowling in accordance with installation procedures.
- i. Refer to Turbocharger Operation Flight check Procedure and perform step 5.

NOTE

Several adjustments and checks may be necessary to achieve correct manifold pressure.

c. (See figure 9-29.) Remove four nuts and bolts attaching waste-gate and actuator (14) to manifold header (10). Allow manifold header and waste-gate and actuator to rest on engine nacelle.

d. (See figure 9-29.) Remove four nuts and bolts attaching waste-gate overboard tube (13) to waste-gate and actuator (14). Remove waste-gate overboard tube (13) from aircraft through access hole.

e. Rotate waste-gate and actuator within the lower aft nacelle until the spring on actuator is facing aft towards the nacelle firewall. With the waste-gate and actuator in this position, work waste-gate and actuator out through the nacelle access hole.

f. Install waste-gate and actuator by reversing removal procedures.

Waste-Gate and Actuator.

NOTE

Removal and Installation of Waste-Gate and Actuator.

When reinstalling waste-gate to the manifold header, use new sealing gaskets.

NOTE

The waste-gate and actuator are considered as matched sets and must be removed and replaced as sets.

- a. (See figure 1-3.) Remove access cover (43).
- b. (See figure 9-13.) Disconnect actuator drain line (27) and line assemblies (25 and 26) from waste-gate actuator (28).

NOTE

Plug actuator and line assemblies to prevent entry of foreign materials.

ENGINE IGNITION SYSTEM.

Engine ignition for the aircraft is provided by two Bendix Scintilla magnetos mounted on each engine. The left magnetos on each engine fires the upper spark plugs on the left bank of the cylinders and the lower spark plugs on the right bank. The right magneto fires the remaining spark plugs on that engine. There are magneto and starter switches mounted on the instrument panel.

Troubleshooting the 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.	Refer to Installation of Magnetos and Ignition Timing for timing procedures.
	Shorted condenser.	Replace condenser.
	Magneto internal timing incorrect or timed for opposite rotation.	Install correctly timed magneto.
ROUGH IDLING	Spark plugs fouled improperly gapped.	Clean spark plugs. Adjust spark plug gap.
	Weak condenser.	Replace condenser.

TROUBLE	PROBABLE CAUSE	CORRECTION
ROUGH AT SPEEDS ABOVE IDLE	Loose or improperly gapped spark plugs.	Tighten to specified torque. Adjust to proper gap.
	High tension leak in ignition harness.	Check for faulty insulation.
SLUGGISH OPERATION AND/OR EXCESSIVE RPM DROP	Weak or burned out condenser as evidenced by burned or pitted breaker points.	Replace points and condenser.
	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.	Refer to Installation of Magnetos and Ignition Timing for proper timing procedure.
	Damaged magneto breaker points or condenser.	Replace points and condenser.

MAGNETOS.

The Bendix-Scintilla S6RN-200 series magnetos consist of a retard breaker, main breaker, starting vibrator and uses a single switch. The starting vibrator is used in conjunction with the retard breaker to obtain voltage necessary at cranking speeds which eliminates the need for impulse couplings.

Removal of Magnetos.

The magneto removal procedure is identical for removing either magneto from either engine.

- Remove the engine cowling in accordance with removal of engine cowl procedure.
- Detach the magneto ground wires from both magnetos and tag for identification when reinstalling.

WARNING

Magnetos are in switch on condition when ground wires have been removed.

- Detach the high tension outlet plate from the magneto to be removed.
- Rotate the propeller by hand in the normal direction of rotation until the No. 1 cylinder is coming up on its compression stroke.

NOTE

To facilitate installation of a replacement magneto, it is good practice to position the crankshaft at the advance firing angle for No. 1 cylinder during this step. Any standard timing device or method can be used, or if the magneto being removed is correctly timed to the engine, the crankshaft can be rotated to a position at which the breaker points will be just opening to fire No. 1 cylinder.

- 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 hole, watch the rubber drive bushings 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 and the drive couplings inspected.

- Inspect the rubber drive bushings in the drive gear hub for deformation and damage.

NOTE

If magneto rubber shows signs of severe distress, inspect the quill shaft, alternator couplings starter adapter drive gear and the tachometer drive for galling, pitting or heavy wear distress.

Replace with new parts if they will not fit the magneto lugs closely.

- 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.

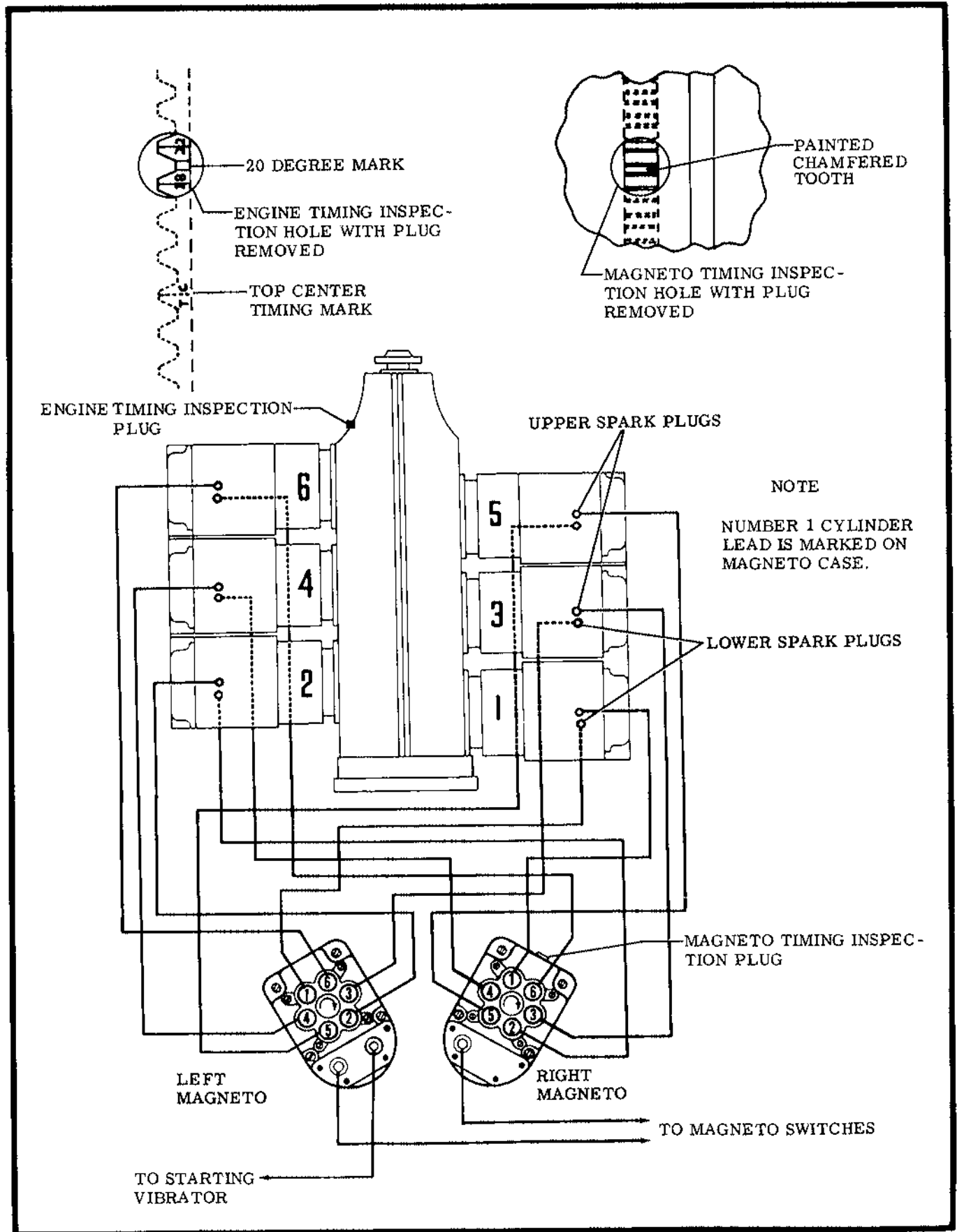


Figure 9-24. Magneto Timing and Ignition Cable Numbering

Breaker Assembly Main Spring Check. (See figure 9-25.)

- Check the main springs of the breaker assemblies for proper tension. Tension must be between 12 and 24 ounces at the instant the breaker opens.
- Check that the cam follower is securely riveted to the follower spring and that the screw which holds the parts of the breaker is tight. Torque breaker assembly screw for 10 to 12 inch-pounds.
- Examine the contact points for excessive wear or burning.

NOTE

Normal points will show a dull, slightly rough contact surface. Points which have deep pits or excessively burned areas should be discarded. If any part of the breaker is defective, the complete breaker assembly must be replaced.

Maintenance.

At the first 50-hour inspection and at each 100-hour inspection thereafter, the breaker compartment should be inspected.

NOTE

If ignition trouble should develop, spark plugs and ignition wiring should be checked first. If the trouble appears definitely to be associated with a magneto, the following may be used to help disclose the source of trouble without overhauling the magneto.

- Moisture Check.
 - Remove the high-tensions cable outlet plate cables, and rubber grommets, and inspect these parts for moisture.
 - Inspect the distributor block high-tension outlet side for moisture.
 - If any moisture is evident, lightly wipe with a soft, dry, clean, lint-free cloth.

CAUTION

Do not use gasoline or any other solvent as these will remove the wax coating on some parts and could cause electrical leakage.

Internal Timing. (See figure 9-26.)

- In 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 9-24.) 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.

- 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.

- Fabricate a timing pointer from a piece of wire (approximately 2½ inches) as follows:

- Remove the cam screw and flat washer from cam.
- Bend one end of the wire around the threads of the screw, loose enough to allow wire to be rotated.
- At the outside diameter of the large washer, bend wire straight up parallel to the screw.
- Install assembly on cam shaft and tighten screw just enough to hold wire in position and yet allowing it to be rotated.
- 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.

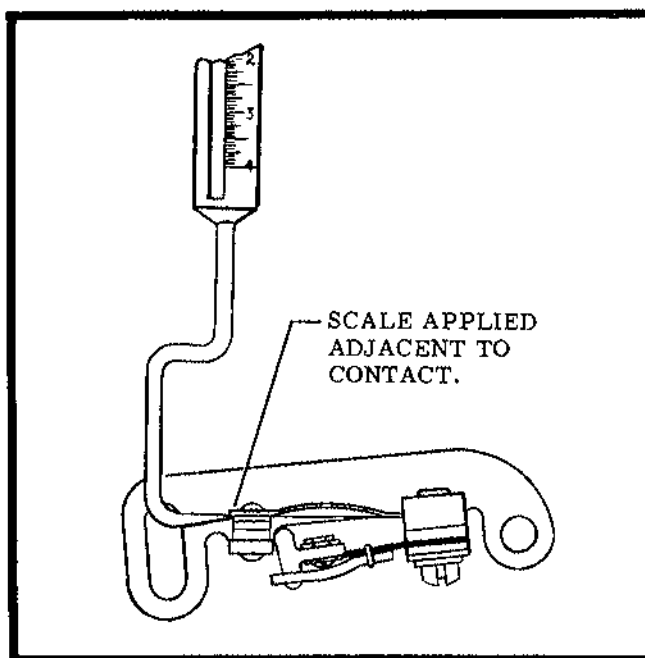


Figure 9-25. Checking Breaker Main Spring Tension

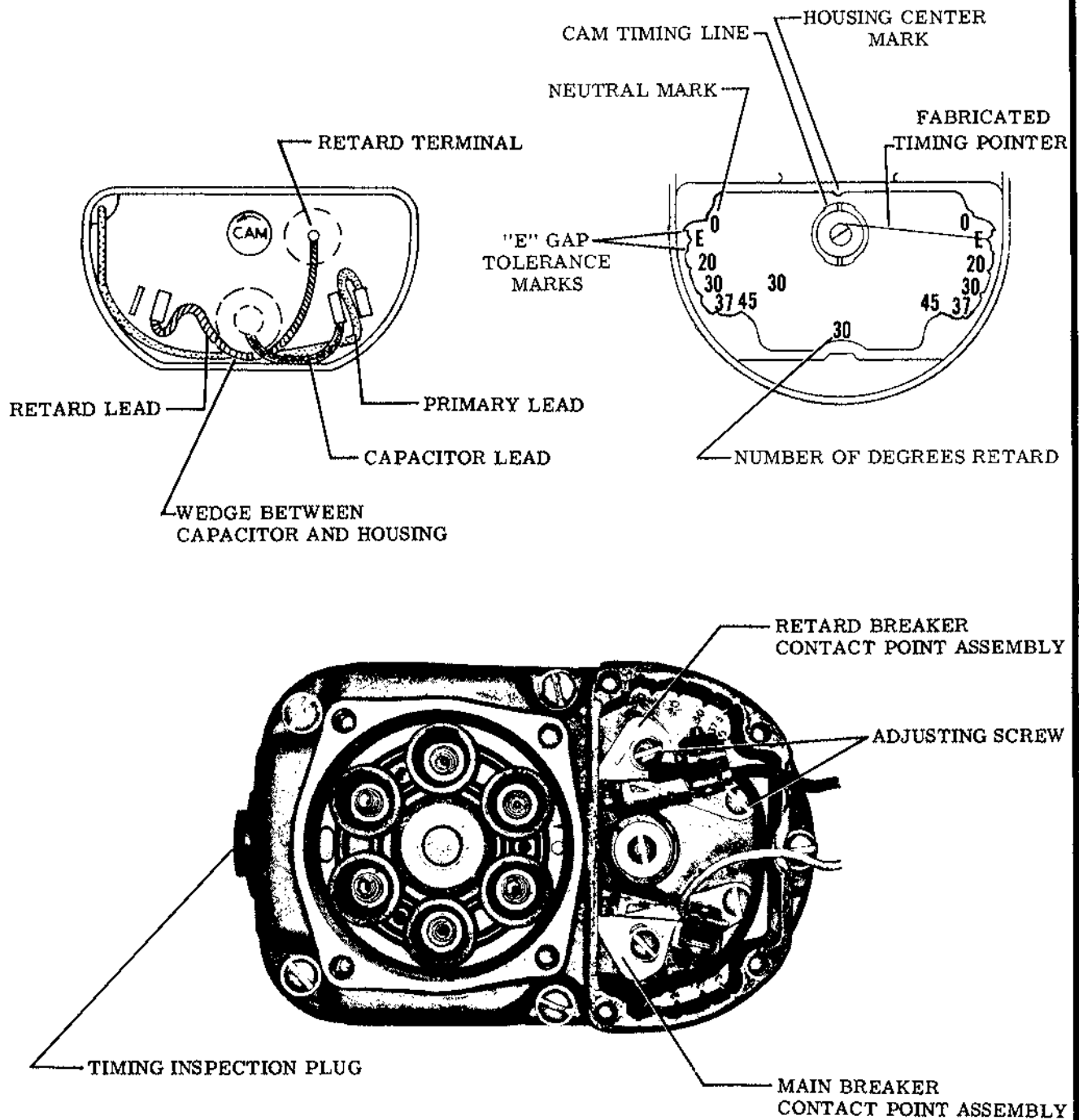


Figure 9-26. Magneto Timing Adjustment

6. With the indented slot on cam aligned with the mark at top of breaker housing and painted chamfered tooth on large distributor gear visible in timing window, set pointer on center of "E" gap mark.

7. Connect the 11-851 timing light, or equivalent, across main breaker.

8. Adjust main breaker contacts to open at this point or over any portion of the "E" gap boss.

9. Turn rotor until cam follower is on the high point of cam lobe, measure contact clearance. It should be 0.018 ± 0.006 . Readjust breaker and recheck to be sure that contacts will open with "E" gap tolerance.

NOTE

Replace breaker assembly if "E" gap tolerance and contact clearance cannot be obtained.

d. On 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 at "E" gap ($10^\circ \pm 4^\circ$) 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. Using 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 0.018 ± 0.006 . 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 of Magnetos and Ignition Timing. (310P0001 AND ON.)(See figure 9-26.)

- Remove either the upper or lower spark plug from No. 1 cylinder.
- Rotate propeller to align engine timing points and marks located on alternator sheave.

NOTE

All starter adapters and alternator sheaves furnished on engines have timing marks stamped on the face. If it is necessary to replace these parts, they will not be furnished with the timing marks. Therefore, it will be necessary to use a top dead center indicator or an inclinometer on the propeller spinner to locate the 20° BTC position for timing magnetos to engines. When it is assured that the No. 1 cylinder is at 20° BTC, it is permissible to index the new starter adapter and sheave.

- With inspection hole plug and breaker cover removed, check magneto to see that it is internally timed for right-hand drive rotation.

NOTE

The magneto installation procedure is identical for installing either magneto on either engine.

- Place the magneto on the crankcase accessory mounting pad and temporarily secure in place with clamps, washers and nuts.
- Attach a timing light to the magneto in accordance with timing light manufacturer's instructions.
- If timing light indicator light is OFF, rotate magneto housing in direction of its magneto rotation a few degrees beyond point where indicator light comes ON. Slowly rotate magneto in opposite direction until indicator light goes OFF. At this point the magneto should be timed to the engine.
- Tighten magneto clamp nuts to prevent any further movement of the magneto.

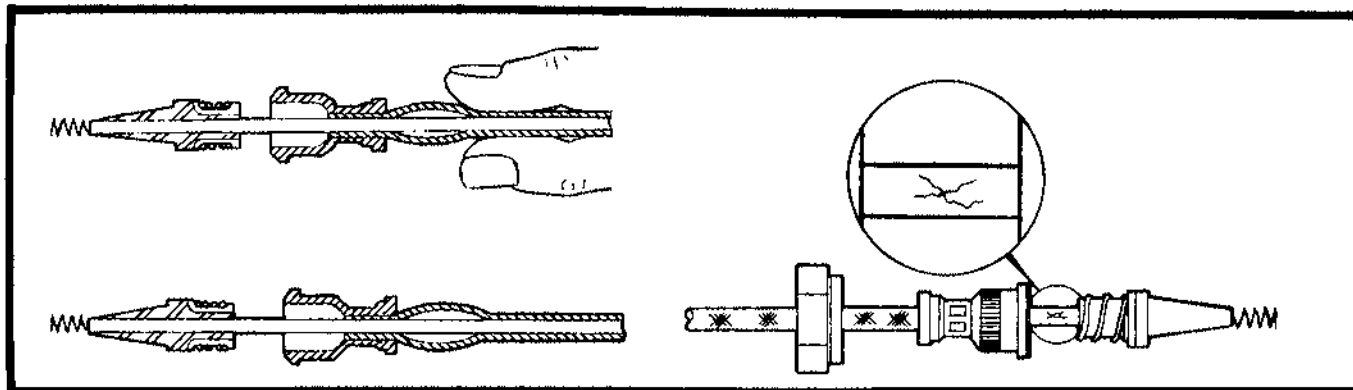


Figure 9-27. Ignition Harness

CAUTION

Do not attempt to adjust breaker points to compensate for ignition timing. Breaker point adjustment is to be used only for internal magneto timing. The effect of adjusting the magneto points to compensate for ignition timing will ultimately produce a weak ignition spark and reduce engine performance.

h. After clamp nuts are tightened, recheck timing as follows:

1. Rotate propeller in opposite direction of normal rotation for a few degrees after light goes ON.
2. Rotate propeller in direction of normal rotation until light goes OFF. If timing mark is visible through magneto inspection hole and the engine timing points are aligned with marks on alternator sheave, the magneto is correctly timed with engine.
- i. Repeat timing procedure for other magneto if applicable.

NOTE

Attach timing light indicator to both magnetos and assure that the magnetos are synchronized (breaker points opening simultaneously). If both indicator lights do not come ON at the same time, loosen the attaching clamps slightly on either magneto and rotate magneto in required direction until indicator lights will come ON at the same time while slowly rotating the propeller shaft to the 20° BTC position.

- j. Remove timing light from the magneto and engine.
- k. Replace magneto timing inspection hole plug and attach high tension outlet plate to magneto.
- l. Attach the magneto ground wire to magneto.
- m. Replace the removed spark plug.
- n. Install the engine cowl.

Installation of Magnetos and Ignition Timing.
(Turbo 310P0001 AND ON). (See figure 9-26.)

- a. (See figure 9-26.) Remove the magneto timing inspection hole plug. Rotate the magneto shaft until the timing pointer inside the magneto case is aligned with marked gear tooth.
- b. Remove either the upper or lower spark plug from No. 1 cylinder.
- c. (See figure 9-26.) Remove timing inspection plug located on the side of the crankcase and forward of No. 5 cylinder.
- d. Rotate propeller to locate timing mark scribed on ring gear through timing inspection hole. When No. 1 cylinder is on the compression stroke.

NOTE

The No. 1 cylinder firing position is 20° BTC. This can be accomplished by rotating the propeller shaft and centering the timing mark on ring gear with the centerline of the crankcase timing inspection hole (see figure 9-26).

- e. Check magneto to see that it is internally timed for right-hand drive rotation.

NOTE

The magneto installation procedure is identical for installing either magneto on either engine.

- 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.

Ignition Switches.

The four magneto ground circuits are controlled by four magneto switches. The switches are located on the left-hand side of the stationary instrument panel.

IGNITION CABLES. (See figure 9-24, for Schematic Wiring Diagram.)

The ignition harness for each engine consists of 12 shielded, high tension cable assemblies with attaching brackets. Six cables are routed from the left magneto, three going to the upper spark plugs on the left bank of cylinders, and the other three are routed between No. 1 and No. 3 cylinders to the lower spark plugs on the right bank of cylinders. The remaining six cables are similarly routed from the right magneto, with three cables going to the upper spark plugs on the right bank of cylinders and the remaining three being routed between No. 2 and No. 4 cylinders to the lower left spark plugs.

Removal of Ignition Cables.

- a. Remove engine cowl in accordance with removal procedure.
- b. To remove any ignition cable:
 1. Remove the cables 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.

Cleaning and Inspection of Ignition Cable.

- a. Inspect the cable for damaged insulation. Replace the cable if the insulation shows any evidence of deterioration.

Installation of Ignition Cables (See figure 9-27.)

- 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. 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 straight 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 twisting the lead while tightening or loosening the coupling nut. A four-inch crescent-type wrench is about the right size.

Don't - Allow the leads to twist while coupling. Twisting leads may rupture the insulating material.

Do - Use as many clamps and wire bundle ties as necessary. When in doubt, use another clamp or tie.

Do - Redress harnesses when engines are mounted in their nacelles to prevent chafing against airframe components, etc. Change nylon ties or clamps if they will hold better in a new position. Check harnesses, ties and clamps when other checks are being made on the engine.

Don't - Allow leads and wire bundles to hang loosely from their clamps. Don't allow leads to come near the exhaust manifold - keep them as far away as possible. Retighten or reposition clamps or ties if they are loosened for any reason.

Do - Check lead terminals, especially bottom cylinder plug terminals (which seem to run the hottest). The heat may cause the insulating sleeve of the plug

terminal to stick in the barrel of the spark plug. If stuck, the insulating sleeve should be removed from the spark plug in such a manner as to protect the silicone insulating on the lead as much as possible. The insulating sleeve, which is readily replaceable, will receive most of any damage incurred during removal.

Don't - Bend and twist the spark plug lead until the insulation is damaged or cut by the edge of the terminal ferrule. Do not damage the 5mm high-tension wire by allowing a screwdriver blade or other sharp tool to pierce it.

Do - Remember to clean the spark plug well ceramic and terminal insulating sleeve. Clean with a cloth dampened in alcohol.

Don't - Touch the terminal insulating sleeve after washing.

Do - Use a high-temperature mold (MS-122 Fluorocarbon Spray, Miller-Stepenson Chemical Co., Inc., 16 Sugar Hollow Rd., Danbury, Connecticut), release on terminal sleeves and on grommets at the magneto cable outlet plates. This will help prevent the hotter running plug insulating sleeves from sticking.

Don't - Apply mold release to dirty plugs or insulating sleeves.

c. 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.
- 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 precaution 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 9-28 the braided conduit should always be pushed along the lead to its original position before assembling the lead to the spark plug.

SPARK PLUGS.

There are two spark plugs in each cylinder. The spark plugs are 18mm short reach type and screw into heli-coil inserts in the cylinders. The spark plugs are shielded to prevent radio interference and have an internal resistor to provide longer gap life. An average life of 200 hours can be expected, however, this time will vary with operating conditions. The correct gap setting is .015 to .018 inch. Torque spark plugs to 330 + 30 pound-inch.

Removal of Spark Plugs.

- a. To remove any spark plug, loosen the coupling nut on the ignition cable and lift the terminal sleeve out of the spark plug shielding barrel well.

CAUTION

When removing terminal sleeve from spark plug, use extreme care to keep the cable terminal sleeve straight in the shielding barrel well. Any misalignment could scratch or break the sleeve or the ceramic insulation in the spark plug, necessitating replacement of either or both.

- b. Unscrew the spark plug from the cylinder using a deep socket wrench of suitable size. Make certain that the copper gasket is removed with the spark plug.

Installation of Spark Plugs.

- a. To install a spark plug, first make certain that the heli-coil insert in the cylinder is undamaged and that the old copper gasket was removed along with the spark plug.

NOTE

If there is any damage to the heli-coil insert, it should be replaced before installing a spark plug.

- b. Apply anti-seize compound sparingly to spark plug threads, being careful not to allow any compound to get on the ground electrodes. A good practice is to leave the bottom two threads of the spark plug uncoated. The anti-seize compound is electrically conductive and any of this material on the electrodes would short out the spark plug.
- c. Screw the spark plug into the cylinders, first installing a new copper gasket or an old one which has been annealed and is in good condition. The plugs should be tightened to the specified torque value using a deep socket wrench with a torque indicating handle.

CAUTION

Make certain that the socket is properly seated on the spark plug hexagon as damage to the plug could result if the wrench is cocked to one side when pressure is applied.

ENGINE EXHAUST SYSTEM.

Removal of Engine Exhaust System (310P0001 AND ON). (See figure 9-28.)

NOTE

Removal of LH exhaust system is given, RH exhaust system is removed in a similar manner.

- a. Remove engine cowl in accordance with removal procedures.

NOTE

The lower portion of the lower nacelle can be removed by simply removing attaching screws. This will greatly ease exhaust assembly removal.

- b. If exhaust temperature system (optional equipment) is installed, disconnect probes.
- c. Remove the four nuts holding each riser to its cylinder.
- d. Work risers down and free of cylinder studs. Separate risers and remove from nacelle.

NOTE

If difficulty is encountered in removing an exhaust stack assembly, follow the engine removal procedure and raise the engine from its mounts far enough to provide the necessary clearance.

Installation of Engine Exhaust System (310P0001 AND ON). (See figure 9-28.)

- a. Assemble and install the exhaust stack assemblies on each engine using one steel gasket between each riser and its mounting pad on the cylinder.
- b. Install four nuts on cylinder studs at each riser.
- c. Torque four nuts on each exhaust riser to 100 to 110 inch-pounds.
- d. Install bolts (3) and nuts which attach center risers (2 and 6) to aft risers (4 and 5).

NOTE

Do not over-tighten bolts (3). It should be possible to rotate the bolts by hand after tightening to provide clearance for thermal expansion of the exhaust stack assembly.

- e. Inspect exhaust system for leaks.

Removal of Engine Exhaust System (Turbo 310P0001 and ON). (See figure 9-29.)

Removal of LH exhaust system is given, RH exhaust system is removed in a similar manner.

a. Remove engine cowling in accordance with removal procedures. Disconnect probes (optional equipment) if installed.

b. Remove heat shields (2 and 15) by removing attaching screws.

c. Remove nuts securing exhaust assembly (1) to engine.

d. Disconnect exhaust assembly.

1. Aircraft 310P0001 thru 310Q0400, disconnect exhaust assembly (1) from bellows assembly (3) by removing cotter pins, nuts, bolts, washers, and springs (17). Remove clamps (16).

2. Aircraft 310Q0401 and On, disconnect exhaust assembly (1) from slip joints (19). Disconnect exhaust assembly (1) from slip joint (20) by removing cotter pins, nuts, bolts, washers, and springs (17). The slip joints separate by pulling assemblies apart.

e. Disconnect tube assemblies (11) from manifold header (10) by loosening clamp. Route tube assembly (11) through canted bulkhead and from engine nacelle.

f. (See figure 9-18.) Remove hose (9) from canister assembly (12).

g. Remove shield (7) from tube assembly (6) by loosening two clamps.

h. Disconnect tube assembly (6) from manifold header (10) by loosening clamp. Route tube assembly (6) through canted bulkhead and from engine nacelle.

i. Remove overboard exhaust tube (9) by removing clamp (24), retention strap (23) and coupling (25). Route overboard exhaust tube (9) from engine nacelle.

j. Remove manifold header (10) as follows:

1. (See figure 9-13.) Disconnect line assemblies (25 and 26), drain line (27) from actuator (28).

2. Remove turbocharger in accordance with removal procedures.

3. Remove turbocharger support brace by removing attaching bolts.

4. Route manifold header from engine nacelle.

Removal and Installation of Exhaust Slip Joint Seals and Expansion Ring. (Turbo 310Q0401 and On) (See figure 9-29.)

a. Remove exhaust system in accordance with removal procedure.

b. Remove seal (21) and expansion ring (22).

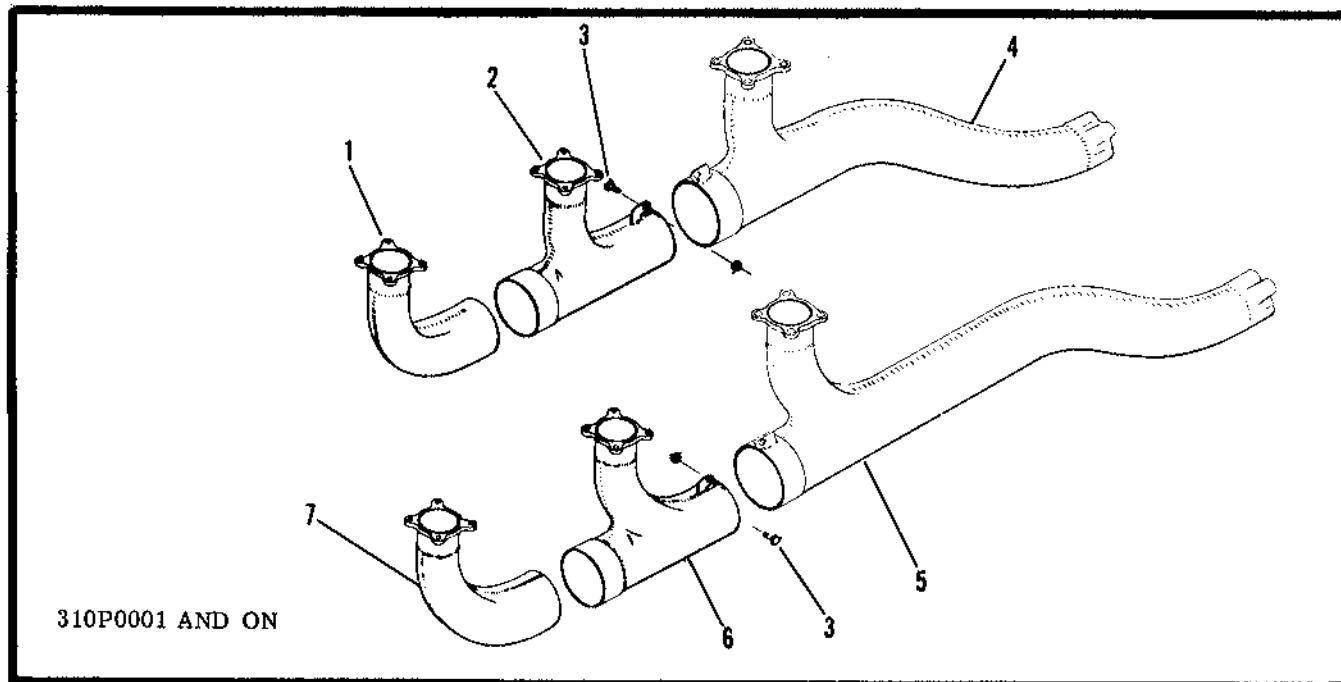
c. Install new expansion ring (22) and seal (21) in accordance with SK421-40.

CAUTION

Do not bend or flex exhaust system after replacing seals. This could cause leakage.

Installation of Engine Exhaust System. (Turbo 310P)

a. Install exhaust system by reversing removal procedures.



1. Right Forward Riser
2. Right Center Riser

3. Bolt
4. Right Aft Riser and Stack
5. Left Aft Riser and Stack

6. Left Center Riser
7. Left Forward Riser

Figure 9-28. Exhaust Stacks

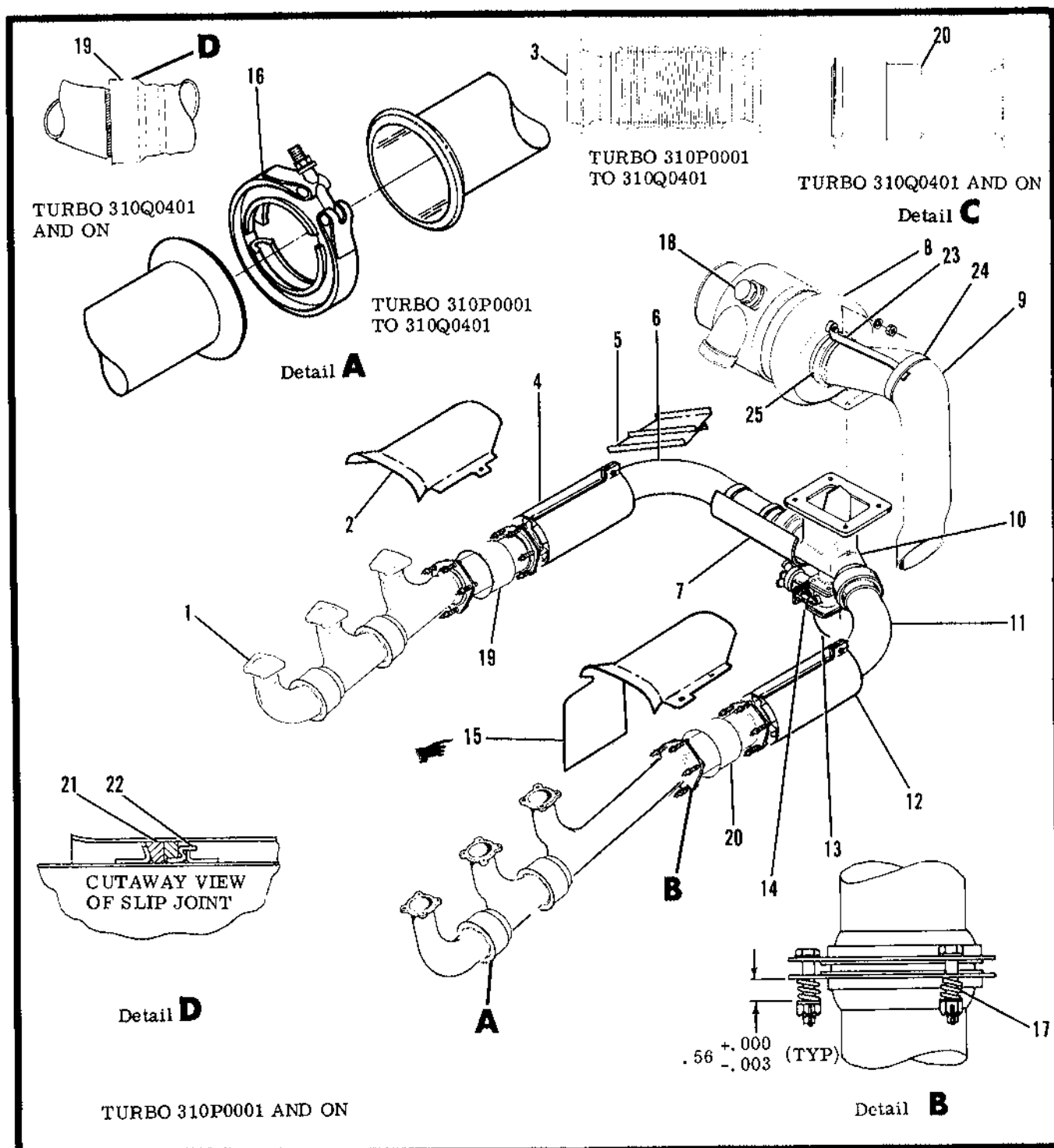


Figure 9-29. Exhaust Manifold System Installation

b. Observe the following precautions during installation:

1. Check free length of exhaust springs (17) before installation. If free length is less than 0.57 inch, the springs must be replaced.
2. Compress springs (17) to a length of 0.51 +0.00, -0.30 inch by adding or removing washers during installation.
3. Apply Fel-Pro C-5 or equivalent (Felt Products Manufacturing Company, Chicago 7, Illinois) high temperature anti-seize compound to attaching bolts and nuts when installing turbocharger to manifold header.
4. Torque the four nuts on each exhaust riser to 100-110 inch-pounds.
5. Torque inter-cylinder riser couplings to 35 inch-pounds.
6. Torque tube assembly to manifold header coupling to 35 inch-pounds.
7. Torque turbine overboard stack coupling to 70-75 inch-pounds.

NOTE

As couplings are being tightened, lightly tap coupling circumferentially in a radial direction with a rawhide or soft plastic mallet. Retorquing after heat cycling in service must be done sparingly and with caution.

8. Check couplings for deformation of outer band. If deformed beyond that defined in figure 2-10A, replace coupling.
9. Inspect exhaust system for leaks. (See Section 2)

EXTREME WEATHER MAINTENANCE.

Cold Weather.

Starting in cold weather will be made easier by the installation of an optional oil dilution system and a ground power receptacle. If these aids are not installed, the following procedure may be accomplished.

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. 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 ratio 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 the initial warm-up 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 deposits 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.

Winterization Kit

A winterization kit consisting of engine cooling air inlet restrictor baffles is available for use during continuous operation in very low temperature conditions. These baffles may be installed as an assist in maintaining engine cylinder head temperatures in the recommended temperature range. The winterization kit must be removed at temperatures of 20°F and above.

Hot Weather.

In hot weather, with a 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 exhausts 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 on "LO" before cranking is started, or place the auxiliary fuel pump switch on "HI" immediately for a richer mixture while cranking.

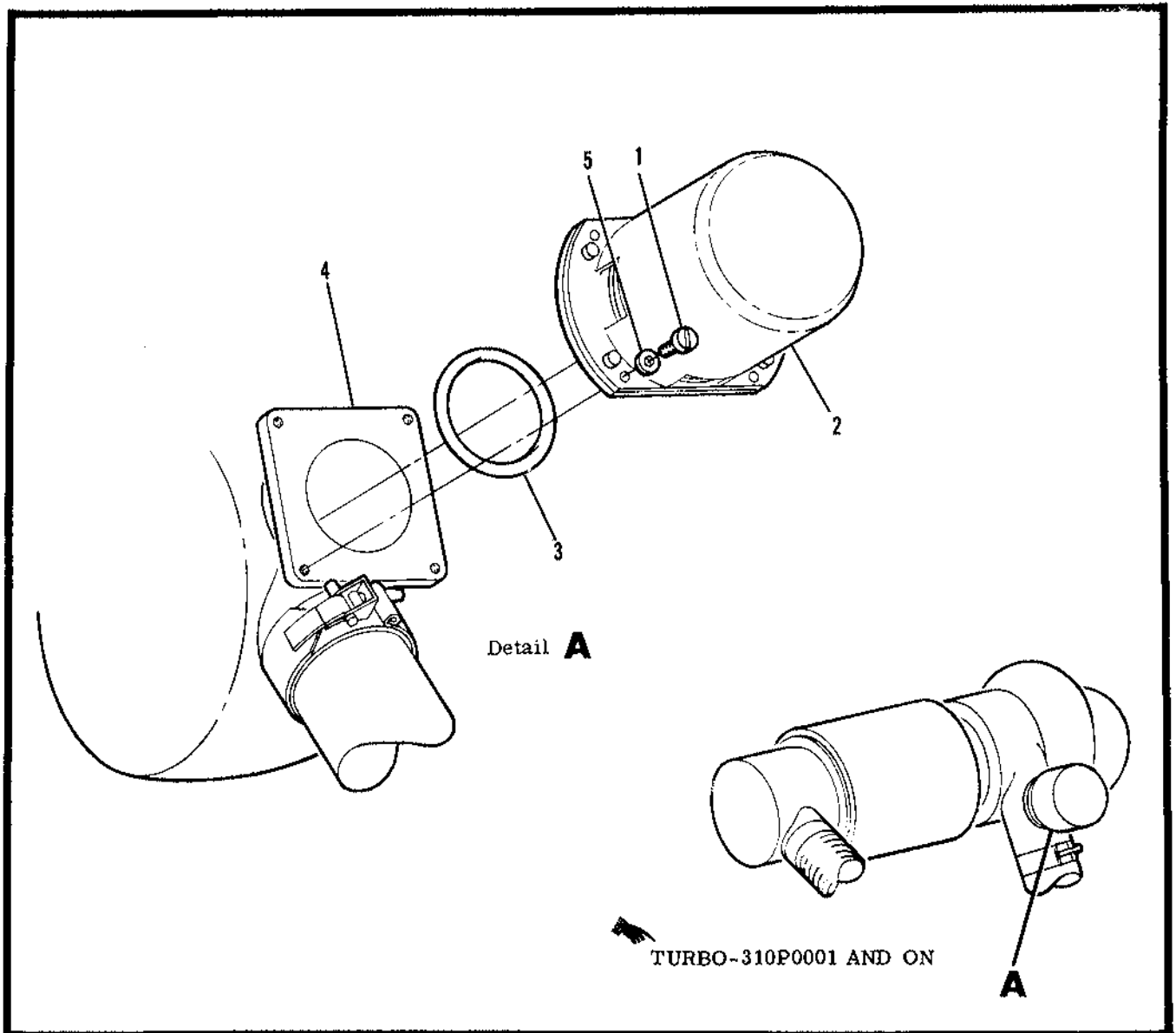
If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the starter.

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.



- 1. Screw
- 2. Relief Valve

- 3. O-Ring

- 4. Adapter Pad
- 5. Washer

Figure 9-30. Manifold Pressure Relief Valve

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SECTION 10

PROPELLER SYSTEM

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PROPELLER.

The Model 310 is equipped with all metal, two bladed (standard equipment) or three bladed (optional equipment), 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 counter-weights urge blades toward high pitch (decreasing rpm). The source of hydraulic pressure for propeller operation is furnished by the engine oil system, boosted in pressure by the governor gear pump, and supplied to the propeller hub through engine shaft flange. When the engine is not in operation, the high pitch latch mechanism prevents the propeller blades from moving into the feathered position. To feather the propeller blades, the propeller control levers on the control pedestal must be placed in the feathered position. Unfeathering the propeller is accomplished by positioning the propeller control levers to increase rpm position and rotating the blades to the low pitch position, or by starting the engine. If installed, the optional unfeathering system uses accumulator air and oil to force the propeller to the low pitch condition.

NOTE

Federal Aviation Regulations define major and minor repairs and alterations and who may accomplish them. This Section may be used as a guide, but the Federal Aviation Regulations and the propeller manufacturer's instructions must be observed.

Repairs.

Repair of metal propellers first involves evaluating the damage and determining whether the repair will be a major or a minor one and, in accordance with Federal Aviation Regulations, who is permitted to accomplish the repair.

a. General Repair Considerations:

Under no circumstances are the raised edges of defects to be corrected by peening. No welding, soldering or compounds of any nature are to be used to fill or correct defects. All repair is to be in accordance with standard approved and accepted practice.

More than one defect on blade is not cause for considering blade not airworthy if repair is within indicated limits. A reasonable number of repairs per blade is permissible if their location with respect to each other is not such as to form a continuous line that may materially weaken the blade. Any transverse crack shall be cause for considering blade not airworthy.

Repair necessitating the removal of an appreciable amount of metal shall be reason to check horizontal and vertical balance.

The repair of defects is permissible providing the treatment does not materially weaken the blade, reduce its weight, or impair its performance.

b. Defects on Thrust Face or Camber Side:

Repair by removal of metal to form shallow, large radius, round bottomed depressions.

Periodic inspection during repair should be made to avoid removal of excessive amounts of metal. All raised edges should be carefully smoothed out to reduce the area of the defect and the amount of metal to be removed. Repair with suitable fine cut files and coarse grain emery cloth and smooth all edges and surfaces with fine grain emery cloth. Any blade repair on these surfaces which necessitates a depression that exceeds the manufacturer's tolerances or those listed in FAA Advisory Circular AC43.13-1 shall be cause for considering blade not air-worthy.

c. Defects on Leading and Trailing Edge:

Repair defects as outlined in "b" above with suitable half-round file and emery cloth. Carefully smooth all edges of repaired defect. Any blade repair on leading and trailing edges which necessitates metal removal that exceeds the manufacturer's tolerances or those listed in FAA Advisory Circular AC43.13-1 shall be cause for considering blade not airworthy.

Blades that have leading or trailing edges pitted from normal wear may be reworked by removing sufficient metal to eliminate the pitting. Start well back from the edge and work over the edge in such a manner that the contour of the blade remains substantially the same. Avoid abrupt section changes and blunt edges. Permissible reductions in blade thickness and width, listed in the manufacturer's publications or FAA Advisory Circular AC43.13-1, must be observed.

d. Tip Damage:

Damage on blade tips may be removed in accordance with "b" and "c" listed above, as long as

metal removal is within the tolerances specified. Damage which cannot be repaired by local removing of metal may be repaired by removing metal so as to shorten blades, although shortening blades is a propeller major repair. Any shortening of one blade requires an identical shortening of the other one, and any change in tip plan form or contour of one blade requires an identical change on the other one. Limitations concerning shortening of blades are specified in the manufacturer's publications or FAA Advisory Circular AC43.13-1.

e. Refinishing:

Prior to corrosion protection treatments, all repair areas should be smoothly polished out and blended in to finish repair and improve appearance. Whenever possible, all repaired blades should be anodized in a sulfuric acid anodize bath. The blades must be anodized with loose blade retention hardware on shank end; therefore, the blade must be supported vertically with steel hardware out of the solution and suitably protected to be unaffected by fumes. The same holds true for caustic baths.

When anodizing is not readily available, local repaired or inspected areas may be treated by other approved methods for corrosion protection; so-called chromodizing, alodine solution, painting, etc. It is doubtful that the finish of these treatments, other than sulfuric acid anodize, will blend in with regard to appearance. If desired, both camber and thrust face sides may be painted with zinc chromate primer and black lacquer to improve appearance. The thrust face side should always be painted.

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.
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.

Troubleshooting the Propellers (Continued).

TROUBLE	PROBABLE CAUSE	CORRECTION
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 AIRSPEED 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 Rigging Procedures.
	Governor arm reaches stop before maximum rpm is obtained.	Adjust in accordance with Rigging Procedures.
	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.
	High governor maximum rpm settings.	Adjust in accordance with Adjustment Procedures.
	Internal binding of governor components.	Replace governor.
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.
MINIMUM RPM TOO HIGH	Control cable rod end bolt installed in wrong control arm hole.	Install in accordance with Rigging Procedures.
	Control lever engaging feather gate stop too soon.	Rerig controls.

Troubleshooting the Propellers (Continued).

TROUBLE	PROBABLE CAUSE	CORRECTION
MINIMUM RPM TOO LOW	Control cable rod end bolt installed in wrong control arm hole.	Install in accordance with Rigging Procedures.
	Inadequate top end control system cushion.	Rerig controls.
PROPELLER FEATHERING PERIODS IN EXCESS OF 9 SECONDS	Feather rpm settings too high.	Adjust in accordance with Adjustment Procedures.
PROPELLER FEATHERS TOO SOON	Improper control cable rigging.	Rerig controls.
	Improper feather rpm settings.	Adjust in accordance with Adjustment Procedures.
PROPELLER FAILS TO UNFEATHER	Improper feather rpm settings.	Adjust in accordance with Adjustment Procedures.
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.
	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.)
OIL LEAKAGE AT MOUNTING FLANGE	Feathering spring weak or broken.	Overhaul propeller.
	Damaged O-ring seal between engine and propeller.	Check visually for oil leakage and replace O-ring seal.
OIL OR GREASE LEAKAGE AT ANY OTHER PLACE	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.
	Defective seals, gaskets, etc., or incorrect assembly.	Check visually for oil or grease leakage, repair or replace propeller as required.

Troubleshooting the Propellers (Continued).

- 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 may 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 troubleshooting a propeller-governor combination, it is recommended that a governor known to be in good condition be installed to check whether the propeller or the governor is at fault. 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. Before removing the propeller it should be placed in the FEATHERED position. This will allow the oil in the blade actuating cylinder to drain back into the engine and will protect the blade actuating cylinder wall from damage during the removal procedure.

- a. Feather the propeller by either the normal or the optional procedure.

Normal Feathering Procedure:

1. Start engine in accordance with "Pilot's Checklist."
2. Operate engine at normal idle (700 rpm).
3. Place the 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 (700 rpm), increase the rpm slightly and attempt to feather again.

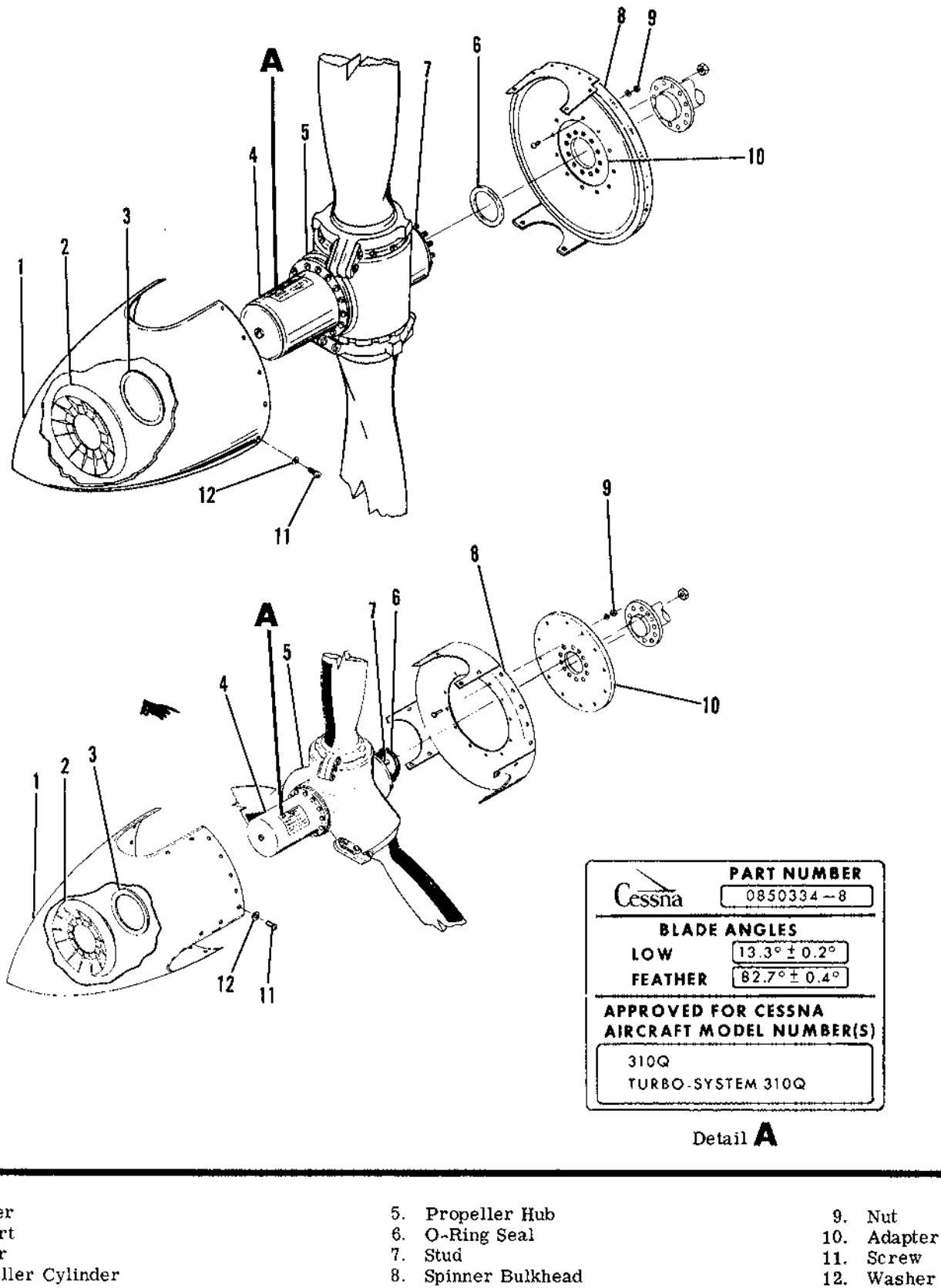


Figure 10-1. Propeller Installation

Feathering Procedures with Optional Unfeathering System Installed:

1. After the propeller has been feathered and the engine shutdown, move propeller control out of the FEATHER position until blades start to unfeather, then quickly pull the control back into FEATHER.
2. Continue to "milk" pressure out of the system with the propeller control until the propeller blades will no longer move. This may require from 15 to 20 movements of the propeller control.

NOTE

Do not allow propeller blades to rotate far enough to let high pitch latches engage, or engine will have to be restarted, propeller feathered again, and the procedure repeated.

- b. Remove cowling in accordance with Section 9.
- c. Remove screws attaching spinner (1) to spinner bulkhead (8). Retain all spacers (3) from behind support (2).

NOTE

The propeller spinner and propeller bulkhead are indexed to each other by having one attaching bolt larger than the others.

- d. Remove six attaching nuts securing the propeller hub to engine crankshaft.

CAUTION

Support the propeller before removing the last nut, to prevent the possibility of dropping propeller.

- e. Remove propeller from engine crankshaft.

NOTE

If the aircraft is equipped with a propeller deice system, loosen the deice wires from terminal strip.

- f. Remove spinner bulkhead (8) from propeller hub.

NOTE

The split spinner bulkhead is a matched set and should be marked on removal.

Installation of Propellers. (See figure 10-1.)

NOTE

For installation of optional three bladed propeller, refer to Installation Procedures on three bladed propellers.

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 nuts.

WARNING

Do not use all steel locknuts. Use only new elastic element locknuts when installing propeller.

- f. Torque nuts 80 to 85 foot-pounds.

- g. Install spinner. (See figure 10-1.)

1. Install spacer (3) and support (2).

2. Lightly press spinner (1) to hold snug against support and check alignment of spinner holes with bulkhead (8).

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 (11) and washers (12). Remove shims, if necessary, until just possible to install screws.

- h. Replace nose cap cowling and check propeller for operation in accordance with the Operational Check procedure.

- i. If optional propeller unfeathering system is installed, charge accumulator in accordance with Section 2.

CAUTION

If the propeller is equipped with a deice system, connect the wires by connecting to terminal strip.

Checking Blade Angles. (See figure 10-2.)

- a. Remove spinner from propeller.

- b. Measure 30 inches from the propeller hub center out towards the tip of each blade and mark. This station is used to check the blade angle setting.

- c. Place blade bars on propeller blades and rotate blades to full low pitch.

NOTE

Allow only enough pressure with blade bars to reach low pitch setting without deflecting blades. Too much pressure on blade bars will change blade angle readings 2 to 3 degrees.

- d. Set propeller protractor or bubble protractor fore and aft on the hub cylinder and obtain reading.

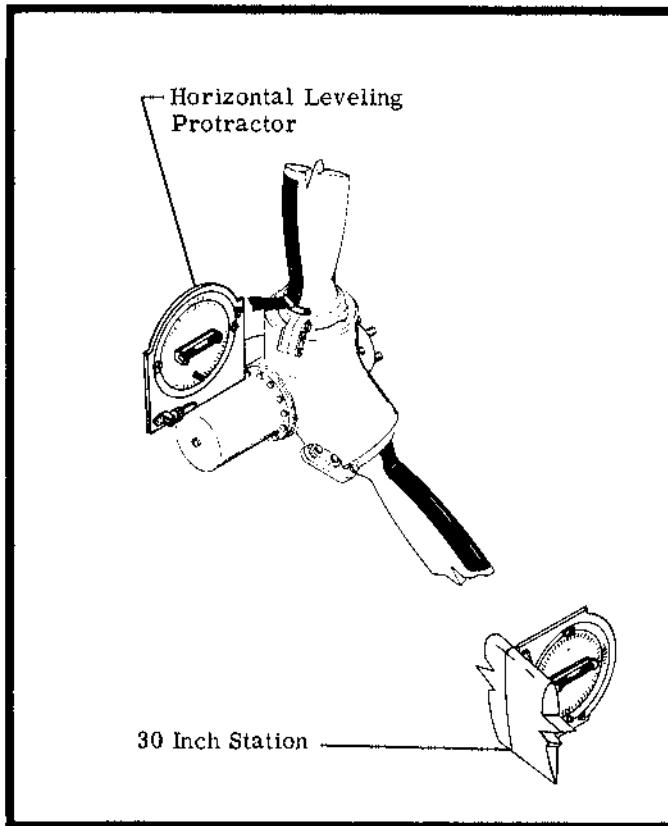


Figure 10-2. Checking Blade Angles

NOTE

Check blade angle of propeller blade that is on the operators right when facing the propeller from the front of the aircraft.

- e. With propeller blade in a horizontal position and the protractor in a vertical position, obtain reading at the 30 inch station; then compute blade angle.
- f. Using the Table in figure 10-3, check blade angle.
- g. To check the No. 2 and No. 3 blades, rotate propeller and check blade angle as outlined in steps c. through f.

NOTE

Blades must be in the same relative position each time blade angle readings are taken.

Setting Blade Angles. (See figure 10-4.)

- a. Remove propeller spinner.
- b. Remove propeller dome (9).

CAUTION

Before removing propeller dome, it is necessary that the propeller be in feathered position; otherwise, the feathering springs are exerting a high pressure against the dome retaining screws. This also allows the oil to drain from the dome back into the engine.

c. To change feather angle, add or remove shims (6) from the feather stop (10) to obtain a feathered angle of 82.7 ± 0.4 degrees.

1. Add shims to decrease blade angle.
2. Remove shims to increase blade angle.

NOTE

Feather stop shims are in two thicknesses. P/N A2390-1 is steel .016 = $1/2^\circ$ pitch change. P/N A2390-2 is bronze .008 = $1/4^\circ$ pitch change.

CAUTION

The addition or removal of shims is the only adjustment which can be made for pitch angles. No other adjustments should be attempted.

d. To set low pitch stop angle, add or remove shims (3) to obtain the desired low pitch angle of 13.3 ± 0.2 degrees.

1. Add shims to increase blade angle (decrease RPM).
2. Remove shims to decrease blade angle (increase RPM).
3. In changing low pitch stop, the same amount of shim must be added or removed from feather stop in order to retain the same feather angle.

NOTE

Low pitch stop shims are in three thicknesses. P/N B2311-1 is steel .016 = $1/2^\circ$ pitch change. P/N B2311-2 is bronze .008 = $1/4^\circ$ pitch change. P/N B2311-3 is bronze .004 = $1/8^\circ$ pitch change.

- f. Install propeller dome (9) securing it by screws (7).
- g. Torque screws to 75-85 inch-pounds and safety.

Operational Check of Propellers. (See figure 10-5.)

Anytime the propellers or propeller governor have been removed, the following check should be performed after reinstallation. This will insure that the engine-propeller-governor combination is in good operating condition and properly adjusted to give maximum performance.

- a. Face aircraft into the wind. Start engines and allow to warm up with the oil temperature operating in the upper two thirds of the operating range, on the oil temperature indicator.

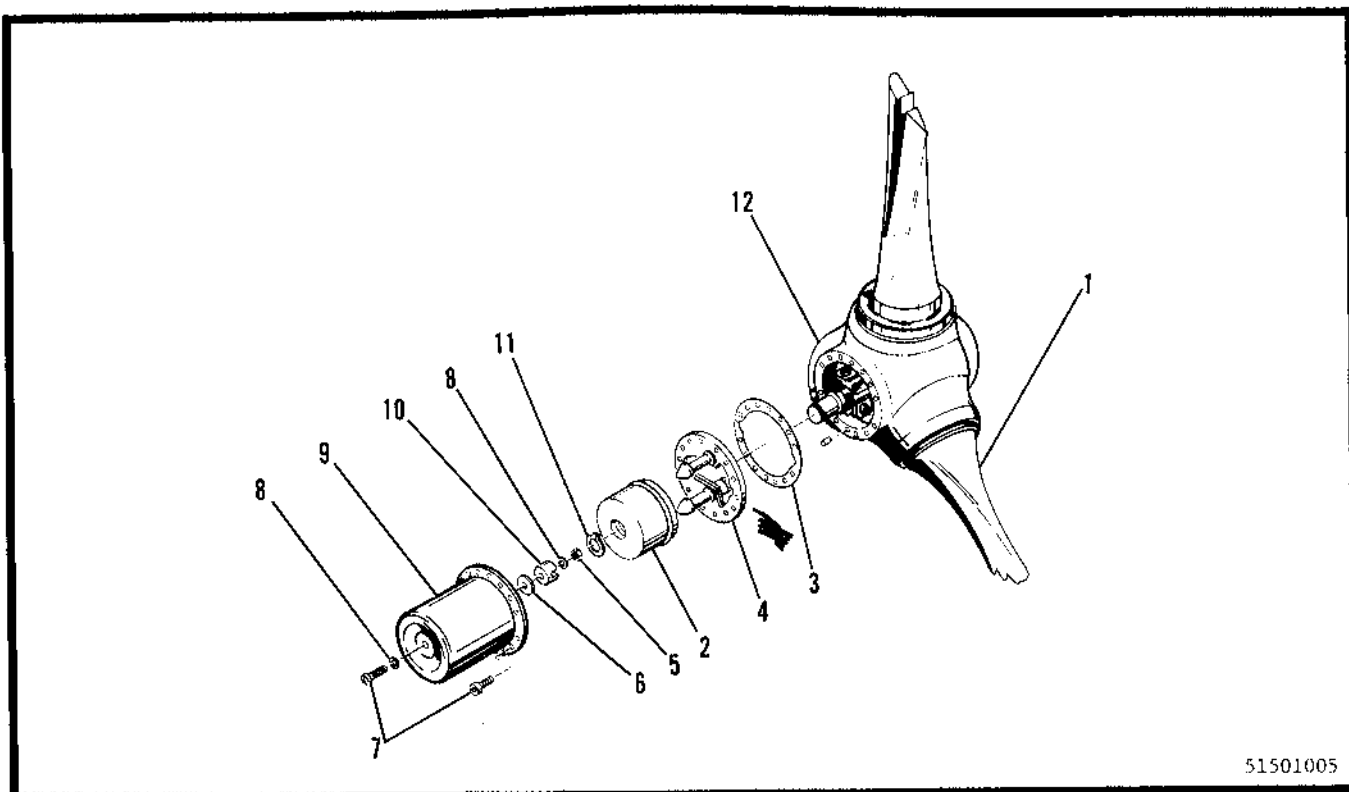
NOTE

Avoid running up engines where loose stones or cinders can be picked up by an inflow or air and damage the propeller blades.

- b. Maximum rpm check. If local wind and ambient temperature conditions allow ground attainment of

MODEL	LOW PITCH ANGLE	FEATHERED ANGLE	INCHES FROM TIP OF BLADE
D2AF34C71-2/84JF-3 (0850334-8/3) (Turbo 310Q)	13.3° ±0.2	82.7° ±0.4	9.0
3AF32C87-2/82NC-4 (0850334-15/3) (Turbo 310Q)	13.0° ±0.2	82.6° ±0.4	10.5
D2AF34C71-1/84JF-3 (0850334-20/3) (310Q)	12.8° ±0.2	82.6° ±0.4	9.0
3AF32C87-1/82NC-4 (0850334-22/3) (310Q)	12.5° ±0.2	81.2° ±0.3	10.5

Figure 10-3. Propeller Low Pitch and Feather Angle



1. Blade
2. Piston
3. Shim Low Pitch Stop
4. Plate Low Pitch Stop

5. Nut
6. Shim Feather Stop
7. Screw
8. Seal

9. Cylinder
10. Feather Stop
11. Retainer Ring
12. Hub

Figure 10-4. Setting Blade Angle

maximum rpm, verify and/or adjust control system as follows:

1. Check maximum rpm (2625 +25 for 310, 2700 +25 rpm for Turbo 310).
2. Check top end of control lever for a minimum of 0.20 inches cushion. If necessary adjust control lever to obtain proper cushion.
3. Check minimum control rpm in accordance with step "c. 1."
4. Check control levers synchronization in accordance with step "c. 2."
5. Check override of control cable travel limits. Control cable should not reach internal stops before contact is established at governor or control quadrant stops.
6. If local wind and ambient temperature conditions do not allow ground attainment of maximum rpm, the aircraft may be flown for flight testing only, providing the engine speed is not lower than 50 rpm from maximum rpm as indicated in step "c," and the difference between both engines does not exceed 25 rpm.

CAUTION

If adjustments performed on the maximum rpm setting screw on the governor fail to provide increments of ground maximum static rpm's (as an indication of inability to attain maximum governing speeds), the governor setting screw must be returned to the original adjustment. This is required to prevent the possibility of an overspeed condition during flight.

c. Minimum control check.

1. With manifold pressure maintained at 24" Hg., gradually retard the propeller control levers and verify that with levers firmly against the feather gate stops, assure the indicated engine speed drop is within the 1800-2000 rpm range. If required adjust control system as required.

2. Gradually advance the propeller control levers and verify that identical engine speeds are available within a half knob differential between control levers.

d. Check control lever cushion as follows:

1. With engine control quadrant friction lock completely relaxed, verify that a minimum top end cushion of 0.20 inches is maintained. Any control cable system adjustments performed to correct inadequate cushion conditions, requires a new verification of maximum rpm (step b) and minimum rpm (step c).

e. Check operation of feathering as follows:

1. With propeller control full forward and mixture control in full rich position, reduce throttle to attain 1050-1000 rpm.
2. After engine speed stabilizes between 1050-1000 rpm, place the propeller control lever behind the feather gate stop on the control pedestal. This motion must be carried at a rapid rate and feathering periods must be timed from the instant the propeller control lever reaches the feather cushion position.
3. Immediately following step "e. 2.," retard the mixture control lever to the idle cut-off position.
4. Feathering periods terminate when the propeller blades cease to rotate about their axis, and must not exceed 9.0 seconds.

NOTE

Changes to the governor head or control arm orientations are not authorized on governors. Lead seals and safety wires installed at the cover retainer and control arms must not be disturbed.

PROPELLER GOVERNORS.

A lever head, base-mounted, constant-speed, single-acting governor is installed on each engine to control the propeller pitch. The governors are engine-driven and mounted on the left side of the crankcase just below the forward cylinder. A gear type pump and relief valve is incorporated in each governor to boost engine oil pressure which, regulates aircraft engine speed by varying the pitch of the propeller to match load torque to engine torque in response to changing conditions of flight. Internal flyweights are attached to a pilot valve that directs high pressure oil to the propeller piston or allows oil to drain from the piston.

Removal of Propeller Governors. (See figure 10-5.)

NOTE

The removal procedure is the same for either propeller governor.

- a. Refer to Section 9, remove engine cowling and baffles as necessary to gain access to propeller governor.
- b. Remove rod end from governor control arm by removing attaching nut, spacer and bolt.

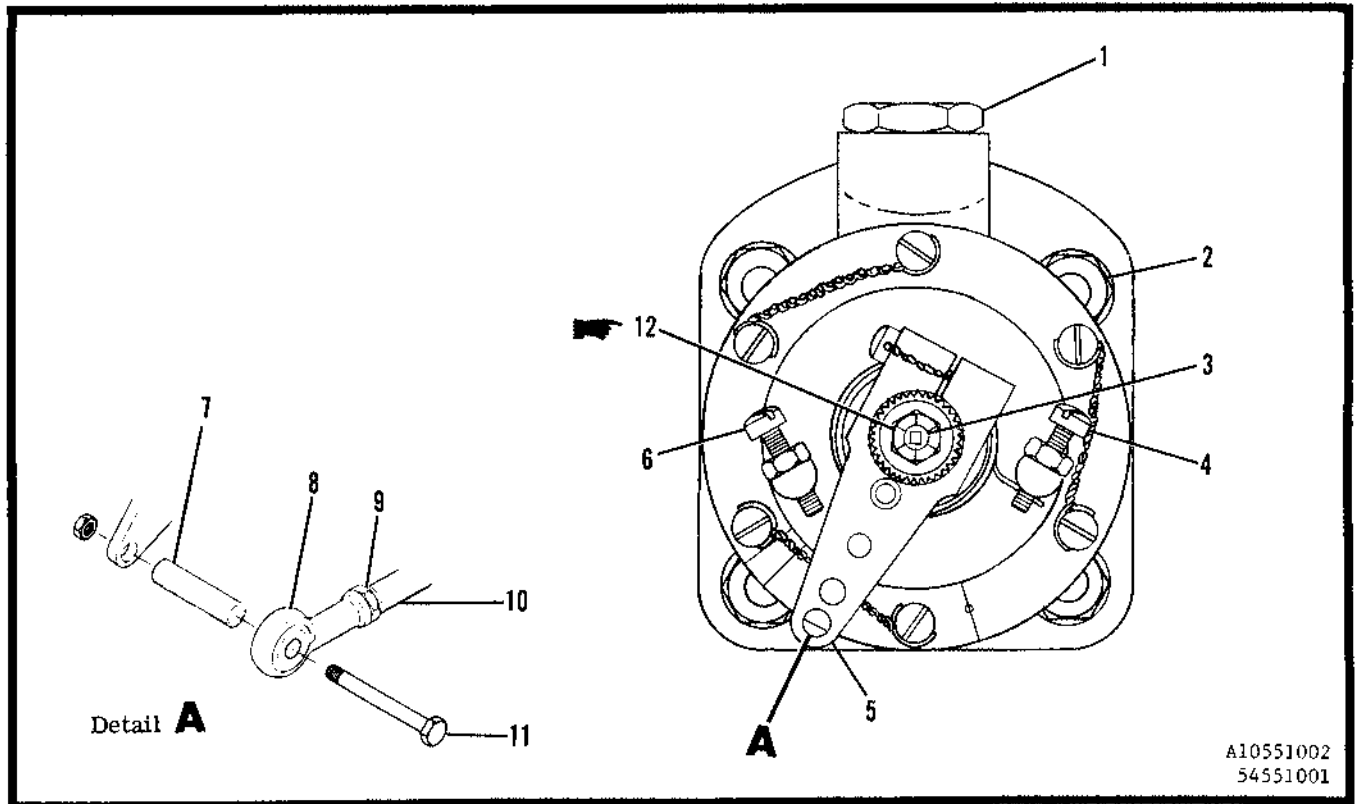
CAUTION

If aircraft is equipped with optional unfeathering system, release accumulator pressure prior to removal of governor.

- c. Remove governor and mounting gasket by removing the four nuts, internal tooth lockwashers, plain washers, and the forward left engine baffle support tab.

Installation of Propeller Governors. (See figure 10-5.)

- a. Place the mounting gasket over the governor mount studs with the raised surface of gasket screen facing away from the engine.
- 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. Tighten nuts to 160 inch-pounds. The forward left engine baffle support tab should be fastened to the lower forward governor mount stud.
- d. Rig propeller in accordance with rigging procedures.



1. Plug	5. Control Arm	9. Locknut
2. Nut	6. High RPM Stop	10. Control Cable
3. Screw Adjustment	7. Spacer	11. Bolt
4. Feather Stop	8. Rod End	12. Locknut

Figure 10-5. Propeller Governor

- e. Refer to Section 9, install engine baffles and cowling in accordance with installation procedures.
- f. Perform an operational check of propellers.
- g. If optional propeller unfeathering system is installed, charge accumulator in accordance with Section 2.

Rigging Propeller Governor Controls. (See figure 10-5.)

- a. Disconnect the propeller control rod end at the governor arm by removing nut, spacer and bolt.
- b. Move propeller control lever from maximum to minimum rpm position (against feather gate stop).
- c. Adjust control system cable rod ends, cable housing and support bracket as required to align rod end hole with rigging pin (No. 8 drill shank or equivalent) installed and positioned over the 2000 rpm index mark.
- d. Remove rigging pin and install bolt, spacer and nut on outboard arm hole. On Turbo 310 aircraft, install bolt in inboard hole of governor arm.
- e. Cycle propeller control lever to insure a minimum top end cushion of 0.20 inch. Make minor adjustments as required to attain minimum cushion at top end and minimum control rpm of 1800 to 2000 rpm at the lower end of lever travel.

Adjustment of Governor. (See figure 10-5.)

If maximum rpm, low minimum rpm or propeller feathering periods are incorrect adjust as required.

- a. If static rpm is too high, reduce by adjusting governor stop screw (6). Turn clockwise one revolution for each 17 rpm decrease. This reduction prevents possible overspeeding at takeoff.
- b. If static rpm is too low, it is possible that either the governor stop screw (6) or the propeller low pitch stop (4, figure 10-4) is the limiting factor. Move the propeller control lever toward decrease rpm and then to increase rpm position; if the maximum attainable rpm is reached at the same time as the governor stop, the governor is the limiting factor. Correct by adjusting the governor stop screw. Turn counterclockwise one revolution for each 25 rpm increase. If the maximum obtainable is reached before governor stop is reached, the propeller low pitch stop may be the limiting factor. This would require an adjustment of the propeller blades to decrease the low pitch angle. This adjustment should be made only by an authorized propeller overhaul station.
- c. If feathering time period is in excess of 9 seconds, adjust by loosening locking nut (12) and turn adjustment screw (3) counterclockwise. Hold screw position while securing locknut.
- d. If propeller feathers before control lever reaches a point 0.20 inch aft of the feather gate stop position, ascertain that propeller control is properly rigged and that minimum rpm is on the high end of the 1800-2000 rpm range. If control rigging is correct, turn feather adjustment screw (3) clockwise to lower the feather position.

- e. If propeller fails to unfeather when propeller control lever is advanced forward of the feather gate stop, turn adjustment screw clockwise.
- f. For minimum rpm adjustments, adjust controls in accordance with rigging procedures.

PROPELLER SYNCHRONIZER SYSTEM.

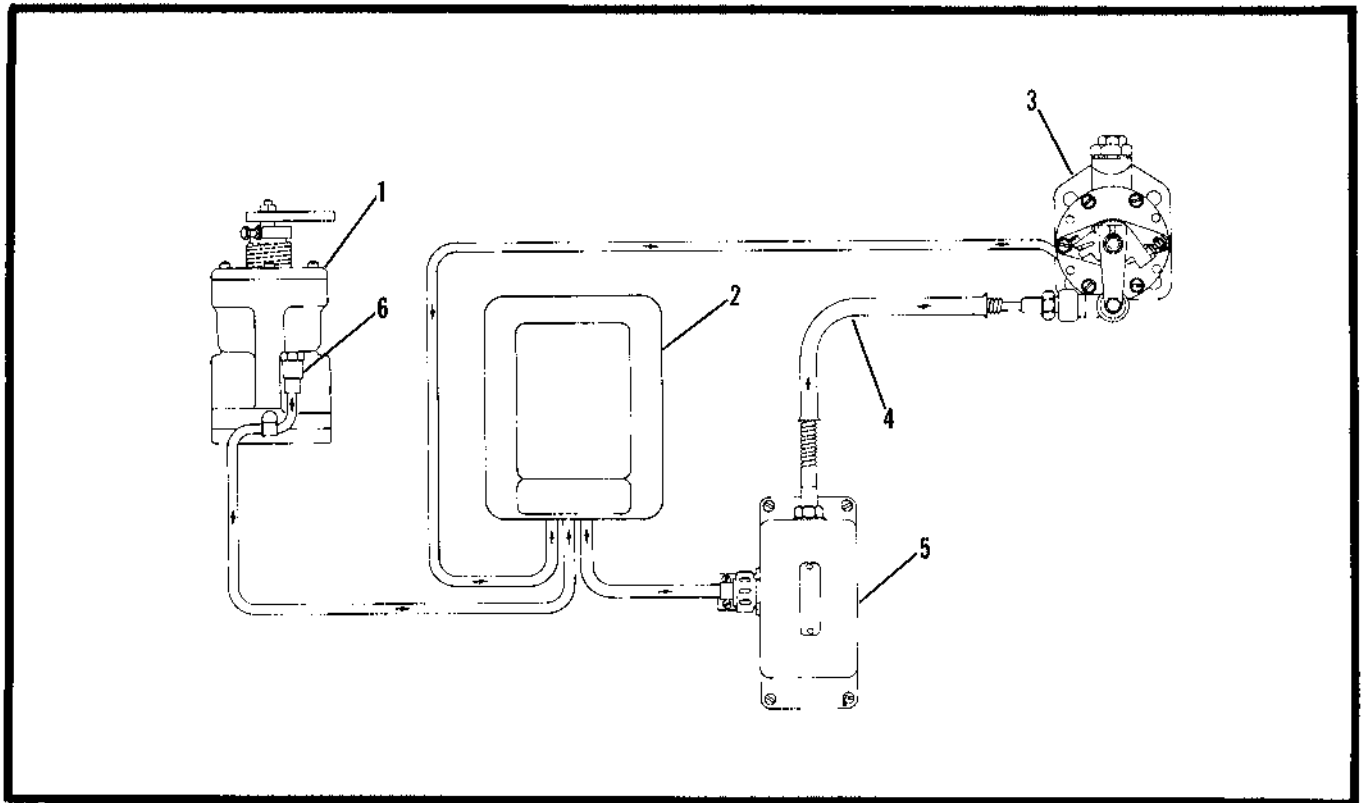
The component parts of the propeller synchronizer system are two electrical pulse pickups, trimmer assembly, actuator motor assembly, switch, interconnecting electrical cable assemblies, and an indicator light. The control box assembly, located on the underside of the glove compartment box, contains an all transistorized circuitry. The actuator motor is a stepping-type that operates on command from the control box and is located in the right engine nacelle. The flexible rotary shaft is connected to the actuator motor and trimmer assembly to trim the right engine speed setting. Magnetic pickups are mounted in each propeller governor to provide engine speed indicators to the control box assembly. The function of the propeller synchronizer system is to automatically match the rpm between the two engines; therefore, the left engine is designated as the "master" engine while the right engine is termed the "slave" engine. The electrical pulse from both magnetic pickups are fed into the control box from the governors. Any difference in these pulse rates will cause the control box assembly to run the actuator motor and through the flexible shaft, trim the "slave" engine governor speed setting to exactly match the "master" engine rpm. Normal governor operations and functions are unchanged but the synchronizer system will continuously monitor engine rpm and reset the "slave" engine governor as required. The limited range feature prevents the "slave" engine losing more than a fixed amount of rpm in case the "master" engine is feathered with the synchronizer on.

Operation of Propeller Synchronizer System.

Electrical pulses from the magnetic pickup in each governor are fed into the control box (figure 10-6). As any difference in the number of pulses is detected, a signal is sent from the control box to the actuator, which trims the slave governor speed to match that of the master engine exactly. Normal governor operation is unaffected. The synchronizer will continuously monitor the engine speeds and reset the slave engine speed setting as required. Operating range of the actuator is approximately 50 rpm.

Removal of Synchronizer System Components. (See figure 10-7.)

- a. Remove flexible shaft (4) as follows:
 - 1. Disconnect flexible shaft (4) from actuator motor (9) and trimmer assembly (3).
 - 2. Remove the lock ring and hex nut from either end of flexible shaft.
 - 3. Remove flexible shaft from engine nacelle by routing through guide tube.



1. Master Governor (LH Engine)
2. Control Box
3. Slave Governor (RH Engine)

4. Flexible Shaft
5. Actuator
6. Magnetic Pickup

Figure 10-6. Schematic Diagram Synchronizer Operation

- b. Remove trimmer assembly (3) from governor (2) by disconnecting flexible shaft (4), propeller control cable (5) and attaching nut, spacer and bolt.
- c. Remove actuator motor (9) by disconnecting flexible shaft (4) and electrical cable (10). Remove four screws attaching motor to brackets.
- d. Remove control box assembly (12) as follows:
 1. Refer to Section 3 and remove forward cabin side upholstery.
 2. Disconnect electrical cable (13) from synchronizer switch (14) and indicator light (15) and route from stationary instrument panel to control box assembly.
 3. Disconnect control box electrical cable at electrical plug (11).
 4. Remove four screws attaching control box assembly (12) to bracket.
- e. Remove switch (14) and indicator light (15) as follows:
 1. Remove four screws attaching upper pedestal panel (16) to pedestal.
 2. Disconnect electrical wiring.
 3. Remove switch and light in accordance with removal procedures outlined in Section 14.

Installation of Synchronizer Components. (See figure 10-7.)

- a. Install components by reversing removal procedures.

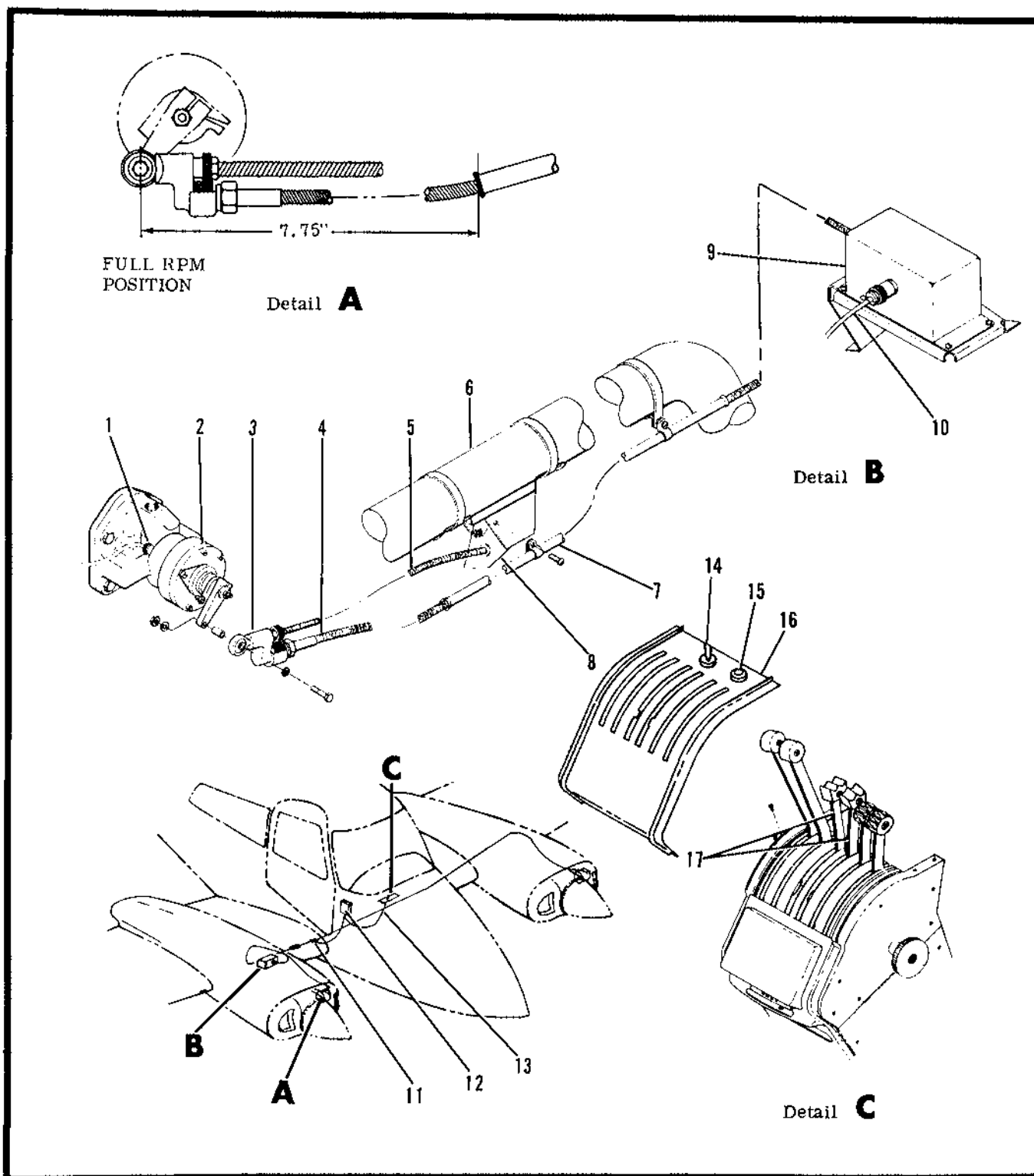
NOTE

Alternate part numbered governors must be installed in pairs.

- b. Adjust in accordance with adjusting procedures.

Adjustment of the Propeller Synchronizer System. (See figure 10-7.)

- a. Start rigging procedures by disconnecting flexible shaft (4) from actuator motor (9).
- b. Rotate free end of flexible shaft (4), counting total turns available on the "slave" governor trimmer assembly (3).
- c. Return trimmer assembly (3) to its center range.
- d. When trimmer assembly (3) is centered, rig governor (2) and control cable (5) in accordance with Rigging Propeller Controls.



1. Governor Electrical Pickup	7. Guide Tube	12. Control Box Assembly
2. Governor	8. Support Bracket	13. Electrical Cable to Control Pedestal
3. Trimmer Assembly	9. Actuator Motor Assembly	14. Synchronizer Switch
4. Flexible Shaft	10. Electrical Cable to Fuselage	15. Indicator Light
5. Propeller Control Cable	11. Electrical Plug	16. Upper Pedestal Panel
6. Intake Manifold		17. Propeller Pitch Levers

Figure 10-7. Propeller Synchronizer System Installation

- e. Manually rotate trimmer assembly (3) to either end of its travel.
- f. Move propeller pitch levers (17) on the pedestal through its entire range, observing the governor speed adjusting lever to be certain it travels to the maximum and minimum rpm limits.
- g. Manually rotate the trimmer assembly (3) to opposite end of its travel.
- h. Perform step f. again.
- i. Recenter the trimmer assembly (3).
- j. Insert a squared shaft into drive of actuator motor (9) and count total turns available.
- k. Place actuator motor (9) in its center range.
- l. With both actuator motor (9) and trimmer assembly (3) centered, connect the flexible shaft (4) to actuator motor.
- m. Check flexible shaft (4) for binding and a clearance of 7.75 inches in the full rpm position.

Functional Test of Synchronizer System.

To test the operation of the synchronizer in flight, first synchronize propellers manually and turn the synchronizer switch ON. Then slowly adjust the master engine propeller governor control lever, in small increments, to increase or decrease rpm. The rpm range over which the slave engine will remain synchronized with the master engine is the limited range mentioned above. With the synchronizer ON, move the master engine propeller governor control lever to a point which is close to the end of this limited travel. Turn the synchronizer OFF. An unsynchronized condition will develop as the actuator moves to its mid-position. When the synchronizer is turned ON again, synchronization will result. If the units do not become synchronized, the actuator has reached the end of its travel and must be recentered in this manner:

- a. Turn the switch OFF.
- b. Synchronize the engines manually.
- c. Turn the switch ON.

Troubleshooting the Propeller Synchronizer.

Refer to Woodward Governor Bulletin 33049 and Woodward Governor Test Procedure SP179 for troubleshooting the Propeller Synchronizer system.

CAUTION

Make sure the master switch is OFF and synchronizer leads are disconnected before attempting any troubleshooting procedures. Turning the propeller synchronizer switch to off WILL NOT give this protection.

Synchronizer Wiring Test.

CAUTION

Do not plug in control box until this test has been satisfactorily completed. Even with switch OFF the box could be seriously damaged.

- a. Before starting this test, be sure the control box is unplugged, the master switch is off, and the synchronizer circuit breaker is pulled. On a new installation, connect the actuator assembly and the magnetic pickups to the cables. Either pickup wire may be connected to pin receptacle No. 8 of the Jones cinch socket. Connect the other wire to pin receptacle No. 6 for slave engine, and No. 7 for the master engine. Before tying down pickup wires, complete continuity checks as indicated in chart between pins 8 and 6 and between pins 8 and 7.

NOTE

If another accessory uses the same circuit breaker, turn this accessory off before starting tests. The control box must be unplugged for these tests.

- b. Make the following tests, using an ohmmeter to the pin receptacles in the Jones cinch socket number 233032: zero the ohmmeter and read on the X1 or X10 scale.

CAUTION

Do not use a probe that exceeds .045 inch in thickness. Insert and remove probe carefully. Failure to do so will result in loose pin connectors and faulty synchronizer operation.

PROPELLER SYNCHRONIZER WIRING CONTINUITY CHECK.

Test Between Receptacle Numbers:	With Actuator Centered	OBTAIN		ACTION (If Out of Limits)
		With Actuator Uncentered 180°		
		Turn Clockwise (Facing Drive End) To Uncenter	Counterclockwise (Facing Drive End) To Uncenter	
5 & 1	open circuit (high resistance)	6.5 to 8.5 OHM	6.5 to 8.5 OHM	Bench check the actuator in accordance with Woodward Synchronizer Manual, Bulletin 33049.
5 & 3	open circuit (high resistance)	closed circuit (0 to 1.0 OHM)	13 - 17 OHM	
5 & 4	open circuit (high resistance)	13 - 17 OHM	closed circuit (0 to 1.0 OHM)	
4 & 1	6.5 to 8.5 OHM	6.5 to 8.5 OHM	6.5 to 8.5 OHM	
4 & 3	13 - 17 OHM	13 - 17 OHM	13 - 17 OHM	
3 & 1	6.5 to 8.5 OHM	6.5 to 8.5 OHM	6.5 to 8.5 OHM	
Test Between Receptacle Numbers:	OBTAIN			ACTION (If Out of Limits)
8 & 7 (with 6 disconnected at pickup)	90 - 110 OHM 52-68 OHM**			Repair wiring if at fault; replace governor if pickup is at fault; replace pickup (Approved Governor Shop).
8 & 6 (with 7 disconnected at pickup)	90 - 110 OHM 52 - 68 OHM**			
8 & aircraft ground	open circuit (very high resistance)			
1 & aircraft ground	short circuit zero OHMS			Trace wiring to determine poor ground.
2 & aircraft ground*	open circuit (very high resistance)			Trace wiring to remove fault.
*2 & aircraft ground will read some low OHM value if you cannot open the circuit breaker. If the synchronizer shares a circuit breaker with another circuit, you may read an OHM value of the other circuit. **Solid Steel pickup end with first length of sheathing out from the pickup colored white and carries P/N723061WG21318 on its outer diameter immediately below the knurled diameter.				

c. When the system meets all of the above test values, turn the master switch on and reset the synchro-

nizer circuit breaker (CONTROL BOX must still be unplugged) and make the following voltage check:

PROPELLER SYNCHRONIZER VOLTAGE CHECK

TEST BETWEEN RECEPTACLE	METER READING	ACTION (If Out of Limits)
2 & 1	Same as supply voltage and polarity of pin No. 2 must be positive and pin No. 1 must be negative.	Trace wiring to determine fault or reversed polarity.

- d. Check magnetic pickup output with the engine running at any cruise rpm. Check potential between pin receptacles 6 and 8. Also check potential between pin receptacles 7 and 8. Voltage must be a minimum of 1/2 volt at minimum cruise rpm, and a maximum of 3 volts at maximum cruise rpm. Voltages and RMS voltages as read on a 5000 OHM/volt AC voltmeter. If you do not obtain this voltage replace governor or have approved governor repair shop adjust or repair the pickup.
- e. When the system complies with the specifications above, the control box may be connected.
- f. If the synchronizer malfunctions now, the cause of the malfunction can probably be traced to the control box, or the mechanical function of the flexible shaft or governor speed trimming device. Check for a high friction level in the trimming mechanism. Be sure to center the actuator and trimming devices before mating cable.

NOTE

To check magnetic pickup resistance at the governor, disconnect both connectors and measure resistance with an ohmmeter. Use X1 or X10 scale. Replace pickup if reading is other than 90-110 OHMS. On aircraft with the first length of sheathing out from the pickup colored white and carries P/N723061WG21318 on its outer diameter immediately below the knurled diameter, replace pickup if reading is other than 52-68 OHMS.

Removal and Installation of Magnetic Pickup in Propeller Governor.

- a. Remove propeller governor in accordance with Removal Procedures.
- b. Tag and disconnect wiring to pickup.
- c. Unscrew magnetic pickup from propeller governor.
- d. Install magnetic pickup as follows:
 1. Set governor for maximum RPM, slowly rotate the governor drive shaft.
 2. Screw in pickup, tighten with fingers until pickup makes contact internally with the rotating flyweight head.

CAUTION

Do not use wrench or pliers to tighten magnetic pickup.

NOTE

When installing new pickup, always install new O-ring.

3. Tighten the pickup 1/8 turn counterclockwise and lightly tighten lock nut.
4. Connect a 5000 Ohm/Voltmeter across the pickup leads.
5. Drive the propeller governor at minimum cruise RPM and adjust pickup output to obtain 1.0 ± .2 volt. Screw pickup in to increase voltage and screw pickup out to decrease voltage.
6. Tighten pickup lock nut and safety with lock wire.

CAUTION

Do not torque lock nut over 25 inch-pounds.

- e. Install propeller governor in accordance with Installation Procedures.
- f. Connect wires and remove tags.

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SECTION 11

FUEL SYSTEM

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FUEL SYSTEM.

The aircraft standard fuel system consists of an integrally sealed (wet) wing tip tank mounted to each wing tip. The auxiliary (optional) fuel system, aircraft 310P0001 to 310Q0601, is comprised of one synthetic rubber cell installed in each wing. On aircraft 310Q0601 and On, the auxiliary (optional) fuel system is comprised of one synthetic rubber cell installed inboard in each wing with option for one additional fuel cell installed outboard of the main auxiliary fuel cell in each wing. Wing locker (optional) fuel system is installed in the forward section of each wing locker. The fuel capacities for the main, auxiliary and wing locker fuel tanks are specified under General Information in Section 1.

Two fuel pumps (auxiliary fuel and fuel transfer) electrically operated, are mounted in each wing (tip) main tank. The auxiliary fuel pump, located 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 main tank near the bulkhead and transfers fuel from the nose section of the main tank to the center baffle area. Where the fuel is picked up and routed to the engine by either the engine-driven or the auxiliary fuel pump. The fuel transfer pump prevents the possibility of fuel starvation to the engine, during steep angles of descent and low quantity of fuel.

The fuel boost 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 fuel line is installed from each auxiliary fuel cell to the respective fuel selector. Auxiliary fuel cells are not equipped with fuel boost pumps.

The wing locker fuel system is equipped with a transfer pump mounted outboard of the wing locker to the wing rib. The transfer pump transfers fuel from the wing locker to the main tank. A pressure switch is

incorporated in the fuel transfer line of each wing and illuminates the respective fuel transfer light on the instrument panel when wing locker fuel transfer to main tank is accomplished. There are no return lines in the wing locker fuel 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 remains in the main tanks before transferring fuel from the wing locker tanks.

Quick-drain valves are provided in the bottom of each main, auxiliary and wing locker tank. Also, a drain valve is located in the crossover line to drain trapped moisture and sediment.

Troubleshooting the Fuel System.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO FUEL QUANTITY INDICATION	Fuel tank empty. Fuel quantity indicator circuit breaker open. Loose connections or open circuit. Defective signal conditioner. Defective fuel quantity indicator. Defective fuel tank unit.	Fill tank with correct grade of fuel. Reset circuit breaker. Tighten connections and check wiring. Replace fuel quantity indicator. Replace fuel quantity indicator. Verify tank unit is defective using Field Calibration Unit Test Box.
FUEL DRIPS FROM NACELLE	Mixture lever not in IDLE CUT-OFF. Mixture lever not in IDLE CUT-OFF due to improper rigging. Broken fuel line or loose fitting.	Place mixture lever in IDLE CUT-OFF. Rig mixture control in accordance with Section 9, Rigging Mixture and Throttle Controls. Check fuel lines and fittings.
AUXILIARY FUEL PUMP INOPERATIVE	Master switch OFF. Circuit breaker open. Open circuit or loose connections. Defective fuel pump.	Turn master switch ON. Reset circuit breaker. Check circuit and repair. Replace fuel pump.
AUXILIARY FUEL PUMP RUNS AT HIGH SPEED WHEN SWITCH IS MOVED TO "ON" POSITION WITH ENGINES RUNNING	Defective fuel pressure switch.	Replace fuel pressure switch.
AUXILIARY FUEL PUMP RUNS AT SLOW SPEED WITH MASTER SWITCH "ON," AUXILIARY FUEL PUMP SWITCH "ON" AND ENGINES NOT RUNNING	Defective fuel pressure switch. Defective auxiliary fuel pump.	Replace fuel pressure switch. Replace auxiliary fuel pump.
ENGINE WILL NOT START OR CONTINUE TO RUN AFTER STARTING	Fuel tank empty. Fuel selector valve in OFF position. Mixture in IDLE CUT-OFF. Engine overprimed. Fuel strainer in fuel control unit dirty. Auxiliary fuel pump switch not in PRIME position. Plugged fuel cap vent.	Fill tank with correct grade of fuel. Move fuel selector valve to main tank. Set mixture to FULL RICH. Place mixture control in IDLE CUT-OFF, turn engine over several revolutions with throttle WIDE OPEN. Clean fuel control unit strainer. Place auxiliary fuel pump switch in PRIME position. Clean vent.

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Troubleshooting the Fuel System. (Cont.)

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START OR CONTINUE TO RUN AFTER STARTING (Cont.)	Bypass valve in engine-driven fuel pump stuck.	Replace engine-driven fuel pump.
VERY HIGH FUEL FLOW INDICATION AT FULL THROTTLE AFTER RAPID ENGINE ACCELERATION ON GROUND	Gage vent line restricted, plugged or leaking.	Clean, tighten or replace vent line.
LOW FUEL FLOW	Fuel control lever does not contact the full rich stop.	Rig mixture control in accordance with Section 9, Rigging Mixture and Throttle Controls.
ROUGH AND ERRATIC ENGINE SHUTDOWN	Fuel control lever does not contact idle cut-off stops firmly.	Rig mixture control in accordance with Section 9, Rigging Mixture and Throttle Controls.
FUEL SHUT-OFF INCOMPLETE	Misaligned linkage or fuel control levers hitting stops too hard.	Align linkage or rig mixture in accordance with Section 9, Rigging Mixture and Throttle Controls.
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.
AUXILIARY PUMP WILL NOT SWITCH TO HIGH SPEED	Pressure switch stuck.	Replace pressure switch.
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.
WING LOCKER INDICATOR TRANSFER LIGHTS INOPERATIVE	Open circuit or loose connection.	Check circuit and repair.
	Defective pressure switch.	Replace pressure switch.

MAIN TANK

Removal of Main Tank. (See figure 11-2.)

NOTE

The removal procedure is the same for either main tank.

- Remove sump door, cut safety wire between drain valve and drain plug.
- Remove fairings, tail cap and rear access cover to gain access to retaining nut.
- Drain fuel by removing drain plug and opening drain valve.
- Disconnect hoses, electrical connections and remove bolts from mounts and remove main tank.

Disassembly of Main Tanks.

Disassemble main tanks in accordance with figure 11-2.

Inspection and Repair of Main Fuel Tanks.

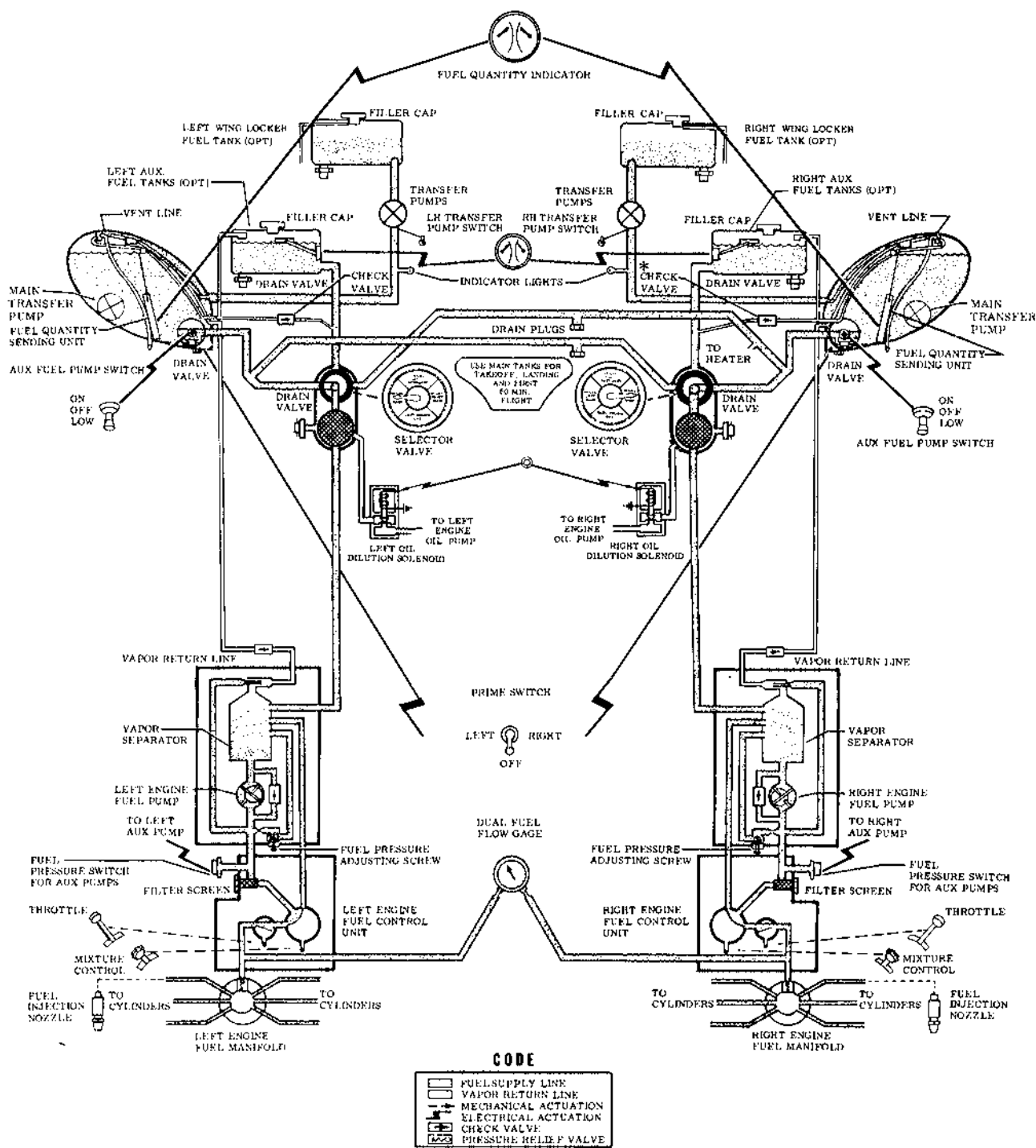
- Inspect filler cap gasket. If crushed or damaged, replace filler gasket. On integrally sealed (wet) tanks, inspect sealing gaskets, loose rivets, cracks or dents for leaks and attaching mounts.
- Purge in accordance with Section 2.
- Repair in accordance with Repair Procedures Section 16.

Assembly of Main Tanks.

- Assemble main tank in accordance with figure 11-2.
- Seal and check tanks 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.



310P0001 TO 310Q0001

* TURBO-310P AIRCRAFT

Figure 11-1. Fuel System Schematic (Sheet 1 of 2)

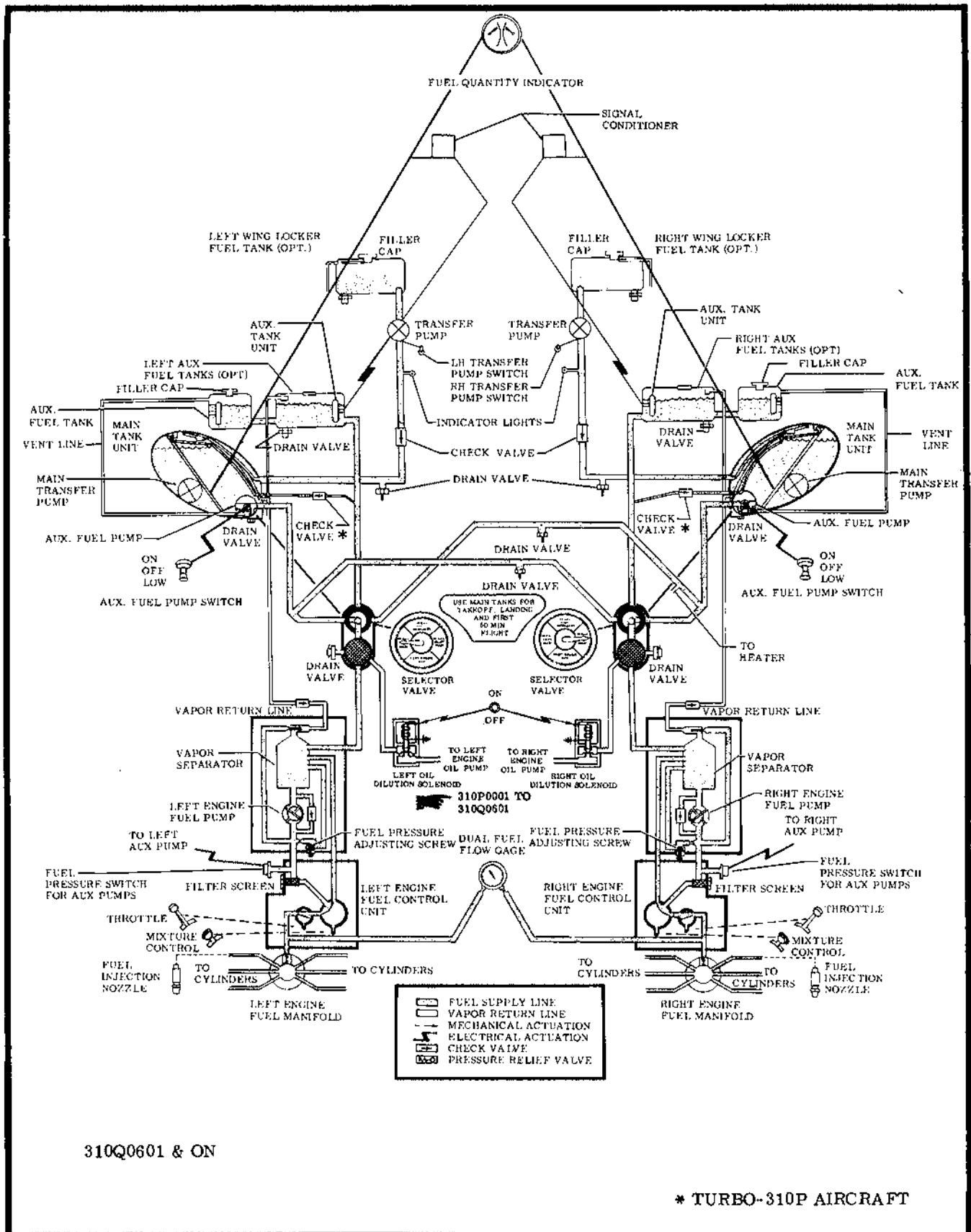


Figure 11-1. Fuel System Schematic (Sheet 2 of 2)

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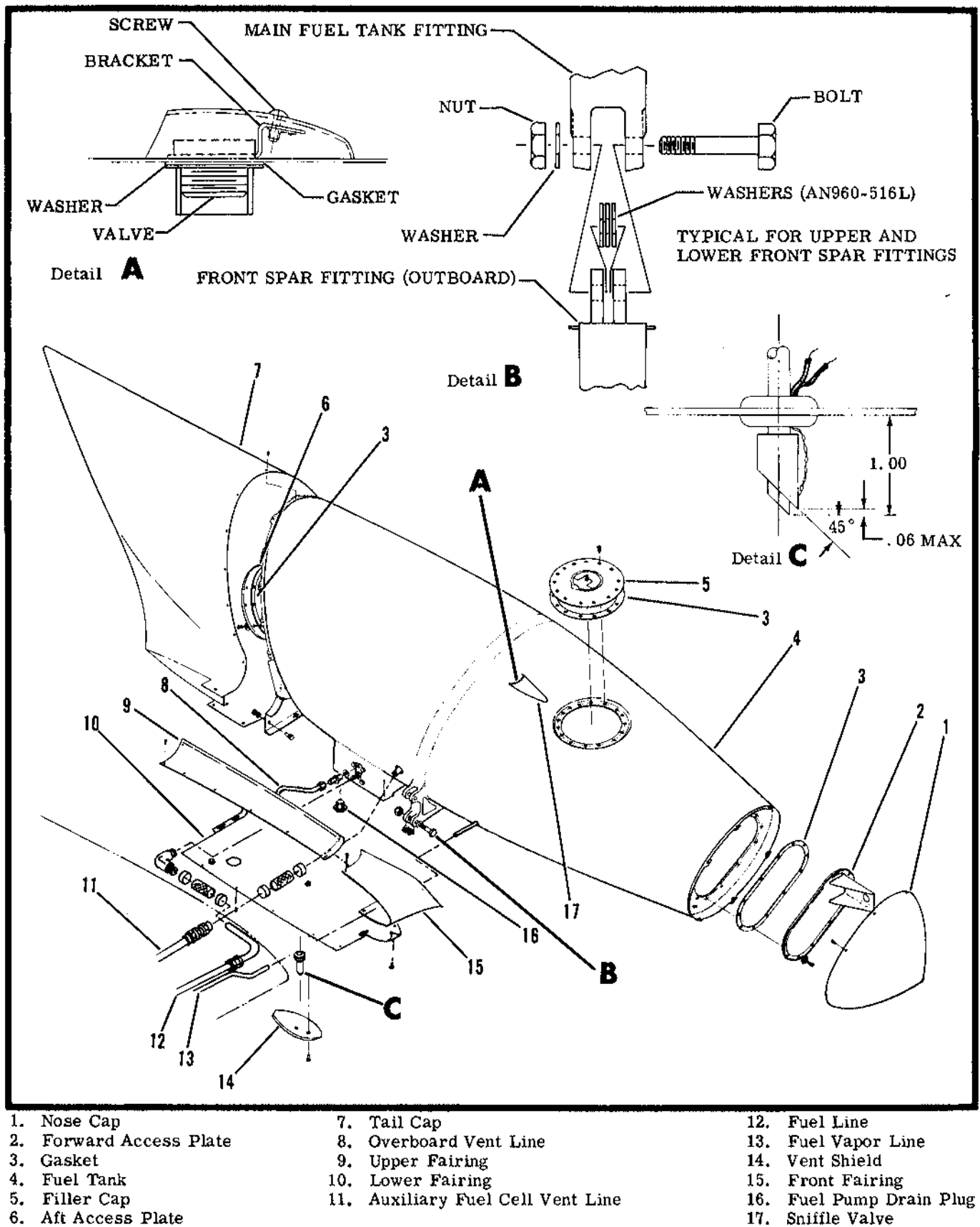
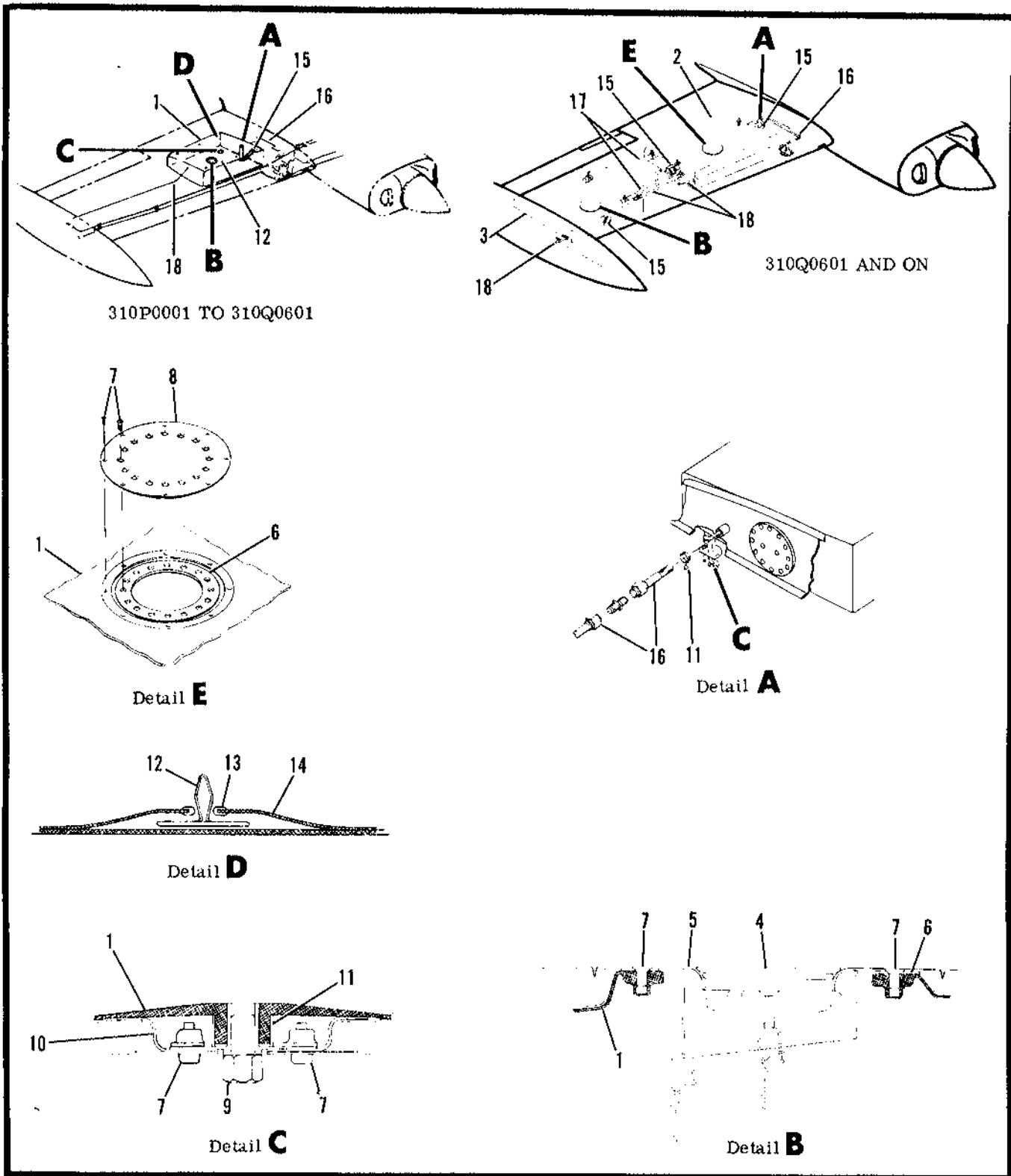


Figure 11-2 Main Fuel Tank Installation



1. Auxiliary Fuel Cell	7. Screw	13. Grommet
2. Inboard Fuel Cell	8. Cover	14. Fuel Cell Web
3. Outboard Fuel Cell	9. Drain	15. Fuel Quantity Tank Unit
4. Fuel Filler Cap	10. Adapter Assembly	16. Line - Fuel Supply
5. Adapter Assembly	11. Clamp	17. Line - Auxiliary Tank to Auxiliary Tank
6. Gasket	12. Fastener	18. Line - Vent

Figure 11-3. Auxiliary Fuel Cell Installation

2. Mix sealant MIL-S-8802 per manufacture's instructions and apply with a spatula over all seams, rivets fittings and possible leak areas.
3. Inspect tank as follows:
 - (a) Seal off all hoses and access holes in tanks. Close vent hole by covering inside with tape.
 - (b) Saturate a clean rag with 25 cubic centimeters of household ammonia. Insert rag in fuel tank and close filler cap.
 - (c) Pressurize fuel tank to a maximum of 2 PSI.
 - (d) Saturate a large clean cloth with indicated solution (1/2 gallon distilled water, 1/2 gallon denatured alcohol and 1/2 ounce of phenolphthalein crystal or powder) and spread smoothly on tank surface.
 - (e) A leak will appear as a pink spot on the cloth. Repair all leaks and repeat testing until tank surface has been tested.

WARNING

Remove tape from filler cap, rag from inside fuel tank and allow fuel cell to air out before using.

Installation of Main Tanks. (See figure 11-2.)

NOTE

The installation procedure is the same for either main tank.

- a. Install main tank by reversing removal procedure.
- b. Torque main tank attaching nuts to 60±10 inch-pounds.

Sniffle Valve. (See figure 11-2.)

The sniffle valve is located in the top of each main tank aft of the filler cap. This valve will vent the tank should the overboard vent become clogged or obstructed.

Removal of Sniffle Valve. (See figure 11-2.)

The removal procedures are the same for either tank.

CAUTION

Care should be taken to guard against foreign matter entering tank.

- a. Defuel 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 sniffle valve.

Installation of Sniffle Valve. (See figure 11-2.)

Install sniffle valve by reversing removal procedure.

Removal of Main Fuel Lines. (See figure 11-4.)

- 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.

NOTE

Removal procedure given is for the left wing; however, the right wing is essentially the same with the exception of heater fuel tee and line.

- b. Remove the access covers from underside of the wing.
- c. Remove wing gap covers and tip tank fairings.
- d. Remove main fuel tip tank in accordance with removal procedures.
- e. Remove the clamps securing lines.
- f. Disconnect line (6) from nacelle rib fitting, check valve (5) and remove from wing.
- g. Disconnect line (8) from selector valve (9) and nacelle fitting and remove from wing.
- h. Disconnect lines (11) and (12) from fuel selector (9), drain tees (13) and remove lines pulling outboard. On right wing disconnect heater line.

NOTE

Lines (30) and (31) are not recommended for removal. If removal is necessary, perform steps i through m.

- i. Remove wing in accordance with Section 3.
- j. Remove lines (30) and (31) from unions (18) connecting to opposite wing.
- k. Remove necessary clamps inside fuselage and route lines from fuselage.

NOTE

Lines (30) and (31) are crossed in the fuselage section. Extreme care should be used to assure that the lines are not damaged on removal, and the lines are marked so they will be connected to their proper fittings on installation.

Installation of Main Fuel Lines. (See figure 11-4.)

NOTE

Installation procedure given is for the left wing; however, the right wing is the same

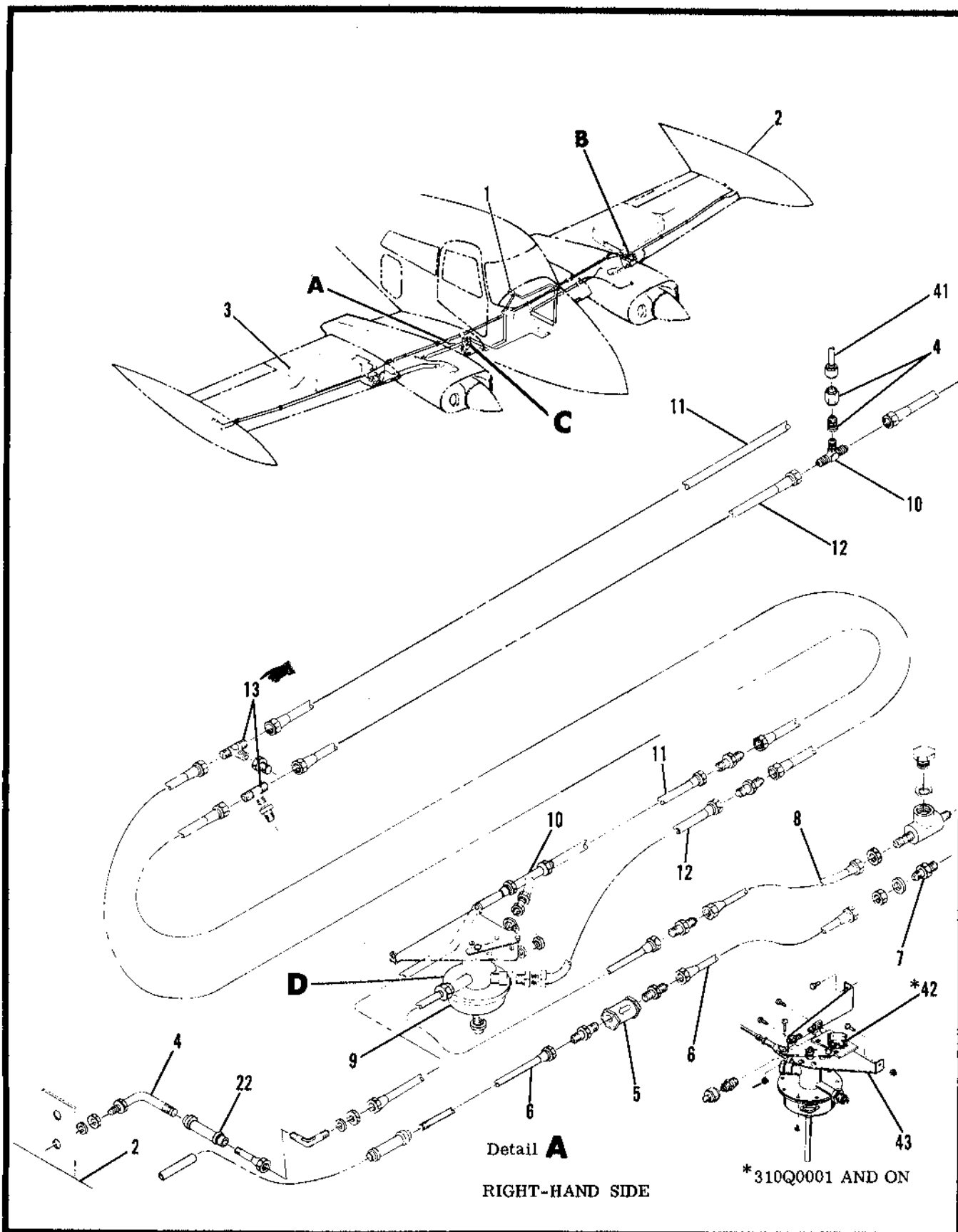
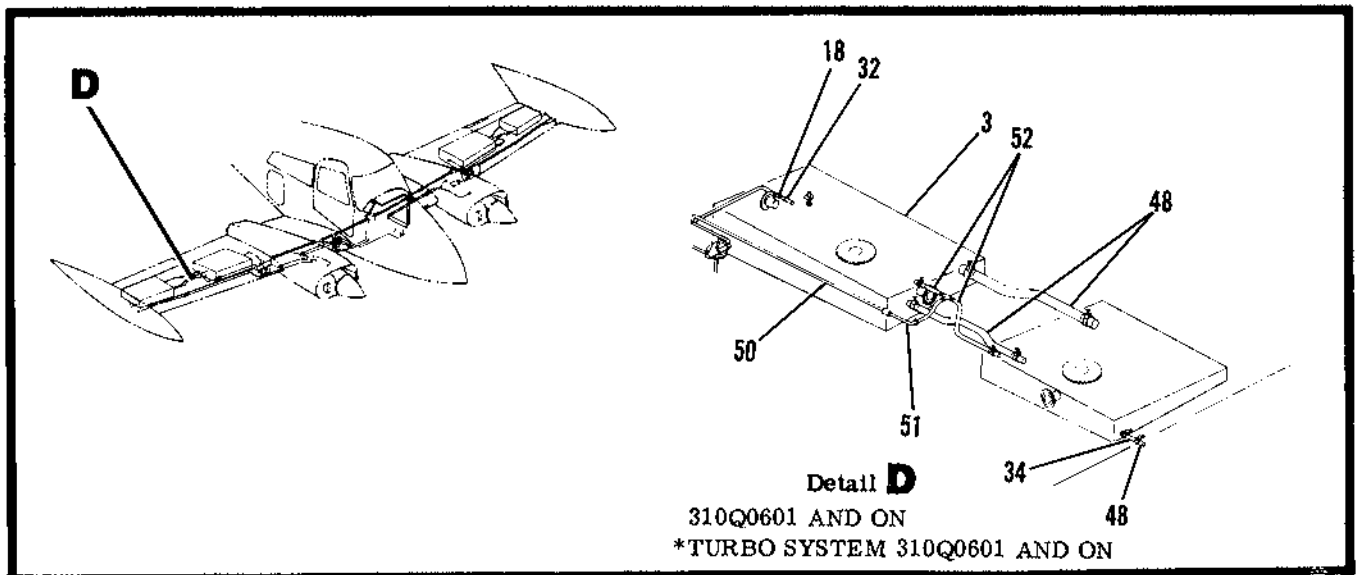


Figure 11-4. Fuel System Plumbing (Sheet 1 of 3)

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1. Fuel Flow Gage	28. Reducer
2. Main Fuel Tank	29. Line Assembly (Tee to wing root)
3. Auxiliary Fuel Tank	30. Crossover Line RH
4. Reducer	31. Crossover Line LH
5. Check Valve	32. Clamp
6. Vapor Return Line (Center)	33. Line Assembly (Fuel vent, auxiliary fuel cell)
7. Reducer	34. Hose (Interconnecting)
8. Line (Strainer to nacelle tee)	35. Vent Line (Main fuel tank)
9. Fuel Selector Valve	36. Line Assembly (Fuel selector valve to elbow)
10. Tee	37. Front Wing Spar
11. Line Assembly (Fuel selector to elbow) LH	38. Nut
12. Line Assembly (Fuel selector to elbow) RH	39. Heater Fuel Filter
13. Tee Drain	40. Solenoid Valve Assembly
14. Line Assembly (Fuel crossfeed) LH	41. Line Assembly to Heater Fuel Shutoff Valve
15. Line Drain	42. Switch
16. Line Drain	43. Mounting Bracket
17. Drain Valve LH and RH	44. Shutoff Valve
18. Union	45. Fuel Pump
19. Fuel Line RH and LH	46. Line Assembly to Heater (310P0001 to 310Q0454)
20. Tee	47. Line Assembly to Heater Fuel Pump (310Q0454 and On)
21. Plug	48. Line Assembly (Fuel tank to fuel tank)
22. Hose	49. Line Assembly (Tip tank vent)
23. Line Assembly (Selector valve to tee)	50. Line Assembly (Fuel line to tee)
24. Line Assembly (Selector valve to union)	51. Line (Tee to valve)
25. Drain Fittings	52. Line (Tank to tee)
26. Drain Valves	
27. Heater Fuel Supply Tee	

Figure 11-4. Fuel System Plumbing (Sheet 3)

with the exception of heater fuel line and tee. Use a fuel soluble thread lubricant on male threads of all fittings only.

a. If fuselage crossfeed lines were removed, install as follows:

1. With wing removed, install lines (30 and 31), secure in position, assuring the lines are crossed in the fuselage and that they are connected to the proper fittings.

2. With wing removed, route lines (11 and 12) through wing, connect line (12) to selector valve (9) and line (11) to tee (10).

3. Check all lines and fittings for tightness and

security, then install wing in accordance with Section 3.

b. Route line (8) through wing and connect to tee.

c. Route vapor return line (61) and check valve (5) through wing and connect to nacelle rib fitting.

d. Install tip tank in accordance with installation procedures and service aircraft with fuel.

e. Check all lines and valves for leakage and proper operation.

f. Install all tip tank fairings, wing gap covers and access covers on underside of wing.

g. Service fuel tanks in accordance with Section 2.

h. Start engines and perform operational check of fuel selector valve per operational check procedures.

Removal of Auxiliary Fuel Cells. (See figure 11-3.)

NOTE

The removal procedures are the same for LH or RH wing auxiliary fuel cells.

- a. Remove the fuel cap adapter assembly (5) and gasket (6) by removing twenty-four attaching screws (7).
- b. (310Q0601 and On) Remove cover (8) and gasket (6) by removing twenty-four attaching screws (7).
- c. Remove the auxiliary fuel quantity sending units (15) in accordance with removal procedures.
- d. (310P0001 to 310Q0601) Loosen clamp and disconnect fuel supply (16) from fuel cell (1).
- e. (310Q0601 and On) Loosen clamps and disconnect fuel supply lines (16 and 17) from fuel cells (2 and 3).
- f. (310P0001 to 310Q0601) Loosen clamps and disconnect vent line (18) from fuel cell.
- g. (310Q0601 and On) Loosen clamps and disconnect vent lines (18) from fuel cells.
- h. Remove the two screws securing the quick-drain adapter assembly to the lower skin.
- i. (310P0001 to 310Q0601) Disconnect the seven fuel cell fasteners.
- j. (310Q0601 and On) Disconnect the fuel cell fasteners, seven for the inboard cell and four for the outboard cell.
- k. Remove fuel cell through the upper wing opening vacated by the adapter assembly (5) and cover (10).

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.

- 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 Auxiliary Fuel Cells. (See figure 11-3.)

NOTE

The installation procedures are the same for LH or RH wing auxiliary fuel cells.

- a. Insert fuel cell through wing opening and arrange the cell in the correct position.

- b. (310P0001 to 310Q0601) Secure the cell in place with seven fasteners.
- c. (310Q0601 and On) Secure the cells with fasteners, seven for the inboard cell and four for the outboard.
- d. Attach quick-drain adapter assembly to the lower wing skin with attaching screws.
- e. (310P0001 to 310Q0601) Install vent line (18), secure with clamps.
- f. (310Q0601 and On) Install vent lines (18), secure with clamps.
- g. (310P0001 to 310Q0601) Install fuel line (16), secure with clamp.
- h. (310Q0601 and On) Install fuel lines (16 and 17), secure with clamps.
- i. Install auxiliary fuel quantity sending units (15) in accordance with installation procedures.
- j. Install fuel cap adapter assembly (5) and gasket (6) with twenty-four attaching screws.
- k. (310Q0601 and On) Install cover (8) and gasket (6) with twenty-four attaching screws.
- l. Service system and leak check.
- m. Install access covers.

Removal of Auxiliary Fuel and Vent Lines. (See figure 11-4.)

- a. Refer to Section 2, and defuel aircraft in accordance with defueling procedures.

CAUTION

During all defueling, tank purging and tank repair 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. Remove the access covers from underside of the wing.

NOTE

It may be necessary to drill off the access hole doubler to gain access to the fuel lines.

- c. Disconnect line (29) from auxiliary fuel cell strainer (31) and elbow fitting (37), remove line (29) from wing.

NOTE

It may be necessary to bend lines slightly during removal. Sharp bends must be avoided.

- d. Disconnect line (36) from elbow fitting (37) and union (30) at fuel selector valve (16), remove line (36) from wing.
- e. Loosen clamp (32) on vent line (33).
- f. (310Q0601 and On) Loosen clamps on vent lines (47 and 48), remove lines from aircraft.
- g. (310Q0601 and On) Loosen clamps on fuel lines (44) and remove lines from aircraft.
- h. Remove auxiliary fuel cells from aircraft in accordance with removal procedures.
- i. (310P0001 to 310Q0600) Loosen clamps attach-

ing hose (34) to vent line (33), remove line (35) from wing.

j. (310Q0601 and On) Loosen clamp attaching hose (34) to vent line (33), remove line (45) from wing.

Installation of Auxiliary Fuel and Vent Lines. (See figure 11-4.)

- a. (310P0001 to 310Q0600) Route line (35) through wing to auxiliary fuel cell line (33), clamp hose (34) to fuel cell line (33).
- b. (310Q0601 and On) Route line (45) through wing to auxiliary fuel line (33), clamp hose (34) to fuel cell line (33).
- c. Install auxiliary fuel cells in accordance with installation procedures.
- d. (310Q0601 and On) Install fuel lines (44) and clamp to fuel cell.
- e. (310Q0601 and On) Install vent lines (47 and 48) and clamp to fuel cell.
- f. Install vent line (33), clamp to fuel cell and hose (34).
- g. Route line (36) through wing and connect to union (30) on fuel selector (16) and elbow fitting (37).
- h. Route line (29) through wing and connect to fuel cell strainer (31) and fitting (37).
- i. Service auxiliary fuel cell in accordance with Section 2 and check for leaks.
- j. Install access covers.

SELECTOR VALVES.

One fuel selector valve is located in each wing just forward of the main spar, and outboard of the 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

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. Drain all fuel from wing.
- 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.
- 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 handles are located between the front seats on the cabin floor. The control valve handle on the right controls fuel flow to the right engine by allowing fuel to be used from the right main tank, right auxiliary tank or through the crossfeed system, from left main tank. The control valve handle on the left controls fuel flow to the left engine by allowing fuel to be used from the left main tank, left auxiliary tank, or through the crossfeed system from the right main tank. The handles are of rotary-type and are operated mechanically through a 270° range by a gear arrangement and a flex cable connected to the fuel selector valve assemblies mounted outboard of the engine nacelles 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.

Removal of fuel selector control system is the same for either selector.

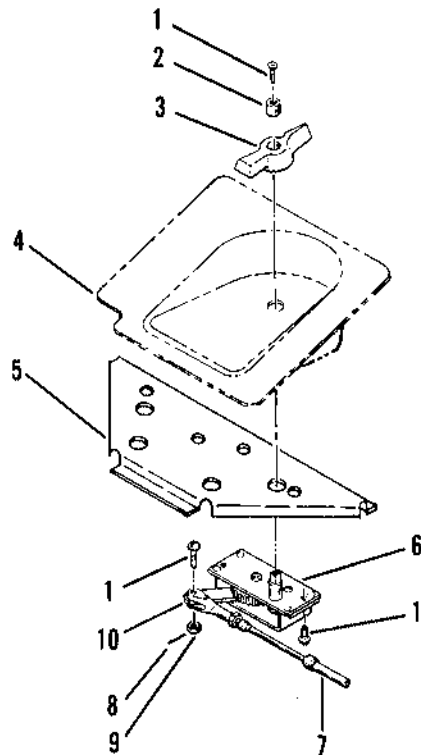
- a. Fuel selector valve handles - OFF.
- b. Remove fuel selector valve handle.
- c. Remove carpet aft of the control pedestal to gain access to gear box through the access hole provided.
- d. Disconnect linkage and remove gear box.
- e. Remove cable fittings and clamps securing cable to stringers.
- f. Remove cable from aircraft.

Installation of Fuel Selector Control System.

- a. Route cable through stringers and clamp.
- b. Connect cable ends to selector valve and gear box and safety.
- c. Install gear box to bracket.
- d. Install bracket and gear box through pan; then install valve handle.
- e. Check operation for binding and smooth actuation through the full 270° range.

NOTE

Support and security of the fuel selector flex



1. Screw	5. Bracket	9. Nut
2. Spacer	6. Gear Box	10. Terminal
3. Handle	7. Cable	
4. Floorboard	8. Cotter Pin	

Figure 11-5. Fuel Selector Control Handle and Gear Box

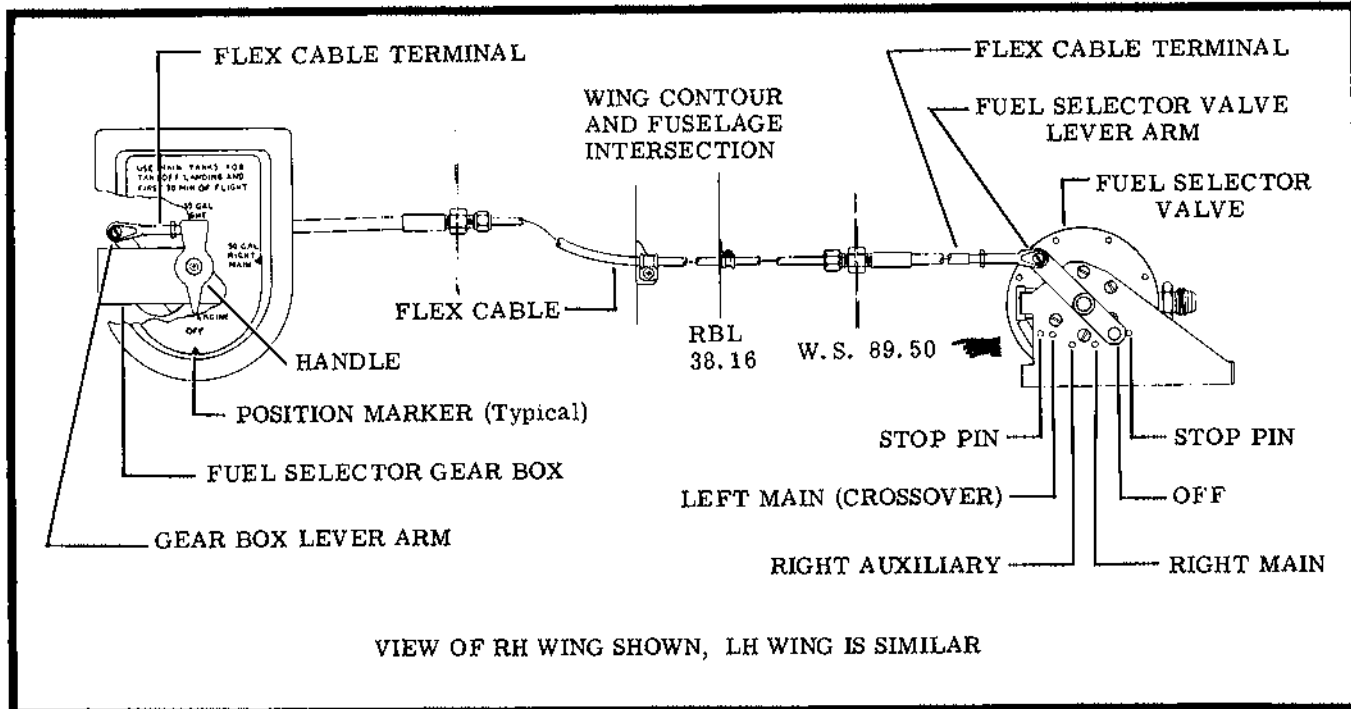
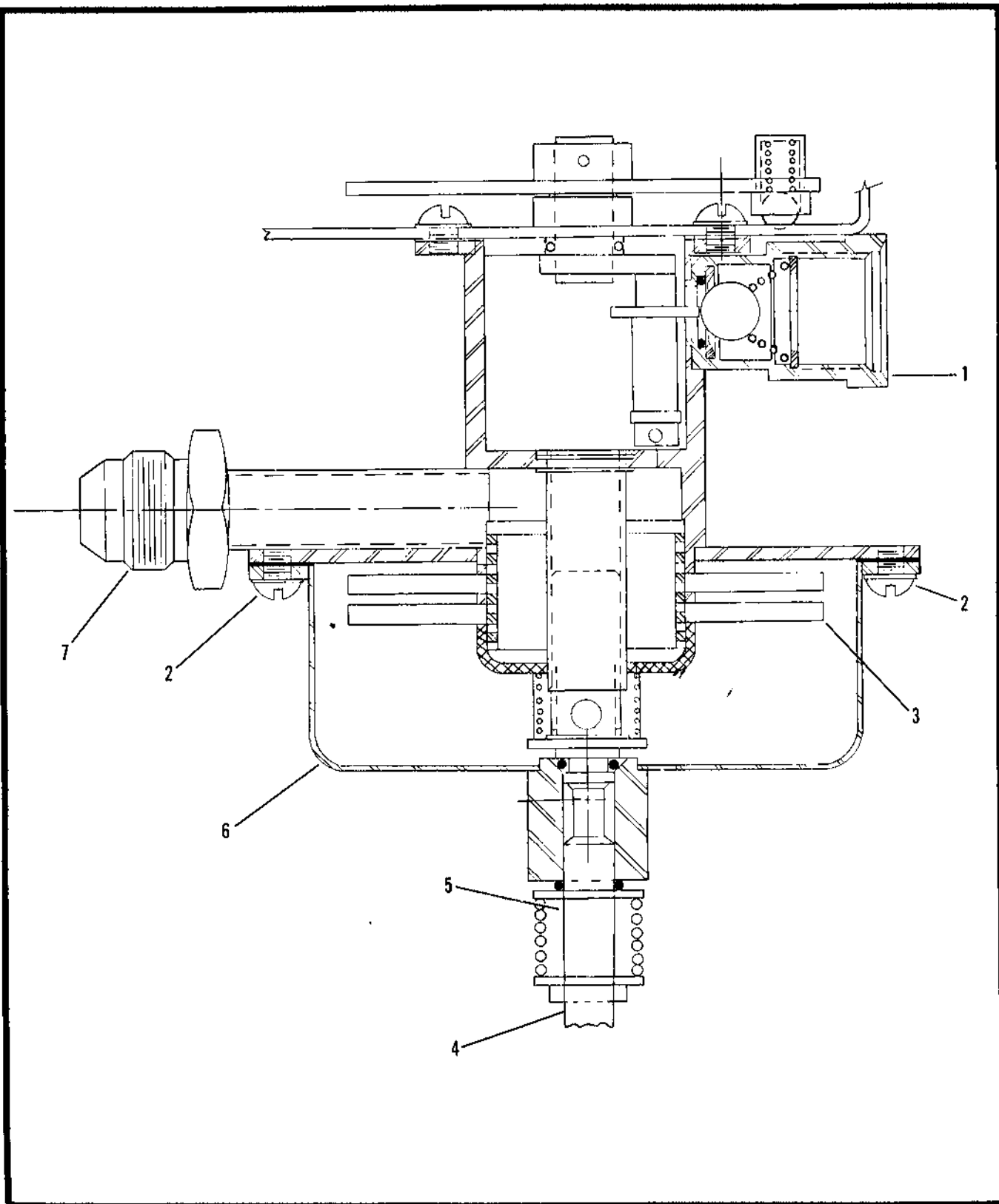


Figure 11-6. Fuel Selector Rigging Schematic



1. Fuel Inlet
2. Screw

3. Filter
4. Drain Tube
5. Drain Valve Push-Rod

6. Sediment Bowl
7. Fuel Outlet

Figure 11-7. Fuel Selector Valve and Strainer

cables is most essential to provide the optimum fuel selector valve operation. Inspect the fuel selector cable support joints for adequate tightness and security.

Rigging the Fuel Selector Valve. (See figure 11-6.)

- a. Remove carpet retainer and fold back carpet just enough to remove floorboard access plate per upholstery removal procedures.
- b. (See figure 1-3.) Remove wing access plates (45 and 46).
- c. Position lever arm on fuel selector valve in wing to the most outboard detent and resting against the stop pin.

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 the 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 handles 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 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 se-

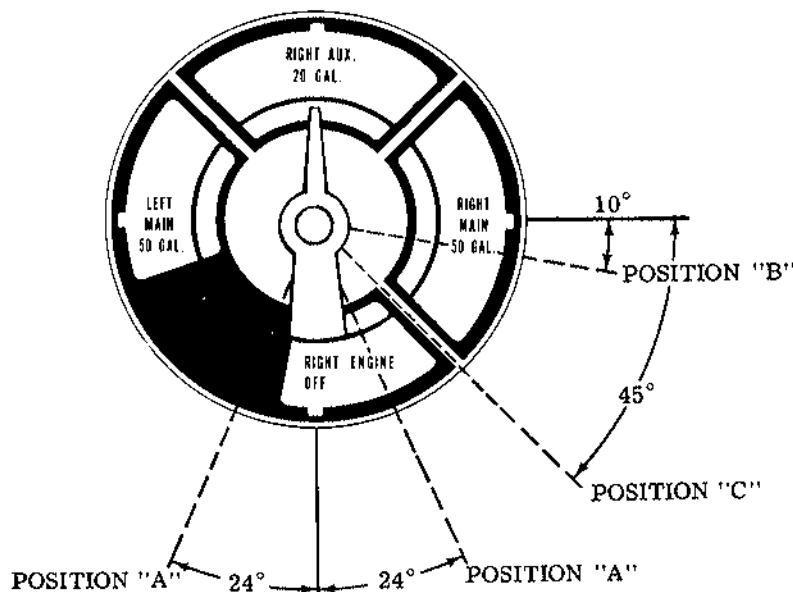


Figure 11-8. Fuel Selector Valve Handle

lector valve lever arm seats in the respective in-board crossover tank detent on the fuel selector valve and against pin stop.

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 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

Place the left fuel selector valve handle in the LEFT MAIN position, and the right fuel selector valve handle in the OFF position. Start the left engine. When the engine is sufficiently warmed up, advance the throttle to 1500 RPM. Observe the fuel flow gage to assure there are no radical fluctuations and for proper fuel flow. Observe the engine for a proper short continuous run. Place the left selector valve handle to the RIGHT MAIN position, repeat the above steps and observations. With engine at idle RPM place the left fuel selector valve handle to the OFF position. The engine should run momentarily, then fail. Check the right fuel selector valve by placing the right fuel selector valve handle in the RIGHT MAIN position, and left fuel selector valve handle in the OFF position. Start the right engine and check the right selector valve in accordance with above procedures for the left fuel selector valve.

NOTE

The crossfeed system allows fuel to be used from the opposite main tanks only. There are no provisions to crossfeed fuel from auxiliary fuel tanks.

Removal of Auxiliary Fuel Pump. (See figure 11-9.)

The removal procedure is the same for either auxiliary fuel pump.

- Make sure fuel selector valve handles are OFF.
- Drain fuel in main tank affected.

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.

- Remove tip tank and wing fairing.
- Loosen hose clamps (7) and remove hose (8).
- Disconnect fuel pump drain line (11) and remove.
- Remove nipple (12), elbow (9), nut (5) and O-ring (4).
- Remove tip tank tail cap, rear access plate and gasket.

- Remove four bolts (10), gaskets (2) and remove auxiliary fuel pump (1) from inside the fuel tank.

Installation of Auxiliary Fuel Pump. (See figure 11-9.)

Installation of auxiliary fuel pump is the same for either auxiliary fuel pump.

- Install auxiliary fuel pump (1) inside tip tank through rear access hole; use new gasket (2). Secure in place with bolts (10).
- Install O-ring (4), nut (5) and elbow (9) in fuel pump.
- Install nipple (12), drain line (11), hose (8) and clamps (7). Connect to line (6).
- Install rear access plate and new gasket.
- Connect electrical leads.
- Fuel aircraft and check for leaks.
- Turn on auxiliary fuel pump and check for operation and leaks.
- Replace tip tank tail cap and wing fairings.

NOTE

Anytime the auxiliary fuel pump has been replaced or altered the auxiliary fuel pump low adjustment must be performed.

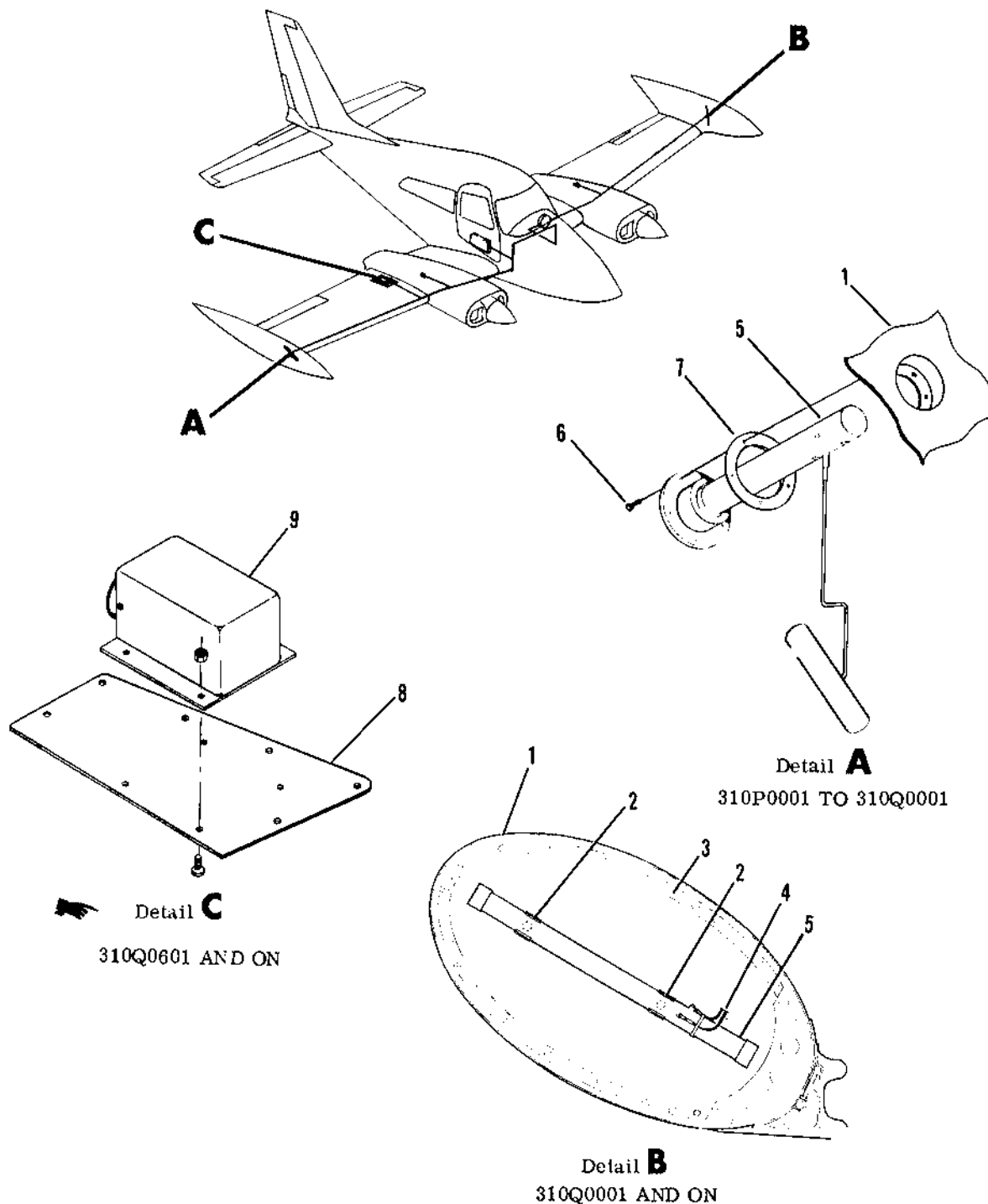
Auxiliary Fuel Pump Low Adjustment.

- Service aircraft in accordance with Section 1.
- Disconnect the electrical leads to the oil pressure switch at the quick disconnect. Connect the two leads together to close the electrical circuit.

NOTE

On 310 aircraft only, a normally open oil pressure switch has been added to the oil pressure indicator line and is electrically connected in series with the auxiliary fuel pump switch. The auxiliary fuel pump will not operate (except by the primer switch) if the respective engine is not running or oil pressure is below approximately 20 PSI. With the engine running and oil pressure above 20 PSI the respective oil pressure switch will be actuated to the closed position, allowing the auxiliary fuel pump to function normally as required by the position of the auxiliary fuel pump switch and available fuel pressure.

- Place fuel selector valve handles to the desired tank.
- Place mixture lever to IDLE CUT-OFF.
- Connect a test pressure gage at engine-driven pump inlet line.
- Connect a 28 volt dc auxiliary power unit to aircraft or run opposite engine at 1500 RPM with no other electrical equipment on to assure full electrical bus voltage.
- Position auxiliary fuel pump to LOW for engine being checked and check test pressure gage connected to engine-driven inlet line for 5.5 PSI of fuel pressure.
- If fuel pressure is not 5.5, adjust resistor (see figure 11-10 for location) until required boost pump



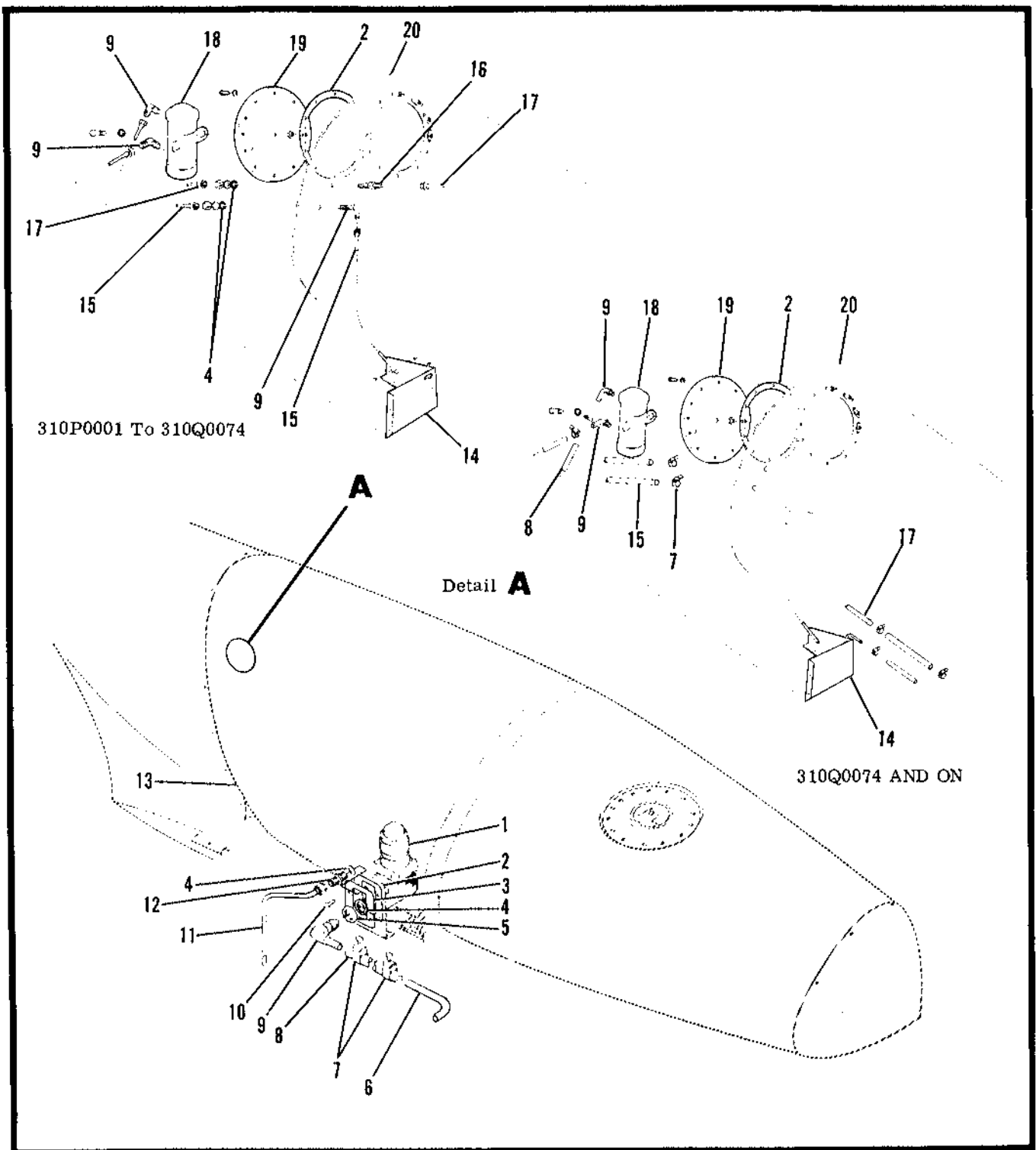
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1. Fuel Cell
2. Tank Unit Clip
3. Access Plate

4. Electrical Bundle
5. Tank Unit
6. Bolt

7. Gasket
8. Cover Plate
9. Signal Conditioner

Figure 11-9. Main Fuel Tank Unit



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	

Figure 11-9A. Auxiliary Fuel and Main Tank Fuel Transfer Pump Installation

pressure is obtained.

NOTE

Keep resistor cool with air blast.

- i. Turn all switches OFF, place fuel selector valve handle to OFF position, remove test pressure gage and replace fairing.
- j. Connect the electrical leads to the oil pressure switch.

NOTE

Procedures given apply to either right or left auxiliary fuel pump.

Ground Check of Fuel Pressure Switch and Oil Pressure Switch.

- a. Turn master switch ON.
- b. Turn auxiliary fuel pump switch ON - auxiliary fuel pump should not run.
- c. Start engine and run at 1000 RPM - check oil pressure above 20 PSI (310P and 310Q).
- d. Position auxiliary fuel pump switch to LOW position - make audio check of pump for low speed operation.
- e. Position auxiliary fuel pump switch to ON position - recheck pump operation for low speed.

NOTE

If audio check indicates pump is running, the oil pressure switch is functioning normally.

- f. Momentarily position mixture lever to IDLE CUT-OFF - make audio check for pump going to high speed.

NOTE

If pump goes to high speed, fuel pressure switch is functioning normally.

- g. Turn auxiliary fuel pump switch OFF when pump goes to high speed.

NOTE

If auxiliary fuel pump does not go into high speed, proceed with the following steps.

- h. Auxiliary fuel pump switch - OFF.
- i. In the engine nacelle, jumper the oil pressure switch electrical leads to close the circuit.
- j. With the engine not running, momentarily position the auxiliary fuel pump switch to ON - make audio check of pump for high speed operation.

NOTE

If auxiliary fuel pump goes into high speed, the fuel pressure switch and pump are functioning normally.

- k. Position master switch to OFF and disconnect jumper from oil pressure switch electrical leads.

FUEL INDICATOR SYSTEM. (310P0001 TO 310Q0001.)

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 unit, powered by the aircraft electrical system, which sends an electrical signal to the fuel quantity indicators in the cabin.

Removal of Main Fuel Quantity Sending Unit. (310P0001 to 310Q0001.)

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. Remove main tip tank tail cap.
- c. Tag and disconnect electrical wires.
- d. (See figure 11-9.) Remove bolts (10), gaskets (2) and fuel quantity sending unit (13).

Installation of Main Fuel Quantity Sending Unit. (310P0001 to 310Q0001.)

The installation procedure is the same for either tank.

- a. (See figure 11-9.) Install fuel quantity sending unit (13) and gasket (2) with bolts (10).
- b. Connect electrical wires and remove tags.
- c. Install main tip tank tail cap.
- d. Check operation of main fuel quantity sending unit by performing an operational check.

Fuel Quantity Sending Units Operational Check. (310P0001 to 310Q0001.)

The procedure for checking the operation of fuel quantity sending units is the same for either unit and either system auxiliary or main fuel quantity sending units.

- a. With fuel tanks completely drained, close the drain valves.
- b. Turn battery switch to the ON position.
- c. Add 1/2 gallon of fuel to tank (the amount determined as unusable fuel) and the fuel quantity indicator should read empty (E).
- d. Add fuel in five gallon increments until the total capacity of the tank is reached. Check fuel quantity indicator for each five gallons of fuel added.

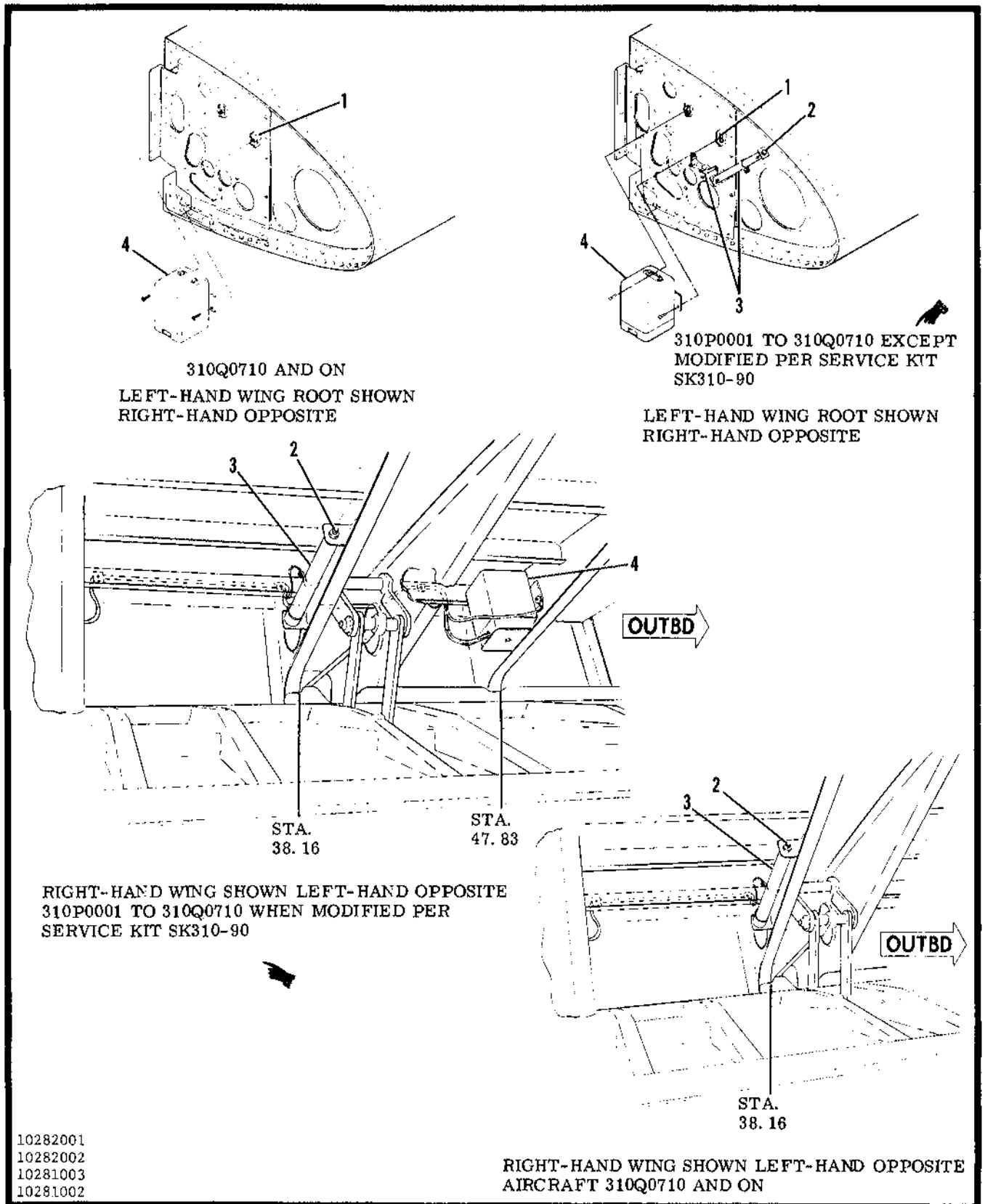


Figure 11-10. Auxiliary Fuel Pump Relay and Resistor Installation

NOTE

Slight adjustment can be made by bending the float arm on the fuel quantity sending unit.

Removal of Auxiliary Fuel Quantity Sending Units.
(See figure 11-11.) (310P0001 to 310Q0001.)

The removal procedure for the auxiliary fuel quantity sending units is the same for either side. However, on the left side the battery box must be removed.

- 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 the five screws (7) securing the auxiliary fuel tank sending unit and 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 Sending Units.
(See figure 11-11.) (310P0001 to 310Q0001.)

The installation procedure for the installation of the auxiliary fuel quantity sending units is the same for either side.

- a. Install the fuel quantity sending unit (13) and gasket (2) and secure with five attaching screws (10) and seal washers.
- b. Connect electrical wires.

FUEL INDICATOR SYSTEM. (310Q0001 AND ON.)

The main and auxiliary fuel systems have a capacitance fuel quantity indicating system that is compensated for specific gravity and reads in both pounds and gallons. The system components include an indicator, a fuel indicator selector switch mounted on the instrument panel, (310Q0001 to 310Q0601) a signal conditioner is located inside the fuel indicator, (310Q0601 and On) two signal conditioners are utilized, one mounted in the bottom side of each wing outboard of the nacelle (refer to Section 1 for access plate location), (310Q0001 to 310Q0601) one tank unit

mounted in each main tank and each wing auxiliary fuel cell, (310Q0601 and On, each main tank includes a tank unit, two tank units are installed in the inboard auxiliary fuel cell and one tank unit in the outboard 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 to a single point ground in the indicator 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 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 positioned to "AUX" the indicator will read Auxiliary Fuel. When the fuel selector valve handles are placed in the "Auxiliary" position, the light will light and the indicator will indicate Auxiliary Fuel. If the override switch is placed in the main position the fuel quantity indicators will indicate Main Fuel. The auxiliary indicator lights are on anytime the selector switches are in the Auxiliary position, regardless of the position of the override switch.

NOTE

Fuel quantity system is solid state. There are no moving parts.

Removal of Main Fuel Quantity Tank Unit.
(310Q0001 and On.) (See figure 11-2.)

The removal procedure is the same for either 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. Remove main tank tail cap (7).
- c. Tag and disconnect electrical wires.
- d. Remove bolts and aft access plate (6).
- e. Remove bolts and filler cap (5).
- f. Working through access openings remove tank unit from mounting clip and remove tank unit.

Installation of Main Fuel Quantity Tank Unit (310Q0001 AND ON). (See figure 11-2.)

The installation procedure is the same for either main tank.

- a. Install main fuel tank unit in position and secure with mounting clips.
- b. Connect electrical wires and install adapter plate (5) with gasket (3) and bolts.
- c. Install filler cap (5) with bolts.
- d. Service main tank in accordance with fueling procedures.
- e. Check for leaks.
- f. Check operation of fuel quantity indicating system.
- g. Check calibration in accordance with calibration procedures.
- h. Install main tank tail cap.

Fuel Quantity Tank Unit Operational Check and Calibration (310Q0001 TO 310Q0601).

The operational check and calibration procedure is the same for either left or right fuel system.

- a. Defuel the aircraft in accordance with Defueling procedures in 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. Apply electrical power - if battery is used make sure voltage is not less than 22 volts.
- c. Position fuel selector valve handle in "Main" position.
- d. Adjust the main empty adjustment screw left and right on rear of fuel quantity indicator for exact zero reading on the indicator.

NOTE

Tap the indicator slightly when reading indicator, this will help overcome friction on the needle when the indicator is in a static condition.

- e. Position fuel selector valve handles to "Auxiliary" position.
- f. Adjust auxiliary adjustment screws on the rear of the indicator to exact zero.

- g. Fuel aircraft in accordance with Servicing procedures in Section 2.
- h. Position fuel selector valve handles to "Main."
- i. Adjust FULL BAL adjust screw so that the left and right fuel quantity indicator readings are the same when both main tanks are full.
- j. Actuate the fuel quantity override switch on the instrument panel to the "MAIN" position, left and right fuel quantity indicator shall not change by more than 5 pounds.
- k. Set both fuel selector valve handles to "Aux" tank position. Actuate the fuel quantity override switch to the "Aux" position. Left and right fuel quantity readings shall not change by more than 5 pounds.
- l. Turn off power and return aircraft to original configuration.

Fuel Quantity System Calibration (310Q0601 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 11-10A 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 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 11-10A.

NOTE

Fabricate test box in accordance with Figure 11-10A.

- f. Position selector switch on capacitance test box to "Main Full".
- g. Adjust the "Main Full" potentiometer on the signal conditioner to read 310 pounds (full scale indication).

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.

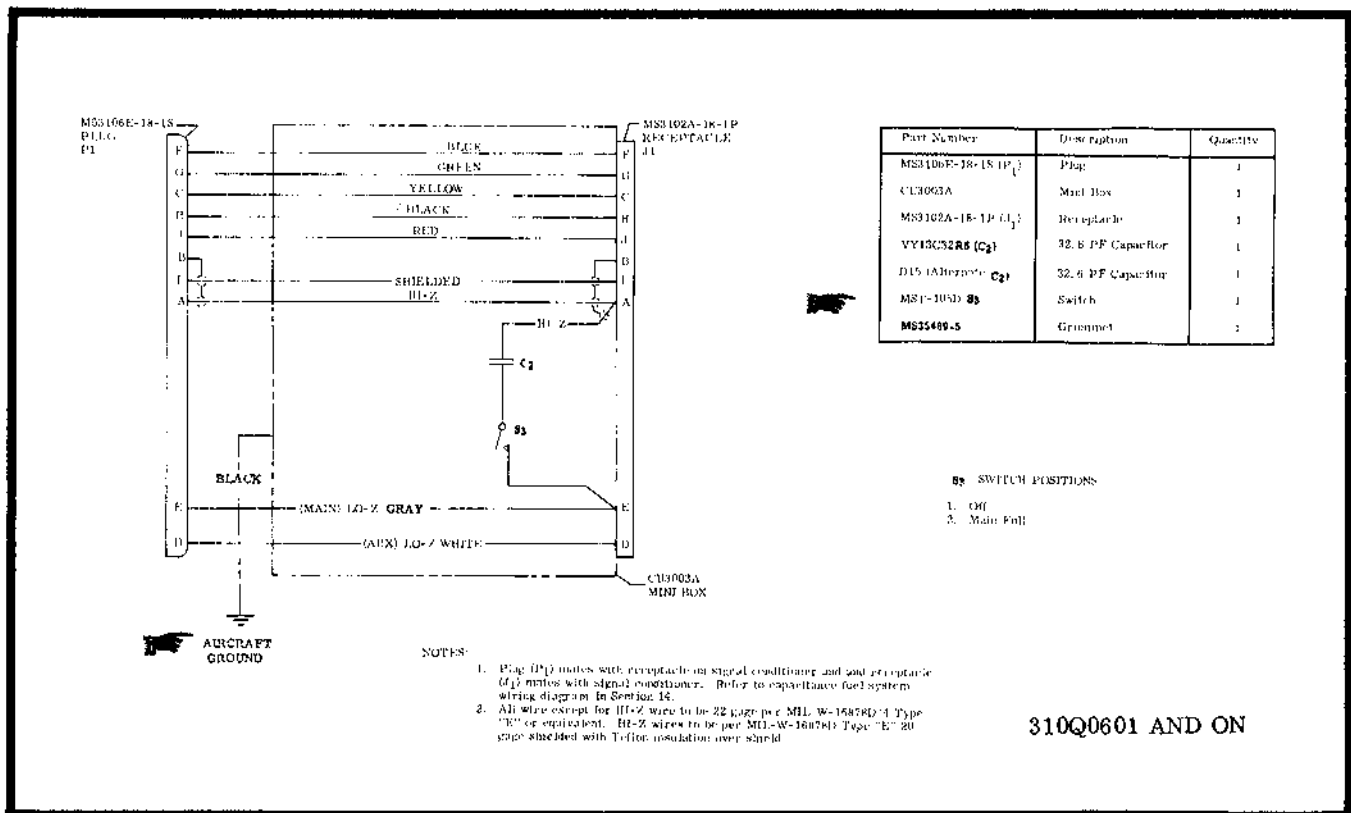


Figure 11-10A. Fabrication of Fuel Quantity Calibration Test Box

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.

- Turn power Off.
- Interconnect capacitance test box in accordance with Figure 11-10A, and recheck "Main Full" indication.
- If calibration has changed repeat steps c thru l until a full indication without change in both main and auxiliary zero indication is obtained.
- 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.
- 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.

- 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.

- Turn on electrical power.
- Place fuel selector control valve to "Main" position.
- 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 11-10B, 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.

Removal of Auxiliary Fuel Quantity Sending Units. (See figure 11-11.)

The removal procedure for the auxiliary fuel quantity sending units is the same for either side. However, on the left side the battery box must be removed.

- a. Defuel aircraft in accordance with Section 2.

CAUTION

During all defueling, tank purging and tank repair operations, 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.

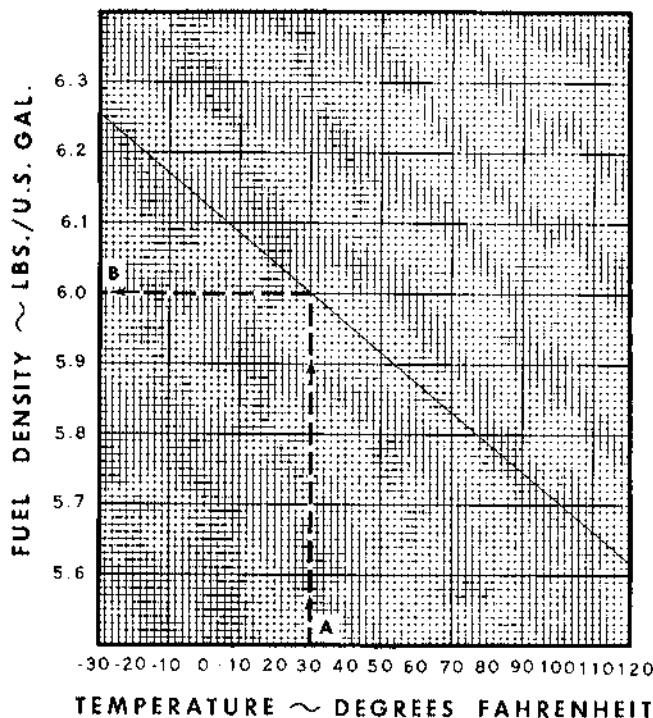
- b. (310Q0001 to 310Q0601.) Remove access cover located just outboard of the engine nacelle on the upper surface of the wing.
- c. (310Q0601 and On.) Remove access cover located just outboard of engine nacelle on upper surface of wing, cover forward of inboard end of aileron, and cover in leading edge forward of fuel filler cap.
- d. Tag and disconnect all wires.
- e. Remove bolts (9) securing the auxiliary fuel cell sending units and carefully remove units from the aircraft.

Installation of Auxiliary Fuel Quantity Sending Units. (See figure 11-11.)

The installation procedure for the auxiliary fuel quantity sending units is the same for either left

or right auxiliary fuel cell.

- a. Carefully position auxiliary fuel cell sending unit into cell and secure in place with bolts (9). 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.



EXAMPLE: A - Fuel Temperature, 30°
 B - Fuel Density, 6.0 Pounds Per Gallon
 Density x Total Gallons =
 Total Fuel Quantity in Pounds

Figure 11-10B. Temperature Conversion Chart

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.	Reset circuit breaker. Replace circuit breaker.
POWER SWITCH ON - POINTER BELOW 0	310Q0001 AND ON No power. Defective indicator.	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.
POWER SWITCH ON - POINTER ABOVE 310 LBS. (INTO STOP)	Open wiring in harness or probe. Defective probe. 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 continuity. Verify probe is defective using Field Calibration Unit Test Box. 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.
INACCURATE FUEL	Defective indicator. Contaminated probe. Capacitance leakage in wiring.	Check for defective indicator. Check for defective probe. Refer to wiring manual.
POWER ON AND BOTH POINTERS AT MID SCALE REGARDLESS OF FUEL LEVEL	LoZ to ground short. Defective indicator.	Use ohmmeter to check for short on LoZ leads. Check for defective indicator.
POWER ON AND POINTER READS APPROXIMATELY 80 TO 100 LB. HIGH	Defective fuel valve switch. Defective selector switch relay.	Use ohmmeter to check switch. Use ohmmeter to check relay.

TROUBLE	PROBABLE CAUSE	CORRECTION
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.	Verify probe is defective using Field Calibration Unit Test Box.
STICKY POINTER	Defective tank selector.	Check switch with ohmmeter.
	Defective indicator.	Replace indicator.

WING LOCKER FUEL TANKS (OPTIONAL).

The optional wing locker fuel tanks are mounted in the forward nacelle baggage area of each wing. The tank is a synthetic rubber cell held in place by button fasteners. Each wing locker tank has an overboard vent and drain tube. A fuel transfer pump, mounted on the rib outboard of the nacelle, transfers fuel from the wing locker tank to the respective wing main tank. Each tank has a total capacity of 20.3 U.S. Gallons.

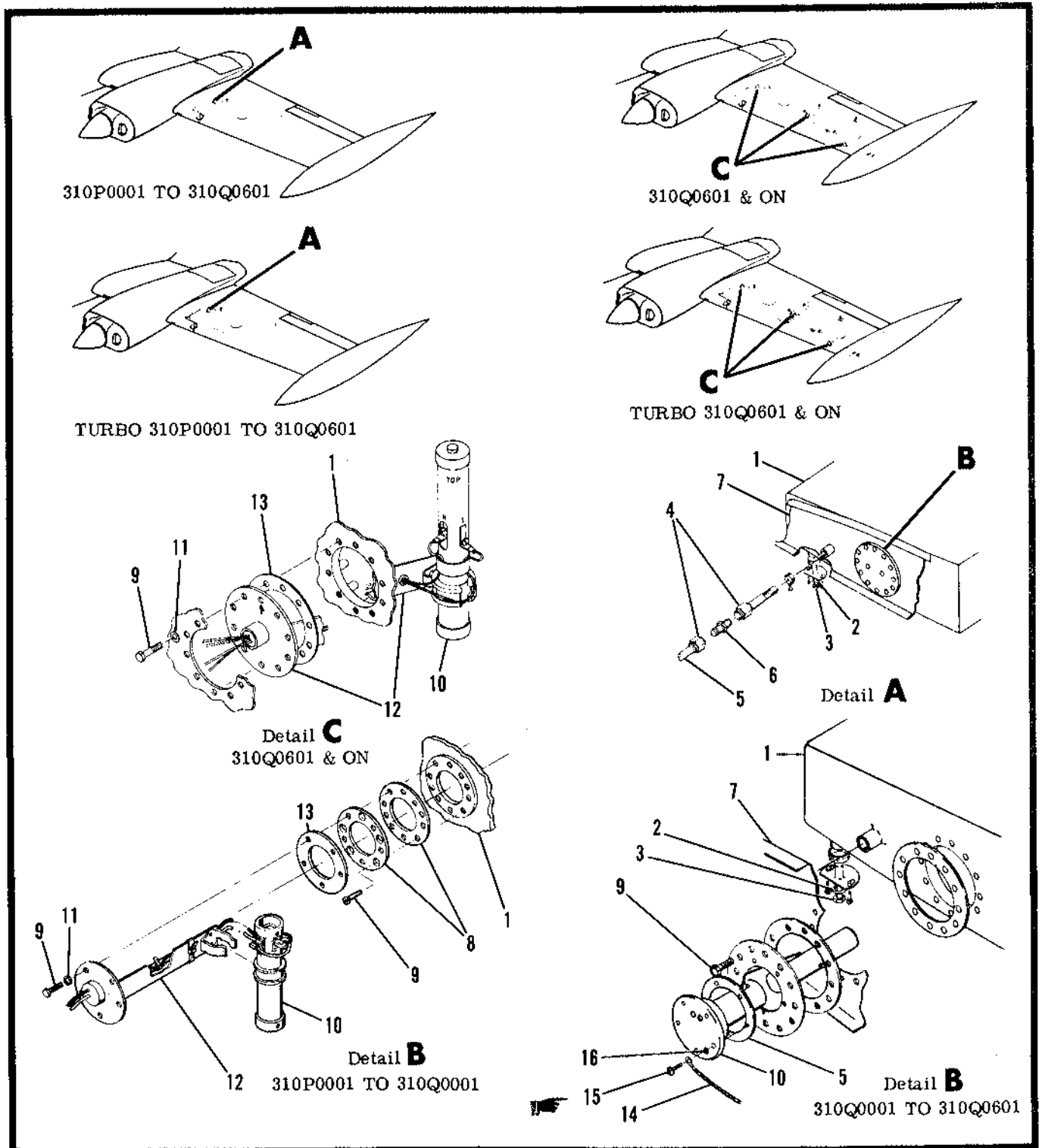
Removal of Wing Locker Fuel Tanks (Optional). (See figure 11-12.)

The removal procedure is the same for either left-hand or right-hand wing locker tank.

- a. Defuel wing locker tank to be removed by transferring fuel to main fuel tank and opening drain valve to drain remaining fuel.
- b. Turn off all power.

CAUTION

During all defueling, tank purging and tank repair 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.



1. Fuel Cell
2. Gasket
3. Quick-Drain Plug
4. Fuel Cell Connection
5. Auxiliary Fuel Line

6. Union
7. Rib
8. Adapter
9. Bolt
10. Auxiliary Tank Unit
11. Washer

12. Cable and Bracket
13. Gasket
14. Bonding Strap
15. Screw
16. Bolt

Figure 11-11. Auxiliary Fuel Quantity Sending Unit

- c. Refer to figure 1-3 and remove access panels (63 and 65) and wing locker fuel tank filler (95).
- d. Loosen clamp and remove strainer (6) from wing locker fuel cell.
- e. Loosen clamp and remove drain line (3) from wing locker fuel cell (5).
- f. Loosen clamp and disconnect vent line (20) from wing locker fuel cell (5).
- g. Pull fasteners down; carefully fold the cell and remove cell through the filler cap opening.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent accumulation of the fuel in the bottom of the nacelle and wing area when lines and fuel cell are removed.

Installation of Wing Locker Fuel Tanks (Optional).
(See figure 11-12.)

- a. Make sure fuel cell area is clean, free from dirt and foreign material.
- b. Carefully insert fuel cell through the filler opening and arrange the cell in the correct position by fastening the fasteners in place.
- c. Install fuel strainer (6) into fuel cell and tighten clamp.
- d. Install drain line (3) in fuel cell (5) and tighten clamp.
- e. Install vent line (20) in wing locker fuel cell (5) and tighten clamp.

NOTE

When installing clamps, be careful not to over-torque.

WING LOCKER FUEL PLUMBING.

Removal of Wing Locker Fuel Plumbing (Optional).
(See figure 11-12.)

The removal procedures are the same for either side of the wing locker fuel system plumbing.

- a. Defuel wing locker fuel system to be removed by transferring fuel to main fuel tank and opening drain valve to drain remaining fuel.
- b. See figure 1-3 and remove access panels, tip tank fairing and wing gap fairing.
- c. Remove wing locker fuel tank in accordance with removal procedures.

CAUTION

During all defueling, tank purging and tank repair operation, 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.

- d. Tag and disconnect electrical wires to vent heater (13), remove clamp and disconnect hose (19), loosen clamps and remove vent line (20). To remove vent line (12), vent hose (19) and vent line (20), it will be necessary to remove the firewall access cover.
- e. Disconnect fuel drain line (14) from transfer pump (16).
- f. Loosen clamp on fuel strainer (6), disconnect line (7) from union (2) and fuel line (8) from transfer pump (16) and carefully work lines out through the access holes.
- g. Disconnect fuel line (9) from drain valve (10) and transfer pump (16) and remove.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent accumulation of the fuel in the bottom of nacelle and wing area when lines and fuel cell are removed.

- h. Removal of fuel line (11) is not recommended; however, fuel line (11) may be removed as follows:
 - 1. Remove main fuel tank in accordance with removal procedures.
 - 2. Remove access covers from underside of wing.
 - 3. Remove clamps and pull fuel line (11) straight out.
- i. Tag and disconnect transfer pump wiring, remove clamp securing transfer pump by removing nut washer and bolts.
- j. Disconnect drain line (1) from mounting bracket and union (2) and remove from wing gap area.
- k. Loosen clamp from wing locker fuel cell (5), remove clamp (4) and remove drain line (3) from wheel well area.

Installation of Wing Locker Fuel Plumbing (Optional).
(See figure 11-12.)

- a. Installation of the wing locker fuel plumbing is the reversal of the removal procedures.

FUEL VENT HEATERS.

Vent heaters installed on each vent tube prevent the vent from freezing of vapors. During removal and installation, care must be used to prevent damage to the wiring and heaters.

- a. Removal of the vent heater is not recommended; if heater is removed, replace as follows:
 - 1. Clean vent tube surface in the area where heater is to be installed with 280 grit sandpaper and Ketone (MEK).
 - 2. (See figure 11-2.) Bond vent heater to vent tube using epoxy cement Epon 834 with curing agent TTA in accordance with the manufacturer's instructions.
 - 3. Pot heater wires with EC2273 to prevent from damage. Mix parts A and B in accordance with manufacturer's instructions.

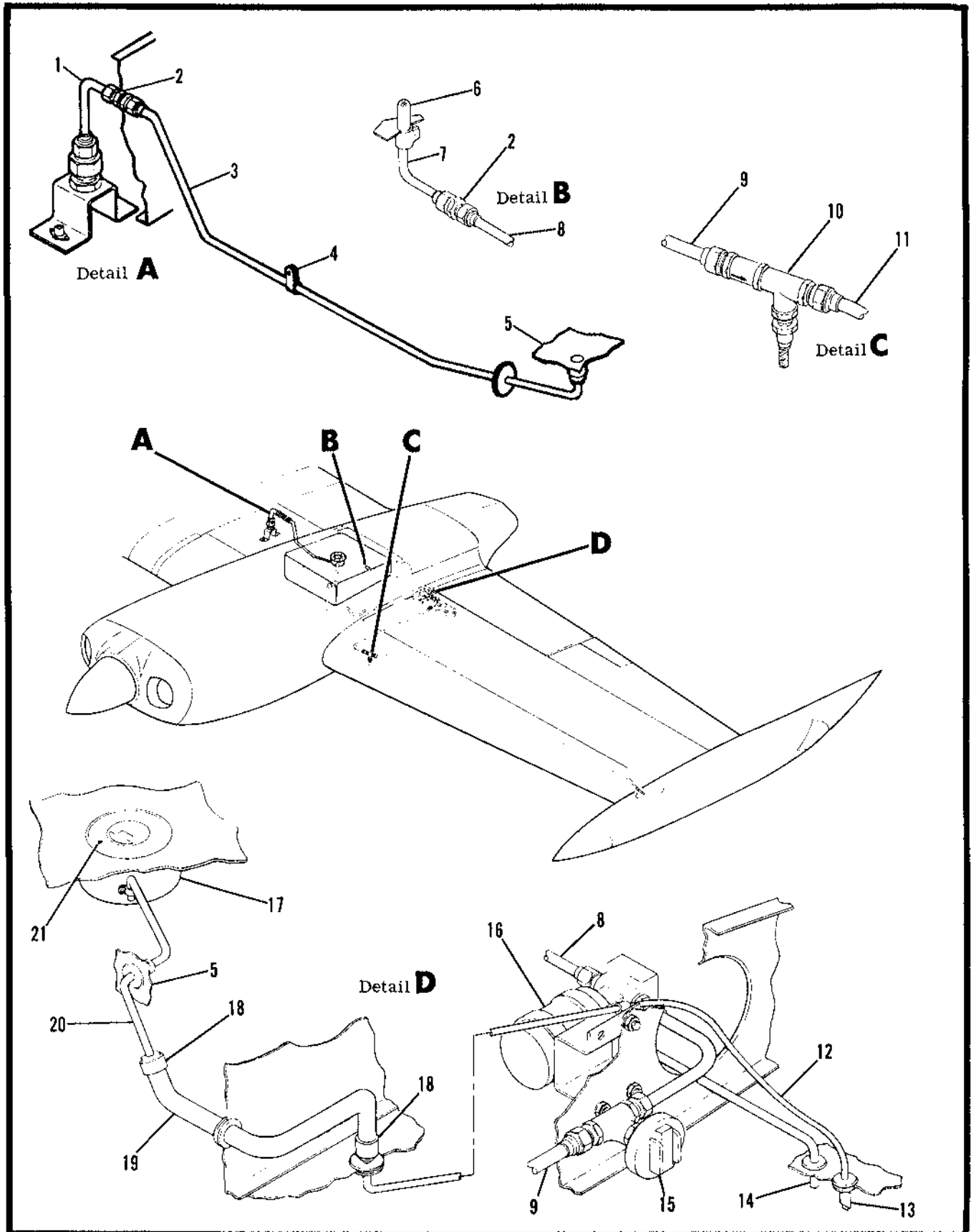


Figure 11-12. Wing Locker Fuel

Figure 11-12. Wing Locker Fuel Callouts

1. Drain Line (Union to Drain Valve)	11. Fuel Line (Drain Valve to Main Fuel Tank)
2. Union	12. Vent Line
3. Drain Line (Fuel Cell to Union)	13. Vent Heater
4. Clamp	14. Transfer Pump Drain
5. Wing Locker Fuel Cell	15. Transfer Light Pressure Switch
6. Fuel Strainer	16. Transfer Pump
7. Fuel Line (Tank to Union)	17. Fuel Filler
8. Fuel Line (Union to Transfer Pump)	18. Clamp
9. Fuel Line (Transfer Pump to Drain Valve)	19. Vent Hose
10. Fuel Drain Valve	20. Vent Line
	21. Vent Hole

MAIN TANK FUEL TRANSFER PUMP.

One main tank fuel transfer pump is mounted on the aft side of the main tank rear bulkhead. The function of these pumps are 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 11-9A.)

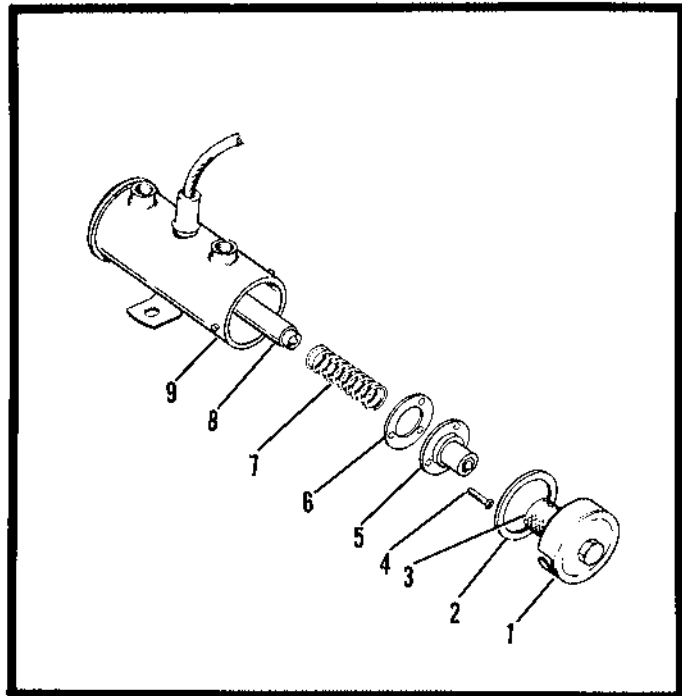
The removal procedure is the same for either main tank fuel transfer pump.

- Make sure fuel selector handles are OFF.
- Defuel main tank in accordance with Section 2.
- Remove tail cap assemblies from wing main fuel tanks by removing attaching screws.
- Disconnect electrical wiring.
- Disconnect fuel lines from pump.
- Remove two nuts attaching pump to bulkhead and remove pump from aft end of main tank.

Disassembly of Main Tank Fuel Transfer Pump.**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.

- 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.
- Remove the gasket from the cover.
- Carefully remove the filter screen.
- Remove the three screws that hold the plunger spring cup to the pump body.
- Remove the gasket and plunger spring.
- Carefully withdraw the plunger from the pump body. Do not drop or mutilate the plunger.



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 11-13. Main Transfer Pump

Cleaning and Inspection of Main Tank Fuel Transfer Pump Parts.

- 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.
- Dip the pump body in clean solvent, shake it lightly, then remove it and dry with compressed air.
- 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.

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 11-9A.)

The installation procedure is the same for either main tank fuel transfer pump.

- a. Install pump to bulkhead.
- b. Connect fuel lines to pump.

CAUTION

Observe "IN" and "OUT" markings on pump relative to lines being connected for correct installation.

- c. Connect electrical wiring.
- d. Perform following operational check of transfer pump:

- (1) Pour approximately 5 gallons of fuel into main tank.
- (2) Turn master switch ON.
- (3) Observe that pump is functioning properly.

NOTE

Transfer pump must be pumping from forward section of main tank to center baffle area.

- e. Install tail cap assemblies to main fuel tank.
- f. Refuel aircraft.

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SECTION 12

INSTRUMENTS AND RELATED SYSTEMS

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GENERAL.

The stationary instrument panel is a part of the fuselage structure and is ordinarily not considered removable. The two individual shock-mounted panels, either of which may be removed individually, are attached to the stationary panel by the use of shock-mounts, an angle assembly, nuts and screws. The LH shock-mounted panel houses the flight instruments while the RH panel houses the radio controls, fuel and engine operation instruments. Individual instruments are positioned behind and secured to each panel with 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 all removals and installations.

INSTRUMENTS.

Vacuum System Instruments.

a. The Directional Gyro is a flight instrument incorporating an air-driven gyro stabilized in the vertical plane. The gyro is rotated at high speed by lowering the pressure in the 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. The Suction Gage is calibrated in inches of mercury and indicates the amount of vacuum created by the engine-driven vacuum pumps. The vacuum gage has three connecting lines. The upper line is routed directly to the directional gyro to monitor vacuum. The lower lines are attached to the vacuum system

manifold for the purpose of monitoring vacuum pump function.

e. 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 Procedures.

NOTE

A gage reading of 5.3 inches of mercury is desirable for gyro instruments; however, a range of 4.75 to 5.25 inches of mercury is acceptable.

5. Vacuum pump for proper operation.

Pitot-Static Instruments.

a. The Sensitive Altimeter is a pressure instrument that measures the change in static pressure and by means of an indicator, translates this change into altitude above sea level. A barometric scale is incorporated in the instrument. The barometric pressure scale is calibrated in inches of mercury and is set manually by a knob on the lower left-hand corner of the altimeter case. Three pointers on the dial of the instrument indicate altitude in units of 100 feet, 1,000 feet and 10,000 feet.

b. The 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 True Airspeed Indicator is composed of three elements; airspeed, altitude and temperature. The altitude and temperature mechanisms are correlated to operate a rotating dial over which the indicated airspeed indicates the true airspeed. The true airspeed indicator senses changes in pressure and temperature. This combination of altitude and temperature change results in a sum total of airspeed corrections to indicate true airspeed.

d. 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.

Engine Instruments.

a. Fuel Quantity Indicator. On Aircraft 310P0001 to 310Q0001, a fuel quantity indicator with two pointers on the dial, one for each wing, is located in the lower right-hand portion of the instrument panel. The fuel quantity indicator receives electrical signals from variable resistor-type fuel quantity sending

units located inside the wing tanks and indicates, in gallons, the amount of remaining usable fuel. On aircraft 310Q0001 and ON, the fuel quantity indicator is located in the upper center of the instrument panel. The indicator receives electrical signals from the signal conditioners which receives its signal from the main or auxiliary tank sending units, depending on the fuel tank selection. The indicator is calibrated in pounds and gallons to indicate the amount of remaining usable fuel.

b. Dual Fuel Flow Gage. On Aircraft 310P0001 to 310Q0001, the dual fuel flow gage senses the pressure at which the 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. On aircraft 310Q0001 and ON, the dual fuel flow gage is calibrated in pounds and gallons per hour. The White scale indicating pounds per hour, and the Blue scale indicating gallons per hour.

c. The Manifold Pressure Gage is a direct reading gage used to indicate the pressure of the fuel-air mixture 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 three cylinder of the respective engine. On Turbo 310 the temperature bulb is located on No. 3 cylinder of RH engine and No. 2 cylinder of LH engine. As the temperature of the bulb changes, the combination gage measures the change and the pointer indicates the temperature 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.

f. Economy Mixture Indicator (Optional Equipment) is an exhaust gas temperature (EGT) sensing device which is used to aid the pilot in selecting the most desirable fuel-air mixture for cruising flight of less than 75% power. EGT varies with the ratio of fuel-to-air mixture entering the engine cylinders. Refer to Section 13 for removal, installation and calibration procedures.

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 Ammeters measure the current received, or current drain on the battery, one being used for alternators the other for optional propeller deice system.

c. The Magnetic Compass is located on the windshield. 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 Horn is mounted behind the instrument panel on the left hand side. 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 located in the lower right portion of the instrument panel. It is calibrated in degrees Fahrenheit and operated electrically from a free air temperature bulb located in the fresh air duct in the nose of the fuselage.

f. (310-0001 to 310P0222) The flap position indicator is electrically operated and indicates the position of the flaps from zero to 35 degrees. The indicator operates in conjunction with a flap position transmitter located just aft of the fuselage rear spar. Refer to Section 8 for flap position transmitter removal and installation procedures.

g. (310P0222 and On) The flap position is indicated by the flap preselect system pointer on the stationary instrument panel.

h. 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.)

NOTE

For steps "a" through "d" refer to figure 12-1.

- a. Remove screws attaching instrument panel section, in which instrument is attached, to angle assembly.
- b. Remove nuts from upper portion of instrument panel section.
- c. Hinge instrument panel section aft on the lower shock mount.
- d. Tag and disconnect electrical wires and hoses from back of instrument being removed.
- e. Plug all hoses and cap fittings to prevent the entry of foreign matter.
- f. Remove the connectors (8), nuts (7), and lockwashers (6).
- g. Remove lower attaching nuts and bolts.

NOTE

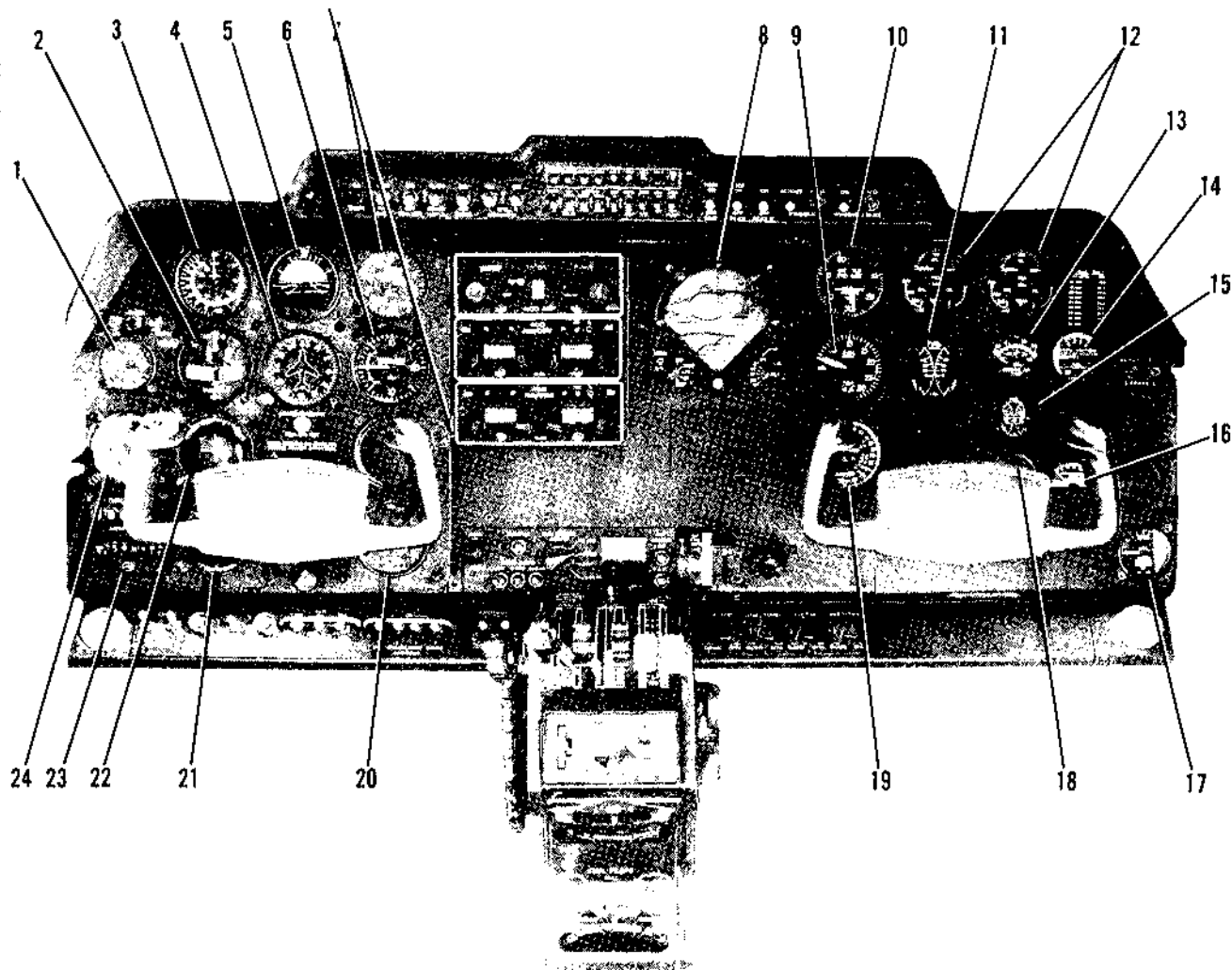
If the instrument is to be replaced, remove the hose fittings or electrical connector and install the replacement unit.

Typical Instrument Installation. (See figure 12-2.)

NOTE

Lubricate straight threads with VV-P-236 petroleum; tapered threads with JAN-A-669 anti-seize compound. Apply lubricant to male threads only, omitting the first two threads.

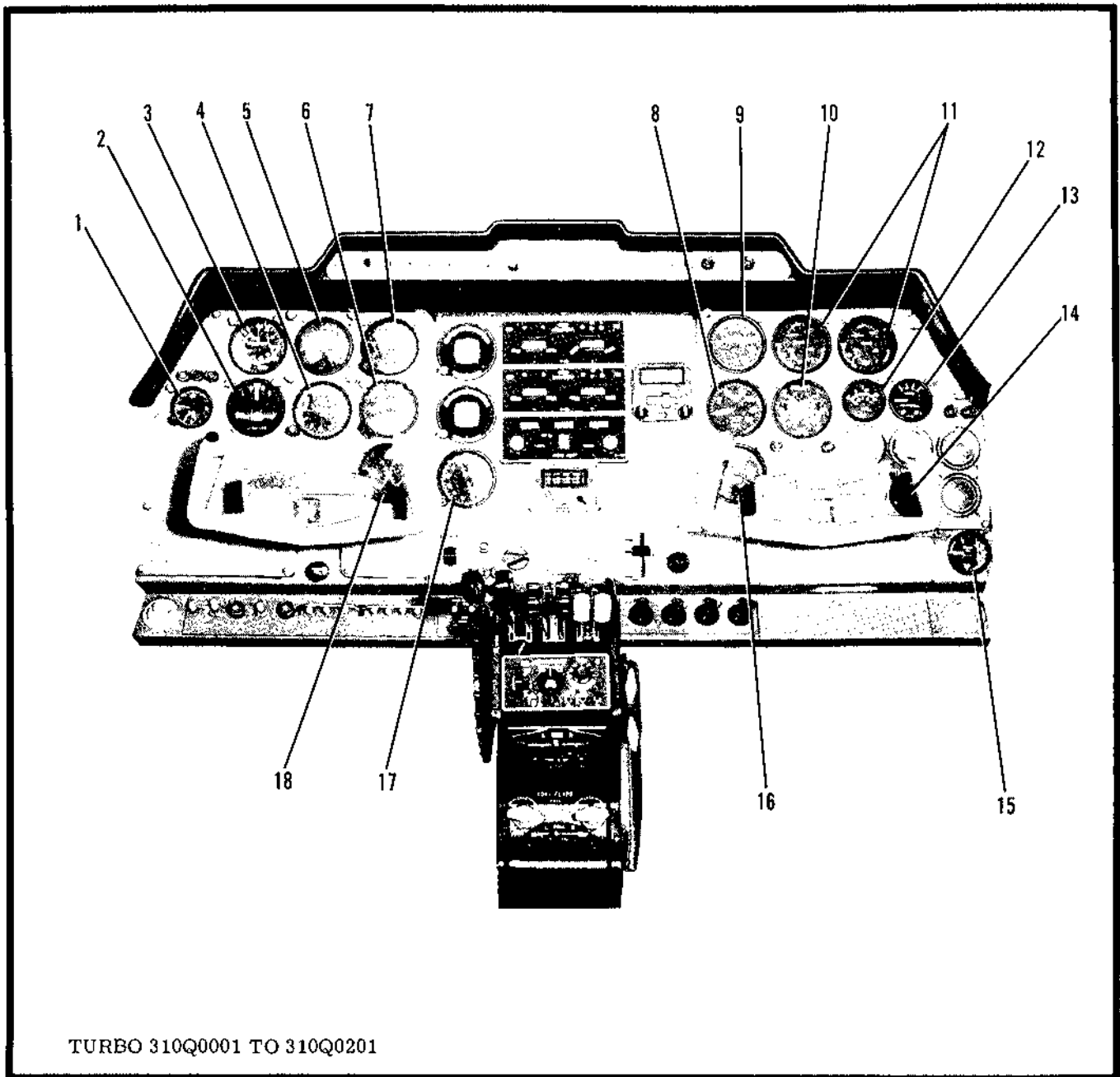
- a. Position instrument on back of instrument panel and secure with lower attaching bolts and nuts illustrated in figure 12-2.
- b. Install lighting fixtures (1) and rubber washers (2), secure with lockwashers (6) and nuts (7).
- c. Attach connectors (8) to lighting fixtures (1).
- d. Connect hoses or electrical connector as tagged at removal.
- e. Hinge instrument panel section forward on lower shock mounts and secure to stationary instrument panel with screws.



