

CESSNA™ 310 Series

1955 thru 1960 Service Manual

Table of Contents

Click on a link below

- [1. GENERAL INFORMATION](#)**
- [2. AIRFRAME AND LANDING GEAR](#)**
- [3. UTILITY SYSTEMS](#)**
- [4. POWERPLANT AND RELATED SYSTEMS](#)**
- [5. INSTRUMENTS](#)**
- [6. ELECTRICAL SYSTEMS AND WIRING DATA](#)**
- [7. ELECTRONIC CIRCUITS AND WIRING DATA](#)**
- [8. STRUCTURAL REPAIR](#)**
- [9. ALPHABETICAL INDEX](#)**

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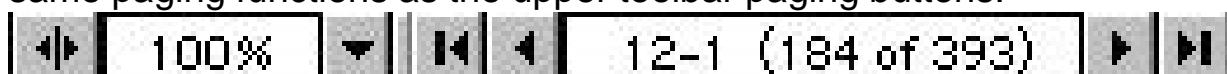


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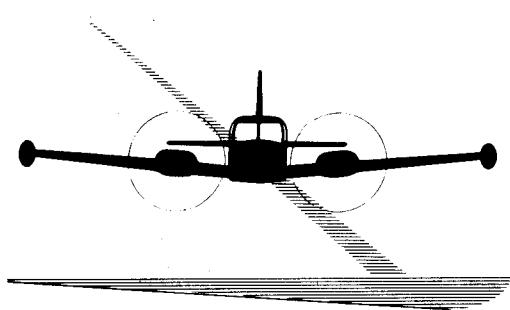


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C E S S N A

150

SERVICE MANUAL

1 APRIL 1960
CHANGED 1 JULY 1960

LIST OF EFFECTIVE PAGES

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

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 725, CONSISTING OF THE FOLLOWING:

Page No.	Issue
*Title	1 July 1960
**"A"	1 July 1960
*i thru ii	1 July 1960
Title (Section 1)	Original
1-1 thru 1-2B	Original
1-3 thru 1-26	Original
Title (Section 2)	Original
2-1 thru 2-2B	Original
2-3 thru 2-52B	Original
2-53 thru 2-62D	Original
2-63 thru 2-64D	Original
2-65 thru 2-66B	Original
2-67 thru 2-134D	Original
2-135 thru 2-148	Original
Title (Section III)	Original
*3-1 thru 3-2B	1 July 1960
3-3 thru 3-29	Original
*3-30 thru 3-38	1 July 1960
Title (Section IV)	Original
4-1 thru 4-2B	Original
4-3 thru 4-18B	Original
4-19 thru 4-36B	Original
4-37 thru 4-42B	Original
4-43 thru 4-48K	Original
4-49 thru 4-62B	Original
4-63 thru 4-88B	Original
4-89 thru 4-98	Original
Title (Section V)	Original
5-1 thru 5-24	Original
Title (Section VI)	Original
6-1 thru 6-124	Original
Title (Section VII)	Original
7-1 thru 7-178	Original
Title (Section VIII)	Original
8-1 thru 8-31	Original
*8-32	1 July 1960
*Index-1 Thru Index-2	1 July 1960
Index-3	Original

* The asterisk indicates pages changed, added or deleted by the current change.

TABLE OF CONTENTS

	Page	310	310B	310C	310D
Section I - GENERAL INFORMATION					
General Description	1-1	1-1	1-1	1-1	1-1
Principal Dimensions	1-1	1-1	1-1	1-1	1-1
Access and Inspection Provisions	1-3	1-3	1-3	1-3	1-3
Ground Handling	1-3	1-3	1-3	1-3	1-3
Servicing	1-6	1-6	1-6	1-6	1-6
Lubrication Requirements	1-9	1-9	1-9	1-9	1-9
Special Tools and Equipment	1-9	1-9	1-9	1-9	1-9
Section II - AIRFRAME AND LANDING GEAR					
Wing Group	2-2A	2-2A	2-2A	2-2A	2-2A
Empennage Group	2-8	2-8	2-8	2-8	2-8
Surface Control Systems	2-15	2-15	2-15	2-15	2-15
Fuselage	2-52	2-52	2-52	2-52	2-52
Landing Gear	2-81	2-81	2-81	2-81	2-81
Rigging of Landing Gear	2-122	2-122	2-122	2-122	2-122
Nose Gear Steering System	2-130	2-130	2-130	2-130	2-130
Cabin Step System	2-133	2-134A	2-134A	2-134A	2-134A
Brake System	2-134D	2-134D	2-134D	2-134D	2-134D
Section III - UTILITY SYSTEMS					
Heating, Ventilating and Defrosting System	3-1	3-10	3-10	3-10	3-10
Four Port Oxygen System	3-18				
Five Port Oxygen System		3-22	3-22	3-22	3-22
Forward Oxygen System				3-26	
Light Weight De-Icer System	3-30	3-30	3-30	3-30	3-30
Section IV - POWERPLANT AND RELATED SYSTEMS					
Engine Cowling	4-2A	4-2A	4-2A	4-2A	4-2A
Engine Assemblies	4-2A	4-2B	4-70	4-70	4-70
Fuel System	4-30	4-30	4-83	4-83	4-83
Fuel Injection System			4-85	4-85	4-85
Engine Controls	4-49	4-49	4-90	4-90	4-90
Rigging Procedures - Engine Controls	4-53	4-53	4-94	4-94	4-94
Propellers	4-57	4-57	4-57	4-57	4-57
Vacuum System	4-62	4-62	4-62	4-62	4-62
Manifold Pressure System	4-69	4-69	4-69	4-69	4-69
Section V - INSTRUMENTS					
Instruments	5-4	5-14	5-19	5-19	5-19
Instrument Panel	5-4	5-15	5-19	5-19	5-19
Vacuum System Instruments	5-6	5-17	5-20	5-20	5-20
Pitot Static System Instruments	5-8	5-17	5-20	5-20	5-20
Electrical Instruments	5-11	5-17	5-20	5-20	5-20
Combination Gages	5-13	5-17	5-20	5-20	5-20
Miscellaneous Instruments	5-13	5-19	5-21	5-21	5-21
Section VI - ELECTRICAL SYSTEMS AND WIRING DATA					
General Description	6-1	6-1	6-1	6-1	6-1
Electrical Power Supply	6-3	6-3	6-3	6-3	6-3
Electrical Power Distribution	6-18	6-18	6-18	6-18	6-18
Interior Lighting	6-23	6-23	6-23	6-23	6-23
Exterior Lighting	6-29	6-29	6-29	6-29	6-29
Miscellaneous Electrical Equipment	6-36	6-36	6-36	6-36	6-36
Index of Electrical Wiring Diagrams and Data	6-41	6-41	6-41	6-41	6-41

TABLE OF CONTENTS Cont.

	Page	310	310B	310C	310D
Section VII - ELECTRONIC CIRCUITS AND WIRING DATA					
Symbols Charts	7-1	7-1	7-1	7-1	7-1
General Description	7-1	7-1	7-1	7-1	7-1
Wiring Code and Identification	7-1	7-1	7-1	7-1	7-1
Index of Wiring Diagrams	7-1	7-1	7-1	7-1	7-1
Radio Combination Charts	7-4	7-6	7-9	7-11	
Table of Electronics Equipment Loading.	7-161	7-161	7-161	7-161	7-161
Section VIII - STRUCTURAL REPAIR					
General	8-1	8-1	8-1	8-1	8-1
Wing	8-2	8-2	8-2	8-2	8-2
Wing Skin	8-2	8-2	8-2	8-2	8-2
Wing Skin			8-32	8-32	
Wing Ribs	8-2	8-2	8-2	8-2	8-2
Flaps and Ailerons	8-3	8-3	8-3	8-3	8-3
Wing Spars	8-3	8-3	8-3	8-3	8-3
Tail Group	8-3	8-3	8-3	8-3	8-3
Vertical Fin and Dorsal Group	8-3	8-3	8-3	8-3	8-3
Rudder	8-3	8-3	8-3	8-3	8-3
Horizontal Stabilizer	8-3	8-3	8-3	8-3	8-3
Elevators	8-3	8-3	8-3	8-3	8-3
Fuselage	8-3	8-3	8-3	8-3	8-3
Bulkheads	8-4	8-4	8-4	8-4	8-4
Landing Gear	8-4	8-4	8-4	8-4	8-4
Engine Mount.	8-4	8-4	8-4	8-4	8-4
Engine Cowling	8-4	8-4	8-4	8-4	8-4
Fiberglas Parts	8-4	8-4	8-4	8-4	8-4

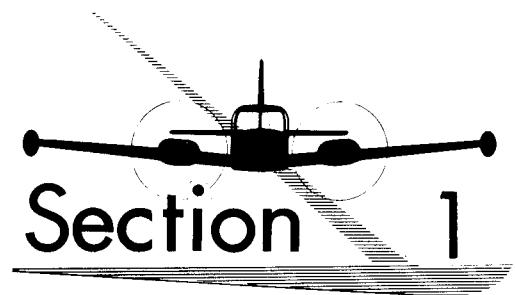
FOREWORD

This manual contains procedures recommended for maintenance of Cessna series 310 aircraft. This manual presents all necessary instructions for ground handling, servicing and maintaining the aircraft. Besides serving as a reference manual for the experienced mechanic this book also covers step-by-step procedure for the less experienced man. This manual should be kept in a handy place for ready reference. If properly used, it will enable the mechanic to better maintain the series 310 aircraft and thereby build or maintain a reputation for reliable service.

The material presented in this manual is divided into eight sections. All sections, and their major paragraph titles are listed in the book table of contents located on page i. A section table of contents, listing each paragraph and the page on which it appears, is located at the front of each individual section. An alphabetical index, located at the back of the manual, provides a handy means of locating a specific item or subject. All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication.

This information is supplemented and kept current by service letters and service news letters published by Cessna Aircraft Company. This information goes to all Cessna Dealers, so that they have the latest authoritative information for servicing Cessna airplanes. Therefore, Cessna recommends that all Cessna Owners utilize the Cessna trained Dealer Service Organization to the fullest, to receive the benefit of their knowledge and experience.

310 SERVICE MANUAL



GENERAL INFORMATION

1 APRIL 1960

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SECTION I

GENERAL INFORMATION

Table of Contents

	Page	310	310B	310C	310D
GENERAL DESCRIPTION	1-1	1-1	1-1	1-1	1-1
PRINCIPAL DIMENSIONS	1-2B	1-2B	1-2B	1-2B	1-2B
ACCESS AND INSPECTION PROVISIONS	1-3	1-3	1-3	1-3	1-3
GROUND HANDLING	1-3	1-3	1-3	1-3	1-3
Towing	1-3	1-3	1-3	1-3	1-3
Assist Step.	1-3	1-3	1-3	1-3	1-3
Assist Handle	1-3	1-3	1-3	1-3	1-3
Wing Walk and Wing Walk Areas	1-3	1-3	1-3	1-3	1-3
Jacking	1-3	1-3	1-3	1-3	1-3
Hoisting	1-3	1-3	1-3	1-3	1-3
Leveling.	1-6	1-6	1-6	1-6	1-6
Parking and Tie-Down	1-6	1-6	1-6	1-6	1-6
SERVICING	1-6	1-6	1-6	1-6	1-6
Fuel	1-6	1-6	1-6	1-6	1-6
Recommended Fuels	1-6	1-6	1-6	1-6	1-6
Drain Valves and Drain Plugs	1-6	1-6	1-6	1-6	1-6
Fuel Strainer Drain Valve	1-8	1-8	1-8	1-8	1-8
Fuel Tank Sump Drain Valve.	1-8	1-8	1-8	1-8	1-8
Fuel Line Drain Plugs	1-8	1-8	1-8	1-8	1-8
Oil	1-8	1-8	1-8	1-8	1-8
Brake Master Cylinder	1-8	1-8	1-8	1-8	1-8
Shimmy Dampener	1-8	1-8	1-8	1-8	1-8
Carburetor Air Filter	1-9	1-9	1-9	1-9	1-9
Battery	1-9	1-9	1-9	1-9	1-9
External Power Receptacle	1-9	1-9	1-9	1-9	1-9
Tires	1-9	1-9	1-9	1-9	1-9
Servicing the Shock Struts	1-9	1-9	1-9	1-9	1-9
LUBRICATION REQUIREMENTS	1-9	1-9	1-9	1-9	1-9
SPECIAL TOOLS AND EQUIPMENT	1-9	1-9	1-9	1-9	1-9
CHECK AND INSPECTION REQUIREMENTS	1-10	1-10	1-10	1-10	1-10

SERIAL BLOCKS

MODEL 310
35000 thru 35546MODEL 310B
35547 thru 35771MODEL 310C
35772 thru 39031MODEL 310D
39032 and on

1-1. GENERAL DESCRIPTION.

1-2. The 310 is an all-metal, low-wing, twin-engine airplane built by the Cessna Aircraft Company of Wichita, Kansas. The airplane is powered by Continental six-cylinder horizontally-opposed engines, driving constant-speed, all-metal, full-feathering propellers. Early models are equipped with O-470-B engines,

later models are equipped with O-470-M engines, and still later models are equipped with fuel injection IO-470-D engines. A fully retractable, tricycle-type landing gear is provided on the aircraft. Electrically operated, split-type wing flaps which can be extended to any angle between zero and 45 degrees are provided. Flight adjustable trim tabs are located on the right elevator, the rudder, and the left aileron.

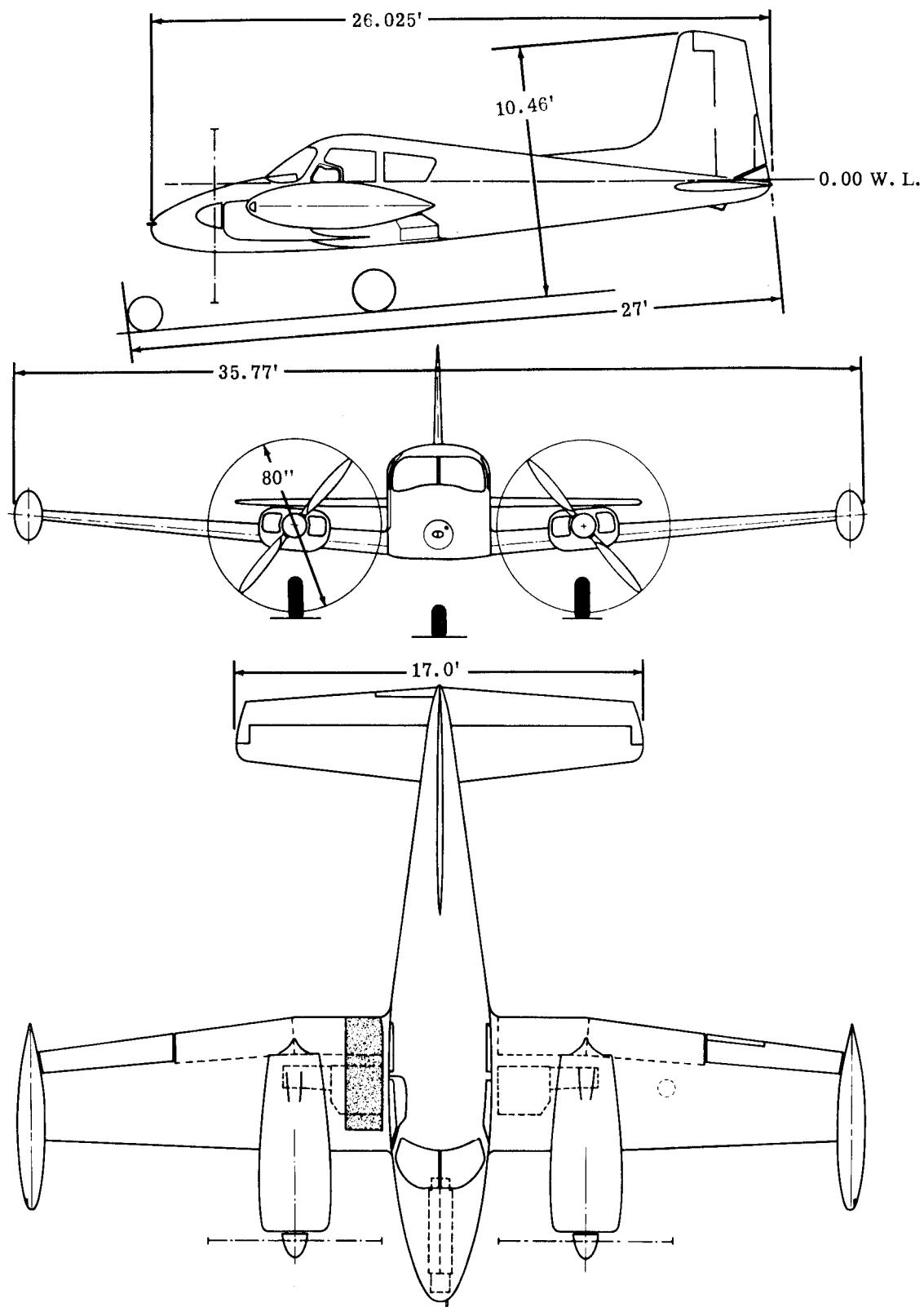


Figure 1-1. Three-View of 310 Airplane (Serials 35000 thru 39031)

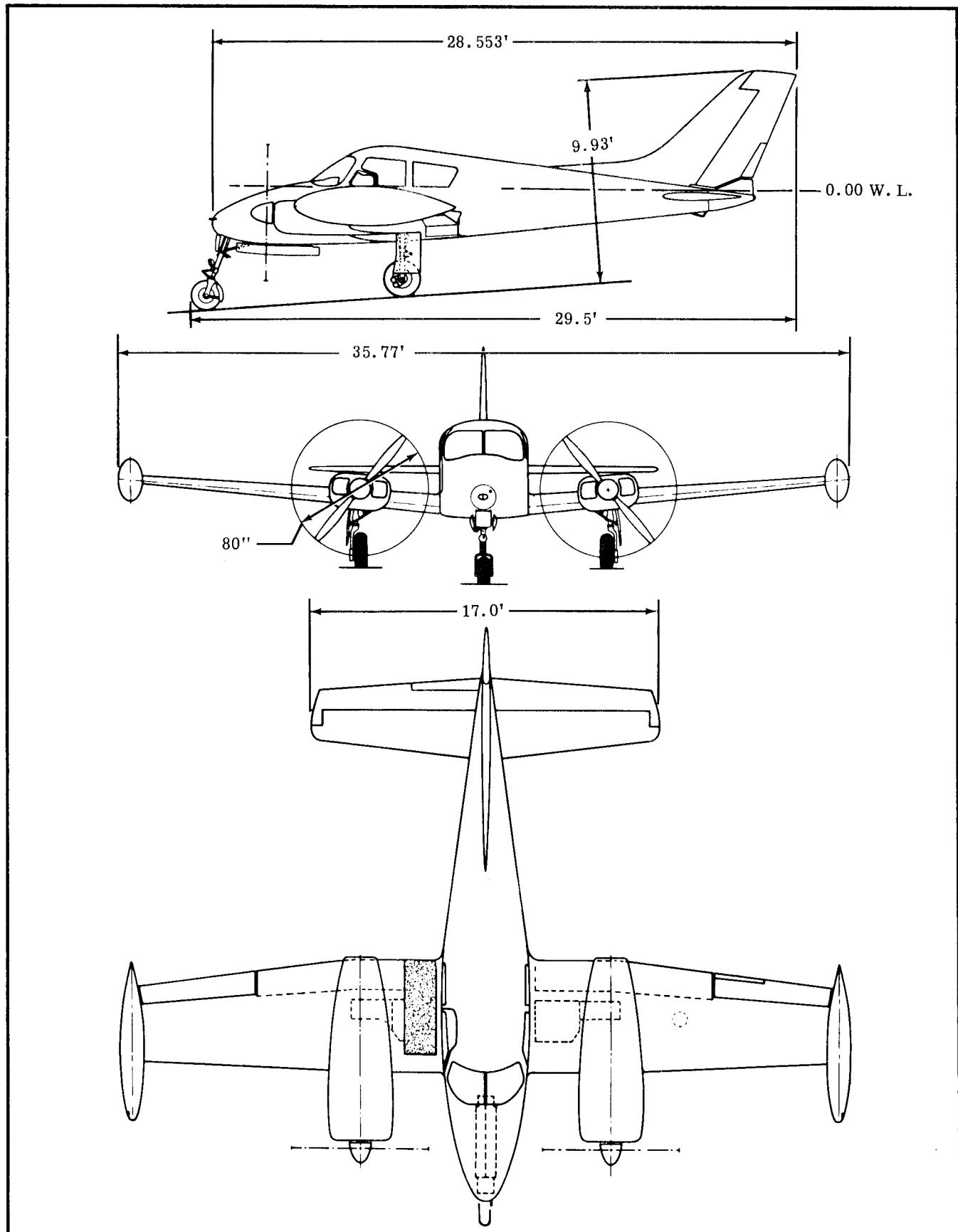


Figure 1-1A. Three-View of 310 Airplane (Serials 39032 and on)

1-3. PRINCIPAL DIMENSIONS. (Airplane in level flight position unless otherwise stated.)

GENERAL	<u>310</u>	<u>310B</u>	<u>310C</u>	<u>310D</u>
Span	35.77'	35.77'	35.77'	35.77'
Length (Overall)	26.976'	26.976'	26.976'	29.5'
Length (Minus pitot tube)	26.025'	26.025'	26.025'	28.553'
Height	10.46'	10.46'	10.46'	9.93'
Propeller Ground Clearance	12.5"	12.5"	12.5"	12.5"
Design Gross Weight	4600 lbs	4700 lbs	4830 lbs	4830 lbs
Empty Weight	2800 lbs	2925 lbs	3020 lbs	3037 lbs
Design Useful Load	1800 lbs	1775 lbs	1810 lbs	1793 lbs
WINGS				
Span	35.77'	35.77'	35.77'	35.77'
Type	Full cantilever	Full cantilever	Full cantilever	Full cantilever
Airfoil (Centerline)	NACA 23018	NACA 23018	NACA 23018	NACA 23018
Airfoil (Tip)	NACA 23009	NACA 23009	NACA 23009	NACA 23009
Airfoil (Nacelle)	NACA 23015	NACA 23015	NACA 23015	NACA 23015
Incidence (Root)	+2°30'	+2°30'	+2°30'	+2°30'
Incidence (Tip)	-0°30'	-0°30'	-0°30'	-0°30'
Dihedral	5°	5°	5°	5°
MAC	61.00"	61.00"	61.00"	61.00"
Taper Ratio	1.517	1.517	1.517	1.517
Aspect Ratio.	7.0	7.0	7.0	7.0
Area (Total)	175 sq ft	175 sq ft	175 sq ft	175 sq ft
Area (Flap)	22.9 sq ft	22.9 sq ft	22.9 sq ft	22.9 sq ft
Area (Aileron)	13.4 sq ft	13.4 sq ft	13.4 sq ft	13.4 sq ft
Aileron Tab Area	0.55 sq ft	0.55 sq ft	0.55 sq ft	0.55 sq ft
Angular Travel (Flap-down)	45°+1°-0°	45°+1°-0°	45°+1°-0°	45°+1°-0°
Angular Travel (Aileron-up)	20°+1°-0°	20°+1°-0°	20°+1°-0°	20°+1°-0°
Angular Travel (Aileron-down)	20°+1°-0°	20°+1°-0°	20°+1°-0°	20°+1°-0°
Angular Travel (Aileron Tab-up)	20°+1°-0°	20°+1°-0°	20°+1°-0°	20°+1°-0°
Angular Travel (Aileron Tab-down)	20°+1°-0°	20°+1°-0°	20°+1°-0°	20°+1°-0°
STABILIZER AND ELEVATOR				
Span (Total)	17'	17'	17'	17'
Airfoil (Root)	NACA 0009	NACA 0009	NACA 0009	NACA 0009
Airfoil (Tip)	NACA 0006	NACA 0006	NACA 0006	NACA 0006
Incidence	-1°45'	-1°45'	-1°45'	-1°45'
Area (Total)	54.25 sq ft	54.25 sq ft	54.25 sq ft	54.25 sq ft
Area (Stabilizer)	32.15 sq ft	32.15 sq ft	32.15 sq ft	32.15 sq ft
Area (Elevator)	22.10 sq ft	22.10 sq ft	22.10 sq ft	22.10 sq ft
Area (Elevator tab)	1.24 sq ft	1.24 sq ft	1.62 sq ft	1.62 sq ft
Angular Travel (Elevator-up)	25°+1°-0°	25°+1°-0°	25°+1°-0°	25°+1°-0°
Angular Travel (Elevator-down)	15°+1°-0°	15°+1°-0°	15°+1°-0°	15°+1°-0°
Angular Travel (Elevator tab-up)	20°+1°-0°	20°+1°-0°	10°+1°-0°	10°+1°-0°
Angular Travel (Elevator Tab-down)	28°+1°-0°	28°+1°-0°	26°+1°-0°	26°+1°-0°
FIN AND RUDDER				
Span	6.0'	6.0'	6.0'	5.82'
Airfoil (Root)	NACA 0009	NACA 0009	NACA 0009	NACA 0009
Airfoil (Tip)	NACA 0006	NACA 0006	NACA 0006	NACA 0006
Area Total	25.85 sq ft	25.85 sq ft	25.85 sq ft	26.02 sq ft
Area Dorsal	2.70 sq ft	2.70 sq ft	2.70 sq ft	1.988 sq ft
Area Fin	14.08 sq ft	14.08 sq ft	14.08 sq ft	14.31 sq ft
Area Rudder.	11.77 sq ft	11.77 sq ft	11.77 sq ft	11.71 sq ft
Area Tab	0.66 sq ft	0.66 sq ft	0.83 sq ft	0.86 sq ft
Area Ratio	1.55	1.55	1.55	1.41
Angular Travel (Rudder-Left)	25°+1°-0°	25°+1°-0°	25°+1°-0°	25°+1°-0°
Angular Travel (Rudder-Right)	25°+1°-0°	25°+1°-0°	25°+1°-0°	25°+1°-0°
Angular Travel (Tab-left)	26°+1°-0°	25°+1°-0°	25°+1°-0°	22°+1°-0°
Angular Travel (Tab-right)	20°+1°-0°	25°+1°-0°	25°+1°-0°	17°+1°-0°

ALIGHTING GEAR

Size	
Main Wheels	650 x 10
Nose Wheel	600 x 10

POWERPLANT

Engine
 Continental, 6-cylinder, horizontally-opposed
 (470 cu. inches)
 240 hp at 2600 rpm
 260 hp at 2625 rpm (fuel injection)

Propeller

Constant-speed Hartzell	
.	HCA2XF-2"12.5"/8433-4
Constant-speed Hartzell	
(fuel injection) . . .	HCA2XF-2"13.5"/8433-4

Governor

Woodward, positive high-pitched, single-acting	
Range 1800-2710 rpm	
Cessna Part No. 0750101-59 (fuel injection)	
Cessna Part No. 0750101-60	

1-4. ACCESS AND INSPECTION PROVISIONS.

1-5. 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. Access to the interior of aft fuselage is gained through the baggage compartment door. To enter aft fuselage, remove the rear baggage compartment curtain assembly by releasing the attaching Dzus fasteners and screws.

CAUTION

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

1-6. GROUND HANDLING.**1-7. TOWING.**

1-8. 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 steer aircraft manually.

CAUTION

Be sure parking brake is released and the external gust lock for rudder is removed before towing.

CAUTION

Never turn nose gear beyond 55-degree stops. Damage to nose wheel steering mechanism will result.

A crew of three, with one man using the tow bar and the other two pushing on the wings, can move aircraft.

CAUTION

Never push on control surfaces or unsupported skin between wing ribs.

Power towing is not recommended. However, aircraft can be power towed in emergencies if towing equipment is attached to the main landing gear. Do not power tow aircraft with towing vehicle attached to nose gear. When power towing, station a crew member in the aircraft to apply brakes in case of emergency.

1-9. ASSIST STEP.

1-10. A retractable assist step, located on the side of the fuselage near the trailing edge of the right wing root, is attached to the linkage of the main landing gear and extends and retracts with this gear.

1-11. ASSIST HANDLE.

1-12. An assist handle is located on the side of the fuselage above the baggage compartment door.

1-13. WING WALK AND WING WALK AREAS.

1-14. A nonskid-surfaced wing walk, located along the inboard side of the right wing, will allow freedom of passage without damaging the wing finish. The entire 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.

1-15. JACKING. (See figure 1-3.)

1-16. Four jack points, two on the 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 1-3 for jacking procedures.

NOTE

Special two-ton tripod jacks, ideally suited to the 310, can be supplied by the Cessna Aircraft Company. Four jacks are required to lift the aircraft. The jacks are manufactured by the Smith-Nelson Company of Santa Barbara, California, and are 26.5 inches high when closed, with an extension height of 44.5 inches.

1-17. HOISTING.

1-18. The 310 may be lifted by means of two stainless steel hoisting lugs which are provided as optional equipment on the aircraft. Each lug may be perman-

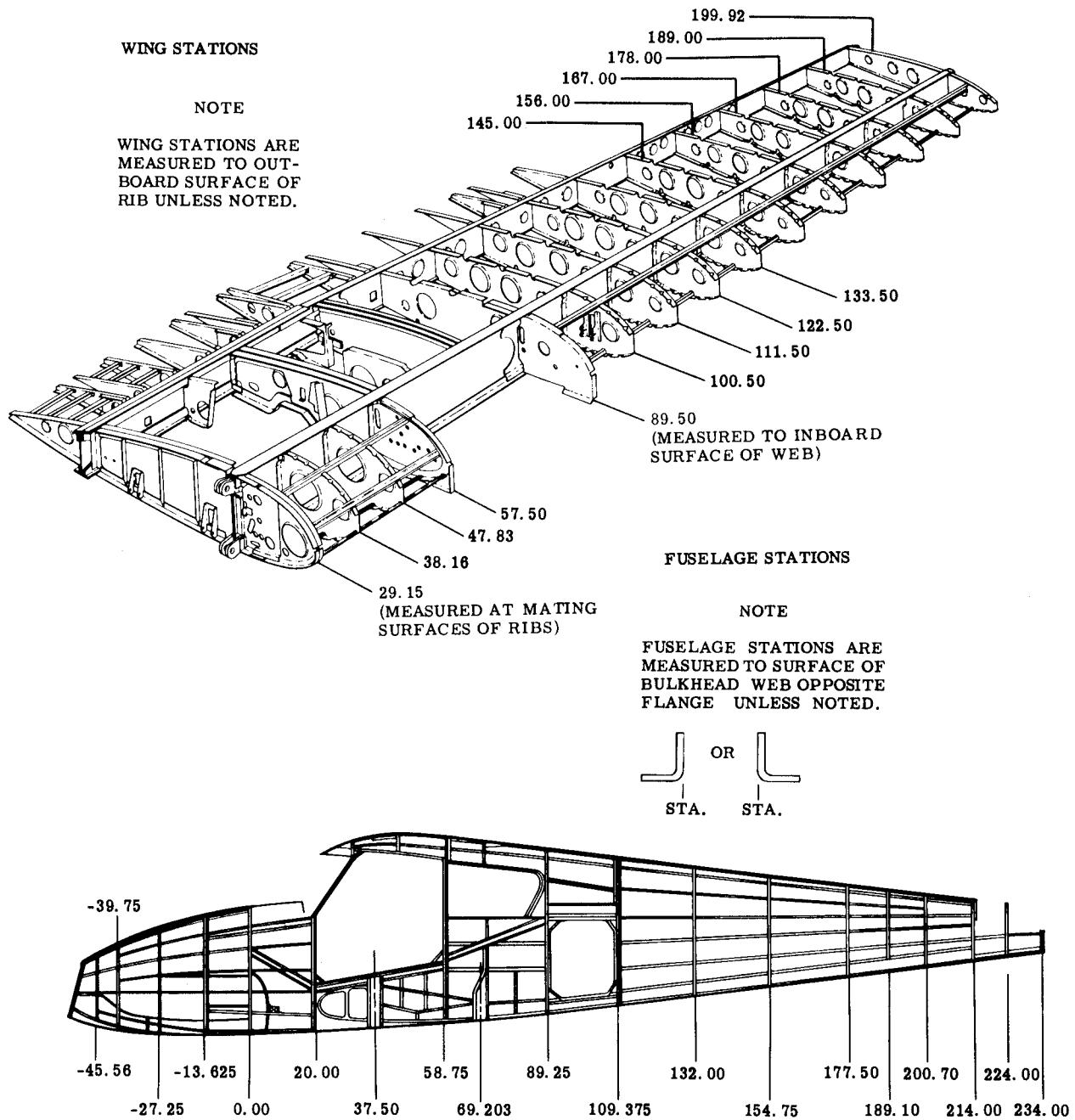


Figure 1-2. Stations And Frames Diagram

NOTES

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 AIRPLANE
 FROM TIPPING BACKWARD WHEN NOSE IS RAISED. TO PREVENT POSSIBLE
 STRUCTURAL DAMAGE, APPLY EQUAL FORCE WITH NOSE JACKS.

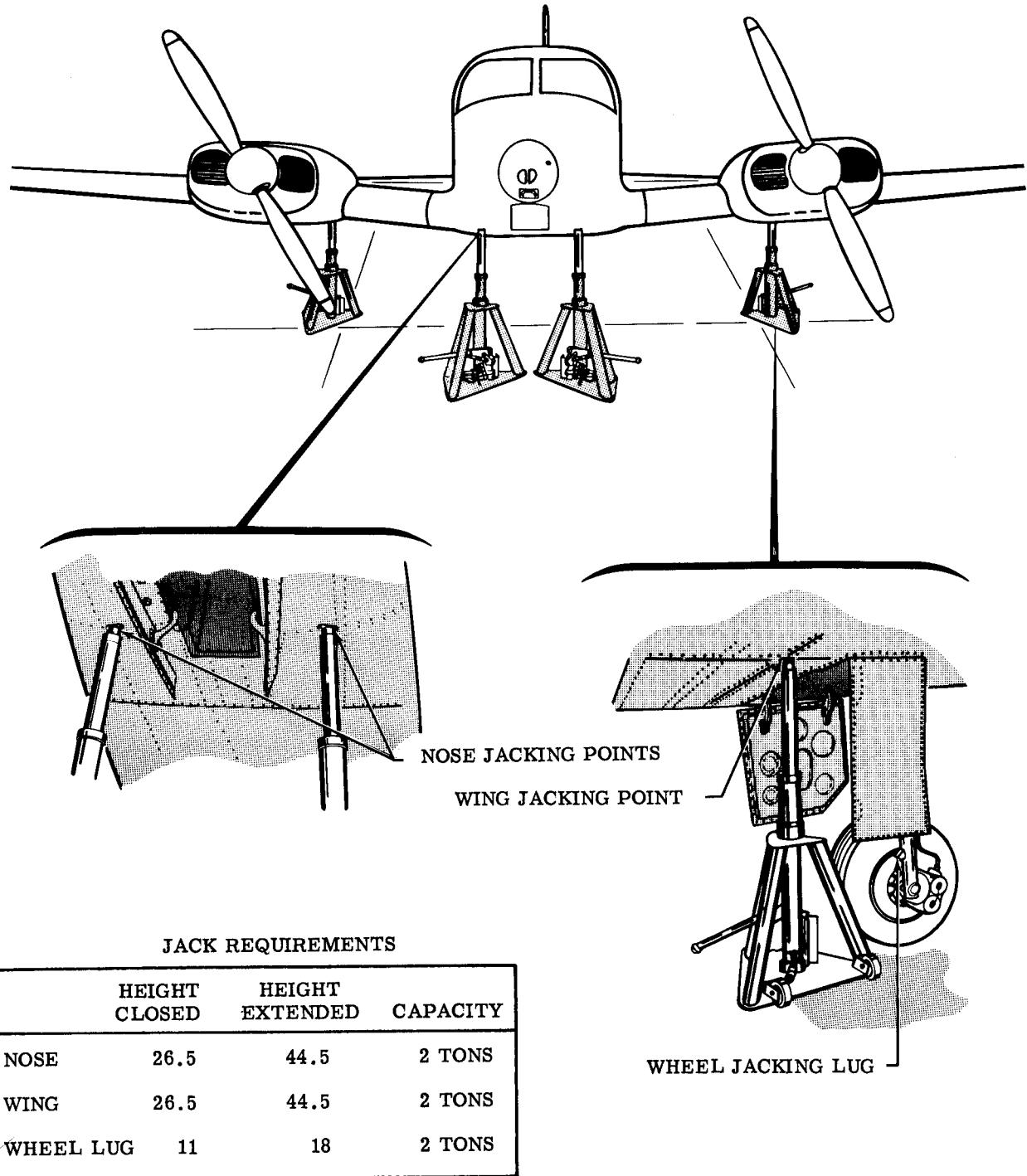


Figure 1-3. Jacking Provisions

ently mounted, attached with the upper bolt which secures the front wing spar to the fuselage spar. Access to the lugs is gained by removing the wing fillet between the fuselage and each wing. Before hoisting the aircraft, position a man at both the nose gear and the tailcone section of the aircraft. Then attach the hoisting cables to the lugs and slowly lift the aircraft. The hoisting lugs are located directly in line with the aircraft's center of gravity, and in most cases the aircraft will remain level in its ascent. However, support at the nose gear or tailcone sections may be furnished by the men stationed at these points.

1-19. LEVELING.

1-20. To attain level flight attitude, inflate the main gear struts to their maximum extension, completely deflate the nose gear strut, and adjust the nose wheel tire pressure until the aircraft is level. Position a spirit level on the upper edge of the outside doubler between stations 40 and 50 outside the pilot's window. The alternate method for leveling the aircraft is to hold the spirit level against the baggage door upper sill. To level the aircraft laterally, remove the carpet from the center section of the front spar between the front seats and place the level on the spar.

1-21. PARKING AND TIE-DOWN. (See figure 1-4.)

1-22. Between flights, the 310 aircraft, under normal weather conditions (winds less than 50 mph), can be parked safely by setting the parking brake and putting the control lock in place. However, for longer periods of parking, or when high winds (gusts of 50 mph or higher) are expected, the aircraft should be tied down at nose gear, wing tie-down fittings, and tailcone bumper in addition to normal parking procedure. In parking the aircraft, it is also important to turn the nose gear to its full limit, either right or left, if external rudder locks are not available. This will place the rudder bellcrank against the stop and hold it there with spring tension from the nose gear steering mechanism.

NOTE

The cabin control lock, normally stored in the map compartment of the 310, is a pin which slips through the control column in the socket on the instrument panel. The pin locks the aileron and elevator systems. A metal warning flag on the end of the pin covers the ignition switches making it impossible to start the engines without first removing the control lock. The rudder is not locked by the cabin control lock, but is held under tension by the springs connecting the rudder cables to the nose wheel mechanism. If the nose gear is left in a straight ahead position during high gusty winds, the rudder will swing back and forth against the stops, causing possible damage between the lower end of the rudder torque tube and the collar to which the bellcrank is attached.

A gust lock which engages the lower part of the rudder to the upper part of the fiberglass stinger assembly is recommended for use when mooring or tieing down the

model 310 under high wind conditions or for a long period of time.

1-23. For tie-down in high wind conditions (50 mph or greater), head the aircraft into the wind if possible and follow this procedure:

- a. Attach ropes or chains of 700 pounds or more tensile strength to the wing tie-down fittings located on the underside of each wing, and secure the opposite ends of the lines to the tie-down rings anchored to the ground.
- b. Install external rudder gust lock. If lock is not available, turn nose wheel to extreme right or left position.
- c. Tie a rope around the nose gear above the torque link, and secure the outer end to a tie-down ring in the ground.
- d. Tie a rope or chain to tailcone bumper and secure other end to a tie-down ring in the ground.
- e. Install control lock at the control column.
- f. Set parking brake or use wheel chocks.
- g. Install pitot tube cover.

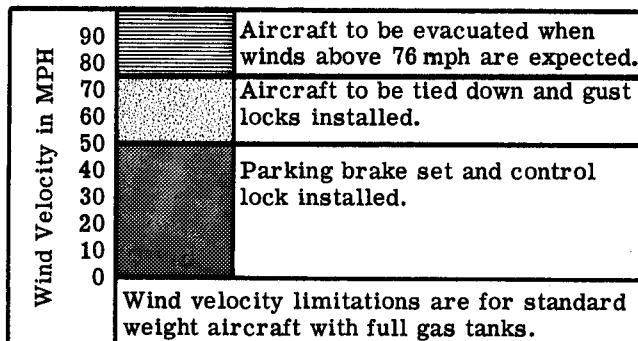


Figure 1-4. Wind Velocity Chart

1-24. SERVICING.

1-25. Tank capacities, specifications, grades, and access points are shown in Servicing Diagram, figure 1-5.

1-26. FUEL.

1-27. The wing-tip fuel cell filler caps are located on top of the wing tip tanks. The filler caps for the two auxiliary fuel tanks (optional equipment) are located immediately above these tanks in the top of each wing. Access to wing tip tanks or auxiliary tanks is gained by unsnapping the Dzus fasteners and opening access doors or fairings which cover the filler caps.

1-28. RECOMMENDED FUELS.

1-29. For recommended fuel grade and maximum lead content, see Servicing Diagram, figure 1-5. Use of fuel with higher lead content than recommended in figure 1-5 will result in severe fouling of the spark plugs.

1-30. DRAIN VALVES AND DRAIN PLUGS.

1-31. Three different types of drain valves or plugs

① External Power Receptacle	Use 24-volt dc external power source.
② Batteries	Maintain electrolyte level at horizontal baffle plate or split ring at bottom of filler hole. Service at 25-hour intervals, or oftener if required.
③ Engine Oil	Drain and refill at 25-hour intervals, or as required. Use aviation grade straight mineral oil; SAE 30 (MIL-L-6082B, grade 1065)below 40°F and SAE 50 (MIL-L-6082B, grade 1100) above 40°F. Oil capacity, each engine, is 12 U.S. Qts., 10 Imp. Qts., or 11.4 Liters. Minimum oil for adequate lubrication, each engine, is 6 U.S. Qts., 5 Imp. Qts., or 5.7 Liters.
④ Oil Drain Plugs	Cut safety wire and open drain plug to drain engine oil. Resafety.
⑤ Fuel Strainers and Tank Sump	Drain small amount before first flight of day and after each refueling operation.
⑥ Shimmy Dampener	Check. Fill each 25 hours, or as required, with MIL-H-5606 hydraulic fluid.
⑦ Nose Gear Shock Strut	Check and fill each 500 hours. Fill to level of filler plug with MIL-H-5606 hydraulic fluid. Inflate strut to two-inch extension with airplane at gross weight.
⑧ Nose Wheel Tire	Maintain 22 psi.
⑨ Master Brake Cylinder	Check and fill each 100 hours with MIL-H-5606 hydraulic fluid.
⑩ Fuel Line Drain Plugs	Drain whenever excessive water or sediment is found in strainer.
⑪ Anti-Ice Fluid	Fill as required with MIL-F-5566 anti-ice fluid (Isopropyl Alcohol). Reservoir capacity: 4.5 U.S. Qts., 3.8 Imp. Qts., or 4.3 Liters.
⑫ Main Gear Shock Struts	Check and fill each 500 hours with MIL-H-5606 hydraulic fluid. Fill to level of filler plug. Inflate strut to two-inch extension with airplane at gross weight.
⑬ Main Gear Tires	Maintain 37 psi.
⑭ Fuel Tank Filler Caps	Service serials 35000 thru 35771 with grade 91/96 or alternate grade 100/130 aviation gasoline. Service serial 35772 and on with grade 100/130 or alternate 115/145 aviation gasoline. MIL-F-5572. Lead content should not exceed 4.60 cc per gallon. Capacity, each wing tip tank: 51 U.S. Gals., 42.5 Imp.Gals. or 193 Liters. Usable fuel: 50.5 U.S. Gals., 42.1 Imp.Gals., or 191 Liters. Capacity, each auxiliary (optional) tank: 15 U.S. Gals., 12.5 Imp.Gals., or 56.8 Liters. Usable fuel: 14.5 U.S. Gals., 12.1 Imp.Gals., or 54.9 Liters.
⑮ Auxiliary Fuel Tank Sump Drains	Drain a small amount of fuel each 100 hours, or any time that water or sediment is found when draining the fuel strainers.
⑯ Heater Fuel Filter	Remove and wash thoroughly in unleaded gasoline each 100 hours.

Figure 1-5. Service Chart

located on the fuel strainers, fuel tank sumps, and fuel lines, are provided for disposal of any water or sediment which may collect in the fuel system.

1-32. FUEL STRAINER DRAIN VALVES. A quick-drain valve is located at the bottom of each fuel strainer. Access to the valve is gained through an access door at the bottom of each engine nacelle. Before the first flight of the day, or after each refueling operation, drain a small quantity of fuel, about two ounces, from the fuel strainer to check for any sign of free water or sediment in the fuel. To open the drain valve, turn handle counterclockwise. Upon release, the spring-loaded handle will return automatically to a closed position.

1-33. FUEL TANK SUMP DRAIN VALVES AND DRAIN PLUGS. The wing tip tank sump drain valve, tank quick-drain plug, and booster pump drain plug are located adjacent to each other on the underside of each tank. Access to all three drain units on each wing tip tank is gained by removing the sump door. Removal of the sump door is not necessary for operation of the drain valve. A special hollow-handled screwdriver provided for operation of the sump drain valves is stowed in the baggage door pocket of each 310B aircraft. The drain valves may be opened by inserting the screwdriver through the hole in the sump door, engaging the screwdriver in the bottom of the drain valve, and pushing up while rotating the screwdriver counterclockwise. Fuel will flow through the hollow handle of the screwdriver. The valves are closed by rotating the screwdriver clockwise and releasing pressure sharply, permitting the spring-loaded valve to seat, thus shutting off fuel flow.

NOTE

For complete draining of tank, remove tank quick-drain plug by unsafelying the plug. The booster pump may be drained if necessary by unsafelying and removing its drain plug.

One drain plug for each auxiliary fuel tank (optional equipment) is located on the underside of each wing. These plugs are used not only to drain any sediment or water that may collect in the auxiliary tanks but also to completely drain the tanks.

NOTE

Before the first flight of the day, or after each refueling operation, drain a small quantity of fuel, about two ounces, from fuel tank sump.

1-34. FUEL LINE DRAIN PLUGS. Two drain plugs are also incorporated in the fuel line. These plugs are located at the right wing root rib, and provide another means of checking for excess water and sediment in the fuel system. To gain access to these plugs, remove the right wing root rib fairing.

1-35. OIL.

1-36. The oil filler caps are located beneath access doors which are located on top of the engine nacelles. The quantity of the oil is checked by reading the oil level on the dipstick located just aft of the rear left

engine cylinder. To gain access to the dipstick, open the aft access door on the left side of the engine nacelle.

NOTE

In order to obtain correct oil level readings on the dipstick, shut down the engines at least five to ten minutes prior to checking the oil. This procedure will permit the engine oil to drain out of the engine oil passages into the oil sump and allow for a more accurate oil level reading. Never allow flight with less than six quarts of oil in the oil system. If the level of oil drops below the six-quart mark, the oil pick-up line will be uncovered in a steep climb, causing the engine to lose oil pressure. When replacing the oil filler caps, make sure that the caps are on firmly, and turned clockwise as far as they will go to prevent loss of oil through the filler neck.

To drain the oil, remove four screws securing plate cover over access hole leading to an oil drain plug located on the underside of the engine. The oil will drain readily when the drain plug is removed.

NOTE

For engine lubrication, use oil specified in the Servicing Diagram, figure 1-5. Use grade 1065 (SAE 30) below 32° F; use grade 1100 (SAE 50) above 32° F.

1-37. If the aircraft is to be used frequently in extremely cold weather, it is advisable to install an oil dilution system. If the aircraft is not equipped with an oil dilution system, and is to be parked for a long period of time during extremely cold weather, drain oil while the engine is hot and store the oil in a warm place until needed for the next flight. If desired, the oil can be heated before it is poured into the engine for the next flight.

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.

1-38. BRAKE MASTER CYLINDERS.

1-39. To refill each brake master cylinder proceed as follows:

- Remove the filler plug from the cover of each master cylinder.
- Add hydraulic fluid Spec. MIL-H-5606 as required.

1-40. SHIMMY DAMPENER.

1-41. Fill the shimmy dampener on the nose wheel with MIL-H-5606 hydraulic fluid at every 25-hour inspection. 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, specification MIL-H-5606.
- 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.

1-42. CARBURETOR AIR FILTER.

1-43. Carburetor air filter maintenance and service, particularly in areas where dust is prevalent, is very important to the life of the engine. The carburetor air filters should be serviced in accordance with the instructions stamped on the bottom of the filters. Frequency of filter servicing should be determined by local conditions. Normally, they should be serviced every 25 hours of engine operation. However, when operating in dusty areas, more frequent servicing is recommended. Engine life will be shortened by improper servicing of the carburetor air filters.

NOTE

Check the flock coating on the air filter after cleaning it. Filters without flock are ineffective and should be replaced.

1-44. BATTERY.

1-45. Two 12-volt batteries connected in series to produce 24 volts are located in the left wing, just outboard of the engine nacelle. Access to the batteries can be gained by removing eight fasteners securing the cover over the batteries. A specific gravity reading of from 1.240 to 1.300, corrected for temperature, indicates a properly charged battery. New batteries should test from 1.275 to 1.300 the specific gravity of the electrolyte should not vary more than .025 between cells. If there is a greater variation the battery should be slow-charged and retested. The batteries should be kept as near fully-charged as possible during cold weather to prevent freezing of the electrolyte. The batteries should be removed and stored in a warm place if the airplane is parked for more than a few hours in temperatures below -29°C (-20F), or for an extended period.

1-46. EXTERNAL POWER RECEPTACLE.

1-47. An external power receptacle may be provided, as optional equipment, in the left wing below and slightly to the rear of the batteries to permit the use of 24-volt dc external power source for cold weather starting and for lengthy ground tests of the electrical system. A spring-loaded access door covers the receptacle opening in the wing when the receptacle is not in use.

1-48. TIRES.

1-49. The landing gear tires should be inflated and maintained at values given in Servicing Diagram, figure 1-5.

1-50. SERVICING THE SHOCK STRUTS.

1-51. To fill any of the landing gear shock struts follow this procedure:

- a. Completely deflate the strut.
- b. Remove the filler cap.
- c. Fill each strut to the filler cap with MIL-H-5606 hydraulic fluid. Hydraulic fluid capacity of the struts is 23.50 cubic inches.
- d. Replace the filler cap and inflate strut to correct extension.

NOTE

With airplane unloaded (but with full fuel tanks), landing gear shock strut extension should be between 2-1/2 to 3 inches. With airplane at gross weight the strut extension should be two inches.

1-52. LUBRICATION REQUIREMENTS.

1-53. Lubrication requirements are shown in the Lubrication Diagram, Figure 1-6. Before adding or applying lubricant, make certain that surrounding areas are clean. After lubricant has been applied, wipe all excess oil or grease from the surrounding areas with a clean cloth.

1-54. SPECIAL TOOLS AND EQUIPMENT.

1-55. The relative simplicity and easy accessibility of components of the 310 eliminates the use of many special tools. In most cases, the well-equipped shop will find it necessary to employ only the following special items for maintenance of the 310.

Part Number	Nomenclature
0800016	Towing Bar - Light Duty
0800020-1	Hoisting Lugs (Optional)
0226-150	Tripod Jack (Smith, Nelson Corp., Santa Barbara, Calif.)

1-56. CHECK AND INSPECTION REQUIREMENTS. Following are requirements for 25-hour and 50-hour checks, 100-hour and 1,000-hour inspections:

25-HOUR AND 50-HOUR CHECKS

1. Drain oil.
2. Clean oil screen.
3. Replace and safety oil screen.
4. Replace and safety drain plug. Fill with oil (proper grade).
5. Remove, clean, re-oil, and reinstall carburetor air cleaner.
6. Drain gas sediment bowl. Complete visual inspection of engine compartment.

7. Thoroughly inspect airplane for loose bolts, missing nuts, broken spotwelds, or any apparent exterior damage.
8. Check battery.
9. Check brakes.
10. Check propeller blades for cuts and nicks.
11. Check spark plugs. Clean if necessary.

100-HOUR INSPECTION

NOTE

Before beginning 100-hour inspection, qualified personnel should run the engines to check for rpm drop, generator charging rate, oil pressure variation, and smoothness and general operation of the engines, propellers, controls, and indicators. Discrepancies noted should be recorded as an aid to the mechanic.

The actual inspection should consist basically of the following steps.

1. PREPARATION FOR INSPECTION.

- a. Remove cowling and propeller spinner.
- b. Disconnect main and nose gear door linkage.
- c. Remove lower wing root fairings from each wing.
- d. Remove all access hole covers from the top and underside of each wing and from each main wheel well.
- e. Remove all wing tip tank fairings.
- f. Remove sump door at bottom of each wing tip tank.
- g. Remove all access hole covers on underside of fuselage.
- h. Remove stabilizer fairings and stinger.
- i. Remove all access hole covers on vertical fin and stabilizer.
- j. Remove front seats.
- k. Remove scuff plates and rudder pedal shields.
- Remove carpet and floorboard access hole covers.
- l. Remove lower right and left upholstery panels forward of front spar.
- m. Remove carpet and all access hole covers between front and rear spars.
- n. Remove baggage compartment rear curtain.
- o. Remove the floor cover, and remove all access hole covers in baggage compartment.

2. POWERPLANT.

- a. Visually check each propeller for oil leaks.
- b. Visually check each engine for oil leaks.
- c. Visually check all fuel and oil plumbing for leaks.
- d. Remove and clean each fuel strainer screen.
- e. Remove and clean each carburetor or fuel-air control unit screen.
- f. Change oil.
- g. Wash down engines and propellers.
- h. Wash cowlings and propeller spinners and check for cracks.
- i. Check condition and security of attachment of magnetos.
- j. Check magneto breaker points and adjust or replace as required.
- k. Check magneto timing and adjust as required.

NOTE

Timing marks on crankshaft flange are covered by propeller spinner bulkhead. Use of top center indicator and clamp-on timing disc is recommended.

- l. Remove, clean, adjust and test spark plugs.
- m. Remove, clean, and re-oil each carburetor air screen.
- n. Check each carburetor alternate air valve for condition and security.
- o. Check each carburetor alternate air spring-loaded door for security and freedom of operation.
- p. Check each firewall and nacelle structure for condition.
- q. Check engine mounts for condition and torque.
- r. Check cylinder base nuts for torque.
- s. Check induction manifold drains and/or sniffle valves for obstructions.
- t. Check induction manifold connections for condition and security.
- u. Check exhaust manifolds for condition and security.
- v. Check augmenter tubes for condition.
- w. Check all controls for travel, freedom of operation, and security.
- x. Check all wiring for condition, routing, and security.
- y. Check all plumbing for condition, routing, and security.
- z. Check each generator belt for condition, and adjust tension as required.
- aa. Check carburetor heat hose and heat shroud.
- ab. Check accessories for condition and security.

3. PROPELLER.

- a. Check each propeller track.
- b. Check propeller blades for condition, and rework as required.
- c. Check link arms and attaching parts for condition, security, and safeties.
- d. Check high-pitch pin assemblies for visible wear, security, and safeties.
- e. Check each propeller mounting on crankshaft for security and safeties.
- f. Check dowel pins for evidence of looseness.
- g. Grease propellers.

4. FUEL SYSTEM.

- a. Check wing tip tanks and fuel boost pumps for leaks.
- b. Check each wing tip tank filler cap vent for obstruction.
- c. Drain each wing tip tank sump.
- d. Check fuel boost pumps for security and safeties.
- e. Check auxiliary tanks for leaks.
- f. Drain each auxiliary tank sump.
- g. Check each auxiliary tank vent for obstruction.
- h. Check fuel system plumbing for leaks, condition, and security.
- i. Check selector valve linkage, including pins and gears, for security and safeties.
- j. Check cabin heater plumbing for leaks.
- k. Check heater control valve container vapor-proof seal for condition. (Serials 35000 thru 35546)

1. Remove and clean the heater fuel filter.
(Serial 35772 and on)

5. AIRFRAME.

- a. Torque wing spar bolts.
- b. Torque wing tip tank attaching bolts.
- c. Check each wing structure for condition and damage.
- d. Torque stabilizer and vertical fin spar bolts.
- e. Check empennage for condition and damage.
- f. Check fuselage structure for condition and damage.
- g. Check baggage door for security, and lock for operation.
- h. Check cabin door for condition, operation, and positive lock.
- i. Check windshield and windows for condition.
- j. Check seats, safety belts, and shoulder harness for condition and security.

6. FLIGHT CONTROL SYSTEMS.

- a. Check each aileron hinge for condition, and each hinge bolt for security.
- b. Check each aileron trim tab for condition, security, and hinge safety.
- c. Check ailerons for condition and freedom of operation.
- d. Check aileron bellcranks and linkage for condition, security, and safeties.
- e. Check aileron travel and stops for security.
- f. Check aileron trim tab travel and stops for security.
- g. Check aileron cables and pulleys for condition, operation, and security.
- h. Check aileron trim tab actuator and linkage for condition and security.
- i. Check aileron trim cables, pulleys, and chains for condition, operation, and security.
- j. Check aileron cable tension and turnbuckle safties.
- k. Check aileron trim cable tension and turnbuckle safeties.
- l. Check flaps for condition, security, and hinge safeties.
- m. Check flap linkage for condition and security.
- n. Check flap bellcranks and linkage for condition, security, and safeties.
- o. Check flap cables and pulleys for condition, security, and safeties.
- p. Check flap cable tension and turnbuckle safeties.
- q. Check flap motor for security and safeties.
- r. Check flap and position indicator operation and travel.
- s. Check elevator and rudder hinges for condition and hinge bolts for security.
- t. Check elevator and rudder for condition and freedom of operation.
- u. Check elevator and rudder trim tabs for condition, security, and hinge safeties.
- v. Check elevator and rudder trim tab actuators and linkage for condition and security.
- w. Check elevator travel.
- x. Check elevator trim tab travel.
- y. Check rudder travel and stops for condition and safeties.
- z. Check rudder trim tab travel.

- aa. Check elevator linkage and bellcranks for condition and security.
- ab. Check elevator stops for security.
- ac. Check elevator cables and pulleys for condition, operation, security, and safeties.
- ad. Check rudder cables and pulleys for condition, operation, security, and safeties.
- ae. Check elevator and rudder trim cables, pulleys, and chains for condition, operation, and security.
- af. Check elevator cable tension and turnbuckle safeties.
- ag. Check rudder cable tension and turnbuckle safties.
- ah. Check elevator and rudder trim cable tensions and turnbuckle safeties.
- ai. Check autopilot servo units for condition and security.
- aj. Check autopilot cable attachments for security and safeties.
- ak. Check autopilot cables and pulleys for condition, operation, and security.
- al. Check autopilot cable tension and turnbuckle safeties.
- am. Check control column for security and safeties.
- an. Check elevator linkage and cable attachments for security and safeties.
- ao. Check trim control mechanism and indicators for condition, freedom of operation, and security.
- ap. Check rudder bar for security, freedom of operation, and safeties.

7. LANDING GEAR.

- a. Check gear box for security.
- b. Check main gear drive tubes for condition and security.
- c. Check nose gear drive tubes and idler mechanism for condition and security.
- d. Check mechanism in wheel wells for condition and security.
- e. Check mechanism in nose well for condition and security.
- f. Check operation of safety switch. (Gear extended.)
- g. Check operation of indicator lights and warning horn. (Gear retracted and extended.)
- h. Check operation of manual emergency extension system.
- i. Check manual system mechanism and linkage for condition, security, and safeties.
- j. Check operation and clearance of gear. (Retracted and extended.)
- k. Check down lock mechanism for positive lock. (Gear extended.)
- l. Check operation of step.
- m. Check main and nose gear torque links for excessive wear and safeties.
- n. Check shimmy dampener fluid level.
- o. Check shimmy dampener for condition, operation, and safeties.
- p. Check nose steering mechanism for condition, operation, and security.
- q. Check nose steering cables and pulleys for condition, operation, and safeties.
- r. Check wheel bearings. Pack if necessary.
- s. Check brake linings for wear.
- t. Check tires for condition.
- u. Check brakes for operation and fluid level. Service as required.

- v. Check brake system plumbing for leaks, condition, and security.
- w. Check parking brake mechanism for operation, condition, and safeties.

8. INSTRUMENTS.

- a. Check all instrument indicating pointers for indications inconsistent with existing temperature, pressure, direction, and altitude; cover glasses for cracks and looseness; slippage; range and limit markings for deterioration; luminescent paint for chips, dirt and fading.
- b. Check vacuum filter. Replace if necessary.

9. ELECTRICAL SYSTEM.

- a. Check junction box wiring and terminals for security and condition.
- b. Check circuit breaker panel wiring and terminals for security and condition.
- c. Check voltage regulator and parallel relay wiring and terminals for security and condition.
- d. Check pedestal wiring for security, condition, and routing.
- e. Check panel wiring and switches for security and condition.
- f. Check panel wiring and plumbing for interference with controls.
- g. Check panel plumbing for security and leakage.
- h. Check landing gear relay and limit switch terminals and wiring for condition and security.
- i. Check flap limit switch and motor terminals and wiring for condition and security.
- j. Check all wing wiring for condition and security.
- k. Check landing gear indicator lights, safety switch, and warning horn wiring for condition and security.
- l. Check powerplant wiring for condition, routing, and security.
- m. Check de-ice and/or anti-ice system wiring for condition and security.
- n. Check battery electrolyte level and specific gravity. Service as required.
- o. Check battery cables for condition and security.
- p. Check battery area for evidence of corrosion.
- q. Check operation of landing and navigation lights.
- r. Check operation of taxi light.
- s. Check operation of pitot heating unit.
- t. Check operation of stall warning horn.
- u. Check operation of all panel, instrument, and cabin lights.

10. RADIO.

- a. Check all radio and/or navigational equipment for condition and security.

11. FLARES.

- a. Check flares for condition and security.
- b. Check wiring and terminals for security.

12. PLACARDS.

- a. Check all placards and decals for presence and legibility. (Interior and exterior.)

13. DE-ICE SYSTEM.

- a. Check de-ice boots for condition and security.
- b. Check system plumbing for condition and security.

14. ANTI-ICE SYSTEM.

- a. Check anti-ice tank and system plumbing for leaks.
- b. Check plumbing for condition and security.
- c. Check tank for security.
- d. Check fluid level. Service as required.
- e. Check anti-ice nozzles for condition and security.

15. OXYGEN SYSTEM.

- a. Check oxygen pressure. Service as required.
- b. Check oxygen bottle mounting for security and safeties.
- c. Check quantity and condition of masks and hoses.

16. POST INSPECTION.

- a. Correct all discrepancies as result of preliminary check and/or inspection.
- b. Replace all doors, fairings, and access hole covers.
- c. Reconnect main and nose gear doors.
- d. Cowl engines and install propeller spinners.
- e. Ground check engines as during preliminary run-up to check ignition drop, generator charging rate, oil pressure, and general operation of engines, propellers, controls, and indicators.

17. CLEAN UP.

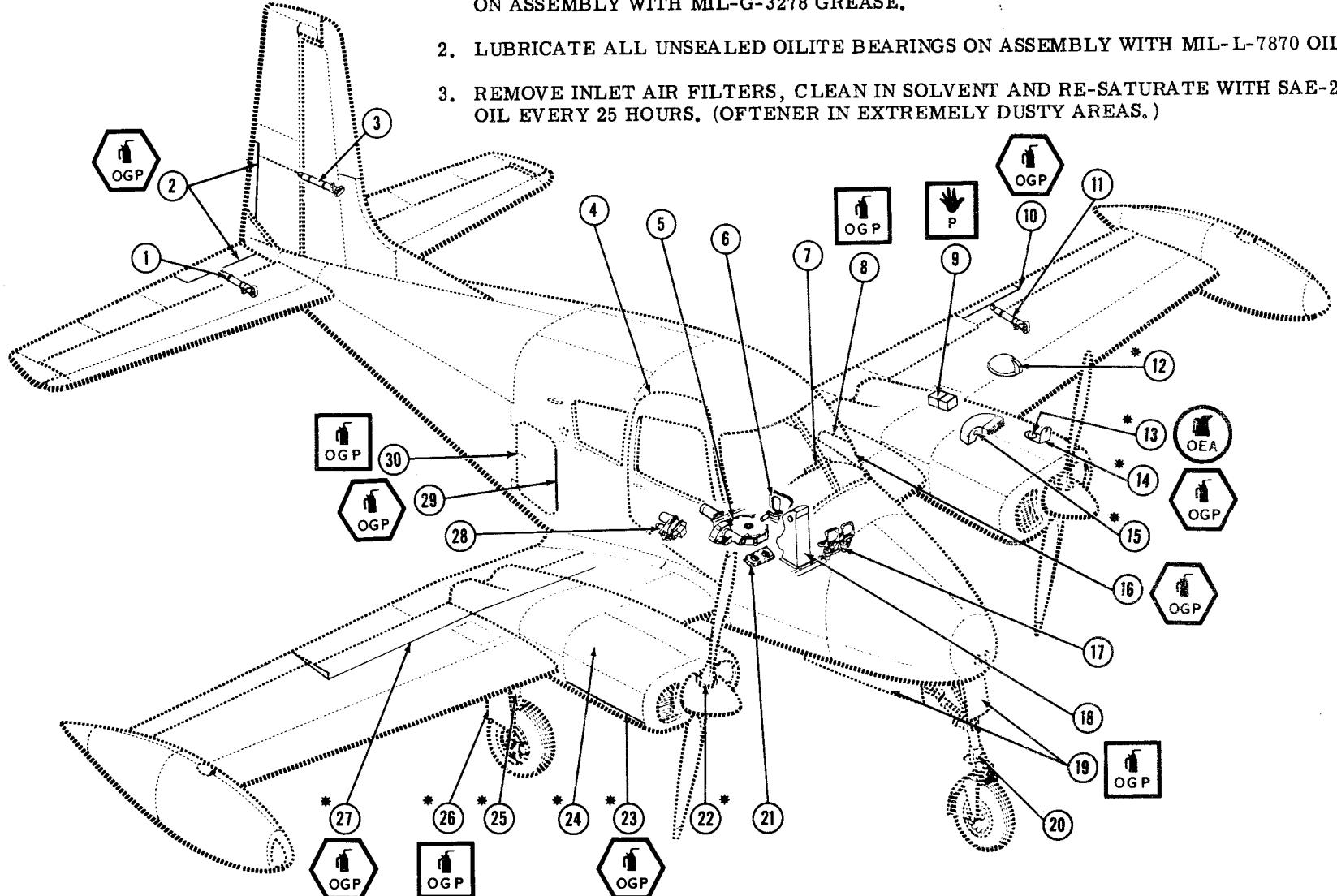
- a. Clean exterior surfaces.
- b. Clean interior upholstery, trim and carpet.
- c. Clean all windows and windshield.

1000 HOUR INSPECTION

NOTE

In addition to the regular 100 hour inspection, it is recommended that at each 1000 hours the following be complied with.

- a. Check the landing gear actuating gears for indications of excessive wear. If indications of wear exist, remove gear box cover, clear out all hard and old grease, inspect and repair as necessary. Repack gear box with MIL-G-3278 and install cover.
- b. Check the flap actuating gears for indications of excessive wear. If indications of wear exist, remove and disassemble actuator assembly, clean out all hard and old grease, inspect and repair as necessary. Repack gear box with MIL-G-3278 and install.
- c. Overhaul engines at 900 hours and comply with all Continental Bulletins that are applicable.
- d. Comply with all 310 Service Letters that are applicable.



*ITEMS TO BE LUBRICATED ON BOTH SIDES OF AIRPLANE.

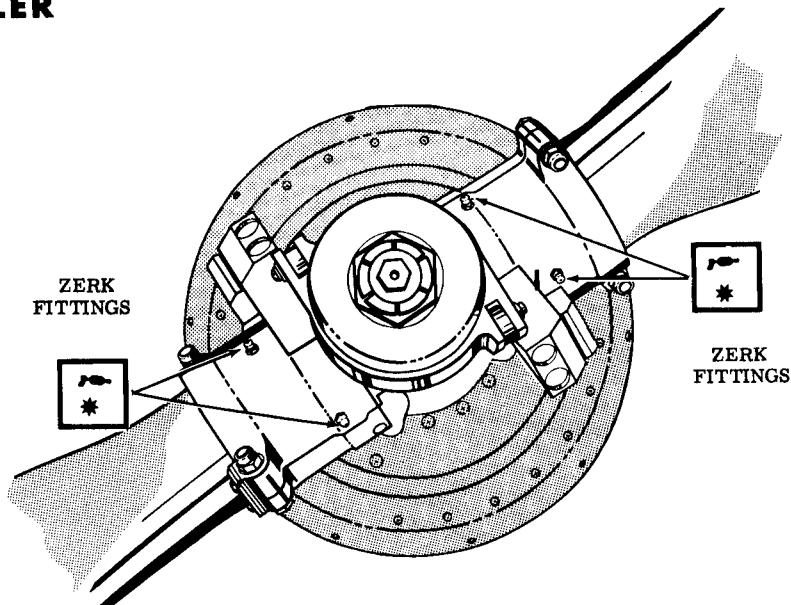
Figure 1-6. Lubrication Diagram (Sheet 1 of 13)

LUBRICATION POINTS

1. Elevator Trim Tab Actuator (See Sheet 5)
2. Trim Tab Hinges
3. Rudder Trim Tab Actuator (See Sheet 5)
4. Cabin Door (See Sheet 13)
5. Landing Gear Actuator Gear Box (See Sheet 4)
6. Landing Gear Manual Extension Mechanism (See Sheet 4)
7. Control Column (See Sheet 7)
8. Pilot's Window Hinges
9. Battery Posts
10. Aileron Trim Tab Hinge
11. Aileron Trim Tab Actuator (See Sheet 5)
12. Landing Light (See Sheet 3)
13. Engine Oil Tank
14. Engine Oil Filler Door Hinge
15. Carburetor Air Box & Filter (See Sheet 10 and Note 3, Sheet 1)
16. Pilot's Window Telescopic Unit
17. Rudder Pedal Mechanism (See Sheet 11)
18. Control Pedestal (See Sheet 10)
19. Nose Gear Door Hinges
20. Nose Gear Linkage (See Sheet 8)
21. Fuel Selector Valve Linkage (See Sheet 6)
22. Propeller (See Sheet 3)
23. Cowling Door Hinges
24. Engine Control Linkage (See Sheet 10)
25. Main Gear Linkage (See Sheet 9)
26. Main Gear Door Hinges
27. Flap Hinges
28. Flap Actuator Motor & Gear Box Assy. (See Sheet 5)
29. Baggage Door Hinge
30. Baggage Door Latch

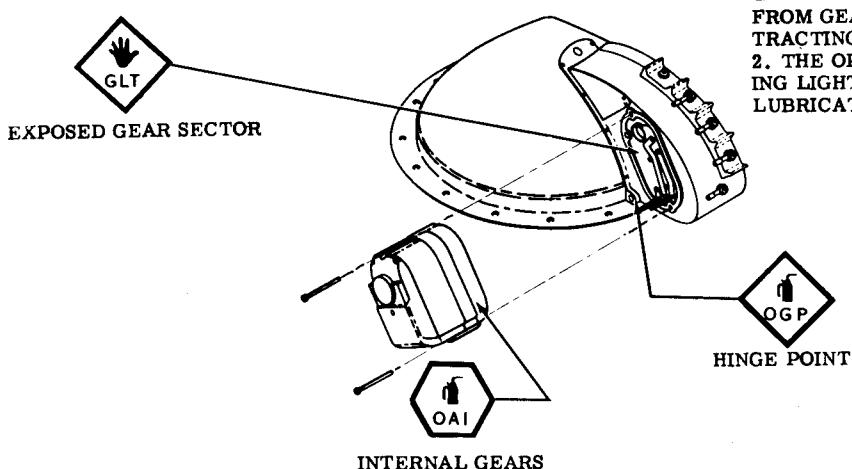
FREQUENCY	METHOD		TYPE OF LUBRICANT	
 OHA 25 HOUR & AS REQUIRED	   	GLT	MIL-G-3278	Grease; Low temperature Aircraft Lubricating (Low Volatility Type)
 OGP 100 HOUR & AS REQUIRED		OGP	MIL-L-7870	Oil; General Purpose, Low Temperature Lubricating
 OHA 500 HOUR & AS REQUIRED		OHA	MIL-H-5606	Hydraulic Fluid, Petroleum Base
		FG	MIL-G-6711	Graphite; Lubricating
		OAI	MIL-O-6085	Oil; Lubricating Aircraft Instrument (Low Volatility)
 OEA 1000 HOUR & AS REQUIRED		P		Petrolatum or Terminal Grease
 GLT ON ASSEMBLY & AS REQUIRED		OEA	Aviation Grade Straight Mineral Oil SAE 50 above 40° F SAE 30 below 40° F MIL-O-6082 GRADE: 1100 above 40° F 1065 below 40° F Where OEA is shown with squirt can, use SAE 20	Oil; Lubricating, Aircraft Engine

Figure 1-6. Lubrication Diagram (Sheet 2 of 13)

PROPELLER

* THE HARTZELL PROPELLER CORPORATION RECOMMENDS THE FOLLOWING LUBRICANTS IN THE ORDER OF LISTING:

- | | | |
|--|--|--|
| a. Lubriplate 630 AA
Fiske Brothers, Toledo, Ohio | d. Stroma LT-1 (Z-815 Grease)
Union Oil Co. of California | g. Mobilgrease Aero Lo-Hi PD635-K
Socony Vacuum Oil Co. |
| b. Stroma HT-1 (Z 801 Grease)
Union Oil Co. of California | e. RPM Aviation Grease No. 1
Standard Oil Co. of California | h. No. 84 Medium Grease
Keystone Lubricating Co. |
| c. RPM Aviation Grease No. 2
Standard Oil Co. of California | f. Lubriplate 707
Fiske Brothers, Toledo, Ohio | i. Texaco Regal Starfak Special |

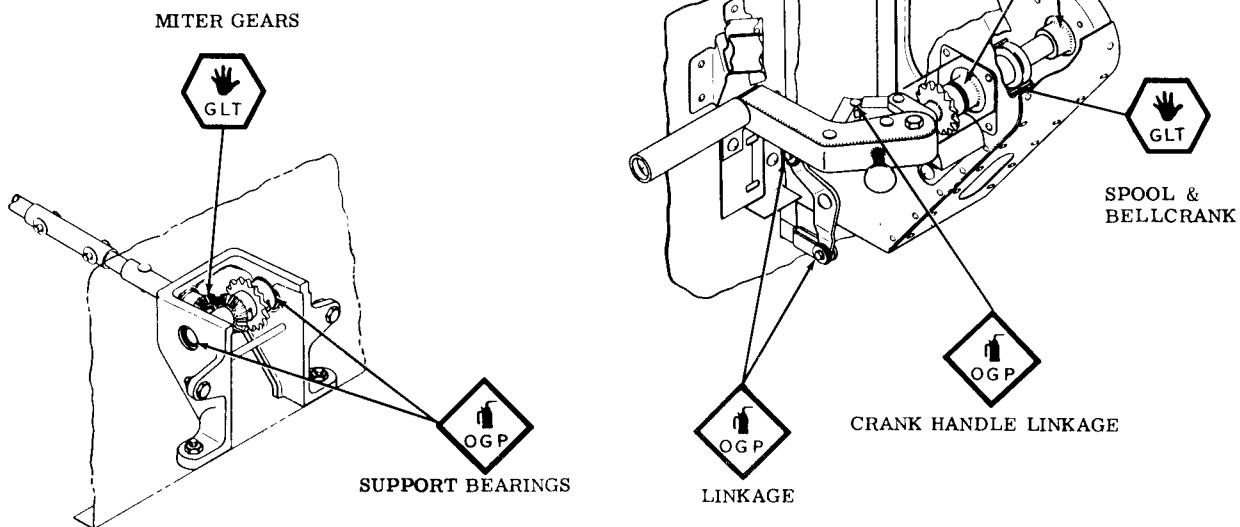
LANDING LIGHT

NOTES

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

Figure 1-6. Lubrication Diagram (Sheet 3 of 13)

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.

LANDING GEAR ACTUATOR GEAR BOX

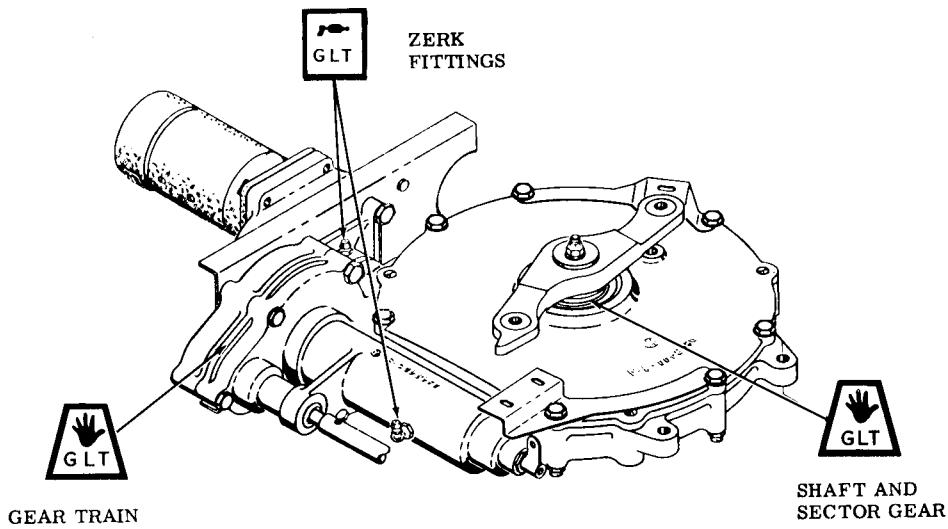
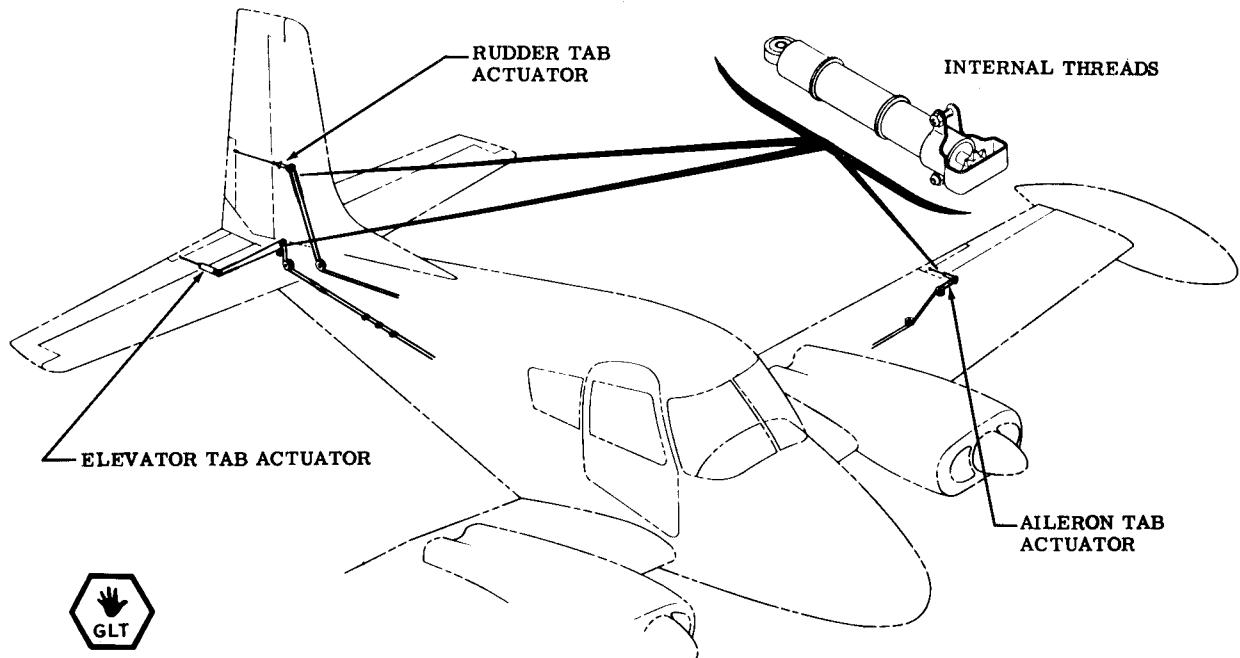


Figure 1-6. Lubrication Diagram (Sheet 4 of 13)

TRIM TAB ACTUATORS



NOTE
CLEAN AND REPACK ACTUATORS WITH
MIL-G-3278 GREASE EVERY 1000 HOURS.

FLAP ACTUATOR MOTOR AND GEAR BOX ASSY

NOTE
LUBRICATE WITH MIL-G-3278
GREASE ON ASSEMBLY AND
EVERY 1000 HOURS.

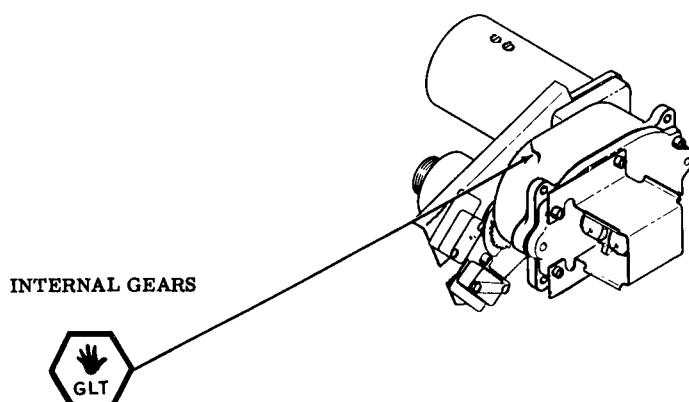
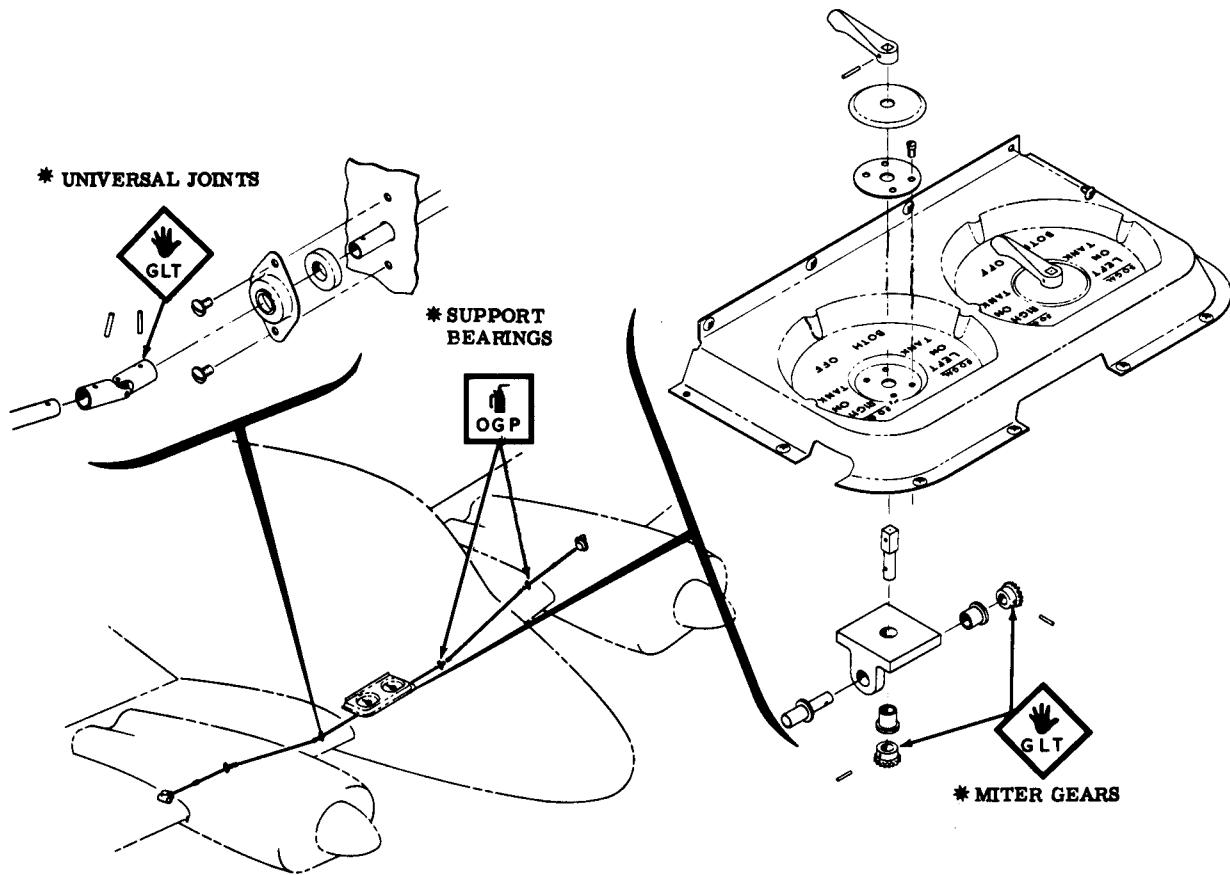
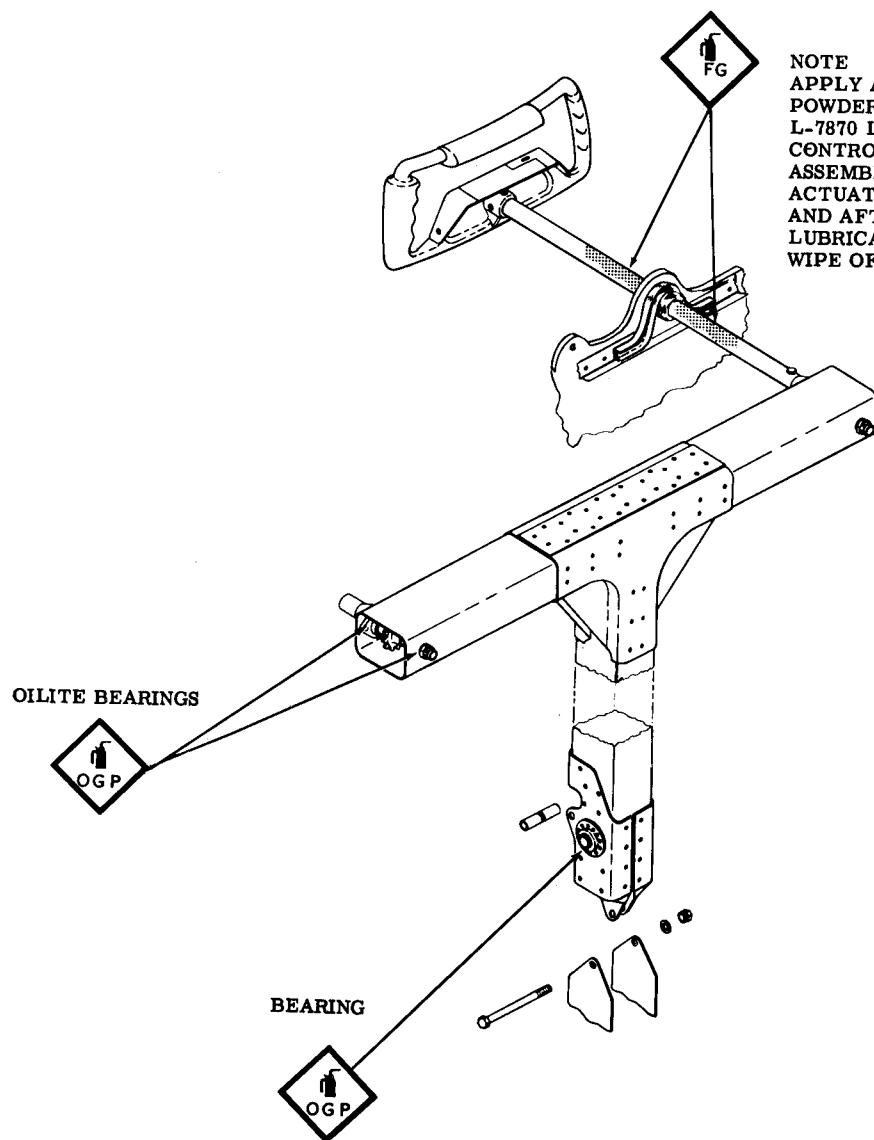


Figure 1-6. Lubrication Diagram (Sheet 5 of 13)

FUEL SELECTOR VALVE LINKAGE

* LUBRICATE THESE ITEMS ON BOTH SIDES OF THE AIRPLANE

Figure 1-6. Lubrication Diagram (Sheet 6 of 13)

CONTROL COLUMN

NOTE
APPLY A SMALL AMOUNT OF MIL-G-6711
POWDERED GRAPHITE, MIXED WITH MIL-
L-7870 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 1-6. Lubrication Diagram (Sheet 7 of 13)

NOSE GEAR LINKAGE

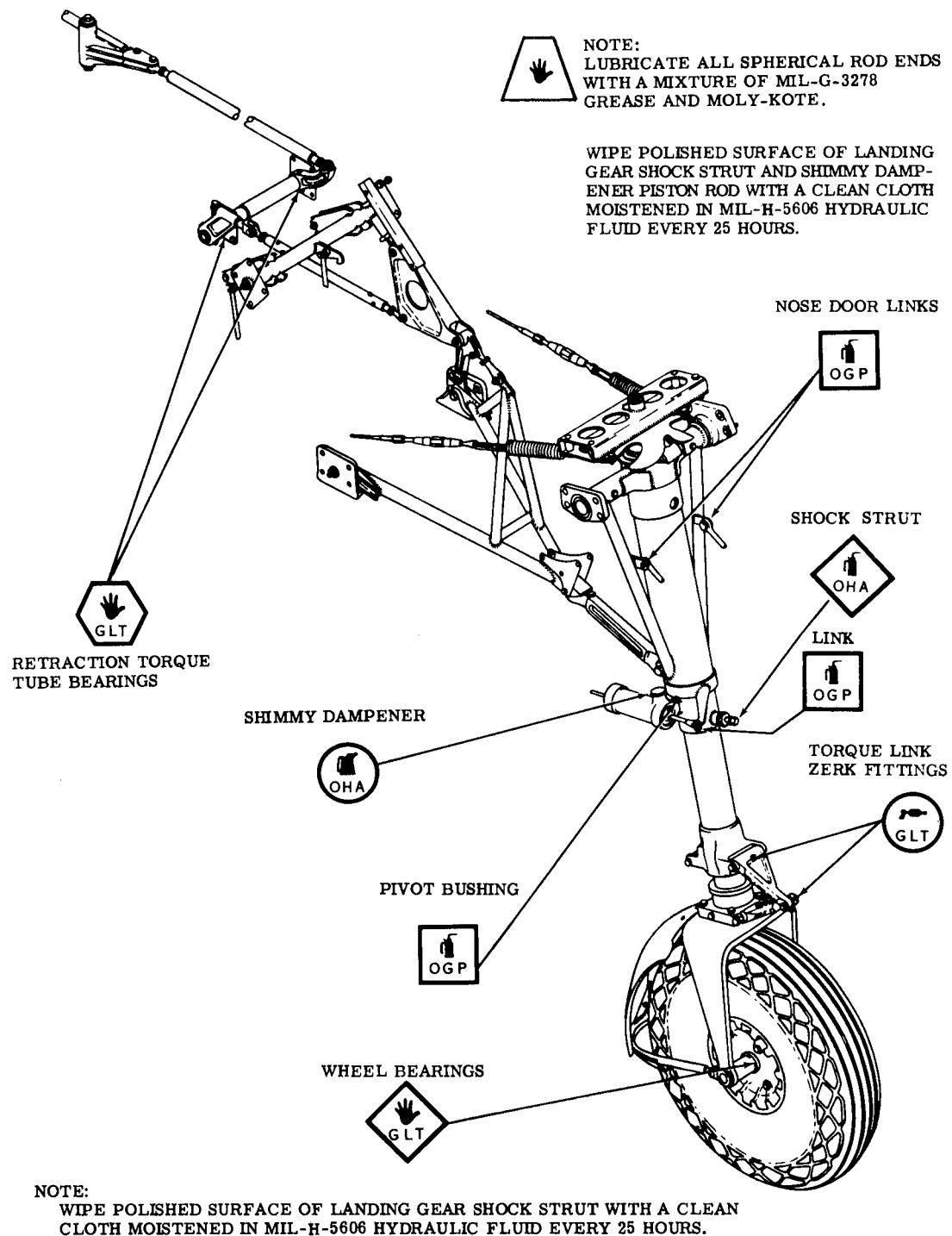


Figure 1-6. Lubrication Diagram (Sheet 8 of 13)

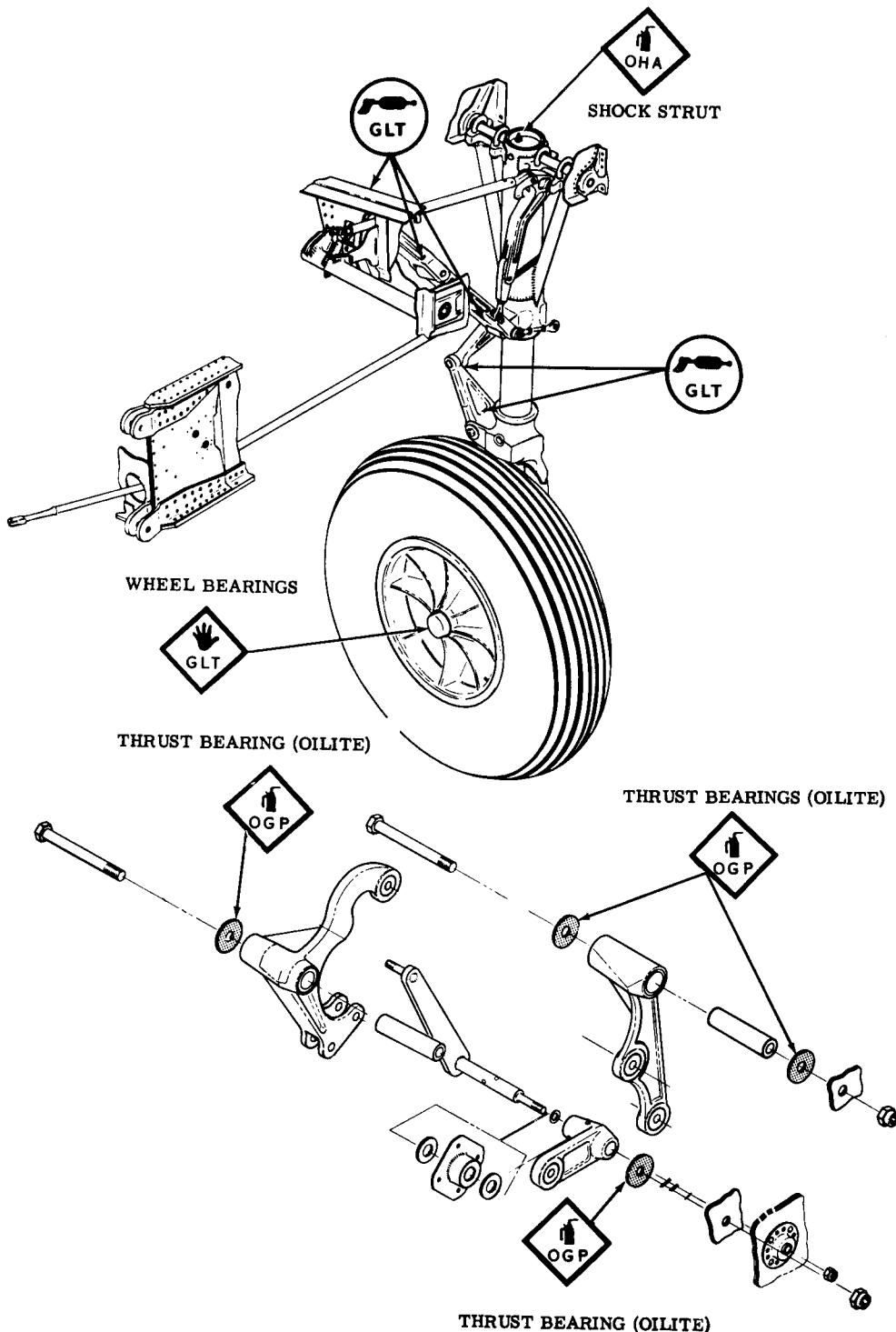
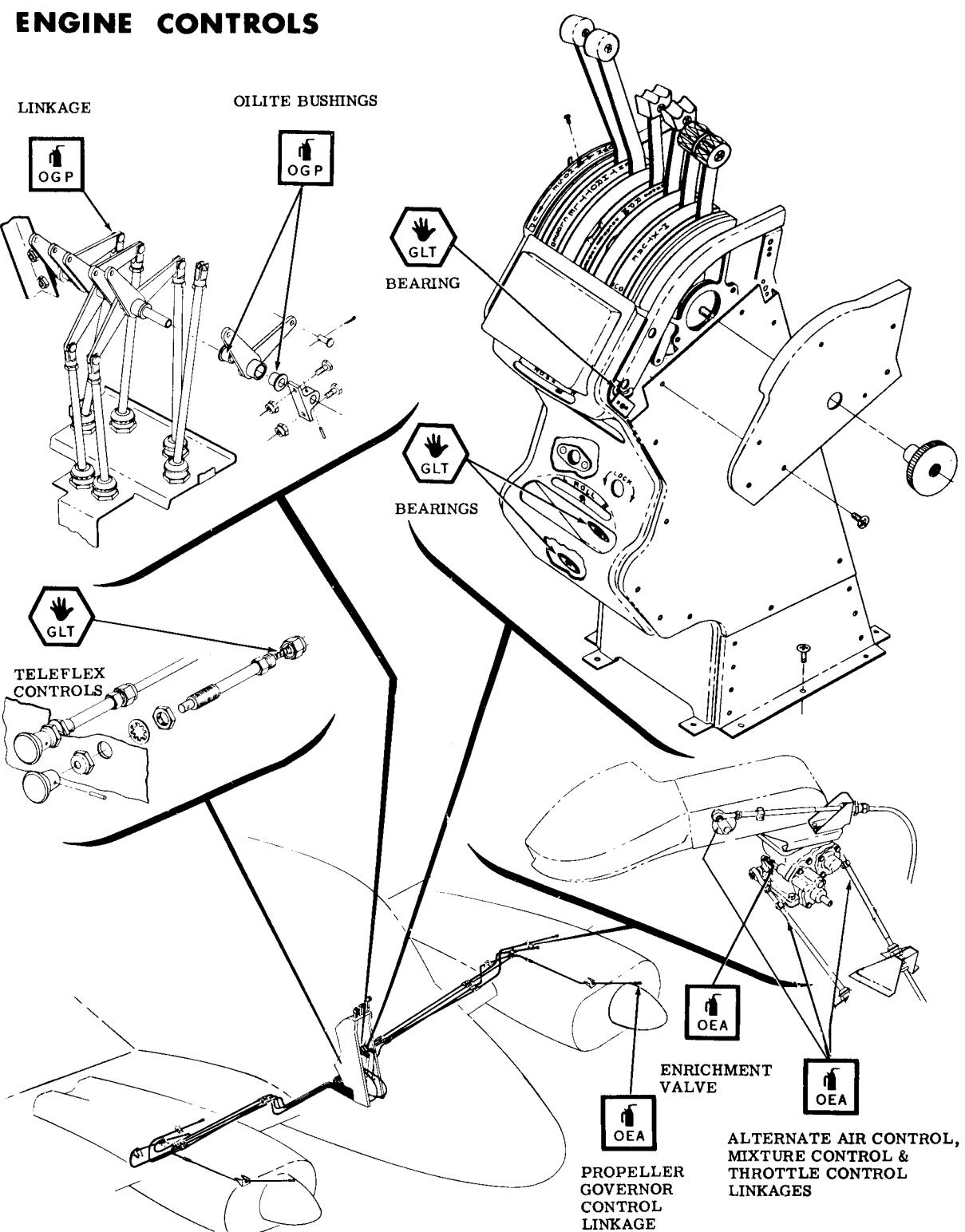
MAIN GEAR LINKAGE

Figure 1-6. Lubrication Diagram (Sheet 9 of 13)

ENGINE CONTROLS

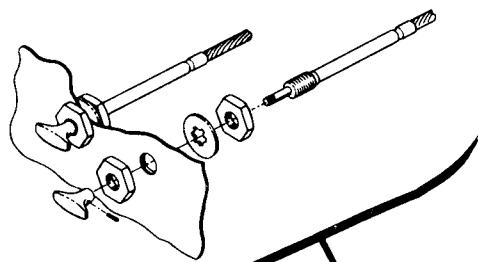


APPLIES TO SERIALS 35000 THRU 35771

Figure 1-6. Lubrication Diagram (Sheet 10 of 13)

ENGINE CONTROLS

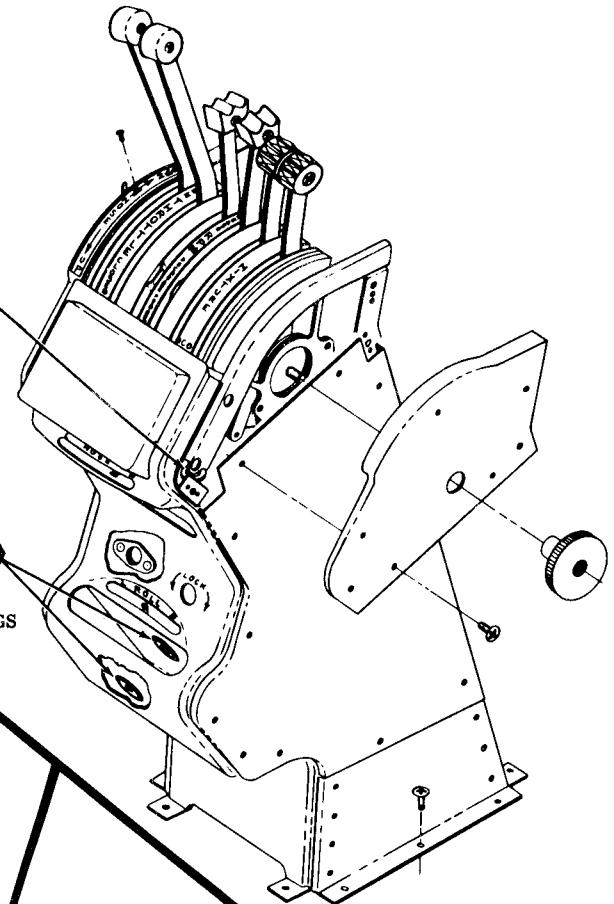
LINKAGE



BEARING



BEARINGS



PROPELLER
GOVERNOR
CONTROL
LINKAGE

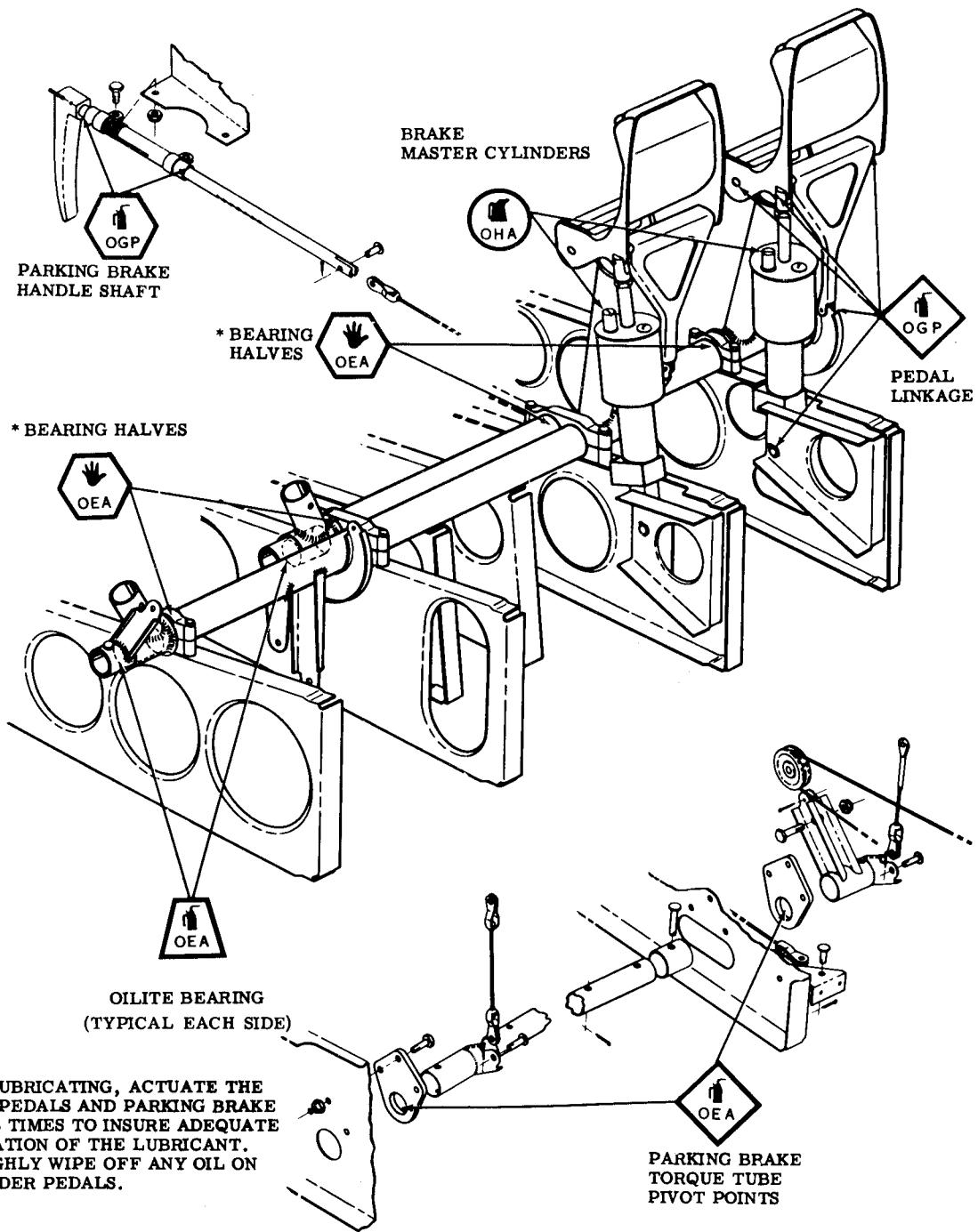


INDUCTION AIR CONTROL,
MIXTURE CONTROL &
THROTTLE CONTROL
LINKAGES

APPLIES TO SERIALS 35772 AND ON

Figure 1-6. Lubrication Diagram (Sheet 11 of 13)

RUDDER PEDAL MECHANISM



*ON SERIAL 39032 AND ON, LUBRICATE BEARING HALVES WITH MIL-L-7870 LUBRICATING OIL EACH 100 HOURS AND AS REQUIRED.

Figure 1-6. Lubrication Diagram (Sheet 12 of 13)

CABIN DOOR

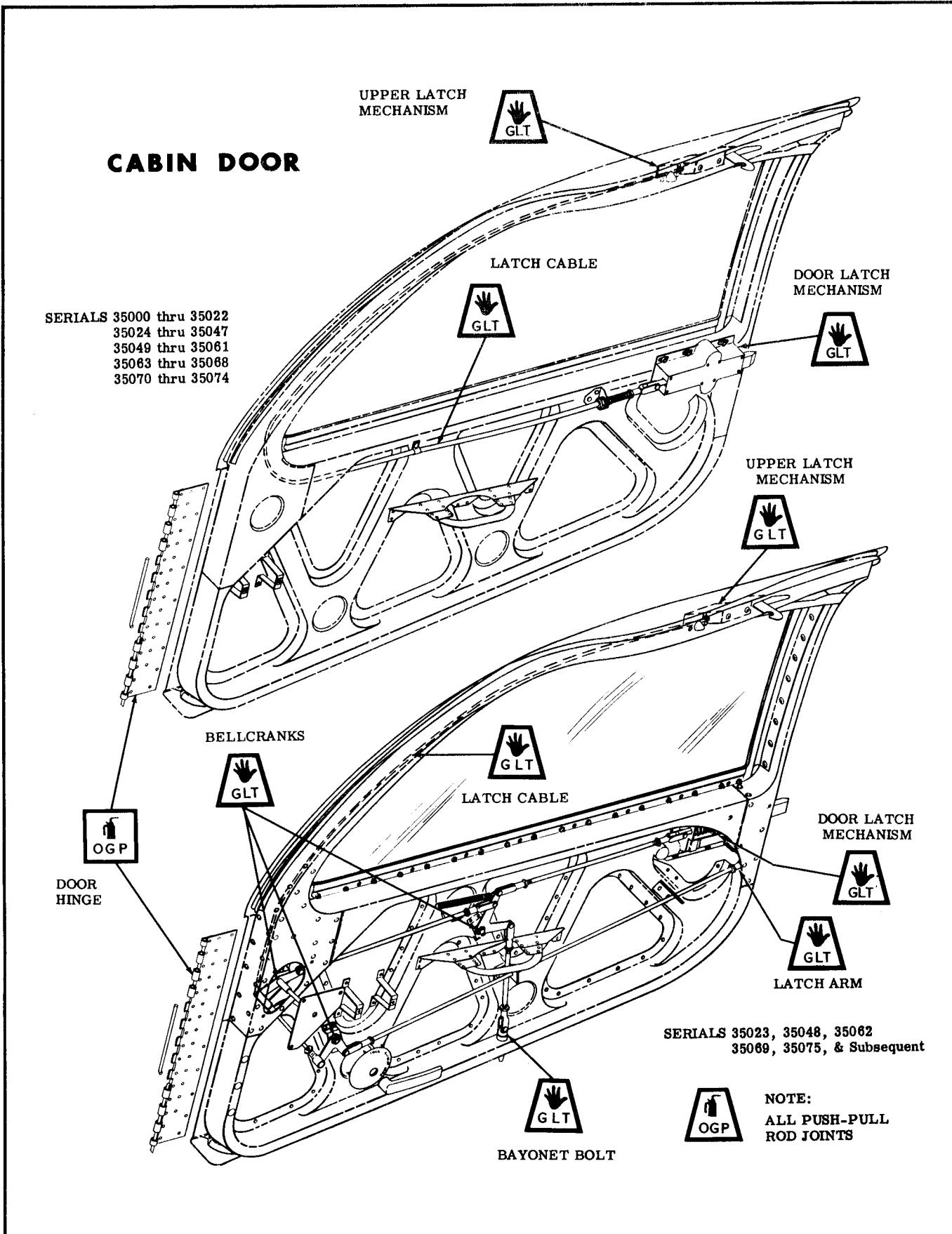
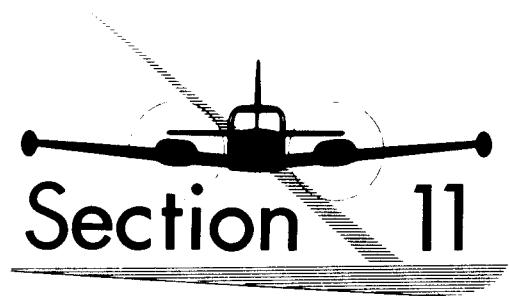


Figure 1-6. Lubrication Diagram (Sheet 13 of 13)

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310 SERVICE MANUAL



AIRFRAME & LANDING GEAR

1 APRIL 1960

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SECTION II

AIRFRAME AND LANDING GEAR

Table of Contents

	Page	310	310B	310C	310D
WING GROUP		2-2A	2-2A	2-2A	2-2A
Wing		2-2A	2-2A	2-2A	2-2A
Ailerons		2-6	2-6	2-6	2-6
Aileron Trim Tab		2-6	2-6	2-6	2-6
Wing Flaps		2-8	2-8	2-8	2-8
EMPENNAGE GROUP		2-8	2-8	2-8	2-8
Vertical Fin		2-8	2-8	2-8	2-8
Rudder		2-10	2-10	2-10	2-10
Rudder Trim Tab		2-12	2-12	2-12	2-12
Horizontal Stabilizer		2-12	2-12	2-12	2-12
Elevators		2-12	2-12	2-12	2-12
Elevator Trim Tab		2-15	2-15	2-15	2-15
SURFACE CONTROL SYSTEMS		2-15	2-15	2-15	2-15
Control Column System		2-15	2-15	2-15	2-15
Aileron Control System		2-18	2-18	2-18	2-18
Aileron Trim Control System		2-22	2-22	2-22	2-22
Flap Control System		2-28	2-28	2-28	2-28
Rudder Control System		2-34	2-34	2-34	2-34
Rudder Trim Control System		2-38	2-38	2-38	2-38
Elevator Control System		2-43	2-43	2-43	2-43
Elevator Trim Control System		2-48	2-48	2-48	2-48
FUSELAGE		2-52	2-52	2-52	2-52
Control Pedestal		2-52	2-52	2-52	2-52
Cabin Door		2-54	2-54	2-54	2-54
Baggage Compartment		2-57	2-57	2-57	2-57
Seat Assemblies		2-57	2-57	2-57	2-57
Safety Belts		2-63	2-63	2-63	2-63
Upholstery		2-64A	2-64A	2-64A	2-64A
Upholstery Trim		2-64A	2-64A	2-64A	2-64A
Baggage Compartment Upholstery		2-66A	2-66A	2-66A	2-66A
Carpet		2-68	2-68	2-68	2-68
Glove Compartment		2-70	2-70	2-70	2-70
Windshield		2-70	2-70	2-70	2-70
Cabin Windows		2-72	2-72	2-72	2-72
Emergency Exit Window		2-72	2-72	2-72	2-72
Fuselage Stinger		2-78	2-78	2-78	2-78
Decals, Metalcals, and Placards		2-80	2-80	2-80	2-80

SECTION II

AIRFRAME AND LANDING GEAR

Table of Contents (Continued)

	Page	310	310B	310C	310D
LANDING GEAR		2-81	2-81	2-81	2-81
Main Landing Gear		2-86	2-86	2-86	2-86
Main Landing Gear Doors		2-91	2-91	2-91	2-91
Main Wheel and Tire Assembly		2-93	2-93	2-93	2-93
Nose Gear		2-96	2-96	2-96	2-96
Nose Gear Doors		2-101	2-101	2-101	2-101
Nose Wheel and Tire Assembly		2-102	2-102	2-102	2-102
Nose Gear Shimmy Dampener		2-104	2-104	2-104	2-104
Torque Link Assemblies		2-106	2-106	2-106	2-106
Main Landing Gear Retracting Linkage		2-107	2-107	2-107	2-107
Nose Gear Retracting Linkage		2-113	2-113	2-113	2-113
Landing Gear Actuator		2-115	2-115	2-115	2-115
Manual Extension System		2-118	2-118	2-118	2-118
Landing Gear Warning System		2-121	2-121	2-121	2-121
RIGGING OF LANDING GEAR		2-122	2-122	2-122	2-122
Rigging of Main Landing Gear		2-122	2-122	2-122	2-122
Rigging of Nose Gear		2-126	2-126	2-126	2-126
Adjustment of Landing Gear Safety Switch		2-128	2-128	2-128	2-128
NOSE WHEEL STEERING SYSTEM		2-130	2-130	2-130	2-130
CABIN STEP SYSTEM		2-133	2-134A	2-134A	2-134A
BRAKE SYSTEM		2-134D	2-134D	2-134D	2-134D
Master Cylinder		2-137	2-137	2-137	2-137
Brake System Plumbing		2-140	2-140	2-140	2-140
Brake Assemblies		2-144	2-144	2-144	2-144
Parking Brake System		2-145	2-145	2-145	2-145

SERIAL BLOCKS

MODEL 310.
35000 thru 35546MODEL 310B
35547 thru 35771MODEL 310C
35772 thru 39031MODEL 310D
39032 AND ON

2-1. WING GROUP.

2-2. Each wing group consists of a wing panel, aileron, flap, engine nacelle, wing tip fuel tank, and main landing gear. The all-metal, full-cantilever wing panel is of semimonocoque construction, utilizing two main spars. A recessed wheel well, located in the underside of the wing panel, completely encloses the main gear in its retracted position.

2-3. WING.**2-4. REMOVAL OF WING. (See figure 2-1.)**

- a. Remove batteries as outlined in paragraph 6-7.
- b. Drain fuel system at three places: wing tip tank, fuel strainer, and fuel line drain plugs at right wing root.

NOTE

Wings can be removed with all fuel tanks installed. If fuel tank removal is desired, re-

move in accordance with section IV.

- c. Remove engine in accordance with section IV.

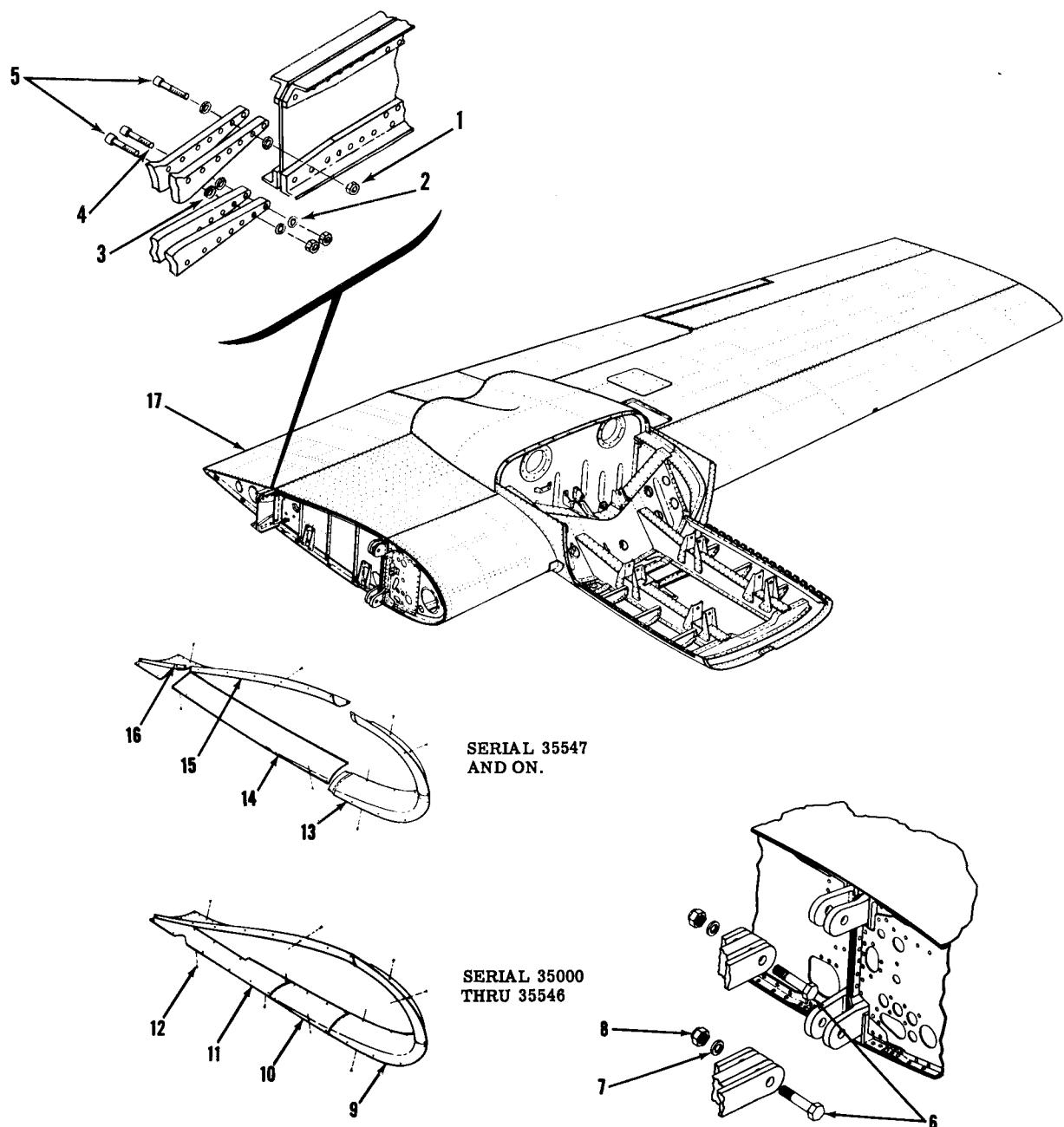
CAUTION

If both engines are removed, the airplane will become tailheavy. To balance the airplane, place weight (such as shot bags or sand bags) in engine nacelles.

- d. Jack airplane in accordance with paragraph 1-15.
- e. Place suitable padded supports beneath cabin section, tail section, and wings; then remove jacks.

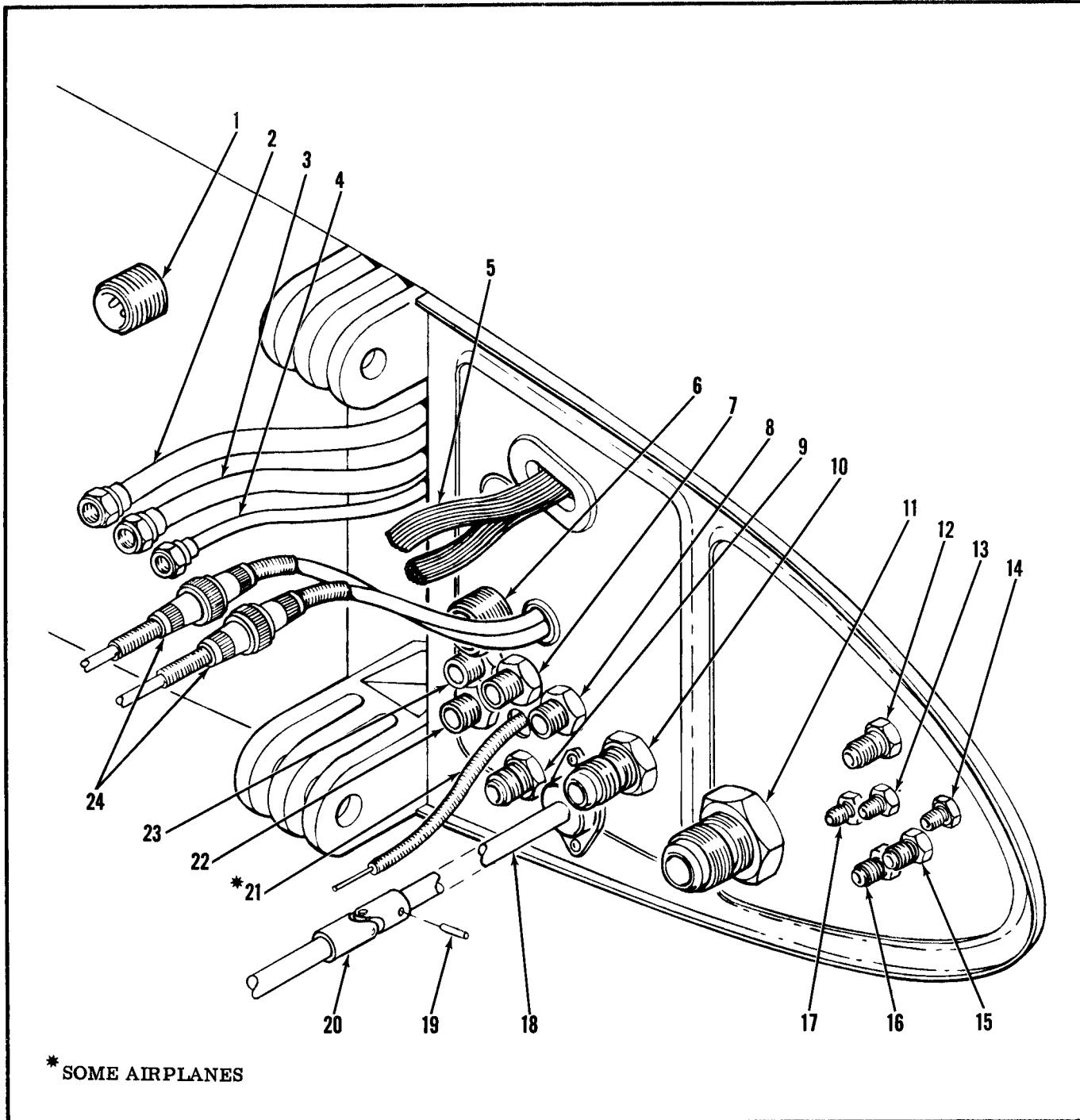
NOTE

To prevent damage to skin, place padded supports beneath front and rear spars in fuselage, beneath wing ribs, and beneath tailcone bumper.



- | | | |
|-----------------------|-------------------|--------------------|
| 1. Nut | 7. Washer | 12. Screw |
| 2. Washer | 8. Nut | 13. Forward Fillet |
| 3. Countersunk Washer | 9. Forward Fillet | 14. Lower Fillet |
| 4. Bolt | 10. Lower Fillet | 15. Upper Fillet |
| 5. Bolt | 11. Aft Fillet | 16. Aft Fillet |
| 6. Bolt | | 17. Wing Panel |

Figure 2-1. Wing Installation



- | | |
|--|--|
| 1. Electrical Connector - Auxiliary Fuel | 13. Fitting - Manifold Pressure Line |
| 2. Fuel Line | 14. Fitting - Fuel Pressure Line |
| 3. Fuel Line | 15. Fitting - Oil Pressure Line |
| 4. Anti-ice Line | 16. Fitting - Brake Line |
| 5. Wire Bundle | 17. Fitting - De-ice Line |
| 6. Electrical Connector - Battery Cable | 18. Torque Tube - Fuel Selector Valve |
| 7. Teleflex Fitting - Mixture | 19. Roll Pin |
| 8. Teleflex Fitting - Alternate Air | 20. Universal Joint |
| 9. Fitting - De-ice Line | 21. Control - Oil Cooler Shutter |
| 10. Fitting - De-ice Line | 22. Teleflex Fitting - Throttle |
| 11. Fitting - De-ice Line | 23. Teleflex Fitting - Propeller |
| 12. Fitting - Vacuum Line | 24. Electrical Connector - Magneto Ground Wire |

Figure 2-2. Wing Root Connections

If both engines were removed and weight was placed in nacelles, remove weight after removing jacks.

f. Remove wing root fillets by removing attaching screws.

g. (See figure 2-51.) Disconnect landing gear main drive tube (43) by removing nut (44), spacers (42), and bolt (40) attaching tube to idler bellcrank (16).

NOTE

Wings can be removed with main gear installed. If gear removal is desired, remove in accordance with paragraph 2-244.

h. Remove flap cables from wing in accordance with paragraph 2-89.

i. Remove aileron cables from wing in accordance with paragraph 2-66.

j. For removal of left wing, remove aileron trim control cables from wing in accordance with paragraph 2-76.

k. Remove sliding ends from engine teleflex controls in nacelle in accordance with section IV.

NOTE

Teleflex control conduits can be left in wing.

If conduit removal is desired, remove in accordance with section IV.

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

m. Disconnect and tag the wires which route to affected wing, at junction box. Pull wire bundle (5, figure 2-2) from fuselage.

NOTE

Two wires in each junction box have soldered connections which must be unsoldered before wing removal.

n. (See figure 2-2.) Disconnect and tag the following items at the wing root:

1. Engine teleflex control conduits at fittings (7, 8, 22, and 23).

2. Magneto wires at electrical connectors (24).

3. Starter cable at electrical connector (6).

4. Fuel lines (2 and 3).

5. Manifold pressure line at fitting (13).

6. Oil pressure line at fitting (15).

7. Fuel pressure line at fitting (14).

8. Vacuum line at fitting (12).

9. Brake line at fitting (16).

10. Fuel selector valve torque tube (18). To disconnect, remove safety wire and inboard roll pin (19) from universal joint (20).

o. (See figure 2-2.) If any of the following items of optional equipment are installed, they must be disconnected at places indicated.

1. Propeller anti-ice line (4).

2. Wing de-ice lines at fittings (9, 10, 11, and

17.) 3. Auxiliary fuel tank wires at electrical connector (1).

4. Speed control system. If right wing is being removed, disconnect and tag flap potentiometer wires at quick-disconnects. If left wing is being removed disconnect the transducer wires at the electrical connector located forward of magneto wires.

5. Oil cooler shutter control (21). Remove attaching clamps, and remove control from wing.

p. (See figure 2-1.) Remove nuts (1 and 8), washers (2, 3, and 7), and bolts (4, 5, and 6) from wing attachment fittings.

q. Move wing and padded wing supports outboard until wing attachment fittings have disengaged.

r. Pull teleflex cables from conduits; coil cables and tie to fuselage.

NOTE

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

2-5. CLEANING OF WING.

a. Clean inside of wheel well with cloth saturated with cleaning solvent.

b. Clean the engine nacelle with vacuum cleaner. Remove accumulations of oil or grease with cleaning solvent, either sprayed or applied with saturated cloth.

CAUTION

To lessen the possibility of accidental fire, remove batteries or disconnect battery cables prior to cleaning with solvent.

2-6. CHECKING WING TWIST AND LOCATION OF THRUST LINE. (See figure 2-3.)

a. Locate wing datum plane as follows:

1. Locate a line at the root rib (wing station 29.15) 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.

b. Locate the engine thrust line as follows:

1. Locate a plane which is six inches above and parallel to the wing datum plane.

2. The thrust line, which lies in this plane, is perpendicular to the front spar, and 46.375 inches outboard from the centerline of the lower bolt hole in the front spar fitting.

2-7. INSTALLATION OF WING. (See figure 2-1.)

a. Position wing approximately one foot from fuselage.

b. Clean and lubricate engine teleflex cables in accordance with Section IV.

c. Insert teleflex cables into corresponding conduits in wing. Care should be taken that the teleflex cables are not kinked as they are inserted into the conduits.

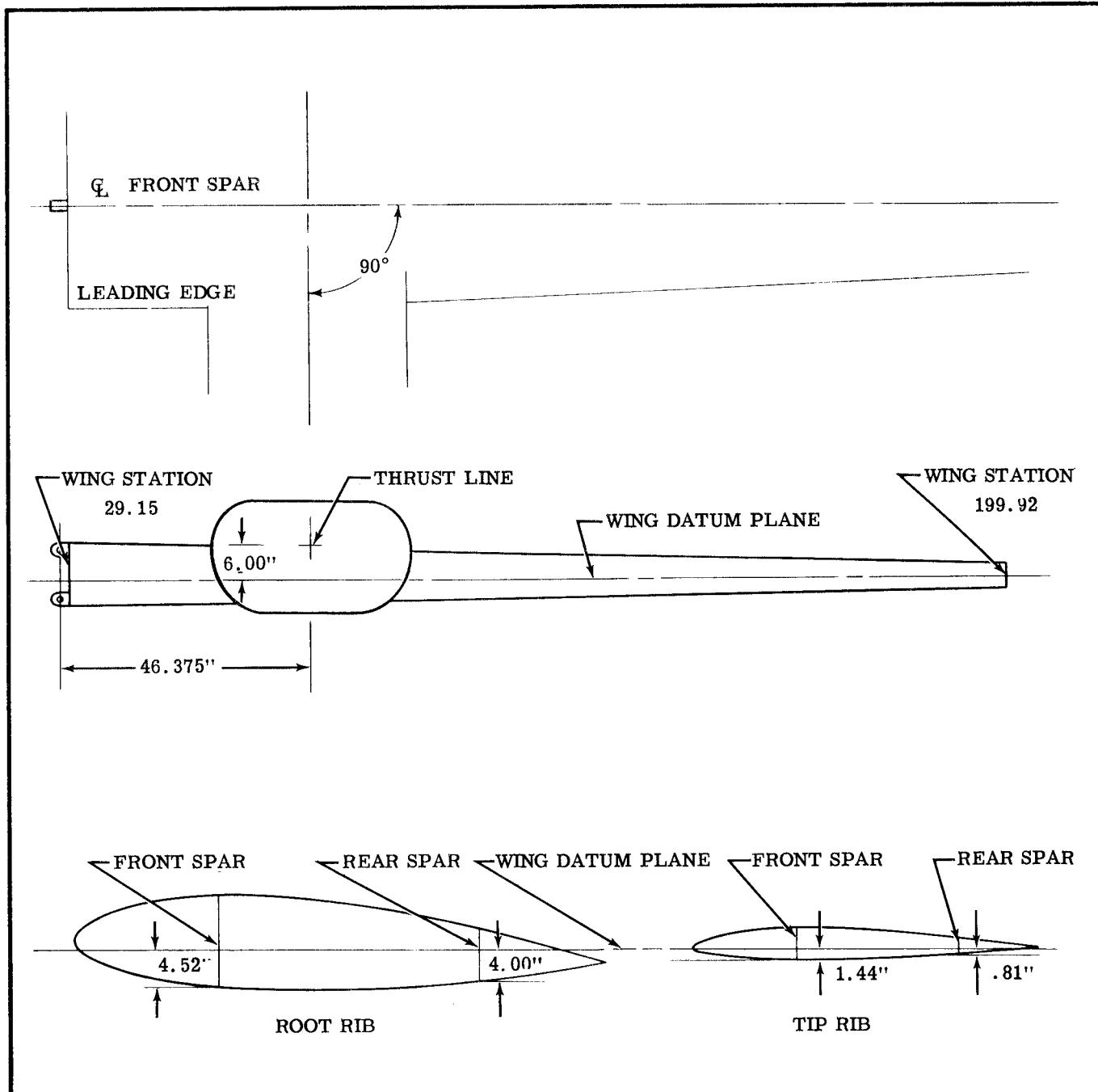


Figure 2-3. Wing Twist and Thrust Line Data

NOTE

If engine teleflex conduits were removed, disregard step "c" and install in accordance with section IV.

d. Move the wing toward fuselage until wing attachment fittings begin to engage, guiding landing gear drive tube (43, figure 2-51) through opening in wing root rib.

e. (See figure 2-2.) Guide fuel selector valve torque tube (18) into universal joint (20).

f. Align bolt holes and install bolts (4, 5, and 6),

washers (2, 3, and 7), and nuts (1 and 8).

NOTE

Install front spar bolts with heads forward and rear spar bolts with heads aft. Place countersunk washers (3) under heads of bolts (4 and 5). Torque front spar nuts (8) to 1200 ± 100 pound-inches and rear spar nuts (1) to 175 ± 15 pound-inches.

g. (See figure 2-2.) Connect any of the following items of optional equipment which were disconnected during wing removal, at places indicated.

NOTE

Lubricate all fittings used on fuel, oil, anti-ice, 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.

1. Propeller anti-ice line (4).
2. Wing de-ice lines at fittings (9, 10, 11, and 17).
3. Auxiliary fuel tank wires at electrical connector (1).
4. Speed control system. If right wing is being installed, connect flap potentiometer wires at quick-disconnects. If left wing is being installed, connect flap transducer wires at the electrical connector located forward of magneto wires.
5. Oil cooler shutter control (21). Install in wing with attaching clamps.
- h. (See figure 2-2.) Connect the following items at the wing root, then remove tags:
 1. Brake line at fitting (16).
 2. Vacuum line at fitting (12).
 3. Fuel pressure line at fitting (14).
 4. Oil pressure line at fitting (15).
 5. Manifold pressure line at fitting (13).
 6. Fuel lines (2 and 3).
 7. Starter cable at electrical connector (6).
 8. Magneto wires at electrical connectors (24).
 9. Engine teleflex control conduits at fittings (7, 8, 22, and 23).
10. Fuel selector valve torque tube (18). To connect, install inboard roll pin (19) into universal joint (20) and safety roll pin.

CAUTION

To insure correct operation of fuel selector valve, place fuel selector handle and valve in OFF positions before installing roll pin.

- i. Connect landing gear drive tube (43, figure 2-51) by installing attaching bolt, spacers, and nut.

NOTE

If main landing gear was removed, disregard step "i" and install in accordance with paragraph 2-248.

- j. Insert wire bundle (5) through grommet in fuselage skin, attach wires to proper terminals in junction box, and remove tags. Solder the two wires in each junction box which require soldered connections.
- k. Reinstall upholstery panels.
- l. Install flap cables in wing in accordance with paragraph 2-90.
- m. Install aileron cables in wing in accordance with paragraph 2-67.
- n. If left wing is being installed, install aileron trim control cables in accordance with paragraph 2-77.
- o. If wing tip fuel tank was removed, install in accordance with section IV. Do not install lower fairing at this time.
- p. Jack airplane in accordance with paragraph 1-15.

CAUTION

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

- q. Remove padded supports from beneath cabin section, tail section, and wings; then remove jacks.
- r. To prevent the possibility of the tail tipping downward, place support beneath tailcone bumper.
- s. Install engine in accordance with section IV.
- t. Remove support from beneath tailcone bumper.
- u. Install sliding ends on engine teleflex controls in nacelle in accordance with section IV.
- v. Install batteries in accordance with paragraph 6-10.
- w. Check for correct cable tension, proper operation, and correct travel of flaps, ailerons, and aileron trim tab. Refer to paragraphs 2-97, 2-72, and 2-85 for limits and tolerances.
- x. Service airplane, then check for fuel leaks, especially at fuel tank and wing root connections.
- y. Install wing root fillets and fuel tank fairings.
- z. Start engines and check operation of electrical equipment and engine controls.

2-8. AILERONS.

2-9. The ailerons are of all-metal construction, statically balanced by lead weights fastened to the leading edges. Each aileron is attached to the outboard trailing edge of the wing by two hinges. The left aileron incorporates the aileron trim tab.

2-10. REMOVAL OF AILERON. (See figure 2-4.)

- a. If the left aileron is being removed, move aileron trim tab to extreme UP position and remove nut (5), bolt (7), and spacer (4) from trim tab push-pull tube (6).
- b. Lower flap and disconnect aileron push-pull rod (10) by removing bolt (11).
- c. Detach aileron from wing by removing bolts (9).

2-11. INSTALLATION OF AILERON. (See figure 2-4.)

- a. Attach aileron to wing with bolts (9).

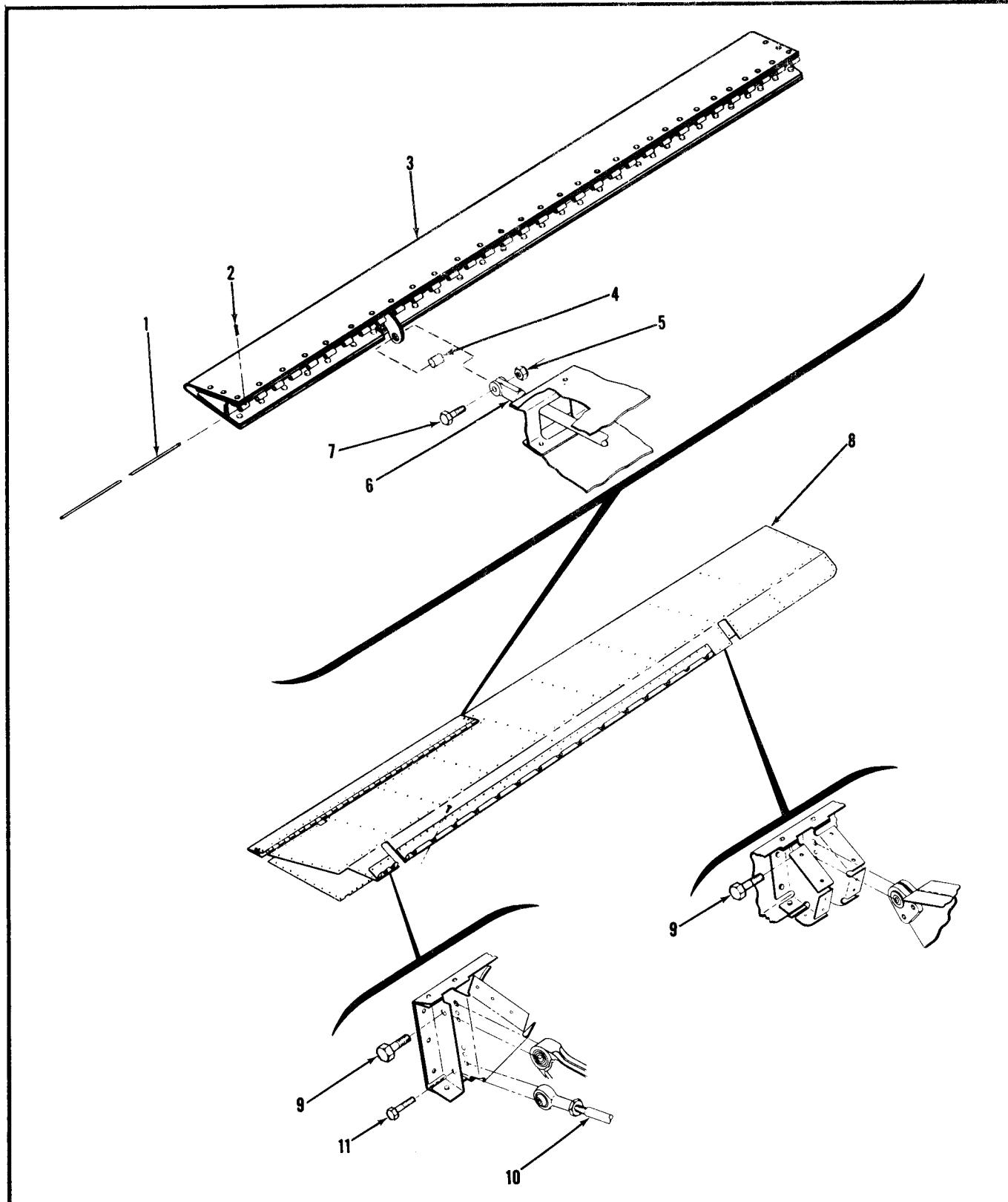
NOTE

When installing left aileron, guide aileron trim tab push-pull tube (6) through opening in aileron.

- b. Attach aileron push-pull rod (10) to aileron with bolt (11).
- c. Attach aileron trim tab push-pull tube (6) to trim tab with bolt (7), spacer (4), and nut (5).
- d. Check aileron and trim tab for proper operation and correct travel. Refer to paragraphs 2-72 and 2-85 for limits and tolerances.

2-12. AILERON TRIM TAB.

2-13. The all-metal aileron trim tab pivots on a continuous hinge and is operated by a push-pull tube which is routed through the left aileron to an actuator in the wing. The tab is located at the inboard trailing edge



- | | | |
|---------------------|------------------------------------|---------------------------|
| 1. Hinge Pin | 5. Nut | 8. Aileron |
| 2. Cotter Pin | 6. Aileron Trim Tab Push-pull Tube | 9. Bolt |
| 3. Aileron Trim Tab | 7. Bolt | 10. Aileron Push-pull Rod |
| 4. Spacer | | 11. Bolt |

Figure 2-4. Aileron and Aileron Trim Tab Installation

of the left aileron and is adjustable in flight.

2-14. REMOVAL OF AILERON TRIM TAB. (See figure 2-4.)

a. Move aileron trim tab to extreme UP position and remove nut (5), bolt (7), and spacer (4) to disconnect push-pull tube.

b. Remove trim tab by removing cotter pins (2) and hinge pin (1).

2-15. INSTALLATION OF AILERON TRIM TAB.

(See figure 2-4.)

a. Attach trim tab to aileron with hinge pin (1) and install cotter pins (2).

b. Attach push-pull tube (6) to trim tab with bolt (7), spacer (4), and nut (5).

c. Check trim tab for proper operation.

2-16. WING FLAPS.

2-17. The electrically-operated, all-metal flaps can be extended to any position between zero and 45 degrees. The split flaps on each wing are divided into two sections, one inboard and one outboard, which move downward from the inboard trailing edge of the wings.

2-18. REMOVAL OF FLAP. (See figure 2-5.) The following is a removal procedure for the left inboard flap. Remove the other flaps in similar manner.

a. Extend flaps.

b. If speed control system is installed and right inboard flap is being removed, disconnect flap potentiometer arm by removing nut, washer, spacer, and screw.

c. If inboard flap is being removed, remove lower aft wing fillet.

d. Disconnect lower scissors link assemblies (10) by removing nuts (15), washers (14), spacers (12 and 13), and bolts (9).

e. Remove safety wire from bent end of hinge pin (17), 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.

2-19. INSTALLATION OF FLAP. (See figure 2-5.)

a. Attach flap to wing with hinge pin (17). Safety-wire bent end of hinge pin.

NOTE

To facilitate hinge pin installation, check hinges and pin for distortion, lubricate hinge pin, and taper end of hinge pin.

b. Connect lower scissors link assemblies (10) to flap by installing bolts (9), spacers (12 and 13), washers (14), and nuts (15).

c. If lower aft wing fillet was removed, install with attaching screws.

d. If speed control system is installed and flap potentiometer arm was disconnected from right inboard flap, attach arm to flap with screw, spacer, wash-

er, and nut.

e. Check flaps for proper operation and correct travel. Refer to paragraph 2-97 for limits and tolerances.

2-20. EMPENNAGE GROUP.

2-21. The empennage consists of a vertical fin, rudder, rudder trim tab, horizontal stabilizer, right elevator, left elevator, and elevator trim tab. The trim tab actuators are located in the vertical fin and horizontal stabilizer.

2-22. VERTICAL FIN.

2-23. The all-metal vertical fin has a fiberglass tip. Three hinge brackets are riveted to the rear spar of the fin to provide rudder attachment points. The lower hinge incorporates the rudder bellcrank stops.

2-24. REMOVAL OF VERTICAL FIN. (See figure 2-6.)

a. Place suitable support beneath tail section.
b. Remove stabilizer fairings (6 and 8, figure 2-8).
c. 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 string or wire should be attached to it before removal to facilitate installation.

d. Remove rudder in accordance with paragraph 2-30.

e. Remove four screws (3) attaching forward dorsal skin to fuselage.

f. Remove nut (12), washer (13), and eyebolt (8) attaching elevator down spring to vertical fin rear spar.

g. Disconnect rudder cables in accordance with paragraph 2-101.

h. Remove rudder trim control cables from actuator in accordance with paragraph 2-112.

i. Remove elevator push-pull tube in accordance with paragraph 2-127.

j. Remove two nuts (5) and bolts (4) attaching front spar to fuselage.

k. Remove four bolts (7) and washers (6) attaching rear spar to fuselage.

l. Lift fin vertically until front spar has cleared fuselage and remove from airplane.

2-25. DISASSEMBLY OF VERTICAL FIN. (See figure 2-6.)

a. Remove rudder trim tab actuator (3, figure 2-18) in accordance with paragraph 2-114.

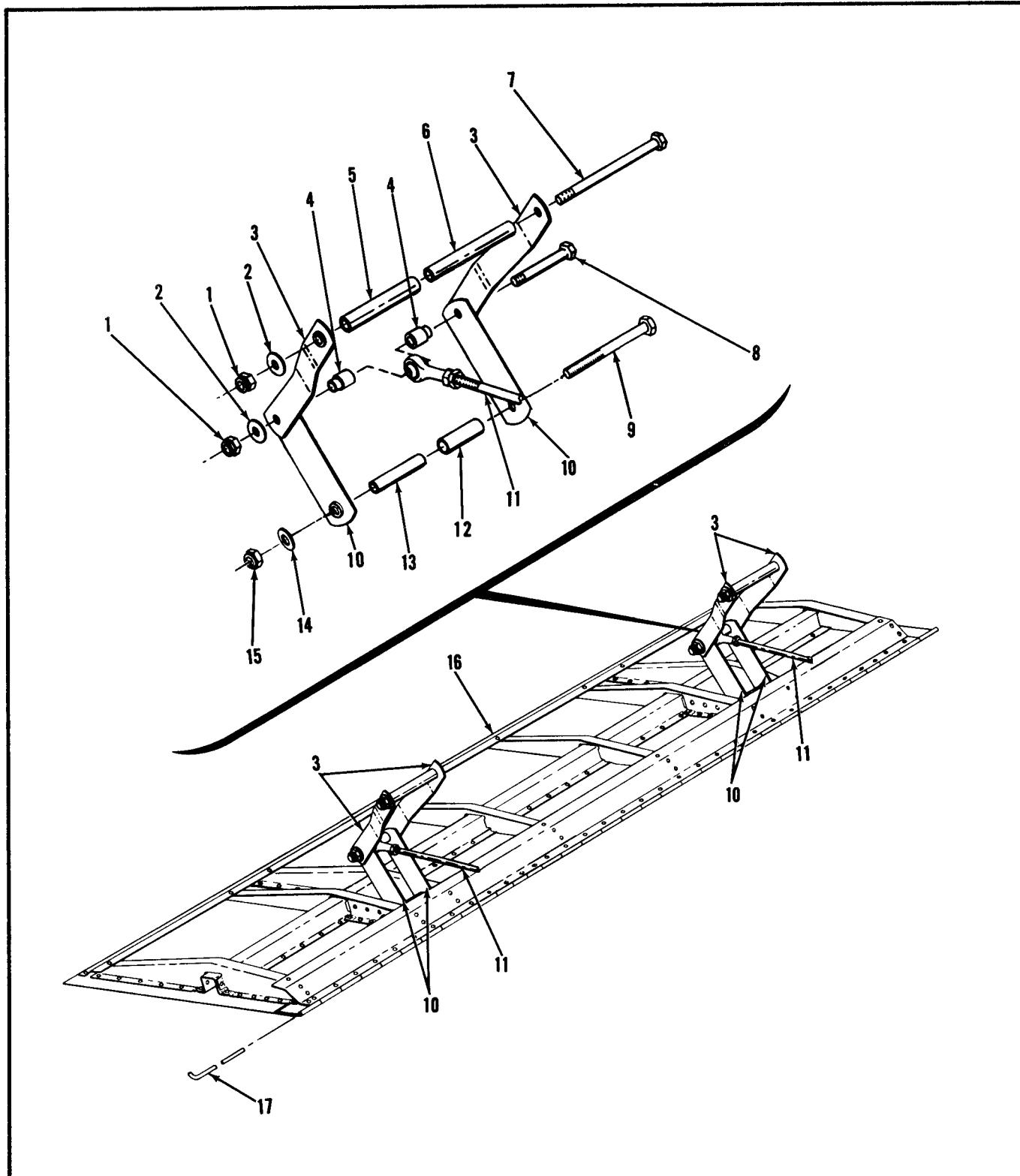
b. (See figure 2-7.) Remove rudder bellcrank (30) by removing nut (27), washer (26), and bolt (25).

c. Remove fiberglass tip by removing attaching screws.

d. If omni-antenna (optional equipment) is installed in fin tip, disconnect coaxial cable and remove antenna.

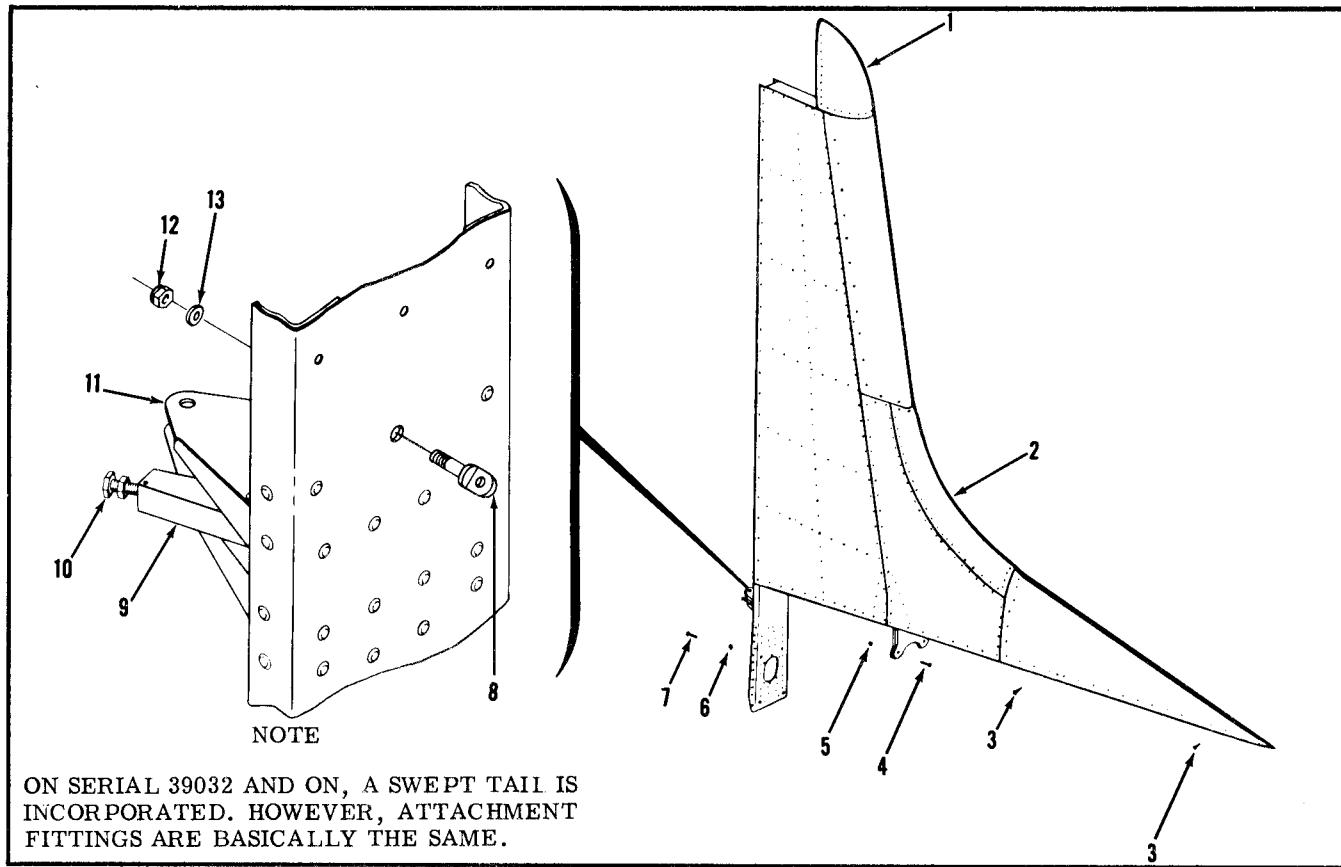
2-26. ASSEMBLY OF VERTICAL FIN. (See figure 2-6.)

a. If omni-antenna (optional equipment) was removed, install in fin tip and connect coaxial cable.
b. Attach fiberglass tip with attaching screws.



- | | | |
|------------------------|-------------------------|-----------------------|
| 1. Nut | 7. Bolt | 12. Spacer |
| 2. Washer | 8. Bolt | 13. Spacer |
| 3. Upper Link Assembly | 9. Bolt | 14. Washer |
| 4. Spacer | 10. Lower Link Assembly | 15. Nut |
| 5. Spacer | 11. Push-pull Rod | 16. Left Inboard Flap |
| 6. Spacer | | 17. Hinge Pin |

Figure 2-5. Flap Installation



- | | | |
|------------------|--------------------------|--------------------------------|
| 1. Fiberglas Tip | 5. Nut | 10. Rudder Bellcrank Stop Bolt |
| 2. Vertical Fin | 6. Washer | 11. Lower Hinge Assembly |
| 3. Screw | 7. Bolt | 12. Nut |
| 4. Bolt | 8. Eyebolt | 13. Washer |
| | 9. Rudder Bellcrank Stop | |

Figure 2-6. Vertical Fin Installation

- c. (See figure 2-7.) Install rudder bellcrank (30) with bolt (25), washer (26), and nut (27).
- d. Install rudder trim tab actuator (3, figure 2-18) in accordance with paragraph 2-116.

2-27. INSTALLATION OF VERTICAL FIN. (See figure 2-6.)

- a. Place vertical fin in position on fuselage and align mounting holes.
- b. Attach vertical fin rear spar to tailcone bulkhead with four bolts (7) and washers (6).

NOTE

Torque vertical fin attaching bolts (4 and 7) to 175 ± 15 pound-inches.

- c. Attach forward dorsal skin to fuselage with four screws (3).
- d. Attach vertical fin front spar to fuselage with two bolts (4) and nuts (5).
- e. Install elevator push-pull tube in accordance with paragraph 2-127.
- f. Connect rudder trim control cables to actuator in accordance with paragraph 2-113.
- g. Connect rudder cables in accordance with paragraph 2-102.

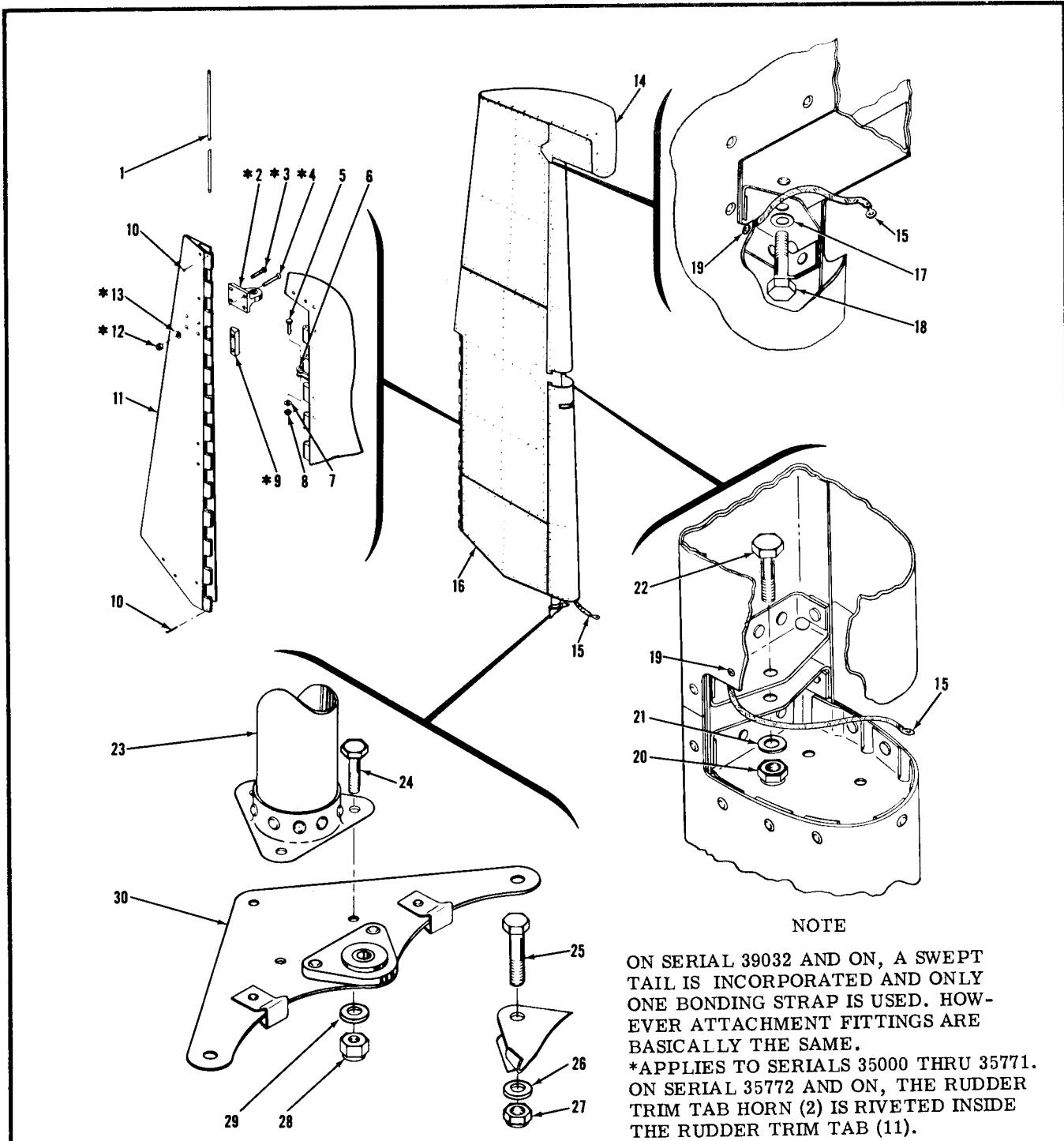
- h. Install elevator down spring with eyebolt (8), washer (13), and nut (12).
- i. Install rudder in accordance with paragraph 2-31.
- j. If omni-antenna (optional equipment) is installed, connect the coaxial cable in the aft fuselage.
- k. Remove support from beneath tail section and install stabilizer fairings (6 and 8, figure 2-8).

2-28. RUDDER.

2-29. The all-metal rudder has a fiberglas tip which encloses a lead weight used for static balance. 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 at the lower hinge.

2-30. REMOVAL OF RUDDER. (See figure 2-7.)

- a. Place suitable support beneath tail section.
- b. Remove stinger in accordance with paragraph 2-233.
- c. Remove nut (8), washer (7), and bolt (5) from rudder trim tab push-pull tube (6).
- d. Disconnect bonding straps (15).
- e. Remove three nuts (28), washers (29), and bolts



- | | | |
|-----------------------------------|---------------------|------------------------|
| 1. Hinge Pin | 11. Rudder Trim Tab | 21. Washer |
| 2. Rudder Trim Tab Horn | 12. Nut | 22. Bolt |
| 3. Screw | 13. Washer | 23. Rudder Torque Tube |
| 4. Screw | 14. Fiberglas Tip | 24. Bolt |
| 5. Bolt | 15. Bonding Strap | 25. Bolt |
| 6. Rudder Trim Tab Push-pull Tube | 16. Rudder | 26. Washer |
| 7. Washer | 17. Washer | 27. Nut |
| 8. Nut | 18. Bolt | 28. Nut |
| 9. Spacer | 19. Screw | 29. Washer |
| 10. Cotter Pin | 20. Nut | 30. Rudder Bellcrank |

Figure 2-7. Rudder and Rudder Trim Tab Installation

(24) attaching rudder torque tube (23) to bellcrank (30).
f. Remove nut (20), washer (21), and bolt (22) from center hinge. Remove bolt (18) and washer (17) from upper hinge.
g. Remove rudder by pulling aft. Guide rudder trim tab push-pull tube (6) out through rudder.

2-31. INSTALLATION OF RUDDER. (See figure 2-7.)

- a. Place rudder in position, guiding rudder trim tab push-pull tube (6) through rudder, and align mounting holes.
- b. Attach rudder to vertical fin with bolt (18) and washer (17) at upper hinge and bolt (22), washer (21), and nut (20) at center hinge.
- c. Attach rudder torque tube (23) to bellcrank (30) with three bolts (24), washers (29), and nuts (28).
- d. Attach bonding straps (15).
- e. Attach rudder trim tab push-pull tube with bolt (5), washer (7), and nut (8).
- f. Remove support from beneath tail section and check rudder and rudder trim tab for proper operation and correct travel. Refer to paragraphs 2-108 and 2-117 for limits and tolerances.
- g. Install stinger in accordance with paragraph 2-235.

2-32. RUDDER TRIM TAB.

2-33. 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.

2-34. REMOVAL OF RUDDER TRIM TAB. (See figure 2-7.)

- a. Disconnect rudder trim tab push-pull tube (6) by removing nut (8), washer (7), and bolt (5).
- b. Remove trim tab from rudder by removing cotter pins (10) and hinge pin (1).

2-35. DISASSEMBLY AND ASSEMBLY OF RUDDER TRIM TAB. (See figure 2-7.)

- a. Remove rudder trim tab horn (2) and spacer (9) by removing nuts (12), washers (13), and screws (3 and 4.)
- b. To assemble, reverse the above procedure.

2-36. INSTALLATION OF RUDDER TRIM TAB. (See figure 2-7.)

- a. Attach rudder trim tab to rudder with hinge pin (1) and cotter pins (10).
- b. Connect rudder trim tab push-pull tube (6) to trim tab with bolt (5), washer (7), and nut (8).
- c. Check rudder trim tab for proper operation and correct travel. Refer to paragraph 2-117 for limits and tolerances.

2-37. HORIZONTAL STABILIZER.

2-38. The all-metal horizontal stabilizer utilizes two main spars which extend the full span of the stabilizer. The elevator trim tab actuator is located in the stabilizer. Four hinges are riveted to the rear spar to provide elevator attachment points.

2-39. REMOVAL OF HORIZONTAL STABILIZER. (See figure 2-8.)

- a. Remove elevators in accordance with paragraph 2-44.
- b. Disconnect elevator trim tab push-pull tube from actuator by removing attaching nut, washer, and bolt.
- c. Remove vertical fin and rudder in accordance with paragraph 2-24.
- d. Remove elevator trim control cables from stabilizer in accordance with paragraph 2-135.
- e. Remove tail navigation light wires by removing screws from attaching clamps and wire terminal.
- f. If de-ice system (optional equipment) is installed, disconnect and tag forward hoses at tees located just forward of center bulkhead in tailcone.
- g. Remove four nuts (3), washers (4), and bolts (1) attaching rear spar to tailcone bulkhead.
- h. Remove two bolts (9) and washers (10) attaching front spar to fuselage bulkhead.
- i. Lift the rear spar until the stabilizer is at an angle of approximately 45 degrees, then remove from airplane by lifting vertically.

2-40. DISASSEMBLY AND ASSEMBLY OF HORIZONTAL STABILIZER.

- a. Remove or install elevator trim tab actuator in accordance with paragraph 2-137 or 2-139.

2-41. INSTALLATION OF HORIZONTAL STABILIZER. (See figure 2-8.)

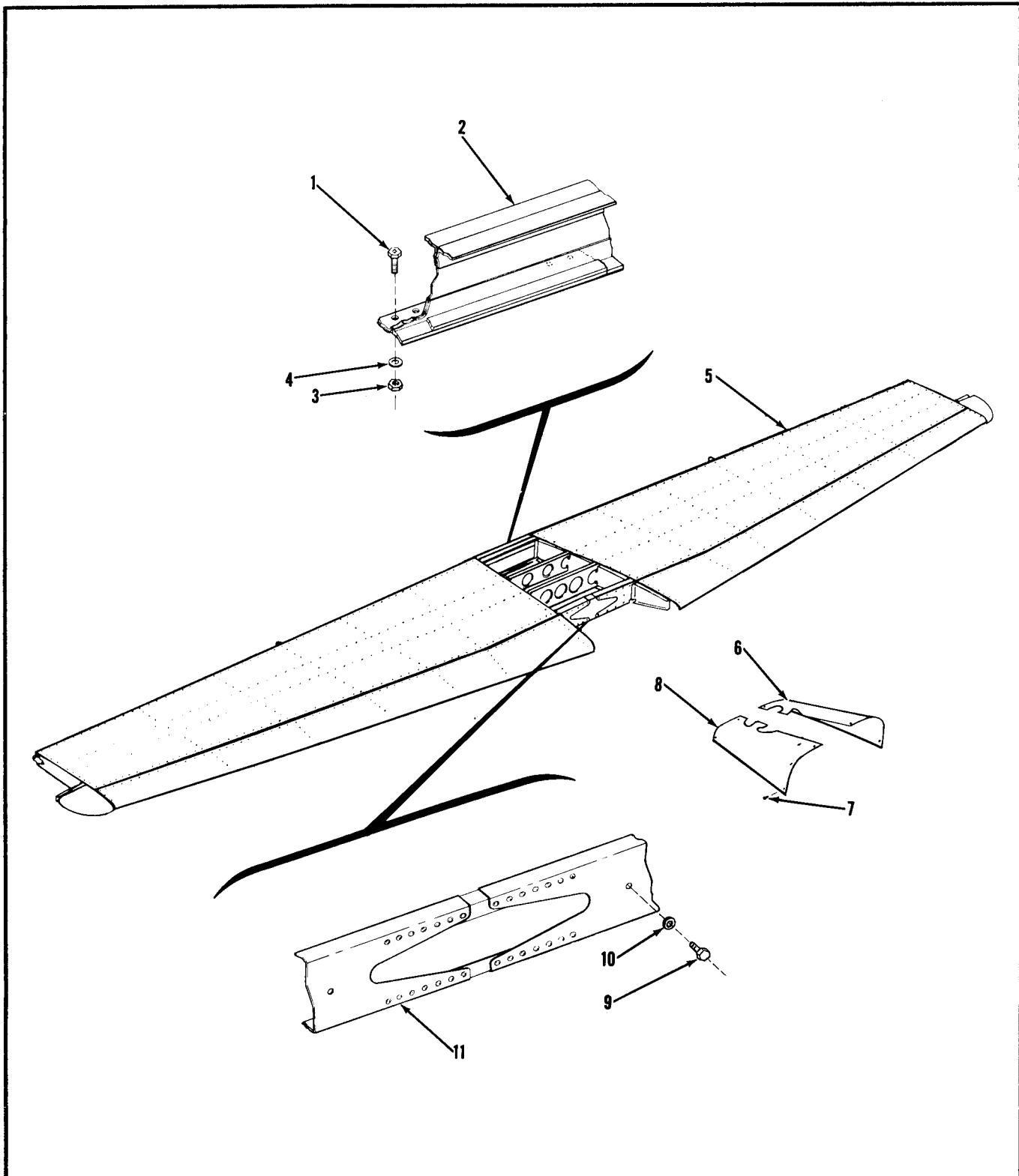
- a. Position horizontal stabilizer on tailcone and align mounting holes. Refer to paragraph 2-39, step "i".
- b. Attach stabilizer front spar to fuselage bulkhead with two bolts (9) and washers (10). Torque bolts (9) to 110 ± 15 pound-inches.
- c. Attach stabilizer rear spar to tailcone bulkhead with four bolts (1), washers (4), and nuts (3). Torque bolts (1) to 120 ± 20 pound-inches.
- d. If de-ice system (optional equipment) is installed, connect hoses to tees located just forward of center bulkhead in tailcone.
- e. Install tail navigation light wires by installing screws in attaching clamps and wire terminal.
- f. Install the elevator trim control cables in the stabilizer in accordance with paragraph 2-136.
- g. Install vertical fin and rudder in accordance with paragraph 2-27.
- h. Connect the elevator trim tab push-pull tube to the actuator by installing attaching bolt, washer, and nut.
- i. Install elevators in accordance with paragraph 2-45.

2-42. ELEVATORS.

2-43. 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.

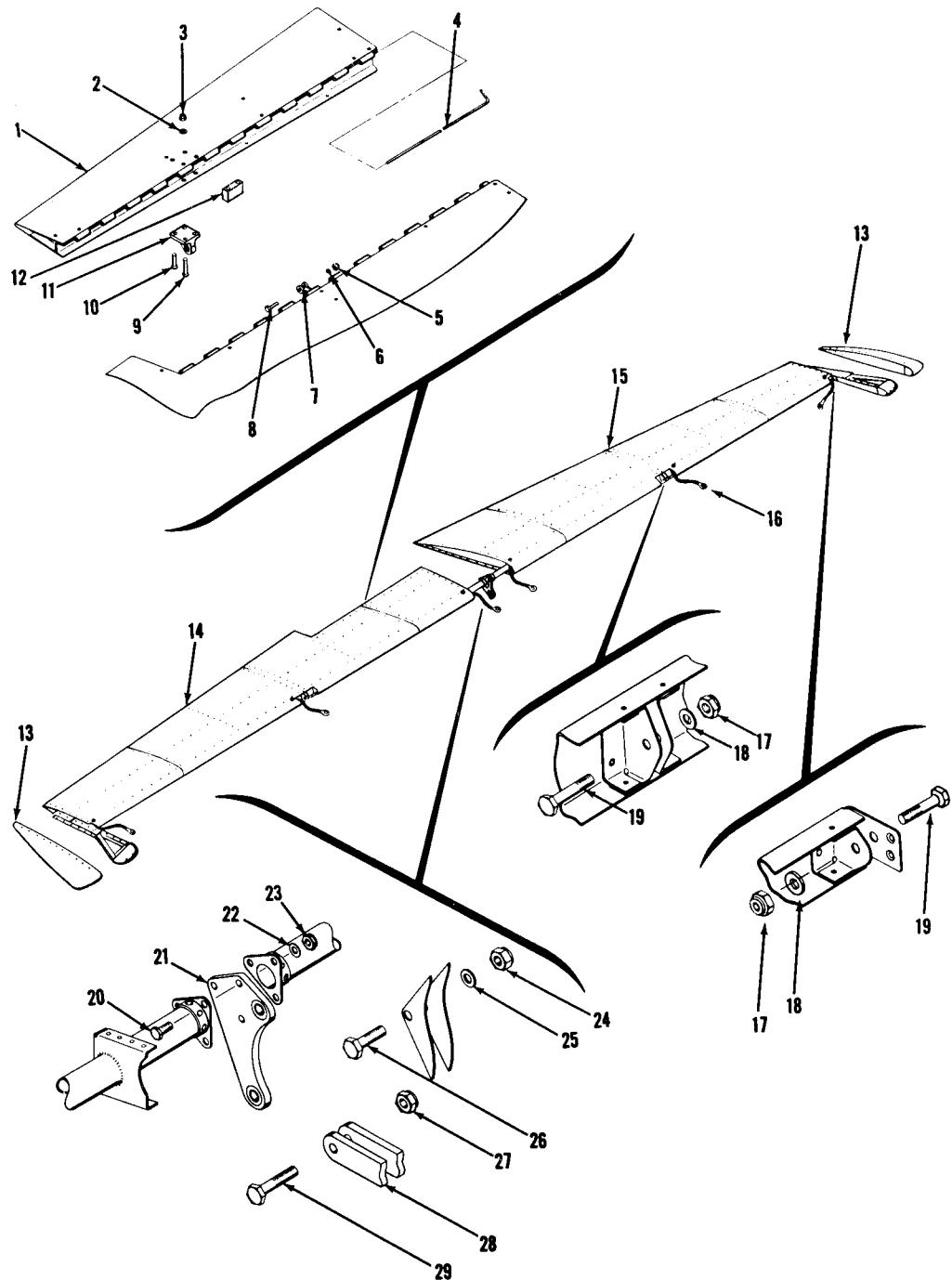
2-44. REMOVAL OF ELEVATORS. (See figure 2-9.)

- a. Remove stinger in accordance with paragraph 2-233.
- b. Disconnect elevator trim tab push-pull tube (7) by removing nut (5), washer (6), and bolt (8).



- | | |
|----------------------------|-----------------------------|
| 1. Bolt | 7. Screw |
| 2. Stabilizer Rear Spar | 8. Right Stabilizer Fairing |
| 3. Nut | 9. Bolt |
| 4. Washer | 10. Washer |
| 5. Horizontal Stabilizer | 11. Stabilizer Front Spar |
| 6. Left Stabilizer Fairing | |

Figure 2-8. Horizontal Stabilizer Installation



- | | | |
|-------------------------------------|----------------------------|-----------------------------|
| 1. Elevator Trim Tab | 11. Elevator Trim Tab Horn | 20. Bolt |
| 2. Washer | 12. Spacer | 21. Elevator Pylon |
| 3. Nut | 13. Fiberglas Tip | 22. Washer |
| 4. Hinge Pin | 14. Right Elevator | 23. Nut |
| 5. Nut | 15. Left Elevator | 24. Nut |
| 6. Washer | 16. Bonding Strap | 25. Washer |
| 7. Elevator Trim Tab Push-pull Tube | 17. Nut | 26. Bolt |
| 8. Bolt | 18. Washer | 27. Nut |
| 9. Screw | 19. Bolt | 28. Elevator Push-pull Tube |
| 10. Screw | | 29. Bolt |

Figure 2-9. Elevator and Elevator Trim Tab Installation

- c. Disconnect elevator torque tubes from elevator pylon (21) by removing nuts (23), washers (22), and bolts (20).
- d. Disconnect six bonding straps (16) by removing attaching screws.
- e. Remove fiberglass tips (13) by removing attaching screws.
- f. Remove each elevator by removing nuts (17), washers (18), and bolts (19).
- g. When removing right elevator, guide elevator trim tab push-pull tube (7) out through elevator.

2-45. INSTALLATION OF ELEVATORS. (See figure 2-9.)

- a. Place elevators in position, guiding elevator trim tab push-pull tube (7) through opening in right elevator, and align mounting holes.
- b. Attach each elevator to horizontal stabilizer with bolts (19), washers (18), and nuts (17).
- c. Attach elevator torque tubes to elevator pylon (21) by installing bolts (20), washers (22), and nuts (23).
- d. Attach six bonding straps (16) with attaching screws.
- e. Install fiberglass tips (13) with attaching screws.
- f. Attach elevator trim tab push-pull tube (7) to trim tab with bolt (8), washer (6), and nut (5).
- g. Install stinger in accordance with paragraph 2-235.
- h. Check elevators and elevator trim tab for proper operation and correct travel. Refer to paragraphs 2-131 and 2-142 for limits and tolerances.

2-46. ELEVATOR TRIM TAB.

2-47. The all-metal elevator trim tab is operated by a push-pull tube extending through the elevator and attached to an actuator in the horizontal stabilizer. The tab is attached to the inboard trailing edge of the right elevator by a continuous hinge and is adjustable in flight.

2-48. REMOVAL OF ELEVATOR TRIM TAB. (See figure 2-9.)

- a. Disconnect elevator trim tab push-pull tube (7) by removing nut (5), washer (6), and bolt (8).
- b. Remove safety wire from the bent end of the hinge pin (4), and detach the trim tab by removing hinge pin.

2-49. DISASSEMBLY AND ASSEMBLY OF ELEVATOR TRIM TAB. (See figure 2-9.)

- a. Remove elevator trim tab horn (11) and spacer (12) by removing nuts (3), washers (2), and screws (9 and 10).
- b. To assemble, reverse the above procedure.

2-50. INSTALLATION OF ELEVATOR TRIM TAB. (See figure 2-9.)

- a. Attach trim tab to elevator with hinge pin (4). Safety wire bent end of hinge pin.
- b. Connect elevator trim tab push-pull tube (7) to trim tab with bolt (8), washer (6), and nut (5).
- c. Check elevator trim tab for proper operation and correct travel. Refer to paragraph 2-142 for limits and tolerances.

2-51. SURFACE CONTROL SYSTEMS.

2-52. The systems used for operating the surface controls consist of various arrangements of cables, bellcranks, quadrants, push-pull tubes, chains and actuators. The electrically operated flap system is the only power-operated flight control system.

2-53. REMOVAL AND INSTALLATION OF SURFACE CONTROL SYSTEMS. Ordinarily a complete surface control system will not be removed. Instructions are given for removal and replacement of the major components of a system.

2-54. CLEANING, INSPECTION, AND LUBRICATION OF SURFACE CONTROL SYSTEMS.

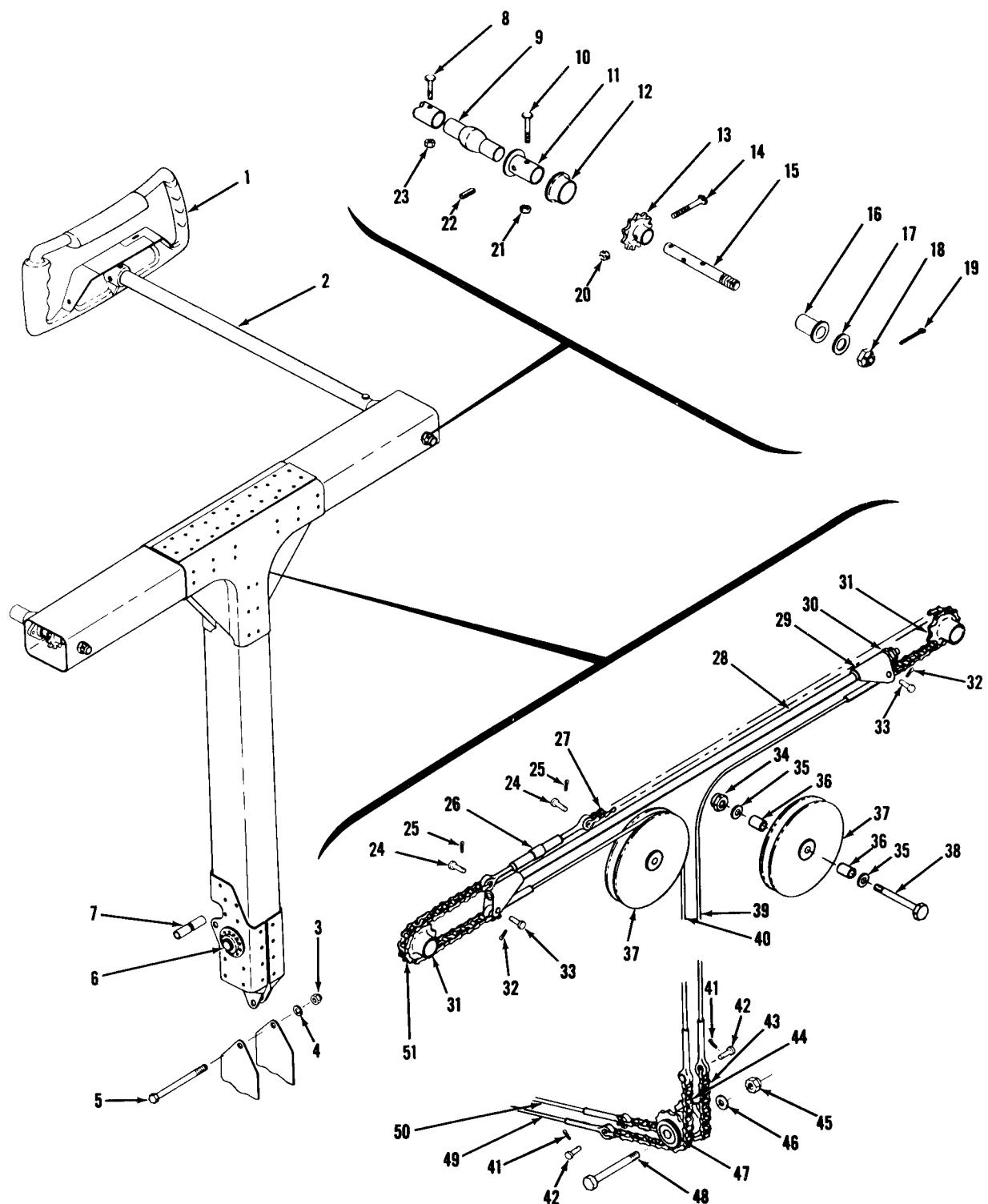
- a. Clean cables, chains, and pulleys by wiping with a clean cloth.
- b. Clean bellcranks, push-pull tubes, and quadrants with a suitable cleaning solvent.
- c. Inspect cables for visible damage, such as excessive wear, faulty terminals, kinks, and fraying. Replace all defective cables.
- d. Inspect pulleys for excessive wear, chipped or cracked flanges, and faulty bearings.
- e. Inspect chains for rust, broken links, and excessive wear.
- f. Inspect bellcranks, quadrants, and push-pull tubes for cracks, dents, broken welds, and excessive wear.
- g. Lubricate chains on assembly by applying a small amount of light oil to each link connection. Wipe excess oil from chains with a clean cloth.
- h. Sealed bearings require no lubrication. Lubricate oilite bearings, needle bearings, and unsealed rod end bearings in accordance with lubrication diagram. Refer to figure 1-6.

2-55. CONTROL COLUMN SYSTEM.

2-56. The control column assembly is a box-shaped tee, enclosing aileron cables, chains, pulleys, and sprockets. The pilot's control wheel is attached to a tube which extends through the instrument panel to the left aileron sprocket. A similar sprocket is located at the right end of the control tee for installation of a copilot's control wheel assembly (optional equipment). The elevator push-pull tube attaches to the lower end of the control tee.

2-57. REMOVAL OF CONTROL COLUMN. (See figure 2-10.)

- a. Remove shock-mounted instrument panel in accordance with paragraph 5-7.
- b. Remove front seats in accordance with paragraph 2-179.
- c. If an automatic pilot (optional equipment) is installed, disconnect electrical wires from control tube assembly (2) at quick-disconnects.
- d. Remove control wheels from control column by removing nuts (23) and bolts (8) from universal joints (9).
- e. Remove attaching screws and fold back right rear section of rear carpet. Remove access hole covers just in front of rear spar.
- f. Remove safety wire from turnbuckle (2, figure 2-11) and loosen turnbuckle to release tension on aileron system.
- g. (See figure 2-19.) Remove access hole cover from underside of fuselage just aft of nose wheel well,



NOTE

ALL CLEVIS PINS 24, 33, 42, ETC., ARE
CLEVIS BOLTS ON SERIAL 39001 AND ON

Figure 2-10. Control Column System

Figure 2-10. Control Column System Callouts

1. Control Wheel	18. Nut	35. Washer
2. Control Tube	19. Cotter Pin	36. Spacer
3. Nut	20. Nut	37. Pulley
4. Washer	21. Nut	38. Bolt
5. Bolt	22. Roll Pin	39. Left Vertical Cable
6. Bearing	23. Nut	40. Right Vertical Cable
7. Spacer	24. Pin	41. Cotter Pin
8. Bolt	25. Cotter Pin	42. Pin
9. Universal Joint	26. Turnbuckle	43. Lower Left Chain
10. Bolt	27. Aileron Left Chain	44. Lower Right Chain
11. Adapter	28. Aileron Follow-thru Assembly	45. Nut
12. Oilite Bearing	29. Aileron Follow-thru Fitting	46. Washer
13. Sprocket	30. Nut	47. Sprocket Assembly
14. Bolt	31. Sprocket	48. Bolt
15. Sprocket Shaft	32. Cotter Pin	49. Forward Right Cable
16. Oilite Bearing	33. Pin	50. Forward Left Cable
17. Washer	34. Nut	51. Aileron Right Chain

and disconnect elevator push-pull tube (45) by removing nut (47), spacers (46), and bolt (48).

h. Remove boot, retainer, and cover (8, 7, and 9, figure 2-30) from lower control column.

i.. Disconnect lower aileron chains (43 and 44) from forward aileron cables (49 and 50) by removing cotter pins (41) and pins (42).

j. Remove nut (3), washer (4), spacer (7), and bolt (5) attaching control column to fuselage, and remove from airplane.

2-58. DISASSEMBLY OF CONTROL COLUMN. (See figure 2-10.)

a. Remove safety wire and loosen turnbuckle (26).

b. Remove nuts (21 and 20) and bolts (10 and 14) attaching adapter (11) and sprocket (13) to shaft (15).

c. Remove cotter pin (19), nut (18), and washer (17) from sprocket shaft (15), and remove shaft from control column.

d. Remove universal joint (9) and adapter (11) from sprocket shaft (15) by removing roll pin (22).

e. Remove oilite bearings (12 and 16). These bearings are a press fit, and should be removed only for replacement.

f. Remove sprocket and shaft assembly from right end of control column in like manner.

g. Remove pulleys (37) by removing nuts (34), washers (35), spacers (36), and bolts (38).

h. Pull aileron follow-thru assembly from control column, and disassemble by removing cotter pins and pins from chains.

i. Remove lower sprocket assembly by removing nut (45), washer (46), and bolt (48).

NOTE

To facilitate assembly, note the number and position of washers and spacers in sprocket assembly.

j. To remove bearings (6) from lower control column it is necessary to remove attaching rivets. Remove bearings only for replacement.

2-59. INSPECTION OF CONTROL COLUMN.

a. Check control wheels for loose attaching rivets.
b. Check universal joints for excessive wear and faulty rubber grease seals.

c. Check all bolt holes for elongation.

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

e. Check control column assembly for cracks and loose rivets.

2-60. ASSEMBLY OF CONTROL COLUMN. (See figure 2-10.)

a. If removed, install bearings (6) in lower control column.

b. Install lower sprocket assembly (47) with bolt (48), washer (46), and nut (45).

c. If removed, install oilite bearings (12 and 16).

d. Assemble aileron follow-thru assembly by connecting chains (27 and 51) to turnbuckle (26) with pins (24) and cotter pins (25). Connect other ends of chains (27 and 51) and vertical cables (39 and 40) to ends of aileron follow-thru assembly (28) with pins (33) and cotter pins (32). Connect lower chains (43 and 44) to vertical cables (39 and 40) with pins (42) and cotter pins (41).

e. Assemble universal joint (9) and adapter (11) to sprocket shaft (15) with roll pin (22).

f. Insert sprocket shaft (15) into control column, through sprocket (13), and install washer (17), nut (18), and cotter pin (19).

NOTE

Tighten nut (18) only enough to remove end play. Sprocket shaft must rotate freely.

g. Install bolts (10 and 14) and nuts (20 and 21) attaching adapter (11) and sprocket (13) to sprocket shaft (15).

h. Insert follow-thru assembly into control column.

NOTE

As the follow-thru assembly is inserted, route vertical cables (39 and 40) beneath the internal guide.

i. Install sprocket and shaft assembly in right end of control column in like manner.

j. Install pulleys (37) with bolts (38), washers (35), spacers (36), and nuts (34), insuring that cables are

in place on pulleys.

k. Center aileron follow-thru assembly by placing chains (27 and 51) on sprockets (31) so that lower ends of vertical cables (39 and 40) are equal in length.

l. Temporarily attach the control wheels to universal joints (9) with bolts (8) and nuts (23), and adjust aileron follow-thru fitting (29) and turnbuckle (26) to bring both control wheels to a horizontal position.

NOTE

To insure proper positioning of aileron follow-thru end fitting against the adjusting nut, chain tension must be greater than aileron system tension.

m. Safety turnbuckle and detach control wheels by removing nuts (23) and bolts (8).

2-61. RIGGING OF CONTROL COLUMN. (See figure 2-10.) Rigging of the control column consists of adjusting the aileron follow-thru assembly to a central position and aligning the control wheels. Ordinarily this is done during assembly of the control column. The following is a procedure for synchronizing the control wheels, with the control column installed in the airplane.

a. Remove shock-mounted instrument panel in accordance with paragraph 5-7.

b. Remove safety wire from turnbuckle (26) and adjust aileron follow-thru fitting (29) and turnbuckle to synchronize control wheels. Control wheels are considered synchronized when a straightedge will fit flush along the bottom edge of both wheels.

NOTE

To insure proper positioning of aileron follow-thru fitting against the adjusting nut, chain tension must be greater than aileron system tension.

c. Resafety turnbuckle (26) and check aileron system tension.

NOTE

If, after control wheels are synchronized, they are not in a horizontal position when ailerons are neutral, the aileron system is improperly rigged.

d. Install shock-mounted instrument panel in accord-

2-65. TROUBLE SHOOTING AILERON CONTROL SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN CONTROL WHEEL AND AILERON.	Cable tension too low.	Adjust cable tension in accordance with paragraph 2-72.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys or quadrants.	Install cables correctly. Check cable guards.

ance with paragraph 5-8.

2-62. INSTALLATION OF CONTROL COLUMN. (See figure 2-10.)

- a. Position control column and align mounting holes.
- b. Install control column with bolt (5), spacer (7), washer (4), and nut (3).

- c. Connect lower aileron chains to forward aileron cables (49 and 50) with pins (42) and cotter pins (41).

WARNING

There is danger of crossing aileron controls at this connection. Insure that the vertical cables inside the control tee are routed correctly, and lower chains are engaged with correct sprockets and attached to corresponding forward aileron cables in fuselage.

d. (See figure 2-19.) Attach elevator push-pull tube (45) with bolt (48), spacers (46), and nut (47).

e. Install control wheels by connecting to universal joints (9) with bolts (8) and nuts (23).

f. If an automatic pilot (optional equipment) is installed, connect electrical wires in control tube assembly (2) at quick-disconnects.

g. (See figure 2-11). Remove access hole covers beneath aileron quadrants (27), and check to see that aileron cables are in place on quadrants and pulleys.

h. Adjust turnbuckle (2, figure 2-11) connecting aileron carry-thru cables for correct tension; then safety turnbuckle.

i. Check aileron system for proper rigging. Refer to paragraph 2-72 for rigging procedure.

j. Replace access hole covers beneath aileron quadrants, on underside of fuselage just aft of nose wheel well, and on cabin floor.

k. Unfold section of rear carpet and install with attaching screws.

l. Install boot, retainer, and cover (8, 7, and 9, figure 2-30) on lower control column.

m. Install front seats in accordance with paragraph 2-181.

n. Install shock-mounted instrument panel in accordance with paragraph 5-8.

2-63. AILERON CONTROL SYSTEM.

2-64. The aileron control system is interconnected by cables, chains, turnbuckles, push-pull rods, quadrants, and bellcranks. This system, as described herein, extends from the cable-to-chain connections at the lower end of the control column, to the ailerons.

TROUBLE	PROBABLE CAUSE	CORRECTION
RESISTANCE TO CONTROL WHEEL ROTATION.	Cable tension too high.	Adjust cable tension in accordance with paragraph 2-72.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance if rubbing pulley brackets or cable guards.
	Control column follow-thru chains too tight.	Adjust in accordance with paragraph 2-61.
	Cables not in place on pulleys or quadrants during installation.	Install cables correctly.
	Bent aileron.	Repair or replace aileron.
CONTROL WHEELS NOT SYNCHRONIZED.	Incorrect control column rigging.	Rig in accordance with paragraph 2-61.
	Aileron system tension greater than control column follow-thru tension.	Adjust tensions in accordance with paragraph 2-61 and 2-72.
CONTROL WHEELS NOT HORIZONTAL WHEN AILERONS ARE NEUTRAL.	Incorrect aileron system rigging.	Rig in accordance with paragraph 2-72.
INCORRECT AILERON TRAVEL.	Aileron quadrant stops incorrectly adjusted.	Adjust in accordance with paragraph 2-72.
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 paragraph 2-72.
	Incorrect rigging of aileron bellcranks.	Rig in accordance with paragraph 2-72.

2-66. REMOVAL OF AILERON CONTROL CABLES. (See figure 2-11.) The following is a procedure for removing cables with turnbuckles attached, including pulley and cable guard removal. If desired, turnbuckle barrels may be unscrewed to leave turnbuckle forks attached to bellcranks.

- Remove front and rear seats in accordance with paragraphs 2-179 and 2-182.
- Remove front and rear carpets in accordance with paragraph 2-204.
- Remove boot, retainer, and cover (8, 7, and 9, figure 2-30) from lower control column.
- If an automatic pilot (optional equipment) is installed, remove rear curtain and floor cover from baggage compartment.
- Remove access hole covers from cabin floor, aft lower section of wheel wells, and aft underside of wing. Remove aft wing root fillets.
- Remove safety wire and disconnect turnbuckle (2) connecting aileron carry-thru cables (1).
- Remove aileron carry-thru pulley (4) by removing nut (3), bolt (5), and cable guard cotter pin (6).
- Remove cotter pins (35) and pins (36) attaching forward aileron cables (11) to chains (34).
- Disconnect forward aileron cables (11) from bellcranks (10) by removing cotter pins (13), nuts (14),

and bolts (15).

- Remove cable guard cotter pin (39), nut (42), washer (41), pulleys (38), spacer (40), and bolt (37), and remove forward aileron cables.

NOTE

When removing control cables, tie safety wire to ends of cables before removal. Leave the wires in the airplane to serve as a guide when cables are installed.

- If an automatic pilot (optional equipment) is installed, disconnect from aileron carry-thru cables and left aileron direct cable by removing attaching cable clamps.

- Disconnect aft aileron cables (8) from bellcranks (10) by removing cotter pins, nuts, and bolts.
- Disconnect aft aileron cables (8) and carry-thru cables (1) from aileron quadrants (27) by removing nuts (28), washers (29), bolts (30), and cable guard cotter pins (21).
- Remove outboard aileron pulleys (18) by removing cable guard pins (20) and bolts (22).
- Remove two sets of pulleys (46) in each wing and one set in each wing root by removing nuts (45), bolts (44),

and cable guards (43).

p. Remove aft aileron cables (8) and aileron carry-thru cables (1) by pulling through wings and removing from inside the cabin.

2-67. INSTALLATION OF AILERON CONTROL CABLES. (See figure 2-11.)

- a. Secure forward aileron cables (11) to guide wires and route from bellcranks (10) to lower control column, then remove guide wires.
- b. Install pulleys (38) with bolt (37), spacer (40), washer (41), and nut (42).
- c. Attach forward aileron cables (11) to chains (34) with pins (36) and cotter pins (35).

d. Insure that cables are not crossed, place in position on pulleys, and install cable guard cotter pin (39).

e. Attach forward aileron cables (11) to bellcranks (10) with bolts (15), nuts (14), and cotter pins (13).

f. Secure aft aileron cables (8) and aileron carry-thru cables (1) to guide wires and pull into position, then remove guide wires.

g. Place aileron carry-thru cables in position on outboard pulleys (18) and install pulleys with bolts (22). Install cable guard pins (20).

h. Attach aft aileron cables (8) and aileron carry-thru cables (1) to quadrants (27) with bolts (30), washers (29), and nuts (28), and install cable guard cotter pins (21).

NOTE

The aileron carry-thru cables are routed above the direct cables, where they pass around the quadrants.

i. Install two sets of pulleys (46) in each wing and one set in each wing root with cable guards (43), bolts (44), and nuts (45).

j. Attach aft aileron cables (8) to bellcranks (10) with bolts, nuts, and cotter pins.

k. Connect aileron carry-thru cables (1) with turnbuckle (2). Do not tighten turnbuckle at this time.

l. Place aileron carry-thru cable (1) in position on pulley (4) and install with bolt (5), nut (3), and cable guard cotter pin (6).

m. If an automatic pilot (optional equipment) is installed, attach to the aileron cables and rig.

n. Rig aileron cables in accordance with paragraph

2-72.

o. Install lower aft wing root fillets. Install access hole covers on cabin floor, aft underside of wings, and aft section of wheel wells.

p. If removed, install rear curtain and floor cover in baggage compartment.

q. Install front and rear carpets in accordance with paragraph 2-204.

r. Install boot, retainer, and cover (8, 7, and 9, figure 2-30) on lower control column.

s. Install front and rear seats in accordance with paragraphs 2-181 and 2-184.

2-68. REMOVAL OF AILERON QUADRANT. (See figure 2-11.)

a. Remove access hole covers from underside of wing beneath aileron quadrant (27).

b. Remove attaching screws, and remove access hole covers just in front of rear spar.

c. Remove safety wire from turnbuckle (2) connecting aileron carry-thru cables (1) and loosen turnbuckle to release tension on aileron system.

d. Disconnect aileron cables from quadrant by removing bolt (30), washer (29), nut (28), and cable guard cotter pins (21).

e. Remove nut (31), washer (32), and bolt (17) attaching aileron push-pull rod (16) to aileron quadrant.

f. Remove aileron quadrant by removing safety wire from bolt (26) and removing bolt and washer (25).

NOTE

Care should be taken that bushing (24) does not fall from quadrant during removal.

2-69. INSTALLATION OF AILERON QUADRANT. (See figure 2-11.)

a. Install aileron quadrant with bolt (26) and washer (25). Safety bolt.

NOTE

Bushing (24) and pivot washer (25) must be in place when installing quadrant.

b. Connect aileron push-pull rod (16) to quadrant with bolt (17), washer (32), and nut (31).

c. Attach aileron cables to quadrant with nut (28),

Figure 2-11. Aileron Control System Callouts

1. Aileron Carry-thru Cable	16. Aileron Push-pull Tube	32. Washer
2. Turnbuckle	17. Bolt	33. Control Column
3. Nut	18. Pulley	34. Lower Aileron Chain
4. Pulley	19. Washer	35. Cotter Pin
5. Bolt	20. Cable Guard Pin	36. Pin
6. Cable Guard Cotter Pin	21. Cable Guard Cotter Pin	37. Bolt
7. Turnbuckle	22. Bolt	38. Pulley
8. Aft Aileron Cable	23. Aileron Quadrant Stop Bolt	39. Cable Guard Cotter Pin
9. Bolt	24. Bushing	40. Spacer
10. Aileron Bellcrank	25. Washer	41. Washer
11. Forward Aileron Cable	26. Bolt	42. Nut
12. Turnbuckle	27. Aileron Quadrant	43. Cable Guard
13. Cotter Pin	28. Nut	44. Bolt
14. Nut	29. Washer	45. Nut
15. Bolt	30. Bolt	46. Pulley
	31. Nut	

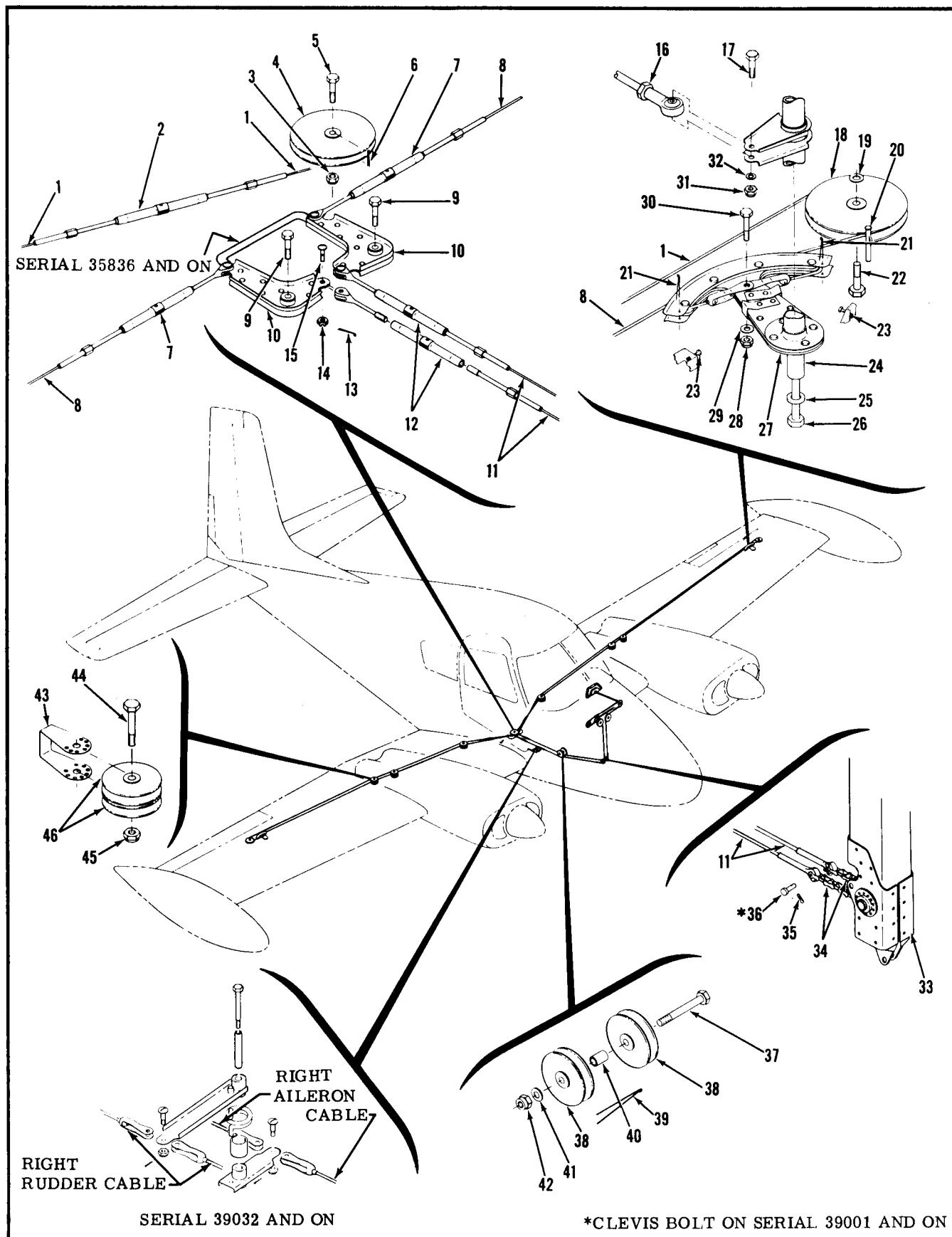


Figure 2-11. Aileron Control System

washer (29), bolt (30), and cable guard cotter pins (21).