TURBO 310P0001 TO TURBO 310Q0001

1. Clock	13. Outside Air Temperature Gage
2. Turn and Bank Indicator	14. Suction Gage
3. Airspeed Indicator	15. Auxiliary Fuel Quantity Indicator (Optional)
4. Directional Gyro	16. Propeller Deice Ammeter (Optional)
5. Horizontal Gyro	17. Oxygen Gage (Optional)
6. Vertical Speed Indicator	18. Flight Hour Recorder (Optional)
7. Altimeter	19. Fuel Flow Gage
8. Radar Display Indicator (Optional)	20. Exhaust Temperature Gage
9. Tachometer	21. Number 2 Omni Course Selector Indicator
10. Manifold Pressure Gage	22. Number 1 Omni Course Selector Indicator
11. Fuel Quantity Indicator	23. Nautical Miles Indicator
12. Engine Combination Gages	24. ADF Indicator

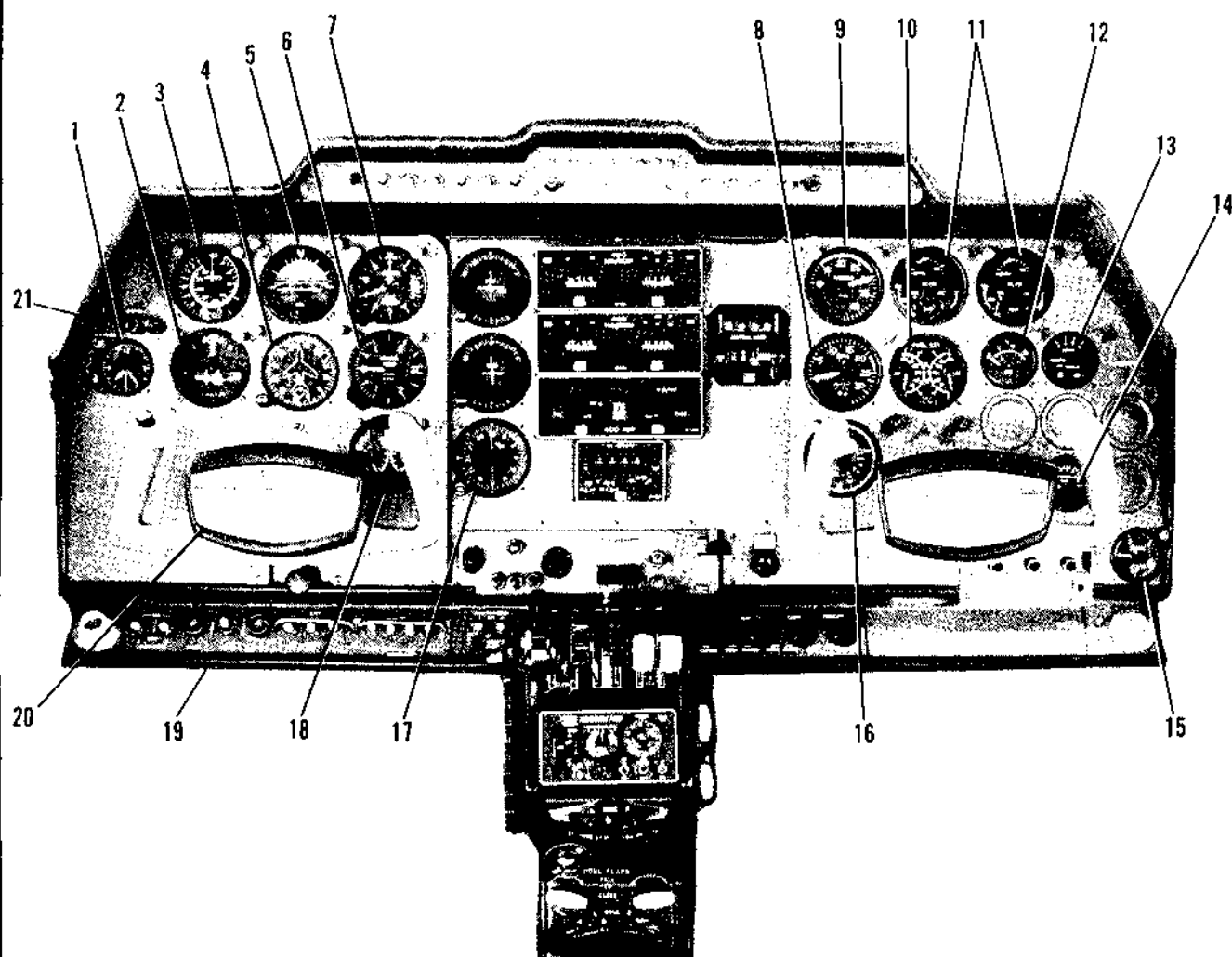
Figure 12-1. Instrument and Instrument Panel



1. Clock
2. Turn and Bank Indicator
3. Airspeed Indicator
4. Directional Gyro
5. Horizontal Gyro
6. Vertical Speed Indicator
7. Altimeter
8. Tachometer
9. Manifold Pressure Gage

10. Fuel Quantity Indicator
11. Engine Combination Gages
12. Outside Air Temperature Gage
13. Suction Gage
14. Propeller Deice Ammeter (Optional)
15. Oxygen Gage
16. Fuel Flow Gage
17. ADF Indicator
18. Exhaust Temperature Gage

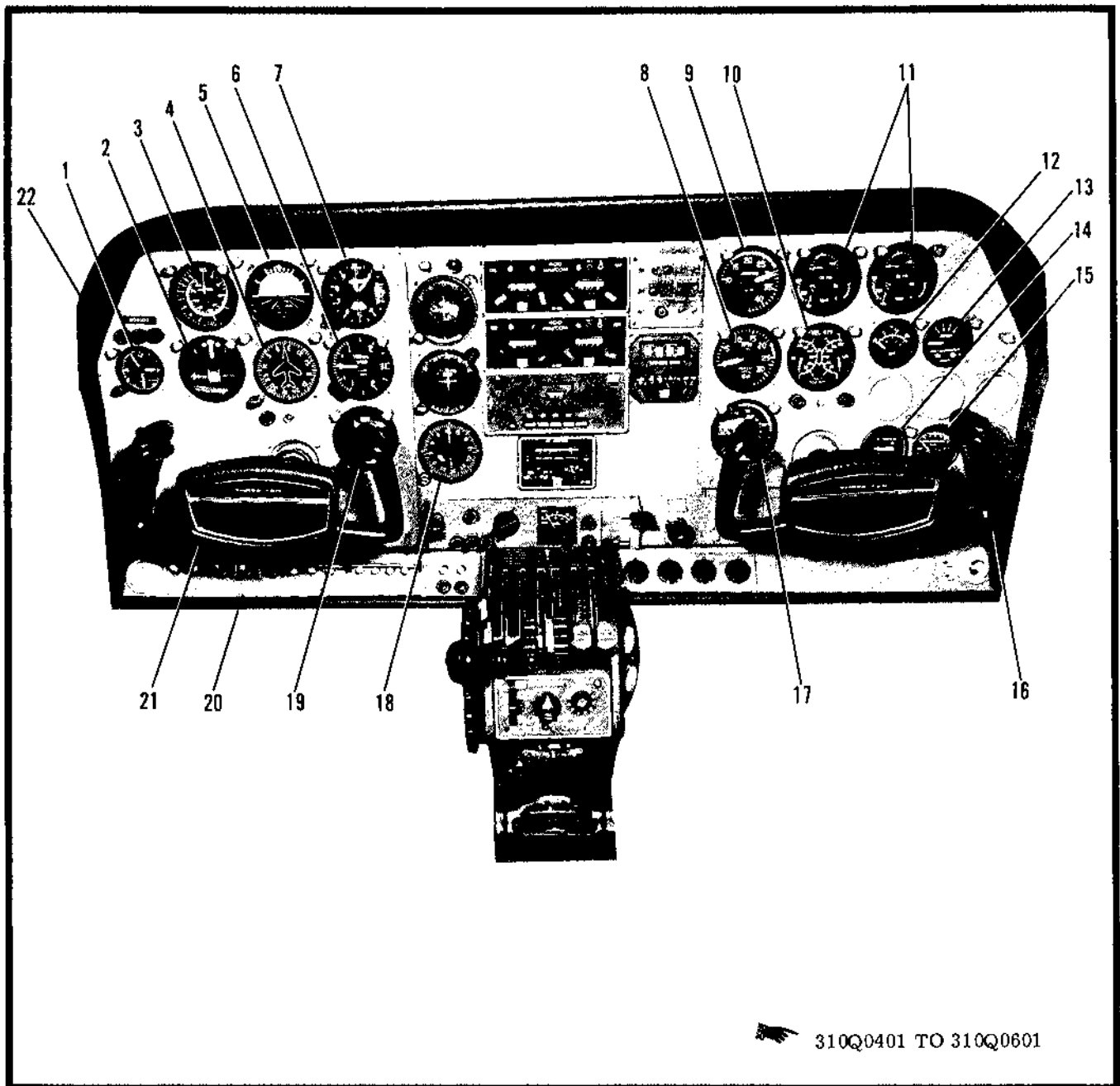
Figure 12-1A. Instrument and Instrument Panel



TURBO 310Q0201 TO 310Q0401

1. Clock	12. Outside Air Temperature Gage
2. Turn and Bank Indicator	13. Suction Gage
3. Airspeed Indicator	14. Propeller Deice Ammeter (Optional)
4. Directional Gyro	15. Oxygen Gage
5. Horizontal Gyro	16. Fuel Flow Gage
6. Vertical Speed Indicator	17. ADF Indicator
7. Altimeter	18. Exhaust Temperature Gage
8. Tachometer	19. Padded Stationary Panel
9. Manifold Pressure Gage	20. Padded Control Wheel
10. Fuel Quantity Indicator	21. Padded Glareshield
11. Engine Combination Gages	

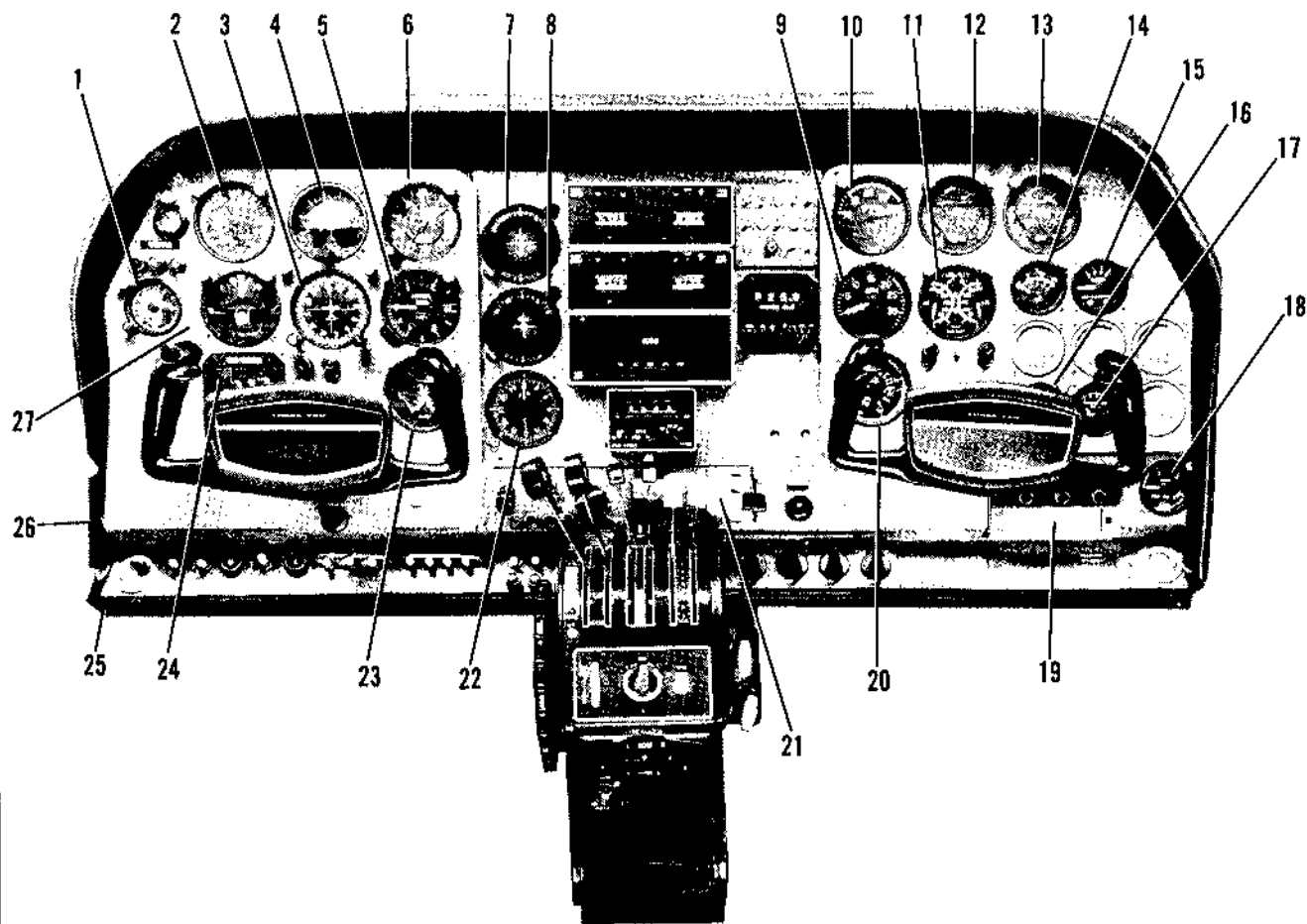
Figure 12-1B. Instrument and Instrument Panel



310Q0401 TO 310Q0601

1. Clock	12. Outside Air Temperature Gage
2. Turn and Bank Indicator	13. Suction Gage
3. Airspeed Indicator	14. Flight Hour Recorder (Optional)
4. Directional Gyro	15. Propeller Deice Ammeter (Optional)
5. Horizontal Gyro	16. Oxygen Gage
6. Vertical Speed Indicator	17. Fuel Flow Gage
7. Altimeter	18. ADF Indicator
8. Tachometer	19. Exhaust Temperature Gage
9. Manifold Pressure Gage	20. Padded Stationary Panel
10. Fuel Quantity Indicator	21. Padded Control Wheel
11. Engine Combination Gages	22. Padded Glare Shield

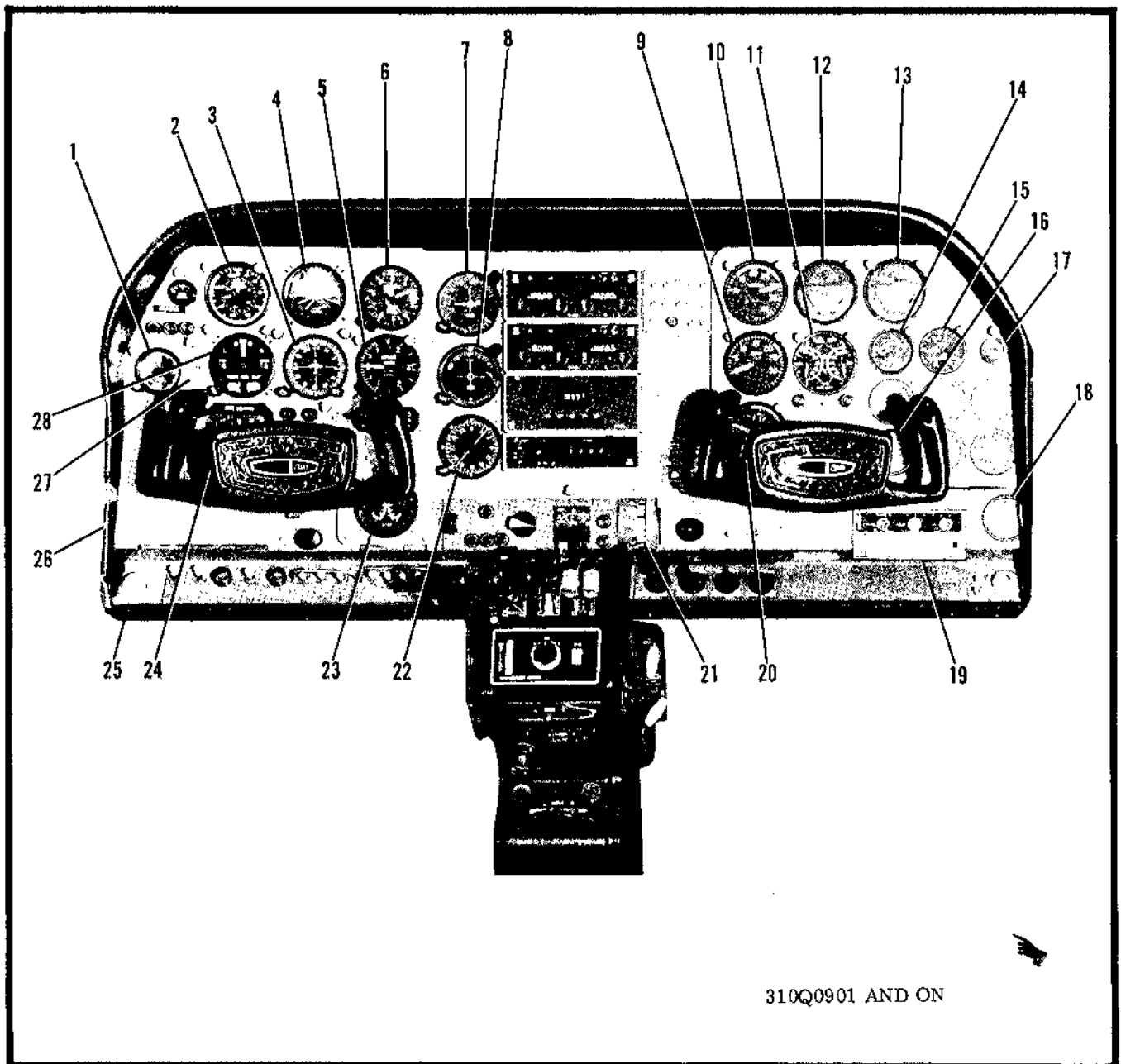
Figure 12-1C. Instrument and Instrument Panel



310Q0601 TO 310Q0901

1. Clock	15. Suction Gage
2. Airspeed Indicator	16. Flight Hour Recorder
3. Directional Gyro	17. Propeller Deice Ammeter
4. Attitude Director Indicator	18. Oxygen Pressure Gage
5. Vertical Speed	19. Mini 8 Stereo
6. Altimeter	20. Fuel Flow Indicator
7. No. 1 OBS Indicator	21. Flap Position Indicator
8. No. 2 OBS Indicator	22. ADF Indicator
9. Tachometer Indicator	23. Exhaust Temperature Indicator
10. Manifold Pressure Indicator	24. Mode Selector
11. Fuel Quantity Indicator	25. Padded Stationary Panel
12. LH Engine Combination Gage	26. Padded Glare Shield
13. RH Engine Combination Gage	27. Yaw Damper Switch
14. Outside Air Temperature Gage	

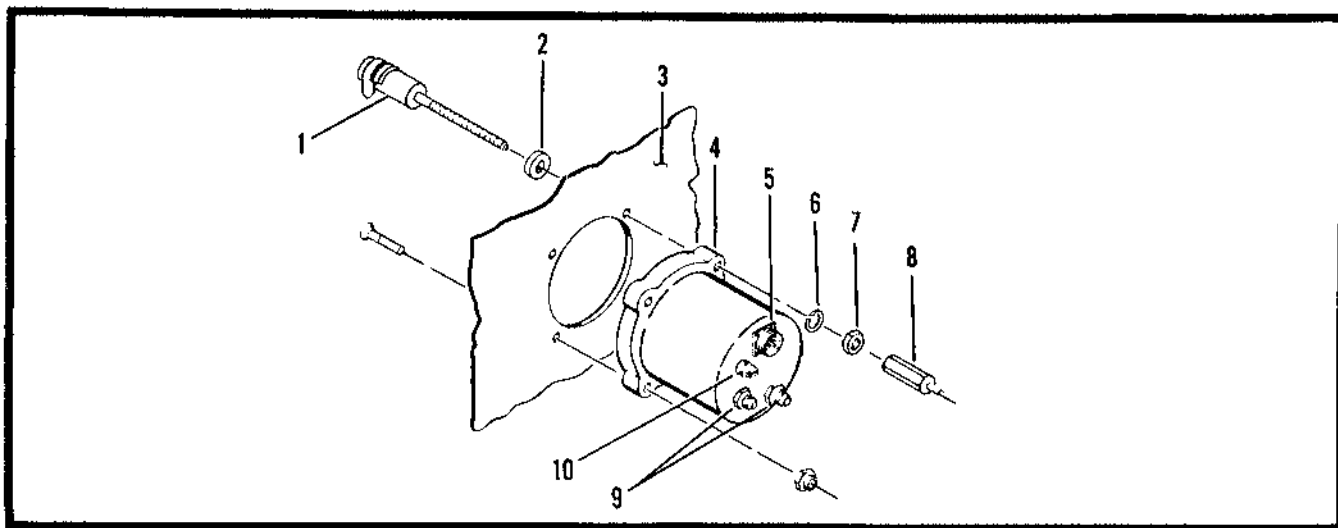
Figure 12-1D. Instrument and Instrument Panel



310Q0901 AND ON

1. Clock	15. Suction Gage
2. Airspeed Indicator	16. Flight Hour Recorder
3. Directional Gyro	17. Propeller Deice Ammeter
4. Attitude Director Indicator	18. Oxygen Pressure Gage
5. Vertical Speed	19. Mini 8 Stereo
6. Altimeter	20. Fuel Flow Indicator
7. No. 1 OBS Indicator	21. Flap Position Indicator
8. No. 2 OBS Indicator	22. ADF Indicator
9. Tachometer Indicator	23. Exhaust Temperature Indicator
10. Manifold Pressure Indicator	24. Mode Selector
11. Fuel Quantity Indicator	25. Padded Stationary Panel
12. LH Engine Combination Gage	26. Padded Glare Shield
13. RH Engine Combination Gage	27. Yaw Damper Switch
14. Outside Air Temperature Gage	28. Turn and Slip Indicator

Figure 12-1E. Instrument and Instrument Panel

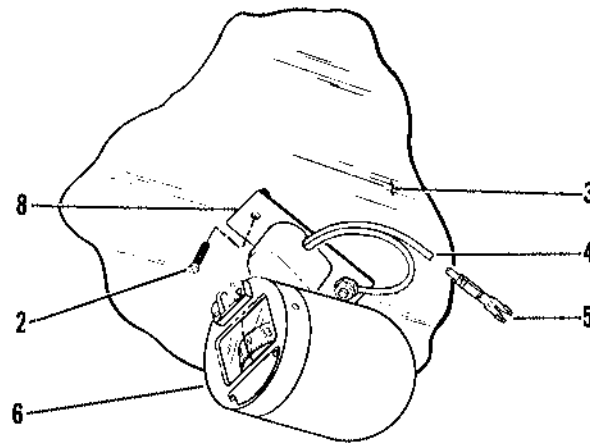


- 1. Lighting Fixture
- 2. Rubber Washer
- 3. Instrument Panel

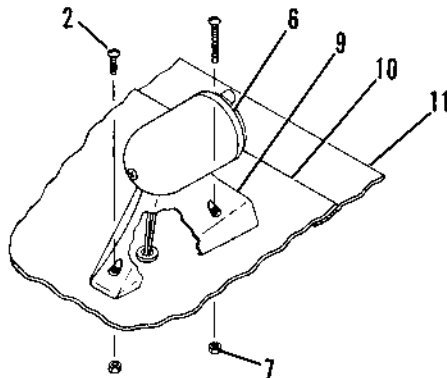
- 4. Instrument
- 5. Electrical Connector
- 6. Lockwasher
- 7. Nut

- 8. Connector
- 9. Hose Fittings
- 10. Vent Plug

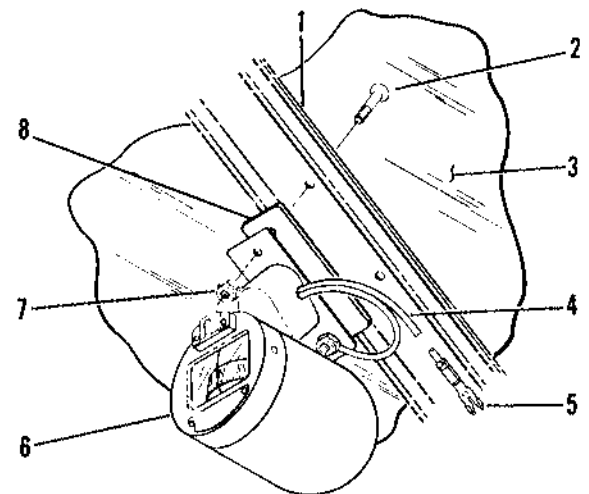
Figure 12-2. Typical Instrument Installation



310P0001 TO 310Q0401



310Q0401 AND ON

AIRCRAFT EQUIPPED WITH HEATED
WINDSHIELD

1. Windshield Centerstrip	5. Wrist Lock	9. Pedestal
2. Bolt	6. Magnetic Compass	10. Panel
3. Windshield	7. Nut	11. Glare Shield
4. Compass Light Wire	8. Mounting Bracket	

Figure 12-3. Magnetic Compass

NOTE

Removal of Magnetic Compass. (See figure 12-3.)

- a. Remove two screws securing compass to bonded base plate. On aircraft 310Q and on, remove panel (10) to gain access; remove three screws and nuts securing pedestal to panel.
- b. Uncouple wrist lock (5) provided on compass light wire (4).

Installation of Magnetic Compass. (See figure 12-3.)

The installation of the magnetic compass is the reversal of the removal procedure.

NOTE

Use nonmagnetic screw and nuts for mounting compass and pedestal.

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.

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 preceeding paragraph, steps j, 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.

Compensation Adjustments.

- a. If the corrected error as calculated in index error alignment paragraph step e is greater than ± 2° 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.

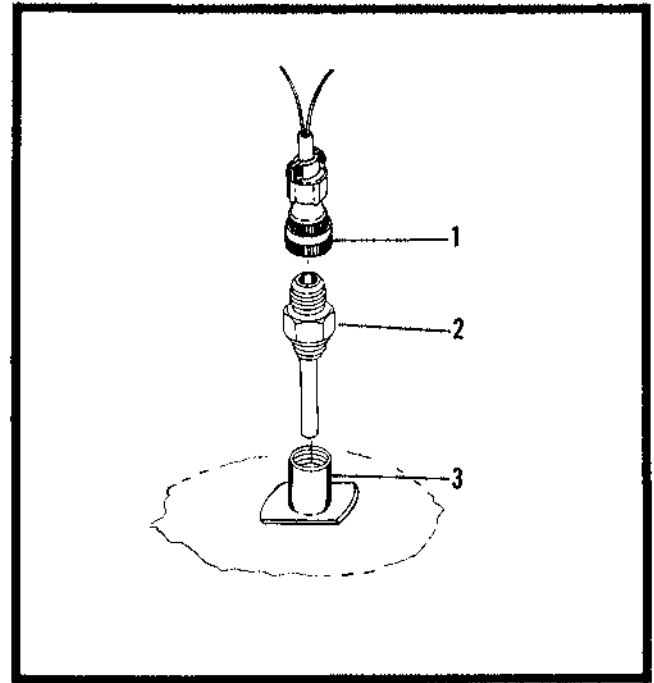
- a. Using cardinal heading errors calculated in index error alignment step e for remote compass system and compass alignment procedure for the standby compass, algebraically sum the north and south errors, divide this sum by two and change the sign of the result. The resulting number is the amount and 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 heading 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.

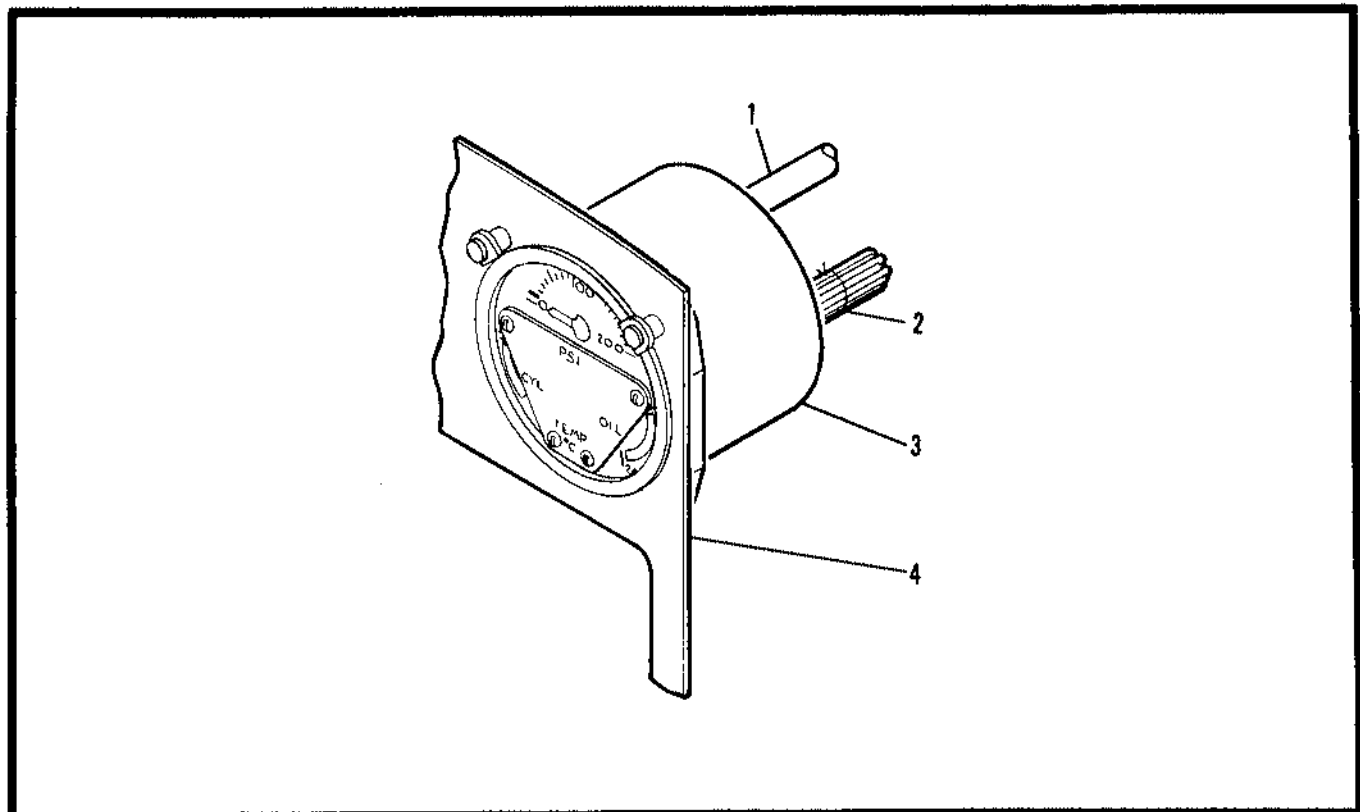
Typical Bulb Removal and Installation. (See figure 12-4.)

- a. Tag and disconnect electrical connector (1).
- b. Remove bulb (2).
- c. Install bulb by reversing removal procedures.



1. Electrical Connector 2. Bulb 3. Flange

Figure 12-4. Indicator Bulb



1. Oil Pressure Line 2. Wire Bundle 3. Gage 4. Instrument Panel

Figure 12-5. Engine Combination Gage

Troubleshooting Instruments.

TROUBLE	PROBABLE CAUSE	CORRECTION
BOTH VACUUM INSTRUMENTS MALFUNCTIONING ONE VACUUM INSTRUMENT MALFUNCTIONING, OTHER VACUUM INSTRUMENT OPERATING NORMAL DIRECTIONAL GYRO PRECESSES AND/OR SPINS GYRO HORIZON WILL NOT ERECT, TUMBLES, AND IS SLUGGISH IN OPERATION	<u>VACUUM SYSTEM INSTRUMENTS</u>	
	Dirty filter element. Restricted airflow or improper adjustment.	Clean and replace filter. Adjust vacuum relief valve.
	Defective instrument.	Replace instrument.
	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.
	Operation limits exceeded.	Replace or overhaul directional gyro.
	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.
INDICATING POINTERS FAIL TO RESPOND EXCESSIVE POINTER VIBRATION ERRONEOUS INDICATIONS	<u>SENSITIVE ALTIMETER</u>	
	Static line obstructed.	Disconnect static line from all instruments and altitude hold on autopilot computer, and blow out line with dry compressed air.
	Excessive vibration of static line or hose.	Secure to aircraft structure or components.
	Water or foreign matter in static line.	Disconnect static line from all instruments and altitude hold on autopilot computer, and blow out line with dry compressed air.
	Loose static line connection.	Test and repair in accordance with testing static pressure line.
	Defective instrument.	Replace instrument.
	<u>AIRSPEED INDICATOR</u>	
	Clogged pitot line.	Disconnect tube from instru-

TROUBLE	PROBABLE CAUSE	CORRECTION
POINTER FAILS TO RESPOND (CONT) ERRONEOUS INDICATIONS	Clogged pitot line. Water or restriction in pitot and/or static line. Leak in pitot and/or static line. Pitot and/or static line improperly connected.	ment and blow out line with dry compressed air. Disconnect tube from all pitot static system instruments and altitude hold on autopilot computer and blow out line with dry compressed air. Test and repair in accordance with testing of pitot pressure line. Connect lines as illustrated in figure 12-8.
POINTER FAILS TO RESPOND	<u>VERTICAL SPEED INDICATOR</u> Water or restriction in static line. Defective instrument.	Disconnect static line from all pitot static system instruments and altitude hold on autopilot computer and blow out with dry compressed air. Replace instrument.
	<u>TURN-AND-BANK INDICATOR</u> NOTE To operate any of the electrical instruments, the battery switch must be in the ON position.	
BALL OFF CENTER	Incorrectly mounted. Defective instrument.	Mount correctly. Replace instrument
TURN INDICATED	Open circuit. Defective instrument.	Reset circuit breaker. Check and repair circuit. Replace instrument.
	<u>DUAL TACHOMETER</u>	
ERRONEOUS INDICATION OR INDICATOR INOPERATIVE	Defective circuit. Defective instrument. Defective tachometer generator.	Check and repair circuit. Replace instrument. Replace tachometer generator.
	<u>DUAL FUEL QUANTITY INDICATOR</u>	
310P0001 TO 310Q0001 NO INDICATION	Sunken float. Open circuit. Defective fuel quantity sending unit.	Replace float. Reset circuit breaker. Check and repair circuit. Replace fuel quantity sending unit.
310P0001 TO 310Q0001 ERRONEOUS INDICATOR	Defective indicator. Damaged float.	Replace indicator. Replace float.

TROUBLE	PROBABLE CAUSE	CORRECTION
310P0001 TO 310Q0001 ERRONEOUS INDICATOR (CONT.)	Defective circuit.	Check and repair circuit.
	Malfunctioning fuel quantity sending unit.	Check in accordance with Section 11. Replace if necessary.
	Defective indicator.	Replace indicator.
310Q0001 AND ON NO INDICATION	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective tank unit.	Replace tank unit.
	Defective signal conditioner.	Replace signal conditioner.
310Q0001 AND ON ERRONEOUS INDICATOR	Defective circuit.	Check and repair circuit.
	Malfunctioning tank unit.	Replace tank unit.
	Defective indicator.	Replace indicator.
	System needs calibrating.	Calibrate in accordance with Calibration Procedures.
	<u>O. A. T. INDICATOR</u>	
POINTER FAILS TO RES- POND	Open circuit.	Reset circuit breaker. Check and repair circuit.
ERRONEOUS INDICATION	Defective circuit.	Check and repair circuit.
	Defective air temperature bulb.	Replace air temperature bulb.
	Defective indicator.	Replace indicator.
	<u>STALL WARNING INDICATOR</u>	
HORN FAILS TO OPERATE	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective transmitter.	Replace transmitter.
	Defective horn.	Replace horn.
	<u>COMBINATION GAGES</u>	
NO INDICATION ON OIL TEMPERATURE GAGE	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective oil temperature bulb.	Replace oil temperature bulb.
	Defective instrument.	Replace instrument.
ERRONEOUS INDICATION OF CYLINDER TEMPERA- TURE GAGE	Defective circuit.	Check and repair circuit.
	Defective cylinder head temperature bulb.	Replace cylinder head temperature bulb.
	Defective instrument.	Replace instrument.
ERRONEOUS OIL PRESSURE INDICATION	Defective instrument.	Replace instrument.
	Broken or restricted oil pressure line.	Repair or replace oil pressure line.

TROUBLE	PROBABLE CAUSE	CORRECTION
ERRONEOUS OIL PRESSURE INDICATION (CONT)	Defective oil pressure relief valve.	Repair or replace relief valve.
	<u>MANIFOLD PRESSURE GAGE</u>	
SLUGGISH POINTER OPERATION	Damaged or restricted lines.	Remove line from instrument and blow out restriction. Replace line or hoses as necessary.
	Defective instrument.	Replace instrument.
	<u>MAGNETIC COMPASS</u>	
EXCESSIVE COMPASS ERROR	Improper compensation.	Compensate the compass.
	External magnetic interference.	Locate the interference and eliminate if possible.
FAILURE TO RESPOND TO COMPENSATION	Compensating magnets demagnetized.	Replace instrument.
	<u>FUEL FLOW GAGE</u>	
ERRONEOUS FUEL PRESSURE 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.
	<u>AMMETER</u>	
NO INDICATION ON AMMETER	Defective ammeter.	Check/replace ammeter.
	Defective ammeter leads.	Check/repair or replace.
	<u>PROPELLER DEICE AMMETER</u>	
NO INDICATION ON AMMETER	Defective ammeter.	Check/replace ammeter.
	Defective ammeter leads.	Check/repair or replace.

INSTRUMENT PANELS.

Removal of Shock-Mounted Instrument Panels. (See figure 12-1.)

- a. Disconnect tubing and lines to instruments and tag.

NOTE

Most hose fittings are more accessible if disconnected from the forward bulkhead.

- b. Remove nuts from shock mounts and pull shock-mounted panel away from stationary panel enough to disconnect electrical leads from terminal block. Tag all electrical leads.

- c. Plug hoses and cap all fittings to prevent entry of foreign matter.

- d. Remove shock-mounted panel from aircraft.

Installation of Shock-Mounted Instrument Panel. (See figure 12-1.)

CAUTION

Clean bonding area between stationary and instrument panel before installing instrument panel.

- a. Inspect rubber shock mounts and bonding straps for deterioration and cracks. If either is damaged, replace before installing instrument panel.

NOTE

On aircraft 310Q0401 and On, the instrument panel is mounted on spacers instead of shock mounts.

- b. Secure shock mounted panel in place on mounts.
c. Remove plugs and caps in all lines and fittings.
d. Connect electrical leads to instruments and ter-

minal strip. Remove tags.

- e. Connect all hoses and lines to instruments.
- f. Secure shock panel to support angle with screws and tighten nuts on shock mounts.

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 and wings to the relief valves. The adjustable relief valves are provided to give the desired vacuum system pressure. From the relief valve, the lines are routed 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 the vacuum air filter and suction gage. The suction gage indicates the amount of vacuum present in the system; also provided are inoperation 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.

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 cubic feet per minute while alternately closing off the ends of the lines. This will create pressure pulses to dislodge and eject foreign matter.

Troubleshooting 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.

TROUBLE	PROBABLE CAUSE	CORRECTION
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 Pump. (See figure 12-6.)

- Remove upper nacelle cowls.
- Loosen the two hose clamps securing hose between line assembly (15) and vacuum pump (16).
- Remove vacuum pump (16) by removing four attaching nuts and washers.

NOTE

Do not clean vacuum pump (16) in solvent.
Clean by wiping with a clean cloth.

Installation of Vacuum Pump. (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.

- Align splines on the vacuum pump drive with splines on the engine drive and slide vacuum pump into position so the ports are facing to the right.
- Secure vacuum pump (16) to the engine with four washers and nuts.
- Slide coupling hose (17) over line assembly (15) and secure with clamp.
- Slide coupling hose over fitting onto "in" port on vacuum pump (16) and secure with clamp.
- Install upper nacelle cowl.

Removal and Installation of Vacuum Air Filter. (See figure 12-6.)

- Disconnect filter hoses (9 and 10) from filter (11).
- Remove vacuum air filter (11) from forward cabin bulkhead, left hand side, by removing attaching bolts and washers.
- Install vacuum air filter (11) by reversing procedures as outlined in steps "a" and "b" above.

Replacement of Vacuum Air Filter Element. (See figure 12-6.)

NOTE

It is not required to remove air filter to replace the element.

- Remove wing nut from bottom of vacuum air filter assembly (11).
- Remove vacuum air filter element.
- Install new vacuum air filter element.
- Fasten element in place using wing nut.

Removal and Installation of Vacuum Relief Valve. (See figure 12-6.)

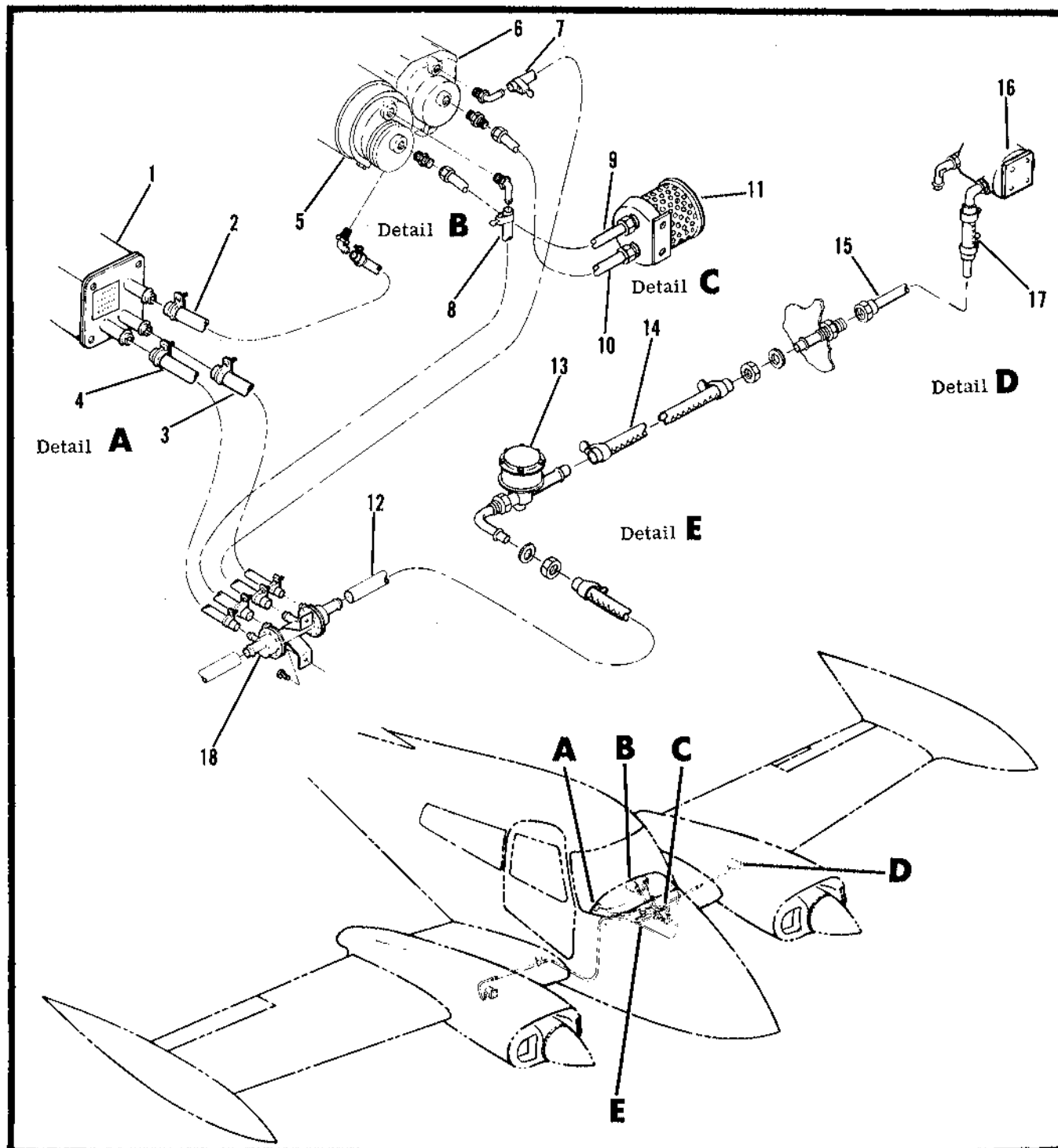
- Remove wing root fillets by removing attaching screws.
- Refer to Section 3, remove the following items:
 - Front seats.
 - Front carpet.
 - Lower center upholstery panel.
- Remove clamps attaching hoses (12) and (14) to relief valve (13).
- Remove relief valve (13) from fuselage skin by removing attaching washer and nut.
- Install vacuum relief valve (13) by reversing procedures as outlined in steps "a" thru "d" above.

Adjustment of Vacuum Relief Valve.

NOTE

Since a relief valve is used for each vacuum source, each relief valve must be adjusted separately.

- Remove wing fairings by removing attaching screws.
- Start the engines and idle the right engine.
- With left engine operating and tachometer reading 1700 RPM, the suction gage should read 5.00 inches of mercury.
- 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.
- Idle the left engine and operate the right engine so tachometer reads 1700 RPM.
- Adjust the right relief valve by loosening the knurled screw locknut and adjusting to obtain the 5.00 vacuum reading. Clockwise rotation of the adjusting screw increases the vacuum.
- With both engines operating at tachometer RPM of 1700, the suction gage should read 5.00 ± 0.25 inches of mercury. If the gage reading is not within these limits, the relief valves should be readjusted to these limits.
- Shutdown both engines and check that the locknuts on the knurled adjusting screw are tight.
- Install wing fairings.



1. Suction Gage
2. Suction Gage to Horizontal Gyro Hose
3. Suction Gage to LH Manifold Hose
4. Suction Gage to RH Manifold Hose
5. Horizontal Gyro
6. Directional Gyro
7. Directional Gyro to Manifold Hose
8. Horizontal Gyro to Manifold Hose
9. Filter to Horizontal Gyro Hose

10. Filter to Directional Gyro Hose
11. Vacuum Air Filter Assembly
12. Manifold to Regulator Valve Hose
13. Relief Valve
14. Regulator Valve to Engine Nacelle Hose
15. Engine Nacelle Line Assembly
16. Vacuum Pump
17. Coupling Hose
18. Manifold

Figure 12-6. Vacuum System Installation

Removal of Vacuum System Plumbing. (See figure 12-6.)

NOTE

Removal procedures will be given for left engine installation only. Removal of right engine installation is basically the same.

- a. Refer to Section 9 and remove engine nacelle cowls.
- b. Refer to Section 3 and remove the following items:
 1. Front and rear seats; or middle seats (optional equipment).
 2. Center carpet.
 3. Lower center upholstery panel.
- c. Disconnect engine nacelle line assembly (15) from vacuum pump (16) by removing clamps and coupling hose (17).
- d. Disconnect line assembly (15) from bulkhead fitting and remove line from engine nacelle.
- e. Remove three wing access covers from underside of wing.
- f. Loosen clamps on hose (14) at relief valve (13) and bulkhead fitting on engine nacelle. Route hose (14) from wing using outboard access openings.
- g. Loosen clamps and disconnect hose (12) from relief valve (13) and manifold (18) and remove hose from fuselage.
- h. Loosen clamps and disconnect hoses (3, 4, 7 and 8) from manifold (18).
- i. Loosen clamps and disconnect hoses (3 and 4) from vacuum gage and hoses (7 and 8) from directional gyro (6) and horizontal gyro (5) respectively. Remove hoses from fuselage.
- j. Loosen clamps on hose (2) and disconnect from vacuum gage and directional gyro. Remove hose from fuselage.
- k. Disconnect hose assemblies (9 and 10) from air filter (11), directional gyro (6) and horizontal gyro (5). Remove hose assemblies from aircraft.

Installation of Vacuum System Plumbing. (See figure 12-6.)

NOTE

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 procedures, except do not install access panels and upholstery until system check is completed.
- b. Check vacuum system and adjust relief valves if system vacuum gage indication is not within specified limits.
- c. Install access covers, upholstery, carpets, seats and engine nacelle cowling.

PITOT-STATIC SYSTEM

A pitot tube, with an electrical heating element to prevent ice from obstructing passage of ram air

pressure, is mounted in the nose of the fuselage. The ram air pressure is routed from the pitot tube to the airspeed indicator through hose and line assemblies. Static pressure is routed from two static pressure flanges, mounted on opposite sides of the aft fuselage, to the airspeed indicator, altimeter, and vertical velocity indicator by a series of hoses, tees, and line assemblies. A drain line and drain valve assembly, located in forward left hand cabin area, is provided to release accumulated moisture and serve as the alternate static pressure source.

Removal of Pitot Tube. (See figure 12-8.)

- a. Remove three screws attaching pitot tube (18) from mount tube (16).
- b. Remove nose cap by removing attaching screws.
- c. Disconnect pitot pressure line (12) from pitot tube (18).
- d. Tag and disconnect pitot tube heating element wires.
- e. Slide pitot tube (18) forward from mount tube (16).

Installation of Pitot Tube. (See figure 12-8.)

- a. Slide pitot tube (18) into mount tube (16).

NOTE

Position pitot tube so drain hole is downward.

- b. Attach pitot pressure line (12) to pitot tube (18).
- c. Attach heater element wires as tagged at removal.
- d. Install nose cap and attaching screws.
- e. Install three screws attaching pitot tube (18) to mount tube (16).

CAUTION

The pitot heater should not be operated on the ground as it will overheat and damage the heating element.

Removal of Pitot and Static Lines. (See figure 12-8.)

The locations of all pitot and static lines are shown in figure 12-8. All lines are standard aluminum tubing except for the flexible hoses attached to the instruments. All the lines and hoses are equipped with conventional fittings and may be removed when necessary.

NOTE

Static line (3) must be cut to facilitate removal and should only be removed if replacement is necessary.

Installation of Pitot and Static Lines. (See figure 12-8.)

Install lines as illustrated in figure 12-8 using petro-

latum to lubricate all male fittings, omitting the first two threads.

NOTE

Install static line (3) through grommets. Install nut (23) and sleeve (22) on static line (3) before flaring forward end of line.

Testing the Static Pressure System. (See figure 12-8.)

a. Set altimeter to read 1500 feet by rotating pressure setting knob.

NOTE

Check to see that static drain valve is closed.

b. Seal static opening (1) on one side of fuselage with masking tape.

c. Connect a suction source to static opening (1) on opposite side of fuselage.

NOTE

If autopilot is installed, the autopilot static line must be disconnected and plugged during testing.

d. Slowly apply suction until altimeter shows a 2000 foot increase in altitude (3500 feet reading), "pinch off" tube and hold for one minute.

CAUTION

When applying or releasing suction, take care not to exceed rate range of vertical velocity indicator.

e. The leak down rate should not exceed 100 feet of altitude in one minute (3400 feet reading).

f. If leak down rate exceeds 100 feet per minute, slowly remove suction source and proceed as follows:

g. Disconnect static lines from altimeter, vertical velocity indicator and airspeed indicator. Plug static lines and attach a source of pressure to static opening (2).

CAUTION

Do not apply positive pressure to static lines with instruments connected. Be sure that the altitude hold on autopilot computer is disconnected.

h. Apply a slight pressure and coat lines with a mild solution of soap and water to locate leak.

i. Tighten or repair faulty connections or replace damaged lines. Remove line plugs and pressure source and reconnect hoses to respective units.

j. Repeat steps "c" through "e" to be sure instruments are connected correctly and do not leak.

k. If scale drop of altimeter pointer is less than 100 feet in one minute, leak is negligible. Slowly remove static suction source.

l. Remove masking tape from static opening (2).

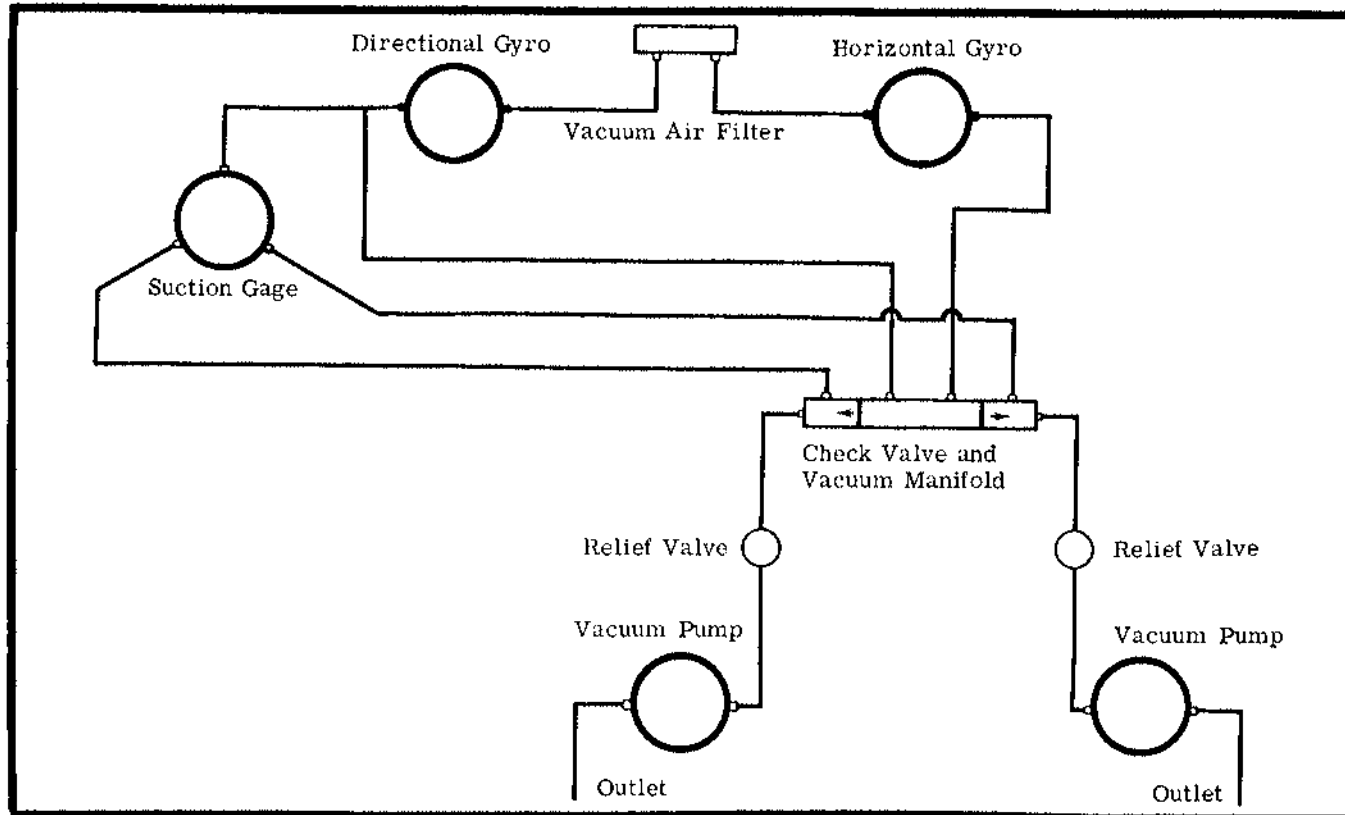
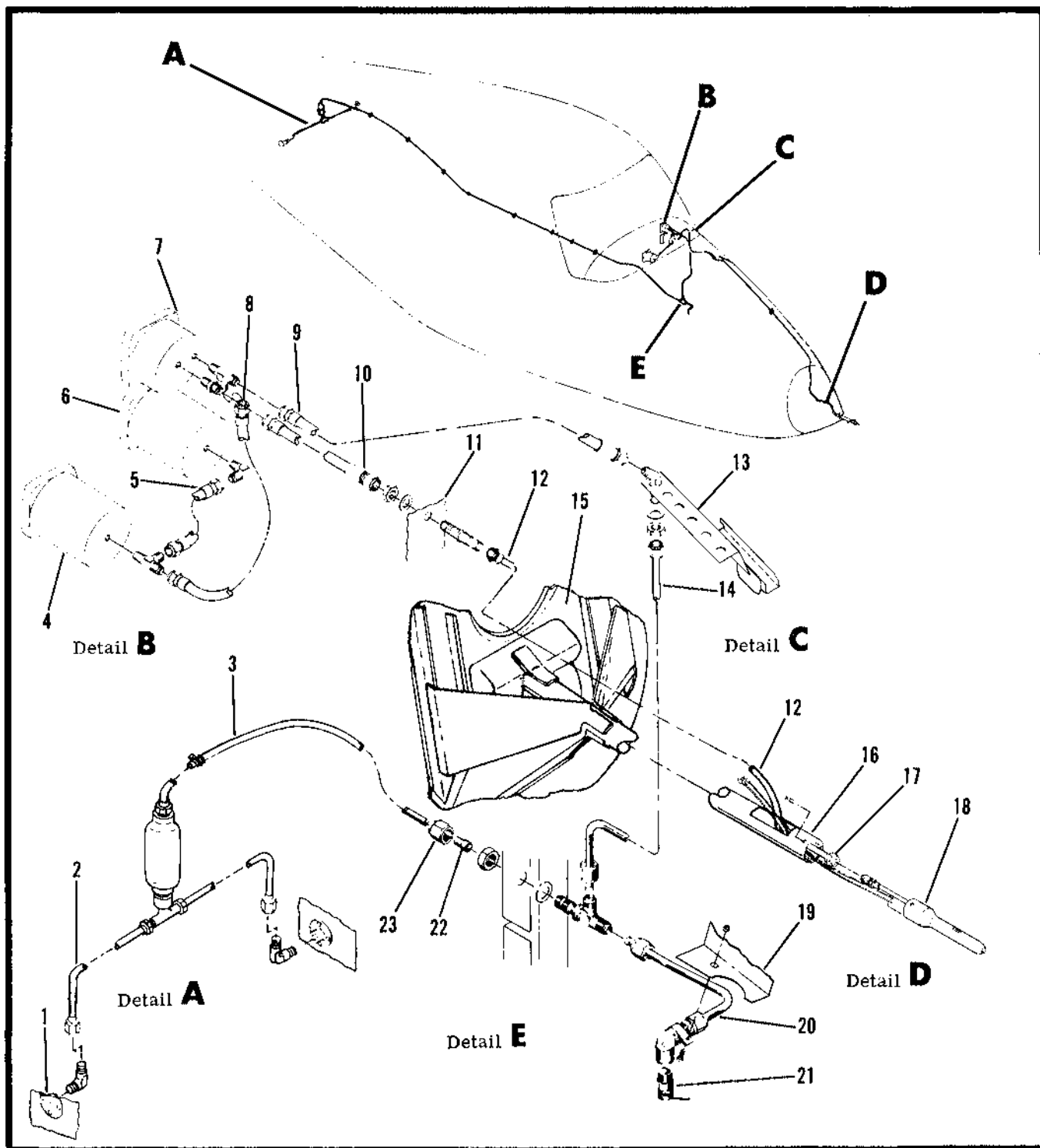


Figure 12-7. Vacuum System Schematic



1. Static Opening	9. Hose (Airspeed to Bracket)	16. Mount Tube
2. Static Crossover Line	10. Hose (Airspeed to Bulkhead)	17. Pitot Extension Line
3. Static Line	11. Forward Cabin Bulkhead	18. Pitot Tube
4. Vertical Velocity Indicator	12. Pitot Pressure Line	19. Parking Brake Bracket
5. Hose (Vertical Velocity to Altimeter)	13. Tube Support Bracket	20. Static Drain Line
6. Altimeter	14. Forward Static Line	21. Drain Valve
7. Airspeed Indicator	15. Nose Bulkhead	22. Sleeve
8. Hose (Vertical Velocity to Airspeed)		23. Nut

Figure 12-8. Pitot-Static System Installation

Testing the Pitot Pressure Lines. (See figure 12-8.)

The pitot pressure line, which carries impact pressure to the airspeed indicator, is tested as follows:

- Connect a pressure source to opening in pitot tube assembly (18).
- 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.

- If airspeed indicator drops more than 10 MPH in one minute, disconnect hose from airspeed indicator.
- Plug hose and apply pressure.
- Coat lines and connections with a solution of soap and water to locate leak.
- Tighten or repair faulty connections. 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 line.

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 or static lines toward the instruments. Doing so may damage them.

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:

- Disconnect static line to instruments from the static line drain valve tee.
- Cap or plug open end of tee.
- Open static source drain valve.
- Plug one static port.
- Purge the system from the drain valve with clean moisture free air for a period of at least two minutes.

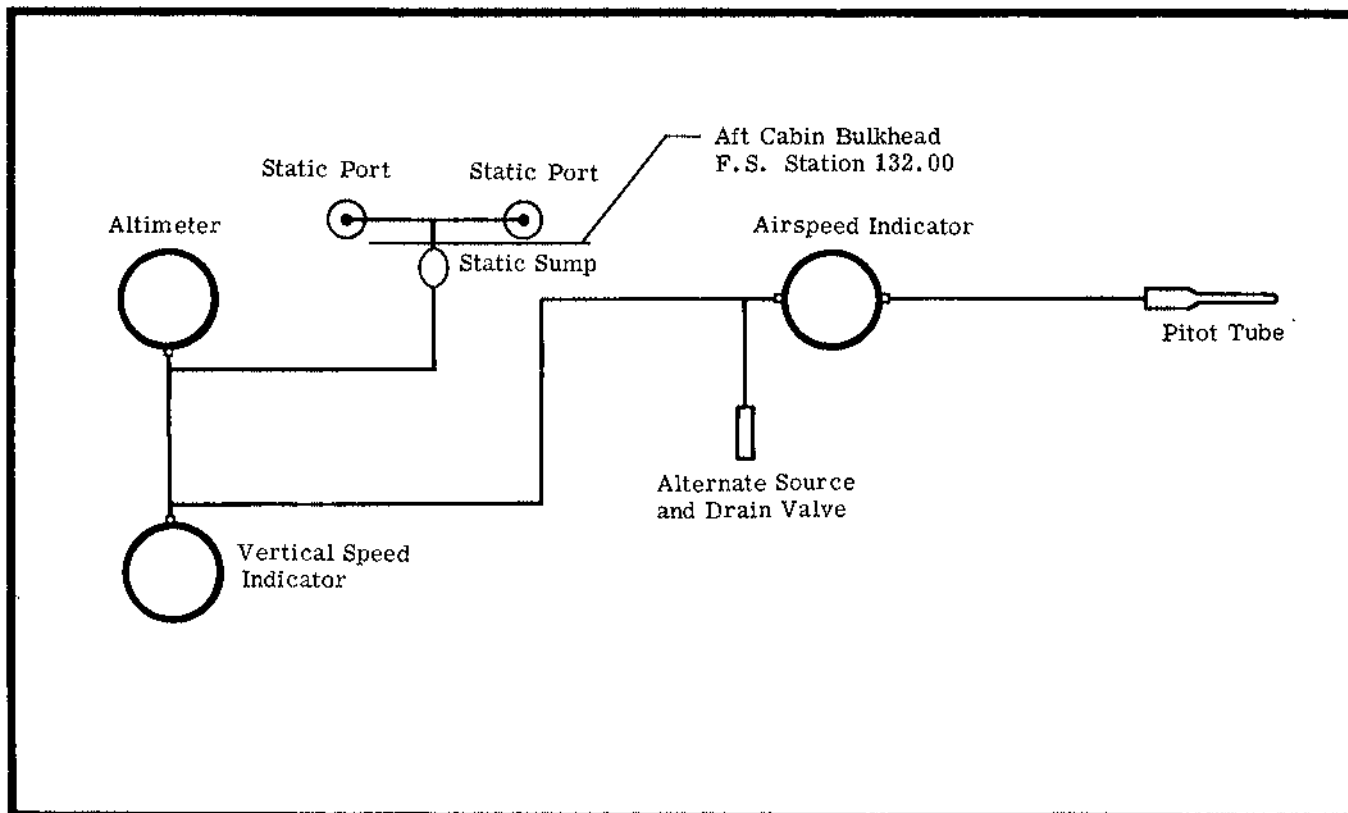
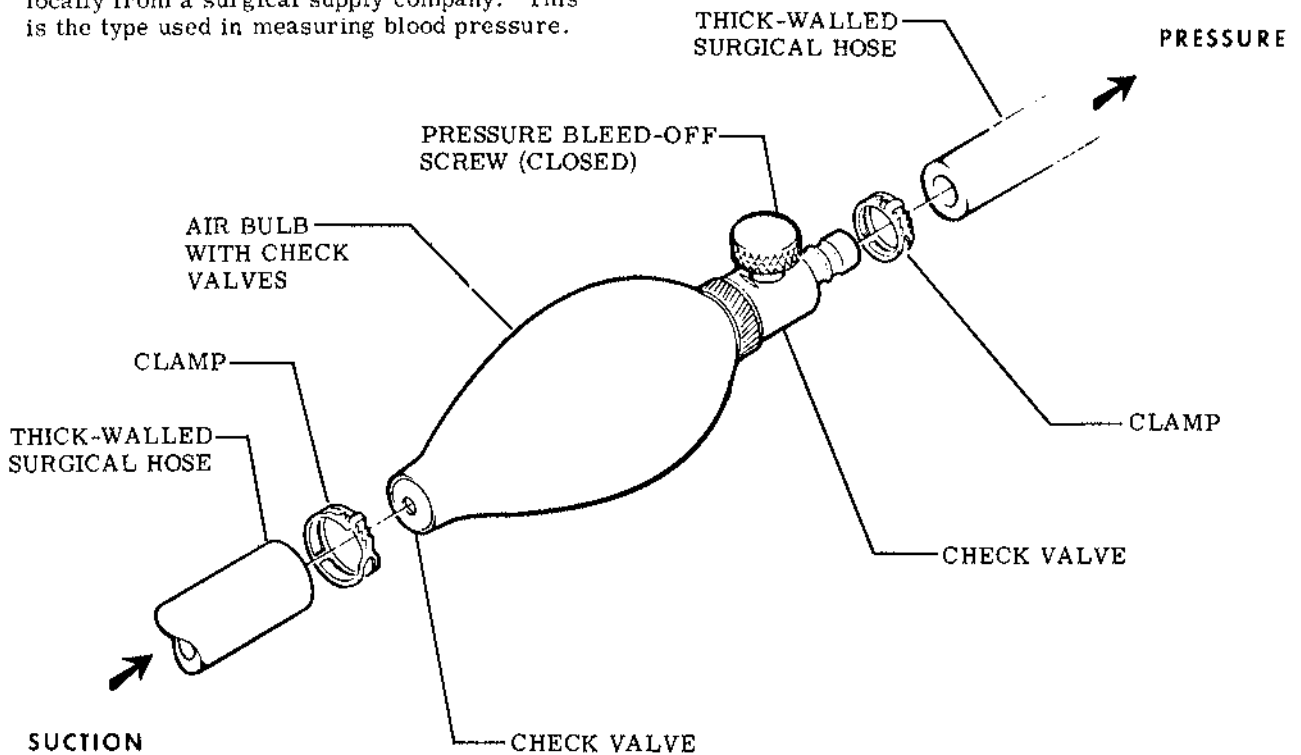


Figure 12-9. Pitot Static System Schematic

NOTE

Air bulb with check valves may be obtained locally from a surgical supply company. This is the type used in measuring blood pressure.



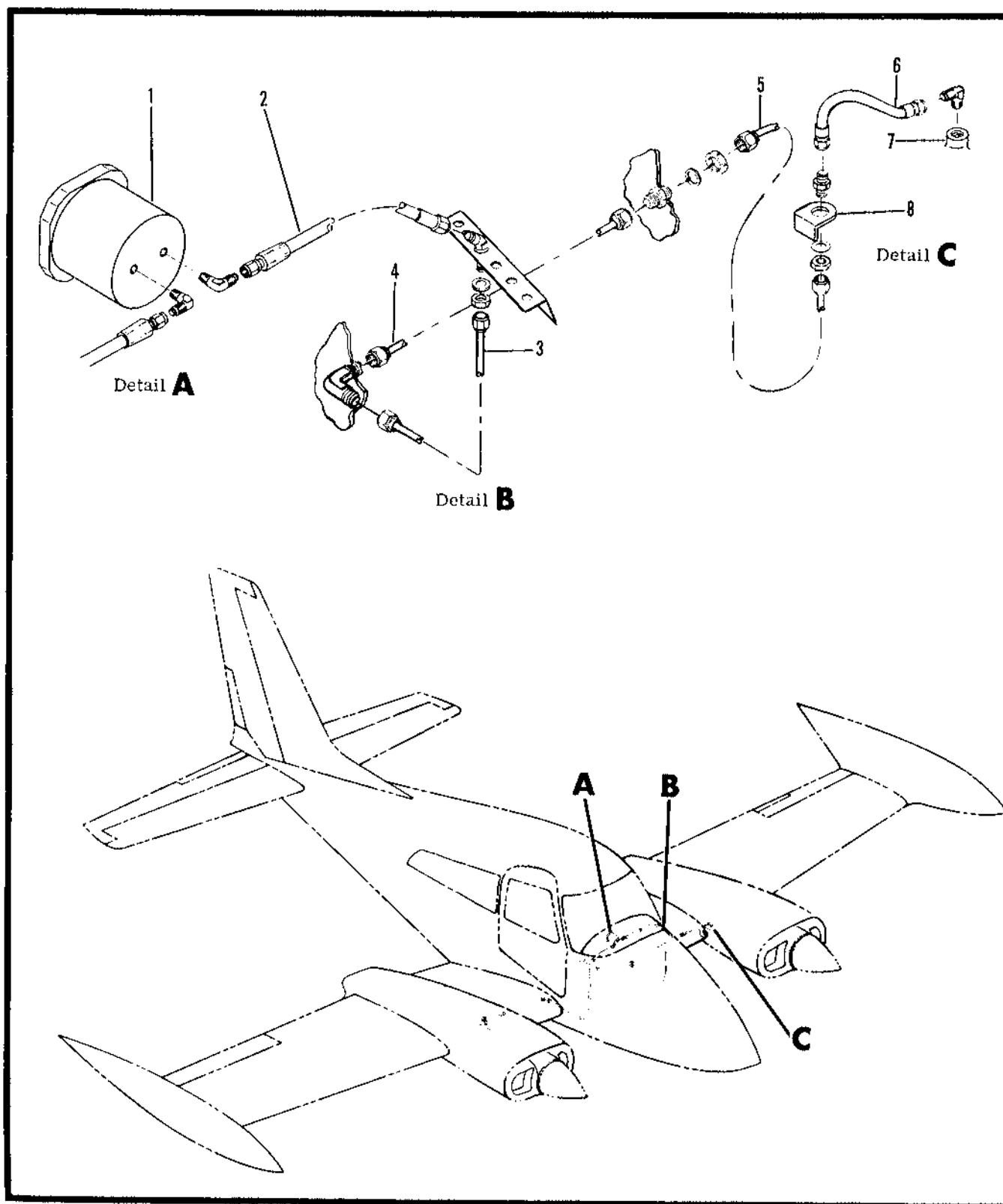
TO APPLY SUCTION:

1. Squeeze air bulb to expel as much air as possible.
2. Hold suction hose firmly against static pressure source opening.
3. Slowly release air bulb to obtain desired suction, then pinch hose shut tightly to trap suction in system.
4. After leak test, release suction slowly by intermittently allowing a small amount of air to enter static system. To do this, tilt end of suction hose away from opening, then immediately tilt it back against opening. Continue to admit this small amount of air intermittently until all suction is released, then remove test equipment.

TO APPLY PRESSURE:

1. Connect pressure hose to pitot tube.
2. Slowly squeeze air bulb to apply desired pressure to pitot system. Desired pressure may be maintained by repeatedly squeezing bulb to replace any air escaping through leaks.
3. Release pressure by slowly opening pressure bleed-off screw, then remove test equipment.

Figure 12-10. Static System Test Equipment



1. Manifold Pressure Gage	5. Line Assembly (Nacelle Rib to Bracket)
2. Hose Assembly (Gage to Bracket)	6. Hose Assembly (Bracket to Manifold)
3. Line Assembly (Bracket to Fuselage Skin)	7. Intake Manifold
4. Line Assembly (Fuselage Skin to Nacelle Rib)	8. Bracket

Figure 12-11. Manifold Pressure System Installation

RELATED SYSTEMS

- f. Plug opposite static port and repeat step e.
- g. Remove cap or plug from static line drain valve tee.
- h. Connect static line to instruments to the static line drain valve tee.
- i. Leak check static system in accordance with testing procedures.

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 Lines. (See figure 12-11.)

- a. Refer to Section 9 and remove engine cowls.
- b. Refer to Section 3 and remove the following items:
 - 1. Front seats.
 - 2. Front carpet.
 - 3. Lower center upholstery panel.
- c. Disconnect hose assembly (2) from manifold gage (1) and bracket.
- d. Disconnect line assembly (3) from bracket and elbow at fuselage skin.

- e. Disconnect line assembly (4) from elbow at fuselage skin and union at nacelle root rib. Route line assembly from wing.

NOTE

It may be necessary to bend the line slightly to facilitate removal, however, excessive bending should be avoided to prevent possible damage to line.

- f. Disconnect line assembly (5) from unions on nacelle root rib and bracket (8) and remove line assembly from engine compartment.

- g. Disconnect hose assembly (6) from union on bracket (8) and intake manifold (7).

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.

Installation of Manifold Pressure Lines. (See figure 12-11.)

- a. Install manifold pressure lines by reversing removal procedures.

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SECTION 13

UTILITY AND OPTIONAL SYSTEMS

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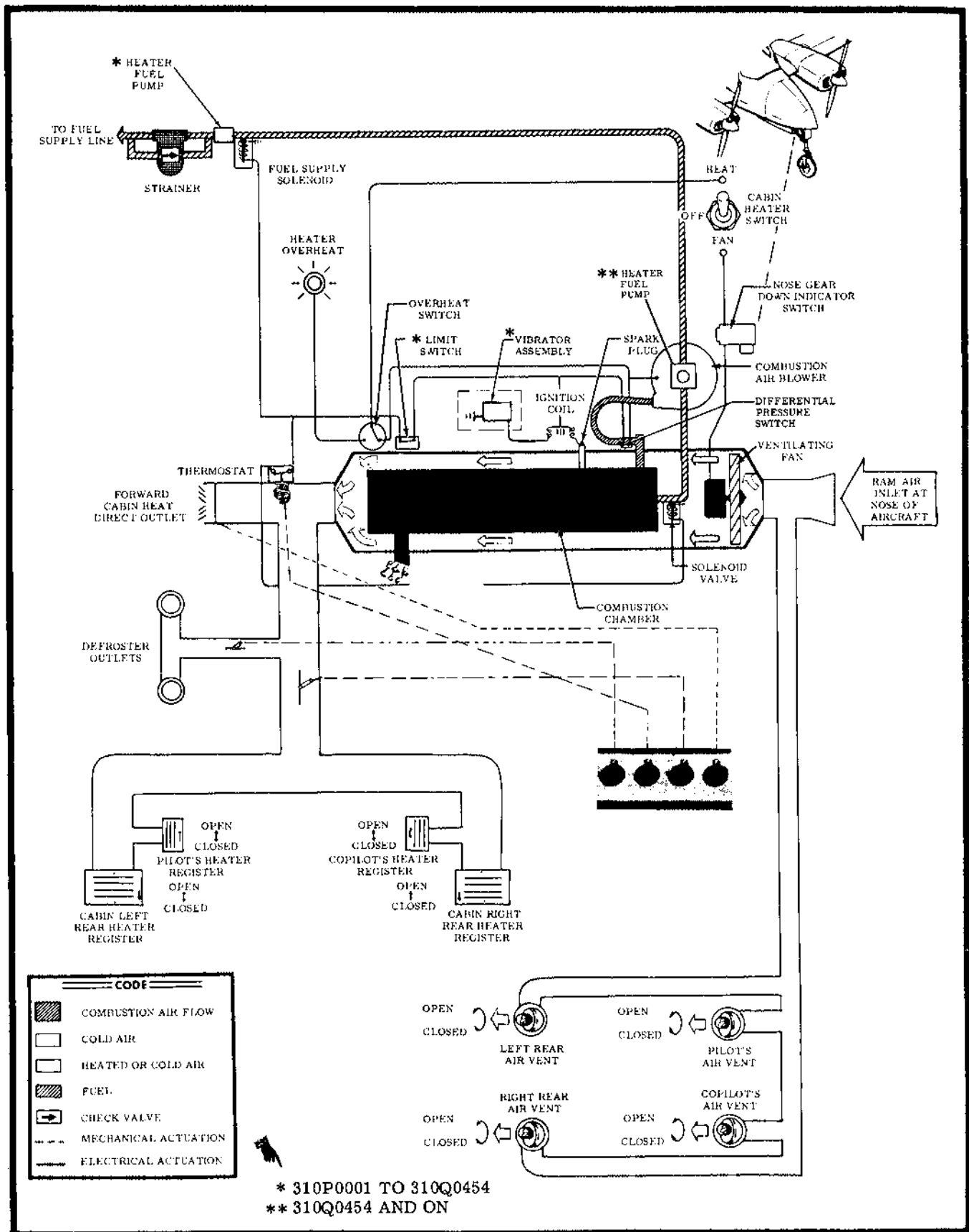


Figure 13-1. Heating, Ventilating and Defrosting Schematic

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HEATING, VENTILATING AND DEFROSTING SYSTEM. (See figure 13-1.)

The heating and ventilating system provides controlled air, either heated or cool, to all areas of the cabin. Air is supplied to the heater through a ram air opening in the nose of the aircraft. From the heater, air is ducted to seven controllable heat outlets in the cabin. Two heat outlets are located at the base of the windshield for defrosting purposes, two are located in the forward upholstery side panels (left and right) slightly aft of the rudder pedals, two are on the aft face of the main spar beneath the pilot's and copilot's seat, and a direct air outlet located on the firewall. To insure a sufficient supply of air when ram air cannot be utilized, a ventilating fan is incorporated in the heater which will deliver either cool or heated air, depending on the heater switch. The electrical circuit leading to the ventilating fan is controlled by the nose gear down indicating switch which allows it to operate only when the landing gear is extended. In addition to the ventilation provided by the heating system, a separate ducting system routes ram air to four adjustable wemacs; two are located on the lower corners of the instrument panel and two on the side walls of the aft cabin compartment. Air in the cabin is not recirculated. Fresh air continually enters the system and cabin air is continually exhausted into the slipstream through a spill vent which is located in the baggage compartment.

Description of Heater and Basic Components.

The heater is a gasoline combustion type and is mounted in the right side of the nose section. Fuel is routed from a tee in the fuel crossfeed line through

a shutoff valve, a filter and pulsating pump to the solenoid valve-regulator which regulates the fuel pressure to 7 psi. On aircraft 310Q0454 and On, the fuel pump is mounted on the combustion blower motor. 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. When the nose gear is in the DOWN position, electrical current is also supplied to the ventilating fan. As the combustion air flow increases, the combustion air pressure switch closes and actuates the ignition coil and heater solenoid valve. Fuel then flows through the heater solenoid valve into the combustion chamber spray nozzle which injects a conical shaped spray cone of fuel into the combustion chamber where the spark plug is already sparking, thus combustion occurs. As the heated air flowing from the heater to the cabin exceeds the thermostat setting, the thermostat automatically closes the solenoid valve, stopping fuel flow into the heater. As the heater cools, the thermostat opens the solenoid valve, allowing fuel to flow and combustion takes place since the spark plug is continually sparking. By cycling on and off, the heater maintains an even air temperature in the cabin. The heater combustion chamber is completely separate from the ventilating system to prevent any exhaust gases from contaminating the cabin air. All exhaust gases are vented overboard through an exhaust tube directly beneath the heater.

Troubleshooting the Heater.

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER FAILS TO LIGHT	Heater switch or circuit breaker open.	Position heater switch to HEAT or close circuit breaker.
	Low voltage.	Connect to auxiliary power supply.
	No fuel to system.	Turn on fuel shutoff valve.
	Insufficient fuel pressure caused by faulty fuel pump or no pump current.	Correct faulty fuel pump wiring or repair or replace fuel pump.
	Fuel pump operating but not building up sufficient pressure.	Remove and repair or replace fuel pump.
	Fuel nozzle clogged in heater.	Remove the nozzle and clean or replace it.
	Heater fuel solenoid not operating.	Remove and check solenoid. Replace it if faulty.

Troubleshooting the Heater (Continued).

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER FAILS TO LIGHT (CONT.)	Fuel lines clogged or broken.	Inspect all lines and connections. It may be necessary to disconnect lines at various points to determine where the restriction is located.
	Fuel filter clogged.	Clean fuel filter element.
	Defective vibrator (310P0001 to 310Q0454)	Replace vibrator.
	Defective ignition assembly.	Replace ignition assembly.
	Manual reset limit switch open.	Press reset button and recheck to determine reason for switch opening.
	Combustion air pressure switch open. (From defective switch or low combustion-air blower output.)	Check for low blower output and correct it. If switch is defective, replace it.
	Cycle switch open.	Replace if defective.
	Thermostat switch open.	Operate control to see if switch will come on. Replace switch if defective.
	Short-circuited radio-noise capacitor.	Replace capacitor.
HEATER WILL NOT START AND BLOWERS DO NOT RUN	Faulty or burned-out motor.	Remove combustion air blower for overhaul or replacement.
	Open circuit breaker.	Reset circuit breaker.
	Defective heater switch or wiring.	Replace switch or replace wiring.
VENT AIR BLOWER RUNS BUT COMBUS- TION AIR BLOWER DOES NOT START	Overheat switch tripped.	Reset switch (find cause of overheating).
	Defective combustion air blower motor.	Replace blower.
VENTILATING AIR BLOWER FAILS TO RUN	Heater switch OFF. Broken or loose wiring to motor.	Turn heater switch to FAN. Check and repair wiring.
	Circuit breaker out.	Close circuit breaker.
	Worn motor brushes.	Replace motor brushes.
	Blower wheel jammed.	Remove and repair the ventilating-air blower.
	Motor burned out.	Remove blower assembly and replace defective motor.
	Defective radio-noise capacitor.	Replace capacitor.
	Faulty wiring to motor.	Inspect and replace faulty wiring.
COMBUSTION AIR BLOWER FAILS TO RUN	Poor ground connection.	Tighten ground screw.
	Worn motor brushes.	Replace motor brushes.

Troubleshooting the Heater (Continued).

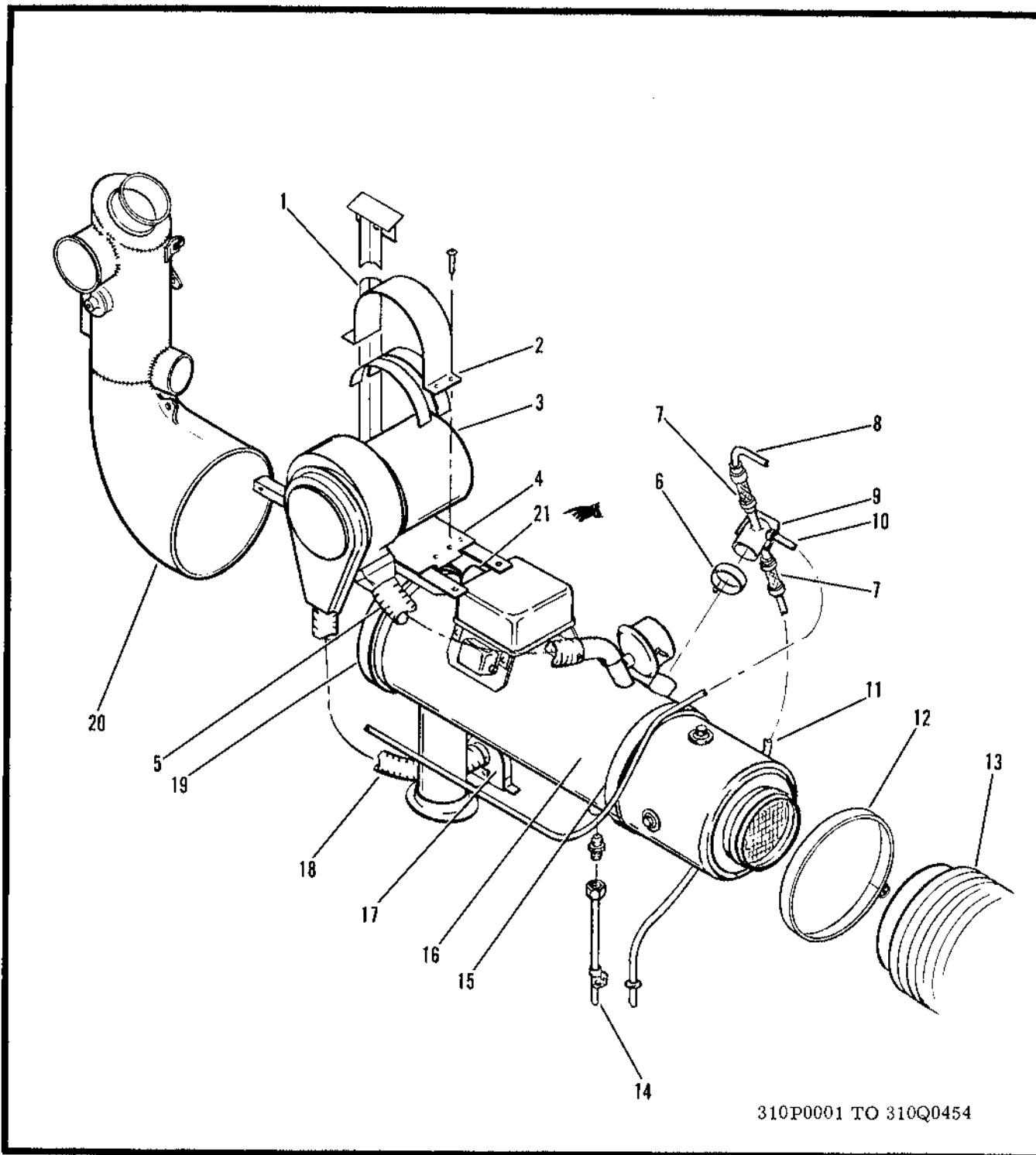
TROUBLE	PROBABLE CAUSE	CORRECTION
COMBUSTION AIR BLOWER FAILS TO RUN (CONT.)	Blower wheel jammed. (Usually indicated by hot motor housing.)	Overhaul the combustion-air blower.
BOTH BLOWERS RUN BUT HEATER FAILS TO START	Defective spark plug.	Replace plug.
	Obstruction in comb. air passage.	Remove obstruction.
	Defective ignition coil.	Replace coil.
	Defective solid state ignition unit.	Replace ignition unit.
	Open circuit in thermostat.	Replace thermostat.
	Defective solenoid coil or clogged nozzle.	Replace nozzle holder and solenoid assembly.
	Open circuit in duct limit switch.	Replace switch.
	Defective fuel pump.	Replace or overhaul pump.
	Remote solenoid closed.	Repair or replace solenoid.
	Open circuit in radio noise filter.	Replace filter.
HEATER STARTS THEN GOES OUT	Airflow switch open.	Recalibrate switch or correct cause of low comb. air flow.
	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.
	Damaged overheat switch.	Replace the switch.
	Damaged cycling switch.	Adjust or replace the switch.
HEATER FIRES BUT BURNS UNSTEADILY	Fouled spark plug.	Replace spark plug.
	Insufficient fuel supply.	Inspect fuel supply to heater, including shutoff 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 fluctuates. (Can be caused by low fluctuating voltage, loose blower wheel, worn brushes or defective motor.)	Remove and overhaul the combustion-air blower assembly as required.
	High-voltage leak in lead between ignition assembly and spark plug.	Replace ignition assembly.

Troubleshooting the Heater (Continued).

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER FIRES BUT BURNS UNSTEADILY (CONT.)	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.
HEATER BURNS BUT THERMOSTAT WILL NOT CONTROL TEM- PERATURE	Defective thermostat.	Replace, or adjust thermostat.
	Defective fuel solenoid.	Replace solenoid.
OUTLET AIR TEM- PERATURE TOO HIGH	Insufficient vent air.	Increase vent air flow.
	Defective thermostat.	Replace, or adjust thermostat.
OUTLET AIR TEM- PERATURE TOO LOW	Excessive vent air flow.	Reduce vent air flow.
	Defective thermostat.	Replace, or adjust thermostat.
	Defective duct limit switch.	Replace, or adjust switch.
	Low fuel pressure.	Repair, or replace pump.
	Dirty fuel nozzle.	Replace nozzle.
	Defective overheating switch.	Replace switch.
HEATER TRIPS OVER- HEAT SWITCH	Defective duct limit switch.	Replace, or adjust duct limit switch.
	Defective nozzle.	Replace nozzle.
	Slow combustion blower.	Replace combustion motor.
SMOKING HEATER EXHAUST	Leaking solenoid valve.	Repair valve.
	Leaking solenoid.	Repair valve.
	Delayed ignition caused by intermittent spark.	Replace sparking plug - check coil, ignition unit
HEATER POPS OR BANGS WHEN START- ING OR CYCLING	Defective fuel nozzle.	Replace nozzle.
	Loose burner assembly mounting screws.	Tighten mounting screws.
	Defective nozzle.	Replace nozzle.
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 OUT- PUT 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.

Troubleshooting the Heater (Continued).

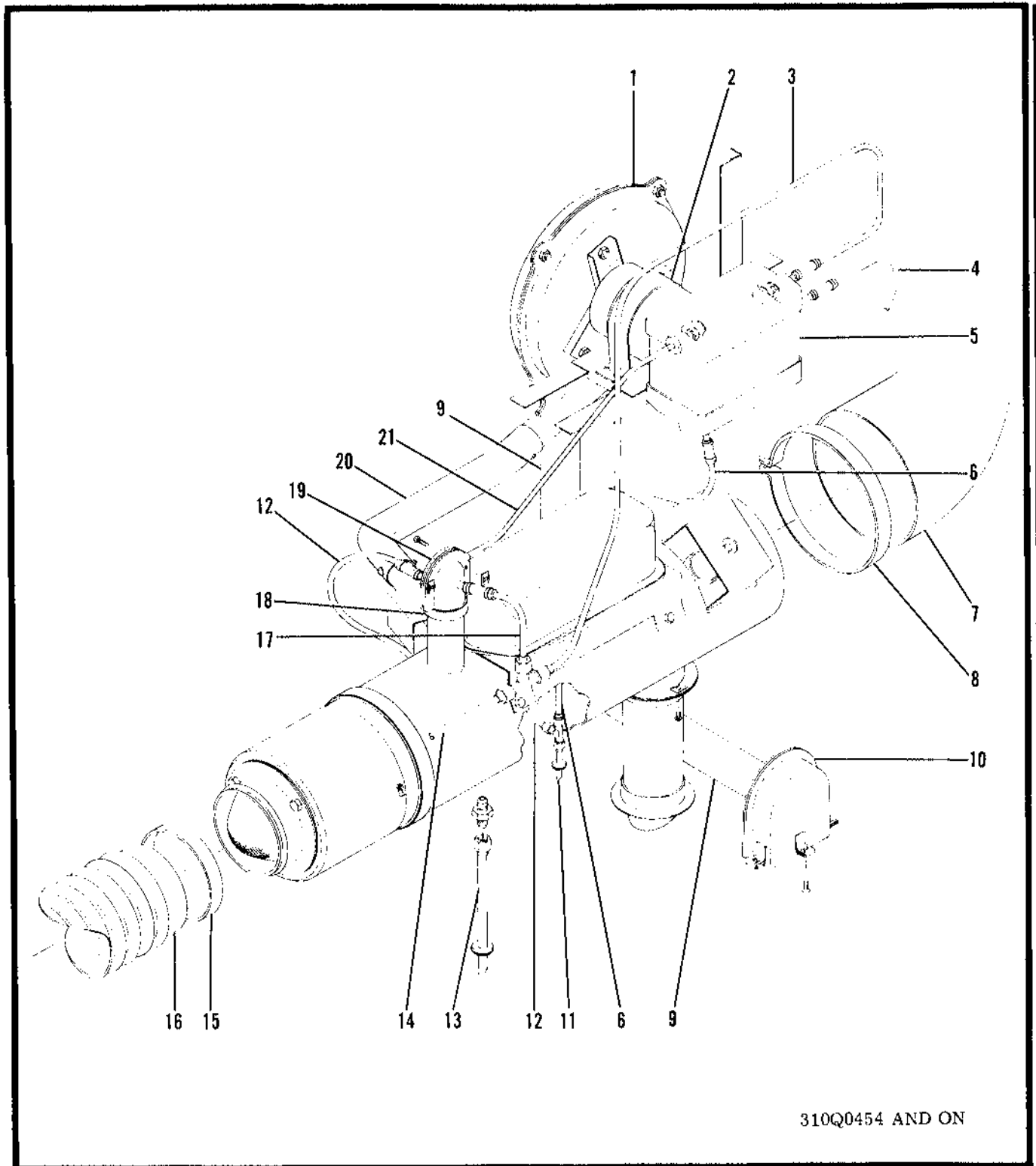
TROUBLE	PROBABLE CAUSE	CORRECTION
INSUFFICIENT HEATER OUTPUT AT HIGH AIR SPEEDS	Malfunction in heater fuel supply.	Perform checks in accordance with functional check of heater fuel supply and heater fuel nozzle. Replace components as necessary.
HEATER OPERATES ON GROUND, BUT NOT IN FLIGHT	Insufficient 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 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.
	Poor thermostat operation	Check thermostat calibration and freedom of movement.
HEATER OPERATES IN FLIGHT, OUTPUT IS LOW	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.



310P0001 TO 310Q0454

1. Support	7. Hose	15. Strap
2. Strap Assembly	8. Vent Air Inlet Line	16. Heater Assembly
3. Combustion Air Blower and Motor Assembly	9. Fuel Inlet Shroud	17. Inlet Assembly
4. Support Assembly	10. Fuel Line Assembly	18. Blower Inlet Tube
5. Blower Outlet Tube	11. Fuel Drain Line	19. Clamps
6. Clamp	12. Clamp	20. Heat Control Assembly
	13. Ram Air Inlet Hose	21. Vibrator
	14. Drain Line	

Figure 13-2. Heater Installation



310Q0454 AND ON

1. Combustion Air Blower Assembly	8. Clamp	15. Clamp
2. Strap Assembly	9. Blower Inlet Tube	16. Ram Air Inlet Hose
3. Vent Air Inlet Line	10. Inlet Assembly	17. Vent Air Inlet Line
4. Fuel Inlet Line	11. Vent Line	18. Clamp
5. Fuel Pump Assembly	12. Shroud Vent Line	19. Fuel Inlet Shroud
6. Fuel Pump Vent Line	13. Drain Line	20. Blower Outlet Tube
7. Heat Control Assembly	14. Vent Air Inlet Line	21. Fuel Line

Figure 13-2A. Heater Installation

Electrical Continuity Checks.

For electrical continuity check, refer to Section 14 and Heater and Components Overhaul/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 fuel pump and heater). Start the heater and observe pressure gage, it should indicate 7 to 8 psi. If this pressure is low, check:

1. Heater Fuel Shutoff Valve (located in right wing leading edge at station 38.16 - check that valve is open.

2. Heater Fuel Pump - with a supply source to the pump (inlet hose in a container of fuel), pump output should be 7 to 8 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. Heater Fuel Pump Filter and Lines - clean filter and check lines for obstructions.

Removal of the Heater. (See figure 13-2.)
310P0001 to 310Q0454

a. If (optional equipment) radio shelves and radio equipment are installed, remove as follows:

1. Tag cable assemblies and remove radio equipment.

2. Drill out rivets attaching angles and angle assemblies to nose bulkheads.

3. Work radio shelves out of nose section through the nose wheel well.

b. Tag and disconnect all electrical wires from the combustion air blower motor (3) and from heater terminal strip.

c. Loosen clamps and slide hoses from fuel inlet shroud (9).

d. Loosen clamp (6) attaching fuel inlet shroud to heater assembly (16), separate shroud halves by removing two attaching screws.

e. Disconnect fuel line assembly (10) from heater assembly (16) at the fitting.

CAUTION

A small amount of fuel will drain from fuel line assembly (10). Wipe away fuel with rags.

f. Disconnect combustion air blower outlet tube (5) from heater elbow by removing attaching nut and bolt.

g. Disconnect combustion air blower inlet tube (18) from inlet assembly (17) by removing attaching nut and bolt.

h. On the underside of heater assembly, loosen support clamp and disconnect drain line (14) from heater assembly (16).

i. Remove four screws attaching clamp (2) to support assembly (4) and remove combustion air blower and motor assembly (3) from aircraft through RH nose access door.

j. Remove four screws and clamp attaching heater assembly (16) to heater control assembly (20).

NOTE

To facilitate removal of blower and motor assembly (3), remove blower inlet tube (18) and outlet tube (5) from blower by removing attaching nuts and bolts.

k. Remove clamp retaining ram air inlet hose (13) to forward inlet of heater assembly and disconnect hose.

l. Remove heater assembly (16) from aircraft by working out through nose wheel well.

Removal of the Heater. (See figure 13-2A.)
(310Q0454 and ON)

a. If (optional equipment) radio shelves and radio equipment are installed, remove as follows:

1. Tag assemblies and remove radio equipment.

2. Drill out rivets attaching angles and angle assemblies to nose bulkheads.

3. Work radio shelves out of nose section through the nose wheel well.

b. Tag and disconnect electrical wires from the heater terminal strip. Disconnect heater case ground wire.

c. Loosen clamps and slide hoses from fuel inlet shroud (18).

d. Loosen clamp (18) and separate shroud halves by removing two attaching screws.

e. Disconnect fuel line (21) from heater fitting.

CAUTION

A small amount of fuel will drain from fuel line. Wipe away fuel with rags.

f. Disconnect combustion air blower outlet tube (20) from heater.

g. Disconnect drain line (13).

h. Remove vent lines (3, 6, 11, 12 and 17).

i. Remove ram air inlet duct (16) by removing clamp (15).

j. Remove heater control assembly (7) by removing clamp (8).

k. Remove heater assembly from aircraft by working out through nose wheel well.

Installation of Heater. (See figure 13-2.)

a. Install in reverse order of removal.

b. If optional radio shelves were removed, install in reverse order of removal.

Disassembly and Assembly of Heater Components.

For disassembly and Assembly of heater components, see Cessna Heater and Components Overhaul/Parts Manual.

Heater Fuel System Components.

These components are a shutoff valve, fuel pump, solenoid valve and a filter, mounted on right wing nose rib, inboard of station 38.16. The fuel pump supplies fuel pressure through the filter to the solenoid valve, which in turn regulates fuel pressure that is supplied to the heater. On aircraft 310Q0454 and On, the fuel pump is mounted on the combustion blower motor. If an overheat condition exists in the heater, the heater fuel pump and solenoid valve will automatically be shut off.

NOTE

Heater fuel pressure is regulated by the solenoid valve which has been preset by the manufacturer. If it becomes necessary to adjust heater fuel pressure, see Cessna Heater and Components Overhaul/Parts Manual.

Removal of Heater Fuel System Components.

- a. Remove access hole covers from lower leading edge at right wing station 38.16.
- b. Close heater fuel shutoff valve.
- c. Disconnect electrical leads from pump and solenoid valve, disconnect and tag all fuel lines to insure proper reinstallation.

NOTE

On aircraft 310Q0454 and On, the fuel pump is mounted on the combustion blower-motor assembly.

- d. Remove bolts attaching pump, filter, and solenoid valve to wing nose rib, route components from wing.

Installation of Heater Fuel System Components.

- a. Install in reverse order of removal.
- b. Move shutoff valve to ON position.
- c. Conduct operational check and check for fuel leaks.
- d. Install access covers.

Cabin Warm Air Vents and Ducting. (See figure 13-3.)

The cabin is heated by five warm air vents. The warm air is routed through warm air ducting and expelled through the heat registers and the forward cabin direct outlet. These registers are controlled by knobs on the right switch and control panel. They also have individual air control knobs which regulate the amount of warm air entering the cabin through the register.

Removal of Cabin Warm Air Vents and Ducting. (See figure 13-3.)

- a. Remove copilot's seat in accordance with Section 3.
- b. Remove right and left warm air registers from

heat ducts by removing attaching screws.

- c. Remove forward floorboard carpeting in accordance with Section 3.
- d. Remove applicable access covers and loosen ducting clamps securing right and left warm air ducting to the heat ducts and the heat control assembly.
- e. Remove right and left cover plate rubber shields and work right and left rear seat ducting out through the nose wheel well opening.

Installation of Cabin Warm Air Vents and Ducting. (See figure 13-3.)

- a. Work right and left rear seat ducting in through nose wheel well opening and replace right and left cover plate rubber shield.
- b. Secure right and left ducting clamps to the heat ducts and heat control assembly, replace access covers.
- c. Replace forward floorboard carpeting in accordance with Section 3.
- d. Replace right and left warm air registers by positioning over heat ducts and securing with screws.
- e. Replace copilot's seat in accordance with Section 3.

Cabin Cool Air Vents and Ducting.

Fresh cool air is routed through the ventilating ducting and expelled through individual wemac valves positioned by each seat. These wemac valves are individually controlled to regulate the amount of fresh air entering each position.

Removal of Cabin Cool Air Vents and Ducting. (See figure 13-3.)

- a. Loosen clamps securing forward air vent ducting to air vent tees and forward air vent adapters. Remove ducting from behind the instrument panel.
- b. Remove forward air vents and forward air vent adapters from the stationary instrument panel, by removing the four attaching screws and nuts.
- c. Loosen clamp securing each end of cool air supply duct and work duct forward and remove.
- d. Loosen clamp securing right warm air duct at each end and remove duct.
- e. Loosen clamps securing crossover duct to air vent tees and remove duct.
- f. Remove front and rear carpets in accordance with Section 3.
- g. Remove upholstery side panels in accordance with Section 3.
- h. Remove outboard access hole covers and cover plates from floorboards by removing attaching screws.
- i. Loosen clamps at the aft end of right and left floorboard ducting and work ducting with supply duct tee and left air vent tee attached, forward and out through routing holes in forward cabin bulkhead.
- j. Loosen clamps at each end of aft air vent ducting and remove ducting.
- k. Remove aft air vent adapters by removing the attaching screws.

Installation of Cabin Cool Air Vents and Ducting. (See figure 13-3.)

- a. Attach forward end of left floorboard duct to air vent tee and work duct into position through routing hole in forward cabin bulkhead. Secure duct to floorboard adapter with clamp.
- b. Attach forward end of right floorboard duct to supply duct tee and work duct into position through routing hole in forward cabin bulkhead. Secure duct to floorboard adapter with clamp.
- c. Position aft air vent adapters and secure with attaching screws.
- d. Install aft air vent ducting and attach to aft air vent adapters and secure with clamps.
- e. Install side panels in accordance with Section 3.
- f. Install front and rear carpet in accordance with Section 3.
- g. Install forward air vents and forward air vent adapters and secure with attaching screws and nuts.
- h. Install forward cool air supply duct and attach to nose duct adapter and supply duct tee with clamps.
- i. Install crossover duct and attach to the air vent tees with clamps.

Heater Switch.

The heater fan is controlled by a three-position toggle switch located on the instrument panel. The positions of the switch are HEAT, OFF and FAN. The HEAT position starts and maintains heater operation, delivering warm air to all heat and defrosting outlets. The OFF position allows the heater ducting to be used as a ventilating system while the aircraft is in flight. The FAN position provides ventilating air to the cabin while the aircraft is on the ground.

Removal and Installation of Heater Switch.

Remove and replace heater switch 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 TEMP CONTROL, LOW (counterclockwise position), and MAX (clockwise position). 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.

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 airflow and heater output.

Removal of Temperature Control.

- a. Loosen screw securing control wire to thermostat actuating arm.
- b. Remove clamp securing coil wire housing to the thermostat.
- 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 thermostat 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 screw.
- d. With control knob turned to the LOW position and the thermostat arm forward, secure arm to the control wire by tightening clamp screw.

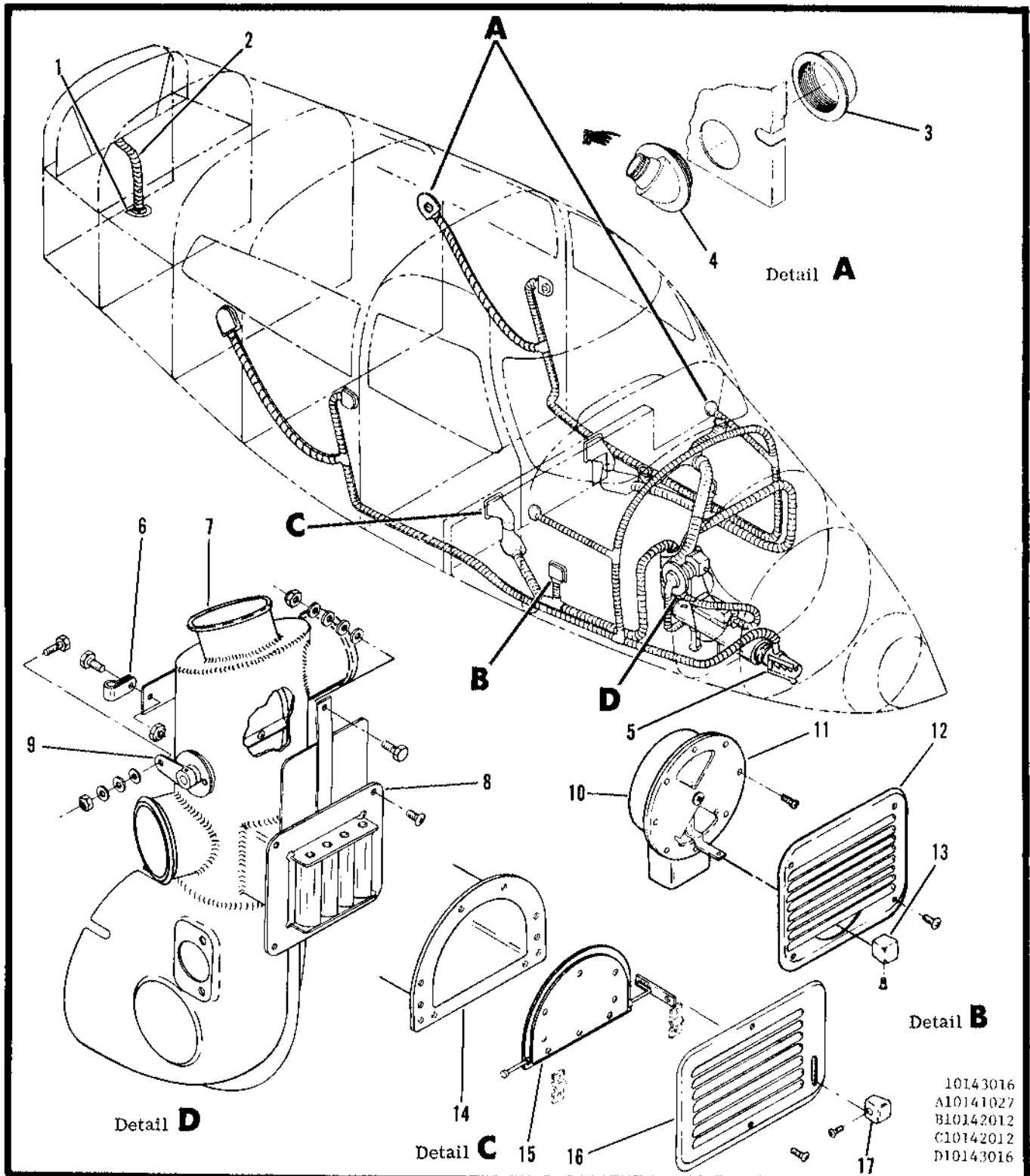
Airflow Controls.

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 routing bracket.
- c. Work defroster control coiled wire housing from routing bracket supporting it to 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 bracket on forward cabin bulkhead, and cabin air control through routing bracket.
- d. With control knobs locked in the CLOSED position and plenum chamber valves closed, insert the control wires through the valve actuating arm clamps and secure by tightening clamp nuts.



1. Clamp	7. Heat Control Assembly	12. Grill
2. Cabin Air Spill Tube	8. Outlet	13. Knob
3. Adapter	9. Arm Assembly	14. Heat Outlet
4. Wemac Valve	10. Adapter	15. Valve and Rod Assembly
5. Nose Inlet Adapter	11. Valve	16. Grill
6. Clamp		17. Knob

Figure 13-3. Heating, Ventilating and Defrosting System Installation

Air Spill Vent Tube.

Removal and Installation of Air Spill Vent Tube.
(See figure 13-3.)

- Refer to Section 3, remove rear upholstery panels.
- Loosen clamps (1) and remove cabin air spill vent tube (2) by sliding from upper and lower adapters.
- Install cabin air spill vent tube (2) by reversing removal procedures.

SURFACE DEICE SYSTEM.

The optional light-weight deicing system consists of inflatable rubber deice boots cemented to the leading edges of the outer wing panels and horizontal stabilizers. Air for inflation of the boots is supplied by the pressure side of the vacuum pump. A left wing light is incorporated on the outboard side of the left

engine nacelle to provide an aid in observing ice formations during night operation.

Operation of the deicing system is through six-second delay action control, labeled WING DEICE ACTUATE, located on the left hand instrument panel. When the control is positioned to ACTUATE, the control valve closes its overboard air valve and redirects the air from the pressure side of the vacuum pump through a filter, shuttle valve and into the deice boots for the inflation cycle. After the six-second inflation cycle is complete, the system returns to its off position. Everytime an inflation cycle is desired, the control must be momentarily positioned to ACTUATE. After a six-second inflation is completed the deflation cycle begins. Air pressure returns through the system and overboard through the control valve. When the shuttle valve has less than 1 psi against it, it closes and the vacuum side of the vacuum pump holds the boots in a deflated position. The pressure indicator light (amber) should light when the control is moved to ACTUATE and the system reaches 10 psi.

Troubleshooting Surface Deice System.

TROUBLE	PROBABLE CAUSE	CORRECTION
DEICE BOOTS DO NOT INFLATE OR INFLATE SLOWLY	Pressure regulator valve set too low or valve malfunction.	Reset or replace pressure regulator valve.
	Solenoid valve malfunction.	Replace solenoid valve.
	Shuttle valve malfunction.	Replace shuttle valve.
	Loose or missing gasket.	Tighten fitting or replace gasket.
	Loose or faulty hose.	Replace hose.
	Loose or faulty wiring.	Tighten or replace wiring.
NOTE If the vacuum pump malfunctions, this system will not operate.		
DEICE BOOTS DO NOT DEFLATE OR DEFLATE SLOWLY	Solenoid valve or control valve malfunction.	Replace valve.

Removal and Installation of Surface Deice System.
(See figure 13-4.)

- For removal and installation of deice system refer to figure 13-4.

Surface Deice System Check.

- Electrical Test:
 - Position deice control to OFF position.
 - Position aircraft battery switch to ON position.
 - Press indicator light to check light circuit and bulb.

- Position deice control to ACTUATE and repeat step 3.

- If indicator light does not function in step 3 and 4, the circuit breaker may have opened. Check for short in the system. Reset circuit breaker and re-check step 3.

b. Air Leakage Test:

- This test can be performed in either the left or right nacelles. The following steps refer to the left nacelle.
 - Disconnect pressure hose from the control valve inlet fitting.
 - Disconnect tube from overboard port and cap the port with an AN929-10 cap assembly.

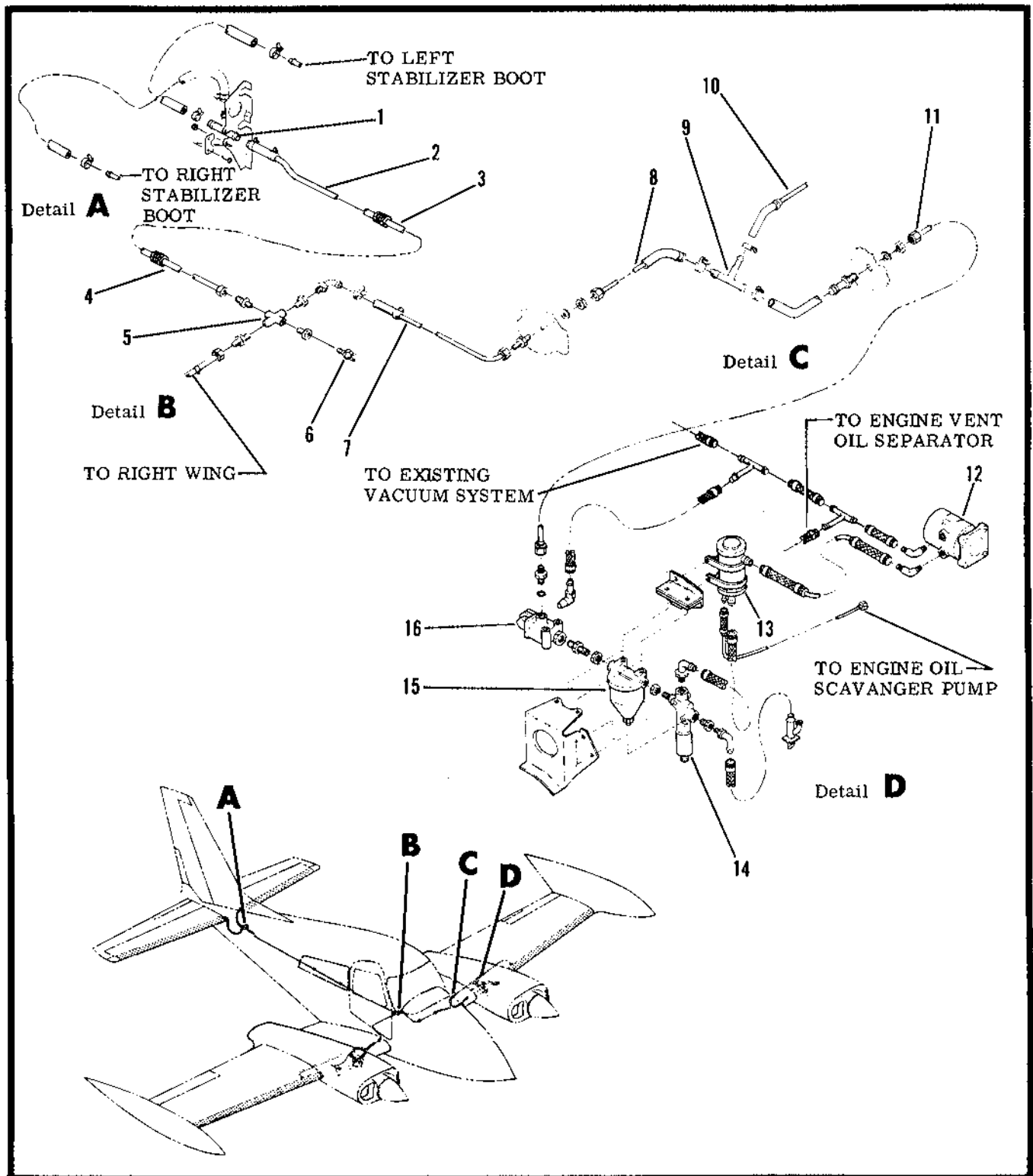


Figure 13-4. Surface Deice Installation

4. Connect a source of clean air to the control valve inlet port. It is necessary that the inlet pressure be a minimum of 18-20 PSIG to perform this test. Include a pressure gage in the air line to observe the system pressures.

5. Apply 18 PSIG pressure to the system and by means of a hand-operated valve, trap the pressure on the deice system. Observe the system for leakage. The leakage rate should not exceed a pressure drop of 4.0 PSIG per minute.

6. To check the pressure switch, turn on the aircraft battery switch while the deice system is under pressure. The indicator light should glow.

7. Remove test equipment, lubricate all threads, and replace all system components.

8. Disassembly or rework of the operating equipment in this system should not be attempted, replace any unit which does not function correctly.

Cold Patch Repair of Deice Boots.

There are four types or areas of damage that are most common to the deice boots. An outline of the cold patch repair procedure for each follows:

NOTE

When repairing the deicer boots and replacement layers are being installed, exercise care to prevent trapping air beneath the replacement layers. If air blisters appear after material is applied, remove them with a hyperdermic needle. Should air blisters appear after boots have been installed, for a length of time, it is permissible to cut a slit in the deicer boot, apply adhesive and repair in accordance with the following cold patch repair procedures. An alternate method of repair is to peel the deicer boot back using Ketone solvent, and reapply using normal adhesives

a. Scuff or Surface Damage. This type of damage is the most commonly encountered and is usually caused by scuffing the outer surface of the deice boots while using scaffolds, refueling hoses, ladders, etc. Repair is generally not necessary because the thick outer veneer provides protection to the natural rubber underneath. If the scuff is severe and has caused removal of the entire thickness of veneer (exposing the brown natural rubber underneath) the damage should be repaired as outlined below:

1. Select a patch (Part Number 3306-1, 3306-2, or 3306-3) of ample size to cover the damaged area.

2. Clean the area to be repaired with a cloth dampened slightly with solvent.

3. Buff the area around the damage with steel wool so that the area is moderately but completely roughened.

4. Wipe the buffed area clean with a cloth slightly dampened in solvent to remove all loose particles.

5. Apply one even thorough coat of cement (Part Number 3306-16) to the patch and to the corresponding damaged area of the deice boot. Allow cement to set until it becomes tacky.

6. Apply patch to the deice boot with an edge or

the center adhering first, then work the remainder of the patch down, being careful to avoid trapping air pockets.

7. Roll the patch thoroughly with a stitcher-roller (Part Number 3306-10) and allow to set for ten to fifteen minutes.

8. Wipe the patch and surrounding area from the center of the patch outward, with a cloth slightly dampened with solvent.

9. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to the patched area.

NOTE

Satisfactory adhesion should be obtained in four hours; however, if the patch is allowed to cure for a minimum of 20 minutes, the deice boots may be inflated to check the repair.

b. Damage to Tube Area. This type of damage consists of cuts, tears, or ruptures to the inflatable tube area and a fabric reinforced patch must be used for this repair. Damage to the tube area should be repaired as outlined below:

1. Select a patch (Part Number 3306-4, 3306-5, or 3306-6) of ample size to extend at least 5/8 inch beyond the damaged area.

NOTE

If none of these patches are of proper size, one may be cut to the size desired from one of the larger patches. If this is done, the edge should be beveled by cutting with the shears at an angle. These patches are manufactured so they will stretch in one direction only. Be sure to cut the patch selected so that the stretch is in the widthwise direction of the inflatable tubes.

2. Clean the area to be repaired with a cloth dampened slightly with solvent.

3. Buff the area around the damage with steel wool so that area is moderately but completely roughened.

4. Wipe the buffed area clean with a cloth slightly dampened in solvent to remove all loose particles.

5. Apply one even thorough coat of cement (Part Number 3306-16) to the patch and the corresponding damaged area of the deice boot. Allow cement to set until it becomes tacky.

6. Apply the patch to the deice boot with the stretch in the widthwise direction of the inflatable tubes, sticking edge of patch in place first and working remainder down with a very slight pulling action so the rupture is closed. Use care not to trap air between patch and deice surface.

7. Roll the patch thoroughly with a stitcher-roller (Part Number 3306-10) and allow to set for ten to fifteen minutes.

8. Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.

9. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to restore conductivity.

NOTE

Satisfactory adhesion of patch to deice boot should be reached in four hours; however,

if the pitch is allowed to cure for a minimum of 20 minutes, the deice boots may be inflated to check the repair.

c. Damage to Fillet Area. This includes any tears or cuts to the tapered area aft of the inflatable tubes. Damage to the fillet area should be repaired as outlined below:

1. Trim damaged area square and remove excess material. Cut must be sharp and clean to permit good butt joint of inlay.

2. Cut inlay from tapered fillet (Part Number 3306-7) to match cutout area.

3. Using solvent, loosen edges of the deice boot around area approximately 1-1/2 inch from all edges.

4. Clean the area to be repaired with a cloth dampened slightly with solvent.

5. Lift back edges of cutout and apply one coat of EC-1300 cement to the underneath side of loosened portion of the boot.

6. Apply one coat of EC-1300 cement to the wing skin underneath the loosened edges of the deice boot and extending 1-1/2 inch beyond edges of deice boot into the cutout area.

7. Apply second coat of cement to underneath side of deice boot as outlined in step 5.

8. Apply one coat of EC-1300 cement to one side of a 2-inch wide neoprene coated fabric tape (Part Number 3306-8) and allow to dry and trim to size.

9. Reactivate cemented surfaces with solvent and apply reinforcing tape to wing skin, using care to center tape under all edges of cutout.

10. Roll down tape on wing skin with stitcher-roller (Part Number 3306-10) to assure good adhesion, being careful to avoid air pockets.

11. Apply one coat of EC-1300 cement to top surface of tape and allow to dry approximately 5 to 10 minutes.

12. Reactivate cemented surfaces with solvent. Working toward cutout, roll down the edges of the loosened deice boot, being careful to avoid trapping air pockets. The edges should overlap on the tape approximately 1 inch.

13. Roughen back surface of inlay repair material (Part Number 3306-7, previously cut to size) with steel wool. Clean with solvent and apply one coat of EC-1300 cement.

14. Apply the second coat of EC-1300 cement to back side of inlay material and allow to dry.

16. Reactivate cemented surfaces with solvent and carefully insert inlay material with feathered edge aft. Working from the leading edge of wing aft, roll down the inlay material carefully to avoid trapping air.

17. Roughen area on outer surface of deice boot and inlay with steel wool 1-1/2 inch on each side of the splice. Clean with solvent and apply one coat of EC-1300 cement to this area.

18. Apply one coat of EC-1300 cement to one side of 2-inch wide neoprene coated fabric tape (Part Number 3306-8) trim to size and center tape over splice on all three sides.

19. Roll down tape on deice boot with stitcher-roller (Part Number 3306-10) to assure good adhesion, being careful to avoid air pockets.

20. Apply one light coat of A-56-B conductive ce-

ment (Part Number 3306-13) to restore conductivity.

d. Damaged Veneer - Loose from Deice Boot. If the veneer should become loosened from the deice boot, repairs should be made as outlined below.

1. Peel and trim the loose veneer to the point where the adhesion of veneer to the deice boot is good.

2. Roughen the area in which veneer is removed with steel wool, rubbing parallel to cut edge of veneer ply to prevent loosening it.

3. Taper edges of veneer down to the tan rubber ply by rubbing parallel to the edges with steel wool and solvent.

4. Cut a piece of veneer material (Part Number 3306-9) to cover the damaged area and extend at least 1 inch beyond in all directions.

5. Mask off an area 1/2 inch larger in length and width than the size of veneer patch.

6. Apply one coat of EC-1300 cement to the damaged area and one coat to the veneer ply. Allow cement to set until it becomes tacky.

7. Roll the veneer ply to the deice boot with a 2-inch rubber roller, applying a slight tension on the veneer ply when applying to prevent trapping air.

8. Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.

9. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to restore conductivity.

Replacement of Surface Deice Boots.

- a. Remove wing tip tank front fairings.

- b. (LH wing only) Remove four screws securing the stall warning transmitter.

- c. Refer to Removal and Installation of Propeller Deice Boots procedures and remove and install deice boots.

- d. Install stall warning transmitter screws on left wing.

- e. Replace tip tank front fairings.

NAV-O-MATIC 400 AUTOPILOT.

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.

Removal of Control Cables. (See figure 13-6.)

- a. Refer to Section 3 and remove the following items:

1. Rear upholstery panel for access to tailcone.

2. Rear reclining, middle individual or fifth and sixth seats (optional equipment).

3. Rear carpet.

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4. Stabilizer fairings.
- b. Remove floorboards above aileron bellcrank and autopilot pulleys.
- c. In the aileron bellcrank area, disconnect turn-buckle (21) and clevis connecting cables (12 and 13) to terminal ends and tie guide wire to cables.
- d. Remove three sets of autopilot pulleys by removing attaching nuts, bolts and cotter pins.
- e. At the roll actuator (15), separate cables (12 and 13) from chain (14) by removing master link on chain.
- f. At the elevator bellcrank (1), disconnect turn-buckles connecting cables (3 and 4) to bellcrank.
- g. At the pitch actuator (5), separate cables (3 and 4) from chain (14) by removing master link on chain.

h. Tag cables (3, 4, 12 and 13) for identification, route through fuselage and remove through the baggage door.

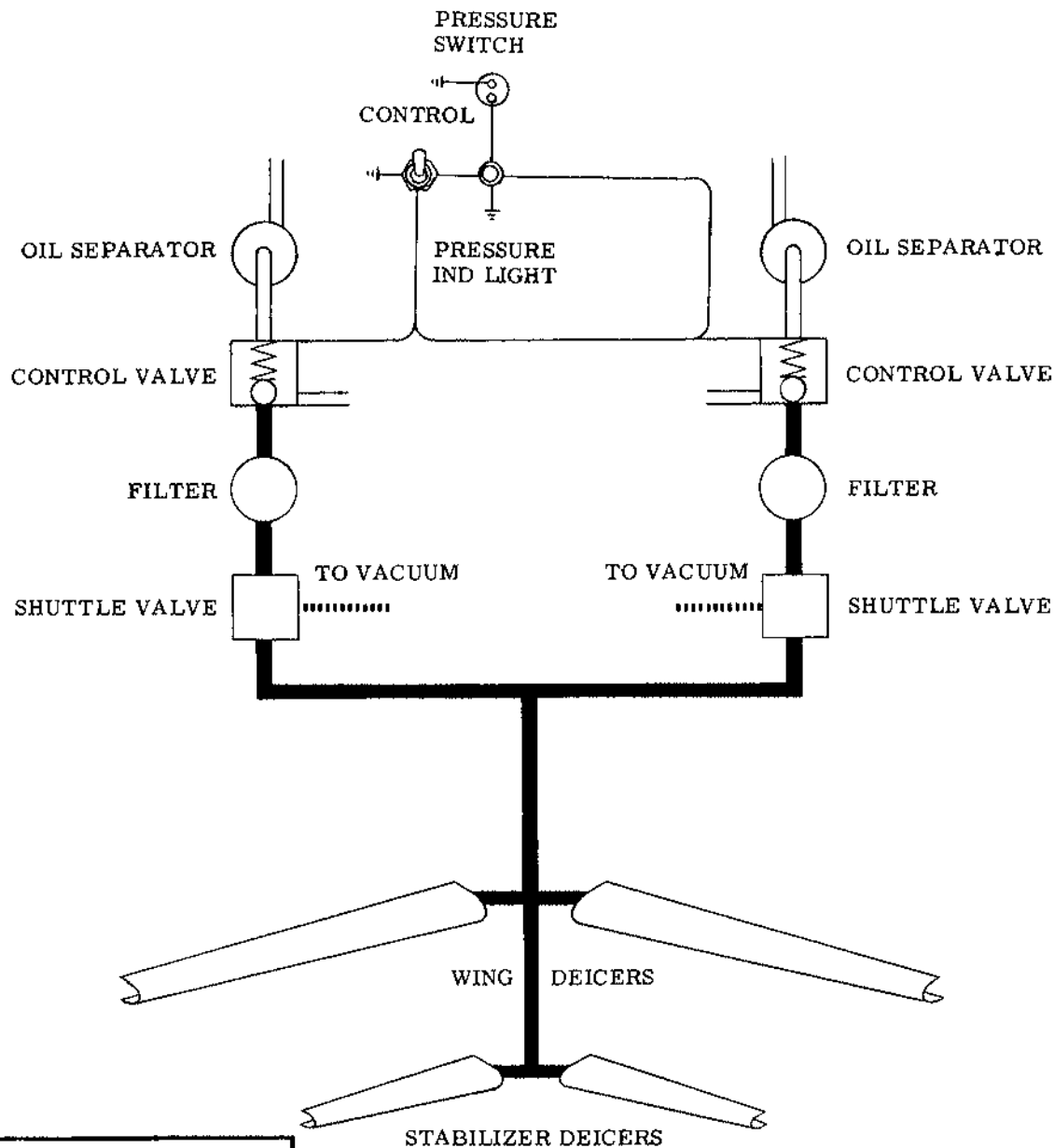
Installation of Control Cables. (See figure 13-6.)

a. Route cables (3, 4, 12 and 13) through baggage

door and tie cables (12 and 13) to guide wires.

b. At the pitch actuator (5), secure cables (3 and 4) to chain (14) with master link.

c. Route cables (3 and 4) to elevator bellcrank (1) and attach cables to terminal ends with turnbuckle and clevis.



SCHEMATIC FOR AIRCRAFT
EQUIPPED WITH LIGHT WEIGHT
DEICE SYSTEM

Figure 13-5. Surface Deice Schematic

- d. Route cables (12 and 13) forward through fuselage, connect cable ends to terminals which are attached to cable clamp (20) with turnbuckle (21).
- e. At the roll actuator (15), secure cables (12 and 13) to chain (14) with master link.
- f. Install three sets of pulleys at fuselage stations 132.00, 109.37 and 89.25 with attaching bolts, nuts and cotter pins.

NOTE

Install pulleys so that cable (12) is routed beneath the upper pulley at fuselage station 132.00 and beneath left-hand pulleys at fuselage stations 109.37 and 89.25. Likewise, cable (13) is routed beneath lower and right-hand pulleys.

- g. Rig cables in accordance with rigging procedures.

NOTE

After rigging is complete, turn on autopilot and verify that the control surfaces respond in the correct direction. Assist the movement of the elevator by pulling back on control wheel, this will aid in overcoming the counterbalance of the elevator bob-weight.

- h. Install floorboards.
- i. Refer to Section 3 and install the following items:
 - 1. Rear upholstery panel.
 - 2. Rear carpet and seats.
 - 3. Install stabilizer fairings.

Removal and Installation of Actuators and Computer.
(See figure 13-6.)

- a. Refer to Section 3 and remove the following items:
 - 1. Remove rear seats and upholstery panel.
 - 2. Stabilizer fairings.
- b. Remove pitch actuator (5) as follows:
 - 1. Relieve tension on cables (3 and 4) by loosening turnbuckles at elevator bellcrank (1).
 - 2. Disengage cables (3 and 4) and chain (14) from sprocket on actuator (5).
 - 3. Disconnect electrical cable assembly (10) from pitch actuator (5).
 - 4. Remove four screws, washers and lockwashers attaching pitch actuator (5) to shelf.
 - 5. Remove pitch actuator from tailcone.
- c. Remove roll actuator (15) as follows:
 - 1. Relieve tension on cables (12 and 13) by loosening turnbuckle (21) near cable clamp (20).
 - 2. Disengage cables (12 and 13) and chain (14) from sprocket on actuator (15).
 - 3. Disconnect electrical cable assembly (9) from roll actuator (15).
 - 4. Remove four screws, washers and lockwashers attaching roll actuator (15) to shelf.
 - 5. Remove roll actuator from tailcone.
- d. Remove computer (7) as follows:
 - 1. Disconnect line assembly (6) from computer (7).
 - 2. Disconnect electrical cable assemblies (8, 9 and 10) from computer (7).

- 3. Remove four nuts and screws attaching computer (7) to shelf.

- 4. Remove computer from tailcone.

- e. Install computer (7), roll actuator (15) and pitch actuator (5) by reversing removal procedures. Rig cables in accordance with rigging procedures.

Removal and Installation of Gyros.

- a. Refer to Section 12 for typical removal and installation.

Removal and Installation of Switches.

- a. Refer to Section 14 for typical removal and installation of electrical switches.

Removal and Installation of Controller. (See figure 13-6.)

- a. Disconnect electrical cable assembly from controller (27).
- b. Remove controller (27) and bezel (26) from retainer (28).
- c. Install controller (27) by reversing removal procedures.

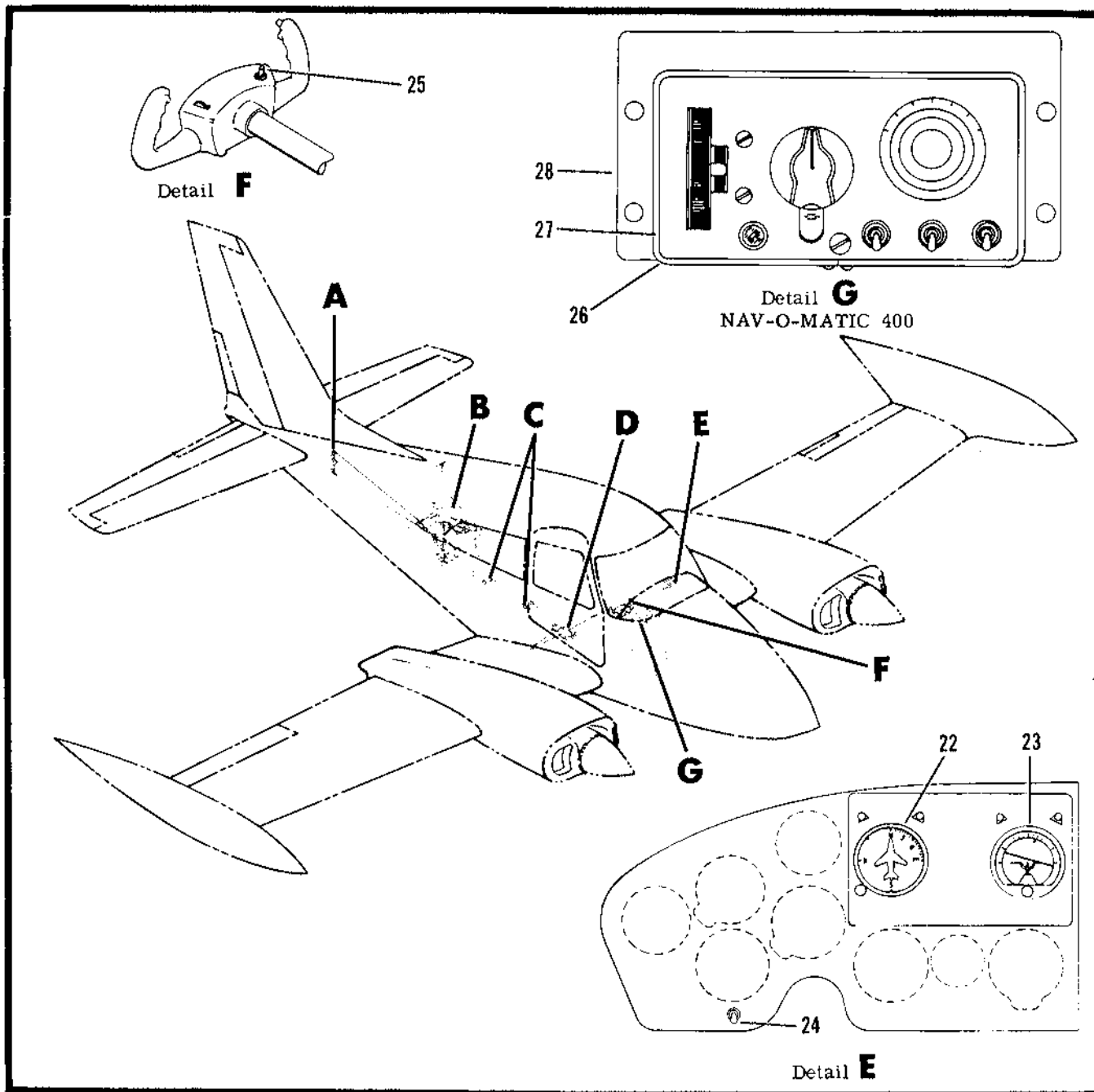
Rigging Nav-O-Matic 400 Autopilot Control Cables.
(See figure 13-6.)

- a. Rig aileron control cables as follows:
 - 1. Verify that aileron control system is properly rigged.
 - 2. Using a clamp or other locking device, lock ailerons in the neutral position.
 - 3. Place chain (14) evenly over sprocket on actuator (15). Slide cable clamps (20) outboard from bracket (16) until slack is removed from cables (12 and 13). Tighten cable clamps (20) in place.

NOTE

Cable clamps (20) must be equal distance from bracket (16) to properly rig aileron cables.

- 4. Rig the aileron actuator cables (12 and 13) to 12 ± 3 inch-pounds tension by tightening turnbuckle.
- 5. Remove locking device from aileron control surfaces and move aileron through entire travel. Observe chain (14) on actuator (15) for sufficient remaining links at the extreme travel limits.
- 6. Safety turnbuckles.
- b. Rig elevator control cables as follows:
 - 1. Verify that aileron control system is properly rigged.
 - 2. Using a clamp or other locking device, lock elevator in the neutral position.
 - 3. With elevator control surface in the neutral position, place chain (14) evenly over sprocket on actuator (5) and attach cables (3 and 4) to links (2) on bellcrank (1).
 - 4. Rig the elevator actuator cables (3 and 4) to 12 ± 3 inch-pounds tension by tightening the turnbuckles.



1. Elevator Bellcrank
2. Link
3. Elevator Cable (Upper, Actuator to Bellcrank)
4. Elevator Cable (Lower, Actuator to Bellcrank)
5. Pitch Actuator
6. Line Assembly (Computer to Static Line)
7. Computer Amplifier
8. Cable Assembly (Computer to Controller)
9. Cable Assembly (Roll Actuator to Computer)
10. Cable Assembly (Pitch Actuator to Computer)
11. Pulley
12. Cable Assembly (Top, Actuator to Aileron Cable)
13. Cable Assembly (Bottom, Actuator to Aileron Cable)
14. Chain Assembly

15. Roll Actuator
16. Bracket
17. Left Aileron Cable
18. Aileron Bellcrank Assembly
19. Right Aileron Cable
20. Cable Clamp
21. Turnbuckle
22. Directional Gyro
23. Horizontal Gyro
24. Selector Switch
25. Disengage Switch
26. Bezel
27. Controller
28. Retainer

Figure 13-6. Nav-O-Matic 400 (Sheet 1 of 2)

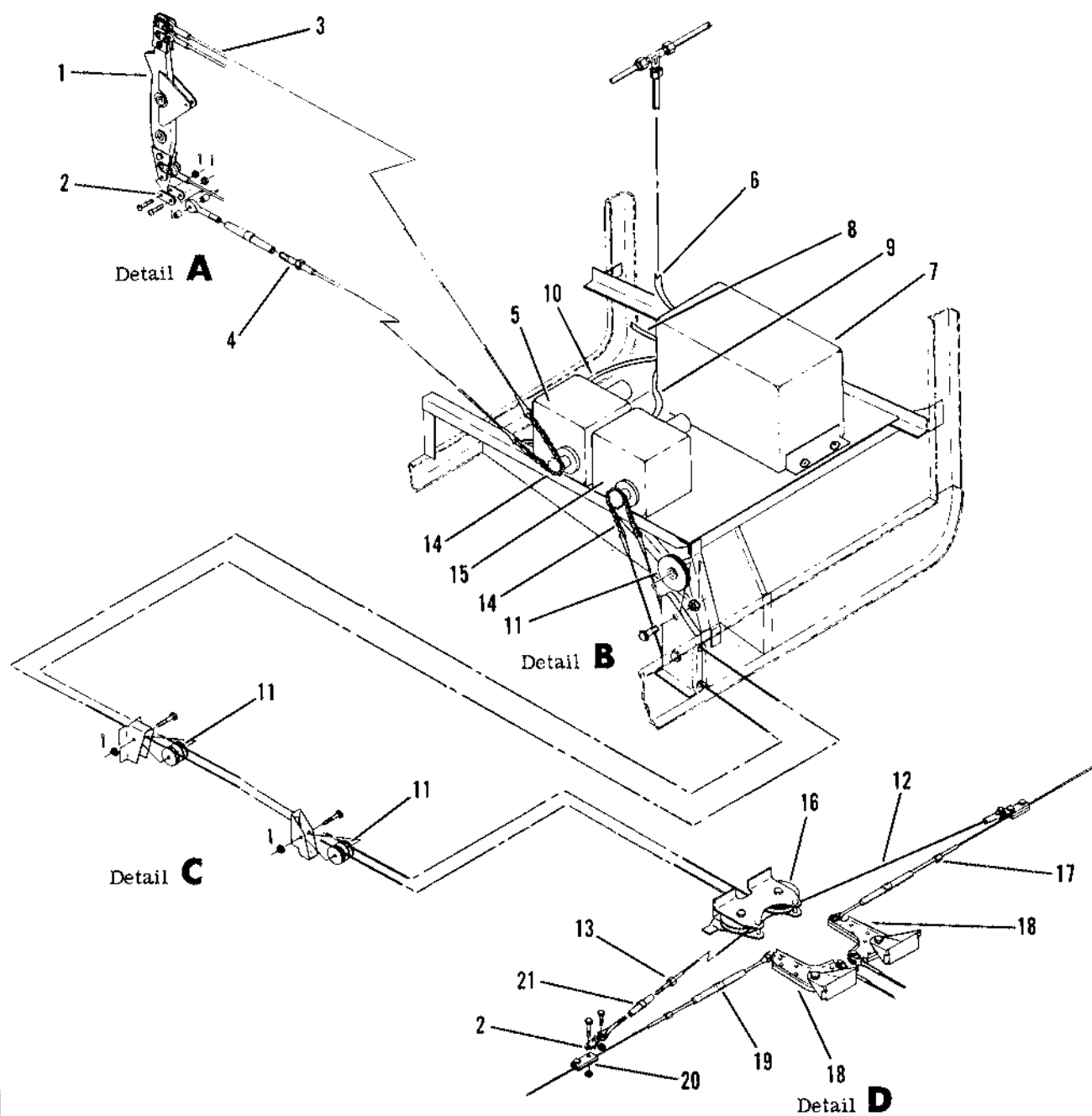
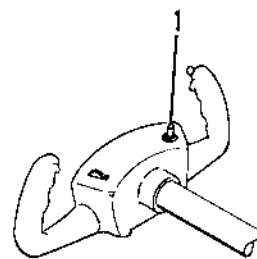
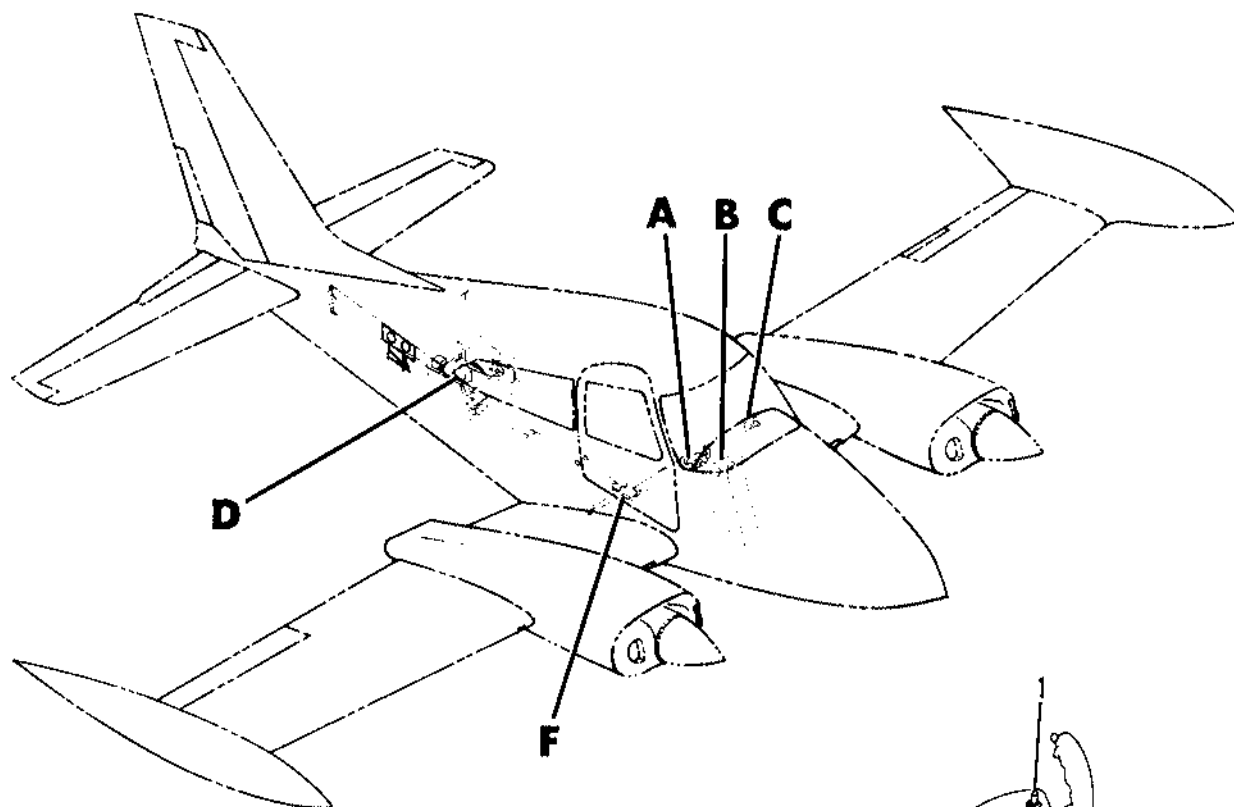
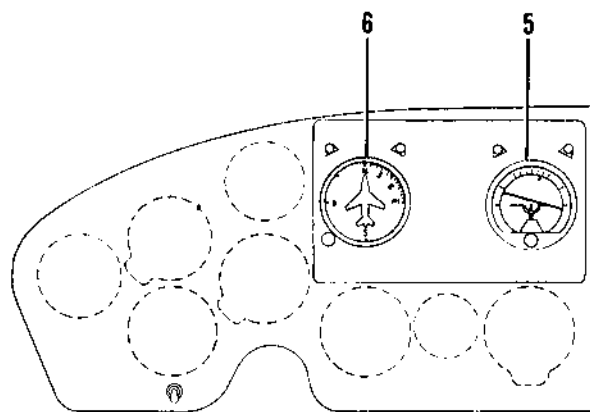


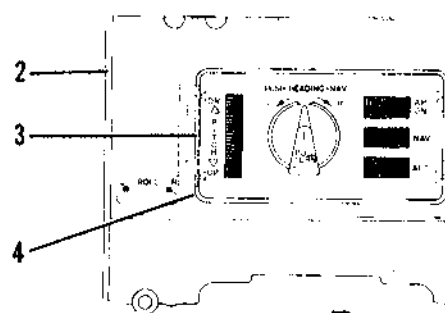
Figure 13-6. Nav-O-Matic 400 (Sheet 2)



Detail A



Detail C



Detail B

10612002R
A51151007
B51141092
C

1. Disengage Switch	11. Follow-up Actuator	20. Link
2. Retainer	12. Elevator Trim Tab Cable	21. Elevator Bellcrank
3. Controller	13. Elevator Trim	22. Aileron Bracket
4. Bezel	14. Follow-up Cable	23. Left Aileron Cable
5. Horizontal Gyro	15. Pulley	24. Aileron Bellcrank
6. Directional Gyro	16. Chain	25. Right Aileron Cable
7. Elevator Cable (Upper)	17. Roll Actuator	26. Cable Clamp
8. Follow-up Sensor	18. Pitch Actuator	27. Turnbuckle
9. Static Line	19. Trim Sensor Bracket	28. Cable Assembly (Bottom)
10. Computer Amplifier	19. Elevator Cable (Lower)	29. Cable Assembly (Top)

Figure 13-6A. 400A Nav-O-Matic (Sheet 1 of 2)

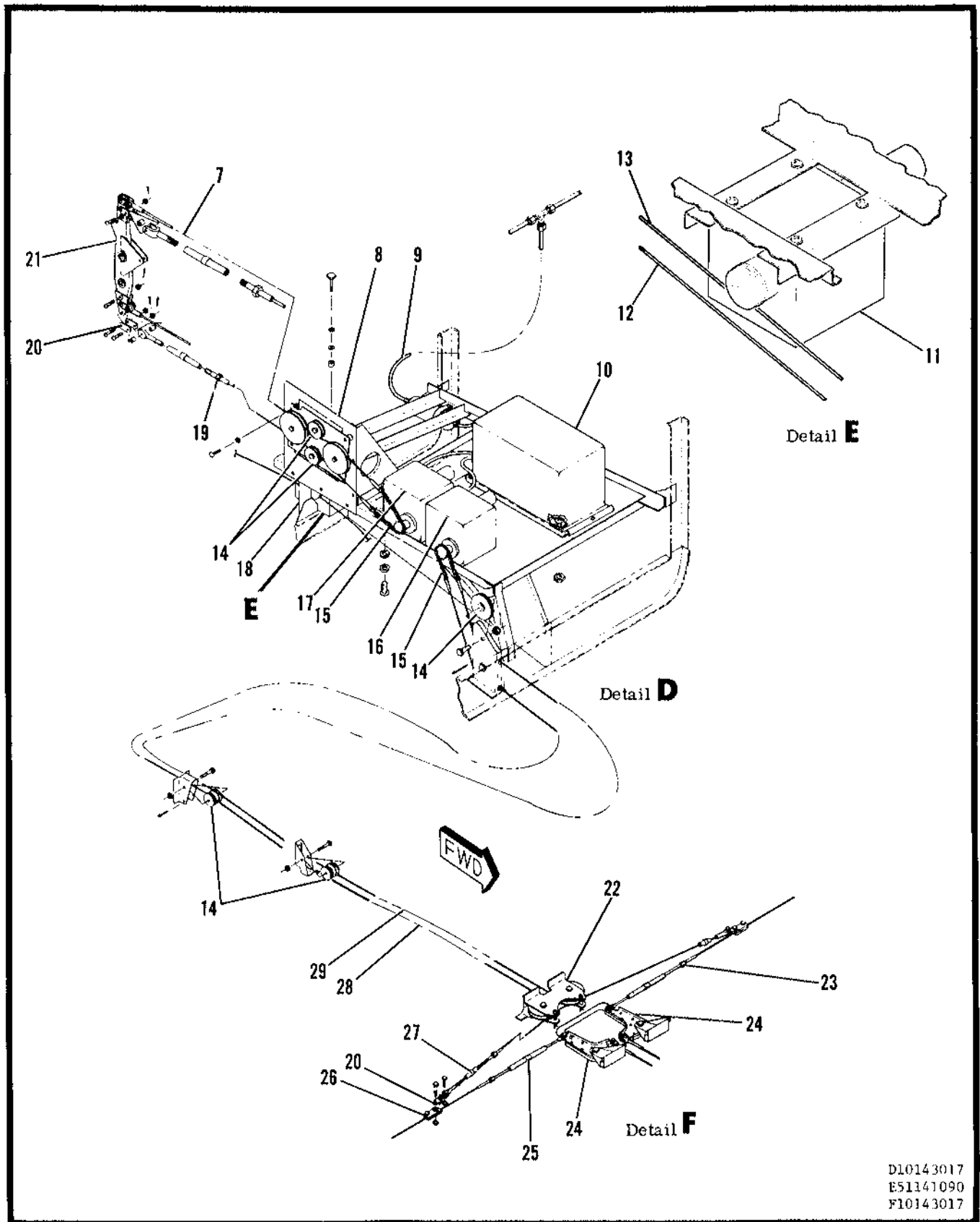


Figure 13-6A. 400A Nav-O-Matic (Sheet 2)

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of 4 hours.

5. Remove locking device from elevator control surfaces and move elevator through entire travel. Observe chain (14) on actuator (5) for sufficient remaining links at the extreme travel limits.
6. Safety turnbuckles.

400A NAV-O-MATIC AUTOPILOT SYSTEM. (See figure 13-6A.)

The Cessna 400A Nav-O-Matic Autopilot is a two-axis flight control system featuring vacuum gyros, altitude hold, synchronous pitch trim, heading pre-select, omni intercept and track, and turn command.

The following offerings are options to the basic autopilot: Automatic pitch trim, ILS approach coupler, and slaved directional gyro. The automatic pitch trim operates in conjunction with the aircraft's elevator trim tab. A sensor installed in the elevator servo cables actuates the elevator trim tab to provide a follow-up system. The ILS approach coupler enables the pilot to fly inbound on ILS front course or back course, this option is installed in the computer and connects to the indicator at the nose junction box. The slaved directional gyro replaces the standard directional gyro and provides heading information for the 400A Nav-O-Matic.

For additional description of the 400A Nav-O-Matic Autopilot and components, refer to Cessna 400A Nav-O-Matic Autopilot Service/Parts manual.

Removal of Control Cables. (See figure 13-6A.)

- a. Refer to Section 3 and remove the following items:
 1. Rear upholstery panel for access to tailcone.
 2. Rear reclining, middle individual or fifth and sixth seats (optional equipment).
 3. Rear carpet.
 4. Stabilizer fairings.
- b. Remove floorboards above aileron bellcrank and autopilot pulleys.
- c. In the aileron bellcrank area, disconnect turnbuckle (27) and clevis connecting cables (28 and 29) to terminal ends and tie guide wire to cables.
- d. Remove three sets of autopilot pulleys by removing attaching nuts, bolts and cotter pins.
- e. At the roll actuator (16), separate cables (28 and 29) from chain (15) by removing master link on chain.
- f. At the elevator bellcrank (21), disconnect turnbuckles connecting cables (7 and 19) to bellcrank.
- g. At the pitch actuator (17), separate cables (7 and 19) from chain (15) by removing master link on chain.
- h. Remove pulleys (14) from trim sensor (8) to free cables (7 and 19).
- i. Route cable (7) from sprocket and remove cable.

- j. Tag cables (7, 19, 28, and 29) for identification; route through fuselage and remove through the baggage floor area.

Installation of Control Cables. (See figure 13-6A.)

- a. Route cables (7, 19, 28 and 29) through baggage floor and tie cables (28 and 29) to guide wires.
- b. At the pitch actuator (29), secure cables (7 and 19) to chain (15) with master link.
- c. Route cables (7 and 19) to elevator bellcrank (21) and attach cables to terminal ends with turnbuckle and clevis.
- d. Route cables (28 and 29) forward through fuselage, connect cable ends to terminals which are attached to cable clamp (26) with turnbuckle (27).
- e. At the roll actuator (16), secure cables (28 and 29) to chain (15) with master link.
- f. Install three sets of pulleys at fuselage stations 132.00, 109.37 and 89.25 with attaching bolts, nuts and cotter pins.

NOTE

Install pulleys so that cable (29) is routed beneath the upper pulley at fuselage station 132.00 and beneath left-hand pulleys at fuselage stations 109.37 and 89.25. Likewise, cable (28) is routed beneath lower and right-hand pulleys.

- g. Rig cables in accordance with rigging procedures.

NOTE

After rigging is complete, turn on autopilot and verify that the control surfaces respond in the correct direction. Assist the movement of the elevator by pulling back on control wheel, this will aid in overcoming the counterbalance of the elevator bob-weight.

- h. Install floorboards.
- i. Refer to Section 3 and install the following items:
 1. Rear upholstery panel.
 2. Rear carpet and seats.
 3. Install stabilizer fairings.

Removal and Installation of Actuators, Computer and Flight Controller. (See figure 13-6A.)

- a. Refer to Section 3 and remove the following items:
 1. Remove rear seats and upholstery panel.
 2. Stabilizer fairings.
- b. Remove pitch actuator (17) as follows:
 1. Relieve tension on cables (7 and 19) by loosening turnbuckles at elevator bellcrank (1).
 2. Disengage cables (7 and 19) and chain (15) from sprocket on actuator (17).
 4. Remove four screws, washers and lockwashers attaching pitch actuator (17) to shelf.
 5. Remove pitch actuator from tailcone.

- c. Remove roll actuator (16) as follows:
 - 1. Relieve tension on cables (28 and 29) by loosening turnbuckle (27) near cable clamp (26).
 - 2. Disengage cables (28 and 29) and chain (15) from sprocket on actuator (14).
 - 3. Disconnect electrical cable assembly from roll actuator (17).
 - 4. Remove four screws, washers and lockwashers attaching roll actuator (17) to shelf.
 - 5. Remove roll actuator from tailcone.
- d. Remove computer (10) as follows:
 - 1. Disconnect line assembly (9) from computer (10).
 - 2. Disconnect electrical cable assemblies from computer (10).
 - 3. Remove four nuts and screws attaching computer (10) to shelf.
 - 4. Remove computer from tailcone.
- e. Install computer (10), roll actuator (16) and pitch actuator by reversing removal procedures. Rig cables in accordance with rigging procedures.

Removal and Installation of Elevator Trim Follow-Up Actuator. (See figure 13-6A.)

- a. Place a suitable support under tailcone.
- b. Remove tailcone access panel.
- c. Disconnect electrical plug from actuator.
- d. Remove four screws securing actuator.
- e. Lift actuator up and slide aft far enough to disconnect cable.
- f. Unwind cable from actuator drum.

NOTE

If elevator trim follow-up cables are to be removed, refer to Section 6 and remove in accordance with Elevator Trim Tab Cable Removal procedures.

- g. The installation of the elevator trim follow-up actuator is the reversal of the removal procedures.

NOTE

The elevator trim follow-up cable must make two complete turns on the actuator drum when installing.

- h. Check elevator trim follow-up rigging and tension in accordance with Section 6, Rigging Elevator Trim System.
- i. If optional electric trim control system is installed, adjust elevator trim stop blocks as follows:
 - 1. Rotate elevator trim control wheel to maximum down position (refer to Section 6), slide aft stop block against electric elevator trim actuator and secure stop block.
 - 2. Rotate elevator trim control wheel to maximum up position (refer to Section 6), slide forward stop block against electric elevator trim actuator and secure stop block.

Removal and Installation of Elevator Trim Follow-Up Sensor. (See figure 13-6A.)

- a. Place a suitable support under tailcone.
- b. Remove tailcone access panel and elevator bell-crank access covers.
- c. Remove pulleys (14) from sensor unit (8) to free cables (7 and 19).
- d. Disconnect electrical plug from sensor units.
- e. Remove sensor unit (8) from bracket (18) by removing attaching screws and nuts.
- f. Install sensor unit by reversing the removal procedures.

Removal and Installation of Gyros.

- a. Refer to Section 12 for typical removal and installation.

Removal and Installation of Switches.

- a. Refer to Section 14 for typical removal and installation of electrical switches.

Removal and Installation of Controller. (See figure 13-6A.)

- a. Disconnect electrical cable assembly from controller (3).
- b. Remove controller (3) and bezel (4) from retainer (2).
- c. Install controller (3) by reversing removal procedures.

Rigging Nav-O-Matic 400A Autopilot Control Cables. (See figure 13-6A.)

- a. Rig aileron control cables as follows:
 - 1. Verify that aileron control system is properly rigged.
 - 2. Using a clamp or other locking device, lock ailerons in the neutral position.
 - 3. Place chain (15) evenly over sprocket on actuator (16). Slide cable clamps (26) outboard from bracket (22) until slack is removed from cables (28 and 29). Tighten cable clamps (26) in place.

NOTE

Cable clamps (26) must be equal distance from bracket (22) to properly rig aileron cables.

- 4. Rig the aileron actuator cables (28 and 29) to 12 $\pm$ 3 inch-pounds tension by tightening turnbuckle.
- 5. Remove locking device from aileron control surfaces and move aileron through entire travel. Observe chain (15) on actuator (16) for sufficient remaining links at the extreme travel limits.
- 6. Safety turnbuckles.
- b. Rig elevator control cables as follows:
 - 1. Verify that aileron control system is properly rigged.

2. Using a clamp or other locking device, lock elevator in the neutral position.
3. With elevator control surface in the neutral position, place chain (15) evenly over sprocket on actuator (17) and attach cables (7 and 19) to links (20) on bellcrank (21).
4. Rig the elevator actuator cables (7 and 19) to 12 : 3 inch-pounds tension by tightening the turnbuckles.

NOTE

Cable tension should be adjusted when ambient temperature is 60°F to 90°F. Allow aircraft temperature to stabilize for a period of 4 hours.

5. Remove locking device from elevator control surfaces and move elevator through entire travel. Observe chain (14) on actuator (5) for sufficient remaining links at the extreme travel limits.
6. Safety turnbuckles.

YAW DAMPER SYSTEM. (See figure 13-6B.)

The independent yaw damper system consists of a G830A (turn and slip indicator), rudder servo actuator and the disengage switch.

The turn and slip indicator provides standard turn and slip information. It also monitors yaw axis motion and supplies the servo actuator with a signal to minimize that motion. The indicator includes an electrically driven gyro, computer circuit, rate-of-turn indicator, turn-and-slip indicator and warning flags. The manually operated trim knob compensates for attitude or airspeed variations.

The rudder servo applies the signal from the gyro through a mechanical linkage to the rudder. An electric clutch in the drive linkage provides a positive disconnect between actuator and rudder when yaw damper is not in use.

The yaw damper switch is located on the left instrument panel and de-energizes the electric clutch and gyro computer. The autopilot/yaw damper disengage switch, located on the pilot's control wheel, also disengages the yaw damper.

Troubleshooting

For troubleshooting the yaw damper system, refer to the Yaw Damper System Service/Parts manual.

Removal and Installation of Yaw Damper Actuator. (See figure 13-6C.)

- a. Place a suitable support under tailcone.
- b. Remove tailcone access panel and rudder bellcrank access covers.
- c. Remove chain guard (11), loosen turnbuckle (7) and remove chain assembly from sprocket.
- d. Remove bolts (9) securing actuator (1) to structure.
- e. Disconnect electrical connector and remove actuator from aircraft.
- f. Install the rudder yaw actuator by reversing the removal procedures.

NOTE

Secure bolts (9) with safetywire after tightening to proper torque value.

- g. Rig cables in accordance with rigging procedures.

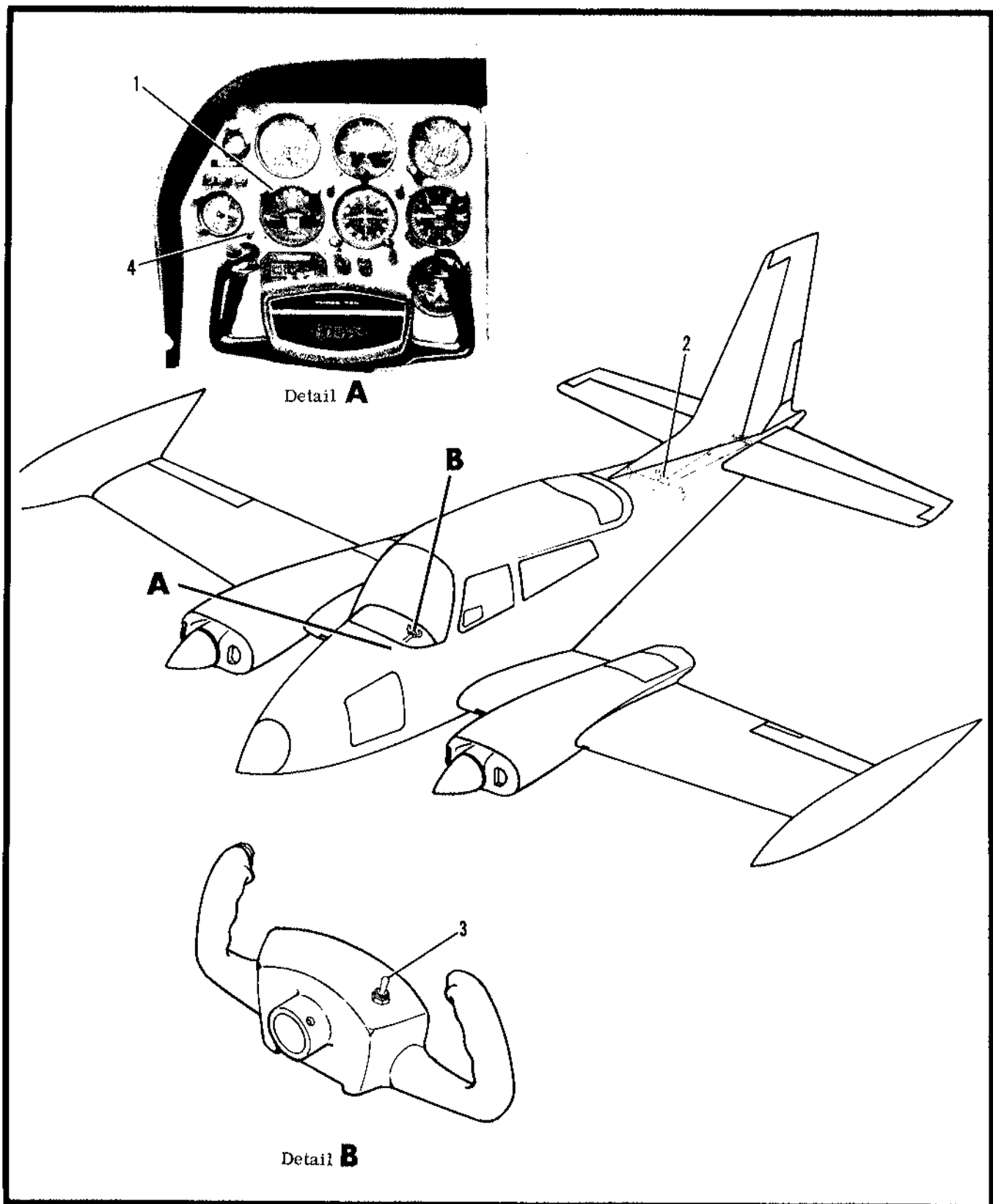
Rigging Yaw Damper System. (Refer to figure 13-6C.)

- a. Refer to Section 7 and verify that rudder control system is properly rigged.
- b. Rig yaw actuator cables (3) and (8) to 16, +2, -2, pounds tension by tightening turnbuckle (7).
- c. Safety turnbuckle.
- d. Adjust actuator in accordance with Actuator Centering Adjustment procedures.

Actuator Centering Adjustment

Before making actuator centering adjustments, assure that rudder system and yaw damper system is rigged in accordance with rigging procedures.

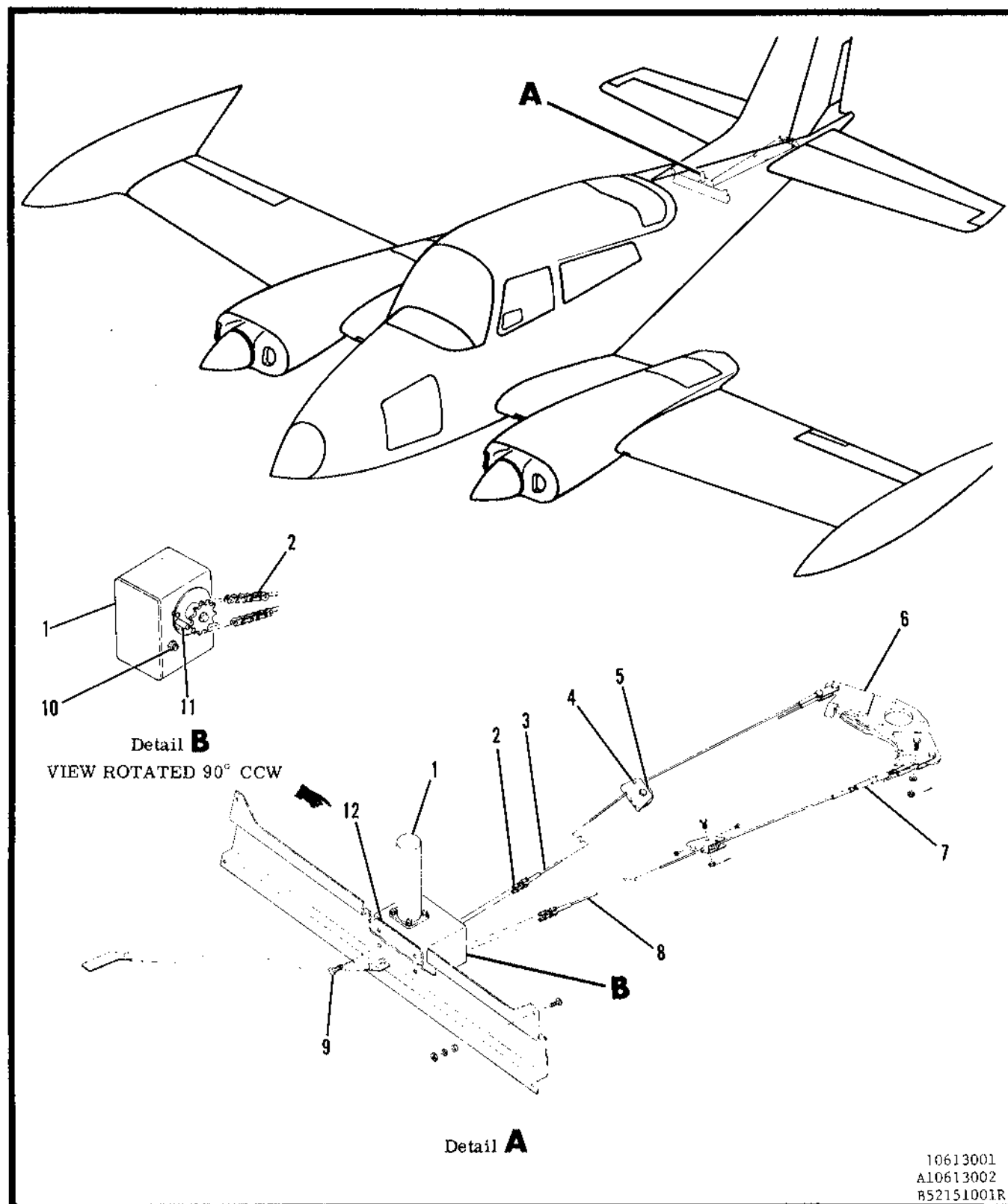
- a. Turn yaw damper system "ON."
- b. Check position of rudder. If rudder deflects from neutral position, manually hold rudder in the assumed position and disengage yaw damper switch. Refer to figure 13-6B, turn and hold centering screw (10) in a full (CW) position while returning rudder to



- 1. Turn and Bank Indicator
- 2. Actuator

- 3. Autopilot Disengage Switch
- 4. Yaw Actuator Switch

Figure 13-6B. Yaw Damper Control System



10613001
A10613002
B52151001R

- 1. Actuator
- 2. Chain
- 3. Cable (Right)

- 4. Guard Pin
- 5. Pulley
- 6. Bellcrank
- 7. Turnbuckle

- 8. Cable (Left)
- 9. Bolt
- 10. Centering Screw
- 11. Chain Guard
- 12. Support

Figure 13-6C. Yaw Damper Installation

neutral position. Release adjusting screw on actuator.

c. Turn yaw damper system "ON" and recheck for zero rudder deflection.

INTEGRATED FLIGHT CONTROL SYSTEM. (See figure 13-6D.)

The Integrated Flight Control System is a two axis (aileron and elevator) automatic flight control system consisting of the autopilot and flight director. Either the flight director or the autopilot may be used separately or as a combination. As an autopilot, in addition to holding the wings level and compensating for rotation about the pitch axis, the autopilot provides an automatic intercept and track of any magnetic heading or VOR radial. Also included is an automatic pitch trim, turn command, pitch command, altitude hold and an ILS approach feature. As a flight director the Integrated Flight Control System provides steering information, visually presented on the attitude director indicator (ADI), for climb, cruise, descent and altitude hold. Heading, VOR navigation, glide slope and ILS approaches are visually presented on the horizontal situation indicator (HSI).

For additional description, installation adjustments, troubleshooting, schematic and parts listing, refer to Cessna Integrated Flight Control System Service/Parts Manual.

300 And 400 Series Integrated Flight Control Systems.

The 300 and 400 Integrated Flight Control Systems consist of the 400A Nav-O-Matic autopilot and flight director, ILS coupler, slaved directional gyro, pitch synchronization and associated avionics. The 300 Integrated Flight Control System uses 300 avionics, while the 400 Integrated Flight Control System uses 400 avionics. Simultaneous or independent operation of the autopilot and flight director are provided. Go-around commands selectable by the pilot are provided in addition to the pitch synchronization.

800 Series Integrated Flight Control System.

The 800 Integrated Flight Control System consists of the 400A Nav-O-Matic autopilot and flight director, with yaw damper, altitude hold, automatic pitch trim, pitch synchronization, heading preselect, omni/ILS couplers and turn and pitch command. Simultaneous or independent operation of the autopilot and flight director is provided and in addition to the autopilot features, the flight director includes pitch synchronization and go-around commands as selected by the pilot. The 800 Integrated Flight Control System includes a vacuum, slaved directional gyro with ADF presentation and an horizontal situation indicator (HSI). Nav 1 is connected to the HSI and Nav 2 is connected to an individual course indicator. 400 or 800 avionics system may be used with the 800 Integrated Flight Control System.

Removal, Installation and Rigging the Integrated Flight Control System Components. (See figure 12-2 and figure 13-6A.)

Refer to Removal, Installation and Rigging Procedures for the Nav-O-Matic 400A Autopilot Section 13 and Typical Instrument Removal and Installation Procedures Section 12 for removal, installation and rigging the Integrated Flight Control System Components.

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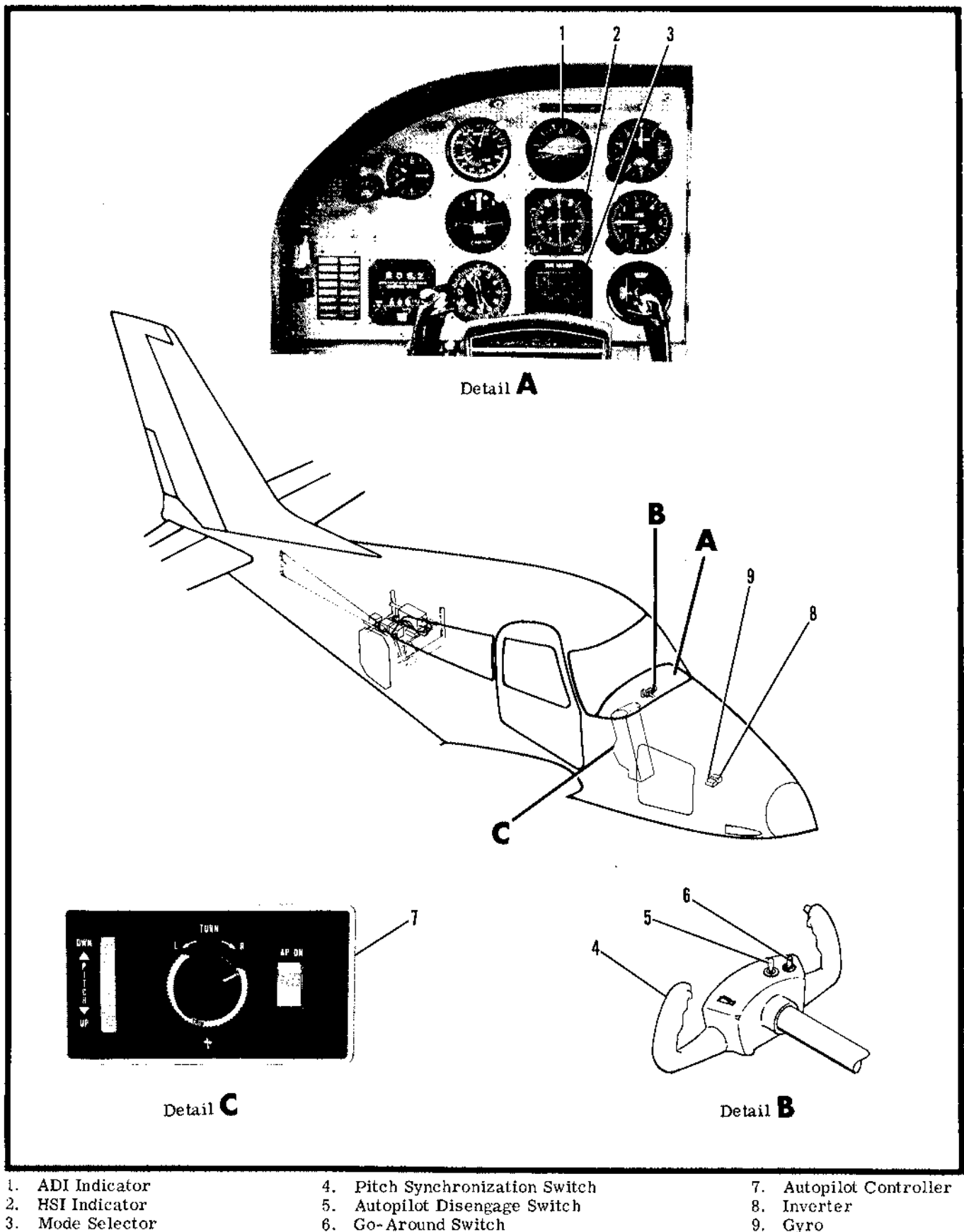


Figure 13-6D. Integrated Flight Control System

NAV-O-MATIC 800 AUTOPILOT.
(310P0001 TO 310Q0401.)

Refer to Cessna Nav-O-Matic 800 Service and Parts Manual for general descriptions of components and troubleshooting procedures. Refer to Section 15 for aircraft electrical wiring diagrams.

Removal and Installation of Autopilot Aileron Cables.
(See figure 13-7.)

- a. Refer to Section 3 and remove the following items:
 1. Front seats, rear, middle and aft rear seats (optional equipment).
 2. Rear carpet.
 3. Rear upholstery panel.
 4. Floorboards over aileron bellcrank and pulleys.
- b. Disconnect turnbuckle (2) and clevis attaching autopilot aileron cable (11) to links (12).
- c. Remove cable guard pins from pulley brackets at fuselage stations 89, 25 and 109, 37.
- d. Route cable ends aft to aileron servo.
- e. Disengage cable (11) from aileron servo as shown in Cessna Nav-O-Matic 800 Service and Parts Manual.
- f. Install autopilot aileron cable (11) by reversing removal procedures.
- g. Rig cable (11) in accordance with rigging procedure.

Removal and Installation of Autopilot Rudder Cable.
(See figure 13-7.)

- a. Refer to Section 3 and remove the following items:
 1. Rear seats and upholstery panel.
 2. Stabilizer fairing.
- b. Refer to Section 2 and support tailcone.
- c. Disconnect turnbuckle (2) connecting LH autopilot rudder cable (4) to link (1) at bellcrank (3).
- d. Disconnect clevis end of autopilot cable (4) from link (1) by removing attaching nut, washers and bolts.
- e. Remove cable guard pins from pulley bracket.
- f. Route autopilot rudder cable (4) forward to rudder servo.
- g. Disengage cable (4) from servo as shown in Cessna Nav-O-Matic 800 Service and Parts Manual.
- h. Install cable (4) by reversing removal procedures.
- i. Rig cable (4) in accordance with rigging procedures.

Removal and Installation of Autopilot Elevator Cables.
(See figure 13-7.)

- a. Refer to Section 3 and remove the following items:
 1. Rear upholstery panel.
 2. Stabilizer fairing.

- b. Refer to Section 2 and support tailcone.
- c. Disconnect turnbuckle (2) connecting lower autopilot elevator cable (9) to links (8) at elevator bellcrank (7).
- d. Disconnect clevis end of cable (9) from link (8) by removing attaching nut, spacer and bolt.
- e. Route cable (9) forward to elevator servo.
- f. Disengage cable (9) from aileron servo as shown in Nav-O-Matic 800 Service and Parts Manual.
- g. Remove cable (9) from aircraft.
- h. Install autopilot elevator cable (9) by reversing removal procedures.
- i. Rig cable (9) in accordance with rigging procedures.

Removal and Installation of Autopilot Elevator Trim Extension Cable. (See figure 13-7.)

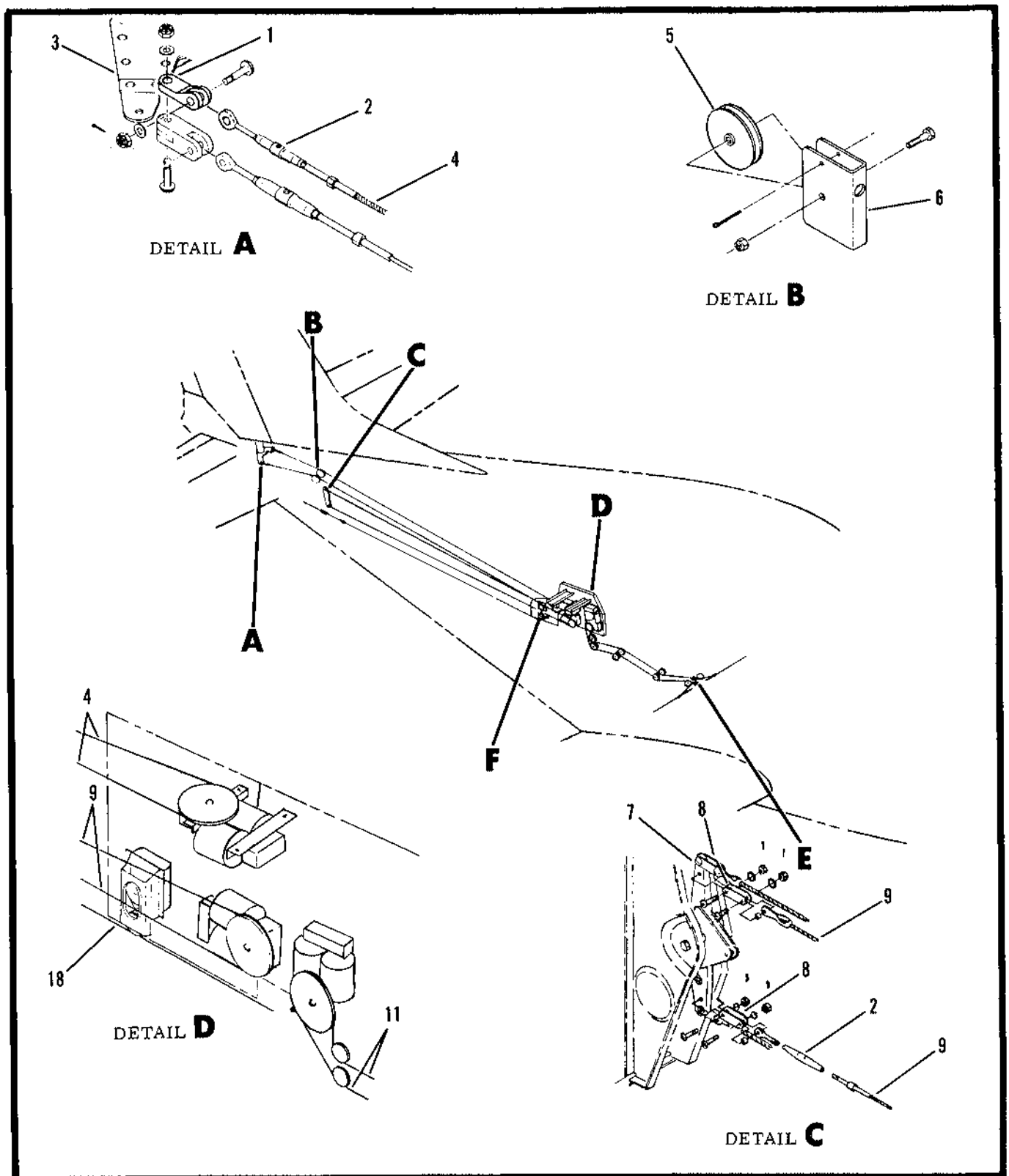
- a. Refer to Section 3 and remove the following items:
 1. Rear upholstery panel.
 2. Stabilizer fairing.
 3. Stinger.
- b. Release tension on elevator trim control system by referring to Section 6 and loosening turnbuckle.
- c. Disconnect autopilot extension cable (19) from elevator trim cable (18) by removing nuts and bolts.
- d. Remove autopilot extension cable (19) from aircraft.
- e. Install autopilot extension cable (19) by reversing removal procedures.
- f. Rig elevator trim cable in accordance with autopilot rigging procedures.

Removal and Installation of Pneumatic System.

- a. Remove and install pneumatic system components, line assemblies and hoses as shown in figure 13-9.

NOTE

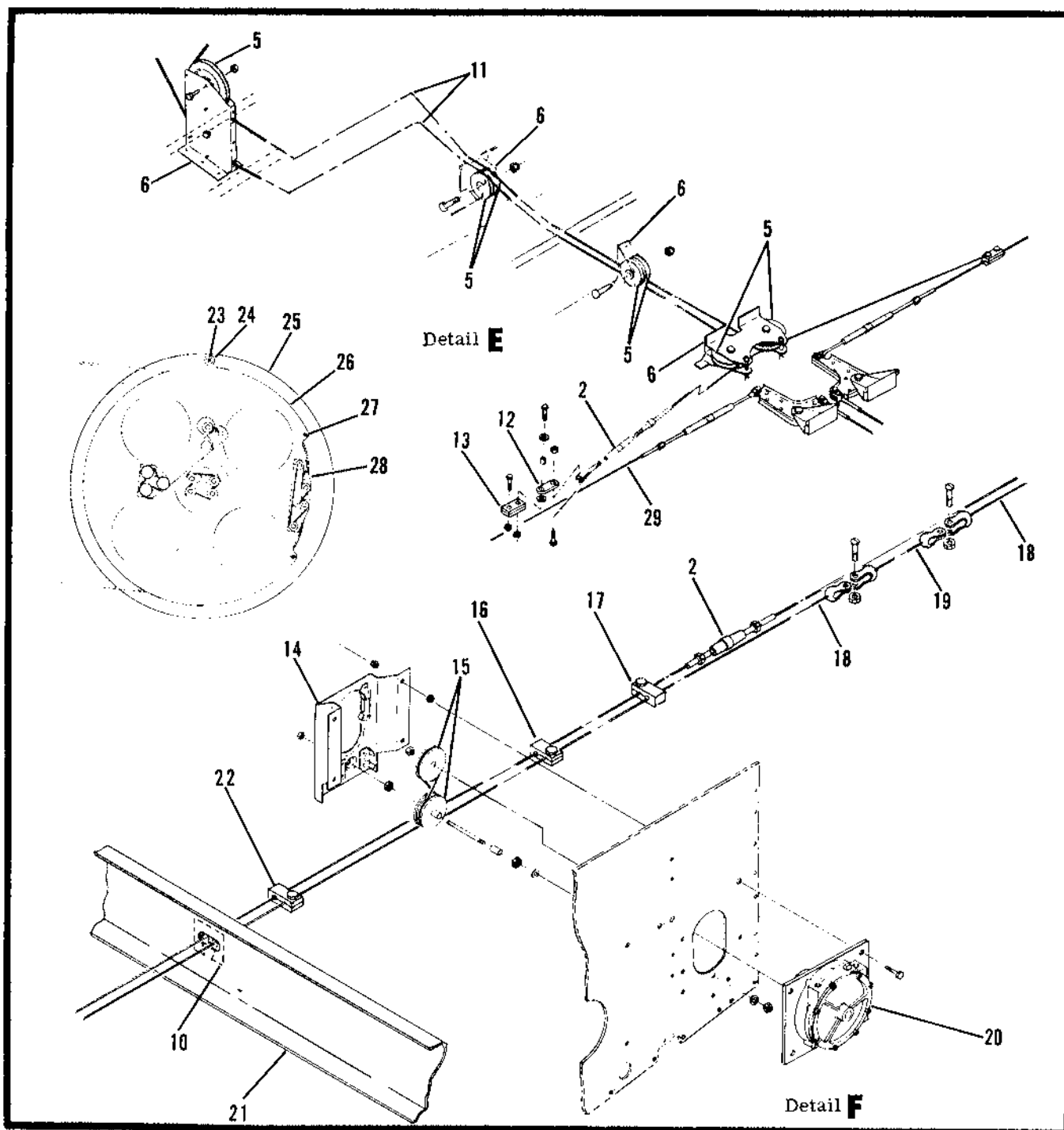
Line assembly (23) can be removed from wing without removing wing. Accomplish removal of line assembly (23) by carefully bending line assembly and route through wing gap area. Line assembly (25) is assembled into the wing nacelle and should not be removed.



1. Link(Rudder)
2. Turnbuckle
3. Rudder Bellcrank
4. Rudder Cable Assembly (Servo to Bellcrank)

5. Pulley
6. Pulley Bracket
7. Elevator Bellcrank
8. Link (Elevator)
9. Link (Elevator)

Figure 13-7. Nav-O-Matic 800 Servos and Cable Installation (Sheet 1 of 2)



9. Elevator Cable Assembly (Servo to Bellcrank)	19. Elevator Trim Extension Cable (Autopilot)
10. Fairlead	20. Elevator Trim Servo
11. Aileron Cable Assembly (Servo to Aileron System)	21. Bulkhead (Station 132.00)
12. Link (Aileron)	22. Trim Stop Block (Forward)
13. Cable Clamps	23. Screw
14. Pulley Bracket Assembly	24. Spacer
15. Pulley (Elevator Trim)	25. Cable Guard
16. Trim Stop Block (Center)	26. Cable Drum
17. Trim Stop Block (Aft)	27. Cotter Pin
18. Elevator Trim Cable	28. Cable Clamp
	29. Aileron Control Cable

Figure 13-7. Nav-O-Matic 800 Servos and Cable Installation (Sheet 2)

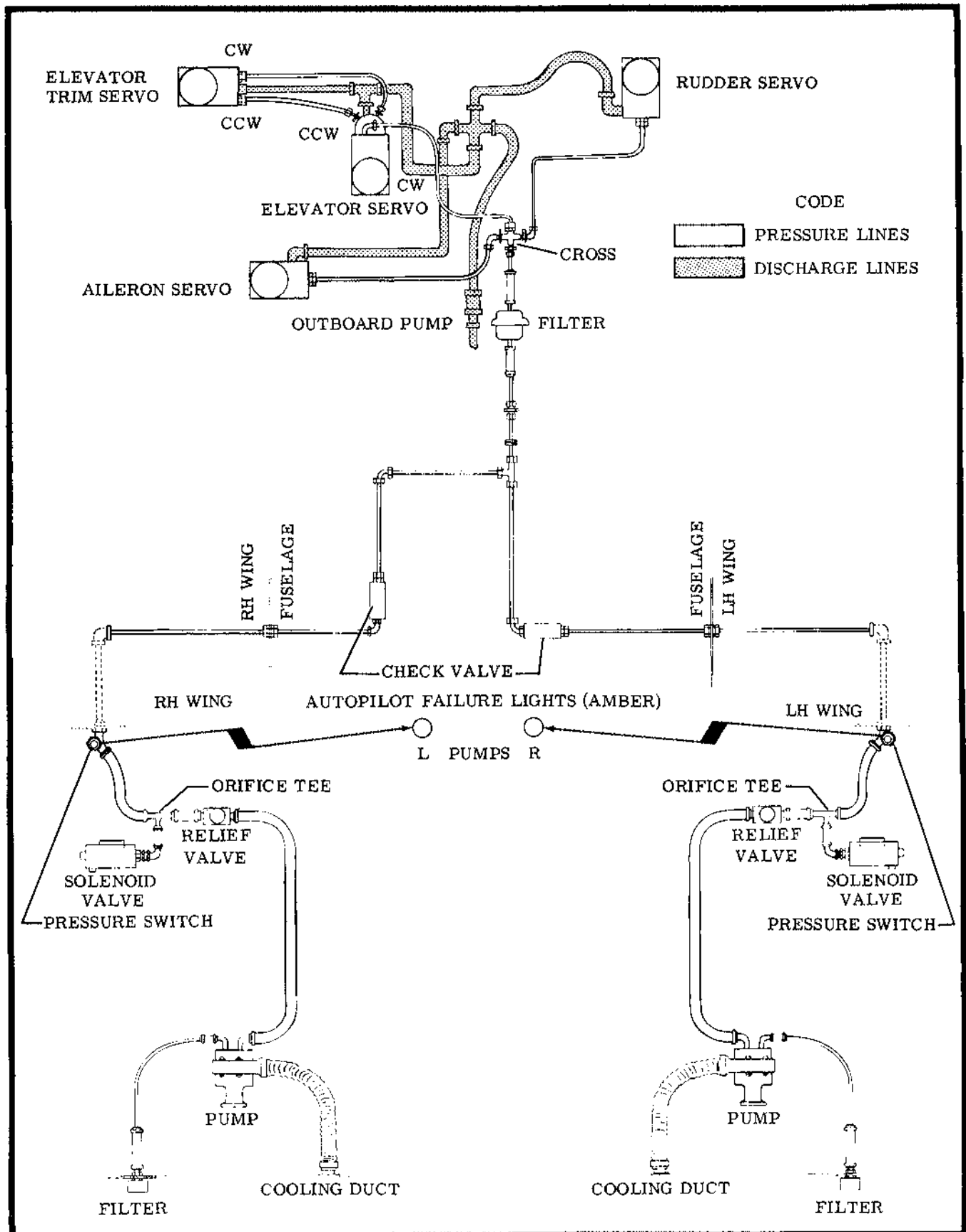
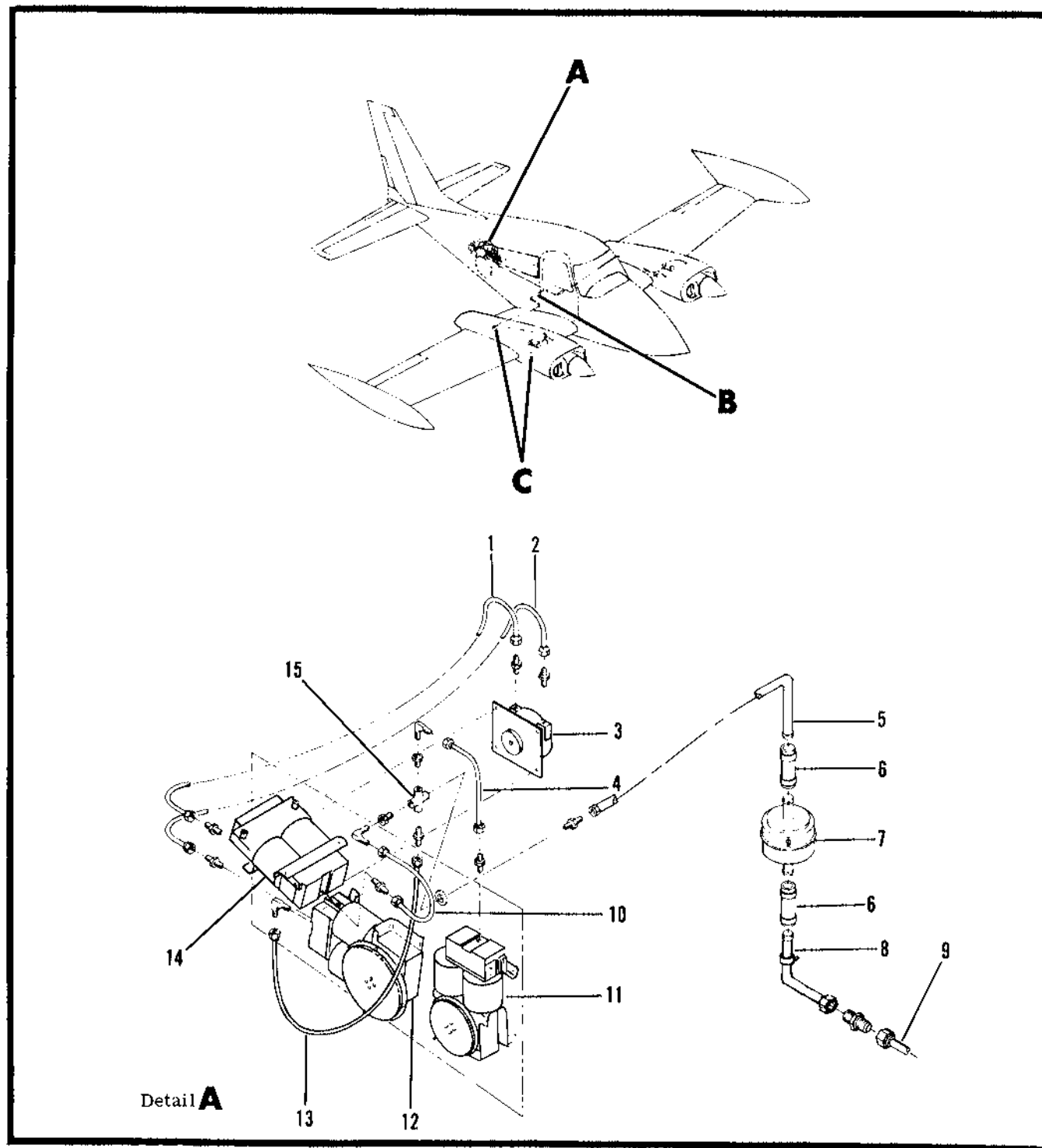
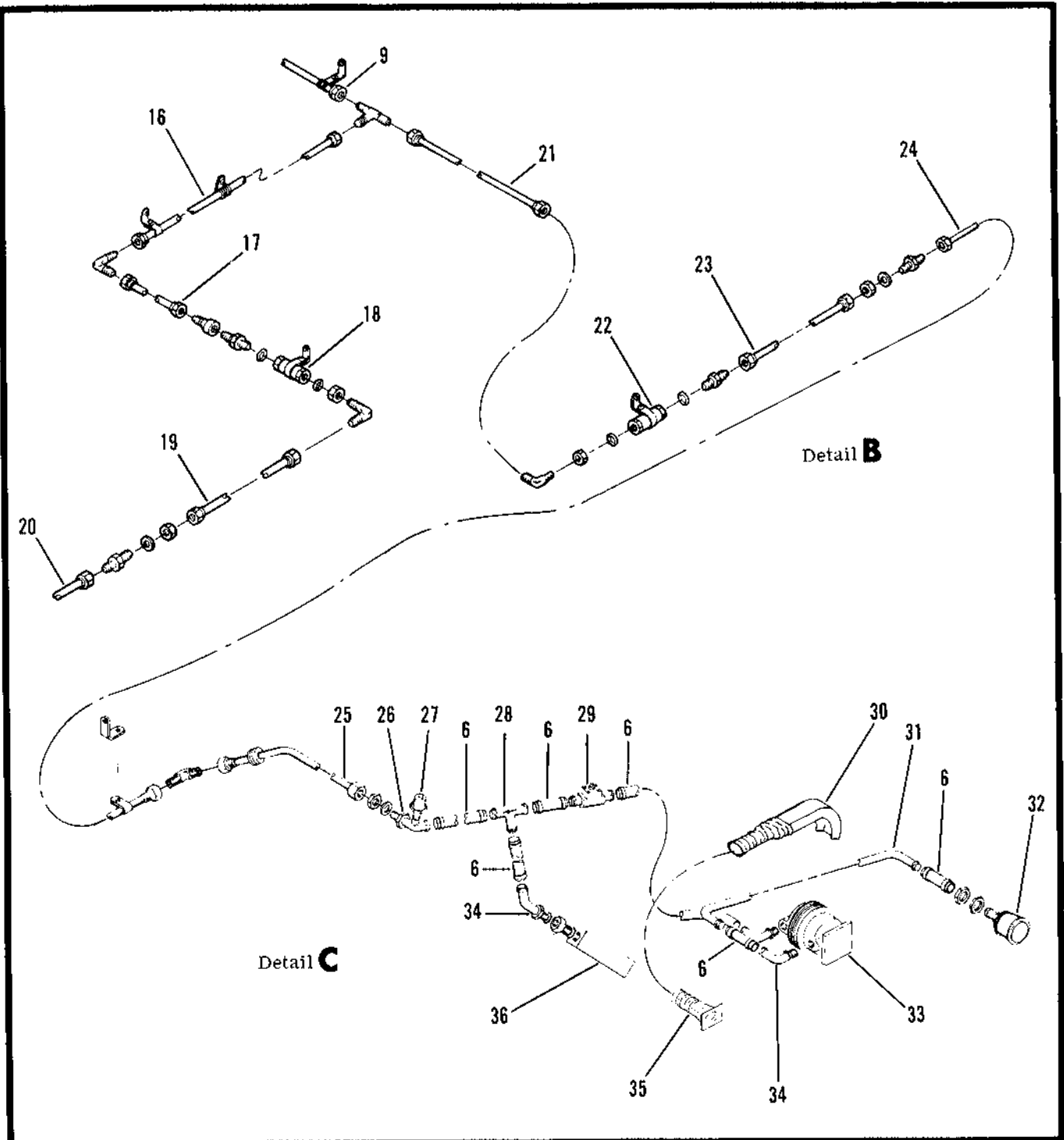


Figure 13-8. Nav-O-Matic 800 Pneumatic System Schematic



1. Line (CCW to Elevator Servo)	10. Line (Cross to Rudder Servo)
2. Line (CW to Elevator Servo)	11. Aileron Servo
3. Elevator Trim Servo	12. Elevator Servo
4. Line (Cross to Aileron Servo)	13. Line (Cross to Elevator Servo)
5. Line (Cross to Filter)	14. Rudder Servo
6. Hose (Interconnecting)	15. Cross
7. Filter Assembly	16. Line (Tee to Elbow, RH Wing)
8. Line (Filter to Cabin Line)	17. Line (Elbow to check Valve)
9. Line (Cabin to Tee)	18. Check Valve (RH Wing)

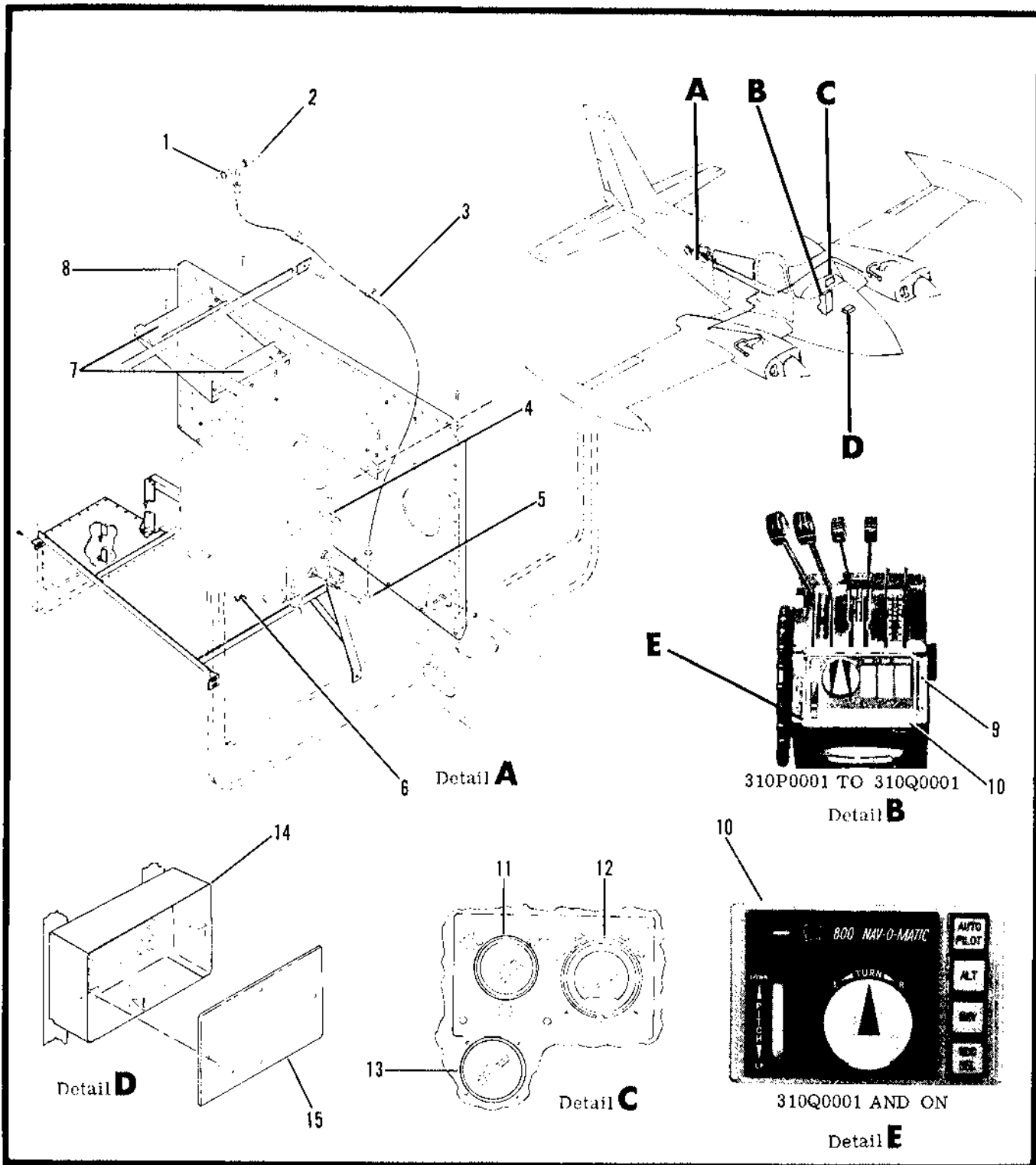
Figure 13-9. Nav-O-Matic 800 Pneumatic System Installation (Sheet 1 of 2)



- 19. Line (Check Valve to Fuselage Skin)
- 20. Line (RH Wing)
- 21. Line (Center Cabin to Check Valve)
- 22. Check Valve (LH Wing)
- 23. Line (Check Valve to Fuselage Skin)
- 24. Line (LH Wing)
- 25. Line (Aft Nacelle to Firewall)
- 26. Adapter (Pressure Switch)
- 27. Pressure Switch

- 28. Tee (Restrictor)
- 29. Pressure Relief Valve
- 30. Shroud
- 31. Line (Air Filter to Pump)
- 32. Air Filter
- 33. Pump
- 34. Elbow Adapter
- 35. Ram Air Hose
- 36. Solenoid Valve

Figure 13-9. Nav-O-Matic 800 Pneumatic System Installation (Sheet 2 of 2)



1. Line Assembly (Tee to static source)	6. Computer Shelf	11. Directional Gyro
2. Line Assembly (Tee to instruments)	7. Channel Assembly (Rudder servo)	12. Horizontal Gyro
3. Hose Assembly (Tee to computer)	8. Panel Assembly (Aileron servo, Elevator, Elevator trim servos)	13. Turn and Bank Indicator
4. Computer	9. Screw	14. Network Loading Box
5. Elbow	10. Controller	15. Cover

Figure 13-10. Nav-O-Matic 800 Components and Shelves Installation

Removal and Installation of Servos. (See figure 13-9.)

- a. Remove autopilot aileron servo (11) as follows:
 1. Remove seats, carpet, rear upholstery panel and floorboards necessary to gain access to turnbuckle on autopilot aileron cables.
 2. Relieve tension on autopilot aileron cables by loosening turnbuckle.
 3. Disengage autopilot aileron cable from servo drum as shown in the Nav-O-Matic 800 Service and Parts Manual.
 4. Disconnect line assembly (4) and electrical cable from aileron servo (11).
 5. Remove four nuts and bolts attaching aileron servo (11) to shelf assembly and remove servo from aircraft.
 6. Install aileron servo (11) by reversing removal procedures.
 7. Rig autopilot aileron cables in accordance with rigging procedures.
- b. Remove autopilot elevator servo (12) as follows:
 1. Remove rear upholstery panel and stabilizer fairings.
 2. Relieve tension on autopilot elevator cables by loosening turnbuckle.
 3. Disengage autopilot elevator cable from servo drum as shown in the Nav-O-Matic 800 Service and Parts Manual.
 4. Disconnect line assemblies (1, 2 and 13) and electrical cable from elevator servo (12).
 5. Remove four nuts and bolts attaching elevator servo (12) to shelf assembly and remove servo from aircraft.
 6. Install elevator servo (12) by reversing removal procedures.
 7. Rig autopilot elevator cables in accordance with rigging procedures.
- c. Remove autopilot rudder servo (14) as follows:
 1. Remove rear upholstery panel and stabilizer fairings.
 2. Relieve tension on autopilot rudder cable by loosening turnbuckle.
 3. Disengage autopilot rudder cable from servo drum as shown in the Nav-O-Matic 800 Service and Parts Manual.
 4. Disconnect line assembly (10) and electrical cable from rudder servo (14).
 5. Remove four nuts and bolts attaching rudder servo (14) to support assemblies and remove servo from aircraft.
 6. Install rudder servo (14) by reversing removal procedures.
 7. Rig autopilot rudder cables in accordance with rigging procedures.
- d. Remove autopilot elevator trim servo (3) as follows:
 1. Remove rear upholstery panel, stabilizer fairing, and stinger.
 2. Relieve tension on elevator trim system by loosening turnbuckle.
 3. (See figure 13-7.) Disconnect cable (18) from cable (19) by removing attaching nut and bolt. Remove pulley bracket assembly (14) from shelf and elevator trim servo by removing five nuts and four bolts.
 4. Remove elevator trim cable from pulleys.

5. (See figure 13-9.) Tag and disconnect line assemblies (1 and 2) from elevator trim servo (3).
6. Remove elevator trim servo from shelf assembly.
7. Install elevator trim servo by reversing removal procedures.
8. Rig elevator trim cables in accordance with rigging procedures.

Removal and Installation of Computer. (See figure 13-10.)

- a. Remove rear upholstery panel.
- b. Disconnect electrical wiring cable from computer.
- c. Disconnect hose assembly (3) from elbow on computer (4).
- d. Loosen thumb screws retaining computer to shock mount and remove computer.
- e. Install computer by reversing removal procedures.

Removal and Installation of Controller. (See figure 13-10.)

- a. Remove four screws (9) attaching controller (10) to pedestal.
- b. Lift controller (10) from pedestal and disconnect electrical plug from controller.
- c. Install controller by reversing removal procedures.

Removal and Installation of Miscellaneous Components. (See figure 13-10.)

- a. Refer to Section 12, remove and install gyros in accordance with removal and installation procedures.
- b. Remove and install support channels (7) and panel (8) as shown in illustration.
- c. Remove and install computer shelf (6) as shown in illustration.

Rigging Autopilot Control Systems. (See figure 13-7.)

- a. Rig autopilot aileron control system as follows:
 1. Refer to Section 5 and verify that the aileron control system is rigged properly.
 2. Place aileron control surfaces to the NEUTRAL position and secure with suitable clamping device.
 3. Insure that cable (11) is properly routed on pulleys and check installation of cable guard pins.
 4. Install cable clamps (13) on aileron control cables (29), attach cable (11) to cable clamps (13).
 5. Thread cable (11) over cable drum (26) and through cable clamp (28). Loosely affix cable clamp (28) to cable drum (26) in such a manner that cable (11) can slip when cable drum is rotated.
 6. Install three cable guard screws and spacers, rotate aileron servo cable drum through entire travel limits and return servo to NEUTRAL position.
 7. Slide cable clamps (13) along aileron control cables (29) until slack in cable (11) is removed, ob-

serve that cable clamps (13) are equal distances from pulleys (5). Secure cable clamps to aileron control cable (29).

8. Rotate cable drum (26) a few degrees clockwise from the NEUTRAL position and tighten cable clamp (28) to cable drum (26), install cotter pins (27), and safety.

9. Rig control cable (11) to a tension of 12 ± 3 pounds by tightening turnbuckle (2), observe that cable drum (26) has returned to the NEUTRAL position.

10. Remove clamping device from aileron control surface, observe that the surfaces remain aligned with trailing edge of wing.

11. Safety wire turnbuckle (2) on cable (11) and install floorboards, carpets, rear upholstery panel and seats.

b. Rig autopilot rudder control system as follows:

1. Refer to Section 7 and verify that the rudder control system is rigged properly.

2. Place rudder to the NEUTRAL position and secure with suitable clamping device.

3. Insure that cable (4) is properly routed on pulleys in tailcone and check installation of cable guard pins.

4. Thread cable (4) over cable drum (26) and through cable clamp (28). Loosely affix cable clamp (28) to cable drum (26) in such a manner that cable (4) can slip when cable drum is rotated.

5. Install three cable guard screws and spacers, rotate rudder servo cable drum through entire travel limits and return servo to NEUTRAL position.

6. With rudder cable (4) attached to bellcrank (3), rotate cable drum (26) a few degrees clockwise (referenced when looking up at cable drum) from the NEUTRAL position and tighten cable clamp (28) to cable drum (26), install cotter pins (27), and safety.

7. Rig control cable (4) to 15 ± 5 pounds tension by tightening turnbuckle (2), observe that cable drum (26) has returned to the NEUTRAL position.

8. Remove clamping device from rudder control surface, observe that the rudder control surface is aligned with the vertical stabilizer.

9. Safety wire turnbuckle (2) on cable (4) and install rear upholstery panel and seats.

c. Rig autopilot elevator control system as follows:

1. Refer to Section 6 and verify that the elevator control system is rigged properly.

2. Place elevator control surface to the NEUTRAL position and secure with suitable clamping device.

3. Thread cable (9) over cable drum (26) and through cable clamp (28). Loosely affix cable clamp (28) to cable drum (26) in such a manner that cable (9) can slip when cable drum is rotated.

4. With elevator cable (9) attached to bellcrank (7), rotate cable drum (26) a few degrees clockwise (referenced when looking directly at servo drum) from the NEUTRAL position and tighten cable clamp (28) to cable drum (26), install cotter pins (27), and safety.

5. Rig control cable (9) to 15 ± 5 pounds tension by tightening turnbuckle (2), observe that cable drum (26) has returned to the NEUTRAL position.

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.

6. Remove clamping device from elevator surface, safety wire turnbuckle (2), and install fairings, rear upholstery panel and seats.

d. Rig autopilot elevator trim control system as follows:

1. Refer to Section 6 and rig trim control system in accordance with rigging procedures.

NOTE

Refer to figure 13-7 for proper cable routing on servo pulleys, and assure that the cable tension is set to 16 ± 3 pounds.

2. Position stop blocks as follows:

(a) Rotate elevator trim tab to full NOSE DOWN position, slide stop block (22) against aft side of bulkhead (21).

(b) Rotate elevator trim tab to full NOSE UP position, slide stop blocks (16 and 17) together and locate at a point where stop block (16) will not come in contact with servo pulleys when the trim tab is positioned to NOSE DOWN.

Autopilot Pressure Check and Adjustment. (See figure 13-9.)

a. Disconnect line assembly (5) from filter (7).

b. Connect a pressure gage to filter outlet.

c. Start one engine and run at cruise RPM.

d. Pressure at the filter outlet should read $10 \pm .75$, -0 PSI.

e. If pressure obtained is below prescribed tolerance, adjust pressure relief valve (29) in engine compartment to obtain correct pressure.

f. Start other engine and perform same check and adjust as necessary.

OXYGEN SYSTEM.

The standard oxygen system is designed to supply regulated oxygen for the pilot, copilot and three passengers. The standard system is used only with aircraft having a standard seating arrangement. Optional oxygen systems are also provided, these systems supply oxygen for the pilot, copilot and two passengers, or: pilot, copilot and four passengers. The oxygen system consists of an oxygen cylinder-regulator, filler valve, plumbing, pressure gage, outlets and mask assemblies. High pressure oxygen is routed from the cylinder-regulator through a capillary line to the pressure gage. Low pressure oxygen is routed from the cylinder-regulator to each individual outlet.

On Aircraft 310Q0601 and ON the 48.3 and 76.6 cubic foot oxygen installations incorporate an oxygen altitude compensator in the line from the regulator to the cabin outlets. This compensator reduces oxygen expenditures at lower altitudes and increases oxygen duration. A continuous flow of oxygen to the oxygen masks is provided whenever the control knob on the stationary panel is pulled to the ON position and the mask hoses are engaged into the outlets. Each outlet contains a spring-loaded valve which

Trouble Shooting the Oxygen System.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO PRESSURE INDICATION ON PRESSURE GAGE	Leak in system has exhausted pressure.	Visually check pressure gage. Charge system and use detector fluids, Type CG-1, MIL-25567A, or its equivalent, to check lines and fittings. Tighten or replace fittings as necessary.
	Defective pressure gage.	Pull knob out, insert mask hose into outlet and note flow indicator. Replace gage.
PRESSURE INDICATION NORMAL BUT OXYGEN FAILS TO FLOW	Defective oxygen cylinder-regulator assembly.	Replace oxygen cylinder-regulator assembly.
OXYGEN DURATION TOO SHORT	Leak in system.	Draw a line on gage cover glass directly over pointer with a grease pencil. Loss of oxygen should not exceed one percent of total supply for a 24-hour period. Charge system and use detector fluids, Type CG-1, MIL-25567A, or its equivalent, to check lines and fittings. Tighten or replace fittings as necessary.

prevents the flow of oxygen until the mask hose is engaged with the outlet. The mask hose contains a flow indicator for visual proof of oxygen flow. The masks, rubber hoses and flow indicators are stored in the oxygen case on the baggage shelf, when not in use.

WARNING

Oil, grease, or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided. Do not permit smoking or open flame in or near aircraft while work is performed on oxygen system, or when the system is in operation. Guard against inadvertently turning the master switch on.

Oxygen Cylinder Identification.

The following information is reflected on each oxygen cylinder.

- Cylinder specification followed by service pressure such as "ICC-3AA 1800 or ICC-3HT 1850" will be stamped on the shoulder or neck of each cylinder.

NOTE

Effective January 1, 1970, all newly manufactured cylinders will be stamped "DOT" (Department of Transportation) in lieu of "ICC" (Interstate Commerce Commission). An example for the new designation would be "DOT-3HT-1850."

- Cylinder serial number will be stamped below or directly following the cylinder specification.
- Hydrostatic test date will be stamped directly below the original manufacture date and shall include the month and year of the hydrostatic test date.

Maintenance.

Before and during maintenance on oxygen systems, the following general rules must be followed.

- Clean hands, tools and working area.
- Keep oil, grease, water and all foreign matter from system.
- Keep all lines dry and capped until installed.
- All compounds used on fittings must conform to MIL-T-5542. No compound shall be used on aluminum alloy flared fittings. Compounds are used only on the first three threads of male fittings. No compound is used on coupling sleeves, or outside of tube flares.

CAUTION

Whenever a component of the oxygen system, (lines, gages, cylinder or regulators, etc.), has been removed, reinstalled, replaced or system has been disassembled in any way, the oxygen system must be leak checked and purged as per procedures outlined in this section.

- Inspection of the cylinder is required before charging. Do not attempt to charge the cylinder if any of the following conditions exist:
 - Contaminated or corroded fitting on cascade cylinder or filler valve.
 - Cylinder out of hydrostatic test date.
 - Cylinder bears no I. C. C. designation.
 - Cylinder completely empty after shutoff valve has been turned off for a length of time. Must be completely disassembled and inspected in an FAA approved facility before charging.

f. Fabrication of pressure lines is not recommended. Lines should be replaced from factory by part number.

g. Lines and fittings shall be clean and dry. One of the following methods may be used to clean lines.

1. A vapor degreasing solution of stabilized trichlorethylene conforming to Specification MIL-T-7003 followed by blowing tubing clean and dry with a stream of clean, dry, filtered air.

CAUTION

Most air compressors are oil lubricated, and a minute amount of oil may be carried by the air stream. A water lubricated compressor should be used to blow tubing clean.

2. Flush with naphtha conforming with Specification TT-N-95, then blow clean and dry with clean, dry, filtered air. Flush with anti-icing fluid conforming to MIL-F-5566 or anhydrous ethyl alcohol. Rinse thoroughly with fresh water and dry with clean, dry filtered air.

3. Flush with hot inhibited alkaline cleaner until free from oil and grease. Rinse with fresh water and dry with clean, dry, filtered air.

NOTE

Cap lines at both ends immediately after drying to prevent moisture from entering.

Bleeding the Oxygen System. (See figure 13-12.)

- a. Pull oxygen control knob (14) to ON position.
- b. Remove tubing from the mask end of one of the passengers oxygen masks and insert into oxygen outlet port. Route the hose outside the cabin area through the pilot's foul weather window.

WARNING

The bleeding procedure should be accomplished outdoors. If the bleeding is done indoors extreme care must be exercised to prevent oxygen flow from oils, grease, contaminants and electrical sparks. The area should be roped off and no smoking or open flame allowed in or near the area.

- c. Bleeding the oxygen system into the cabin area is not recommended.

Removal of Oxygen Cylinder-Regulator Assembly.
(See figure 13-12.)

- a. Position control knob to OFF position.

WARNING

The oxygen cylinder-regulator may be removed with the cylinder charged; however, extreme care must be taken when installing or working near the cylinder-regulator to prevent damaging the cylinder. The slightest scratch, nick or dent is cause for immediate condemnation of the cylinder.

- b. Disconnect three line assemblies (4, 5 and 11) from oxygen cylinder-regulator assembly (10) and cap lines.

CAUTION

Do not move control to the ON position with outlet ports (low pressure) open to atmosphere. Damage to regulator metering poppet may occur.

- c. Disconnect control cable (8) from oxygen cylinder-regulator assembly (10). Safety in the OFF position.
- d. Remove control mounting clamp (9) from oxygen cylinder-regulator assembly (10).
- e. Remove safety wire and loosen wing nuts securing mounting straps (15) around oxygen cylinder-regulator assembly (10).
- f. Lower oxygen cylinder-regulator assembly and remove through nose wheel well opening.

Installation of Oxygen Cylinder-Regulator Assembly.
(See figure 13-12.)

- a. Install oxygen cylinder-regulator assembly (10) through nose wheel well into position in mounting straps (15).
- b. Align oxygen cylinder-regulator assembly (10) with control cable (8) and three line assemblies (4, 5 and 11), tighten wing nuts on mounting straps (15) and secure with safety wire.
- c. Install three line assemblies (4, 5 and 11) on the oxygen cylinder-regulator assembly (10).
- d. Install control mounting clamp (9) on the oxygen cylinder-regulator assembly (10) and connect the control cable (8) to the control actuator with a cotter pin (7).

CAUTION

Make sure cutout is in clamp (9) and is in line with vent hole in regulator (10). Also make sure that no foreign material such as nylon or gasket material is used between clamp and regulator.

Removal of Altitude Compensating Oxygen Regulator. (See figure 13-12.) (310Q0601 and On)

- a. Move oxygen control knob to the OFF position.

NOTE

Repair or maintenance of this unit is not recommended. If malfunction should occur, remove and replace.

- b. Disconnect inlet and outlet lines from compensating regulator (18).
- c. Loosen mounting clamp and remove compensating regulator from aircraft.
- d. Install clean dry caps in inlet and outlet ports of compensating regulator and install clean dry plugs in disconnected oxygen lines.

Installation of Altitude Compensating Oxygen Regulator. (See figure 13-12.) (310Q0601 and On)

- a. Remove protective caps and plugs from compensating regulator and supply lines.
- b. Install compensating regulator in clamp mount.
- c. Connect supply lines to compensating regulator.
- d. Tighten clamp mount screws.

Removal of Pressure Gage. (See figure 13-12.)

The oxygen pressure gage may be removed without bleeding the oxygen pressure system. A check valve is incorporated in the high and low pressure side of the regulator to shutoff the flow of oxygen from the cylinder when either the high or low pressure lines are disconnected from the cylinder.

WARNING

Use non-sparking tools and make sure tools and hands are free from oils, grease and other contaminants when working with oxygen.

- a. Disconnect pressure gage line (4) at the regulator. The check valve should close as the gage line is loosened.

CAUTION

If oxygen continues to flow when line is loosened, reconnect the line and bleed off pressure in accordance with bleeding procedure.

- b. Disconnect gage line (4) from nipple in back of pressure gage (16) and cap line.
- c. Remove light assembly in accordance with Section 14.

- d. Remove pressure gage (16) by removing three screws.

Installation of Pressure Gage. (See figure 13-12.)

- a. Position pressure gage (16) in mounting hole and secure with three attaching screws.
- b. Install light assembly in the upper right position.
- c. Remove caps from line and connect pressure gage line (4) to nipple in back of pressure gage.
- d. Connect pressure gage line (4) to oxygen regulator.

Removal of Filler Valve. (See figure 13-12.)

The oxygen filler valve may be removed without bleeding the oxygen pressure system. A check valve is incorporated in the high pressure side of the oxygen regulator to shutoff the flow of oxygen from the cylinder when the high pressure lines are disconnected from the oxygen cylinder.

WARNING

Use non-sparking tools and make sure tools and hands are free from oils, grease and other contaminants when working with oxygen.

CAUTION

If oxygen continues to flow when line is loosened, reconnect the line and bleed off oxygen pressure in accordance with bleeding procedures.

- a. Disconnect the filler valve line (11) from the filler valve (12) and cap line.
- b. Remove filler valve protective cap (13).
- c. Remove filler valve (12) by removing three nuts and bolts.

Installation of Filler Valve. (See figure 13-12.)

- a. Position filler valve (12) in mounting bracket and secure with three attaching bolts and nuts.
- b. Replace filler valve protective cap (13).
- c. Connect filler valve line (11) to filler valve (12).

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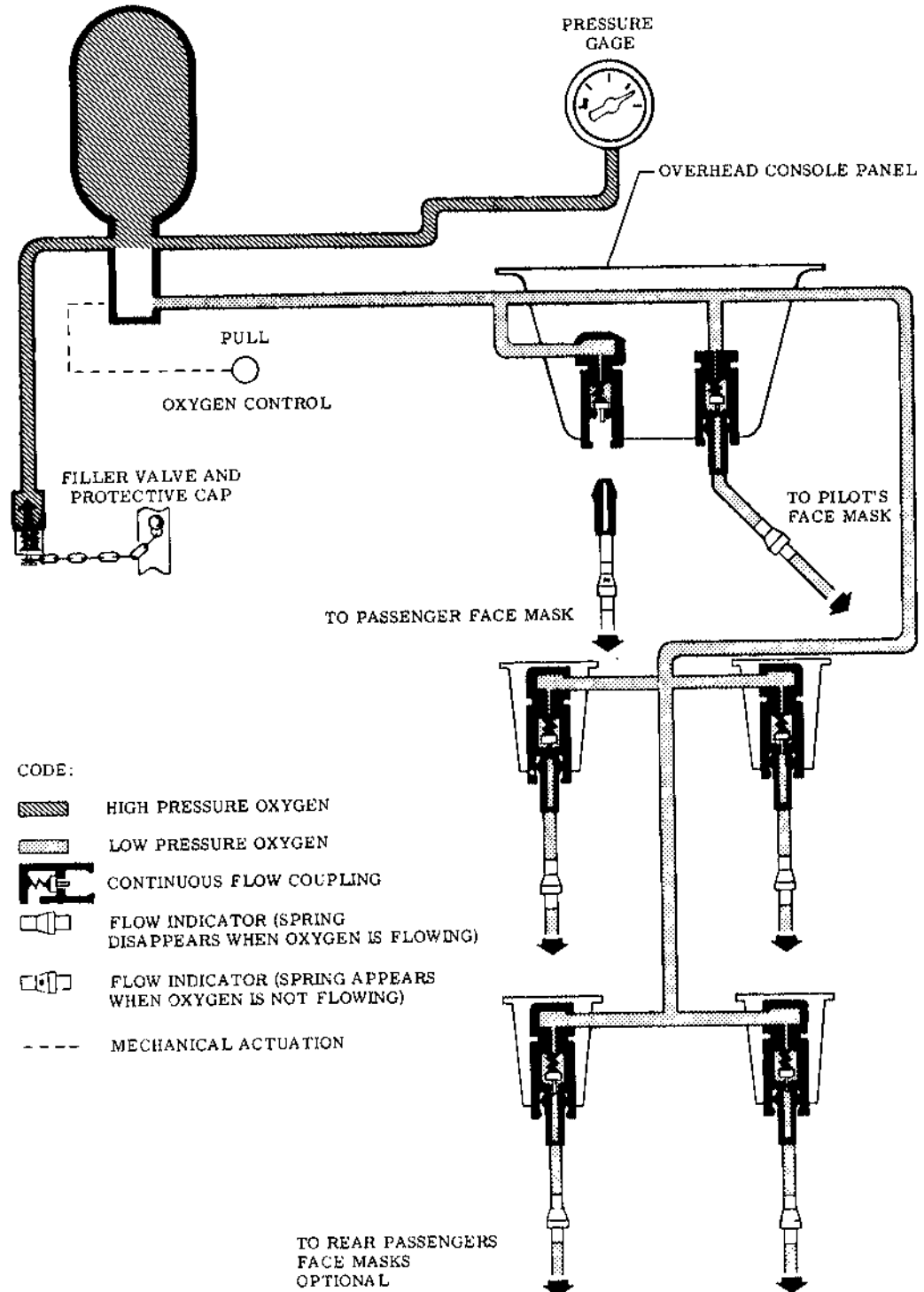
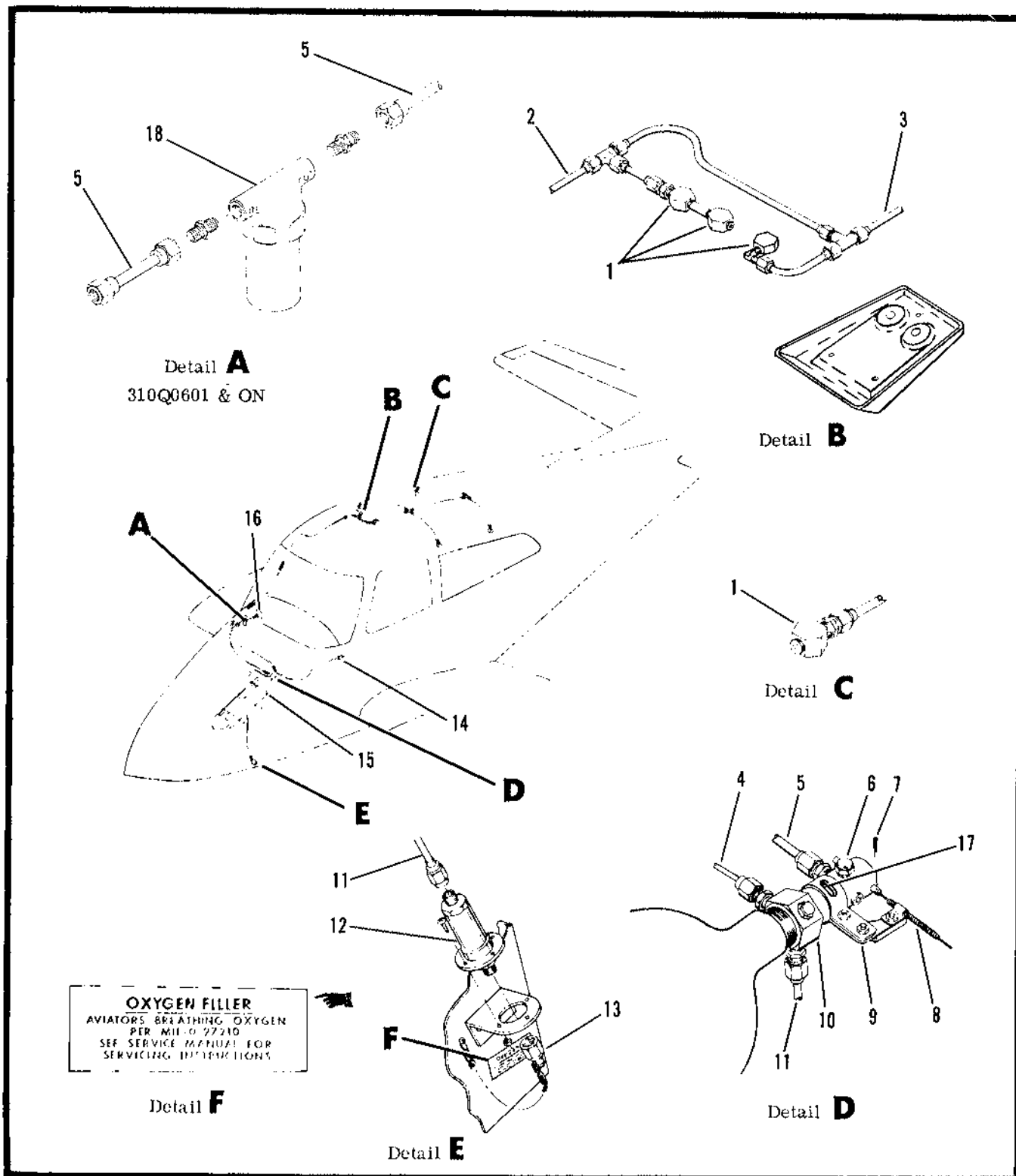
OXYGEN CYLINDER AND
PRESSURE REGULATOR ASSY.

Figure 13-11. Oxygen Supply Systems Schematic



1. Oxygen Outlet	8. Control Cable	14. Control Knob
2. Line Assembly (Tee to union)	9. Control Cable Mounting Clamp	15. Mounting Strap (Cylinder)
3. Line Assembly (Port to cross)	10. Cylinder-Regulator Assembly	16. Pressure Gage
4. Line Assembly (To pressure gage)	11. Line Assembly (Regulator to filler valve)	17. Atmospheric Vent Hole
5. Line Assembly (Regulator to union)	12. Filler Valve	18. Altitude Compensating Oxygen Regulator
6. Pressure Relief Valve	13. Cap	
7. Cotter Pin		

Figure 13-12. Oxygen System Installation

TABLE OF FILLING PRESSURES

Initial temperature refers to ambient temperature in filling room. A rise of approximately 25°F may be expected as a result of compression. The cylinder should be filled as quickly as possible and allowed to cool by ambient air only.

Initial Temp. °F	Filling Pressure Psig	Initial Temp. °F	Filling Pressure Psig
0	1,600	70	1,925
10	1,650	80	1,950
20	1,675	90	2,000
30	1,725	100	2,050
40	1,775	110	2,100
50	1,825	120	2,150
60	1,875	130	2,200

Charging the Oxygen System.

The following procedure may be used in conjunction with the table of pressure/temperature values for charging the cylinder.

- Connect the cascade connection to filler valve.
- Slowly open valve on cascade cylinder having lowest pressure and allow pressure to equalize.
- Close cylinder valve on cascade cylinders, and slowly open valve on cylinder with next highest pressure until cylinder has been charged in accordance with chart.

Leak Testing the Oxygen System.

Test the oxygen system for leakage by applying detector fluids, Type CG-1 solution per Specification MIL-L-25567A, or its equivalent, to each fitting and observe for formation of bubbles. No visible leakage should occur. Remove all traces of solution and repair or replace leaky fittings and repeat preceding procedure. Further test the oxygen system for leakage by pressurizing it to service pressure. The leak rate should not exceed one per cent of total supply per 24-hour period.

Each interconnected series of oxygen cylinders is equipped with a single gage. The trailer type cascade may also be equipped with a nitrogen cylinder (shown reversed) for filling landing gear struts, accumulators, etc. Cylinders are not available for direct purchase, but are usually leased and refilled by a local compressed gas supplier.

Service Kit SK310-32 (available from the Cessna Service Parts Center) contains an adapter, a pressure gage, hose, lines, and fittings for equipping two oxygen cylinders to service oxygen systems. As noted in the Service Kit, a tee (Part No. 11844) and a pigtail (Part No. 1243-2) should be ordered for each additional cylinder to be used in the cascade of cylinders. Be sure to ground the aircraft and ground servicing equipment before use.

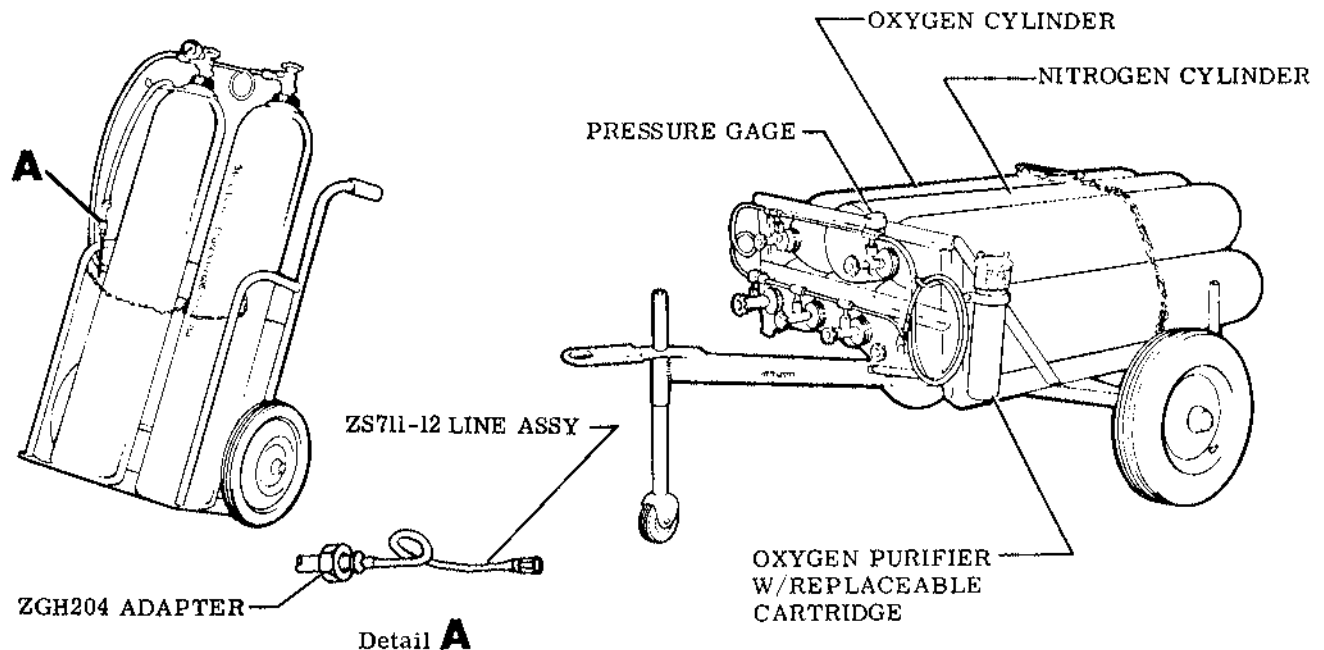


Figure 13-13. Typical Portable Oxygen Cascades

INSPECTION CRITERIA FOR ACCEPTANCE OF OXYGEN CYLINDERS

The following data may be used to determine that oxygen cylinders are acceptable for service. This criteria should be used prior to charging cylinders.

Discrepancies	Cylinder Classification		
	ICC-3HT	1800	
Isolated pitting or corrosion (Depth)	.010	2	3
Local pitting or corrosion or line corrosion (Depth)	.005	3	4
General corrosion	Not allowed		5
Cuts, Digs, Gouges (Depth)	.005	6	
Dents (Depth)	.031	7	
Fire damage	Not allowed		8
Bulges	Not allowed		9

- Isolated pits of small cross section involving loss of wall thickness by corrosive media. Small isolated pits with a maximum depth as shown are acceptable.
- If depth exceeds figure shown, cylinder must be returned to the manufacturer for disposition.
- Local pitting or corrosion or line corrosion involving loss of wall thickness by corrosive media with a pattern of pits which are connected to others in a band or line. A small area with a minimum depth as shown is acceptable. Areas extending beyond 3 inches in diameter or 4 inches long shall be considered general corrosion.
- General corrosion (sometimes accompanied by pitting) involving loss of wall thickness by corrosive media covering a considerable area. Cylinder must be returned to the manufacturer for hydrostatic testing.
- Deformations caused by contact with a sharp object cutting or upsetting the material of the cylinder, decreasing the wall thickness. Maximum defect permissible without corrective action. If this depth is exceeded, the cylinder must be returned to the manufacturer for removal of defects and verification of cylinder strength by hydrostatic testing.
- Deformations caused by contact with blunt objects in such manner that the thickness of the metal is not materially impaired. The major diameter of the dent must be equal to or greater than 32 times the depth of the dent. Sharper dents (or deeper dents) than this are considered too abrupt and must be returned to the cylinder manufacturer for disposition.
- Fire damage is indicated by charring or burning or sintering of the metal, charring or burning of the paint, distortion of the cylinder, functioned safety relief devices, melting of valve parts, etc. Cylinders must be returned to the cylinder manufacturer for disposition.
- Bulged cylinders are not acceptable. Cylinders must be returned to the cylinder manufacturer for disposition.

TABLE I

NOTE

Oxygen installations utilize a standard filler valve. To attach to this valve, the oxygen service cart must be equipped with an AN805-3 nut.

2. Light weight (ICC or DOT-3HT 1850) cylinder must be hydrostatically tested to 5/3 their working pressure every three years starting with the date of the last hydrostatic test.

NOTE

Servicing and Inspection of Oxygen System

Servicing and inspection of oxygen shall be accomplished as follows:

a. Hydrostatic test requirement:

1. Standard weight (ICC or DOT-3AA 1800) cylinder must be hydrostatically tested to 5/3 their working pressure every five years starting with the date of the last hydrostatic test.

These test requirements are established by the Interstate Commerce Commission Code of Federal Regulations, Title 49, Chapter 1, Paragraph 73.34.

b. Service life requirements:

1. Standard weight (ICC or DOT-3AA 1800) cylinders have no life limitations, and may continue to be used until they fail hydrostatic testing.

2. Lightweight (ICC or DOT-3HT 1850) cylinders must be retired from service after 12 years or 4,380 filling cycles after date of manufacture, whichever occurs first.

c. Oxygen inspection requirements: A careful visual inspection of the cylinders should be performed during routine maintenance and periodic inspections. If any bad dents, scratches or areas of corrosion are found, the cylinder must be carefully checked per the criteria Table I.

NOTE

If the acceptability of the cylinder is questionable after using Criteria Table I, do not hesitate to return cylinder to manufacturer.

d. Regulator shall be removed and overhauled by manufacturer or an FAA approved facility during hydrostatic testing.

e. Pressure Gage. The pressure gage shall be checked for accuracy and cleaned by the manufacturer every 3 years or 3000 flight hours, whichever occurs first.

f. Individual outlets shall be disassembled and inspected, and the sealing core, and/or all rubber parts replaced, regardless of condition every 3 years or 3000 flight hours, whichever occurs first.

g. The filler valve should be disassembled, inspected and the O-rings replaced, regardless of condition every 3 years or 3000 flight hours, whichever occurs first.

h. High pressure lines should be inspected for scratches, dents, cracks, deep gouges if a leak is indicated. Lines should be tested to not less than 3000 PSIG if trouble is indicated.

WARNING

Whenever components have been removed and replaced or oxygen system has been allowed to deplete to below 50 psi, the system must be purged in accordance with purging procedures before charging the system.

i. Mask and Hose.

1. Cleaning - Clean mask and hose with a mild solution of soap and water. Rinse thoroughly with clean water and allow to dry. Make sure all soap is removed after rinsing. Masks may be disinfected with a hospital type antiseptic spray or Zep Aero SBT-12.

2. Inspection - Inspect mask and hoses for leaks, cracks, deterioration, check mask storage compartment for cleanliness and general condition, check flow indicators for free movement, and inspect couplings for proper insertion.

NOTE

Remove mike from pilot's mask when cleaning.

Purging the Oxygen System

a. Charge the oxygen system in accordance with charging procedures.

b. Move aircraft outdoors if possible. If unable to move aircraft outdoors, make sure area is roped off, no smoking or open flame permitted in the area, no grease or lubricant near cabin area, cabin door and pilot's window open. Allow only qualified personnel to perform the purging operation.

c. Plug all masks into outlets and purge system by allowing the oxygen to flow for at least 10 minutes. Smell the oxygen flowing from the outlets and continue to purge until the oxygen is odorless. Refill cylinder as required during and after purging.

Functional Testing the Oxygen System.

Whenever the oxygen system regulator (or regulator-cylinder assembly) has been replaced or overhauled, perform the following flow and internal leakage tests to check that the system functions properly.

a. Fully charge the oxygen system per charging instructions.

b. Install an oxygen outlet adapter (Cessna Part Number C166005-0506) into a pressure gage (gage should be calibrated in one-pound increments from 0 to 100 PSIG), and insert adapter into pilots' oxygen outlet. Place control lever in the "ON" position. The gage pressure should be 70 ±10 PSIG.

c. Insert adapters (or mask and line assemblies if they are operating properly) into all remaining outlets. With oxygen flowing from all outlets, the pressure should still be 70 ±10 PSIG. Flow check shall be accomplished with a ground check flow meter model 40400, or equivalent.

d. Place oxygen control lever in the "OFF" position and allow pressure to fall to 0 PSI. Remove all adapter assemblies except the one with the pressure gage. The pressure must not rise above 0 PSI when observed for one minute. Remove pressure gage and adapter from oxygen outlet.

NOTE

If pressure specified in the foregoing procedures are not obtained, the oxygen regulator is not operating properly. Remove and replace cylinder-regulator assembly with another unit and repeat test procedure.

e. Connect oxygen masks to each outlet and check each mask for proper operation.

f. After checking, return all masks to mask case.

g. Recharge oxygen system as required.

OIL DILUTION SYSTEM (OPTIONAL EQUIPMENT). (See figure 13-14.) Aircraft 310P0001 To 310Q0601

The oil dilution system consists of two solenoid valves, one mounted on the firewall of each engine compartment. Each valve is connected to the main fuel supply line, and to each engine crankcase at an oil passage on the suction side of the engine oil pump. The valves are operated electrically by placing the oil dilution switch in either the left or right position. When the switch is depressed, oil in the selected engine will be diluted. When the switch is released, it automatically returns to the OFF position.

OIL DILUTION SYSTEM. (Optional Equipment.)

Oil Dilution System Operation. (Aircraft 310P0001 to 310Q0601.)

If oil dilution is required, dilute the oil with the engines operating at 1000 RPM and the auxiliary fuel pump switch in ON or LOW position. Refer to the applicable Owner's Manual for oil dilution time. On 310 aircraft, the fuel will flow into the oil pump of the engine being diluted at the rate of four quarts every one minute and 20 seconds. On Turbo 310 aircraft the fuel will flow into the oil pump of the engine being diluted at the rate of four quarts every two minutes. Diluting oil in each engine for two minutes (4 quarts of fuel) is the maximum dilution that should be used. Oil dilution longer than two minutes per engine will exceed the sump capacity of the engines. When diluting, watch the oil pressure closely. A slight, gradual pressure drop is to be expected as the oil is thinned. Stop the engine if any sharp fluctuation in pressure is observed, it may be caused by an oil screen being clogged with sludge washed down by the fuel. On starting and warm-up after diluting the oil, watch the oil pressure closely for an indication of sludge blocking the oil screens. If the full dilution time was used, starting with full sumps, run the engines long enough to evaporate some of the fuel and lower the sump level to 12 quarts before takeoff. To avoid progressive dilution of the oil, flights of at least one hour duration should be conducted between oil dilution operations.

Removal of Oil Dilution System. (See figure 13-14A.)

NOTE

Plug all open ports and lines to prevent entry of foreign materials.

- a. Disconnect connector (6) from oil dilution valve (7).
- b. Disconnect line assembly (3) from tee (4) and oil dilution valve (7), remove line assembly from nacelle.
- c. Disconnect hose assembly (9) from oil dilution valve (7) and tee, remove hose assembly from nacelle.
- d. Remove oil dilution valve (7) by removing two screws retaining clamp (1), bracket (8) and oil dilution valve (7) to nacelle canted bulkhead.

Installation of Oil Dilution System. (See figure 13-14A.)

- a. Install oil dilution system by reversing removal procedures.
- b. Connect electrical connector (6) to solenoid valve and secure with safety wire.

NOTE

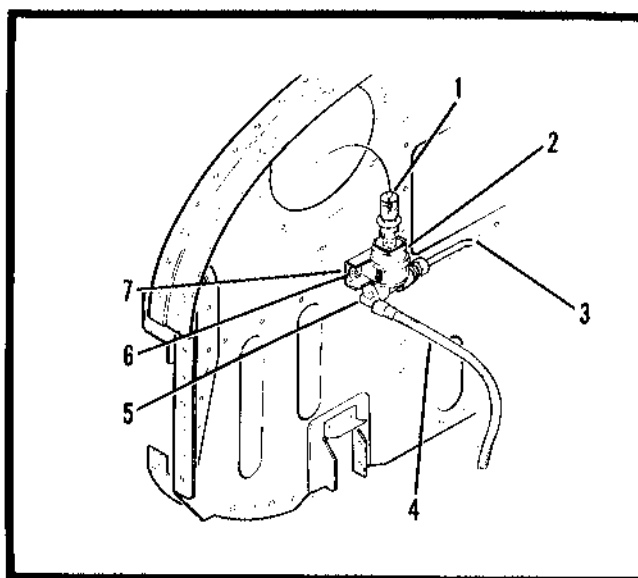
When the dilution system is used for the first time each season, it is recommended that the oil be changed and the oil screens cleaned to remove sludge accumulations washed down by the fuel. Use the full oil dilution period, drain the oil, clean the screens, refill with new oil and redilute as required for anticipated temperature.

Removal of Oil Dilution Solenoid Valve. (See figure 13-14.)

- a. Disconnect oil dilution hose (4) and fuel line (3).
- b. Disconnect oil dilution electrical connector (1).
- c. Remove two screws (6), clamp and bracket (7) attaching the solenoid valve (2) to engine firewall, and remove solenoid valve (2) from firewall.

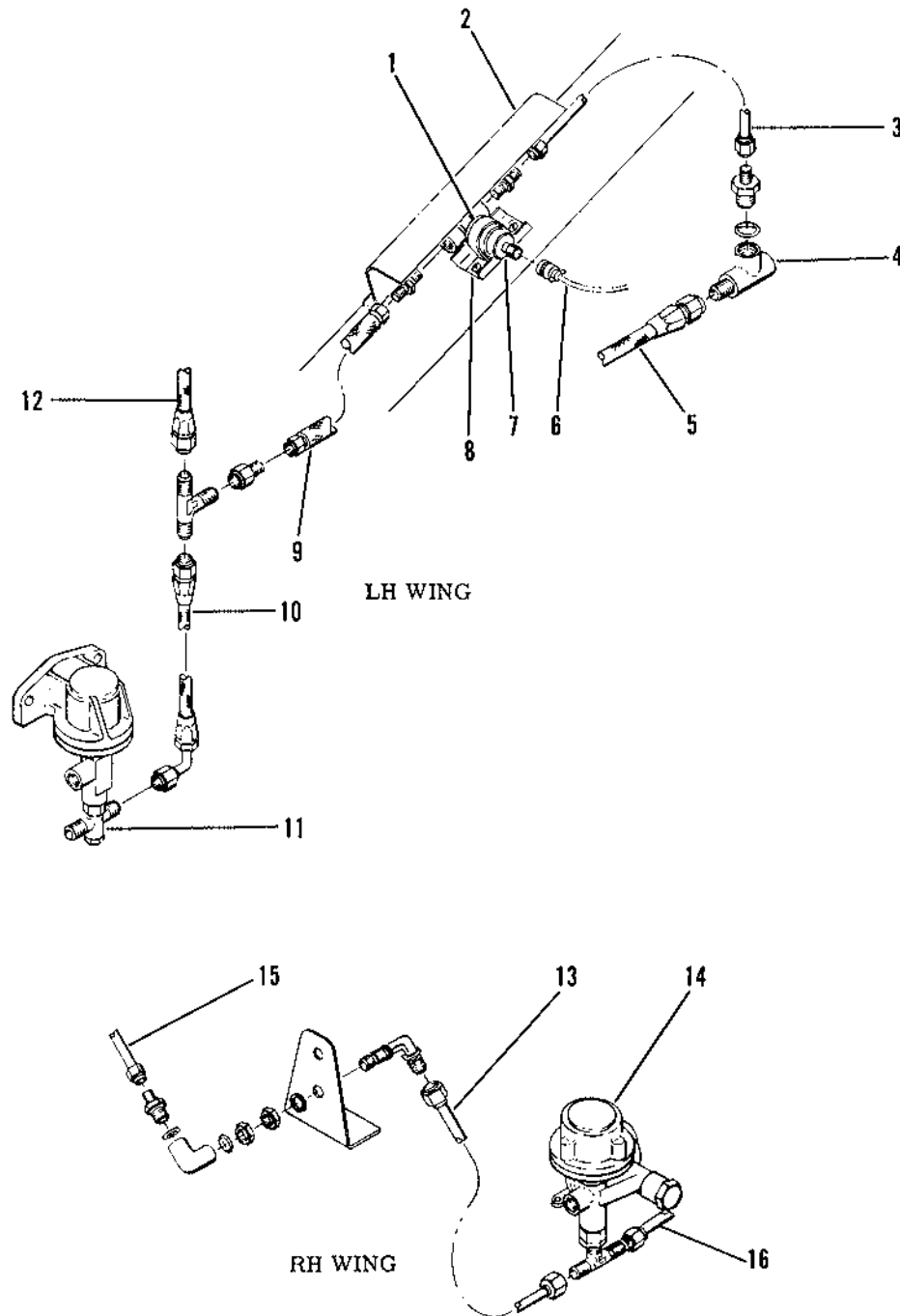
Installation of Oil Dilution Solenoid Valve. (See figure 13-14.)

- a. Attach solenoid valve to engine firewall as shown in figure 13-14.
- b. Connect electrical connector (1) to the solenoid valve and secure with safety wire.
- c. Connect fuel line (3) from main fuel supply line. Connect oil dilution hose (4) to solenoid valve.



1. Electrical Connector	5. Elbow
2. Oil Dilution Solenoid Valve	6. Screw
3. Fuel Line	7. Bracket
4. Oil Dilution Hose	

Figure 13-14. Oil Dilution Solenoid Valve



1. Clamp	9. Hose Assembly (Valve to tee)
2. Shield	10. Hose Assembly (Tee to controller)
3. Line Assembly (Tee to Valve)	11. Pressure Ratio Controller
4. Tee (Outboard nacelle rib)	12. Hose Assembly (Tee to Scavenger pump)
5. Fuel line Assembly (To fuel Pump)	13. Line Assembly (Controller to elbow)
6. Electrical Connector	14. Absolute Pressure-Rate Controller
7. Oil Dilution Valve	15. Line Assembly (Valve to elbow)
8. Bracket	16. Line Assembly (Controller to controller)

Figure 13-14A. Oil Dilution System

PROPELLER DEICE SYSTEM. (OPTIONAL)

The propeller deice system is the electrothermal type. It consists of the following components added to the propeller installation: propeller blade deice boots bonded to the propeller blades, slip ring assembly mounted to engine crankshaft, brush holder assembly mounted to the engine crankcase, a repeat cycle timer, ammeter mounted in the instrument panel, a switch and circuit breaker. The propeller blade deice boots are designed to remove ice under all probable icing conditions. Deicing is accomplished by raising the temperature of the ice and deice boot interface to a point at which centrifugal force removes the ice. The cycle timer used on the deicing system heats the propeller deice boots from 28 to 40 seconds. For example: if the timer should start on cycle number 1, the deicing system heats the outer element on the right propeller from 28 to 40 seconds (the timer pauses one second between cycles), then proceeds into cycle number 2, which heats the inner element on the right propeller from 28 to 40 seconds. It then cycles to the outer element on the left propeller from 28 to 40 seconds and to the inner element for 28 to 40 seconds to complete cycles numbers 3 and 4. The cycling is done in order to maintain a balance between the left and right propellers and reduce power drain on the electrical system.

Removal of Propeller Deice Boot.

CAUTION

Do not use sharp tools or objects to remove boot as damage to the propeller may result.

- a. Remove deice boot from the propeller by softening the bond line of boot with Toluol until loosened.
- b. Pull deice boot slowly from propeller blade as bond line is loosened.

Installation of Propeller Deice Boot.

- a. Place deice boot on hub end of propeller blade, centered on blade leading edge and lead strap (terminal end) of boot aligned and against attach holes of installed terminal bracket.
- b. Mark off an area on propeller blade (using masking tape) 1/2 inch from each side and outer end of deice boot.
- c. Remove boot and clean the masked area of propeller blade using Methyl-Ethyl-Ketone (MEK) cleaning solvent. For final cleaning, wipe the solvent film off quickly with a clean dry cloth before it has time to dry.

CAUTION

Methyl-Ethyl-Ketone (MEK) must be used in a well ventilated area; avoid prolonged breathing of fumes. During all surface cleaning operations take precaution to guard against spark or open flame in work area.

d. Mix thoroughly the EC1300LP cement and apply one brush coat evenly to the cleaned metal surface. Allow to air dry for a minimum of one hour and then apply a second coat of EC1300LP cement.

e. Moisten a clean cloth with MEK and clean the unglazed back surface of the deice boot, changing cloth frequently to avoid contamination of the area.

f. Apply an even brush coat of EC1300LP cement to the unglazed back surface of the deice boot.

g. Allow cement to dry; then using a silver (non-graphite, greaseless) pencil, mark a centerline along the leading edge of the propeller blade and a corresponding centerline on the cemented side of the deice boot.

h. Reactivate the surfaces of the cement using a clean, lint-free cloth, heavily moistened with Toluol solvent. Avoid excessive rubbing of cement which would remove it from surfaces.

i. Position the deice boot centerline on the propeller leading edge, with all marks and terminal leads aligned. Tack the deice boot centerline to the leading edge of the propeller blade.

NOTE

If the deice boot is allowed to get off centerlines, pull up with a quick motion and reposition properly. Roll firmly along centerline with a rubber roller.

j. Roll outwardly from the centerline to the edge. If excessive material at the edges tend to form puckers, work them out smoothly and carefully with fingers.

k. Roll the tapered edges of the deice boot with a metal hand-stitch roller and ensure there are no bubbles entrapped under the boot and that all edges firmly adhere to the propeller.

NOTE

In the event it becomes necessary to remove or loosen installed deice boots, Toluol shall be used to soften the "cement" line. A minimum amount of this solvent should be applied to the cement line as tension is applied to peel back the deice boot. The removal should be slow enough to allow the solvent to undercut the cement so that parts will not be damaged.

l. Apply one brush coat of EC539P coating, mixed per manufacturer's instructions, evenly around the edges of the installed deice boot.

m. Remove masking tape from the propeller blade and clean the surface of the blade with a clean cloth dampened with Toluol.

Removal and Installation of Slip Rings. (See figure 13-15.)

- a. Remove propeller spinner from aircraft in accordance with Propeller Removal Procedures.
- b. Tag and disconnect electrical leads at terminal strip (7).
- c. Remove bolts attaching wire supports to spinner bulkheads, push grommets and wires through spinner bulkhead.
- d. Remove propeller from aircraft in accordance with Propeller Removal Procedures.
- e. Remove four bolts attaching slip ring, supports, and wires to aft propeller flange.
- f. Install slip ring (3), propeller and propeller spinner by reversing removal procedures.

CAUTION

Make sure cable dimensions shown in figure are correct and attaching clamp is behind antislip ring (19) to prevent damage from centrifugal force or propeller feathering.

Brush Holder Assembly.

Contact pressure of the brushes in the slip rings is provided by means of a spring in back of each brush. The spring is designed to provide a maximum of brush life consistent with obtaining sufficient contact pressure of the brushes against the slip rings to provide good operating characteristics. The average life of the brushes is approximately 500 hours.

Removal and Installation of Brush Holder Assembly and Mount Bracket. (See figure 13-15.)

- a. Disconnect electrical connector from brush holder assembly (14).
- b. Remove brush holder assembly (14) from bracket (10) by removing nuts, spacers, washers and screws.
- c. If required, remove mounting bracket (10) from engine assembly by removing attaching nuts, washers, spacers and bolts.
- d. Install mounting bracket (10) and brush holder assembly (14) by reversing removal procedures.

NOTE

When installing brush holder, hold the brushes back in the holder until the mounting bolts have been inserted through the crankcase. Be careful not to apply any side loading on the brushes during installation.

Inspection and Testing of Propeller Deice System.

- a. Visually check the completed installation.
 1. Check propeller deicers for wrinkling or loose spots.
 2. Check wiring connections for correctness and tightness.
 3. Check continuity of wiring. Remove plug from timer. Using ohmmeter, check continuity from:
 - (a) Pin C of the plug to Terminal A of one prop shoe on the right engine.
 - (b) Pin D of the plug to Terminal B of one prop shoe on the right engine.

- (c) Pin E of the plug to Terminal A of one prop shoe on the left engine.
- (d) Pin F on the plug to Terminal B of one prop shoe on the left engine.
- (e) Pin G of the plug to ground.
- (f) Terminal C of one prop shoe on the right engine to ground.
- (g) Terminal C of one prop shoe on the left engine to ground.

b. System Tests.

1. Propeller Deicer Resistance Check:

- (a) Using an ohmmeter, check the resistance between terminals A-C, B-C of prop shoes in both engines. Resistance should be 2.23 to 2.58.

2. Timer Tests:

- (a) Connect a jumper wire from Pin B of the timer receptacle to Terminal B of the connector plug and from Pin G of the timer receptacle to ground.
- (b) Place the prop deicing system switch in the "ON" position.
- (c) Using a voltmeter check the DC volts to ground from Pin B of the timer. This should be approximately 24 volts DC.
- (d) Check DC volts to ground from Pins, C, D, E, F; these are the points at which the system voltage is applied in sequence to cycle power to the propeller deicers. The following cycling action of the timer should be:
 - (1) Timing sequence Pin C, 30 seconds, right engine propeller outboard halves.
 - (2) Timing sequence Pin D, 30 seconds, right engine propeller inboard halves.
 - (3) Timing sequence Pin E, 30 seconds, left engine propeller outboard halves.
 - (4) Timing sequence Pin F, 30 seconds, left engine propeller inboard halves.

NOTE

On time is approximately 30 seconds when operating on alternator voltage. When operating on battery voltage as in this checkout procedure, on time may be longer.

NOTE

The timer does not reposition itself to start at Pin C when the system is turned off, but will begin its cycling at the same position in which it was last turned off. Cycling will then proceed in the order of C, D, E, F, as shown.

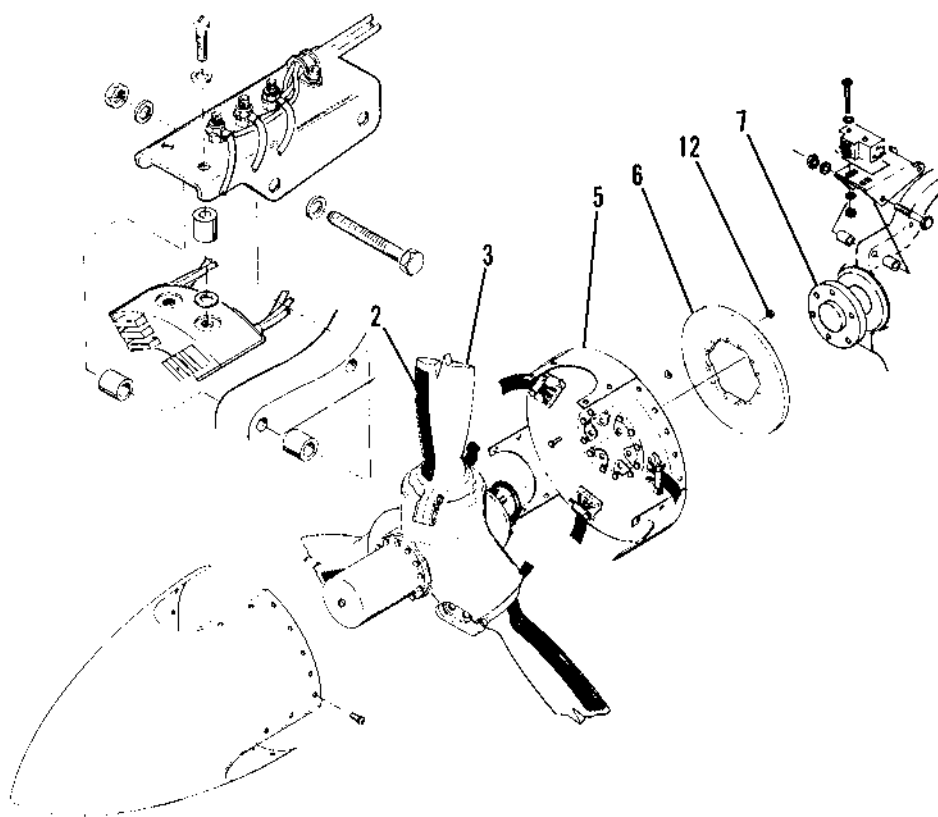
NOTE

Check Pins C, D, E, F, until a voltage reading of approximately 24 volts DC is obtained. Hold the voltmeter probe on the pin until the voltage drops to 0. Move the probe to the next pin in the sequence C, D, E, F. Check volts DC at each pin in sequence, 24 volts DC should be measured at each pin in the sequence C, D, E, F. When correctness of the cycling sequence is established, turn

turned on, place a hand on each of the two
deicer areas which should be heated per
paragraph b. 2. (d).

(c) The assistant in the cabin should note and record the prop deicer system ammeter reading. This should be from 8 to 12 amps (for two bladed propellers) or 11 to 18 amps (for three bladed propellers). Keep a close watch on the ammeter needle. The ammeter needle will deflect every 30 seconds because of the switching action of the timer. Each deflection will indicate a change in the heating areas of the prop deicers.

- (a) Remove the jumper wire installed in paragraph b. 2. (a), and replace the connector plug in the timer receptacle.
- (b) Referring to the position in which the timer was left in paragraph b. 2. (d), have an assistant place the prop device system switch in the "ON" position. As the switch is



310P0001 TO 310Q0601

Figure 13-15. Propeller Deice Installation (Sheet 1 of 2)

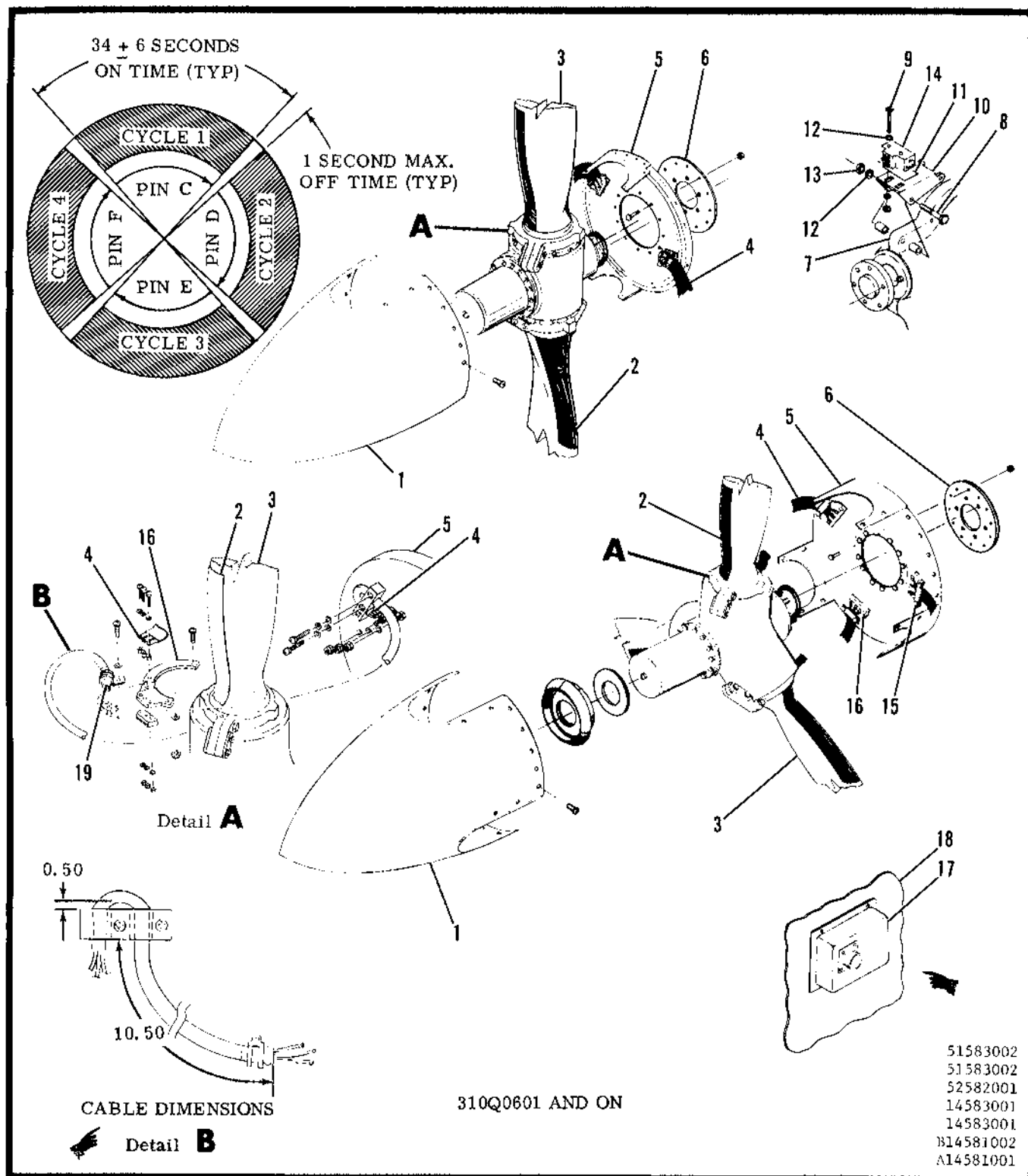
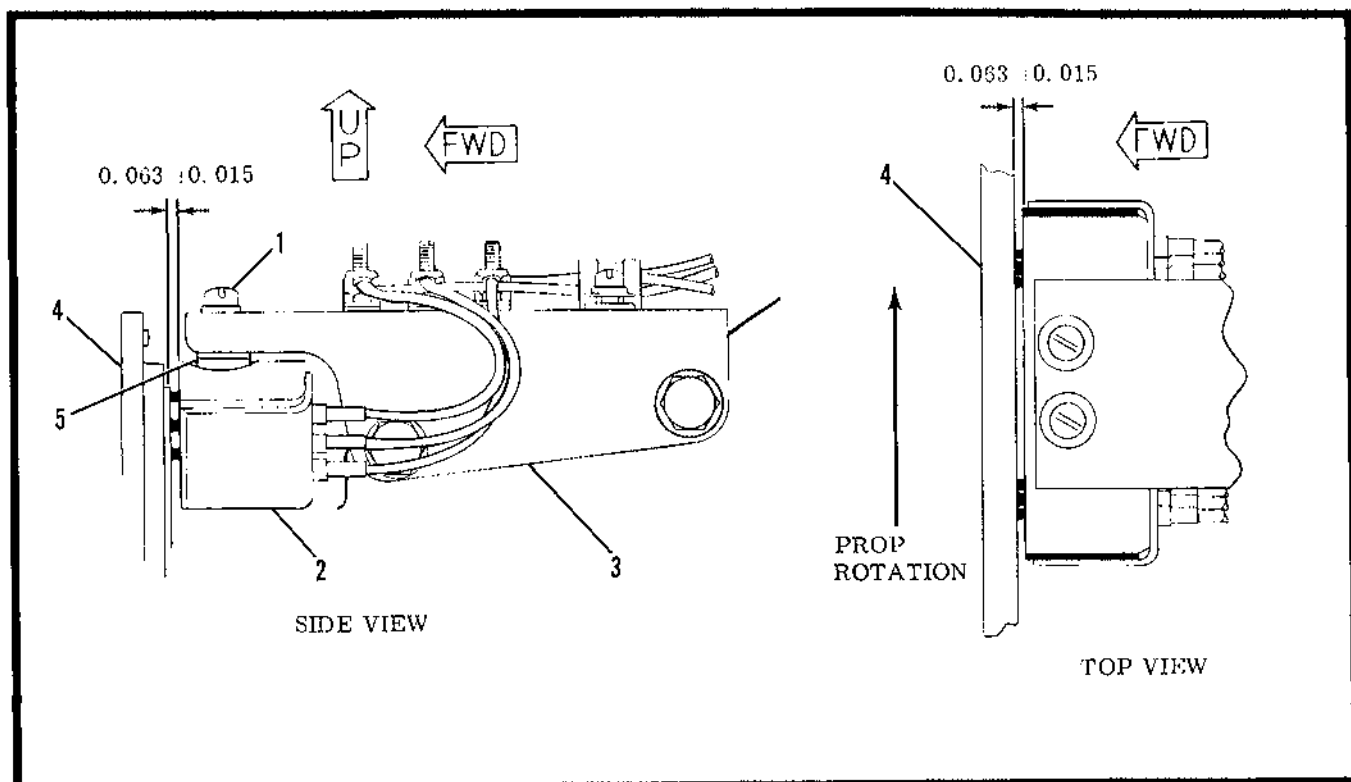


Figure 13-15. Propeller Deice Installation (Sheet 2)

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1. Screw 2. Brush Holder 3. Bracket Assembly 4. Slip Ring 5. Washer

Figure 13-16. Deice Brush Holder Installation

NOTE

The observer in the cabin should call out these 30 second interval deflections and the inspector at the propellers should change the position of his hands on the prop deicers accordingly, to check proper heating sequence of the prop deicer areas.

NOTE

If any irregularities are noted, recheck the wiring from the timer to the brush holder assembly and the prop deicer terminal connections. Make corrections as necessary and retest.

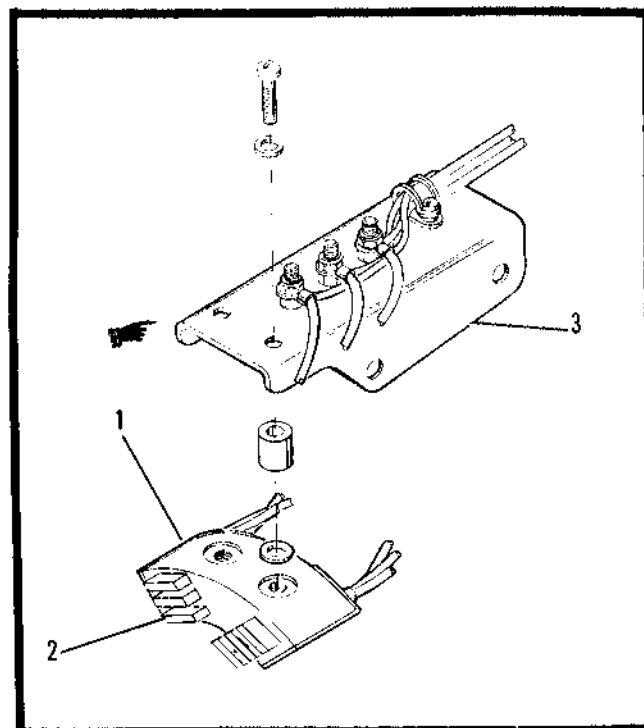
c. Slip Ring and Holder Assembly Check.

1. Check for out of flatness:
 - (a) Allowable tolerance is .008. If .008 is exceeded, shim under mounting bolts to bring within tolerance.

NOTE

Ground checkout of the system is allowed, with the engines not running.

Allow a minimum of 5 hours of engine running time to allow the brushes to become seated before turning on the propeller deice system.



1. Brush Block 2. Brush 3. Brush Bracket

Figure 13-16A. Brush Holder Assembly

Adjustment of Brush Holder Assembly. (See figure 13-16.)

a. When a chattering or screeching noise is emitted from the brush slip ring area, the probable cause is the improper alignment of the brushes and slip ring.

NOTE

If this chattering or screeching is noticed over idling engine noises, the trouble is severe and should be remedied immediately. A less severe chattering or screeching may be detected by pulling each propeller through slowly in the direction of rotation.

b. The brush holder assembly should be positioned as follows:

1. Loosen screws through bracket assembly and brush holder.
2. Adjust brush holder assembly by twisting brush holder assembly in brackets so that the brushes are perpendicular to the slip ring surfaces.
3. Check each brush for correct alignment with the slip ring surfaces through 360° rotation. Add or remove washers (5) for correct alignment.
4. Check for a 0.063 ± 0.015 inch (nominal) clearance between the main body of the brush holder assembly and the slip ring through 360° rotation.
5. Check flatness of slip ring as follows:
 - (a) Mount a dial indicator on engine.

- (b) Rotate slip ring through 360° of rotation.
- (c) Observe dial indicator for a T.I.R. (Total Indicator Reading) of .012 to .015.
- (d) If reading is not in tolerance, replace slip ring.

Removal and Installation of Timer Unit.

- a. Locate timer unit on shelf in upper left-hand nose section, just forward of cabin bulkhead.
- b. Disconnect electrical connector from timer unit.
- c. Remove timer unit from shelf by removing four attaching screws and nuts.
- d. Install timer unit by reversing removal procedures.

Removal and Installation of Deice Ammeter.

- a. To remove and install ammeter, refer to Section 12.

Removal and Replacement of Switch and Circuit Breaker.

- a. Turn battery switch off.
- b. Remove hood retaining switches.
- c. Loosen decorative nut securing switch, and remove switch from panel.
- d. To replace switch, reverse this procedure.

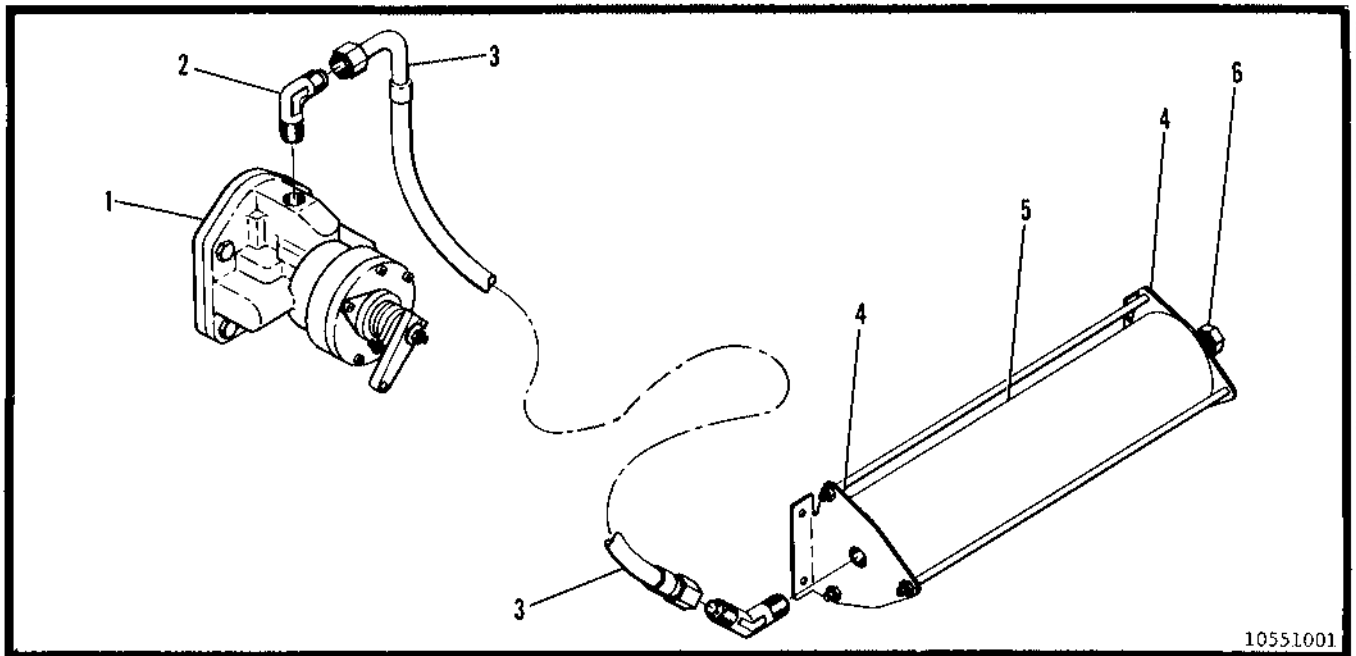
Troubleshooting the Propeller Deice System.

TROUBLE	PROBABLE CAUSE	CORRECTION
ELEMENTS DO NOT HEAT	Open circuit.	Reset circuit breaker.
	Defective switch.	Replace switch.
	Brushes not adjusted properly.	Readjust brushes.
	Broken ground.	Reground.
	Defective brushes.	Replace brushes.
	Defective timer.	Replace timer.
ELEMENTS HEAT IN ERRATIC MANNER	Defective timer.	Replace timer.
	Defective slip ring.	Replace slip ring.
	Defective brushes.	Replace or readjust brushes.
FOUR ELEMENTS HEAT	Defective timer.	Replace timer.
CHATTERING OR SCREECHING	Alignment of brush block assembly.	Replace brushes and adjust in accordance with adjusting procedures.

PROPELLER UNFEATHERING SYSTEM. (OPTIONAL)

Each optional unfeathering system consists of a dry air or nitrogen-charged accumulator, a special governor, and a hose running between the governor and

the accumulator. The governor contains a spring-loaded check valve which is unseated while the propeller control is in any position except FEATHER, thus permitting governor-pressurized oil to flow to



1. Governor
2. Elbow

3. Hose
4. Bracket

5. Accumulator
6. Filler Valve

Figure 13-17. Propeller Unfeathering System

and from the accumulator. When the propeller control is moved to the FEATHER position, the check valve is seated and oil under governor-pressure is trapped in the accumulator and hose. As the propeller control is moved out of the FEATHER position, the trapped oil flows back through the governor to the propeller to unfeather it.

CAUTION

Always leave propeller control in the unfeathered position when the aircraft is on the ground. This procedure prevents the possibility of heat causing trapped oil to expand to pressures which could damage the accumulator.

Removal of Propeller Unfeathering System. (See figure 13-17.)

CAUTION

Release system pressure by placing propeller control in UNFEATHER position and release accumulator pressure through the filler valve.

- Disconnect hose (2) from governor (1) and accumulator (3).
- Remove accumulator by removing four bolts attaching brackets (4) to the engine beam assembly.
- Remove governor (1) by removing attaching nuts.

Installation of Propeller Unfeathering System. (See figure 13-17.)

- Install propeller unfeathering system by reversing removal procedures.
- Refer to Section 2 and service accumulator.

Operational Check of Propeller Unfeathering System.

- With engines operating at 2000 RPM, move propeller controls to the FEATHER position, then position mixture to IDLE CUT-OFF. The propellers should move to the feathered position.
- Move propeller controls to an unfeathered position. Propellers should unfeather.
- If propellers do not unfeather, check system for leaks and proper pressure.

NOTE

When propellers do not unfeather sufficiently to engage high pitch stop pins, bleed off accumulator pressure to 100-110 psi, then recheck operation.

THREE BLADED PROPELLER. (OPTIONAL)

Removal of Propellers. (See figure 13-18.)

- Place propeller in the feathered position.
- Refer to Section 9 and remove engine cowlings in accordance with removal procedures.
- Remove six attaching nuts (9) securing the propeller hub to engine crankshaft.

CAUTION

Support the propeller before removing the last nut to prevent the possibility of dropping propeller.

- d. Carefully remove propeller assembly from engine crankshaft.

Installation of Propellers. (See figure 13-18.)

- a. Clean the propeller hub (5) and engine crankshaft flange with crocus cloth.
- b. Wipe dust and foreign particles from the propeller hub, crankshaft flange, and oil passages with a clean rag.

NOTE

Inspect O-ring seal (6) in propeller hub flange for damage and replace as necessary.

- c. Secure propeller assembly to engine crankshaft by six self-locking nuts (9).

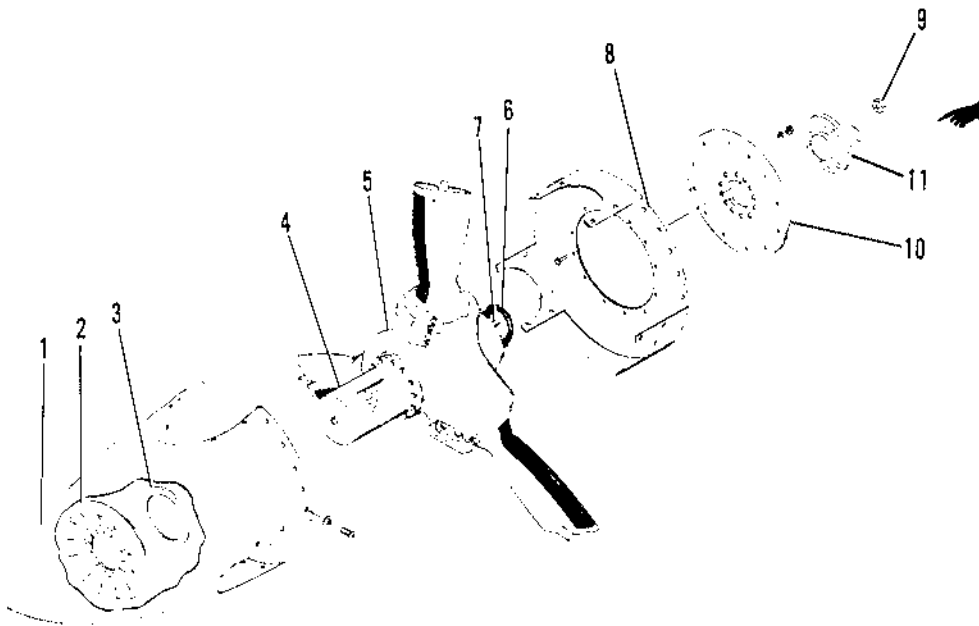
WARNING

Do not use all steel locknuts. Use only new elastic element locknuts when installing propeller.

NOTE

Torque nuts (12) from 80 to 85 ft lbs.

- d. Replace engine cowling in accordance with Section 9.
- e. Perform an operational check in accordance with the Operational Check for Propellers.



1. Spinner	5. Propeller Hub	9. Nut
2. Support	6. O-Ring Seal	10. Adapter
3. Spacer	7. Stud	11. Crankshaft
4. Propeller Cylinder	8. Spinner Bulkhead	

Figure 13-18. Three Bladed Propeller Installation

CESSNA ECONOMY MIXTURE INDICATOR.

The exhaust gas temperature (commonly referred to as EGT) sensing device is used to aid the pilot in selecting the most economical fuel-air mixture for cruising flight at a power setting of 75% or less. Exhaust gas temperature (EGT) varies with the ratio of fuel-to-air mixture entering the engine cylinders. Refer to the appropriate aircraft Owner's Manual for correct operation procedures of system.

Removal and Installation of EGT System. (See figure 13-19.)

- Tag and disconnect electrical leads on indicators.
- Refer to Section 14 and remove two light assemblies attached to indicator and stationary panel.
- Remove indicator by removing two remaining screws and nuts.
- Route electrical wires from cabin, through wing, to probe in engine nacelle.
- Remove probe from exhaust manifold.
- Install components by reversing the removal procedures.

NOTE

Do not alter length of electrical wires.

Calibration of EGT System. (See figure 13-19.)

- To check calibration, obtain an average cruise

Troubleshooting the EGT System.

TROUBLE	PROBABLE CAUSE	CORRECTION
GAGE INOPERATIVE	Defective gage, probe or wiring.	Isolate defective circuit, replace defective probe or gage.
INCORRECT READING	Indicator needs calibrating.	Calibrate in accordance with calibrating procedure.
FLUCTUATING READING	Loose, frayed or broken electrical lead.	Tighten connections, and repair or replace defective leads.

POWER FRONT SEAT. (310P0001 to 310Q0201)

Removal of Power Front Seat. (See figure 13-20.)

- Raise seat to the full UP position.
- Pull plunger on circuit breaker (9) out to OPEN electrical circuit, disconnect aircraft power cord (11) from terminal block located on forward seat base.
- Locate seat stop block on inboard seat track, remove two screws and stop block from seat track.
- Pull up on the adjustment handle (6) and slide the seat aft to clear seat support (10).
- Remove seat from the aircraft.

Installation of Power Front Seat. (See figure 13-20.)

- Check seat for the full UP position.
- Pull up on the adjustment handle (6) and slide seat onto seat support (10).
- Install seat stop block on inboard seat track by

condition of 65% power at 7500 feet and lean mixture to peak exhaust temperature on indicator.

NOTE

To obtain peak exhaust temperature, lean out mixture control slowly enough for pointer to follow. When the pointer stops going up and starts a downward movement, enrich mixture enough to regain peak reading.

- Record reading achieved after system has stabilized.
- Repeat step a. several times to insure a positive reading has been achieved.
- Lean mixture to a setting of not less than 25° below peak exhaust gas temperature.
- Use adjust screw on face of indicator and position pointer to 4/5 scale.

NOTE

Adjustment should not exceed $\pm 75^{\circ}\text{F}$ or three divisions.

- If adjustment for more than $\pm 75^{\circ}\text{F}$ is required, perform the following steps:

- Gain access to rear of indicator.
- Viewing meter from rear, turn calibration screws one turn clockwise for increase in indicator reading of 25° F (one division) or one turn counter-clockwise for decrease.

installing two screws through seat track and seat block.

- Connect power cord (11) to seat terminal block located on forward seat base.
- Push IN on circuit breaker plunger to CLOSE electrical circuit and functionally test for proper operation.

WARNING

After seat has been installed, insure that stop block has been installed properly and that the seat adjustment mechanism functions properly.

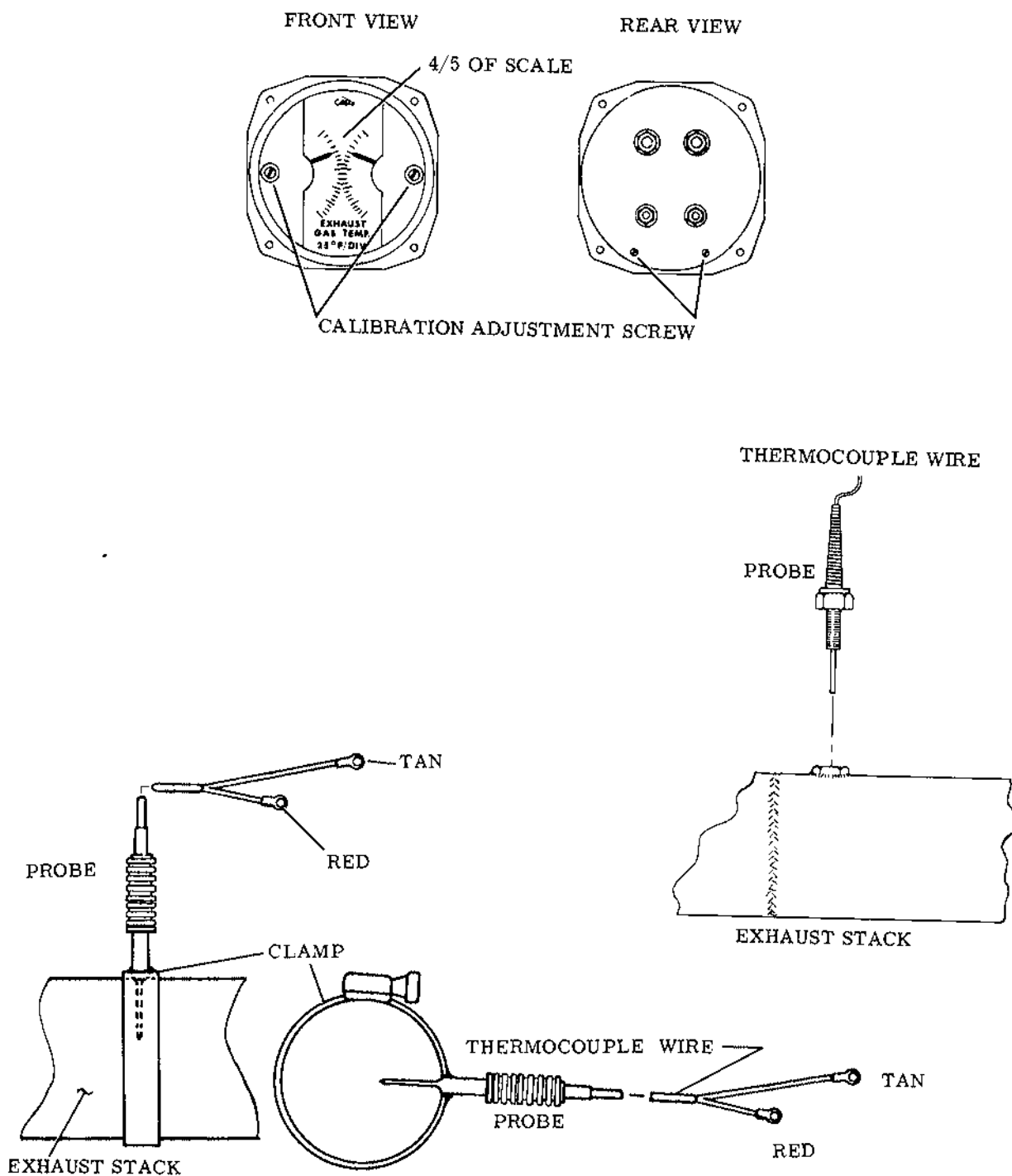
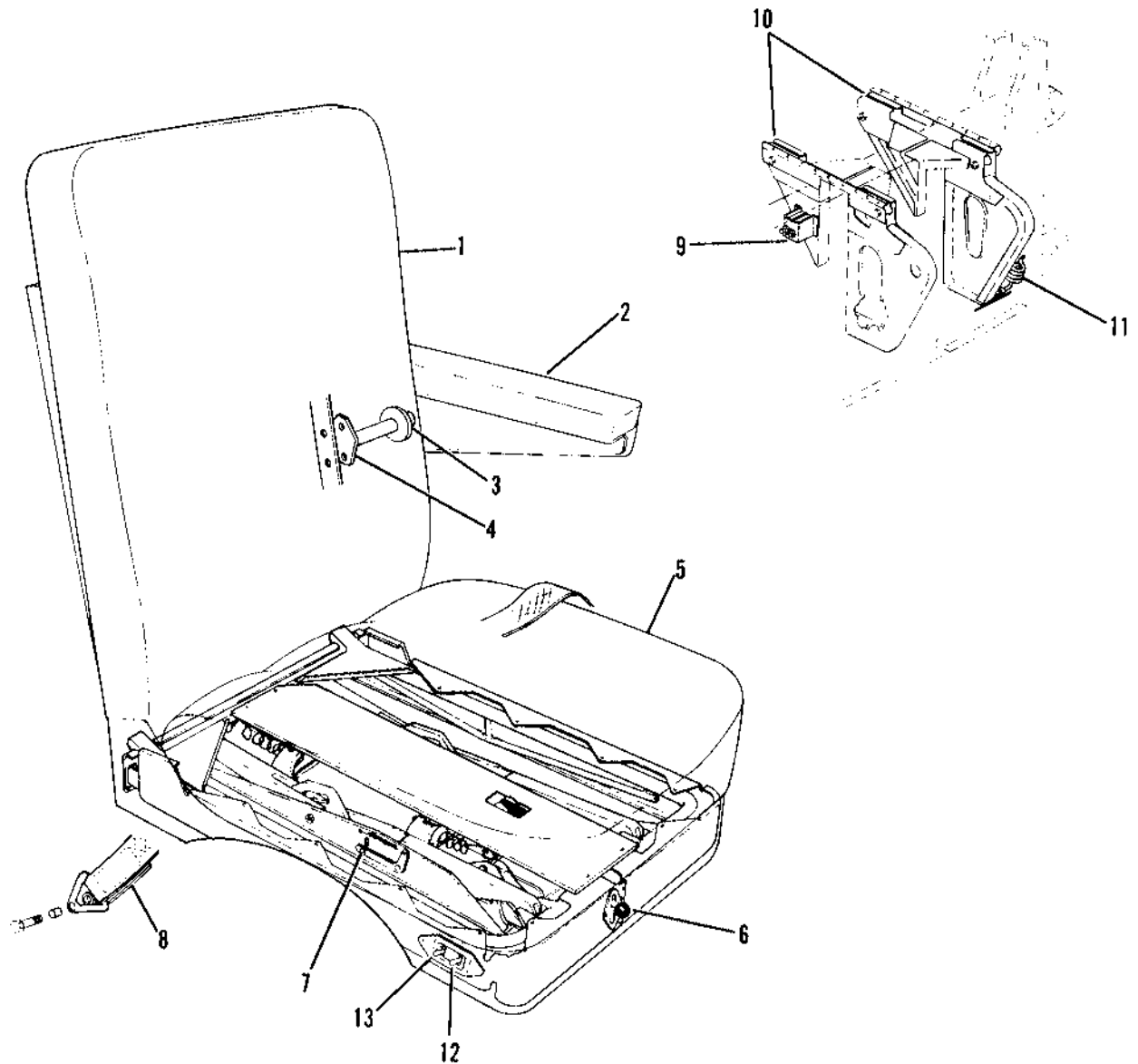


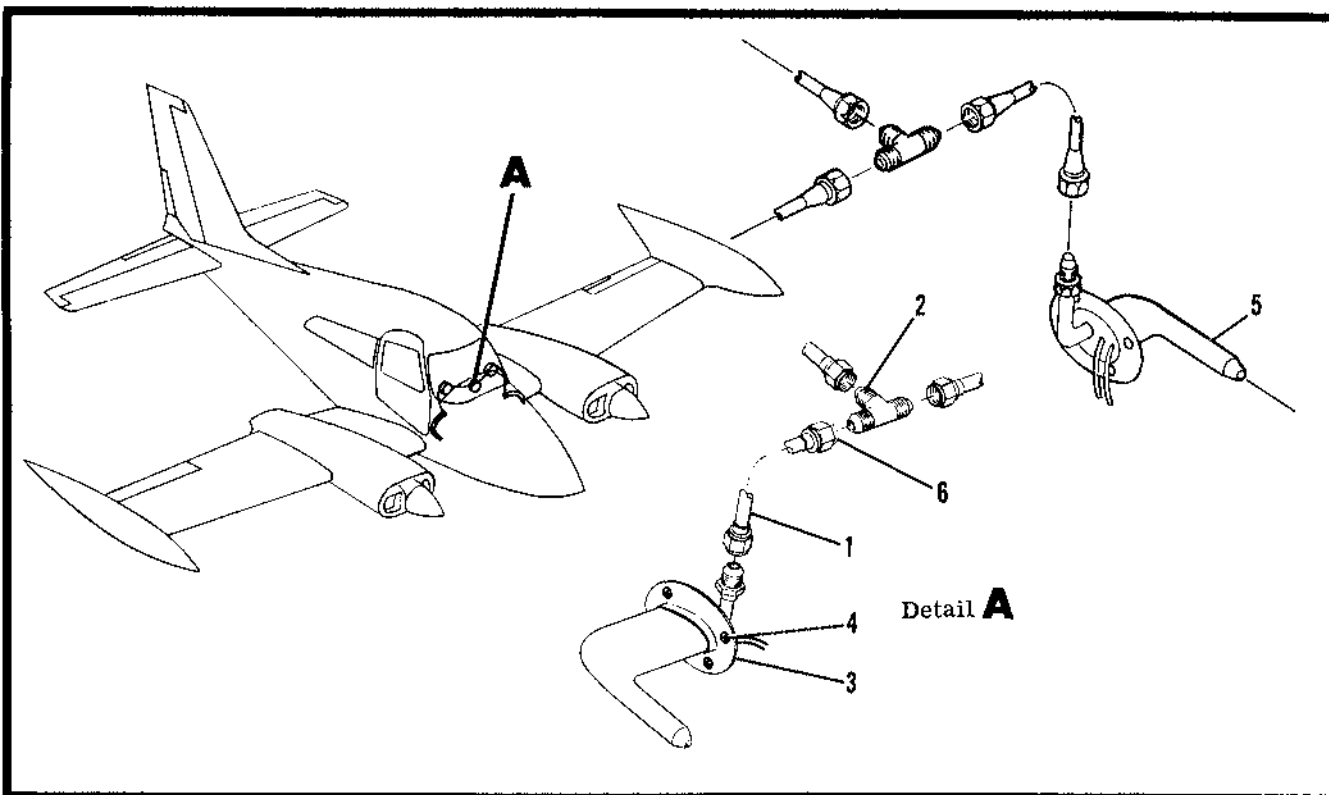
Figure 13-19. Cessna Economy Mixture Indicator



310P0001 TO 310Q0201

1. Seat Back Assembly	5. Seat Bottom Assembly	10. Seat Support
2. Armrest	6. Adjustment Handle	11. Power Cord
3. Nut and Washer	7. Power Assembly	12. Switch (Forward Bridge)
4. Armrest Assembly	8. Seat Belt	13. Switch (Aft Bridge)
	9. Circuit Breaker	

Figure 13-20. Power Front Seat Installation



1. Pitot Line
2. Tee
3. Pitot Tube Bracket

4. Screw
5. Pitot Tube
6. Connector

Figure 13-21. Dual Pitot Installation

Dual Pitot System. (See figure 13-21.)

Removal of Dual Pitot Tubes. (See figure 13-21.)

Remove four screws (4) attaching pitot tube (5) to pitot tube bracket.
Disconnect pitot line (1) from connector (6).
Tag and disconnect pitot tube heater element wires.
Remove pitot tube (5) by pulling straight out from bracket.

Installation of Dual Pitot Tubes. (See figure 13-21.)

Slide pitot line (1) into pitot tube (5).
Connect pitot line (1) to connector (6).
Attach heater element wires as tagged on removal.
Install four screws (4) attaching pitot tube to pitot tube bracket.

NOTE

Use petrolatum to lubricate all male fittings, omitting the first two threads.

Testing the Dual Pitot Tubes.

Refer to Section 12 for testing the pitot pressure lines. The testing procedure is the same except that one pitot tube should be capped while testing is being performed on the opposite line.

Blowing out Pitot Lines.

Refer to Section 12 for blowing out pitot lines. The blowing out procedure is the same except that both instruments must be disconnected when blowing out lines.

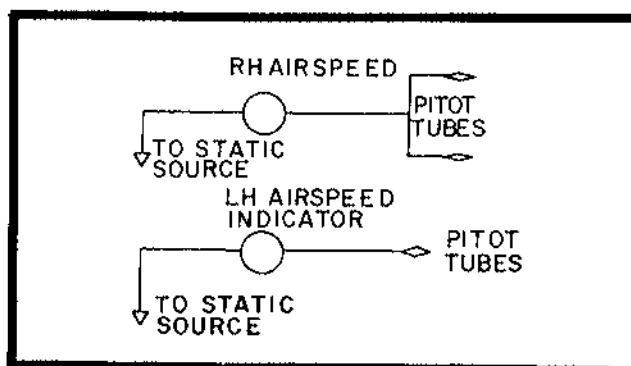


Figure 13-22. Dual Pitot System Schematic

MINI-8 STEREO

Removal of Mini-8 Stereo. (See figure 13-23.)

- Turn electrical power OFF.
- Remove screw (4) and washer (3).
- Remove stereo unit out far enough to gain access to wiring.
- Tag and disconnect electrical wiring.
- Remove stereo.

Installation of Mini-8 Stereo. (See figure 13-23.)

- Position stereo in glove box and connect electrical wiring.
- Remove tags.
- Secure stereo in place with washers (3) and screws (4).
- Turn on electrical power and check operation of stereo.

FIRE EXTINGUISHER. (See figure 13-23A.)

The fire extinguisher mounted on the copilot's seat contains a pressurized Dry Chemical Charge. The fire extinguisher may be used on combustible, liquid, or electrical fires. The dry charge is non-toxic and non-corrosive. Residue left after use may be wiped off with a damp cloth or picked up with a vacuum source. The fire extinguisher may be recharged by most Fire Equipment Dealers.

ENGINE COMPARTMENT FIRE EXTINGUISHER.

The engine compartment fire extinguisher consists of three major components, control panel, thermal detectors, and the extinguisher unit. The annuncia-

tor panel may be mounted in any unused standard three-inch instrument hole, the three thermal detectors are mounted in the high heat areas of the engine nacelle and the fire extinguisher is mounted in the nacelle area. An exit line is routed from the fire extinguisher into the forward section of the engine where the freon gas is expelled. A smaller discharge hose which routes off of the large discharge hose expels freon gas from the center of the nacelle area towards the inboard side of the nacelle.

A test function is provided to test the system circuitry. When the test switch is pushed (shown in figure 13-24), all lights should illuminate.

NOTE

The test switch does not check detector system (refer to Servicing paragraph).

If an overheat condition is detected, the appropriate "Fire" light will annunciate the engine to be extinguished. To activate the extinguisher, open the guard for the appropriate engine and press the "Fire" light. Freon, under pressure, will be discharged to the engine and engine accessory compartments. The amber light E (figure 13-24) will illuminate after the extinguisher has been discharged and will continue to show empty until a new bottle is installed. The "Fire" light will remain illuminated until compartment temperatures cool.

NOTE

Only one discharge is available per engine.

Troubleshooting Engine Fire Extinguisher.

TROUBLE	PROBABLE CAUSE	CORRECTION
POWER ON TO INDICATOR PANEL TEST SWITCH DEPRESSED ALL LIGHTS FAIL TO ILLUMINATE	Open circuit breaker.	Close circuit breaker.
	Open circuit between pin A and B of connector at panel. (Pin A is ground.)	Repair wiring.
	Voltage present between Pin A and B at panel connector. Faulty panel.	Replace panel.
GREEN LIGHT(S) ILLUMINATED LIGHT(S) FAIL TO LIGHT	Defective light bulb(s).	Replace bulb(s).
	(Bulb(s) good.) Disconnect wire from bottom stud of cartridge. Ground wire, light(s) illuminate. Defective cartridge.	Replace cartridge.

Troubleshooting Engine Fire Extinguisher (Cont.)

TROUBLE	PROBABLE CAUSE	CORRECTION
GREEN LIGHT(S) ILLUMINATED LIGHT(S) FAIL TO LIGHT (CONT.)	(Light(s) fail to illuminate.) Open circuit between bottom stud wire of cartridge and panel connector.	Repair wiring.
	(Circuit exists between bottom wire of cartridge and connec- tor.) Faulty panel.	Replace panel.
RED (FIRE) LIGHT(S) FAIL TO ILLUMINATE	Defective light bulb(s).	Replace bulb(s).
	(Bulb(s) good.) Defective panel.	Replace panel.
AMBER LIGHT (E) LIGHT(S) FAIL TO LIGHT	Defective light bulb(s).	Replace bulb(s).
	(Bulb(s) good.) Defective panel.	Replace panel.
POWER ON TO INDICATOR PANEL TEST SWITCH NOT DEPRESSED. RED (FIRE) LIGHT(S) LIGHTED	Shorted detectors or shorts in detector wiring. (Check for shorts in detector wiring be- tween pin C or D of harness connector and ground.)	Replace shorted detector or correct shorted wiring.
	(No short in wiring or detec- tor.) Indicator panel defective.	Replace detector.
GREEN LIGHTS OUT LIGHT(S) LIGHTED	(Depress test switch.) If light(s) stay on, indicator panel defective. Also, check affected cartridge for bridge-wire re- sistance.	Replace indicator panel.
AMBER (E) LIGHT(S) FLICKERING	Empty container.	Replace container.
AMBER (E) LIGHT(S) FLICKERING (CONT.)	If container is full, unscrew cartridge, scratch some anodize off cartridge thread and reinstall. Torque 90 to 100 inch-pounds. If light is still intermittent, ground sen- sor wire to aircraft. Light goes out.	Replace container.
	If light does not go out. Probable open circuit between sensor wire and connector pin H or G.	Repair wiring.
	If circuit exists between sen- sor wire and connector pin H or G. Faulty panel.	Replace indicator panel.

Troubleshooting Engine Fire Extinguisher. (Cont.)

TROUBLE	PROBABLE CAUSE	CORRECTION
AMBER (E) LIGHT(S) ON	Empty container.	Replace container.
	If container is full, unscrew cartridge, scratch some anodize of cartridge thread and reinstall. Torque 90 to 100 inch-pounds. If light is still on ground sensor wire to aircraft. Light goes out.	Replace container.
	If light does not go out. Probable open circuit between sensor wire and connector pin H or G.	Repair wiring.
	If circuit exists between sensor wire and connector pin H or G. Faulty panel.	Replace indicator panel.

Removal of Fire Extinguisher. (See figure 13-24.)

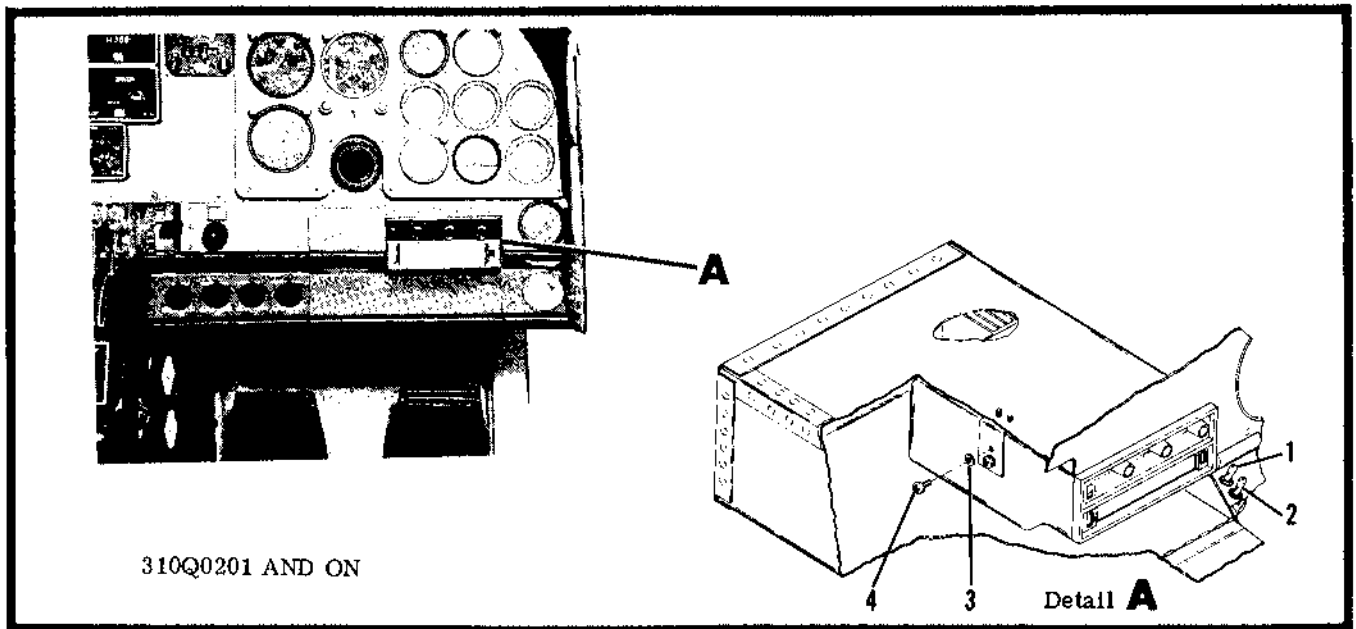
- a. Remove engine cowling.
- b. Make sure battery switch is OFF.
- c. Disconnect electrical wires from extinguisher.

- d. Disconnect discharge hose (1).
- e. Remove clamps (2) securing extinguisher unit to mounting clips.
- f. Remove extinguisher from nacelle.

WARNING

Install a grounding wire between ground terminal and squib terminal before attempting to remove a charged extinguisher unit or cartridge.

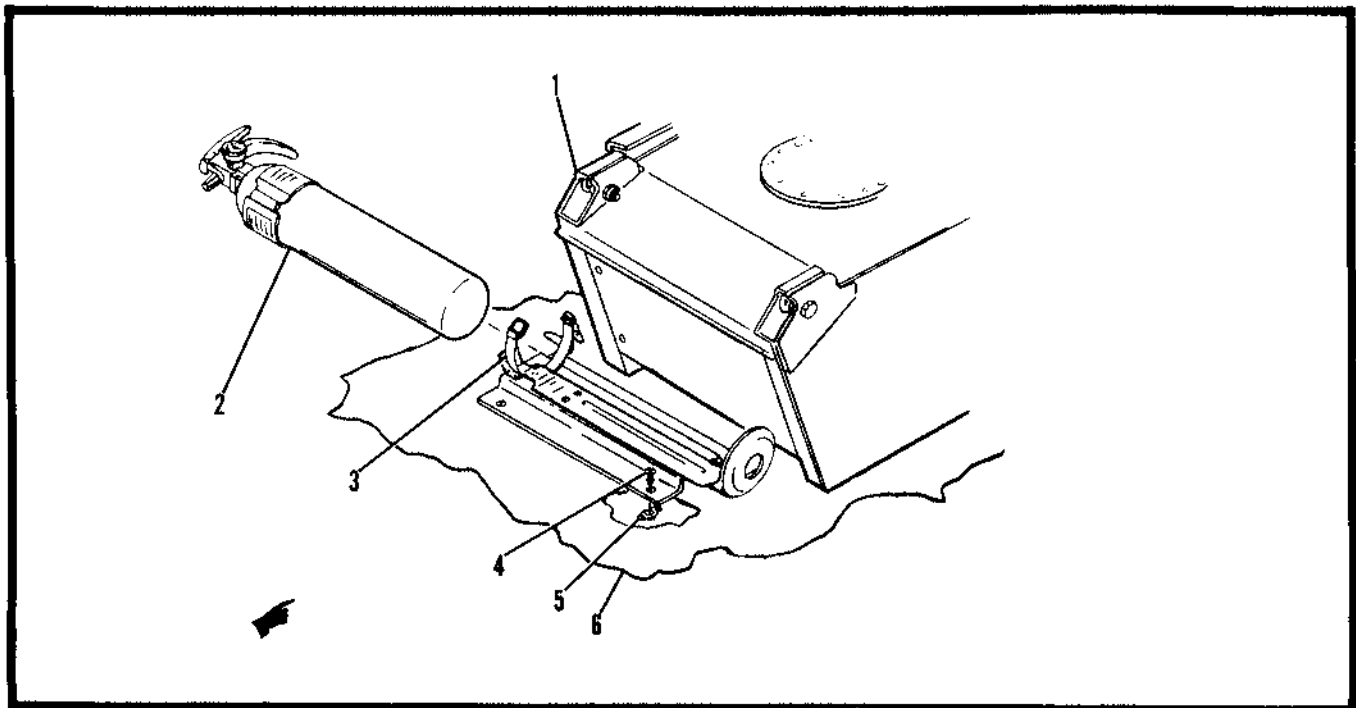
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1. Headset Speaker Selector Switch
2. "On" "Off" Switch

3. Washer
4. Screw

Figure 13-23. Mini-8 Stereo



1. Seat Support
2. Fire Extinguisher

3. Bracket
4. Screw

5. Nut
6. Floorboard

Figure 13-23A. Fire Extinguisher Installation

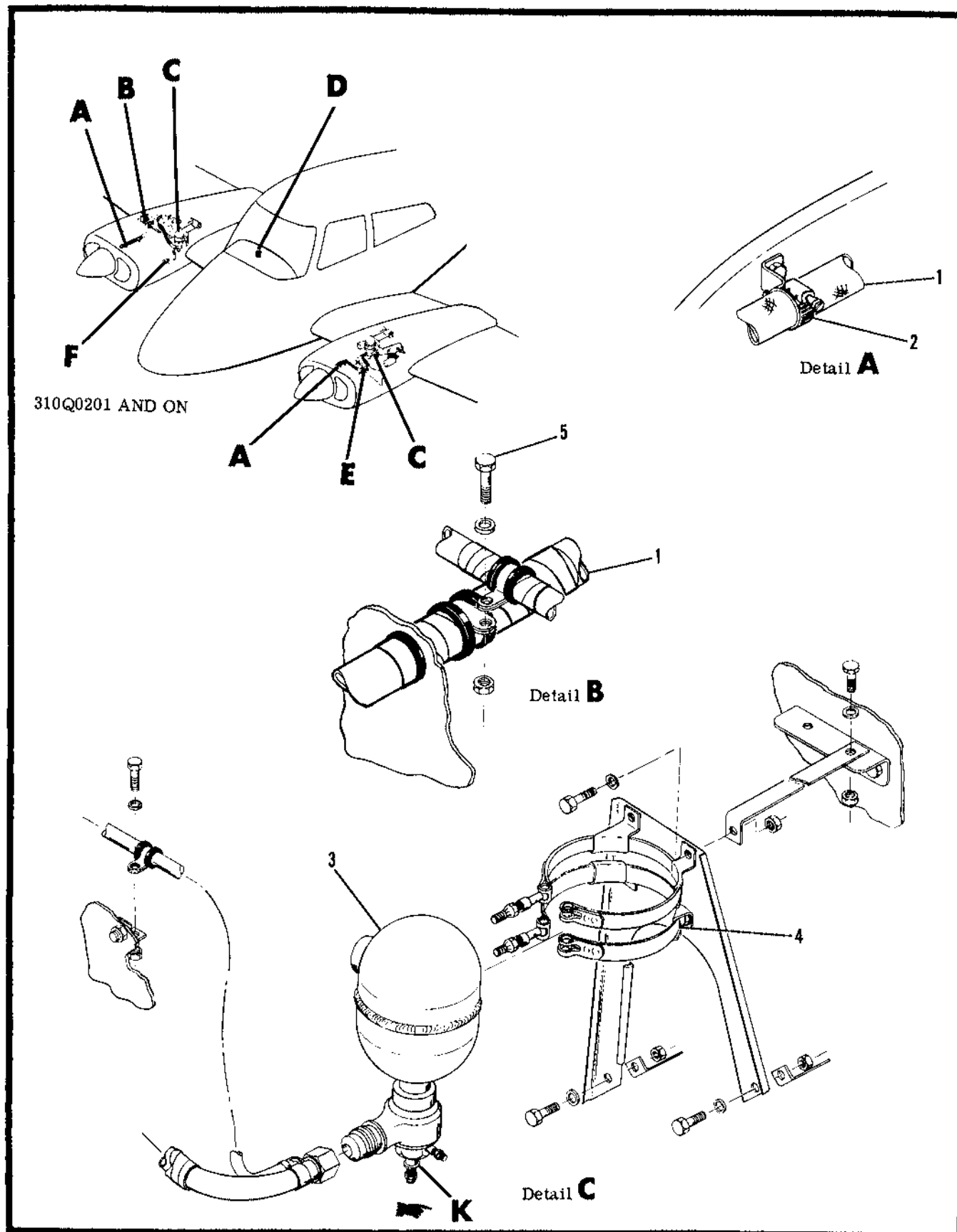
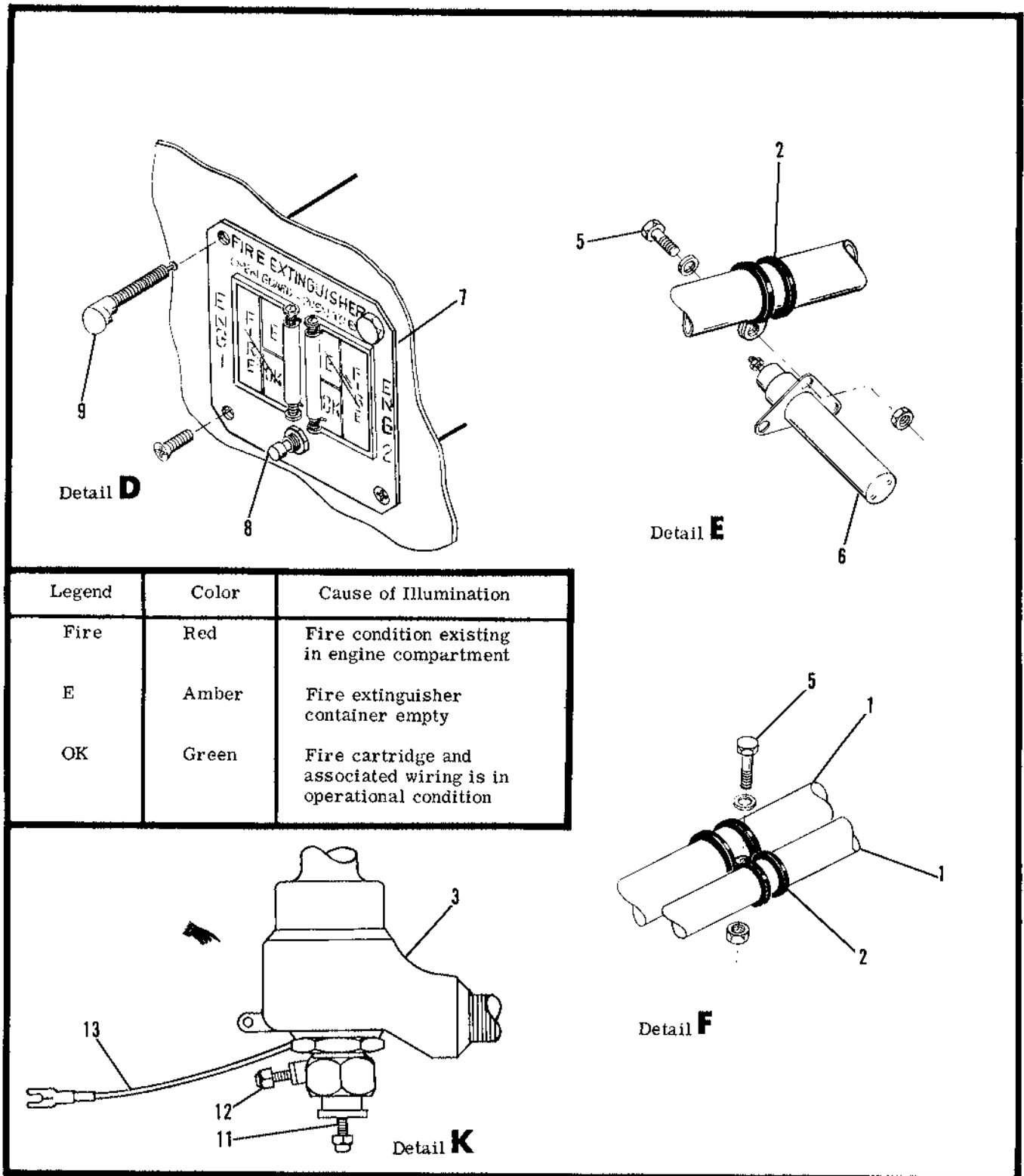
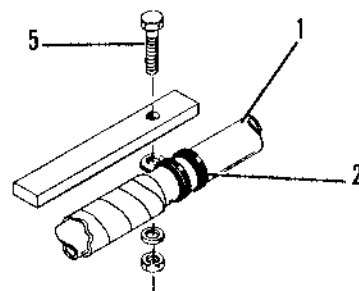
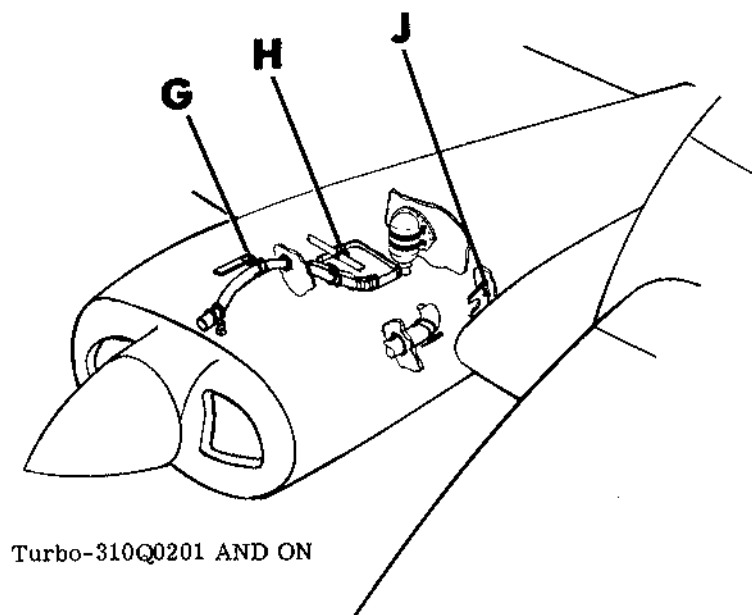


Figure 13-24. Engine Compartment Fire Extinguisher (Sheet 1 of 3)

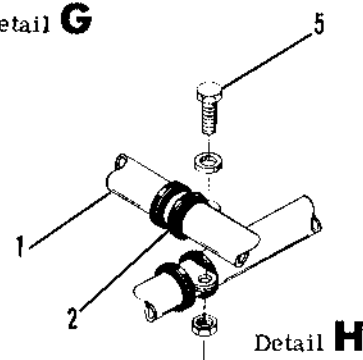


1. Hose (Discharge)	5. Bolt	10. Firewall
2. Clamp	6. Thermal Detector	11. Squib Terminal
3. Fire Extinguisher	7. Annunciator Panel	12. Ground Terminal
4. Mounting Clamp	8. Test Switch	13. Discharge Sensor Lead
	9. Light	

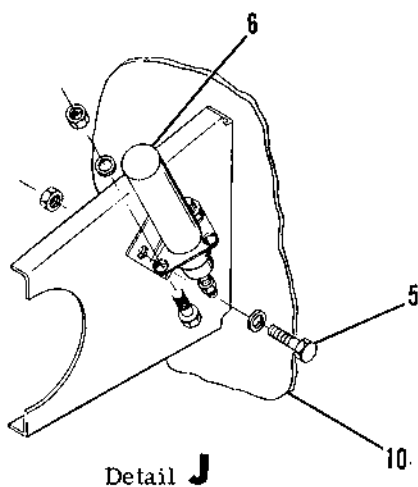
Figure 13-24. Engine Compartment Fire Extinguisher (Sheet 2 of 3)



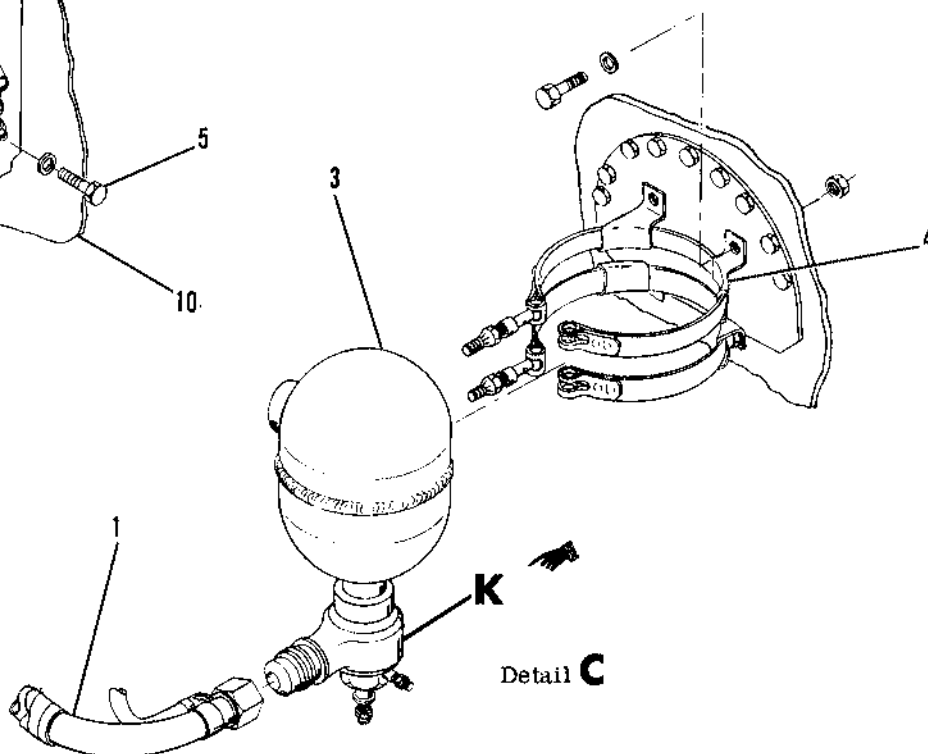
Detail **G**



Detail **H**



Detail **J**



Detail **C**

Figure 13-24. Engine Compartment Fire Extinguisher (Sheet 3 of 3)

Installation of Fire Extinguisher. (See figure 13-24.)

- a. Position fire extinguisher in place and connect hose (1).

WARNING

Do not remove grounding wire from extinguisher unit or cartridge until installed in aircraft.

- b. Clamp fire extinguisher in place with clamps (2).
- c. Connect electrical wires.

WARNING

Before connecting electrical connectors to cartridges, check connectors with multi-meter to ensure no voltage is present at connector.

- d. Continuity check detector circuitry in accordance with Servicing Fire Extinguisher.
- e. Turn on electrical power and check system for proper operation at the control panel. Press the test switch.
- f. Install engine cowling.

Removal and Installation of Fire Extinguisher Thermal Detectors. (See figure 13-24.)

- a. Make sure battery switch is OFF.
- b. Remove engine cowling.
- c. Loosen and remove bolts, washers and nuts attaching thermal detector to bracket or clamp.
- d. Disconnect electrical wire from detector.
- e. Remove detector from nacelle.
- f. The installation procedure for the fire extinguisher thermal detector is the reversal of the removal procedure.
- g. Continuity check detector circuit in accordance with Servicing Fire Extinguisher.

Removal and Installation of Annunciator Panel. (See figure 13-24.)

- a. The removal and installation procedures for the annunciator panel is the same as any Typical Instrument Removal and Installation Procedures found in Section 12.

NOTE

When removing annunciator panel always make sure the battery switch is in the OFF position.

PRESSURE-TEMPERATURE CORRECTION TABLE					
F° Temp	-60	-40	-20	0	+20
Ind	110	127	148	174	207
Pressure	134	155	180	212	251
F° Temp	+40	+60	+80	+100	+120
Ind	249	304	367	442	532
Pressure	299	354	417	492	582

Servicing Fire Extinguisher.

The following item should be checked at every 100 hour inspection. Check the pressure gage on each bottle to ensure the pressures indicated in the Pressure-Temperature Correction Table. If these pressures are not indicated, the bottle must be serviced.

Every six months, remove containers and weigh. (The scale used must be a 5 to 10 pound scale with an accuracy of .1% full scale.) Weight of .25 pound below marked weight indicates a leaky container. After bottle has been replaced check the following:

- a. Check the test function; if any light fails, replace bulb. If green light (OK) does not light after replacing bulb, replace firing cartridge *(P/N 13083-5) in fire extinguisher. Any other light failure, after replacing bulbs and firing cartridge, indicates malfunction in the unit or associated wiring circuit.

NOTE

The test switch does not check the detector circuit.

- b. Conduct a continuity check of detector circuitry as follows:
 1. Apply power to the aircraft.
 2. Disconnect sensor wire from fire extinguisher bottle. The EMPTY light should come on.
 3. With sensor wire disconnected, press the Press-To-Test switch on the control panel. The OK light should come on indicating the squib is in operational condition.
 4. Reconnect sensor wire to bottle.

WARNING

Do not attempt to check the continuity of the sensor and/or the squib with a V.O.M. tester. Most V.O.M. testers have enough AMP capability to fire the cartridge. Continuity of the circuit shall be checked only when using a 100 MA current regulated source.

- c. Conduct fire detect thermo detector check as follows:
 1. Apply power to the aircraft.
 2. Using an Alpha Heat gun, apply heat to each thermo detector body for approximately ten seconds and observe that fire light on panel comes on.

NOTE

Heat gun must have a capacity of 500° F or higher.

3. If light does not come on, remove thermo detector and check further in a temperature oven. Switch should actuate at 450° F.

*P/N of HTL Industries, 1900 Walker Avenue, Monrovia, California, 91016.

EMERGENCY LOCATOR TRANSMITTER.

Description.

The emergency locator transmitter (ELT) is a self-contained, solid state unit, having its own power supply with an external mounted antenna. The transmitter is designed to transmit on dual emergency frequencies of 121.5 and 243.0 megahertz simultaneously. Emergency locator transmitter P/N CIR10 is located in the leading edge of the dorsal fin at approximately fuselage station 309.56 and water line 125.00. The antenna is also enclosed in the dorsal. Emergency locator transmitter SHARC-7 is mounted in the tailcone on the side of the fuselage.

On P/N CIR10 transmitter power is supplied from the aircraft system through a switch on the panel or the battery pack located inside the transmitter. The SHARC-7 transmitter is entirely portable operating on the power supplied by a battery pack. The battery pack service life is placarded on the batteries and also on the outside of the cover on the end of the transmitter.

The transmitter broadcast tone is audio modulated in a swept manner over the range of 1600 to 300 Hz and is a distinct, easily recognizable distress signal for reception by search and rescue personnel, and others monitoring the emergency frequencies.

The transmitter meets or exceeds the requirements of the following specifications:

- (1) R.S.S. 147 Issue 2, D.O.C.
- (2) TSO C612, F.A.A.
- (3) F.C.C. Part 87, F.C.C.
- (4) TSO C91, F.A.A.

Under favorable conditions, a distress signal from the ELT can be intercepted at a distance of 100 miles. It exhibits line of sight transmission characteristics which correspond approximately to 100 miles at a search altitude of 10,000 feet.

When battery inspection and replacement schedules are adhered to, the transmitter will broadcast an emergency signal at rated power, for a continuous period of at least 48 hours at temperatures from +55°C to -20°C after an emergency landing.

The military monitors 243.0 MHz. The 121.5 MHz frequency is monitored by the general aviation aircraft as well as C.A.P., D.O.T., F.A.A. and some commercial aircraft.

Operation.

A three position switch on the forward end of the unit controls operation. Placing the switch in the ON position will energize the unit to start transmitting emergency signals. In the OFF position, the unit is inoperative. Placing the switch in the ARM position will set the unit to start transmitting emergency sig-

nals only after the unit has received a 5G (tolerances are +2G and -0G) impact force. On emergency locator transmitter P/N CIR10, a remote on-off switch on the instrument panel is provided in addition to the switch located on the front end of the transmitter.

CAUTION

Do not leave the emergency locator transmitter in the ON position longer than 10 seconds or you may activate downed aircraft procedures by C.A.P., D.O.T., or F.A.A. personnel.

Removal of Emergency Locator Transmitter. (See figure 13-25.)

The following steps "a" through "d" pertain to emergency locator transmitter P/N CIR10:

- a. Refer to figure 1-3 and remove fin access cover.
- b. Assure aircraft electrical power is off and the on-off switch on the front of the transmitter is in the OFF position.
- c. Disconnect electrical leads from transmitter.
- d. Remove screws securing transmitter to mount and remove transmitter from dorsal fin.

Steps "e" through "g" pertain to the SHARC-7 emergency locator transmitter.

- e. Remove tailcone access door.
- f. Disconnect coaxial cable from end of transmitter.
- g. Cut sta-straps securing transmitter and remove transmitter from mounting bracket.

Installation of Emergency Locator Transmitter. (See figure 13-25.)

The following steps "a" through "c" pertain to emergency locator transmitter P/N CIR10:

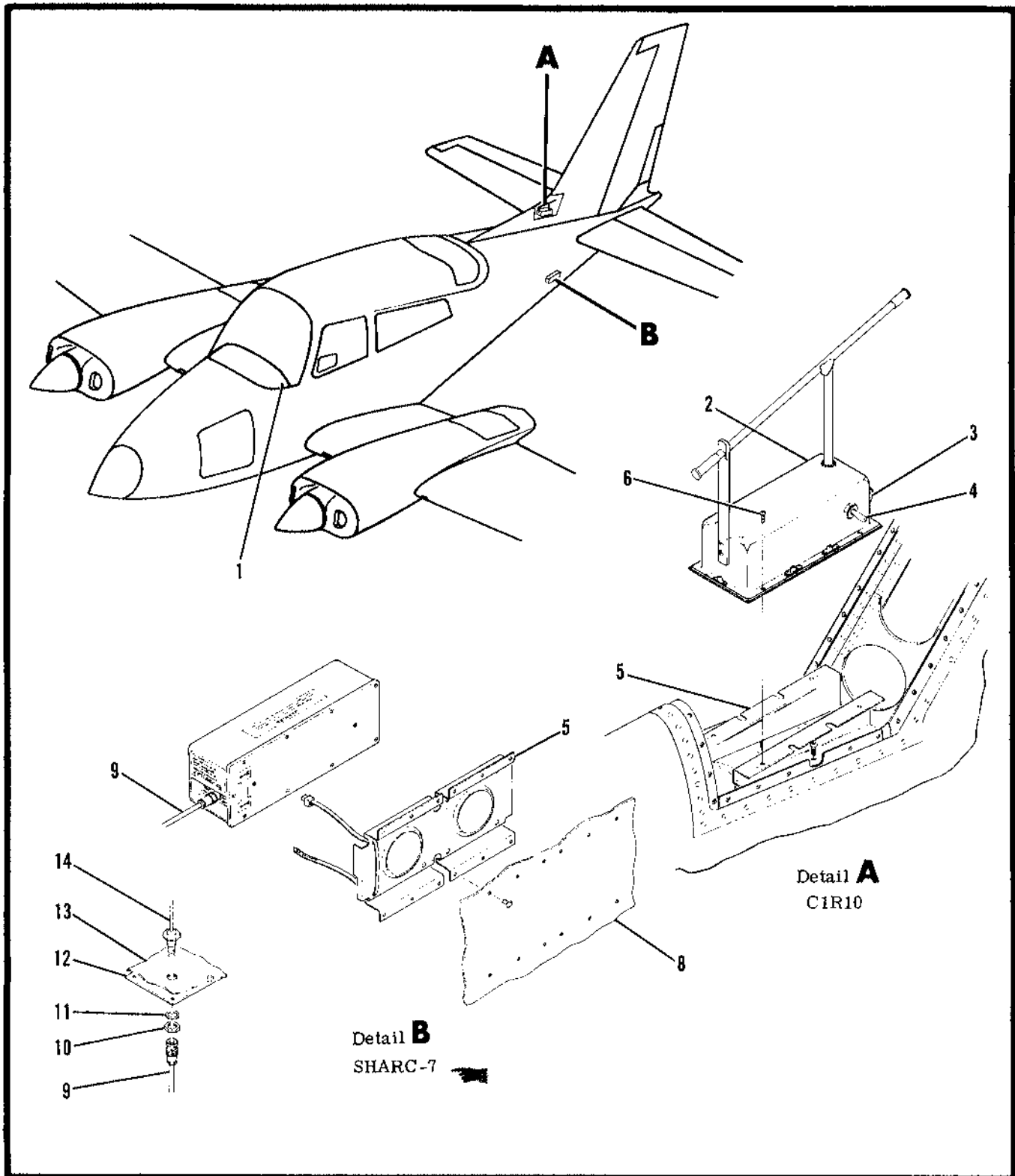
- a. Position transmitter in mount and install four mounting screws.

NOTE

Before installing the emergency locator transmitter to the mount, check condition of battery pack and make sure function switch is in the ARM position and the power switch is in the OFF position.

- b. Connect electrical leads to terminals.
- c. Install dorsal fin access cover.

Steps "d" through "h" pertain to the SHARC-7 emergency locator transmitter.



1. Panel Switch	6. Screw	10. Nut
2. Power Switch	7. Battery Access	11. Lockwasher
3. Terminal Block	8. Fuselage Side Skin	12. Doubler
4. Function Switch	9. Antenna Coaxial	13. Upper Tailcone Skin
5. Mount		14. Antenna

Figure 13-25. Emergency Locator Transmitter

- d. Assure that the direction of flight arrows (placarded on the transmitter) are pointing towards the nose of the aircraft.
- e. Install transmitter in bracket and secure with new sta-straps.
- f. Connect coaxial cable to antenna.
- g. Position on-off switch to ARM position.
- h. Check operation of emergency locator transmitter in accordance with Section 2.

Removal and Installation of Emergency Locator Transmitter Antenna SHARC-7.

- a. Disconnect coaxial cable from base of antenna.
- b. Remove nut and lockwasher attaching the antenna base to the fuselage and the antenna will be free to remove.
- c. Install the antenna by reversing the removal procedures.

Removal and Replacement of Battery Pack.

- a. Remove emergency locator transmitter in accordance with removal procedures.
- b. Remove screws attaching the cover to the case and remove cover. Remove rubber gasket to gain access to battery pack.
- c. When the battery pack is supplied with a plastic connector attached to the battery leads, merely disconnect the old battery pack and replace with a new battery pack, making sure the plastic connectors are completely mated.

CAUTION

Some early transmitters were delivered with transmitter leads soldered directly to the battery pack. Failure to observe proper polarity in connecting a new battery pack in the transmitter may result in immediate failure of transistorized components attached to the printed circuit board in the transmitter.

NOTE

- Before installing the new battery pack, check to ensure that its voltage is 10.8 volts or greater.
- After relatively short periods of inactivation, the magnesium cell develops a coating over its anode which drastically reduces self-discharge and thereby gives the cell an extremely long storage life. This coating will exhibit a high resistance to the flow of electric current when the battery is first switched on. After a short while (less than 15 seconds), the battery current will completely dissolve this coating and enable the battery to operate normally. If this coating is present when your ELT is activated, there may be a few seconds delay before the transmitter reaches full power.

- d. Replace the transmitter cover by positioning the rubber gasket on the cover and pressing the cover and case together and attach with nine screws. Care should be taken to avoid trapping the gasket and over-tightening screws.
- e. Remove the old battery placard from the end of transmitter and replace with new battery placard supplied with the new battery pack.

CAUTION

Be sure to enter the new battery pack expiration date in the aircraft records.

- f. Check operation in accordance with Section 2.
- g. Refer to Section 2 and Inspection Chart, figure 2-7 for inspection intervals.

CAUTION

Do not leave the emergency locator transmitter in the ON position longer than 10 seconds. This could initiate downed aircraft search procedures by C. A. P., D. O. T. or F. A. A. personnel.

Troubleshooting the Emergency Locator Transmitter

Should your Emergency Locator Transmitter fail the Periodic or 100 Hours performance checks, it is possible to a limited degree, to isolate the fault to a particular area of the equipment.

CAUTION

In order to protect your warranty, troubleshooting should be conducted without removing the unit cover.

In performing the following troubleshooting procedure to test, peak effective radiated power, you will be able to determine if battery replacement is necessary or if your unit should be returned to your dealer for repair.

CAUTION

Do not leave the emergency locator transmitter in the ON position longer than 10 seconds. This could initiate downed aircraft search procedures by C. A. P., D. O. T. or F. A. A. personnel.

Troubleshooting the Emergency Locator Transmitter.

TROUBLE	PROBABLE CAUSE	CORRECTION
*POWER LOW SHARC-7	Low battery voltage. Faulty transmitter. Faulty coaxial antenna cable.	1. Set toggle switch to OFF. 2. Remove plastic plug from the remote jack and by means of a Switchcraft #750 jackplug, connect a Simpson 260 model voltmeter and measure voltage. If the voltage is 10-volts or less, the battery is below specification. 3. If the battery voltage is 10.8 volts or more, it is O. K. If the battery is O. K., check the transmitter as follows: a. Remove the voltmeter. b. By means of a Switchcraft #750 jackplug and 3 inch long maximum leads, connect a Simpson Model 1223 ammeter to the jack. c. Set the toggle switch to ON and observe the ammeter current drain. If it is in the range 0-50 MA, the transmitter or the coaxial cable is faulty. 4. Check coaxial antenna cable for high resistance joints. If this is found to be the case, the cable should be replaced.

*This test should be carried out with the coaxial cable provided with your unit.

Troubleshooting the Emergency Locator Transmitter (Continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
POWER LOW CIR10	Low battery voltage. Faulty transmitter.	1. Pull cabin lights circuit breaker. 2. Remove access cover to transmitter. 3. Remove transmitter from mount. 4. Remove battery access cover. 5. Measure voltage at battery contacts. NOTE Transmitter should be turned on when measuring battery voltage. 6. If the battery voltage is 10 volts or less, the battery pack should be replaced. If the battery voltage is greater than 10 volts, insert a 0-150 MA meter in series with power leads and check as follows: 1. Set power switch on transmitter to ON and observe current drain. 2. If current drain is 0-50 MS, the transmitter or the antenna is faulty and should be bench tested.

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**PILOT AND COPILOT MANUAL AND ELECTRICAL
ADJUSTABLE SEAT.**

Removal of Pilot and Copilot Manual and Electrical Adjustable Seat. (See figure 13-26.)

The procedures given pertain to either the pilot's or copilot's manual or electrical adjustable seat. The difference between the manual and electrical is the electrical seat utilizes an electric motor in lieu of the manual crank for the up and down and tilting movements.

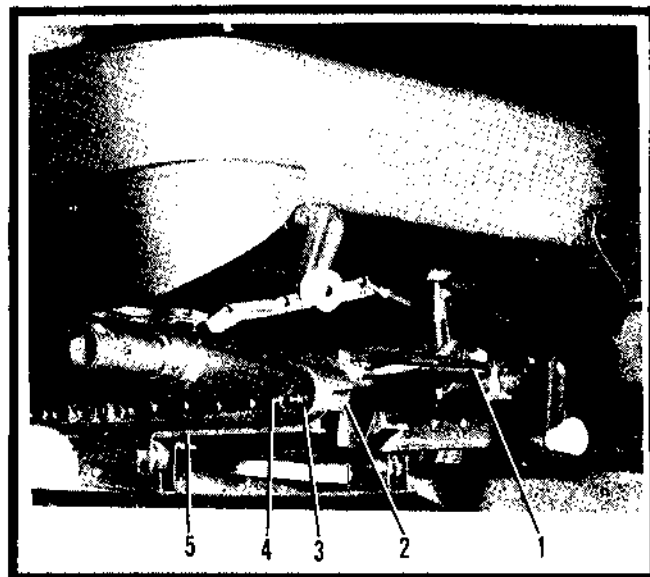
- a. Raise seat to the highest position.
- b. Remove seat stops on each side of the rail by removing nuts and screws.
- c. Tag and disconnect wiring.
- d. Pull up on seat stop handle and slide seat aft and remove seat from its mounting.

Disassembly of Pilot and Copilot Manual and Electrical Adjustable Seat. (See figure 13-27.)

- a. Disassemble pilot's and copilot's manual and electrical adjustable seat in accordance with Figure 13-27.

Installation of Pilot's and Copilot's Manual and Electrical Adjustable Seat. (See figure 13-26.)

- a. Insert seat on seat rails and slide forward.
- b. Pull up on seat stop handle and allow seat to move forward far enough to install seat stops.
- c. Connect wiring and remove tags.
- d. Install seat stops with screws and nuts.
- e. Turn on electrical power and check operation.
- f. If seat is not electrical, check operation using crank provided on the front of the seats.



1. Adjust Handle	3. Nut	4. Screw
2. Seat Stop		5. Seat Rail

Figure 13-26. Pilot and Copilot Manual and Electrical Seat Installation

Figure 13-27. Pilot and Copilot Manual and Electrical Adjustable Seat Callouts

1. Seat Back	9. Seat Bellcrank	18. Bearing Block
2. Screw	10. Seat Stop	19. Seat Bottom
3. Bolt	11. Nut	20. Arm Rest
4. Washer	12. Shaft	21. Arm Rest Stop
5. Spacer	13. Crank	22. Escutcheon
6. Seat Belt	14. Seat Stop Handle	23. Wire Bundle
7. Nut	15. Seat Base	24. Vertical Adjust Motor
8. Side Skirt	16. Shaft	25. Recline Motor
	17. Housing	

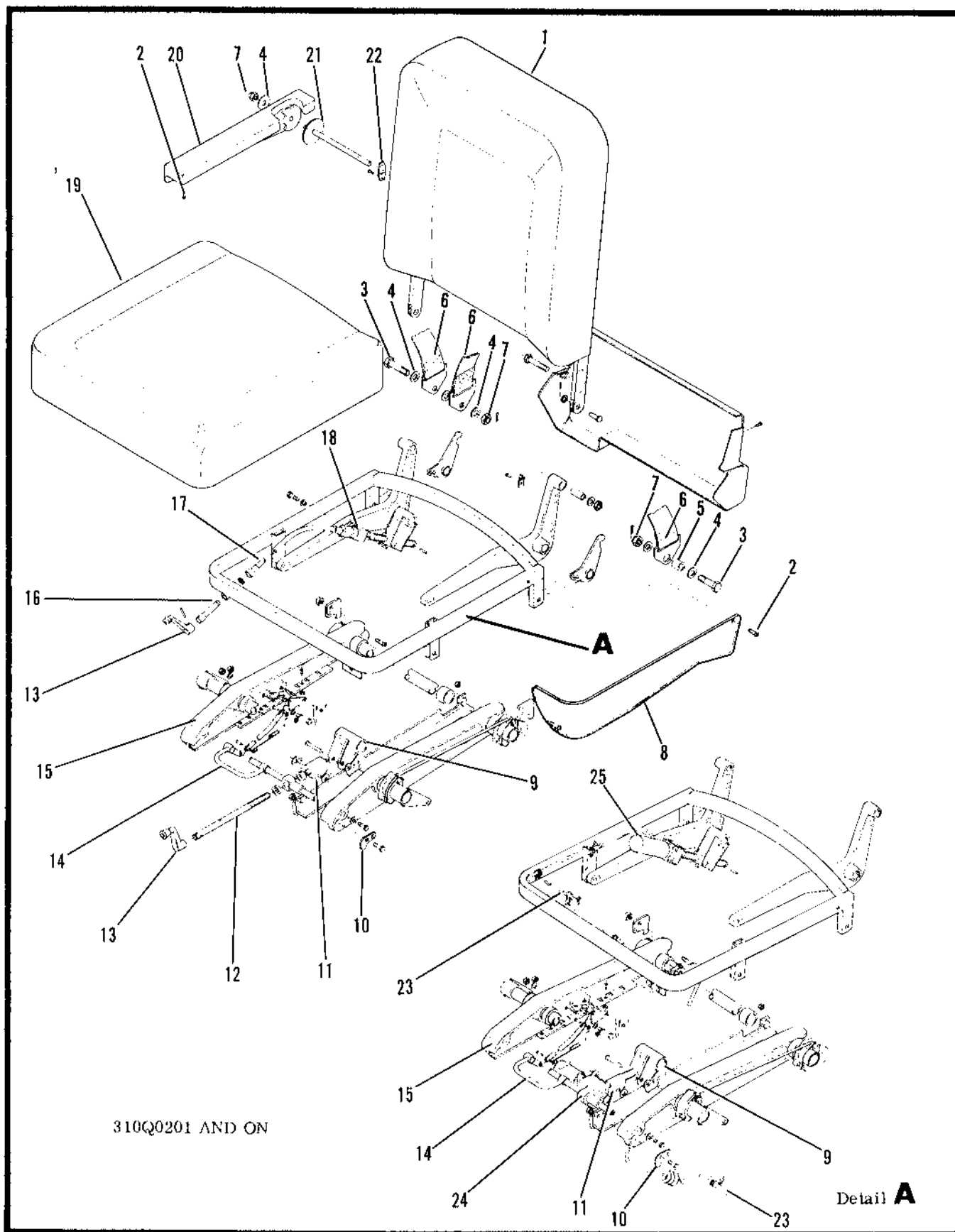


Figure 13-27. Pilot and Copilot Manual and Electrical Adjustable Seat

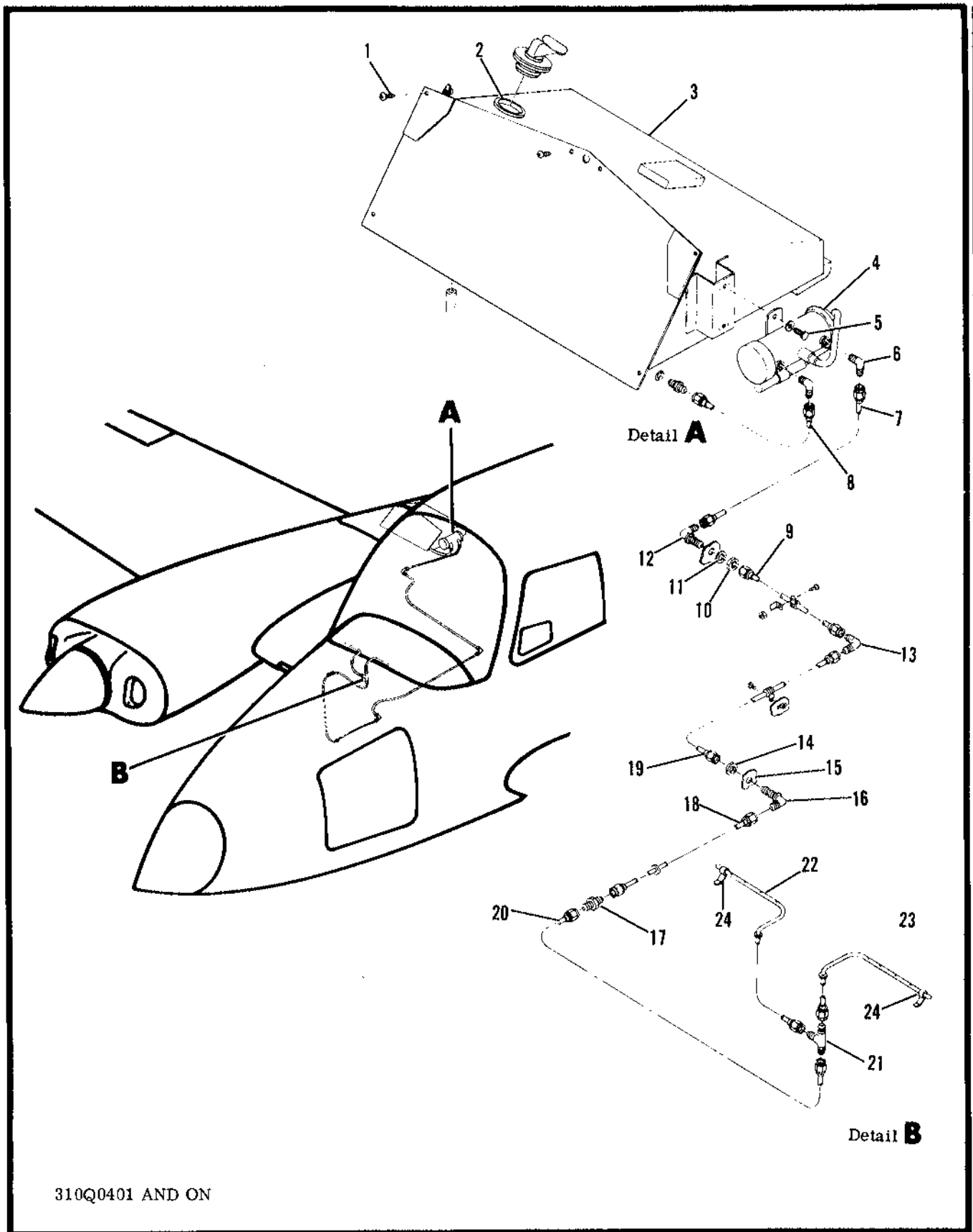


Figure 13-28. Alcohol Windshield Anti-Ice System

Figure 13-28. Alcohol Windshield Anti-Ice System Callouts

1. Screw	9. Line (Elbow to Elbow)	17. Union
2. Filler	10. Nut	18. Line (Union to Union)
3. Tank	11. Washer	19. Line (Union to Elbow)
4. Pump	12. Elbow	20. Line (Union to Tee)
5. Bolt	13. Elbow	21. Restrictor Tee
6. Elbow	14. Nut	22. Tube RH
7. Line (Pump to Elbow)	15. Cabin Skin	23. Tube LH
8. Line (Tank to Pump)	16. Elbow	24. Clamp

ALCOHOL WINDSHIELD ANTI-ICE SYSTEM. (310Q0401 and ON).

The alcohol windshield anti-ice system consists of a three gallon capacity tank which provides approximately one hour anti-icing capability, an electrically operated pump actuated by a switch breaker located on the LH console, and orificed tubes to disperse the anti-ice fluid over the windshield. A restrictor orifice is provided in the dispersal system to meter the alcohol for maximum efficiency. The system is serviced with isopropyl alcohol.

Removal of Alcohol Windshield Anti-Ice System. (See figure 13-28.)

- Remove aft nacelle baggage compartment upholstery panel.
- Disconnect line (7) at elbow (12) and using a suitable tube attached to the line, pump remaining fluid from tank (3).
- Disconnect line (7) from tank and remove line (8).
- Disconnect electrical wire from pump (4) at splice.
- Remove pump (4) from tank by removing bolts (5).
- Remove screws (1) securing tank (3) to structure.
- Lift forward end of tank until vent tube clears bottom skin and carefully slide tank forward until clear of structure, then lift tank from aircraft.
- Extend flaps and remove RH wing gap fairings to gain access to lines.
- Remove clamps and remove lines (9) and (19).
- Remove RH forward side upholstery panel to gain access to line (18). Remove clamp and remove line.
- Working through RH nose baggage door, remove line (20), restrictor tee (21) and tubes (22) and (23).

Installation of Alcohol Windshield Anti-Ice System. (See figure 13-28.)

- Position tank in place and secure with screws (1).

NOTE

Make certain vent extends below lower skin 0.40" and scarfed side is forward.

- Install pump (4) with two bolts (5) and washers.
- Install lines (7) and (8).
- Install lines (9) and (19) and clamp in place.

Change 8

- Install line (18) and clamp in place.
- Install line (20) and restrictor tee (21).

NOTE

Restrictor tee must be installed with restrictor end upstream and arrow pointing downstream of flow.

- Install tubes (22) and (23), and clamp in place.

NOTE

Make certain tubes (22) and (23) maintain a minimum gap of 0.10" between tubes and windshield retainer.

- Install forward right cabin upholstery panel, wing gap fairings and access covers.
- Install aft nacelle baggage compartment upholstery panel.

Operational Check of Windshield Anti-Ice System.

- Fill reservoir with isopropyl alcohol (MIL-F-5566).
- Turn master switch ON.
- Switch windshield anti-ice switch ON.
- Assure alcohol flows evenly from all five holes on each side. Nominal flow rate is approximately 20 minutes per gallon.

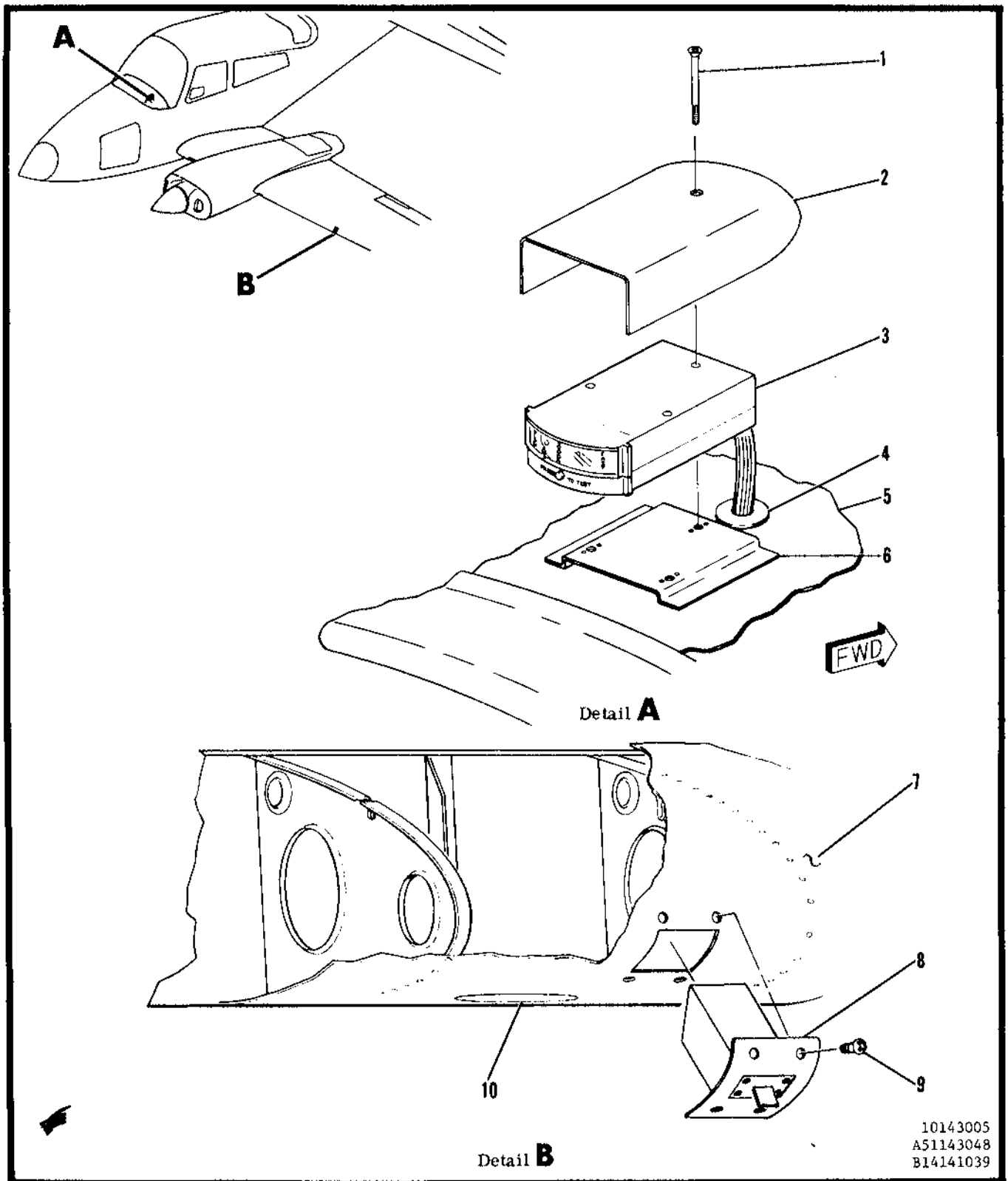
NOTE

The left-hand spray pattern may be slightly greater than the right spray pattern. Spray should extend approximately 4 to 6 inches above nozzles during ground operation.

- Turn windshield anti-ice switch OFF. Alcohol flow should cease.
- If alcohol flow is irregular or fails to shut off properly, check pressure at pump. Pressure should be 4.0 to 4.75 PSIG.

ANGLE OF ATTACK SYSTEM. (310Q0901 and On.)

The angle of attack system consists of an indicator incorporating a press-to-test circuit (for ground test or in flight test of the system) and a transducer. The indicator is mounted forward of the glareshield and visually displays the angle of attack of the aircraft.



- 1. Screw
- 2. Cover
- 3. Indicator
- 4. Grommet

- 5. Deck Cover
- 6. Mounting Bracket

- 7. Wing Leading Edge
- 8. Transducer
- 9. Screw
- 10. Access Cover

Figure 13-29. Angle of Attack System

The transducer is located on the leading edge of the left wing and transmits electrical signals to the indicator for angle of attack display. The transducer incorporates a heater element operated by the pitot heater switch, to prevent ice from hampering the operation of transducer. The system also incorporates a stall warning circuit which, when energized, causes the stall warning horn to sound.

Removal of Angle of Attack Indicator. (See figure 13-29.)

- a. Assure aircraft electrical power is off.
- b. Disconnect electrical connector to indicator.
- c. Remove screws securing indicator to mounting bracket.
- d. Remove grommet from deck cover; remove indicator.

Installation of Angle of Attack Indicator. (See figure 13-29.)

- a. Insert wire cable of indicator through hole in deck cover.
- b. Install grommet in deck cover.
- c. Position indicator on mounting bracket and secure with screws.
- d. Reconnect electrical plug.

Removal of Angle of Attack Transducer. (See figure 13-29.)

NOTE

Before removal of transducer, it is important that the exact fore-aft location of the vane be marked on the wing so that the replacement unit may be adjusted identically.

- a. Assure aircraft electrical power is off.
- b. Remove access cover.
- c. Disconnect electrical plug to transducer.
- d. Remove screws securing transducer to leading edge and remove transducer.

Installation of Angle of Attack Transducer. (See figure 13-29.)

- a. Insert wire cable of transducer through transducer mounting hole.
- b. Secure transducer to leading edge with screws.
- c. Reconnect transducer electrical plug.
- d. Replace access cover.

Operational Check of Angle of Attack System.

a. Ground Check.

1. Move battery switch to ON position.
2. Push the "PRESS TO TEST" button on the indicator and check that the indicator needle moves to the left (SLOW) end of scale and the stall warning horn sounds with the needle in the red zone. The needle should return to the SLOW diamond when the button is released.
3. Turn the pitot heat switch ON and check to see that the transducer mounting plate on the left wing leading edge heats up.
4. Turn pitot heat OFF.

NOTE

The pitot heat switch should not be left on any longer than necessary to determine that mounting plate is heating.

5. Push the transducer vane gently aft (down). Check that the needle moves to the right (FAST) end of scale. When released, the vane should return to the approximate center of its travel and the needle should return to the SLOW diamond.
6. Push the transducer vane gently forward (up). The indicator needle should move to the left (SLOW) end of scale and the stall warning horn should sound. When released, the vane should return to the approximate center of travel, the needle to the slow diamond, and the stall warning horn should stop.
7. Turn battery switch OFF.
- b. Flight Check and Adjustment.
 1. Using the data recorded in the Flight Check portion of the Operational Check of Stall Warning System, adjust the angle of attack system to provide an "on speed" indication when the indicated airspeed is within ± 2 knots of the approach speed determined from the chart in Figure 12-3A (corrected for weight at time of the test) for the following configurations:
 - (a) Landing Gear down.
 - (b) Flaps full down.
 - (c) Power as required to maintain a stable rate of descent at 500 FPM.
 2. Record the centered approach speed and the aircraft weight.
 3. When the system is properly adjusted as above, the prestall warning adjustment screw in the indicator unit should be adjusted as required to provide a stall warning horn at 4 to 9 knots IAS prior to idle power landing configuration stall.

SECTION 14

ELECTRICAL SYSTEMS

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POWER DISTRIBUTION.

Electrical energy for the aircraft is supplied by a 24 volt, direct current, single wire, negative ground electrical system. Two 12 volt storage batteries wired in series supply power for starting, and furnish a reserve source of power for electrical components in the event of alternator failure. The two batteries are contained in a battery box located in the left-hand wing outboard of the engine nacelle. The battery box contains a vent and drain tube which vents underneath the wing outboard of the landing gear. Two engine-driven alternators supply the current needed to operate the electrical equipment and to charge the storage battery. The standard alternator system includes two 50 ampere alternators, the optional system includes two 100 ampere alternators. Both standard and optional systems have two voltage regulators. One voltage regulator is used for regu-

lation of the system, the second is used as a spare in the event of regulator failure. The system is protected by a circuit breaker, three fuses and an overvoltage relay. The alternator switches are mounted on the stationary instrument panel. The electrical circuits are protected by circuit breakers housed in a circuit breaker panel located on the left cabin wall forward of the pilot's seat. The aircraft is equipped with standard navigation lights and rotating beacons. The navigation lights will remain on steady when the navigation light switch is in the FLASHING position and the rotating beacon switch is ON. When the rotating beacon switch is OFF, the navigation lights will flash. The retractable landing light is located in the tail cap of the left tip tank. The cabin lighting consists of a map light in each control wheel, a console light, and a left and right reading light above the third and fourth seats. The reading lights for the fifth and sixth seats are optional. A fuel selector

located on the front spar between the pilot's and co-pilot's seats. Post lights provide lighting for the switch panel and instruments. Lighting for the com-

pass and radio control units are contained within the units. Other optional lighting equipment consists of a right landing light and wing deice light.

Troubleshooting the Battery and Starter Circuit.

TROUBLE	PROBABLE CAUSE	CORRECTION
SLOW ENGINE CRANKING SPEED	Partially discharged battery.	Charge or change battery.
	Low capacity battery.	Cycle battery to improve capacity or replace it.
	Faulty battery cell.	Replace battery.
	Loose or corroded terminals.	Clean and tighten terminals.
	Burned starter solenoid switch contacts.	Replace solenoid.
STARTER ENGAGES BUT WILL NOT CRANK ENGINE	Starter motor drags.	Overhaul starter motor.
	Partially discharged battery.	Charge or change battery.
	Faulty battery cells.	Replace battery.
	Damaged or shorted starter motor.	Overhaul starter motor.
STARTER WILL NOT ENGAGE	Faulty armature or field in starter motor.	Overhaul starter motor.
	Battery fully discharged.	Replace or charge battery.
	Disconnected battery cable.	Replace faulty cable.
	Shorted or open starter solenoid.	Replace solenoid.
	Defective starter switch.	Replace starter switch.

Removal of Batteries. (See figure 14-1.)

- Release the fasteners securing the battery access cover and remove cover.
- Remove battery box lid.
- Disconnect the ground cable from the negative battery terminal on the rear battery.

CAUTION

Always remove the ground cable first and install it last to prevent accidental short circuits.

- Disconnect the power cable from the positive terminal on the forward battery.
- Remove the battery bus bar that connects the negative terminal of the forward battery with the positive terminal of the rear battery.
- Lift the batteries from the battery box.

Installation of Batteries. (See figure 14-1.)

- Place batteries in the battery box with the

terminal-post sides of the batteries together.

b. Coat battery terminals, bus bar and cable terminals with a light coating of grease.

c. Place bus bar across the two outboard battery terminals (positive post of rear battery and negative post of forward battery) and secure with battery wing nuts.

d. Attach the battery power cable marked "+" (the forward cable) to the forward battery terminal.

e. Attach the ground cable marked "-" to the rear battery terminal.

NOTE

When attaching the battery cables to the battery, be sure cable grommets are properly placed over the edges of the battery box.

CAUTION

Make sure battery Master Switch is OFF. Use voltmeter to determine polarity. Reverse polarity will damage diodes in the alternators.

tween the external power receptacle and the engine nacelle.

e. Install the eight screws that secure the battery box in place.

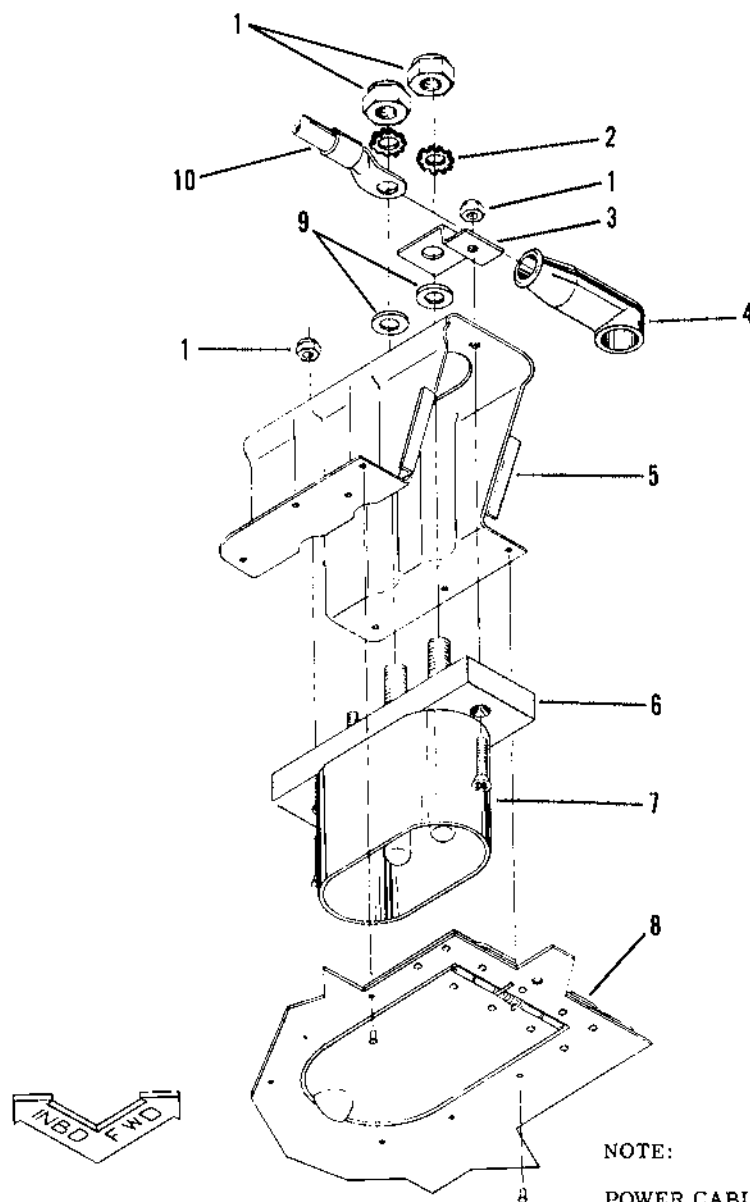
f. Feed the battery cables through the grommets into the battery box.

g. Install the batteries in accordance with battery installation procedure.

Removal of External Power Receptacle. (See figure 14-2.)

a. Remove the access hole cover located between the external power receptacle and engine nacelle.

b. Remove the nuts and lockwashers retaining the power cable and ground strap.



NOTE:

POWER CABLE (11) CONNECTS THE EXTERNAL POWER RECEPTACLE TO THE BATTERY SOLENOID LOCATED IN THE LEFT ENGINE NACELLE.

1. Nut
2. Lockwasher
3. Ground Strap

4. Rubber Nipple
5. Bracket
6. Receptacle
7. Screw

8. Access Door
9. Washer
10. Power Cable

Figure 14-2. External Power Receptacle

CAUTION

The battery switch must remain in the OFF position while the external power receptacle is being removed or installed. If there is any possibility of the switch being turned ON during this procedure, it is advisable to disconnect the ground cable from the battery.

- c. Disassemble receptacle from the bracket according to figure 14-2 and remove receptacle from wing.

NOTE

The bracket is riveted to the wing structure and should not be removed unless it is damaged.

Installation of External Power Receptacle. (See figure 14-2.)

- a. Place a plain washer on each terminal stud of the receptacle.
- b. Open the receptacle access door and place the receptacle into position on the bracket.
- c. Hold the receptacle in position and place the ground strap on the negative terminal stud.
- d. Install the screws and nuts to secure the receptacle to the bracket, making sure the screw near the negative terminal post also secures the ground strap to the bracket.
- e. Secure the ground strap to the receptacle terminal with a lockwasher and nut.
- f. Secure the power cable on the positive terminal with the lockwasher and nut and position the rubber shield over the terminal.
- g. Replace the access hole cover between the power receptacle and the engine nacelle. Replace the battery cable, if it was disconnected.

ALTERNATORS AND REGULATORS.

The alternator is designed and constructed to give long periods of trouble-free service with a minimum amount of maintenance. The rotor is mounted on a ball bearing at the drive end, and each bearing has a grease reservoir. Only two brushes are required to carry through the two slip rings to the field coil which is mounted on the rotor. The brushes are

extra long and under normal operating conditions will provide long periods of service.

The stator windings are assembled on the inside of a laminated core that forms part of the alternator frame. Six rectifier diodes are mounted in the slip ring end frame and are connected to the stator windings. The six diodes replace the separately mounted rectifier as used in other applications, and they act to change the alternator AC voltages to DC voltage which appears at the battery terminals on the alternators. The transistor regulator is an assembly composed principally of transistors, diodes, condensers and resistors to form a completely static unit containing no moving parts. The transistor is an electrical device which limits the alternator voltage to a preset value by controlling the alternator field current. The diodes, condensers, and resistors act together to aid the transistors in performing this function, which is the only function that the regulator performs in the charging circuit. The voltage at which the alternator operates is determined by the regulator adjustment. Once adjusted, the voltage remains almost constant, since the regulator is unaffected by either length of service, by change in temperature or by changes in the alternator output and speed.

There are two solid state regulators installed in the voltage regulating system. On aircraft 310P0001 to 310Q0601 one regulator is used and the second regulator is a spare. In the event of a regulator failure, the regulator switch can be positioned to STANDBY. On aircraft 310Q0601 and on the regulating system includes a voltage regulator in the left and a voltage regulator in the right alternator systems. Should adjustment be required, insert a small flat blade screwdriver in the hole provided and turn adjustment screw. Turn screw clockwise to increase and counterclockwise to decrease.

NOTE

On aircraft 310P0001 to 310Q0601 any problem which seems to be in the voltage regulator or the overvoltage protector may be quickly isolated by simply switching the voltage regulator switch to STANDBY position. If the system then operates properly, the problem is with the main voltage regulator, overvoltage relay, fuses or other wiring. If the same problem still exists, the problem can then be assumed to be in some other portion of the system, probably in the alternators themselves.

Troubleshooting Alternators and Regulator System.

TROUBLE	PROBABLE CAUSE	CORRECTION
ALTERNATOR OUTPUT CONTINUOUSLY HIGH BATTERY CONSUMES WATER RAPIDLY BATTERY DOES NOT COME UP TO FULL CHARGE - ALTERNATORS OPERATING AMMETER SHOWS HIGH DISCHARGE WHEN ALTERNATOR SWITCH & BATTERY SWITCH TURNED ON (ENGINE NOT RUNNING) REGULATOR POWER CIRCUIT BREAKER OPENS	310P0001 AND ON Faulty wiring. Regulator set too high. Regulator faulty. Faulty battery. Regulator or regulators set too high. Faulty battery. Faulty wiring. Regulator or regulators set too low. Shorted diode inside alternator. Short in regulator or overvoltage protector.	Correct as required. Adjust to 27.5 VDC. Replace. Replace. Adjust to 27.5 VDC. Replace Correct as required. Adjust to 27.5 VDC. Disconnect negative battery terminal. Connect a #313 light bulb in series with a 24 volt battery. Connect test leads from battery and bulb to output terminal of alternator and alternator case. Reverse leads - light should light on one polarity only, if no diodes are shorted. Replace shorted diodes. Aircraft 310P to 310Q0601. Switch to standby regulator. Reset regulator power breaker. If breaker does not reopen, determine and replace faulty regulator or overvoltage protector. Aircraft 310Q0601 and on. Determine which regulator is causing circuit breaker to open. Replace regulator. If breaker reopens replace overvoltage relay.
BOTH ALTERNATORS FAIL TO OPERATE	310P001 TO 310Q0601 Regulator power circuit breaker open. Switch faulty. Overvoltage protector tripped or faulty. Regulator faulty. Alternator defective.	Reset. Replace. Reset or replace. Replace. Replace.

Troubleshooting Alternators and Regulator System. (Continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
	310Q0601 AND ON	
ALTERNATOR FIELD FUSE OPENS	Faulty wiring.	Locate and repair.
	Wiring shorted.	Locate and repair.
	Alternator field shorted.	Replace alternator.
OVERVOLTAGE PROTECTOR TRIPS	Regulators set too high.	Adjust to 27.5 VDC.
	Protector faulty.	Replace.
NO OUTPUT FROM ONE ALTERNATOR WITH BOTH ALTERNATOR SWITCHES ON	Alternator field fuse blown.	Replace.
	Alternator brushes worn.	Replace.
	Faulty wiring.	Repair.
	Faulty switch.	Replace.
ONE ALTERNATOR OUTPUT LOW	Faulty wiring.	Repair.
	Faulty alternator field.	Replace alternator.
	Faulty alternator diode.	Replace diode.

Removal of Alternators. (310P0001 and On)

The alternator removal procedure is the same for both engines and either 50 Amp or 100 Amp alternator.

- Remove the engine cowlings in accordance with removal of engine cowl procedures.
- Disconnect and tag electrical leads.
- Disconnect ram air tube.
- Remove bolt from alternator at slotted upper brace.
- Remove belt from alternator sheave.
- Remove locknut, nut and washer from bolt attaching alternator to lower mount.
- Support alternator while pulling attaching bolt aft.
- Remove alternator from mounting bracket.

Installation of Alternator. (310P0001 and On)

The alternator installation procedure is the same for either engine.

- If alternator sheave (8) and/or back plate (14) was removed for inspection of fan, insure that the sheave retaining nut (10) is tightened to 35 to 40 foot-pounds torque. Do not overtorque.
- Position alternator (1) on mount (13) and install bolt (11), washers (12 and 14) and nut (5). Torque nut to 425 : 25 inch-pounds after belt tension is adjusted and install locknut (16).
- Place alternator drive belt on alternator sheave and engine drive sheave.
- Start bolt (2) in alternator at slotted upper brace (4).

e. Adjust alternator belt tension by exerting a force of 14 pounds on (new) belt (or 10 pounds after 25 hours service) at a point midway between the sheaves. Move alternator away from engine drive sheave until force results in 5/16" deflection of belt. While holding this tension, tighten bolt (2) attaching alternator to upper brace to 200 : 20 inch-pounds.

f. An alternate slip torque method may be used to determine proper belt tension. This method consists of installing a torque wrench on the sheave retaining nut and measuring the amount of torque required to make the pulley slip. Turn in a clockwise direction. Torque should be 11 to 13 foot-pounds for new belt or 7 to 9 foot-pounds after 25 hours of service.

g. Connect electrical leads and remove tags.

CAUTION

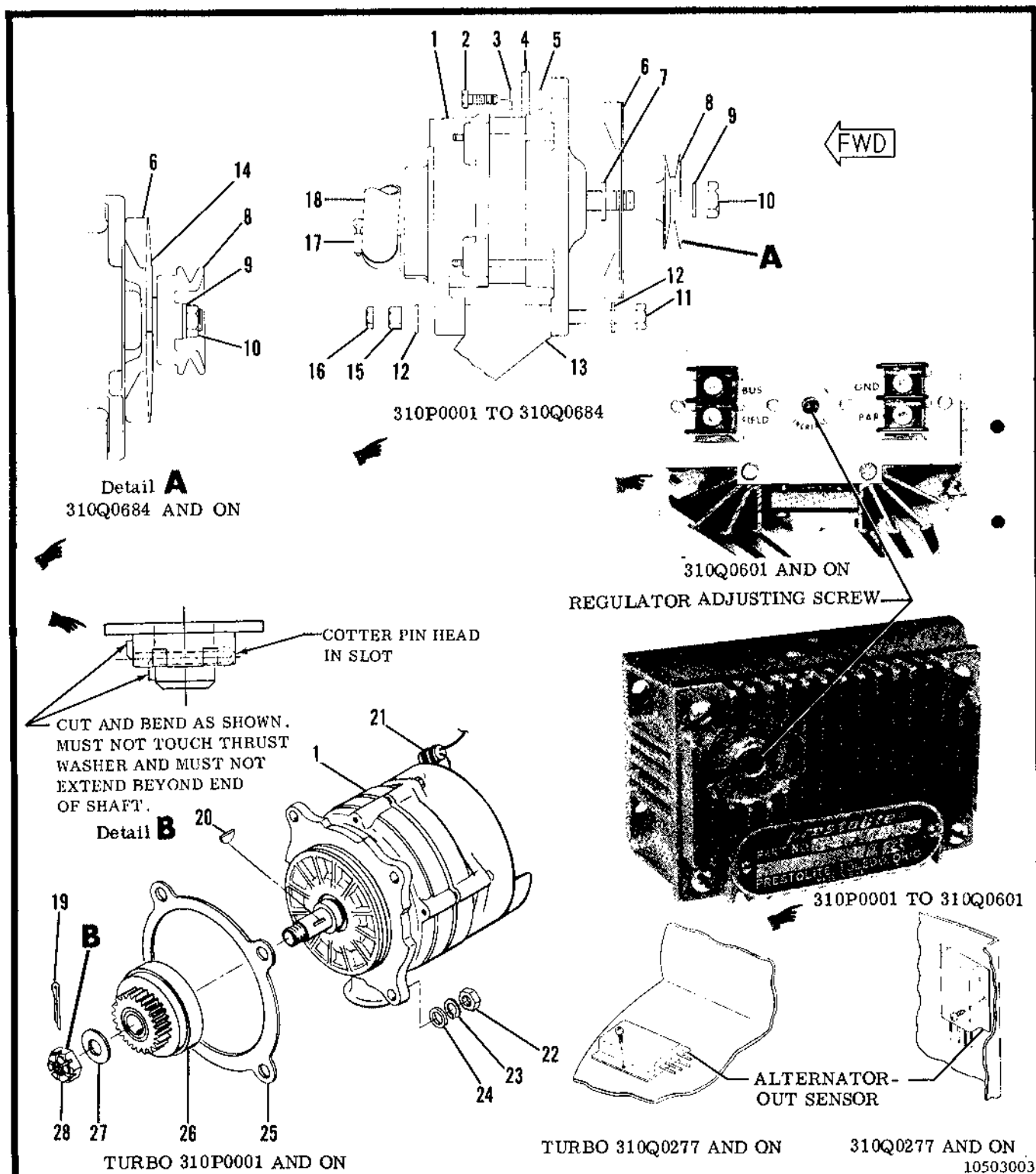
Make sure wires are connected to the proper terminals. Reversed polarity will damage alternator diodes.

- Connect ram air tube (18).
- Install engine cowlings in accordance with installation procedures.

Removal of Alternators. (Turbo 310P0001 and On)

- Remove engine cowlings in accordance with removal procedures.
- Disconnect and tag electrical leads and stow out of the area.

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1. Alternator	8. Sheave	15. Nut	22. Nut
2. Bolt	9. Lock Washer	16. Locknut	23. Lockwasher
3. Washer	10. Nut	17. Clamp	24. Washer
4. Upper Brace	11. Bolt	18. Ram Air Tube	25. Gasket
5. Washer	12. Washer	19. Cotter Pin	26. Hub
6. Fan	13. Mount	20. Key	27. Washer
7. Spacer	14. Backplate	21. Diode	28. Nut

Figure 14-3. Alternator and Regulator Installation

- c. Remove nuts, lockwashers and washers securing alternator to engine.
- d. Carefully work alternator from the engine pad.

CAUTION

Use care when removing alternator to prevent damage to splines on the alternator.

- e. Install protective covers to prevent entry of foreign material.

Alternator Hub Replacement. (See figure 14-3.)

- a. Remove alternator hub as follows:
 - 1. Remove alternator.
 - 2. Remove cotter pin (19); then using special wrench P/N 5090005-1, to hold shaft from turning, remove nut (28) and thrust washer (27).
 - 3. Pull alternator drive gear hub (26) from alternator shaft, using care not to damage hub assembly.
- b. Install alternator hub as follows:
 - 1. Apply clean engine oil to shaft of alternator and install key (20).
 - 2. Slide alternator drive gear hub (26) onto shaft and onto key (20).
 - 3. Install thrust washer (27) on alternator shaft with bearing material (copper color) side toward the hub.
 - 4. Install nut (28); then use special wrench P/N 5090005-1 to hold shaft from turning, torque nut to 450-500 inch-pounds.

NOTE

Ensure wrench 5090005-1 is aligned and seated in notch of alternator drive gear hub flange so that no damage will occur when torque is applied to nut.

- 5. Install cotter pin as shown in Detail B.
- 6. Install alternator.

Installation of Alternator. (Turbo 310P0001 and On)

- a. Remove protective covers.
- b. Make sure gasket has not been damaged or has been replaced.
- c. Position alternator on engine pad.

CAUTION

Before installing alternator, always make sure the nut on the drive shaft of the alternator is safetied with the cotter pin installed as shown in figure 14-3. If the nut is not safetied properly damage could result to the gears and alternator shaft.

- d. Work alternator in position and install washers, lockwashers, and ground lead terminal and install the nuts securing alternators.
- e. Torque nuts to 155 to 175 inch-pounds.
- f. Connect electrical wiring.

CAUTION

Be sure alternator wiring is connected properly. Reverse polarity will destroy diodes in the electrical system.

Operational Check of Alternator and Regulator.

- a. With both engines operating at 1000 RPM and the battery and alternator switches on, check the following:
 - 1. Select voltage position on voltmeter and assure bus voltage is 27.5 ± 1.0 volts.
 - 2. Select battery position on voltmeter and note battery is charging; charging amperage indication will vary as the battery builds up to normal charge.
 - 3. Load electrical system with all external lights, fuel pumps, pitot heat, etc., and check the alternator output; it should be positive and equal within 10 amps when loaded up to 100 amps total load.

NOTE

If total load is below 15 amps, one alternator may show little or no output. If so, turn producing alternator OFF; the other alternator should then pick up the load. Also, when one alternator is not carrying any load, the corresponding light may come on or flicker on and off. This is normal.

Operational Check of Alternator Failure Circuit.

- a. With both engines operating at idle RPM, place battery switch and alternator switches to OFF, and observe that failure lights are out.
- b. Reduce electrical load to minimum to avoid discharging the battery.
- c. Turn on battery switch and observe both alternator failure lights illuminate full on.
- d. Increase engine RPM to 1800 and ensure failure light remains on.

NOTE

The reference voltage used for alternator out indication is approximately one half of whatever voltage the alternator is producing. When the alternator is turned OFF, it is capable of producing some voltage which will be a function of load and RPM of unit. At high RPM such as maximum power, the residual voltage at times can exceed the fail triggering level of the sensor, turning the failure lights OFF; this is acceptable.

- e. With both alternators and battery switches ON and light electrical load of 15 amps, operate both engines at idle RPM and observe that lights remain off without any flickering. Increase RPM on both engines, together, to 1800 RPM and again observe lights for any flickering.

NOTE

It is important that both engine RPM be as close to each other as possible because at light loads, the alternator which is set at higher RPM will tend to take all of the load and the alternator running at lower RPM will be at a no load condition which will tend to give a false alternator out indication.

Operational Check of Alternator Warning System.

- a. With both engines operating 1700 RPM and normal electrical load applied, push the press-to-test switch and hold in for at least 30 seconds, and ensure both alternator out lights are on.
- b. Ensure that pushing the press-to-test switch does not trip the landing gear motor breaker.

Removal and Installation of Voltage Regulator.

- a. Remove copilot's seat (see Section 3).
- b. Remove electrical wires from regulator.
- c. Remove the screws securing the regulator to the support bracket.
- d. Remove the regulators from the aircraft.
- e. Install by reversing the removal procedures.

Operational Check and Adjustment of Alternator and Regulators. (310P0001 to 310Q0601)

- a. Remove wires from field terminals of main voltage regulators and check resistance of alternator field; resistance should be approximately 15 ohms. Replace each wire after resistance measurement.
- b. Remove wire from positive (+) terminals of voltage regulators and measure voltage with battery and applicable alternator field switch ON. Voltage should be battery voltage, approximately 24 volts DC. Voltage should be interrupted by either opening battery switch or its own alternator field switch. Replace wire after measuring voltage.
- c. Start left engine per normal starting procedure. With left alternator switch ON, increase RPM slowly and monitor alternator output voltage. Adjust voltage if required to prevent voltage exceeding 29 volts DC. Operate engine at 1500 RPM. Allow system to warm-up a minimum of 10 minutes with aircraft ammeter reading 30 to 50 Amps output, loading the system with equipment when operating requires this amount of load. Adjust voltage regulator to 27.5 $\pm$.25 volts DC. Record exact alternator output amperage. Shut down engine.
- d. Start right engine and repeat above procedure, except after warmup, adjust regulator to obtain the same ammeter reading as recorded on left engine.
- e. Operate both engines and warmup per above procedure. Check voltage setting for 27.5 volts on each alternator.

NOTE

To adjust voltage regulator, remove the snap plug from the face of the regulator and insert a small flat blade screwdriver. Turn screw clockwise to increase and counterclockwise to decrease voltage.

Operational Check and Adjustment of Alternators and Regulators. (310Q0601 and On.)

- a. Install a 2% voltmeter connected to the aircraft power bus. (The power bus is considered to be between the alternator power circuit breakers and the individual circuit breakers for each system and not at the cigar lighter.)
- b. Disconnect the paralleling wire (terminal marked "PAR") from either regulator and leave it disconnected thru step 11.

NOTE

All adjustments are performed while operating only the LH engine. (RH engine shall not be running.)

- c. With LH engine running at 1200 prop RPM, turn LH alternator field switch ON. (RH alternator switch must be OFF.) Add 10 to 15 amp load to LH alternator. Run this load for at least 2 minutes.

NOTE

To adjust voltage regulator, remove the snap plug from the face of the regulator and insert a small flat blade screwdriver. Turn screw clockwise to increase and counterclockwise to decrease voltage.

- d. Adjust LH regulator adjustment to read 27.5 volts on the voltmeter connected to the aircraft bus. Allow sufficient time for voltage to stabilize between adjustment.

NOTE

The aircraft voltammeter shall not be used for voltage setting.

c. Replace the snap plug in the LH regulator adjustment access hole and do not make any further adjustments on the LH regulator.

f. While continuing to operate the LH engine and alternator with the same electrical load as before, turn the RH alternator field switch ON. (RH engine is still not running.)

g. The remaining adjustments should be made using either a Simpson 260 or a Triplet 630 VOM.

CAUTION

Observe with caution that the field circuits of either system never touch ground or other electrical circuits, even for an instant, or the regulators may be damaged.

h. Select VOM to 0-50V scale and connect VOM between the field terminals of the left and right regulators (plus side meter to LH regulator).

i. Now very slowly rotate the RH regulator voltage adjustment while observing the voltmeter which has been connected to the two field terminals.

1. If a reverse (downscale) reading is obtained, turn the RH regulator adjustment counterclockwise, this should bring the meter upscale.

2. Then very slowly turn RH regulator adjustment clockwise to the point where the field voltmeter will read near zero.

NOTE

A stable reading should not be expected, voltage will fluctuate.

3. Then using the 0-10 volt and 0-2.5 volt scales on the VOM continue adjustment of the RH regulator to a lower voltage differential. (The 0-2.5 volt scale is recommended for making the final adjustment.) The correct adjustment has been achieved when the meter will remain briefly in the vicinity of zero, swinging both upscale and downscale.

j. Replace the snap plug in the RH regulator adjustment hole.

k. Shut down all power to the aircraft and disconnect VOM from field terminals.

l. Restore the paralleling wire removed by step 2 above.

m. After aircraft has been restored to original configuration, the RH engine should be started, both alternators turned on and system should be operated at different loads to verify that paralleling is within 10% of load and bus voltage has remained within the 27.5 ± .25 volt limit.

Removal and Installation of Circuit Breaker Panel.

a. Master switch OFF.

CAUTION

When removing the circuit breaker panel, the master switch must remain in the OFF position or ground cable should be disconnected from the battery.

b. Remove the four screws from the front of the circuit breaker panel.

c. Pull the panel away from the side of the cabin. If complete removal of the panel is desired, remove the breakers from the panel or disconnect the wiring from the breakers and bus bar.

d. Installation of the circuit breaker panel is accomplished by reversing removal procedures.

Removal and Installation of Junction Box. (See figure 14-4.)

a. Access to the left junction box is accomplished by grasping the upholstery panel (small panel containing the map pocket and pushing it down to disengage it from the upholstery along the left cabin wall.

b. Access to the right junction box is accomplished by removing three screws along the forward end of the upholstery retaining strip (adjacent to the lower cabin door jamb) and pulling the small upholstery panel from under the retaining strip and away from the right cabin wall.

c. Remove the junction box covers by removing the four screws securing each cover and pulling the cover from the box.

d. Remove the bundled electrical leads from the junction box by removing the small nuts securing the leads to the terminal strip. Pull the bundled leads from the junction box.

e. Remove the wing fairing to gain access to the four screws that secure the left junction box to the fuselage. Removing the screws will allow the left junction box to be removed. The four screws that mount the right junction box are accessible from inside the cabin.

f. Installation of the left and right junction boxes is accomplished by reversing the removal procedure.

BATTERY MASTER SWITCH AND ALTERNATOR SWITCH.

A battery master switch is located between the left and right alternator switches on the left side of the stationary panel. A switch bar is installed across the top of the three switches to permit simultaneous shutoff. When the battery switch is placed in the ON position, it actuates a heavy duty relay which connects the battery to the bus bar.

The alternator switches are connected electrically in the alternator field excitation circuit.

Removal of Battery and Alternator Switches. (See figure 14-6.)

a. Remove cotter pin and pin securing switch bar to bracket.

b. Remove nut securing switch to left control panel.

c. Tag and remove the wires from the switch.

CAUTION

During removal of any switch except the battery switch, the battery switch must remain OFF. When removing the battery switch, disconnect the ground cable from the aft battery to prevent an accidental short circuit.

Installation of Battery and Alternator Switches. (See figure 14-6.)

- a. Connect the wires to the proper switches and remove tags.
- b. Insert switch in proper position in the switch panel and secure with nut.
- c. Install switch bar using pin and cotter pin.

LEFT-HAND SWITCH PANEL.

All switches mounted on the left-hand switch panel are a two position, one hole mounting, toggle-type switch, except the starter switches, which are a button-type switch with a safety guard. Rheostats mounted on the switch panel include the flight instruments and radio, engine instruments, switch panel and fuel selector and compass lights. Post lights and overhead flood lights illuminate the switch panel.

SWITCHES.

Typical Switch Removal. (See figure 14-6.)

- a. Loosen and remove the decorative nut securing switch to the switch panel and remove switch from the panel.
- b. Tag and remove the wires from the switch.

Typical Switch Installation. (See figure 14-6.)

- a. Install wires on switch and remove tags.
- b. Install switch in panel and secure with decorative nut.

Removal and Installation of Ignition System Switches.

- a. Loosen switch guard and remove nut securing guard and switch to panel.
- b. Tag and remove wires from the switch.

CAUTION

When removing starter switches, it is advisable to remove negative cable from the battery to prevent the starter circuit from becoming energized during removal of switch.

- c. To install ignition switch, connect the wires to the switch and remove tags.
- d. Install switch in the panel, secure with guard and nut.

LIGHTS.

Removal of Landing Gear Switch and Indicator Light. (See figure 14-7.)

- a. Unscrew and remove wheel shaped knob from switch.
- b. Remove the nut holding switch to the panel and pull the switch from the rear of the panel.
- c. Tag and disconnect the wires from the switch.
- d. To remove the indicator lights, remove the lens and bulb.
- e. Loosen nut securing light to panel and pull light aft from panel.
- f. Unsolder and tag wires from light.

Installation of Landing Gear Switch and Indicator Light. (See figure 14-7.)

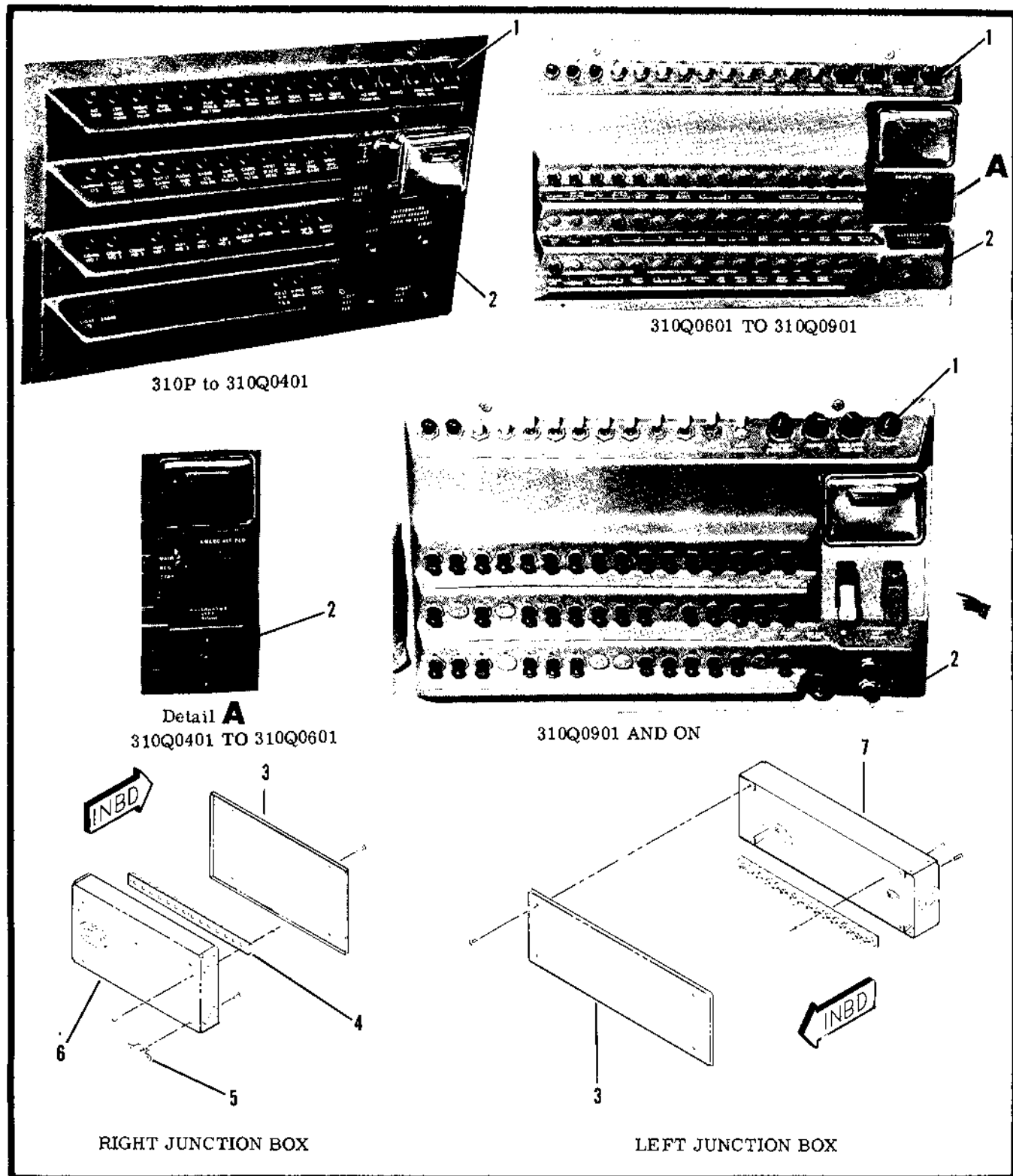
- a. To install the indicator light, solder wires to light and remove tags.
- b. Install light in panel and secure with nut.
- c. Install bulb and lens.
- d. To install landing gear switch, connect wires to switch and remove tags from wires.
- e. Place two nuts on the switch shaft and run them down finger-tight against the switch body.
- f. Place the keyed washer on the switch shaft and position the switch on the instrument panel.
- g. Place another nut on the switch shaft from front of the instrument panel. Tighten only finger-tight.
- h. Tighten nuts on back side of panel (counterclockwise) on switch shaft until the switch is secured against panel. Be sure the keyed washer mates the small hole in the panel below switch mounting hole.
- k. Screw the wheel shaped knob on the switch toggle.

Removal and Installation of Interior Lights Rheostat. (See figure 14-6.)

- a. Loosen setscrew securing rheostat knob using a 3/32 inch allen wrench, then remove rheostat knob.
- b. Remove nut securing rheostat to left switch control panel and remove rheostat from panel.
- c. Tag and remove the wires by unsoldering from the rheostat connections.
- d. To install the interior light rheostat, reverse this procedure.

Removal and Installation of Instrument Lights. (See figure 14-8.)

- a. To remove Type C or D post instrument lights, remove wire connector from light and remove nut, lockwasher and spacer (if used) securing light to stationary instrument panel.
- b. To install post instrument light, reverse the above procedure.
- c. To remove the eyebrow type instrument light, cut the wire to the light and remove the two screws securing the light to the instrument panel.
- d. To install an eyebrow type instrument light, feed the light wire through the hole in the instrument panel and secure the light to the panel with two screws.



- 1. Circuit Breaker and Switch Panel
- 2. Alternator Fuse and Switch Panel

- 3. Cover
- 4. Terminal Block
- 5. Bracket

- 6. RH Junction Box
- 7. LH Junction Box

Figure 14-4. Circuit Breaker and Junction Box Installations

Electroluminescent Panel Lights

The electroluminescent panel emanates light from crystalline powders, or phosphors, sandwiched between two electrically conducted surfaces, of which one surface is translucent. When the panel lights are turned on, the powders absorb electrical AC energy and convert it to light without the use of starters, or ballasts and with minimal heat.

Removal of Electroluminescent Panels. (See figure 14-8.)

- Turn off power.
- Remove the necessary switch circuit breaker nuts.
- Lift panel off and tag and disconnect wiring.

NOTE

Operational checks on the electroluminescent panels should be performed using 120 volt,

400 cycle AC. However, panel will operate without damage on 120 volt, 60 cycle AC.

Installation of Electroluminescent Panels. (See figure 14-8.)

- The installation procedure for the electroluminescent panels is the reversal of the removal procedures.

Removal of Fuel Selector Valve Light.

- Loosen and remove the two screws securing the selector valve light cover to the spar. Remove the cover.
- Push the bulb up and twist to the left to unlock it, and remove the bulb from the socket.
- Straighten the tabs of the bulb socket, and push the socket down and out of the socket bracket.
- Loosen the small screw securing the electrical lead to the socket. Pull the lead from the socket.

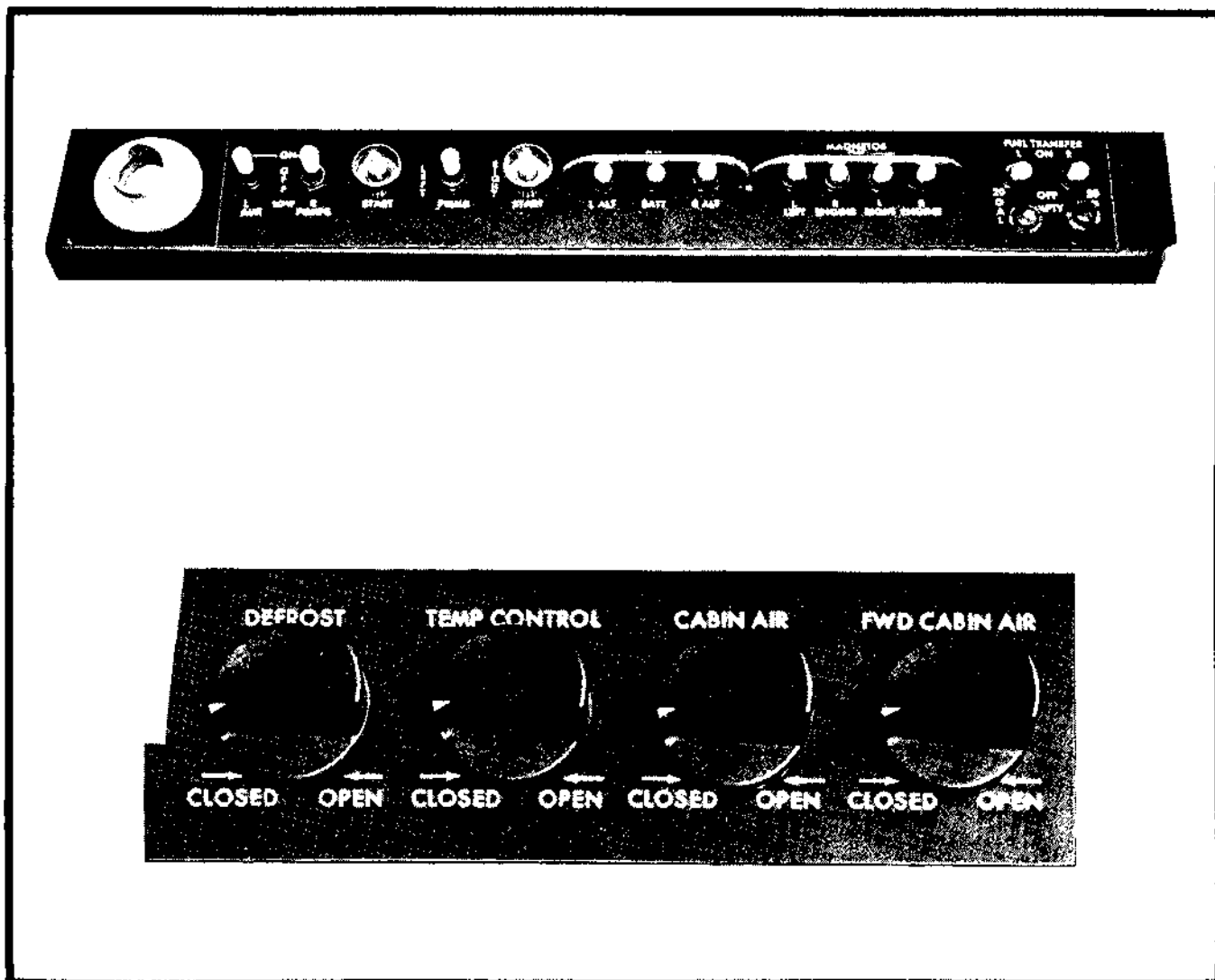
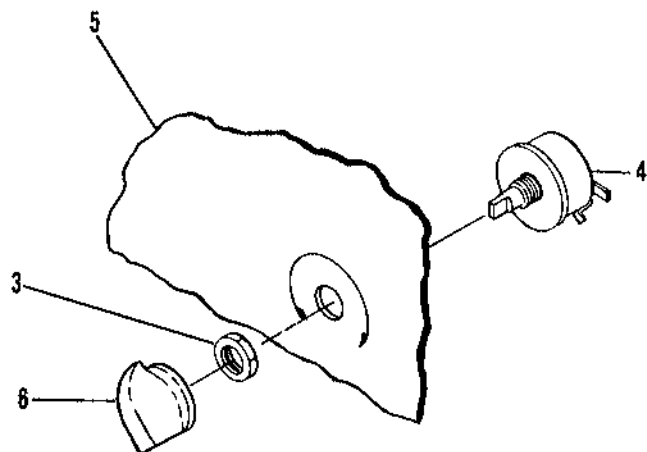
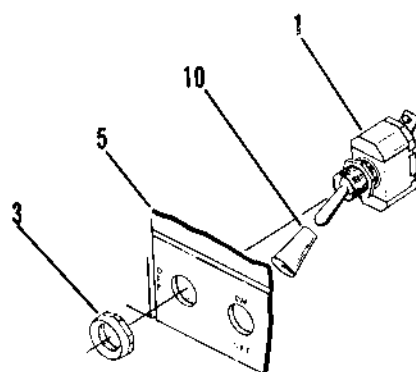


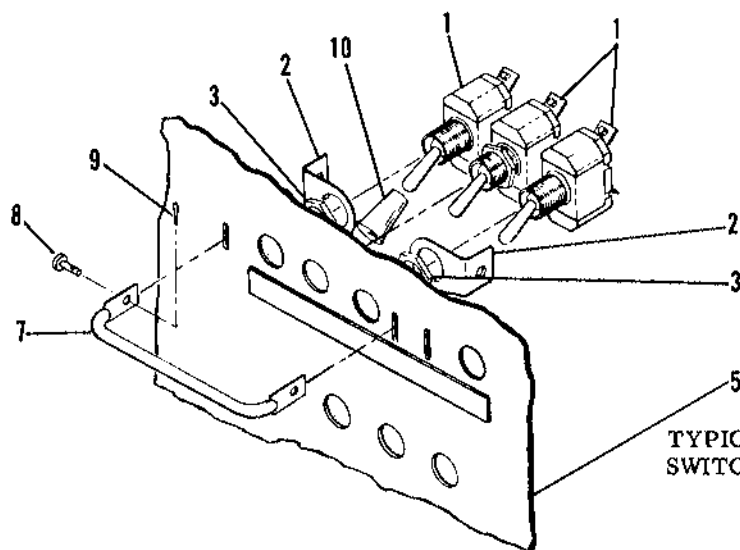
Figure 14-5. Stationary Panel Switches



TYPICAL RHEOSTAT
INSTALLATION



TYPICAL SWITCH
INSTALLATION



TYPICAL BATTERY AND ALTERNATOR
SWITCH INSTALLATION

- 1. Switch
- 2. Switch Bar Bracket
- 3. Nut

- 4. Rheostat
- 5. Instrument Panel
- 6. Knob
- 7. Switch Bar

- 8. Pin
- 9. Cotter Pin
- 10. Decorative Knob

Figure 14-6. Typical Switch and Rheostat Installations

Installation of Fuel Selector Valve Light.

- a. Position the socket of the fuel selector valve light so that the two tabs of the socket fit up into slots provided in the socket bracket on the front spar. Bend or twist the tabs of the socket to secure it in place.
- b. Insert the end of the light electrical lead into the socket and tighten the small lead securing the screw.
- c. Push the bulb up into the socket and twist it to the right to lock into position.
- d. Position the fuel selector valve light cover and install two screws to secure it in place.

Removal and Installation of Front Dome and Individual Reading Lights. (See figure 14-8.)

- a. To remove the overhead console lights, remove the four screws and oxygen caps from the console and lower the console approximately eight inches for minor repair.
- b. If a complete removal is necessary, tag wires and unsolder rheostats.
- c. The individual reading lights are removed by removing the two screws securing the switch and removing the cap from the oxygen outlet. Then re-

move the cover.

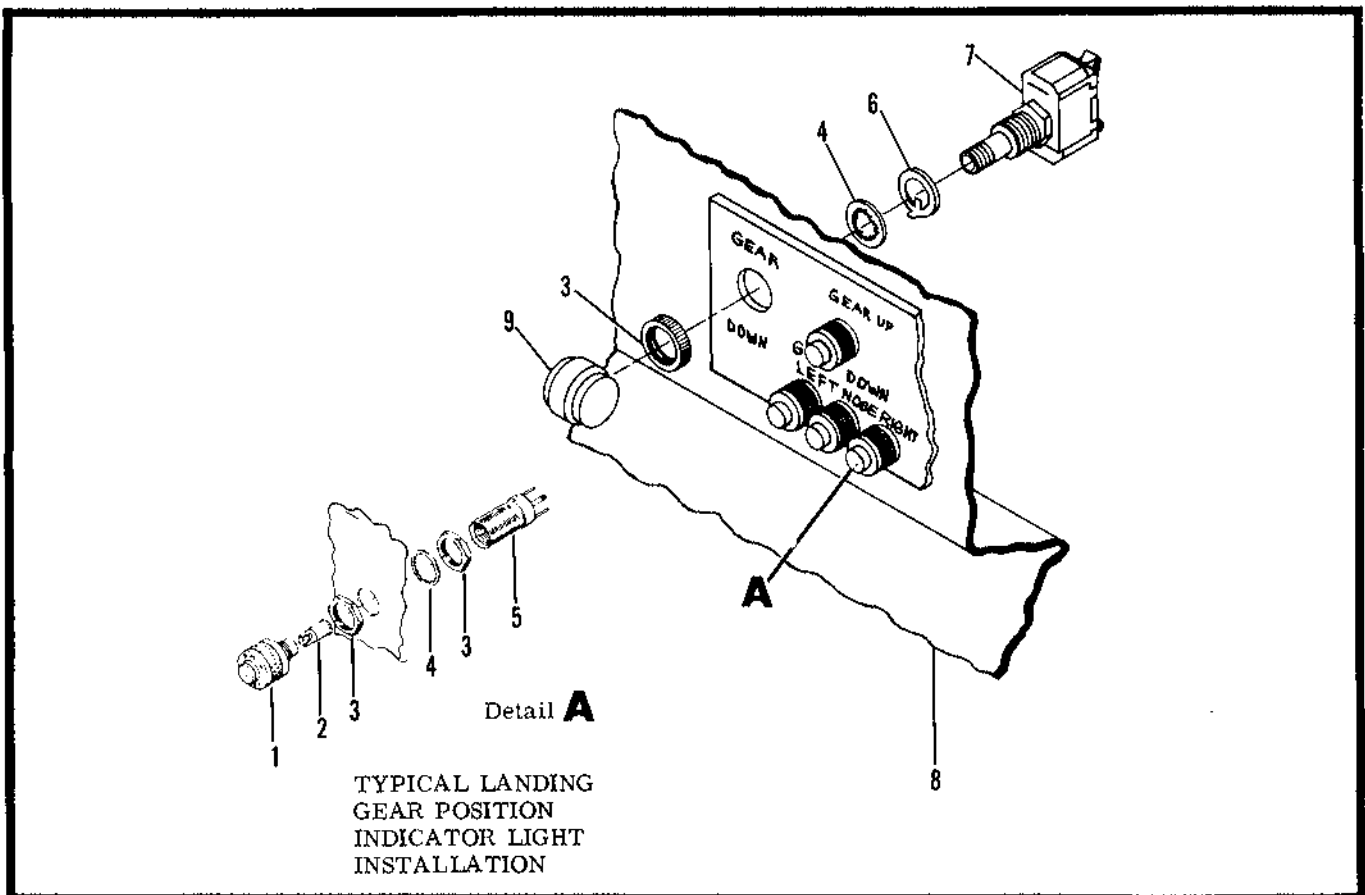
- d. Remove the four screws securing light to bracket and tag wires and disconnect.
- e. Installation of front dome and individual reading lights is accomplished by reversing this procedure.

Removal and Installation of Wing Navigation Lights. (See figure 14-9.)

- a. Remove the tip tank nose cap.
- b. (See figure 14-9.) Remove and install navigation light in sequence as shown.

Removal and Installation of Tail Navigation Lights. (See figure 14-9.)

- a. Two screws secure the tail light assembly to the stinger. Removing these two screws and disconnecting the electrical connector from the rear of the light assembly will allow the tail light to be removed. If the tail light wiring is to be removed, the stinger assembly must be removed to disconnect the wires at the rear fuselage bulkhead. To replace the tail light, reverse the above procedure.



1. Lens Cap
2. Bulb
3. Nut

4. Lockwasher
5. Light Body
6. Keyed Washer

7. Switch
8. Instrument Panel
9. Knob

Figure 14-7. Landing Gear Switch and Position Indicator Installation

Troubleshooting Exterior Lights.

TROUBLE	PROBABLE CAUSE	CORRECTION
ONE NAVIGATION LIGHT IS OUT	Lamp burned out. Defective wiring. Defective lamp socket.	Replace lamp. Inspect wiring from J-box to light. Replace light assembly.
ALL NAVIGATION LIGHTS ARE OUT	Circuit breaker out. Defective wiring or navigation lights switch.	Check/reset circuit breaker. Check/repair or replace wiring. Replace switch.
NAVIGATION LIGHTS DO NOT BLINK	Defective flasher unit.	Replace flasher unit.
LANDING LIGHT EXTENDS BUT DOES NOT LIGHT	Circuit breaker out. Lamp burned out. Defective wiring.	Check/reset circuit breaker. Replace lamp. Check/repair or replace wiring.
LANDING LIGHT WILL NOT EXTEND	Circuit breaker out. Defective wiring or switch.	Check/reset circuit breaker. Check/repair or replace wiring. Replace landing light switch.
LANDING LIGHT WILL NOT RETRACT	Circuit breaker out. Defective wiring.	Check/reset circuit breaker. Check/repair or replace wiring.
ROTATING BEACON LIGHTS BUT DOES NOT ROTATE	Defective jumper wire. Defective motor.	Check/repair or replace jumper. Replace motor.
TAXI LIGHT DOES NOT OPERATE	Circuit breaker out. Defective wiring or switch. Lamp burned out.	Check/reset circuit breaker. Check/repair or replace wiring. Replace taxi light switch. Replace lamp.

Removal and Installation of Rotating Beacons. (See figure 14-9.)

- To remove the rudder-mounted rotating beacon, remove the screws in the fiberglass tip and lift rotating beacon.
- Disconnect electrical plug.
- To remove the belly-mounted rotating beacon, remove the screws in the flange mounting and lower rotating beacon from fuselage.
- Disconnect the electrical plug.
- Installation of the rotating beacons may be accomplished by reversing the above procedure.

CAUTION

When replacing the bulb in the rotating beacons do not allow the reflector to move. Always grasp the bulb base and unscrew bulb from bayonet fittings. This will prevent motor drive spring damage.

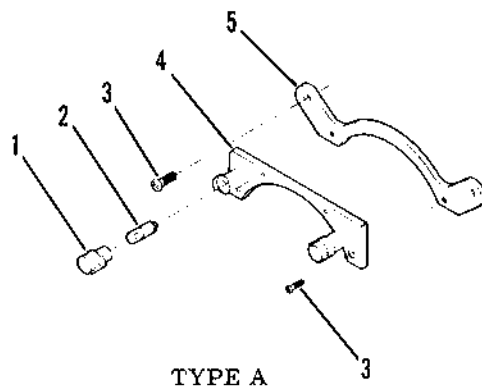
Removal of Landing Light. (See figure 14-10.)

- Support the light assembly and remove screws which secure lamp housing to retainer band.
- Lower the light assembly out of the tip tank tail cap and place on a stand of suitable height.

NOTE

The wiring to the light contains sufficient slack to permit the light assembly to be brought down below the tip tank tail cap for removal of light wiring.

- Tag and remove the wires from the terminal block on the light.
- To remove the lamp from the landing light, extend the light approximately 60 degrees and remove the lamp retainer ring. Pull the lamp from the inner canopy and disconnect the wires from the lamp.

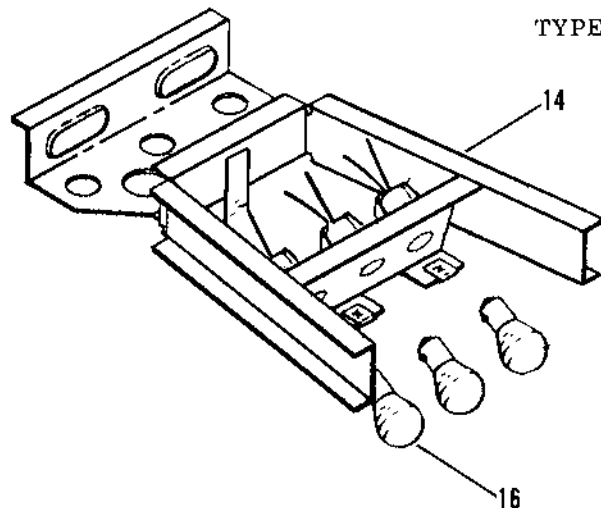
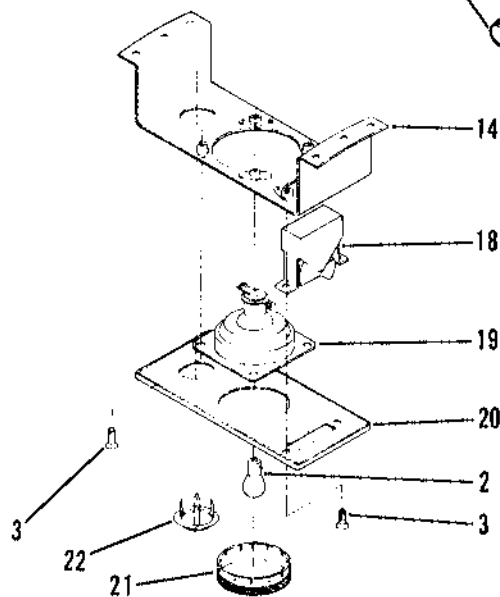
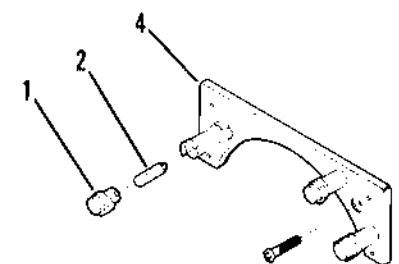
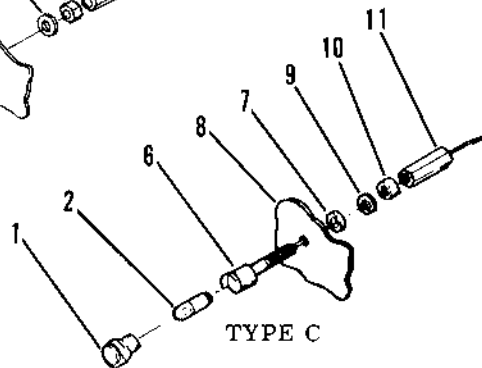
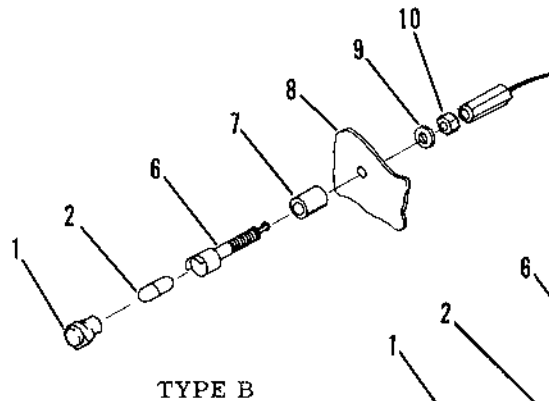


DETACHABLE (TYPE A & D)

Unscrew nylon attach and remove as shown.

NON-DETACHABLE (TYPE B & C)

The lead must be severed before removal. Upon re-installation, a line splice is required (quick-disconnect, permanent splice, etc.). Use adequate insulation on the splice. Protect the end of the lead during removal to prevent accidental shorting.