NOTE

The aileron carry-thru cable is routed above direct cable where they pass around quadrant.

d. Rig 25 ± 5 pounds tension on aileron system with turnbuckle (2), resafety, and check ailerons for proper operation and correct travel. Refer to paragraph 2-72 for limits and tolerances.

e. Install access hole covers on aft cabin floor and underside of wing beneath aileron quadrant.

f. Unfold section of rear carpet and install with attaching screws.

2-70. REMOVAL OF AILERON BELLCRANK. (See figure 2-11.)

a. Remove attaching screws, fold back right rear section of rear carpet, and remove access hole covers just in front of rear spar.

b. Remove safety wire from turnbuckle (2) connecting aileron carry-thru cables, and loosen to release tension on aileron system.

c. Disconnect forward and aft aileron cables (11 and 8) from bellcrank (10) by removing cotter pins (13), nuts (14), and bolts (15).

d. Remove bellcrank (10) by removing bolt (9).

2-71. INSTALLATION OF AILERON BELLCRANK. (See figure 2-11.)

a. Install bellcrank (10) with bolt (9).

b. Attach forward and aft aileron cables (11 and 8) to bellcrank (10) with bolts (15), nuts (14), and cotter pins (13).

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.

c. Rig 25 ± 5 pounds tension on the aileron system with turnbuckle (2). Resafety the turnbuckle and check the ailerons for proper operation and correct travel. Refer to paragraph 2-72 for limits and tolerances.

d. Install access hole covers on cabin floor, unfold section of rear carpet, and install with attaching screws.

2-72. RIGGING OF AILERON CONTROL SYSTEM. (See figure 2-11.)

a. Remove rear carpet in accordance with paragraph 2-203.

b. Remove access hole covers from cabin floor in front of rear spar.

c. Remove access hole covers from underside of wings beneath aileron quadrants.

d. Align control wheels horizontally and tape a straightedge to the lower edge of both wheels to insure

alignment during rigging.

NOTE

Dual controls are optional equipment. If only one wheel is installed, it must be kept in horizontal position during rigging.

e. Remove safety wire from any turnbuckle which must be adjusted during rigging.

f. Adjust turnbuckles (12) on forward aileron cables and turnbuckles (7) on aft aileron cables so that aileron bellcranks (10) are in the same relative position to each other, and the bellcranks are 4.625 inches apart, measured between the centerlines of the aft bolt holes.

NOTE

During all aileron rigging adjustments, maintain 25 ± 5 pounds tension of the aileron cables. Check tension at wing cables.

g. Adjust turnbuckles (7) connecting aft aileron cables and turnbuckle (2) connecting aileron carry-thru cables so that ailerons align with trailing edges of wings.

NOTE

If length of aileron push-pull rods (16) has been changed, or new push-pull rods are being installed, adjust rod ends so that centerline of holes are 9.10 inches apart, prior to alignment of ailerons with trailing edges of 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 (23) so that aileron travel is 20 degrees up and 20 degrees down. Travel tolerance is plus one degree and minus zero degrees.

WARNING

Insure that ailerons move in the proper direction when operated by the control wheel.

j. Install access hole covers on underside of wings beneath aileron quadrants.

k. Install access hole covers on cabin floor, and install rear carpet in accordance with paragraph 2-205.

2-73. AILERON TRIM CONTROL SYSTEM.

2-74. 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.

2-75. TROUBLE SHOOTING AILERON TRIM CONTROL SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE.	Cable tension too high.	Adjust tension in accordance with paragraph 2-85.
	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.
	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB.	Cable tension too low.	Adjust tension in accordance with paragraph 2-85.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install pulleys correctly. Check cable guards.
	Excessive backlash in miter gear assembly.	Repair or replace miter gear assembly.
	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 paragraph 2-85.
INCORRECT TRIM TAB TRAVEL.	Travel stop blocks loose or incorrectly adjusted.	Adjust stop blocks in accordance with paragraph 2-85.
CORRECT TRAVEL CAN-NOT BE OBTAINED BY ADJUSTING STOP BLOCKS.	Actuator screw incorrectly adjusted.	Adjust in accordance with paragraph 2-85.

2-76. REMOVAL OF AILERON TRIM CONTROL CABLES AND CHAINS. (See figure 2-12.)

- a. Remove front seats in accordance with paragraph 2-179.
- b. Remove front and rear carpets in accordance with paragraph 2-203.
- c. Remove side panels from control pedestal in accordance with paragraph 2-147.
- d. Remove access hole covers from cabin floor, aft underside of left wing, and underside of fuselage aft of nose wheel well. Remove aft left wing root fillet.
- e. Remove safety wire and disconnect turnbuckle (49) connecting left cable to top cable.
- f. Remove nut (48) and bolt (47) connecting right cable to bottom cable.
- g. Remove four sets of pulleys (8) in wing and two sets of pulleys in fuselage by removing nuts (7) and bolts (10).
- h. Remove chain guard (15) from actuator (13) by removing nuts (19) and screws (14). Remove chain (18).
- i. Remove stop blocks (3) and bushings (1) by re-

moving nuts (2) and bolts (4).

j. Remove cables from wing by pulling out through access hole in wing.

NOTE

When removing cables, tie safety wire to ends of cables before removal. Leave the wires in the airplane to facilitate installation.

k. Remove chain guard (43) by removing attaching screws (44) and washers (41), and pull cables (45 and 46) out through access hole.

l. Remove upper chain (31) 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

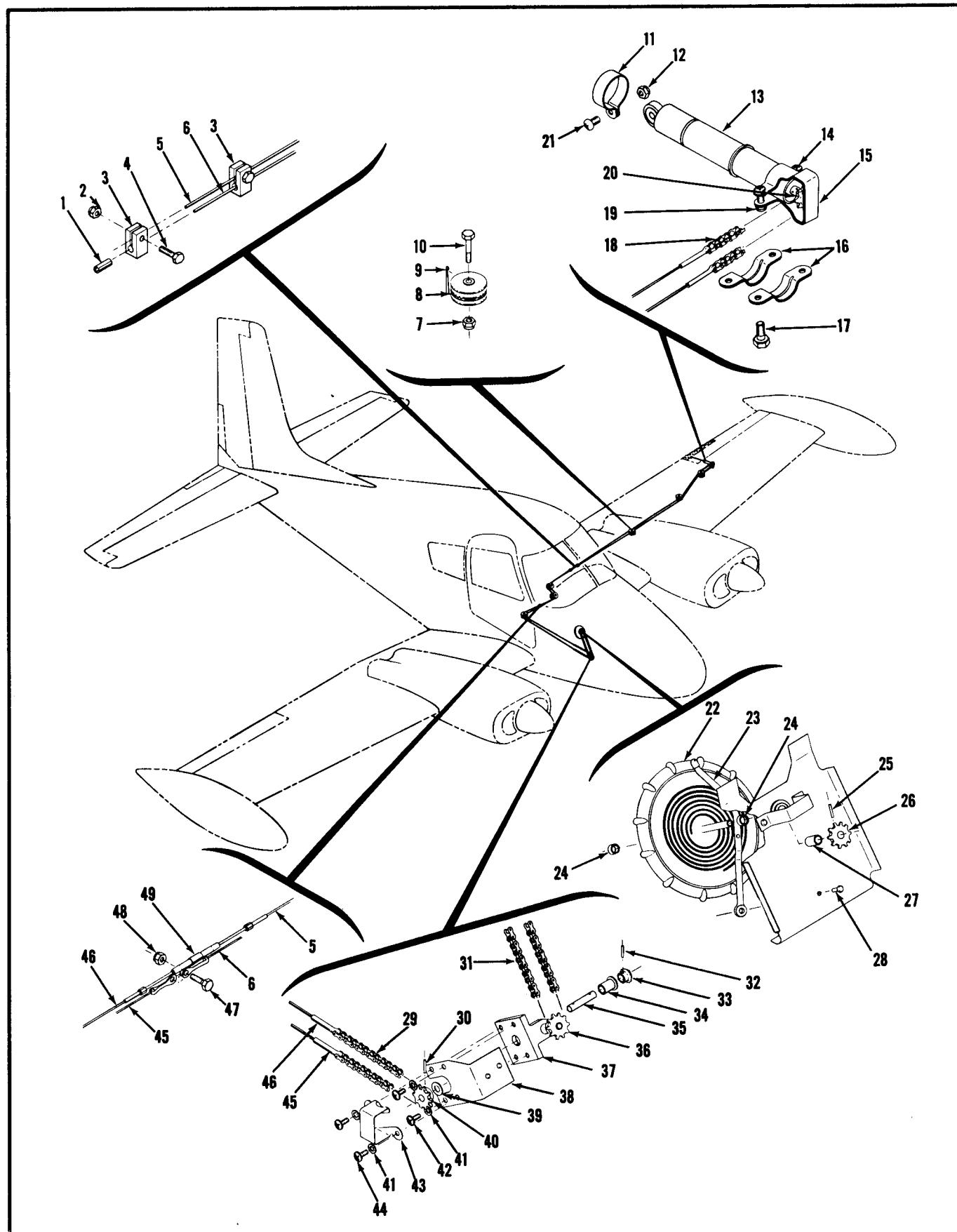


Figure 2-12. Aileron Trim Control System

Figure 2-12. Aileron Trim Control System Callouts

- | | | |
|--------------------------------------|--------------------------------|--------------------------------|
| 1. Bushing | 18. Actuator Chain | 35. Gear Shaft |
| 2. Nut | 19. Nut | 36. Sprocket |
| 3. Stop Block | 20. Actuator Sprocket | 37. Gear Support |
| 4. Bolt | 21. Screw | 38. Support Guard |
| 5. Top Aileron Trim Control Cable | 22. Aileron Trim Control Wheel | 39. Washer |
| 6. Bottom Aileron Trim Control Cable | 23. Aileron Trim Indicator | 40. Sprocket |
| 7. Nut | 24. Spacer | 41. Washer |
| 8. Pulley | 25. Roll Pin | 42. Screw |
| 9. Cable Guard Cotter Pin | 26. Sprocket | 43. Chain Guard |
| 10. Bolt | 27. Spacer | 44. Screw |
| 11. Clamp | 28. Rivet | 45. Right Aileron Trim Control |
| 12. Nut | 29. Lower Chain | Cable |
| 13. Aileron Trim Tab Actuator | 30. Roll Pin | 46. Left Aileron Trim Control |
| 14. Screw | 31. Upper Chain | Cable |
| 15. Chain Guard | 32. Roll Pin | 47. Bolt |
| 16. Clamp | 33. Miter Gear | 48. Nut |
| 17. Bolt | 34. Bearing | 49. Turnbuckle |

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.

2-77. INSTALLATION OF AILERON TRIM CONTROL CABLES AND CHAINS. (See figure 2-12.)

- a. Install upper chain (31) on sprockets and connect at master link.
- b. Secure forward cables (45 and 46) to guide wires and pull into position, then remove guide wires.
- c. Rotate trim control wheel to center indicator, engage lower chain with sprocket (40) so that ends of chain are equal in length, and install chain guard (43) with screws (44) and washers (41).
- d. Secure cables (5 and 6) to guide wires and route from actuator to fuselage connections, then remove guide wires.
- e. Align aileron with trailing edge of wing; then rotate actuator sprocket (20) to move trim tab to neutral. Engage chain with sprocket so that ends of chain are equal in length, and install chain guard (15) with screws (14) and nuts (19).
- f. Install four sets of pulleys (8) in wing and two sets of pulleys in fuselage with bolts (10) and nuts (7).
- g. Connect right cable (45) to bottom cable (6) with bolt (47) and nut (48).
- h. Connect left cable (46) to top cable (5) with turnbuckle (49), tighten cables to 15 ± 3 pounds tension, and safety turnbuckle.
- i. Install stop blocks (3) and bushings (1) on cables (5 and 6) between ribs at wing stations 100.5 and 111.5 with bolts (4) and nuts (2), and rig in accordance with paragraph 2-85.
- 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 in accordance with paragraph 2-150.
- m. Install front and rear carpets in accordance with paragraph 2-204.
- n. Install front seats in accordance with paragraph 2-181.

2-78. REMOVAL OF AILERON TRIM TAB ACTUA-

TOR. (See figure 2-12.)

- a. Remove rear carpet in accordance with paragraph 2-204.
- b. Remove access hole covers from cabin floor above landing gear actuator and from underside of wing beneath trim tab actuator.
- c. Remove safety wire from turnbuckle (49) and disconnect.
- d. Remove left aileron in accordance with paragraph 2-10.
- e. Remove aileron trim tab push-pull tube from actuator (13) by removing attaching nut and bolt.
- f. Remove chain guard (15) from actuator by removing nuts (19) and screws (14).
- g. Disengage chain from sprocket (20).
- h. Remove actuator by loosening clamp (11) and removing bolts (17) from clamps (16).

2-79. DISASSEMBLY, OVERHAUL, AND REASSEMBLY OF AILERON TRIM TAB ACTUATOR. (See figure 2-13.)

- a. Disassemble aileron trim tab actuator assembly in accordance with exploded view, figure 2-13. 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. Dimensions of parts shall be as follows:
- | | |
|---------------------------------|----------------|
| Front bearing (13) ID | 0.373 in. min. |
| | 0.380 in. max. |
| Rear Bearing (6): | |
| Small hole ID | 0.248 in. min. |
| | 0.253 in. max. |
| Large hole ID | 0.373 in. min. |
| | 0.380 in. max. |
| Screw (5) OD (shank) | 0.242 in. min. |
| | 0.246 in. max. |
| Screw (11) OD | 0.367 in. min. |
| | 0.370 in. max. |

NOTE

Maximum end play (linear movement) of screw (5) in screw (11) is 0.030 inch.

- f. Examine screws (5 and 11) for damaged threads or dirt particles that may impair smooth operation.
- g. Check sprocket (14) for broken, chipped, and/or worn teeth.
- h. Check bearing (4) for smoothness of operation.
- i. Do not attempt to repair damaged or worn parts of the actuator assembly. Discard all defective items and install new parts during reassembly.
- j. Always discard the following items and install new parts during reassembly: nuts (16), Groov-pins (10 and 12), and O-ring packing (8).
- k. During reassembly, lubricate collars (7) and screw (11) with general purpose lubricating grease (Specification MIL-G-3278).
- l. Reassemble actuator in accordance with the following:
 1. Press sprocket (14) into hollow end of screw (11), making sure pin holes are aligned. Press two new Groov-pins (12) into pin holes.
 2. 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).
 3. 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.

- 2-80. INSTALLATION OF AILERON TRIM TAB ACTUATOR. (See figure 2-12.)
- a. Place actuator in position, install clamps (16) with bolts (17), and tighten clamp (11).
 - b. Engage chain (18) with sprocket (20) and install chain guard (15) with screws (14) and nuts (19).
 - c. Connect trim cables with turnbuckle (49), tighten cables to 15 ± 3 pounds tension, and safety turnbuckle.
 - d. Connect aileron trim tab push-pull tube to actuator (13) with attaching bolt and nut.
 - e. Install left aileron in accordance with paragraph 2-11.
 - f. Rotate aileron trim control wheel (22) to neutral and align aileron with trailing edge of wing. With trim tab in neutral, adjust actuator screw (5, figure

2-13) so that push-pull tube aft hole is aligned with hole in trim tab horn, and install attaching bolt, spacer, and nut (7, 4, and 5, figure 2-4).

g. Check aileron trim tab for proper operation and correct travel. Refer to paragraph 2-85 for limits and tolerances.

- h. Install access hole covers on cabin floor and underside of wing beneath trim tab actuator.
- i. Install rear carpet in accordance with paragraph 2-204.

2-81. REMOVAL OF AILERON TRIM GEAR ASSEMBLY. (See figure 2-12.)

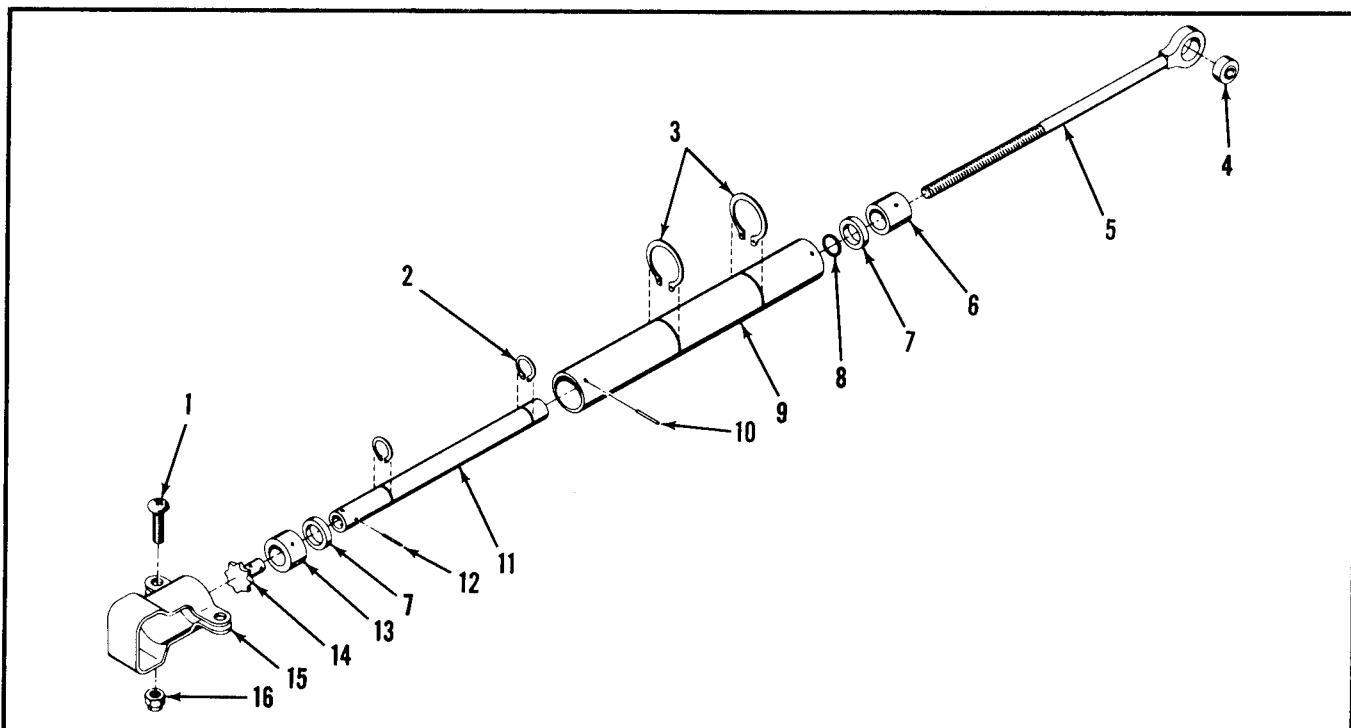
- a. Remove front seats in accordance with paragraph 2-179.
- b. Remove left front carpet in accordance with paragraph 2-203.
- c. Remove attaching screws and fold back left half of rear carpet.
- d. Remove access hole covers from forward cabin floor, aft cabin floor above the landing gear actuator, and underside of fuselage just aft of the nose wheel well.
- e. Remove safety wire from turnbuckle (49) and disconnect.
- f. Remove chain guard (43) by removing two screws (44) and washers (41), and disengage chain from sprocket (40).
- g. Remove sprocket (40) from shaft by removing roll pin (30).
- h. Remove two screws (42) and washers (41) attaching gear assembly support (37) and support guard (38) to fuselage.
 1. Rotate forward side of gear assembly support upward, disengage upper chain (31) from sprocket, and remove support guard and gear assembly support through access hole in cabin floor.

2-82. DISASSEMBLY, OVERHAUL, AND REASSEMBLY OF AILERON TRIM GEAR ASSEMBLY. (See figure 2-12.)

- a. Remove miter gears (33) and sprocket (36) from shafts by driving out roll pins (32). Remove shafts (35) from gear assembly support (37).
- b. Remove press-fit oilite bearings (34) 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 the above procedure.

2-83. INSTALLATION OF AILERON TRIM GEAR ASSEMBLY. (See figure 2-12.)

- a. Insert gear assembly support (37) and support guard (38) through access hole in cabin floor, and engage upper chain (31) with sprocket (36).
- b. With support guard in position align mounting holes in gear assembly support and install with two screws (42) and washers (41). Use the two mounting holes that are not utilized to attach chain guard (43).
- c. Attach sprocket (40) to shaft by installing roll pin (30).
- d. Engage chain (29) with sprocket (40) and install chain guard (43) with two screws (44) and washers (41).
- e. Connect trim control cables with turnbuckle (49), tighten cables to 15 ± 3 pounds tension, and safety



- | | | |
|-------------------|-------------------|-----------------|
| 1. Screw | 6. Bearing | 12. Groov-Pin |
| 2. Retaining Ring | 7. Collar | 13. Bearing |
| 3. Retaining Ring | 8. O-ring Packing | 14. Sprocket |
| 4. Bearing | 9. Housing | 15. Chain Guard |
| 5. Screw | 10. Groov-Pin | 16. Nut |
| | 11. Screw | |

Figure 2-13. Aileron Trim Tab Actuator

turnbuckle.

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 and correct travel. Refer to paragraph 2-85 for limits and tolerances.

h. Install access hole covers on forward cabin floor, aft cabin floor, and underside of fuselage aft of nose wheel well.

i. Unfold rear carpet and install with attaching screws.

j. Install front seats in accordance with paragraph 2-181.

2-84. REMOVAL AND INSTALLATION OF AILERON TRIM WHEEL AND INDICATOR ASSEMBLIES. (See figure 2-12.) 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.

2-85. RIGGING OF AILERON TRIM CONTROL SYSTEM. (See figure 2-12.)

a. Remove attaching screws and fold back left half of rear carpet.

b. Remove access hole covers from the underside of the fuselage just aft of nose wheel well, the cabin floor above the landing gear actuator, and the underside of the wing beneath trim tab actuator (13) and stop blocks (3).

c. Remove safety wire from turnbuckle (49) connecting aileron trim control cables, adjust to 10 ± 3 pounds tension, and resafety turnbuckle.

d. Move aileron trim control system to neutral by rotating trim control wheel so that ends of chain (18) are equal in length from actuator sprocket (20), and ends of chain (29) are equal in length from sprocket (40).

e. Adjust aileron trim indicator (23) 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 (5, 7, and 4, figure 2-4) attaching push-pull tube to aileron trim tab.

g. Align aileron with trailing edge of wing and place trim tab in neutral. Adjust actuator screw (5, figure 2-13) so that aft hole in push-pull tube is aligned with hole in trim tab horn, and attach with bolt, spacer and nut (7, 4, and 5, figure 2-4).

h. Loosen stop blocks (3), 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 (3) should be installed so that bottom cable (6) passes through bushings (1), and top cable is clamped by stop blocks.

i. Move trim tab to 20 degrees UP, slide inboard stop block against inboard rib (wing station 100.5), and tighten stop block.

j. 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.

k. Install access hole covers on cabin floor, underside of fuselage aft of nose wheel, and underside of wing.

l. Unfold rear carpet and install with attaching screws.

2-86. FLAP CONTROL SYSTEM.

2-87. The flap control system is operated by an electric motor which drives a gear reduction unit. Two sprockets, connected in tandem to the reduction unit output shaft by a key and setscrews, drive four chain-connected cables which actuate the flap bellcranks. The four bellcranks in each wing are interconnected by push-pull tubes. A cam, driven by a gear attached to the aft output shaft of the reduction unit, operates two limit switches.

2-88. TROUBLE SHOOTING 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.	Replace flap switch.
	Defective flap motor.	Replace flap motor.
	Defective electrical circuit.	Replace defective wires.
	Stripped or broken drive gear on flap motor.	Replace flap motor.
	Stripped or broken gears in reduction unit.	Replace reduction unit.
	Drive sprockets not secured to reduction unit output shaft.	Replace key and/or sprockets. Check keyway.
FLAPS FAIL TO RETRACT COMPLETELY.	UP limit switch incorrectly adjusted.	Adjust in accordance with paragraph 2-97.
	Incorrect rigging of flap cables, compensated for by incorrect adjustment of push-pull rods.	Rig in accordance with paragraph 2-97.
FLAPS FAIL TO EXTEND COMPLETELY.	DOWN limit switch incorrectly adjusted.	Adjust in accordance with paragraph 2-97.
	Incorrect rigging of flap cables, compensated for by incorrect adjustment of push-pull rods.	Rig in accordance with paragraph 2-97.
FLAPS NOT SYNCHRONIZED OR FAIL TO FIT EVENLY WHEN RETRACTED.	Incorrect adjustment of push-pull rods.	Adjust in accordance with paragraph 2-97.
	Bent push-pull rods.	Straighten or replace.
	Incorrect adjustment of bellcrank interconnecting push-pull tubes.	Adjust in accordance with paragraph 2-97.

TROUBLE	PROBABLE CAUSE	CORRECTION
	Incorrect rigging of cables and chains.	Rig in accordance with paragraph 2-97.
	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 key and/or sprocket. Check keyway.
	Broken chain, cable, or attaching pin.	Replace broken parts.

- 2-89. REMOVAL OF FLAP CONTROL CABLES AND CHAINS. (See figure 2-14.)
- Remove rear seat in accordance with paragraph 2-182.
 - Remove rear carpet in accordance with paragraph 2-204.
 - Remove access hole covers from cabin floor, aft wheel wells, and underside of fuselage beneath flap motor.
 - Remove aft wing root fillet (11, figure 2-1).
 - Lower flaps several degrees to decrease tension on return cables, remove safety wire from four turnbuckles (35), and disconnect turnbuckles.
 - Disconnect flap direct and return cables from bellcranks (8) by removing cotter pins (15) and pins (16).
 - Remove outboard pulleys (23) by removing nuts (22) and bolts (21).

NOTE

Cable guard cotter pins (20) are quite difficult to install and should be removed only for replacement.

- Remove pulleys (13) and cable guards (27) by removing nuts (28) and bolts (14).
- Remove pulleys (38) by removing nuts (39), bolts (36), and cable guard cotter pins (37).
- Tie guide wires to flap cables, pull out through access hole in cabin floor, and disconnect guide wires.
- (See figure 2-15.) Unsafety and remove four screws (12), remove chain guard (11), and disengage chains from sprockets (14).

2-90. INSTALLATION OF FLAP CONTROL CABLES AND CHAINS. (See figure 2-14.)

- Tie flap cables to guide wires and pull into position.
- Attach flap direct and return cables (12, 31, 19, and 32) to links of bellcranks (8) with pins (16) and cotter pins (15).
- Place return cables in position on pulleys (23) and install with bolts (21) and nuts (22).
- Install pulleys (13) and cable guards (27) with bolts (14) and nuts (28).
- Install pulleys (38) with bolts (36), nuts (39), and cable guard cotter pins (37).
- Engage chains (29 and 30) with reduction unit sprockets, connect to cables with four turnbuckles

- (35), and rig in accordance with paragraph 2-97.
- Install rear carpet in accordance with paragraph 2-204.
 - Install rear seat in accordance with paragraph 2-184.

2-91. REMOVAL OF FLAP BELLCRANK. (See figure 2-14.) 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 bellcrank in a similar manner.

- Remove rear seat in accordance with paragraph 2-182.
- Remove rear carpet in accordance with paragraph 2-204.
- Remove access hole covers from aft cabin floor and aft wheel well.
- Lower flaps several degrees to decrease tension on return cables, remove safety wire from turnbuckles (35), and loosen turnbuckles to release tension on cables which route to affected bellcrank only.
- Disconnect flap cables (12 and 19) from bellcrank by removing cotter pins (15) and pins (16).

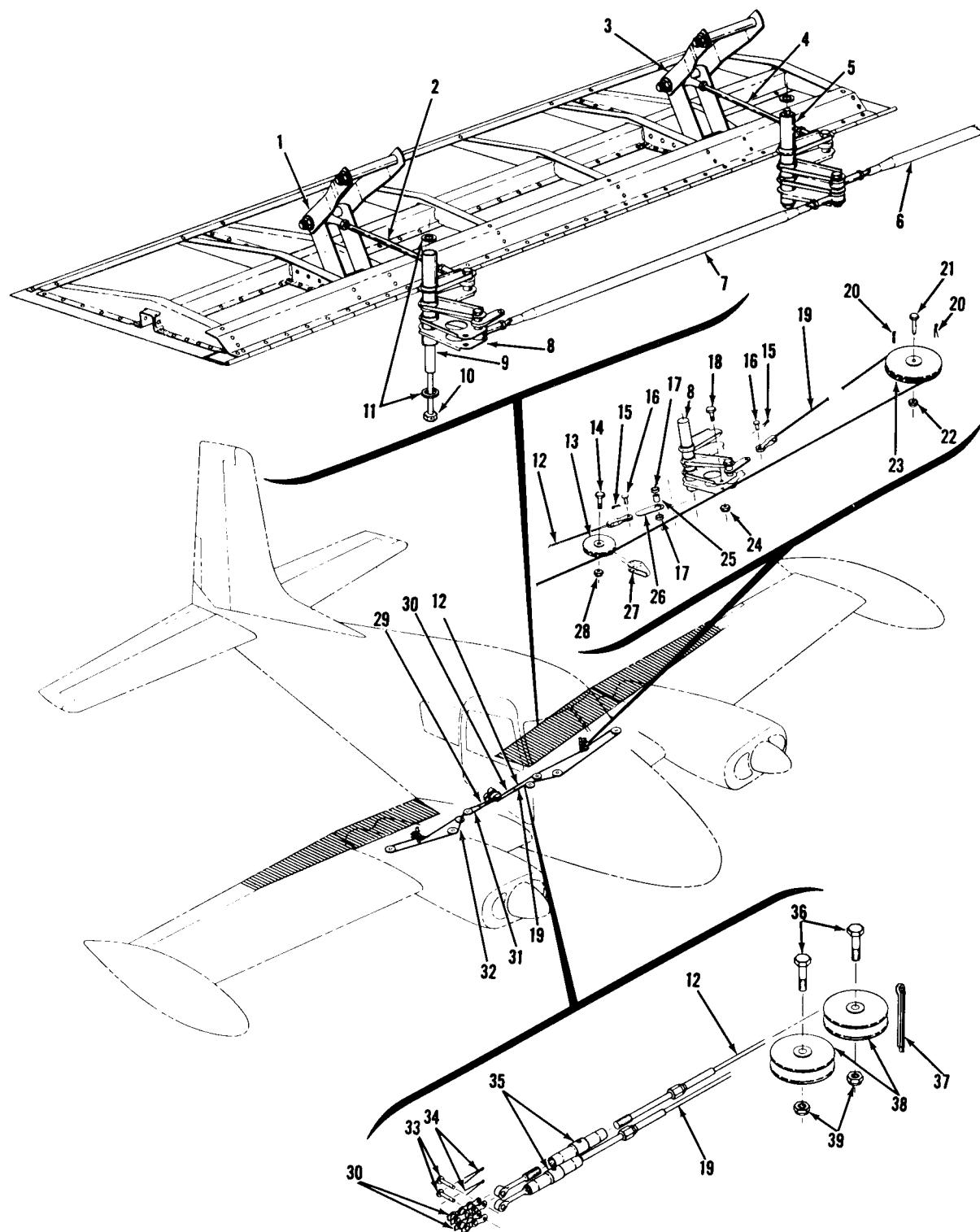
NOTE

Steps "a" through "e" 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.

- Disconnect push-pull rod (2) from bellcrank by removing attaching nut, spacers, and bolt.
- Disconnect interconnecting push-pull tube (7) from bellcrank by removing attaching nut and bolt.
- Remove bellcrank by removing safety wire from bolt (10) and removing bolt and washers (11), taking care that bushing (9) does not fall from bellcrank during removal.

NOTE

Access to bolt (10) is gained by removing a plug button from the underside of the wing beneath the bolt.

**NOTE**

ALL CLEVIS PINS 16, 33, ETC., ARE
CLEVIS BOLTS ON SERIAL 39001 AND ON

Figure 2-14. Flap Control System

Figure 2-14. Flap Control System Callouts

- | | | |
|--|----------------------------|---------------------------|
| 1. Inboard Scissors Assembly | 13. Pulley | 26. Cable Attachment Link |
| 2. Inboard Push-pull Rod | 14. Bolt | 27. Cable Guard |
| 3. Outboard Scissors Assembly | 15. Cotter Pin | 28. Nut |
| 4. Outboard Push-pull Rod | 16. Pin | 29. Right Flap Chain |
| 5. Outboard Bellcrank | 17. Spacer | 30. Left Flap Chain |
| 6. Center Interconnecting Push-pull
Tube | 18. Bolt | 31. Right Direct Cable |
| 7. Inboard Interconnecting Push-pull
Tube | 19. Left Return Cable | 32. Right Return Cable |
| 8. Inboard Bellcrank | 20. Cable Guard Cotter Pin | 33. Pin |
| 9. Bushing | 21. Bolt | 34. Cotter Pin |
| 10. Bolt | 22. Nut | 35. Turnbuckle |
| 11. Washer | 23. Pulley | 36. Bolt |
| 12. Left Direct Cable | 24. Nut | 37. Cotter Pin |
| | 25. Spacer | 38. Pulley |
| | | 39. Nut |

2-92. INSTALLATION OF FLAP BELLCRANK. (See figure 2-14.)

a. Insert bellcrank through access hole and install with washers (11) and bolt (10). Safety bolt and install plug button on underside of wing beneath bolt.

NOTE

Washers (11) and bushing (9) must be in place before installing bolt (10).

- 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 (12 and 19) to bellcrank (8) with pins (16) and cotter pins (15).
 e. Rig flaps in accordance with paragraph 2-97.
 f. Reinstall access hole covers.
 g. Install rear carpet in accordance with paragraph 2-204.
 h. Install rear seat in accordance with paragraph 2-184.

NOTE

Steps "d," "g," and "h" apply only to installation of the inboard bellcrank of each inboard flap.

2-93. REMOVAL AND INSTALLATION OF FLAP SCISSORS ASSEMBLY. Remove, disassemble, assemble, and install flap scissors assembly as illustrated in figure 2-5.

2-94. REMOVAL OF FLAP ACTUATOR ASSEMBLY. (See figure 2-15.) Flap motor and/or position transmitter can be removed without removing reduction unit; however, due to limited working space, it is desirable to remove reduction unit.

- a. Remove rear seat in accordance with paragraph 2-182.
 b. Remove rear carpet in accordance with paragraph 2-204.
 c. Remove access hole covers from aft cabin floor and underside of fuselage beneath flap motor.
 d. Disconnect electrical connector from position transmitter (27).
 e. Lower flaps several degrees to release tension on return cables, remove safety wire from turnbuckles

(35, figure 2-14), and loosen enough to disengage chains.

f. Unsafety and remove four screws (12), remove chain guard (11), and disengage chains from sprockets (14).

- g. Remove four nuts (8) and screws (9) attaching reduction unit to fuselage rear spar.
 h. Pull complete actuator assembly aft, tilt it, and remove through access hole.

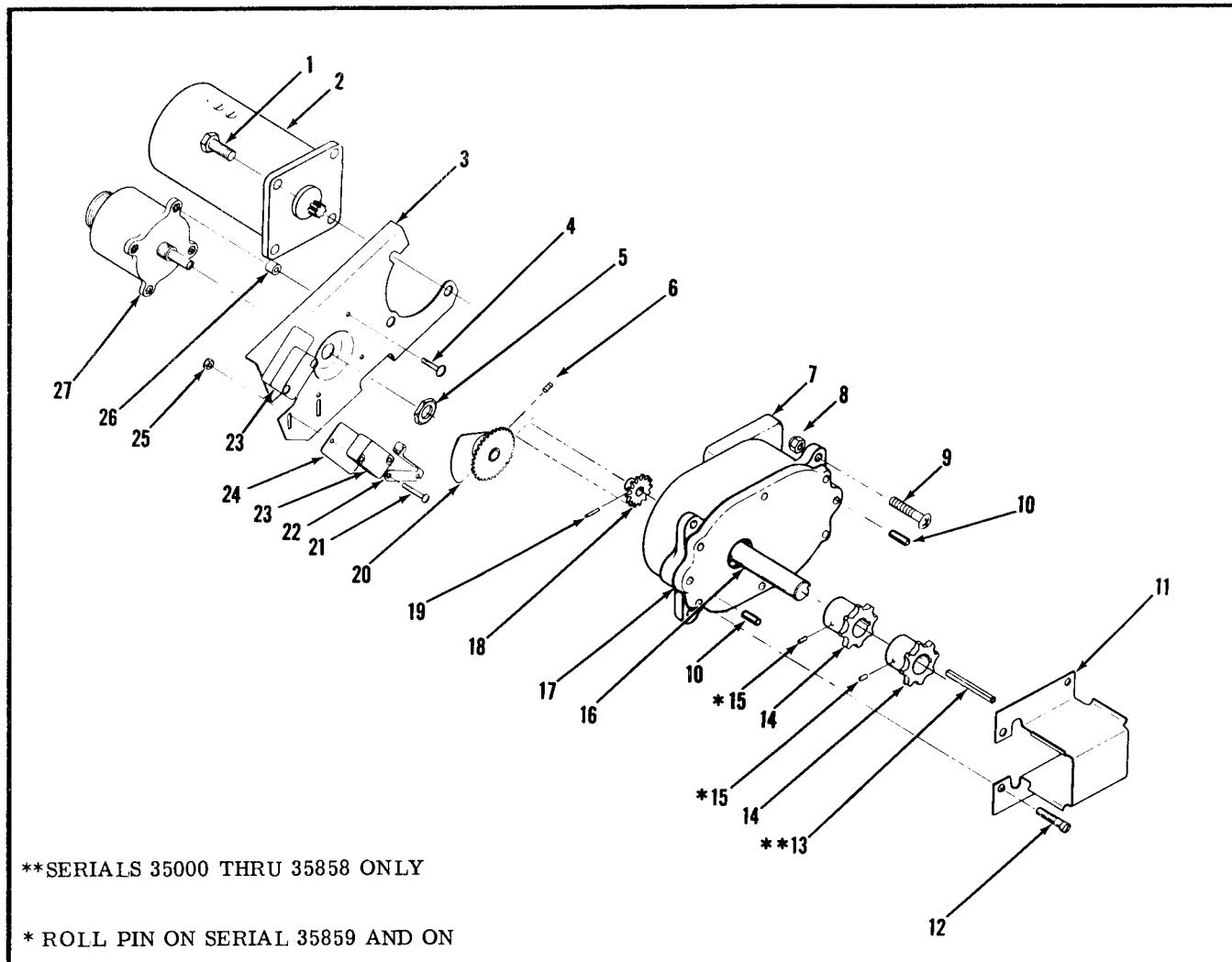
NOTE

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 airplane.

- i. Disconnect and tag wires leading from wire bundle to limit switches (23).

2-95. DISASSEMBLY, OVERHAUL, AND ASSEMBLY OF FLAP ACTUATOR ASSEMBLY. (See figure 2-15.)

- a. Remove flap motor (2) and bracket (3) from reduction unit (7) by removing four bolts (1). Disconnect and tag wires leading from motor to limit switches and motor to ground.
 b. Loosen setscrew (6) and remove cam (20) from position transmitter shaft.
 c. Remove position transmitter (27) from bracket (3) by removing nut (5), screws (4), and spacers (26).
 d. Remove limit switches (23), spacers (24), and switch actuators (22) by removing nuts (25) and screws (21).
 e. Remove pinion gear (18) from reduction unit (7) by removing roll pin (19).
 f. Remove sprockets (14) and key (13) from reduction unit (7) by loosening setscrews (15).
 g. Remove cover plate (17) from reduction unit (7) by removing remaining two screws (12). Two dowel pins (10) locate the cover plate.
 h. Remove gears from reduction unit and clean all component parts except sealed bearings with suitable solvent. Do not clean sealed bearings.
 i. Inspect all component parts for visible damage such as cracks, chipped or broken gear teeth, deep nicks or dents, and excessive wear. Check sealed bearings for smoothness of operation.
 j. Do not attempt to repair or replace internal



- | | | |
|-------------------|--------------------------------|---------------------------|
| 1. Bolt | 10. Dowel Pin | 19. Roll Pin |
| 2. Flap Motor | 11. Chain Guard | 20. Cam |
| 3. Bracket | 12. Screw | 21. Screw |
| 4. Screw | 13. Key | 22. Limit Switch Actuator |
| 5. Nut | 14. Sprocket | 23. Limit Switch |
| 6. Setscrew | 15. Setscrew | 24. Spacer |
| 7. Reduction Unit | 16. Output Shaft | 25. Nut |
| 8. Nut | 17. Reduction Unit Cover Plate | 26. Spacer |
| 9. Screw | 18. Pinion Gear | 27. Position Transmitter |

Figure 2-15. Flap Actuator Assembly

component parts of the reduction unit. If any item is defective, the complete reduction unit should be returned to the manufacturer for replacement.

k. Coat gear teeth with MIL-G-3278 grease and install gears in reduction unit housing. Pack housing with MIL-G-3278 grease.

l. Coat bearing surface of cover plate (17) with a thin layer of suitable sealing compound and attach to reduction unit housing with two screws (12), using the screw holes that are not utilized to attach chain guard (11).

NOTE

When assembling reduction unit, insure that

no foreign material is left on gears or in reduction unit housing.

m. Install key (13) on reduction unit output shaft, slide sprockets (14) into position, and tighten setscrews (15).

NOTE

Clearance between aft sprocket and cover plate (17) should be adjusted to .04 inch.

n. Install pinion gear (18) with roll pin (19).
o. Install limit switches (23), spacers (24), and switch actuators (22) with screws (21) and nuts (25).

NOTE

Install limit switches at the end of the adjusting slot which is farthest from cam (20) to allow for travel when rigging.

- p. Attach position transmitter (27) to bracket (3) with screws (4), spacers (26), and nut (5).
- q. Attach cam (20) to position transmitter shaft with setscrew (6).
- r. Attach flap motor (2) and bracket (3) to reduction unit (7) with four bolts (1).
- s. Attach wires from motor to limit switches and from motor to ground at their respective connections, and remove tags.
- t. Prior to installation, check flap actuator assembly as follows:
 - 1. Check flap motor, reduction unit, and position transmitter for proper operation.
 - 2. Check for positive clearance between reduction unit aft output shaft and cam. Clearance can be obtained by loosening setscrew (6), sliding cam slightly toward position transmitter, and tightening setscrew.
 - 3. Check for .04 clearance between aft sprocket (14) and reduction unit cover plate. Clearance can be adjusted by loosening setscrews (15), moving sprockets (14), and tightening setscrews.
 - 4. Check that reduction unit output shaft does not turn when 800 pound-inches torque is applied.
 - 5. Check limit switches for proper operation.

2-96. INSTALLATION OF FLAP ACTUATOR ASSEMBLY. (See figure 2-15.)

- a. Place flap actuator assembly near access hole in underside of fuselage, attach wires from wire bundle to respective limit switches (23), and remove tags.
- b. Insert actuator assembly through access hole and install with four screws (9) and nuts (8).

NOTE

If an automatic pilot (optional equipment) is installed, connect the automatic pilot cables to the clamps which attach them to the aileron cables.

- c. Connect the electrical connector to the position transmitter (27).
- d. Engage chains with sprockets (14) and rig flap control system in accordance with paragraph 2-97.
- e. Install access hole covers on aft cabin floor and underside of fuselage beneath flap motor.
- f. Install rear carpet in accordance with paragraph 2-204.
- g. Install rear seat in accordance with paragraph 2-184.

2-97. RIGGING OF FLAP CONTROL SYSTEM. (See figure 2-14.)

The flap control system can be rigged using the flap control switch in the airplane; however, to facilitate rigging, a 24-volt external power source and a two-position momentary switch similar to the one installed in the airplane should be attached to the wires from the flap motor so that the flaps may be observed while being operated during rigging. Use

caution while operating flaps in this manner because limit switches are being bypassed.

- a. Remove rear seat in accordance with paragraph 2-182.
- b. Remove rear carpet in accordance with paragraph 2-204.
- c. Remove access hole covers from aft cabin floor, aft wheel wells, aft underside of wings, and underside of fuselage beneath flap motor.
- d. Check length of inboard push-pull rod (2) on each inboard flap and adjust to 10.45 inches.

NOTE

Length of push-pull rods is measured between the centerlines of rod end bolt holes.

- e. With flaps in the UP position, check for correct positioning of chains (29 and 30) on sprockets and, if necessary, adjust as follows:

- 1. Tape flaps in the Up position.
- 2. Unsafety and disconnect four turnbuckles (35).
- 3. (See figure 2-15.) Unsafety and remove four screws (12), remove chain guard (11), and disengage chains from sprockets (14).
- 4. Engage right chain with aft sprocket and left chain with forward sprocket so that end of chain to which cable (12) attaches has three links clearing sprocket, and end of chain to which cable (31) attaches has four links clearing sprocket.
- 5. (See figure 2-15.) Reinstall chain guard (11) with four screws (12) and safety.
- 6. Connect chains to cables with turnbuckles (35).
- f. With flaps in UP position, temporarily rig approximately 110 pounds tension on return cables (32 and 19).
- g. Remove tape used to hold flaps up while cables were disconnected, lower flaps to 45 degrees, and temporarily rig approximately 110 pounds tension on direct cables (31 and 12).

NOTE

Final flap cable tension is not rigged at this time because of probable change during the following rigging procedure.

- h. Check length of interconnecting push-pull tubes and adjust, if necessary, to the following dimensions:
 - Outboard interconnecting
push-pull tubes 33.35 inches.
 - Center interconnecting
push-pull tubes 23.80 inches.
 - Inboard interconnecting
push-pull tubes 23.80 inches.
- i. Adjust remaining push-pull rods from bellcranks to scissors so flaps fit evenly when in the UP position.
- j. If used, disconnect the switch and outside power source which were wired into the flap circuit.
- k. (See figure 2-15.) Adjust limit switches as follows:
 - 1. Loosen limit switches (23) and position them where they will be actuated by the cam.
 - 2. With flaps in the UP position, flex flap switch bracket (3) aft to disengage cam (20) from pinion gear (18), rotate cam to a point where it actuates the UP limit switch, and re-engage cam with pinion gear by releasing tension on bracket (3).

NOTE

The UP limit switch, which is the lower switch, should be adjusted so that the flaps raise completely, while the tension on the return cables does not increase to more than 200 pounds.

3. Lower flaps to 45 degrees and adjust down limit switch so that cam (20) actuates switch at this point.

4. Tolerance for flap travel is plus one degree and minus zero degrees.

1. Raise flaps to the UP position, adjust tension on return cables (19 and 32), and safety turnbuckles.

NOTE

With flaps UP, the direct cable will be completely slack. With flaps DOWN, the return cable will be completely slack.

m. Lower flaps to 45 degrees, adjust tension on direct cables (12 and 31), and safety turnbuckles.

NOTE

Limits for flap cable tensions are 200 pounds maximum and 110 pounds minimum. The maximum differential tension between right and left direct cables, and between right and left return cables, is 15 pounds.

- n. Reinstall access hole covers.
- o. Install rear carpet in accordance with paragraph 2-204.
- p. Install rear seat in accordance with paragraph 2-184.

2-98. RUDDER CONTROL SYSTEM.

2-99. The rudder control system consists of rudder pedals (copilot's optional), rudder pedal torque tubes, control cables, a rudder bellcrank, and adjustable bellcrank stops. Nose wheel steering cables are attached to the rudder pedal torque tubes so that rudder pedals steer the airplane while taxiing.

2-100. TROUBLE SHOOTING RUDDER CONTROL SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN RUDDER PEDALS AND RUDDER.	Cable tension too low.	Adjust in accordance with paragraph 2-108.
	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 paragraph 2-108.
	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 paragraph 2-107, step "a."
	Cables not in place on pulleys during installation.	Install cables correctly.
	Bent rudder.	Repair or replace rudder.
RUDDER PEDALS NOT NEUTRAL WHEN RUDDER IS STREAMLINED.	Aft rudder cables incorrectly rigged.	Rig in accordance with paragraph 2-108.
INCORRECT RUDDER TRAVEL.	Rudder bellcrank stop incorrectly adjusted.	Adjust in accordance with paragraph 2-108.
CORRECT RUDDER TRAVEL CANNOT BE OBTAINED.	Rudder pedals contacting fuselage bulkhead.	Rig position cable, nose wheel, steering cables, and rudder cables in accordance with paragraph 2-108.

- 2-101. REMOVAL OF RUDDER CONTROL CABLES.** (See figure 2-16.)
- Remove front and rear seats in accordance with paragraphs 2-179 and 2-182.
 - Remove front carpet, rear carpet, and baggage compartment floor cover in accordance with paragraph 2-204.
 - Remove rear curtain from baggage compartment.
 - Remove access hole covers from cabin floor as necessary to gain access to rudder cables, pulleys, and attachment points.
 - Remove stabilizer fairings (6 and 8, figure 2-8).
 - Disconnect rudder cables (6 and 9) from bellcrank (1) by unsafelying and disconnecting turnbuckles (5).

NOTE

To remove rudder cables (6 and 9) it is necessary to remove turnbuckles; however, if cables are only to be disconnected, one turnbuckle can be loosened and cotter pins (8), nuts (7), and bolts (3) removed from rudder bellcrank (1).

- Remove three sets of rudder cable pulleys (33) as illustrated in figure 2-16.
- Remove fairleads through which rudder cables pass at fuselage rear spar and fuselage station 132.
- Remove forward pulleys (23) by removing nut (25), spacers (21), and bolt (22).

NOTE

Attaching nut and bolt for pulleys (23) must be removed from inside nose wheel well.

- Disconnect rudder cables (6 and 9) from rudder pedal torque tubes (13 and 28) by removing cotter pins (26), nuts (27), and bolts (19).
- Tie guide wires to ends of rudder cables (6 and 9), remove cables by pulling them out aft of baggage compartment, and disconnect guide wires.

NOTE

If an automatic pilot (optional equipment) is installed, disconnect from rudder cables by removing attaching clamps.

- Release tension on nose wheel steering cables (18 and 24) as follows:
 - Manually turn nose wheel to an extreme right or left position to release tension on spring (39).
 - Disconnect nose wheel steering cables (18 and 24) by either separating nose wheel steering spring components or removing cotter pins (37), washers (36), and pins (35).

CAUTION

Tension on nose wheel steering cables must be released before rudder position cable (12) is disconnected.

- Disconnect rudder position cable (12) from rud-

der pedal torque tubes (13 and 28) by removing cotter pins (15) and pins (14).

- Remove nut (30), bolt (10), and pulley (11), and remove rudder position cable (12).

- 2-102. INSTALLATION OF RUDDER CONTROL CABLES.** (See figure 2-16.)

- Place rudder position cable (12) in position and install pulley (11) with bolt (10) and nut (30).
- Connect rudder position cable to rudder pedal torque tubes (13 and 28) with pins (14) and cotter pins (15).

NOTE

The right nose wheel steering cable (24) 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.

- Connect nose wheel steering cables (18 and 24) and springs (39) in accordance with the method used to release tension.
- Tie rudder cables (6 and 9) to guide wires, pull into position, and remove guide wires.
- Install forward pulleys (23) with bolt (22), spacers (21), and nut (25).

NOTE

When installing pulleys (23), 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.

- Install three sets of rudder cable pulleys (33) as illustrated in figure 2-16.
- Install fairleads through which rudder cables pass at fuselage station 132 and fuselage rear spar.
- Connect rudder cables (6 and 9) to rudder pedal torque tubes (13 and 28) with bolts (19), nuts (27), and cotter pins (26).
- Connect rudder cables (6 and 9) to rudder bellcrank (1) with turnbuckles (5).
- Rig rudder cables in accordance with paragraph 2-108.

NOTE

If an automatic pilot (optional equipment) is installed, the automatic pilot cables must be connected to the rudder cables.

- Install stabilizer fairings (6 and 8, figure 2-8).
- Install access hole covers on cabin floor.
- Install rear curtain in baggage compartment.
- Install front carpet, rear carpet, and baggage compartment floor cover in accordance with paragraph 2-204.
- Install front and rear seats in accordance with paragraphs 2-181 and 2-184.

- 2-103. REMOVAL OF RUDDER PEDAL ASSEMBLY.** (See figure 2-16.)

- Remove front seats in accordance with para-

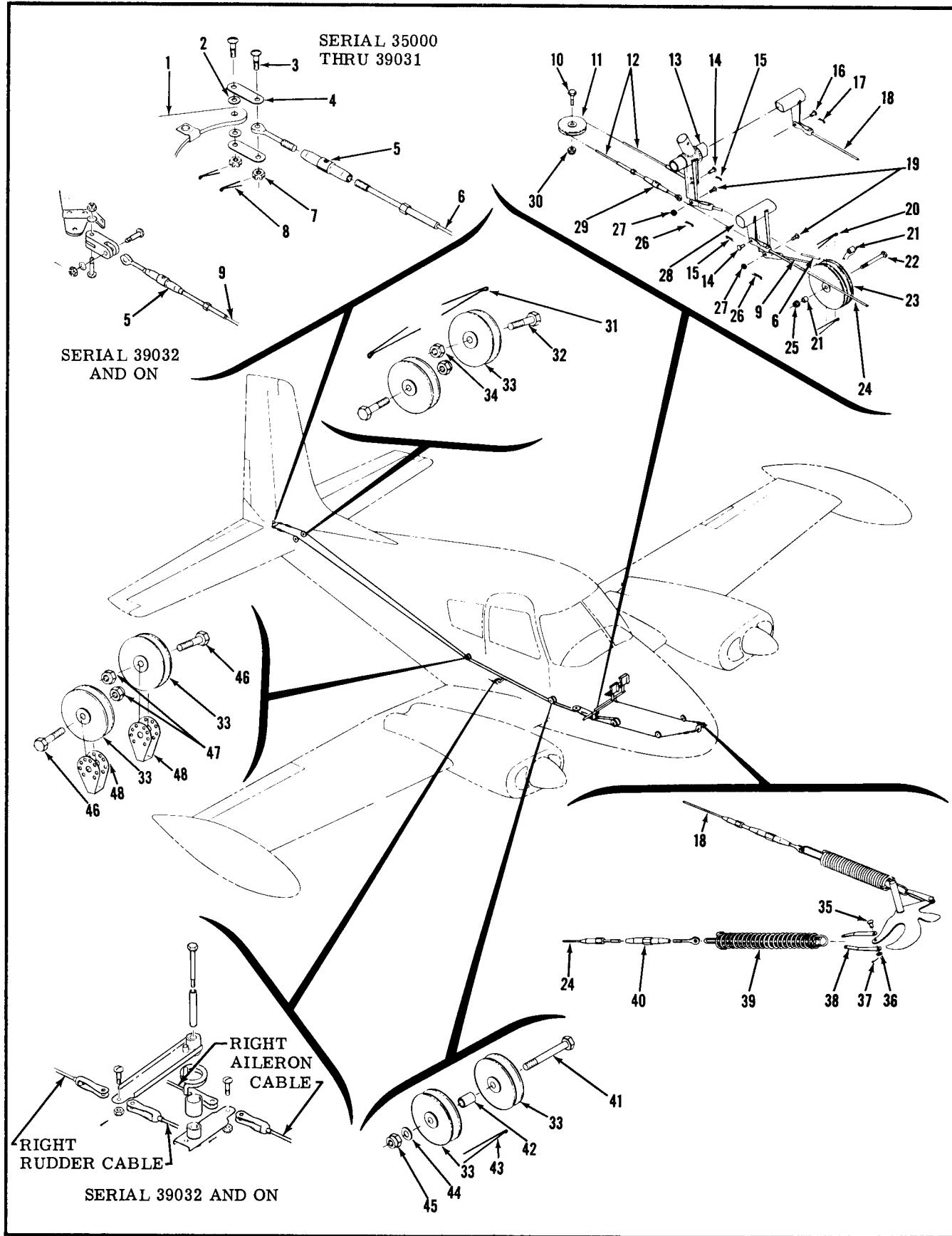


Figure 2-16. Rudder Control System

Figure 2-16. Rudder Control System Callouts

1. Rudder Bellcrank	17. Cotter Pin	33. Pulley
2. Washer	18. Left Nose Wheel Steering Cable	34. Nut
3. Bolt	19. Bolt	35. Pin
4. Rudder Cable Link	20. Cable Guard Cotter Pin	36. Washer
5. Turnbuckle	21. Spacer	37. Cotter Pin
6. Left Rudder Cable	22. Bolt	38. Link
7. Nut	23. Pulley	39. Spring
8. Cotter Pin	24. Right Nose Wheel Steering Cable	40. Turnbuckle
9. Right Rudder Cable	25. Nut	41. Bolt
10. Bolt	26. Cotter Pin	42. Spacer
11. Pulley	27. Nut	43. Cable Guard Cotter Pin
12. Rudder Position Cable	28. Right Rudder Torque Tube	44. Washer
13. Left Rudder Torque Tube	29. Turnbuckle	45. Nut
14. Pin	30. Nut	46. Bolt
15. Cotter Pin	31. Cable Guard Cotter Pin	47. Nut
16. Pin	32. Bolt	48. Cable Guard

graph 2-179.

- b. Remove front carpet and rudder bar shields in accordance with paragraph 2-204.
- c. Remove boot, retainer, and cover (8, 7, and 9, figure 2-30) from lower control column.
- d. Remove access hole covers from forward cabin floor.
- e. Release tension on nose wheel steering cables (18 and 24) in accordance with paragraph 2-101, step "m."
- f. Unsafety and loosen turnbuckle (29) and disconnect rudder position cable (12) and right nose wheel steering cable (24) from rudder pedal torque tubes (13 and 28) by removing cotter pins (15) and pins (14).
- g. Disconnect left nose wheel steering cable (18) from rudder pedal torque tube (13) by removing cotter pin (17) and pin (16).
- h. Disconnect rudder cables (6 and 9) from rudder pedal torque tubes (13 and 28) by removing cotter pins (26), nuts (27), and bolts (19).

NOTE

Refer to figure 2-17 for the following steps.

- i. Disconnect brake master cylinders (24) from pilot's rudder pedals by removing cotter pins (5) and pins (3).
- j. 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).
- k. Remove copilot's rudder pedals by removing nuts (20) and bolts (21).
- l. Remove upper and lower bearing halves (26 and 27) by removing eight bolts (25). Remove rudder pedal assembly from airplane.

NOTE

The upper and lower halves of each bearing are matched parts and should be tagged and kept in pairs.

2-104. DISASSEMBLY OF RUDDER PEDAL ASSEMBLY. (See figure 2-17.)

- 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 only for replacement.

2-105. CLEANING, INSPECTION, AND LUBRICATION OF RUDDER PEDAL ASSEMBLY.

- a. Clean component parts with suitable solvent.
- b. Check component parts for visible damage, such as dents, cracks, and broken welds.
- c. Check all bearings for scoring, binding, and excessive wear.
- d. Check all pin and bolt holes for elongation.
- e. Lubricate rudder pedal assembly in accordance with figure 1-6, sheet 11.

2-106. ASSEMBLY OF RUDDER PEDAL ASSEMBLY. (See figure 2-17.)

- 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 tube 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.

2-107. INSTALLATION OF RUDDER PEDAL ASSEMBLY. (See figure 2-17.)

- 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 figure 1-6, sheet 11. 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).

NOTE

Refer to figure 2-16 for the following steps.

- e. Attach rudder cables (6 and 9) to rudder pedal torque tubes (13 and 28) with bolts (19), nuts (27), and cotter pins (26).

- f. Attach left nose wheel steering cable (18) to rudder pedal torque tube (13) with pin (16) and cotter pin (17).

- g. Attach right nose wheel steering cable (24) and rudder position cable (12) to rudder pedal torque tubes (13 and 28) with pins (14) and cotter pins (15).

- h. Connect nose wheel steering cables (18 and 24) and springs (39) in accordance with the method used to release tension.

- i. Rig rudder control system in accordance with paragraph 2-108.

- j. Install access hole covers on cabin floor.

- k. Install boot, retainer, and cover (8, 7, and 9, figure 2-30).

- l. Install front carpet and rudder bar shields in accordance with paragraph 2-204.

- m. Install front seats in accordance with paragraph 2-181.

2-108. RIGGING OF RUDDER CONTROL SYSTEM. (See figure 2-16.)

- a. Remove front seats in accordance with paragraph 2-179.

- b. Remove front carpet and rudder bar shields in accordance with paragraph 2-204.

- c. Remove access hole covers from forward cabin floor.

- d. Remove stabilizer fairings (6 and 8, figure 2-8).

- e. Remove safety wire from any turnbuckle which must be adjusted during rigging.

- f. Position cable (12) is a "balance" cable, used to close the rudder system. Turnbuckle (29) should be adjusted so that the remaining cables can be correctly rigged and turnbuckles properly safetied.

NOTE

To facilitate rigging of the rudder system, adjust turnbuckle (29) 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.

- g. Place nose wheel in the neutral position and adjust nose wheel steering cable turnbuckles (40) so that rudder pedals are in neutral and tension on nose wheel steering cables (18 and 24) is 85 pounds, plus zero and minus five pounds.

- h. With nose wheel and rudder pedals in neutral, adjust aft rudder cable turnbuckles (5) so that rudder is in neutral (streamlined) and tension on rudder cables is 25 ± 5 pounds, measured aft of fuselage station 214.

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.

- i. Adjust rudder bellcrank stop bolts (10, figure 2-6) so that rudder travel is 25 degrees left and 25 degrees right (measured along water line), plus one degree, minus zero degrees. Resafety bolts.

- j. Safety all turnbuckles from which safety wire was removed.

- k. (See figure 2-17.) Adjust clevis rod ends (6) on brake master cylinders (24) so that tips of 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.

- l. Install stabilizer fairings (6 and 8, figure 2-8).

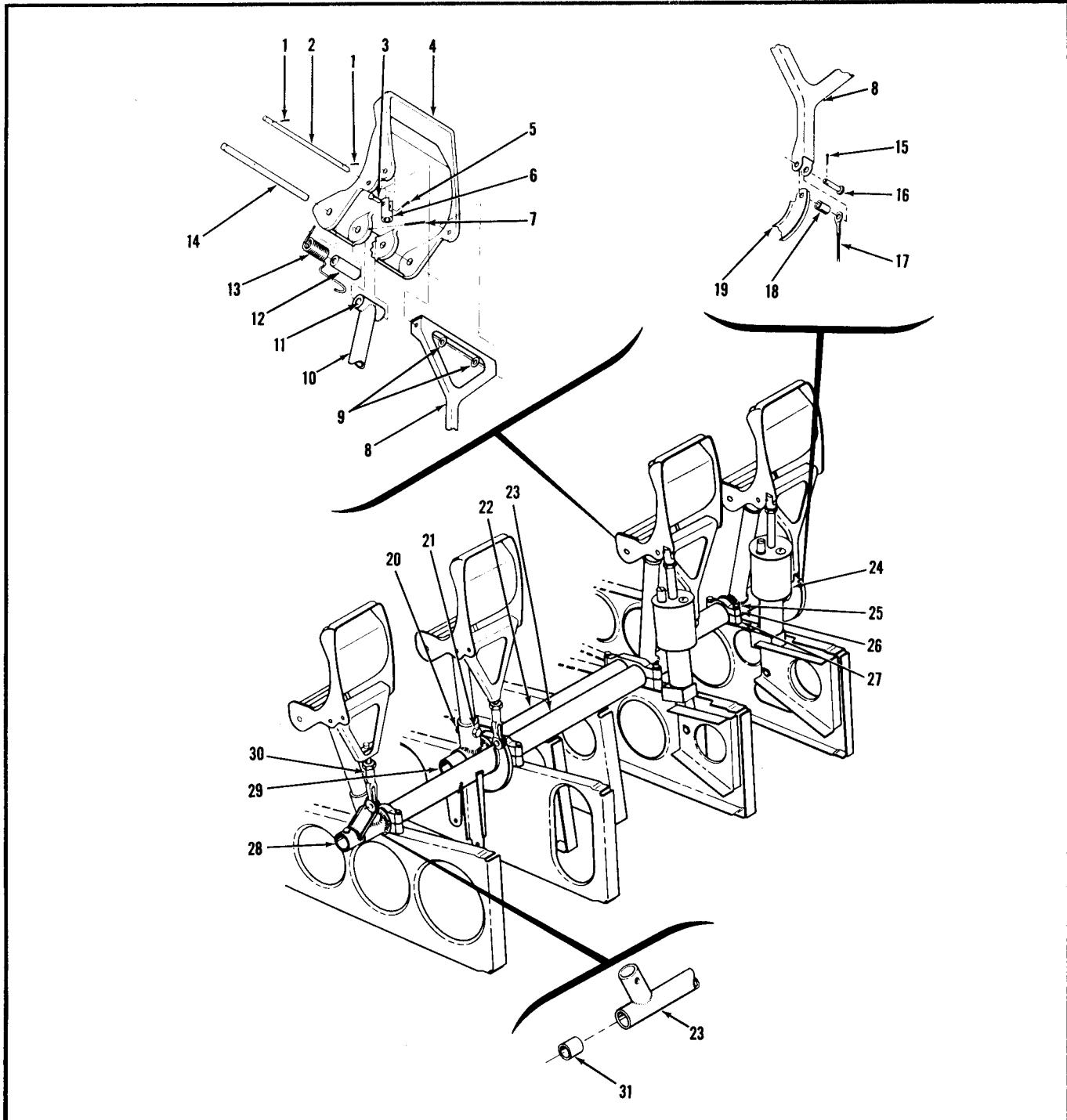
- m. Install access hole covers on cabin floor.

- n. Install front carpet and rudder bar shields in accordance with paragraph 2-204.

- o. Install front seats in accordance with paragraph 2-181.

2-109. RUDDER TRIM CONTROL SYSTEM.

- 2-110. The rudder trim control system is interconnected by chains, cables, sprockets, pulleys, miter gears, a torque tube, an actuator, and a 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.



- | | | |
|---------------------|--------------------------|------------------------------|
| 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 2-17. Rudder Pedal Assembly

2-111. TROUBLE SHOOTING RUDDER TRIM CONTROL SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE.	Cable tension too high.	Adjust tension in accordance with paragraph 2-117.
	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.
LOST MOTION BETWEEN TRIM CONTROL WHEEL AND TRIM TAB.	Cables not in place on pulleys during installation.	Install cables correctly.
	Cable tension too low.	Adjust tension in accordance with paragraph 2-117.
	Broken pulley.	Replace pulley.
	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.
TRIM INDICATOR FAILS TO INDICATE CORRECT TRIM POSITION.	Cables not in place on pulleys.	Install cables correctly. Check cables guards.
	Indicator incorrectly engaged with wheel track.	Engage in accordance with paragraph 2-117.
INCORRECT TRIM TAB TRAVEL.	Travel stop blocks loose or incorrectly adjusted.	Adjust stop blocks in accordance with paragraph 2-117.
CORRECT TRAVEL CAN-NOT BE OBTAINED BY ADJUSTING STOP BLOCKS.	Actuator screw incorrectly adjusted.	Adjust in accordance with paragraph 2-117.

2-112. REMOVAL OF RUDDER TRIM CONTROL CABLES AND CHAINS. (See figure 2-18.)

- Remove front seats in accordance with paragraph 2-179.
- Remove front carpet, rear carpet, and baggage compartment floor cover in accordance with paragraph 2-204.
- Remove rear curtain from baggage compartment.
- Remove access hole covers from floor as necessary to gain access to cables, pulleys, and attachment points.
- Remove right side panel from control pedestal in accordance with paragraph 2-147.

- Remove access hole cover from vertical fin adjacent to rudder trim tab actuator.
- Remove stabilizer fairings (6 and 8, figure 2-8).
- Unsafety turnbuckle (19) and disconnect aft cables (9 and 10) by removing turnbuckle, cotter pin (17), and pin (16).
- Remove aft pulleys (56) by removing nut (58), bolt (55), and cable guard cotter pins (57). Pull cables aft into tailcone.
- Remove chain guard (8) from rudder trim tab actuator (3) by removing nuts (13) and screws (7).
- Disengage chain (11) from sprocket (12), 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.

1. Remove stop blocks (21) by removing nuts (24), bolts (22), and bushings (23).
- m. Remove three sets of pulleys (52) from forward cables (18 and 20) by removing nuts (54), washers (53), and bolts (51).
- n. Disengage forward chain (44) from sprocket (43).

NOTE

Chain guards (39 and 40) are flexible enough to allow chain to be disengaged without removing chain guards.

- o. Remove forward cables (18 and 20) 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.

- p. Remove upper chain (31) by disconnecting master link.

NOTE

If, during removal or installation of chain, the indicator reaches its extreme travel, disengage from trim control wheel track by inserting a screwdriver beneath indicator and prying out of track. This permits indicator to be moved, or wheel to be turned, before indicator is re-engaged with track.

- q. 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 (28) and indicator (25) 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 (35) can be removed by removing upper roll pin (46) and lower roll pin (45).

NOTE

To gain access to lower roll pin (45), it may be necessary to remove the control pedestal, or to drill out the rivets which attach lower right side panel.

3. Sprocket (30) and sprocket shaft (34) can be removed by removing roll pin (46). Plate assembly (33) can be removed by removing nuts (47) and screws (48).

4. Miter gear assembly can be removed by removing the control pedestal and drilling out enough floor attaching rivets to allow the section of floor above the miter gear assembly to be lifted for access.

2-113. INSTALLATION OF RUDDER TRIM CONTROL CABLES AND CHAINS. (See figure 2-18.)

- a. Install upper chain (31) on sprockets (30 and 49)

and connect with master link.

- b. Tie ends of cables (18 and 20) to the guide wires, pull into position, and remove guide wires.
- c. Rotate rudder trim control wheel (28) to center indicator (25), and engage forward chain (44) with sprocket (43) so that the ends of the chain are equal in length from the sprocket.

d. Install three sets of pulleys (52) with bolts (51), washers (53), and nuts (54), insuring that cables are correctly in place as pulleys are installed.

- e. Tie aft chain (11) to the guide wire, pull into position in vertical fin, and remove guide wire.

f. Rotate actuator sprocket (3) so that rudder trim tab is in neutral, and engage chain (11) with sprocket (12) so that the ends of the chain are equal in length from the sprocket.

- g. Install chain guard (8) with screws (7) and nuts (13).

h. Install aft pulleys (56) with bolt (55), nut (58), and cable guard cotter pins (57).

- i. Connect aft left cable (10) to forward left cable (18) with pin (16) and cotter pin (17). Connect aft right cable (9) to forward right cable (20) with turnbuckle (19).

j. Install stop blocks (21) with bushings (23), bolts (22), and nuts (24), and rig rudder trim control system in accordance with paragraph 2-117.

- k. Install stabilizer fairings (6 and 8, figure 2-8).

l. Install access hole covers on vertical fin and cabin floor.

- m. Install rear curtain in baggage compartment.

n. Install right side panel on control pedestal in accordance with paragraph 2-150.

o. Install baggage compartment floor cover, rear carpet, and front carpet in accordance with paragraph 2-204.

p. Install front seats in accordance with paragraph 2-181.

2-114. REMOVAL OF RUDDER TRIM TAB ACTUATOR. (See figure 2-18.)

a. Remove access hole cover from vertical fin adjacent to rudder trim tab actuator (3).

b. Remove rear curtain from baggage compartment.

c. Unscrew turnbuckle (19) and disconnect aft cables (9 and 10) by removing turnbuckle, cotter pin (17) and pin (16).

d. Remove chain guard (8) by removing nuts (13) and screws (7).

e. Disengage chain (11) from sprocket (12) and tie chain to screw hole in vertical fin.

f. Disconnect rudder trim tab push-pull tube (59) from actuator screw (2) by removing nut (14), washer (15), and bolt (1).

g. Remove clamps (6) by removing bolts (4) and washers (5), and remove rudder trim tab actuator (3).

2-115. DISASSEMBLY OF RUDDER TRIM TAB ACTUATOR. The instructions for disassembly, over-haul, and assembly of the aileron trim tab actuator, given in paragraph 2-79, also apply to the rudder trim tab actuator.

2-116. INSTALLATION OF RUDDER TRIM TAB ACTUATOR. (See figure 2-18.)

- a. Insert rudder trim tab actuator (3) into position in vertical fin, and install clamps (6) with bolts (4)

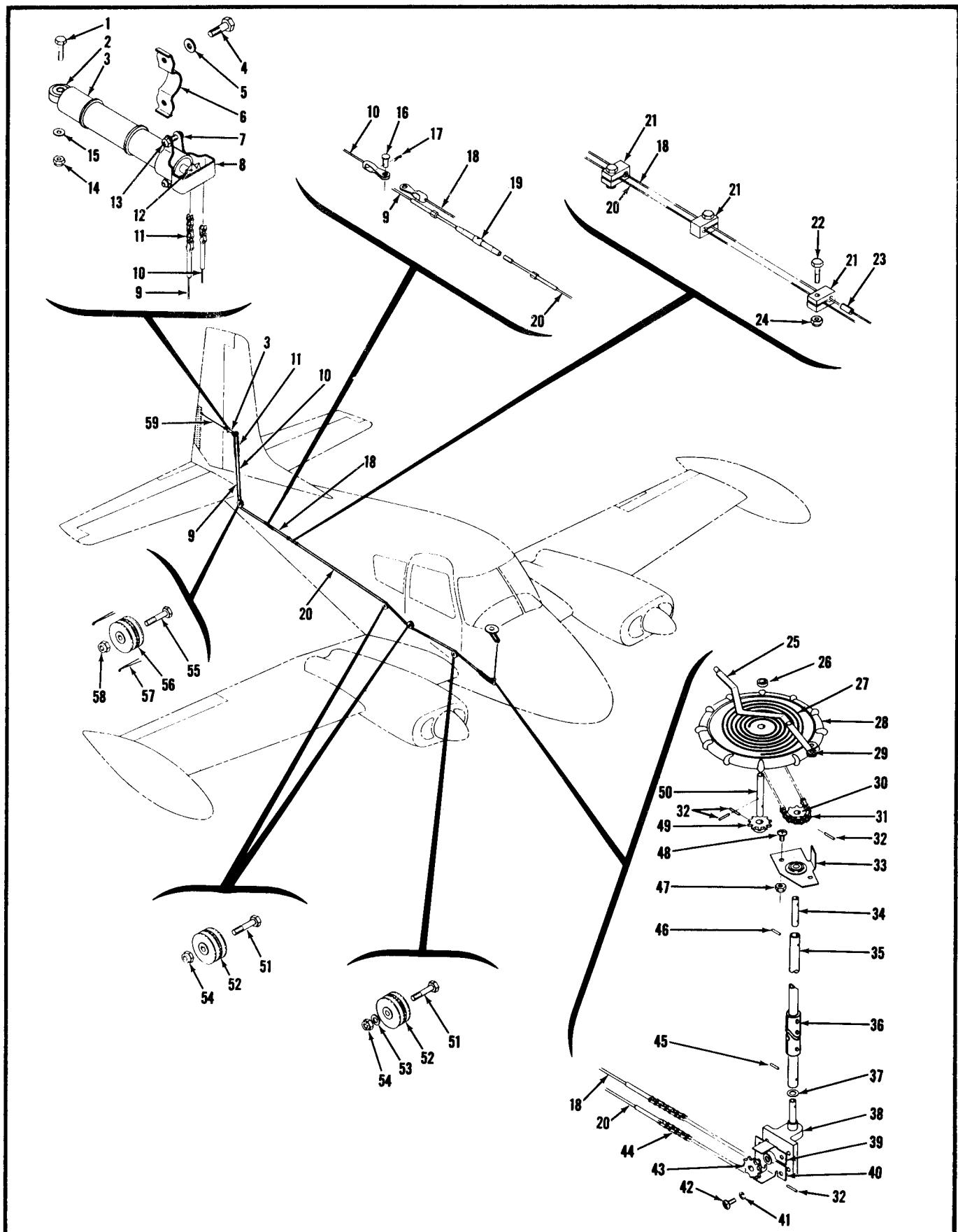


Figure 2-18. Rudder Trim Control System

Figure 2-18. Rudder Trim Control System Callouts

1. Bolt	20. Forward Right Rudder Trim Control Cable	39. Upper Chain Guard
2. Actuator Screw	21. Stop Block	40. Lower Chain Guard
3. Rudder Trim Tab Actuator	22. Bolt	41. Washer
4. Bolt	23. Bushing	42. Screw
5. Washer	24. Nut	43. Sprocket
6. Clamp	25. Aileron Trim Indicator	44. Forward Chain
7. Screw	26. Spacer	45. Roll Pin
8. Chain Guard	27. Aileron Trim Control Wheel Track	46. Roll Pin
9. Aft Right Rudder Trim Control Cable	28. Aileron Trim Control Wheel	47. Nut
10. Aft Left Rudder Trim Control Cable	29. Washer	48. Screw
11. Aft Chain	30. Sprocket	49. Sprocket
12. Sprocket	31. Upper Chain	50. Sprocket Shaft
13. Nut	32. Roll Pin	51. Bolt
14. Nut	33. Plate Assembly	52. Pulley
15. Washer	34. Sprocket Shaft	53. Washer
16. Pin	35. Torque Tube	54. Nut
17. Cotter Pin	36. Universal Joint	55. Bolt
18. Forward Left Rudder Trim Control Cable	37. Washer	56. Pulley
19. Turnbuckle	38. Support	57. Cable Guard Cotter Pin
		58. Nut
		59. Rudder Trim Tab Push-pull Tube

and washers (5).

- b. Attach rudder trim tab push-pull tube (59) to actuator screw (2) with bolt (1), washer(15), and nut (14).
- c. Rotate actuator sprocket (12) so that rudder trim tab is in neutral, and engage chain (11) with sprocket (12) so that the ends of the chain are equal in length from the sprocket.
- d. Install chain guard (8) with screws (7) and nuts (13).
- e. Connect aft left cable (10) to forward left cable (18) with pin (16) and cotter pin (17). Connect aft right cable (9) to forward right cable (20) with turnbuckle (19).
- f. Rig rudder trim control system in accordance with paragraph 2-117.
- g. Install rear curtain in baggage compartment.
- h. Install access hole cover on vertical fin.

2-117. RIGGING OF RUDDER TRIM CONTROL SYSTEM. (See figure 2-18.)

- a. Remove front seats in accordance with paragraph 2-179.
- b. Remove front carpet in accordance with paragraph 2-204.
- c. Remove access hole covers from cabin floor above forward chain (44).
- d. Remove the rear curtain from baggage compartment.
- e. Remove access hole cover from vertical fin adjacent to rudder trim tab actuator.
- f. Remove safety wire from turnbuckle (19) connecting rudder trim control cables, adjust to 10 ± 3 pounds tension, and resafety turnbuckle.
- g. Move rudder trim control system to neutral by rotating trim control wheel so that the ends of chain (11) are equal in length from actuator sprocket (12), and the ends of chain (44) are equal in length from sprocket (43).
- h. Adjust rudder trim indicator (25) to the neutral position by inserting a screwdriver beneath indicator and prying out of track in trim control wheel, moving

the indicator to neutral, and re-engaging with the track.

- i. Remove nut, washer, and bolt (8, 7, and 5, figure 2-7) attaching push-pull tube to rudder trim tab.
- j. Place rudder and rudder trim tab in neutral. Adjust actuator screw (2) so that the aft hole in push-pull tube is aligned with hole in trim tab horn, attach with bolt, washer, and nut (5, 7, and 8, figure 2-7).
- k. Loosen stop blocks (21) and move rudder trim tab to (20° right on serial 35000 thru 39031) and (17° right on serial 39032 and on - measured along water line). Locate aft stop block adjacent to cable (20) terminal and tighten. Slide center stop block against aft stop block and tighten.
- l. Move rudder trim tab to (26° left on serial 35000 thru 39031) and (22° left on serial 39032 and on - measured along water line). Slide forward stop block against center stop block and tighten.
- m. Tolerance for rudder trim tab travel is plus one degree and minus zero degrees.

WARNING

Insure that rudder trim tab moves in proper direction when operated by trim control wheel.

- n. Install access hole covers on vertical fin and cabin floor.
- o. Install rear curtain in baggage compartment.
- p. Install front carpet in accordance with paragraph 2-204.
- q. Install front seats in accordance with paragraph 2-181.

2-118. ELEVATOR CONTROL SYSTEM.

- 2-119. 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.

2-120. TROUBLE SHOOTING ELEVATOR CONTROL SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOST MOTION BETWEEN CONTROL WHEEL AND ELEVATORS.	Cable tension too low.	Adjust cable tension in accordance with paragraph 2-131.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Excessive end play in control wheel sprocket shaft.	Tighten sprocket shaft nut. Refer to paragraph 2-60, step "f."
RESISTANCE TO ELEVATOR CONTROL MOVEMENT.	Cable tension too high.	Adjust cable tension in accordance with paragraph 2-131.
	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 figure 1-6, sheet 7.
	Binding control column pivot bearings.	Lubricate in accordance with figure 1-6, sheet 7.
INCORRECT ELEVATOR TRAVEL.	Beat elevator or hinge.	Repair or replace elevator or hinge.
	Elevator bellcrank stops incorrectly adjusted.	Adjust in accordance with paragraph 2-131.
	Elevator cables incorrectly rigged.	Rig cables in accordance with paragraph 2-131.
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 tube in accordance with paragraph 2-131.
	Incorrect positioning of forward elevator bellcrank.	Rig elevator cables in accordance with paragraph 2-131.

2-121. REMOVAL OF ELEVATOR CONTROL CABLES. (See figure 2-19.)

- a. Remove front and rear seats in accordance with paragraphs 2-179 and 2-182.
- b. Remove front carpet, rear carpet, and baggage compartment floor cover in accordance with paragraph 2-204.
- c. Remove rear curtain from baggage compartment.
- d. Remove access hole covers from floor as necessary to gain access to cables, pulleys, and attachment points.
- e. Unsafety turnbuckles (44) and disconnect elevator cables (21 and 28) from forward elevator bellcrank (54) by removing turnbuckles.
- f. Remove four pulleys (58) by removing nuts (57), bolts (59), and cable guards (60).
- g. Remove fairleads through which elevator cables pass at fuselage rear spar.
- h. Disconnect elevator cables (21 and 28) from aft

elevator bellcrank (32) by removing cotter pins (26), nuts (27), washers (29), and bolts (30).

- i. Tie guide wires to forward ends of elevator cables (21 and 28), remove cables by pulling them out aft of baggage compartment, and disconnect guide wires.

2-122. INSTALLATION OF ELEVATOR CONTROL CABLES. (See figure 2-19.)

- a. Tie elevator cables (21 and 28) 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 (58) with bolts (59), cable guards (60), and nuts (57), insuring that cables are correctly in place as pulleys are installed.
- d. Attach elevator cables (21 and 28) to aft elevator bellcrank (32) with bolts (30), washers (29), nuts (27), and cotter pins (26).
- e. Connect elevator cables (21 and 28) to forward

- elevator bellcrank (54) with turnbuckles (44), and rig elevator system in accordance with paragraph 2-131.
- f. Install access hole covers on floor.
 - g. Install rear curtain in baggage compartment.
 - h. Install front carpet, rear carpet, and baggage compartment floor cover in accordance with paragraph 2-204.
 - i. Install front and rear seats in accordance with paragraphs 2-181 and 2-184.

2-123. REMOVAL OF AFT ELEVATOR BELLCRANK. (See figure 2-19.)

- a. Remove rear curtain from baggage compartment.
- b. Remove front seats in accordance with paragraph 2-179.
- c. Remove front carpet in accordance with paragraph 2-204.
- d. Remove access hole covers from cabin floor above forward elevator bellcrank (54).
- e. Unsafety and loosen either turnbuckle (44) to release tension on elevator cables.
- f. Disconnect elevator cables (21 and 28) from aft elevator bellcrank (32) by removing cotter pins (26), nuts (27), and bolts (30).

NOTE

If an automatic pilot (optional equipment) is installed, disconnect from aft elevator bellcrank.

- g. Disconnect aft elevator push-pull tube (2) from elevator bellcrank (32) by removing nut (37) and bolt (38).
- h. Release tension on elevator down spring cables (20 and 36) by either disconnecting elevator down spring (6) or blocking elevator down spring channel assembly (15) forward.
- i. Disconnect elevator down spring cables (20 and 36) from elevator bellcrank (32) by removing cotter pin (22), nut (23), washers (24), spacer (25), and bolt (33).
- j. Remove aft elevator bellcrank (32) by removing nut (9), spacers (34 and 35), and bolt (41).

2-124. INSTALLATION OF AFT ELEVATOR BELLCRANK. (See figure 2-19.)

- a. Place aft elevator bellcrank (32) in position, and install with bolt (41), spacers (34 and 35), and nut (9).
- b. Connect elevator down spring cables (20 and 36) to elevator bellcrank (32) with bolt (33), spacer (25), washers (24), nuts (23), and cotter pin (22).
- c. Connect elevator down spring (6) or remove block aft of elevator down spring channel assembly (15) in accordance with the method used to release tension on elevator down spring cables.
- d. Attach aft elevator push-pull tube (2) to elevator bellcrank (32) with bolt (38) and nut (37).
- e. Attach elevator cables (21 and 28) to elevator bellcrank (32) with bolts (30), nuts (27), and cotter pins (26).

NOTE

If an automatic pilot (optional equipment) is installed, connect to aft elevator bellcrank.

- f. Rig elevator control system in accordance with

paragraph 2-131.

- g. Install access hole covers on cabin floor.
- h. Install front carpet in accordance with paragraph 2-204.
- i. Install front seats in accordance with paragraph 2-181.
- j. Install rear curtain in baggage compartment.

2-125. REMOVAL AND INSTALLATION OF ELEVATOR PYLON. (See figure 2-9.)

- a. Remove stinger in accordance with paragraph 2-233.
- b. Disconnect aft elevator push-pull tube (28) by removing nut (27) and bolt (29).
- c. Remove three nuts (23), washers (22), and bolts (20) attaching elevators to elevator pylon (21). Remove nut (24), washer (25), and bolt (26) attaching elevator pylon (21) to hinge bracket, and remove by sliding aft.
- d. To install elevator pylon, reverse the above procedure.

2-126. REMOVAL AND INSTALLATION OF ELEVATOR DOWN SPRING AND CHANNEL ASSEMBLY. (See figure 2-19.)

- a. Remove rear curtain from baggage compartment.
- b. Remove stabilizer fairings (6 and 8, figure 2-8).
- c. Stretch elevator down spring (6) aft and unhook from eyebolt (4).
- d. Remove elevator down spring (6) from elevator down spring channel assembly by removing cotter pin (13), nut (14), washers (10), spacers (11), and bolt (12).
- e. Disconnect elevator down spring cables (20 and 36) by removing cotter pin (16), nut (17), spacer (19), and bolt (39).
- f. Remove elevator down spring channel assembly (15) by removing nut (7), spacer (18) and bolt (43).
- g. To install elevator down spring and channel assembly, reverse the above procedure.

2-127. REMOVAL AND INSTALLATION OF AFT ELEVATOR PUSH-PULL TUBE. (See figure 2-19.)

- a. Remove rear curtain from baggage compartment.
- b. Remove stinger in accordance with paragraph 2-233.
- c. Remove nut (37) and bolt (38) attaching push-pull tube (2) to aft elevator bellcrank (32).
- d. Remove nut (3) and bolt (1) attaching push-pull tube (2) to elevator pylon and remove push-pull tube by pulling aft.
- e. To install aft elevator push-pull tube, reverse the above procedure.

2-128. REMOVAL OF FORWARD ELEVATOR BELLCRANK. (See figure 2-19.)

- a. Remove front seats in accordance with paragraph 2-179.
- b. Remove front carpet in accordance with paragraph 2-204.
- c. Remove access hole covers from cabin floor above forward elevator bellcrank (54).
- d. Unsafety and loosen either turnbuckle (44) to release tension on elevator cables (21 and 28).
- e. Disconnect elevator cables (21 and 28) from forward elevator bellcrank (54) by removing cotter pins (51), nuts (52), and bolts (53).

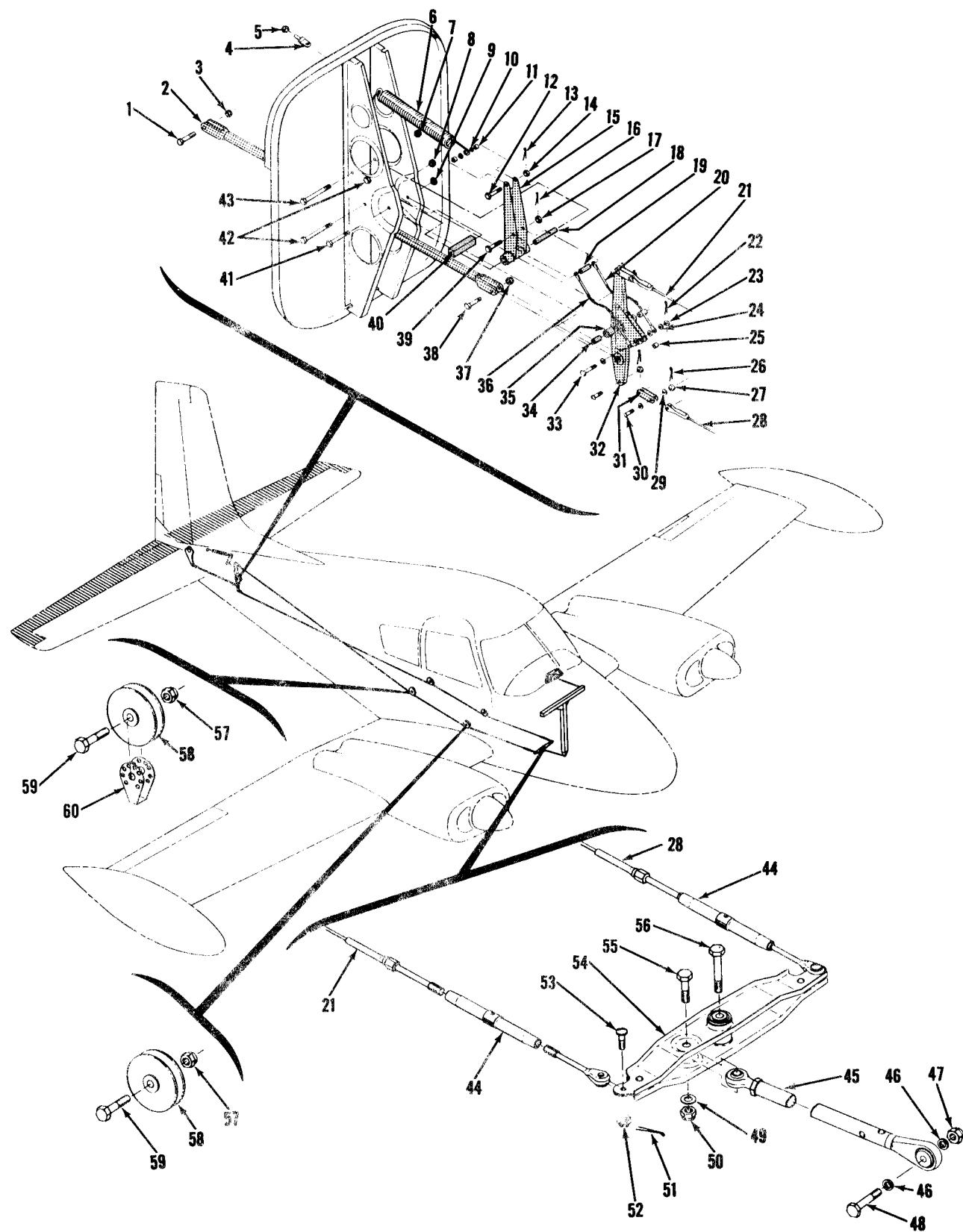


Figure 2-19. Elevator Control System

Figure 2-19. Elevator Control System Callouts

1. Bolt	21. Right Elevator Control Cable	41. Bolt
2. Aft Elevator Push-pull Tube	22. Cotter Pin	42. Bolt
3. Nut	23. Nut	43. Bolt
4. Eyebolt	24. Washer	44. Turnbuckle
5. Nut	25. Spacer	45. Forward Elevator Push-pull
6. Elevator Down Spring	26. Cotter Pin	Tube
7. Nut	27. Nut	46. Spacer
8. Nut	28. Left Elevator Control Cable	47. Nut
9. Nut	29. Washer	48. Bolt
10. Washer	30. Bolt	49. Washer
11. Spacer	31. Link	50. Nut
12. Bolt	32. Aft Elevator Bellcrank	51. Cotter Pin
13. Cotter Pin	33. Bolt	52. Nut
14. Nut	34. Spacer	53. Bolt
15. Elevator Down Spring Channel Assembly	35. Spacer	54. Forward Elevator Bellcrank
16. Cotter Pin	36. Elevator Down Spring Cable	55. Bolt
17. Nut	37. Nut	56. Bolt
18. Spacer	38. Bolt	57. Nut
19. Spacer	39. Bolt	58. Pulley
20. Elevator Down Spring Cable	40. Elevator Bellcrank Stop	59. Bolt
		60. Cable Guard

- f. Disconnect forward elevator push-pull tube (45) from elevator bellcrank (54) by removing nut (50), washer (49), and bolt (55).
- g. Remove elevator bellcrank (54) by removing bolt (56).

2-129. INSTALLATION OF FORWARD ELEVATOR BELLCRANK. (See figure 2-19.)

- a. Place forward elevator bellcrank (54) in position, and install with bolt (56).
- b. Attach forward elevator push-pull tube (45) to elevator bellcrank (54) with bolt (55), washer (49), and nut (50).
- c. Attach elevator cables (21 and 28) to elevator bellcrank (54) with bolts (53), nuts (52), and cotter pins (51).
- d. Rig elevator control system in accordance with paragraph 2-131.
- e. Install access hole covers on cabin floor.
- f. Install front carpet in accordance with paragraph 2-204.
- g. Install front seats in accordance with paragraph 2-181.

2-130. REMOVAL AND INSTALLATION OF FORWARD ELEVATOR PUSH-PULL TUBE. (See figure 2-19.)

- a. Remove front seats in accordance with paragraph 2-179.
- b. Remove front carpet in accordance with paragraph 2-204.
- c. Remove access hole covers from cabin floor above forward elevator bellcrank (54) and from underside of fuselage aft of nose wheel well.
- d. Disconnect forward elevator push-pull tube (45) from elevator bellcrank (54) by removing nut (50), washer (49), and bolt (55).
- e. Disconnect forward elevator push-pull tube (45) from control column by removing nut (47), spacers (46), and bolt (48).
- f. To install forward elevator push-pull tube (45), reverse the above procedure.

NOTE

If length of forward elevator push-pull tube (45) has been changed or a new push-pull tube is being installed, adjust length in accordance with paragraph 2-131.

2-131. RIGGING OF ELEVATOR CONTROL SYSTEM. (See figure 2-19.)

- a. Remove front seats in accordance with paragraph 2-179.
- b. Remove front carpet in accordance with paragraph 2-204.
- c. Remove access hole covers from cabin floor above forward elevator bellcrank (54).
- d. Remove rear curtain from baggage compartment.
- e. Adjust elevator bellcrank stops (40) so that elevator travel is 25 degrees up and 15 degrees down. Travel tolerance is plus one and minus zero degrees.

CAUTION

Do not operate elevator from the elevator tips as damage to the elevator may result.

NOTE

The holes through the elevator bellcrank stops (40) are drilled off-center to provide a means of adjusting elevator travel. Elevator travel is changed by each 90-degree rotation of the elevator bellcrank stops.

- f. Unsafety turnbuckles (44) and adjust so that tension on elevator cables (21 and 28) is 32 ± 5 pounds, insuring that forward elevator bellcrank (54) does not contact the bulkhead located just forward of the bellcrank. When elevators are in either extreme position, the bellcrank should clear the bulkhead by approximately 1/4 inch.
- g. Resafety turnbuckles (44).

WARNING

Insure that elevator moves in the proper direction when operated by the control wheel.

- h. Adjust length of forward elevator push-pull tube (45) 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 (45) should be approximately 12 inches, measured between the centerlines of the rod end bolt holes.

2-134. TROUBLE SHOOTING ELEVATOR TRIM CONTROL SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
TRIM CONTROL WHEEL MOVES WITH EXCESSIVE RESISTANCE.	Cable tension too high.	Adjust tension in accordance with paragraph 2-142.
	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 paragraph 2-142.
	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 paragraph 2-142.
INCORRECT TRIM TAB TRAVEL.	Stop blocks loose or incorrectly adjusted.	Adjust stop blocks in accordance with paragraph 2-142.
CORRECT TRAVEL CANNOT BE OBTAINED BY ADJUSTING STOP BLOCKS.	Actuator screw incorrectly adjusted.	Adjust in accordance with paragraph 2-142.

2-135. REMOVAL OF ELEVATOR TRIM CONTROL CABLES AND CHAINS. (See figure 2-20.)

- a. Remove front and rear seats in accordance with paragraphs 2-179 and 2-182..
 b. Remove front carpet, rear carpet, and baggage compartment floor cover in accordance with paragraph 2-204.
 c. Remove rear curtain from baggage compartment.
 d. Remove access hole covers from floor as necessary to gain access to cables, pulleys, and attachment points.

- i. Install rear curtain in baggage compartment.
- j. Install access hole covers on cabin floor.
- k. Install front carpet in accordance with paragraph 2-204.
- l. Install front seats in accordance with paragraph 2-181.

2-132. ELEVATOR TRIM CONTROL SYSTEM.

2-133. 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.

- e. Remove access hole covers from underside of fuselage aft of nosewheel well and underside of stabilizer beneath elevator trim tab actuator.
- f. Remove stabilizer fairings (6 and 8, figure 2-8).
- g. Remove stinger in accordance with paragraph 2-233.
- h. Unsafety turnbuckle (22) and disconnect aft cables (17 and 18) by removing turnbuckle, cotter pin (20), and pin (19).
- i. Remove aft pulleys (14 and 16) by removing nuts (15), bolts (12), and cable guard cotter pins (13).

- j. Remove chain guard from elevator trim tab actuator (7) by removing nuts (5) and screws (6).
- k. Disengage chain (1) from sprocket (2), 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.
- l. Remove stop blocks (48) by removing nuts (47), bolts (49), and bushings (46).
- m. Remove three sets of pulleys (43) as illustrated in figure 2-20.
- n. Remove elevator trim control wheel (30) by removing four screws (33) and washers (32).
- o. Remove upper left side panel from control pedestal.
- p. Remove four cable guard pins (36).
- q. Tie guide wires to aft ends of cables (21 and 23) and pull chain and cables out through control pedestal. Disconnect guide wires and leave in position to facilitate installation.

NOTE

Pulleys (41) are difficult to reinstall and should be removed only for replacement.

2-136. INSTALLATION OF ELEVATOR TRIM CONTROL CABLES AND CHAINS. (See figure 2-20.)

- a. Tie aft ends of cables (21 and 23) to guide wires, pull into position, and remove guide wires.
- b. Engage chain (34) with sprocket (29) and install upper left side panel on control pedestal.
- c. Install four cable guard pins (36).
- d. Install three sets of pulleys (43) as illustrated in figure 2-20.
- e. Tie aft chain (1) to the guide wire, pull into position, and remove guide wire.
- f. Engage aft chain (1) with actuator sprocket (2) and install chain guard with screws (6) and nuts (5).
- g. Install aft pulleys (14 and 16) with bolts (12), nuts (15), and cable guard cotter pins (13), insuring that cables are correctly in place.
- h. Connect forward left cable (21) to aft left cable (17) with pin (19) and cotter pin (20), and forward right cable (23) to aft right cable (18) with turnbuckle (22).
- i. Install stop blocks (48) and bushings (46) with bolts (49) and nuts (47). Do not tighten at this time.
- j. Install elevator trim control wheel (30) with washers (32) and screws (33), and rig elevator trim control system in accordance with paragraph 2-142.
- k. Install stinger in accordance with paragraph 2-235.
- l. Install stabilizer fairings (6 and 8, figure 2-8).
- m. Install access hole covers on cabin floor, underside of stabilizer and underside of fuselage aft of nose wheel well.
- n. Install rear curtain in baggage compartment.
- o. Install front carpet, rear carpet, and baggage compartment floor cover in accordance with paragraph 2-204.
- p. Install front and rear seats in accordance with paragraphs 2-181 and 2-184.

2-137. REMOVAL OF ELEVATOR TRIM TAB ACTUATOR. (See figure 2-20.)

- a. Remove rear curtain from baggage compartment.

- b. Remove access hole cover from underside of horizontal stabilizer beneath elevator trim tab actuator.
- c. Unsafety and loosen turnbuckle (22) to release tension on elevator trim control cables.
- d. Remove chain guard from elevator trim tab actuator (7) by removing nuts (5) and screws (6), and disengage chain from sprocket (2).
- e. Remove right elevator in accordance with paragraph 2-44.
- f. Remove elevator trim tab push-pull tube from elevator trim tab actuator screw (10) by removing nut (8), washer (9), and bolt (11).
- g. Remove clamps (4) by removing bolts (3), and remove elevator trim tab actuator.

2-138. DISASSEMBLY OF ELEVATOR TRIM TAB ACTUATOR. (See figure 2-20.) The instructions for disassembly, overhaul, and reassembly of the aileron trim tab actuator, given in paragraph 2-79, also apply to the elevator trim tab actuator.

2-139. INSTALLATION OF ELEVATOR TRIM TAB ACTUATOR. (See figure 2-20.)

- a. Insert elevator trim tab actuator through access hole, place in position, and install clamps (4) with bolts (3).
- b. Attach elevator trim tab push-pull tube to elevator trim tab actuator screw (10) with bolt (11), washer (9), and nut (8).
- c. Install right elevator in accordance with paragraph 2-45.
- d. Engage chain (1) with sprocket (2), and install chain guard with screws (6) and nuts (5).
- e. Rig elevator trim control system in accordance with paragraph 2-142.
- f. Install access hole cover on underside of horizontal stabilizer.
- g. Install rear curtain in baggage compartment.

2-140. REMOVAL OF ELEVATOR TRIM CONTROL WHEEL, SPROCKET, AND INDICATOR ASSEMBLY. (See figure 2-20.)

- a. Remove rear curtain from baggage compartment.
- b. Unsafety and loosen turnbuckle (22) to release tension on elevator trim control system.
- c. Remove elevator trim control wheel (30) by removing four screws (33) and washers (32).
- d. Remove upper left side panel from control pedestal.

NOTE

Elevator trim indicator assembly is riveted to the side panel. To remove, the rivet around which the indicator pivots must be removed.

- e. Disengage chain (34) from sprocket (29), remove upper right side panel from control pedestal, and remove sprocket (29) by removing cotter pin (25), nut (24), washer (27), spacer (28), and bolt (26).

2-141. INSTALLATION OF ELEVATOR TRIM CONTROL WHEEL, SPROCKET, AND INDICATOR ASSEMBLY. (See figure 2-20.)

- a. Install sprocket (29) with bolt (26), spacer (28), washer (27), nut (24), and cotter pin (25).
- b. Install upper right side panel on control pedestal.

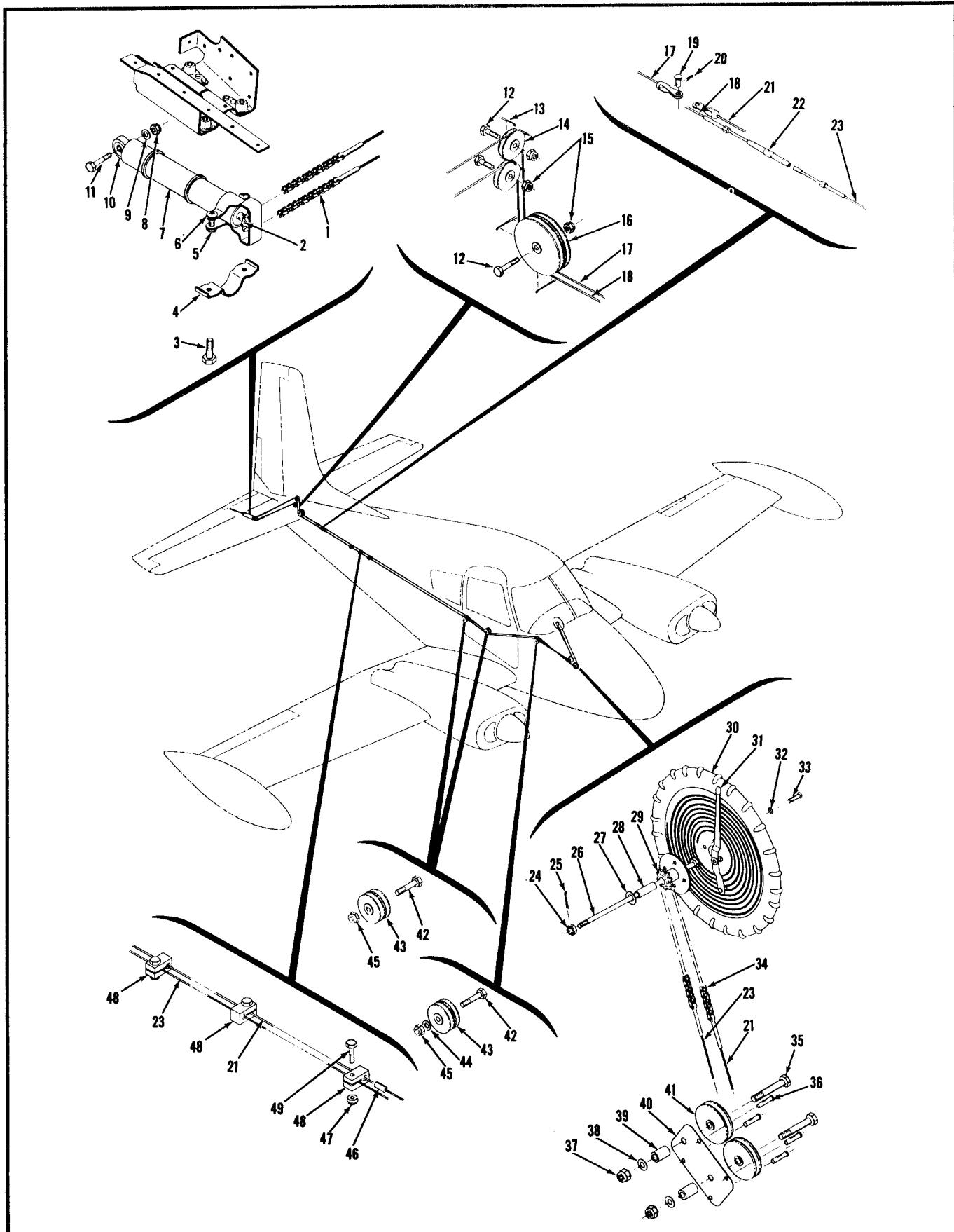


Figure 2-20. Elevator Trim Control System

Figure 2-20. Elevator Trim Control System Callouts

1. Aft Chain	18. Aft Right Elevator Trim Control Cable	32. Washer
2. Actuator Sprocket	19. Pin	33. Screw
3. Bolt	20. Cotter Pin	34. Forward Chain
4. Clamp	21. Forward Left Elevator Trim Control Cable	35. Bolt
5. Nut	22. Turnbuckle	36. Cable Guard Pin
6. Screw	23. Forward Right Elevator Trim Control Cable	37. Nut
7. Elevator Trim Tab Actuator	24. Nut	38. Washer
8. Nut	25. Cotter Pin	39. Spacer
9. Washer	26. Bolt	40. Cable Guard Bracket
10. Actuator Screw	27. Washer	41. Pulley
11. Bolt	28. Spacer	42. Bolt
12. Bolt	29. Sprocket	43. Pulley
13. Cable Guard Cotter Pin	30. Elevator Trim Control Wheel	44. Washer
14. Pulley	31. Elevator Trim Indicator	45. Nut
15. Nut		46. Bushing
16. Pulley		47. Nut
17. Aft Left Elevator Trim Control Cable		48. Stop Block
		49. Bolt

- c. Engage chain (34) with sprocket (29) and install upper left side panel on control pedestal.
- d. Rig elevator trim control system in accordance with paragraph 2-142, and install elevator trim control wheel (30) with four washers (32) and screws (33).
- e. Install rear curtain in baggage compartment.

2-142. RIGGING OF ELEVATOR TRIM CONTROL SYSTEM. (See figure 2-20.)

- a. Remove rear curtain from baggage compartment.
- b. Loosen stop blocks (48) by loosening nuts (47).
- c. Unsafety turnbuckle (22), adjust so that tension on 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 16 ± 3 pounds.

- d. Disconnect elevator trim tab push-pull tube from elevator trim tab horn (11, figure 2-9) by removing attaching nut, washer, and bolt.
- e. Rotate elevator trim control wheel (30) forward (nose down) until aft chain (1) and forward chain (34) have approximately two links clearing sprockets.

NOTE

If elevator trim indicator (31) reaches its extreme travel during rigging, it can be relocated by removing elevator trim control wheel, moving the indicator, and reinstalling wheel.

- f. With chains in the above position and elevators in neutral, adjust actuator screw (10) by rotating push-pull tube so that aft bolt hole in push-pull tube aligns with bolt hole in trim tab horn, when elevator trim tab is approximately 20 degrees up. Connect push-pull tube to elevator trim tab horn (11, figure 2-9) with attaching bolt, washer, and nut.

NOTE

The threaded end of bolt (11) attaching elevator

trim tab push-pull tube to actuator screw (10) must be inboard; therefore, exact travel adjustment is not made by this means.

- g. Rotate elevator trim control wheel (30) so that elevator trim tab is (20° up on serial 35000 thru 35771) and (10° up on serial 35772 and on), locate aft stop block (48) adjacent to cable (23) terminal, and tighten. Slide center stop block against aft stop block and tighten.

NOTE

If an automatic pilot (optional equipment) is installed, locate aft stop block approximately eight inches forward of cable (23) terminal.

- h. Rotate elevator trim control wheel (30) so that elevator trim tab is ($28^\circ +1^\circ -0^\circ$ down on serial 35000 thru 35771) and ($26^\circ +1^\circ -0^\circ$ down on serial 35772 and on). Slide forward stop block against center stop block and tighten.

- i. When the elevator trim control system is in either extreme position, the elevator trim indicator (31) 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 (30) so that elevator trim control system is in the extreme NOSE DOWN position.
2. Remove elevator trim control wheel (30) by removing four screws (33) and washers (32), and place elevator trim indicator (31) at the NOSE DOWN position on the decal.
3. While elevator trim indicator is in this position, install elevator trim control wheel (30), with four washers (32) and screws (33).

NOTE

Elevator trim control wheel (30) 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.

- j. Install rear curtain in baggage compartment.

2-143. FUSELAGE.

2-144. The fuselage is an all-metal assembly of semimonocoque construction. Fuselage front and rear spars support the wings of the aircraft. Four plastic windows and a one-piece plastic windshield, which is supported by a center metal stiffener, are provided in the cabin area. A pilot's storm window, which opens out and down and has a latch at the top, is located in the lower section of the left front window. The left rear window is provided as an emergency exit in that the window is jettisonable when the emergency release is pulled. The fuselage has one cabin door located on the right side, to provide entrance and exit from the cabin. The baggage compartment is located just aft of the rear seat. A baggage compartment door is located just aft of the wing on the right side of the fuselage. The recessed nose wheel well, located in the underneath side of the nose section, completely encloses the nose gear in its retracted position.

2-145. CONTROL PEDESTAL.

2-146. 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, induction air controls, 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.

2-147. REMOVAL OF CONTROL PEDESTAL. (See figure 2-21.)

- a. Remove the teleflex control conduit cover from immediately forward of the fuel selector support pan. Loosen the carpet and insulation adjacent to the control pedestal.
- b. Remove elevator trim control wheel (4), by removing four screws (2) and washers (3).
- c. Remove cover plate (13) and side panels (29 and 32), from both sides of control pedestal by removing attaching screws.
1. Remove map light rheostat from left center side panel and detach clamp which fastens the rheostat wires to the control pedestal.
- d. Remove elevator trim control sprocket (5) in accordance with paragraph 2-140.
- e. Disconnect rudder trim control torque tube (57) by removing roll pin (58).
- f. Disconnect upper aileron trim control chain (38) at master link.
- g. Remove teleflex control cables in accordance with paragraph 4-150.
- h. Disconnect all teleflex control conduits (21) by loosening the conduit coupling nuts.
- i. Remove two screws (26) fastening upper part of control pedestal to stationary instrument panel (27).
- j. Remove ten screws (33) which fasten control pedestal to floor.
- k. Carefully lift control pedestal upward to disengage the rudder trim control torque tube (57) from torque tube shaft (56). Tilt the control pedestal aft, work it free of all units, and remove from the cabin.

2-148. DISASSEMBLY OF CONTROL PEDESTAL. (See figure 2-21.) 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 procedures should be used. For disassembly of removed components refer to the appropriate paragraph in this manual.

- a. Remove control quadrant (12) and linkage in accordance with paragraph 4-155.
- b. Remove teleflex control swivel connectors (22)

Figure 2-21. Control Pedestal Installation Callouts

1. Elevator Trim Indicator	21. Teleflex Control Conduit	40. Coupling Nut
2. Screw	22. Swivel Connector	41. Teleflex Cable
3. Washer	23. Pin	42. Teleflex Push-pull Unit
4. Elevator Trim Control Wheel	24. Cotter Pin	43. Nut
5. Sprocket	25. Control Links	44. Washer
6. Chain	26. Screw	45. Nut
7. Bearing	27. Stationary Instrument Panel	46. Roll Pin
8. Washer	28. Control Pedestal	47. Alternate Air Control Knob
9. Bolt	29. Upper Side Panel	48. Rudder Trim Indicator
10. Nut	30. Friction Knob	49. Rudder Trim Control Wheel
11. Cotter Pin	31. Screw	50. Chain
12. Control Quadrant	32. Center Side Panel	51. Sprocket
13. Cover Plate	33. Screw	52. Screw
14. Screw	34. Aileron Trim Indicator	53. Roll Pin
15. Nut	35. Aileron Trim Control Wheel	54. Bearing Plate
16. Spacer	36. Sprocket	55. Nut
17. Washer	37. Bearing	56. Torque Tube Shaft
18. Bolt	38. Upper Chain	57. Torque Tube
19. Bellcrank	39. Mounting Bracket	58. Roll Pin
20. Teleflex Push-pull Unit		59. Sprocket

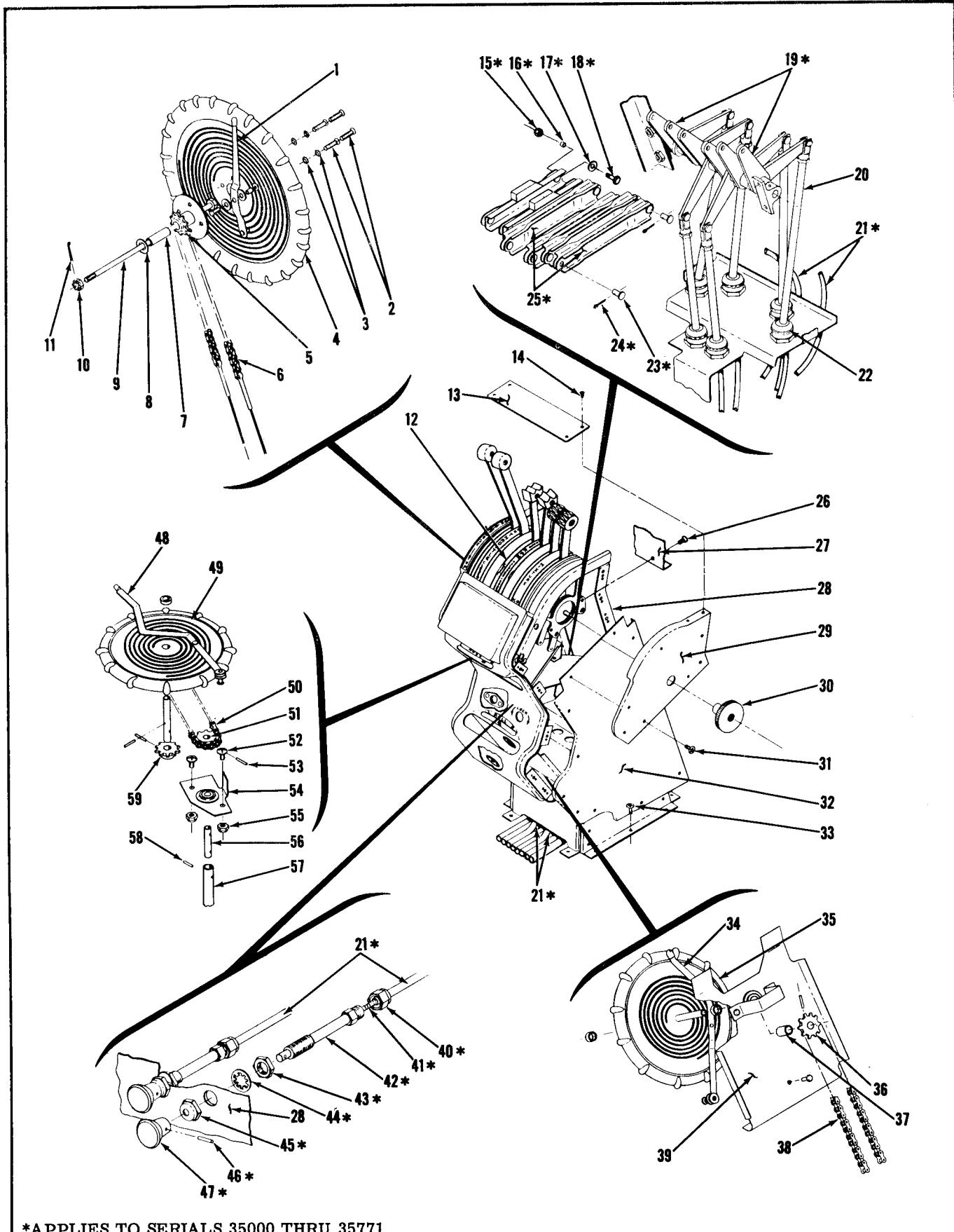
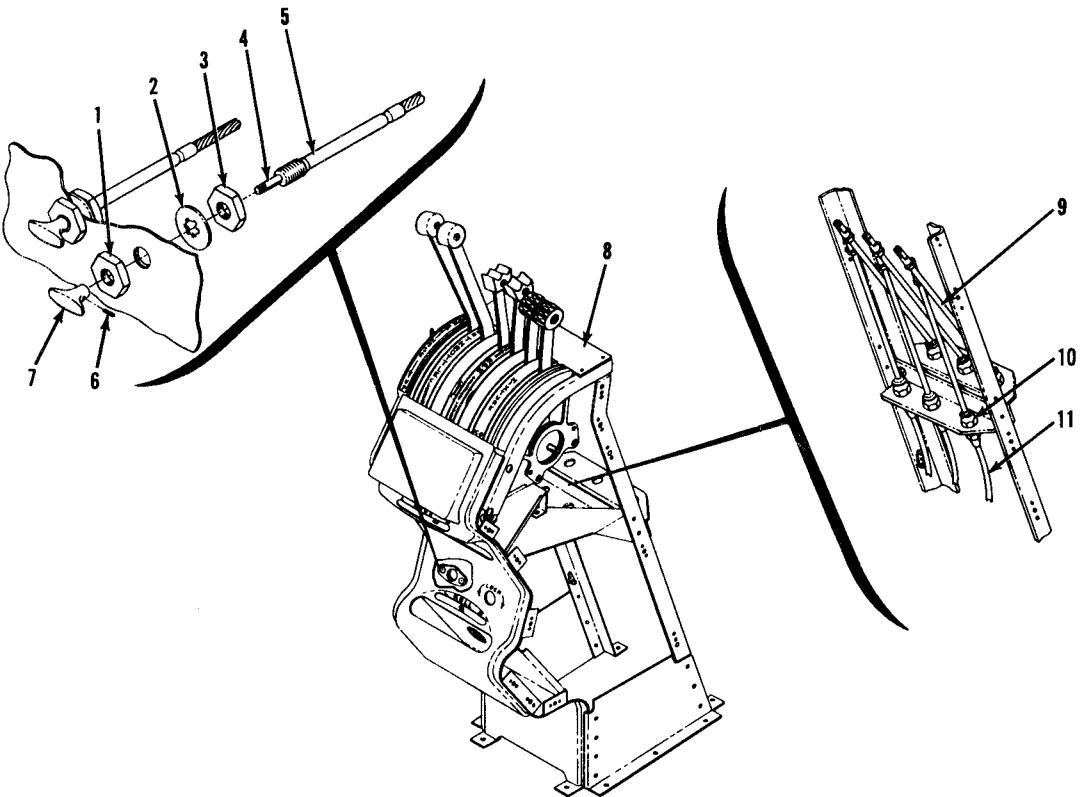


Figure 2-21. Control Pedestal Installation



- 1. Nut
- 2. Washer
- 3. Nut
- 4. Control Wire
- 5. Control Wire Housing

- 6. Roll Pin
- 7. Induction Air Control Knob
- 8. Control Pedestal
- 9. Teleflex Push-pull Unit
- 10. Swivel

11. Teleflex Control Conduit

Figure 2-21A. Control Pedestal Installation (Serial 35772 & on)

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and push-pull units (20 and 42) by removing mounting nuts (43 and 45) with which they are attached.

c. Remove rudder trim control chain (50) by disconnecting at master link. Remove sprocket (51) and shaft (56). Remove bearing plate (54) by removing screws (52) and nuts (55). Removal of remaining rudder trim control components is not recommended.

2-149. ASSEMBLY OF CONTROL PEDESTAL. (See figure 2-21.) Assembly of control pedestal should be accomplished in reverse order of disassembly procedure outlined in paragraph 2-148, and as illustrated.

2-150. INSTALLATION OF CONTROL PEDESTAL. (See figure 2-21.)

a. Work control pedestal carefully into position over teleflex control conduits (21) and rudder trim control torque tube (57). Lower into place to align holes in pedestal flanges with nutplates in floor, so that torque tube shaft (56) enters into upper end of torque tube (57).

b. Fasten control pedestal to floor with ten screws (33) and to stationary instrument panel (27) with two screws (26).

c. Insert roll pin (58) through rudder trim control torque tube (57) and shaft (56), 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 paragraph 2-117.

d. Install upper aileron trim control chain (38) 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 paragraph 2-85.

e. Install elevator trim control sprocket (5), chain (6), left upper side panel, and other components in

accordance with paragraph 2-141.

f. Attach teleflex conduits (21) in place by tightening the conduit coupling nuts. (Use a suitable thread lubricant on the male threads of all connectors.)

g. Attach all engine teleflex controls in accordance with section IV.

h. Rig all engine teleflex controls in accordance with section IV.

i. Attach rheostat wire clamp to the control pedestal (28) and fasten map light rheostat to left center side panel.

j. Install the two center side panels (32), the right upper side panel (29), and the cover plate (13).

k. Fasten carpet and floor covering in place and replace teleflex control conduit cover.

2-151. CABIN DOOR. (See figure 2-22.)

2-152. The cabin door incorporates a large, acrylic plastic window. The door is equipped with a key lock and a flush-type exterior door handle. On the inside, a conventional type door handle and a door stop are incorporated in the door. The key lock is located above the outside door handle and is operated by turning the key approximately 180 degrees. The key which operates the door lock also operates the baggage door lock. The door stop, located at the bottom edge of the door, is engaged by opening the door to the limit of its travel.

2-153. REMOVAL OF CABIN DOOR. (See figure 2-22.)

a. With the cabin door open and supported, remove screw (22), washer (23), spacer (24), and washer (25) securing door stop strap assembly (26) to fuselage.

b. Remove cotter pins securing hinge pins (39).

c. Remove hinge pins (39) by pulling pins through hinge halves (38).

d. Remove the door from the airplane.

2-154. DISASSEMBLY OF CABIN DOOR. (See figure 2-22.)

a. Remove door stop strap assembly from cabin door by removing screws (29), washers (30 and 32), and spacer (31).

b. Press in the escutcheon plate (36) enough to permit removal of the setscrew securing door handle (34).

c. Pull off inside door handle (34) from door and remove escutcheon plate (36).

Figure 2-22. Cabin Door Installation Callouts

1. Screw	15. Retainer Pad	30. Washer
2. Escutcheon Latch Plate	16. Screw	31. Spacer
3. Cabin Door Window Panel	17. Screw	32. Shake Proof Spring Washer
4. Nut	18. Screw	33. Screw
5. Upper Window Retainer	19. Ash Receiver	34. Door Handle
6. Screw	20. Door Stop Roller	35. Spacer
7. Screw	21. Rivet	36. Escutcheon Plate
8. Screw	22. Screw	37. Ash Receiver Adapter
9. Aft Window Retainer	23. Washer	38. Hinge Half
10. Screw	24. Spacer	39. Hinge Pin
11. Washer	25. Shake Proof Spring Washer	40. Nut
12. Window Trim Panel	26. Strap Assembly	41. Screw
13. Trim Pad	27. Spring Clip	42. Retainer
14. Upholstery Panel	28. Strap Assembly	43. Tape
	29. Screw	

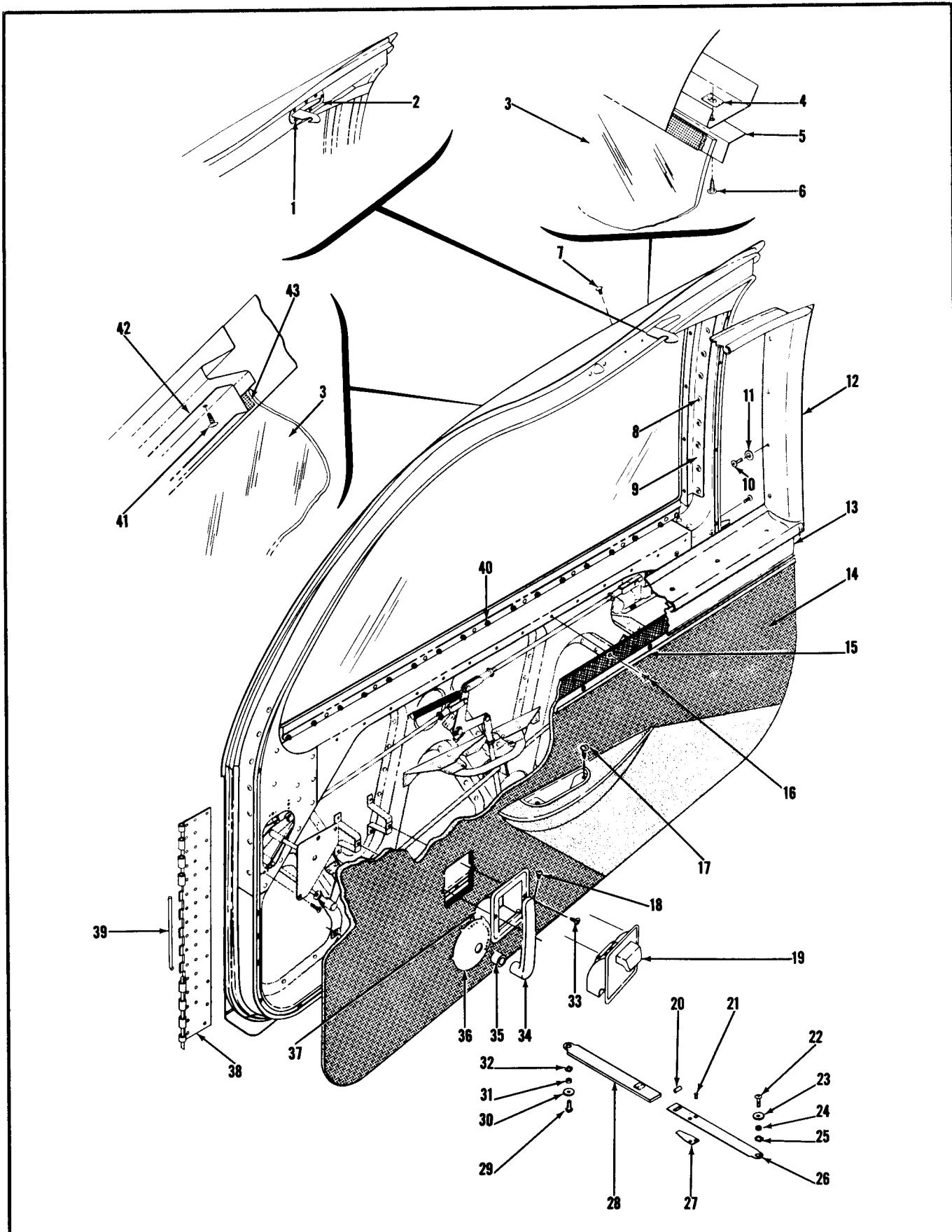


Figure 2-22. Cabin Door Installation

- d. Remove trim pad (13) and retainer pad (15).
- e. Remove window trim panel (12) by removing screws (10) and washers (11).
- f. Remove screws (16) securing upholstery panel (14).
- g. Remove window lower retainer by removing attaching screws and nuts (40).
- h. Remove aft window retainer (9) by removing attaching screws (8).
- i. Remove window forward retainer (42) by removing attaching screws (41).
- j. Remove window upper retainer (5) by removing attaching screws (6) and remove cabin door window (3).

2-155. CLEANING, INSPECTION, AND LUBRICATION OF CABIN DOOR. Wipe all parts clean with a suitable cloth. Remove grease by using a suitable solvent. Inspect all parts for wear, metal breaks, improper threads, and improper functioning. Replace all worn and damaged parts. Lubricate cabin door in accordance with figure 1-6, sheet 13. To aid the door seal to slip into the groove, lubricate seal with petrolatum.

2-156. ASSEMBLY OF CABIN DOOR. To reassemble cabin door, reverse the procedure in paragraph 2-154.

2-157. INSTALLATION OF CABIN DOOR. To install cabin door, reverse the procedure in paragraph 2-153.

2-158. CABIN DOOR LATCH ASSEMBLIES.

2-159. The cabin door latching mechanism consists of three assemblies: the upper arm lock, the lower lock assembly, and the bayonet assembly. The upper arm lock located at the top aft edge secures the door to the striker plate. (To adjust the upper striker plate remove two rivets and one bolt, reposition the plate and secure with two bolts. On serial 39037 and on, the striker plate is adjustable.) The lower lock assembly latches the aft edge to the fuselage bulkhead. The bayonet assembly at the door's lower edge secures the bayonet bolt to the door jamb. Series of bellcrank assemblies, a cable assembly, and linkage interconnect each latch assembly; and when either door handle is actuated, all latches work simultaneously.

2-160. TROUBLE SHOOTING 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.
CASE AND HANDLE ASSEMBLY FAILS TO OPERATE PROPERLY.	Spring broken.	Replace spring.
	Pin broken.	Replace pin.
	Plate loose.	Check screws.
BAYONET ASSEMBLY FAILS TO OPERATE.	Broken pin.	Replace pin.
	Linkage too tight.	Adjust linkage.
	Bellcrank broken or bent.	Replace bellcrank.

2-161. REMOVAL OF CABIN DOOR LATCH ASSEMBLIES. (See figure 2-23.)

- a. Remove cabin door in accordance with paragraph 2-153.
- b. Disassemble cabin door in accordance with paragraph 2-154.
- 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.

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

e. Remove spring (61) and linkage rod (62) from bellcrank (29) and lower latch assembly (22).

f. Remove linkage rod (26) from door latch cam (48).
g. Remove screws (21) from lower latch assembly

- (22). Remove lower latch assembly (22).
 - h. Remove linkage rod (26) from idler bellcrank (32) and pull linkage rod (26) through bracket assembly guides (25 and 27).
 - i. Remove door handle plate (57) and linkage rod (58) from door handle bellcrank (59). Remove linkage rod (60) from door handle bellcrank (59) and bayonet bellcrank (29). Remove bayonet assembly (28) from bayonet bellcrank (29). Remove bellcrank from door assembly.

2-162. DISASSEMBLY OF CABIN DOOR LATCH ASSEMBLIES. If further disassembly of the latch assemblies is necessary for repair or replacement see figure 2-23 which illustrates the sequence for disassembly.

2-163. CLEANING, INSPECTION, AND LUBRICATION OF CABIN DOOR LATCH ASSEMBLIES. Clean all parts with a suitable solvent. Inspect parts for signs of wear, damaged threads, proper functioning, bent parts, broken parts, and cotter pins secured and in place. Lubricate latch assemblies in accordance with figure 1-6 sheet 13.

2-164. ASSEMBLY OF CABIN DOOR LATCH ASSEMBLIES. Assemble latch assemblies as illustrated in figure 2-23.

2-165. INSTALLATION OF CABIN DOOR LATCH ASSEMBLIES. Install latch assemblies in reverse procedure in accordance with paragraph 2-161.

2-166. BAGGAGE COMPARTMENT.

2-167. The baggage compartment is located just aft of the rear seat and is equipped with a light for night use. The baggage door, located aft of the wing on the right side of the fuselage, provides access to the compartment from outside of the airplane. Access to the baggage compartment may also be gained from inside the cabin by tilting the back of the rear seat forward.

2-168. BAGGAGE DOOR.

2-169. The baggage door is located just aft of the cabin door on the right side of the fuselage. A push type, flush, snap latch is provided for opening the door. The door lock is opened by the same key that operates the cabin door. A limit chain is used as a stop to prevent the door from opening against the fuselage. To close the door, push it shut until the latch snaps and latches. A small pocket is provided on the upholstery panel of the baggage door for a screwdriver.

2-170. REMOVAL OF BAGGAGE DOOR. (See figure 2-24.)

- a. Remove screw (27) attaching limit chain (20) to fuselage.
- b. Remove door hinge pin (22) and remove baggage door (16) from aircraft.

2-171. DISASSEMBLY OF BAGGAGE DOOR.

- a. Remove screw (21) attaching limit chain (20) to upholstery panel (17).

- b. Remove upholstery panel (17) by releasing the attaching trimount studs.
- c. If removal of the cylinder lock assembly (15) is necessary, proceed as follows: remove screw (9) and washer (8) from cam (7).

NOTE

When cam (7) is removed the cylinder assembly (15) remains free within the shell (14). Care should be taken not to lose or disarrange tumblers or the key will not operate the locking mechanism. When cam (7), shell nut (6), and lock-flap stop plate (5) are removed or replaced, tape the cylinder (15) to the shell (14), keeping the tumblers intact within the cylinder assembly (15).

- d. To replace spring (3), remove latch assembly (29) from door. Drive out pin (2).
- e. To remove and replace lock flap (1), drill out attaching rivets.
- f. To replace locking bolt (11), remove cotter pin (12) and pin (10) from lock flap (1).
- g. To replace cam (7), remove screw (9) and washer (8).

NOTE

If cylinder lock assembly is replaced, mark keys accordingly or install a new cylinder in cabin door latch assembly.

2-172. CLEANING, INSPECTION, AND LUBRICATION OF BAGGAGE DOOR.

- a. Clean upholstery panel with suitable cleaning solvent.
- b. Wipe all dirt and grease from door assembly with suitable solvent.
- c. Clean latch assembly and cylinder assembly with suitable solvent.
- d. Inspect upholstery panel for tears and signs of excessive wear.
- e. Inspect hinge assembly for proper functioning, wear, and broken hinge pin.
- f. Inspect door for skin damage and general structural damage.
- g. Inspect latch assembly for proper functioning, bent, broken, or damaged parts.
- h. Lubricate baggage door in accordance with figure 1-6 sheet 1.

2-173. ASSEMBLY OF BAGGAGE DOOR. (See figure 2-24.) Assemble latch assembly in reverse procedure as outlined in paragraph 2-171. Position latch (29) in baggage door (16) and rivet. Install upholstery panel (17).

2-174. INSTALLATION OF BAGGAGE DOOR. (See figure 2-24.) Position baggage door (16) and install hinge pin (22). Attach limit chain (20) to door and fuselage.

2-175. SEAT ASSEMBLIES.

2-176. The standard five place cabin is equipped

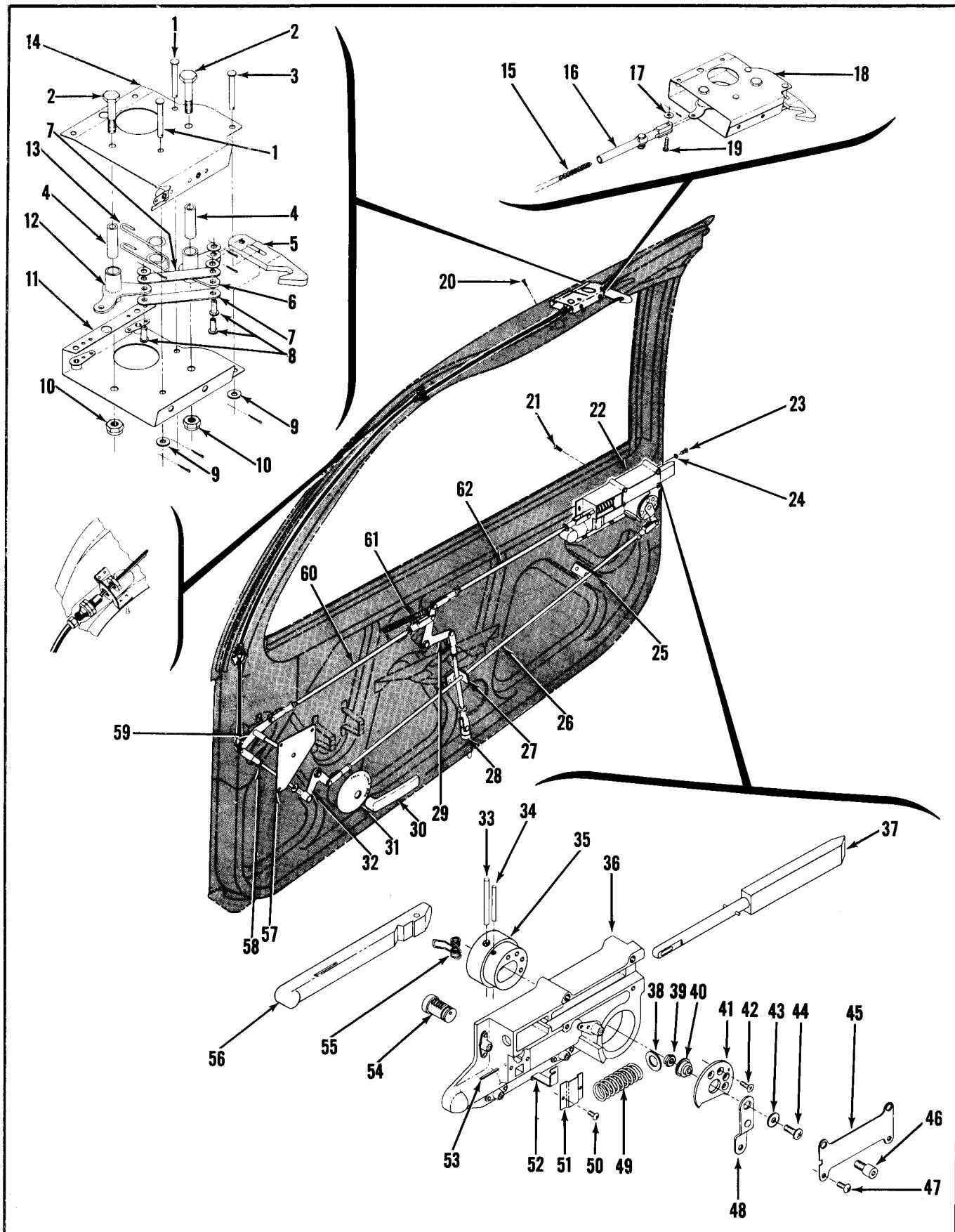
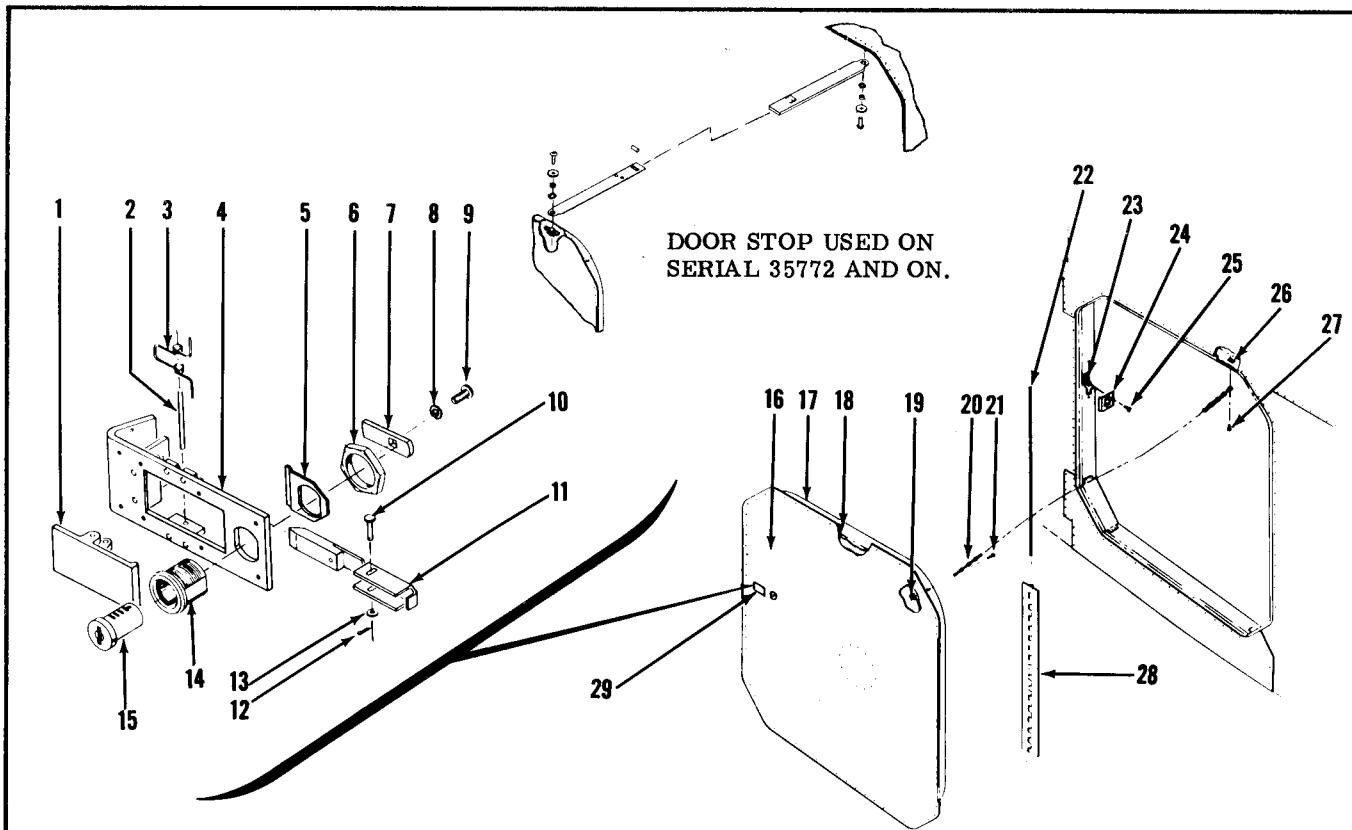


Figure 2-23. Cabin Door Latch Assemblies



- | | | |
|-------------------------|------------------------------|--------------------|
| 1. Lock Flap | 11. Locking Bolt | 20. Chain |
| 2. Lock Flap Pin | 12. Cotter Pin | 21. Screw |
| 3. Spring | 13. Washer | 22. Hinge Pin |
| 4. Case Assembly | 14. Shell | 23. Esna Nut |
| 5. Lock Flap Stop Plate | 15. Cylinder Assembly | 24. Striker Plate |
| 6. Shell Nut | 16. Baggage Door | 25. Screw |
| 7. Cam | 17. Baggage Upholstery Panel | 26. Anchor Nut |
| 8. Washer | 18. Seal | 27. Screw |
| 9. Screw | 19. Nut | 28. Hinge Assembly |
| 10. Pin | | 29. Latch Assembly |

Figure 2-24. Baggage Door Installation

Figure 2-23. Cabin Door Latch Assemblies Callouts

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

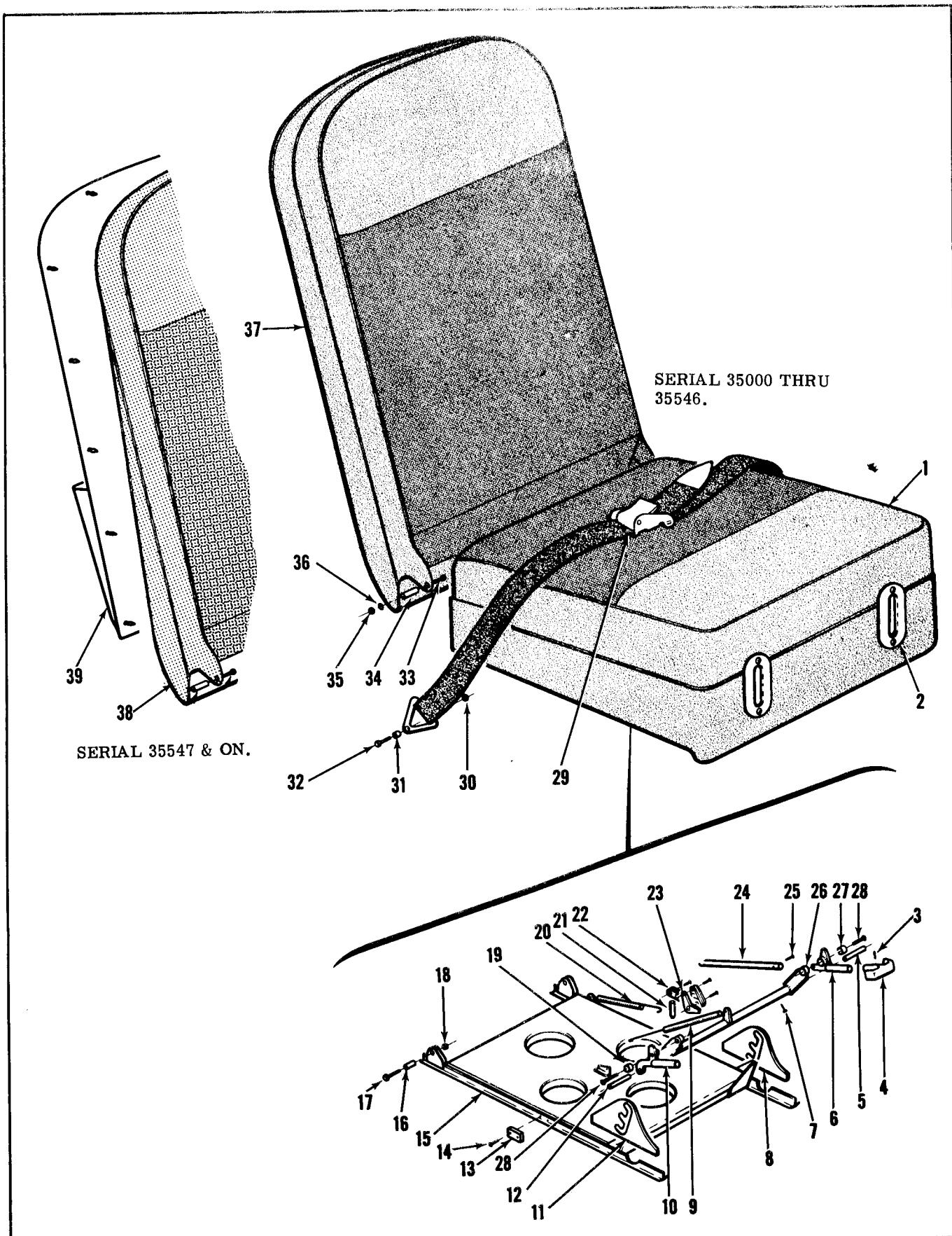


Figure 2-25. Front Seat and Safety Belt Assembly

with two forward seats mounted on tracks and a three passenger rear seat with an adjustable single panel seat back. Four optional seating arrangements are available, comprised of the following: (1) two reclining rear seats, (2) two adjustable rear seats, identical to the pilot's and copilot's seats, (3) one

adjustable rear seat on the right side and a lounge on the left side behind the pilot's seat, (4) two adjustable rear seats plus a non-adjustable fifth seat located in the left, aft end of the cabin. Applicable serials and details of each arrangement are covered in the following paragraphs.

2-177. TROUBLE SHOOTING SEAT ASSEMBLIES.

TROUBLE	PROBABLE CAUSE	CORRECTION
LOCKING MECHANISM FAILS TO LOCK.	Broken spring or missing spring.	Replace spring.
	Distorted parts.	Repair or replace.
TILTING MECHANISM FAILS TO OPERATE.	Broken spring or missing spring.	Replace spring.
	Distorted parts.	Repair or replace.
SEAT ASSEMBLY FAILS TO SLIDE FREELY.	Improper lubrication.	Apply paraffin wax to the seat rails on the pan assembly.
	Parts bent or broken.	Repair or replace.
REAR SEAT ARM FAILS TO OPERATE.	Broken spring or missing spring.	Replace spring.
	Parts bent or broken.	Repair or replace.

2-178. CLEANING AND INSPECTION OF THE SEATS. Cleaning fluids having a tetrachloride or naptha base are recommended for use in cleaning the seats. When cleaning the seats, follow this procedure:

- Carefully brush off and vacuum all loose particles of dirt.
- 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.
- 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 spread-

ing and is less likely to leave a ring.

- 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 cleaner.

- Brush again to remove any more particles which may have become loosened. Inspect seat assemblies

Figure 2-25. Front Seat and Safety Belt Assembly Callouts.

- Front Seat Bottom Assembly
- Escutcheon Plate
- Roll Pin (Serial 35000 thru 35546.) Screw (Serial 35547 & on.)
- Adjustment Handle
- Left Actuator Pin
- Left Arm
- Pin
- Left Adjustment Bracket
- Spring
- Right Arm
- Right Adjustment Bracket
- Right Actuator Pin
- Stop Plate
- Screw
- Seat Pan Assembly
- Spacer
- Bolt
- Nut
- Spacer
- Spring
- Bolt
- Lock Pin
- Pivot Arm
- Stop Arm
- Slide Release Tube
- Pin
- Actuator Assembly
- Spacer
- Left and Right Arm Pin
- Safety Belt
- Nut
- Spacer
- Bolt
- Spacer
- Nut
- Washer
- Front Seat Back (Serial 35000 thru 35546.)
- Front Seat Back (Serial 35547 & on.)
- Front Seat Back Upholstery Panel (Serial 35547 & on.)

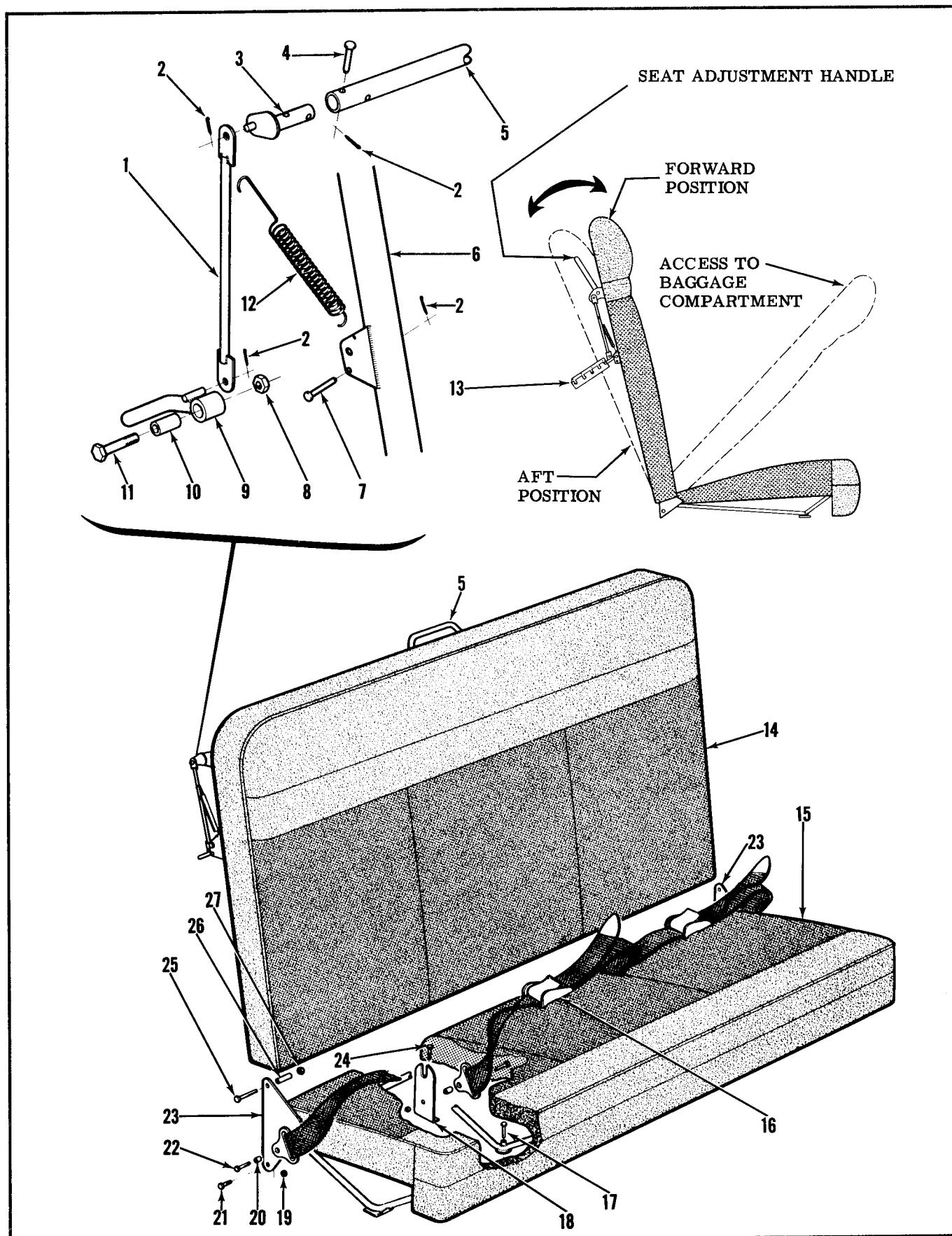


Figure 2-26. Rear Seat and Safety Belt Assembly

Figure 2-26. Rear Seat and Safety Belt Assembly Callouts

- | | | |
|--------------------|-------------------------------------|----------------|
| 1. Tie Rod | 10. Spacer | 19. Nut |
| 2. Cotter Pin | 11. Bolt | 20. Spacer |
| 3. Seat Back Arm | 12. Spring | 21. Bolt |
| 4. Pin | 13. Seat Adjustment Bracket | 22. Bolt |
| 5. Handle Assembly | 14. Rear Seat Back | 23. Seat Frame |
| 6. Seat Back Frame | 15. Rear Seat Bottom | 24. Bolt |
| 7. Stop Pin | 16. Safety Belt | 25. Bolt |
| 8. Nut | 17. Bolt | 26. Spacer |
| 9. Right Latch | 18. Rear Seat Bottom Frame Assembly | 27. Nut |

for signs of wear, tears, soiled conditions, and damaged stitching. Inspect front seats for lubrication of the seat rails, proper functioning of adjusting handles, tilting mechanism functioning properly, and safety belts secured properly.

2-179. REMOVAL OF PILOT'S AND COPILOT'S SEATS. See figure 2-25 to remove pilot's and co-pilot's seats:

- a. Pull up on the seat right-hand adjusting handle and tilt the seat back as far as possible.
- b. Remove two screws (14), securing the seat stop plate (13), to the right side of the seat pan assembly (15).
- c. Remove the stop plate (13).
- d. Pull up on the seat left-hand adjusting handle (4) and slide the seat either forward or aft to clear it from the seat tracks.
- e. Remove the seat from the airplane.

2-180. DISASSEMBLY AND ASSEMBLY OF PILOT'S AND COPILOT'S SEATS. (See figure 2-25.) Remove either seat by the following procedure:

- a. Remove seat back assembly (37) by reversing nuts (35), washers (36), spacers (34), and bolts (33).
- b. Remove nuts (18), bolts (17), and spacers (16).
- c. Remove adjustment handles (4) by removing roll pins (3), serial 35000 thru 35546. Item (3) is a screw, serial 35547 and on.
- d. Remove arm pins (28) after removing cotter pins. Spacers (27) will fall out and should be retained.
- e. Lift seat bottom assembly (1) off pan assembly (15).
- f. Remove springs (9 and 20).
- g. Remove pins securing slide release tube (24).
- h. Remove pivot arm (22) by removing attaching pins. Stop arm (23) will fall free and should be retained.
- i. Remove actuator assembly (26) by removing actuator pin (5).
- j. To assemble the front seats, reverse the disassembly procedure outlined above. Replace all worn or defective parts during reassembly.

2-181. INSTALLATION OF PILOT'S AND COPILOT'S SEATS. Install pilot's and copilot's seats by reversing procedure outlined in paragraph 2-179.

WARNING

After pilot's seat has been installed, insure that stop plate (13) has been installed and that the seat adjustment mechanism functions.

2-182. REMOVAL OF REAR SEAT. (See figure 2-26.)

- a. Enter at the baggage compartment door. Remove the attaching screws from the skirt at the floorboard and rear seat bottom.

NOTE

On aircraft serial 35547 and on the skirt at the rear of the seat bottom has three sections: right, center, and left.

- b. Remove bolts (17) attaching seat assembly to the floorboard.
- c. Remove bolts (24) from seat frame at rear spar. Remove bolts (25) from seat back (14) and remove seat back from airplane.
- d. Remove seat bottom (15) from airplane.

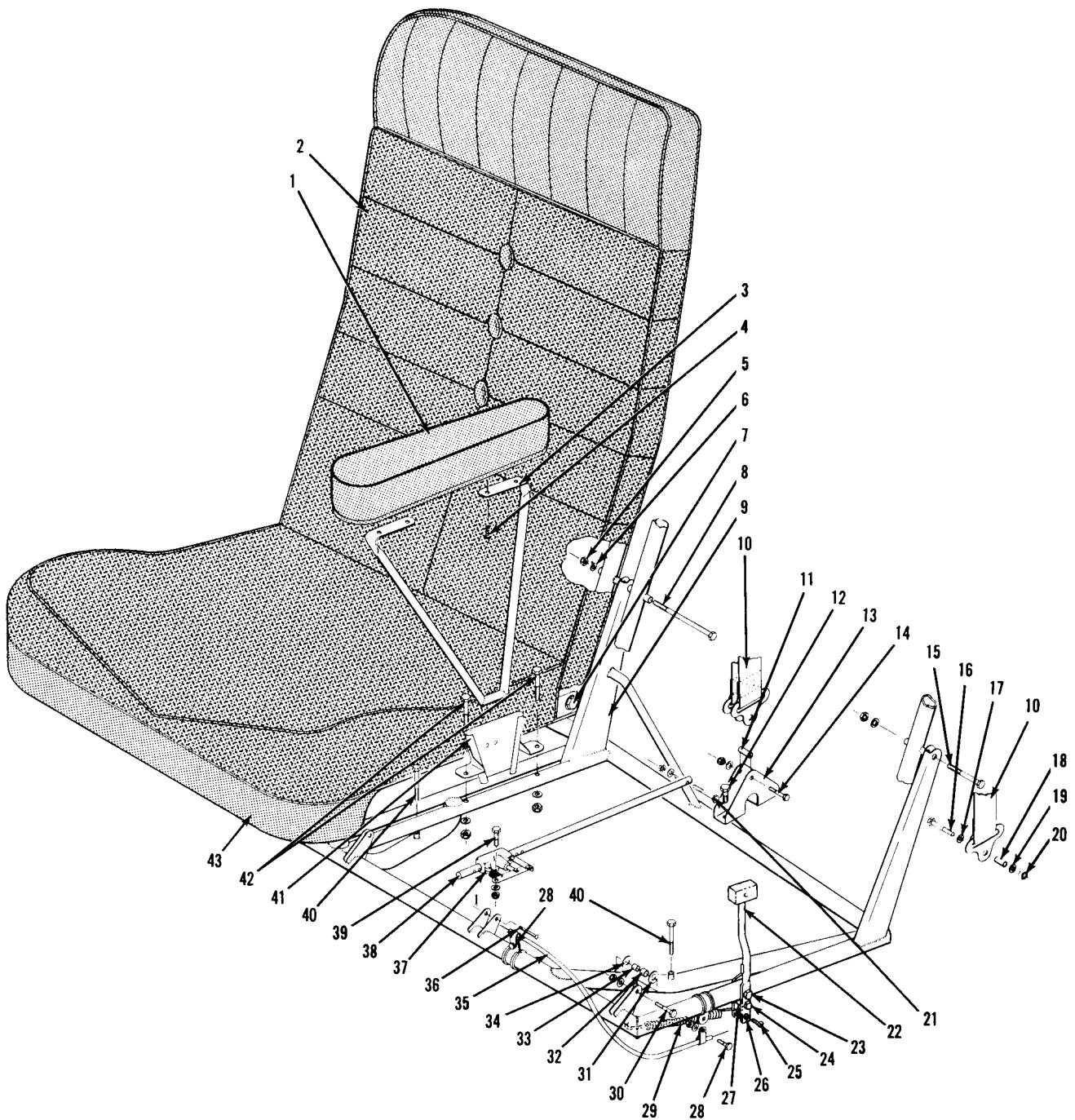
2-183. DISASSEMBLY AND ASSEMBLY OF REAR SEAT. (See figure 2-26.) Remove safety belts and their attaching parts from the rear seat bottom frame assembly in accordance with paragraph 2-187. Remove either latch assembly as follows:

- a. Remove spring (12) from seat back frame (6) and tie rod (1).
- b. Remove tie rod (1) by removing cotter pins (2) from seat back arm (20) and right latch (9).
- c. Remove nut (8) from bolt (11), releasing spacer (10) and right latch (9).
- d. Remove cotter pin (2) from pin (4), releasing seat back arm (3) from handle assembly (5).
- e. To assemble the rear seat reverse the preceding procedure.

2-184. INSTALLATION OF REAR SEAT. (See figure 2-26.) Install the rear seat in reverse procedure as outlined in paragraph 2-182.

2-184A. RECLINING REAR SEAT INSTALLATION.

2-184B. A reclining rear seat is provided as optional equipment in aircraft serial 35547 and on. The seat is divided in the center, either side may be adjusted individually. Although the seat is designed for two people, three safety belts are provided to permit three people to use the rear seat, when desired.

**NOTE**

ON SERIAL 39032 AND ON, A SPACER
IS INCORPORATED UNDER THE SAFETY
BELT BRACKET (13).

Figure 2-26A. Reclining Rear Seat (Optional equipment serial 35547 and on.)

Figure 2-26A. Reclining Rear Seat Callouts

- | | | |
|--------------------------|----------------------------|----------------------|
| 1. Arm Rest Center Cover | 15. Bolt | 30. Bolt |
| 2. Seat Back | 16. Bolt | 31. Washer |
| 3. Arm Rest Center | 17. Washer | 32. Roller |
| 4. Screw | 18. Spacer | 33. Roller |
| 5. Nut | 19. Washer | 34. Washer |
| 6. Washer | 20. Nut | 35. Teleflex Cable |
| 7. Bolt | 21. Bolt | 36. Pin |
| 8. Bolt | 22. Seat Adjustment Handle | 37. Stop Assembly |
| 9. Seat Frame | 23. Bolt | 38. Adjustment Tube |
| 10. Safety Belt | 24. Bolt | 39. Bolt |
| 11. Spacer | 25. Screw | 40. Bolt |
| 12. Bolt | 26. Spacer | 41. Arm Rest Support |
| 13. Safety Belt Bracket | 27. Spacer | 42. Bolt |
| 14. Bolt | 28. Bolt | 43. Seat Bottom |
| | 29. Spring | |

2-184C. TROUBLE SHOOTING THE RECLINING REAR SEAT.

TROUBLE	PROBABLE CAUSE	CORRECTION
SEAT WILL NOT CHANGE POSITION.	Teleflex cable disconnected.	Connect teleflex cable and observe operation.
	Defective stop assembly.	Replace stop assembly.
	Seat adjustment tube bent.	Replace seat adjustment tube.
SEAT HARD TO OPERATE.	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 operating.
	Seat rollers broken or binding.	Repair or replace seat rollers.

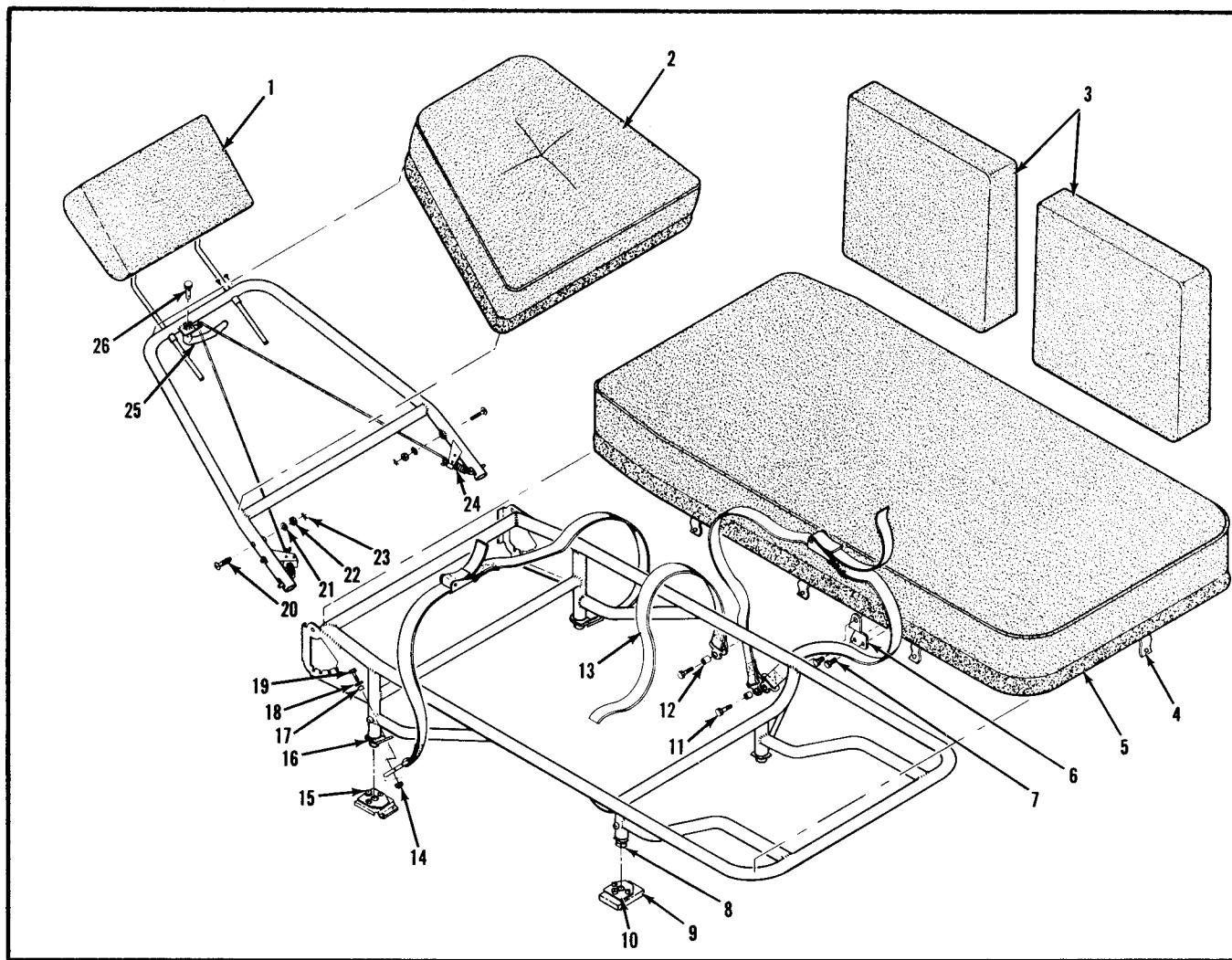
2-184D. REMOVAL OF RECLINING REAR SEAT.

(See figure 2-26A.) To remove the reclining rear seat enter the baggage compartment and proceed as follows:

- a. Unfasten snaps securing the upholstery at the bottom of the seat backs.
- b. Remove bolt (8) and bolt (15) securing seat back to seat frame (9).
- c. Tilt the seat back forward and remove the two bolts (7) securing the seat back to the seat bottom.
- d. Remove the seat back (2) from the airplane.
- e. Repeat this procedure to remove the other seat back.
- f. Remove the two safety belt brackets (13), with safety belts attached by removing bolts (12).
- g. Tilt the seat bottoms (43) as far forward as possible.
- h. Remove the three bolts (40) securing the seat frame to the aircraft structure.
- i. Remove the seat frame (9), with seat bottoms (43) attached, from the airplane.

2-184E. DISASSEMBLY AND ASSEMBLY OF RECLINING REAR SEAT. (See figure 2-26A.) This procedure is described for the left side of the reclining rear seat only. The procedure for the right side of the seat is the same.

- a. Remove seat as described in paragraph 2-184C.
- b. Disconnect the teleflex cable (35) at stop assembly (37) by removing bolt (39).
- c. Remove seat bottom (43) by removing bolt (30), washers (31 and 34), and rollers (32 and 33).
- d. Remove bolt (21) securing seat adjustment tube (38) to seat bottom (43).
- e. Remove seat adjustment tube (38) with stop assembly (37) attached.
- f. Remove stop assembly (37) from seat adjustment tube (38).
- g. Disconnect teleflex cable (35) from seat adjustment lever (22) by removing bolt (25).
- h. Remove teleflex cable (35) and clamps by removing bolts (28).



- | | | |
|---------------------------|----------------------------|-----------------------|
| 1. Headrest | 10. Wedjit | 18. Washer |
| 2. Backrest | 11. Bolt | 19. Bolt |
| 3. Lounge Pillow | 12. Spacer | 20. Bolt |
| 4. Snap-on Strap | 13. Safety Belt | 21. Washer |
| 5. Lounge Bottom | 14. Nut | 22. Nut |
| 6. Safety Belt Attachment | 15. Wedjit Release Screw | 23. Cotter Key |
| 7. Bolt | 16. Safety Belt Attachment | 24. Tilting Mechanism |
| 8. Wedjit Bolt | 17. Spacer | 25. Adjusting Handle |
| 9. Phenolic Block | | 26. Bolt |

Figure 2-26B. Lounge (Optional - Serial 35772 and on)

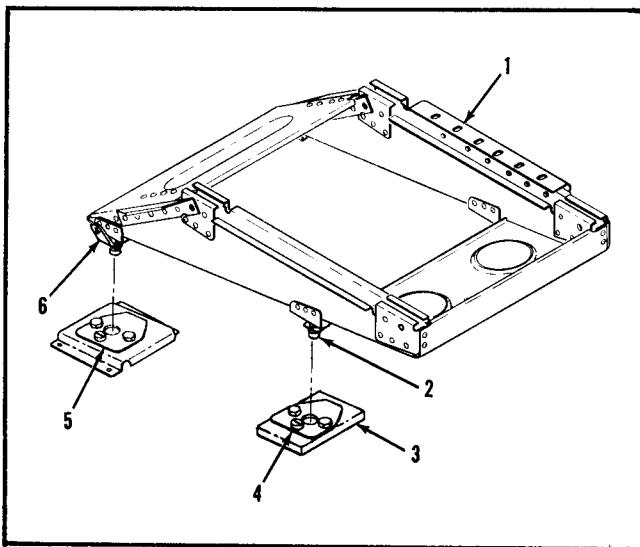
- i. Remove spring (29).
- j. Remove bolt (24) and spacer (27) from seat adjustment lever (22).
- k. Remove bolt (23) from seat adjustment lever (22) and remove seat adjustment lever.
- l. Remove bolts (42) from arm rest support (41) and remove arm rest support.
- m. To remove arm rest center cover (1) from arm rest center (3) remove screws (4).
- n. To assemble the reclining rear seat reverse the procedure as described in this paragraph.

2-184F. INSTALLATION OF RECLINING REAR SEAT.
(See figure 2-26A.) To install the reclining rear seat reverse the procedure described in paragraph 2-184C.

2-184G. ADJUSTABLE REAR SEATS. (Optional - Serial 35772 and on. See figure 2-26C.)

2-184H. Individual rear seats are provided as optional equipment on serial 35772 and on. They are mounted on tracks which are attached to the cabin floor by Wedjits for ease of removal and installation. The seats are adjustable fore and aft and have three reclining positions. Adjusting handles are located on the forward portion of the seat bottom. The individual rear seats are identical to, and interchangeable with, the pilot's and copilot's seats illustrated in figure 2-25.

2-184J. REMOVAL OF THE REAR SEAT. (See figure 2-26C.)



1. Seat Track Assembly 4. Wedjit Release Screw
 2. Wedjit Bolt 5. Wedjit
 3. Phenolic Block 6. Safety Belt Attachment

Figure 2-26C. Rear Seat Track (Optional - Serial 35772 & on.)

- To remove the rear seat and seat track, turn slotted screws (4) on Wedjits (5) and remove seat and seat track from airplane.
- To remove the seat from the seat track (1) follow procedure outlined in paragraph 2-179.

2-184K. DISASSEMBLY AND ASSEMBLY OF THE REAR SEAT.

a. The disassembly and assembly procedure of the rear seat is identical to the pilot's and copilot's seats described in paragraph 2-180.

2-184L. INSTALLATION OF THE REAR SEAT. (See figure 2-26C.)

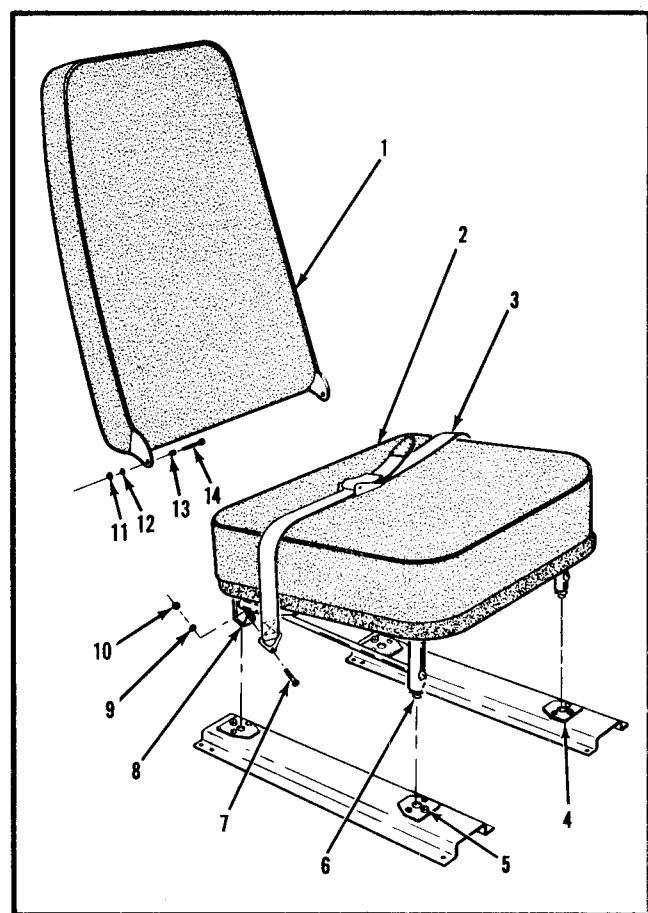
- Assemble the seat and the seat track (1) by reversing the procedure outlined in paragraph 2-179.
- Align the four round headed bolts (2) with the receptacles in the Wedjits (5) and apply pressure downward on the seat until the bolts snap into position.

2-184M. LOUNGE. (Optional - Serial 35772 and on.) (See figure 2-26B.)

2-184N. A lounge is provided as optional equipment on serial 35772 and on. The lounge is attached to the cabin floor by Wedjits for ease of removal and installation. An adjusting handle located on the aft portion of the lounge back rest adjusts the back rest to the desired reclining position.

2-184O. REMOVAL AND INSTALLATION OF THE LOUNGE. (See figure 2-26B.)

- To remove the lounge, turn slotted screws (15) on Wedjits (10) and remove entire lounge assembly from airplane.
- To install the lounge, align the four round headed bolts (8) with the receptacles in the Wedjits (10) and apply pressure downward on the seat until the bolts snap into position.



1. Seat Back	8. Safety Belt Attachment
2. Seat Bottom	9. Washer
3. Safety Belt	10. Nut
4. Wedjit	11. Nut
5. Wedjit Release	12. Washer
6. Wedjit Bolt	13. Spacer
7. Bolt	14. Bolt

Figure 2-26D. Fifth Seat (Optional - Serial 35772 & on)

2-184P. FIFTH SEAT. (Optional - Serial 35772 and on. See figure 2-26D.)

2-184Q. A non-adjustable fifth seat is available as optional equipment with the two center seats installation. The fifth seat is located in the aft left hand corner of the cabin and is attached to the floor by Wedjits for ease of removal and installation.

2-184R. REMOVAL AND INSTALLATION OF THE FIFTH SEAT. (See figure 2-26D.)

- To remove the fifth seat, turn slotted screws (5) on Wedjits (4) and lift seat from the floor.
- To install the fifth seat, align the four round headed bolts (6) with the receptacle in the Wedjits (4) and apply pressure downward on the seat until the bolts snap into position.

2-185. SAFETY BELTS. (See figures 2-25 thru 2-26D.)

2-186. Each seat position is equipped with a safety

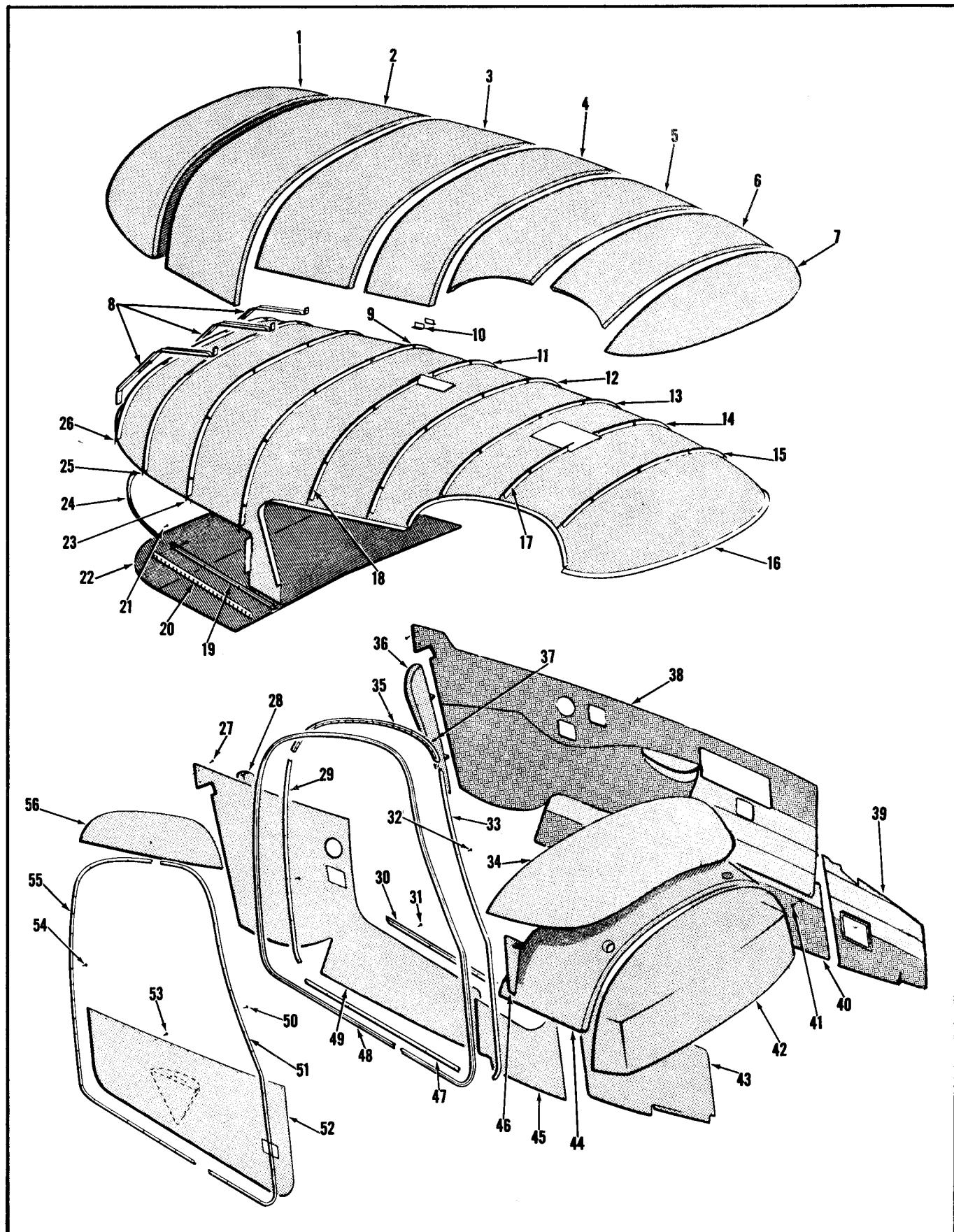


Figure 2-27. Upholstery Installation

Figure 2-27. Upholstery Installation Callouts

- | | | |
|-----------------------------|---------------------------------|---------------------------------------|
| 1. Boot Assembly Insulation | 20. Retainer | 38. Left Upholstery Panel |
| 2. Aft Insulation | 21. Screw | 39. Left Forward Upholstery Panel |
| 3. Aft Insulation | 22. Baggage Shelf Cover | 40. Left Lower Upholstery Panel |
| 4. Center Insulation | 23. Aft Wire Bow | 41. Screw |
| 5. Forward Insulation | 24. Right Retainer | 42. Firewall Insulation |
| 6. Forward Insulation | 25. Aft Wire Bow | 43. Right Forward Upholstery Panel |
| 7. Forward Insulation | 26. Aft Wire Bow | 44. Instrument Panel Check Insulation |
| 8. Headliner Support | 27. Screw | 45. Right Lower Upholstery Panel |
| 9. Aft Wire Bow | 28. Right Aft Upholstery Panel | 46. Right Forward Upholstery Panel |
| 10. Switch Shield Assembly | 29. Aft Jamb Retainer | 47. Retainer Lower Jamb |
| 11. Left Center Wire Bow | 30. Retainer | 48. Windlace |
| 12. Forward Wire Bow | 31. Screw | 49. Right Upholstery Panel |
| 13. Forward Wire Bow | 32. Screw | 50. Screw |
| 14. Left Forward Wire Bow | 33. Forward Jamb Retainer | 51. Retainer |
| 15. Forward Wire Bow | 34. Instrument Panel Deck Cover | 52. Cabin Door Upholstery Panel |
| 16. Headliner Assembly | 35. Clip Assembly | 53. Screw |
| 17. Right Forward Wire Bow | 36. Left Aft Upholstery Panel | 54. Screw |
| 18. Right Center Wire Bow | 37. Screw | 55. Retainer |
| 19. Retainer | | 56. Upper Cabin Door Upholstery Panel |

belt. All safety belts are attached either to the aircraft structure or to the welded seat frames. Safety belts may be easily removed for cleaning or replacement by removing the attaching bolts. Install safety belts according to their respective seat position illustrated in figures 2-25 thru 2-26D.

2-187. CLEANING AND INSPECTION OF SAFETY BELTS. Clean webbing with a suitable dry cleaning solvent. Inspect webbing for breaks, tears, and signs of wear. Inspect buckles for loose, broken or bent parts. Inspect buckles for proper fastening and correct tension on webbing.

WARNING

Never repair webbing or buckles. Replace with a new safety belt.

2-188. UPHOLSTERY.

2-189. The cabin door upholstery panel, the forward side panels, the cabin side panels, the headliner and the baggage area panel assemblies are upholstered in durable fabrics, and are installed over spun glass insulation. Each assembly is easily removed for repair or replacement. The headliner assembly is secured to the inside fuselage cabin area with the use of wire bows and supports. A small pocket is provided on the left forward side panel for the pilot's check list, maps, and miscellaneous items. The forward cabin area has an arm rest and ash tray on the pilot's left side panel and the cabin door panel. The rear cabin area has a cigarette lighter on the right trim panel and an ash tray in each side panel. With the exception of removing the upholstery panels for inspection purposes of the equipment secured to the bulkhead or the fuselage, no removal is necessary. Each upholstered panel can be removed by removing the upholstery trim and mounting screws. If proper care is maintained, the durable fabrics will last indefinitely. Removal of each panel assembly is covered in the following paragraphs.

2-190. UPHOLSTERY TRIM.

2-191. The windshield, the cabin door, and the windows have decorative royalite trim. The royalite trim panels are painted to blend with the upholstery panels and the cabin seat assemblies. The rear windows have two plexiglas window panels to each window assembly. The inner window panel is cushioned in rubber and then secured by two supports and a one piece formed royalite trim panel. The rear windows, have a curtain assembly which slides on a lower and upper track assemblies. When the curtain is extended, it covers the rear window area preventing sunrays from entering the rear cabin area. Two leather-covered assist cords are provided, one located just forward of each rear window. A removable ash tray is located just below each rear window and a cigar lighter is located on the right rear trim panel. Two sun visors are located above the windshield, one for the pilot and one for the copilot. A door jamb protects the area just below the cabin door against scuffing.

2-192. REMOVAL AND INSTALLATION OF UPHOLSTERY AND UPHOLSTERY TRIM. (Serials 35000 thru 35546. See figures 2-27 and 2-28.)

- Remove front seats in accordance with paragraph 2-179.
- Remove rear seat in accordance with paragraph 2-182.
- Remove dome and instrument light console panel in accordance with paragraph 6-73.
- Remove rear dome light in accordance with paragraph 6-85.
- To remove headliner assembly (16) proceed as follows: (see figure 2-27).
 - Remove windshield upper trim (figure 2-28).
 - Start at the left, aft side of the windshield, and unfasten the headliner edge (16) from the prong edges of the windshield upper retainer (figure 2-32).
 - Remove headliner assembly from retainer above the cabin door.
 - Remove headliner assembly aft to wire bow (15). Remove wire bow (15) from support. Remove wire bow (15) from sewed loop of the headliner as-

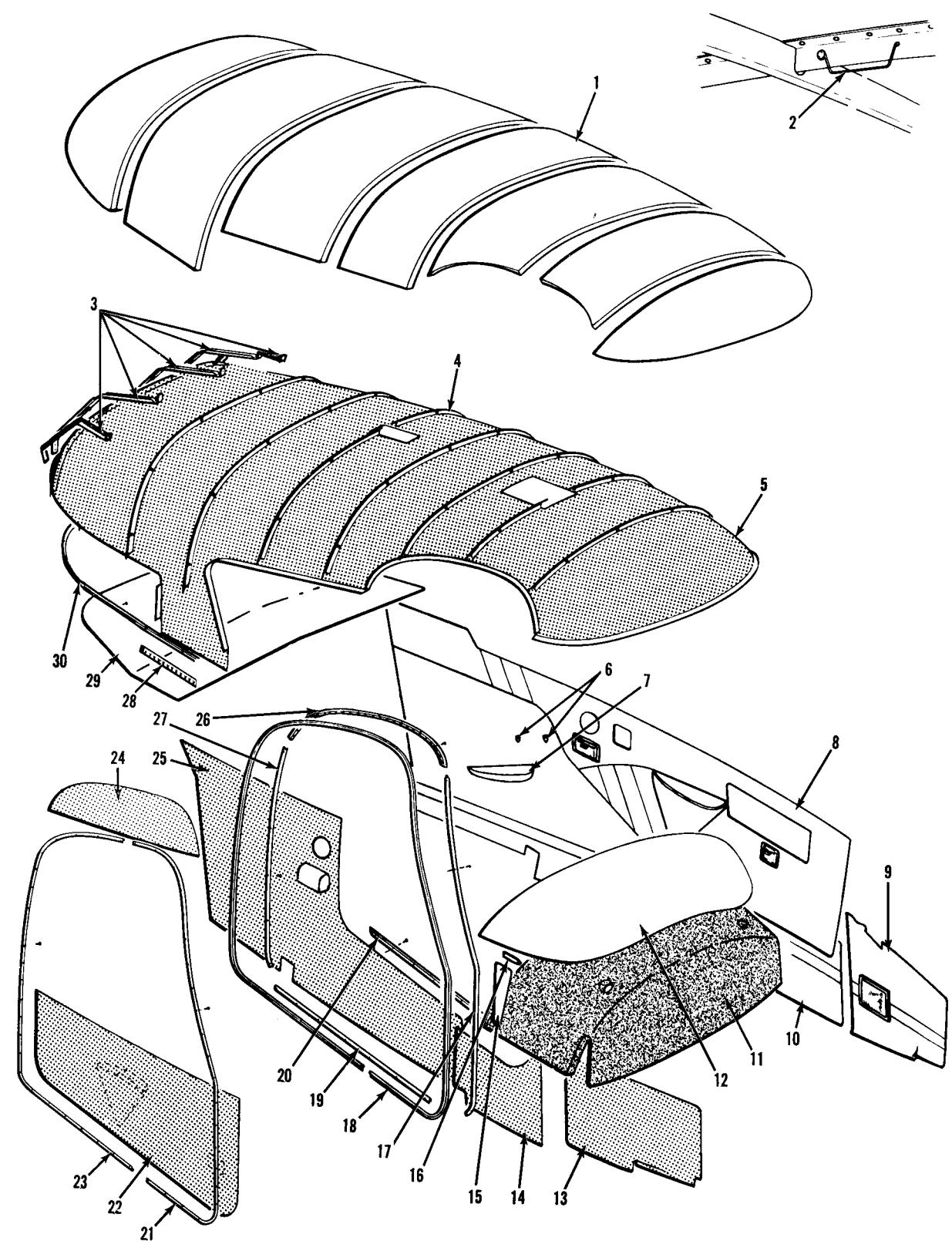


Figure 2-27A. Upholstery Installation (Serial 35547 thru 35771)

Figure 2-27A. Upholstery Installation (Serials 35547 thru 35771) Callouts

- | | | |
|----------------------------|----------------------------------|---------------------------------|
| 1. Cabin Top Insulation | 11. Instrument Panel Deck | 19. Lower Door Jamb Retainer |
| 2. Headliner Support | Insulation | 20. Retainer |
| 3. Aft Headliner Support | 12. Instrument Panel Deck Cover | 21. Forward Retainer |
| 4. Headliner Wire | 13. Right Forward Upholstery | 22. Lower Door Panel Upholstery |
| 5. Headliner | Panel | 23. Aft Retainer |
| 6. Armrest Tab Sockets | 14. Lower Right Upholstery Panel | 24. Upper Door Panel Upholstery |
| 7. Armrest | 15. Upper Right Upholstery Panel | 25. Right Upholstery Panel |
| 8. Left Upholstery Panel | 16. Retainer | 26. Clip Assembly |
| 9. Left Forward Upholstery | 17. Forward Door Jamb | 27. Aft Door Jamb Retainer |
| Panel | 18. Windlace | 28. Headliner Retainer |
| 10. Lower Left Upholstery | | 29. Baggage Shelf Cover |
| Panel | | 30. Headliner Retainer |

sembly (16). Repeat this procedure aft to headliner supports (8) above the baggage shelf. Remove lower edge of headliner assembly (16) from left (19) and right upholstery retainer. Remove left (19) and right upholstery retainer. Remove left (20) and right retainer which will release the headliner edge from the clip retainer.

f. Remove left upholstery panel (38, figure 2-27) as follows: (See figure 2-28.)

1. Remove left rear window trim (3) and left front window trim (10) by removing attaching screws.
2. Remove left trim pad (21) from upholstery retainer (23).
3. Remove ash receivers (22) by tilting ash receiver forward and releasing spring. Remove screws securing unit to upholstery panel.

4. Remove wemac unit by removing four screws from the upholstery panel.

5. Remove emergency exit window pan in accordance with paragraph 2-225.

6. Remove circuit breaker panel door.

7. (See figure 2-27.) Remove attaching screws (41) securing upholstery panel (38). Remove panel from cabin area.

g. Remove attaching screws from lower left upholstery panel and remove upholstery panel.

h. Remove attaching screws (31) from right rear upholstery panel and remove panel.

i. If further removal of the upholstery group or the upholstery trim is necessary, figure 2-27 and 2-28 illustrates the respective position of all components.

j. Install upholstery and upholstery trim by reversing the procedure outlined in this paragraph.

2-193. REMOVAL AND INSTALLATION OF UPHOLSTERY AND UPHOLSTERY TRIM. (Serials 35547 thru 35771. See figures 2-27A and 2-28A.)

a. Remove front seats in accordance with paragraph 2-179.

b. Remove rear seat in accordance with paragraph 2-182.

c. Remove dome and instrument light console panel in accordance with paragraph 6-73.

d. Remove rear dome light in accordance with paragraph 6-85.

e. To remove headliner (5, figure 2-27A.) Proceed as follows:

1. Remove windshield upper trim (15, figure 2-28A).
2. Remove left front window trim (8, figure 2-28A).
3. Remove rear window trim (3, figure 2-28A).

4. Remove forward curtain stops (6, figure 2-28A) and remove curtains (34).

5. Remove curtain tracks (5, figure 2-28A).

6. Remove tiara (2, figure 2-28A).

7. Remove coat hooks (1, figure 2-28A).

8. Start at the left aft side of the windshield and remove the headliner edge from the prong edges of the windshield upper retainer.

9. Remove headliner (5, figure 2-27A) from retainer above cabin door.

10. Remove headliner aft to first wire bow.

11. Remove the wire bow (4, figure 2-27A) from support (2). Remove wire bow (4) from sewed loop of headliner. Repeat this procedure aft to the baggage shelf.

12. Remove upholstery retainer (20, figure 2-27A).

13. Remove retainer (28, figure 2-27A) which will release the headliner.

14. Remove remaining headliner bows and remove headliner (5, figure 2-27A).

f. Remove left upholstery panel (8, figure 2-27A) as follows: (See figure 2-28A.)

1. Remove left trim pad (18).

2. Remove armrest (7, figure 2-27A) by lifting from armrest tab sockets (6, figure 2-27A).

3. Remove ash receivers (19) by tilting ash receiver forward and releasing spring. Remove screws securing unit to upholstery panel.

4. Remove wemac unit by removing attaching screws.

5. Remove emergency exit window pan in accordance with paragraph 2-225.

6. Remove circuit breaker panel door.

7. Remove attaching screws securing upholstery panel (8, figure 2-27A) and remove upholstery panel from the aircraft.

g. Remove attaching screws from lower left upholstery panel and remove panel.

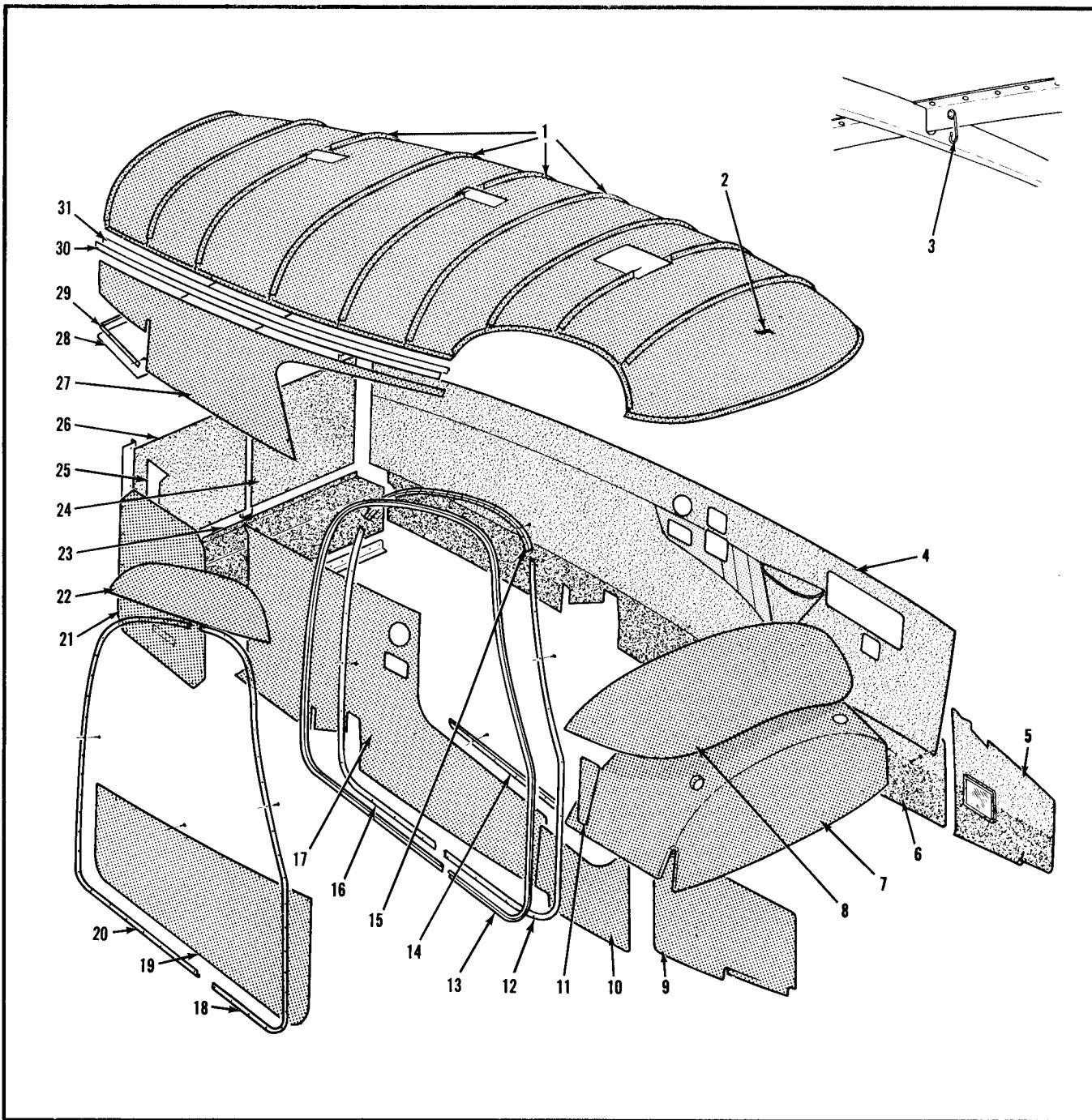
h. Remove attaching screws from right rear upholstery panel (25, figure 2-27A) and remove panel.

i. If further removal of the upholstery group or the upholstery trim is necessary, figure 2-27A and 2-28A illustrates the respective position of all components.

j. Install upholstery and upholstery trim by reversing the procedure outlined in this paragraph.

2-194. REMOVAL AND INSTALLATION OF UPHOLSTERY AND UPHOLSTERY TRIM. (Serials 35772 and on. See figures 2-27B and 2-28A.)

a. Remove front seat in accordance with paragraph 2-179.



- | | | |
|-------------------------------------|----------------------------------|---------------------------------|
| 1. Headliner Wire | 11. Upper Right Upholstery Panel | 22. Upper Door Panel Upholstery |
| 2. Headliner Assembly | 12. Forward Door Jamb | 23. Lower Curtain |
| 3. Headliner Wire Clip | 13. Windlace | 24. Left Curtain Assembly |
| 4. Left Upholstery Panel | 14. Retainer | 25. Right Rear Upholstery Panel |
| 5. Left Forward Upholstery Panel | 15. Clip Assembly | 26. Right Curtain Assembly |
| 6. Lower Left Upholstery Panel | 16. Right Upholstery Panel | 27. Aft Right Upholstery Panel |
| 7. Instrument Panel Deck Insulation | 17. Aft Door Jamb Retainer | 28. Baggage Shelf Cover |
| 8. Instrument Panel Deck Cover | 18. Forward Retainer | 29. Baggage Shelf Trim |
| 9. Right Forward Upholstery Panel | 19. Lower Door Panel Upholstery | 30. Retainer Support Strip |
| 10. Lower Right Upholstery Panel | 20. Aft Retainer | 31. Retainer Strip |
| | 21. Baggage Door Cover | |

Figure 2-27B. Upholstery Installation (Serial 35772 and on)

- b. Remove rear seat in accordance with paragraph 2-182.
- c. Remove dome, rear dome, and instrument light console panel in accordance with paragraph 6-73.
- d. To remove headliner assembly (2, figure 2-27B) proceed as follows:
 - 1. Remove windshield upper trim (15, figure 2-28A).
 - 2. Remove left front window trim (8, figure 2-28A).
 - 3. Remove both rear window trims (3, figure 2-28A).
 - 4. Remove curtain stops, curtains, and tracks (6, 34, and 5, figure 2-28A).
 - 5. Remove coat hooks (1, figure 2-28A).
 - 6. Remove trim strips (18, 32, figure 2-28A).
 - 7. Remove both aft upholstery panels (28, figure 2-27B).
 - 8. Remove both retainer strips (32, figure 2-27B).
 - 9. Remove luggage shelf trim (30, figure 2-27B).
 - 10. Start at the left side of the windshield and remove the headliner from the prong edges of the windshield upper retainer.
 - 11. Working from the front to the rear, remove headliner assembly by unhooking headliner wires (1, figure 2-27B) from headliner wire clips (3, figure 2-27B).
- e. Remove cabin door upholstery as follows:
 - 1. Remove door window trim (25, figure 2-28A).
 - 2. Remove upper door panel upholstery from retainer.
 - 3. Remove door trim (27, figure 2-28A) from retainer.
 - 4. Remove lower door panel upholstery by removing two screws from the armrest and the two end screws from retainer (26, figure 2-28A).
 - f. Baggage compartment upholstery (24, 25, and 27, figure 2-27B) is removed by rotating the Dzus fasteners.
 - g. Remove cabin side upholstery (4, 5, 6, 9, 10, and 17, figure 2-27B) as follows:
 - 1. Remove carpeting in accordance with 2-204.
 - 2. Remove right forward upholstery panel (9, figure 2-27B), and right upholstery panel (17, figure 2-27B) in the order listed.
 - 3. Remove lower left upholstery panel (6, figure 2-27B), left forward upholstery panel (5, figure 2-27B), and left upholstery panel (4, figure 2-27B) in the order listed.
 - h. If further removal of the upholstery group or the upholstery trim is necessary, figure 2-27B and 2-28A illustrates the respective position of all components.
 - i. Install upholstery and upholstery trim by reversing the procedure outlined in this paragraph.

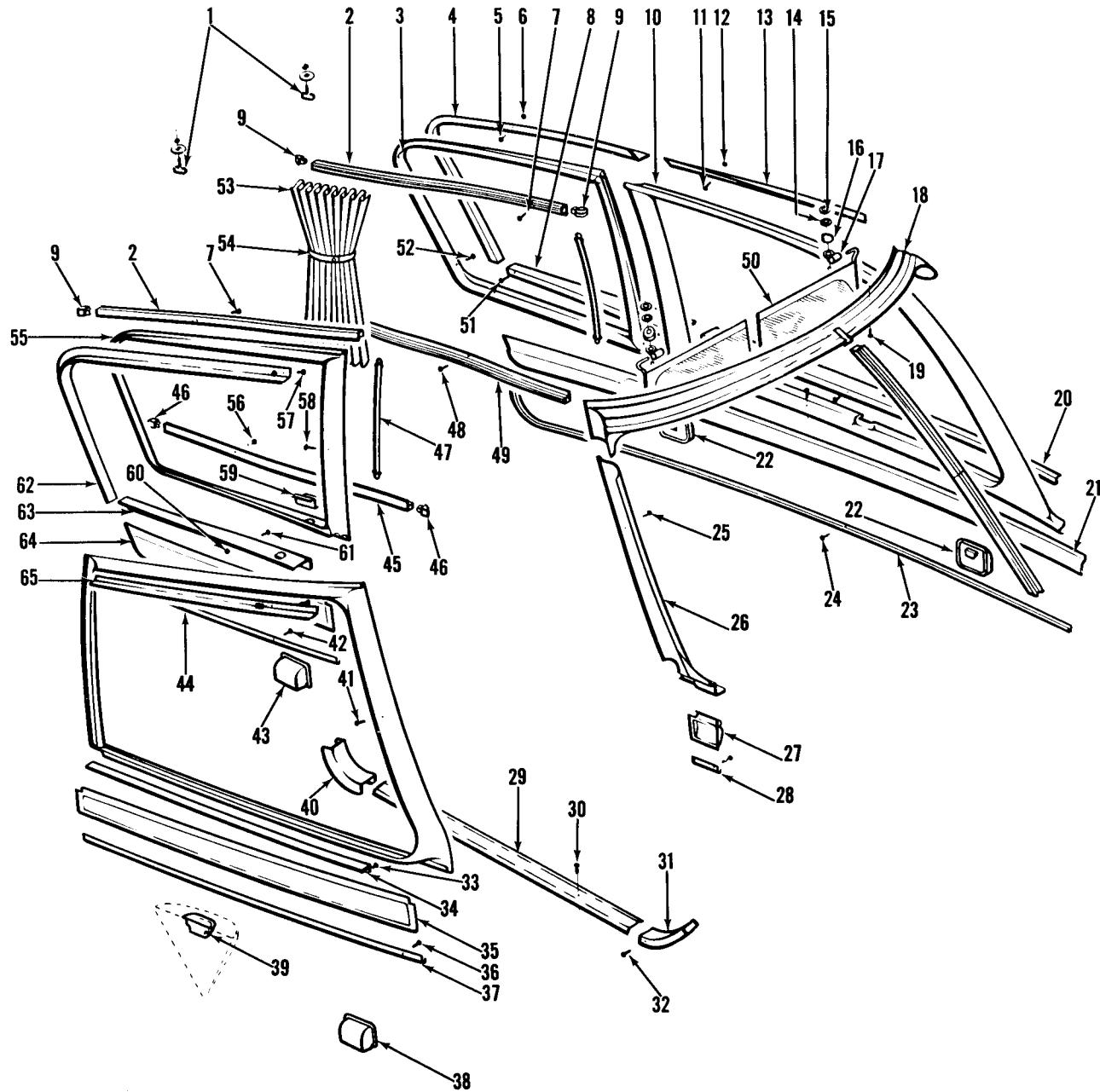


Figure 2-28. Upholstery Trim Installation (Serial 35000 thru 35546)

Figure 2-28. Upholstery Trim Installation Callouts

- | | | |
|------------------------------------|---------------------------------|--------------------------------|
| 1. Coat Hanger Hook | 22. Ash Receiver | 45. Right Lower Curtain Track |
| 2. Left Upper Curtain Track | 23. Upholstery Retainer | 46. Curtain Track Stop |
| 3. Left Rear Window Trim | 24. Screw | 47. Right Assist Cord |
| 4. Left Upper Window Support | 25. Screw | 48. Screw |
| 5. Screw | 26. Right Window Post Trim | 49. Left Lower Curtain Track |
| 6. Nut | 27. Trim Pad | 50. Sun Visor |
| 7. Screw | 28. Upholstery Retainer | 51. Screw |
| 8. Left Lower Window Support | 29. Door Jamb Step | 52. Screw |
| 9. Curtain Track Stop | 30. Screw | 53. Curtain Assembly |
| 10. Left Front Window Trim | 31. Forward Door Jamb Fillet | 54. Curtain Strap |
| 11. Screw | 32. Screw | 55. Right Window Trim |
| 12. Nut | 33. Screw | 56. Screw |
| 13. Left Upper Window Trim Support | 34. Lower Window Trim Support | 57. Screw |
| 14. Washer | 35. Main Door Trim Pad | 58. Screw |
| 15. Washer | 36. Screw | 59. Cigar Lighter Trim Cover |
| 16. Visor Mount | 37. Main Door Trim Pad Retainer | 60. Nut |
| 17. Visor Mount | 38. Cabin Door Ash Receiver | 61. Screw |
| 18. Windshield Upper Trim | 39. Arm Rest Cup | 62. Right Upper Window Support |
| 19. Screw | 40. Aft Door Jamb Fillet | 63. Right Lower Window Support |
| 20. Left Lower Window Trim Support | 41. Screw | 64. Right Trim Pad |
| 21. Left Trim Pad | 42. Screw | 65. Right Window Trim Support |
| | 43. Ash Receiver | |
| | 44. Retainer | |

2-195. CLEANING OF UPHOLSTERY AND UPHOLSTERY TRIM. The upholstery panels can be dry-cleaned with a non-inflammable solvent while installed. The headliner and the baggage shelf area can be cleaned with a vacuum cleaner, brushed with a hard bristle brush, and cleaned again with the vacuum cleaner. Spots or stains can be removed by following the cleaning procedure outlined in paragraph 2-178.

2-196. BAGGAGE COMPARTMENT UPHOLSTERY

2-197. The baggage compartment upholstery varies with the different 310 models. However, all models have baggage compartment rear curtains that are installed with Dzus fasteners for ease of removal and installation. The different baggage compartment upholstery installations are serialized and illustrated in figures 2-27B, 2-29, and 2-29A.

2-198. REMOVAL AND INSTALLATION OF BAGGAGE COMPARTMENT UPHOLSTERY. (Serials 35000 thru 35546 — See figure 2-29.)

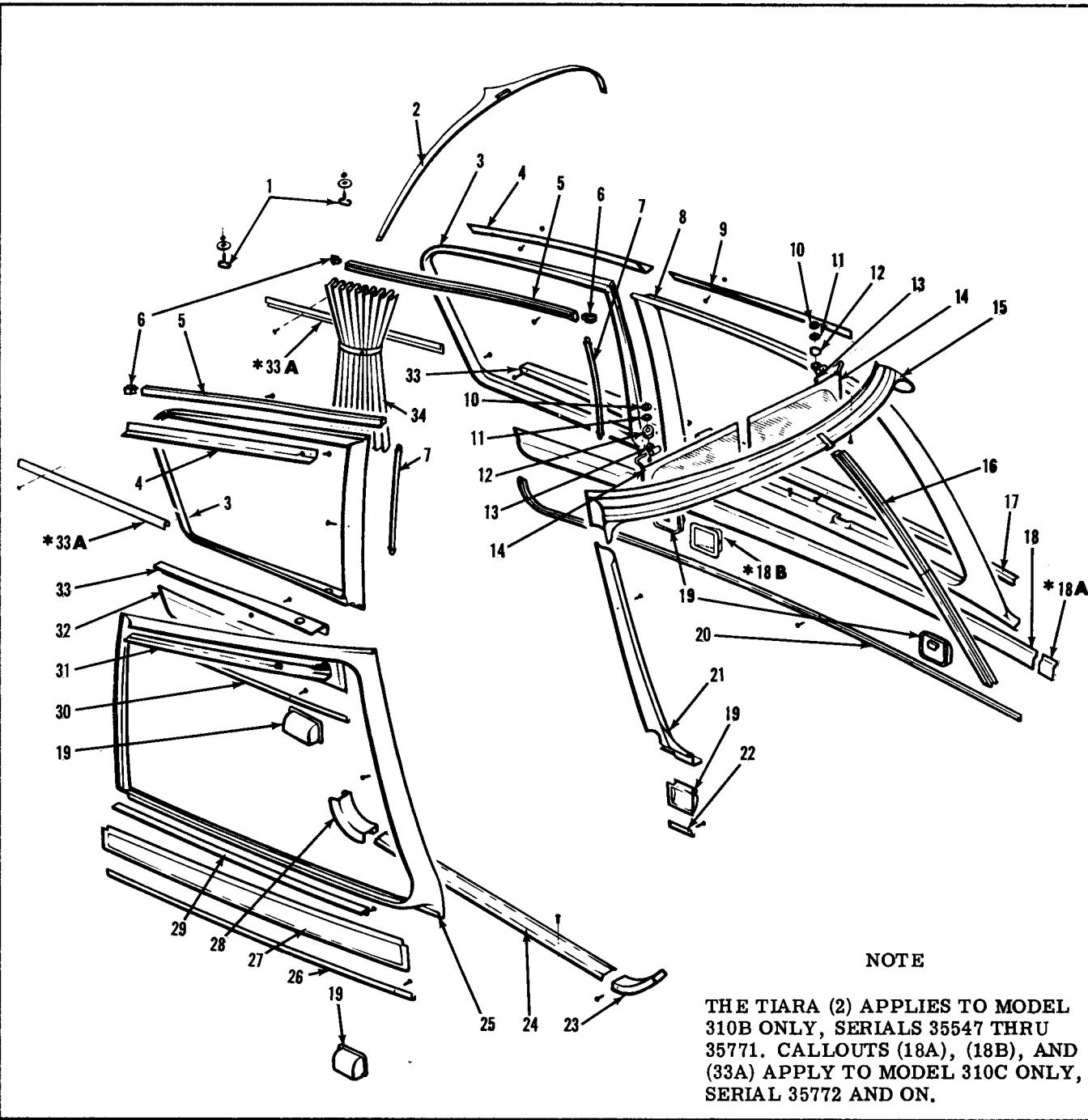
- a. Remove rear baggage compartment curtains by releasing the fasteners.
- b. Remove baggage compartment floor cover (1, figure 2-30).
- c. Remove baggage door upholstery in accordance with paragraph 2-170.
- d. Remove left side panel (10) by removing attaching screws (9).
- e. Remove screws (14) from right forward panel (15) and right upper panel (3) and remove panels from baggage compartment.
- f. Remove screws (5) from upper aft panels (4 and 6) and remove panels.
- g. Install the baggage compartment upholstery by reversing this procedure.

2-199. REMOVAL AND INSTALLATION OF BAGGAGE COMPARTMENT UPHOLSTERY. (Serials 35547 thru 35771 — See figure 2-29A.)

- a. Remove lower curtain (11) by releasing the fasteners.
- b. Remove left and right curtains (2 and 6) by releasing the fasteners.
- c. Remove the skirt at the bottom of the rear seat by removing the attaching screws.
- d. Remove scuff plate (13) by removing the attaching screws.
- e. Remove baggage compartment floor cover (28, figure 2-30).
- f. Remove left side panel (8) and door cover (15) by removing attaching screws.
- g. Remove the baggage compartment light by removing attaching screws.
- h. Remove upper right panel (16) by removing attaching screws.
- i. Install the baggage compartment upholstery by reversing this procedure.

2-200. REMOVAL AND INSTALLATION OF BAGGAGE COMPARTMENT UPHOLSTERY. (Serial 35772 and on — See figure 2-27B.) On serial 35772 and on, the baggage compartment upholstery is part of the cabin upholstery and is removed with the cabin upholstery 2-194.

2-201. CLEANING OF BAGGAGE COMPARTMENT UPHOLSTERY. All leatherette panels can be cleaned with lukewarm water and a mild soap solution. Fabric upholstery and carpeting can be brushed and vacuumed.

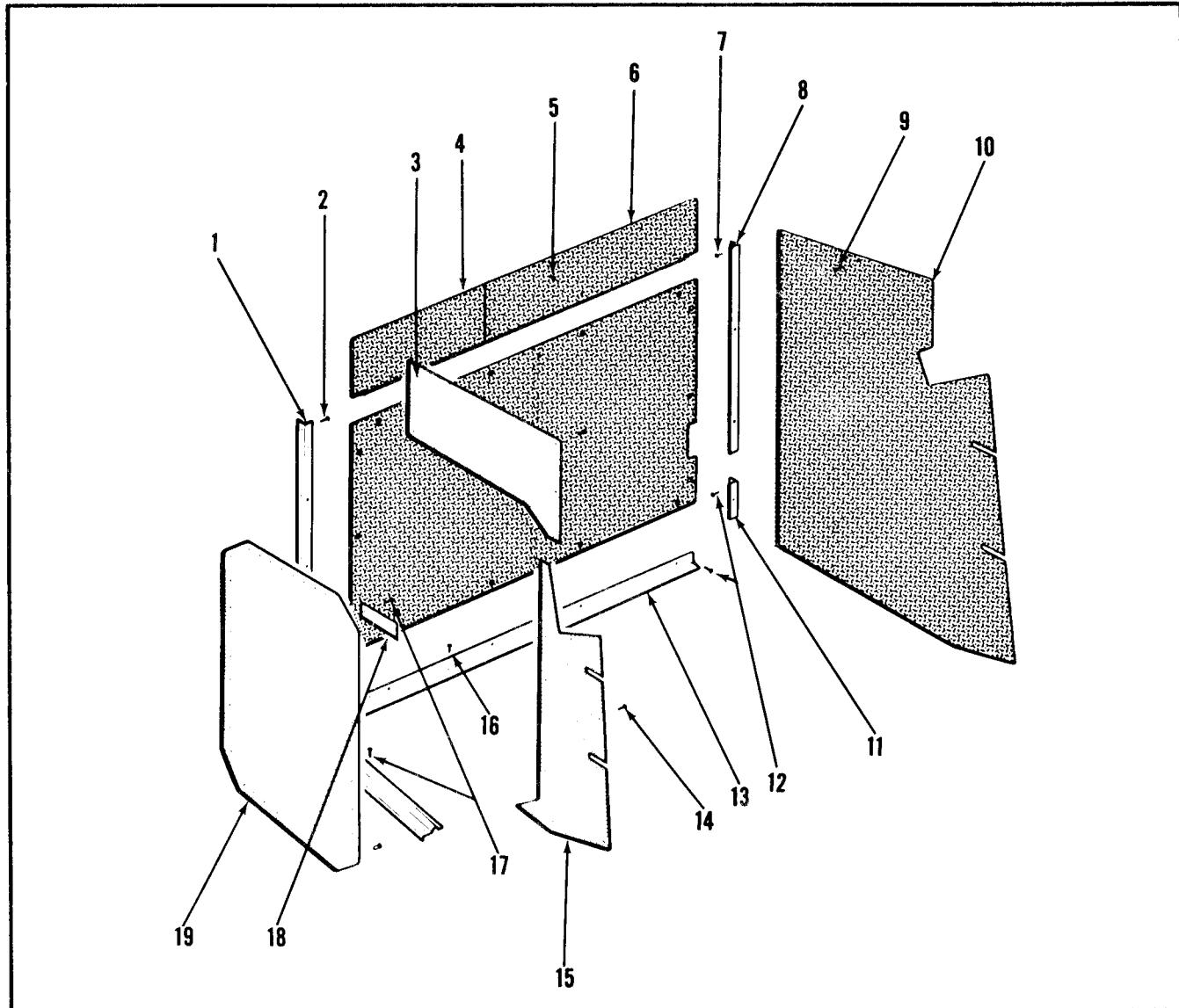


NOTE

THE TIARA (2) APPLIES TO MODEL
310B ONLY, SERIALS 35547 THRU
35771. CALLOUTS (18A), (18B), AND
(33A) APPLY TO MODEL 310C ONLY,
SERIAL 35772 AND ON.

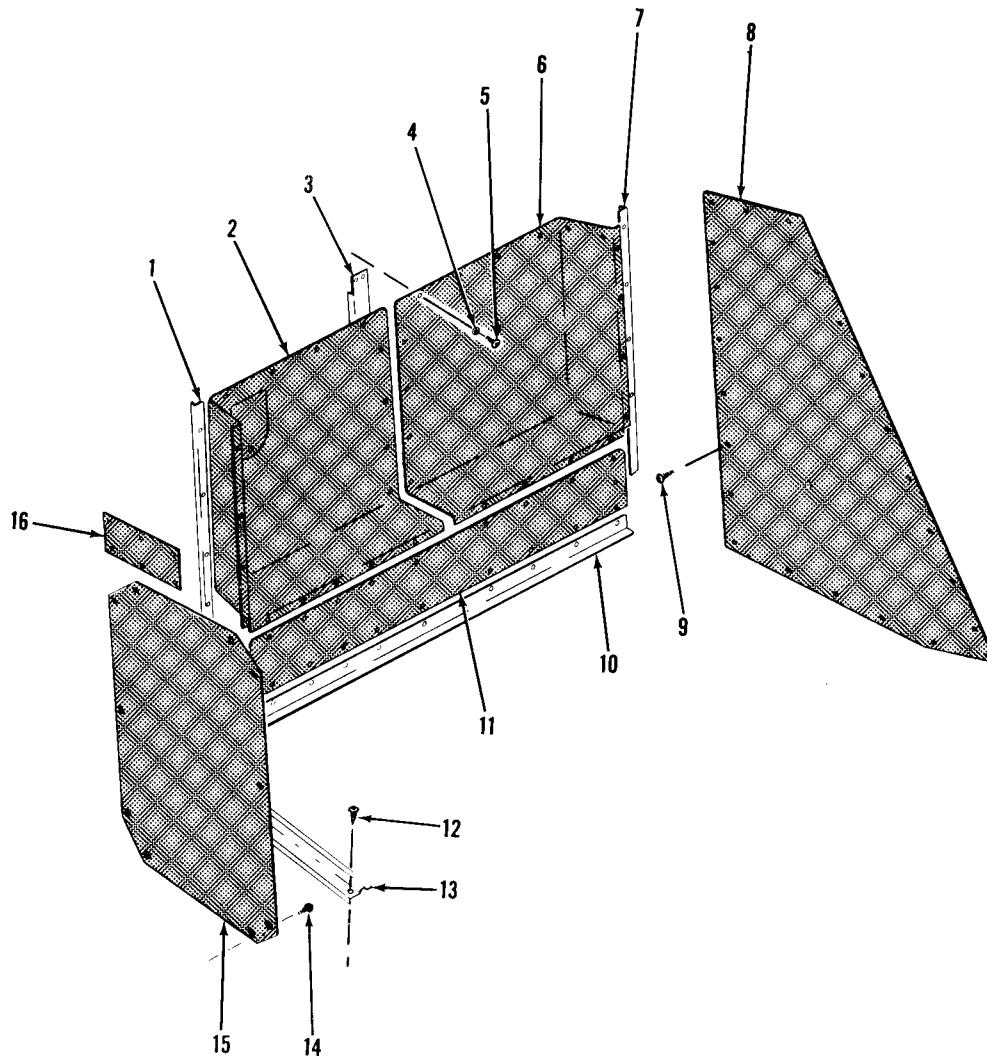
1. Coat Hook
2. Tiara
3. Rear Window Trim
4. Upper Trim Support
5. Curtain Track
6. Curtain Stop
7. Assist Cord
8. Left Front Window Trim
9. Upper Trim Support
10. Washer
11. Washer
12. Visor Mount
13. Bolt
14. Sun Visor
15. Upper Windshield Trim
16. Center Windshield Trim
17. Lower Trim Support
18. Left Trim Pad
- *18A. Insert Panel
- *18B. Cigar Lighter Trim Cup
19. Ash Receiver
20. Retainer
21. Window Post Trim
22. Retainer
23. Forward Door Jamb Fillet
24. Door Jamb Step
25. Door Window Trim
26. Retainer
27. Door Trim Pad
28. Aft Door Jamb Fillet
29. Lower Trim Support
30. Retainer
31. Upper Trim Support
32. Rear Trim Pad
33. Lower Trim Support
- *33A. Retainer
34. Curtain

Figure 2-28A. Upholstery Trim (Serial 35547 and on)



- | | | |
|-------------------------------|-------------------------------------|------------------------------|
| 1. Right Rear Curtain Support | 7. Screw | 14. Screw |
| 2. Screw | 8. Left Upper Rear Curtain Support | 15. Right Forward Panel |
| 3. Right Upper Panel | 9. Screw | 16. Screw |
| 4. Right Upper Aft Panel | 10. Left Side Panel | 17. Screw |
| 5. Screw | 11. Left Lower Rear Curtain Support | 18. Baggage Capacity Placard |
| 6. Left Upper Aft Panel | 12. Screw | 19. Baggage Door Cover |
| | 13. Lower Rear Curtain Support | |

Figure 2-29. Baggage Compartment Upholstery (Serials 35000 thru 35546)



- | | | |
|-------------------------------|------------------------------|------------------------|
| 1. Right Rear Curtain Support | 6. Left Curtain Assembly | 12. Screw |
| 2. Right Curtain Assembly | 7. Left Rear Curtain Support | 13. Scuff Plate |
| 3. Center Curtain Support | 8. Left Panel | 14. Screw |
| 4. Grommet | 9. Screw | 15. Baggage Door Cover |
| 5. Fastener | 10. Lower Curtain Support | 16. Upper Right Panel |
| | 11. Lower Curtain | |

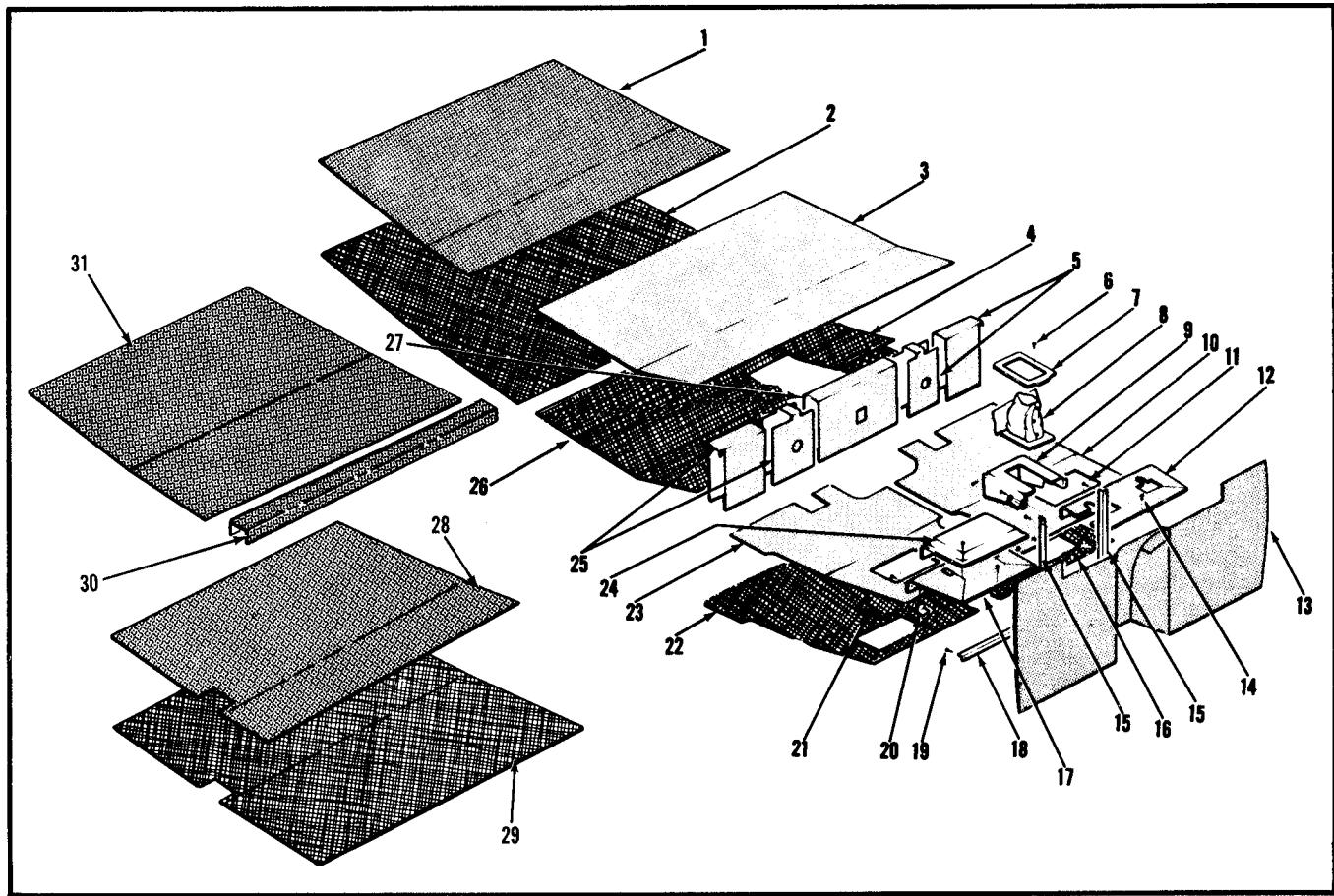
Figure 2-29A. Baggage Compartment Upholstery (Serial 35547 thru 35771)

2-202. CARPET.

2-203. The cabin floor, from the firewall aft to the rear spar, is installed and carpeted. The baggage compartment floor is also covered. The insulation reduces the noise in the cabin area and also provides adequate cushioning for the carpet. The insulation is glued to the floorboards. The carpet is secured over the insulation by use of screws, support angles, and retainers. The carpet is easily removed for repair or replacement by removing the attaching screws. The carpet will give long service provided the correct care and maintenance is performed.

2-204. REMOVAL AND INSTALLATION OF THE CARPET. (See figure 2-30.)

- a. Remove front seats in accordance with paragraph 2-177.
- b. Remove rear seat in accordance with paragraph 2-181.
- c. Remove regulator shield by removing attaching screws. The regulator shield is located underneath the copilot's seat, protecting the paralleling relay and the generator regulator terminals.
- d. Remove screws (19) from angles (15 and 18) securing the bulkhead carpet (13). Remove angles (15 and 18) and bulkhead carpet.
- e. Remove left and right rudder bar shields (12 and 17) by removing attaching screws.
- f. Remove scuff plates (11) by removing attaching screws.
- g. Remove control column boot (8) and retainer (7)



1. Baggage Compartment Floor Cover (Serial 35000 thru 35546)
2. Baggage Compartment and Aft Cabin Insulation (Serial 35000 thru 35546)
3. Center Floorboard Carpet
4. Landing Gear Actuator Access Door Insulation
5. Left Front Spar Carpet
6. Screw
7. Control Column Boot Retainer
8. Control Column Boot
9. Control Column Cover
10. Left Front Floorboard Carpet
11. Scuff Plate
12. Left Rudder Bar Shield
13. Bulkhead Carpet
14. Screw
15. Support Angle
16. Left Front Floorboard Insulation
17. Right Rudder Bar Shield
18. Right and Left Support Angle
19. Right Floorboard Insulation - Screw
20. Support Angle
21. Scuff Plate Insulation
22. Right Floorboard Insulation
23. Right Front Floorboard Carpet
24. Right Rudder Shield Cover Plate
25. Right Front Spar Carpet
26. Floorboard Insulation
27. Front Spar Center Carpet
28. Baggage Compartment Floor Cover (Serial 35547 thru 35771)
29. Baggage Compartment and Aft Cabin Insulation (Serial 35547 thru 35771)
30. Aft Spar Carpet (Serial 35772 and on)
31. Baggage Compartment Floor Cover (Serial 35772 and on)

Figure 2-30. Carpet Installation

by removing screws (6).

h. Remove control column cover (9) by removing attaching screws.

i. Remove left (10) and right (23) carpets by removing attaching screws, and freeing carpet from glued insulation.

j. Remove front center spar carpet (27) by loosening and freeing carpet from glued insulation.

k. Remove center floorboard carpet (3) by removing attaching screws. The center floorboard carpet has an insulation cover glued to the assembly.

l. Remove the baggage floor cover by removing the lower rear curtain support and attaching screws.

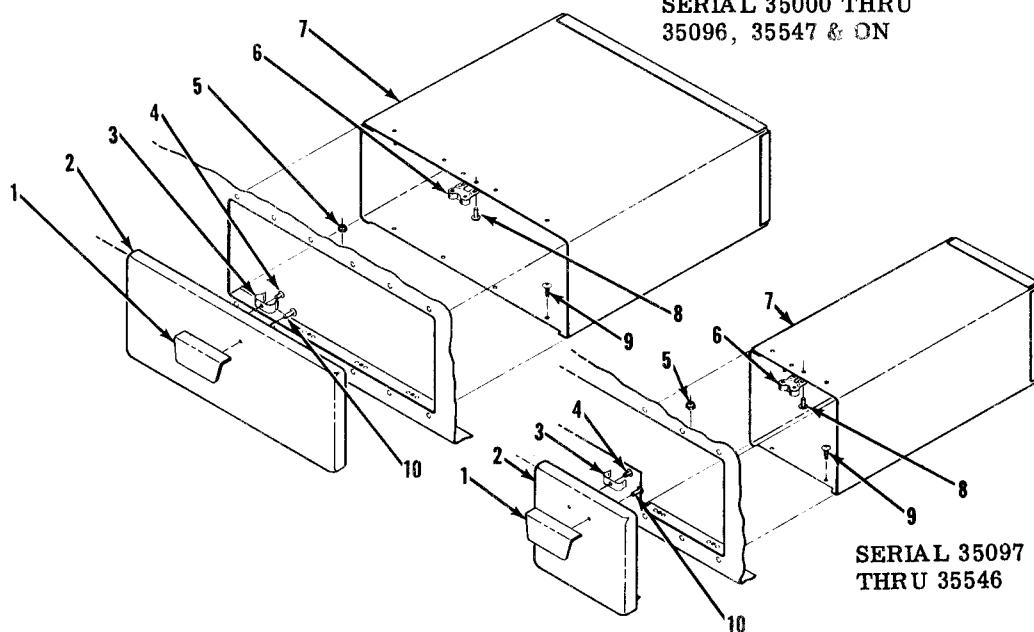
m. Carefully loosen the left (16) and right (22) front floorboard insulation from the floorboard area. The insulation assembly is glued to the floorboard and un-

less considerable damage is noted, replace only the areas affected. Provisions are made for the access holes. These areas are cut out and the insulation is glued to the access hole cover. This also refers to the floorboard insulation (26) and the baggage compartment insulation (2).

n. Install carpet by reversing the removal procedure outlined in this paragraph.

2-205. CLEANING OF CARPET. Using a small whisk broom loosen the dirt and then vacuum clean the carpet. The more difficult spots or stains can be removed by using a non-inflammable dry-cleaning fluid. General care of the carpets is the same as the care of the carpets in your home.

SERIAL 35000 THRU
35096, 35547 & ON



- | | |
|------------------|-------------------------|
| 1. Knob Assembly | 6. Catch Assembly |
| 2. Door Assembly | 7. Compartment Assembly |
| 3. Clip | 8. Screw |
| 4. Screw | 9. Screw |
| 5. Nut | 10. Screw |

Figure 2-31. Glove Compartment Assembly

2-206. GLOVE COMPARTMENT.

2-207. A glove compartment is located on the lower right side of the stationary instrument panel. The door assembly is hinged at the bottom and is secured to the compartment assembly at the top by a catch assembly. A knob assembly is located on the front of the door assembly for pulling open the door. The compartment can be easily removed for repair or replacement.

2-208. REMOVAL OF GLOVE COMPARTMENT. Remove screws (8 and 9), and nut (5) from instrument panel. Remove glove compartment assembly (7) from aircraft.

2-209. DISASSEMBLY AND ASSEMBLY OF GLOVE COMPARTMENT. (See figure 2-31.) Remove door assembly (2) by pulling hinge pin. Remove screw (10) from knob assembly (1). Remove screw (4) from clip (3). Remove screw (8) and nut (5) from catch assembly (6). To assemble, reverse the preceding procedure.

2-210. INSTALLATION OF GLOVE COMPARTMENT. Position glove compartment assembly in stationary instrument panel and secure with screws (9).

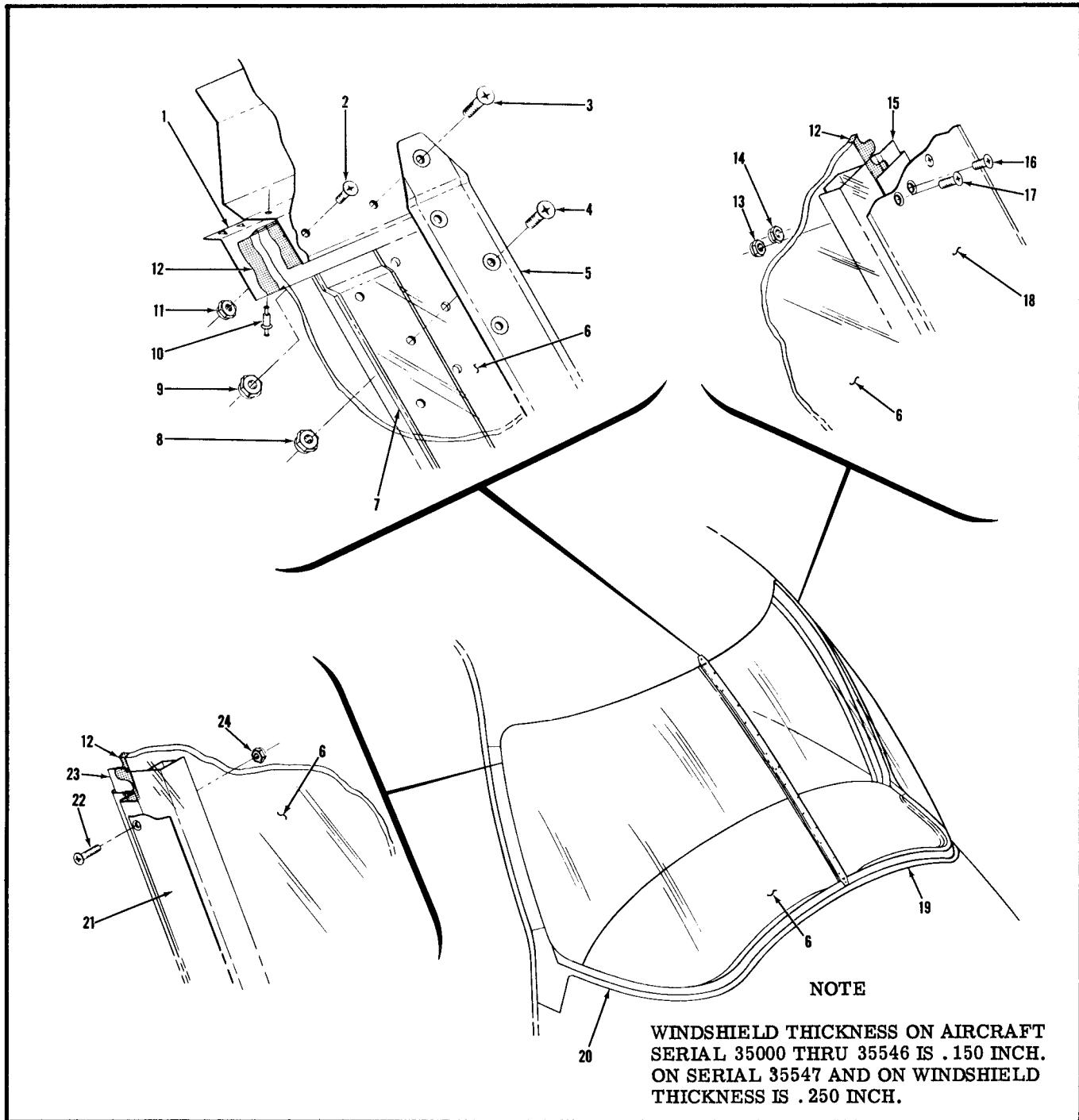
2-211. WINDSHIELD.

2-212. The windshield is a single piece of formed plastic. The windshield is secured to the fuselage by rivet and screw fastened retainers. Inside and outside metal stiffeners provide support at the center of the windshield. The inside stiffener supports the magnetic compass.

2-213. REMOVAL OF WINDSHIELD. (See figure 2-32.)

- Remove magnetic compass in accordance with paragraph 5-71.
- Remove left, right and upper windshield upholstery trim panels in accordance with paragraph 2-192, 193, or 194.
- Remove headliner form upper edge of windshield in accordance with paragraph 2-192, 193, or 194.
- Drill rivets out of left outside retainer (19) and right outside retainer (20).
- Remove nuts (8 and 9), and screws (3 and 4), and windshield center stiffeners (5 and 7).
- Remove left skin (18) by removing nuts (13 and 14) and screws (16 and 17).
- Remove right skin (21) by removing nuts (24) and screws (22).
- Remove windshield (6) from aircraft.

2-214. INSTALLATION OF WINDSHIELD. (See figure 2-32.)



- | | |
|-----------------------------|----------------------------|
| 1. Inside Upper Retainer | 13. Nut |
| 2. Screw | 14. Nut |
| 3. Screw | 15. Left Inside Retainer |
| 4. Screw | 16. Screw |
| 5. Outside Center Stiffener | 17. Screw |
| 6. Windshield Panel | 18. Left Skin |
| 7. Inside Center Stiffener | 19. Left Outside Retainer |
| 8. Nut | 20. Right Outside Retainer |
| 9. Nut | 21. Right Skin |
| 10. Cherry Rivet | 22. Screw |
| 11. Nut | 23. Right Inside Retainer |
| 12. Tape | 24. Nut |

Figure 2-32. Windshield Assembly

- a. Place seal tape (12) on windshield edges and apply sealing compound (Presstite Engineering Co., No. 579.6) on all edges of windshield.
- b. Position windshield (6) and upper retainer (1). Temporarily fasten in place.
- c. Position right-hand skin (21) and left-hand skin (18). Temporarily fasten in place.
- d. Install left-hand retainer (15) and right-hand retainer (23).
- e. Secure left (18) and right-hand (21) skins with screws (16, 17, and 22) and nuts (13, 14, and 24).
- f. Secure inside upper retainer (1) with screws (2), nuts (11) and cherry rivets (10).
- g. Align inside (7) and outside (5) metal stiffeners and secure with screws (3 and 4) and nuts (8 and 9).
- h. Install magnetic compass in accordance with paragraph 5-72.
- i. Install headliner assembly in accordance with paragraph 2-192, 193, or 194.
- j. Install windshield upholstery trim panels in accordance with paragraph 2-192, 193, or 194.

2-215. CABIN WINDOWS.

2-216. The windshield, and the cabin windows are made of one piece formed plastic sheet. The cabin door, the right rear window, and the pilot's window are fixed windows. The left rear window is provided as the emergency exit and the window assembly is jettisonable when the emergency release pull ring is executed. The cabin door has a single one piece panel. The two rear windows have two window panels, the inboard panel is set in channeled rubber and the outboard panel, is flush with the fuselage skin and secured with retainers and rivets. The pilot's storm window is located at the forward lower section of the pilot's window. The pilot's storm window opens out and down and is held at the extended position by a telescope tube assembly. The cabin windows are tinted giving eye comfort within the cabin area. The rear double window panels add to the sound proofing of the aircraft.

2-217. REMOVAL OF CABIN WINDOWS. (See figure 2-33.)

- a. Remove upholstery trim panels, trim pads and trim pad of right rear window and pilot's window retainers in accordance with upholstery removal.

- b. Remove right rear window by removing window trim support (9) and retainer (5).

1. Remove inner window panel (2) if removal of the outboard window panel (1) is necessary. Drill out rivets in the fuselage skin, releasing window panel (1) and retainers.

- c. Remove pilot's window as follows:

1. Remove screw (20) from retainer (17). Remove screw (22) from retainer (21). Remove screws (23) from retainer (24) and lift out window panel (16).

d. Remove pilot's storm window by removing telescopic stop assembly from frame assembly (48) and window frame (40) by removing pins (25) from bracket (26) and tube assembly end (28). Remove hinge pin (43) from hinge half (42) located on window frame (40) and hinge half (47), from frame assembly (48). Remove window frame assembly (40) from airplane.

1. To remove latch assembly (36) remove screws (38) and Esna cap nut (35).

2. If removal of window panel (41) is necessary remove retainer (39).

2-218. INSTALLATION OF CABIN WINDOWS. Install right rear window, pilot's window and pilot's storm window by reversing procedure outlined in paragraph 2-217.

2-219. EMERGENCY EXIT WINDOW.

2-220. The emergency exit window is located on the left rear side of the cabin. The emergency exit window consists of two plastic window panels, a riveted window frame assembly, window panel retainers, and two latches. The frame assembly is locked in place by the two latches. When the emergency release pull ring is pulled, a cable assembly releases the frame assembly so the emergency exit window assembly can be pushed out. A decal is located on the emergency exit window and reads as follows: EMERGENCY EXIT, PULL RING - PUSH WINDOW OUT.

2-221. REMOVAL OF EMERGENCY EXIT WINDOW. (See figure 2-34.)

- a. Remove the upholstery trim from the exit window.
- b. Remove inboard window panel (3).
- c. If removal of the outboard panel (4) is necessary, drill out rivets from skin (9 and 11). This will re-

Figure 2-33. Pilot's and Right Rear Window Installation Callouts

1. Outboard Window Panel	17. Retainer	33. Weather Strip
2. Inboard Window Panel	18. Nut	34. Terminal Assembly
3. Window Trim	19. Window Post Skin	35. Esna Cap Nut
4. Rubber Moulding	20. Screw	36. Latch Assembly
5. Retainer	21. Retainer	37. Latch Handle
6. Tape	22. Screw	38. Screw
7. Nut	23. Screw	39. Retainer
8. Window Post Skin	24. Retainer	40. Window Frame
9. Trim Support and Retainer	25. Esna Roll Pin	41. Plastic Window
10. Nut	26. Bracket	42. Hinge Half
11. Nut	27. Shaft Assembly	43. Hinge Pin
12. Retainer	28. Tube Assembly	44. Terminal Assembly
13. Screw	29. Spring	45. Telescopic Assembly
14. Retainer	30. Nut	46. Screw
15. Nut	31. Screw	47. Hinge Half
16. Window Panel	32. Rubber Channel	48. Frame Assembly

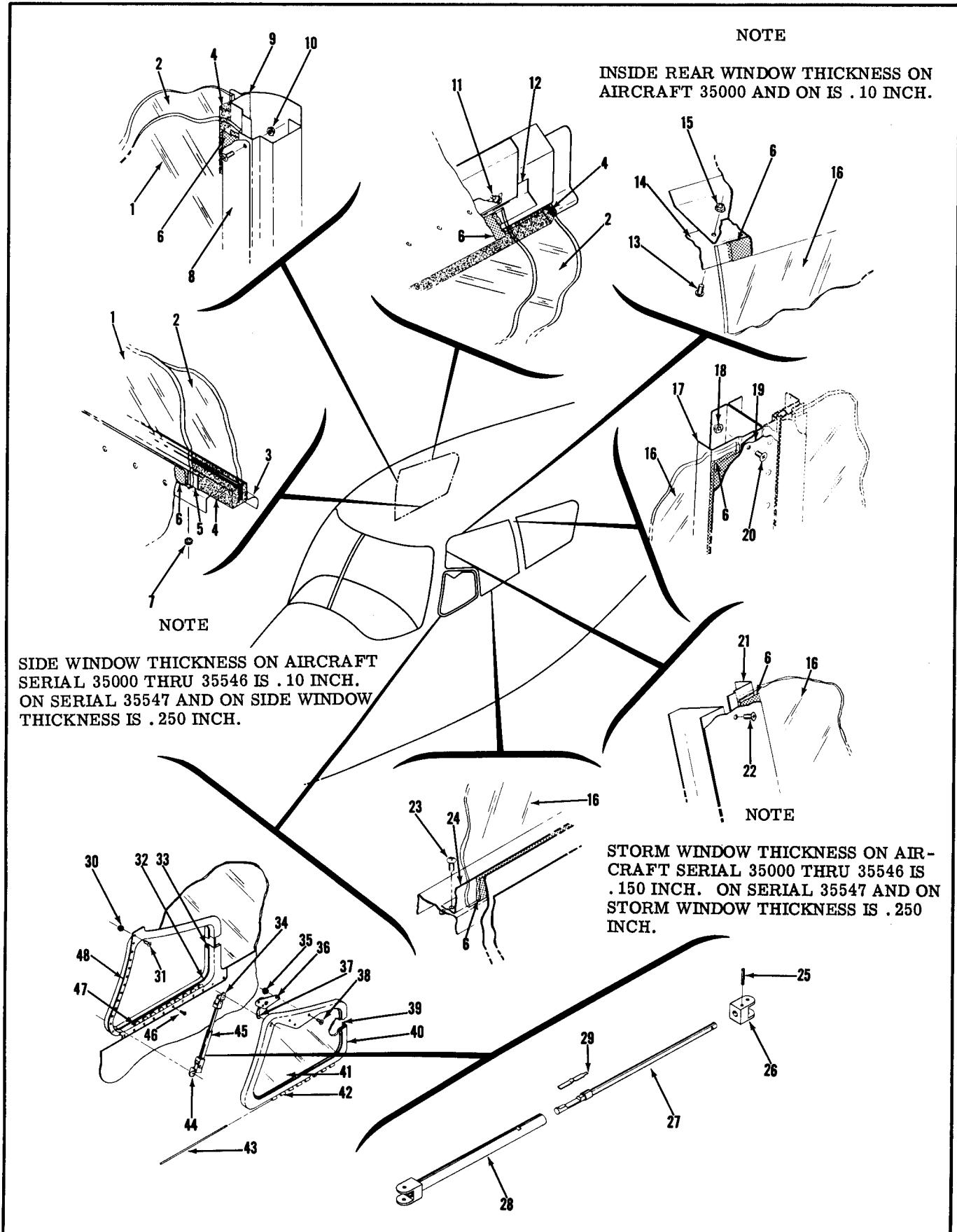


Figure 2-33. Pilot's and Right Rear Window Installation

Figure 2-34. Emergency Window and Mechanism Callouts

- | | | |
|------------------------------|------------------------|--------------------------|
| 1. Trim Support and Retainer | 9. Window Skin | 18. Hat Section |
| 2. Rubber Moulding | 10. Window Trim | 19. Window Release Pan |
| 3. Inboard Window Panel | 11. Window Skin | 20. Window Release Ring |
| 4. Outboard Window Panel | 12. Fuselage Skin | 21. Truloc Ball |
| 5. Tape | 13. Window Frame | 22. Screw |
| 6. Trim | 14. Window Support | 23. Ring Clip |
| 7. Retainer | 15. Window Seal | 24. Window Release Cover |
| 8. Fuselage Skin | 16. Cable Assembly End | 25. Cable Assembly |
| | 17. Flat Head Pin | |

lease retainer (13 and 7). Then remove window panel (4) by releasing cable end (16) from latch assembly.

2-222. INSTALLATION OF EMERGENCY EXIT WINDOW.

a. Install emergency exit window by reversing procedure outlined in paragraph 2-221.

2-223. EMERGENCY EXIT WINDOW RELEASE MECHANISM.

2-224. The emergency release mechanism is located in the left rear upholstery panel, just forward 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.

2-225. REMOVAL OF EMERGENCY WINDOW RELEASE MECHANISM. (See figure 2-34.)

- Remove upholstery trim in accordance with paragraph 2-192, 193, or 194.
- Remove lower curtain track in accordance with paragraph 2-192, 193, or 194.
- Remove rear seat in accordance with paragraph 2-182.
- Remove ash tray and wemac in accordance with paragraph 2-192, 193, or 194.
- Remove cover (24) from pan assembly (19).
- Remove pull ring (20) by removing valve ball from cable assembly.
- Remove upholstery panels in accordance with paragraph 2-192, 193, or 194.
- If removal of the cable assembly (25) is necessary, remove cable ends (16) from catch assembly and remove cable back to hat section (18).

2-226. INSTALLATION OF EMERGENCY WINDOW RELEASE MECHANISM. Install emergency window release mechanism by reversing procedure outlined in paragraph 2-225.

2-227. TRANSPARENT PLASTIC MAINTENANCE. For general maintenance of transparent plastic window panels used in this airplane the subsequent instructions have been included.

2-228. CLEANING.

- Remove dust and dirt from the panels by washing with a solution of mild soap and warm water.
- Dissolve grease and oil deposits with aliphatic naptha, Specification No. TT-N-95. 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 aliphatic naptha Specification No. TT-N-95, as many commercial solvents will soften and 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 airplane.

- Allow the plastic to dry, then wax to give maximum transparency.

CAUTION

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.

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

2-229. REPAIR OF PLASTIC SURFACES. Damaged window panels and windshield of this airplane are ordinarily removed and replaced if the damage is extensive. However, certain repairs as prescribed in the following paragraphs can be made successfully without removing the damaged part from the airplane. 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. See figure 2-35.

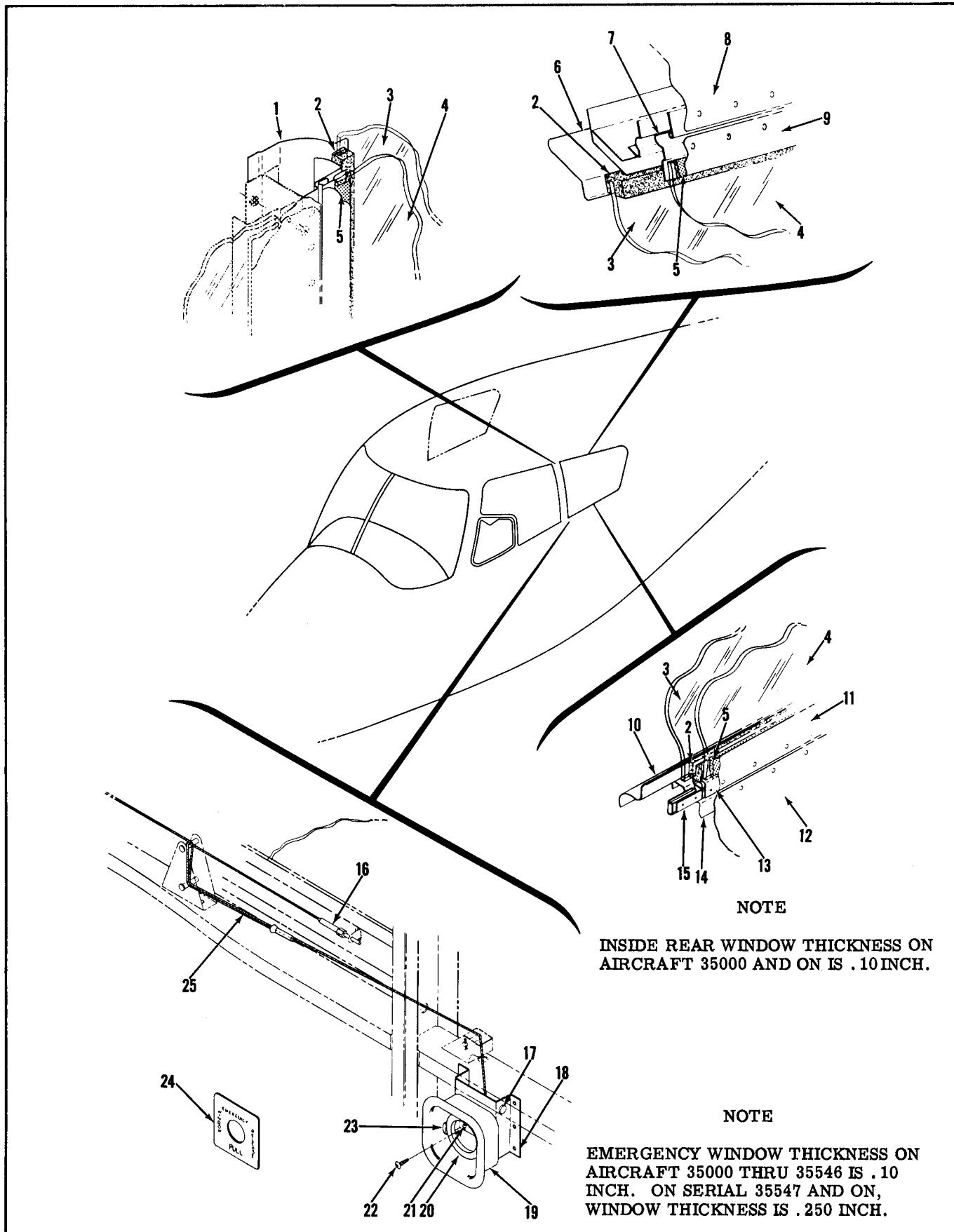


Figure 2-34. Emergency Window and Mechanism Installation

2-230. INSPECTION CRITERIA -- TRANSPARENT PLASTIC ENCLOSURES.

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.
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.
NOTE: Repairs on cabin top windows are to be water tight.				

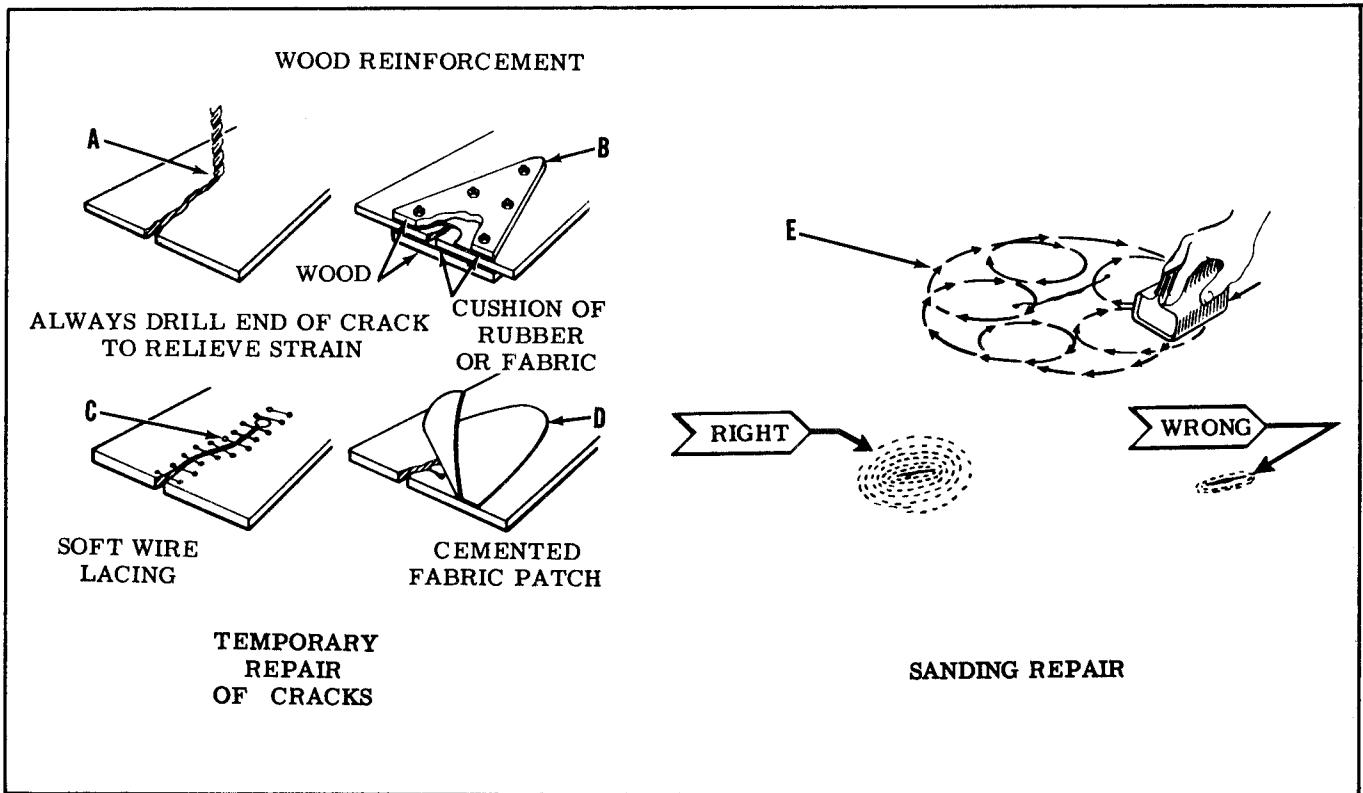


Figure 2-35. Plastic Repairs

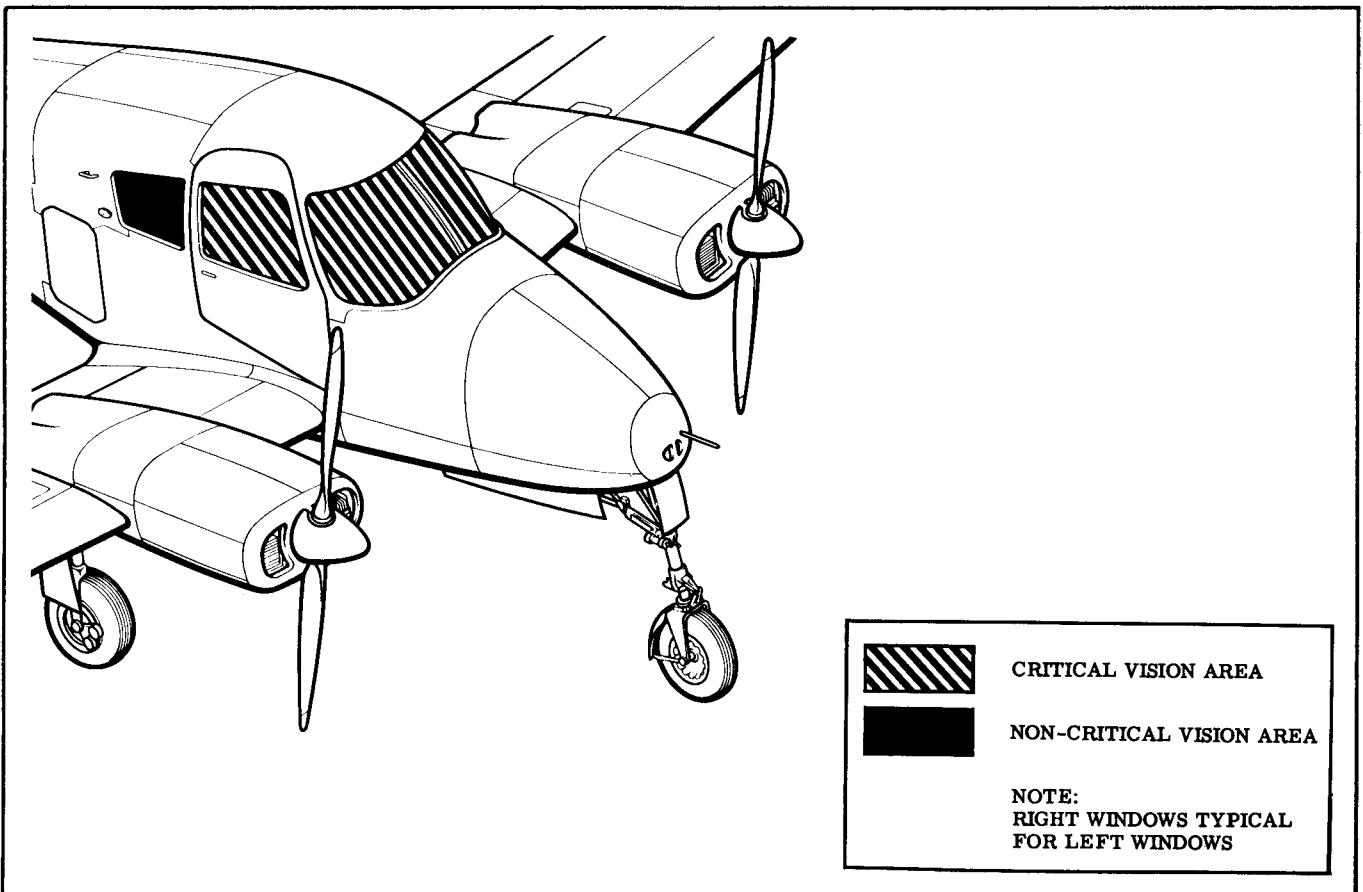


Figure 2-36. Critical Vision Areas

a. 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.

b. Temporary repairs on flat surfaces can be affected 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 airplane fabric should be placed between the wood and plastic on both sides.

c. A temporary repair can be made on a curved surface by placing fabric patches over the affected areas. Secure the patches with airplane 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.

d. 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 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.

e. 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 "bull's-eyes" or other optical distortions.

CAUTION

Do not use a coarse grade of abrasive; No. 320 is the maximum coarseness permitted.

f. Continue the sanding operation, using progressively finer grade abrasives.

g. When the scratches have been removed, wash the area thoroughly with clean water to remove all gritty particles. The entire sanded area will be clouded with minute scratches which must be removed to restore transparency.

h. Apply fresh tallow and buffeting compound to a motor-driven buffering wheel. Hold the wheel against

the plastic surface, moving it constantly over the damages 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 buffering wheel.

i. When buffering 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.

2-231. FUSELAGE STINGER.

2-232. The fuselage stinger is made of reinforced fiberglass and supported with metal stiffeners. The stinger assembly locates the tail navigation light. When VHF radio transceiver (optional equipment) is installed, the reel antenna is located in the fuselage stinger assembly.

2-233. **REMOVAL OF FUSELAGE STINGER.** (See figure 2-38.) Remove attaching screws (2) and move assembly aft from tailcone. Disconnect the electrical wires (4) of the tail navigation light. If a reel antenna (optional equipment) has been installed, disconnect the reel antenna lead wires. Remove stinger assembly (1) from tailcone.

2-234. **CLEANING, INSPECTION AND REPAIR OF FUSELAGE STINGER.** Clean fiberglass area with a suitable solvent. Inspect assembly for dents, cracks, and breaks in the fiberglass area of the fuselage stinger.

Figure 2-37. Decals and Placards Installation Callouts

1. Emergency Window Release Cover
2. Emergency Window - Decal
3. Operational Limits - Decal
4. Stall Speed Limits - Decal
5. Pilot's Storm Window - Decal
6. Filling Instructions - Metalcal
- 6A. Auxiliary Tank Drain - Decal
- 6B. Strainer Drain Pull Handle - Decal
7. Fuel Cap - Decal
8. Fuel Tank Sump Door - Decal
9. Lower Nacelle Fuel Strainer Doors - Decal
10. M.A.A. Nameplate
11. Finish and Trim-Plate
12. Elevator Tab Indicator - Metalcal
13. Fuel and Gear - Placard
14. Left Fuel Selector Valve - Metalcal
15. Right Fuel Selector Valve - Metalcal
16. Trade Mark Registration Placard
17. Cessna - Decal
18. Cross-Feed Line Drain - Decal
19. Baggage Door - Placard
20. Nameplate
21. 310 - Decal
22. Escutcheon Plate
23. Flap Indicator - Decal

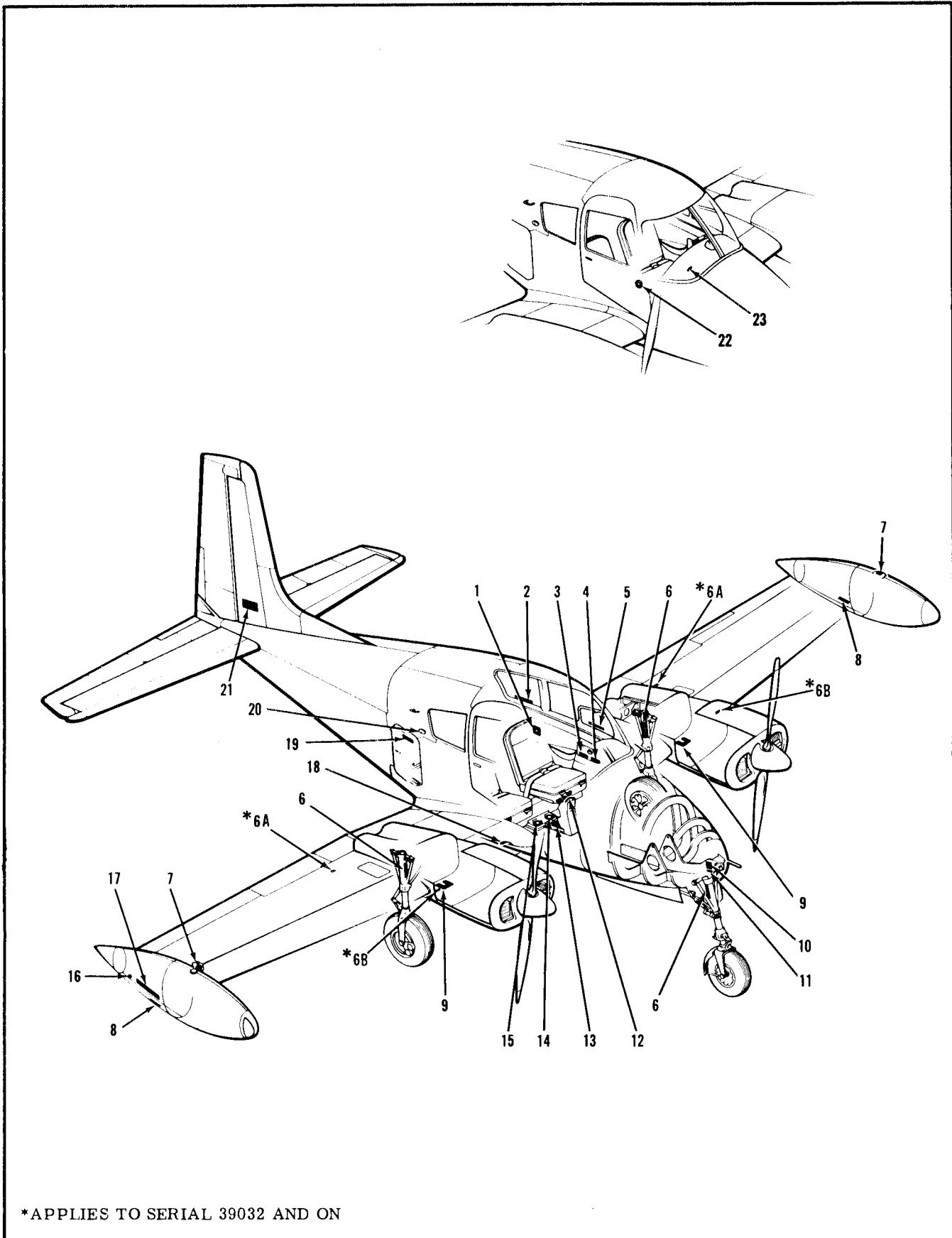


Figure 2-37. Decals and Placards Installation

Temporary repair of the fiberglass area can be made, but replacement should be accomplished as soon as possible. The tail navigation light should be replaced if damaged.

2-235. INSTALLATION OF FUSELAGE STINGER.

(See figure 2-38.)

- a. If removed, install tail navigation light, in accordance with paragraph 6-100.
- b. Place stinger assembly (1) near tailcone.
- c. If antenna reel (optional equipment) is installed, connect reel and lead wires.
- d. Connect electrical wire (4).
- e. Secure stinger assembly (1) to tailcone with screws (2).

2-236. DECALS, METALCALS, AND PLACARDS.

(See figure 2-37.)

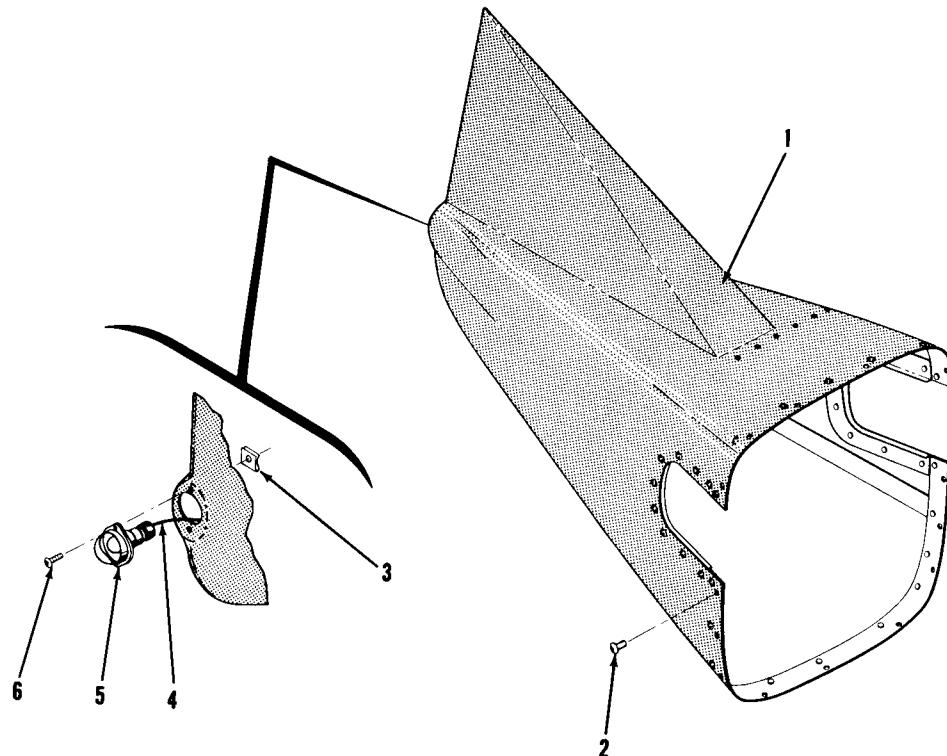
2-237. REMOVAL OF DECALS AND PLACARDS.

- a. Remove decals by sponging with lukewarm water and a mild powdered soap.

- b. Remove placards by removing attaching screws.
- c. Remove metalcals by lifting edges and pulling off.
- d. When removing escutcheon plate (22) loosen set screw in cabin door handle and remove handle and spacer.
- e. To remove and replace fuel selector valve metalcals (14), remove indicator arm by removing roll pin and peel off metcal.

2-238. INSTALLATION OF DECALS, METALCALS, AND PLACARDS.

- a. Install decals by soaking in water and sliding transfer to the desired location. Make certain the area is free of dirt before applying decal.
- b. Install metalcals by peeling off the protective coating and applying the metcal to a clean surface. Smooth out the metcal and roll smooth. Be certain all outer edges are secured and rolled flat.
- c. Install placards with attaching screws. Never tighten screws down to the point of cracking the placard.



1. Fuselage Stinger
2. Screw

3. Tinnerman Nut
4. Electrical Wire

5. Tail Light Assembly
6. Screw

Figure 2-38. Fuselage Stinger

2-239. LANDING GEAR.

2-240. 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 overtravel 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 airplane is on the gear.

2-241. TROUBLE SHOOTING LANDING GEAR.

TROUBLE	PROBABLE CAUSE	CORRECTION
LANDING GEAR FAILS TO RETRACT — GEAR MOTOR OPERATES.	Manual extension crank improperly stowed.	Stow crank properly.
	Defective landing gear actuator.	Replace actuator.
	Defective reduction unit.	Replace reduction unit.
	Pin sheared on gear motor shaft.	Replace pin.
	Broken bolts or retracting linkage, or disconnected retracting linkage.	Replace broken parts. Connect linkage if disconnected.
LANDING GEAR FAILS TO RETRACT — 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 UP limit switch.	Replace switch. Adjust in accordance with paragraph 2-315.
	Defective landing gear safety switch.	Replace switch. Adjust in accordance with paragraph 2-317.
	Incorrectly adjusted landing gear safety switch.	Adjust in accordance with paragraph 2-317.
	Defective landing gear relay.	Replace relay.
	Defective landing gear switch.	Replace switch.
	Defective landing gear motor.	Replace motor.
	Defective UP electrical circuit.	Repair circuit.
LANDING GEAR FAILS TO RETRACT COMPLETELY.	Landing gear incorrectly rigged for retracted position.	Rig in accordance with paragraph 2-315 or 2-316.
	Circuit breaker out, due to overload caused by incorrect landing gear rigging.	Reset circuit breaker and rig in accordance with paragraph 2-315 or 2-316.
	Circuit breaker out, due to overload caused by defective retracting linkage.	Reset circuit breaker, replace defective linkage, and rig in accordance with paragraph 2-315 or 2-316.

TROUBLE	PROBABLE CAUSE	CORRECTION
	UP limit switch incorrectly adjusted.	Adjust in accordance with paragraph 2-315.
ONE LANDING GEAR FAILS TO RETRACT.	Retracting linkage to affected gear broken or disconnected.	Replace broken parts. Connect linkage if disconnected. Rig in accordance with paragraph 2-315 or 2-316.
ONE LANDING GEAR FAILS TO RETRACT COMPLETELY.	Affected landing gear incorrectly rigged for retracted position.	Rig in accordance with paragraph 2-315 or 2-316.
	Defective retracting linkage to affected landing gear.	Replace defective linkage and rig in accordance with paragraph 2-315 or 2-316.
LANDING GEAR FAILS TO EXTEND — GEAR MOTOR OPERATES.	Manual extension crank improperly stowed.	Stow crank properly.
	Defective landing gear actuator.	Replace actuator.
	Defective reduction unit.	Replace reduction unit.
	Pin sheared on gear motor shaft.	Replace pin.
	Broken bolts or retracting linkage, or disconnected retracting linkage.	Replace broken parts. Connect linkage if disconnected.
LANDING GEAR FAILS TO EXTEND — GEAR MOTOR DOES NOT OPERATE.	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Insufficient electrical power.	Recharge batteries. Check voltage regulators.
	Defective DOWN limit switch.	Replace switch. Adjust in accordance with paragraph 2-315.
	Defective landing gear switch.	Replace switch.
	Defective landing gear motor.	Replace motor.
	Defective DOWN electrical circuit.	Repair circuit.
LANDING GEAR FAILS TO EXTEND COMPLETELY.	DOWN limit switch incorrectly adjusted.	Adjust in accordance with paragraph 2-315.
	Landing gear incorrectly rigged for the DOWN position.	Rig in accordance with paragraph 2-315 or 2-316.
	Circuit breaker out, due to overload caused by incorrect rigging.	Reset circuit breaker and rig in accordance with paragraph 2-315 or 2-316.
	Circuit breaker out, due to overload caused by defective retracting linkage.	Reset circuit breaker, replace defective linkage, and rig in accordance with paragraph 2-315 or 2-316.
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 paragraph 2-315 or 2-316.

TROUBLE	PROBABLE CAUSE	CORRECTION
ONE LANDING GEAR FAILS TO EXTEND COMPLETELY.	Affected landing gear incorrectly rigged for the DOWN position.	Rig in accordance with paragraph 2-315 or 2-316.
	Defective retracting linkage to affected gear.	Replace defective linkage and rig in accordance with paragraph 2-315 or 2-316.
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 paragraph 2-309.
	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 paragraphs 2-315 and 2-316.
GEAR UP (RED) LIGHT FAILS TO LIGHT.	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Lamp burned out.	Replace lamp.
	Lamp loose.	Repair or replace receptacle.
	Defective electrical circuit.	Repair circuit.
	Landing gear not fully retracted.	Retract fully.
	Defective or incorrectly adjusted UP limit switch.	Replace and/or adjust switch in accordance with paragraph 2-315.
GEAR UP (RED) LIGHT REMAINS ON WHEN GEAR IS DOWN.	Defective UP limit switch.	Replace switch and adjust in accordance with paragraph 2-315.
	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 electrical circuit.	Replace circuit breaker. Repair defective 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 switches defective or incorrectly adjusted.	Replace defective switches and/or adjust in accordance with paragraph 2-313.
GEAR DOWN (GREEN) LIGHT REMAINS ON WHEN GEAR IS UP.	Circuit shorted to another system.	Locate and repair.

TROUBLE	PROBABLE CAUSE	CORRECTION
GEAR DOWN (GREEN) LIGHT FLICKERS WHEN GEAR IS DOWN.	One or more DOWN indicator switches defective or incorrectly adjusted.	Replace defective switches and/or adjust in accordance with paragraph 2-313.
	Loose lamp.	Repair or replace receptacle.
GEAR WARNING HORN SOUNDS IN FLIGHT WHEN LANDING GEAR IS DOWN AND THROTTLES ARE RE-TARDED.	Defective nose gear DOWN indicator switch.	Replace defective switch and adjust in accordance with paragraph 2-313.
GEAR WARNING HORN SOUNDS IN FLIGHT WHEN LANDING GEAR IS UP AND THROTTLES ARE NOT RE-TARDED.	Defective throttle microswitch.	Replace switch and adjust in accordance with paragraph 2-313.
	Incorrectly adjusted throttle microswitch.	Adjust in accordance with paragraph 2-313.
GEAR WARNING HORN SOUNDS ON THE GROUND WHILE LANDING GEAR SWITCH IS DOWN.	Incorrectly adjusted nose gear DOWN indicator switch.	Adjust switch in accordance with paragraph 2-313.
	Defective nose gear DOWN indicator switch.	Replace switch and adjust in accordance with paragraph 2-313.
GEAR WARNING HORN SOUNDS WHEN BATTERY SWITCH IS TURNED ON, OR SOUNDS WHEN AN UNRELATED SYSTEM IS TURNED ON.	Circuit shorted to another system.	Locate and repair.
	Incorrectly adjusted nose gear DOWN indicator switch.	Adjust switch in accordance with paragraph 2-313.
	Defective nose gear DOWN indicator switch.	Replace switch and adjust in accordance with paragraph 2-313.
GEAR WARNING HORN FAILS TO SOUND WHEN LANDING GEAR SWITCH IS PLACED UP WHILE ON THE GROUND.	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Landing gear safety switch incorrectly adjusted.	Adjust in accordance with paragraph 2-317.
	Defective landing gear safety switch.	Replace switch and adjust in accordance with paragraph 2-317.
	Defective electrical circuit.	Repair circuit.
	Defective warning horn or flasher unit.	Replace horn or flasher unit.
GEAR WARNING HORN FAILS TO SOUND IN FLIGHT WHEN LANDING GEAR IS UP AND THROTTLES ARE RETARDED.	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace circuit breaker.
	Defective nose gear DOWN indicator switch.	Replace switch and adjust in accordance with paragraph 2-313.
	Defective electrical circuit.	Repair circuit.
	Defective warning horn or flasher unit.	Replace horn or flasher unit.
	Throttle microswitch incorrectly adjusted.	Adjust in accordance with paragraph 2-313.

TROUBLE	PROBABLE CAUSE	CORRECTION
	Defective throttle microswitch.	Replace switch and adjust in accordance with paragraph 2-313.
LANDING GEAR DOORS FAIL TO OPERATE PROPERLY.	Doors incorrectly rigged.	Rig doors in accordance with paragraphs 2-253 and 2-272.
	Defective door operating linkage.	Replace defective linkage.
LANDING GEAR SHIMMIES DURING FAST TAXI, TAKE-OFF, OR LANDING.	Insufficient fluid in shimmy dampener.	Service shimmy dampeners in accordance with paragraph 1-41.
	Internal leakage in shimmy dampener.	Replace defective seals and/or piston.
	Roll pin attaching piston to piston rod sheared.	Replace roll pin.
	Shimmy dampener loose at mounting.	Replace worn housing and/or attaching bolt.
	Tires out of balance.	Replace tires with tread worn unevenly or flat spots.
	Worn or loose wheel bearings.	Replace and/or adjust wheel bearings.
	Excessive clearance between upper and lower torque links.	Adjust clearance in accordance with paragraph 2-318.
	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 paragraph 2-318.
	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 paragraph 2-108.
	One brake dragging.	Determine cause and correct.
	Steering cam roller sheared at top of nose strut.	Replace defective assembly.
	Defective nose gear steering springs.	Replace springs.
NOSE GEAR FAILS TO STRAIGHTEN WHEN LANDING GEAR EXTENDS.	Steering cam roller sheared at top of nose strut.	Replace defective assembly.
	Incorrect rigging of nose gear steering system.	Rig in accordance with paragraph 2-108.
NOSE GEAR FAILS TO STRAIGHTEN WHEN LANDING GEAR RETRACTS.	Centering cam follower sheared at steering yoke support.	Replace defective assembly.
ATTITUDE OF AIRPLANE ON GROUND IS INCORRECT.	Landing gear struts incorrectly inflated.	Inflate struts correctly.

TROUBLE	PROBABLE CAUSE	CORRECTION
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.

2-242. MAIN LANDING GEAR.

NOTE

2-243. Each main landing gear consists of a wheel and tire assembly, brake assembly, lower strut, cantilever axle, upper truss assembly, and torque links. The air-oleo shock strut contains an orifice and tapered metering pin which vary the resistance to shock according to its severity. During extension and retraction, the landing gear pivots on heavy-duty needle bearings by means of trunnion shafts attached to the upper truss assembly.

2-244. REMOVAL OF MAIN LANDING GEAR. (See figure 2-39.)

- a. Jack airplane in accordance with paragraph 1-15.
- b. Drain brake system by removing bleeder screw and loosening bleeder valve (10 and 17, figure 2-67).
- 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 (2) and down indicator switch (22) 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 in accordance with paragraph 2-251.
- h. Disconnect retracting linkage as follows:
 - 1. Disconnect outboard push-pull tube (33) from bellcrank (18) by removing nut (20), washers (19), and bolt (17).
 - 2. Disconnect upper side link (30) from lower side link (29) by removing nut (32), washer (31), and bolt (27).
 - i. Remove landing gear by removing nuts (14), washers (15 and 16), and U-bolts (12). Support gear to prevent dropping.

After removing landing gear, attaching shafts (11) can be removed by pulling them from landing gear supports (8). Needle bearings (9) in which the attaching shafts pivot are a press fit, and should be removed only for replacement. Attaching shafts and bearings must both be removed by driving them toward wheel well.

CAUTION

If attaching shafts (11) are removed, note the amount and thickness of washers (10). These washers should be installed exactly as they were located before removal, to insure proper alignment of side link assembly.

2-245. DISASSEMBLY OF MAIN LANDING GEAR. (See figure 2-40.)

- a. Remove wheel and tire assembly in accordance with paragraph 2-256.
- b. If desired, retracting linkage components remaining attached to landing gear may be removed. Remove in accordance with paragraph 2-292.
- c. Completely deflate strut, and, after all air has been expelled, remove valve body (19) and drain fluid.
- d. Remove brake assembly from lower strut in accordance with paragraph 2-347.
- e. Remove lower strut assembly (20) from upper truss assembly (17) as follows:
 - 1. Remove torque links (3), brake hose clamps (4 and 12), bushing (5), and safety switch bracket (16) by removing cotter pins (8), nuts (7 and 13), washers (2, 6, and 14), and bolts (1 and 9).
 - 2. Disconnect brake hose (15) from brake line (10) at union (11), and remove hose.
 - 3. Remove lock ring (24) from lower end of truss

Figure 2-39. Main Landing Gear Installation Callouts

- | | | |
|-------------------------------|---------------------------|-----------------------------|
| 1. Screw | 12. U-bolt | 23. Screw |
| 2. Landing Gear Safety Switch | 13. Truss Weld Assembly | 24. Side Brake Lock Link |
| 3. Bracket | 14. Nut | 25. Bracket |
| 4. Nut | 15. Washer | 26. Nut |
| 5. Bolt | 16. Washer | 27. Bolt |
| 6. Washer | 17. Bolt | 28. Door Link Rod |
| 7. Nut | 18. Bellcrank | 29. Lower Side Link |
| 8. Landing Gear Support | 19. Washer | 30. Upper Side Link |
| 9. Bearing | 20. Nut | 31. Washer |
| 10. Washer | 21. Spacer | 32. Nut |
| 11. Attaching Shaft | 22. Down Indicator Switch | 33. Outboard Push-pull Tube |

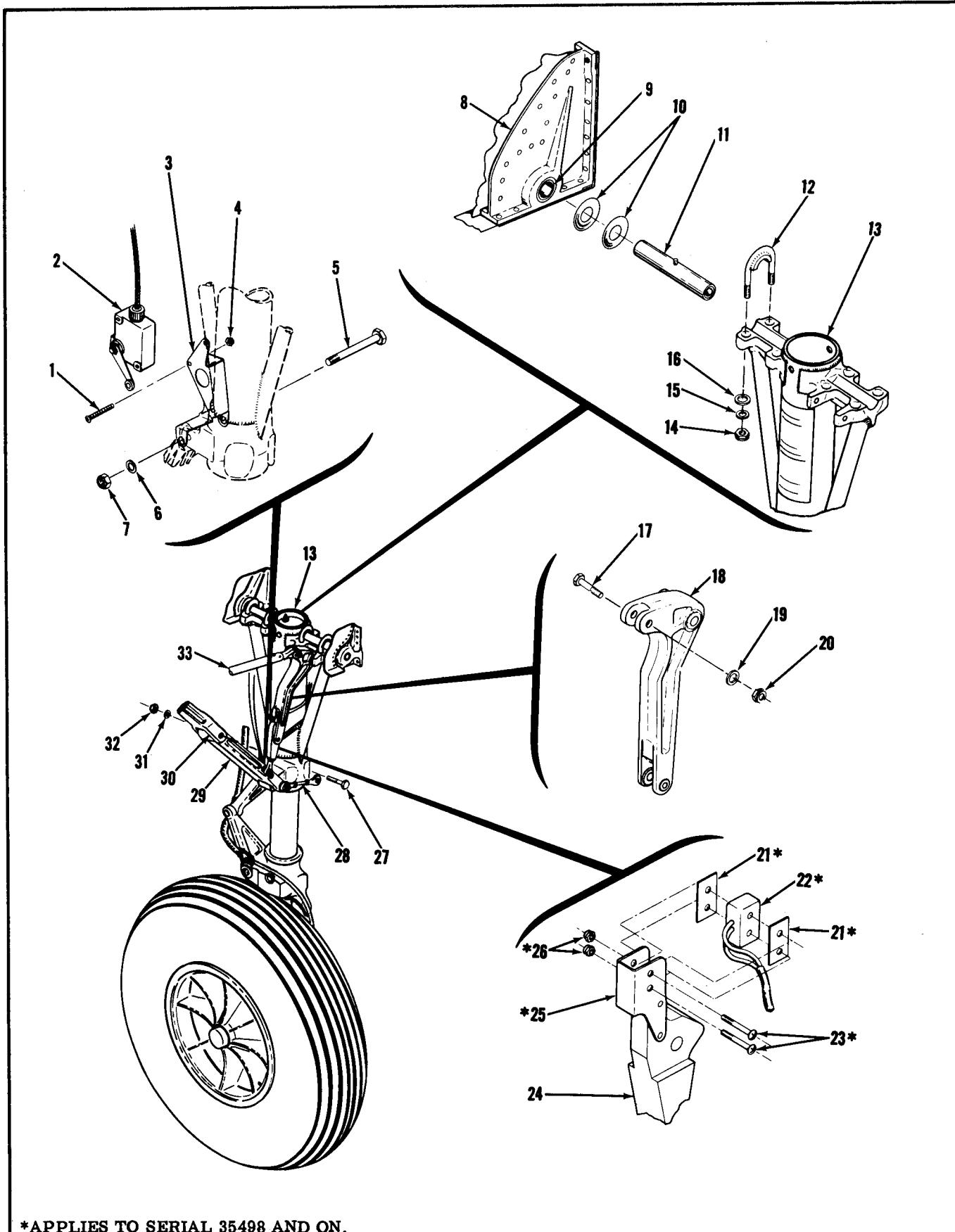
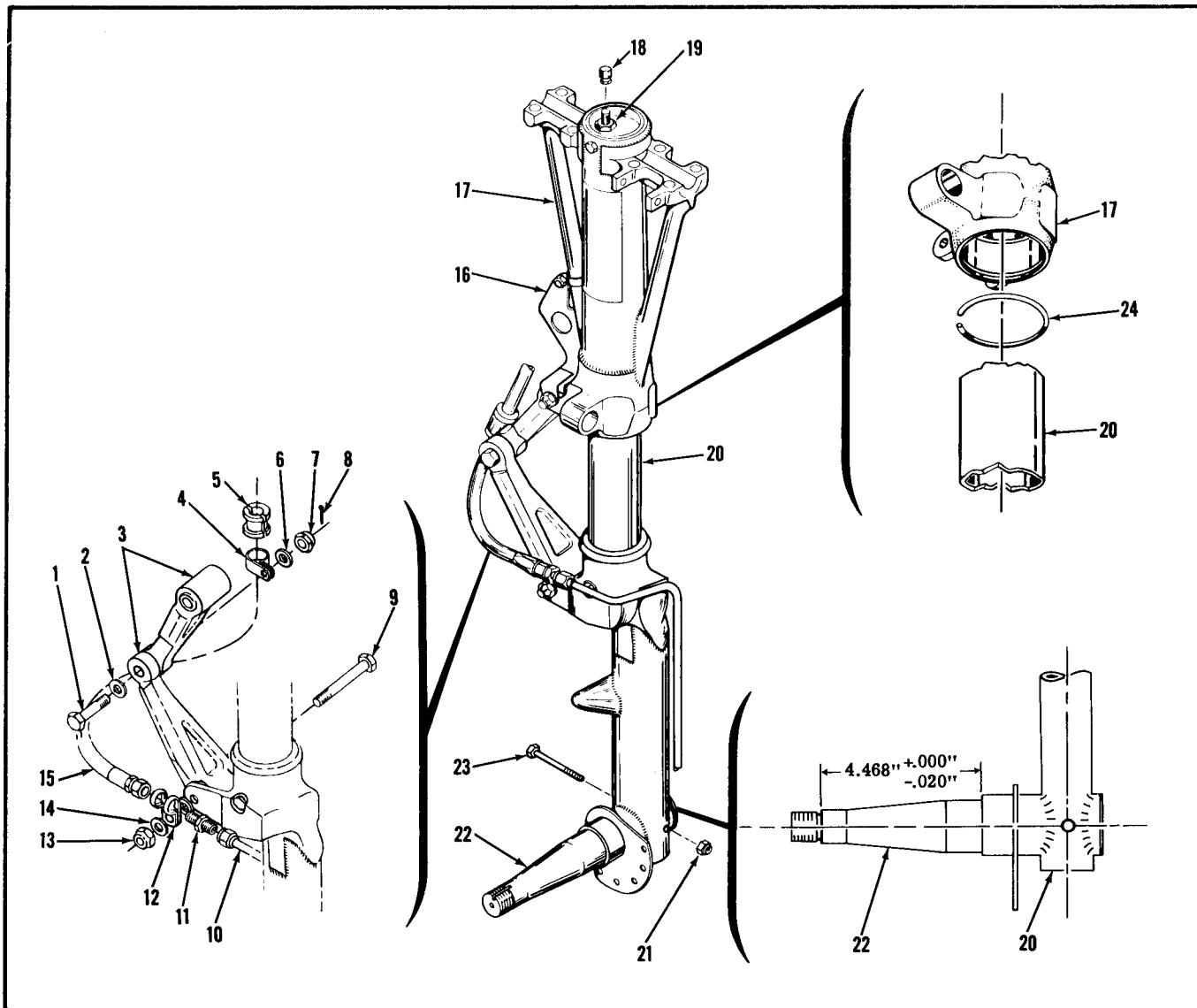


Figure 2-39. Main Landing Gear Installation



- | | |
|----------------|--------------------------|
| 1. Bolt | 13. Nut |
| 2. Washer | 14. Washer |
| 3. Torque Link | 15. Brake Hose |
| 4. Clamp | 16. Switch Bracket |
| 5. Bushing | 17. Truss Weld Assembly |
| 6. Washer | 18. Valve Cap |
| 7. Nut | 19. Valve Body |
| 8. Cotter Pin | 20. Lower Strut Assembly |
| 9. Bolt | 21. Nut |
| 10. Brake Line | 22. Axle |
| 11. Union | 23. Bolt |
| 12. Clamp | 24. Lock Ring |

Figure 2-40. Main Landing Gear Disassembly

assembly (17).

4. Separate lower strut assembly (20) from truss assembly (17) by applying a sharp, straight pull.

CAUTION

Removal and handling of the lower strut should be done with care to prevent the possibility of

damage to exposed parts.

f. (See figure 2-41.) Disassemble upper truss assembly (2) as follows:

1. Unsafety and remove two bolts (1), and remove orifice piston support assembly (3) from upper truss (2).
2. Remove O-ring (31) from orifice piston support assembly (3).

3. If desired, orifice piston (6) and tube (4) can be removed from orifice piston support assembly (3) by removing eight screws (5).

NOTE

These three parts are drilled and tapped on assembly. Mark each part before disassembly, and reassemble in the same position to assure proper mating of parts.

- g. (See figure 2-41.) Disassemble lower strut assembly (19) as follows:
1. Remove lock ring (30) from upper end of strut.
 2. Remove bearing (29), spacer (28), shim (27), packing support ring (25), scraper ring (22), remaining ring (21), and lock ring (20).

NOTE

Shim (27) is installed as required, and may not be found on all struts.

3. Remove O-rings (24 and 26) and backup rings (23) from packing support ring (25).
4. Remove metering pin base plug (10) by removing nut (12), washer (13), and bolt (18), and remove through the top of lower strut.

CAUTION

If metering pin and base plug are to be reinstalled, use extreme caution during removal.

5. Remove metering pin (7) from pin base plug (10) by removing nut (11) and O-ring (8). Remove outer O-ring (9) from pin base plug.
6. Remove axle (16) by removing nut (15) and bolt (17), and pressing out of strut.

2-246. CLEANING, INSPECTION, AND REPAIR OF MAIN LANDING GEAR.

- a. Clean all metal parts with suitable cleaning 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 suitable solvent.

- b. Clean all O-rings and seals with system hydraulic fluid.
- c. Inspect all components for excessive wear, cracks, dents, nicks, and scratches. Especially check the outer barrel of the lower strut assembly for any defects that may damage seals.
- d. 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.

2-247. ASSEMBLY OF MAIN LANDING GEAR. (See

figure 2-41.) 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. Align mounting holes of axle (16) with holes in strut (19), press into position, and install with bolt (17) and nut (15).

NOTE

If a new axle is being installed, press the axle to a depth of 4.468 inches (plus zero, minus .020 inch) from face of thread relief to axle receiving sleeve. Using the existing holes in lower strut as guides, drill and ream the axle to .250 inch (plus .002, minus .001 inch). Refer to figure 2-40.

- b. (See figure 2-41.) Assemble lower strut (19) as follows:

1. Carefully work O-ring (8) over threads of metering pin (7) and install in pin base plug (10) with nut (11).
2. Install O-ring (9) in groove on outside of pin base plug (10).
3. Insert pin base plug (10), with metering pin and O-ring assembled, into lower strut (19). Align mounting holes and install bolt (18), washer (13), and nut (12).

NOTE

If a new pin base plug is being installed, insert into strut to $12.54 \pm .03$ inches from top of strut to top of pin base plug. Using the existing holes in strut as guides, drill and ream pin base plug to .313 inch (plus .002, minus zero inches). Refer to figure 2-41.

4. Install O-ring (26) in groove provided on outside of packing support ring (25). Install O-ring (24) and backup rings (23) in groove provided on inside of packing support ring (25), with the O-ring between the two backup rings.

5. Slide over the top of lower strut (19), in the order mentioned, the following parts: lock ring (20), retaining ring (21), scraper ring (22), packing support ring (25), shim (27), spacer (28), and bearing (29). Install lock ring (30) in groove at upper end of strut (19).

NOTE

Install shim (27) as required to remove end play from packing support ring (25), when installed in upper truss (2).

- c. Assemble upper truss (2) as follows:

1. If orifice piston (6) and tube (4) were removed from orifice piston support (3), reassemble by installing eight screws (5). Safety the screws so that safety wire cannot damage lower strut.

NOTE

These three parts are drilled and tapped on assembly, and should be assembled in their

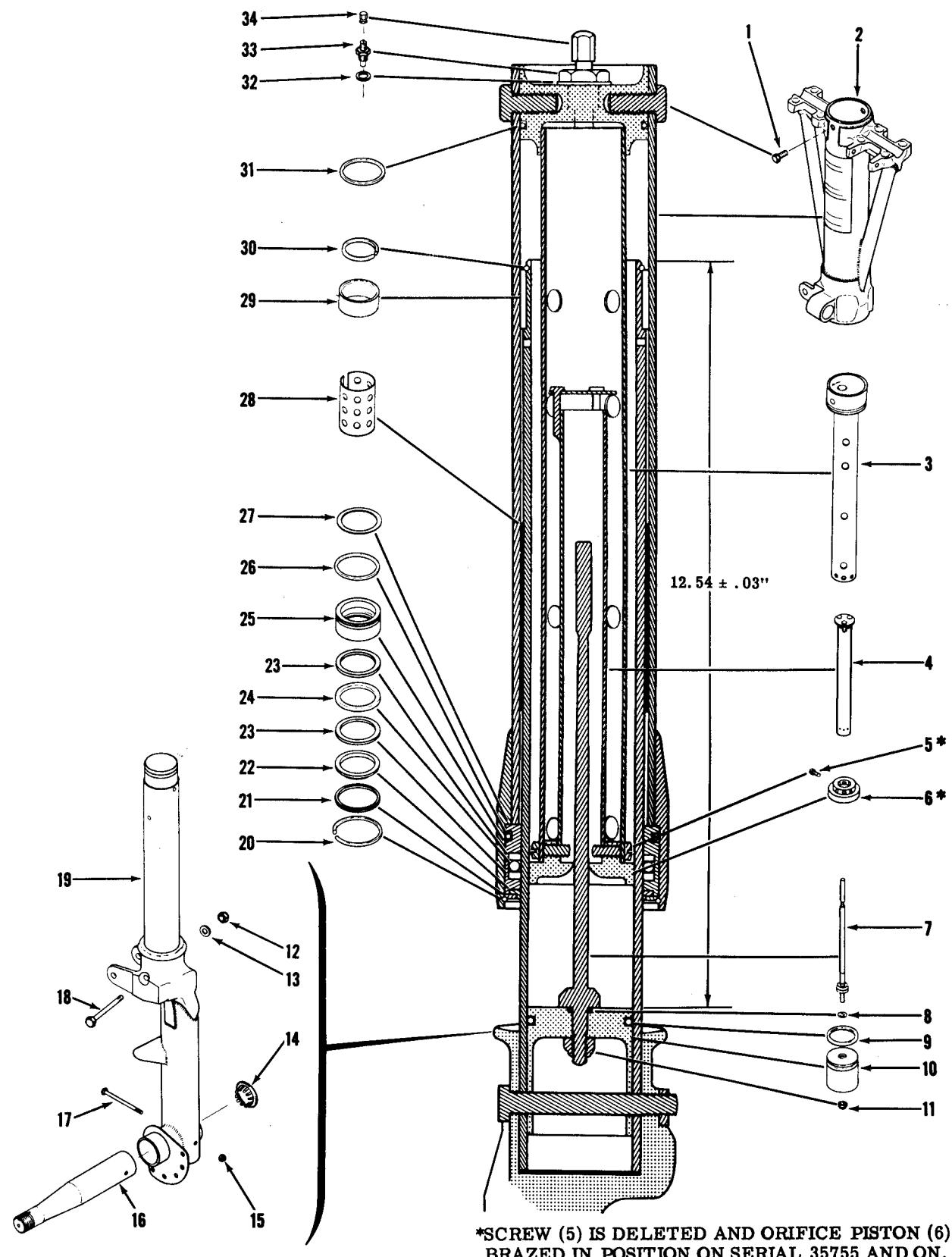


Figure 2-41. Main Landing Gear Strut Disassembly

Figure 2-41. Main Landing Gear Strut Disassembly Callouts

1. Bolt	12. Nut	24. O-ring
2. Upper Truss Assembly	13. Washer	25. Packing Support Ring
3. Orifice Piston Support Assembly	14. Plug Button	26. O-ring
4. Orifice Piston Support Tube	15. Nut	27. Shim
5. Screw	16. Axle	28. Spacer
6. Orifice Piston	17. Bolt	29. Bearing
7. Metering Pin	18. Bolt	30. Lock Ring
8. O-ring	19. Lower Strut	31. O-ring
9. O-ring	20. Lock Ring	32. O-ring
10. Pin Base Plug	21. Retainer Ring	33. Valve Body
11. Nut	22. Scraper Ring	34. Valve Cap
	23. Backup Ring	

previous positions to assure proper mating of parts.

2. Install O-ring (31) in groove provided on orifice piston support (3).

3. Insert orifice piston support (3) into upper truss (2), align mounting holes, install with two bolts (1), and safety.

d. Assemble lower strut (19) to upper truss (2) as follows:

1. Insert lower strut (19) into upper truss (2) and slide packing support ring (25), scraper ring (22), and retaining ring (21) into lower end of upper truss (2). Secure with lock ring (24, figure 2-40).

NOTE

See figure 2-40 for the remaining steps.

2. Remove plug and cap from brake hose (15) and union (11), and connect brake hose to brake line (10) at union. Use suitable lubricant on threads.

3. Install torque links (3), bushing (5), brake hose clamps (4 and 12), and safety switch bracket (16) with bolts (1 and 9), washers (2, 6, and 14), nuts (7 and 13), and cotter pins (8).

e. With strut completely deflated, fill with MIL-O-5606 hydraulic fluid and install valve body (19). Do not inflate strut at this time.

f. Install brake assembly on lower strut in accordance with paragraph 2-350.

g. If the retracting linkage components remaining attached to the landing gear were removed, they should be reinstalled. Install in accordance with paragraph 2-294.

h. Install wheel and tire assembly in accordance with paragraph 2-260.

2-248. INSTALLATION OF MAIN LANDING GEAR. (See figure 2-39.)

a. If attaching shafts (11) and needle bearings (9) were removed, install as follows:

1. Press needle bearings (9) into landing gear supports (8). Bearings must seat against shoulders provided in supports.

2. Place the removed washers (10) on attaching shafts (11) and install shafts in supports (8) so that ends of shafts are flush with back side of supports.

b. Place landing gear in position and install U-bolts (12) with washers (15 and 16) and nuts (14). Check clearance between landing gear and supports (8). Clearance should not exceed .010 inch on either side.

NOTE

Adjust clearance by adding washers (10) to forward attaching shaft, or removing washers from aft attaching shaft. This procedure prevents misalignment of side link assembly. To install or remove washers, remove U-bolts, lower the gear enough to allow washers to be removed or installed, and reinstall gear with U-bolts. Torque U-bolt nuts (14) to 120 ± 20 pound-inches.

c. Connect retracting linkage as follows:

1. Attach upper side link (30) to lower side link (29) with bolt (27), washer (31), and nut (32). Torque nut (32) to 110 ± 5 pound-inches.

2. Attach push-pull tube (33) to bellcrank (18) with bolt (17), washer (19), and nut (20).

d. Install safety switch (2) and down indicator switch (22) with screws (1 and 23) and nuts (4 and 26), and adjust in accordance with paragraphs 2-313 and 2-317.

e. Remove plug and cap, and connect brake hose to union at forward wheel well bulkhead. Use suitable lubricant on threads.

f. Install clamps securing switch wire bundle and brake hose.

g. Service and bleed brake system in accordance with paragraph 2-352.

h. Perform an operational check of landing gear.

i. Connect and adjust main landing gear doors in accordance with paragraph 2-253.

j. Remove jacks, and inflate strut in accordance with paragraph 1-50.

k. Check landing gear alignment in accordance with paragraph 2-318.

2-249. MAIN LANDING GEAR DOORS.

2-250. 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.

2-251. REMOVAL OF MAIN LANDING GEAR DOORS. (See figure 2-42.)

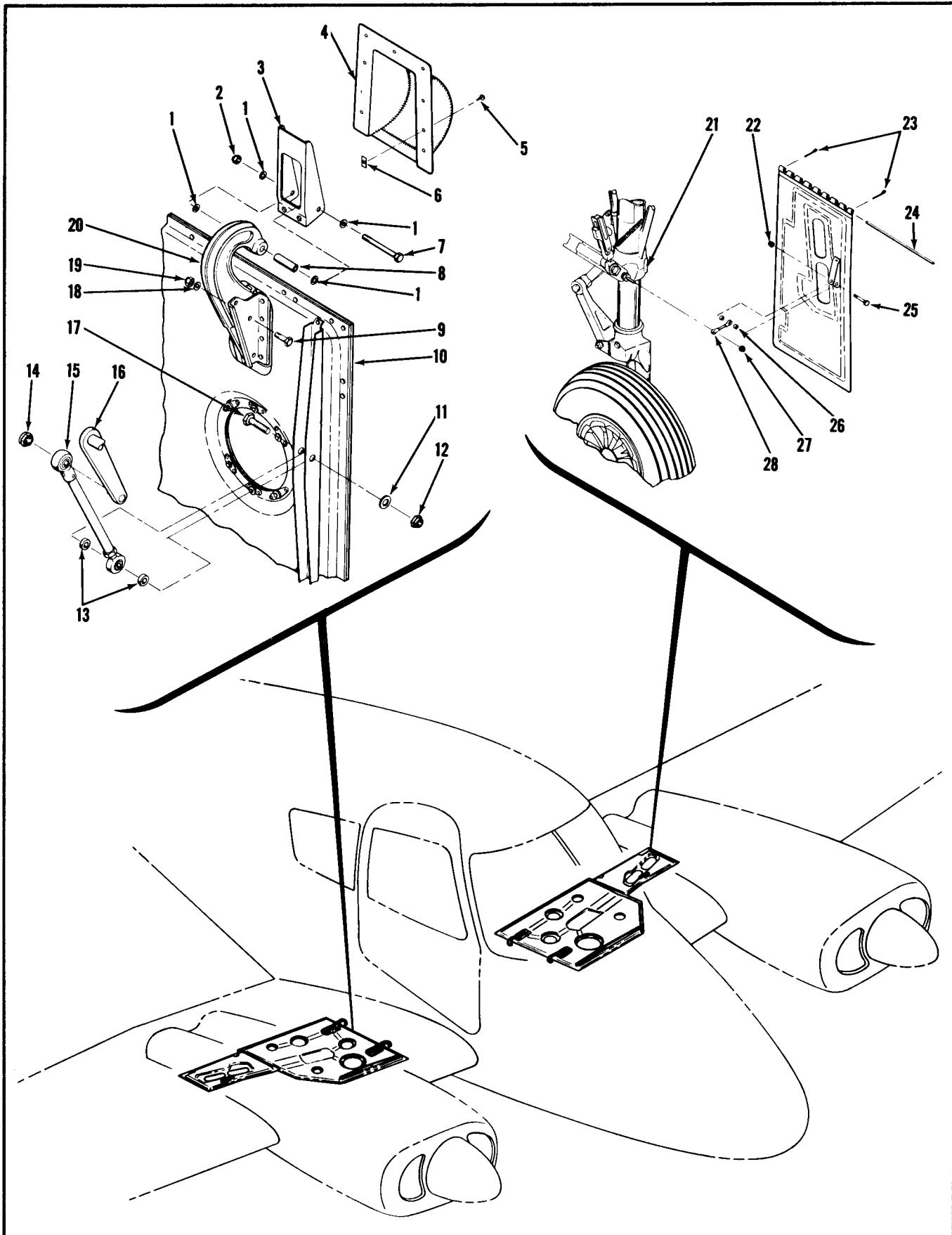


Figure 2-42. Main Landing Gear Doors Installation

Figure 2-42. Main Landing Gear Doors Installation Callouts

- | | | |
|----------------|--------------------------|-----------------------|
| 1. Washer | 10. Main Wheel Well Door | 20. Hinge |
| 2. Nut | 11. Washer | 21. Main Landing Gear |
| 3. Bracket | 12. Nut | 22. Nut |
| 4. Hinge Cover | 13. Spacer | 23. Cotter Pin |
| 5. Screw | 14. Nut | 24. Hinge Pin |
| 6. Nut | 15. Door Link Tube | 25. Bolt |
| 7. Bolt | 16. Door Actuator Arm | 26. Spacer |
| 8. Spacer | 17. Bolt | 27. Nut |
| 9. Bolt | 18. Washer | 28. Door Link Rod |
| | 19. Nut | |

- a. Remove strut door as follows:
 1. Disconnect door link rod (28) from strut by removing nut (27).
 2. Remove cotter pins (23) and hinge pin (24) attaching strut door to wing.
 - b. Remove wheel well door as follows:
 1. Remove access hole cover from wheel well door.
 2. Disconnect door link tube (15) from actuator arm (16) by removing nut (14).
 3. Remove wheel well door by removing nuts (19), washers (18), and bolts (9) attaching hinge arms (20) to door.
 - c. If desired, remove hinge arms (20) as follows:
 1. Remove lower wing root fillet and hinge covers (4) by removing attaching screws.
 2. Remove hinge arms (20) from brackets (3) by removing nuts (2), washers (1), spacers (8), and bolts (7).

2-252. INSTALLATION OF MAIN LANDING GEAR DOORS. (See figure 2-42.)

- a. If hinge arms (20) were removed, attach to brackets (3) with bolts (7), spacers (8), washers (1), and nuts (2). Install hinge covers (4) and lower wing root fillet with attaching screws.
- b. Install wheel well door as follows:
 1. Place wheel well door in position, align mounting holes, and attach to hinge arms (20) with bolts (9), washers (18), and nuts (19).
 2. Attach door link tube (15) to actuator arm (16) with nut (14).

NOTE

If length of door link tube (15) has been changed, or new door components are being installed, rig in accordance with paragraph 2-253.

3. Install access hole cover on wheel well door.
- c. Install strut door as follows:
 1. Place strut door in position and install hinge pin (24). Safety hinge pin by installing cotter pins (23).
 2. Attach door link rod (28) to strut with nut (27).

NOTE

If length of door link rod (28) has been changed or new door components are being installed, rig in accordance with paragraph 2-253.

2-253. RIGGING OF MAIN LANDING GEAR DOORS. (See figure 2-42.)

- a. Jack airplane in accordance with paragraph 1-15.
- b. Remove access hole cover from wheel well door.
- c. Disconnect wheel well door by removing nut (14) attaching door link tube (15) to actuator arm (16).
- d. Disconnect strut door by removing nut (27) attaching door link rod (28) to strut.
- e. 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.

- f. Close strut door and adjust door link rod (28) so that door fits flush.
- g. Operate gear to the DOWN position.
- h. Close wheel well door and adjust door link tube (15) so that door fits flush.
- i. Operate gear to the UP position.

CAUTION

When retracting gear while rigging door, be prepared to stop before damage can occur.

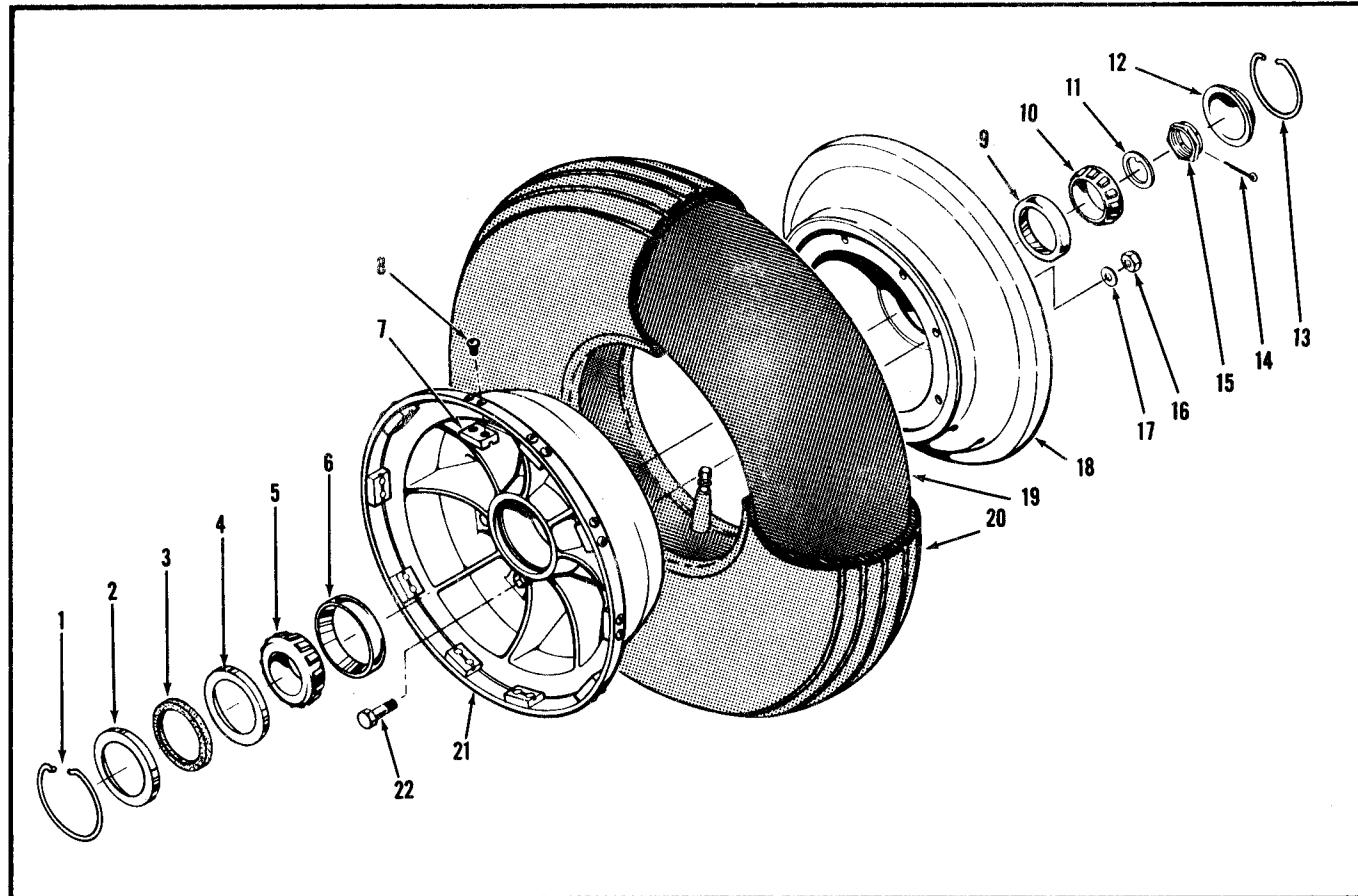
- j. If necessary, readjust door link tube (15) so that door fits flush. (On serials 35638 and on, a nutplate is provided as a stop adjustment on the actuating arm. Adjust nutplate so actuating arm stops slightly over center.)
- k. Repeat steps "e" through "j" as necessary to obtain proper fit of doors, checking that wheel well door clears tire and wheel.
- l. Install access hole cover on wheel well door.
- m. Insure that landing gear is DOWN, remove jacks.

2-254. MAIN WHEEL AND TIRE ASSEMBLY.

2-255. The main wheel is a two-piece, magnesium alloy casting, equipped with a single-disc type brake. The two halves of the wheel, which are bolted together, can be separated to install the conventional tire and tube. Tapered roller bearings seated in hardened steel cups are provided in each wheel half. The brake side of the main wheel is equipped with hardened steel drive keys, which furnish contact surface for driving the brake disc.

2-256. REMOVAL OF MAIN WHEEL AND TIRE ASSEMBLY. (See figure 2-43.)

- a. Jack airplane in accordance with paragraph 1-15.



- | | | |
|-----------------|------------------|-------------------------|
| 1. Snap Ring | 8. Screw | 16. Nut |
| 2. Retainer | 9. Bearing Cup | 17. Washer |
| 3. Felt Seal | 10. Bearing Cone | 18. No-brake Wheel Half |
| 4. Retainer | 11. Washer | 19. Inner Tube |
| 5. Bearing Cone | 12. Bearing Cap | 20. Tire |
| 6. Bearing Cup | 13. Snap Ring | 21. Brake Wheel Half |
| 7. Drive Key | 14. Cotter Pin | 22. Bolt |
| | 15. Nut | |

Figure 2-43. Main Wheel and Tire Assembly

b. Remove snap ring (13), bearing cap (12), cotter pin (14), nut (15), and washer (11) from axle.

c. Remove brake disc clips from brake side of 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 outer bearing cone (10) from wheel to prevent it from dropping out of wheel after wheel removal.

a. Remove tire (20) and tube (19) as follows:
1. Deflate tire by removing valve core.

WARNING

Always deflate tire before separating wheel halves.

2. Remove nuts (16), washers (17), and bolts (22), and separate wheel halves (18 and 21).

3. Remove each wheel half from tire, and remove tube from tire.

b. Remove snap ring (1), felt retainers (2 and 4), felt seal (3), and bearing cone (5) from wheel half (21).

c. Bearing cups (6 and 9) are a shrink fit and should be removed only for replacement.

NOTE

If removal is necessary, place wheel half in

2-257. DISASSEMBLY OF MAIN WHEEL AND TIRE ASSEMBLY. (See figure 2-43.)

boiling water for at least 30 minutes, then remove bearing cup by tapping cup evenly from the inner side.

- d. If necessary, remove drive keys (7) by removing screws (8).

NOTE

Screws (8) are staked to drive keys (7) and should be removed only for replacement.

2-258. CLEANING, INSPECTION, AND LUBRICATION OF MAIN WHEEL AND TIRE ASSEMBLY.

- a. Clean all metal parts with suitable cleaning solvent.
- b. Wash felt seal in suitable cleaning solvent, dry thoroughly, and lubricate with light oil.
- c. Inspect wheel castings for cracks, nicks, dents, and scratches. Replace cracked castings, and smooth out minor nicks, dents, and scratches.
- d. Inspect castings for corrosion. Badly corroded castings should be replaced. Slightly corroded areas should be thoroughly cleaned, and areas which have the protective coating removed should be repainted with two coats of zinc chromate primer and two coats of aluminum lacquer.
- e. Inspect disc drive keys for damage, looseness, and excessive wear. Replace keys worn to 1.116 inches or less. Replace damaged keys and tighten loose keys.
- f. Inspect bearing cups for visible damage and wear, but do not remove unless replacement is necessary.
- g. Clean bearing cones by washing thoroughly in suitable cleaning solvent, inspect for visible damage and wear, and repack with MIL-G-3278 grease.
- h. Inspect tire for breaks, cuts, foreign objects imbedded in tread, and flat spots and/or exposed cord. Breaks or cuts that damage cord, and flat spots and/or exposed cord are cause for rejection.

CAUTION

If there is any doubt about a tire's reliability, don't hesitate to reject it.

- i. Inspect retainers and snap rings for damage and distortion. Straighten or replace as necessary.

2-259. ASSEMBLY OF MAIN WHEEL AND TIRE ASSEMBLY. (See figure 2-43.)

- a. If removed, replace disc drive keys (7) and install retaining screws (8).

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 (6 and 9).

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. Dust inner tube (19) sparingly with tire talcum powder and place inside tire (20). Install valve core in tube and inflate only enough to round out tube.

NOTE

Airplane tires and tubes are balanced by the manufacturer as individual units. Place tube in tire so that the yellow stripe on the tube is located at the red dot on the tire.

- d. Place wheel half (18) in position on the tire and insert valve stem through the hole provided in the wheel half.

NOTE

Soap, oil or other solution should not be used on beads of the tire because of possible bead slippage during service.

- e. Place wheel half (21) in position on the tire, insure that tube is not pinched between the two wheel halves, and install bolts (22), washers (17), and nuts (16). Torque nuts (16) to 83 pound-inches.

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 (5), felt seal (3), felt retainers (2 and 4), and snap ring (1) in wheel half (21).

CAUTION

Insure that bearing cones (5 and 10) are properly greased before installing.

2-260. INSTALLATION OF MAIN WHEEL AND TIRE ASSEMBLY. (See figure 2-43.)

- a. Place wheel and tire assembly in position on axle, aligning brake disc with disc drive keys in wheel.
- b. Install outer bearing cone (10), washer (11), and nut (15).

NOTE

Tighten wheel bearing nut (15) until a slight bearing drag is felt as wheel is rotated. Loosen nut to the nearest slot that will align cotter pin hole.

- c. Install cotter pin (14), bearing cap (12), and snap ring (13).

- d. Install brake disc clips 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 drive keys, and repeat the above procedure until all five disc clips are installed.

e. Check that all disc clips are properly installed and that wheel rotates freely, remove jack, and inflate tire to correct operating pressure.

2-261. NOSE GEAR.

2-262. 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 support tubes attached to the trunnion assembly. A wheel straightener and steering mechanism are provided so that nose wheel turns while taxiing, but is straightened during retraction.

2-263. REMOVAL OF NOSE GEAR. (See figure 2-44.)

- If a taxi light (optional equipment) is installed, remove in accordance with paragraph 6-128.
- Jack airplane in accordance with paragraph 1-15.
- Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward UP position.
- Disconnect nose gear doors in accordance with paragraph 2-270.
- Disconnect retracting linkage as follows:

1. Remove nut (23), washer (22), and bolt (24) attaching drag brace (25) to strut.

2. Remove nut (10), washer (2), and bolt (4) attaching connector link (1) to retracting arm (3).

3. Disconnect nose gear DOWN indicator switch (32) and electrical wires from truss assembly (6).

NOTE

To facilitate installation, note the number and position of attaching clamps and the routing of the electrical wires.

- Remove truss assembly (6) by removing nuts

Figure 2-44. Nose Gear Installation Callouts

(5), washers (7), and bolts (8) attaching truss assembly to both retainers (9).

f. Remove nose gear steering assembly (33) in accordance with paragraph 2-321.

g. Remove eight nuts (20), washers (19), and bolts (17) attaching retainers (14) to airframe.

h. Remove two nuts (15), washers (16), and bolts (18) from each side of nose wheel well so that gear can be removed.

i. Force nose gear assembly aft, then turn it to clear airframe and remove from nose wheel well.

NOTE

Rub wax or paraffin on wheel well bulkheads just aft of retainers (14) to facilitate removal.

2-264. DISASSEMBLY OF NOSE GEAR. (See figure 2-44.)

WARNING

Deflate the nose gear strut before removing or disconnecting nose gear torque links.

- Remove wheel and tire assembly in accordance with paragraph 2-275.
- Remove mud guard and scraper assembly (27) by removing nuts (26 and 29) and bolts (28 and 31).
- Remove shimmy dampener in accordance with paragraph 2-280.
- Remove retainers (14) from trunnion assembly (11).

NOTE

Needle bearings (13) are a press fit and should be removed only for replacement. Removal of support tubes (12) is not recommended.

e. Completely deflate strut, and after all air has been expelled, remove valve body and drain fluid.

f. Separate upper strut assembly (6) from trunnion assembly (4) as follows: (See figure 2-45.)

- Align head of bolt (9) with hole (3) in trunnion assembly, and remove nut (11), spacers (8 and 10), and bolt (9).
- Remove external retainer ring (1) and wheel straightener (2).
- Pull upper strut from trunnion assembly.

NOTE

Upper bearing (7) will remain in the trunnion

1. Connector Link	12. Support Tube	23. Nut
2. Washer	13. Bearing	24. Bolt
3. Retracting Arm	14. Retainer	25. Drag Brace
4. Bolt	15. Nut	26. Nut
5. Nut	16. Washer	27. Mud Guard and Scraper Assembly
6. Truss Assembly	17. Bolt	28. Bolt
7. Washer	18. Nut	29. Bolt
8. Bolt	19. Washer	30. Eyebolt
9. Retainer	20. Nut	31. Bolt
10. Nut	21. Nose Wheel Well Doubler	32. Nose Gear Down Indicator Switch
11. Trunnion	22. Washer	33. Nose Gear Steering Assembly

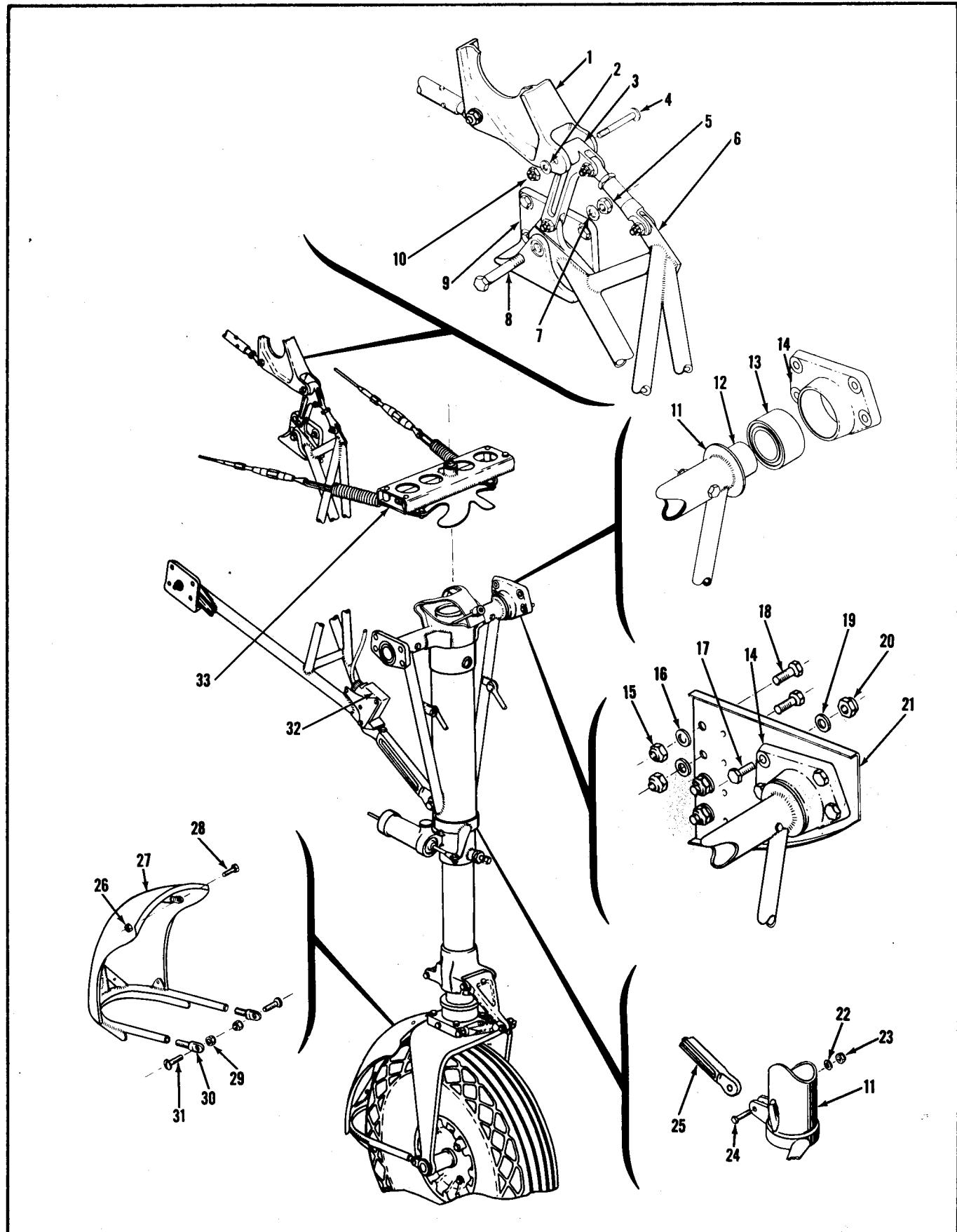
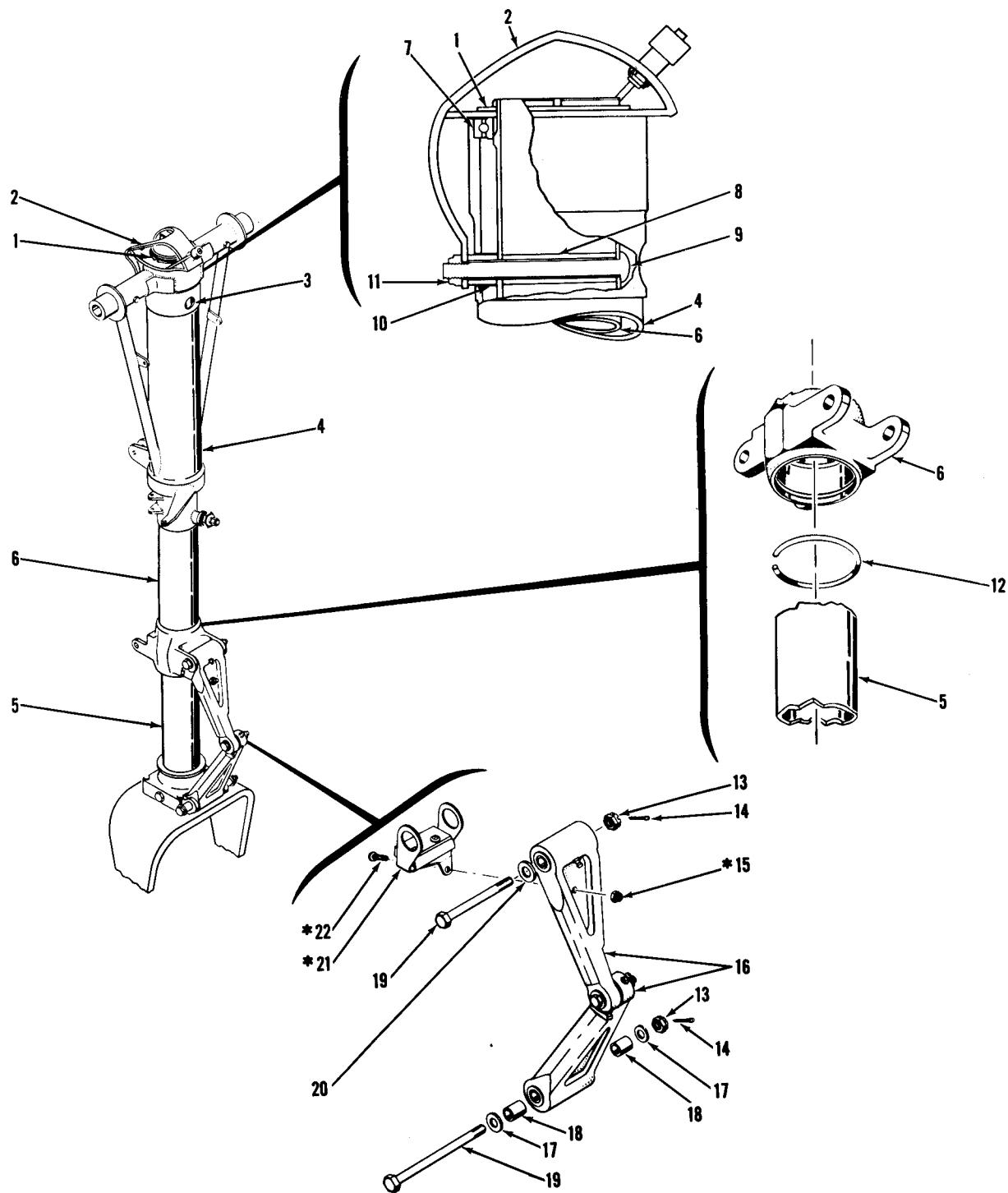


Figure 2-44. Nose Gear Installation



*APPLIES TO SERIALS 35449 THRU 35823 ONLY.

- | | | |
|---------------------------|----------------|---------------------------|
| 1. External Retainer Ring | 8. Spacer | 16. Torque Link |
| 2. Wheel Straightener | 9. Bolt | 17. Washer |
| 3. Access Hole | 10. Spacer | 18. Spacer |
| 4. Trunnion Assembly | 11. Nut | 19. Bolt |
| 5. Lower Strut | 12. Lock Ring | 20. Shim |
| 6. Upper Strut | 13. Nut | 21. Nose Gear Extend Stop |
| 7. Upper Bearing | 14. Cotter Pin | 22. Screw |
| | 15. Nut | |

Figure 2-45. Nose Gear Disassembly

assembly and can be removed if desired.

- g. Separate upper strut (6) from lower strut (5) as follows:

1. Remove torque links (16) by removing cotter pins (14), nuts (13), washers (17), shim (20), spacers (18) and bolts (19).
2. Remove lock ring (12) from lower end of upper strut (6) and separate lower strut from upper strut by applying a straight, sharp pull.

CAUTION

Removal and handling of the lower strut should be done with care to prevent the possibility of damage to exposed parts.

NOTE

See figure 2-46 for the remaining steps.

- h. Disassemble upper strut (1) as follows:

1. Remove cotter pin (6), pin (4), and bearing (2).
2. Remove orifice piston support assembly (8) through lower end of upper strut.
3. Remove O-ring (7) from orifice piston support head (5).
4. If desired, orifice piston (11) and tube (9) can be removed from orifice piston support assembly by removing eight screws (10).

NOTE

These three parts are drilled and tapped on assembly. Mark each part before disassembly, and reassemble in the same position to assure proper mating of parts.

- i. Disassemble lower strut (32) as follows:

1. Remove lock ring (16) and bearing (17) from upper end of strut.
2. Remove shim (31), packing support ring (18), scraper ring (22), packing retainer ring (23), and lock ring (24).

NOTE

Shim (31) is installed as required, and may not be found on all struts.

3. Remove O-rings (19 and 21) and backup rings (20) from packing support ring (18).

4. Remove metering pin base plug (12) by removing nut and bolt (27), and removing through the hole provided in the top of nose wheel yoke (14).

5. Remove metering pin (30) from pin base plug (12) by removing nut (29) and O-ring (25). Remove outer O-ring (26) from pin base plug.

6. Remove yoke (14) by removing nuts (13) and bolts (15).

NOTE

Lower strut (32) and yoke hub (28) are a press fit and drilled on assembly. Disassembly is not recommended.

2-265. CLEANING, INSPECTION, AND REPAIR OF NOSE GEAR. The instructions for cleaning inspection, and repair of the main landing gear, given in paragraph 2-246, also apply to the nose gear.

2-266. ASSEMBLY OF NOSE GEAR. (See figure 2-46.) Before each component of the nose gear shock strut is assembled, assure that it is thoroughly clean, then lubricate with system hydraulic fluid.

- a. Assemble lower strut (32) as follows:

1. Carefully work O-ring (25) over threads of metering pin (30) and install in pin base plug (12) with nut (29).

2. Install O-ring (26) in groove on outside of pin base plug (12).

3. Insert pin base plug (12), with metering pin and O-ring assembled, into lower end of strut, through the hole provided in top of yoke (14).

4. Align mounting holes and install bolt(27) and nut.

NOTE

If a new pin base plug is being installed, insert into strut to a depth of $.380 \pm .03$ inches from the lower end of the strut to the lower end of the pin base plug as illustrated in figure 2-46. Using the existing holes in the strut, drill and ream pin base plug to $.313$ inch (plus $.003$, minus zero inches).

5. Install O-ring (19) in groove provided on outside of packing support ring (18). Install O-ring (21) and backup rings (20) in groove provided on inside of packing support ring (18), with O-ring (21) between the two backup rings.

6. Slide over the top of lower strut (32) in the order mentioned, the following parts: Lock ring (24), retaining ring (23), scraper ring (22), packing support ring (18), and shim (31).

NOTE

Install shim (31) as required to remove end play from packing support ring (18), when installed in upper strut.

7. Install bearing (17) and lock ring (16) on upper end of strut.

- b. Assemble upper strut (1) as follows:

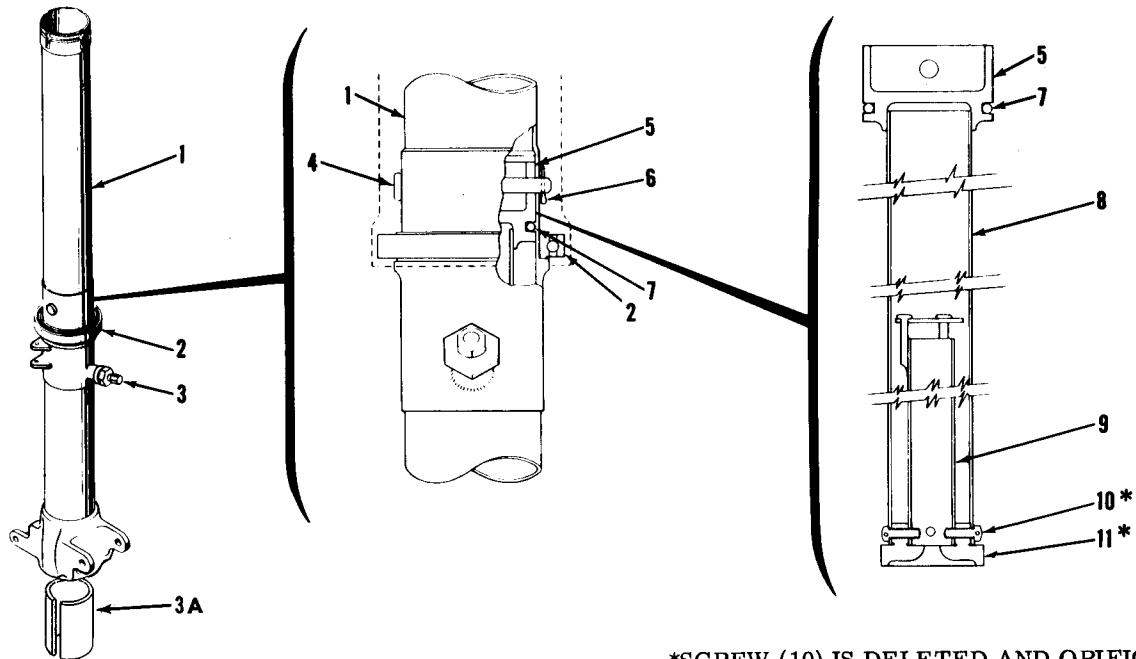
1. If orifice piston (11) and tube (9) were removed from orifice piston support assembly (8), reassemble by installing eight screws (10). Safety the screws so that safety wire cannot damage lower strut.

NOTE

These three parts are drilled and tapped on assembly, and should be assembled in their previous positions to assure proper mating of parts.

2. Install O-ring (7) in groove provided on orifice piston support head (5).

3. Insert orifice piston support assembly (8) into lower end of upper strut (1), slide bearing (2) down past the holes for pin (4), align the holes and install pin (4) and cotter pin (6).



*SCREW (10) IS DELETED AND ORIFICE PISTON (11) IS BRAZED IN POSITION ON SERIAL 35748 AND ON.

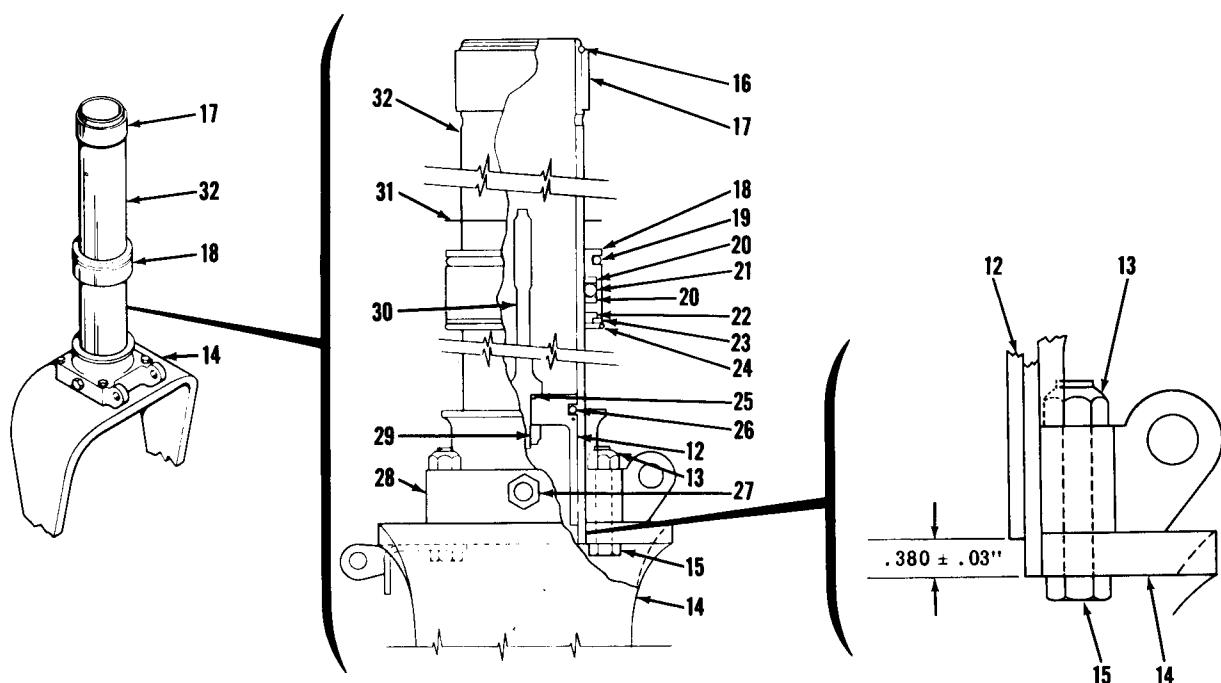


Figure 2-46. Nose Gear Strut Disassembly

Figure 2-46. Nose Gear Strut Disassembly Callouts

- | | | |
|------------------------------------|--------------------------|-------------------|
| 1. Upper Strut | 11. Orifice Piston | 22. Scraper Ring |
| 2. Lower Bearing | 12. Pin Base Plug | 23. Retainer Ring |
| 3. Valve Assembly | 13. Nut | 24. Lock Ring |
| 3A. Spacer-Extend Stop | 14. Nose Wheel Yoke | 25. O-Ring |
| 4. Pin | 15. Nut | 26. O-Ring |
| 5. Orifice Piston Support Head | 16. Lock Ring | 27. Bolt |
| 6. Cotter Pin | 17. Bearing | 28. Yoke Hub |
| 7. O-Ring | 18. Packing Support Ring | 29. Nut |
| 8. Orifice Piston Support Assembly | 19. O-Ring | 30. Metering Pin |
| 9. Orifice Piston Support Tube | 20. Backup Ring | 31. Shim |
| 10. Screw | 21. O-Ring | 32. Lower Sturt |

NOTE

The upper strut and orifice piston support head (5) are drilled on assembly. If a new orifice piston support assembly is being installed, align the pilot hole provided in the new support and drill and ream to .312 inches (plus .003, minus zero inches).

c. To assemble lower strut (32) to upper strut (1):

1. Insert lower strut into upper strut, slide packing support ring (18), scraper ring (22), and retaining ring (23) into lower end of upper strut (1). Secure with lock ring (12, figure 2-45).

NOTE

The nose strut requires only one stop, either stop (21, figure 2-45) or stop (3A, figure 2-46). If extend stop (3A) is used, install between bearing (17) and packing support ring (18).

2. (See figure 2-45.) Install torque links (16) with bolts (19), washers (17), shim (20), spacers (18), nuts (13), and cotter pins (14).

d. Assemble upper strut (6) to trunnion assembly (4) as follows:

1. Insert upper strut into trunnion assembly and install upper bearing (7).
2. Align hole (3) in trunnion assembly with mounting hole in upper strut and install bolt (9), spacers (8 and 10), wheel straightener (2), and nut (11).
3. Install external retainer ring (1) in groove at upper end of strut.
- e. (See figure 2-44.) If needle bearings (13) were removed from retainers, press into place. Install retainers (14) on support tubes (12).
- f. Install shimmy dampener in accordance with paragraph 2-284.
- g. Install mud guard and scraper assembly (27) with bolts (28 and 31) and nuts (26 and 29).

NOTE

Mud guard and scraper assembly must have a minimum clearance of .70 inch at the center of the tire tread, with side clearance divided equally. Side clearance adjustment is provided by eye-bolts (30).

- h. Install wheel and tire assembly in accordance with paragraph 2-277.

- i. With strut completely deflated, fill with MIL-O-5606 hydraulic fluid and install valve body. Do not inflate strut at this time.

2-267. INSTALLATION OF NOSE GEAR. (See figure 2-44.)

- a. Place nose gear in the 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.

- b. Install eight bolts (17), washers (19), and bolts (20) attaching retainers (14) to airframe. Torque to 85 ± 15 pound-inches.

- c. Install nose gear steering assembly (33) in accordance with paragraph 2-323.

- d. Install two bolts (18), washers (16), and nuts (15) in each side of wheel well.

- e. Install retracting linkage as follows:

1. Place truss assembly (6) in position and install bolts (8), washers (7), and nuts (5) attaching truss assembly to retainers (9).

2. Attach the electrical wires and nose gear DOWN indicator switch (32) to truss assembly (6).

3. Attach retracting arm (3) to connector link (1) with bolt (4), washer (2), and nut (10).

4. Attach drag brace (25) to strut with bolt (24), washer (22), and nut (23).

- f. If taxi light (optional equipment) was removed, install in accordance with paragraph 6-110.

- g. Check rigging of nose gear steering system in accordance with paragraph 2-108.

- h. Check rigging of nose gear retracting linkage in accordance with paragraph 2-316.

- i. Connect nose gear doors and check door rigging in accordance with paragraph 2-272.

- j. Remove jacks, and inflate strut in accordance with paragraph 1-50.

2-268. NOSE GEAR DOORS.

- 2-269. Right and left main doors, and a forward door, are used to enclose the nose gear in its retracted position. The main doors, connected to the nose gear retracting linkage and hinged at their outboard ends, pivot downward during nose gear extension and remaining down while the nose gear is down. The forward door, attached to the nose gear and hinged at its upper end, opens and closes during extension and retraction of the nose gear.

2-270. REMOVAL OF NOSE GEAR DOORS. (See figure 2-47.)

- a. Remove forward nose gear door (11) as follows:
 - 1. Disconnect door from strut by removing cotter pins (10) and pins (9).
 - 2. Remove door by removing cotter pin (13), washer (12), and pin (14).
 - b. Remove either main nose gear door (1) as follows:
 - 1. Disconnect door link tube (28) from hinge (22) by removing cotter pin (25) and pin (26).
 - 2. Remove door by removing nuts (3), washers (4), spacers (6), and bolts (7) attaching hinges (2 and 22) to hinge brackets (16 and 5).
 - 3. If desired, center hinge (22) can be removed from door by removing four nuts (21), washers (20), and screws (17).

2-271. INSTALLATION OF NOSE GEAR DOORS.

(See figure 2-47.)

- a. Install either main nose gear door (1) as follows:
 - 1. If removed, install center hinge (22) with four screws (17), washers (20), and nuts (21).
 - 2. Place door in position and attach hinges (2 and 22) to hinge brackets (5 and 16) with bolts (7), and spacers (6), washers (4), and nuts (3).
 - 3. Attach door link tube (28) to hinge (22) with pin (26) and cotter pin (25).
- b. Install forward nose gear door (11) as follows:
 - 1. Place door in position and install pin (14), washer (12), and cotter pin (13).
 - 2. Attach door to strut with pins (9) and cotter pins (10).
 - c. If new components have been installed, or connecting linkage adjustments have been changed, rig nose gear doors in accordance with paragraph 2-272.

2-272. RIGGING OF NOSE GEAR DOORS. (See figure 2-47.)

- a. Jack airplane in accordance with paragraph 1-15.
- b. Disconnect main door link tubes (28) from center hinges (22) by removing cotter pins (25) and pins (26).
- 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 dam-

age 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 (28) until main doors close snugly when gear is in the UP position.
- f. Extend and retract gear, check for clearance between nose tire and doors, and readjust door link tubes (28) as necessary to obtain clearance.
- g. Insure that landing gear is DOWN, then remove jacks.

2-273. NOSE WHEEL AND TIRE ASSEMBLY.

2-274. The nose wheel is a two-piece, magnesium alloy casting. The two halves of the wheel, which are bolted together, can be separated to install the conventional tire and tube. Each wheel half contains a tapered roller bearing which seats in hardened steel cups. The nose wheel rotates around a tubular axle attached to the nose strut yoke.

2-275. REMOVAL OF NOSE WHEEL AND TIRE ASSEMBLY. (See figure 2-48.)

- a. Jack airplane in accordance with paragraph 1-15.
- 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 yoke (1).
- d. Remove spacers (5) and axle tube (6) from wheel.

2-276. DISASSEMBLY OF NOSE WHEEL AND TIRE ASSEMBLY. Instructions for the disassembly, cleaning, inspection, repair, lubrication, and reassembly of the main wheel and tire assembly, given in paragraph 2-257 through 2-259, also apply to the nose wheel and tire assembly.

CAUTION

Insure that spacer (20) seats properly in the nose wheel halves during assembly.

2-277. INSTALLATION OF NOSE WHEEL AND TIRE ASSEMBLY. (See figure 2-48.)

- a. Insert axle tube (6) in wheel and place spacers (5) on ends of axle tube.
- b. Place wheel and tire assembly in position, align with mounting holes in yoke (1), and install axle bolt buckets (4).
- c. Install bolt (7) and nut (3).

Figure 2-47. Nose Gear Doors Installation Callouts

- | | | |
|------------------------|----------------------------|-----------------------|
| 1. Nose Gear Main Door | 11. Nose Gear Forward Door | 22. Hinge |
| 2. Hinge | 12. Washer | 23. Spacer |
| 3. Nut | 13. Cotter Pin | 24. Cotter Pin |
| 4. Washer | 14. Pin | 25. Cotter Pin |
| 5. Bracket | 15. Hinge | 26. Pin |
| 6. Spacer | 16. Bracket | 27. Eyebolt |
| 7. Bolt | 17. Screw | 28. Door Link Tube |
| 8. Tie Rod Assembly | 18. Nut | 29. Bolt |
| 9. Pin | 19. Washer | 30. Nut |
| 10. Cotter Pin | 20. Washer | 31. Door Actuator Arm |
| | 21. Nut | |

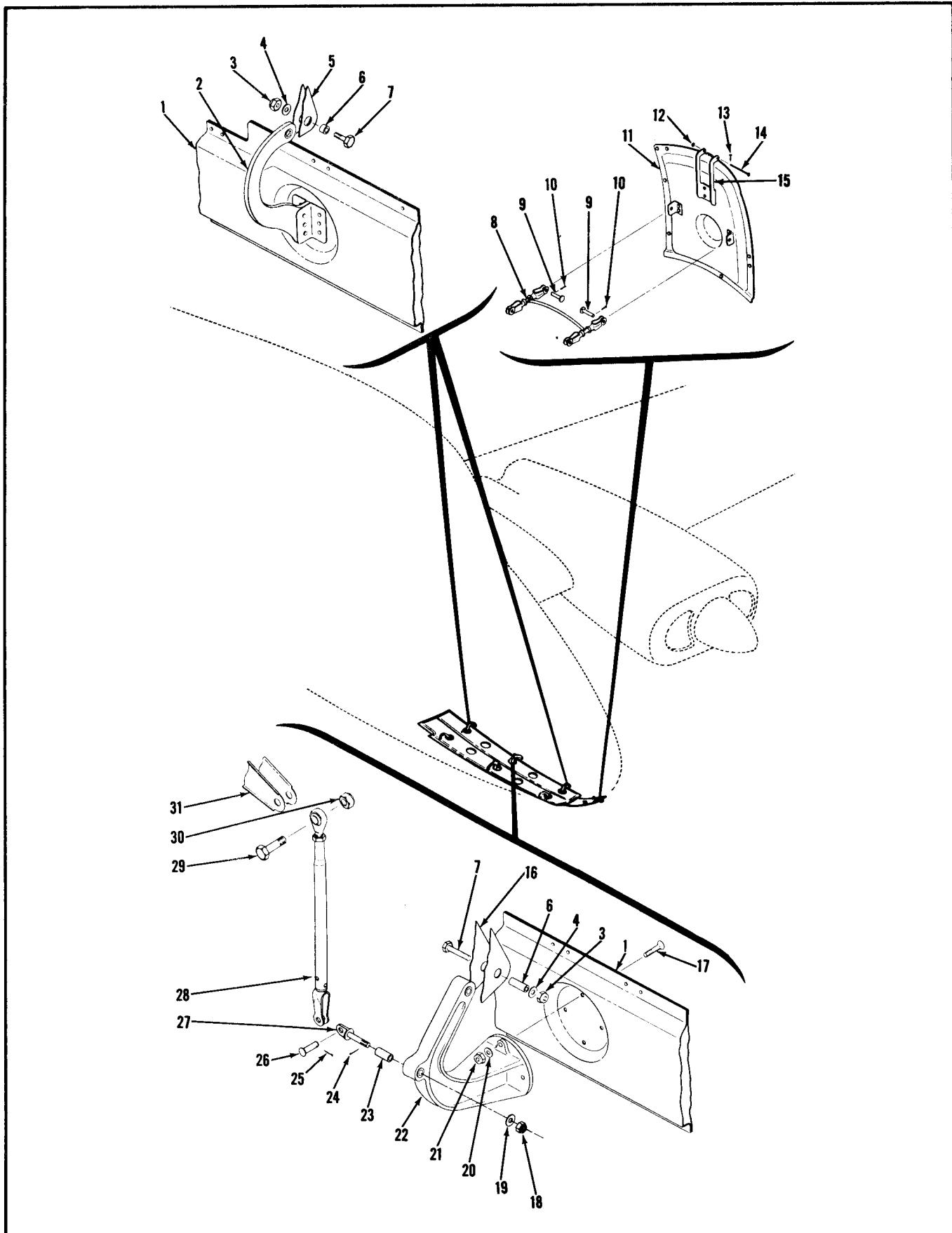
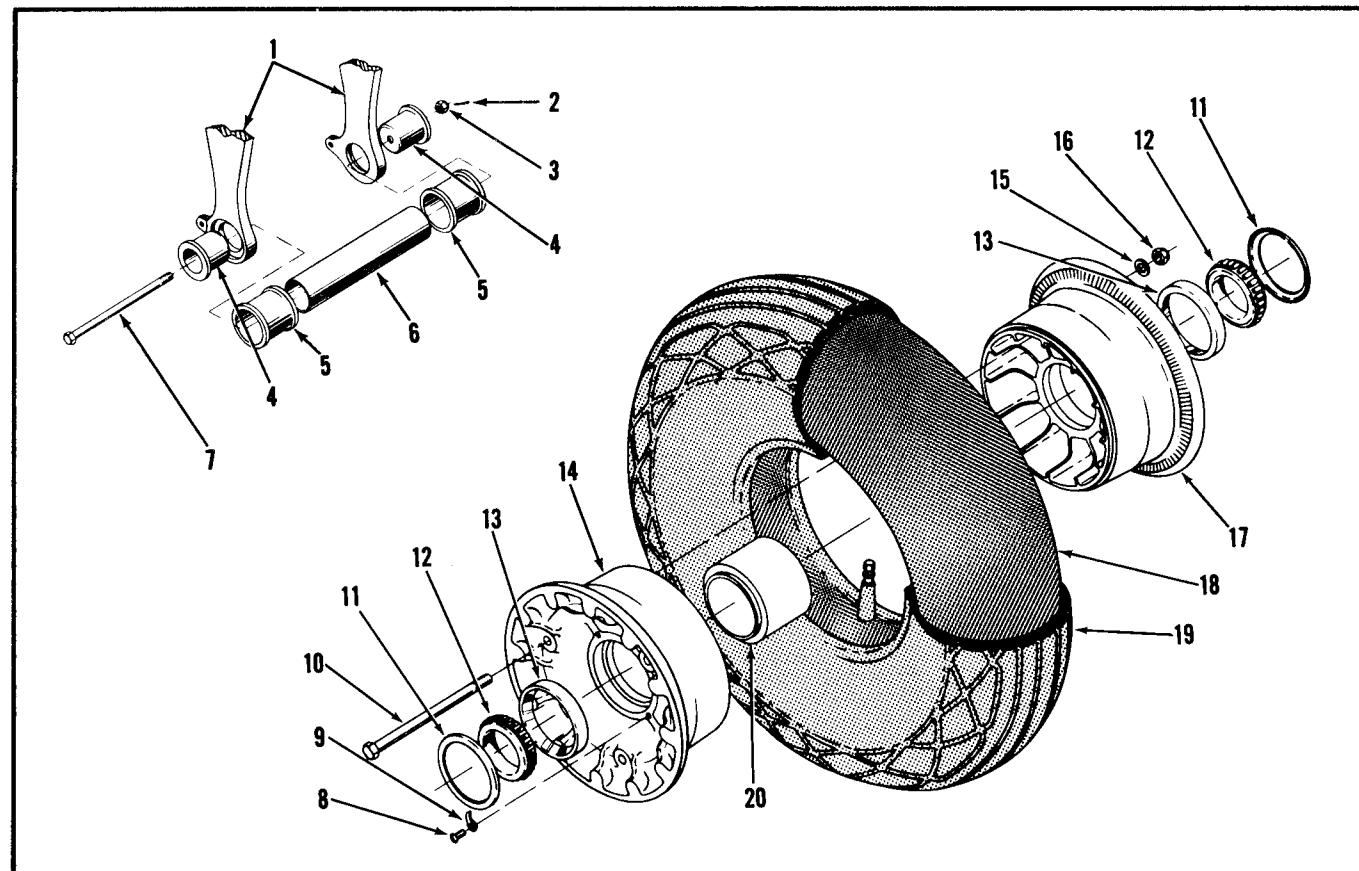


Figure 2-47. Nose Gear Doors Installation



- | | | |
|---------------------|------------------|-----------------------|
| 1. Nose Wheel Yoke | 8. Screw | 14. Female Wheel Half |
| 2. Cotter Pin | 9. Terminal | 15. Washer |
| 3. Nut | 10. Bolt | 16. Nut |
| 4. Axle Bolt Bucket | 11. Retainer | 17. Male Wheel Half |
| 5. Spacer | 12. Bearing Cone | 18. Inner Tube |
| 6. Axle Tube | 13. Bearing Cup | 19. Tire |
| 7. Bolt | | 20. Spacer |

Figure 2-48. Nose Wheel and Tire Assembly

NOTE

Tighten nut (3) until a slight bearing drag is felt as wheel is rotated. Loosen nut to the nearest slot that will align cotter pin hole.

- d. Install cotter pin (2).

2-278. NOSE GEAR SHIMMY DAMPENER.

2-279. The shimmy dampener provided for the nose gear offers resistance to shimmy by forcing hydraulic fluid through small orifices in a 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 piston.

2-280. REMOVAL OF NOSE GEAR SHIMMY DAMPENER. (See figure 2-49.)

- Disconnect piston rod (19) from trunnion assembly by removing cotter pin (14), nut (13), washer (12), and bolt (11).
- Remove shimmy dampener by removing cotter

pin (9), nut (8), bushing (18), and bolt (17).

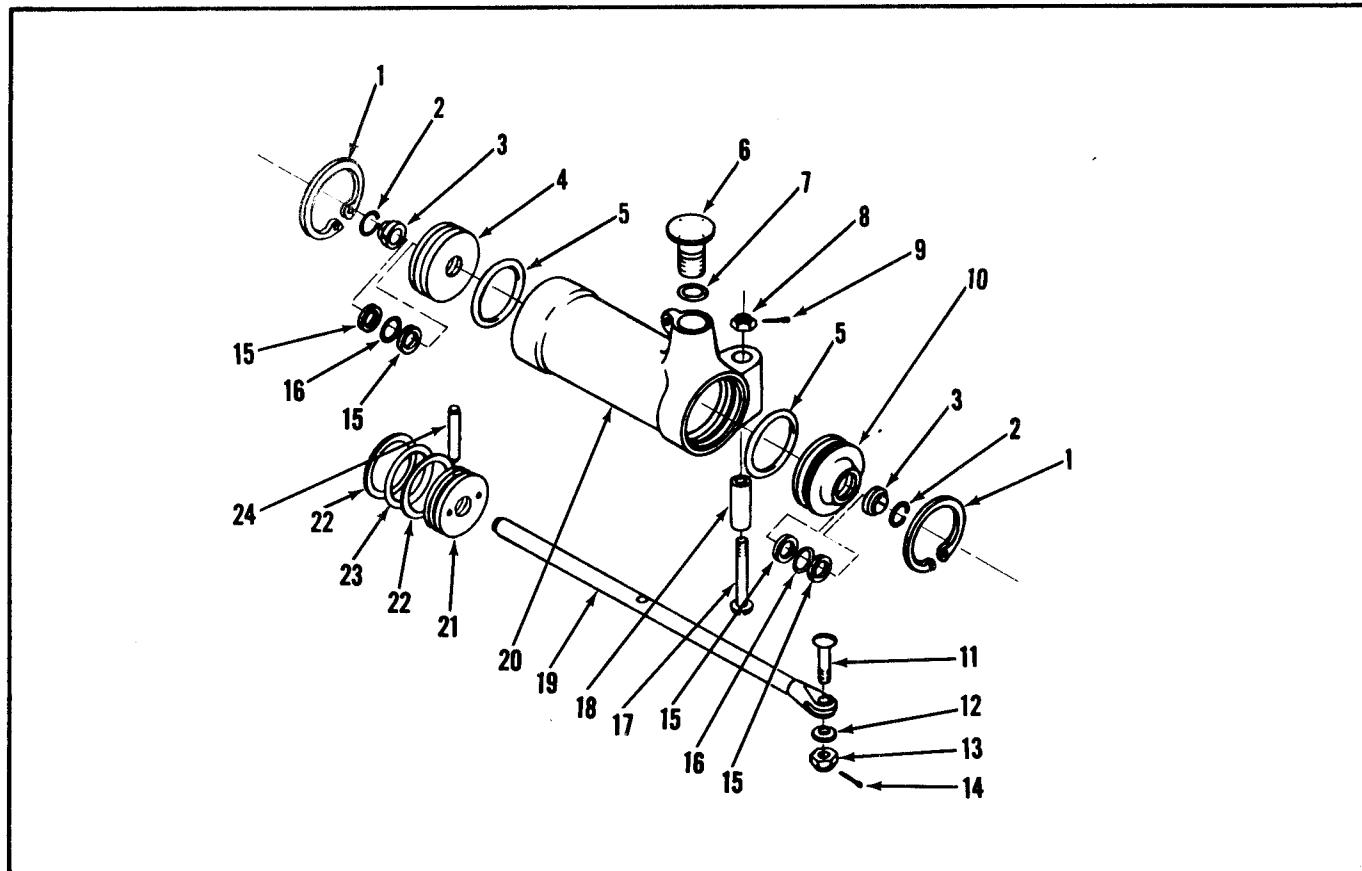
2-281. DISASSEMBLY OF NOSE GEAR SHIMMY DAMPENER. (See figure 2-49.)

- Push piston rod (19) into shimmy dampener, remove filler plug (6) and O-ring (7), and drain fluid.
- Remove lock ring (1) from forward end of shimmy dampener and pull piston and rod assembly from barrel (20).

CAUTION

Remove bearing heads and piston assemblies with care to prevent damage to seals.

- Remove O-ring (23) and backup rings (22) from piston (21).
- Remove piston (21) from piston rod (19) by removing roll pin (24).
- Remove bearing head (10) from piston rod (19).
- Remove lock ring (1) from aft end of shimmy dampener and pull bearing head (4) from barrel (20).
- Remove outer O-rings (5) from bearing heads (4)



1. Lock Ring

2. Internal Retaining Ring

3. Wiper Ring

4. Bearing Head

5. O-ring

6. Filler Plug

7. O-ring

8. Nut

9. Cotter Pin

10. Bearing Head

11. Bolt

12. Washer

13. Nut

14. Cotter Pin

15. Backup Ring

16. O-ring

17. Bolt

18. Bushing

19. Piston Rod

20. Barrel

21. Piston

22. Backup Ring

23. O-ring

24. Roll Pin

Figure 2-49. Shimmy Dampener

and 10).

h. Remove internal retaining rings (2), wiper rings (3), O-rings (16) and backup rings (15) from bearing heads (4 and 10).

2-282. CLEANING, INSPECTION, AND REPAIR OF NOSE GEAR SHIMMY DAMPENER.

a. Clean all metal parts with suitable cleaning 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 suitable solvent.

b. Clean all O-rings and seals with clean system hydraulic fluid.

c. Inspect all components for excessive wear, cracks, dents, nicks, and scratches.

d. Repair of shimmy dampener is limited to re-

placement of parts, smoothing out of minor scratches nicks and dents, and repainting of areas where paint has chipped or peeled.

2-283. ASSEMBLY OF NOSE GEAR SHIMMY DAMPENER. (See figure 2-49.) Before each component of the shimmy dampener is assembled, assure that it is thoroughly clean, then lubricate with system hydraulic fluid.

a. Install O-rings (16), backup rings (15), wiper rings (3), and internal retaining rings (2) inside bearing heads (4 and 10).

b. Install outer O-rings (5) on bearing heads (4 and 10).

c. Install bearing head (4) in barrel (20) and secure with aft lock ring (1).

d. Position bearing head (10) on piston rod (19), then assemble piston (21) to piston rod (19) with roll pin (24).

e. Install O-ring (23) and backup rings (22) on piston (21).

f. Insert piston and piston rod assembly into barrel (20), slide bearing head (10) into position, and secure with forward lock ring (1).

CAUTION

Insert piston and bearing heads with care to prevent damage to O-rings.

g. Completely fill shimmy dampener with MIL-O-5606 hydraulic fluid, and install filler plug (6) and O-ring (7).

NOTE

For proper operation, shimmy dampener must be completely full of hydraulic fluid, with no trapped air present. Push piston rod into 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 paragraph 1-41.

2-284. INSTALLATION OF NOSE GEAR SHIMMY DAMPENER. (See figure 2-49.)

a. Place bushing (18) in barrel (20), align mounting holes, and install bolt (17), nut (8), and cotter pin (9).

NOTE

Lubricate bushing (18) with light oil during installation.

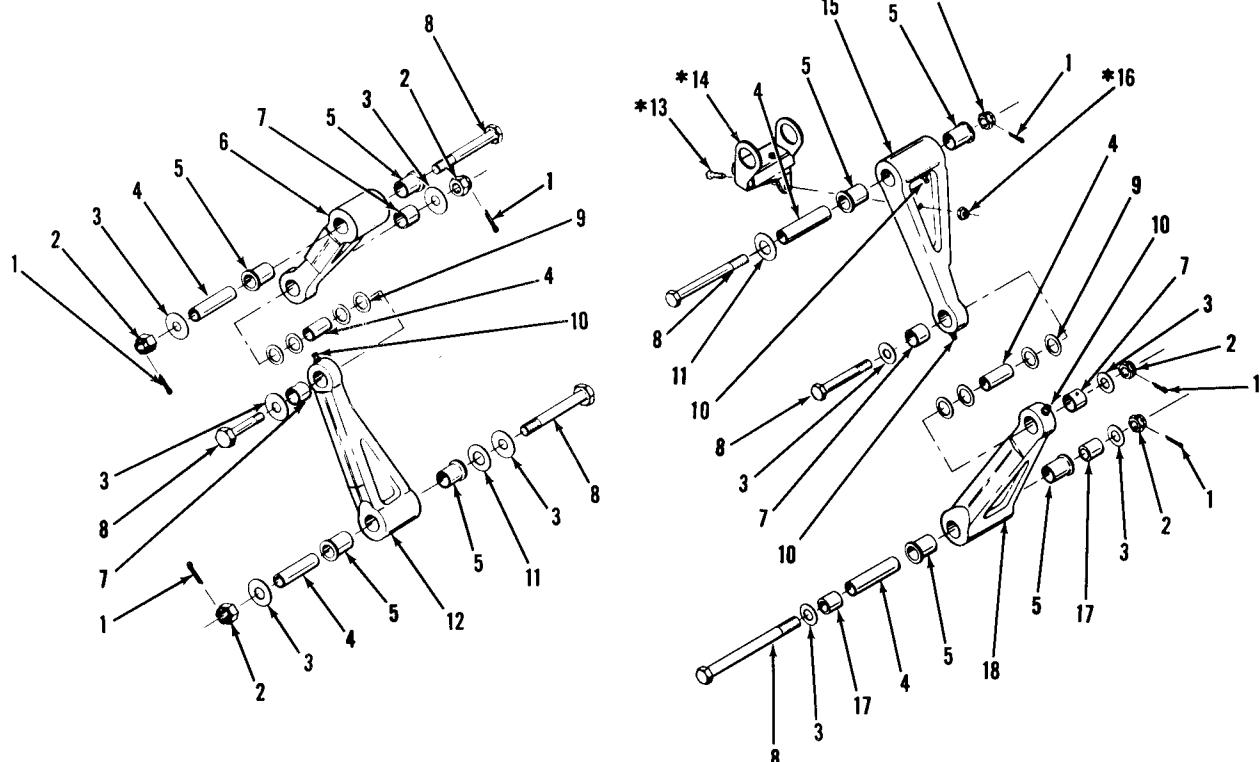
b. Connect the piston rod (19) to the trunnion assembly with bolt (11), washer (12), nut (13), and cotter pin (14).

c. If not filled with hydraulic fluid during assembly, service shimmy dampener in accordance with paragraph 1-41.

2-285. TORQUE LINK ASSEMBLIES.

2-286. A forged aluminum alloy torque link assembly, which keeps the lower strut from rotating but permits shock strut action, is provided for each landing gear. The nose gear torque link is equipped with a down stop which limits the lower strut extension. The left main landing gear torque link actuates the landing gear safety switch.

2-287. REMOVAL AND DISASSEMBLY OF TORQUE LINK ASSEMBLIES. (See figure 2-50.)



*APPLIES TO SERIALS 35449 THRU 35823 ONLY.

- | | | |
|--------------------------------|---------------------------------|---------------------------------|
| 1. Cotter Pin | 7. Bushing | 13. Screw |
| 2. Nut | 8. Bolt | 14. Nose Gear Extend Stop |
| 3. Washer | 9. Washer | 15. Nose Gear Upper Torque Link |
| 4. Spacer | 10. Grease Fitting | 16. Nut |
| 5. Bushing | 11. Shim | 17. Spacer |
| 6. Main Gear Upper Torque Link | 12. Main Gear Lower Torque Link | 18. Nose Gear Lower Torque Link |

Figure 2-50. Torque Link Installation

WARNING

Deflate nose strut before removing or disconnecting nose gear torque link assembly. It is not necessary to deflate main landing gear struts as they contain internal stops.

- a. Remove cotter pins (1), nuts (2), washers (3 and 9), shims (11), and bolts (8) attaching torque links to struts, and attaching upper torque links to lower torque links.

NOTE

Observe thickness, number, and position of all shims and washers before removing bolts.

- b. Remove nose gear torque links by pulling forward, and main gear torque links by pulling aft.
- c. Remove spacers (4) from torque links.
- d. Remove extend stop (14) from nose gear upper torque link by removing nut (16) and screw (13).
- e. Remove bushings (5 and 7) from torque links.

NOTE

Torque link bushings are a press fit, and should be removed only for replacement.

- f. Remove grease fittings (10) from torque links.

2-288. CLEANING, INSPECTION, AND REPAIR OF TORQUE LINK ASSEMBLIES. (See figure 2-50.)

- a. Clean all components with suitable cleaning solvent.
- b. Inspect all components for excessive wear, cracks, dents, nicks, and scratches.
- c. 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.

2-289. ASSEMBLY AND INSTALLATION OF TORQUE LINK ASSEMBLIES. (See figure 2-50.)

- a. Install grease fittings (10) in torque links.
- b. If removed, install bushings (5 and 7) in torque links by pressing into position, insuring that holes in bushings are aligned with grease fittings (10).

NOTE

Either of two types of bushings may be found in the smaller end of torque links. Later model airplanes, as well as replacement links obtained from the factory, use a bushing which does not have a flange. When installing flanged bushings in the smaller end of torque links, press into position so that the flanges of both bushings will be located between the upper and lower torque links. When replacing flanged bushings with ones that do not have a flange, add two AN960-716 washers between the upper and lower torque links.

- c. Attach extend stop (14) to torque link (15) with screw (13) and nut (16). If an internal stop (3A, figure 2-46) is used, (13, 14, and 16) are not required.

- d. Insert spacers (4) into torque links.
- e. Position torque links and install bolts (8), shims (11), washers (3 and 9), nuts (2), and cotter pins (1).

NOTE

Shims and washers should be installed in the same positions from which they were removed. If new components are being installed, align landing gear in accordance with paragraph 2-318.

- f. Inflate nose strut in accordance with paragraph 1-50.
- g. Lubricate torque links in accordance with figure 1-6, sheet 8.

2-290. MAIN LANDING GEAR RETRACTING LINKAGE.

2-291. The main landing gear retracting linkage consists of push-pull tubes, bellcranks, torque tubes, braces, and links, interconnected between the landing gear actuator and the main landing gear. A positive downlock is obtained by rigging the main side links to an over-center position. The link assemblies which hold the main side links in an over-center position are also rigged over-center. Downlock springs, which apply spring tension to the over-center position of the link assemblies, are provided as an added safety feature. Hook-type mechanical locks are provided to lock the landing gear in its retracted position. The main landing gear retracting linkage also operates the main landing gear door operating mechanism.

2-292. REMOVAL OF MAIN LANDING GEAR RETRACTING LINKAGE. (See figure 2-51.)

- a. Jack airplane in accordance with paragraph 1-15.
- b. Disconnect main landing gear doors in accordance with paragraph 2-251.
- c. Release tension on retracting linkage by engaging hand crank and operating a few turns toward the UP position.
- d. Remove access hole covers from underside of wing forward of wheel well.
- e. Remove rear carpet in accordance with paragraph 2-203, and remove access hole cover above landing gear actuator.
- f. Remove intermediate push-pull tube (4) as follows:
 1. Disconnect tube (4) from idle bellcrank (16) by removing nut (45), spacers (18), and bolt (41).
 2. Disconnect push-pull tube from torque tube (3) by removing nut (6), washer (5), and bolt (2).
 - g. Remove landing gear drive tube (43) as follows:
 1. Disconnect drive tube from landing gear actuator bellcrank in accordance with paragraph 2-302.
 2. Disconnect drive tube from idler bellcrank (16) by removing nut (44), spacers (42), and bolt (40). Remove drive tube by pulling it into wheel well.
 - h. Remove idler bellcrank (16) and door operating linkage as follows:
 1. Remove two roll pins (21) attaching door actuator arm (19) to bellcrank (33).
 2. Remove nut (27) and thrust bearing washer (29), and pull door actuator arm (19) from bellcrank (33). Remove thrust bearing washers (36).

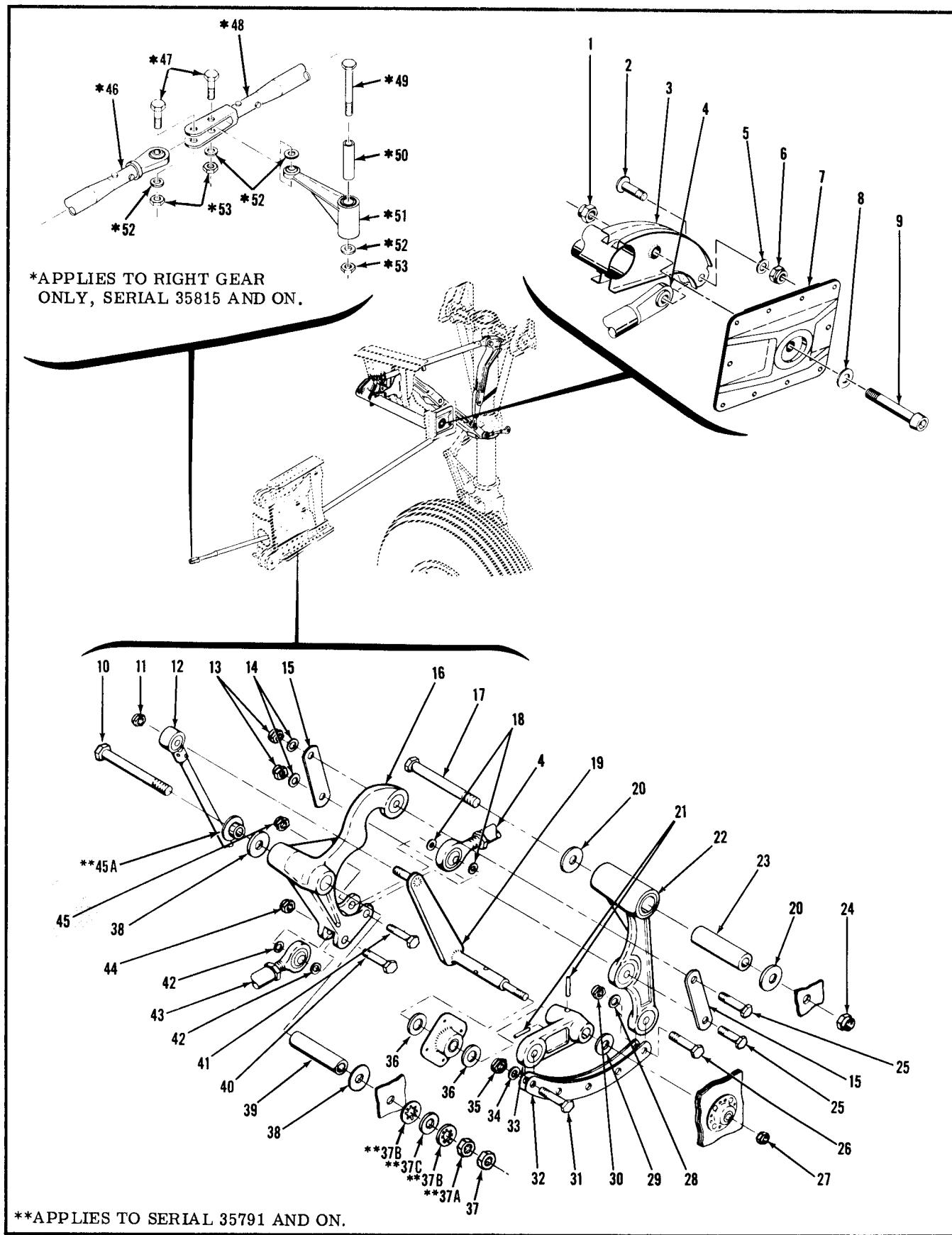


Figure 2-51. Main Landing Gear Retracting Linkage — Inboard Components

Figure 2-51. Main Landing Gear Retracting Linkage - Inboard Components Callouts

1. Nut	20. Thrust Bearing Washer	37B. Lock Washer
2. Bolt	21. Roll Pin	37C. Washer
3. Torque Tube	22. Bellcrank Rocker Arm	38. Thrust Bearing Washer
4. Intermediate Push-pull Tube	23. Spacer	39. Spacer
5. Washer	24. Nut	40. Bolt
6. Nut	25. Bolt	41. Bolt
7. Torque Tube Support	26. Bolt	42. Spacer
8. Washer	27. Nut	43. Main Drive Tube
9. Bolt	28. Washer	44. Nut
10. Bolt	29. Thrust Bearing Washer	45. Nut
11. Nut	30. Nut	45A. Bearing
12. Door Link Tube	31. Bolt	46. Inner Drive Tube
13. Nut	32. Rocker Arm Lower Link	47. Bolt
14. Washer	33. Bellcrank	48. Outer Drive Tube
15. Upper Connecting Link	34. Washer	49. Bolt
16. Idler Bellcrank	35. Nut	50. Bushing
17. Bolt	36. Washer	51. Idler
18. Spacer	37. Nut	52. Washer
19. Door Actuator Arm	37A. Nut	53. Nut

NOTE

Door actuator arm (19) and bellcrank (33) are a matched set.

3. Remove nut (37), thrust bearing washers (38), and bolt (10) attaching idler bellcrank (16) to front spar and support web.
4. Remove nut (24), thrust bearing washers (20), and bolt (17) attaching bellcrank rocker arm (22) to front spar and support web.
5. Pull bellcranks and attached linkage from between front spar and support web.
6. Remove spacers (23 and 39) from idler bellcrank (16) and bellcrank rocker arm (22).
7. Remove upper connecting links (15) by removing nuts (13), washers (14), and bolts (25).
8. Remove rocker arm lower link (32) by removing nuts (30 and 35), washers (28 and 34), and bolts (26 and 31).

NOTE

See figure 2-52 for the following steps.

- i. Remove outboard push-pull tube (1) as follows:
 1. Disconnect push-pull tube from bellcrank (35) by removing nut (31), washer (32), and bolts (34).
 2. Disconnect push-pull tube from torque tube (3) by removing nut (5) and bolt (4).
 - j. Remove bellcrank (35) and side brace lock link (42) as follows:
 1. Disconnect DOWN indicator switch (37) by removing nuts (39) and screws (40).
 2. Remove downlock spring.
 3. Disconnect side brace lock link from lower side link (57) by removing nut (55), washer (60) and bolt (45).
 4. Disconnect bellcrank (35) from upper truss by removing nut (29), spacer (30), and bolt (33).
 5. Remove the side brace lock link (42) from bellcrank (35) by removing setscrew (41) and pin (36).
 - k. Remove uplock assembly as follows:
 1. Disconnect uplock push-pull tube (10) from uplock assembly by removing nut (22), washer (23), and bolt (24).

2. Remove nut (21), washer (20), spacer (26), and bolt (25) attaching uplock assembly to side link (18).

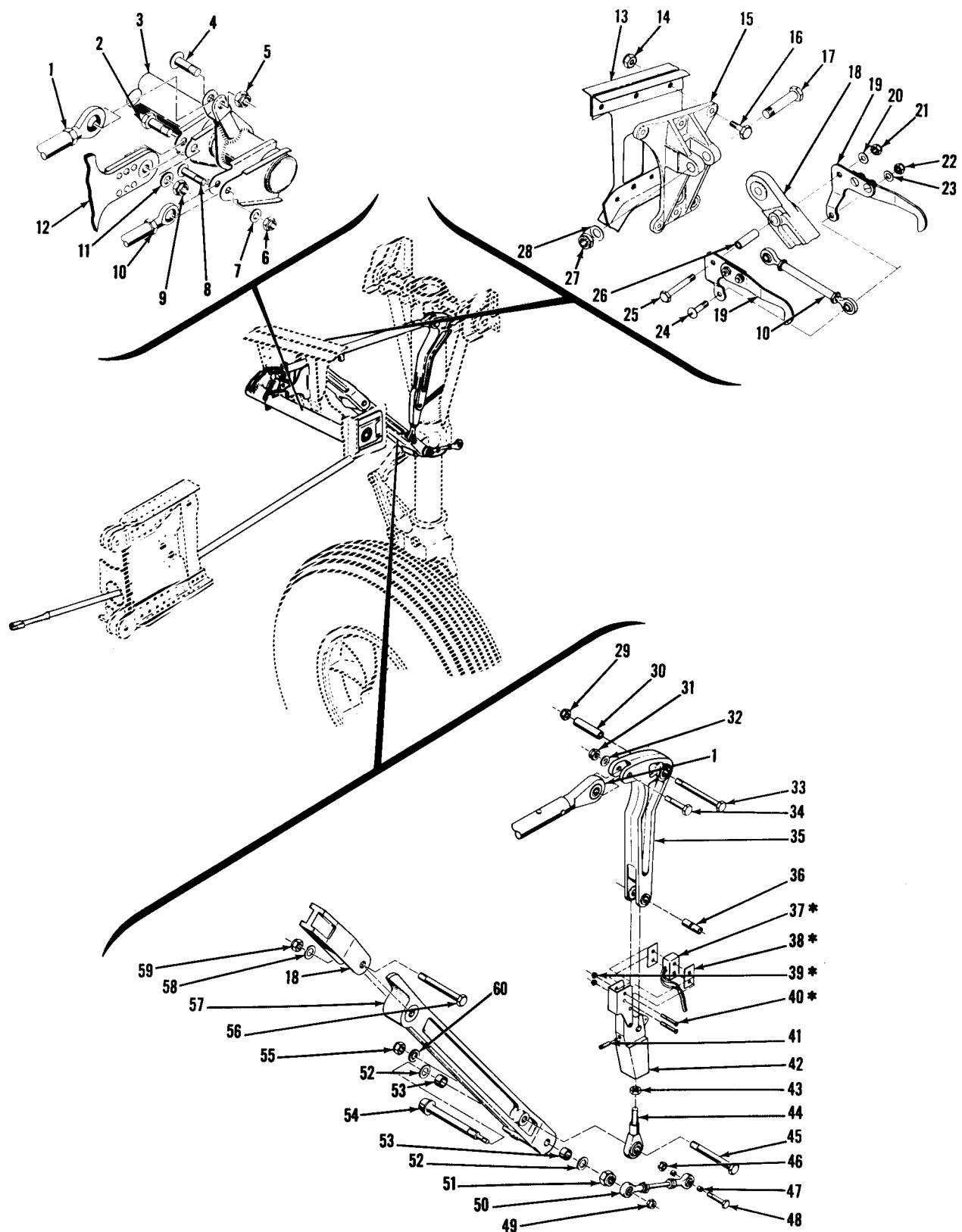
1. Remove side links (18 and 57) as follows:
 1. Disconnect lower side link (57) from upper truss by removing nut (49), door link rod (50), nut (51), washers (52), spacers (53), and bolt (54).
 2. Disconnect upper side link (18) from support (45) by removing nut (27), washer (28), and bolt (17).
 3. Separate side links by removing nut (59), washer (58), and bolt (56).
- m. Remove torque tube (3) as follows:
 1. Disconnect uplock push-pull tube (10) from torque tube by removing nut (6), washer (7), and bolt (8).
 2. Remove nut (9), washer (11), and bolt (2) attaching torque tube to rib mounting bracket.
 3. (See figure 2-51.) Remove nut (1), washer (8), and bolt (9) attaching torque tube to torque tube support (7).

2-293. CLEANING, INSPECTION, AND REPAIR OF MAIN LANDING GEAR RETRACTING LINKAGE.

- a. Clean linkage components with cloth saturated with suitable cleaning solvent. Do not clean sealed bearings or needle bearings which do not have provisions for lubrication.
- b. Inspect linkage components for cracks, nicks, dents, scratches, and excessive wear.
- c. Check all bearings for smoothness of operation.
- d. 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.

2-294. INSTALLATION OF MAIN LANDING GEAR RETRACTING LINKAGE. (See figure 2-52.)

- a. Install torque tube as follows:
 1. (See figure 2-51.) Attach torque tube (3) to torque tube support (7) with bolt (9), washer (8), and nut (1).
 2. (See figure 2-52.) Attach torque tube (3) to rib mounting bracket (12) with bolt (2), washer (11), and nut (9).
 3. Connect uplock push-pull tube (10) to torque tube (3) with bolt (8), washer (7), and nut (6).



*APPLIES TO SERIAL 35498 AND ON.

Figure 2-52.. Main Landing Gear Retracting Linkage – Outboard Components

Figure 2-52. Main Landing Gear Retracting Linkage -- Outboard Components Callouts

1. Outboard Push-pull Tube	21. Nut	41. Setscrew
2. Bolt	22. Nut	42. Side Brace Lock Link
3. Torque Tube	23. Washer	43. Check Nut
4. Bolt	24. Bolt	44. End Fitting
5. Nut	25. Bolt	45. Bolt
6. Nut	26. Spacer	46. Nut
7. Washer	27. Nut	47. Spacer
8. Bolt	28. Washer	48. Bolt
9. Nut	29. Nut	49. Nut
10. Uplock Push-pull Tube	30. Spacer	50. Door Link Rod
11. Washer	31. Nut	51. Nut
12. Mounting Bracket	32. Washer	52. Washer
13. Rib Assembly	33. Bolt	53. Spacer
14. Nut	34. Bolt	54. Bolt
15. Support	35. Bellcrank	55. Nut
16. Bolt	36. Pin	56. Bolt
17. Bolt	37. Down Indicator Switch	57. Lower Side Link
18. Upper Side Link	38. Spacer	58. Washer
19. Uplock Assembly	39. Nut	59. Nut
20. Washer	40. Screw	60. Washer

b. Install side links (18 and 57) as follows:

1. Attach upper side link (18) to lower side link (57) with bolt (56), washer (58), and nut (59). Torque nut (59) to 110 ± 5 pound-inches.
2. Attach upper side link (18) to support with bolt (17), washer (28), and nut (27). Torque nut (27) to 200 ± 25 pound-inches.
3. Attach lower side link (57) to upper truss with bolt (54), washers (52), spacers (53), and nut (51). Torque nut (51) to 110 ± 5 pound-inches.

d. Install door link rod (50) on bolt (54) with nut (49).

c. Install uplock assembly as follows:

1. Insert spacer (26) into upper side link (18) and attach uplock assembly with bolt (25), washer (20), and nut (21).

2. Attach uplock push-pull tube (10) to uplock assembly with bolt (24), washer (23), and nut (22).

d. Install bellcrank (35) and side brace lock link (42) as follows:

1. Attach side brace lock link (42) to bellcrank (35) with pin (36) and setscrew (41).

2. Attach bellcrank (35) to upper truss with bolt (33), spacer (30), and nut (29).

3. Attach side brace lock link (42) to lower side link (57) with bolt (45), washer (60) and nut (55).

4. Install downlock spring.

5. Install DOWN indicator switch (37) with attaching screws and nuts.

e. Install outboard push-pull tube (1) as follows:

1. Attach push-pull tube to bellcrank (35) with bolt (34), washer (32), and nut (31).

2. Attach push-pull tube to torque tube (3) with bolt (4) and nut (5).

NOTE

See figure 2-51 for the following steps.

f. Install idler bellcrank (16) and door operating linkage as follows:

1. Attach rocker arm lower link (32) to bellcrank rocker arm (22) and bellcrank (33) with bolts (26 and 31), washers (28 and 34), and nuts (30 and 35).

2. Attach upper connecting links (15) to bellcrank rocker arm (22) and idler bellcrank (16) with bolts (25), washers (14), and nuts (13).

3. Install spacers (23 and 39) in idler bellcrank (16) and bellcrank rocker arm (22).

4. Place bellcranks and attached linkage in position between front spar and support web.

5. Install bellcrank rocker arm (22) with bolt (17), thrust bearing washers (20), and nut (24).

6. Install idler bellcrank (16) with bolt (10), thrust bearing washers (38), and nut (37).

7. Position thrust bearing washers (36), insert door actuator arm (19) into position through bellcrank (33) and washers (36), and install thrust bearing washer (29) and nut (27).

8. Install two roll pins (21) attaching door actuator arm (19) to bellcrank (33). Safety the roll pins.

NOTE

Door actuator arm (19) and bellcrank (33) are a matched set.

g. Install landing gear drive tube (43) as follows:

1. Insert drive tube into position from the wheel well and attach to idler bellcrank (16) with bolt (40), spacers (42), and nut (44).

2. Attach drive tube to landing gear actuator bellcrank in accordance with paragraph 2-304.

h. Install intermediate push-pull tube (4) as follows:

1. Attach push-pull tube to torque tube (3) with bolt (2), washer (5), and nut (6).

2. Attach push-pull tube to idler bellcrank (16) with bolt (41), spacers (18), and nut (45).

i. Rig main landing gear in accordance with paragraph 2-315.

j. Install access hole covers above landing gear actuator and on underside of wing forward of wheel well.

k. Install rear carpet in accordance with paragraph 2-204.

l. Connect landing gear doors in accordance with paragraph 2-252, and rig doors in accordance with paragraph 2-253.

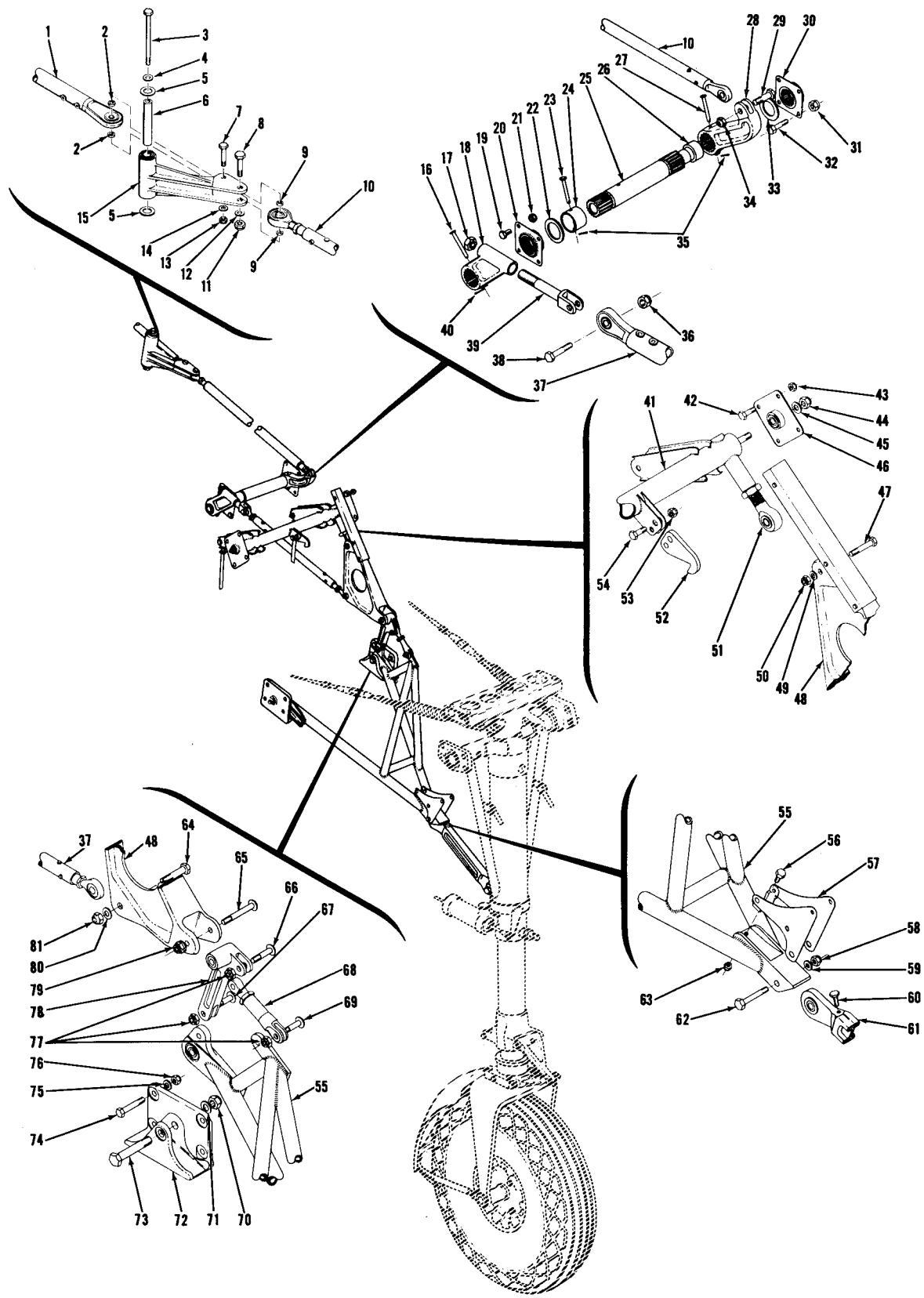


Figure 2-53. Nose Gear Retracting Linkage

Figure 2-53. Nose Gear Retracting Linkage Callouts

1. Nose Gear Drive Tube	28. Outboard Bellcrank	55. Truss Assembly
2. Spacer	29. Bolt	56. Bolt
3. Bolt	30. Outboard Support Bearing	57. Switch Bracket
4. Washer	31. Nut	58. Nut
5. Washer	32. Bolt	59. Washer
6. Spacer	33. Washer	60. Adjusting Bolt
7. Bolt	34. Nut	61. Drag Brace
8. Bolt	35. Cotter Pin	62. Bolt
9. Spacer	36. Nut	63. Nut
10. Intermediate Push-pull Tube	37. Forward Push-pull Tube	64. Bolt
11. Nut	38. Bolt	65. Bolt
12. Washer	39. Fork Bolt	66. Bolt
13. Nut	40. Cotter Pin	67. Bolt
14. Washer	41. Uplock Torque Tube	68. Adjusting Fork
15. Idler Bellcrank	42. Bolt	69. Bolt
16. Pin	43. Nut	70. Nut
17. Nut	44. Nut	71. Washer
18. Adjusting Bellcrank	45. Washer	72. Retainer
19. Bolt	46. Bearing Assembly	73. Bolt
20. Inboard Support Bearing	47. Bolt	74. Bolt
21. Nut	48. Connector Link Assembly	75. Washer
22. Washer	49. Washer	76. Nut
23. Pin	50. Nut	77. Nut
24. Collar	51. Adjusting Rod End	78. Retracting Arm
25. Torque Tube	52. Uplock Hook	79. Nut
26. Collar	53. Nut	80. Washer
27. Pin	54. Bolt	81. Nut

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

NOTE

During removal of nose gear linkage, manually move gear as required for access to attaching bolts and nuts.

2-295. NOSE GEAR RETRACTING LINKAGE.

2-296. The nose gear retracting linkage consists of a drag brace, truss assembly, bellcranks, torque tubes, and push-pull tubes, interconnected between the landing gear actuator and the nose gear. A positive downlock is obtained by rigging the drag brace to an over-center position. The connector link assembly which holds the drag brace in an over-center position is also rigged over-center. A hook-type mechanical lock is provided to lock the nose gear in its retracted position. The nose gear retracting linkage also operates the main nose gear doors.

2-297. REMOVAL OF NOSE GEAR RETRACTING LINKAGE. (See figure 2-53.)

- a. Jack airplane in accordance with paragraph 1-15.
- b. Remove pilot's seat in accordance with paragraph 2-179.
- c. Remove left front carpet in accordance with paragraph 2-204.
- d. Remove access hole covers from left cabin floor and underside of fuselage beneath landing gear actuator.
- e. Disconnect nose gear main doors in accordance with paragraph 2-270.
- f. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- g. Remove forward push-pull tube (37) as follows:
 1. Remove nut (36) and bolt (38) attaching push-pull tube to fork bolt (39).
 2. Remove nut (81), washer (80), and bolt (64) attaching push-pull tube to connector link (48).

h. Remove nose gear drive tube (1) as follows:

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 (38, 37, 36, and 35, figure 2-54) attaching drive tube to landing gear actuator lower bellcrank.