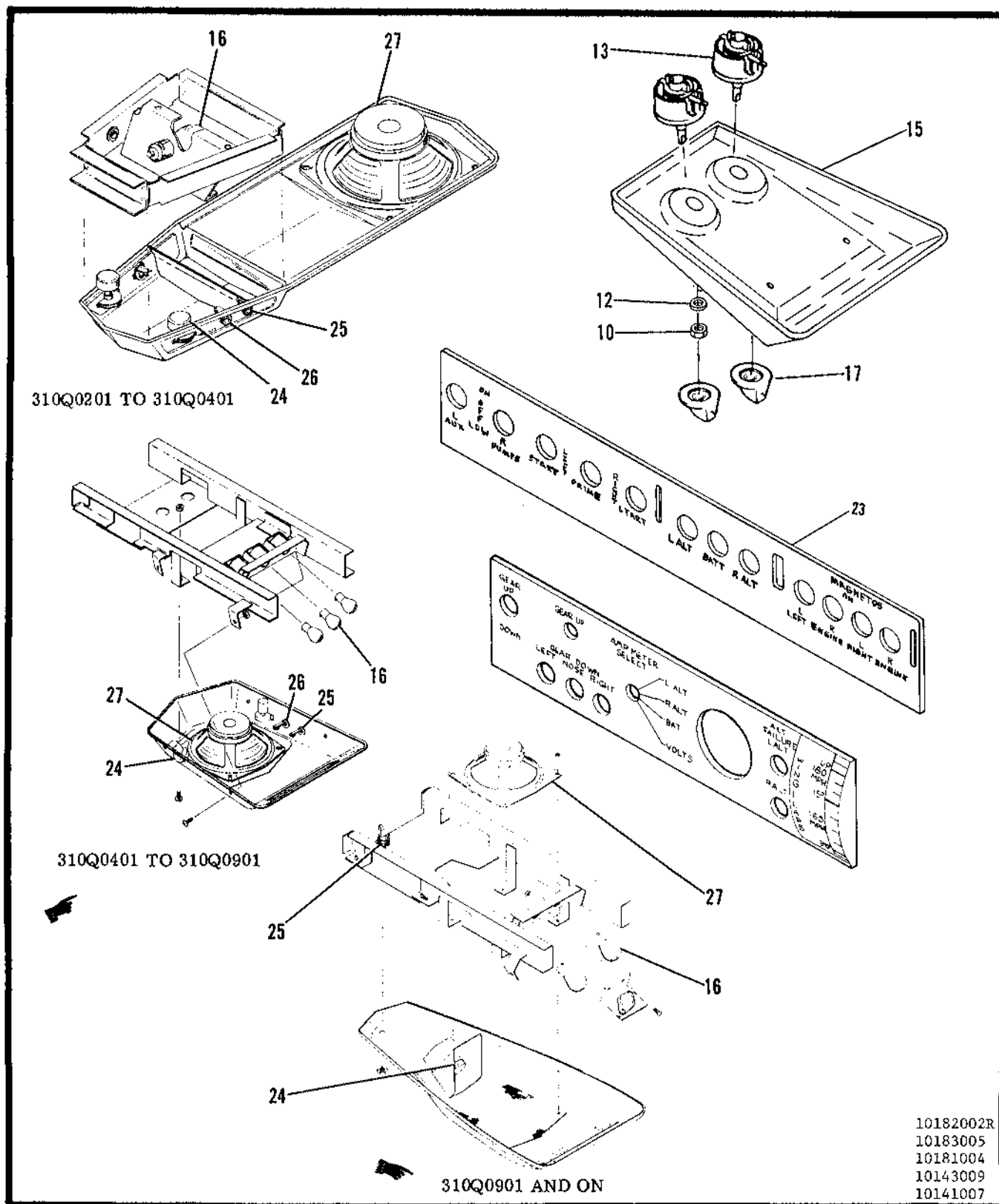


1. Hood
2. Bulb
3. Screw
4. Cover Plate
5. Mounting Plate
6. Socket

7. Spacer
8. Instrument Panel
9. Washer
10. Nut
11. Connector
12. Washer

13. Rheostat
14. Bracket
15. Console Cover
16. Flood Light
17. Knob
18. Switch

Figure 14-8. Instrument Panel, Front Dome and Individual Reading Light (Sheet 1 of 2)

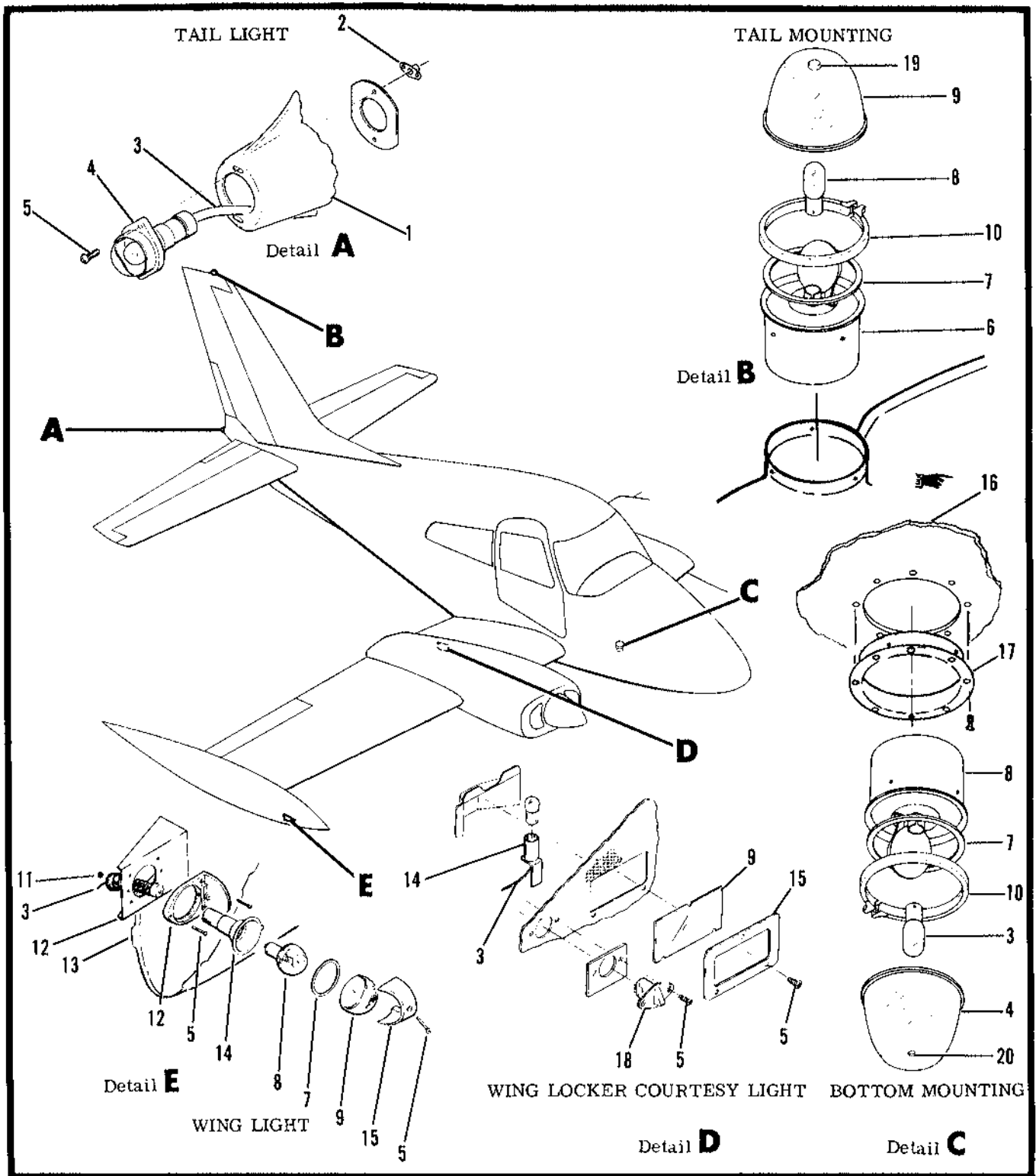


19. Reading Light
20. Cover
21. Lens

22. Oxygen Port Cover
23. Electroluminescent Panel
24. Rheostat

25. Phone Jack
26. Mic Jack
27. Speaker

Figure 14-8. Instrument Panel, Front Dome and Individual Reading Lights (Sheet 2 of 2)



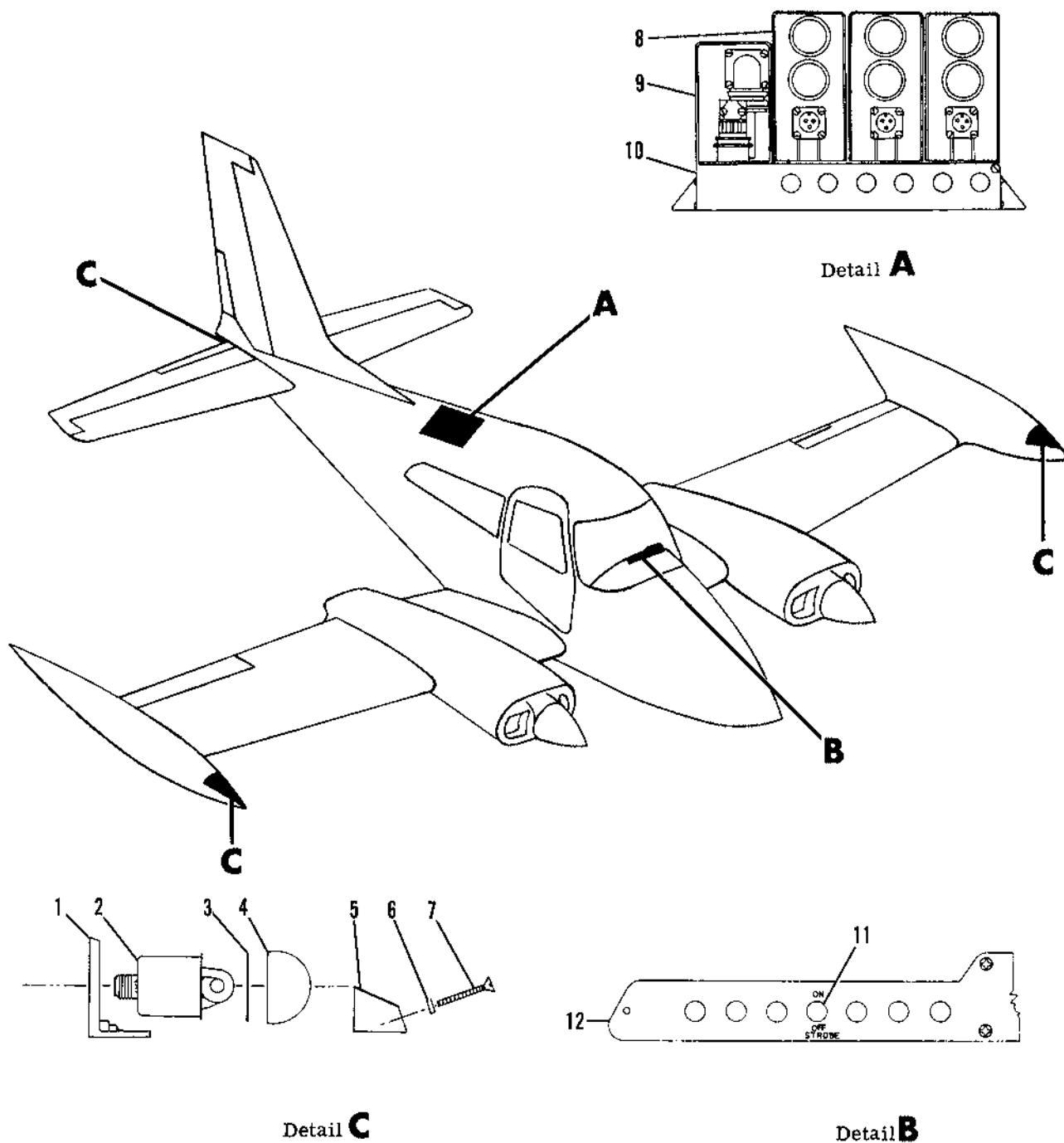
1. Stinger Assembly
2. Nutplate
3. Wire
4. Tail Light Assembly
5. Screw

6. Beacon
7. Gasket
8. Bulb
9. Lens
10. Clamp

11. Nut
12. Bracket
13. Tip Tank
14. Socket
15. Lens Retainer

16. Bottom Skin
17. Mounting Ring
18. Switch
19. Plug
20. Drain Hole

Figure 14-9. Rotating Beacon, Wing and Tail Navigation Lights Installation



310P0001 TO 310Q0257

1. Base
2. Flash Tube Assembly
3. Gasket
4. Lens

5. Retainer
6. Washer
7. Screw
8. Power Supply

9. Timing Circuit
10. Sub - Chassis
11. Strobe Light Switch
12. Instrument Panel

Figure 14-9A. Strobe Light Installation

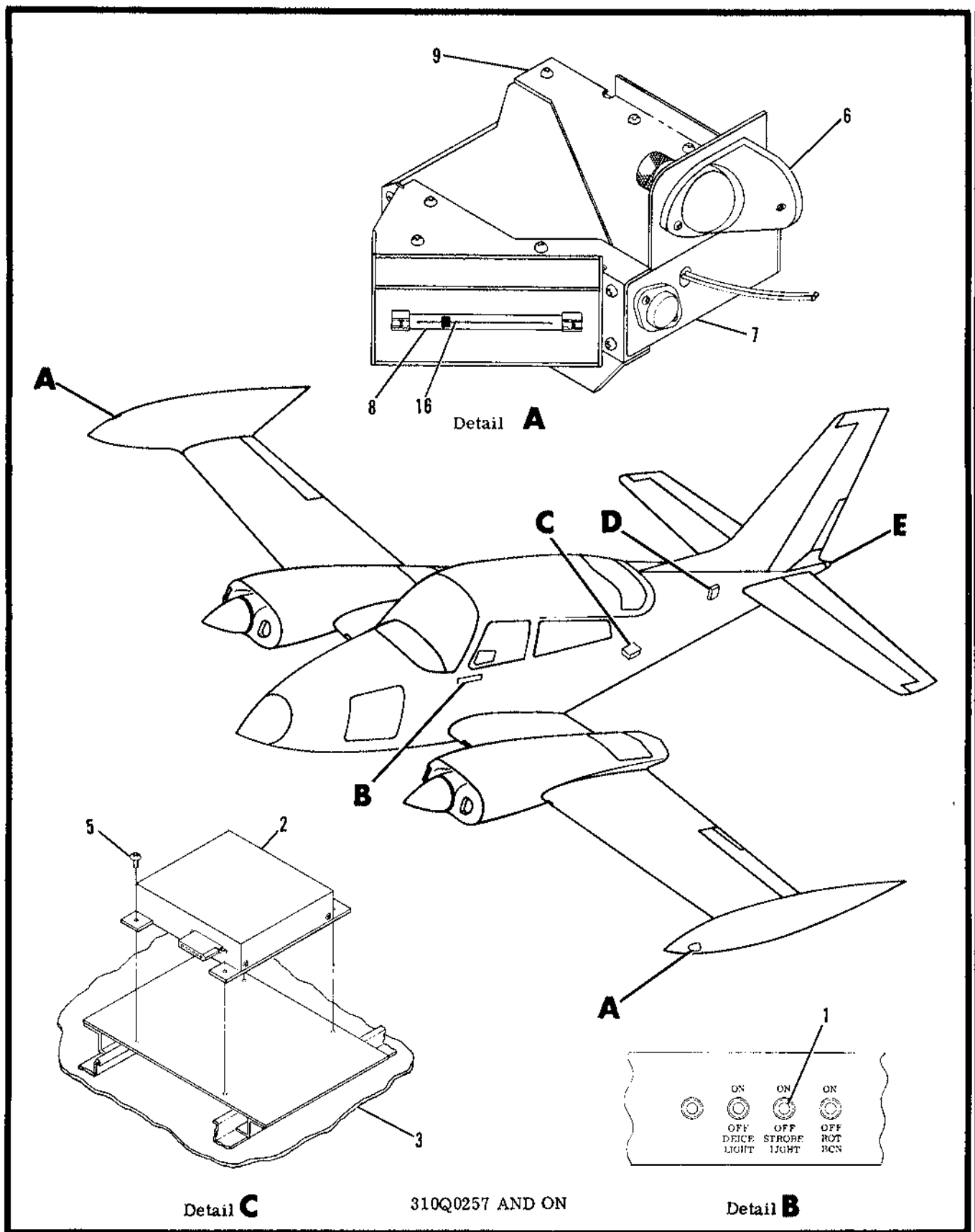
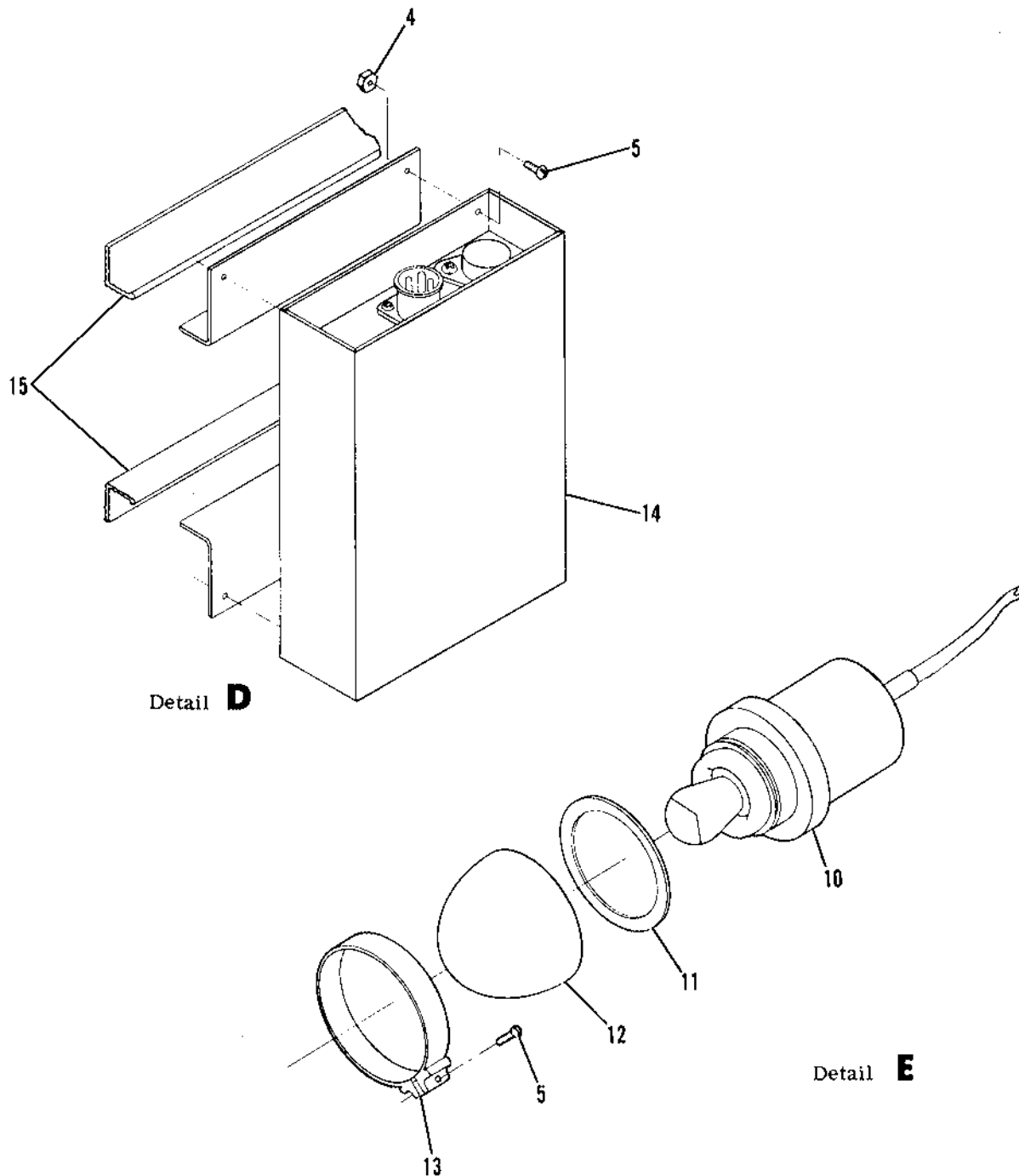


Figure 14-9B. Strobe Light System (Sheet 1)



1. Breaker Switch	6. Navigation Light	12. Lens
2. Flasher Unit	7. Power Supply	13. Clamp
3. Lower Skin	8. Flash Tube	14. Power Supply
4. Nut	9. Bracket	15. Tailcone Stringer
5. Screw	10. Tail Light	16. Trigger Grid
	11. Gasket	

Figure 14-9B. Strobe Light System (Sheet 2)

NOTE

When the light assembly is removed from the aircraft, the light may be extended by applying a 28 volt power source across the OPEN and ground terminals.

- c. Remove the two screws securing the power unit to the housing.

Installation of Landing Light. (See figure 14-10.)

- a. Position power unit within drive housing of light

assembly and secure with two screws.

- b. To install a new lamp, connect the wires to the lamp and position the lamp within the canopy with the filament shield inboard. Position the lamp retainer band over the edges of the lamp and canopy with the flat side toward the apex of the canopy. Using needle nose pliers, pull the retainer band tight around the lamp and canopy and fasten the clip on the band.

NOTE

Before installing a new lamp, it will be ne-

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cessary to extend the light approximately 60 degrees to gain access to the retainer band.

- c. Position the retainer ring inside the tip tank tail cap with the open side forward and tape it to the tip tank tail cap to hold it in position temporarily while the light assembly is installed.
- d. Connect the wires to the light assembly and remove the identification tags.
- e. Place the light assembly into the wing and secure with screws.

NOTE

Start all screws through the nutplates on the retainer band before attempting to tighten any of them to prevent distortion or misalignment of the band.

Adjustment of Landing Light. (See figure 14-11.)

Landing lights are adjusted in the factory to extend to an angle of 90 degrees from the fully retracted position. The angle of extension may be altered by means of an adjustment screw as illustrated in figure 14-11.

NOTE

Do not turn the adjusting screw counterclockwise more than three full turns without closing and opening the light before further adjustment. Excessive turns of the screw in a counterclockwise direction will distort an actuator contact within the assembly, thus changing the fixed setting which controls the light retract position.

The angle of extension of the landing light may be checked with a bubble protractor. Check the degree of opening according to the following steps:

- a. Retract the landing light and place the flat surface of the protractor across the retainer band which secures the lamp within the inner canopy.

NOTE

Two blocks of equal thickness may be placed on the retainer band to raise the protractor so it will clear the surface of the lamp for a more positive location of the protractor.

- b. Run the landing light full down and measure the angle of extension. If the light has not reached the desired degree of extension, turn the landing light adjustment screw in the direction necessary to achieve the desired angle of extension.
- c. Retract the light to the full up position, fully extend the light, and check the angle of extension.

Removal and Installation of Taxi Light. (See figure 14-10.)

- a. Remove screw securing lamp and move lamp.
- b. Tag and disconnect wires; then loosen knurled nut.
- c. Remove nut securing light to strut bracket.
- d. Installation of taxi light is a reversal of this procedure.

Adjustment of Taxi Light.

The taxi light should be adjusted to an angle of approximately three degrees below horizontal. The light should also be adjusted to point in the direction of the nose wheel. The fore and aft positions of the light may be adjusted by removing the cotter pin and loosening the nut to free the mounting bracket. The light may be aligned with the nose wheel by loosening the mounting nut and pivoting the light on the mounting bracket.

CAUTION

After adjustment, make sure the nut securing light to the bracket is tight and the bolt securing the bracket is tight and cotter pin installed.

Removal and Installation of Deice Light. (See figure 14-12.)

- a. Remove upper cowling from left engine.
- b. Remove screws securing socket assembly and clamp holding wires.
- c. Pull socket assembly apart from lamp shield to remove bulb.
- d. If further disassembly is required, tag and remove wires. Drill out rivets securing shield assembly to nacelle skin.
- e. Installation of deice light is accomplished by reversing this procedure.

Strobe Light System. (Optional)

The high intensity strobe light system consists of a strobe light located on each wing tip, a power supply and flasher unit located in the tail section of the aircraft, a switch circuit breaker located on the side console, and a tail light unit located in the stringer. The wiring is shielded to guard against radio noise interference.

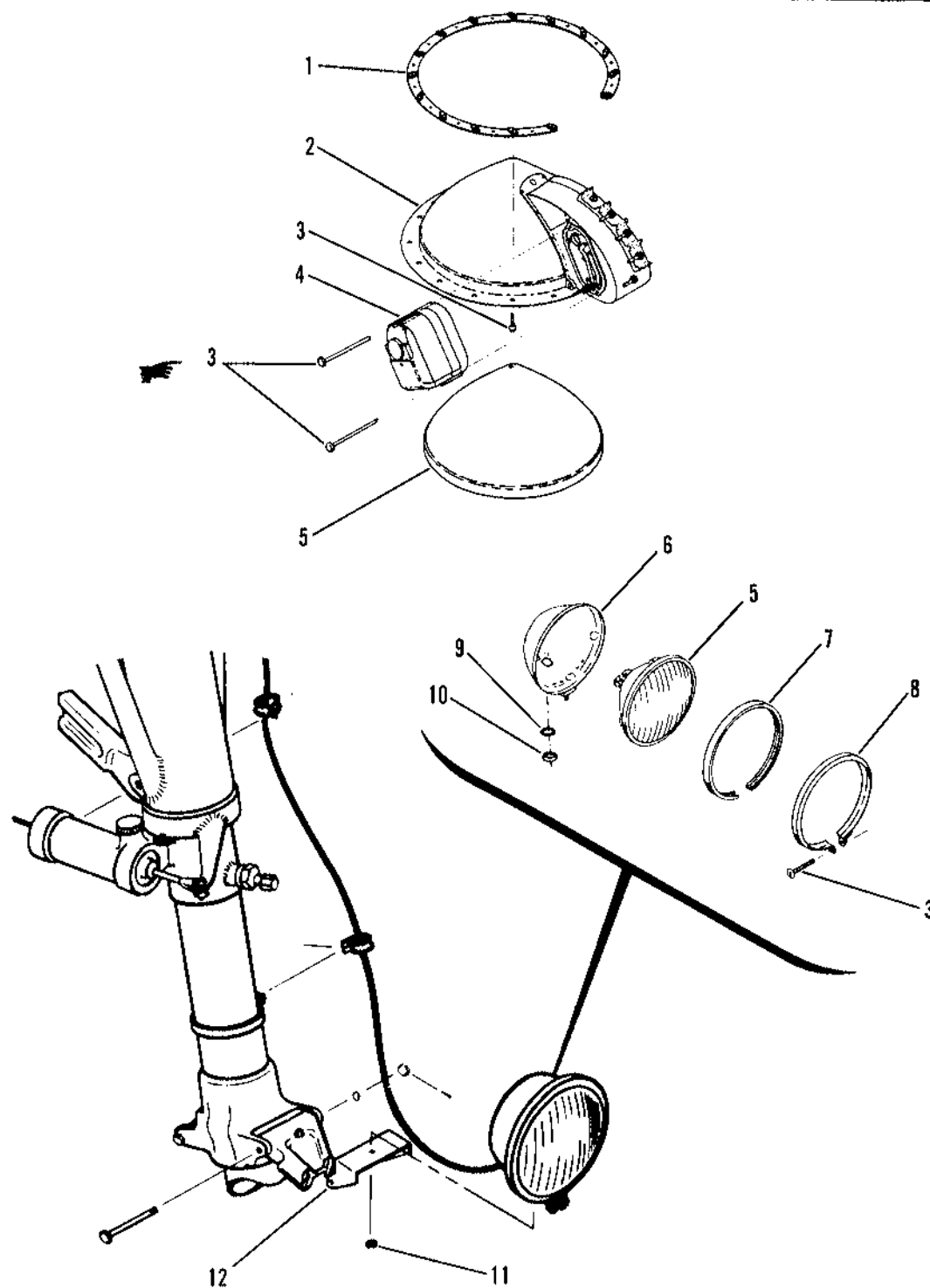


Figure 14-10. Landing and Taxi Light Installation

Troubleshooting the Strobe Light System.

TROUBLE	PROBABLE CAUSE	CORRECTION
ONE STROBE LIGHT OUT	Flash tube burned out.	Replace flash tube.
	Power supply defective.	Replace power supply.
ALL STROBE LIGHTS OUT	Circuit breaker out.	Reset breaker.
	Defective switch.	Replace switch.
	Power supply defective.	Replace power supply.
	Timer inoperative.	Replace timer.
STROBE LIGHT WILL NOT FLASH	Defective timer.	Replace timer.

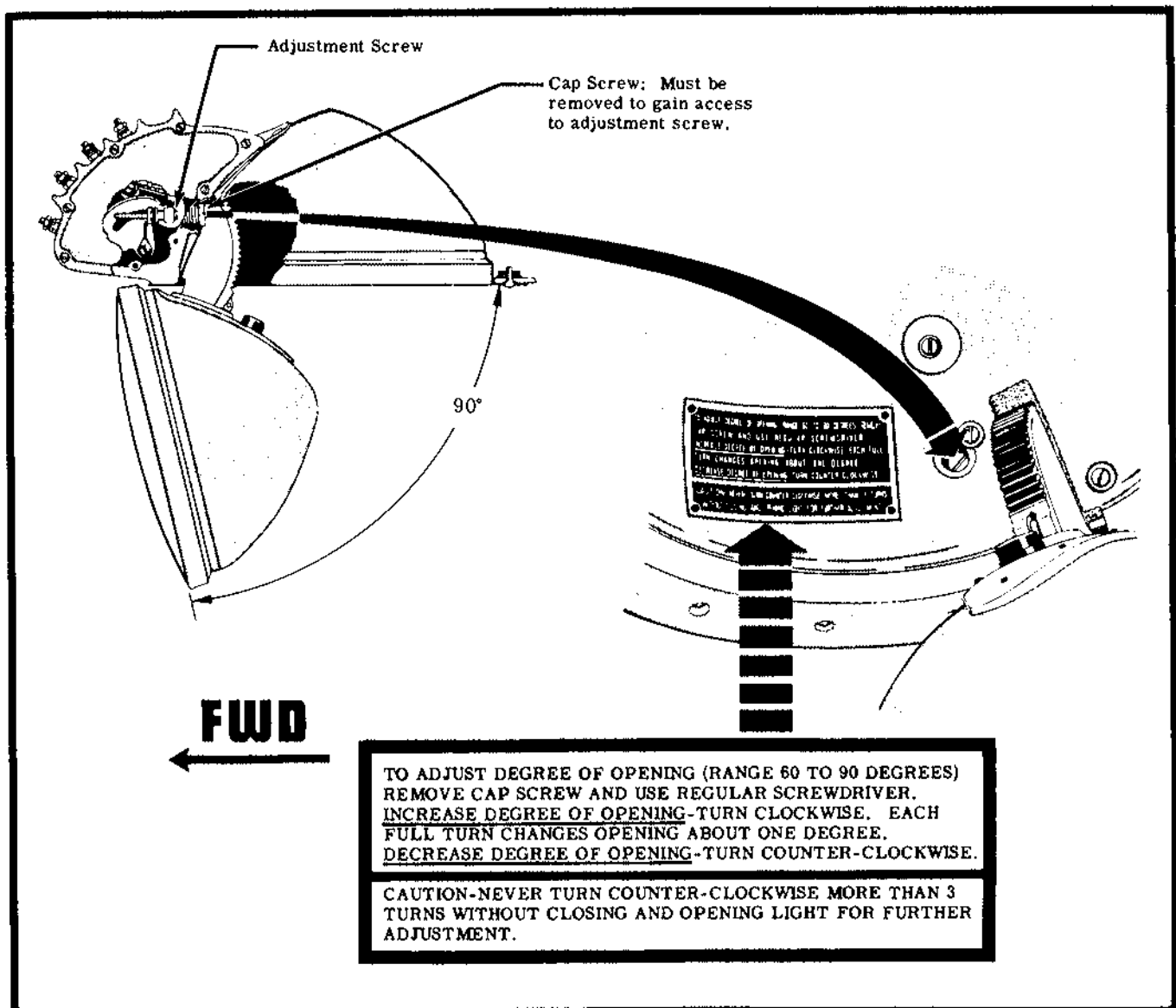
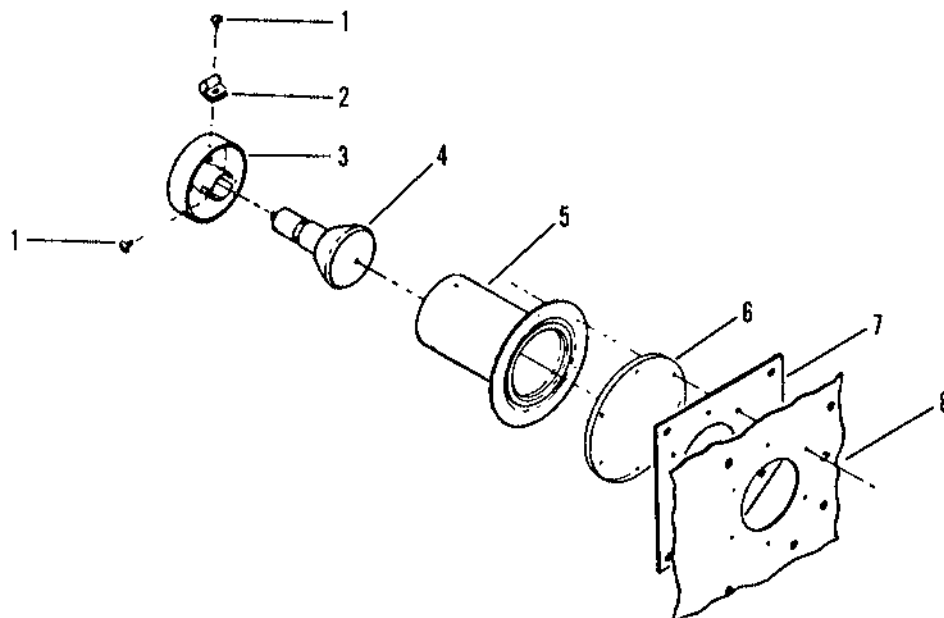


Figure 14-11. Adjustment of Landing Light



- 1. Screw
- 2. Plastic Clamp

- 3. Socket Assembly
- 4. Lamp

- 5. Shield
- 6. Lens

- 7. Doubler
- 8. Nacelle Skin

Figure 14-12. Wing Deice Light Installation

Removal and Installation of the Strobe Light System Components. (See figure 14-9A.)

- a. Remove nose cap on each wing tip.

NOTE

If strobe light bulb is burned out, unsafely and remove from clips. Reinstall new bulb and safety.

CAUTION

Install bulb with trigger grid facing outward towards the lens and away from the reflector.

- b. Disconnect electrical wiring to strobe light.
- c. Remove strobe light unit from supporting bracket.
- d. Remove access cover to gain access to flasher.
- e. Disconnect electrical wiring from flasher.
- f. Remove flasher from supporting beam.

- g. Remove access cover to gain access to power supply unit.

- h. Disconnect electrical plug.

- i. Remove power supply unit from supporting bracket.

- j. Remove tail light in accordance with figure 14-9.

- k. The installation of the strobe system components is the reversal of the removal procedure.

Removal and Installation of Cabin Step Light and Wing Walkway Light. (See figure 14-13.)

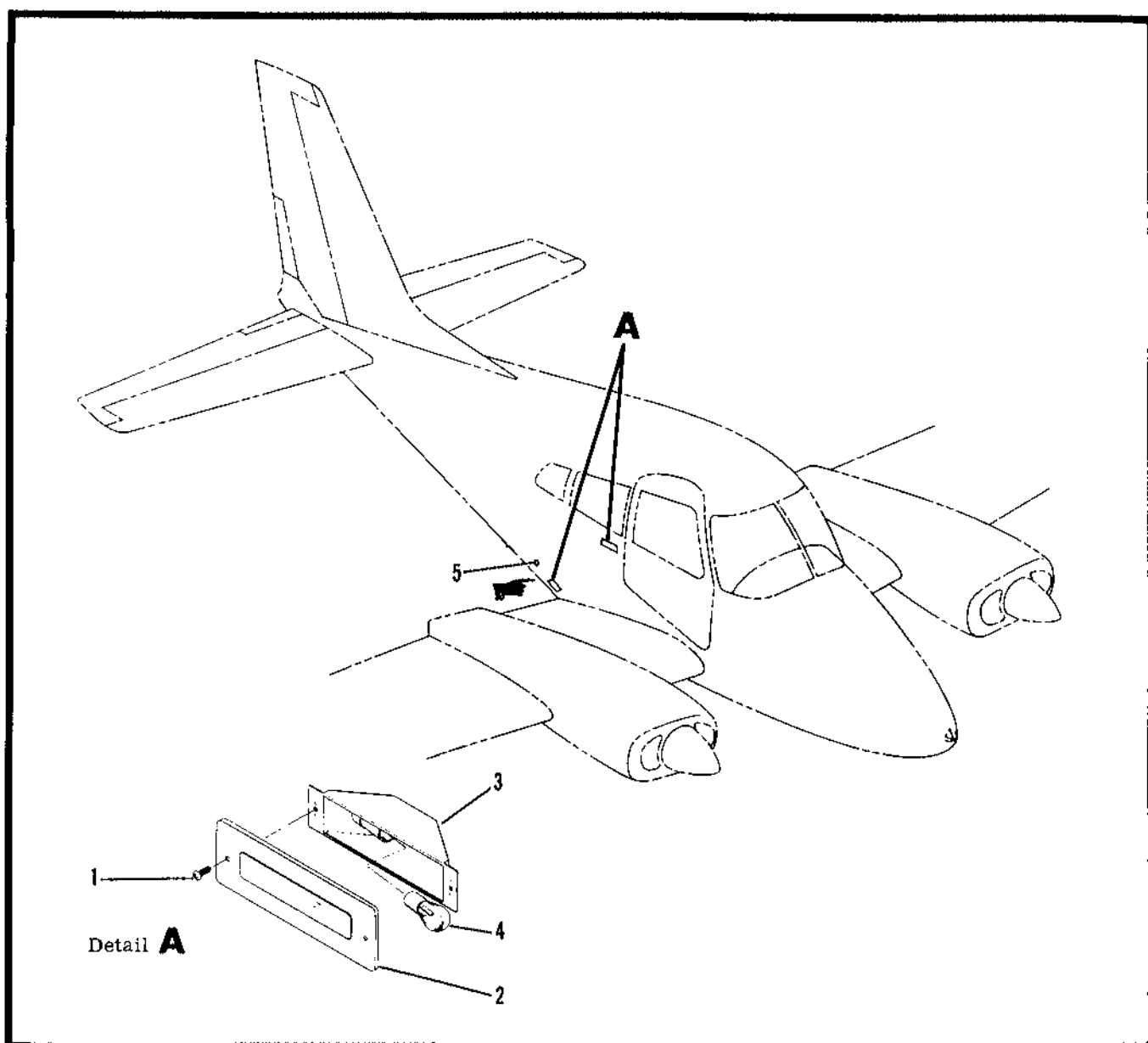
- a. Remove screws (1) holding lens assembly.

- b. Remove lens assembly (2) from housing assembly.

- c. Remove bulb (4) from socket.

- d. If further disassembly is required, lift out housing assembly (3) remove wires from socket and tag.

- e. Installation of cabin step light is accomplished by reversing this procedure.



1. Screw
2. Lens Assembly

3. Housing Assembly

4. Bulb
5. Switch

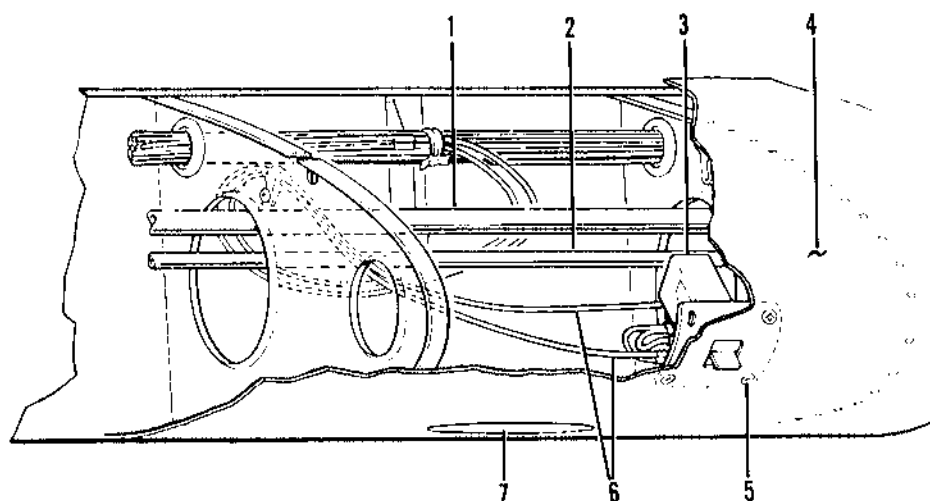
Figure 14-13. Installation of Cabin Step and Wing Walkway Light

Removal and Installation of Wing Locker Courtesy Light. (See figure 14-9.)

- a. Remove upper left engine cowl.
- b. Remove the 5 Amp fuse to the wing locker light from fuse holder.
- c. Remove the three screws securing the light and remove light from nacelle.
- d. Installation of the wing locker courtesy light is the reversal of the removal procedures.
- e. Replace fuse and check operation.
- f. Install upper left engine cowl.

Removal and Installation of Wing Locker Courtesy Light Switch. (See figure 14-9.)

- a. Remove upper left engine cowl.
- b. Remove 5 Amp fuse to the wing locker light from fuse holder.
- c. Remove two screws securing switch.
- d. Tag and disconnect wires to switch.
- e. Installation of the nacelle wing locker light switch is the reversal of the removal procedures.
- f. Replace fuse and check operation.
- g. Install upper left engine cowl.



1. Left Fuel Supply Line
2. Vapor Return Line

3. Stall Warning Transmitter
4. Wing Skin
5. Screw

6. Electrical Wires
7. Access Hole Cover

Figure 14-14. Stall Warning Transmitter

STALL WARNING SYSTEM.

The stall warning system is comprised of a stall warning horn mounted on the forward bulkhead and the actuating switch mounted on the leading edge of the left wing. When the aircraft approaches a stall the switch energizes the electrical circuit and causes the warning horn to sound. A heater element is provided in the actuating switch, to prevent ice from hampering the operation, is energized when the pitot heat switch is turned on.

Removal of Stall Warning Transmitter. (See figure 14-14.)

NOTE

Before removal of stall warning transmitter, it is important that the exact fore-aft location of the vane be marked on the wing so that the replacement unit may be adjusted identically.

- a. Remove access hole cover (7).
- b. Remove four screws (5) attaching stall warning transmitter (3) to wing skin (4).
- c. Tag and disconnect electrical wires (6) and remove stall warning transmitter (3).

Installation of Stall Warning Transmitter. (See figure 14-14.)

- a. Attach electrical wires (6) as tagged at removal.
- b. Secure stall warning transmitter (3) to wing skin (4) with four attaching screws (5).

Operational Check of Stall Warning System.

- a. Ground Check.
 1. Turn electrical power on.
 2. Activate vane on stall warning transmitter and observe audible warning signal.
- b. Flight Check.
 1. Check the stall warning in two configurations: landing gear up, flaps up and gear down, flaps full down.
 2. Check each configuration in step a at 65% power using power computer furnished with aircraft and at idle power.
 3. Approach the stall by reducing airspeed at a rate as close as possible to 1 knot per second. In the stall the aircraft roll attitude should be controllable up to the time the aircraft nose pitches downward or full up elevator stop is reached. The fuel should be managed to minimize asymmetric fuel prior to conducting the stall.
 4. The indicating stall speed in the landing configuration at idle power shall fall within ± 4 knots of a

line drawn from the light weight stalling speed to the heavy weight stalling speed as shown by the appropriate chart in Figure 14-15. The weight at the time of takeoff minus the fuel used shall be used for the weight at stall.

Adjustment of Stall Warning System.

a. Using the data recorded in the Flight Check portion of the Operational Check of Stall Warning Sys-

tem, adjust the stall warning vane to provide a stall warning horn at 4 to 9 knots IAS prior to the idle power landing configuration stall.

b. Raising the stall warning vane position will increase the stall warning indication and lowering the stall warning vane will lower the stall warning indication.

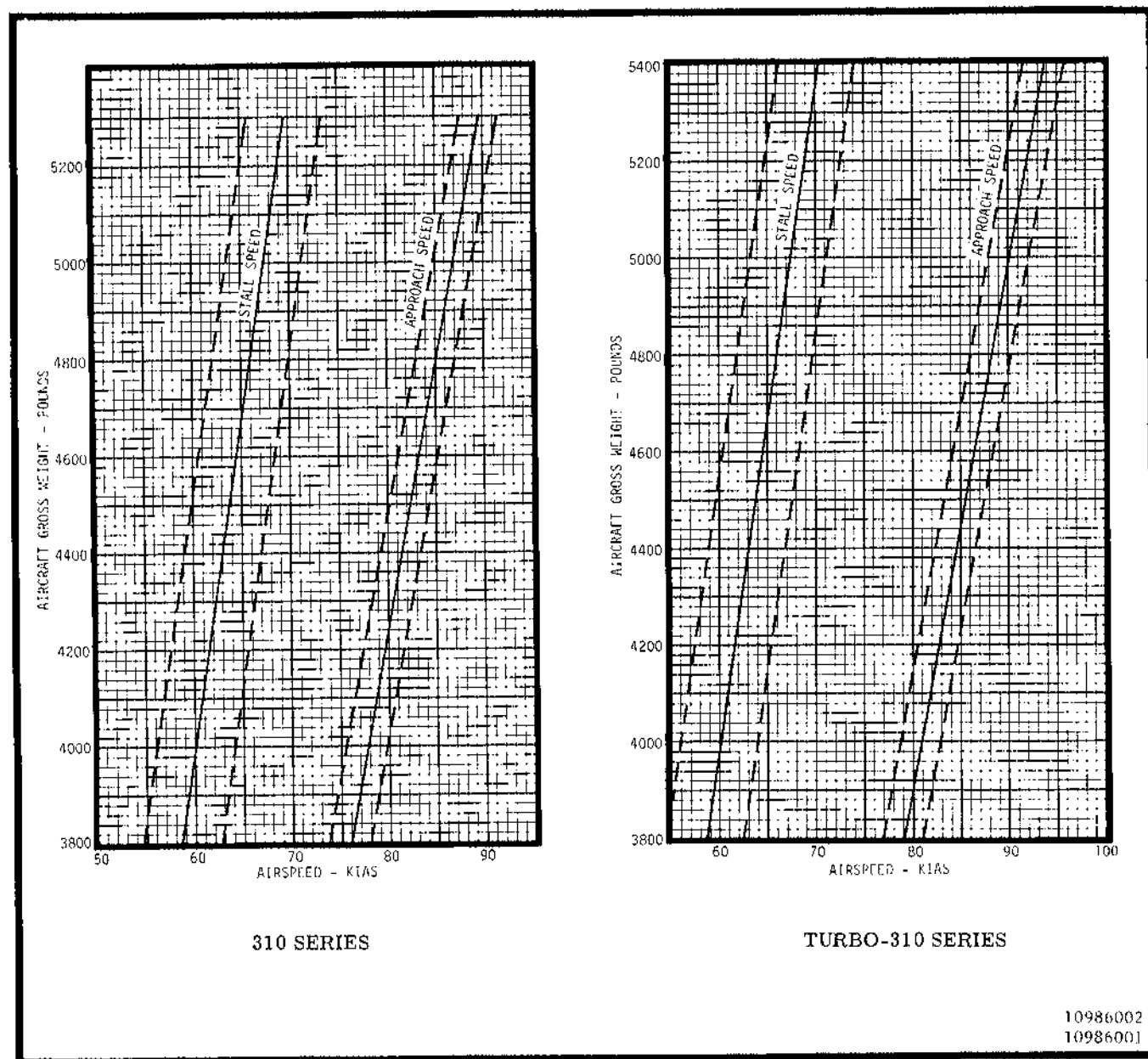


Figure 14-15. Approach and Stall Speed Chart

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10986001

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ELECTRICAL LOADING CHART.

CONTINUOUS ELECTRICAL LOAD CHART (STANDARD)

	Amps Req'd.
Battery Relay	0.60
Cabin Heater	6.00
Compass Light	0.08
Engine Gage Units	0.64
Turn & Bank Indicator	0.15
Post Lights - Instrument Panel	1.16
Fuel Gages - Auxiliary Indicator Light	0.08
Fuel Selector Light	0.30
Gear Indicator Light	0.04
Heater - Stall Warning	0.72
Heaters - Tip Tank Vent	0.50
Heaters - Auxiliary Tank Vent	0.58
Heater - Pitot	4.00
Navigation Lights	1.86
Tail Light	0.51
Switch Panel (E. L.)	0.50
Fuel Pumps - Tip Tank	10.00
Fuel Transfer Pumps - Tip Tank	0.80
Voltage Regulator	1.50

CONTINUOUS ELECTRICAL LOAD CHART (OPTIONAL)

Air Conditioning - Cabin	60.00
Prop Deicer - Electric (two bladed)	10.00
Prop Deicer - Electric (three bladed)	15.00
Prop Synchronous	3.00
Windshield Deice (Alcohol)	0.40
Flight Hour Recorder	0.04
Fuel Pumps - Wing Locker	6.00
Outside Air Temperature	0.08
Rotating Beacon	1.90
Strobe Light System	3.00
Heater - Static Ports	0.72

NON-CONTINUOUS ELECTRICAL LOAD CHART

Cabin Dome Lights	1.20
Map Light (Each)	0.51
Cigarette Lighter (Each)	6.80
Walkway Lights (Each)	0.51
Nacelle Baggage Compartment Lights (Each)	0.52
Console Lights	1.11
Flap Motor	10.00
Gear Warning	1.50
Stall Warning	1.50
Goodrich Wing Deice System	2.80
Ice Light (Each)	0.70
Landing Gear Motor	25.00
Landing Gear Relay	0.45
Landing Light (Each)	9.10
Taxi Light	3.50
Oil Dilution	1.02
Starting Relay (Each)	0.60
Starting Vibrator	2.50
Electric Trim	0.60

NOTE

Total continuous load should not exceed 80% of total rated alternator capacity.

WIRING DIAGRAMS

NOTE

The page numbering method of this portion of Section 14 differs from that of the rest of the manual. All referenced page numbers appearing in the wiring diagram index can be found within the title block of each wiring diagram. These page numbers are in numerical order, but may appear in broken sequence. Aircraft serial effectivity is given in the wiring diagram index.

NOTE

Wiring diagrams in this section, pages 25.04
thru 90.00 apply to aircraft 310P0001 to
310Q0601 only. For aircraft 310Q0601 and on
see diagrams 0808080 beginning at page 14-100.

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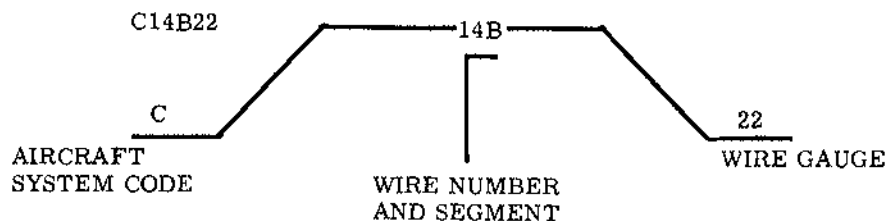
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CIGAR LIGHTERS - FRONT AND REAR	310Q0401 TO 310Q0601	53.03
DUAL TACHOMETER SYSTEM	310P0001 TO 310Q0601	54.00
SPEAKER CIRCUIT	310P0001 TO 310Q0601	55.00
PHONE JACK CIRCUIT	310P0001 TO 310Q0201	56.00
PHONE JACK CIRCUIT	310Q0201 TO 310Q0601	56.01
AUXILIARY FUEL INDICATION SYSTEM (OPT.)	310P0001 TO 310Q0001	57.00
PROPELLER DEICE SYSTEM (OPT.)	310P0001 TO 310Q0401	58.03
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AUXILIARY FUEL TRANSFER VENT HEATER (OPT.)	310P0001 TO 310Q0601	76.01
BOOM MIKE CIRCUIT (OPT.)	310P0001 TO 310Q0601	77.01
ELECTRIC ELEVATOR TRIM (OPT.)	310P0001 TO 310P0202	79.00
ELECTRIC ELEVATOR TRIM (OPT.)	310P0202 TO 310Q0015	79.01
ELECTRIC ELEVATOR TRIM (OPT.)	310Q0015 TO 310Q0401	79.02
ELECTRIC ELEVATOR TRIM (OPT.)	310Q0401 TO 310Q0601	79.03
WING WALKWAY LIGHT (OPT.)	310Q0001 TO 310Q0201	80.00
WING WALKWAY LIGHT (OPT.)	310Q0201 TO 310Q0601	80.01
CAPACITANCE FUEL SYSTEM (OPT.)	310Q0001 TO 310Q0106	81.00
CAPACITANCE FUEL SYSTEM (OPT.)	310Q0106 TO 310Q0401	81.01
CAPACITANCE FUEL SYSTEM (OPT.)	310Q0401 TO 310Q0601	81.02
STROBE LIGHT SYSTEM (OPT.)	310Q0001 TO 310Q0257	82.00
STROBE LIGHT SYSTEM (OPT.)	310Q0257 TO 310Q0401	82.01
STROBE LIGHT SYSTEM (OPT.)	310Q0401 TO 310Q0601	82.02
CAPACITANCE FUEL AUXILIARY INDICATOR LIGHTS (OPT.)	310Q0001 TO 310Q0601	83.00
REGULATOR FILTER (OPT.)	310Q0062 TO 310Q0601	84.00
WING LOCKER BAGGAGE LIGHT	310Q0201 TO 310Q0601	85.00
WING LOCKER BAGGAGE LIGHT	310Q0201 TO 310Q0601	85.02
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STEREO TAPE SYSTEM	310Q0201 TO 310Q0401	86.01
STEREO TAPE SYSTEM	310Q0401 TO 310Q0601	86.02
STEREO TAPE SYSTEM	310Q0401 TO 310Q0601	86.03
RH MIKE JACK CIRCUIT	310Q0201 TO 310Q0601	87.00
LOCATOR BEACON	310Q0201 TO 310Q0601	88.00
ALCOHOL WINDSHIELD ANTI-ICE SYSTEM	310Q0401 TO 310Q0601	90.00

NOTE

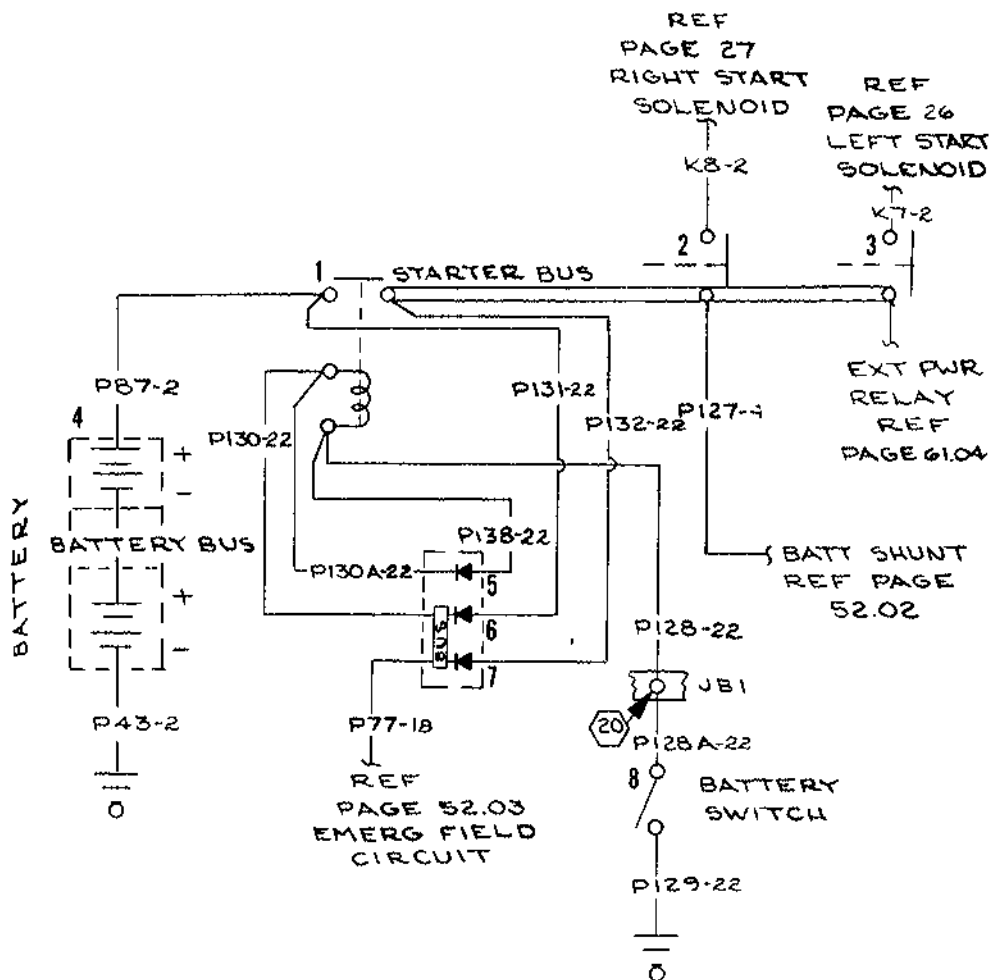
Part numbers referred to on Wiring Diagrams are for reference only. When ordering spare or replacement parts, refer to applicable Parts Catalog.

The wiring diagrams contained in this section clearly show the complete wiring on each item of electrical components listed in the Wiring Diagram Index. The first portion of wire number indicates the Aircraft System, the center portion indicates Wire Number, and the last portion indicates Wire Gauge Size. Each wiring diagram contains part number and nomenclature for each component.



BATTERY

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	0850469-1	Battery Relay
2	0850469-1	Right Starter Relay
3	0850469-1	Left Starter Relay
4	0511319-201	Battery
5	IN1201	Diode
6	IN1201	Diode
7	IN1201	Diode
8	MS35059-22	Battery Switch

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310Q
MODEL

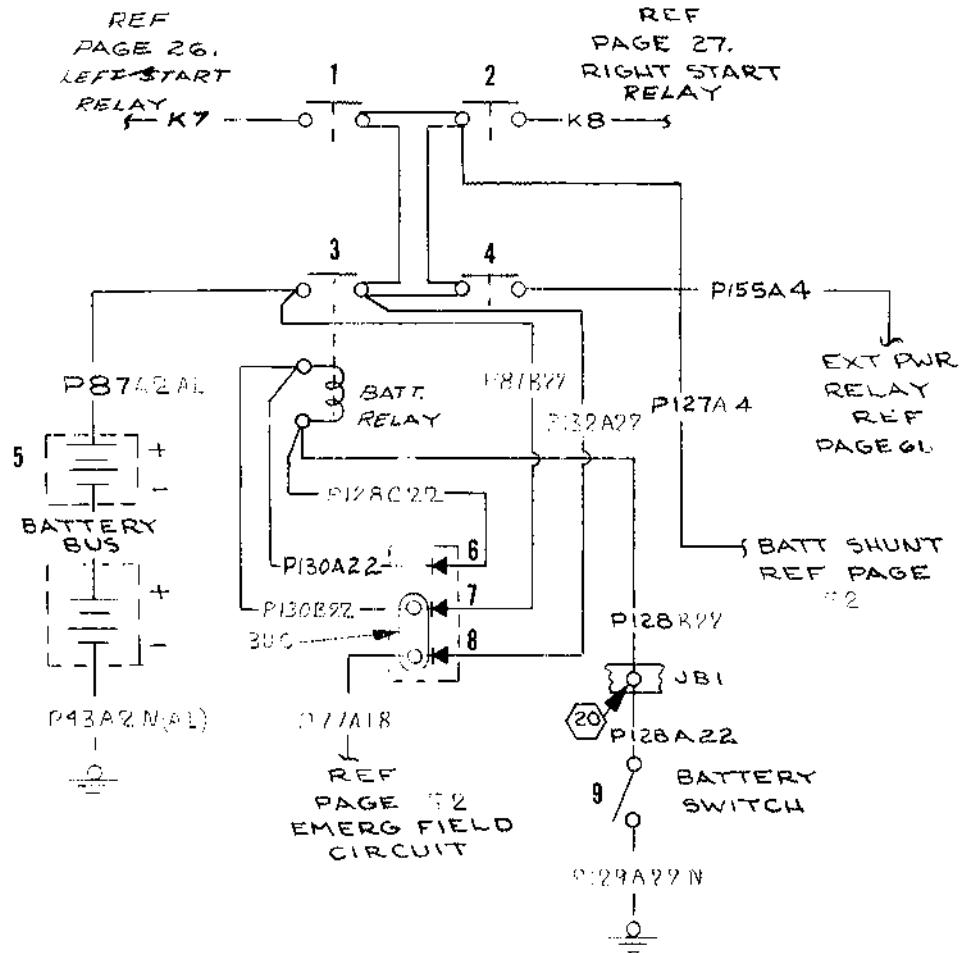
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BATTERY

EFF. SERIALS



ITEM

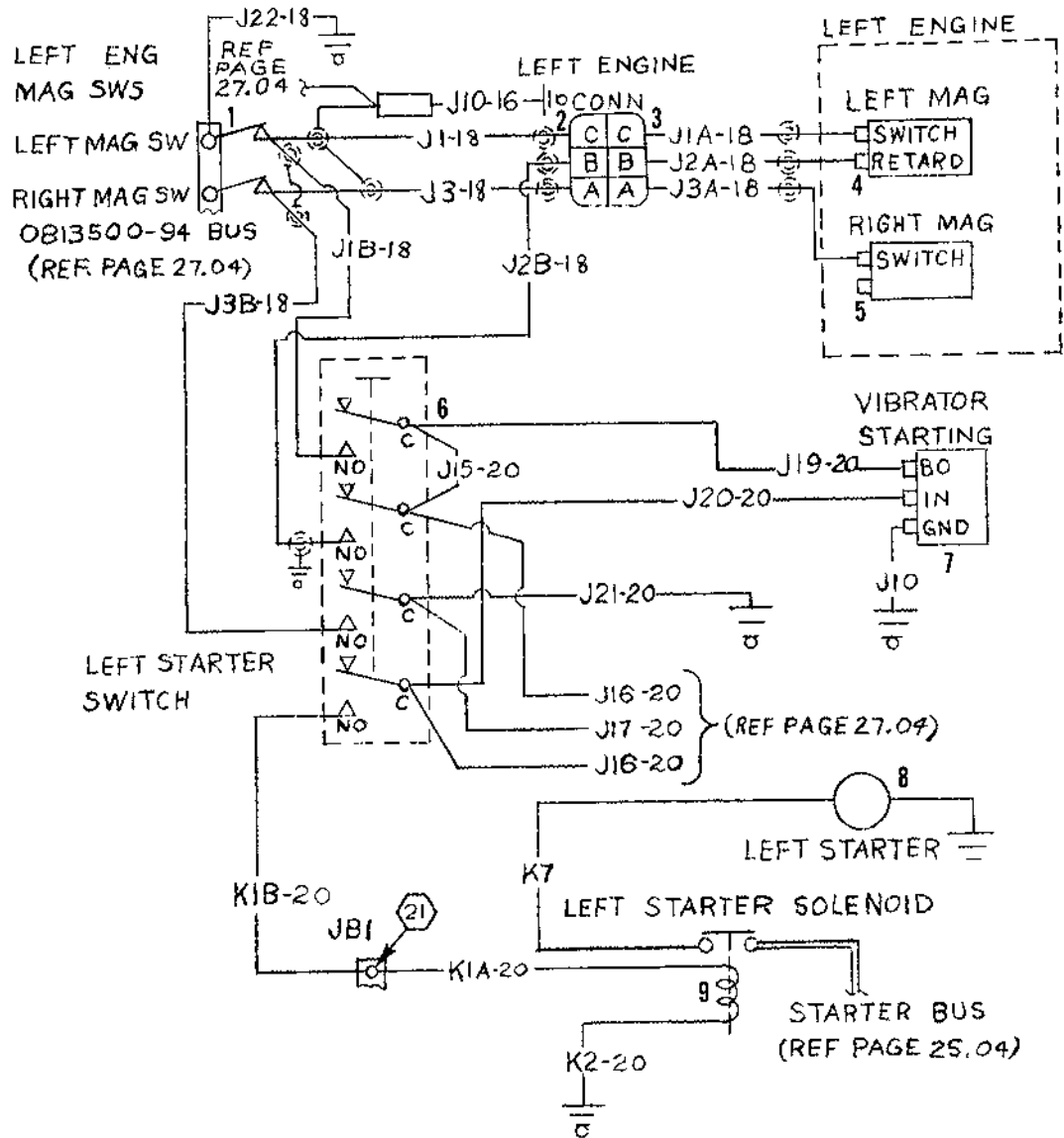
PART NUMBER

NOMENCLATURE

1	0850469-1	Left Starter Solenoid
2	0850469-1	Right Starter Solenoid
3	0850469-1	Battery Relay
4	0850469-1	External Power Relay
5	0511319-201	Battery
6	IN1201	Diode
7	IN1201	Diode
8	IN1201	Diode
9	MS35059-22	Battery Switch

START & IGNITION - LEFT ENGINE

EFF. SERIALS

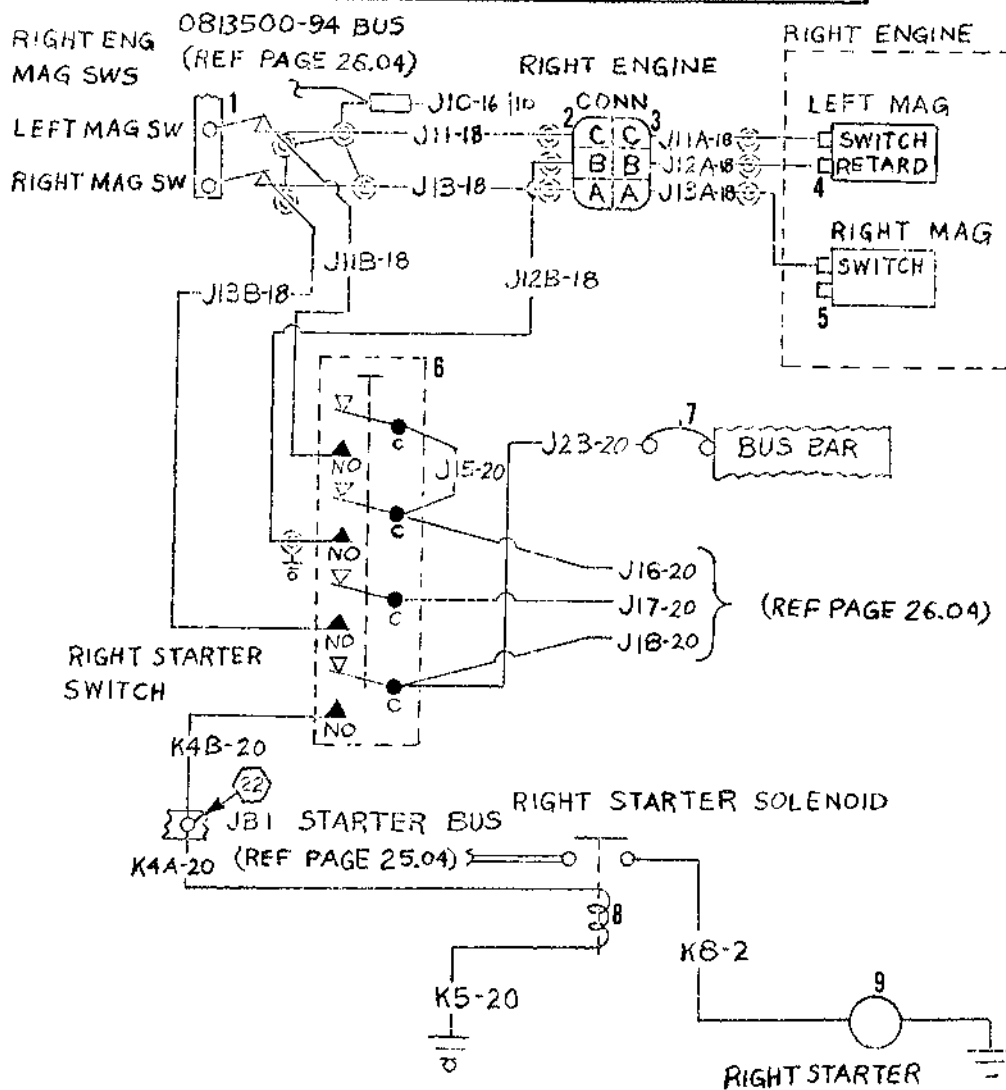


ITEM	PART NUMBER	NOMENCLATURE
1	S382-2	Left Mag Switch
2	MS3106B-10SL-3S	Connector
3	MS3106B-10SL-3P	Connector
4	628472	Left Mag (Left Engine)
5	628473	Right Mag (Left Engine)
6	4PB12T2	Left Start Switch
7	0812689-1	Starting Vibrator
8	0850461-1	Left Starter
	*627841	Left Starter
9	0850469-1	Left Starting Relay

*Turbo-System 310P0001 AND ON

START & IGNITION - RIGHT ENGINE

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	S382-2	Right Mag Switch
2	MS3106B-10SL-3S	Connector
3	MS3106B-10SL-3P	Connector
4	628472	Left Mag (Right Engine)
5	628473	Right Mag (Right Engine)
6	4PB12T2	Right Start Switch
7	S1232-505	Circuit Breaker
8	0850469-1	Right Starting Relay
9	0850461-1	Right Starter
	*627841	Right Starter

*Turbo-System 310P0001 AND ON

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310P
MODEL

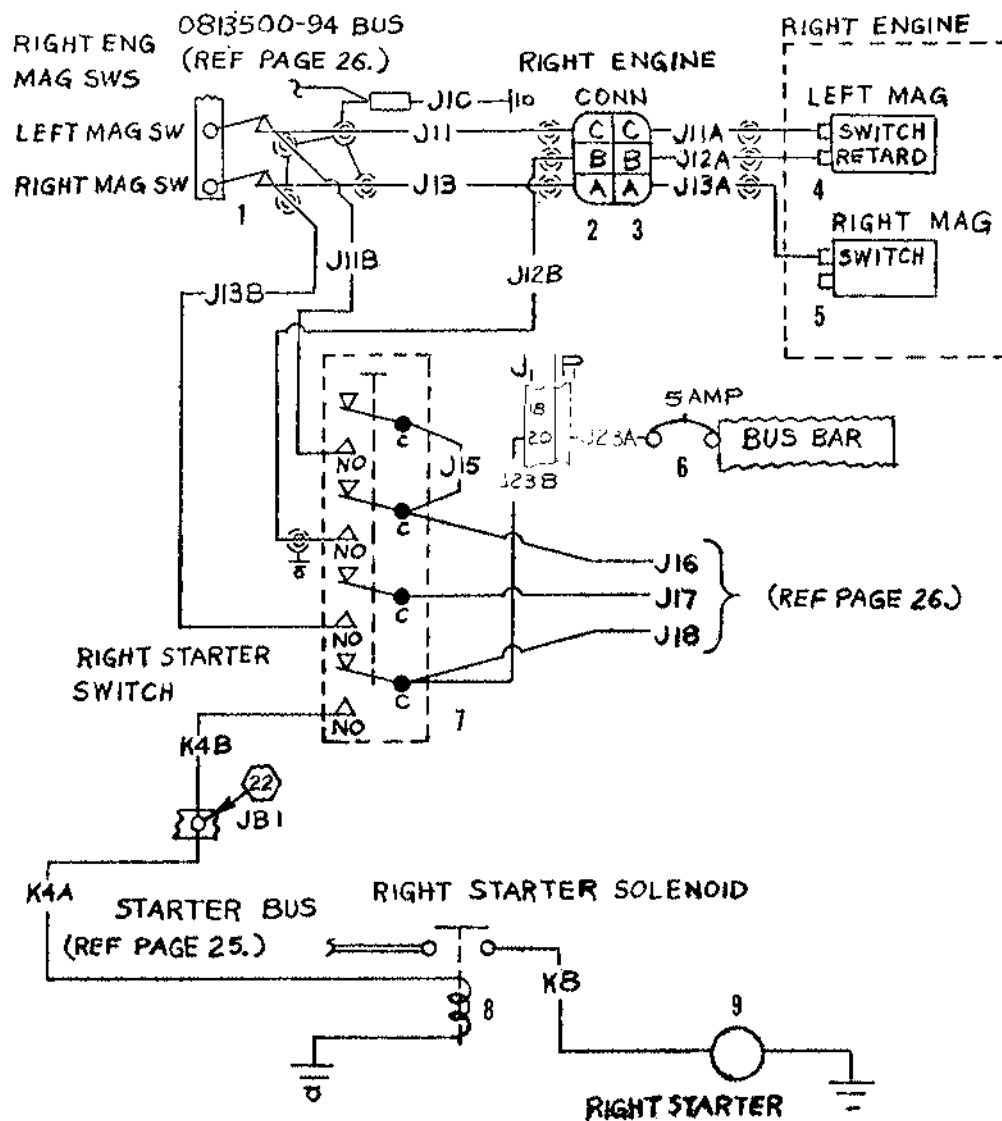
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START & IGNITION-RIGHT ENGINE

EFF. SERIALS

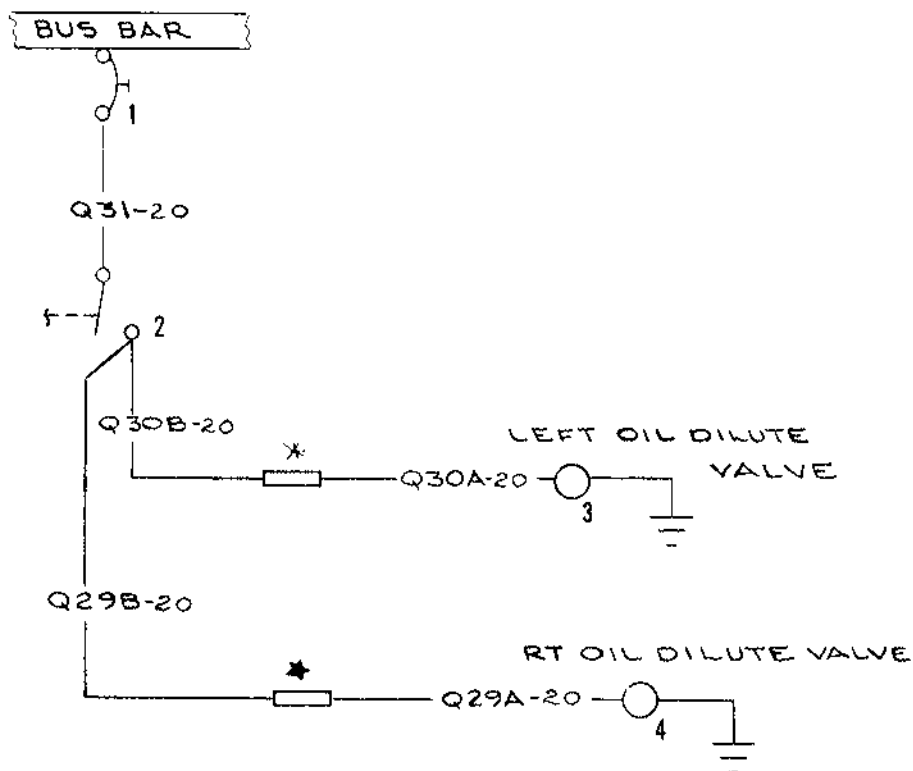


ITEM	PART NUMBER	NOMENCLATURE
1	S382-2	Right Mag Switch
2	MS3106B-10SL-3S	Connector
3	MS3106B-10SL-3P	Connector
4	628472	Left Mag (Right Engine)
5	628473	Right Mag (Right Engine)
6	S1232-505	Circuit Breaker
7	4PB12T2	Right Start Switch
8	0850469-1	Right Starting Relay
9	0850461-1	Right Starter
	*627841	Right Starter

*Turbo 310P0001 AND ON

LEFT & RIGHT OIL DILUTE (OPT)

EFF. SERIALS



* LOCATE IN JB1

* LOCATE IN JB2

ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4

S1232-505
D201L5B
0850450
0850450

Circuit Breaker
Switch
Left Oil Dilte Valve
Right Oil Dilute Valve

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310P
MODEL

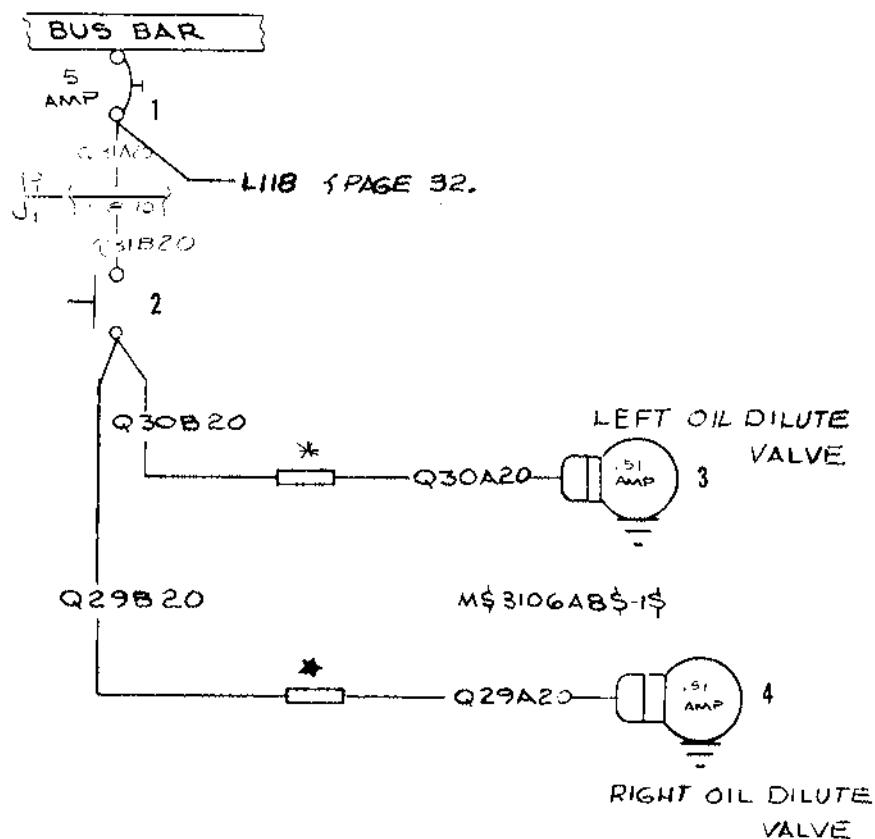
W
REV.

0870090
DRAWING NO.

28.04
PAGE

LEFT & RIGHT OIL DILUTE (OPT)

EFF. SERIALS

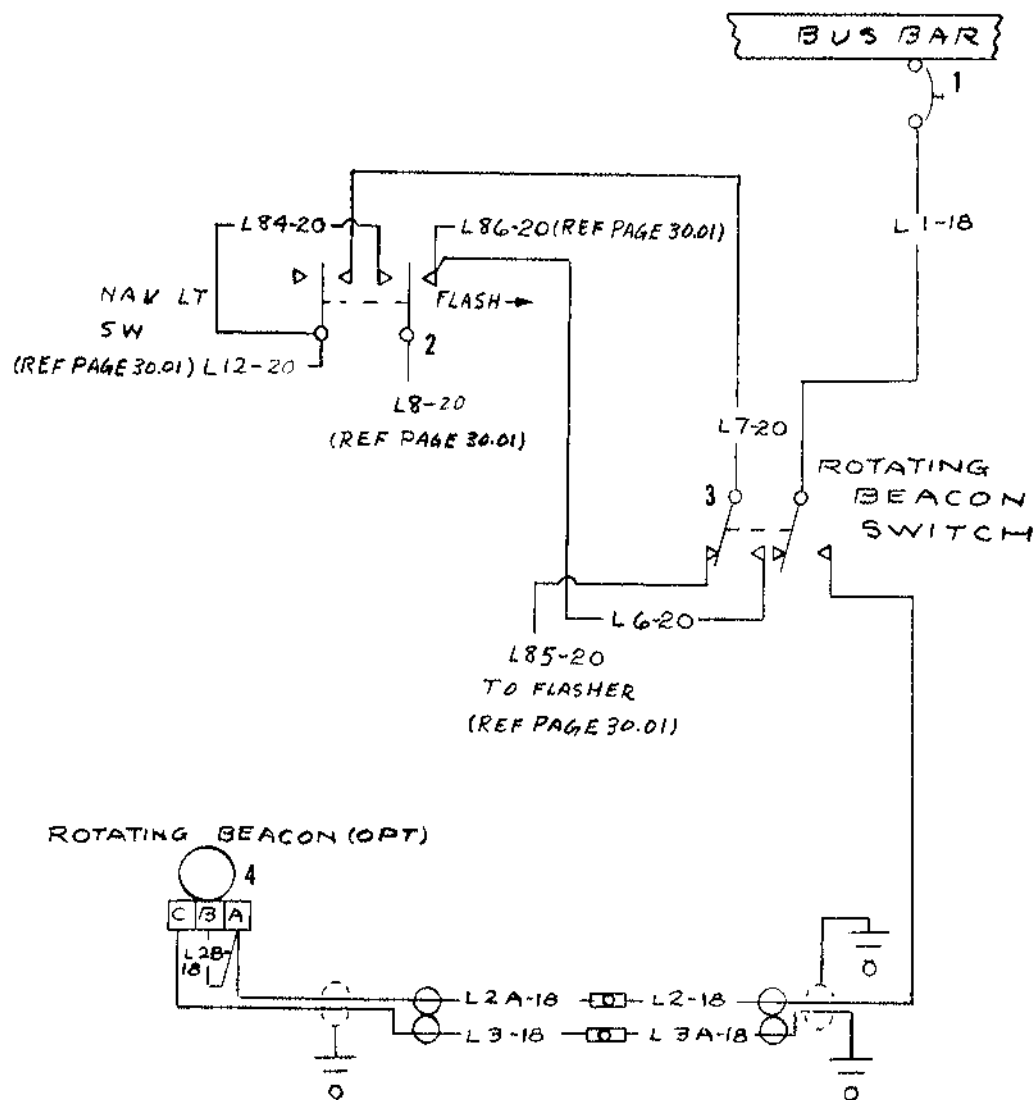


* LOCATE IN JB1
* LOCATE IN JB2

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	D201L5B	Switch
3	0850450	Left Oil Dilute Valve
4	0850450	Right Oil Dilute Valve

ROTATING BEACON - TAIL (OPT)

EFF. SERIALS



NOTE:

RECONNECT L85 FOR THIS OPT

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-510	Circuit Breaker
2	S392-1	Switch (Nav Lite)
3	S392-3	Switch (Rotating Beacon)
4	C621002-0106	Rotating Beacon

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

REV.

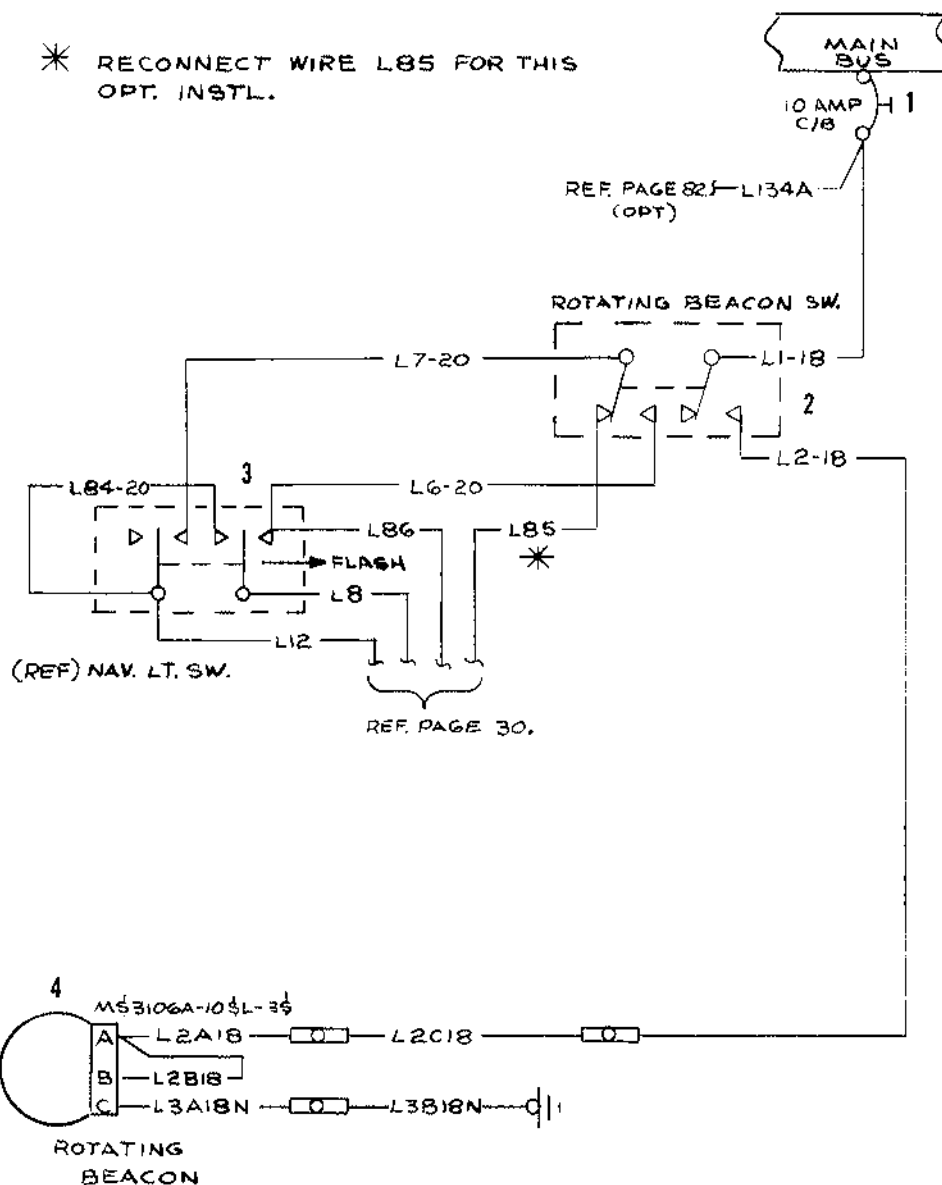
0870090
DRAWING NO.

29.02
PAGE

ROTATING BEACON - TAIL (OPT)

EFF. SERIALS

* RECONNECT WIRE L85 FOR THIS
OPT. INSTL.



ITEM

PART NUMBER

NOMENCLATURE

1

S1232-510

Circuit Breaker

2

S392-3

Switch (Rotating Beacon)

3

S392-1

Switch (Nav Lite)

4

C621002-0106

Rotating Beacon

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

3109
MODEL

W
REV.

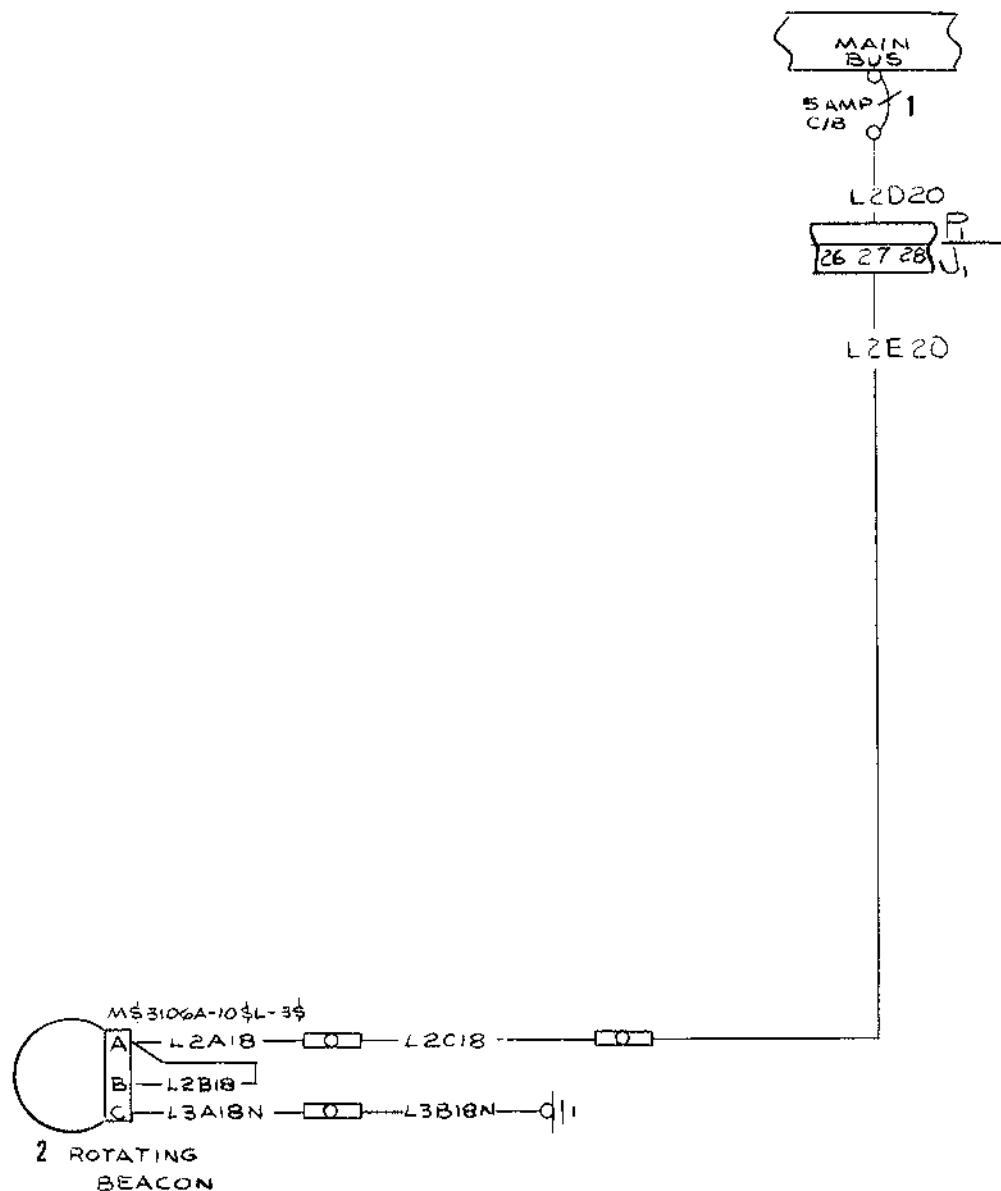
0870090
DRAWING NO.

29.03
PAGE

ROTATING BEACON - TAIL

(OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

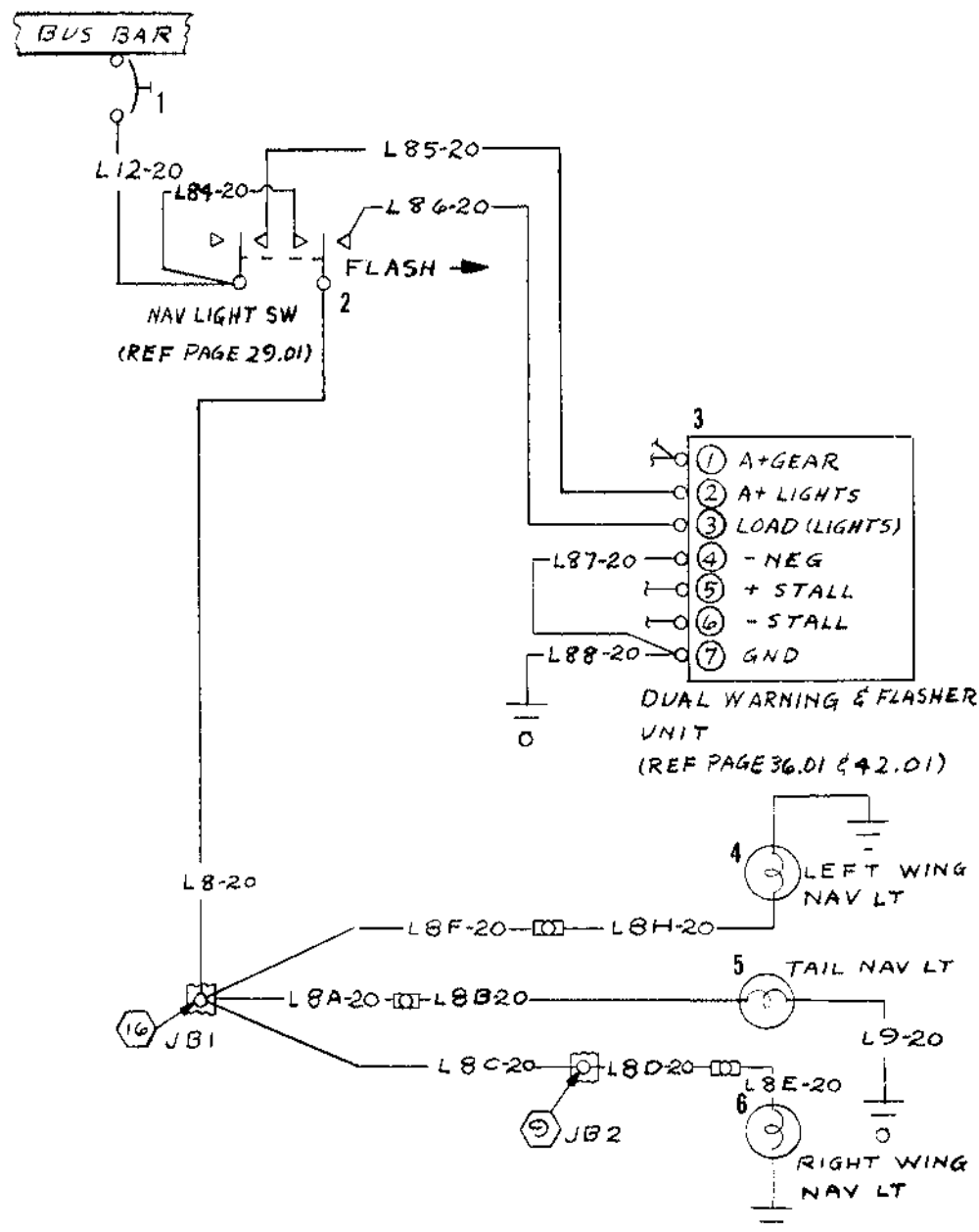
1
2

112-210-101
C621002-0106

Circuit Breaker
Rotating Beacon

NAVIGATION LIGHTS

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-510	Circuit Breaker
2	S392-1	Switch (NavLite)
3	285	Dual Warning & Flashing Unit
4	0823200-1	Left NavLite (Red)
5	C622001-0103	Tail NavLite
6	0823200-2	Right NavLite (Green)

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

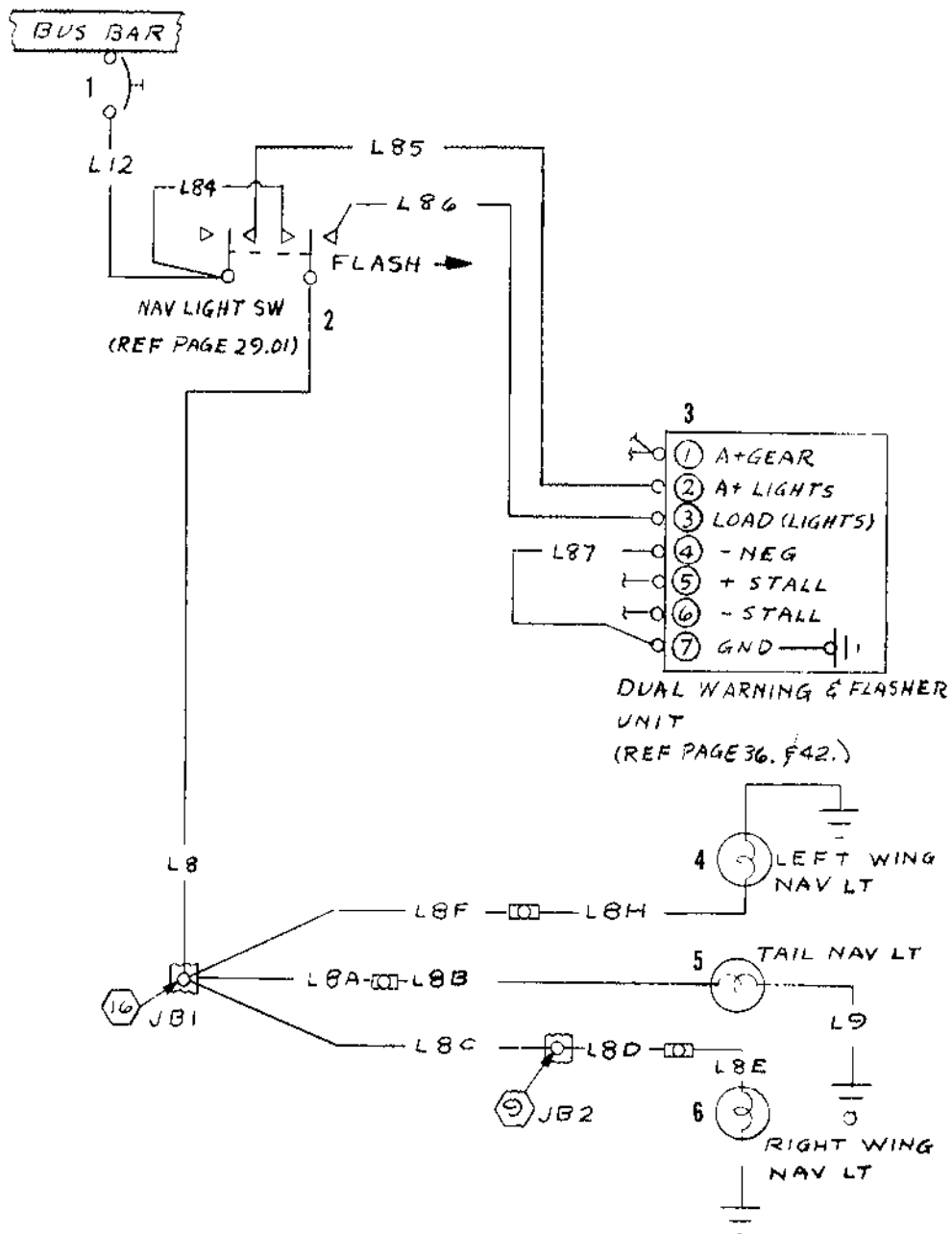
REV.

0870090
DRAWING NO.

30.02
PAGE

NAVIGATION LIGHTS

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6

S1232-510
S392-1
285
0823200-1
C622001-0103
0823200-2

Circuit Breaker
Switch (Nav Lite)
Flasher
Left Wing (Nav Lite)
Tail (Nav Lite)
Right Wing (Nav Lite)

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310Q
MODEL

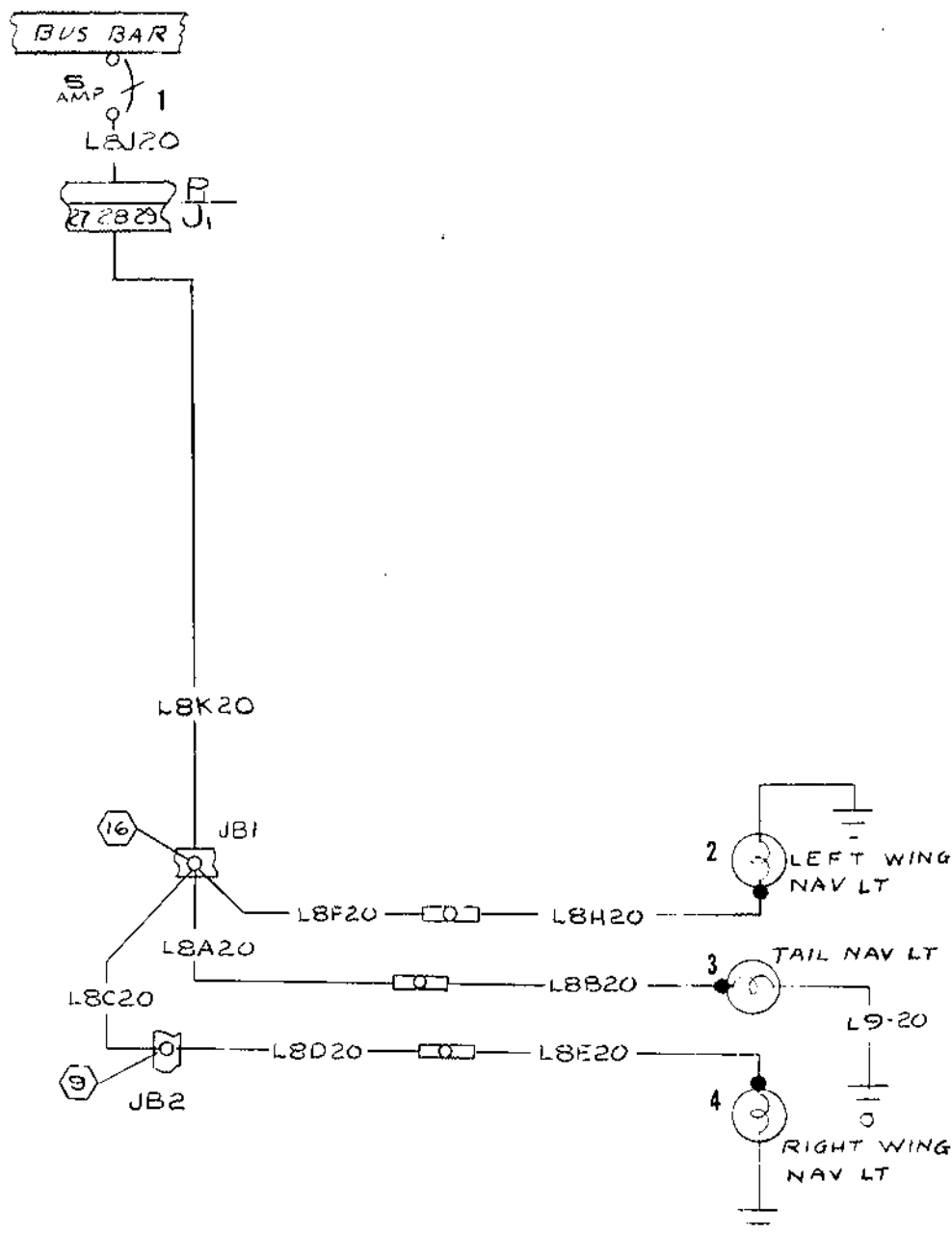
W
REV.

0870090
DRAWING NO.

30.03
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NAVIGATION LIGHTS

EFF. SERIALS



ITEM

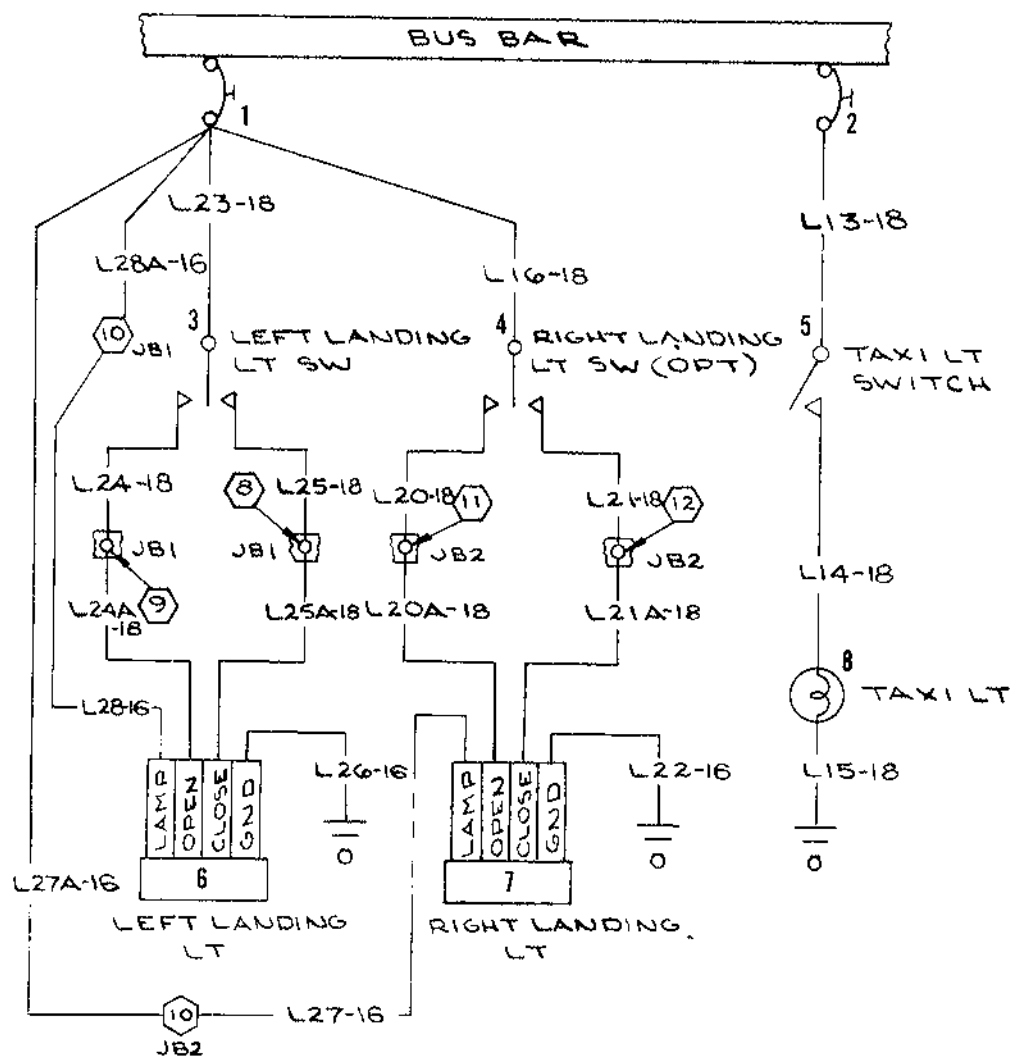
PART NUMBER

NOMENCLATURE

1	112-205-101	Circuit Breaker
2	0823200-1	Left Wing (Nav Lite)
3	C622001-0103	Tail (Nav Lite)
4	0823200-2	Right Wing (Nav Lite)

LANDING LIGHT - LEFT WING (OPT) & TAXI LIGHT

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-520	Circuit Breaker
2	S1232-510	Circuit Breaker
3	S382-1	Left Landing Light Switch
4	S382-1	Right Landing Light Switch
5	S382-1	Taxi Light Switch
6	0870132-1	Left Landing Light
7	0870132-1	Right Landing Light
8	0842215-8	Taxi Light

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

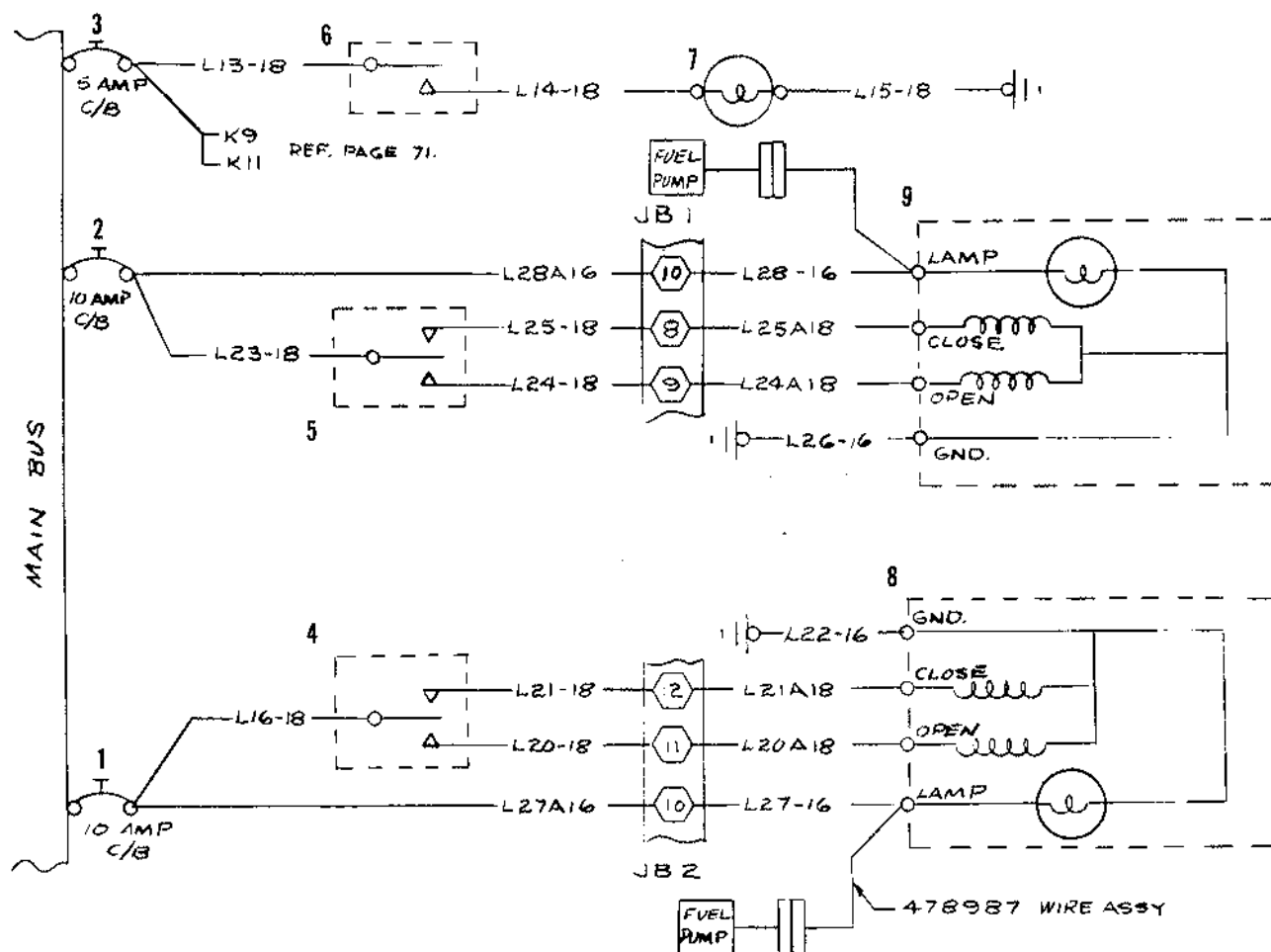
REV.

0870090
DRAWING NO.

31.02
PAGE

LANDING LIGHTS, LEFT (STD) RIGHT (OPT) AND TAXI LIGHT

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-510	Circuit Breaker
2	S1232-510	Circuit Breaker
3	S1232-510	Circuit Breaker
4	S382-1	Switch - RH Landing Light Switch
5	S382-1	Switch - LH Landing Light Switch
6	S382-1	Switch - Taxi Light
7	0842215-8	Taxi Light
8	0870132-1	RH Landing Light
9	0870132-1	LH Landing Light

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

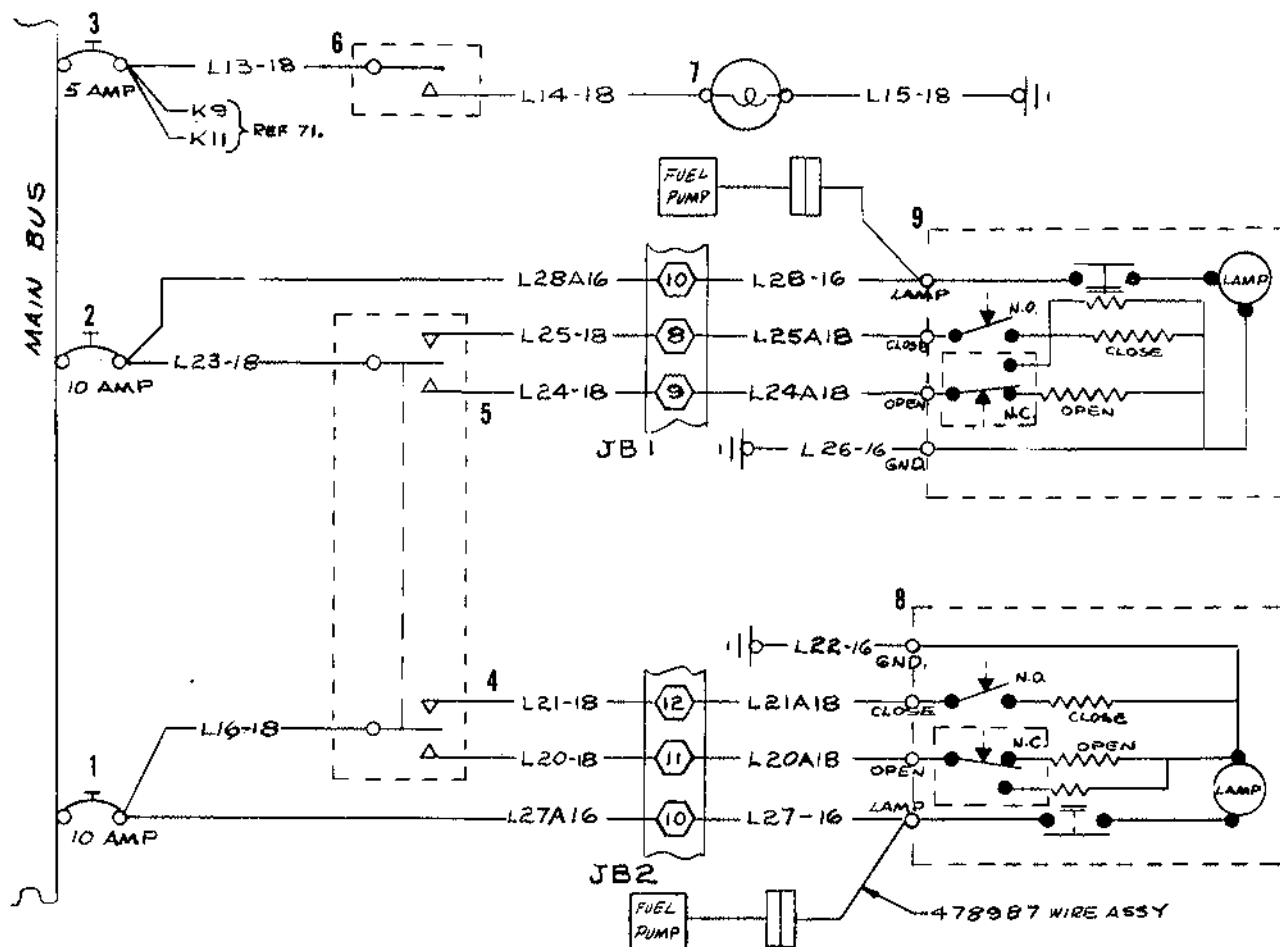
310
MODEL REV.

0870090
DRAWING NO.

31.03
PAGE

LANDING LIGHTS, LEFT(STD) RIGHT(OPT) AND TAXI LIGHT

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-510	Circuit Breaker
2	S1232-510	Circuit Breaker
3	S1232-510	Circuit Breaker
4	S382-1	Switch - RH Landing Light Switch
5	S382-1	Switch - LH Landing Light Switch
6	S382-1	Switch - Taxi Light
7	0842215	Taxi Light
8	0870132-1	RH Landing Light
9	0870132-1	LH Landing Light

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310Q
MODEL

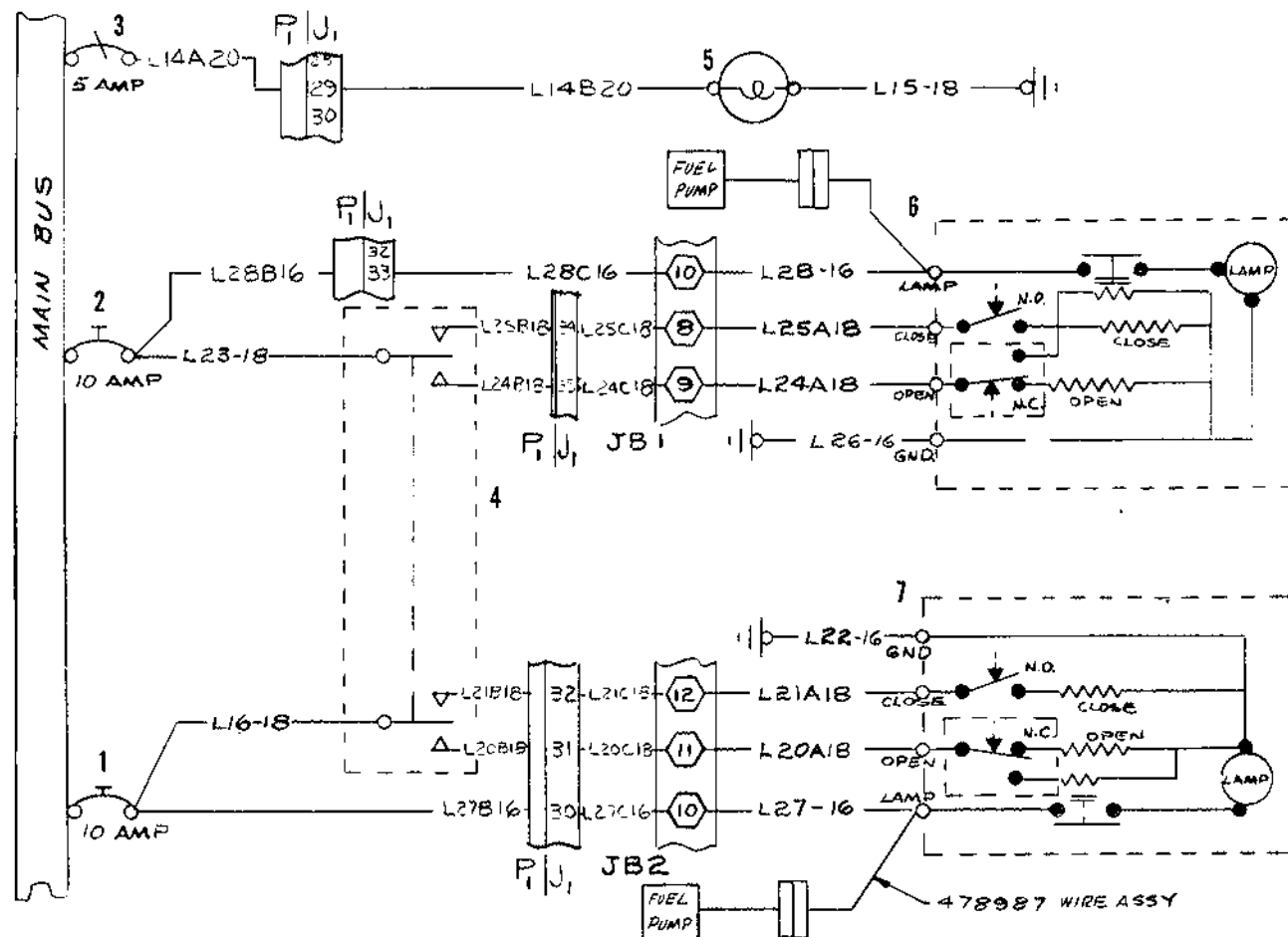
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REV.

0870090
DRAWING NO.

31.04
PAGE

LANDING LIGHTS, LEFT (STD) RIGHT (OPT) TAXI LIGHT (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6
7

S1232-510
S1232-510
112-210-101
S382-1
0842215-8
0870132-1
0870132-1

Circuit Breaker
Circuit Breaker
Circuit Breaker
Switch - Landing Lights
Taxi Light
LH Landing Light
RH Landing Light

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

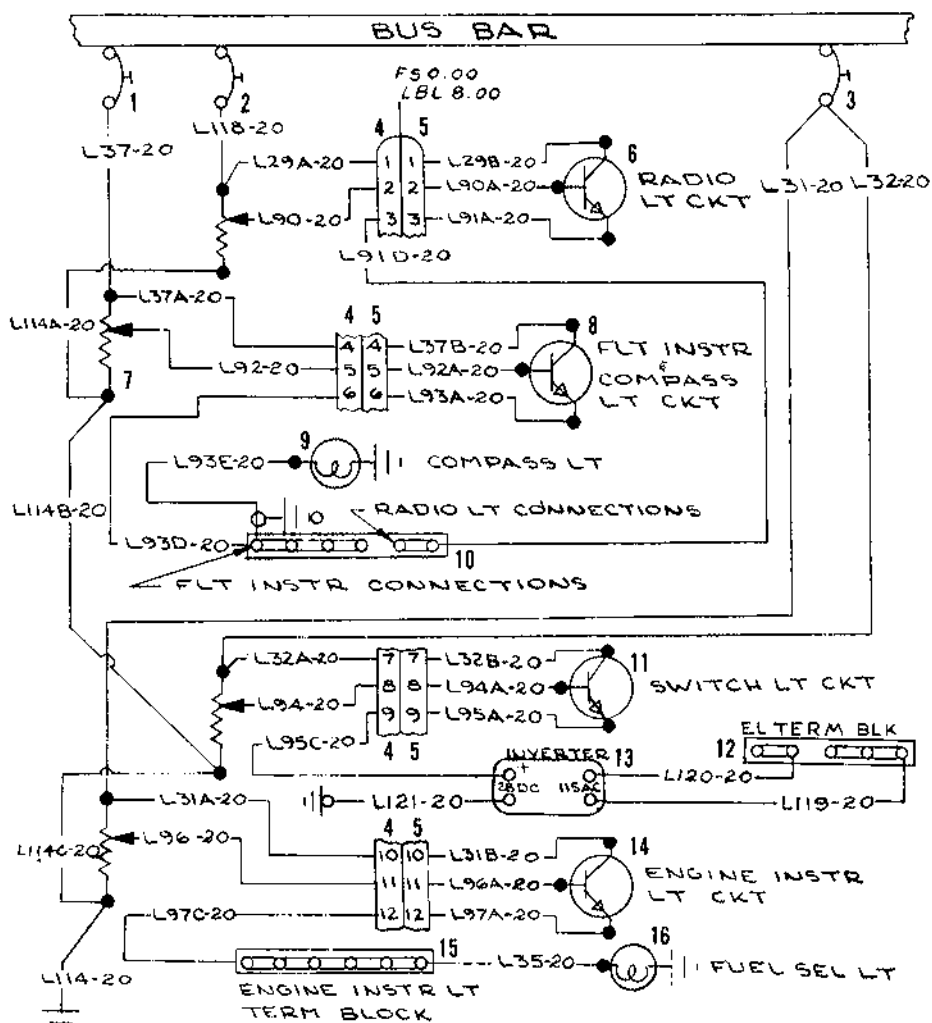
REV.

0870090
DRAWING NO.

32. 04
PAGE

INSTRUMENT & PANEL LIGHTING

EFF. SERIALS



ITEM

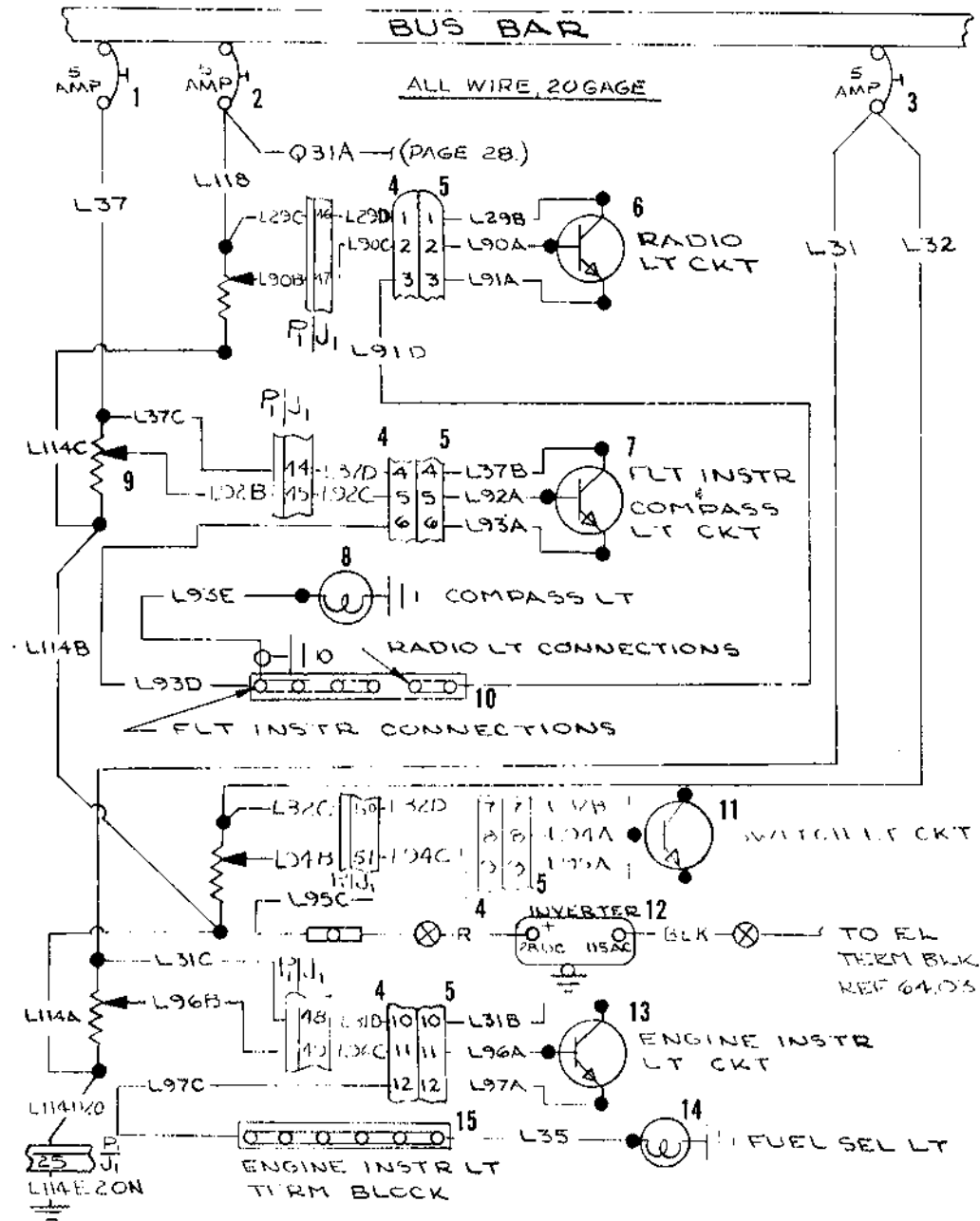
PART NUMBER

NOMENCLATURE

1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	S1232-505	Circuit Breaker
4	DB-25P, DB20962, D20419	Connector
5	DB-25P, DB20962, D20419	Connector
6	2N3055	Transistor
7	0870142-2	Rheostat
8	2N3055	Transistor
9	CM2639-5	Light Compass
10	MS25123-2-6	Terminal Block
11	2N3055	Transistor
12	MS25123-1-5	Terminal Block (EL)
13	9910047-1	Inverter
14	2N3055	Transistor
15	MS25123-2-6	Terminal Block (Engine Inst.)
16	MS25237R-301	Light (Fuel Selector)

INSTRUMENT & PANEL LIGHTING

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	81232-505	Circuit Breaker
2	81232-505	Circuit Breaker
3	81232-505	Circuit Breaker
4	10-25P, DB20362, D20419	Connector
5	DB-25P, DB20362, D20419	Connector
6	2N3055	Transistor
7	2N3055	Transistor
8	CA12039-5	Compass Light
9	0670142-3	Rheostat
10	MS25121-3-6	Terminal Block
11	2N3055	Transistor
12	9910047-1	Inverter
13	2N3055	Transistor
14	MS25278-301	Light (Fuel Selector)
15	MS25121-2-6	Terminal Block

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

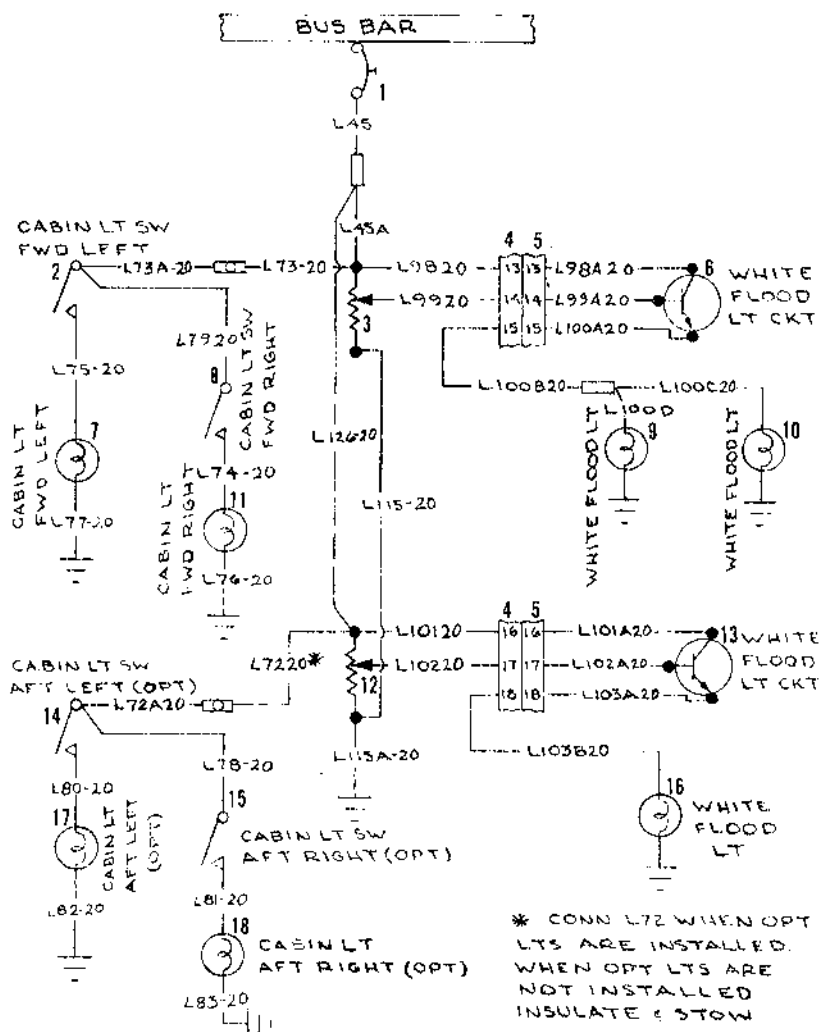
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0870090
DRAWING NO.

33. 06
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CABIN LIGHTING

EFF. SERIALS



ITEM

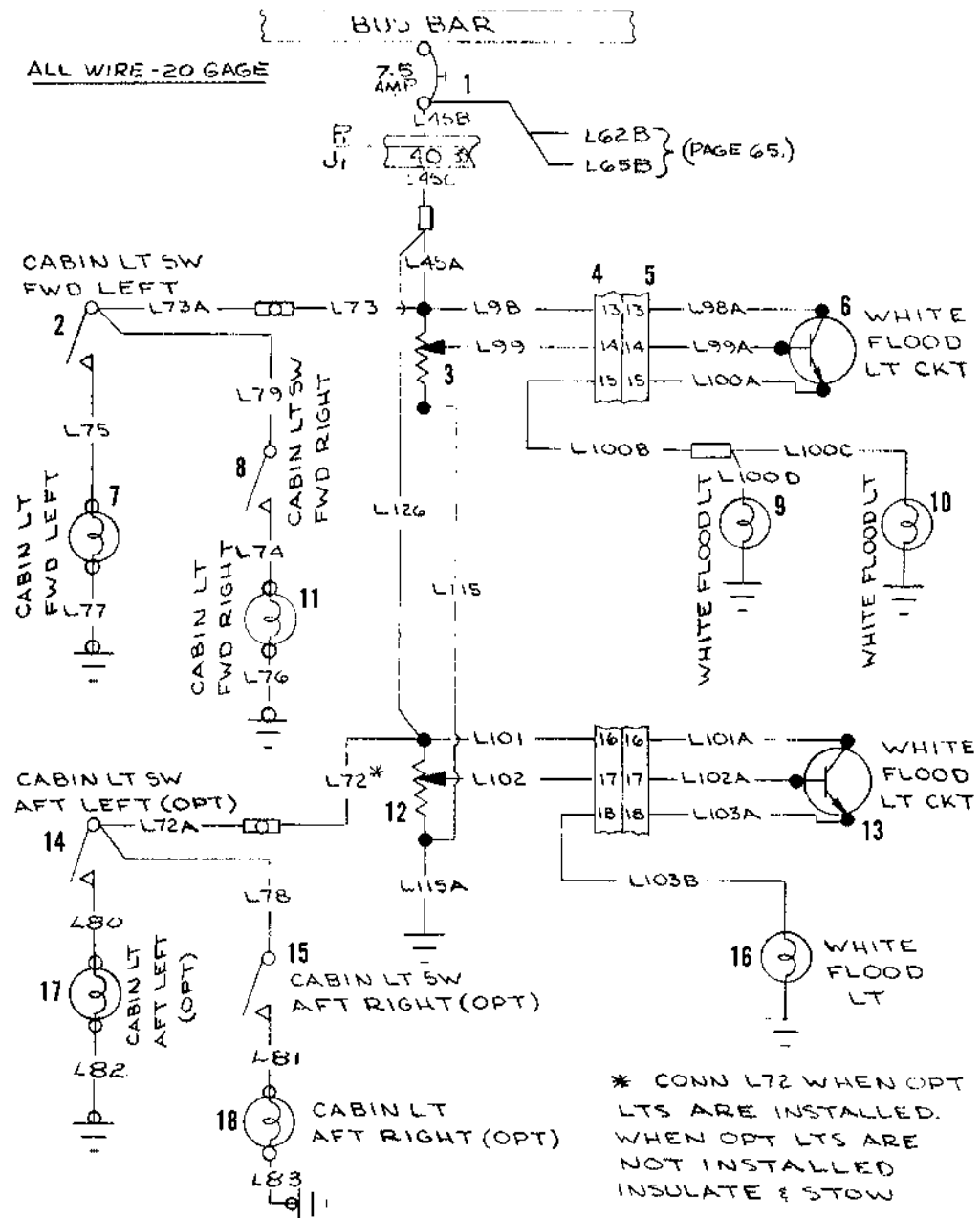
PART NUMBER

NOMENCLATURE

1	S1232-510	Circuit Breaker
2	CM2686-1	Switch (Forward Left)
3	0870142-1	Rheostat
4	DB-25P, DB-20962, D20419	Connector
5	DB-25P, DB-20962, D20419	Connector
6	2N3055	Transistor
7	1845	Cabin Light (Forward Left)
8	CM2686-1	Switch (Forward Right)
9	MS15570-303	White Flood Light
10	MS15570-303	White Flood Light
11	1845	Cabin Light (Forward Right)
12	0870142-1	Rheostat
13	2N3055	Transistor
14	CM2686-1	Switch (Aft Left)
15	CM2686-1	Switch (Aft Right)
16	305	White Flood Light
17	1845	Cabin Light (Aft Left)
18	1845	Cabin Light (Aft Right)

CABIN LIGHTING

EFF. SERIALS



ITEM

1
2
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4
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11
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13
14
15
16
17
18

PART NUMBER

S1232-510
CM2686-1
DH70142-1
DH-25P, DH-20962, D20419
DH-25P, DH-20962, D20419
2H0075
1845
CM2686-1
MN15570-303
MN15570-303
1845
DH70142-1
2H0075
CM2686-1
CM2686-1
305
1845
1845

NOMENCLATURE

Current Breaker
Switch (Forward Left)
Rheostat
Connector
Connector
Translator
Cabin Light (Forward Left)
Switch (Forward Right)
White Flood Light
White Flood Light
Cabin Light (Forward Right)
Rheostat
Translator
Switch (Aft Left)
Switch (Aft Right)
White Flood Light
Cabin Light (Aft Left)
Cabin Light (Aft Right)

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

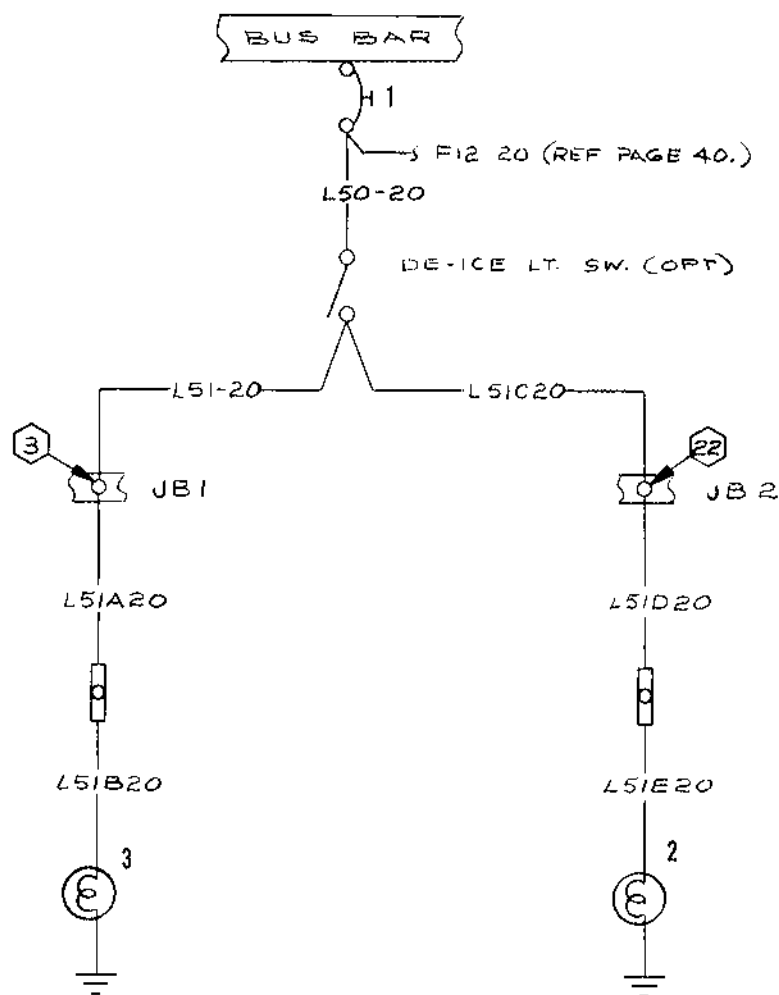
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0870090
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34.01
PAGE

WING DEICE LIGHT (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3

S1232-505
0820501-5
0820501-5

Circuit Breaker
RH Deice Light
LH Deice Light

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

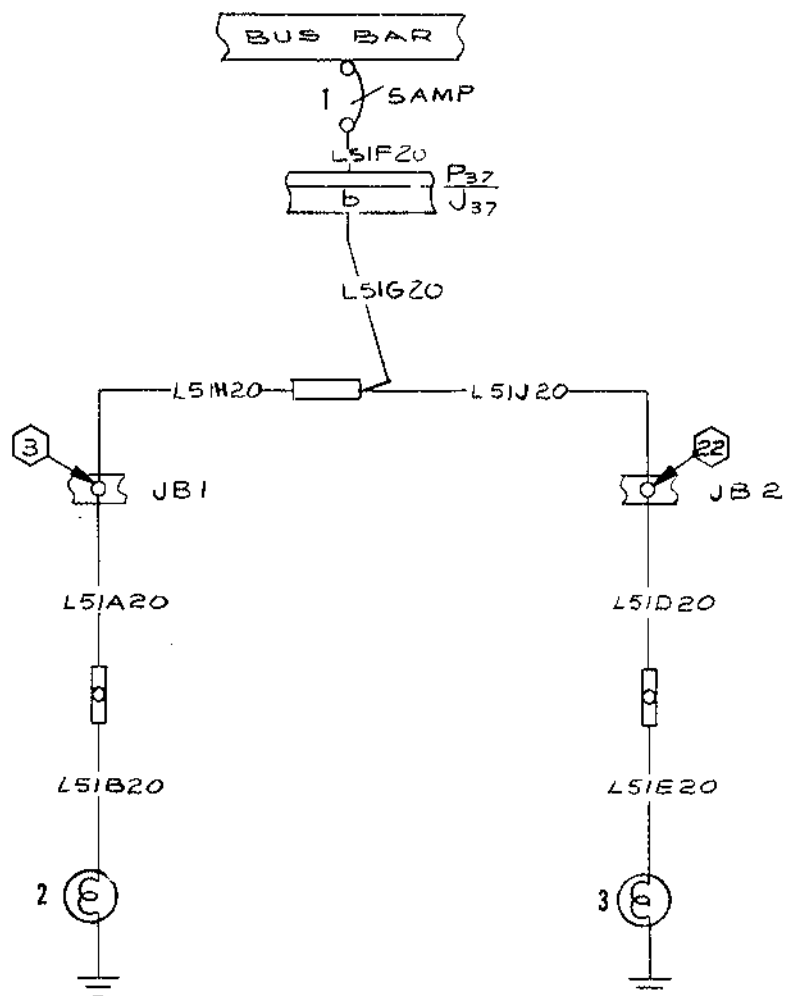
310
MODEL REV.

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DRAWING NO.

34.02
PAGE

WING DE-ICE LIGHT (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1

112-205-101

Circuit Breaker

2

0820501-5

LH Deice Light

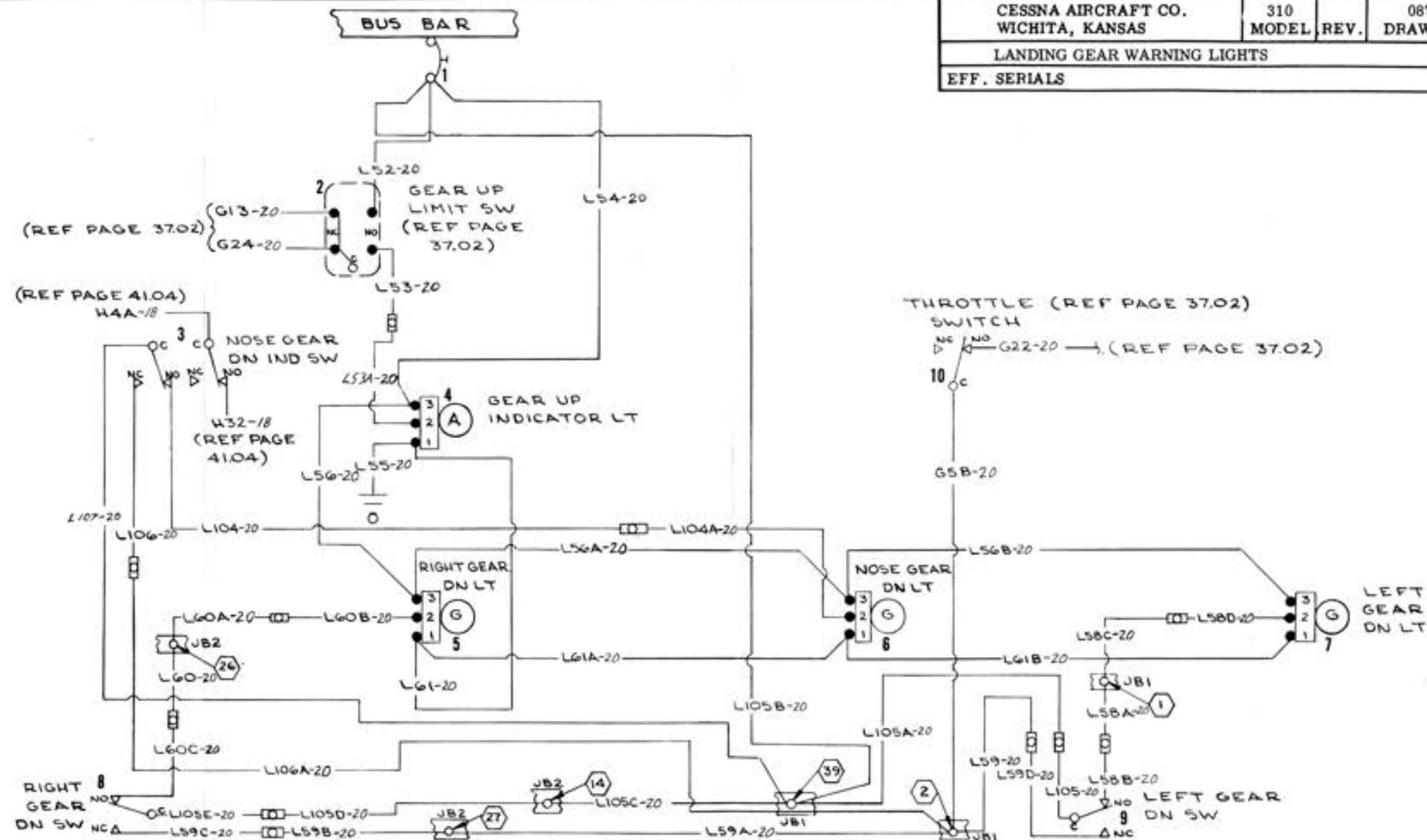
3

0820501-5

RH Deice Light

LANDING GEAR WARNING LIGHTS

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-505	Circuit Breaker
2	OT2RA7	Switch (Gear Up Limit)
3	2VB1	Switch (Nose Gear Down Indicator)
4	VM911M4	Light (Gear Up Indicator)
5	VM911M3	Light (Right Gear Down)
6	VM911M3	Light (Nose Gear Down)
7	VM911M3	Light (Left Gear Down)
8	1SE3-3	Switch (Left Gear Down Indicator)
9	1SE3-3	Switch (Right Gear Down Indicator)
10	8ZR31	Switch Throttle

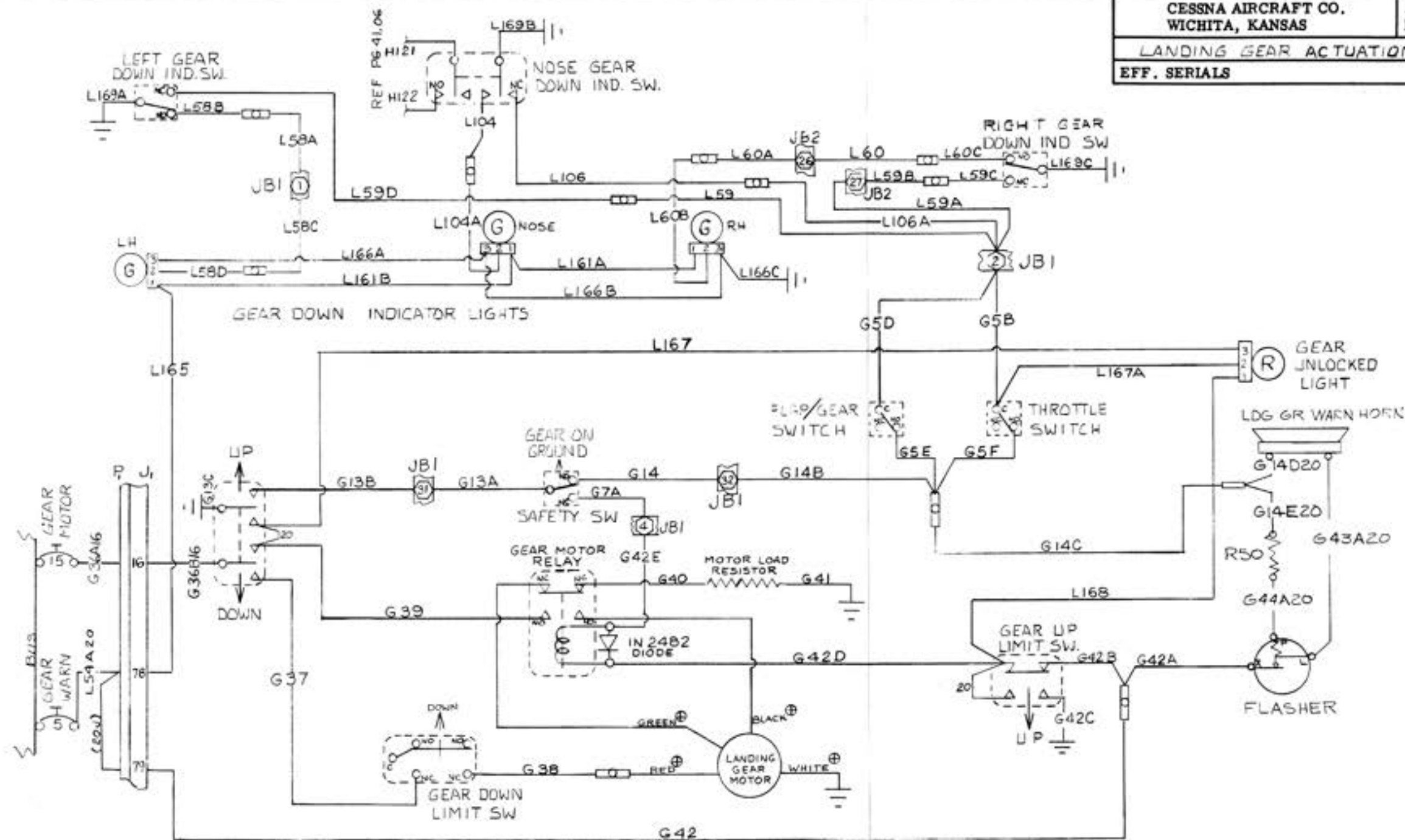
EFF. SERIALS



10	MS25253-1	Switch
11	BZR31	Switch
12	01-911806-6	Light
13	IVA20	Switch
14	6D41H220	Relay
15	FR100-5	Resistor
16	BZ7RT04	Switch
17	9910002-3	Motor
18	BZ3YT	Switch
19	No. 285	Dual Warning Flasher Unit

LANDING GEAR ACTUATION & WARNING

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE	ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker	11	BZR31	Switch
2	S1232-515	Circuit Breaker	12	01-911806-6	Light
3	0813525-4	Switch	13	IVA20	Switch
4	VM911M3	Light	14	6D41H220	Relay
5	1SE1-3	Switch	15	FR100-5	Resistor
6	2VB1	Switch	16	BZ7RT04	Switch
7	VM911M3	Light	17	9910002-3	Motor
8	VM911M3	Light	18	BZ3YT	Switch
9	1SE1-3	Switch	19	R102-12V	Warning Horn Flasher
10	MS25253-1	Switch	20	A2948	Gear Warning Horn
			21	1-3/4D48F40	Resistor

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

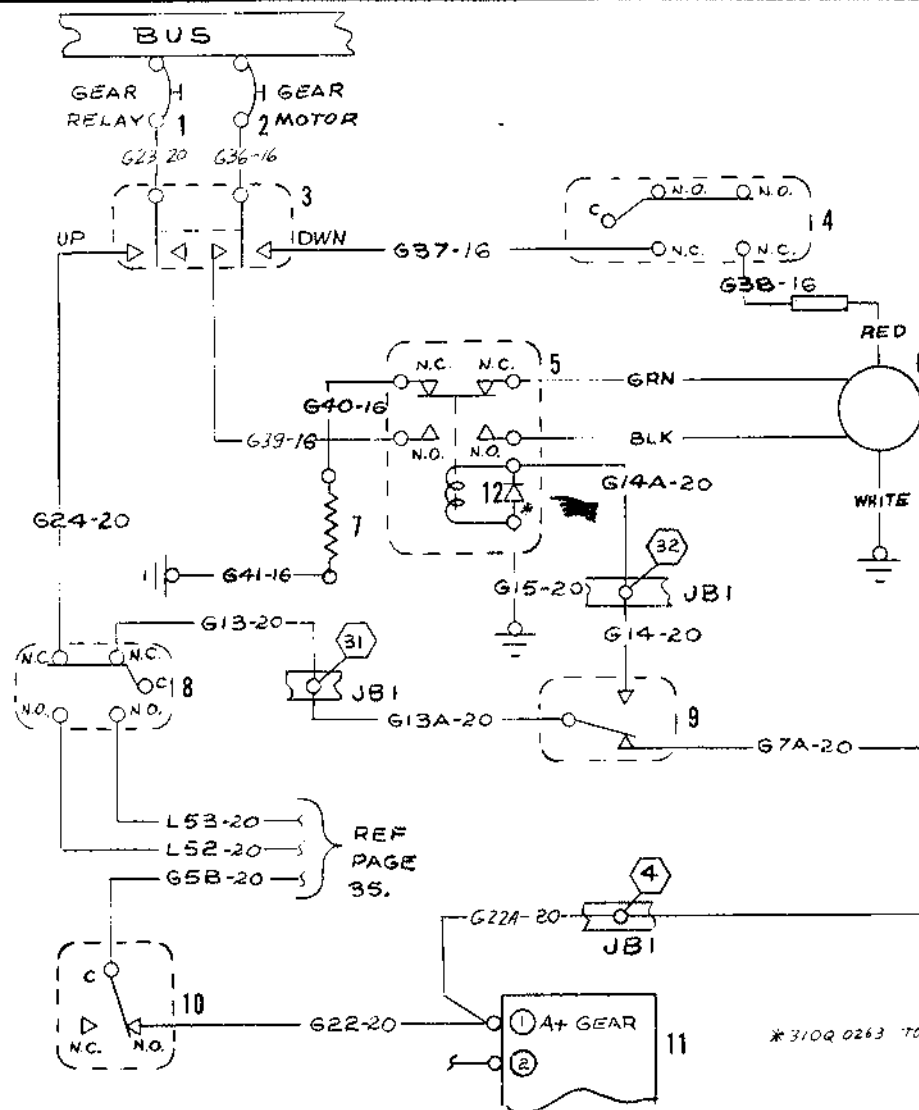
REV.

0870090
DRAWING NO.

37.03
PAGE

LANDING GEAR ACTUATOR

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-505	Circuit Breaker
2	S1232-515	Circuit Breaker
3	0813525-4	Switch Landing Gear
4	DT2RA7	Switch - Gear Down Limit
5	BZ7RT04	Relay - Gear Motor
6	9910002-3	Motor - Landing Gear
7	FR-100-5	Resistor - Motor Load
8	BZ3YT	Switch - Gear Up Limit
9	IVA20	Switch - Gear Safety L/H
10	BZR31	Switch - Throttle
11	285	Dual Warning & Flasher Unit
12	IN2482	Diode

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CESSNA AIRCRAFT CO.
WICHITA, KANSAS

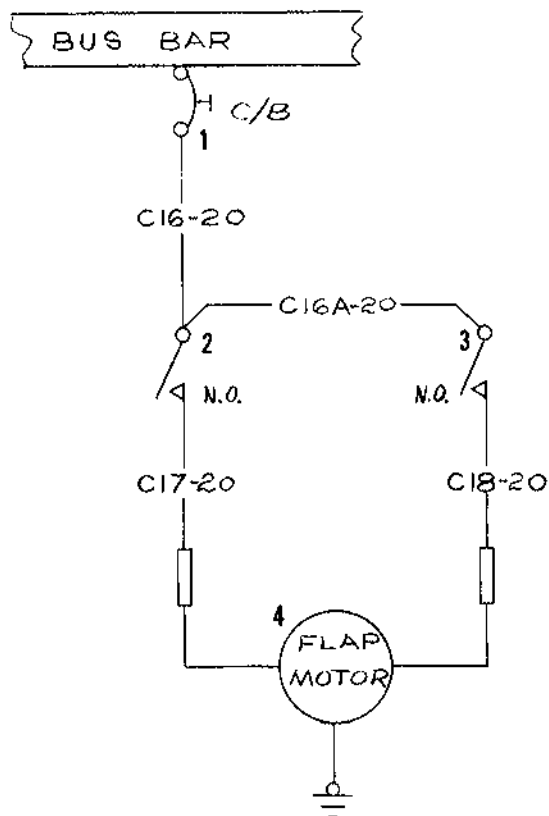
310
MODEL REV.

0870090
DRAWING NO.

38.02
PAGE

FLAP ACTUATION

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

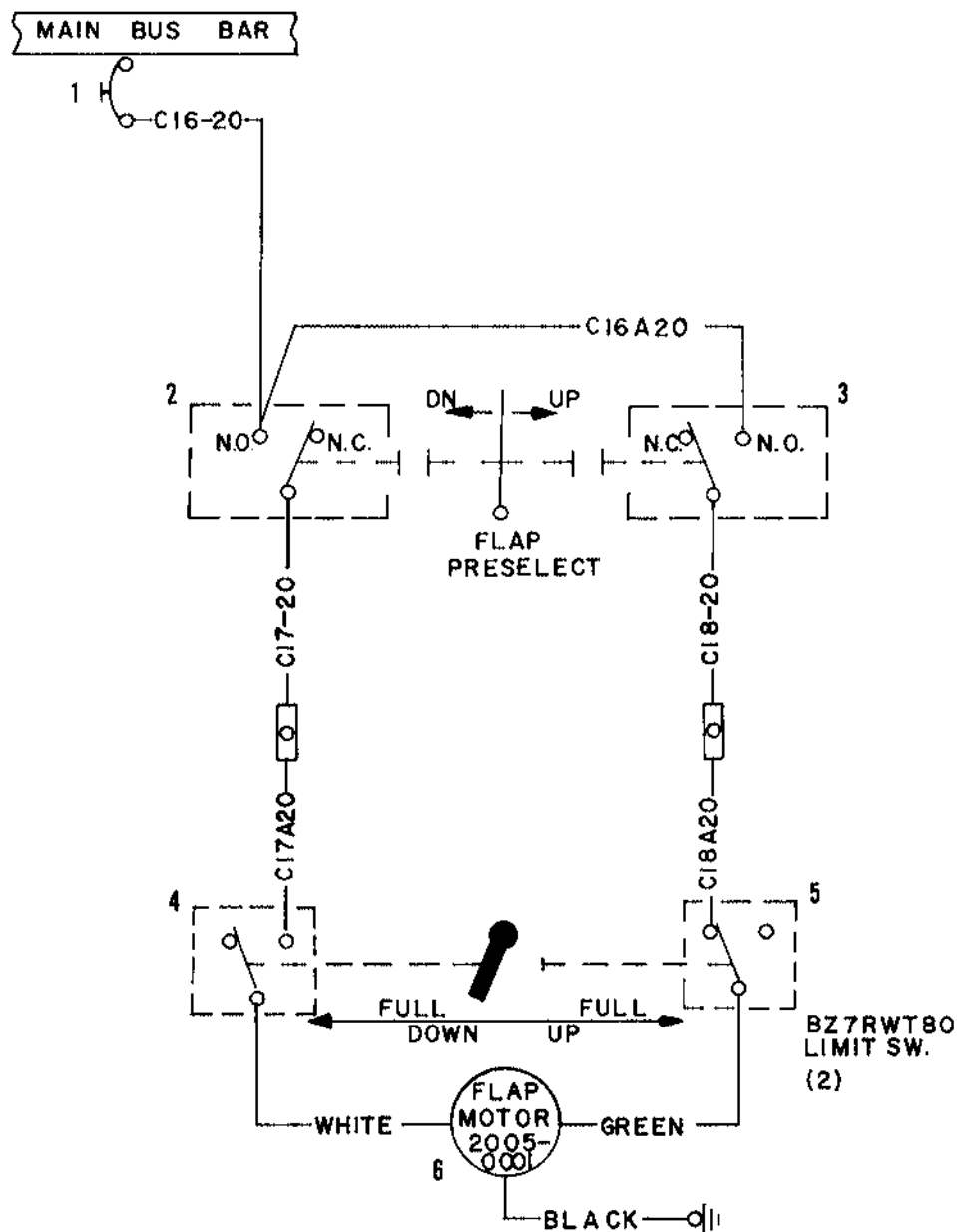
1
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4

S1232-510
MS25253-1
MS25253-1
2005-0001

Circuit Breaker
Switch - Down Limit
Switch - Up Limit
Flap Motor

FLAP ACTUATION

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

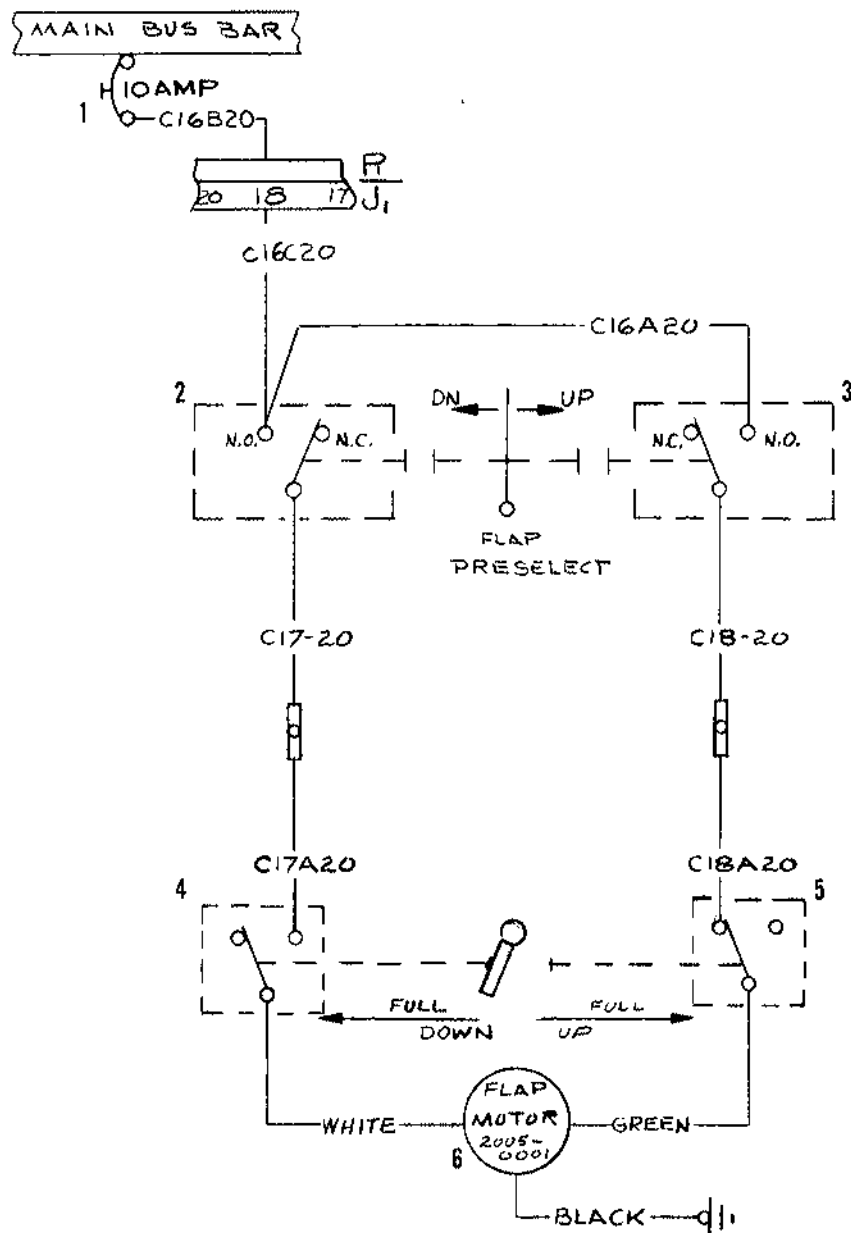
1
2
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6

S1232-510
MS25253-1
MS25253-1
BZ7RWT80
BZ7RWT80
2005-0001

Circuit Breaker
Switch - Down Limit
Switch - Up Limit
Switch - Full Down Limit
Switch - Full Up Limit
Flap Motor

FLAP ACTUATION

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-510	Circuit Breaker
2	MS25253-1	Switch - Down Limit
3	MS25253-1	Switch - Up Limit
4	BZ7RWT80	Switch - Full Down Limit
5	BZ7RWT80	Switch - Full Up Limit
6	2005-0001	Flap Motor

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

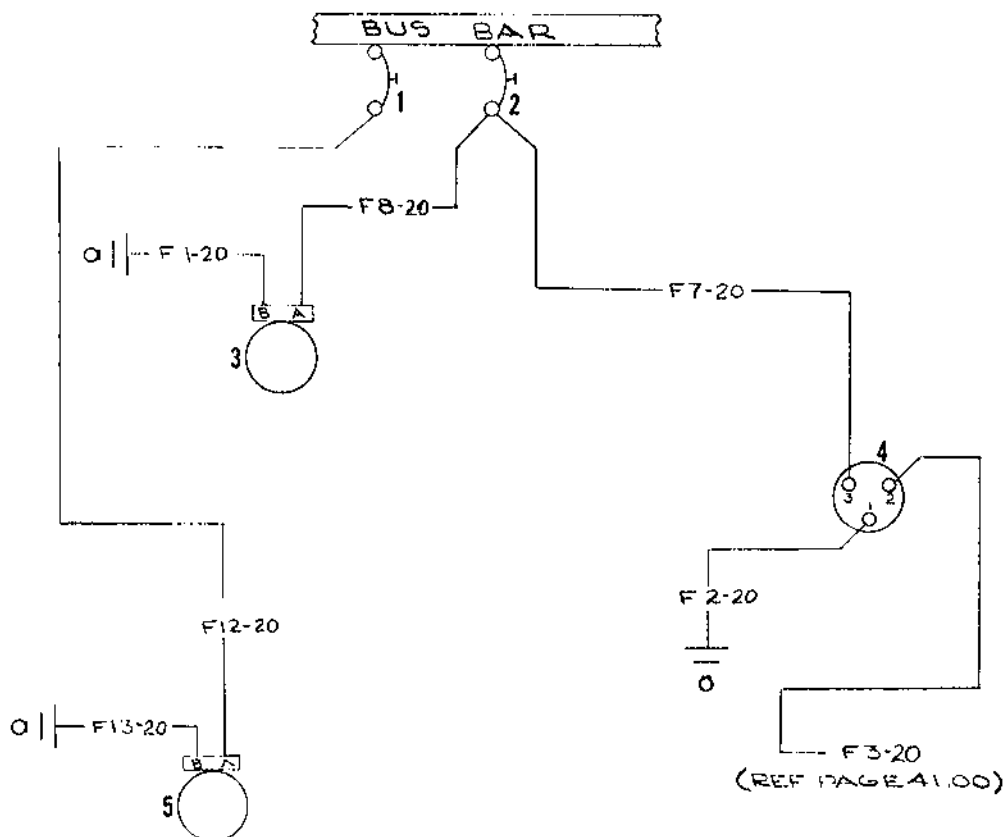
310
MODEL REV.

0870090
DRAWING NO.

40.01
PAGE

TURN & BANK INDICATOR & TEST LIGHT

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5

S1232-505
S1232-505
C661031-0101
L3100AM
C661031-0101

Circuit Breaker
Circuit Breaker
Turn and Bank - L/H
Turn and Bank Test Light
Turn and Bank - R/H

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

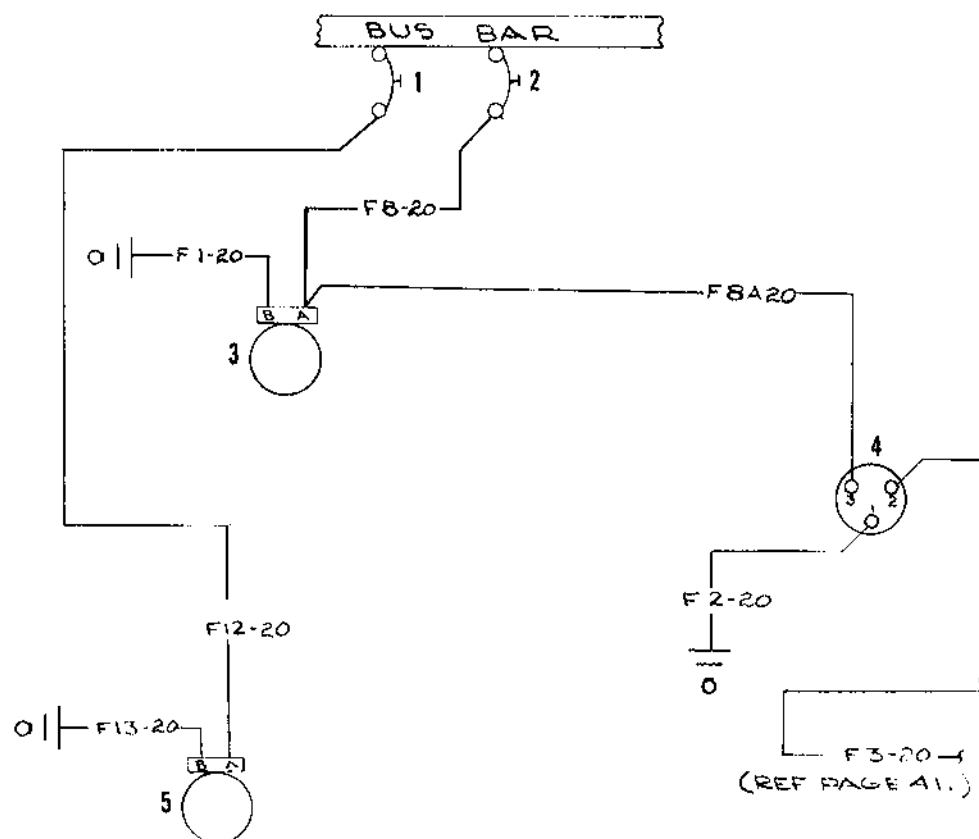
310
MODEL REV.

0870090
DRAWING NO.

40.02
PAGE

TURN AND BANK INDICATOR AND TEST LIGHT

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	C661031-0101	Turn and Bank Indicator - LH
4	L3100AM	Turn and Bank Test Light
5	C661031-0101	Turn and Bank Indicator - RH

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310Q
MODEL

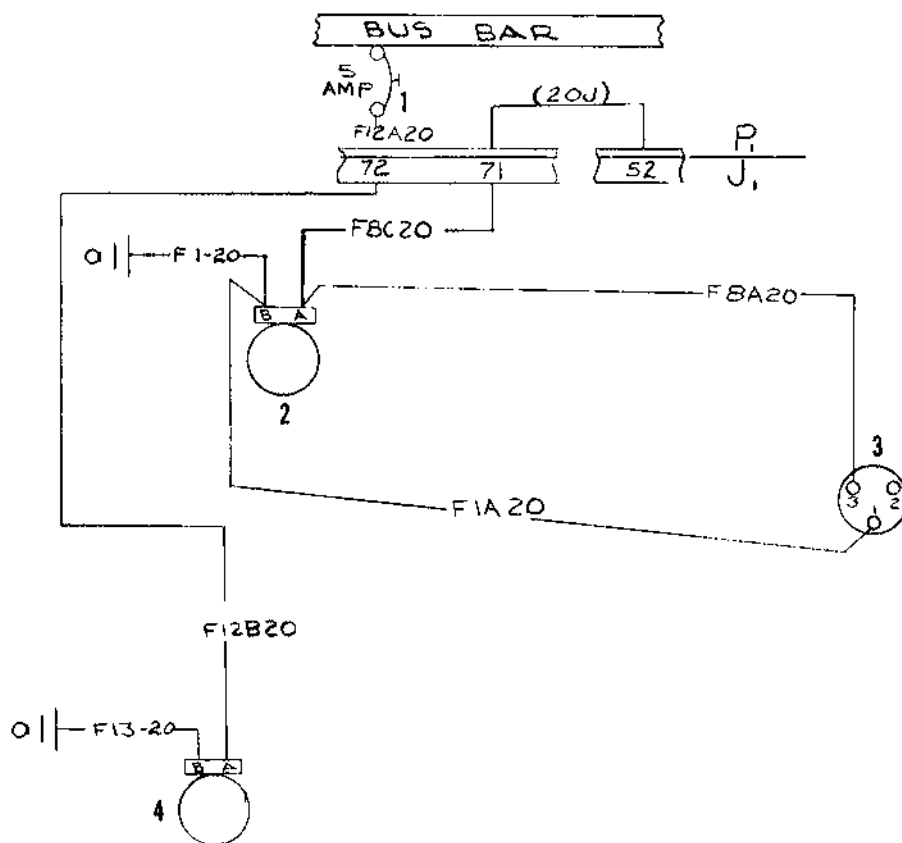
AE
REV.

0870090
DRAWING NO.

40.03
PAGE

TURN & BANK INDICATOR & TEST LIGHT

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-505	Circuit Breaker
2	C661031-0101	Turn and Bank Indicator - LH
3	L3100AM	Turn and Bank Test Light
4	C661031-0101	Turn and Bank Indicator - RH

EFF. SERIALS



1	2VB1	Switch (Nose Gear Down Ind)
2	S392-1	Switch (Cabin Heat)
3	S1232-507	Circuit Breaker
4	0818141-4	Thermostat
5	0813841-3	Fuel Pump
6	07D44	Cabin Heater Term Block
7	C291501-0101	Valve - Fuel Source
8	0813841-8	Blower - Combustion Air
9	A07D77	Radio Noise Filter
10	A07D29	Limit Switch - Overheat
11	A07D32	Switch - Cycling
12	07D74	Filter Assembly
13	A08D53	Motor - Blower
14	B07D97	Ignition Assembly
15	A13D16	Solenoid Valve - Fuel

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

3107
MODEL

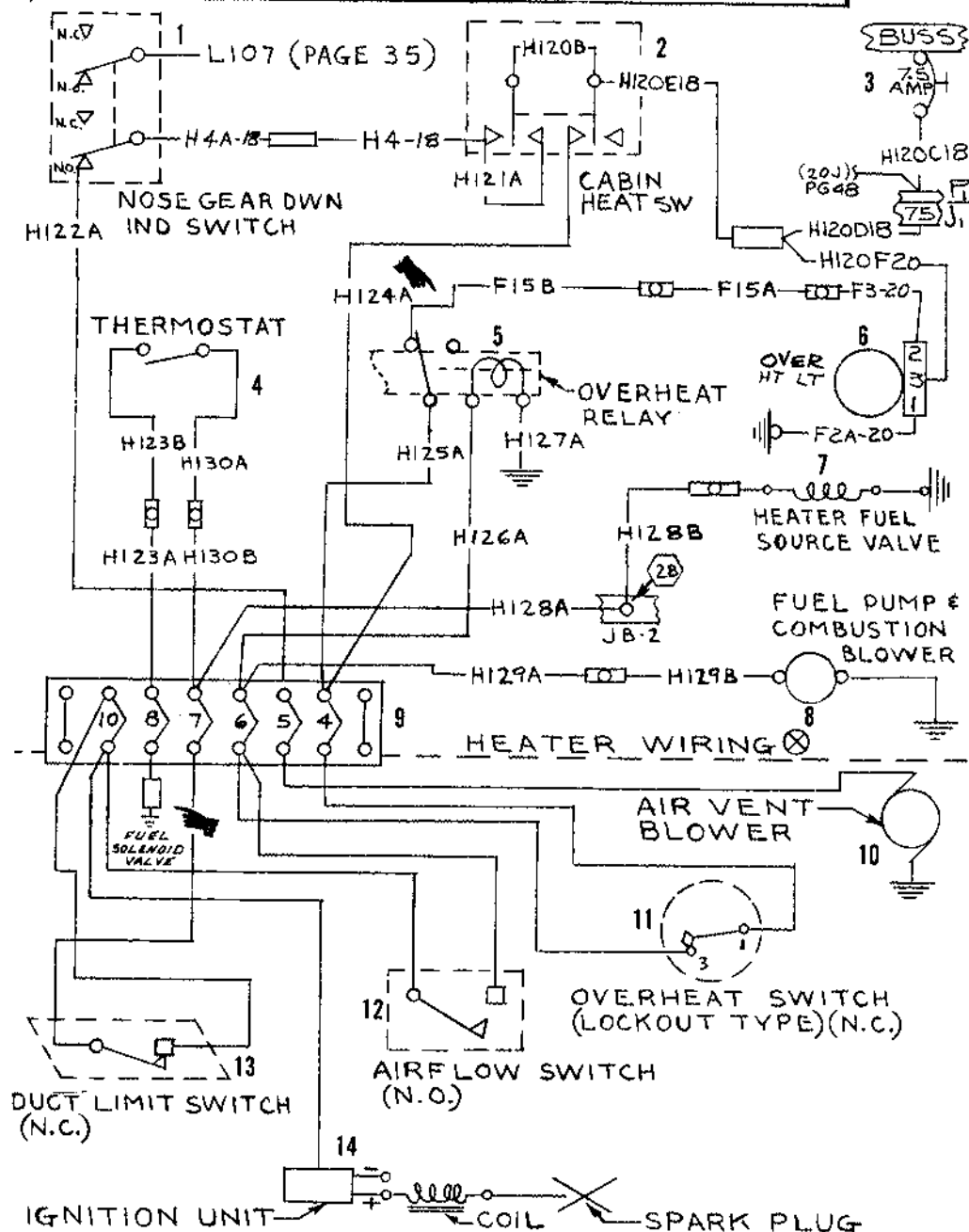
AE
REV.

0870090
DRAWING NO.

41.06
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CABIN HEAT SYSTEM

EFF. SERIALS



TERM

PART NUMBER

NOMENCLATURE

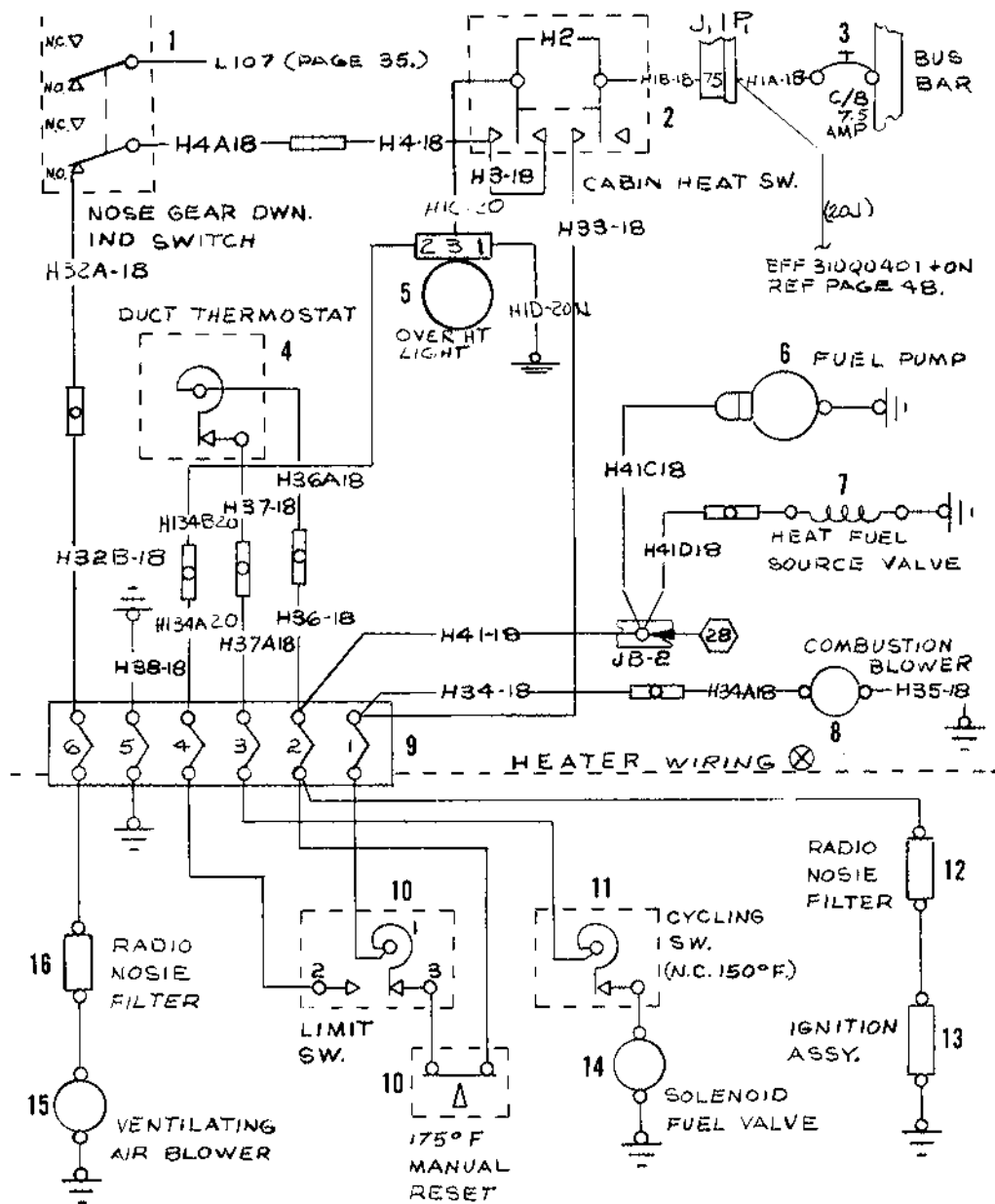
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14

2VH1
R382-1
S1232-507
0413767-3
KHDP17011
L3100AM
0813905-5
G721973
SW484149
G721022
SW719831-3
G720765
G719983
G721240

Switch (Nose Gear Down Ind)
Switch (Cabin Heat)
Circuit Breaker
Thermostat
Overheat Relay
Overheat Light
Valve - Fuel Source
Fuel Pump & Combustion Blower
Cabin Heater Terminal Block
Ventilating Air Blower
Overheat Switch
Airflow Switch
Limit Switch - Duct
Ignition Unit

CABIN HEAT SYSTEM

EFF. SERIALS



ITEM

1
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14
15
16

PART NUMBER

2V01
S392-1
S1232-507
0812841-4
T3100AM
0812841-3
C241501-0101
0812841-8
07D44
A071229
A070312
07D71
0072901
A13D061
A07D48
A071077

NOMENCLATURE

Switch (Nose Gear Down Ind)
Switch (Cabin Heat)
Circuit Breaker
Thermostat
Overheat Light
Fuel Pump
Valve - Fuel Source
Combustion Blower
Cabin Heater Term Block
Limit Switch - Overheat
Switch - Cycling
Radio Noise Filter
Ignition Assembly
Solenoid Fuel Valve
Motor - Blower
Radio Noise Filter

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

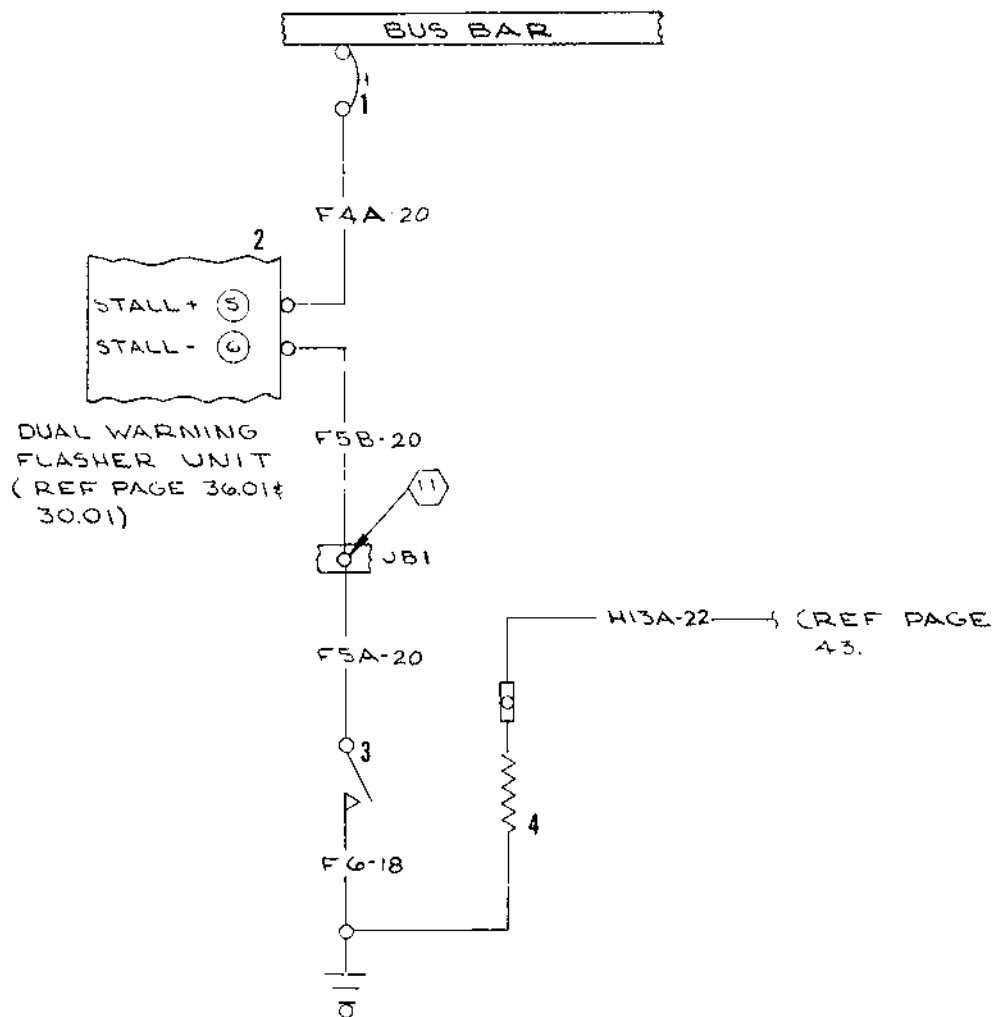
REV.

0870090
DRAWING NO.

42.02
PAGE

STALL WARNING SYSTEM

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4

S1232-505
285
0511062-6
0511062-6

Circuit Breaker
Flasher - Dual Stall Warning
Switch - Stall Warning Actuator
Heater - Stall Warning

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

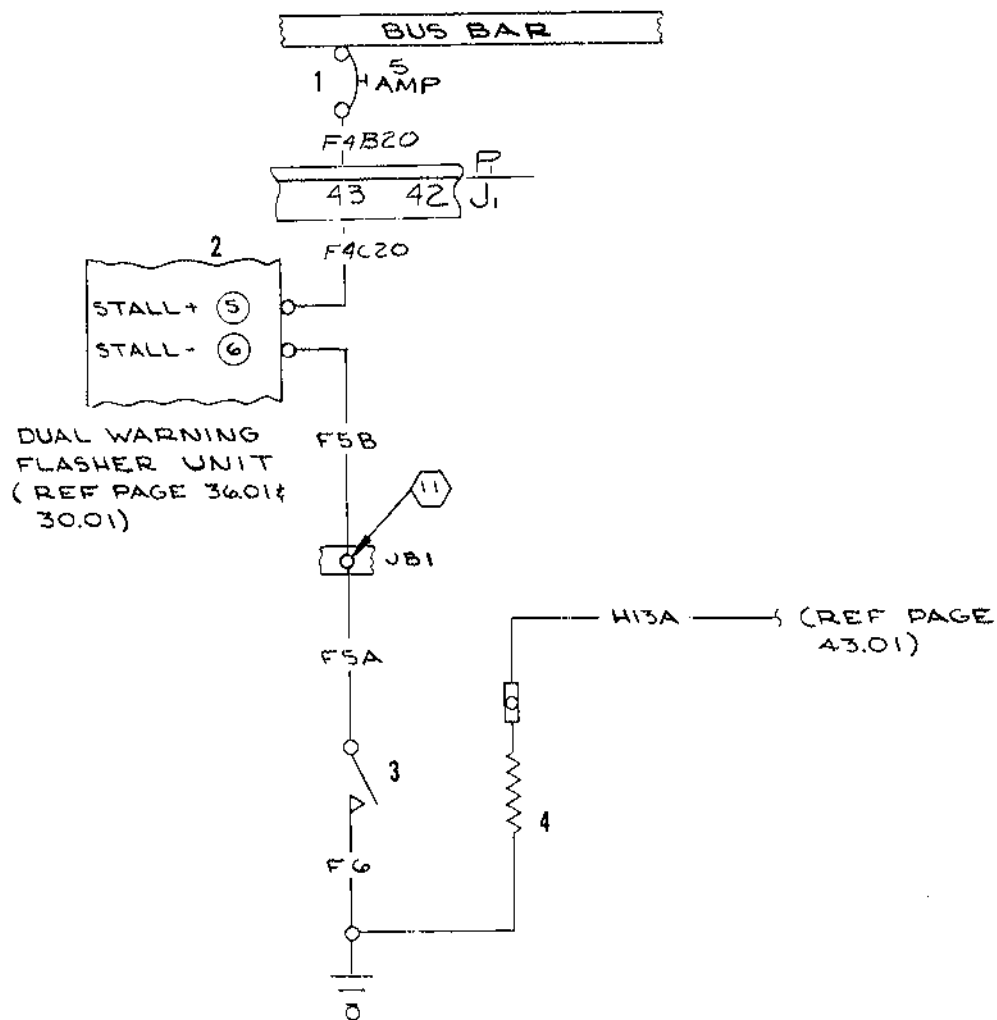
W
REV.

0870090
DRAWING NO.

42.03
PAGE

STALL WARNING SYSTEM

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

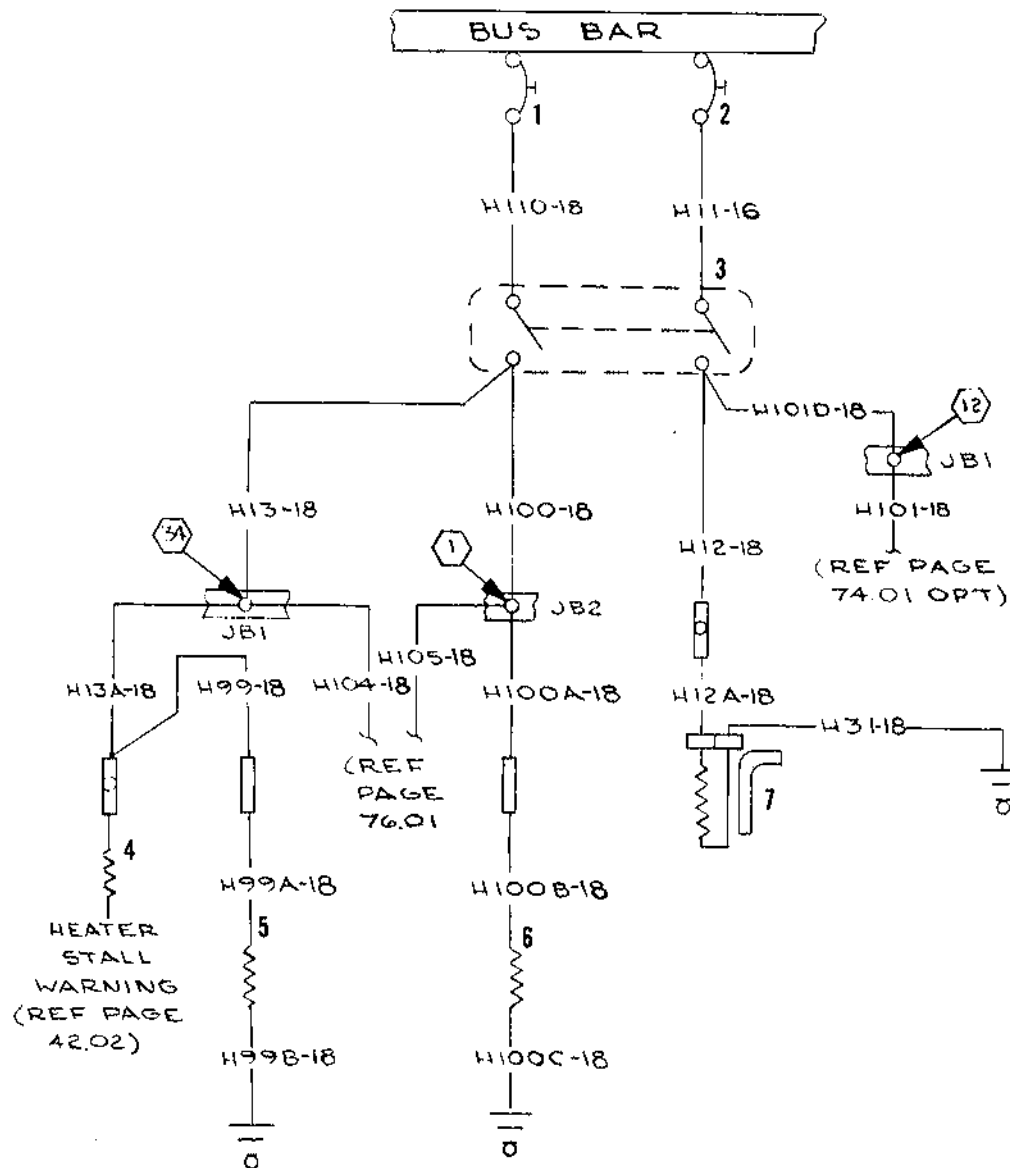
1
2
3
4

S1232-505
285
0511062-6
0511062-6

Circuit Breaker
Flasher - Dual Stall Warning
Switch - Stall Warning Actuator
Heater - Stall Warning

PITOT HEAT SYSTEM

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	S382-1	Switch - Pitot Heat
4	0511062-1	Heater - Stall Warning
5	104738	Heater - Fuel Vent L/H
6	104738	Heater - Fuel Vent R/H
7	0813177-2	Heater - Pitot Tube

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

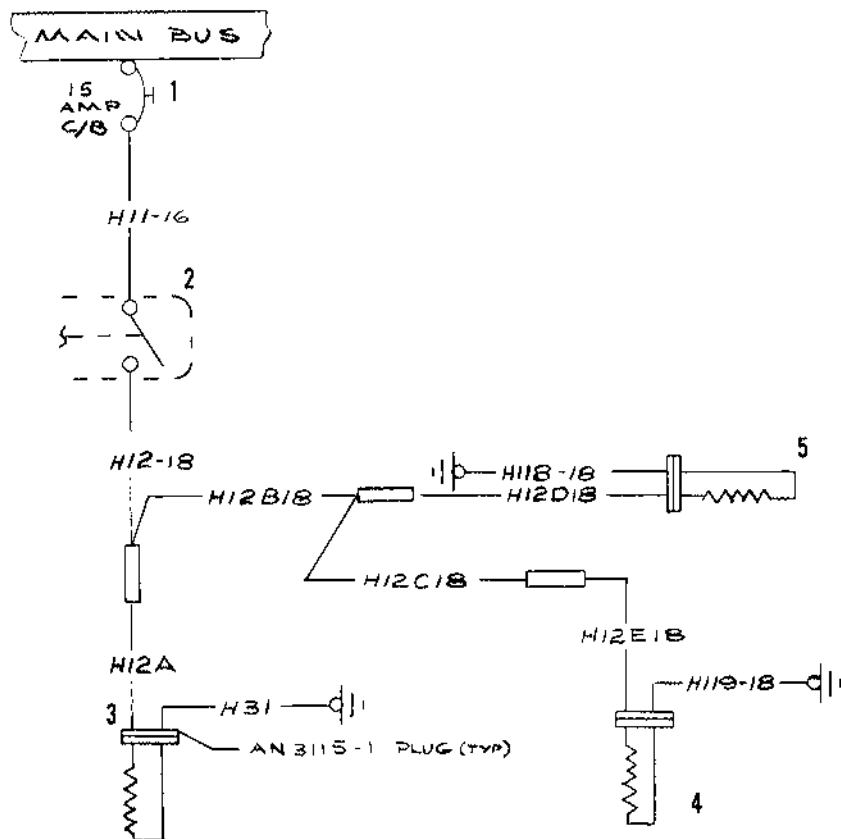
REV.

0870090
DRAWING NO.

43.03
PAGE

DUAL PITOT HEAT SYSTEM (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

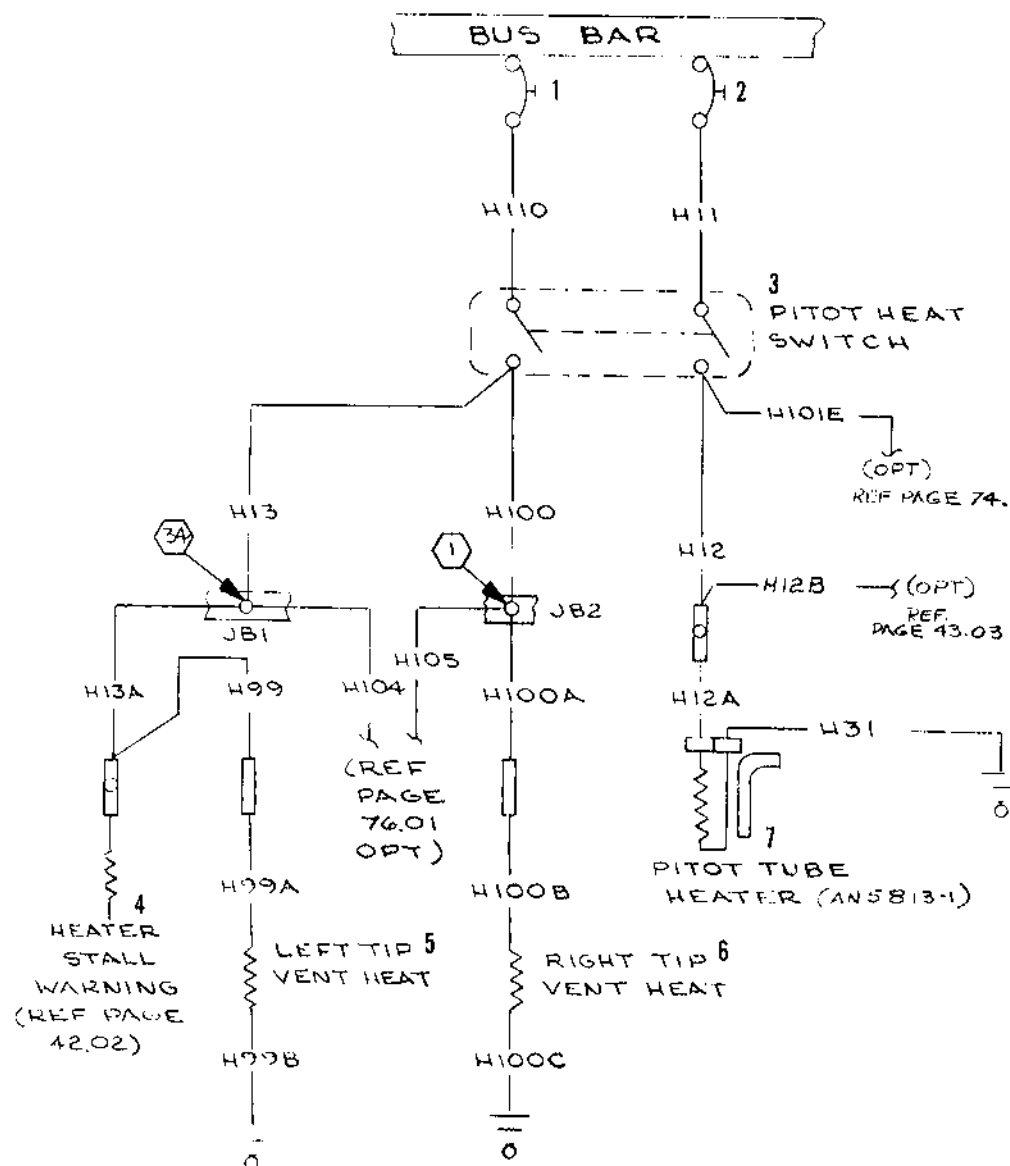
1
2
3
4
5

S1232-505
S382-1
AN5813-1
PH-506R
PH-506L

Circuit Breaker
Switch - Pitot Heat
Tube - Pitot Heater
Tube - RH Pitot Heater
Tube - LH Pitot Heater

PITOT HEAT SYSTEM

EFF. SERIALS



ITEM

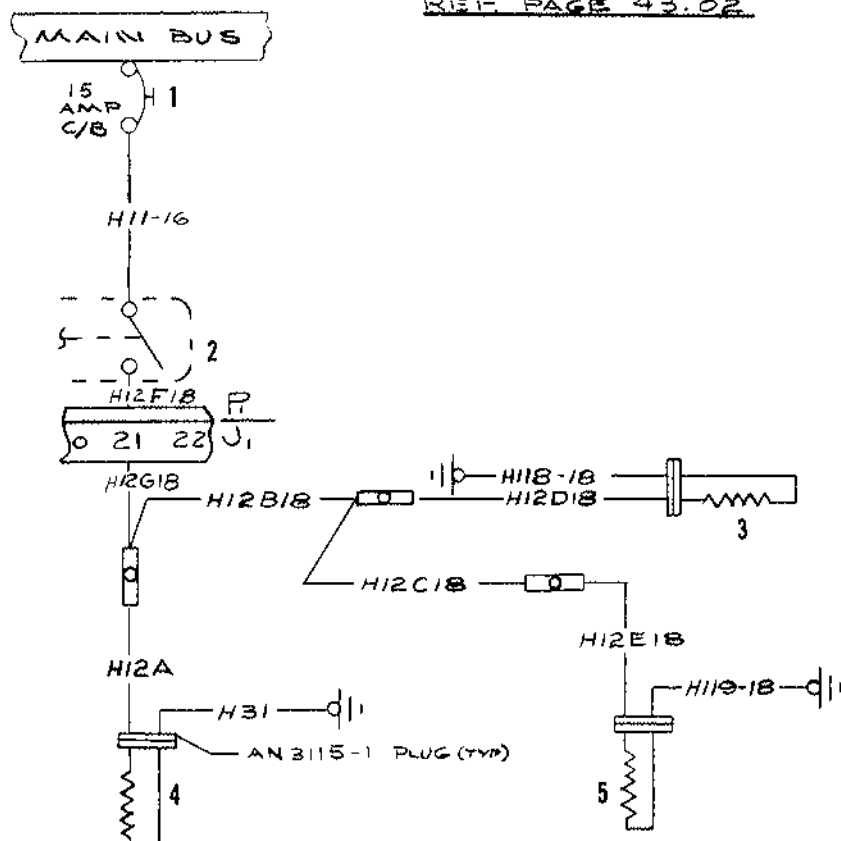
PART NUMBER

NOMENCLATURE

1
2
3
4
5
6
7

S1232-505
S1232-505
MS35059-22
0511062-1
104738
104738
AN5813-1

Circuit Breaker
Circuit Breaker
Switch - Pitot Heat
Heater - Stall Warning
Heater - Fuel Vent LH
Heater - Fuel Vent RH
Heater - Pitot Tube

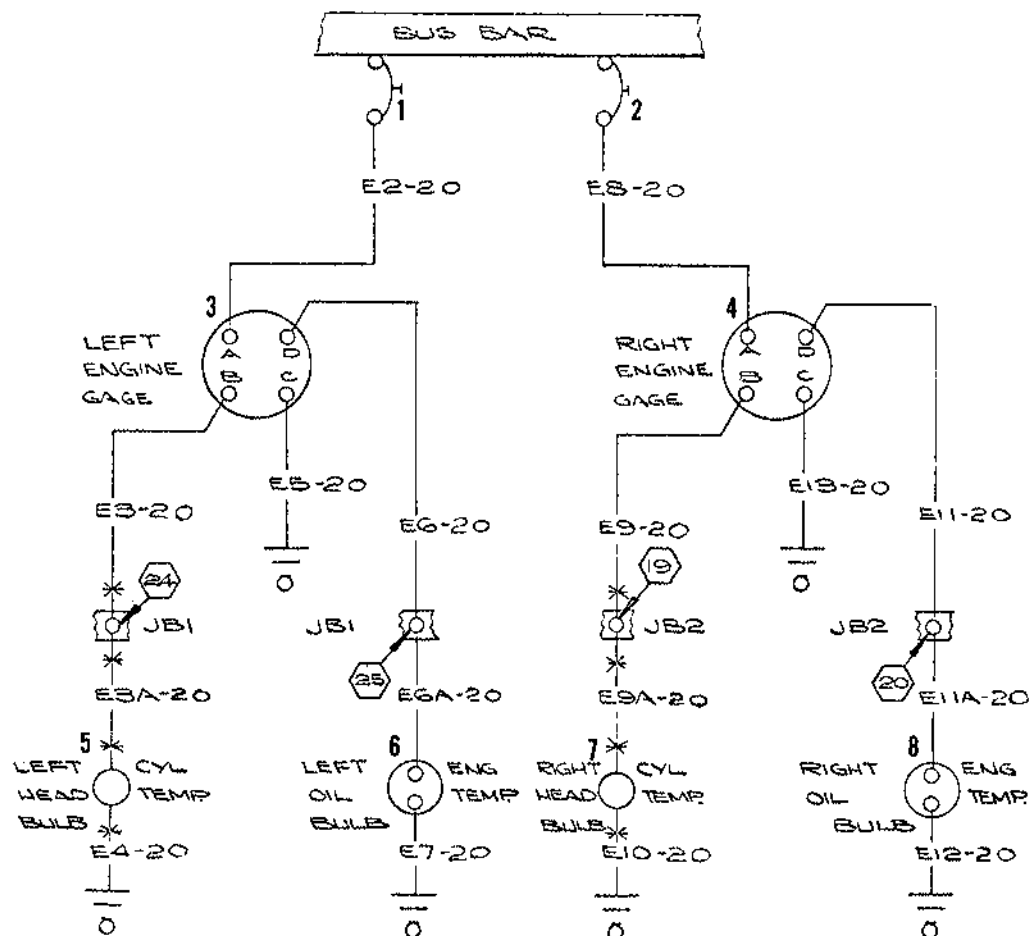
EFF. SERIALS

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-215	Circuit Breaker
2	MS24524-22	Switch - Pitot Heat
3	0813059-3	Heater - LH Pitot
4	AN5813-1	Heater - Nose Pitot
5	PH-506R	Heater - RH Pitot

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	MS35059-22	Switch - Pitot Heat
4	0511062-1	Heater - Stall Warning
5	104738	Heater - Fuel Vent LH
6	104738	Heater - Fuel Vent RH
7	AN5813-1	Heater - Pitot Tube

LEFT & RIGHT ENGINE GAGE SYSTEM

EFF. SERIALS

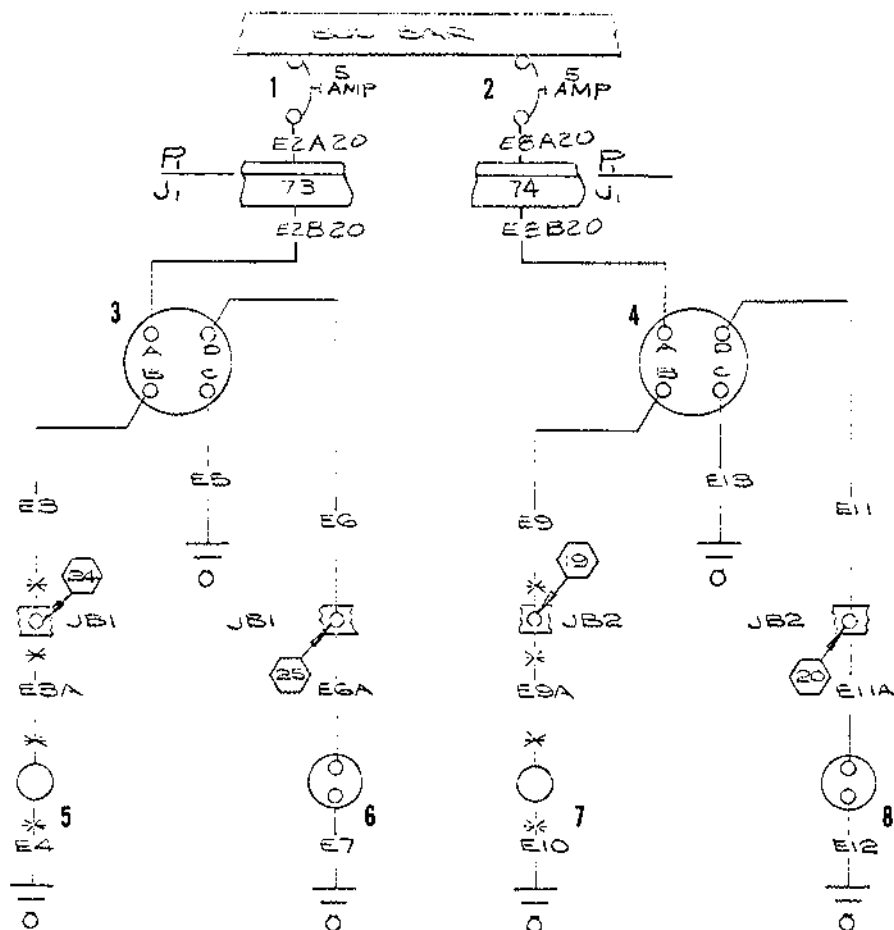


ITEM

PART NUMBER

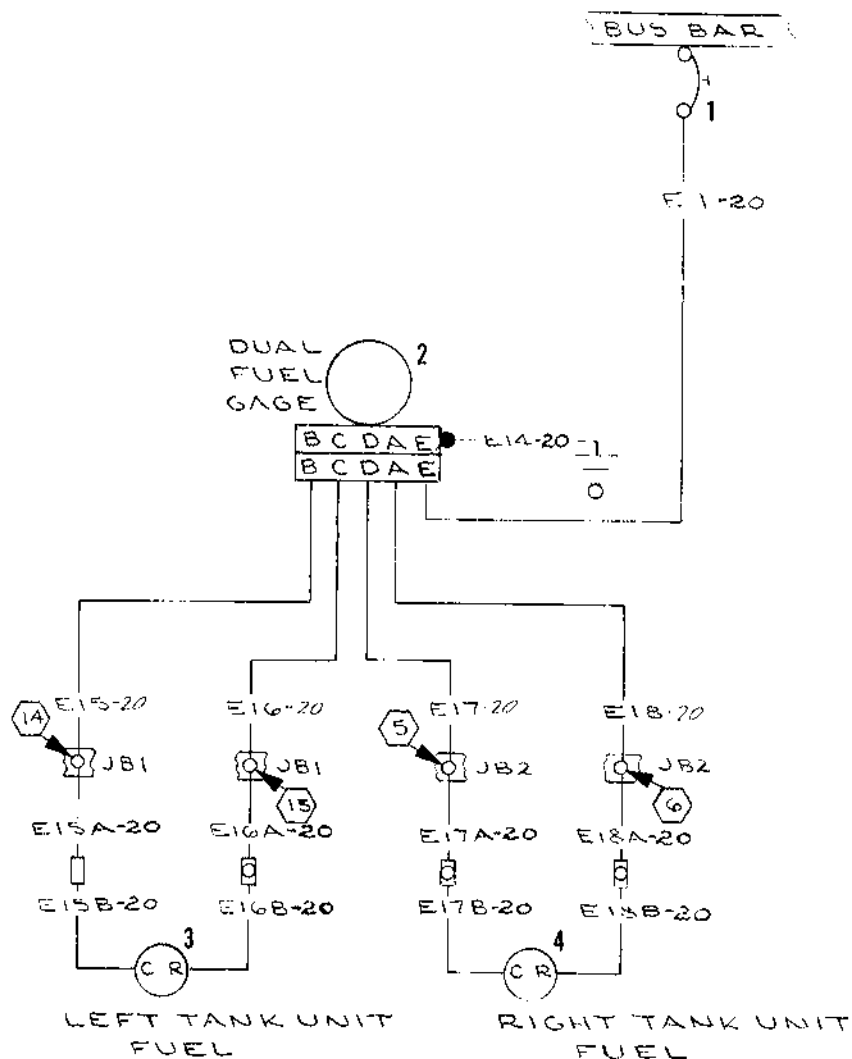
NOMENCLATURE

1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	CM2634L1	Gage - Left Engine
4	CM2634L1	Gage - Right Engine
5	0813601-4	Bulb - L/H Cylinder Head Temp
6	0813601-3	Bulb - L/H Oil Temp
7	0813601-4	Bulb - R/H Cylinder Head Temp
8	0813601-3	Bulb - R/H Oil Temp



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	CM2634L1	Gage - Left Engine
4	CM2634L1	Gage - Right Engine
5	0813601-4	Bulb - LH Cylinder Head Temp
6	0813601-3	Bulb - LH Oil Temp
7	0813601-4	Bulb - RH Cylinder Head Temp
8	0813601-3	Bulb - RH Oil Temp

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	45.00 PAGE
DUAL FUEL GAGE SYSTEM				
EFF. SERIALS 310H0001 TO 310Q0001				



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	CM2645L1	Gage - Dual Fuel
3	EA470B2340M	Tank Unit - Left
4	EA470B2340M	Tank Unit - Right

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

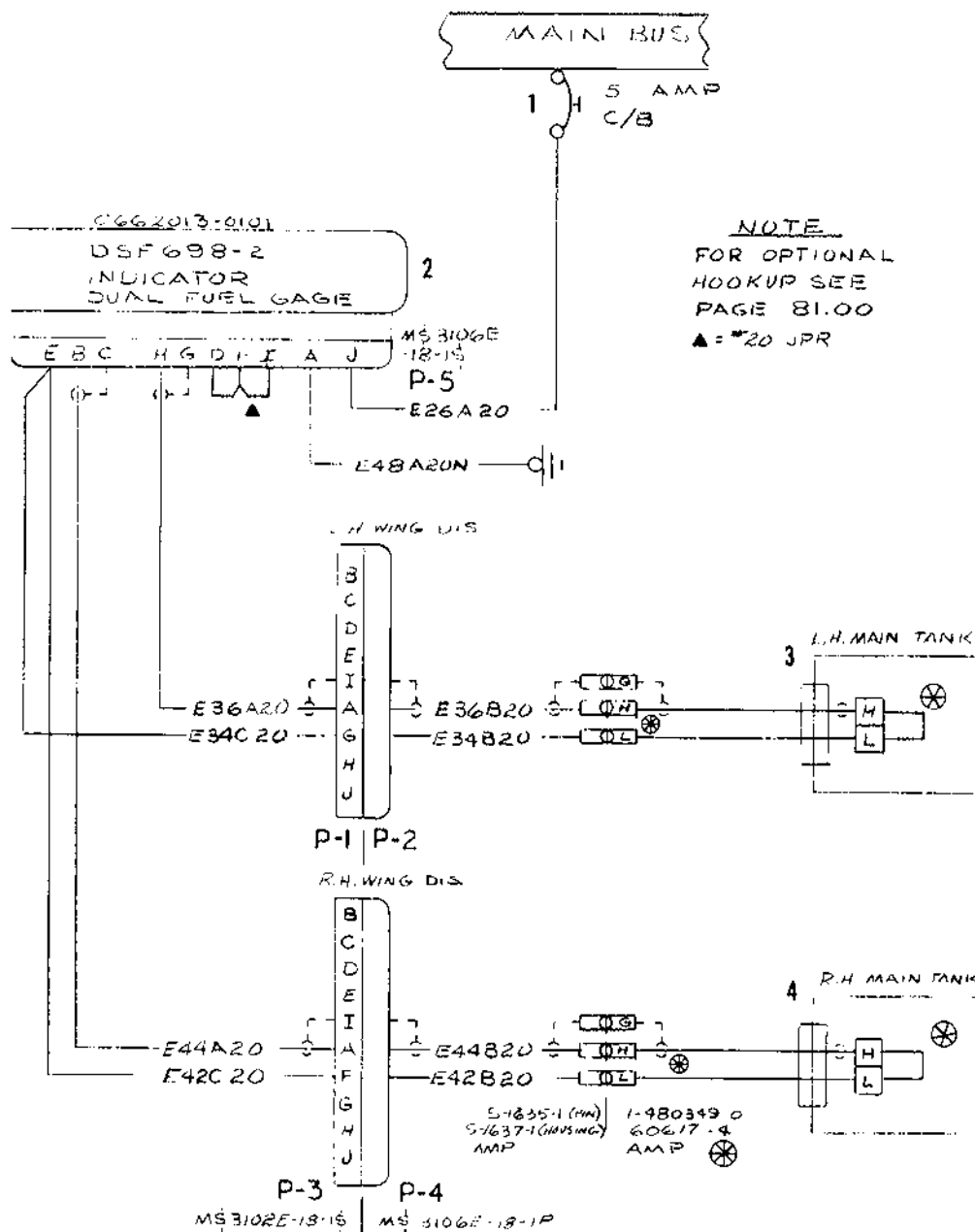
310
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DUAL FUEL GAGE SYSTEM (STD)

EFF. SERIALS



ITEM

PART NUMBER

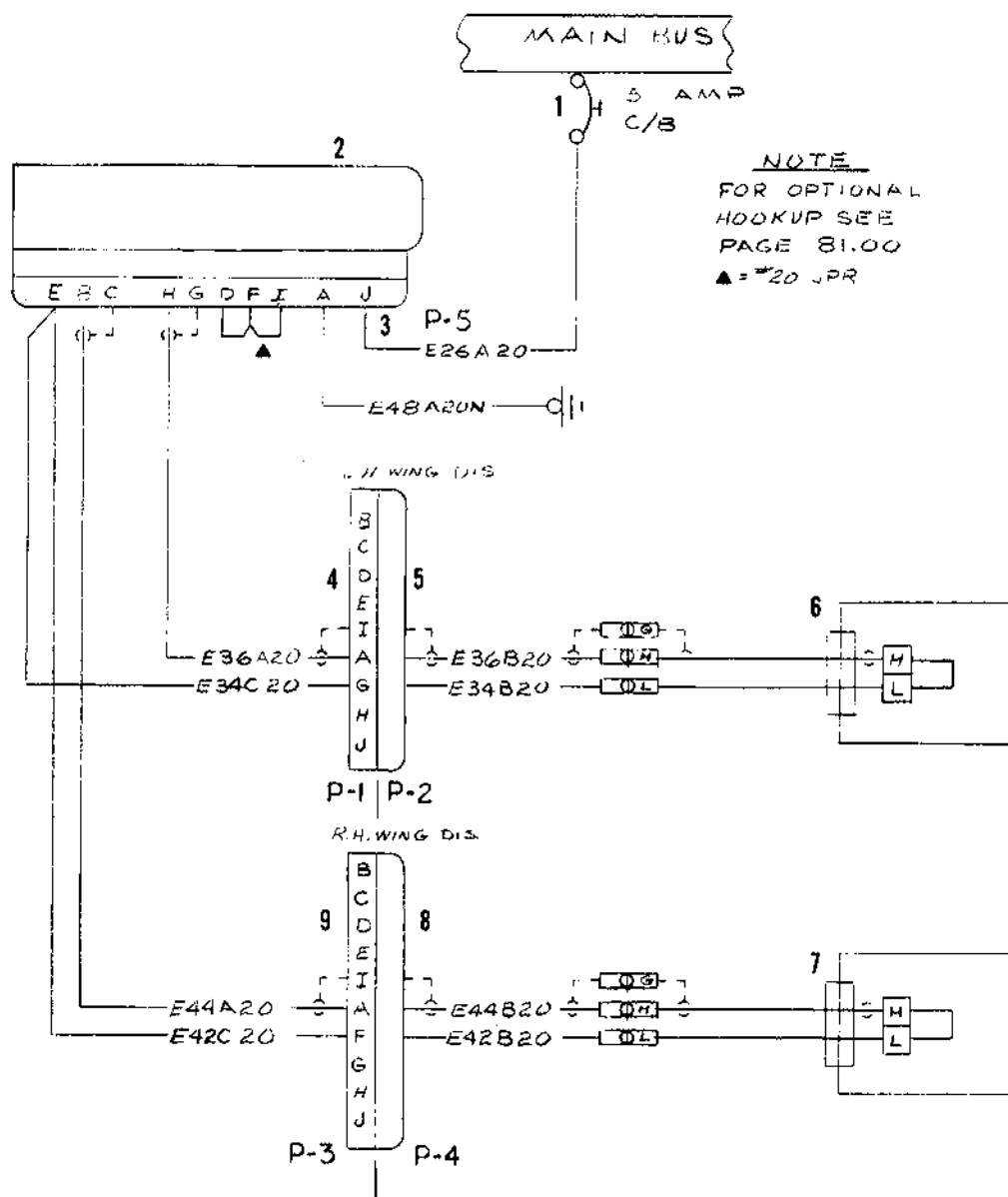
NOMENCLATURE

1
2
3
4

S1232-505
C662013-0101
EA470B2340M
EA470B2340M

Circuit Breaker
Gage - Dual Fuel
Tank - LH Main Fuel
Tank - RH Main Fuel

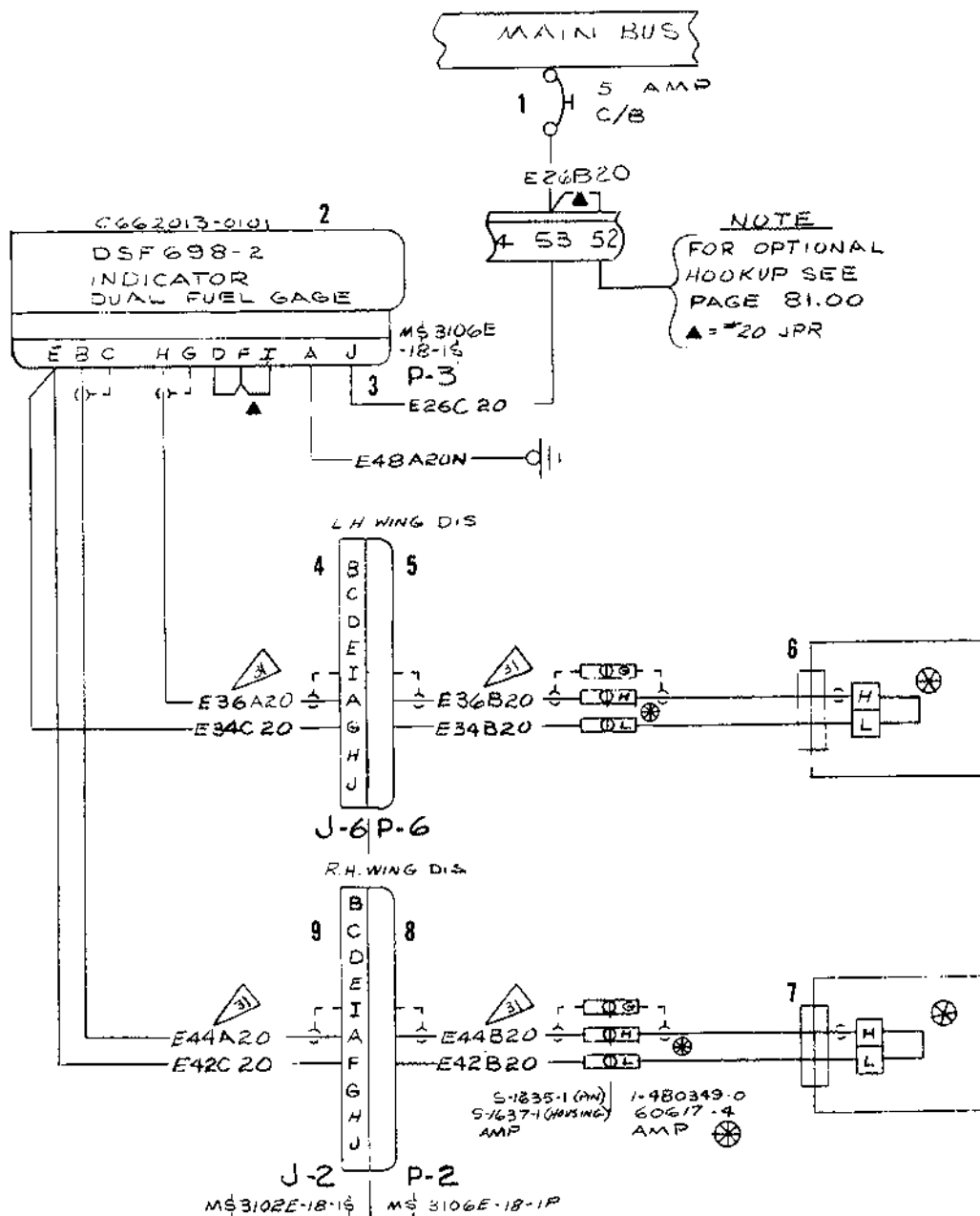
CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	45.02 PAGE
DUAL FUEL GAGE SYSTEM (STD)				
EFF. SERIALS				



Item	Part Number	Nomenclature
1	S1232-505	Circuit Breaker
2	C662013-0101	Indicator
3	MS3106E-18-1S	Plug
4	MS3102E-18-1S	Receptacle (LH)
5	MS3106E-18-1P	Plug (LH)
6	PAA700-3	Tank Unit (LH)
7	PAA700-3	Tank Unit (RH)
8	MS3106E-18-1P	Plug (RH)
9	MS3102E-18-1S	Receptacle (RH)

DUAL FUEL GAGE SYSTEM (STD)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6
7
8
9

S1232-505
C662013-0101
MS3106E-18-1S
MS3102E-18-1S
MS3106E-18-1P
PAA700-3
PAA700-3
MS3106E-18-1P
MS3102E-18-1S

Circuit Breaker
Indicator
Plug
Receptacle (LH)
Plug (LH)
Tank Unit (LH)
Tank Unit (RH)
Plug (RH)
Receptacle (RH)

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

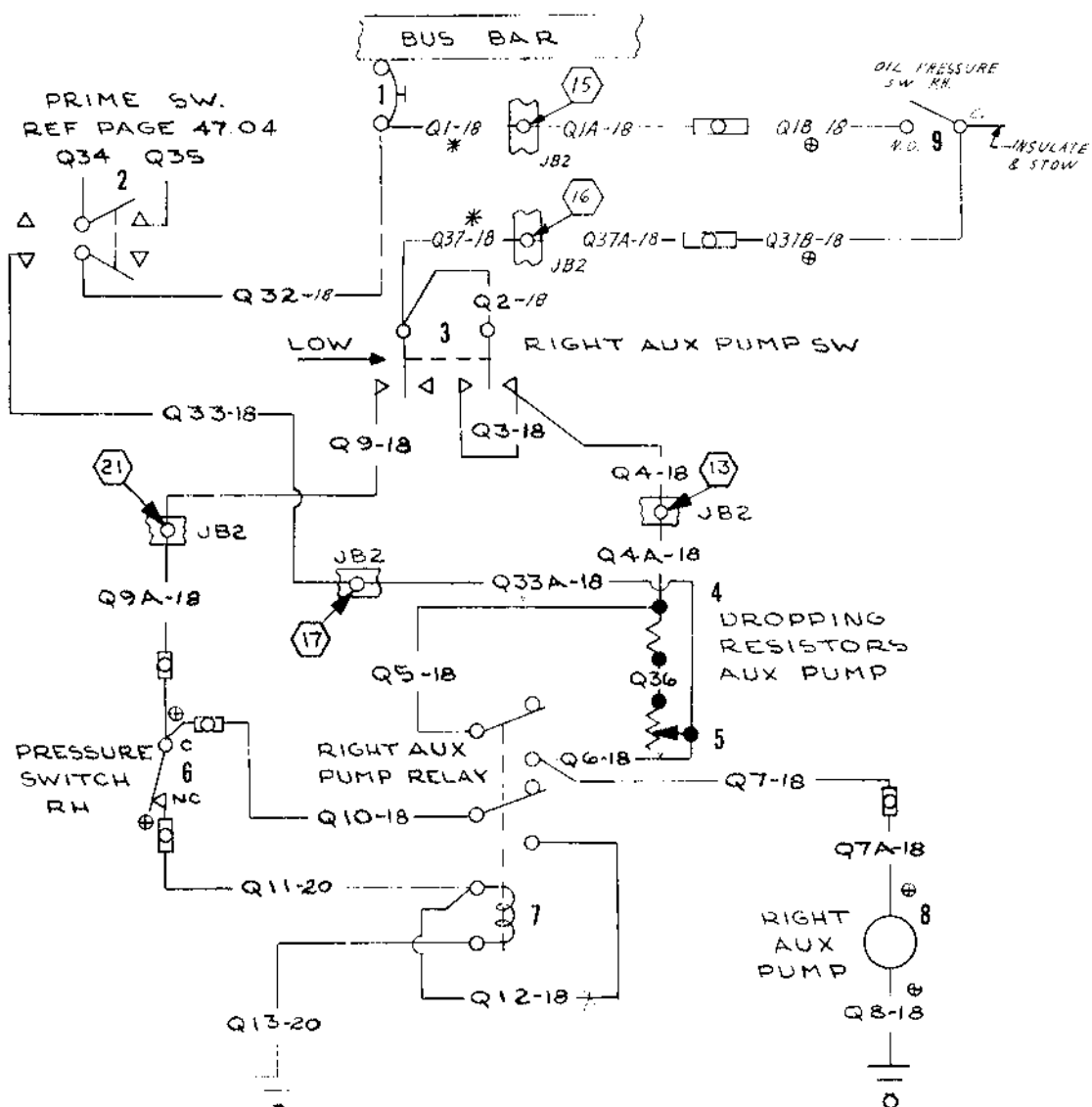
310
MODEL REV.