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 forward as far as possible to gain access to idler bellcrank attachment point, and remove nut (13), washer (14), spacers (2), and bolt (7).

1. Remove intermediate push-pull tube (10) as follows:

1. Remove nut (11), washer (12), spacers (9), and bolt (8) attaching push-pull tube to idler bellcrank (15).

2. Remove nut (34) and bolt (29) attaching push-pull tube to outboard bellcrank (28).

- j. Remove idler bellcrank (15) by removing bolt (3), and washers (4 and 5). Remove spacer (6) from idler bellcrank.

NOTE

Access to bolt (3) is provided by a hole in the

cabin floor above the bolt head.

k. Remove torque tube (25) as follows:

1. Remove adjusting bellcrank (18) by removing cotter pin (40) and pin (16). If desired, fork bolt (39) can be removed from adjusting bellcrank.

2. Remove inboard support bearing (20) by removing four nuts (21) and bolts (19). Remove washer (22).

3. Pull torque tube (25) inboard until it clears outboard support bearing (30), then tilt the outboard end upward and remove from nose section. Remove washer (33).

4. If desired, outboard support bearing (30) can be removed by removing attaching nuts (31) and bolts (32).

5. Remove stop collar (24) from torque tube by removing cotter pin (35) and pin (23).

NOTE

Removal of collar (26) and outboard bellcrank (28) from torque tube (25) is not recommended. These are matched parts and collar (26) is a press fit.

l. Remove connector link assembly (48) as follows:

1. Remove nut (79) and bolt (65) attaching connector link assembly to retracting arm (78).

2. Remove nut (50), washer (49), and bolt (47) attaching connector link assembly to adjusting rod end (51).

NOTE

Access to bolt (47) is provided by a hole in the adjacent structure. Rotate connector link assembly to align hole.

m. Remove drag brace (61) as follows:

1. Remove nut (58), washer (59), and bolt (62) attaching drag brace to truss assembly (55).

2. Remove nut and bolt attaching drag brace to strut.

n. Remove uplock torque tube (41) as follows:

1. Remove nut (44) and washer (45) from each end of assembly.

NOTE

Uplock torque tube (41) can be removed with left bearing assembly in place.

2. Remove bearing assemblies (46) by removing attaching nuts (43) and bolts (42).

NOTE

Bearings are a press fit, and should be removed from supports only for replacement.

3. If desired, uplock hook (52) and adjusting rod end (51) can be removed from uplock torque tube.

o. Remove truss assembly (55), retracting arm (78), and adjusting fork (68) as an assembly as follows:

1. Remove nut (63) and bolt (56) attaching switch

bracket (57) to truss assembly.

2. Remove clamps attaching switch wires to retracting linkage and tie switch where it will not interfere with linkage removal.

3. Remove nuts (70), washers (71), and bolts (73) attaching truss assembly to retainers (72).

4. Pull truss assembly forward and remove from airplane.

5. If desired, retracting arm (78) and adjusting fork (68) can be removed from truss assembly by removing attaching nuts and bolts.

6. If desired, retainers (72) can be removed from airplane by removing nuts (76), washers (75) and bolts (74).

2-298. CLEANING, INSPECTION, AND REPAIR OF NOSE GEAR RETRACTING LINKAGE. The instructions for cleaning, inspection, and repair of the main landing gear retracting linkage, given in paragraph 2-293, also apply to the nose gear retracting linkage.

2-299. INSTALLATION OF NOSE GEAR RETRACTING LINKAGE. (See figure 2-53.)

a. Install truss assembly (55) as follows:

1. If removed, install retracting arm (78) and adjusting fork (68) on truss assembly.

NOTE

Lower retracting arm bolt (67) is inaccessible after truss assembly is installed.

2. If removed, install retainers (72) with bolts (74), washers (75), and nuts (76).

3. Place truss assembly in position and attach to retainers with bolts (73), washers (71), and nuts (70).

4. Install clamps attaching switch wires to retracting linkage and attach switch bracket (57) to truss assembly with bolt (56) and nut (63).

b. Install uplock torque tube assembly (41) as follows:

1. If removed, attach uplock hook (52) and adjusting rod end (51) to uplock torque tube.

2. Install left bearing assembly, then place uplock torque tube in position and install right bearing assembly. Install bearing assemblies (46) with bolts (42) and nuts (43).

3. Install washer (45) and nut (44) on each end of uplock torque tube assembly.

c. Install drag brace (61) as follows:

1. Attach drag brace to truss assembly (55) with bolt (62), washer (59), and nut (58).

NOTE

When installing bolt (62), insure that down indicator switch bracket (57) is properly in place.

2. Connect drag brace to strut with attaching bolt and nut.

d. Install connector link assembly (48) as follows:

1. Attach connector link assembly to retracting arm (78) with bolt (65) and nut (79).

2. Attach connector link assembly to adjusting rod end (51) with bolt (47), washer (49), and nut (50).

NOTE

Access to bolt (47) is provided by a hole in the adjacent structure. Rotate connector link assembly to align hole.

e. Install torque tube (25) as follows:

1. Install stop collar (24) on torque tube with pin (23) and cotter pin (35).

NOTE

Bellcrank (28) and collar (26), located at the outboard end of torque tube (25), 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 (30) with bolts (32) and nuts (31).

NOTE

Torque the nuts attaching inboard and outboard support bearings to 13.5 ± 1.5 pound-inches.

3. Install outboard washer (33) on torque tube and place in position.

NOTE

Insert inboard end of torque tube through the inboard mounting hole from the left, pull into wheel well area until outboard end of torque tube can be inserted into outboard support bearing.

4. Place inboard washer (22), then inboard support bearing (20), on inboard end of torque tube. Install support bearing with bolts (19) and nuts (21).

5. If removed, install fork bolt (39) in adjusting bellcrank (18).

6. Install adjusting bellcrank (18) on torque tube with pin (16) and cotter pin (40).

NOTE

Splines must align so that pin (16) can be installed, and bellcranks (18 and 28) both extend forward from torque tube.

- f. Insert spacer (6) into idler bellcrank (15), place bellcrank in position, and install with bolt (3) and washers (4 and 5).

- g. Install intermediate push-pull tube (10) as follows:

1. Attach push-pull tube to outboard bellcrank (28) with bolt (29) and nut (34).

NOTE

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

2. Attach push-pull tube to idler bellcrank (15) with bolt (8), washer (12), spacers (9), and nut (11).

NOTE

To gain access to idler bellcrank attachment points, rotate bellcrank forward as far as possible.

h. Install nose gear drive tube (1) as follows:

1. Attach drive tube to idler bellcrank (15) with bolt (7), washer (14), spacers (2), and nut (13).

2. Attach drive tube to landing gear actuator lower bellcrank with bolt, washer, nut and cotter pin (35, 36, 37, and 38, figure 2-54).

NOTE

Access to lower bellcrank is gained through an access hole on underside of fuselage.

i. Install forward push-pull tube (37) 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 to connector link assembly (48) with bolt (64), washer (80), and nut (81).

3. Attach push-pull tube to fork bolt (39) with bolt (38) and nut (36).

- j. Rig nose gear retracting linkage in accordance with paragraph 2-316.

- k. Connect nose gear doors in accordance with paragraph 2-271, and rig nose gear doors in accordance with paragraph 2-272.

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

- m. Install left front carpet in accordance with paragraph 2-204.

- n. Install pilot's seat in accordance with paragraph 2-181.

- o. Insure that landing gear is DOWN, then remove jacks.

2-300. LANDING GEAR ACTUATOR.

2-301. The landing gear actuator consists of an electric motor, a reduction unit, and a worm-and-sector assembly. The actuator is normally operated by the electric motor; however, linkage is provided to disengage the motor-driven reduction unit and engage the manual extension system, which is linked directly to the actuator worm gear. The bellcrank that operates the main landing gear drive tubes is attached to the upper end of the sector shaft, which extends vertically through the actuator assembly, and the bellcrank that operates the nose gear drive tube is attached to the lower end of the sector shaft. Adjustable limit switches are provided so that correct landing gear travel can be obtained.

2-302. REMOVAL OF LANDING GEAR ACTUATOR.
(See figure 2-54.)

- a. Jack airplane in accordance with paragraph 1-15.

- b. Remove rear carpet in accordance with paragraph 2-204.

- c. Remove access hole covers from cabin floor above landing gear actuator and from underside of fuselage beneath landing gear actuator.

- d. Release tension on retracting linkage by engaging manual extension crank and operating a few turns to-

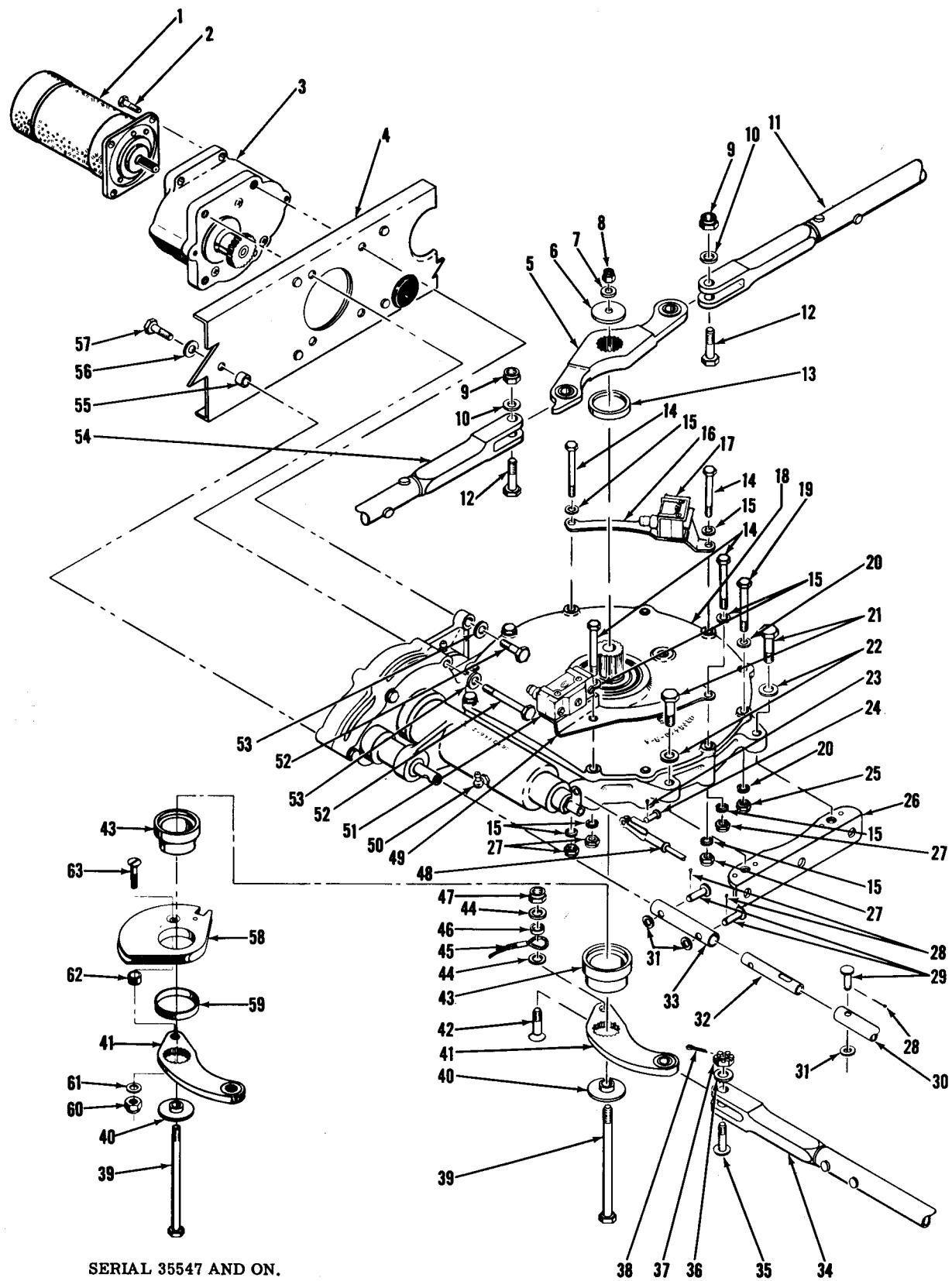


Figure 2-54. Landing Gear Actuator Installation

Figure 2-54. Landing Gear Actuator Installation Callouts

1. Landing Gear Motor	17. UP Limit Switch	33. Outer Shaft	48. Manual Extension
2. Bolt	18. Actuator Assembly	34. Nose Gear Drive	Disengage Rod
3. Reduction Unit	19. Bolt	Tube	49. Switch Bracket
4. Bulkhead	20. Washer	35. Bolt	50. Grease Fitting
5. Upper Bellcrank	21. Bolt	36. Washer	51. DOWN Limit Switch
6. Cap	22. Washer	37. Nut	52. Bolt
7. Washer	23. Cotter Pin	38. Cotter Pin	53. Washer
8. Nut	24. Pin	39. Bolt	54. Main Gear Drive Tube
9. Nut	25. Nut	40. Cap	55. Spacer
10. Washer	26. Mounting Bracket	41. Lower Bellcrank	56. Washer
11. Main Landing Gear	27. Nut	42. Screw	57. Bolt
Drive Tube	28. Cotter Pin	43. Spacer	58. Pulley
12. Bolt	29. Pin	44. Washer	59. Spacer
13. Spacer	30. Gear Shaft	45. Step Retracting Cable	60. Nut
14. Bolt	31. Washer	46. Spacer	61. Washer
15. Washer	32. Inner Shaft	47. Nut	62. Spacer
16. Switch Bracket			63. Screw

ward the UP position.

e. (See figure 2-53.) Disconnect nose gear forward push-pull tube (37) from fork bolt (39) by removing nut (36) and bolt (38).

f. (See figure 2-51.) Disconnect both main landing gear drive tubes (43) from idler bellcranks (16) by removing nuts (44), spacers (42), and bolts (40).

g. Disconnect cabin step retracting cable (45) from lower bellcrank (41) as follows:

1. Fasten cabin step in a partially UP position. A suitable stand or block can be placed beneath step, or step can be wired to its stop bolt to keep it from extending.

2. Operate landing gear to the DOWN position. This releases tension on the retracting cable.

3. Remove nut (47), washers (44), spacer (46), and screw (42) attaching retracting cable to lower bellcrank (41).

4. On aircraft serial 35547 and on, the cabin step retracting cable (45) attaches to pulley (58).

NOTE

To facilitate installation, do not permit step to extend while retracting cable is disconnected.

h. Remove cotter pin (38), nut (37), washer (36), and bolt (35) attaching nose gear drive tube (34) to lower bellcrank (41).

i. Remove nut (8), washer (7), caps (6 and 40), and bolt (39) attaching upper and lower bellcranks to the sector shaft.

j. Lift upper bellcrank (5) enough to allow main gear drive tubes (11 and 54) to be disconnected. Remove nuts (9), washers (10), and bolts (12) attaching main gear drive tubes to upper bellcrank (5). Slide both tubes outboard so they will not interfere with actuator removal, then remove upper bellcrank and spacer (13).

k. Disconnect manual extension disengage rod (48) by removing cotter pin (23) and pin (24).

l. Disconnect manual extension drive tubes by removing three cotter pins (28), washers (31), and pins (29). To disconnect, slide outer shaft (33) aft and inner shaft (32) forward.

m. Remove safety wire from all bolts which must

be removed.

n. Remove four bolts (52) and washers (53) attaching reduction unit (3) and actuator assembly (18) to bulkhead (4).

NOTE

To remove reduction unit (3) or motor (1) from airplane, remove four bolts (2). When removing motor, disconnect and tag the electrical wires at the quick-disconnects provided.

o. Remove four nuts (27), washers (15), and bolts (14) attaching switch brackets (16 and 49) to actuator assembly. Do not disturb switch adjustment except to replace switches or brackets.

p. Remove remaining nut (25), washers (20), and bolt (19) attaching actuator assembly to mounting channel.

q. Remove bolts (21) and washers (22) attaching actuator assembly to forward mounting bracket (26).

r. Remove bolt (57), washer (56), and spacer (55) attaching actuator assembly to bulkhead (4).

s. Lift actuator assembly vertically and remove from airplane.

t. Remove lower bellcrank (41) and spacer (43) from end of sector shaft.

u. On aircraft serial 35547 and on, remove pulley (58) from lower bellcrank (41) by removing screw (63).

2-303. CLEANING, INSPECTION, AND LUBRICATION OF LANDING GEAR ACTUATOR.

a. Disassembly of the landing gear actuator assembly or reduction unit is not recommended, and no repairs are permissible. If malfunction occurs, return the defective assembly to factory for replacement.

b. Clean external parts of landing gear actuator assembly and reduction unit by wiping with a clean cloth. Dampen cloth with suitable cleaning solvent to remove oil or grease accumulations.

c. Inspect assemblies externally for visible damage such as cracks, nicks, dents, and scratches. Check all bolt holes for elongation. Inspect splines in the upper and lower bellcranks and splines on the protruding portions of sector shaft for visible damage.

d. Lubricate landing gear actuator in accordance with figure 1-6, sheet 4.

2-304. INSTALLATION OF LANDING GEAR ACTUATOR. (See figure 2-54.)

a. Install spacer (43) and lower bellcrank (41) on lower end of sector shaft. On aircraft serial 35547 and on, attach pulley (58) to lower bellcrank (41) before installing bellcrank on shaft. Be certain that spacers (59 and 62) are in place.

NOTE

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

b. Position actuator assembly and install spacer (55), washer (56), and bolt (57) attaching actuator assembly to bulkhead (4). Outer shaft (33) and inner shaft (32) must be in place before positioning actuator.

NOTE

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

c. Install two bolts (21) and washers (22) attaching actuator assembly to forward mounting bracket (26).
d. Install switch brackets (16 and 49) with bolts (14), nuts (27), and washers (15).

CAUTION

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

e. Install bolt (19), washers (20), and nut (25) attaching actuator assembly to mounting channel.

NOTE

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

f. Install four bolts (52) and washers (53) attaching actuator assembly and reduction unit to bulkhead (4).

NOTE

Shim as required between reduction unit (3) and bulkhead (4) to align reduction unit drive gear with the driven gear in the actuator.

g. If removed, install four bolts (2) attaching motor (1) to reduction unit (3).

h. If motor was removed, connect the electrical wires at the quick-disconnects provided.

i. Tighten all nuts and bolts which were installed but not tightened.

j. Safety bolts (2) attaching motor (1) to reduction unit (3).

k. Safety bolt (57) to bulkhead (4).

l. Safety bolts (52) attaching actuator to bulkhead.

m. Connect manual extension drive tubes with pins (29), washers (31), and cotter pins (28).

n. Connect manual extension disengage rod (48) with pin (24) and cotter pin (23).

o. Position upper bellcrank (5) above actuator assembly, slide main gear drive tubes (11 and 54) inboard, and attach to bellcrank with bolts (12), washers (10), and nuts (9). Install bolts (12) with their threaded ends UP.

NOTE

The collar-end of the vertical inboard hi-shear rivet must point downward for clearance.

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

NOTE

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

q. Insure that lower bellcrank (41) and spacer (43) are correctly in place and install bolt (39), caps (40 and 6), washer (7), and nut (8).

r. Attach nose gear drive tube (34) to lower bellcrank (41) with bolt (35), washer (36), nut (37), and cotter pin (38).

s. Connect cabin step retracting cable (45) to lower bellcrank (41). On aircraft serial 35547 and on attach cabin step retracting cable to pulley (58).

NOTE

If cabin step was permitted to extend while the retracting cable was disconnected, it will be necessary to place step partially UP. Refer to paragraph 2-302, step "g."

t. (See figure 2-51.) Connect main landing gear drive tubes (43) to idler bellcranks (16) with bolts (40), spacers (42), and nuts (44).

u. (See figure 2-53.) Connect forward push-pull tube (37) to fork bolt (39) with bolt (38) and nut (36).

v. Perform an operational check of landing gear, checking especially that limit switches are correctly adjusted and landing gear is correctly rigged. Refer to paragraph 2-315 for limit switch adjustment and landing gear rigging procedure.

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

x. Install rear carpet in accordance with paragraph 2-204

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

2-305. MANUAL EXTENSION SYSTEM.

2-306. The manual extension system consists of a hand crank, which is connected to the landing gear actuator by an arrangement of chain and sprockets, bellcranks, miter gears, and push-pull rods. The hand crank, located at the right of the pilot's seat, is provided with a spring-loaded release button which unlocks the hand crank so that it can be folded into the stowed position. When the hand crank is folded, it disengages the manual extension system; when unfolded into its operating position, the hand crank disengages the normal landing gear operating system.

2-307. REMOVAL OF MANUAL EXTENSION SYSTEM.

(See figure 2-55.)

- a. Remove pilot's seat in accordance with paragraph 2-179.
- b. Remove rear carpet in accordance with paragraph 2-203.
- c. Remove access hole cover from cabin floor above landing gear actuator.
- d. Remove chain guards by removing attaching screws.
- e. Remove chain (17) by disconnecting at master link.
- f. Remove crank handle and shaft assembly as follows:
 1. Remove roll pin (1), collar (2), and washer (3) from shaft (7).
 2. Remove cotter pin (18) and pin (19) attaching spool (5) to shaft (7).
 3. Pull crank handle and shaft from supports, removing spool (5) as shaft is pulled through it.
 - g. If desired, disassemble crank handle and shaft by removing nut (14), bolt (12), cotter pins (15), and pins (16).
 - h. Remove upper rod assembly (28) by removing cotter pins (26), washers (27), and pins (25) attaching rod assembly to bellcranks (24 and 40).
 - i. Remove upper bellcrank (24) by removing nut (29), washers (21), and bolt (20). Remove bushing (23) from bellcrank.
 - j. Remove lower rod assembly (44) by removing cotter pins (42), washer (36), and pins (43) attaching rod assembly to lower bellcrank and landing gear actuator.
 - k. Remove lower bellcrank (40) by removing nut (37), washer (38), spacer (39), and bolt (41).
 - l. Remove chain tightener (30) by removing attaching screw (33) and washer (34), and adjusting screw (32), washers (31), and nut (35).
 - m. Remove gear support bracket (62) as follows:
 1. Disconnect shafts (52, 59, and 60) by removing the three cotter pins (53), washers (54), and pins (50).
 2. Slide outer shaft (60) aft and inner shaft (59) forward to disconnect.
 3. Remove two bolts (58) attaching gear support bracket to front spar.
 4. Remove two screws (57), washers (56), and nuts (55) attaching gear support bracket to bottom of fuselage.
 - n. If desired, disassemble gear support bracket as follows:
 1. Remove three roll pins (46) attaching sprocket (47) and gears (48 and 51) to gear shafts (63 and 52).
 2. Remove snap ring (49) from gear shaft (63).
 3. Remove gear shaft (63) through the left side of the bracket, removing sprocket (47) and gear (48) as shaft is removed.
 4. Remove gear (51) and shaft (52) from gear support bracket.

NOTE

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

2-308. CLEANING, INSPECTION, AND LUBRICATION**OF MANUAL EXTENSION SYSTEM.**

- a. Clean all components with suitable cleaning solvent.
- b. Inspect miter gears and sprockets for visible damage such as chipped or broken teeth, nicks, dents, cracks and deep scratches.
- c. Inspect all bolt and pin holes for elongation.
- d. Inspect all welds for cracks.
- e. Repair of manual extension system components is limited to replacement of parts, smoothing out of minor nicks, dents, and scratches, and repainting of areas where paint has chipped or peeled.
- f. Lubricate manual extension system in accordance with figure 1-6, sheet 4.

2-309. INSTALLATION OF MANUAL EXTENSION SYSTEM. (See figure 2-55.)

- a. If disassembled, assemble gear support bracket (62) as follows:
 1. If removed, press oilite bearings into gear support bracket.
 2. Assemble gear (51) to shaft (52) with attaching roll pin (46), and insert into position in gear support bracket.
 3. Insert shaft (63) through the left side of gear support bracket, through sprocket (47) and gear (48). Install two roll pins attaching sprocket and gear to shaft, and safety all three roll pins (46).
 4. Install snap ring (49) on gear shaft (63).
- b. Install gear support bracket (62) as follows:
 1. Place outer shaft (60) on actuator shaft (61) and slide aft.
 2. Insert inner shaft (59) into gear shaft (52) and slide forward.
 3. Position gear support bracket in airplane and attach to fuselage bottom with two screws (57), washers (56), and nuts (55).
 4. Install two bolts (58) 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 (50), washers (54), and cotter pins (53).
 - c. Install chain tightener (30) with attaching screw (33) and washer (34). Install adjusting screw (32), washers (31), and nut (35), but do not tighten at this time.
 - d. Install lower bellcrank (40) with bolt (41), spacer (39), washer (38), and nut (37).
 - e. Insert bushing (23) into upper bellcrank (24) and install bellcrank with bolt (20), washers (21), and nut (29).
 - f. If disassembled, reassemble crank handle and shaft with pins (16), cotter pins (15), nut (14), and bolt (12).
 - g. Install crank handle and shaft assembly as follows:
 1. Insert crank handle and shaft through inboard support (6), spool (5), and outboard support (4).
 2. Engage upper bellcrank (24) with spool (5), align spool attaching holes, and install pin (19) and cotter pin (18).
 3. Place washer (3) and collar (2) on shaft (7), install roll pin (1), and safety.

NOTE

Washer (3) is used as required to eliminate end play from the shaft assembly.

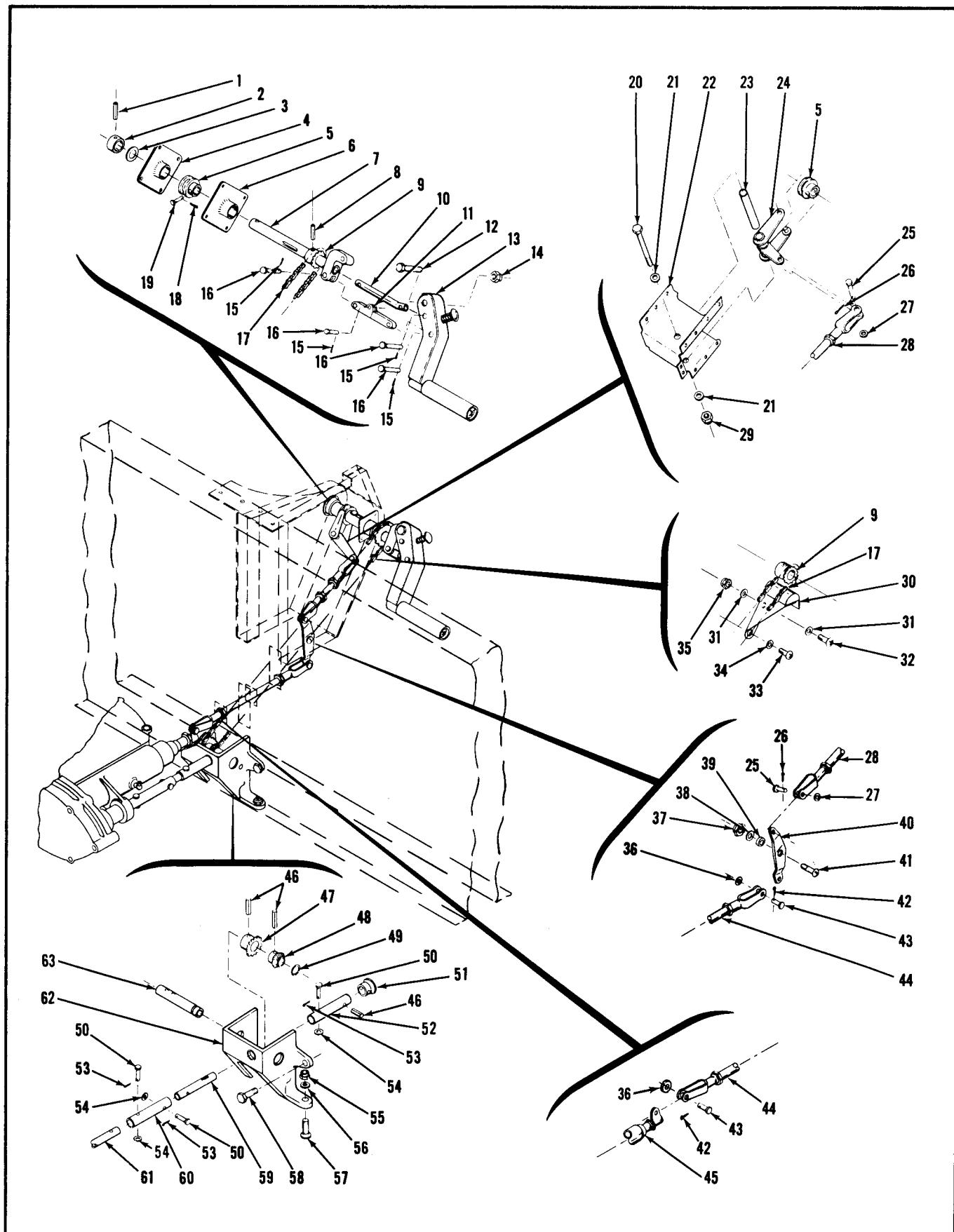


Figure 2-55. Manual Extension System

Figure 2-55. Manual Extension System Callouts

1. Roll Pin	22. Bracket	43. Pin
2. Collar	23. Bushing	44. Lower Rod Assembly
3. Washer	24. Upper Bellcrank	45. Landing Gear Actuator
4. Outboard Support	25. Pin	46. Roll Pin
5. Spool	26. Cotter Pin	47. Sprocket
6. Inboard Support	27. Washer	48. Gear
7. Shaft	28. Upper Rod Assembly	49. Snap Ring
8. Roll Pin	29. Nut	50. Pin
9. Sprocket	30. Chain Tightener	51. Gear
10. Spool Link	31. Washer	52. Gear Shaft
11. Crank Link	32. Adjusting Screw	53. Cotter Pin
12. Bolt	33. Screw	54. Washer
13. Crank	34. Washer	55. Nut
14. Nut	35. Nut	56. Washer
15. Cotter Pin	36. Washer	57. Screw
16. Pin	37. Nut	58. Bolt
17. Chain	38. Washer	59. Inner Shaft
18. Cotter Pin	39. Spacer	60. Outer Shaft
19. Pin	40. Lower Bellcrank	61. Actuator Shaft
20. Bolt	41. Bolt	62. Gear Support Bracket
21. Washer	42. Cotter Pin	63. Gear Shaft

h. Install chain (17) on sprockets (9 and 47) and connect with master link. Adjust chain tightener (30), and tighten adjusting screw (32) and nut (35).

i. Attach lower rod assembly (44) to lower bellcrank and landing gear actuator with pins (43), washer (36), and cotter pins (42).

j. Attach upper rod assembly (28) to bellcranks (24 and 40) with pins (25), washers (27), and cotter pins (26).

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 (44) to a length of approximately 4.80 inches, measured between the centerlines 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 (28) so that rod end bolt holes align with holes in upper and lower bellcranks (24 and 40).

4. Lengthen upper rod assembly (28) 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 steps "3" and "4."

1. 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 hole cover on cabin floor above landing gear actuator.

o. Install rear carpet in accordance with paragraph 2-204.

p. Install pilot's seat in accordance with paragraph 2-181.

2-310. LANDING GEAR WARNING SYSTEM.

2-311. The landing gear warning system consists of a red light, green light, and warning horn. The red light is illuminated when the landing gear UP limit switch is actuated. The green light is illuminated when the nose gear and both main gear DOWN indicator switches are actuated. The warning horn is sounded when the throttle microswitch is actuated by retarding either throttle while the landing gear is not in the DOWN position. The warning horn is also sounded if the landing gear switch is placed in the UP position while the landing gear safety switch is being actuated by the weight of the airplane while on the ground. A flasher unit in the warning horn electrical circuit causes it to sound intermittently.

2-312. REMOVAL OF LANDING GEAR WARNING SYSTEM. The complete landing gear warning system will not ordinarily be removed. Switches, lights and the warning horn can be removed using standard shop procedures. The nose gear DOWN indicator switch is located at the lower end of the drag brace truss assembly, and the main gear DOWN indicator switches are located at the main gear side brace lock links. The warning horn and flasher unit are located beneath the pilot's seat; the horn on the outboard support web, and the flasher unit on the front spar.

2-313. 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 airplane. 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 airplane 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 airplane in accordance with paragraph 1-15 and retract the landing gear.
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

On aircraft serial 35000 thru 35713 elongated slots are provided to permit adjustment of the microswitch. On aircraft serial 35714 and on elongated slots are provided for vertical adjustment and an adjusting screw positions the microswitch horizontally.

10. After microswitch adjustment is completed, place throttle levers in the CLOSED position and the mixture levers in IDLE CUT-OFF.
- b. Adjust DOWN indicator switches as follows:
 1. Disconnect main wheel well doors in accordance with paragraph 2-251.
 2. Disconnect nose gear main doors in accordance with paragraph 2-270.
 3. Release tension on retracting linkage by en-

gaging manual extension crank and operating a few turns toward the UP position.

4. (See figure 2-53.) Disconnect nose gear forward push-pull tube (37) from fork bolt (39) by removing nut (36) and bolt (38).

5. (See figure 2-51.) Disconnect main gear intermediate push-pull tube (4) from idler bellcrank (16) by removing nut (45), spacers (18), and bolt (41).

6. Adjust all three DOWN indicator switches so that they are not actuated until landing gear is DOWN and locked by the over-center linkage. Adjust the main landing gear switches by repositioning. Adjust the nose gear switch by adjusting the switch actuating bolt.

7. Attach the push-pull tubes disconnected in steps "4" and "5."

8. Using the normal landing gear retraction system, operate landing gear to the UP position.

9. Place landing gear switch in a neutral position, engage the manual extension crank, and lower the landing gear. Stop cranking immediately when the green light illuminates, and note the exact angular position of the crank.

10. Check that both main gear and nose gear are DOWN and locked in the over-center position.

11. Resume cranking toward the DOWN position, noting the number of turns required, until the internal stop in the landing gear actuator is reached. The number of turns required should be not less than four, nor more than eight.

12. If necessary, readjust DOWN indicator switches as required to meet the conditions of steps "6" and "11."

13. Connect nose gear main doors in accordance with paragraph 2-271.

14. Connect main wheel well doors in accordance with paragraph 2-252.

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

2-314. RIGGING OF LANDING GEAR.

2-315. RIGGING OF MAIN LANDING GEAR. (See figure 2-56.)

- a. Jack airplane in accordance with paragraph 1-15.

- b. Remove rear carpet in accordance with paragraph 2-204.

- c. Remove access hole cover from cabin floor above landing gear actuator.

- d. Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.

- e. (See figure 2-42.) Remove main wheel well door link tubes (15) by removing nuts (14 and 12), washers (11), spacers (13), and bolts (17).

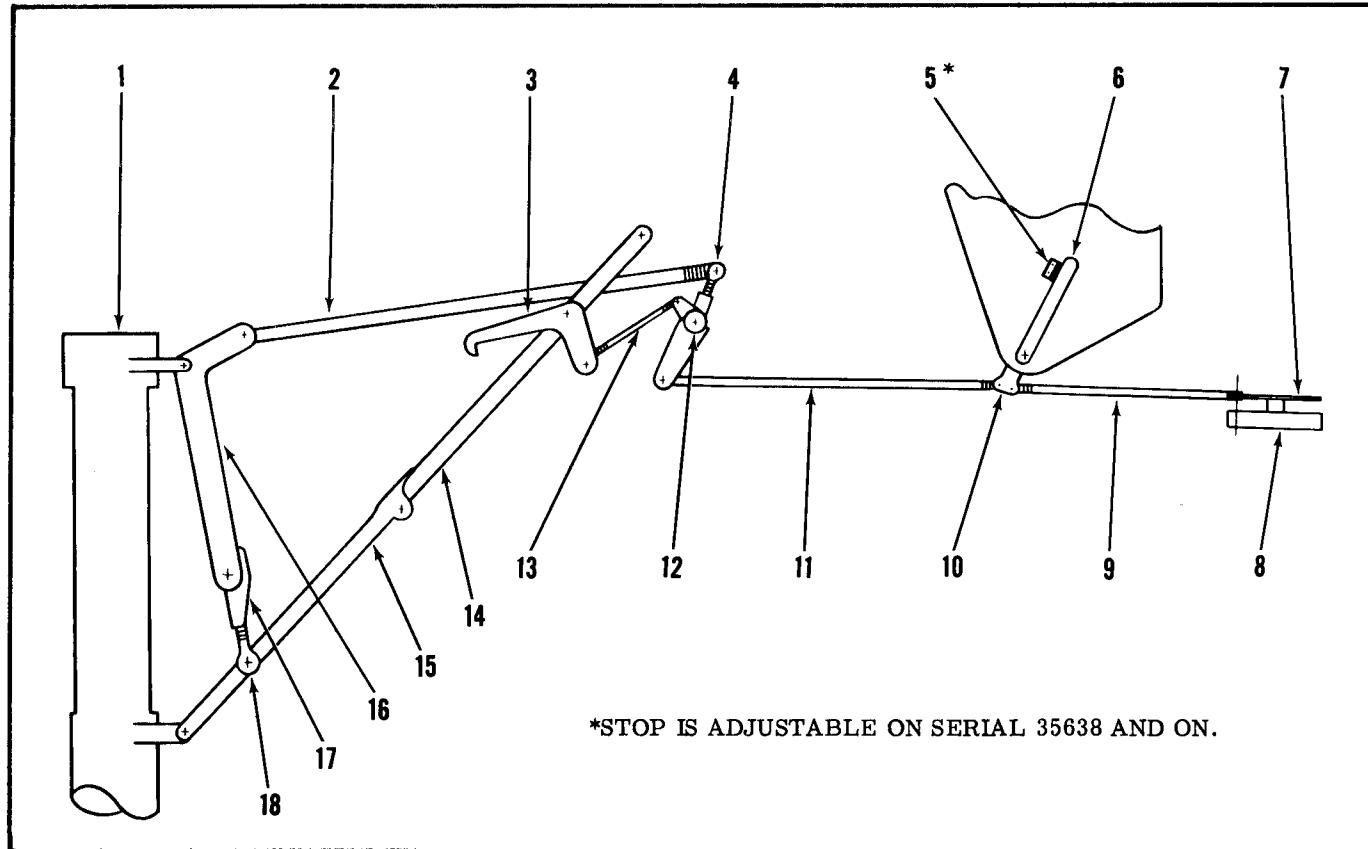
- f. (See figure 2-53.) Disconnect nose gear retracting linkage by removing nut (36) and bolt (38) attaching forward push-pull tube (37) to fork bolt (39).

- g. (See figure 2-51.) Disconnect the inboard ends of both intermediate push-pull tubes (4) by removing nuts (45), spacers (18), and bolts (41).

- h. Adjust limit switches (17 and 51, figure 2-54) and main drive tubes (9) as follows:

1. Disconnect both main drive tubes (9) from idler bellcranks (10).

2. Adjust both limit switches to the end of their adjusting slots in a direction which will permit maxi-



- | | | |
|----------------------------|---------------------------------|---------------------------|
| 1. Main Landing Gear Strut | 7. Bellcrank | 13. Uplock Push-pull Tube |
| 2. Outboard Push-pull Tube | 8. Landing Gear Actuator | 14. Upper Side Link |
| 3. Uplock | 9. Main Drive Tube | 15. Lower Side Link |
| 4. Fork Bolt | 10. Idler Bellcrank | 16. Bellcrank |
| 5. Stop | 11. Intermediate Push-pull Tube | 17. Side Brace Lock Link |
| 6. Door Actuator Arm | 12. Torque Tube | 18. Lock Link End Fitting |

Figure 2-56. Schematic of Main Landing Gear Retracting Linkage

mum bellcrank travel.

NOTE

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

3. Engage manual extension crank and operate toward the UP position until the internal stop in the actuator is reached.

CAUTION

To prevent possible damage to the actuator, do not force against the internal stop.

4. Note the angular position of the crank when internal stop is reached, back crank off two turns, then advance crank one-half turn. Adjust the UP limit switch (17, figure 2-54) so that it is just actuated at this point.

5. Manually operate gear toward the DOWN position until the internal stop in the actuator is reached.

CAUTION

To prevent possible damage to the actuator, do not force against the internal stop.

6. Note the angular position of the crank when internal stop is reached, then back crank off two turns. Adjust the DOWN limit switch (51, figure 2-54) so it is just actuated at this point.

7. After these preliminary adjustments to the limit switches have been made, stow the manual extension crank and operate the actuator electrically until the UP limit switch is actuated.

CAUTION

Caution must be observed during gear 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 suit-

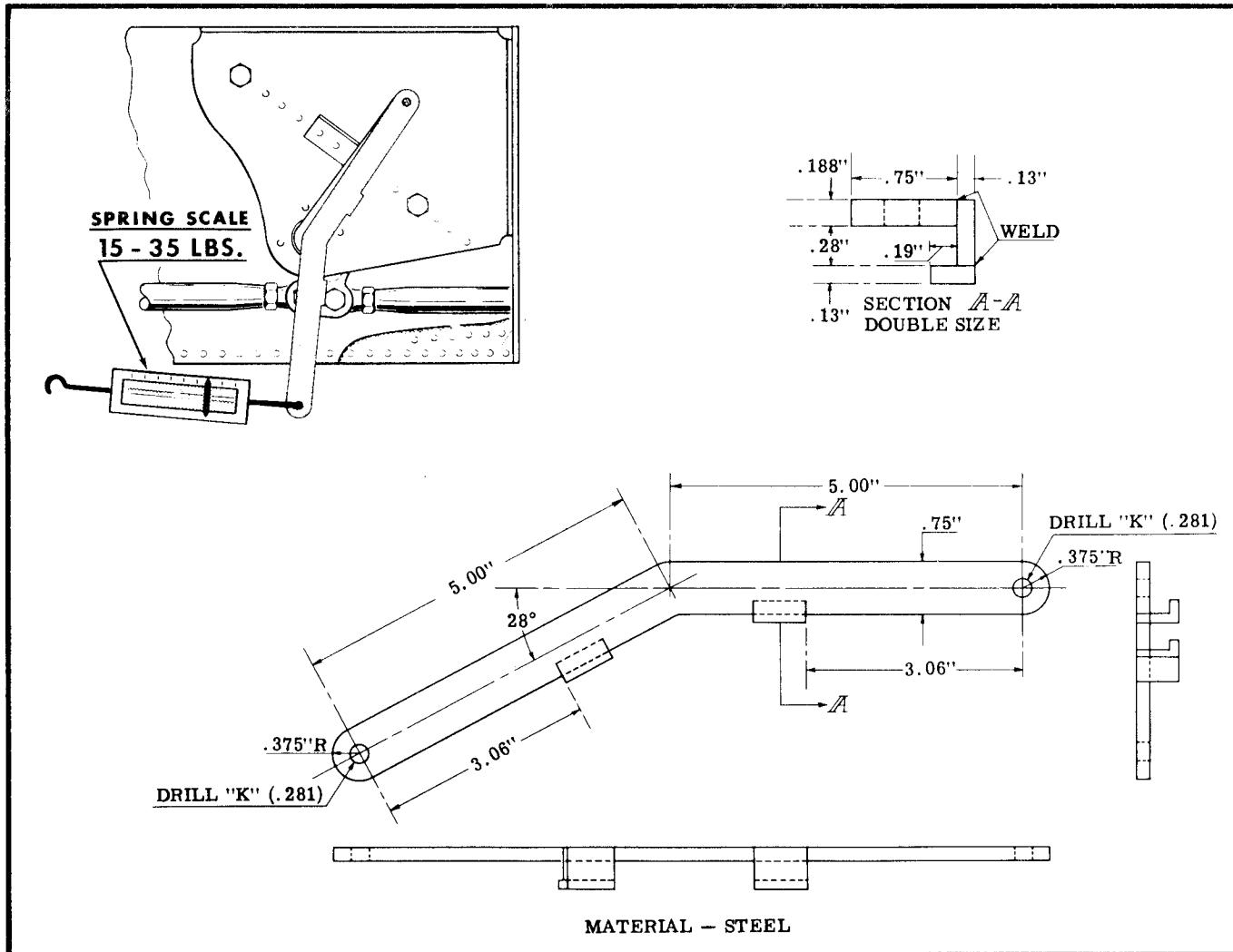


Figure 2-57. Fabrication and Use of Tool for Measuring Door Actuator Arm Tension

able 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.

8. 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 and the maximum (and desired) number of turns is one and one-half turns. If necessary, adjust UP limit switch to obtain this requirement.

9. Stow the manual extension crank and operate the actuator electrically until the DOWN limit switch is actuated.

10. Engage the manual extension crank and note the position of the crank. Operate crank toward the DOWN position, noting 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 turn and the maximum (and desired) number of turns is two turns. If necessary, adjust the DOWN

limit switch to obtain this requirement.

11. Adjust the length of both main drive tubes (9) as short as possible and connect to idler bellcranks (10).

12. Operate actuator to the UP position and check the pull required to move door actuator arms (6) from stops (5) as illustrated in figure 2-57.

NOTE

The pull required to move door actuator arm from the stop must be measured at a right angle to the arm. The tool illustrated in figure 2-57 can be made to facilitate this measurement.

13. Adjust the length of both main drive tubes as necessary to obtain a force of 15 to 35 pounds required to move door actuator arms from stops, in both the UP position and the DOWN position. The maximum difference between the forces required to move one door actuator arm from its stop, in both UP and DOWN positions, is ten pounds. If necessary, readjust the UP limit switch to obtain the required forces and maximum differences. If UP limit switch is readjusted, recheck the minimum turn requirement specified in step 8.

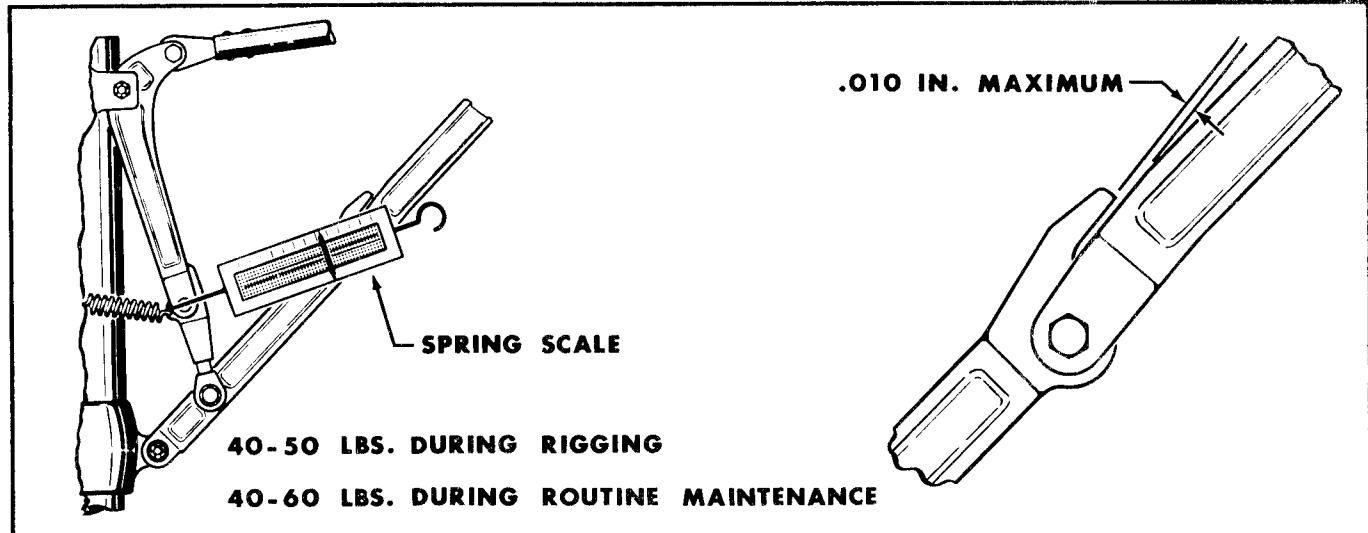


Figure 2-58. Main Landing Gear Downlock Requirements

NOTE

On some airplanes adjustable stop bolts are provided for the door actuator arms instead of the fixed stops formerly used. Adjust the stop bolts to a preliminary dimension of approximately 1/2 inch, measured between the nutplate and the contact surface of the bolt head. Adjust the length of the main drive tubes so that the difference between the forces required to move one door actuator arm from its stop, in both the UP and DOWN positions, is not more than ten pounds, then adjust the stop bolts to obtain forces within limits specified in steps "8" and "10."

1. Adjust side brace lock links (17) as follows:
 1. With landing gear in DOWN position, adjust end fitting (18) so that side brace lock link is held snugly in over-center position.
 2. Manually "break" the lock link from its over-center 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

Adjust the side brace lock link end fitting to the greatest length at which the free fall requirement can be obtained and maintained.

3. Check for clearance between upper end of lower side link and lower end of upper side link as illustrated in figure 2-58. Zero clearance is desired, maximum clearance is .010 inch.
4. Adjust side brace lock links for both main landing gear in this manner.

NOTE

After the preceding steps have been completed, the main landing gear retraction system is rigged from the limit switches through the idler bellcranks, and both side brace lock links are

adjusted at the landing gear. The following procedure is to rig the retraction system from the idler 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 intermediate push-pull tubes (11) as short as possible, and install.
 3. Screw fork bolts (4) into torque tubes (12) as far as possible.
 4. Operate landing gear actuator to DOWN position.
 5. With landing gear DOWN, adjust length of outboard push-pull tubes (2) so that rod end holes align with the holes in fork bolts (4) and bellcranks (16), then shorten one turn. Operate landing gear actuator toward the UP position far enough to permit installation and install outboard push-pull tubes (2). Install with the collar-end of the hi-shear rivets pointing upward for clearance.

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.
 2. The wheel should make contact with the corrugated reinforcement at the top of wheel well, then drop down a specified distance. Refer to step "m."
 3. Adjust the fork bolts for both main landing gear in this manner.
 - 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 1/16 inch. The maximum is 1/8 inch.

2. If drop-off is too much, lengthen intermediate push-pull tube (11) in half-turn increments until drop-off is correct.

3. If drop-off is too little, shorten intermediate push-pull tube (11) in half-turn increments until drop-off is correct.

4. Adjust the amount of drop-off for both main landing gear in this manner.

n. Adjust the downlock tension as follows:

1. Operate the landing gear to the DOWN position. The main landing gear downlock tension should be 40 to 60 pounds. During rigging, the downlock tension should be maintained between 40 and 50 pounds. The 60 pound upper limit during routine maintenance is established in order to compensate for variances of aircraft loading and temperature. If at anytime either main landing gear downlock tension checks under 40 or over 60 pounds, re-rig as necessary.

NOTE

On all serials prior to 35772 if the right hand main landing gear downlock tension checks less than 40 pounds, remove right hand main landing gear push-pull tube from aircraft and check tube for straightness by measuring between tube and a flat reference surface. A maximum of .050 in. deviation from straight, measured between tube wall and the flat reference surface, is allowable. A tube out of straight by more than .050 in. should be rejected and replaced with a new tube. Recheck landing gear rigging and re-rig as necessary holding 40 to 50 pounds tension. The maximum clearance between the upper and lower side links is .010 in. with a zero clearance desired.

2. If downlock tension is too high, lengthen outboard 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 outboard push-pull tube (2) and the fork bolt (4), this combined length must remain unchanged to maintain the correct highest position. When adjusting the outboard 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.

3. If downlock tension is too low, shorten outboard push-pull tube (2) until the correct downlock tension is obtained. Readjust the fork bolt (4) as required in the preceding "NOTE."

4. Adjust the downlock tension for both main landing gear in this manner.

NOTE

In addition to the downlock tension requirement, the landing gear must also "free fall" and lock when released from a position which

is not more than six inches inboard from the DOWN position, while main drive tube is disconnected. If necessary readjust side brace lock link (17) to obtain this condition.

o. (See figure 2-52.) Install and adjust uplocks as follows:

1. Insure that spacers (26) are in place, position uplock assemblies (19), and attach to upper side links with bolts (25), washers (20) and nuts (21).

2. Adjust uplock push-pull tubes (10) to a preliminary length of 5.15 inches and attach to torque tube with bolts (8), washers (7) and nuts (6).

3. Connect uplock push-pull tubes to uplock assemblies with bolts (24), washers (23), and nuts (22).

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, re-adjust 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.

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.

p. (See figure 2-53.) Connect nose gear retracting linkage by installing bolt (38) and nut (36) attaching forward push-pull tube (37) to fork bolt (39).

NOTE

If landing gear retraction system limit switch adjustment was changed while rigging the main landing gear, disregard step "p" and rig nose gear in accordance with paragraph 2-316.

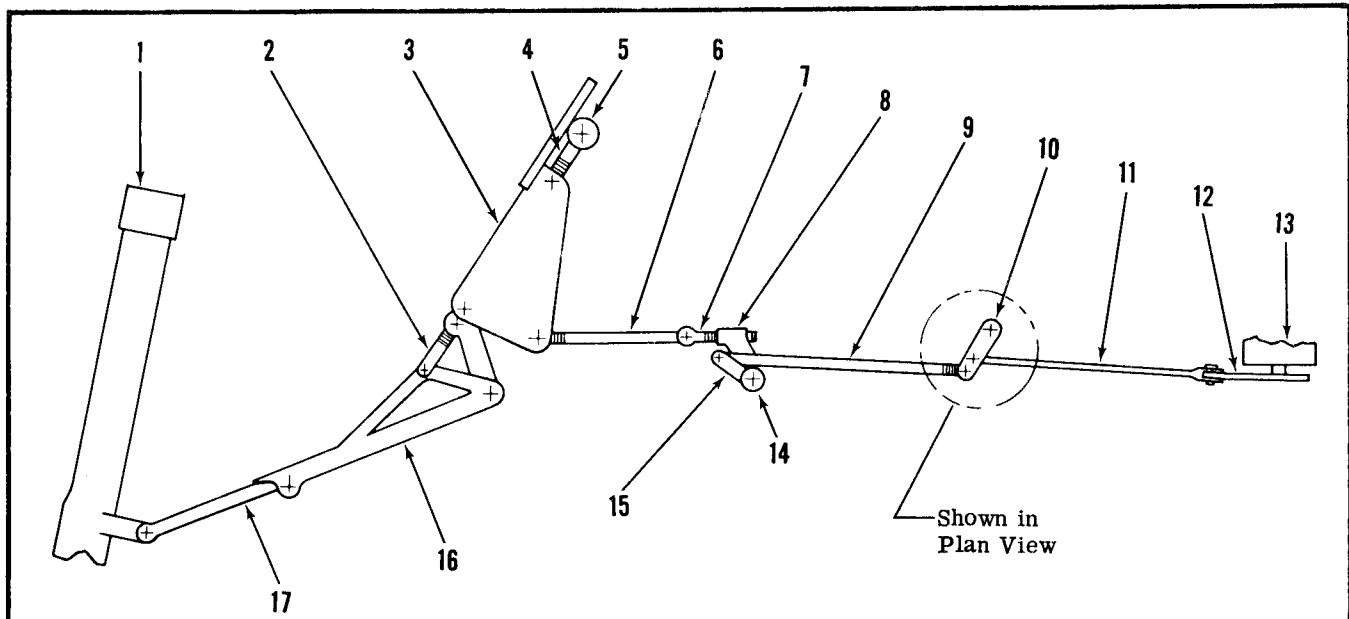
q. (See figure 2-42.) Install main wheel well door link tubes (15) with bolts (17), spacers (13), washers (11), and nuts (14 and 12). Rig doors in accordance with paragraph 2-272.

r. Install access hole cover on cabin floor above landing gear actuator.

s. Install rear carpet in accordance with paragraph 2-204.

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

2-316. RIGGING OF NOSE GEAR. (See figure 2-59.) The following is a procedure for rigging the nose gear. The main landing gear should be properly rigged before rigging the nose gear.



- | | | |
|---------------------------|--------------------------------|---------------------------|
| 1. Nose Gear Strut | 7. Fork Bolt | 12. Actuator Bellcrank |
| 2. Adjusting Fork | 8. Adjusting Bellcrank | 13. Landing Gear Actuator |
| 3. Connector Link | 9. Intermediate Push-pull Tube | 14. Torque Tube Assembly |
| 4. Adjusting Rod End | 10. Idler Bellcrank | 15. Outboard Bellcrank |
| 5. Uplock Torque Tube | 11. Nose Gear Drive Tube | 16. Truss Assembly |
| 6. Forward Push-pull Tube | | 17. Drag Brace |

Figure 2-59. Schematic of Nose Gear Retracting Linkage

- Jack airplane in accordance with paragraph 1-15.
- (See figure 2-47.) Remove door link tubes (28) by removing nuts (30), bolts (29), cotter pins (25), and pins (26).
- Release tension on retracting linkage by engaging manual extension crank and operating a few turns toward the UP position.
- Remove forward push-pull tube (6) as follows:
 - Remove nut and bolt attaching the push-pull tube to fork bolt (7).
 - Remove nut and bolt attaching the push-pull tube to connector link (3).

NOTE

Because the nose gear drive tube (11) is a fixed length the idler bellcrank (10) is correctly positioned to the actuator bellcrank (12).

- Operate the actuator to the down position, then adjust the length of the intermediate push-pull tube (9) as follows:
 - Disconnect intermediate push-pull tube from outboard bellcrank of torque tube assembly (14).
 - Adjust the length of intermediate push-pull tube 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 fork bolt may point downward any amount caused by less than one turn of the push-pull tube.

NOTE

When adjusting the length of the intermediate

push-pull tube, adjust in full-turn increments. The collar-end of the forward horizontal hi-shear rivet must point inboard for clearance.

- Make the following preliminary adjustments:
 - Screw fork bolt (7) into adjusting bellcrank (8) as far as possible.
 - Screw adjusting rod end (4) into uplock torque tube (5) as far as possible.
 - Shorten adjusting fork (2) as much as possible.
 - Lengthen forward push-pull tube (6) as much as possible, but do NOT install. Insure that rod end is visible through the inspection hole for thread engagement.
 - (See figure 2-53.) Adjust uplock hook (52) to the end of its adjusting slots in the direction that will prevent hook from fully engaging.
 - Adjust connector link (3) as follows:
 - With nose gear DOWN, check the over-center position of connector link (3).

NOTE

A slight force should be required to snap connector link into its over-center position.

- Lengthen adjusting rod end (4) in half-turn increments to increase the force required to snap connector link over-center; shorten, to decrease.
- Manually place nose gear UP, push upward on door actuator arm to lock connector link over-center, and check the retracted position.

NOTE

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

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

NOTE

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

5. If the retracted position is too high, shorten adjusting rod end (4) and lengthen adjusting fork (2) in half-turn increments. Refer to the preceding "NOTE."

- h. Adjust uplock and downlock tensions as follows:

 1. Temporarily install forward push-pull tube (6).
 2. Retract landing gear electrically.

NOTE

If the auxiliary switch described in paragraph 2-315 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.

3. Check the uplock tension at the nose gear door actuator arm, as illustrated in figure 2-60. The force required to move the connector link from its position against uplock torque tube must be 60 ± 15 pounds.

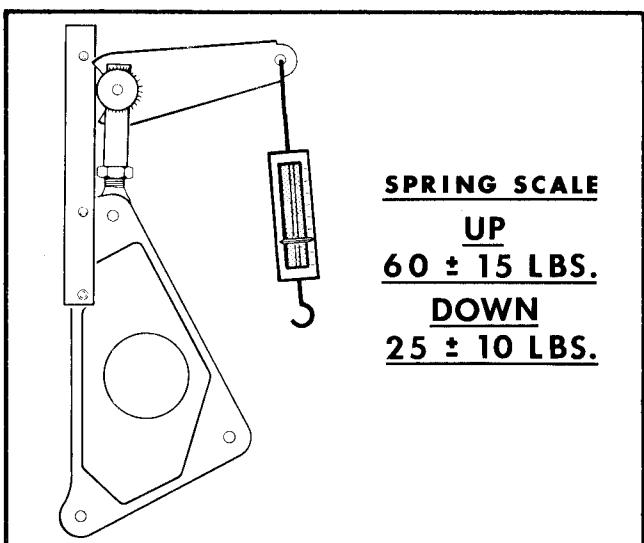


Figure 2-60. Nose Gear Tension Requirements

4. Shorten forward push-pull tube (6) in half-turn increments to increase uplock tension; lengthen, to decrease.

5. Operate landing gear to the DOWN position and check the downlock tension in the same manner. The force required to move the connector link from its position against the uplock torque tube must be 25 ± 10 pounds.

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

7. Operate landing gear to the UP position and recheck the uplock tension. If necessary, readjust forward push-pull tube (6) in accordance with step (4).

NOTE

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

- i. 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.

2. Adjust uplock hook to obtain a minimum clearance of .002 inch and a maximum clearance of .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.

- j. (See figure 2-47.) Install door link tubes (28) with bolts (29), nuts (30), pins (26), and cotter pins (25), and rig nose gear doors in accordance with paragraph 2-272.

- k. Insure that landing gear is DOWN, then remove jacks.

2-317. ADJUSTMENT OF LANDING GEAR SAFETY SWITCH. 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 airplane in accordance with paragraph 1-15.
- b. Place landing gear switch in the DOWN position.
- c. Insure that battery switch is OFF.
- d. 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 .30 inch from torque link.

NOTE

The arm is adjusted by removing the cotter

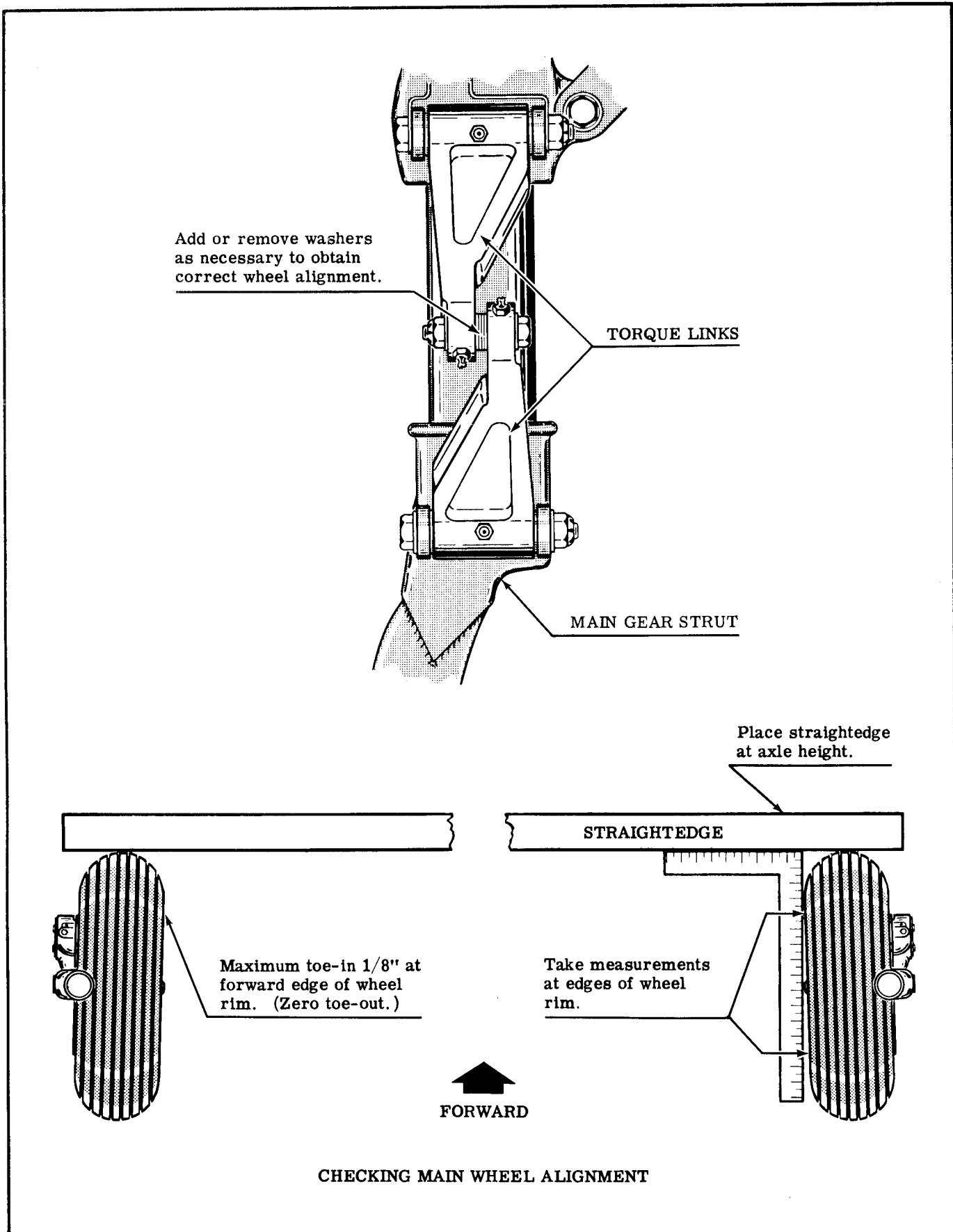


Figure 2-61. Main Wheel Alignment

pin and nut which attach the arm to the switch, repositioning the arm, and reinstalling the nut and cotter pin.

e. Check the adjustment of the landing gear safety switch as follows:

WARNING

Since landing gear may retract if adjustment of safety switch is incorrect, insure that all wheel well areas are clear while performing the following checks:

1. If available, connect an external power source. If not available, turn battery switch ON.
2. Raise the switch arm to the position adjusted in step "d." While holding the switch arm in this position, have an assistant place the landing gear switch in the UP position. Landing gear should NOT retract.
3. Continue to raise the switch arm upward to the end of its travel. Landing gear should NOT retract.
4. Release the switch arm. Landing gear SHOULD retract.
5. Operate landing gear through several cycles, checking landing gear for proper operation.
- f. Insure that landing gear switch and landing gear are DOWN and battery switch is OFF, then remove jacks.
- g. If used, disconnect the external power source.

2-318. MAIN WHEEL ALIGNMENT. (See figure 2-61.) Correct alignment of the main landing wheels is necessary to minimize tire wear. If tires are wearing excessively or unevenly, the wheel alignment should be checked and corrected in accordance with the following procedure:

- a. Position the airplane with the main wheels resting on grease plates.

NOTE

With the main wheels resting on grease plates, adjustments for correct alignment can be made with the landing gear struts and wheels under normal load from the weight of the airplane. 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 carpenters framing square against the straightedge, with the other leg against the inboard side of the wheel being checked. Measure distance from framing square leg adjacent to wheel, to wheel rim, at extreme forward and at extreme aft circumference of wheel rim. The difference between the two measurements will be the toe-in or toe-out for that wheel. Maximum permissible toe-in for either wheel is 1/8 inch, with no toe-out allowable.
- d. Remove washers from between torque links to correct for toe-out, or add washers between torque links to correct for excessive toe-in. Wheel alignment after adjustment must be within limits prescribed in step "c."

NOTE

AN "standard" and "light" washers are used as shims between upper and lower torque links. Different combinations of "standard" and "light" washers can be used between the torque links to obtain any variation in adjustment which might be necessary to obtain correct wheel alignment. Any washers removed from between the torque links should be placed over the torque link spacer, on the outside of the torque links, and secured with the torque link bolt, nut and washers. Placing the washers in this position will prevent excessive side play of the torque links.

2-319. NOSE WHEEL STEERING SYSTEM.

2-320. The nose wheel steering system permits nose wheel steering with the rudder pedals, for angles up to 15 degrees, either right or left of center. Spring-loaded nose wheel steering cables permit continued free turning action of the nose wheel for steering angles greater than 15 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 yoke which pivots in a support mounted directly above the nose gear trunnion assembly. When the nose gear is in the DOWN position, the steering

Figure 2-62. Nose Wheel Steering System Callouts

- | | | |
|-----------------------------|---------------------------|----------------------------|
| 1. Bolt | 15. Pin | 28. Spacer |
| 2. Pulley | 16. Nut | 29. Support Spacer |
| 3. Rudder Position Cable | 17. Pulley | 30. Washer |
| 4. Left Rudder Torque Tube | 18. Turnbuckle | 31. Nut |
| 5. Left Steering Arm | 19. Steering Yoke Support | 32. Centering Cam Follower |
| 6. Pin | 20. Steering Cam Roller | 33. Grease Fitting |
| 7. Cotter Pin | 21. Steering Yoke | 34. Pin |
| 8. Left Steering Cable | 22. Trunnion Assembly | 35. Washer |
| 9. Right Rudder Torque Tube | 23. Cotter Pin | 36. Cotter Pin |
| 10. Right Steering Arm | 24. Nut | 37. Spring Link |
| 11. Left Rudder Cable | 25. Washer | 38. Spring |
| 12. Right Rudder Cable | 26. Bearing | 39. Bale |
| 13. Right Steering Cable | 27. Bolt | 40. Turnbuckle Eye |
| 14. Cotter Pin | | 41. Turnbuckle Barrel |

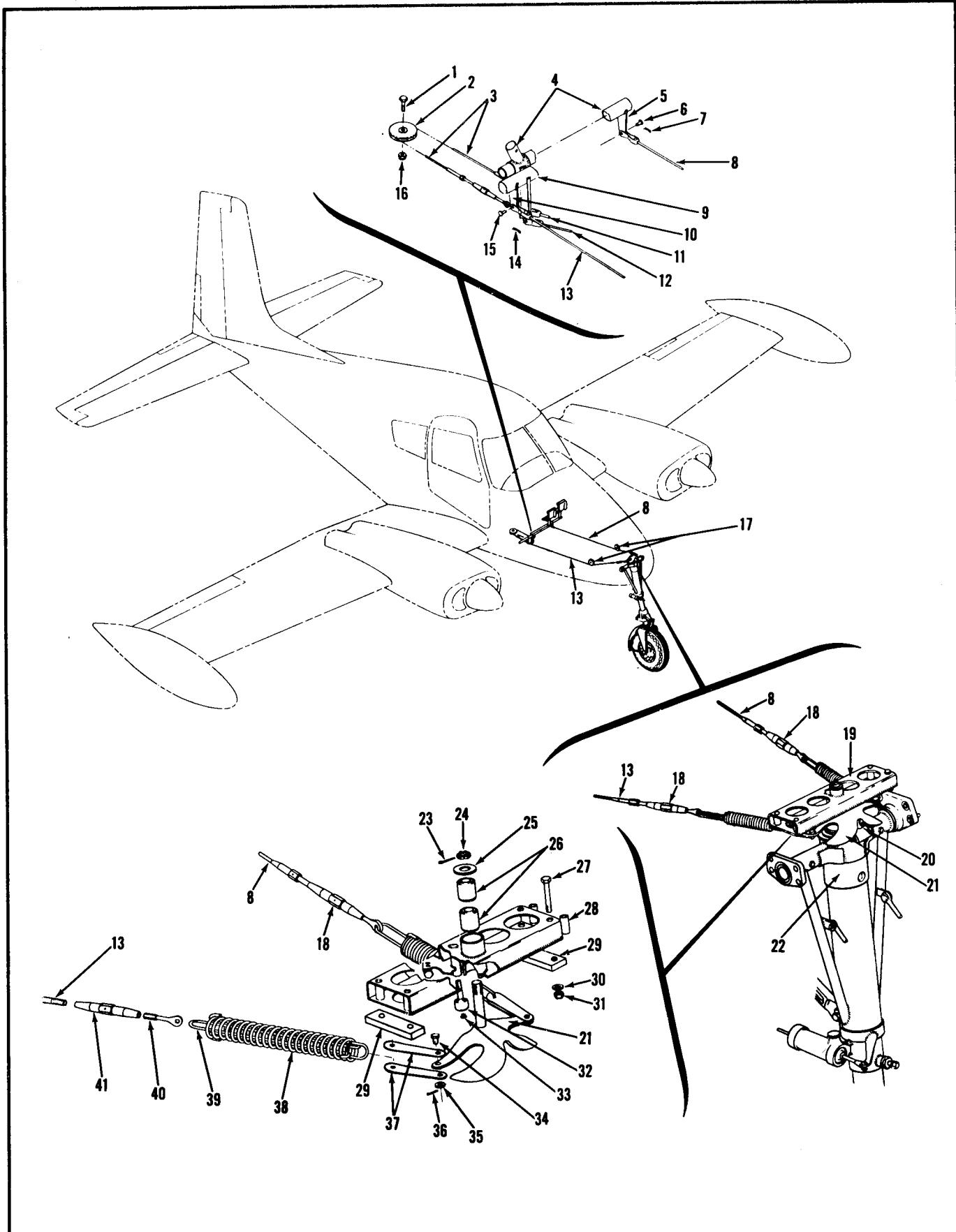


Figure 2-62. Nose Wheel Steering System

yoke is coupled to the nose gear strut by the engagement of a steering cam roller at the top of the strut, with a cam slot in the steering yoke. This roller disengages from the steering yoke when the landing gear is retracted, so that the nose wheel steering system will be uncoupled while the airplane is flying.

2-321. REMOVAL OF NOSE WHEEL STEERING SYSTEM. (See figure 2-62.)

- a. Remove pilot's and copilot's seats in accordance with paragraph 2-179.
- b. Remove scuff plates from front carpets by removing attaching screws.
- c. Disconnect left and right steering cables (8 and 13) by removing cotter pins (7 and 14) and pins (6 and 15).

NOTE

Outboard end of rudder position cable (3) is attached with the same pin used to attach the right steering cable (13) and will be disconnected when right steering cable is released.

- d. Remove attaching nuts, washers, and bolts to remove pulleys (17).
- e. Cut safety wire from turnbuckles (18) and detach left and right steering cables (8 and 13) from springs (38) by unscrewing turnbuckle barrels (41).

NOTE

To detach cables from steering yoke when cable removal is not required, turn nose wheel to an extreme right or left position to ease cable tension, and disassemble spring by removing bale to which turnbuckle eye is attached.

- f. Withdraw left and right steering cables (8 and 13) aft through fairleads in forward cabin bulkhead and remove through access holes in cabin floorboards.
- g. Remove four nuts (31), washers (30), and bolts (27) to remove steering yoke support (19) with components attached. Spacers (28), and support spacers (29) will be released when bolts (27) are removed.
- h. Remove springs (38) from steering yoke (21) by removing cotter pins (36), washers (35) and pins (34). Springs can be disassembled to release spring links (37) and turnbuckle eyes (40), by removing bales (39).
- i. Remove cotter pin (23), nut (24), and washer (25) to remove steering yoke (21) from steering yoke support (19). Bearings (26) are a press fit and should be removed only as required for replacement.

NOTE

Centering cam follower (32) is threaded into a tube welded to the steering yoke support (19) and is secured by a roll pin. Removal of this cam follower is not recommended.

2-322. CLEANING AND INSPECTION OF NOSE WHEEL STEERING SYSTEM. Clean metal parts with a suitable solvent. Wipe cables and pulleys with a clean cloth. Inspect metal parts for excessive wear, corrosion, or cracks. Inspect cables for wear and

broken strands, check swaged cable fittings for slippage, and check threaded cable fittings for thread damage. Check bearings for smooth operation. Replace defective parts. Greasing of replacement bearings is not necessary as replacements are factory grease-packed. A grease fitting provided in the centering cam follower allows this bearing to be greased as required (use MIL-G-3278 grease or equivalent).

2-323. INSTALLATION OF NOSE WHEEL STEERING SYSTEM. (See figure 2-62.)

- a. Set steering yoke (21) in place in steering yoke support (19) and secure with washer (25), nut (24) and cotter pin (23).
- b. Place turnbuckle eyes (40) and spring links (37) on bales (39), and assemble spring as illustrated.

NOTE

Bales should be attached to large ends of spring links.

Attach springs (38) to steering yoke (21) with pins (34), washers (35) and cotter pins (36).

- c. Set steering yoke support (19) in position above trunnion assembly (22), with support spacers (29) in place as illustrated. Fasten with bolts (27), washers (30), and nuts (31), making sure that spacers (28) are in place.

NOTE

When positioning steering yoke support, make certain that centering cam follower (32) is aft, with cam surface of steering yoke facing forward as illustrated.

- d. Position left and right steering cables (8 and 13) forward from floorboard access holes through fairleads in forward cabin bulkhead, with threaded turnbuckle fittings forward.
- e. Attach pulleys (17) to pulley brackets, with left and right steering cables (8 and 13) in position around pulleys.

NOTE

Cable guard cotter pins are installed through pulley brackets at lower circumference of pulleys (17). If these cotter pins are not in place, they should be installed to prevent cables from leaving pulley grooves.

- f. Attach aft ends of left and right steering cables (8 and 13) to left and right steering arms (5 and 10), with pins (6 and 15), and cotter pins (7 and 14).

NOTE

Outboard end of rudder position cable (3) must be attached to right steering arm (10) with (15) and cotter pin (14) which are used to attach right steering cable (13).

- g. Assemble turnbuckles (18) as illustrated, and rig in accordance with paragraph 2-108. Safety turnbuckles.

- h. Replace scuff plates over access holes in front carpets.
- i. Replace pilot's and copilot's seats in accordance with paragraph 2-181.

2-324. CABIN STEP SYSTEM.

2-325. The cabin step and support tube assembly retracts into a well provided for it in the bottom right side of the fuselage, beneath the baggage compartment floor. The actuating mechanism is linked by a series of retracting cables, to the landing gear actuator lower bellcrank. A spring assembly incorporated in the cable linkage provides flexibility to prevent damage in the event something should keep the step assembly from fully retracting into the well. Extension is accomplished by a torsion spring forcing the actuator mechanism out of its over-center uplock position and into its over-center downlock position. Extension and retraction are simultaneous with landing gear operation.

2-326. REMOVAL OF CABIN STEP SYSTEM. (See figure 2-63.)

- a. Remove rear carpet and baggage compartment floor cover in accordance with paragraph 2-204.
- b. Remove access hole cover from floorboard above landing gear actuator (16), and access hole cover from fuselage skin, below actuator.
- c. Remove one oval, and three round access hole covers from baggage compartment floor, just aft of rear seat back.
- d. Disconnect forward retraction cable (10) from landing gear actuator lower bellcrank (14), by removing nut (11), washers (12), spacer (13), and screw (15).

NOTE

If necessary to ease cable tension in order to disconnect cable end, break over-center position of actuator assembly by depressing torsional actuator arm. Hold step assembly in a partially retracted position to maintain cable slack.

- e. Remove cotter pin (9) and pin (7) to release cable spring assembly (8) from intermediate retraction cable (6). Withdraw cable spring assembly and forward retraction cable aft to remove. Remove cotter pin (9), and pin (7), to detach cable spring assembly from forward retraction cable (10).

NOTE

Attach guide wire to forward end of cable before withdrawing it from position. This wire should be left in place to be used to pull forward retraction cable back through bulkhead fairleads and routing hole when reinstalling.

- f. To remove intermediate retraction cable (6), remove cotter pins (2), and remove pulley (4) by removing nut (5) and bolt (1). Cut safety wire on turnbuckle (17) and detach cable from turnbuckle barrel.
- g. Release actuator cable (18) from pulley (22) by removing cotter pins (21) and nut and bolt attaching pulley (22) to pulley bracket (23).
- h. Remove torsional actuator assembly (45) with

actuator cable (18) attached, as follows:

1. Remove cotter pin (38) and washer (39), and position torsional actuator (36) so that pin (41) is aligned with access hole (20) through supporting bracket (43). Remove pin (41).

WARNING

Do not allow torsional actuator arm to spring upward when pin is removed.

2. Remove upper bolt (19) and washers (25) to release, and remove torsional actuator assembly (45) with actuator cable (18) attached.
3. Remove torsion spring (32), phenolic spacer (31), and torsional actuator (36), from spacer (30).
4. Remove cotter pin (27), washer (28), pin (24), and clamp (42) from torsional actuator (36), to release actuator cable (18).

NOTE

Eccentric bushing (29) is a press fit in torsional actuator (36) and should be removed only as required for replacement.

- i. Remove lower bolt (44) to release, and remove step assembly (37), spacer (35), and washers (25).

NOTE

Oilite bearings (34) are a press fit in step assembly (37), and should be removed only as required for replacement.

2-327. CLEANING AND INSPECTION OF CABIN STEP SYSTEM. Clean accumulated dirt from metal parts with a suitable solvent. Clean cables and phenolic parts with a clean cloth. Inspect all parts for wear and replace as necessary. Inspect cables for broken strands, swaged cable fittings for signs of slippage, and threaded cable fittings for damaged threads. Replace as required. Wipe oilite bearings with a clean cloth and lubricate with a few drops of general purpose oil. Sealed bearing pulleys require no lubrication.

2-328. INSTALLATION OF CABIN STEP SYSTEM. (See figure 2-63.)

- a. Slide spacer (35) through oilite bearings (34) pressed into step assembly (37). Position step assembly between support brackets (33 and 43) and install lower bolt (44), with washers (25) in place.
- b. Set clamp (42) over ball end of actuator cable (18) in position illustrated, and secure to torsional actuator (36) with pin (24), washer (28), and cotter pin (27).
- c. With eccentric bushing (29) pressed in place, assemble torsional actuator (36) by placing phenolic spacer (31) and torsion spring (32) on spacer (30) and inserting spacer (30) into the torsional actuator. Position the assembly between support brackets (33 and 43) and install bolt (19), with washers (25) in place.

NOTE

Make certain that outboard end of torsion spring

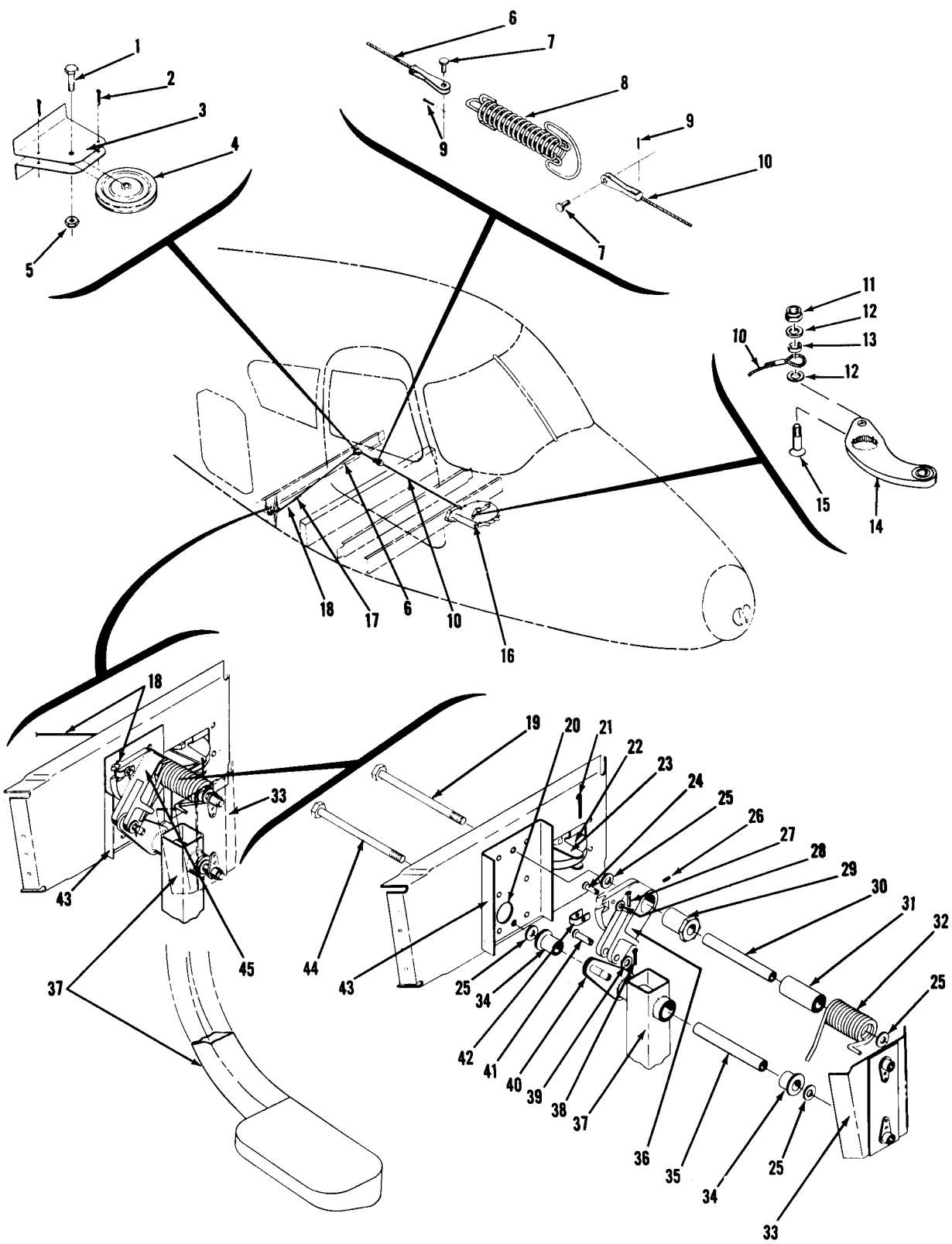


Figure 2-63. Cabin Step System

Figure 2-63. Cabin Step System Callouts

1. Bolt	16. Landing Gear Actuator	31. Phenolic Spacer
2. Cotter Pin	17. Turnbuckle	32. Torsion Spring
3. Pulley Bracket	18. Actuator Cable	33. Support Bracket
4. Pulley	19. Upper Bolt	34. Oilite Bearing
5. Nut	20. Access Hole	35. Spacer
6. Intermediate Retraction Cable	21. Cotter Pin	36. Torsional Actuator
7. Pin	22. Pulley	37. Step Assembly
8. Cable Spring Assembly	23. Pulley Bracket	38. Cotter Pin
9. Cotter Pin	24. Pin	39. Washer
10. Forward Retraction Cable	25. Washer	40. Lever Arm
11. Nut	26. Setscrew	41. Pin
12. Washer	27. Cotter Pin	42. Clamp
13. Spacer	28. Washer	43. Support Bracket
14. Lower Bellcrank	29. Eccentric Bushing	44. Lower Bolt
15. Screw	30. Spacer	45. Torsional Actuator Assembly

is seated in cutout provided in outboard support bracket and that inboard end of spring is seated in hole provided in lug on torsional actuator arm.

- d. Use bolt and nut to attach pulley (22) to pulley bracket (23), with actuator cable (18) in position around pulley (22). Install cable guard cotter pins (21).
- e. Position lever arm (40) of step assembly (37) to align cam slot in arm with access hole (20) through supporting bracket (43). Depress arm of torsional actuator (36) to align holes in arm with cam slot in lever arm (40) of step assembly (37). Insert pin (41), set washer (39) in place and secure with cotter pin (38).
- f. Adjust step assembly to align surface of step support tube flush with surface of fuselage skin when step assembly (37) is in the retracted position as follows:
 - 1. Loosen setscrew (26) and rotate eccentric bushing (29) as required to obtain alignment of actuator end of tube.
 - 2. Adjust length of stop bolt in step assembly well, to obtain alignment of step end of step support tube.
 - 3. Tighten setscrew (26) to prevent eccentric bushing (29) from moving out of adjustment.
- g. Position intermediate retraction cable (6) around pulley (4), and fasten pulley to pulley bracket (3), with bolt (1) and nut (5). Install cable guard cotter pins (2) and attach outboard end of cable (6) to actuator cable (18), with barrel of turnbuckle (17).

NOTE

Do not secure turnbuckle with safety wire at this point in the procedure.

- h. Install forward retraction cable (10) and cable spring assembly (8) as follows:
 - 1. Attach cable spring assembly (8) in position illustrated, to aft end of forward retraction cable (10), with pin (7) and cotter pin (9).
 - 2. Pull forward retraction cable (10) into position through bulkhead fairleads and routing hole, with loop end forward.
 - 3. Attach cable spring assembly (8) to end of intermediate retraction cable (6), with pin (7) and cotter pin (9), as illustrated.

- 4. Attach forward end of forward retraction cable (10) to landing gear actuator lower bellcrank (14), with screw (15), washers (12), spacer (13), and nut (11), as illustrated.

NOTE

If it is necessary to obtain cable slack to make this connection, depress torsional actuator arm to release from over-center downlock position, and hold step assembly in partially retracted position.

- i. Rig step retraction cables as follows:
 - 1. Jack airplane in accordance with paragraph 1-15.
 - 2. Retract landing gear, using normal retraction system.

NOTE

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

- j. Adjust turnbuckle (17) to place step assembly (37) in retracted position. Safety turnbuckle.
- k. Insure that landing gear is DOWN, then remove jacks.
- l. Replace landing gear actuator access hole covers. Replace access hole covers in baggage compartment.
- m. Replace rear carpet and baggage compartment floor cover in accordance with paragraph 2-204.

2-328A. CABIN STEP SYSTEM. (Serial 35547 and on.) In aircraft serial 35547 and on the cabin step strut has been lengthened and a step added to provide easier access to the cabin. 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.

2-328B. TROUBLE SHOOTING THE CABIN STEP. (Serial 35547 & on.)

TROUBLE	PROBABLE CAUSE	CORRECTION
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 paragraph 2-238E.
CABIN STEP DOES NOT EXTEND.	Cable off pulley track and binding.	Place cabin in pulley track. Check pulley for freedom of operation. Check that pulley cable retaining pin is installed.
	Extension spring incorrectly installed.	Install spring correctly.
	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 paragraph 2-238E.
	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 paragraph 2-238E.

2-328C. REMOVAL OF CABIN STEP SYSTEM.

(Serial 35547 & on. See figure 2-63A.)

- a. Remove rear carpet and baggage compartment floor cover in accordance with paragraph 2-204.
- b. Remove access hole cover from floorboard above landing gear actuator, and access hole cover from baggage compartment floor.
- c. Remove one oval and three round access hole covers from baggage compartment floor.
- d. Disconnect cable at turnbuckle (47).
- e. Disconnect cable from spring bale (46) and remove spring bale.
- f. Remove cable (10) from pulley (9) by removing

pin (8) and clip (11).

- g. Remove cable (10) from aircraft.
- h. Disconnect cable (41) from yoke (22) by removing pin (38) and clip (40).
- i. Remove cable (41) from aircraft.
- j. Remove nut (20) and washer (21) and remove bolt (43).
- k. Remove cabin step assembly from aircraft being careful to disengage spring (23) from step support (42).
- l. Location and parts necessary for disassembly or assembly of the cabin step assembly and pulleys are clearly shown in figure 2-63A.
- m. For removal of pulley (9) from landing gear actu-

Figure 2-63A. Cabin Step System Callouts (Serial 35547 and on)

- | | | |
|--------------------------|--------------------|------------------------|
| 1. Bolt | 17. Pulley Bracket | 32. Step |
| 2. Cotter Pin | 18. Washer | 33. Nut |
| 3. Pulley | 19. Nut | 34. Tube |
| 4. Pulley Bracket | 20. Nut | 35. Nut |
| 5. Washer | 21. Washer | 36. Nut |
| 6. Nut | 22. Yoke | 37. Nut |
| 7. Landing Gear Actuator | 23. Spring | 38. Pin |
| 8. Pin | 24. Spacer | 39. Cotter Pin |
| 9. Pulley | 25. Bolt | 40. Washer |
| 10. Cable | 26. Bolt | 41. Cable |
| 11. Clamp | 27. Screw | 42. Step Support |
| 12. Washer | 28. Stop | 43. Bolt |
| 13. Cotter Pin | 29. Bolt | 44. Fuselage Structure |
| 14. Bolt | 30. Step | 45. Bolt |
| 15. Cotter Pin | 31. Bolt | 46. Spring Bale |
| 16. Pulley | | 47. Turnbuckle |

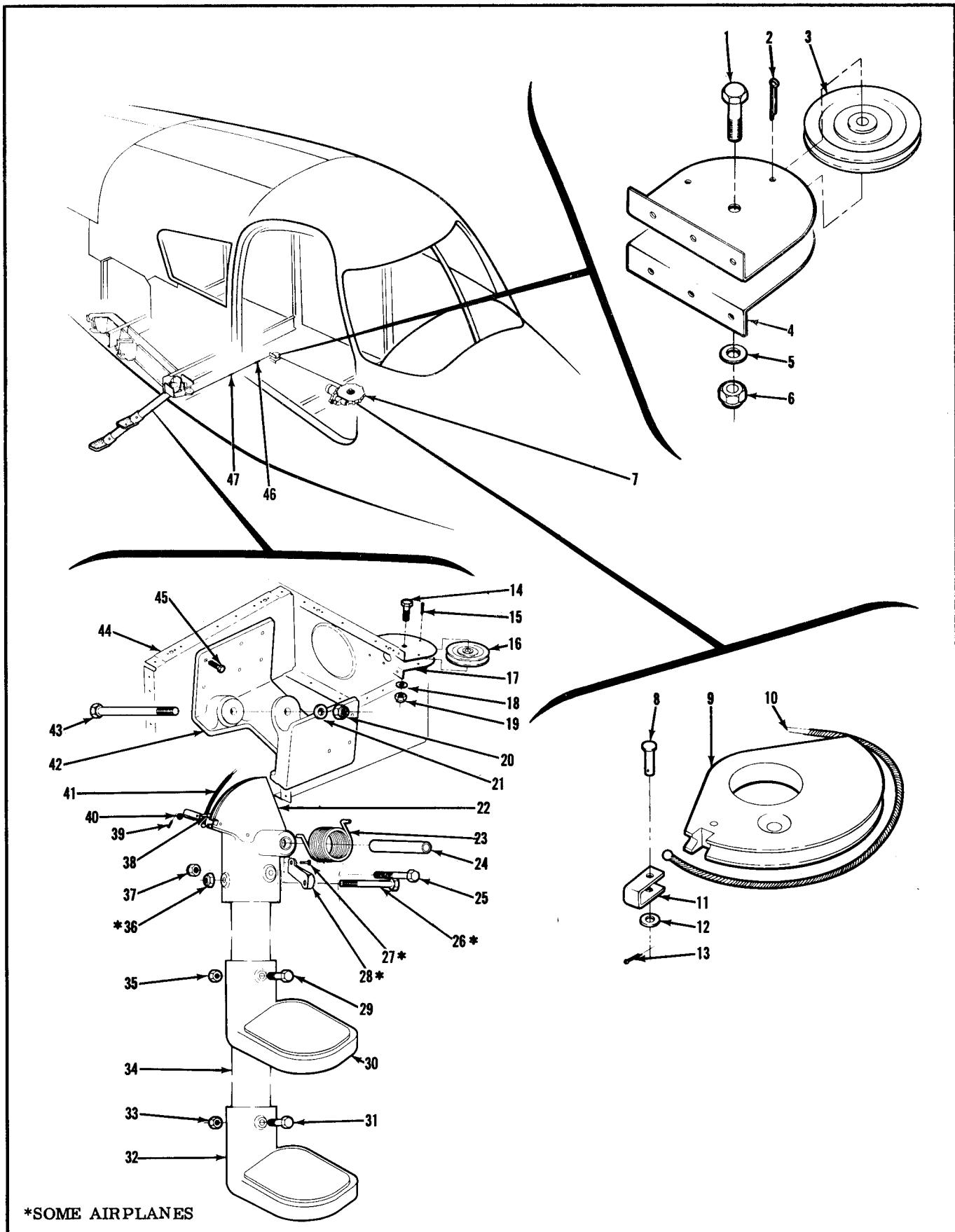


Figure 2-63A. Cabin Step System (Serial 35547 and on)

ator (7) refer to paragraph 2-300.

2-328D. CLEANING AND INSPECTION OF CABIN STEP SYSTEM. (See figure 2-63A.) For cleaning and inspection of the cabin step system refer to paragraph 2-327.

2-328E. INSTALLATION OF CABIN STEP SYSTEM. (See figure 2-63A.)

- a. Place ball at end of cable (10) just outside the pulley (9) track and with the cable (10) in the pulley track install clip (11) and secure with pin (8), washer (12) and cotter pin (13).
- b. Route cable (10) aft through pulley (3) and attach spring bale (46).
- c. Make certain that cotter pin (2) is installed in pulley bracket (4) to prevent the cable from leaving the pulley track.
- d. Attach the short cable, between the turnbuckle (47) and the spring bale (46), to the spring bale.
- e. Attach cable (41) to step support (22) in the same manner as described in step "a."
- f. Before installing step assembly make certain that spacer (24) is installed in step support (22).
- g. Install spring (23) on step support (22).
- h. Place step assembly, with spring (23) installed, into step support (42) and install bolt (43) and secure with nut (20) and washer (21).
- i. Route cable (41) through pulley (16).
- j. Make certain that cotter pin (15) is 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 (41) and install turnbuckle (47).
- m. Install turnbuckle (47) and return the step to its extended position.
- n. Adjust turnbuckle (47) to place tension on the cable until just a small amount of light may be seen between the step assembly stop (28) and the step support (42).
- o. Check the cabin step installation as follows:

1. Jack aircraft in accordance with paragraph 1-15.
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 fuselage aft.
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. Replace landing gear actuator access covers. Replace access hole covers in baggage compartment.
- q. Replace rear carpet and baggage compartment floor cover in accordance with paragraph 2-204.

2-329. BRAKE SYSTEM.

2-330. The Model 310 Airplane has a hydraulically actuated braking 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 wings, and to the brake assemblies on each main landing gear. The brakes are Goodyear single-disc, non self-adjusting type, with two actuating cylinders in each brake assembly. No manual adjustment is required on these brakes. The brakes can be operated by applying pressure to either the pilot's or the copilot's rudder pedals; the right pedals operating the right brake, and the left pedals operating the left brake.

NOTE

On early model airplanes, self-adjusting

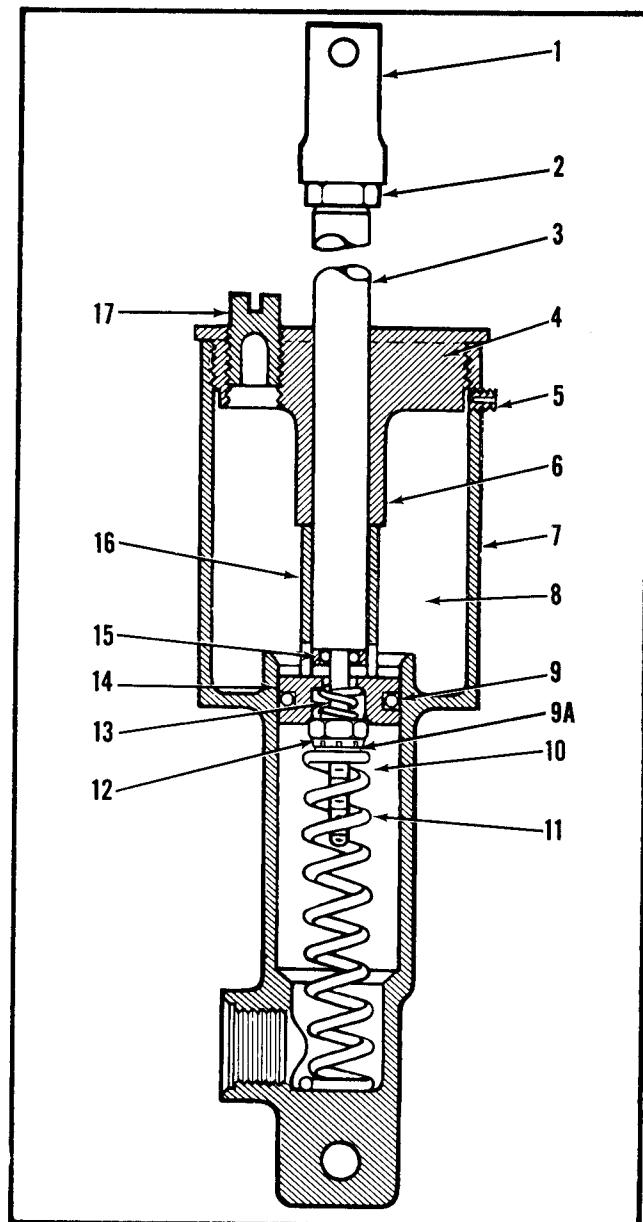
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brakes were used. A kit is available with which these brakes can be converted to non self-adjusting type if desired.

2-331. TROUBLE SHOOTING BRAKE SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
BRAKE PEDAL BOTTOMS.	Insufficient brake fluid in system.	Bleed and fill system in accordance with paragraph 2-352.
	Brake disc warped, causing excessive clearance.	Replace disc.
	Disc clips missing.	Replace disc clips.
	Loose bleeder screw, faulty bleeder screw washer, or adapter not tight.	Tighten bleeder screw. Replace washer. Tighten adapter.
	Leaking connections or broken lines or hoses.	Tighten connections. Replace or repair lines or hoses.
	Rudder pedals not connected to master cylinders.	Connect pilot's rudder pedals to master cylinders.
	Damaged O-ring seal in master cylinder or in brake actuating cylinder.	Replace O-ring seal.
"SPONGY" BRAKES.	Air trapped in system.	Bleed system.
	Swollen 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 seals. Flush system with denatured alcohol. Bleed and fill system in accordance with paragraph 2-352.
BRAKES FAIL TO HOLD.	Brake linings worn out.	Replace lining in accordance with paragraph 2-351.
	New linings just installed.	Taxi airplane and apply brakes several times to condition linings.
	Air in system.	Bleed and fill system in accordance with paragraph 2-352.
	Oil, grease or other foreign material on disc or brake linings.	Clean and flush with carbon tetrachloride, then taxi the airplane slowly, applying the brakes several times to condition the linings.

TROUBLE	PROBABLE CAUSE	CORRECTION
	Rudder pedals positioned so that brakes cannot be fully applied.	Reposition pedals.
	Brakes too hot from extensive use.	Allow time for brakes to cool.



- | | |
|---------------|--------------------------|
| 1. Clevis | 9A. Washer |
| 2. Jamb Nut | 10. Cylinder |
| 3. Piston Rod | 11. Piston Return Spring |
| 4. Cover | 12. Nut |
| 5. Setscrew | 13. Piston Spring |
| 6. Cover Boss | 14. Piston |
| 7. Body | 15. Lock-o-seal |
| 8. Reservoir | 16. Compensating Sleeve |
| 9. O-ring | 17. Filler Plug |

Figure 2-64. Brake Master Cylinder

2-332. MASTER CYLINDER. (See figure 2-64.)

2-333. Each vertical mounting type master cylinder used on the Model 310 airplane incorporates a fluid reservoir (8) and cylinder (10) within the same body (7). A plastic filler plug (17) is used to close the filler opening in the cover (4), which is threaded into the body. The filler plug is not vented, as sufficient ventilation is provided by clearance between the piston rod (3) and piston rod passage through the cover boss (6). With the exception of the piston return spring (11), all internal operating parts are assembled onto the piston rod: piston (14), piston spring (13), lock-o-seal (15), and compensating sleeve (16). A seal between the piston (14) and the cylinder walls is provided by an O-ring (9) installed in a groove around the piston. As pressure is applied to advance the piston rod into the cylinder, the piston remains stationary until the lock-o-seal is seated on the piston (.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.

2-334. REMOVAL OF MASTER CYLINDERS. (See figure 2-65.) Removal of either master cylinder can be accomplished as follows:

- a. Remove pilot's seat in accordance with paragraph 2-179.
- b. Remove left rudder bar shield, left scuff plate and left carpet in accordance with paragraph 2-204.
- c. Remove the cover plate from around the master cylinder by removing the four screws with which it is fastened.
- d. 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 material into the brake.

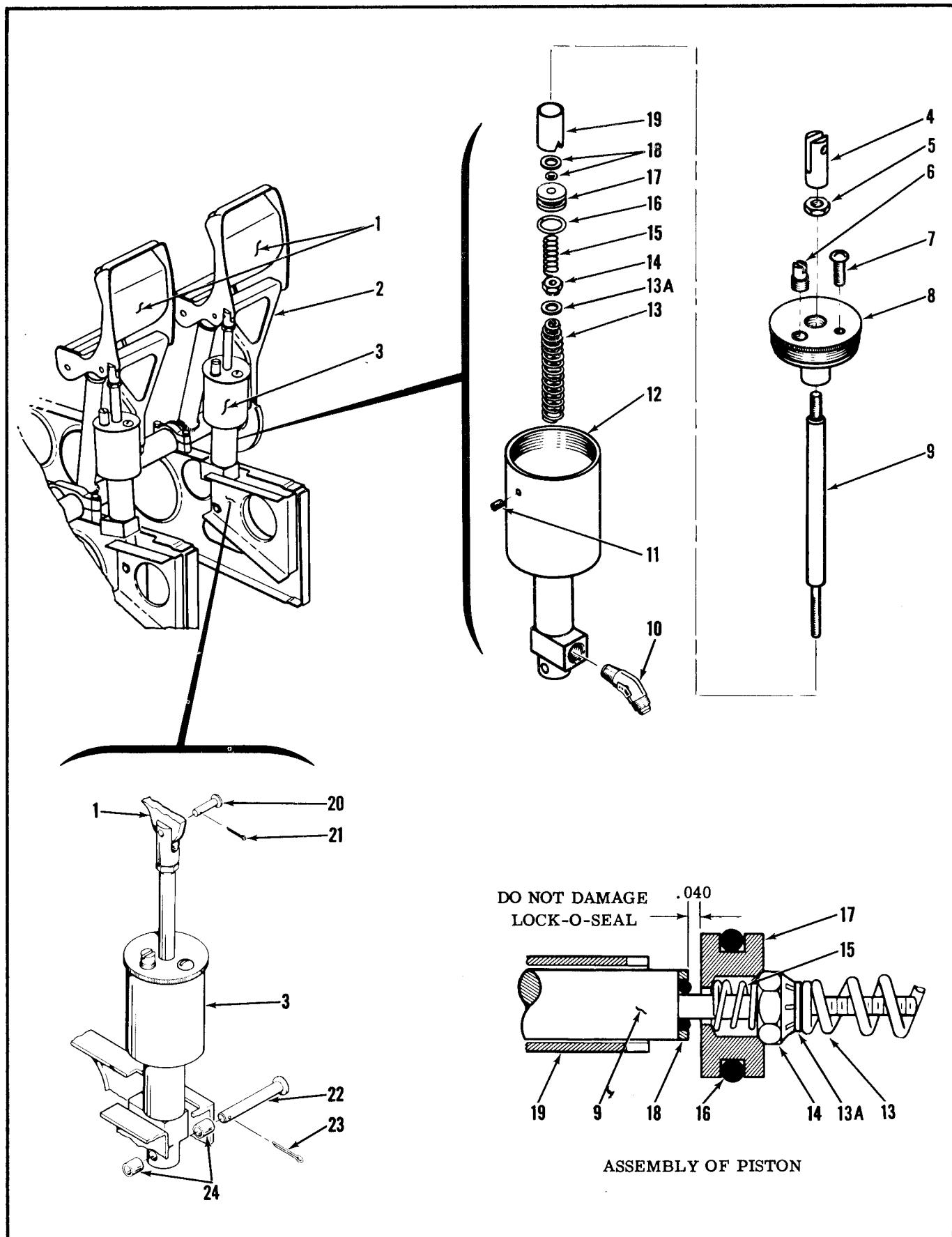


Figure 2-65. Brake Master Cylinder Removal

Figure 2-65. Brake Master Cylinder Removal Callouts

- | | | |
|--------------------------|--------------------------|-------------------------|
| 1. Pilot's Rudder Pedals | 9. Piston Rod | 17. Piston |
| 2. Brake Link | 10. Elbow | 18. Lock-o-seal |
| 3. Master Cylinder | 11. Setscrew | 19. Compensating Sleeve |
| 4. Clevis | 12. Body | 20. Pin |
| 5. Jamb Nut | 13. Piston Return Spring | 21. Cotter Pin |
| 6. Filler Plug | 13A. Washer | 22. Pin |
| 7. Screw | 14. Nut | 23. Cotter Pin |
| 8. Cover | 15. Piston Spring | 24. Spacer |
| | 16. O-ring | |

NOTE

When making connections on hydraulic lines, use only system fluid as a lubricant.

- e. Disconnect clevis (4) from rudder pedal (1) by removing cotter pin (21) and pin (20).
- f. Disconnect lower end of master cylinder (3), by removing cotter pin (23), pin (22), and spacers (24).
- g. Disconnect hose from fitting (10) in base of master cylinder (3), by lifting master cylinder enough to allow the coupling nut on the hose to be disconnected.
- h. Remove master cylinder (3), and install a suitable cap on the end of the hose to prevent the entry of foreign material.

2-335. DISASSEMBLY OF MASTER CYLINDERS. (See figure 2-65.) Disassembly of either master cylinder can be accomplished as follows:

- a. Remove filler plug (6) and drain residual hydraulic fluid from reservoir portion of master cylinder (3). Screw (7) 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 (11) and unscrew cover (8) to remove cover and piston rod (9) along with the other illustrated parts which are attached to the piston rod. The piston return spring (13) will remain inside the master cylinder (3); to remove, lift from position.
- c. Remove nut (14) from piston rod (9), to remove piston spring (15), piston (17), lock-o-seal (18), and compensating sleeve (19).
- d. Back off jamb nut (5) from its locking position against base of clevis (4) and remove both parts from piston rod (9).
- e. Remove O-ring (16) from piston (17).
- f. Remove elbow (10) from body (12), if required.

2-336. CLEANING, INSPECTION, AND REPAIR OF MASTER CYLINDERS. (See figure 2-65.) Clean all metal parts with a suitable solvent. O-ring seals should be washed with clean system hydraulic fluid or denatured alcohol. Inspect metal parts for wear and thread damage. Inspect cylinder walls for corrosion, pitting, and scores. Damaged cylinder walls require replacement of the body (12). Inspect O-ring seal (16) and O-ring portion of lock-o-seal (18) for swelling, chipping, or other evidence of damage. Replace as necessary. Repairs to master cylinder components are not recommended. Damaged or defective parts should be replaced.

2-337. ASSEMBLY OF MASTER CYLINDERS. (See figure 2-65.) Assemble either master cylinder as follows:

- a. Install lock-o-seal (18) on shank of piston rod (9).

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 portion of lock-o-seal (18) should be installed first, then set retainer in place around O-ring and against piston rod shank base as illustrated.

b. Slip O-ring (16) into groove in piston (17) as illustrated, using clean system hydraulic fluid as a lubricant.

CAUTION

Install O-ring carefully to prevent chipping on sharp corner of piston.

c. Install piston (17), piston spring (15), and nut (14), on piston rod (9) as illustrated. Tighten nut (14), and with piston spring (15) compressed to seat piston (17) against nut, adjust clearance between piston and lock-o-seal (18) to .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 (13) into cylinder section of body (12), broad base down, as illustrated.
- e. Lubricate cylinder walls and piston (17) with clean system hydraulic fluid and insert piston rod (9), piston end down, into the cylinder seating nut (14) against piston return spring (13).
- f. Place compensating sleeve (19) notched end toward piston, over piston rod (9). Slide cover (8) over piston rod, and tighten into body. Install setscrew (11) and tighten to prevent movement of cover (8).
- g. Screw jamb nut (5) and clevis (4) onto piston rod end.

h. Install filler plug (6), and elbow (10) 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.

2-338. INSTALLATION OF MASTER CYLINDERS.
(See figure 2-65.) 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 (10) 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 master cylinder (3), with spacers (24) in place as illustrated. Secure pin (22) with cotter pin (23).

c. Connect clevis (4) to rudder pedal (1) with pin (20). Adjust clevis (4) to align tips of rudder pedals (1) with rudder pedals in a neutral position. Secure pin (20) with cotter pin (21), and secure clevis with jamb nut (5).

d. Attach cover plate to floor around master cylinder with four screws.

e. Bleed and refill system in accordance with paragraph 2-352.

f. Replace left carpet, left scuff plate and left rudder bar shield in accordance with paragraph 2-204.

g. Replace pilot's seat in accordance with paragraph 2-181.

2-339. BRAKE SYSTEM PLUMBING.

2-340. Hydraulic pressure is transmitted from the brake master cylinders to the brake actuating cylinders on the main gear, through a system of lines and flexible hoses, which are routed beneath the floorboards,

through the wings, and down each main gear strut assembly. Standard fittings, and tubing and hose assemblies are used throughout.

2-341. REMOVAL OF BRAKE SYSTEM PLUMBING.
(See figure 2-66.)

a. Remove pilot's and copilot's seats in accordance with paragraph 2-179.

b. Remove front carpets and scuff plates in accordance with paragraph 2-204.

c. Remove upholstery side panels in accordance with paragraph 2-192, 193, or 194.

d. Remove control tee well access cover from underside of fuselage by removing attaching screws.

e. Remove the rectangular access hole cover from right floorboard adjacent to the aft part of control pedestal.

f. Drain system fluid by removing bleeder screws from both main wheel brake assemblies.

g. Remove brake master cylinders in accordance with paragraph 2-334.

h. Disconnect left master cylinder hose (32) from elbow (30) in web of pilot's left rudder pedal bracket, and remove through access hole.

i. Remove left cabin brake line (29) 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 (29) 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.

1. Cut line at riser portion forward of bulkhead and as close to the floorboard as is practicable.

2. Loosen coupling nuts from elbows (28 and 30), and remove each section of line.

j. To remove right master cylinder hose:

1. Disconnect cabin crossover brake line (34) from elbow (37) in web of pilot's right rudder pedal bracket.

2. Remove attaching nut and washer from elbow (37) to allow its removal from web or rudder pedal

Figure 2-66. Brake System Plumbing Callouts

1. Left Bulkhead Brake Line	18. Bolt	35. Right Master Cylinder Hose
2. Union	19. Washer	36. Elbow
3. Left Floorboard Brake Line	20. Lower Torque Link	37. Elbow
4. Bushing	21. Upper Torque Link	38. Intermediate Cabin Brake Line
5. Cotter Pin	22. Clamp	39. Nut
6. Nut	23. Elbow	40. Bulkhead Web
7. Washer	24. Left Wing Outboard Brake Line	41. Washer
8. Clamp	25. Clamp	42. Elbow
9. Bolt	26. Elbow	43. Right Cabin Brake Line
10. Main Gear Strut	27. Left Wing Inboard Brake Line	44. Elbow
11. Left Brake Line	28. Elbow	45. Right Wing Inboard Brake Line
12. Union	29. Left Cabin Brake Line	46. Elbow
13. Clamp	30. Elbow	47. Right Wing Outboard Brake Line
14. Washer	31. Left Master Cylinder	48. Elbow
15. Nut	32. Left Master Cylinder Hose	49. Right Brake Hose
16. Cotter Pin	33. Right Master Cylinder	50. Right Brake Line
17. Left Brake Hose	34. Cabin Crossover Brake Line	51. Parking Brake Handle

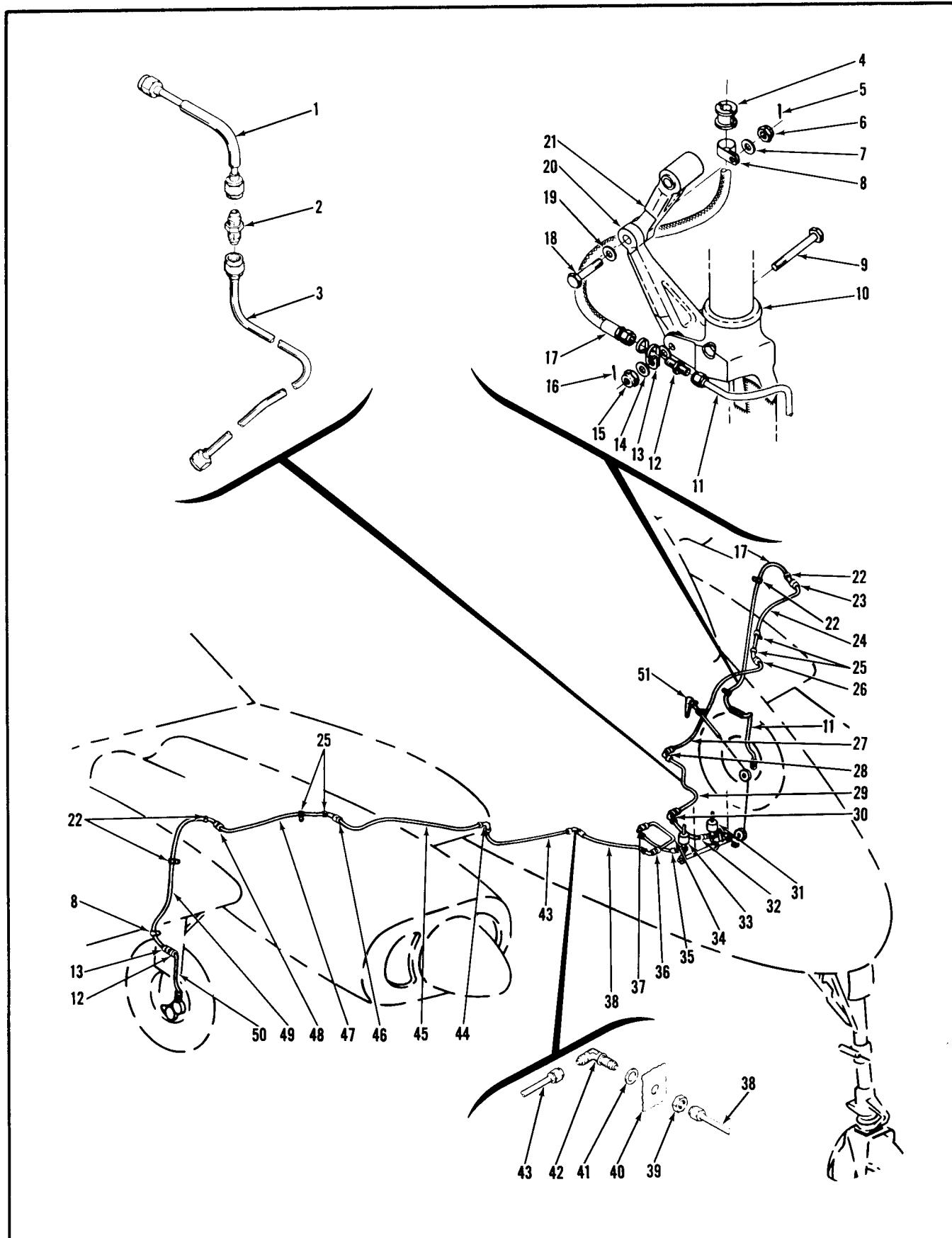


Figure 2-66. Brake System Plumbing

bracket. Remove hose (35), with elbow attached, through master cylinder mounting position.

3. Detach hose from elbow.

k. Disconnect cabin crossover brake line (34) from elbow (36) in right side of control tee well and remove through access hole in left floorboard.

l. Remove intermediate cabin brake line (38) as follows:

NOTE

Due to difficulty of access, it is recommended that this line be removed only as necessary for replacement.

1. Remove attaching nut and washers from elbow (36) in right side of control tee well to allow its withdrawal from position.

2. Disconnect line (38) from aft elbow (42).

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.

3. Remove line through lightening hole, with elbow (36) still attached, by manipulating forward end outboard and forward, to allow aft end to clear edge of lightening hole.

4. Detach line (38) from elbow (36).

m. Disconnect right cabin brake line (43) from elbows (42 and 44). Carefully work line from its position beneath the floorboards, and remove through access hole.

CAUTION

It may be necessary to flex this line slightly to facilitate removal. However, excessive bending should be avoided to prevent deformation or other damage to the line.

n. Remove forward wing root fillets, and the two in-board access hole covers from underside of each wing leading edge.

o. To remove right and left wing inboard brake lines (27 and 45), 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 (24 and 47) from fittings at both ends, remove clamps (25) and remove lines through main wheel wells.

q. Disconnect right and left brake hoses (17 and 49) from elbows at their upper ends, and detach right and left brake lines (11 and 50) from unions (12) at lower ends of hoses. Remove two upper hose clamps (22). To release hoses, remove hose clamps (8 and 13) by removing nuts (6 and 15) from bolts (9 and 18) in main gear torque links. Replace nuts

and secure with cotter pins after hose clamps have been removed. Separate unions (12) from hoses (17 and 49).

r. Remove brake lines (11 and 50) by detaching coupling nuts from fittings in main brake assemblies. Install temporary caps over brake assembly fittings to prevent entry of foreign material.

2-342. CLEANING, INSPECTION, AND REPAIR OF BRAKE SYSTEM PLUMBING. Clean hydraulic components with clean system hydraulic fluid, or with denatured alcohol. 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; hoses for swelling, cracking, abrasion through protective plies, and leaks. Repairs should be made in accordance with best shop practice, using standard parts and procedures, and should be conducted in compliance with applicable regulations.

2-343. INSTALLATION OF BRAKE SYSTEM PLUMBING. (See figure 2-66.)

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 lines (11 and 50) to fittings.

b. Attach unions to lower ends of brake hoses (17 and 49). Attach upper hose ends to elbows (23 and 48). Fasten hoses (17 and 49) in position illustrated. Securing clamps (8 and 13) to torque link bolts (9 and 18), with nuts (6 and 15). Secure nuts with cotter pins (5 and 16). Attach clamps (22) to upper portion of hoses. Attach upper ends of right and left brake lines (11 and 50) to unions (12).

c. Working through main wheel wells, place right and left wing outboard brake lines (24 and 47) in position and attach ends to elbows as illustrated. Attach clamps (25).

d. Working through wing access holes carefully work right and left wing inboard brake lines (27 and 45) into position and attach ends to elbows as illustrated.

CAUTION

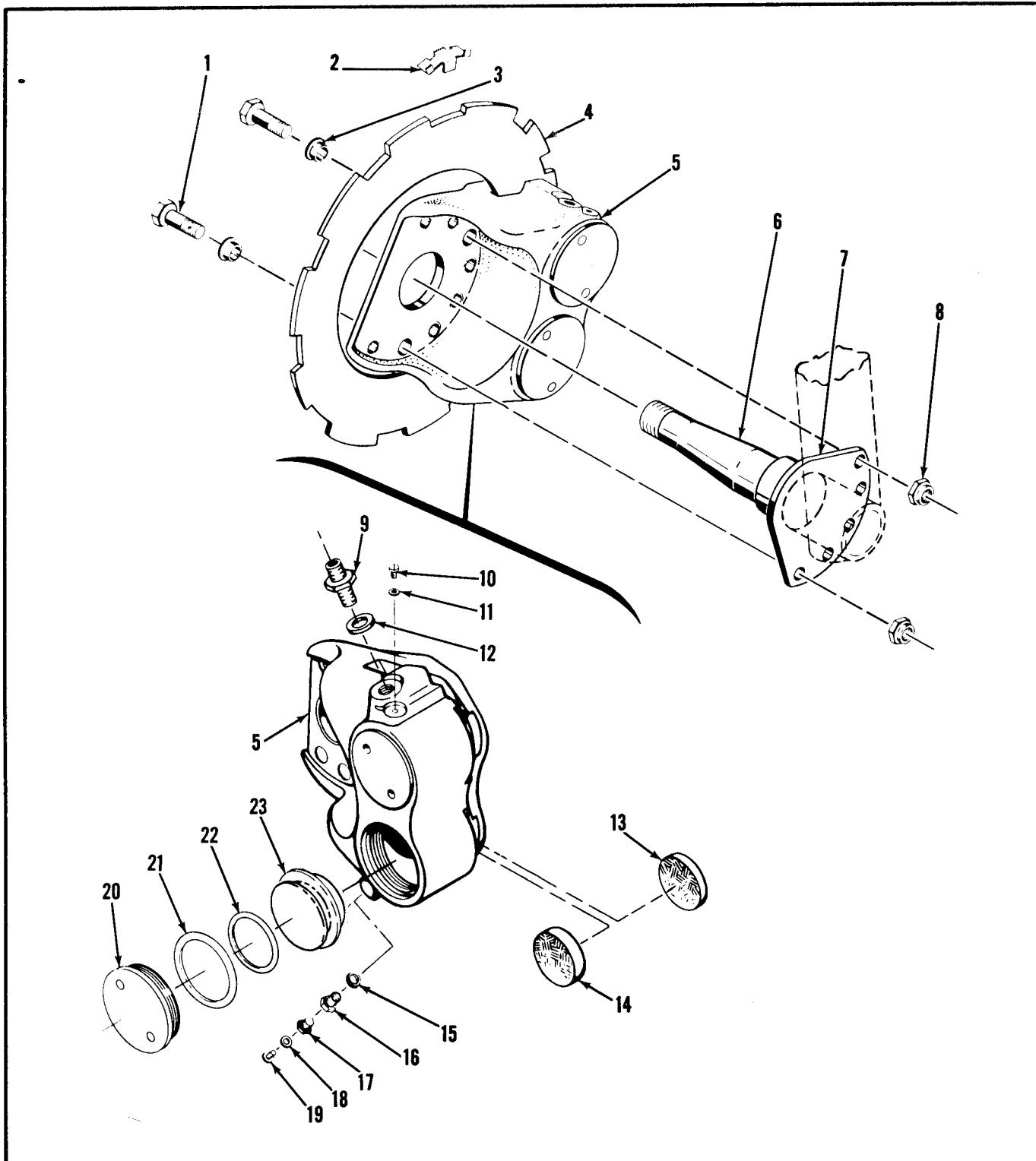
Some flexing of the lines may be necessary to work them into position. However, excessive bending should be avoided.

e. Replace access hole covers and wing root fillets.

f. Working through aft, right rectangular floorboard access hole, carefully work right cabin brake line (43) into position beneath the floorboard, with outboard end extending upward through routing hole in floorboard. Attach ends to elbows (42 and 44).

CAUTION

Some flexing of this line will be required to



- | | | |
|-----------------------|--------------------|---------------------|
| 1. Bolt | 9. Union | 16. Bleeder Adapter |
| 2. Disc Clip | 10. Bleeder Screw | 17. Bleeder Valve |
| 3. Bushing | 11. Bleeder Washer | 18. Bleeder Washer |
| 4. Brake Disc | 12. O-ring | 19. Bleeder Screw |
| 5. Brake Housing | 13. Anvil Lining | 20. Cylinder Head |
| 6. Axle | 14. Piston Lining | 21. O-ring |
| 7. Axle Torque Flange | 15. O-ring | 22. O-ring |
| 8. Nut | | 23. Piston |

Figure 2-67. Main Wheel Brakes

work it into position. However, excessive bending should be avoided.

g. Install intermediate cabin brake line (38) as follows:

1. Attach elbow (36) 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 co-pilot's left rudder pedal bracket, work line (38) into position, with elbow (36) extending through routing hole in right side of control tee 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 (38) to elbow (42).

4. Secure elbow (36) in place at right side of control tee well, with washer and attaching nut.

h. Working through left floorboard access hole, position U-shaped cabin crossover brake line (34) beneath left floorboard, with longer leg extending through routing hole in left side of control tee well. Attach coupling nut to elbow (36) in right side of control tee well.

i. To install right master cylinder hose (35):

1. Connect elbow (37) to hose end.

2. Place washer over elbow (37), and working aft through right master cylinder mounting position place elbow (37) with hose (35) 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 (37) with washer and nut.

4. Attach coupling nut on cabin crossover line (34) to elbow (36).

j. To install left cabin brake line (29):

NOTE

If left cabin brake line (29) 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 (30).

3. Position left bulkhead brake line (1) through routing hole in bulkhead, and attach coupling nuts to elbow (28) and union (2).

k. Attach coupling nut on left master cylinder hose (32) to elbow (30) in web of pilot's left rudder pedal bracket.

l. Replace brake master cylinder (31 and 33) in accordance with paragraph 2-338.

m. Bleed and refill system in accordance with paragraph 2-352.

n. Replace all floorboard access hole covers and control tee well access cover.

o. Replace upholstery side panels in accordance with paragraph 2-192, 193, or 194.

p. Replace front carpets in accordance with paragraph 2-204.

q. Replace pilot's and copilot's seats in accordance with paragraph 2-181.

2-344. BRAKE ASSEMBLIES.

2-345. The brakes used on this airplane are Good-year single-disc, non self-adjusting type, incorporating two hydraulic actuating cylinders within each brake housing. One brake assembly is bolted to an axle torque flange welded to each main gear lower strut. Inlet ports are provided in both tops and bottoms of the brake housings, so that either may be mounted in a right or a left hand position. The hydraulic connections are made at the top ports, and bleeder valve assemblies are installed in the bottom ports. Additional bleeder screws are provided in both tops and bottoms of the housings. The brake discs are keyed to the main wheels with ten disc drive keys bolted to each wheel rim. When actuated, hydraulic pressure forces the piston brake linings against the outboard surfaces of the brake discs. The inboard surfaces of the discs are backed up by the anvil brake linings, which are stationary.

2-346. REMOVAL OF BRAKE ASSEMBLIES. (See figure 2-67.) To remove either brake assembly, proceed as follows:

a. Remove wheel and tire assembly in accordance with paragraph 2-256.

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 (19) and bleeder washer (18) and opening bleeder valve (17). Replace bleeder screw and washer when housing is drained.

c. Remove brake housing (5) and brake disc (4) by removing five bolts (1) and nuts (8).

2-347. DISASSEMBLY OF BRAKE ASSEMBLIES.

(See figure 2-67.) To disassemble a brake assembly:

a. Remove brake disc (4) and linings (13 and 14).

b. Use cylinder head adapter or spanner wrench to unscrew cylinder heads (20).

c. Push pistons (23) from cylinders.

d. Remove O-ring seals (21 and 22) from pistons (23) and cylinder heads (20).

e. Remove bleeder screws (10 and 19) and bleeder washers (11 and 18). Remove bleeder valve (17), bleeder adapter (16), and O-ring (15).

f. Remove union (9) and O-ring (12).

NOTE

Bushings (3) are a press fit and should be removed only for replacement.

2-348. CLEANING AND INSPECTION OF BRAKE

ASSEMBLIES. Wash all metal parts in a suitable solvent, and wash O-rings with clean system hydraulic fluid or denatured alcohol. Inspect metal parts for wear and thread damage. Replace worn or damaged parts. Replace brake discs if dished in excess of .0625 inches or if keyways are worn to a size in excess of 1.188 inches. (Minimum width for wheel disc drive keys is 1.116 inches.) Inspect cylinder walls for corrosion, pitting and scoring. Minor nicks can be polished out with 400 grit wet-or-dry sandpaper used with system hydraulic fluid. Brake linings can be cleaned with carbon tetrachloride if required. They should be replaced at each overhaul or when worn to limits prescribed in paragraph 2-351. Replace O-rings if chipped, stretched, or otherwise damaged.

2-349. ASSEMBLY OF BRAKE ASSEMBLIES. (See figure 2-67.) Reassemble either brake assembly as follows:

- a. Install union (9) and O-ring (12) in upper inlet port of housing (5).
- b. Install bleeder valve assembly (parts 15, 16, 17, 18, and 19) in lower inlet port of housing (5), as illustrated.
- c. Install bleeder washers (11) and bleeder screws (10) in upper and lower openings in housing (5).
- d. Using clean system hydraulic fluid as a lubricant, set new serviceable O-rings (21 and 22) in place on cylinder heads (20) and pistons (23).
- e. Lubricate cylinder walls and pistons (23) with clean system hydraulic fluid and insert pistons into cylinders.
- f. Screw cylinder heads (20) in place, and torque to 75 pound-feet.

NOTE

If removed, press bushing (3) into brake housing (5).

- g. Install new or serviceable brake linings (13 and 14), setting piston lining (14) in piston side of housing (5) and anvil lining (13) in anvil side, with smooth sides of linings facing each other.
- h. Set brake disc (4) in place between linings.

2-350. INSTALLATION OF BRAKE ASSEMBLIES. (See figure 2-67.)

- a. Position brake housing (5) over axle (6), against axle torque flange (7) so that uppermost hole in the axle torque flange (7) is aligned with the third hole in the uppermost side of the brake housing (5). Install five bolts (1) and nuts (8) and torque to 100 pound-inches. Tolerance is plus zero and minus ten pound-inches.
- b. Install wheel and tire assembly in accordance with paragraph 2-260.
- c. Attach brake line coupling nut to union (9).
- d. Bleed and refill system in accordance with paragraph 2-352.
- e. Remove jacks.

2-351. REPLACEMENT OF BRAKE LININGS. (See figure 2-67.)

NOTE

Brake linings should be replaced at overhaul

periods and at such time as they become worn beyond limits.

- a. Checking brake lining wear.
1. Set the parking brakes to force the brake disc (4) against the anvil linings (13).
2. Check clearance between outboard surface of brake discs (4) and surface (piston side) of the slot in the housing (5). If a 5/32 (.156) inch feeler gauge can be inserted the linings are worn too far for continued safe use and should be replaced.
- b. Replacement of brake linings.
1. Remove wheel and tire assembly in accordance with paragraph 2-256.
2. Remove brake disc (4) from slot in brake housing (5) and remove worn linings (13 and 14).
3. Install new linings (13 and 14) with the thicker piston lining (14) in piston side of housing (5), and the thinner, anvil lining (13) 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 in accordance with paragraph 2-260.

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.

2-352. BLEEDING OF BRAKE SYSTEM. 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 figure 1-5 for hydraulic fluid specification).
- b. Remove filler plug from master cylinder.
- c. Remove bleeder screw and washer from bleeder valve in brake housing and open valve to allow any 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 bleeder valve and detach bleeder pump hose connection.
- g. Replace bleeder screw and washer in master cylinder and check brake operation.

2-353. PARKING BRAKE SYSTEM.

2-354. The manually operated parking brake system consists of a handle assembly, cable linkage, and a torque tube assembly connected in a manner to actuate the brake master cylinders when the brake handle is pulled. The handle is located at the left side of the cabin, below the stationary instrument panel. A cable, connected to the handle assembly, is routed forward, through the forward cabin bulkhead, around two pulleys

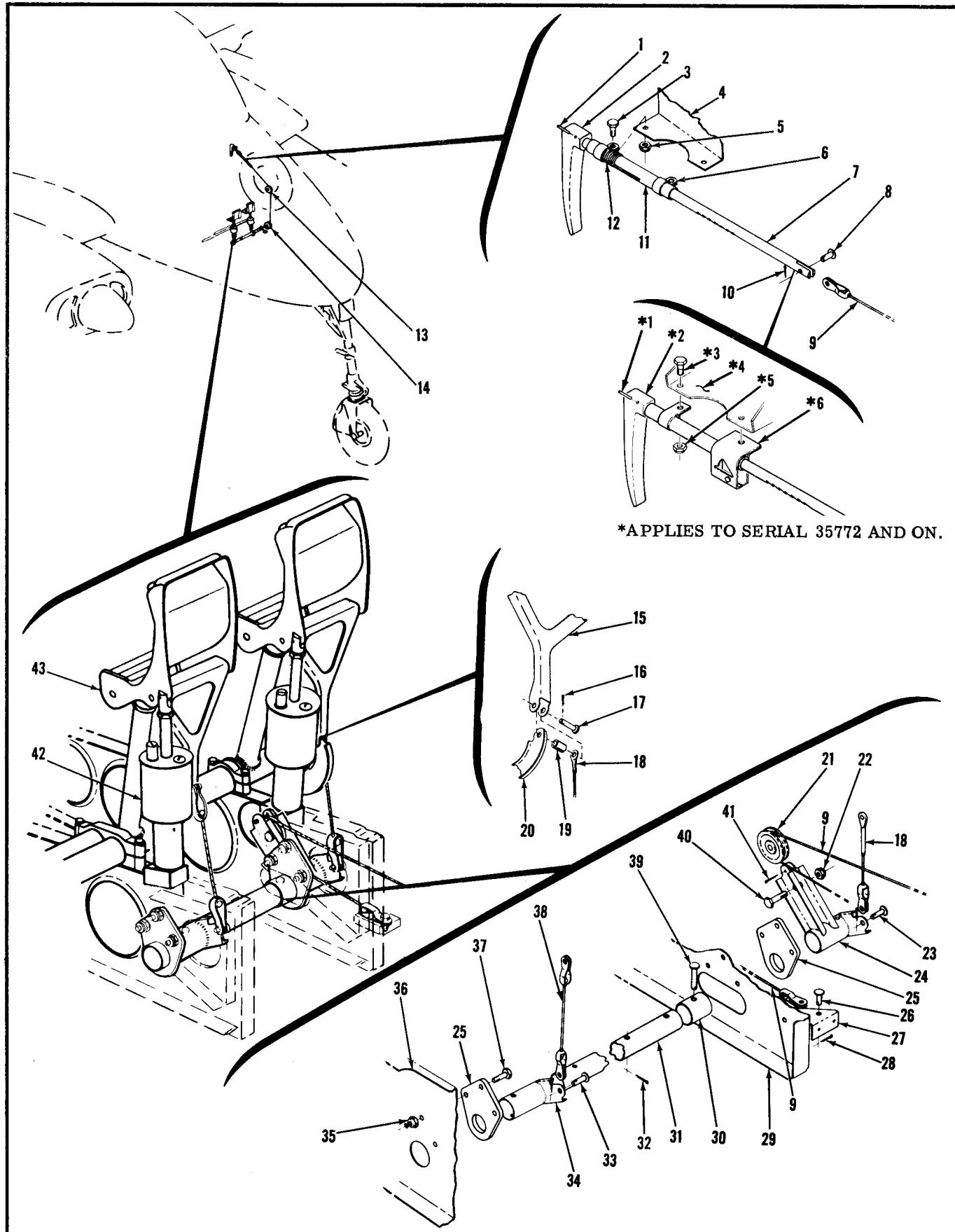


Figure 2-68. Parking Brake System

- | | | |
|-------------------------|---------------------------------|----------------------------------|
| 1. Roll Pin | 15. Brake Link | 30. Collar |
| 2. Parking Brake Handle | 16. Cotter Pin | 31. Parking Brake Torque Tube |
| 3. Bolt | 17. Pin | 32. Cotter Pin |
| 4. Mounting Bracket | 18. Left Brake Cable | 33. Pin |
| 5. Nut | 19. Spacer | 34. Right Parking Brake Coupling |
| 6. Clamp | 20. Brake Torque Tube Coupling | 35. Nut |
| 7. Parking Brake Tube | 21. Pulley | 36. Right Rudder Pedal Bracket |
| 8. Pin | 22. Nut | 37. Bolt |
| 9. Parking Brake Cable | 23. Pin | 38. Right Brake Cable |
| 10. Cotter Pin | 24. Left Parking Brake Coupling | 39. Pin |
| 11. Housing | 25. Torque Tube Support | 40. Bolt |
| 12. Spring | 26. Pin | 41. Cotter Pin |
| 13. Upper Pulley | 27. Cable Bracket | 42. Brake Master Cylinder |
| 14. Lower Pulley | 28. Cotter Pin | 43. Rudder Pedal |
| | 29. Left Rudder Pedal Bracket | |

then aft, back through the bulkhead to a pulley on the parking brake torque tube assembly, with the cable end attaching to a bracket just forward of the torque tube. The parking brake torque tube assembly, located beneath the floorboard at the pilot's rudder pedals position, is connected to the pilot's rudder pedal brake links by two short cables routed through holes in the floorboard. The pilot's rudder pedals are in turn connected to the brake master cylinders.

2-355. REMOVAL OF PARKING BRAKE SYSTEM. (See figure 2-68.)

- a. Remove pilot's and copilot's seats in accordance with paragraph 2-179.
- b. Remove left rudder bar shield, left scuff plate and left carpet in accordance with paragraph 2-203.
- c. To obtain working room beneath the left floorboard, remove left warm air duct in accordance with paragraph 3-32.
- d. Detach left and right brake cables (18 and 38) from brake links (15) by removing cotter pins (16), pins (17), and bushings (19).
- e. Disconnect parking brake cable (9) at its upper end by removing cotter pin (10), and pin (8).
- f. Remove handle assembly (parts 1, 2, 6, 7, 11 and 12) by removing nuts (5) and bolts (3). Slide housing (11), clamps (6), and spring (12) from parking brake tube (7), and remove spring from housing. Remove roll pin (1) and handle (2) from the parking brake tube (7).
- g. Working through nose wheel well, remove nuts, bolts, cable guards and pulleys (13 and 14) 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.

- h. To remove parking brake torque tube (31) and attached components, proceed as follows:

NOTE

Because of difficulty of access, removal of parking brake torque tube and attached com-

ponents is not recommended, except as required for replacement.

1. Remove cotter pin and pin attaching left parking brake coupling (24) to parking brake torque tube (31), 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 (24) aft, clear of the floorboard, with parking brake cable (9) still in place around pulley (21). Remove cotter pins (41), and nut (22), bolt (40), and pulley (21) to free coupling from parking brake cable (9).

2. Remove three nuts and bolts attaching left torque tube support (25) to left rudder pedal bracket (29) and remove.
3. Slide torque tube (31), with attached components, outboard to clear hole in right torque tube support (25), then work forward to clear the floorboards.
4. Remove three nuts (35) and bolts (37) to remove right torque tube support (25).
5. Further disassembly of removed components can be accomplished as shown in figure 2-68.
 - i. To remove parking brake cable (9), detach from cable bracket (27) by removing cotter pin (28) and pin (26), and work free of routing holes in forward cabin bulkhead.
 - j. Inspect all components for excessive wear, cracks or deformation which could cause failure, and cables for wear or broken strands. Replace defective parts.

2-356. INSTALLATION OF PARKING BRAKE SYSTEM. (See figure 2-68.)

- a. Assemble right parking brake coupling (34), and collar (30) to parking brake torque tube (31) and attach right brake cable (38) as illustrated.
- b. Attach right torque tube support (25) to right rudder pedal bracket (36), in position illustrated, using three bolts (37) and nuts (35).
- c. Attach end of parking brake cable (9) to cable bracket (27) with pin (26) 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 (21) to left parking brake coupling (24) with bolt (40) and nut (22). Loop of parking brake cable (9) should be in place around pulley (21) as illustrated. Insert cable guard cotter pins (41), and attach left brake cable (18) as illustrated.

e. Position parking brake torque tube (31) between left and right rudder pedal brackets (29 and 36) with inboard end through hole in right torque tube support (25). Position left torque tube support (25) over outboard end of torque tube (31) as illustrated, and fasten to left rudder pedal bracket (29) with three attaching bolts and nuts.

f. Position left parking brake coupling (24) over end of parking brake torque tube (31) as illustrated, and secure with attaching pin and cotter pin.

g. Pull free end of parking brake cable (9) through upper routing hole in forward cabin bulkhead. Attach pulleys (13 and 14) and cable guards to mounting brackets on forward side of forward cabin bulkhead, with parking brake cable (9) 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, 7, 11, and 12) as illustrated, and attach handle assembly to mounting bracket (4) with bolts (3) and nuts (5).

i. Connect free end of parking brake cable (9) to parking brake tube (7) with pin (8) and cotter pin (10).

j. Retrieve free ends of left and right brake cables (18 and 38) through routing holes in floorboards and attach to brake links (15) as illustrated.

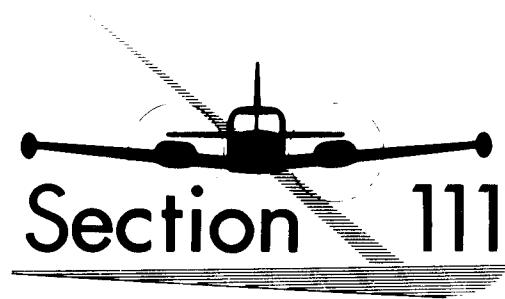
k. Replace left warm air duct in accordance with paragraph 3-33.

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 (42) should be positively actuated when parking brake handle (2) is pulled. Parking position of handle (2) should be maintained by action of spring (12) in notches of parking brake tube (7).

m. Replace left carpet, left scuff plate, and left rudder bar shield in accordance with paragraph 2-204.

n. Replace pilot's and copilot's seats in accordance with paragraph 2-181.

310 SERVICE MANUAL



UTILITY SYSTEMS

1 APRIL 1960

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SECTION III

UTILITY SYSTEMS

Table of Contents

	Page	310B	310C	310D
HEATING, VENTILATING, AND DEFROSTING SYSTEM	310	3-1	3-10	3-10
Heater	3-2	3-13	3-13	3-13
Safety Valve and Housing	3-4			
Plenum Chamber	3-6	3-15	3-15	3-15
Ducting	3-8	3-15	3-15	3-15
Heater and Plenum Chamber Supply Ducting	3-8	3-15	3-15	3-15
Defroster Vents and Ducting	3-8	3-15	3-15	3-15
Cabin Warm Air Vents and Ducting	3-8	3-15	3-15	3-15
Cabin Cool Air Vents and Ducting	3-9	3-15	3-15	3-15
Heater Switch	3-9	3-15	3-15	3-15
Temperature Control	3-9	3-15	3-15	3-15
Air Flow Controls	3-10	3-17	3-17	3-17
Air Spill Vent	3-10	3-10,	3-10,	3-10,
		3-17	3-17	3-17
				3-17
Air Spill Vent				3-17
FOUR PORT OXYGEN SYSTEM	3-18			
Testing the Oxygen System	3-18			
Oxygen Cylinder	3-18			
Pressure Gage	3-20			
Pressure Regulator	3-20			
Oxygen Manifold	3-20			
Oxygen System Plumbing	3-21			
FIVE PORT OXYGEN SYSTEM	3-22	3-22	3-22	3-22
Testing the Oxygen System	3-22	3-22	3-22	3-22
Filler Valve	3-22	3-22	3-22	3-22
Oxygen Cylinder	3-24	3-24	3-24	3-24
Pressure Gage	3-24	3-24	3-24	3-24
Pressure Regulator	3-24	3-24	3-24	3-24
Oxygen Manifold	3-25	3-25	3-25	3-25
Oxygen System Plumbing	3-25	3-25	3-25	3-25
FORWARD OXYGEN SYSTEM				3-26
Testing the Oxygen System				3-26
Filler Valve				3-28
Oxygen Cylinder				3-28
Pressure Gage				3-28
Pressure Regulator				3-28
Oxygen Manifold				3-29
Oxygen System Plumbing				3-29
LIGHT WEIGHT DE-ICER SYSTEM	3-30	3-30	3-30	3-30
Testing the De-Icer System	3-34	3-34	3-34	3-34
Adjustment of the De-Icer System	3-34	3-34	3-34	3-34
Filler Valve	3-35	3-35	3-35	3-35
De-Icer Boots	3-35	3-35	3-35	3-35
Pressure Reservoir	3-35	3-35	3-35	3-35
Cycling Controls and Linkage	3-35	3-35	3-35	3-35
Distributor Valve	3-35	3-35	3-35	3-35
De-Icer System Components	3-35	3-35	3-35	3-35
Cold Patch Repair of De-Icer Boots	3-35	3-35	3-35	3-35

SERIAL BLOCKS

MODEL 310
35000 Thru 35546MODEL 310B
35547 Thru 35771MODEL 310C
35772 Thru 39031MODEL 310D
39032 AND ON

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3-1. HEATING, VENTILATING, AND DEFROSTING SYSTEM — Serials prior to 35547. (See figure 3-1.)

3-2. 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 airplane. From the heater, air is routed into a plenum chamber and is ducted to six controllable heat outlets in the cabin. Two heat outlets are located at the base of the windshield for defrosting purposes, two are located on the forward cabin bulkhead just forward of each set of rudder pedals, and two are on the aft face of the main spar beneath the pilot's and copilot's seat. To insure a sufficient supply of air when ram air cannot be uti-

lized, a ventilating fan is incorporated in the heater which will deliver either cool or heated air, depending on the position of 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 beneath the passenger seat.

3-3. TROUBLE SHOOTING THE HEATING, VENTILATING, AND DEFROSTING SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER WILL NOT START, COMBUSTION AIR BLOWER DOES NOT RUN.	Defective wiring.	Check connections and wiring and repair or replace.
	Defective combustion air blower.	Replace.
BLOWER RUNS WHEN SWITCH IS IN "HEAT" POSITION, BUT HEATER WILL NOT IGNITE.	Defective igniter glow plug.	Replace.
	Defective fuel control valve.	Replace fuel control valve.
	Defective overheat switch.	Replace overheat switch.
	Defective preheater resistor.	Replace preheater resistor.
HEATER IGNITES, BUT VENTI- LATING AIR BLOWER WILL NOT START.	Defective or improperly ad- justed flame detector switch.	Reset or replace flame detector switch.
HEATER STARTS AND RUNS, BUT GOES OUT LATER.	Restriction in ventilating air flow.	Remove restriction.
	Defective overheat switch.	Replace switch.
	Defective safety valve.	Replace valve.
HEATER OVERHEATS.	Defective fuel control valve.	Replace valve.
	Restriction in ventilating air flow.	Remove restriction.
	Defective overheat switch.	Replace switch.
HEATER OUTPUT LOW.	Defective fuel control valve.	Replace fuel control valve.
	Thermostat out of calibration.	Replace thermostat.
HEATER SMOKES EX- CESSIVELY.	Leaking fuel control valve.	Replace fuel control valve.
VENTILATING BLOWER WILL NOT STOP WHEN HEATER IS TURNED "OFF."	Defective flame detector switch.	Replace or reset switch.

3-4. MAINTENANCE OF THE HEATING, VENTILATING, AND DEFROSTING SYSTEM. An optional orifice may be installed on the forward portion of the heater, between the blower assembly and the lower adapter, to restrict air flow for winter operation. If this orifice has been installed, it should be removed for summer operation to obtain the maximum air flow for ventilating purposes. Periodic checks should be performed to insure that all clamps and ducting are securely fastened in position. If there is reason to believe the air flow through the heater is restricted,

remove the three screws securing the blower adapter to the blower assembly and remove any foreign objects lodged in the heater inlet screen. The blower motors have factory sealed bearings and require no lubrication.

3-5. HEATER. (See figure 3-2.)

3-6. The heater is a South Wind gasoline combustion type and is mounted on brackets at the right side of the nose section, adjacent to the nose wheel well. Fuel for the heater is obtained from the fuel pressure gage

lines and is supplied to the heater through a safety valve assembly mounted near the heater. The safety valve, fuel control valve, and the fittings for each are enclosed in metal housings which are vented and drained as a precaution against fire in the event of leaking valves or fittings. Fuel passes to a control valve, and through an electrically preheated standpipe into the combustion chamber where it is ignited by an electrical glow plug igniter. Air for combustion is cir-

culated by a blower fan completely separate from the ventilating fan. After combustion takes place, a flame detector switch cuts off the electrical current to the preheated standpipe and to the igniter glow plug, and starts the ventilating fan operating if the airplane is on the ground. At the same time, the flame detector switch energizes the solenoid safety valve to the open position, allowing a continuous flow of fuel to the heater. The combustion chamber is completely

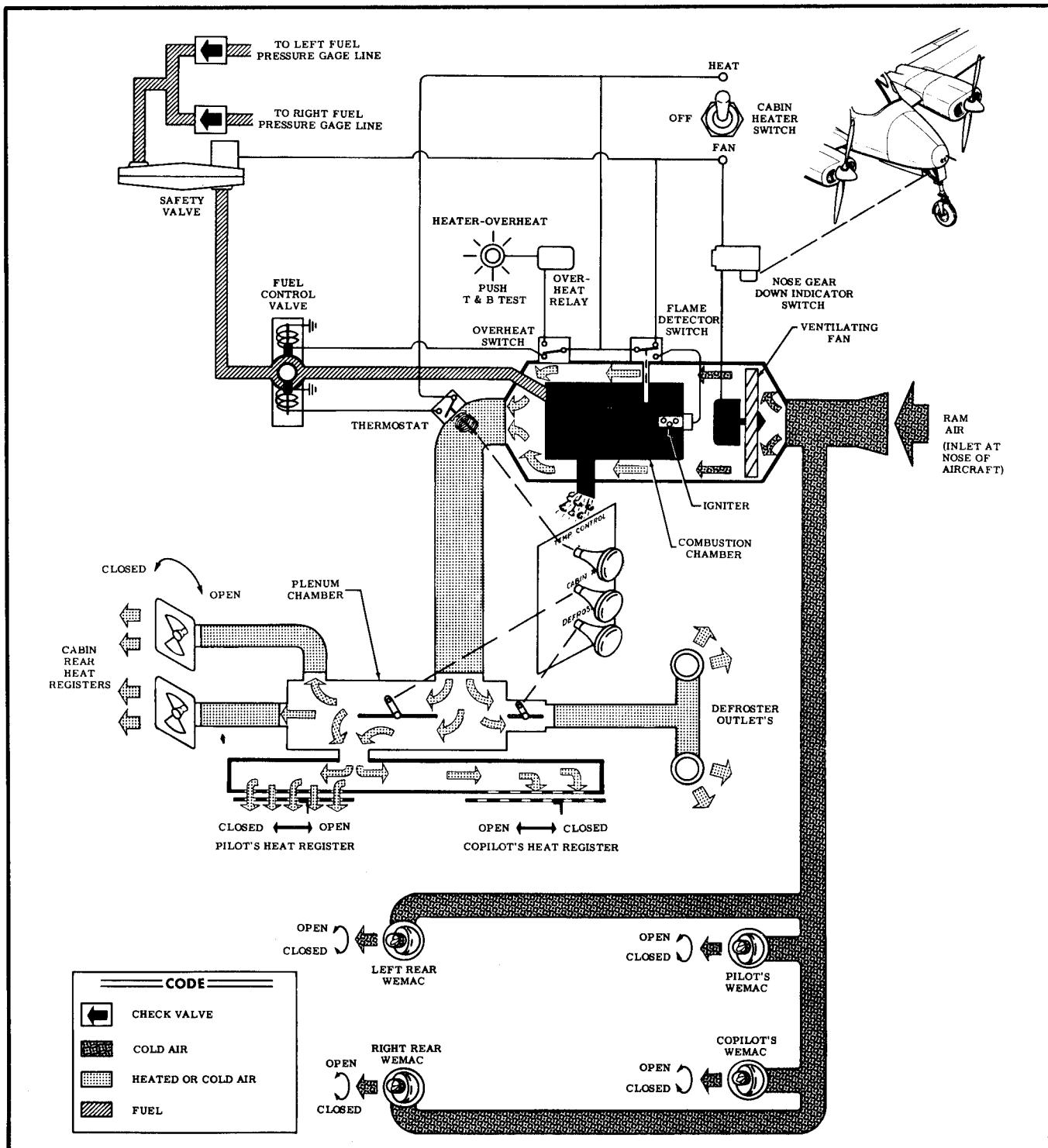


Figure 3-1. Heating, Ventilating, and Defrosting System Diagram

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 which extends through the airplane skin directly beneath the heater.

3-7. REMOVAL OF THE HEATER. (See figure 3-2.)

NOTE

If a radio (optional equipment) has been installed, remove radio and radio shelf to gain access to the heater.

- a. Remove two screws (31) and nut (30) from fuselage skin on right side of nose wheel well securing combustion air intake (28) to fuselage skin.
- b. Disconnect control valve housing vent line (23) at each end and remove.
- c. Remove control valve housing cover (24) by loosening the four attaching screws.
- d. Disconnect the control valve supply line (7) from the elbow at the fuel control valve.
- e. Loosen hose clamps securing control valve housing drain hose (35), and slide hose from control valve drain fitting.
- f. Tag and disconnect all electrical wiring from heater.
- g. Loosen ducting clamp securing inlet ducting to blower adapter (32) and slide ducting free of adapter.
- h. Loosen ducting clamps and remove ducting from between heater outlet adapter (45) and plenum chamber.
- i. Disconnect temperature control wire by loosening screw on thermostat actuating arm and removing attaching clamp.
- j. Remove bolts (26) and nuts (27) securing the two mounting straps (33) and remove straps from around heater and support mounts.
- k. Lift heater straight up and remove through nose wheel well opening.

3-8. CLEANING AND INSPECTION. Inspect fuel control valve fittings and lines for stains indicating fuel leaks and replace lines or tighten fittings as necessary. Clean heater assembly with a suitable solvent and allow to air dry. Check heater for cracks, loose bolts, screws and wiring. Inspect all electrical connections for corrosion. Remove any corrosion with a soda and water solution. When connections are dry, wipe terminals with a slightly oily rag.

3-9. INSTALLATION OF HEATER. (See figure 3-2.)

- a. Insert heater assembly through nose wheel well opening and position heater on supporting mounts with exhaust shroud (41) and combustion air intake (28) in their proper locations.
- b. Install the two mounting straps (33) under support mounts and secure with bolts (26) and self-locking nuts (27).
- c. Connect control valve supply line (7) to inlet elbow on control valve, using a suitable thread lubricant on the elbow threads.

CAUTION

Do not allow thread lubricant to enter the el-

bow orifice, as this will clog the fuel passage to the heater.

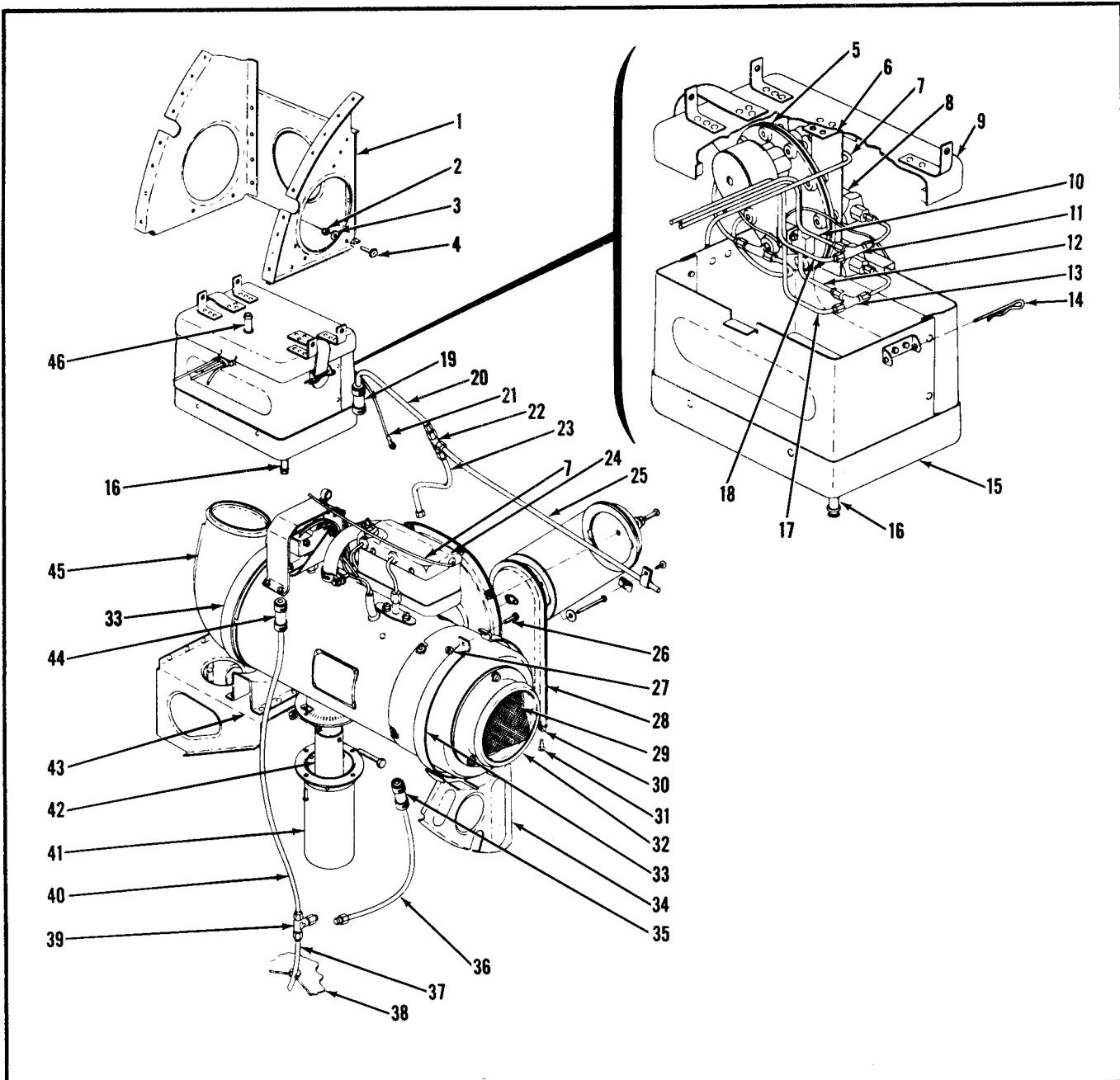
- d. Position the control valve housing cover (24) and secure with four attaching screws.
- e. Connect all electrical wiring as tagged at removal.
- f. Install ducting between heater outlet adapter (45) and plenum chamber and secure with ducting clamps.
- g. Insert temperature control wire through hole provided on thermostat actuating arm and secure by tightening screw. Secure coiled wire housing to thermostat by installing screw and nut in clamp.
- h. Slip inlet ducting over blower adapter (32) and secure in position with ducting clamp.
- i. Slide control valve housing drain hose (35) onto housing drain fitting and secure with hose clamps.
- j. Install control valve housing vent line (23) by attaching the upper end to the vent tee (22) and the lower end to the fitting on the control valve housing lid.
- k. Attach combustion air intake (28) to fuselage skin with two screws.

3-10. SAFETY VALVE AND HOUSING. (See figure 3-2.)

3-11. The safety valve consists of a shut-off solenoid and a casting which encloses a large spring-loaded diaphragm. The safety valve provides the initial flow of fuel for ignition. Additional fuel flows through the safety valve only after combustion takes place. The flame detector switch energizes the safety valve solenoid and opens a bypass through which fuel then flows to the heater. Gasoline will continue to flow through this bypass until the heater is turned off. The initial fuel chamber behind the diaphragm will refill during heater operation or may be recharged manually by turning the heater switch to FAN position for about 30 seconds. The safety valve and fittings are enclosed in a metal housing which is vented and drained overboard as a precaution against fire.

3-12. REMOVAL OF SAFETY VALVE AND HOUSING. (See figure 3-2.)

- a. Loosen drain hose clamps and slide safety valve housing drain hose (44) free from safety valve housing bottom (15).
- b. Loosen vent hose clamps and slide vent hose (19) free from safety valve housing lid (9).
- c. Tag and disconnect safety valve solenoid wire (21) from heater terminal strip.
- d. Remove pins (14) and remove safety valve housing bottom (15).
- e. Disconnect the control valve supply line (7) from the safety valve outlet elbow.
- f. Disconnect lines (10, 12, 17, and 18) from tees (11 and 13).
- g. Remove the safety valve housing lid (9), with the safety valve (5) attached, by removing the four nuts (2), washers (3), and bolts (4), attaching the housing lid to the lid mounting bracket (1).
- h. Loosen the two check valve mounting straps by removing the two bolts, washers and nuts securing them to the safety valve bracket (6).
- i. Remove safety valve (5) and check valves (8) from safety valve bracket by removing the three attaching screws.



- | | | |
|-----------------------------------|-------------------------------------|--------------------------------------|
| 1. Lid Mounting Bracket | 16. Drain Fitting | 32. Blower Adapter |
| 2. Nut | 17. Right Cabin Fuel Pressure Line | 33. Mounting Strap |
| 3. Washer | 18. Left Cabin Fuel Pressure Line | 34. Forward Supporting Mount |
| 4. Bolt | 19. Vent Hose | 35. Control Valve Housing Drain Hose |
| 5. Safety Valve | 20. Safety Valve Housing Vent Line | 36. Control Valve Housing Drain Line |
| 6. Safety Valve Bracket | 21. Safety Valve Solenoid Wire | 37. Overboard Drain Line |
| 7. Control Valve Supply Line | 22. Vent Tee | 38. Fuselage Skin |
| 8. Check Valve | 23. Control Valve Housing Vent Line | 39. Drain Tee |
| 9. Safety Valve Housing Lid | 24. Control Valve Housing Cover | 40. Safety Valve Housing Drain Line |
| 10. Left Fuel Pressure Gage Line | 25. Main Vent Line | 41. Exhaust Shroud |
| 11. Upper Tee | 26. Bolt | 42. Exhaust Tube |
| 12. Right Fuel Pressure Gage Line | 27. Nut | 43. Aft Supporting Mount |
| 13. Lower Tee | 28. Combustion Air Intake | 44. Safety Valve Housing Drain Hose |
| 14. Pin | 29. Heater Inlet Screen | 45. Outlet Adapter |
| 15. Safety Valve Housing Bottom | 30. Nut | 46. Vent Fitting |
| | 31. Screw | |

Figure 3-2. Heater Installation

- 3-13. INSTALLATION OF SAFETY VALVE AND HOUSING. (See figure 3-2.)
a. Secure safety valve (5) to the safety valve bracket (6) with three attaching screws.
b. Secure the two check valves (8) and mounting straps to the safety valve bracket (6) by installing two bolts, washers and nuts.
c. Install the safety valve housing lid (9) to the lid mounting bracket (1) with four bolts, washers and nuts.
d. Connect lines (10, 12, 17, and 18) to tees (11 and 13) as illustrated in figure 3-2.
e. Connect the control valve supply line (7) to the safety valve outlet elbow.

NOTE

Use a suitable thread lubricant on the male threads of all fittings.

CAUTION

Do not allow any thread lubricant to clog the passages through the fittings.

- f. Install safety valve housing bottom (15) and secure with pins (14).
g. Connect safety valve solenoid wire (20) to terminal strip as tagged at removal.
h. Slide vent hose (19) on vent fitting (46) in safety valve housing lid (9) and secure with hose clamp.
i. Slide safety valve housing drain hose (44) onto drain fitting (16) in safety valve housing bottom (15) and secure with drain hose clamp.

3-14. PLENUM CHAMBER. (See figure 3-3.)

3-15. The plenum chamber is located in the nose wheel well and is attached to the forward cabin bulkhead. The chamber is moulded from fiberglas and has a large inlet opening to which flexible ducting from the heater is attached. Four smaller outlet openings and two butterfly type valves, controllable from the cabin, are incorporated to direct air flow to the desired areas.

3-16. REMOVAL OF THE PLENUM CHAMBER. (See figure 3-3.)

- a. Disconnect plenum chamber supply ducting (38) from plenum chamber (16) by loosening ducting clamp.
b. Disconnect defroster supply ducting (12) from plenum chamber (16) by loosening ducting clamp.
c. Disconnect left and right warm air ducts (19 and 21) from plenum chamber (16) by loosening ducting clamps.
d. Disconnect the defroster valve control wire by loosening the clamp nut on the defroster valve arm (32).
e. Disconnect the cabin air valve control wire by loosening the clamp nut on the cabin air valve arm (31).
f. Remove the cabin air valve control from its routing bracket (33) by sliding the coiled wire housing from bracket.
g. Remove the plenum chamber (16) by removing the four attaching screws and Tinnerman nuts. Two screws are located inside the forward heat register and two are located directly above these two on the slanted portion of the control tee well.

3-17. DISASSEMBLY OF THE PLENUM CHAMBER. (See figure 3-3.)

- a. Remove the plenum chamber end (26) by removing the screws and Tinnerman nuts securing the plenum chamber end in position.
b. Remove cabin air valve arm (31), with shaft attached, from plenum chamber (16) by disconnecting spring (30) and removing two bolts (29) and nuts (27).
c. Remove cabin air valve (28) from plenum chamber (16).
d. Remove the defroster valve arm (32) with shaft attached, and the defroster valve (35) from the plenum chamber (16), by removing the two bolts (36) and nuts (34).

3-18. ASSEMBLY OF THE PLENUM CHAMBER. (See figure 3-3.)

- a. Position cabin air valve (28) in plenum chamber (16), insert shaft and secure with two bolts (29) and nuts (27) and attach spring (30).
b. Position defroster valve (35), in plenum chamber

Figure 3-3. Heating, Ventilating, and Defrosting System Callouts

- | | | |
|--------------------------------|-----------------------------------|------------------------------|
| 1. Screw | 20. Left Floorboard Ducting | 39. Outlet Adapter |
| 2. Stationary Instrument Panel | 21. Left Warm Air Ducting | 40. Right Warm Air Ducting |
| 3. Wemac | 22. Heater Supply Ducting | 41. Supply Ducting Tee |
| 4. Forward Wemac Adapter | 23. Nose Duct Adapter | 42. Wemac Tee |
| 5. Nut | 24. Nose Duct | 43. Defrosting Control |
| 6. Aft Wemac Ducting | 25. Cool Air Supply Ducting | 44. Temperature Control |
| 7. Aft Wemac Adapter | 26. Plenum Chamber End | 45. Warm Air Vent Adapter |
| 8. Floorboard Adapter | 27. Nut | 46. Warm Air Vent |
| 9. Cabin Air Control | 28. Cabin Air Valve | 47. Screw |
| 10. Defroster Ducting | 29. Bolt | 48. Right Floorboard Ducting |
| 11. "Y" Adapter | 30. Spring | 49. Air Spill |
| 12. Defroster Supply Ducting | 31. Cabin Air Valve Arm | 50. Fuselage Skin |
| 13. Defroster Outlet | 32. Defroster Valve Arm | 51. Air Spill Adapter |
| 14. Toe Tab | 33. Routing Bracket | 52. Air Spill Ducting |
| 15. Forward Heat Register | 34. Nut | 53. Ducting Clamp |
| 16. Plenum Chamber | 35. Defroster Valve | 54. Floorboard |
| 17. Cross Over Ducting | 36. Bolt | 55. Nut |
| 18. Forward Wemac Ducting | 37. Heater Assembly | 56. Screw |
| 19. Right Warm Air Ducting | 38. Plenum Chamber Supply Ducting | 57. Air Spill Elbow |

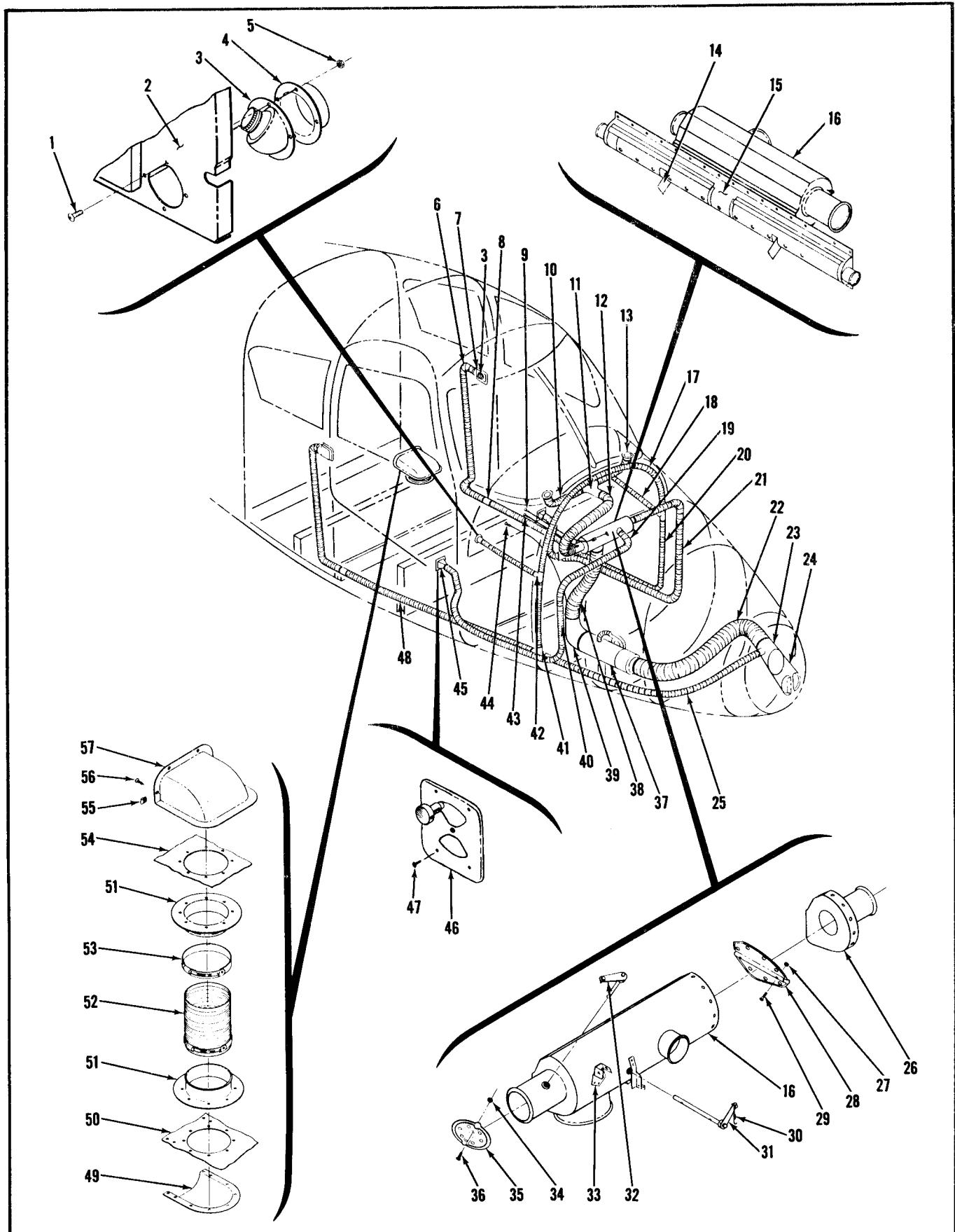


Figure 3-3. Heating, Ventilating, and Defrosting System

(16), insert shaft and secure with two bolts (36) and nuts (34).

c. Place plenum chamber end (26) in position and secure with screws and Tinnerman nuts.

3-19. INSTALLATION OF PLENUM CHAMBER.

(See figure 3-3.)

a. Secure plenum chamber (16) to forward cabin bulkhead with four attaching screws and Tinnerman nuts. Install two screws through the forward heat register and two through the slanted portion of the control tee well.

NOTE

Check and make certain the defroster control and the cabin air control are both all the way in and locked before performing steps "b" and "c."

b. Insert defroster valve control wire through hole in clamp on defroster valve arm (32) and secure, with defroster valve (35) completely closed, by tightening clamp nut.

c. Insert cabin air valve control coiled wire housing through holes in routing bracket (33) and control wire through hole in clamp on cabin air valve arm (31). Secure control wire, with cabin air valve (28) completely closed, by tightening clamp nut.

d. Attach right and left warm air ducting (19 and 21) to plenum chamber (16) as illustrated and secure with ducting clamps.

e. Attach defroster supply ducting (12) to plenum chamber (16) as illustrated and secure with ducting clamp.

f. Attach plenum chamber supply ducting (38) to plenum chamber (16) as illustrated and secure with ducting clamp.

3-20. DUCTING. (See figure 3-3.)

3-21. Figure 3-3 illustrates the routing of both the heating and ventilating ducting. Flexible, wire supported ducting is used to direct the heating or ventilating air to the desired location within the cabin. Periodic inspection of the ducting for deterioration is desirable. For removal or installation of specific ducting see the following paragraphs.

3-22. HEATER AND PLENUM CHAMBER SUPPLY DUCTING. (See figure 3-3.)

3-23. The heater and plenum chamber supply ducting directs air from the nose inlet along the right side of the nose section to the heater where the air is warmed, and from the heater to the plenum chamber to be routed as desired.

3-24. REMOVAL OF HEATER AND PLENUM CHAMBER SUPPLY DUCTING. (See figure 3-3.)

a. Loosen ducting clamps securing heater supply ducting (22) to heater (37) and nose duct adapter (23).

b. Work heater supply ducting (22) forward and remove through nose wheel well opening.

c. Remove plenum chamber supply ducting (38) by loosening ducting clamps securing it to heater outlet adapter (39) and plenum chamber (16).

3-25. INSTALLATION OF HEATER AND PLENUM CHAMBER SUPPLY DUCTING. (See figure 3-3.)

a. Position plenum chamber supply ducting (38) on heater outlet adapter (39) and plenum chamber (16) and secure in position with two ducting clamps.

b. Work heater supply ducting (22) into position from the nose aft, and secure to the heater (37) and nose duct adapter (23) with two ducting clamps.

3-26. DEFROSTER VENTS AND DUCTING. (See figure 3-3.)

3-27. The defroster supply ducting directs warm air from the outlet on the right side of the plenum chamber, to a fiberglas "Y" adapter mounted in the center of the forward cabin bulkhead directly above the plenum chamber. From the "Y" adapter flexible ducting routes warm air to defroster outlets below the windshield.

3-28. REMOVAL OF DEFROSTER DUCTING. (See figure 3-3.)

a. Loosen ducting clamp securing the defroster supply ducting (12) to the plenum chamber (16) and the "Y" adapter (11). Remove defroster supply ducting (12).

b. Loosen ducting clamps and remove defroster ducts (10) from "Y" adapter (11) and defroster outlets (13).

3-29. INSTALLATION OF DEFROSTER DUCTING. (See figure 3-3.)

a. Install defroster ducts (10) on "Y" adapter (11) and defroster outlets (13), and secure each with two ducting clamps.

b. Install defroster supply ducting (12) on the defroster outlet on plenum chamber (16) and on "Y" adapter (11) and secure with two ducting clamps.

3-30. CABIN WARM AIR VENTS AND DUCTING. (See figure 3-3.)

3-31. The cabin is heated by four warm air vents. Heated air enters the front compartment through two outlets located just forward and above the rudder pedals. Each outlet has a slide type valve which controls the amount of air flow. Each slide valve has a large tab which permits toe-operation of the valve. The valve may be placed in any intermediate position to regulate the desired flow of air. Heated air is routed from the plenum chamber to the rear seat compartment by flexible ducting beneath the floorboards. The air is then emitted from registers located under each front seat on the aft face of the front spar. Each register incorporates a rotary type slide valve which may be adjusted for any desired air flow.

3-32. REMOVAL OF CABIN WARM AIR VENTS AND DUCTING. (See figure 3-3.)

a. Remove right front seat in accordance with paragraph 2-179.

b. Remove the right and left rear seat warm air vents (46) by removing the four attaching screws (47).

c. Loosen ducting clamps securing right and left warm air ductings (19 and 21) to the vent outlet adapters (45) and the plenum chamber (16).

d. Remove right and left cover plate rudder shields and work right and left rear seat warm air ducting (19 and 21) out through the nose wheel well opening.

3-33. INSTALLATION OF CABIN WARM AIR VENTS AND DUCTING. (See figure 3-3.)

- a. Position warm air vents (46) on warm air vent adapters (45) and secure each with four attaching screws (47).
- b. Work right and left warm air ducting (19 and 21) through routing holes in forward cabin bulkhead, aft beneath the floorboards, and up through the holes provided under the front seats. Attach ducting (19 and 21) to warm air vent adapters (45) and secure with ducting clamps.
- c. Replace cover plate rudder shields and secure with attaching screws.
- d. Replace right front seat in accordance with paragraph 2-180.

3-34. CABIN COOL AIR VENTS AND DUCTING. (See figure 3-3.)

3-35. Cool air is supplied to the cabin by a ducting system completely separate from the heating system. Fresh air is routed from the nose duct adapter to four individual wemacs. Each wemac is mounted in a socket and can be adjusted to direct the air flow in the desired direction. The amount of air flow is controlled by the position of the knurled ring surrounding the wemac outlet. Clockwise rotation of the knurled ring decreases airflow and counterclockwise rotation increases airflow. One wemac is located in each lower corner of the instrument panel for the front seat occupants and one wemac is located on each side panel in the rear cabin compartment for use by the rear seat passengers. Ram air pressure is utilized for the cool air ventilation, therefore the system is operative in flight only and for ground ventilation the ventilating fan of the heater system should be operated.

3-36. REMOVAL OF CABIN COOL AIR VENTS AND DUCTING. (See figure 3-3.)

- a. Loosen clamps securing forward wemac ducting (18) to wemac tees (42) and forward wemac adapters (4). Remove ducting (18) from behind the instrument panel.
- b. Remove forward wemacs (3), and forward wemac adapters (4) from the stationary instrument panel (2), by removing the four attaching screws (1) and nuts (5).
- c. Loosen clamp securing each end of cool air supply ducting (25) and work ducting forward and remove.
- d. Loosen clamp securing right cool air ducting (40) at each end and remove ducting.
- e. Loosen clamps securing cross over ducting (17) to wemac tees (42) and remove ducting.
- f. Remove front and rear carpets in accordance with paragraph 2-204.
- g. Remove upholstery side panels in accordance with paragraphs 2-192, 193, or 194.
- h. Remove outboard access hole covers and cover plates from floorboards by removing attaching screws.
- i. Loosen clamps at aft end of right and left floorboard ducting (48 and 20) and work ducting with supply ducting tee (41) and left wemac tee (42) attached, forward and out through routing holes in forward

cabin bulkhead.

- j. Loosen clamps at each end of aft wemac ducting (6) and remove ducting.
- k. Remove aft wemac adapters (7) by removing the attaching screws.

3-37. INSTALLATION OF CABIN COOL AIR VENT AND DUCTING. (See figure 3-3.)

- a. Attach forward end of left floorboard ducting (20) to wemac tee (42) and work ducting into position through routing hole in forward cabin bulkhead. Secure ducting (20) to floorboard adapter (8) with ducting clamp.
- b. Attach forward end of right floorboard ducting (48) to supply ducting tee (41) and work ducting into position through routing hole in forward cabin bulkhead. Secure ducting (48) to floorboard adapter (8) with ducting clamp.
- c. Position aft wemac adapters (7) and secure with attaching screws.
- d. Install aft wemac ductings (6) and attach to aft wemac adapters (7) and secure with ducting clamps.
- e. Install side panels in accordance with paragraphs 2-192, 193, or 194.
- f. Install front and rear carpets in accordance with paragraph 2-204.
- g. Install forward wemacs (3) and forward wemac adapters (4) and secure with attaching screws (1) and nuts (4).
- h. Install forward wemac ductings (18) and attach to forward wemac adapters (4) and wemac tees (42) with ducting clamps.
- i. Install forward cool air supply ducting (25) and attach to nose duct adapter (23) and supply ducting tee (41) with ducting clamps.
- j. Install cross over ducting (17) and attach to the wemac tees (42) with ducting clamps.

3-38. HEATER SWITCH.

3-39. The heater is controlled by a three-position toggle switch located directly below the left control column. The positions of the switch are HEAT (up position), OFF (middle position), and FAN (down position). The HEAT position starts and maintains heater operation, delivering warm air to all heat and defroster outlets. The OFF position allows the heater ducting to be used as a ventilating system while the airplane is in flight. The FAN position performs two functions; it provides ventilating air to the cabin while the airplane is on the ground and, it energizes the safety valve which primes the heater for its next starting operation.

3-40. REMOVAL OF HEATER SWITCH. Remove heater switch in accordance with paragraph 6-83.

3-41. INSTALLATION OF HEATER SWITCH. Install heater switch in accordance with paragraph 6-83.

3-42. TEMPERATURE CONTROL. (See figure 3-3.)

3-43. The temperature control is located below and slightly to the left of the right control column. It is a push-pull type and is labeled "TEMP CONTROL". Pull the knob out to increase cabin temperature and push knob in to decrease cabin temperature. 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 between high and low heat positions to maintain the cabin temperature setting selected with the control knob.

3-44. REMOVAL OF TEMPERATURE CONTROL. (See figure 3-3.)

- a. Loosen screw securing control wire to thermostat actuating arm.
- b. Remove clamp securing coiled wire housing to thermostat.
- c. Loosen nut securing control assembly to lower instrument panel and slide assembly aft.

3-45. INSTALLATION OF TEMPERATURE CONTROL. (See figure 3-3.)

- a. Insert control assembly through mounting hole in lower instrument panel.
- b. Slide lockwasher and nut over coiled wire housing and secure control assembly to lower instrument panel by tightening nut.
- c. Route temperature control coiled wire housing through forward cabin bulkhead and attach to thermostat with attaching clamp.
- d. Insert control wire through hole in thermostat actuating arm clamp. With control knob in, and thermostat arm forward, secure arm to control wire by tightening clamp screw.

3-46. AIRFLOW CONTROLS. (See figure 3-3.)

3-47. The cabin air and defroster valves within the plenum chamber are actuated by push-pull type airflow controls. Each control consists of a control wire operating within a coiled wire housing, with a knob attached to the cockpit end. This knob is located just to the right of the control pedestal. To open either plenum chamber valve, turn the control knob counterclockwise to unlock and pull knob out. Turn knob clockwise to lock in position at any desired setting.

3-48. REMOVAL OF AIRFLOW CONTROLS. (See figure 3-3.)

- a. Loosen clamp nuts securing control wires to the cabin air and defroster valve arms (31 and 32) on the plenum chamber (16).
- b. Work cabin air control coiled wire housing from routing bracket (33) supporting housing to plenum chamber (16).
- 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.

3-49. INSTALLATION OF AIRFLOW CONTROLS. (See figure 3-3.)

- 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 (43) through bracket on forward cabin bulkhead and cabin air control (9) through routing bracket (33) on plenum chamber (16).
- 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.

3-50. AIR SPILL VENT. (See figure 3-3.)

3-51. The air spill vent is located under the left side of the passenger seat. It exhausts cabin air into the slip stream as the heating and ventilating system provide a continuous supply of fresh air to the cabin. A screen at the entrance of the air spill elbow prevents foreign objects from entering the air spill vent. Access to the air spill vent is through the baggage compartment.

3-52. REMOVAL OF AIR SPILL VENT. (See figure 3-3.)

- a. Remove baggage compartment floor cover by removing attaching screws.
- b. Remove screws (56) and nuts (55) attaching air spill elbow (57) and remove elbow from beneath passenger seat by sliding aft.
- c. Remove access hole cover just aft of spill vent by removing attaching screws.
- d. Loosen ducting clamps (53) and remove air spill ducting (52) through access hole.

3-53. INSTALLATION OF AIR SPILL VENT. (See figure 3-3.)

- a. Insert air spill ducting (52) through access hole and secure in position on air spill adapters (51) with ducting clamps (53).
- b. Slide air spill elbow (57) forward into position under left side of passenger seat and secure to metal seat skirt with attaching screws (56) and self-locking nuts (55).
- c. Replace access hole cover and secure with screws.
- d. Replace baggage compartment floor cover and secure with attaching screws.

3-54. HEATING, VENTILATING, AND DEFROSTING SYSTEM – Serial 35547 and on. (See figure 3-4.)

3-55. The 310B, 310C, and 310D heating, ventilating, and defrosting system is basically the same as that of the earlier 310 model described in paragraph 3-1. Varied arrangements of the rear heat outlets and the air spill vent were used on these models as standard, optional and field modification kits. For your particular airplane see the following pages.

3-56. MAINTENANCE OF THE HEATING, VENTILATING, AND DEFROSTING SYSTEM. Periodically check that all clamps and ducting are securely fastened in position. If the air flow through the heater is restricted, remove the three screws securing the blower adapter to the blower assembly and remove any foreign objects lodged in the heater inlet screen. The blower motors have factory packed sealed bearings and require no lubrication. The model 8240-A heater is designed so service procedures and maintenance can be confined to replacement of subassemblies if tools and test equipment are not available.

3-57. TROUBLE SHOOTING THE HEATING, VENTILATING, AND DEFROSTING SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
HEATER WILL NOT START BLOWERS DO NOT RUN.	Open circuit breaker.	Reset circuit breaker.
	Defective heater switch or wiring.	Replace switch or wiring as necessary.
VENT AIR BLOWER RUNS BUT COMBUSTION AIR BLOWER DOES NOT START.	Overheat switch tripped.	Reset switch and find cause of overheating.
	Defective combustion air blower motor.	Replace blower assembly.
BOTH BLOWERS RUN BUT HEATER FAILS TO START.	Breaker points defective.	Replace breaker points assembly.
	Defective spark plug.	Replace plug.
	Defective airvane switch.	Replace switch assembly.
	Obstruction in combustion air passage.	Replace obstruction.
	Defective ignition coil.	Replace coil.
	Open circuit in thermostat.	Replace thermostat.
	Defective solenoid.	Replace nozzle solenoid.
	Open circuit in duct limit switch.	Replace switch.
	Defective fuel pump.	Replace blower assembly.
	Defective supply solenoid.	Replace solenoid.
HEATER BURNS BUT THERMOSTAT WILL NOT CONTROL TEMPERATURE.	Defective thermostat.	Replace thermostat.
	Defective duct limit switch.	Replace switch.
OUTLET AIR TEMPERATURE TOO LOW.	Excessive vent air flow.	Reduce vent air flow.
	Defective thermostat.	Replace thermostat.
	Defective duct limit switch.	Replace switch.
	Defective fuel supply solenoid.	Replace fuel supply solenoid.
	Defective solenoid valve.	Replace solenoid valve.
HEATER TRIPS OVERHEAT SWITCH.	Defective overheat switch.	Replace switch.
	Insufficient vent air plus defective duct limit switch.	Replace duct limit switch and increase air rate.
SMOKING HEATER EXHAUST.	Defective nozzle.	Replace nozzle.
	Leaking solenoid valve.	Replace valve.
HEATER POPS OR BANGS WHEN STARTING OR CYCLING.	Leaking solenoid valve.	Replace valve.
	Delayed ignition caused by intermittent spark.	Replace spark plug or coil as necessary.
RUMBLE OR COMBUSTION NOISE IN HEATER.	Loose burner assembly mounting screws.	Tighten mounting screws.
	Defective nozzle.	Replace nozzle.

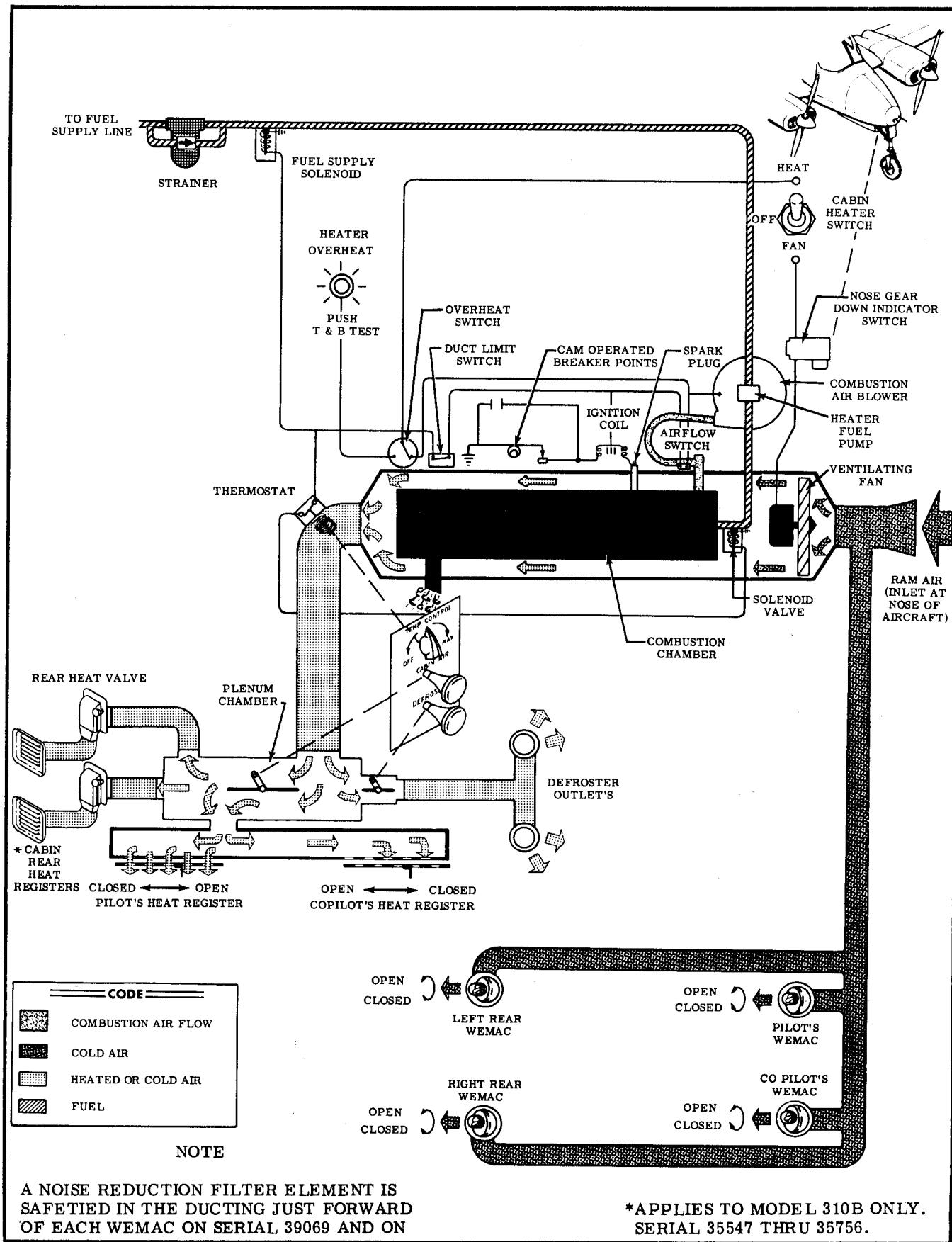


Figure 3-4. Heating, Ventilating, and Defrosting System Diagram

3-58. HEATER. (See figure 3-5.)

3-59. The 310B and 310C heater is a model 8240-A South Wind 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 filter and a solenoid supply valve to the heater fuel pump. The diaphragm type heater fuel pump is operated by the combustion air blower motor which is mounted above the heater assembly. This pump provides the heater with sufficient fuel pressure and no auxiliary boost pump assistance is necessary for proper operation of the heater. The heater fuel pump and all external fittings on the heater are enclosed in metal housings which are vented and drained as a precaution against fire in the event of leaky fittings. Fuel passes from the heater fuel pump through a solenoid valve to the combustion chamber spray nozzle. When the cabin heater switch is placed in the HEAT position, current is supplied to the combustion air blower (which operates the heater fuel pump) and to the ventilating fan. The ventilating fan actuates the cam-operated breaker points which start the spark plug to sparking. As the combustion air blower air flow increases, the vane type valve at the inlet of the combustion chamber opens. This actuates a microswitch which in turn operates the solenoid valve allowing fuel to spray into the heater where the plug is already sparking and combustion takes place. 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.

3-60. REMOVAL OF THE HEATER. (See figure 3-5.)

NOTE

If a radio (optional equipment) has been installed, remove the radio and radio shelf to gain access to the heater.

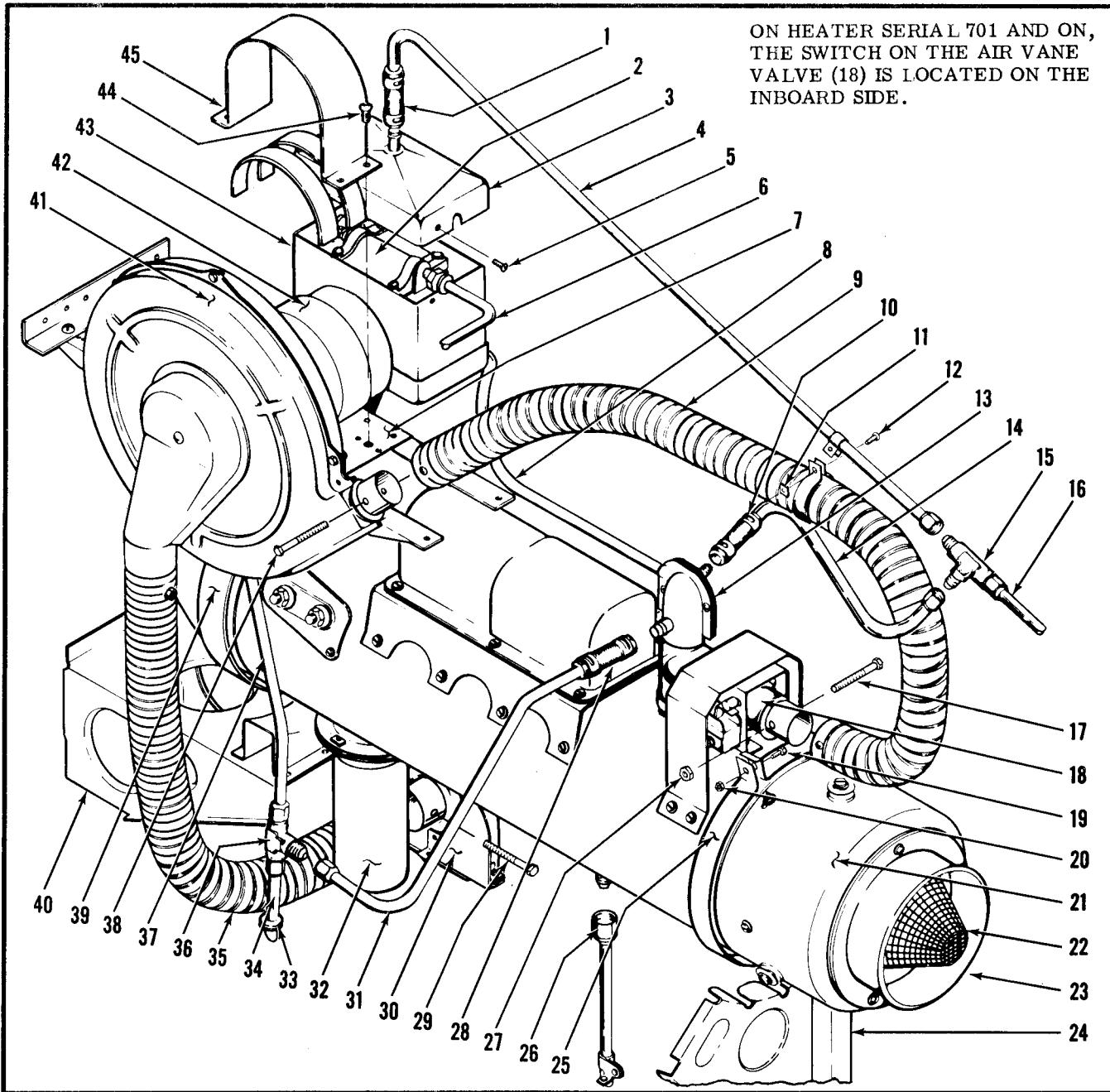
- a. Tag and disconnect all electrical wires from the combustion blower motor (42) and from heater terminal strip.
- b. Loosen clamps and slide hoses (1, 10 and 28) free from fuel pump housing lid (3) and fuel inlet shroud (13).
- c. Loosen clamp and slide hose free from bottom of fuel pump housing (43).
- d. Remove fuel pump housing vent line (4) by disconnecting from tee (15) and removing screw (12) and nut (11).
- e. Disconnect fuel inlet shroud vent line (14) from tee (15) and remove line (14).
- f. Remove combustion blower outlet hose (9) by removing nuts (27) and bolts (17 and 38).
- g. Remove screws (5) and lift fuel pump housing lid (3) from heater fuel pump housing (43).

- h. Disconnect fuel pump supply line (6) and heater fuel supply line (8) from heater fuel pump (2).
- i. Disconnect combustion blower inlet hose (35) from combustion air inlet (30) by removing attaching bolt (29) and nut.
- j. Remove motor clamp (45) by removing attaching screws (44).
- k. Apply a slight downward pressure on the forward end of the combustion blower mounting bracket (7) and remove the fuel pump (2), housing (43), motor (42), blower (41) and blower inlet hose (35) as a unit.
- l. Disconnect fuel inlet shroud drain line (31) from tee (36) and remove line (31).
- m. Remove fuel pump housing drain line (37), tee (36) and overboard drain line (34) by lifting upwards free of grommet (33).
- n. Disconnect heater drain line (26) from heater.
- o. Remove heater supply ducting (22, figure 3-3) from blower adapter (23) by loosening duct clamp.
- p. Remove mounting straps (25 and 39) by removing nuts (20) and bolts (19).
- q. Slide elbow from aft end of heater and remove heater by working upwards and forward.

3-61. CLEANING AND INSPECTION. Inspect fuel lines and fittings for stains indicating fuel leaks. Replace lines or tighten fittings as necessary. Clean heater assembly with a suitable solvent and allow to dry. Check heater for cracks, loose bolts, screws and wiring. Inspect all electrical connections for corrosion. Remove any corrosion with a soda and water solution. When connections are dry, wipe terminals with a slightly oil rag. After 250 hours of heater operation, remove the ventilating air blower and check breaker point gap. This should be within the limits of 0.016 to 0.020 in. Also inspect the cam for signs of wear. If a groove or step is worn into the cam, install a new cam and recheck breaker point gap. At the 250 hour period, also remove and inspect the spark plug. If the plug shows signs of pitting, fouling or erosion, return the entire heater to the shop for repair and testing since the nozzle is probably at fault. If the plug is in good condition it should be cleaned and replaced. Repeat the 250 hour inspection at 250 hour intervals up to 1000 hours, at which time the heater should be overhauled.

3-62. INSTALLATION OF HEATER. (See figure 3-5.)

- a. Position heater on supporting brackets (24 and 40) as illustrated in figure 3-5.
- b. Slide elbow onto aft end of heater and secure heater to supporting brackets (24 and 40) with mounting straps (25 and 39) by installing bolts (19) and nuts (20).
- c. Connect heater drain line (26) to heater.
- d. Insert overboard drain line (34) through grommet (33) as illustrated in figure 3-5.
- e. Connect hose (28) to fuel inlet shroud (13) and secure by tightening hose clamp. Attach fuel inlet shroud drain line (31) to tee (36).
- f. Apply a slight downward pressure on the forward end of the combustion blower mounting bracket (7) and position the fuel pump (2), housing (43), motor (42), blower (41) and blower inlet hose (35) assembly as illustrated in figure 3-5.
- g. Secure motor clamp (45) with screws (44).



- | | | |
|----------------------------------|--------------------------------|----------------------------------|
| 1. Hose | 16. Forward Vent Line | 31. Fuel Inlet Shroud Drain Line |
| 2. Heater Fuel Pump | 17. Bolt | 32. Exhaust Shroud |
| 3. Fuel Pump Housing Lid | 18. Air Vane Valve | 33. Grommet |
| 4. Fuel Pump Housing Vent Line | 19. Bolt | 34. Overboard Drain Line |
| 5. Screw | 20. Nut | 35. Combustion Blower Inlet Hose |
| 6. Fuel Pump Supply Line | 21. Ventilating Blower | 36. Tee |
| 7. Combustion Blower Bracket | 22. Heater Inlet Screen | 37. Fuel Pump Housing Drain Line |
| 8. Heater Fuel Supply Line | 23. Blower Adapter | 38. Bolt |
| 9. Combustion Blower Outlet Hose | 24. Forward Supporting Bracket | 39. Mounting Strap |
| 10. Hose | 25. Mounting Strap | 40. Aft Supporting Bracket |
| 11. Nut | 26. Heater Drain Line | 41. Combustion Air Blower |
| 12. Screw | 27. Nut | 42. Combustion Blower Motor |
| 13. Fuel Inlet Shroud | 28. Hose | 43. Heater Fuel Pump Housing |
| 14. Fuel Inlet Shroud Vent Line | 29. Bolt | 44. Screw |
| 15. Tee | 30. Combustion Air Inlet | 45. Motor Clamp |

Figure 3-5. Heater Installation

- h. Secure hose to bottom of fuel pump housing (43) with hose clamp.
- i. Attach combustion blower inlet hose (35) to combustion air inlet (30) with bolt (29) and nut.
- j. Attach fuel pump supply line (6) and heater fuel supply line (8) to heater fuel pump (2).
- k. Position fuel pump housing lid (3) on heater fuel pump housing (43) and secure with two screws (5).
- l. Position combustion blower outlet hose (9) as illustrated in figure 3-5 and secure at each end with bolts (17 and 38) and nuts (27).
- m. Attach fuel inlet shroud vent line (14) to tee (15) and secure hose (10) to fuel inlet shroud (13) with hose clamp.
- n. Secure hose (1) to fuel pump housing lid (3) with hose clamp and connect fuel pump housing vent line (4) to tee (15).
- o. Secure fuel pump housing vent line (4) and combustion blower outlet hose (9) to bulkhead with screw (12) and nut (11).
- p. Connect wires to heater terminal strip and to combustion blower motor (42) as tagged at removal.
- q. Slide heater supply ducting (22, figure 3-3) onto blower adapter (23) and secure with ducting clamp.

3-63. PLENUM CHAMBER. (See figure 3-3.)

3-64. For description, removal, disassembly, and assembly and installation of the plenum chamber refer to paragraphs 3-14 through 3-19.

3-65. DUCTING. (See figure 3-3 and 3-6.)

3-66. Figure 3-3 and 3-6 illustrates the 310B and 310C heating and ventilating ducting. For additional information refer to paragraph 3-20.

3-67. HEATER AND PLENUM CHAMBER SUPPLY DUCTING. (See figure 3-3.)

3-68. For description, removal and installation of the heater and plenum chamber supply ducting refer to paragraphs 3-22 through 3-25.

3-69. DEFROSTER VENTS AND DUCTING. (See figure 3-3.)

3-70. For description, removal and installation of the defroster vents and ducting refer to paragraphs 3-26 through 3-29.

3-71. CABIN WARM AIR VENTS AND DUCTING. (See figure 3-3 and 3-6.)

3-72. The 310B and 310C warm air vents and ducting are the same as described in paragraph 3-30 with the exception of the two heat outlets located on the aft face of the main spar. A box assembly covers these rear heat outlets and routes the warm air through ducting beneath the rear cabin floorboards and expells it from the side panel just aft of the cabin rear seat. The box assembly contains an airflow control valve which may be adjusted by hand or foot. The valves are OPEN when the knob is in the up position.

3-73. REMOVAL OF CABIN WARM AIR VENTS AND DUCTING. (See figure 3-6.)

- a. Remove forward cabin warm air vents and ducting in accordance with paragraph 3-32.
- b. Remove rear seats in accordance with paragraph 2-182 or 2-184D.
- c. Remove center floorboard carpet and upholstery side panels.
- d. Remove baggage compartment side panel.
- e. Remove left and right rear heat valves (22) by disconnecting the rear warm air ducting clamps and removing screws (21) and nuts (20).
- f. Remove rear outlet adapters (1) by disconnecting ducting clamps and removing screws (6).
- g. Remove access hole covers necessary to reach ducting (7 and 23) and work ducting out from routing position.

3-74. INSTALLATION OF CABIN WARM AIR VENTS AND DUCTING. (See figure 3-6.)

- a. Work left and right rear warm air ducting (7 and 23) into their routing positions illustrated in figure 3-6.
- b. Slide aft ends of ducting onto outlet adapters (1) and secure with ducting clamps.
- c. Secure rear outlet adapters (1) to fuselage with attaching screws (6).
- d. Slide forward ends of ducting onto the rear heat valves (22) and secure with ducting clamps.
- e. Secure rear heat valves (22) to the front spar with attaching screws (21) and nuts (20).
- f. Install upholstery side panels.
- g. Install center floorboard carpet.
- h. Install baggage compartment side panel.
- i. Install rear seats in accordance with paragraph 184 or 184F.
- j. Install forward cabin warm air vents and ducting in accordance with paragraph 3-33.

3-75. CABIN COOL AIR VENTS AND DUCTING. (See figure 3-3.)

3-76. For description, removal and installation of the cabin cool air vents and ducting refer to paragraphs 3-34 through 3-37.

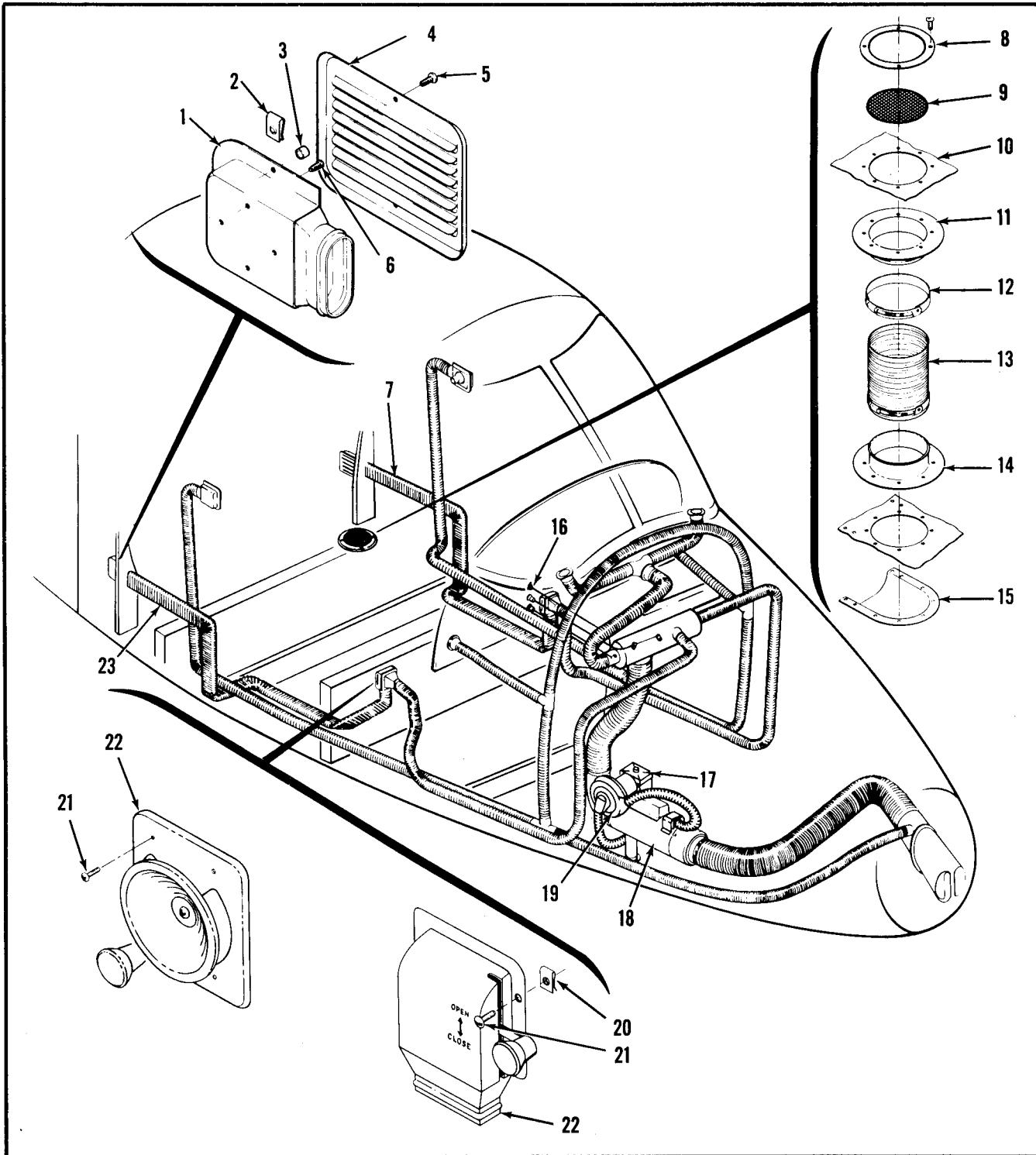
3-77. HEATER SWITCH.

3-78. The heater is controlled by a three-position toggle switch located on top of the control quadrant directly forward of the mixture control. The positions of the switch are HEAT (forward position), OFF (middle position), and FAN (aft position). The HEAT position starts and maintains heater operation, delivering warm air to all heat and defrost outlets. The OFF position allows the heater ducting to be used as a ventilating system while the airplane is in flight. The FAN position provides ventilating air to the cabin while the airplane is on the ground.

3-79. REMOVAL AND INSTALLATION OF HEATER SWITCH. Remove and install heater switch in accordance with paragraph 6-83.

3-80. TEMPERATURE CONTROL. (See figure 3-6.)

3-81. 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,



- | | | |
|-------------------------------|------------------------------|---------------------------------|
| 1. Rear Outlet Adapter | 9. Air Spill Screen Retainer | 16. Temperature Control |
| 2. Nut | 10. Air Spill Screen | 17. Heater Fuel Pump Housing |
| 3. Spacer | 11. Upper Air Spill Adapter | 18. Heater Assembly |
| 4. Rear Outlet Grill | 12. Ducting Clamp | 19. Combustion Air Blower |
| 5. Screw | 13. Air Spill Ducting | 20. Nut |
| 6. Screw | 14. Lower Air Spill Adapter | 21. Screw |
| 7. Left Rear Warm Air Ducting | 15. Air Spill | 22. Rear Heat Valve |
| 8. Screw | | 23. Right Rear Warm Air Ducting |

Figure 3-6. Heating, Ventilating, and Defrosting System

OFF (counterclockwise position), and MAX (clockwise position). Clockwise rotation of the temperature control knob increases cabin temperature and counter-clockwise 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.

3-82. REMOVAL OF TEMPERATURE CONTROL.

- Loosen screw securing control wire to thermostat actuating arm.
- Remove clamp securing coiled wire housing to the thermostat.
- Remove control knob by removing knob setscrew.
- 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.

3-83. INSTALLATION OF TEMPERATURE CONTROL.

- Route temperature control wire housing through forward cabin bulkhead and attach to thermostat with attaching clamp.
- Insert temperature control assembly through hole in stationary instrument panel and secure with nut.
- Place control knob on temperature control assembly and secure with setscrew.
- With control knob turned to the OFF position and the thermostat arm forward, secure arm to the control wire by tightening clamp screw.

3-84. AIRFLOW CONTROLS. (See figure 3-3.)

3-85. For description, removal and installation of the airflow controls refer to paragraphs 3-46 through 3-49.

3-86. AIR SPILL VENT. (See figure 3-6.)

3-87. The air spill vent illustrated in figure 3-6 applies to serials 35547 thru 35756 and aircraft equipped with individual reclining rear seats. The air spill vent is located beneath the left rear passenger seat.

3-88. REMOVAL OF AIR SPILL VENT. (See figure 3-6.)

- Remove rear seat in accordance with paragraph 2-182 or 2-184D.
- Remove air spill screen retainer (9) and air spill screen (10) by removing screws (8).
- Remove baggage compartment floor cover.
- Remove access hole cover aft of spill vent and remove ducting (13) by removing ducting clamps (12).

3-89. INSTALLATION OF AIR SPILL VENT. (See figure 3-6.)

- Insert air spill ducting (13) through access hole and secure in position on air spill adapters (11 and 14) with ducting clamps (12).
- Install access hole cover.
- Install baggage compartment floor cover.
- Secure air spill screen (10) and air spill screen retainer (9) with screws (8).
- Install rear seats in accordance with paragraph 2-184 or 2-184F.

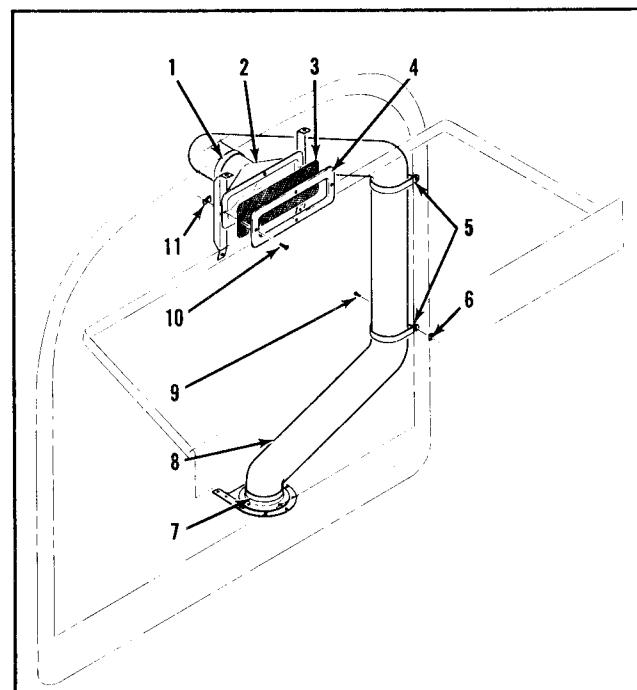


Figure 3-7. Air Spill Vent

1. Clamp	7. Clamp
2. Adapter	8. Duct
3. Screen	9. Screw
4. Retainer	10. Screw
5. Clamp	11. Nut
6. Nut	

3-90. AIR SPILL VENT. (See figure 3-7.)

3-91. The air spill vent illustrated in figure 3-7 was installed on serials 35772 thru 35937 with the following optional seating arrangements: the five single seat arrangement, the four single seat arrangement, and the lounge. On serial 35938 and on, the air spill vent illustrated in figure 3-7 is standard equipment.

3-92. REMOVAL OF AIR SPILL VENT. (See figure 3-7.)

- Remove baggage compartment curtain by loosening Dzus fasteners.
- Remove screws (9) and nuts (6).
- Loosen upper clamp (1) and lower clamp (7) and remove duct (8) by sliding from upper and lower adapters.
- Remove retainer (4), screen (3), and adapter (2) by removing screws (10) and nuts (11).

3-93. INSTALLATION OF AIR SPILL VENT. (See figure 3-7.)

- Position adapter (2), screen (3), and retainer (4) as illustrated in figure 3-7 and secure with screws (10) and nuts (11).
- Position duct (8) on upper and lower adapters and secure with clamps (1 and 7).
- Attach duct to bulkhead with clamps (5) by installing screws (9) and nuts (6).
- Replace baggage compartment curtain and secure with Dzus fasteners.

3-94. FOUR PORT OXYGEN SYSTEM. (See figure 3-8.)

WARNING

USE NO OIL! Also keep equipment free of organic material (dust, lint, etc.,). Be sure hands and clothing are free of oil and grease before handling equipment.

3-95. The oxygen system is designed to supply oxygen for a pilot and three passengers. The system consists of an oxygen cylinder, plumbing, an oxygen pressure gage, pressure regulator, outlet couplings, and four disposable type oxygen masks complete with rubber hoses and flow indicators. Oxygen is routed from the high pressure cylinder, to the pressure gage and through a regulator which reduces high cylinder pressure to a low usable pressure. From the regulator, low pressure oxygen is routed to four outlet couplings which supply a continuous flow of oxygen to the oxygen masks whenever the mask hoses are plugged into the couplings. Each coupling contains a spring-loaded valve which restricts the flow of oxygen until the mask hose is plugged into the coupling. Each mask hose contains a flow indicator for visual proof of oxygen flow. The oxygen masks, rubber hoses and flow indicators are stored in the oxygen mask case on the baggage shelf when not in use.

NOTE

Use MIL-T-5542 thread compound on all oxygen fittings to prevent seizure. Apply compound to the male fittings only, omitting the first two threads.

3-96. TESTING THE OXYGEN SYSTEM. Test the oxygen system for leakage by applying type CG-1 solution per specification MIL-L-25567A or its equivalent, to each fitting and observe for the 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 percent of the total supply per 24-hour period.

3-97. OXYGEN CYLINDER. (See figure 3-8.)

3-98. The supply of oxygen for the system is stored, under high pressure, in the oxygen cylinder. The cylinder is located aft of the baggage compartment in the right side of the fuselage and incorporates a shut-off valve to facilitate removal and refilling. When the system pressure drops below 300 psi the tank should be removed and filled with aviation (dry) grade oxygen to 1800 psi. For removal of the oxygen cylinder refer to paragraph 3-99.

WARNING

A fully charged oxygen cylinder contains a pressure of 1800 psi. Serious injury to personnel and damage to equipment can result from accidental release of the oxygen.

3-99. REMOVAL OF OXYGEN CYLINDER. (See figure 3-8.)

- a. Remove baggage compartment curtain by loosening Dzus fasteners.
- b. Close control valve (45) on oxygen cylinder (46) by turning clockwise.

NOTE

Before disconnecting the oxygen pressure line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- c. Disconnect oxygen pressure line (12) from control valve (45).
- d. Remove safety wire and loosen wing nuts securing mounting straps (47) around oxygen cylinder (46).
- e. Slide oxygen cylinder (46) forward and remove through baggage compartment door.

3-100. INSTALLATION OF OXYGEN CYLINDER. (See figure 3-8.)

- a. Slide oxygen cylinder (46), with control valve (45) forward, into position on mounting supports.
- b. Attach oxygen pressure line (12) to control valve (45).
- c. Tighten wing nuts on mounting straps (47) and

Figure 3-8. Four Port System Callouts

1. Pressure Gage Cover	17. Screw	32. Passenger's Restrictor
2. Mounting Bracket	18. Nipple	33. Dust Cover
3. Screw	19. Pressure Regulator	34. Dust Cover Retaining Nut
4. Nut	20. Nipple	35. Screw
5. Pressure Gage Line	21. Union	36. Union
6. Elbow	22. Manifold Supply Line	37. Leather Bead
7. Pressure Gage	23. Flow Indicator	38. Pan Cover
8. Screw	24. Mask Hose	39. Washer
9. Nut	25. Oxygen Mask	40. Upper Pan
10. Line Clamp	26. Nut	41. Clamp
11. Screw	27. Bulkhead	42. Screw
12. Oxygen Pressure Line	28. Coupling	43. Nutplate
13. Tee	29. Pilot's Restrictor	44. Oxygen Mask Case
14. Regulator Supply Line	30. Lower Pan	45. Control Valve
15. Low Pressure Line	31. Tee	46. Oxygen Cylinder
16. Grommet		47. Mounting Strap

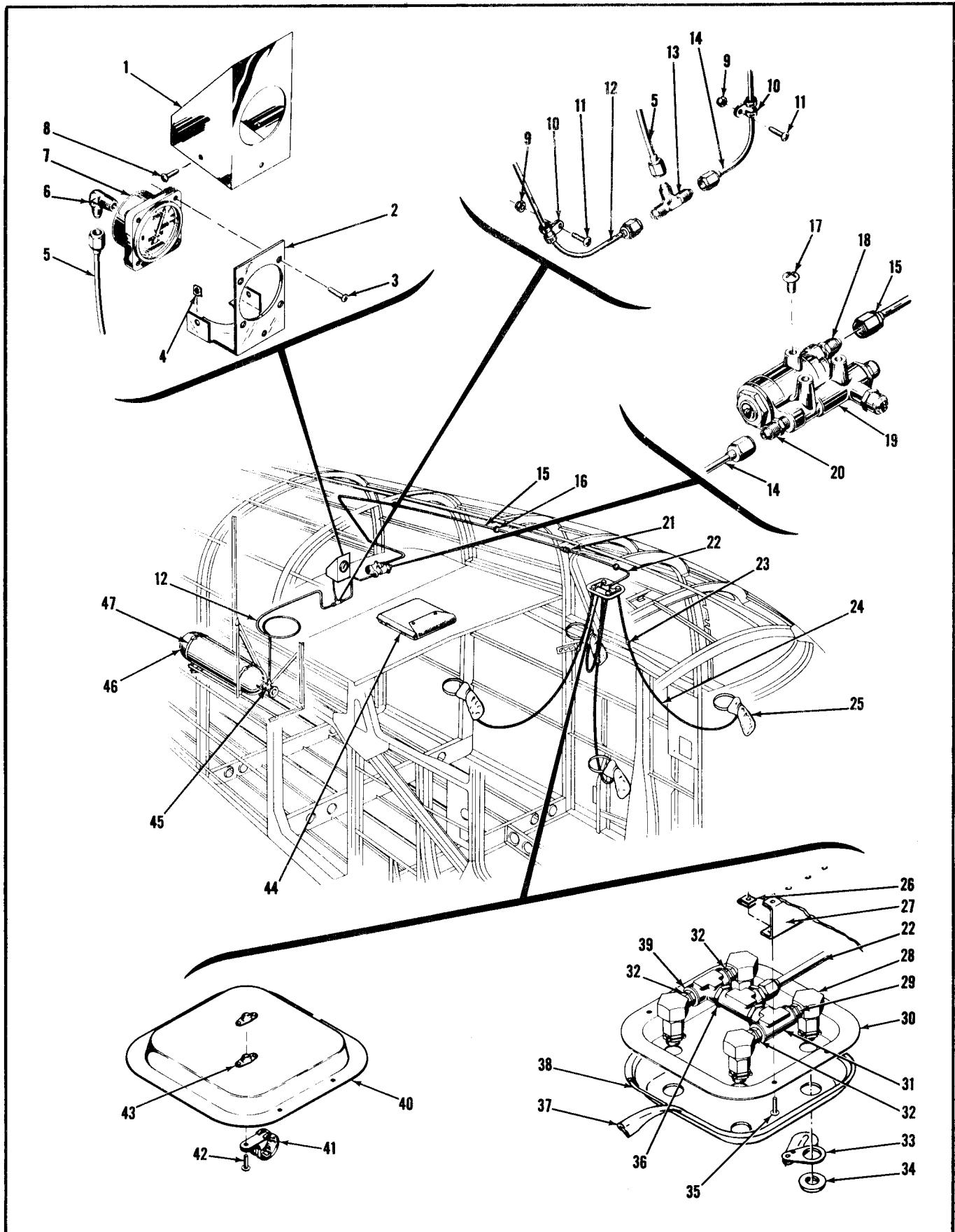


Figure 3-8. Four Port Oxygen System

secure with safety wire.

- d. Open control valve (45) on oxygen cylinder (46) by turning counterclockwise to its full limit.
- e. Replace baggage compartment curtain and secure with Dzus fasteners.

3-101. PRESSURE GAGE. (See figure 3-8.)

3-102. The oxygen pressure gage is mounted on the baggage shelf and is visible to all occupants of the airplane. The cylinder pressure and remaining oxygen supply is determined by the gage indication. When the gage indication is 300 psi or less, the oxygen cylinder should be recharged to 1800 psi.

3-103. REMOVAL OF PRESSURE GAGE. (See figure 3-8.)

- a. Remove baggage compartment curtain by loosening Dzus fasteners.
- b. Close control valve (45) on oxygen cylinder (46) by turning clockwise.
- c. Remove pressure gage cover (1) by removing three attaching screws (8) and nuts (4).

NOTE

Before disconnecting the pressure gage line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- d. Disconnect pressure gage line (5) from elbow (6) in back of oxygen pressure gage (7).
- e. Remove pressure gage (7) from mounting bracket (2) by removing the four attaching screws (3).

3-104. INSTALLATION OF PRESSURE GAGE. (See figure 3-8.)

- a. Position pressure gage (7) in mounting bracket (2) and secure with four attaching screws (3).
- b. Connect pressure gage line (5) to elbow (6) in back of oxygen pressure gage (7).
- c. Replace pressure gage cover (1) and secure to mounting bracket (2) with three attaching screws (8) and nuts (4).
- d. Open control valve (45) on oxygen cylinder (46) by turning counterclockwise to its full limit.
- e. Replace baggage compartment curtain and secure with Dzus fasteners.

3-105. PRESSURE REGULATOR. (See figure 3-8.)

3-106. The pressure regulator is located aft of the baggage compartment curtain and is attached to the baggage shelf. The purpose of the regulator is to reduce the high pressure oxygen in the oxygen cylinder to a suitable working pressure. The regulator automatically compensates for changes in altitude and furnishes the required oxygen distribution pressure at all times. This relieves the user of the necessity for making periodic adjustment while in flight. A fine mesh screen is incorporated in the regulator to prevent foreign particles from entering the system.

3-107. REMOVAL OF PRESSURE REGULATOR. (See figure 3-8.)

- a. Remove baggage compartment curtain by loosen-

ing Dzus fasteners.

- b. Close control valve (45) on oxygen cylinder (46) by turning valve clockwise.
- c. Disconnect low pressure line (15) from nipple (18) in the OUT port of pressure regulator (19).
- d. Disconnect regulator supply line (14) from nipple (20) in the IN port of pressure regulator (19).
- e. Remove pressure gage cover (1) from mounting bracket (2) by removing three attaching screws (8) and nuts (4).
- f. Remove left baggage shelf cover retainer by removing attaching screws.
- g. Roll baggage shelf cover forward far enough to gain access to the three screws (17) securing pressure regulator (19) to baggage shelf.
- h. Remove pressure regulator (19) by removing three screws (17) securing regulator to baggage shelf.

3-108. INSTALLATION OF PRESSURE REGULATOR. (See figure 3-8.)

- a. Position pressure regulator (19) on underside of baggage shelf and secure with three attaching screws (17).
- b. Glue baggage shelf cover in position with an approved adhesive.
- c. Replace left baggage shelf cover retainer and secure with attaching screws.
- d. Replace pressure gage cover (1) and secure to mounting bracket (2) with three attaching screws (8) and nuts (4).
- e. Connect low pressure line (15) to nipple (18) in the OUT port of pressure regulator (19).
- f. Connect regulator supply line (14) to nipple (20) in the IN port of pressure regulator (19).
- g. Open control valve (45) on forward end of oxygen cylinder (46) by turning valve counterclockwise to its full limit.
- h. Replace baggage compartment curtain and secure with Dzus fasteners.

3-109. OXYGEN MANIFOLD.

3-110. The oxygen manifold is located in a console panel on the cabin ceiling. The manifold has four couplings that are automatically opened for continuous flow when the oxygen mask hoses are plugged into the couplings. Each coupling has an individual dust cover which is spring-loaded in a position covering the outlet opening. The forward left coupling is clearly marked "pilot" and is to be used by the pilot. It supplies approximately twice the amount of oxygen as any of the other three couplings.

3-111. REMOVAL OF OXYGEN MANIFOLD. (See figure 3-8.)

- a. Close control valve (45) on oxygen cylinder (46) by turning valve clockwise.
- b. Remove the dust covers (33) from the couplings (28) by removing the dust cover retaining nuts (34).
- c. Slide pan cover (38) with leather bead (37) attached from manifold couplings (28).
- d. Remove lower pan (30) by removing four attaching screws (35) and nuts (26).
- e. Remove upper pan (40) and clamps (41) by removing screws (42).
- f. Remove the oxygen manifold by disconnecting the manifold supply line (22) from the manifold.

3-112. DISASSEMBLY OF THE OXYGEN MANIFOLD.
(See figure 3-8.)

- a. Remove couplings (28) from restrictors (29 and 32).
- b. Remove pilot's restrictor (29), passenger's restrictors (32), and washers (39) from tees (31).
- c. Disconnect tees (31) and unions (36).

3-113. CLEANING AND INSPECTION OF OXYGEN MANIFOLD. Flush tees, unions and restrictors with inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry completely with a stream of clean, dry, oil-free air or by heating to a temperature of 250 to 300 degrees Fahrenheit for a suitable period. Inspect passages for obstructions and remove any foreign material.

3-114. ASSEMBLY OF OXYGEN MANIFOLD. (See figure 3-8.)

- a. Connect unions (36) and tees (31) as illustrated.
- b. Install washers (39), pilot's restrictor (29) and passengers' restrictors (32) into tees (31) as illustrated in figure 3-8.

NOTE

When installing restrictors make certain the pilot's restrictor, which has a larger orifice, supplies the forward left coupling marked "pilot."

- c. Install couplings (28) on pilot's restrictor (29) and passengers' restrictors (32).

3-115. INSTALLATION OF OXYGEN MANIFOLD.
(See figure 3-8.)

- a. Attach the manifold supply line (22) to the oxygen manifold.
- b. Secure upper pan (40) to oxygen manifold with two attaching clamps (41) and screws (42).
- c. Install lower pan (30) and secure in position with four attaching screws (35).
- d. Slide pan cover (38), with leather bead (37) attached, into position so hole marked "pilot" is over forward left coupling.
- e. Slide dust covers (33) into couplings (28) and secure with dust cover retaining nuts (34).
- f. Open control valve (45) on oxygen cylinder (46) by turning counterclockwise to its full limit.

3-116. OXYGEN SYSTEM PLUMBING. (See figure 3-8.)

3-117. Stainless steel plumbing routes high pressure oxygen from the supply cylinder, to the pressure gage and into the pressure regulator. From the pressure regulator, low pressure oxygen is supplied to the oxygen manifold by aluminum plumbing routed between the headliner and the fuselage skin.

3-118. REMOVAL OF OXYGEN SYSTEM PLUMBING.
(See figure 3-8.)

- a. Remove baggage compartment curtain by loosening Dzus fasteners.
- b. Close control valve (45) on oxygen cylinder (46) by turning clockwise.
- c. Disconnect low pressure line (15) from nipple

- (18) in the OUT port of pressure regulator (19).
- d. Remove two screws (11) and nuts (9) attaching line clamps (10) to altitude control bracket.
- e. Remove regulator supply line (14) by disconnecting at each end.
- f. Remove nipples (18 and 20) from pressure regulator (19).
- g. Remove pressure gage cover (1) by removing three attaching screws (8) and nuts (4).
- h. Remove oxygen pressure line (12) by disconnecting at each end.
- i. Remove tee (13) by disconnecting pressure gage line (5).
- j. Remove pressure gage line (5) by disconnecting from elbow (6) in back of pressure gage (7).
- k. Remove elbow (6) from pressure gage (7).
- l. Remove oxygen manifold in accordance with paragraph 2-110.
- m. Remove headliner assembly in accordance with paragraphs 2-192, 193, or 194.
- n. Disconnect manifold supply line (22) from union (21). Remove grommet (16) and slide line (22) forward through routing hole and remove.
- o. Disconnect low pressure line (15) from union (21). Remove grommet (16) and slide line (15) aft through routing holes and remove.
- p. Remove union (21) from bulkhead by removing attaching nut and washer.

3-119. CLEANING AND INSPECTION OF OXYGEN SYSTEM PLUMBING. Flush lines and fittings with inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry completely with a stream of clean, dry, oil-free air or by heating at a temperature of 250 to 300 degrees Fahrenheit, for a suitable period. Inspect all fittings, lines, and flares for kinks, dents, cracks, scratches, and abrasions. Repair or replace all damaged parts of the oxygen system plumbing.

3-120. INSTALLATION OF OXYGEN SYSTEM PLUMBING.
(See figure 3-8.)

- a. Install union (21) in bulkhead and secure with washer and nut.
- b. Slide low pressure line (15) through routing holes, install grommets (16) and attach line (15) to union (21).
- c. Slide manifold supply line (22) aft through routing hole, install grommet (16) attach line (22) to union (21).
- d. Install nipples (18 and 20) in pressure regulator (19) as illustrated.
- e. Connect low pressure line (15) to nipple (18) in the OUT port of pressure regulator (19).
- f. Install elbow (6) in pressure gage (7).
- g. Connect pressure gage line (5) to tee (13) and attach line (5) to elbow (6).
- h. Connect regulator supply line (14) to tee (13) and to nipple (20) in the IN port of pressure regulator (19).
- i. Connect oxygen pressure line (12) to tee (13) and to control valve (45).
- j. Secure oxygen pressure line (12) and regulator supply line (14) to altitude control bracket with line clamps (10), screws (11) and nuts (9).
- k. Install headliner in accordance with paragraphs 2-192, 193, or 194.
- l. Install oxygen manifold in accordance with paragraph 3-115.

m. Position pressure gage cover (1) on mounting brackets (2) and attach with three screws (8) and nuts (4).

n. Open control valve (45) on oxygen cylinder (46) by turning valve counterclockwise to its full limit.

3-121. FIVE PORT OXYGEN SYSTEM. (See figure 3-9.)

WARNING

USE NO OIL! Also keep equipment free of organic material (dust, lint, etc.,). Be sure hands and clothing are free of oil and grease before handling equipment.

3-122. The oxygen system is designed to supply oxygen for a pilot, copilot, and three passengers. The system consists of an oxygen cylinder, filler valve, plumbing, an oxygen pressure gage, pressure regulator, outlet couplings, and five disposable type oxygen masks complete with rubber hoses and flow indicators. Oxygen is routed from the high pressure cylinder to the pressure gage and through a regulator which reduces high cylinder pressure to a low usable pressure. From the regulator, low pressure oxygen is routed to five outlet couplings which supply a continuous flow of oxygen to the oxygen masks whenever the mask hoses are plugged into the couplings. Each coupling contains a spring-loaded valve which prevents the flow of oxygen until the mask hose is plugged into the coupling. Each mask hose contains a flow indicator for visual proof of oxygen flow. The oxygen masks, rubber hoses and flow indicators are stored in the oxygen mask case on the baggage shelf when not in use.

NOTE

Use MIL-T-5542 thread compound on all oxygen fittings to prevent seizure. Apply to male fittings only, omitting the first two threads.

3-123. TESTING THE OXYGEN SYSTEM. Test the oxygen system for leakage by applying type CG-1 solution per specification MIL-L-25567A or its equivalent, to each fitting and observe for the for-

mation 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 percent of the total supply per 24-hour period.

3-124. FILLER VALVE. (See figure 3-9.)

3-125. The filler valve is located behind a small access door aft of the baggage compartment door. It is accessible from outside the airplane and eliminates the removal of the oxygen cylinder for refilling. A protective cap screws over the filler valve to prevent entry of foreign particles. The valve is self-sealing and requires no manual opening or closing. It automatically closes when the filler adapter of the recharging hose is disconnected.

3-126. REMOVAL OF FILLER VALVE. (See figure 3-9.)

- a. Remove baggage compartment curtain by loosening Dzus fasteners.
- b. Close shutoff valve (45) on oxygen cylinder (48).

NOTE

Before disconnecting the filler valve line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- c. Disconnect filler valve line (44) from filler valve (39).
- d. Remove filler valve protective cap (40).
- e. Remove filler valve (39) by removing three nuts (43) and bolts (42).

3-127. CLEANING AND INSPECTION OF FILLER VALVE. Flush filler valve with inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry completely with a stream of clean, dry, oil-free air or by heating at a temperature of 250 to 300 degrees Fahrenheit for a suitable period. Inspect filler valve for cracks, scratches, damaged threads and valve passage obstruction. Replace filler valve if damaged.

Figure 3-9. Five Port Oxygen System Callouts

1. Pressure Gage Line	17. Screw	33. White Instrument Light Rheostat
2. Nipple	18. Nipple	34. Instrument Light Cover
3. Pressure Gage	19. Pressure Regulator	35. Screw
4. Pressure Gage Cover	20. Nipple	36. Screw
5. Screw	21. Oxygen Mask Case	37. Screw
6. Mounting Bracket	22. Union	38. Filler Valve Access Door
7. Nut	23. Manifold Supply Line	39. Filler Valve
8. Screw	24. Flow Indicator	40. Cap
9. Regulator Supply Line	25. Mask Hose	41. Chain
10. Tee	26. Oxygen Mask	42. Bolt
11. Oxygen Pressure Line	27. Bracket Support	43. Nut
12. Screw	28. Upholstery Support	44. Filler Valve Line
13. Line Clamp	29. Oxygen Manifold	45. Shutoff Valve
14. Nut	30. Mounting Bracket	46. Safety Strap
15. Grommet	31. Red Instrument Light Rheostat	47. Mounting Straps
16. Low Pressure Line	32. Dome Light Switch	48. Oxygen Cylinder

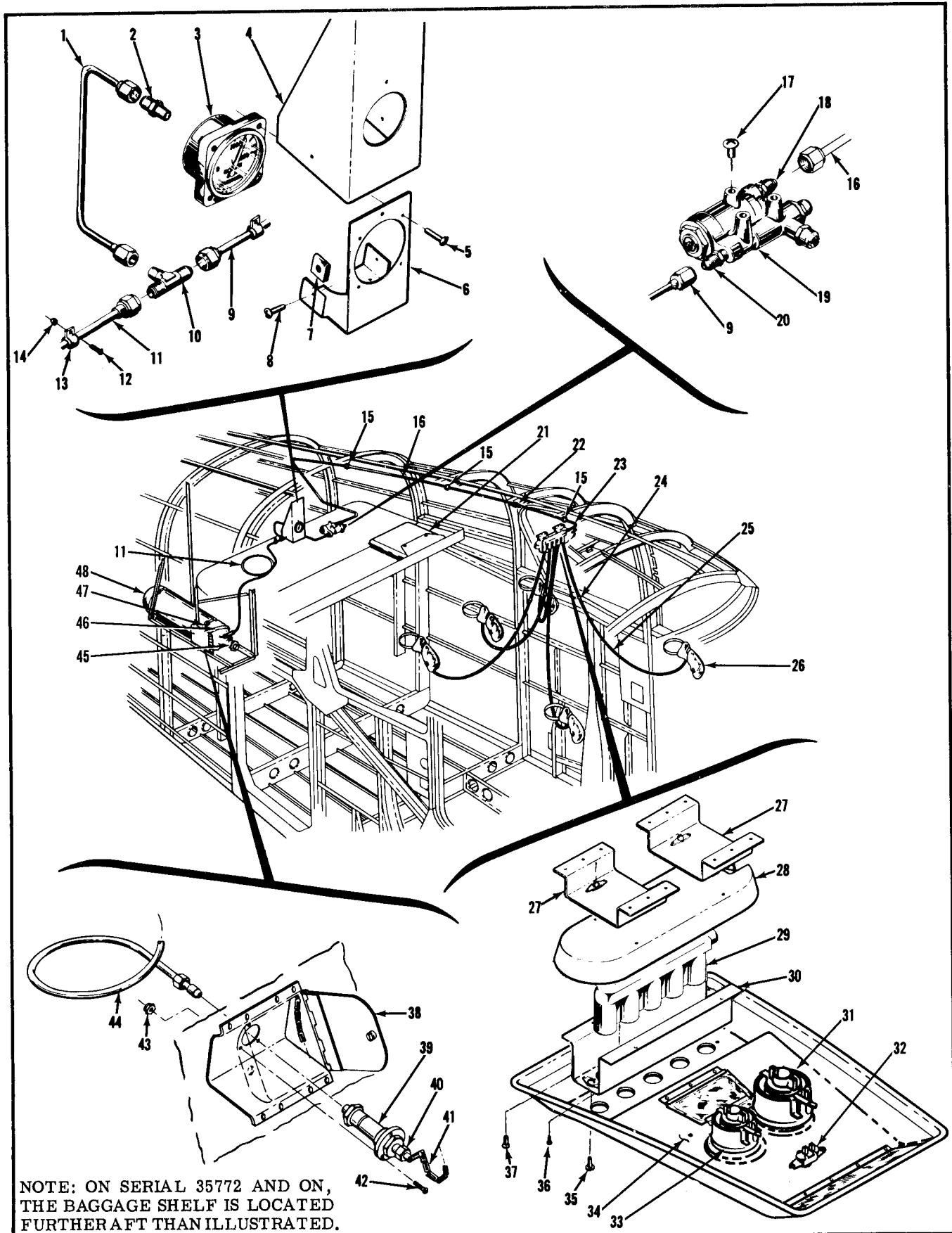


Figure 3-9. Five Port Oxygen System

3-128. INSTALLATION OF FILLER VALVE. (See figure 3-9.)

- a. Position filler valve (39) in mounting bracket and secure with three attaching bolts (42) and nuts (43).
- b. Replace filler valve protective cap (40).
- c. Connect filler valve line (44) to filler valve (39).
- d. Open shutoff valve (45) by turning counterclockwise to its full limit.
- e. Replace baggage compartment curtain and secure with Dzus fasteners.

3-129. OXYGEN CYLINDER. (See figure 3-9.)

3-130. The supply of oxygen for the system is stored, under high pressure, in the oxygen cylinder. The cylinder is located aft of the baggage compartment in the right side of the fuselage and incorporates a shutoff valve to facilitate removal.

WARNING

A fully charged oxygen cylinder contains a pressure of 1800 psi. Serious injury to personnel and damage to equipment can result from accidental release of the oxygen.

3-131. REMOVAL OF OXYGEN CYLINDER. (See figure 3-9.)

- a. Remove baggage compartment curtain by loosening Dzus fasteners.
- b. Close shutoff valve (45) on oxygen cylinder (48) by turning clockwise.

NOTE

Before disconnecting the oxygen pressure line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- c. Loosen Dzus fastener on safety strap (46).
- d. Disconnect oxygen pressure line (11) and filler valve line (44) from tee fitting on shutoff valve.
- e. Remove safety wire and loosen wing nuts securing mounting straps (47) around oxygen cylinder (48).
- f. Slide oxygen cylinder (48) forward and remove through baggage compartment door.

3-132. INSTALLATION OF OXYGEN CYLINDER.

(See figure 3-9.)

- a. Slide oxygen cylinder (48) into position on mounting supports as illustrated in figure 3-9.
- b. Attach oxygen pressure line (11) and filler valve line (44) to tee fitting on shutoff valve (45).
- c. Tighten wing nuts on mounting straps (47) and secure with safety wire.
- d. Position safety strap (46) and secure with Dzus fastener.
- e. Open shutoff valve (45) on oxygen cylinder (48) by turning counterclockwise to its full limit.
- f. Replace baggage compartment curtain and secure with Dzus fasteners.

3-133. PRESSURE GAGE. (See figure 3-9.)

3-134. The oxygen pressure gage is centrally mounted on the aft portion of the baggage shelf and is visible to all occupants of the airplane. The cylinder pressure and remaining oxygen supply is determined by the gage indication. When the system is fully charged, the pressure gage should indicate 1800 psi.

3-135. REMOVAL OF PRESSURE GAGE. (See figure 3-9.)

- a. Remove baggage compartment curtain by loosening Dzus fasteners.
- b. Close shutoff valve (45) on oxygen cylinder (48) by turning clockwise.
- c. Remove pressure gage cover (4) by removing three attaching screws (8) and nuts (7).

NOTE

Before disconnecting the pressure gage line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- d. Disconnect pressure gage line (1) from nipple (2) in back of oxygen pressure gage (3).

- e. Remove pressure gage (3) from mounting bracket (6) by removing the four attaching screws (5).

3-136. INSTALLATION OF PRESSURE GAGE. (See figure 3-9.)

- a. Position pressure gage (3) in mounting bracket (6) and secure with four attaching screws (5).
- b. Connect pressure gage line (1) to nipple (2) in back of oxygen pressure gage (3).
- c. Replace pressure gage cover (4) and secure to mounting bracket (6) with three attaching screws (8) and nuts (7).
- d. Open shutoff valve (45) on oxygen cylinder (48) by turning counterclockwise to its full limit.
- e. Replace baggage compartment curtain and secure with Dzus fasteners.

3-137. PRESSURE REGULATOR. (See figure 3-9.)

3-138. The pressure regulator is located aft of the baggage compartment curtain and is attached to the baggage shelf. The purpose of the regulator is to reduce the high pressure oxygen from the oxygen cylinder to a usable working pressure. The regulator automatically compensates for changes in altitude and furnishes the required oxygen distribution pressure at all times. This relieves the user of the necessity for making periodic adjustment when in flight. A fine mesh screen is incorporated in the regulator to prevent foreign particles from entering the system.

3-139. REMOVAL OF PRESSURE REGULATOR. (See figure 3-9.)

- a. Remove baggage compartment curtain by loosening Dzus fasteners.
- b. Close shutoff valve (45) on oxygen cylinder (48) by turning valve clockwise.
- c. Disconnect low pressure line (16) from nipple (18) in the OUT port of pressure regulator (19).
- d. Disconnect regulator supply line (9) from nipple

(20) in the IN port of pressure regulator (19).

e. Remove pressure gage cover (4) from mounting bracket (6) by removing three attaching screws (8) and nuts (7).

f. Remove baggage shelf cover retainer by removing attaching screws.

g. Roll baggage shelf cover forward far enough to gain access to the three screws (17) securing pressure regulator (19) to baggage shelf.

h. Remove pressure regulator (19) by removing three screws (17) securing regulator to baggage shelf.

3-140. INSTALLATION OF PRESSURE REGULATOR.

(See figure 3-9.)

a. Position pressure regulator (19) on underside of baggage shelf and secure with three attaching screws (17).

b. Glue baggage shelf cover in position.

c. Replace baggage shelf cover retainer and secure with attaching screws.

d. Replace pressure gage cover (4) and secure to mounting bracket (6) with three attaching screws (8) and nuts (7).

e. Connect low pressure line (16) to nipple (18) in the OUT port of pressure regulator (19).

f. Connect regulator supply line (9) to nipple (20) in the IN port of pressure regulator (19).

g. Open shutoff valve (45) on forward end of oxygen cylinder (48) by turning valve counterclockwise to its full limit.

h. Replace baggage compartment curtain and secure with Dzus fasteners.

3-141. OXYGEN MANIFOLD. (See figure 3-9.)

3-142. The oxygen manifold is located in a console panel on the cabin ceiling. The manifold has five couplings that are automatically opened for continuous flow when the oxygen mask hoses are plugged into the couplings. The left coupling is clearly marked "pilot" and is to be used by the pilot. It supplies approximately twice the amount of oxygen as any of the other four couplings.

3-143. REMOVAL OF OXYGEN MANIFOLD. (See figure 3-9.)

a. Open shutoff valve access door in baggage compartment curtain and close shutoff valve (45) by turning clockwise.

b. Remove four screws (35) securing instrument light cover (34). Tag and disconnect electrical wires.

c. Remove four screws (36) securing oxygen manifold (29) to the mounting bracket (30).

d. Remove four screws (37) securing mounting bracket (30) to bracket supports (27).

e. Disconnect manifold supply line (23) and remove oxygen manifold (29).

3-144. CLEANING AND INSPECTION OF OXYGEN MANIFOLD. Flush tees, unions and restrictors with inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry completely with a stream of clean, dry, oil-free air or by heating to a temperature of 250 to 300 degrees Fahrenheit for a suitable period. Inspect passages for obstructions and remove any foreign material.

3-145. INSTALLATION OF OXYGEN MANIFOLD.

(See figure 3-9.)

a. Position oxygen manifold (29) and attach manifold supply line (23).

b. Install four screws (36) securing mounting bracket (30) to the oxygen manifold (29).

c. Install four screws (37) securing mounting bracket (30) to bracket supports (27).

d. Connect electrical wires as tagged. Position instrument light cover (34) and secure with four screws (35).

e. Open shutoff valve (45) by turning counterclockwise to its full limit. Close shutoff valve access door and secure with Dzus fasteners.

3-146. OXYGEN SYSTEM PLUMBING. (See figure 3-9.)

3-147. Copper tubing connects the filler valve with the shutoff valve and routes high pressure oxygen to the pressure gage and into the pressure regulator.

From the pressure regulator, low pressure oxygen is supplied to the oxygen manifold by aluminum plumbing routed between the headliner and the fuselage skin.

3-148. REMOVAL OF OXYGEN SYSTEM PLUMBING. (See figure 3-9.)

a. Remove baggage compartment curtain by loosening Dzus fasteners.

b. Close shutoff valve (45) on oxygen cylinder (48) by turning clockwise.

c. Disconnect low pressure line (16) from nipple (18) in the OUT port of pressure regulator (19).

d. Remove two screws (12) and nuts (14) attaching line clamps (13) to baggage shelf.

e. Remove regulator supply line (9) by disconnecting at each end.

f. Remove nipples (18 and 20) from pressure regulator (19).

g. Remove filler valve line (44) by disconnecting at each end.

h. Remove pressure gage cover (4) by removing three attaching screws (8) and nuts (7).

i. Remove oxygen pressure line (11) by disconnecting at each end.

j. Remove tee (10) by disconnecting pressure gage line (1).

k. Remove pressure gage line (1) by disconnecting from nipple (2) in back of pressure gage (3).

l. Remove nipple (2) from pressure gage (3).

m. Remove oxygen manifold (29) in accordance with paragraph 3-143.

n. Remove headliner assembly in accordance with paragraphs 2-192, 193, or 194.

o. Disconnect manifold supply line (23) from union (22). Remove grommet (15) and slide line (23) forward through routing holes and remove.

p. Disconnect low pressure line (16) from union. Remove grommets (15) and slide line aft through routing holes and remove.

q. Remove union (22) from bulkhead by removing attaching nut and washer.

3-149. CLEANING AND INSPECTION OF OXYGEN SYSTEM PLUMBING. Flush lines and fittings with inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry com-

pletely with a stream of clean, dry, oil-free air or by heating at a temperature of 250 to 300 degrees Fahrenheit, for a suitable period. Inspect all fittings, lines, and flares for kinks, dents, cracks, scratches, and abrasions. Repair or replace all damaged parts of the oxygen system plumbing.

3-150. INSTALLATION OF OXYGEN SYSTEM PLUMBING. (See figure 3-9.)

- a. Install union (22) in bulkhead and secure with washer and nut.
- b. Slide low pressure line (16) through routing holes, install grommets (15) and attach line to union (22).
- c. Slide manifold supply line (23) aft through routing hole, install grommet (15) and attach line to union (22).
- d. Install nipples (18 and 20) in pressure regulator (19).
- e. Connect low pressure line (16) to nipple (18) in the OUT port of pressure regulator (19).
- f. Install nipple (2) in pressure gage (3).
- g. Connect pressure gage line (1) to tee (10) and nipple (2).
- h. Connect regulator supply line (9) to tee (10) and to nipple (20) in the IN port of pressure regulator (19).
- i. Connect oxygen pressure line (11) to tee (10) and to shutoff valve (45).
- j. Secure oxygen pressure line (11) and regulator supply line (9) to baggage shelf with line clamps (13), screws (12), and nuts (14).
- k. Install headliner in accordance with paragraphs 2-192, 193, or 194.
- l. Install oxygen manifold (29) in accordance with paragraph 3-145.
- m. Position pressure gage cover (4) on mounting bracket (30) and secure with three screws (8) and nuts (7).
- n. Attach filler valve line (44) to filler valve (39) and tee fitting on shutoff valve (45).
- o. Open shutoff valve (45) on oxygen cylinder (48) by turning valve counterclockwise to its full limit.

3-151. FORWARD OXYGEN SYSTEM. (See figure 3-10.)

WARNING

USE NO OIL! Also keep equipment free of organic material (dust, lint, etc.,). Be sure hands and clothing are free of oil and grease before handling equipment.

3-152. The oxygen system is designed to supply oxygen for a pilot, copilot, and three passengers. The system consists of an oxygen cylinder, filler valve, plumbing, an oxygen pressure gage, pressure regulator, outlet couplings, and five disposable type oxygen masks complete with rubber hoses and flow indicators. Oxygen is routed from the high pressure cylinder to the pressure gage and through a regulator which reduces high cylinder pressure to a low usable pressure. From the regulator, low pressure oxygen is routed to five outlet couplings which supply a continuous flow of oxygen to the oxygen masks whenever the mask hoses are plugged into the couplings. Each coupling contains a spring-loaded valve which prevents the flow of oxygen until the mask hose is plugged into the coupling. Each mask hose contains a flow indicator for visual proof of oxygen flow. The oxygen masks, rubber hoses and flow indicators are stored in the oxygen mask case on the baggage shelf when not in use.

NOTE

Use MIL-T-5542 thread compound on all oxygen fittings to prevent seizure. Apply to male fittings only, omitting the first two threads.

3-153. TESTING THE OXYGEN SYSTEM. Test the oxygen system for leakage by applying type CG-1 solution per specification MIL-L-25567A or its equivalent, to each fitting and observe for the 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 percent of the total supply per 24-hour period.

Figure 3-10. Forward Oxygen System Callouts

1. Bracket Support	13. Union	26. Oxygen Cylinder
2. Upholstery Support	14. Low Pressure Line	27. Cap
3. Oxygen Manifold	15. Pressure Gage Line	28. Chain
4. Mounting Bracket	16. Tee	29. Nut
5. Red Instrument Light Rheostat	17. Regulator Supply Line	30. Filler Valve
6. Dome Light Switch	18. Nipple	31. Bolt
7. White Instrument Light Rheostat	19. Screw	32. Filler Valve Line
8. Instrument Light Cover	20. Regulator	33. Pressure Gage
9. Screw	21. Low Pressure Line	34. Union
10. Screw	22. Nipple	35. Mask Hose
11. Screw	23. Oxygen Pressure Line	36. Oxygen Mask
12. Manifold Supply Line	24. Shutoff Valve	37. Flow Indicator
	25. Mounting Straps	

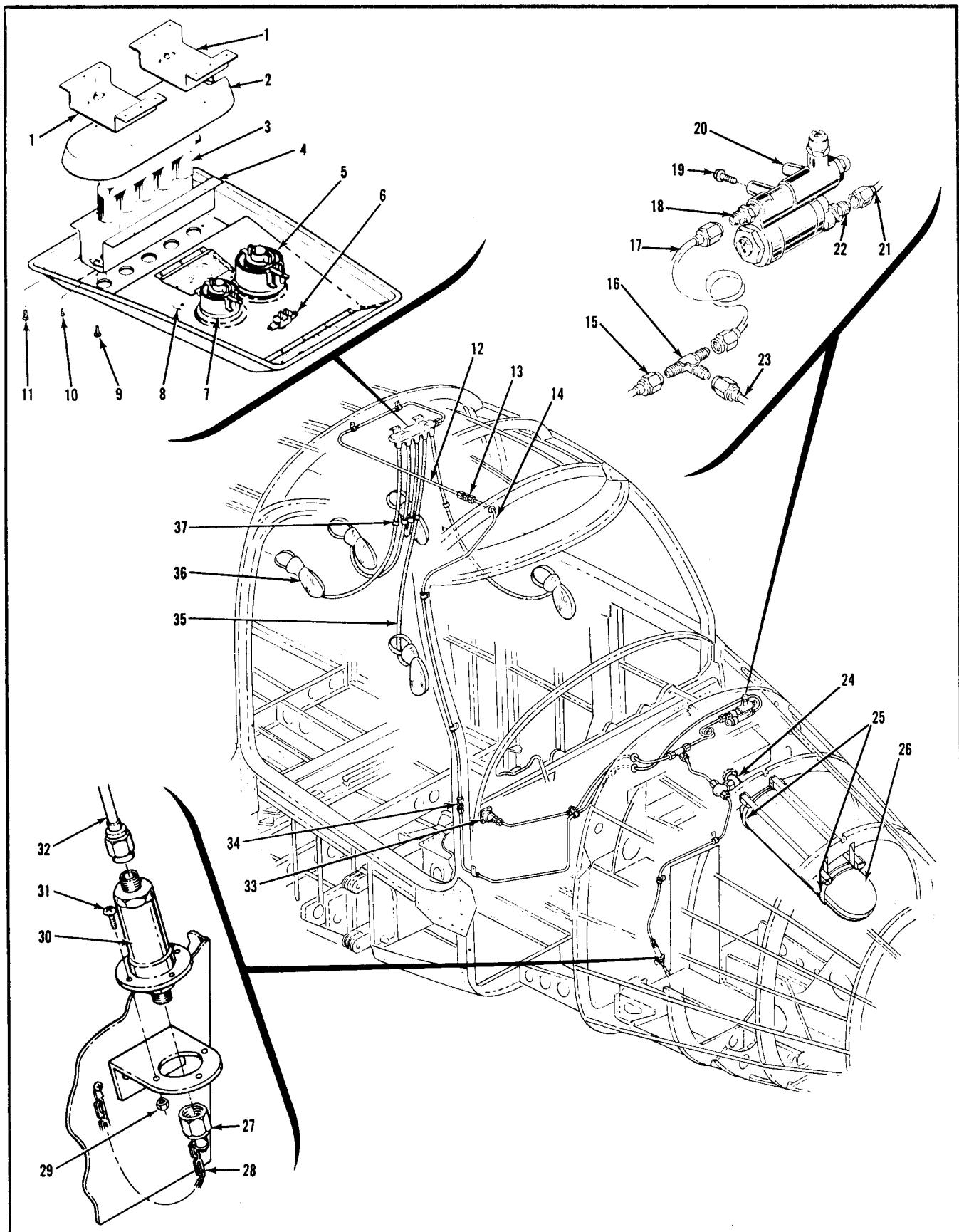


Figure 3-10, Forward Oxygen System

3-154. FILLER VALVE. (See figure 3-10.)

3-155. The filler valve is located on the forward side of the forward cabin bulkhead in the nose wheel compartment. It is accessible through the nose wheel well opening and eliminates the removal of the oxygen cylinder for refilling. A protective cap screws over the filler valve to prevent entry of foreign particles. The valve is self-sealing and requires no manual opening or closing. It automatically closes when the filler adapter of the recharging hose is disconnected.

3-156. REMOVAL OF FILLER VALVE. (See figure 3-10.)

- a. Close shutoff valve (24) on oxygen cylinder (26).

NOTE

Before disconnecting the filler valve line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- b. Disconnect filler valve line (32) from filler valve (30).
- c. Remove filler valve protective cap (27).
- d. Remove filler valve (30) by removing three nuts (29) and bolts (31).

3-157. CLEANING AND INSPECTION OF FILLER VALVE. Flush filler valve with inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry completely with a stream of clean, dry, oil-free air or by heating at a temperature of 250 to 300 degrees Fahrenheit for a suitable period. Inspect filler valve for cracks, scratches, damaged threads and valve passage obstruction. Replace filler valve if damaged.

3-158. INSTALLATION OF FILLER VALVE. (See figure 3-10.)

- a. Position filler valve (30) in mounting bracket and secure with three attaching bolts (31) and nuts (29).
- b. Replace filler valve protective cap (27).
- c. Connect filler valve line (32) to filler valve (30).
- d. Open shutoff valve (24) by turning counterclockwise to its full limit.

3-159. OXYGEN CYLINDER. (See figure 3-10.)

3-160. The supply of oxygen for the system is stored, under high pressure, in the oxygen cylinder. The cylinder is located in the upper portion of the nose section and is accessible through the nose wheel well. The cylinder incorporates a shutoff valve to facilitate removal.

WARNING

A fully charged oxygen cylinder contains a pressure of 1800 psi. Serious injury to personnel and damage to equipment can result from accidental release of the oxygen.

3-161. REMOVAL OF OXYGEN CYLINDER. (See figure 3-10.)

- a. Close shutoff valve (24) on oxygen cylinder (26) by turning clockwise.

NOTE

Before disconnecting the oxygen pressure line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- b. Disconnect tee from fitting on shutoff valve (24).
- c. Remove safety wire and loosen wing nuts securing mounting straps (25) around oxygen cylinder (26).
- d. Lower oxygen cylinder and remove through nose wheel well opening.

3-162. INSTALLATION OF OXYGEN CYLINDER. (See figure 3-10.)

- a. Lift oxygen cylinder (26) into position in mounting straps (25) as illustrated in figure 3-10.
- b. Tighten wing nuts on mounting straps (25) and secure with safety wire.
- c. Attach tee fitting to shutoff valve (24).
- d. Open shutoff valve (24) on oxygen cylinder (26) by turning counterclockwise to its full limit.

3-163. PRESSURE GAGE. (See figure 3-10.)

3-164. The oxygen pressure gage is located just to the right of the map compartment door. The cylinder pressure and remaining oxygen supply is determined by the gage indication. When the system is fully charged, the pressure gage should indicate 1800 psi.

3-165. REMOVAL OF PRESSURE GAGE. (See figure 3-10.)

- a. Close shutoff valve (24) on oxygen cylinder (26) by turning clockwise.

NOTE

Before disconnecting the pressure gage line, insert a blunt object into an outlet coupling and bleed off the pressure trapped in the system plumbing.

- b. Disconnect pressure gage line (15) from nipple in back of pressure gage (33).
- c. Remove pressure gage (33) by removing the four securing bolts and nuts.

3-166. INSTALLATION OF PRESSURE GAGE. (See figure 3-10.)

- a. Position pressure gage (33) in mounting hole and secure with the four attaching bolts and nuts.
- b. Connect pressure gage line (15) to nipple in back of pressure gage (33).
- c. Open shutoff valve (24) on oxygen cylinder (26) by turning counterclockwise to its full limit.

3-167. PRESSURE REGULATOR. (See figure 3-10.)

3-168. The pressure regulator is located on the forward side of the forward cabin bulkhead in the upper left portion. The purpose of the regulator is to reduce the high pressure oxygen from the oxygen cylinder to a usable working pressure. The regulator

automatically compensates for changes in altitude and furnishes the required oxygen distribution pressure at all times. This relieves the user of the necessity for making periodic adjustment when in flight. A fine mesh screen is incorporated in the regulator to prevent foreign particles from entering the system.

3-169. REMOVAL OF PRESSURE REGULATOR.

(See figure 3-10.)

- a. Close shutoff valve (24) on oxygen cylinder (26) by turning valve clockwise.
- b. Remove the three screws (19) securing the pressure regulator to the forward cabin bulkhead.
- c. Disconnect low pressure line (21) from nipple (22) in the OUT port of the pressure regulator (20).
- d. Remove regulator by disconnecting regulator supply line (17) from nipple (18) in the IN port of pressure regulator (20).

3-170. INSTALLATION OF PRESSURE REGULATOR.

(See figure 3-10.)

- a. Position pressure regulator (20) as illustrated in figure 3-10.
- b. Connect regulator supply line (17) to nipple (18) in the IN port of pressure regulator (20).
- c. Connect low pressure line (21) to nipple (22) in the OUT port of the pressure regulator (20).
- d. Secure pressure regulator (20) to forward cabin bulkhead with three screws (19).

3-171. OXYGEN MANIFOLD. (See figure 3-10.)

3-172. The oxygen manifold is located in a console panel on the cabin ceiling. The manifold has five couplings that are automatically opened for continuous flow when the oxygen mask hoses are plugged into the couplings. The left coupling is clearly marked "pilot" and is to be used by the pilot. It supplies approximately twice the amount of oxygen as any of the other four couplings.

3-173. REMOVAL OF OXYGEN MANIFOLD. (See figure 3-10.)

- a. Close shutoff valve (24) on oxygen cylinder (26) by turning clockwise.
- b. Remove four screws (9) securing instrument light cover (8). Tag and disconnect electrical wires.
- c. Remove four screws (10) securing oxygen manifold (3) to the mounting bracket (4).
- d. Remove four screws (11) securing mounting bracket (4) to bracket supports (1).

3-174. CLEANING AND INSPECTION OF OXYGEN MANIFOLD.

Flush tees, unions and restrictors with

inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry completely with a stream of clean, dry, oil-free air or by heating to a temperature of 250 to 300 degrees Fahrenheit for a suitable period. Inspect passages for obstructions and remove any foreign material.

3-175. INSTALLATION OF OXYGEN MANIFOLD.

(See figure 3-10.)

- a. Position oxygen manifold (3) and attach manifold supply line (12).
- b. Install four screws (10) securing mounting bracket (4) to the oxygen manifold (3).
- c. Install four screws (11) securing mounting bracket (4) to bracket supports (1).
- d. Connect electrical wires as tagged. Position instrument light cover (8) and secure with four screws (9).
- e. Open shutoff valve (24) by turning counterclockwise to its full limit.

3-176. OXYGEN SYSTEM PLUMBING. (See figure 3-10.)

3-177. Copper tubing connects the filler valve with the shutoff valve and routes high pressure oxygen to the pressure gage and into the pressure regulator. From the pressure regulator, low pressure oxygen is supplied to the oxygen manifold by aluminum plumbing routed up through the right door post and between the headliner and the fuselage skin.

3-178. REMOVAL AND INSTALLATION OF OXYGEN SYSTEM PLUMBING. Removal of the cabin headline is necessary for access to some of the oxygen plumbing. Extensive bending is required to accomplish removal of parts of the oxygen system plumbing, therefore, removal of these parts is not recommended unless replacement of a line necessitates it. If replacement should become necessary, route and clamp the system plumbing as illustrated in figure 3-10 and install the upholstery removed.

3-179. CLEANING AND INSPECTION OF OXYGEN SYSTEM PLUMBING. Flush lines and fittings with inhibited alkaline cleaner until free from oil and grease. Rinse thoroughly with fresh water. Dry completely with a stream of clean, dry, oil-free air or by heating at a temperature of 250 to 300 degrees Fahrenheit, for a suitable period. Inspect all fittings, lines, and flares for kinks, dents, cracks, scratches, and abrasions. Repair or replace all damaged parts of the oxygen system plumbing.

3-180. LIGHT WEIGHT DE-ICER SYSTEM. (See figures 3-11 and 3-12.)

WARNING

Do not use oxygen or other corrosive or explosive gases in this system. These gases are dangerous to use and detrimental to the de-icer materials.

3-181. The optional light-weight de-icing system consists of inflatable rubber de-icer boots cemented to the leading edges of the outer wing panels and horizontal stabilizers. Air for inflation of the boots is supplied by a high-pressure reservoir mounted just aft of the baggage compartment. A pressure gage is located on the back of the baggage compartment shelf and is calibrated in inflation cycles. It indicates the number of cycles remaining in the reservoir. A left wing light is incorporated on the outboard side of the

left engine nacelle. The light provides an aid in observing ice formations during night operation. Operation of the de-icing system is entirely manual. A shut-off valve at the reservoir is operated through a flexible push-pull control by the charge knob on the instrument panel. The cycle knob on the instrument panel operates the distributor valve behind the panel. When the cycle knob is pushed IN, the distributor valve directs pressure to the boots, inflating them. When a preset pressure is reached, the distributor valve returns to its normal position, connecting the boots to the deflation vent and to the right engine vacuum pump, which aids in deflation and holds the boots in a completely deflated position. As the distributor valve returns to normal the cycle knob pops OUT. An adjustable pressure regulator is mounted on the reservoir and is fitted with both reservoir and regulated pressure gages, both calibrated in psi. The reservoir is charged through a high-pressure filler valve that is mounted behind a small access door on the left side of the fuselage.

3-182. TROUBLE SHOOTING THE DE-ICER SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
DE-ICERS DO NOT INFLATE OR INFLATE SLOWLY.	Reservoir empty.	Recharge reservoir.
	Regulator pressure set too low.	Adjust regulator in accordance with the chart in paragraph 3-184.
	Shut-off valve not opening.	Check cam and operating cable for proper adjustment. Adjust if necessary.
	Distributor valve not operating properly.	Check valve plunger for proper lubrication at valve ball seat rings. Lubricate as necessary.
	Distributor valve not completely engaged.	Check distributor valve for tightness at instrument panel. Tighten and adjust as necessary.
	Lines disconnected or clogged.	Connect lines or blow out as necessary.

NOTE

With the right engine not running, the vacuum supply to aid deflation and hold down the de-icers is not available and deflation will be slow and not entirely complete.

DE-ICERS DO NOT DEFLECT OR DEFLECT SLOWLY.	Distributor valve not operating or not completely acting.	Check cycle knob shaft for proper adjustment and possible binding. Adjust and free as necessary.
	Malfunction of air dump valve.	Observe action of air dump valve and repair or replace if necessary.
	Distributor valve loose at instrument panel.	Check distributor valve and tighten as necessary.
	Distributor valve plunger insufficiently lubricated.	Check valve plunger for lubrication at valve ball seat rings. Lubricate if necessary.

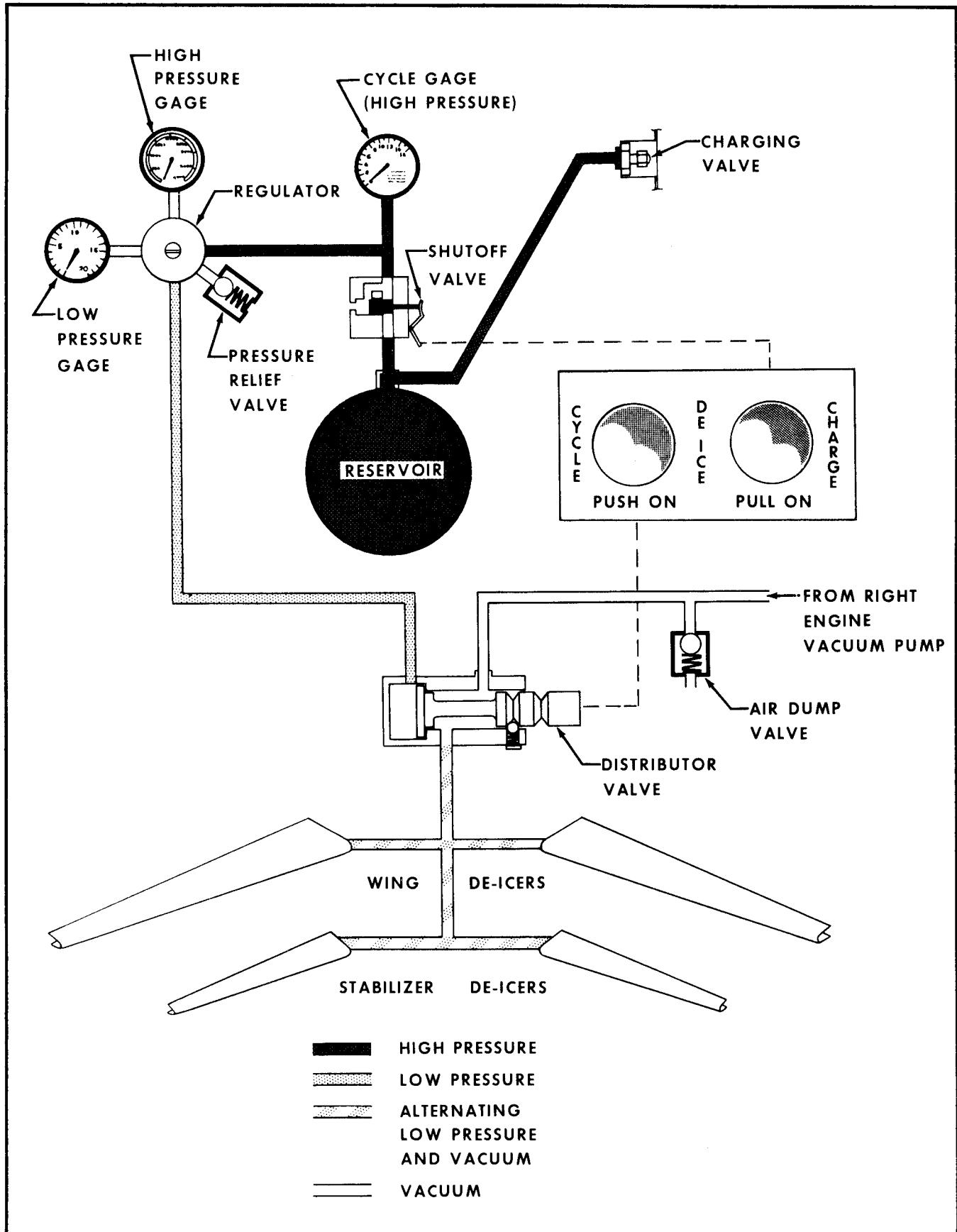


Figure 3-11. Light Weight De-Ice System Schematic

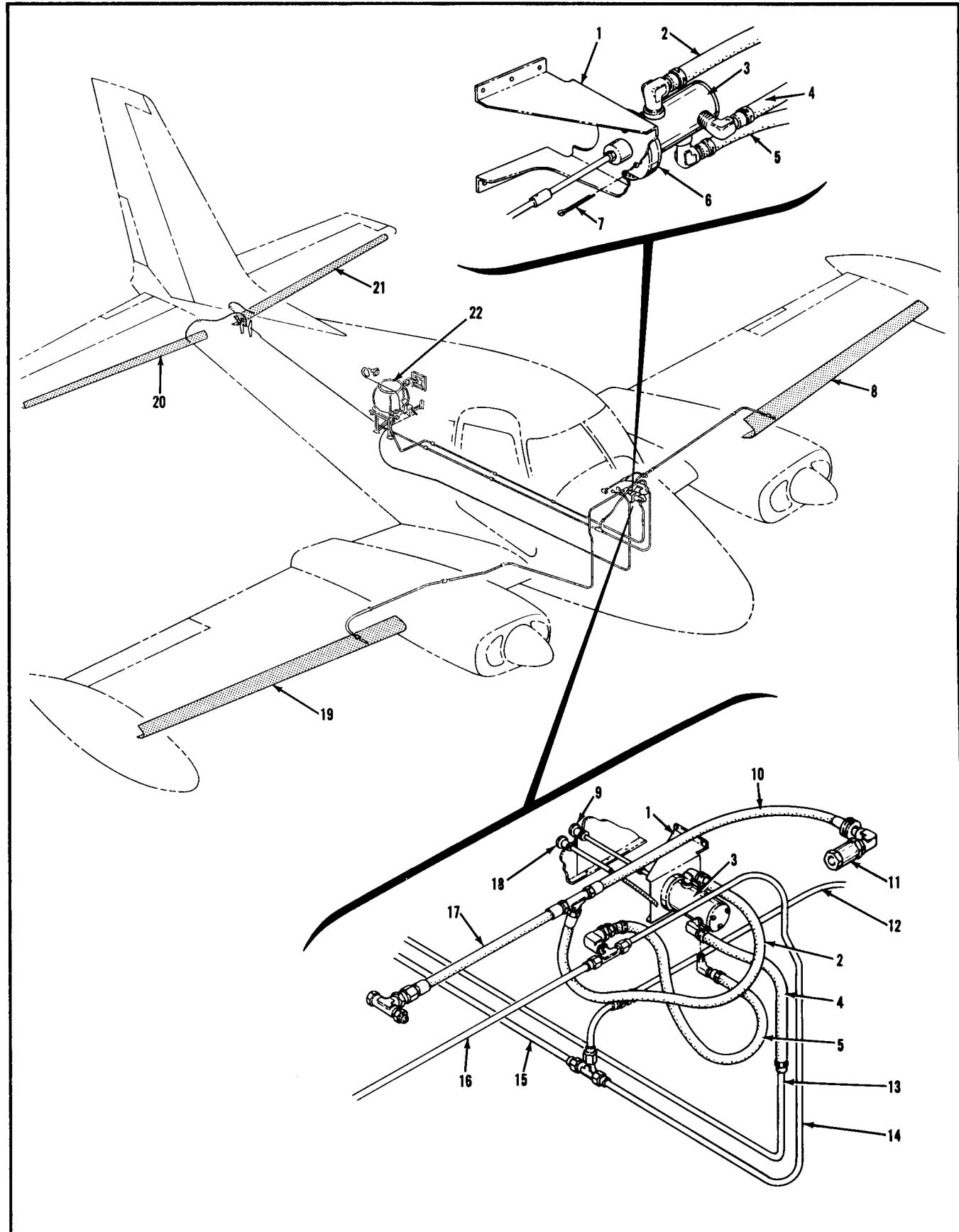


Figure 3-12. Light Weight De-Icer System Components (Sheet 1 of 2)

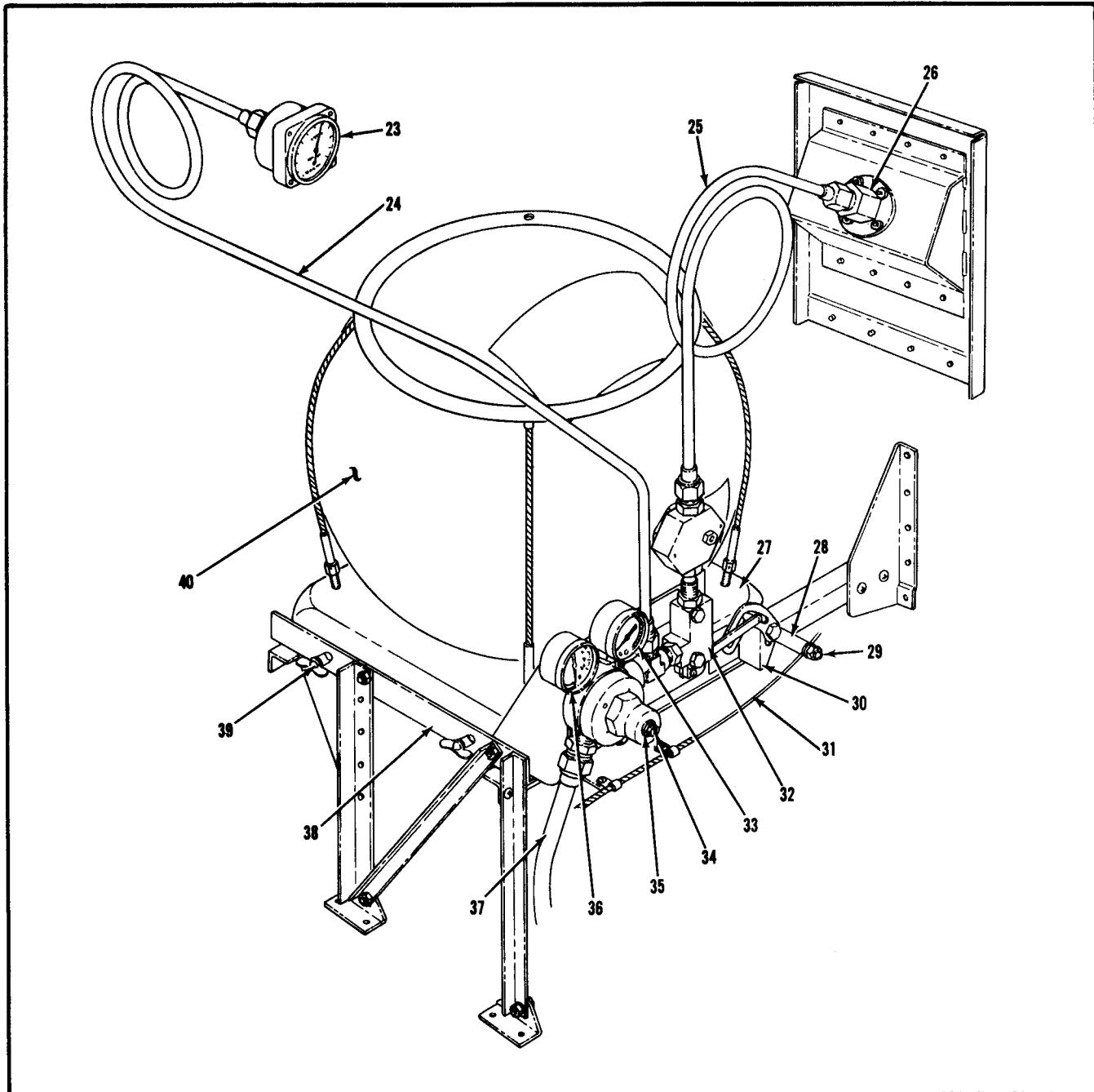


Figure 3-12. Light Weight De-Icer System Components (Sheet 2 of 2)

- | | | |
|---------------------------|----------------------------|--------------------------------|
| 1. Bracket | 14. Supply Line | 28. Cam |
| 2. Bleed Off Hose | 15. Stabilizer Supply Line | 29. Clamp |
| 3. Distributor Valve | 16. Right Wing Supply Line | 30. Support |
| 4. Pressure Supply Hose | 17. Vacuum Attaching Hose | 31. Control Cable |
| 5. System Pressure Hose | 18. Charge Knob | 32. Shut-off Valve |
| 6. Adjusting Ring | 19. Right Wing Boot | 33. High Pressure Gage |
| 7. Cotter Pin | 20. Right Stabilizer Boot | 34. Regulator Adjustment Screw |
| 8. Left Wing Boot | 21. Left Stabilizer Boot | 35. Adjustment Screw Lock Nut |
| 9. Cycle Knob | 22. Accumulator Assembly | 36. Low Pressure Gage |
| 10. Discharge Hose | 23. Cycle Gage | 37. System Pressure Line |
| 11. Air Dump Valve | 24. Cycle Gage Line | 38. Accumulator Shelf |
| 12. Left Wing Supply Line | 25. Filler Line | 39. Dzus Fastener |
| 13. Pressure Supply Line | 26. Filler Valve | 40. Accumulator Base |
| | 27. Accumulator | |

TROUBLE	PROBABLE CAUSE	CORRECTION
DE-ICERS REMAIN INFLATED, RESERVOIR DRAINS ON FIRST CYCLE, OR AUTOMATIC RETURN OF DISTRIBUTOR VALVE DOES NOT FUNCTION.	Plumbing incorrectly connected to distributor valve.	Check plumbing routing. Connect as illustrated in figure 3-12.
REGULATOR SAFETY VALVE POPPING UNDER 30 PSI.	Regulator safety valve set incorrectly.	Reset regulator safety valve.
SHUT-OFF VALVE DOES NOT COMPLETELY SHUT-OFF.	Actuating pin does not drop free so as to let the shaft inside the valve seat completely.	Adjust the operating mechanism to allow the actuating pin to drop freely.
DISTRIBUTOR VALVE ACTUATES BEFORE DE-ICERS ARE FULLY INFLATED.	Distributor valve pop OUT pressure set too low.	Adjust pressure as outlined in paragraph 3-184.
INFLATION CYCLE IS TOO LONG.	Pressure regulator set too low.	Adjust regulator in accordance with the chart in paragraph 3-184.

3-183. TESTING THE DE-ICER SYSTEM OPERATIONS. (See figure 3-12.)

- a. Open the shut-off valve (32) by pulling the charge knob (18) to the OUT position.
- b. Push the cycle knob (9) IN, boots should inflate for a period of about 5 to 8 seconds, then deflate.

The cycle knob should automatically pop OUT as deflation begins.

NOTE

With the right engine not running no vacuum is available for the de-icer system. De-icers will not deflate completely until vacuum is applied.

- c. Push the charge knob (18) IN, to close the shut-off valve (32).

3-184. ADJUSTMENT OF THE DE-ICER SYSTEM. (See figure 3-12.) The following steps should be taken in the order indicated to readjust the system.

a. Regulator Adjustment.

1. Open the shut-off valve (32) by pulling the charge knob (18) on the instrument panel to the OUT position.

2. If the indications on the gages do not correspond to the chart below, reset the regulator adjustment screw (34) as necessary. Secure with locknut (35).

High Pressure Gage (PSI) Low Pressure Gage (PSI)

3000	17.00
2500	18.00
2000	19.00
1500	20.25
1000	21.50
750	22.75
500	24.00
250	25.50

b. Shut-off Valve Operating Mechanism Adjustment.

1. Disconnect the control cable (31) from the cam (28) and place the charge knob (18) in the OFF position.

2. Using vertical slot in support (30), and horizontal slot in accumulator base (27), adjust cam (28) to bleed off system in 10 seconds or less.

NOTE

Use only the high pressure gage (33) for this test since the low pressure gage (36) will bleed off more slowly.

3. Holding the cam (28) in the position necessary to bleed off the system in 10 seconds, connect the control cable (31) to the cam (28) with clamp (29).

NOTE

The cam arm (28) should make an angle of approximately 30 to 35 degrees with the vertical at this point.

4. Operate the shut-off valve (32) by actuating the charge knob (18) on the instrument panel. If the control operates extremely hard, readjust cam (28) in vertical slot in support (30) however; maintain pressure bleed-off time by adjusting support (30) in horizontal slots in accumulator base (27).

c. Distributor Valve Adjustment.

1. Cycle the distributor valve (3) and observe the pop-off pressure on the low pressure gage (36) to the regulator.

2. Remove the cotter pin (7) locking the adjusting ring (6) to the valve body (3).

3. Rotate the adjusting ring (6), recycle the valve (3) and again observe the pop-off pressure.

NOTE

Determine from the pop-off pressure, the direction of rotation of the adjusting ring to increase or decrease the pop-off pressure.

4. Set the adjusting ring (6) so that pop-off pressure on the low pressure gage (36) is 17 ± 2 psi with the system fully charged.

NOTE

The low pressure gage on the regulator will show a higher value after the valve completes the de-icing cycle. This higher value is the set pressure of the regulator. The pop-off is not the set pressure of the regulator but is an indication of the system pressure.

5. Replace the cotter pin (7) securing the adjusting ring (6) to the valve body (3).

3-185. FILLER VALVE. (See figure 3-12.)

3-186. The filler valve is located behind a small access door on the left side of the fuselage. It is accessible from outside the airplane and is used to recharge the reservoir. The maximum service pressure of the system is 3000 psi. Nitrogen bottles are normally only pressurized to 1800 to 2000 psi. However pressurizing the system to 2000 psi will avail approximately 98 cycles or a duration of slightly less than 5 hours. To charge the reservoir the following procedure should be followed:

- a. Remove cap from filler valve.
- b. Fasten high pressure charging line to the filler valve.

WARNING

Do not use oxygen or other corrosive or explosive gases in this system. These gases are both dangerous to use and detrimental to the de-icer materials.

- c. Turn upper charging valve hex counterclockwise to open interior seal.
- d. Charge reservoir to the desired level.
- e. Turn upper charging valve hex clockwise to close interior seal.
- f. Remove high pressure charging line and install cap on filler valve.

3-187. DE-ICER BOOTS. (See figure 3-12.)

3-188. The de-icer boots consists of inflatable rubber boots cemented to the leading edges of the outer wing panels and horizontal stabilizers. For repair of the de-icer boots refer to paragraph 3-197.

3-189. PRESSURE RESERVOIR. (See figure 3-12.)

3-190. The pressure reservoir is a wound filament, non-shatterable fiberglass accumulator with integral fittings. The high-pressure gage, low pressure gage, regulator, pressure relief valve, and shut-off valve are all factory installed and integral parts of the accumulator platform. If a malfunction that cannot be corrected by the adjusting procedure listed in paragraph 3-184 should occur, then the entire accumulator unit should be replaced with a factory assembled unit. An allowance will be made for the faulty unit when turned in for replacement.

3-191. CYCLING CONTROLS AND LINKAGE. (See figure 3-12.)

3-192. Two manual push-pull controls are provided on the extreme left switch and control panel. The control labeled "charge" operates the shut-off valve located on the pressure reservoir and the control labeled "cycle" operates the distributor valve located forward of the instrument panel. For routing and adjustment of the controls and linkage see paragraph 3-184 and figure 3-12.

3-193. DISTRIBUTOR VALVE. (See figure 3-12.)

3-194. The distributor valve is located directly forward of the cycle knob. In the closed position the distributor valve connects the plane's vacuum system with the de-icing system, thus, holding the de-icer boots in a completely deflated position. When the distributor valve is actuated it supplies the de-icer system with operating pressure. When a pre-set pressure is reached in the de-icer system the distributor valve automatically returns to the closed position.

3-195. DE-ICER SYSTEM COMPONENTS. (See figure 3-12.)

3-196. The de-icer system plumbing consists of aluminum tubing and flexible hoses which route the accumulator pressure to the de-icer boots. The system plumbing, including fittings and routing, is illustrated in figures 3-12. Certain parts of the system plumbing are installed during assembly of the aircraft and removal should not be attempted. All clamps and couplings should be checked periodically to guard against air leakage and vibration.

3-197. COLD PATCH REPAIR OF DE-ICER BOOTS.

3-198. There are four types or areas of damage that are most common to the de-icer boots. An outline of the cold patch repair procedure for each follows:

NOTE

When repairing the de-icer 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 hypodermic needle.

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 de-icer 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 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 de-icer boot. Allow cement to set a couple of minutes until it becomes tacky.

6. Apply patch to the de-icer with an edge or the center adhering first, and 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 de-icer 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" 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 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 the corresponding damage area of the de-icer. Allow cement to set a couple of minutes until it becomes tacky.

6. Apply the patch to the de-icer 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 injury is closed. Use care not to trap air between patch and de-icer 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 de-icer should be reached in four hours, however, if the patch is allowed to cure for a minimum of 20 minutes, the de-icer 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 de-icer around area approximately 1 1/2" 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-1403 cement to the underneath side of the loosened portion of the boot.

6. Apply one coat of EC-1403 cement to the wing skin underneath the loosened edges of de-icer and extending 1 1/2" beyond edges of de-icer into the cutout area.

7. Apply second coat of cement to underneath side of de-icer as outlined in step 5.

8. Apply one coat of EC-1403 to one side of a 2" 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-1403 cement to top surface of tape and allow to dry approximately 5 to 10 minutes.

12. Reactivate cemented surfaces with solvent. Working toward the cutout, roll down the edges of the loosened de-icer 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-1403 cement.

14. Apply one coat of EC-1403 cement to wing skin inside of the cutout area and allow to dry.

15. Apply the second coat of EC-1403 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 de-icer and inlay with steel wool 1 1/4" on each side of splice. Clean with solvent and apply one coat of EC-1403

cement to this area.

18. Apply one coat of EC-1403 cement to one side of 2" 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 de-icer 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 cement (Part Number 3306-13) to restore conductivity.

d. Damaged Veneer — Loose From De-Icer. If the veneer should become loosened from the de-icer, repairs should be made as outlined below:

1. Peel and trim the loose veneer to the point where the adhesion of veneer to the de-icer 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" beyond in all directions.

5. Mask off an area 1/2" larger in length and width than the size of veneer patch.

6. Apply one coat of EC-1403 cement to the damaged area and one coat to the veneer ply. Allow cement to set a couple of minutes until it becomes tacky.

7. Roll the veneer ply to the de-icer with a 2" rubber roller, applying a slight tension on the veneer ply when applying to prevent trapping air.

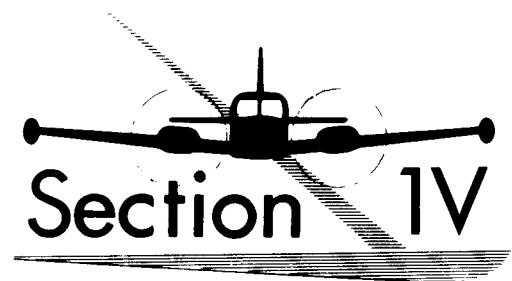
8. Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.

9. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to restore conductivity.

310 SERVICE MANUAL

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310 SERVICE MANUAL



POWER PLANT & RELATED SYSTEMS

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SECTION IV

POWER PLANT AND RELATED SYSTEM

Table of Contents

	Page	310	310B	310C	310D
ENGINE COWLING	4-2A	4-2A	4-2A	4-2A	4-2A
ENGINE ASSEMBLIES	4-2B	4-2B	4-70	4-70	4-70
Engine Shock Mounts	4-16	4-16	4-16	4-16	4-16
Engine Oil System	4-16	4-16	4-16	4-16	4-16
Oil Pressure System	4-17	4-17	4-17	4-17	4-17
Oil Dilution System	4-19	4-19	4-76	4-76	4-76
Oil Dilution System Operation			4-76	4-76	4-76
Oil Temperature Bulbs	4-19	4-19	4-19	4-19	4-19
Engine Ignition System	4-20	4-20	4-20	4-20	4-20
Magnetos	4-21	4-21	4-21	4-21	4-21
Ignition Switches	4-22	4-22	4-22	4-22	4-22
Ignition Harness	4-22	4-22	4-22	4-22	4-22
Spark Plugs	4-24	4-24	4-24	4-24	4-24
Air Induction System	4-25	4-25	4-76	4-76	4-76
Carburetor Air Box	4-24	4-24			
Air Intake Box			4-78	4-78	4-78
Carburetor Air Filter	4-27	4-27			
Engine Air Filter			4-78	4-78	4-78
Engine Exhaust System	4-27	4-27	4-79	4-79	4-79
Exhaust Ejector and Muffler				4-80	4-80
Engine Baffles	4-27	4-27	4-80	4-80	4-80
FUEL SYSTEM	4-30	4-30	4-83	4-83	4-83
Carburetors	4-32	4-32			
Fuel Pumps	4-35	4-35	4-89	4-89	4-89
Fuel Strainers	4-36	4-36	4-89	4-89	4-89
Fuel Selector Valve Controls	4-39	4-39	4-39	4-39	4-39
Fuel Selector Valves	4-39	4-39	4-39	4-39	4-39
Wing Tip Tanks	4-41	4-41	4-41	4-41	4-41
Fuel Boost Pumps	4-43	4-43	4-83	4-83	4-83
Fuel Pressure System	4-45	4-48	4-48	4-48	4-48
Fuel Lines and Vents	4-47	4-48B	4-48B	4-48B	4-48B
Fuel Quantity Sending Units	4-48C	4-48C	4-48C	4-48C	4-48C
Auxiliary Fuel System	4-48C	4-48C	4-48C	4-48C	4-48C
Auxiliary Fuel Cells	4-48D	4-48D	4-48D	4-48D	4-48D
Auxiliary Fuel Lines and Vents	4-48F	4-48F	4-48F	4-48F	4-48F
Auxiliary Fuel Selector Valves	4-48F	4-48F	4-48F	4-48F	4-48F
Auxiliary Fuel Selector Valve Controls	4-48J	4-48J	4-48J	4-48J	4-48J
Engine Priming System	4-48J	4-48J	4-48J	4-48J	4-48J
FUEL INJECTION SYSTEM					
Fuel Air Control Unit			4-86	4-86	4-86
Fuel Manifold			4-88	4-88	4-88
Fuel Discharge Nozzle			4-88	4-88	4-88
Fuel Injection Pump			4-89	4-89	4-89
Fuel Strainer			4-89	4-89	4-89

SECTION IV

POWERPLANT AND RELATED SYSTEM

Table of Contents (Continued)

	310	310B	310C	310D
ENGINE CONTROLS	4-49	4-49	4-90	4-90
Engine Control Quadrant	4-51	4-51	4-94	4-94
RIGGING PROCEDURES-ENGINE CONTROLS	4-53	4-53	4-94	4-94
Rigging Procedure for Throttle Controls	4-53	4-53	4-96	4-96
Rigging Procedure for Mixture Controls	4-55	4-55	4-96	4-96
Rigging Procedure for Propeller Controls	4-55	4-55	4-96	4-96
Rigging Procedure for Alternate Air Controls	4-55	4-55	4-96	4-96
Rigging Procedure for Induction Air Controls			4-96	4-96
PROPELLERS	4-57	4-57	4-57	4-57
Propeller Governors	4-62	4-62	4-62	4-62
Anti-Ice Slinger Ring	4-62	4-62	4-62	4-62
VACUUM SYSTEM	4-62	4-62	4-62	4-62
Vacuum Pumps	4-63	4-63	4-63	4-63
Air-Oil Separators	4-63	4-63	4-63	4-63
Vacuum Air Filter	4-65	4-65	4-65	4-65
Vacuum Relief Valve	4-65	4-65	4-65	4-65
Vacuum System Plumbing	4-65	4-65	4-65	4-65
MANIFOLD PRESSURE SYSTEM	4-69	4-69	4-69	4-69

SERIAL BLOCKS

MODEL 310
35000 Thru 35546MODEL 310B
35547 Thru 35771 MODEL 310C
35772 Thru 39031MODEL 310D
39032 and On

SECTION IV

POWERPLANT AND RELATED SYSTEM

4-1. ENGINE COWLING.

4-2. The engine cowling is installed to streamline the engine installations and to aid in the control of the cooling air for the engines. The cowling is divided into sections. These sections can be readily removed to provide quick and easy access to all parts of the engine installations. On each engine there are two forward cowl doors, two aft cowl doors, a split nose section, and an upper cowl which incorporates an oil filler door. The lower engine nacelles are a combination cowling and engine mount. They are an integral part of the wing panel assemblies and are not removable.

4-3. REMOVAL OF ENGINE COWLING. (See figure 4-1.) This procedure is the same for either engine.

- a. Release cowl door fasteners (6) to open cowl doors (5).
- b. Remove screws (4) attaching the two halves (9 and 10) of the cowling nose section together.
- c. Remove all remaining screws (4) which attach cowling nose section to nacelle and upper cowl sec-

tion (1) and remove the two nose section halves (9 and 10).

NOTE

Screws (4) are replaced by Camlock fasteners on aircraft serial 35655 and on.

- d. Remove screws (4) which attach aft end of upper cowl section (1) to nacelle and remove upper section.

NOTE

To remove oil filler door (2) from upper cowl section pull hinge pin (3).

- e. Remove cotter pins (7) from cowl doors (5) and remove hinge pin (8) to free cowl doors from nacelle.

4-4. CLEANING INSPECTION AND REPAIR OF COWLING. The cowling should be cleaned by spraying with a suitable solvent and then wiping the sections clean with a cloth. After cleaning inspect cowling for

dents, cracks, and loose rivets. Repair all defects to prevent further damage.

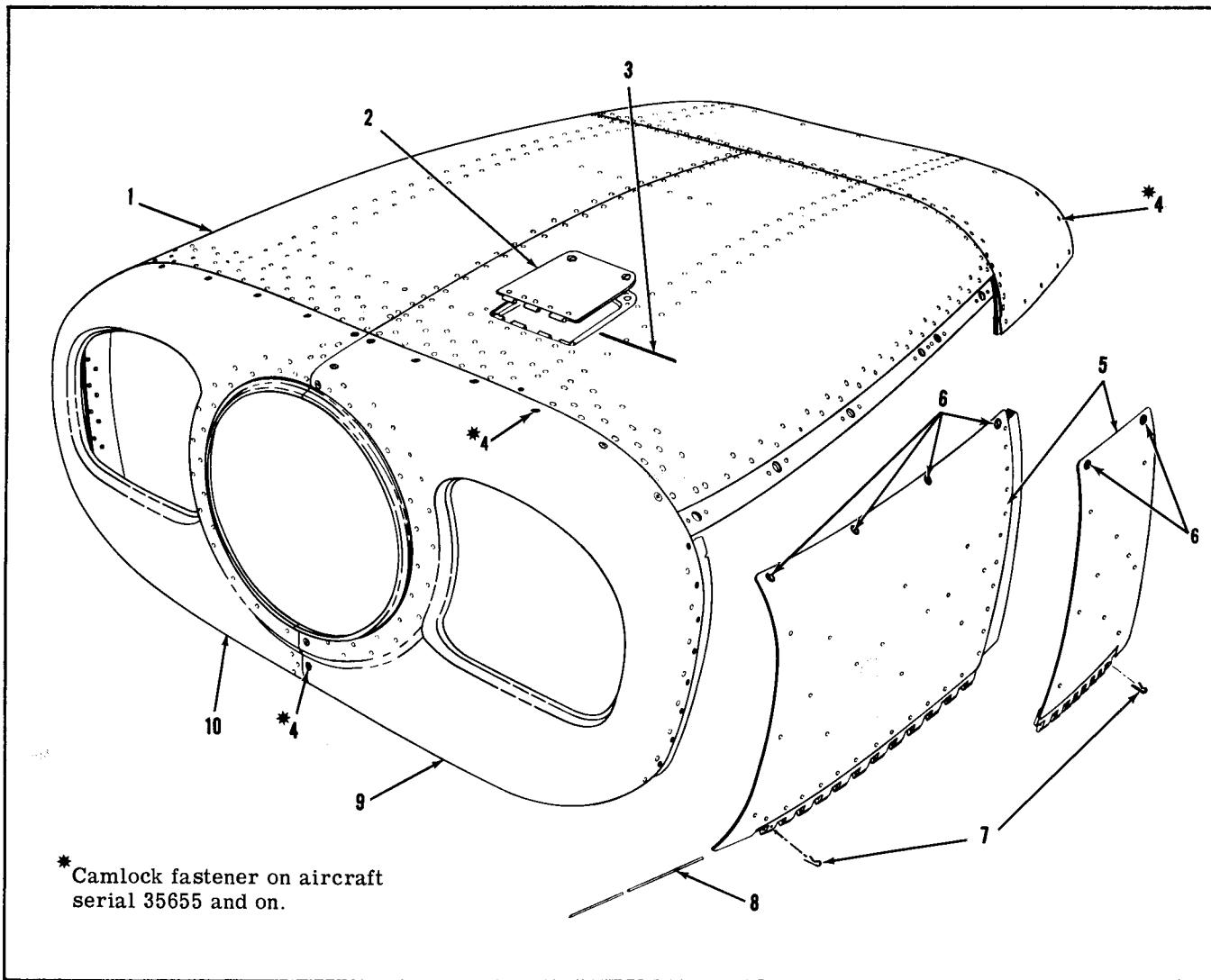
4-5. INSTALLATION OF ENGINE COWLING. (See figure 4-1). The procedure is the same for either engine.

- a. Install cowl doors (5) by inserting hinge pin (8). Install cotter pins (7) through hinges to safety the pin.
- b. Install upper cowl section (1) with screws (4) (Camlock fasteners on aircraft serial 35655 and on).
- c. Install right and left halves (9 and 10) of cowling nose section with attaching screws (4).
- d. Fasten cowl door fasteners (6).

4-6. ENGINE ASSEMBLIES.

4-7. Two Continental O-470 series engines are mounted in the Model 310 airplane. Each 240 horsepower, six-cylinder, horizontally opposed engine has

an all metal, constant speed, full feathering propeller installed. The complete engine assembly consists of the engine, and in addition to the propeller, the following Cessna installed items: Propeller governor, baffles, carburetor air filter and air box assembly, vacuum pump and air-oil separator, tachometer generator, exhaust stack assemblies, cylinder head temperature bulb, oil temperature bulb, crankcase breather line and various other lines, hoses, fittings and brackets necessary for the proper assembly and operation of the engine. In addition to the above listed items, each engine has installed on it two magnetos, twelve spark plugs, ignition harness and wiring, primer distribution lines and fittings, engine driven fuel pump, pressure type carburetor and intake manifold piping, integral oil pump and externally mounted oil cooler, starter and generator, and various adapters, clamps and brackets for mounting these items on the engine.



- | | | |
|-----------------------|------------------------|-------------------------------|
| 1. Upper Cowl Section | 4. Screw | 8. Hinge Pin |
| 2. Oil Filler Door | 5. Cowl Doors | 9. Nose Section - Left Half |
| 3. Hinge Pin | 6. Cowl Door Fasteners | 10. Nose Section - Right Half |
| | 7. Cotter Pins | |

Figure 4-1. Engine Cowling

4-8. TROUBLE SHOOTING CHART.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START.	Fuel tank empty. Improper starting procedure. Cylinder overprimed. Induction system leak. Excessive starter slippage. Fuel system malfunction. Ignition system malfunction.	Fill with correct grade of fuel. Refer to Pilot's Check List for starting procedure and check for performance of each item. Place mixture levers in IDLE CUT-OFF position. Switch ignition OFF. Open throttle wide. Turn engine over several revolutions to clear cylinders. Check to see if sniffle valve in balance tube is free to operate and loosen if necessary. Tighten or replace loose or damaged hose connections. Replace starter adapter. Isolate cause and correct. (See paragraphs 4-83 and 4-87.) Isolate cause and correct. (See paragraph 4-39.)
ENGINE WILL NOT RUN AT IDLING SPEED.	Propeller levers set in high pitch (DECREASE RPM) position. Carburetor improperly adjusted. Air leak in intake manifold. Spark plugs fouled by oil escaping past piston rings.	Use low pitch (INCREASE RPM) position for all ground operations. See paragraph 4-87. Tighten loose connection or replace damaged part. Top overhaul.
ROUGH IDLING.	Carburetor improperly adjusted or carburetor malfunction. Mixture levers set for lean mixture. Fouled spark plugs. Small air leak into induction system. Hydraulic lifters fouled. Burned or warped exhaust valves, worn seats, scored valve guides.	See paragraph 4-87. Use FULL RICH position for all ground operation. Remove and clean. Adjust gaps. With mixture control in IDLE CUT-OFF, ignition switches OFF and throttle open, brush soap lather around tube joints and carburetor mount flange one at a time. Turn propeller backwards and check for bubbles at points of leakage. Tighten connection or replace damaged gasket or seal. 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. Fuel pressure too low. Carburetor malfunction.	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. Check fuel strainer for clogging. Clean screen. (See paragraph 4-101.) See paragraph 4-87.
ENGINE RUNS TOO RICH AT CRUISING POWER.	Carburetor alternate air valve closed. Restrictions in air intake passages.	Place control knob IN. Check for broken linkage and repair or replace. Check passages and remove restriction.
ENGINE RUNS TOO LEAN OR TOO RICH AT THROTTLE SETTINGS OTHER THAN CRUISE.	Carburetor malfunction.	See paragraph 4-87.
CONTINUOUS FOULING OF SPARK PLUGS.	Piston rings excessively worn or broken. Piston rings inverted or not seated.	Replace rings. Replace cylinder if damaged. Install with side marked "TOP" toward piston head. Allow approximately 50 hours for new rings to "wear in."
ENGINE RUNS ROUGH AT HIGH SPEED.	Loose mounting bolts or damaged mount pads. Propeller out of balance. Ignition system malfunction.	Tighten mounting bolts. Replace mount pads. Remove and repair. See paragraph 4-39.
REGULAR MISSING AT HIGH SPEED.	Broken valve spring. Burned or warped valve. Hydraulic tappet dirty or worn.	Replace. Top overhaul. Remove and clean or replace.
SLUGGISH OPERATION AND LOW POWER.	Throttle not opening wide. Carburetor alternate air valve closed. Ignition system malfunction. Carburetor malfunction. Valve seats worn and leaking. Piston rings worn or stuck in grooves.	Check and adjust linkage. (See paragraph 4-161.) Place control knob IN. Check for broken linkage and repair or replace. See paragraph 4-39. See paragraph 4-87. Top overhaul.
HIGH CYLINDER HEAD TEMPERATURE.	Low octane fuel. Lean fuel/air mixture due to improper manual leaning procedure.	Drain tanks and replace with correct grade of fuel. (See figure 1-5.) See "CORRECTION" under "Engine runs too lean at cruising power".

TROUBLE	PROBABLE CAUSE	CORRECTION
HIGH CYLINDER HEAD TEMPERATURE (Cont.).	Cylinder baffles loose or bent. Dirt between cylinder fins. Excessive carbon deposits in cylinder head and on pistons. Exhaust valves leaking.	Check and correct. Clean thoroughly. Top overhaul. Top overhaul.
OIL LEAKS.	At front of engine: Damaged crankshaft oil seal. Around push rod housings: Damaged push rod housing packing. Around propeller mounting flange: Damaged hub O-ring seal. Around plugs, fittings, and gaskets due to looseness or damage.	Replace. Replace. Replace. Tighten or replace.
LOW COMPRESSION.	Piston rings excessively worn. Valve faces and seats worn. Excessively worn cylinder walls.	Top overhaul. Replace cylinders and piston rings.

4-9. ENGINE REMOVAL. (See figure 4-2, sheets 1 and 2.) The removal procedure is the same for either engine. Although the routing of wire bundles, cables, lines, hoses, and conduit varies between engines, the following description will be typical for either engine. Identify each item as it is disconnected to aid in re-installation. Cover the open ends of all lines and hoses to prevent entry of foreign materials.

NOTE

If engine being removed is to be placed in storage, proper preparatory steps should be taken prior to beginning the removal procedure.

- a. Turn all cockpit switches OFF and fuel selector valve handles BOTH OFF.
- b. Open the battery circuit by disconnecting the ground cable (see paragraph 6-7, steps a, b, and c).
- c. Remove the engine cowling in accordance with paragraph 4-3.
- d. Disconnect magneto ground wires (8) from the magnetos and withdraw them aft through the right rear engine baffle (9).

NOTE

When the magneto ground wires are removed, internal grounding springs will ground out the magneto primary coils to prevent accidental sparking.

- e. Drain the oil in accordance with paragraph 1-36.

Replace the drain plug.

f. Remove the propeller in accordance with paragraph 4-168.

g. Disconnect the engine controls as follows:

1. Disconnect the propeller control (31), and alternate air control (44), the throttle control (46) and the mixture control (43).

2. Remove the propeller control sliding end (31) in accordance with paragraph 4-150, and separate the propeller control conduit (48) at the connector (47).

3. Remove the alternate air control sliding end (44) in accordance with paragraph 4-150. Withdraw the control cable from the conduit (42). Disconnect the conduit (42) from the swivel connector (37).

h. Disconnect wires and cables as follows:

1. Disconnect oil temperature electrical connector (4). Disconnect oil temperature bulb ground wire from nacelle attachment point.

2. Disconnect tachometer generator electrical connector. The tachometer generator is mounted directly below the starter (11).

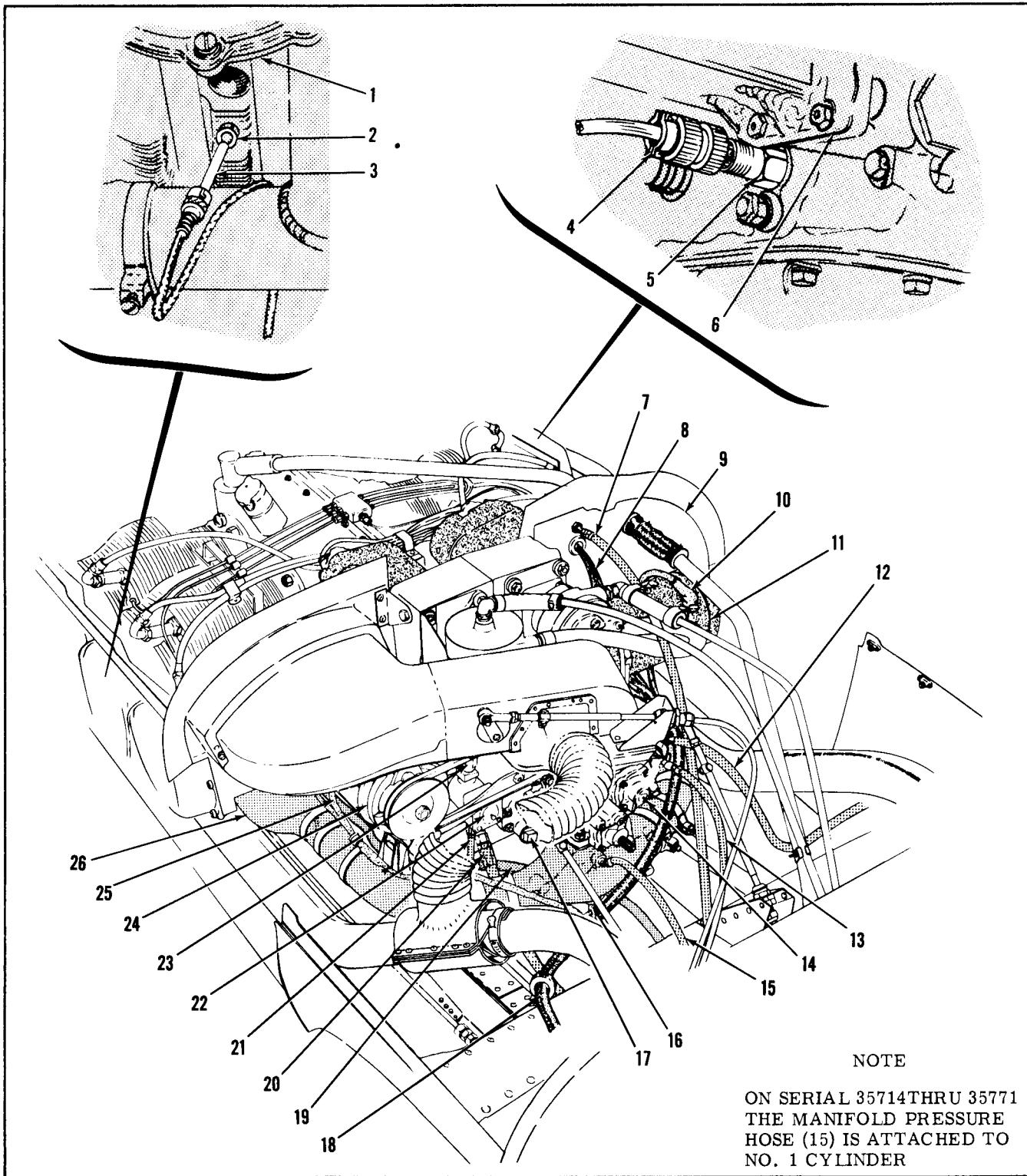
3. Disconnect starter cable (10).

4. Remove the cylinder head temperature bulb (3) from the cylinder. Disconnect the ground wire from nacelle attachment point.

NOTE

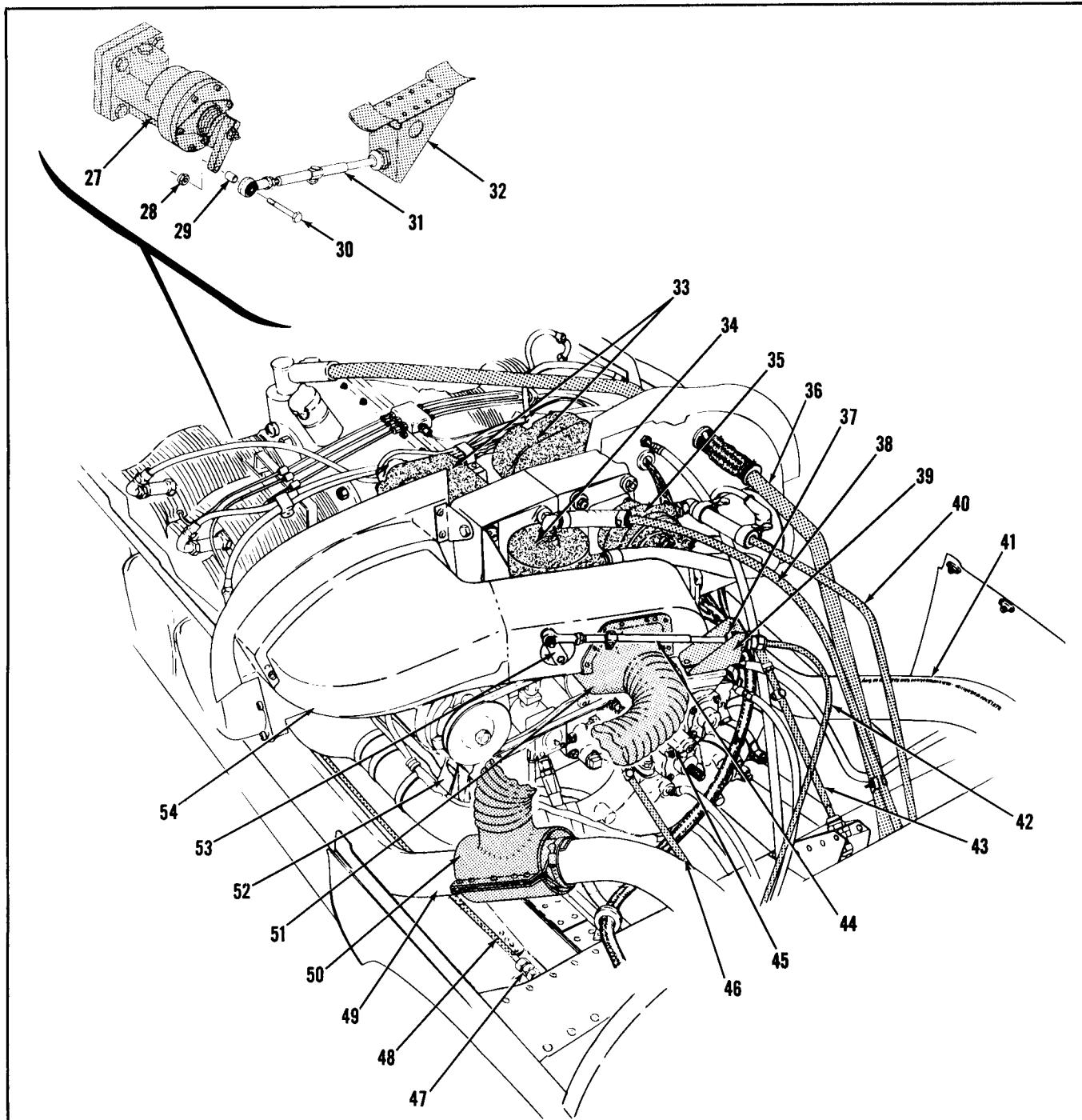
The cylinder head temperature bulb (3) is installed in No. 3 cylinder on O-470-B engines and in No. 4 cylinder on O-470-M engines.

5. Disconnect generator cables (22) and cable



- | | | |
|---|-----------------------------|-------------------------------|
| 1. Engine Cylinder | 6. Oil Cooler | 13. Fuel Pressure Hose |
| 2. Cylinder Head Temperature Bulb Adapter | 7. Primer Hose | 14. Carburetor |
| 3. Cylinder Head Temperature Bulb | 8. Magneto Ground Wires | 15. Manifold Pressure Hose |
| 4. Oil Temperature Electrical Connector | 9. Right Rear Engine Baffle | 16. Manifold Drain Fitting |
| 5. Oil Temperature Bulb | 10. Starter Cable | 17. Oil Pressure Relief Valve |
| | 11. Starter | 18. Wire Bundle |
| | 12. Fuel Vapor Return Hose | 19. Oil Pressure Hose |

Figure 4-2. Engine Removal (Sheet 1 of 2 Sheets)



- | | | |
|------------------------------------|------------------------------------|---------------------------------------|
| 20. Fuel Pump Supply Hose | 32. Propeller Control Bracket | 44. Alternate Air Control Sliding End |
| 21. Fuel Pump Drain Hose | 33. Magneto | 45. Carburetor |
| 22. Fuel Pump | 34. Air-Oil Separator | 46. Throttle Control Sliding End |
| 23. Carburetor Supply Hose Fitting | 35. Vacuum Pump | 47. Propeller Control Conduit |
| 24. Generator | 36. Crankcase Breather Line | Connector |
| 25. Generator Cables | 37. Alternate Air Connector | 48. Propeller Control Conduit |
| 26. Intake Manifold | 38. Air-oil Separator Exhaust Line | 49. Right Exhaust Stack |
| 27. Propeller Governor | 39. Control Mounting Bracket | 50. Carburetor Heat Shroud |
| 28. Nut | 40. Vacuum Line | 51. Carburetor Heat Adapter |
| 29. Spacer | 41. Right Exhaust Stack | 52. Engine Mount |
| 30. Bolt | 42. Alternate Air Control Conduit | 53. Alternate Air Actuating Arm |
| 31. Propeller Control Sliding End | 43. Mixture Control Sliding End | 54. Carburetor Air Box Assembly |

Figure 4-2. Engine Removal (Sheet 2 of 2 Sheets)

shielding ground connections.

6. Disconnect all wire attachment clamps from points of attachment to engine. Pull all wires and cables aft to clear the engine assembly.

i. Disconnect lines and hoses as follows:

1. Separate crankcase breather line (36) at hose connector just aft of right rear engine baffle (9).

2. Disconnect vacuum line (40) from vacuum pump (35).

3. Disconnect air-oil separator exhaust line (38) from air-oil separator (34).

4. Disconnect primer hose (7) from connection at right rear engine baffle (9).

5. Disconnect fuel vapor return hose (12) and fuel pressure hose (13) from connections at carburetor (14).

6. Disconnect manifold pressure hose (15) from its fitting in the manifold riser and the manifold drain hose from the manifold drain fitting (16).

7. Disconnect oil pressure hose (19) from its connection at the inboard nacelle rib and remove the clamp which fastens it to the canted bulkhead. Pull it forward, free of the canted bulkhead.

8. Disconnect fuel pump supply hose (20) and fuel pump drain hose (21) from their connections at the fuel pump (22).

NOTE

If anti-ice system and oil dilution system are installed, disconnect anti-ice hose from line fitting below No. 1 cylinder and disconnect oil dilution hose from the engine crankcase fitting just below the fuel pump (22). If oil cooler shutters are installed, disconnect control from oil cooler shutter and from other engine attachment points.

WARNING

Residual fuel and oil draining from lines and hoses as they are disconnected is a fire hazard. Precautions should be taken to prevent this residual material from collecting in the nacelle.

j. Disconnect both exhaust stack assemblies (41 and 49) from the firewall by removing the centering spring assemblies (see paragraph 4-73, step a).

k. Attach a hoist to the lifting eye at the top of the engine crankcase. Lift the engine just enough to relieve its weight from the engine mounts (52).

CAUTION

Place a stand under the airplane tailcone bumper before removing an engine. This will prevent the tail section from being inadvertently rocked downward.

l. Disconnect engine ground strap from nacelle attachment point.

m. Remove O-470-M engines as follows (see figure 4-3, "O-470-M Engine Equipped Airplanes"):

1. Remove bolts (10).

2. Hoist engine out of nacelle and clear of the

airplane.

CAUTION

Hoist engine slowly and make certain that all wires, lines and hoses have been properly disconnected and that they do not catch on nacelle fittings during engine removal.

3. Remove mount pads (3 and 8), spacers (5 and 7) and pin (4) from engine mount bracket (6).

NOTE

To remove O-470-B engines or O-470-M, Spec. 5 engines (see figure 4-3, "O-470-B and O-470-M Spec. 5 Engine Equipped Airplanes"): Remove bolt (1) and nut (6). Hoist engine and remove mount pads (2 and 5) and spacer (4).

4-10. ENGINE DISASSEMBLY. (See figure 4-4, sheets 1 and 2.) 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. Further disassembly is not recommended unless required for overhaul of the engine components.

a. Hoist engine assembly to a convenient working height.

b. Spray engine assembly with a suitable solvent to clean off any dirt accumulation, and allow to drain. Blow off residual dirt and solvent with compressed air.

NOTE

As each item is removed from the engine, place a temporary cover over the hole left by the removal of the item. This will prevent the accidental entry of foreign material which could cause engine damage or lead to engine malfunction.

c. Remove right and left exhaust stack assemblies (41 and 49, figure 4-2, sheet 2) in accordance with paragraph 4-73.

d. Remove propeller control conduit (23), swivel connector and mounting bracket (26) as follows:

1. Remove propeller control conduit (23) from mounting bracket (26).

2. Remove propeller control swivel connector from mounting bracket (26) by removing the mounting nuts with which it is attached.

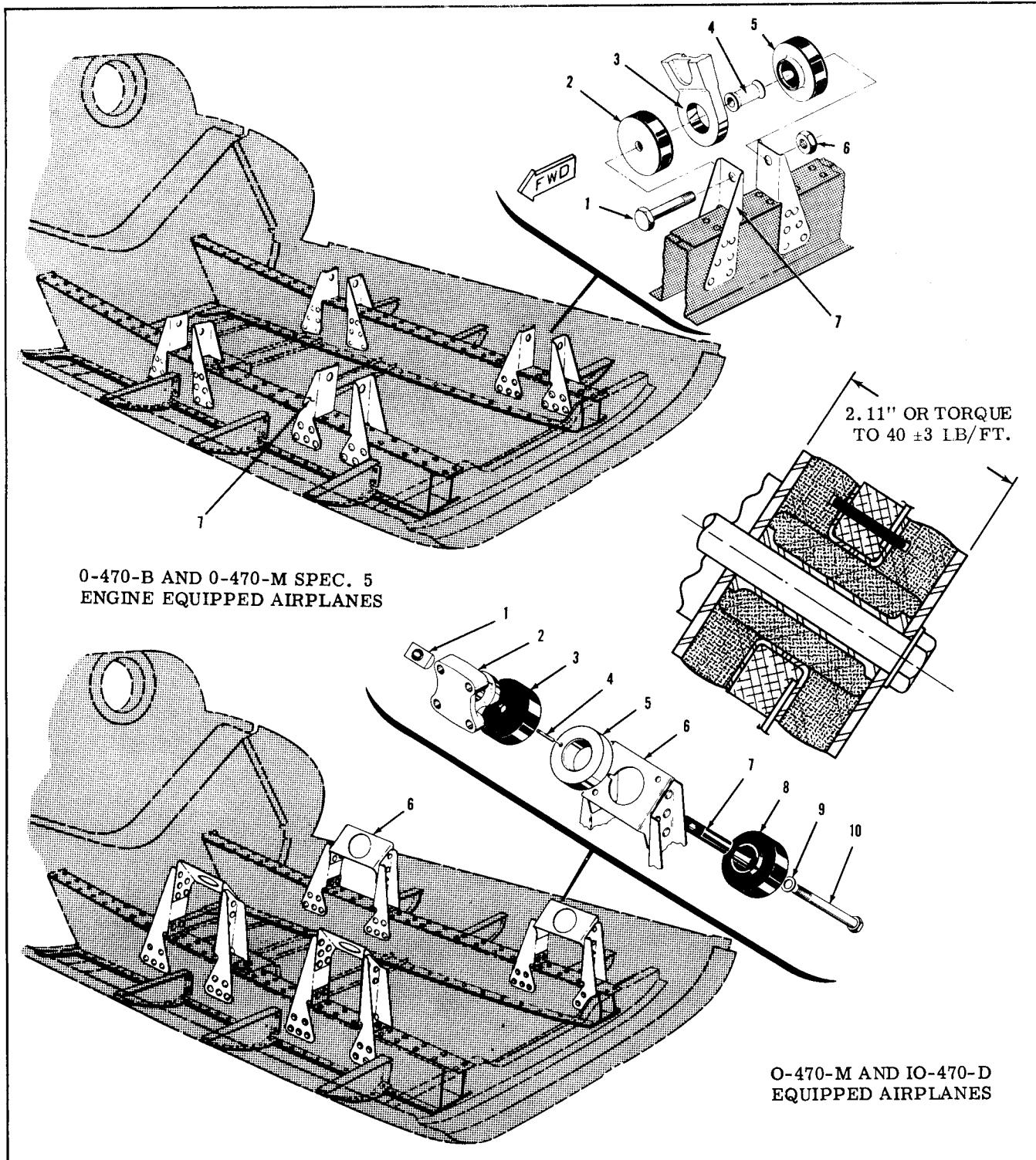
3. Remove propeller control mounting bracket (26) by loosening clamps which attach it to the left intake manifold (22).

e. Remove oil pressure hose (17) by disconnecting it from its fittings at lower left side of engine crankcase and by removing clamp which fastens it to the manifold riser bracket.

f. Remove carburetor air filter (4) and carburetor air box assembly (10) as follows:

1. Remove carburetor air filter (4) by removing four bolts which attach it to the carburetor air box assembly (10).

2. Remove carburetor air box assembly (10) by



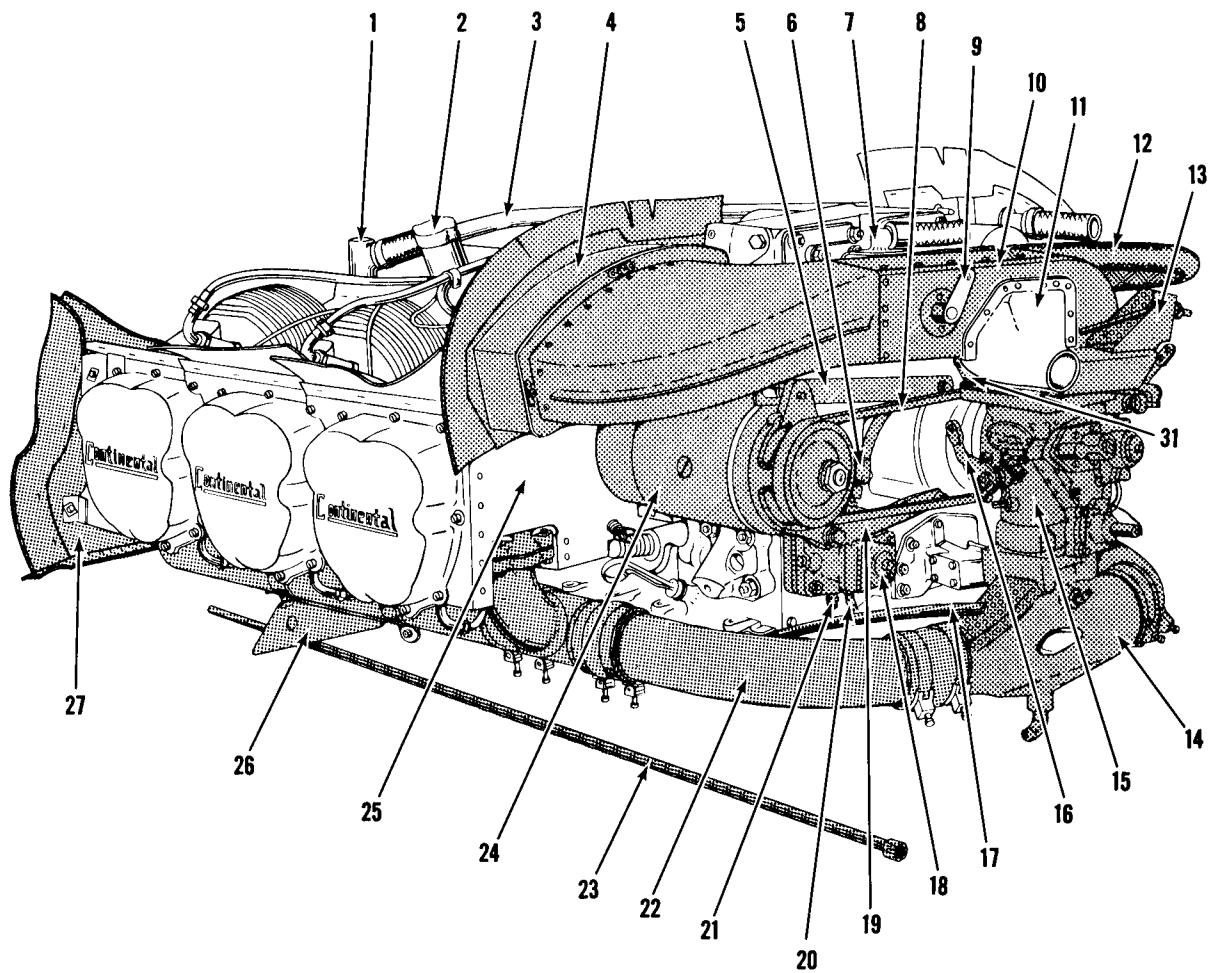
**O-470-B AND O-470-M SPEC. 5
ENGINE EQUIPPED AIRPLANES**

- | | |
|-----------------|-------------------------|
| 1. Bolt | 6. Nut |
| 2. Mount Pad | 7. Engine Mount Bracket |
| 3. Engine Mount | |
| 4. Spacer | |
| 5. Mount Pad | |

**O-470-M AND IO-470-D
EQUIPPED AIRPLANES**

- | | |
|-----------------|-------------------------|
| 1. Barrel Nut | 6. Engine Mount Bracket |
| 2. Engine Mount | 7. Spacer |
| 3. Mount Pad | 8. Mount Pad |
| 4. Pin | 9. Washer |
| 5. Spacer | 10. Bolt |

Figure 4-3. Engine Mounts



- | | | |
|--|---|---|
| 1. Crankcase Breather Fitting | 10. Carburetor Air Box Assembly | 19. Generator Mounting Bracket
(Lower) |
| 2. Oil Filler Cap | 11. Carburetor Heat Adapter | 20. Fuel Pump Supply Fitting |
| 3. Crankcase Breather Line | 12. Vacuum Pump Outlet Hose | 21. Fuel Pump Drain Fitting |
| 4. Carburetor Air Filter | 13. Alternate Air Control Mounting
Bracket | 22. Left Intake Manifold |
| 5. Generator Mounting Bracket
(Upper) | 14. Manifold Riser | 23. Propeller Control Conduit |
| 6. Carburetor Supply Hose | 15. Carburetor | 24. Generator |
| 7. Air-Oil Separator | 16. Throttle Arm | 25. Lower Left Rear Baffle |
| 8. Generator Drive Belt | 17. Oil Pressure Hose | 26. Propeller Control Mounting
Bracket |
| 9. Alternate Air Valve Actuating
Arm | 18. Fuel Pump | 27. Forward Left Engine Baffle |

Figure 4-4. Engine Buildup (Sheet 1 of 2 Sheets)

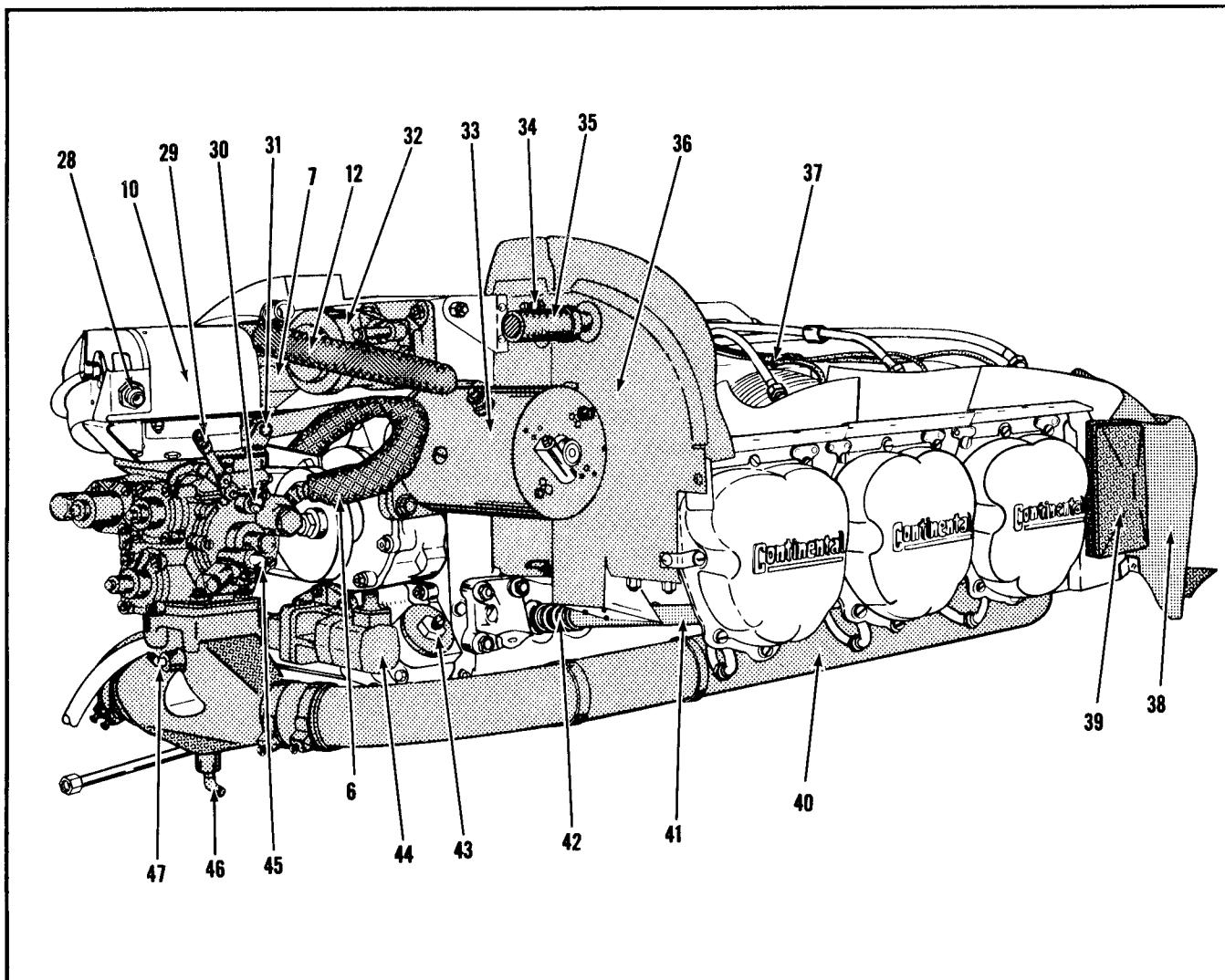
removing the carburetor heat hose and four bolts which attach the carburetor throat to carburetor (15).

NOTE

When carburetor air box assembly is removed, use the four attaching bolts to fasten a temporary cover plate over the carburetor to prevent entry of foreign material. Make certain that the carburetor is braced by the carburetor support brackets (31) to which the carburetor is fastened by the two forward carburetor air-

box assembly attachment bolts.

3. Remove the alternate air control swivel connector (28) from its mounting bracket (13) by removing the mounting nuts with which it is attached.
- g. Remove the generator (24) in accordance with paragraph 6-24.
- h. Remove the starter (33) by removing two mounting nuts and washers, and pulling it straight outward from the starter adapter.
- i. Remove the vacuum pump (32) as follows:
1. Remove vacuum pump outlet hose (12) by



- | | | |
|--|--|-------------------------------|
| 28. Alternate Air Control Swivel Connector | 34. Primer Fitting | 41. Push Rod Housing |
| 29. Mixture Control Arm | 35. Crankcase Breather Line Hose Connector | 42. Push Rod Housing Spring |
| 30. Fuel Vapor Return Fitting | 36. Right Rear Engine Baffle | 43. Oil Filter |
| 31. Carburetor Support Bracket | 37. Primer Distributor Lines | 44. Tachometer Generator |
| 32. Vacuum Pump | 38. Forward Oil Cooler Baffle | 45. Fuel Pressure Fitting |
| 33. Starter | 39. Oil Cooler | 46. Manifold Drain Fitting |
| | 40. Right Intake Manifold | 47. Manifold Pressure Fitting |

Figure 4-4. Engine Buildup (Sheet 2 of 2 Sheets)

loosening clamps which fasten it to the vacuum pump (32) and to the air-oil separator (7).

2. Remove the four nuts which attach the vacuum pump (32) to the engine accessory drive mounting pad. Pull the vacuum pump (32) straight aft to remove it.

j. Remove the air-oil separator (7) as follows:

1. Loosen the hose clamps which attach the air-oil separator (7) to the crankcase return oil fitting.

2. Remove the air-oil separator (7) by removing the screw which attaches it to its mounting bracket.

3. Remove the air-oil separator mounting bracket by removing the nuts which attach it to two accessory drive mounting studs.

k. Remove the tachometer generator (44) by removing four nuts and pulling it free of the tachometer

generator drive adapter.

1. Remove the crankcase breather line (3) as follows:

1. Loosen clamps on hose connector which attaches the crankcase breather line (3) to the crankcase breather fitting (1).

2. Remove crankcase breather line hose connector (35) and pull crankcase breather line (3) forward, free of right rear engine baffle (36).

m. Remove all baffles (including 25, 27, 36, and 38) in accordance with paragraph 4-78.

NOTE

If oil cooler shutters are installed, remove from oil cooler.

n. Remove propeller governor (27, figure 4-2, sheet 2) by removing four nuts which attach it to the propeller governor mounting pad at the forward left side of the engine crankcase. Pull it straight outward from the engine.

o. Disconnect the carburetor supply hose (6) from the fuel pump (18) and from the carburetor (15) and remove.

p. Remove the fuel pump (18) by removing four nuts which attach it to the engine, and pulling it straight aft.

NOTE

Do not remove fuel pump drive adapter assembly when removing the fuel pump (18). This assembly should be left in place and a temporary cover fastened over it.

q. Remove the carburetor (15) as follows:

1. Remove two nuts which attach the carburetor (15) to the carburetor support brackets (31). Rotate the brackets (31) upward to clear the top of the carburetor.

2. Remove the four nuts which attach the carburetor (15) to the manifold riser (14), and lift the carburetor free of the studs.

r. Remove the ignition harness in accordance with paragraph 4-50.

s. Remove the spark plugs making sure that all copper gaskets are also removed. Install temporary protective plugs.

t. Remove the magnetos (33, figure 4-2, sheet 2) in accordance with paragraph 4-42.

u. Remove the oil temperature bulb by unscrewing it from its position in the engine crankcase, directly below the oil cooler (39).

v. Remove the engine ground strap by removing the sump assembly bolt with which it is attached.

NOTE

If anti-ice lines are installed, remove by removing attaching clamps.

w. Remove primer line from fitting in primer distributor mounted on top of engine crankcase and remove fitting.

x. Remove adapters and plumbing fittings as follows:

1. Remove cylinder head temperature bulb adapter (2, figure 4-2, sheet 1) from No. 4 cylinder.

NOTE

On O-470-B engines the cylinder head temperature bulb adapter will be found in No. 3 cylinder.

2. Remove air-oil separator crankcase return oil fitting from hole in upper left aft portion of engine crankcase, directly below the left accessory drive mount pad.

3. Remove oil pressure hose restrictor elbow and bushing from lower left side of engine crankcase, between No. 2 and No. 4 cylinders.

4. Remove the manifold drain fitting (46) and manifold pressure fitting (47) from manifold riser (14).

NOTE

If oil dilution was installed, remove the oil dilution fitting from the crankcase, directly below the fuel pump mounting pad.

5. Remove fuel supply fitting, fuel vapor return fitting (30) and fuel pressure fitting (45) from the carburetor (15).

6. Remove fuel pump supply fitting (20), fuel pump drain fitting (21) from fuel pump (18). Remove carburetor supply hose fitting (23, figure 4-2, sheet 1) from top of fuel pump.

7. Remove the vacuum line fitting and the vacuum pump outlet fitting from the vacuum pump (32).

8. Remove primer fitting (34) from right rear engine baffle (36).

NOTE

To prevent thread damage or entry of foreign material, install suitable plugs into the holes left by removal of these fittings.

4-11. INSPECTION AND REPAIRS. For specific instructions concerning a particular component, refer to the applicable paragraph.

a. Inspect all hoses for evidence of internal swelling, chafing through protective plies, cuts and breaks. Replace if damaged.

b. Inspect all fittings for thread damage and for damage to chamfered seats. Replace if damaged.

c. Inspect air-oil separator for clogging. Wash out with clear, unleaded gasoline or a suitable solvent.

d. Visually inspect the engine for loose nuts, bolts, cracks, and fin damage. Repairs and corrections should be made in accordance with best shop practice and in compliance with applicable regulations.

4-12. ENGINE ASSEMBLY. (See figure 4-4, sheets 1 and 2.) The assembly procedure is the same for either engine. This paragraph will deal only with those items described in paragraph 4-10 (Engine Disassembly).

NOTE

Use all new gaskets for engine assembly. Do not attempt to reuse old gaskets regardless of apparent condition.

a. Hoist engine crankcase to a convenient working height.

b. Install plumbing fittings in engine crankcase, using suitable anti-seize thread lubricant on male threads of the fittings.

CAUTION

Use care in the application of thread lubricant to prevent entry of the lubricant into the engine passages.

1. Install cylinder head temperature bulb adapter (2, figure 4-2, sheet 1) in bottom side of No. 4 cylinder.

NOTE

On O-470-B engines, this adapter is installed in the lower side of No. 3 cylinder.

2. Install the air-oil separator crankcase return oil fitting in hole in upper left portion of the engine crankcase, directly below the left accessory drive mount pad.
3. Install oil pressure hose bushing and restrictor elbow in hole at lower left side of engine crankcase between No. 2 and No. 4 cylinders.
4. Install the manifold drain fitting (46) and manifold pressure fitting (47) into holes in the manifold riser (14).

NOTE

If oil dilution is to be installed, install oil dilution fitting in hole directly below fuel pump mounting pad.

- c. Install engine ground strap with left aft sump assembly attachment bolt.
- d. Install oil temperature bulb into hole in engine crankcase directly below oil cooler (39), and safety.
- e. Install the spark plugs, making certain that only one new or old annealed copper gasket is used on each one. Refer to paragraph 4-56 for detailed information concerning spark plug installation.
- f. Install the magnetos (33, figure 4-2, sheet 2) in accordance with paragraph 4-44.
- g. Install the ignition harness in accordance with paragraph 4-52.
- h. Install the carburetor (15) as follows:
 1. Install the fuel supply fitting, the fuel vapor return fitting (30) and the fuel pressure fitting (45).
 2. Set a new gasket in place on the carburetor mounting pad on the manifold riser (14). Install the carburetor (15) to the manifold riser (14), fastening it with four nuts, washers and lock washers.
 3. Install a temporary cover plate on the carburetor with four bolts, using the two forward bolts to fasten the carburetor to the support brackets (31).
 - i. Install the fuel pump (18) as follows:
 1. Install the carburetor supply hose fitting (23, figure 4-2, sheet 1) in the top of the fuel pump (18). Install fuel pump drain fitting (21) and fuel pump supply fitting (20) in the bottom of the fuel pump.
 2. Remove the cover plate from the fuel pump drive adapter assembly and set a new gasket in place. Install the fuel pump (18), using four nuts, washers, and lock washers.
 - j. Install the carburetor supply hose (6) to fittings in fuel pump (18) and carburetor (15).
 - k. Install propeller governor (27, figure 4-2, sheet 2) as follows:
 1. Inspect governor for proper bypass plug location in accordance with paragraph 4-175.
 2. Remove cover plate from governor mounting pad and set a new governor gasket in place. Install the governor using four nuts, washers and lock washers.

NOTE

The forward left engine baffle support tab (24,

figure 4-10) should be installed during this step. Use the forward lower propeller governor mounting nut to fasten it in place.

1. Install the air-oil separator (7) as follows:
 1. Install the air-oil separator mounting bracket to the two left hand studs on the left accessory mounting pad. Fasten in place with two nuts, washers and lock washers.
 2. Install hose to bottom outlet of air-oil separator and fasten air-oil separator to the mounting bracket. The outlet hose should be connected to the crankcase return oil fitting directly below the left accessory mount pad.
 - m. Install the vacuum pump (32) as follows:
 1. Install the vacuum line fitting and the vacuum pump outlet fitting in the vacuum pump.
 2. Remove the cover from the right hand accessory drive mount pad and set a new gasket in place. Install the vacuum pump (32), fastening it to the mount pad with four nuts, washers, and lock washers.
 - n. Remove the cover from the tachometer generator drive adapter and set a new gasket in place. Install the tachometer generator and fasten in place with four nuts, washers, and lock washers.
 - o. Install primer fitting (34) in right rear engine baffle (36). Install all baffles in accordance with paragraph 4-80.

NOTE

If oil cooler shutters are to be installed, this should be done during baffle installation.

- p. Install crankcase breather line (3) as follows:
 1. Insert aft end of line through grommet in right rear engine baffle (36) and slide crankcase breather line hose connector (35) in place.
 2. Fasten forward end of line to crankcase breather fitting (1) with hose connector and clamps.
 - q. Remove cover from starter adapter and set a new gasket in place. Install starter, fastening it to the adapter with two nuts and lock washers.
 - r. Install the generator in accordance with paragraph 6-30.
 - s. Install primer line fitting in primer distributor on top of engine crankcase. Attach primer line to this fitting and to fitting in right rear engine baffle.
 - t. Install the oil pressure hose (17) by connecting it to its fitting at the lower left side of the engine crankcase. Attach clamp which holds it to the left manifold riser bracket.
 - u. Install carburetor air box assembly (10) and carburetor air filter (4) as follows:
 1. Remove cover from carburetor (15) and set a new gasket in place.
 2. Install carburetor air box assembly (10) as illustrated. Fasten to carburetor (15) with four bolts, and safety. Make certain that carburetor support brackets (31) are fastened in place as the air box assembly (10) is installed.
 3. Install the carburetor air filter (4) as shown, using four attachment bolts.
 4. Attach the alternate air control/swivel connector (28) to the mounting bracket (13) in the position illustrated.

- v. Install propeller control components as follows:
 1. Install propeller control mounting bracket (26) to left intake manifold (22) as illustrated.
 2. Attach propeller control swivel connector to the mounting bracket (26).
 3. Attach propeller control conduit (23) to connector on mounting bracket (26) as illustrated.
- w. Install right and left exhaust stack assemblies (41 and 49, figure 4-2, sheet 2) in accordance with paragraph 4-75.

NOTE

If the airplane has a propeller anti-ice system installed, the necessary clamps and lines should be attached to the engine prior to installation of the right exhaust stack assembly.

- x. Inspect completed assembly for safeties, missing bolts, nuts, proper alignment of parts, and check to see that all clamps, nuts, bolts, and screws are tight. Correct any discrepancies.

4-13. INSTALLATION OF ENGINE ASSEMBLY. (See figure 4-2, sheets 1 and 2.) Although there is some difference in the routing of wire bundles, lines, hoses, and conduit, the same procedure should be followed for installation of either engine.

- a. Hoist engine to a point just above the nacelle.
- b. Install engine to engine mount brackets in nacelle (see figure 4-3). Install an O-470-M engine as follows:
 1. Temporarily install mount pads (3), spacers (5), and pins (4) to all four engine mounts (2) using AN7-24 bolts and suitable washers. See that the pins (4) are in a position which will align them with the slots at the side of the holes in the engine mount brackets (6).
 2. Position the engine so that as it is lowered the propeller control cable can be inserted into the propeller control conduit.
 3. Lower the engine slowly into place on the engine mount brackets (6).
- Install an O-470-B or O-470-M Spec. 5 engine as follows:
 1. Set a mount pad (2), a spacer (4), and a mount pad (5) in position on each engine mount (3).
 2. Guide the engine so that as it is slowly lowered the engine mounts (3) with pads held in place will slip between the engine mount brackets (7).
 3. Align the holes in the mount pads (2 and 5) with the holes in the engine mount brackets (7). Insert bolts (1) and tighten nuts (6) on the bolts.

CAUTION

To prevent damaging the propeller control cable or propeller control conduit, be careful to avoid misalignment while lowering the engine into place

4. Remove the temporary bolts and washers. Insert the spacers (7) into the mount pads (3) and slip the mount pads (8) into place over the spacers (7). Insert bolts (10) with washers (9) in place and tighten to proper torque value.

NOTE

Engine mounting bolt torque value for either O-470-B or O-470-M engine installation is 40 ± 3 lb - ft. (See figure 4-3.)

- c. Fasten engine ground strap to left aft engine mount bracket
- d. Connect wires and cables as follows:
 1. Attach wire bundle (18) to right intake manifold pipe with three clamps, and generator cables (25) 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 pipes. 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 (4) to oil temperature bulb (5), and safety. Connect ground wire to nacelle attachment point just below forward right engine mount bracket.
 3. Route the magneto ground wires (8) forward through the right rear engine baffle (9) as illustrated.

WARNING

To prevent accidental sparking, do not connect the ground wires to the magnetos at this point in the procedure.

4. Connect the starter cable (10) to the starter (11).
5. Attach the tachometer generator electrical connector to the tachometer generator, and safety.
6. Route the cylinder head temperature bulb wires forward along left side of engine, below cylinders and behind intake manifold pipes. Install cylinder head temperature bulb (3) in No. 4 cylinder as illustrated.

NOTE

The cylinder head temperature bulb is installed in No. 3 cylinder on O-470-B engines.

Attach cylinder head temperature bulb ground wire to nacelle attachment point just below left aft engine mount bracket.

7. Attach generator cables (25) to generator (24). The generator cable shielding is grounded by attaching to the lower stud on which the air-oil separator bracket is mounted.
- e. Connect lines and hoses as follows:
 1. Connect fuel pump drain hose (21) and fuel pump supply hose (20) as illustrated.
 2. Connect manifold drain hose to manifold drain fitting (16).
 3. Route oil pressure hose (19) aft through lightening hole in canted bulkhead and attach to oil pressure fitting at inboard nacelle rib. Fasten hose to canted bulkhead with a clamp.

NOTE

If anti-ice and oil dilution are installed, connect the anti-ice hose to the anti-ice line and connect

the oil dilution hose to the crankcase fitting directly below the fuel pump.

4. Attach manifold pressure hose (15) as illustrated.
5. Attach fuel vapor return hose (12) and fuel pressure hose (13) to carburetor fittings.
6. Attach primer hose (7) to fitting at right rear engine baffle (9).
7. Connect vacuum line (40) to vacuum pump inlet and air-oil separator exhaust line (38) to air-oil separator (34).
8. Connect crankcase breather line (36) as illustrated.
 - f. Attach propeller control conduit (48) to conduit connector (47).
 - g. Attach alternate air control conduit (42) to swivel connector (37) at mounting bracket (39).
 - h. Attach and rig all engine controls (31, 43, 44, and 46) in accordance with paragraph 4-160.
 - i. Attach exhaust stack spring assemblies in accordance with paragraph 4-75.
 - j. Install propeller in accordance with paragraph 4-170.
 - k. Connect battery circuit by connecting the battery ground cable (see paragraph 6-10).
 - l. Inspect the installation for safeties, loose connections, missing bolts, clamps, screws, or nuts; proper routing of cables, hoses and lines and correct points of connection (see paragraph 4-14 for check list). Correct all discrepancies.
 - m. Make a magneto switch ground-out and continuity check. If the switches are functioning properly connect the magneto ground wires to the magnetos.
 - n. Service the engine in accordance with figure 1-5.
 - o. Install the engine cowling in accordance with paragraph 4-5.

4-14. INSPECTION OF ENGINE INSTALLATION.

The following check list may be used as a guide for inspecting the installation of either engine.

- a. Check the following items:
 1. Propeller securely in place and mounting bolts safetied.
 2. Engine mounting secure, bolts tight.
 3. Oil temperature bulb electrical connector secure and safetied, and ground wire connection tight.
 4. Oil pressure relief valve plug safetied.
 5. Tachometer generator electrical connector secure and safetied.
 6. Starter cable connection secure with insulating boot in place.
 7. Cylinder head temperature bulb in place and ground wire connection tight.
 8. Generator cable connections secure and cable shielding grounded.
 9. All wiring securely clamped in place.
 10. Fuel pump hose connections tight.
 11. Manifold pressure hose connections tight.
 12. Oil pressure connections clamped and tight.
 13. Primer hose connections tight.
 14. Carburetor hose connections tight.
 15. Carburetor heat hose properly clamped.
 16. Crankcase breather line connections secure.
 17. Air-oil separator exhaust line connections and return oil hose connections secure.
 18. Vacuum line connections and vacuum pump

outlet hose connections secure.

19. Oil dilution hose connections tight (optional equipment).
 20. Propeller anti-ice hose connections tight (optional equipment).
 21. Engine control connections secure. Check for full travel (see paragraph 4-160).
 22. Oil drain plugs tight and safetied.
 23. Oil quantity check, 12 quart capacity each engine, 6 quart minimum for flight. (Add oil at 9 quarts.) Check for oil leaks.
 24. Hose and line connections secure at firewall components and at nacelle rib.
 25. Carburetor mounting secure and carburetor air box assembly attachment bolts tight and safetied.
 26. Induction system clamps and bolts secure.
 27. Exhaust system attachments secure.
 28. Spark plugs and ignition harness tight and secure. (Check routing of harness if engine is being put back in service after disassembly; see paragraph 4-49 and figure 4-7.)
 29. Magneto ground wires connected and safetied.
 30. Propeller anti-ice lines securely attached and clearance at propeller .125 inches minimum.
 31. Engine nacelle for loose objects (tools, rags, trash), and remove.
 32. Cowling and access doors for security of attachment.
- 4-15. ENGINE OPERATIONAL CHECK. An operational check should be made after engine installation and as indicated by maintenance requirements. Ground operation should be held to a minimum. Operate the engine with the mixture lever in FULL RICH and head the airplane into the wind to aid in cooling.

CAUTION

The oil temperature and cylinder head temperature should not be allowed to exceed these limits:
 Oil Temperature 225° maximum
 Cylinder Head Temperature . . . 470° maximum

- a. Inspect the engine installation in accordance with paragraph 4-14.
- b. Set the parking brake (use of wheel chocks is advisable where practical.)
- c. Start engine in accordance with "Pilots Check List."

CAUTION

If there is no oil pressure indication within 60 seconds of starting, stop the engine and determine the cause before attempting a subsequent start.

- d. Idle engine at 800 to 1000 rpm until it reaches operating temperatures.

CAUTION

If one engine only is being operated on an airplane equipped with 50 ampere generators, place the inoperative engine generator switch

OFF to prevent possible damage to the paralleling circuit.

- e. Perform magneto ground-out check as follows:
1. Throttle engine back to idle (600 rpm).
 2. Momentarily switch both magnetos OFF.

The tachometer should indicate by a sudden rpm drop that the magnetos have ceased to fire.

CAUTION

If magneto switches are left OFF for a prolonged period, afterfiring may occur when they are switched back on.

If engine continues to run with the switches OFF, stop engine immediately by placing the mixture lever in IDLE CUT-OFF. Determine cause and correct before attempting further operation of the engine.

- f. Advance throttle to 1700 rpm and perform a magneto check as follows:

1. Place right magneto switch in OFF position and note rpm drop. Return switch to ON position.
2. Allow engine rpm to stabilize at original setting. Repeat check with left switch.
3. The rpm drop should not exceed 100 rpm when operating on either magneto. If rpm drop is excessive, determine cause and correct before attempting to operate the engine in flight.

g. Starting at 1700 rpm, exercise the propeller by retarding the propeller pitch lever to obtain a 1000 rpm tachometer indication. Exercise propeller twice and watch for any indication of sluggish or erratic operation. If operation is not normal, determine the cause and correct it. (See paragraph 4-167.)

h. With rpm still at 1700, pull alternate air control knob OUT. Note drop in rpm due to excessive rich mixture. Return air control knob to COLD position.

i. Make a mixture control check by slowly moving the mixture lever toward IDLE CUT-OFF (ICO) position until a slight drop in rpm is noted. Immediately return mixture lever to FULL RICH position.

j. Perform a power check by advancing the throttle to FULL OPEN position (approximately 26-inch Hg.).

CAUTION

Mixture lever should be FULL RICH and propeller pitch lever in HIGH RPM (INC) position.

Engine rpm should be approximately 2500 to 2550 rpm (static rpm). Engine operation should not be excessively rough. Retard throttle to IDLE, and allow temperatures to stabilize.

4-22. TROUBLE SHOOTING CHART.

TROUBLE	PROBABLE CAUSE	CORRECTION
HIGH OIL TEMPERATURE INDICATION.	Low oil supply. Cooler air passages clogged. Cooler core plugged.	Replenish. Clean thoroughly. Remove cooler and flush thoroughly.

k. Stop engine by placing mixture lever in IDLE CUT-OFF (ICO) position. As soon as propeller has stopped turning, place ignition switches OFF.

4-16. ENGINE SHOCK MOUNTS. (See figure 4-3.)

4-17. 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.

4-18. REMOVAL AND INSTALLATION OF ENGINE SHOCK MOUNTS. (See figure 4-3.) Removal of engine shock mounts is described in the engine removal procedure, paragraph 4-9, step "m". Installation of engine shock mounts is described in the engine installation procedure paragraph 4-13, step "b".

4-19. CLEANING AND INSPECTION OF ENGINE SHOCK MOUNTS. All metal parts of the shock mount assemblies may be cleaned in a suitable dry cleaning solvent. The rubber pads should be wiped clean with a dry, clean cloth.

NOTE

Do not clean the rubber pads with any type of solvent.

Inspect the metal parts for cracks and excessive wear. Replace all parts that show evidence of damage. Inspect the rubber pads for separation between pad and metal backing, swelling and cracking, or a pronounced set of the pad. Replace all rubber pads that show evidence of damage.

4-20. ENGINE OIL SYSTEM. (See figures 4-5A and 4-5B.)

4-21. The Continental O-470 series engines installed in the Model 310 airplane have wet sump, pressure lubrication systems. Oil temperature 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 completely internal oil system eliminates all difficulties associated with external oil lines. Engine oil is filtered through an internally mounted screen filter. A bypass valve will route the oil around this filter if it should become clogged. Oil pressure is maintained by a spring-loaded pressure relief valve which is non-adjustable.

TROUBLE	PROBABLE CAUSE	CORRECTION
HIGH OIL TEMPERATURE INDICATION. (Cont.)	<p>Thermostat damaged or held open by solid matter.</p> <p>Oil viscosity too high.</p> <p>Prolonged ground operation.</p> <p>Malfunctioning gage or bulb unit.</p>	<p>Remove, clean valve and seat. If still inoperative, replace.</p> <p>Drain and refill with correct seasonal weight. (See figure 1-5.)</p> <p>Limit ground operation to a minimum.</p> <p>Check wiring. Check bulb unit. Check gage. Replace defective parts.</p>
LOW OIL PRESSURE INDICATION.	<p>Low oil supply.</p> <p>Oil viscosity too low.</p> <p>Foam in oil due to presence of alkaline solids in system.</p> <p>Defective pressure pump.</p> <p>Malfunctioning pressure gage.</p> <p>Weak or broken oil pressure relief valve spring.</p>	<p>Replenish.</p> <p>Drain and refill with correct seasonal weight. (See figure 1-5.)</p> <p>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.)</p> <p>Replace pump.</p> <p>Check gage. Clean plumbing. Replace if required.</p> <p>Replace spring.</p>

4-23. OIL PRESSURE SYSTEM.

4-24. 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.

4-25. REMOVAL OF OIL PRESSURE LINES. (See figure 4-5.)

a. Disconnect oil pressure hoses (11 and 22) at in-board nacelle ribs (14) 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 20) from between support brackets (6) and fuselage skin (19), remove upholstery

side panels below instrument panel and back to main wing spar in accordance with paragraph 2-193. 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 (10) from between fuselage skin (19) and inboard nacelle ribs (14) 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.

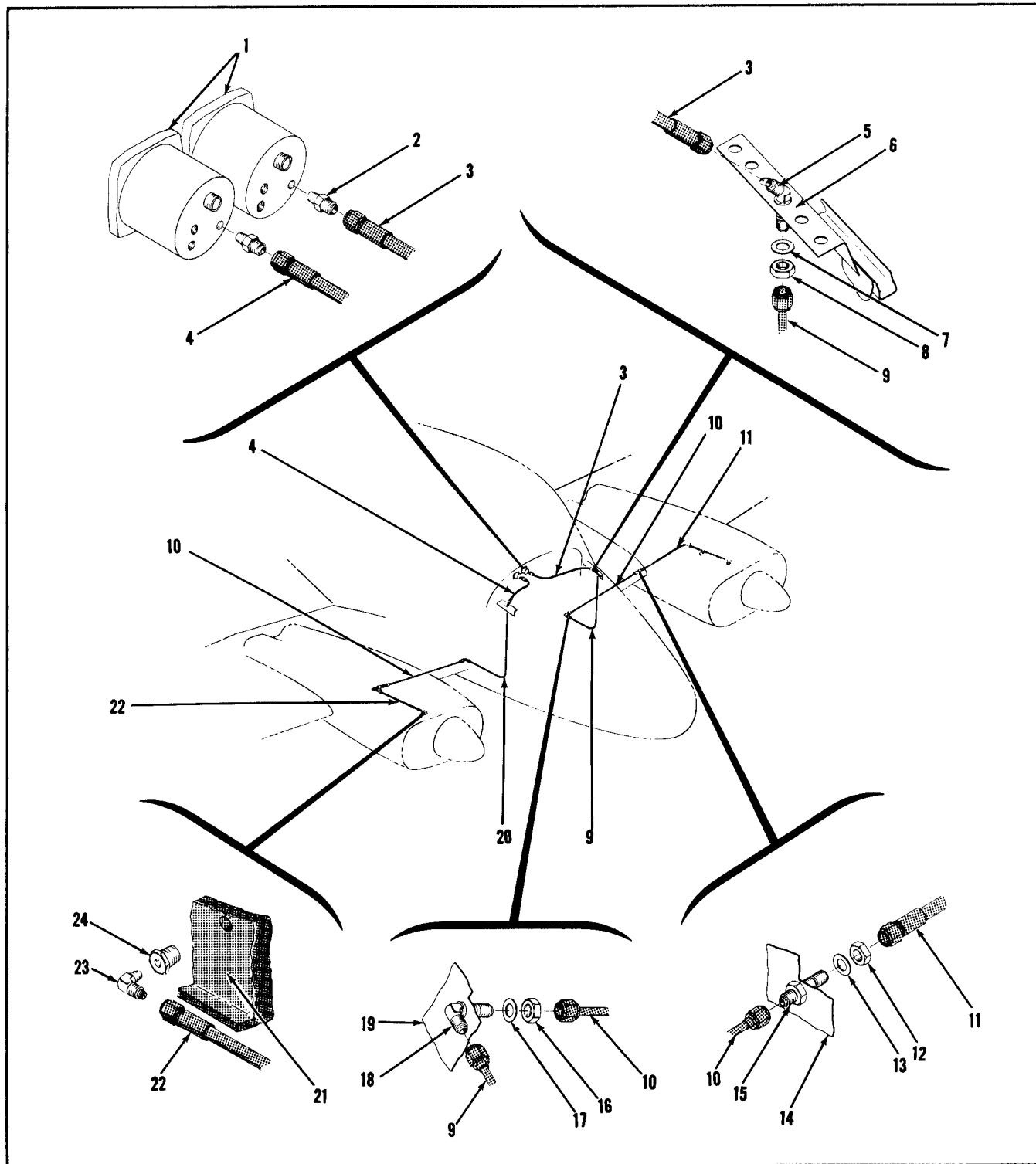
NOTE

It may be necessary to bend the lines slightly to facilitate removal, however, excessive bending should be avoided.

e. To remove hoses (11 and 22) from between in-board nacelle ribs (14) and each engine crankcase (21), remove left exhaust stack assemblies from the engines in accordance with paragraph 4-73. Disconnect hoses at each end.

NOTE

The left exhaust stack assemblies are removed to provide access to the crankcase oil pressure connections.



- | | | |
|----------------------------------|-----------------------------------|-------------------------------------|
| 1. Engine Gage Unit | 9. Cabin Oil Pressure Line (Left) | 17. Washer |
| 2. Nipple | 10. Wing Oil Pressure Line | 18. Elbow |
| 3. Engine Gage Unit Hose (Left) | 11. Oil Pressure Hose | 19. Fuselage Skin |
| 4. Engine Gage Unit Hose (Right) | 12. Nut | 20. Cabin Oil Pressure Line (Right) |
| 5. Elbow | 13. Washer | 21. Engine Crankcase |
| 6. Support Bracket | 14. Inboard Nacelle Rib | 22. Oil Pressure Hose |
| 7. Washer | 15. Union | 23. Restrictor Elbow |
| 8. Nut | 16. Nut | 24. Bushing |

Figure 4-5. Oil Pressure System

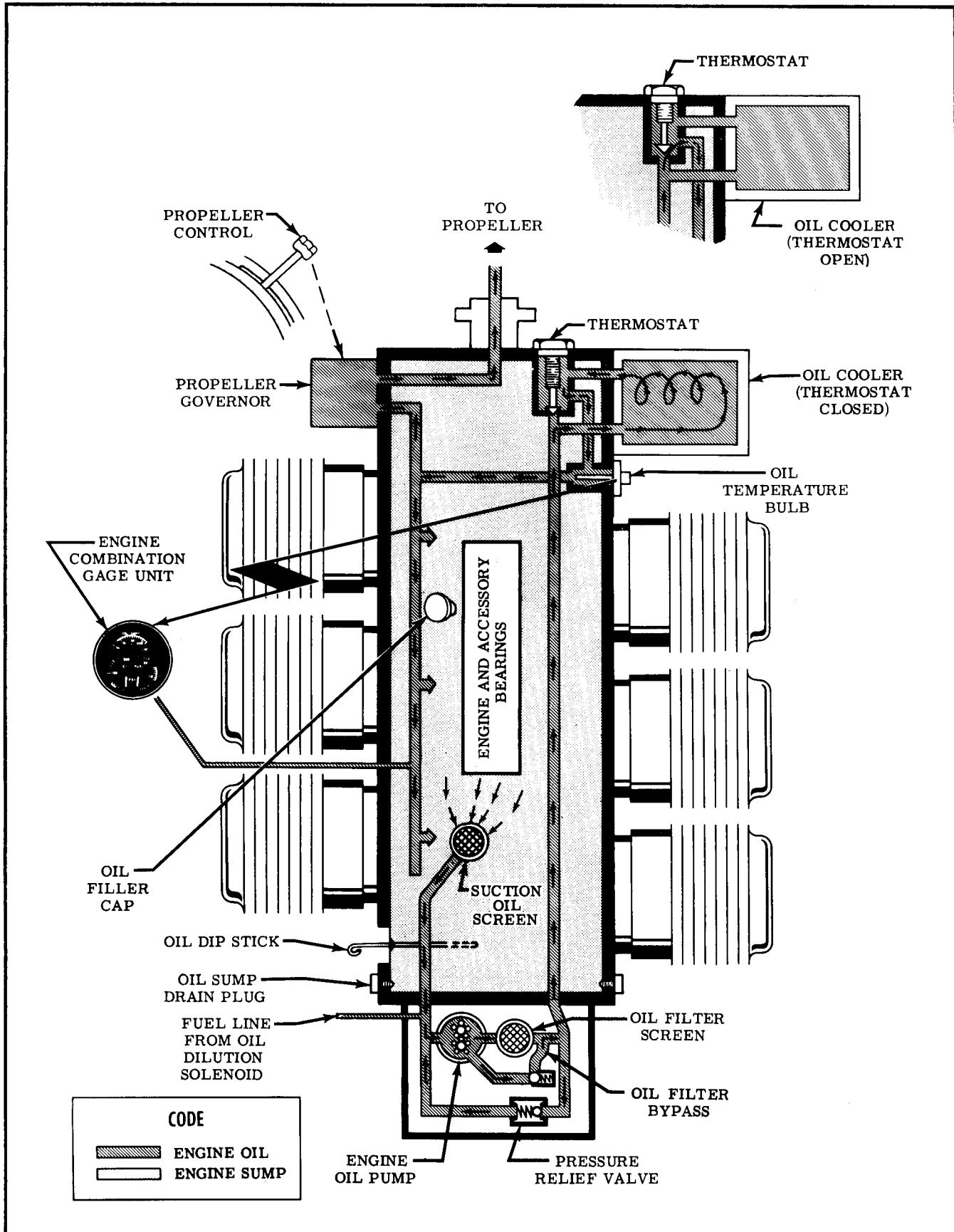


Figure 4-5A. Engine Oil System Schematic

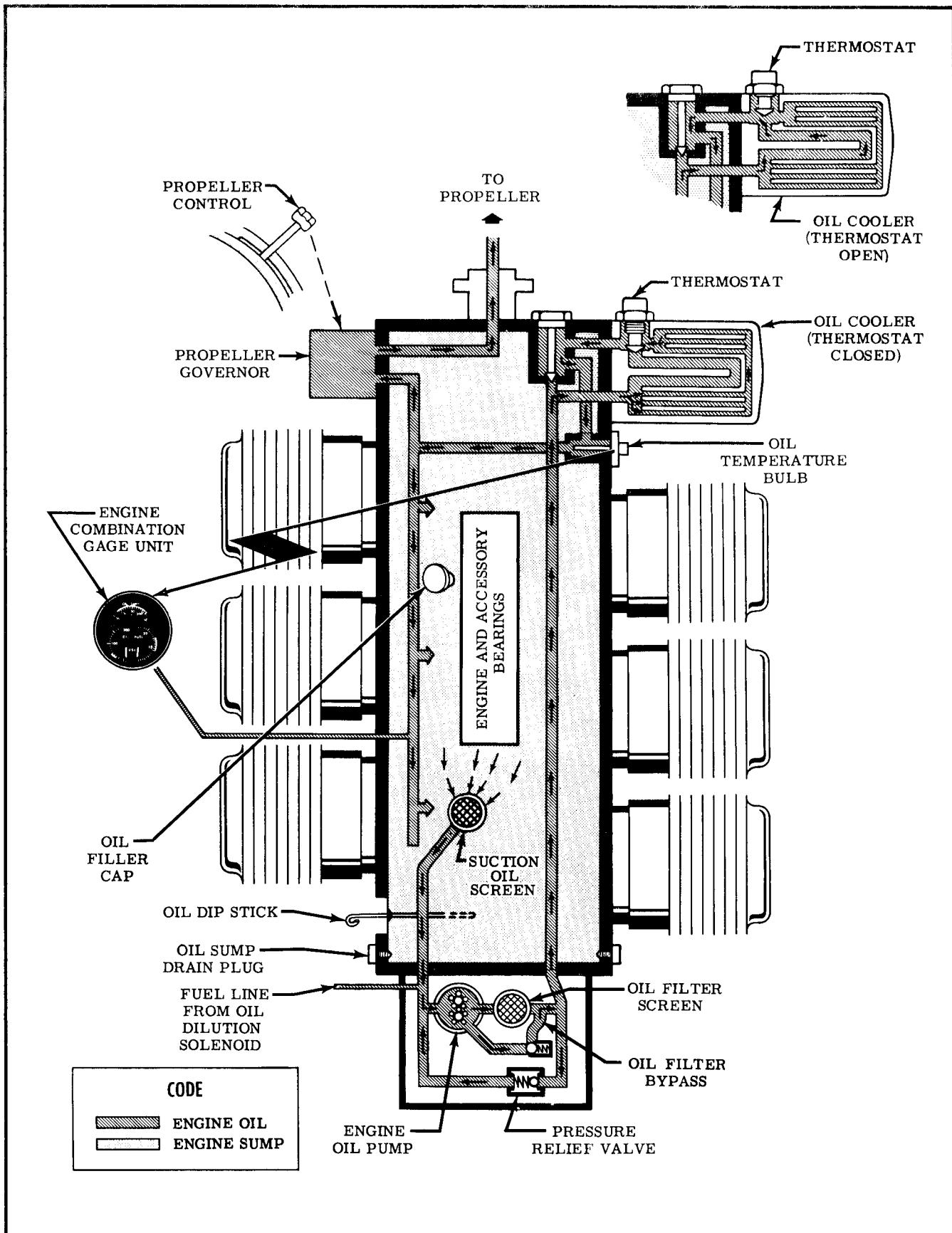


Figure 4-5B. Engine Oil Systems Schematic (With Non-Congealing Oil Cooler)

4-26. INSTALLATION OF OIL PRESSURE LINES. (See figure 4-5.) Before proceeding with installation of oil pressure lines refer to paragraph 4-27, for proper servicing of lines. When installing oil pressure hoses and lines, coat threads of fittings with a suitable thread lubricant to facilitate installation.

a. To install hoses (11 and 22), connect the hoses to the crankcase elbows (23) and to the unions (15) at the inboard nacelle ribs. Replace the exhaust stack assemblies in accordance with paragraph 4-75.

b. To install lines (10) between fuselage skin (19) and inboard nacelle ribs (14), pass them through access holes nearest to inboard side of nacelles and connect the ends to their proper fittings.

NOTE

It may be necessary to bend the lines slightly to facilitate installation. Excessive bending should be avoided.

c. Install three access hole covers on underside of each wing leading edge and install forward wing fillets.

d. To install lines (9 and 20) between fuselage skin (19) and support brackets (6), pass lower end of lines through routing holes in bulkhead and connect the ends to their fittings. Replace upholstery side panels in accordance with paragraph 2-195.

e. To install hoses (3 and 4) between engine gage units (1) and support brackets (6), pass hoses up behind instrument panel. Connect one end of hoses to fittings marked "OIL" on back of engine gage units and other end to elbows (5) at support brackets (6).

CAUTION

To prevent possible damage to the engine gage units, make certain that the oil pressure hoses are connected to the proper fittings.

4-27. 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.

4-28. COLD WEATHER SERVICING OF OIL PRESSURE LINES. (See figure 4-5.) Disconnect engine hoses (11 and 22) at inboard nacelle ribs (14) 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 hanger or the engines operated before the lines are disconnected.

Attach a small hand pump filled with kerosene or instrument oil to a nacelle fitting (15) 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.

4-29. OIL DILUTION SYSTEM. (OPTIONAL EQUIPMENT.)

4-30. The oil dilution system consists of a three-position oil dilution switch located in the cockpit switch panel, a solenoid valve in each engine nacelle, and interconnecting wiring and plumbing. Fuel for oil dilution is directed from the top of the fuel strainers to tee fittings which connect the oil dilution solenoid valves and the engine primer solenoid valves. When the oil dilution solenoid valves are actuated by the oil dilution switch, with the fuel boost pumps on, fuel is routed through the solenoid valves to the engines, entering directly below the fuel pumps, where it mixes with the oil in the engine sumps. From there the diluted oil is distributed through the engines by the engine oil pumps.

4-31. REMOVAL OF AN OIL DILUTION SOLENOID VALVE. (See figure 4-6.) The removal procedure is identical for either engine solenoid valve.

a. Disconnect oil dilution hose (12), engine primer hose (9), and fuel line (11) from elbow located in tee fitting (8).

b. Disconnect oil dilution electrical connector (7) and engine primer electrical connector (1). Tag both electrical connectors for identification when reinstalling.

c. Remove four screws and two clamps and brackets attaching the two solenoid valves (3 and 6) to engine firewall and remove solenoid valves from firewall.

d. Unscrew oil dilution solenoid valve (6) and nipple from tee fitting (8).

4-32. INSTALLATION OF AN OIL DILUTION SOLENOID VALVE. (See figure 4-6.)

a. Screw oil dilution solenoid valve (6) and nipple on to tee fitting (8) until connection is tight and both solenoid valves are approximately in line vertically.

NOTE

Coat threads of all fittings with a suitable thread lubricant before installing fittings.

b. Attach solenoid valves to engine firewalls as shown in figure 4-6.

c. Connect each electrical connector (1 and 7) to the proper solenoid valve and secure with safety wire.

d. Connect fuel line (11) from fuel strainer (10) to the elbow in tee fitting (8). Connect engine primer hose (9) and oil dilution hose (12) to the proper solenoid valve.

4-33. OIL TEMPERATURE BULBS.

4-34. The oil temperature bulb in each engine is a heat variable resistor type and is attached to the oil temperature gage by a single electrical wire. A short ground wire attaches to the nacelle assembly. The bulb is located directly below the oil cooler on the right side of the engine crankcase.

4-35. REMOVAL OF AN OIL TEMPERATURE BULB.
(See figure 4-2, sheet 1.)

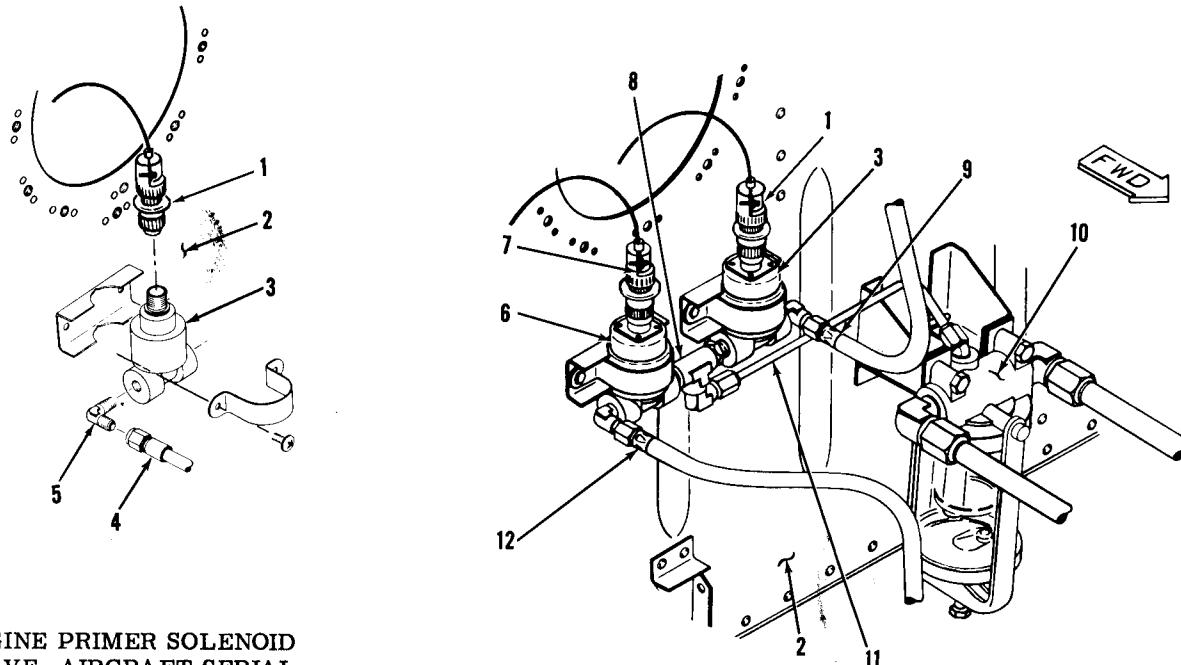
- a. Remove safety wire from electrical connector (4) and disconnect the connector from temperature bulb (5).
- b. Remove safety wire from temperature bulb (5) and unscrew to remove the bulb from the engine crank-case.

4-36. INSTALLATION OF AN OIL TEMPERATURE BULB. (See figure 4-2, sheet 1.)

- a. Install temperature bulb (5) into engine crank-case and secure with safety wire.
- b. Install electrical connector (4) onto temperature bulb (5) and secure with safety wire.

4-37. ENGINE IGNITION SYSTEM.

4-38. Engine ignition for the Model 310 airplane is provided by two Bendix-Scintilla magnetos mounted on each engine. The left magneto on each engine fires the upper spark plugs on the left bank of cylinders and the lower spark plugs on the right bank. The right magneto fires the remaining spark plugs on that engine. There are four, two-position ignition switches mounted on the instrument panel, one for each magneto. When a magneto switch is in the OFF position the magneto is grounded and will not produce a spark. When the switch is in the ON position the magneto primary coil is not grounded and the magneto will supply power to the spark plugs.



ENGINE PRIMER SOLENOID VALVE, AIRCRAFT SERIAL 35000 THRU 35771.

NO ENGINE PRIMER SOLENOID VALVE IS REQUIRED ON AIRCRAFT SERIAL 35772 AND ON.

OIL DILUTION AND ENGINE PRIMER SOLENOID VALVE INSTALLATION, AIRCRAFT SERIAL 35000 THRU 35771.

OIL DILUTION IS PROVIDED AS OPTIONAL EQUIPMENT.

ON 310C AIRCRAFT, SERIAL 35772 AND ON, THE ENGINE PRIMER SOLENOID VALVE (3) IS NOT USED, AND FUEL LINE (11) CONNECTS DIRECTLY TO THE OIL DILUTION SOLENOID VALVE (6). TEE FITTING (8) IS NOT USED.

1. Engine Primer Electrical Connector
2. Firewall
3. Engine Primer Solenoid Valve
4. Primer Hose
5. Elbow
6. Oil Dilution Solenoid Valve

7. Oil Dilution Electrical Connector
8. Tee Fitting
9. Primer Hose
10. Fuel Strainer
11. Fuel Line
12. Oil Dilution Hose

Figure 4-6. Engine Primer and Oil Dilution Solenoid Valves

4-39. TROUBLE SHOOTING CHART.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE FAILS TO START DUE TO IGNITION TROUBLE.	Ignition switch OFF or grounded switch wires. Spark plugs fouled, improperly gapped, or loose. Magnetos improperly timed to engine. Shorted condenser. Magneto internal timing incorrect or timed for opposite rotation.	Flip switch ON. Check for grounded wires. Remove and clean. Adjust to proper gap. Tighten to specified torque. Refer to paragraph 4-45 for timing procedure. Replace condenser. Install correctly timed magneto.
ROUGH IDLING.	Spark plugs fouled or improperly gapped. Weak condenser.	Clean spark plugs. Adjust spark plug gap. Replace condenser.
ROUGH AT SPEEDS ABOVE IDLE.	Loose or improperly gapped spark plugs. High tension leak in ignition harness. Weak or burned out condenser as evidenced by burned or pitted breaker points.	Tighten to specified torque. Adjust to proper gap. Check for faulty insulation. Replace points and condenser.
SLUGGISH OPERATION AND/ OR EXCESSIVE RPM DROP.	Fouled or dead spark plugs. Improperly gapped spark plugs. Magnetos out of time with engine. Damaged magneto breaker points or condenser.	Clean spark plugs. Replace dead spark plugs. Adjust to proper gap. Refer to paragraph 4-45 for proper timing procedure. Replace points and condenser.

4-40. MAGNETOS.

on its compression stroke.

4-41. The two Bendix-Scintilla S6RN-25 Magnetos installed on the engines have impulse couplings to provide a hot, retarded spark for easier starting. By retarding the starting spark they aid in preventing engine kickback. These magnetos have a self grounding feature which prevents the possibility of accidental sparking at the spark plugs whenever the ground wires are pulled from the magnetos.

4-42. REMOVAL OF MAGNETOS. The magneto removal procedure is identical for removing either magneto from either engine.

- a. Remove the engine cowling in accordance with paragraph 4-3.
- b. Detach the magneto ground wires from both magnetos and tag for identification when reinstalling.
- c. Detach the high tension outlet plate from the magneto to be removed.
- d. Rotate the propeller by hand in the normal direction of rotation until the No. 1 cylinder is coming up

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.

- e. Remove the two magneto flange clamp nuts, washers, and clamps. Pull the magneto forward from the crankcase mounting pad.

NOTE

As the magneto flange clears the crankcase hole, watch the rubber drive bushings and

steel retainer in the gear hub to make sure they will not drop out.

4-43. INSPECTION OF MAGNETOS.

a. Inspect the rubber drive bushings in the drive gear hub for deformation. Replace with new parts if they will not fit the magneto coupling lugs closely.

b. Remove the magneto breaker cover plate and inspect the points. They should have a gray, frosty appearance. If burning or pitting is apparent, determine the cause and correct it before replacing the points. If the breaker points are oily, they can be cleaned with clear unleaded gasoline. Avoid getting any gasoline on the breaker felt as this will wash away the lubricant.

4-44. INSTALLATION OF MAGNETOS.

a. The engine crankshaft should be positioned to No. 1 cylinder firing position.

b. Remove the magneto timing inspection hole plug. Rotate the magneto shaft backwards (so that the magneto impulse coupling latches will not engage) until the timing pointer inside the case is aligned with the white gear tooth.

c. Set the magneto in place on the crankcase mounting pad. Install the two magneto flange clamp nuts, washers, and clamps. Tighten the nuts just enough so that the magneto can be rotated without side play.

d. Time the magneto to the engine (see paragraph 4-45).

e. Tighten the clamp nuts and attach the high tension outlet plate. Install the timing inspection hole plug.

f. Attach the magneto ground wires to both magnetos.

g. Replace the engine cowling in accordance with paragraph 4-5.

4-45. IGNITION TIMING. The ignition timing procedure for the engines installed in this airplane is similar to that used for timing other aircraft engines. To time the magnetos to an engine:

1. Check both magnetos to see that they are internally timed for right hand drive rotation.

2. Remove lower spark plugs from the cylinders to allow free crankshaft rotation.

3. Install the magnetos to the engine in accordance with paragraph 4-44, making certain that No. 1 cylinder is on its compression stroke.

NOTE

The No. 1 cylinder firing position is 24° B.T.C. This position can be determined by any accepted standard procedure ("Timerite", timing disc, timing marks on crankshaft propeller mounting flange).

4. Attach a timing light to the magnetos in accordance with the timing light manufacturer's instructions.

5. Rotate crankshaft a few degrees in a direction opposite normal rotation to a position where the magneto breaker points are closed.

NOTE

If crankshaft is backed up too far, the mag-

neto impulse coupling latches will engage. This will cause retarded breaker point opening when the crankshaft is rotated forward. Disengage the latches by rotating crankshaft 720° opposite normal rotation (to position the crankshaft at its advance firing angle for No. 1 cylinder).

Rotate crankshaft in direction of normal rotation until breaker points are just opening, (as indicated by timing light). The crankshaft should be at the advance firing angle for No. 1 cylinder as the magneto breaker points are just opening. Corrections for timing should be made by rotating the magnetos slightly. (Clockwise to advance timing and anti-clockwise to retard timing.)

CAUTION

Do not adjust breaker points to compensate for ignition timing. Breaker point adjustment is for internal magneto timing only. If used to compensate for ignition timing, weak sparking with consequent reduced engine performance will result.

6. When ignition timing is complete (breaker point opening of both magnetos synchronized at 24° B.T.C.), tighten magneto clamp nuts to prevent any further movement of the magnetos.

7. Remove timing devices from the magnetos and engine.

8. Replace the spark plugs.

9. Complete the installation in accordance with paragraph 4-44.

4-46. IGNITION SWITCHES.

4-47. Each of the four magneto ground circuits is controlled by a two position toggle switch. These switches are located in the center of the left hand switch panel just above the red-ringed starter buttons. Directly above the switches is a switch bar which allows them to be turned off simultaneously if desired. A ground bus bar is connected to one terminal of each switch. These connections are shielded by an ignition switch shielding assembly at the rear of the switch panel.

NOTE

To aid in trouble shooting, it should be remembered that when these ignition switches are ON, the magneto grounding circuits are open and any circuit checks should be conducted accordingly.

For removal and installation of ignition switches see paragraph 6-67 and 6-68.

4-48. IGNITION HARNESS. (See figure 4-7, for schematic wiring diagram.)

4-49. 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.

4-50. REMOVAL OF IGNITION CABLES. The ignition cables connected to the upper spark plugs of No. 2 and No. 4 cylinders and those connected to the upper spark plugs of No. 3 and No. 5 cylinders are clamped together by a riveted bracket. Each of these

pairs of cables must be removed as a unit. Any of the other cables can be removed individually.

a. Remove engine cowling in accordance with paragraph 4-3.

b. To remove any ignition cable:

1. Detach the cable elbow from the spark plug and withdraw the contactor from the spark plug barrel.

2. Loosen the cable ferrule coupling nut at the magneto high tension outlet plate.

3. Remove the outlet plate attachment screws, and pull the plate, with plate grommet attached, from the magneto.

4. Remove the slotted-head screw and brass washer from plate grommet boss which is in line with

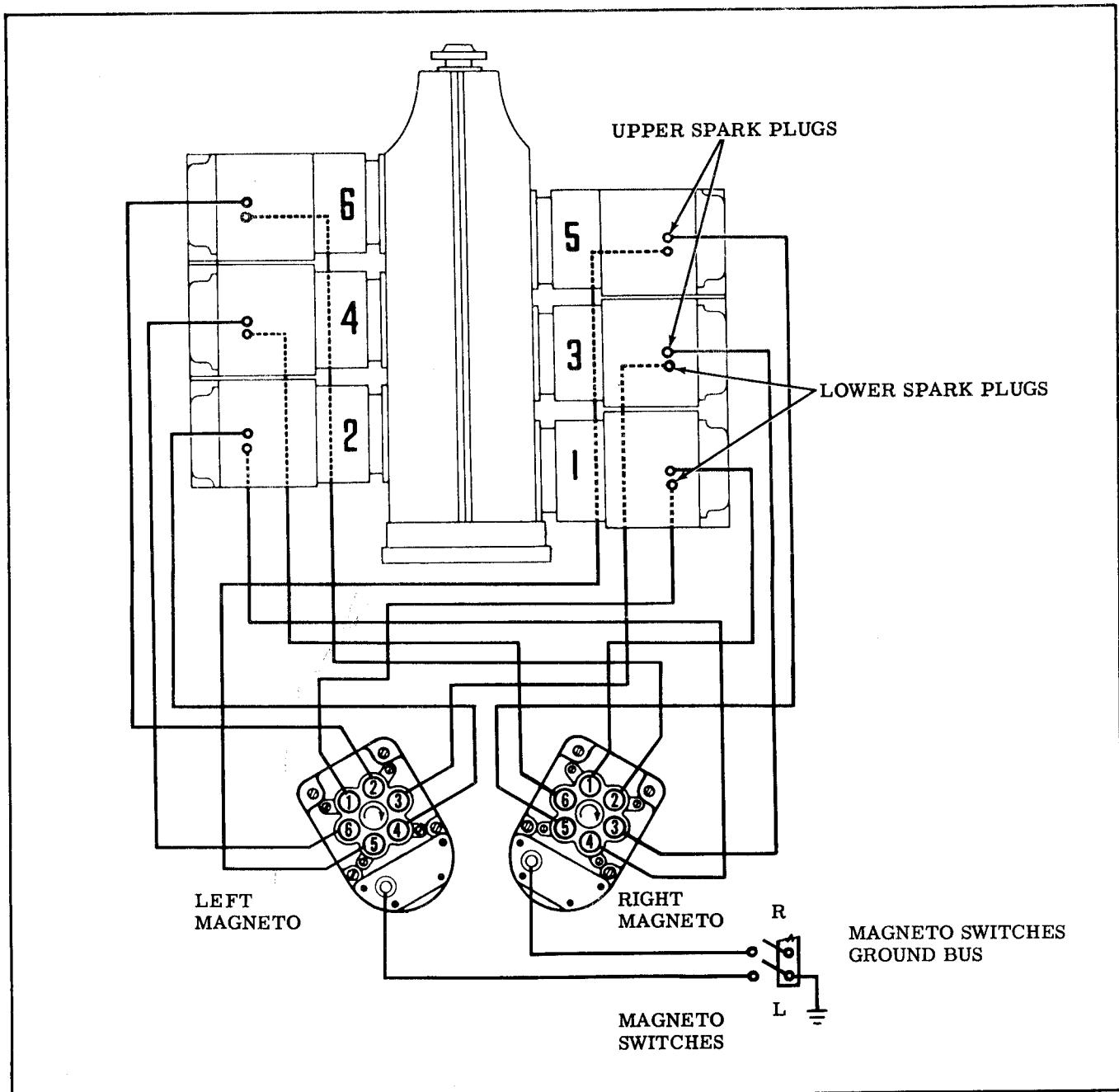


Figure 4-7. Ignition System

the cable to be detached. Withdraw the cable end.

5. If it is a lower spark plug cable, detach the clip from the six-cable clamp attached to the crankcase (upper spark plug cables will be free when detached from the magneto high tension outlet plate).

4-51. DISASSEMBLY, CLEANING & INSPECTION OF IGNITION CABLES.

a. The terminal sleeves can be removed from the individual cables by bending the wire strands of the cable ends straight where they protrude through the contactor and withdrawing the cable from the sleeve. The insides of the sleeves should be cleaned by wiping with a clean dry cloth wrapped around a suitable dowel rod.

NOTE

Terminal sleeves should be handled only with clean, dry hands.

b. To remove the elbow from the spark plug end of the cable the terminal sleeve must first be removed. Loosen the coupling nut which fastens the metal shielding to the elbow and withdraw the elbow from the cable. The inside of the elbow should be wiped clean and dry with a clean cloth.

c. To assemble the elbow to the cable, coat the cable end with DC-4 Silicone compound to aid in assembly and to help prevent moisture condensation inside the elbow. Insert the cable end through the elbow and attach the elbow to the metal shielding by tightening the coupling nut.

d. To install a new terminal sleeve, first cut away the cable insulation to expose approximately one-quarter inch of wire strands. Coat the cable end with DC-4 Silicone compound to aid in assembly and to help prevent moisture condensation inside the sleeve. Insert the cable into the sleeve so that the bare wires are exposed through the contactor. Carefully bend the wires outward, and downward to make a firm contact with the contactor base.

e. Inspect the cable for damaged insulation, particularly at the section around the elbows. Replace the cable if the insulation shows any evidence of deterioration. Cracked or broken terminal sleeves should be replaced.

4-52. INSTALLATION OF IGNITION CABLES. If a new cable is being installed, check it for correct length by comparing it with the cable which is being replaced. All cables can be installed in the same manner.

a. Connect cable to magneto high tension outlet.

1. Insert 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 end of cable in place with cable piercing screw and brass washer. Do not over tighten screw.

3. Attach high tension outlet plate, with grommet and cables in place, to the magneto with four attachment screws.

4. Tighten ferrule coupling nut.

b. If a lower spark plug cable is being installed, attach it to the six-cable clamp which is fastened to the engine crankcase (upper spark plug cables are not

fastened by this clamp).

c. Route cable to spark plug and insert terminal sleeve into spark plug barrel. Tighten cable elbow coupling nut.

d. Replace engine cowling in accordance with paragraph 4-5.

4-53. SPARK PLUGS.

4-54. 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.

Carburetor Equipped Engines:

Champion	RC26S
AC	S86R
AC Platinum Point	SR83P
BG Platinum Point	RB485S

For Use With High Temperature

Waterproof Ignition Harness:

AC	HSR86
Champion	RHM40E

Fuel Injection Equipped Engines:

AC	HSR86L
Champion	RHB37N

The correct gap setting is .015 to .018 inch. Torque spark plugs to 350 lb-in. ± 30 .

4-55. REMOVAL OF SPARK PLUGS.

a. To remove any spark plug, loosen the coupling nut on the ignition cable elbow 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.

4-56. 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 prac-

tice 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.

4-57. INDUCTION SYSTEM.

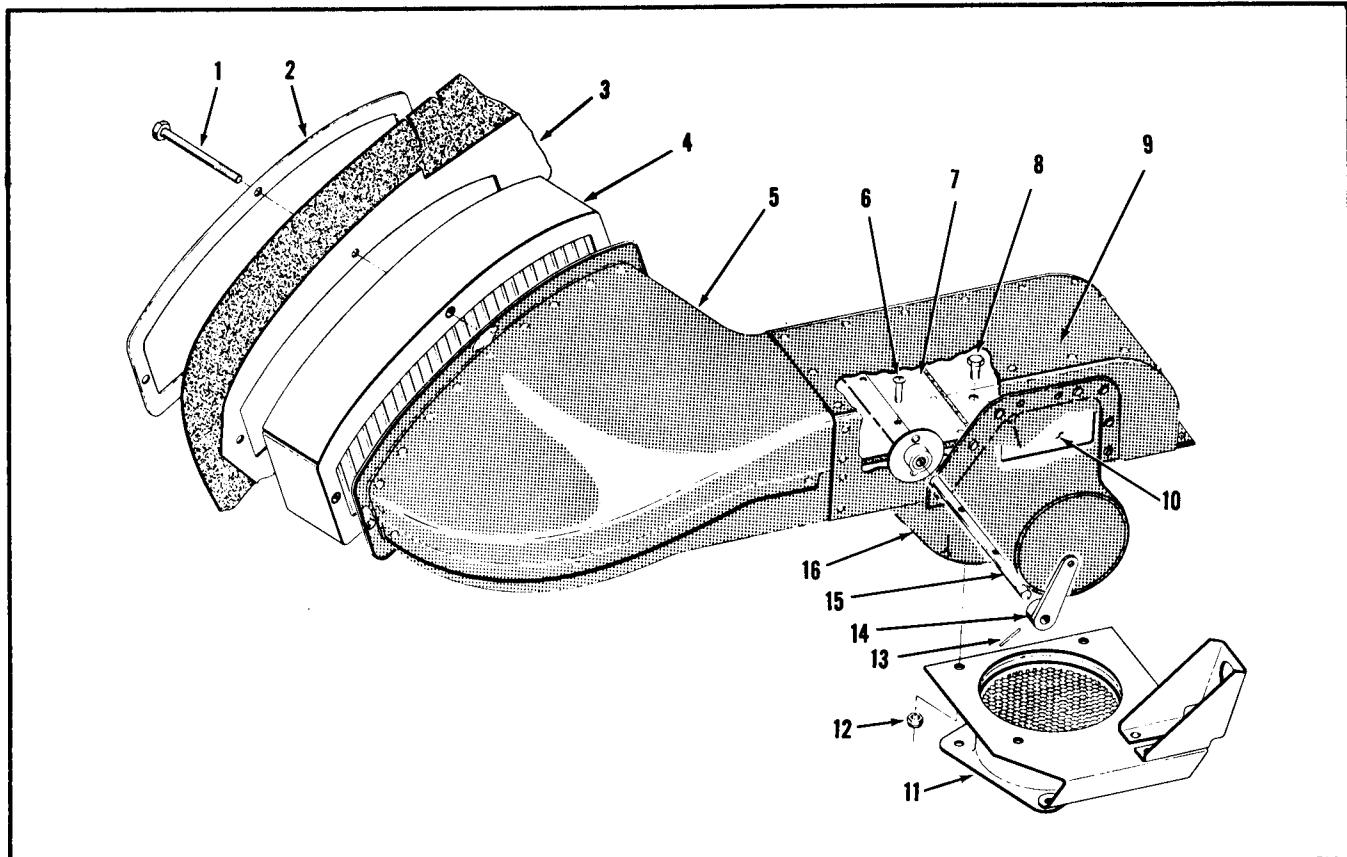
4-58. The induction system for each engine on this airplane utilizes ram air for more efficient engine operation and is designed to minimize the possibility of icing difficulties. Ram air passes through a filter located at the left rear engine baffle, goes through a

duct into the carburetor air box and through a screen into the carburetor. A down draft Stromberg pressure-type carburetor is mounted at the rear of the engine and manifold piping distributes the fuel/air mixture from the carburetor to the cylinder intake ports. Manifold drain valves are installed in the bottom of the manifold riser casting below the carburetor, and at the center of a balance tube at the front of the engine. The balance tube connects the right hand and left hand assemblies of manifold piping.