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DRAWING NO.

46.04
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RIGHT AUX PUMP SYSTEM (OPTIONAL)

EFF. SERIALS

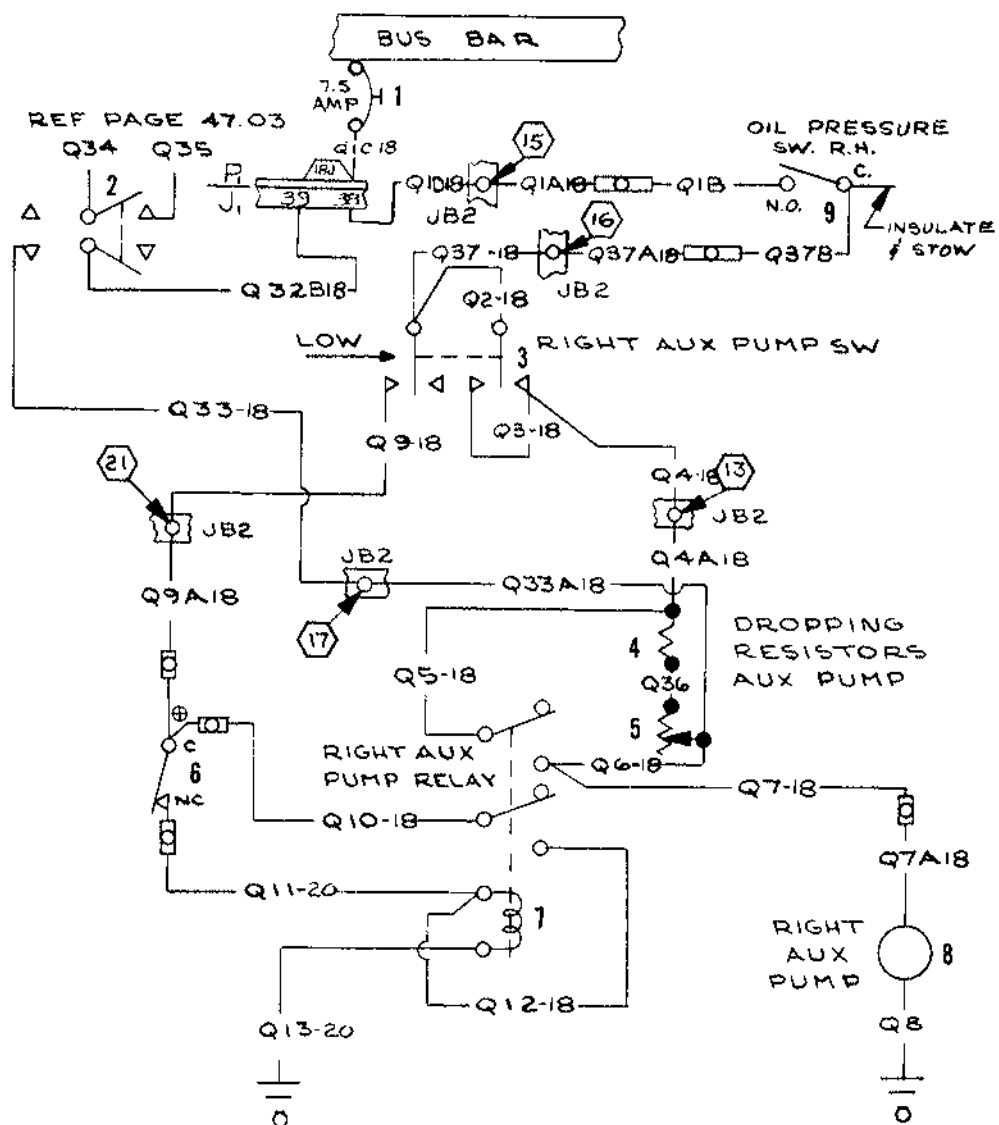


* WHEN OPTIONAL ENGINE (LESS "OIL PRESSURE SW") IS INSTL CONNECT WIRE Q1-18 TO Q37-18 IN JB2

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	MS35059-27	Switch - Prime
3	S392-1	Switch - Right Aux Pump
4	0771	Resistor
5	0771	Resistor
6	0850452-6	Switch - Pressure
7	0850404-1	Relay - Aux Pump RH
8	0850421-1	Pump - Aux Pump RH
9	0850452-8	Oil Pressure Switch

RIGHT AUX PUMP SYSTEM

EFF. SERIALS

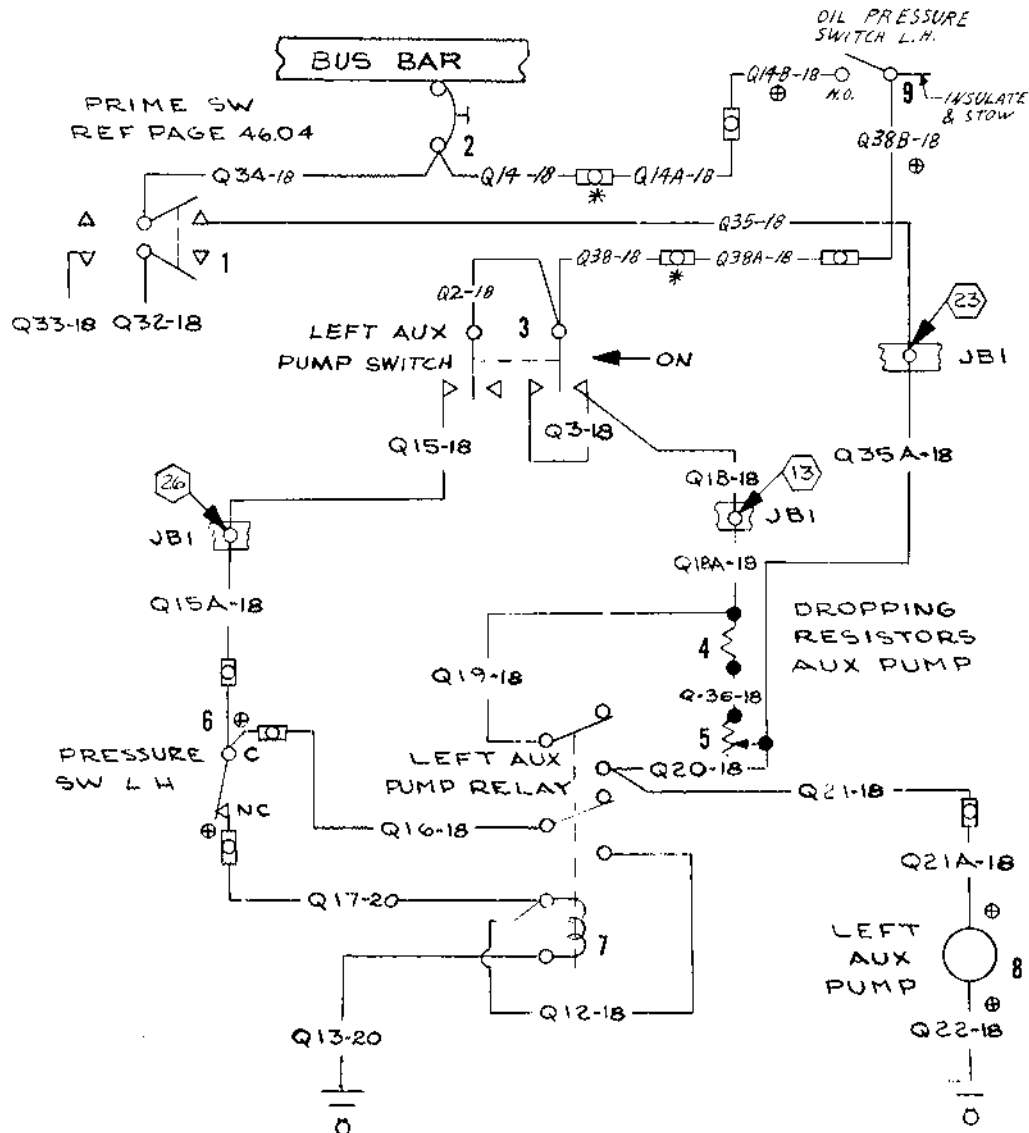


* WHEN OPTIONAL ENGINE (LESS "OIL PRESSURE SW") IS INSTL
CONNECT WIRE Q10 TO Q37 IN JB2

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	MS35059-27	Switch - Prime
3	S392-1	Switch - Right Aux Pump
4	0771	Resistor
5	0771	Resistor
6	0850452-6	Switch - Pressure
7	0850404-1	Relay - Aux Pump RH
8	0850421-1	Pump - Aux Pump RH
9	0850452-8	Oil Pressure Switch

LEFT AUX PUMP SYSTEM (OPT)

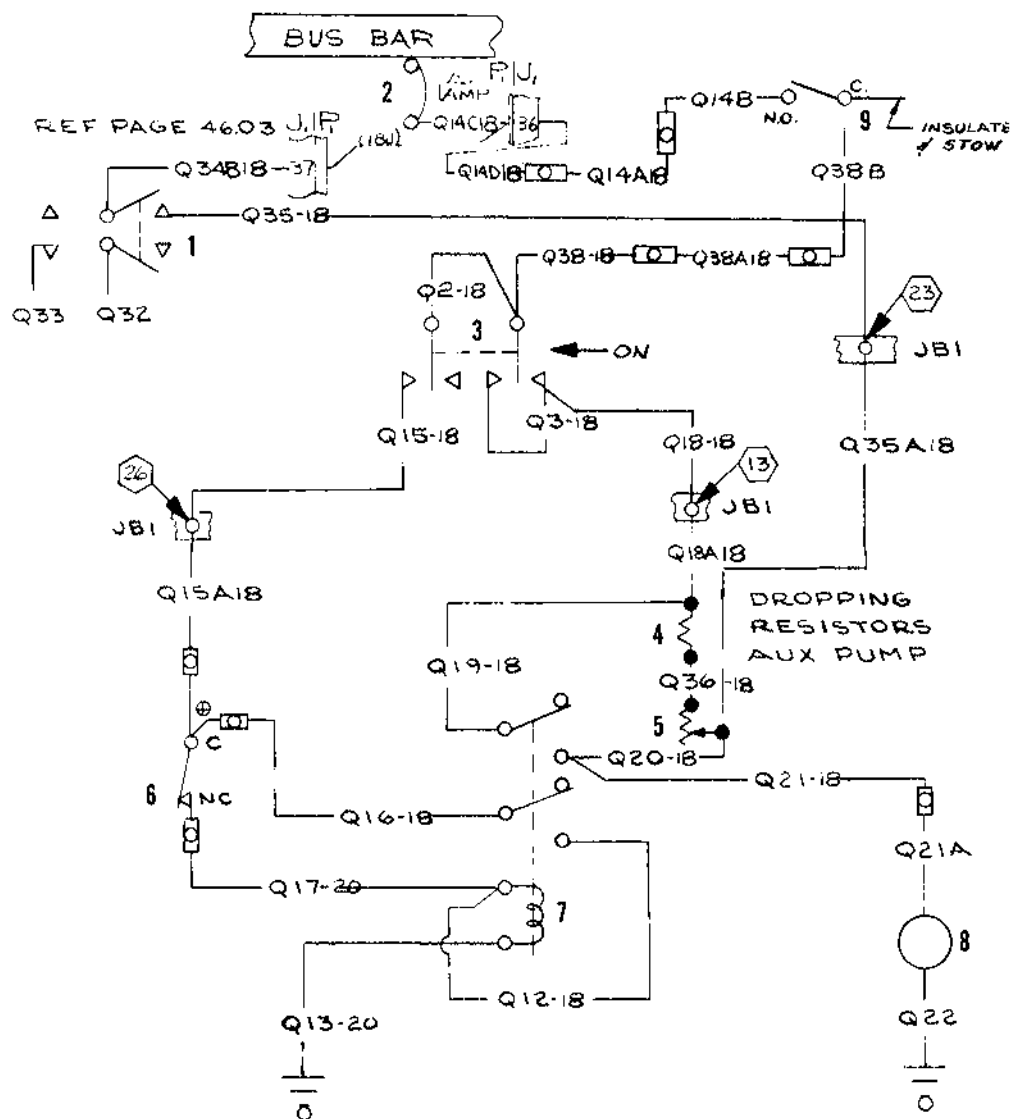
EFF. SERIALS



* DISCONNECTS IN LEFT JUNCTION BOX. WHEN OPTIONAL ENGINE (LESS "OIL PRESSURE SW") IS INSTALLED, SPLICE WIRE Q14-18 TO Q38-18 IN L. JCT. BOX.

ITEM	PART NUMBER	NOMENCLATURE
1	MS35059-27	Switch - Prime
2	S1232-505	Circuit Breaker
3	S392-1	Switch - Aux Pump L/H
4	0771	Resistor
5	0771	Resistor
6	0850452-6	Switch Pressure
7	0850404-1	Relay - Aux Pump L/H
8	0850420-1	Pump - Aux Pump L/H
9	0850452-8	Oil Pressure Switch

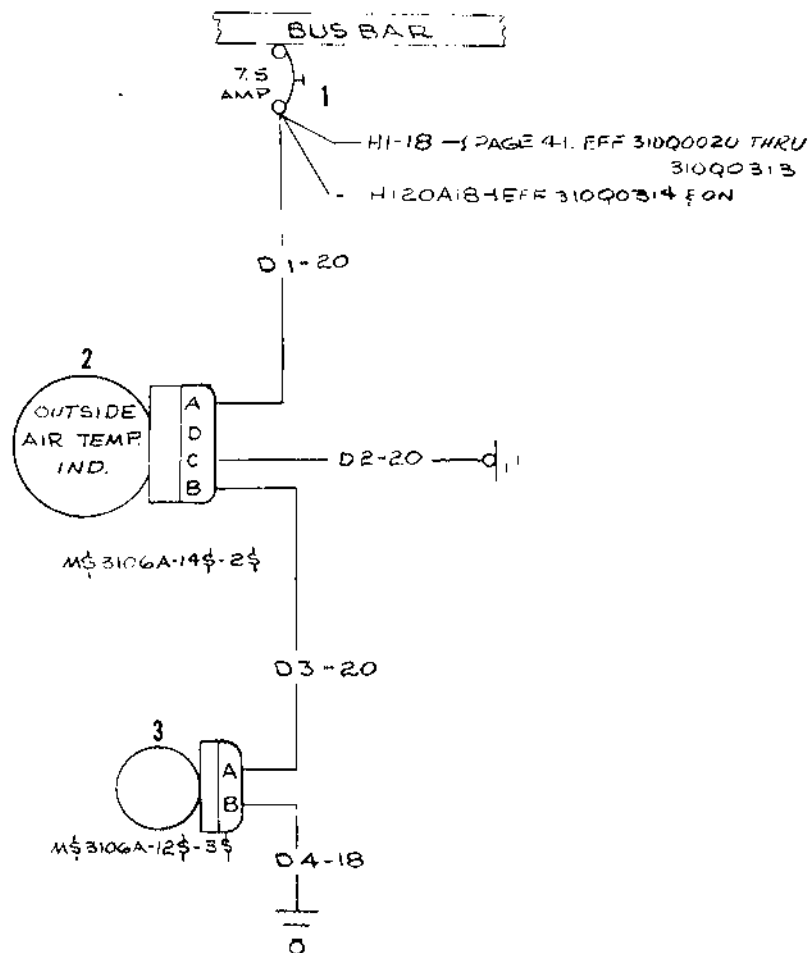
EFF. SERIALS



* DISCONNECTS IN LEFT JUNCTION BOX. WHEN OPTIONAL ENGINE (LESS "OIL PRESSURE SW") IS INSTALLED, SPLICE WIRE Q140 TO Q38 IN L. JCT. BOX.

ITEM	PART NUMBER	NOMENCLATURE
1	MS35059-27	Switch - Prime
2	S1232-507	Circuit Breaker
3	S392-1	Switch - Aux Pump LH
4	0771	Resistor
5	0771	Resistor
6	0850452-6	Switch - Pressure
7	0850404-1	Relay - Aux Pump LH
8	0850420-1	Pump - Aux Pump LH
9	0850452-8	Oil Pressure Switch

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310N MODEL	W REV.	0870090 DRAWING NO.	48.01 PAGE
OUTSIDE AIR TEMPERATURE SYSTEM (OPT)				
EFF. SERIALS				



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	CM2628L1	Indicator - Outside Air
3	0813601-3	Bulb - Outside Air Temp

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

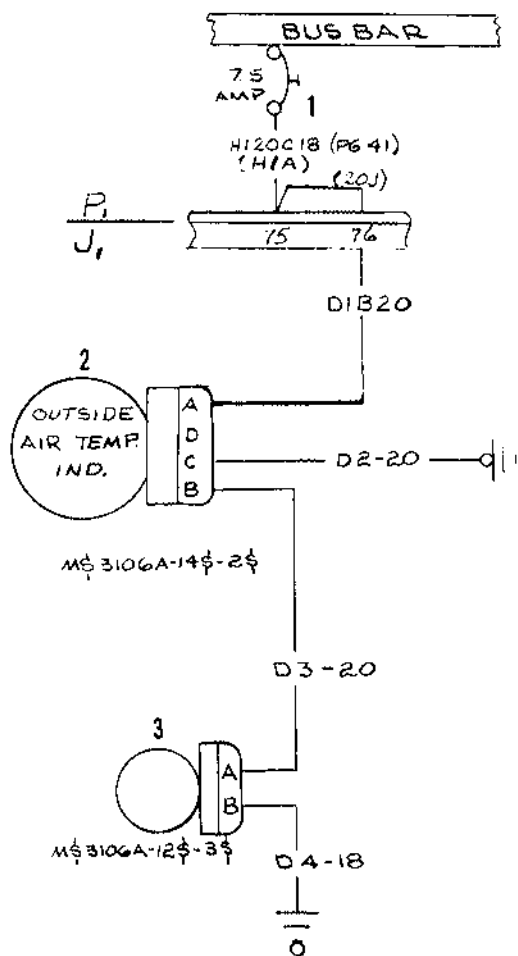
AE
REV.

0870090
DRAWING NO.

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OUTSIDE AIR TEMPERATURE SYSTEM (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

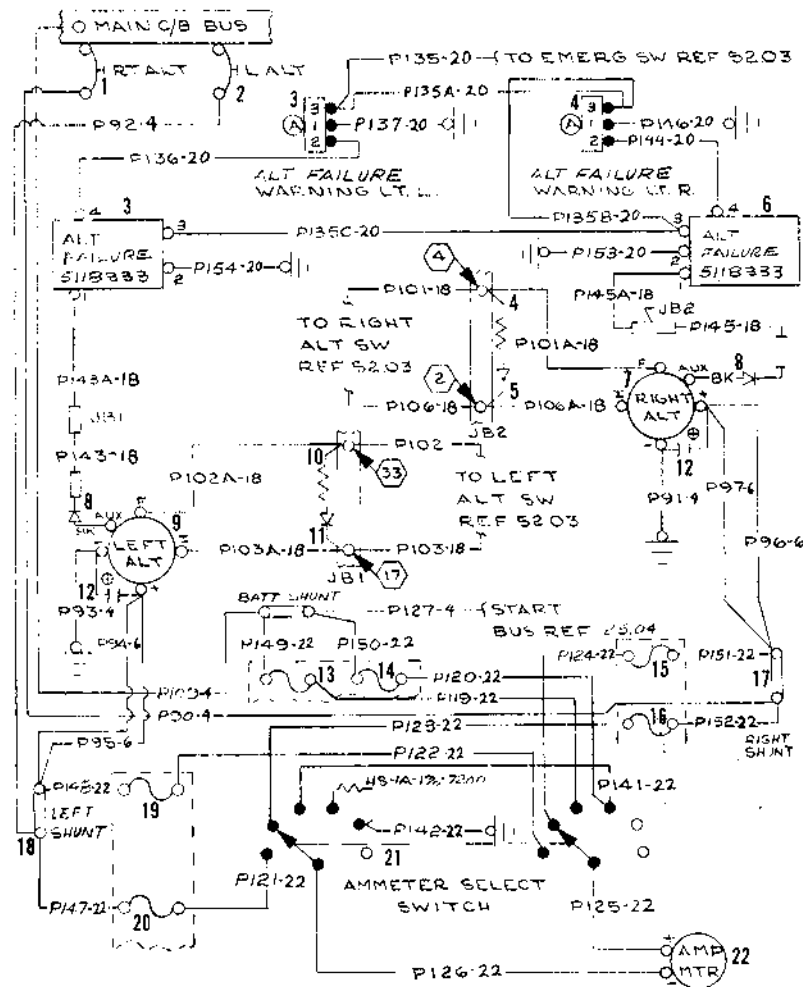
1
2
3

S1232-505
CM2628L1
0813601-3

Circuit Breaker
Indicator - Outside Air
Bulb - Outside Air Temp

50/100 AMP ALTERNATOR & AMMETER SYSTEM

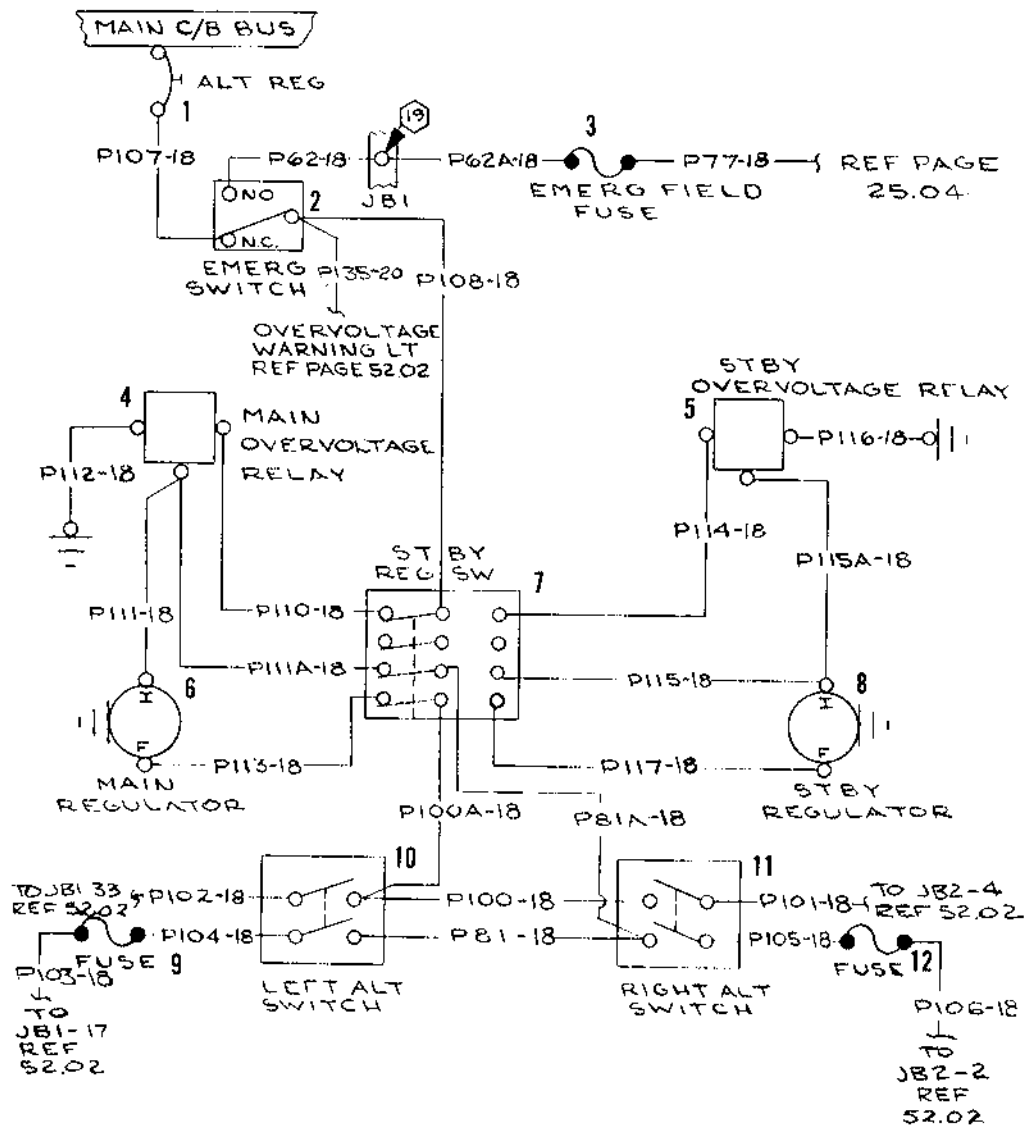
EFF. SERIALS



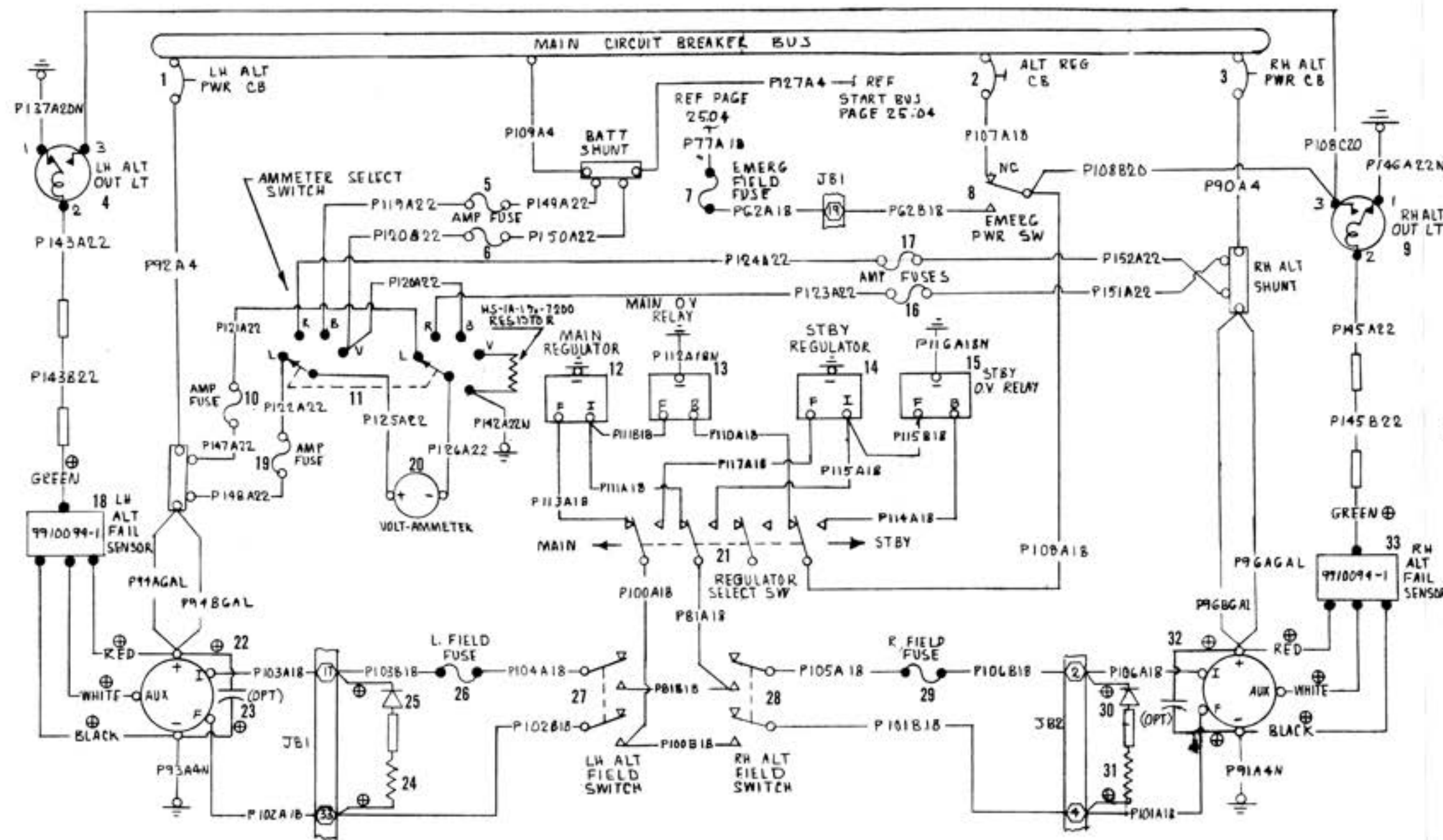
ITEM	PART NUMBER	NOMENCLATURE
1		Circuit Breaker
2		Circuit Breaker
3	5118333	Alternator Fail Module L/H
4	1000Ω 1 Watt	Resistor
5	IN4720	Diode
6	5118333	Alternator Fail Module R/H
7	634692	Alternator R/H
8	IN4720	Diode
9	634692	Alternator L/H
10	1000Ω 1 Watt	Resistor
11	IN4720	Diode
12		Capacitor
13	311005	Fuse
14	311005	Fuse
15	311005	Fuse
16	311005	Fuse
17	22370-60	Alternator Shunt R/H
18	22370-60	Alternator Shunt L/H
19	311005	Fuse
20	311005	Fuse
21	0861106-5	Switch - Ammeter Select
22	CM2627L1	Ammeter

50/100 AMP ALTERNATOR & AMMETER SYSTEM

EFF. SERIALS

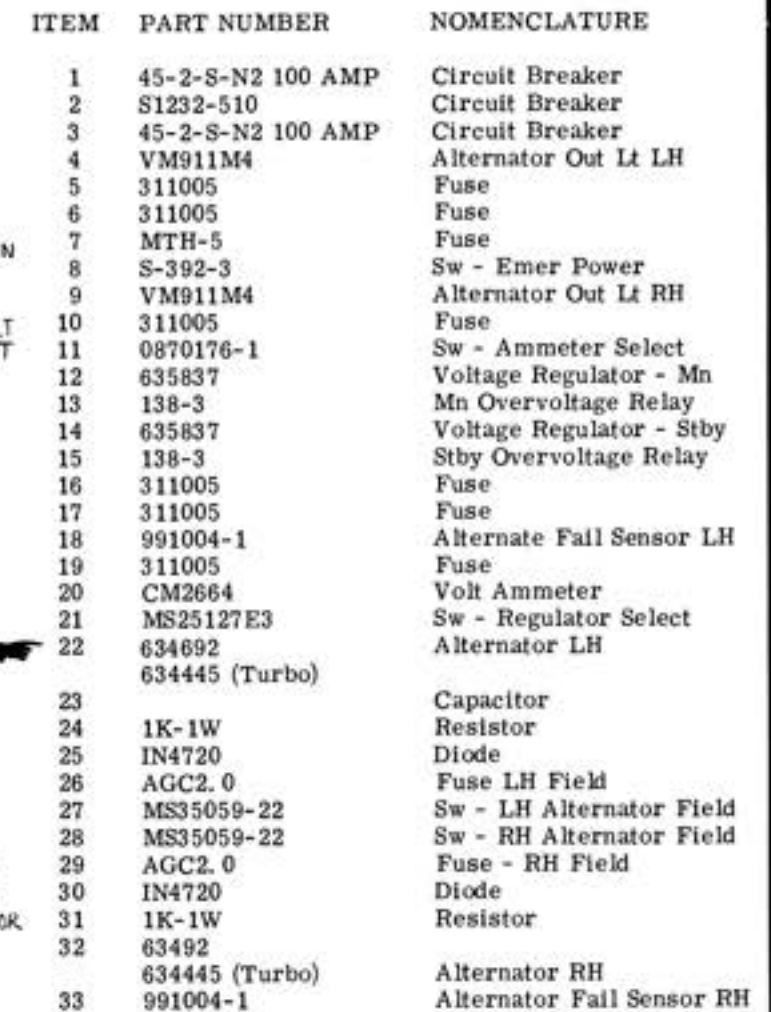


ITEM	PART NUMBER	NOMENCLATURE
1	S1232-5	Circuit Breaker
2	S392-3	Switch - Emergency
3	311005	Fuse Emergency Field
4		Main Overvoltage Relay
5		Standby Overvoltage Relay
6	CM631656	Voltage Regulator - Main
7	MS25127E3	Switch - Standby Regulator
8	CM631656	Voltage Regulator - Standby
9	311005	Fuse Alternator Field
10	MS35059-22	L/H Alternator Switch
11	MS35059-22	R/H Alternator Switch
12		Fuse Alternator Field

50/100 AMP ALTERNATOR & AMMETER SYSTEM
EFF. SERIALS

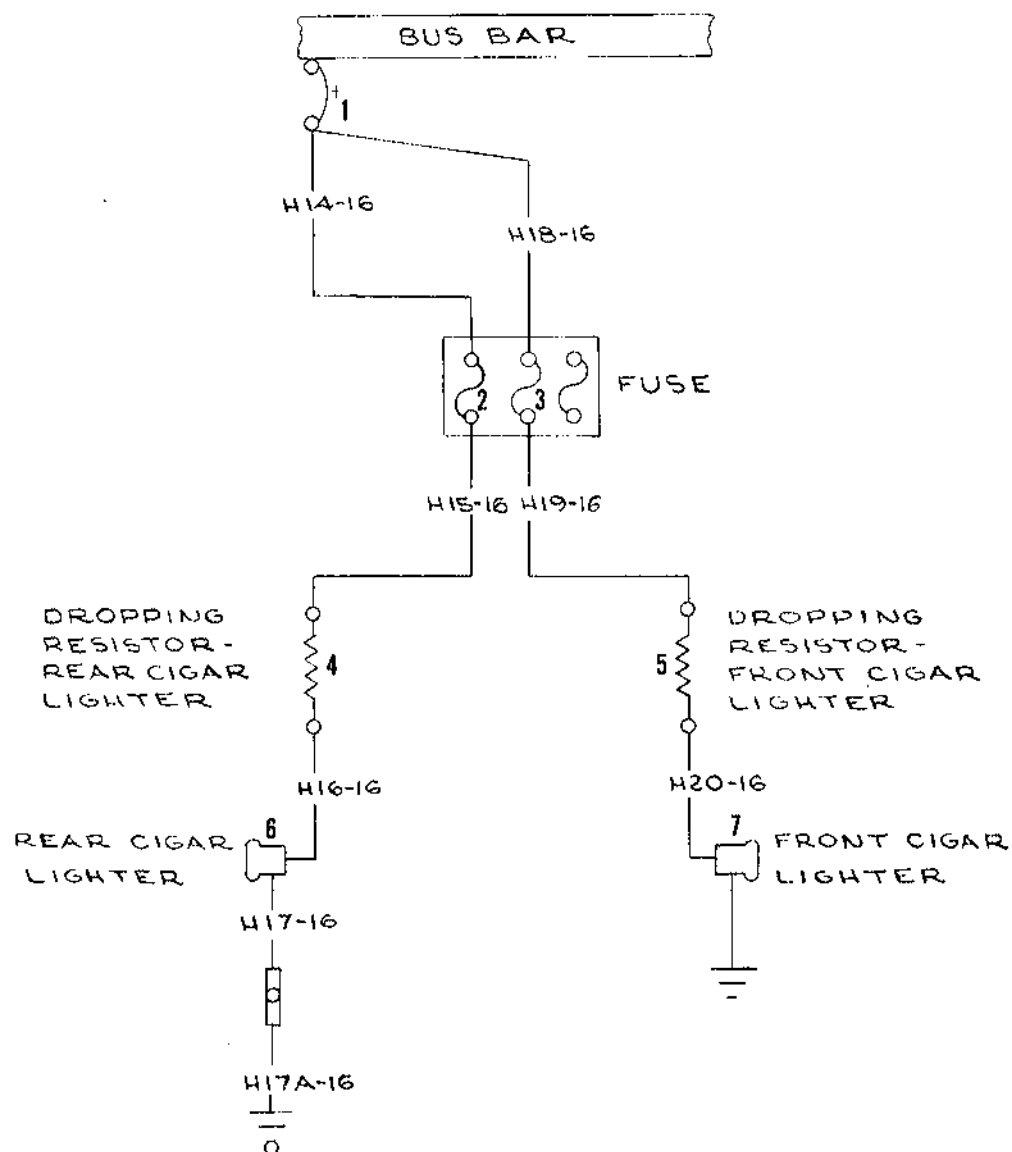
ITEM	PART NUMBER	NOMENCLATURE
1	45-2-S-N2 100 AMP	Circuit Breaker
2	S1232-510	Circuit Breaker
3	45-2-S-N2 100 AMP	Circuit Breaker
4	VM911M4	Alternator Out Lt LH
5	311005	Fuse
6	311005	Fuse
7	MTH-5	Fuse
8	S-392-3	Sw - Emer Power
9	VM911M4	Alternator Out Lt RH
10	311005	Fuse
11	0870176-1	Sw - Ammeter Select
12	635837	Voltage Regulator - Mn
13	138-3	Mn Overvoltage Relay
14	635837	Voltage Regulator Stby
15	138-3	Stby Overvoltage Relay
16	311005	Fuse
17	311005	Fuse
18	991004-1	Alternate Fail Sensor LH
19	311005	Fuse
20	CM2664	Volt Ammeter
21	MS25127E3	Sw - Regulator Select
22	634692	Alternator LH
	634445 (Turbo)	
23		Capacitor
24	1K-1W	Resistor
25	IN4720	Diode
26	AGC2.0	Fuse LH Field
27	MS35059-22	Sw - LH Alternator Field
28	MS35059-22	Sw - RH Alternator Field
29	AGC 2.0	Fuse - RH Field
30	IN4720	Diode
31	1K-1W	Resistor
32	63492	Alternator RH
	634445 (Turbo)	
33	991004-1	Alternator Fail Sensor RH

EFF. SERIALS



CIGAR LIGHTERS - FRONT & REAR

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6
7

S1232-515
SFE6
SFE6
1D1760
1D1760
0513052
0513052

Circuit Breaker
Fuse
Fuse
Resistor
Resistor
Rear Lighter
Front Lighter

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

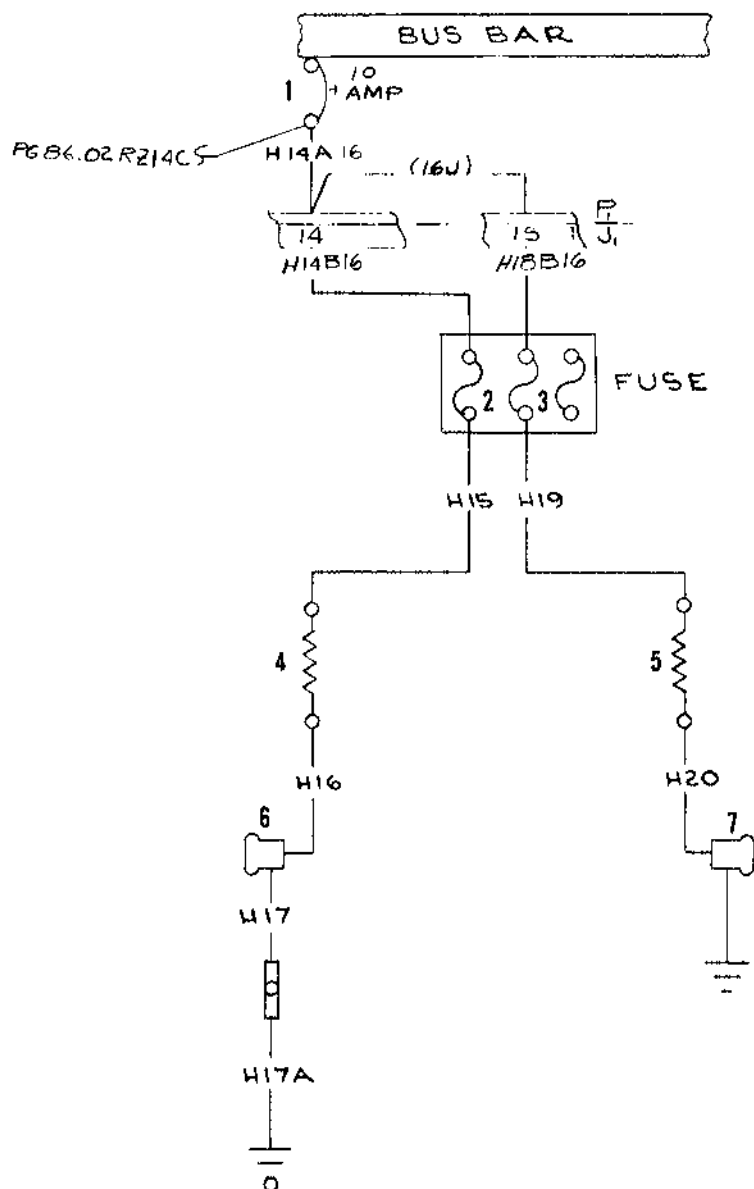
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CIGAR LIGHTERS - FRONT & REAR

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-515	Circuit Breaker
2	SFE6	Fuse
3	SFE6	Fuse
4	1D1760	Resistor
5	1D1760	Resistor
6	0513052	Rear Lighter
7	0513052	Front Lighter

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

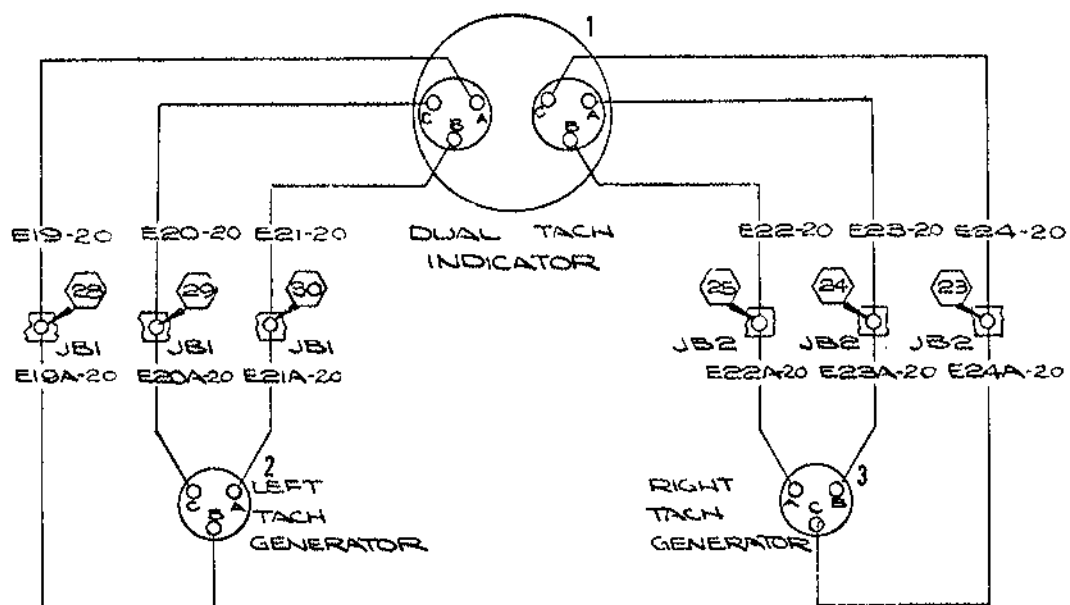
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54.00
PAGE

DUAL TACHOMETER SYSTEM

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3

CM2638L1
0850350-3
0850350-3

Tachometer Indicator
Tachometer Generator
Tachometer Generator

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

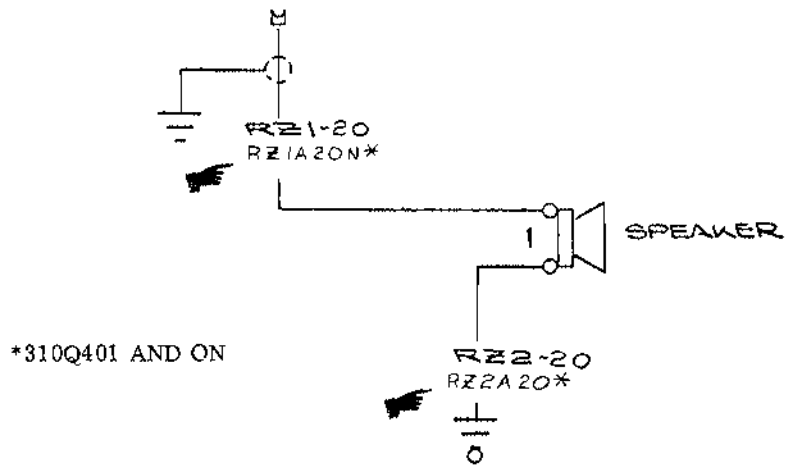
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SPEAKER CIRCUIT

EFF. SERIALS



ITEM

PART NUMBER

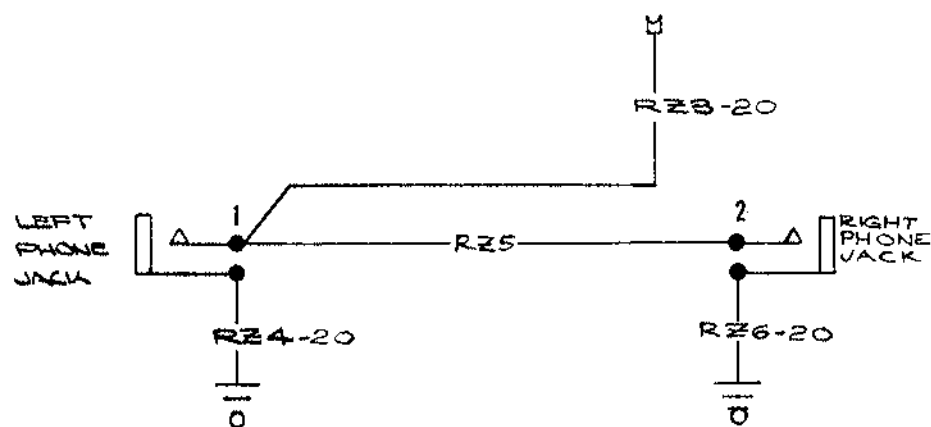
NOMENCLATURE

1

525-10C4HT

Speaker - Cabin

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	56.00 PAGE
PHONE JACK CIRCUIT				
EFF. SERIALS				



ITEM	PART NUMBER	NOMENCLATURE
1	S1103-1	Headphone Jack - L/H
2	S1103-1	Headphone Jack - R/H

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

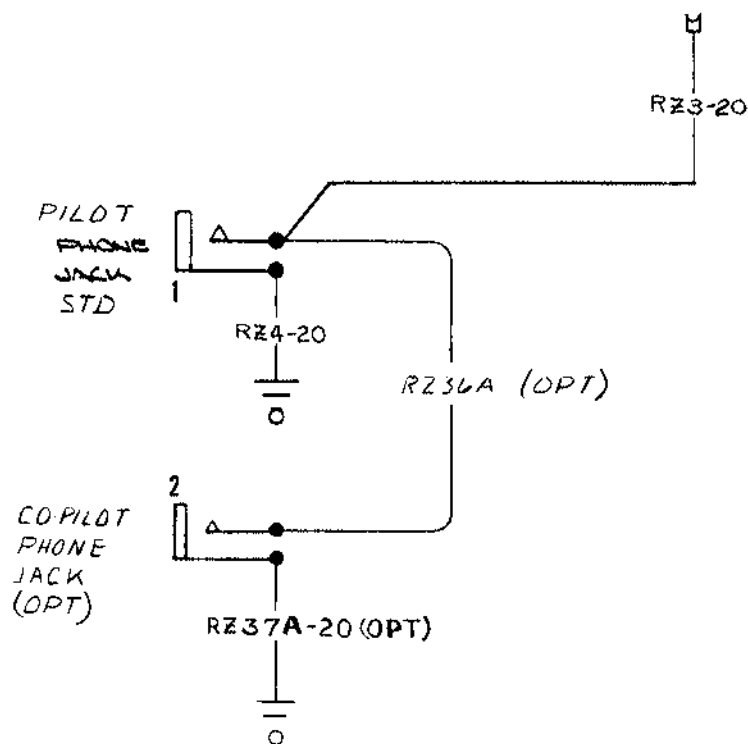
REV

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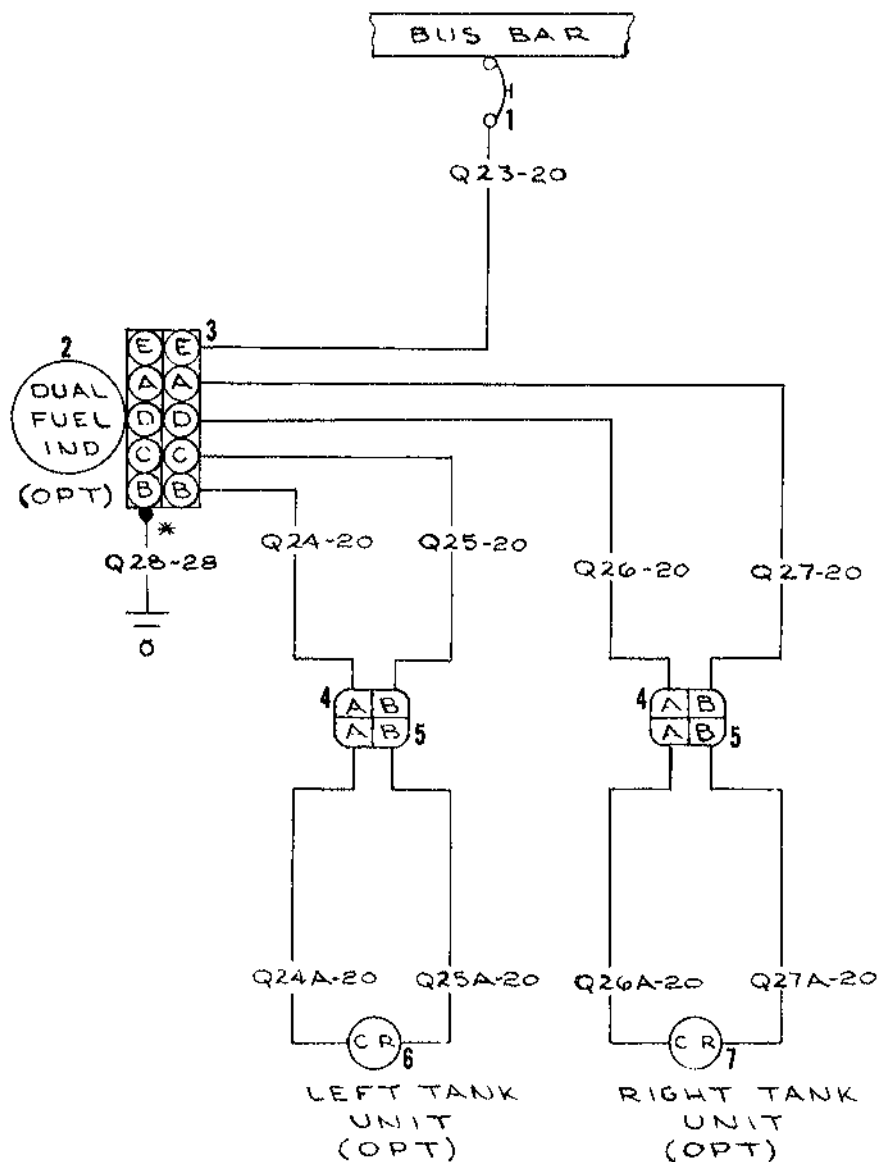
PHONE JACK CIRCUIT

EFF. SERIALS 310Q0201 & ON



Item	Part Number	Nomenclature
1	S1103-1	Headphone Jack
2	S1103-1	Headphone Jack

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	57.00 PAGE
AUXILIARY FUEL INDICATION SYSTEM (OPT)				
EFF. SERIALS 310P0001 TO 310Q0001				

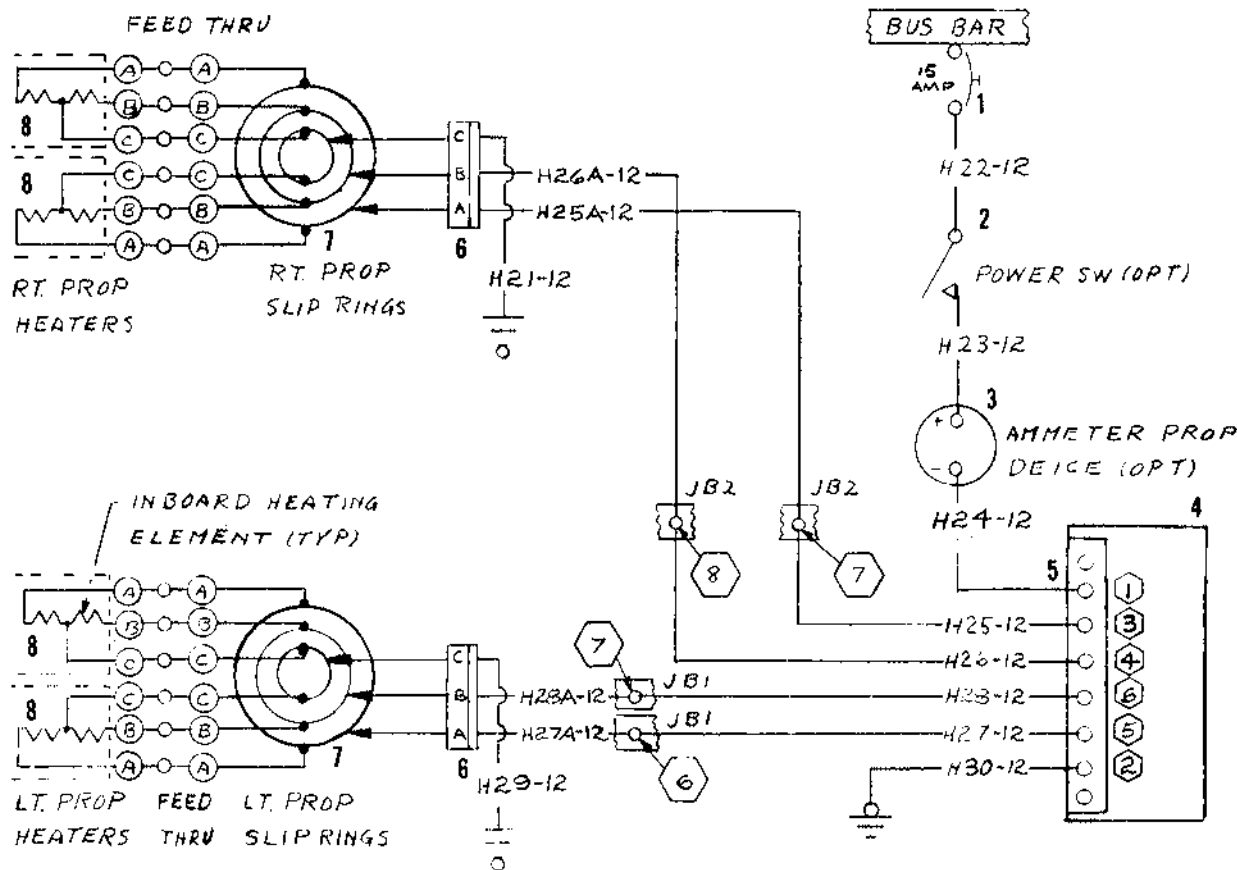


* GND WIRE TO BE SOLDERED TO GND TAB
LOCATED ON BACK OF INSTRUMENT.

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	C662005-0101	Dual Fuel Indicator
3	MS2106B-14S-5S	Connector
4	MS2100A-10SL-4P	Connector
5	MS2108B-10SL-4S	Connector
6	0823344-1	Tank Unit L/H
7	0823344-1	Tank Unit R/H

PROP DEICE SYSTEM

EFF. SERIALS



NOTE: DIAG SHOWN IS FOR TWO BLADED PROP.
FOR THREE BLADED PROP ADD ONE SET OF
HEATERS & RE-ARRANGE CONNECTION
TO SLIP RING.

ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6
7
8

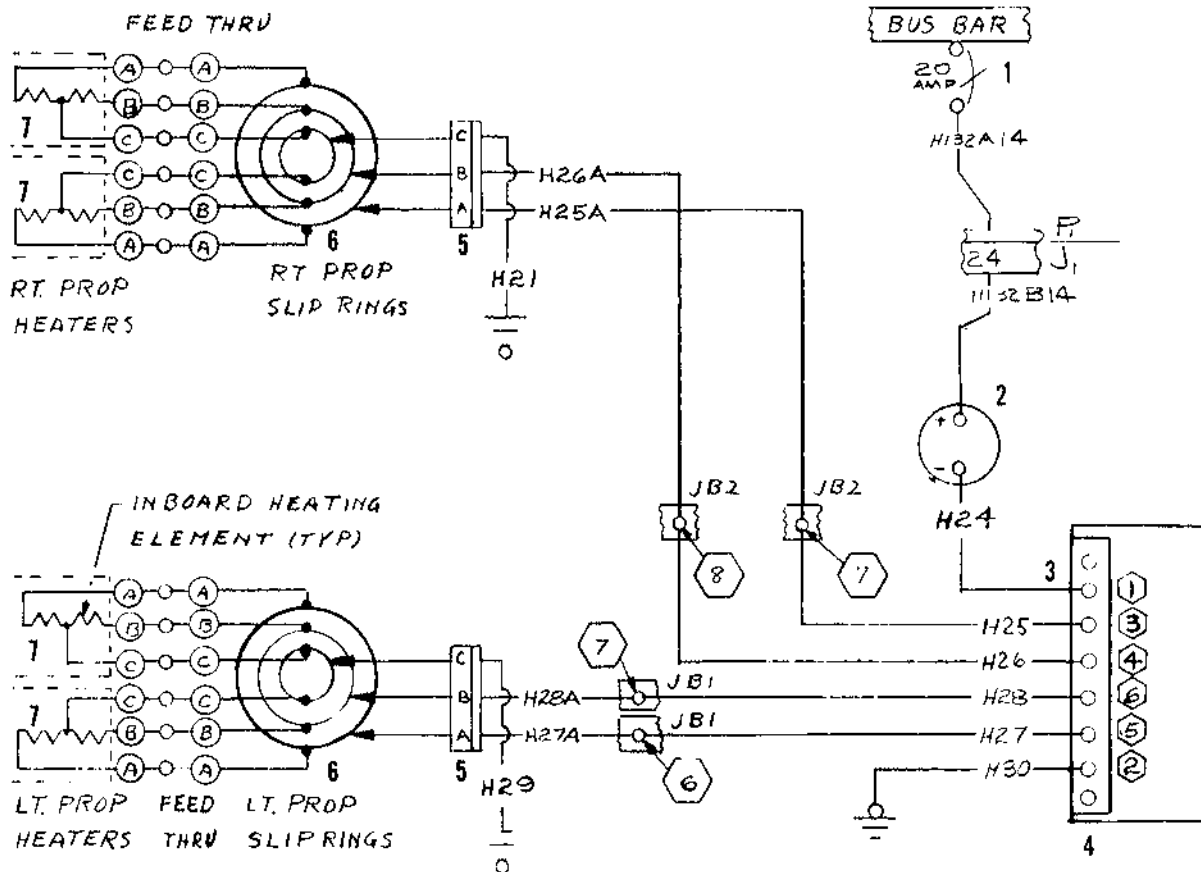
S1232-510
S382-2
CM2631-2
0870177-1
MS3106-A-20-15S
0870155-18
0870155-14
C165013-0301

Circuit Breaker
Switch
Ammeter Prop Deice
Timer
Connector
Brush Holder
Slip Ring
Heating Element

PROP DE-ICE SYSTEM

(OPT)

EFF. SERIALS



NOTE: DIAG SHOWN IS FOR TWO BLADED PROP.
FOR THREE BLADED PROP ADD ONE SET OF
HEATERS & RE-ARRANGE CONNECTION
TO SLIP RING.

ITEM	PART NUMBER	NOMENCLATURE
1	112-220-101	Switch Breaker
2	CM2631-2	Ammeter - Prop Deice
3	MS3106-A-20-15S	Connector
4	0870177-1 or A43420-P3	Timer
5	0870155-18	Brush Holder
6	0870155-14	Slip Ring
7	C165013-0301	Heating Element

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

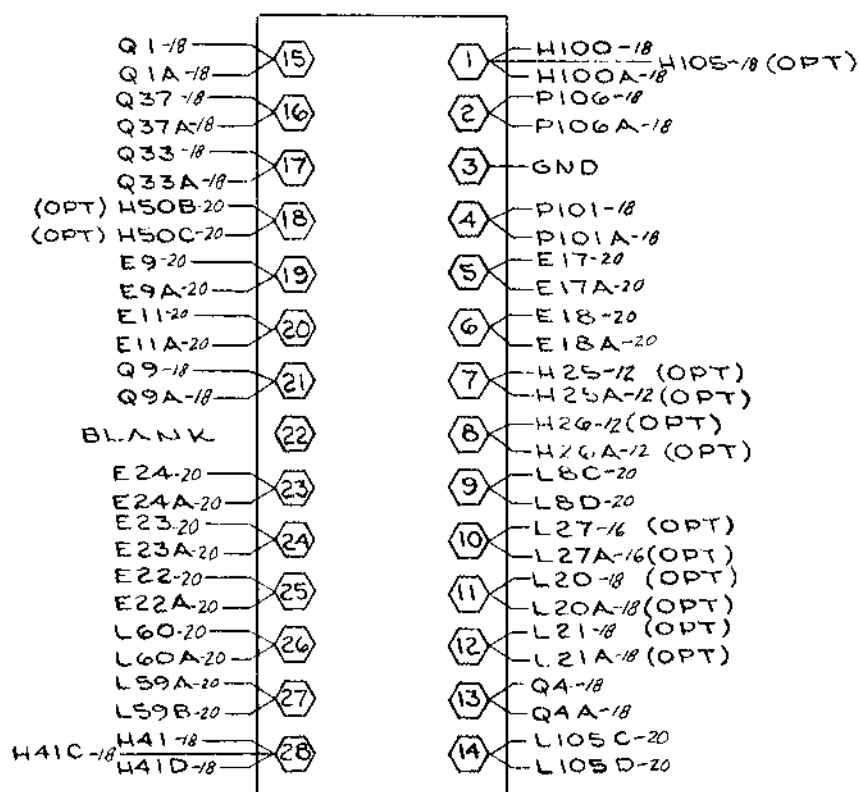
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RIGHT JUNCTION BOX CONNECTIONS

EFF. SERIALS 310P0001 TO 310Q0001



RIGHT JUNCTION
BOX
JB2

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

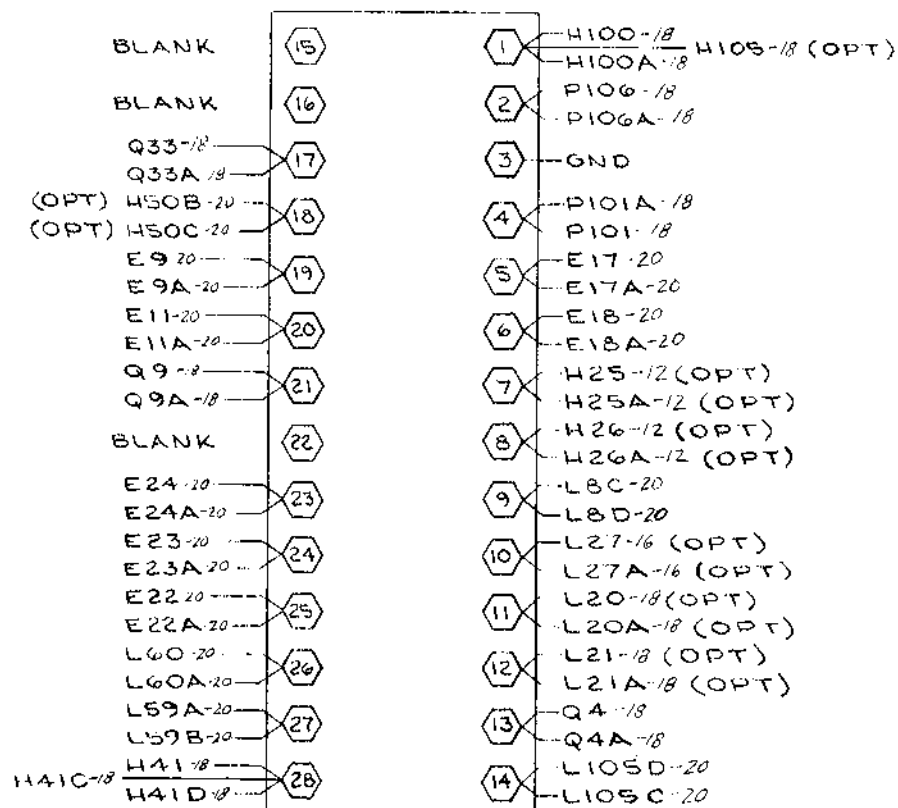
REV.

0870090
DRAWING NO.

59.07
PAGE

RIGHT JUNCTION BOX CONNECTIONS (OPT)

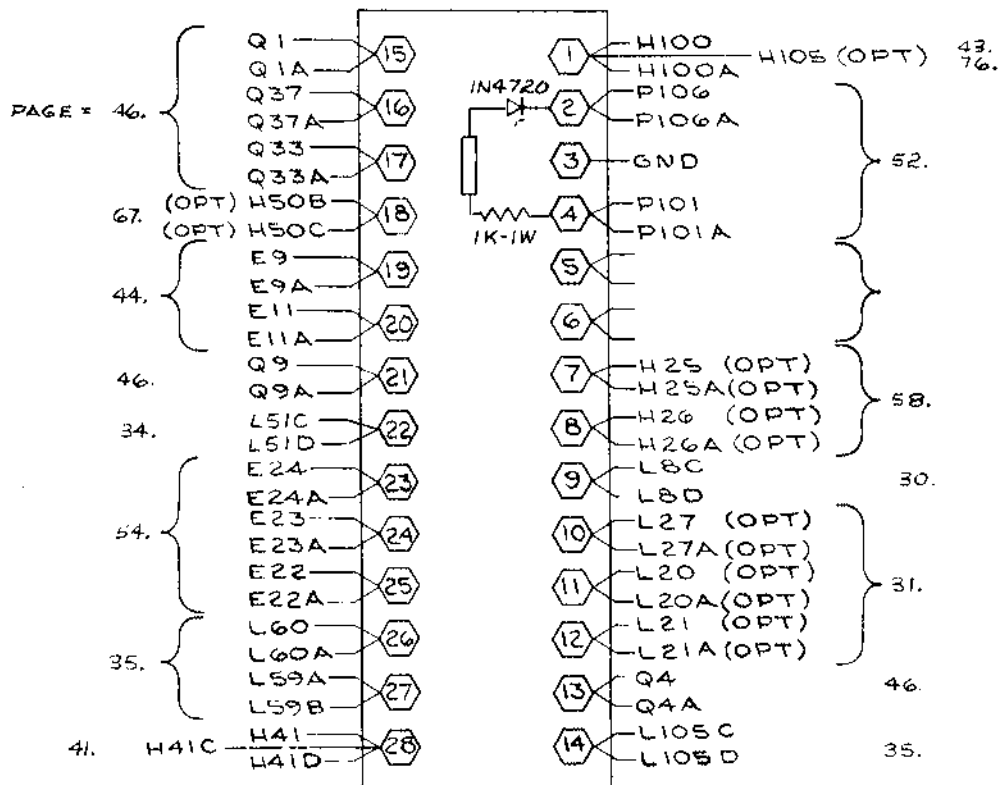
EFF. SERIALS 310P0001 TO 310Q0001



RIGHT JUNCTION
BOX
JB2

RIGHT JUNCTION BOX CONNECTIONS

EFF. SERIALS 310Q0001 AND ON



CESSNA AIRCRAFT CO.
WICHITA, KANSAS

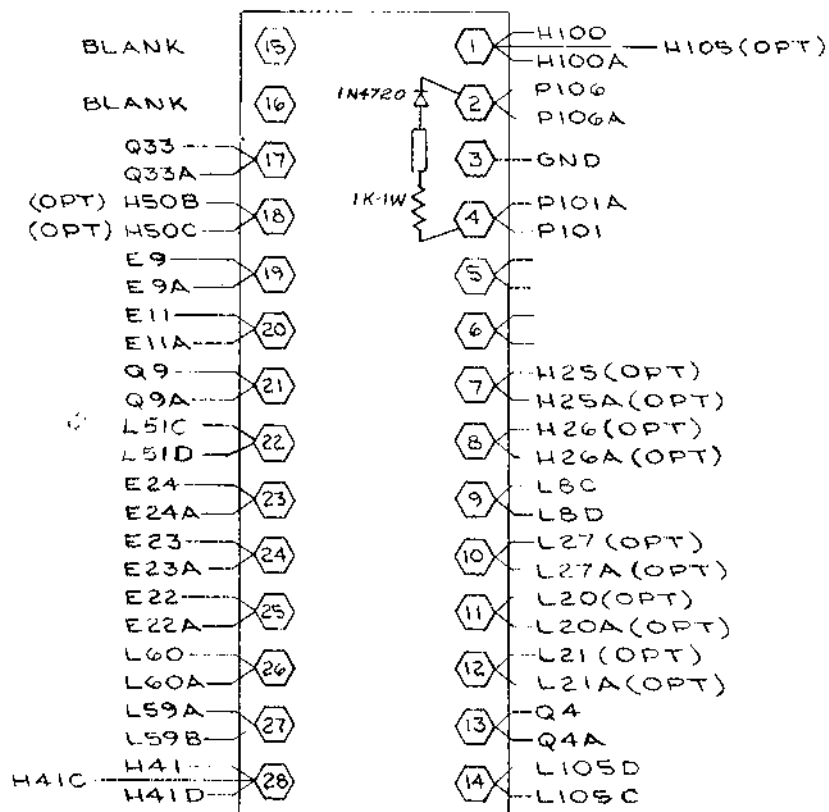
MODEL REV.

DRAWING NO.

59.09
PAGE

RIGHT JUNCTION BOX CONNECTIONS (OPT)

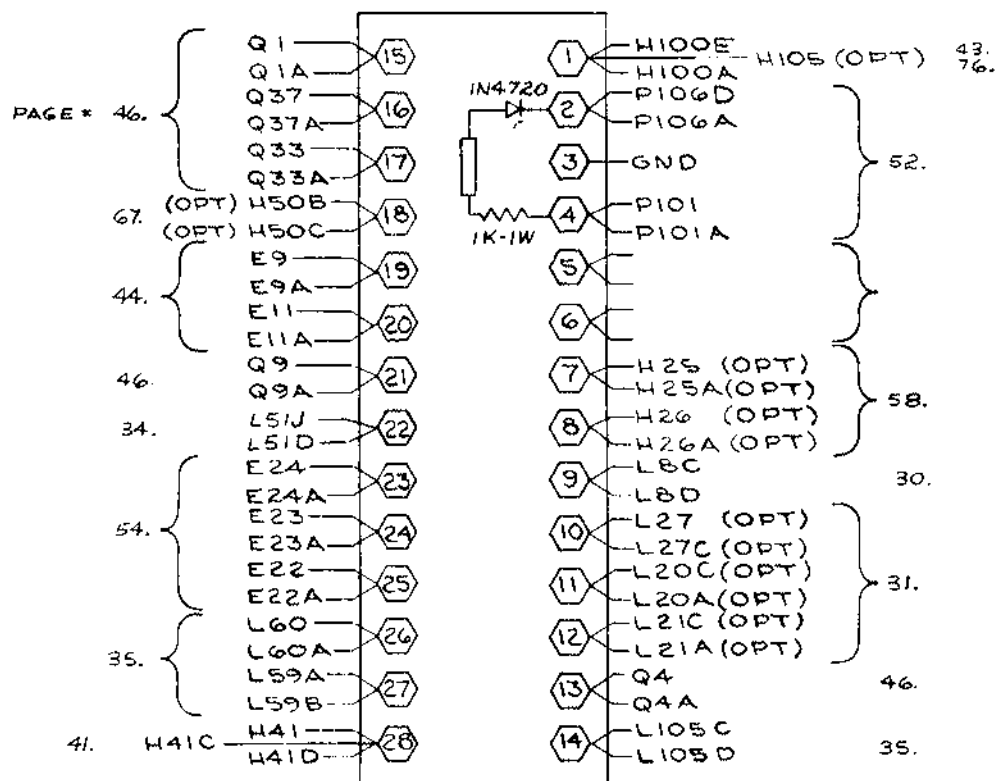
EFF. SERIALS 310Q0001 AND ON



RIGHT JUNCTION
BOX
JB2

RIGHT JUNCTION BOX CONNECTIONS

EFF. SERIALS



RIGHT JUNCTION
BOX
JB2

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

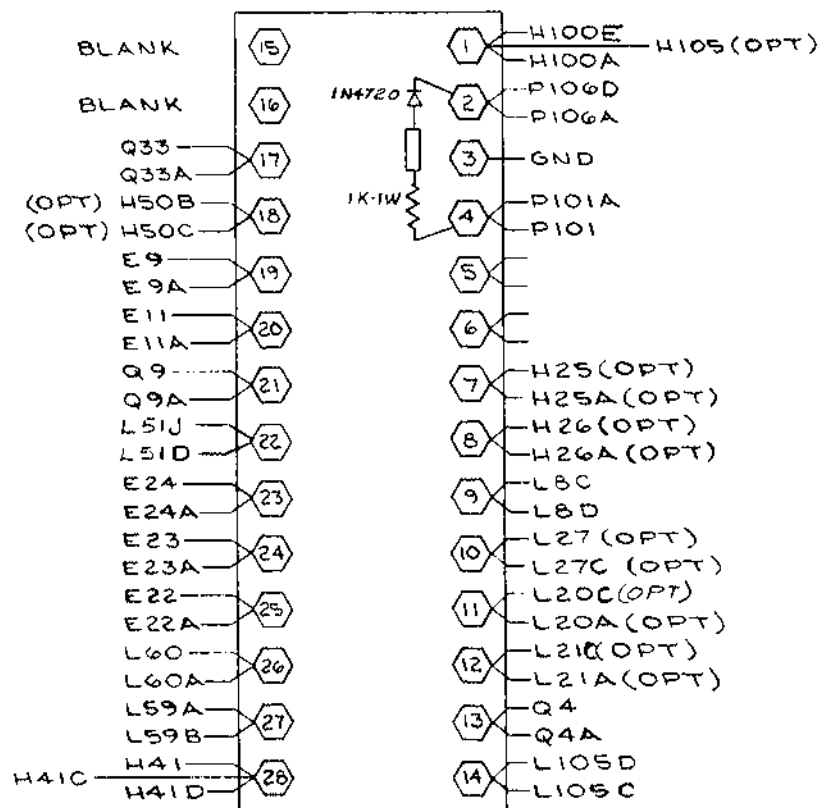
310 Q W
MODEL REV.

0870090
DRAWING NO.

59.11
PAGE

RIGHT JUNCTION BOX CONNECTIONS (OPT)

EFF. SERIALS



RIGHT JUNCTION
BOX
JB2

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

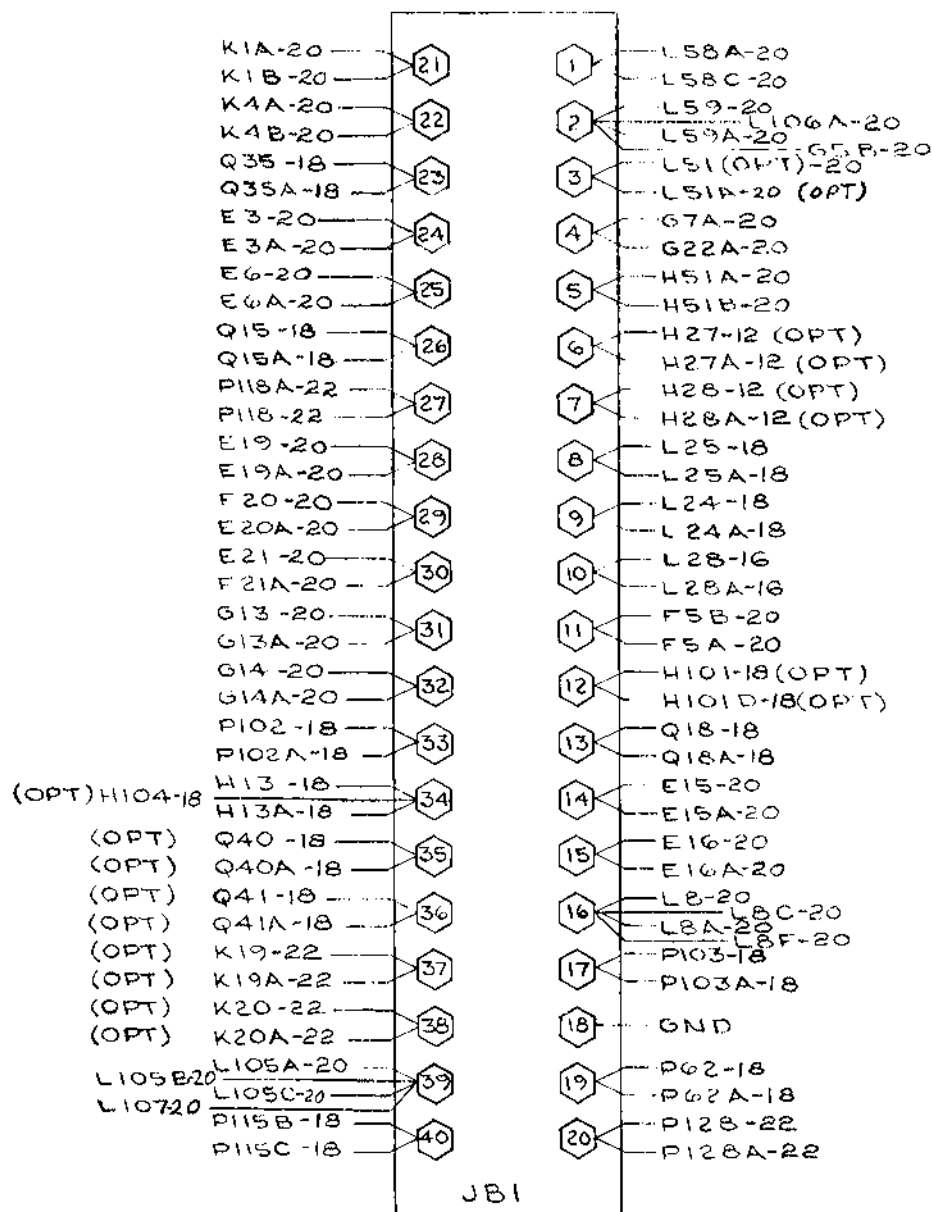
REV.

0870090
DRAWING NO.

60.07
PAGE

LEFT JUNCTION BOX CONNECTIONS

EFF. SERIALS 310P0001 TO 310Q0001



LEFT JUNCTION BOX

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

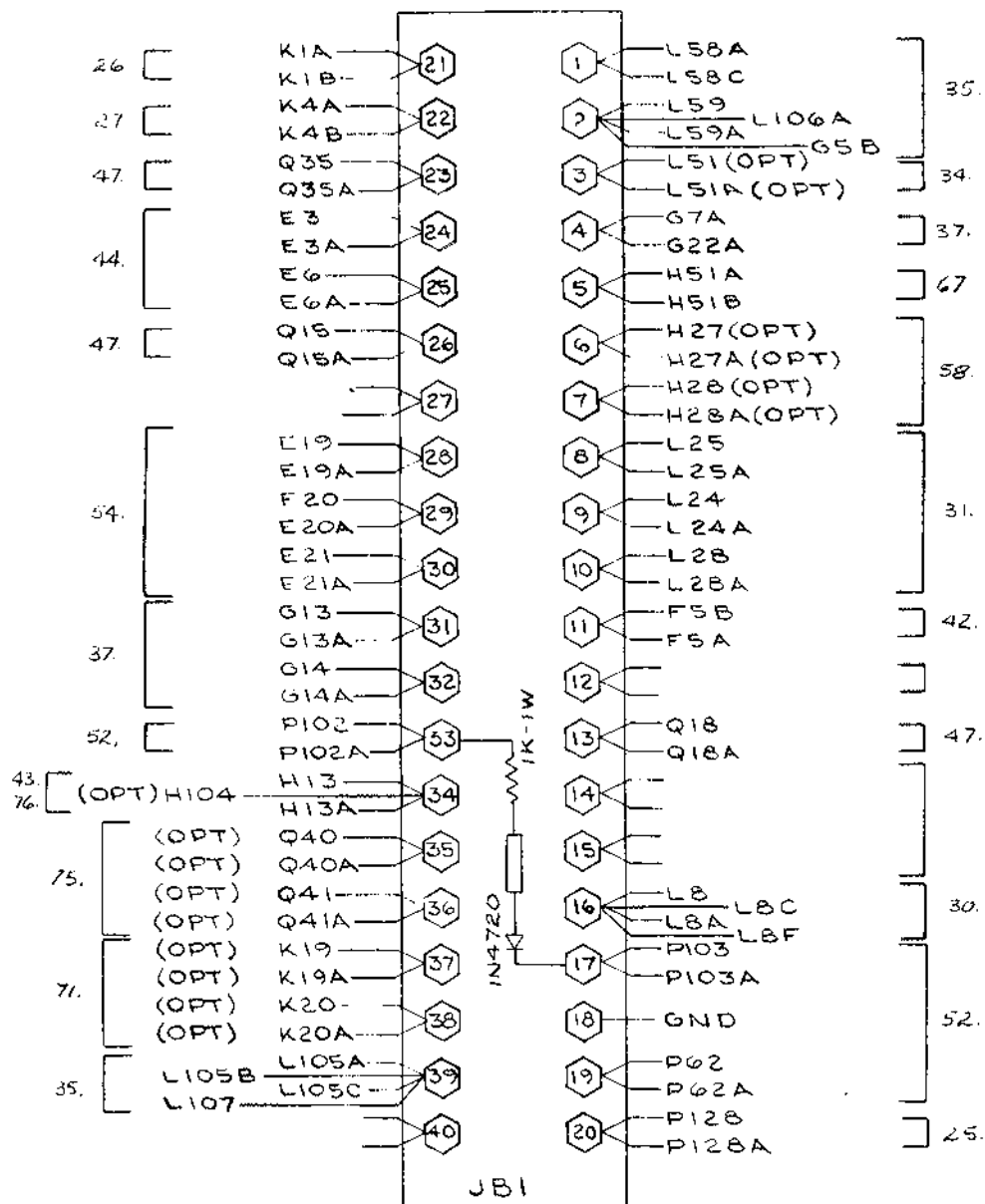
REV.

0870090
DRAWING NO.

60.08
PAGE

LEFT JUNCTION BOX CONNECTIONS

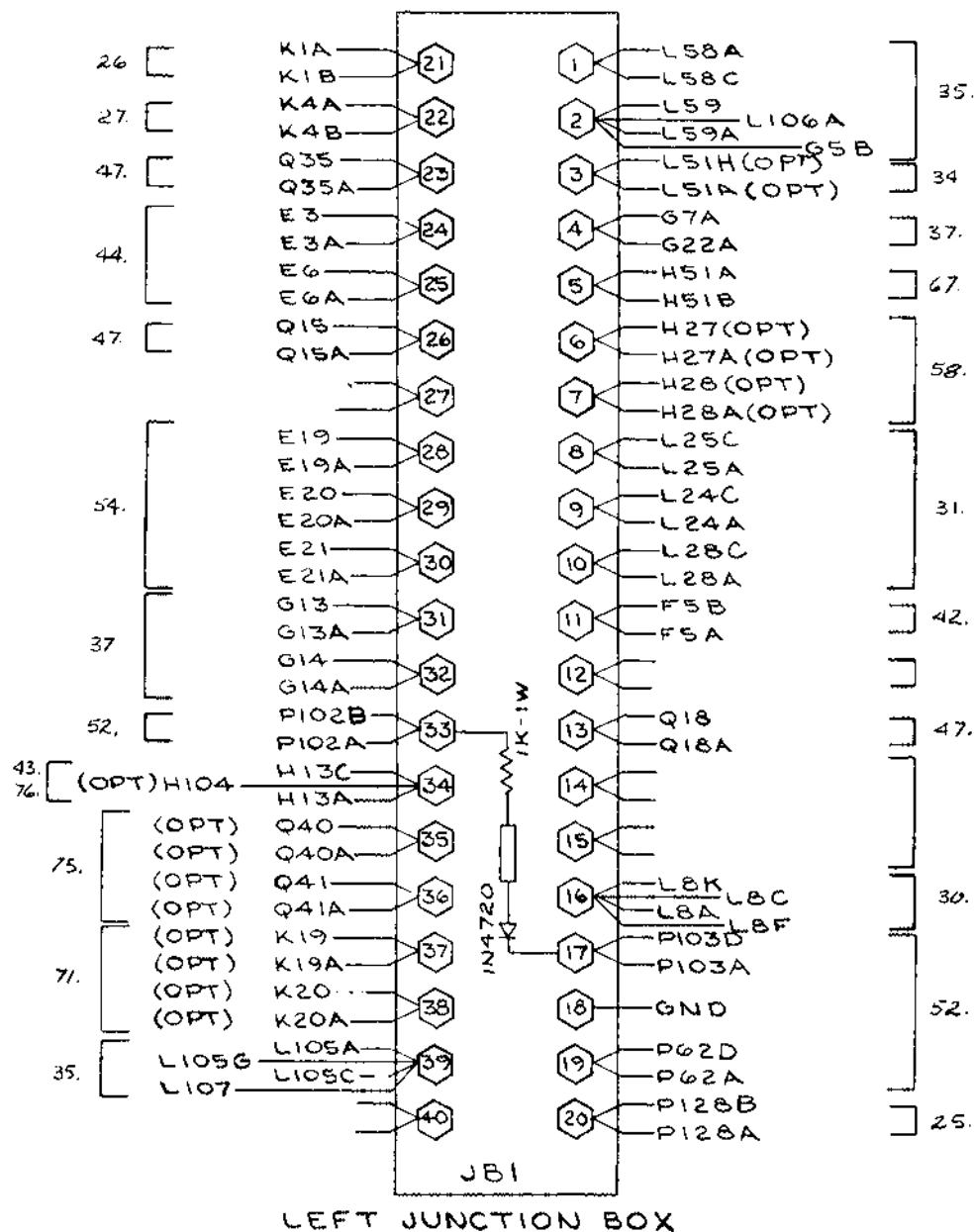
EFF. SERIALS 310Q0001 AND ON



LEFT JUNCTION BOX

LEFT JUNCTION BOX CONNECTIONS

EFF. SERIALS



CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

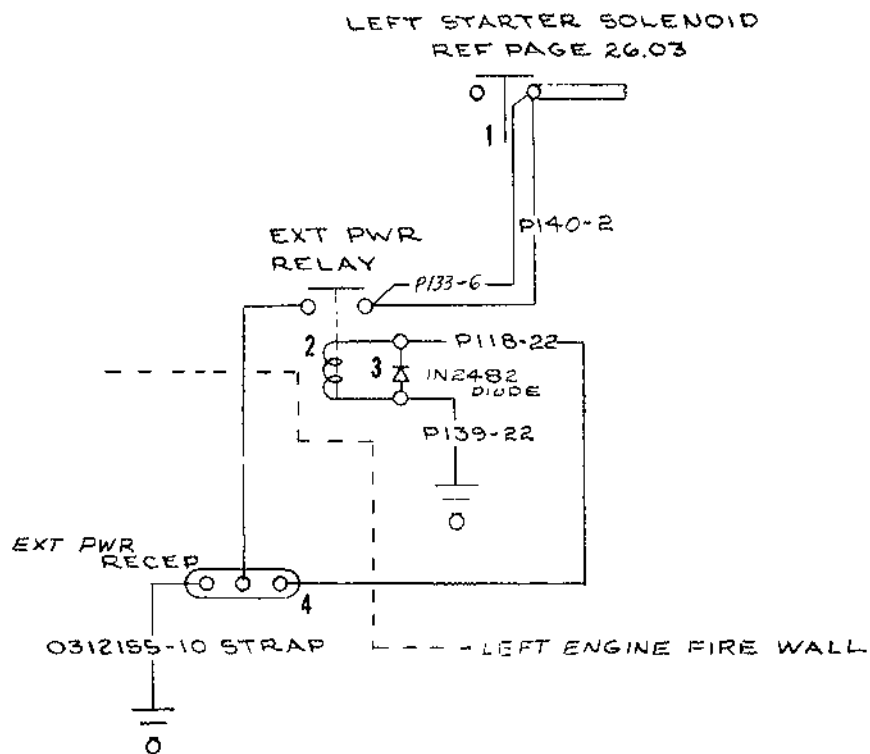
REV.

0870090
DRAWING NO.

61. 04
PAGE

EXTERNAL POWER RECEPTACLE (OPT)

EFF. SERIALS 310P0001 TO 310P0073



ITEM

PART NUMBER

NOMENCLATURE

1	0850469-1	Left Starter Relay
2	0850469-1	External Power Relay
3	IN2482	Diode
4	AN2552-3A	External Power Receptacle

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

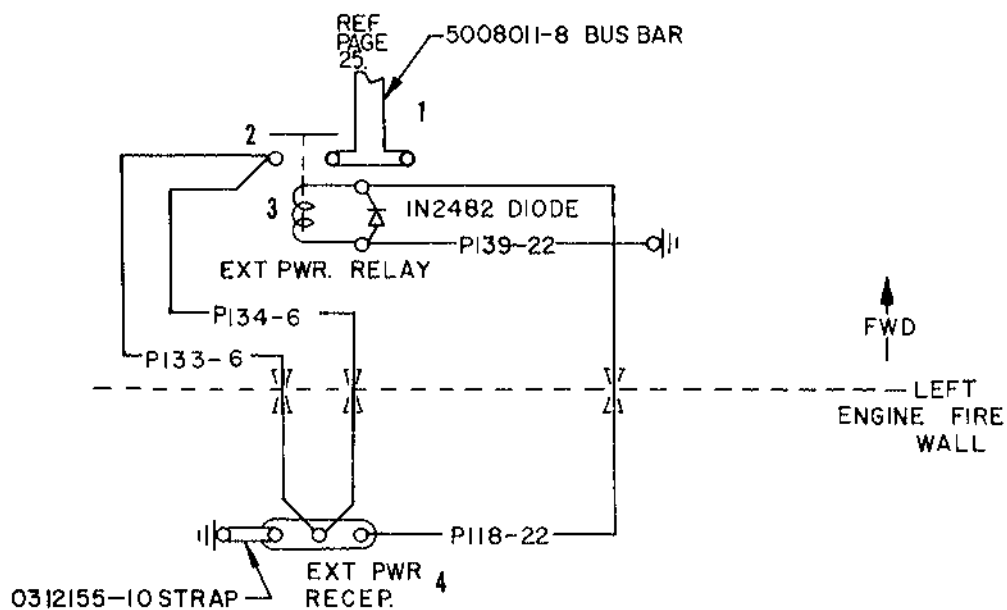
REV.

0870090
DRAWING NO.

61.05
PAGE

EXTERNAL POWER RECEPTACLE (OPT)

EFF. SERIALS 310P0073 AND ON



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4

5008011-8
0850469-1
IN2482
AN2552-3A

Bus Bar
External Power Relay
Diode
External Power Receptacle

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310

MODEL

REV.

0870090

DRAWING NO.

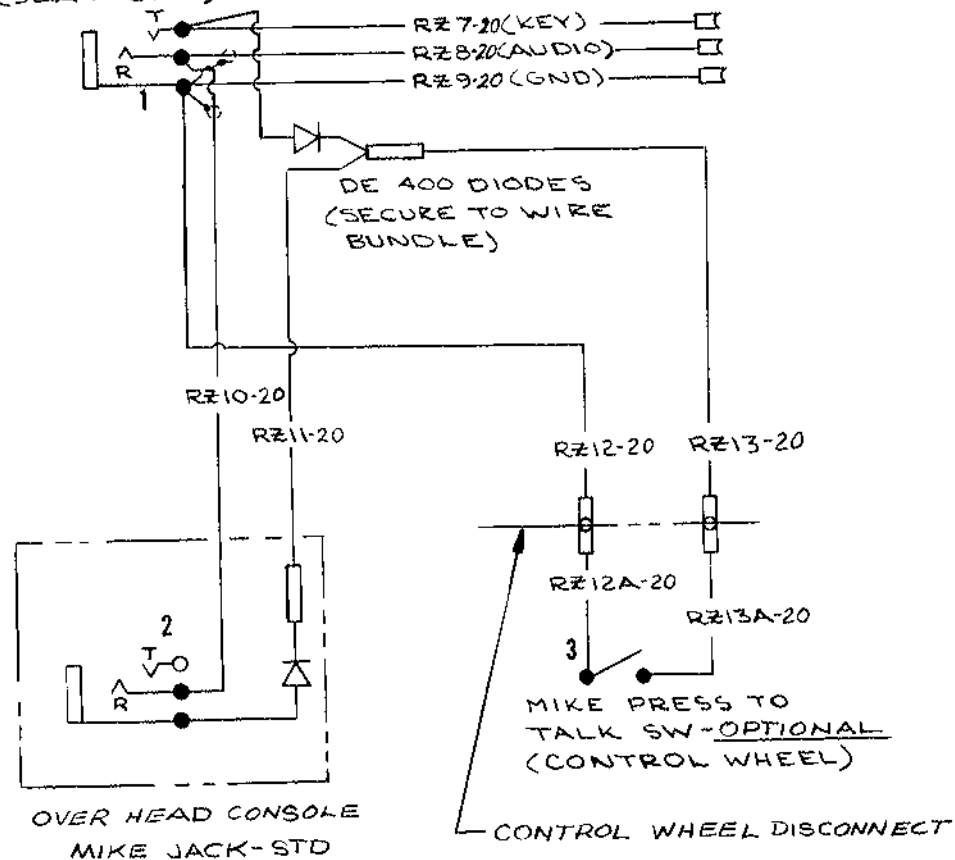
62.02

PAGE

MIKE JACK CIRCUIT (OPT)

EFF. SERIALS 310P0001 TO 310Q0201

MIKE JACK-STD
(SEAT BKT)



NOTE:

SEE PAGE 77. FOR BOOM MIKE
INSTALLATION.

ITEM

PART NUMBER

NOMENCLATURE

1
2
3

S1102-1
S1102-1
T2114

Microphone Jack (Seat)
Mic Jack (Console Mounted)
Mic Switch - Control Wheel

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

REV.

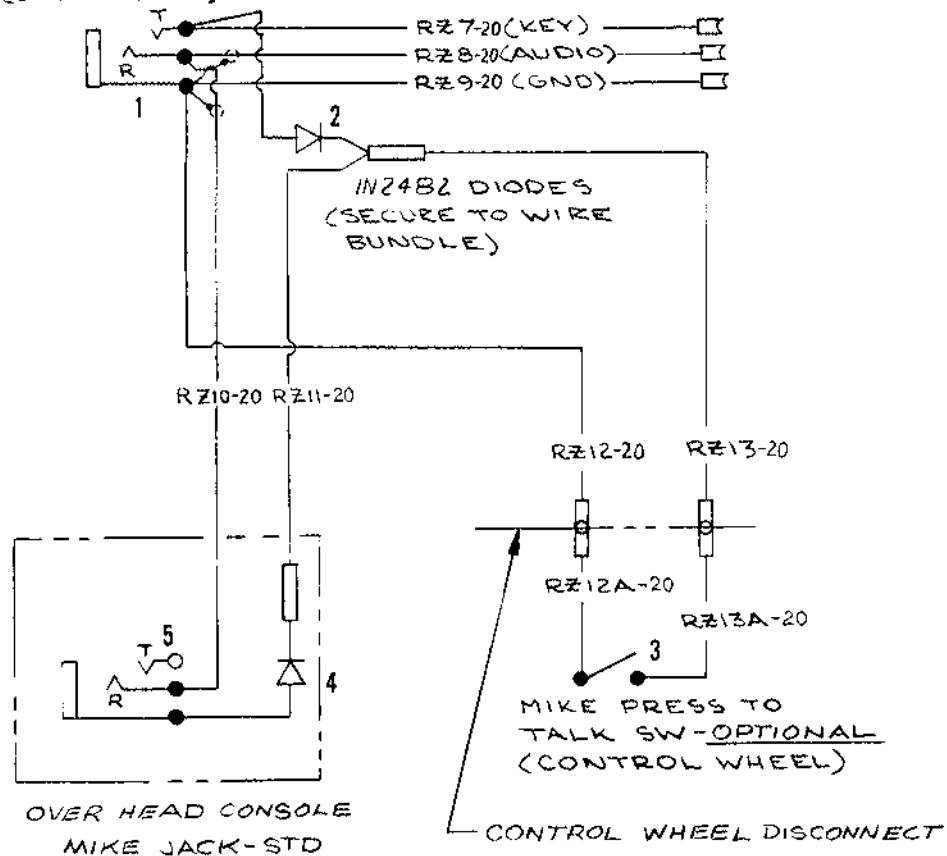
0870090
DRAWING NO.

62.03
PAGE

MIKE JACK CIRCUIT (PARTIAL)

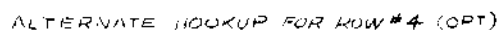
EFF. SERIALS 310Q0201 & ON

MIKE JACK-STD
(SEAT BKT)



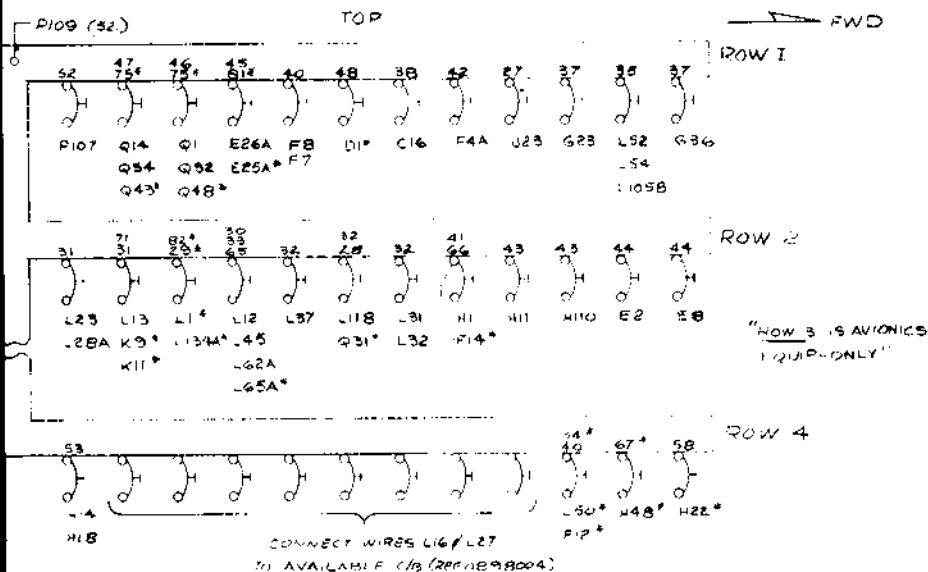
Item	Part Number	Nomenclature
1	S1102-1	Mike Jack
2	IN2482	Diode
3	T2114	Switch
4	IN2482	Diode
5	S1102-1	Mike Jack

EFF. SERIALS 310P0001 TO 310Q0001



EXCEPTIONAL EQUIP
- AVIONICS EQUIP

EFF. SERIALS 310Q0001 TO 310Q0020



ALTERNATE HOOKUP FOR ROW #4 (OPT)

PAGE	53				72	72	70	70	84 40	67	58
NRE NO	H14 H18				p9g	p9g	493	480	L50 F12	HAB	H22

* OPTIONAL EQUIP
/ AVIONICS EQUIP

PAGE	53		/	/	/	/	76	70	70	34 40	67	58
WIRE NO.	H9A H1B	/	/	/	/	/	Q57+	M95+	H80+	L50+	H4B+	NER+
							Q58+			FZ:		

PAGE	53				72	72	75	70	70	34			
WIRE	H14						Q57	H95	H80	L50	H48	H22	
NO.	H18				P98	P99	Q58			H12			

PAGE	63	/	/	/	/	75	72	72	34 40	67	58
WIRE	H14	/	/	/	/	Q57 ⁺			L50 ⁺	H48 ⁺	HE2 ⁺
NO.	H18	/	/	/	/	Q58 ⁺	P98 ⁺	P99 ⁺	F12 ⁺		

PAGE	68	/	/	/	/	72	73	70	70	34 40	67	58
WINE NO.	H14 H14	/	/	/	/	P38*	C15*	H35*	H80*	L50* F12*	H48*	H22*

PAGE	53	/	/	78	72	76	75	70	70	84	80	88
WIRE NO.	H14	H18	/	115 *	108 *	100 *	287 *	105 *	480 *	450 *	448 *	112 *
							287 *			412 *		

[illegible][illegible]

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

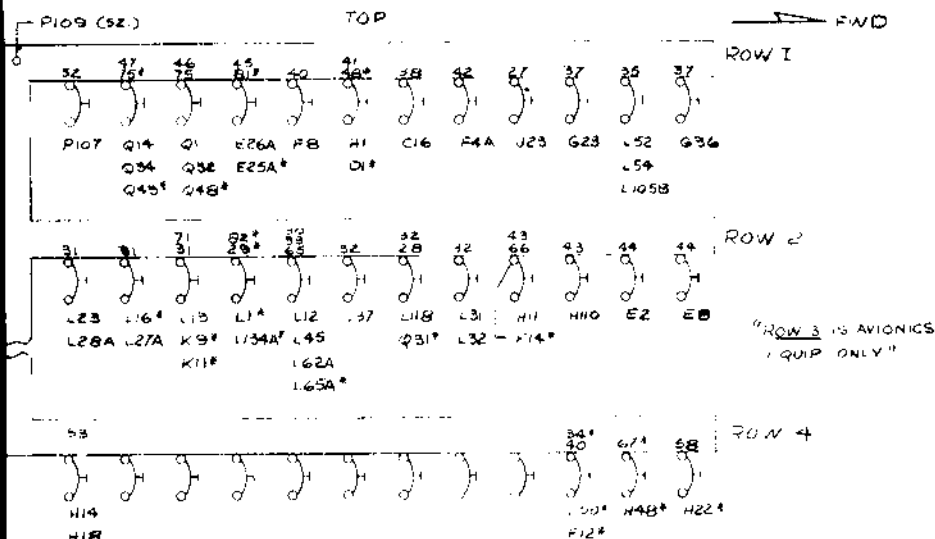
310
MODEL REV.

0870090
DRAWING NO.

63.09
PAGE

ALTERNATE CONNECTIONS FOR ROW #4 CIRCUIT BREAKERS

EFF. SERIALS 310Q0020 TO 310Q0201



ALTERNATE LOOKUP FOR ROW #4 (OPT)

PAGE	13	12	12	70	70	34	67	58
WIRE	H14			H35*	H80*	L50*	H48*	H22*
NO.	H18			H38*		F12*		

* OPTIONAL EQUIP
* AVIONICS EQUIP

PAGE	13	12	12	70	70	34	67	58
WIRE	H14			H35*	H80*	L50*	H48*	H22*
NO.	H18			H38*		F12*		

PAGE	53	12	12	70	70	34	67	58
WIRE	H14			H35*	H80*	L50*	H48*	H22*
NO.	H18			H38*		F12*		

PAGE	53	12	72	72	34	67	58
WIRE	H14				L50*	H48*	H22*
NO.	H18				F12*		

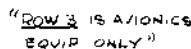
PAGE	53	12	70	70	34	67	58
WIRE	H14				L50*	H48*	H22*
NO.	H18				F12*		

PAGE	53	70	72	72	70	34	67	58
WIRE	H14					L50*	H48*	H22*
NO.	H18					F12*		

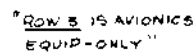
PAGE								
WIRE								
NO.								

PAGE								
WIRE								
NO.								

EFF. SERIALS 310Q0201 AND ON

[illegible]

EFF. SERIALS 310Q0001 TO 310Q0020



* = OPTIONAL EQUIP.
- = AVIONICS EQUIP.

[illegible]

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL REV.

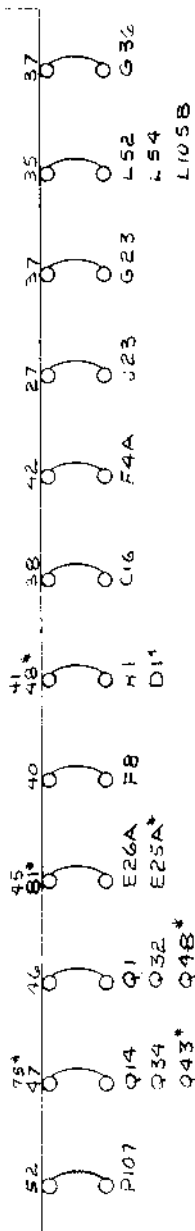
0870090
DRAWING NO.

63.12
PAGE

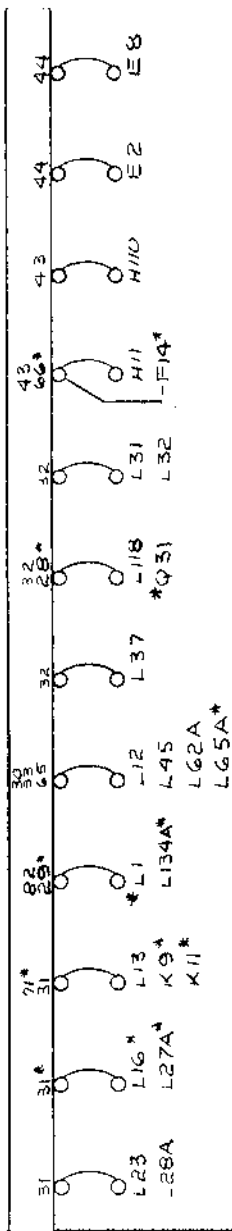
CIRCUIT BREAKER CONNECTIONS

EFF. SERIALS 310Q0020 AND ON

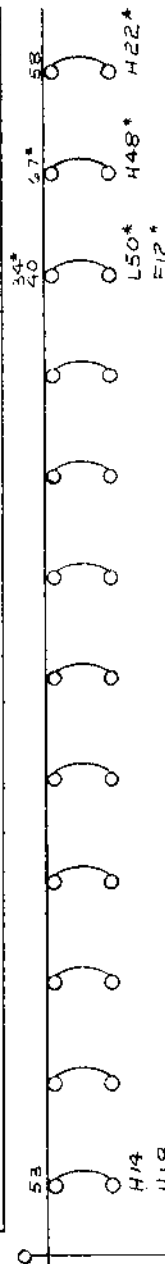
ROW 1 (TOP)



ROW 2.



ROW 4



P109
(52.)

* OPT EQUIP

FOR ALTERNATE HOOKUP ON ROW #4 SEE PAGE 63.09
63.10

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL REV.

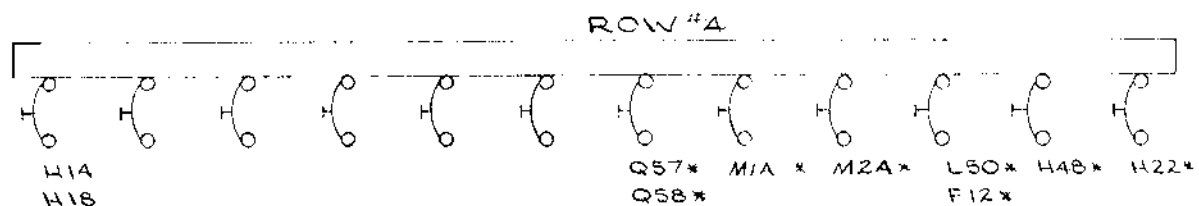
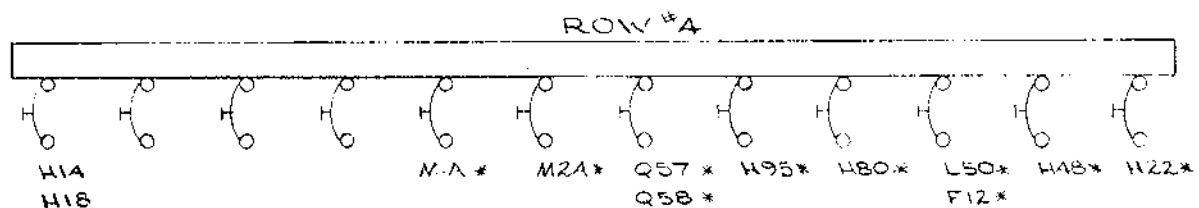
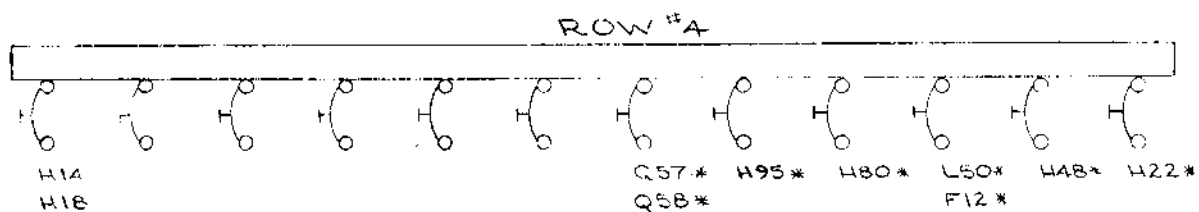
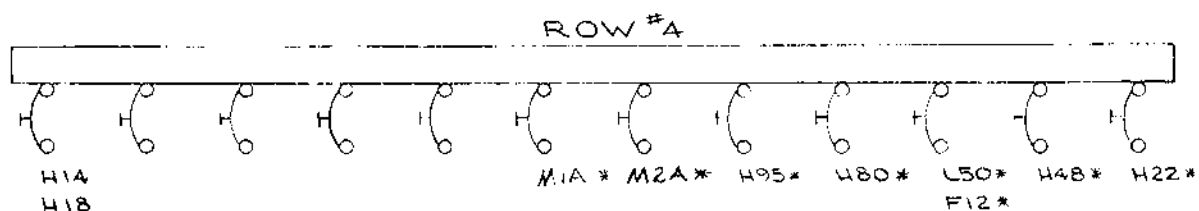
0870090
DRAWING NO.

63.13
PAGE

ALTERNATE CONNECTIONS FOR ROW #4 CKT BKRS

EFF. SERIALS 310Q0201 & ON

→ FWD



* OPT EQUIP.

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310Q
MODEL

REV.

0870090
DRAWING NO.

63.14
PAGE

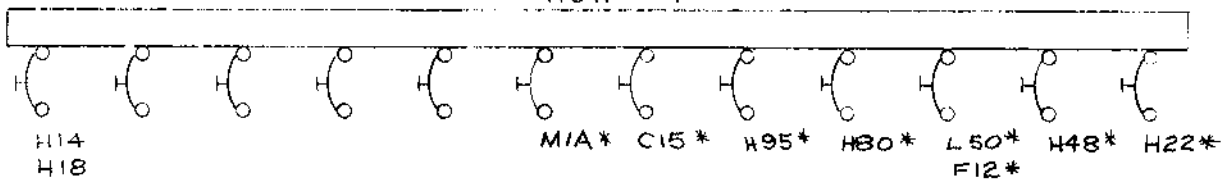
ALTERNATE CONNECTIONS FOR ROW #4 CKT BKRS

EFF. SERIALS

310Q0201 & ON

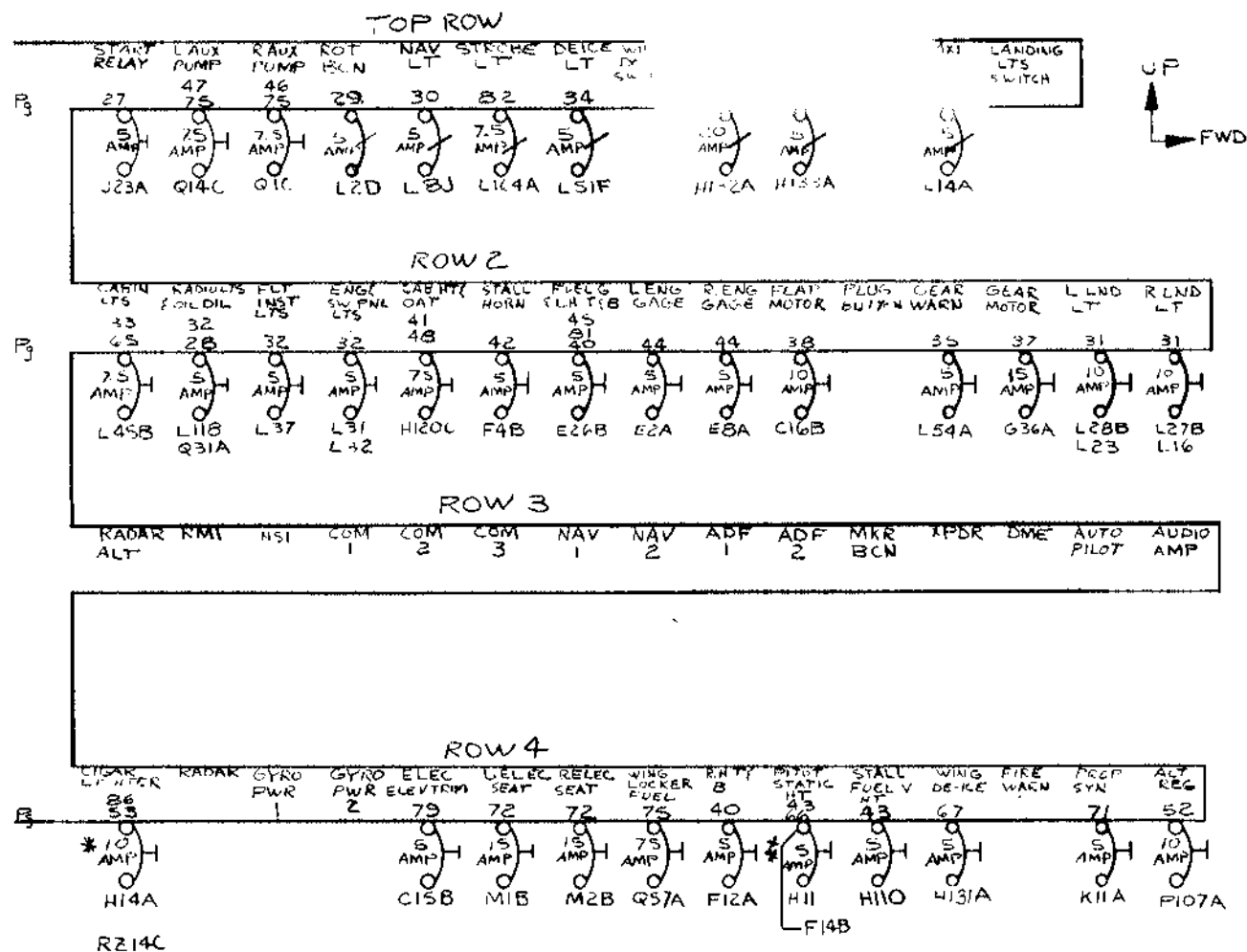
→ FWD

ROW # 4



*OPT. EQUIP.

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	AE REV.	0870090 DRAWING NO.	63.15 PAGE
CIRCUIT BREAKER CONNECTIONS				
EFF. SERIALS				



*15 AMP WHEN STEREO
IS INSTALLED

*15 AMP WHEN DUAL PITOT
SYSTEM IS INSTALLED

EFF. SERIALS

COMP.	PAGE	SYSTEM	WIRE NUMBERS	CIRCUIT
75-02	WING LOCKER FUEL	(18U)	Q48B	LIGHT
75-02	WING LOCKER FUEL	(18A)	Q43B	LIGHT
75-02	WING LOCKER FUEL	Q57A	Q57B	LEFT PUMP
75-02	WING LOCKER FUEL	(18U)	Q58B	RIGHT PUMP
30-00	WINDSHIELD WAX	H133A	H133B	LIGHT PUMP
74-03	STATIC SOURCE HT	H101F	H101G	STATIC HEATER
28-04	OIL DILUTE	Q31A	G31B	OIL DIL VALVE
13-03	ELEC TRIM	C13A R	C13C	ELEC GLEV TRIM
67-04	WING DE ICE	(20U)	H48D	FUSE, DURE LT
67-04	WING DE ICE	H131B	H131C	RELAY
67-04	WING DE ICE	H91D	H91E	RELAY
67-03	CIGAR LIGHTER	H14A	H14B	FUSE
67-03	CIGAR LIGHTER	(16U)	H18B	FUSE
37-05	L.G. MOTOR	G36A	G36B	L.G. SW
36-05	FLAP ACTUATOR	L16B	L16C	FLAP MOTOR
75-03	START RELAY	J23A	J23B	RIGHT START SWITCH
43-03	PITOT HT SWITCH	H12F	H12G	PITOT TUBE NTR
43-03	PITOT HT SWITCH	H13E	H13C	LEFT TIP VENTHT
43-03	PITOT HT SWITCH	H10D	H10G	RIGHT TIP VENTHT
58-04	PROP DE ICE	H132A	H132B	AIRMETER PROP
38-03	ENGINE ST LT	L14D	L14E	GROUND
58-04	STROBE LIGHT	L164A	L164B	FLASHER
39-03	ROT BCLN	L20	L2E	ROT BEALON LT
30-03	NAV LT	L8J	L8K	JUNCTION BOX
31-04	TAXI LT	L14A	L14B	TAXI LT
31-04	R.H. LANDING LT	L27B	L27C	JUNCTION BOX R.H.
31-04	R.H. LANDING LT	L20B	L20C	JUNCTION BOX L.H.
31-04	R.H. LANDING LT	L31B	L31C	JUNCTION BOX R.H.
31-04	R.H. LANDING LT	L28B	L28C	JUNCTION BOX L.H.
31-04	R.H. LANDING LT	L29B	L29C	JUNCTION BOX L.H.
31-04	R.H. LANDING LT	L2AB	L2AC	JUNCTION BOX L.H.
47-00	LEFT AUX PUMP	Q14C	Q14D	OIL PRESS. GAGE SW
47-00	LEFT AUX PUMP	(18U)	G34B	PRIME SW
40-00	R.AUX PUMP	G1C	G1D	OIL PRESSURE SW
16-05	R.AUX PUMP	(18U)	G32B	PRIME SW
33-07	CABIN LIGHTING	L45B	L45C	LT RHEO STATS
33-02	CHART LTS	(20U)	L62C	CHART LT RHEO PILOT
33-02	CHART LTS	(20U)	L65C	CHART LT RHEO CO-PILOT
33-03	STALL WARN	L45B	L45C	DUAL WARNING FLASHER
32-05	FLT INST LT	L37C	L37D	FLT COMPASS LT CKT
32-05	KADIO LT	L92B	L92C	FLT COMPASS LT CKT
32-05	KADIO LT	L29C	L29D	KADIO LT CKT
32-05	KADIO LT	L90B	L90C	KADIO LT CKT
32-05	ENG INST LT	L31C	L31D	ENG LT CKT
32-05	ENG INST LT	L36B	L36C	ENG LT CKT
32-05	SW INLT LT	L34C	L32D	SW LT CKT
32-05	WINL LT	L34B	L34C	SW LT CKT
31-03	CAP FUEL SYS	(20U)	L25C	CAP FUEL FIELD
45-00	FUEL GAGE SYS	E26B	E26C	FUEL GAGE
00-00	REG STBY SW	H11C B	H11C	MAIN OVER VOLTAGE RELAY
00-00	REG STBY SW	H11B	H11D	MAIN REG
00-00	REG STBY SW	H13B	H13C	ALT SW
00-00	REG STBY SW	H13C	H13D	ALT SW
00-00	REG STBY SW	H13D	H13E	ST BY REG
00-00	REG STBY SW	H13E	H13F	ST BY REG
00-00	REG STBY SW	H13F	H13G	OVER VOLTAGE RELAY
00-00	EMERG PWR SW	H15B	H15C	JUNCTION BOX L.H.
00-00	EMERG PWR SW	H15C	H15D	ALT OUT LT R.H.
00-00	FUSE ALT FIELD L	H103D	H104C	ALT SW
00-00	FUSE ALT FIELD R	H103C	H103D	JUNCTION BOX L.H.
00-00	FUSE ALT FIELD R	H106C	H106D	JUNCTION BOX R.H.
00-00	FUSE ALT FIELD R	H105B	H105C	ALT SW
40-03	L.H. TEB INDICATOR	(20U)	F82C	TEB INDICATOR
40-03	R.H. TEB INDICATOR	F12A	F12B	TEB INDICATOR
44-01	L ENG GAGE	E2A	E2B	L ENG GAGE
44-01	R ENG GAGE	E2A	E2B	R ENG GAGE
44-06	CABIN HT	H120C	H120D	CABIN HT SW
48-02	OUTSIDE AIR TEMP	(20U)	D1B	O.A.T. INDICATOR
35-05	L.G. WARNING LT	L54A	L165	GEAR DOWN LIGHTS
35-05	L.G. WARNING	(20U)	G42	GEAR WARNING HORN
72-03	H.ELEC SEAT	M1B	M1C	MOTOR
72-03	R.H.ELEC SEAT	M2B	M2C	MOTOR

P 1-203739-S PLUG

P. J. J. 1-20 3739-6 RECEIPT

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

AE
REV.

0870090
DRAWING NO.

63.17
PAGE

CIRCUIT BREAKER DISCONNECT

EFF. SERIALS

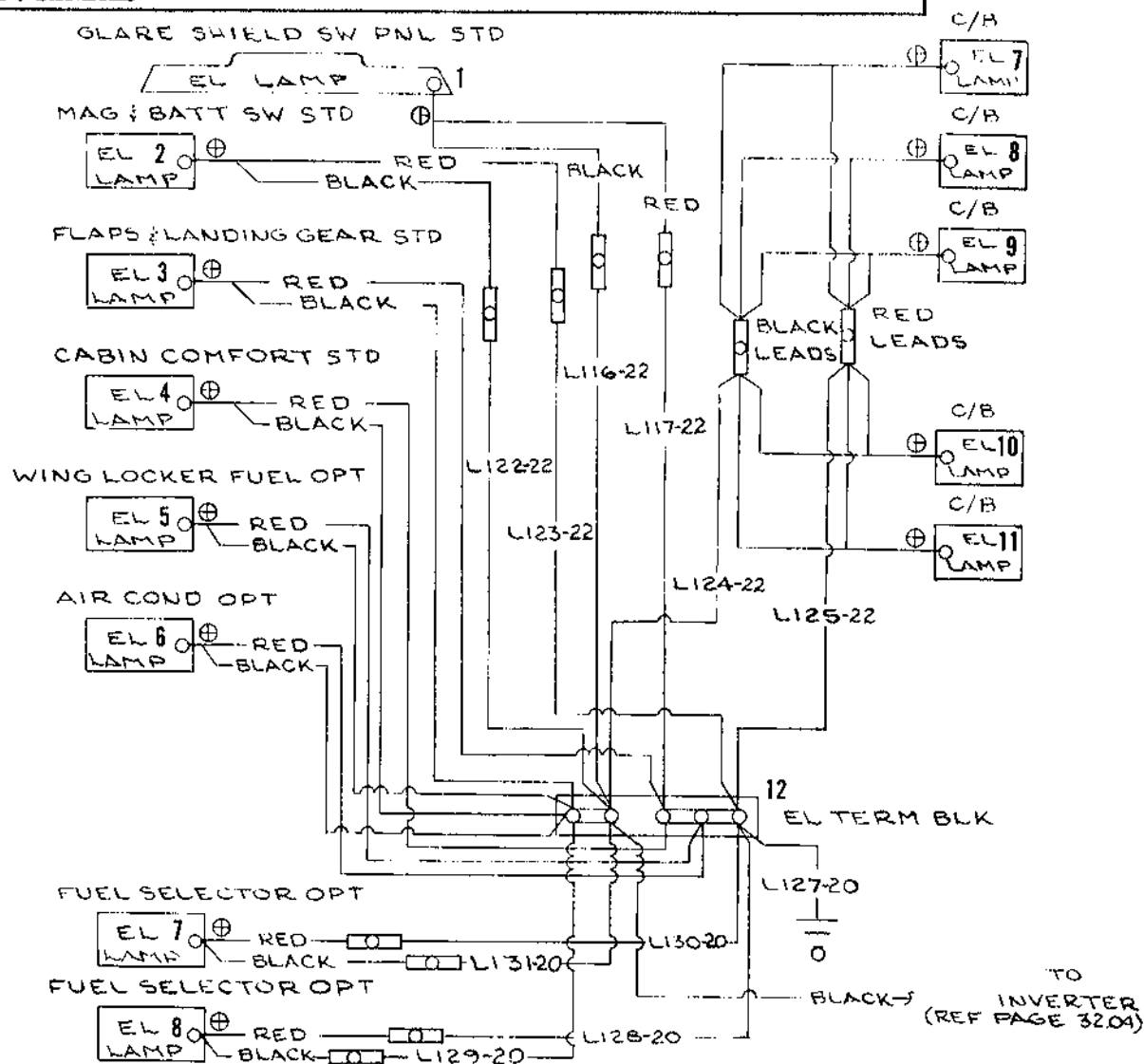
COMP	PAGE	SYSTEM	WIRE NUMBERS	CIRCUIT
C/B		FIRE WARNING	F16A	A
C/B	86.02	STEREO	RZ14C	B
C/B		HSI	RP17A	C
C/B		GYRO PWR 2	RP1A	D
C/B		AUTO PILOT	RP2A	E
C/B		NAV 2	RP3A	F
C/B		NAV 1	RP4A	H
C/B		COM 2	RP5A	J
C/B		COM 1	RP6A	K
C/B		ADF 2	RP7A	L
C/B		ADF 1	RP8A	M
C/B		XPDR	RP9A	N
C/B		MKR BCN	RP10A	P
C/B		RADAR	RP11A	R
C/B		AUDIO AMP	RP12A	S
C/B		COM 3	RP13A	T
C/B		GYRO PWR 1	RP14A	U
C/B		DME	RP15A	V
		E.L. PANELS	L170A	W — L170 EL TERM BLK
		E.L. PANELS	L171A	X — L171 EL TERM BLK
C/B		RMI	RP18A	Y
C/B		RADAR ALT	RP16A	Z
		BUSS 66.02 FLT HR RECORDER	F14B	2 — F14C ACT SW
C/B	34.02	WING DE-ICE LT	LS1F	D — LS1G DE-ICE LT
Pnd	71.02	PROP SYNCH	20J	C — K9B INDICATOR LT
C/B	71.02	PROP SYNCH	K11A	d — K11B CONTROL BOX

P₃₇ J₃₇

P₃₇ 203735-6 PLUG

J₃₇ 203735-7 RECPT

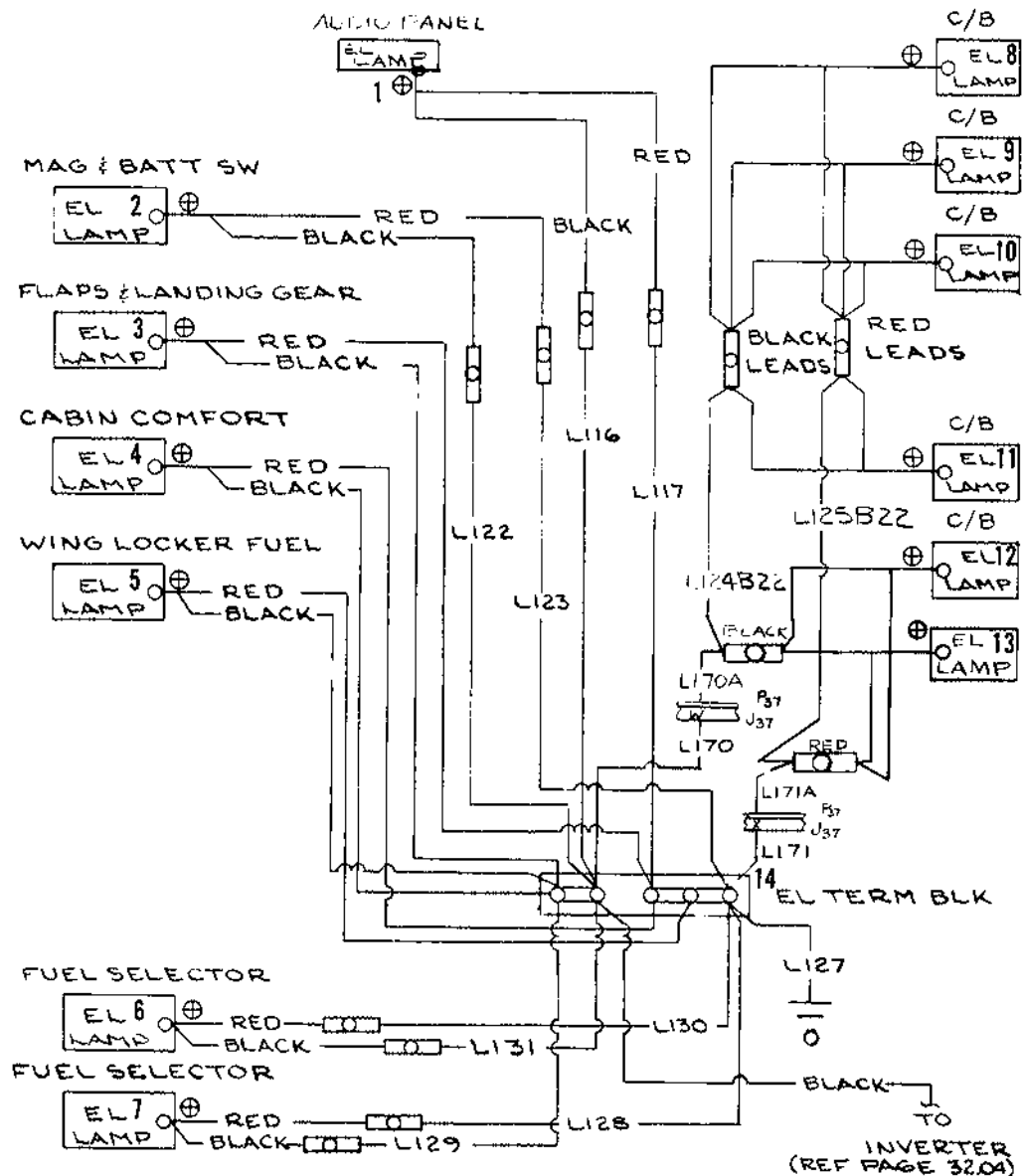
EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	9910034-2	El Lamp - Glare Shield Switch Panel
2	9910031-3	El Lamp - Mag and Battery Switch
3	9910051-1	El Lamp - Flaps and Landing Gear
4	9910033-3	El Lamp - Cabin Comfort
5	9910030-1	El Lamp - Wing Locker Fuel
6	9910030-	El Lamp - Air Cond
7	9910052-3	El Lamp - Fuel Selector
8	9910052-4	El Lamp - Fuel Selector
9	9910032-10	El Lamp - Circuit Breaker
10	9910032-11	El Lamp - Circuit Breaker
11	9910032-3	El Lamp - Circuit Breaker
12	MS25123-1-5	El Terminal Block

ELECTROLUMINESCENT LAMP CKT. (OPT) 1/8 PNL EL

EFF. SERIALS



ITEM

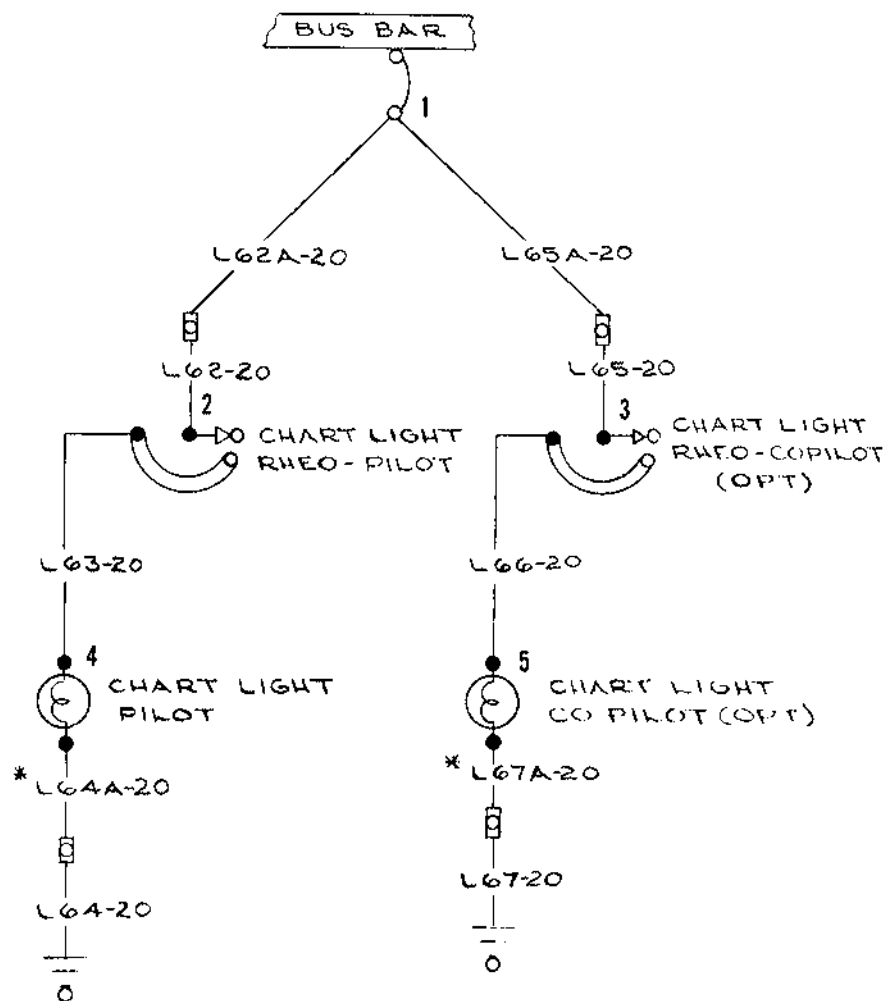
PART NUMBER

NOMENCLATURE

1	9910034-2	El Lamp - Glare Shield Switch Panel
2	9910031-3	El Lamp - Mag and Battery Switch
3	9910051-1	El Lamp - Flaps and Landing Gear
4	9910033-3	El Lamp - Cabin Comfort
5	9910030-1	El Lamp - Wing Locker Fuel
6	9910030-	El Lamp - Air Cond
7	9910052-3	El Lamp - Fuel Selector
8	9910052-4	El Lamp - Fuel Selector
9	9910032-10	El Lamp - Circuit Breaker
10	9910032-11	El Lamp - Circuit Breaker
11	9910032-3	El Lamp - Circuit Breaker
12	MS25123-1-5	El Terminal Block

CHART LIGHTS - CONTROL WHEEL

EFF. SERIALS

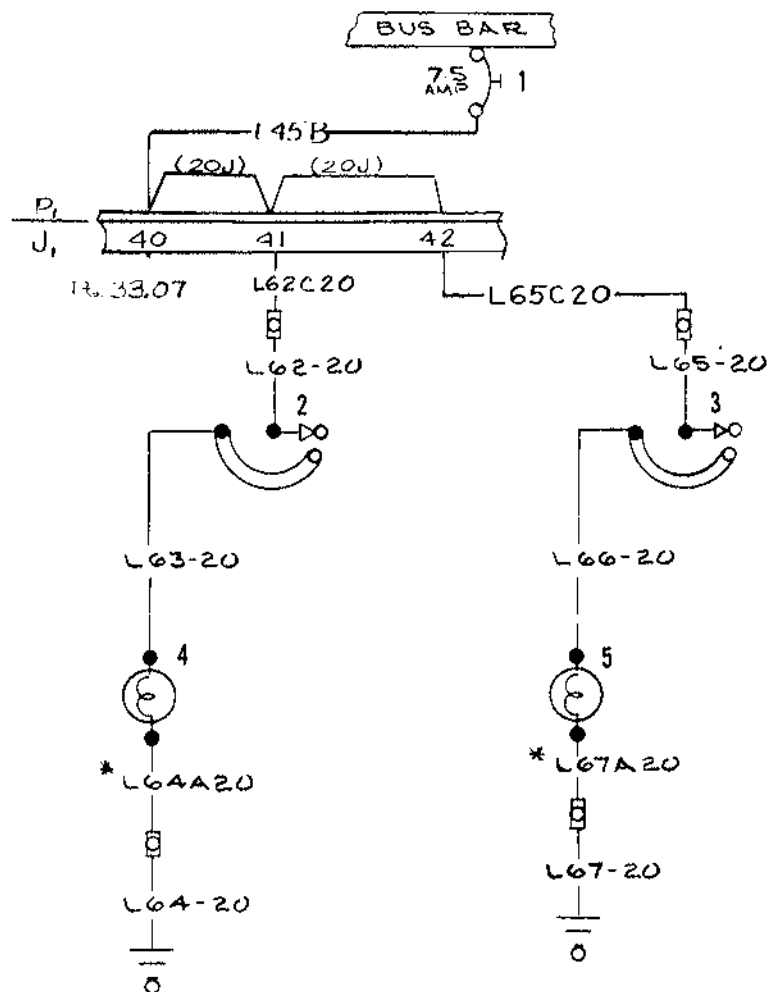


* GND WIRE TO BE SOLDERED
TO LIGHT SOCKET

ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	E5-352A	Rheostat
3	E5-352A	Rheostat
4	305	Light - Pilot Chart
5	305	Light - CoPilot Chart

CHART LIGHTS - CONTROL WHEEL

EFF. SERIALS



* GND WIRE TO BE SOLDERED
TO LIGHT SOCKET

ITEM

PART NUMBER

NOMENCLATURE

1	S1232-507	Circuit Breaker
2	E-50-R-1-352A	Rheostat
3	E-50-R-1-352A	Rheostat
4	1309	Light - Pilot Chart
5	1309	Light - Copilot Chart

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

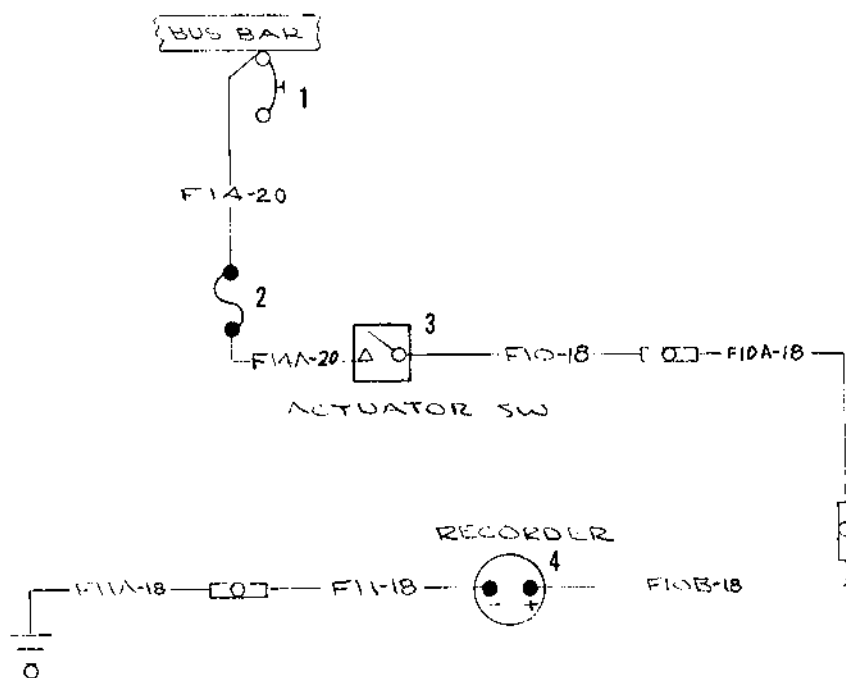
REV.

0870090
DRAWING NO.

66. 01
PAGE

FLIGHT HOUR RECORDER (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4

S1232-505
311005
S1498-2
CM2926-1

Circuit Breaker
Fuse
Switch - Actuator
Recorder

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

W
REV.

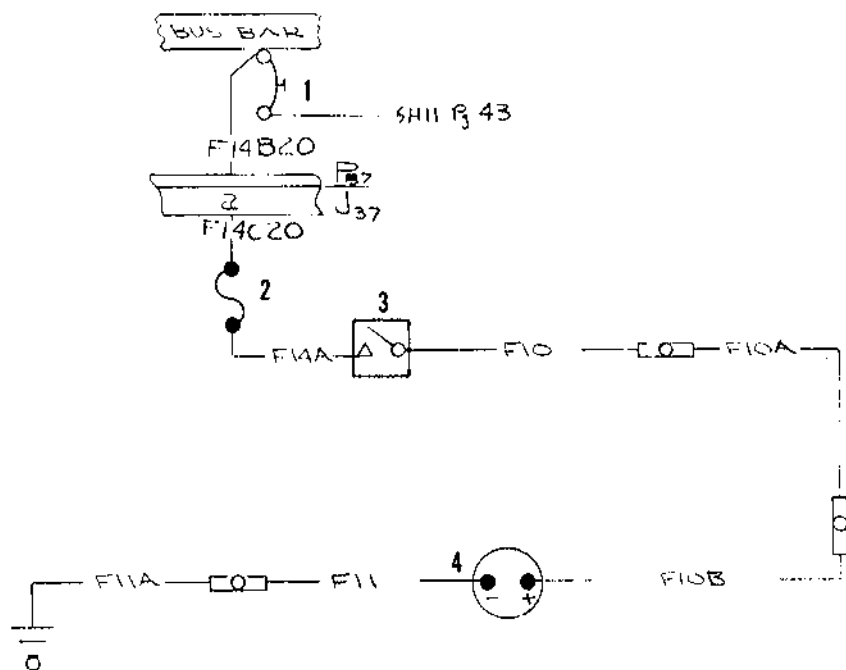
0870090
DRAWING NO.

66.02
PAGE

FLIGHT HOUR RECORDER (OPTIONAL)

EFF. SERIALS

2N



ITEM

PART NUMBER

NOMENCLATURE

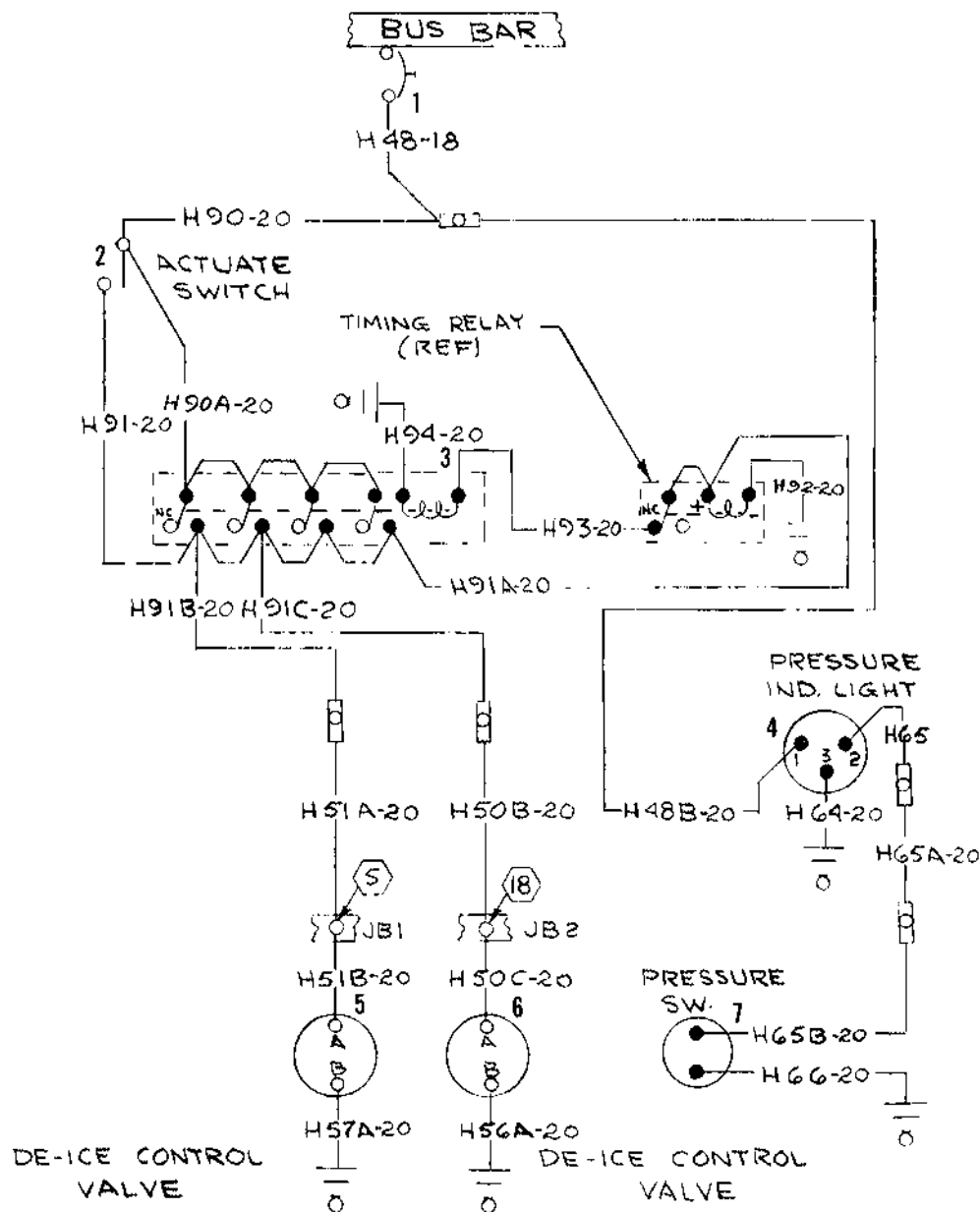
1
2
3
4

S1232-505
AGC 5
S1498-2
CM2926-1

Circuit Breaker
Fuse
Switch - Actuator
Recorder

WING DEICE SYSTEM (OPT) (FOR ALTERNATE SEE PAGE 67.03)

EFF. SERIALS 310K0001 AND ON



ITEM

PART NUMBER

NOMENCLATURE

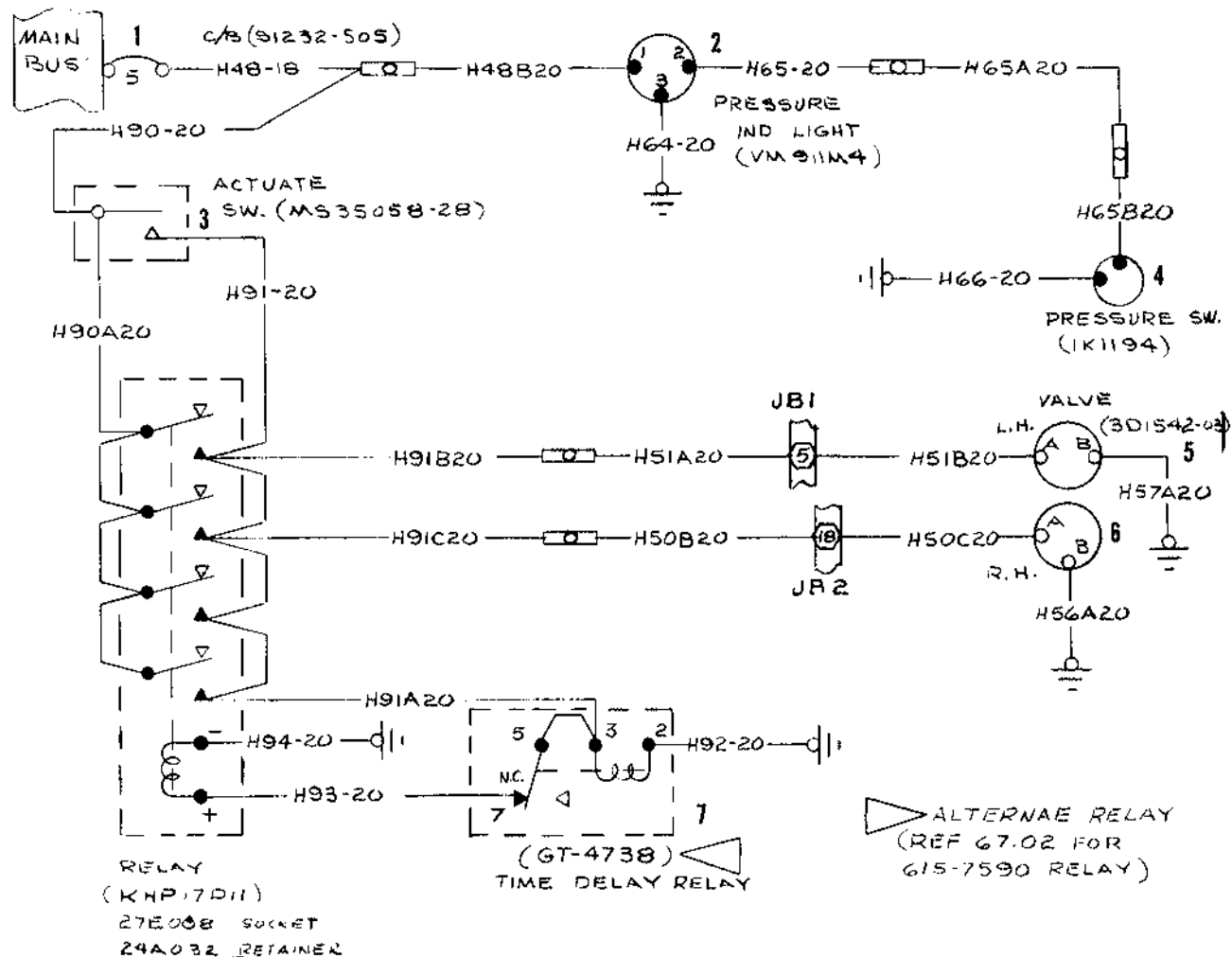
1
2
3
4
5
6
7

S1232-505
MS35058-28
615-7590
VM911M4
3D1542-03
3D1542-03
1K1194

Circuit Breaker
Actuator Switch
Timing Relay
Pressure Indicator Light
Valve - Deice Control L/H
Valve - Deice Control R/H
Pressure Switch

WING DEICE SYSTEM

EFF. SERIALS



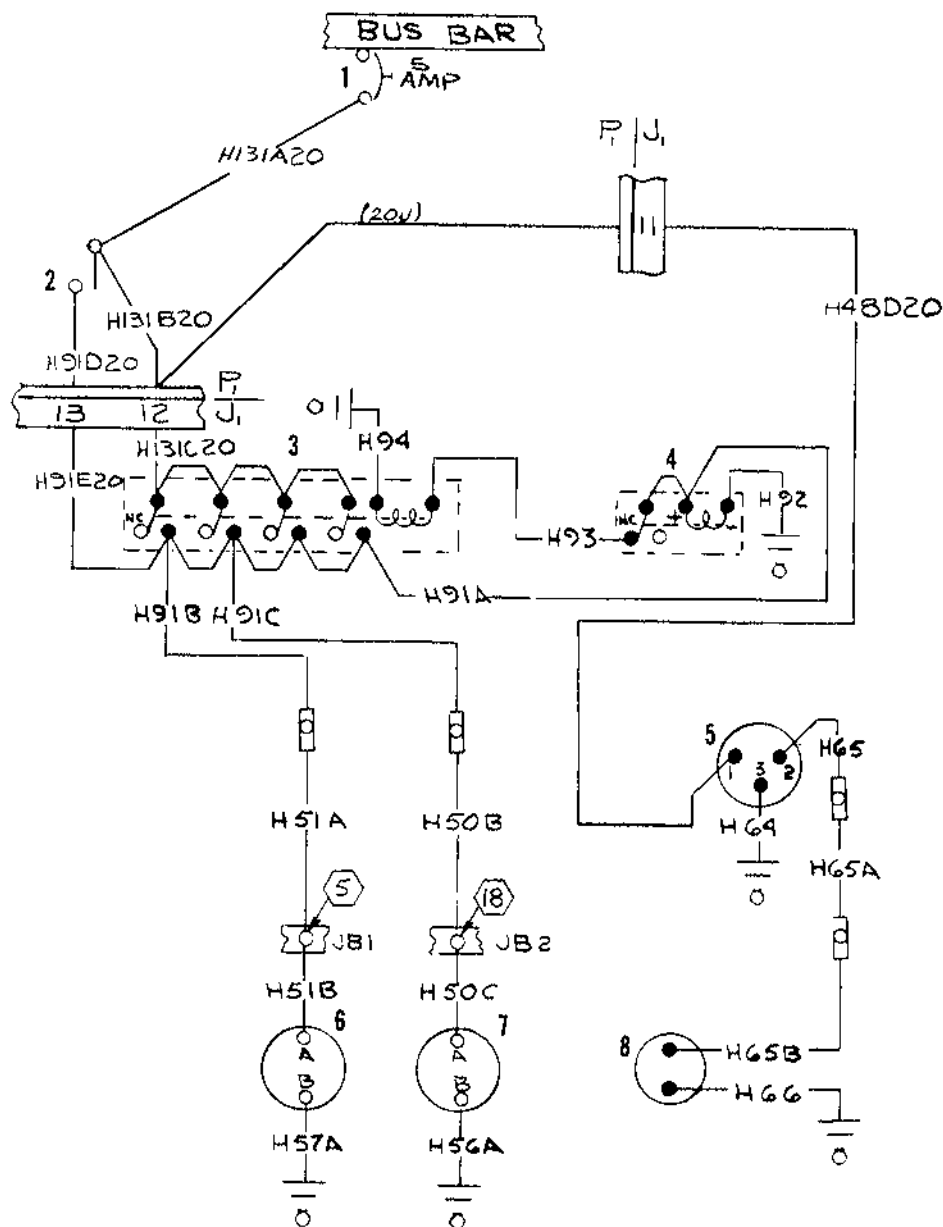
ITEM

PART NUMBER

NOMENCLATURE

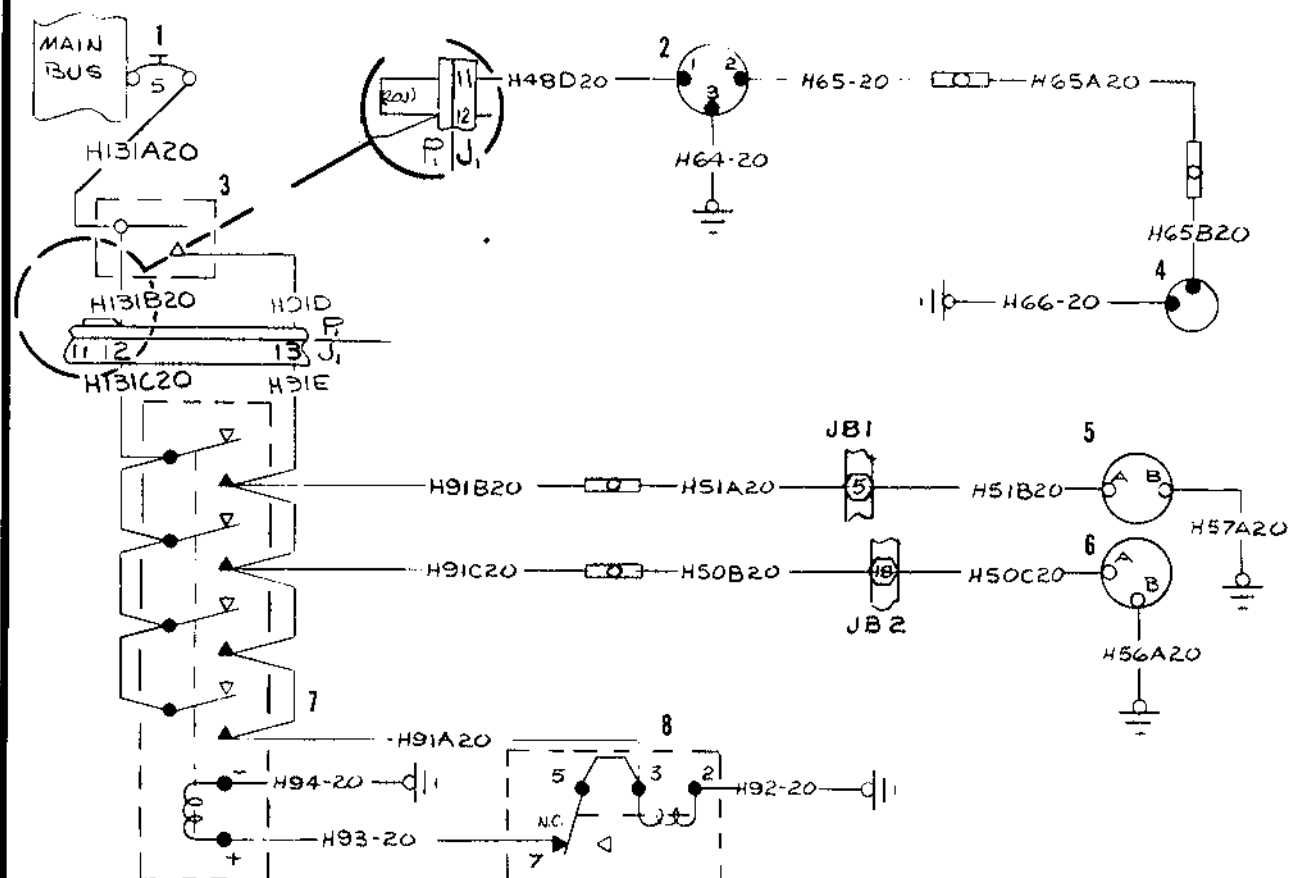
1	S1232-505	Circuit Breaker
2	VM911M4	Pressure Indicator Light
3	MS35058-28	Actuator Switch
4	IK1194	Pressure Switch
5	3D1542-03	Valve - Deice Control LH
6	3D1542-03	Valve - Deice Control RH
7	GT-4738	Time Delay Relay

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	MS35033-02	Actuator Switch
3		Deice Timer Relay
4		Timer Delay Relay
5	V.A.	Pressure Indicator Light
6	3D1541	Valve - Deice Control LH
7	3D1542-03	Valve - Deice Control RH
8	1K1194	Pressure Switch

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	AE REV.	0870090 DRAWING NO.	67.05 PAGE
WING DE-ICE SYSTEM (OPT)			((ALTERNATE)) FOR 67.00	
EFF. SERIALS				



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	VM911M4	Pressure Indicator Light
3	MS35058-28	Actuator Switch
4	1K1194	Pressure Switch
5	3D1542-03	Valve - Deice Control LH
6	3D1542-03	Valve - Deice Control RH
7	KHP17D11	Deice Timer Relay
8	GT-4738	Timer Delay Relay

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

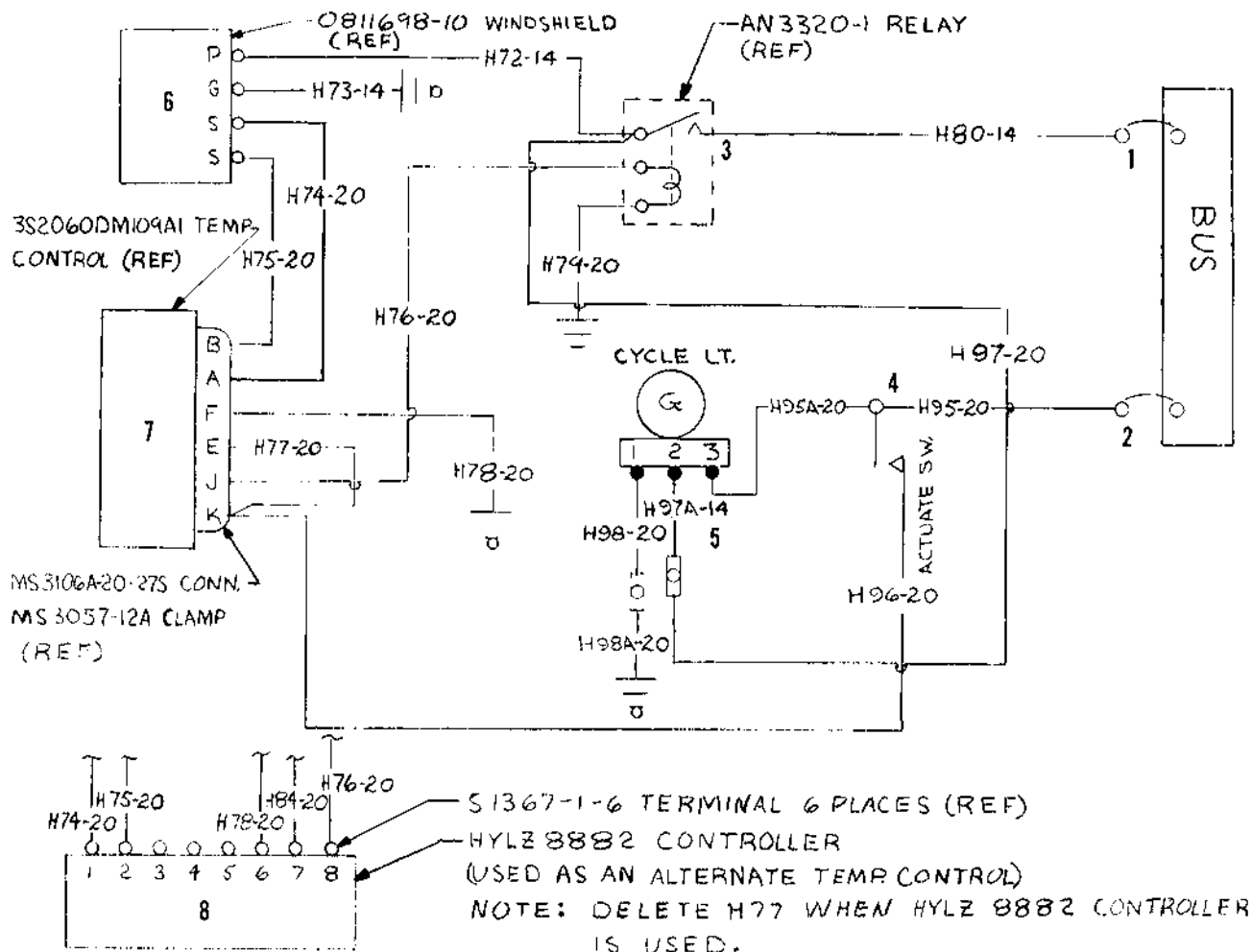
REV.

0870090
DRAWING NO.

70.01
PAGE

AIRCON WINDSHIELD (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6
7
8

S1234 505
3S2060DM109A1
HYLZ8882

Circuit Breaker
Circuit Breaker
Relay
Actuator Switch
Cycle Light
Windshield
Temperature Control
Controller

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

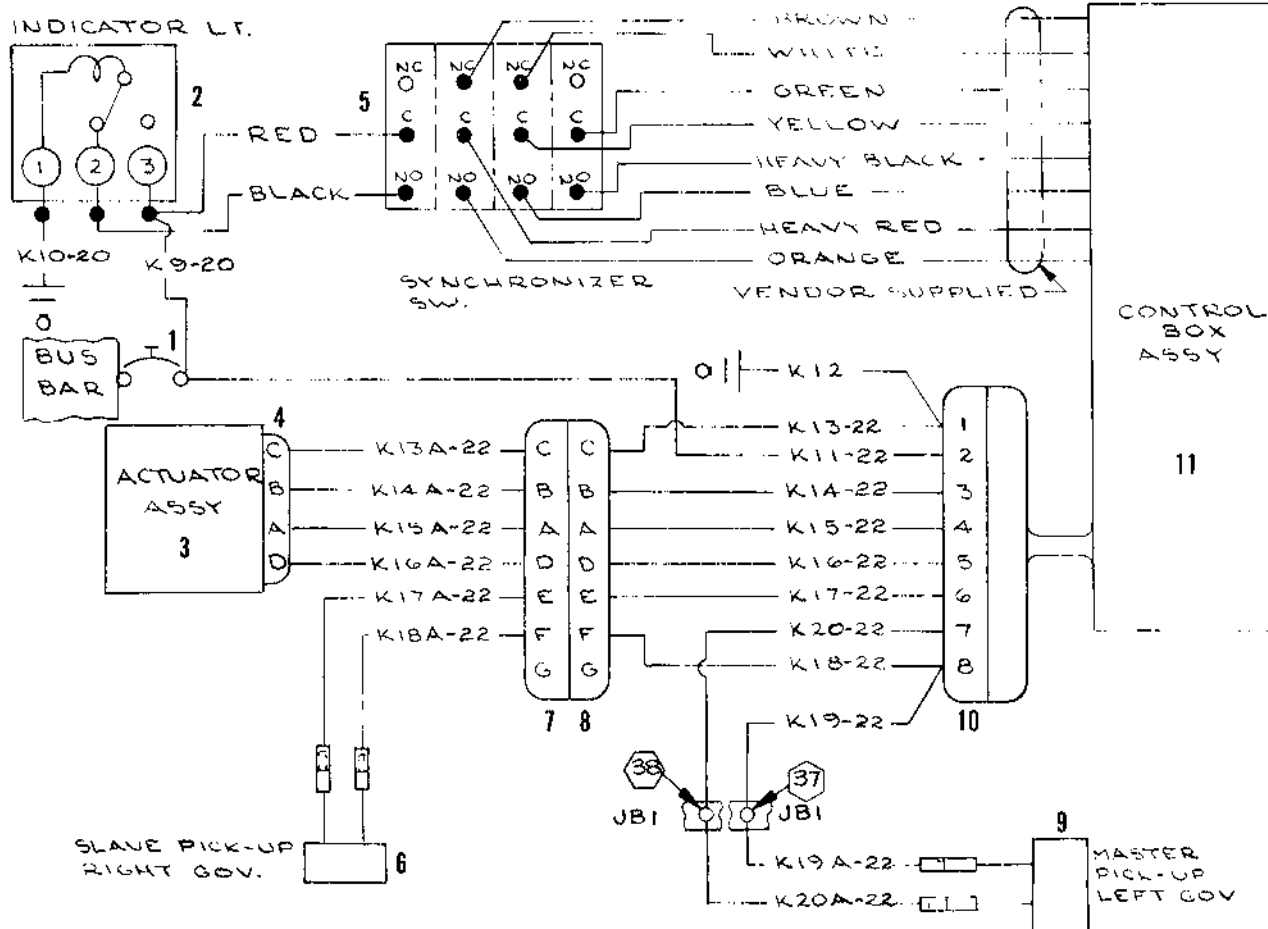
310
MODEL REV.

0870090
DRAWING NO.

71.01
PAGE

PROP SYNCHRONIZER - WOODWARD

EFF. SERIALS



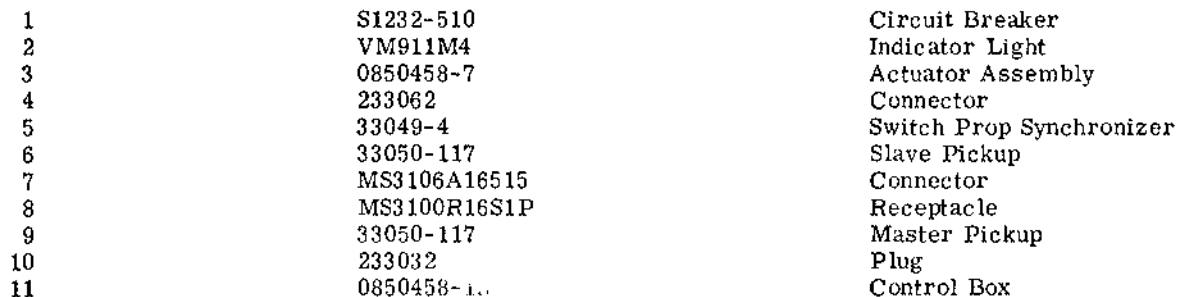
ITEM

PART NUMBER

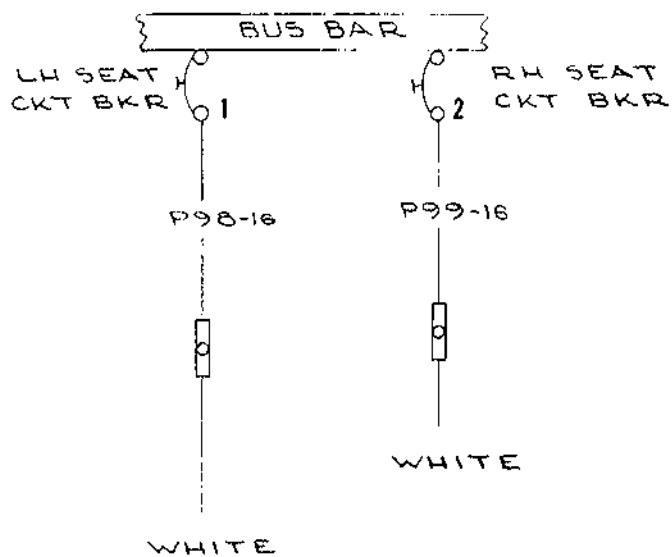
NOMENCLATURE

1	S1232-510	Circuit Breaker
2	VM911M4	Indicator Light
3	0850458-7	Actuator Assembly
4	233062	Connector
5	33049-4	Switch Prop Synchronizer
6	33050-117	Slave Pickup
7	MS3106A16515	Connector
8	MS3100R16S1P	Receptacle
9	33050-117	Master Pickup
10	233032	Plug
11	0850458-12	Control Box

EFF. SERIALS



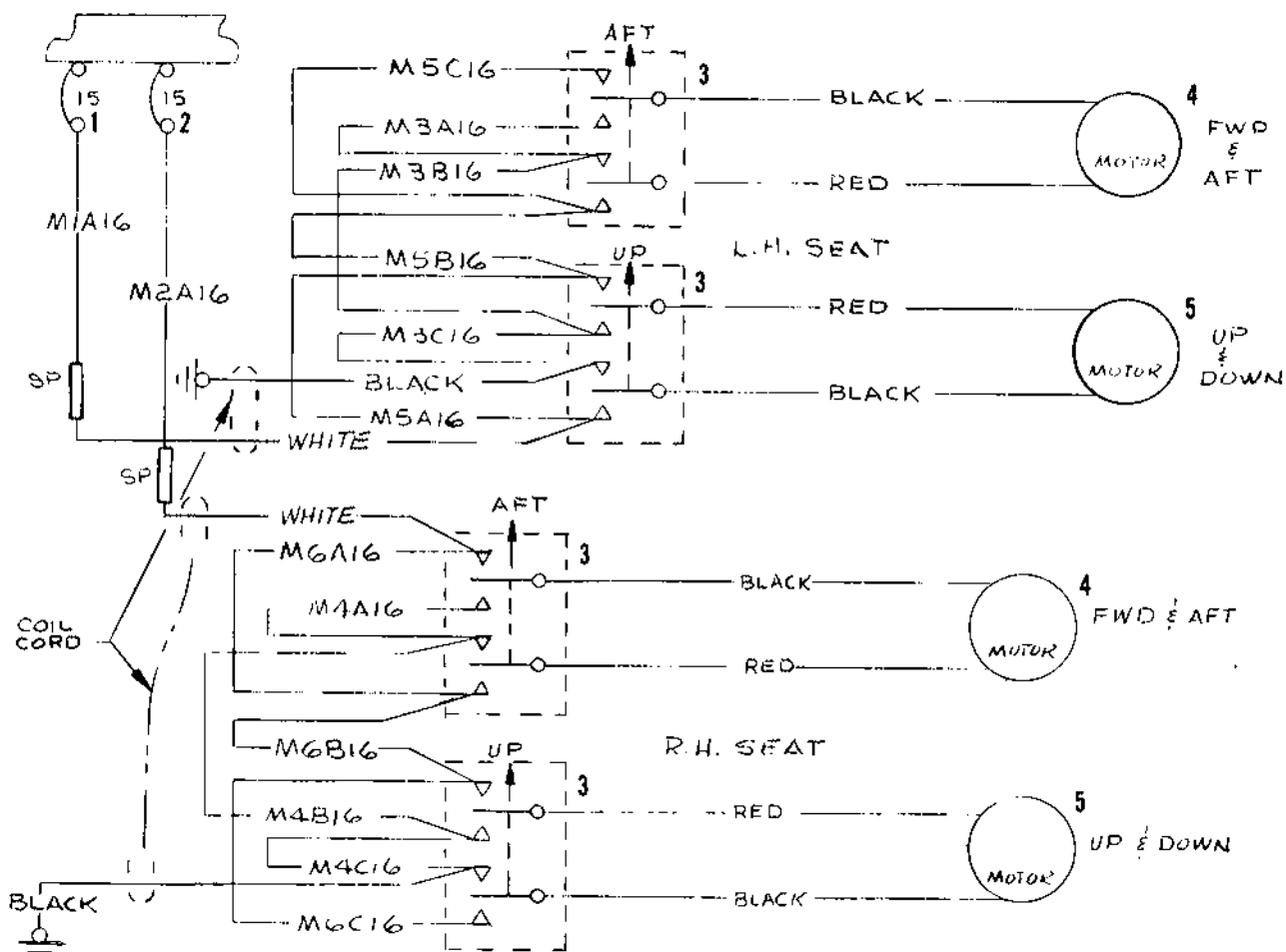
CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	72.01 PAGE
ELECTRIC SEAT - OPTIONAL				
EFF. SERIALS				



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-515	Circuit Breaker
2	S1232-515	Circuit Breaker

ELECTRICAL SEAT, RIGHT & LEFT (OPTIONAL)

EFF. SERIALS



Item	Part Number	Nomenclature
1	S1232-515	Circuit Breaker
2	S1232-515	Circuit Breaker
3	MS35059-27	Switch
4	9910091-1	Motor
5	9910090-1	Motor

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310Q
MODEL

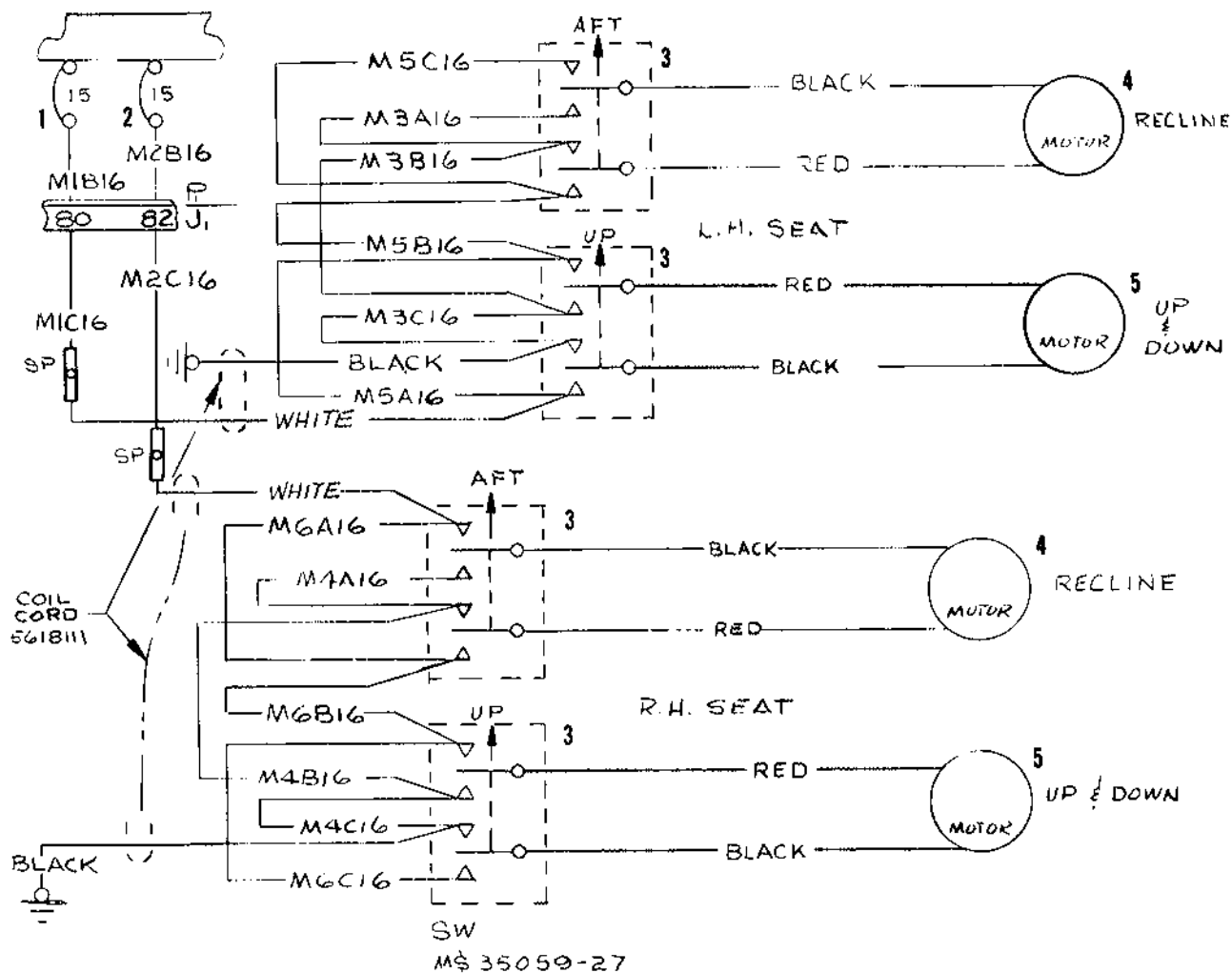
W
REV.

0870090
DRAWING NO.

72.03
PAGE

ELECTRICAL SEAT, RIGHT & LEFT (OPTIONAL)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5

S1232-515
S1232-515
MS35059-27
9910091-1
9910091-1

Circuit Breaker
Circuit Breaker
Switch
Motor
Motor

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

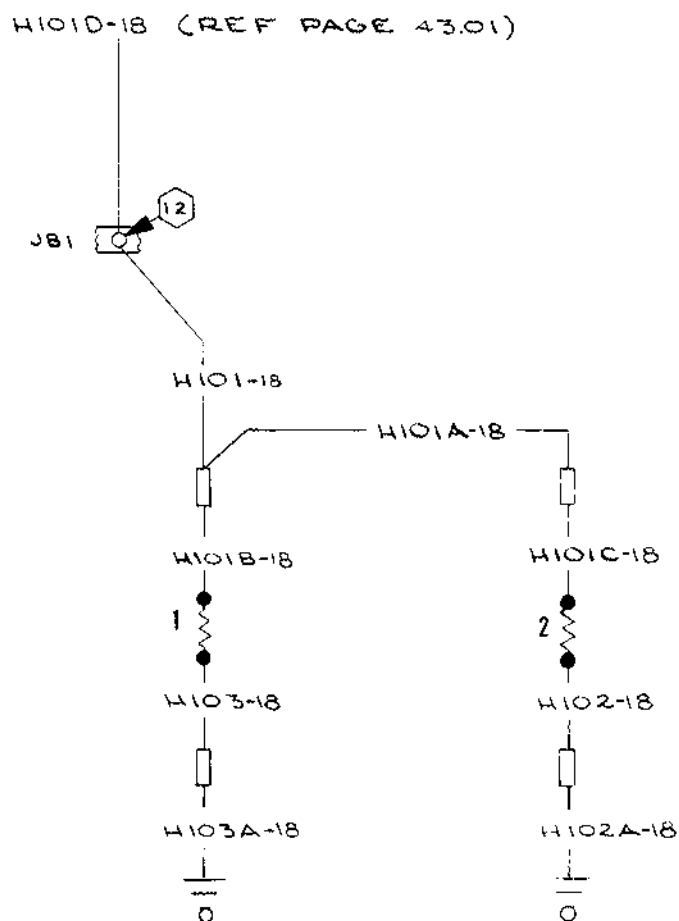
310
MODEL REV.

0870090
DRAWING NO.

74.01
PAGE

STATIC SOURCE HEAT (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2

CM2933-5
CM2933-5

Static Heater - L/H
Static Heater - R/H

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL REV.

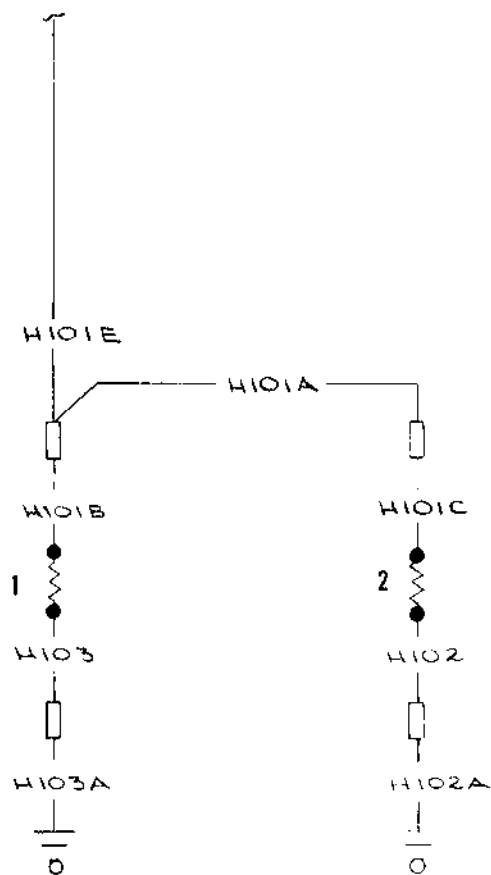
0870090
DRAWING NO.

74.02
PAGE

STATIC SOURCE HEAT (OPT)

EFF. SERIALS

(REF PAGE 43.)



ITEM

PART NUMBER

NOMENCLATURE

1

CM2933-5

LH-Static Heater

2

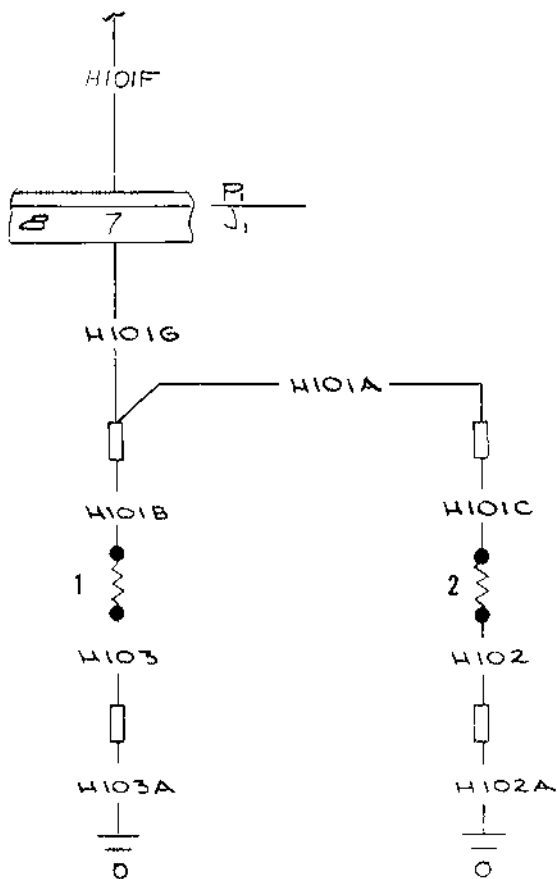
CM2933-5

RH-Static Heater

STATIC SOURCE HEAT (OPT)

EFF. SERIALS

(REF PAGE 43.)



ITEM

PART NUMBER

NOMENCLATURE

1

CM2933-5

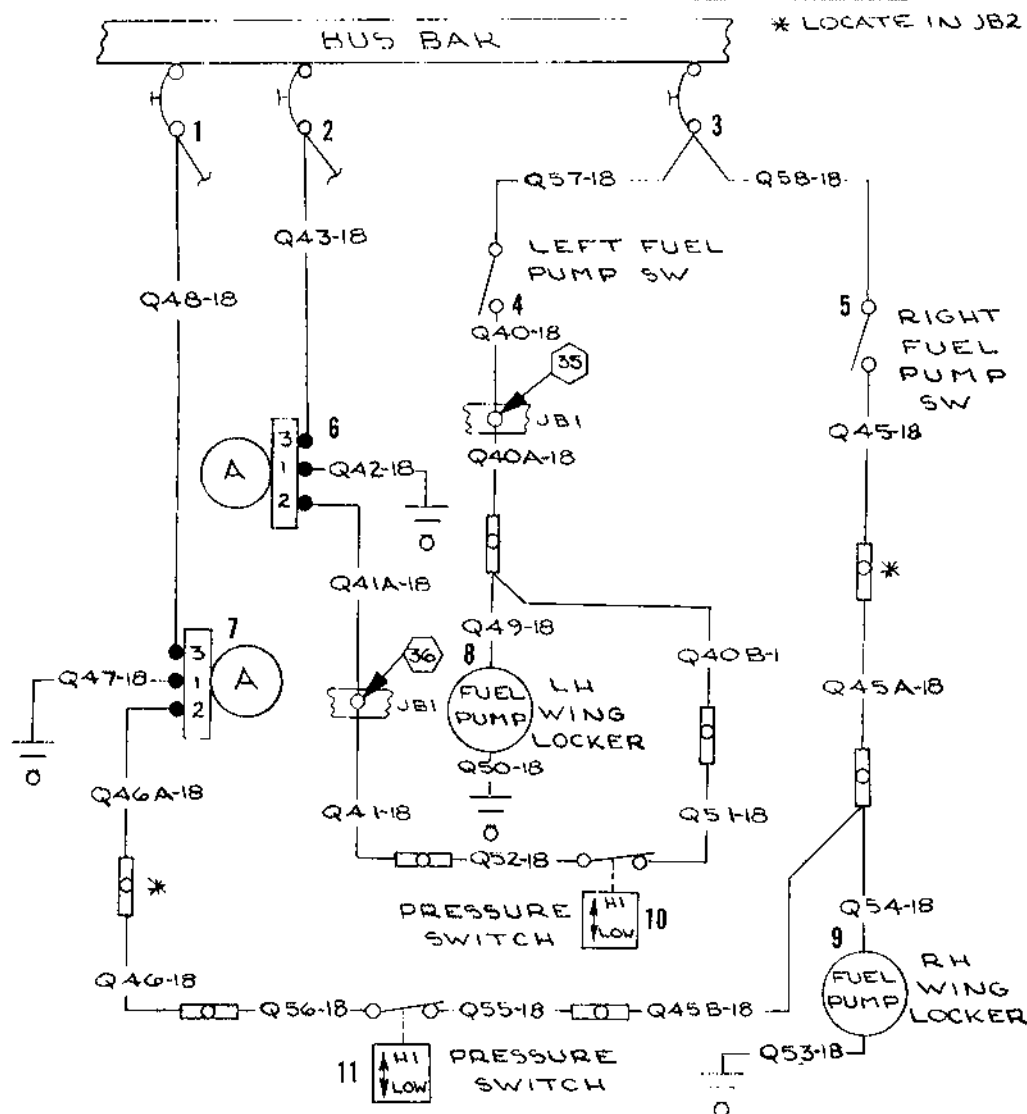
Static Heater - LH

2

CM2933-5

Static Heater - RH

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	S1232-507	Circuit Breaker
4	S382-2	Left Fuel Pump Switch
5	S382-2	Right Fuel Pump Switch
6	VM911M4	L/H Light Fuel Pressure Indicator
7	VM911M4	R/H Light Fuel Pressure Indicator
8	4140-00-153	Fuel Pump L/H Wing Locker
9	4140-00-153	Fuel Pump R/H Wing Locker
10	0850452-3	Pressure Switch - R/H
11	0850452-3	Pressure Switch - L/H

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

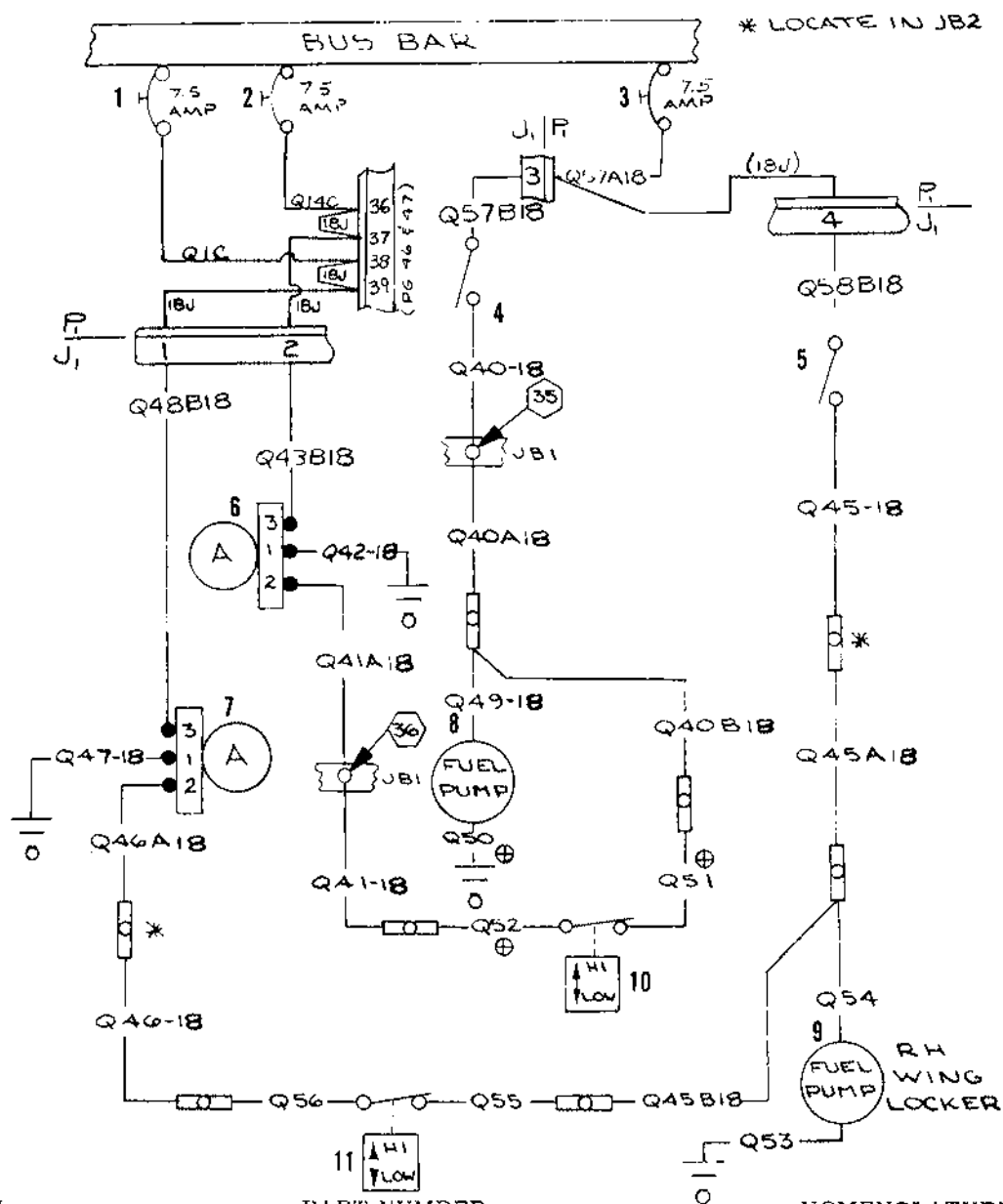
AE
REV.

0870090
DRAWING NO.

75.02
PAGE

AUX FUEL TRANSFER PUMP (OPT) WING LOCKER

EFF. SERIALS



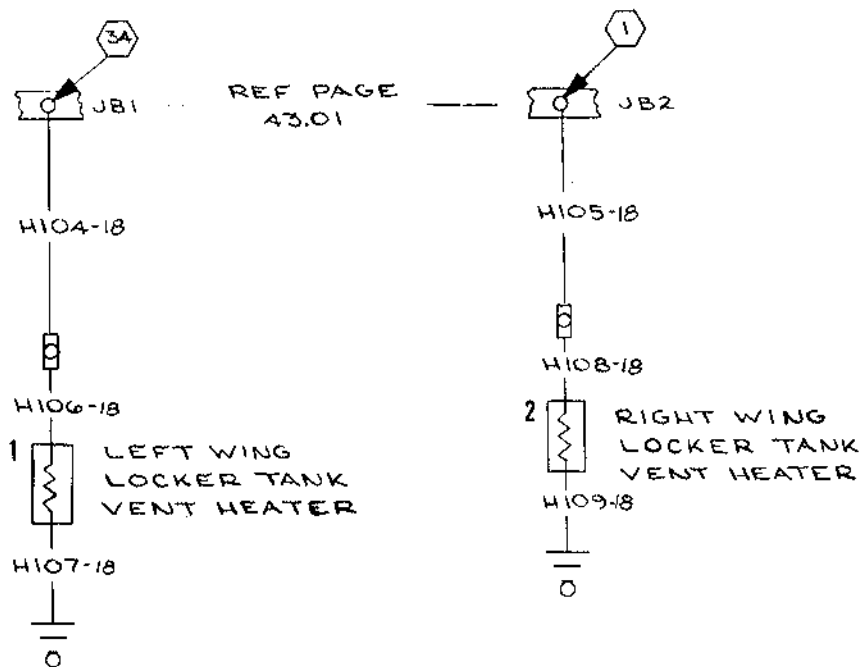
ITEM

PART NUMBER

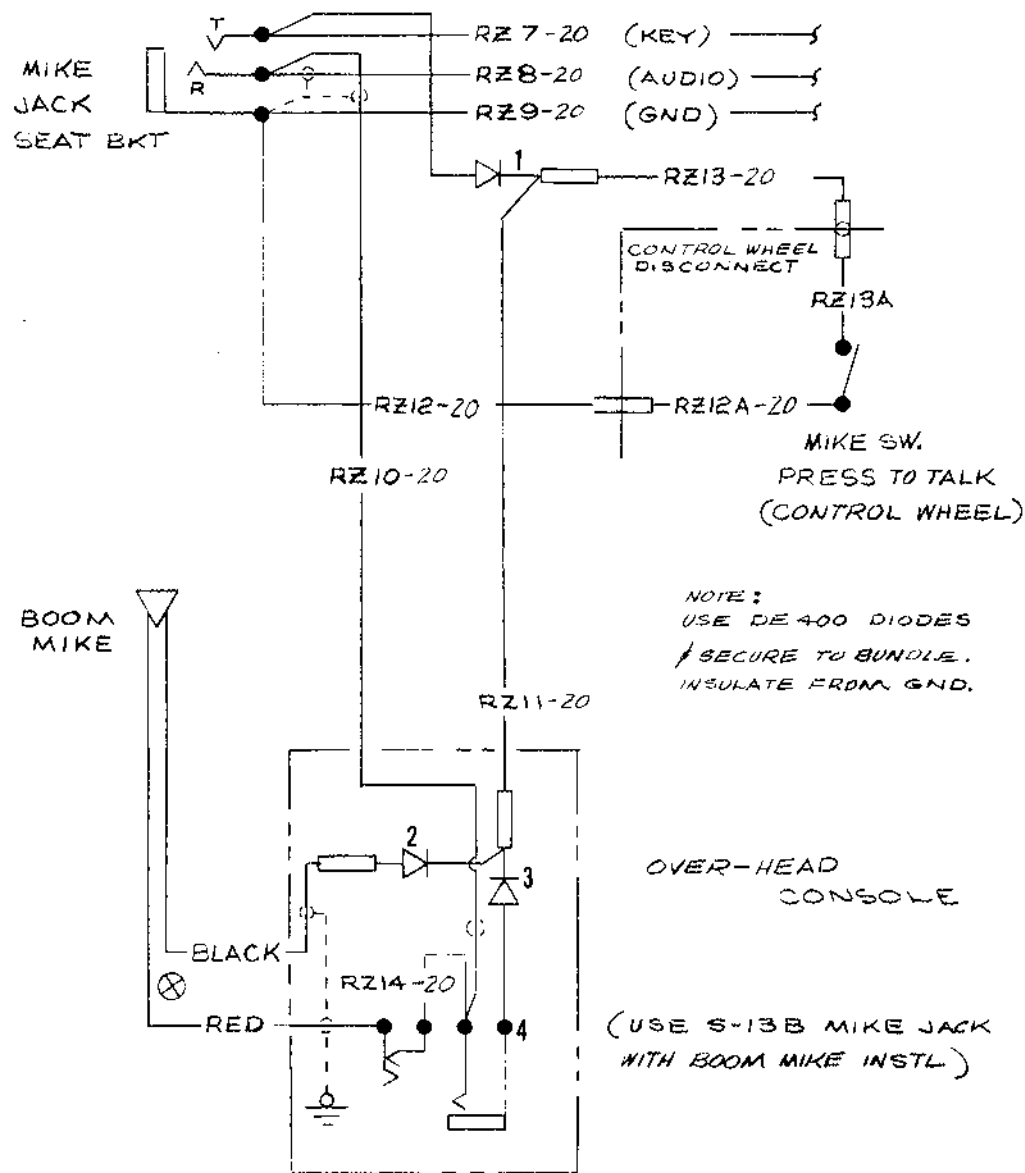
NOMENCLATURE

1	S1232-505	Circuit Breaker
2	S1232-505	Circuit Breaker
3	S1232-507	Circuit Breaker
4	S382-2	Left Fuel Pump Switch
5	S382-2	Right Fuel Pump Switch
6	VM911M4	LH Light Fuel Pressure Ind
7	VM911M4	RH Light Fuel Pressure Ind
8	4140-00-153	Fuel Pump LH Wing Locker
9	4140-00-153	Fuel Pump RH Wing Locker
10	0850452-3	Pressure Switch - RH
11	0850452-3	Pressure Switch - LH

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	76. 01 PAGE
AUX FUEL TRANSFER VENT HEATER (OPT)				
EFF. SERIALS				



ITEM	PART NUMBER	NOMENCLATURE
1	105880	Left Wing Locker Vent Heater
2	105880	Right Wing Locker Vent Heater

EFF. SERIALS

NOTE: SEE PAGE 62. FOR PARTIAL MIKE JACK INSTL.