4-59. CARBURETOR AIR BOX ASSEMBLIES.

4-60. The carburetor air box assemblies are mounted between the left aft engine baffles and the carburetors and are designed to direct filtered air to the carburetors. Each has a cockpit controlled alternate air valve which closes off the filtered air supply and draws warm air from a shroud mounted on the left exhaust stack. The warm air is directed to the carburetor air box by a flexible tube and enters the air box through two spring loaded air doors.

4-61. REMOVAL OF CARBURETOR AIR BOX. (Refer to paragraph 4-10, step "f. ")



- | | | |
|---------------------------|------------------------|-----------------------------|
| 1. Bolt | 6. Screw | 12. Nut |
| 2. Stiffener | 7. Alternate Air Valve | 13. Roll Pin |
| 3. Left Aft Engine Baffle | 8. Bolt | 14. Actuating Arm |
| 4. Carburetor Air Filter | 9. Air Box | 15. Actuating Shaft |
| 5. Duct | 10. Air Door | 16. Carburetor Heat Adapter |
| | 11. Air Box Throat | |

Figure 4-8. Carburetor Air Box Assembly

4-62. DISASSEMBLY OF A CARBURETOR AIR BOX.

(See figure 4-8.)

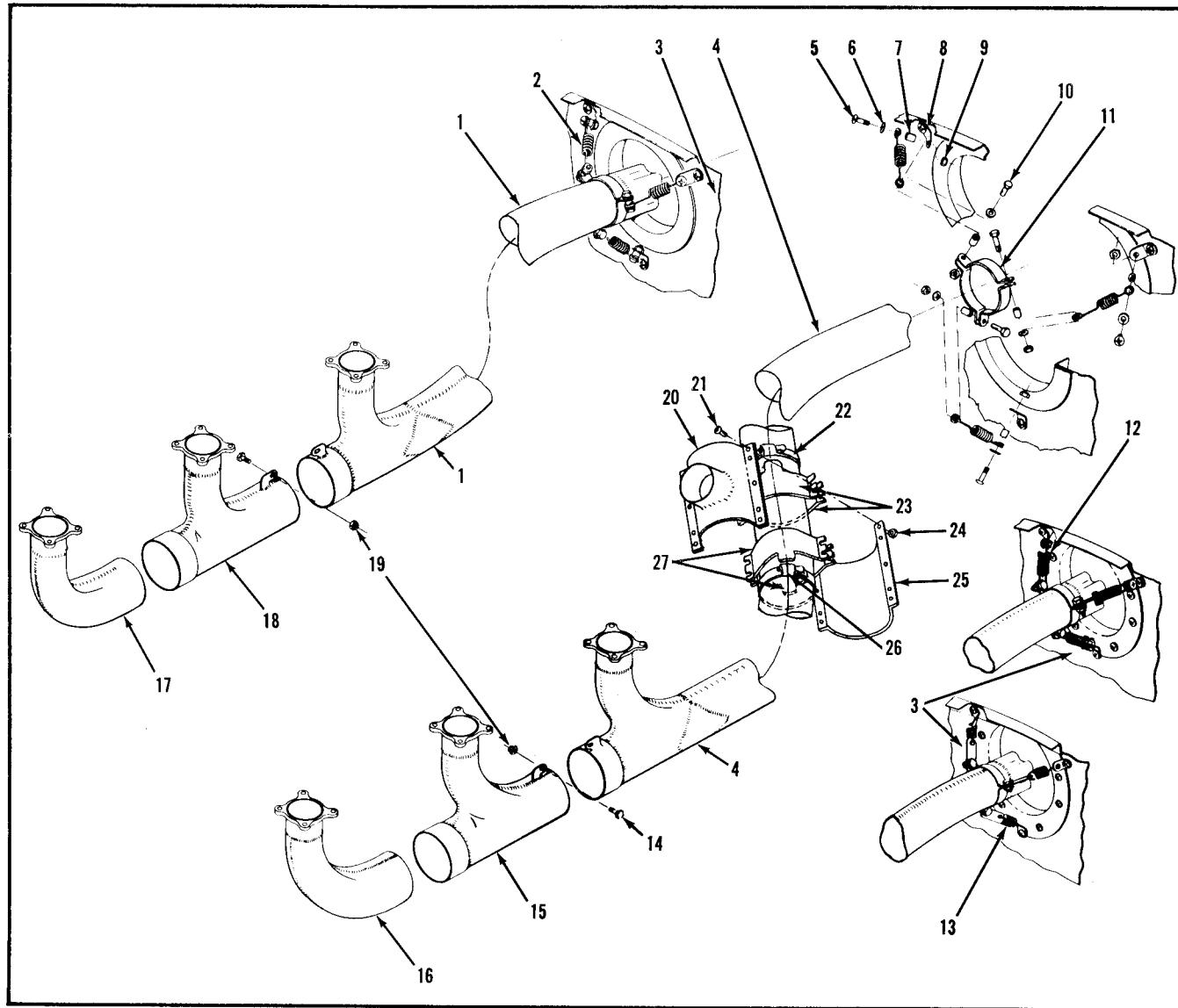
a. To remove air box throat (11) remove four attaching bolts (8) and nuts (12). Access to bolts is through air doors (10).

b. To remove alternate air valve (7) remove two screws (6) attaching air valve (7) to actuating shaft (15). Pull actuating shaft (15) from air box (9) and remove air valve (7) through large end of air box.

c. To remove actuating arm (14) from actuating

shaft (15) punch out roll pin (13).

4-63. CLEANING AND INSPECTION OF CARBURETOR AIR BOXES. Clean all metal parts with a suitable solvent, and inspect for cracks or dents. Minor cracks in the air boxes may be stop drilled. In cases of continued or severe cracking, replace air box. Cracks in an alternate air valve will necessitate its replacement as failure in flight could lead to engine failure by obstructing air flow through the carburetor.



- | | | |
|---|---|--|
| 1. Aft Riser and Exhaust Stack Assembly (Right) | 10. Bolt | 18. Exhaust Stack Riser (Center Right) |
| 2. Centering Spring | 11. Clamp | 19. Nut |
| 3. Firewall | 12. Centering Assembly | 20. Upper Shroud Half |
| 4. Aft Riser and Exhaust Stack Assembly (Left) | 13. Centering Assembly | 21. Screw |
| 5. Screw | 14. Bolt | 22. Aft Clamp |
| 6. Washer | 15. Exhaust Stack Riser (Center Left) | 23. Aft Shroud Supports |
| 7. Spacer | 16. Exhaust Stack Riser (Forward Left) | 24. Nut |
| 8. Bracket | 17. Exhaust Stack Riser (Forward Right) | 25. Lower Shroud Half |
| 9. Nut | | 26. Forward Clamp |
| | | 27. Forward Shroud Supports |

Figure 4-9. Exhaust Stacks

Replace an alternate air valve seal if damaged. If the honeycomb element of an air box throat is damaged or loose, the air box throat should be replaced.

4-64. ASSEMBLY OF A CARBURETOR AIR BOX. (See figure 4-8.)

- a. Install actuating arm (14) on actuating shaft (15) and secure with roll pin (13).
- b. Insert alternate air valve (7) through large end of air box (9) and install actuating shaft (15) attaching air valve (7) to actuating shaft with two screws (6).
- c. Install air box throat (11) on air box (9) with four bolts (8) and nuts (12).

4-65. INSTALLATION OF A CARBURETOR AIR BOX. (Refer to paragraph 4-12, step "u.")

4-66. CARBURETOR AIR FILTERS.

4-67. The air maze filters remove dust particles from the ram air by collecting them on the oil coated filtering units. To insure maximum engine protection these filters should be maintained as prescribed. (See paragraph 1-43.)

4-68. REMOVAL OF A CARBURETOR AIR FILTER. (See figure 4-8.) To remove carburetor air filter (4) remove four bolts (1) securing filter between left aft engine baffle (3) and carburetor air duct (5).

4-69. CLEANING OF A CARBURETOR AIR FILTER. Refer to paragraph 1-43 for proper cleaning and servicing of filter unit.

4-70. INSTALLATION OF A CARBURETOR AIR FILTER. (See figure 4-8.) Install carburetor air filter (4) between left aft engine baffle (3) and carburetor air duct (5) with four attaching bolts (1), making sure that stiffener (2) is in place.

4-71. ENGINE EXHAUST SYSTEM.

4-72. The exhaust system consists of two exhaust stack assemblies, one for each side of the engine. Each cylinder has a riser pipe attached to its exhaust port. The three risers at each side of the engine are joined together into a common pipe to form a stack assembly. These assemblies are routed aft under the engine cylinders and pass beneath the rear engine baffles, upwards over the canted bulkhead to the firewall. Each is supported at the firewall by three centering springs. From the firewall the exhaust gases are expelled overboard at the trailing edge of the wing by augmenter tubes.

4-73. REMOVAL OF EXHAUST STACK ASSEMBLIES. (See figure 4-9.) Due to the clean lines and closely fitted cowling of the Model 310 Airplane, some difficulty may be encountered in removing an exhaust stack assembly while the engine is in place.

- a. Remove carburetor heat shroud as follows:
 1. Remove flexible tube from shroud half (20).
 2. Remove the ten screws (21) and nuts (24) securing the shroud halves (20 and 25).
 3. Remove shroud halves (20 and 25).
 4. Remove clamps (22 and 26) and remove shroud supports (23 and 27).

- b. Remove exhaust stack assembly centering springs (2) by removing attaching bolts (10) and screws (5).
- c. Disconnect center risers (15 and 18) from aft risers by removing attaching bolts (14).
- d. Remove nuts holding each riser to its cylinder.
- e. Work risers down and free of cylinder studs. Separate risers if necessary and remove from nacelle.

NOTE

If difficulty is encountered in removing an exhaust stack assembly, follow the engine removal procedure in paragraph 4-9 to raise the engine from its mounts far enough to provide the necessary clearance.

4-74. INSPECTION OF EXHAUST STACK ASSEMBLIES.

Visually inspect each exhaust stack assembly for evidence of cracks. Pay particular attention to the weld areas where the risers join the flanges and to the weld areas along the risers to the exhaust pipe. Check centering springs and bolts for wear at points of contact. Replace all worn parts. Any welded repairs to cracks should be made in accordance with accepted practice and applicable regulations.

4-75. INSTALLATION OF EXHAUST STACK ASSEMBLIES. (See figure 4-9.)

- a. Assemble and install the exhaust stack assemblies on each engine using one copper asbestos gasket between each riser and its mounting pad on the cylinder.
- b. Install four nuts on cylinder studs at each riser.
- c. Install bolts (14) which attach center risers (15 and 18) to aft risers (1 and 4).

CAUTION

Do not over tighten bolts and nuts (14 and 19). It should be possible to rotate the bolts by hand after tightening to provide clearance for thermal expansion of the stack assembly.

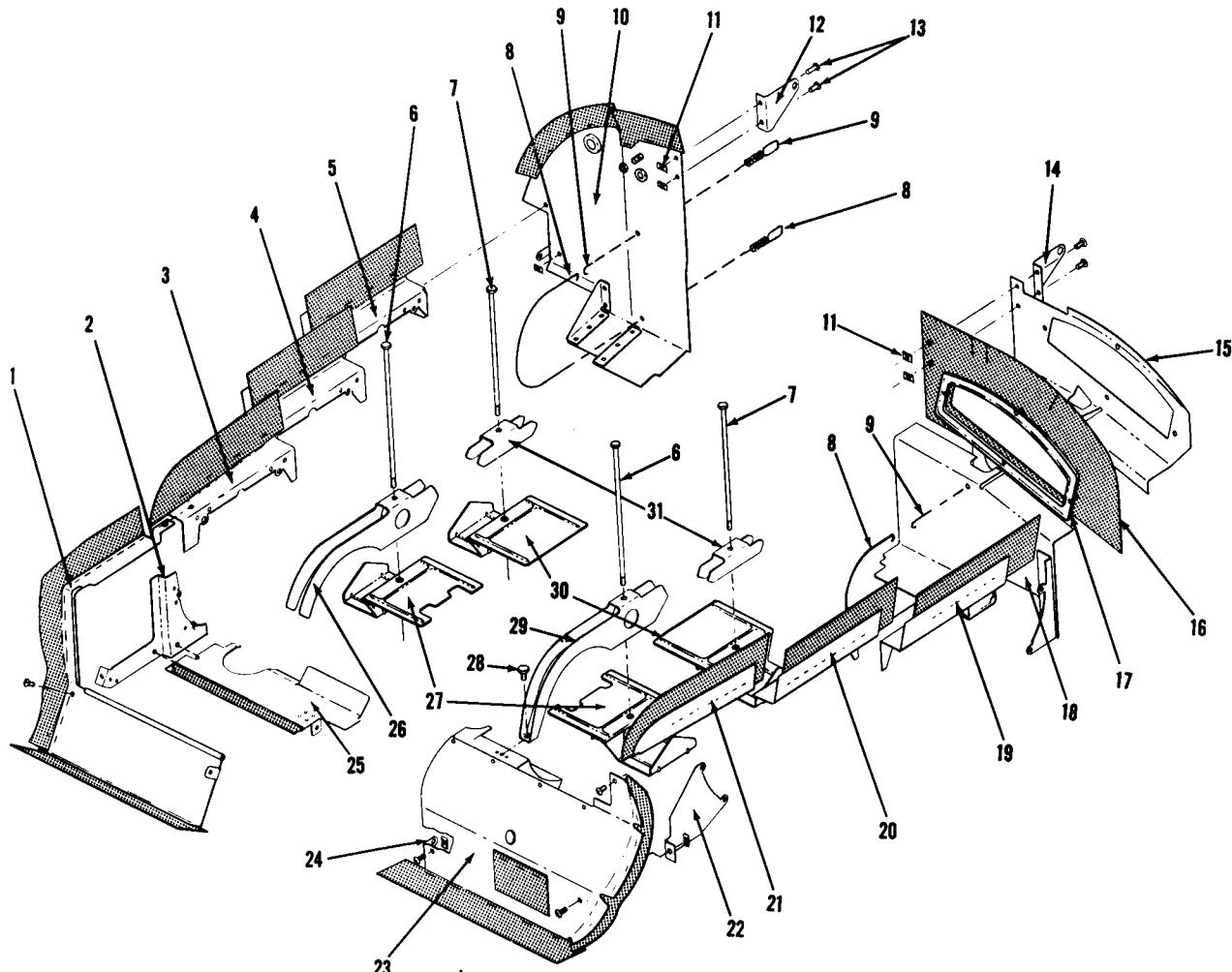
- d. Install exhaust stack assembly centering springs (2) as illustrated.

e. Install carburetor heat shroud on left exhaust stack as follows:

1. Place shroud halves (20 and 25) around the exhaust stack and start the screws (21) on one side only. Do not tighten.
2. Install shroud supports (23 and 27) using the two end screws on each end of the shroud.
3. Install remaining screws (21) in shroud.
4. Position shroud on exhaust stack and tighten screws (21). Install clamps (22 and 26) and tighten.
5. Install flexible tube from carburetor air box to carburetor heat shroud.

4-76. ENGINE BAFFLES.

4-77. The sheet metal baffles installed on each engine direct the flow of incoming, cooling air around the cylinders and other engine components. These baffles incorporate rubber-asbestos composition seals at points of contact with the inside of the nacelle skin to help confine and direct the air flow to the desired area.



- | | | |
|---------------------------------|--------------------------------|---------------------------------------|
| 1. Forward Oil Cooler Baffle | 12. Support Bracket | 24. Support Tab |
| 2. Support Bracket | 13. Screws | 25. Aft Oil Cooler Baffle |
| 3. Forward Right Baffle | 14. Support Bracket | 26. Forward Right Intercylinder |
| 4. Center Right Baffle | 15. Upper Rear Baffle | Baffle Support |
| 5. Aft Right Baffle | 16. Seal | 27. Forward Intercylinder Baffle |
| 6. Bolt | 17. Stiffener | Assembly |
| 7. Bolt | 18. Lower Rear Baffle | 28. Bolt |
| 8. Rear Baffle Fastener (Lower) | 19. Left Aft Baffle | 29. Forward Left Intercylinder |
| 9. Rear Baffle Fastener (Upper) | 20. Center Left Baffle | Baffle Support |
| 10. Right Rear Engine Baffle | 21. Forward Left Baffle | 30. Aft Intercylinder Baffle Assembly |
| 11. Tinnerman Nut | 22. Support Bracket | 31. Aft Intercylinder Baffle Support |
| | 23. Forward Left Engine Baffle | |

Figure 4-10. Engine Baffles

4-78. REMOVAL OF ENGINE BAFFLES. (See figure 4-10.)

- Remove engine cowling accordance with paragraph 4-3.
- To remove right and left baffles (3, 4, 5, 19, 20, and 21) remove the cylinder rocker box cover screws and other screws and nuts with which they are attached.
- To remove the oil cooler baffles (1 and 25), remove the four attaching screws and nuts and two oil

cooler mounting bolts which hold them in place.

d. To remove the forward left engine baffle (23), remove the three screws and nuts, and bolt (28) with which it is attached.

e. To remove the forward intercylinder baffle assemblies (27) and supports (26 and 29), first detach the primer line clamps which are attached to the supports, then remove the bolts (6 and 28) and lift out the supports. Carefully work the baffles (27) free of the

cylinders.

- f. To remove the aft intercylinder baffle assemblies (30) and supports (31), remove the bolts (7). Lift out the supports and work the baffles free.

NOTE

The intercylinder baffle assemblies separate into two sections to facilitate removal and installation. However, due to the close fit, considerable manipulation may be required to work them free.

- g. To remove the upper and lower left rear baffles (15 and 18) and seal (16):
 1. Remove stiffener (17) and carburetor air filter by removing the four air filter mounting bolts.
 2. Remove the generator in accordance with paragraph 6-24.
 3. Disconnect the rear baffle fasteners (8 and 9) and work the lower fastener free of the cylinder.
 4. Remove the two rocker box cover screws, and screws and nuts (11) which hold the baffle assembly in place. Work the assembly free.
 5. Remove five screws to separate the upper and lower baffle sections.

NOTE

The upper baffle (15) can be removed separately by removing the screws attaching it to the support bracket (14) and to the lower baffle (18).

- h. To remove the right rear engine baffle (10):
 1. Disconnect the primer line from the baffle connector.
 2. Disconnect the magneto ground wires and withdraw them aft, through the baffle.
 3. Remove the crankcase breather line in accordance with paragraph 4-10, step "l".
 4. Detach the starter cable and remove the starter by removing the two mounting nuts and washers, and pulling it straight outward.
 5. Disconnect the rear baffle fasteners (8 and 9) and work the lower fastener free of the cylinder.
 6. Remove attaching screws and nuts and work baffle (10) free.
 i. Mounting brackets (2 and 22) can be removed by removing the cylinder rocker box cover screws with which they are attached.
 j. Remove support tab (24) by removing the propeller governor mounting nut and washers with which it is attached.
 k. To remove the rear baffle support brackets (12 and 14), the aft upper crankcase through-bolt must be removed.

CAUTION

In removing upper crankcase through-bolt use care to prevent damaging the O-ring seals installed on the bolt.

- 4-79. 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 torn seals. Replace defective parts.

4-80. INSTALLATION OF ENGINE BAFFLES. (See figure 4-10.)

- a. To install the upper rear support brackets (12 and 13), remove the upper crankcase through-bolt.

CAUTION

If the through-bolt O-ring seals are damaged during removal, they must be replaced. Oil the bolt and work the seals carefully over the threads when installing.

Using the aft upper crankcase through-bolt and nut, attach the support brackets to the engine in the position illustrated.

- b. Install support tab (24) on forward lower propeller governor mounting stud with governor mounting nut and washers.
 c. Install mounting brackets (2 and 22) with cylinder rocker box cover screws.
 d. To install the right rear engine baffle (10) the starter must first be removed from the engine.
 1. Work baffle (10) carefully into place as illustrated. Attach to bracket (12) with screws (13) and nuts (11). Attach to cylinder head with cylinder rocker box cover screw.
 2. Work lower fastener (8) into place around cylinder and attach to upper fastener (9).
 3. Install starter and starter cable. Install crankcase breather line, primer line, and attach magneto ground wires.
 e. To install upper and lower rear baffles (15 and 18) and seal (16) the generator must first be removed from the engine.
 1. Place lower baffle (18) carefully into position. Work lower fastener (8) into place around cylinder and attach to upper fastener (9). Attach baffle to cylinder head with two rocker box cover screws.
 2. Work upper baffle (15) into position with seal (16) in place as illustrated. Attach seal and baffle to bracket (14) with screws and nuts (11). Attach to lower baffle (18) with five screws and nuts.

NOTE

The upper and lower baffle (15 and 18) and seal (16) may be installed as an assembly. Assemble upper and lower baffle and seal, with five screws and nuts. Install assembly in same manner as described in sub-paragraph "e".

3. Install generator in accordance with paragraph 6-30.
 4. Install stiffener (17) and carburetor air filter with the four air filter attachment bolts.
 f. To install the aft intercylinder baffles (30), set the supports (31) in place. Work the baffles into po-

sition between the center and aft cylinders and install the bolts (7). The aft end of the left hand primer line support bracket should be attached with the left bolt.

g. To install the forward intercylinder baffles (27) set the supports (26 and 29) in place. Work the baffles into position between the forward and center cylinders, and install the bolts (6), attaching the primer line support brackets in place at the same time.

NOTE

The intercylinder baffle assemblies separate into two sections to facilitate removal and installation. However, due to the close fit, considerable manipulation may be required to work them into position.

Attach the primer lines and clamps in place on the support brackets.

h. Position the forward left engine baffle (23) as illustrated. Fasten in place with screws and nuts, and bolt (28).

i. To install the oil cooler baffles (1 and 25), first remove the lower forward and lower aft oil cooler attachment bolts. Position the baffles as illustrated and fasten in place with the oil cooler attachment bolts. Fasten with screws and nuts to the baffle support bracket (2).

j. Fasten right and left baffles (3, 4, 5, 19, 20, and 21)

in place with cylinder rocker box cover screws. Attach baffles (1, 10, and 23) to baffles (3, 5, and 21) with screws and nuts.

k. Inspect completed installation for loose or missing bolts and screws.

l. Replace engine cowling in accordance with paragraph 4-5.

4-81. FUEL SYSTEM. (See figure 4-11.)

4-82. The fuel supply is contained in two rubberized fuel bladders, one located in each wing tip tank. The total fuel capacity of each bladder is 51 gallons, of which 50.5 gallons is useable. An electrically operated boost pump is incorporated in each fuel tank which is used as an emergency pump and to provide fuel pressure for engine priming and starting. From the boost pumps, fuel is fed to selector valves located in the wings, through the fuel strainers and engine-driven fuel pumps to the pressure carburetors. A vapor return line is installed between each carburetor inlet chamber and the respective fuel bladder. The vapor return lines return unused fuel from the pressure carburetors to the fuel bladders. Quick drain valves are provided in each wing tip tank and in each fuel strainer to facilitate draining of water or sediment. Use extreme care in the application of thread lubricant, on all fittings, to prevent entry of the lubricant into the fuel system.

4-83. TROUBLE SHOOTING THE FUEL SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO INDICATION ON FUEL QUANTITY GAGE.	Fuel tank empty. Fuel quantity indicator circuit breaker open. Loose connections or open circuit. Defective fuel quantity indicator. Defective fuel quantity sending unit.	Fill tank with correct grade of fuel. Reset circuit breaker. Tighten connections, check wiring circuit and repair. Replace fuel quantity indicator. Replace fuel quantity sending unit.
FUEL DRIPS FROM UNDERSIDE OF NACELLE.	Mixture lever left in FULL RICH. Mixture lever not in IDLE CUT-OFF due to improper linkage adjustment. Dirt or foreign matter in poppet valve. Broken fuel line or loose fitting.	Place mixture lever in IDLE CUT-OFF. Adjust linkage in accordance with paragraph 4-162. Clean poppet valve seat as described in paragraph 4-89. Check fuel lines, tighten fitting.
FUEL BOOST PUMP FAILS TO OPERATE.	Battery switch not ON. Circuit breaker open. Open circuit or loose connections. Defective fuel boost pump.	Place battery switch ON. Reset circuit breaker. Check circuit and repair. Replace fuel boost pump.

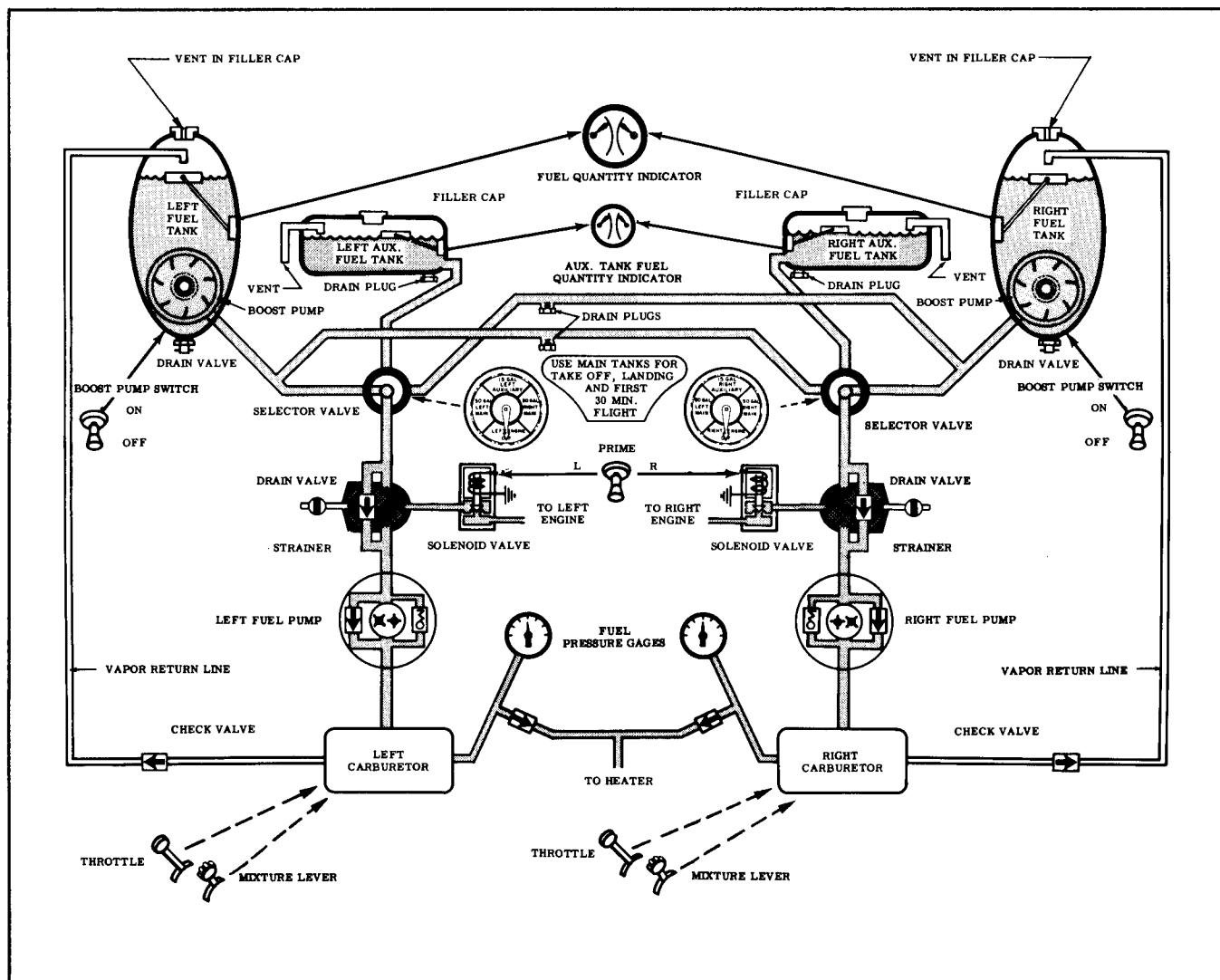
TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START OR CONTINUE TO RUN AFTER STARTING.	Fuel tank empty. Fuel selector valve in OFF position. Mixture lever in IDLE CUT-OFF. Engine insufficiently primed. Engine overprimed. Dirty and restricted fuel strainer. Dirty carburetor fuel screen. Clogged fuel line. Plugged fuel cap vent. Insufficient fuel pressure. Bypass valve in engine driven fuel pump not operating.	Fill tank with correct grade of fuel. Move fuel selector valve handle to ON position. Move mixture lever to FULL RICH. Refer to Pilots Check List. Place mixture lever in IDLE CUT-OFF and turn engine over several revolutions with throttle WIDE OPEN. Clean fuel strainer. Clean carburetor fuel screen. Clean all fuel lines. Clean vent. Check fuel strainer. Check fuel pump adjustment. Replace engine driven fuel pump.
ROUGH IDLING.	Idle mixture too rich. Idle mixture too lean. Insufficient fuel pressure. Air leaks in manifolds or intake pipes.	See paragraph 4-87. See paragraph 4-87. Check fuel strainer. Check pump pressure adjustment. Check carburetor fuel screen. Check with soapy water or oil.
LOW FUEL PRESSURE.	Engine driven fuel pump relief valve improperly set. Partially clogged carburetor fuel screen.	Adjust relief valve setting. Clean carburetor fuel screen.
ENGINE RUNS TOO LEAN AT CRUISING POWER.	Fuel pressure too low. Carburetor malfunction.	See "LOW FUEL PRESSURE". See paragraph 4-87.
ENGINE RUNS TOO RICH AT CRUISING POWER.	Alternate air control in the HEAT position. Restriction in air intake passages. Carburetor improperly adjusted or carburetor malfunction.	Place alternate air control in the COLD AIR position. Clear air intake passages. See paragraph 4-87.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT SHUT OFF IN IDLE CUT-OFF	Control linkage improperly rigged. Fuel leakage through primer solenoid valve.	See paragraph 4-162. Check primer solenoid valve.

4-84. MAINTENANCE INSTRUCTIONS FOR THE FUEL SYSTEM. For instructions pertaining to fuel system drains, see Servicing Chart, figure 1-5. Clean and inspect fuel strainers in accordance with paragraph 4-101. Periodically remove fuel strainer screens from carburetors by removing the large plugs near carburetor supply hose inlet fittings and clean thoroughly with unleaded gasoline and compressed air. Safety wire the plugs when reinstalling the screens and plugs in the carburetors.

4-85. CARBURETORS.

4-86. Each carburetor is mounted on top of the intake manifold directly behind the engine and is bracketed to the engine. They are Stromberg down draft, single barrel pressure type carburetors incorporating manually operated enrichment valves. The principal purpose of the carburetors is to meter fuel accurately in proportion to the amount of air being utilized by the engine.



CODE

FUEL
VAPOR RETURN LINE

→ MECHANICAL ACTUATION
→ ELECTRICAL ACTUATION

□ PRESSURE RELIEF VALVE
→ CHECK VALVE

Figure 4-11. Fuel System Diagram

4-87. TROUBLE SHOOTING THE CARBURETORS.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START OR CONTINUE TO RUN AFTER STARTING.	No fuel in carburetor. Mixture control arm on carburetor in the wrong position.	Fill tank with correct grade of fuel. Check control linkage.
IDLE TOO RICH.	Improper idle adjustment. Leaking poppet valve. Leaking discharge nozzle. Leaking accelerating pump diaphragm.	See paragraph 4-91 for adjustment procedure. Flush regulator chamber as described in paragraph 4-89. Overhaul carburetor. Remove the pump cover and inspect.
IDLE TOO LEAN.	Control linkage improperly rigged. Improper idle adjustment.	See paragraph 4-162. See paragraph 4-91.
ENGINE RUNS TOO LEAN AT CRUISING POWER.	Air leaks into suction side of air diaphragm. Foreign material in main metering jet. Restriction missing from vapor vent connection in carburetor. Plugs loose or missing.	Overhaul carburetor. Check by removing jet plug in regulator cover. Disconnect vapor return hose and check. Check all 1/8 inch and taper seat plugs for tightness.
ENGINE RUNS TOO RICH AT CRUISING POWER.	Mixture control arm on carburetor in the wrong position.	Check control linkage
ENGINE RUNS TOO LEAN OR TOO RICH AT TAKE-OFF OR RATED POWER, BUT SATISFACTORY AT CRUISING POWER.	Improper fuel pressure. Incorrect jet installed.	Check gage and clean strainer if pressure will not rise when fuel boost pump is operated. Check by removing jet plug in regulator cover.
ENGINE RUNS TOO LEAN OR TOO RICH AT TAKE-OFF OR RATED POWER, BUT SATISFACTORY AT CRUISING POWER.	Power enrichment and idle needle not opening properly.	Remove housing and check.
ENGINE DOES NOT ACCELERATE PROPERLY BUT RUNS SATISFACTORY WITH SLOW THROTTLE MOVEMENTS.	Idle setting too lean. Suction hole to air side of accelerating pump diaphragm closed. Pump spring broken or weak. Punctured pump diaphragm.	See paragraph 4-91. Remove pump cover and check to see that the channels are properly aligned and open. Remove pump cover and inspect. Remove pump cover and inspect.

TROUBLE	PROBABLE CAUSE	CORRECTION
SLUGGISH OPERATION AND LOW POWER.	Fuel/air mixture too rich or too lean.	See applicable headings under "TROUBLE" column or remove and overhaul carburetor.
ENGINE DOES NOT SHUT OFF IN "IDLE CUT-OFF"	Leaking poppet valve. Mechanism does not permit poppet valve to close completely. Linkage does not permit the cut-off lever on carburetor full travel into IDLE CUT-OFF position.	Flush regulator chamber as described in paragraph 4-89. Overhaul carburetor. Check linkage for full travel.

4-88. REMOVAL OF CARBUREATORS. Either carburetor can be removed as follows:

- a. Place fuel selector valve handles in BOTH OFF position.
- b. Remove engine cowling in accordance with paragraph 4-3.
- c. Remove carburetor air box assembly in accordance with paragraph 4-10, step "f."
- d. Disconnect throttle control sliding end from throttle arm by removing the attaching bolt.
- e. Disconnect mixture control sliding end from mixture control arm by removing the attaching bolt.
- f. Disconnect the three hoses attached to the carburetor.
- g. Rotate the bracket on the carburetor support assembly upward clear of the carburetor top.
- h. Remove the four nuts, plain washers and internal tooth lockwashers securing the carburetor to the manifold riser. Lift carburetor from attaching studs.

4-89. CLEANING AND INSPECTION OF CARBUREATORS. To check either carburetor:

- a. Inspect carburetor for stains and discoloration indicating leaking plugs, fittings, gaskets, etc. Tighten or replace plugs, fittings, and gaskets as necessary. If a carburetor is leaking at the safetied and sealed portion, replace carburetor.
- b. Clean carburetor exterior thoroughly with clean unleaded gasoline.

CAUTION

Do not apply air pressure to an assembled carburetor; high air pressure will rupture the diaphragms.

- c. Cut safety wire free from poppet valve plug, fuel strainer plug and drain plug.
- d. Remove fuel strainer screen by removing fuel strainer plug and gasket.
- e. Remove poppet valve and spring by removing poppet valve plug and gasket.
- f. Remove drain plug from regulator cover.
- g. Flush regulator chamber with clean unleaded gasoline.
- h. Clean dirt or other foreign matter from the poppet valve seat with a clean lint free cloth.

CAUTION

Do not force a wire into the poppet valve seat or use any abrasive to clean the poppet valve or seat. These two parts are a matched assembly and any scratches will cause malfunction.

- i. Install poppet valve, spring, new gasket and poppet valve plug.
- j. Install fuel strainer screen, new gasket and fuel strainer plug.
- k. Install drain plug in regulator cover.
- l. Secure poppet valve plug, fuel strainer plug and drain plug, with safety wire.
- m. Check all nuts, safety wire and cotter pins for security.

4-90. INSTALLATION OF CARBUREATORS.

Either carburetor can be installed as follows:

- a. Position carburetor on manifold riser with throttle arm facing to the left.
- b. Secure carburetor to manifold riser with four plain washers, four internal tooth lockwashers and four nuts.
- c. Connect carburetor supply hose to inlet port fitting of carburetor, fuel pressure hose to pressure port fitting of carburetor, and vapor return hose to vapor port fitting of carburetor. (Use a suitable thread lubricant on the male threads of all fittings.)
- d. Attach and rig control sliding ends to throttle arm and mixture control arm in accordance with paragraphs 4-161 and 4-162.

NOTE

If a new carburetor has been installed, or the previous one drained, the procedure in step "e," should be followed to fill, flush, and vent the carburetor, and to soak the diaphragms.

- e. To fill, flush and vent a newly installed carburetor:
 1. Open the fuel selector valve.
 2. Set the mixture lever in the FULL RICH position.

3. Open the throttle about halfway.
4. Remove the 1/8-inch drain pipe plug located at the bottom of the regulator cover on the carburetor.
5. Operate the fuel boost pump until the fuel flowing from the drain plug hole is free of oil.
6. Replace the drain plug in the bottom of the regulator cover and continue fuel boost pump operation until a small amount of fuel discharges from the carburetor discharge nozzle. All included air must pass through the discharge nozzle or the vapor return line.
7. Place the mixture lever in the IDLE CUT-OFF position. Because this carburetor has a closed fuel system, it will remain full of fuel as long as this lever is in the IDLE CUT-OFF position.
8. Fill the carburetor with fuel and let it stand for an 8-hour soaking period before starting the engine. This soaking period is important. The carburetor was originally calibrated with its fuel diaphragms thoroughly soaked with fuel, so these diaphragms must be restored to this condition before the carburetor can be expected to function properly.

NOTE

The soaking period may be performed prior to carburetor installation or prior to the installation of the engine in the airplane. This procedure will serve to reduce the elapsed time between the completion of the installation and engine starting.

- f. Replace carburetor air box assembly in accordance with paragraph 4-12, step "u."
- g. Replace engine cowling in accordance with paragraph 4-5.

4-91. IDLE ADJUSTMENT OF CARBURETORS.

To set the idle adjustment on either carburetor:

- a. Start engine in accordance with "Pilots Check List."
- b. Warm up the engine until oil and cylinder head temperatures are normal for takeoff.
- c. Test for rpm drop by grounding each magneto, in turn, with the ignition switch. Correct excessive drops in rpm due to fouled plugs or other ignition trouble before proceeding with the idle adjustment.
- d. Close the throttle to its idle stop. Adjust idling speed to 600 rpm by turning the idle speed adjusting screw, a notch at a time, inward to increase or outward to decrease speed. If idling speed changes during the following steps, readjust in the same manner.
- e. Move the mixture lever slowly and smoothly into the IDLE CUT-OFF position, watching the tachometer closely for any change in rpm. As soon as the first rpm change occurs, return the lever to its FULL RICH position before the engine can stop. An increase of more than 10 rpm after "leaning out" the mixture in this manner indicates an excessively rich idling mixture, while an immediate drop in rpm indicates an excessively lean mixture.
- f. Correct excessively rich idling mixture by turning the idle mixture adjusting screw inward. Correct excessively lean mixture by turning the idle mixture adjusting screw outward. Turn the screw only a notch at a time, and check the result as described in the preceding step, between successive adjustments.

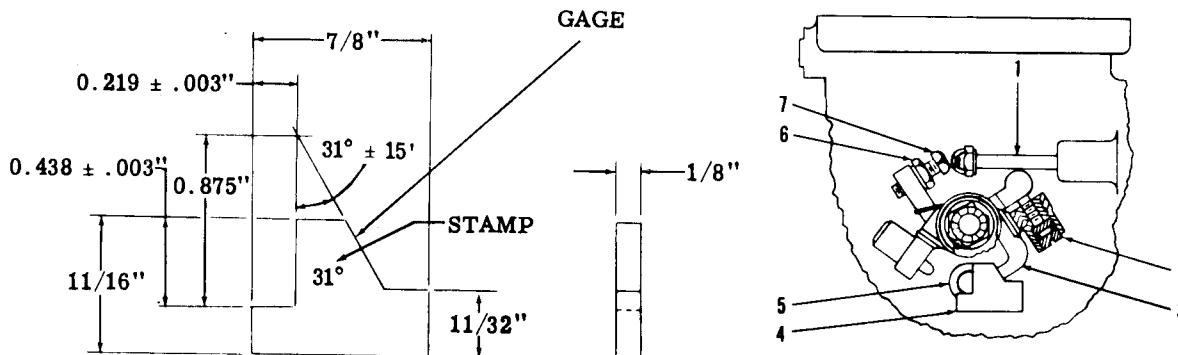
The idling mixture will be correct when "leaning out" with the mixture lever results in a momentary increase of approximately 5 (never more than 10) rpm. After each check and mixture adjustment and before testing the effect, increase the engine speed to about 2000 rpm for a few seconds to clear the spark plugs. Make the mixture check after the throttle has closed and idling speed stabilizes at 600 rpm.

NOTE

The ideal idle mixture setting will give a maximum rpm with minimum manifold pressure. If the setting does not remain stable, check for looseness in the throttle linkage and the carburetor lever assembly which would allow the control rod freedom to move with the throttle closed. Allowance should be made for the effect of weather conditions on idling performance. This method should eliminate frequent adjustments, except to correct for wide variations in weather and altitude. When making the adjustment, the aircraft should be parked crosswind to avoid variations in propeller loading. If the foregoing adjustments have appreciably changed the angular relation between the power enrichment adjustment screw and the wide open throttle stop, it will be necessary to readjust the screw so that it will contact the end of the idle control rod when the wide open throttle stop is approximately 31 degrees from the throttle stop stud. The angle may be checked with a gage, similar to that shown in figure 4-11A. The gage is placed so that its shoulder rests on the stop block (5, figure 4-11A), with its long side on top and the sides forming a 31 degree angle touching the stop block and the wide open stop on the throttle stop assembly. If the adjusting screw (2, figure 4-11A) does not contact the rod end precisely the same time when the throttle stop touches the gage, remove lockwire and loosen the locknut; then readjust the screw (2, figure 4-11A) while holding the throttle stop against the gage and tighten the locknut. After completing the adjustment, lockwire the screw and nut.

4-91A. OFF-IDLE DISCHARGE NOZZLE ADJUSTMENT OF CARBURETORS. (See figure 4-11B.) Some carburetors used on the 310 aircraft incorporate a discharge nozzle adjustment limiter such as the one illustrated in figure 4-11B. If engine roughness occurs in the off-idle range (between idle and cruise) and all other probable causes for roughness have been eliminated, the discharge nozzle may be adjusted as follows:

- a. Start engine in accordance with "Pilots Check List" and warm engine up to normal operating temperature.
- b. Make mixture check in off-idle range (1700 RPM).
1. The mixture check must be made with the propeller control in full low pitch (high RPM) and with the aircraft headed into the wind. Manually lean by pulling the mixture control slowly toward idle cut-off. As the fuel flow is being leaned, observe for the maximum momentary RPM rise which should occur just before the RPM starts to fall off. Immediately return the mixture control to full rich to prevent the engine from dying.



1. Idle and Power Enrichment Control Rod
2. Idle Mixture Adjustment Screw
3. Throttle Stop Assembly

4. Gage
5. Stop Block
6. Locknut

4-11A. Idle Mixture Adjustment and Dimensions For Adjusting Gage

2. If an RPM rise occurs, the carburetor setting is on the rich side of best power mixture.
3. If there is no RPM rise, the carburetor setting is at or below best power mixture.
- c. A RPM rise of approximately 50 RPM should result from the mixture check in the off-idle range. If mixture check indicates a poor mixture setting, adjust the discharge nozzle to get a rise of approximately 50 RPM in the off-idle range.
1. To richen the off-idle range, insert a screwdriver through the end of the discharge nozzle adjustment locking cap and turn the adjusting screw in a counterclockwise direction one notch at a time until the desired engine operation is obtained.
2. To lean the off-idle range, turn the adjusting screw in a clockwise direction one notch at a time until the desired engine operation is obtained.
3. Clear the engine before each mixture check by running up to cruise power.
4. Repeat the mixture check after each nozzle adjustment.
- d. After the off-idle mixture has been adjusted with the discharge nozzle adjustment, readjust the idle mixture in accordance with paragraph 4-91.

4-92. FUEL PUMPS.

4-93. An engine-driven fuel pump is mounted on the accessory section of each engine, at lower left. The pumps are of the constant output type and incorporate integral fuel bypass valves and fuel pressure relief valves. The fuel bypass valves allow fuel flow to the carburetors from the fuel boost pumps any time the engine pumps are inoperative. Fuel pressure is regulated by the adjusting screws on the aft part of the pumps.

4-94. REMOVAL OF ENGINE-DRIVEN FUEL PUMPS. Either fuel pump can be removed as follows:

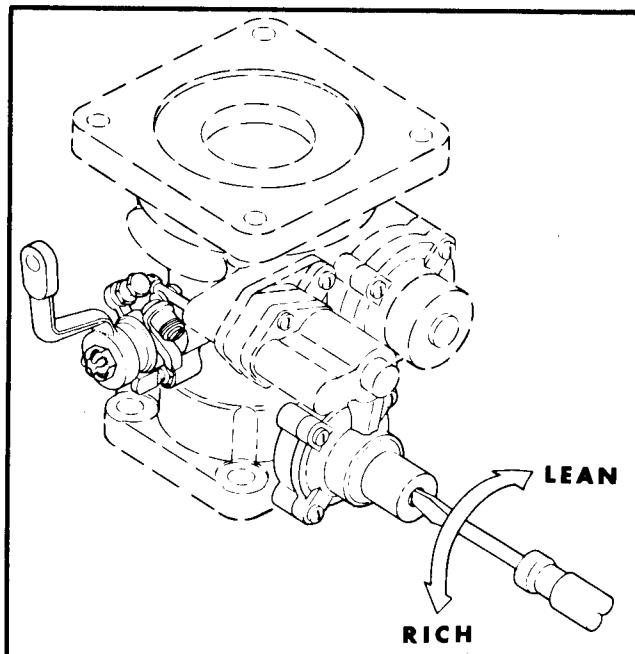


Figure 4-11B. Discharge Nozzle Adjustment Limiter

- a. Place fuel selector valve handles in the BOTH OFF position.
- b. Open left hand aft cowl door.
- c. Disconnect fuel hoses from pump.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Care should be exercised in disposal of such fuel when lines or hoses are disconnected to prevent it from collecting in the bottom of the nacelle.

- d. Remove four nuts and washers attaching pump to engine.
- e. Remove pump and gasket, leaving adapter in position on engine mount.

NOTE

If a replacement pump is not being installed immediately, a temporary cover should be secured over the adapter with the four washers and attaching nuts.

4-95. INSTALLATION OF ENGINE-DRIVEN FUEL PUMPS. Either fuel pump can be installed as follows:

- a. Remove temporary cover from fuel pump adapter.
- b. Position new gasket and fuel pump on the four mounting studs so outlet port of pump is on top.

NOTE

If a replacement pump is being installed, the serviceable fittings from the old pump should be installed in the replacement pump.

- c. Secure pump to engine with four plain washers, four internal tooth lockwashers and nuts.
- d. Connect fuel supply hose from fuel strainer to fitting in inlet port of fuel pump, carburetor supply hose to fitting in outlet port of pump, and drain hose to fitting in lowest drain hole in fuel pump base.
- e. Close aft cowl door.
- f. Turn fuel selector valve ON. Start engine in accordance with "Pilots Check List." Check to see if fuel pressure indication on the fuel pressure gage is within the green arc (9 to 15 psi).

4-96. FUEL PRESSURE RELIEF VALVE SETTING. The procedure is identical for either fuel pump. Open left hand aft cowl door. Locate the pressure adjusting screw on the aft part of the fuel pump. Remove safety wire and turn adjusting screw clockwise to increase fuel pressure or counterclockwise to decrease fuel pressure. When proper adjustment has been obtained, secure adjusting screw with safety wire. Close aft cowl door.

4-97. FUEL STRAINERS. (See figure 4-12.)

4-98. A fuel strainer is located in each engine nacelle and is attached to a mounting bracket in the lower center part of the firewall. The strainers remove foreign material from the fuel before it reaches the fuel pumps, carburetors and primers. A quick drain valve is provided at the bottom of each fuel strainer to drain trapped water and sediment. This valve is accessible through the access door in the underside of each engine nacelle. To open the drain valve, turn handle counterclockwise. Upon release, the spring-loaded handle will return to the closed position.

4-99. REMOVAL OF FUEL STRAINERS. (See figure 4-12.) To remove either fuel strainer:

- a. Place fuel selector valve handle in the BOTH OFF position.
- b. Remove engine cowling in accordance with paragraph 4-3.

- c. Disconnect fuel inlet line from fitting (4, left engine installation), or (5, right engine installation), and fuel pump supply hose from elbow(22). Disconnect primer line from elbow (2).

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent accumulation of this fuel in the bottom of the nacelles when lines or hoses are disconnected.

- d. Remove nuts (7) and bolts (1), attaching fuel strainer to mounting bracket (6) and remove strainer.

4-100. DISASSEMBLY OF FUEL STRAINERS.

(See figure 4-12.) Either fuel strainer can be disassembled as follows:

- a. Remove safety wire and loosen bolt (9) holding stiffener (13) and arm assembly (8). Swing arm assembly (8) clear of cap (12).
- b. Remove cap (12), lower gasket (11), and glass bowl (10).
- c. Remove quick drain valve (14) from cap (12).
- d. Pull retainer spring (16) on lid assembly (15) free of slot in standpipe (20) and remove lid assembly (15).
- e. Remove filter (17), upper gasket (18), flat screen (19), and filter ring (21).
- f. Remove primer line elbow (2), inlet fitting (4 or 5), and outlet elbow (22) from the body assembly (3).

4-101. CLEANING AND INSPECTION OF FUEL STRAINERS. Clean the disassembled fuel strainers by washing in unleaded gasoline and allowing to dry. The filters and the flat screens can be cleaned of sediment by blowing compressed air through them. If either is ruptured or damaged, replace it with a new one. Be sure all sediment and foreign particles have been removed before assembly.

4-102. ASSEMBLY OF FUEL STRAINERS. (See figure 4-12.) To assemble either fuel strainer: (Use a suitable thread lubricant on all male threads.)

- a. Install primer line elbow (2), inlet fitting either (4 or 5), and outlet elbow (22) in the body assembly (3) as illustrated.
- b. Slide the filter ring (21), flat screen (19), filter (17), and lid assembly (15) over the standpipe (20) and secure with the retainer spring (16).
- c. Connect quick drain valve (14) to the cap (12).
- d. Slide upper gasket (18), glass bowl (10), lower gasket (11), and cap (12) in position and secure with arm assembly (8) by tightening bolt (9).

NOTE

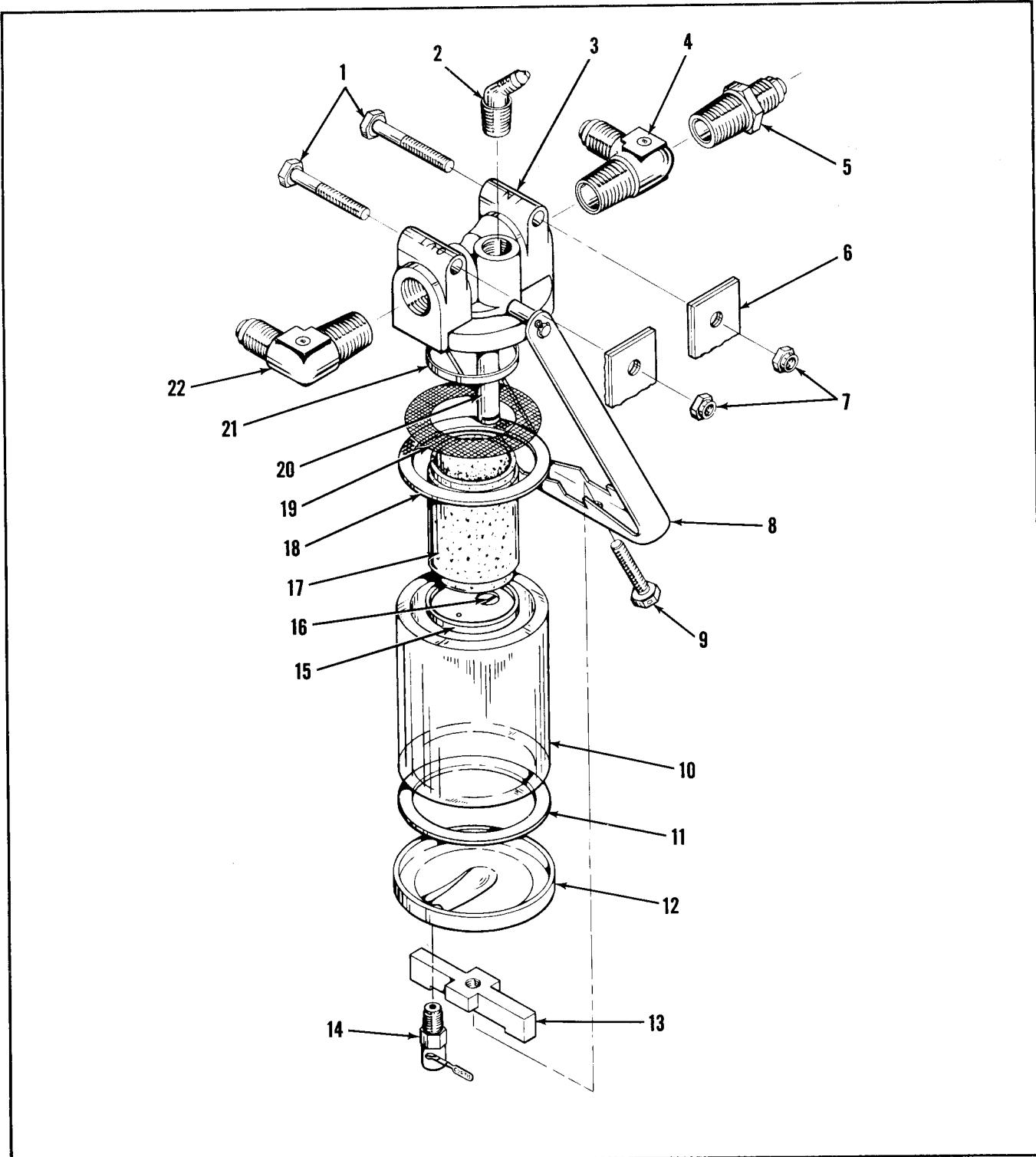
Use new gaskets when reassembling strainer.

- e. Secure bolt (9) to arm assembly (8) with safety wire.

4-103. INSTALLATION OF FUEL STRAINERS. (See figure 4-12.) To install either fuel strainer:

- a. Place fuel strainer in position on its mounting

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|---|------------------|---------------------|
| 1. Bolt | 8. Arm Assembly | 15. Lid Assembly |
| 2. Elbow | 9. Bolt | 16. Retainer Spring |
| 3. Body Assembly | 10. Glass Bowl | 17. Filter |
| 4. Fitting for Left Engine Installation | 11. Lower Gasket | 18. Upper Gasket |
| 5. Fitting for Right Engine
Installation | 12. Cap | 19. Flat Screen |
| 6. Mounting Bracket | 13. Stiffener | 20. Standpipe |
| 7. Nut | 14. Drain Valve | 21. Filter Ring |
| | | 22. Elbow |

Figure 4-12. Fuel Strainer

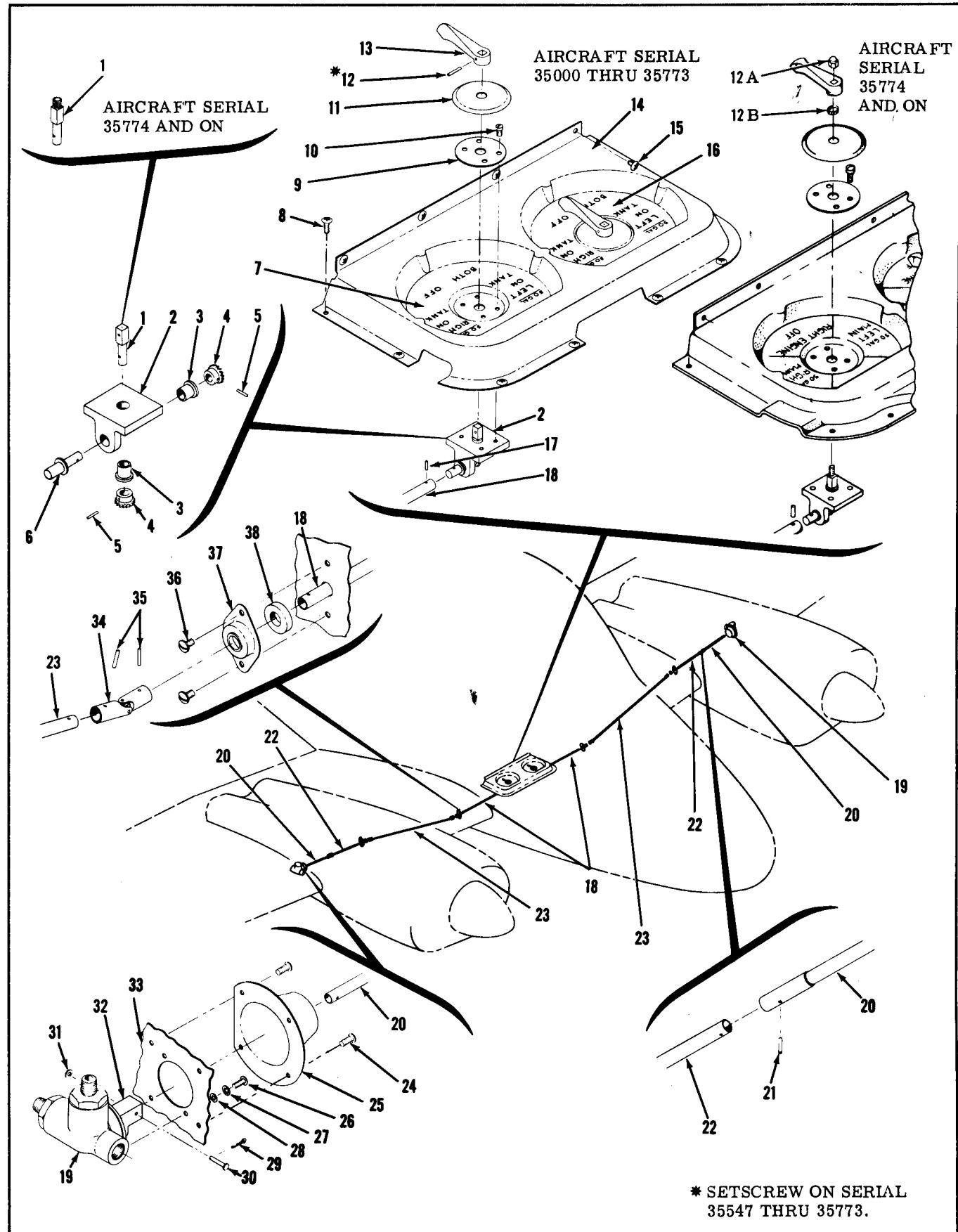


Figure 4-13. Fuel Selector Valve Control System

Figure 4-13. Fuel Selector Valve Control System Callouts

- | | | |
|--------------------------|---------------------------------|---------------------------------|
| 1. Handle Shaft | 12B. Snap Ring | 26. Screw |
| 2. Gear Support Assembly | 13. Fuel Selector Valve Handle | 27. Lockwasher |
| 3. Bearing | 14. Pan Assembly | 28. Washer |
| 4. Gear | 15. Screw | 29. Cotter Pin |
| 5. Roll Pin | 16. Left Hand Metalcal | 30. Pin |
| 6. Torque Tube Shaft | 17. Roll Pin | 31. Washer |
| 7. Right Hand Metalcal | 18. Fuselage Torque Tube | 32. Fuel Selector Valve Housing |
| 8. Screw | 19. Fuel Selector Valve | 33. Outboard Nacelle Rib |
| 9. Doubler | 20. Outboard Torque Tube | 34. Universal Joint |
| 10. Gear Support Screw | 21. Roll Pin | 35. Roll Pins |
| 11. Disc | 22. Inboard Nacelle Torque Tube | 36. Screw |
| 12. Roll Pin | 23. Wing Torque Tube | 37. Bearing Block Shield |
| 12A. Cap Nut | 24. Screw | 38. Bearing Block |
| | 25. Fuel Valve Shield | |

- bracket (6), install attaching bolts (1) and nuts (7).
 b. Connect primer line to elbow (2) on top of body assembly (3).
 c. Connect line from fuel selector valve to inlet fitting (4 or 5), and connect fuel pump supply hose to outlet elbow (22).
 d. Turn fuel selector valve handle to the ON position and start fuel boost pump operating. Check fuel strainer for leaks and replace gaskets or tighten fittings as necessary.

CAUTION

Be certain that the mixture lever is in the IDLE CUT-OFF position before operating the fuel boost pump.

- e. Replace engine cowling in accordance with paragraph 4-5.

4-104. FUEL SELECTOR VALVE CONTROL SYSTEM. (See figure 4-13.)

4-105. The fuel selector valve controls are located between the front seats on the cabin floor. The valve control on the right controls fuel flow to the right engine and the valve control on the left controls the fuel flow to the left engine. The handles are of rotary type and are connected mechanically to the fuel selector valve assemblies mounted on the outboard sides of the outboard nacelle ribs. The three valve positions which are marked on the "metalcals" are LEFT TANK ON, RIGHT TANK ON and BOTH OFF. The fuel selector valve handles indicate the position of the fuel selector valves.

4-106. REMOVAL OF FUEL SELECTOR VALVE CONTROL SYSTEM. (See figure 4-13.) Remove linkage to either fuel selector valve as follows:

- a. Place fuel selector valve handle in BOTH OFF position.
- b. Remove engine cowling in accordance with paragraph 4-3.
- c. Loosen fuel valve shield (25) by removing four screws (24).
- d. Disconnect outboard torque tube (20) by removing roll pin (21), cotter pin (29), washer (31) and pin (30). Slide outboard torque tube inboard until outer end is free of fuel selector valve housing (32) and remove from engine nacelle.

- e. Loosen bearing block shield (37) at inboard nacelle rib by removing two screws (36).
- f. Remove forward wing fillets and two access hole covers nearest fuselage by removing attaching screws.
- g. Disconnect and remove universal joint (34) at wing root by removing safety wire and roll pins (35).
- h. Remove wing torque tube (23) and inboard nacelle torque tube (22) through engine nacelle.
- i. Remove pan assembly (14) by removing roll pin (12), (cap nut (12A) aircraft serial 35774 and on) handles (13), gear support screws (10), and attaching screws (8 and 15).
- j. Remove front carpets in accordance with paragraph 2-204.
- k. Remove the two round access hole covers under pilot's and copilot's seats.
- l. Remove the two rectangular access hole covers in center of floorboards.
- m. Remove fuselage torque tube (18) and gear support assembly (2) by working back and forth until they can be removed through the rectangular access hole in the cabin floor.
- n. Further disassembly may be accomplished as illustrated in figure 4-13.

4-107. CLEANING AND INSPECTION OF FUEL SELECTOR VALVE CONTROL SYSTEM. Wash parts with a suitable solvent. Check for cracked or bent tubes. Inspect roll pins, universal joints and bearing blocks for wear. Check gear support assembly for bearing wear, gear wear, and freedom of movement. Replace all worn or damaged parts.

4-108. INSTALLATION OF FUEL SELECTOR VALVE CONTROL SYSTEM. (See figure 4-13.) For installation, reverse removal procedure outlined in paragraph 4-106. Safety wire all roll pins.

NOTE

Before installing fuel valve shield, make certain the position of the fuel selector valve handle agrees with the position of the fuel selector valve housing. (Install in BOTH OFF position.)

4-109. FUEL SELECTOR VALVES. (See figure 4-14.)

4-110. One fuel selector valve is located in each wing just forward of the main spar and is attached to

the outboard side of the outboard nacelle rib. Each is a cam actuated, spring-loaded ball type valve and is operated from the cabin through mechanical linkage. Each valve has three positions which allows fuel to flow to the respective engine from the left tank, the right tank or stops all fuel flow through the valve.

4-111. REMOVAL OF FUEL SELECTOR VALVES. (See figure 4-17.)

NOTE

This procedure is for the right fuel selector valve only. Remove left fuel selector valve in the same way, except as shown in figure 4-17.

- a. Remove wing tip tank sump door by removing attaching screws.
- b. Cut safety wire between quick drain valve and drain plug. Drain fuel from tank by removing drain plug and opening quick drain valve.
- c. Remove cowling in accordance with paragraph 4-3.
- d. Remove the rectangular access hole cover located on the underside of the wing in front of the main spar just outboard of the outboard nacelle rib.
- e. Disconnect left tank right nacelle cross feed line (3) and fuel valve supply line (46) from nipples (38).

WARNING

Residual fuel draining from 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 or bottom of the nacelle.

- f. Disconnect right fuel valve outlet line (41) from right valve outlet fitting (40).
- g. To complete removal of the fuel selector valve see figure 4-13.
 1. Remove four screws (24) attaching fuel valve shield (25) to outboard nacelle rib (33) and slide fuel valve shield (25) inboard.
 2. Remove cotter pin (29) from pin (30) and remove pin and washer (31) from fuel selector valve housing (32).
 3. Remove two mounting screws (26) and washers (27 and 28) attaching fuel selector valve (19) to outboard nacelle rib (33).
 4. Remove the fuel selector valve (19) through access hole.

4-112. DISASSEMBLY OF FUEL SELECTOR VALVES. (See figure 4-14.) The disassembly sequence is clearly illustrated in figure 4-14.

4-113. INSPECTION OF FUEL SELECTOR VALVES.

- a. Inspect all parts for obvious indications of damage such as cracks, damaged threads, nicks, burrs, deep scratches, pitting and corrosion. Replace defective parts.

4-114. ASSEMBLY OF FUEL SELECTOR VALVES. (See figure 4-14.) Either fuel selector valve can be assembled as follows:

- a. Install bearing (17), cam shaft (16), washer (15), new O-ring (14), new gasket (18), and plate (13) with three screws (8).
- b. Insert spring (11) and ball (12) into housing (10). Hold ball (12) in place and slide housing (10) onto cam shaft (16). Insert roll pin (9) through housing (10) and secure with safety wire.
- c. Turn housing (10) to the OFF position and assemble remainder of fuel selector valve in sequence illustrated in figure 4-14.

CAUTION

Lubricate fitting threads with engine oil and exercise care when installing O-ring seals to prevent damage from fitting threads.

4-115. INSTALLATION OF FUEL SELECTOR VALVES. (See figure 4-13.)

NOTE

This procedure is for the right fuel selector valve only. Install left fuel selector valve in the same way, except as shown in figure 4-17.

- a. Insert fuel selector valve (19) through access hole in underside of wing and slide fuel selector valve housing (32) onto outboard torque tube (20).
- b. Install two screws (26) and washers (27 and 28) attaching fuel selector valve (19) to outboard nacelle rib (33).

NOTE

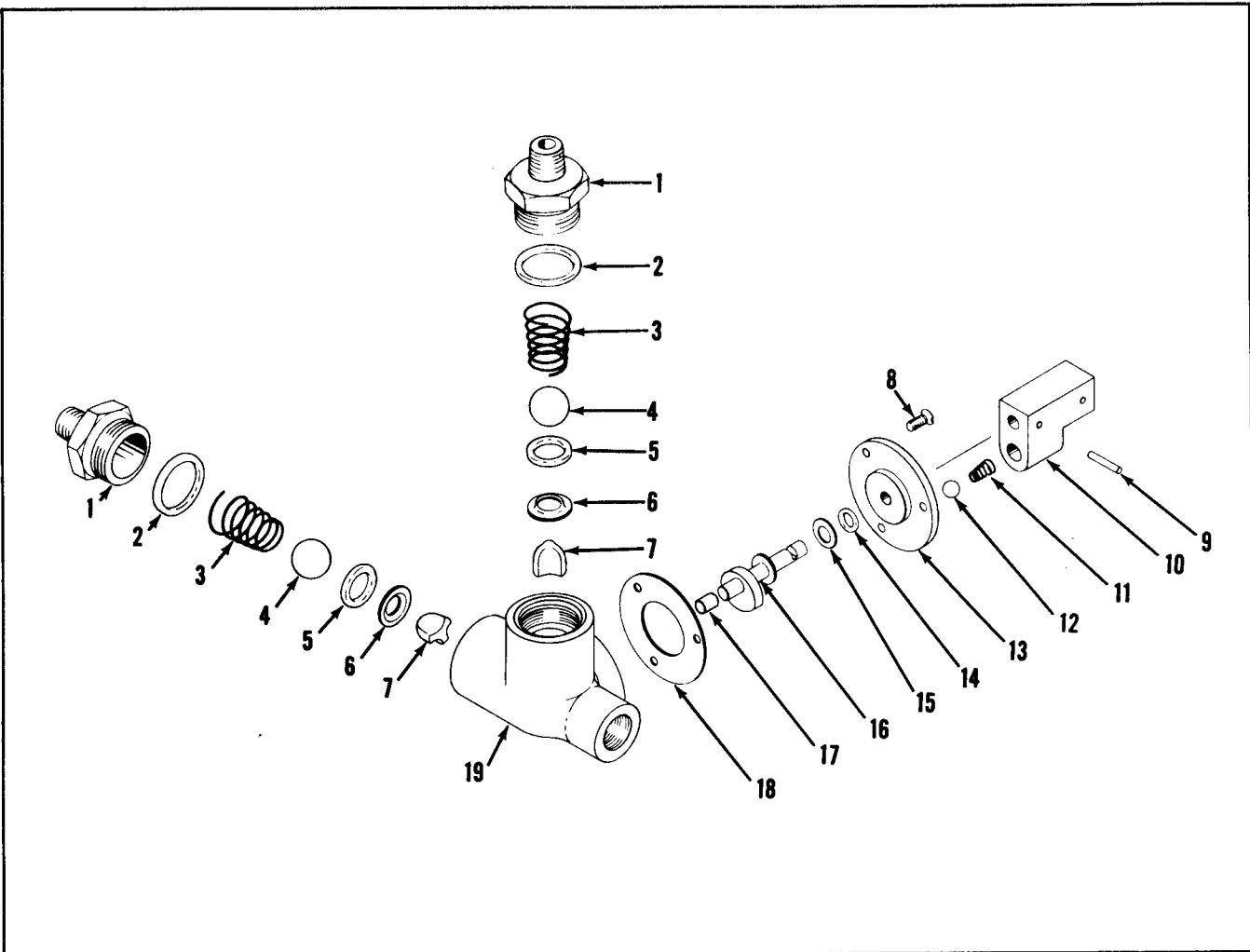
Before connecting fuel lines, check fuel selector handle on cockpit control and fuel selector valve housing on fuel selector valve to see that they both point to the OFF position. If they do not, reposition outer torque tube to coincide with position of fuel selector valve housing.

- c. Insert pin (30) through fuel selector valve housing (32) and secure with cotter pin (29) and washer (31).
- d. To complete installation of the fuel selector valve, see figure 4-17. (Use suitable thread lubricant on male threads of all fittings.)
 1. Attach right fuel valve outlet line (41) to right valve outlet fitting (40).
 2. Attach fuel valve supply line (46) to nipple (38) in right valve main fuel inlet fitting (45).
 3. Attach left tank right nacelle cross feed line (3) to nipple (38) in right valve cross feed inlet fitting (39).

NOTE

Fill fuel tank and with boost pump operating check valve fittings for leaks. Tighten fittings if necessary.

4. Replace all access hole covers.
5. Slide fuel valve shield into position and secure with four screws.
6. Replace cowling in accordance with paragraph 4-5.



- | | | | |
|------------|-------------|------------|---------------|
| 1. Fitting | 6. Retainer | 11. Spring | 16. Cam Shaft |
| 2. O-Ring | 7. Flute | 12. Ball | 17. Bearing |
| 3. Spring | 8. Screw | 13. Plate | 18. Gasket |
| 4. Ball | 9. Roll Pin | 14. O-Ring | 19. Base |
| 5. O-Ring | 10. Housing | 15. Washer | |

Figure 4-14. Fuel Selector Valve

4-116. WING TIP TANKS. (See figure 4-15.)

4-117. Each wing tip tank is attached to the outboard end of both spars and is streamlined to the wing by fairing strips. The filler cap is easily accessible by loosening two Dzus fasteners and opening the cover assembly on top of the tank. Inside the tank is a fuel bladder which is held in position by four nylon cords. An electrically operated fuel boost pump and a float arm actuated fuel quantity sending unit are located inside the fuel bladder. They are accessible only by removal through the sump floor. A quick drain valve is incorporated in the fuel boost pump for draining the sump of moisture and sediment.

4-118. REMOVAL OF WING TIP TANKS. (See figure 4-15.) The removal procedure is the same for either wing tip tank.

a. Remove sump door (31) by removing attaching screws (32).

b. Cut safety wire between quick drain valve and drain plug. Drain fuel by removing drain plug and by opening quick drain valve.

c. Remove front fairing (33), lower fairing (36), and upper fairing (41) by removing attaching screws (34 and 42).

d. Disconnect fuel supply hose (4) and vapor return hose (7) by loosening clamps (5 and 8).

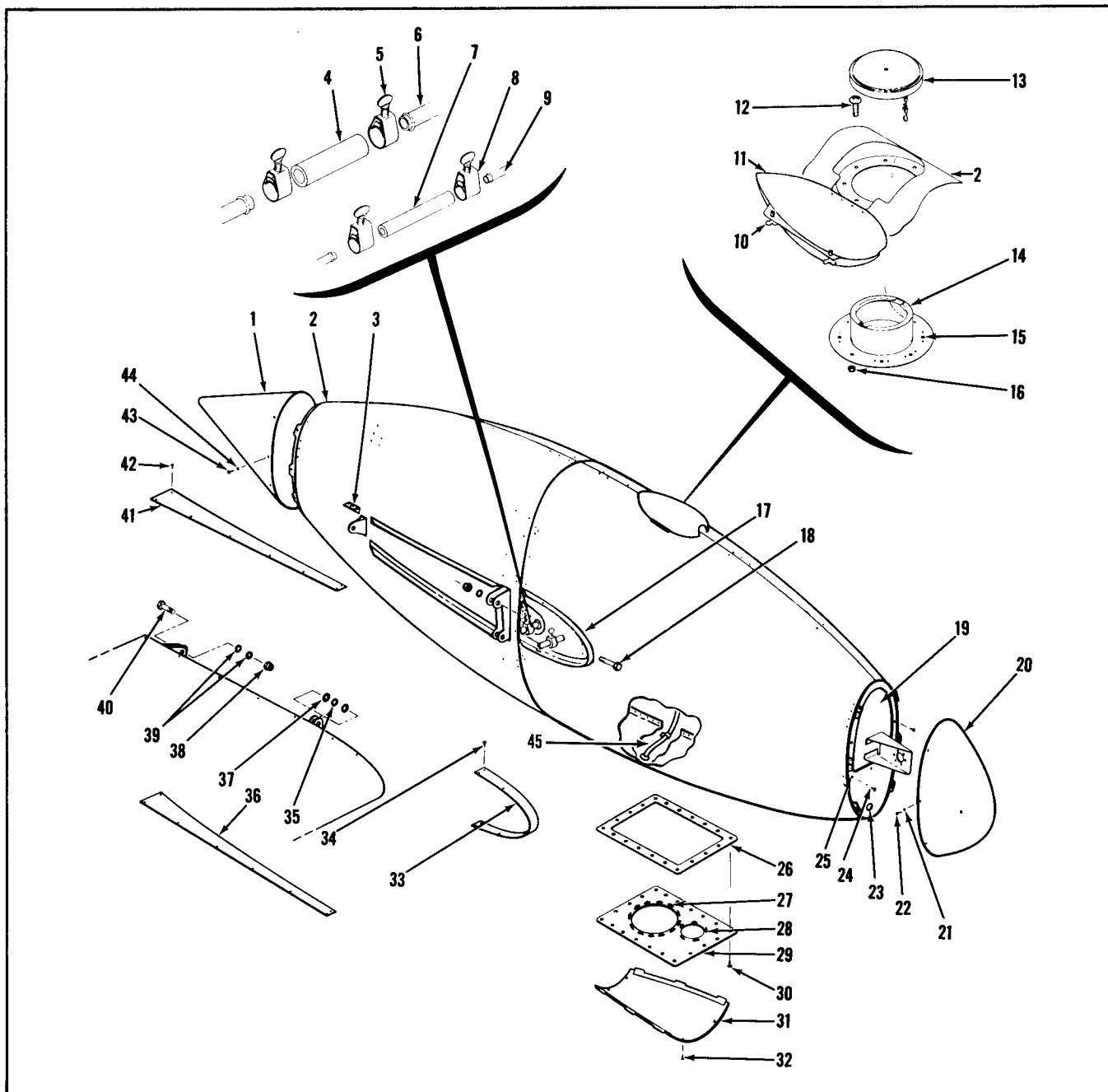
e. Disconnect electrical quick-disconnects between wing and tip tank.

f. Remove tip tank by removing nuts (38), washers (35, 37 and 39), and bolts (40 and 18) from wing attaching mounts.

4-119. DISASSEMBLY OF WING TIP TANKS. (See figure 4-15.) The disassembly procedure is the same for either wing tip tank.

a. Remove tail cap (1) by removing screws (43) and washers (44).

b. Remove navigation light in accordance with para-



- | | | |
|----------------------------|------------------------|-----------------------|
| 1. Tail Cap | 16. Nut | 31. Sump Door |
| 2. Fuel Tank | 17. Front Nutplate | 32. Screw |
| 3. Rear Nutplate | 18. Bolt | 33. Front Fairing |
| 4. Fuel Supply Hose | 19. Nose Door Assembly | 34. Screw |
| 5. Clamp | 20. Nose Cap | 35. Washer |
| 6. Outlet Fuel Supply Line | 21. Washer | 36. Lower Fairing |
| 7. Vapor Return Hose | 22. Screw | 37. Washer |
| 8. Clamp | 23. Grommet | 38. Nut |
| 9. Inlet Vapor Return Line | 24. Screw | 39. Washer |
| 10. Dzus Fastener | 25. Nutplate | 40. Bolt |
| 11. Cover Assembly | 26. Gasket | 41. Upper Fairing |
| 12. Screw | 27. Nutplate | 42. Screw |
| 13. Filler Cap | 28. Cap Nut | 43. Screw |
| 14. Filler Neck | 29. Sump Floor | 44. Washer |
| 15. Nutplate | 30. Bolt | 45. Filler Neck Drain |

Figure 4-15. Wing Tip Tank

graph 6-112.

- c. Remove nose door assembly (19) by removing attaching screws (24).
- d. Remove fuel boost pump in accordance with paragraph 4-126.
- e. Remove fuel quantity sending unit in accordance with paragraph 4-140.
- f. Remove sump floor (29) and gasket (26) by cutting safety wire and removing attaching bolts (30).
- g. Remove filler cap (13) by removing snap ring securing filler cap chain in filler neck (14).
- h. Remove attaching screws (12) and remove filler neck (14) through bottom of fuel tank.
- i. Disconnect tank vapor return line from inlet elbow inside of fuel bladder and remove line through opening in bottom of fuel tank.
- j. Untie nylon cords in forward portion of fuel tank and detach fuel bladder from tank by removing nylon cords and wire loops.
- k. Remove fuel bladder through bottom of fuel tank.
- l. Remove inlet vapor return line (9) and elbow from line attachment neck by loosening hose clamp inside of fuel bladder.
- m. Remove outlet fuel supply line (6) and elbow from line attachment neck by loosening hose clamp inside of fuel bladder.
- n. Remove tape, screw, and clamp attaching filler neck drain line to fuel tank and remove drain line by sliding it out of rubber hose at filler neck assembly.

4-120. CLEANING OF WING TIP TANKS. Clean fuel bladders thoroughly with unleaded gasoline. Clean interior of tanks and all other parts with a suitable solvent.

4-121. INSPECTION AND REPAIR OF WING TIP TANKS. Inspect filler cap gasket. If gasket is crushed or damaged, replace filler cap. Inspect bladder for chafing and cover worn spots with rubber tape or replace bladder. Inspect tank for cracks and loose rivets, particularly around the wing attaching mounts. Repair all defects.

4-122. ASSEMBLY OF WING TIP TANKS. (See figure 4-15.) The assembly procedure is the same for either wing tip tank. (Use a suitable thread lubricant on male threads of all fittings.)

- a. If a new fuel bladder is being installed, remove the two hose clamps and plugs from the discarded bladder and install in the new fuel bladder.

NOTE

Lubricate lines and plugs with oil to facilitate installation into the line attachment necks.

- b. Slide drain line into rubber hose at filler neck assembly and secure to lower portion of tank with clamp and screw. Route filler neck drain down outboard side of tip tank.

CAUTION

Tape any irregularities that may damage the fuel bladder.

- c. Lay fuel tank on a table with the wing attachment

downward.

- d. Insert fuel bladder through opening in bottom of fuel tank.
- e. Position fuel bladder inside of fuel tank with round filler assembly opening towards the top of the fuel tank.
- f. Thread the bottom nylon cord through the row of wire loops on the lower side of fuel tank and through the corresponding wire hangers on the fuel bladder.
- g. Thread second nylon cord through the row of wire loops just below the filler assembly opening in fuel tank and through the corresponding wire hangers on the fuel bladder.
- h. Thread third nylon cord through the row of wire loops just above the filler assembly opening in fuel tank and through the corresponding wire hangers on the fuel bladder.
- i. Thread upper nylon cord through the row of wire loops in the top side of the fuel tank and through the corresponding wire hangers on the fuel bladder.
- j. Pull slack out of nylon cords and tie each cord to the most forward wire loop in the fuel tank with two half hitches and a slip knot.
- k. Insert inlet vapor return line (9), with elbow attached, through line attachment neck and secure with hose clamp.
- l. Insert outlet fuel supply line (6), with elbow attached, through line attachment neck and secure with hose clamp.
- m. Attach tank vapor return line to elbow on inlet vapor return line (9) inside of fuel bladder.
- n. Insert filler neck (14) through bottom of tank and secure in position with attaching screws.

NOTE

Position tank vapor return line and clamp to filler neck (14) and secure with screw (12) and nut (16).

- o. Attach filler cap (13) by positioning snap ring, which is attached to filler cap chain, in filler neck (14).
- p. Insert nut plate through opening in bottom of fuel tank and align with sump floor mounting holes.
- q. Position gasket (26) and sump floor (29) and secure with attaching bolts (30). Safety all attaching bolts (30) with safety wire.
- r. Install fuel boost pump in accordance with paragraph 4-127.
- s. Install fuel quantity sending unit in accordance with paragraph 4-141.
- t. Install nose door assembly (19) and secure with attaching screws (24).
- u. Install navigation light in accordance with paragraph 6-112.
- v. Position tail cap (1) on aft of tank and secure with screws (43) and washers (44).

4-123. INSTALLATION OF WING TIP TANKS. (See figure 4-15.) The installation procedure is the same for either wing tip tank. For installation of wing tip tanks, reverse removal procedure outlined in paragraph 4-118.

4-123A. BLADDERLESS WING TIP TANKS. (See Figure 4-15.)

4-123B. The bladderless tip tanks are basically the same as the tanks containing bladders (see paragraph 4-117) except that the bladderless tank seams and rivets are sealed and the bladders have been eliminated. A standpipe is incorporated in the filler neck assembly and the same tank capacity as the bladder type tanks is being utilized.

4-123C. REMOVAL OF BLADDERLESS WING TIP TANKS. (See figure 4-15.) The removal procedure is the same for either wing tip tank.

- a. Remove sump door (31) by removing attaching screws (32).
- b. Cut safety wire between quick drain valve and drain plug. Drain fuel by removing drain plug and by opening quick drain valve.
- c. Remove front fairing (33), lower fairing (36), and upper fairing (41) by removing attaching screws (34 and 42).
- d. Disconnect fuel supply hose (4) and vapor return hose (7) by loosening inboard clamps.
- e. Disconnect electrical quick-disconnects between wing and tip tank.
- f. Remove tip tank by removing nuts (38), washers (35, 37 and 39), and bolts (40 and 18) from wing attaching mounts.

4-123D. DISASSEMBLY OF BLADDERLESS WING TIP TANKS. (See figure 4-15.) The disassembly procedure is the same for either wing tip tank.

- a. Remove tail cap (1) by removing screws (43) and washers (44).
- b. Remove navigation light in accordance with paragraph 6-112.
- c. Remove fuel boost pump in accordance with paragraph 4-126.
- d. Remove fuel quantity sending unit in accordance with paragraph 4-140.
- e. Remove sump floor (29) and gasket (26) by cutting safety wire and removing attaching bolts (30).

4-123E. INSPECTION AND REPAIR OF BLADDERLESS WING TIP TANKS. Inspect the filler cap gasket. If gasket is crushed or damaged, replace filler cap. Inspect tank for cracks and loose rivets particularly around the wing attaching mounts. Repair all defects in a conventional manner. After repairs to the fuel cell have been made the following procedure should be followed for sealing and testing of the tank.

Sealing of Bladderless Tip Tanks.

- a. Clean all surfaces to be sealed with an oil-free low moisture content solvent using one clean, lintless, cotton cloth for solvent application and another for wiping surface dry.

NOTE

Do not allow the cleaning solvent to evaporate; the area should be wiped dry.

- b. Mix Pro-Seal EP711 in accordance with the manufacturers recommendations and apply smoothly with a

spatula over all seams, rivets, fittings, and possible leak areas.

Inspection Of Bladderless Tip Tanks.

- a. Seal off fuel supply hose (4) and vapor return hose (7) by inserting dowels into the hoses and securing with clamps.
- b. Using the sump floor (29) for a pattern, fabricate a cover plate and secure in position over opening in bottom of fuel tank.
- c. Close vent hole in tank cap by covering hole on inside of cap with tape.
- d. Saturate a clean rag with at least 25 cubic centimeters of household ammonia. Insert rag in fuel tank and close tank cap.
- e. Pressurize fuel tank to a maximum of 2 psi.
- f. Saturate a large cloth with indicator and spread smoothly on the tank surface and move around until all the tank surface has been tested.

NOTE

Indicator solution is made of 1/2 gallon of distilled water, 1/2 gallon of denatured alcohol and 1/2 ounce of phenolphthalein crystals or powder.

- g. A leak will appear as a pink spot on the cloth. Repair all leaks and repeat the testing procedure.

WARNING

Remove tape from filler cap. Remove rag from inside of fuel cell and allow fuel cell to air out before using.

4-123F. ASSEMBLY OF BLADDERLESS WING TIP TANKS. (See figure 4-15.) The assembly procedure is the same for either wing tip tank. (Use a suitable thread lubricant on male threads of all fittings.)

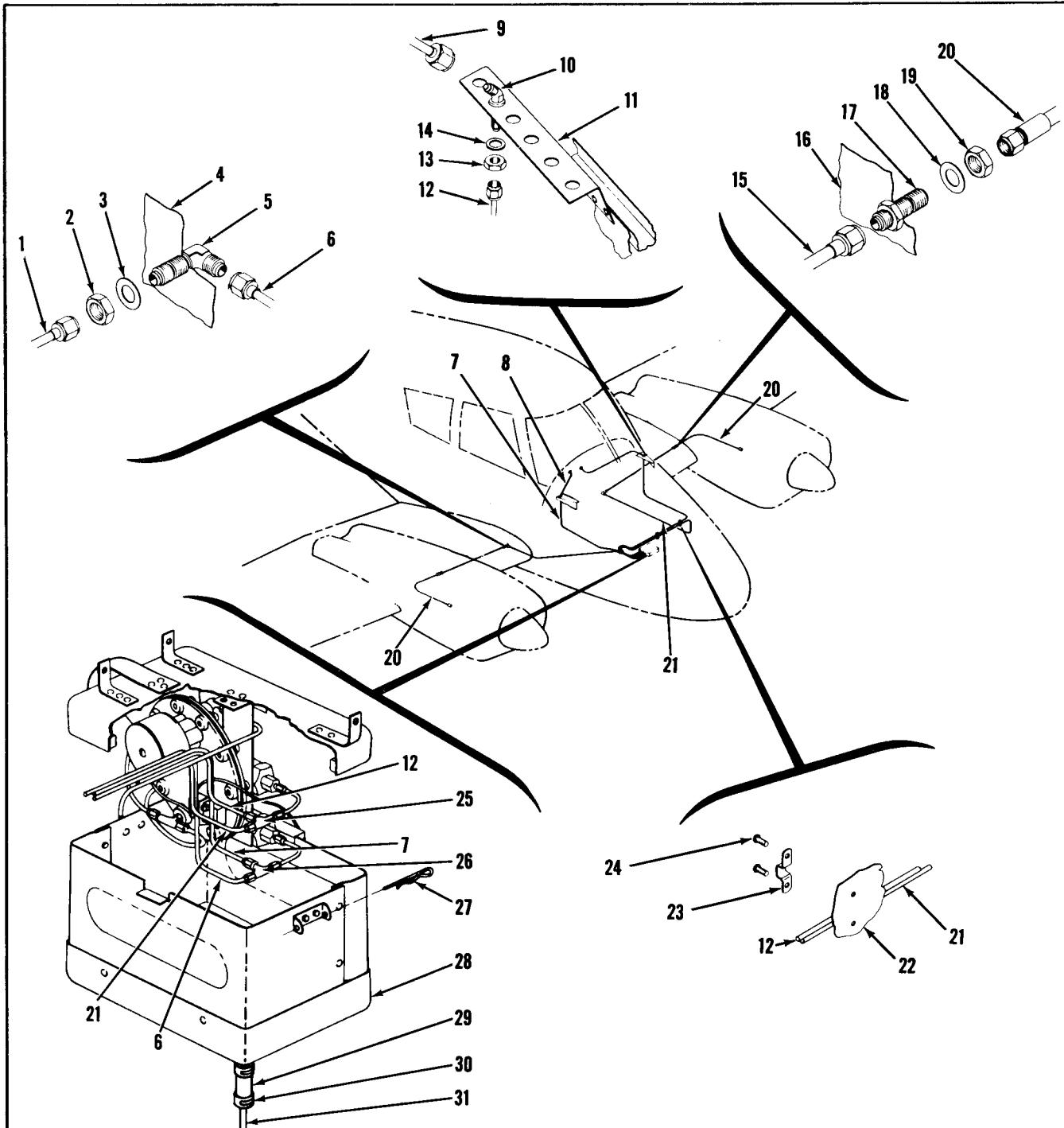
- a. Insert plate retainer through opening in bottom of fuel tank and align with sump floor (29) mounting holes.
- b. Position gasket (26) and sump floor (29) and secure with attaching bolts (30). Safety all attaching bolts (30) with safety wire.
- c. Install fuel boost pump in accordance with paragraph 4-127.
- d. Install fuel quantity sending unit in accordance with paragraph 4-141.
- e. Install navigation light in accordance with paragraph 6-112.
- f. Position tail cap (1) on aft of tank and secure with screws (43) and washers (44).

4-123G. INSTALLATION OF BLADDERLESS WING TIP TANKS. (See figure 4-15.) The installation procedure is the same for either tip tank. For installation of wing tip tanks, reverse removal procedure outlined in paragraph 4-123C.

4-124. FUEL BOOST PUMPS.

4-125. One fuel boost pump is contained inside of

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- | | | |
|-----------------------------------|-----------------------------------|---------------------------------|
| 1. Right Wing Fuel Pressure Line | 11. Bracket | 22. Forward Cabin Bulkhead |
| 2. Nut | 12. Left Fuel Pressure Gage Line | 23. Clip |
| 3. Washer | 13. Nut | 24. Attaching Screws |
| 4. Fuselage Skin | 14. Washer | 25. Upper Tee |
| 5. Fuselage Skin Fitting | 15. Left Wing Fuel Pressure Line | 26. Lower Tee |
| 6. Right Cabin Fuel Pressure Line | 16. Inboard Nacelle Rib | 27. Pin |
| 7. Right Fuel Pressure Gage Line | 17. Nacelle Rib Fitting | 28. Fuel Control Housing Bottom |
| 8. Right Fuel Pressure Gage Hose | 18. Washer | 29. Drain Hose |
| 9. Left Fuel Pressure Gage Hose | 19. Nut | 30. Drain Hose Clamp |
| 10. Bracket Fitting | 20. Fuel Pressure Hose | 31. Drain Line |
| | 21. Left Cabin Fuel Pressure Line | |

Figure 4-16. Fuel Pressure System

each fuel bladder and is mounted to the sump floor. They are submerged pumps, operated electrically and controlled from the cabin. The fuel boost pumps provide fuel pressure in the event of engine driven fuel pump failure and for priming and starting.

4-126. REMOVAL OF FUEL BOOST PUMPS. Either fuel boost pump can be removed as follows:

- a. Remove wing tip tank sump door by removing attaching screws.
- b. Cut safety wire between quick drain valve and drain plug. Drain fuel by removing drain plug and opening quick drain valve.
- c. Tag and disconnect electrical wiring.
- d. Remove attaching bolts from fuel boost pump and remove pump far enough to expose hose connection at outlet port on top side of pump.
- e. Complete removal of fuel boost pump by disconnecting hose from outlet port fitting.
- f. Remove pump hose from inside of fuel bladder by disconnecting hose at tank outlet elbow.

NOTE

If pump was malfunctioning, replace or over-haul pump.

4-127. INSTALLATION OF FUEL BOOST PUMPS.

To install either fuel boost pump (use a suitable thread lubricant on male threads of all fittings):

- a. Insert pump hose through opening in bottom of fuel tank and attach to tank outlet elbow inside tank.
- b. Install drain plug in fuel boost pump and secure to quick drain valve with safety wire.
- c. Position new gasket on fuel boost pump base and attach fuel supply hose to outlet port fitting on top of pump.
- d. Secure fuel boost pump to sump floor with attaching bolts.
- e. Connect electrical connections as tagged.
- f. Replace sump door with attaching screws.

4-128. FUEL BOOST PUMP OPERATIONAL CHECK.

- a. Fill fuel bladder with proper grade of fuel. (See figure 1-5.)
- b. Move fuel selector valve handle to the desired tank.
- c. Place mixture lever in IDLE CUT-OFF.
- d. With battery switch ON, operate fuel boost pump and check fuel pressure gage to see if fuel boost pump is supplying the required pressure.
- e. If pressure is inadequate, remove wing tip tank sump door and adjust fuel boost pump pressure relief valve until required pressure is obtained.
- f. Turn all switches OFF, place fuel selector valve handle in BOTH OFF position and replace sump door.

4-129. FUEL PRESSURE SYSTEM. (See figure 4-16.)

4-130. The fuel pressure system plumbing attaches to a pressure port at each carburetor and is routed through the wing, through the fuselage skin into the cabin, and under the side panel upholstery to the forward side of the forward cabin bulkhead where it supplies fuel for the cabin heater. From the heater, the plumbing is routed back through the forward cabin bulkhead to behind the instrument panel where it con-

ncts to a separate engine gage unit for each engine.

4-131. REMOVAL OF FUEL PRESSURE SYSTEM. (See figure 4-16.)

NOTE

Removal procedure will be outlined for the left installation only. For removal of the right installation use the same procedure except step "j," which is to be disregarded.

- a. Remove engine cowling in accordance with paragraph 4-3.
- b. Remove fuel pressure hose (20) by disconnecting from carburetor and inboard nacelle rib fitting (17).
- c. Remove front fillet between fuselage and wing by removing attaching screws.
- d. Remove three access hole covers on underside of wing in front of wheel well.
- e. Disconnect left wing fuel pressure line (15) at inboard nacelle rib fitting (17) and at fuselage skin fitting. Remove through access hole closet to inboard nacelle rib.
- f. Remove inboard nacelle rib fitting (17) by removing nut (19) and washer (18).

NOTE

It may be necessary to bend all the fuel pressure lines slightly to facilitate removal, however, excessive bending should be avoided.

- g. Remove upholstery side panel in accordance with paragraph 2-193.
- h. Disconnect left cabin fuel pressure line (21) at fuselage skin fitting (5).
- i. Remove fuselage skin fitting (5) by removing attaching nut and washer.
- j. Loosen left fuel pressure gage line (12) and left cabin fuel pressure line (21) from forward cabin bulkhead (22) by removing attaching screws (24) and clips (23).
- k. Loosen drain hose clamps (30) from drain hose (29) and work drain hose free from fuel control housing bottom (28). Access is through nose wheel well.
- l. Remove fuel control housing bottom (28) by removing two pins (27).
- m. Disconnect left fuel pressure gage line (12) from upper tee (25) and remove by working through routing hole in forward cabin bulkhead.
- n. Disconnect left cabin fuel pressure line (21) from upper tee (25) and remove by working through routing hole in forward cabin bulkhead.
- o. Disconnect left fuel pressure gage hose (9) from bracket fitting (11) and left engine gage unit fitting. Remove hose by working from behind instrument panel.

4-132. INSTALLATION OF FUEL PRESSURE SYSTEM. (See figure 4-16.) To install fuel pressure system, reverse removal procedure in paragraph 4-131. Use a suitable thread lubricant on male threads of all fittings during installation of fuel pressure system plumbing. It may be necessary to bend the fuel pressure lines slightly to facilitate installation. However, excessive bending should be avoided to prevent damage to the lines.

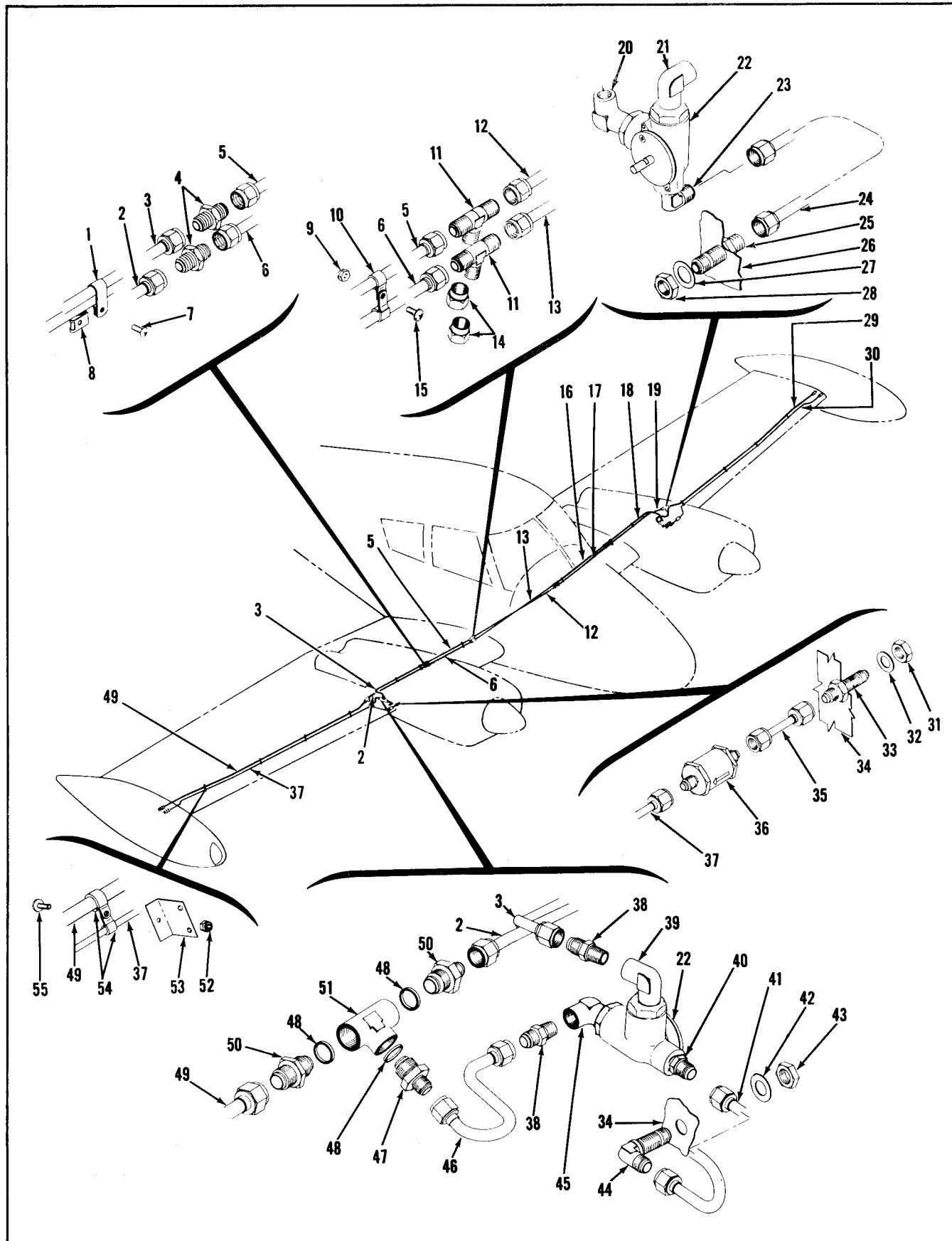


Figure 4-17. Fuel System Plumbing

Figure 4-17. Fuel System Plumbing Callouts

1. Clamp
2. Right Tank Right Nacelle Cross Feed Line
3. Left Tank Right Nacelle Cross Feed Line
4. Union
5. Left Tank Right Wing Cross Feed Line
6. Right Tank Right Wing Cross Feed Line
7. Screw
8. Nut
9. Nut
10. Clamp
11. Drain Tee
12. Left Tank Cabin Cross Feed Line
13. Right Tank Cabin Cross Feed Line
14. Cap
15. Screw
16. Right Tank Left Wing Cross Feed Line
17. Left Tank Left Wing Cross Feed Line
18. Right Tank Left Nacelle Cross Feed Line
19. Left Tank Left Nacelle Cross Feed Line
20. Left Valve Main Fuel Inlet Fitting
21. Left Valve Cross Feed Inlet Fitting
22. Fuel Selector Valve
23. Left Valve Outlet Fitting
24. Left Fuel Valve Outlet Line
25. Fitting
26. Left Engine Outboard Nacelle Rib
27. Washer
28. Nut
29. Left Fuel Supply Line
30. Left Vapor Return Line
31. Nut
32. Washer
33. Nacelle Rib Fitting
34. Right Engine Outboard Nacelle Rib
35. Vapor Return Check Valve Line
36. Check Valve
37. Right Vapor Return Line
38. Nipple
39. Right Valve Cross Feed Inlet Fitting
40. Right Valve Outlet Fitting
41. Right Fuel Valve Outlet Line
42. Washer
43. Nut
44. Elbow
45. Right Valve Main Fuel Inlet Fitting
46. Fuel Valve Supply Line
47. Union
48. Gasket
49. Right Fuel Supply Line
50. Reducer
51. Tee
52. Nut
53. Support Bracket
54. Clamps
55. Screw

4-133. FUEL LINES AND VENTS. (See figure 4-17.)

4-134. The fuel lines are arranged in such a manner that fuel can be supplied to either engine from either tank. The excess fuel from the pressure carburetor is returned to the fuel tank by a vapor return line. The main supply line and the vapor return line are routed through the wing forward of the main spar. The cross feed lines between the selector valves are routed aft of the firewall and forward of the main spar in each wing and through the hollow main spar inside the cabin. A fuel line drain plug is incorporated in each of these lines between the fuselage and right wing root rib. These drain plugs are accessible by removing the fillets between the fuselage and the right wing. A vent is provided in the filler cap of each tank to allow atmospheric pressure to enter the fuel cell.

4-135. REMOVAL OF FUEL LINES. (See figure 4-17.)**NOTE**

Removal procedure will be given for the right wing installation only. Removal of the left wing installation is the same except as illustrated in figure 4-17.

- a. Remove sump door at bottom of fuel tank by removing attaching screws.

b. Cut safety wire between quick drain valve and drain plug. Drain fuel by removing drain plug and opening quick drain valve.

c. Remove three access hole covers nearest wing tip tank and three access hole covers just outboard of engine nacelle on underside of wing in front of main spar.

d. Disconnect right fuel supply line (49) and right vapor return line (37) from wing tip tank by removing hose clamps.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent accumulation of such fuel when lines or hoses are disconnected.

e. Disconnect right fuel supply line (49) from reducer (50) and right vapor return line (37) from check valve (36).

f. Loosen right fuel supply line (49) and right vapor return line (37) by removing four clamps (54) from support brackets (53). Remove lines (49 and 37) through access hole nearest engine nacelle.

g. Disconnect fuel valve supply line (46) from union (47) and nipple (38) and remove.

h. Remove check valve (36) and vapor return check valve line (35) by disconnecting from nacelle rib fitting (33).

- i. Remove nacelle rib fitting (33) by disconnecting fuel vapor return hose and removing nut (13) and washer (32).
- j. Remove access hole cover from firewall directly above fuel strainer and remove clamp which secures right tank right nacelle cross feed line (2) and left tank right nacelle cross feed line (3) in place.
- k. Remove three access hole covers on underside of wing between fuselage and engine nacelle.
- l. Disconnect right and left tank right nacelle cross feed lines (2 and 3) at both ends.
- m. Detach clamps securing right and left tank right nacelle cross feed lines (2 and 3) to inboard nacelle rib. Remove lines by working them through access hole just outboard of engine nacelle.
- n. Remove leading edge wing fillet between wing and fuselage by removing attaching screws.
- o. Disconnect left and right tank right wing cross feed lines (5 and 6) from drain tees (11).
- p. Detach clamp securing left and right tank right wing cross feed lines (5 and 6) to wing root rib. Remove lines through access hole just inboard of engine nacelle.
- q. To remove left and right tank cabin cross feed lines (12 and 13) detach from connections to wing cross feed lines at each wing root.
- r. Remove front spar center carpet in accordance with paragraph 2-204.
- s. Detach clamp which fastens left and right tank cabin cross feed lines (12 and 13) to support bracket inside front spar. Work lines into wing by feeding through routing hole in wing root rib and remove through second access hole from fuselage.

NOTE

Due to the difficulty encountered, it is not recommended that the left and right tank cabin cross feed lines (12 and 13) be removed.

4-136. INSPECTION AND REPAIR OF FUEL LINES. Inspect all lines, fittings and flares for dents, cracks, scratches, and abrasions. Clean lines with compressed air. Repair or replace any damaged lines.

4-137. INSTALLATION OF FUEL LINES. (See figure 4-17.) To install fuel lines, reverse removal procedure outlined in paragraph 4-135. (Use a suitable thread lubricant on male threads of all fittings.)

Figure 4-17A. Fuel System Plumbing Callouts (Serial 35547 and on)

1. Fuel Line	14. Elbow	26. Cap
2. Clamp	15. Bracket	27. Cap
3. Union	16. Left Fuel Pressure Line	28. Screw
4. Fuel Line	17. Nut	29. Fuel Line
5. Fuel Line	18. Washer	30. Clamp
6. Tee	19. Nut	31. Electrical Connector
7. Filter Line	20. Clamp	32. Heater Solenoid Valve
8. Elbow	21. Fuel Line	33. Fuel Line (Solenoid to Heater)
9. Coupling	22. Tee	34. Fuel Line (Filter to Solenoid)
10. Screw	23. Fuel Line	35. Heater Fuel Supply Line
11. Fuel Line	24. Fuel Line	36. Heater Fuel Filter
12. Nut	25. Tee	37. Filter Mounting Bracket
13. Left Fuel Pressure Hose		38. Fuel Pressure Line

CAUTION

When connecting left tank cabin cross feed line (12) and right tank cabin cross feed line (13), be certain that the left tank cabin cross feed line (12) connects to the left tank right wing cross feed line (5) in the right wing, and to the left wing cross feed line (17) in the left wing. The right tank cabin cross feed line (13) should connect to the right tank right wing cross feed line (6) in the right wing and to the right tank left wing cross feed line (16) in the left wing.

4-137A. FUEL PRESSURE SYSTEM. (Aircraft serial 35547 and on. See figure 4-17A.) The fuel pressure gage plumbing attaches to a pressure port at each carburetor (fuel control unit aircraft serial 35772 and on) and is routed through the wing into the cabin, under the side panel upholstery to the back of the instrument panel where the lines connect to the fuel pressure gages, one gage for each engine.

4-137B. REMOVAL OF FUEL PRESSURE SYSTEM. (See figure 4-17A.)

NOTE

Removal procedure will be outlined for the left installation only. Removal of the right installation is the same.

- a. Remove engine cowling in accordance with paragraph 4-3.
- b. Remove fuel pressure hose (20) by disconnecting from carburetor (or fuel control unit) and inboard nacelle rib fitting (17), figure 4-16.
- c. Remove front fillet between fuselage and wing by removing attaching screws.
- d. Remove three access hole covers on underside of wing between fuselage and engine nacelle.
- e. Disconnect fuel pressure line (38) at inboard nacelle rib fitting and at fuselage skin. Remove through access hole nearest inboard nacelle rib.
- f. Remove inboard nacelle rib fitting (17) by removing nut (19) and washer (18), figure 4-16.

NOTE

It may be necessary to bend the fuel pressure lines slightly to facilitate removal.

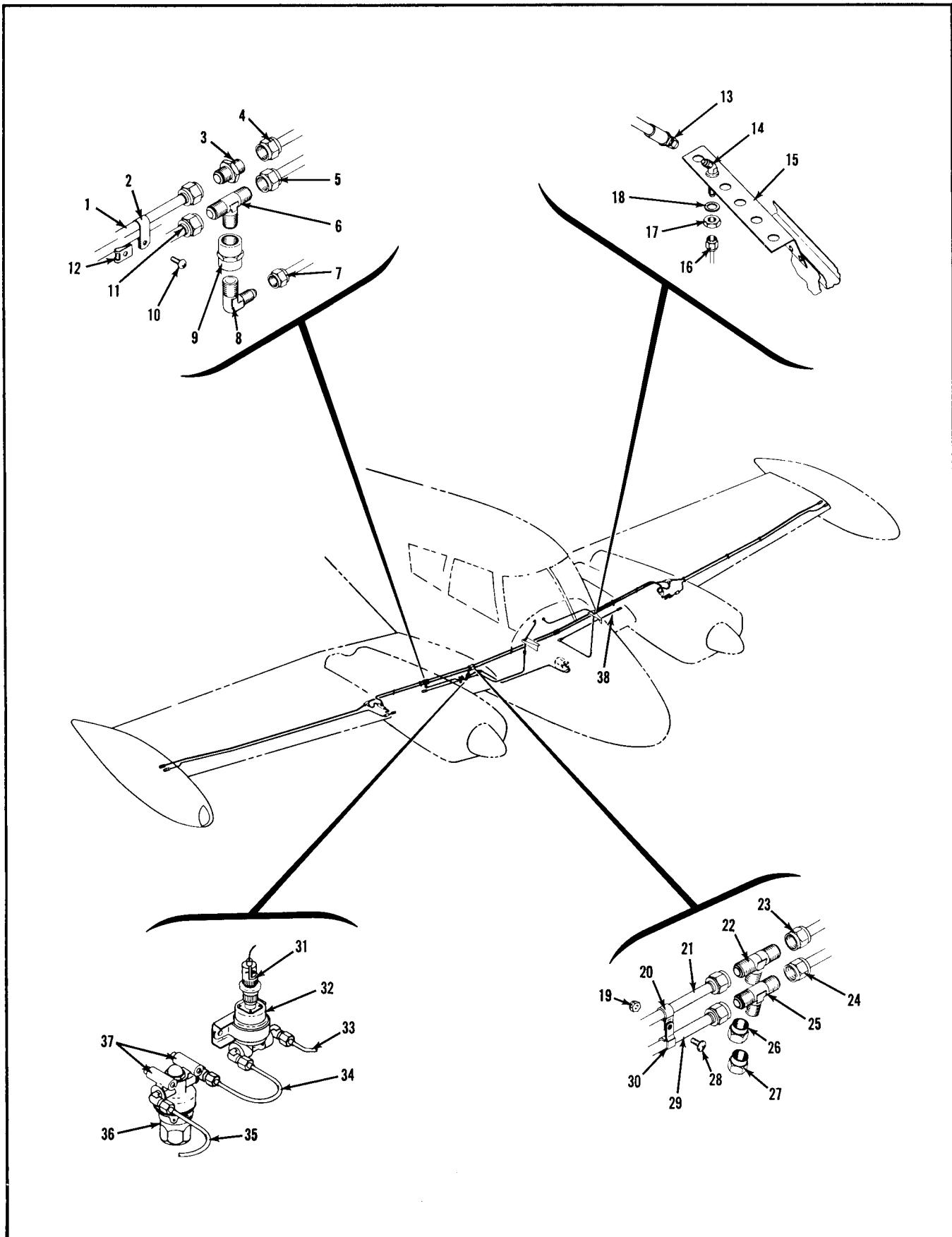


Figure 4-17A. Fuel System Plumbing (Serial 35547 and on)

- g. Remove upholstery side panel in accordance with paragraph 2-192, 193, or 194.
- h. Disconnect line (16) at elbow (14) and remove.
- i. Disconnect fuel pressure hose (13) at elbow (14) and at the fuel pressure gage and remove.
- j. Remove elbow (14) by removing nut (17) and washer (18).

4-137C. INSTALLATION OF FUEL PRESSURE SYSTEM. (See figure 4-17A.) To install fuel pressure system, reverse removal procedure described in paragraph 4-137B. Use a suitable thread lubricant on male threads of all fittings. It may be necessary to bend the fuel pressure lines slightly to facilitate installation, however, excessive bending should be avoided.

4-137D. FUEL LINES AND VENTS. (See figure 4-17A.) Fuel from either main tank may be routed to either engine. Fuel vapor from the carburetor is returned to the fuel tank through a vapor return line. On aircraft serial 35772 and on fuel vapor is returned to the tank from a vapor separator located in the engine driven fuel pump. The main supply line and the vapor return line are routed through the wing forward of the main spar. The cross feed lines between the selector valves are routed aft of the firewall and forward of the main spar to the fuselage and through the hollow main spar inside the cabin. A fuel line drain plug, located between the fuselage and the right wing root rib, is installed in each cross feed line. These drain plugs are accessible by removing the right wing root fillets. The main fuel tanks are vented through the filler caps.

4-137E. REMOVAL OF FUEL LINES. (See figure 4-17A.) Removal procedure will be given for the right wing fuel line installation only. Removal of the left wing fuel line installation is the same except as shown in figure 4-17A.

- a. Remove sump door at bottom of fuel tank.
- b. Drain fuel by removing drain plug and opening quick drain valve.
- c. Remove three access hole covers nearest tip tank and three access hole covers just outboard of engine nacelle on underside of wing in front of main spar.

NOTE

For steps "d" through "j" see figure 4-17.

- d. Disconnect right fuel supply line (49) and right vapor return line (37) from wing tip tank by removing hose clamps.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent accumulation of such fuel when lines or hoses are disconnected.

- e. Disconnect right fuel supply line (49) from reducer (50) and right vapor return line (37) from check valve (36).

- f. Loosen right fuel supply line (49) and right vapor return line (37) by removing four clamps (54) from brackets (53). Remove lines (49 and 37) through access hole nearest engine nacelle.

- g. Disconnect fuel valve supply line (46) from union (47) and nipple (38) and remove.

- h. Remove check valve (36) and vapor return check valve line (35) by disconnecting from nacelle rib fitting (33).

- i. Remove nacelle rib fitting (33) by disconnecting fuel vapor return hose and removing nut (31) and washer (32).

- j. Remove access hole cover from firewall directly above fuel strainer and remove clamp which secures right tank right nacelle cross feed line (2) and left tank right nacelle cross feed line (3) in place.

NOTE

For following steps refer to figure 4-17A.

- k. Remove three access hole covers on underside of wing between fuselage and engine nacelle.

- l. Remove right wing root fillet.

- m. Disconnect heater fuel filter line (7) and remove elbow (8) and coupling (9).

- n. Disconnect fuel line (4) and remove union (3).

- o. Disconnect fuel line (5) and remove tee (6).

- p. Remove fuel line clamp (20 and 30).

- q. Remove fuel line caps (26 and 27) from tees (22 and 25).

- r. Disconnect fuel line (21) from tee (22) and remove.

- s. Disconnect fuel line (29) from tee (25) and remove.

- t. Disconnect line (35) at heater fuel strainer (36) and remove.

- u. Remove line (34) between heater fuel strainer (36) and heater solenoid valve (32).

- v. Disconnect heater fuel line (33).

- w. Remove heater fuel strainer (36) by removing attaching screws.

- x. Remove electrical connector (31) from heater solenoid (32) and remove heater solenoid by removing attaching screws.

- y. To remove left and right cabin cross feed lines (23 and 24) disconnect lines from fittings at each wing root.

- z. Remove front spar center carpet in accordance with paragraph 2-204.

- aa. Remove clamp which fastens left and right tank cabin cross feed lines (23 and 24) to support bracket inside front spar. Work lines into wing by feeding through routing hole in wing root rib and remove through second access hole from fuselage.

4-137F. INSPECTION AND REPAIR OF FUEL LINES.

Inspect all lines fittings and flares for dents, cracks, scratches and abrasions. Clean lines with compressed air. Replace any damaged lines.

4-137G. INSTALLATION OF FUEL LINES. (See figure 4-17A.) To install fuel lines, reverse removal procedure outlined in paragraph 4-137E. Use a suitable thread lubricant on male threads of all fittings.

CAUTION

(See figure 4-17.) When connecting left tank cabin cross feed line (12) and right tank cabin cross feed line (13), be certain that the left tank cabin cross feed line (12) connects to the left tank right wing cross feed line (5) in the right wing, and to the left wing cross feed line (17) in the left wing. The right tank cabin cross feed line (13) should connect to the right tank right wing cross feed line (6) in the right wing and to the right tank left wing cross feed line (16) in the left wing.

4-138. FUEL QUANTITY SENDING UNITS.

4-139. One fuel quantity sending unit is located inside of each fuel bladder and is mounted to the sump floor just forward of the fuel boost pump. It is a float arm actuated variable resistor type of unit, powered by the aircraft electrical system, which sends an electrical signal to the fuel quantity indicator in the cabin. The wiring is routed through the wings and into the cabin.

4-140. REMOVAL OF FUEL QUANTITY SENDING UNITS. Either fuel quantity sending unit can be removed by the following procedure.

- a. Remove sump door by removing attaching screws.
- b. Cut safety wire between quick drain valve and drain plug. Drain fuel supply by removing drain plug and opening quick drain valve.
- c. Tag and disconnect electrical wiring.
- d. Remove fuel quantity sending unit by removing attaching bolts.

4-141. INSTALLATION OF FUEL QUANTITY SENDING UNITS. Either fuel quantity sending unit can be installed by the following procedure:

- a. Place new gasket on mounting flange at the base of the fuel quantity sending unit.

4-142B. TROUBLE SHOOTING AUXILIARY FUEL QUANTITY INDICATOR SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
INCORRECT OR NO FUEL QUANTITY INDICATION.	Circuit breaker out.	Reset circuit breaker.
	Defective circuit breaker.	Replace defective circuit breaker.
	Defective wiring.	Replace defective wiring.
	Defective sending unit.	Remove wires from unit and attach ohmmeter to unit terminals. Operate float by hand. A good unit, either main or auxiliary, will read approximately 15 ohms empty to 180 ohms full.
	Defective fuel quantity indicator.	Replace defective fuel quantity indicator.

CAUTION

The fuel quantity sending unit should be positioned with the float and actuating arm forward. This will prevent the boost pump hose on the fuel boost pump from interfering with the movement of the actuating arm.

- c. Connect electrical connections as tagged.
- d. Replace drain plug and secure to quick drain valve with safety wire.
- e. Replace sump door.

4-142. FUEL QUANTITY SENDING UNITS OPERATIONAL CHECK.

- a. With fuel tanks completely drained, place the quick drain valves in the closed position.
- b. Turn battery switch to the ON position and reset circuit breaker if necessary.
- c. Add 1/2 gallon of fuel to each tank (the amount determined as unusable fuel) and the fuel quantity indicator should read empty (E).
- d. Add fuel in five gallon increments until a total of 50 gallons has been added to each tank. Check fuel quantity indicator reading for each five gallons of fuel added.

4-142A. AUXILIARY FUEL SYSTEM. The auxiliary fuel system is optional equipment on the 310, 310B, and 310C. The auxiliary tanks are rubberized cells located in the wings just outboard of the engine nacelles. Each tank has a filler cap assembly, a fuel outlet, a vent, a drain plug and a fuel quantity sending unit. The cell is held in position by six bayonet fasteners. The fuel capacity of each auxiliary tank is 15.5 gallons of which 15 gallons is usable. The auxiliary tanks are not equipped with fuel boost pumps.

4-142C. REMOVAL OF AUXILIARY TANK FUEL QUANTITY SENDING UNIT. (See figure 4-17B.)

- a. Remove the access cover located just outboard of the engine nacelle on the upper surface of wing.
- b. Drain the fuel tank.
- c. Tag and disconnect the electrical wiring at the fuel quantity transmitter (6).
- d. Remove the five attaching screws (7) and remove the fuel quantity transmitter (6) and gasket (5).

4-142D. REPLACEMENT OF AUXILIARY TANK FUEL QUANTITY SENDING UNIT. (See figure 4-17B.)

- a. Install the fuel quantity transmitter (6) and gasket (5) and secure with five attaching screws (7) and seal washers (9).
- b. Connect the electrical wiring as tagged at removal.
- c. Replace any cover plates which were removed.

4-142E. OPERATIONAL CHECK OF AUXILIARY FUEL QUANTITY SENDING UNITS. With fuel tanks completely drained, turn the battery switch on. Add one-half gallon of fuel to each tank, the amount determined as unusable fuel, and the fuel quantity indicator should read empty(E). Add fuel in five-gallon increments until a total of 15 gallons of fuel has been added to each auxiliary tank. Check the fuel quantity indicator for each five gallons of fuel added.

NOTE

Slight adjustment can be made by bending the float arm on the fuel quantity sending unit.

4-142F. REMOVAL OF AUXILIARY FUEL CELLS. (See figure 4-17C.) The removal procedure is the same for either auxiliary fuel cell.

- a. Remove the fuel quantity sending unit in accordance with paragraph 4-142C.
- b. Remove adapter (4) and gaskets (2) by removing bolts (10).
- c. Loosen clamp (44) and disconnect fuel supply line (42) from the fuel cell.
- d. Actuate the landing lights to the extended position, loosen clamp (40) and disconnect vent line (38) from the fuel cell.
- e. Remove two screws (13) securing drain plug adapter (14) to the lower wing skin.
- f. Remove fuel cap (32) and fuel neck (31) by unscrewing fuel neck (31).
- g. Remove screws (36 and 24). Lift one side of filler neck weld assembly (25) and remove filler neck adapter (29) and gaskets (27 and 30).
- h. Disconnect overflow line (17) from union (33) and remove filler neck weld assembly (25).
- i. Disconnect the six bayonet fasteners and remove the fuel cell through the fuel door plate opening.

4-142G. REPLACEMENT OF AUXILIARY FUEL CELLS. (See figure 4-17C.) The replacement procedure is the same for either auxiliary fuel cell.

- a. Insert the fuel cell through the fuel door plate opening and arrange the cell in the correct position.
- b. Secure the fuel cell with the six bayonet fasteners.
- c. Attach drain plug adapter (14) to the lower wing skin with screws (13). Install the drain plug and safety.
- d. Connect vent line (38) to the fuel cell and secure with clamp (40).

e. Connect fuel supply line (42) to the fuel cell and secure by tightening clamps (44).

f. Place filler neck weld assembly (25) in position and attach overflow line (17) to union (33).

g. Lift one edge of filler neck weld assembly (25), slide filler neck adapter (29) and gaskets (27 and 30) into position, and secure with screws (36).

h. Secure filler neck weld assembly (25) with screws (24).

i. Screw fuel neck (31) into position in filler neck adapter (29).

j. Position adapter (4) and gaskets (2) and secure with bolts (10).

k. Install fuel quantity sending unit (6) in accordance with paragraph 4-142D.

4-142H. REMOVAL AND REPLACEMENT OF FUEL LINES AND VENTS. (See figure 4-17D.) The following procedure is given for removal and replacement of fuel lines and vents installed in the right wing. The procedure is similar for those installed in the left wing, although the routing of some lines is different and there are no drain tees in the left wing root. To facilitate installation, tag all lines before removal.

- a. Remove the sump door at the bottom of the fuel tank by removing attaching screws.
- b. Drain the fuel by removing the drain plug and opening the quick-drain valve.

CAUTION

During all defueling, tank purging and tank re-pairing operations, two ground wires from different points on the aircraft to separate approved grounding stakes shall be used to prevent un-grounding of the aircraft due to accidental disconnecting of one ground wire.

- c. Remove the three access hole covers nearest the wing tip tank and the three access hole covers just outboard from the engine nacelle on the underside of the wing in front of the main spar.
- d. Disconnect right fuel supply line (40) and right vapor return line (27) from the main tank by removing the hose clamps.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Use care to prevent the accumulation of such fuel.

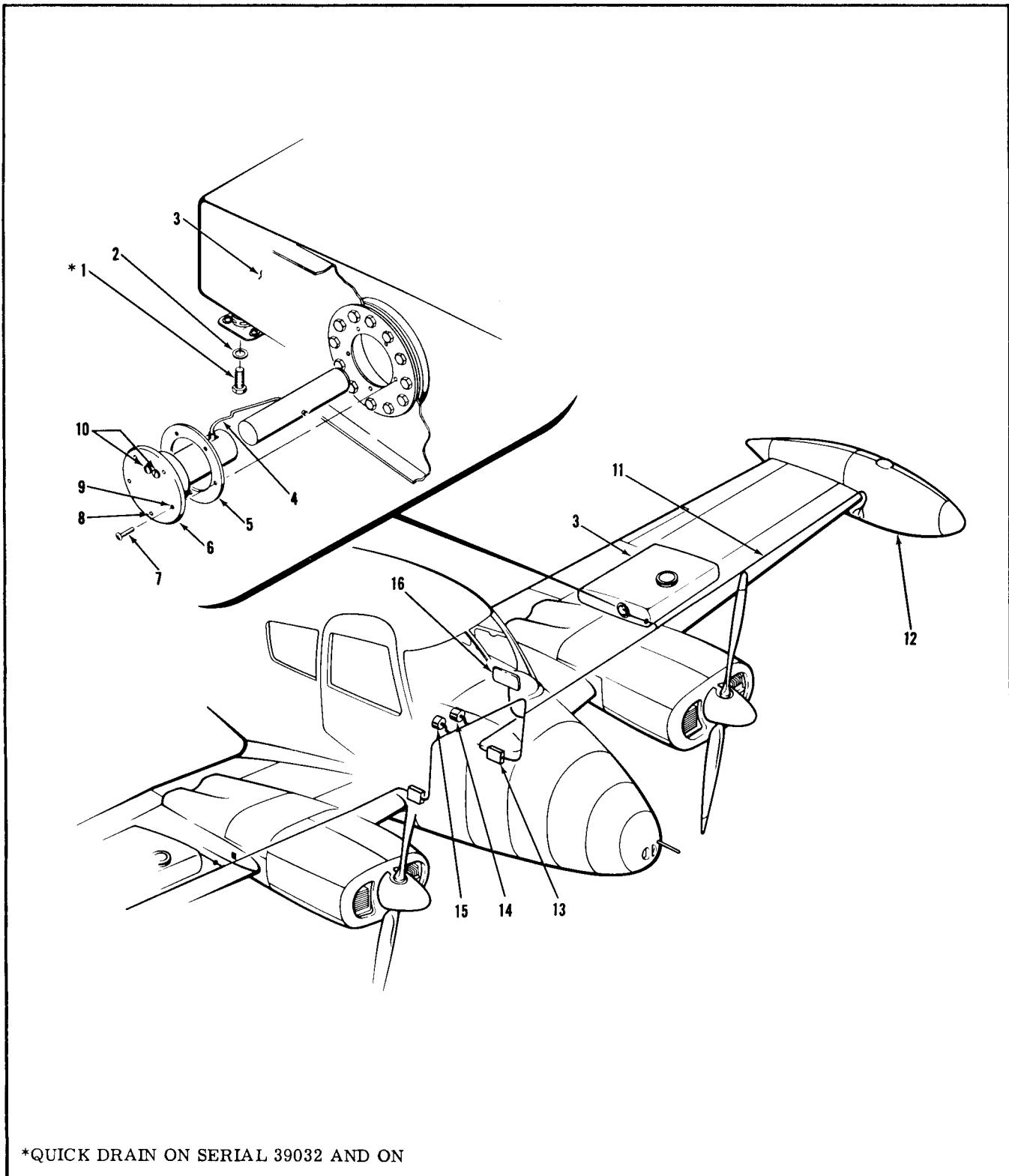
- e. Disconnect right fuel supply line (40) from reducer (41) and right vapor return line (27) from check valve (26).

f. Loosen right fuel supply line (40) and right vapor return line (27) by removing four clamps (45) from support brackets (44). Remove lines (40 and 27) through the access hole nearest the engine nacelle.

g. Disconnect fuel valve supply line (38) from nipples (39 and 33) and remove.

h. Remove check valve (26) and vapor return check valve line (25) by disconnecting from nacelle rib fitting (24).

i. Remove nacelle rib fitting (24) by disconnecting the fuel vapor return hose and removing nut (22) and washer (23).



- | | | |
|------------------------|-------------------------------|------------------------------|
| 1. Drain Plug | 6. Fuel Quantity Sending Unit | 12. Main Fuel Tank |
| 2. Gasket | 7. Screw | 13. Electrical Junction Box |
| 3. Auxiliary Fuel Tank | 8. Bonding Strap | 14. Main Tank Fuel Gage |
| 4. Float Arm | 9. Seal Washer | 15. Auxiliary Tank Fuel Gage |
| 5. Gasket | 10. Electrical Terminals | 16. Circuit Breaker Panel |
| | 11. Wire Bundle | |

Figure 4-17B. Auxiliary Fuel Quantity Indicator

- j. Remove the access hole cover, located directly above the fuel strainer, from the firewall. Remove the clamp which secures right tank right nacelle cross-feed line (2) and left tank right nacelle cross-feed line (3).
- k. Remove three access hole covers on the underside of the wing between the fuselage and engine nacelle.
- l. Disconnect right and left tank nacelle cross-feed lines (2 and 3) at both ends.
- m. Detach the clamps securing right and left tank, right nacelle cross-feed lines (2 and 3) to the inboard nacelle rib. Remove lines by working them through the access hole just outboard of the engine nacelle.
- n. Remove the forward wing fillet by removing attaching screws.
- o. Disconnect left and right tank right wing cross-feed lines (5 and 6) from drain tees (11).
- p. Detach the clamp securing left and right tank right wing cross-feed lines (5 and 6) to the wing root rib. Remove the lines through the access hole just inboard of the engine nacelle.
- q. To remove left and right tank cabin cross-feed lines (12 and 13), detach from the connections to the wing cross-feed lines at each wing root.
- r. Remove the front spar center carpet in accordance with paragraph 2-203.
- s. Detach the clamp which fastens left and right tank cabin cross-feed lines (12 and 13) to the support bracket inside the front spar. Work the lines into the wing by feeding them through the routing hole in the wing root rib and remove through the third access hole from the fuselage.

NOTE

Due to the difficulty that may be encountered, it is recommended that left and right tank cabin cross-feed lines (12 and 13) not be removed.

- t. To replace the fuel lines, reverse the preceding steps.

NOTE

Lubricate all straight thread fittings with VV-P-236 petrolatum and all tapered thread fittings with JAN-A-669 anti-seize compound. Apply lubricant to the male threads only, omitting the first two threads.

CAUTION

When connecting left tank cabin cross-feed line (21) and right tank cabin cross-feed line (13), be certain that the left tank cabin cross-feed line (12) connects to the left tank right wing cross-feed line (5) in the right wing, and to the left wing cross-feed line (17) in the left wing. The right tank cabin cross-feed line (13) should connect to the right tank right wing cross-feed line (6) in the right wing and to the right tank left wing cross-feed line (16) in the left wing.

4-142I. REMOVAL AND REPLACEMENT OF AUXILIARY FUEL LINES AND VENTS. (See figure 4-17C.) The removal and replacement procedure is the same for either the right or left auxiliary fuel lines.

- a. Remove the large access hole cover from the top side of the wing just outboard of the engine nacelle.
- b. Operate the landing light to its extended position.
- c. Remove the batteries and battery box from the left wing.
- d. Loosen clamp (44) and disconnect the lines from union (43) and elbow at the forward spar.
- e. Remove the screw from the clamp securing the lines to the structure and remove the lines.
- f. Remove selector valve access hole cover from the lower side of the wing just outboard of the engine nacelle.
- g. Disconnect auxiliary fuel inlet lines (42) and remove through the selector valve access hole.
- h. Loosen clamp (40), disconnect the vent lines from union (39) and remove the vent lines through the landing light retraction hole.
- i. To replace auxiliary fuel lines, reverse the preceding steps.

NOTE

Lubricate all straight thread fittings with VV-P-236 petrolatum and all tapered thread fittings with JAN-A-669 anti-seize compound. Apply lubricant to the male threads only, omitting the first two threads.

4-142J. REMOVAL AND REPLACEMENT OF FUEL SELECTOR VALVES. (See figure 4-17E.) The procedure is the same for either selector valve.

- a. Remove the main tank sump door by removing attaching screws.
- b. Drain the fuel from the tank by removing the drain plug and opening the quick-drain valve.

CAUTION

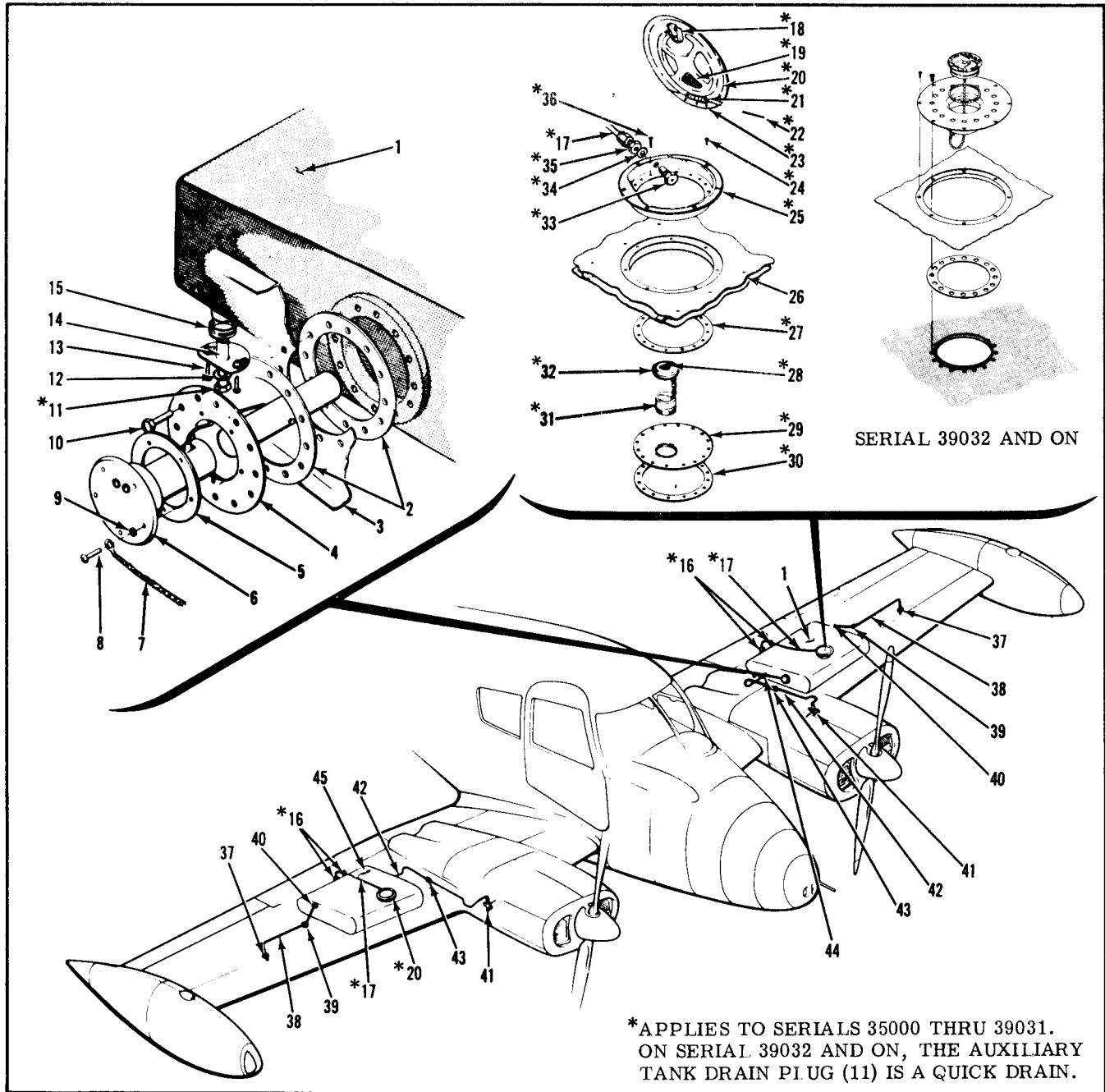
During all defueling, tank purging and tank repairing operations, two ground wires from different points on the aircraft to separate approved grounding stakes shall be used to prevent ungrounding of the aircraft due to accidental disconnecting of one ground wire.

- c. Remove cowling in accordance with paragraph 4-3.
- d. Remove the selector valve access hole cover on the underside of the wing outboard of the engine nacelle.
- e. Disconnect all lines from the fuel selector valve.

WARNING

Residual fuel draining from lines and hoses is a fire hazard. Care should be exercised to dispose of such fuel.

- f. Remove four screws (34) attaching fuel valve shield (27) to the outboard nacelle rib and slide fuel valve shield (27) inboard.
- g. Remove cotter pin (31) from pin (32) and remove the pin and washer (33) from the fuel selector valve housing.
- h. Remove two mounting screws (28) and washers (29 and 30) attaching fuel selector valve (17) to the outboard nacelle rib.



- | | | |
|-------------------------------|-------------------------------|--------------------------|
| 1. Left Hand Fuel Cell | 16. Grommet | 31. Fuel Neck |
| 2. Gasket | 17. Overflow Line | 32. Fuel Cap |
| 3. Rib | 18. Latch | 33. Union |
| 4. Adapter | 19. Decal | 34. Washer |
| 5. Gasket | 20. Fuel Door | 35. Nut |
| 6. Fuel Quantity Sending Unit | 21. Fuel Door Hinge | 36. Screw |
| 7. Bonding Strap | 22. Fuel Door Hinge Pin | 37. Grommet |
| 8. Bolt | 23. Fuel Door Plate | 38. Vent Line |
| 9. Lock-O-Seal | 24. Screw | 39. Union |
| 10. Bolt | 25. Filler Neck Weld Assembly | 40. Clamp |
| 11. Drain Plug | 26. Wing Skin | 41. Fuel Selector Valve |
| 12. Gasket | 27. Gasket | 42. Fuel Supply Line |
| 13. Screw | 28. Metalcal | 43. Union |
| 14. Drain Plug Adapter | 29. Filler Neck Adapter | 44. Clamp |
| 15. Clamp | 30. Gasket | 45. Right Hand Fuel Cell |

Figure 4-17C. Auxiliary Fuel Cells

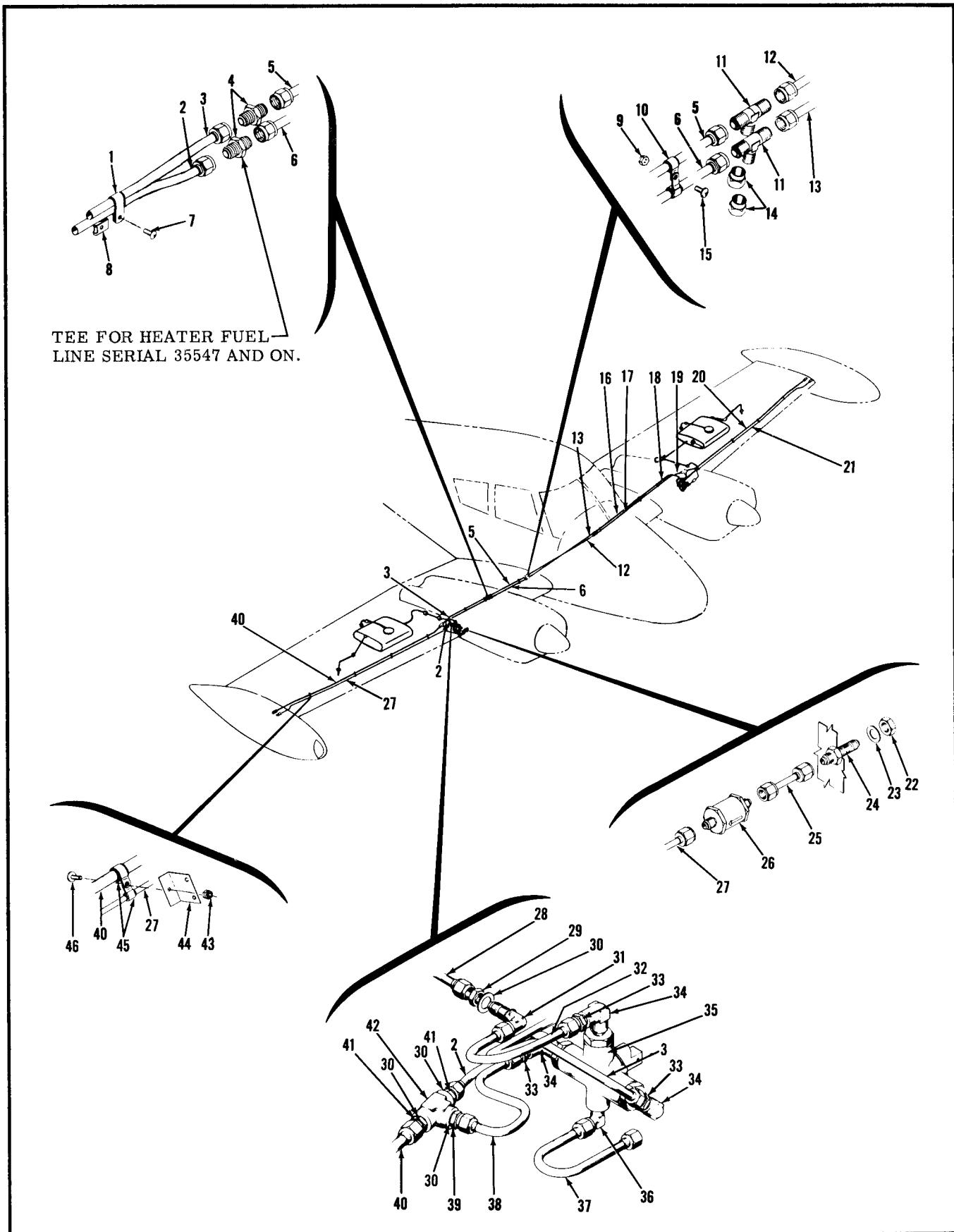


Figure 4-17D. Auxiliary Fuel System Plumbing

Figure 4-17D. Auxiliary Fuel System Plumbing Callouts

- | | | |
|-----------------------------|---------------------------------|----------------------------------|
| 1. Clamp | 14. Cap | 28. Auxiliary Fuel Supply Line |
| 2. Right Tank Right Nacelle | 15. Screw | 29. Nut |
| Cross-feed Line | 16. Right Tank Left Wing Cross- | 30. Washer |
| 3. Left Tank Right Nacelle | feed Line | 31. Elbow |
| Cross-feed Line | 17. Left Tank Left Wing Cross- | 32. Auxiliary Fuel Inlet Line |
| 4. Union | feed Line | 33. Nipple |
| 5. Left Tank Right Wing | 18. Right Tank Left Nacelle | 34. Elbow |
| Cross-feed Line | Cross-feed Line | 35. Fuel Selector Valve |
| 6. Right Tank Right Wing | 19. Left Tank Left Nacelle | 36. Elbow |
| Cross-feed Line | Cross-feed Line | 37. Right Fuel Valve Outlet Line |
| 7. Screw | 20. Left Fuel Supply Line | 38. Fuel Valve Supply Line |
| 8. Nut | 21. Left Vapor Return Line | 39. Nipple |
| 9. Nut | 22. Nut | 40. Right Fuel Supply Line |
| 10. Clamp | 23. Washer | 41. Reducer |
| 11. Drain Tee | 24. Nacelle Rib Fitting | 42. Tee |
| 12. Left Tank Cabin Cross- | 25. Vapor Return Check Valve | 43. Nut |
| feed Line | Line | 44. Support Bracket |
| 13. Right Tank Cabin Cross- | 26. Check Valve | 45. Clamp |
| feed Line | 27. Right Vapor Return Line | 46. Screw |

- i. Remove fuel selector valve (17).
- j. To replace the fuel selector valves, reverse the preceding steps.

NOTE

Lubricate all straight thread fittings with VV-P-236 petrolatum and all tapered thread fittings with JAN-A-669 anti-seize compound. Apply lubricant to the male threads only, omitting the first two threads.

4-142K. REMOVAL AND REPLACEMENT OF FUEL SELECTOR VALVE CONTROLS. (See figure 4-17E.)

The removal and replacement procedure is the same for either fuel selector valve control.

- a. Place the fuel selector valve handle in the OFF position.
- b. Remove engine cowling in accordance with paragraph 4-3.
- c. Loosen valve shield (27) by removing four screws (34).
- d. Disconnect outboard torque tube (14) by removing roll pin (15), cotter pin (31), washer (33), and pin (32). Slide the outboard torque tube inboard until its outer end is free of the fuel selector valve housing and remove from the engine nacelle.
- e. Loosen bearing block shield (24) at the inboard nacelle rib by removing two screws (23).
- f. Remove the forward wing fillets and the two access hole covers nearest the fuselage.
- g. Disconnect and remove universal joint (20) at the wing root by removing roll pins (21 and 22).
- h. Remove wing torque tube (18) and inboard nacelle torque tube (16) through the engine nacelle.
- i. Remove pan assembly (4) by removing roll pins (1), (cap nut (1A) on aircraft serial 35774 and on), handles (2), gear support screws (3), and attaching screws (10 and 11).
- j. Remove front carpet.
- k. Remove the two round access hole covers under the front seats.
- l. Remove the two rectangular access hole covers from the center of the floorboards.
- m. Remove fuselage torque tube (8) and gear support

assembly (6) by working them back and forth until they can be removed through the rectangular access hole in the cabin floor.

n. To replace the fuel selector valve controls, reverse the preceding steps. Safety wire all roll pins.

NOTE

Before installing the fuel valve shield, make certain the position of the fuel selector valve handle agrees with the position of the fuel selector valve housing. (Install in the OFF position.)

4-143. ENGINE PRIMING SYSTEM.

4-144. The engine priming system is standard equipment on all Model 310 airplanes and is installed to provide a starting aid for cold weather operation. A three-position switch spring-loaded to the center, OFF position, is provided on the instrument panel to actuate the primer solenoid valves located in the engine nacelles. Fuel is routed from the fuel strainers to the solenoid valves. When the valves are actuated by the cockpit switch, fuel is allowed to pass through the valves and is routed to the primer distributors mounted on top of the engines. From each distributor, fuel is routed to the priming jets in each cylinder where it is discharged into the intake chamber outside the valve seat. The fuel boost pump must be operating to provide pressure for the system.

4-145. REMOVAL OF ENGINE PRIMER SOLENOID VALVES. (See figure 4-6.) The following procedure is standard for all airplanes except those equipped with oil dilution. For airplanes equipped with oil dilution the removal procedure for an engine primer solenoid valve is the same as the removal procedure for an oil dilution solenoid valve. Refer to paragraph 4-31 for removal of an oil dilution solenoid valve. To remove either solenoid valve:

- a. Detach electrical connector (1) from solenoid valve (3).
- b. Disconnect line to fuel strainer, and hose (4) to right rear engine baffle.

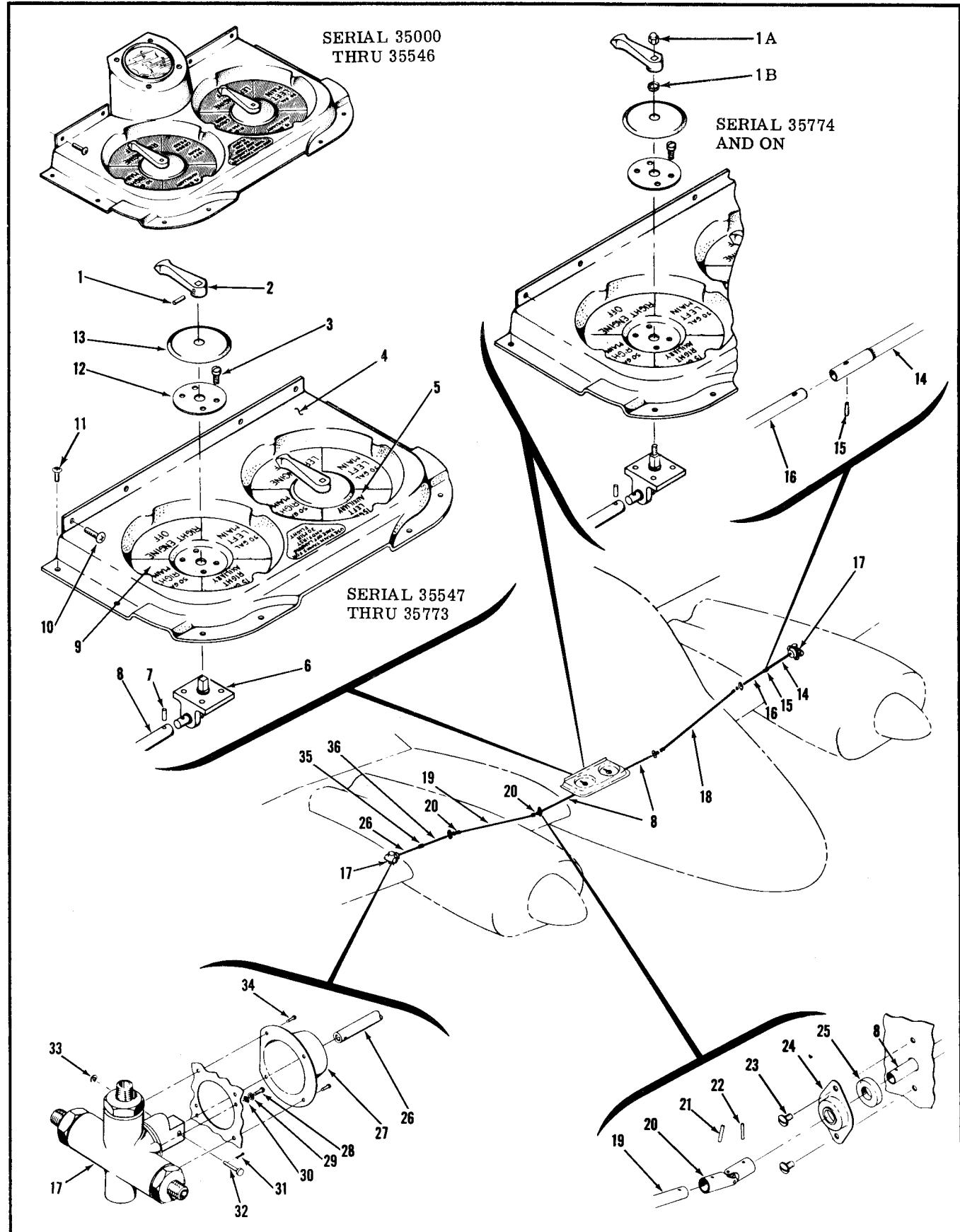


Figure 4-17E. Fuel Selector Controls

Figure 4-17E. Fuel Selector Control Callouts

1. Setscrew	12. Doubler	24. Bearing Block Shield
1A. Cap Nut	13. Disc	25. Bearing Block
1B. Snap Ring	14. Outboard Torque Tube	26. Outboard Torque Tube
2. Fuel Selector Valve Handle	15. Roll Pin	27. Fuel Valve Shield
3. Screw	16. Inboard Nacelle Torque Tube	28. Screw
4. Pan Assembly	17. Fuel Selector Valve	29. Lockwasher
5. Left Metalcal	18. Wing Torque Tube	30. Washer
6. Gear Support Assembly	19. Wing Torque Tube	31. Cotter Pin
7. Roll Pin	20. Universal Joint	32. Pin
8. Fuselage Torque Tube	21. Roll Pin	33. Washer
9. Right Metalcal	22. Roll Pin	34. Screw
10. Screw	23. Screw	35. Roll Pin
11. Screw		36. Inboard Nacelle Torque Tube

- c. Remove two screws and clamp which attach solenoid valve (3) to engine firewall.

4-146. INSTALLATION OF ENGINE PRIMER SOLENOID VALVES. (See figure 4-6.) The following procedure is standard for all airplanes except those equipped with oil dilution. For airplanes equipped with oil dilution the installation procedure for an engine primer solenoid valve is the same as the installation procedure for an oil dilution solenoid valve. Refer to paragraph 4-32, for installation of an oil dilution solenoid valve. To install an engine primer solenoid valve:

- a. Install solenoid valve (3) on engine firewall as illustrated.
- b. Connect the primer hose (4), and line from fuel strainer to solenoid valve.
- c. Attach electrical connector (1) to solenoid valve (3) and secure with safety wire.

4-147. OPERATIONAL CHECK.

- a. To check for proper operation of solenoid, turn battery switch ON and operate the primer switch. A click will indicate solenoid operation.
- b. Disconnect primer hose (4) from engine rear baffle and with booster pump operating, momentarily operate the primer switch to see that fuel will flow from the end of the line. Flow to any of the cylinders may be checked in the same manner by disconnecting the distributor line at that cylinder.

4-148. ENGINE CONTROLS.

4-149. This aircraft is equipped with a teleflex control system for throttle, mixture, propeller pitch control, and carburetor alternate air source operation. This system consists of spiral-wound steel cables operating within rigid conduits. A positive response to manipulation of the cockpit controls, and ease of maintenance and replacement of components is inherent in this system.

4-150. REMOVAL OF ENGINE CONTROLS. (See figure 4-18.) The following procedure for removal of the propeller control system is typical for all engine control systems used on the airplane and can be used as a guide for the removal of any such system.

a. Remove the following units in preparation for removal of the complete system:

1. Center side panels from control pedestal.

2. Pilot's and copilot's seats in accordance with paragraph 2-179.

3. Conduit cover and conduit clamp from immediately forward of fuel selector support pan.

4. Carpet and upholstery side panels in accordance with paragraphs 2-204, 192, 193, or 194.

5. Fuel selector support pan in accordance with paragraph 4-106, step "h".

6. Forward wing fillet.

7. Three access hole covers on underside of wing leading edge between fuselage and engine nacelle.

8. Fuel selector torque-tube between fuselage and engine nacelle in accordance with paragraph 4-106.

- b. Removal of teleflex cable.

1. Disconnect control rod end (23) from propeller governor (26) by removing nut (25), bolt (22), and spacer (24).

2. Unlock sliding end (21) from teleflex cable by loosening nut on locking plug (20). Remove by unscrewing in clockwise direction.

3. Disconnect control pedestal end of teleflex cable by removing pin (2) which holds clevis (3) to bellcrank (1). Remove cable from system by pulling upward on teleflex push-pull unit (4).

NOTE

To remove an alternate air control teleflex cable, disconnect the fitting at the carburetor air box and pull cable from conduit by pulling outward on alternate air control knob (35). It is not necessary to disconnect any fittings at the control pedestal to remove this cable.

- c. Removal of teleflex conduit.

CAUTION

To prevent possible binding of the teleflex control system, extreme care should be exercised when removing teleflex conduit to avoid kinking, denting or altering its shape.

1. Disconnect cabin section conduit (6) at control pedestal swivel connector (5) and at fuselage skin connector (10). Remove by raising aft end of conduit and carefully working the forward end free of the control pedestal.
2. Disconnect wing section conduit (11) at fuse-

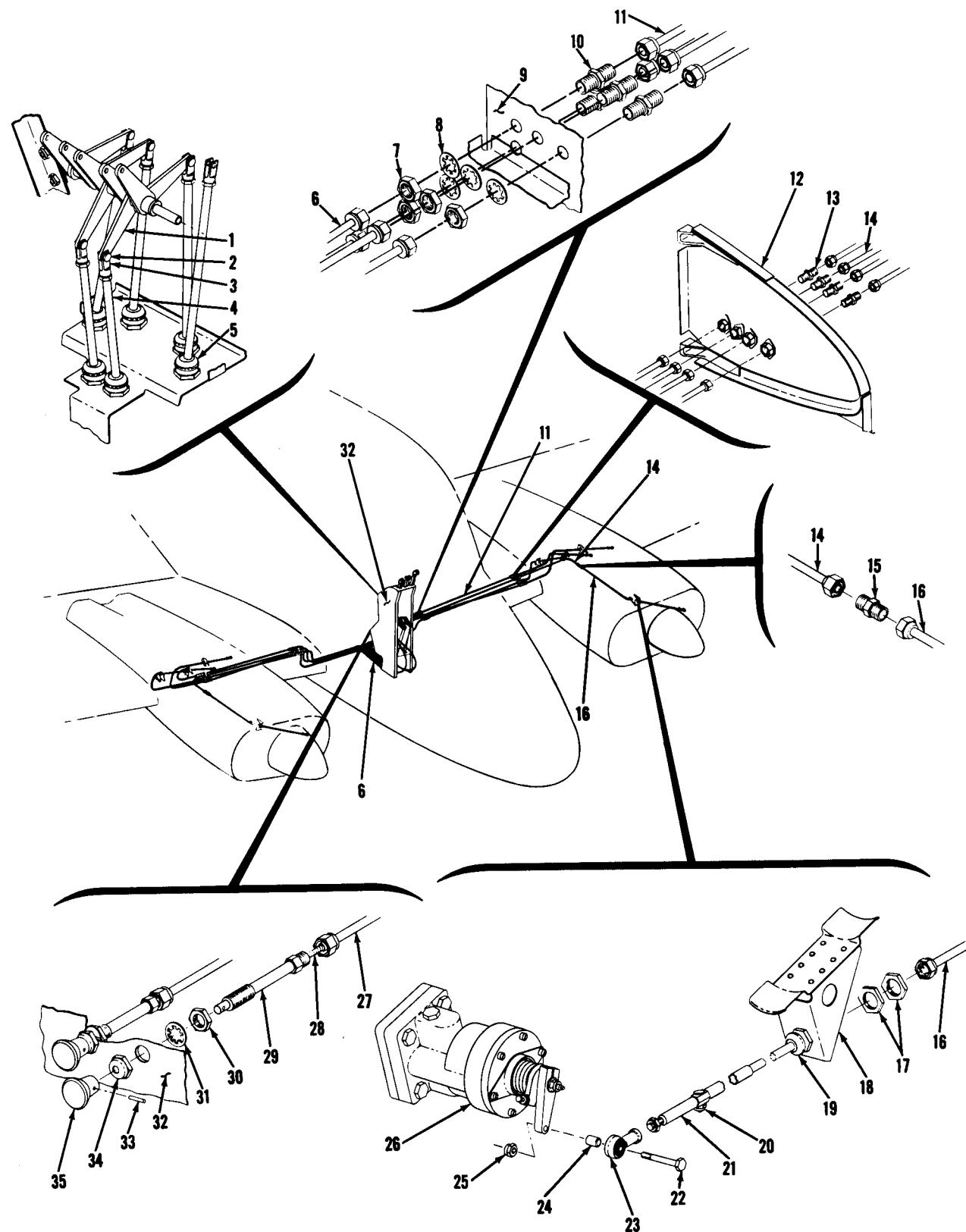


Figure 4-18. Engine Controls

Figure 4-18. Engine Controls Callouts

- | | | |
|----------------------------|-------------------------------|--------------------------------|
| 1. Bellcrank | 13. Connector | 24. Spacer |
| 2. Pin | 14. Nacelle Conduit | 25. Nut |
| 3. Clevis | 15. Propeller Control Conduit | 26. Propeller Governor |
| 4. Teleflex Push-Pull Unit | Connector | 27. Conduit |
| 5. Swivel Connector | 16. Propeller Control Conduit | 28. Teleflex Cable |
| 6. Cabin Section Conduit | 17. Mounting Nuts | 29. Teleflex Push-Pull Unit |
| 7. Mounting Nut | 18. Mounting Bracket | 30. Nut |
| 8. Lock Washer | 19. Swivel Connector | 31. Washer |
| 9. Fuselage Skin | 20. Lock Plug | 32. Control Pedestal |
| 10. Connector | 21. Sliding End | 33. Roll Pin |
| 11. Wing Section Conduit | 22. Bolt | 34. Nut |
| 12. Inboard Nacelle Rib | 23. Control Rod End | 35. Alternate Air Control Knob |

lage skin connector (10) and at inboard nacelle rib connector (13). Pass outboard end of the conduit through the hole in the web of the inboard nacelle rib which was left by removal of the fuel selector torque tube. This will allow the inboard end of the conduit to clear the center access hole on underside of wing leading edge, through which it can then be removed.

3. Disconnect engine section of propeller control conduit (16) at swivel connector (19) and at line connector (15). Remove from nacelle.

4. Disconnect the nacelle conduit (14) at the inboard nacelle rib connector (13). Remove the clamps which fasten it to the canted bulkhead and to the fuel strainer. Carefully work the conduit free of the canted bulkhead and out of the nacelle.

5. Remove the swivel connectors (5 and 19) and the bulkhead type connectors (10 and 13) by removing the mounting nuts with which they are installed.

4-151. CLEANING AND INSPECTION OF TELEFLEX CABLES AND CONDUIT. Teleflex cables should be cleaned in a suitable solvent to remove old grease. The conduits can be cleaned by inserting a clean section of teleflex cable to remove any dirt or metal particles which may have accumulated during the installation of a new section. The cable should be inspected for breaks and excessive wear, and the conduit for dents, kinks or evidence of change in conformation. Defective parts should be replaced. Teleflex cable should be greased while installing (see Lubrication Chart, figure 1-5). No periodic lubrication is necessary as the close fit between cable and conduit permanently seals the grease in the control.

4-152. INSTALLATION OF TELEFLEX CONTROL. (See figure 4-18.) Install all components in reverse order of procedure outlined in paragraph 4-150, REMOVAL OF ENGINE CONTROLS.

4-153. ENGINE CONTROL QUADRANT.

4-154. 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 and also allows a variation in the "feel" of the throttle levers to suit individual pilots during takeoffs and landings.

4-155. REMOVAL OF ENGINE CONTROL QUADRANT AND LINKAGE. (See figure 4-19.)

- a. Remove elevator trim control wheel in accordance with paragraph 2-140.
- b. Remove cover plate (29), unscrew friction knob (21), and remove upper and center side panels (20 and 27), from both sides of control pedestal by removing screws (22).
- c. Remove cover box (23) from upper face of control pedestal by removing four screws.

NOTE

An automatic pilot control box is installed in this position as optional equipment on some airplanes.

- d. Disconnect teleflex push-pull units from bellcranks (8) by removing pins (9).
- e. Remove control links (1) by removing cotter pins (10), pins (16), and bolts (5). Tag each link in order of removal for identification when reassembling.
- f. Remove bellcrank assembly by removing two bolts (12) which attach each end bracket (14) to control pedestal. To disassembly bellcranks, remove roll pin (13) from one end bracket (14) and slide bellcranks (8) and bushings (11) from pivot tube (6) as illustrated.
- g. Remove elevator trim control parts from control quadrant in accordance with paragraph 2-140.
- h. Remove control quadrant (18) from control pedestal (19), by removing four attaching screws (17) and nuts (2).

4-156. DISASSEMBLY OF CONTROL QUADRANT. (See figure 4-20.)

- a. Remove three screws (1) attaching right mounting plate (25) to guide rods (18).
- b. Remove washer (28) and spring (29) from end of center stud (27).
- c. Remove spacer (17) and rack (15), and spacers (7) from guide rods, then remove spacer (30), friction disc (31), and control lever (32) from hub (37). Follow this sequence and remove the remaining parts assembled on the guide rods and hub.

NOTE

The several spacers are of different thicknesses. A careful observation of the disassembly sequence is necessary to assure proper positioning on reassembly.

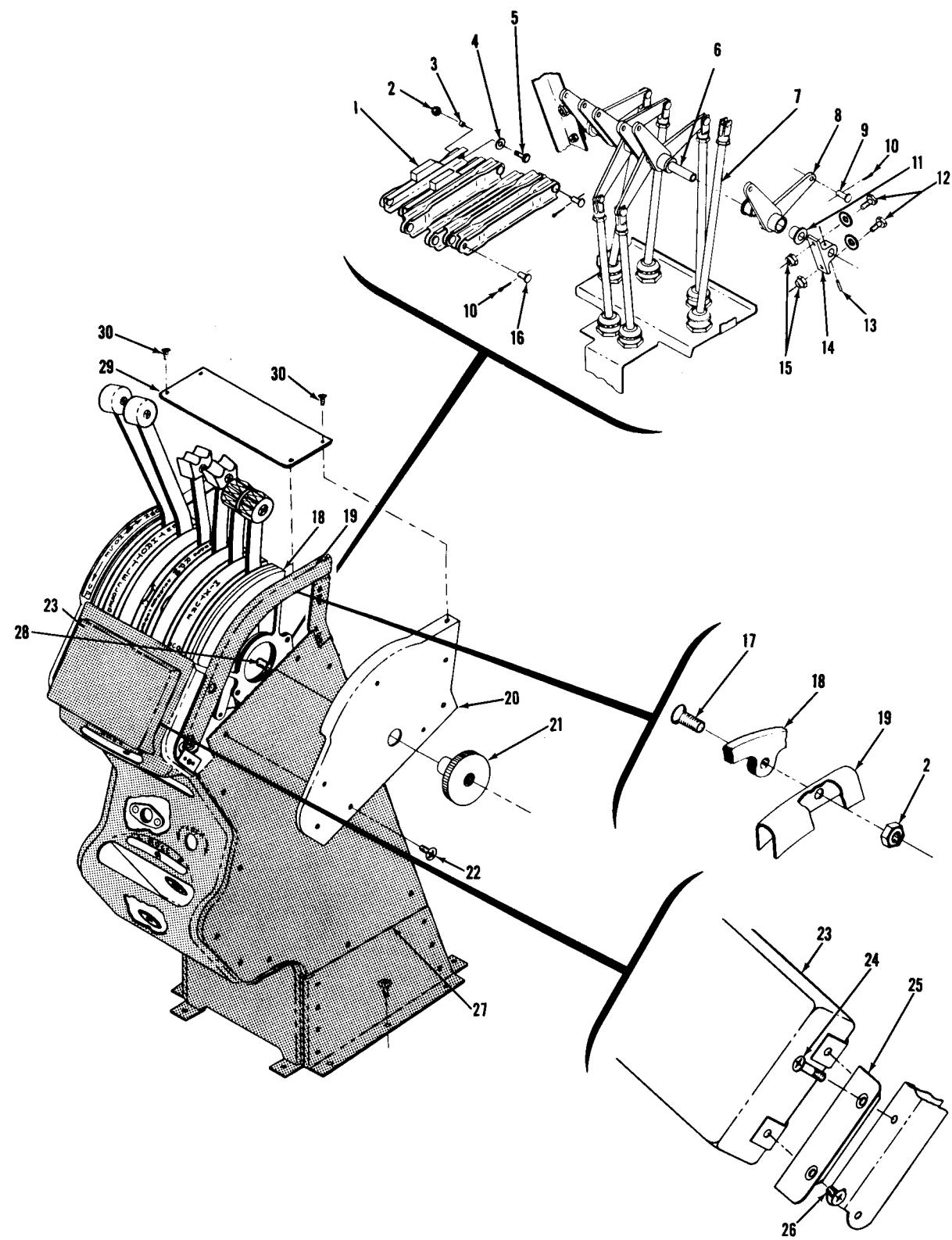


Figure 4-19. Control Quadrant Removal

Figure 4-19. Control Quadrant Removal Callouts

1. Control Links	11. Bushing	21. Friction Knob
2. Nut	12. Bolt	22. Screw
3. Spacer	13. Roll Pin	23. Cover Box
4. Washer	14. End Bracket	24. Screw
5. Bolt (Attach Throttle Links)	15. Nut	25. Support Angle
6. Pivot Tube	16. Pin	26. Screw
7. Teleflex Push-Pull Unit	17. Screw	27. Center Side Panel
8. Bellcrank	18. Control Quadrant	28. Center Stud
9. Pin	19. Control Pedestal	29. Cover Plate
10. Cotter Pin	20. Upper Side Panel	30. Screw

CAUTION

Hold the ratchet stop (21) on the mixture levers (32) down when removing the racks to prevent them from springing out of their housings.

- d. Remove three screws (1) attaching guide rods to left mounting plate (4) and remove guide rods.
- e. Remove lock screw (2) from left mounting plate (4) and remove hub (37) from mounting plate.
- f. Unscrew retainer (3) from hub (37) and center stud (27) from retainer to complete disassembly.

4-157. CLEANING AND INSPECTION OF CONTROL QUADRANT. Clean all metal parts in a suitable solvent and allow to dry. Inspect all parts for evidence of cracking and excessive wear. The racks and ratchet stops for the mixture levers should be inspected for excessive wear and broken teeth. Replace if worn to a point where positive locking is not assured. Replace ratchet stop springs if springs appear to be weak.

4-158. ASSEMBLY OF CONTROL QUADRANT. (See figure 4-20.)

- a. Screw center stud (27) into retainer (3).
- b. Screw retainer into hub (37) 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 it, to prevent it from becoming loose and dropping out.

- c. Install three guide rods (18) 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 spring (29) and washer (28) on end of center stud.
- f. Install right mounting plate (25) with three screws (1), attaching mounting plate to guide rods (18).

4-159. INSTALLATION OF CONTROL QUADRANT

AND LINKAGE. (See figure 4-19.)

- a. Install control quadrant in top of control pedestal with four attaching screws (17) and nuts (2).
- b. Install elevator trim control parts in control quadrant in accordance with paragraph 2-141.
- c. Install bellcranks (8) on pivot tube (6) as illustrated, and secure end brackets (14) with roll pins (13). Install bellcrank assembly in control pedestal with four attaching bolts (12) and nuts (15), two in each end bracket.
- d. Install control links (1) between control levers and bellcranks (8) with attaching pins (16) and cotter pins (10), bolts (5), washers (4), spacers (3), and nuts (2).
- e. Connect teleflex push-pull units (7) to bellcranks with pins (9) and cotter pins (10).
- f. Refer to rigging procedure in following paragraphs for each engine control and check for proper operation of control systems.
- g. Install cover box (23) in upper face of control stand.

NOTE

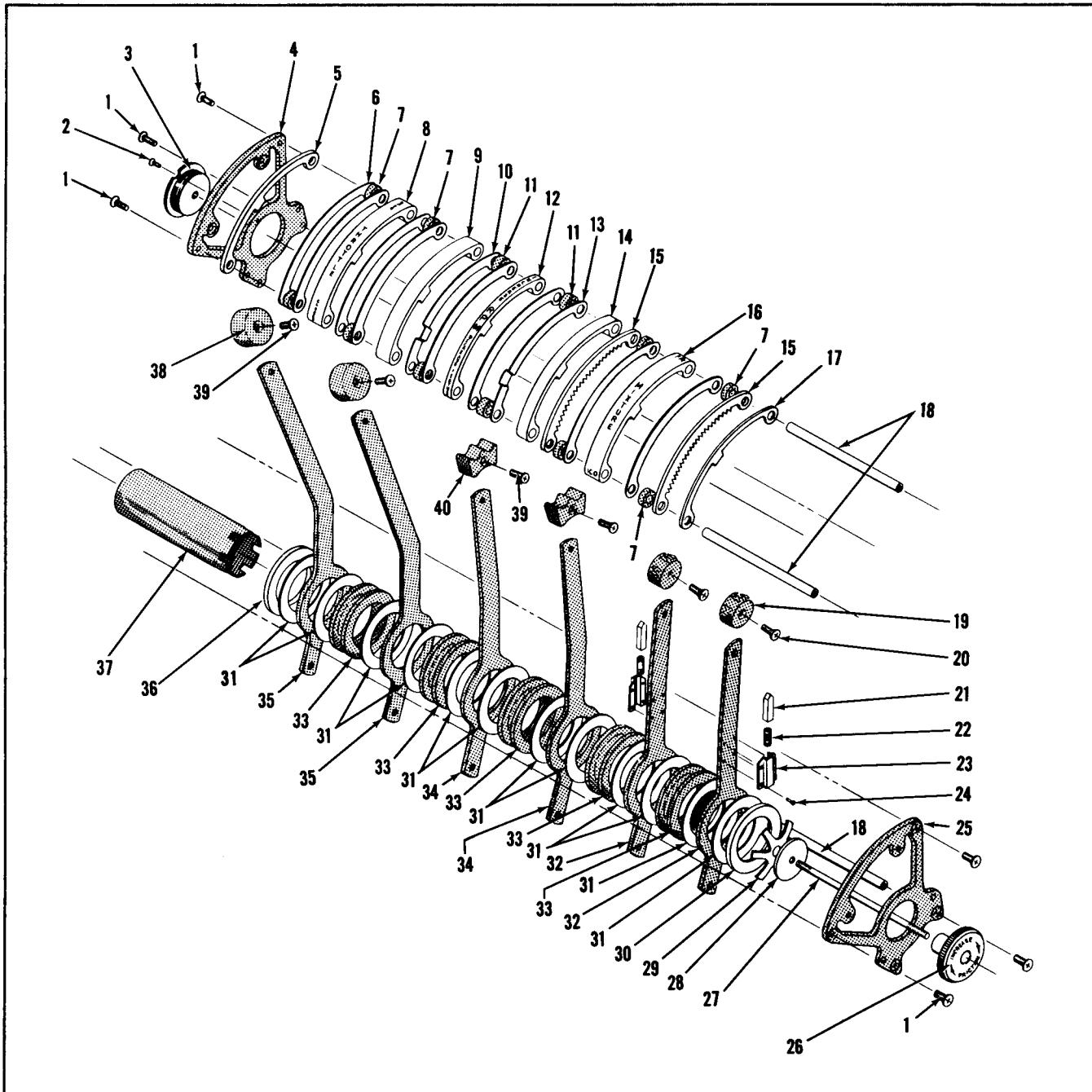
An automatic pilot control box is installed in this position as optional equipment on some airplanes.

- h. Install upper and center side panels (20 and 27), and cover plate (29), on control pedestal.
- i. Screw friction knob (21) onto center stud (28), protruding from right upper side panel.
- j. Install elevator trim control wheel in accordance with paragraph 2-141.

4-160. RIGGING PROCEDURES - ENGINE CONTROLS. (See figure 4-21.)

4-161. RIGGING PROCEDURE FOR THROTTLE CONTROLS. (See figure 4-21.) The rigging procedure is the same for either throttle control.

- a. Disconnect throttle control rod end (6) at throttle arm (1) on carburetor (3) by removing attaching bolt (2).
- b. Place throttle lever in control pedestal in the closed position against aft stop. Advance lever approximately 1/4 inch from stop and lock in this position by tightening friction knob on right side of control quadrant.
- c. Move throttle arm (1) on carburetor to closed (full forward) position against throttle stop.
- d. Loosen jamb nut (5) on throttle control sliding end (4). Adjust position of rod end (6) by screwing in or out until bolt (2) can be inserted through throttle



- | | | |
|----------------------------|--------------------------|---------------------------|
| 1. Screw | 14. Spacer | 28. Washer |
| 2. Lock Screw | 15. Rack | 29. Spring |
| 3. Retainer | 16. Spacer | 30. Spacer |
| 4. Left Mounting Plate | 17. Spacer | 31. Friction Disc |
| 5. Spacer | 18. Guide Rod | 32. Mixture Lever |
| 6. Guide | 19. Mixture Lever Knob | 33. Spacer |
| 7. Spacer | 20. Screw | 34. Propeller Pitch Lever |
| 8. Spacer | 21. Ratchet Stop | 35. Throttle Lever |
| 9. Spacer | 22. Spring | 36. Spacer |
| 10. Left Pitch Lever Stop | 23. Housing | 37. Hub |
| 11. Spacer | 24. Screw | 38. Throttle Lever Knob |
| 12. Spacer | 25. Right Mounting Plate | 39. Screw |
| 13. Right Pitch Lever Stop | 26. Friction Knob | 40. Pitch Lever Knob |
| | 27. Center Stud | |

Figure 4-20. Control Quadrant Disassembly

arm and control rod end as illustrated.

NOTE

Do not allow throttle lever in control pedestal or throttle arm on carburetor to move from positions specified in steps "b" and "c" during adjustment of the rod end.

- e. Tighten nut (7) on attaching bolt (2). Tighten jamb nut (5).
- f. Unlock throttle lever in control pedestal. Actuate carburetor arm against both stops by moving cockpit control. With the carburetor arm against either stop, the throttle lever should be approximately 1/4 inch from the quadrant stop. This unused travel provides the necessary cushion to assure full travel of the carburetor throttle arm (1).

NOTE

Both throttle levers should be rigged to coincide in range of travel.

4-162. RIGGING PROCEDURE FOR MIXTURE CONTROLS.

(See figure 4-21.) The rigging procedure is the same for either mixture control.

- a. Disconnect mixture control rod end (6) at mixture control arm (9) on carburetor (3) by removing attaching bolt (2).
- b. Place mixture lever in control pedestal in FULL RICH position against forward stop. Retard lever approximately 1/4 inch from stop and lock lever in this position by tightening friction knob on right side of control quadrant.
- c. Move mixture control arm (9) on carburetor to FULL RICH (aft) position against stop.
- d. Loosen jamb nut (5) on mixture control sliding end (8). Adjust position of rod end (6) by screwing in or out until bolt (2) can be inserted through mixture control arm and control rod end as illustrated.

NOTE

Do not allow mixture lever or mixture control arm to move from position during adjustment of control rod end.

- e. Tighten nut (7) on attaching bolt (2). Tighten jamb nut (5).
- f. Unlock mixture lever in control pedestal. Actuate mixture control arm against both stops by moving mixture lever. With the mixture control arm against either stop, the mixture lever should be approximately 1/4 inch from the quadrant stop. This unused travel provides the necessary cushion to assure full travel of the mixture control arm.

WARNING

Failure of the mixture control arm to reach the FULL RICH position may cause engine damage or possible engine failure at prolonged high power settings.

4-163. RIGGING PROCEDURE FOR PROPELLER

CONTROLS. (See figure 4-21.) The rigging procedure is the same for either propeller control.

- a. Disconnect propeller control rod end (6) at propeller governor arm (15) by removing attaching bolt (2) and spacer (14).
- b. Place propeller pitch lever in control pedestal, in FULL INCREASE RPM position against forward stop. Retard lever approximately 1/4 inch from stop and lock lever in this position by tightening friction knob on right side of control quadrant.
- c. Place governor arm (15) in full forward position against stop (FULL INCREASE RPM).
- d. Loosen jamb nut (5) on propeller control sliding end (13) and adjust position of control rod end (6), by screwing in or out, until bolt (2) can be inserted through rod end and governor arm (15) without binding.

NOTE

Do not allow propeller pitch lever or propeller governor arm to move from position during adjustment of the control rod end.

- e. Install bolt (2) as illustrated, with spacer (14) between rod end (6) and governor arm (15). Tighten nut (7) on attaching bolt (2). Tighten jamb nut (5).

- f. Unlock propeller pitch lever in control pedestal. Move the pitch lever to the feather position (full aft). Check to see that the propeller governor arm is against its stop in the full aft position. With the governor arm against either stop, the pitch lever should be approximately 1/4 inch from the quadrant stop. This unused travel provides the necessary cushion to assure full travel of the governor arm.

4-164. RIGGING PROCEDURE FOR ALTERNATE AIR CONTROLS.

(See figure 4-21.) The rigging procedure is the same for either alternate air control.

- a. Disconnect alternate air control rod end (6) from alternate air valve actuating arm (21) on carburetor air box (17) by removing attaching bolt (2).
- b. Place alternate air control knob in control pedestal in the COLD (full in) position and turn knob clockwise to lock it in this position.
- c. Position alternate air valve actuating arm (21) so that the air valve (16) in the air box (17) is parallel with the bottom of the air box.

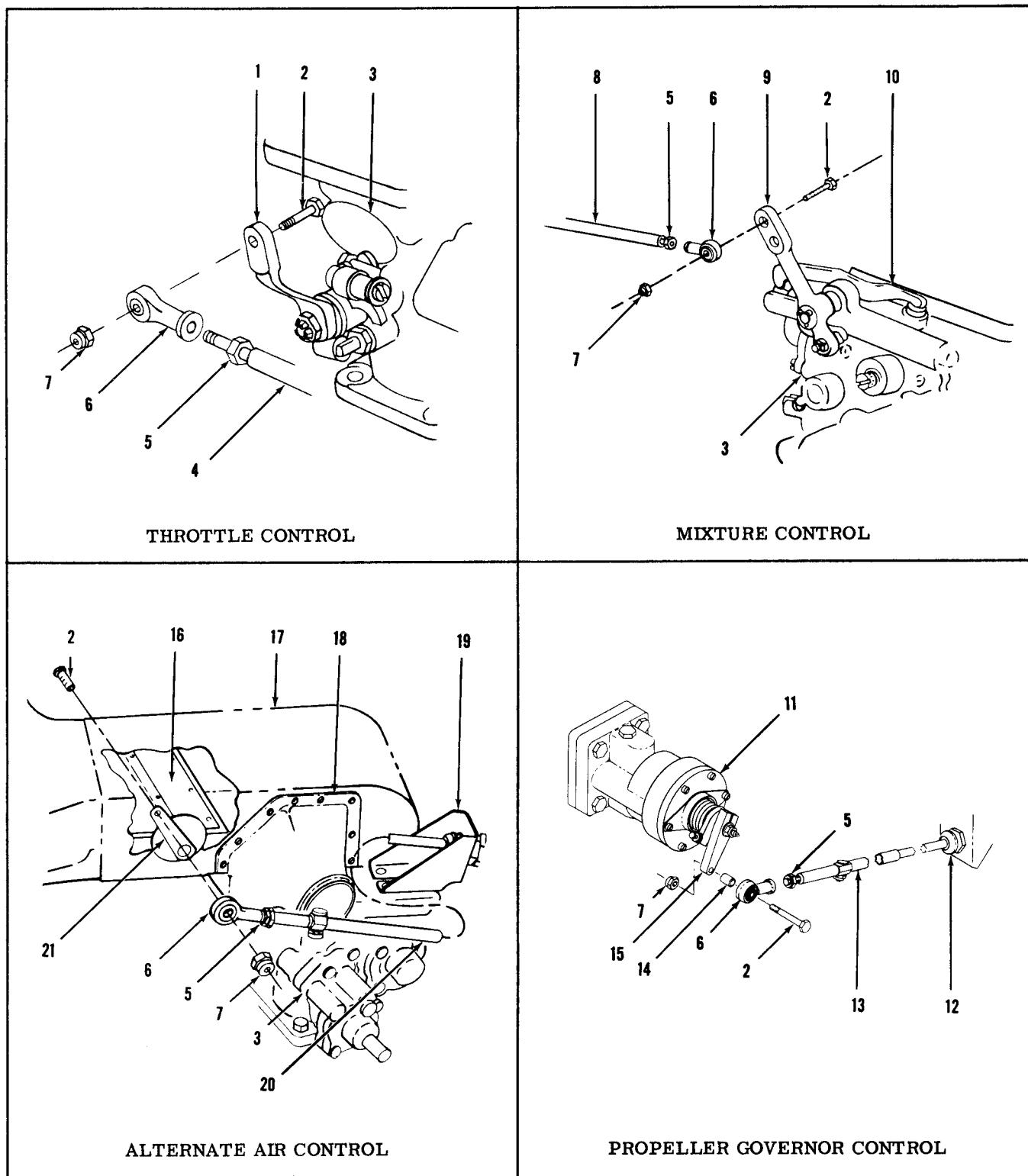
NOTE

The position of the air valve may be checked by opening the spring-loaded alternate air door (18). The air valve should be parallel with the bottom of the air box to provide minimum interference with air flow.

- d. Loosen jamb nut (5) on alternate air control sliding end (20). Adjust position of rod end (6) by screwing in or out until bolt (2) can be inserted through air valve actuating arm (21) and rod end (6) as illustrated.

NOTE

Do not allow alternate air control knob in control pedestal or the alternate air valve actuating arm to move from the positions speci-



- | | | |
|---------------------------------|-----------------------------------|---------------------------------------|
| 1. Throttle Arm | 8. Mixture Control Sliding End | 15. Propeller Governor Arm |
| 2. Bolt | 9. Mixture Control Arm | 16. Alternate Air Valve |
| 3. Carburetor | 10. Idle Cut-Off Lever | 17. Carburetor Air Box Assembly |
| 4. Throttle Control Sliding End | 11. Propeller Governor | 18. Carburetor Hot Air Adapter |
| 5. Jamb Nut | 12. Swivel Connector | 19. Mounting Bracket |
| 6. Control Rod End | 13. Propeller Control Sliding End | 20. Alternate Air Control Sliding End |
| 7. Nut | 14. Spacer | 21. Alternate Air Valve Actuating Arm |

Figure 4-21. Engine Control Rigging

fied in steps "b" and "c" during adjustment of the rod end.

- e. Tighten nut (7) on attaching bolt (2). Tighten jamb nut (5).
- f. Unlock alternate air control knob and pull knob out to HEAT position. Open spring loaded alternate air door (18) on air box (17) and check to see that air valve (16) is fully closed.

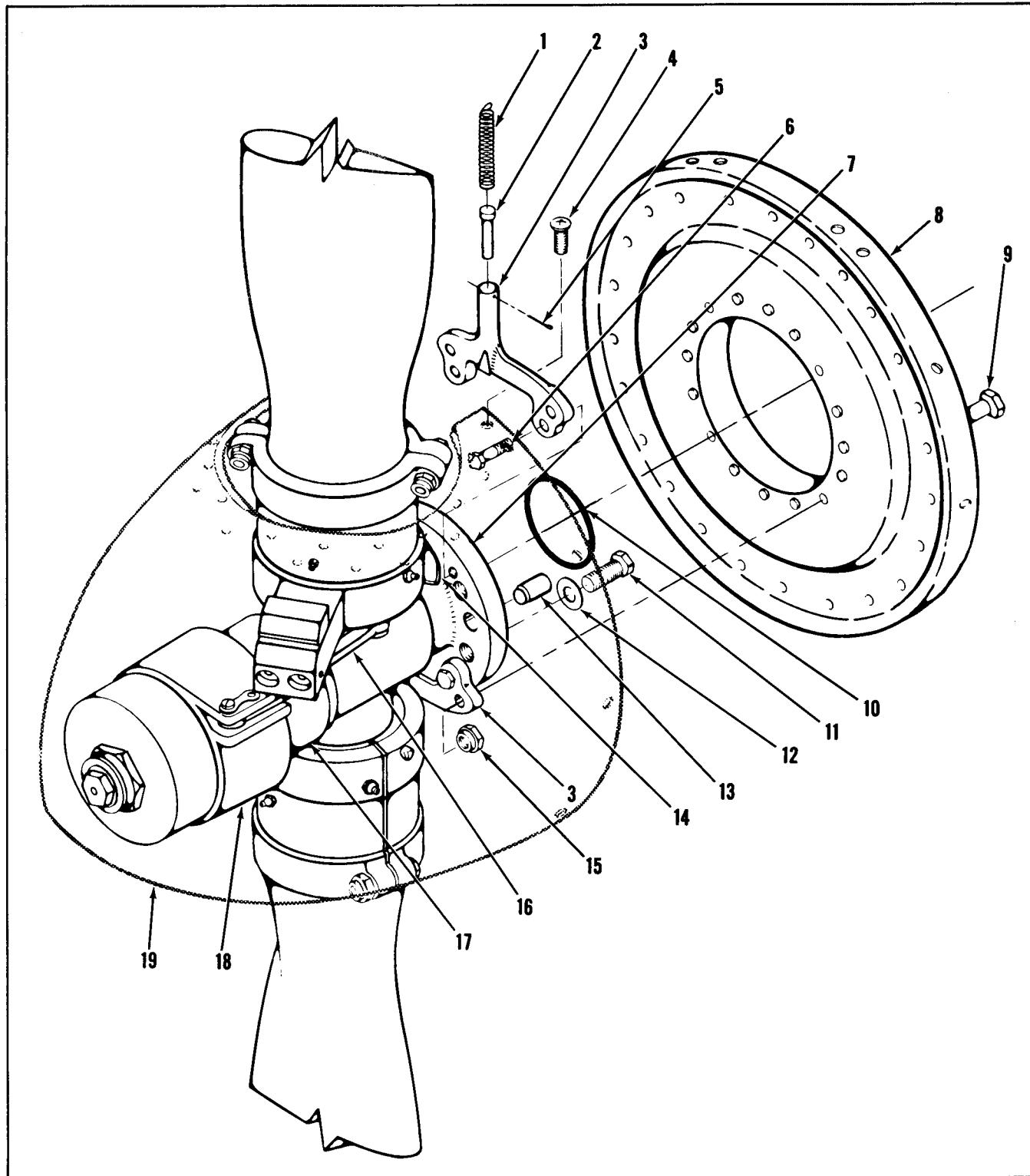
4-165. PROPELLERS.

4-166. All metal, full-feathering, constant speed, Hartzell propellers are standard equipment on the Cessna 310. Each propeller is controlled by a governor, mounted on a governor mount pad at the left forward side of the engine. Boosted oil pressure from

the governor, acting on the blade actuating piston, changes the propeller blade to a low pitch angle. Centrifugal force acting on counterweights moves the propeller blades to a high pitch angle and a combination of centrifugal and spring forces changes the blades to the feathered position. High-pitch stops are attached to the propeller hub clamps, and high-pitch stop brackets incorporating spring-loaded high-pitch stop pins are mounted on the propeller hub flange. When the engine is not running, these stops prevent the blades from moving into the feathered position as the feathering spring tends to force oil from the actuating cylinder back to the engine sump. The spring-loaded high-pitch stop pins are moved from the locking position by centrifugal force so the propeller can be feathered any time the engine speed exceeds 500 rpm.

4-167. TROUBLE SHOOTING THE PROPELLERS.

TROUBLE	PROBABLE CAUSE	CORRECTION
PROPELLER DOES NOT RESPOND TO MOVEMENT OF PROPELLER PITCH LEVER.	Control linkage disconnected. Governor speeder spring broken. Screen in governor mounting gasket clogged. Governor drive shaft sheared. Base plug, body plug or by-pass plug installed in wrong passage.	Refer to paragraph 4-163 for proper rigging. Overhaul or replace governor. Remove governor and replace gasket. Overhaul or replace governor. Install plugs in accordance with paragraph 4-175.
ENGINE SPEED WILL NOT STABILIZE.	Governor relief valve sticking. Excessive clearance in pilot valve. Excessive governor oil pump clearance. Excessive propeller blade friction.	Overhaul or replace governor. Overhaul or replace governor. Overhaul or replace governor. Grease in accordance with figure 1-6, sheet 3. If trouble continues overhaul propeller.
EXCESSIVE RPM CHANGES WITH AIR SPEED OR POWER CHANGES.	Sludge in governor.	Remove and clean governor. Drain engine oil, clean oil filter, service engine with new oil.
FAILURE OF PROPELLER TO GO TO FULL LOW PITCH. (HIGH RPM.)	Improper rigging of governor control system. Governor arm reaches stop before maximum rpm is obtained. Defective governor.	Refer to paragraph 4-163 for proper rigging. Adjust in accordance with paragraph 4-171. Overhaul or replace governor.
SLUGGISH PROPELLER MOVEMENT TO EITHER HIGH OR LOW PITCH.	Excessive propeller blade friction.	Grease in accordance with figure 1-6, sheet 3. If trouble continues overhaul propeller.



- | | | |
|----------------------------|-------------------------|-------------------------|
| 1. High Pitch Stop Spring | 7. Propeller Hub Flange | 14. High Pitch Stop |
| 2. High Pitch Stop Pin | 8. Spinner Bulkhead | 15. Nut |
| 3. High Pitch Stop Bracket | 9. Bolt | 16. Pitch Changing Link |
| 4. Screw | 10. O-ring Seal | 17. Cylinder Wall |
| 5. Cotter Pin | 11. Bolt | 18. Piston |
| 6. Bolt | 12. Washer | 19. Spinner |
| | 13. Dowel Pin | |

Figure 4-22. Propeller

TROUBLE	PROBABLE CAUSE	CORRECTION
FAILURE OF PROPELLER TO FEATHER.	Attempting to feather from too low an engine rpm. Automatic high pitch stop pin stuck in the engaged position. Excessive propeller blade friction. Feathering spring weak or broken.	Increase rpm and attempt to feather again. (See paragraph 4-168, step "a.") Disengage stop pin. Check for freedom of operation and correct cause of pin sticking. Grease in accordance with figure 1-6, sheet 3. If trouble continues overhaul propeller. Overhaul propeller.
OIL LEAKING AROUND PROPELLER MOUNTING FLANGE.	Damaged hub O-ring seal.	Remove propeller and replace O-ring seal.
GREASE LEAKING AROUND BLADE CLAMP.	Blade clamp gasket leaking. O-ring seal at base of blade clamp leaking.	Overhaul propeller. Overhaul propeller.
OIL LEAKING AROUND BASE OF CYLINDER OR PISTON.	O-ring seal damaged.	Overhaul propeller.
OIL LEAKING AROUND BASE OF PROPELLER GOVERNOR.	Governor mounting gasket leaking. Oil seal in governor base leaking.	Remove governor and replace gasket. Remove base and replace seal.

4-168. REMOVAL OF PROPELLERS. (See figure 4-22.) 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, permit easy removal of the automatic high-pitch stops and will protect the blade actuating cylinder wall from damage during the removal procedure.

- a. Feather the propeller by either the normal or the alternate procedure as follows:

Normal Procedure:

1. Start engine in accordance with "Pilots Check List."
2. Operate engine at normal idle (600 rpm).
3. Place the propeller pitch lever in the FEA-THER 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 pos-

sible damage to the engine. If the propeller fails to feather at idling (600 rpm), increase the rpm slightly and attempt to feather again.

If the propeller cannot be feathered at a safe rpm and manifold pressure, use the alternate feathering procedure.

Alternate Feathering Procedure:

1. With engines running, place the propeller pitch levers in full INCREASE RPM position.
2. Move the mixture controls to IDLE CUT-OFF.
3. After the engines have stopped, place the magneto switches in the OFF position.

NOTE

After stopping the engines DO NOT move the propeller pitch levers until ready to feather. If a propeller pitch lever is moved from full INCREASE RPM the engine must be restarted and shut down again.

4. Remove propeller spinner (19).
5. Lift the high pitch stop pins (2) and hold while

a helper moves the propeller pitch lever for that engine to the FEATHER position.

WARNING

Stay clear of propeller. Keep hands clear of moving parts while propeller is feathering.

b. Remove cowling in accordance with paragraph 4-3.

c. Drive dowel pins (13) from holes in propeller hub flange (7) and crankshaft mounting flange with a brass drift punch.

d. Cut safety wire and remove six attaching bolts (11) and washers (12) attaching propeller hub flange (7) to crankshaft mounting flange.

CAUTION

Support the propeller before removing the last bolt, to prevent the possibility of it dropping from the crankshaft.

e. Remove propeller from engine crankshaft.

NOTE

If the airplane is equipped with a propeller anti-ice system, loosen the anti-ice discharge line by removing the two screws securing the line clamps to the brackets mounted on the forward sump bolts. Tie the discharge line clear of the slinger ring before removing the propeller.

f. Remove O-ring seal (10) from the engine crankshaft.

g. Remove spinner bulkhead (8) from propeller by removing four bolts (9) and self-locking nuts (15).

4-169. CLEANING AND INSPECTION OF PROPELLERS. Clean propeller blades and spinners with a clean rag soaked in a noncorrosive solvent.

WARNING

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

Inspect each blade for nicks and scratches, paying particular attention to the last ten inches near the tips. Any repairs should be made in accordance with best shop practice and with applicable CAA regulations. Inspect areas around blade clamps and blade clamp gaskets for possible grease leakage. Overhaul propeller if required.

4-170. INSTALLATION OF PROPELLERS. (See figure 4-22.) The installation procedure is the same for either propeller.

a. Position spinner bulkhead (8) over propeller hub flange (7) and secure to the high-pitch stop brackets (3) with four bolts (6) and self-locking nuts (15) as illustrated.

b. Clean the propeller hub flange (7) and the engine crankshaft flange with crocus cloth.

c. 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 rag.

d. Install O-ring seal (10) at base of flange on engine crankshaft.

e. Press dowel pins (13) through holes in propeller hub flange (7) until pins extend slightly from forward side of flange.

NOTE

Install dowel pins with the chamfered end forward. This will prevent the dowel pins from swelling and freezing when they are driven from the flanges.

f. Position propeller on engine crankshaft.

CAUTION

If the propeller has an anti-ice system, disconnect the discharge line by removing the two screws attaching the discharge line clamps to the brackets mounted on the forward sump bolts. Tie the discharge line clear of the slinger ring before the propeller is installed. Reinstall screws after propeller has been installed.

g. Attach propeller with six bolts (11) and washers (12). Safety bolts in pairs with safety wire.

h. With a brass drift punch, drive dowel pins (13) flush with forward surface of propeller hub flange (7).

i. Secure spinner (19) to spinner bulkhead (8) with screws (4).

j. Replace engine cowling in accordance with paragraph 4-5.

4-171. OPERATIONAL CHECK OF PROPELLERS.

(See figure 4-23.) Anytime propeller or propeller governor has been removed, the following check should be performed after reinstallation. This will insure that the engine - propeller - governor combination is in good operating adjustment and will give maximum performance.

a. Start engines and perform normal ground run-up in accordance with paragraph 4-15.

CAUTION

Avoid running up engines where loose stones or cinders can be sucked up by inflow of air and damage the propeller blades.

b. Check tachometer indication during power check (step "j," paragraph 4-15). Static rpm should be 2500 to 2550 rpm.

1. If static rpm is too high, reduce by adjusting governor stop screw (7). Turn clockwise one revolution for each 25 rpm decrease. This reduction prevents possible overspeeding at takeoff.

2. If static rpm is too low, it is possible that

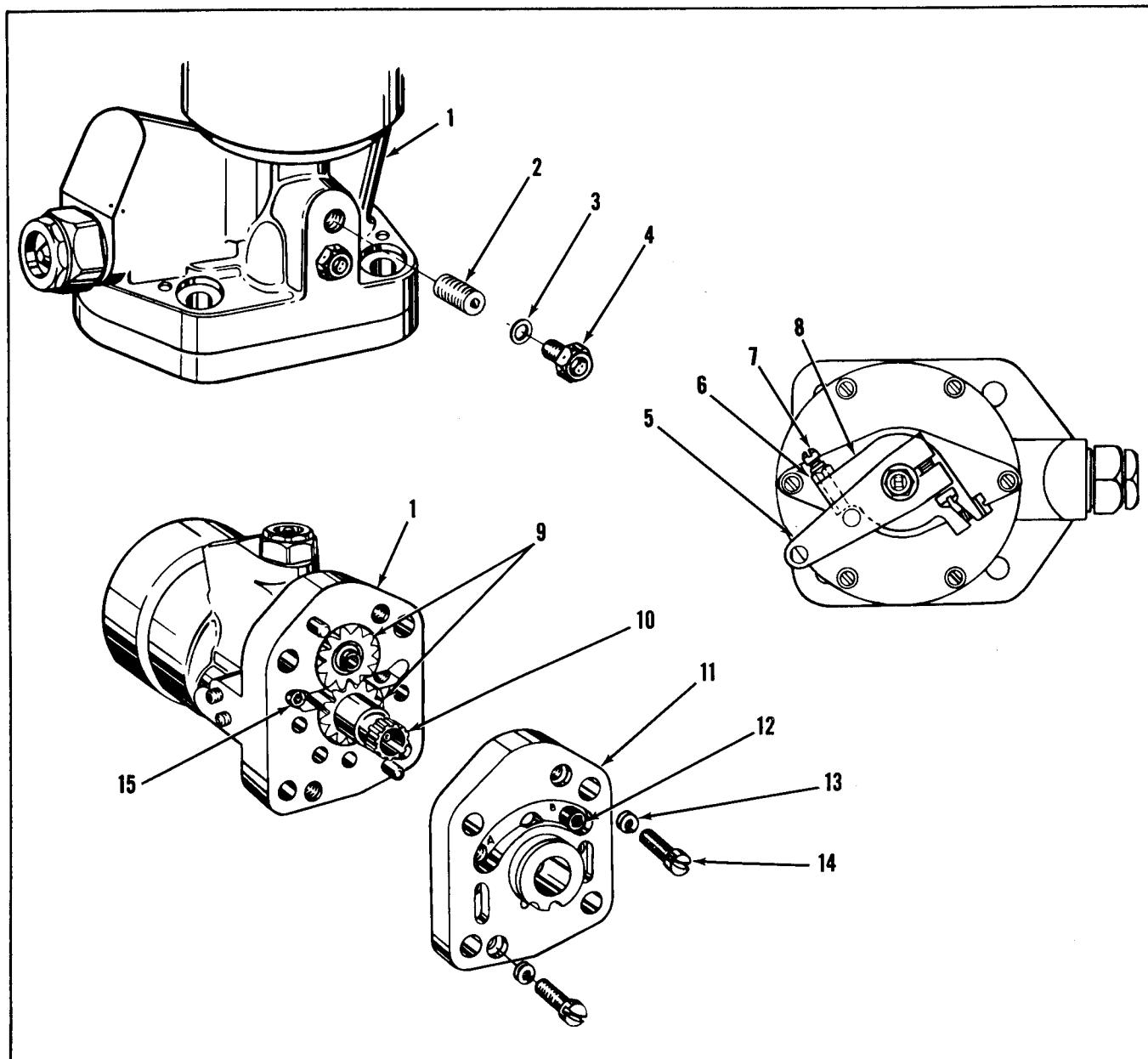
either the governor stop or the propeller low pitch stop is the limiting factor. Open the throttle and move the propeller pitch lever back and forth. If the maximum obtainable rpm is reached at the same time as the governor stop is reached, the governor is the limiting factor. Correct by adjusting the governor stop screw (7). Turn counterclockwise one revolution for each 25 rpm increase. If the maximum obtainable rpm is reached before the governor stop is reached, the propeller low pitch stop is the limiting factor. This would require an adjustment of the propeller blades to decrease the low pitch angle.