ITEM	PART NUMBER	NOMENCLATURE
1	DE400	Diode
2	DE400	Diode
3	DE400	Diode
4	S-13B	Boom Mic Jack

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

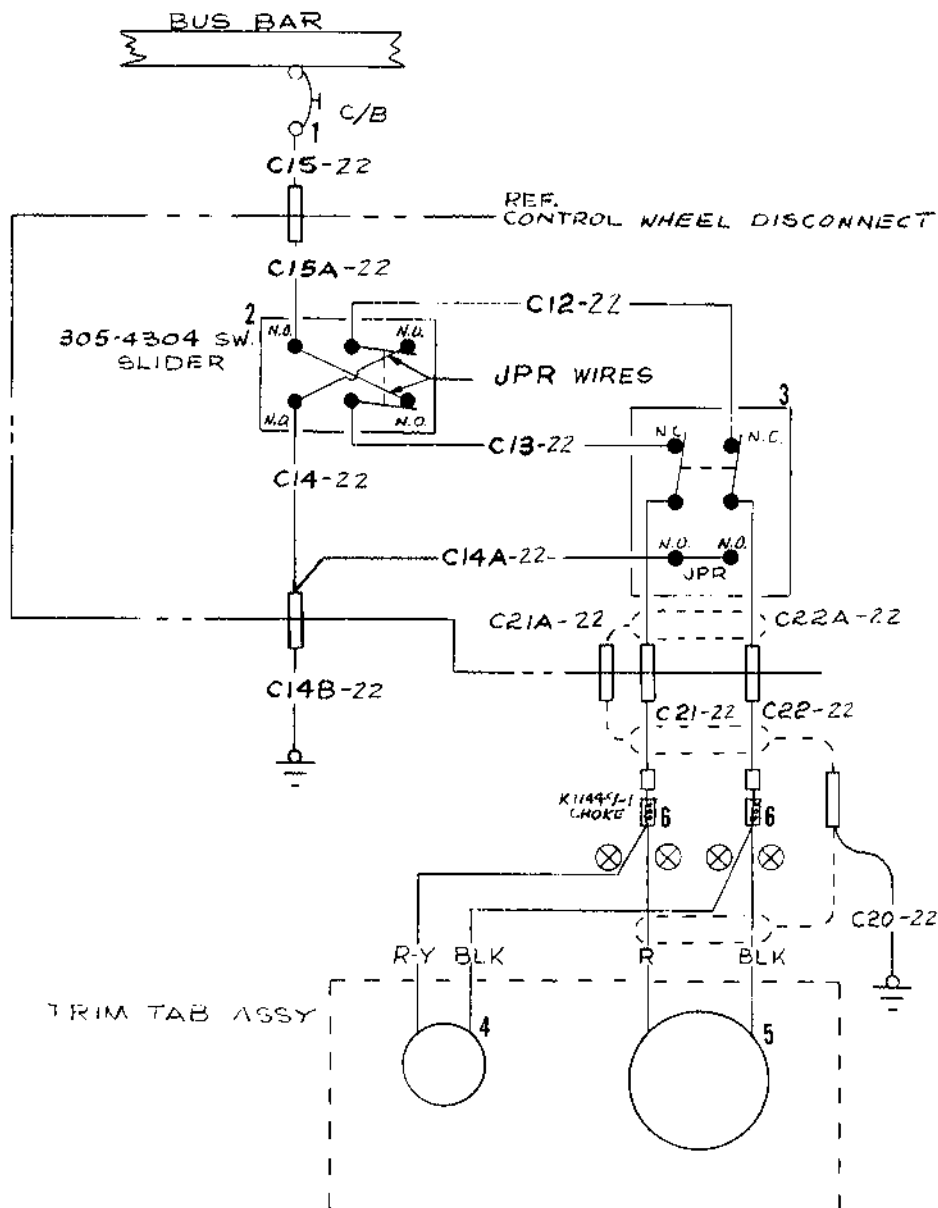
REV.

0870090
DRAWING NO.

79. 00
PAGE

ELECTRIC ELEVATOR TRIM (OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6

S1232-505
305-4320
T20057
38100-0028
9910059-1
K11449-1

Circuit Breaker
Slider
Switch - Trim Disengage
Clutch Unit
Motor Assembly
Choke

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

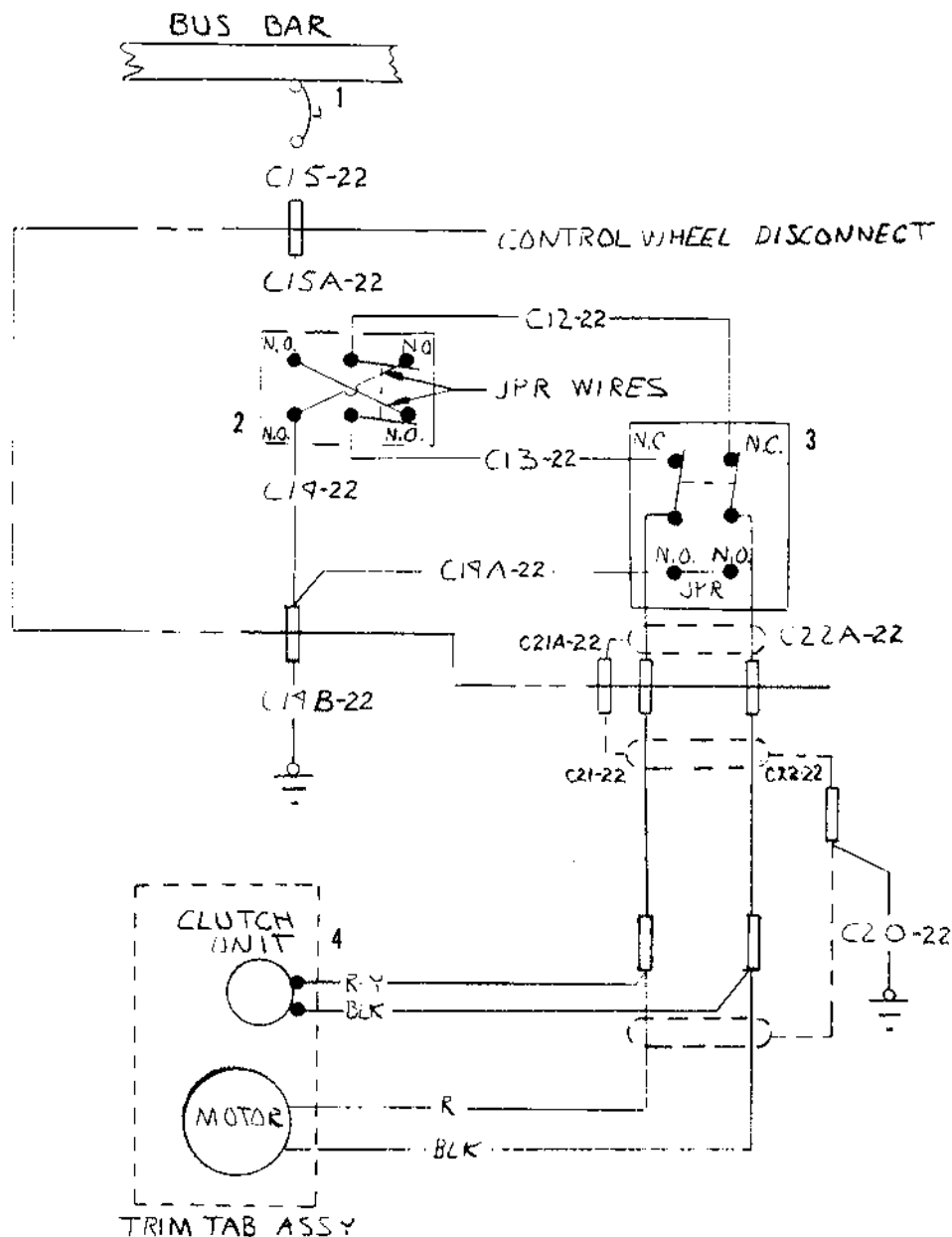
REV.

0870090
DRAWING NO.

79.01
PAGE

ELECTRIC ELEVATOR TRIM (OPTIONAL)

EFF. SERIALS



Item	Part Number	Nomenclature
1	S1232-505	Circuit Breaker
2	305-4320	Slider Switch
3	T2153	Switch (Disengage)
4	1560322-47	Actuator

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

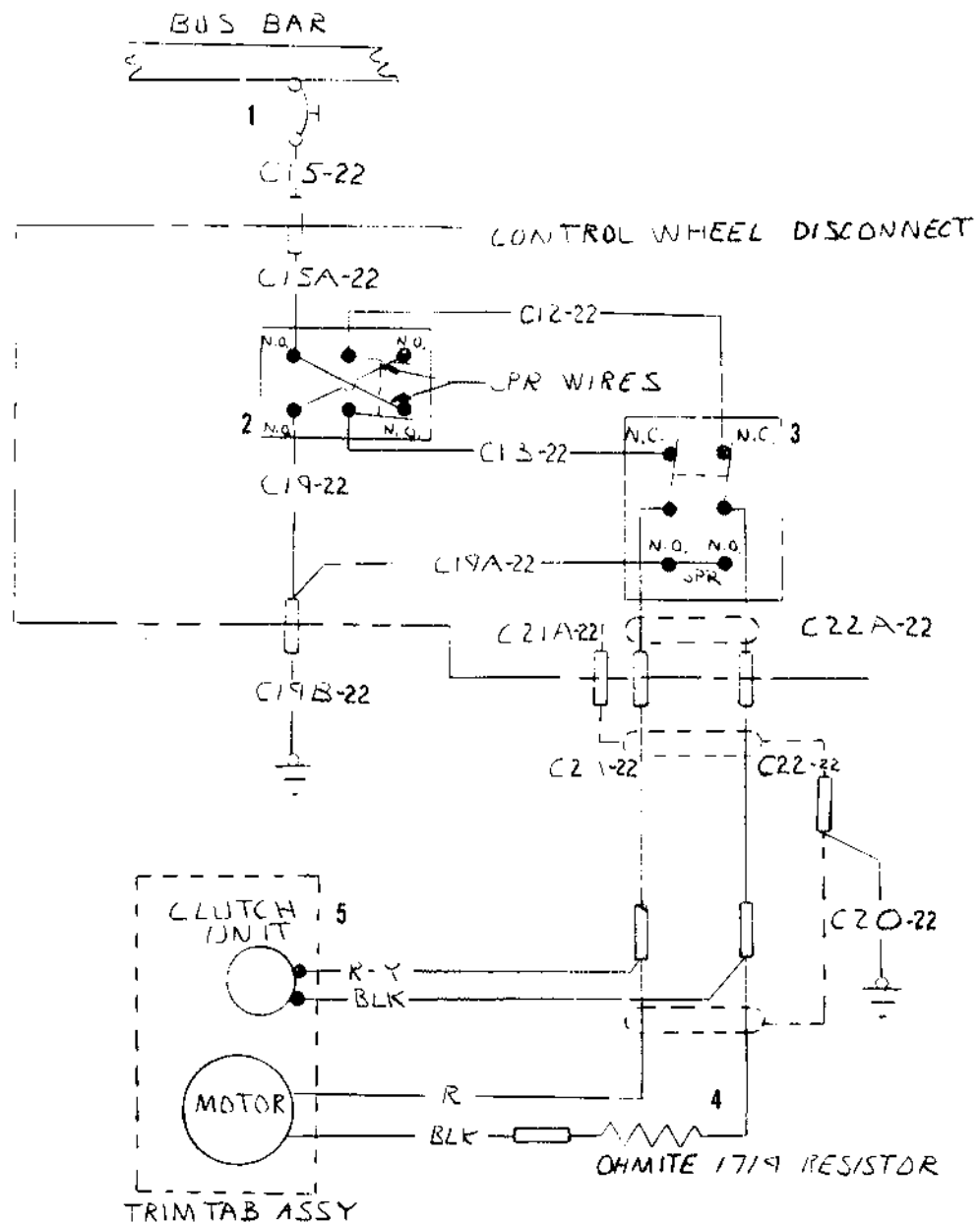
REV.

0870090
DRAWING NO.

79.02
PAGE

ELECTRIC ELEVATOR TRIM (OPTIONAL)

EFF. SERIALS



Item	Part Number	Nomenclature
1	S1232-505	Circuit Breaker
2	305-4320	Slider Switch
3	T2153	Switch (Disengage)
4	1714	Resistor
5	1560322-47	Actuator

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

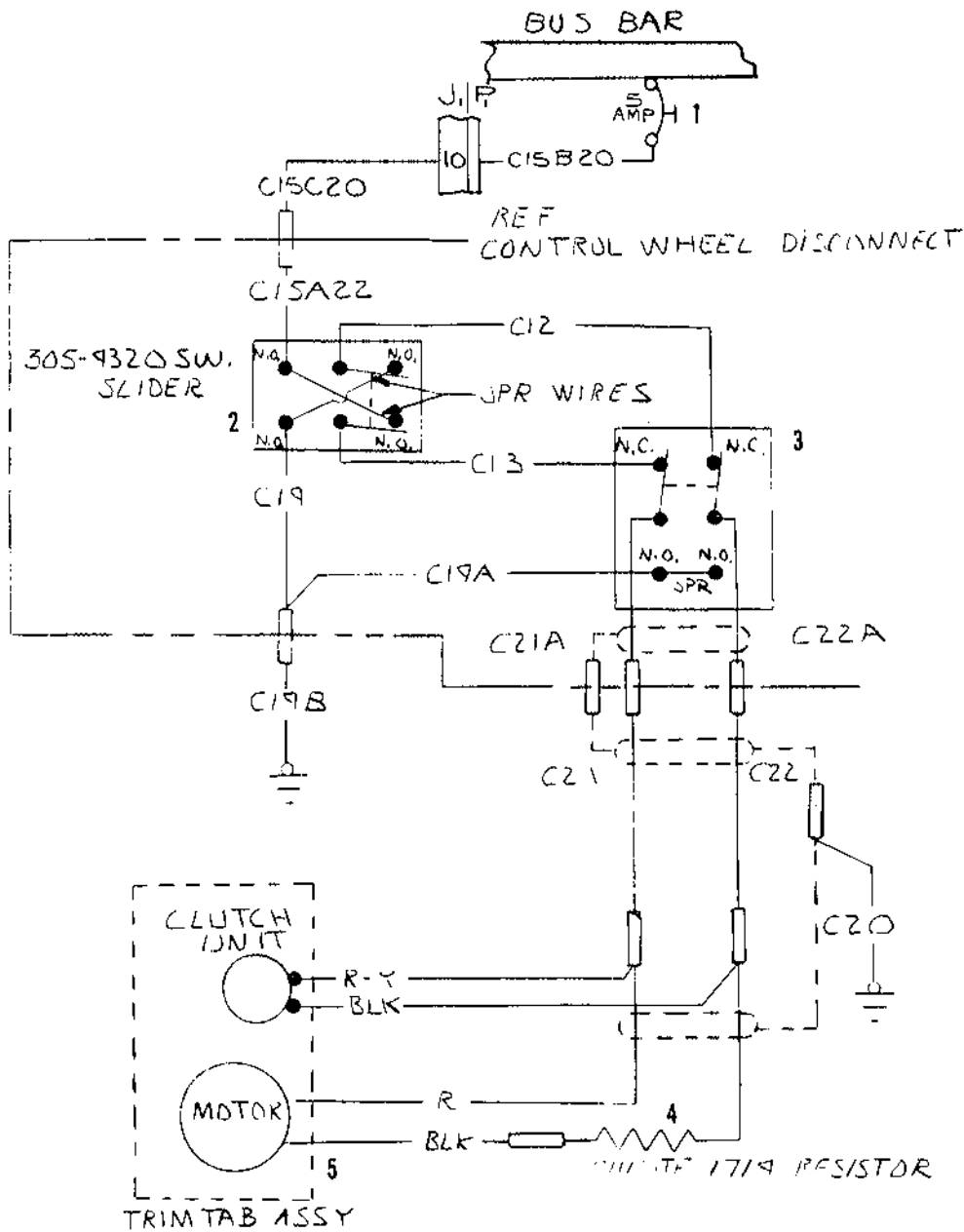
W
REV.

0870090
DRAWING NO.

79.03
PAGE

ELECTRIC ELEVATOR TRIM (OPTIONAL)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1

S1232-505

Circuit Breaker

2

305-4320

Slider Switch

3

T2153

Switch - Disengage

4

1714

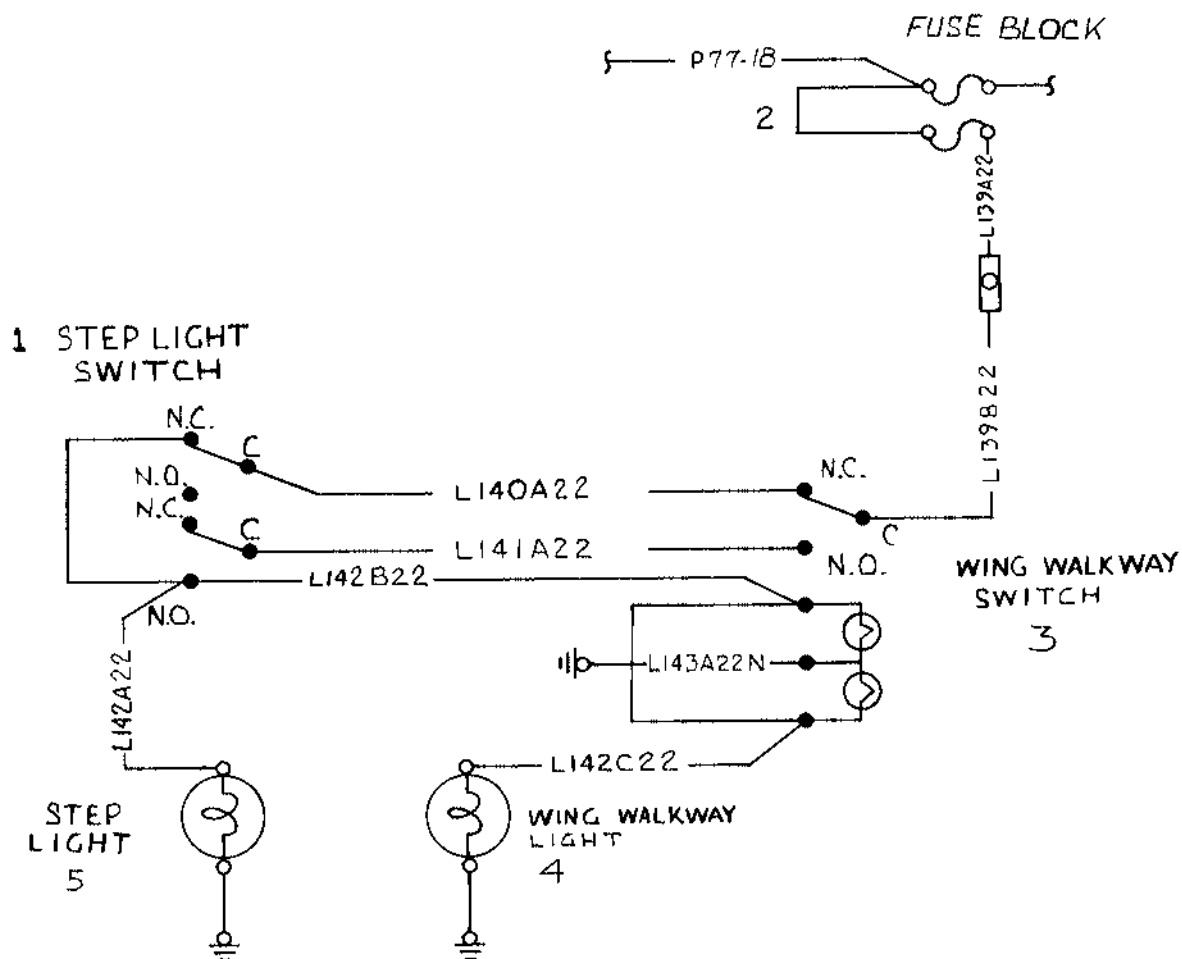
Resistor

5

1560322-47

Actuator

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	80.00 PAGE
WING WALKWAY LIGHT (OPT)				
EFF. SERIALS 310Q0001 TO 310Q0201				



ITEM	PART NUMBER	NOMENCLATURE
1	82PB19-T2	Switch - Step Light
2		Fuse Block
3	90LA1C4J1(G)	Switch - Wing Walkway
4	30-0513	Light - Wing Walkway
5	30-0513	Light - Step

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310

MODEL

REV.

0870090

DRAWING NO.

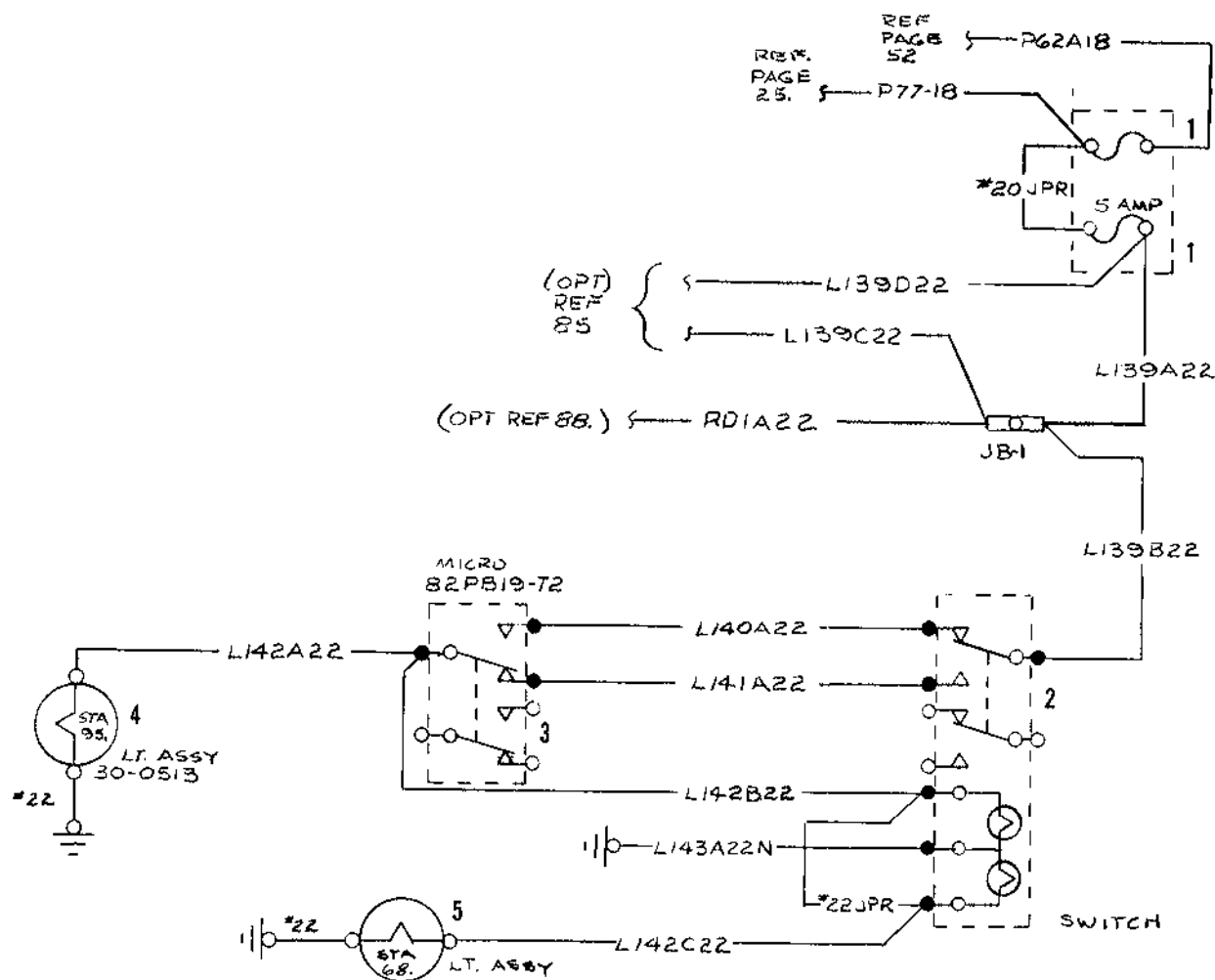
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PAGE

WING WALKWAY LIGHT (OPTIONAL)

EFF. SERIALS

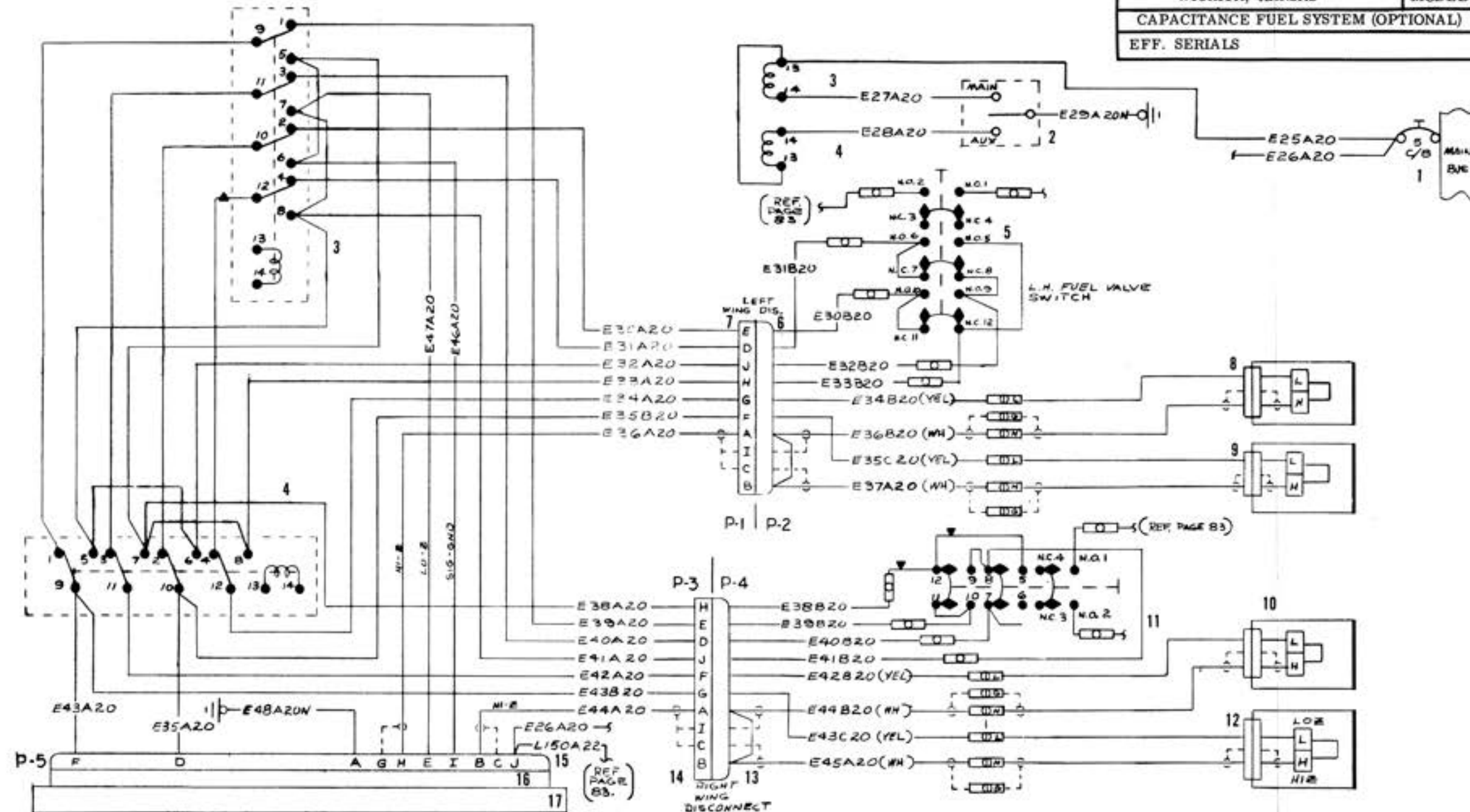
310Q0201 & ON



Item	Part Number	Nomenclature
1	AGC5	Fuse
2	90E-AIC4-J1(G)-L1-NIR133	Walkway Light Switch
3	82PB19-T2	Switch
4	30-513	Light
5	30-513	Light

CAPACITANCE FUEL SYSTEM (OPTIONAL)

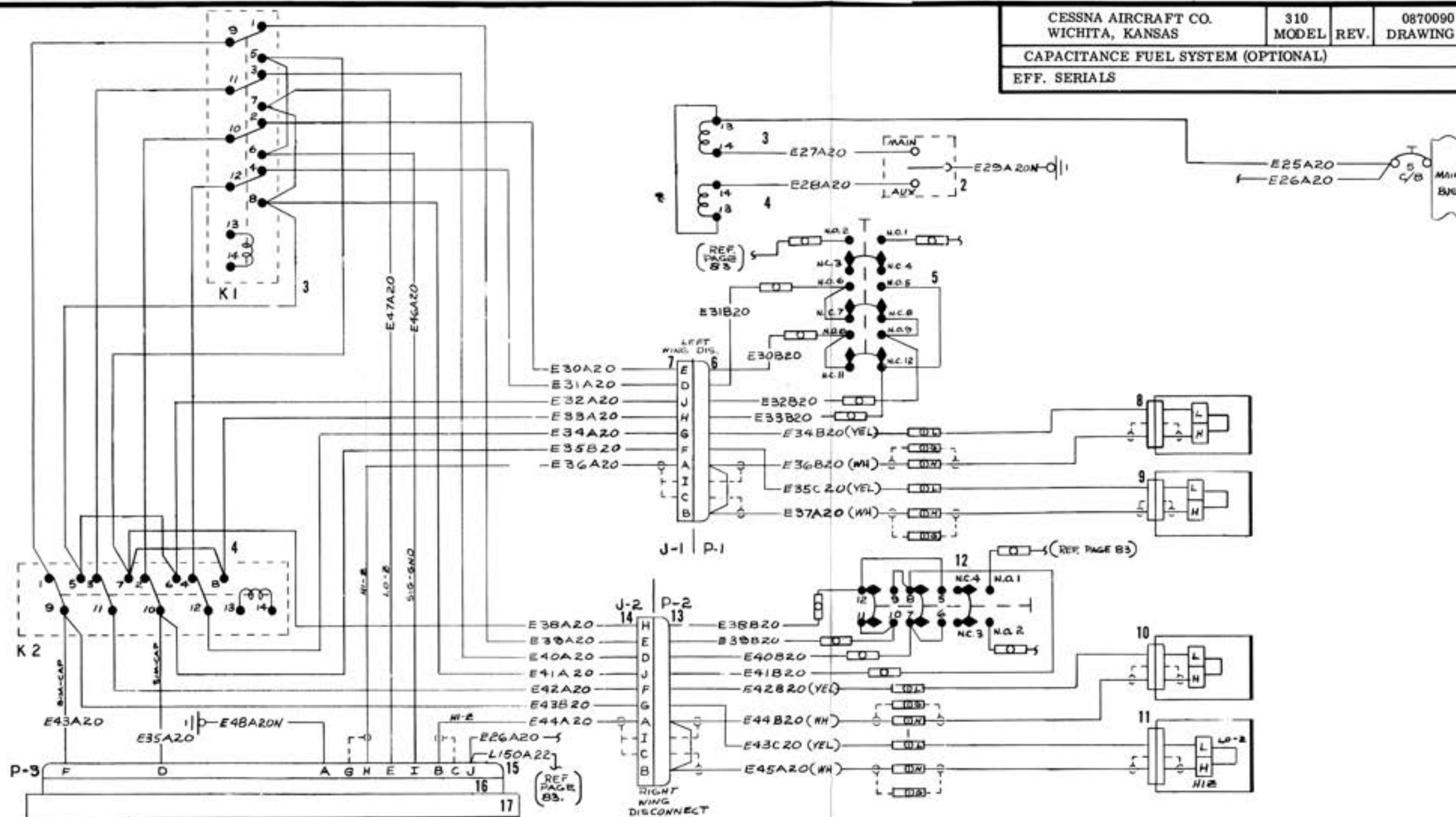
EFF. SERIALS



Item	Part Number	Nomenclature	Item	Part Number	Nomenclature
1	S1232-505	Circuit Breaker	10	PAA700-3	(RH) Main Tank Unit
2	S1695-4	Selector Switch	11	36-604	(RH) Selector Valve Switch
3	281XDX-24VDC	Relay	12	PAA700-2	(RH) Aux Tank Unit
4	281XDX-24VDC	Relay	13	MS3106R-18-1P	Plug
5	36-604	(LH) Selector Valve Switch	14	MS3100R-18-1S	Receptacle
6	MS3106R-18-1P	Plug	15	MS3106E-18-1S	Receptacle
7	MS3100R-18-1S	Receptacle	16	MS3100E-18-1P	Plug
8	PAA700-3	(LH) Main Tank Unit	17	C662013-0101	Indicator
9	PAA700-2	(LH) Aux Tank Unit			

CAPACITANCE FUEL SYSTEM (OPTIONAL)

EFF. SERIALS



Unit

Part Number

Nomenclature

Unit

Part Number

Nomenclature

1
2
3
4
5
6
7
8
9S1232-505
S1695-4
281XDX-24VDC
281XDX-24VDC
36-604
MS3106R-18-1P
MS3100R-18-1S
PAA700-3
PAA700-2Circuit Breaker
Selector Switch
Relay
Relay
(LH) Selector Valve Switch
Plug
Receptacle
(LH) Main Tank Unit
(LH) Aux Tank Unit10
11
12
13
14
15
16
17PAA700-3
PAA700-2
36-604
MS3106R-18-1P
MS3100R-18-1S
MS3106E-18-1S
MS3106E-18-1P
C662013-0101(RH) Main Tank Unit
(RH) Aux Tank Unit
(RH) Selector Valve Switch
Plug
Receptacle
Receptacle
Plug
Indicator

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310 Q
MODEL

AE
REV.

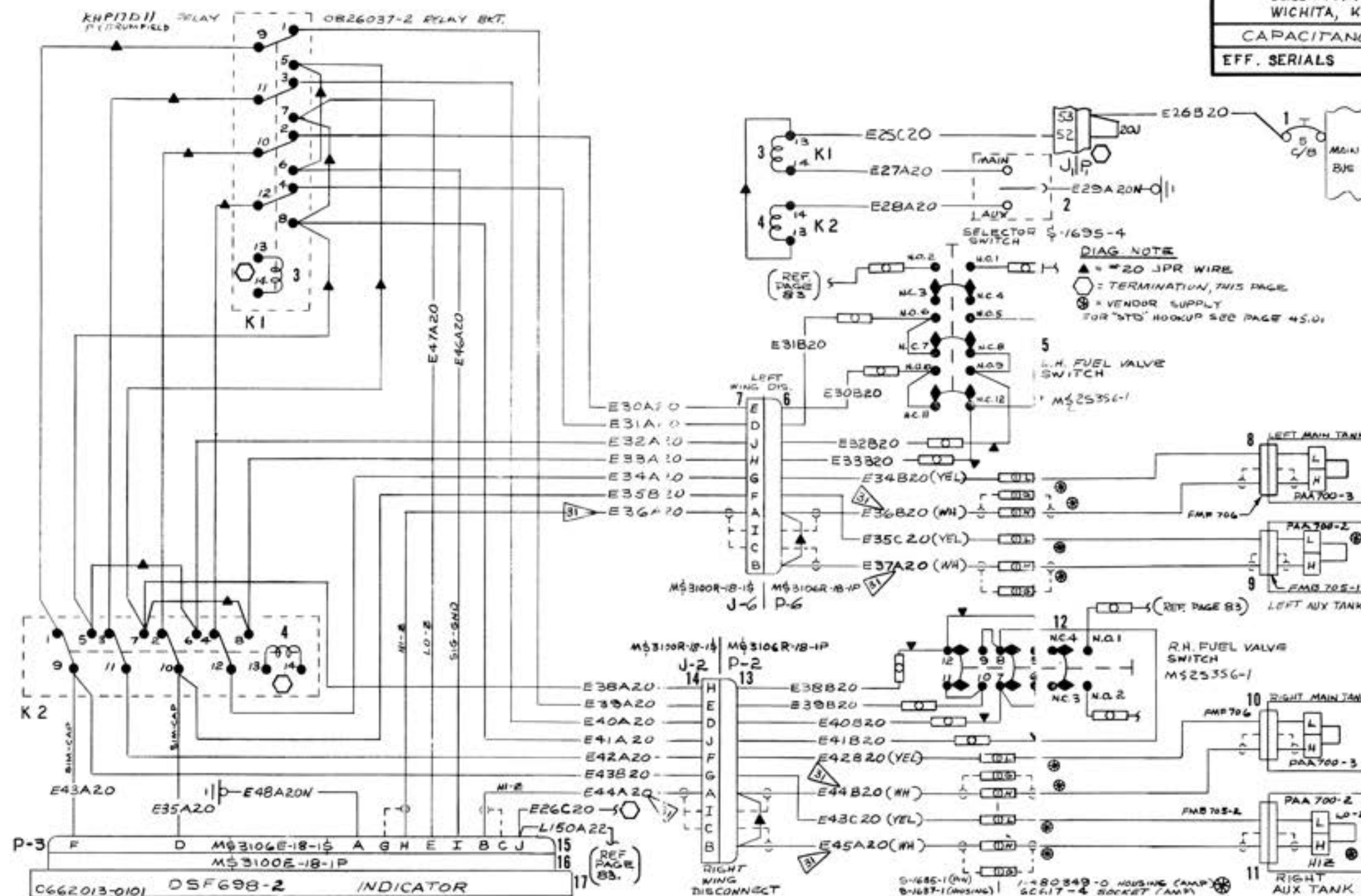
0870090
DRAWING NO.

81.02
PAGE

CAPACITANCE FUEL SYSTEM

(OPTIONAL)

EFF. SERIALS



CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310

MODEL

REV.

0870090

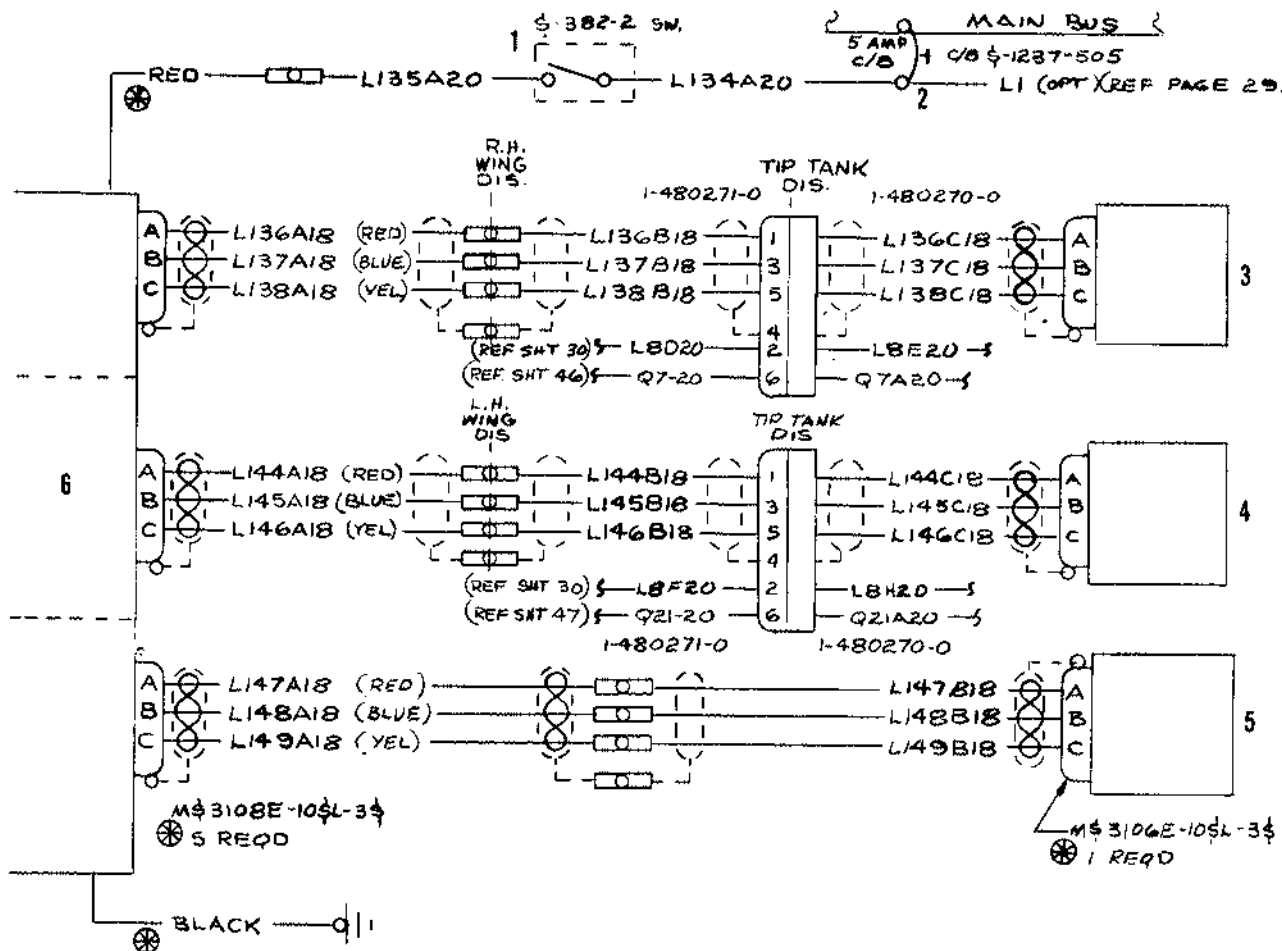
DRAWING NO.

82.00

PAGE

STROBE LIGHT SYSTEM (OPT)

EFF. SERIALS



VENDOR FURNISHED

ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6

S382-2
S1232-510
30-0199-3LH
30-0199-3RH
30-0329-3
60-1038

Switch
Circuit Breaker
Light Assembly
Light Assembly
Light-Stinger
Power Supply

EFF. SERIALS

Wiring diagram for the TAIL STROBE LIGHT NAV LT. (30-0516-5). The diagram shows connections between a 1625-SR PLUG, a MAIN BUS, and various components including a TAIL STROBE LIGHT NAV LT. (30-0516-5), a REF L8A20, and several other components labeled with part numbers like LI56B20, LI55B20, LI55A20, LI56A20, LI57A20, LI58A20N, LI59A20, LI60A20, LI61A20, LI62A20, LI63A20N, and LI34A20. Wires are color-coded: BLACK, RED, WHITE, ORANGE, and RED. A switch is labeled 2, and a fuse is labeled 5A. The diagram is labeled REF PAGE 30.

Item	Part No.	Nomenclature
1	S1232-505	Circuit Breaker
2	S382-2	Switch
3	70-0075	Flasher
4	30-0515-1	Right Wing Strobe Light
5	30-0516-5	Tail Strobe Light
6	60-1520-3	Tail Strobe Light Power Supply
7	30-0515-1	Left Wing Strobe Light

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310Q
MODEL

W
REV.

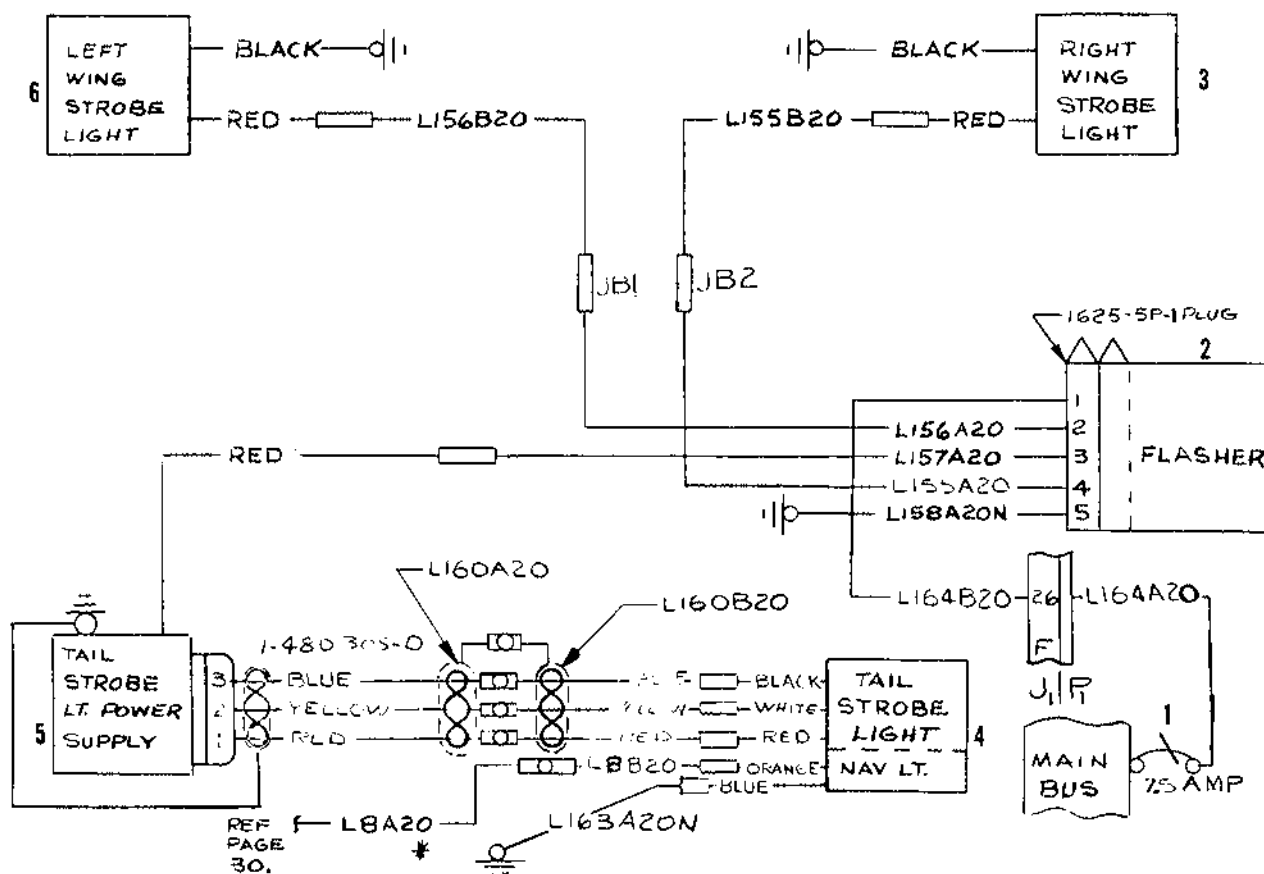
0870090
DRAWING NO.

82.02
PAGE

(GRIMES INC.) STROBE LIGHT SYSTEM (OPTIONAL)

EFF. SERIALS

* CHANGE CONNECTION FOR WIRE L8A20 WHEN STROBE OPT IS INSTL



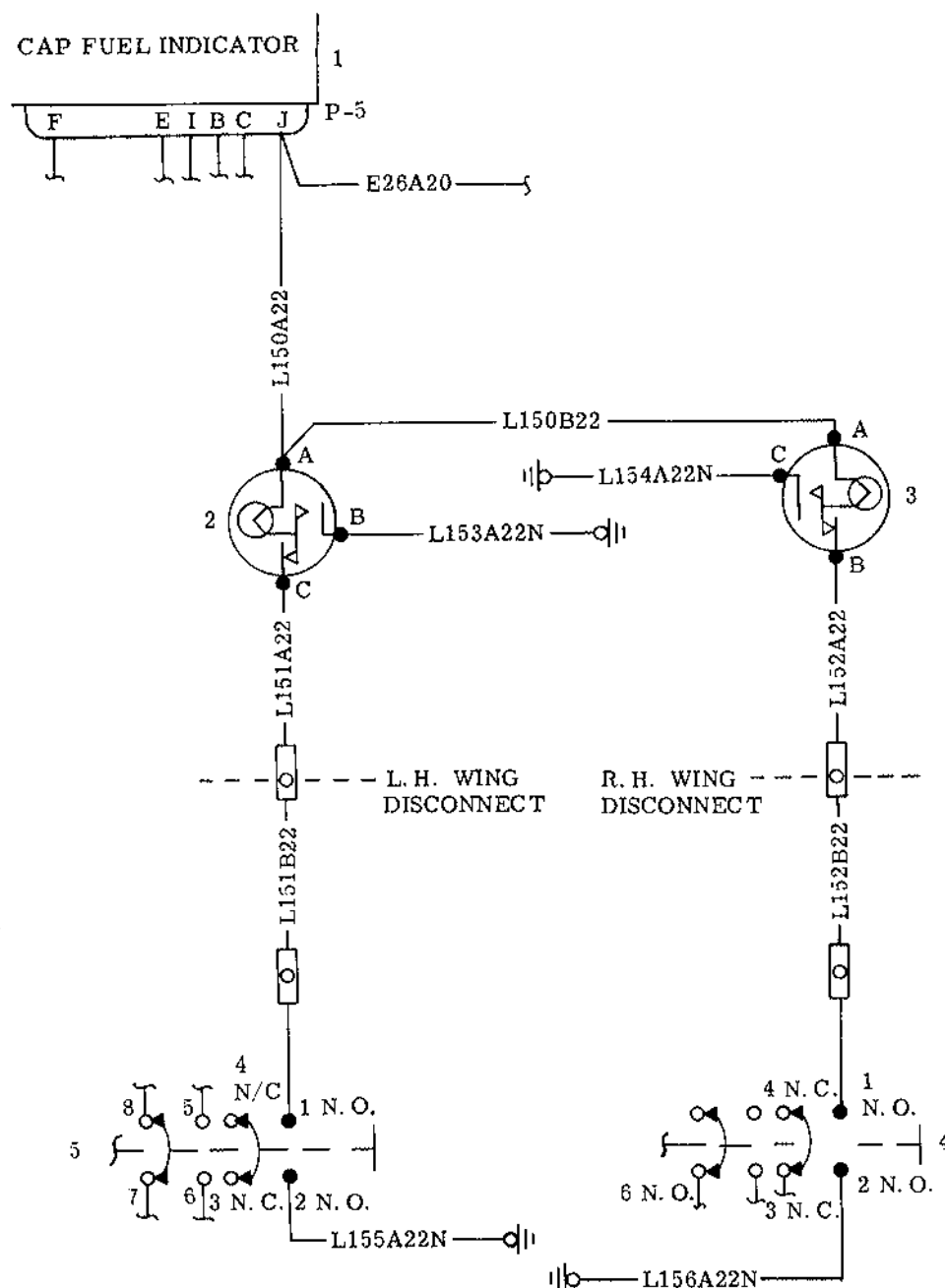
ITEM

PART NUMBER

NOMENCLATURE

1	112-507-101	Switch Breaker
2	70-0075	Flasher
3	30-0515-1	Right Wing Strobe Light
4	30-0516-5	Tail Strobe Light
5	60-1520-3	Tail Strobe Light Power Supply
6	30-0515-1	Left Wing Strobe Light

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	83.00 PAGE
CAPACITANCE FUEL AUXILIARY INDICATOR LIGHTS (OPT)				
EFF. SERIALS 310Q0001 AND ON				

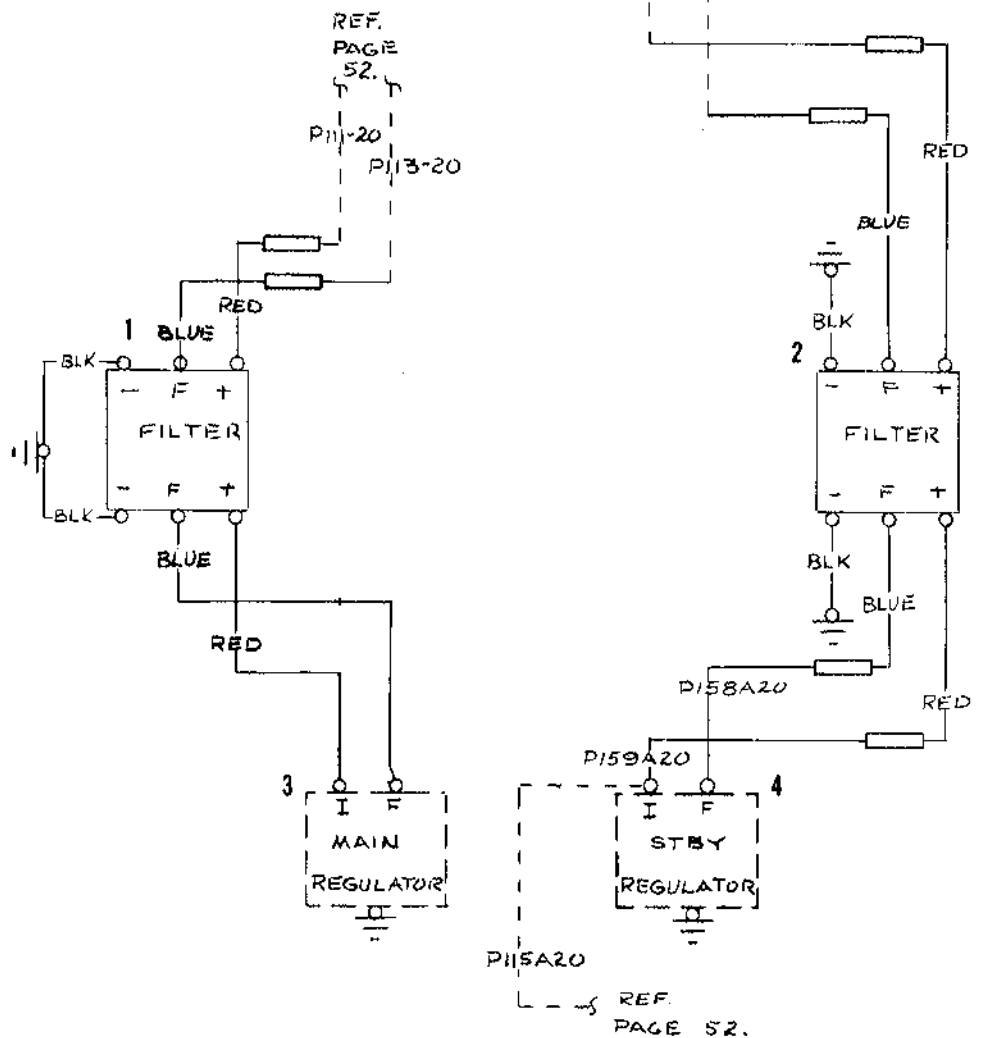


ITEM	PART NUMBER	NOMANCLATURE
1	C662013-0101	Fuel Indicator
2	VM911M-4	LH Indicator
3	VM911M-4	RH Indicator
4	36-604	LH Fuel Valve Switch
5	36-604	RH Fuel Valve Switch

REGULATOR FILTER (OPT)

EFF. SERIALS 310Q0062 AND ON

FILTER P/N JN14-1357B-1
CHANGE CONNECTION AS
SHOWN WHEN FILTERS ARE
INSTL.



ITEM

PART NUMBER

NOMENCLATURE

1	JN14-1357B-1	Filter
2	JN14-1357B-1	Filter
3	CM631656	Main - Voltage Regulator
4	CM631656	Standby - Voltage Regulator

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

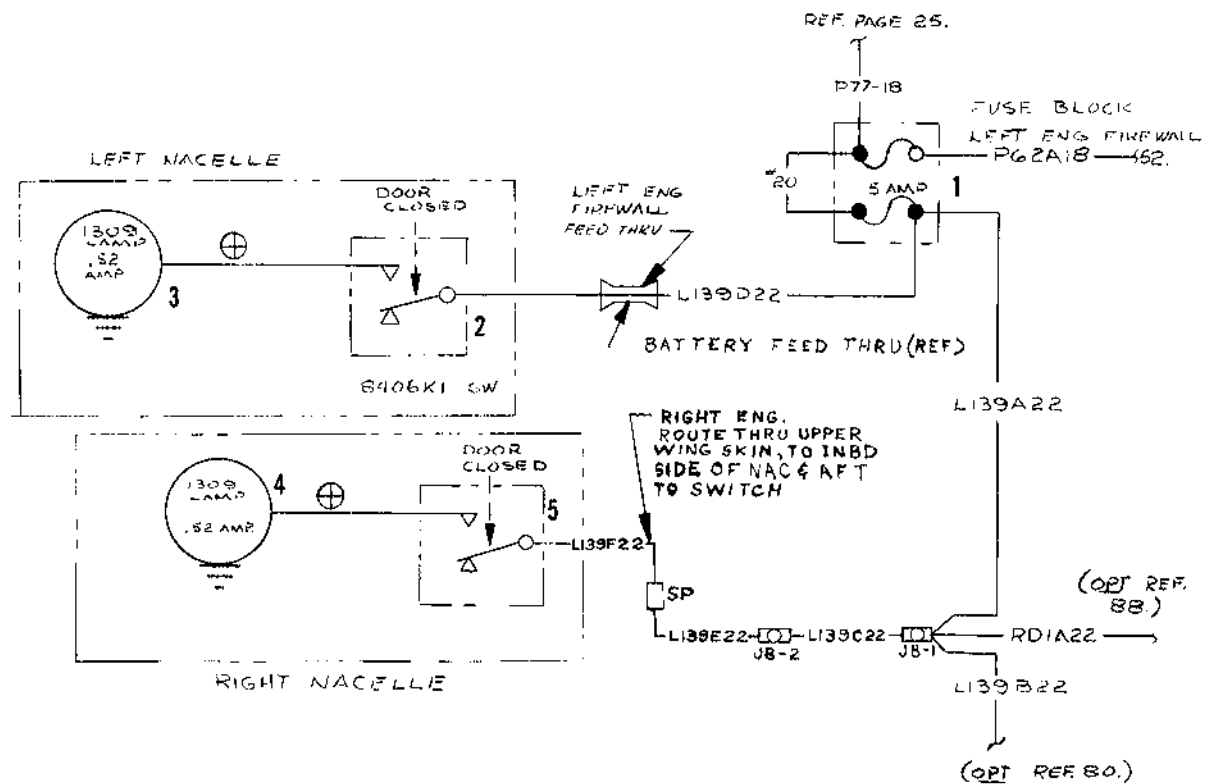
310
MODEL REV.

0870090
DRAWING NO.

85.00
PAGE

NACELLE LIGHT INSTALLATION (OPTIONAL)

EFF. SERIALS 310Q0201 & ON



Item

Part Number

Nomenclature

1
2
3
4
5

AGC5
8406K1
1309
1309
8406K1

Fuse
Switch
Lamp
Lamp
Switch

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310R
MODEL

J
REV.

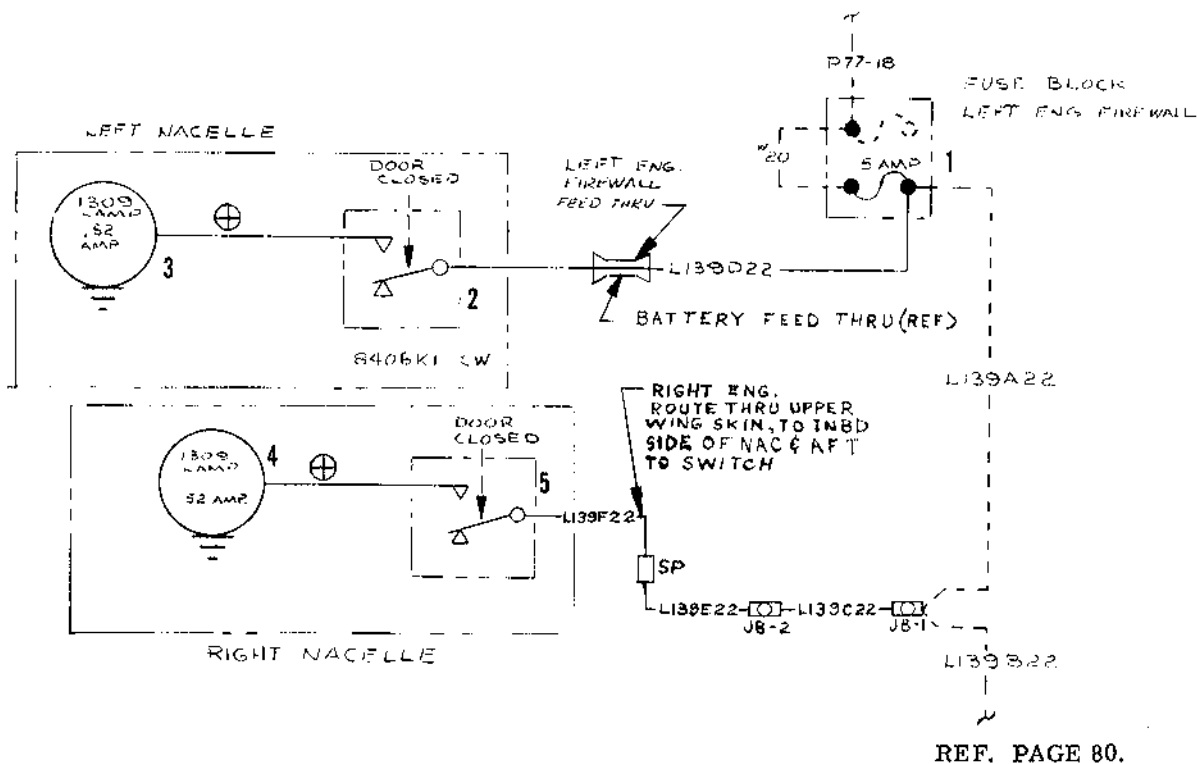
0870090
DRAWING NO.

85.02
PAGE

NACELLE LIGHT INSTALLATION (OPTIONAL)

EFF. SERIALS 310Q0201 & ON

REF. PAGE 52.

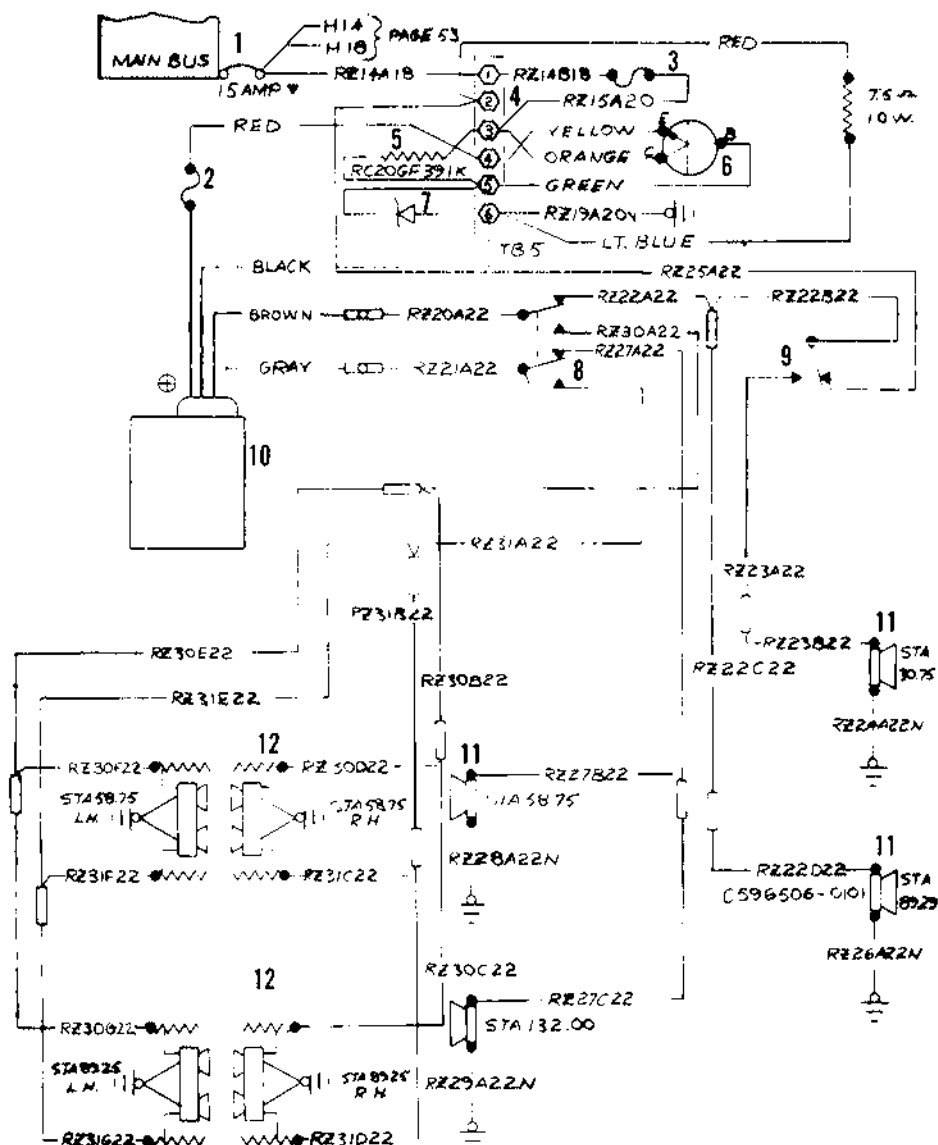


REF. PAGE 80.

NOTE: WIRES L139A, L139B & #20 JPR ARE OPTIONAL FOR WING WALKWAY LT. INSTL. WHEN WALKWAY OPT. IS NOT INSTL. WIRE L139A & #20 JPR WILL BE REQD. ON THIS OPT. INSTL.

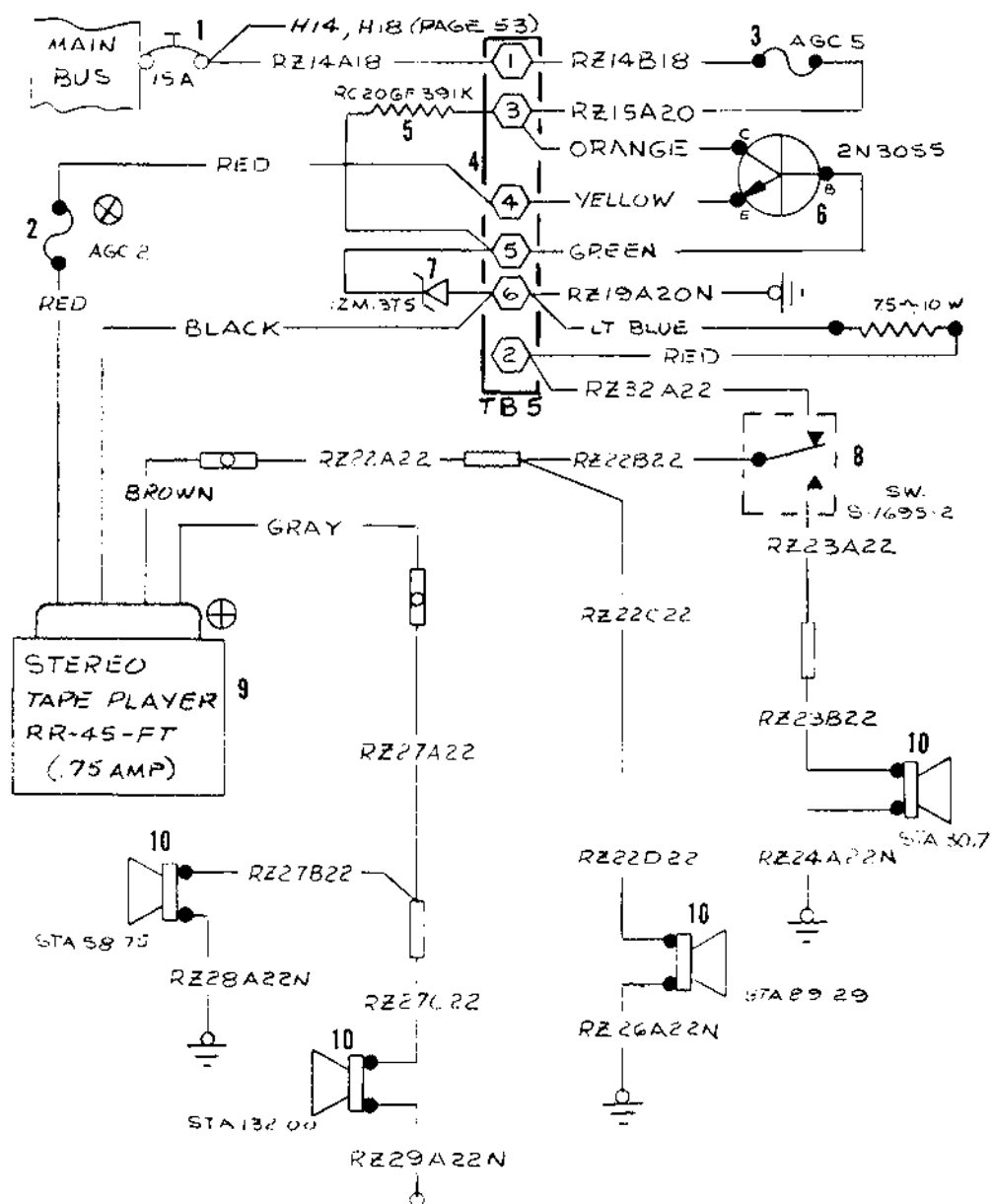
Item	Part Number	Nomenclature
1	AGC5	Fuse
2	8406K1	Switch
3	1309	Lamp
4	1309	Lamp
5	8406K1	Switch

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	86.00 PAGE
STEREO TAPE SYSTEM (OPTIONAL)				
EFF. SERIALS				



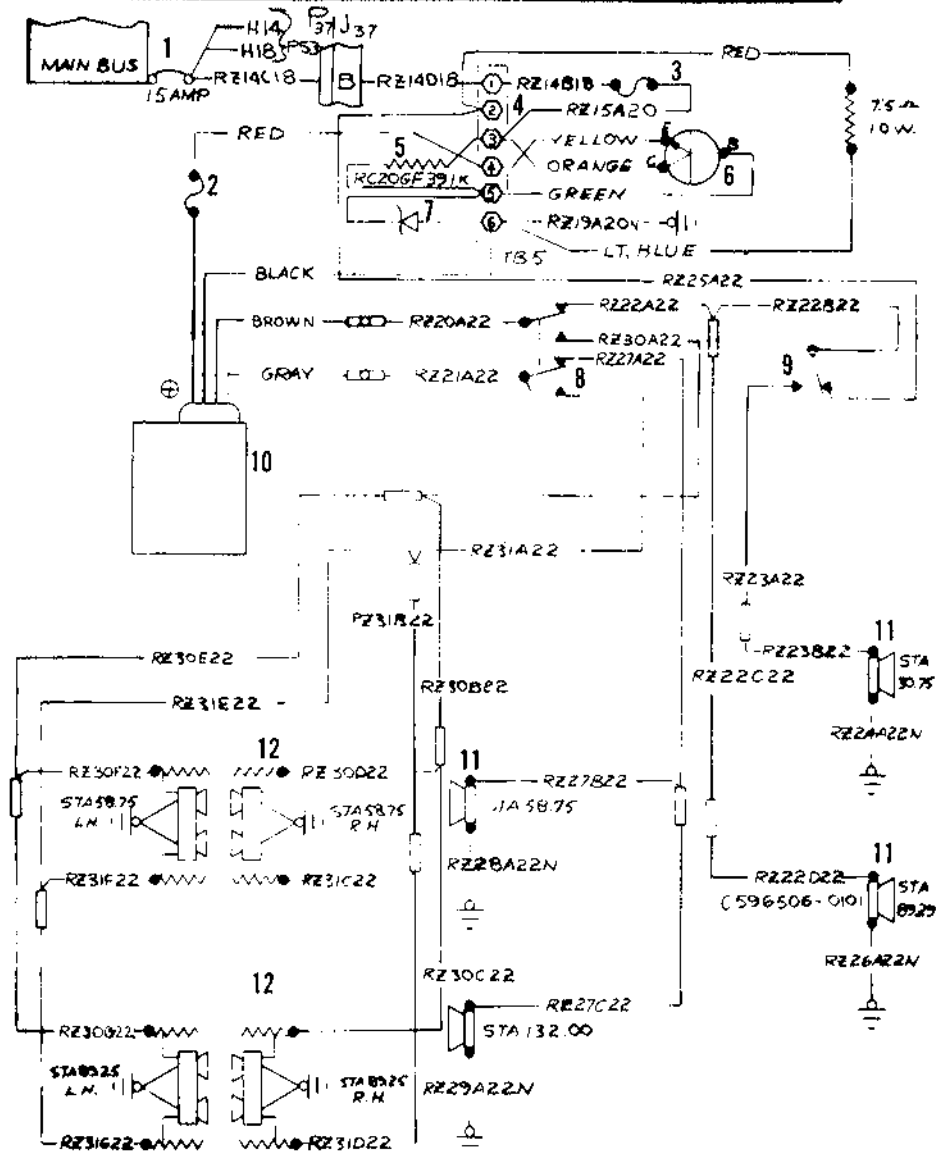
Item	Part Number	Nomenclature
1	S1232-515	Circuit Breaker
2	AGC2	Fuse
3	AGC5	Fuse
4	MS27212-1-6	Terminal Block
5	RC20GF391K	Resistor
6	2N3055	Transistor
7	12M13T5	Diode
8	S1096-1	Switch
9	S-1695-2	Switch
10	PR-45-FT	Stereo Tape Player
11	C596506-0101	Speaker
12	RV6NA4SD252A	Transducer

EFF. SERIALS



ITEM	PART NUMBER	NOMENCLATURE
1	SI232-515	Circuit Breaker
2	AGC2	Fuse
3	AGC5	Fuse
4	MS27212-1-6	Terminal Block
5	RC20GF391K	Resistor
6	2N3055	Transistor
7	1ZM13T5	Diode
8	S-1695-2	Switch
9	PR-45-FT	Stereo Tape Player
10	C596506-0101	Speaker

CESSNA AIRCRAFT CO. WICHITA, KANSAS	310 MODEL	REV.	0870090 DRAWING NO.	86.02 PAGE
STEREO TAPE SYSTEM (OPTIONAL)				
EFF. SERIALS				



Item	Part Number	Nomenclature
1	S1232-515	Circuit Breaker
2	AGC2	Fuse
3	AGC5	Fuse
4	MS27212-1-6	Terminal Block
5	RC20GF391K	Resistor
6	2N3055	Transistor
7	12M13T5	Diode
8	S1096-1	Switch
9	S-1695-2	Switch
10	PR-45-FT	Stereo Tape Player
11	C596506-0101	Speaker
12	RV6NA4SD252A	Transducer

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

3100
MODEL

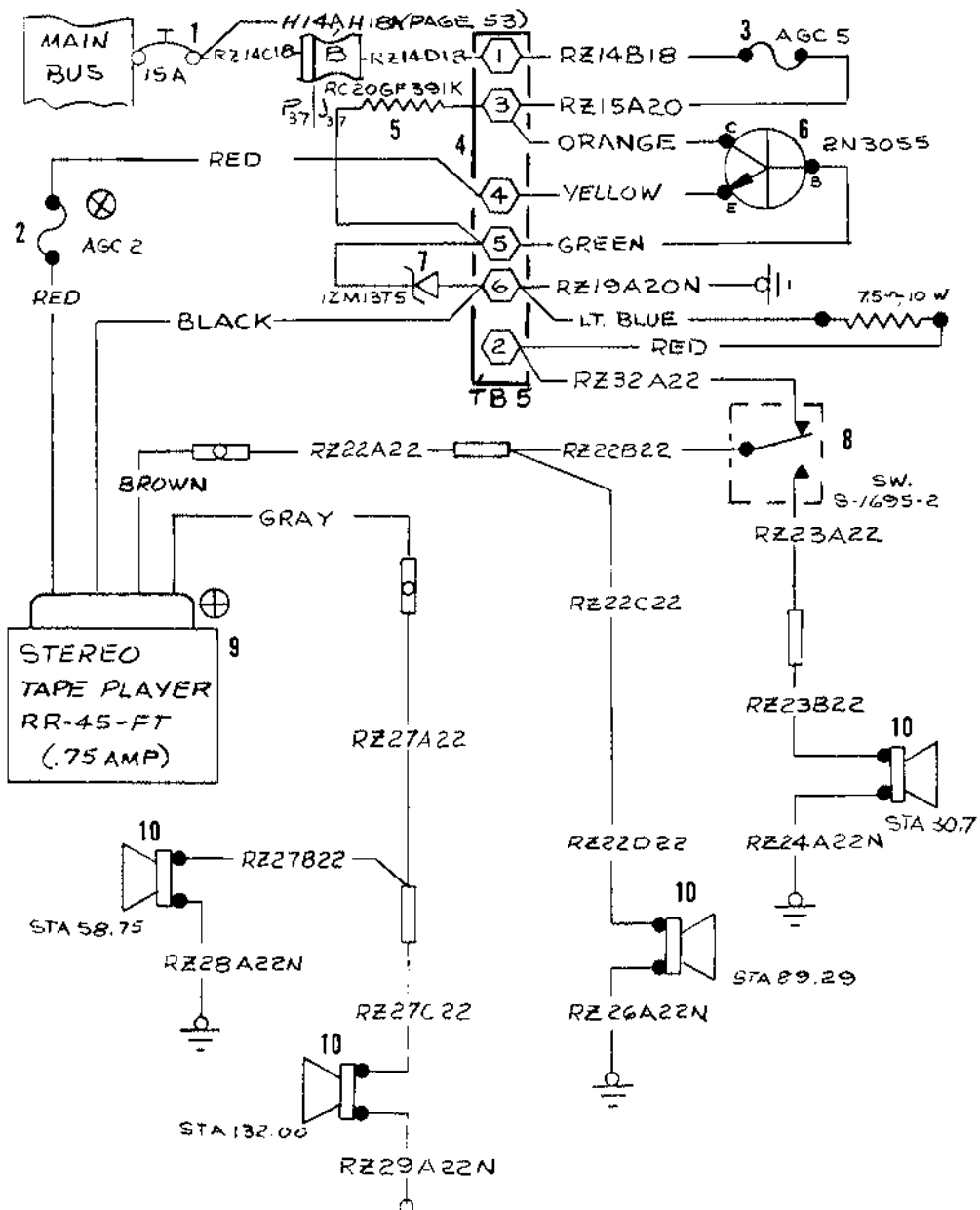
W
REV.

0870090
DRAWING NO.

86.03
PAGE

STEREO TAPE SYS (STD-OPT)

EFF. SERIALS



ITEM

PART NUMBER

NOMENCLATURE

1
2
3
4
5
6
7
8
9
10

S1232-515
AGC2
AGC5
MS27212-1-6
RC20GF391K
2N3055
1ZM13T5
S-1695-2
PR-45-FT
C596506-0101

Circuit Breaker
Fuse
Fuse
Fuse
Terminal Block
Resistor
Transistor
Diode
Switch
Stereo Tape Player
Speaker

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

310
MODEL

REV.

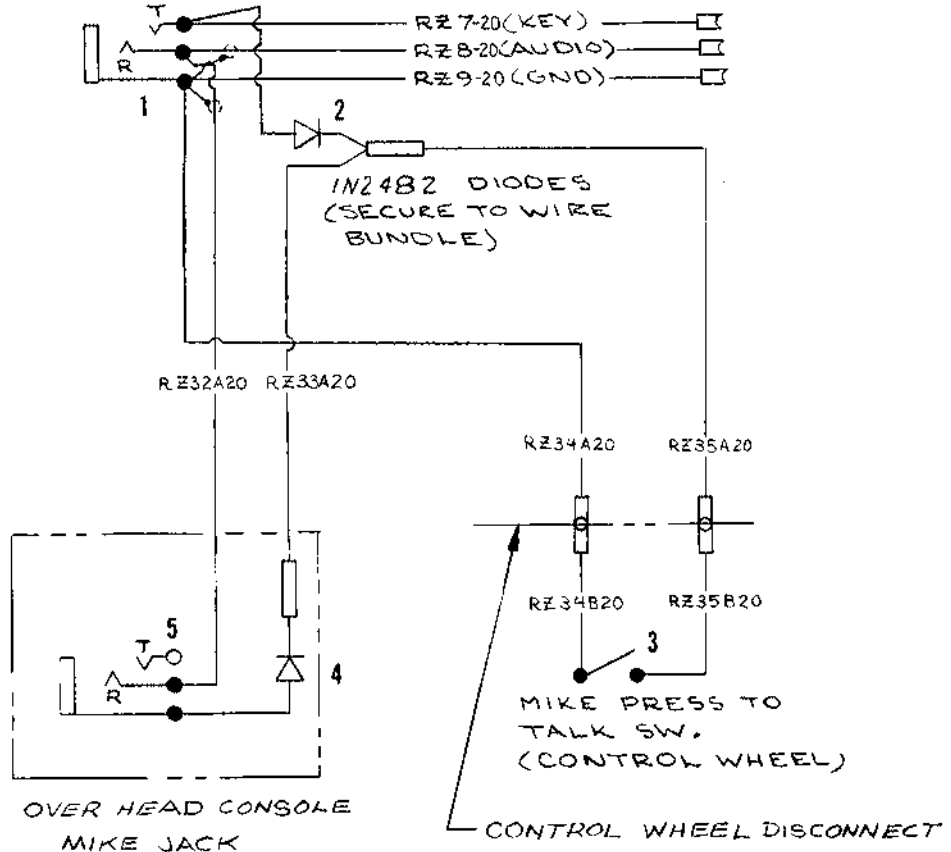
0870090
DRAWING NO.

87.00
PAGE

RH MIKE JACK CIRCUIT (OPTIONAL)

EFF. SERIALS 310Q0201 & ON

MIKE JACK-STD
(SEAT BKT)



Item

Part Number

Nomenclature

1

S1102-1

Mike Jack

2

IN2482

Diode

3

T2114

Switch

4

IN2482

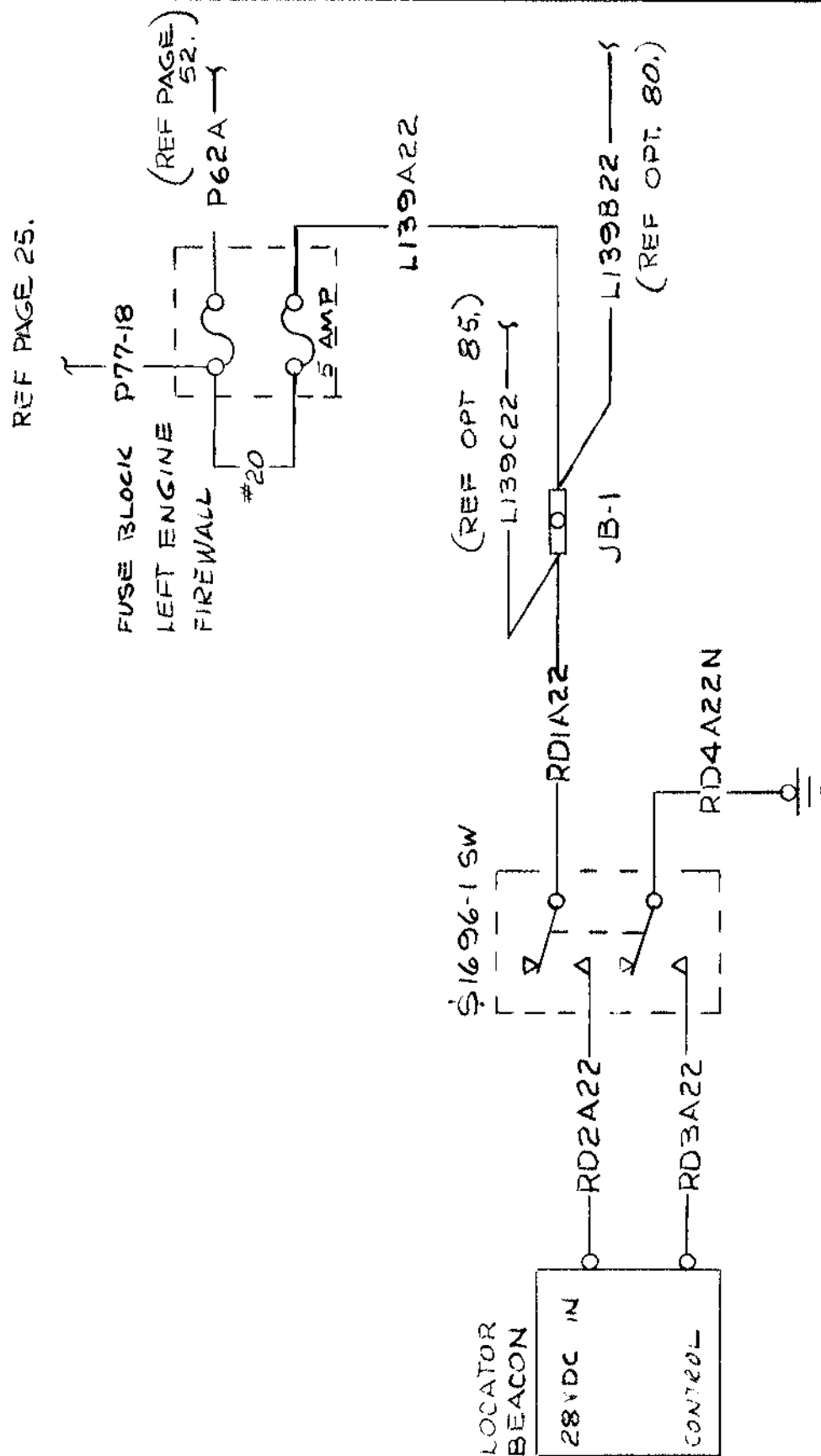
Diode

5

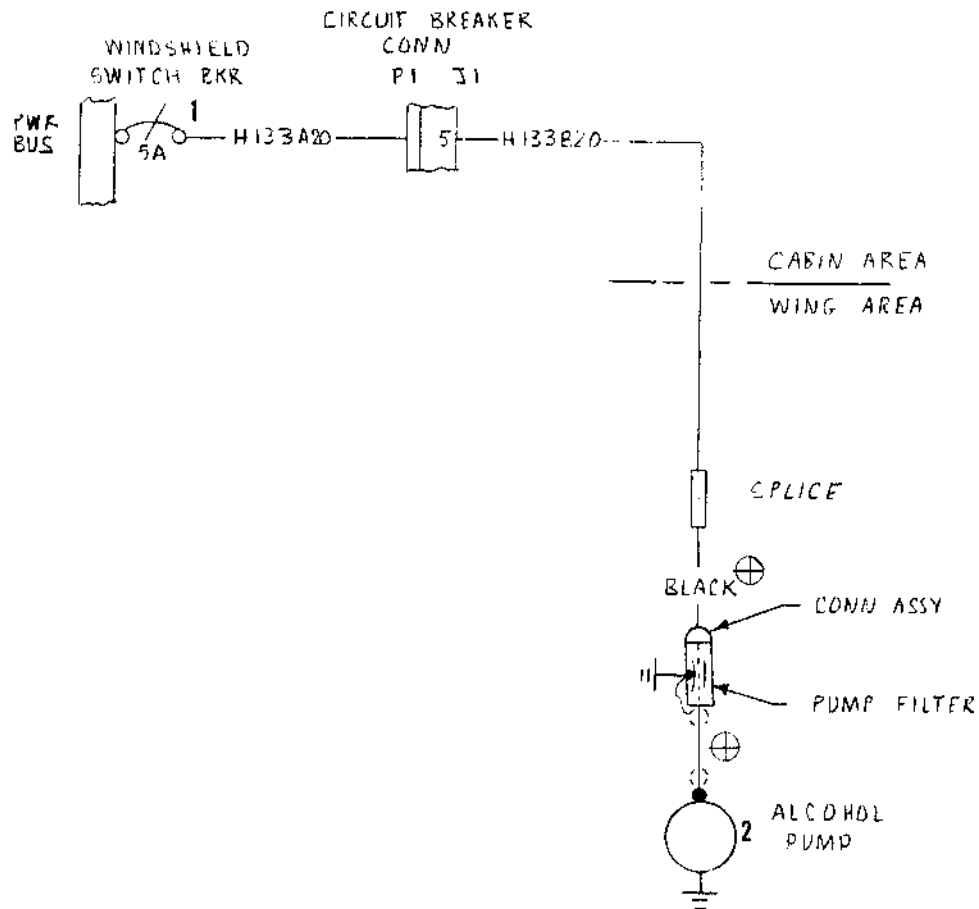
S1102-1

Mike Jack

EFF. SERIALS 310Q0201 & ON



CESSNA AIRCRAFT CO. WICHITA, KANSAS	310Q MODEL	AB REV.	0870040 DRAWING NO.	90.00 PAGE
"ALCOHOL" WINDSHIELD ANTI-ICE SYSTEM (OPT)				
EFF. SERIALS				



ITEM	PART NUMBER	NOMENCLATURE
1	112-205-101	Switch Breaker
2	476411	Pump

WIRING DIAGRAM INDEX

310Q0601 AND ON

TITLE	PAGE
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Terminal Boards (Junction Box Connections)	14-105
Starter, Ignition and APU	14-106
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Stereo, Speakers, and Headsets	14-117

310Q0601 AND ON

REFERENCE DESIGNATOR CODE:

Reference designators are used in these diagrams to more quickly identify and locate a part or assembly used in any electrical system. A part is identified by reference number on a diagram. The reference number called out on the following page identifies by part number, the description and diagram sheet location.

EXAMPLE -

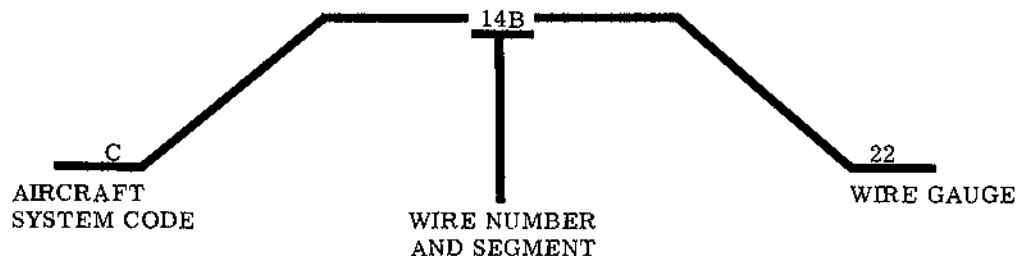
REF. DESIGNATOR	DIA. SHT. NO.	PART NO.	DESCRIPTION
BB20	6	0820001-1	Battery Bus

NOTE

Part numbers referred to on Wiring Diagrams are for reference only. When ordering spare or replacement parts, refer to applicable Parts Catalog.

The wiring diagrams contained in this section clearly show the complete wiring on each item of electrical components listed in the Wiring Diagram Index. The first portion of wire number indicates the Aircraft System, the center portion indicates Wire Number, and the last portion indicates Wire Gauge Size. Each wiring diagram contains part number and nomenclature for each component.

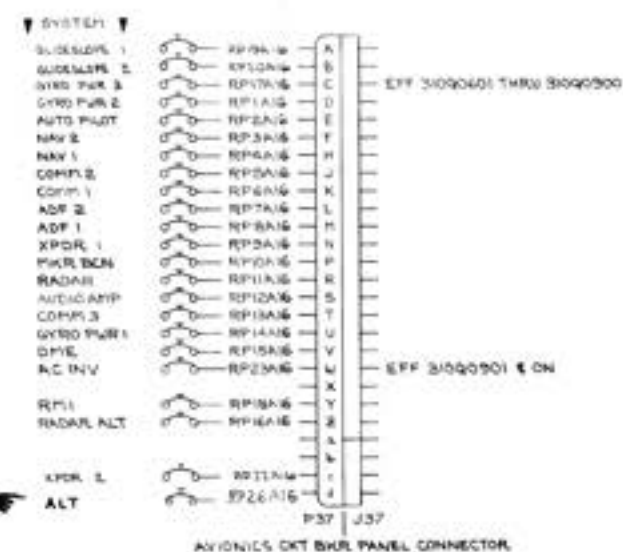
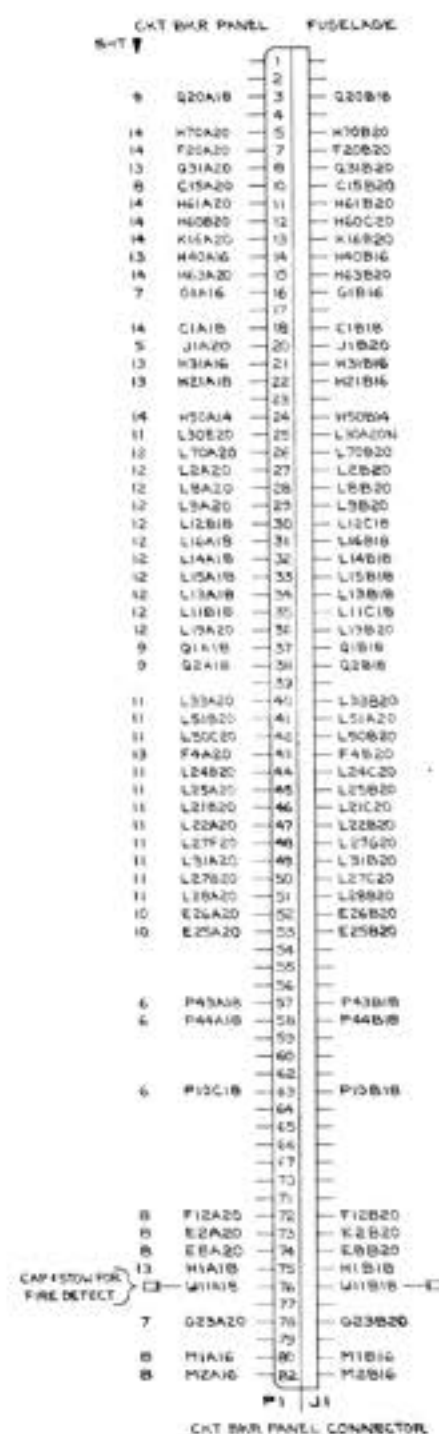
EXAMPLE : C14B22



NOTE

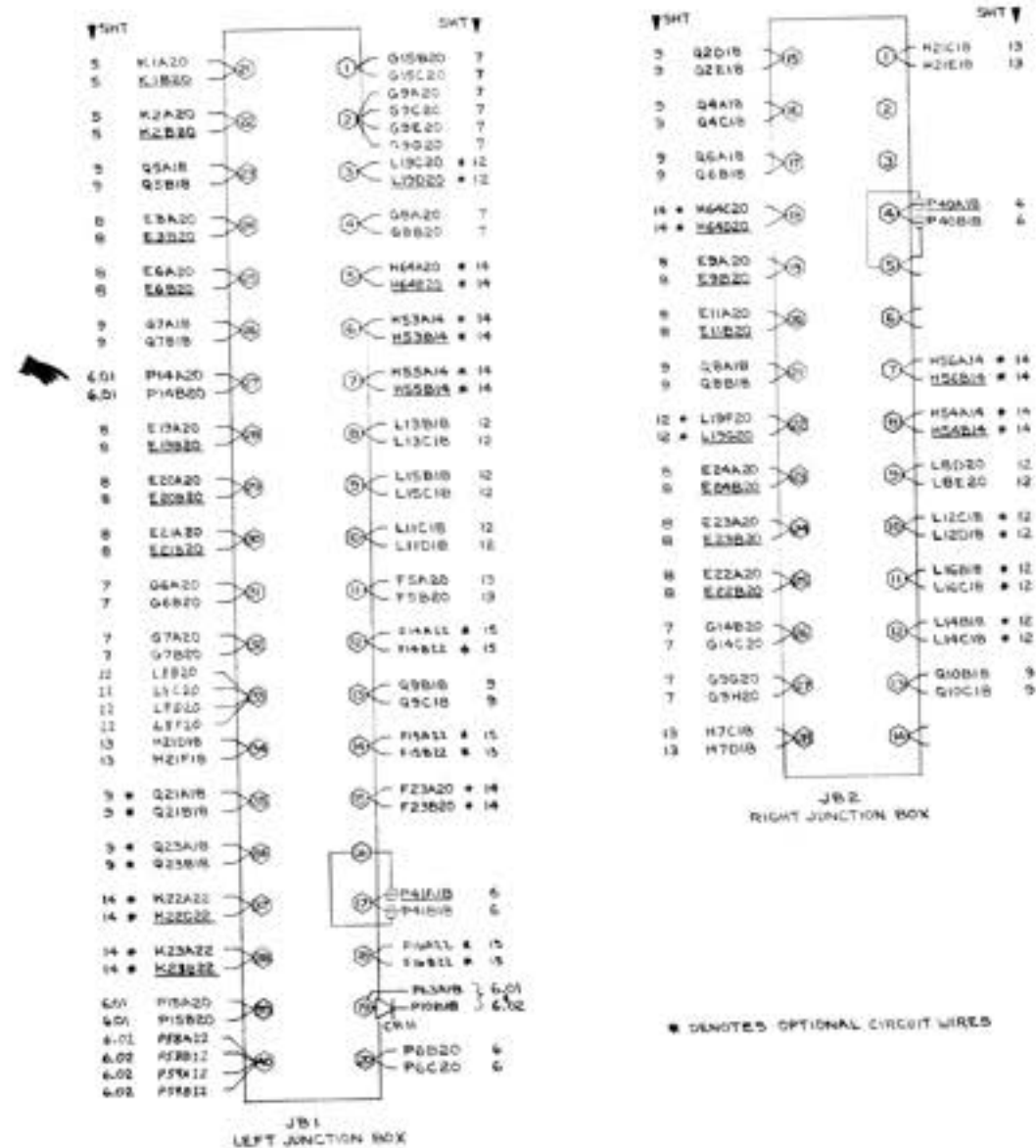
Optional wires (300 and 500 Series) may be determined by dropping the hundreds digit.

EXAMPLE: E327B18 becomes E27B18
E527C18 becomes E27C18

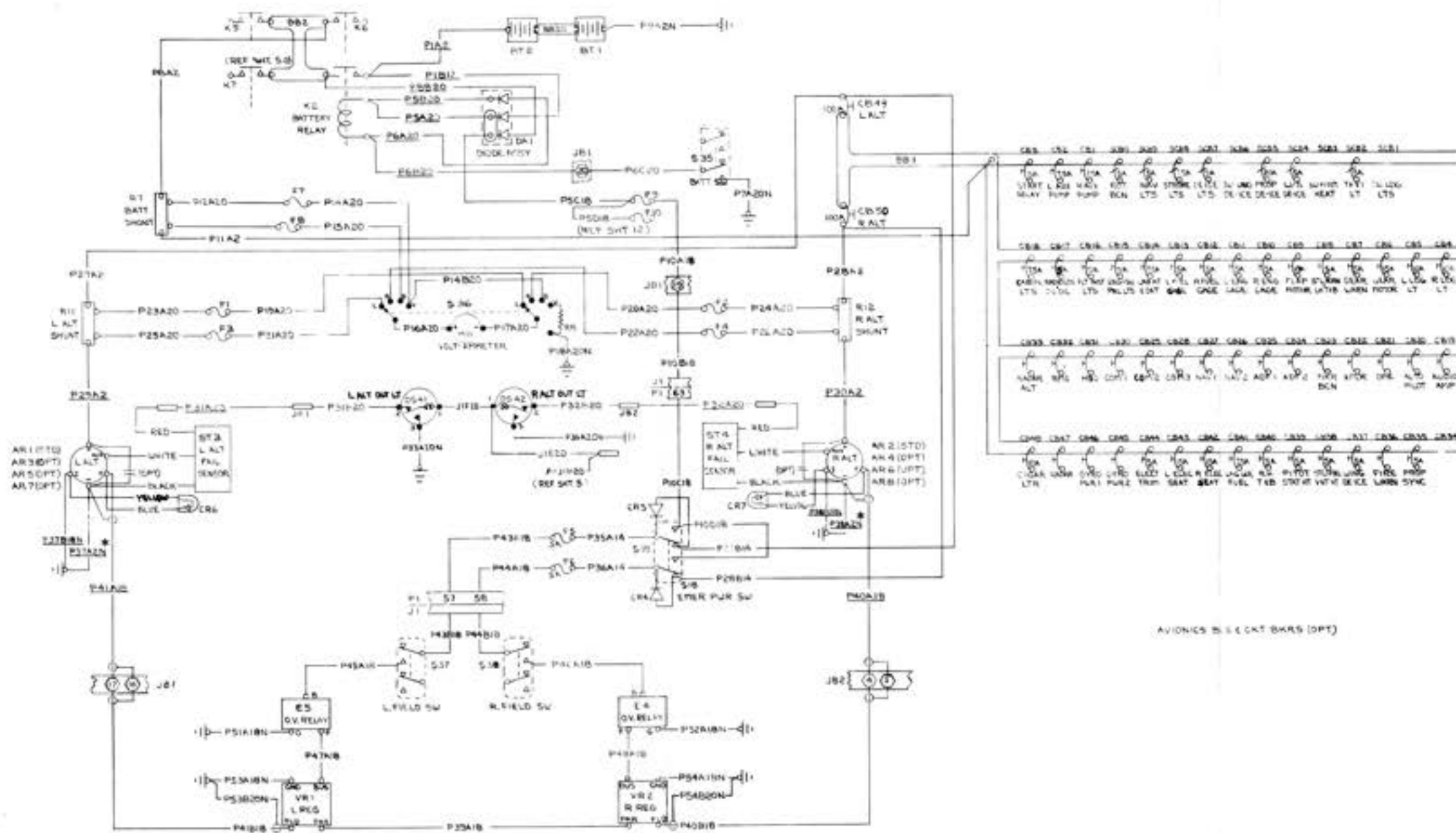


Cessna		AIRCRAFT CO.	
D 71379		0808080	
SCALE: NONE		SHEET 3 OF 10	

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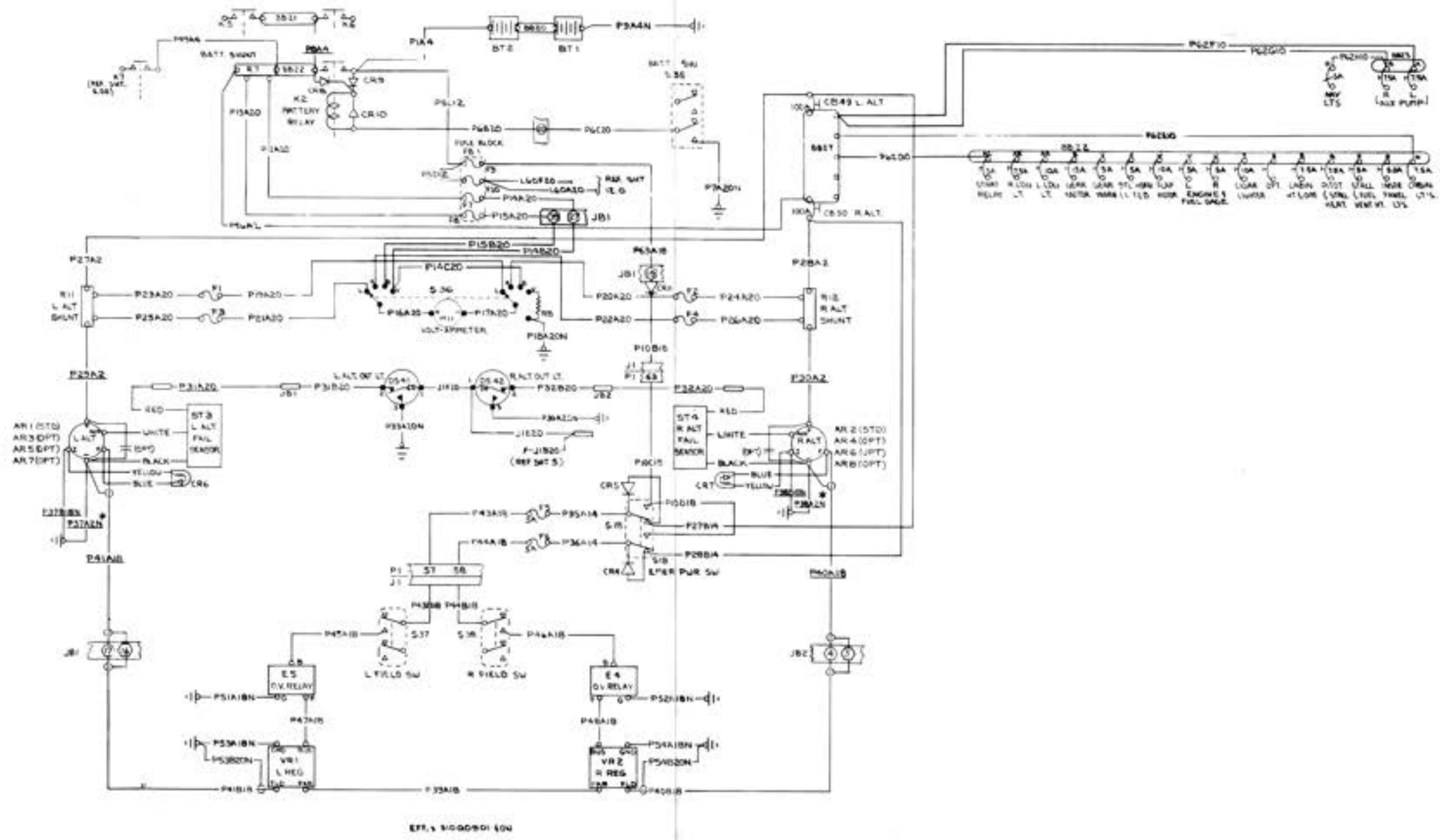


*P37A2N AND P38A2N USED ON 100 AMP OPTION ONLY

REF. 1 BISS. OUCH. THRO. 51550500

AVIONICS BUS CANT BARS (OPT)

Cessna		AIRCRAFT	
MODEL		71379	
POWER DISTRIBUTION		DRAWING NO.	
D 71379		0808080	
REVISION		REV. 2	
DATE		10/10/08	



*P37A2N AND P38A2N USED ON 100 AMP OPTION ONLY

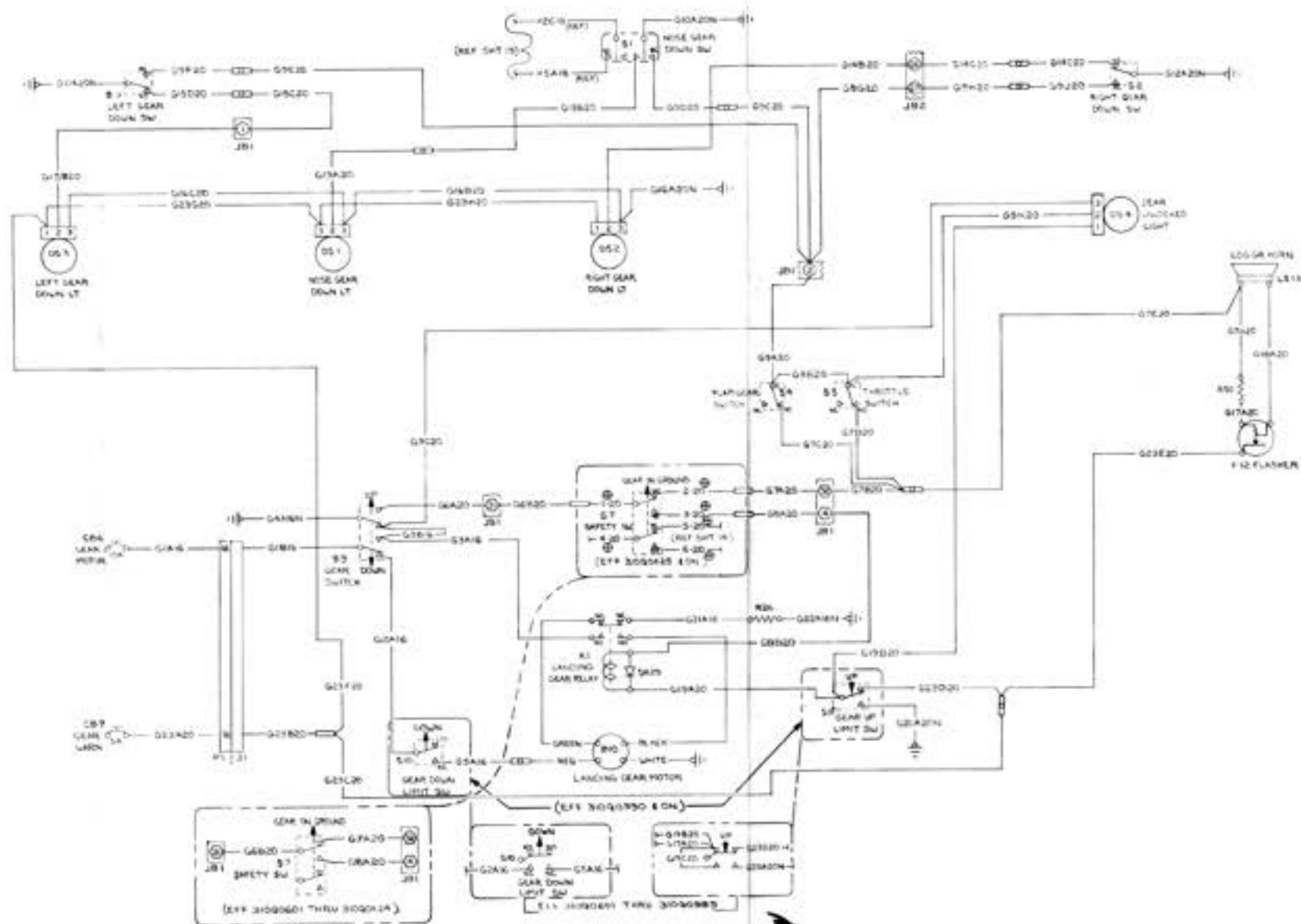
Cessna

AIRCRAFT

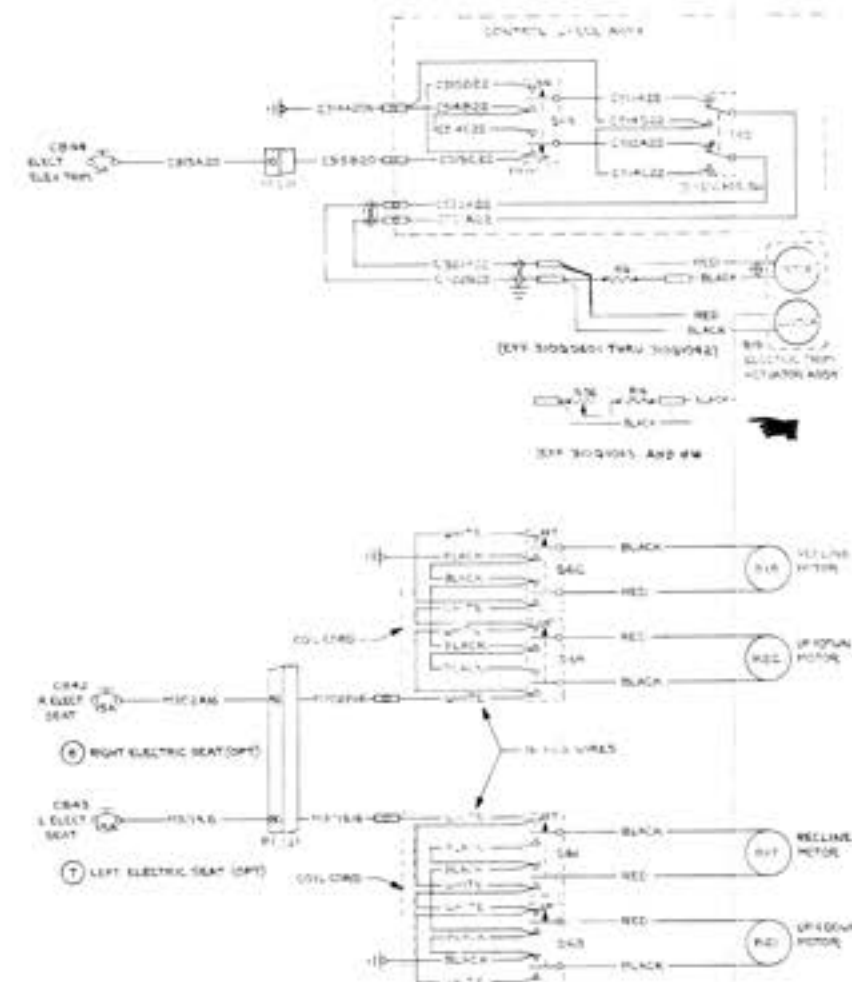
POWER DISTRIBUTION (STD.)

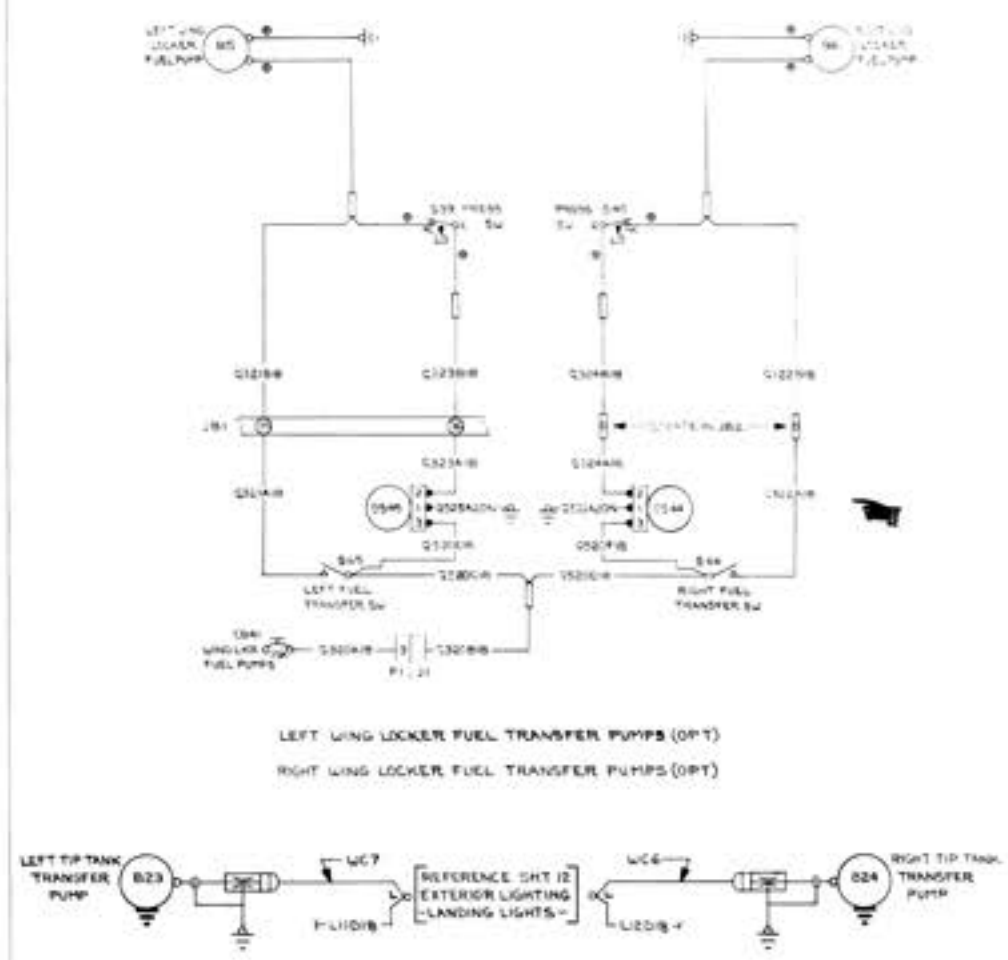
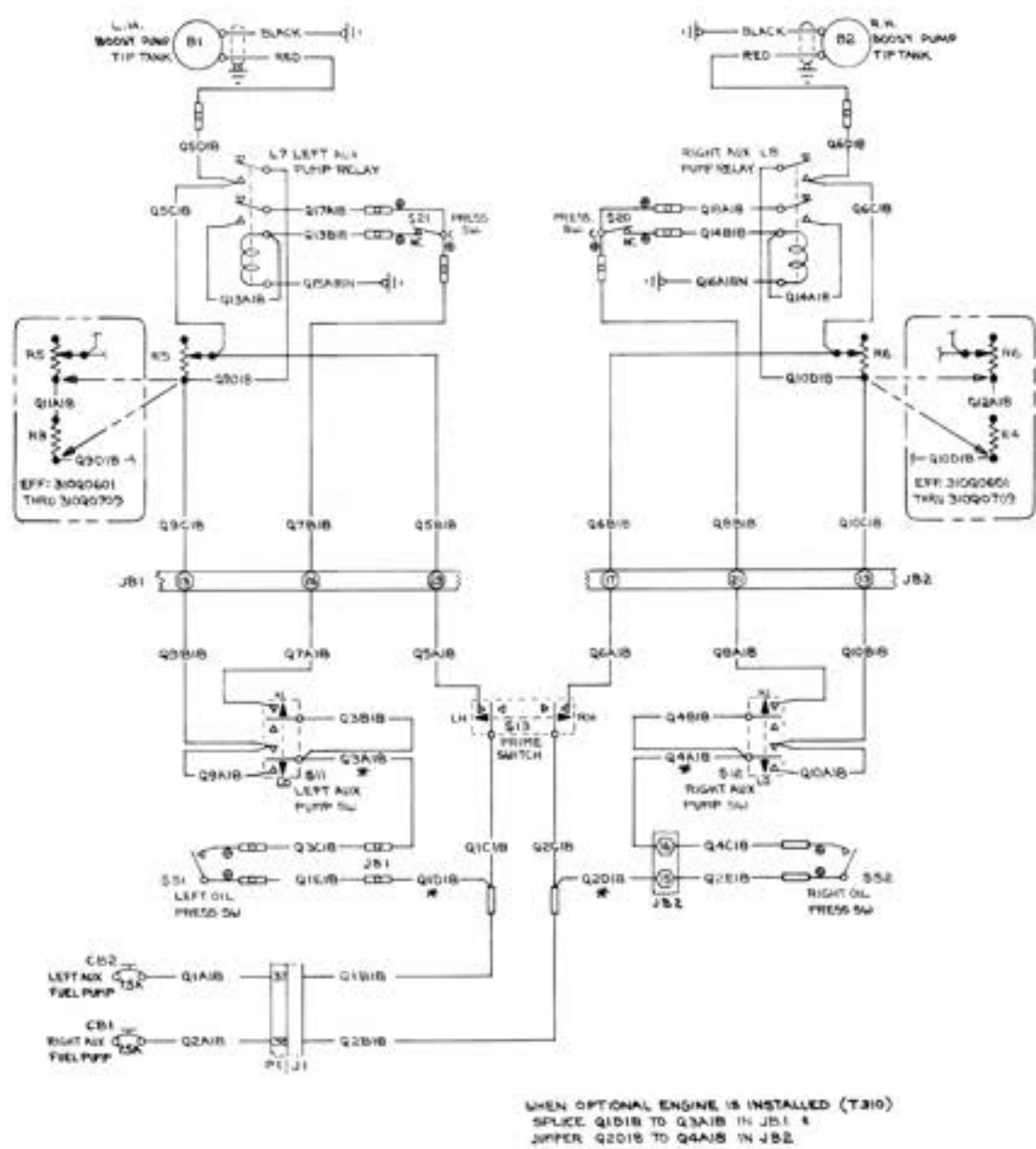
71379 0808080

6 OF 16

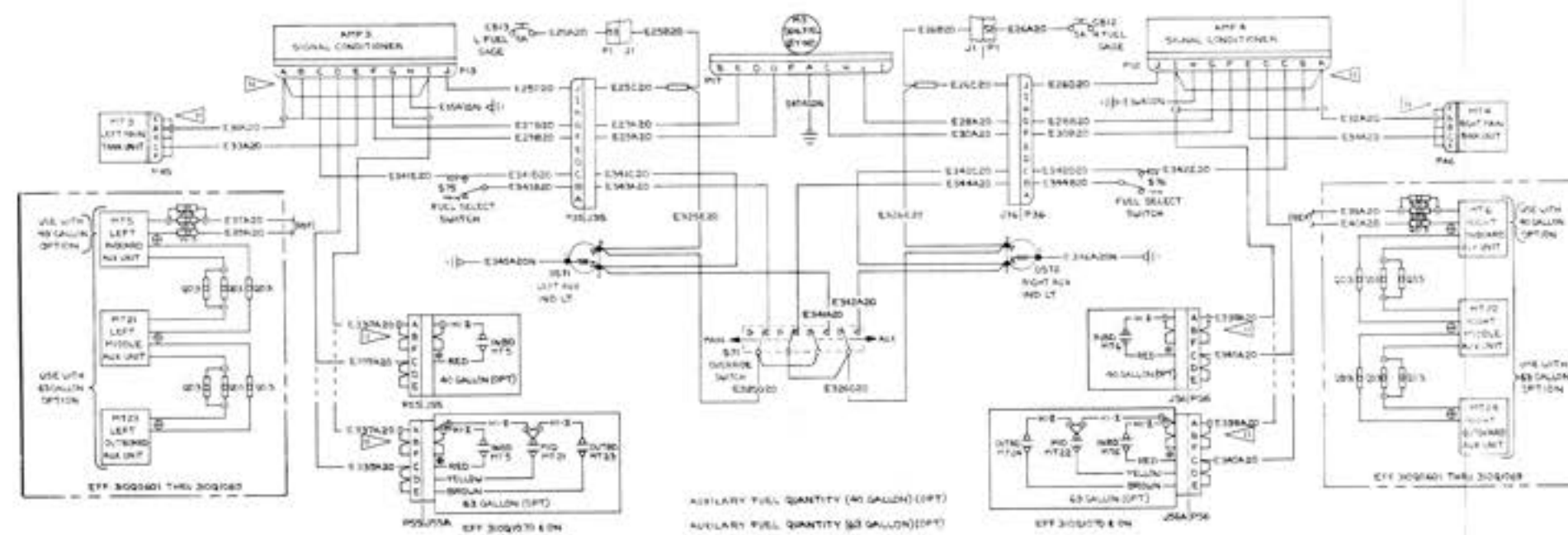
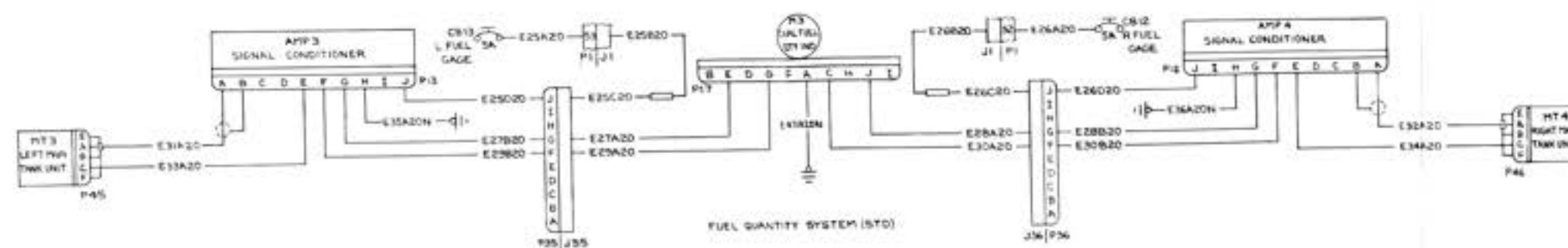


Cessna AIRCRAFT		P. O. BOX 1807 WICHITA, KANSAS 67201	
TITLE LANDING GEAR			
WIRING	DIAGRAM NO. D 71379	DRAWING NO. 0808080	
SCALE: NONE	REV: 0	SHEET 2 OF 16	

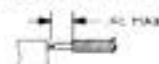




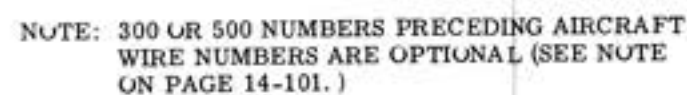
Cessna		AIRCRAFT CO.		P. O. BOX 1007 MILWAUKEE, WISCONSIN 53210	
FUEL PUMPS ~ STD & OPT					
DATE	71379	REVISION	0808080		
SHEET 1 OF 16					



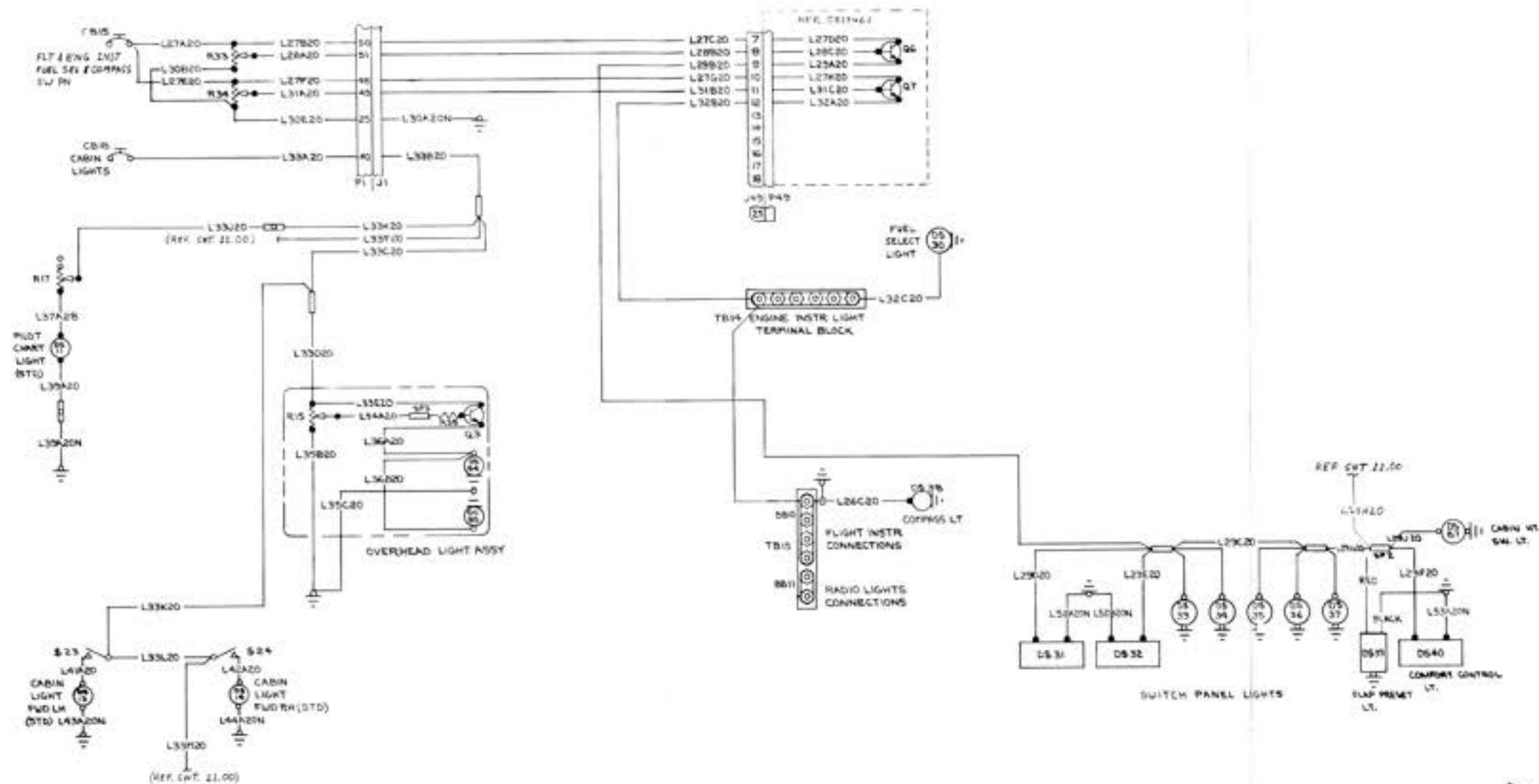
ALL WIRE SHIELDS SHOULD TERMINATE AT LESS THAN 1/4 IN FROM WIRE END OF WIRE PIN (AS SHOWN). ALL WIRE JUMPER WIRING SHOULD REMAIN INSIDE THE WIRE PLUG HOUSING BUT THE SHIELD JUMPER MAY BE LOOPED EXTERNALLY.



Cessna		AIRCRAFT CO.		P.O. BOX 1070 MILWAUKEE, WISCONSIN 53210	
FUEL QUANTITY SYSTEM - STD & OPT (CAPACITANCE)					
REV	DATE	REV	DATE	REV	DATE
D	7/13/79				0808080
SCALE	1/2" = 1"	REV	9	PAGE 10 OF 10	

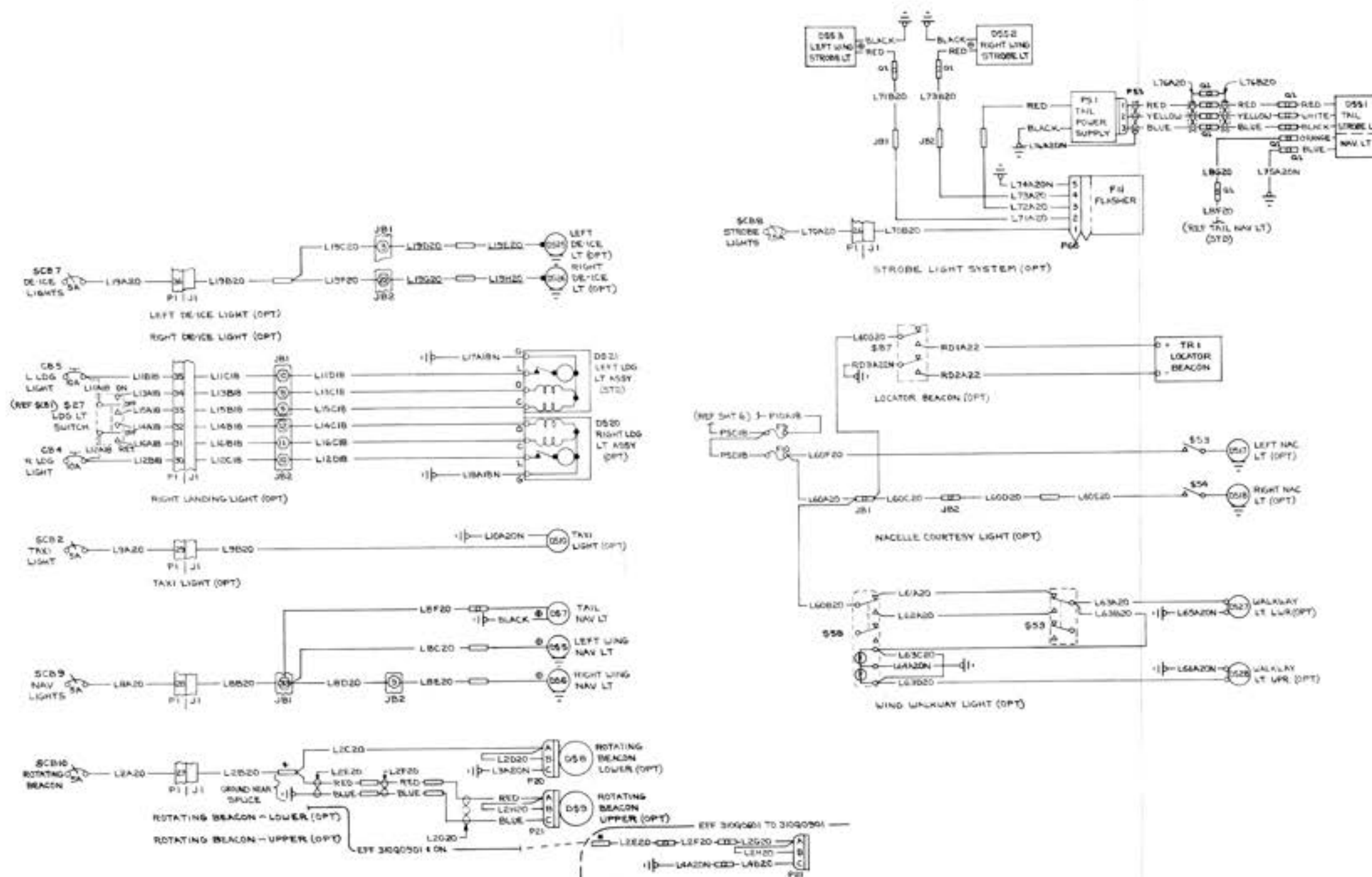


Cessna		AIRCRAFT	P O BOX 9577 MILWAUKEE 43009-0577
TITLE INTERIOR LIGHTING ~ (OPT)			
BOX D	CASE ORGT NO 71379	DISPATCH NO 0808080	
MAIL	NAME	REF	ENTRY DATE



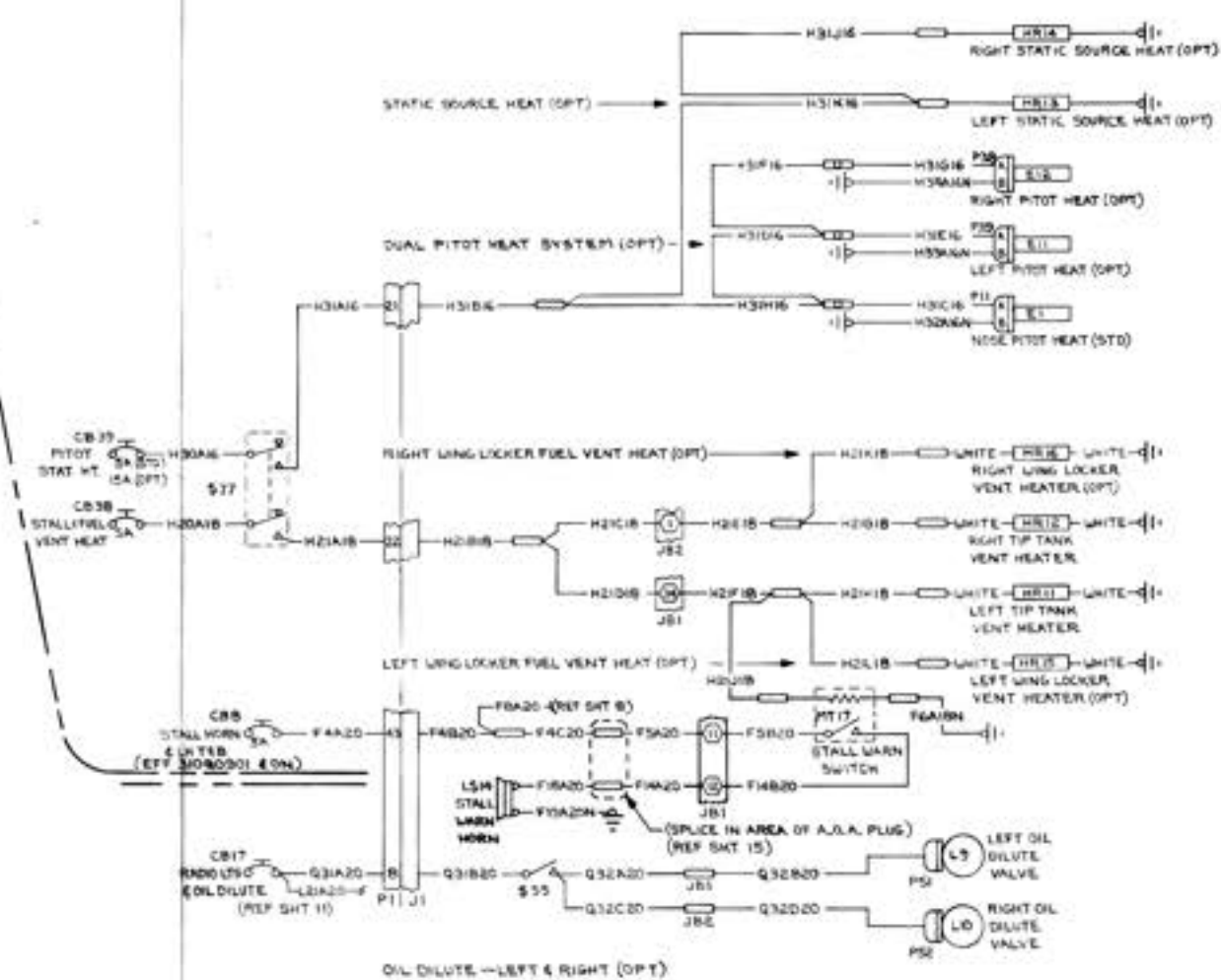
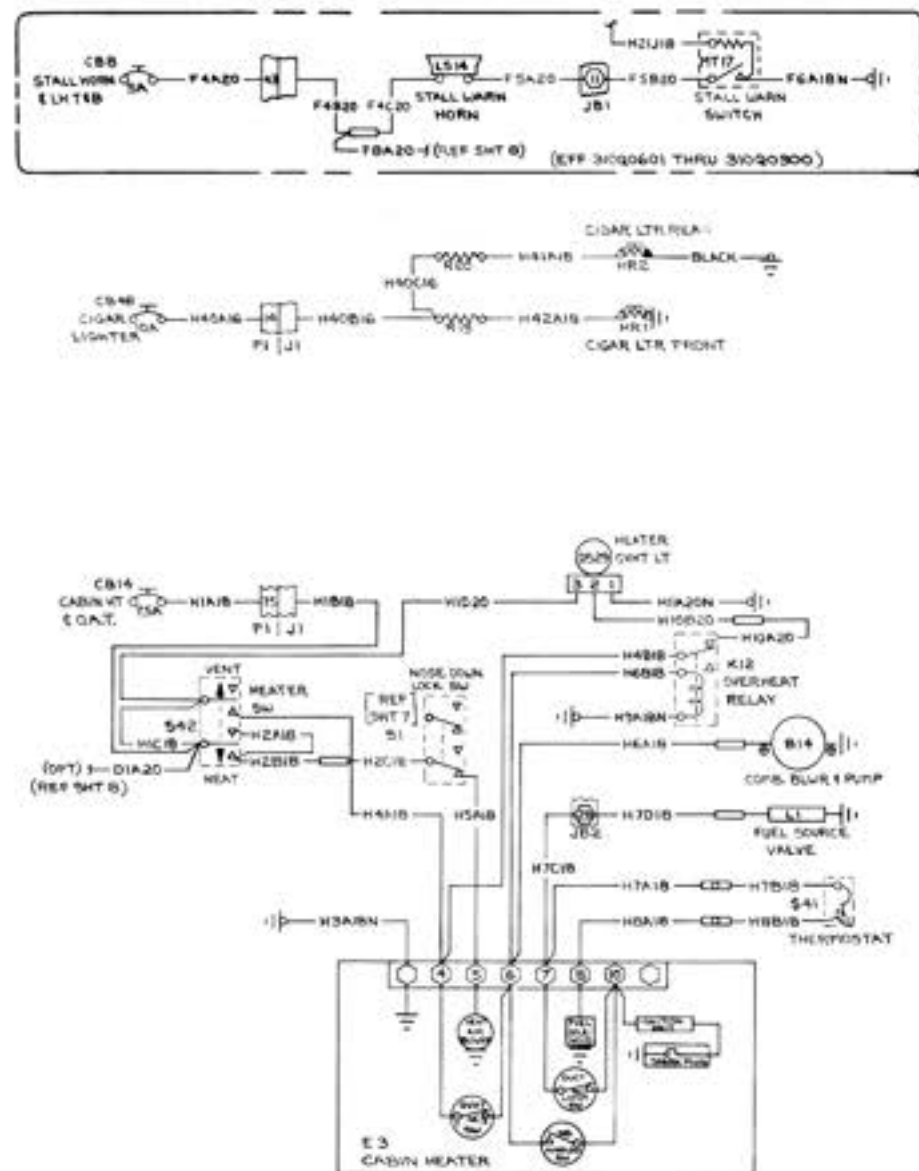
Cessna		AIRCRAFT CO.		P.O. BOX 1877 MILWAUKEE, WISCONSIN 53218	
TITLE					
INTERIOR LIGHTING					
STD					
DATE	CHANGE NO.	REVISION NO.	REVISION NO.	REVISION NO.	REVISION NO.
D	71379		0808080		
SCALE NONE					
SHEET 1 OF 16					

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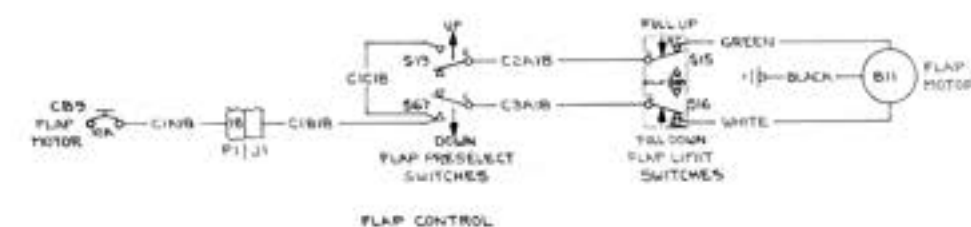
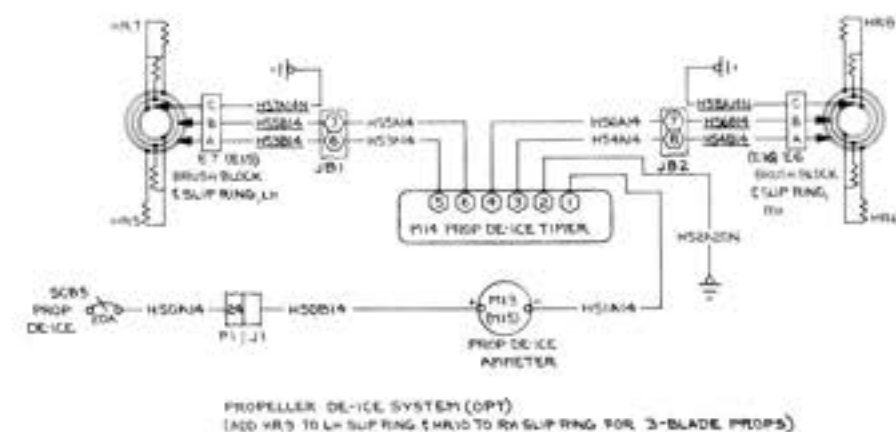
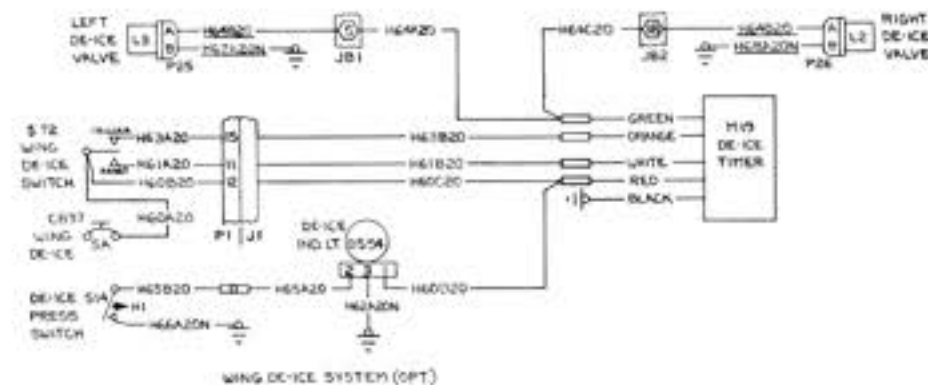


NOTE: 300 OR 500 NUMBERS PRECEDING AIRCRAFT WIRE NUMBERS ARE OPTIONAL (SEE NOTE ON PAGE 14-101.)

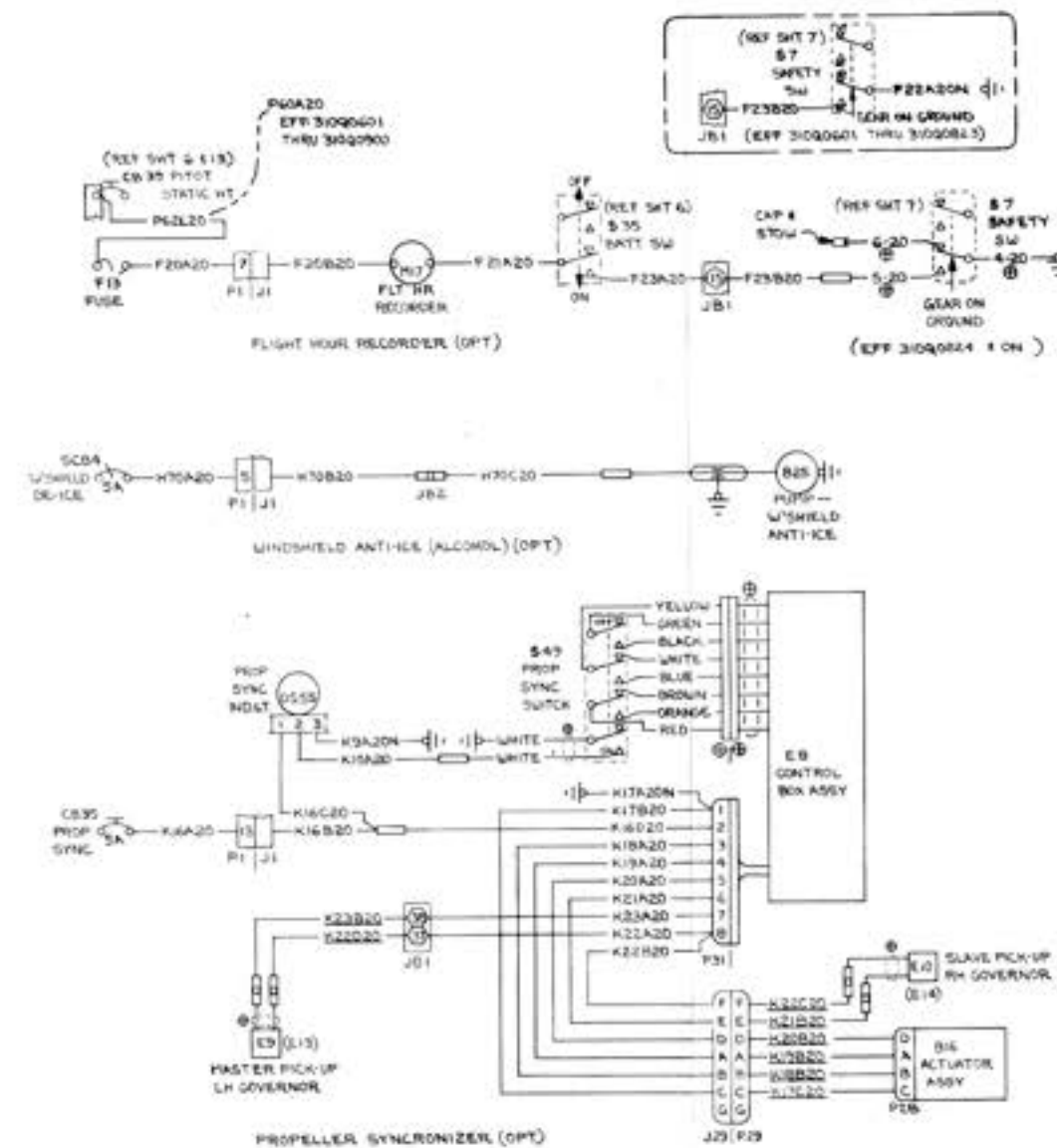
Cessna		AIRCRAFT		P.O. BOX 1071	
		100		MILWAUKEE & TWIN FALLS DIVISION	
EXTERIOR LIGHTING - STD & OPT					
REV	DATE	BY	CHKD	APP'D	DESCRIPTION
D	71379				0808080
PAGE 1 OF 1					



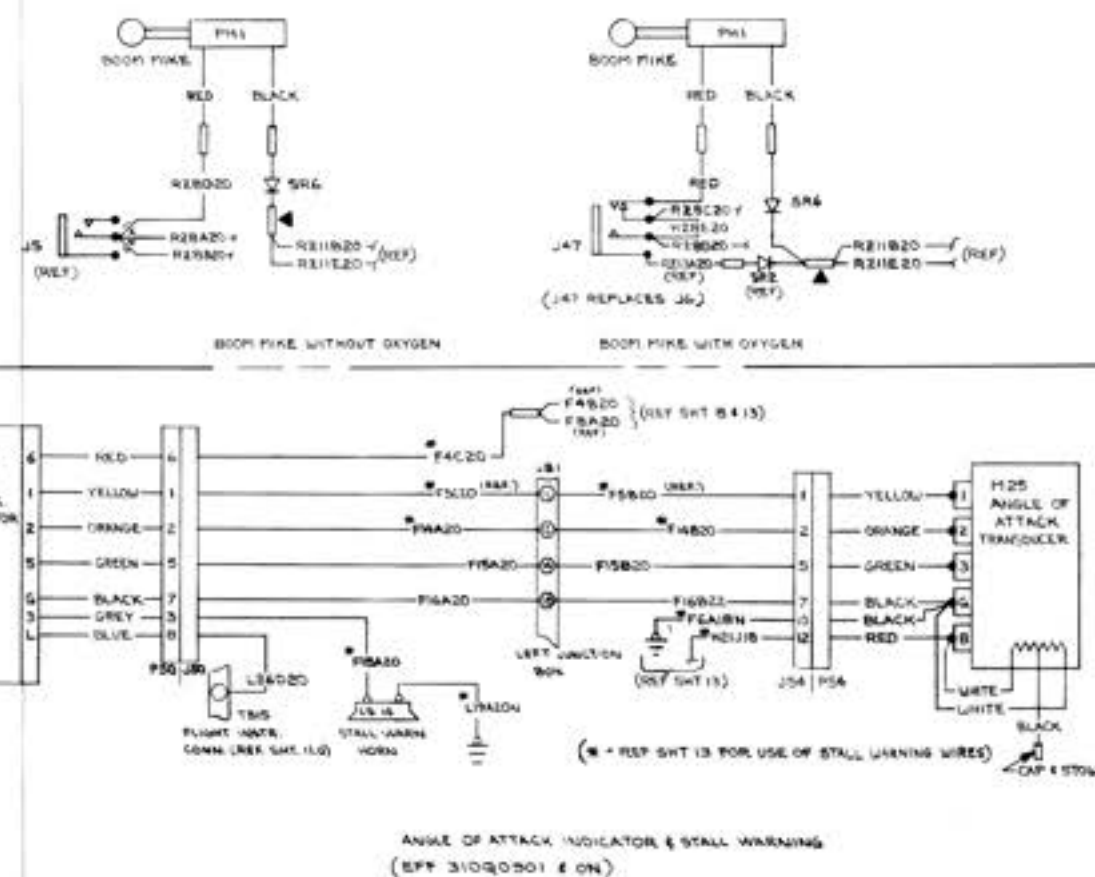
Cessna		AIRCRAFT		P. O. BOX 1000	
CABIN HEAT, CIGAR LTRS,		71379		0808080	
PITOT STATIC HT, STALL HORN,		D		15 OF 15	
FUEL VENT HT, & OIL DILUTE		NONE			



NOTE: 300 OR 500 NUMBERS PRECEDING AIRCRAFT WIRE NUMBERS ARE OPTIONAL (SEE NOTE ON PAGE 14-101.)



		AIRCRAFT Cessna	A 1000 WTT MILITARY & TOUR VERSION W/SHIELD, SENSITIVE POWER
TITLE FLAP CONTROL, PROP SYNC, PROP DE-ICE, WING DE-ICE, W/SHIELD ANTI-ICE, FLT HR RCDR			
DATE D	ISSUE 71379	REVISION NO. 0808080	
SCALE 1/2 INCH		REP C	SHEET 14 OF 15

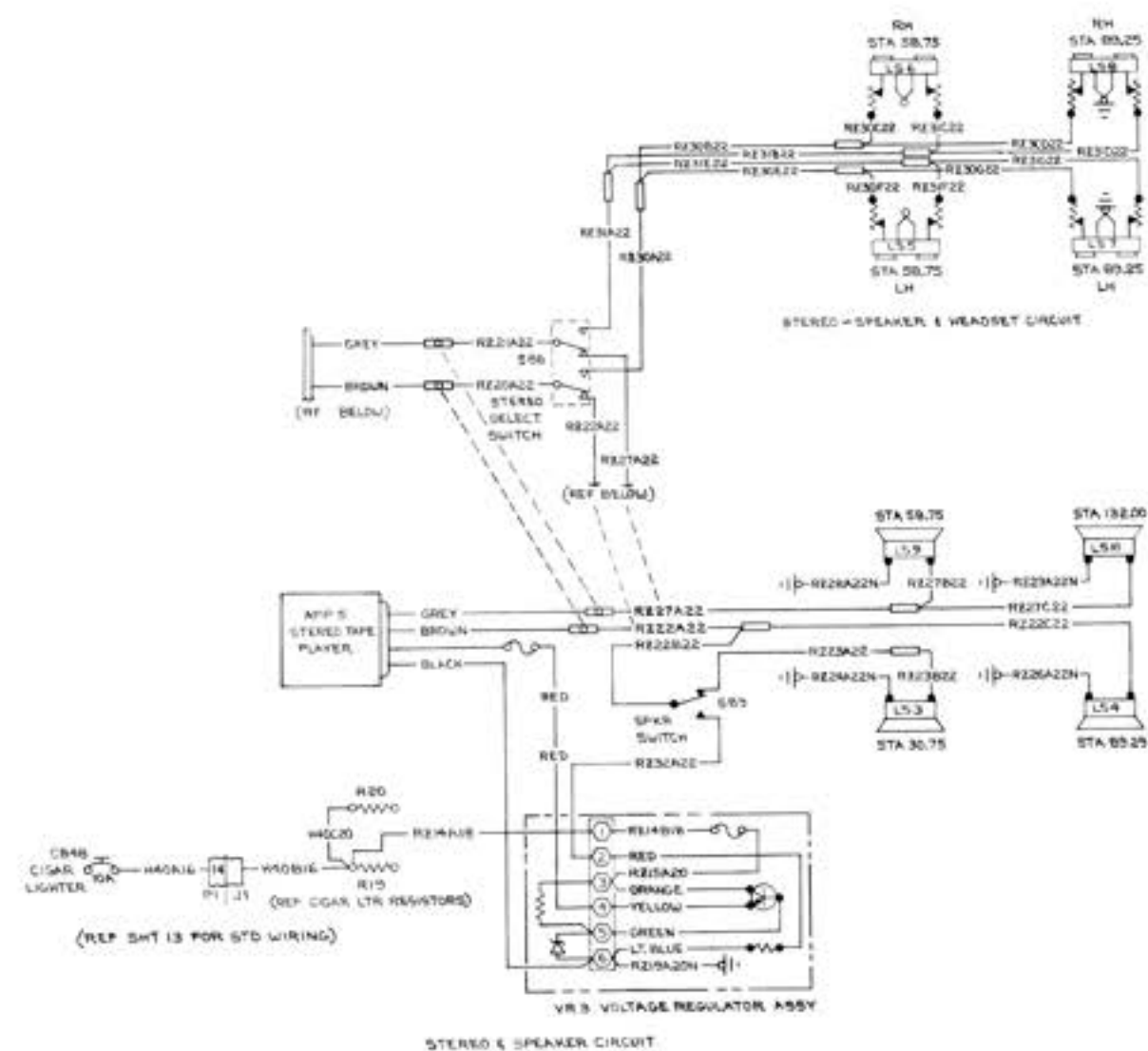


Cessna AIRCRAFT 170
170 170 170
MILITARY & TROOP SUPPORT
WILSON, KANSAS 67401

FLIGHT
SPEAKER, PHONE JACKS.
MIKE JACKS, BOOM MIKE
4 ANGLE OF ATTACK

D 71379 **O** 0808080

DATE 14 JUL 79 **TIME** 15:07:34



Cessna.		AIRCRAFT		P. O. BOX 1877	
				MILWAUKEE, WISCONSIN 53190	
TITLE					
STEREO - SPEAKERS & HEADSETS					
REV	DATE	BY	CHKD	DATE	BY
D	71379			0808080	
CHANGE 8					



Cessna		AIRCRAFT CO.		P.O. BOX 1977 WILMIST & PAUL AVENUE WICHITA, KANSAS 67201	
FIRE DETECT SYSTEM WIRING ASSY					
QTY	UNIT PRICE	TOTAL PRICE		C	
D	71379	5118461			
		33370525			
SCALE	UNITS	REP	REMARKS		

SECTION 15 ELECTRONICS SYSTEMS

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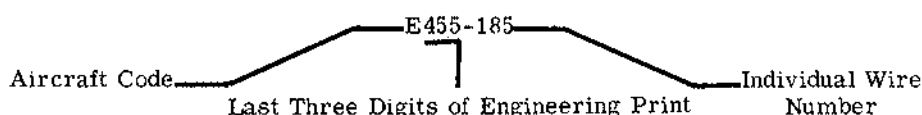
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GENERAL DESCRIPTION.

This section contains wiring diagrams which clearly show the complete wiring on each item of electronic

equipment listed in the wiring diagram index. The last portion of the section contains tables showing the electronic loading of various components on the shelves and rack in the aircraft.

Wiring Code.



NOTE

The wiring diagrams in this section pertain to Aircraft 310P0001 thru 310Q0130 and 310Q0211 thru 310Q0215 and 310Q0217 thru 310Q0218.

For wiring diagrams on Aircraft 310Q0201 and On, except Aircraft 310Q0211 thru 310Q0215 and 310Q0217 thru 310Q0218, refer to the applicable wiring diagram book furnished with your aircraft.

Each wire used in the electronics system is identified by code. This coding provides a convenient way of identifying wires when installing new wiring or servicing existing wires. The wire code is shown on each diagram. Some cabling is supplied by vendors of the electronics equipment and do not carry Cessna identification. The diagrams covering such wiring may refer to the instruction manuals of such equipment where a more complete wiring diagram may be found. The wiring code used by Cessna on the 310 is shown above.

ELECTRONIC INTERFERENCE

Radio Noise

Radio noise is a problem of great importance to the aircraft industry. A noisy radio system may actually imperil the safety of the aircraft occupants. The performance of radio navigation equipment can be completely erroneous if radio noise is excessive. For this reason, radio installations should be made only by persons who are qualified. Radio noise is not generated in a properly operating radio set, but is merely presented to the listener in an audible form exactly the same way that a radio station is received. Many forms of noise can exist in any particular aircraft and, ironically, sometimes certain aircraft can be amazingly quiet. This condition is unusual and even though the aircraft is quiet without noise suppression, it cannot be released without proper suppression. A quiet aircraft without suppression may degenerate into a noisy aircraft with changes in age, temperature, and humidity. Common radio noise is generated by ordinary electrical devices in the aircraft such as flap or gear motors, navigation light flashers and ignition or alternator systems. By properly installing capacitive and inductive devices in these circuits, the noise can usually be reduced to a tolerable level. A more difficult type of noise to suppress, is that generated by friction between two components or by rectification. Another difficult problem is noise that is carried to sensitive areas by grounding loops. The following paragraphs contain solutions that have been effective for the factory. It is important to remember that each aircraft may present a slightly different problem and, therefore, a "fix" on one aircraft will not necessarily be effective in all cases.

Alternator Noise.

While the alternators are relatively free from radio noise, there is the possibility the alternators will produce an audible noise in the radio and electronic systems. Inside the alternator a three phase AC voltage is applied to a full wave rectifier assembly, thus converting the AC voltage to DC. During the rectification, an AC ripple appears on top of the DC voltage, thus the bus voltage is actually fluctuating. While the battery acts as a capacitance, it is also necessary to have additional filtering. This is accomplished by the use of a capacitor from the output terminal to ground at the alternator. The use of solid state regulators reduces the possibility of regulator noise to a minimum and will not require filtering.

Ignition Noise.

The sound of ignition noise is easily identified because of its timing. The 310 has a shielded magneto ignition system. Each secondary lead from the magneto to the plug is a shielded wire. Double shielded wiring is used in the primary circuit with a special suppressor in series with the switch lead. The suppressor is constructed coaxially with a shielded lead coming out of the end which is connected to the magneto cigarette cartridge. The double shielded wire is connected to the terminal end of the filter (the shield is grounded). The double shielded wire enters the cabin area through connectors in the wing root rib to prevent noise transfer to the junction box wiring. The double shielding is continued to the inside of the cabin to the magneto switch. The magneto switches are enclosed in a shielded case to which the double shield of the wire is grounded. If ignition noise is prevalent in the radio system, the entire magneto system should be checked for tight connections, especially in the root rib connectors and at the switch and suppressor. All ground connections in the circuit are critical and any oil or dirt accumulation should be cleaned from the connection and the metal should be brightened to provide the best possible ground. Ignition harness should be replaced if the shielding becomes questionable.

Flap and Landing Gear Motor Noise.

During a landing approach, an unfiltered motor in the flap or gear circuits can produce a startling volume of noise which is very distracting. There is also the possibility of the noise blanketing a message from the tower during the approach. It is possible that sufficient noise could be created through these circuits to blanket an ILS signal, creating a hazardous situation. For these reasons, the circuits have a filter section built into the motor. The filter should be very effective if the unit is properly grounded. If noise becomes excessive with good grounding, a motor overhaul or replacement may be necessary.

Auxiliary Fuel Pump Noise.

Coaxial type capacitors produce effective results, when installed on the base of the fuel boost pumps. Because of the location of the fuel pump and capacitors, the connections must be kept tight to avoid any possible arcing. When proper filtering and grounding do not produce the desired filtering results, a new pump should be tried.

Lighting Circuit Noise.

All lighting components on the 310 have internal filters and usually do not require external capacity. The light wiring, however, because of its route to the extremities of the aircraft can, in unusual cases, conduct noise to vital areas. The light wires and electrical wiring bundles should be routed away from the antenna and loop antenna cables to prevent picking up noise in the radio systems. Shielding should be properly grounded.

ELECTRONIC INTERFERENCE TROUBLESHOOTING GUIDE.

The following general troubleshooting information is presented as a guide to determine the system or systems producing the interference.

- a. Pinpoint the particular system causing the noise by the process of elimination.
- b. Once the system causing a particular noise is isolated, investigate the particular system or systems to determine which component or components are causing the noise, by observing which components are actually operating when the noise occurs.
- c. Check the component for proper operation or damage.
- d. Check wiring connections and wiring coming in contact with moving parts.
- e. Check wire routing for proper separation.
- f. Check wire shielding where applicable.
- g. Check all system grounds.

Alternator Noise

If alternator noise is experienced and it is determined it is coming from the output of the alternator, the following troubleshooting should be accomplished before attempting additional filtering.

- a. Check attenuator output bypass filter for broken leads or inadequate ground.
- b. Check the lead attaching to alternator power (+) terminal is as short as possible or approximately 1 to 2 inches long.
- c. Check alternator ground wire for any damage or improper contact or corrosion between terminal and grounding point.
- d. Check alternator brushes for damage that could be arcing.
- e. Check alternator brush tension for proper seating.

Regulator Noise

If regulator noise is present and traced to the regulator and its associated control leads, the following checks should be made before attempting to add additional filtering.

- a. Check regulator adjustment for proper setting (27.25 to 27.75 volts).
- b. Check regulator noise filter for damage, loose wires, broken leads, or improper connections.
- c. Check shield wire on regulator to alternator field wires for proper termination (single point ground), shield damage, check for adequate coverage at termination ends.
- d. Check alternator for brush arcing.

E. L. Inverter Noise

In most cases noise produced by the E. L. inverters could be due to the light capacitive load on inverter. When this problem occurs, it can be eliminated by the addition of .01 to .05 ufd 200 WV capacitor to the

output terminals of the inverter. If the noise cannot be eliminated it should be determined whether the noise is due to one of the following:

- a. Radiation from AC wiring, requiring shielding.
- b. Noise conducted to the power bus by the DC input, requiring filtering.
- c. Radiation from DC power leads requiring shielding.
- d. Radiation from inverter, necessitating replacement of inverter.
- e. If the aircraft has an ADF installed the following guidelines may be used to locate E. L. inverter noise:
 1. Tune ADF to a low frequency band.
 2. Place all panel light controls in the lowest position.
 3. Turn each panel control fully on one at a time and listen for a high pitched buzzing sound similar to an electric drill motor.
 4. After isolation of the noisy control, check panels on that control for operation.
 5. If the inverter has a capacitor across its output terminals, check the capacitor for damage or substitute a capacitor known to be good.

Electric Trim Motor Noise

In the event of noise difficulties caused by the trim system motors the following should be checked to insure standard noise suppression equipment is properly installed.

- a. Check that motor frame and actuator assembly are properly grounded.
- b. Check capacitors inside of motor for broken leads or damage.
- c. Check to make sure shielded wires are properly grounded at the actuator assembly and that the shields are not shorted in other areas to structure which could create noise loops.
- d. If the filters are good and noise is not totally eliminated the following procedures should be attempted to eliminate the noise.
 1. Change C₁ to .05 microfarad.
 2. Add a 1.0 microfarad feed-thru capacitor with shielded lead to (+) lead of the side producing the noise. Attach the housing or capacitance ground to the actuator housing assembly.
 3. Make sure shielding wire and motor frame are making good ground.
 4. If the motor is noisy in both directions of rotation add a 1.0 microfarad feed-thru capacitor to both leads and insure that shield and housing or capacitor ground are attached to the actuator housing assembly.
 5. The addition of larger capacitors, inductors or RF chokes is not recommended; experience has proven no significant change in additional filtering.

Fuel Boost and Auxiliary Transfer Pump Noise.

If boost pump noise is experienced in the audio system, check for following:

- a. Insure that wiring is properly shielded.

- b. Insure shields are properly grounded.
- c. Check loose wiring connections for looseness and breaks.

NOTE

If the cause of the noise cannot be eliminated, a .47 microfarad 50 WV feed-thru capacitor should be installed in the power (AX) lead as close to the pump as possible and insure the case of the capacitor is properly grounded to the airframe.

Tip Tank Transfer Pump Noise.

If the tip tank transfer pump is causing noise in the audio system, check the following:

- a. Check capacitor case ground.
- b. Check capacitor for damage, open circuit, short circuit, loose wiring and damaged shielding.
- c. Substitute a capacitor of the same value known to be good in place of the original capacitor.

Rotating Beacon Noise.

If the rotating beacons are causing noise in the audio system, the following should be checked:

- a. Filter for proper ground.
- b. Lamp circuit for loose connections and wiring.
- c. Bulb for loose socket.
- d. Internal filter for damage.
- e. External light for proper ground to frame or structure of aircraft.

Strobe Light Noise.

If the strobe lights are causing noise in the audio

system from radiation or in-line interference, the following should be checked:

- a. Make sure all power supply units are grounded properly to the airframe.
- b. Insure the shielded wires and twisted pairs from the tail light are grounded.

NOTE

Grounds must be terminated at the power supply.

- c. Insure tail Nav light is adequately grounded.

NOTE

If it is determined the noise is being radiated from the tail light, flash tube, the interference can be minimized by installing a strip of aluminum metalized tape on top of the existing white stripe painted on the glass and insuring the aluminum strip is grounded to the metal case of the light assembly.

AVIONICS MASTER SWITCHES AND CIRCUIT BREAKER. (310Q0901 and On.)

Two avionics master switches are provided with factory-installed avionics. Power is supplied from the battery, through a circuit breaker, located in the left wing outboard of the engine nacelle, to the AVIONICS MASTER switch breaker, located on the upper forward section of the side panel and on to avionics bus. The ALTERNATE AVIONICS power switch breaker, located on the lower section of the side panel, provides backup power in the event the circuit breaker, switch breaker or their associated wiring and battery circuits become inoperative.

Access to the avionics circuit breaker is gained by removing access plate (66), figure 1-3.

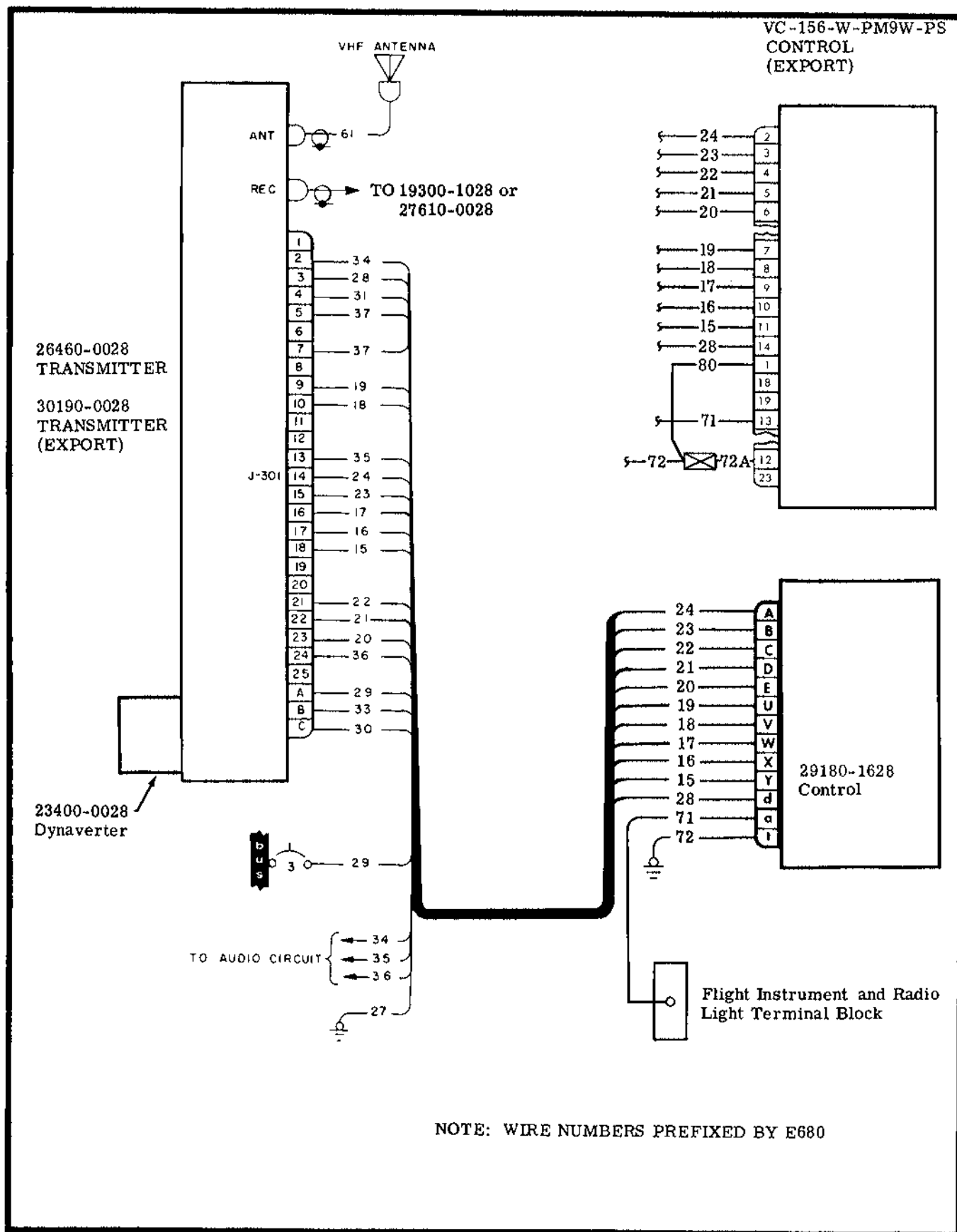
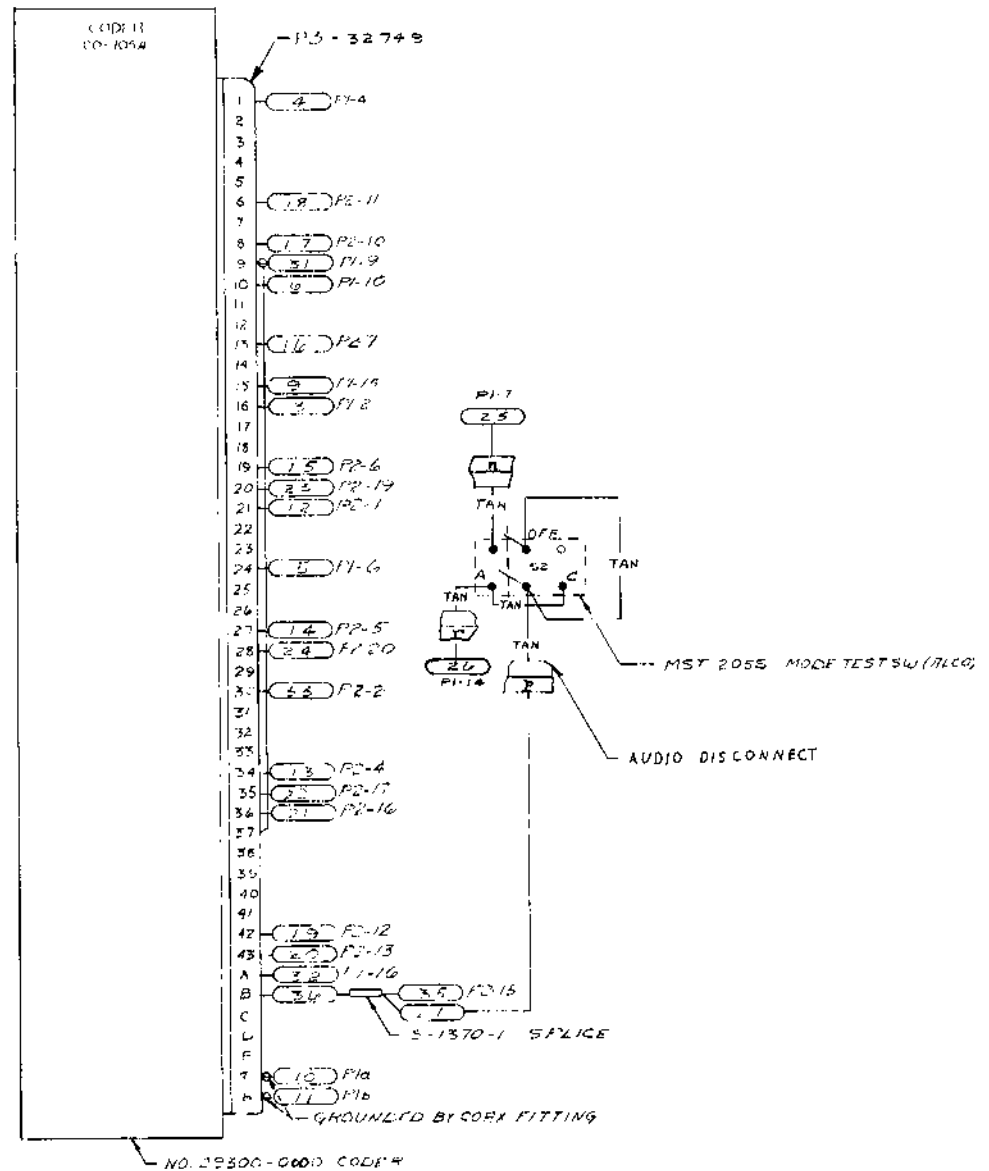


Figure 15-2. Cessna Transmitter 800

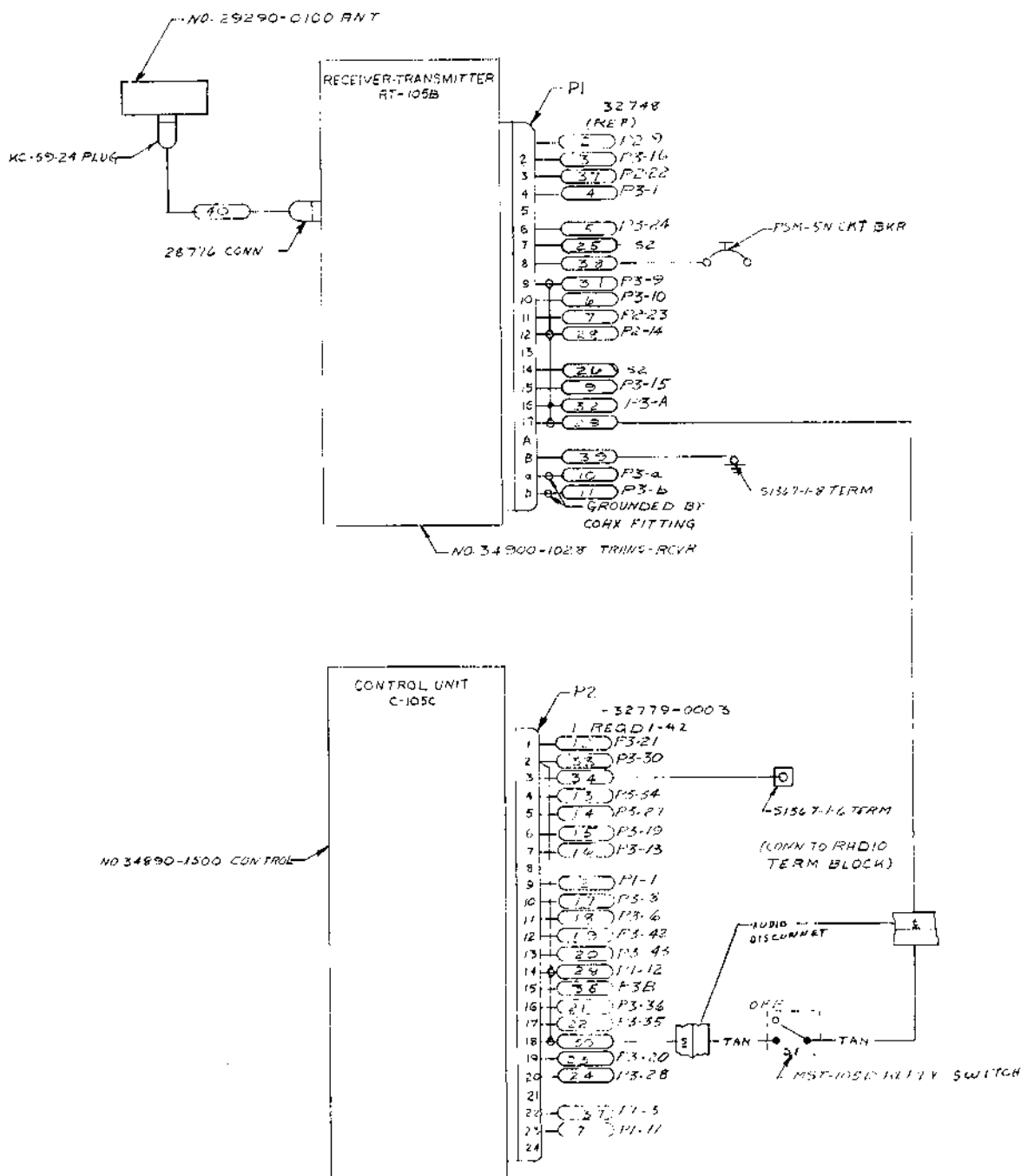


310P0001 TO 310P0015

TURBO-SYSTEM 310P0001 TO 310P0015

NOTE: WIRE NUMBERS PREFIXED BY E1206

Figure 15-3. Cessna Transponder 800 (Sheet 1 of 2)

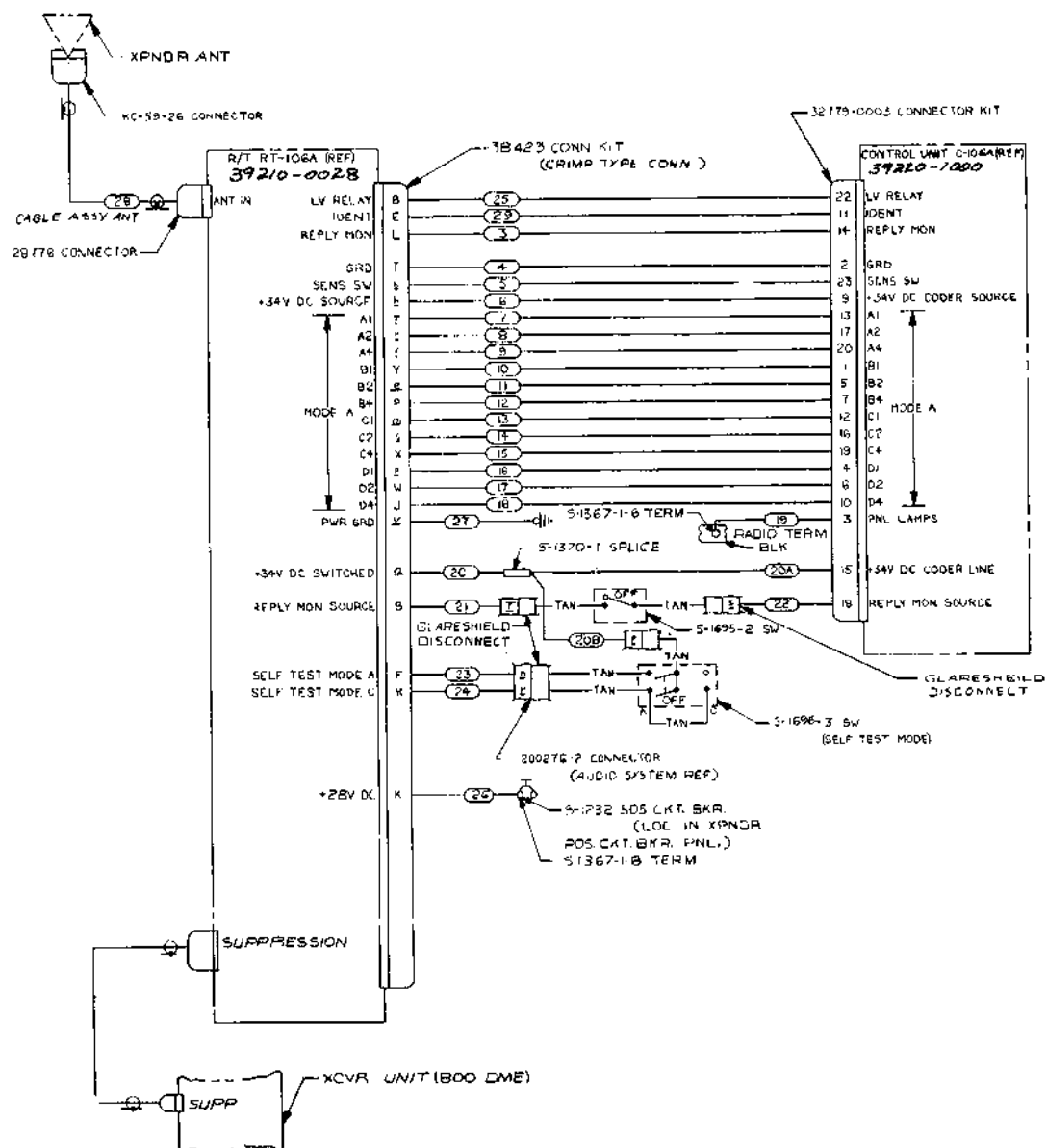


310P0001 TO 310P0015

TURBO-SYSTEM 310P0001 TO 310P0015

NOTE: WIRE NUMBERS PREFIXED BY E1206

Figure 15-3. Cessna Transponder 800 (Sheet 2 of 2)

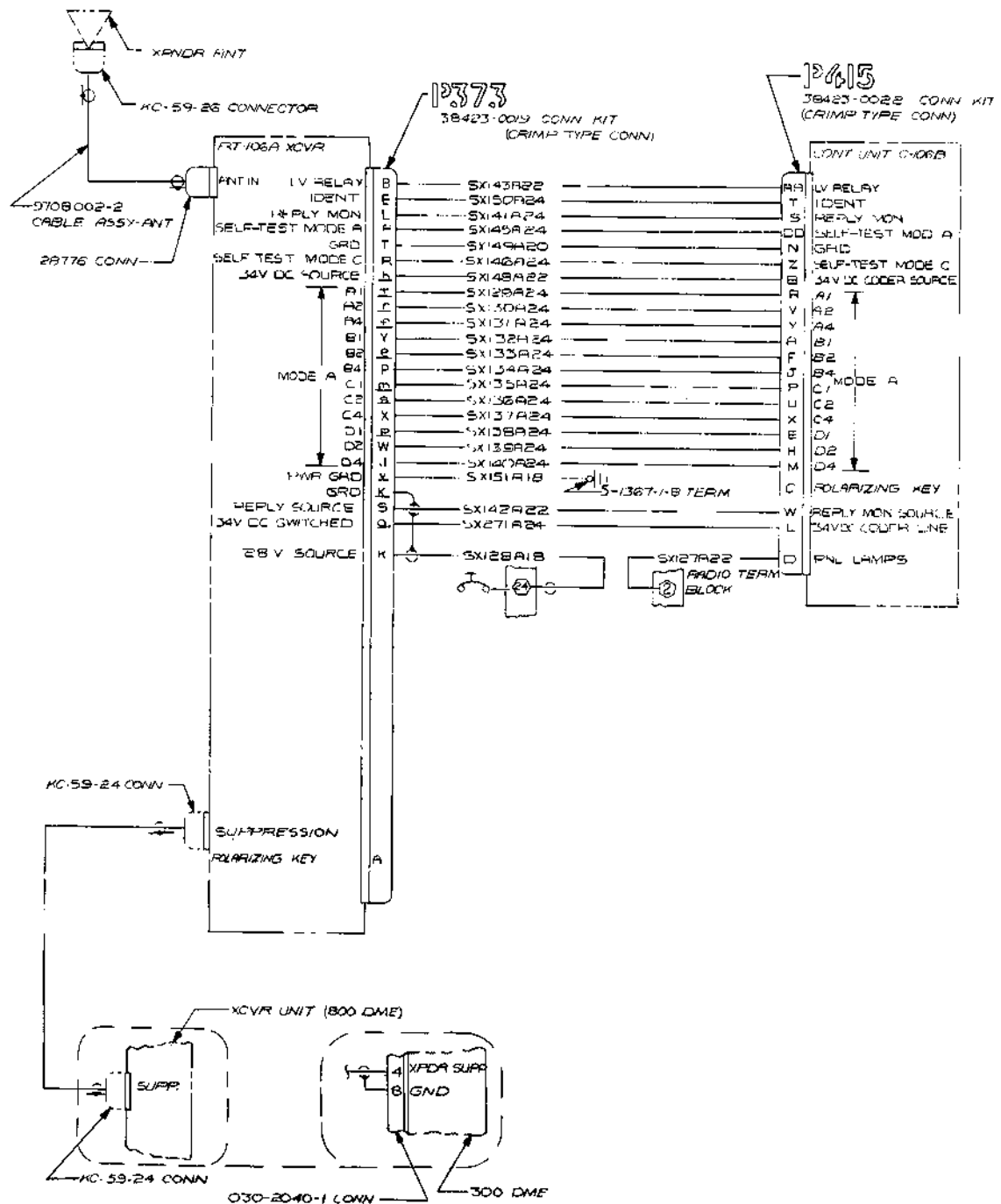


AIRCRAFT 310P0001 TO 310P0200

NOTE: WIRE NUMBERS PREFIXED BY E1333

Figure 15-3A. Cessna 800 Transponder

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AIRCRAFT 310P0200 AND ON

NOTE: WIRE NUMBERS PREFIXED BY 9708012

Figure 15-4. Cessna 800 Transponder

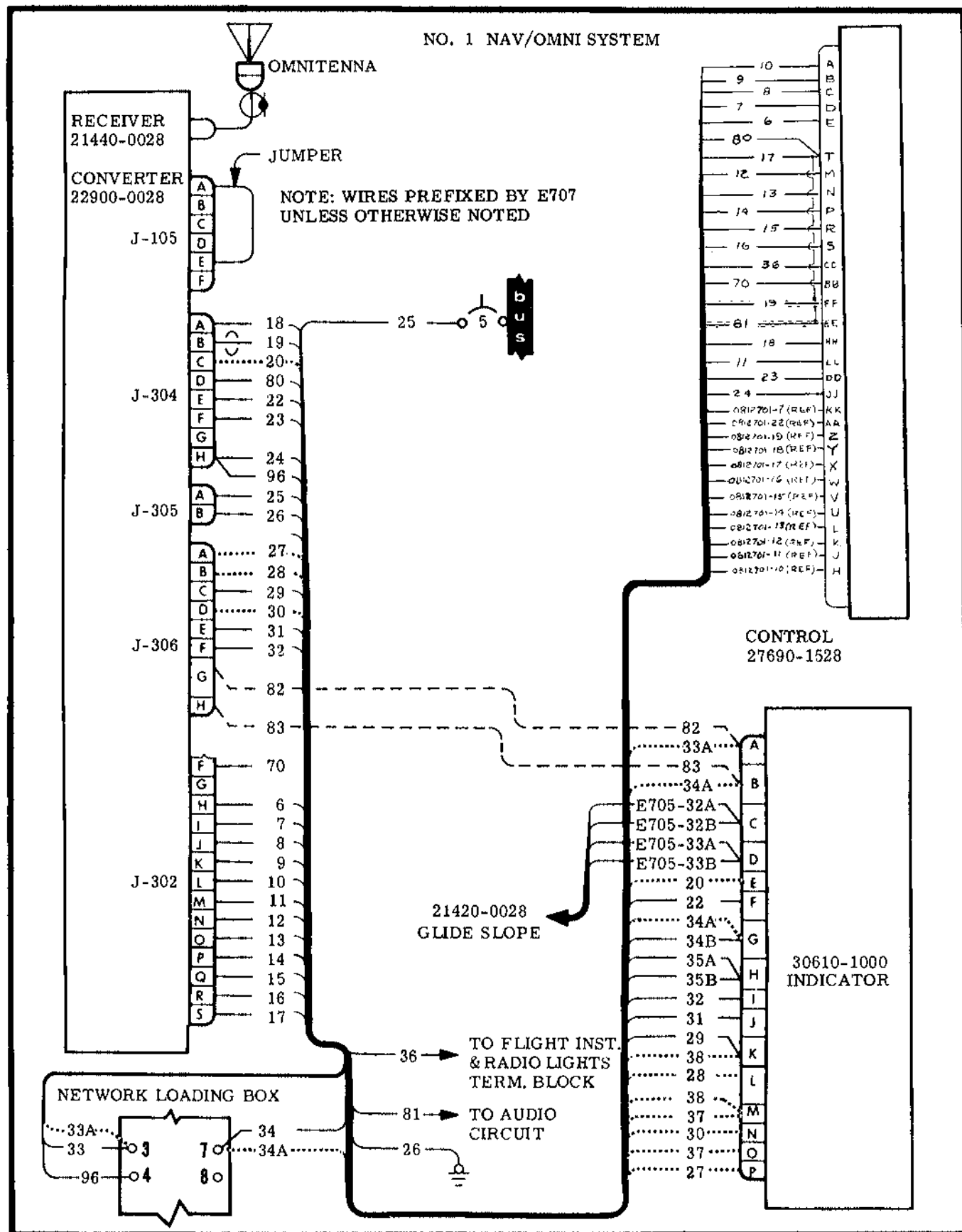


Figure 15-5. Cessna Nav/Omni 800 (190 Channel) (Sheet 1 of 2)

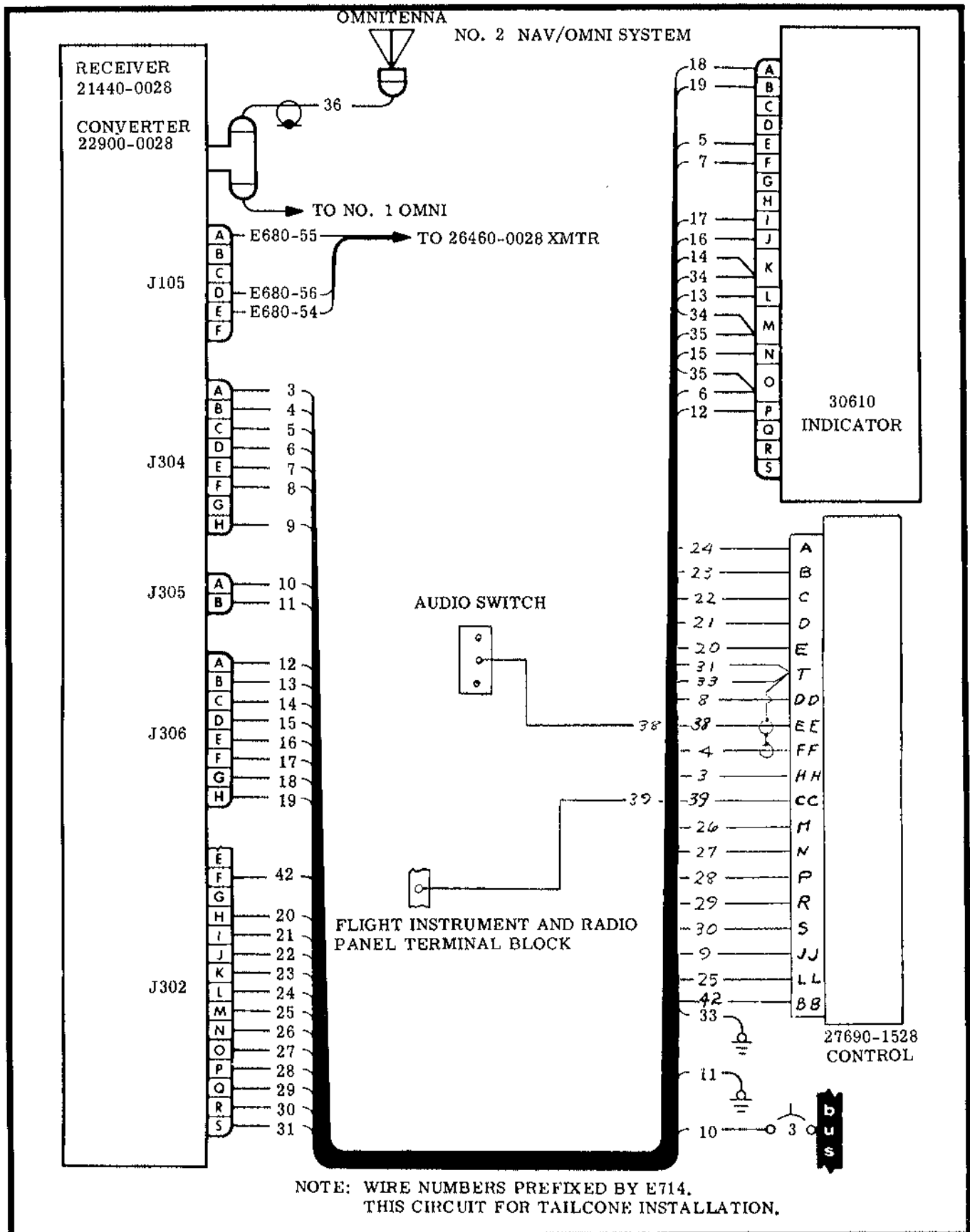


Figure 15-5. Cessna Nav/Omni 800 (190 Channel) (Sheet 2 of 2)

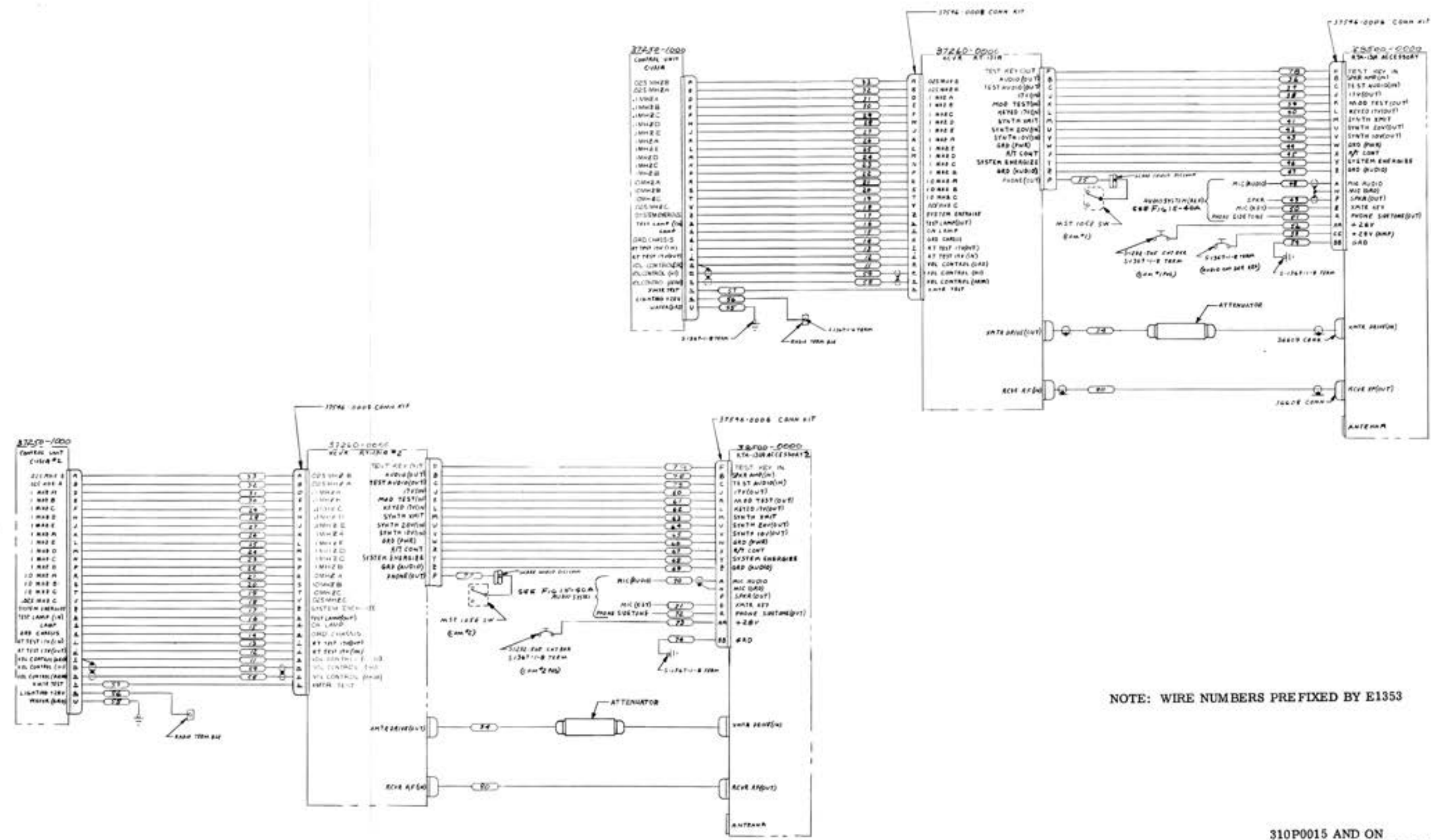
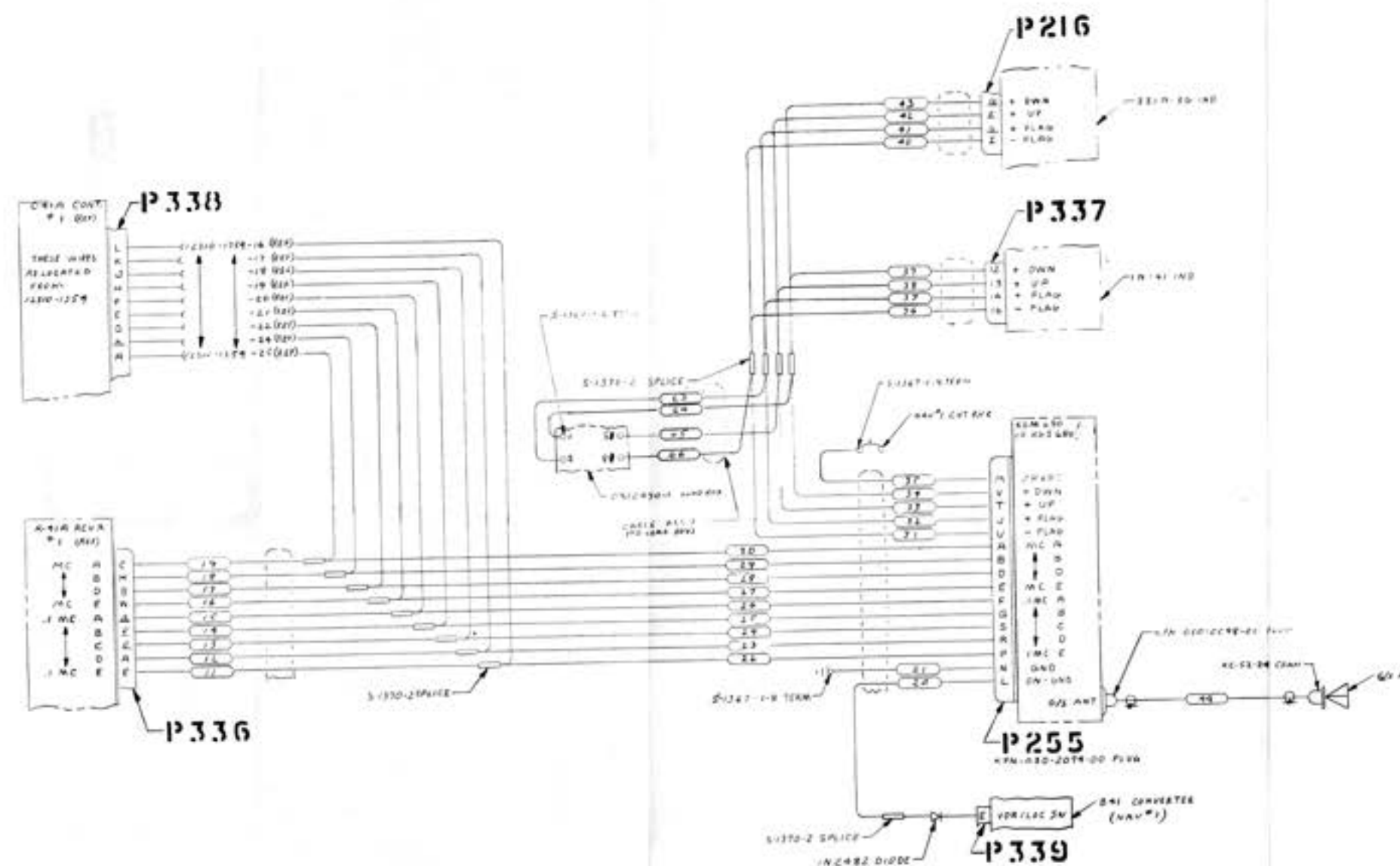


Figure 15-6. Cessna Com 800

310P0015 AND ON
TURBO-SYSTEM 310P0015 AND ON



Figure 15-8. Cessna Nav/Omni 800 (560 Channel) (Sheet 1 of 2)



310P0015 AND ON
TURBO-SYSTEM 310P0015 AND ON

Figure 15-10. Cessna 800 Glide Slope

SWITCH WIRES IN PINS F AND G IN POWER
UNIT AND WIRES IN PINS L AND M IN CONTROL
UNIT FOR BELLY INSTALLATION
NOTE: WIRE NUMBERS PREFIXED BY E580

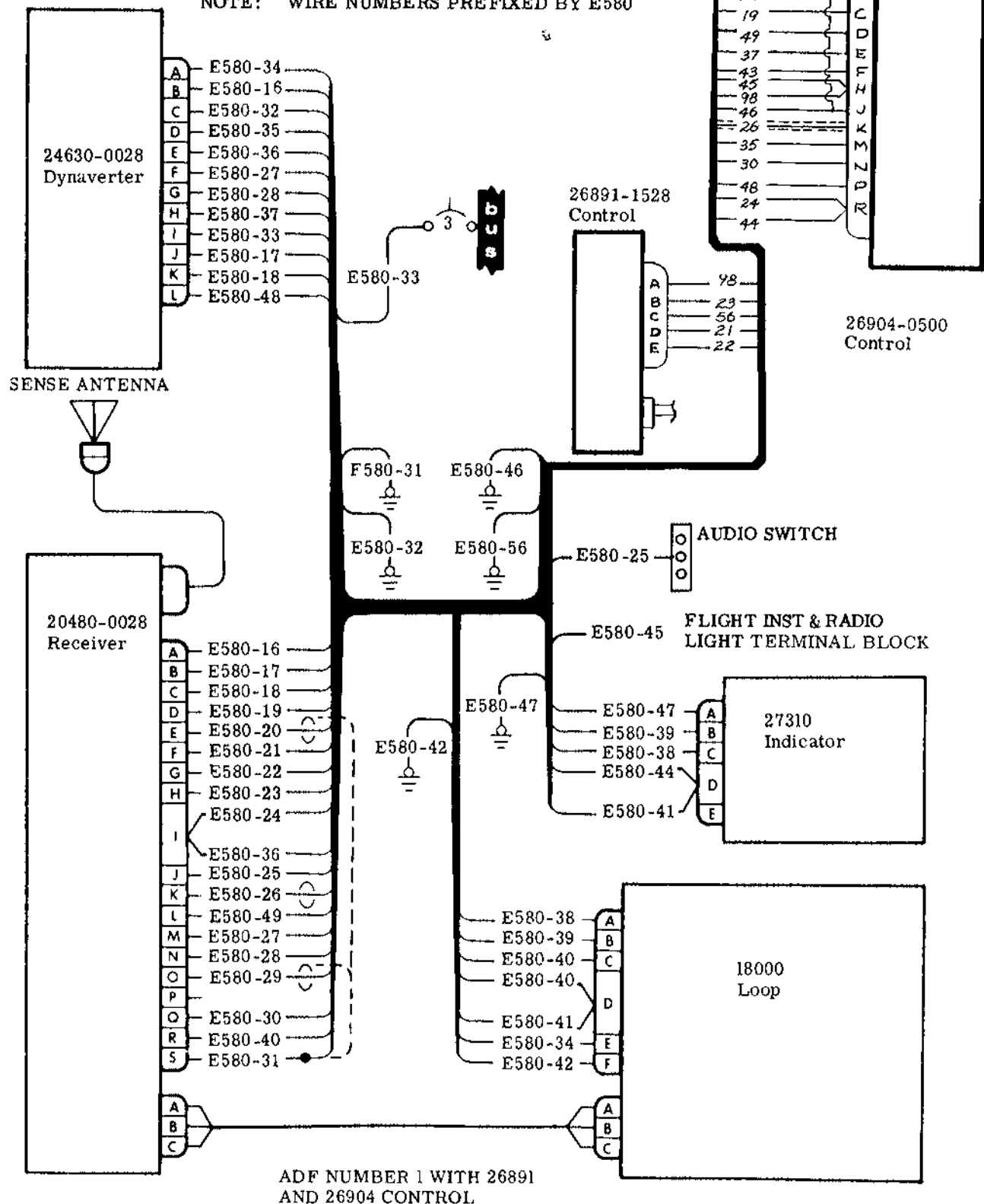


Figure 15-11. Cessna ADF 800 Rotatable Loop (Sheet 1 of 2)

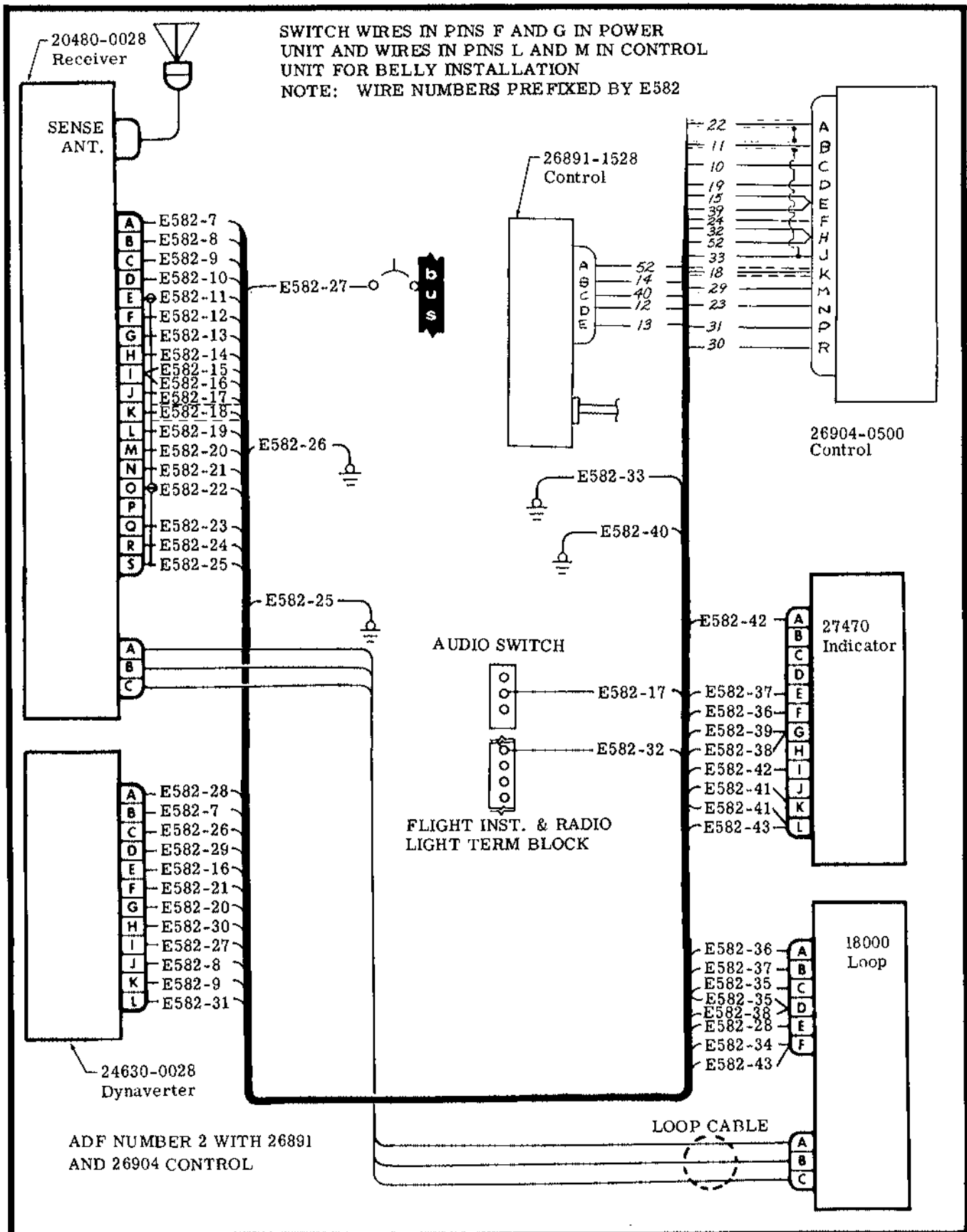
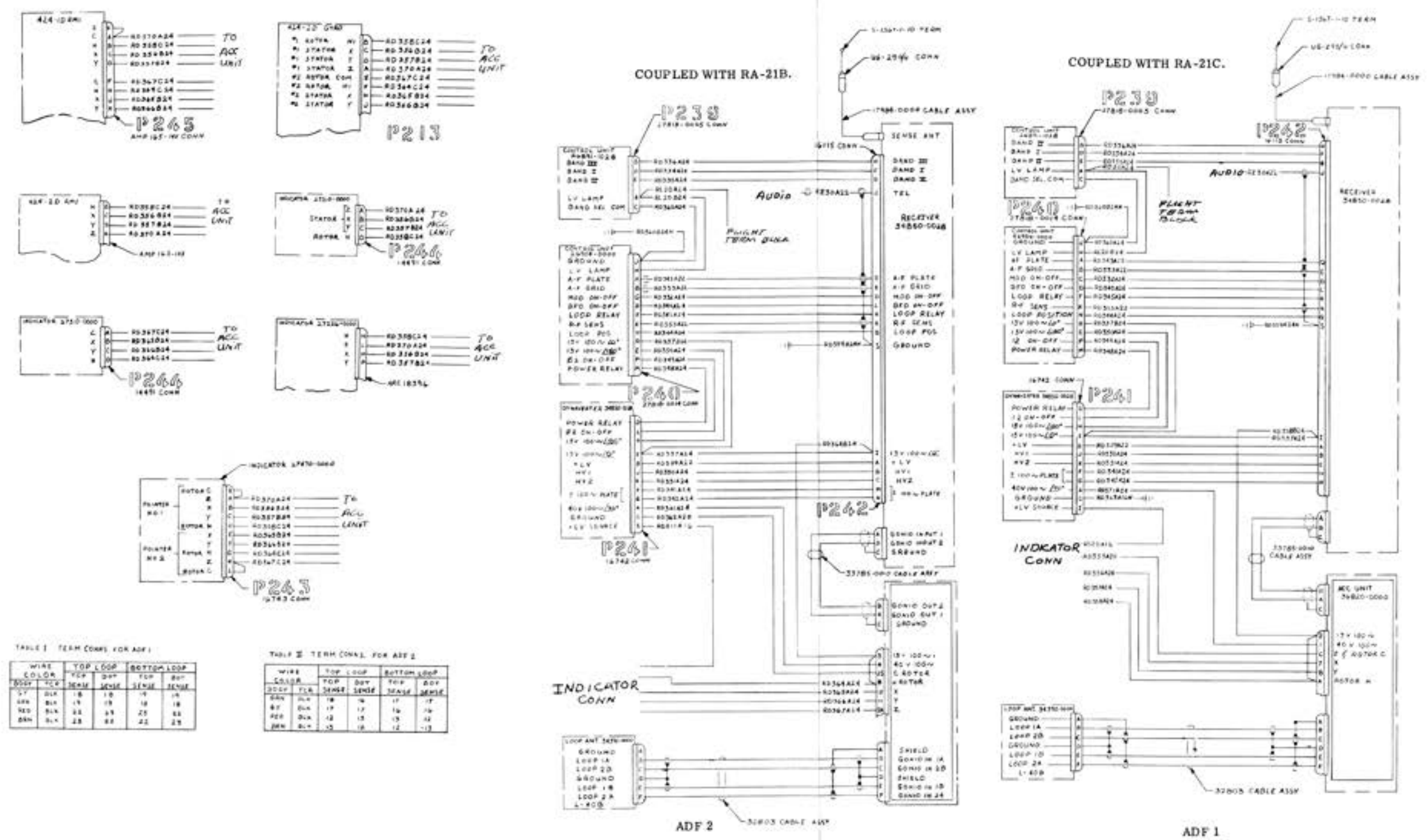


Figure 15-11. Cessna ADF 800 Rotatable Loop (Sheet 2 of 2)



310P0015 AND ON
TURBO-SYSTEM 310P0015 AND ON

Figure 15-14. Cessna 800 Dual ADF

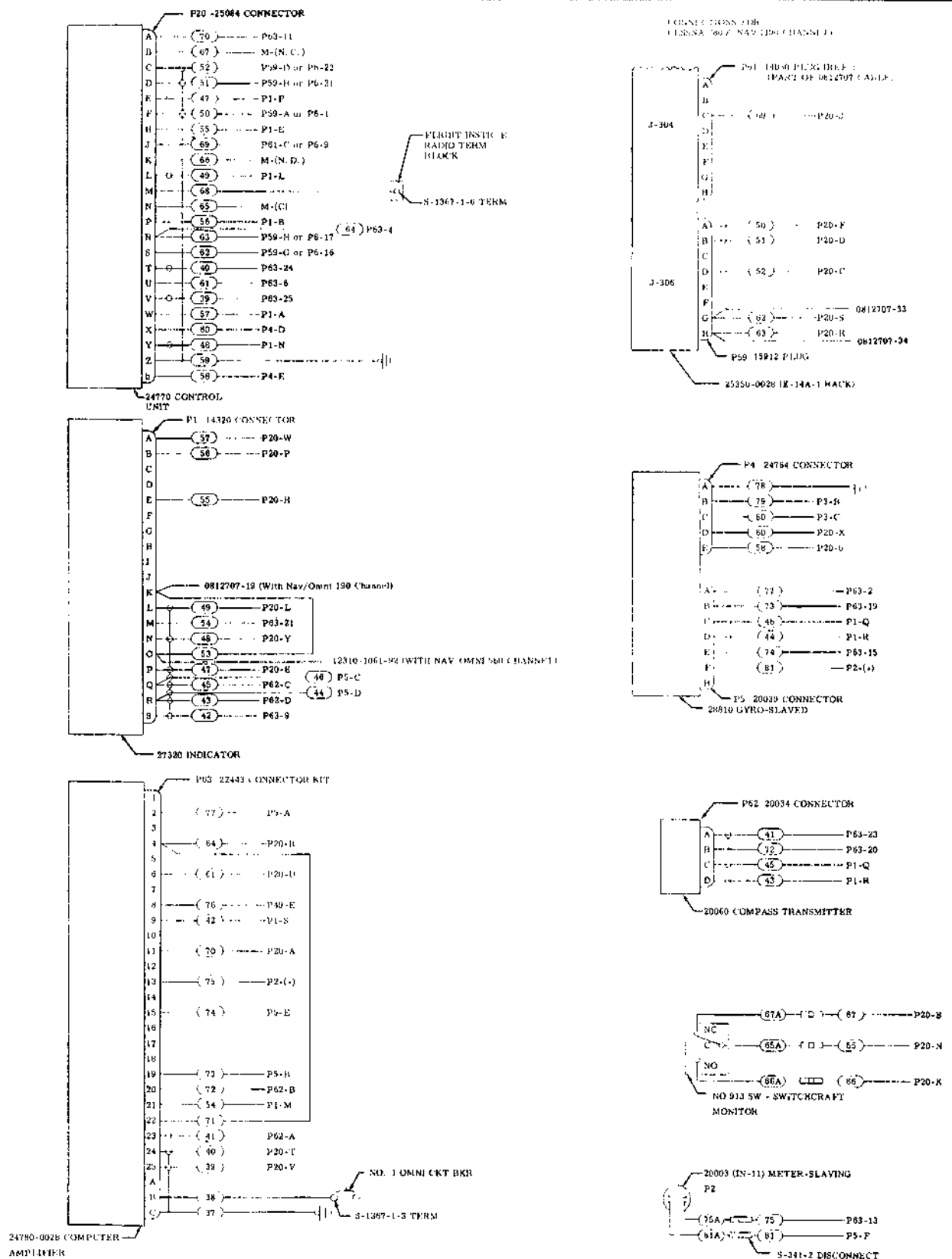
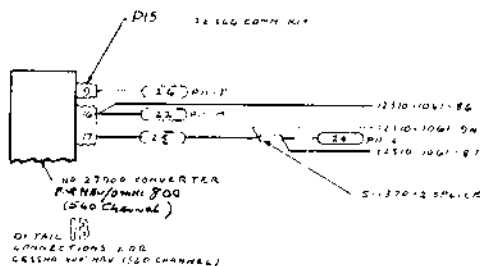
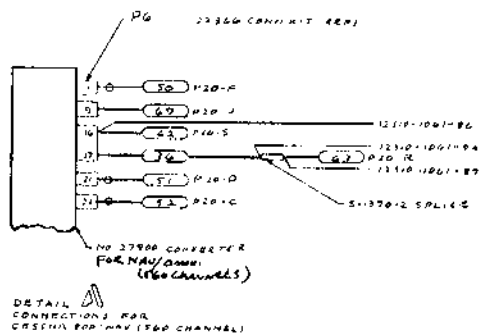


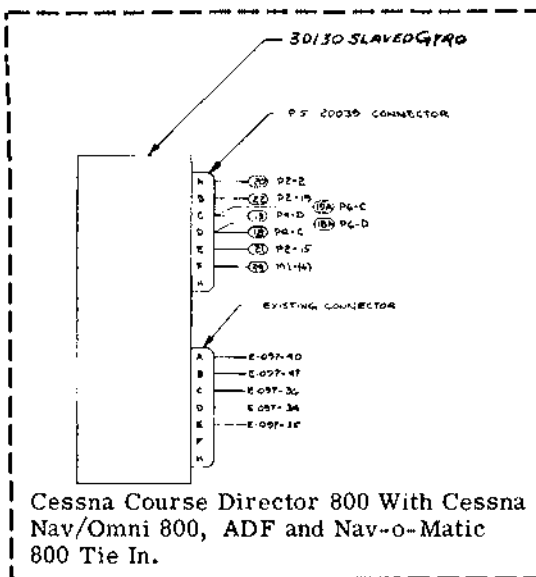
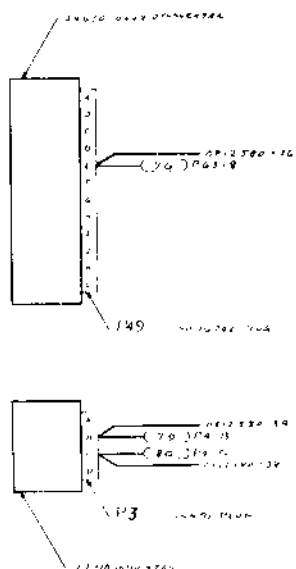
Figure 15-15. Cessna Course Director 800 (Sheet 1 of 3)



NOTE

1. WHEN A 1210-1061 IS INSTALLED WITH CESSNA FOR NAV SYSTEM (560 CHANNELS) DELETE THE FOLLOWING WIRE DRILL HOLES: 20, 27, 30, 35 FOR PMA, 10, 15, 20, 25 FOR NAV.