This adjustment should be made only by an authorized propeller overhaul station.

CAUTION

Do not allow engine temperatures to exceed operating limits while these checks are being performed.

c. Check flight rpm after making any static rpm adjustments. Tachometer indication during takeoff



- | | | |
|-----------------|------------------------|----------------|
| 1. Body | 6. Lock Nut | 11. Base |
| 2. Bypass plug | 7. Governor Stop Screw | 12. Base Plug |
| 3. Washer Seal | 8. Stop Ring | 13. Lockwasher |
| 4. Pipe Plug | 9. Pump Gears | 14. Screw |
| 5. Governor Arm | 10. Splined Drive | 15. Body Plug |

Figure 4-23. Propeller Governor

should not exceed 2600 rpm. Make necessary adjustments with the governor stop screw as outlined in the preceding step. Make additional flight tests after each adjustment.

NOTE

It is desirable for the governor stop to limit the high static rpm, with the propeller stop reached at 50 to 100 rpm beyond. This allows for variations in engine power without affecting maximum rpm.

4-172. PROPELLER GOVERNORS.

4-173. One Woodward, base mounted, centrifugal, single acting governor is installed on each engine to control propeller pitch. The governors are engine driven and are mounted on the left side of each crankcase just below and forward of the most forward cylinder. A gear type pump and relief valve is incorporated in each governor to boost engine oil pressure to the pressure required to actuate the propeller piston, (approximately 200 psi). 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. Pitch changing links connect the propeller piston to the propeller blades. The position of the piston determines the propeller blade angle which is either increased or decreased by the governor as flight conditions vary, to maintain a constant rpm.

4-174. REMOVAL OF PROPELLER GOVERNORS.

The removal procedure is the same for either propeller governor.

- a. Remove engine cowling in accordance with paragraph 4-3.
- b. Remove forward left engine baffle in accordance with paragraph 4-78, step "d."
- c. Remove teleflex control rod end from governor arm by removing attaching bolt and spacer.
- d. Remove governor and mounting gasket by removing the four nuts, internal tooth lockwashers, plain washers, and the forward left engine baffle support tab.

4-175. INSPECTION OF PROPELLER GOVERNORS. If a new or overhauled governor is to be installed, it should be remembered that it will not function unless various plugs are installed correctly to form oil passages in the base and body. For correct installation see figure 4-23 and install body plug (15) in the body "B" passage. Install base plug (12) in the base "B" passage. Install the by-pass plug (2) in the outermost passage from the governor base. Inspect the governor splined drive for excessive wear and all screws, relief valve cap, and plugs for secure safety wiring.

4-176. INSTALLATION OF PROPELLER GOVERNORS. If a new or overhauled governor is being installed, install the body plug, base plug, and by-pass plug in accordance with paragraph 4-175. To install either propeller governor:

- a. Place the mounting gasket over the governor mount studs with the raised surface of gasket screen facing away from the engine.

CAUTION

Do not use sealing compound of any kind on the mounting gasket.

- b. Align the splines on the governor shaft with the engine drive and slide the governor into position.
- c. Secure the governor in place with the four plain washers and nuts on the governor mount studs. The forward left engine baffle support tab should be fastened to the lower forward governor mount stud.
- d. Rig propeller governor in accordance with paragraph 4-163.
- e. Replace forward left engine baffle in accordance with paragraph 4-80, step "h."
- f. Replace engine cowling in accordance with paragraph 4-5.
- g. Make an operational check in accordance with paragraph 4-171.

4-176A. ANTI-ICE SLINGER RING.

4-176B. Propeller anti-ice slinger ring 0850308-1 is standard equipment on all anti-ice equipped aircraft serial 35696 and on and also is the standard replacement for all previous slinger rings. The propeller anti-ice slinger ring on aircraft serials 35000 through 35695 must be replaced with slinger ring 0850308-1 to provide proper clearance when a non-congealing oil cooler, AK310-53, is to be installed on the aircraft.

4-176C. REMOVAL AND INSTALLATION OF ANTI-ICE SLINGER RING. (See figure 4-23A.)

- a. Remove propeller in accordance with paragraph 4-168.
- b. Remove twelve rivets (5) attaching old slinger ring.
- c. Align and install new slinger ring with twelve AN470AD6 rivets.
- d. After riveting new slinger ring (3) to bulkhead (2) drill out the four holes for mounting bolts (4).

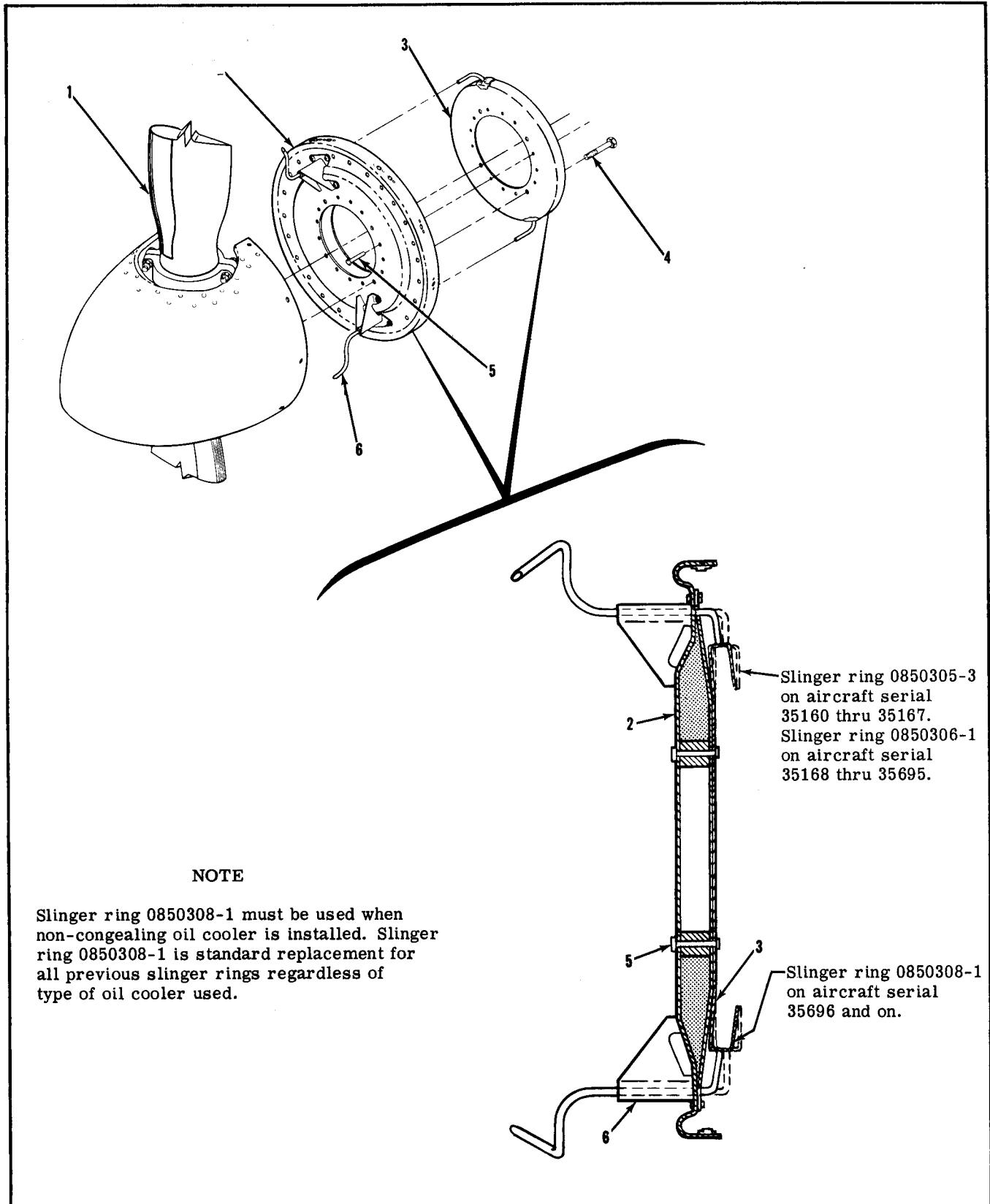
NOTE

The inside diameter of the new slinger ring is .035" undersize. After riveting to spinner bulkhead enlarge slinger ring hole to match the hole in spinner bulkhead.

- e. Install propeller in accordance with paragraph 4-170.
- f. Perform an operational check of the propeller in accordance with paragraph 4-171.

4-177. VACUUM SYSTEM.

4-178. The source of vacuum for the gyro instruments is two engine-driven vacuum pumps. One vacuum pump is mounted on the aft right accessory mount pad on each engine. Each pump exhaust outlet is connected to an air-oil separator mounted adjacent to the pump. From the bottom of the air-oil separator, a hose returns oil recovered from the vacuum pump exhaust air, to the engine crankcase. Lines are routed from the tops of the air-oil separators to

**NOTE**

Slinger ring 0850308-1 must be used when non-congealing oil cooler is installed. Slinger ring 0850308-1 is standard replacement for all previous slinger rings regardless of type of oil cooler used.

1. Propeller
2. Bulkhead

3. Slinger Ring
4. Bolt

5. Rivet
6. Anti-ice Line

Figure 4-23A. Anti-ice System - Propeller Components

fittings in the bottoms of the nacelles to vent exhaust air overboard. Vacuum line plumbing is routed from the vacuum pumps, through the wings into the cabin and to the forward cabin bulkhead. At this bulkhead the vacuum lines attach to an assembly of relief valve, check valves and fittings, from which hoses are routed to the vacuum-operated instruments and to a selec-

tor test valve installation. This manually-operated selector test valve allows the system pressure to be checked at four different locations. All air entering the vacuum-operated instruments is first filtered by a vacuum air filter. The filtered air is routed by a hose from the air filter to fittings at the backs of the vacuum operated instruments.

4-179. TROUBLE SHOOTING THE VACUUM SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO VACUUM PRESSURE GAGE INDICATION AT ONE SOURCE.	Pump inoperative. Disconnected, broken or restricted line.	Replace pump. Locate cause and correct.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO VACUUM PRESSURE GAGE INDICATION AT INSTRUMENT.	Hose from instrument to gage leaking or restricted.	Locate cause and correct.
NO VACUUM PRESSURE GAGE INDICATION AT EITHER SOURCE OR AT EITHER INSTRUMENT.	Faulty gage.	Check operation of instruments. If instrument operation is normal, replace gage.
	Malfunctioning vacuum relief valve.	Check operation of instruments. If inoperative replace vacuum relief valve.
LOW SYSTEM VACUUM PRESSURE.	Vacuum relief valve incorrectly adjusted.	Adjust in accordance with paragraph 4-204.
	Leak in vacuum plumbing.	Check all fittings, lines and hoses with soap suds.
NORMAL PRESSURE INDICATION, BUT SLUGGISH INSTRUMENT OPERATION.	Vacuum air filter element dirty.	Replace vacuum air filter element.
HIGH SYSTEM VACUUM PRESSURE.	Vacuum relief valve incorrectly adjusted.	Adjust in accordance with paragraph 4-204.
	Vacuum relief valve sticking or dirty screen.	Clean relief valve in accordance with paragraph 4-198 or replace.

4-180. VACUUM PUMPS. (See figure 4-24.)

4-181. One vacuum pump is mounted on the upper right aft accessory drive mount pad of each engine. The vacuum pumps are engine-driven four-vane, rotary, positive displacement type, either one of which is capable of maintaining vacuum system pressure.

4-182. REMOVAL OF VACUUM PUMPS. (See figure 4-24.) Either vacuum pump can be removed by the following procedure:

- a. Remove cowling in accordance with paragraph 4-3.
- b. Loosen the two hose clamps (29) securing hoses (26 and 28) to the vacuum pump (24) and remove hoses from the vacuum pump (24).
- c. Remove vacuum pump (24) by removing four attaching nuts, internal tooth lockwashers and plain washers.

4-183. CLEANING AND INSPECTION OF VACUUM PUMPS. Clean vacuum pumps thoroughly with a suitable solvent. Inspect drive splines for cracks or chipped area. If damaged, replace vacuum pumps. Check to make certain that all screws and plugs are properly safetied.

4-184. INSTALLATION OF VACUUM PUMPS. (See figure 4-24.) Either vacuum pump can be installed by the following procedure:

NOTE

If a new vacuum pump is being installed, remove the serviceable fittings from the old

pump and install in the new pump. Use a suitable thread lubricant on the male threads of all fittings.

- a. 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.
- b. Secure vacuum pump (24) to the engine with four plain washers, internal tooth lockwashers and nuts.
- c. Slide vacuum line hose connector (26) onto the fitting in the upper port and secure by tightening hose clamp.
- d. Slide vacuum pump outlet hose (28) onto the fitting in the lower port and secure by tightening hose clamp.
- e. Replace cowling in accordance with paragraph 4-5.

4-185. AIR-OIL SEPARATORS. (See figure 4-24.)

4-186. The air-oil separators are fastened to brackets which are attached to two studs at the upper left aft accessory drive mount pads. They are connected by hoses to the exhaust side of the vacuum pumps. The air-oil separators remove oil from the air that is expelled from the vacuum pumps. This oil is then returned to the engine crankcase through a hose connected to a fitting in the crankcase, directly beneath the air-oil separator.

4-187. REMOVAL OF AIR-OIL SEPARATORS. (See figure 4-24.) Either air-oil separator can be removed by the following procedure:

- a. Remove screw (33) and nut securing air-oil separator (30) to the mounting bracket (21).

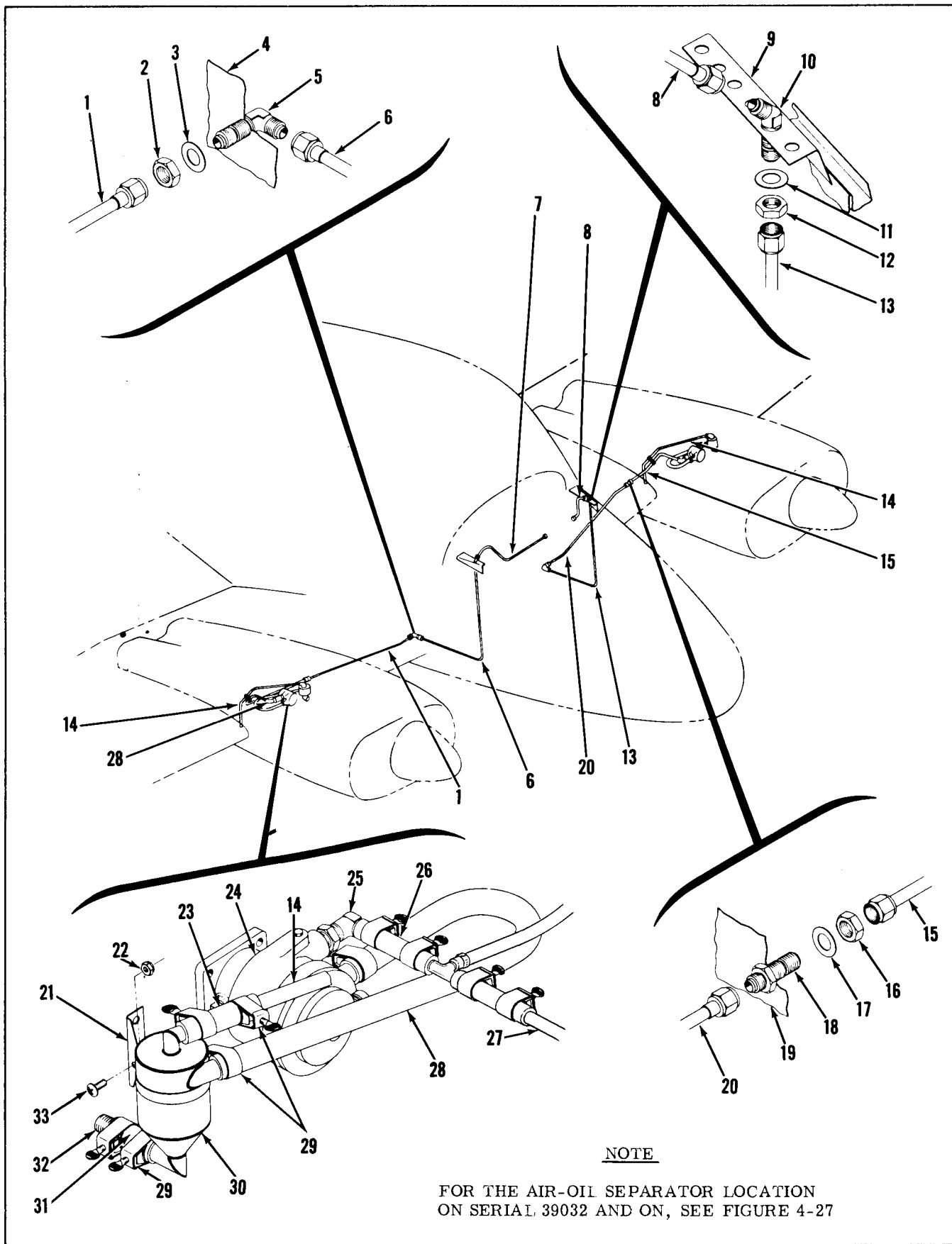


Figure 4-24. Vacuum System - Wing Components

Figure 4-24. Vacuum System - Wing Component Callouts

- | | | |
|------------------------------------|------------------------------------|----------------------------------|
| 1. Right Wing Vacuum Line | 12. Nut | 23. Exhaust Line Hose Connector |
| 2. Nut | 13. Lower Left Cabin Vacuum Line | 24. Vacuum Pump |
| 3. Washer | 14. Air-Oil Separator Exhaust Line | 25. Elbow |
| 4. Fuselage Skin | 15. Left Engine Vacuum Line | 26. Vacuum Line Hose Connector |
| 5. Elbow | 16. Nut | 27. Right Engine Vacuum Line |
| 6. Lower Right Cabin Vacuum Line | 17. Washer | 28. Vacuum Pump Outlet Hose |
| 7. Forward Right Cabin Vacuum Line | 18. Connector | 29. Hose Clamps |
| 8. Forward Left Cabin Vacuum Line | 19. Inboard Nacelle Rib | 30. Air-Oil Separator |
| 9. Support Bracket | 20. Left Wing Vacuum Line | 31. Return Oil Hose |
| 10. Elbow | 21. Mounting Bracket | 32. Return Oil Crankcase Fitting |
| 11. Washer | 22. Nut | 33. Screw |

- b. Loosen the three hose clamps (29) securing exhaust line hose connector (23), vacuum pump outlet hose (28), and return oil hose (31) to the air-oil separator (30).
 c. Remove air-oil separator (30) by slipping loose from hoses.

4-188. CLEANING AND INSPECTION OF AIR-OIL SEPARATORS. Clean the air-oil separators by submerging and rinsing in a suitable solvent. Dry with compressed air and inspect all welds for cracks. Check the small orifice in the "oil out" tube on the bottom of the air-oil separator and make certain the orifice is open.

4-189. INSTALLATION OF AIR-OIL SEPARATORS. (See figure 4-24.) Either air-oil separator can be installed by the following procedure:

- Slide exhaust line hose connector (23), vacuum pump outlet hose (28), and return oil hose (31) onto the air-oil separator as illustrated and secure by tightening the three hose clamps (29).
- Attach air-oil separator (30) to the mounting bracket (21) by installing screw (33) and nut.
- Replace engine cowling in accordance with paragraph 4-5.

4-190. VACUUM AIR FILTER.

4-191. The vacuum air filter is located on the aft side of the forward cabin bulkhead, in the upper right corner. Air being drawn into the vacuum system first passes through a replaceable micronic filter element which removes dust particles and vapor from the air, providing dry, clean air for the instruments.

4-192. REMOVAL OF VACUUM AIR FILTER. (See figure 4-25.)

- Disconnect filter hose (30) from elbow in vacuum air filter (31).
- Remove vacuum air filter (31) from forward cabin bulkhead by removing the two attaching bolts.

NOTE

It is recommended that the filter element be replaced at each 100 hours of operation.

4-193. REPLACEMENT OF VACUUM AIR FILTER ELEMENT. Cut safety wire and remove bolt from left side of vacuum air filter. Remove cover plate and vacuum air filter element. Install new vacuum air filter element and replace cover plate. Fasten

with bolt, and safety wire in place.

4-194. INSTALLATION OF VACUUM AIR FILTER. (See figure 4-25.)

- Position the vacuum air filter (31) on the forward cabin bulkhead with the air inlet directed downward and secure in place with the two attaching bolts.
- Apply a small amount of suitable thread lubricant to the elbow threads and connect filter hose (30).

4-195. VACUUM RELIEF VALVE.

4-196. The vacuum relief valve is located on the forward side of the forward cabin bulkhead and is accessible through the nose wheel well. The vacuum relief valve is a spring-loaded disc type valve that may be adjusted to give the desired vacuum system pressure. It allows air to enter the lines whenever suction in the lines becomes greater than the relief valve setting.

4-197. REMOVAL AND INSTALLATION OF VACUUM RELIEF VALVE. (See figure 4-25.)

- To remove the vacuum relief valve, remove nipple (24), with relief valve (22) attached, from cross (25).
- To install the vacuum relief valve, apply a small amount of suitable thread lubricant to threads of nipple (24) and install nipple (24) into cross (25).

4-198. CLEANING AND INSPECTION OF VACUUM RELIEF VALVE. Submerge the vacuum relief valve in a suitable solvent and allow to soak, or wash until all foreign particles are dislodged from the inlet screen. Dry off the vacuum relief valve with compressed air.

4-199. VACUUM SYSTEM PLUMBING.

4-200. The vacuum system plumbing consists of lines and hoses routed from the vacuum pump on each engine, through the wings into the cabin, and behind the upholstery side panels to the check valves and vacuum relief valve assembly which is attached to the forward cabin bulkhead. From here, hoses are routed to the vacuum operated instruments, and the vacuum selector test valve. Other hoses connect the vacuum air filter to the vacuum operated instruments, and the instruments to the gage and selector test valve.

4-201. REMOVAL OF VACUUM SYSTEM PLUMBING. (See figure 4-24.)

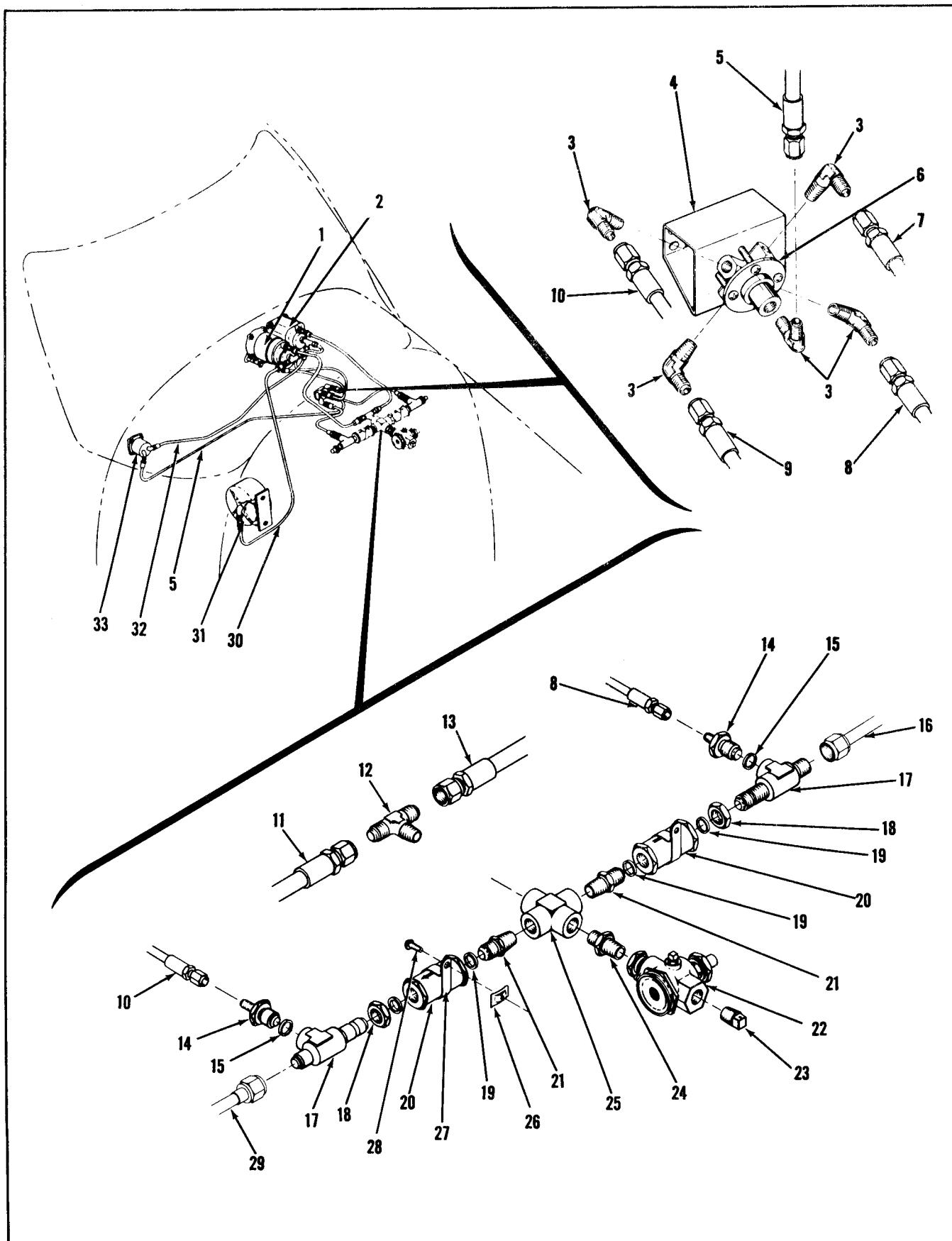


Figure 4-25. Vacuum System - Cabin Components

Figure 4-25. Vacuum System - Cabin Components Callouts

- | | | |
|------------------------------------|---------------------------------------|---------------------------------|
| 1. Attitude Indicator | 12. Tee Fitting | 22. Vacuum Relief Valve |
| 2. Directional Indicator | 13. Directional Indicator Vacuum Hose | 23. Plug |
| 3. Elbow | 14. Reducer | 24. Nipple |
| 4. Vacuum Test Valve Assembly | 15. Gasket | 25. Cross |
| 5. Vacuum Gage Test Hose | 16. Forward Left Cabin Vacuum Line | 26. Nut |
| 6. Test Valve Retainer | 17. Tee Fitting | 27. Clamp |
| 7. Directional Indicator Hose | 18. Nut | 28. Screw |
| 8. Left Source Hose | 19. Gasket | 29. Right Cabin Vacuum Line |
| 9. Right Source Hose | 20. Check Valve | 30. Vacuum Air Filter Hose |
| 10. Attitude Indicator Hose | 21. Nipple | 31. Vacuum Air Filter |
| 11. Attitude Indicator Vacuum Hose | | 32. Vacuum Gage Instrument Hose |
| | | 33. Vacuum Gage |

NOTE

Removal procedure will be given for the left engine installation only. Removal of the right engine installation is the same except as illustrated.

- a. Remove engine cowling in accordance with paragraph 4-3.
- b. Remove hoses (23, 26, 28 and 31) by loosening hose clamps (29).
- c. Remove air-oil separator exhaust line (14) by removing the two screws and clips which attach the exhaust line to the crankcase breather line.
- d. Remove left engine vacuum line (15) by detaching from connector (18) at inboard nacelle rib (19).
- e. To insure adequate removal space for the left wing vacuum line (20) remove engine control left wing teleflex conduits in accordance with applicable steps in paragraph 4-150, and remove left fuel selector valve wing torque tube in accordance with applicable steps in paragraph 4-106.
- f. Disconnect left wing vacuum line (20) from elbow at fuselage skin and connector (18) at inboard nacelle rib (19). Remove through access hole nearest engine nacelle.

NOTE

Slight bending of the left wing vacuum line may be necessary to facilitate removal, however, excessive bending should be avoided.

- g. Remove connector (18) by removing nut (16) and washer (17).
- h. Remove upholstery side panel in accordance with applicable steps in paragraph 2-193.
- i. Remove lower left cabin vacuum line (13) by disconnecting from elbow at fuselage skin, and from elbow (10) at support bracket (9).
- j. Remove elbow from fuselage skin by removing nut and washer.
- k. Remove forward left cabin vacuum line (8) by disconnecting from elbow (10) at support bracket (9), and from tee fitting at check valves and relief valve assembly.
- l. Remove elbow (10) from support bracket (9) by removing nut (12) and washer (11).
- m. Remove check valves and relief valve assembly as follows: (See figure 4-25.)
1. Remove vacuum relief valve (22) by removing nipple (24) with relief valve attached, from cross (25).

2. Disconnect left source hose (8) and right source hose (9) from reducers (14).

3. Disconnect attitude indicator vacuum hose (11) and directional indicator vacuum hose (13) from tee fitting (12).

4. Remove check valves assembly by removing the two screws (28) and nuts (26), securing the check valves (22) to the forward cabin bulkhead.

5. Disassembly sequence of the check valves assembly is clearly illustrated in figure 4-25.

4-202. CLEANING AND INSPECTION OF VACUUM SYSTEM PLUMBING. Inspect all hoses, lines, fittings and flares for dents, cracks, scratches and abrasions. Clean hoses, lines and fittings with compressed air and repair or replace any damaged plumbing.

4-203. INSTALLATION OF VACUUM SYSTEM PLUMBING. (See figure 4-24.)

NOTE

Apply a small amount of suitable thread lubricant to male threads of all fittings before installation.

- a. Install check valves and relief valve assembly as follows: (See figure 4-25.)

1. Assembly sequence of check valves assembly is illustrated in figure 4-25.

2. Secure check valves assembly in position by installing screws (28) through clamps (27) and forward cabin bulkhead, and securing with nuts (26).

3. Connect attitude indicator vacuum hose (11) and directional indicator vacuum hose (13) to tee fitting (12).

4. Connect left source hose (8) and right source hose (9) to reducers (14).

5. Install vacuum relief valve (22), by screwing nipple (24) with relief valve attached, into cross (25).

- b. Install elbow (10) in support bracket (9) and secure with washer (11) and nut (12).

- c. Install forward left cabin vacuum line (8), by attaching to elbow (10) at support bracket (9) and attaching to tee fitting at check valves and relief valve assembly.

- d. Install elbow in fuselage skin and secure with washer and nut.

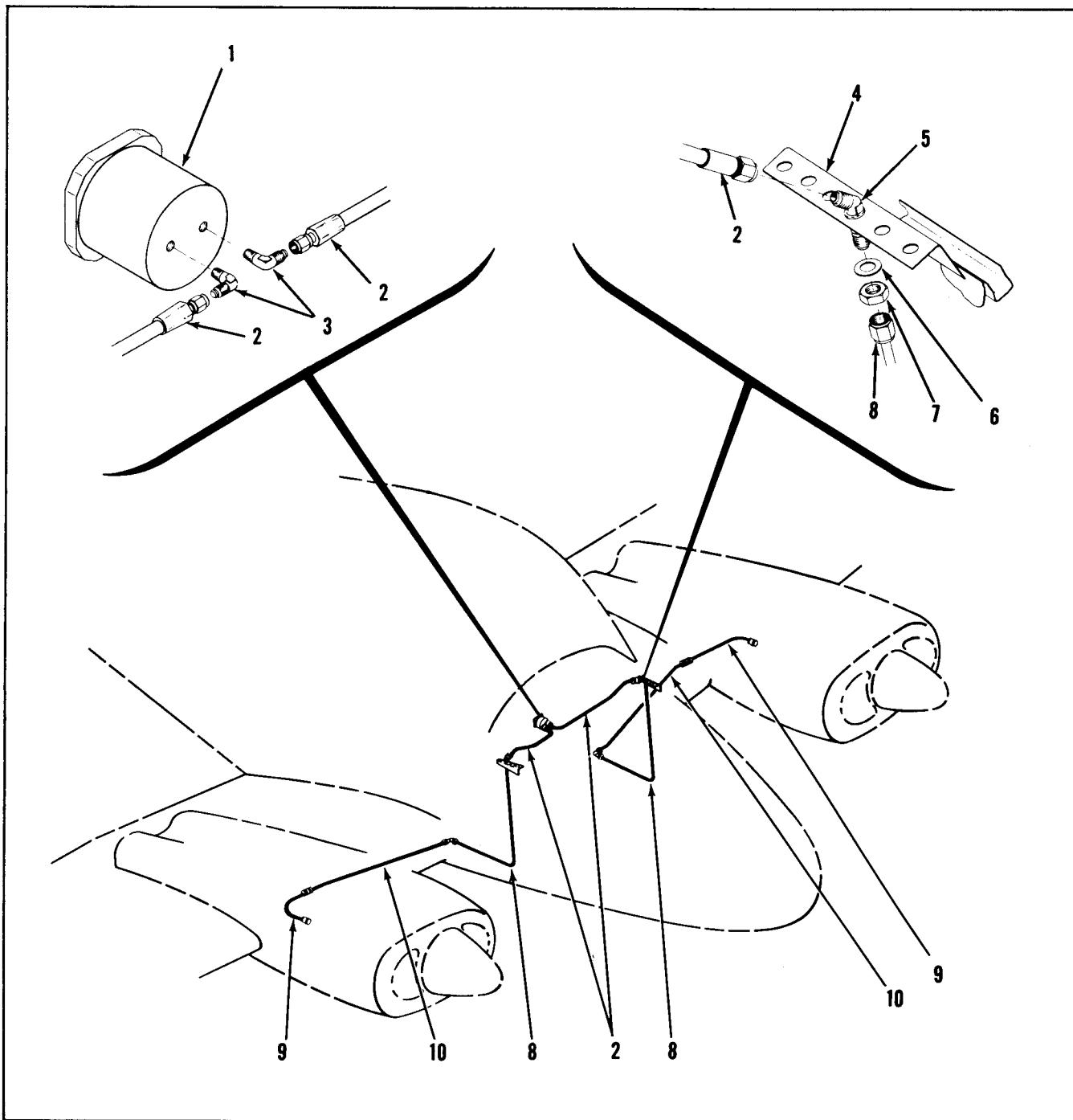
- e. Install lower left cabin vacuum line (13) by attaching to elbow at fuselage skin and elbow (10) at support bracket (9).

- f. Replace upholstery side panels in accordance with applicable steps in paragraph 2-195.
- g. Install connector (18) in inboard nacelle rib (19), and secure with washer (17) and nut (16).
- h. Install left wing vacuum line (20) by inserting through access hole nearest engine nacelle and attaching to elbow at fuselage skin and to connector (18) at

inboard nacelle rib (19).

NOTE

Slight bending of the left wing vacuum line may be necessary to facilitate installation, however, excessive bending should be avoided.



- | | | |
|--------------------------------|--------------------|---------------------------|
| 1. Manifold Pressure Gage | 4. Support Bracket | 8. Cabin Line |
| 2. Manifold Pressure Gage Hose | 5. Elbow | 9. Manifold Pressure Hose |
| 3. Elbow | 6. Washer | 10. Wing Line |
| | 7. Nut | |

Figure 4-26. Manifold Pressure System

- i. Install left fuel selector valve wing torque tube in accordance with applicable steps in paragraph 4-108.
- j. Install the engine control left wing teleflex conduits in accordance with applicable steps in paragraph 4-159.

NOTE

After reinstallation, teleflex controls should be rigged in accordance with paragraph 4-160.

- k. Install hoses (23, 26, 28 and 31) and secure with clamps (29) as illustrated.
- l. Install left engine vacuum line (15) by attaching to connector (18).
- m. Insert lower end of air-oil separator exhaust line (14) through hole in bottom of nacelle and secure with two attaching clips and screws.
- n. Replace engine cowling in accordance with paragraph 4-5.

4-204. VACUUM SYSTEM CHECK AND ADJUSTMENT. To check the operation of the vacuum system, start both engines in accordance with "Pilots Check List" and check the vacuum gage for proper indication. A manually operated selector test valve is incorporated in the vacuum system. This provides a means of obtaining a pressure check from four different locations in the system which aids in making a system check and also localizes trouble in the event that a portion of the system is malfunctioning. The vacuum gage should indicate between 4.75 and 5.25 inches of mercury, the minimum and maximum suction for satisfactory operation, when checking either vacuum driven instrument. When checking the right or left source an indication higher than either vacuum driven instrument reading should be observed. If the vacuum gage indication is not within the specified limits, remove the safety wire from the locknut securing the adjusting screw on the vacuum relief valve. Loosen the locknut and turn the adjusting screw clockwise to decrease and counterclockwise to increase the vacuum gage indication. After adjustment has been completed, tighten locknut and secure with safety wire. If proper vacuum gage indication cannot be obtained by this adjustment, refer to the trouble shooting chart in paragraph 4-179.

4-205. MANIFOLD PRESSURE SYSTEM.

4-206. The manifold pressure system consists of a dual manifold pressure gage mounted in the instrument panel and plumbing which connects the gage to the intake manifold on each engine. The gage, calibrated in inches of mercury, indicates the absolute pressure in the intake manifold of each engine.

4-207. REMOVAL OF MANIFOLD PRESSURE PLUMBING. (See figure 4-26.) The removal procedure is the same for either left or right engine manifold pressure plumbing.

- a. Remove engine cowling in accordance with paragraph 4-3.
- b. Remove manifold pressure hose (9) by disconnecting from intake manifold and inboard nacelle rib.

- c. Remove forward wing fillet and three access hole covers on lower side of wing between fuselage and engine nacelle.
- d. Disconnect wing line (10) from inboard nacelle rib fitting and fuselage skin fitting, and remove through access hole nearest engine nacelle.

NOTE

It may be necessary to bend the line slightly to facilitate removal, however, excessive bending should be avoided to prevent possible damage to the lines.

- e. Remove inboard nacelle rib fitting by removing attaching nut and washer.
- f. Remove upholstery side panel in accordance with applicable steps in paragraphs 2-192, 193, or 194.
- g. Remove cabin line (8) by disconnecting at fuselage skin fitting and elbow. (5).
- h. Remove fuselage skin fitting by removing attaching nut and washer.
- i. Remove manifold pressure gage hose (2) by disconnecting from elbow (5) and elbow (3).
- j. Remove elbow (5) from support bracket (4) by removing nut (7) and washer (6).

4-208. INSTALLATION OF MANIFOLD PRESSURE PLUMBING. (See figure 4-26.) The installation procedure is the same for either left or right engine plumbing.**NOTE**

Apply a small amount of suitable thread lubricant to male threads of all fittings before installing connections.

- a. Position elbow (5) in support bracket (4) and secure with washer (6) and nut (7).
- b. Install manifold pressure gage hose (2) by attaching to elbow (3) and elbow (5).
- c. Position fuselage skin fitting in fuselage skin and secure with washer and nut.
- d. Install cabin line (8) and attach to elbow (5) and fuselage skin fitting.
- e. Replace upholstery side panel in accordance with applicable steps in paragraphs 2-192, 193, or 194.
- f. Position inboard nacelle rib fitting in inboard nacelle rib and secure with washer and nut.
- g. Insert wing line (10) through access hole nearest engine nacelle and attach to inboard nacelle rib fitting and fuselage skin fitting.

NOTE

It may be necessary to bend the wing line slightly to facilitate installation, however, excessive bending should be avoided.

- h. Replace wing root fairing and three access hole covers on lower side of wing between fuselage and engine nacelle.
- i. Attach manifold pressure hose (9) to inboard nacelle rib and intake manifold.
- j. Replace engine cowling in accordance with paragraph 4-5.

4-209. ENGINE ASSEMBLIES. Aircraft serials 35772 and on, are equipped with two Continental IO-470-D engines. This engine will develop 260 horsepower at 2625 rpm. The IO-470-D is a six-cylinder, horizontally opposed engine and is equipped with an all-metal, constant speed, full-feathering propeller. A low pressure, multi-nozzle, continuous flow fuel injection system is installed on this engine.

4-210. ENGINE REMOVAL. (See figure 4-27, sheets 1 and 2.) Although the routing of wire bundles, cables, lines, hoses, and conduit varies between engines, the following description will be typical for either engine. Identify each item as it is disconnected to aid in replacement.

NOTE

Plug or cap all disconnected lines and hoses.

- a. Turn all cockpit switches and the fuel selector valves OFF.
- b. Open the battery circuit by disconnecting the ground cable (see paragraph 6-7, steps a, b, and c).
- c. Remove the engine cowling in accordance with paragraph 4-3.
- d. Disconnect magneto ground wires (33) at the magnetos and withdraw them aft through the right rear engine baffle (18).

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 paragraph 1-36. Replace the drain plug.
- f. Remove the propeller in accordance with paragraph 4-168.
- g. Disconnect the engine controls as follows:
 1. Disconnect the induction air control (4), the mixture control (25), and the throttle control (3) in accordance with paragraph 4-275.
 2. Disconnect the propeller control (31) at the governor (27). Remove the propeller control bracket (32) from the intake manifold (21) by loosening the bracket clamps.
 - h. Disconnect wires and cables as follows:
 1. Disconnect oil temperature electrical connector (13) located directly below the oil cooler (15). Disconnect oil temperature ground wire.
 2. Disconnect tachometer generator (22) electrical connector.
 3. Disconnect starter cable (20).
 4. Remove the cylinder head temperature bulb (10) from No. 4 cylinder. Disconnect the cylinder head temperature ground wire.
 5. Disconnect generator cables (52) and cable shielding ground.
 6. Disconnect fuel pressure switch (41) 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.
 - i. Disconnect lines and hoses as follows:

1. Separate crankcase breather line (34) at hose connector just aft of right rear engine baffle (18).
2. Disconnect vacuum line (38) from vacuum pump (7).

3. Disconnect air-oil separator exhaust line (36) from air-oil separator (6).
4. Disconnect fuel vapor return line (40) and fuel pressure gage line (42) at the fuel-air control unit (37).

5. Disconnect the manifold pressure hose (26) and the two manifold drain hoses (24 and 45).
6. Disconnect oil pressure hose (46) at the in-board 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 (44) at the fuel pump (50).

WARNING

Fuel and oil draining from lines and hoses is a fire hazard. Prevent fuel and oil from collecting in the engine nacelle.

8. Loosen clamp and remove ram air tube (1) at the fuel strainer.

NOTE

If anti-ice and/or oil dilution systems are installed, disconnect anti-ice hose at fitting below No. 1 cylinder and disconnect oil dilution hose at crankcase fitting just below the fuel pump.

- j. Disconnect both exhaust stacks assemblies at the firewall, by removing the centering springs.
- k. 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.

1. Remove IO-470-D engines as follows: (See figure 4-3).
 1. Remove bolts (10).
 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 8), spacers (5 and 7), and pin (4) from engine mount bracket (6).

4-211. ENGINE DISASSEMBLY (See figure 4-27, sheets 1 and 2.) Only the components of the fuel injection engine which differ from the carburetor

equipped engine will be covered in this paragraph. For removal of engine parts not covered here refer to paragraph 4-9. Although routing of cable, lines and hoses will vary between engines, the following description will be typical for either engine. Tag each item as it is disconnected to aid in replacement.

NOTE

Plug or cap all disconnected lines, hoses and fittings.

- a. Remove the air intake box in accordance with paragraph 4-221.
- b. Spray engine assembly with a suitable solvent and allow to dry. Blow off residual dirt and solvent with compressed air.
- c. Disconnect fuel line (8) at fuel manifold (9).
- d. Disconnect fuel injection lines (16) at the fuel manifold (9) and at the fuel injection nozzles (17).
- e. Remove the fuel injection nozzles (17).
- f. Remove the fuel manifold (9) by removing the crankcase thru-bolt which secures it.

NOTE

In removing the crankcase thru-bolt use care to prevent damaging the O-ring seals.

g. The two fuel lines which run between the fuel control unit (43) and the fuel pump (50) are enclosed in flexible tubing which is clamped to the shroud surrounding the fuel control unit. This tubing directs ram air, which is supplied to the fuel control shroud from the air intake box, to aid in cooling the fuel in these lines.

1. Loosen the tubing clamps at the fuel control shroud (43) and pull the tubing down to gain access to the fuel line fittings.
2. Remove the two fuel lines.
- h. Disconnect fuel line (8) at the fuel control unit (43).
- i. Loosen clamps (47) which secure the fuel-air control unit (37) to the intake manifold (21). Be sure the bolts securing support (35) to the fuel-air control unit (37) are removed. Remove the fuel-air control unit (37).

NOTE

The engine-driven fuel pump (50) is enclosed in a shroud to confine ram air supplied by the air intake box to aid in cooling the fuel. This shroud must be removed to remove the fuel pump.

4-212. INSPECTION AND REPAIR. For specific instructions concerning a particular component, refer to the applicable paragraph.

- a. Inspect all hoses for internal swelling, chafing through protective plies, cuts and breaks. Replace any damaged or doubtful hoses.
- b. Inspect all fittings for thread damage.
- c. Inspect air-oil separator for clogging. Wash out with a suitable solvent.
- d. Visually inspect the engine for loose nuts, bolts, cracks, and fin damage.

4-213. ENGINE ASSEMBLY. (See figure 4-27, sheets 1 and 2.) Only the components of the fuel injection engine which differ from the carburetor equipped engine will be covered in this paragraph. For assembly of engine parts not covered here refer to paragraph 4-12. Although routing of cables, lines and hoses will vary between engines, the following description will be typical for either engine.

NOTE

Use all new gaskets for engine assembly. Do not use old gaskets regardless of apparent condition.

- a. Install fuel air control unit (37) and secure to the intake manifold (21) with clamps (47). Bolt support (35) to the fuel-air control unit temporarily to obtain the correct position.

NOTE

When replacing fuel lines use only a fuel soluble lubricant (such as engine oil) on the fitting threads. DO NOT USE ANY OTHER FORM OF THREAD COMPOUND.

- b. Install the flexible tubing on the two fuel lines which run between the fuel control unit (43) and the fuel pump (50) and install these lines. Install the tubing on the air horns at the bottom of the shroud surrounding the fuel control unit and secure with clamps.
- c. Install the fuel manifold (9).

CAUTION

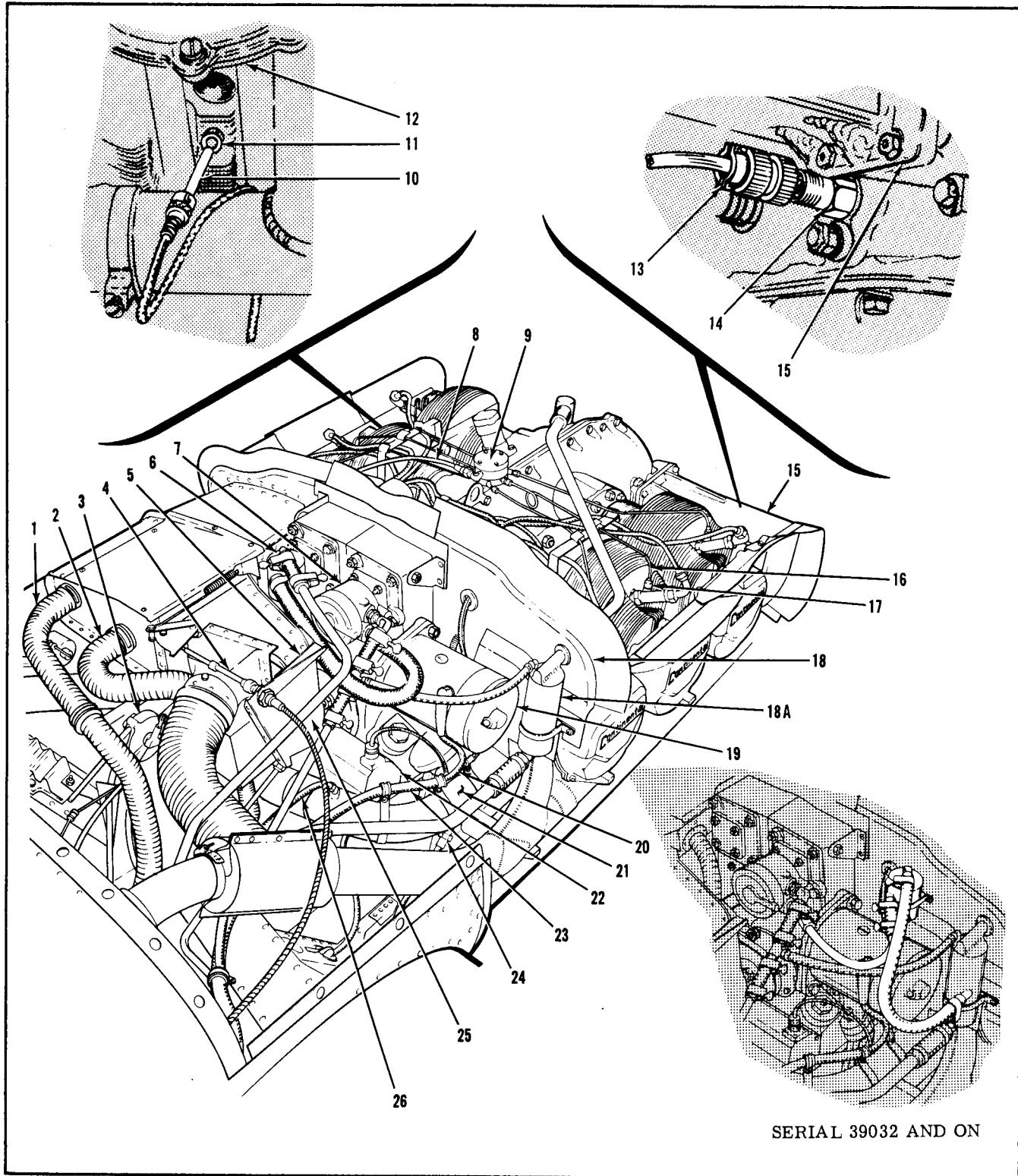
If the thru-bolt O-ring seals were damaged during removal, they must be replaced. Oil the bolt and work the O-ring seals carefully over the bolt threads when installing.

- d. Install fuel line (8) at the fuel control unit (43).
- e. Install fuel injection nozzles (17).
- f. Install the fuel injection lines (16).
- g. Install the air intake box in accordance with paragraph 4-223.
- h. Inspect completed assembly for safeties, missing bolts, nuts, proper alignment of parts, and that all clamps, nuts, bolts, and screws are tight.

4-214. INSTALLATION OF ENGINE ASSEMBLY. (See figure 4-27, sheets 1 and 2.) Although there is some difference in the routing of wire bundles, lines, hoses, and conduit, this procedure is typical for installation of either engine.

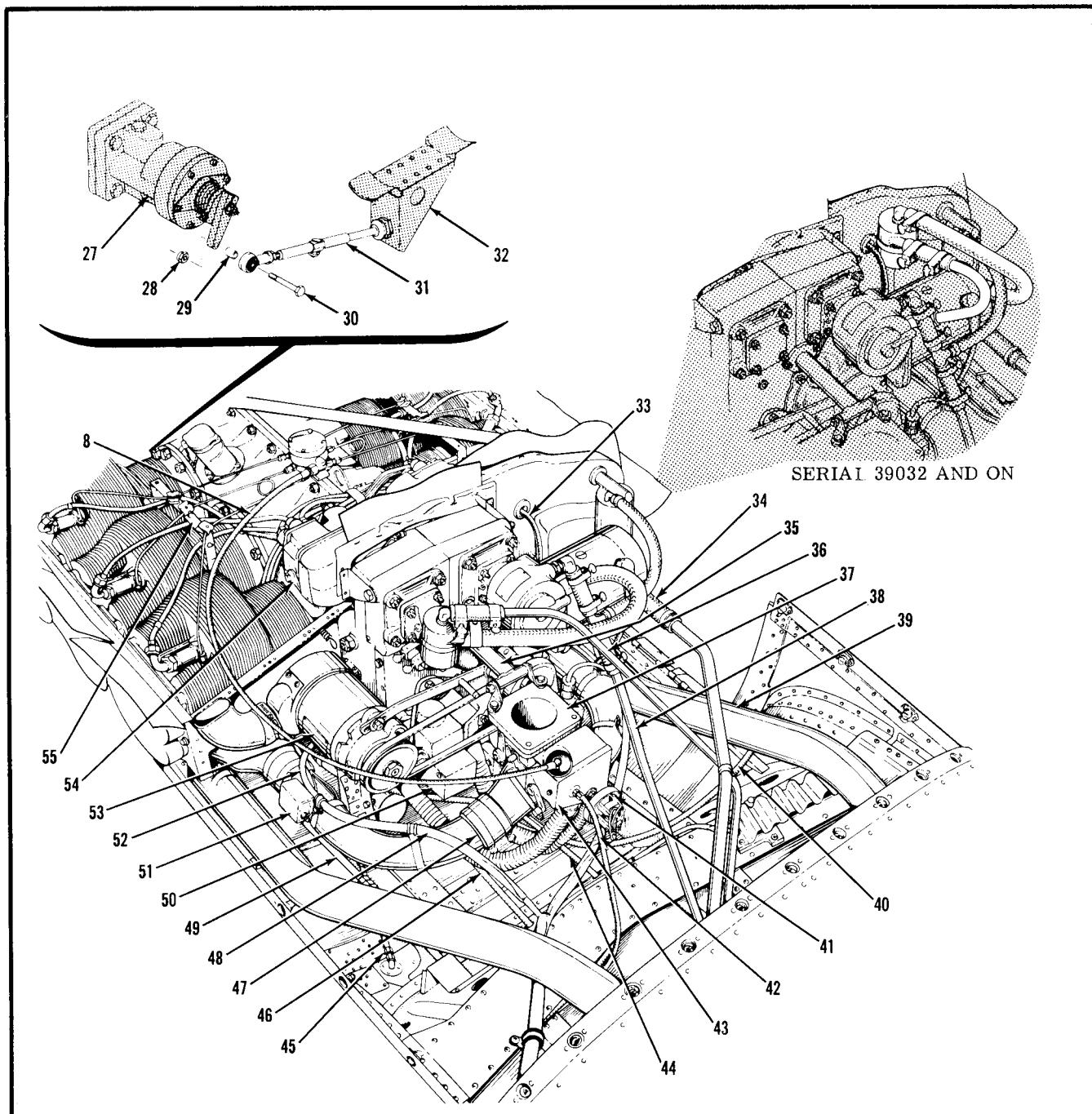
- a. Hoist engine to a point just above the nacelle.
- b. Install IO-470-D engine on engine mounts as follows: (See figure 4-3).

1. Temporarily install mount pads (3), spacers (5), and pins (4) to all four engine mounts (2) using AN7-24 bolts and suitable washers. See that the pins (4) are in a position which will align them with the slots at the side of the holes in the engine mount brackets (6).



- | | | |
|-------------------------------|---|---|
| 1. Fuel Strainer Ram Air Tube | 8. Fuel Line (Fuel Control to
Fuel Manifold) | 12. No. 4 Cylinder |
| 2. Fuel Pump Ram Air Tube | 9. Fuel Manifold | 13. Oil Temperature Electrical
Connector |
| 3. Throttle Control | 10. Cylinder Head Temperature
Bulb | 14. Oil Temperature Bulb |
| 4. Induction Air Control | 11. Cylinder Head Temperature
Bulb Adapter | 15. Oil Cooler |
| 5. Air Box Bracket | | 16. Fuel Injection Line |
| 6. Air-Oil Separator | | 17. Fuel Injection Nozzle |
| 7. Vacuum Pump | | |

Figure 4-27. IO-470-D Engine Assembly (Sheet 1 of 2 Sheets)



- | | | |
|------------------------------------|------------------------------------|----------------------------------|
| 18. Right Rear Engine Baffle | 30. Bolt | 43. Fuel Control Unit |
| 18A. Engine Breather Oil-Separator | 31. Propeller Control Sliding End | 44. Fuel Line (Strainer to Pump) |
| 19. Starter | 32. Propeller Control Bracket | 45. Manifold Drain Line |
| 20. Starter Cable | 33. Magneto Ground Wires | 46. Oil Pressure Line |
| 21. Intake Manifold | 34. Crankcase Breather Line | 47. Clamp |
| 22. Tachometer Generator | 35. Fuel-Air Control Unit Support | 48. Wire Bundle |
| 23. Wire Bundle | 36. Air-Oil Separator Exhaust Line | 49. Propeller Control Conduit |
| 24. Manifold Drain Line | 37. Fuel-Air Control Unit | 50. Fuel Pump |
| 25. Mixture Control | 38. Vacuum Line | 51. Radio Noise Filter |
| 26. Manifold Pressure Hose | 39. Exhaust Stack | 52. Generator Cable |
| 27. Propeller Governor | 40. Fuel Vapor Return Line | 53. Generator |
| 28. Nut | 41. Fuel Pressure Switch | 54. Magneto |
| 29. Spacer | 42. Fuel Pressure Gage Line | 55. Bracket |

Figure 4-27. IO-470-D Engine Assembly (Sheet 2 of 2 Sheets)

2. Be certain that the propeller control conduit and bracket is outside of the engine mounts.
3. Lower the engine slowly into place on the engine mount brackets (6).
4. Remove the temporary bolts and washers. Install spacer (7), mount pad (8), washer (9), and bolt (10). Torque bolt (10) to 40 ± 3 lb. ft.

c. Fasten engine ground strap to left aft engine mount bracket.

d. Connect wires and cables as follows:

1. Attach wire bundle (23) to right manifold intake pipe with three clamps, and generator cables (52) 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 (13) to oil temperature bulb, located directly below oil cooler (15), and safety. Connect ground wire to nacelle just below forward right engine mount bracket.

3. Route magneto ground wires (33) forward through the right rear engine baffle (18).

WARNING

These magnetos DC 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 (20) to starter (19).
5. Attach the tachometer generator electrical connector to the tachometer generator (22) 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 (10) in No. 4 cylinder. Attach cylinder head temperature bulb ground wire to nacelle just below left aft engine mount bracket.
7. Attach generator cables (52) to generator (53). Ground the generator cable shielding to the lower stud of the air-oil separator bracket.
8. Attach wiring at the radio noise filter (51).
9. Attach wiring at the fuel pressure switch (41).
- e. Connect lines and hoses as follows:
 1. Connect crankcase breather line (34).
 2. Connect vacuum line (38) to vacuum pump (7).
 3. Connect air-oil separator exhaust line (36) at air-oil separator (6).
 4. Connect fuel vapor return line (40) and fuel pressure gage line (42) to the fuel-air control unit.
 5. Connect the manifold pressure hose (26) and the two manifold drain lines (24 and 45).
 6. Route oil pressure hose (46) 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.
 7. Connect fuel pump supply line (44) at fuel pump (50).
 8. Connect ram air tube (1) at the fuel strainer shroud and clamp.

NOTE

If anti-ice and/or oil dilution systems are installed, connect anti-ice hose at fitting below No. 1 cylinder and connect the oil dilution hose at the crankcase fitting just below the fuel pump.

- f. Attach propeller control bracket (32) with two clamps. Connect the propeller control (31) at the governor. Rig the propeller control in accordance with paragraph 4-278.
- g. Connect the induction air control (4), the mixture control (25) and the throttle control (3). Rig these controls in accordance with paragraph 4-275.
- h. Install the exhaust stack centering springs.
- i. Install the propeller in accordance with paragraph 4-170.
- j. Connect the battery ground cable in accordance with paragraph 6-10.
- 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 figure 1-5.
- n. Install the engine cowling in accordance with paragraph 4-5.

4-215. INSPECTION OF ENGINE INSTALLATION.

The following check list may be used as a guide for inspecting the installation of either engine.

1. Propeller mounting bolts safetied.
2. Engine mounts secure.
3. Oil temperature bulb electrical connector secure and safetied, ground wire connection tight.
4. Oil pressure relief valve plug safetied.
5. Tachometer generator electrical connector secure and safetied.
6. Starter cable connection secure and insulating boot in place.
7. Cylinder head temperature bulb installed and ground wire connection tight.
8. Generator cable connections secure and cable shielding grounded.
9. All wiring securely clamped in place.
10. Fuel pump connections tight.
11. Manifold pressure hose connections tight.
12. Oil pressure connections clamped and tight.
13. Fuel injection nozzles tight.
14. Fuel injection lines clamped and tight.
15. Fuel manifold secure.
16. All flexible tubing in place and clamped.
17. Crankcase breather line connections secure.
18. Air-oil separator exhaust line and return oil hose connections secure.
19. Vacuum line and vacuum pump outlet hose connections secure.
20. Oil dilution hose connections tight (optional equipment).
21. Propeller anti-ice hose connections tight (optional equipment).
22. Engine controls properly rigged.
23. Oil drain plugs tight and safetied.
24. Oil quantity check, 12 quarts in each engine.

25. Hoses and lines secure at firewall.
26. Fuel-air control unit and air intake box secure.
27. Shrouds installed on engine-driven fuel pump, fuel filter, and fuel control unit. Ram air tubes installed and clamped.
28. Induction system clamps tight.
29. Exhaust system secure.
30. Spark plugs tight. Ignition harness connections tight and harness properly clamped.
31. Magneto ground wires connected and safetied.
32. Engine nacelle for loose objects (tools, rags, etc.).
33. Cowling and access doors for security.

4-216. ENGINE OPERATIONAL CHECK.

BEFORE STARTING ENGINES:

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 airplane with nose headed into prevailing wind.
- b. Install wheel chocks and position a fire extinguisher for easy access in event of engine fire.
- c. Clear area directly in front and to rear of airplane of all objects that may be affected by propeller and propeller slipstream.

CAUTION

Avoid engine run-up with airplane parked in a loose gravel area. The propeller will pick up small stones which may damage propeller blades.

- d. Release parking brake handle if previously set, and test-operate brakes, noting any sponginess or excessive pedal travel. Reset parking brake handle after test.

CAUTION

Do not perform engine run-up if brake action is not normal. If airplane should jump chocks during run-up, brakes will be needed.

- e. Position the following switches as indicated:

<u>Switch</u>	<u>Setting</u>
Ignition	OFF
Landing Gear	DOWN
Cabin Heater	OFF
Radio Switches	OFF
Auxiliary Fuel Pumps	OFF
Generator Switches	OFF
Battery	ON

- f. Check all circuit breakers.
- g. Check fuel quantity indicators for sufficient fuel.
- h. Set left engine fuel selector valve to LEFT MAIN.
- i. Set right engine fuel selector valve to RIGHT MAIN.
- j. Check landing gear down (green) light for illumination.

NOTE

The battery switch should be turned OFF when an external power source is connected for use during starting. Weak batteries will drain off part of the current being supplied by the external power source, resulting in less electrical power available during the start.

STARTING ENGINES: Although either engine may be started first and the starting procedure is identical for either engine, it is recommended that the left engine be started first. The battery cable is much shorter to this engine, thus permitting more electrical power to be delivered to the starter.

WARNING

Immediately prior to starting the engines, call out CLEAR in a loud tone and do not start the engines until an answering CLEAR is received if there are people in the immediate area.

- a. Place propeller pitch levers in full INCREASE RPM.
- b. Set induction air controls to COLD (full in).
- c. Turn ignition switches ON.
- d. Open throttle approximately 1/2 inch.
- e. Set mixture lever to FULL RICH.
- f. Turn the auxiliary fuel pump switch to PRIME.
- g. Depress starter button when fuel pressure reaches 2 to 2.5 PSI.
- h. Turn auxiliary fuel pump switch OFF when engine runs smoothly.

NOTE

If engine fails to start, it is probably loaded. Repeat starting procedure with throttle approximately 1/2 open, mixture lever in IDLE CUT-OFF, and auxiliary fuel pump OFF. As engine fires, move mixture lever to full rich and decrease throttle to idle.

- i. Check for an oil pressure indication within 30 seconds in normal weather and 60 seconds in cold weather. If no indication appears shut off engine and investigate.

NOTE

During very hot weather, if there is an indication of vapor in the fuel system (fluctuating fuel pressure), turn the auxiliary fuel pump ON until the system is purged.

- j. After both engines have started, disconnect the external power source, turn the battery switch and both generator switches ON.

NOTE

If an external power source has not been used, turn the generator switch for the engine being operated ON. Start the other engine, then turn the generator switch for that engine ON. If only one engine is being operated, place the inoperative engine generator switch OFF to prevent possible damage to the generator paralleling circuit.

ENGINE WARM-UP AND OPERATIONAL CHECK.

- a. Set throttles at 800 to 1000 rpm.

NOTE

The engines are set to idle at 600 rpm to insure satisfactory taxi control; however, prolonged idling should be done at 800 to 1000 rpm to insure satisfactory lubrication.

- b. Leave induction air controls in COLD (full in) position.
c. Perform magneto ground-out check as follows:
1. Throttle engine back to idle (600 rpm).
2. Momentarily switch both magnetos OFF.
RESULT: The tachometer will indicate a sudden rpm drop when magnetos cease firing.

CAUTION

If magneto switches are left OFF for a prolonged period, after firing may occur when they are switched back on. If the engine continues to run with switches OFF, stop engine by placing control in IDLE CUT-OFF and check magneto ground.

- d. Advance throttle to 1700 rpm and perform a magneto check as follows:
1. Place right magneto switch to OFF position and note rpm drop. Return switch to ON position. Repeat check with left magneto switch.
RESULT: The rpm drop should not exceed 125 rpm.
e. With engine at 1700 rpm, exercise the propeller.
1. Retard the propeller pitch lever to obtain a 1000 rpm tachometer indication.
RESULT: Exercise propeller and watch for any indication of sluggish or erratic operation.
f. With rpm still at 1700, pull induction air control OUT.
RESULT: Note drop in rpm. Return induction air control to COLD (full in) position.
g. Make a mixture control check by slowly moving the mixture lever toward IDLE CUT-OFF.
RESULT: When a slight drop in rpm is noted immediately return mixture lever to FULL RICH position.
h. Place auxiliary fuel pump switches OFF before stopping engines.
i. Stop engine by placing mixture lever in IDLE CUT-OFF. As soon as propeller has stopped turning, place ignition switches OFF. Turn all switches OFF.

4-217. OIL DILUTION SYSTEM (OPTIONAL EQUIPMENT.) (See figure 4-6.) The oil dilution system consists of two solenoid valves, one mounted on the firewall of each engine, connected to the outlets of the fuel strainers, and to each engine crankcase at an oil passage on the suction side of the engine oil pump. The valves are operated electrically by operation of a single momentary hold-on switch. The switch is labeled OIL DIL, L (left engine) and R, (right engine). When the switch is held to the L and R position with the auxiliary fuel pumps ON, the oil in each engine is diluted. When the switch is released, it automatically returns to the OFF position.

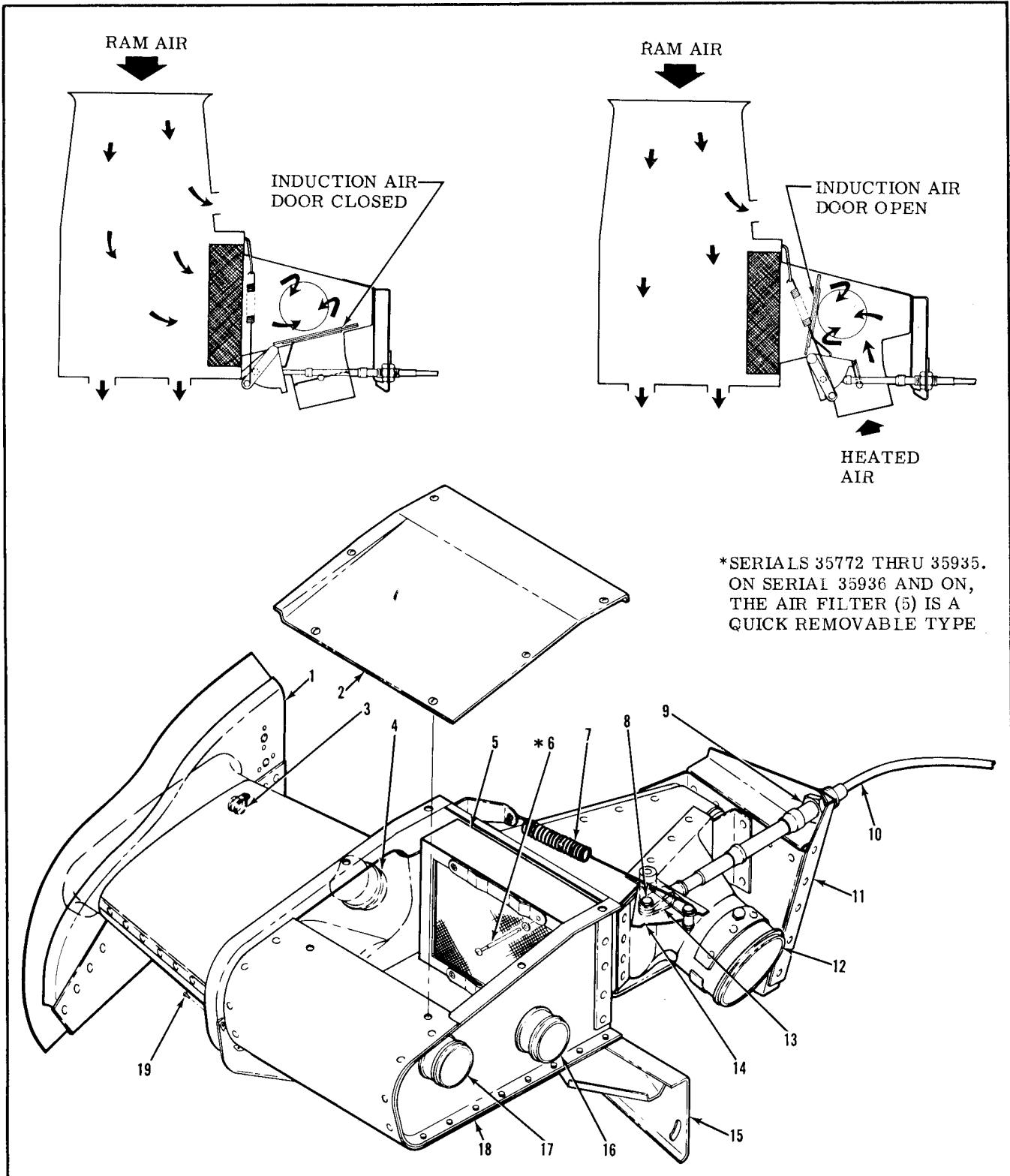
4-218. OIL DILUTION SYSTEM OPERATION. If oil dilution is required, dilute the oil with the engines running. With the engines operating at 1000 rpm, and with the auxiliary fuel pumps in the ON position, hold the oil dilution switch to L (left engine) and R (right engine) for the necessary time. Fuel will flow into the oil pump of the engine being diluted at the rate of one quart every two minutes. Diluting the oil in each engine for eight minutes (4 quarts of fuel) is the maximum dilution that should be used. Oil dilution longer than eight 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.

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 the anticipated temperature.

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 13 quarts before take-off. To avoid progressive dilution of the oil, flights of at least one hour duration should be conducted between oil dilution operations.

4-219. AIR INDUCTION SYSTEM. Ram air enters the airbox at the left rear engine baffle and is ducted aft where it passes through an air filter before entering the fuel-air control unit. An induction air door, located in the air intake box, will operate automatically in case of filter clogging, or, may be operated manually to provide heated air to prevent or eliminate icing. The fuel-air control unit on the fuel injection engine replaces the conventional carburetor. From the fuel-air control unit air is supplied to the cylinders through manifold piping. A manifold drain valve is located in both the right and left intake manifold. A balance tube connects the left and right manifold at the front of the engine.



- | | | |
|-----------------------|-----------------------------|------------------------------|
| 1. Baffle | 7. Spring | 14. Control Plate |
| 2. Cover Plate | 8. Bolt | 15. Throttle Control Bracket |
| 3. Clamp | 9. Nut | 16. Fuel Control Air Horn |
| 4. Fuel Pump Air Horn | 10. Control Cable | 17. Fuel Strainer Air Horn |
| 5. Air Filter | 11. Mixture Control Bracket | 18. Air Intake Box |
| 6. Fastener | 12. Induction Air Horn | 19. Screw |
| | 13. Clevis | |

Figure 4-28. Air Intake Box

4-220. AIR INTAKE BOX. An air intake box is mounted between the left rear baffle and the fuel-air control unit. An air filter is located at the right rear of the airbox. Besides furnishing filtered ram air to the fuel-air control unit, three air horns supply ram air, through flexible tubing, to aid in cooling the fuel control unit, fuel strainer, and fuel pump. The fuel line from the fuel control unit to the fuel manifold is routed through the flexible cooling tube, into and through the air intake box to cool the fuel and minimize the possibility of vapor lock. The mixture and throttle controls are attached to brackets mounted on the air intake box. An induction air door, located in the filtered air chamber of the air intake box, will open by engine suction, approximately 45 degrees, in the event that the air filter is clogged. The induction air door may be manually operated, from the cockpit, to a fully open position, approximately 90 degrees. This stops the air, coming through the air intake box, and draws heated air, from a shroud mounted on the right exhaust pipe, to prevent or eliminate icing. A spring-loaded backfire door, mounted in the airbox at the heated air inlet, is opened by engine suction whenever the induction air door is opened. In the event of an engine backfire, when the induction air door is open, the backfire door will close. This confines the backfire to the airbox, preventing fire from traveling through the heated air tube and discharging into the aft engine nacelle, which would create a fire hazard.

4-221. REMOVAL OF AIR INTAKE BOX. (See figure 4-28.)

- a. Remove the engine cowling in accordance with paragraph 4-3.
- b. Remove clamps and slide tubing clear of air horns (4, 12, 16, and 17).
- c. Remove cover plate (2).
- d. The fuel supply line from the fuel control unit to the fuel manifold enters the airbox at air horn (16) and is secured inside the airbox by clamp (3). Remove clamp (3).
- e. Remove the fuel supply line at the fuel manifold and withdraw aft through the airbox.

NOTE

Plug or cap the fuel supply line and the fitting at the fuel manifold to prevent the entry of foreign matter.

- f. Remove the bolt which secures the teleflex cable clevis (13) to control plate (14).
- g. Loosen nut (9) and remove teleflex cable (10) from bracket (11).
- h. Remove the throttle control from bracket (15).
- i. Remove the mixture control bracket (11).
- j. Remove the screws which attach baffle (1) to other engine baffles. Remove screws (19).
- k. Remove the four bolts which attach the air intake box to the fuel-air control unit.
- l. Remove the air intake box.

4-222. CLEANING AND INSPECTION OF AIR INTAKE BOX. Remove and clean the air filter in accordance with paragraph 4-225. Clean all metal parts with a suitable solvent, and inspect for cracks or

dent. Minor cracks in the airbox may be stop drilled. In cases of continued or severe cracking, replace airbox.

4-223. INSTALLATION OF AIR INTAKE BOX. (See figure 4-28.)

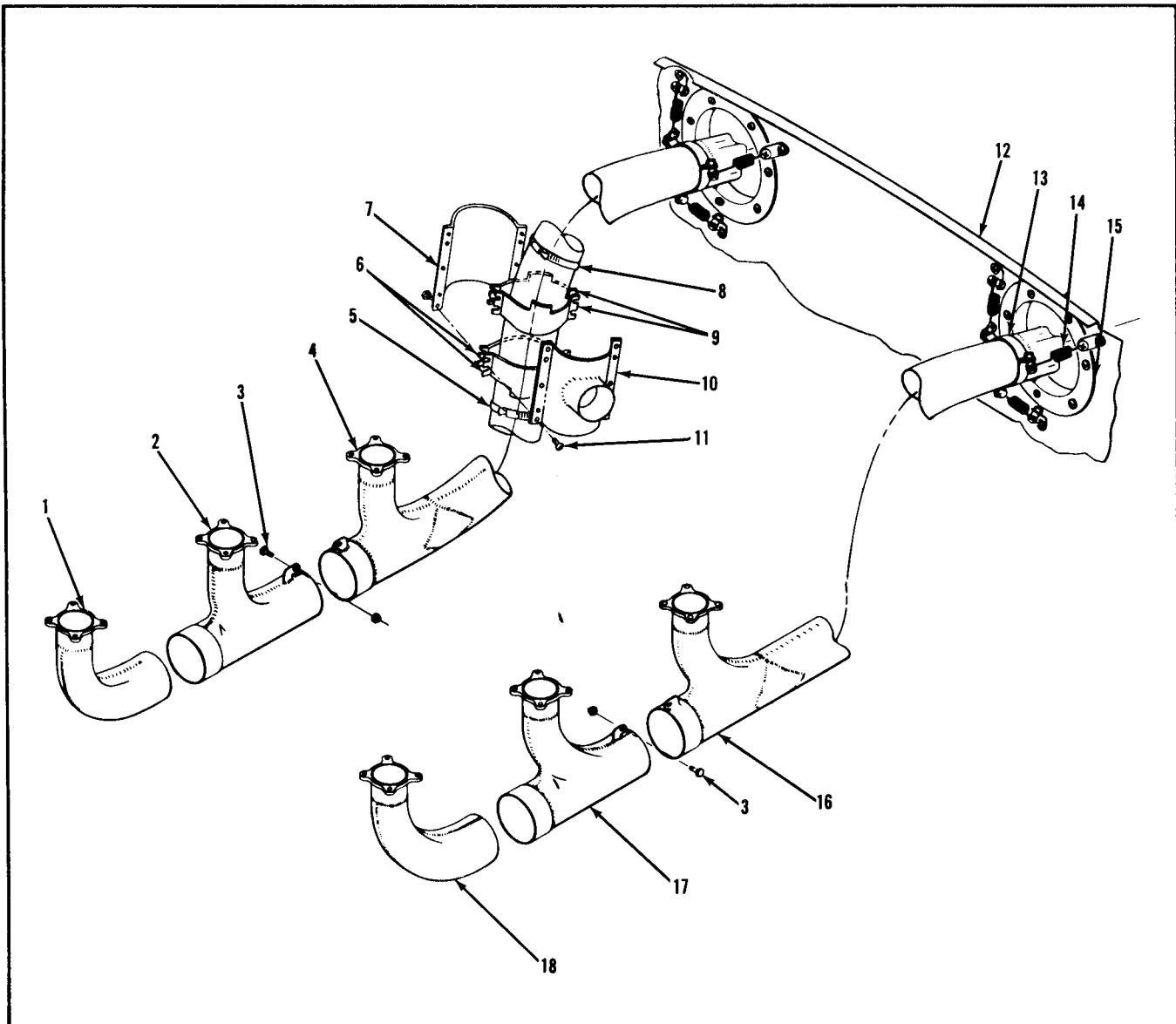
- a. Install airbox (18) in position at left rear of engine.
- b. Secure airbox (18) to the fuel-air control unit with four bolts.
- c. Secure baffle (1) to the other engine baffles with attaching screws. Install screws (19).
- d. Install the throttle control to bracket (15) and rig in accordance with paragraph 4-276.
- e. Install the mixture control to bracket (11) and rig in accordance with paragraph 4-277.
- f. Route teleflex cable (10) through hole in bracket (11) and secure with nut (9).
- g. Attach clevis (13) to induction air control plate (14) with bolt and nut.
- h. Rig induction air control in accordance with paragraph 4-279.
- i. If air filter (5) is removed, install in accordance with paragraph 4-227.
- j. Route the fuel supply line through air horn (16), and out the front of the airbox.
- k. Attach the fuel supply line to the fuel manifold.
- l. Secure the fuel supply line to the airbox with clamp (3).
- m. Install tubing to air horns (4, 12, 16 and 17) as follows:
 1. Tube from engine-driven fuel pump to air horn (4).
 2. Tube from fuel control unit to air horn (16).
 3. Tube from fuel filter to air horn (17).
 4. Tube from induction air shroud to air horn (12).
 - n. Secure all tubing to the air horns with clamps.
 - o. Check airbox for tools, rags, etc., and install cover plate (2).
 - p. Check all controls for proper rigging.
 - q. Replace engine cowling in accordance with paragraph 4-5.

4-224. ENGINE AIR FILTER. The air maze filter, located in the air intake box, removes dust particles from the ram air by collecting them on oil coated filtering units. Air filter maintenance and service, particularly in areas where dust is prevalent, is very important to the life of the engine.

4-225. REMOVAL OF ENGINE AIR FILTER. (See figure 4-28.)

- a. Remove the engine cowling in accordance with paragraph 4-3.
- b. Remove cover plate (2).
- c. Release the four fasteners (6) securing the air filter and remove the filter.

4-226. CLEANING OF ENGINE AIR FILTER. The engine air filters should be serviced in accordance with the instructions stamped on the bottom of the filter. Frequency of filter servicing should be determined by local conditions. Normally, filters should be serviced every 25 hours of engine operation. When operating in dusty areas, more frequent servicing is recommended.



- | | | |
|------------------------------|--------------------------|------------------------------|
| 1. Right Fwd Riser | 7. Shroud Half | 13. Clamp |
| 2. Right Center Riser | 8. Clamp | 14. Centering Spring |
| 3. Bolt | 9. Upper Shroud Supports | 15. Augmentor Tube |
| 4. Right Aft Riser and Stack | 10. Shroud Half | 16. Left Aft Riser and Stack |
| 5. Clamp | 11. Screw | 17. Left Center Riser |
| 6. Lower Shroud Supports | 12. Firewall | 18. Left Fwd Riser |

Figure 4-29. Exhaust Stacks

4-227. INSTALLATION OF ENGINE AIR FILTER.
(See figure 4-28.)

- Install the air filter (5) in the air intake box (18). Be sure that the gasket is in place between the airbox (18) and the filter (5). Secure the filter with the four fasteners (6).
- Install cover plate (2).
- Replace the cowling in accordance with paragraph 4-5.

4-228. ENGINE EXHAUST SYSTEM. The exhaust system consists of two exhaust stack assemblies per engine, one assembly for the left and one for the right bank of cylinders. Each cylinder has a riser pipe

attached to the exhaust port. The three risers at each bank of cylinders are joined together into a common pipe to form a stack assembly. These assemblies are routed aft under the engine cylinders and pass beneath the rear engine baffles, up over the canted bulkhead to the firewall. Each assembly is supported at the firewall by three centering springs. From the firewall the exhaust gases are routed aft through augmentor tubes, through a muffler, and expelled at the trailing edge of the wing. A shroud, mounted on the right exhaust stack, will furnish heated air to the air intake box through flexible tubing whenever the induction air control, mounted on the control pedestal, is pulled aft.

4-229. REMOVAL OF ENGINE EXHAUST SYSTEM. (See figure 4-29.) Due to the clean lines and closely fitted cowling, some difficulty may be encountered in removing the exhaust stack assemblies while the engine is in place.

a. Remove the induction air shroud as follows:

1. Remove the flexible tube from shroud half (10).
2. Remove the ten screws (11) and remove shroud halves (7 and 10).
3. Remove clamps (5 and 8) and remove shroud supports (6 and 9).
- b. Remove exhaust stack centering springs (14).
- c. Remove bolts (3).
- d. Remove the four nuts holding each riser to its cylinder.
- e. 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 in paragraph 4-210 to raise the engine from its mounts far enough to provide the necessary clearance.

4-230. INSTALLATION OF ENGINE EXHAUST SYSTEM. (See figure 4-29.)

- a. Assemble and install the exhaust stack assemblies on each engine using one copper asbestos gasket between each riser and its mounting pad on the cylinder.
- b. Install four nuts on cylinder studs at each riser.
- c. Install bolts (3) and nuts which attach center risers (2 and 17) to aft risers (4 and 16).

NOTE

Do not overtighten 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.

d. Install exhaust stack assembly centering springs (14).

e. Install the induction air shroud on the right exhaust stack as follows:

1. Place shroud supports (6 and 9) around the exhaust pipe, with the clamp lips out, and install clamps (5 and 8). Tighten clamps (5 and 8) only enough to hold the shroud supports.

2. Install shroud halves (7 and 10) in the position shown in the illustration and install screws (11). Do not tighten screws (11).

3. Work the intake air shroud assembly into the correct position on the exhaust pipe and tighten screws (11) and clamps (5 and 8).

4. Install the flexible tube, from the air intake box, to shroud half (10) and secure with clamps.

f. Check completed installation for loose or missing nuts or bolts.

4-231. EXHAUST EJECTOR AND MUFFLER. An exhaust muffler, one for each engine, is standard equipment on all model 310C aircraft. The mufflers are mounted just forward of the trailing edge of the wing and directly aft of the engines. The mufflers are fiberglass lined and of the "straight through"

type, therefore there is no exhaust back pressure. The exhaust gases are carried from the firewall to the muffler through exhaust ejector tubes which also act as augmentors to aid in engine cooling.

4-232. REMOVAL AND INSTALLATION OF EXHAUST EJECTOR TUBES. (See figure 4-30.)

- a. Remove the engine cowling in accordance with paragraph 4-3.
- b. Remove the exhaust stack assemblies in accordance with paragraph 4-229.
- c. Remove the eight screws (9) securing each exhaust ejector tube (8).
- d. Remove the exhaust ejector tubes (8).
- e. Install the exhaust ejector tubes by reversing the procedure outlined above.

NOTE

When installing exhaust ejector tubes, remove access door (5) to aid in fitting the ejector tubes to the muffler.

4-233. REMOVAL OF MUFFLER. (See figure 4-30.) To remove the mufflers the flaps must be down to gain access to screws (10).

- a. Remove cap assembly (1) by removing screws (2 and 4).
- b. Remove two screws (10) and remove the muffler.

4-234. INSPECTION OF MUFFLER. Clean the muffler with a stiff brush and blow clean with compressed air. Inspect the muffler for cracks, burning, etc.

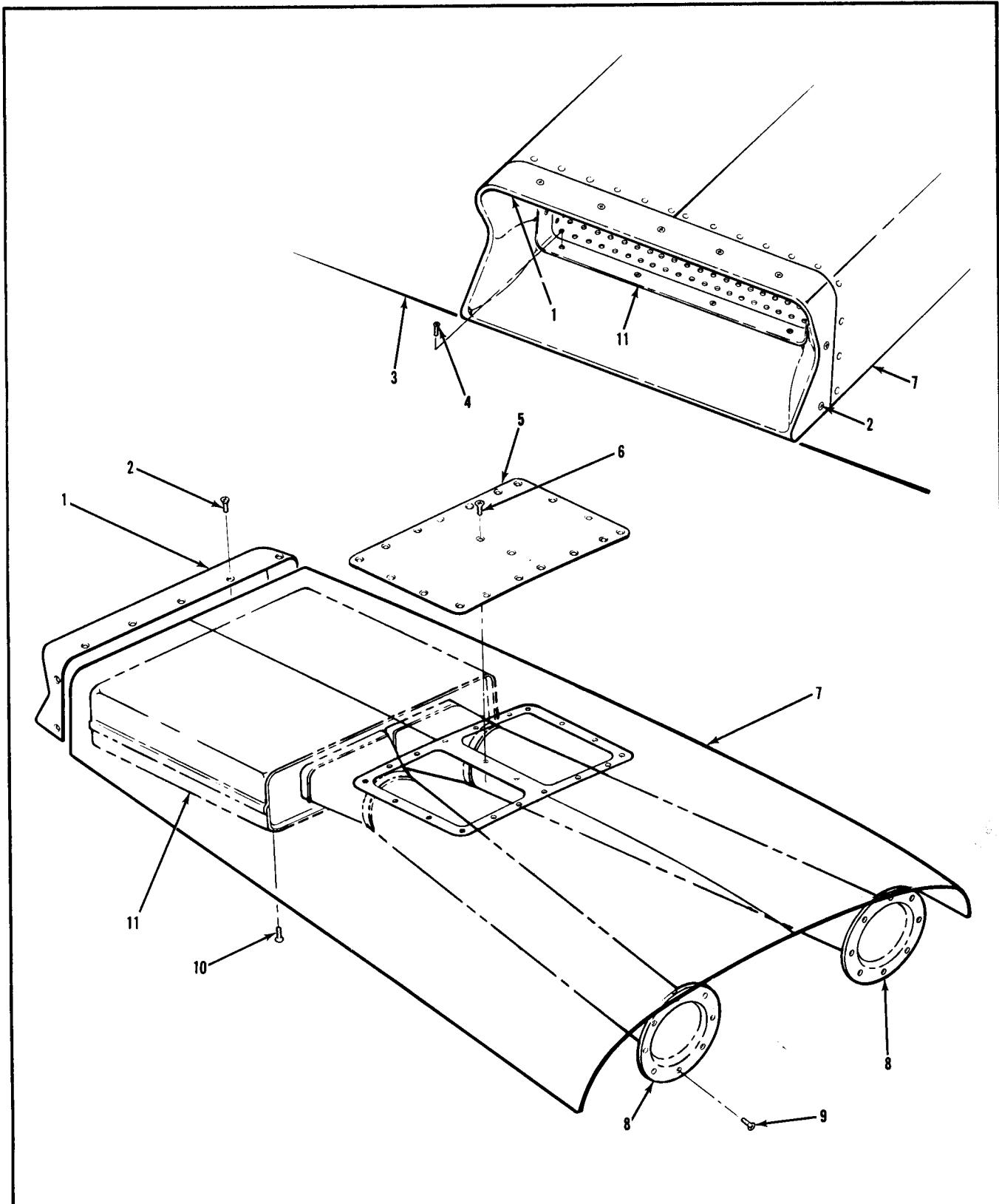
4-235. INSTALLATION OF MUFFLER. (See figure 4-30.) To install the muffler the flaps must be down to gain access to screws (10).

- a. Remove access door (5).
- b. Install the muffler (11) in the aft nacelle.
- c. Fit the muffler (11) to the ejector tubes (8).
- d. Install cap assembly (1) with screws (2 and 4).
- e. Replace access door (5).

4-236. 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.

4-237. REMOVAL OF ENGINE BAFFLES. (See figure 4-31.)

- a. Remove engine cowling in accordance with paragraph 4-3.
- b. To remove right and left baffles (3, 4, 6, 14, 15, and 16), remove the upper rocker box cover screws and nuts with which they are attached.
- c. To remove the oil cooler baffles (1 and 19), 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 (18), remove the three attaching screws and bolt.
- e. To remove the right and left forward intercylinder baffles (21 and 24) and the right and left intercylinder baffle supports (20 and 22) remove bolts (5).



- | | | |
|-----------------------|----------------|----------------------|
| 1. Cap Assembly | 5. Access Door | 8. Ejector Tube |
| 2. Screw | 6. Screw | 9. Screw |
| 3. Wing Trailing Edge | 7. Aft Nacelle | 10. Screw |
| 4. Screw | | 11. Muffler Assembly |

Figure 4-30. Exhaust Ejector and Muffler

f. To remove the right and left rear intercylinder baffles (23 and 25) and the rear intercylinder baffle supports (26) 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 (5 and 7). It is not necessary to remove these lines, leads or brackets to remove the baffles.

g. The upper left rear baffle (12) is a permanent part of the air intake box. To remove the air intake box refer to paragraph 4-221.

h. To remove the lower left rear baffle (13):

1. Remove the generator in accordance with paragraph 6-24.

2. Disconnect the left rear baffle fasteners (27 and 28) and work the lower fastener free of the cylinder.

3. Remove the two rocker box cover screws and remove the lower left rear baffle (13).

i. To remove rear center baffle (9) remove the screws from support brackets (10 and 11).

j. To remove the right rear baffle (8):

1. Disconnect the magneto ground wires and withdraw them aft, through the baffle.

2. Loosen clamps on crankcase breather line hose connectors and remove the crankcase breather line.

3. Disconnect the starter cable and remove the starter by removing the two mounting nuts and washers and pulling the starter straight out.

4. Disconnect the right rear baffle fasteners (27 and 28) and work the lower fastener free of the cylinder.

5. Remove the right rear baffle.

k. Support brackets (2 and 7) may be removed by removing the rocker box cover screws which attach them.

l. To remove the rear baffle support brackets (10 and 11) the aft upper 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.

4-238. 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.

4-239. INSTALLATION OF ENGINE BAFFLES. (See figure 4-31.)

a. To install the rear baffle support brackets (10

and 11), the aft upper crankcase thru-bolt must be removed.

CAUTION

If the thru-bolt O-ring seals are damaged during removal, they must be replaced. Oil the bolt and work the O-ring seals carefully over the bolt threads when installing.

Using the aft upper crankcase thru-bolt and nut, attach the support brackets (10 and 11) to the engine in the position illustrated.

b. Install support brackets (2 and 17) with rocker box cover screws.

c. To install the right rear baffle (8) the starter must be removed.

1. Work baffle (8) carefully into place. Attach to bracket (10) with screws.

2. Work lower fastener (27) into place around cylinder and attach to upper fastener (28).

3. Install starter and connect starter cable. Install crankcase breather line and attach magneto ground wires.

d. To install the left rear baffles (12 and 13), the generator must first be removed from the engine.

1. Place lower left rear baffle (13) carefully into position. Work lower fastener (27) in place around the cylinder and attach to upper fastener (28). Attach baffle to cylinder head with two rocker box cover screws.

2. The upper left rear baffle (12) is a permanent part of the air intake box. Install the air intake box in accordance with paragraph 4-223.

3. Install generator in accordance with paragraph 6-30.

e. Install rear center baffle (9) and secure to support brackets (10 and 11).

f. To install the right and left rear intercylinder baffles, set the supports (26) in place. Work the baffles into position between the center and aft cylinders and install bolts (7). The aft end of the fuel line and spark plug lead support brackets should be attached with bolts (7).

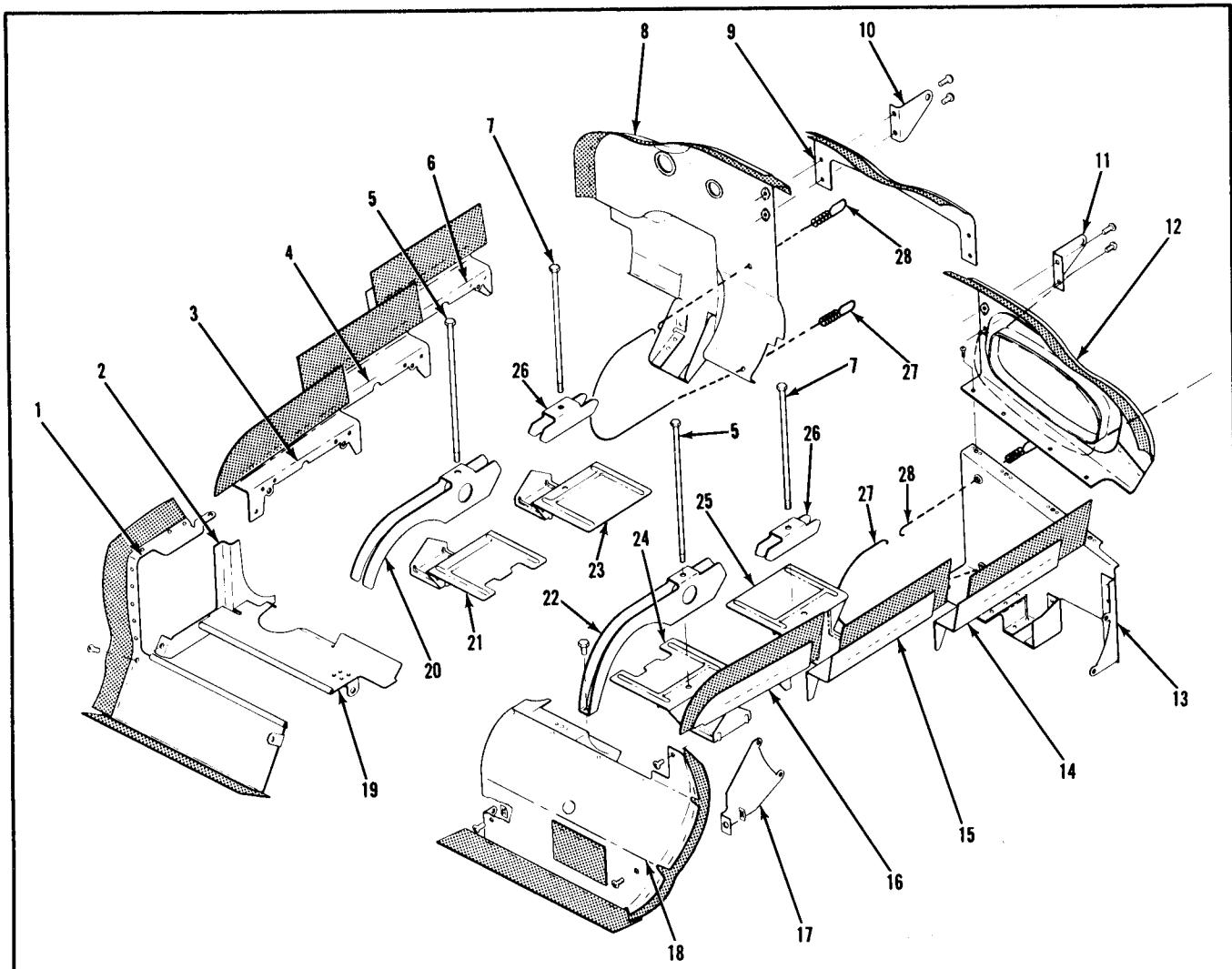
g. To install the right and left forward intercylinder baffles, set the supports (20 and 22) in place. Work the baffles into position between the forward and center cylinders and install bolts (5). Attach the fuel line and spark plug lead support bracket at the same time.

NOTE

The intercylinder baffle assemblies separate into two sections to facilitate installation. However, due to the close fit, considerable manipulation may be required to work them into position.

h. To install left front baffle (18), place the baffle in position and secure with three screws and bolt.

i. To install oil cooler baffles (1 and 19), first remove the lower oil cooler attaching bolts. Position the baffles and secure with lower oil cooler attaching bolts. Secure baffles (1 and 19) to support bracket (2) with screws.



- | | | |
|------------------------------|--|---|
| 1. Forward Oil Cooler Baffle | 12. Upper Left Rear Baffle | 21. Right Forward Intercylinder Baffle |
| 2. Support Bracket | 13. Lower Left Rear Baffle | 22. Left Forward Intercylinder Baffle Support |
| 3. Right Forward Baffle | 14. Left Aft Baffle | 23. Right Rear Intercylinder Baffle |
| 4. Right Center Baffle | 15. Left Center Baffle | 24. Left Forward Intercylinder Baffle |
| 5. Bolt | 16. Left Forward Baffle | 25. Left Rear Intercylinder Baffle |
| 6. Right Aft Baffle | 17. Support Bracket | 26. Rear Intercylinder Baffle Support |
| 7. Bolt | 18. Left Front Baffle | 27. Rear Baffle Fastener (Lower) |
| 8. Right Rear Baffle | 19. Aft Oil Cooler Baffle | 28. Rear Baffle Fastener (Upper) |
| 9. Rear Center Baffle | 20. Right Forward Intercylinder Baffle Support | |
| 10. Right Support Bracket | | |
| 11. Left Support Bracket | | |

Figure 4-31. Engine Baffles

- j. Fasten right and left baffles (3, 4, 6, 14, 15, and 16) in place with cylinder rocker box cover screws. Attach baffles (1, 8, and 18) to baffles (3, 6, and 16) with screws.
 k. Inspect completed installation.
 l. Replace engine cowling in accordance with paragraph 4-5.

4-240. FUEL SYSTEM. The fuel system for the Model 310C aircraft, serial 35772 and on, is the same as the Model 310B aircraft, serial 35547 thru 35771, with the following exceptions. The auxiliary fuel pumps, located in the main (wing tip)

fuel tanks, have two operating speeds. The auxiliary fuel pump will run at slow speed when the switch is in the PRIME position. The auxiliary pump will also run at slow speed when the switch is in the ON position except in the event that the engine-driven fuel pump pressure drops below 5.0 psi, in which case a fuel pressure switch will actuate and the auxiliary fuel pump will operate at a high speed. Once the fuel pressure switch has actuated the auxiliary fuel pump will operate at a high speed until the auxiliary fuel pump switch is moved to OFF. The auxiliary fuel pump switch must be ON before the fuel pressure switch will operate the auxiliary fuel pump.

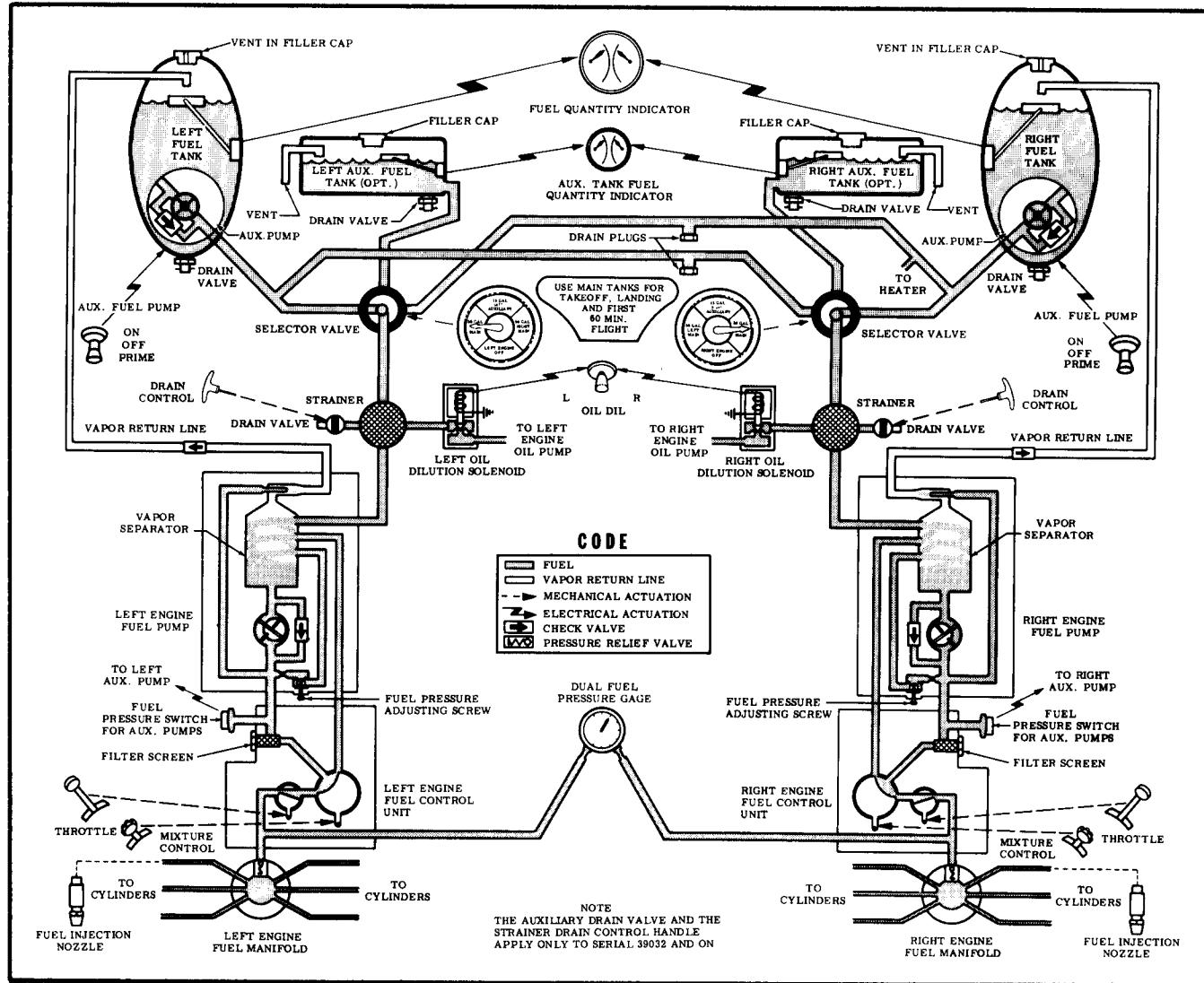


Figure 4-32. Fuel Injection System Schematic

4-241. TROUBLE SHOOTING 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 fuel quantity indicator. Defective fuel quantity sending unit.	Fill tank with correct grade of fuel. Reset circuit breaker. Tighten connections and check wiring. Replace fuel quantity indicator. Replace fuel quantity sending unit.
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 paragraph 4-277. Check fuel lines and fittings.

TROUBLE	PROBABLE CAUSE	CORRECTION
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. Bypass valve in engine-driven fuel pump stuck.	Fill tank with correct grade of fuel. Move fuel selector valve to tank desired. 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. Replace engine-driven fuel pump.

4-242. FUEL INJECTION SYSTEM. Fuel injection is standard equipment on serial 35772 and on. This 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 pressure 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.

4-243. TROUBLE SHOOTING THE FUEL INJECTION SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START - NO GAGE PRESSURE.	No fuel to engine.	Check mixture control for proper position, auxiliary pump PRIME and operating, selector valve in correct position, tank fuel level.

TROUBLE	PROBABLE CAUSE	CORRECTION
ENGINE WILL NOT START WITH GAGE PRESSURE.	Engine flooded. No fuel to engine.	Reset throttle, clear engine of excess fuel, try another start. Loosen one line at nozzle. If no fuel flow shows, with fuel pressure on gage, replace fuel manifold valve.
ROUGH IDLE.	Nozzle air screens restricted. Improper idle mixture.	Remove nozzles and clean. Adjust as described in paragraph 4-248.
POOR ACCELERATION.	Idle mixture too lean. Worn linkage.	Adjust as described in paragraph 4-248. Replace worn elements of linkage.
ENGINE RUNS ROUGH.	Restricted nozzle. Improper mixture.	Remove and clean all nozzles. Improper pump pressure, replace pump.
LOW GAGE PRESSURE.	Restricted flow to metering valve. Inadequate flow from pump.	Check mixture control for full travel. Check for clogged fuel filters. Replace pump.
HIGH GAGE PRESSURE.	Restricted flow beyond metering valve. Restricted recirculation passage in pump.	Check for restricted nozzles or fuel manifold valve. Clean or replace as required. Replace pump.
FLUCTUATING GAGE.	Vapor in system, excess fuel temperature. Fuel in gage line. Leak at gage connection.	If not cleared with auxiliary pump, check for clogged ejector jet in vapor separator cover. Clean only with solvent, no wires. Drain gage line and repair leak.
POOR IDLE CUT-OFF.	Engine getting fuel.	Check mixture control to be in full idle cut-off. Check auxiliary pump to be OFF. If neither, replace manifold valve.

4-244. FUEL-AIR CONTROL UNIT. 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 unit is enclosed in a shroud and is blast air cooled to help prevent vapor lock. A fuel pressure switch, connected to the fuel

control unit, actuates to cause the auxiliary fuel pump to operate at a high speed if the engine-driven fuel pump pressure drops below 5 psi. The auxiliary fuel pump switch must be ON for the fuel pressure switch to operate. On serials 35982, 35986 and on, a throttle open spring is used on the fuel-air control unit.

4-245. REMOVAL OF FUEL-AIR CONTROL UNIT. (See figure 4-27, sheets 1 and 2.)

- Remove the engine cowling.
- Place the fuel selector valve handles OFF.
- Remove the air intake box in accordance with paragraph 4-221.
- Remove fuel line (8) at the fuel control unit (43).

NOTE

Plug or cap all open lines, hoses, and fittings.

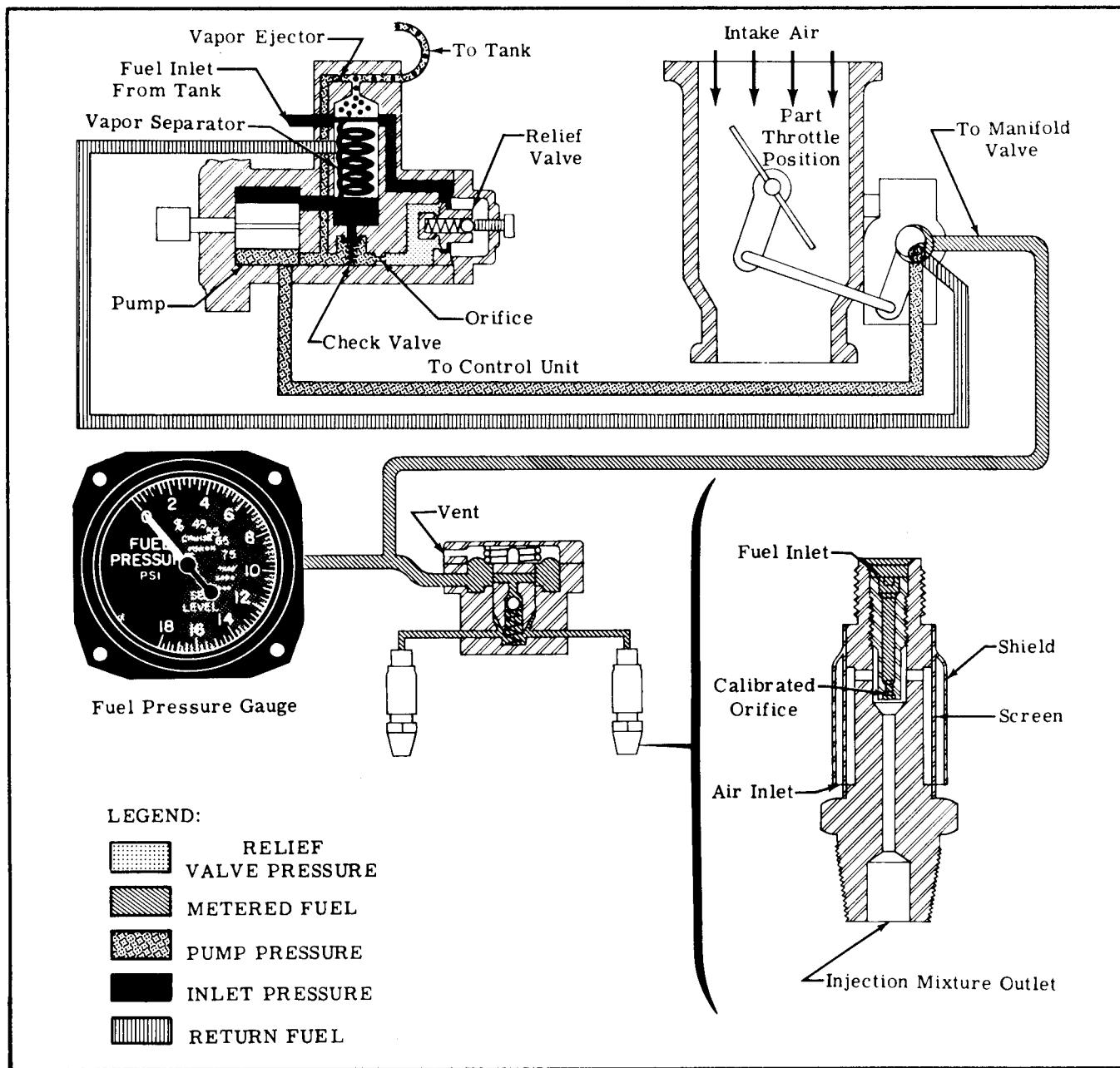


Figure 4-33. Fuel Injection Schematic

- e. Loosen the clamps securing the two flexible tubes to the bottom of the fuel control unit shroud and slide the tubing down. Disconnect the two fuel lines, which run between the fuel control unit (43) and the fuel pump (50), at the fuel control unit.
- f. Disconnect fuel pressure gage line (42).
- g. Disconnect the wiring at the fuel pressure switch (41).
- h. Loosen the clamps (47) which secures the fuel-air control unit to both the right and left intake manifold.
- i. Remove the fuel-air control unit (37).

4-246. CLEANING AND INSPECTION OF FUEL-AIR CONTROL UNIT.

- a. Check control connections, levers, and linkages for tight attaching parts, for safetying, and for lost

motion due to wear.

- b. Remove the fuel strainer and clean the screen in fresh cleaning solvent. Reinstall and safety.
- c. Check the air control body for cracks and the fuel-air control unit for overall condition.

4-247. INSTALLATION OF FUEL-AIR CONTROL UNIT. (See figure 4-27, sheets 1 and 2.)

- a. Place the fuel-air control unit (37) in position on the engine.

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.

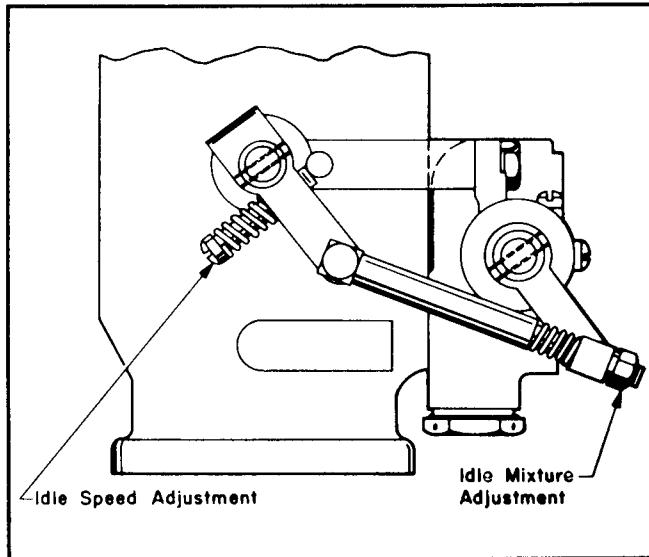


Figure 4-34. Fuel-Air Control Unit Adjustments

- b. Install support (35) temporarily to obtain the correct position for the fuel-air control unit (37).
- c. Install hose connectors and clamps (47) which secure the unit to the intake manifold.
- d. Before connecting the two fuel lines which run between the fuel control unit (43) and the fuel pump (50) make certain that the two flexible tubes are installed on these lines. Connect these two lines at the fuel control unit. Install the flexible tubes on the air horns located at the bottom of the fuel control shroud and secure with clamps.
- e. Connect fuel line (8) at the fuel control unit (43).
- f. Connect wiring at fuel pressure switch (41).
- g. Connect fuel pressure gage line (42).
- h. Inspect completed installation.
- i. Install the air intake box in accordance with paragraph 4-223.
- j. Rig the engine controls in accordance with paragraph 4-275.
- k. Install engine cowling.

4-248. 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 the locknut 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. Adjust to obtain a slight and momentary gain in idle speed as the mixture control is slowly moved toward IDLE CUT-OFF. If set too lean, idle speed will drop under the same conditions.

4-249. FUEL MANIFOLD. From the fuel control unit fuel is delivered to the fuel manifold which provides a central point for dividing fuel to the individual cylinders. In the fuel manifold, a diaphragm and plunger valve raises or lowers - by fuel pressure - to open or close the individual cylinder fuel supply ports simultaneously. A ball check valve under the plunger serves to insure that the plunger fully opens the outlet ports before fuel flow starts. Thus, there is no unbalanced restriction to fuel flow in the fuel manifold. A fine mesh screen is included in the fuel

manifold as additional protection of the injection nozzles against dirt or foreign matter.

4-250. REMOVAL OF FUEL MANIFOLD. (See figure 4-27, sheets 1 and 2.)

NOTE

Plug or cap all disconnected lines, hoses, and fittings.

- a. Disconnect fuel line (8) at the fuel manifold (9).
- b. Disconnect the six fuel injection lines (16) at the fuel manifold.
- c. Remove the fuel manifold (9) by removing the crankcase thru-bolt which secures it.

NOTE

In removing the crankcase thru-bolt use care to prevent damaging the O-ring seals.

4-251. CLEANING AND INSPECTION OF FUEL MANIFOLD.

- a. Hold the top cover down against internal spring until all four attaching screws have been removed, then gently lift off the cover. Use care not to damage the spring-loaded diaphragm below it.
- b. Remove the upper spring and lift the diaphragm assembly straight up.

NOTE

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

- c. Remove the lower ball and spring.
- d. 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.

- e. Using clean gasoline, flush out the chamber below the screen.
- f. 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.
- g. Replace flushing plug.
- h. Clean the diaphragm and valve, top cover, and ball and springs in the same manner.
- i. Replace lower spring and ball (ball on TOP of spring).
- j. Carefully replace diaphragm and valve, making sure ball and spring feed into hollow end of valve. Check that valve works freely.
- k. Place upper spring in position.

m. Align mounting holes in body, diaphragm, and top cover locating the small vent hole in the cover to the rear. Hold the cover down against the spring while installing and tightening all four attaching screws. Safety the screws.

4-252. INSTALLATION OF FUEL MANIFOLD. (See figure 4-27, sheets 1 and 2.)

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).

CAUTION

If the thru-bolt O-ring seals were damaged during removal, they must be replaced. Oil the bolt and work the O-ring seals carefully over the bolt threads when installing.

- b. Connect fuel line (8) at the fuel manifold (9).
- c. Connect the six fuel injection lines (16) at the fuel manifold.
- d. Inspect the completed installation

4-253. 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 ar-

angement is incorporated in each nozzle. This aids in vaporization of fuel and, by breaking the high vacuum at idle, maintains the fuel lines solidly filled and ready for instant acceleration of the engine. Nozzles are calibrated in several ranges, and all nozzles furnished for one engine are of the same range identified by a letter stamped on the hex of the nozzle body.

4-254. REMOVAL OF FUEL DISCHARGE NOZZLES. (See figure 4-27, sheets 1 and 2.)

- a. Disconnect the fuel injection lines (16) at the fuel discharge nozzles (17).

NOTE

Plug or cap all disconnected lines and fittings.

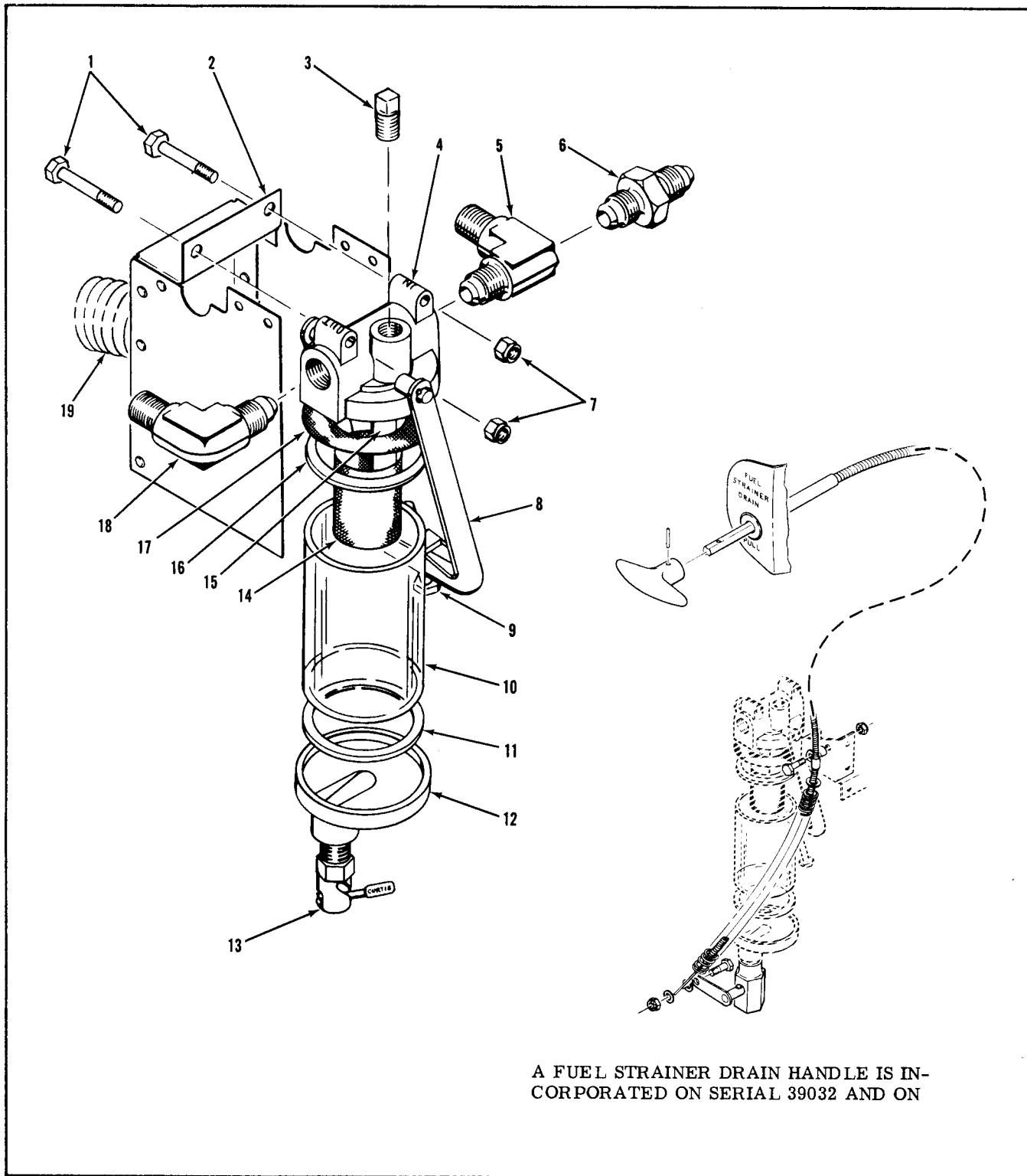
- b. Remove fuel discharge nozzles (17) from cylinders, (use 1/2 inch deep socket).

4-255. CLEANING AND INSPECTION OF FUEL DISCHARGE NOZZLES. To clean nozzles, immerse in fresh cleaning solvent. Use compressed air to dry. Do not remove shield to clean air screens in nozzle. Do not use a wire or other object to clean orifices.

4-256. INSTALLATION OF FUEL DISCHARGE NOZZLES. (See figure 4-27, sheets 1 and 2.)

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 FUEL STRAINER DRAIN HANDLE IS INCORPORATED ON SERIAL 39032 AND ON

- | | | |
|--|------------------|------------------|
| 1. Bolt | 7. Nut | 14. Filter |
| 2. Shroud | 8. Arm Assembly | 15. Standpipe |
| 3. Plug | 9. Bolt | 16. Upper Gasket |
| 4. Body Assembly | 10. Glass Bowl | 17. Flat Screen |
| 5. Fitting for Left Engine Installation | 11. Lower Gasket | 18. Elbow |
| 6. Fitting for Right Engine Installation | 12. Cap | 19. Ram Air Tube |
| | 13. Drain Valve | |

Figure 4-34A. Fuel Strainer (Serial 35772 and on)

- a. Install the fuel discharge nozzles (17) in the cylinders (use 1/2 inch deep socket).
- b. Connect fuel injection lines (16) at the fuel discharge nozzles (17).
- c. Check installation for crimped lines, loose fittings, etc.

4-257. 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. 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.

4-258. REMOVAL OF FUEL INJECTION PUMP. (See figure 4-27, sheets 1 and 2.) Place fuel selector valve handles OFF.

- a. Remove the engine cowling.
- b. Remove the air intake box in accordance with paragraph 4-221.
- c. Remove the generator (53) drive belt.
- 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.

4-259. INSTALLATION OF FUEL INJECTION PUMP. (See figure 4-27, sheets 1 and 2.)

- 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 generator (53) drive belt and tighten the nut on the adjusting arm so that the belt is tight.
- f. Install the air intake box in accordance with paragraph 4-223.
- g. Rig the engine controls in accordance with paragraph 4-275.
- h. Replace the engine cowling.

4-260. FUEL INJECTION PUMP ADJUSTMENTS. The fuel injection pump pressure is part of the basic calibration and requires the services of an authorized representative with the necessary equipment for testing and/or resetting. Do not attempt any adjustment.

4-261. FUEL STRAINERS. A fuel strainer is located in each engine nacelle and is attached to a mounting bracket in the lower center part of the firewall. The strainners remove foreign material from the fuel before it reaches the fuel pumps. A quick drain valve is provided at the bottom of each fuel strainer to drain trapped water and sediment. The fuel strainer is enclosed in a shroud and is blast cooled by air from the air intake box.

4-262. REMOVAL OF FUEL STRAINERS. (See figure 4-34A.) To remove either fuel strainer:

- a. Place fuel selector valve handle in the BOTH OFF position.
- b. Remove engine cowling in accordance with paragraph 4-3.
- c. Disconnect fuel inlet line from fitting (5, left engine installation), or (6, right engine installation), and fuel pump supply hose from elbow (18).

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 nacelles when lines or hoses are disconnected.

- d. Remove nuts (7) and bolts (1), attaching shroud (2) and fuel strainer to mounting bracket. Remove strainer assembly.

4-262A. DISASSEMBLY OF FUEL STRAINERS. (See figure 4-34A.) Either fuel strainer can be disassembled as follows:

- a. Remove safety wire and loosen bolt (9) holding arm assembly (8). Swing arm assembly (8) clear of cap (12).
- b. Remove cap (12), lower gasket (11), and glass bowl (10).

- c. Remove filter (14), upper gasket (16), and flat screen (15).
- d. Remove plug (3) and drain valve (13).

4-263. CLEANING AND INSPECTION OF FUEL STRAINERS. Clean the disassembled fuel strainers by washing in unleaded gasoline and allowing to dry. The filters and the flat screens can be cleaned of sediment by blowing compressed air through them. If either is ruptured or damaged, replace it with a new one. Be sure all sediment and foreign particles have been removed before assembly.

- 4-263A. ASSEMBLY OF FUEL STRAINERS. (See figure 4-34A.) To assemble either fuel strainer: (Use a suitable thread lubricant on all male threads.)
- a. Install plug (3), inlet fitting either (5 or 6), and outlet elbow (18) in the body assembly (4) as illustrated.
 - b. Install the quick drain valve (13) in cap (12).
 - c. Slide flat screen (17), upper gasket (16), and filter (14) into position as illustrated.
 - d. Position glass bowl (10), lower gasket (11), and cap (12) as illustrated.

NOTE

Use new gaskets when reassembling strainer.

- e. Secure bolt (9) to arm assembly (8) with safety wire.

- 4-264. INSTALLATION OF FUEL STRAINERS. (See figure 4-34A.) To install either fuel strainer:
- a. Place fuel strainer and shroud in position on its mounting bracket and secure with bolts (1) and nuts (7). Install flexible ram air tube.
 - b. Connect line from fuel selector valve to inlet fitting (5 or 6), and connect fuel pump supply hose to outlet elbow (18).
 - c. Turn fuel selector valve handle to the ON position and start fuel boost pump operating. Check fuel strainer for leaks and replace gaskets or tighten fittings as necessary.

CAUTION

Be certain that the mixture lever is in the IDLE CUT-OFF position before operating the fuel boost pump.

- d. Replace engine cowling in accordance with paragraph 4-5.

4-265. ENGINE CONTROLS. This aircraft is equipped with a teleflex control system for throttle, mixture, and propeller pitch operation. The teleflex system consists of spiral-wound steel cables which operate within rigid conduits. The induction air control is a spiral-wound steel cable which operates within a one-piece flexible conduit. These controls are attached to the engine in such a way that engine vibration will not affect the controls.

- 4-266. REMOVAL OF ENGINE CONTROLS. (See figure 4-35.)

- a. Remove the center side panels from the control pedestal (29).
- b. Disconnect and remove the propeller control cable as follows:
 1. Disconnect control rod end (22) from propeller governor (25) by removing bolt (21).
 2. Unlock sliding end (20) from teleflex cable by loosening nut on locking plug (19). Remove by unscrewing in a clockwise direction.
 3. Disconnect control pedestal end of teleflex cable by removing the pin, which secures the clevis, at the end of the teleflex push-pull unit (2), to the propeller control lever.
 4. Remove cable from conduit by pulling upward on teleflex push-pull unit (2).
- c. Disconnect and remove the mixture control cable as follows:

NOTE

If the mixture control is being removed only to remove the air intake box, follow this procedure. (Refer to figure 4-38.) Remove bolts (7) which attach the control box (6) to bracket (3).

1. Remove nut (10, figure 4-38) and slide the control arm free of the splined shaft.
2. Disconnect control pedestal end of teleflex cable by removing the pin which secures the teleflex cable clevis end to the mixture control arm.
3. Remove cable from conduit by pulling upward on teleflex push-pull unit (2).
- d. Disconnect and remove the throttle control cable as follows:

Figure 4-35. Engine Controls Callouts

- | | | |
|----------------------------|-------------------------------|---------------------------------|
| 1. Swivel Connector | 12. Nacelle Conduit | 23. Spacer |
| 2. Teleflex Push-Pull Unit | 13. Induction Air Cable | 24. Nut |
| 3. Cabin Section Conduit | 14. Propeller Control Conduit | 25. Propeller Governor |
| 4. Nut | Connector | 26. Induction Air Control Cable |
| 5. Washer | 15. Propeller Control Conduit | Housing |
| 6. Fuselage Skin | 16. Mounting Nuts | 27. Nut |
| 7. Connector | 17. Mounting Bracket | 28. Washer |
| 8. Wing Section-Conduit | 18. Swivel Connector | 29. Control Pedestal |
| 9. Induction Air Cable | 19. Lock Plug | 30. Nut |
| 10. Inboard Nacelle Rib | 20. Sliding End | 31. Roll Pin |
| 11. Connector | 21. Bolt | 32. Induction Air Control Knob |
| | 22. Control Rod End | |

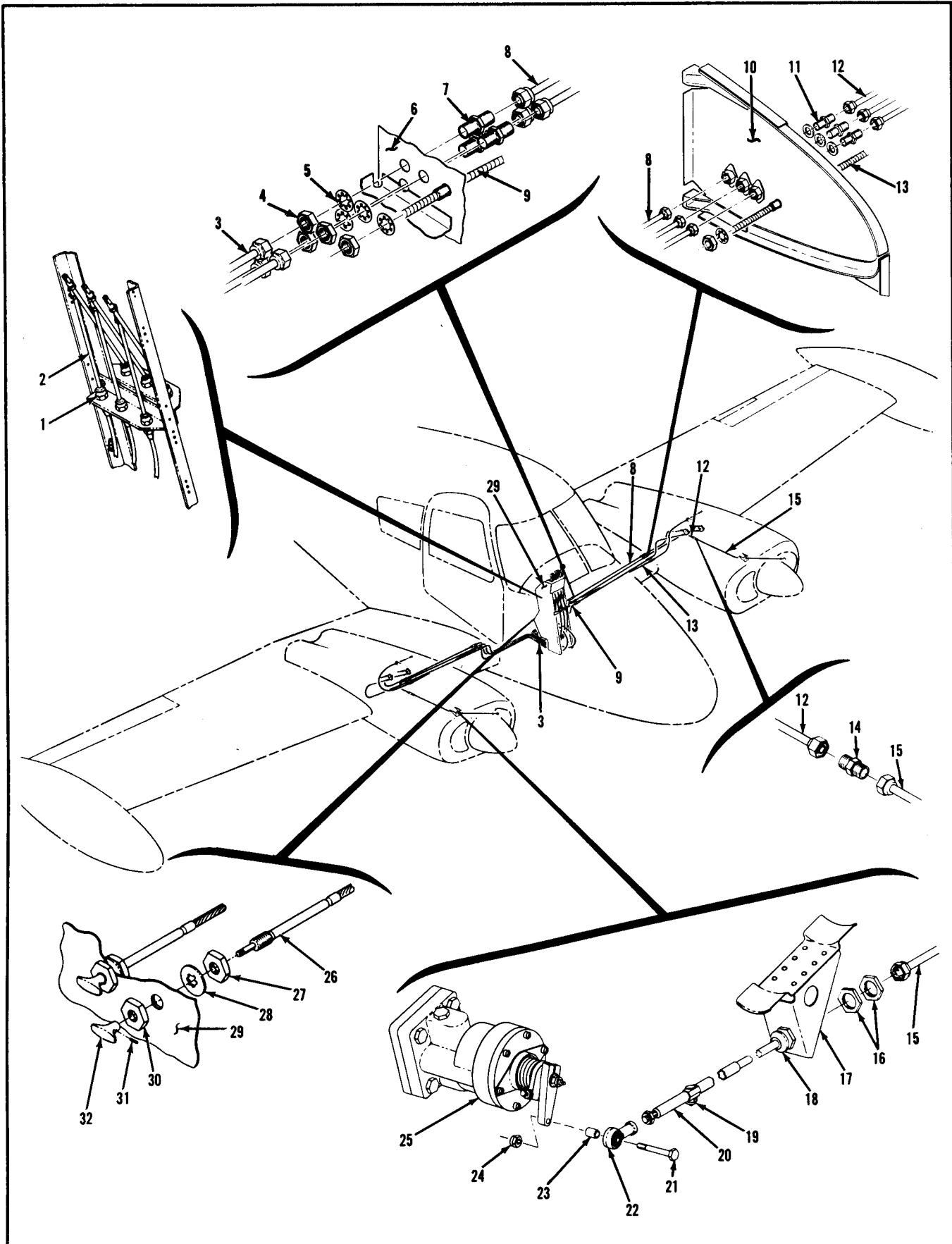


Figure 4-35. Engine Controls

NOTE

If the throttle control is being removed only to remove the air intake box, follow this procedure. (Refer to figure 4-38.) Remove nuts (14) and bolts which attach control box (13) to the bracket.

1. Remove nut which secures arm (12, figure 4-38) to the control box splined shaft. Slide arm (12) free of the splined shaft.

2. Disconnect control pedestal end of teleflex cable by removing the pin which secures the teleflex cable clevis end to the throttle control arm.

3. Remove cable from conduit by pulling upward on teleflex push-pull unit (2).

e. Disconnect and remove the induction air control cable as follows:

NOTE

If the induction air control is being removed only to remove the air intake box, follow this procedure. (Refer to figure 4-38.) Remove bolt (19) and nut (4), pull the control free of bracket (3).

1. Remove bolt (19) and clevis end (18), figure 4-38.

2. No disconnection is necessary at the control pedestal. Remove cable by pulling out on knob (32).

f. If removal of engine control conduit is necessary the following units must be removed.

1. Center side panels from control pedestal.

2. Pilot's and copilot's seats.

3. Conduit cover from immediately forward of fuel selector support pan.

4. Carpet and upholstery side panels.

5. Fuel selector support pan in accordance with paragraph 4-106.

6. Forward wing fillet.

7. Three access hole covers on underside of wing leading edge between fuselage and engine nacelle.

8. Fuel selector torque-tube between fuselage and engine nacelle in accordance with paragraph 4-106.

g. The rigid control cable conduit for the propeller control, mixture control, and throttle control is in sections which are joined together at various bulkheads. These bulkheads and connections are clearly shown in figure 4-35. The induction air cable conduit is flexible and is one continuous piece between the control pedestal and the engine. Threaded fittings are swedged to the flexible conduit for attachment at various bulkheads which are clearly shown in figure 4-35.

4-267. CLEANING AND INSPECTION OF ENGINE CONTROLS. Clean and inspect the engine controls and cables in accordance with paragraph 4-151.

4-268. INSTALLATION OF ENGINE CONTROLS. (See figure 4-35.)

a. If the engine control conduit was removed, replace this conduit. Routing and attaching parts are clearly shown in figure 4-35. Replace the following units.

1. Fuel selector torque tube between fuselage and engine nacelle in accordance with paragraph 4-108.

2. Three access hole covers on underside of wing leading edge between fuselage and engine nacelle.

3. Forward wing fillet.

4. Fuel selector support pan in accordance with paragraph 4-108.

5. Carpet and upholstery side panels.

6. Conduit cover located immediately forward of fuel selector support pan.

7. Pilot's and copilot's seats.

b. Install and connect the induction air cable as follows:

NOTE

If the induction air cable was disconnected only to remove the air intake box, replace as follows: (Refer to figure 4-38.) Install the induction air control (5) in the hole provided in bracket (3) and secure with nut (4). Rig the induction air control in accordance with paragraph 4-279.

1. Insert the induction air control cable in the conduit (26) at the control pedestal (29).

2. Rig the induction air control in accordance with paragraph 4-279.

c. Install and connect the throttle control cable as follows:

NOTE

If the throttle control was disconnected only to remove the air intake box, replace as follows: (Refer to figure 4-38.) Install bolts and nuts (14) which attach the control (13) to the airbox bracket. Rig the throttle control in accordance with paragraph 4-276.

1. Insert the throttle control cable in the proper conduit at the control pedestal.

2. Attach the cable clevis end to the throttle control arm with pin. Safety the pin with a cotter pin.

3. Rig the throttle control in accordance with paragraph 4-276.

d. Install and connect the mixture control cable as follows:

NOTE

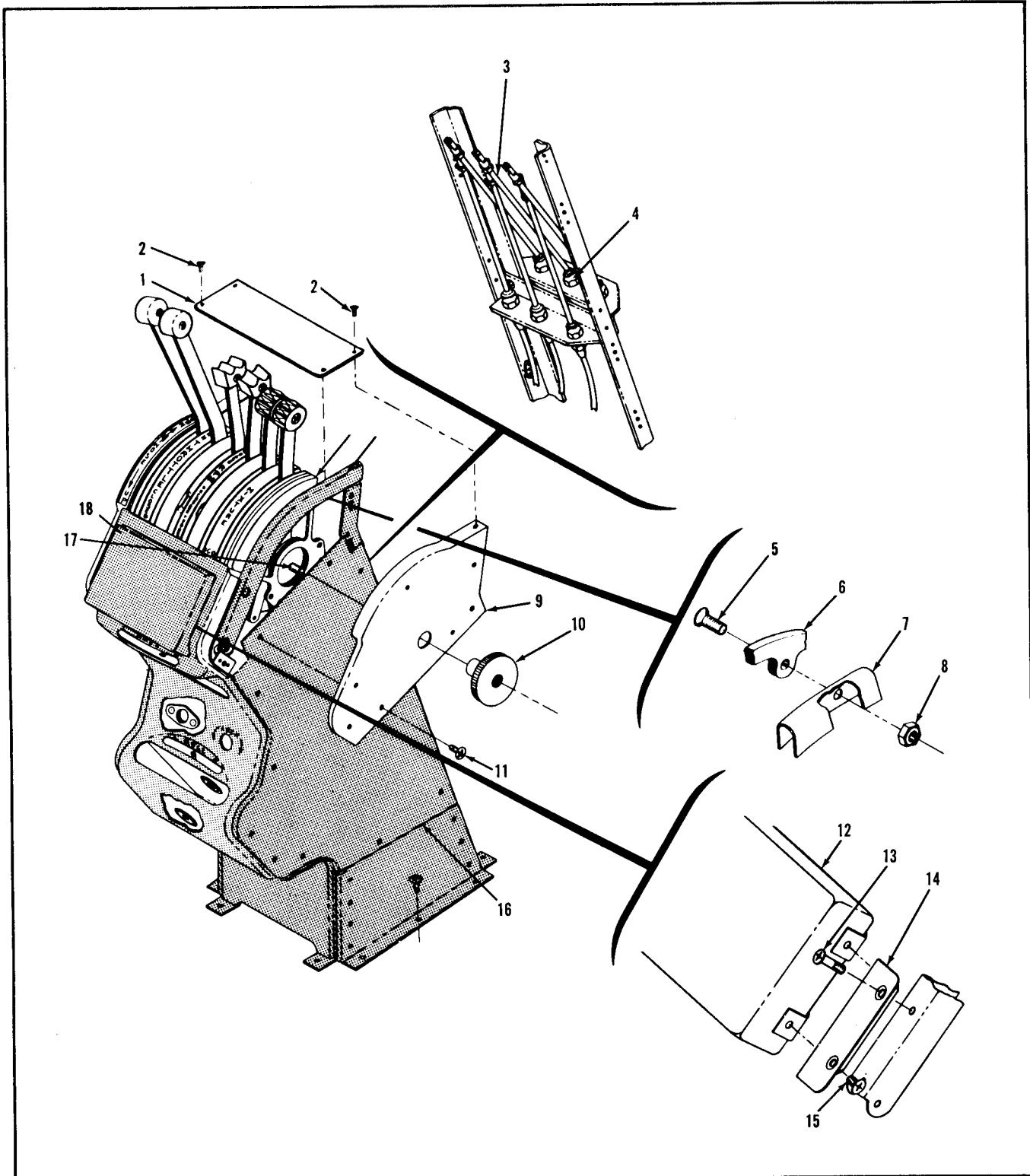
If the mixture control was disconnected only to remove the air intake box, replace as follows: (Refer to figure 4-38.) Attach control (6) to bracket (3) with bolts (7). Rig the mixture control in accordance with paragraph 4-277.

1. Insert the mixture control cable in the proper conduit at the control pedestal.

2. Attach the cable clevis end to the mixture control arm with pin. Safety the pin with a cotter pin.

3. Rig the mixture control in accordance with paragraph 4-277.

e. Install and connect the propeller control cable as follows:



- | | | |
|----------------------------|---------------------|-----------------------|
| 1. Cover Plate | 7. Control Pedestal | 13. Screw |
| 2. Screw | 8. Nut | 14. Support Angle |
| 3. Teleflex Push-pull Unit | 9. Upper Side Panel | 15. Screw |
| 4. Swivel Connector | 10. Friction Knob | 16. Center Side Panel |
| 5. Screw | 11. Screw | 17. Center Stud |
| 6. Control Quadrant | 12. Cover | 18. Cover Box |

Figure 4-36. Control Quadrant Removal

1. Insert the propeller control cable in the proper conduit at the control pedestal.
2. Attach the cable clevis end to the propeller control arm with pin. Safety the pin with a cotter pin.
3. Connect sliding arm (20) and lock by tightening nut on locking plug (19).
4. Rig the propeller control in accordance with paragraph 4-278.
- f. Install the center side panels on the control pedestal (29).

4-269. 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.

4-270. REMOVAL OF ENGINE CONTROL QUADRANT. (See figure 4-36.)

- a. Remove elevator trim control wheel in accordance with paragraph 2-140.
- b. Remove cover plate (1), unscrew friction knob (10), and remove upper and center side panels (9 and 16).
- c. Remove cover box (18) from upper face of control pedestal by removing screws (13) from support angle (14).
- d. Disconnect teleflex push-pull units (3) from engine control arms by removing the connecting pins. The pins are safetied with cotter pins.
- e. Remove elevator trim control wheel and attaching parts from the control quadrant in accordance with paragraph 2-140.
- f. Remove control quadrant (6) from control pedestal (7) by removing attaching screws (5).

4-271. DISASSEMBLY OF CONTROL QUADRANT.

(See figure 4-37.)

- a. Remove three screws (1) attaching right mounting plate (25) to guide rods (18).
- b. Remove washer (28) and spring (29) from end of center stud (27).
- c. Remove spacer (17), rack (15), and spacers (7) from guide rods, then remove spacer (30), friction disc (31), and control lever (32) from hub (37). 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 guide rods to left mounting plate (4) and remove guide rods.

CAUTION

Hold the ratchet stop (21) on the mixture levers (32) 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 (37) from mounting plate.
- f. Unscrew retainer (3) from hub (37), and, center stud (27) from retainer, to complete disassembly.

4-272. CLEANING AND INSPECTION OF CONTROL QUADRANT. Clean all metal parts in a suitable solvent and allow to dry. Inspect all parts for evidence of cracking and excessive wear. The racks and ratchet stops for the mixture levers should be inspected for excessive wear and broken teeth. Replace if worn to a point where positive locking is not assured. Replace ratchet stop springs if springs appear to be weak.

4-273. ASSEMBLY OF CONTROL QUADRANT.

(See figure 4-37.)

- a. Screw center stud (27) into retainer (3).
- b. Screw retainer into hub (37) 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 (18) 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

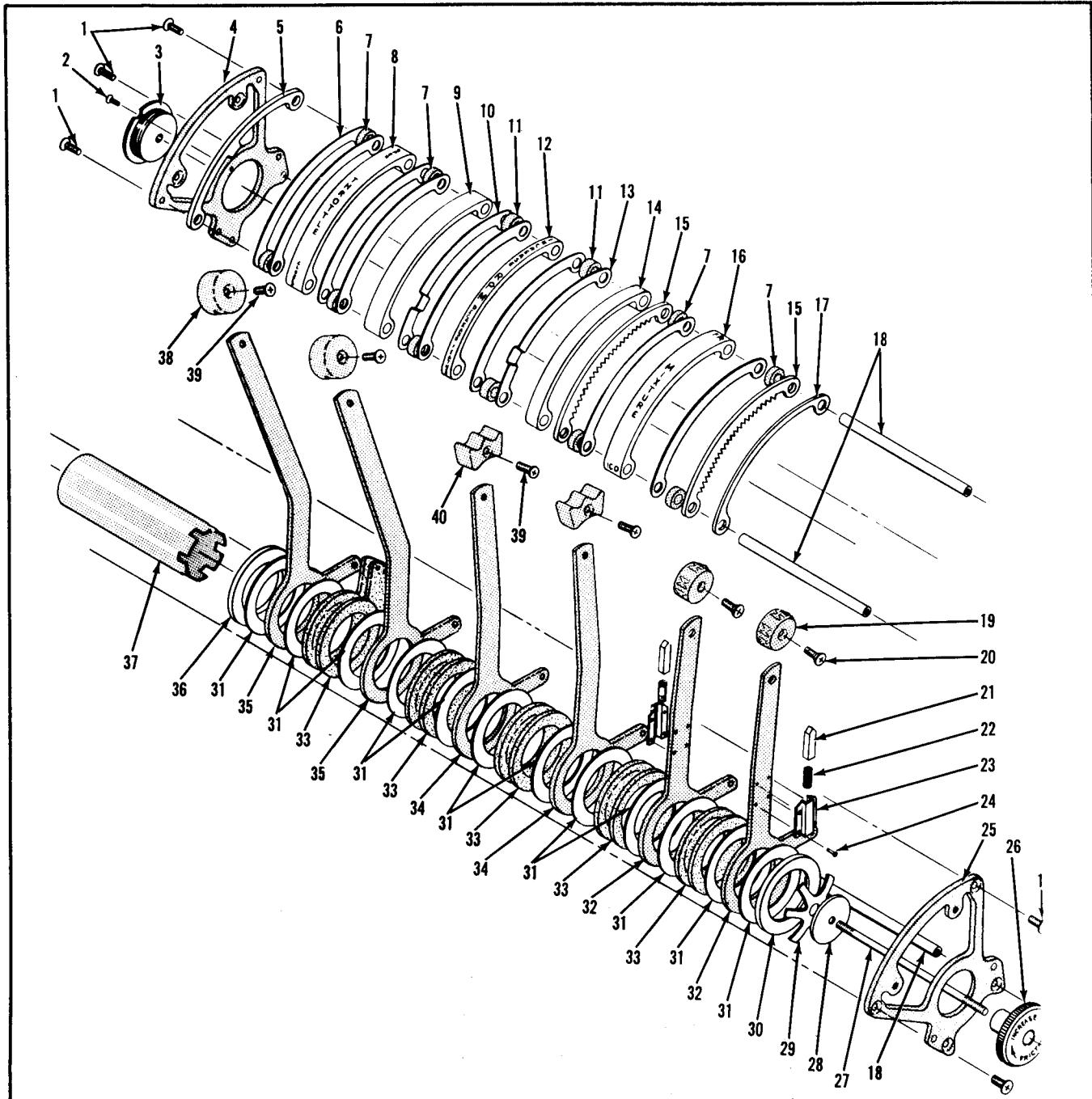
Do not lubricate the parts to be assembled on the hub. These parts must remain dry for proper operation of the control friction lock.

- e. Install right mounting plate (25) with three screws (1), attaching mounting plate to guide rods (18).

4-274. INSTALLATION OF CONTROL QUADRANT. (See figure 4-36.)

- a. Install control quadrant in top of control pedestal with four attaching screws (5).
- b. Install elevator trim control sprocket and attaching parts in the control quadrant in accordance with paragraph 2-141.
- c. Connect teleflex push-pull units (3) to the engine control arms by installing the connecting pins. Safety with cotter pins.
- d. Refer to rigging procedure in the following paragraphs for rigging each engine control and check for proper operation of control systems.
- e. Install cover box (18) on upper face of control pedestal by installing attaching screws (13) in support angle (14).
- f. Install upper and center side panels (9 and 16), and cover plate (1), on control pedestal.
- g. Screw friction knob (10) onto center stud (17).
- h. Install elevator trim control wheel in accordance with paragraph 2-141.

4-275. RIGGING PROCEDURES - ENGINE CONTROLS. (See figure 4-38.)



- | | | |
|----------------------------|--------------------------|---------------------------|
| 1. Screw | 14. Spacer | 28. Washer |
| 2. Lockscrew | 15. Rack | 29. Spring |
| 3. Retainer | 16. Spacer | 30. Spacer |
| 4. Left Mounting Plate | 17. Spacer | 31. Friction Disc |
| 5. Spacer | 18. Guide Rod | 32. Mixture Lever |
| 6. Guide | 19. Mixture Lever Knob | 33. Spacer |
| 7. Spacer | 20. Screw | 34. Propeller Pitch Lever |
| 8. Spacer | 21. Ratchet Stop | 35. Throttle Lever |
| 9. Spacer | 22. Spring | 36. Spacer |
| 10. Left Pitch Lever Stop | 23. Housing | 37. Hub |
| 11. Spacer | 24. Screw | 38. Throttle Lever Knob |
| 12. Spacer | 25. Right Mounting Plate | 39. Screw |
| 13. Right Pitch Lever Stop | 26. Friction Knob | 40. Pitch Lever Knob |
| | 27. Center Stud | |

Figure 4-37. Control Quadrant Disassembly

4-276. RIGGING THROTTLE CONTROLS. (See figure 4-38.)

- a. Remove nut (10) which secures control arm (12) to the throttle control (13).
- b. Pull control arm (12) free of splined shaft on throttle control (13). Do not disconnect linkage (15) from either the fuel control unit or control arm (12).
- c. Place throttle lever in control pedestal in the closed position against the aft stop. Advance lever approximately 1/4 inch from stop and lock in this position by tightening friction knob on right side of control quadrant.
- d. Move throttle arm on the fuel control unit to closed (full forward) position.
- e. Replace control arm (12) on splined shaft of throttle control (13). Do not move the throttle control arm from the full closed position while placing control arm (12) on shaft.
- f. Secure control arm (12) on the splined shaft with a nut.
- g. Release the friction lock on the control pedestal and operate the throttle lever to full open (full forward) position and tighten the friction lock.
- h. Remove the bolt which attaches control arm (12) and linkage (15) and check that the throttle arm on the fuel control unit is full open.
- i. If the throttle arm on the fuel control unit is not fully operated by the throttle operation, screw the eye-bolt on control arm (12) out to increase the travel.
- j. If the control arm on the fuel control unit reaches full open before the throttle control in the pedestal hits the forward stop the travel is too long and the eyebolt on control arm (12) must be screwed in.
- k. After the eyebolt on control arm (12) has been screwed in or out, steps "a" through "e" may have to be repeated to correct the position of control arm (12) on the splined shaft.
- l. With the throttle arm, at the fuel control unit, against either stop, the throttle lever should be approximately 1/4 inch from the quadrant stop. This unused travel provides the necessary cushion to assure full travel of the throttle arm.
- m. Fine adjustment may be accomplished by loosening nuts (14) and rotating throttle control (13) on the mounting bracket.

4-277. RIGGING MIXTURE CONTROLS. (See figure 4-38.)

- a. Remove nut (10) which secures control arm (9) to the mixture control (6).
- b. Pull control arm (9) free of splined shaft on mixture control (6). Do not disconnect linkage (11) from either the fuel control unit or control arm (9).
- c. Place mixture lever in control pedestal in IDLE CUT-OFF position against the aft stop. Advance lever approximately 1/4 inch from stop and lock in this position by tightening friction knob on right side of control quadrant.
- d. Move mixture arm on the fuel control unit to IDLE CUT-OFF (full back) position.
- e. Replace control arm (9) on splined shaft of mixture control (6). Do not move the mixture control from the IDLE CUT-OFF position while placing control arm (9) on shaft.
- f. Secure control arm (9) on the splined shaft with nut (10).

g. Release the friction knob on the control pedestal and operate the mixture lever to the full open (FULL RICH) position and tighten the friction lock.

h. Remove the bolt which attaches control arm (9) and linkage (11) and check that the mixture arm on the fuel control unit is full open (FULL RICH).

i. If the mixture arm on the fuel control unit is not fully operated by mixture lever operation, screw the eyebolt on control arm (9) out to increase the travel.

j. If the control arm on the fuel control unit reaches full open before the mixture control in the pedestal hits the forward stop the travel is too long and the eyebolt on control arm (9) must be screwed in.

k. After the eyebolt on control arm (9) has been screwed in or out, steps "a" through "e" may have to be repeated to correct the position of control arm (9) on the splined shaft.

l. With the mixture arm, at the fuel control unit, against either stop, the mixture lever should be approximately 1/4 inch from the quadrant stop. This unused travel provides the necessary cushion to assure full travel of the mixture arm.

m. Fine adjustment may be accomplished by loosening bolts (7) and rotating mixture control (6) on bracket (3).

4-278. RIGGING PROPELLER CONTROLS. (See figure 4-38.)

- a. Disconnect propeller control rod end (27) at propeller governor arm (29) by removing bolt (26).
- b. Place propeller pitch lever in control pedestal in FULL INCREASE RPM position against the forward stop. Retard lever approximately 1/4 inch from stop and lock lever in this position by tightening friction knob on right side of control quadrant.
- c. Place governor arm (29) in the full forward position against stop (FULL INCREASE RPM).
- d. Loosen jam's nut (22) on propeller control sliding end and adjust position of control rod end (27), by screwing in or out until bolt (26) can be inserted through rod end and governor arm without binding.

NOTE

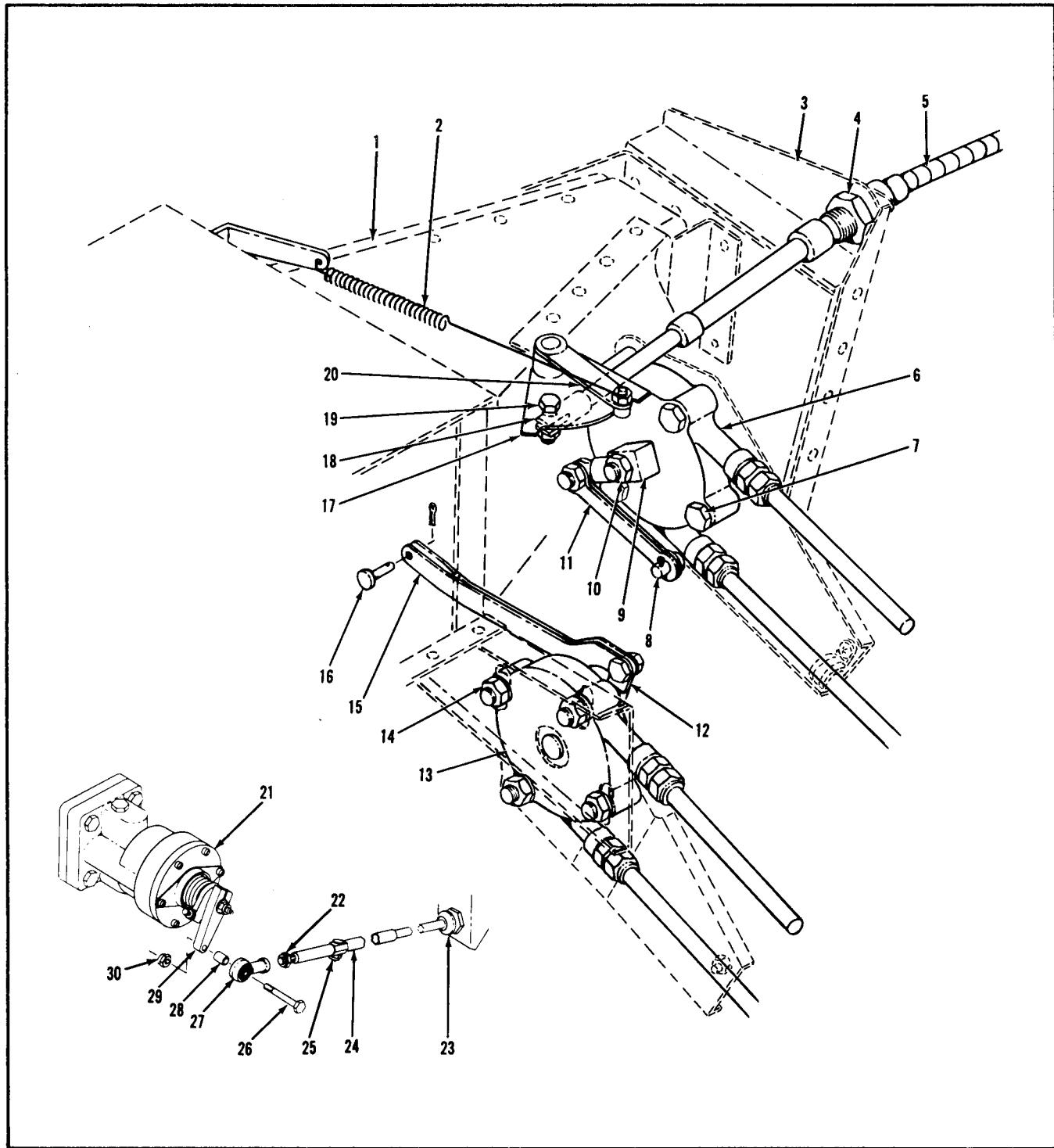
Do not allow propeller pitch lever or propeller governor arm to move from position during adjustment of the control rod end.

e. Install bolt (26), with spacer (28) between rod end (27) and governor arm (29). Tighten nut (30). Tighten jam's nut (22).

f. Unlock propeller pitch lever in control pedestal. Move the pitch lever to the FEATHER position (full aft). Check to see that the propeller governor arm is against its stop in the full aft position. With the governor arm against either stop, the pitch lever should be approximately 1/4 inch from the quadrant stop. This unused travel provides the necessary cushion to assure full travel of the governor arm.

4-279. RIGGING INDUCTION AIR CONTROLS. (See figure 4-38.)

- a. Remove bolt (19) from control plate (17).



- | | | |
|--------------------|---------------------------------|------------------------|
| 1. Air Intake Box | 11. Linkage | 21. Propeller Governor |
| 2. Spring | 12. Control Arm | 22. Lock Nut |
| 3. Bracket | 13. Throttle Control | 23. Swivel Connector |
| 4. Nut | 14. Nut | 24. Sliding End |
| 5. Cable Housing | 15. Linkage | 25. Lock Plug |
| 6. Mixture Control | 16. Pin | 26. Bolt |
| 7. Bolt | 17. Induction Air Control Plate | 27. Control Rod End |
| 8. Pin | 18. Clevis | 28. Spacer |
| 9. Control Arm | 19. Bolt | 29. Governor Arm |
| 10. Nut | 20. Spring Arm | 30. Nut |

Figure 4-38. Engine Control Rigging

NOTE

Spring arm (20) is shown against the right control plate stop only to clarify the illustration. Spring arm (20) normally rides against the left stop of the control plate.

- b. Place the induction air knob on the control pedestal all the way in and locked.

NOTE

Spring arm (20) is the only part actually attached to the induction air door. Control plate (17) merely controls the position of the spring arm.

- c. When the spring arm (20) is at the limit of its travel to the left, the induction air door is fully closed. With the spring arm in this position, set the

control plate (17) so that its left stop just clears the cam on the end of the spring arm.

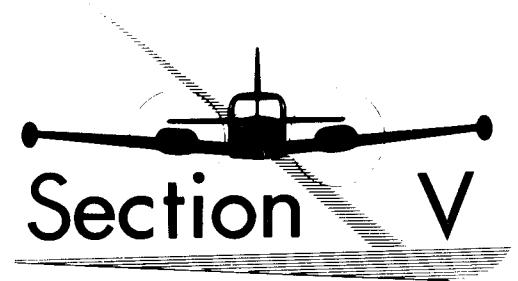
d. Being careful not to move the control plate (17), screw clevis (18) in or out until bolt (19) may be installed without binding. Install nut on bolt (19).

e. With the induction air control knob still in and locked, manually move spring arm (20) to the right until the spring arm cam hits the right stop of the control plate. Release the spring arm. The spring arm should return to the control plate left stop.

f. If the spring arm does not return to the left stop, more gap must be allowed between the spring arm cam and the control plate left stop. Refer to step "c."

g. Unlock and pull the induction air knob out until the induction air door hits its open stop. Check for freedom of operation. Push the induction air knob in and lock. Check that the induction air door is fully closed.

310 SERVICE MANUAL



INSTRUMENTS

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SECTION V

INSTRUMENTS

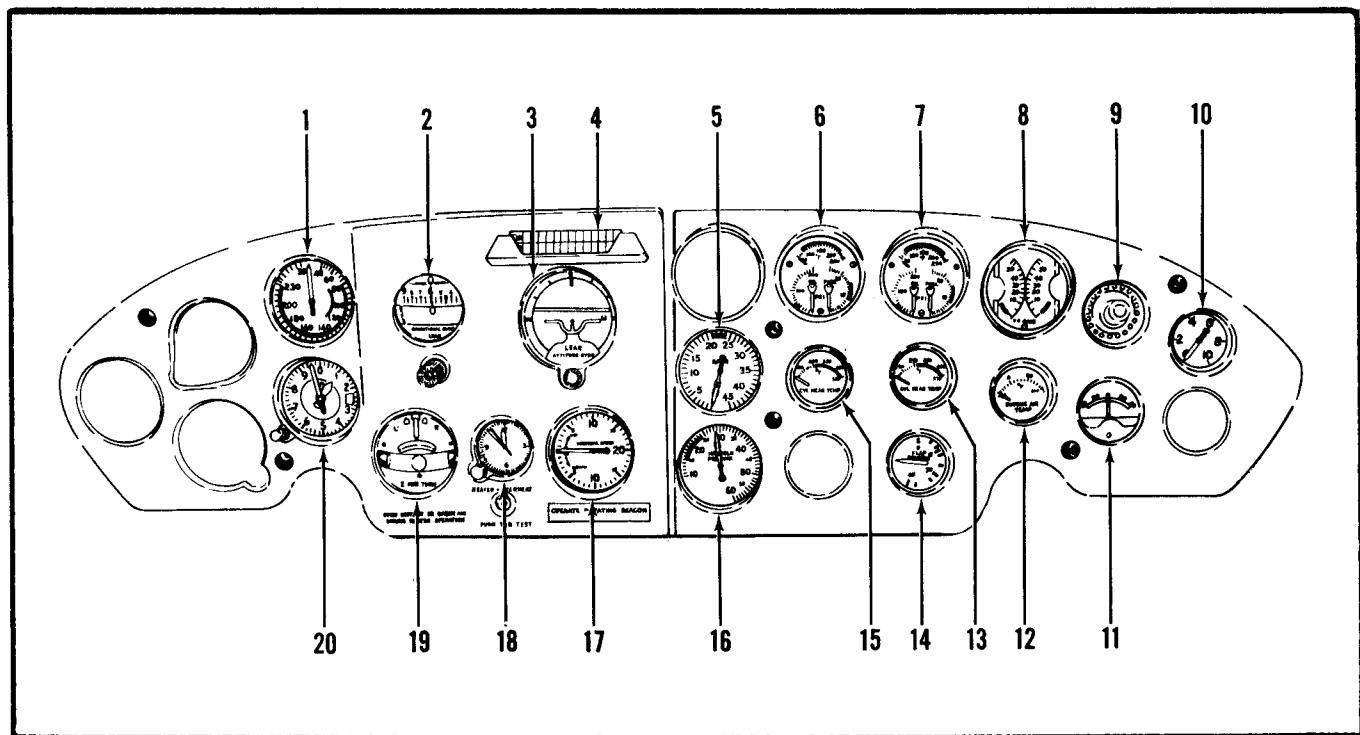
Table of Contents

	Page	310	310B	310C	310D
INSTRUMENTS	5-4	5-14	5-19	5-19	5-19
INSTRUMENT PANEL	5-4	5-15	5-19	5-19	5-19
VACUUM SYSTEM INSTRUMENTS	5-6	5-17	5-20	5-20	5-20
Directional Indicator	5-6				
Attitude Indicator	5-6				
Vacuum Gage	5-8				
Vacuum Test Valve	5-8			5-20	5-20
PITOT STATIC SYSTEM INSTRUMENTS	5-8	5-17	5-20	5-20	5-20
Sensitive Altimeter	5-10				
Airspeed Indicator	5-10				
Vertical Velocity Indicator	5-10				
Pitot Tube Assembly	5-11	5-17	5-20	5-20	5-20
ELECTRICAL INSTRUMENTS	5-11	5-17	5-20	5-20	5-20
Turn-and-Slip Indicator	5-11				
Dual Tachometer	5-11				
Engine Cylinder Head Temperature Gage	5-12				
Dual Fuel Quantity Indicator	5-12				
Flap Position Indicator	5-12				
Stall Warning Indicator and Transmitter	5-12				
Free Air Temperature Gage	5-13				
Ammeter	5-13				
COMBINATION GAGES	5-13	5-17	5-20	5-20	5-20
MISCELLANEOUS INSTRUMENTS	5-13	5-19	5-21	5-21	5-21
Dual Manifold Pressure Gage	5-13				
Clock	5-13				
Magnetic Compass	5-14				
FUEL PRESSURE GAGE				5-21	5-21
TROUBLE SHOOTING CHART	5-14	5-19	5-21	5-21	5-21

SERIAL BLOCKS

MODEL 310
35000 Thru 35546MODEL 310B
35547 Thru 35771MODEL 310C
35772 Thru 39031MODEL 310D
39032 and On

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1. Airspeed Indicator
2. Directional Indicator
3. Attitude Indicator
4. Compass Correction Card
5. Dual Tachometer
6. Left Engine Combination Gage
7. Right Engine Combination Gage
8. Dual Fuel Quantity Indicator
9. Stall Warning Indicator
10. Vacuum Gage
11. Ammeter
12. Free Air Temperature Gage
13. Right Engine Cylinder Head Temperature Gage
14. Flap Position Indicator
15. Left Engine Cylinder Head Temperature Gage
16. Dual Manifold Pressure Gage
17. Vertical Velocity Indicator
18. Clock
19. Turn-and-Slip Indicator
20. Sensitive Altimeter

Figure 5-1. Instruments

5-1. INSTRUMENTS. (See figure 5-1.)

5-2. All instruments, except the magnetic compass which is mounted on the windshield centerstrip, are located on the shock-mounted instrument panel. Specific locations are illustrated in figure 5-1. For ease of maintenance, each instrument may be removed individually or the entire panel with instruments attached may be removed. The instruments are positioned in back of and attached to the instrument panel by three or four attaching bolts and nuts. Since all instruments are mounted in a similar manner, a description of a typical removal and installation is provided as a guide for the removal and installation of all the instruments. The instruments are grouped and listed in the table of contents according to systems: the vacuum system, the pitot static system and the electrical system. The remainder of the instruments are listed under combination or miscellaneous instruments. For functional trouble shooting refer to paragraph 5-73.

NOTE

Disassembly or overhaul of instruments should be performed only in approved shops by authorized personnel.

5-3. TYPICAL INSTRUMENT REMOVAL. (See figure 5-2.)

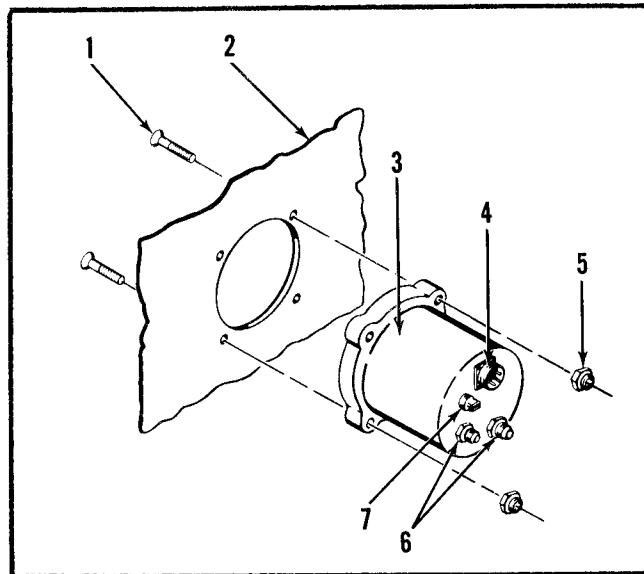
NOTE

For steps "a" through "e" refer to figure 5-3.

- a. Remove panel cover (15) by removing the cover retainers (14) securing panel cover (15) to instrument panel.
- b. Remove trim strip (8) and instrument panel hood (1) by removing attaching screws (2 and 9).
- c. Remove screws (20) attaching instrument panel section, in which instrument is attached, to angle assembly (11).
- d. Remove nuts (17) from upper portion of instrument panel section.
- e. Hinge instrument panel section aft on lower shock mount (5).
- f. Tag and disconnect electrical wires or hoses from back of instrument being removed.
- g. Remove instrument by removing attaching bolts (1) and nuts (5) as illustrated in figure 5-2.

NOTE

If instrument is to be replaced, remove fittings from back of instrument and install in replacement unit.



- | | |
|--------------------------|-----------------|
| 1. Bolt | 5. Nut |
| 2. Instrument Panel | 6. Hose Fitting |
| 3. Instrument | 7. Vent Plug |
| 4. Electrical Connection | |

Figure 5-2. Typical Instrument Installation

5-4. TYPICAL INSTRUMENT INSTALLATION. (See figure 5-2.)

NOTE

Lubricate all fittings used on fuel, oil and air lines with Specification AN-P-51 petrolatum. Apply lubricant to the male fittings only, omitting the first two threads.

- a. Position instrument on back of instrument panel and secure with attaching bolts (1) and nuts (5).
- b. Connect hoses or electrical wires as tagged at removal.
- c. Hinge instrument panel section forward on lower shock mounts (5) and secure to stationary instrument panel (4) with nuts (17) as illustrated in figure 5-3.
- d. Install instrument panel hood (1) and trim strip (8) and secure with screws (2 and 9) as illustrated in figure 5-3.
- e. Install panel cover (15) and secure to instrument panel with cover retainers (14) as illustrated in figure 5-3.

5-5. INSTRUMENT PANEL (See figure 5-3.)

5-6. The instrument panel is located directly in front

Figure 5-3. Instrument Panel Callouts

- | | | |
|--------------------------------|------------------------------------|-----------------------------------|
| 1. Instrument Panel Hood | 8. Trim Strip | 15. Panel Cover |
| 2. Screw | 9. Screw | 16. Compass Correction Card |
| 3. Hood Mounting Bracket | 10. Control Guide | 17. Nut |
| 4. Stationary Instrument Panel | 11. Angle Assembly | 18. Lockwasher |
| 5. Shock Mount | 12. Bonding Strap | 19. Left Instrument Panel Section |
| 6. Lockwasher | 13. Right Instrument Panel Section | 20. Screw |
| 7. Nut | 14. Cover Retainer | 21. Washer |

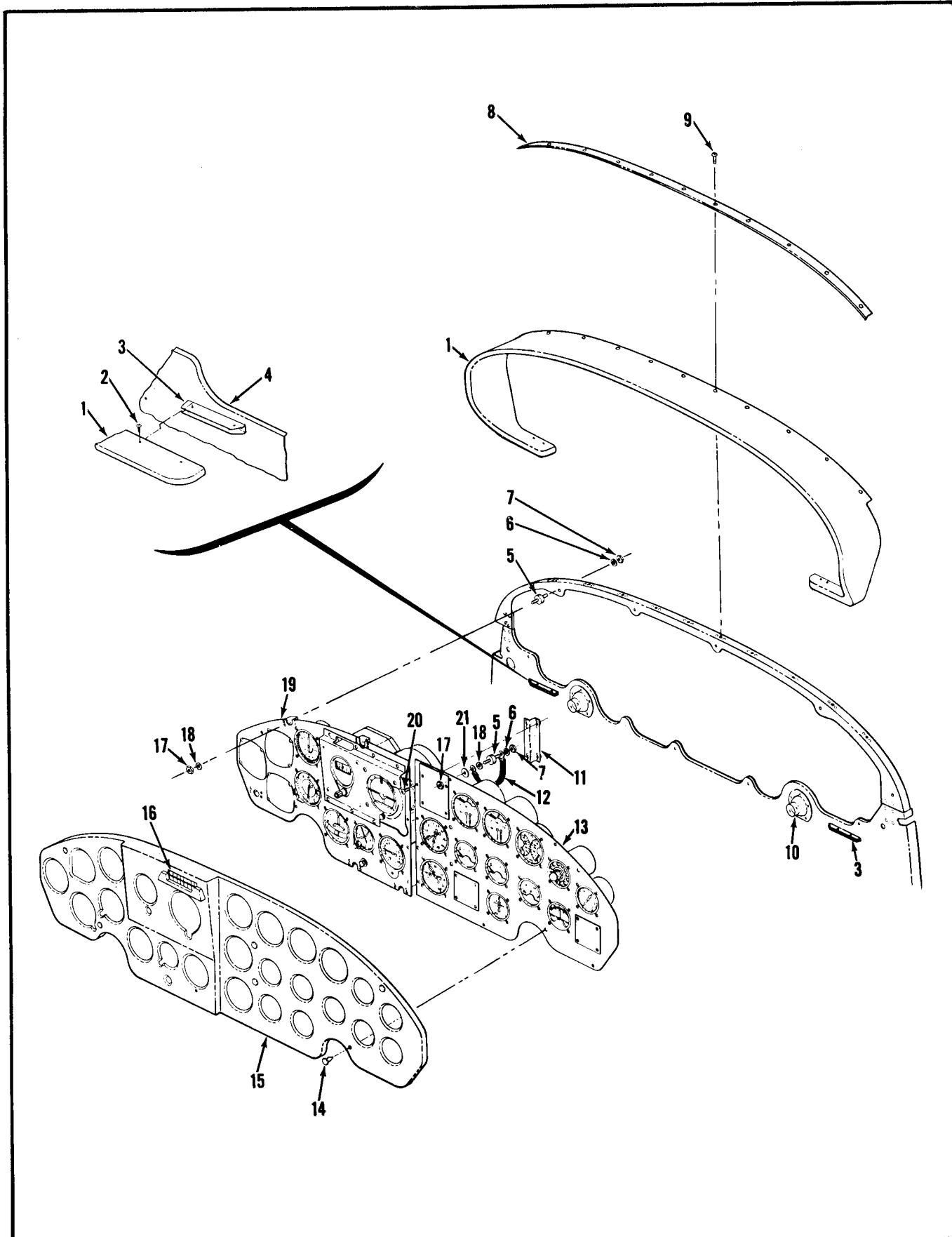


Figure 5-3. Instrument Panel

of the pilot and copilot. It is shock-mounted on soft rubber washers and contains all the aircraft instruments except the compass. The instrument panel is mounted in two sections, either of which may be removed individually for access and removal of any specific instrument.

5-7. REMOVAL OF INSTRUMENT PANEL. (See figure 5-3.)

- a. Remove panel cover (15) by removing the cover retainers (14) securing panel cover (15) to instrument panel.
- b. Remove trim strip (8) and instrument panel hood (1) by removing attaching screws (2 and 9).
- c. Remove screws (20) attaching right instrument panel section (13) to angle assembly (11).
- d. Remove nuts (17) from upper portion of right instrument panel section (13).
- e. Hinge right instrument panel section (13) aft on lower shock mounts (5).
- f. Tag and disconnect all hoses and electrical wires from instruments.
- g. Remove right instrument panel section (13), with instruments attached, by removing lower attaching nuts (17).
- h. Repeat steps "d," through "g" for removal of left instrument panel section (19).

NOTE

Plug all lines, and cap fittings to prevent entry of foreign objects.

5-8. INSTALLATION OF INSTRUMENT PANEL. (See figure 5-3.)

NOTE

Inspect rubber shock mounts and bonding straps for deterioration and cracks. If either is damaged, replace before installing instrument panel.

- a. Position left instrument panel section (19) and install lower attaching nuts (17).
- b. Hinge left instrument panel section (19) aft and connect all hoses and electrical wires as tagged at removal.

NOTE

Lubricate all fittings used on fuel, oil and air lines with Specification AN-P-51 petrolatum.

Apply lubricant to the male fittings only, omitting the first two threads.

- c. Hinge left instrument panel section (19) forward and secure to stationary instrument panel (4) with attaching nuts (17).
- d. Repeat steps "a," "b," and "c" to install right instrument panel section (13).
- e. Attach right instrument panel section (13) to angle assembly (11) with screws (20).
- f. Install instrument panel hood (1) and trim strip (8). Secure with attaching screws (2 and 9).
- g. Position panel cover (15) and secure to instrument panel with cover retainers (14).

5-9. VACUUM SYSTEM INSTRUMENTS. (See figure 5-1.)

5-10. The vacuum system instruments are: a directional indicator, attitude indicator and a vacuum gage. Vacuum is created by two engine-driven pumps, one located on each engine. A check valve is incorporated in each vacuum pump line to permit normal operation of the system in the event of either pump malfunctioning. A manually operated vacuum test valve provides a means of obtaining a pressure check from different locations in the system. Air entering the system is first filtered free of dust particles and moisture by a vacuum air filter. An adjustable vacuum relief valve is provided to give the desired vacuum system pressure. For maintenance of the pumps, plumbing, check valves, filter, relief valve and system check and adjustment see paragraphs 4-177 through 4-204.

5-11. DIRECTIONAL INDICATOR. (See figure 5-1.)

5-12. The directional indicator is a flight instrument incorporating an air-driven gyro stabilized in the vertical plane. The gyro is rotated at high speed by lowering the pressure in the air tight case with the engine-driven vacuum pumps and simultaneously allowing air at atmospheric pressure to enter against the gyro buckets. Due to gyroscopic inertia, the spin axis continues to point in the same direction even though the aircraft yaws to the left or right. This relative motion between the gyro and the instrument case is shown on the instrument dial which is similar to a compass card. The dial, when set to agree with the airplane's magnetic compass, provides a "dead beat" azimuth indication that is free from "swing."

5-13. ATTITUDE INDICATOR. (See figure 5-1.)

Figure 5-4. Vacuum System Instrument Callouts

- | | | |
|----------------------------------|------------------------------------|---------------------------------|
| 1. Left Instrument Panel Section | 11. Expander Gasket | 22. Reducer |
| 2. Attitude Indicator | 12. Expander | 23. Elbow |
| 3. Directional Indicator | 13. Vacuum Air Filter Hose | 24. Vacuum Test Valve |
| 4. Nipple | 14. Vacuum Gage Instrument Hose | 25. Test Valve Mounting Bracket |
| 5. Tee | 15. Attitude Indicator Hose | 26. Test Valve Retainer |
| 6. Directional Indicator Hose | 16. Directional Indicator Hose | 27. Left Source Hose |
| 7. Attitude Indicator Hose | 17. Elbow | 28. Right Source Hose |
| 8. Crossover Hose Assembly | 18. Elbow | 29. Check Valve |
| 9. Tee | 19. Vacuum Gage Test Hose | 30. Vacuum Relief Valve |
| 10. Expander | 20. Right Instrument Panel Section | 31. Vacuum Air Filter |

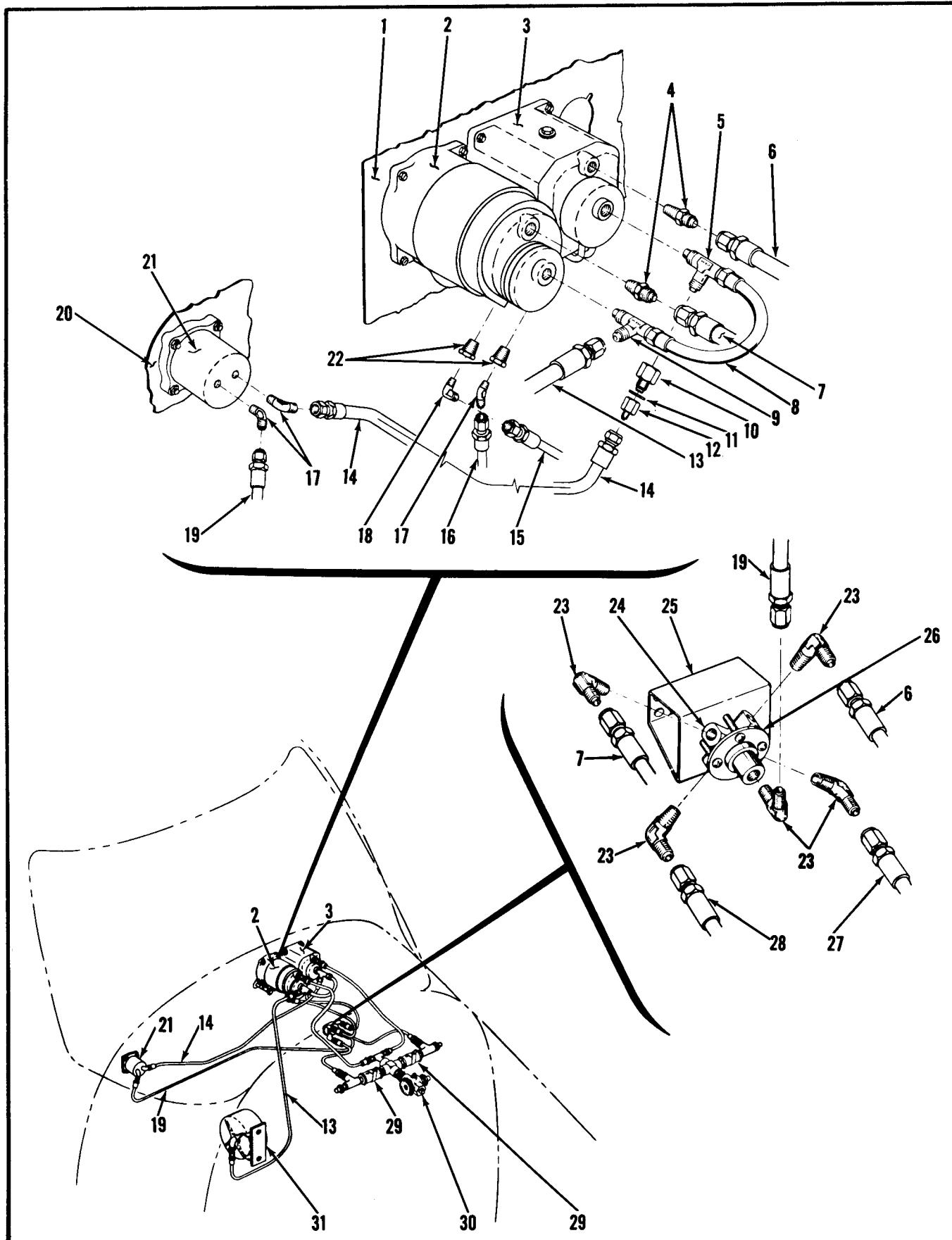


Figure 5-4. Vacuum System Instruments

5-14. The attitude indicator is essentially an air-driven gyroscope rotating in a horizontal plane, operated by the same supply of vacuum as the directional indicator. Due to gyroscopic inertia, the spin axis continues to point in the vertical direction providing a constant visual reference to the attitude of the airplane relative to its pitch and roll axis. A bar across the face of the indicator represents the horizon and a miniature adjustable airplane is mounted to the case. Aligning the miniature airplane to the horizon bar simulates the alignment of the airplane to the actual horizon and any deviation simulates the deviation of the airplane from the true horizon. The indicator is marked from zero to 90 degrees.

5-15. VACUUM GAGE. (See figure 5-1.)

5-16. The vacuum gage is calibrated in inches of mercury and indicates the amount of vacuum created by the engine-driven vacuum pumps. The gage has two connecting lines. One line is routed directly to the vacuum test valve and the other line is attached to a common intake of the directional and attitude indicators.

5-17. VACUUM TEST VALVE. (See figure 5-4.)

5-18. The vacuum test valve, located at the upper right corner of the lower left switch panel, is a four position, manually operated, (push-to-turn) valve. This valve provides a means of obtaining a pressure check from different locations in the system and also aids in making a system check, localizing trouble in the event that a portion of the system is malfunctioning.

5-19. REMOVAL OF VACUUM TEST VALVE. (See figure 5-4.)

- Remove vacuum test valve knob by loosening set screw and pulling knob aft.
- Disconnect hoses (6, 7, 19, 27 and 28) from elbows (23).
- Remove four bolts securing test valve retainer (26) and remove vacuum test valve (24).

5-20. INSTALLATION OF VACUUM TEST VALVE. (See figure 5-4.)

- Position vacuum test valve in mounting bracket and secure with test valve retainer (26) by installing four attaching screws.
- Connect hoses (6, 7, 19, 27 and 28) to elbows (23) as illustrated in figure 5-4.
- Install vacuum test valve knob and secure with set screw.

5-21. VACUUM SYSTEM INSTRUMENT MAINTENANCE.

CAUTION

Under no circumstances should the directional or attitude indicators be disassembled except by instrument personnel.

Periodically check the instruments for broken, cracked or loose glasses and security of panel mounting and hose connections. The shafts and bearings of these instruments are lubricated before assembly and no further lubrication is required until the instruments are overhauled. However, continuous use of the instruments in a hot climate may increase the evaporation of the oil and necessitate replenishment of oil. Replacement of the vacuum air filter element is not considered disassembly and the element should be replaced approximately every 50 hours of operation to insure a clean, dust free supply of air for the instruments. For replacement of the air filter element refer to paragraph 4-193.

5-22. PITOT STATIC SYSTEM INSTRUMENTS. (See figure 5-1.)

5-23. The pitot static system instruments are the sensitive altimeter, airspeed indicator and vertical velocity indicator. A pitot tube mounted on the nose of the fuselage provides the airspeed indicator with ram air pressure; two holes mounted on opposite sides of the fuselage, aft of the baggage compartment,

Figure 5-5. Pitot Static System Callouts

1. Fuselage Skin	20. Elbow	40. Fuselage Nose Skin
2. Static Opening	21. Elbow	41. Pitot Tube Mounting Bracket
3. Nipple	22. Support Bracket	42. Reducer
4. Static Crossover Line	23. Forward Static Line	43. Gasket
5. Clamp	24. Nut	44. Nut
6. Screw	25. Washer	45. Elbow
7. Tee	26. Pitot Pressure Line	46. Nut
8. Static Line	27. Elbow	47. Parking Brake Mounting Bracket
9. Grommet	28. Forward Cabin Bulkhead	48. Static Drain Line
10. Vertical Velocity Indicator	29. Washer	49. Nipple
11. Altimeter	30. Nut	50. Clamp
12. Airspeed Indicator	31. Grommet	51. Screw
13. Tee	32. Pitot Tube Assembly	52. Drain Valve
14. Nipple	33. Pitot Nose Cap	53. Elbow
15. Instrument Static Hose	34. Heater Element	54. Tee
16. Static Hose	35. Pitot Stem	55. Washer
17. Pitot Pressure Hose	36. Heater Element Wires	56. Nut
18. Tee	37. Pitot Tube	57. Sleeve
19. Instrument Static Line	38. Grommet	58. Nut
	39. End Fitting	

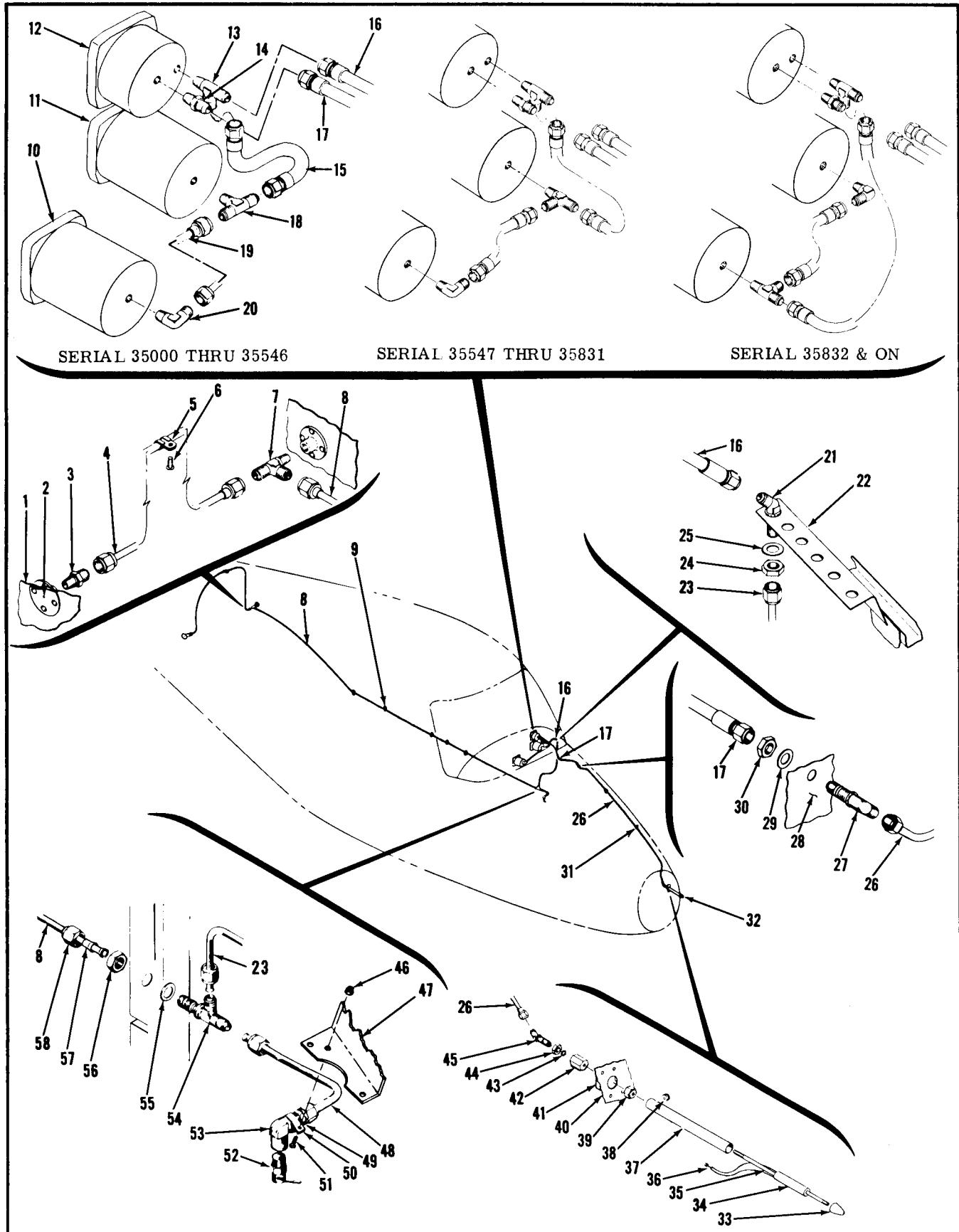


Figure 5-5. Pitot Static System

provides the system with static pressure. An electrical heating element is installed within the pitot tube to prevent ice from obstructing the pitot tube opening during severe weather conditions.

5-24. SENSITIVE ALTIMETER. (See figure 5-1.)

5-25. 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.

5-26. AIRSPEED INDICATOR. (See figure 5-1.)

5-27. 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 TSO-2C.

5-28. VERTICAL VELOCITY INDICATOR. (See figure 5-1.)

5-29. 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 or descent of the airplane in feet per minute.

5-30. TESTING STATIC PRESSURE LINES. (See figure 5-5.)

- Set altimeter to read 1000 feet by rotating pressure setting knob.

NOTE

Check to see that static drain valve is closed.

- Seal static opening (2), on one side of the fuselage with masking tape.
- Connect a suction source to static opening (2) on opposite side of fuselage.
- Slowly apply suction until altimeter shows a 1000 foot increase in altitude (2000 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.

- The leak down rate should not exceed 150 feet of altitude in one minute (1850 feet reading).
- If leak down rate exceeds 150 feet per minute, slowly remove suction source and proceed as follows.
- 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.

- Apply slight pressure and coat lines with a mild solution of soap and water to locate leak.
- Tighten or repair faulty connections or replace damaged lines. Remove line plugs and pressure source and reconnect hoses to respective units.
- Repeat steps "c" through "e" to be sure instruments are connected correctly and do not leak.
- If scale drop of altimeter pointer is less than 150 feet in one minute, leak is negligible. Slowly remove static suction source.
- Remove masking tape from static opening (2).

5-31. TESTING PITOT PRESSURE LINE. (See figure 5-5.) 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 (32).
- 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 or replace lines. Connect hose to instrument and repeat step "b" to be certain connections and lines do not leak.

CAUTION

Do not apply suction to pitot pressure line.

5-32. REMOVAL OF PITOT AND STATIC LINES. (See figure 5-5.) The locations of all pitot and static lines are shown in figure 5-5. 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 (8) must be cut to facilitate removal and should only be removed if replacement is necessary.

5-33. CLEANING OF PITOT AND STATIC LINES.

- Immerse lines in dry cleaning solvent.
- Dry lines with filtered compressed air.
- Wipe exterior of lines with a clean dry cloth.

5-34. INSTALLATION OF PITOT AND STATIC LINES. (See figure 5-5.) Install lines as illustrated in figure 5-5 using Specification AN-P-51 petrolatum to lubricate all male fittings, omitting the first two threads.

NOTE

Install static line (8) through grommets (9) as illustrated in figure 5-5. Install nut (58) and sleeve (57) before flaring forward end of static line (8).

5-35. PITOT TUBE ASSEMBLY. (See figure 5-5.)

5-36. The pitot tube assembly is mounted in the nose of the fuselage slightly above and to the left of the heater and ventilator opening. It extends forward through the fuselage skin and receives impact or ram air which is routed to the airspeed indicator. A heating element is incorporated to prevent icing in the pitot tube assembly opening during extreme weather conditions. The pitot heater is controlled by a toggle switch located in the lower right corner of the left switch panel.

CAUTION

The pitot heater should not be operated on the ground as it will overheat and damage the heating element.

5-37. REMOVAL OF PITOT TUBE ASSEMBLY. (See figure 5-5.)

- a. Disconnect pitot pressure line (26) from elbow (45).
- b. Remove pitot nose cap (33).
- c. Place two check nuts on forward end of pitot stem (35). Secure check nuts so that pitot stem (35) may be rotated.
- d. Hold check nuts and remove reducer (42) with elbow (45) attached.
- e. Disconnect heater element wires (36) remove grommet (38) and work wires (36) through routing hole and into pitot tube (37).
- f. Hold end fitting (39) with a screw driver and rotate pitot stem (35) with check nuts to remove end fitting (39).
- g. Remove pitot stem (35) by sliding forward.
- h. Remove pitot tube (37) and heater element (34) by sliding forward.
- i. Remove heater element (34) from pitot tube (37) by pushing forward with a blunt object.

5-38. CLEANING PITOT TUBE ASSEMBLY. (See figure 5-5.)

- a. Immerse pitot tube assembly in dry cleaning solvent.
- b. Dry all parts with filtered compressed air.
- c. Clean opening in pitot stem with a soft brush or an ordinary pipe cleaner.

NOTE

Check small moisture drain hole in reducer (42) and make certain it is free of obstructions.

5-39. INSTALLATION OF PITOT TUBE ASSEMBLY. (See figure 5-5.)

- a. Insert pitot tube (37) through fuselage nose skin (40).
- b. Attach a length of safety wire onto heater element wires (36). Run safety wire through installed pitot tube (37), through wire routing hole, and into nose wheel well. Pull heater element wires (36) through wire routing hole and slide heater element (34) into pitot tube (37) until flush with forward end of pitot tube (37).
- c. Insert pitot stem (35) through heater element (34).
- d. Position end fitting (39) on forward side of pitot tube mounting bracket (41) and screw pitot stem (35) into end fitting (39).
- e. Secure reducer (42) with elbow (45) attached to aft end of pitot stem (35).

NOTE

Position reducer (42) so drain hole is directed downward.

- f. Connect pitot pressure line (26) to elbow (45).
- g. Remove check nuts and connect pitot nose cap (33) to pitot stem (35).

5-40. ELECTRICAL INSTRUMENTS. (See figure 5-1.)

5-41. The electrical instruments consist of: the turn-and-slip indicator, the dual tachometer, the cylinder head temperature gages, dual fuel gage, flap position indicator, free air temperature gage, the ammeter and the oil temperature gage. In general these instruments are only indicators for remote sensing units. Extensive maintenance is not required on the instruments; however, if instruments are malfunctioning refer to trouble shooting chart in paragraph 5-73. For individual instrument description and function refer to the following paragraphs.

WARNING

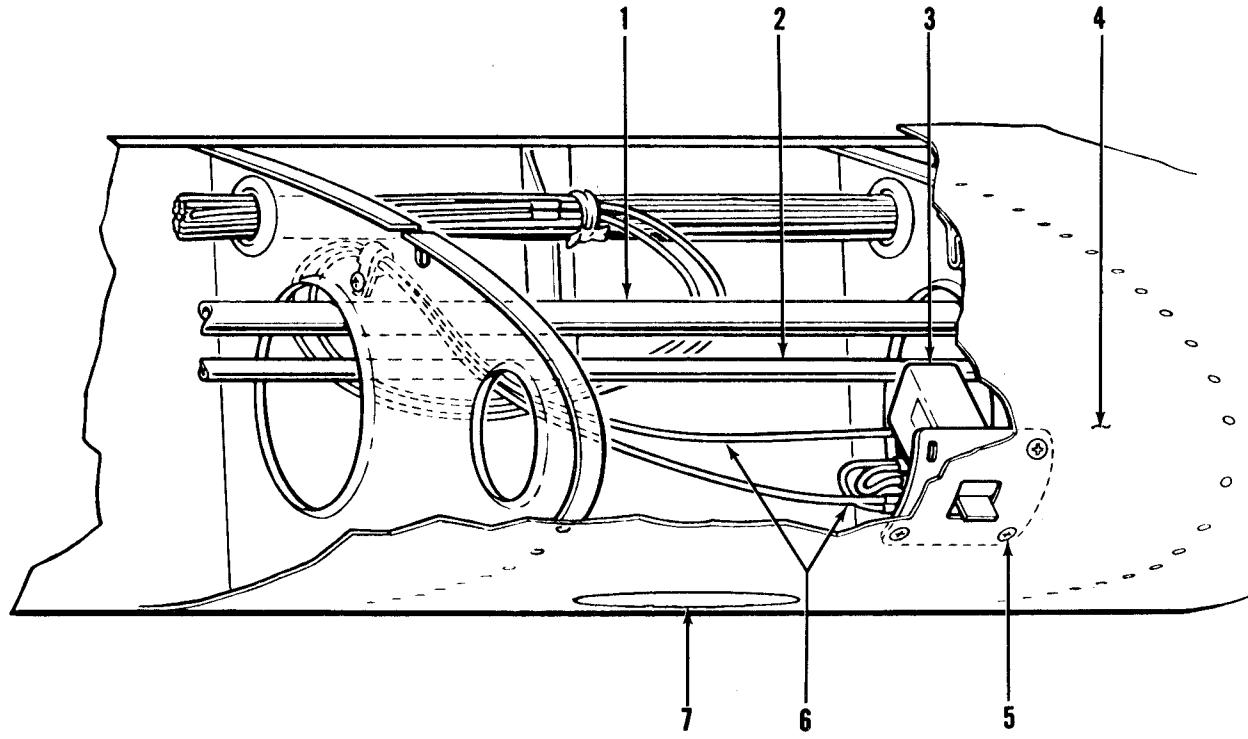
While removing and installing any electrical instruments be certain the battery switch remains in the OFF position.

5-42. TURN-AND-SLIP INDICATOR. (See figure 5-1.)

5-43. The turn-and-slip 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 damped motion, changes positions according to the gravitational and centrifugal force acting upon the airplane.

5-44. DUAL TACHOMETER. (See figure 5-1.)

5-45. The dual tachometer is a remote electrical instrument that is connected by electrical leads to a



- | | | |
|--------------------------|------------------------------|----------------------|
| 1. Left Fuel Supply Line | 3. Stall Warning Transmitter | 6. Electrical Wires |
| 2. Vapor Return Line | 4. Wing Skin | 7. Access Hole Cover |
| | 5. Screw | |

Figure 5-6. Stall Warning Transmitter

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.