2. WHEN A 1210-1061 IS INSTALLED WITH CESSNA FOR NAV SYSTEM (560 CHANNELS) DELETE THE FOLLOWING WIRE DRILL HOLES: 20, 27, 30, 35 FOR PMA, 10, 15, 20, 25 FOR NAV.



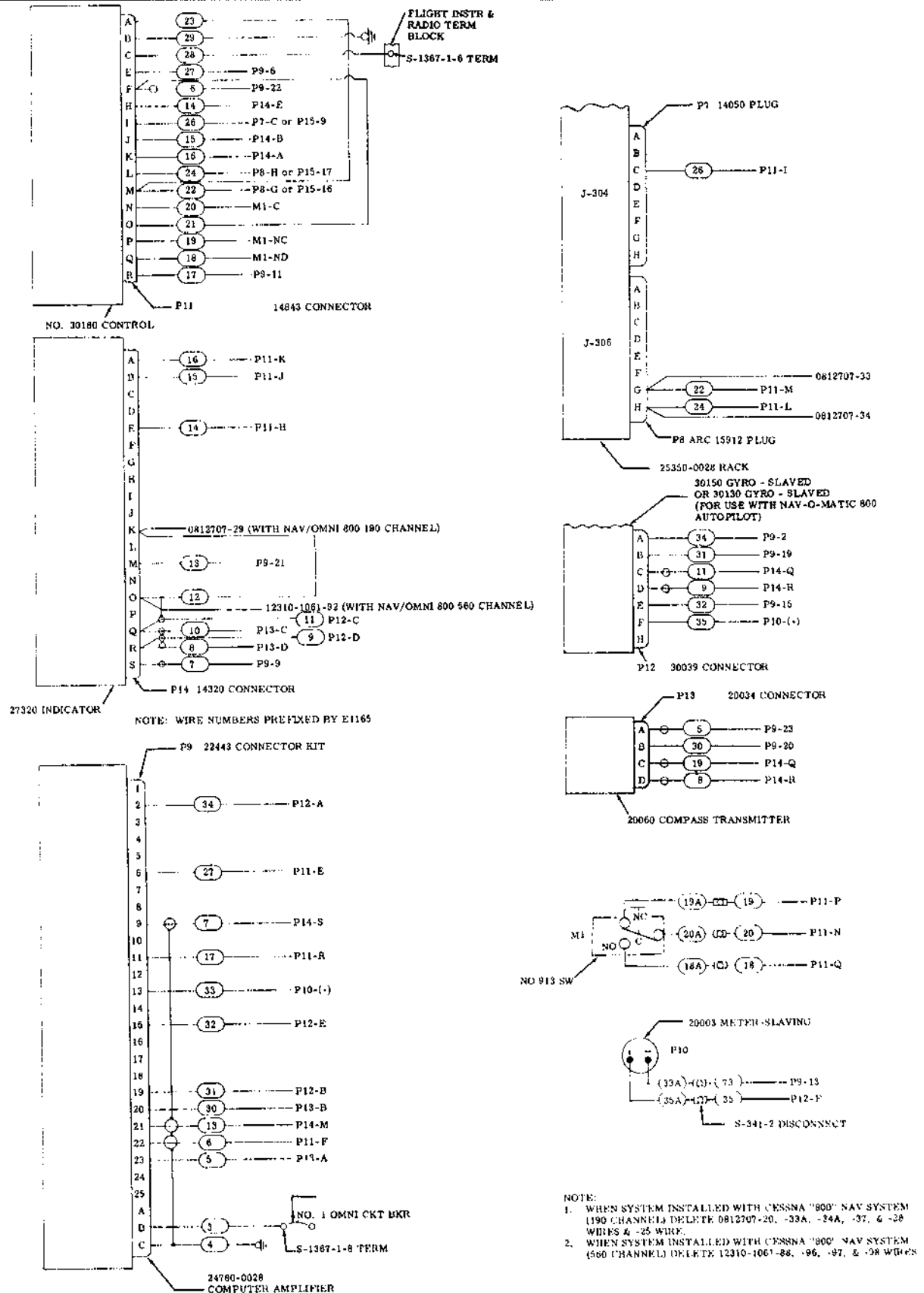


Figure 15-15. Cessna Course Director 800 (Sheet 3 of 3)

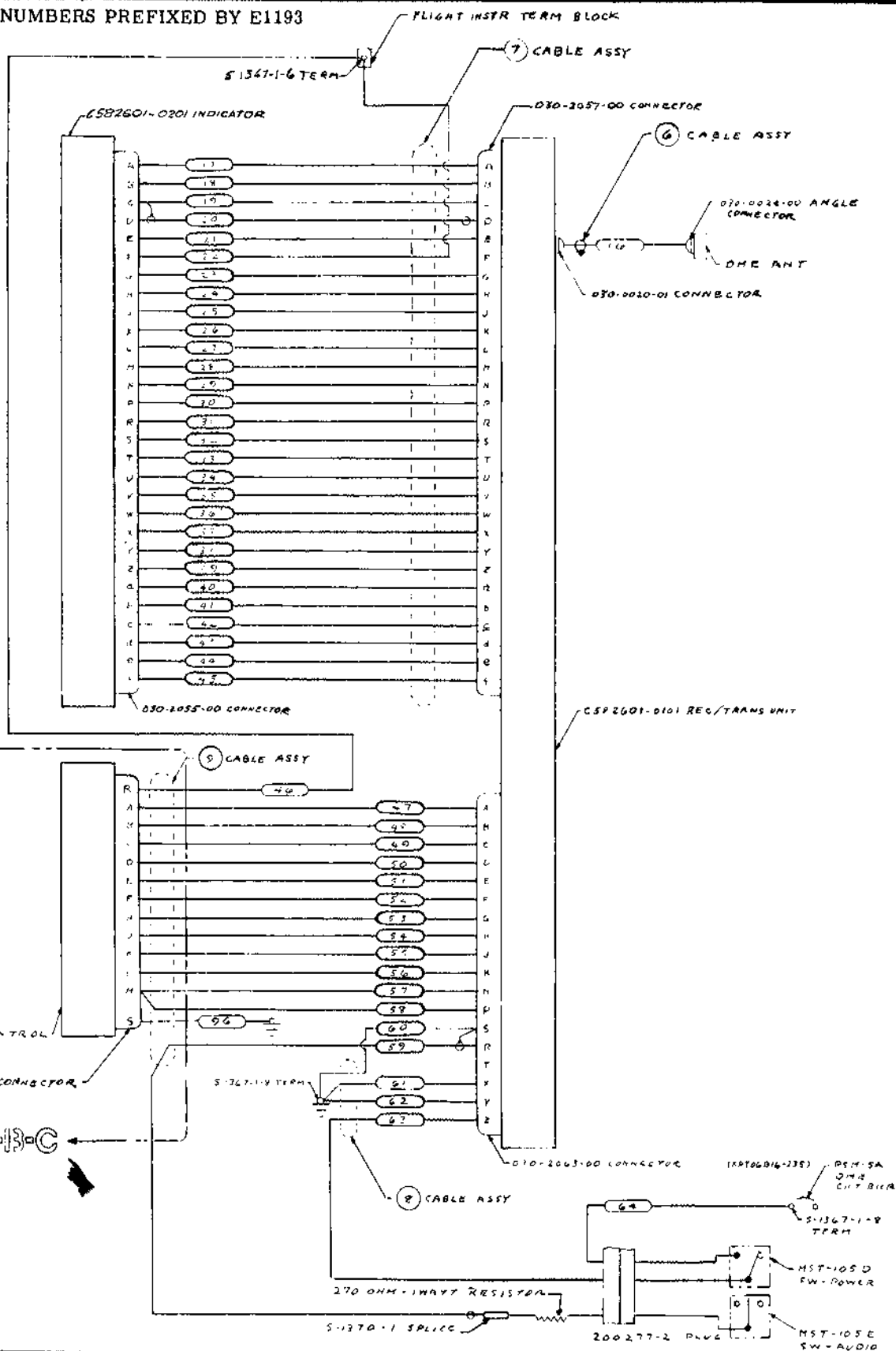


Figure 15-16. Cessna DME 800 (Sheet 1 of 4)

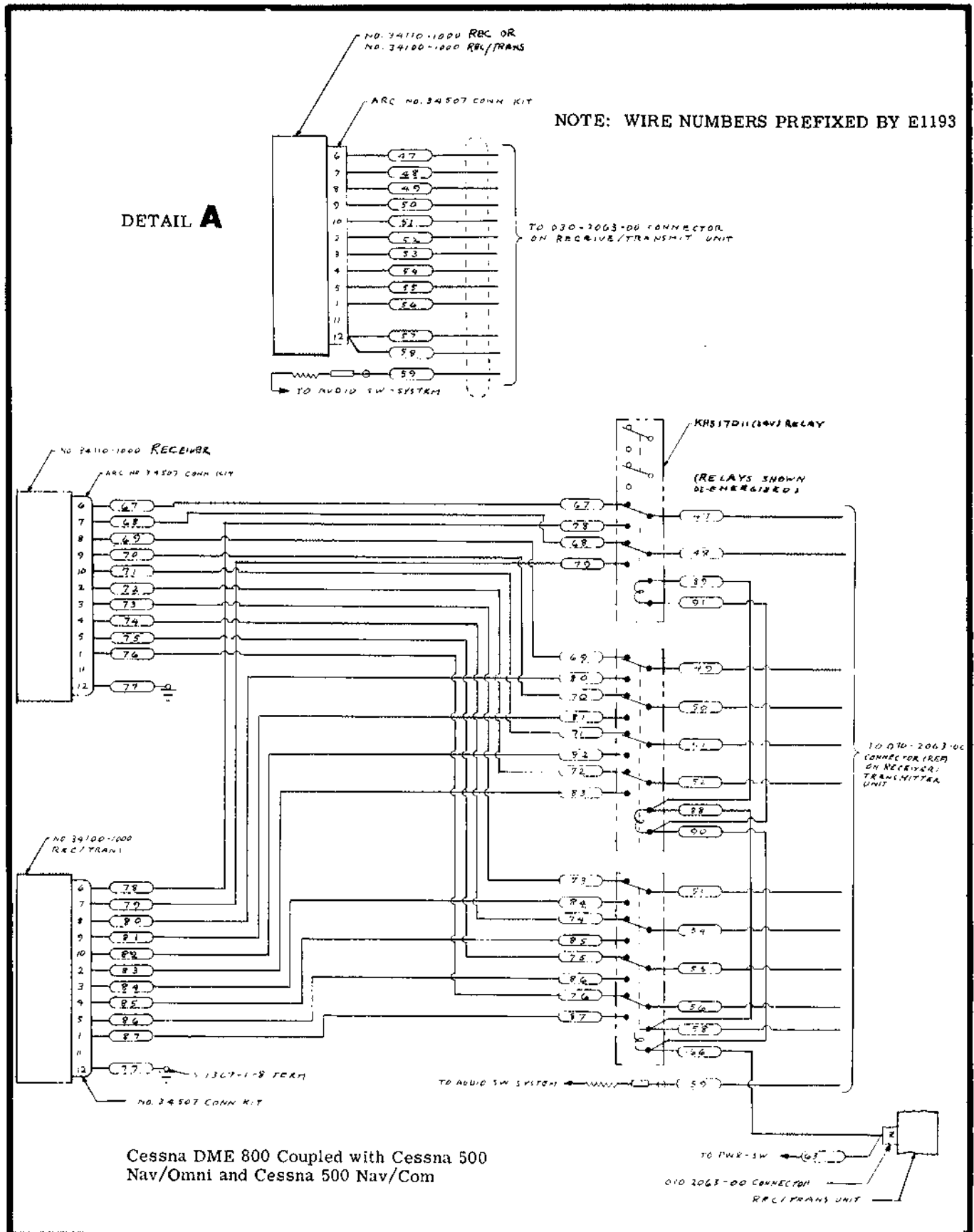


Figure 15-16. Cessna DME 800 (Sheet 2 of 4)



NOTE: WIRE NUMBERS PREFIXED BY E1193

32960 CONTROL

52960 CONTROL

27811-0050 COMM

KHS 17011 (24V) RELAY
(RELAY SHOWN DE-BULKED)

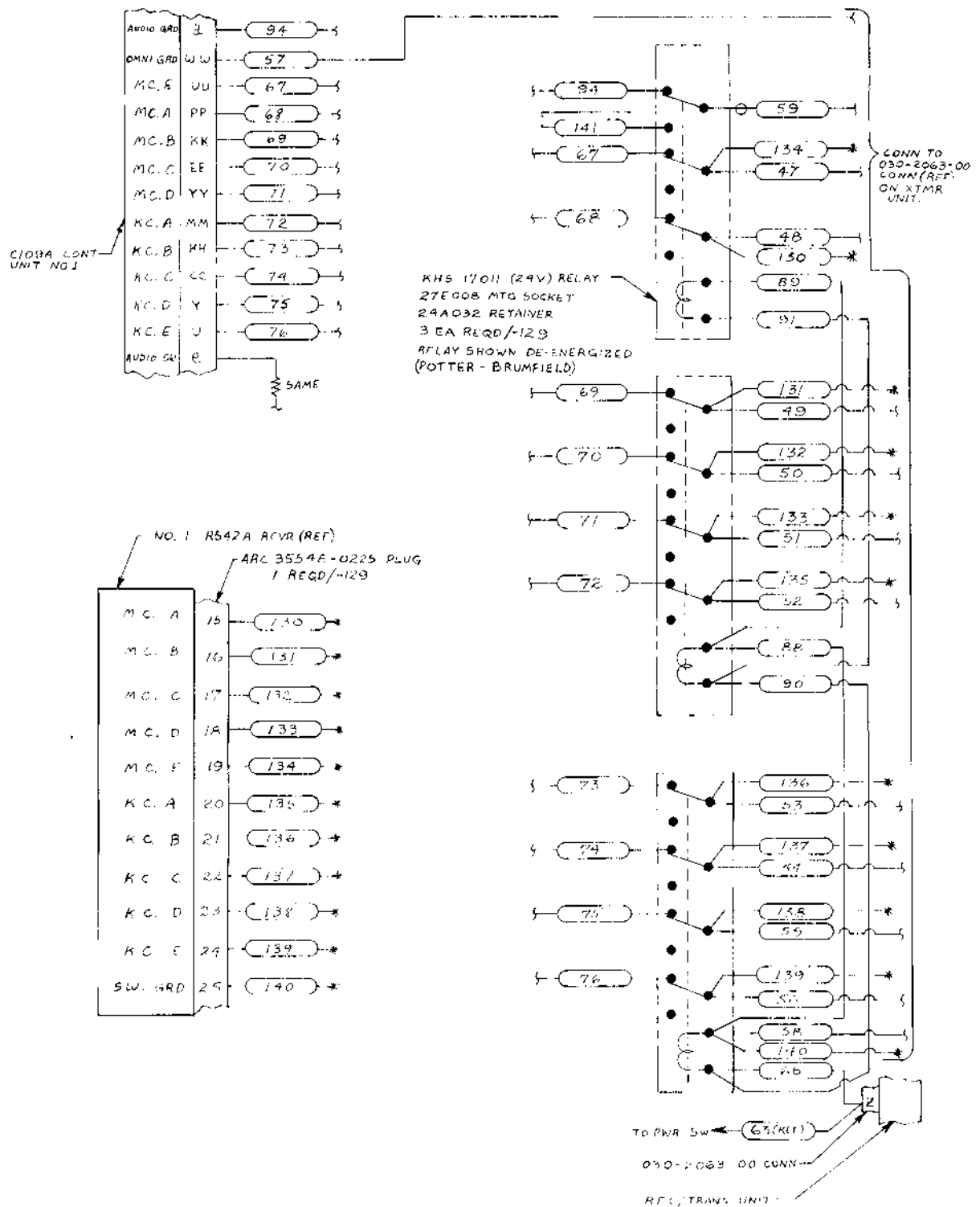
TO 030-2063-00 COMM/FWD OR REC/TRANS UNIT

TO PWR SW (T141)

030-2063-00 COMM
REC/TRANS UNIT

Cessna DME 800 Coupled with Cessna 800 Nav/Omni (560 Channels)

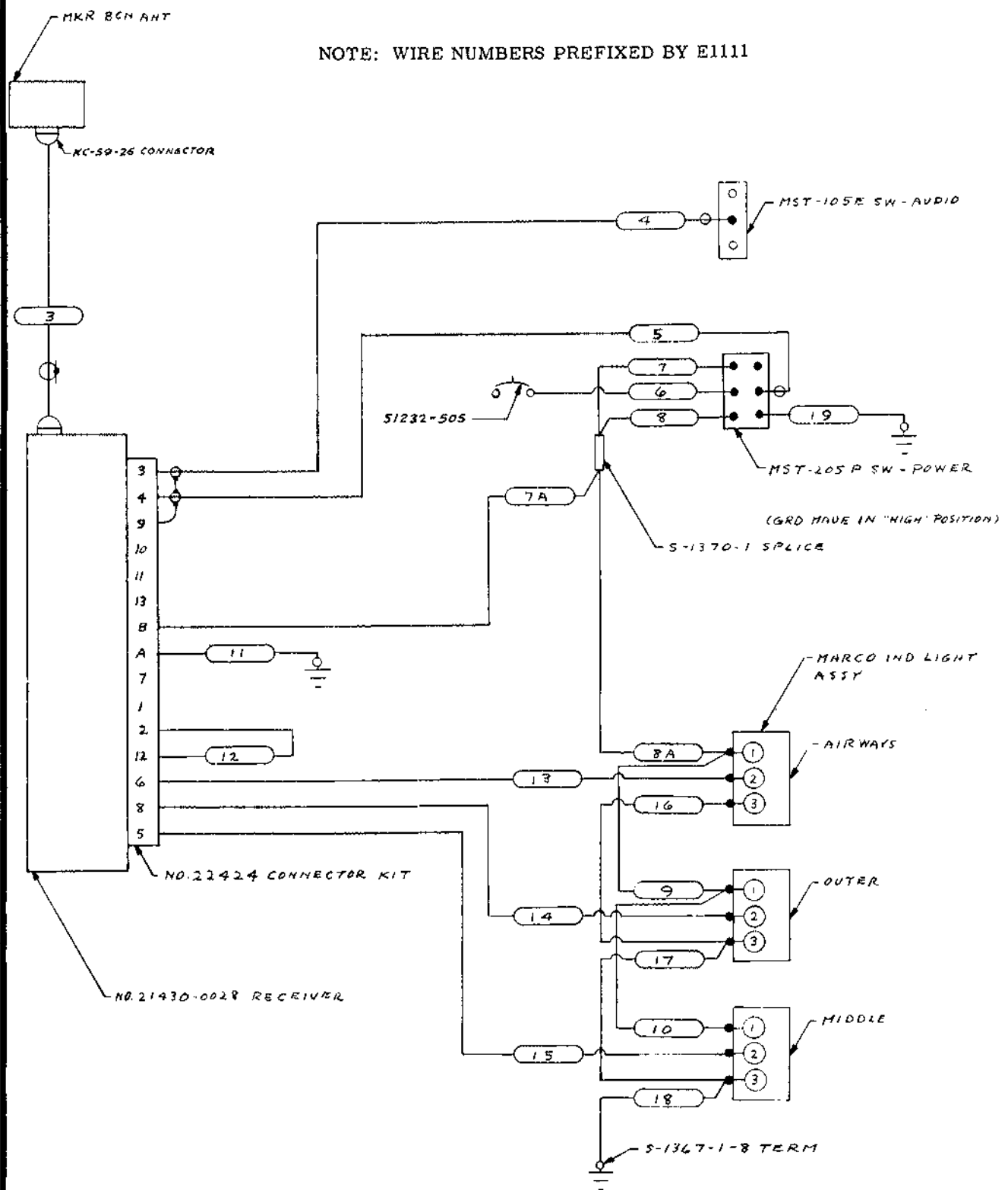
Figure 15-16. Cessna DME 800 (Sheet 3 of 4)



NOTE: WIRE NUMBERS PREFIXED BY E1193

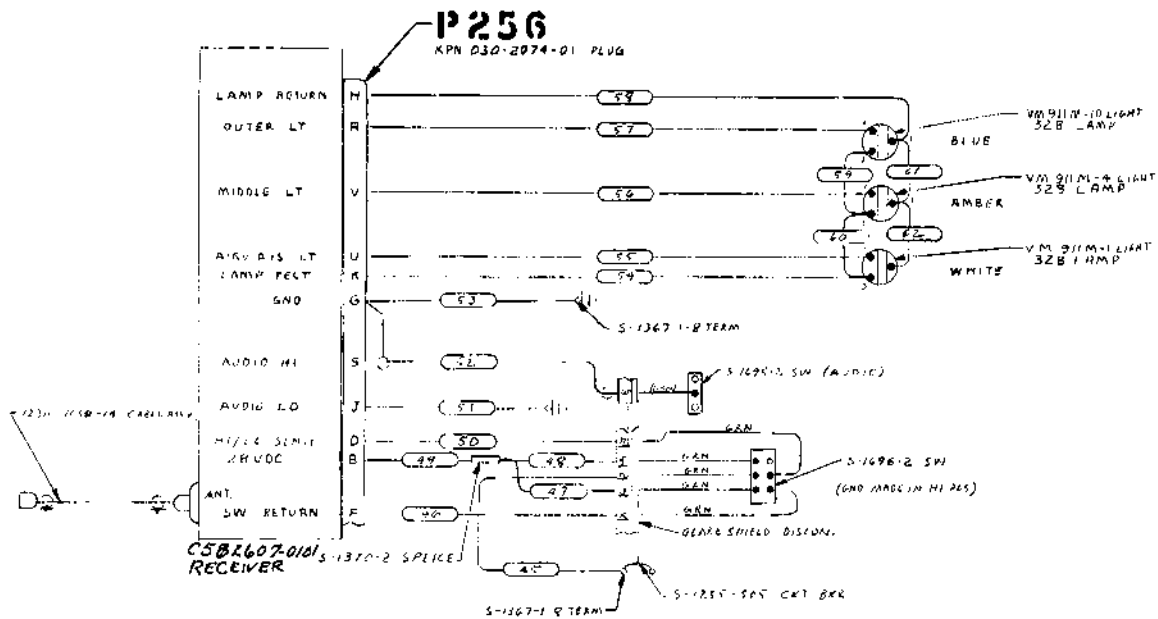
Figure 15-16. Cessna DME 800 (Sheet 4 of 4)

NOTE: WIRE NUMBERS PREFIXED BY E1111



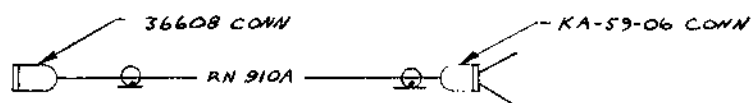
310P0001 TO 310P0015
 TURBO-SYSTEM 310P0001 TO 310P0015

Figure 15-17. Cessna Marker Beacon 800

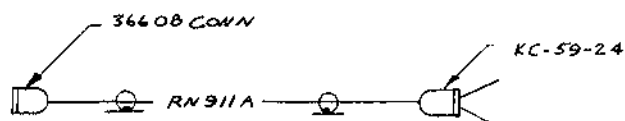


310P0015 AND ON
TURBO-SYSTEM 310P0015 AND ON

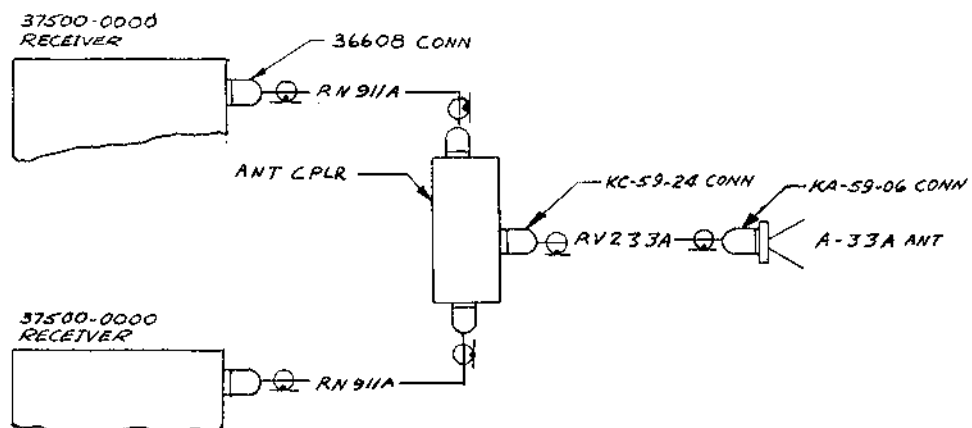
Figure 15-18. Cessna 800 Marker Beacon



A-33A ANTENNA

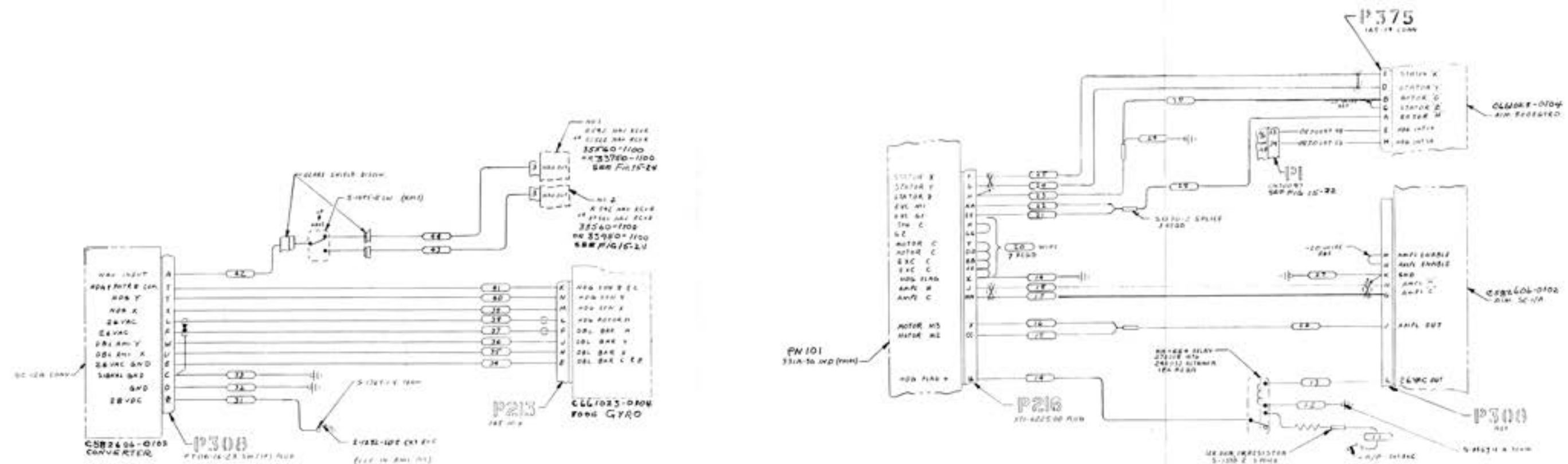


OMNI-TENNA OR COUPLER



NOTE: WIRE NUMBERS PREFIXED BY E1354

Figure 15-19. Cessna 800 Antenna Interconnects



NOTE: WIRE NUMBERS PREFIXED BY E1360

Figure 15-20. Cessna 800 RMI



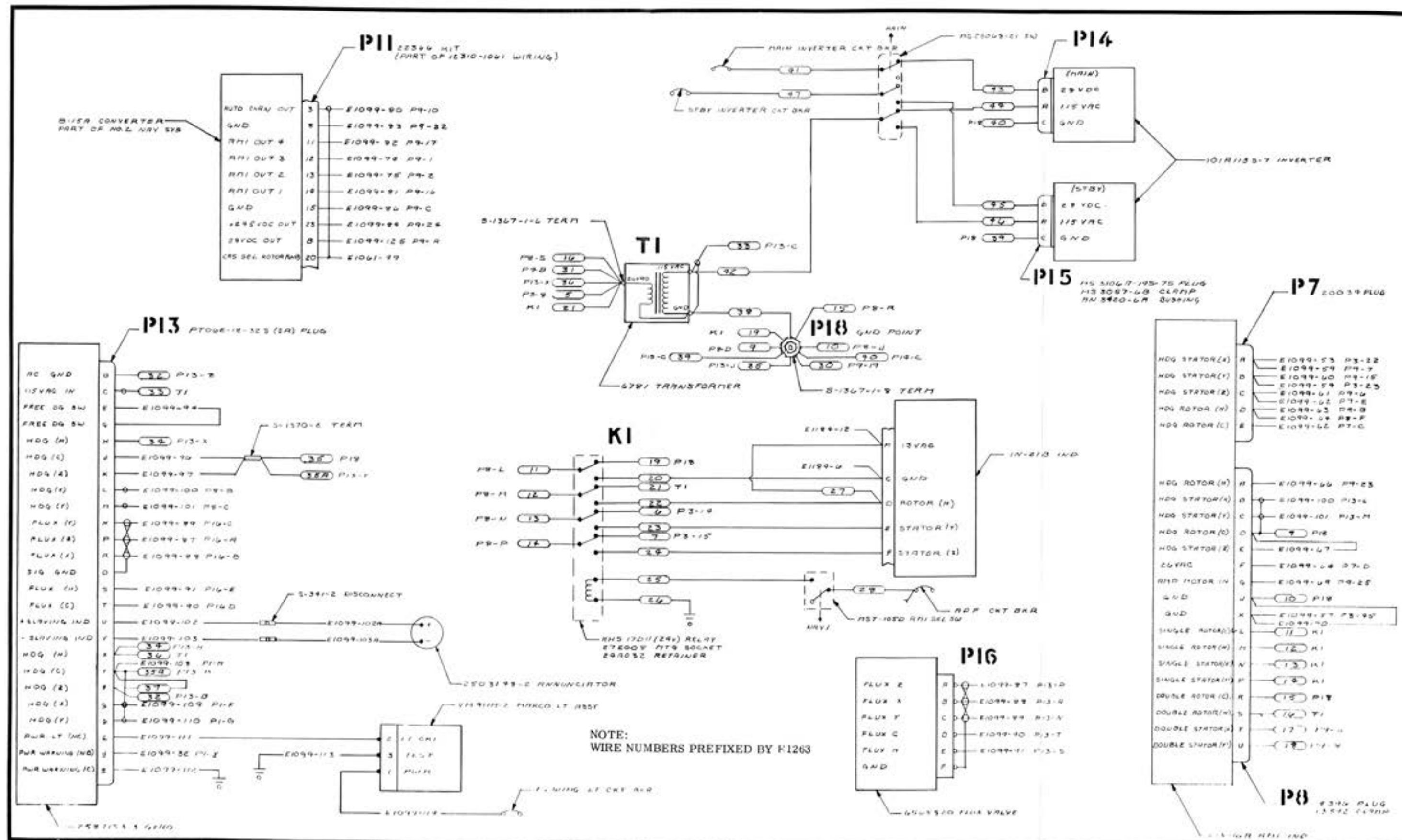
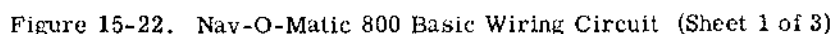
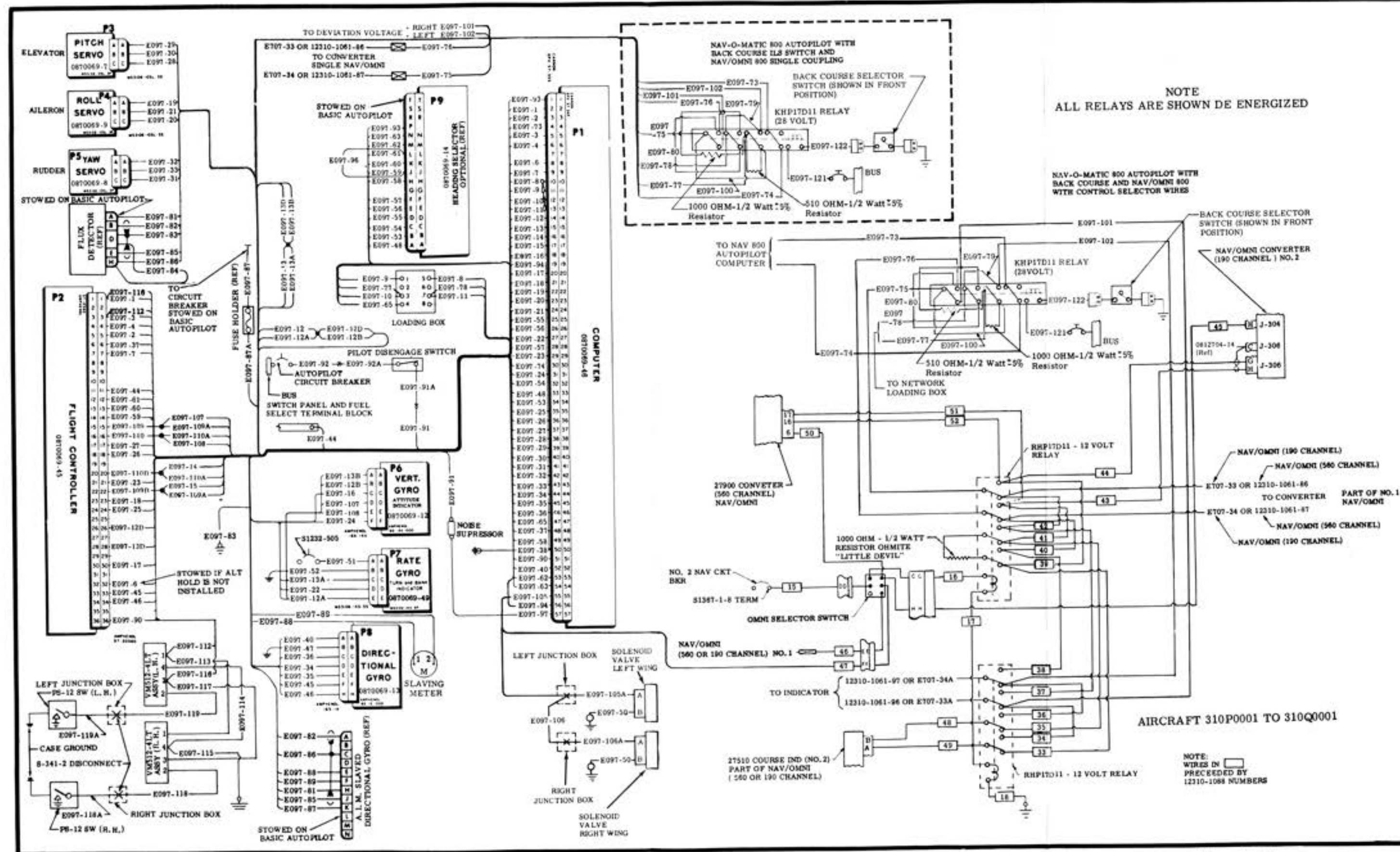


Figure 15-21. PN101 NAV System Coupled with C-14 Gyro and Cessna 800 RMI (Sheet 2 of 2)





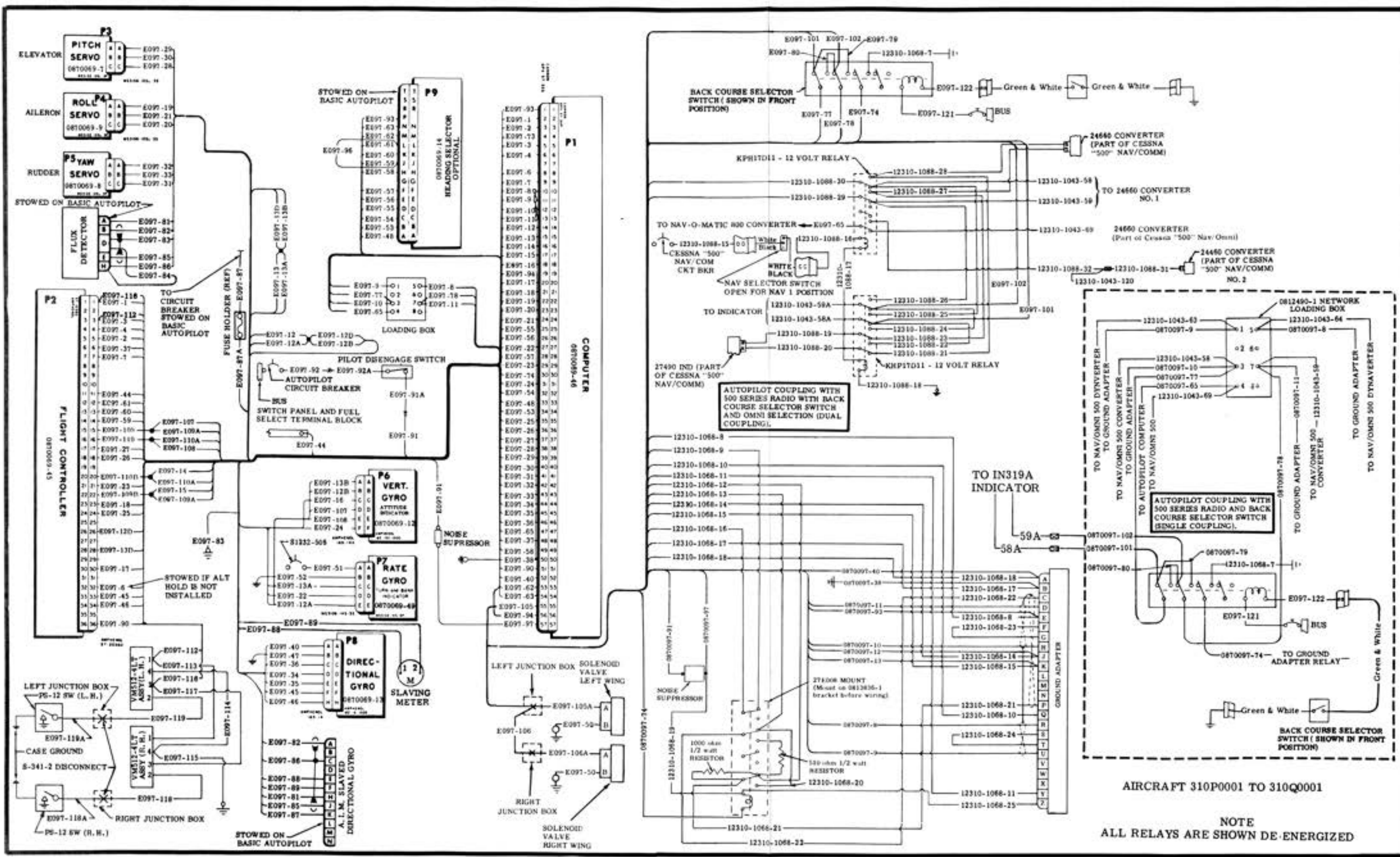


Figure 15-22. Nav-O-Matic 800 Basic Wiring Circuit (Sheet 3 of 3)



Figure 15-22A. Cessna 800 Nav-O-Matic with Nav Selection and Backcourse Switching (Sheet 2 of 2)





Figure 15-22B. Cessna 800 Nav-O-Matic Autopilot (Sheet 2 of 2)

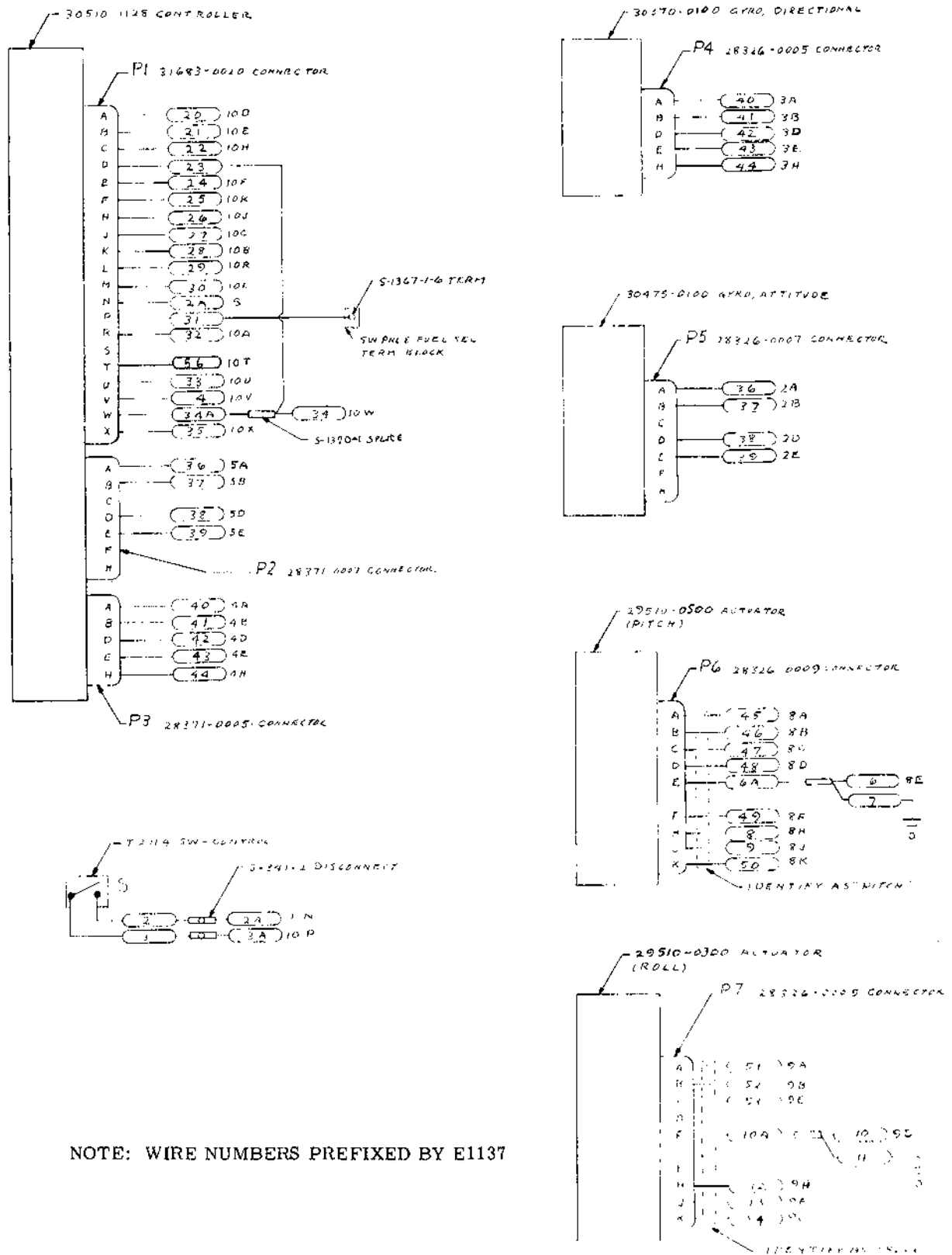
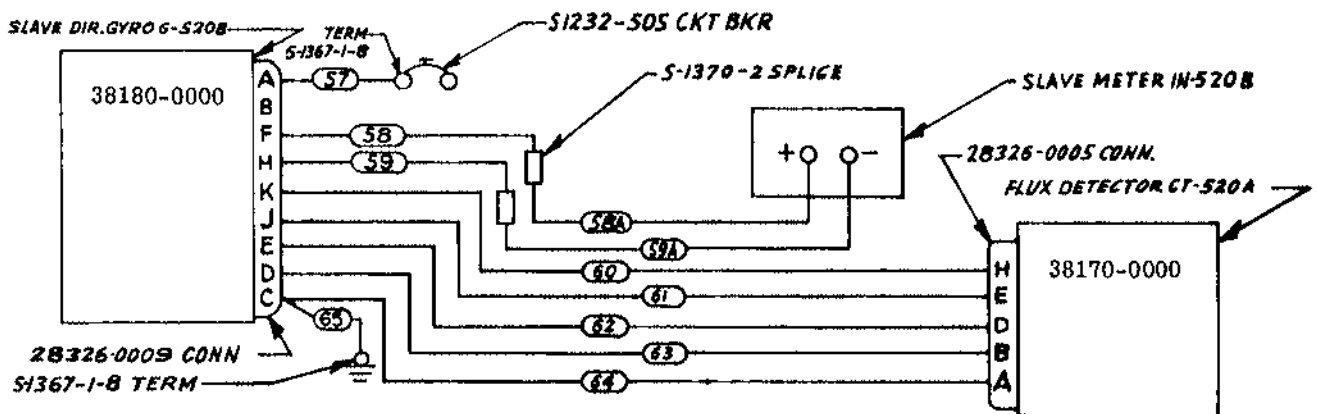


Figure 15-23. Cessna Nav-O-Matic 400 Autopilot (Sheet 1 of 3)

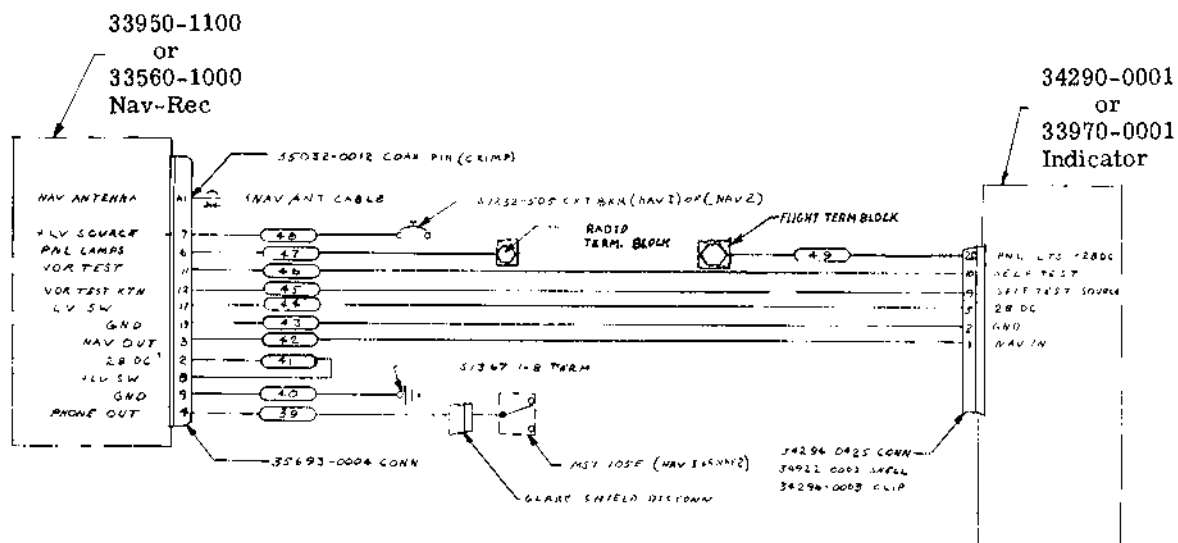


Figure 15-23. Cessna Nav-O-Matic 400 Autopilot (Sheet 2 of 3)



NAV-O-MATIC 400 COUPLED WITH SLAVED GYRO

NOTE: WIRE NUMBERS PREFIXED BY E1137



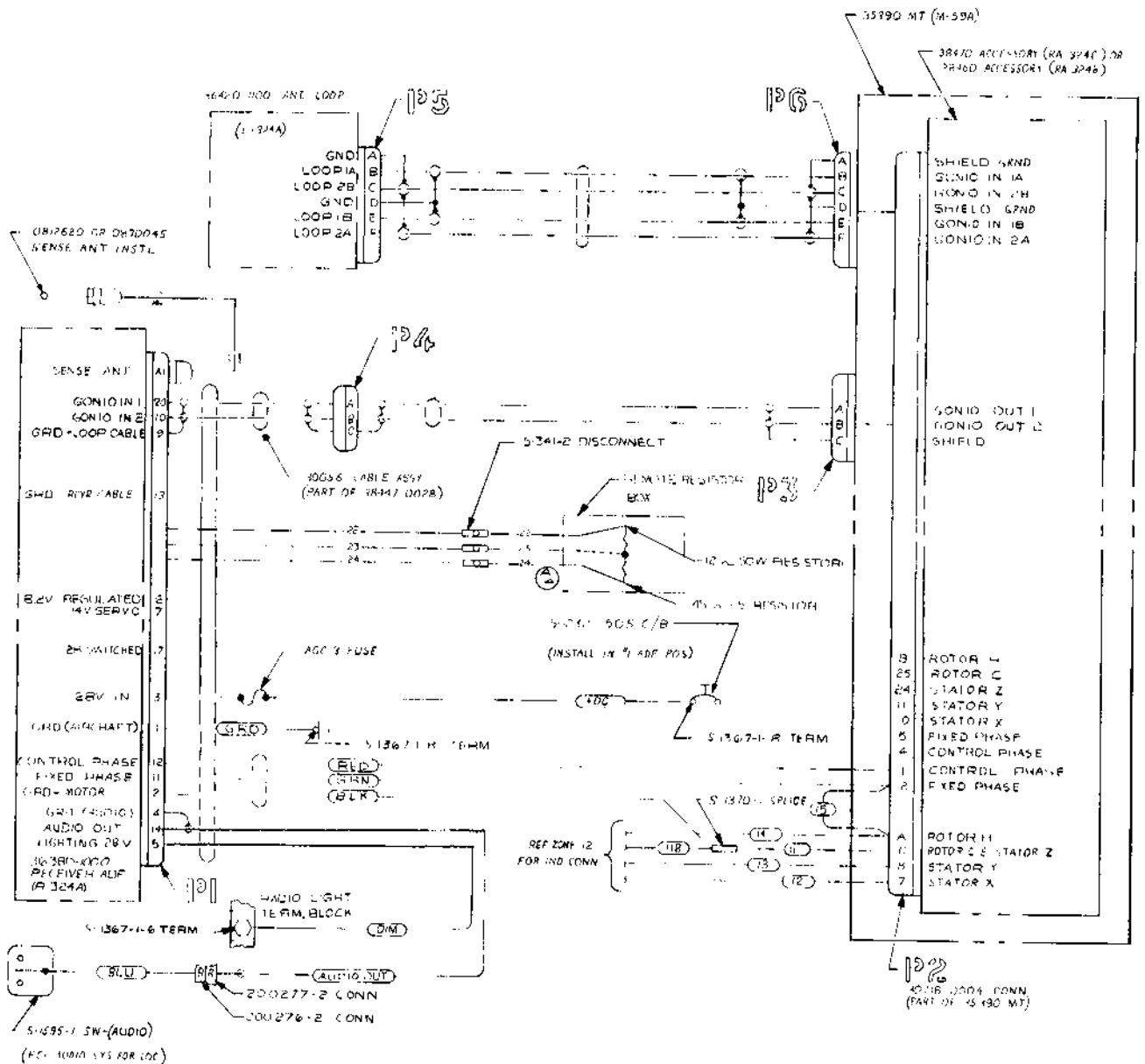
NOTE: WIRE NUMBERS PREFIXED BY E1265

Figure 15-24. Cessna Nav/Omni 400 (100 Channel)

TABLE #1

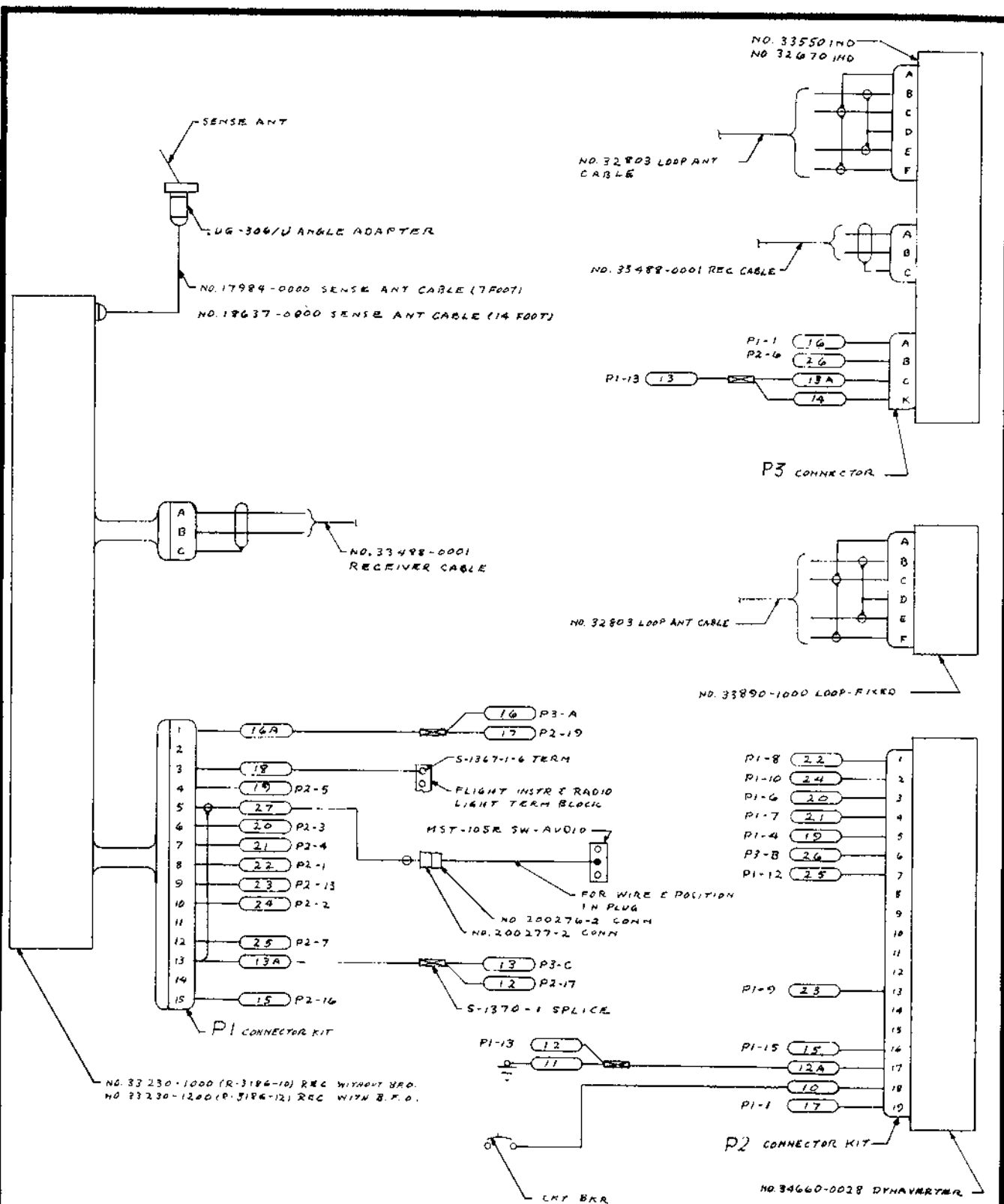
FOR RA 324C OR RA 324B (1 ADF)

WIRE COLOR	CONN. PIN NOS.			
	TOP LOOP SENSE	BOTTOM LOOP SENSE	TOP LOOP SENSE	BOTTOM LOOP SENSE
WH/BK/GR	18	18	19	19
WH/BK/GRN	19	19	18	18
WH/BK/RED	21	21	23	23
WH/BK/BRN	22	22	22	22



310P0015 AND ON
TURBO-SYSTEM 310P0015 AND ON

Figure 15-25. Cessna 400 ADF (Sheet 2 of 2)



NOTE: WIRE NUMBERS PREFIXED BY E1175

310P0001 TO 310P0015
TURBO-SYSTEM 310P0001 TO 310P0015

Figure 15-26. Cessna ADF 400

35695-0003 CONN
35032-0012 COAL PIN (CRIMP)

LIARE SHIELD DISCONN
MST 105F SWITCH (COMM 1)

TOTL 2W RESISTOR
51370-2 SP4LE

35525-0003 CONN
35328 SHCLL
20914-0002 LOGC

PHONE OUT
PNL LAMP
GND
150 AUDIO
+ LV SOURCE
ACVR ANT
R.F.
FLV SWB
+ LV

3
5
1
15
6
7
A1
A2
6
2

37
38
15367-1-6 TERM
RADIO INSTR
TEAM BLK
51367-1-8 TERM
51370-2 SP4LE
51370-2 SP4LE
51332 505 GET BKR (COMM 1 POS)

TO AUDIO
SYSTEM
37A
37
32
30
25
26
27
24
23
24
28
29

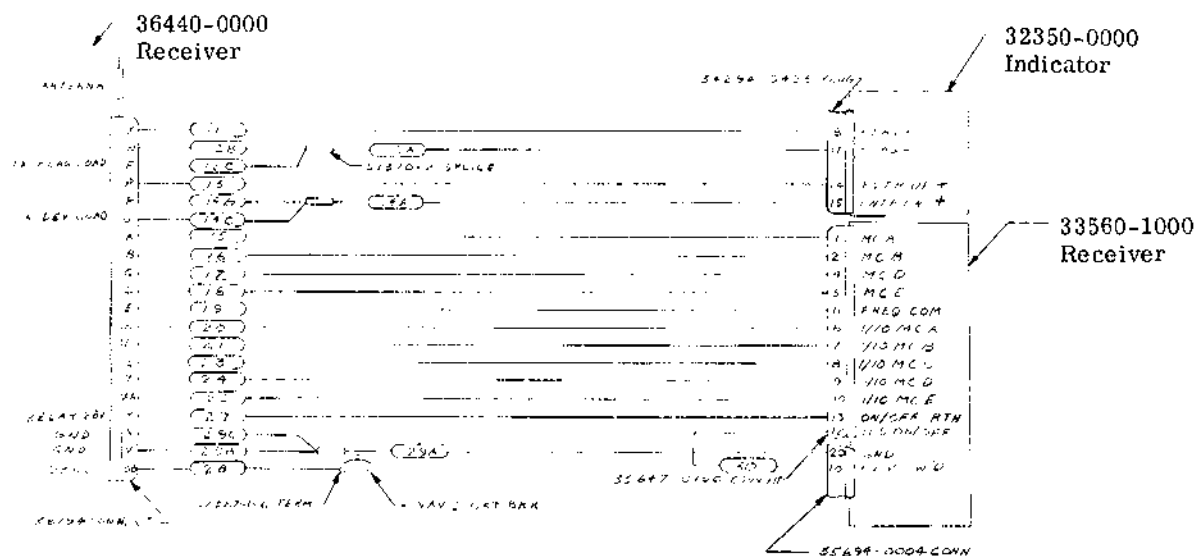
36600-0000
Accessary Unit

SPKR
MIC KEY
PH. S10FTONE
MIC AUDIO
GND
GND
GND
150 AUDIO
(+V REG (28V))
RCVR ANT
R.F. IN
TX 14VDC
28 VDC SUPPLY
ANTENNA

33570-1000
or
33950-1100
Rec-Trans

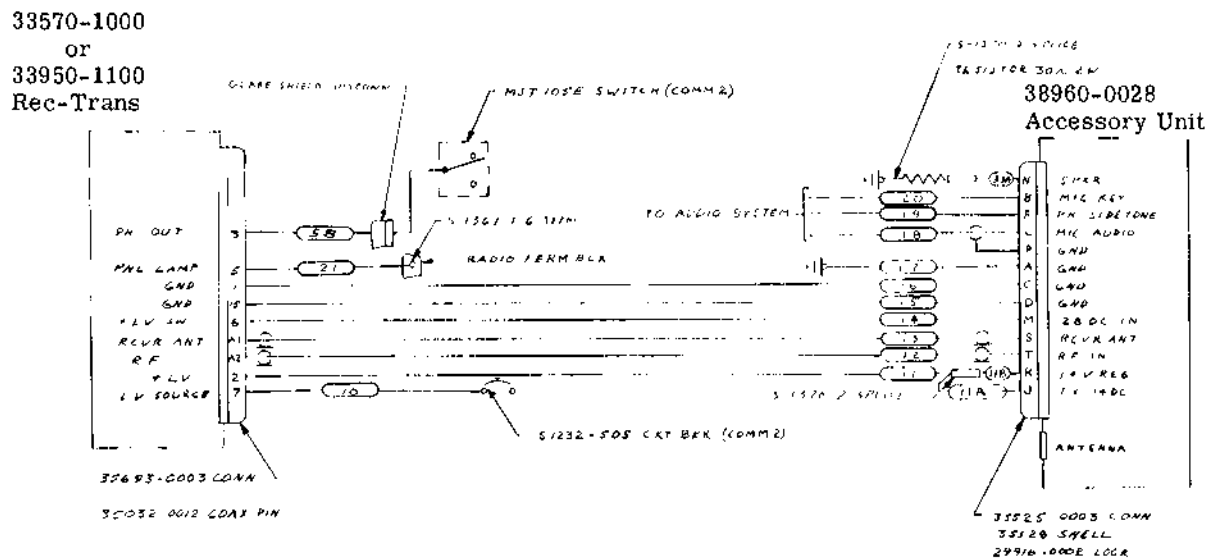
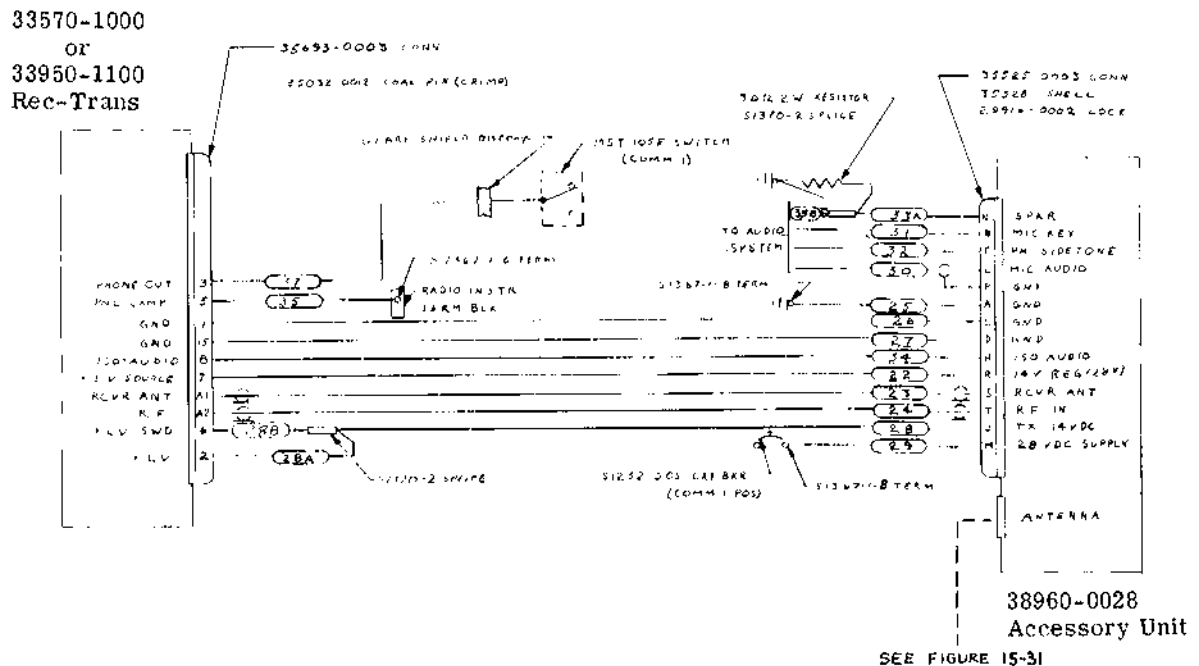
COM





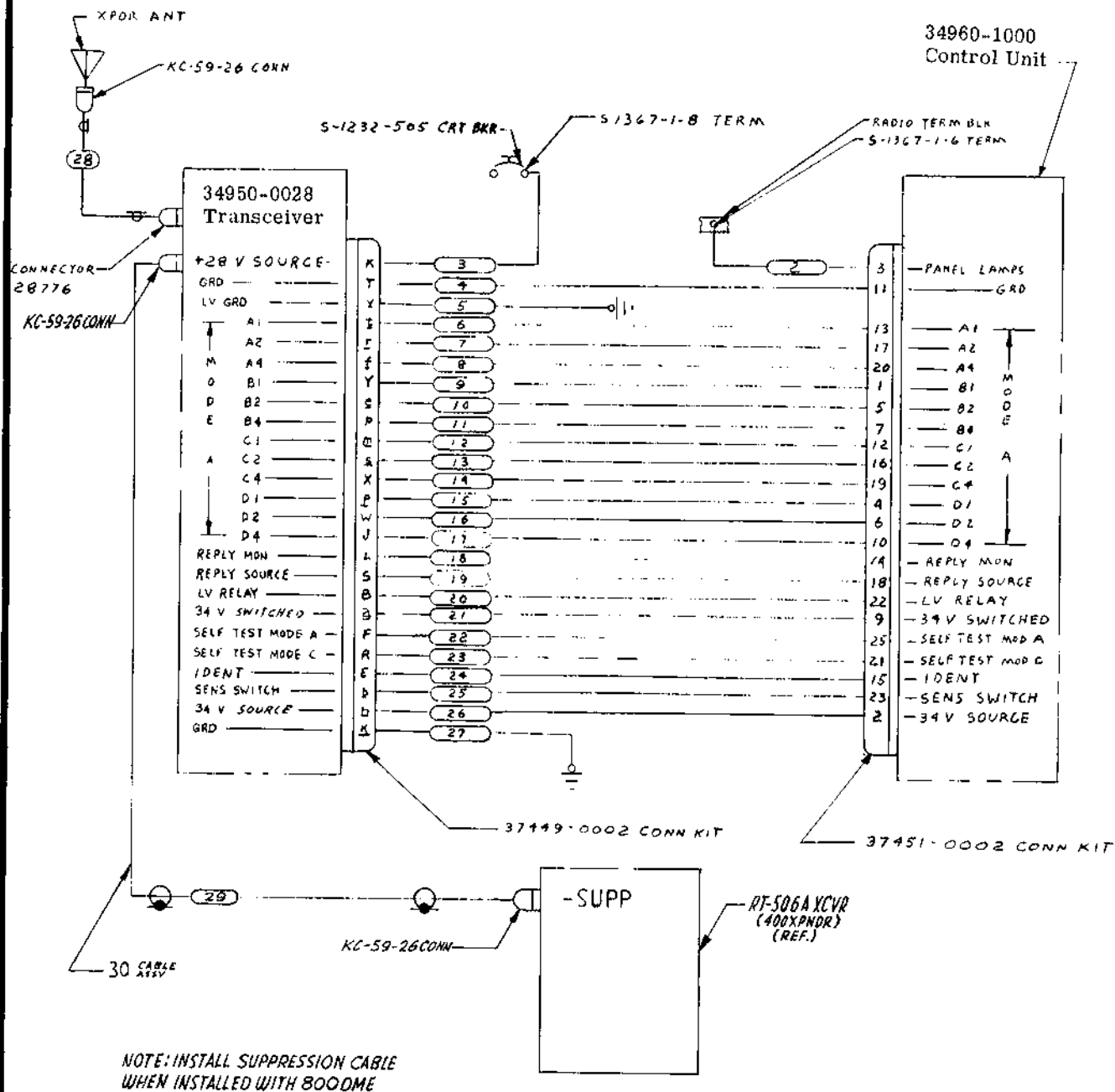
NOTE: WIRE NUMBERS PREFIXED BY 1299.

Figure 15-28. Cessna Glide Slope 400



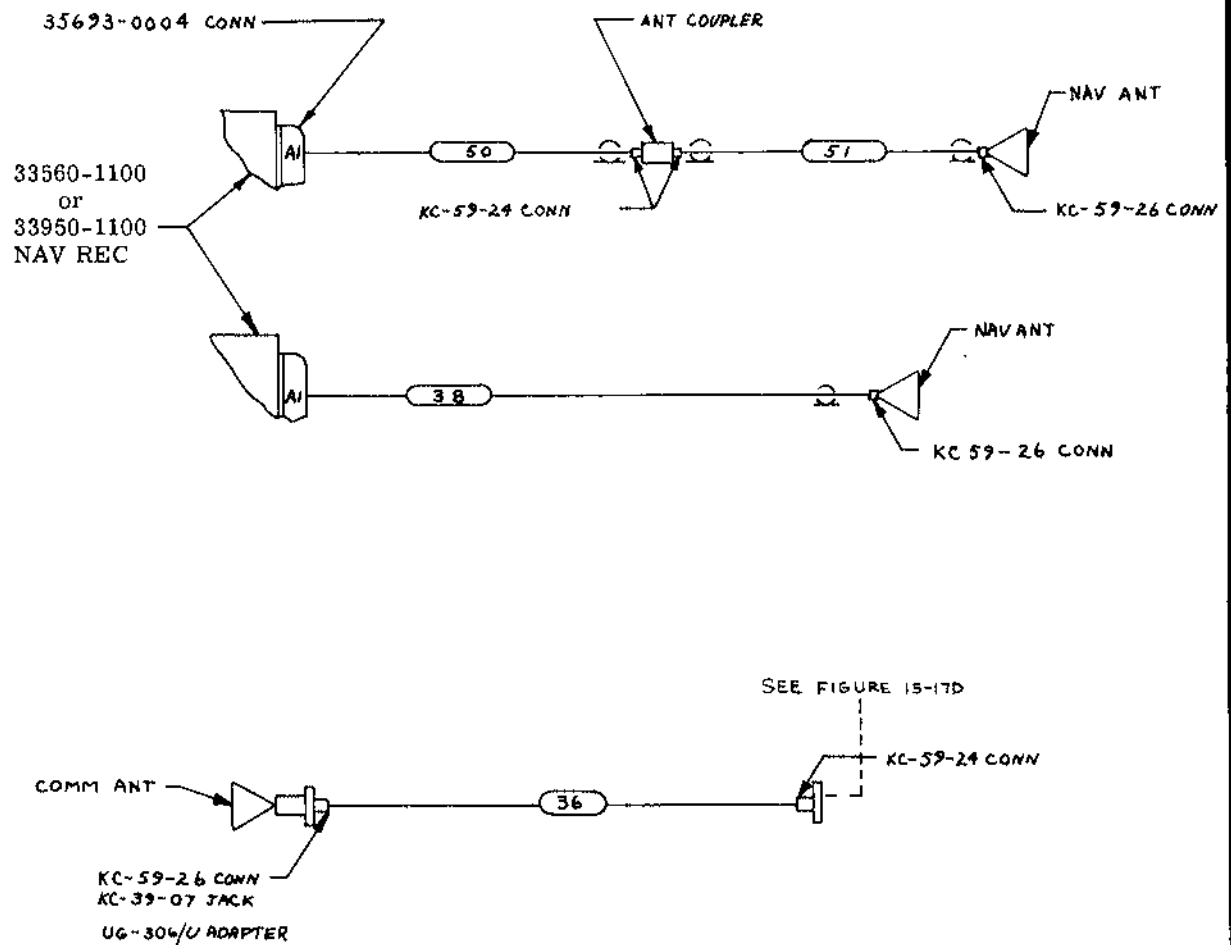
NOTE: WIRE NUMBERS PREFIXED BY E1265

Figure 15-29. Cessna Transceiver 400



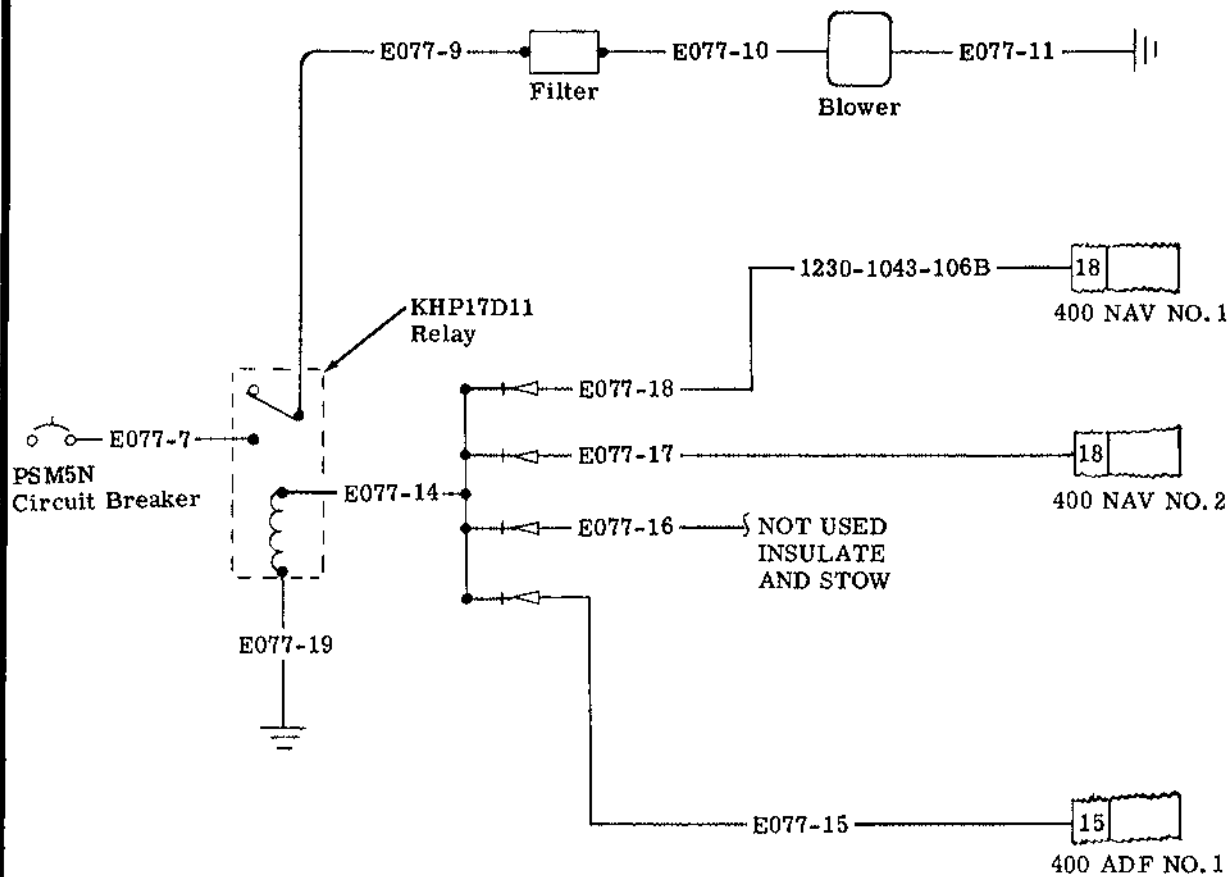
NOTE: WIRE NUMBERS PREFIXED BY E1306

Figure 15-30. Cessna Transponder 400



NOTE: WIRE NUMBERS PREFIXED BY E1265.

Figure 15-31. Cessna 400 Series Antenna Interconnects



NOTE: WIRE NUMBERS PREFIXED BY E1077.

Figure 15-32. Radio Cooling Blower (400 Series Radio)

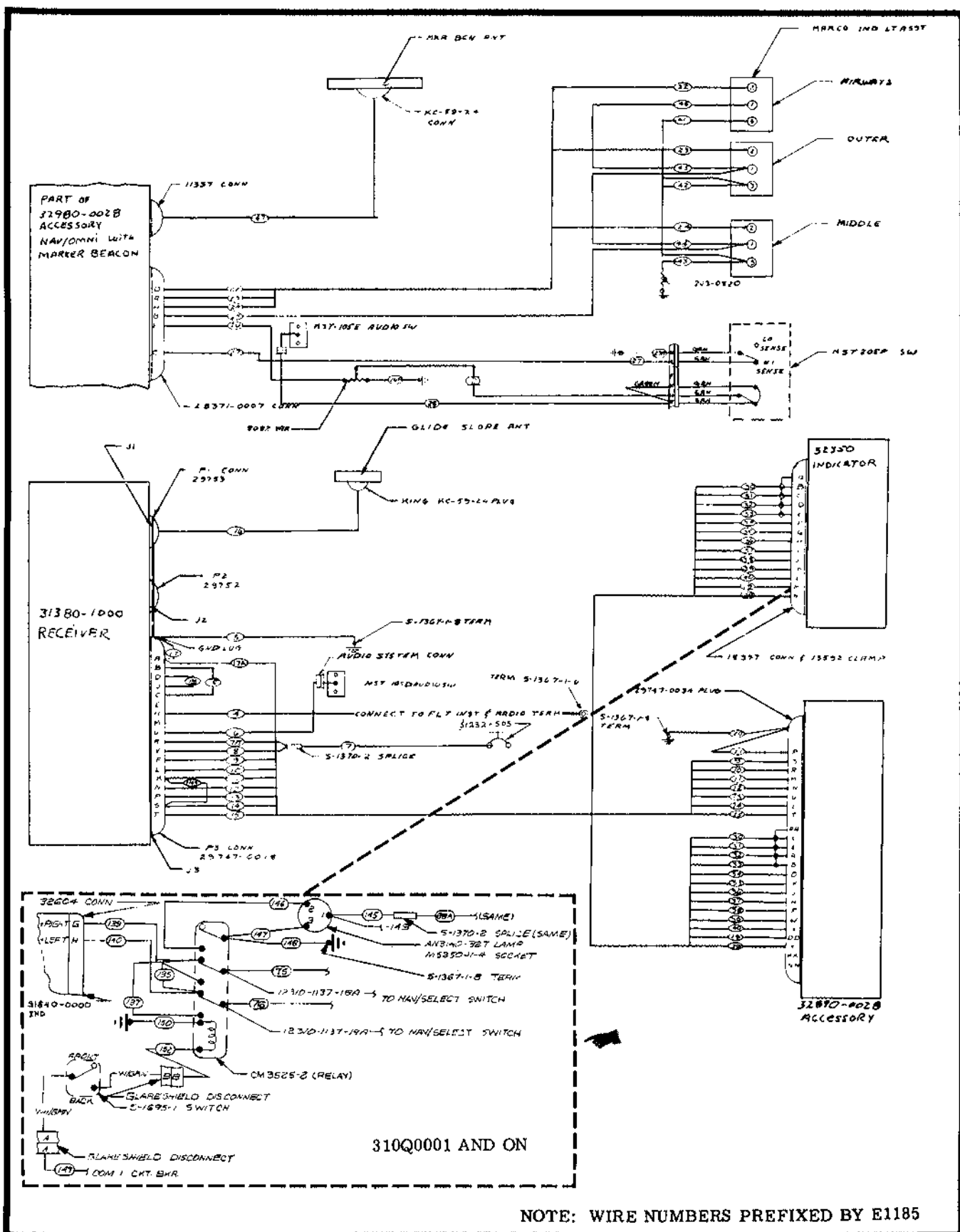


Figure 15-33. Cessna Nav/Omni 300

NOTE: WIRE NUMBERS PREFIXED BY E185

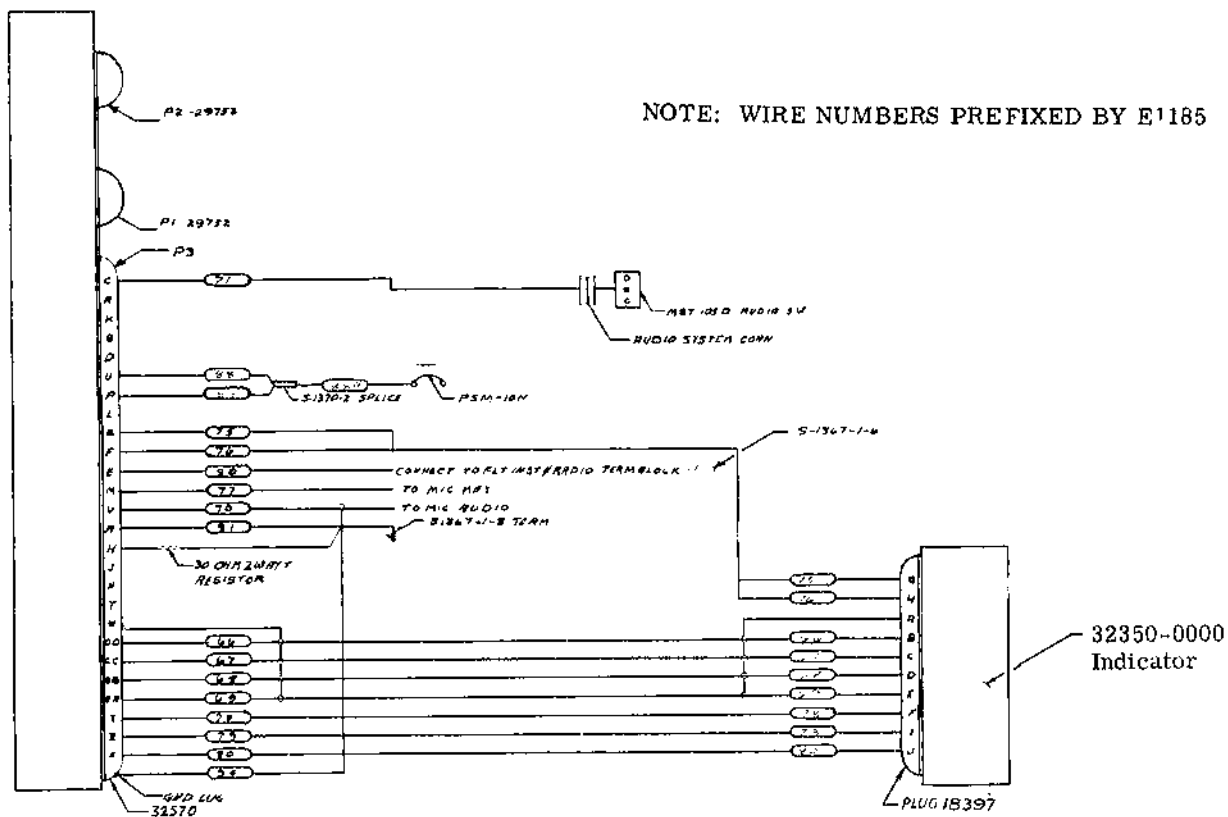
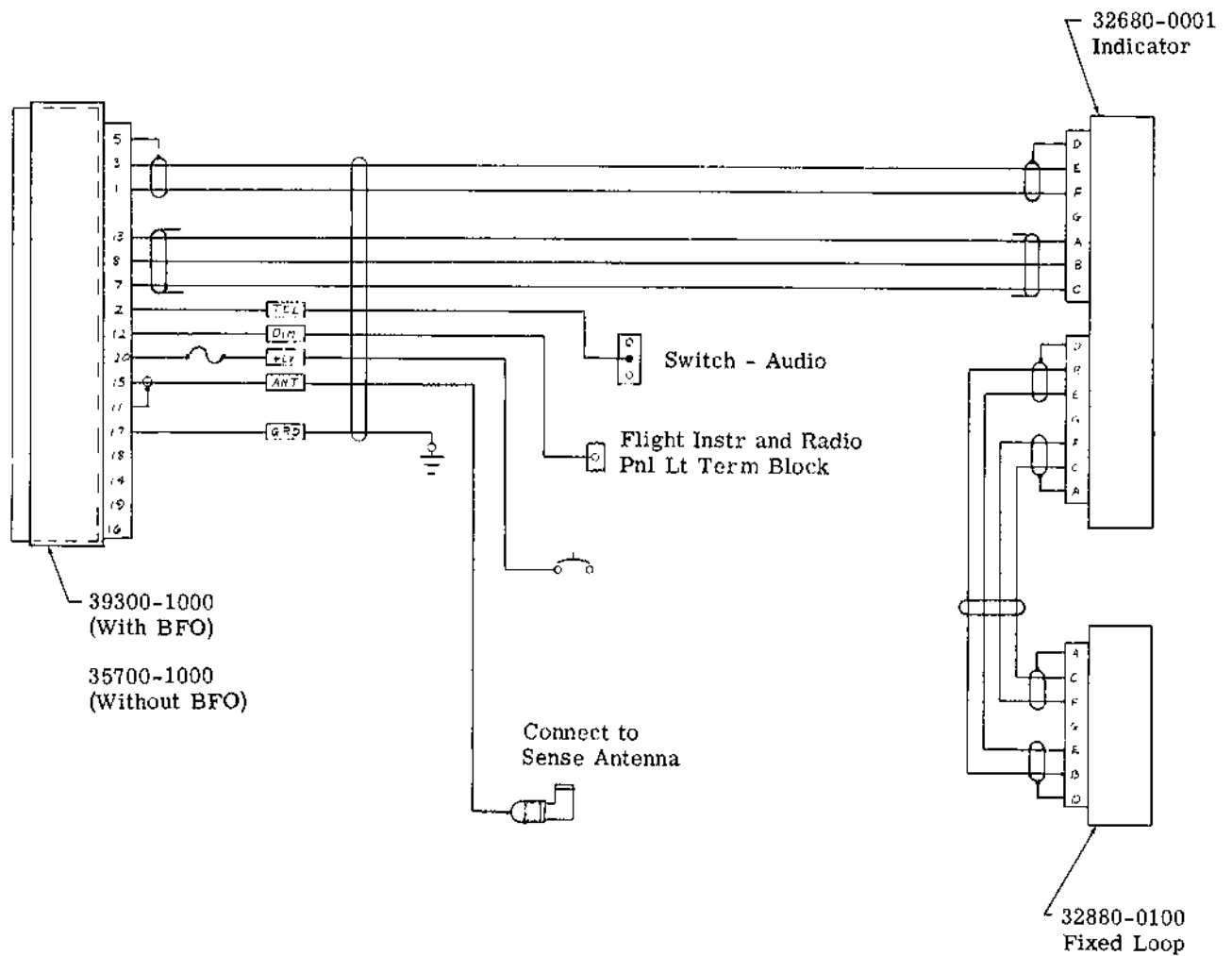


Figure 15-34. Cessna Nav/Com 300R

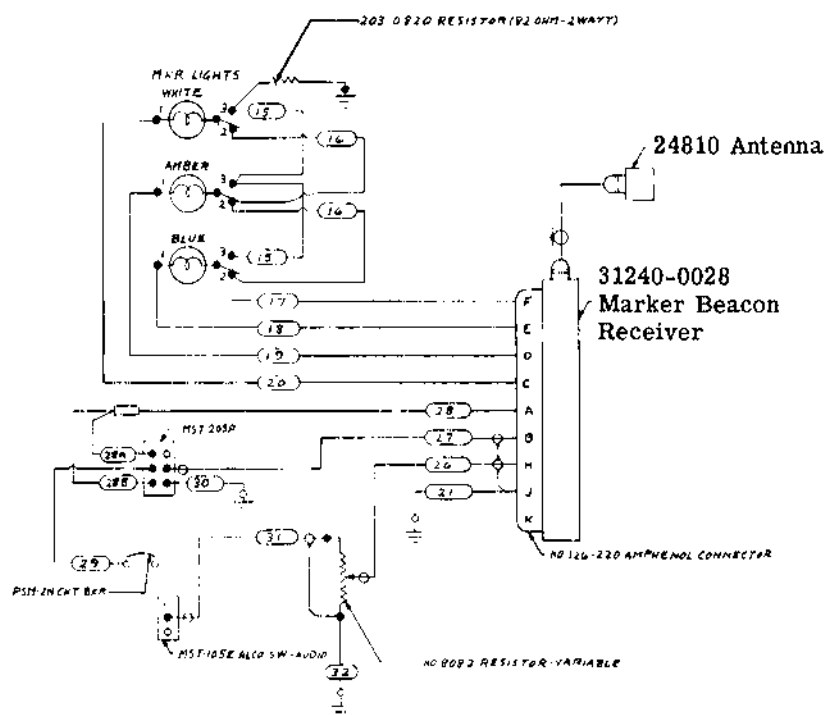


INDICATOR IS INTERNALLY WIRED FOR A BELLY-MOUNTED LOOP ANTENNA & TOP-MOUNTED SENSE ANTENNA. IF OTHER LOCATIONS ARE USED, REMOVE INDICATOR DUST COVER & REWIRE TERMINAL BOARD AS FOLLOWS:

WIRE COLOR	TERMINAL NUMBER			
	TOP LOOP		BELLY LOOP	
	SENSE	SENSE	SENSE	SENSE
RED	6	5	5	6
BLACK	5	6	6	5
GREEN	1	1	2	2
WHITE	2	2	1	1

NOTE: WIRE NUMBERS PREFIXED BY E1109.

Figure 15-35. Cessna ADF 300



NOTE: WIRE NUMBERS PRECEDED BY E1059

Figure 15-36. Cessna Marker Beacon 300

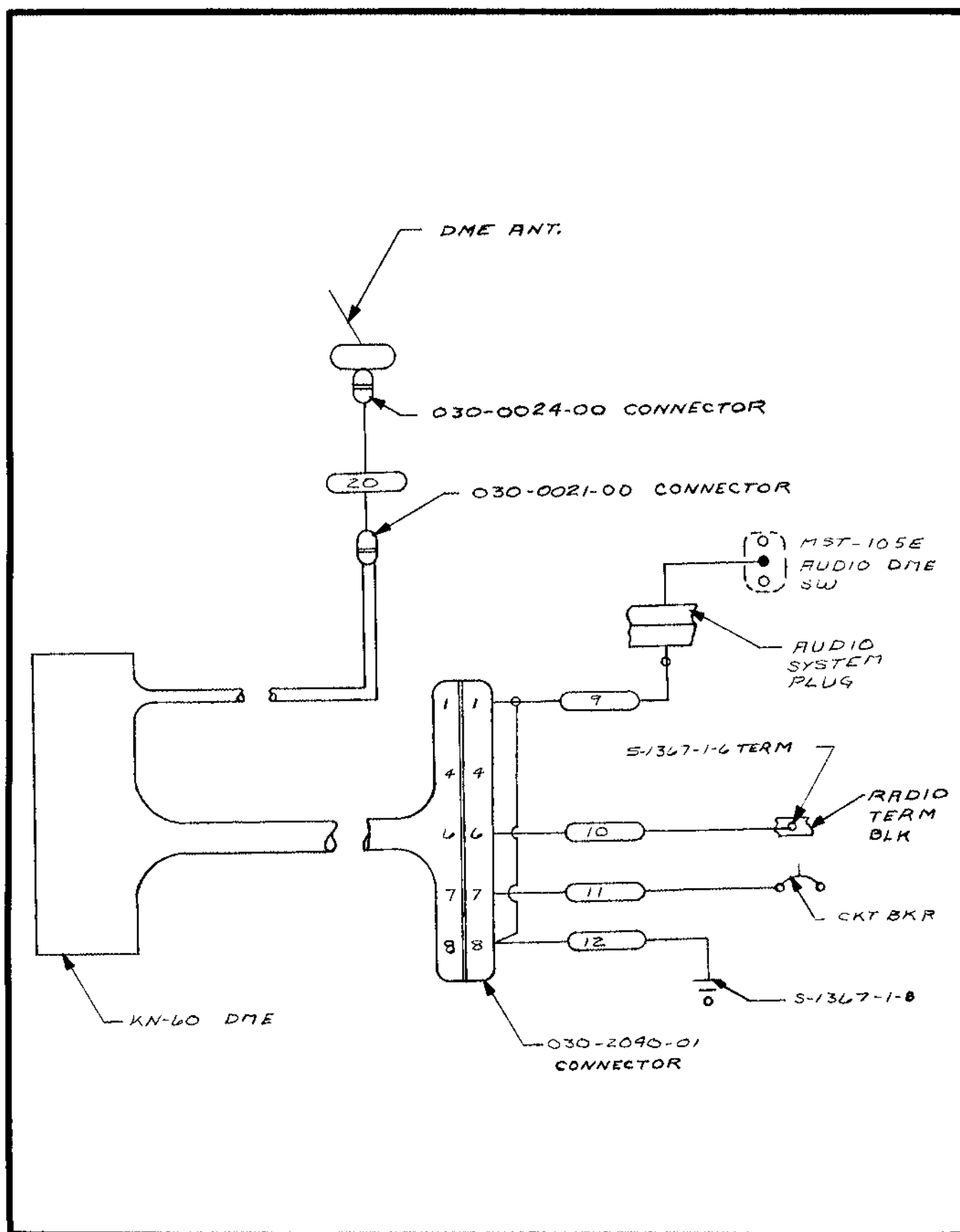
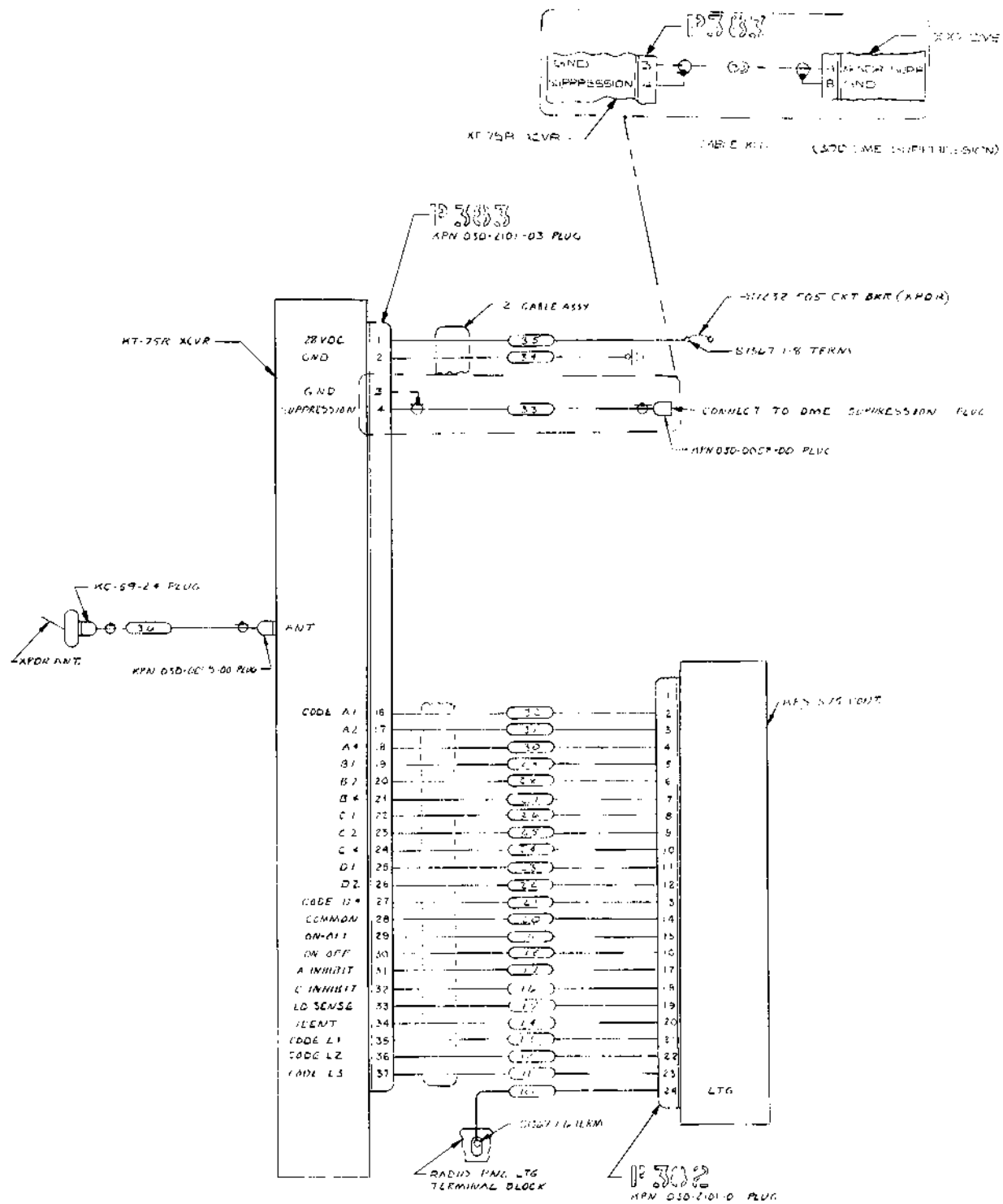
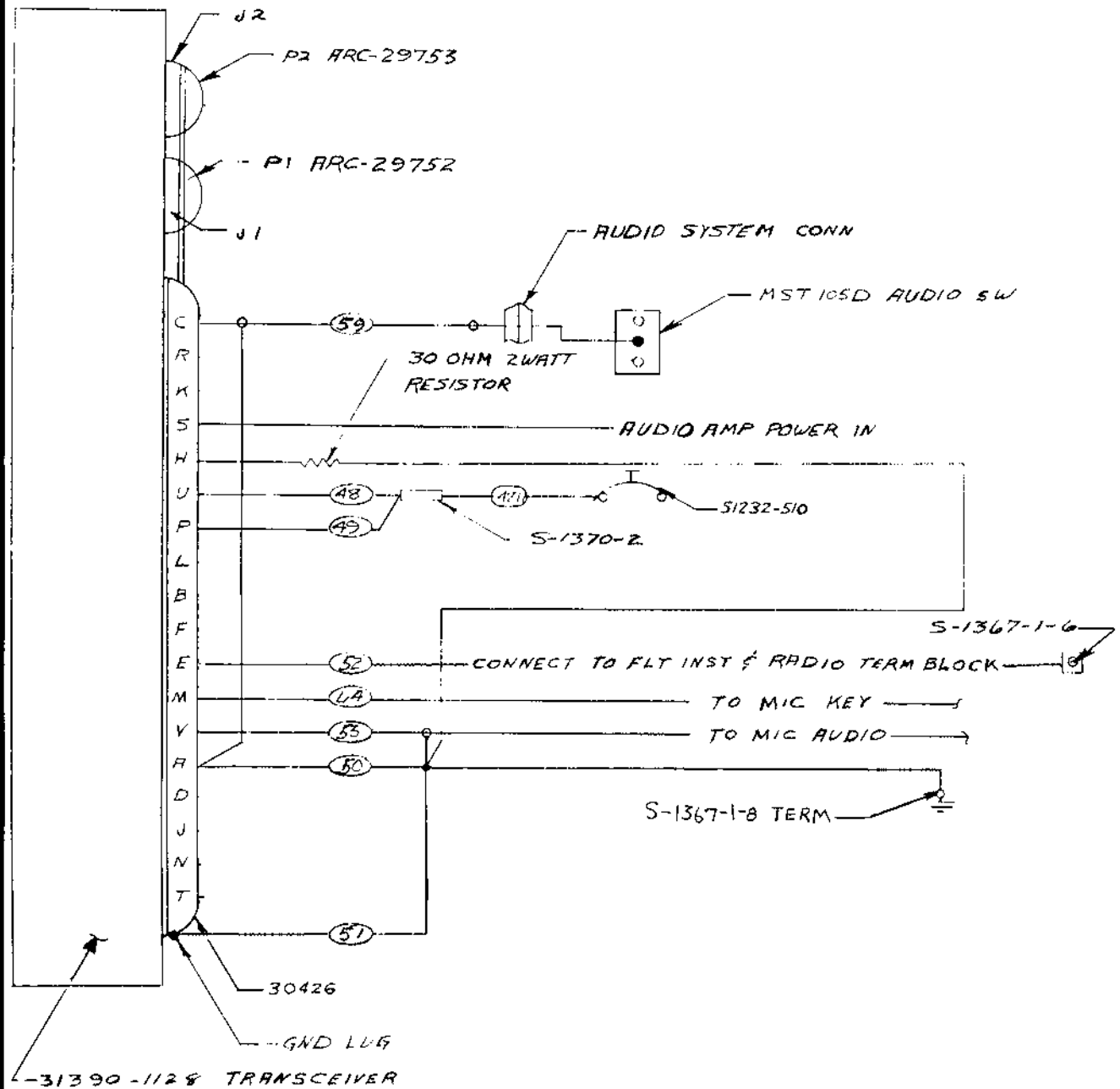


Figure 15-36A. Cessna 300 DME



NOTE: WIRE NUMBERS PREFIXED BY E1367

Figure 15-36B. Cessna 300 Transponder



NOTE: WIRE NUMBERS PREFIXED BY E1185

Figure 15-37. Cessna Transceiver 300

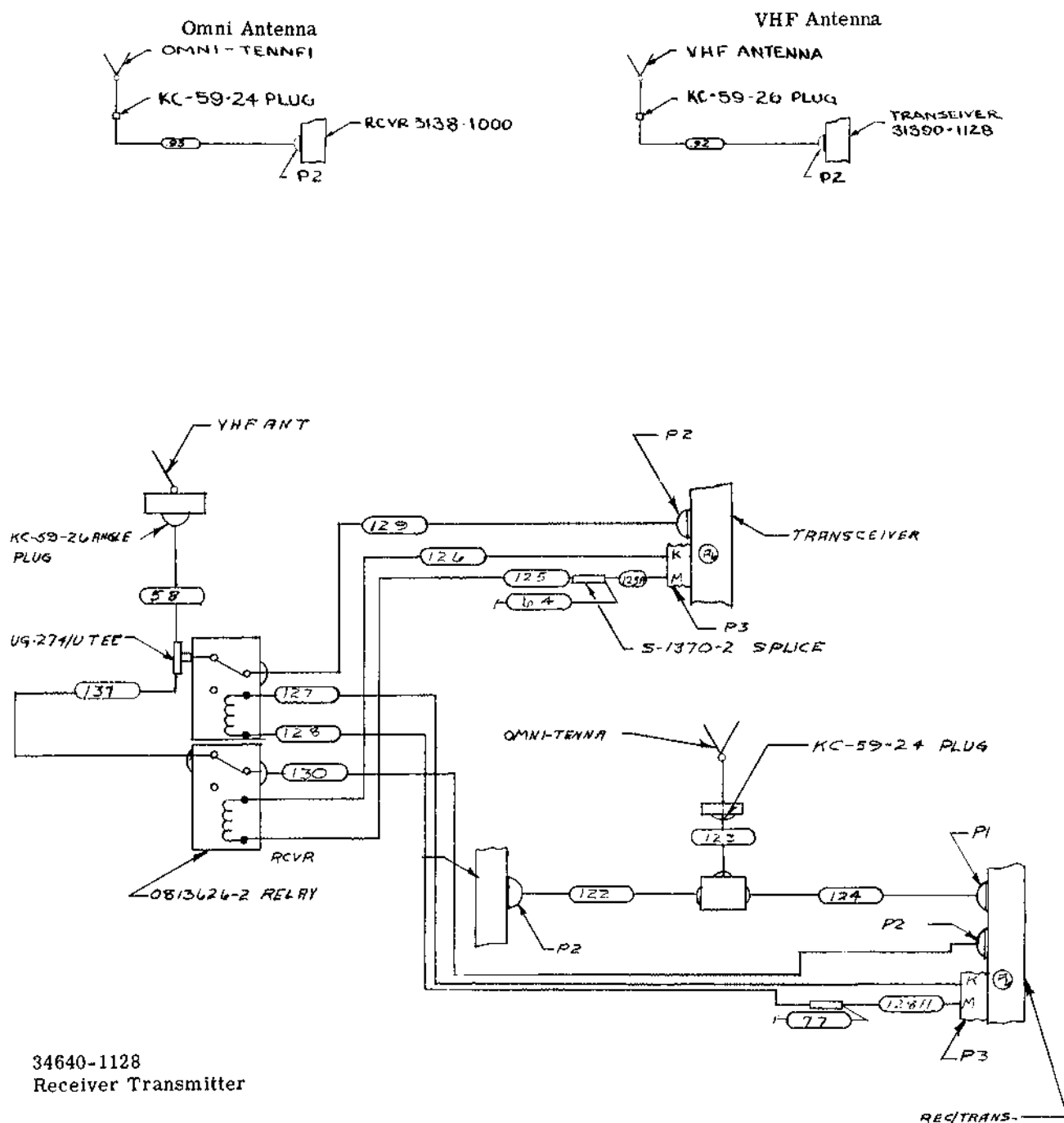
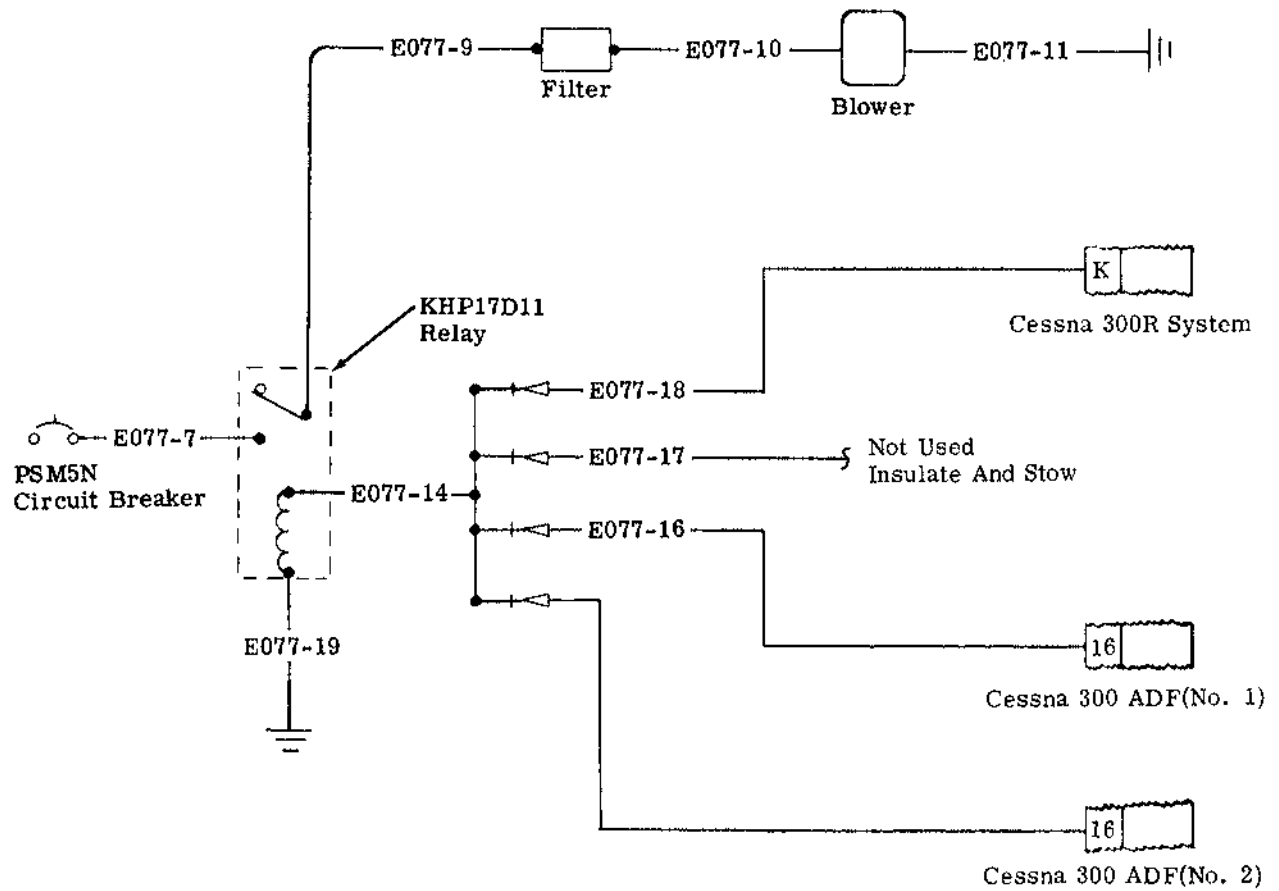
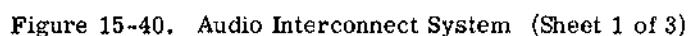


Figure 15-38. Cessna 300 Series Antenna Interconnect



NOTE: WIRE NUMBERS PREFIXED BY E1077.

Figure 15-39. Radio Cooling Blower (300 Series Radio)



300 SERIES AUDIO SYSTEM

(3 TRANSMITTERS)

NOTE: WIRE NUMBERS PREFIXED BY E1232

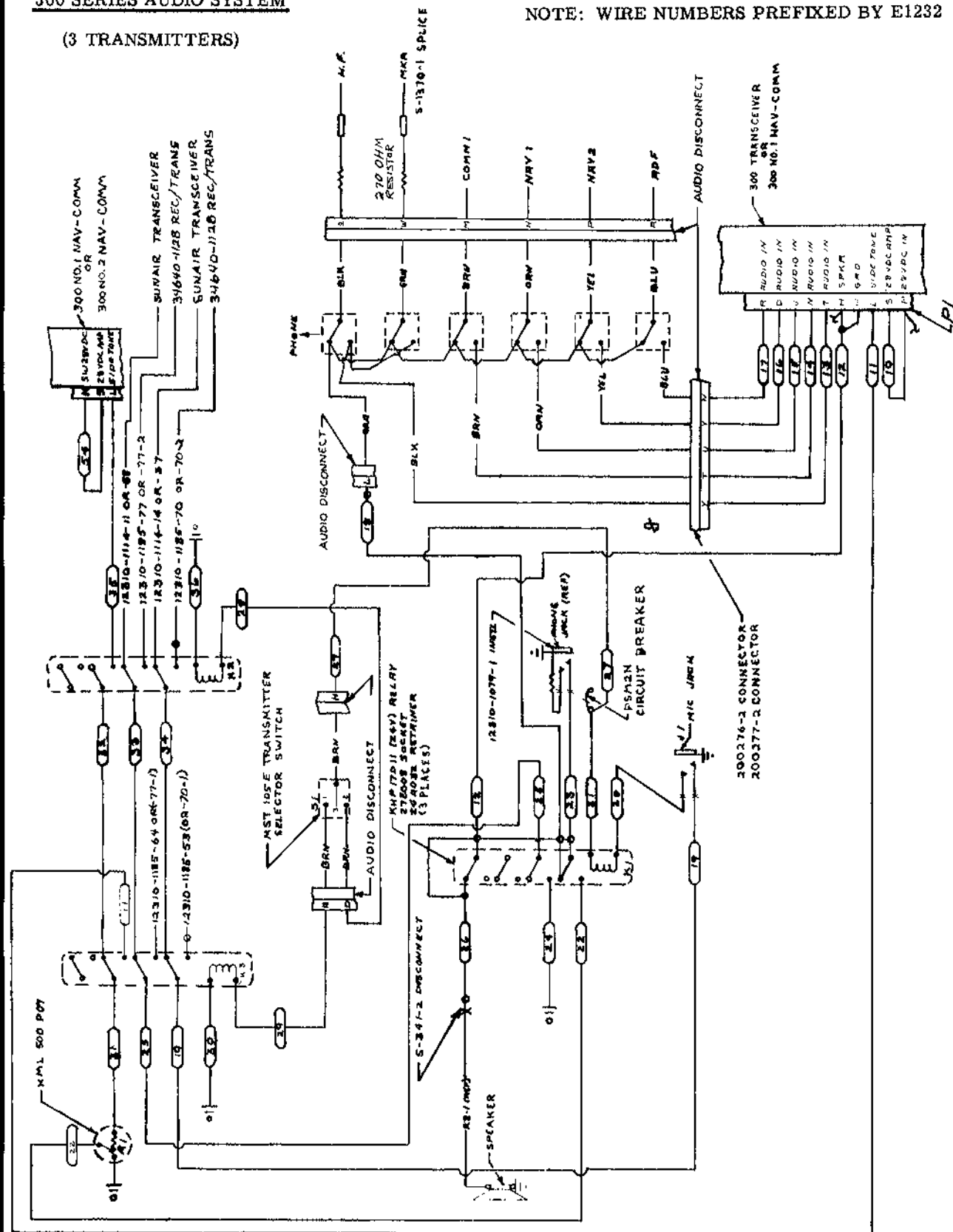
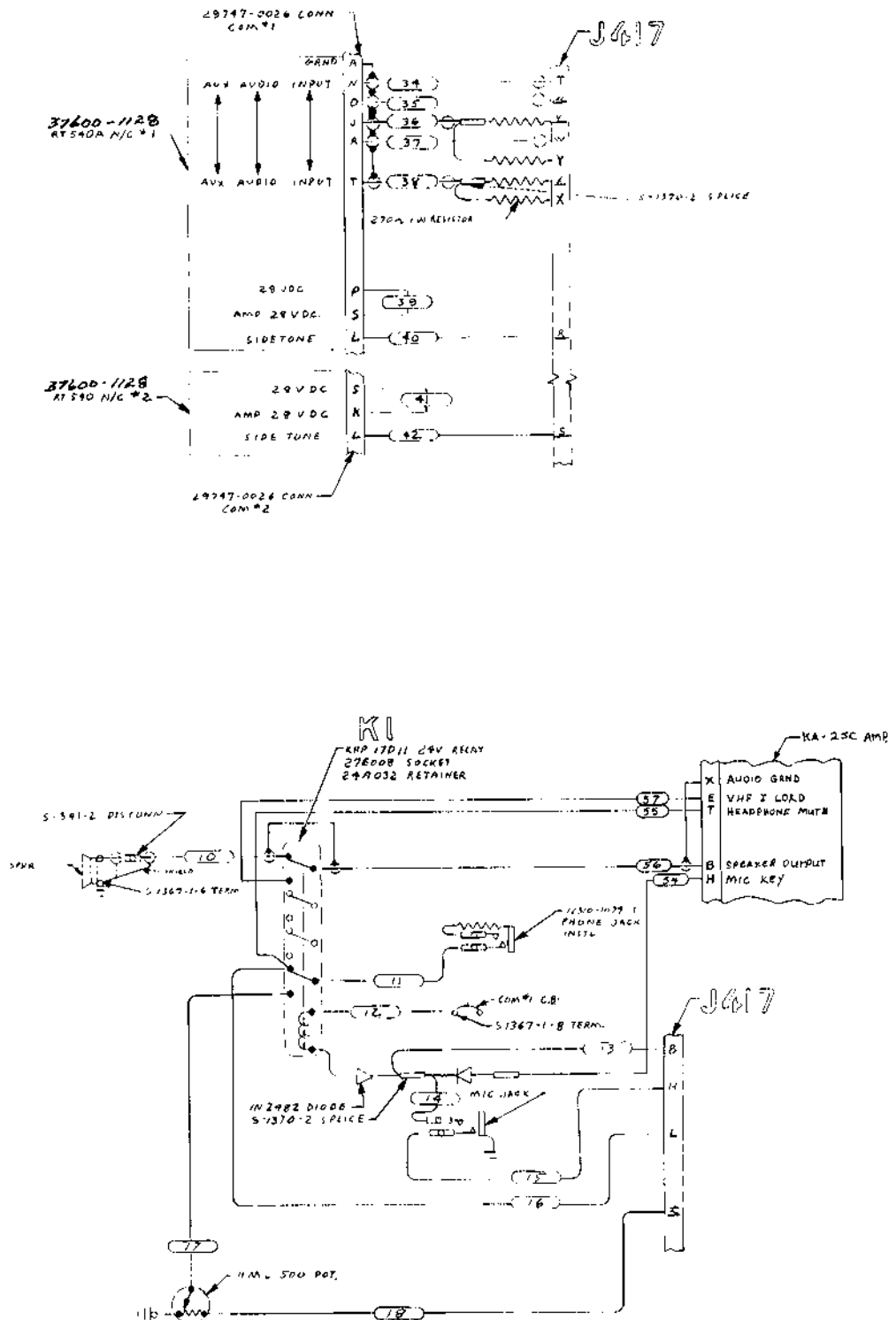


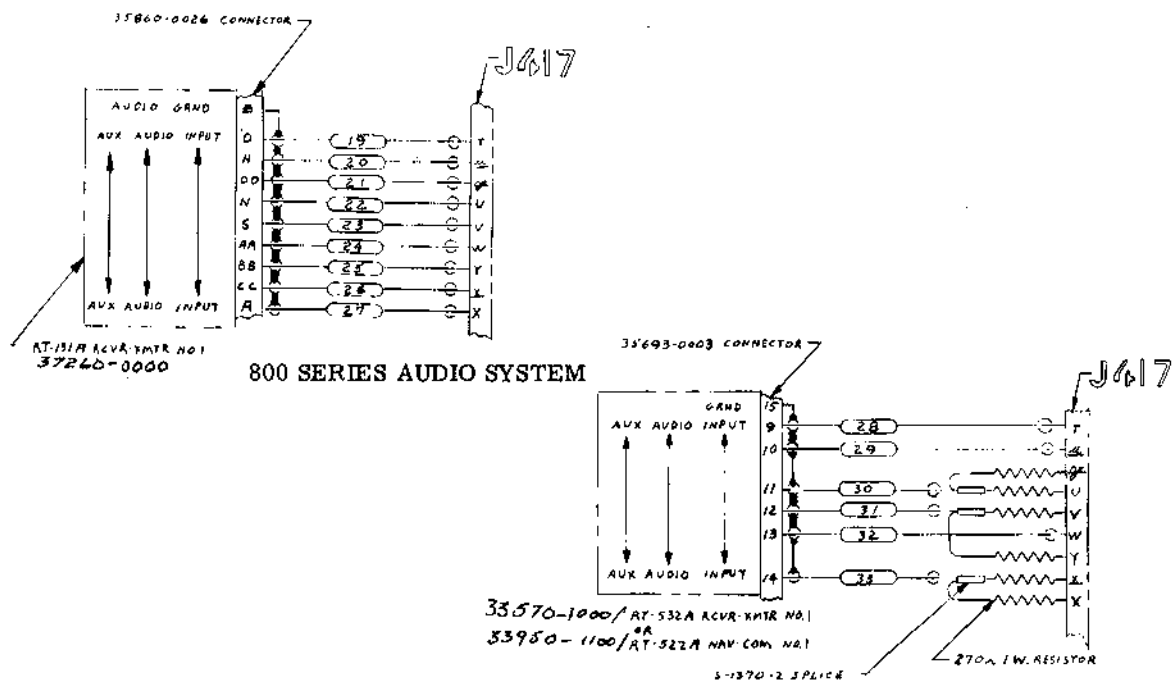
Figure 15-40. Audio Interconnect System (Sheet 2 of 3)



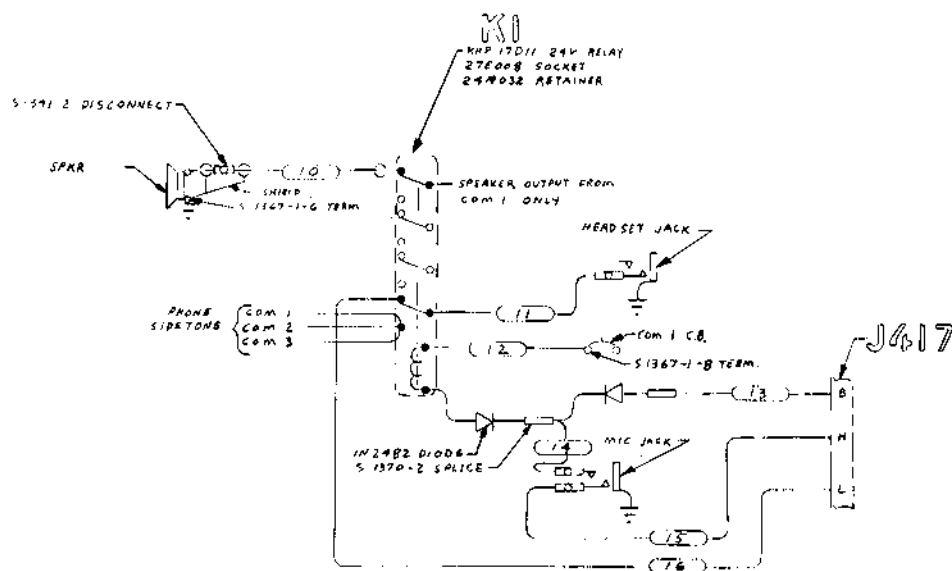
NOTE: WIRE NUMBERS PREFIXED BY E1383

300 SERIES AUDIO SYSTEM

Figure 15-40A. Audio System (Sheet 1 of 5)



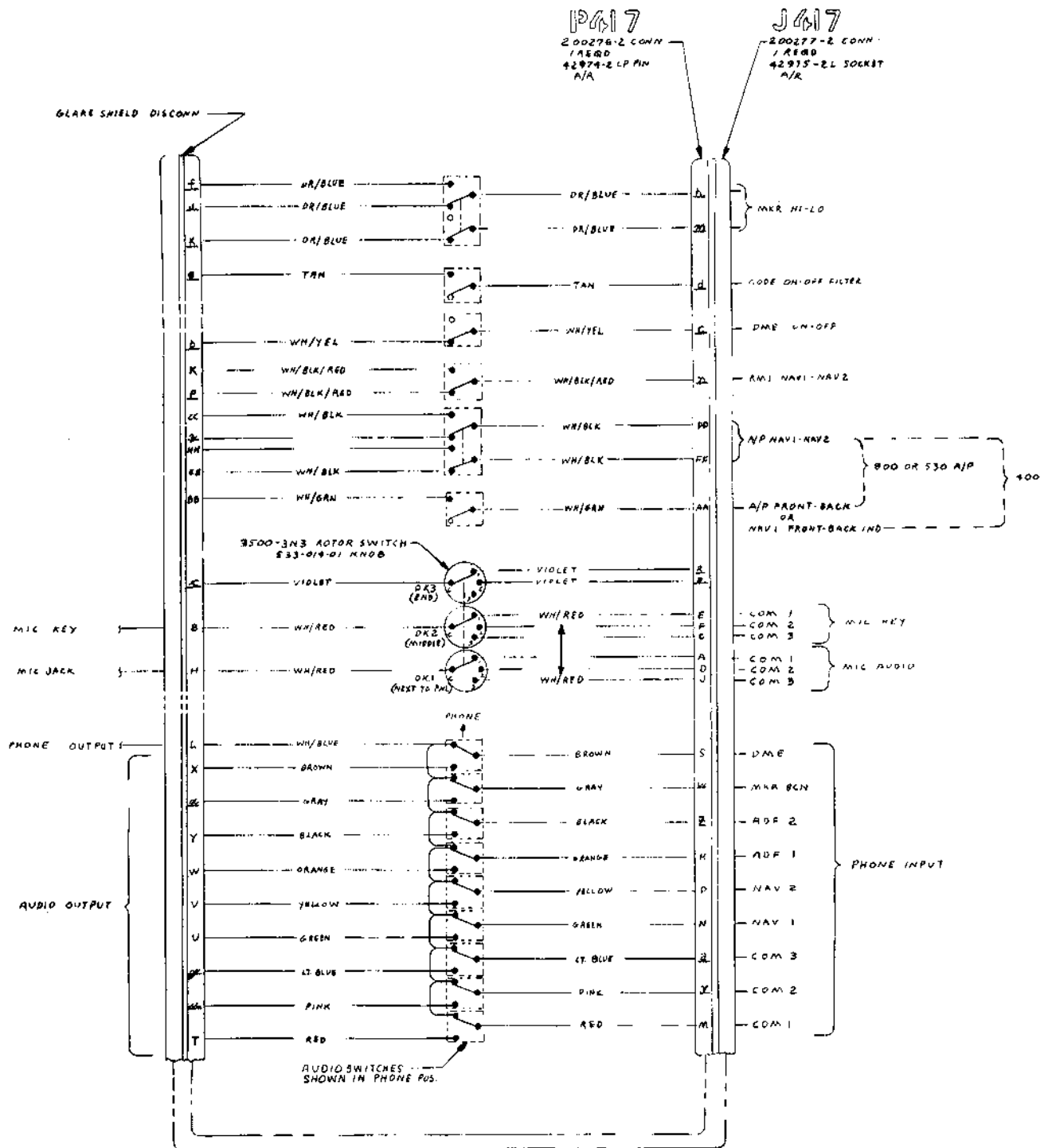
400 SERIES AUDIO SYSTEM



NOTE: WIRE NUMBERS PREFIXED BY E1383

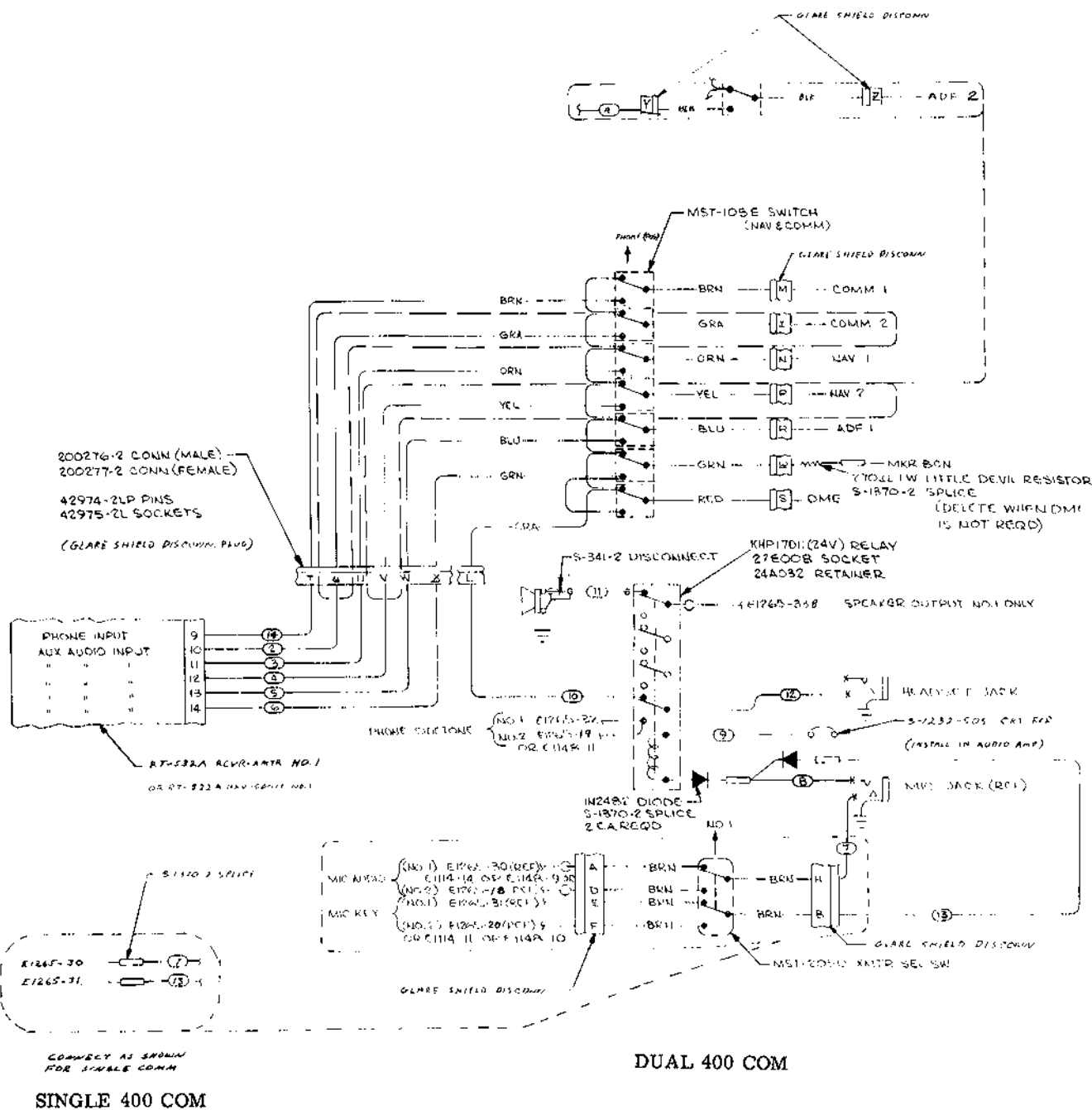
400 AND 800 SERIES AUDIO SYSTEMS

Figure 15-40A. Audio System (Sheet 2 of 5)



NOTE: WIRE NUMBERS PREFIXED BY E1383

Figure 15-40A. Audio System (Sheet 3 of 5)



NOTE: WIRE NUMBERS PREFIXED BY E1267

Figure 15-40A. Audio System (Sheet 4 of 5)

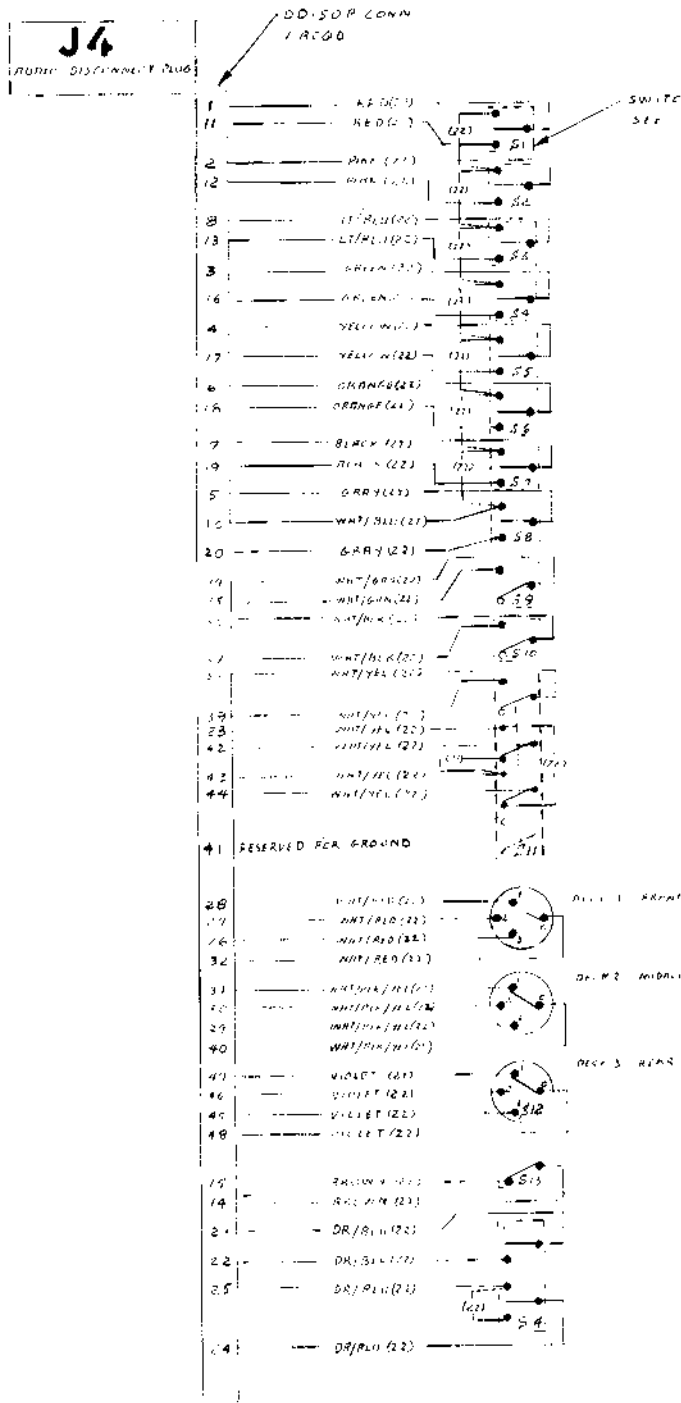


TABLE A		
NAME	PART NO.	POSITION
COM 1 AUDIO	S 1695-1	S 1
COM 2 AUDIO	S 1695-1	S 2
COM 3 AUDIO	S 1695-1	S 3
NAV 1 AUDIO	S 1695-1	S 4
NAV 2 AUDIO	S 1695-1	S 5
ADF 1 AUDIO	S 1695-1	S 6
ADF 2 AUDIO	S 1695-1	S 7
MR 1 AUDIO	S 1695-1	S 8
R/P FRONT BACK	S 1695-2	S 9
R/P NAV 1-NAV 2	S 1695-2	S 10
NAV FRONT BACK	S 1697-1	S 11
MIC SELECT	2500-3N3	S 12
ONE IN-1 FR	S 1695-2	S 13
MR 11-12	S 1696-2	S 14

Figure 15-40B. Audio Control Panel

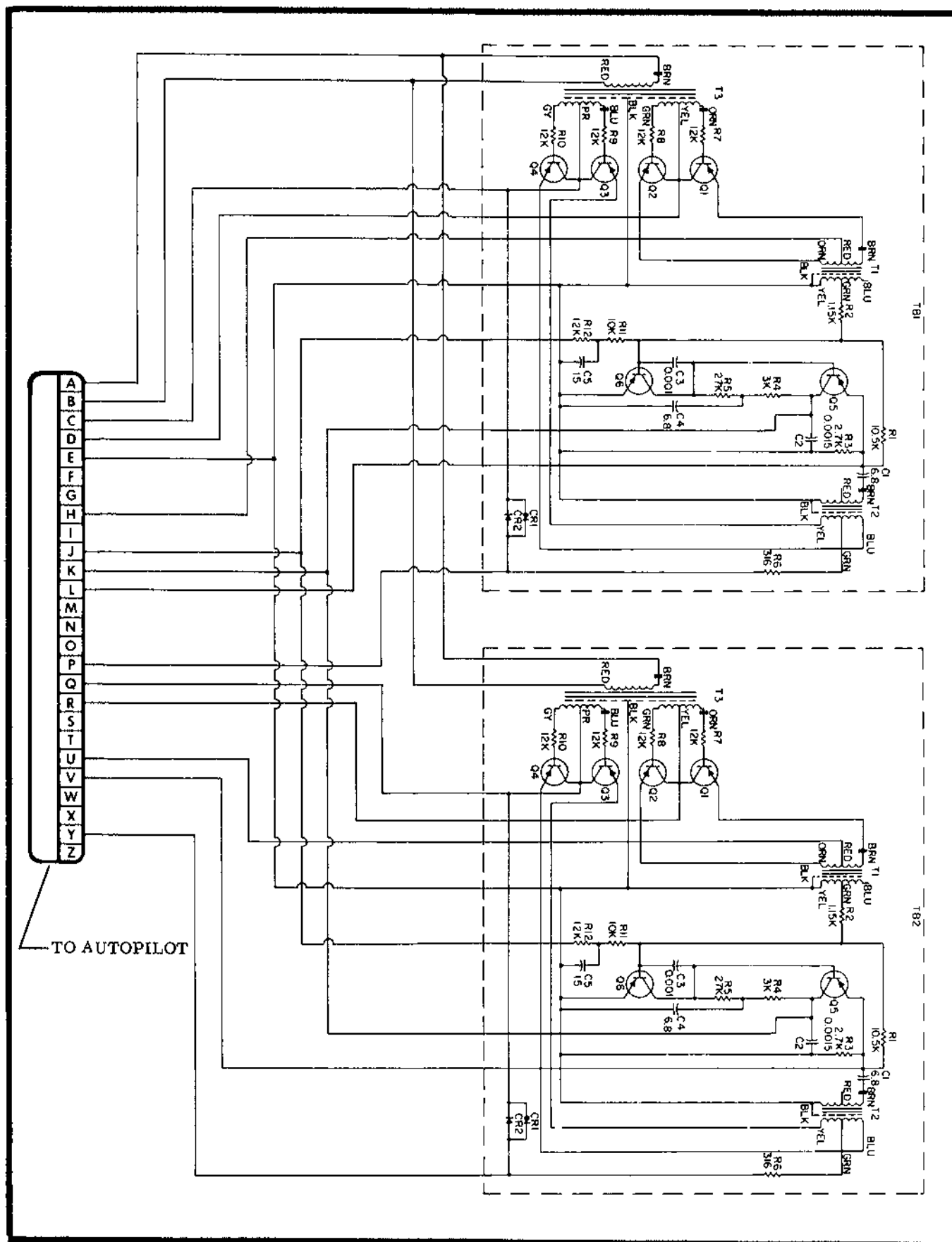


Figure 15-42. DG104B-1 Ground Adapter

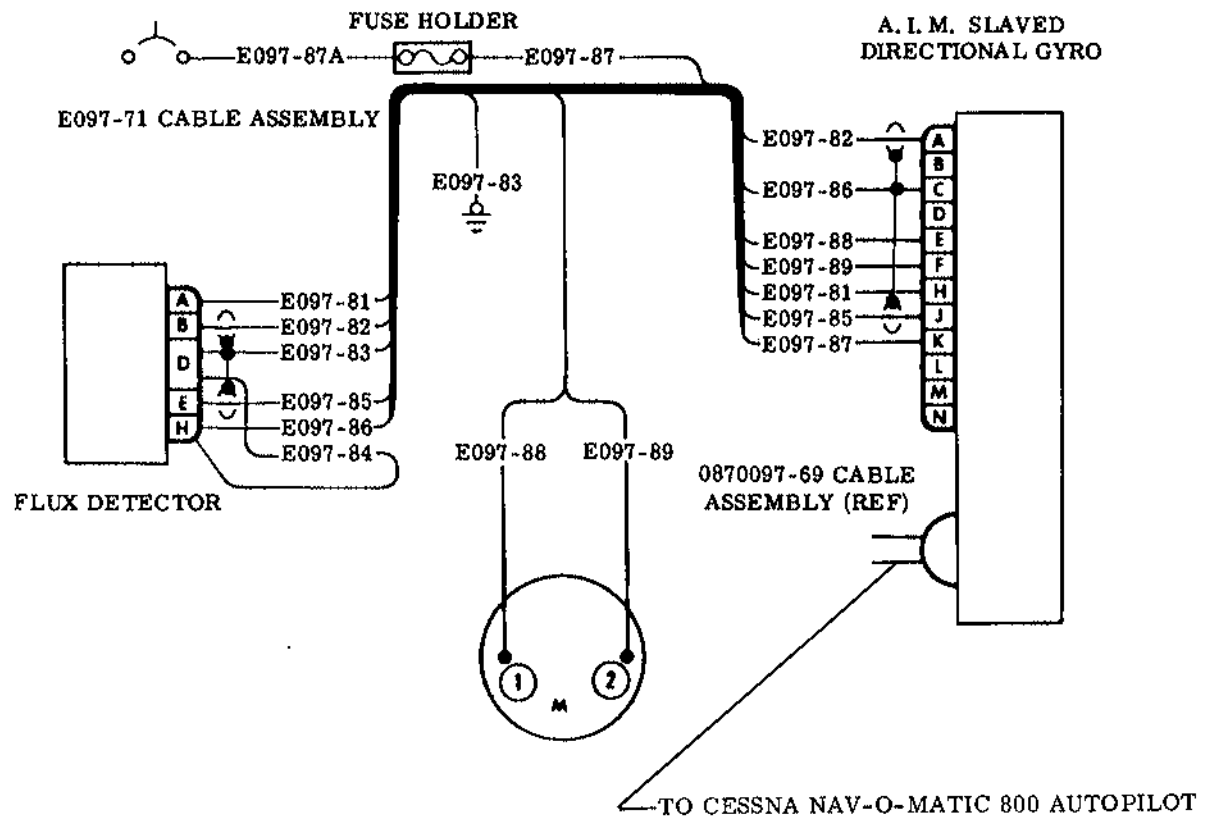


Figure 15-43. AIM Slaved Directional Gyro System

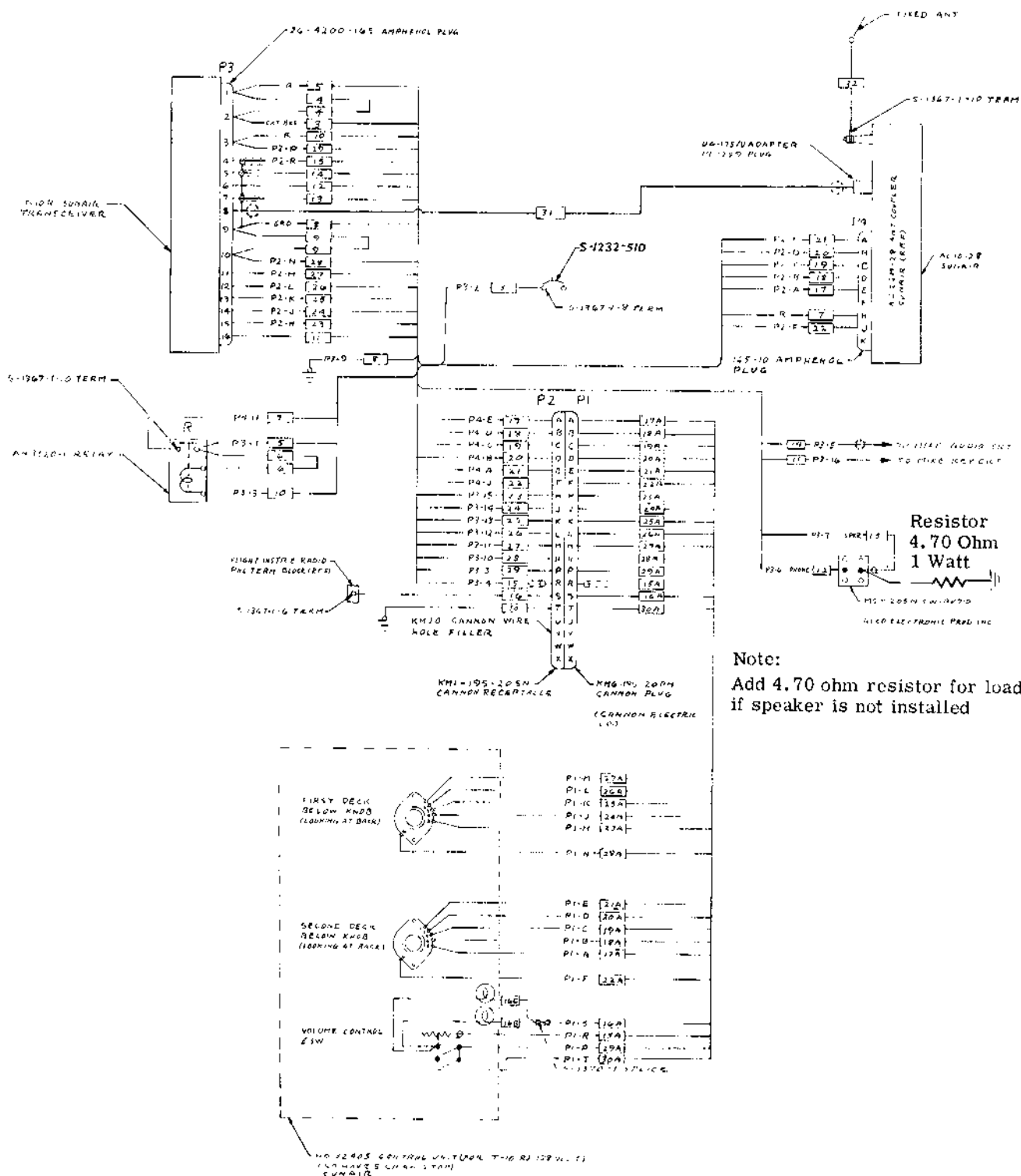


Figure 15-44. T-10-R Transceiver

NOTE: WIRE NUMBERS PREFIXED BY E 1148.

WIRING SYSTEM
 1 TO DC NO 18 (DEPENDS ON REGS)
 14 TO DC NO 18 (DEPENDS ON REGS)
 15 TO DC NO 18 (DEPENDS ON REGS)
 16 TO DC NO 18 (DEPENDS ON REGS)
 17 TO DC NO 18 (DEPENDS ON REGS)
 18 TO DC NO 18 (DEPENDS ON REGS)
 19 TO DC NO 18 (DEPENDS ON REGS)
 20 TO DC NO 18 (DEPENDS ON REGS)
 21 TO DC NO 18 (DEPENDS ON REGS)
 22 TO DC NO 18 (DEPENDS ON REGS)
 23 TO DC NO 18 (DEPENDS ON REGS)
 24 TO DC NO 18 (DEPENDS ON REGS)
 25 TO DC NO 18 (DEPENDS ON REGS)
 26 TO DC NO 18 (DEPENDS ON REGS)
 27 TO DC NO 18 (DEPENDS ON REGS)
 28 TO DC NO 18 (DEPENDS ON REGS)
 29 TO DC NO 18 (DEPENDS ON REGS)
 30 TO DC NO 18 (DEPENDS ON REGS)
 31 TO DC NO 18 (DEPENDS ON REGS)
 32 TO DC NO 18 (DEPENDS ON REGS)
 33 TO DC NO 18 (DEPENDS ON REGS)
 34 TO DC NO 18 (DEPENDS ON REGS)
 35 TO DC NO 18 (DEPENDS ON REGS)
 36 TO DC NO 18 (DEPENDS ON REGS)
 37 TO DC NO 18 (DEPENDS ON REGS)
 38 TO DC NO 18 (DEPENDS ON REGS)
 39 TO DC NO 18 (DEPENDS ON REGS)
 40 TO DC NO 18 (DEPENDS ON REGS)
 41 TO DC NO 18 (DEPENDS ON REGS)
 42 TO DC NO 18 (DEPENDS ON REGS)
 43 TO DC NO 18 (DEPENDS ON REGS)
 44 TO DC NO 18 (DEPENDS ON REGS)
 45 TO DC NO 18 (DEPENDS ON REGS)

Figure 15-45. T-22-RA Transceiver

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Figure 15-45A. ASB-100 Transceiver

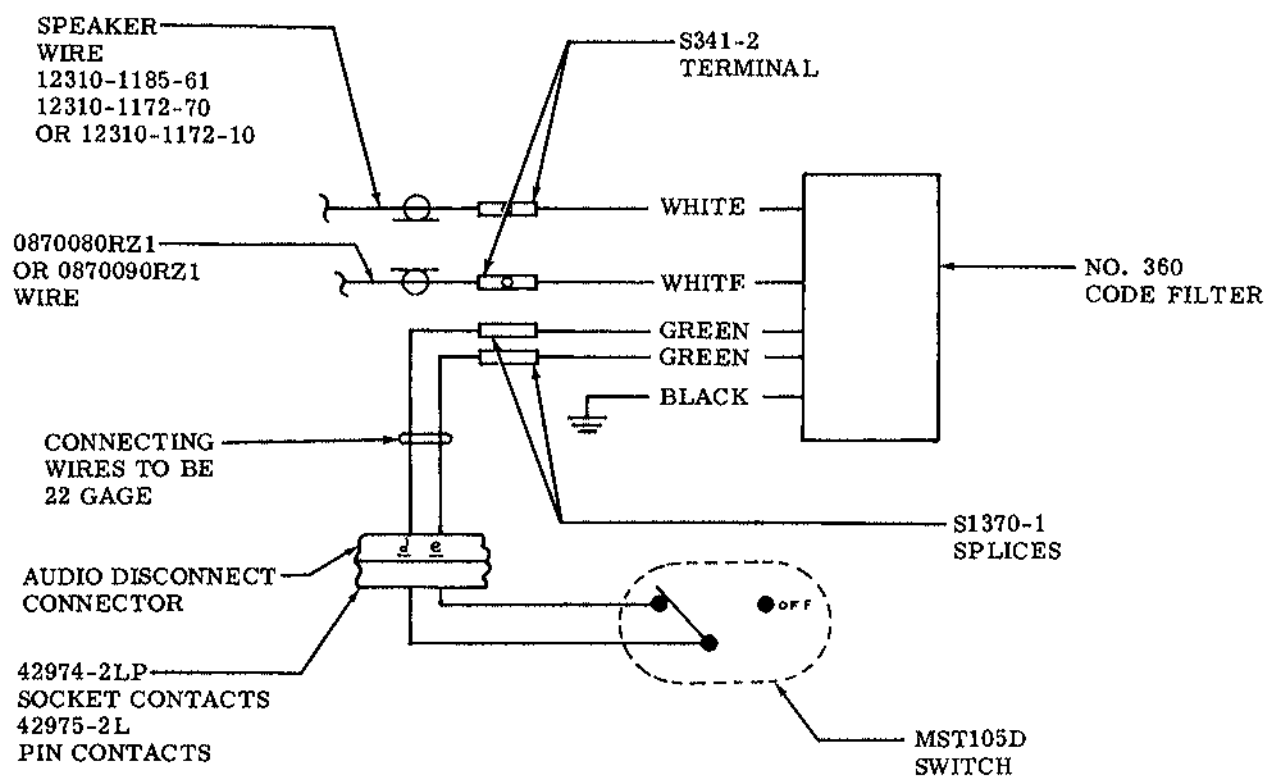
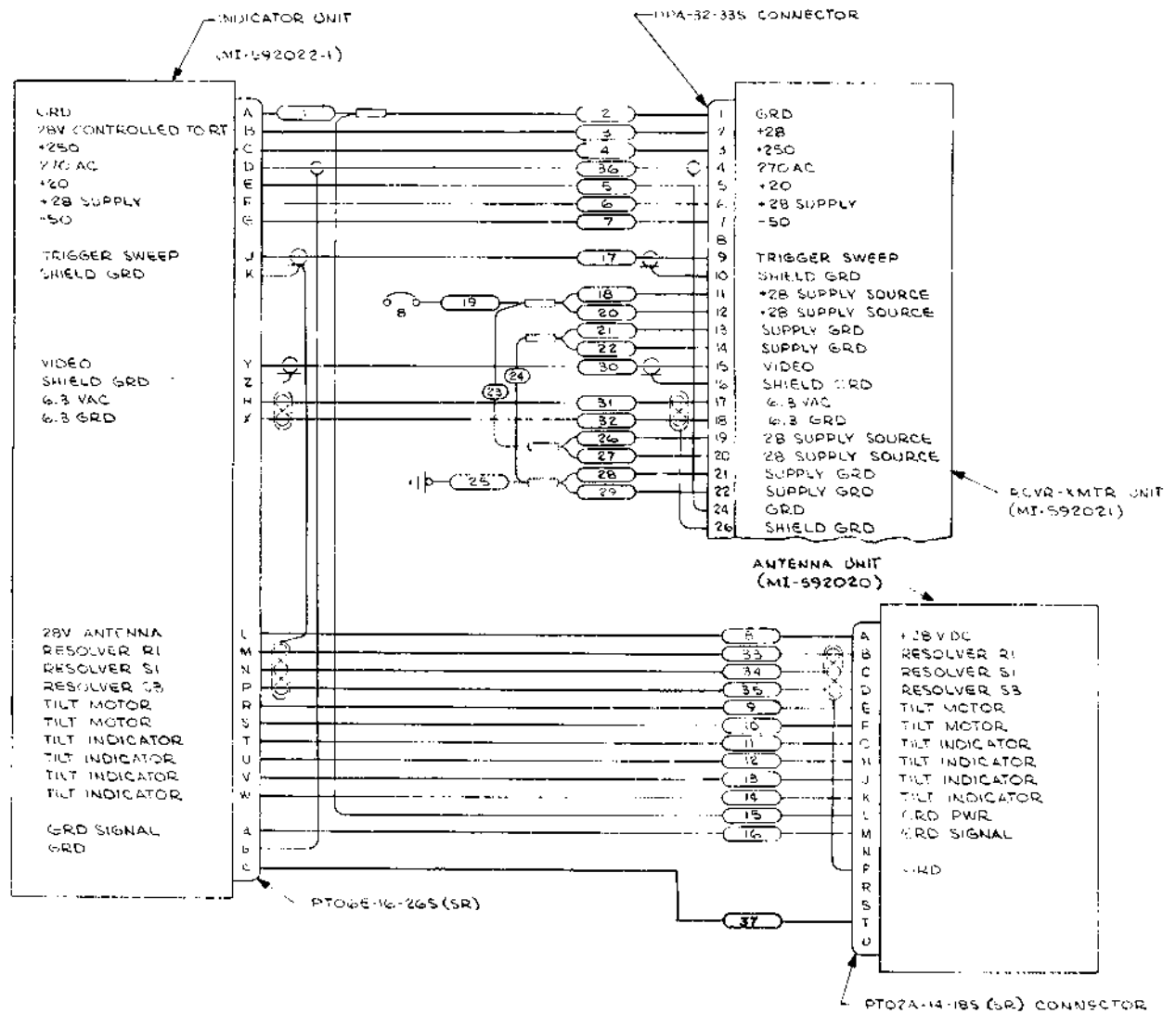


Figure 15-46. Audio Code Filter



NOTE: WIRE NUMBERS PREFIXED BY E1257

Figure 15-47. AVQ-45 Weather Radar

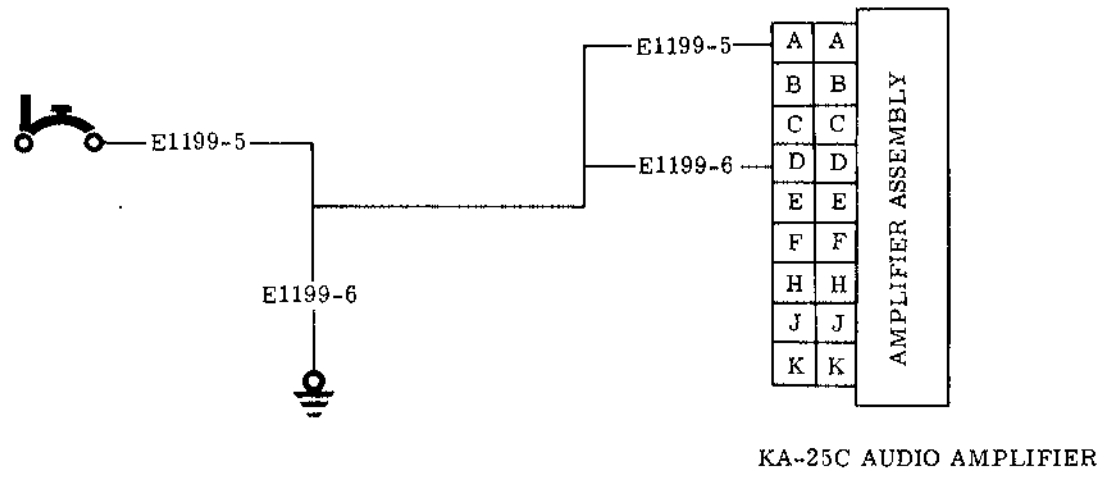
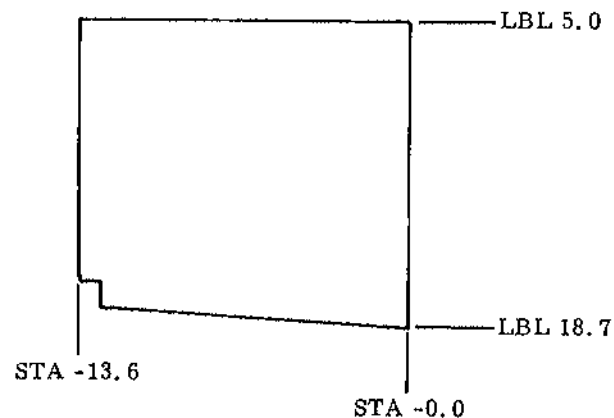


Figure 15-48. Audio Amplifier System

	Amp. Req'd.
Cessna Transceiver 800	4.5
Cessna Transmitter 800	0.9
Cessna Transponder 800	0.25
DV-20B Dynaverter	2.7
Cessna 800 Transponder	1.5
Cessna Nav/Omni 800 (190 Channel)	2.5
Cessna Com 800	1.5
Cessna Nav 800	0.075
Cessna Nav/Omni 800 (560 Channel)	1.96
Cessna Glide Slope 800	1.7
Cessna 800 Glide Slope/800 Marker Beacon	0.15
Cessna ADF 800	2.8
Cessna 800 ADF	2.8
Cessna Course Director 800	0.5
Cessna DME 800	2.75
Cessna Marker Beacon 800	0.4
Cessna 800 RMI	2.5
Cessna Nav-O-Matic 800	0.4
Cessna 800 Nav-O-Matic	0.4
Cessna RMI 800	3.0
Cessna Nav/Com 400	1.5
Cessna Glide Slope 400	0.45
Cessna Transceiver 400	1.0
Cessna Transponder 400	1.5
Cessna Nav-O-Matic 400	1.2
Cessna 400A Nav-O-Matic	1.2
Cessna ADF 400	1.5
Cessna Nav/Omni 300	3.0
Cessna Nav/Com 300R	3.0
Cessna ADF 300	1.1
Cessna Marker Beacon 300	0.015
Cessna Transceiver 300	2.1
AIM Slaved Directional Gyro	0.08
T-10-R Transceiver	2.0
T-22-RA Transceiver	3.0
AVQ-45 Weather Radar	5.0
ASB-100A Transceiver	2.5

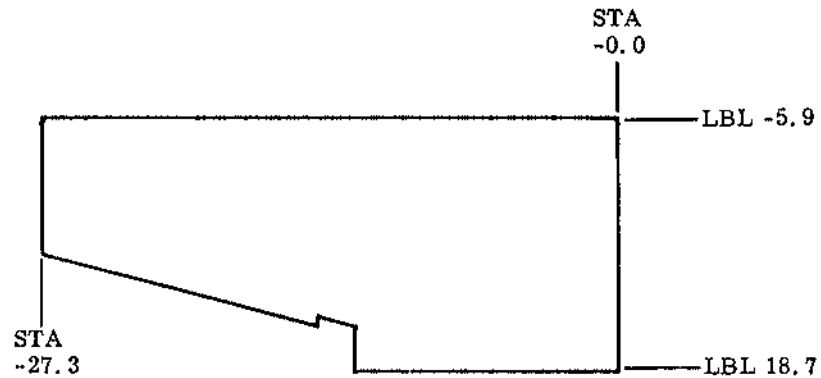
Figure 15-49. Electronics Continuous Load Chart

FOR SHELF ASSEMBLY
PART NO. 0813300-59



EQUIPMENT	COMPONENT WEIGHT	REMARKS
Cessna Nav/Omni 800 (190 Channel) Receiver (21440-0028) Converter (22900-0028)	6.70 lbs. 6.10 lbs.	
Cessna Nav/Omni 800 (560 Channel) Receiver (264101-0028) Converter (27900) Receiver (26410) Converter (27900-0028)	7.0 lbs. 4.5 lbs. 14.0 lbs. 9.0 lbs.	Single Installation Single Installation Dual Installation Dual Installation
Cessna 800 Nav 37500-0000 Receiver 35950-0000 Converter 36450-0000 Mounting	2.7 lbs. 1.9 lbs.	Includes Mount Includes Mount
Cessna 800 Com 38500-0000 Accessory Unit 37260-0000 Transceiver 36280-0000 Mounting (Transceiver) 34980-0000 Mounting (Accessory Unit)	5.6 lbs. 4.1 lbs.	Includes Mount Includes Mount
Cessna Nav/Omni 300 Accessory Unit (3389-0028)	5.5 lbs.	
Cessna Nav/Com 400 Accessory Unit (36600)	12.2 lbs.	
Cessna Nav/Omni 400 Accessory Unit (36600)	7.3 lbs.	
Cessna Glide Slope 400 Receiver (34340-0000)	4.9 lbs.	

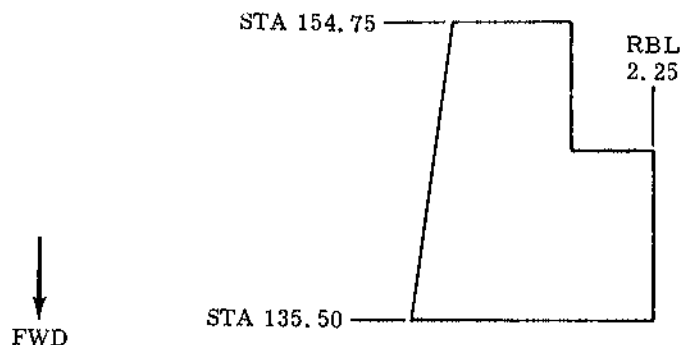
SHELF ASSEMBLY
PART NO. 0813300-103



EQUIPMENT	COMPONENT WEIGHT	REMARKS
Cessna ADF 800 Receiver (34850-0028) Dynaverter (24630-0028)	7.4 lbs. 4.1 lbs.	Includes Mount Includes Mount
Cessna DME 800 Receiver/Transmitter (C582601-0101)	11.4 lbs.	
T-22-RA Transceiver	15.0 lbs.	
Marker Beacon 800 Receiver (21430-0028)	3.7 lbs.	Includes Mount
Transponder 800 Receiver/Transmitter (3490-0028) Coder (29300-0000)	7.1 lbs. 3.5 lbs.	
Cessna 800 Transponder 39210-0028 Transceiver 34980-0000 Mounting	6.5 lbs.	Includes Mount

TABLE OF ELECTRONIC EQUIPMENT LOADING (Sheet 2 of 6)

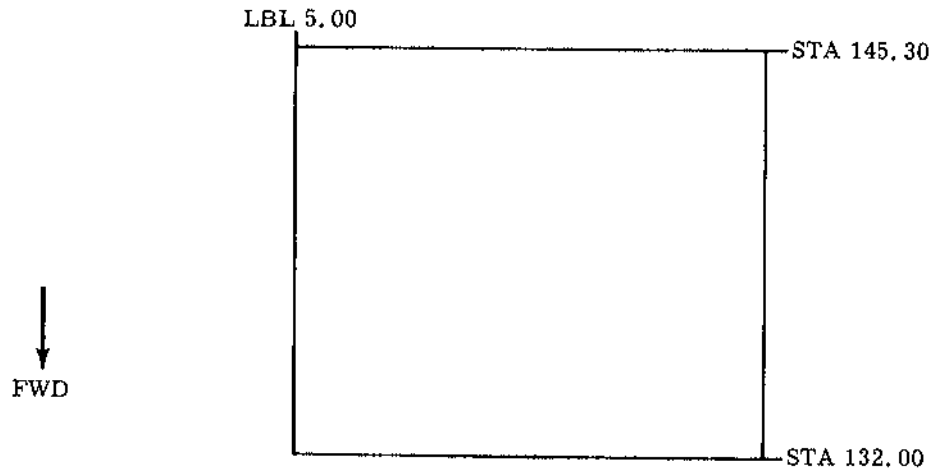
FOR SHELF INSTALLATION
PART NO. 0870140-3



EQUIPMENT	COMPONENT WEIGHT	REMARKS
Cessna Nav-O-Matic 800 Autopilot Computer (0870069-1)	9.9 lbs.	A/Pilot, Includes Mount
Cessna Transceiver 800 Receiver/Transmitter (19300-1028) Dynaverter (22560-0028)	12.2 lbs. 3.8 lbs.	
Cessna Transmitter 800 Transmitter (26460-0028)	7.1 lbs.	
Cessna Glide Slope 800 Receiver (21420-0028)	6.0 lbs.	
Marker Beacon 800 Receiver (21430-0028)	3.7 lbs.	
Cessna 800 Marker Beacon/Glide Slope C582607-0101 Receiver C582607-0103 Mounting	4.2 lbs.	Includes Mount
T-22-RA Transceiver	15.0 lbs.	Includes Mount

TABLE OF ELECTRONIC EQUIPMENT LOADING (Sheet 3 of 6)

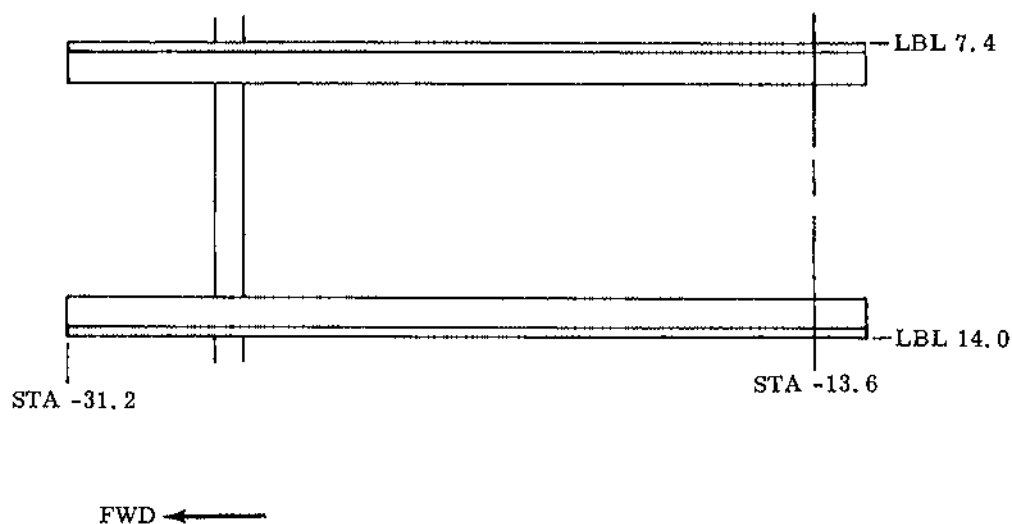
FOR SHELF INSTALLATION
PART NO. 0870140-1



EQUIPMENT	COMPONENT WEIGHT	REMARKS
Cessna Transponder 800 Coder (29300-0000)	3.5 lbs.	
Cessna Nav/Omni 800 (190 Channel) Receiver (21440-0028) Converter (22900-0028)	6.70 lbs. 6.10 lbs.	
Cessna DME 800 Receiver/Transmitter (C582601-0101)	11.4 lbs.	
Cessna 800 RMI C582606-0101	5.8 lbs.	Includes Mount
C582606-0102	4.6 lbs.	Includes Mount
C582606-0103		

TABLE OF ELECTRONIC EQUIPMENT LOADING (Sheet 4 of 6)

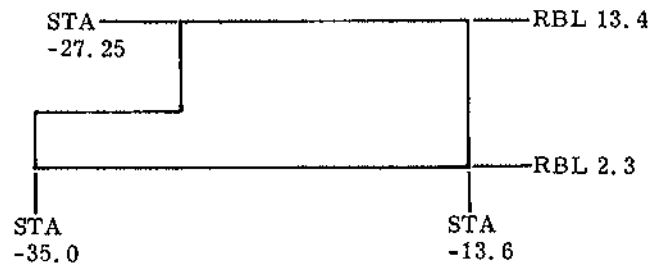
FOR SHELF ASSEMBLY
PART NO. 0813316-2



EQUIPMENT	COMPONENT WEIGHT	REMARKS
Cessna Glide Slope 800 Receiver (21420-0028)	6.0 lbs.	Includes Mount
Cessna Marker Beacon 800 Receiver (21430-0028)	3.7 lbs.	
Cessna Transponder 800 Receiver/Transmitter (34900-0028) Coder (29300-0000)	7.1 lbs. 3.5 lbs.	
Course Director 800 Computer Amplifier (24780-0028)	4.4 lbs.	
Cessna Transmitter 800 Transmitter 800 (26460-0028) Dynaverter (23400-0028)	7.1 lbs. 1.0 lbs.	
T-10-R Transceiver	13.0 lbs.	
Cessna Transponder 400 Receiver-Transmitter (34950-0028)	1.5 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING (Sheet 5 of 6)

FOR SHELF ASSEMBLY
PART NO. 0813201-8



EQUIPMENT	COMPONENT WEIGHT	REMARKS
Cessna Transceiver 800 Receiver/Transmitter (19300-1028) Dynaverter (22560-0028)	12.2 lbs. 3.8 lbs.	
Cessna Marker Beacon 300 Receiver (31240-0028)	1.0 lbs.	Mounted on Lower Side
Cessna Transceiver 300 Receiver/Transmitter (31390-1128)	7.2 lbs.	
Cessna Nav/Omni 300 Accessory Unit (3389-0028)	5.5 lbs.	
AVQ-45 Weather Radar Receiver/Transmitter	15.0 lbs.	Includes Mount

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SECTION 16

STRUCTURAL REPAIR

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GENERAL.

Type of Construction.

The 310 is an all-metal aircraft of semimonocoque type construction with the skin carrying a portion of all structural loads. The fuselage is comprised of a forward cabin section and a tailcone. It is constructed of formed bulkhead rings, stringers, and

stiffeners all of which are riveted to the external skin. The wing, horizontal stabilizer and vertical fin are built up around two main spars, with ribs, formers and riveted skin forming the basic structure. Torsional stiffness of this structure is afforded by the skin closure of areas between the spars forming enclosed "boxes." Each movable surface consists of a hinge support spar with ribs, formers and riveted outer covering skin.

Ground Handling.

Leveling, jacking and other ground handling details are covered in Section 2.

Investigation of Damage.

After a thorough cleaning of the damaged area, all structural parts should be carefully examined to determine the extent of damage. Frequently the force causing the initial damage is transmitted from one member to the next, causing strains and distortions. Abnormal stresses incurred by shock or impact forces on a rib, bulkhead or similar structure may be transmitted to the extremity of the structural member, resulting in secondary damage such as sheared or stretched rivets, elongated bolt holes, canned skin plate or bulkheads. Points of attachment should be examined particularly for distortion and security of fastenings in the primary and secondary damaged areas.

Definition of Damage.

Structural Damage to the aircraft is divided into the following classifications:

- a. Negligible Damage shall be considered damage that will not affect the airworthiness of the aircraft and can be permitted to exist as is or can be corrected with a simple repair such as removing dents, burnishing scratches and stop drilling cracks in non-structural parts.
- b. Damage Repairable by Patching will be considered damage that may be repaired by covering or reinforcing a portion of the aircraft.
- c. Damage Repairable by Insertion will be considered damage requiring replacement of a section with the correct repair material.
- d. Damage Necessitating Replacement of Parts will be considered as damage not repairable by patching or insertion, but that may be repaired by installing a new or reconditioned part. If a part or area of an assembly is damaged to the extent that it requires replacement, and a replacement cannot be made because of tooling or jig requirements, the entire assembly must be replaced.

Preparing Damaged Area for Repairs.

To prepare an area for repair, examine and classify the damage. Make a thorough check before beginning repairs. In some cases a damaged part may be classified as needing replacement when after removal, closer inspection indicates the part may be repaired. Take more time for the damage estimate and save man-hours on repairs. To prepare a damaged area for patch or inserting repairs:

- a. Remove all ragged edges, dents, tears, cracks, punctures and similar damages.
- b. Leave edges, after removal of damaged area, parallel to any square or rectangular edges of the unit.
- c. Round all square corners.
- d. Smooth out abrasions and dents.

- e. Brush Iridite all rough edges and scratches with a solution of Iridite mixed in a ratio of 1 ounce of Iridite to 1 gallon of water and rinse thoroughly.
- f. Apply two coats of zinc-chromate primer to all internal surfaces and edges lapping over another.

NOTE

Damage adjacent to a previous repair requires removal of the old repair and inclusion of the entire area in the new repair.

Control Surface Rebalancing Data.

The control surfaces of the aircraft have been 100% statically balanced. After each repair or painting of the control surfaces they must be rebalanced. Correct balance is restored by the addition or removal of lead ballast weights in the counterbalance sections of the surfaces.

WING.

The wings are all-metal, full cantilever, semimonocoque type construction, utilizing two main spars. Each wing consists of a wing panel, aileron, flaps, engine nacelle, wing tip fuel tank, and main landing gear. The landing gear is attached to and retracts into the wing.

Access Openings.

Access openings with removable cover plates are located in the underside of the wing between the root rib and the tip section. These openings afford access to the aileron bellcranks, flap bellcranks, electrical wiring, pulleys, cables and inspection of internal structure. When work is done on the trailing edge wing structure in the flap area, partial access can be provided by lowering the flaps. Outboard of this area, the trailing edge wing structure can be made available for repair by removing the aileron.

Wing and Horizontal Stabilizer Angle of Incidence.

Angle of incidence is defined as the angle between the wing or stabilizer chord line and aircraft waterline (aircraft level longitudinally). Stabilizers do not have twist. Wings have a constant rate of twist from the wing root rib to the tip rib. All twist is between these two ribs. The amount of twist between these points is the difference between the angle of incidence at the root rib and the angle of incidence at the tip. Refer to Section 3 to check wing twist.

Wing Skin.

All wing, aileron, and flap skin thickness and temper are listed in figure 16-10.

Negligible Damage.

Any smooth dents in the wing skin that are free from cracks, abrasions and sharp corners, which are not

stress wrinkles and do not interfere with any internal structure or mechanism may be considered as negligible damage. In areas of low stress intensity, cracks, deep scratches, or deep sharp dents, which after trimming or stop drilling can be enclosed by a two-inch circle, can be considered as negligible if the damaged area is at least one diameter of the enclosing circle away from all existing rivet lines. Stop drilling is considered a temporary repair.

Repairable Damage.

Skin damage ahead of the front spar and also where the optimum in appearance is desired should be repaired by the insertion method. Typical insertion repairs are illustrated in figure 16-16. Skin damage aft of the front spar which exceeds the negligible damage limit but is not extensive enough to necessitate replacement of a skin panel can be repaired by patching. Typical wing repairs are illustrated in the back of the Section.

Damage Necessitating Replacement of Parts.

In case the skin is extensively damaged, repairs should be made by replacing an entire sheet panel from one structural member to the next. The repair seams should be made to lie along stiffening members, or bulkheads, and each seam should be made exactly the same in regard to rivet size, spacing and rivet pattern as the manufactured seam at the edges of the original sheet. If the two manufactured seams are different, the stronger one should be copied.

Wing Ribs.

All ribs except those exposed to the wheel well contain flanged lightening holes. Flanged upper and lower edges of all ribs serve as cap-strips in addition to providing rigidity to the rib. The skin riveted directly to each rib flange provides the cellular strength for each successive rib bay. The nose, center and trailing edge rib segments are riveted together through the front and rear spars to form the basic airfoil sections. Spanwise alclad stringers stiffen the skin between ribs.

Negligible Damage.

Refer to negligible damage paragraph under wing skin.

Repairable Damage.

Repairs for wing rib webs and flanges are shown in figures 16-25 and 16-26. Before repairing is attempted, all cracks or deep scratches must be stop-drilled with a 3/32-inch drill, and all sharp corners and ragged edges must be trimmed and deburred.

Damage Necessitating Replacement of Parts.

Parts such as stiffeners, small ribs, clips and brackets should be replaced if their damage exceeds that specified as negligible. These parts, due to their size, are usually impractical to repair. In many instances, the time required to replace the damaged part may be considerably less than the time required to repair it. This should be considered carefully prior to making any repair whether it be only a small part or a complete component.

Wing Spars.

Repair of spar damage affecting the alignment of the wing spar should not be attempted in the field. Permissible spar repairs are illustrated in the back of this Section.

Flaps and Ailerons.

Negligible Damage.

Minor skin dents and nicks are considered negligible and can be worked out by burnishing.

Repairable Damage.

Skin damage exceeding that considered negligible damage can be repaired by patching. Typical skin repairs are illustrated in the back of the section.

Damage Necessitating Replacement of Parts.

Warped and cracked skin, ribs, hinge brackets and torque tubes are replaceable items. Any damage that covers more than half of the unit will require replacement of the entire unit.

TAIL GROUP.

The all-metal tail group is of full cantilever design, consisting of the conventional arrangement of vertical fin and rudder, horizontal stabilizer and elevators. The right elevator and the rudder both contain flight adjustable trim tabs, actuated by a system of cables and pulleys controlled from the pilot's tab control wheels.

Vertical Fin and Dorsal Group.

The vertical fin and dorsal area are constructed jointly to form a single unit. Basically the unit consists of formed sheet metal spars and ribs to which the outer skin is attached. The front spar is reinforced at its root end and drilled to facilitate the installation of two attachment bolts. Stiffness to the entire fin and dorsal assembly is provided by the attachment of the skins and the forward leading edge skin.

Negligible Damage.

Refer to negligible damage paragraph under wing skin.

Repairable Damage.

Repair of the skins, ribs and spars can be accomplished as illustrated in the back of the section. Access to the internal fin structure is best gained by removing the skin attaching rivets on one side of the rear spar and springing back the skin.

Damage Necessitating Replacement of Parts.

Extrusion, hinge brackets and small ribs should be replaced rather than repaired. In general, where parts are available, the easiest and most satisfactory repairs can be accomplished by replacing the damaged parts.

Rudder.**Negligible Damage.**

Minor skin dents and nicks are considered negligible and will be worked out by burnishing.

Repairable Damage.

Skin damage, exceeding that considered negligible damage, can be repaired by patching. Typical skin repairs are illustrated in the back of the section.

Damage Necessitating Replacement of Parts.

Warped and cracked skin, ribs, hinge brackets and torque tubes are replaceable items. Any damage that covers more than half of the rudder will require replacement of the rudder.

Horizontal Stabilizer.**Negligible Damage.**

Refer to negligible damage paragraph under wing skin.

Repairable Damage.

Skin damage, exceeding that considered negligible damage, can be repaired by patching. Typical skin repairs are illustrated in the back of the section. Repairs to spars should consist of channels formed of the same material and bend radius as the spar and extending at least three inches each side of the damaged area. Access to the internal stabilizer structure may be gained by removing a portion of the rivets along the rear spar and ribs and springing back the skin. By using the proper bucking bars

through holes in the spar web, the skins may be closed with a minimum of blind rivets.

Damage Necessitating Replacement of Parts.

Extrusions, hinge brackets, stabilizer tab, spar and ribs should be replaced rather than repaired. In general, where parts are available, the easiest and most satisfactory repairs can be accomplished by replacing the damaged parts.

Elevators.**Negligible Damage.**

For a description of negligible damage, refer to negligible damage paragraph under wing skin. The exception to negligible damage on the elevator surfaces is the front spar, a crack appearing in the web at the hinge fittings or in the tip rib which supports the overhanging balance weight is not considered negligible. Cracks in the overhanging tip rib, in the area at the front spar intersection with the web of the rib, also cannot be considered negligible.

Repairable Damage.

Skin damage, exceeding that considered negligible damage, can be repaired by patching. Typical skin repairs are illustrated in the back of the Section.

Damage Necessitating Replacement of Parts.

Warped and cracked skin, ribs, hinge brackets and torque tubes are replaceable items. Any damage that covers more than half of the elevator will require replacement of the elevators.

FUSELAGE.

The fuselage is of semimonocoque construction consisting of formed bulkhead, longitudinal stringers, reinforcing channels and skin platings. The fuselage forward section consists of all the fuselage structure from the nose to station 109.375. Formed bulkheads, channels and extrusions constitute the frame members of the cabin area.

Negligible Damage.

Refer to negligible damage paragraph under wing skin.

Repairable Damage.

Mild wrinkles occurring in the upper or lower skin panels in the bay forward of the horizontal stabilizer and which extend through the corners (shoulder areas) may be repaired by the addition of a stringer. A wrinkle, which is hand removable, should be rein-

forced by a 1/2 x 1/2 x .050-inch 2024-T42 extruded angle. The angle should be inserted fore and aft across the center of the wrinkle and should extend to within 1/16 to 1/8-inch of the fuselage bulkheads comprising the ends of the bay. If wrinkles cannot be removed by hand, the damaged area should be repaired.

Damage Necessitating Replacement of Parts.

All forgings and castings of any material and structural parts made of steel must be replaced if damaged. Structural members of a complicated nature that have been distorted or wrenched should be replaced. Major skin damage should be repaired by replacing the entire damaged sheet.

NOTE

When replacing entire skin panels, duplication of the forward edge of the original sheet is required. In effect, this flange is a structural member, carrying specific loads across the open areas.

Bulkheads.

Bulkheads are composed of formed "U" channel sections. The principle material of construction is 2024-O clad aluminum alloy, which after forming is heat treated to a 2024-T42 condition. All bulkheads in the fuselage are of the formed sheet metal or the reinforced formed sheet metal type.

Cracked Bulkhead Webs or Flanges.

Acceptable methods of repairing various types of cracks occurring in service are shown in the back of the section. Small holes (3/32-inch) should be drilled at the extreme ends of the cracks to prevent further spreading. Reinforcement should be added to carry the stresses across the damaged portion and stiffen the joints. The condition causing such cracks to develop at a particular point may be stress concentration at that point, in conjunction with repetition of stress (such as produced by vibration of the structure). The stress concentration may be due to defects such as nicks, scratches, tool marks and initial stresses or cracks from forming or heat treating operations.

NOTE

An increase in sheet thickness alone is usually beneficial but does not necessarily remedy the conditions leading to cracking. Patch type repairs are generally employed and are usually satisfactory in restoring the original material strength characteristics.

Severely Bent, Kinked or Torn Channels.

If practical, severely bent, kinked or torn portions of bulkheads should be removed and a replacement

section installed and joined at the original splice joint. If this is not justified, cutting away the damaged portion and inserting a trimmed portion of the original section, adequately reinforced by splice plates or doublers, will prove satisfactory. This is known as an insertion type repair.

LANDING GEAR.

The main gears are carried by the wings and are housed within the wing wheel wells when retracted. The nose gear retracts into the fuselage nose wheel well. Doors covering the wells are regarded as parts of the landing gear assemblies but the wells are structural features of the wings and fuselage.

Repairs of Landing Gear.

The landing gear assemblies are composed of parts that are not regarded as repairable. Minor repairs are permissible on the doors but when they are re-installed there must be no distortion that will prevent perfect operation.

ENGINE NACELLE.

The engine nacelle group, located in each wing, is composed of the semicantilever bed-type mount, the stainless steel firewall, and the cowling group. The engine mount structure is made of .063 inch 2024-T4 aluminum and 4130 cad-plated steel. The cowling is made up of three sections; the upper, the lower which includes the left and right access doors, and the two piece nose section which fastens in the center of the cowling. All sections fasten in place with Camloc quick fasteners. The nacelle firewall is made up of stainless steel sheet with a clad aluminum angle riveted around its contour.

a. Negligible Damage.

Minor dents in the firewall and cowling, if straightened, may be classified as negligible damage. Scratches and dents should be burnished out.

Engine Firewall.

a. Repair of Stainless Steel Firewall.

The firewall may be repaired by using the clear of structure-type patch, as shown in figure 16-24A of this section, providing the patch is of the same thickness as the firewall and monel rivets are used. Maximum diameter on holes that can be patched is 2 inches. The holes should be routed and repaired in accordance with figure 16-24A. Cracks should be stop drilled and repaired in accordance with figure 16-24A. Parts having cracks extending to the edge of the part must be replaced. Maximum allowable length of cracks to be repaired is 3 inches.

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Engine Firewall Sealing.

The engine firewall should be sealed with pro-seal #700 (Coast Pro-Seal Company) using the following procedures:

- a. Clean area on surface to be sealed with solvent
- b. Mix 1 part of Pro-seal #700 curing agent with 100 parts of Pro-seal #700 sealant.

NOTE

Sealant should be mixed by weight. It is important that accelerator be completely and uniformly dispersed throughout the base compound.

- c. Using a spatula, caulking gun, or flow gun, apply a fillet of sealer along cracks, seams, joints and rows of rivets.

NOTE

If the sealing is done before the parts are mated, use enough sealing compound to completely fill the joint and wipe away the excess after parts are mated.

NOTE

If the sealant is applied with a brush or a brush flow gun, more than one coat of sealant will be necessary on very porous material. The sealant should be allowed to air dry 10 minutes between coats.

- d. Pro-seal #700 is the only sealant authorized for the stainless steel firewall. If sealant other than pro-seal #700 has been used it should be removed from the firewall and resealed using only the recommended sealant.

Engine Mount.

Replacement of mount is the only recommended procedure.

Repair of Engine Cowling.

Skin, if damaged extensively, should be replaced with a section of original manufacture. Small damaged areas should be reinforced with a doubler installed on the inner side. Material selected should be of the same thickness and characteristics as the original part.

Repair of Cowling Reinforcement.

Cowling reinforcements, if damaged, should be replaced. Due to their small size and complex angles they are easier to replace than to repair.

Repair Procedures for Bonded Honeycomb Engine Cowls. (See figure 16-33.)

a. The 310 engine cowl is fabricated using a sandwich type honeycomb construction. Sometime during the life of the aircraft damage may occur to the skin and/or honeycomb which will require repairs. In the event damage does occur, the following repair procedures have been developed with the objective of equaling, as nearly as possible, the strength of the original part with a minimum loss of aerodynamic characteristics, electrical properties and minimize increase in overall weight.

b. Damages to sandwich honeycomb construction are divided into classes according to severity and possible effect upon the airframe structure. Damage classifications are as follows:

Class 1. Dents, scars, scratches, cracks, etc., in the facings not accomplished by a puncture or a fracture.

Class 2. Punctures or fractures on one facing only, possibly accompanied by damage to the honeycomb core but without damage to the opposite facing.

Class 3. Holes or damage extending completely through the sandwich, affecting both facings and the core.

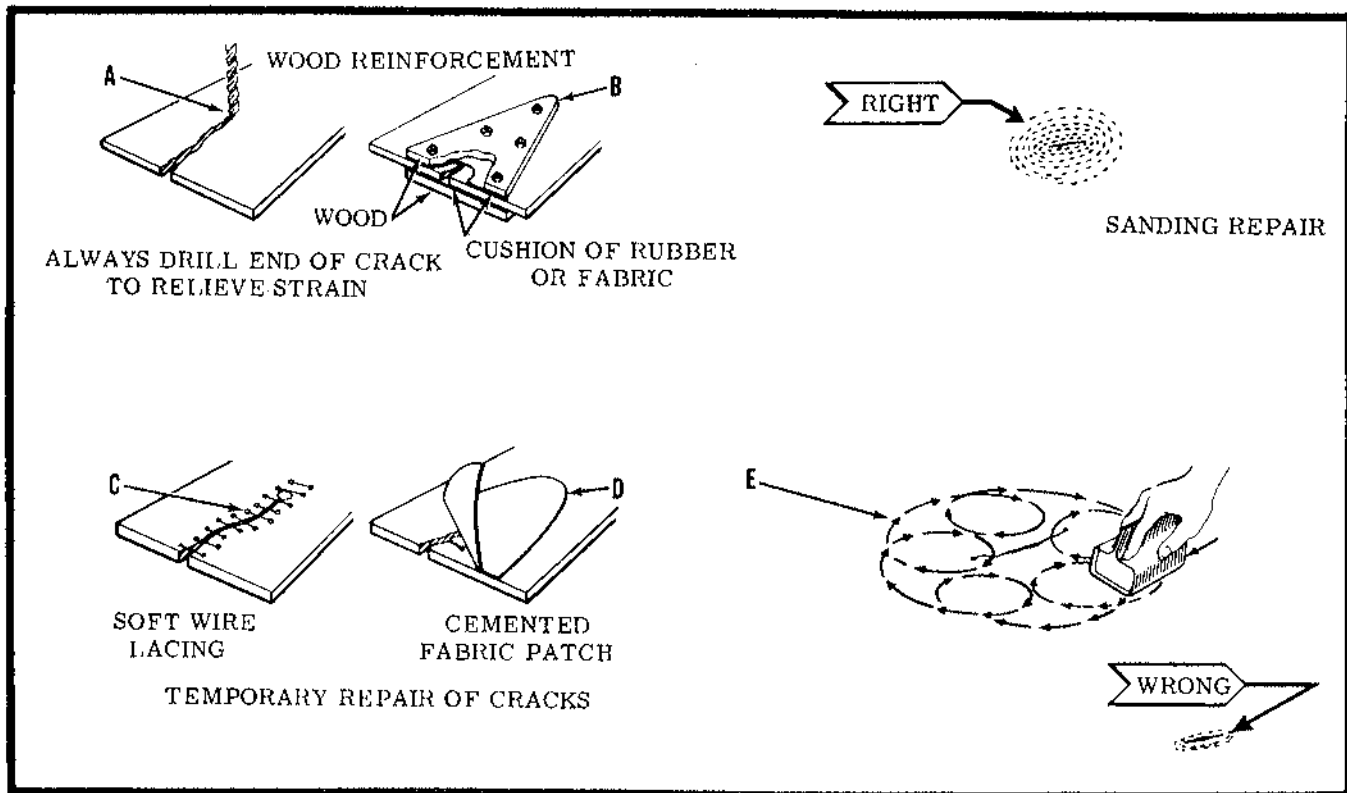


Figure 16-1. Plastic Repairs

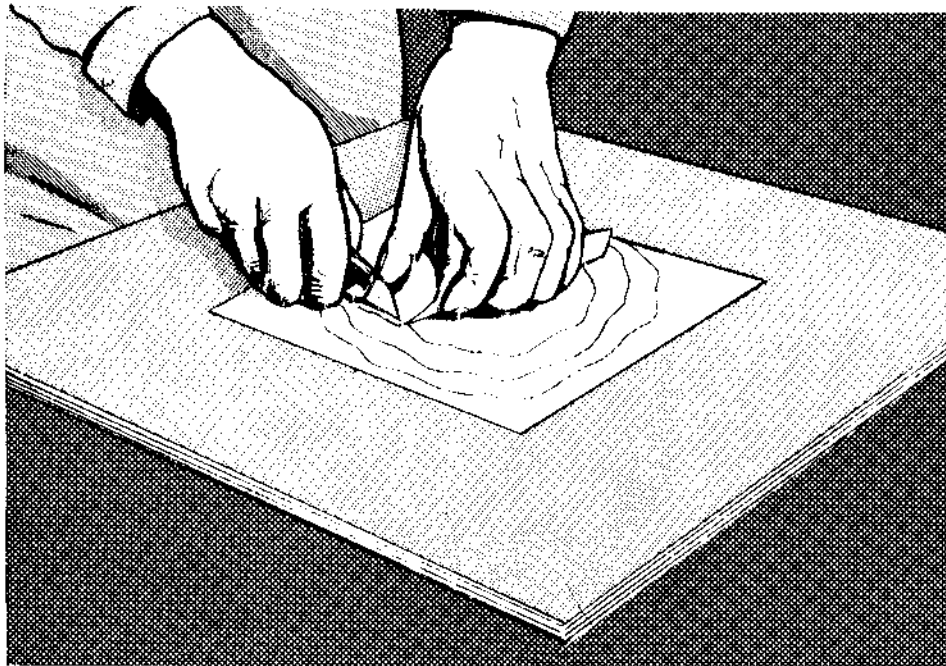


Figure 16-2. Removing Damaged Face Plies - Step Joint Method

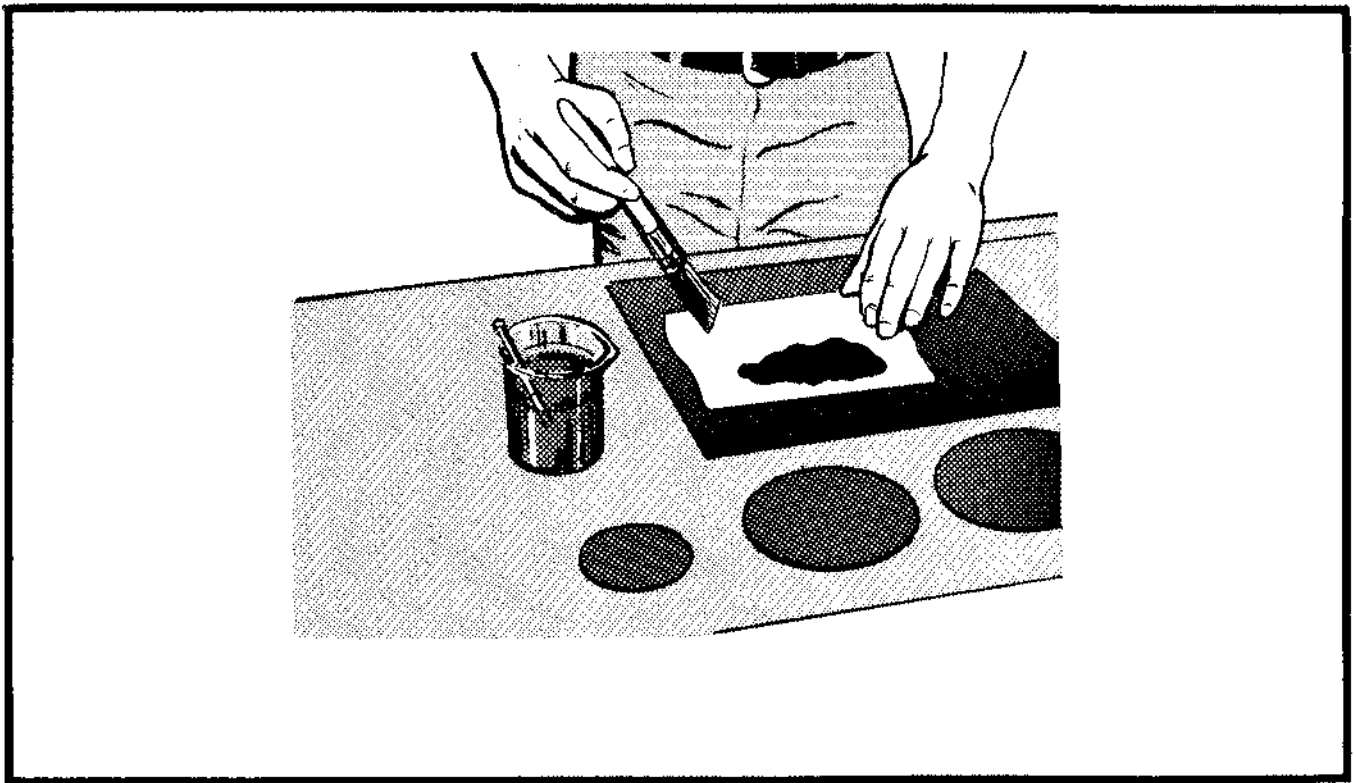


Figure 16-3. Suggested Method of Resin Impregnating Replacement Plies

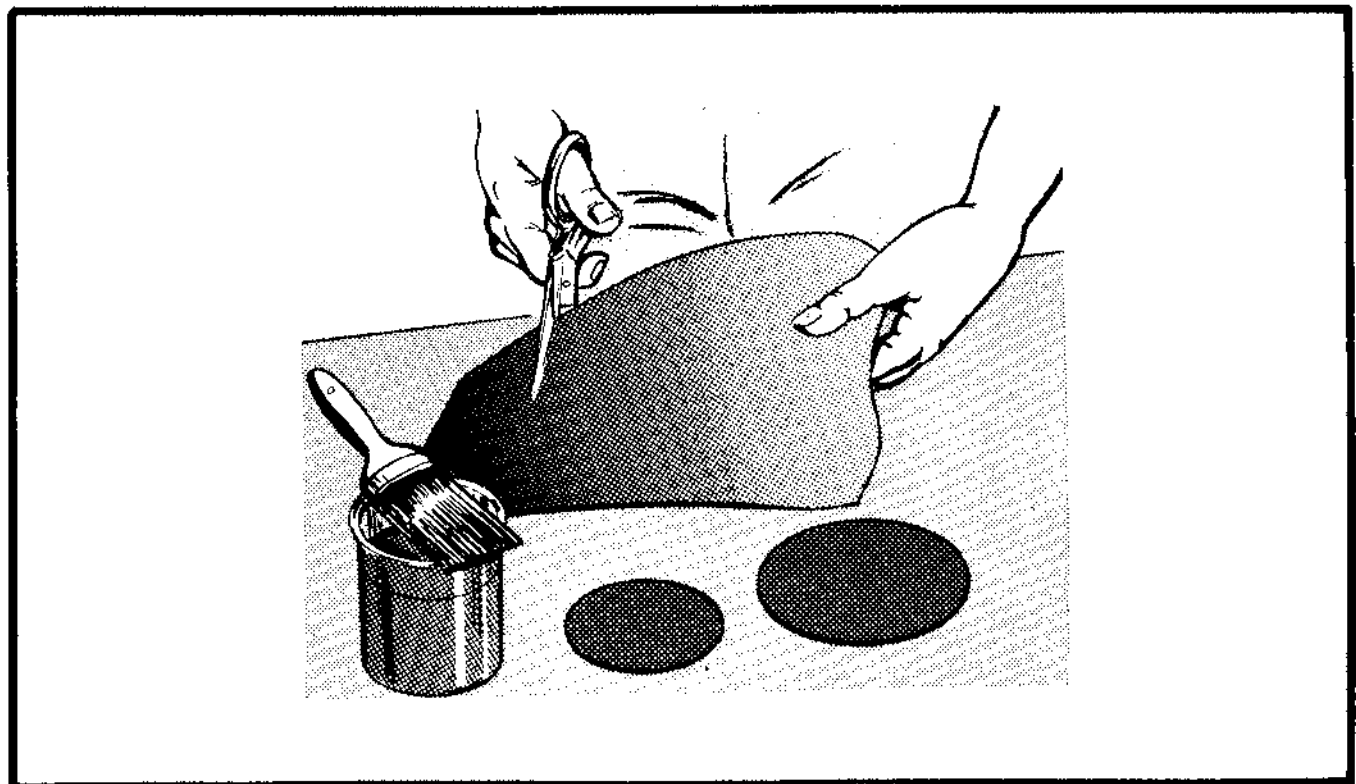


Figure 16-4. Cutting Replacement Plies from Impregnated Glass Cloth Sandwiched Between Sheet of Cellophane

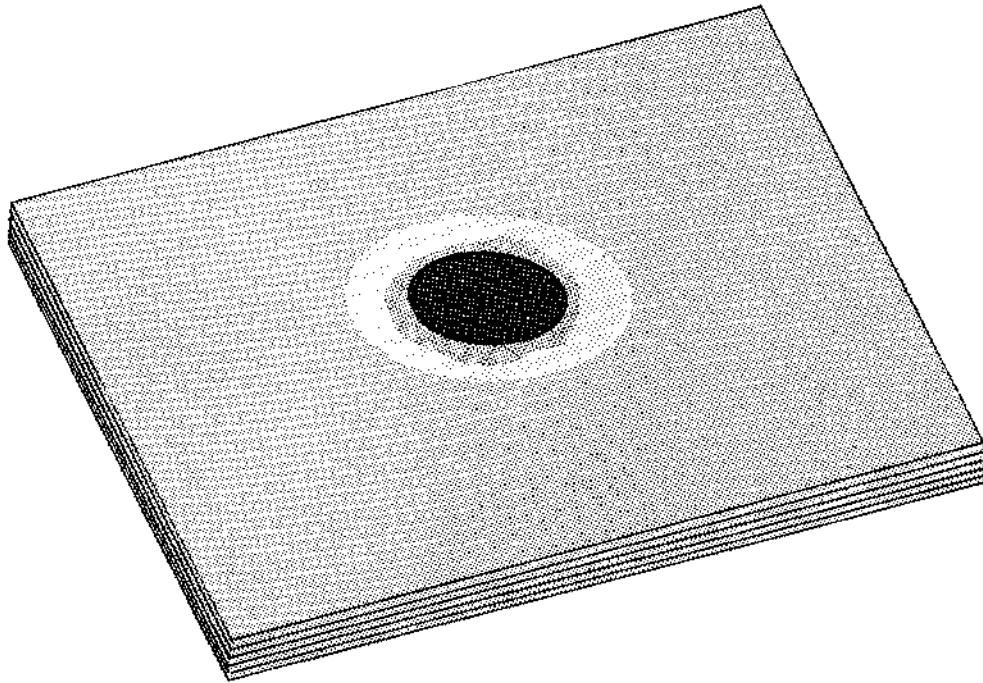


Figure 16-5. Damaged Face Plies Removed - Scarf Method

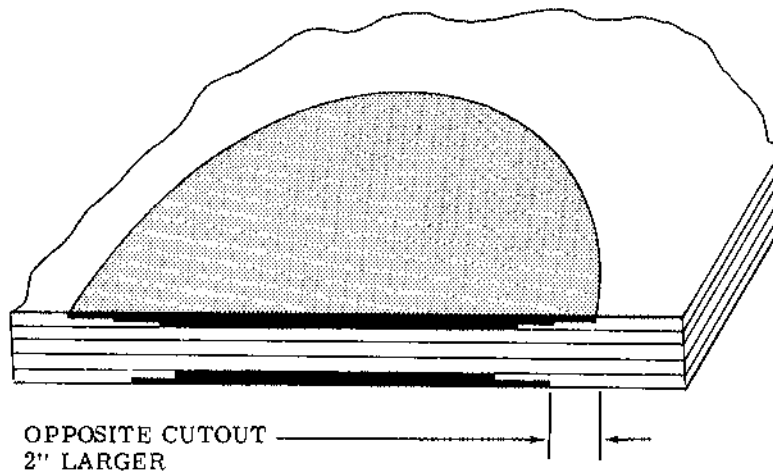


Figure 16-6. Completed Double Face Patch Repair

Class 4. Adhesive voids between skin and honeycomb core.

WARNING

Solvents used must be stored in, transported in, and used from safety containers. Adequate ventilation must be provided in storage and usage areas. The solvents specified are flammable and caution to prevent fires must be taken. No smoking, sparks or open flames shall be permitted in the immediate area where the solvents are being used. Storage and usage areas shall be free from excessive heat, sparks, and open flames when possible and practical, rubber gloves shall be worn when performing solvent operations.

c. Repair of Class 1 damage shall be as follows:

1. Class 1 damage resulting in a hole not exceeding 1-1/2 inches diameter, dents, scratches or scars of .030 inch deep shall be repaired as follows:

- (a) Remove paint to bare metal using either 400 or 600 grit wet sandpaper.
- (b) Mask area adjacent to sanded area.
- (c) Mix thoroughly equal portions, by volume, of Epon 828 and Versamid 125. Add aluminum powder until a thick non-flowing paste is obtained.

NOTE

Prepare only that quantity of material that will be used in 30 minutes.

- (d) Fill damaged area with mix and smooth with a putty knife or spatula.
 - (e) Allow the mix to cure at room temperature until hard (approximately 4 hours).
 - (f) Wet sand the repaired area with 400 grit wet sandpaper until smooth.
 - (g) Clean the repaired area with a clean cloth moistened with Isopropyl Alcohol, Naphtha or Toluene. Allow to air dry.
 - (h) Brush a minimum of two coats of Zinc Chromate primer over the repaired area, allowing each coat to dry.
 - (i) Refer to Section 2, and paint in accordance with applicable finish specifications.
2. Class 1 damage resulting in cracks shall be repaired as follows:
- (a) Stop drill crack at both ends with 3/16 inch diameter holes.
 - (b) Prepare a circular external patch, which will extend one inch beyond damage area from .012 or .015 aluminum.
 - (c) Remove all paint and primer around damage area by sanding with 400 to 600 grit wet sandpaper.

NOTE

Sanded area must be approximately 1/2 inch wider than aluminum patch.

- (d) Lightly sand entire damage area with 400 grit sandpaper until a satin finish is ob-

tained. Mask off around damage area.

- (e) Wipe damage area with a clean cloth moistened with Isopropyl Alcohol, Naphtha or Toluene. Wipe dry with a clean cloth.
- (f) Mix thoroughly 100 parts (by weight) Epon VIII Adhesive with 6 parts (by weight) of curing agent "A".

NOTE

Prepare only that quantity of material that will be used in two hours.

- (g) Work some of the prepared adhesive in the crack and drilled holes. Apply a thin film over sanded surface.
 - (h) Prepare a one-ply No. 191 glass cloth or similar scrim cloth 1/8 inch wider than aluminum patch.
 - (i) Apply a thin film of the adhesive on the aluminum patch and, then place cloth between patch and damaged assembly and apply sufficient pressure to assure positive contact.
 - (j) Using mylar or cellophane over aluminum patch, place a clamping device on patch to insure complete contact of all bonding surfaces.
 - (k) Remove excess adhesive with a clean cloth dampened with Naphtha or Toluene.
 - (l) Cure at 150° to 200° F using heat lamps or oven.
 - (m) Remove clamps, pressure pads, etc., and sand away remaining excessive adhesive.
 - (n) Brush a minimum of two coats of Zinc Chromate primer over the repaired area, allowing each coat to dry.
 - (o) Refer to Section 2, and paint in accordance with applicable finish specifications.
- d. Repair of Class 2 damage shall be as follows:
1. Class 2 damage to upper cowl resulting in damages that extend completely through the aluminum outer skin and into the aluminum honeycomb core but without damage to the inner skin:
- (a) Carefully trim out skin to a circular or oval shape with a hole saw or fly cutter removing honeycomb core completely to the opposite skin.

CAUTION

Extreme care should be taken not to damage the inner skin.

- (b) Remove completely all the damaged honeycomb core.
- (c) Prepare either an aluminum honeycomb core or balsa wood replacement plug as follows:
 - (1) If balsa wood is used, fabricate plug so that the grain will be perpendicular to the skins.
 - (2) Lightly sand balsa plug with 400 grit sandpaper and wipe off dust with a clean cloth.

NOTE

Do not touch the bare surface with bare hands

after sanding. If the balsa wood is cut too short, the distance between shall be shimmed up until positive contact is made with all surfaces.

- (3) Wrap balsa plug in clean waxed paper until ready for use.
- (4) When aluminum honeycomb plug is used, the core shall be the approximate density of the original core.
- (5) Cut aluminum honeycomb plug so that the top edge will be even with the adjacent skins and completely fills the damaged area.
- (d) Remove all paint and primer (approximately 1-1/2 inches larger in diameter than cutout) from around damage area with either 400 or 600 grit wet sandpaper.
- (e) Mask around sanded area and cutout area.
- (f) Mix thoroughly 100 parts (by weight) Epon VIII adhesive with 6 parts (by weight) of curing agent "A".

NOTE

Prepare only that quantity of material that will be used in two hours.

- (g) If balsa plug is being used, spread the adhesive lightly over all surfaces. If aluminum plug is being used, brush or trowel adhesive on the internal side of the existing skin and where the plug will make contact with core.
- (h) Position balsa wood or aluminum plug into place.
- (i) Prepare a circular external patch, which will be one inch larger than plug hole, from .012 or .015 aluminum.
- (j) Prepare a one-ply circular No. 191 glass cloth or similar scrim cloth 1/8 inch larger than plug hole.
- (k) Apply a thin film of adhesive over sanded surface and place the No. 191 glass cloth or similar cloth over the plug.
- (l) Clean the bond surface of aluminum patch and coat with adhesive.
- (m) Assemble patch over glass cloth and plug and apply sufficient pressure to assure positive contact.

NOTE

Care should be taken to insure that plug and glass cloth remain in place.

- (n) Using mylar or cellophane over aluminum patch, place a clamping device on patch to insure complete contact of all bonding surfaces.
- (o) Remove excessive adhesive with a clean cloth moistened with Naphtha or Toluene.
- (p) Cure at 150° to 200° F using heat lamps or oven.
- (q) Remove clamps, pressure pads, etc., and sand away excessive adhesive.
- (r) Brush a minimum of two coats of Zinc

Chromate primer over the repaired area, allowing each coat to dry.

- (s) Refer to Section 2, and paint in accordance with applicable finish specifications.
2. Class 2 damage to upper cowl resulting in damage which extends completely through the fiberglass inner skin and into aluminum honeycomb core but without damage to the outer aluminum skin.
- (a) Carefully trim out skin to a circular or oval shape with a hole saw or fly cutter removing aluminum honeycomb core completely to opposite skin.
 - (b) Prepare a balsa wood or aluminum honeycomb plug as stated in step 1. (c) above.
 - (c) Sand undamaged fiberglass skin lightly approximately 2 inches out from around the hole.

CAUTION

Do not sand through fiberglass skin.

- (d) Prepare two No. 181 glass fabric patches, 1/8 inch larger than hole diameter.
- (e) Mix thoroughly 100 parts (by weight) Epon 828 and 10 parts (by weight) Diethlenetriamine (DTA).
- (f) Coat plugs with Epon 828 and DTA mix as described in step 1. (g).
- (g) Impregnate the two No. 181 glass patches with mixture to the content of approximately 50% and assemble patches over plug.

NOTE

Smooth out all wrinkles.

- (h) Prepare one No. 181 glass fabric patch large enough to cover sanded area and impregnate with mixture.
 - (i) Assemble third patch over the two previous layers and remove all wrinkles as before.
 - (j) Using mylar or cellophane, cover patches and apply a clamping device.
 - (k) Cure assembly at 150° to 200° F for approximately 90 minutes.
 - (l) Remove clamps, pressure pads, etc., and sand smooth to original contour.
3. Class 2 damage to side cowl which extends completely through aluminum skin and the aluminum honeycomb core shall be repaired as follows:
- (a) Repair damage as described under step 1. (d), except use Bloomingdale's HT-424 or Narmco's Metlbond 302 adhesives.
 - (b) The cure time for adhesives described in step (a) above, will be a minimum of 5 hours.
4. Class 2 damage to side cowl which extends completely through fiberglass skin and aluminum honeycomb core shall be repaired as follows:
- (a) Repair damage as described under step 2. (d), except, use either Bloomingdale's HT-424 or Narmco's Metlbond 302 adhesives.
 - (b) The skins shall be fabricated from either Cordo's Pyroreg AC, U. S. Polymeric's Poly Preg 502, or Narmco's 506 (color black).
 - (c) The reinforcement shall be 181-150 Valan.

- (d) Cure time for adhesives described in step (a) above, will be a minimum of 5 hours.
- e. Repair of Class 3 damage is as follows:
 - 1. Class 3 damage to upper and side cowls resulting in damage to both aluminum and fiberglass skins having a minimum damage size of 1.0 inch or maximum damage size of 4 inches.
 - (a) Prepare surfaces, plugs and patches as described in step (d).
 - (b) Fabricate a temporary mold or block to hold the plug in place while aluminum outer skin is being repaired.
 - (c) Repair outer aluminum skin in accordance with step (d).
 - (d) Remove temporary mold or block and repair fiberglass skin in accordance with step (d), and flare in patch with existing skin contour.
- f. Repair of Class 4 damage is as follows:
 - 1. Class 4 repairs are those repairs needed to fill voids between aluminum core and skin surfaces.
 - (a) Drill sufficient 1/8 inch holes in the fiberglass inner skin adjacent to voids.
 - (b) Remove all burrs around drilled holes.
 - (c) Mix thoroughly 100 parts (by weight) Epon 828 with 10 parts (by weight) curing agent "D".

NOTE

Prepare only that quantity that can be used in one hour.

- (d) Using a syringe or pressure gun, inject resin mix into the aluminum honeycomb cells until they become filled.
- (e) Wipe off excess resin with a cloth that has been dampened with MIBK or MEK and cover the holes with masking tape.
- (f) Position the structure so that both skins will be in positive contact with resin.
- (g) Cure adhesive for 2 hours at 150° to 200° F.
- (h) Remove masking tape and sand away excess resin.

FIBERGLASS PARTS.

The engine cowlings nose caps, tail stinger, tail surface tips, fairings, heater ducts, and other parts of the aircraft are made of fiberglass.

Repairable Damage.

Damaged fiberglass parts may be repaired by the methods shown in figure 16-7. Cut and trim the area just beyond the noticeable damage. If the parts are painted, remove paint and sand clear an area at least two inches beyond the edge of the cutout. Prepare the necessary size and number of patches of glass cloth. Mix a sufficient amount of resin in accordance with the manufacturer's instructions.

WARNING

Always follow the manufacturer's mixing instructions carefully as the mixing of peroxide

and cobalt together will result in a spontaneous fire.

Be sure that your hands are free from oil, grease, and dirt. Apply an even coat of resin on the sanded area. Impregnate all the glass cloth patches by laying them on a clear paper and working the resin through the fabric with a small brush. Place the larger patch over the cutout area, working out all air bubbles and wrinkles. If the cutout is large enough to cause the patch to sag, place a suitable support behind the repair area. Coat the support with automobile wax or wax paper to prevent the resin from adhering to the support. Apply a second patch over the first patch, etc., working out all wrinkles and air bubbles. After all the patches have been applied, brush the area with an even coat of resin and allow to cure. Smooth the patch area with fine sandpaper until the desired finish is obtained. Repaint the finished area with matching paint.

Damage Necessitating Replacement of Parts.

When the fiberglass parts are torn or cracked over a large area or show signs of strain through the appearance of small cracks or show signs of loss of rigidity through the use of too much pressure on the surface, then the parts shall be removed and replaced.

POLYCARBONATE AND ACRYLIC PLASTIC BONDING.

a. When it becomes necessary to bond Polycarbonate and acrylic - such as the magnetic compass base plate to the windshield - 5% solution of methylene chloride is recommended as a bonding agent. This solution can be prepared as follows:

100 parts (by weight) Methylene Chloride
5 parts (by weight) Polycarbonate powder
(such as Lexan 105 powder).

NOTE

Due to the short pot life of this solution, no more material than that which can be used in 30 minutes should be mixed.

b. Following coating of the parts to be bonded, positive contact of the mating surfaces must be made within 10 to 15 seconds. A locally manufactured tool capable of exerting 50 to 60 psi should be used to hold the bonded parts for a minimum of 4 hours.

c. Curing the bond should be accomplished by allowing the bonded parts to remain at room temperature for at least 24 hours before any stress is applied.

REPAIR OF PLASTIC WINDOW SURFACES. (See figure 16-1.)

a. Damaged window panels and windshield of this aircraft are ordinarily removed and replaced if the damage is extensive. However, certain repairs as prescribed in the following paragraphs can be made successfully without removing the damaged part from

NOTE: SEE FIBERGLASS PARTS PARAGRAPH BEFORE ATTEMPTING A FIBERGLASS REPAIR.

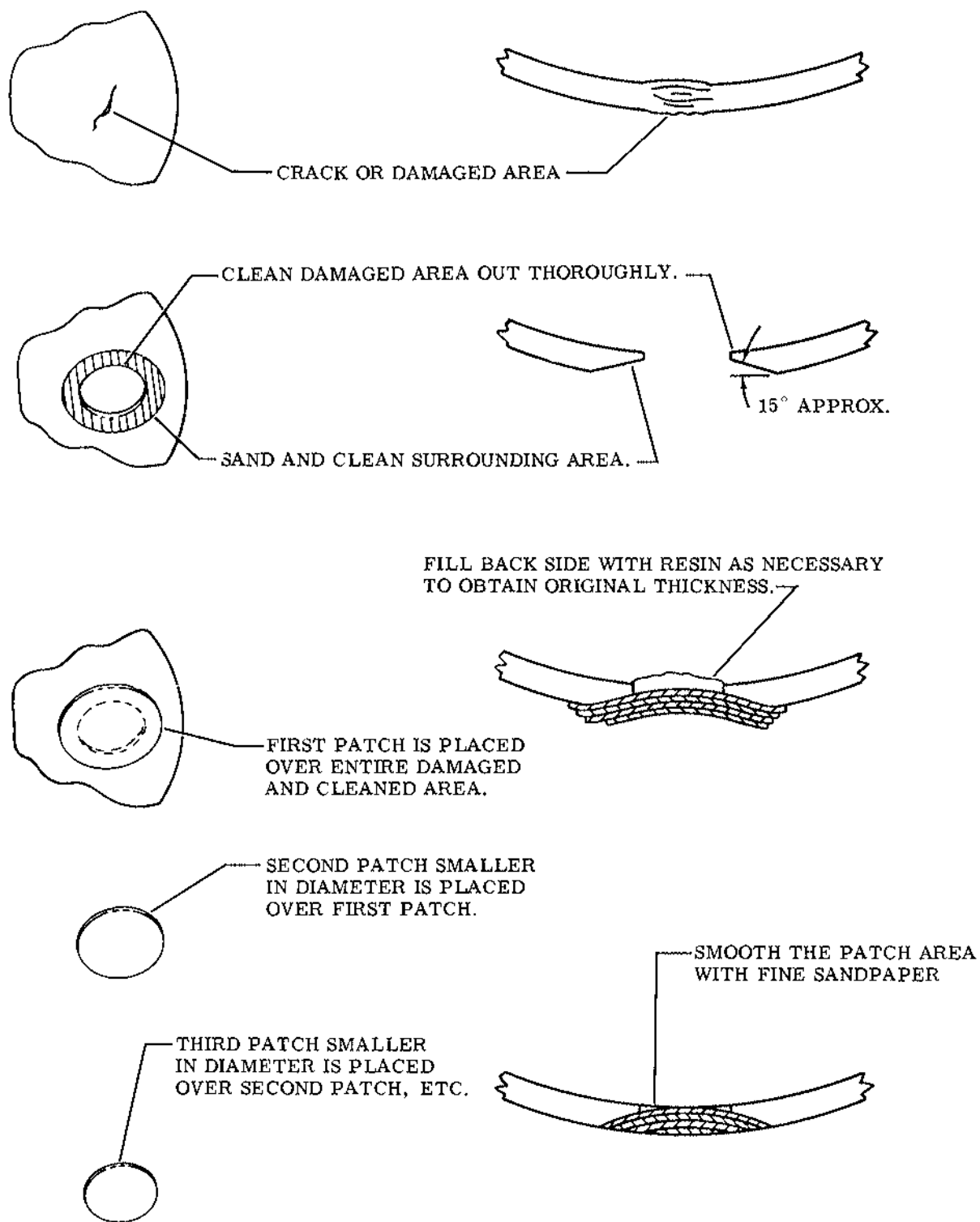


Figure 16-7. Fiberglass Repair

the aircraft. Three types of temporary repairs for cracked plastic are possible. No repairs of any kind are recommended on highly-stressed or compound curves where the repair would be likely to affect the pilot's or copilot's field of vision. Curved areas are more difficult to repair than flat areas and any repaired area is both structurally and optically inferior to the original surface.

b. When a crack appears in a panel, drill a hole at the end of the crack to prevent further spreading. The hole should be approximately 1/8 inch in diameter, depending on the length of the crack and thickness of the material.

c. Temporary repairs on flat surfaces can be effected by placing a thin strip of wood over each side of the surface and then inserting small bolts through the wood and plastic. A cushion of sheet rubber or aircraft fabric should be placed between the wood and plastic on both sides.

d. A temporary repair can be made on a curved surface by placing fabric patches over the affected areas. Secure the patches with aircraft dope, Specification No. MIL-D-5549, or lacquer, Specification No. MIL-L-7178. Lacquer thinner, Specification No. MIL-T-6094 can also be used to secure the patch temporarily.

e. A temporary repair can be made by drilling small holes along sides of the crack 1/4 to 1/8 inch apart and lacing the edges together with a soft wire. Small stranded antenna wire makes a good temporary lacing material. This type of repair is used as a temporary measure only, and as soon as facilities are available, the panel should be replaced.

f. Scratches on transparent plastic surfaces can be removed by hand-sanding operations followed by buffing and polishing, provided subsequent instructions are followed carefully. Wrap a piece of No. 320 (or finer) sandpaper or abrasive cloth around a rubber pad or wood block. Rub the surface around the scratch with a circular motion, keeping the abrasive constantly wet with clean water to prevent scratching the surface further. Use minimum pressure and cover an area large enough to prevent the formation of the "bull's-eye" or other optical distortions.

CAUTION

Do not use a coarse grade of abrasive; No. 320 is the maximum coarseness permitted.

g. Continue the sanding operation, using progressively finer grade abrasives.

h. When the scratches have been removed, wash the area thoroughly with clean water to remove all the gritty particles. The entire sanded area will be clouded with minute scratches which must be removed to restore transparency.

i. Apply fresh tallow and buffing compound to a motor-driven buffing wheel. Hold the wheel against the plastic surface, moving it constantly over the damaged area until the cloudy appearance disappears. A 2000-foot-per-minute surface speed is recommended to prevent heating, distortion, or burns.

NOTE

Polishing can be accomplished by hand, but

it will require a considerably longer period of time to attain the same result as produced by the buffing wheel.

j. When buffing is finished, wash the area thoroughly and dry it with a soft flannel cloth. Allow the surface to cool and inspect the area to determine if full transparency has been restored. Then apply a thin coat of hard wax and polish the surface lightly with a clean flannel cloth.

NOTE

Rubbing a plastic surface with a dry cloth will build up an electrostatic charge which attracts dirt particles and may eventually cause scratching of the surface. After the wax has hardened dissipate this charge by rubbing the surface with a slightly damp chamois. This will also remove the dust particles which have collected while the wax was hardening.

RADOME REPAIR PROCEDURES.

a. Remove radome in accordance with Section 3. Repair procedures are developed with the objective of equaling as nearly as possible the electrical and strength properties of the original part with a minimum increase in weight. This can only be accomplished by repairing damaged parts with approved materials and working techniques. For convenience in presentation and for clarity in designating repair procedures to be used, damages to solid laminate radomes in this procedure shall be divided into classes according to severity, as follows:

1. Class I Repair. Surface scratches, scars or erosion not penetrating through the first ply of fabric.

2. Class II Repair. Punctures, delaminations, contaminants or fractures extending through the first ply down into the laminate but without damage to the opposite facing.

3. Class III Repair. Damage extending completely through the laminate affecting both facings.

4. Class IV Repair. Defect which does not exceed an area .5 inch square and surface has not been broken and does not occur more than twice in any 1 foot square area.

5. Class V Repair. Delamination in edge bond extending up to 1/8 inch out from drilled holes; delaminations not extending more than 1/2 inch from trimmed edges and approximately 1 inch in size.

b. Repair Techniques.

1. Class I Repair. Surface scratches, scars or erosion not penetrating through the first ply shall be repaired as follows:

(a) Clean damaged area thoroughly and carefully using a clean cloth saturated with methyl-ethyl-ketone or another approved cleaning agent.

(b) Lightly sand the damaged area, using No. 280 grit sandpaper, clean the sanded surface thoroughly, using methyl-ethyl-ketone, Specification TT-M-261. Moisture and solvents should be completely removed to prevent their inhibiting the cure of

the resin.

(c) Apply one or two coats (depending on severity of the abrasion) of the following resin mix to the abraded surface.

Composition

Resin Selectron 5003 (Alternate: Hetrion 92)	100 parts by weight
Lupersol DDM	0.5 to 1.5 parts by weight
Luperco ATC Paste	.95 to 1.05 parts by weight
Nuodex Cobalt	4 to 8 drops/lb. resin

Refer to last page of Section 16 for vendor information.

Mixing Procedure

Dissolve ATC Paste in the resin and thoroughly mix. Add Nuodex Cobalt and mix. Add DDM and thoroughly mix.

Bench Life

Approximately 30 minutes at room temperature.

(d) Over this coated surface, apply a sheet of colored cellophane or polyvinyl alcohol film extending two or three inches beyond the surface. The cellophane or PVA prevents exposure to the air and will provide a smooth surface against which the resin may cure.

(e) Tape cellophane or PVA in place and work out air bubbles and excessive resin with the hand or a rubber squeegee. Cure the resin as follows:

- (1) Gel resin any surface temperature from 80°F up to a maximum of 150°F.
- (2) After gelation the repaired area is cured at a surface temperature of 120 to 150°F for 30 minutes. The surface temperature is then raised to 200-230°F and maintained for 30 minutes. Heat may be obtained by heat lamps, glow rods, etc.

(f) After the resin has cured or set, remove the cellophane or PVA from the cured resin and remove any excessive resin by sanding lightly.

2. **Class II Repair.** Punctures, delaminations, contaminants or fractures extending through the first ply down into the laminate but without damage to the opposite facing.

Method I (Stepped Joint Method).

(a) The preferred method of removing damaged plies in accomplishing a Class II Repair is by the stepped joint method. For small damages the scarf method of repair may be used.

(b) Ascertain the extent of the damaged area by visual inspection, using a strong light source, prior to beginning repair. With aid of a straight edge or compass, outline the damaged area by scribing a rectangle with rounded corners or circle that will necessitate removal of a minimum of sound material. Extend the sides of the circle a distance in inches equal to the number of plies to

be removed less one inch. (Five inches if six plies are to be removed, four inches if five plies are to be removed, etc.) Overlap should be at least one inch per ply of glass cloth.

(c) With the aid of a straight edge, use a sharp knife or other specially prepared cutter and cut along the lines scribed in the outermost ply. Use extreme care not to cut or score the underlying ply. A suggested method is to cut through the overlaying ply in a series of cuts rather than attempt to cut through the ply in one cut.

(d) Remove the cut outermost ply by inserting the knife blade under the corner and prying loose carefully. When this outermost ply is removed, scribe on the next exposed ply a similar outline except reducing the dimensions one inch in all directions. (Overlaps shall be one inch each ply.) Repeat this procedure until all the damaged plies have been removed.

(e) Lightly sand exposed plies and clean surfaces using methyl-ethyl-ketone, Specification TT-M-261, and allow to dry thoroughly preparatory to completing repair buildup.

WARNING

The sanding operation on glass cloth reinforced laminates gives off a fine dust that may cause skin irritation. Breathing of an excessive amount of this dust may be injurious, therefore, precaution as to skin and respiratory protection will be observed.

(f) Cut patches from the same type of fabric as was used in the original part. Cut the fabric patches to the size of each hole. Impregnate the cloth patches with the resin mix specified under Repair Method I, paragraph (c). Sandwich each patch ply between two sheets of PVA or cellophane larger than the patch by at least two inches on all sides. (See Figures 16-3. and 16-4.) The impregnated glass cloth shall contain 45-50 percent of catalyzed resin after cellophane has been removed. (Weight of resin equal to weight of dry glass cloth comprises 50 percent resin content.) Brush a coat of resin on the surface of the scarfed plies.

(g) Fit the smallest patch in place taking care to avoid entrapping air under the patch. Smooth out all wrinkles and trim to fit. Add successive plies in a like manner the warp direction of each patch ply approximately the same as that of the original ply.

(h) Surround the patch with a bleeder and cover the entire area with polyvinyl alcohol film and secure in an air tight seal with either double-backed tape or extruded sealing tape or both. Evacuate the area under the PVA film. Sweep out entrapped air and excess resin with the motion of a rubber squeegee or a similar device. The motion of the squeegee shall be slow enough so that the air bubbles will be swept clear of the laminate by the wave, or motion of the excess resin. The air bubbles may be observed through the transparent PVA sheeting and the wiping process will continue until all air bubbles are swept past the edge of the laminate. The working or wiping of the lami-

nate will be stopped when the plies of fabric are firmly packed together. Further wiping will create air or vapor voids observable as a whitening and a loss of transparency. Should the PVA sheet be punctured during the void-free working or wiping process, the hole may be repaired with transparent tape and the air which has penetrated the bag shall be worked from the laminate. Vacuum pressure shall be maintained during the complete curing process.

(i) Cure repaired area as described under Repair Method I, paragraph (c). After the resin has cured, remove the PVA from the cured resin and remove any excessive resin by sanding lightly.

Method II (Scarf Joint Method).

(a) The scarf joint method may be used when the repair of a damaged area will require removal of an area less than three-inches in diameter.

(b) The scarf method consists of sanding out the damaged plies to a circular or oval disc shape. (See Figure 16-5.) The damaged plies will be scarfed back carefully to a distance of at least 50 times the total face ply thickness by using polisher-sander Stock No. 5130-537-3394, or by hand-sanding using No. 180 grit sandpaper. The scarfing operation will be performed very accurately to provide a uniform taper and usually requires some practice before acceptable scarfs are obtained.

(c) The glass cloth laminations for the facing repairs are prepared with the largest piece being cut to the exact shape of the outside of the scarfed area. The smallest piece is cut so that it overlaps the scarfed area by its proportionate amount, depending on the number of plies in the repair and the intermediate pieces are cut so as to have equal taper.

(d) Process the prepared area in accordance with paragraphs (f), (g), (h) and (i) under Class II Repairs, Method I.

3. Class III Repair. Damage extending completely through the laminate affecting both facings.

(a) Damages completely through the laminate shall be repaired by removing and replacing the damaged material as previously outlined under Class II Repair. Never remove inner and outer radome face ply at the same time. One facing will be completed before repair is made on the opposite facing. On solid laminate radomes, 1/2 of the damaged face plies will be removed from one side and the buildup repair completed, then repeat removal and new ply buildup procedures on opposite side.

(b) To accomplish Class III Repairs, it is necessary that the opposite side of the laminate be provided with a temporary mold or block to hold the laminate in place during the first face ply buildup.

(c) The damaged facing shall be removed and replaced as previously outlined for removing and replacing damaged plies for Class II Repair. Repeat repair procedures on the opposite facing except the cut out ply area will be larger by approximately two inches than the first ply cut out area on the opposite face repair. This will prevent the joints in the inner and outer repair area from being

in the same position. (See Figure 16-6.)

4. Class IV Repair. Defects which do not exceed an area 0.5 inch square and the surface has not been broken and does not occur more than twice in any 1 foot square area.

(a) If surface is broken, sand smooth.

(b) Drill 2 to 3 No. 50 holes into the damaged skin spaced throughout the damaged area. Inject resin mix under Class I Repair, paragraph (c), with a hypodermic syringe and needle to insure contact with all surfaces and to obtain a maximum possible "wetting up" of the fractured skin.

(c) Cure as described under Class I Repair, paragraph (c).

5. Class V Repair. Delamination in edge band extending up to 1/8 inch out from drilled holes; delaminations not extending more than 1/2 inch inward from trimmed edges and approximately 1 inch in size.

(a) Work as much resin mix as possible under Class I Repair, paragraph (c), into the discrepant area. Resin may be injected into the delaminated area along the panel edges with a hypodermic syringe and needle through holes drilled with a No. 50 drill bit. Extruded Sealing Tape placed around the needle and against the panel will force the resin throughout the delaminated area.

(b) Apply pressure, if necessary, with C-clamps or vacuum blanket. Cure per paragraph (3), under Class I Repairs.

Rain Erosion Coating Application (Radome).

Rain erosion resistant coatings shall be repaired if worn away, blistered, peeled or otherwise defective. If the area is exposed to spilled or leaked oil, use only the epoxy enamel finish described later in this paragraph. Normal rain erosion coating specifications are:

MIL-C-7439, Coating Systems, Elastomeric, Rain Erosion Resistant and Rain Erosion Resistant with Anti-static Treatment for Exterior Aircraft and Missile Plastic Parts.

The repair materials are listed below, in order of their application:

Primer: Bostick No. 1007, made by B. B. Chemical Co., Cambridge, Mass. Methyl-ethyl Ketone is a suitable thinner.

Rain Erosion Resistant Coating: consists of No. 1801C Top Coat Cement and No. 983C Accelerator. Both made by Goodyear Tire and Rubber Co., Akron, Ohio.

The above items (Primer, Top Coat Cement and Accelerator) are included in Goodyear Kit No. 23-56 for brush application. For spraying, use Kit No. 23-56S which includes No. 1803C Diluting Solvent.

Goodyear Kit No. 23-57 (brushing) or No. 23-57S (spraying) Kits differ from Nos. 23-56 and 23-56S in that they include Anti-static Surfacer Cement No. 1804C and No. 983C Accelerator.

Gaco N-79 Rain Erosion Coating Kit may be used as

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an alternate and is manufactured by Gates Engineering Co., P. O. Box 1711, Wilmington, Delaware. This kit includes N-700-9 Top Coat Cement, N-300-9 Accelerator and N-450-9 Thinner (Methyl-ethyl Ketone or Toluene may be used as alternate).

All materials must be free of lumps, separation, gelation or dry skin on the surface of liquids. Accelerators must be stirred before mixing with other materials. Allowable age, work life, standing time at drying intervals for the materials shall all be governed by the manufacturer's instructions, where given. Damaged coatings should be removed by covering the area with a cloth pad saturated with toluene and allowing it to remain for several minutes. Remove loosened material with a stiff brush or by scraping with a dull edged metal or wooden scraper. The original surface should be exposed and remnants of the old coating removed by sanding if necessary. Rough places or pits in the fiberglass should be smoothed over by use of:

Tuf-on Putty, No. P244, manufactured by Brooklyn Varnish and Mfg. Co., Brooklyn, N. Y.

When the putty is dry, sand the surface with 180 grit or finer sandpaper, wash the fiberglass surfaces at least three times with a generous amount of xylene (TT-X-916), if not available, use toluene (TT-T-548) or Trichloroethylene Military Specification MIL-T-7003. Avoid touching the surface with bare hands before applying finish. The work must be protected from dust and other contaminants during the drying periods. A sample strip should always be coated and examined before application to the aircraft parts. Apply the primer, properly thinned, to a total dried depth of 0.001 to 0.002 inch in two or three brushed coats. Allow to dry at least five minutes between coats and 20 minutes for the last coat to dry. Mix Top Coat Cement and Accelerator in the proportions of 16 parts Cement to 1.37 parts Accelerator by volume. Apply about 4 brushed coats to a total dried thickness of 0.008 to 0.012 inch. Dry each application for a period of from ten to sixty minutes before applying the next. Air bubbles may be removed by spraying lightly with equal parts of Methyl-ethyl Ketone and toluene after each coat is applied. Protect from dust and allow the final coat to cure at

room temperature until tack free. On the antenna housing only, follow with Anti-Static Surfacers Cement properly prepared by mixing with accelerator and thinning as required. Allowing a minimum of five and a maximum of 15 minutes between applications, apply three to four coats to give a total thickness of 0.001 to 0.003 inch when dry. Allow to cure to a tack free condition which requires about eight hours at room temperature or four hours if held at 65°C (149°F) ±5°C. The oil resistant coating materials are:

MIL-C-8514 Wash (Pretreatment).

O-A-396 Alcohol-Ethyl, Grade III.

No. 3725 Black Enamel Epoxy, manufactured by Andrew Brown Co., Irving, Texas.

Catalyst Thinner for No. 3725 Black Enamel Epoxy, manufactured by Andrew Brown Co., Irving, Texas.

Prepare the surface as described above. Mix the Wash Primer by mixing one part of acid additive (supplied with primer) to four parts of the base primer. Thin as necessary by adding a maximum of 1 part of the Alcohol to 5 parts of well-stirred acidulated primer and again stirring. Brush or spray one coat to a cured film thickness of 0.0002 to 0.0003 inch. Allow not less than one hour nor more than four hours drying time before applying next material. The basic Epoxy Enamel and Catalyst Thinner are stirred, then mixed in equal parts and stirred well again. The mixture must then be tightly sealed and stored for one hour at 27°C (80°F). It must not be thinned or thickened but shall be discarded if not suitable for use. The mixture must be used within 24 hours or discarded. Apply in three spray coats, allowing 20 minutes between coats. For a smooth surface, sand with very fine abrasive when dry, between coats. Elevated temperature drying for 15 minutes at approximately 49°C (120°F) is permissible.

NOTE

In case of conflict between the above instructions and those supplied by the repair materials manufacturer, the latter will take precedence.

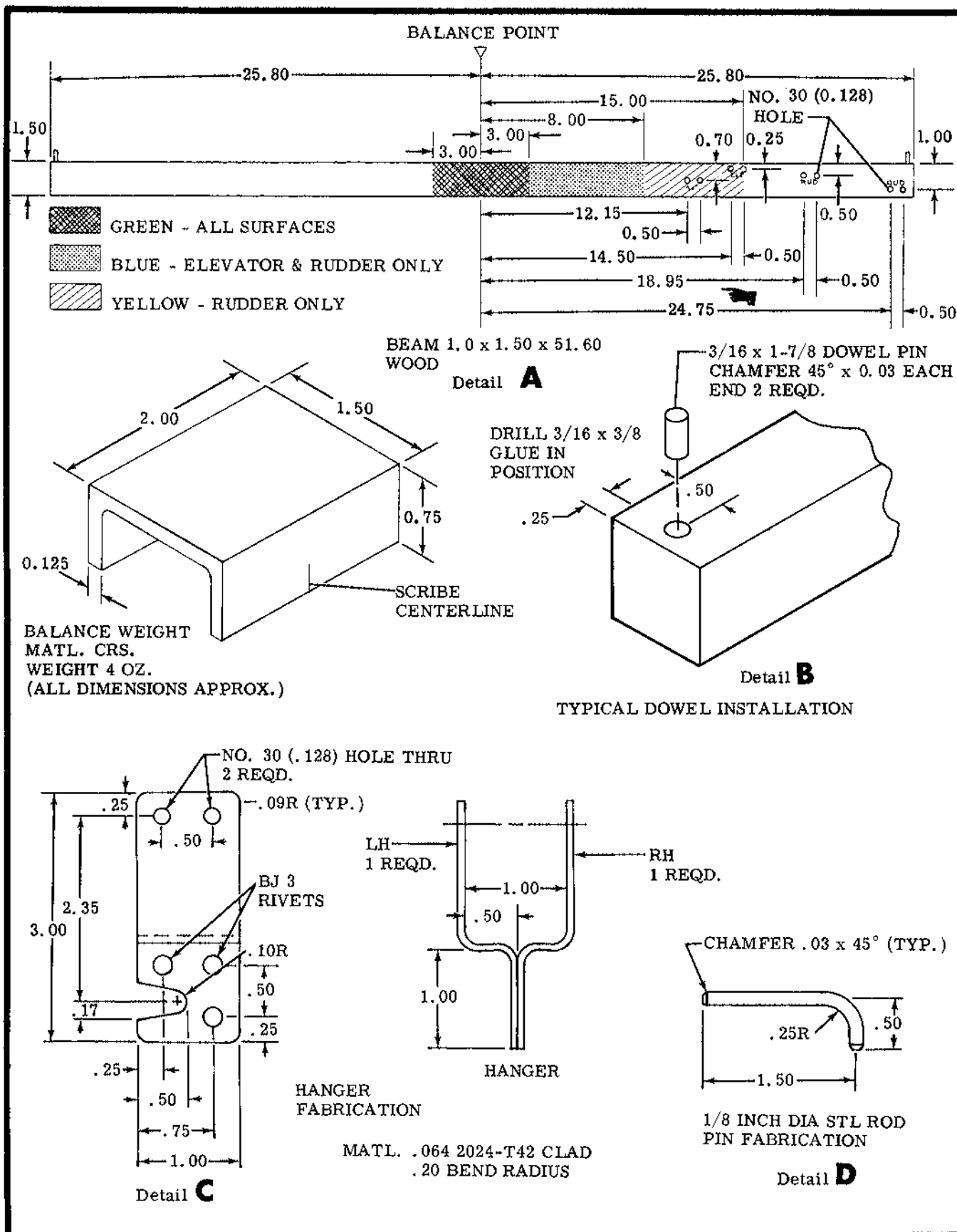
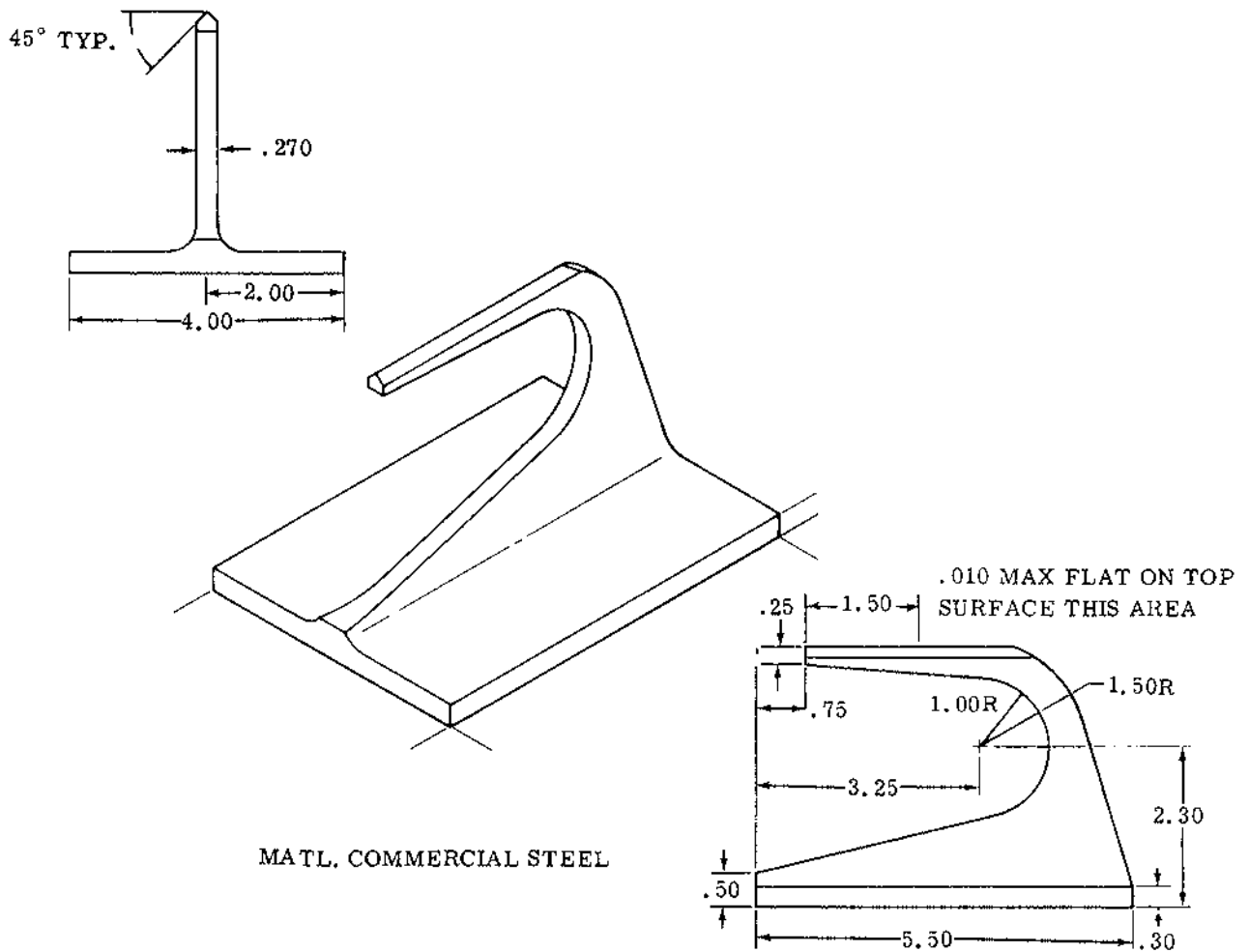


Figure 16-8. Balancing Fixture Fabrication. (Sheet 1 of 2)



FABRICATION OF BALANCE FIXTURE.

Beam.

- Fabricate beam from wood (yellow pine) or equivalent, one by one and one-half inch stock.
- Locate center of beam. (Should be 25.80 inches from end.)
- Locate and drill $3/16$ (.1875) x $3/8$ (.375) holes .25 in from each end of beam.
- (See Detail B.) Fabricate dowel and install in beam using glue for security.
- Measuring from the center point of beam or 25.80 inch station, locate and drill No. 30 (.128) diameter holes for aileron, elevator and rudder hanger locations.
- Mark off and paint the beam as indicated for aileron, rudder and elevator positions.

Hanger.

- Fabricate right and left hanger halves per Detail C.

- Assemble the hanger using three MS20470AD3-5 rivets.

Pin.

- Fabricate pin from $1/8$ stl. rod per Detail D.

Balance Weight.

- Fabricate balance weight per Detail A.

NOTE

If necessary, grind or file balance weight to obtain four (4) ounce weight. Scribe center-line after fabrication.

Mandrel.

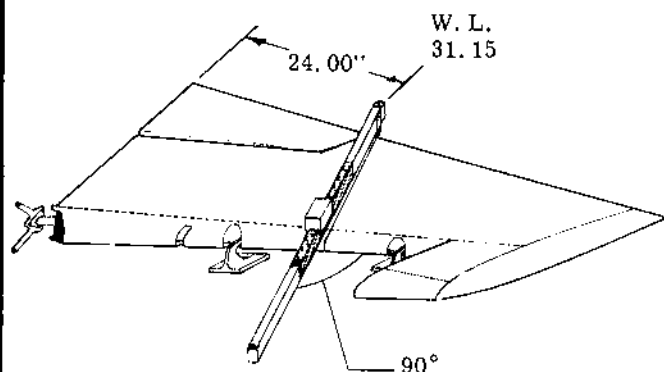
- Fabricate mandrel in accordance with Detail E.

NOTE

Mandrel may be fabricated from any suitable material.

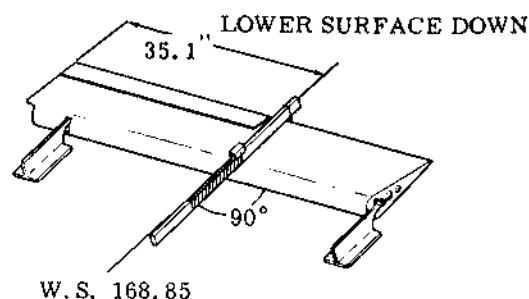
Figure 16-8. Balancing Fixture Fabrication. (Sheet 2 of 2)

LEFT-HAND SIDE SURFACE DOWN



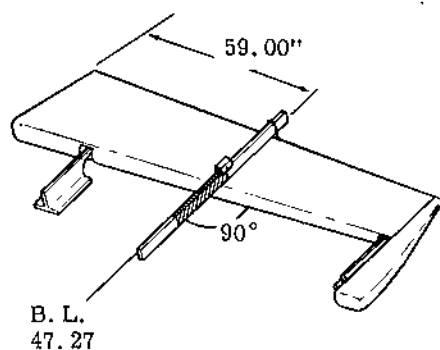
RUDDER:

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

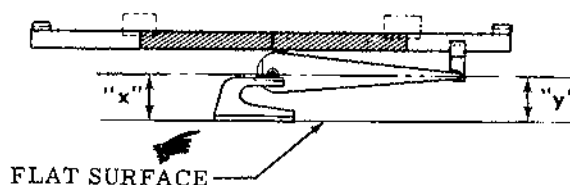


AILERON:

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



LOWER SURFACE DOWN



TYPICAL BALANCED CONTROL

ELEVATOR:

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

NOTE

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

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

NOTE:

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

Figure 16-9. Static Balancing Aileron, Rudder and Elevator (Sheet 1 of 4)

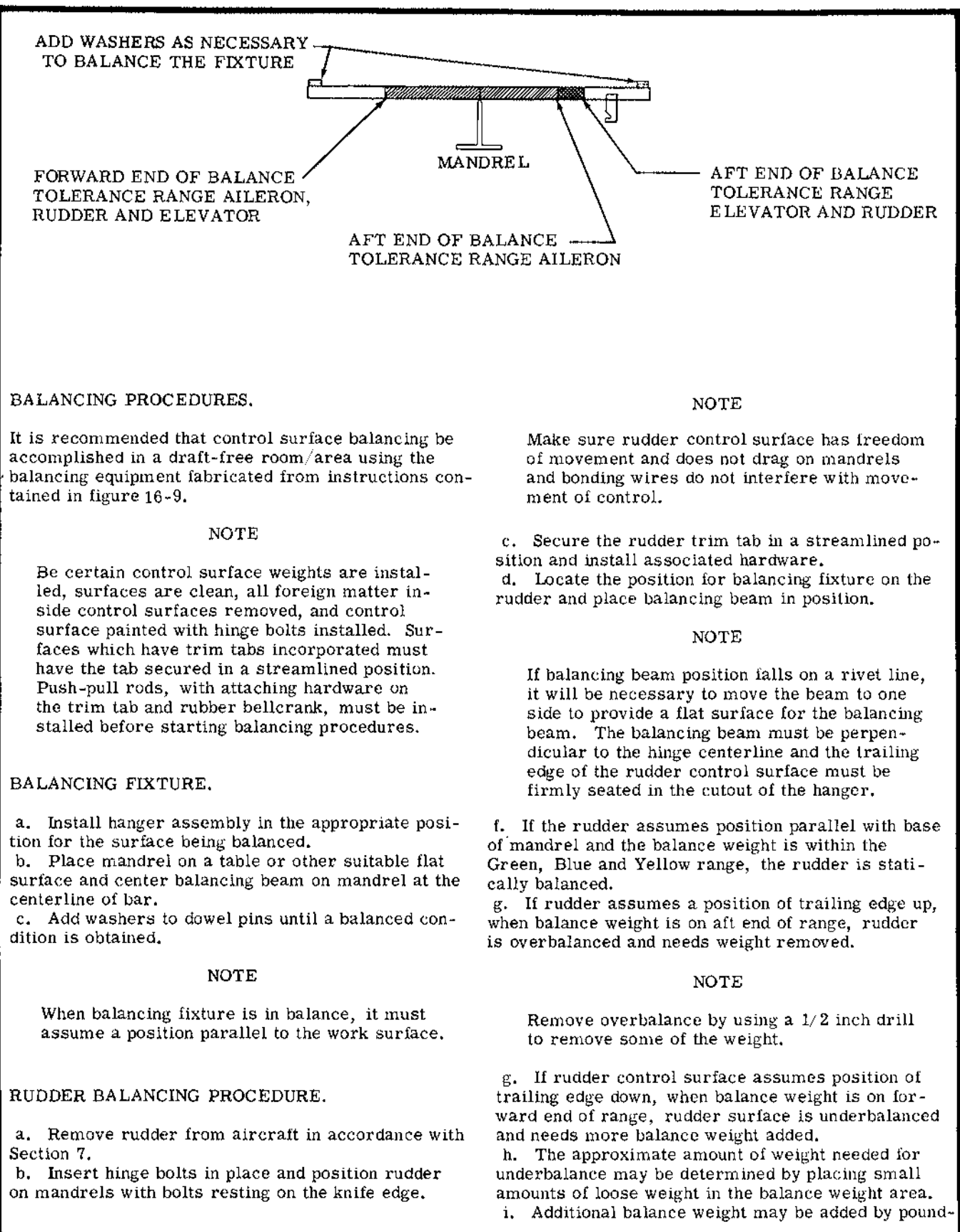


Figure 16-9. Static Balancing Aileron, Rudder and Elevator (Sheet 2 of 4)

ing lead into existing holes of weight and staking. If holes are not available to insert added weight, it will be necessary to add 2 nutplates on each side of lightening hole and add a lead bar weight secured by two bolts.

NOTE

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

- j. Install rudder in accordance with Section 7.

AILERON BALANCING PROCEDURE.

- a. Remove aileron from aircraft in accordance with Section 5. (The outboard hinge is a pin.)
- b. Balance the fixture for aileron control surface.
- c. Insert hinge bolt in place and position aileron on the mandrels with bolt and pin resting on the knife edge.

CAUTION

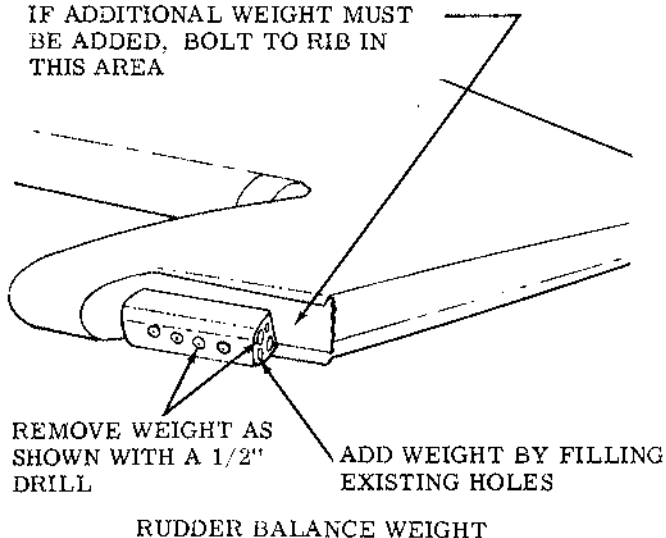
Be sure bolt is inserted in correct hinge location (upper hole).

NOTE

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

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

IF ADDITIONAL WEIGHT MUST BE ADDED, BOLT TO RIB IN THIS AREA



RUDDER BALANCE WEIGHT

NOTE

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

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

NOTE

Remove overbalance by removing weight as necessary.

- h. If the aileron assumes position of trailing edge down, when balance weight is on forward end of range, aileron is underbalanced and needs more balance weight added.

- i. The approximate amount of weight needed for underbalance may be determined by placing small amounts of loose weight in the balance weight area.

- j. Addition of balance weight may be added by inserting lead into existing holes of the weight. If holes are not available additional weight may be added by removing existing screws and installing longer screws to attach added weight.

NOTE

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

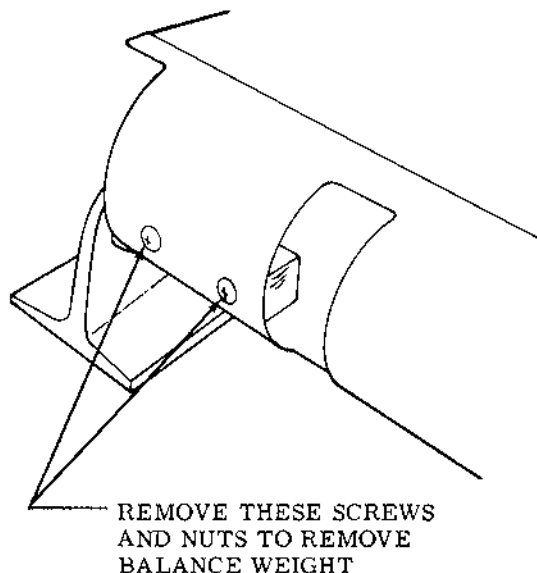


Figure 16-9. Static Balancing Aileron, Rudder and Elevator (Sheet 3 of 4)

CAUTION

Make certain bolts securing weight in place are tight before installing aileron on aircraft.

- k. Install aileron in accordance with Section 5.

ELEVATOR BALANCING PROCEDURE.

- a. Remove elevator in accordance with Section 6.
- b. Balance the fixture for elevator control surface.
- c. Insert hinge bolts in place and position elevator on the mandrels with bolts resting on the knife edge.

NOTE

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

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

NOTE

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

- f. If the elevator assumes a position parallel with base of mandrel, and the balance weight is within the Green and Blue range, the elevator is statically balanced.

- g. If the elevator assumes a position of trailing edge up, when balance weight is on aft end of range, elevator is overbalanced and needs weight removed.

NOTE

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

- h. If the elevator assumes position of trailing edge down, when balance weight is on forward end of range, elevator is underbalanced and needs more balance weight added.

- i. The approximate amount of weight needed for underbalance may be determined by placing small amounts of loose weight in the balance weight area.
- j. Additional balance weight may be added by inserting lead in existing holes of the weight. If holes are not available, additional weight may be added by bolting a lead bar in the center of existing weight.

NOTE

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

- k. Install elevator in accordance with Section 6.

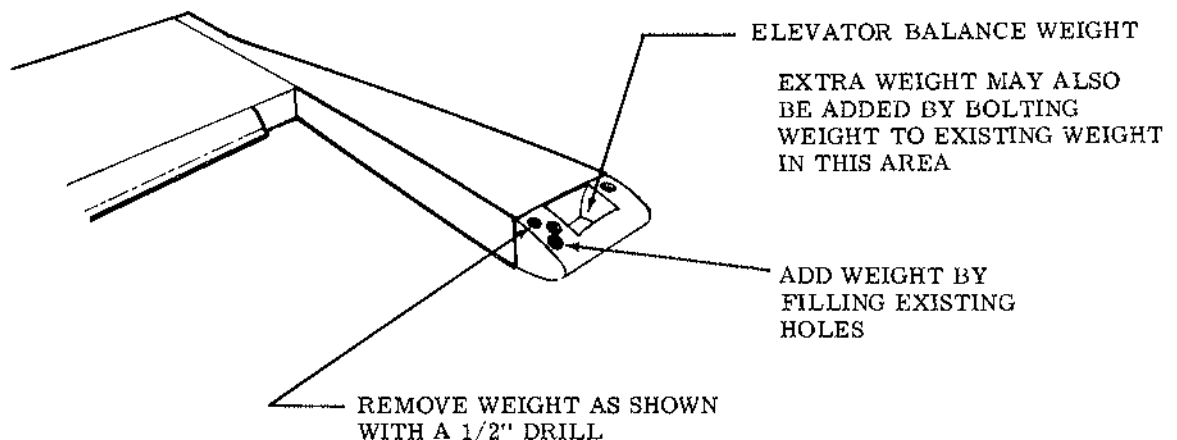


Figure 16-9. Static Balancing Aileron, Rudder and Elevator (Sheet 4 of 4)

1. FIBERGLASS	7. .040 INCH 2024 T42 ALCLAD
2. .016 INCH 2024 T3 ALCLAD	8. .020 INCH 2024 T3 ALCLAD
3. .025 INCH 2024 T3 ALCLAD	9. .040 INCH 2024 T3 ALCLAD
4. .025 INCH 2024 T42 ALCLAD	10. HONEYCOMB
5. .032 INCH 2024 T3 ALCLAD	11. .020 INCH 2024 T42 ALCLAD
6. .032 INCH 2024 T42 ALCLAD	

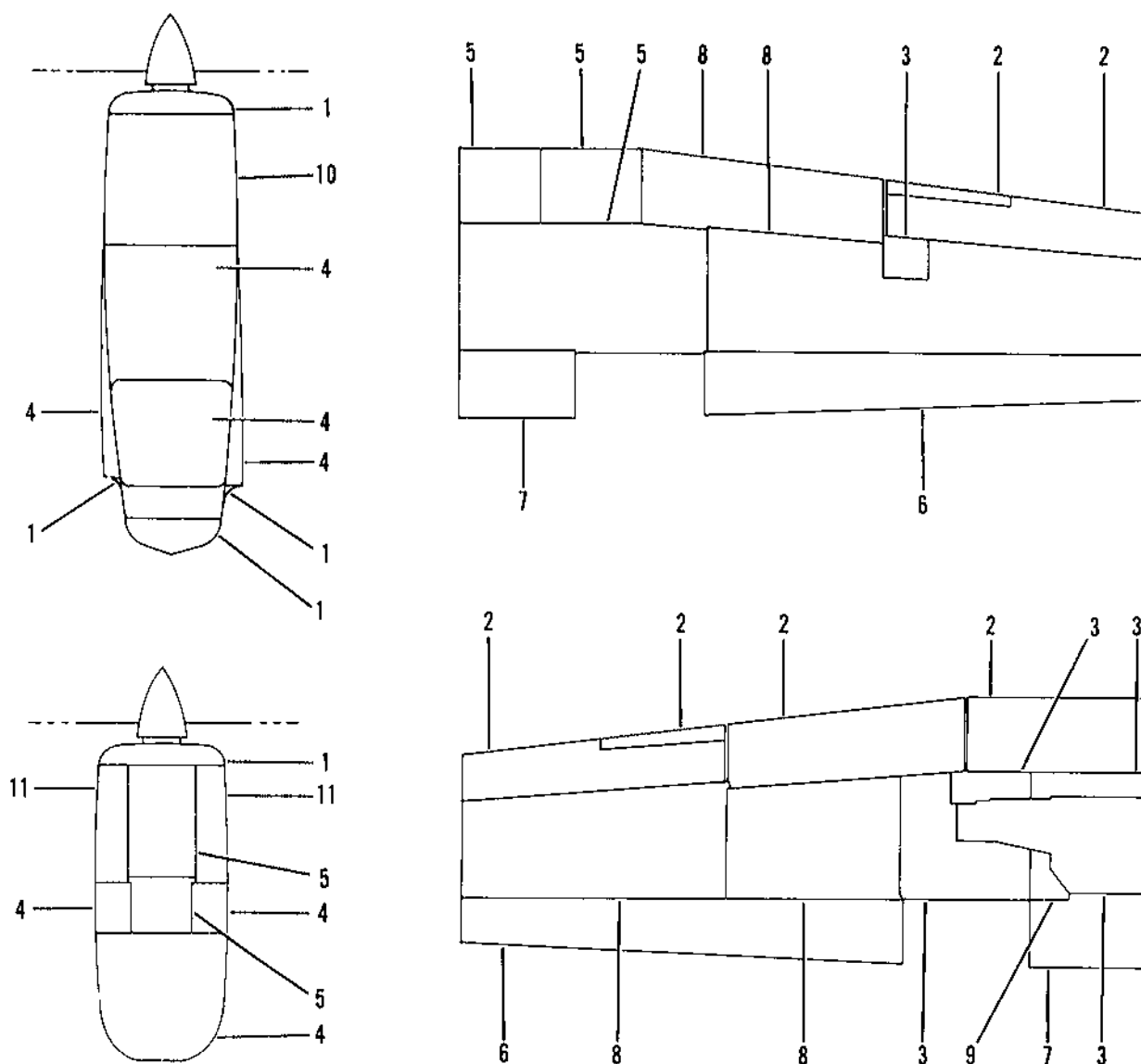


Figure 16-10. Wing Skin

1. .016 INCH 2024 T3 ALCLAD	7. FIBERGLASS
2. .025 INCH 2024 T42 ALCLAD	8. .050 INCH 2024 T42 ALCLAD
3. .032 INCH 2024 T3 ALCLAD	9. .063 INCH 2024 T42 ALCLAD
4. .032 INCH 2024 T4 ALCLAD	10. .080 INCH 2024 T42 ALCLAD
5. .032 INCH 2024 T42 ALCLAD	11. POLY-CARB
6. .040 INCH 2024 T3 ALCLAD	12. ROYALITE

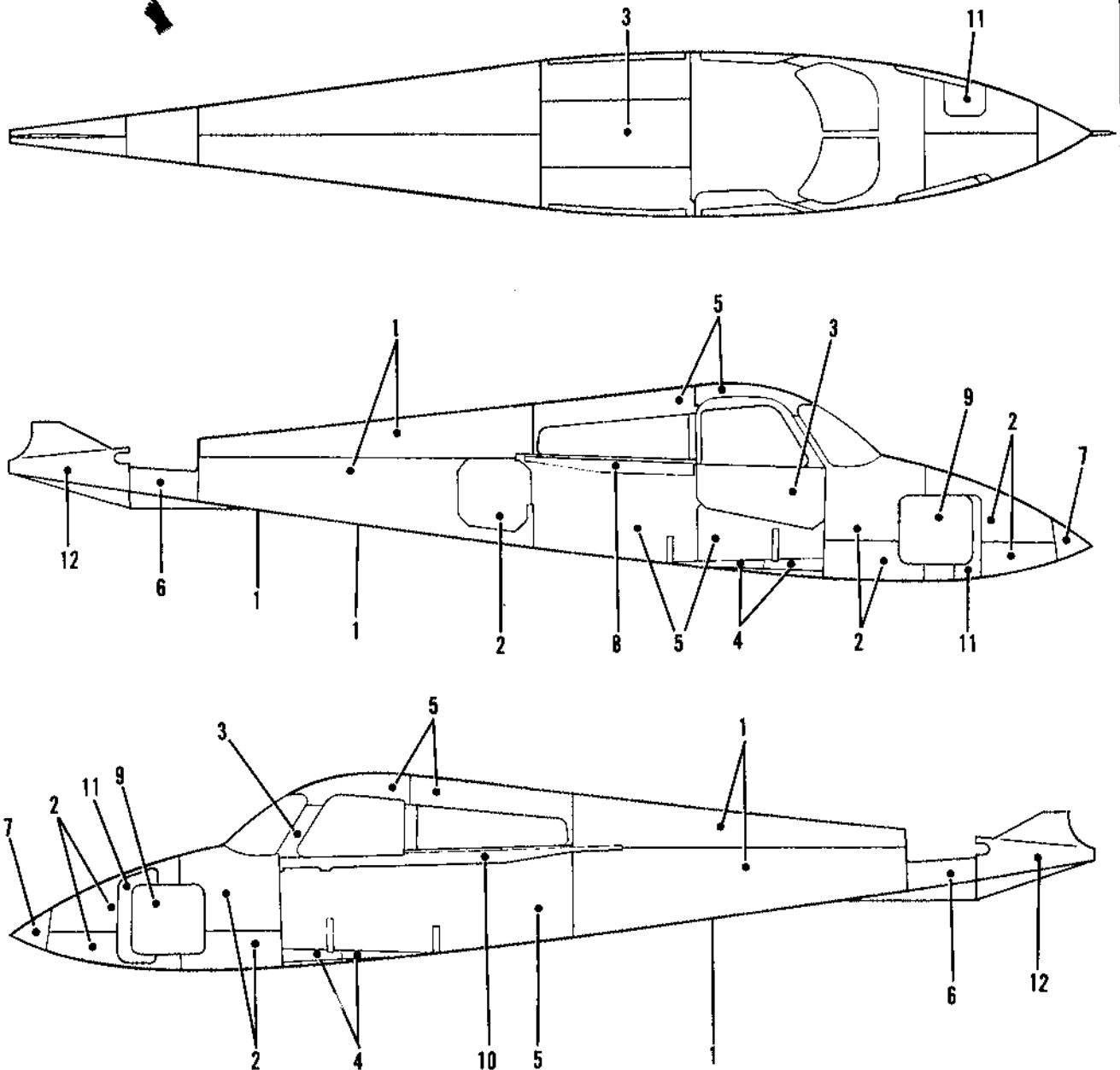
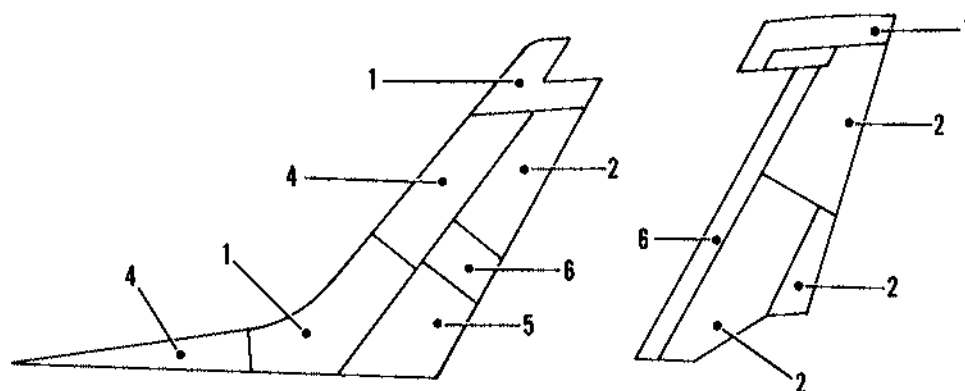
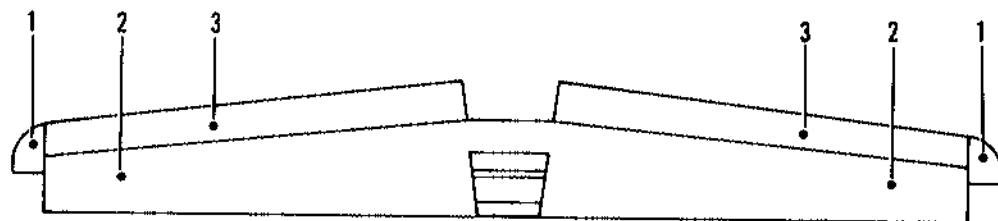


Figure 16-11. Fuselage Skin

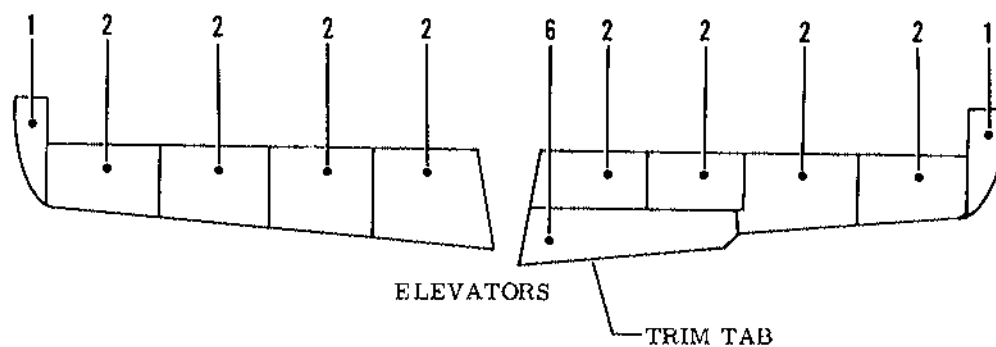
1. FIBERGLASS
2. .016 INCH 2024 T3 ALCLAD
3. .025 INCH 2024 T3 ALCLAD
4. .025 INCH 2024 T42 ALCLAD
5. .032 INCH 2024 T3 ALCLAD
6. .020 INCH 2024 T3 ALCLAD



VERTICAL FIN AND RUDDER



HORIZONTAL STABILIZER



ELEVATORS

TRIM TAB

Figure 16-12. Empennage Skin

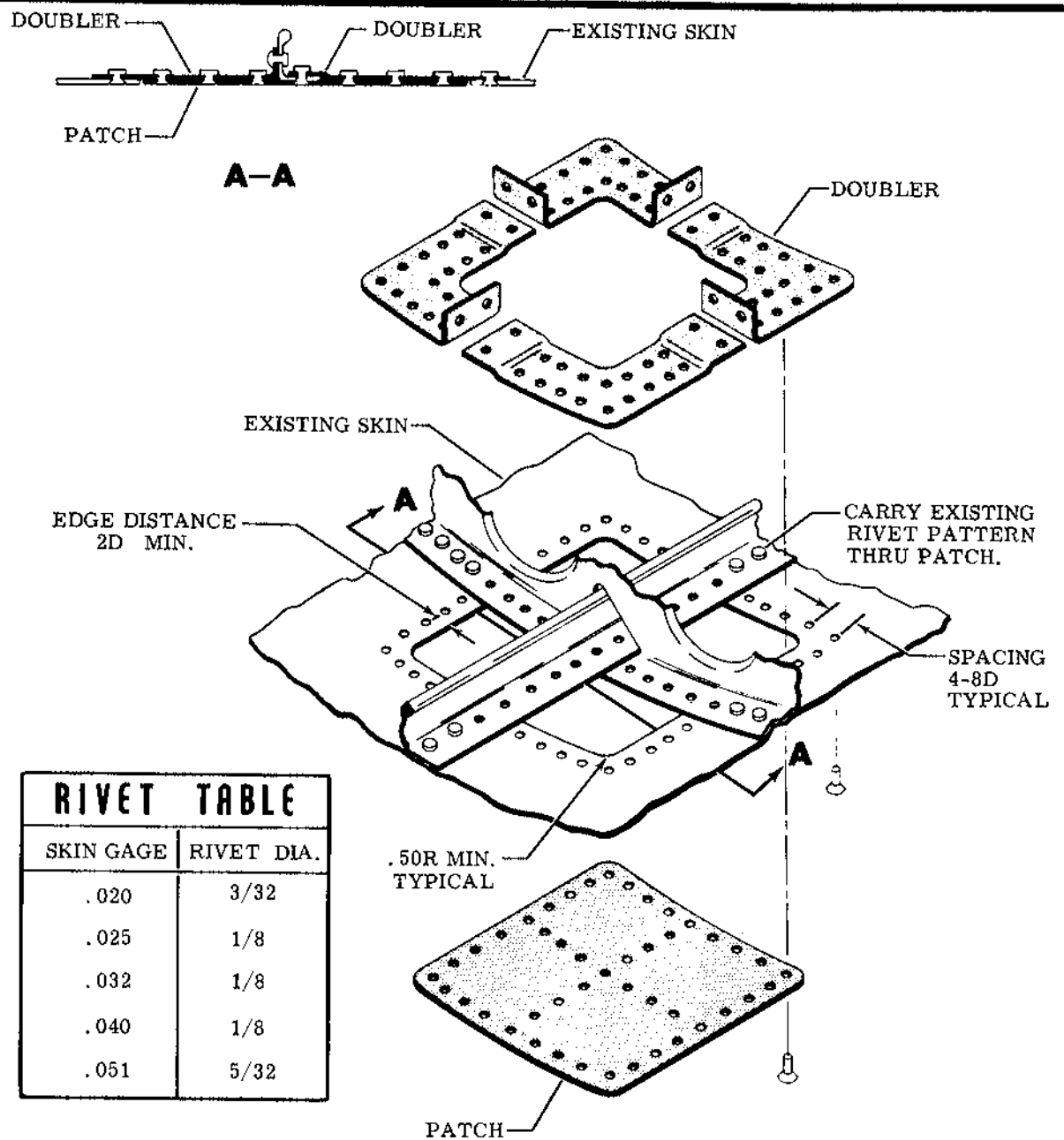


Figure 16-13. Typical Over-Structure Skin Repair (Sheet 1 of 2)

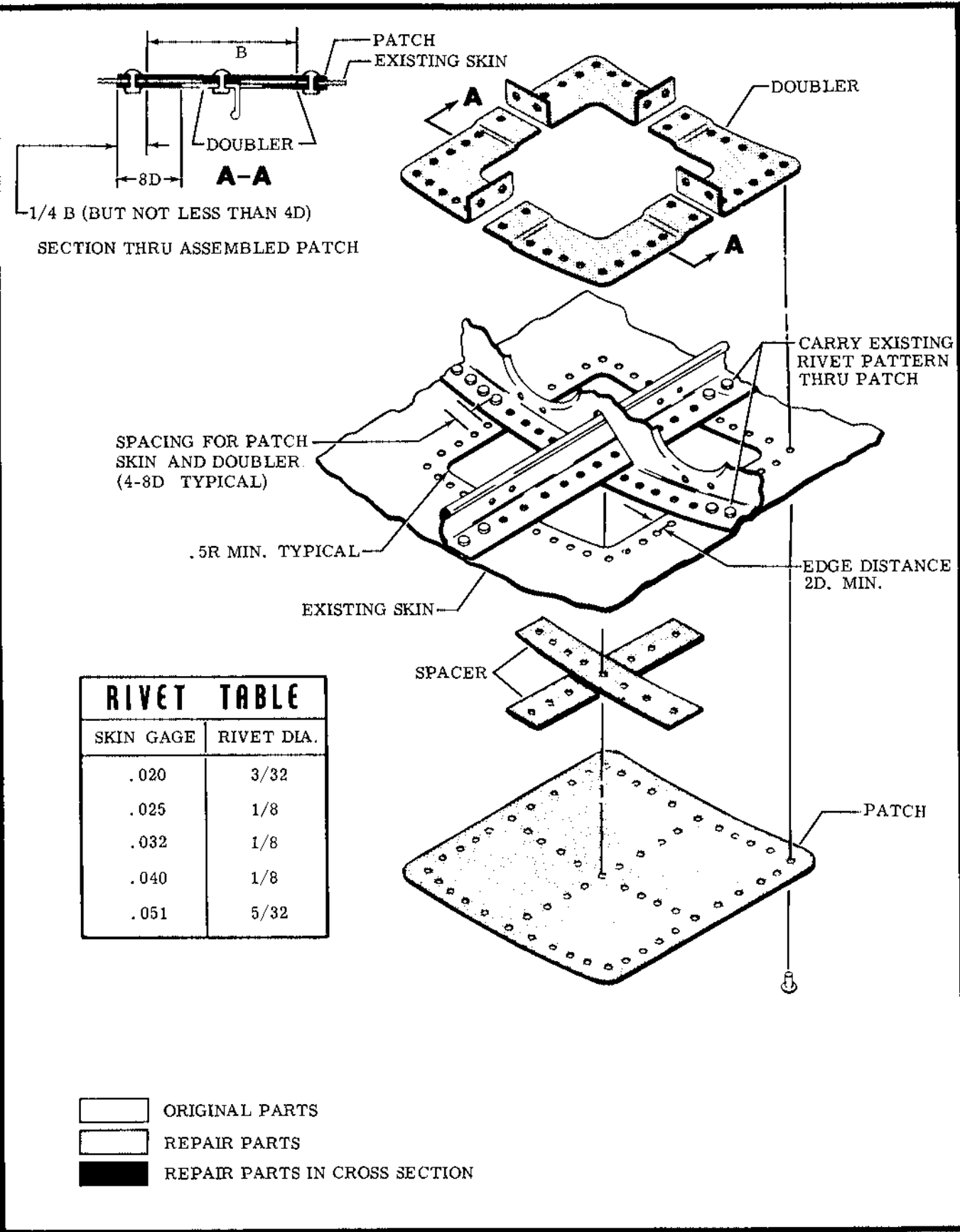
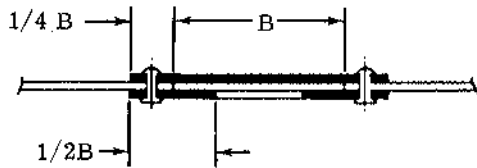
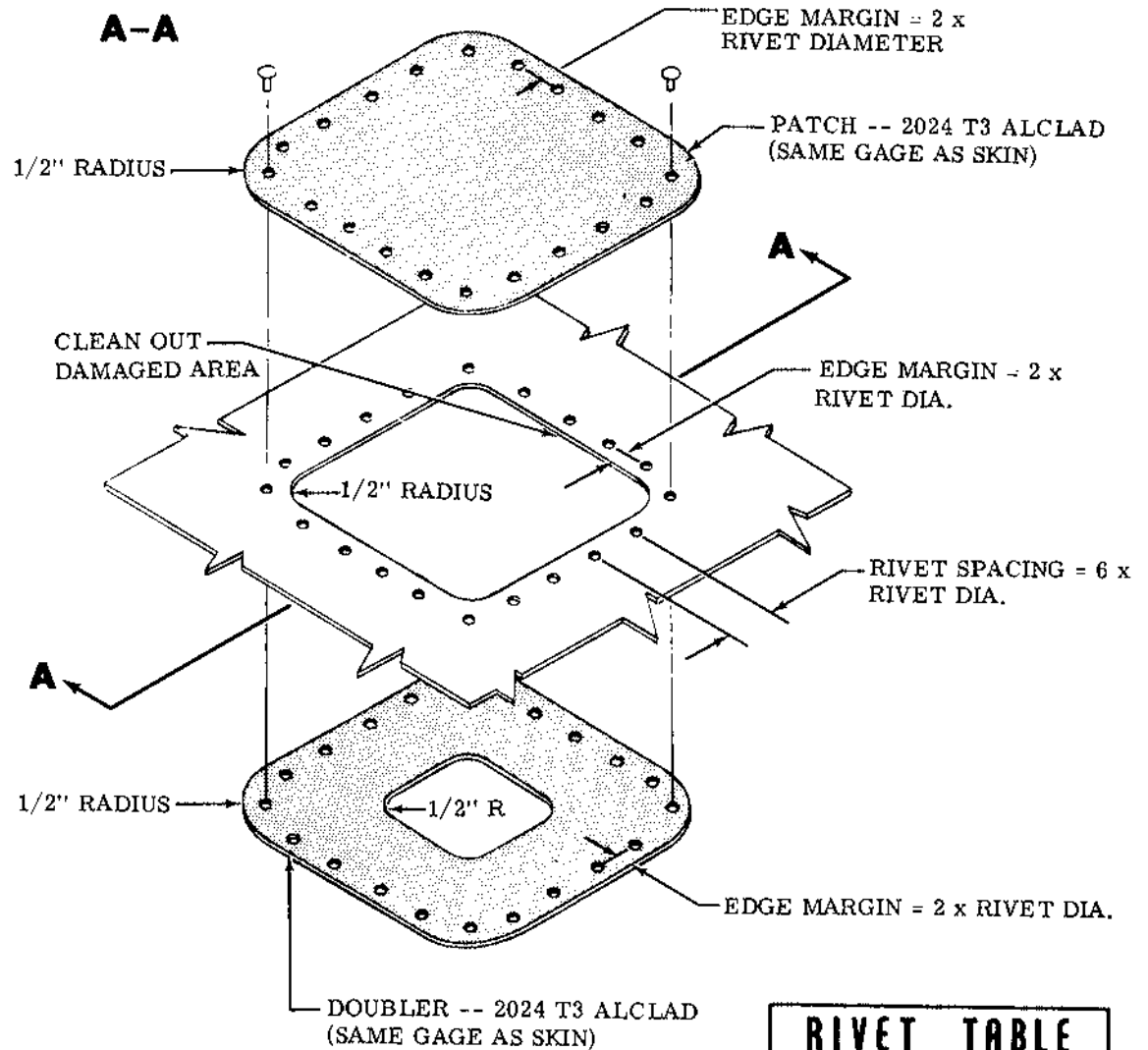


Figure 16-13. Typical Over-Structure Skin Repair (Sheet 2 of 2)



SECTION THRU ASSEMBLED PATCH



-  ORIGINAL PARTS
 REPAIR PARTS
 REPAIR PARTS IN CROSS SECTION

RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	3/32
.025	1/8
.032	1/8
.040	1/8
.051	5/32

Figure 16-14. Typical Clear-of-Structure Skin Repair

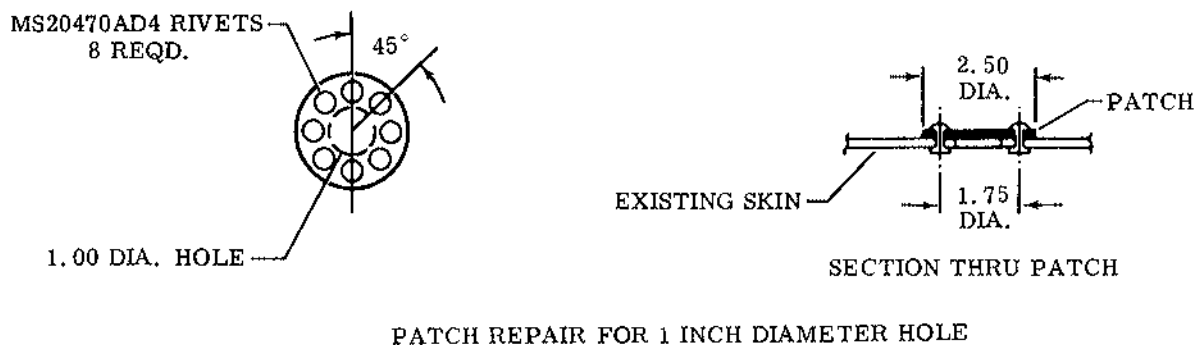
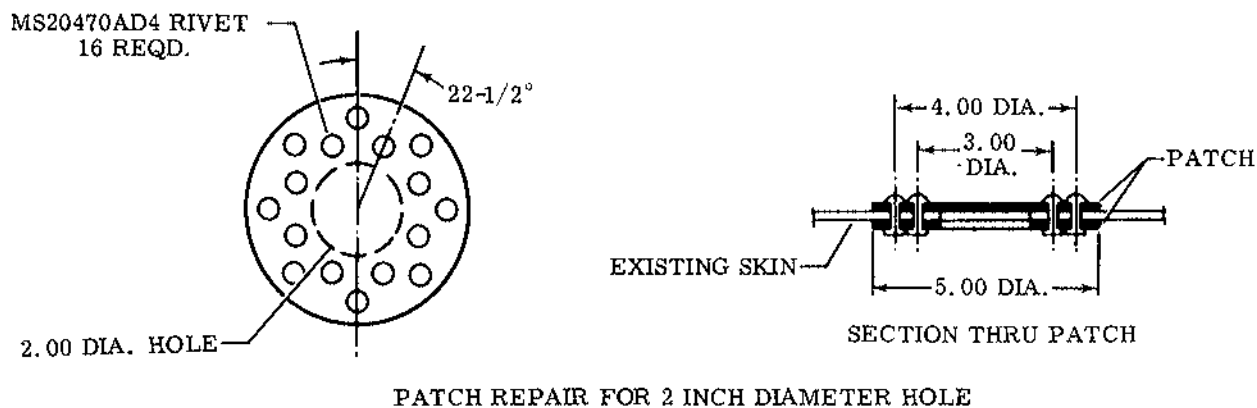
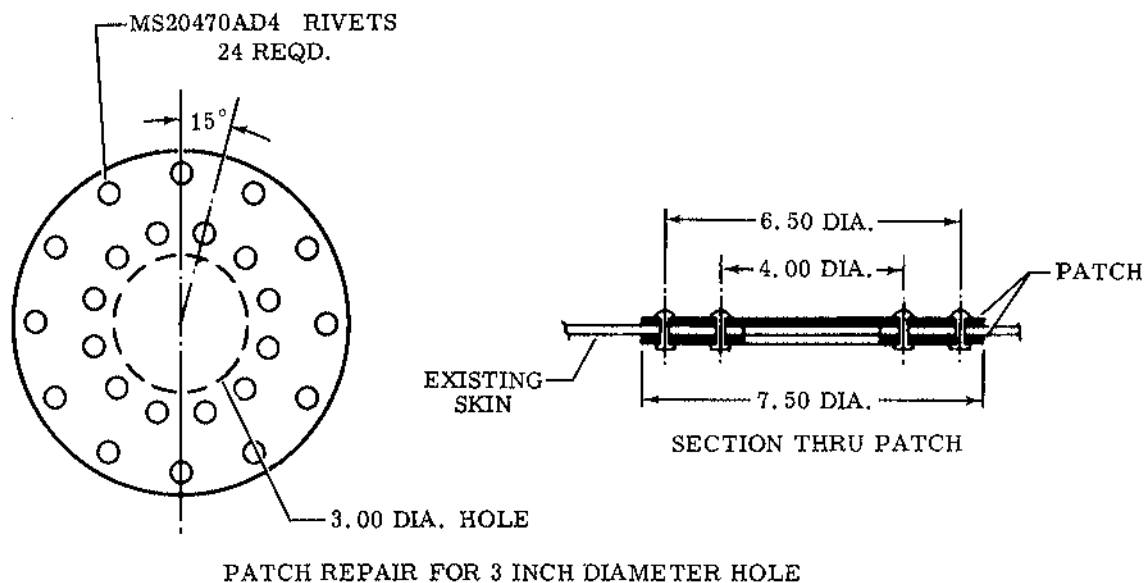
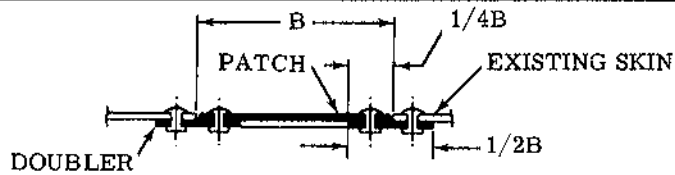


Figure 16-15. Typical Patch Repair of Circular Holes



SECTION THRU ASSEMBLED PATCH

A--A

RIVET TABLE	
SKIN GAGE	RIVET DIA.
.020	3/32
.025	1/8
.032	1/8
.040	1/8
.051	5/32

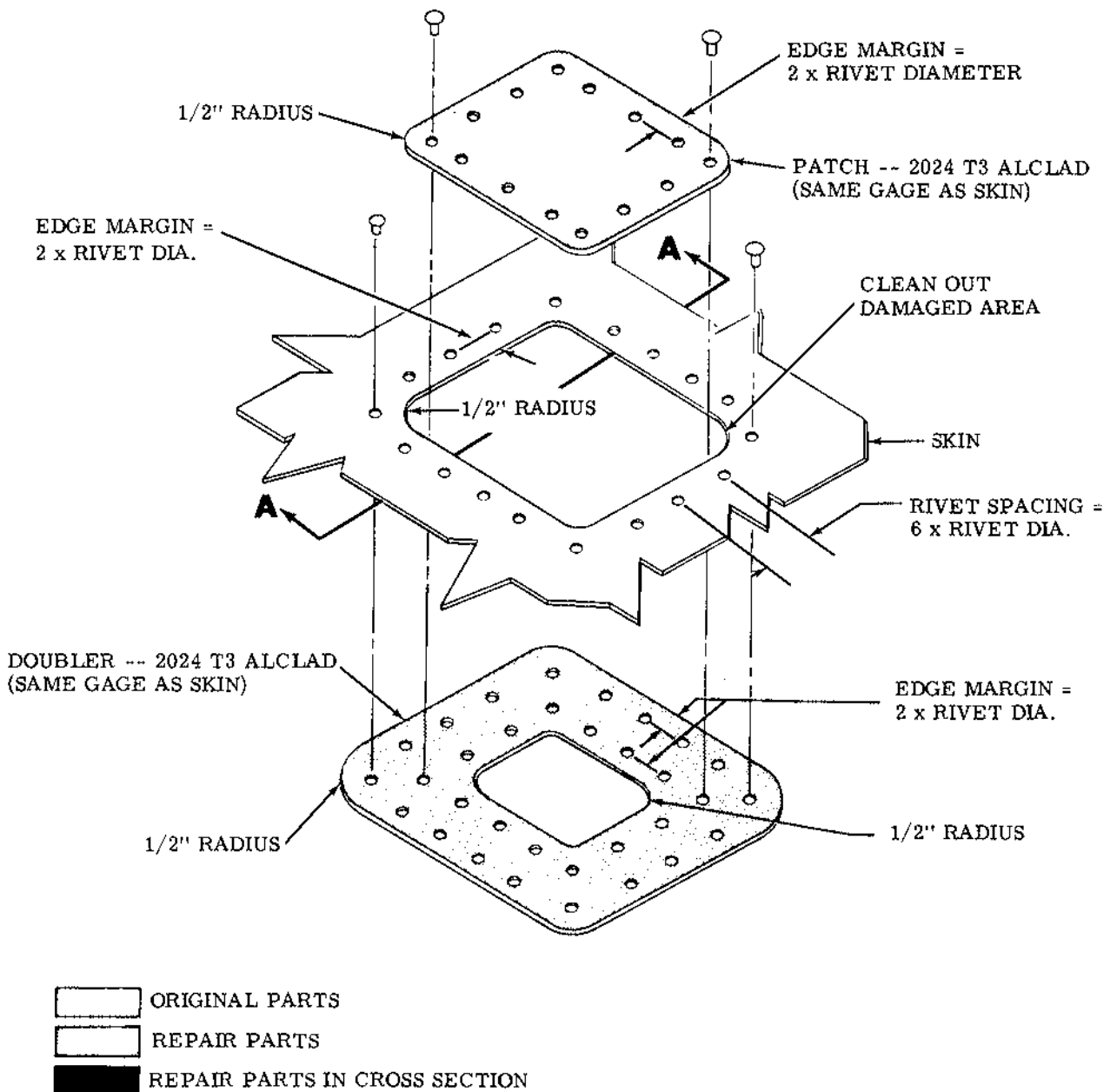


Figure 16-16. Typical Insert Patch

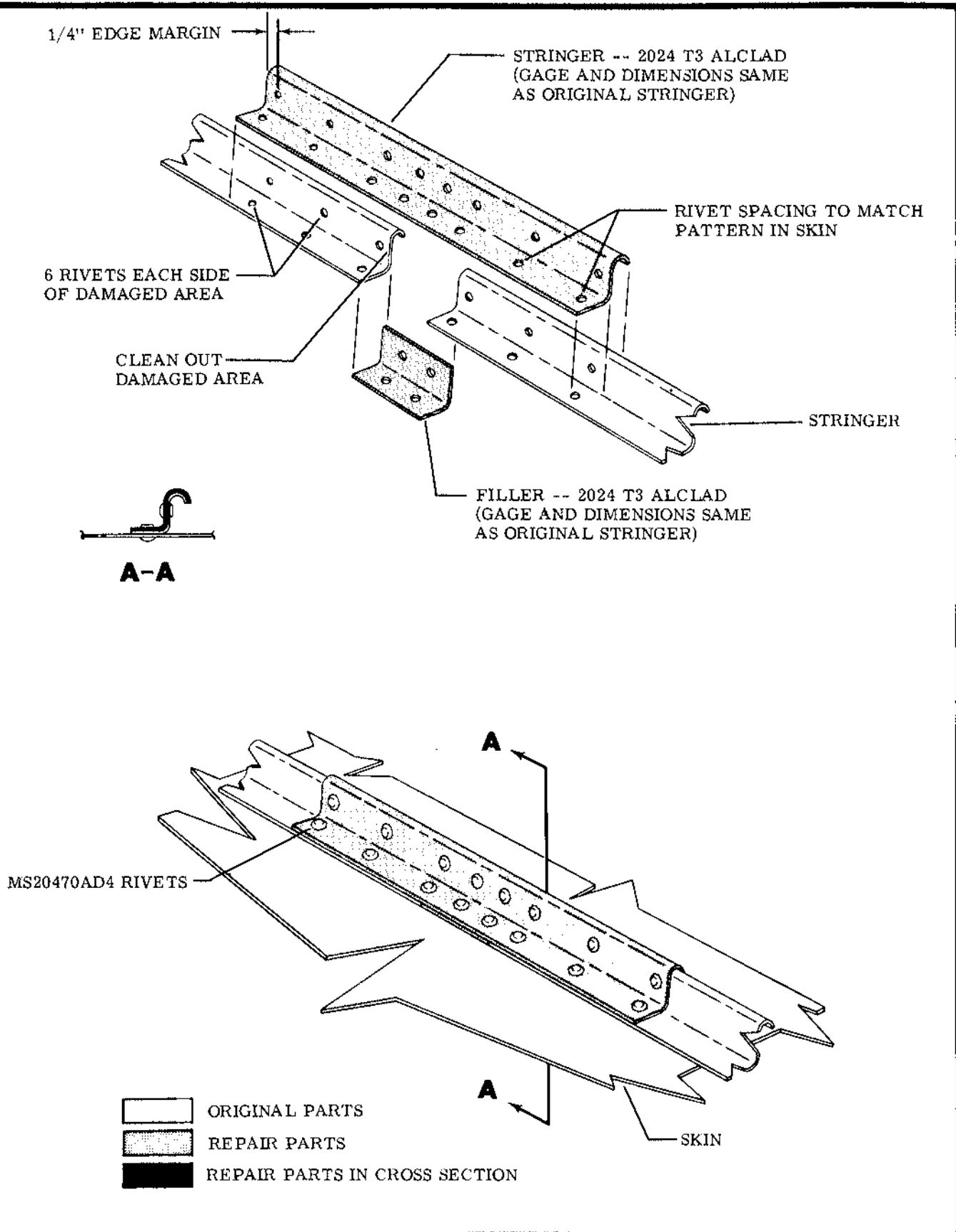


Figure 16-17. Typical Fuselage Stringer Repair (Sheet 1 of 2)

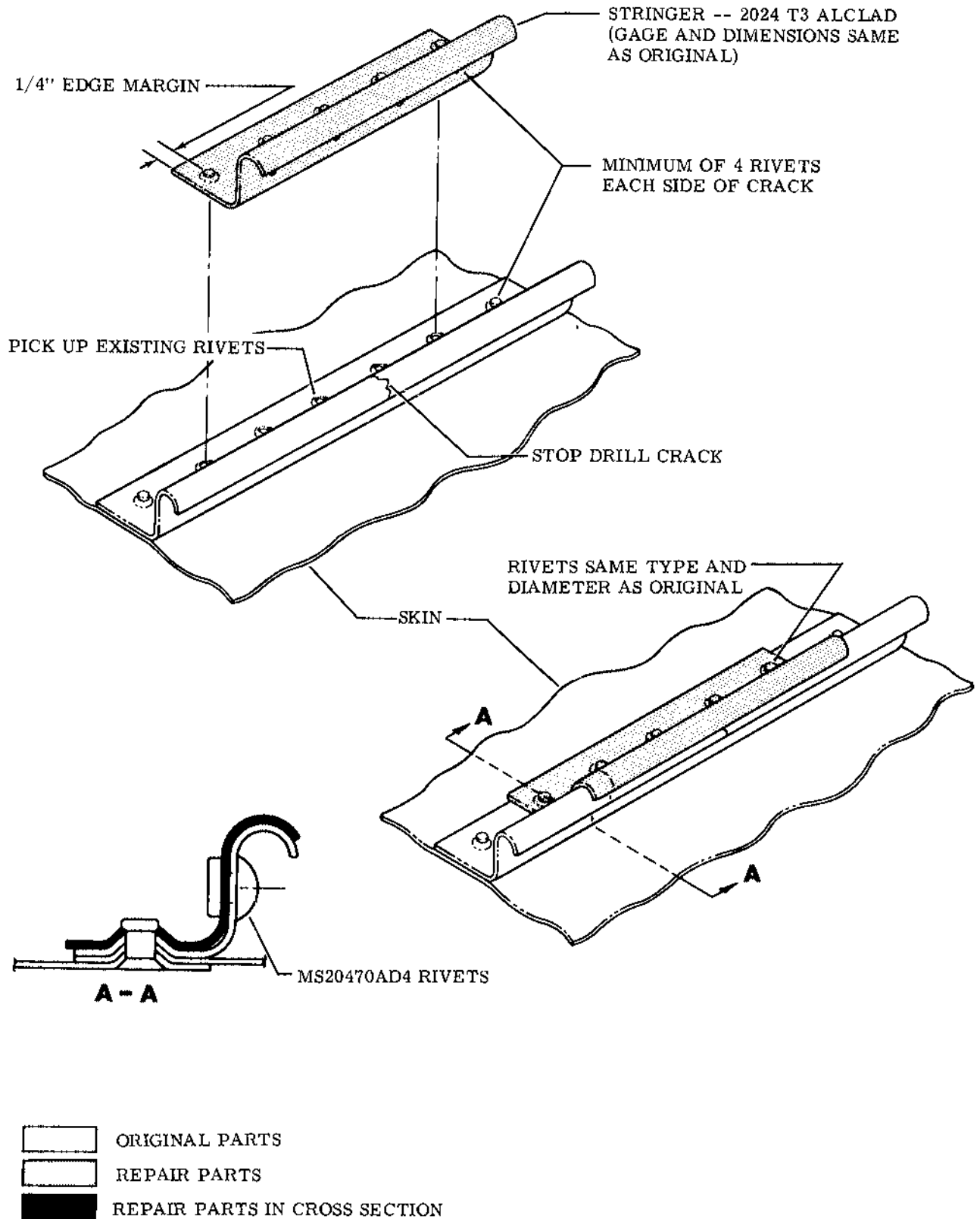


Figure 16-17. Typical Fuselage Stringer Repair (Sheet 2 of 2)

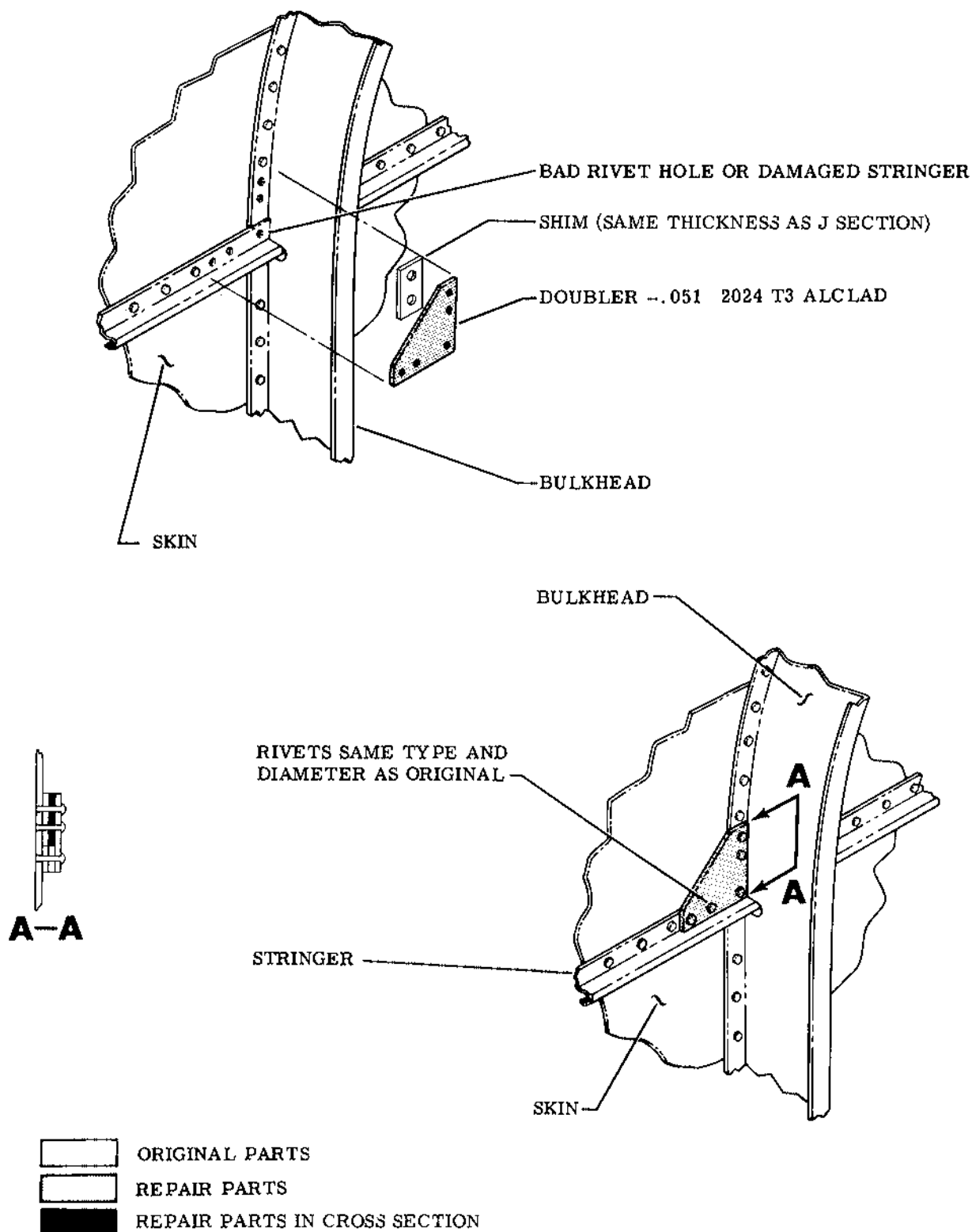


Figure 16-18. Typical Stringer to Bulkhead Repair

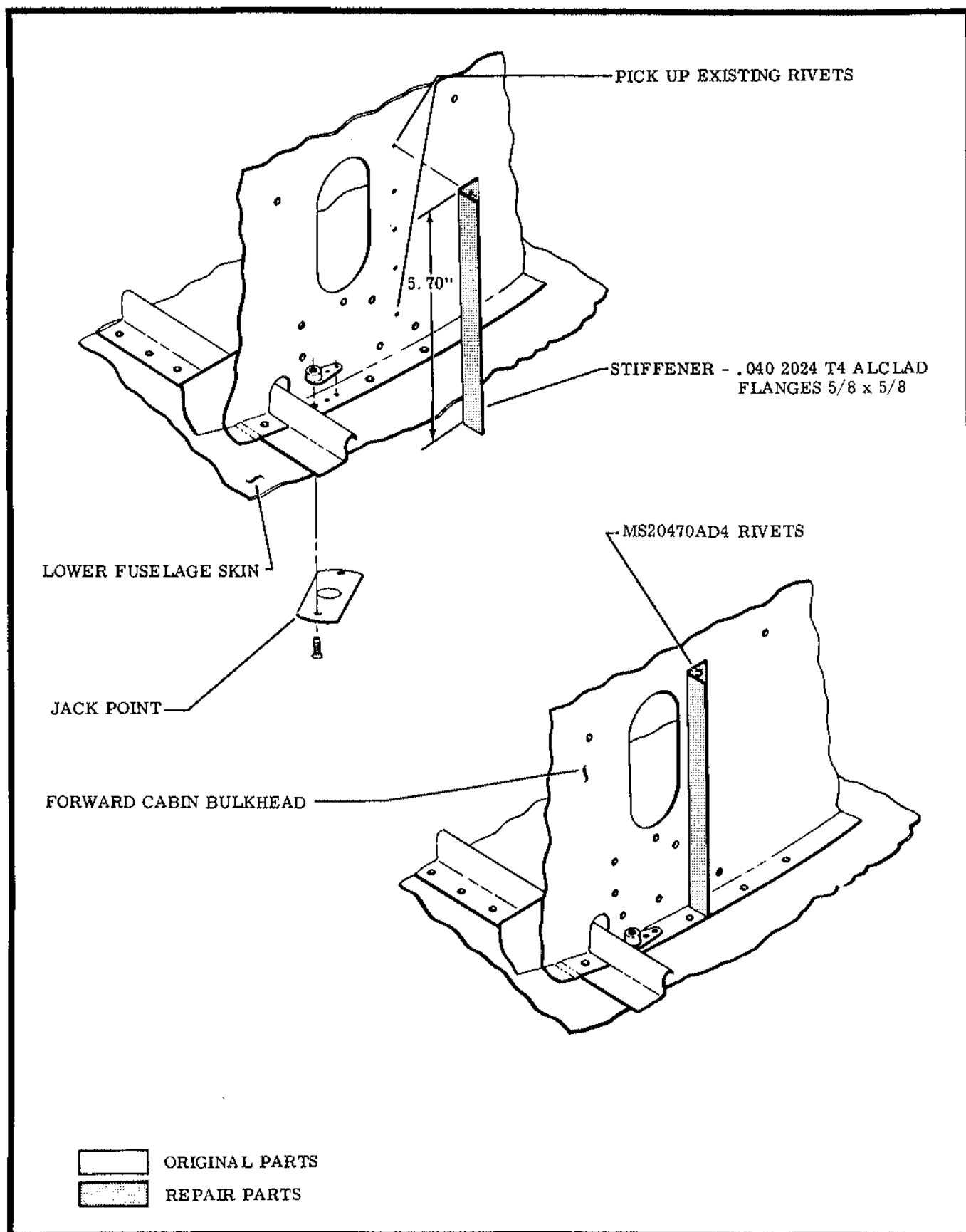


Figure 16-19. Typical Jacking Point Reinforcement (Sheet 1 of 2)

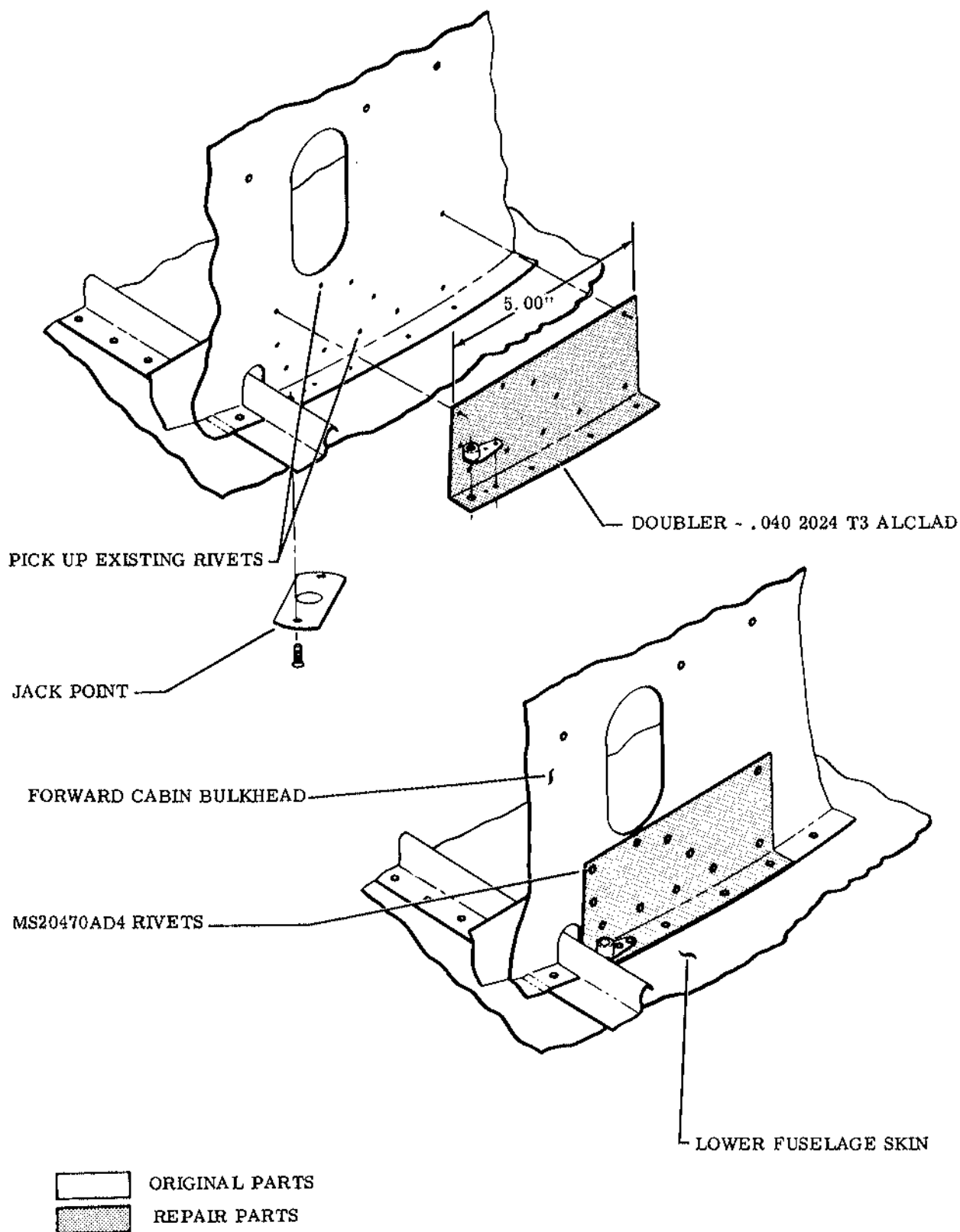


Figure 16-19. Typical Jacking Point Reinforcement (Sheet 2 of 2)

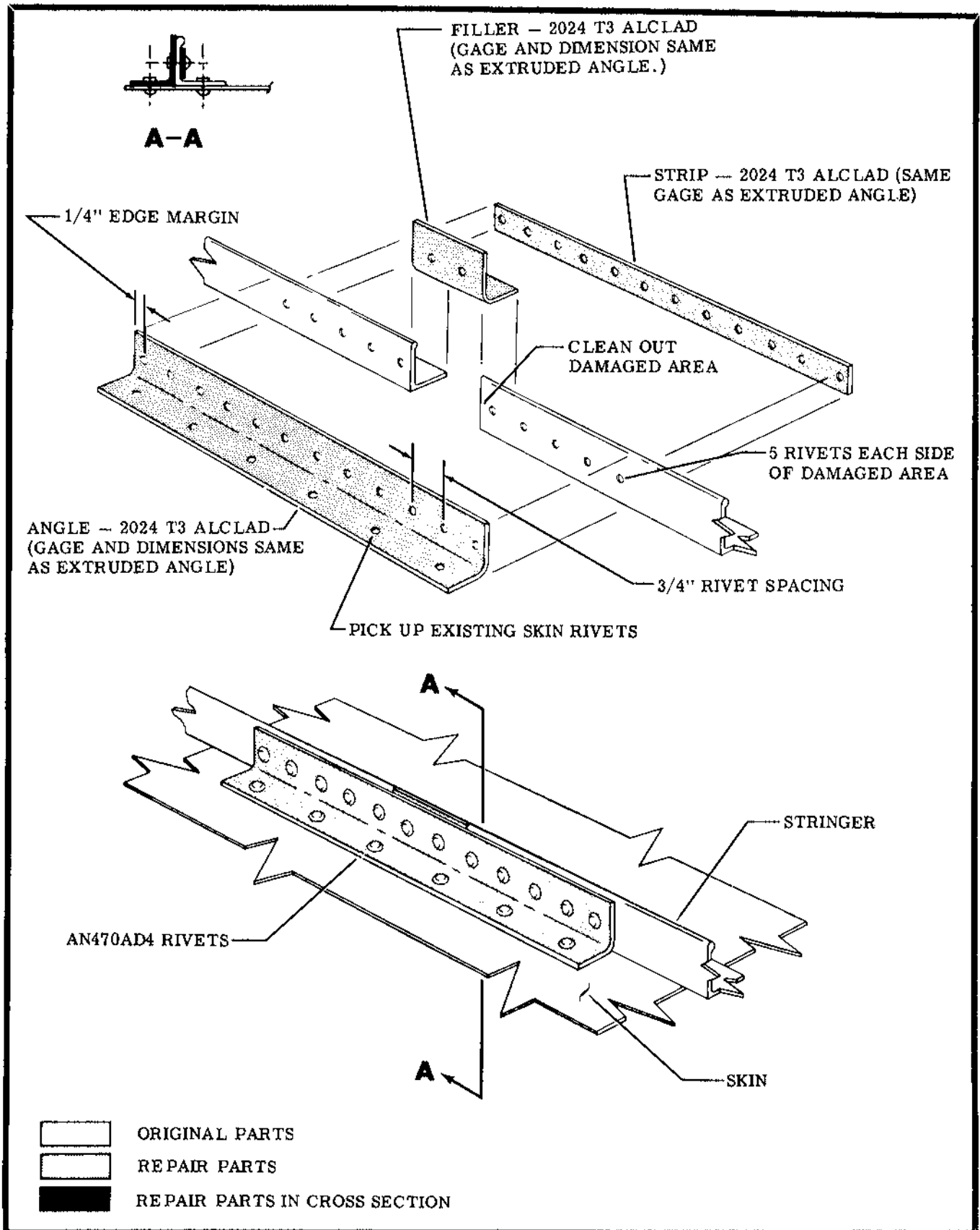
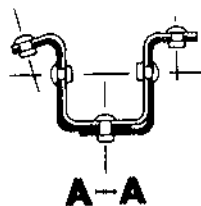


Figure 16-20. Typical Stringer Repair

FILLER--2024 T3 (SAME GAGE AND DIMENSIONS AS ORIGINAL)



CLEAN OUT DAMAGED AREA

HAT SECTION

1/4" EDGE MARGIN

DOUBLERS--2024 T3
(SAME GAGE AND
DIMENSION AS ORIGINAL)

3/4" RIVET SPACING

25 RIVETS EACH SIDE
OF DAMAGED AREA

MS20470AD4 RIVET



ORIGINAL PARTS

REPAIR PARTS

REPAIR PARTS IN CROSS SECTION

Figure 16-21. Typical Hat Section Repair

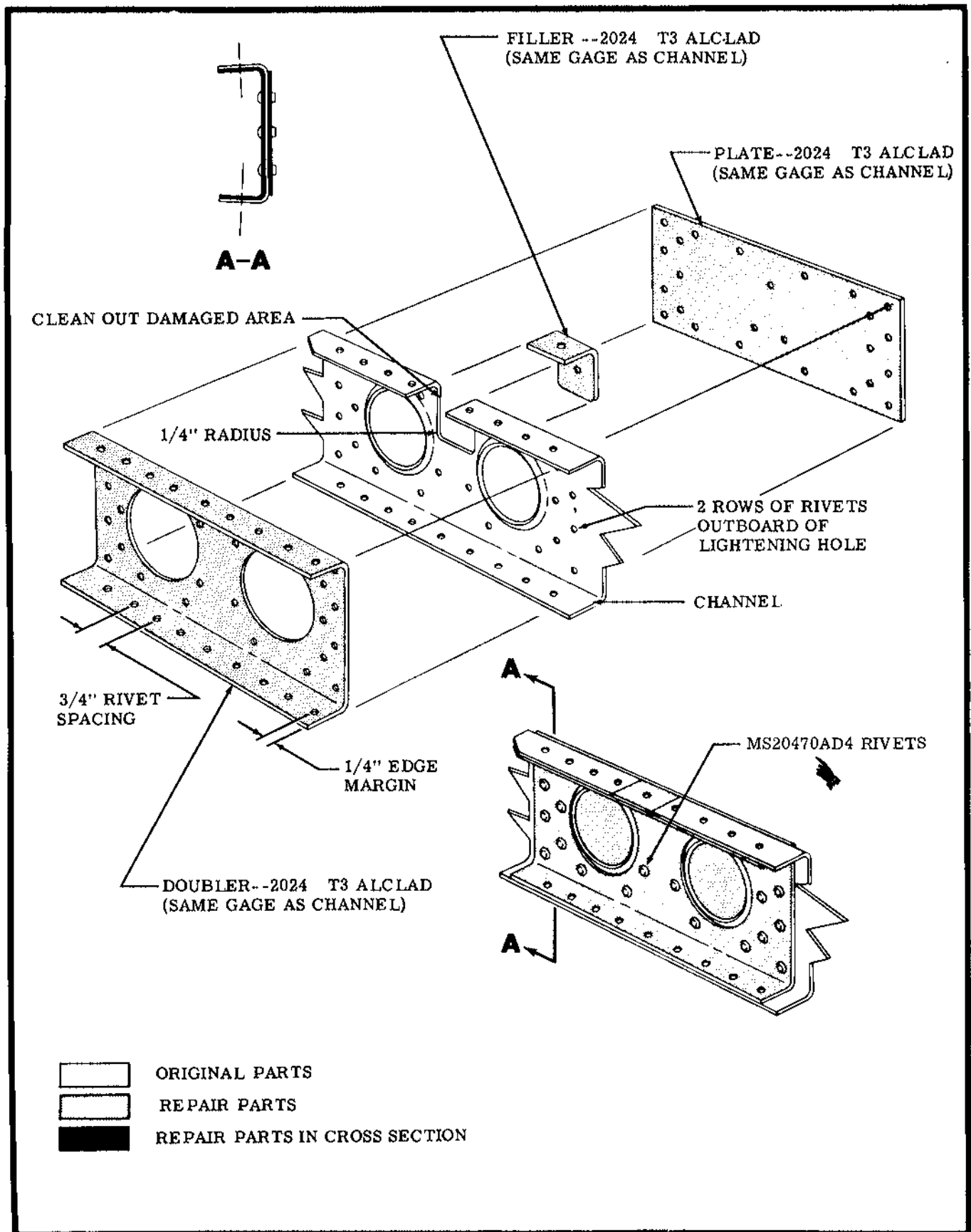


Figure 16-22. Typical Channel Flange Repair

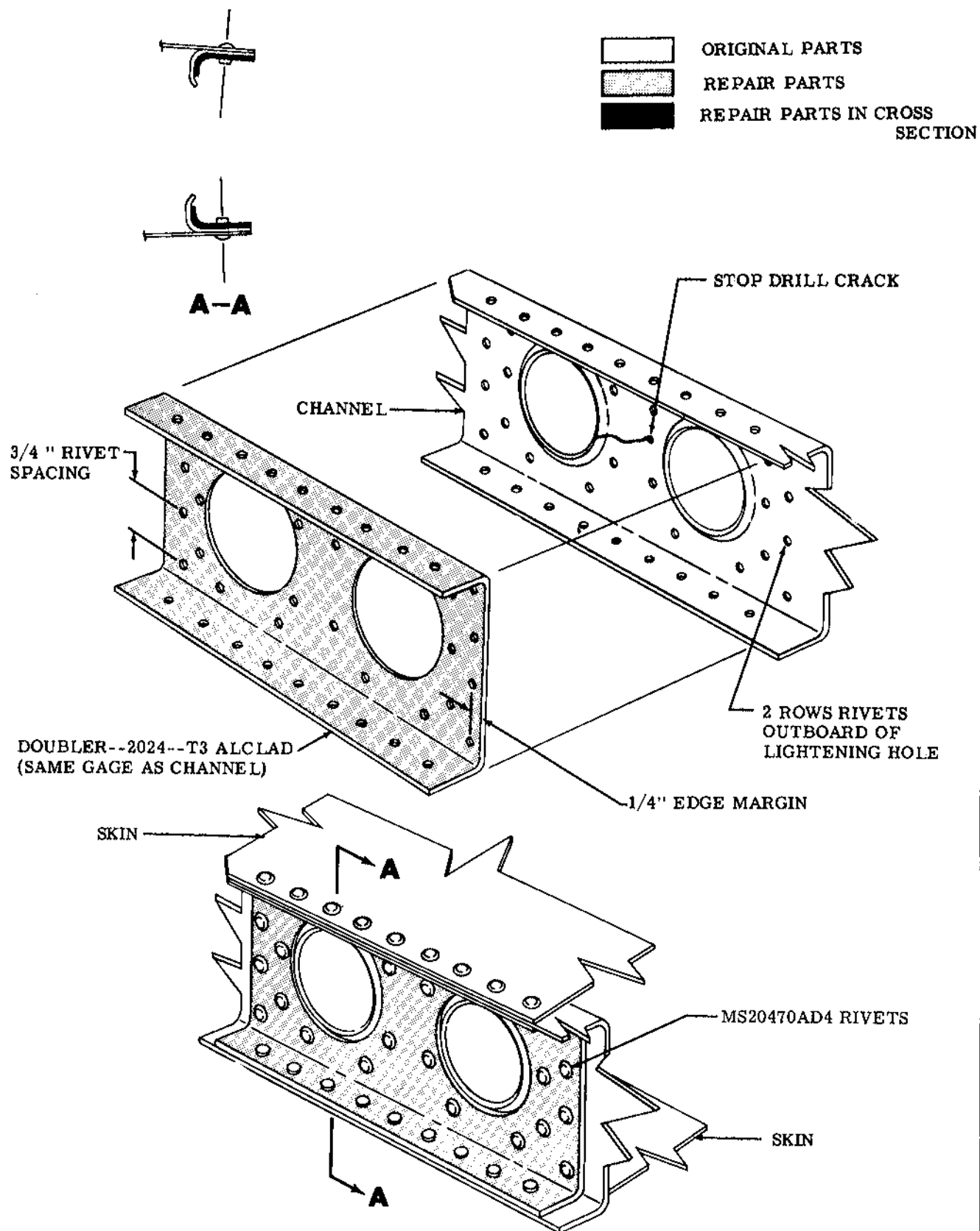


Figure 16-23. Typical Channel Repair

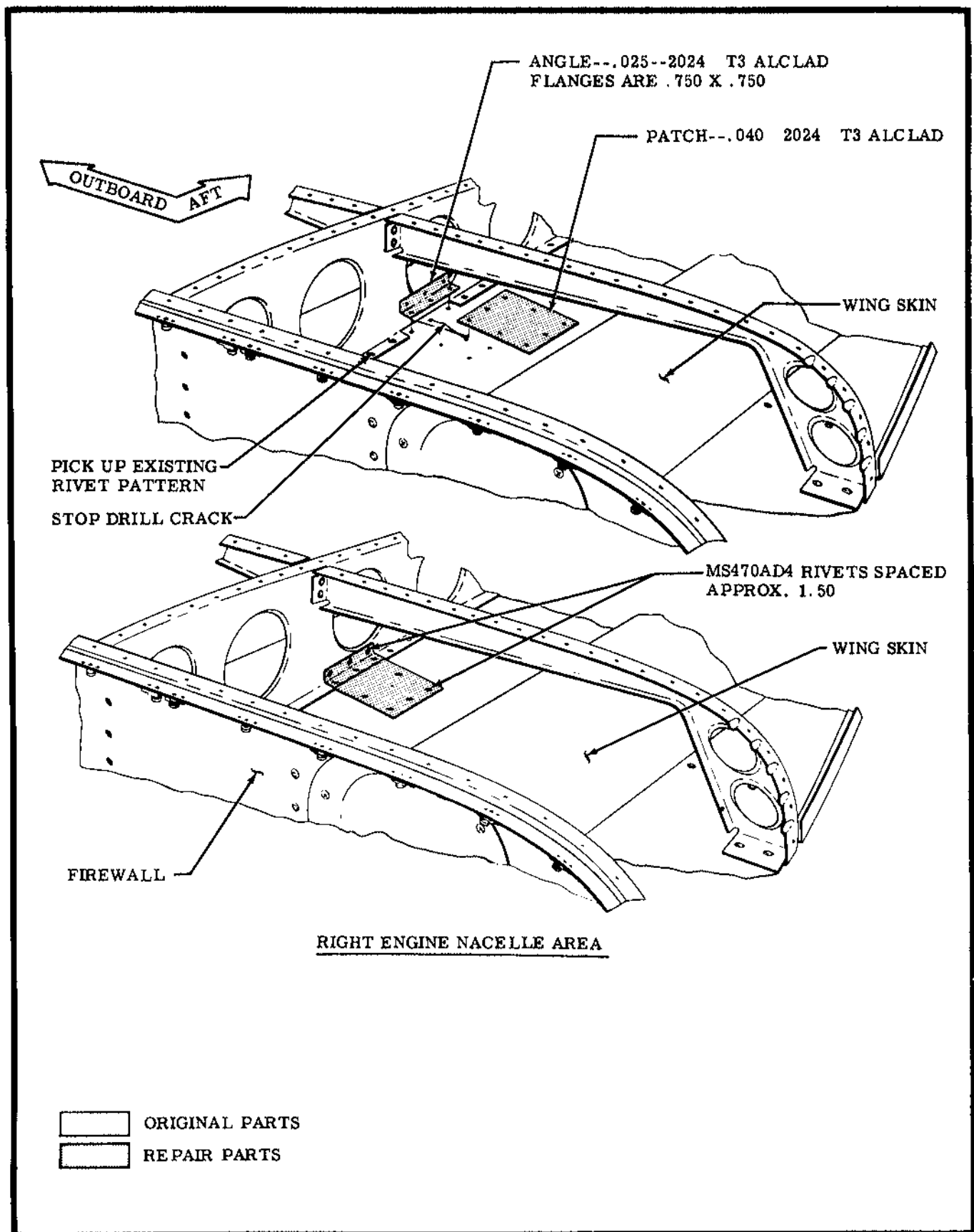


Figure 16-24. Typical Wing Skin Repair - Nacelle Area

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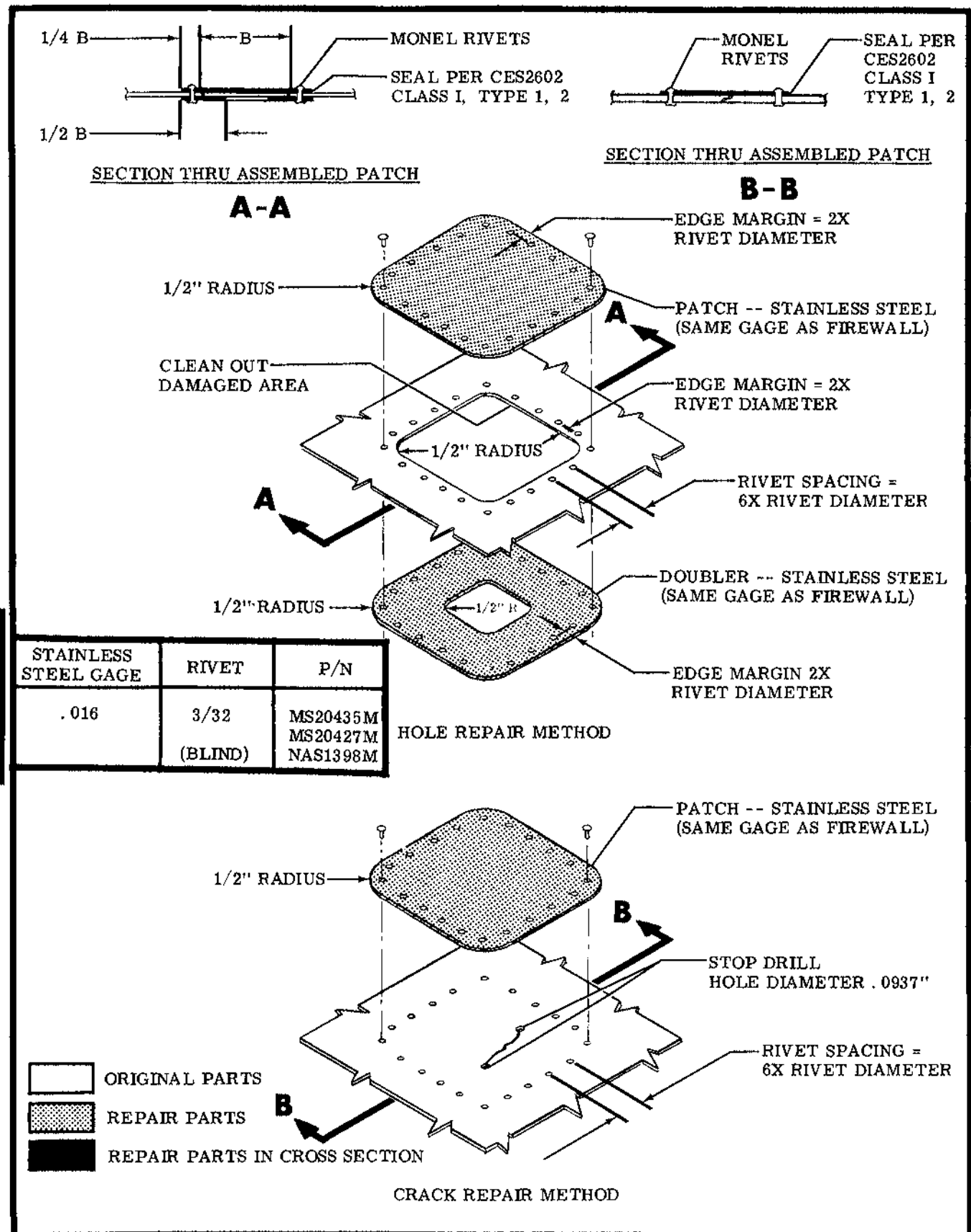


Figure 16-24A. Repair of Firewall

STOP DRILL CRACK IF CRACK DOES
NOT EXTEND TO EDGE OF PART

DOUBLER—.032 2024 T3 ALCLAD

1/4" EDGE
MARGIN

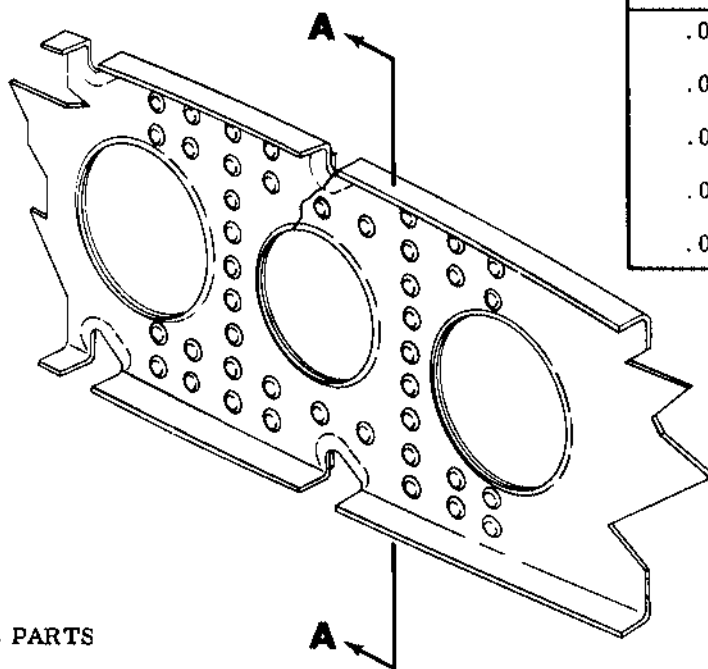
RIB

RIVET TABLE

SKIN GAGE	RIVET DIA.
.020	3/32
.025	1/8
.032	1/8
.040	1/8
.051	5/32



A-A



ORIGINAL PARTS

REPAIR PARTS

REPAIR PARTS IN CROSS SECTION

Figure 16-25. Typical Rib Web Repair

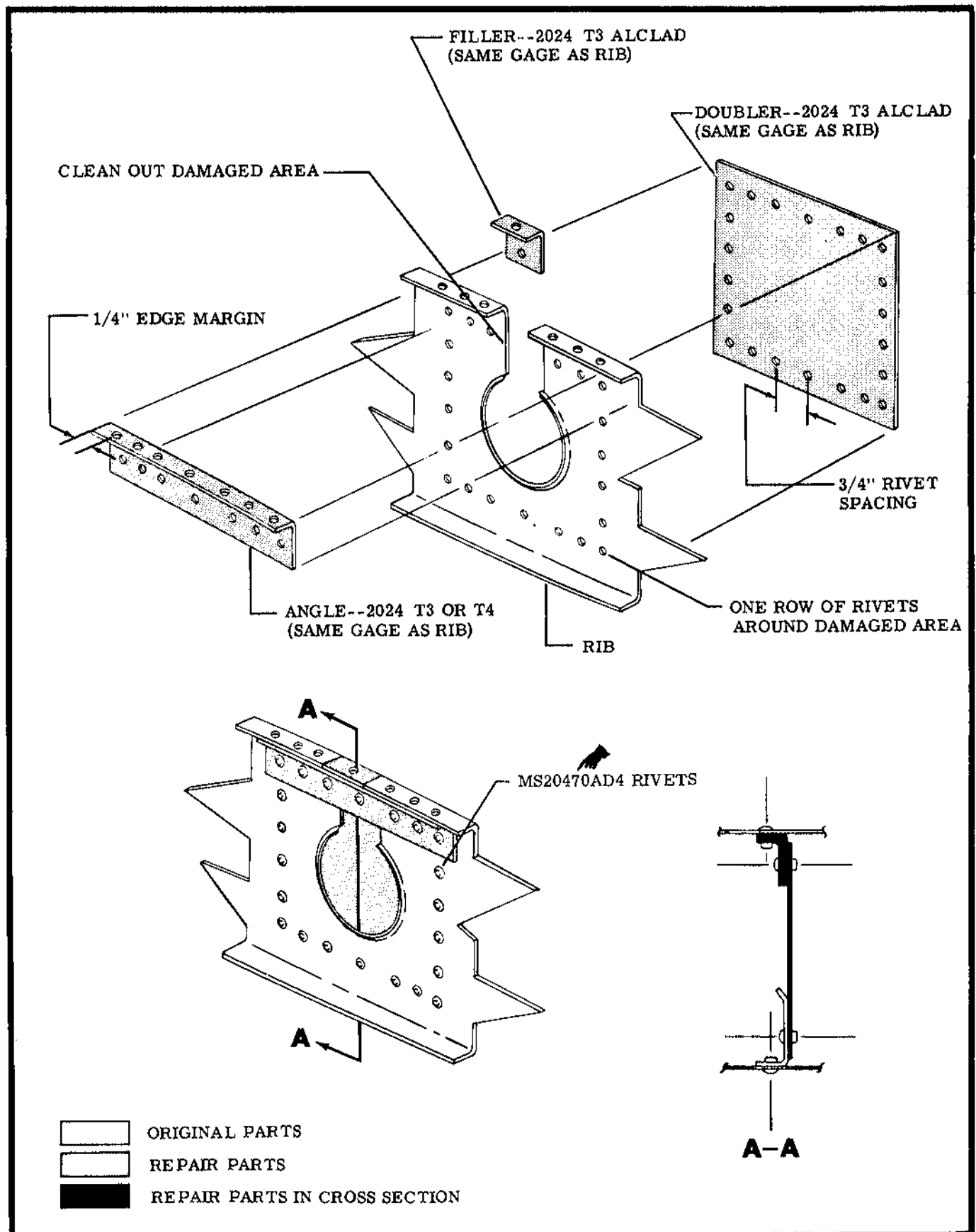


Figure 16-26. Typical Rib Flange Repair

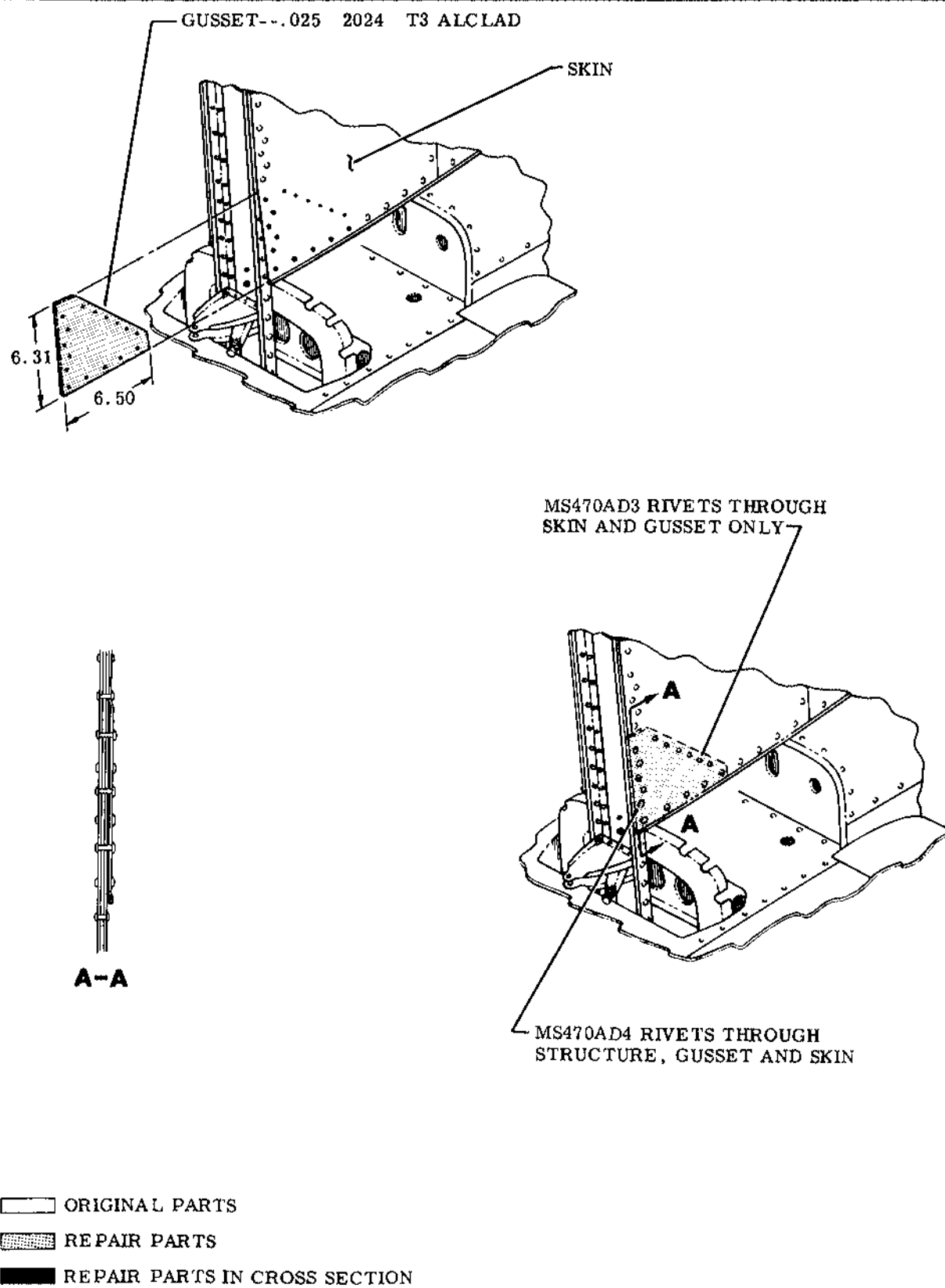


Figure 16-27. Typical Vertical Fin Repair

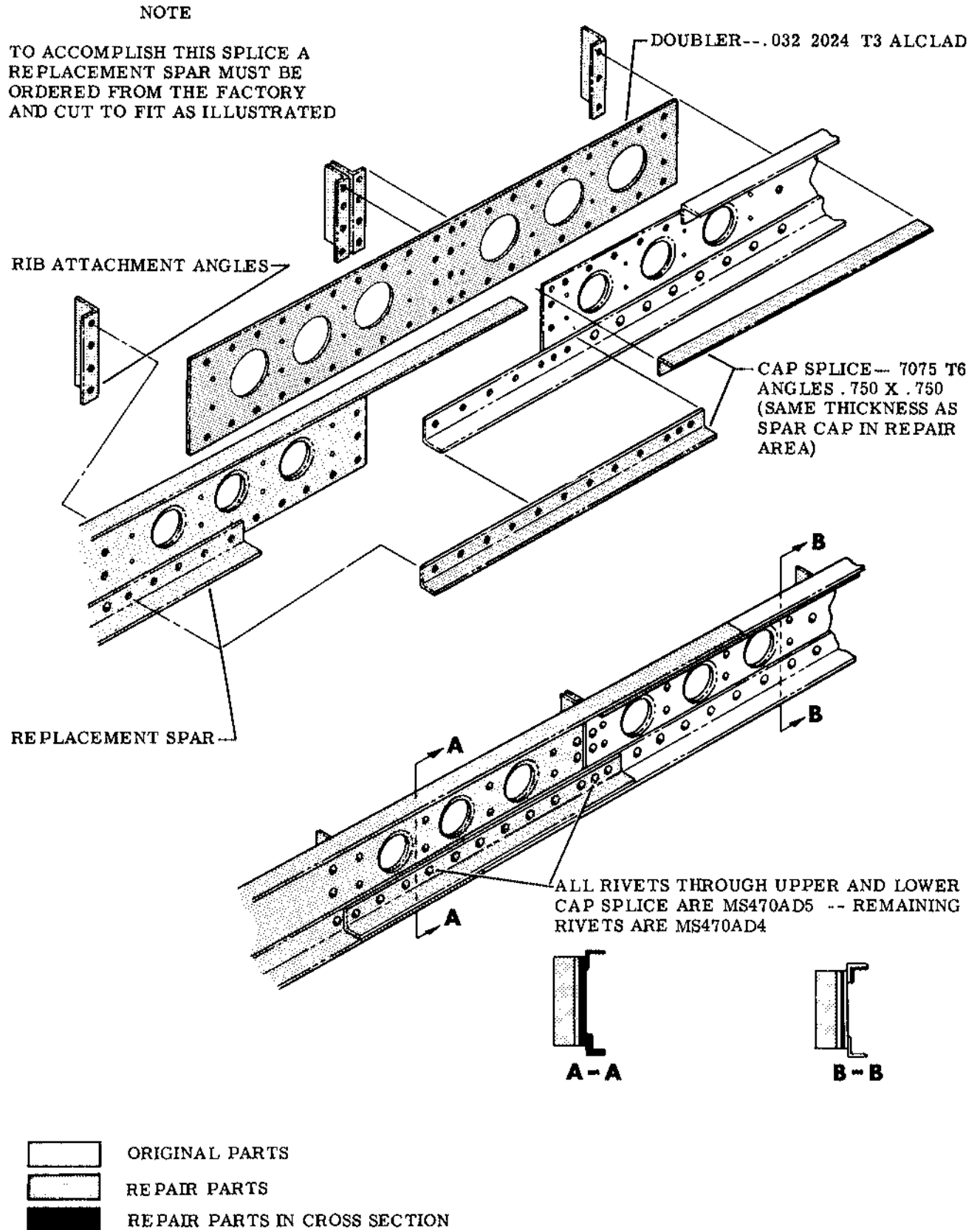


Figure 16-28. Typical Rear Spar Repair (Station 111, 12 and outboard)

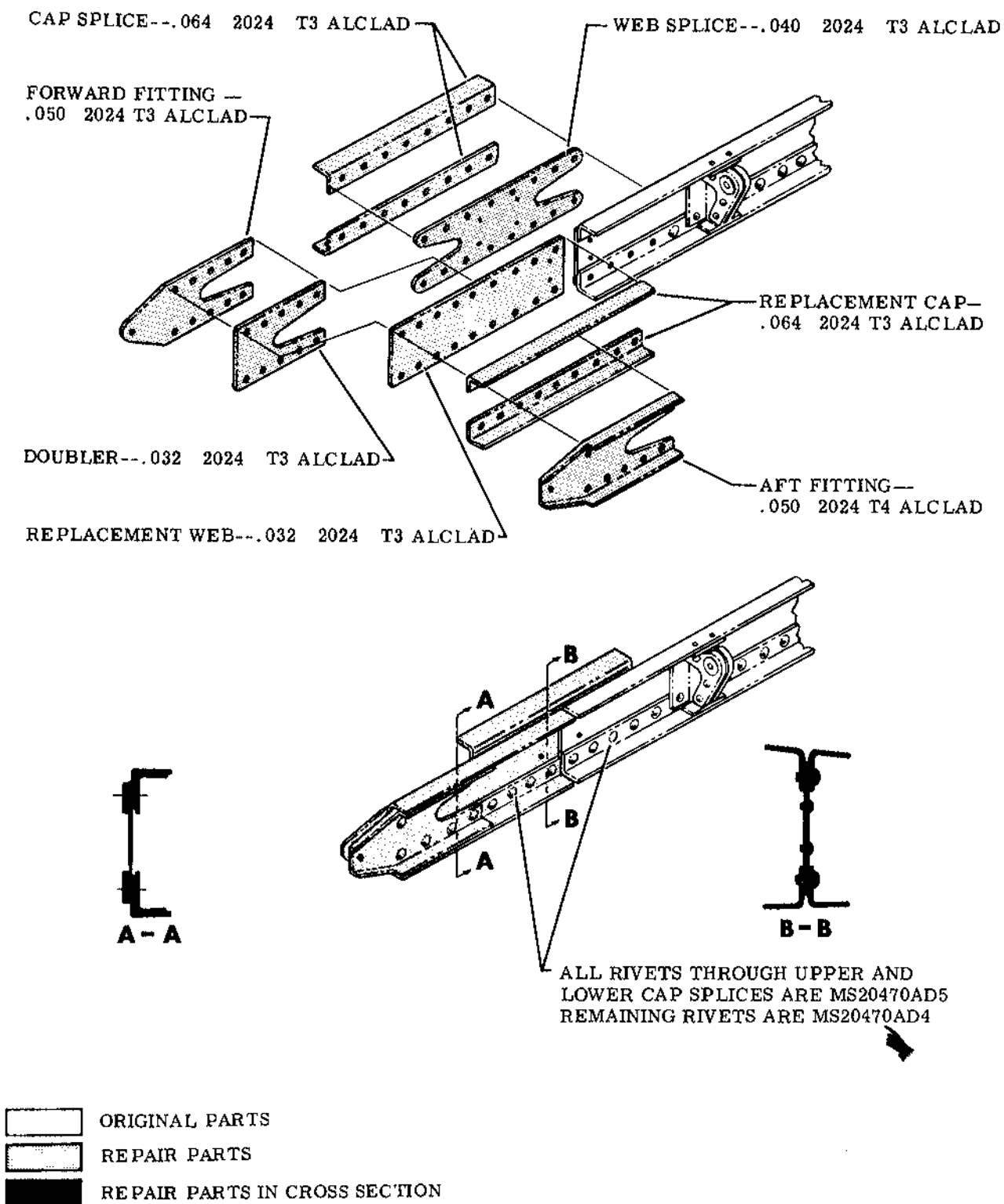


Figure 16-29. Typical Rear Spar Repair (Station 189, 20 and outboard)

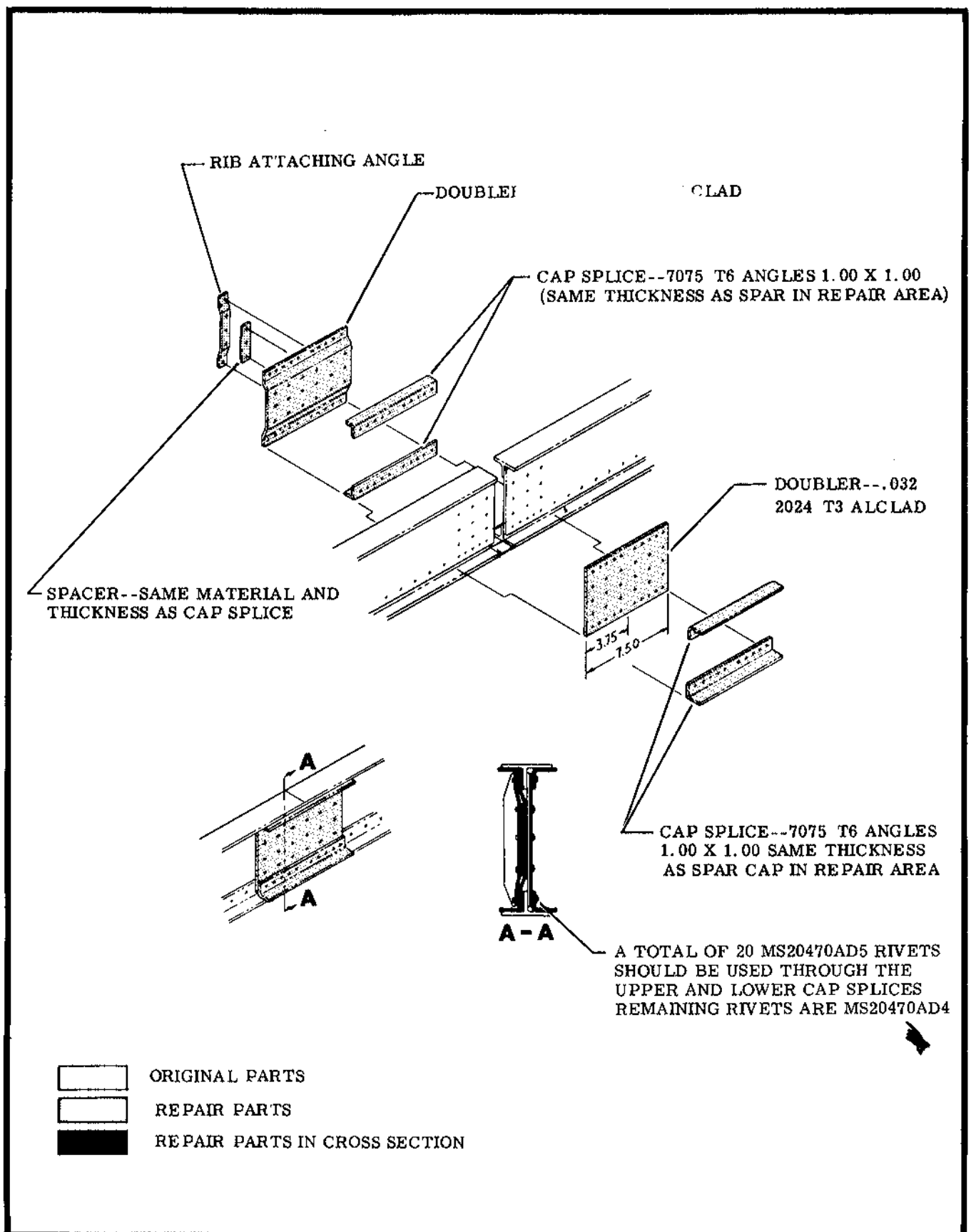


Figure 16-30. Typical Front Spar Repair (Station 168.75 and outboard)

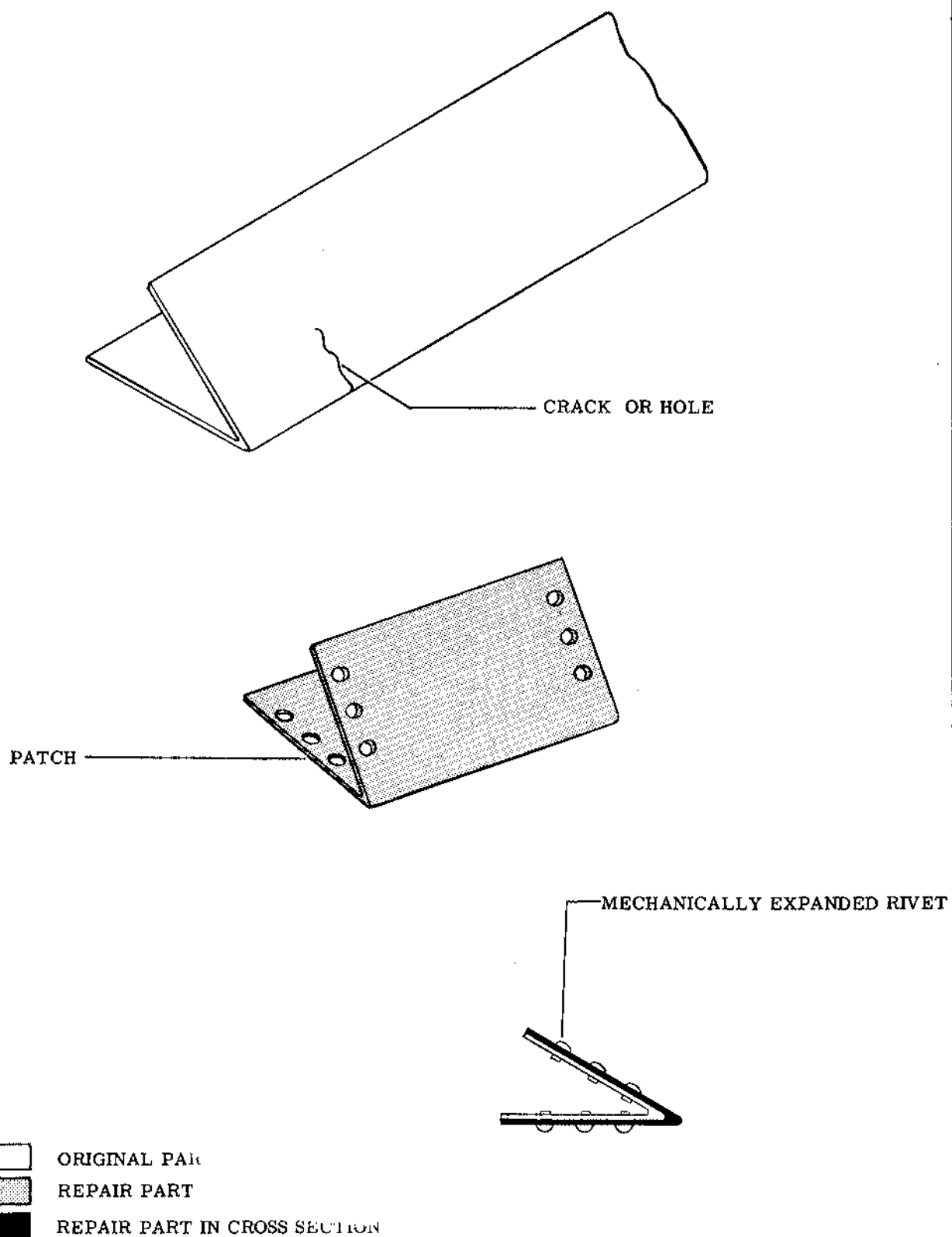
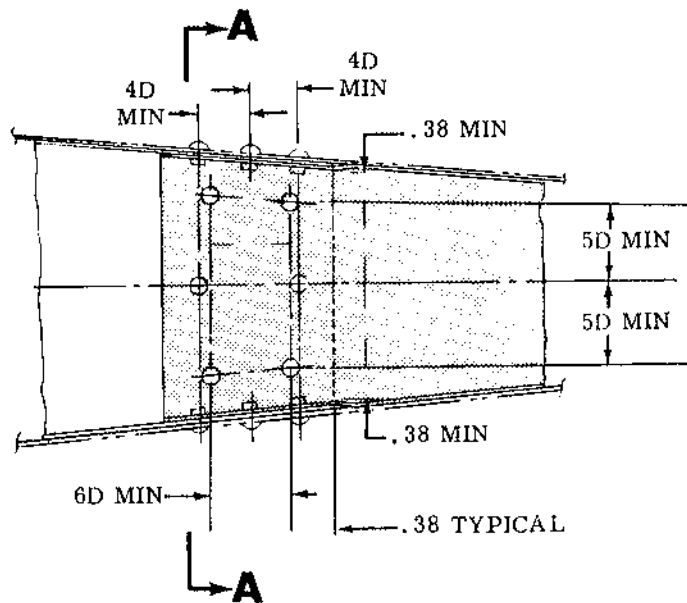
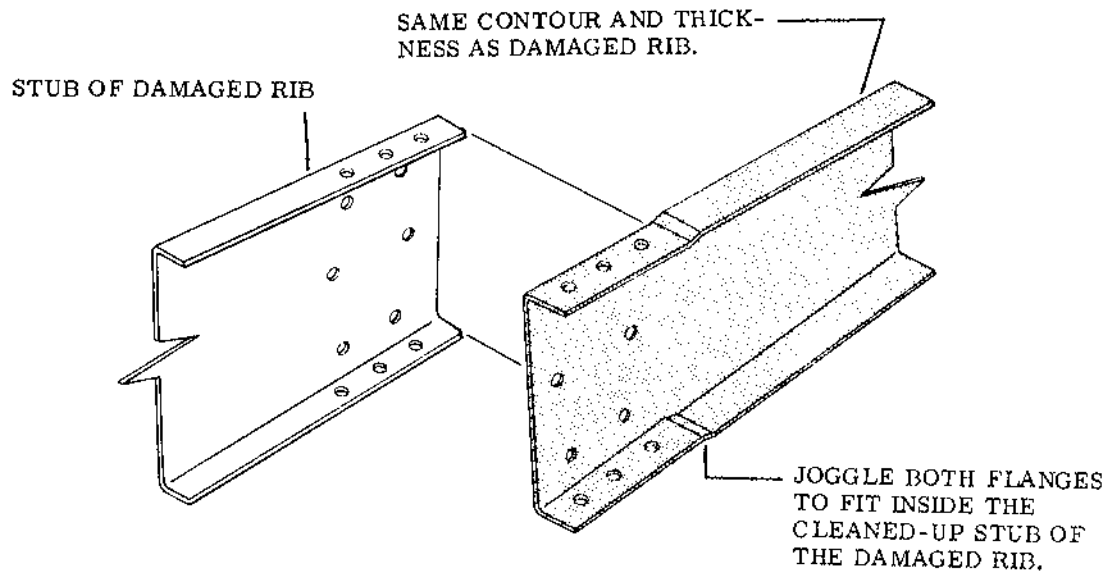


Figure 16-31. Typical Repair of Trailing Edge of a Control Surface



NUMBER OF ROWS OF RIVETS IN WEB DEPENDS ON AREA AVAILABLE. SEE MINIMUM SPACING. MAXIMUM SPACING IS ONE INCH. RIVETS IN FLANGES MUST BE AS SHOWN.

FOR RIB THICKNESS OF .032 OR LESS USE AD-3 RIVETS AND FOR THICKER MATERIAL USE AD-4.

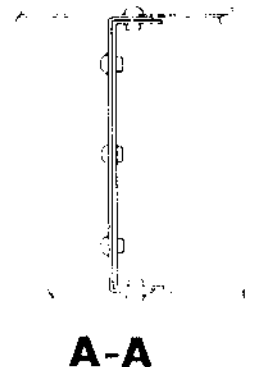
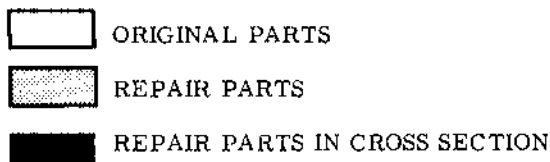


Figure 16-32. Typical Repair of Control Surface Rib

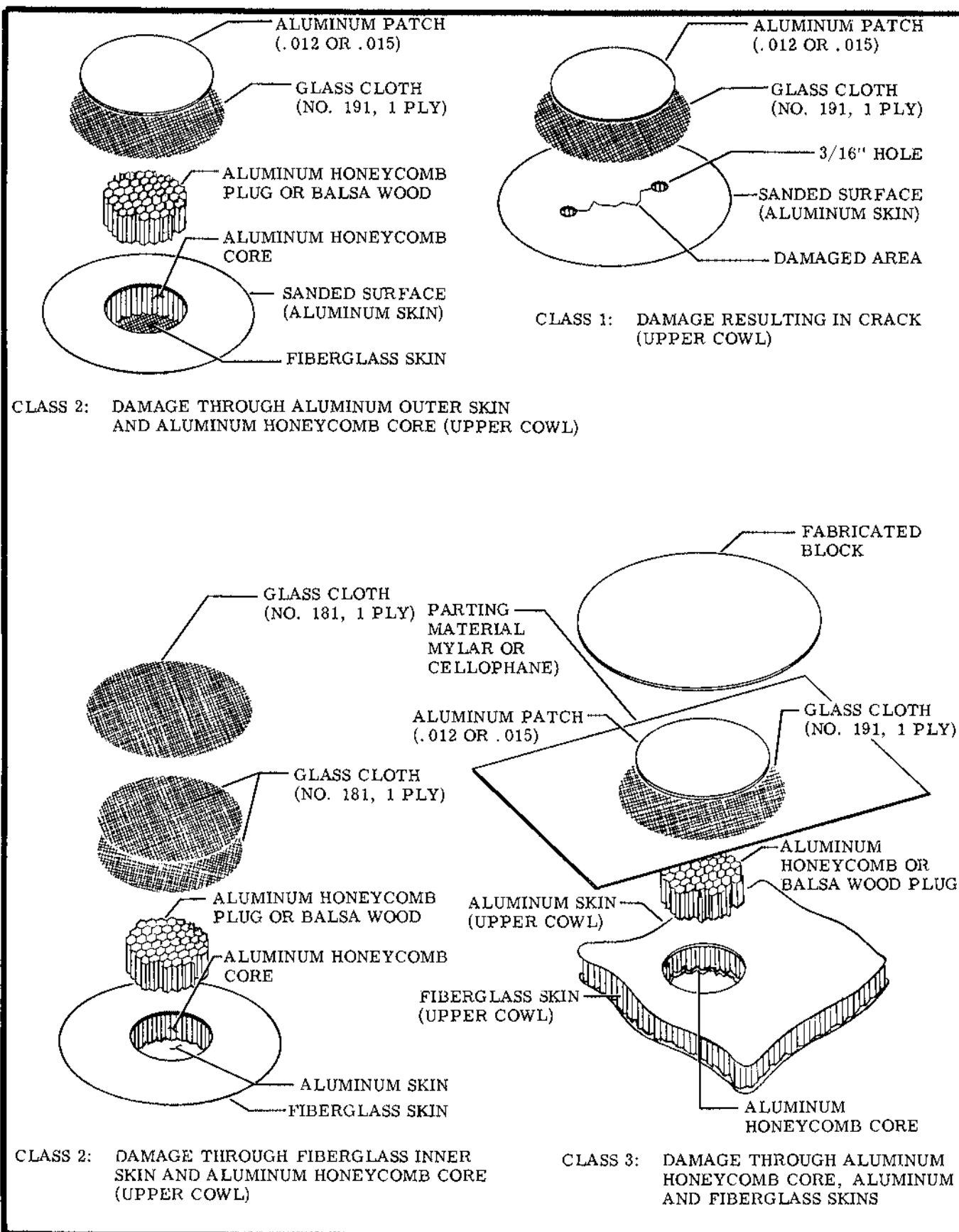


Figure 16-33. Repair of Upper and Side Engine Cowling

ALIGNMENT AND SYMMETRY CHECK. (See figure 16-34.)

Before making an alignment and symmetry check the aircraft should be defueled and leveled in accordance

with Section 2. Figure 16-34 provides the measurements and shows the relative elevation points to be measured during the alignment symmetry check. Measurements are made with a steel tape projected between alignment points.

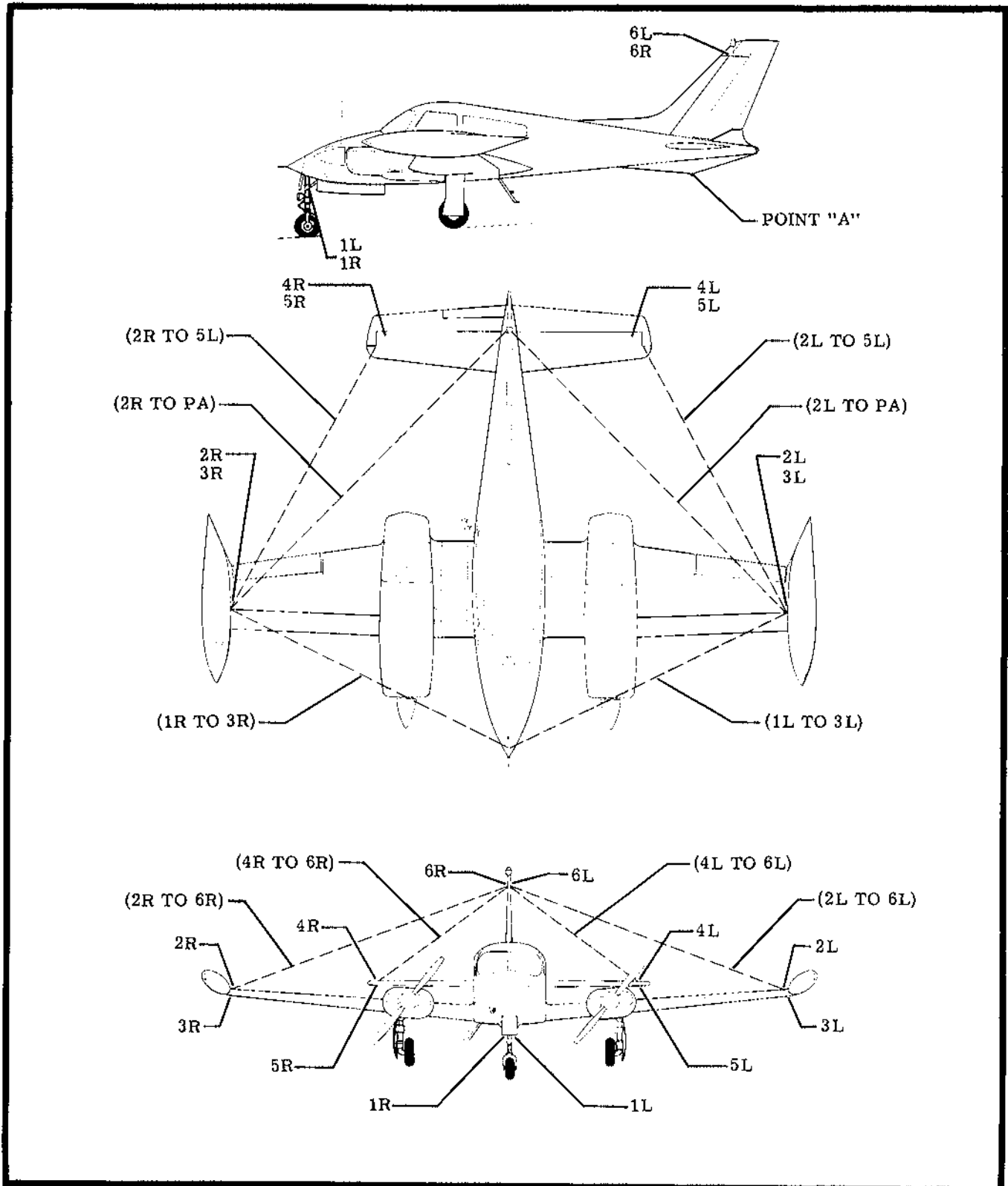
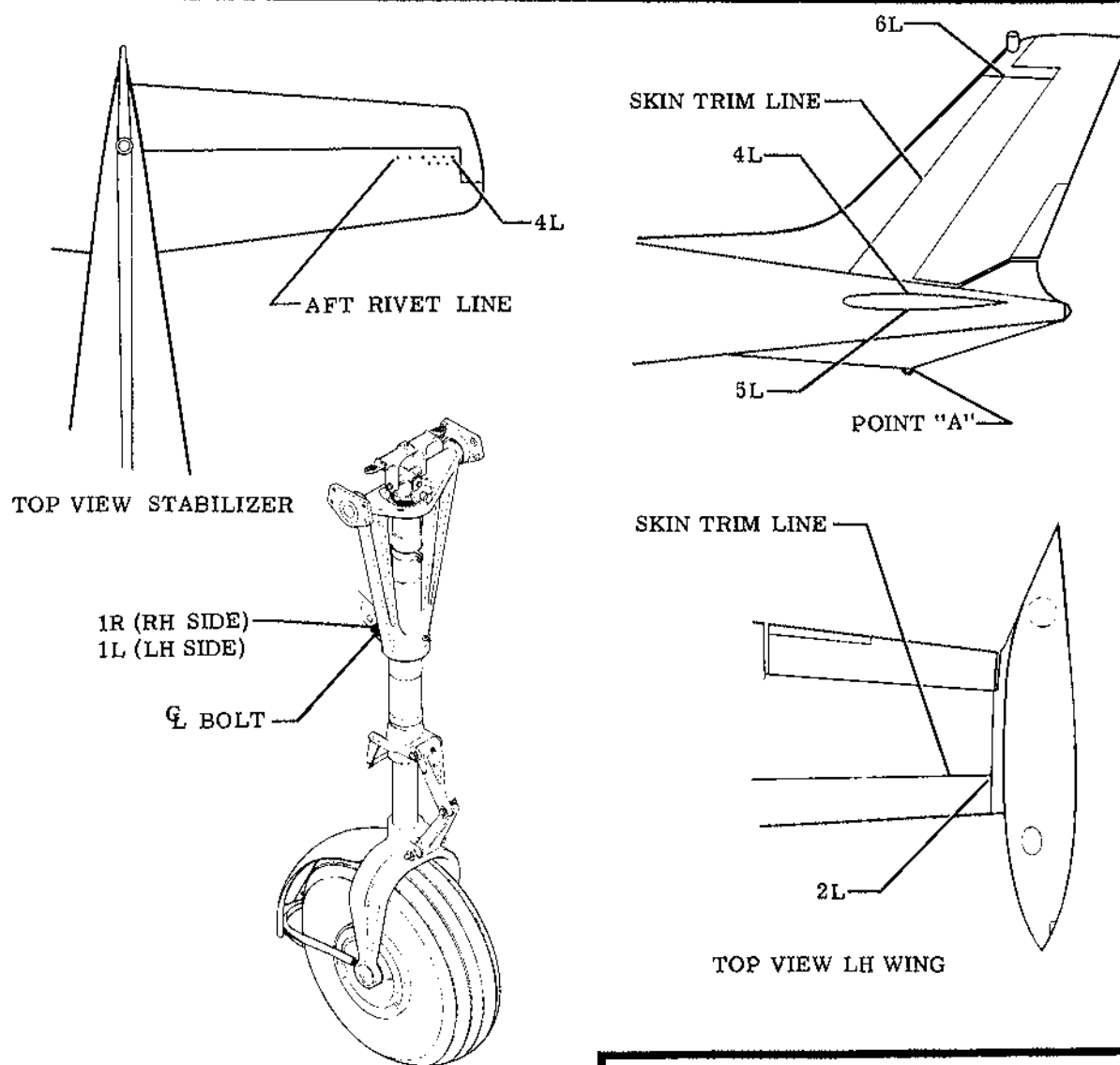


Figure 16-34. Alignment and Symmetry Check (Sheet 1 of 2)



Details of Check Points:

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

ALIGNMENT AND SYMMETRY CHECK	
POINTS	DISTANCE
1L TO 3L 1R TO 3R	18' 2.50" $\pm$ 1.25"
2L TO 5L 2R TO 5R	18' 6.70" $\pm$ 2.00"
2L TO PA 2R TO PA	23' 3.40" $\pm$ 1.50"
4L TO 6L 4R TO 6R	9' 6.70" $\pm$ 1.00"
2L TO 6L 2R TO 6R	24' 11.00" $\pm$ 2.00"

Figure 16-34. Alignment and Symmetry Check (Sheet 2 of 2)

CHECKING WING TWIST AND LOCATION OF THRUST LINE. (See Figure 16-35)

a. Remove wing in accordance with wing removal procedures and place wing on suitable supports beneath the root and tip ribs.

NOTE

The wing tip tank must be removed during check.

b. Locate wing datum plane as follows:

1. Locate a line at the root rib (wing station 28.40)

which is 4.52 inches up from the lower surface of the front spar, and 4.00 inches up from the lower surface of the rear spar.

2. Locate a line at the tip rib (wing station 199.92) which is 1.44 inches up from the lower surface of the front spar, and .81 inches up from the lower surface of the rear spar.

3. These two lines locate the wing datum plane, and the three degrees of twist will be present if the lines are parallel.

c. Detail A, B and C, locate engine thrust line.

d. Install wing and wing tip tank in accordance with installation procedures.

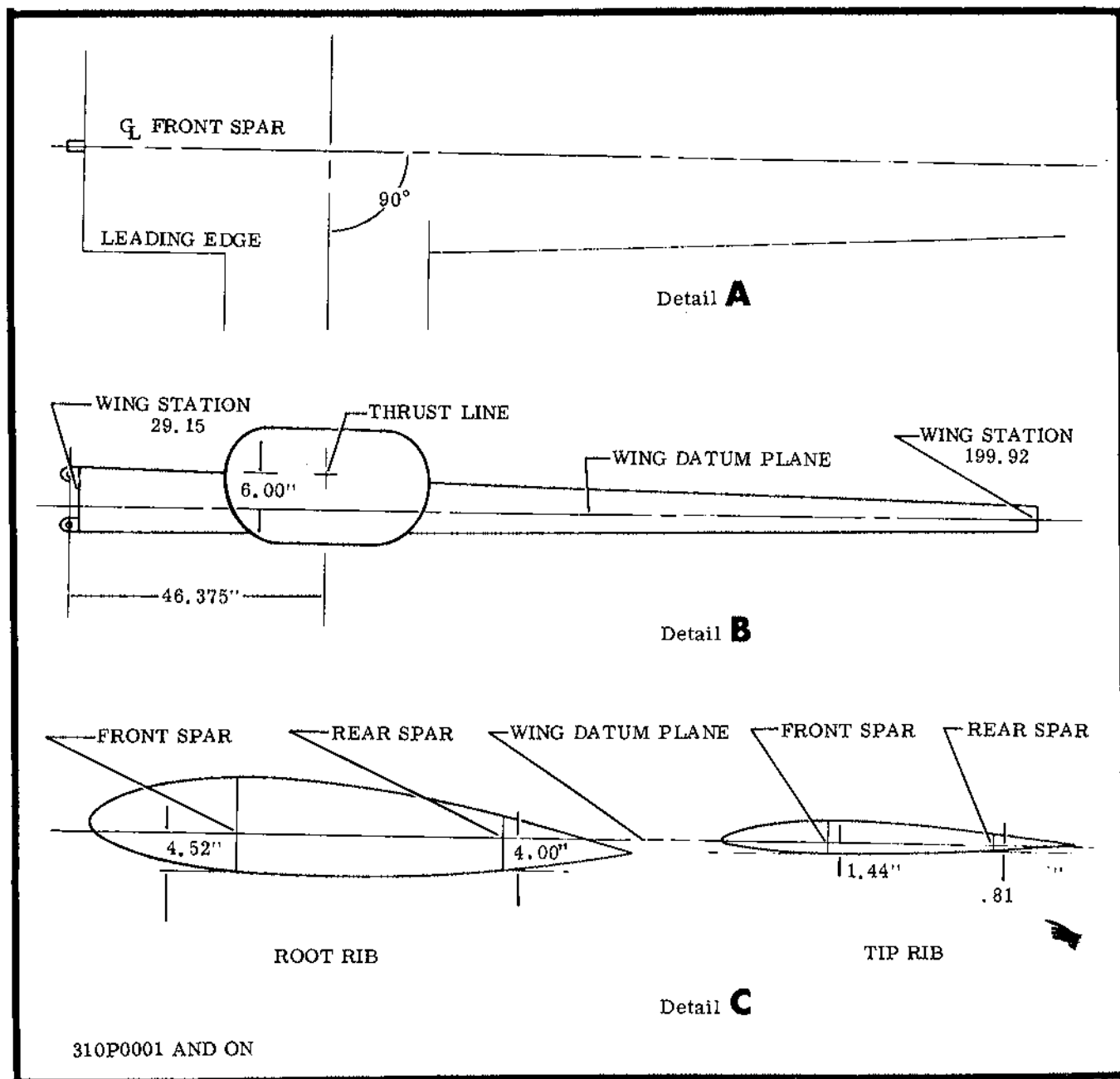


Figure 16-35. Wing Twist and Thrust Line Data (Sheet 1 of 2)

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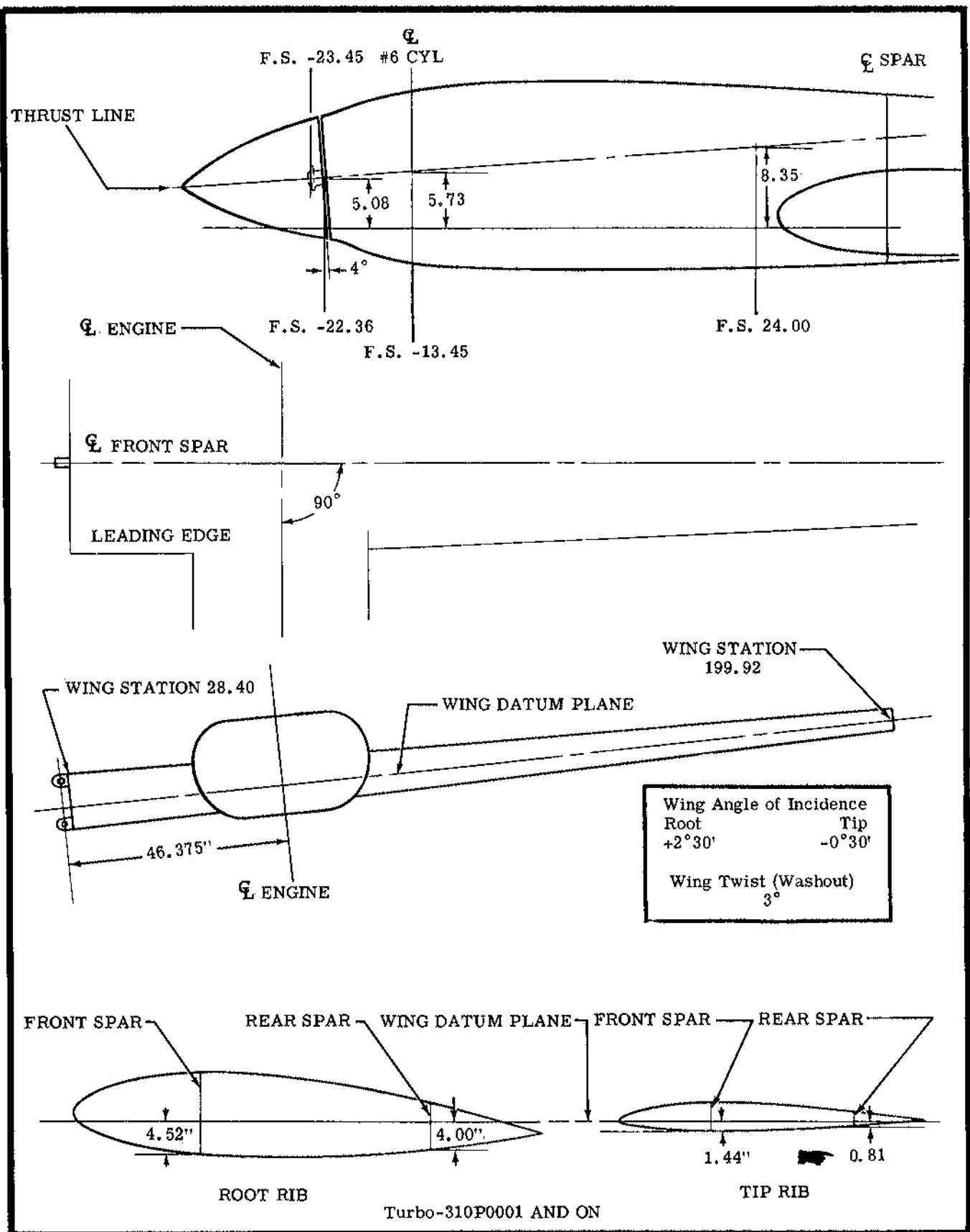


Figure 16-35. Wing Twist and Thrust Line Data (Sheet 2 of 2)

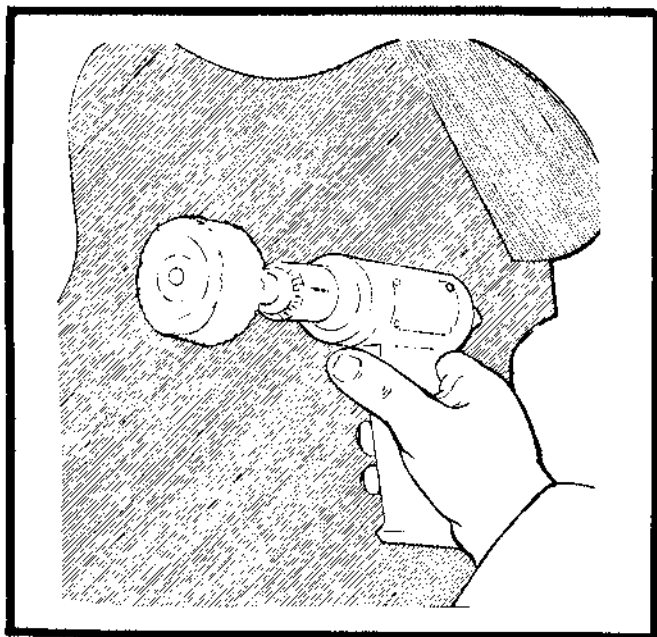


Figure 16-36. Buffing With Air Drill

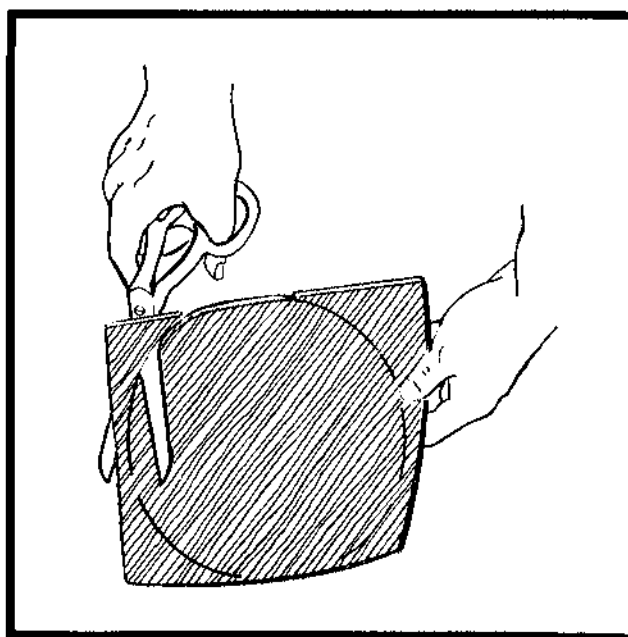


Figure 16-37. Fabrication of Patch

FUEL CELL REPAIR.

The fuel cells installed in the wings are a bladder-type, known as Construction BTC-39, manufactured by Goodyear Tire and Rubber Company. The following cold patch repair procedures are approved repair practices of Vithane BTC-39 fuel cells. These procedures apply only to BTC-39 fuel cells and deviations from these procedures should not be permitted.

CAUTION

Repair of the BTC-39 Vithane fuel cells is restricted to authorized personnel, and/or those certified or approved by factory trained schools.

a. The following equipment will be needed to make the cold patch repair:

1. Repair Kit, Dwg #2F1-3-35342, available from the Cessna Service Parts Center, consisting of the following:

- (a) 2331 Repair Cement (1/2 pint cans, 173 cc in each can).
- (b) 2328C Cross-linker (1 Oz. bottle, 28 cc in each bottle).
- (c) Methyl Ethyl Ketone (1 pint cans).
- (d) FT-160 Repair Fabric (sheet 12" x 12").
- (e) Cellophane (sheet 12" x 24").
- (f) Foam rubber, cloth back (sheet 12" x 12").

2. Paintbrush, 1-inch.

3. Roller, 1-inch diameter x 3/4" flat, or equivalent.

NOTE

The repair should be made on a well lighted table and natural contours maintained if pos-

sible. Prevent cell from contact with sharp edges, corners, dirty floors or other surfaces.

WARNING

Repair area must be well ventilated and no open flame or smoking in area of cell repair.

b. Repair Limitations.

1. FT-160 repair fabric is for repair of simple

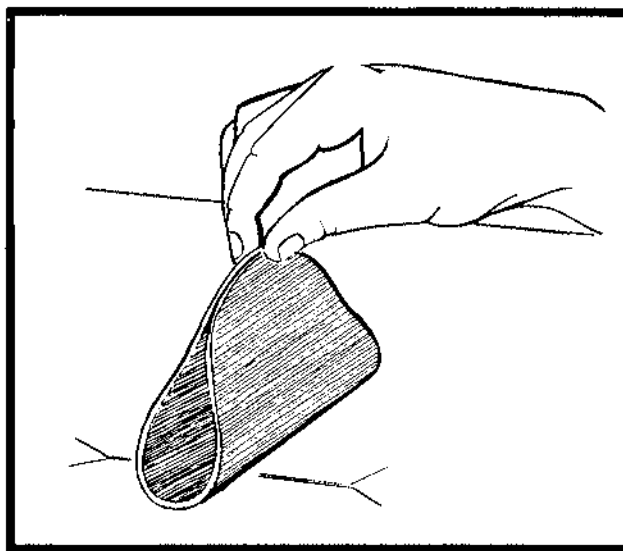


Figure 16-38. Centering Patch Over Injury

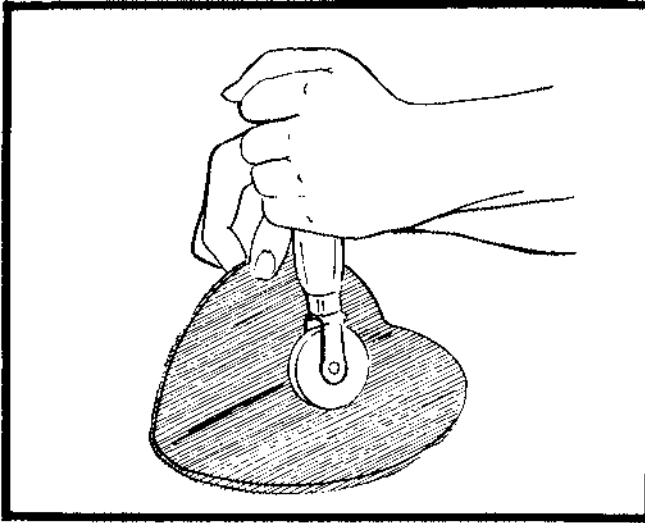


Figure 16-39. Use of Roller Stitcher

contours only. Patches referred to in these procedures are of this material.

2. Inside patches are to lap defect edges two-inches (2") in each direction.
3. Outside patches are to lap two and one-quarter inches (2-1/4") in each direction.
4. Outside patches are to be applied and cured prior to applying an inside patch.
5. Blisters between interliner and fabric larger than 1/4" in diameter, require an outside and an inside patch.
6. Separations between outer plies larger than one-inch (1") in diameter require an outside and inside patch. Holes and punctures require an outside and inside patch.
7. Slits and tears, up to three-inches (3") maximum length, require an outside and inside patch.
8. External abraided or scuffed areas, without fabric damage, require an outside patch only.
9. A loose lap may be trimmed, provided that a one-inch (1") effective bond remains.
10. Air cure repair patches are to remain clamped and undisturbed for 72 hours at room temperature of approximately 75°F.

c. Repair Patch.

1. Prepare exterior cell wall and exterior patch first. Cut repair patch from FT-160 material to size required (see figure 16-37) to insure proper lap over injury in all directions in accordance with Repair Limitations. Hole shears at an angle to produce a beveled edge (feather) on patch when cutting patch. Round corners of patch. Dull side or gum contact face of repair patch should be the largest surface after beveling.
2. Wash one square foot of cell wall surrounding injury, and repair patch contact side with a clean cloth soaked with Methyl Ethyl Ketone solvent.
3. Abraid cell wall surface about injury and contact side of patch with fine emery cloth or emery buffer wheel (see figure 16-36) to remove shine.
4. Repeat Methyl Ethyl Ketone washings two more times. A total of three washings each surface.

5. Tape a piece of cellophane inside cell over injury.

6. When all the above preparatory work has been completed, and all has been positioned for patch application on repair table, mix the 2331C cement (173 cc) with the cross-linker 2328C (28 cc), and stir mixture thoroughly.

7. Brush one even coat of mixed repair cement on the cell wall around injury and on the contact side of repair patch. Allow to dry for twenty minutes.

8. Repeat a second mixing of repair cement and brush on a second coat.

CAUTION

DO NOT USE FIRST CAN OF MIXED CEMENT FOR THIS COAT.

9. Allow cement to dry approximately ten minutes and then center patch over injury as shown in figure 16-38.

10. (See figure 16-39.) Lay repair patch by rolling down on surface from center of edge without trapping air. Hold the unrolled portion of repair patch off the cemented surface until roller contact insures an air-free union. At this time repair patch may be moved by hand on wet surface to improve lap. Do not lift repair patch, slide it.

CAUTION

Make sure cellophane inside cell over injury remains in place, because any cement will

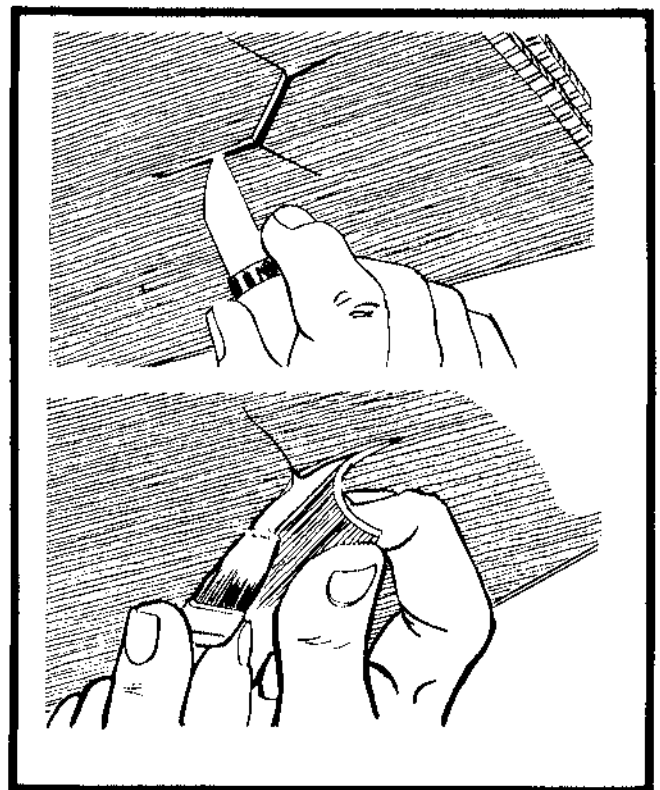


Figure 16-40. Repair of Blisters

stick cell walls together without it as a separator.

11. Cover one smooth surface each of two aluminum plates (plates must be larger than patch, with 1/4" fabric-backed airfoam, fabric side out. Tape airfoam in place. Foam must cover edges of plate for protection.

12. Fold cell adjacent to patch and place prepared plates, one over repair patch, and one on opposite side.

13. Secure the assembly with a "C" clamp, tighten by hand. Check cement flow to determine pressure.

CAUTION

Make sure that cell fold is not clamped between plates. This would cause a hard permanent crease. Also, be sure patch does not move when clamp is tightened.

14. Inside patch is applied in the same manner as the outside patch. See Repair Limitations paragraph for size of inside patch, after outside patch has been cured.

CAUTION

Success of applying both an outside and inside repair simultaneously is doubtful and not recommended.

d. Metal Fitting - Sealing Surfaces.

1. Rub off roughness of affected area with a fine file, emery cloth or emery wheel as shown in figure 16-36.

2. Clean metal surfaces using a clean cloth dipped in Methyl Ethyl Ketone. Moisten cleaned surface with clean cloth dipped in water. Apply Alodine 1200 solution, undiluted, to the affected area with a small nylon brush. Allow solution to dry until a light golden color appears. When coating has been formed, remove excess solution by wiping with a clean water-moistened cloth. Wipe dry.

WARNING

Do not allow solution to come in contact with hands, eyes or clothing.

e. Accessory Replacement.

1. Obtain cured repair accessory from manufacturer.

2. Mark location of old accessory and preserve marking for guide lines to locate new part.

3. Remove old accessory by gradually loosening an edge with a blunt probe-like instrument.

4. When an edge is loose, grasp accessory by loose edge with pliers and gently pull accessory off

fuel cell wall. Be careful not to pull cell lap open while peeling accessory off. Pull from blind side of cell lap toward the exposed edge.

5. Buff the cell surface under accessory with emery cloth or emery buffer wheel (see figure 16-36) to smooth roughness and prepare for cement.

NOTE

Removal of accessory may leave an uneven cavity and surface. The surface under accessory should be buffed even and smooth.

6. Prepare replacement accessory by buffing and washing contact surface. Also wash cell surface (see Repair Patch paragraph).

7. Apply mixed 2331C repair cement to both surfaces.

8. Roll new accessory into place as with a repair patch and place suitable padded plates in position to insure adequate pressure when clamped. Use cellophane separator to prevent cement sticking in wrong places.

9. Cure as with repair patch procedure cure method.

f. Defects Repair.

1. Blisters (see figure 16-40).

(a) Remove loose material by buffing or trimming. Apply an outside and inside patch.

2. Holes, punctures, cuts, tears and deep abraded areas.

(a) Trim away any ragged material and apply an outside and inside repair patch.

3. Loose seams.

(a) Buff loose edge and contact surface. Wash three times with MEK. Apply 2331C mixed cement, two coats, as with repair patch. Clamp and cure. Loose seams may be trimmed if minimum lap remains.

4. Loose fitting flange - Inside.

(a) Buff edge of flange and contact surface under flange.

(b) Apply 2331C mixed repair cement, cellophane padded plates and clamp.

(c) Follow procedure as outlined for repair patch except patch itself.

5. Missing coat.

(a) Buff surface.

(b) Wash three times with MEK.

(c) Apply 2331C mixed cement two coats as with repair patch.

(d) Clamp and cure.

6. Looseness against metal.

(a) Prepare metal as per metal fitting-sealing surface.

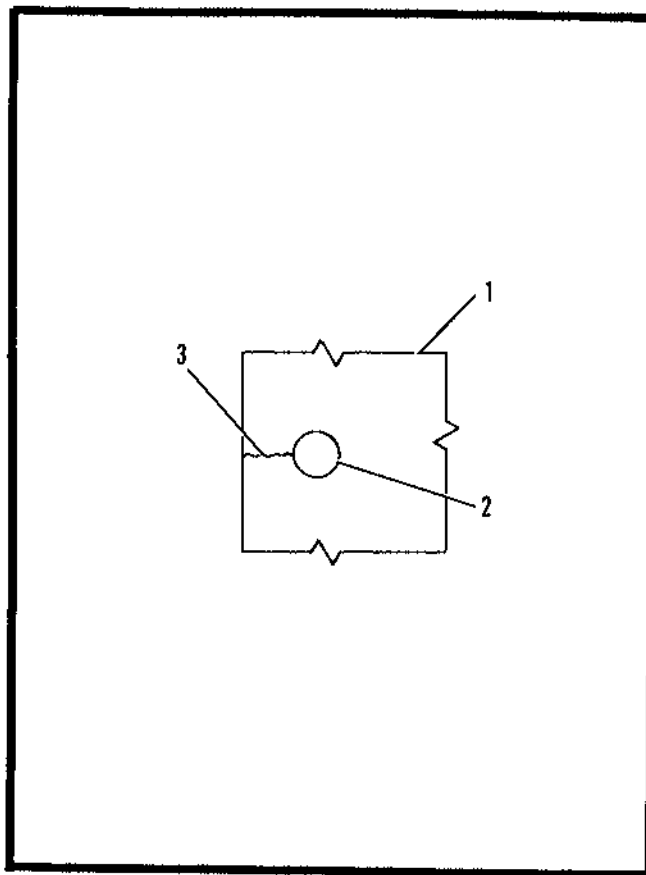
(b) Apply 2331C mixed cement and cure.

g. Testing.

1. Attach test plates to all fittings.

2. Inflate the cell with air to a pressure of 1/4 PSI maximum.

3. Apply soap suds to patched area and check for leaks.



1. Ice Protection Panel 2. Rivet 3. Crack

Figure 16-41. Repairing Crack in Ice Protection Panel

REPAIR OF ICE PROTECTION PANELS.

The following repair procedures should be used for repairing the polycarbonate type ice protection panels. See figure 16-41 and 16-42 for types of cracks and method of repair. Figure 16-41 is an example of the cracks starting at a rivet hole propagating to the outer edge of the panel.

- See figure 16-41, route the crack using router bit. Route material approximately $1/32$ wide and $1/2$ the depth of the panel thickness.
- Clean routed crack with isopropyl or ethyl alcohol.
- Fill crack with epibond 1331 in accordance with manufacturer's instructions.

NOTE

Epibond 1331 may be procured from Furane Plastics, 4514 Brazil Street, Los Angeles, California 90039.

- Figure 16-42 illustrates a combination of cracks which may occur. Cracks which do not extend to the outer edge of the ice protection panel shall be

drilled through the ice protection panel with a #40 drill.

- Fill the stop drilled hole with Epibond 1331 as per manufacturer's instructions.

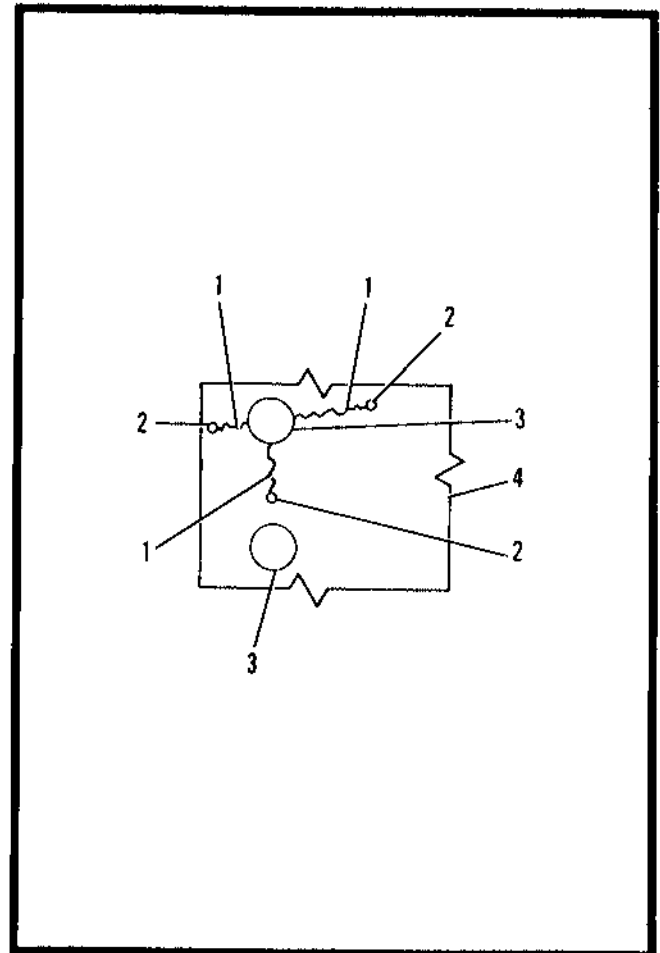
NOTE

Bondtite or Ditzler DX-666 may be used as an alternate for Epibond 1331.

- Normal finishing, priming and painting shall be accomplished following the repair.

NOTE

Refer to section 2 for painting Polycarbonate.



1. Crack 2. Stop Drill 3. Rivet 4. Ice Protection Panel

Figure 16-42. Repairing Combination of Cracks in Ice Protection Panel

RIVETS

General.

The following rivets are commonly used in aircraft structures: standard solid shank, hi-shear, and blind. Rivets used in aircraft construction are most generally fabricated from aluminum alloys. In special cases monel, corrosion - resistant steel, mild steel, copper and iron rivets are used.

Types.

a. Standard solid shank rivets are those generally used in aircraft construction. They are fabricated in the following head types: roundhead, flathead, countersunk-head, and brazier-head. Roundhead rivets are generally used in the interior of aircraft except where clearance is required for adjacent members. Flathead rivets are generally used in the interior of the aircraft where head clearance is required. Countersunk-head rivets are used on the exterior surfaces of the aircraft to minimize turbulent airflow. Brazier-head rivets are used on the exterior surfaces of the aircraft where strength requirements necessitate a stronger rivet head than that of the countersunk-head rivet. Both the brazier-head and the countersunk-head rivets are used on the exterior of the aircraft where head clearance is required.

b. Hi-shear rivets are special patented rivets having a high shear strength equivalent to that of the standard AN bolts. They are used in special cases in locations where high shear loads are present, such as spars, wings and heavy bulkhead ribs. The rivet consists of a cadmium plated pin of alloy steel and a collar of aluminum alloy. The installed rivet can be readily identified by the presence of the attached collar in place of the formed head on standard rivets.

c. Blind rivets are used where strength requirements permit when one side of the structure is inaccessible making it impossible or impractical to drive standard solid shank rivets.

Substitution of Rivets.

a. Standard solid shank rivets.

1. In the replacement of rivets in installations which require the raised headrivets it is desirable to use whichever of the rivets that correspond to the type of rivet removed.

2. Countersunk head rivets are to be replaced by rivets of the same type and degree of countersink.

3. When rivet holes become enlarged, deformed, or otherwise damaged use the next larger size as replacement.

4. Replacements shall not be made with rivets of lower strength material unless they are larger than those removed.

5. In the absence of aluminum rivets, stainless, monel, or iron rivets may be used with generous application of zinc chromate primer only to permit necessary flights of the aircraft. The proper replacement shall be made as soon as facilities are available.

b. Hi-shear rivets. When hi-shear rivets are not available, replacement of sizes 3/16 or greater shall be made with bolts of equal or greater strength than

the rivet being replaced and with self-locking nuts of the same diameter. The flush-type hi-shear rivet may be temporarily replaced by like diameter flush-type steel screws of equal or greater strength and self-locking nuts provided the threaded part of the screw does not extend into the material being fastened together. This latter procedure is temporary only and replacement with the hi-shear flush-type rivet must be accomplished as soon as they become available.

c. Blind rivets. Blind rivets have higher deflection rates in shear than standard solid rivets. For this reason, it is not advisable to replace any considerable number of solid rivets in a given joint by blind rivets inasmuch as this may result in over-stressing the remaining solid rivets. The following specific instructions apply.

1. The hollow blind rivet shall not be used.

2. The blind rivet used shall be of the same or greater strength and one size larger than the rivet it replaces, except that blind rivets may be replaced size for size.

3. In cases of dimpled assembly, the rivet holes shall be drilled after the sheets are dimpled.

4. When possible, the exposed end of each clipped plug shall be coated with a 10 per cent chromic acid solution or with zinc chromate primer.

5. Blind rivets shall not be used in hulls, floats, or tanks except in cases of absolute necessity.

6. If blind fasteners other than the blind rivets are encountered, it is recommended that replacements be made by either of these fasteners or by standard rivets.

Diameters.

a. Rivet diameters range from 3/32 inch to 3/8 inch. The 1/8, 5/32 and 3/16 inch sizes are the most frequently used.

b. Since smaller rivets lack the proper structural qualities and larger rivets may dangerously reduce the splice or patch area, care must be exercised before substituting other than the specified sizes of rivet diameter.

Lengths.

a. The proper length of rivet is an important part of the repair. Should too long a rivet be used, the formed head will be too large, or the rivet may bend or be forced between the sheets being riveted.

Should too short a rivet be used the formed head will be too small or the riveted material will be damaged.

b. If proper length rivets are not available, longer rivets may be cut off to equal the proper length (not grip).

c. The rivet length is based on the grip.

Removal of Solid Rivets. (See figure 16-43).

a. When it becomes necessary to replace rivets, great care should be taken in their removal so that the rivet hole will retain its original size and not acquire replacement with a larger size rivet.

b. To remove a rivet, file a flat on the manufactured head. It is always preferable to work on the original head rather than on the one that is bucked

over, since the former will always be more symmetrical about the shank. Indent the flat surface with a counter-punch so the drill may be correctly centered. A drill slightly less in diameter than the rivet shank should be used to drill and weaken the head. Take care that the rivet shank does not turn with the drill and cause a tear. If the other end of the rivet is supported, the head may be sheared off with a sharp chisel. This cutting should always be done along the direction of the plate edge. If the shank is unduly tight after the removal of the head, the rivet should be drilled out completely. It may be forced out with a counterpunch of a smaller diameter than the rivet, provided the sheet is properly supported from the opposite side; however, there is greater danger of damaging the sheet and enlarging the hole when using this method. This procedure will also apply to flush rivets.

Riveting Installation. (See figure 16-44).

a. Riveting procedure. A large percentage of the riveting of aircraft structures is done on thin gage aluminum alloy and the work must be so accomplished that the material is not distorted by hammer blows or injured with riveting tools. All aircraft power riveting is done by upsetting or heading the rivets against a bucking bar instead of striking the shank with a hammer.

1. To prevent deforming of its head a rivet set must be selected to fit each type. The depth of this set must be such that it does not touch the material being riveted.

2. Parts which are to be heat-treated should be heat-treated before riveting since heat treating after this process causes warping. This is also necessary when assemblies are heated in a salt bath as the salt cannot be entirely washed out of the cracks.

3. Rivets of a diameter smaller than three thirty-seconds inch must not be used for any structural parts, control parts, wing covering, cowling, or similar sections of aircraft except where there are actual replacements.

4. Rivets through hollow tubes, which are loaded only in shear, should be hammered just enough to form a small head. No attempt should be made to form the standard round head as the amount of hammering required often causes the rivet to buckle inside the tube, with resultant injury to the member.

5. Aluminum alloy rivets must never be used in tension for structural, control, or other critical parts of aircraft. Whenever such an installation is required, bolts should be used.

6. The use of hollow rivets in joining highly stressed parts is not permitted. When rivets cannot be driven because of the inaccessibility of the end for bucking or driving, the next size self-plugging cherry rivet may be used.

7. The selection of the proper rivet and proper number of rivets is very important.

8. The rivets must be of the proper length for the total thickness of the pieces being riveted. Ordinarily, from 1-1/2 to 2 times the diameter of the rivet is about the right amount for the rivet shank to protrude through the material to form the head. For heavy material such as plates or fittings, from 2 to 2-1/2 diameters may be used.

9. The rivet should not be too loose in the hole as this condition will cause it to bend over while being headed, and the shank will not be sufficiently expanded to completely fill the hole. A drill from 0.002 to 0.004 inch larger than the rivet should be used for sheet and plate riveting.

10. Pieces should be held firmly together by clamps, screws or bolts while they are being drilled and riveted.

11. Where rivets are headed on the inside of the structure, the bucking bar is held against the end of the rivet shank. Care must be exercised doing this operation to prevent unseating the rivet by the application of too much pressure. For the first few blows the bucking bar should be held lightly against the rivet shank so that it will receive the impact of the blow through the rivet. The bucking bar must be held square with rivet to avoid turning it over.

12. Only a sufficient number of blows should be struck to properly upset a rivet. The blows must be as uniform as possible.

- b. Spacing and diameter of rivets. There are no specific rules which are applicable to every case or type of riveting. There are, however, certain general rules which should be understood and followed.

1. The edge distance of rivets should not be less than two diameters of the rivet measured from the edge of the sheet or plate to the center of the rivet hole. (See figure 16-44).

2. The spacing between rivets, when in rows, depends upon several factors, principally the thickness of the sheet, the diameter of the rivets and the manner in which the sheet will be stressed. This spacing is seldom less than four diameters of the rivet, measured between the centers of the rivet holes. Rivets spaced four diameters apart are found in certain seams of monocoque and semimonocoque fuselages, webs of built-up spars, various plates or fittings, and floats or hulls.

3. Where there are two rows of rivets, they are usually staggered. The transverse pitch or distance between rows should be slightly less than the pitch of the rivets, 75% of the rivet pitch being the usual practice.

4. An average spacing or pitch of rivets in the cover or skin of most structures, except at highly stressed joints, will be from 6 to 12 diameters of the rivet.

5. The best practice in repair jobs is to make the pitch of the rivets equal to those in the original structure.

Loose or Working Rivets in Outboard Section of Wing.

Loose or working rivets attaching skin to upper and lower front spar cap may be repaired by adding MS20470AD4 or equivalent rivets midway between and in line with existing working rivets and four rivets beyond the last loose rivet, starting repair at the wing tip and working inboard. This repair is limited to the area between the nacelle and tip tank fitting.

NOTE

Care must be taken to avoid damage to fuel tanks and wiring.

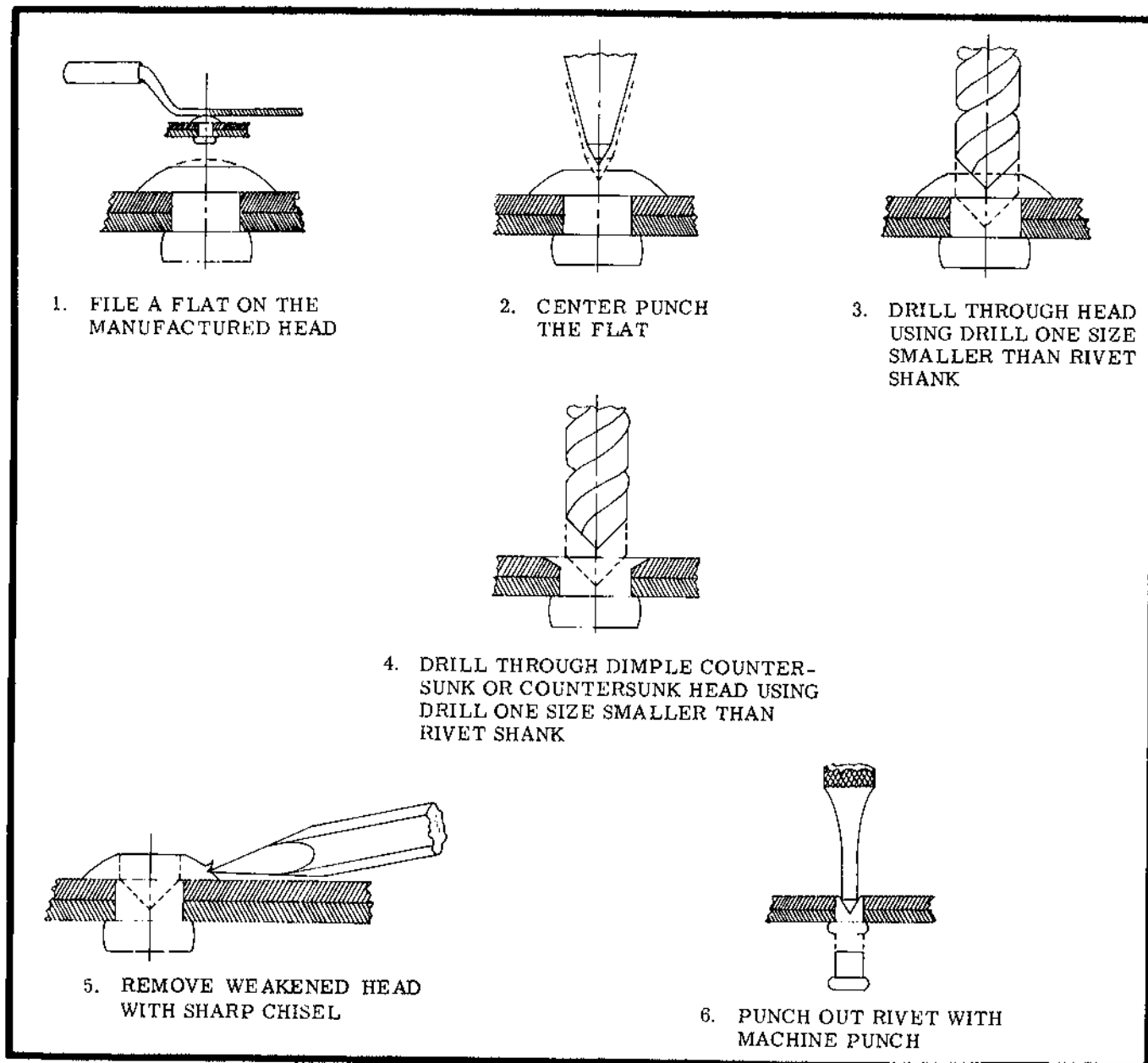


Figure 16-43. Removal of Rivets

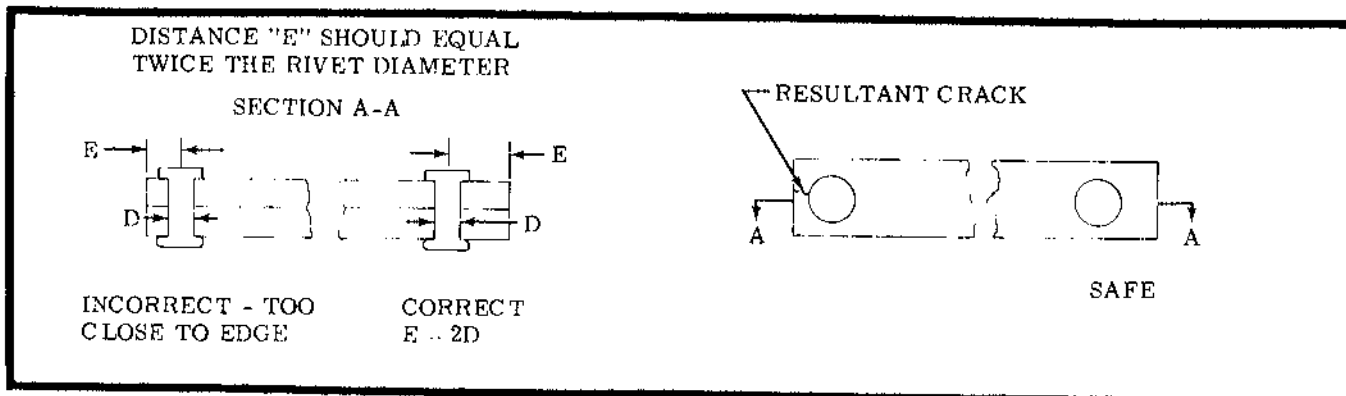


Figure 16-44. Rivet Edge Distance

Loose or Working Rivets.

- a. Rivets which appear to be loose shall be checked by the use of a 0.002 feeler gage by inserting the gage around the head of the rivet in question. If the feeler gage can be inserted to the shank of the rivet, it shall be classified as a loose rivet and shall be replaced.
- b. If the feeler gage can be inserted approximately half-way to the shank for 30% of the circumference of the rivet head, it shall not be classified as a loose rivet.
- c. The feeler gage shall be used to check the shear section between the riveted members, such as skin to spar or different sections of skins in a similar manner to that used around the rivet head.
- d. If the skin around the brazier head or counter-sunk rivet can be moved by depressing the skin with finger pressure around the rivet, the rivet shall be replaced.

e. If rivets are found to turn by applying a rotating load to the head of the rivet, they should be replaced.

f. In areas where exterior paint has been applied to rivet heads, the paint may harden due to aging processes and show hairline cracks around the edge of the rivet heads. This should not be used as a basis for determining whether the rivet is loose or not. The hardened paint may crack at times and collect dirt or exhaust fumes which will appear as discoloration. It is not possible to detect loose rivets visually.

g. When replacing rivets, it is desirable to replace them with like size and type. In some instances, it will be necessary to go to the next size larger diameter. For general repair practices, the spacing between the centerlines of adjacent rivet holes shall be four diameters or greater. In areas where the spacing between rivets prohibits the use of the next size larger rivets, special repair instructions and procedures shall be utilized.

Resin Selectron 5003 - Comparable to MIL-R-7575 -
Vendor: PPG Industries, Inc., One Gateway Center,
Pittsburg, Penn., Attention: International Dept.
a. Alternate: Hetron 92 - Comparable to MIL-R-
7575 - Vendor: Hooker Electrochemical Co.,
Niagara Falls, N. Y.

Luperson DDM - No MIL specification - Vendor:
Lucidol Division, Wallace and Tiernan, Inc.,
Buffalo, N. Y.

Luperco ATC Paste - No MIL specification -
Vendor: Lucidol Division, Wallace and Tiernan,
Inc., Buffalo, N. Y.

Nuodex Cobalt - Federal Standard TT-D-642 -
Manufacturer: Nuodex Canada Ltd., 34 Industrial
St., Toronto 352, Ontario, Canada.

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