5-46. ENGINE CYLINDER HEAD TEMPERATURE GAGES. (See figure 5-1.)

5-47. The cylinder head temperature gages, one for each engine, are remote electrical indicators. Each gage is connected electrically to a cylinder head temperature bulb (see figure 4-2) located in the number four cylinder of the respective engine. As the temperature of the bulb changes, the cylinder head temperature gage measures the change and the pointer of the instrument indicates the temperature in degrees centigrade.

5-48. DUAL FUEL QUANTITY INDICATOR. (See figure 5-1.)

5-49. A fuel quantity indicator with two pointers on the dial, one for each wing tip tank, is located in the upper right hand portion of the instrument panel. The fuel quantity indicator receives electrical signals from the variable resistor type fuel quantity sending

units (see paragraph 4-138) located inside the wing tip tanks and indicates, in gallons, the amount of remaining useable fuel.

5-50. FLAP POSITION INDICATOR. (See figure 5-1.)

5-51. The flap position indicator is electrically operated and indicates the position of the flaps from zero to 45 degrees. The indicator operates in conjunction with a flap position transmitter located just aft of the fuselage rear spar. (For removal and installation of the flap position transmitter refer to paragraph 2-95.)

5-52. STALL WARNING INDICATOR AND TRANSMITTER. (See figure 5-1 and 5-6.)

5-53. The stall warning indicator is a combination horn and warning light mounted in the upper right hand portion of the instrument panel. A stall warning transmitter, mounted on the leading edge of the left wing, energizes the electrical circuit when the airplane approaches a stall and causes the horn and red warning light to operate simultaneously. The stall warning transmitter incorporates a heater element, operated by the pitot heater switch, to prevent ice from hampering its operation.

5-54. REMOVAL OF STALL WARNING TRANSMITTER. (See figure 5-6.)

- 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).

5-55. INSTALLATION OF STALL WARNING TRANSMITTER. (See figure 5-6.)

- a. Attach electrical wires (6) as tagged at removal.
- b. Secure stall warning transmitter (3) to wing skin (4) with four attaching screws (5).
- c. Replace access hole cover (7).

5-56. FREE AIR TEMPERATURE GAGE. (See figure 5-1.)

5-57. A free 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.

5-58. AMMETER. (See figure 5-1.)

5-59. The ammeter measures the amount of current received, or the amount of current drain on the batteries and is calibrated in amperes.

5-60. COMBINATION GAGES. (See figure 5-1.)

5-61. A combination engine gage unit with oil temperature, oil pressure, and fuel pressure indicators is provided for each engine and is marked LEFT ENGINE or RIGHT ENGINE accordingly. Oil temperature is electrically received from the oil temperature bulb (see paragraph 4-33), located in the engine oil passage, and calibrated in degrees Fahrenheit. Oil and fuel pressures are taken directly from the pressurized engine oil passage and the carburetor inlet chamber respectively. Both are routed through small lines and hoses to the combination gage which calibrates the pressures to pounds per square inch. (For oil pressure plumbing refer to paragraph 4-23, and for fuel pressure plumbing refer to paragraph 4-129.)

5-62. MISCELLANEOUS INSTRUMENTS. (See figure 5-1.)

5-63. The miscellaneous instruments are: the dual manifold pressure gage, clock and compass. For details of individual instruments see the following paragraphs.

5-64. DUAL MANIFOLD PRESSURE GAGE. (See figure 5-1.)

5-65. The dual manifold pressure gage is a vapor proof, absolute pressure-type instrument. Pressures from the intake manifolds of both engines are transmitted to the instrument through lines and connecting flexible hoses, (for manifold pressure plumbing refer to paragraph 4-205). Two pointers, one for each engine, indicates the manifold pressure of the respective engine in inches of mercury. Concentric

mounting of the pointers permits easy visual synchronization of the engines manifold pressures.

5-66. TESTING MANIFOLD LINES AND GAGES. To test either engine installation use the following procedure:

- a. Remove manifold pressure hose from intake manifold.

NOTE

A properly operating instrument should indicate field barometric pressure.

- b. Attach suction source to engine end of manifold pressure hose.

c. Apply suction until pointer indicates lowest calibration (ten inches of mercury). Shut off suction and seal line.

d. Instrument pointers should return to atmospheric pressure at a rate of not more than two inches of mercury in five minutes.

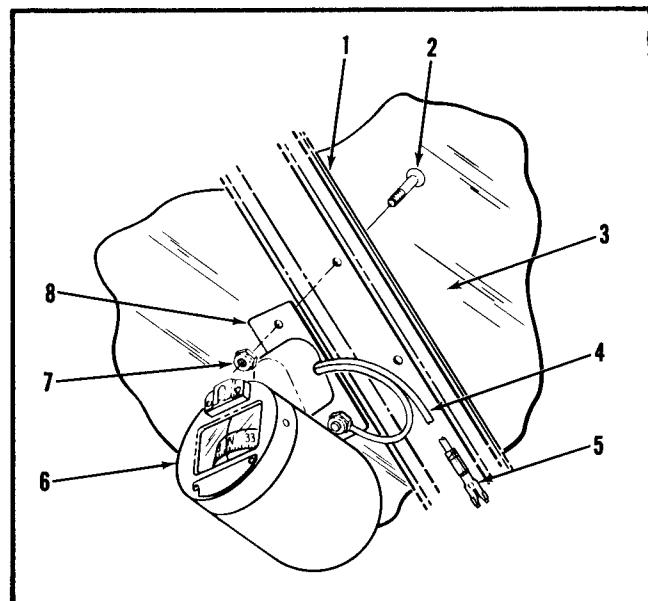
e. If excessive leakage is indicated, disconnect manifold pressure gage hose from instrument and check instrument for leaks by applying suction as outlined above.

f. Plug manifold pressure gage hose and apply pressure to manifold pressure hose. Coat all lines and connections with a solution of soap and water to locate leak.

g. Repair or replace all leaking parts and connect hoses to intake manifold and instrument.

5-67. CLOCK. (See figure 5-1.)

5-68. 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.



- | | |
|---------------------------|---------------------|
| 1. Windshield Centerstrip | 5. Wrist Lock |
| 2. Bolt | 6. Magnetic Compass |
| 3. Windshield | 7. Nut |
| 4. Compass Light Wire | 8. Mounting Bracket |

Figure 5-7. Magnetic Compass

5-69. MAGNETIC COMPASS. (See figure 5-7.)

5-70. The magnetic compass is located on the windshield centerstrip. It consists of a pair of parallel magnetic bars surrounded by a circular calibrated compass card visible through a window in the compass case. The compass case is a metal bowl filled with liquid to dampen dial oscillation. Lighting is integral and controlled by a rheostat on the switch panel.

5-71. REMOVAL OF MAGNETIC COMPASS. (See figure 5-7.)

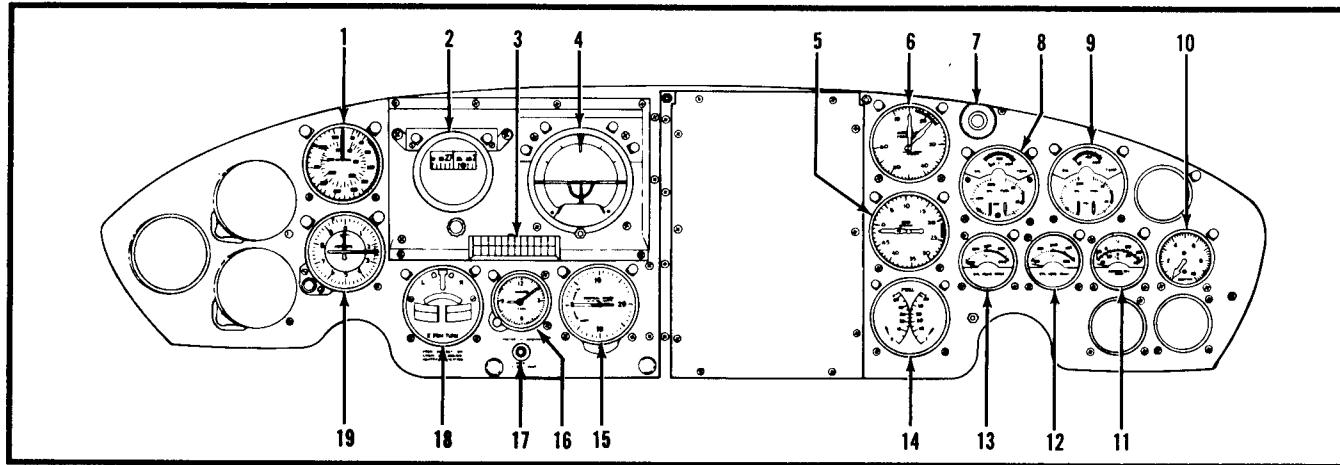
- Remove upper and lower centerstrip trim from windshield centerstrip (1).
- Uncouple wrist lock (5) provided on compass light wire (4).

- Remove nuts (7) from bolts (2) securing mounting bracket (8) to windshield centerstrip.

5-72. INSTALLATION OF MAGNETIC COMPASS. (See figure 5-7.)

- Position mounting bracket (8) on windshield centerstrip (1) and secure with bolts (2) and nuts (7) as illustrated in figure 577.
- Connect wrist lock (5) provided on compass light wire (4).
- Replace upper and lower centerstrip trim on windshield centerstrip (1).

5-73. TROUBLE SHOOTING CHART. For trouble shooting information on all the instruments, refer to paragraph 5-126.



1. Airspeed Indicator
2. Directional Indicator
3. Compass Correction Card
4. Attitude Indicator
5. Dual Tachometer
6. Dual Manifold Pressure Gage
7. Stall Warning Light
8. Left Engine Combination Gage
9. Right Engine Combination Gage
10. Vacuum Gage
11. Free Air Temperature Gage
12. Right Engine Cylinder Head Temperature Gage
13. Left Engine Cylinder Head Temperature Gage
14. Dual Fuel Quantity Indicator
15. Vertical Velocity Indicator
16. Clock
17. Heater Overheat Light and Turn-and-Slip Test Light
18. Turn-and-Slip Indicator
19. Sensitive Altimeter

Figure 5-8. Instruments

5-74. INSTRUMENTS — Serial 35547 thru 35771.

5-75. All instruments except the magnetic compass, the ammeter, and the flap position indicator are located on the shock mounted instrument panel. Post

type lighting is used to illuminate the fluorescent markings and pointers on panel mounted instruments. All flight instruments are located on the left instrument panel section and the engine instruments are located on the right instrument panel section.

5-76. TYPICAL INSTRUMENT REMOVAL. (See figure 5-9.)

- a. Tag and disconnect electrical wires and hoses from back of instrument being removed.
- b. Plug all hoses and cap fittings to prevent the entry of foreign matter.
- c. Remove the connectors (8), nuts (7), and lockwashers (6).
- d. Remove lower attaching nuts and bolts illustrated in figure 5-9.

NOTE

If the instrument is to be replaced, remove the hose fittings and install in the replacement unit.

5-77. TYPICAL INSTRUMENT INSTALLATION. (See figure 5-9.)

NOTE

Lubricate straight threads with VV-P-236 petrodatum; 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 5-9.
- 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 wires as tagged at removal.

5-78. INSTRUMENT PANEL.

5-79. The 310B instrument panel is shock mounted on soft rubber washers as illustrated in figure 5-10. Either the left or right instrument panel may be removed individually; however, access to the right panel is difficult when the left panel is installed, and it is recommended to follow the removal procedure outlined in paragraph 5-80 if removal of the right instrument panel is desired.

5-80. REMOVAL OF INSTRUMENT PANEL. (See figure 5-10.)

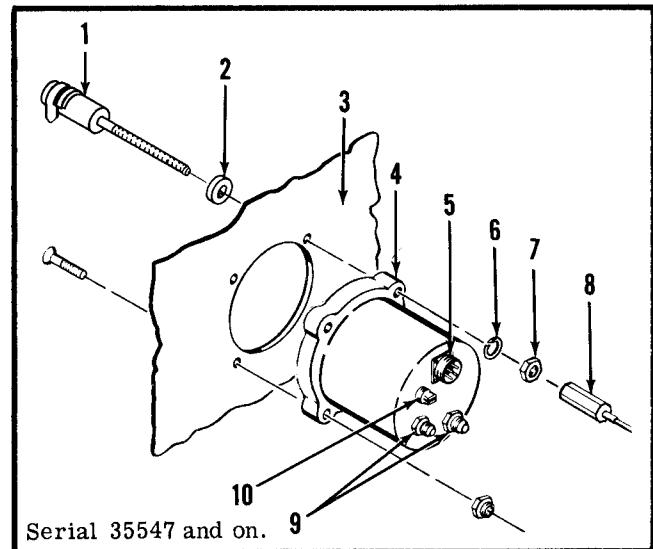
- a. Disengage hood (1) from trim strip (5) after removing screws (2) and washers (3).
- b. Remove screws (16) securing right instrument panel (15) to angle support (19).
- c. Tag and disconnect left instrument panel hoses and wires from instruments.

NOTE

Most hose fittings are more accessible if disconnected from the forward bulkhead.

- d. Disconnect all leads from the lower terminal strip (20).

e. Remove nuts (7) from shock mounts on left instrument panel (18) and pull left portion of panel aft until angle support (19) is free from behind right instrument panel (15).



- | | |
|-------------------------|------------------|
| 1. Lighting Fixture | 6. Lockwasher |
| 2. Rubber Washer | 7. Nut |
| 3. Instrument Panel | 8. Connector |
| 4. Instrument | 9. Hose Fittings |
| 5. Electrical Connector | 10. Vent Plug |

Figure 5-9. Typical Instrument Installation

- f. Remove nuts (7) from upper shock mounts on right instrument panel (15). Allow panel (15) to tilt aft slightly and unsolder wire from stall warning light.
- g. Tag and disconnect all instrument electrical leads and instrument hoses.
- h. Remove nuts (7) from the lower shock mounts and remove right instrument panel (15).

NOTE

Plug all lines, and cap fittings to prevent entry of foreign objects.

5-81. INSTALLATION OF INSTRUMENT PANEL — SERIAL 35547 AND ON. (See figure 5-10.)

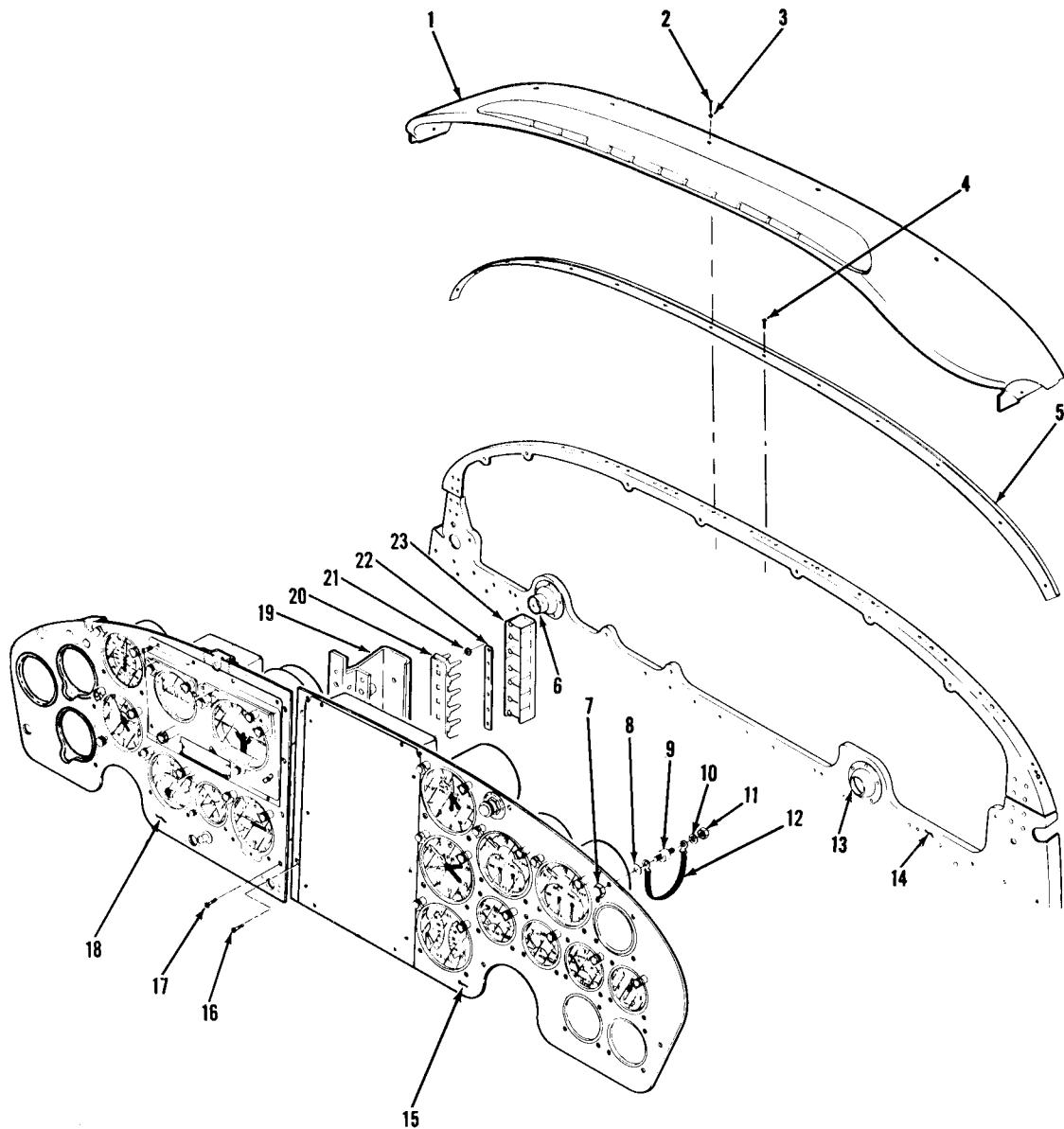
NOTE

Inspect rubber shock mounts and bonding straps for deterioration and cracks. If either is damaged, replace before installing instrument panel.

- a. Position right instrument panel (15) and install nuts (7) to lower shock-mounts (9) allowing panel to tilt aft slightly.
- b. Solder wire to stall warning light and secure panel to shock-mounts (9) with nuts (7).
- c. Attach hoses and electrical wires as tagged at removal.

NOTE

Lubricate straight threads with VV-P-236 petrodatum; tapered threads with JAN-A-669 anti-seize compound. Apply lubricant to male threads only, omitting the first two threads.



Serial 35547 and on.

- | | | |
|-----------------|---------------------------------|---------------------------|
| 1. Hood | 9. Shock Mount | 16. Screw |
| 2. Screw | 10. Washer | 17. Screw |
| 3. Washer | 11. Nut | 18. Left Instrument Panel |
| 4. Screw | 12. Bonding Strap | 19. Angle Support |
| 5. Trim Strip | 13. Control Guide | 20. Terminal Strip |
| 6. Control Lock | 14. Stationary Instrument Panel | 21. Nut |
| 7. Nut | 15. Right Instrument Panel | 22. Terminal Bus |
| 8. Washer | | 23. Terminal Cover |

Figure 5-10. Instrument Panel

- d. Position left instrument panel (18) and secure to shock-mounts (9) with nuts (7).
- e. Connect instrument light wires to lower terminal block (20).
- f. Attach hoses and electrical wires as tagged at removal.
- g. Position hood (1) in retaining strip (5) and install washers (3) and screws (2) to secure the hood.

5-82. VACUUM SYSTEM INSTRUMENTS. (See figure 5-8.)

5-83. The vacuum system instruments are the directional indicator, attitude indicator and a vacuum gage. For description, maintenance, and adjustment of the vacuum system see paragraphs 5-9 through 5-16 and paragraph 5-21.

5-84. VACUUM TEST VALVE. (See figure 5-4.)

5-85. For description, removal and installation see paragraphs 5-17 through 5-20.

5-86. PITOT STATIC SYSTEM INSTRUMENTS. (See figure 5-8.)

5-87. The pitot static system instruments are: the sensitive altimeter, airspeed indicator and vertical velocity indicator. For description of the instruments, testing, removal, cleaning and installation of the static and pitot pressure lines refer to paragraphs 5-22 through 5-34.

5-88. PITOT TUBE ASSEMBLY. (See figure 5-11.)

5-89. The 310B pitot tube assembly is illustrated in figure 5-11. The remainder of the pitot static system plumbing is the same as the earlier 310 model illustrated in figure 5-5. The pitot tube extends forward through the fuselage nose skin and receives impact or ram air which is routed to the airspeed indicator. A heating element is incorporated to prevent icing in the pitot tube during extreme weather conditions. The pitot heater is controlled by a toggle switch located on top of the control quadrant. The same switch also controls the heating element in the stall warning indicator.

CAUTION

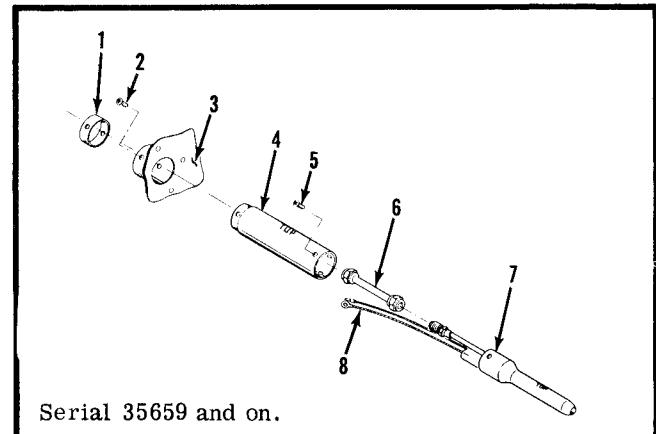
The pitot heater should not be operated on the ground as it will overheat and damage the heating element.

5-90. REMOVAL OF THE PITOT TUBE ASSEMBLY. (See figure 5-11.)

NOTE

Access to pitot tube is through nose wheel well opening.

- a. Disconnect pitot extension line (6) from elbow (45, figure 5-5).
- b. Tag and disconnect heater element wires (8).
- c. Remove four screws (2) and slide pitot tube as-



- | | |
|------------------|-------------------------|
| 1. Spacer | 5. Screw |
| 2. Screw | 6. Pitot Extension Line |
| 3. Nose Bulkhead | 7. Pitot Tube |
| 4. Sleeve | 8. Heater Element Wires |

Figure 5-11. Pitot Tube Assembly

sembly forward from nose bulkhead (3) and nose skin.

5-91. CLEANING PITOT TUBE ASSEMBLY. (See figure 5-11.)

- a. Clean pitot tube assembly with dry cleaning solvent.
- b. Dry all parts with filtered compressed air.

5-92. INSTALLATION OF PITOT TUBE ASSEMBLY. (See figure 5-11.)

- a. Position pitot tube assembly through fuselage nose skin and nose bulkhead (3).

NOTE

Position sleeve (4) so drain hole is downward.

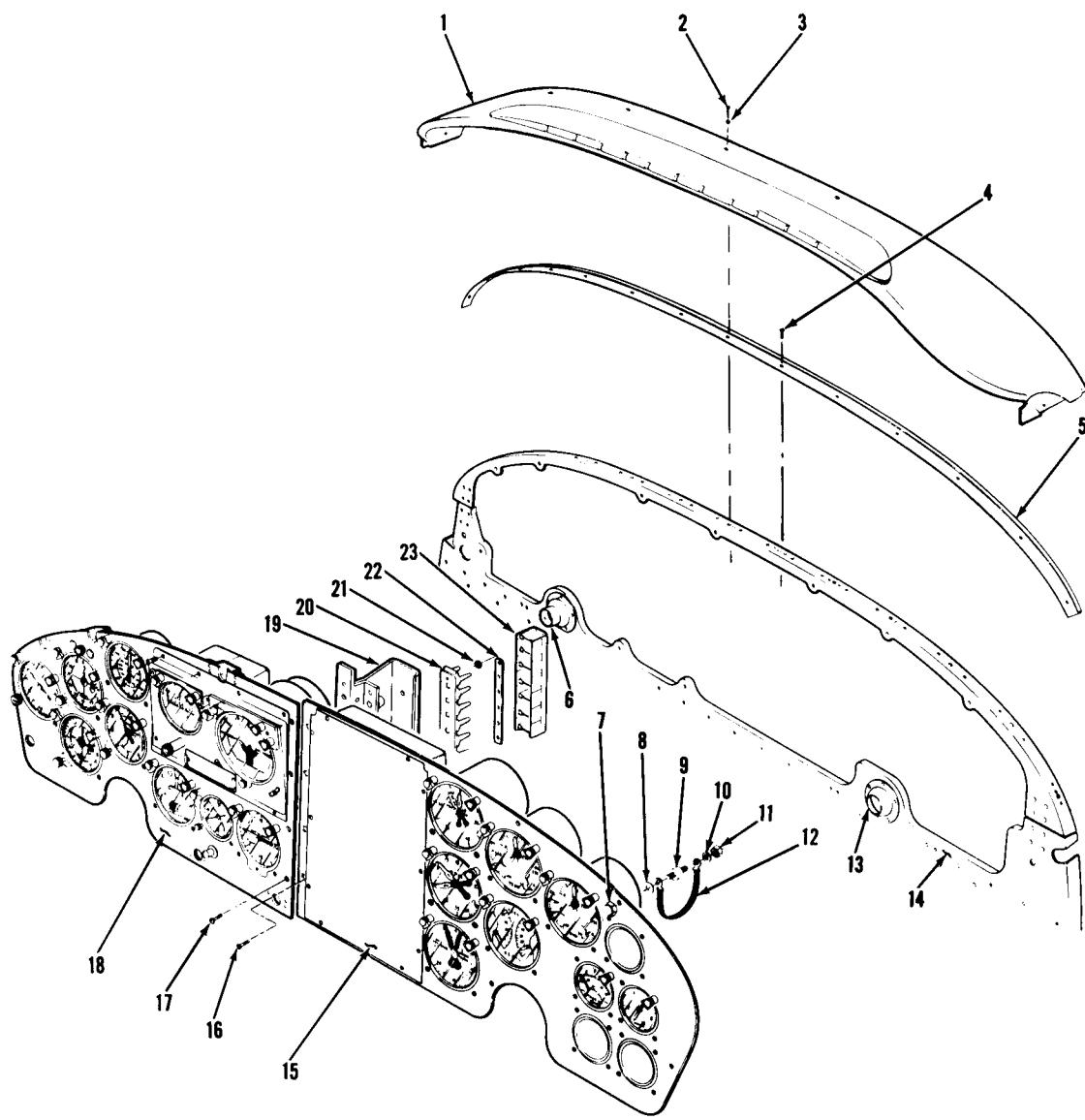
- b. Secure sleeve (4) and reducer (1) to nose bulkhead with screws (2).
- c. Attach pitot extension line (6) to elbow (45, figure 5-5).
- d. Attach heater element wires (8) as tagged at removal.

5-93. ELECTRICAL INSTRUMENTS. (See figure 5-8.)

5-94. The electrical instruments are the turn-and-slip indicator, the dual tachometer, the cylinder head temperature gages, dual fuel gage, flap position indicator, free air temperature gage, the ammeter and the oil temperature gage. For individual instrument description and removal and installation of the stall warning transmitter refer to paragraphs 5-40 through 5-61.

5-95. COMBINATION GAGES. (See figure 5-8.)

5-96. The combination engine gages include oil temperature, oil pressure, and fuel pressure indicators for each engine and is marked LEFT ENGINE or RIGHT ENGINE accordingly. For additional information refer to paragraph 5-61.



- | | | |
|-----------------|---------------------------------|---------------------------|
| 1. Hood | 9. Shock Mount | 16. Screw |
| 2. Screw | 10. Washer | 17. Screw |
| 3. Washer | 11. Nut | 18. Left Instrument Panel |
| 4. Screw | 12. Bonding Strap | 19. Angle Support |
| 5. Trim Strip | 13. Control Guide | 20. Terminal Strip |
| 6. Control Lock | 14. Stationary Instrument Panel | 21. Nut |
| 7. Nut | 15. Right Instrument Panel | 22. Terminal Bus |
| 8. Washer | | 23. Terminal Cover |

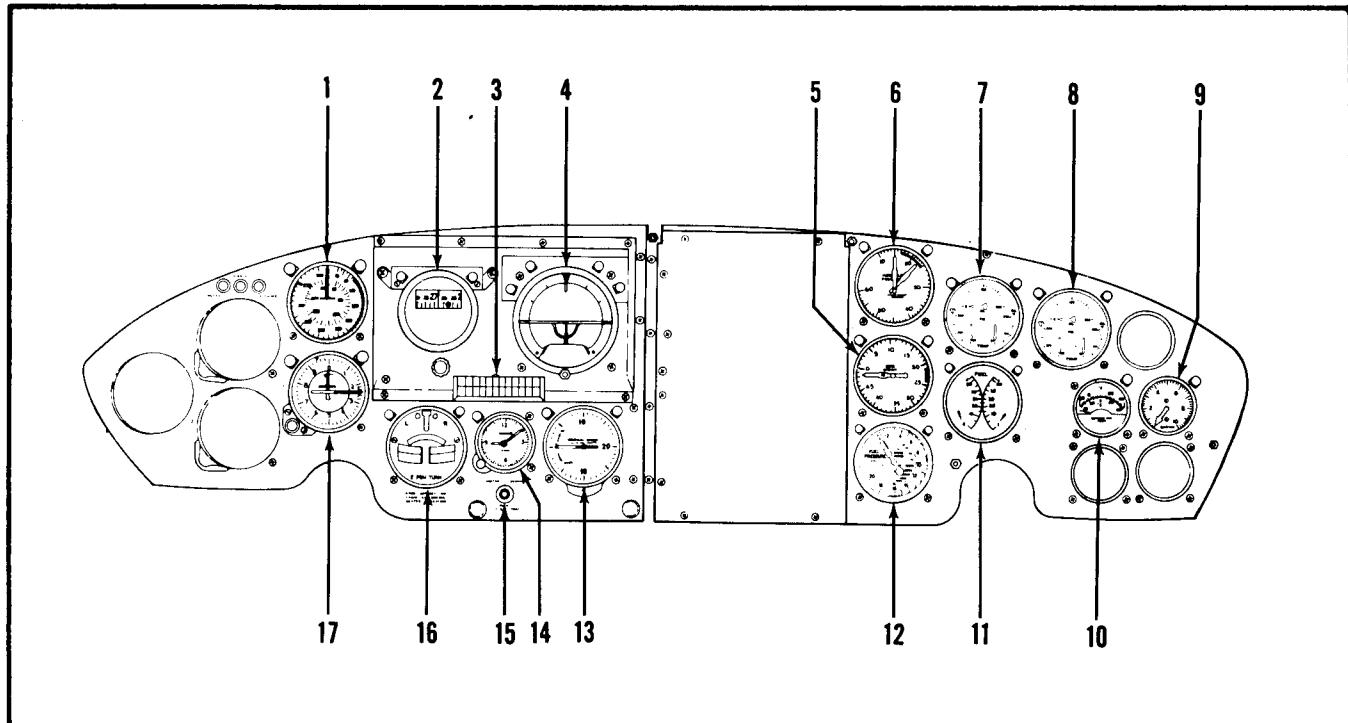
Figure 5-12. Instrument Panel

5-97. MISCELLANEOUS INSTRUMENTS. (See figure 5-8.)

5-98. The miscellaneous instruments are: the dual manifold pressure gage, clock and compass. For

details of individual instruments see paragraphs 5-62 through 5-72.

5-99. TROUBLE SHOOTING CHART. For trouble shooting information on all the instruments, refer to paragraph 5-126.



- | | | |
|--------------------------------|----------------------------------|--|
| 1. Airspeed Indicator | 7. Left Engine Combination Gage | 13. Vertical Velocity Indicator |
| 2. Directional Indicator | 8. Right Engine Combination Gage | 14. Clock |
| 3. Compass Correction Card | 9. Vacuum Gage | 15. Heater Overheat Light and Turn-and-Slip Test Light |
| 4. Attitude Indicator | 10. Free Air Temperature Gage | 16. Turn-and-Slip Indicator |
| 5. Dual Tachometer | 11. Dual Fuel Quantity Indicator | 17. Sensitive Altimeter |
| 6. Dual Manifold Pressure Gage | 12. Dual Fuel Pressure Gage | |

Figure 5-13. Instruments

5-100. INSTRUMENTS. — Serial 35772 and on.

5-101. All instruments except the magnetic compass, the ammeter, and the flap position indicator are located on the shock mounted instrument panel. Specific locations are illustrated in figure 5-13. Post type lighting is used to illuminate the fluorescent markings and pointers on panel mounted instruments. All flight instruments are located on the left instrument panel section and the engine instruments are located on the right instrument panel section.

NOTE

Disassembly or overhaul of instruments should be performed only in approved shops by authorized personnel.

5-102. TYPICAL INSTRUMENT REMOVAL AND INSTALLATION. (See figure 5-9.)

5-103. For a typical instrument removal and installation refer to paragraphs 5-76 and 5-77.

5-104. INSTRUMENT PANEL. (See figure 5-12.)

5-105. The instrument panel is shock mounted on serial 35772 and on as illustrated in figure 5-12. Either the left or right instrument panel may be removed individually; however, access to the right panel is difficult when the left panel is installed, and it is recommended to follow the removal procedure outlined in paragraph 5-106 if removal of the right instrument panel is desired.

5-106. REMOVAL OF INSTRUMENT PANEL. (See figure 5-12.)

- a. Disengage hood (1) from trim strip (5) after removing screws (2) and washers (3).
- b. Remove screws (16) securing right instrument panel (15) to angle support (19).
- c. Tag and disconnect left instrument panel hoses and wires from instruments.

NOTE

Most hose fittings are more accessible if disconnected from the forward bulkhead.

- d. Disconnect all leads from the lower terminal strip (20).

e. Remove nuts (7) from shock mounts on left instrument panel (18) and pull left portion of panel aft until angle support (10) is free from behind right instrument panel (15).

f. Remove nuts (7) from upper shock mounts on right instrument panel (15).

g. Tag and disconnect all instrument electrical leads and instrument hoses.

h. Remove nuts (7) from the lower shock mounts and remove right instrument panel (15).

NOTE

Plug all lines, and cap fittings to prevent entry of foreign objects.

5-107. INSTALLATION OF INSTRUMENT PANEL. (See figure 5-12.)

NOTE

Inspect rubber shock mounts and bonding straps for deterioration and cracks. If either is damaged, replace before installing instrument panel.

a. Position right instrument panel (15) and install nuts (7) to shock-mounts (9).

b. Attach hoses and electrical wires as tagged at removal.

NOTE

Lubricate straight threads with Specification VV-P-236 petrolatum; tapered threads with Specification JAN-A-669 antiseize compound. Apply lubricant to male threads only, omitting the first two threads.

c. Position left instrument panel (18) and secure to shock-mounts (9) with nuts (7).

d. Connect instrument light wires to lower terminal block (20).

e. Attach hoses and electrical wires as tagged at removal.

f. Position hood (1) in retaining strip (5) and install washers (3) and screws (2) to secure the hood.

5-108. VACUUM SYSTEM INSTRUMENTS. (See figure 5-8.)

5-109. The vacuum system instruments are the directional indicator, attitude indicator and vacuum gage. For description, maintenance, and adjustment of the vacuum system see paragraphs 5-9 through 5-16 and paragraph 5-21.

5-110. VACUUM TEST VALVE. (See figure 5-4.)

5-111. For description, removal and installation see paragraphs 5-17 through 5-20.

5-112. PITOT STATIC SYSTEM INSTRUMENTS. (See figure 5-13.)

5-113. The pitot static system instruments are: the sensitive altimeter, airspeed indicator and vertical velocity indicator. For description of the instruments, testing, removal, cleaning and installation of the static and pitot pressure lines refer to paragraphs 5-22 through 5-34.

5-114. PITOT TUBE ASSEMBLY. (See figure 5-11.)

5-115. The pitot tube assembly on serial 35772 and on is illustrated in figure 5-11. The remainder of the pitot static system plumbing is illustrated in figure 5-5. The pitot tube extends forward through the fuselage nose skin and receives impact or ram air which is routed to the airspeed indicator. A heating element is incorporated to prevent icing in the pitot tube during extreme weather conditions. The pitot heater is controlled by a toggle switch located on top of the control quadrant. The same switch also controls the heating element in the stall warning indicator.

CAUTION

The pitot heater should not be operated on the ground as it will overheat and damage the heating element.

5-116. REMOVAL AND INSTALLATION OF THE PITOT TUBE ASSEMBLY. (See figure 5-11.)

5-117. For removal, cleaning, and installation of the pitot tube assembly refer to paragraphs 5-90 through 5-92.

5-118. ELECTRICAL INSTRUMENTS. (See figure 5-13.)

5-119. For description and function of the electrical instruments refer to paragraphs 5-40 through 5-59.

5-120. COMBINATION GAGES. (See figure 5-13.)

5-121. A combination engine gage unit with oil temperature, oil pressure, and cylinder head temperature is provided for each engine and is marked LEFT ENGINE or RIGHT ENGINE accordingly. Oil temperature is electrically received from the oil temperature bulb (see paragraph 4-33), located in the engine oil passage, and calibrated in degrees Fahrenheit. Oil pressure is taken directly from the pressurized engine oil passage and routed through small

lines and hoses to the combination gage which calibrates the pressure to pounds per square inch. (For oil pressure plumbing refer to paragraph 4-23.) The cylinder head temperature gage is connected electrically to a cylinder head temperature bulb (see figure 4-2) located in the number four cylinder of the respective engine. As the temperature of the bulb changes, the cylinder head temperature gage measures the change and the pointer of the instrument indicates the temperature in degrees centigrade.

5-122. MISCELLANEOUS INSTRUMENTS. (See figure 5-13.)

5-123. The miscellaneous instruments are: the dual manifold pressure gage, fuel pressure gage, clock, and compass. For all miscellaneous instruments except the fuel pressure gage refer to paragraphs 5-62 through 5-72.

5-124. FUEL PRESSURE GAGE.

5-125. The fuel pressure gage is a dual unit registering fuel pressure for each engine respectively. Fuel pressures are taken directly from the pressurized fuel control unit and routed through small lines and hoses to the fuel pressure gage. For fuel pressure plumbing refer to paragraph 4-129.

5-126. TROUBLE SHOOTING THE INSTRUMENTS.

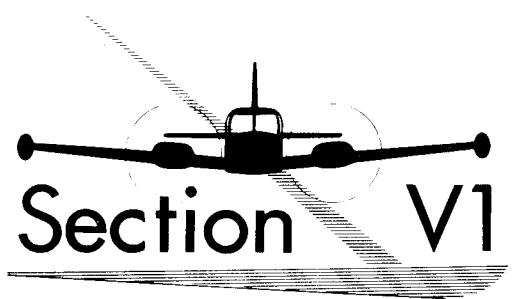
TROUBLE	PROBABLE CAUSE	CORRECTION
VACUUM SYSTEM INSTRUMENTS		
BOTH VACUUM INSTRUMENTS MALFUNCTIONING.	Dirty filter element. Restricted airflow or improper adjustment.	Check system in accordance with paragraph 4-177 through 4-204.
ONE VACUUM INSTRUMENT MALFUNCTIONING, OTHER VACUUM INSTRUMENT OPERATING NORMAL.	Defective instrument.	Replace instrument.
SENSITIVE ALTIMETER		
INDICATING POINTERS FAIL TO RESPOND.	Static line obstructed.	Disconnect static line from all instruments and blow out line with dry compressed air.
EXCESSIVE POINTER VIBRATION	Excessive vibration of static line or hose.	Secure to airplane structure or components.
ERRONEOUS INDICATIONS.	Water or foreign matter in static line.	Disconnect static line from all instruments and blow out line with dry compressed air.
	Loose static line connection.	Test and repair in accordance with paragraph 5-30.
	Defective instrument.	Replace instrument.
AIRSPEED INDICATOR		
POINTER FAILS TO RESPOND.	Clogged pitot line.	Disconnect hose from instrument and blow out line with dry compressed air.
ERRONEOUS INDICATIONS.	Water or restriction in pitot and/or static line.	Disconnect lines from all pitot static system instruments and blow out lines with dry compressed air.
	Leak in pitot and/or static line.	Test and repair in accordance with paragraph 5-30 and 5-31.
	Pitot and/or static line improperly connected.	Connect lines as illustrated in figure 5-5.
	Defective instrument.	Replace instrument.

TROUBLE	PROBABLE CAUSE	CORRECTION
VERTICAL VELOCITY INDICATOR		
POINTER FAILS TO RESPOND.	Water or restriction in static line.	Disconnect static line from all pitot static system instruments and blow out line with dry compressed air.
	Defective instrument.	Replace instrument.
TURN-AND-SLIP INDICATOR		
NOTE		
<p>To operate any of the electrical instruments, the battery switch must be in the ON position.</p>		
BALL OFF CENTER.	Incorrectly mounted.	Mount correctly.
	Defective instrument.	Replace instrument.
TURN INDICATOR INOPERATIVE.	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective instrument.	Replace instrument.
DUAL TACHOMETER		
ERRONEOUS INDICATION OR INDICATOR INOPERATIVE.	Defective circuit.	Check and repair circuit.
	Defective instrument.	Replace instrument.
	Defective tachometer generator.	Replace tachometer generator.
CYLINDER HEAD TEMPERATURE GAGE		
ERRONEOUS INDICATION.	Defective circuit.	Check and repair circuit.
	Defective cylinder head temperature bulb.	Replace cylinder head temperature bulb.
	Defective instrument.	Replace instrument.
DUAL FUEL QUANTITY INDICATOR		
NO INDICATION.	Sunken float.	Replace float.
	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective fuel quantity sending unit.	Replace fuel quantity sending unit.
	Defective indicator.	Replace indicator.
ERRONEOUS INDICATION.	Damaged float.	Replace float.
	Defective circuit.	Check and repair circuit.
	Malfunctioning fuel quantity sending unit.	Check in accordance with paragraph 4-142. Replace if necessary.
	Defective indicator.	Replace indicator.

TROUBLE	PROBABLE CAUSE	CORRECTION
FLAP POSITION INDICATOR		
NO INDICATION WITH FLAPS DOWN.	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective indicator.	Replace indicator.
	Defective transmitter.	Replace transmitter.
ERRONEOUS INDICATION WITH FLAPS DOWN.	Improper engagement of transmitter cam with pinion gear.	Rig in accordance with paragraph 2-97.
	Defective circuit.	Check and repair circuit.
	Defective indicator.	Replace indicator.
	Defective transmitter.	Replace transmitter.
FREE AIR TEMPERATURE INDICATOR		
POINTER FAILS TO RESPOND.	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.
AMMETER See paragraph 6-23.		
STALL WARNING INDICATOR		
HORN FAILS TO OPERATE.	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective transmitter.	Replace transmitter.
	Defective horn.	Replace horn.
LIGHT FAILS TO OPERATE.	Open circuit.	Reset circuit breaker. Check and repair circuit.
	Defective bulb.	Replace bulb.
	Defective transmitter.	Replace transmitter.
COMBINATION GAGES		
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 FUEL PRESSURE INDICATION.	Clogged or restricted fuel lines.	Clean fuel lines and fuel strainer.
	Broken or restricted fuel pressure line.	Replace fuel pressure line.

TROUBLE	PROBABLE CAUSE	CORRECTION
ERRONEOUS FUEL PRESSURE INDICATION (Cont.).	Defective fuel pump.	Replace fuel pump.
	Defective instrument.	Replace instrument.
ERRONEOUS OIL PRESSURE INDICATION.	Defective instrument.	Replace instrument.
	Broken or restricted oil pressure line.	Repair or replace oil pressure line.
	Defective oil pressure relief valve.	Repair or replace relief valve.
MANIFOLD PRESSURE GAGE		
SLUGGISH POINTER OPERATION.	Damaged or restricted line.	Remove line and blow out restriction. Replace line or hoses as necessary.
	Defective instrument.	Replace instrument.
MAGNETIC COMPASS		
EXCESSIVE COMPASS ERROR.	Improper compensation.	Compensate the compass.
	External magnetic interference.	Locate the interference and eliminate if possible.
FAILURE TO RESPOND TO COMPENSATION.	Compensating magnets demagnetized.	Replace instrument.

310 SERVICE MANUAL



ELECTRICAL SYSTEMS & WIRING DATA

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SECTION VI

ELECTRICAL SYSTEMS AND WIRING DATA

Table of Contents

	310	310B	310C	310D
GENERAL DESCRIPTION	6-1	6-1	6-1	6-1
ELECTRICAL POWER SUPPLY	6-3	6-3	6-3	6-3
Batteries	6-3	6-3	6-3	6-3
Battery Boxes	6-7	6-7	6-7	6-7
Battery Master Switch	6-8	6-8	6-8	6-8
External Power Receptacle	6-8	6-8	6-8	6-8
Generators - 35-Ampere	6-8	6-8	6-8	6-8
Generator Switch	6-13	6-13	6-13	6-13
Voltage Regulators - 35-Ampere	6-13	6-13	6-13	6-13
Paralleling Relay	6-14	6-14	6-14	6-14
Generators - 50-Ampere	6-14	6-14	6-14	6-14
Generator Switch	6-13	6-13	6-13	6-13
Voltage Regulators - 50-Ampere	6-16	6-16	6-16	6-16
Reverse-Current Cutouts	6-18	6-18	6-18	6-18
ELECTRICAL POWER DISTRIBUTION				
Circuit Breaker Panel	6-18	6-18	6-18	6-18
Junction Boxes	6-19	6-19	6-19	6-19
Left Hand Switch Panel	6-22	6-22	6-22	6-22
Stationary Instrument Panel Switches	6-22	6-22	6-22	6-22
INTERIOR LIGHTING				
Front Dome and Instrument Lights Console	6-23	6-23	6-23	6-23
Instrument Panel Lights	6-23	6-25	6-25	6-25
Switch Panel and Map Light	6-25	6-25	6-25	6-25
Fuel Selector Valve Light	6-28	6-28	6-28	6-28
Rear Dome Light and Baggage Lights	6-29	6-29	6-29	6-29
EXTERIOR LIGHTS				
Navigation Lights	6-31	6-31	6-31	6-31
Wing Navigation Lights	6-31	6-31	6-31	6-31
Navigation Light Flasher	6-31	6-31	6-31	6-31
Tail Navigation Light	6-31	6-31	6-31	6-31
Landing Lights	6-32	6-32	6-32	6-32
Taxi Light	6-34	6-34	6-34	6-34
Rotating Beacon	6-35	6-35	6-35	6-35
MISCELLANEOUS ELECTRICAL EQUIPMENT				
Cigar Lighters	6-36	6-36	6-36	6-36
Auxiliary Fuel Pump Circuits	6-41	6-41	6-41	6-41
INDEX OF ELECTRICAL WIRING DIAGRAMS				
Symbols Charts	6-42	6-42	6-42	6-42
Wire Table	6-100	6-100	6-100	6-100

SERIAL BLOCKS

MODEL 310
35000 thru 35546

MODEL 310B
35547 thru 35771

MODEL 310C
35772 thru 39031

MODEL 310D
39032 and on

6-1. GENERAL DESCRIPTION.

6-2. Electrical energy for the airplane 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 generator failure. Two engine-driven, direct-current, 24-volt, 35-ampere generators are standard equipment, and are capable of supplying

the current needed to operate the electrical equipment and to charge the storage batteries. As optional equipment, a pair of 50-ampere generators may be installed in place of the standard 35-ampere generators. Two generator regulator assemblies composed of a voltage regulator, current regulator and reverse-current cutout, are installed in the generator circuits to control the systems and their component parts. An external power receptacle can be provided as optional equipment in the left wing under the batteries to per-

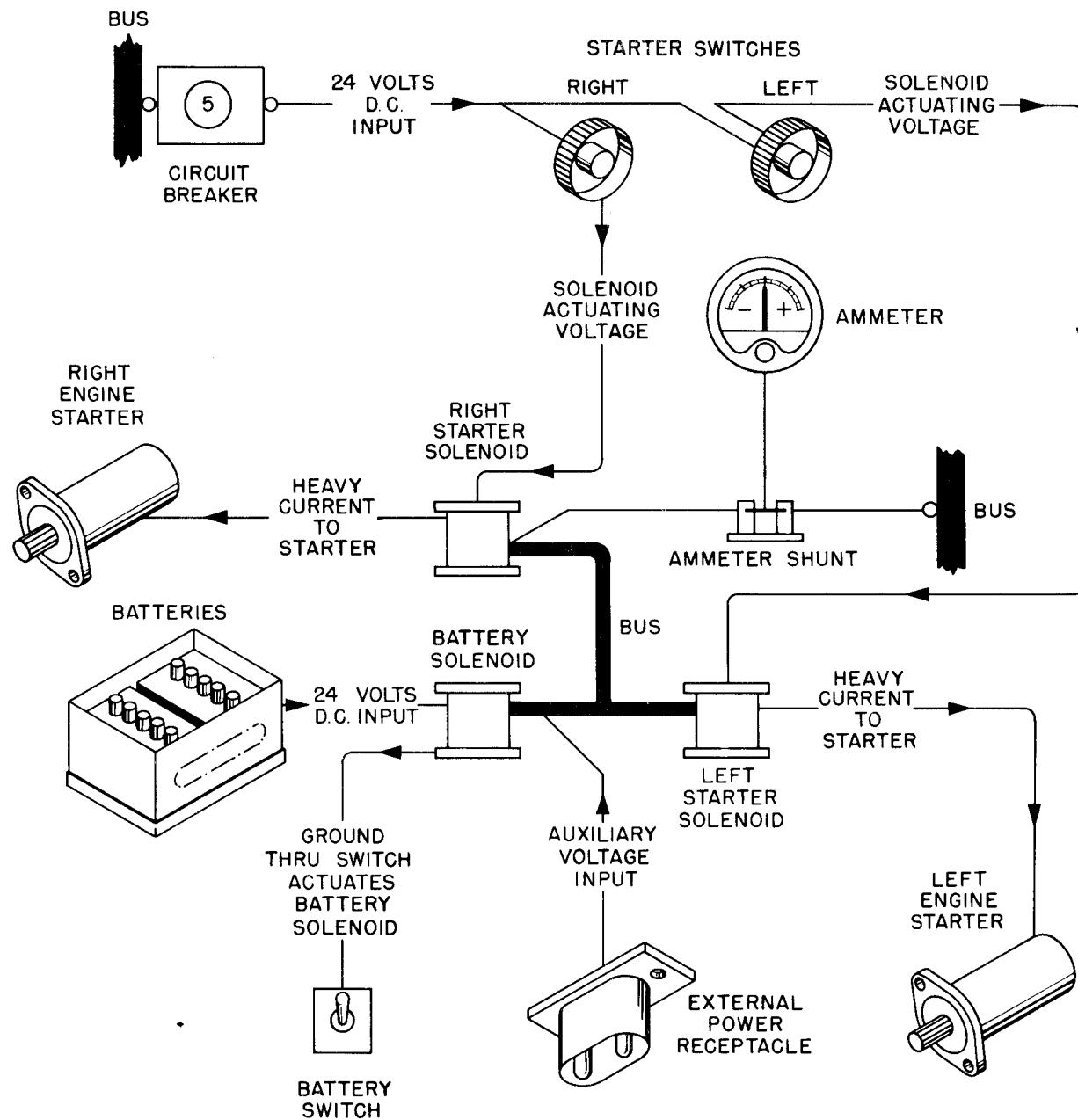


Figure 6-1. Engine Starting System Schematic

mit the use of an external power source for cold weather starting. On aircraft prior to serial 35547, all electrical circuits in the aircraft except the interior lighting and baggage compartment light circuits are controlled by switches mounted on the switch panel located to the left and below the instrument panel. On later aircraft, all switches except those controlling the overhead console panel lights, the rear dome light, and the baggage compartment light are mounted on the stationary instrument panel. All electrical circuits in the aircraft except the battery circuit are protected by circuit breakers housed within a circuit breaker panel located on the left cabin wall just forward of the pilot's seat. The airplane is equipped with standard navigation lights including a blinker, a retractable landing light in the left wing, a compass light, a fuel selector valves light, two cabin dome lights and a baggage compartment light. On aircraft prior to serial 35547, the left hand switch panel is illuminated by a map light mounted on the left cabin wall above the circuit breaker panel. On later aircraft the shock panel, stationary instrument panel and some optional radio control panels are illuminated by post lights. The instrument panel and radio control panels in aircraft prior to serial 35547 are illuminated by two ultra-violet lights and a red light which are mounted in the forward end of a console panel on the cabin ceiling. On later aircraft, this console panel contains two red flood lights and one white flood light which provide auxiliary instrument panel illumination. Optional lighting equipment consists of a right wing landing light, a taxi light, a de-ice light, and rotating beacon light.

6-3. ELECTRICAL POWER SUPPLY.

6-4. The electrical power is supplied by two 12-volt storage batteries wired in series, and two 24-volt, direct-current generators which include a paralleling relay within their circuits. The generators are located on the left side of the engine accessory sections, and utilize belt drives. Voltage regulators and current regulators are incorporated to prevent overloading the batteries and electrical circuits, and reverse-current cutouts prevent the generators from being motorized by the batteries when generator output drops below the battery voltage. The battery circuit and each generator circuit incorporates a master switch to provide manual control as desired by the pilot.

6-5. BATTERIES.

6-6. Two 12-volt, 24-ampere hour batteries, wired in series, are installed in the aircraft. Positive and negative terminal posts are clearly marked on the side of each battery, and on the terminal posts. The batteries are secured within the battery box positioned one behind the other and located outboard of the left engine nacelle. Access to the batteries is gained by removing the access hole cover on the upper surface of the wing. On early models the batteries are contained in the two similar boxes which are riveted together, and separate lids enclose each box.

6-7. REMOVAL OF BATTERIES. (See figures 6-2 and 6-3.)

a. Release the fasteners securing the battery access cover, and remove the cover.

- b. Remove the battery box lid(s).
- c. 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.

- d. Disconnect the power cable from the positive terminal on the forward battery.
- e. Remove the battery bus bar that connects the negative terminal of the forward battery with the positive terminal of the rear battery. Early aircraft have a grommet placed on the bus bar to provide insulation from the battery box covers.
- f. Lift the batteries from the battery box.

6-8. CLEANING OF BATTERIES. For maximum efficiency, batteries and battery connections should be kept clean at all times. Clean batteries with a mild solution of bicarbonate of soda (baking soda) and water to remove acid corrosion. Rinse with clear water. Sponge off excess water and allow batteries to dry.

CAUTION

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

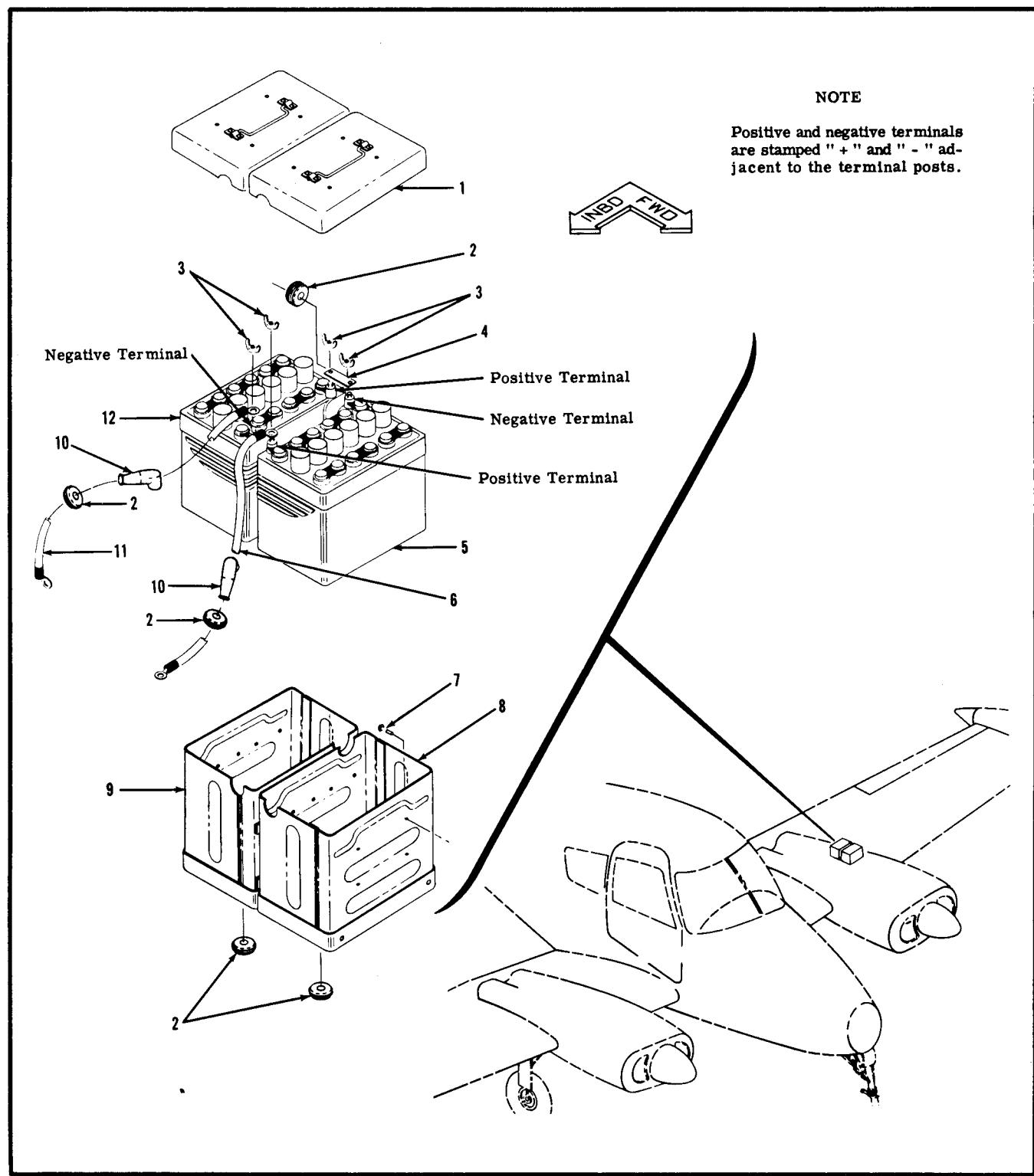
If additional cleaning of battery terminals is needed, use a wire brush and brighten up the terminals to insure a good electrical contact.

6-9. SERVICING OF BATTERIES. Maintain the level of the battery electrolyte at the level of the horizontal baffle plate (the plate with the holes in it), which is approximately two inches below the filler plug, by adding water as required. This water level should be maintained when the battery is in the level position.

CAUTION

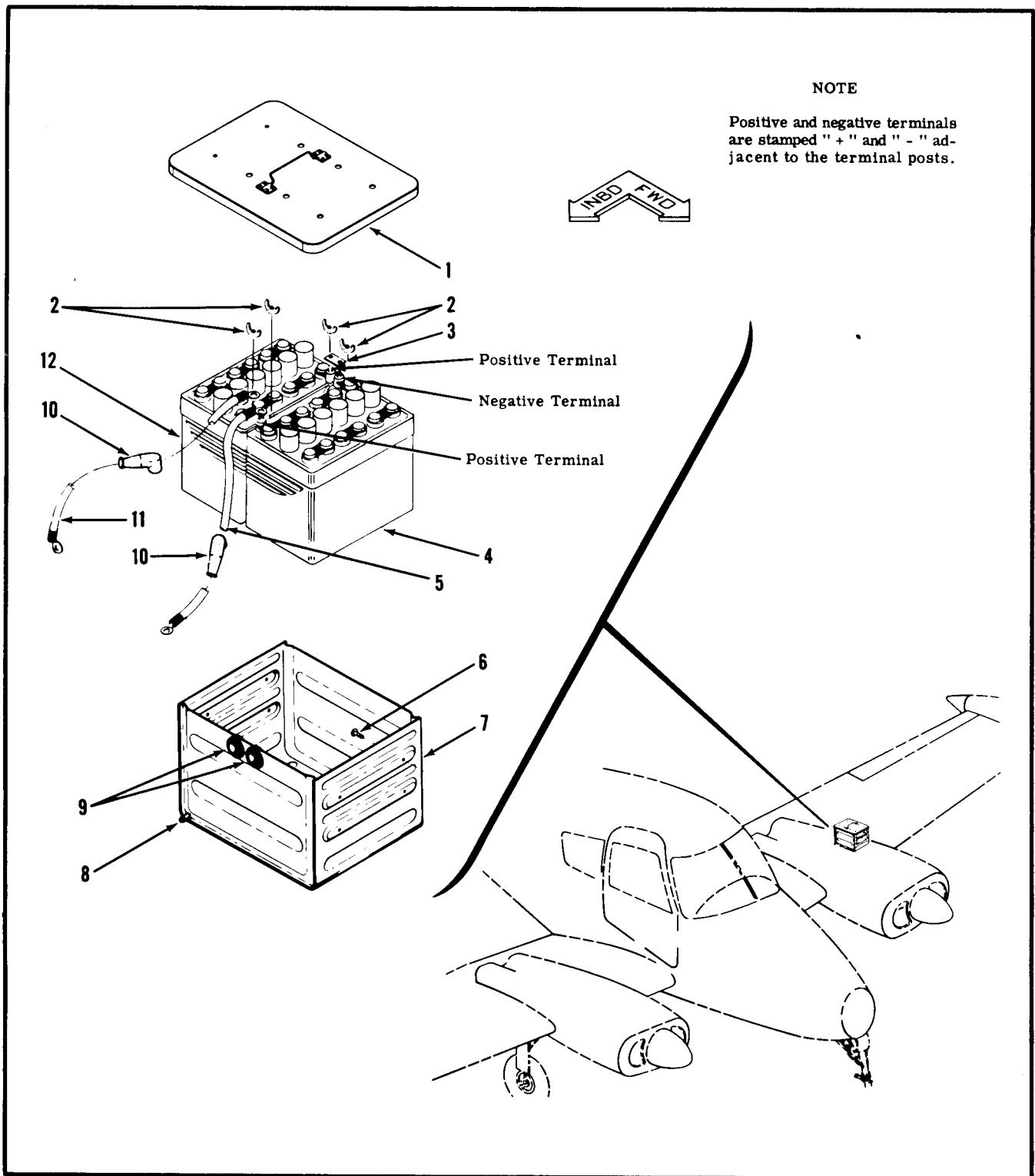
Do not fill the batteries above the horizontal baffle plate. The space above the plate is a fluid reservoir when the battery is tipped to the side or inverted during maneuvers. When the electrolyte level is too high, spillage of fluid may result.

Sponge off any spilled acid and corrosion products with a soda water solution to neutralize the acid, then rinse with clean water. An electrolyte specific gravity reading should be taken of all battery cells at regular intervals, preferably every 25 hours. A specific gravity reading of from 1.250 to 1.280, corrected for temperature, indicates a properly charged battery. New batteries should test from 1.275 to 1.300. The specific gravity of the electrolyte should not vary more than (.025) between cells. If there is a greater variation, the battery should be slow charged and retested.



- | | |
|---|---|
| 1. Battery Box Lids | 7. Screws |
| 2. Grommets | 8. Forward Battery Box |
| 3. Wing Nuts | 9. Aft Battery Box |
| 4. Battery Bus Bar | 10. Rubber Terminal Shield |
| 5. Forward Battery | 11. Ground Cable —
Battery to Grounding Bolt |
| 6. Power Cable —
Battery to Battery Solenoid | 12. Aft Battery |

Figure 6-2. Batteries and Battery Boxes Installation (35000 thru 35316)



- | | |
|---|---|
| 1. Battery Box Lid | 7. Battery Box |
| 2. Wing Nuts | 8. Drain Outlet |
| 3. Battery Bus Bar | 9. Grommets |
| 4. Forward Battery | 10. Rubber Terminal Shield |
| 5. Power Cable –
Battery to Battery Solenoid | 11. Ground Cable –
Battery to Grounding Bolt |
| 6. Screw | 12. Aft Battery |

Figure 6-3. Batteries and Battery Box Installation (35317 and on)

6-10. INSTALLATION OF BATTERIES. (See figure 6-2 and 6-3.)

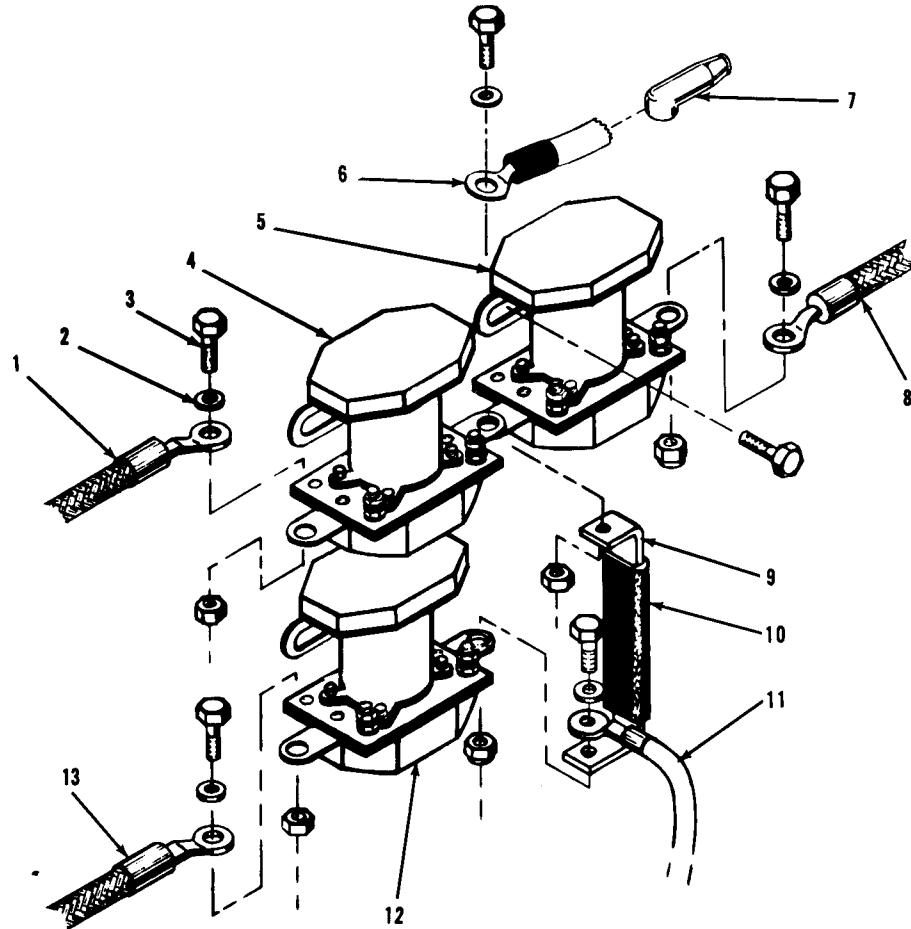
- a. Place the batteries in the battery box with the terminal-post sides of the batteries together.
- b. Coat battery terminals, bus bar and cable terminals with a light coating of grease.
- c. Place bus bar across the two outboard battery terminals (positive post of rear battery and negative post of forward battery) and secure with wing nuts. On early aircraft using two battery boxes, place the rubber grommet on the bus bar before installing the bus bar on the battery posts. Adjust the grommet so it fits over the edges of the battery boxes.
- 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 terminals.

NOTE

When attaching the battery cables to the battery, be sure the cable grommets are properly placed over the edges of the battery box.

- f. Install the battery box lid(s). On early aircraft position the grommets so the edges of the battery box fit the grooves in the grommets.
- g. Replace the battery access hole cover and secure the eight fasteners.



- | | | |
|--------------------------|-------------------------|---------------------------------|
| 1. Left Starter Cable | 5. Battery Solenoid | 10. Insulator |
| 2. Lockwasher | 6. External Power Cable | 11. Power Cable to Aircraft Bus |
| 3. Bolt | 7. Rubber Nipple | 12. Right Starter Solenoid |
| 4. Left Starter Solenoid | 8. Battery Power Cable | 13. Right Starter Cable |
| | 9. Bus | |

Figure 6-4. Battery and Starter Solenoids (Serial 35000 thru 35728)

6-11. BATTERY BOXES.

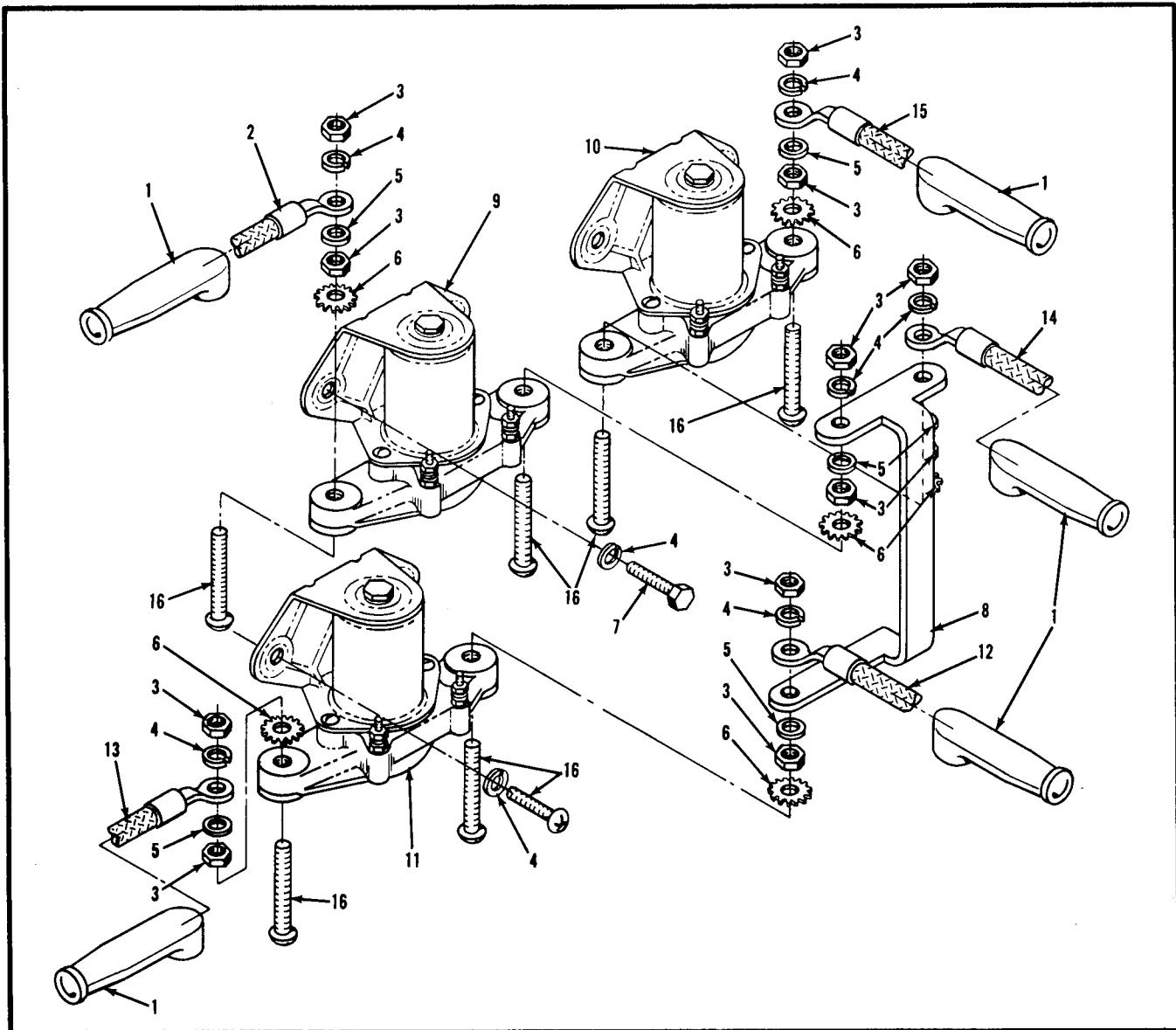
6-12. REMOVAL OF BATTERY BOX. (See figures 6-2 and 6-3.)

- a. Remove batteries according to paragraph 6-7.
- b. Push the battery cables through the grommets in the battery box until the terminals are just protruding from the wing rib.
- c. Remove the access panel located between the external power receptacle and engine nacelle.
- d. Disconnect the rubber hose from the battery drain line and push the hose through the grommet into the battery compartment.

- e. Remove the eight screws securing the battery box and lift the battery box from the wing.

NOTE

On early aircraft the two battery boxes are riveted together and must be removed from the aircraft as a single unit. The boxes drain through the bottom of the wing and do not have any rubber hose attached.

6-13. CLEANING AND REPAIR OF BATTERY BOX.
Battery boxes should be cleaned with a strong solution

- | | | |
|-----------------------|----------------------------|--------------------------|
| 1. Rubber Nipple | 6. Tooth Lockwasher | 12. Power Cable |
| 2. Left Starter Cable | 7. Bolt | 13. Right Starter Cable |
| 3. Nut | 8. Bus | 14. Battery Power Cable |
| 4. Washer | 9. Left Starter Solenoid | 15. External Power Cable |
| 5. Spacer | 10. Battery Solenoid | 16. Screw |
| | 11. Right Starter Solenoid | |

Figure 6-5. Battery and Starter Solenoids (35729 and on)

of bicarbonate of soda (baking soda) and water. Hard deposits of spilled acid and corrosion products may be removed using a wire brush. When all foreign material has been removed from the box, flush it thoroughly with clean water.

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.

Inspect the cleaned battery box for physical damage and for areas lacking proper acid proofing. Badly damaged or corroded boxes should be replaced. 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.

6-14. INSTALLATION OF BATTERY BOX. (See figures 6-2 and 6-3.)

- a. Inspect the battery compartment to insure that the battery cables will not obstruct the installation of the battery box.
- b. Tilt the battery box into the battery compartment and start the rubber hose and battery cables through the grommets. Lower the battery box down into the compartment while guiding the hose through the grommet. Aircraft having the two battery boxes riveted together do not have the rubber hose and it is only necessary to align the battery drain tubes with the rubber grommets.
- c. Attach the rubber hose to the battery drain tube that extends to the trailing edge of the wing and replace the hose clamp.
- d. Replace and secure the access hole cover between 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 batteries in accordance with paragraph 6-10.

6-15. BATTERY MASTER SWITCH. (See figures 6-12 and 6-13.)

6-16. A battery master switch is located between the right and left generator switches on the left hand switch panel. A switch bar is installed across the top of the three switches. All of the switches may be turned off simultaneously or independently. The battery master switch is a single pole, two position type and is secured in place by a single nut. When the switch is placed in the ON position it actuates a heavy duty battery contactor which connects the batteries to the electrical system. For removal and installation of the battery master switch refer to paragraphs 6-72 and 6-73.

6-17. EXTERNAL POWER RECEPTACLE.

6-18. An external power receptacle is installed on the bottom side of the left wing outboard of the engine nacelle. An external power source may be plugged into the receptacle for cold weather starting or for lengthy ground tests of electrical equipment. A spring-loaded access door covers the receptacle opening in the wing when the receptacle is not in use.

6-19. REMOVAL OF EXTERNAL POWER RECEPTACLE. (See figure 6-6.)

- 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.

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 bracket according to figure 6-6 and remove receptacle from wing.

NOTE

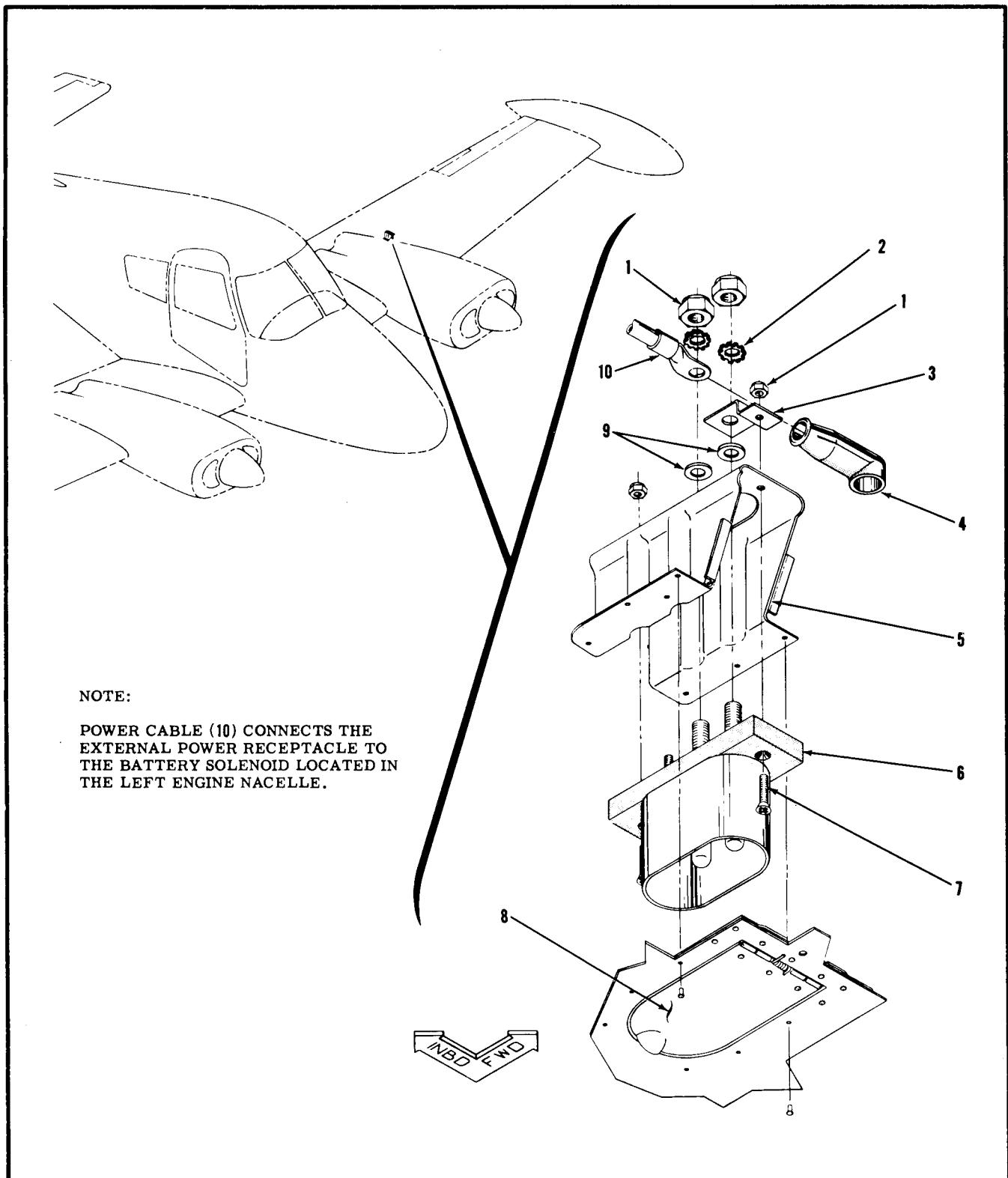
The bracket is riveted to the wing structure and should not be removed unless it is damaged.

6-20. INSTALLATION OF EXTERNAL POWER RECEPTACLE. (See figure 6-6.)

- 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.

6-21. GENERATORS.

6-22. Two 24-volt, 35-ampere generators are installed as standard equipment. Generators of 50-ampere capacity are available as optional equipment. The generators are located on the left side of each engine accessory section and are belt driven at twice the engine speed. Each generator is shock mounted to brackets on the engine by two nuts and bolts below the generator housing, and a single bolt above the generator which slides within a slot on a mounting bracket. The lower mounting bolts act as a pivot while the belt tension is adjusted and the top screw secures the adjustment.



- | | | |
|-----------------|------------------|-----------------|
| 1. Nut | 4. Rubber Nipple | 8. Access Door |
| 2. Lockwasher | 5. Bracket | 9. Washer |
| 3. Ground Strap | 6. Receptacle | 10. Power Cable |
| | 7. Screw | |

Figure 6-6. External Power Receptacle

6-23. TROUBLE SHOOTING GENERATOR POWER SYSTEM

TROUBLE	PROBABLE CAUSE	CORRECTION
NO INDICATION ON AMMETER.	Defective ammeter.	Check/replace.
	Defective ammeter leads.	Check/repair or replace.
NO GENERATOR OUTPUT.	Poor generator brush contact.	Check/replace defective brushes.
		Check brush holders and replace weak brush springs.
	Dirty commutator.	Clean commutator.
	Defective generator switch.	Check/replace.
	Defective generator leads.	Check/repair.
	Faulty voltage regulator.	Check/repair or replace
	Faulty generator.	Check/repair.
AMMETER SHOWS HEAVY DISCHARGE WHEN ENGINE IS STOPPED OR AT SLOW IDLE.	Faulty generator cutout unit in regulator causes "motorizing" of generator.	Check points on cutout relay/replace regulator.
ERRATIC OPERATION OF GENERATOR SYSTEM.	Faulty paralleling relay.	Check/repair relay.
HIGH CHARGING RATE WITH BATTERIES FULLY CHARGED.	Improper voltage regulator setting.	Reset voltage regulator.
	Defective voltage regulator unit.	Check/repair regulator.
	Grounded generator field circuit.	Check field wire for short.
		Check generator field for internal grounding.
		Check regulator for improper grounding.

TROUBLE	PROBABLE CAUSE	CORRECTION
HIGH CHARGING RATE WITH BATTERIES FULLY CHARGED (CONT)	Poor ground connection at regulators.	Check grounding of regulator.
	High temperature reducing battery resistance to charge.	No correction necessary.
LOW CHARGING RATE WITH BATTERIES NOT FULLY CHARGED.	Shorted or faulty leads from generator to regulator.	Check/replace wiring.
	Defective generator.	Repair or replace generator.
	Low voltage (or current) regulator setting.	Reset regulator.
	Oxidized control points in regulator.	Dress contact points with spoon or riffler file. Reset or replace regulator.
	One generator system has low output (paralleling relay will equalize output of one generator with the other.)	Check generator circuits individually by use of generator switches.
	Generator has lost residual magnetism.	Flash generator field by momentarily shorting between battery and armature terminals of regulator.

6-24. REMOVAL OF GENERATORS.

- Open the engine nacelle left hand cowling by unsnapping the fasteners along the top of the cowling.
- On the generator armature and field terminals, remove the nuts, and remove the cable assemblies from the generator.

NOTE

Place identification tags on the cable assemblies as an aid to correct reinstallation.

- Remove the safety wire from the belt-tension-adjusting bolt, and remove the bolt.
- Remove the nuts from both generator lower attaching bolts.
- Tilt the generator toward the right hand side of the engine, and remove the generator drive belt from the generator pulley.
- Support the generator, and remove the lower attaching bolts. Remove the generator from the engine.

6-25. CLEANING OF GENERATORS.

- Clean the outside of the generator housing with a cloth moistened with carbon tetrachloride or unleaded gasoline.
- Remove the brush cover band retaining screw and nut and remove the cover band. Using compressed air, blow out all brush dust from the brush assembly. If

the commutator and brushes are dirty, and if there is evidence of grease accumulation, use a lint-free cloth to wipe the brushes and commutator clean.

NOTE

The brushes will have to be removed from their brush holders if they are to be cleaned thoroughly. Use a stiff wire hook to raise the brush springs enough to permit the removal of brushes. Raise the brush springs carefully to prevent weakening the springs.

- Polish the commutator with No. 000, or finer, sandpaper and blow out with compressed air.

6-26. DISASSEMBLY OF GENERATORS.

- Holding the generator drive pulley securely, loosen and remove the pulley-securing nut and lockwasher.
- Pull the drive pulley from the generator shaft, and remove the woodruff key.
- Loosen and remove the brush cover band securing nut and screw. Remove the brush cover band.
- Brushes may be removed, if required, by using a stiff wire hook and raising the brush springs enough to permit the removal of brushes. The brush leads can then be disconnected, and the brushes removed from the generator.
- Further disassembly of the generator is accom-

lished by cutting the safety wire and removing the two long bolts from the brush assembly end of the generator. The mounting brackets, brush assembly, and armature can then be removed from the field assembly housing.

6-27. REPAIR OF GENERATORS. Repairs to the generator other than the seating or replacing of brushes, or polishing of the commutator should be accomplished at a shop specializing in generator repair. Replacement of the generator is recommended if serious damage has occurred. For information concerning the types of brushes used, the allowable minimum brush length, and the recommended brush spring tension, consult the generator service manual. New generator brushes should be seated against the commutator after installation. Seating of the brushes is performed by wrapping the commutator with a single thickness of fine sandpaper, gritty side out, and allowing the brushes to ride against the sandpaper as the commutator is rotated by hand several revolutions.

NOTE

In seating the brushes, the commutator should be turned in the direction of normal operation so that the brushes will not tend to bind or chip.

Polishing of the commutator is performed by holding a piece of No. 000, or finer, sandpaper, or crocus cloth, against the commutator, and twisting the generator shaft several revolutions in the direction of normal operation. After seating generator brushes or polishing the commutator, always blow out the brush assembly with compressed air.

6-28. LUBRICATION OF GENERATORS. No lubrication of the generators is required between overhaul periods. Sealed, pre-lubricated bearings in the generator must be replaced when there is an indication of abnormal wear.

6-29. ASSEMBLY OF GENERATORS.

- a. Insert the two long bolts through the forward mounting bracket of the generator. Position the brush assembly over the two bolts.
- b. Insert the commutator end of the armature assembly into the brush assembly.
- c. Position the field assembly housing over the armature, and install the rear mounting bracket.
- d. Screw the two long bolts, previously installed, into tapped holes in the rear mounting bracket. Tighten the two bolts and safety wire them in place.
- e. Use a stiff wire hook and lift the brush springs enough to permit the insertion of brushes. Insert brushes into their holders.

CAUTION

Do not apply excessive pressure to brush springs, as this will weaken them.

- f. Connect the brush leads to the brush housing.
- g. If new brushes have been installed they should be seated to the commutator at this time. Seat new brushes

in accordance with paragraph 6-27.

- h. Position the brush cover band over the brush assembly and install the cover band screw and nut.

NOTE

The cover band should not be tightened completely as it will have to be repositioned when the generator is installed on the airplane.

- i. On the drive end of the generator, insert the woodruff key in the slot provided on the generator shaft. Align the slot in the drive pulley over the woodruff key and press the pulley on the shaft. Install the lockwasher and nut, and tighten.

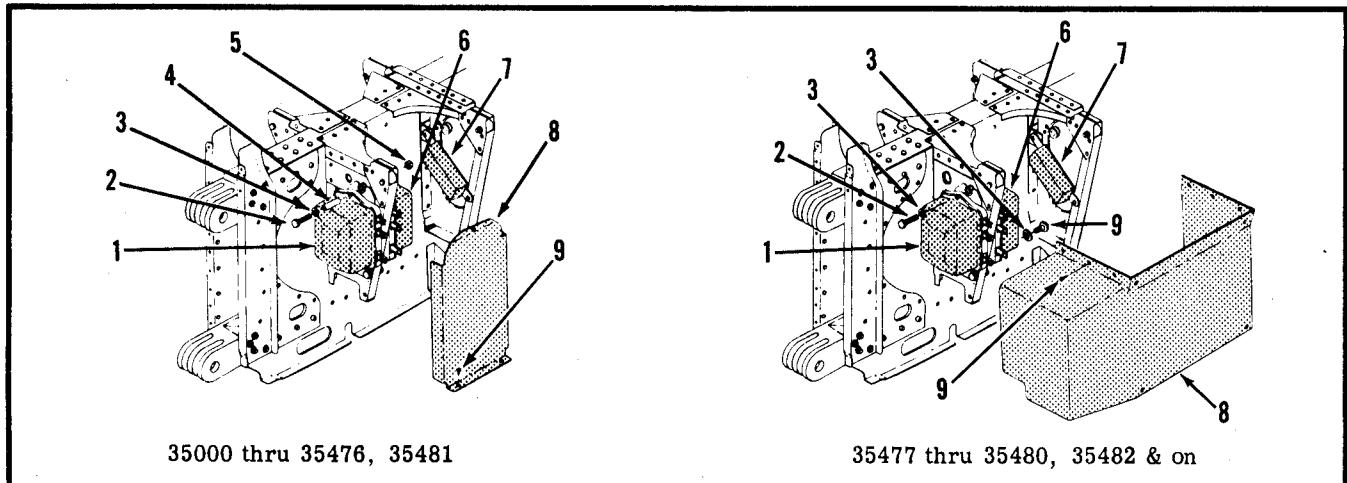
6-30. INSTALLATION OF GENERATORS.

- a. Position the generator on the engine so that the lower mounting holes of the generator line up with the engine bracket.
- b. Install two plain washers under the head of the lower forward mounting bolt and insert the bolt, bolt head to the rear, through the engine and generator brackets.
- c. Install the lower rear mounting bolt, bolt head to the rear, through the rear bracket holes.
- d. Tilt the generator up and toward the right side of the engine, and slip the drive belt over the generator drive pulley.
- e. Install nuts on the two lower mounting bolts.
- f. Insert the upper belt tension adjusting bolt, bolt head forward, through the elongated slot in the upper support bracket and into the generator upper mounting hole.
- g. Adjust generator for belt tension. The belt is properly adjusted when it can be flexed one half inch from the normal position. Resafety the adjusting bolt. Tighten the nuts on the two lower mounting bolts.
- h. Connect the previously tagged armature and field terminal cables to the generator and remove the identification tags.
- i. Adjust the brush assembly cover band so that the blast tube is positioned within the hole provided in the rear engine baffle. Tighten the screw and nut on the brush assembly cover band.

6-31. TESTING GENERATORS.

- a. Operate both engines for one to three minutes at 1200 to 1500 rpm, with lights and radio equipment on.
- b. Stop engines and check generators for excessive heating.
- c. If excessive heating is evident, check the position of the blast tube. Align blast tube with ventilating hole in the rear engine baffle. Check generator drive belt for excessive tightness or slack. Readjust drive belt tension as required.
- d. If, after operating the engines for another three to five minutes from 1200 to 1500 rpm with all lights and radio equipment on, the generators, either one or both, continue to overheat, they should be removed and disassembled in accordance with paragraphs 6-24 and 6-26. Inspect for excessive wear, defective bearings, or melted solder within the generator.

6-32. CHECKING GENERATOR SYSTEM. Although the system consists of two generators and two voltage regulator units connected to a bus and "equalized" by a paralleling relay, the generators and their regulators



1. Right Voltage Regulator	4. Spacer	7. Paralleling Relay
2. Bolt	5. Nut	8. Terminal Shield
3. Washer	6. Left Voltage Regulator	9. Screw

Figure 6-7. Voltage Regulators and Paralleling Relay

are most easily checked individually. Either generator system may be checked as follows:

a. If the batteries are fully charged and the charging rate remains high, disconnect wire lead from "F" terminal of regulator. If charging rate is high with engine at medium speed (1200 rpm), generator field, or field wire is grounded. If output drops off, regulator is faulty, and should be checked for high voltage setting or for internal grounding.

b. If the batteries are low, but the charging rate is low, ground "F" terminal of regulator momentarily and increase generator speed. If output does not increase, generator (or generator-to-regulator wiring) is faulty. If output increases, regulator is faulty.

6-33. GENERATOR SWITCH. (See figures 6-12 and 6-13.)

6-34. Two generator switches, one for each generator circuit, are located on the left hand switch panel on either side of the battery switch. A switch bar is positioned above the switches to permit their being turned off simultaneously. Also, each switch may be turned off independently as desired by the pilot. The generator switches are two position, single pole, one-hole mounting toggle type switches. Placing the switches in the "OFF" position opens the generator field circuits, thus taking the generators out of operation. For switch removal and installation procedures, refer to paragraphs 6-72 and 6-73.

6-35. VOLTAGE REGULATORS. (See figure 6-7.)

6-36. Two 24-volt, 35-ampere voltage regulator units are installed forward of the front spar under the copilot's seat.

CAUTION

If 24-volt, 50-ampere voltage regulators are to be installed in the airplane, generators of similar capacity must be used also. Generators of a lesser capacity would be seriously

damaged if used in conjunction with 50-ampere regulators.

The voltage regulators are fastened, one on each side of the copilot's seat right hand support bracket, by three bolts and nuts. The right hand regulator governs the right generator, and the left hand regulator governs the left generator. Each regulator unit is composed of a voltage regulator, current regulator, and reverse-current relay. The voltage and current regulators are designed to prevent variations in generator output voltage and current caused by changes in generator speed and load conditions. The reverse-current relays are designed to prevent the generators from being motorized by the batteries when generator output voltage drops below that of the batteries.

6-37. REMOVAL OF VOLTAGE REGULATORS.

Access to the voltage regulators is simplified by removing the copilot's seat. Removal of the seat and regulators is performed in the following manner:

- a. Pull up on the seat right hand adjusting handle, and tilt the seat back as far as possible. Remove two screws, securing the seat stop plate, from the right hand side of the seat adjacent to the seat track. Remove the stop plate. Pull up on the seat left hand adjusting handle, and slide the seat either forward or aft to clear it from the seat tracks. Remove the seat from the airplane.

b. Remove the four electrical leads from each regulator unit and tag them for identification purposes.

c. Remove three nuts, bolts, spacers and washers securing the regulator units to the copilot's seat right hand support bracket.

d. Remove the regulators from the airplane.

6-38. INSTALLATION OF VOLTAGE REGULATORS.

a. Position regulator unit on the outboard side of the copilot's seat right hand support bracket.

b. Install a thin plain washer under the head of each of the three regulator securing bolts. Insert the bolts, bolt heads outboard, through the base of the regulator unit and through the seat support bracket.

c. Install spacers on each bolt and position the inboard regulator unit on the three bolts.

d. Install three washers and nuts on the regulator securing bolts, and tighten.

e. Install the four electrical leads to each regulator and remove their identification tags.

f. Install the copilot's seat by reversing the procedure given in step "a," paragraph 6-37.

6-39. ADJUSTMENT AND TESTING OF GENERATOR REGULATORS. For procedures and specifications concerning adjustment and testing of voltage regulator units, consult applicable Delco-Remy service bulletins.

6-40. PARALLELING RELAY. (See figure 6-7.)

6-41. The paralleling relay contains two single-pole, single-throw relays whose contacts are connected in series. Each generator actuates a relay automatically as the generator approaches rated output voltage.

When both generators are producing rated voltage, both relays close completing a circuit between terminals "1" and "6" of the paralleling relay. This connects the "P" terminals of the right and left regulator together. The "P" terminal of each regulator is connected to a special paralleling winding on the voltage relay of each regulator; any change in the output of one generator is reflected through the paralleling circuit and induced upon the voltage relay of the other generator system. This produces a balancing action between the two generator systems. If the output of either generator should fail, the paralleling relay for that generator will drop out and disconnect the paralleling circuit. The paralleling relay is mounted on the inboard seat support under the copilot's seat.

6-46. TROUBLE SHOOTING 50-AMPERE GENERATOR POWER SYSTEM.

TROUBLE	PROBABLE CAUSE	CORRECTION
NO INDICATION ON AMMETER (GENERATOR SWITCH ON.)	Defective ammeter.	Check/replace.
	Defective ammeter wiring.	Check/repair or replace.
AMMETER SHOWS DISCHARGE ONLY.	Generator circuit breaker out.	Check/reset.
	Defective generator switch.	Check/replace.
	Defective generator wiring.	Check/repair or replace.
	Poor generator brush contact.	Check/repair brushes.
		Clean brush holders and replace weak brush springs.

6-42. REMOVAL OF PARALLELING RELAY.

a. Remove the copilot's seat in accordance with instructions in step "a," paragraph 6-37.

b. Remove the four electrical wires and tag each wire for identification and location as an aid to re-installation.

c. Remove the two bolts and nuts attaching the paralleling relay to the seat support and remove the relay.

6-43. INSTALLATION OF PARALLELING RELAY.

a. Position the paralleling relay on the outboard side of the copilot's seat left hand support bracket.

b. Insert two bolts, bolt heads outboard, through the relay base and support bracket. Install and tighten two nuts.

c. Attach the four electrical leads to the relay terminals, and remove the previously attached identification tags.

d. Install the copilot's seat in accordance with step "f," paragraph 6-38.

6-44. 50-AMPERE GENERATOR POWER SYSTEM.

6-45. Two 50-ampere generators are installed as optional equipment in the Model 310. A belt-driven generator is located on the left side of each engine accessory section. Each generator is shock mounted to brackets on the engine by two nuts and bolts below the generator housing, and a single bolt above the generator which slides within a slot on a mounting bracket. The slot provides a means of adjusting generator drive belt tension. A carbon pile voltage regulator is installed in the bottom of each engine nacelle to control the output of the generators. A paralleling resistor is located in each nacelle. These resistors operate in conjunction with the voltage regulators to balance the output of the generators.

TROUBLE	PROBABLE CAUSE	CORRECTION
AMMETER SHOWS DISCHARGE ONLY (Cont.).	Dirty commutator.	Clean commutator.
	Faulty voltage regulator.	Check/reset or replace.
	Faulty generator.	Check/repair or replace.
LOW VOLTAGE.	Voltage regulator improperly adjusted.	Adjust regulator.
	Loose wire connections.	Tighten connections.
	Dirty commutator.	Clean commutator.
HIGH VOLTAGE.	Voltage regulator improperly adjusted.	Adjust regulator.
	Short circuit between field and armature control circuits.	Repair or replace defective items.
	Faulty generator.	Check/repair or replace.
	Pitted or dirty commutator.	Check/clean or resurface commutator.
	Defective regulator.	Overhaul regulator.

6-47. REMOVAL OF GENERATOR.

- a. Open rear cowl door on the left-hand side of the engine nacelle.
- b. Remove the clamp attaching the blast tube to the generator and remove the blast tube.
- c. Remove the safety wire from the belt-tension-adjusting bolt, and remove the bolt.
- d. Remove the nuts from both generator lower attaching bolts.
- e. Tilt the generator toward the right-hand side of the engine, and remove the generator drive belt from the generator pulley.
- f. Support the generator, and remove the lower attaching bolts. Disconnect and tag the wiring and remove the generator from the engine.

6-48. CLEANING OF GENERATORS.

- a. Clean the outside of the generator housing with a cloth moistened with unleaded gasoline or other approved solvent.
- b. Loosen the brush cover band retaining screws and remove the cover band. Use compressed air to blow out all brush dust from the brush assembly. If commutator brushes are dirty, and if there is evidence of grease accumulation, use a lint-free cloth moistened with the cleaning solvent and wipe the brushes and

commutator clean. Dry all parts thoroughly with compressed air.

CAUTION

Do not use carbon tetrachloride for cleaning generator parts. It may cause excessive brush wear, sparking and corrosion. Do not allow the parts to soak in the cleaning solution.

NOTE

Remove brushes from holders for cleaning. Use a stiff wire hook to raise brush springs enough to remove brushes. Raise brush springs carefully to prevent weakening them.

- c. Polish the commutator with No. 000 or finer sandpaper and blow out with compressed air.

6-49. INSTALLATION OF GENERATOR. (See figure 6-9.)

- a. Position the generator on engine so lower mounting holes of generator line up with engine bracket.
- b. Refer to figure 6-9 for installation of generator mounting bolts.

c. To install generator drive pulley loosen the mounting bolts and tilt generator up and toward right side of engine, and slip drive belt over generator drive pulley.

d. Adjust the generator for belt tension. The belt is properly adjusted when it can be flexed one half inch from the normal position. Secure the mounting bolts in this position.

e. Connect the armature and shield wires to their respective terminals on the generator.

f. Adjust the brush assembly cover band so the blast tube fits into the hole in the engine baffle. Tighten the brush assembly cover band.

6-50. 50-AMPERE VOLTAGE REGULATORS.

6-51. Two carbon-pile voltage regulators are utilized with the 50-ampere generator system. The regulators control the output of the generators by varying the generator field current. Each regulator has a manually-adjusted rheostat that allows setting the generator voltage to a desired value. After the voltage has been selected, the generator will maintain this voltage under varying generator load conditions.

6-52. REMOVAL OF VOLTAGE REGULATORS. (See figure 6-9.)

a. Remove regulator access hole cover located on the underside of the engine nacelle.

b. Remove screws attaching regulator mounting plate and lower regulator out of the wing.

c. Release spring clips holding regulator to regulator base and remove regulator.

6-53. INSTALLATION OF VOLTAGE REGULATOR. (See figure 6-9.)

a. Place regulator into base assembly and secure with the spring clips on the base.

b. Position the mounting plate with regulator and base attached, in place against the wing skin and secure with screws.

c. Replace regulator access hole cover and secure with screws.

6-54. ADJUSTMENT OF VOLTAGE REGULATOR.

NOTE

All checking or adjustment of the regulators must be made with the regulators at normal operating temperature. A warm up period of 15 minutes is required before adjustments can be made. The airplane should be facing the direction of the wind and an engine speed of approximately 1500 rpm maintained.

CAUTION

When only one engine is running, the generator switch for the inoperative generator must be turned OFF to prevent overloading the operating generator. Do not allow engine temperatures to exceed normal operating limits.

a. Shut off engines. Remove voltage regulator access hole covers and lower voltage regulators out of

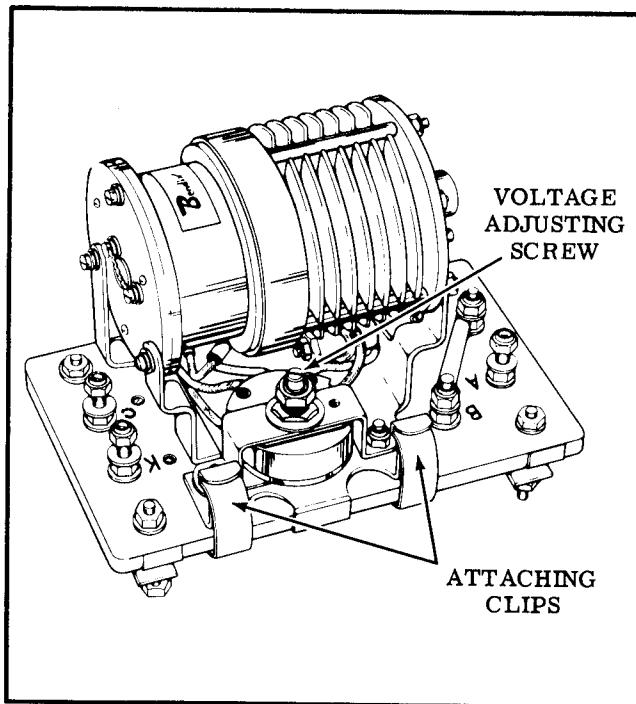


Figure 6-8. Voltage Regulator, 50-Ampere

nacelles.

b. Attach a pair of high-impedance headphones, with a 1-microfarad condenser in series with one lead, to terminals "A" and "C" on the right voltage regulator base.

c. Attach a 0-30 volt dc voltmeter between terminals "C" and "G" on the right voltage regulator base.

WARNING

Stay clear of propeller area during the remainder of the adjustment procedure.

d. Place left generator switch in OFF position. Turn off all electrical load.

e. Start right engine and accelerate to between 2000 and 2200 rpm.

f. Listen to headphones to hear operation of carbon pile. A steady hum or roar should be heard. If popping sounds are audible, replace regulator.

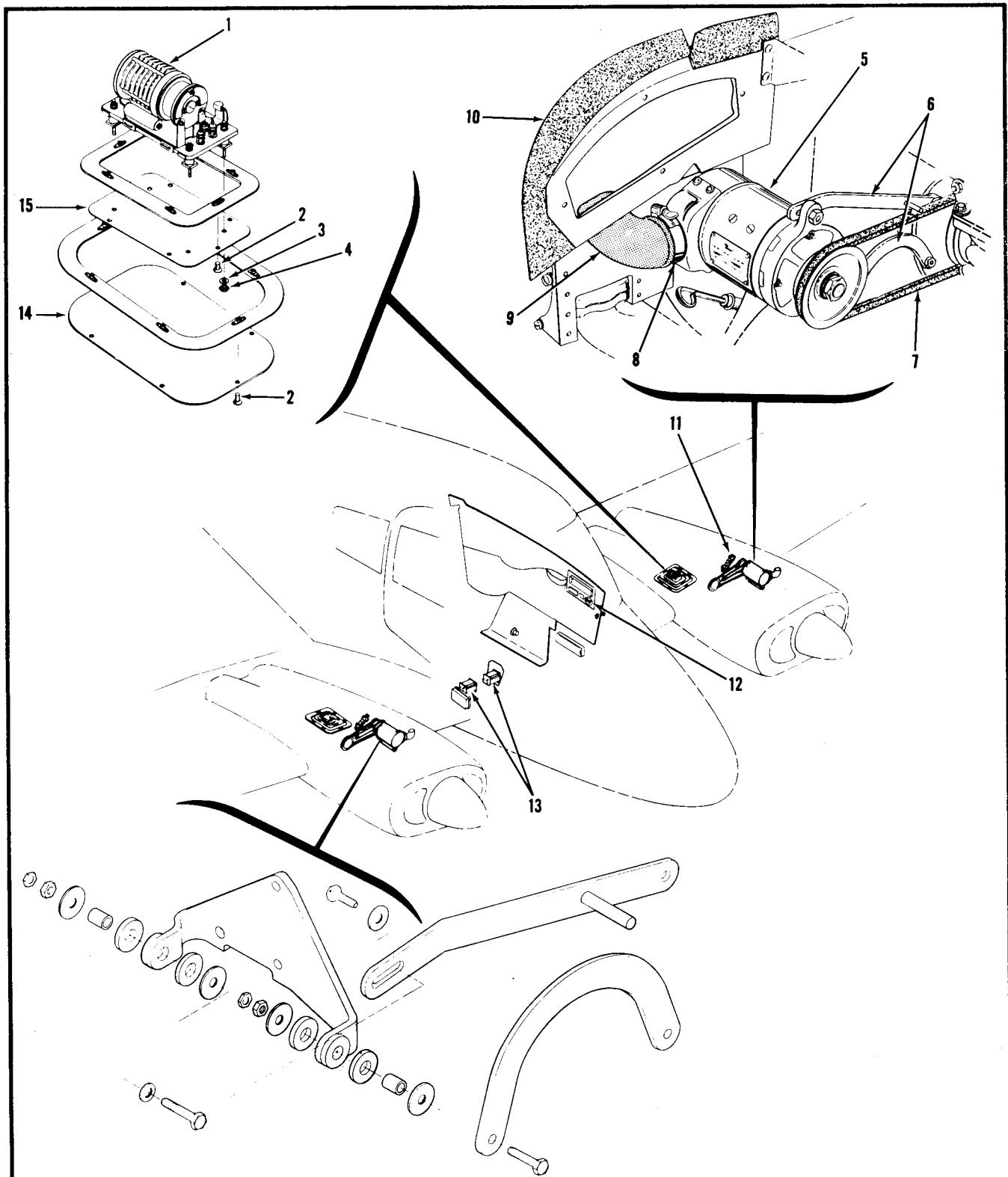
g. Apply as much load as possible to the regulator and listen for popping sounds. If popping sounds are heard, the regulator is unstable and should be replaced.

NOTE

Each time the load is applied or removed a popping noise will be heard as the switches are thrown. Do not confuse this sound with regulator instability.

h. Remove all load from the generator system.

i. Observe the reading on the voltmeter. The voltage should be 28 volts. If the voltage is not correct, adjust the rheostat on the regulator for proper reading.



- | | | |
|----------------------|-------------------------------|------------------------------|
| 1. Voltage Regulator | 6. Generator Support Brackets | 11. Paralleling Resistor |
| 2. Screw | 7. Generator Drive Belt | 12. Circuit Breakers |
| 3. Washer | 8. Clamp | 13. Reverse-Current Cutouts |
| 4. Nut | 9. Blast Tube | 14. Access Hole Cover |
| 5. Generator | 10. Engine Baffle | 15. Regulator Mounting Plate |

Figure 6-9. 50-Ampere Generator Power System

- j. Repeat the procedure listed in steps "b" through "i" to adjust the left regulator.
- k. Shut down the engines.

6-55. PARALLELING ADJUSTMENTS.

- a. Remove right front seat from airplane.
- b. Insert accurate 50-ampere ammeters in series with each generator output. Disconnect the wire attached to the BAT terminal of the reverse-current cutout and attach the ammeter in series with the wire and BAT terminal.

CAUTION

If 310 type ammeters are used, be sure the meters are shunted.

- c. Start engines and accelerate to between 2000 and 2200 rpm.
- d. Turn the left generator switch to OFF position and right generator to ON.
- e. Turn on enough electrical load to total 50 amperes on right generator circuit ammeter.
- f. Compare right circuit ammeter reading with left circuit ammeter by switching left generator switch ON and right generator switch OFF. The reading should be the same on both ammeters before proceeding. If readings do not agree, replace inaccurate ammeter.
- g. Turn both generator switches to ON position. Each ammeter should read 25 amperes within 10 percent accuracy.
- h. If ammeter readings differ by more than 10 percent, adjust the potentiometer on the voltage regulator to correct the current division. Adjust the voltage regulator that shows the greatest deviation from the 25 ampere reading.
- i. Increase generator load to maximum - do not exceed 100 amperes. Check amperage division between generator systems and readjust regulators if necessary.
- j. Measure bus voltage with accurate dc voltmeter. The voltage should be 28 volts. If the voltage is too high or too low, adjust voltage regulators by turning the potentiometers to increase or decrease voltage and at the same time maintain the current division of the generator systems.
- k. Proper paralleling will be achieved when the current division of the load indicates an equal amount on each ammeter and when the system voltage indicates 28 volts. If the system does not balance, generator or voltage regulator repair or replacement will be necessary.
- l. Shut off engines and replace the aircraft components which were removed.

6-56. REVERSE-CURRENT CUTOUTS. (See figure 6-9.) Two reverse-current cutouts are mounted on the copilot's seat support brackets. The units are protected against accidental short circuits by a plastic shield attached to the seat supports. The cutouts are incorporated in the generator power system as protective devices to prevent current flow to the generators when the voltage output of the generators is lower than the voltage of the aircraft bus. The cutout contains a contactor that is controlled by a voltage relay and a differential relay. The contactor will close when the generator voltage is between 20 and 24 volts and the

generator voltage exceeds the voltage on the aircraft bus by 0.35 to 0.65 volt. The contactor opens automatically to disconnect the generator from the aircraft bus when from 16 to 25 amperes of current is flowing from the bus to the generator.

6-57. REMOVAL OF REVERSE-CURRENT CUTOUT. (See figure 6-9.)

- a. Remove the copilot's seat according to paragraph 2-179.
- b. Remove the screws attaching the plastic shield to the seat support webs and remove the shield.
- c. Remove the wires from the terminals on the cutout and tag the wires for identification.
- d. Remove the three bolts, nuts, spacers, and washers securing the cutout to the seat support web and remove the cutout.

6-58. REPLACEMENT OF REVERSE-CURRENT CUTOUT. (See figure 6-9.)

- a. Attach cutout to seat support web with three bolts, spacers, washers, and nuts. Place long spacers on aft mounting bolts and short spacer on forward mounting bolts between cutout and seat web. Bolt heads should be outboard and a washer should be placed under each nut.
- b. Attach wires to terminals on cutout and remove identification tags.
- c. Install plastic shield and secure to seat webs with screws.
- d. Replace seat according to paragraph 2-181.

6-59. ELECTRICAL POWER DISTRIBUTION.

6-60. CIRCUIT BREAKER PANEL.

6-61. All electrical systems in the airplane are protected by circuit breakers. These circuit breakers are the "push-to-reset," one-hole mounting type, and are located in a circuit breaker panel on the left cabin wall just forward of the pilot's seat. The panel is covered by a metal door which is hinged along the bottom.

6-62. REMOVAL OF CIRCUIT BREAKER PANEL. (See figure 6-10.)

CAUTION

When removing the circuit breaker panel, the master switch must remain in the off position or the ground cable should be disconnected from the battery.

- a. Remove the four screws from the front of the circuit breaker panel.
- b. 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.

6-63. INSTALLATION OF CIRCUIT BREAKER PANEL. (See figure 6-10.)

- a. Smooth the upholstery around circuit breaker cutout.
- b. With circuit breakers, and all electrical leads installed, position circuit breaker panel thru circuit breaker cutout, and install four screws.

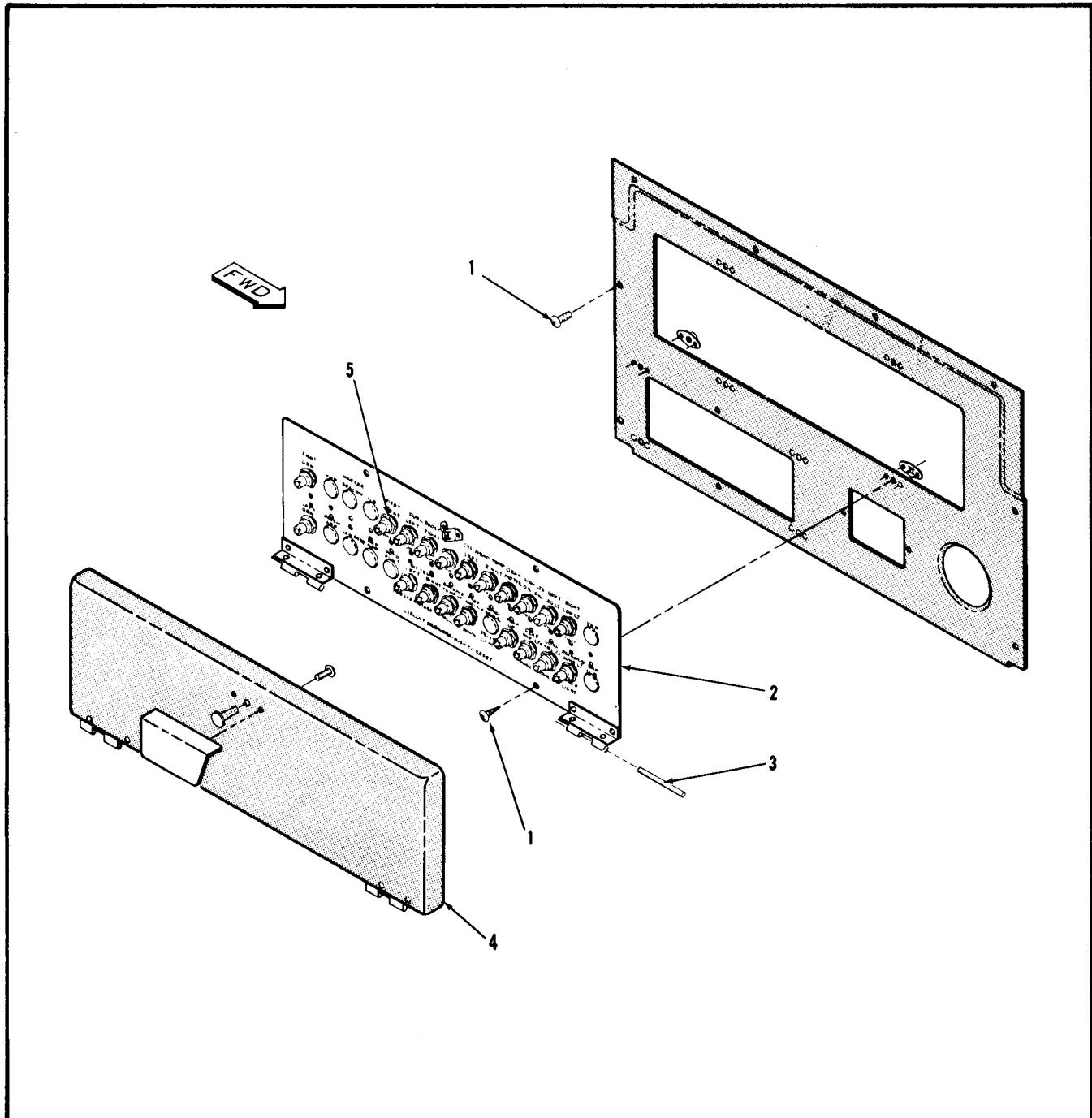
6-64. JUNCTION BOXES.

6-65. Two junction boxes are located within the cabin area of the fuselage to centralize and provide easy access to the lead terminals of electrical components situated throughout the aircraft. The left junction box is secured to the left cabin wall slightly below the circuit breaker panel. The right junction box is secured to the right cabin wall directly beneath the cabin door.

Small upholstery panels cover each junction box. These panels must be removed to permit the removal of installation of electrical leads within either junction box.

6-66. REMOVAL OF JUNCTION BOXES. (See figure 6-11.)

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.

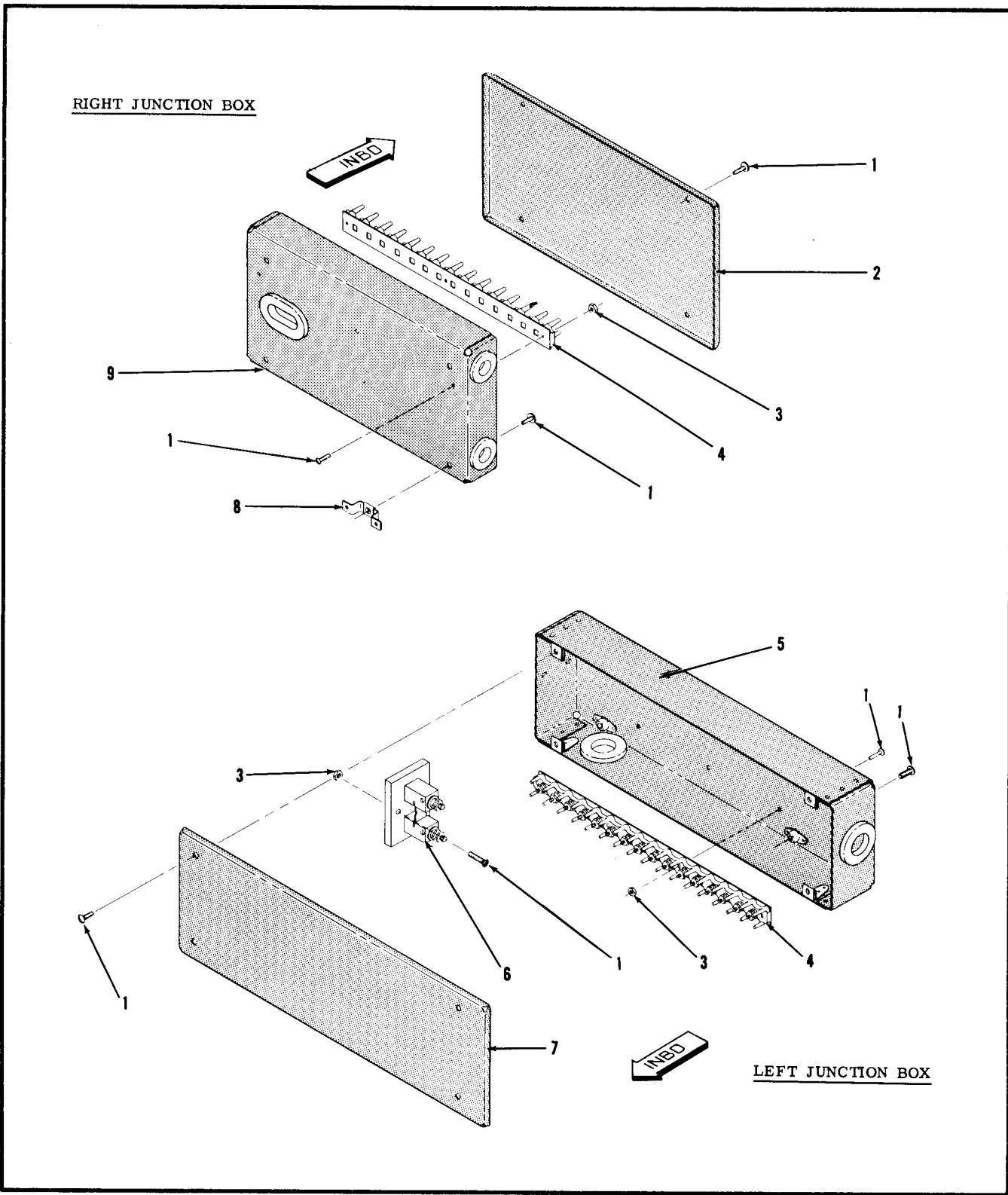


1. Screw
2. Circuit Breaker Panel

3. Hinge Pin

4. Circuit Breaker Door
5. Circuit Breaker

Figure 6-10. Circuit Breaker Panel Installation



- | | |
|-----------------------------|----------------------------|
| 1. Screw | 6. Shunt (Left box only) |
| 2. Right Junction Box Cover | 7. Left Junction Box Cover |
| 3. Nut | 8. Bracket |
| 4. Terminal Strip | 9. Right Junction Box |
| 5. Left Junction Box | |

Figure 6-11. Right and Left Junction Boxes

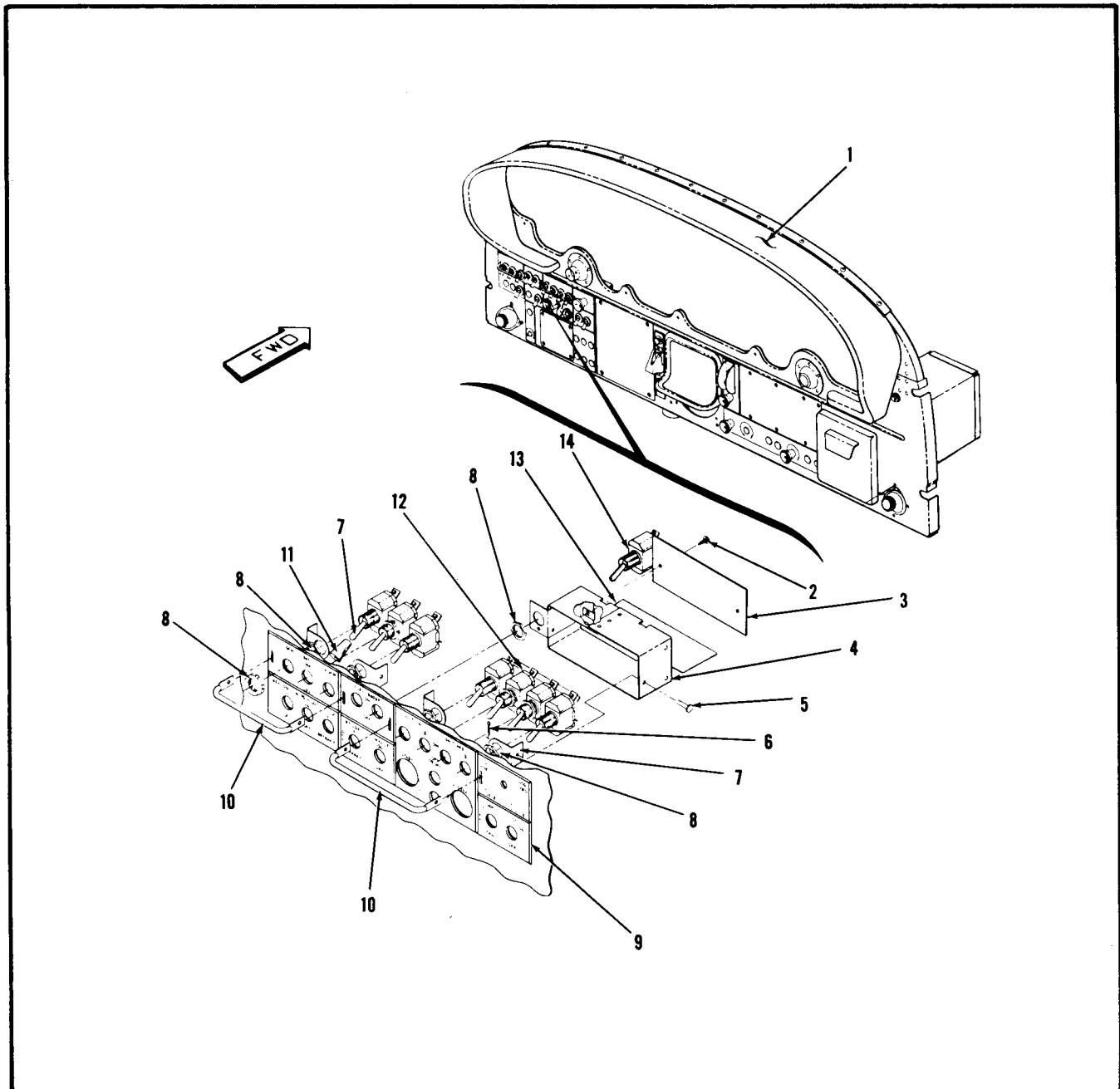
b. Access to the right junction box is accomplished by removing three screws along the forward end of the upholstery retaining strip (adjacent to the lower cabin door jamb) and one screw slightly forward of the door jamb, and pulling the small upholstery panel from under the retaining strip and away 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 strips. Pull the bundled leads from the junction box.

c. Remove the left 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



- | | | |
|-----------------------------------|-----------------------|-----------------------------|
| 1. Instrument Panel Hood | 6. Cotter Pin | 11. Decorative Switch Knob |
| 2. Screw | 7. Switch Bar Bracket | 12. Ignition Bus Bar |
| 3. Ignition Switches Shield Cover | 8. Nut | 13. Insulation Strip |
| 4. Ignition Switches Shield | 9. Decorative Panel | 14. Right Fuel Boost Switch |
| 5. Clevis Pin | 10. Switch Bar | |

Figure 6-12. Left Hand Switch Panel

Paragraphs 6-67 to 6-77

junction box to be removed. The four screws that mount the right junction box are accessible from the inside the cabin.

6-67. INSTALLATION OF JUNCTION BOXES. (See figure 6-11.)

a. Position the left junction box against the cabin wall and secure with four screws. The junction box must be held in position while the four screws are put into place from outside the cabin.

b. Route the wire bundles through the grommets and attach wires to the terminal strip and ammeter shunt.

c. The right junction box may be installed completely from inside the cabin. Fasten the box in place with four screws and attach the wiring to the terminal strip and ammeter shunt.

d. Replace the junction box covers, upholstery panels and wing fairing.

6-68. LEFT HAND SWITCH PANEL — 35000 thru 35546. (See figure 6-12.)

6-69. The left hand switch panel contains all instrument panel switches except the landing gear and flap control switches, the radio equipment switches, and various optional equipment switches. All switches contained on the panel are two-position, one-hole mounting, toggle-type switches except the two red-ringed push-button starter switches. A switch bar is positioned above the four ignition switches to permit their being turned off simultaneously. The battery switch and the two generator switches are also equipped with a switch bar. The left hand switch panel is illuminated by a combination switch panel and map light located on the left cabin wall above the circuit breaker panel. The instrument panel lights located in the front of the overhead lights console also provide a limited amount of switch panel illumination.

6-70. STATIONARY INSTRUMENT PANEL SWITCHES — 35547 and on. (See figures 6-12 and 6-13.)

6-71. The stationary instrument panel contains switches for control of all electrical circuits in the aircraft except the cabin heater circuit, pitot heater circuit, overhead cabin lights circuit and baggage light circuit. The cabin heater and pitot heater switches are mounted atop the control pedestal; the overhead cabin lights switches and baggage light switch are located adjacent to the lights they control.

6-72. REMOVAL AND REPLACEMENT OF SWITCHES. During removal and replacement of any switch except the battery switch, the battery switch must remain OFF. When removing or replacing the battery switch, disconnect the ground cable from the aft battery to prevent an accidental short circuit.

6-73. TYPICAL SWITCH REMOVAL AND REPLACEMENT. (See figures 6-12 and 6-13.)

a. Loosen and remove the decorative nut securing the switch to the switch panel and withdraw the switch from panel.

b. Tag and remove the wires from the switch.

c. To replace switch, reverse this procedure.

6-74. REMOVAL OF GENERATOR SWITCH. (See

figures 6-12 and 6-13.)

- a. Pull the decorative knob from the switch toggle.
- b. Remove cotter pin and pin securing switch bar to bracket.

c. Remove decorative nut securing generator switch to left switch and control panel.

- d. Tag and remove the wires from the switch.
- e. To remove bracket from switch, remove nut.

6-75. REPLACEMENT OF GENERATOR SWITCH.

(See figures 6-12 and 6-13.)

- a. Install bracket on switch in proper position and secure with nut.

b. Connect the wires to the switch and remove the identification tags.

c. Insert the switch through the left switch and control panel and secure switch to panel with decorative nut.

- d. Install pin and cotter pin securing switch bar to bracket.

6-76. REMOVAL OF IGNITION SWITCH. (See figure 6-12 and 6-13.)

a. Pull decorative knob from the switch toggle.

b. Remove two screws securing ignition switches shield cover to shield.

c. Using needle nose pliers, remove cotter pin from inboard switch bar pin.

d. Remove right fuel boost pump switch which secures outboard end of shield to left switch and control panel.

e. Remove shield and insulator strip.

f. Remove ignition bus bar from switches.

g. Remove the decorative nut securing the ignition switch to the left switch and control panel. If outboard switch is to be removed, remove cotter pin and pin securing switch bar to switch bar bracket and remove switch bar.

h. Tag and remove the wires from the switch.

i. Remove switch bar bracket by removing nut.

6-77. REPLACEMENT OF IGNITION SWITCH. (See figures 6-12 and 6-13.)

- a. Connect the wires to the switch and remove the identification tags.

b. If switch bar bracket was removed, place it on the switch and secure with nut.

c. Insert the switch through the left switch and control panel and secure with decorative nut.

d. Install ignition switches bus bar across upper terminals of switches.

e. If the outboard switch is being installed, install pin through switch bar and bracket and secure with cotter pin.

f. Install ignition switches shield around ignition switches and install right fuel boost pump switch to secure shield to left switch and control panel.

g. Insert switch bar pin through shield switch bar and switch bar bracket.

h. Install cotter pin through switch bar pin.

i. Position insulation strip inside ignition switches shield between lower terminals of switches and shield.

j. Position ignition switches shield cover over end of ignition switches shield and secure with two screws.

k. Press the decorative switch knob onto the switch toggle.

6-78. REMOVAL OF LANDING GEAR SWITCH. (See figure 6-13.)

- a. Unscrew and remove the wheel shaped knob from the switch.
- b. Unsnap the switch gate retainer ring and remove the switch gate.
- c. Remove the nut holding the switch to the panel and pull the switch from the rear of the panel.
- d. Tag and disconnect the wires from the switch.

6-79. REPLACEMENT OF LANDING GEAR SWITCH. (See figure 6-13.)

- a. Place two nuts on the switch shaft and run them down finger tight against the switch body.
- b. Attach the wires to the switch.
- c. Place the keyed washer on the switch shaft and position the switch on the instrument panel.
- d. Place another nut on the switch shaft from the front of the instrument panel. Tighten the nut only finger tight.
- e. Position the gate halves on the switch shaft and lock into place with the gate retainer clip.

NOTE

One gate half if keyed to fit the keyway on the switch shaft.

- f. Tighten the nut on the front side of the panel (counterclockwise) against gate.
- g. Tighten nuts on backside of panel counterclockwise on switch shaft until the switch is secure against panel. Be sure the keyed washer mates the small hole in the panel below the switch mounting hole.
- h. Screw the wheel shaped knob on the switch toggle.

6-80. REMOVAL AND REPLACEMENT OF LANDING GEAR INDICATOR LIGHT — 35000 thru 35749. (See figure 6-13.)

- a. Melt the solder securing the wire to the terminal on the light.
- b. Remove the nuts, washers and spacers from the light assembly and remove the light body from the instrument panel.
- c. To replace the light, reverse this procedure and refer to figure 6-13 for the sequence of parts to be reassembled.

6-81. REMOVAL AND REPLACEMENT OF LANDING GEAR INDICATOR LIGHT — 35749 and on. (See figure 6-13.)

- a. Melt the solder securing the wires to the terminals on the light and tag the wires.
- b. Remove the light lens and bulb.
- c. Loosen the nut holding the light assembly to the panel and remove the light.
- d. To replace the light, reverse this procedure. The lockwasher should be on the back side of the panel.

6-82. REMOVAL AND REPLACEMENT OF FLAP SWITCH.

- a. Unscrew the airfoil-shaped knob from the flap switch.
- b. Remove the decorative nut securing the flap switch to the right switch and control panel. Remove flap switch guard.

- c. Tag and remove the wires from the switch.
- d. To replace flap switch, reverse this procedure.

6-83. REMOVAL AND REPLACEMENT OF CABIN HEAT AND PITOT HEAT SWITCHES — 35547 and on. (See figure 6-13.)

- a. Remove the four screws securing the switch mounting plate to the top of the control pedestal and lift the mounting plate up to gain access to the wire connections on the switch.
- b. Remove the decorative nut securing the switch to the mounting plate.
- c. Tag and disconnect the wires from the switch.
- d. To install the cabin heat or pitot heat switches, reverse this procedure.

6-84. REMOVAL AND REPLACEMENT OF INTERIOR LIGHTS RHEOSTAT SWITCHES — 35547 and on.

- a. Loosen setscrew securing rheostat knob using a 3/32 inch Allen wrench and remove rheostat knob.
- b. Remove nut securing rheostat to left switch and control panel and remove rheostat from panel.
- c. Tag and remove the wires from the rheostat.
- d. To replace an interior lights rheostat switch, reverse this procedure.

6-85. INTERIOR LIGHTING — 35000 thru 35546.

6-86. Cabin lighting equipment consists of a front dome light and instrument light console panel, a rear dome light, a switch panel and map light, and a fuel selector valve light. Each light assembly is located to give maximum illumination at a desired point. A baggage compartment light is provided to aid in loading and unloading the baggage compartment during night operations. Switches or rheostats, as each light may require, are positioned adjacent to the instrument and front dome light, rear dome light, and baggage compartment light. A rheostat switch, located on the left side of the engine control pedestal directly below the elevator trim wheel, controls the switch panel and map light, and the fuel selector valve light.

6-87. INTERIOR LIGHTING — 35547 and on.

6-88. Cabin lighting equipment consists of post-type instrument and switch panel lights, radio dial lights, a compass light, an overhead dome and floodlight console panel, a rear dome light, and a fuel selector valve light. In addition, the baggage compartment is provided with a light in the outer wall of the compartment near the door. All lights are protected by push-to-reset circuit breakers and receive their power from the aircraft bus.

6-89. FRONT DOME AND INSTRUMENT LIGHTS CONSOLE PANEL — 35000 thru 35546. (See figure 6-14.)

6-90. The front dome and instrument lights console panel is located on the cabin ceiling directly above the front seats. Three instrument lights are located within the forward end of the panel. The middle light has a red lens and is capable of illuminating the entire instrument panel. The two outside lights are ultraviolet,

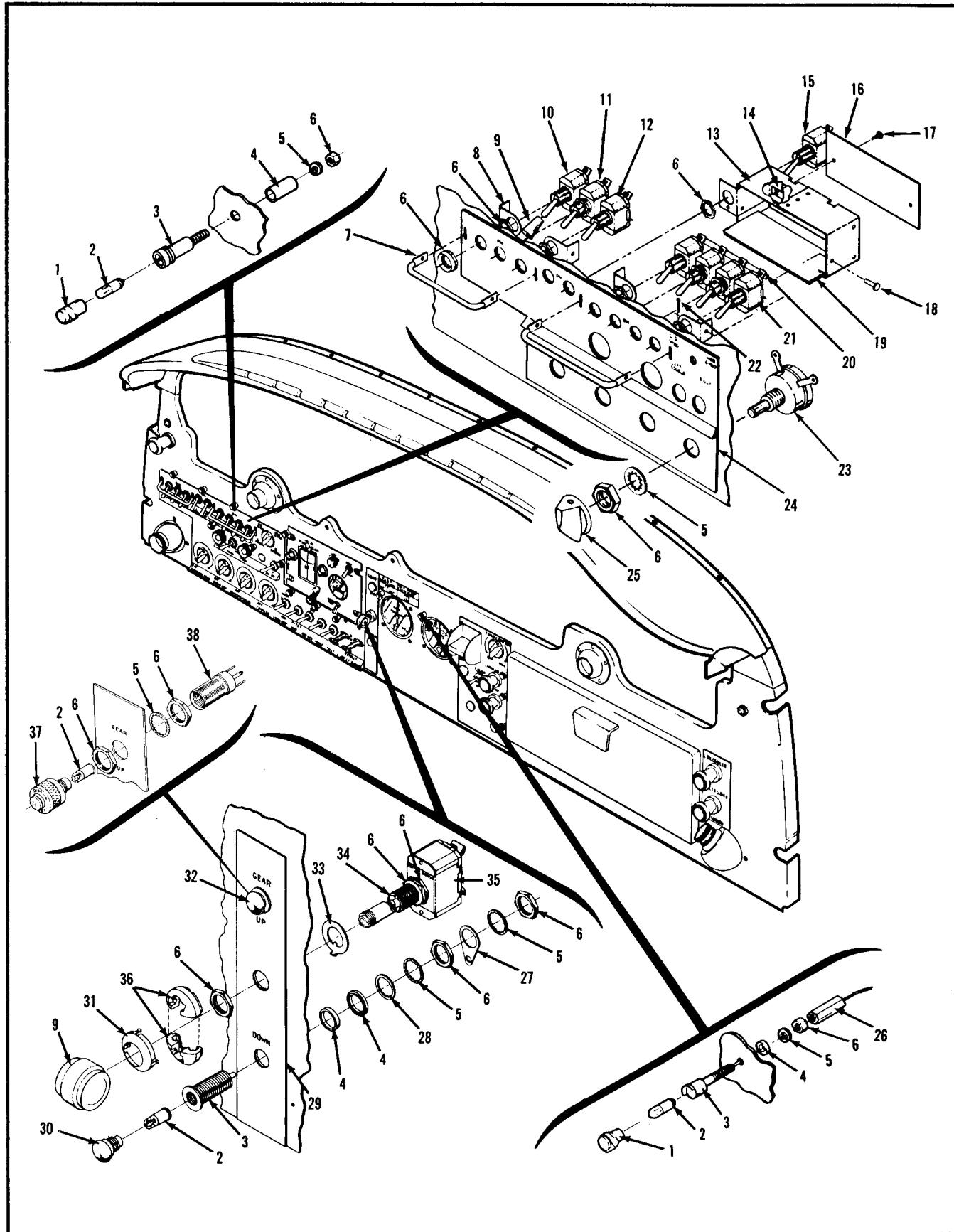


Figure 6-13. Stationary Instrument Panel Switches

Figure 6-13. Stationary Instrument Panel Switches

- | | | |
|------------------------------|-----------------------------------|-------------------------|
| 1. Hood | 14. Tinnerman Nut | 26. Connector |
| 2. Lamp | 15. Right Fuel Boost Switch | 27. Ground Lug |
| 3. Light Body | 16. Ignition Switches Shield | 28. Washer |
| 4. Spacer | 17. Screw | 29. Decorative Panel |
| 5. Lockwasher | 18. Switch Bar Hinge Pin | 30. Lens Cap |
| 6. Nut | 19. Insulation Strip | 31. Gate Retainer Clip |
| 7. Switch Bar | 20. Ignition Bus Bar | 32. Indicator Light |
| 8. Switch Bar Bracket | 21. Ignition Switch | 33. Keyed Washer |
| 9. Decorative Knob | 22. Cotter Pin | 34. Switch Shaft |
| 10. Left Generator Switch | 23. Campass Light Rheostat | 35. Landing Gear Switch |
| 11. Battery Switch | 24. Left Switch and Control Panel | 36. Gate |
| 12. Right Generator Switch | 25. Knob | 37. Lens Cap |
| 13. Ignition Switches Shield | | 38. Socket |

and are used to illuminate the fluorescent dials and numbers on the instruments. The ultraviolet lights are controlled by two starter buttons mounted directly behind the lights and by the left rheostat switch. The front dome light is located in the rear of the console panel and is controlled by a slide switch just forward of the light. The red instrument light is controlled by the right rheostat switch.

6-91. FRONT DOME AND INSTRUMENT LIGHTS CONSOLE PANEL — 35547 and on. (See figure 6-14.)

6-92. The overhead console panel is located on the cabin ceiling above the front seats. Three auxiliary instrument lights are located in the forward end of the panel. The lights are controlled by two rheostat switches located on the console panel. The right rheostat controls the white light and the left rheostat controls the two red lights. The front dome light is located just aft of the rheostats and is controlled by a slide switch located just forward of the rheostats.

6-93. REMOVAL AND REPLACEMENT OF FRONT DOME AND INSTRUMENT LIGHT CONSOLE. (See figure 6-14.)

a. Four screws on the bottom of the console panel secure the panel to the ceiling. When the screws are removed the panel may be lowered about eight inches for repair and bulb replacement. If complete removal of the console is necessary, tag and disconnect the electrical wiring. When replacing the console, route the wiring carefully so it does not interfere with the operation of the rheostats. On later aircraft a shield is provided to cover the rheostats.

6-94. INSTRUMENT PANEL LIGHTS — 35547 and on. (See figures 6-14 and 6-15.)

6-95. The instrument panel and some radio control panels are illuminated by red post lights. Operation of the lights is controlled by three rheostat switches located along the lower left edge of the stationary instrument panel. Additional instrument panel illumination is provided by flood lights mounted in the front of the overhead lights console panel.

6-96. REMOVAL AND REPLACEMENT OF INSTRUMENT LIGHTS. (See figure 6-15.)

a. To remove a post instrument light, remove the wire connector from the light and remove the nut,

lockwasher and spacer securing the light to the stationary instrument panel.

b. To replace a post instrument light, reverse this procedure.

c. To remove an eyebrow type instrument light, cut the wire to the light and remove the two screws securing the light to the instrument panel.

d. To replace an eyebrow instrument light, feed the light wire through the hole in the instrument panel and secure the light to the panel with two screws. Install a permanent splice to join the wire together.

6-97. SWITCH PANEL AND MAP LIGHT — 35000 thru 35546.

6-98. A switch panel and map light is mounted on the left cabin wall just above the circuit breaker panel. The light illuminates the switch panel and circuit breaker panel as well as serving as a map light. The light is adjustable directionally and incorporates a lens adjustment knob, integrally mounted on the rear of the light, which makes it possible to change the beam from spot to flood illumination.

6-99. REMOVAL OF SWITCH PANEL AND MAP LIGHT.

a. For bulb removal, grasp the cylindrical lens section of the light, and while holding bulb retainer rigid, pull the lens section off. Push bulb in and twist it to the left to unlock it, and pull bulb free of the light.

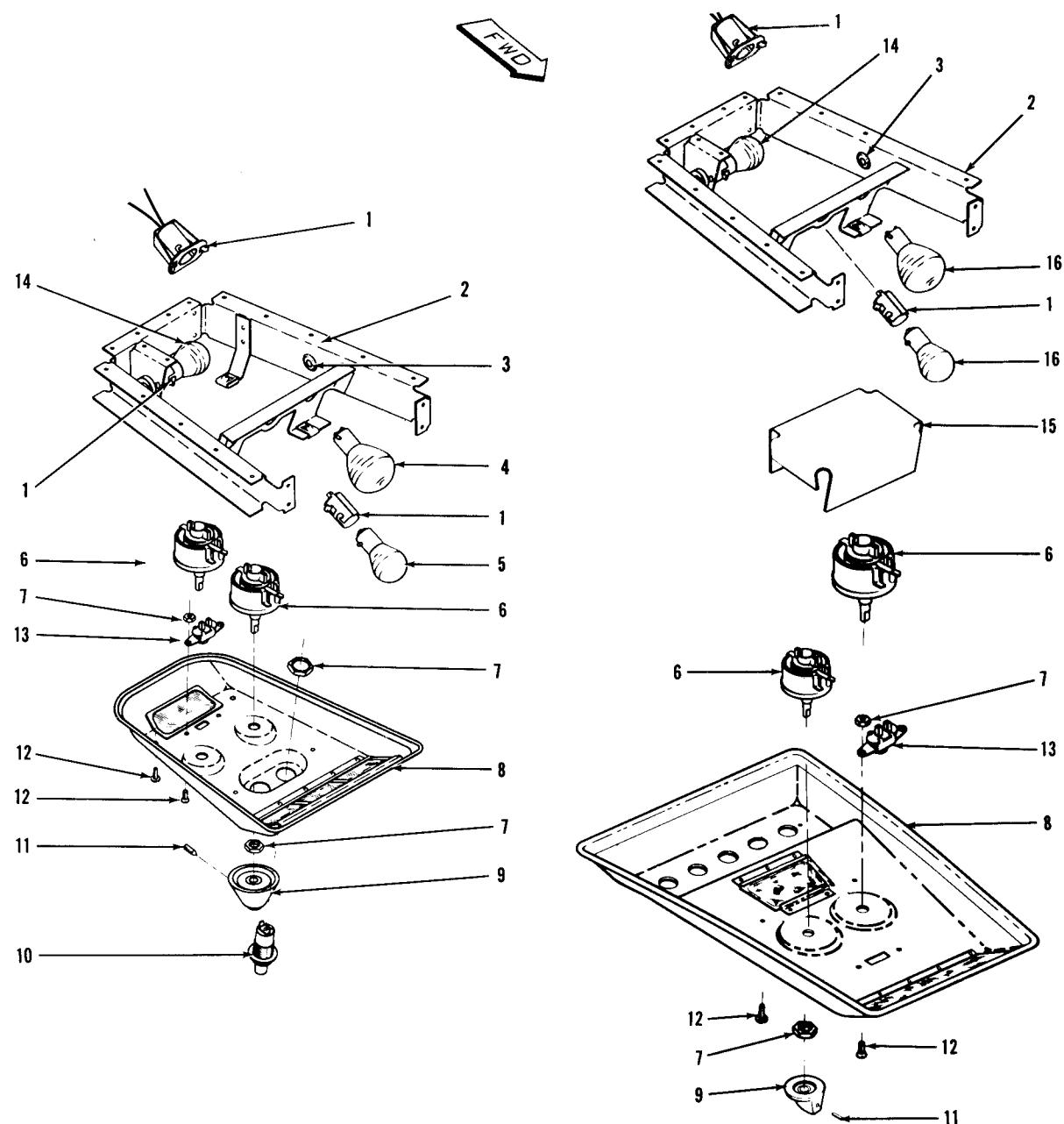
NOTE

A sufficient amount of slack is left in the light electrical lead to permit the light to be pulled out for ease of maintenance.

b. For complete removal of the light from the airplane, first remove the light lens section and bulb as described above. Loosen the screw and nut on the light retaining clamp sufficiently to allow the removal of the bulb retainer from the clamp. Pull the bulb retainer out a short distance. Slide the bulb retainer back along the electrical lead. A quick-disconnect will become visible at the end of the electrical lead. Cut the quick-disconnect from the end of the electrical lead and pull the bulb retainer from the airplane.

6-100. INSTALLATION OF SWITCH PANEL AND MAP LIGHT.

a. Position the bulb retainer of the map light over the

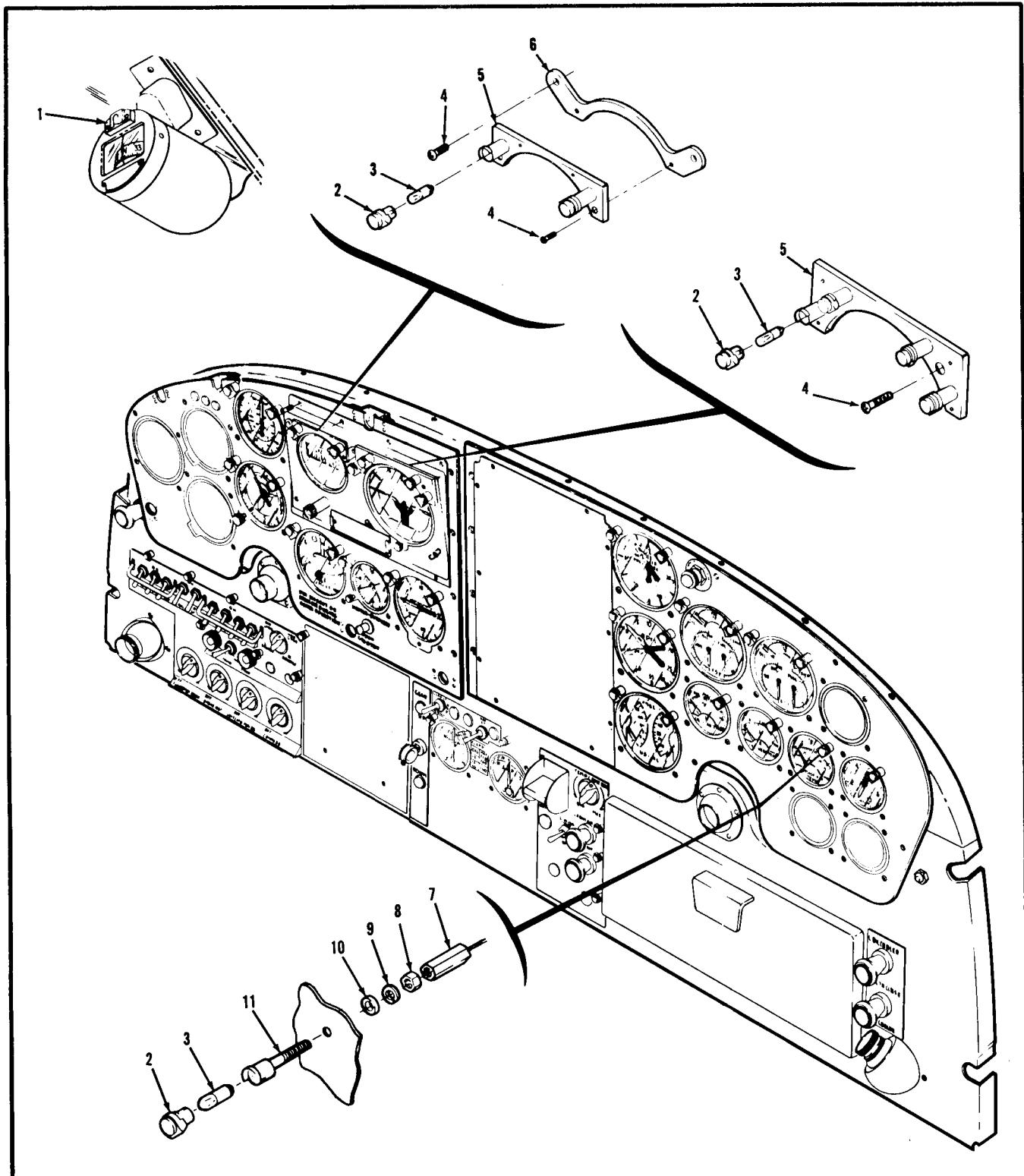


35000 THRU 35546

35547 & ON

- | | | |
|---------------------|--------------------------------|-----------------------|
| 1. Lamp Socket | 6. Rheostat | 12. Screw |
| 2. Console Bracket | 7. Nut | 13. Dome Light Switch |
| 3. Grommet | 8. Console Cover | 14. Dome Lamp |
| 4. Ultraviolet Lamp | 9. Knob | 15. Rheostat Shield |
| 5. Instrument Lamp | 10. Ultraviolet Starter Switch | 16. Flood Lamp |
| | 11. Setscrew | |

Figure 6-14. Front Dome and Instrument Light Console



- | | |
|-----------------------|----------------|
| 1. Compass Lamp Cover | 7. Connector |
| 2. Hood | 8. Nut |
| 3. Lamp | 9. Lockwasher |
| 4. Screw | 10. Spacer |
| 5. Instrument Light | 11. Light Body |
| 6. Mounting Plate | |

Figure 6-15. Instrument Panel Lights (35547 and on)

light electrical lead. Thread the thin insulating spacer, the spring, and the thick insulating spacer over the electrical lead. Remove approximately 3/8 inch of insulation from the end of the lead, and crimp a quick-disconnect contactor on the lead. Slide the thick insulating spacer, spring, thin insulating spacer, and bulb retainer of the map light up against the quick disconnect. Insert the bulb in the bulb retainer, and twist the bulb to the right to lock it in position. Place the cylindrical lens section of the map light over the installed bulb and lock it in place with the spring clip which encircles the bulb retainer.

NOTE

If the light retaining clamp was removed during the removal of the light, it must be reinstalled over the ball fitting located above the circuit breaker panel.

- b. Insert the end of the bulb retainer in the light retaining clamp. Tighten the screw and nut on the light retaining clamp until the light is held securely. Test the light assembly for ease of movement in all directions. Push the excess length of light electrical lead back into the cabin wall.

NOTE

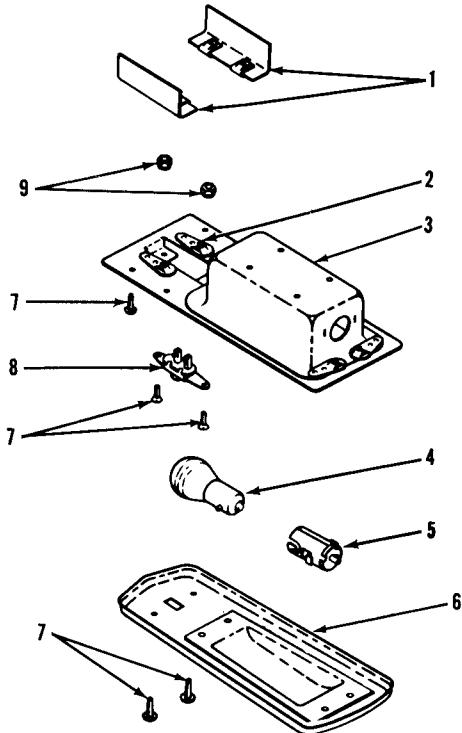
A sufficient amount of slack is left in the electrical lead during manufacture of the airplane so that the light may be removed and installed several times, if required, before the electrical lead becomes too short for proper installation.

6-101. FUEL SELECTOR VALVE LIGHT.

6-102. A fuel selector valve light is mounted on the forward side of the front spar directly above the two fuel selector valves. The degree of brilliancy of the red light is controlled by a rheostat located on the left side of the engine control pedestal. Both the fuel selector valve light and the switch panel and map light are controlled by the same rheostat.

6-103. REMOVAL OF FUEL SELECTOR VALVE LIGHT.

- a. Loosen and remove the two screws securing selector valve light cover to the spar. Remove the cover.
- b. Push the bulb up, twist it to the left to unlock it, and remove the bulb from the socket.
- c. Straighten the tabs of the bulb socket, and push the socket down and out of the socket bracket.



1. Shields
2. Nutplate
3. Housing Box
4. Lamp
5. Socket

6. Cover Assembly
7. Screws
8. Switch
9. Nuts

Figure 6-16. Rear Dome and Baggage Light

d. Loosen the small screw securing the electrical lead to the socket. Pull the lead from the socket.

6-104. 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 screw.

c. Push the bulb up into the socket and twist it to the right to lock into position.

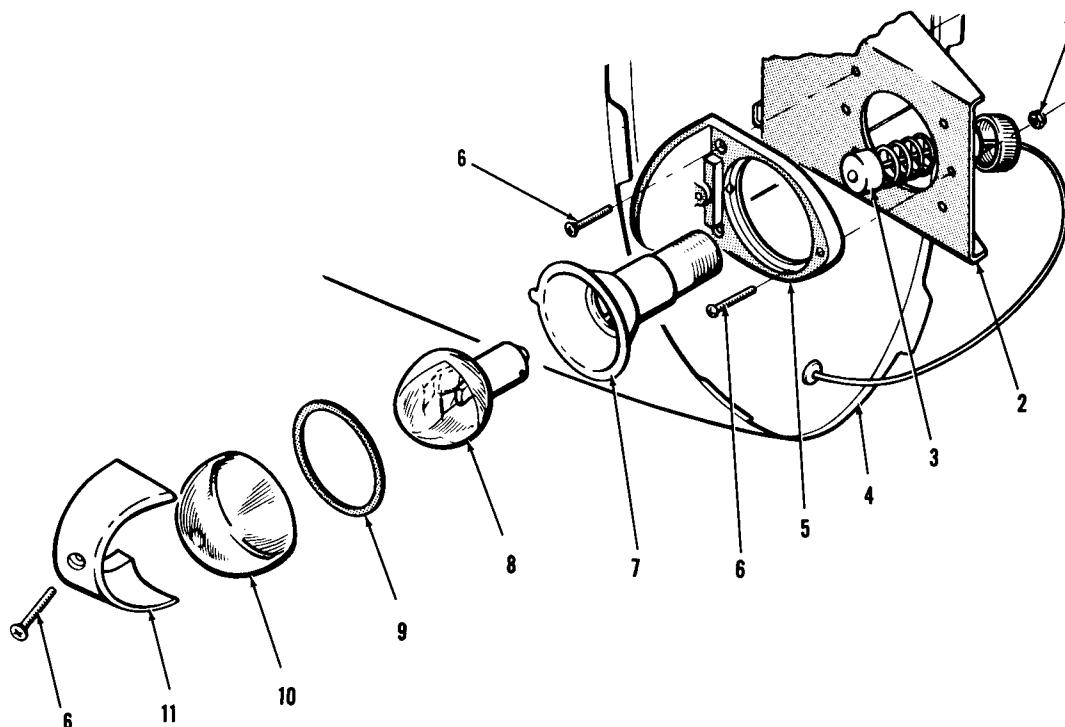
d. Position the fuel selector valve light cover, and install two screws to secure it in place.

6-105. REAR DOME LIGHT AND BAGGAGE LIGHT.

6-106. The rear dome and baggage lights are identical units. Each light has a cover held in place with four screws which when removed gives access to the lamp and switch. The switch is secured within the light by two screws.

6-107. EXTERIOR LIGHTS.

6-108. Standard exterior lighting equipment on the airplane consists of wing and tail navigation lights, including a navigation light blinker system, and a landing light in the left wing. Optional lighting equipment which may be installed consists of a right wing landing light, a taxi light, a de-ice light and a rotating beacon light.



- 1. Nut
- 2. Bracket
- 3. Contact Assembly
- 4. Tip Tank Nacelle
- 5. Light Housing
- 6. Screw

- 7. Socket
- 8. Bulb
- 9. Rubber Washer
- 10. Lens
- 11. Lens Retainer

Figure 6-17. Wing Navigation Light Installation

6-109. TROUBLE SHOOTING EXTERIOR LIGHTS.

TROUBLE	PROBABLE CAUSE	CORRECTION
ONE NAVIGATION LIGHT IS OUT.	Lamp burned out.	Replace lamp.
	Defective wiring.	Inspect wiring from J-Box to light.
	Defective lamp socket.	Replace light.
ALL NAVIGATION LIGHTS ARE OUT.	Circuit breaker out.	Check/reset circuit breaker.
	Defective wiring or navigation lights switch.	Check/repair or replacing wiring. Replace switch.
NAVIGATION LIGHTS DO NOT BLINK.	Defective flasher unit.	Replace flasher unit.
GEAR INDICATOR LIGHT GOES OUT WHEN NAV LIGHTS ARE TURNED ON.	Dimming resistor failure on nav light switch.	Replace.
LANDING LIGHT EXTENDS BUT DOES NOT LIGHT.	Circuit breaker out.	Check/reset circuit breaker.
	Lamp burned out.	Replace lamp.
	Defective wiring.	Check/repair or replace wiring.
LANDING LIGHT WILL NOT EXTEND.	Circuit breaker out.	Check/reset breaker.
	Defective wiring or switch.	Check/repair or replace wiring. Replace landing light switch.
LANDING LIGHT WILL NOT RETRACT.	Circuit breaker out.	Check/reset breaker.
	Defective wiring.	Check/repair or replace wiring.
ROTATING BEACON LIGHTS BUT DOES NOT ROTATE. (35547 and on).	Defective jumper wire.	Check/repair or replace jumper.
	Defective motor.	Replace motor.
TAXI LIGHT DOES NOT OPERATE.	Circuit breaker out.	Check/reset circuit breaker.
	Defective wiring or switch.	Check/repair or replace wiring. Replace switch.
	Lamp burned out.	Replace lamp.

6-110. NAVIGATION LIGHTS.

6-111. The aircraft is equipped with standard navigation lights consisting of a red light in the nose of the right wing tip tank, a green light in the nose of the left wing tip tank and a clear light on the tip of the fuselage stinger. A flasher is incorporated in the circuit which blinks the lights at regular intervals. The flasher is of the "safety-fail" type which will not open the circuit if it becomes defective. Operation of the navigation lights is controlled by a two-position toggle switch which is located on the left hand switch panel on aircraft prior to serial 35547. On later aircraft, the switch is located in the middle of the stationary instrument panel.

6-112. WING NAVIGATION LIGHTS.

6-113. REMOVAL AND REPLACEMENT OF WING NAVIGATION LIGHTS. Figure 6-17 shows the parts of the wing navigation lights installation and the order of removal and replacement.

6-114. NAVIGATION LIGHT FLASHER.

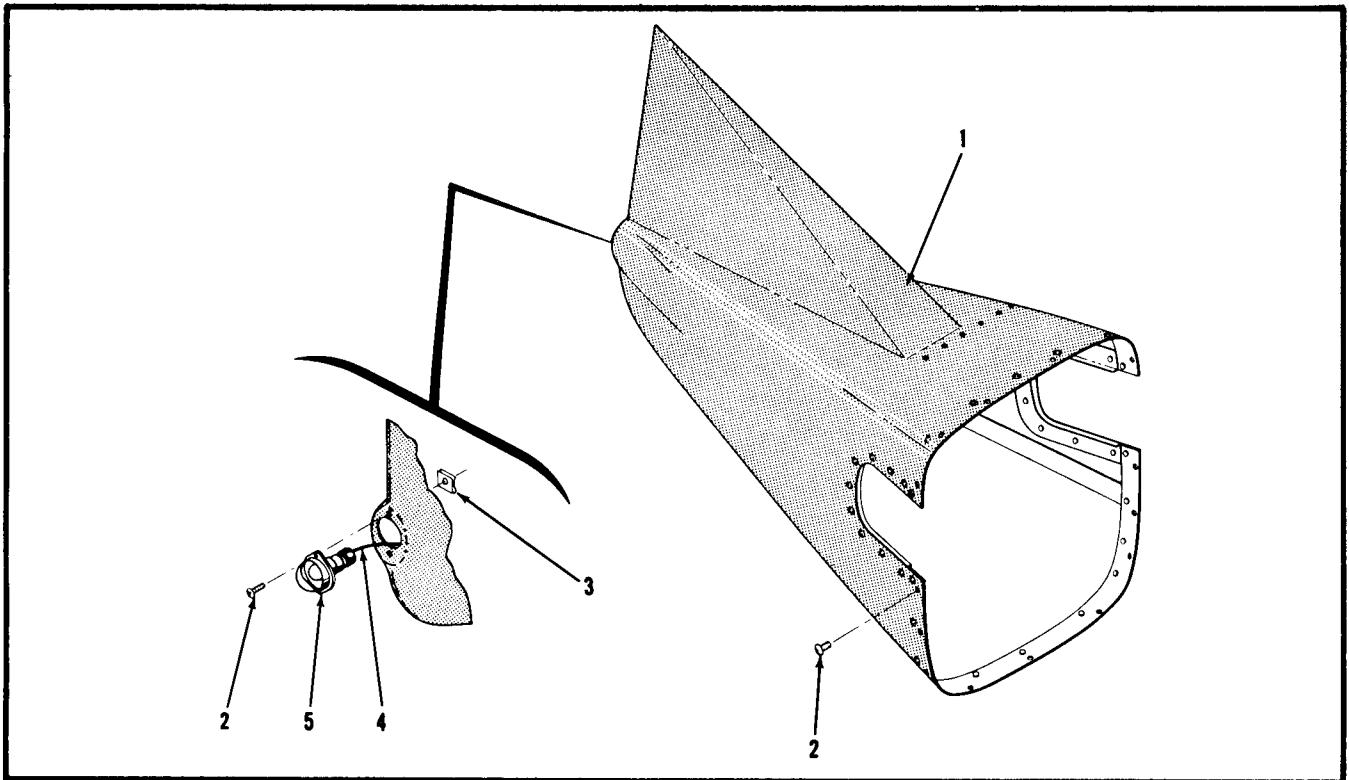
6-115. The navigation light flasher is mounted on the cabin side of the Sta. 0.00 nose bulkhead. The flasher is connected in series with the navigation lights. Timing of the flashes is determined by a timing cartridge mounted inside the flasher. The cartridge is held in place by a set of clips that allow rapid replacement. A relay actuated by the timing unit performs the

actual switching. The flasher contains a noise filter circuit to prevent interference with radio equipment. In the event of flasher failure the navigation lights will remain turned on. The flasher cartridge may be checked by removing the flasher cover and placing a jumper across the cartridge. If the relay opens, the cartridge should be replaced. The flashing rate should be between 60 and 120 flashes per minute. If this rate is not maintained by the flasher unit the cartridge should be replaced. Careful inspection of the relay contacts should be made during maintenance for excessive pitting.

6-116. REMOVAL AND REPLACEMENT OF NAVIGATION LIGHT FLASHER. The navigation light flasher is secured to the bulkhead by three screws. The screws pass through grommets in the flasher base and into nutplates which are riveted to the bulkhead. The grommets provide a shock resistant mounting for the flasher. When a flasher is installed the screws should be tightened only enough to prevent the flasher from moving freely but not so tight as to compress the grommets. The wiring to the unit is provided with disconnects for easy removal. A ground wire is attached to a bulkhead support angle with a screw and nut.

6-117. TAIL NAVIGATION LIGHT.

6-118. The rear navigation light is mounted in the end of the fiberglas stinger. This necessitates two wires for the light, one for power and the other a ground return. The ground return wire is grounded



1. Stinger Assembly
2. Screw

3. Tinnerman Nut

4. Electrical Wires
5. Tail Light Assembly

Figure 6-18. Tail Navigation Light Installation

to the airframe at the rear fuselage bulkhead. On 310 models that have an ADF loop antenna mounted in the stinger the navigation light wires are twisted together and tied. This procedure has been adopted to minimize the possibility of noise being transferred to the antenna from the wiring. When it is necessary to service the wiring it should be replaced in this manner when the aircraft is equipped with an ADF loop antenna.

6-119. REMOVAL AND REPLACEMENT OF THE TAIL NAVIGATION LIGHT. (See figure 6-18.)

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 this procedure.

6-120. LANDING LIGHTS.

6-121. A retractable landing light is installed as standard equipment on the lower surface of the left wing. An identical landing light may be installed on the right wing as optional equipment. The landing lights are controlled from switches located on the stationary instrument panel. On aircraft prior to serial 35547 the right landing light switch also oper-

ates the taxi light circuit. On later aircraft a separate taxi light switch is provided adjacent to the landing light switches.

6-122. REMOVAL OF LANDING LIGHT. (See figure 6-19.)

- Support the light assembly and remove the fifteen screws which secure it to the wing skin.
- Lower the light assembly out of the wing and place it on a stand of suitable height.

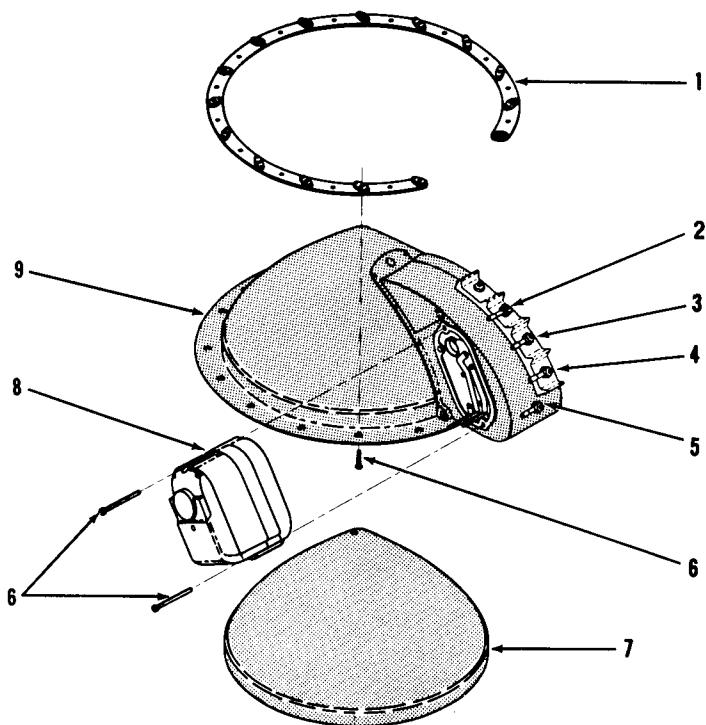
NOTE

The wiring to the light contains sufficient slack to permit the light assembly to be brought down below the wing for removal of the 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.

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



- | | | |
|--------------------|----------------------|-----------------|
| 1. Retainer Band | 4. "Close" Terminal | 7. Lamp |
| 2. "Lamp" Terminal | 5. "Ground" Terminal | 8. Power Unit |
| 3. "Open" Terminal | 6. Screw | 9. Lamp Housing |

Figure 6-19. Landing Light Installation

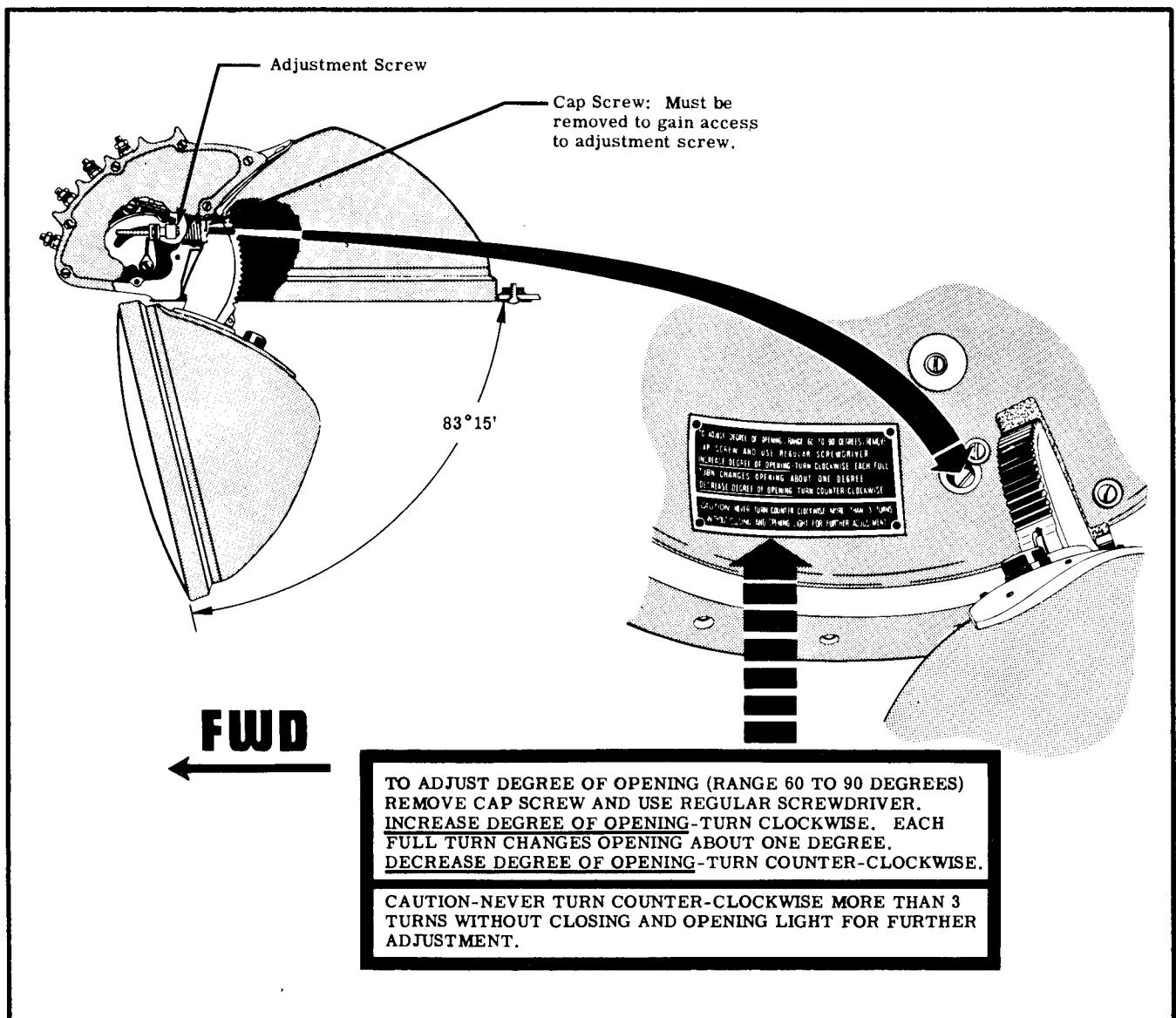


Figure 6-20. Adjustment of Landing Light

ground terminals.

- e. The power unit may be removed from the light assembly by removing the two screws which secure the power unit to the housing.

6-123. LUBRICATION OF LANDING LIGHTS.

Lubricate the landing lights according to figure 1-6.

6-124. REPLACEMENT OF LANDING LIGHT. (See figure 6-19.)

- 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 necessary to extend the light approximately 60 degrees to gain access to the retainer band.

- c. Position the retainer ring inside the wing with the open side forward and tape it to the wing skin 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 fifteen 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.

6-125. ADJUSTMENT OF LANDING LIGHT. (See figure 6-20.) Landing lights are adjusted in the factory to extend to an angle of 83 degrees, 15 minutes from the fully retracted position. The angle of extension may be altered by means of an adjustment screw as illustrated in figure 6-20.

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 settings which control 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:

- 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

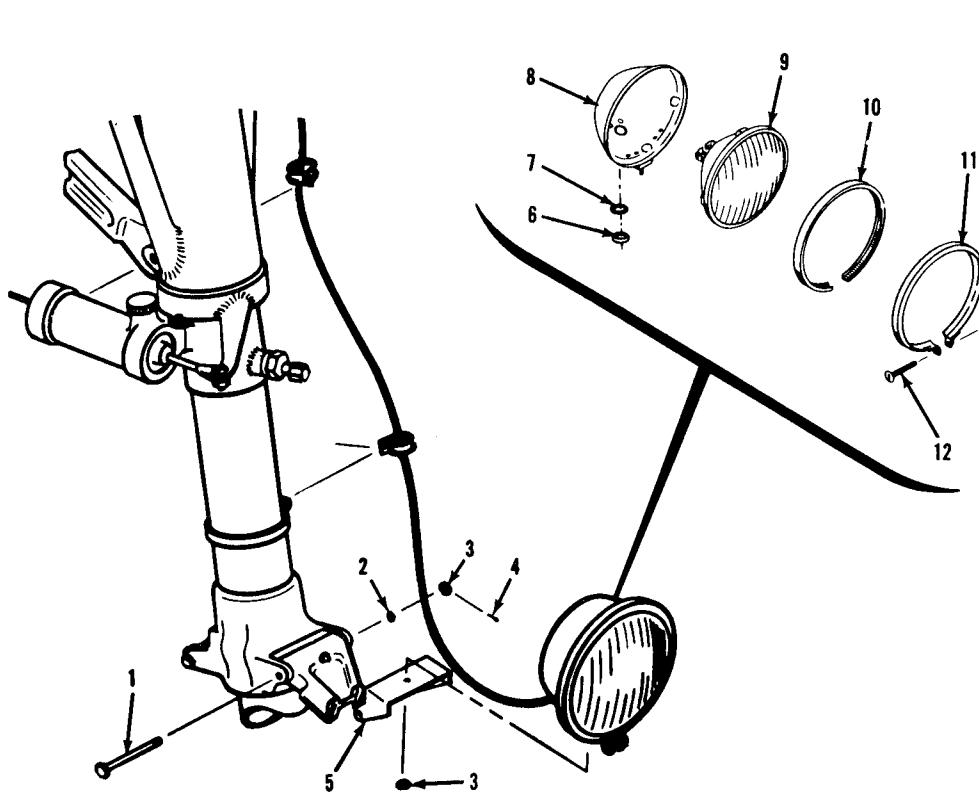
Two blocks of equal thickness may be placed on the retainer band to raise the protractor so it will clear the surface of the lamp for a more positive location of the protractor.

- 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.

- Retract the light to the full up position, fully extend the light, and check the angle of extension.

6-126. TAXI LIGHT.

6-127. A taxi light, which is provided as optional equipment, is mounted just above the torque links on the nose wheel shock strut. On aircraft prior to 35547, operation of the taxi light is controlled by the right landing light switch. The taxi light operates when the switch is in the down ("RETRACT & TAXI") position. Later aircraft are provided with a taxi light



- | | | |
|---------------|---------------------|-------------------|
| 1. Bolt | 5. Mounting Bracket | 9. Lamp |
| 2. Washer | 6. Knurled Nut | 10. Gasket |
| 3. Nut | 7. Grommet | 11. Retainer Band |
| 4. Cotter Pin | 8. Canopy | 12. Screw |

Figure 6-21. Taxi Light Installation

switch which is mounted on the stationary instrument panel near the landing light switch.

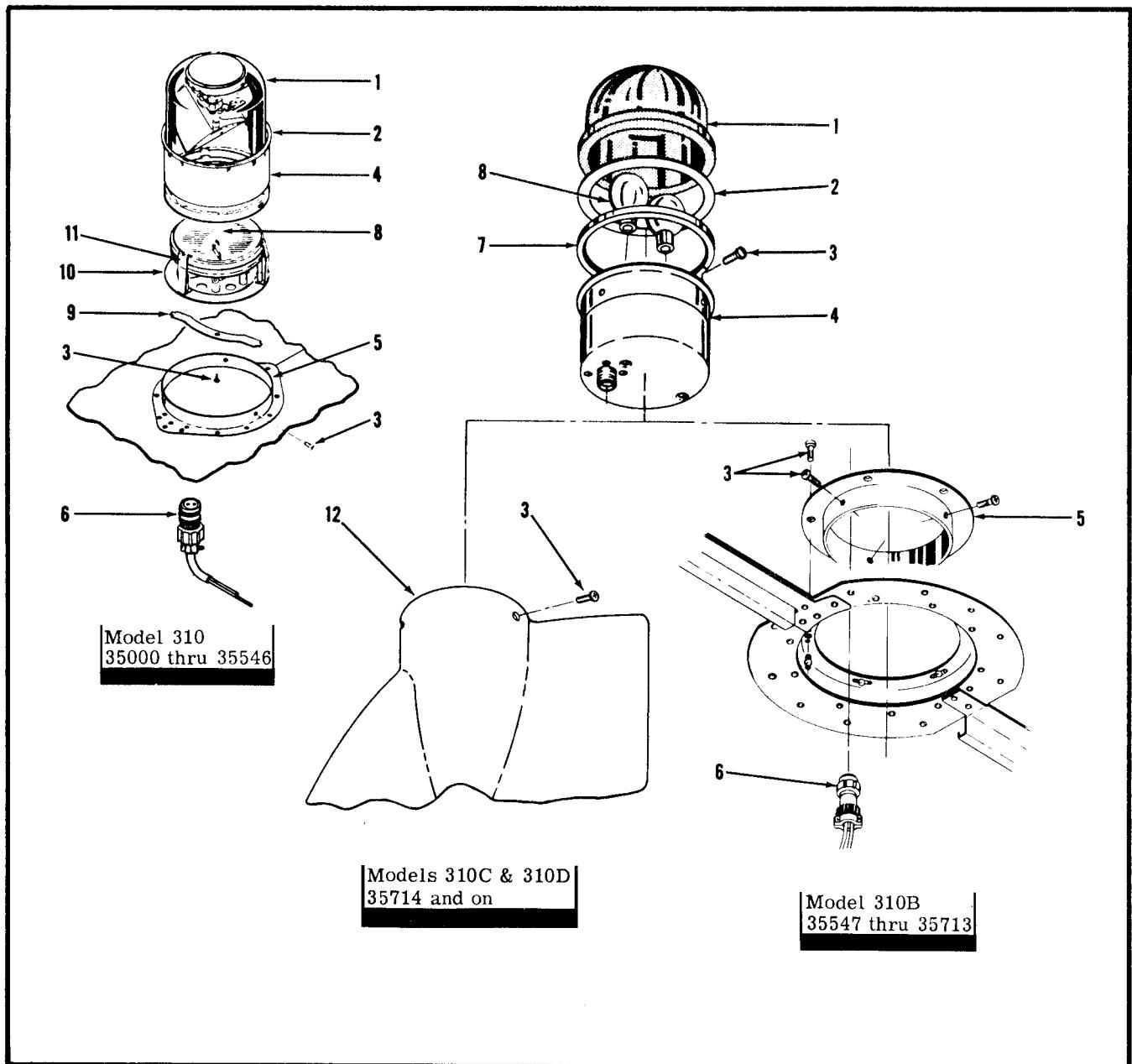
6-128. REMOVAL AND INSTALLATION OF TAXI LIGHT. (See figure 6-21.) The components of the taxi light installation and the order of their removal and installation is clearly shown in figure 6-21.

6-129. ADJUSTMENT OF TAXI LIGHT. (See figure 6-21.) 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 position of the light may be adjusted by removing cotter pin (4) and loosening nut (3) to free mounting bracket (5). The light may be aligned with the nose wheel by loosening nut (6) and pivoting the light on mounting bracket (5).

6-130. ROTATING BEACON.

6-131. Two different types of rotating beacon have been offered as optional equipment for the aircraft. The early type beacon installed on aircraft prior to 35547 contains a powerful sealed beam lamp.



- | | | |
|-----------|------------------------|-------------------------|
| 1. Globe | 5. Mounting Ring | 9. Base Retainer Spring |
| 2. Gasket | 6. Plug | 10. Base Assembly |
| 3. Screw | 7. Globe Retainer Band | 11. Lamp Retainer Clip |
| 4. Tube | 8. Lamp | 12. Tip Assembly - Fin |

Figure 6-22. Rotating Beacon Installation (Serial 35000 and on)

Positioned over the lamp is a v-shaped reflector which is rotated by an electric motor. The lamp in this type beacon produces a considerable amount of heat. In flight the flow of air over the plastic globe dissipates the heat; however, on the ground the heat produced becomes excessive and may distort the shape of the plastic globe.

CAUTION

Do not operate the early type beacon without allowing the plastic globe to cool.

The later type beacon installed on aircraft after 35547 is a smaller unit which contains two reflector lamps mounted on an electrically rotated plate. This light does not produce excessive heat and may be left on when the aircraft is on the ground without damage. A baffle shield has been added to the newer type beacon installation at serials 39032 and on, in order to reduce pilot glare.

6-132. REMOVAL AND REPLACEMENT OF ROTATING BEACON. An exploded view of each rotating beacon is shown in figure 6-22. Reference to this figure will show the order of removal and replacement. When

installing a beacon, seal the light and mounting bracket with No. 576 Presstite Permagum.

NOTE

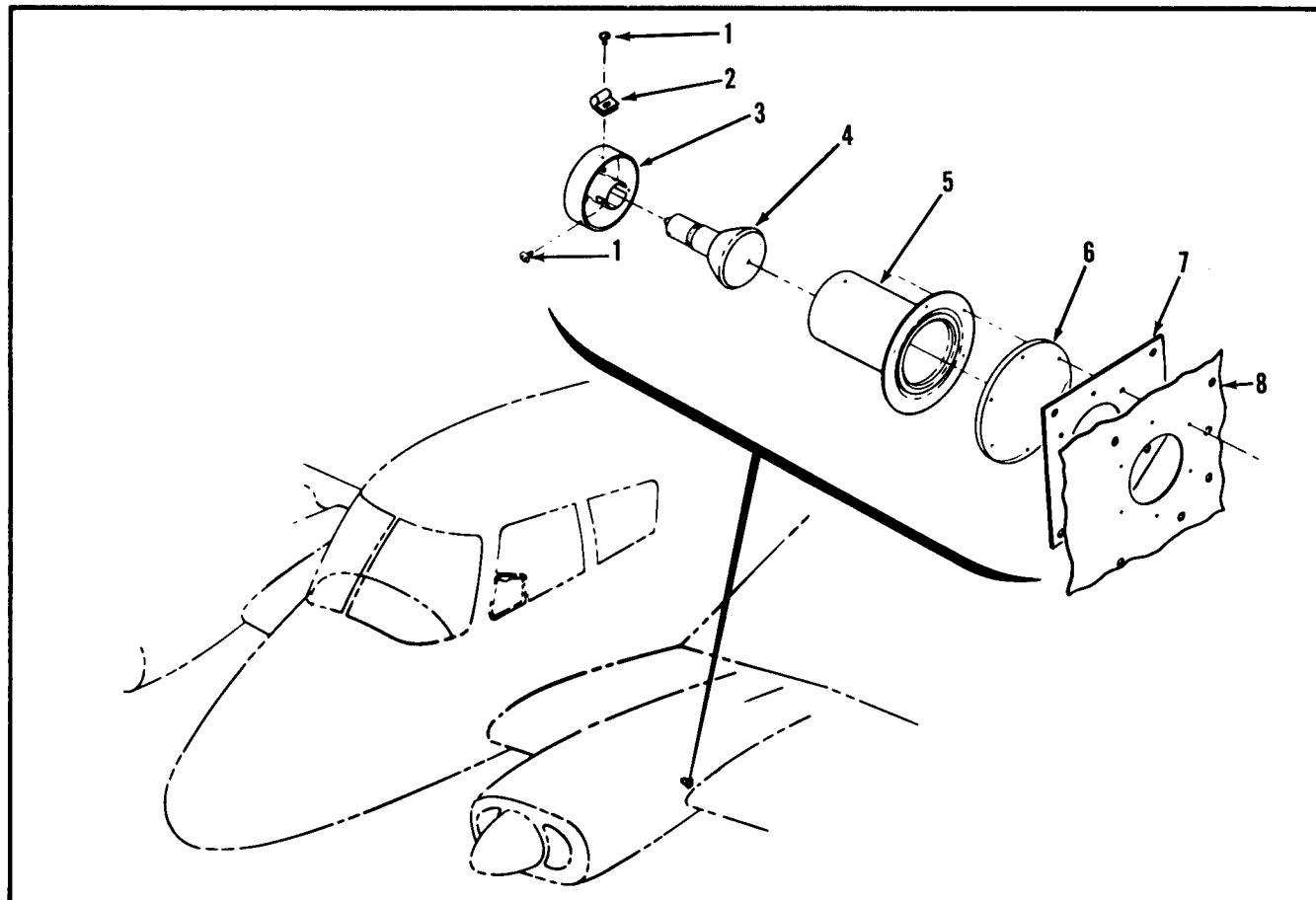
The area marked forward on early beacons should be positioned about 30 degrees to the right of the aircraft centerline. On later models having the baffle shield incorporated, mount with the baffle forward.

6-133. DE-ICE OR LEFT WING LIGHT.

6-134. A de-ice light is provided as optional equipment to illuminate the leading edge of the wing. The light is located in the outboard side of the left engine nacelle. Operation of the light is controlled by a toggle switch located on the switch panel. Figure 6-23 may be used as a guide for removal and replacement of the light.

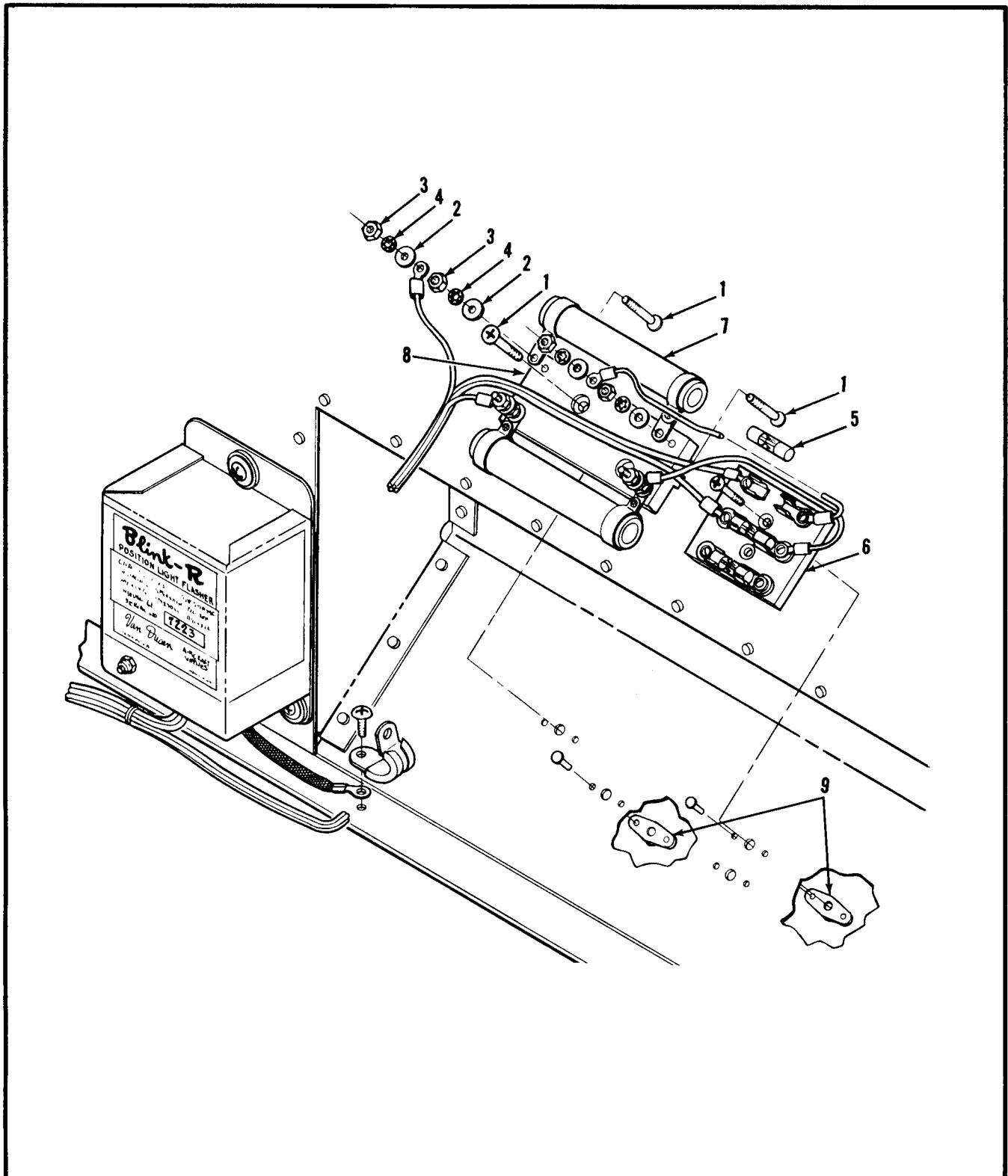
6-135. MISCELLANEOUS ELECTRICAL EQUIPMENT.

6-136. CIGAR LIGHTERS. The aircraft is equipped with two automotive-type cigar lighters. The front



- | | |
|--------------------|-----------------|
| 1. Screw | 5. Shield |
| 2. Plastic Clamp | 6. Lens |
| 3. Socket Assembly | 7. Doubler |
| 4. Lamp | 8. Nacelle Skin |

Figure 6-23. De-Ice Light Installation



- | | |
|---------------|---------------------|
| 1. Screw | 6. Fuse Block |
| 2. Washer | 7. Resistor |
| 3. Nut | 8. Insulating Block |
| 4. Lockwasher | 9. Nutplates |
| 5. Fuse | |

Figure 6-24. Cigar Lighter Fuse Block and Resistor Installation (Serials 35651 and on)

lighter is located at the extreme left edge of the stationary instrument panel. On 35000 thru 35771 the rear cigar lighter is located below the right rear cabin window. On 35772 and on the rear cigar lighter is located close to the emergency window release. The lighters are identical and may be interchanged if desired. The front cigar lighter receptacle is grounded directly to the stationary instrument panel. The rear receptacle however, is provided with a ground strap due to the inadequate metal-to-metal contact of its installation. The power lead to each lighter is secured by a nut and lockwasher. A dropping resistor and fuse are incorporated in each cigar lighter circuit on later model aircraft (see figure 6-24). The resistors drop the voltage from 24-volts down to 12-volts so that automotive type cigar lighters may be used. The fuses are used as protection against short circuiting of the cigar lighters. A spare fuse is mounted on the fuse block. To remove the dropping resistors, it is necessary first to remove the insulating block which the resistors are mounted on. The fuse block and resistor mounting block are secured to the control tee cutout by screws with nutplates.

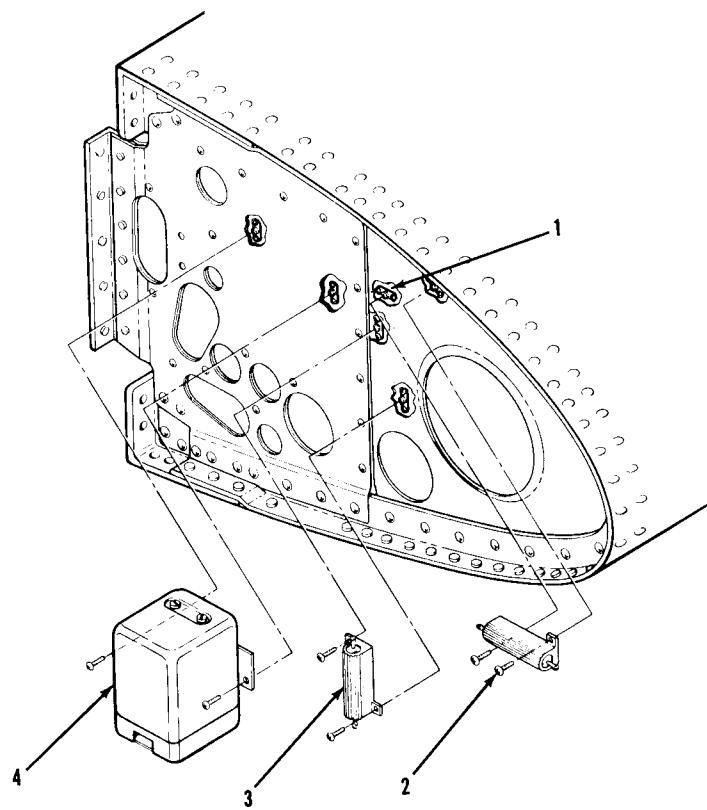
6-137. REMOVAL AND REPLACEMENT OF CIGAR

LIGHTER RECEPTACLES.

CAUTION

The aircraft battery switch must remain OFF while the cigar lighter receptacles are being removed or replaced. If there is any possibility that the battery switch may be turned on during the procedure, the ground cable should be removed from the aft battery.

To remove the forward cigar lighter receptacle, remove the nut and washer securing the wire to the receptacle and uncover the retainer sleeve from the receptacle. The receptacle may then be removed from the front of the instrument panel. To remove the aft cigar lighter receptacle remove the right upholstery panel on 35000 thru 35771, or the left upholstery panel on 35772 and on. Remove the screw attaching the receptacle ground strap to the cabin structure and remove the wire from the receptacle. Unscrew the retainer sleeve from the upholstery panel. To replace the cigar lighter receptacles, reverse this procedure.



1. Nutplate
2. Screw

3. Resistor
4. Relay

Figure 6-25. Auxiliary Fuel Pump Relay Installation (Serials 35772 thru 35842)

6-138. AUXILIARY FUEL PUMP CIRCUIT. (See figure 6-25, serials 35772 thru 35842 and figure 6-26, serials 35843 and on.)

6-139. An auxiliary fuel pump relay and two resistors are located in each wing root rib of the aircraft. Each auxiliary pump relay operates in conjunction with a two position auxiliary fuel pump switch. When the switch is in the "PRIME" position, voltage is supplied through a dropping resistor to the relay, and in turn is transferred to the pump. This activates the pump at a slow speed. In the "ON" position, voltage is again supplied through a dropping resistor to the relay, and is transferred to the pump. This also activates the pump at a slow speed. If the fuel pressure drops below 5.0 psi while in the "ON" position, a pressure switch closes actuating the relay; voltage is then supplied from the bus directly through the relay, activating the pump at a higher speed.

6-140. Adjustment of the auxiliary fuel pump resistors on serials 35843 and on (figure 6-26), is as follows:

1. Remove the fillet assembly covering the leading edge wing root on the wing containing the auxiliary fuel pump to be adjusted.

2. On the engine disconnect the metered fuel line from the distributor valve and plug the line.

3. Disconnect wire E440-432 or E440-437 from fuel pressure switch. This is the wire connected by itself to one of the pressure switch terminals.

4. Run other engine at sufficient speed to indicate a charge on the ammeter.

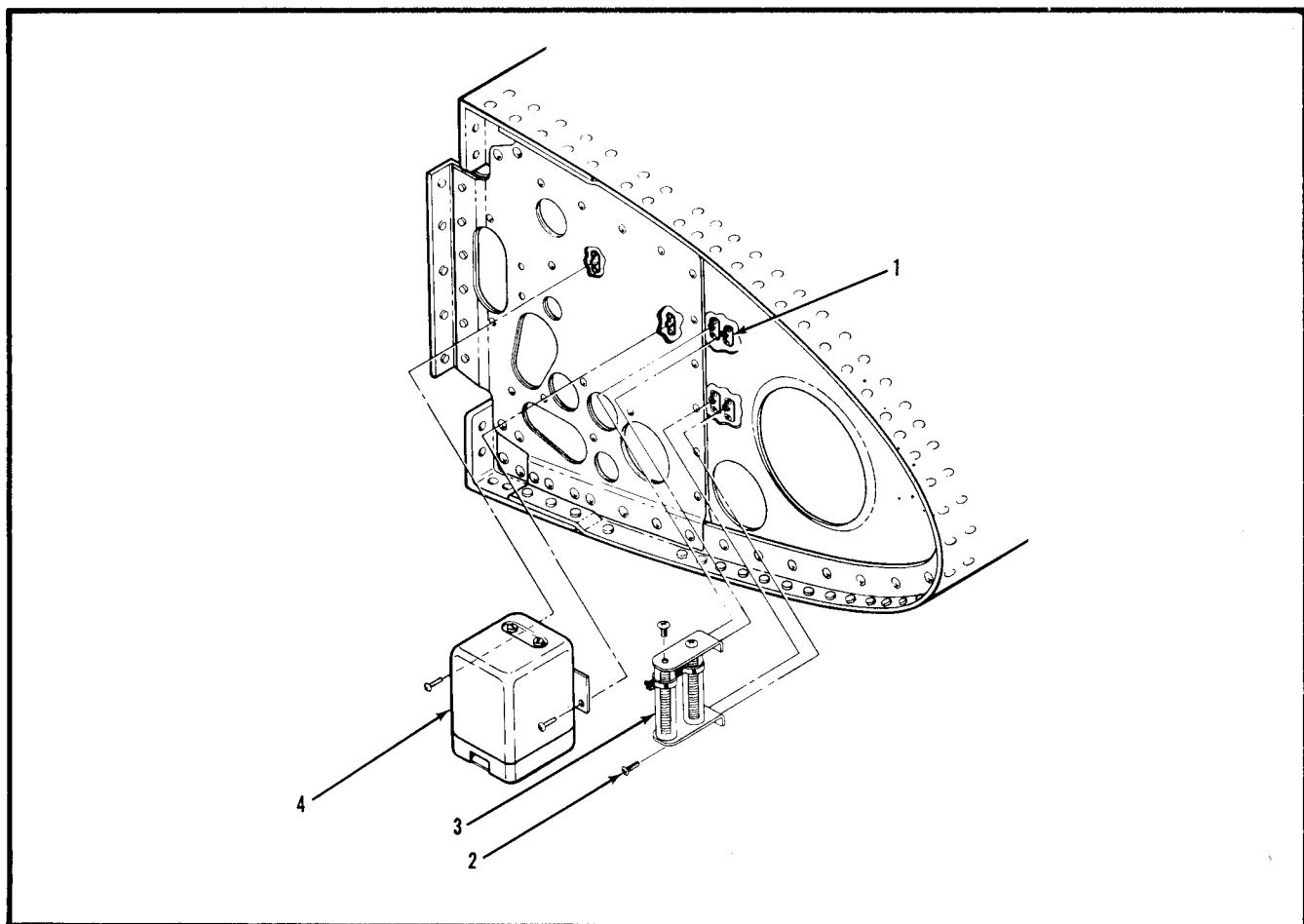
5. Hold throttle and mixture levers for the inoperative engine in the full forward position.

6. With the auxiliary fuel pump switch for the inoperative engine in the "PRIME" position, adjust the slide on the outboard resistor until the metered fuel pressure indicated by the proper pointer on the dual fuel pressure gage on the instrument panel is between 5.5 and 7.0 psi.

7. With the auxiliary pump switch for the inoperative engine in the "ON" position, adjust the slide on the inboard resistor until the metered fuel pressure indicated by the pointer on the dual fuel pressure gage on the instrument panel is between 4.5 and 5.5 psi.

8. Connect metered fuel line to distributor valve and connect wire to pressure switch as originally installed.

9. Run engine which has just had resistors



1. Nutplate
2. Screw

3. Resistor
4. Relay

Figure 6-26. Auxiliary Fuel Pump Relay Installation (Serial 35843 and on)

adjusted at 600 rpm, full rich mixture and run other engine at sufficient speed to indicate charge on the ammeter. Metered fuel pressure for the idling engine (600 rpm) should not change when the auxiliary pump switch is moved from "OFF" to "PRIME."

10. Run engine which has just had resistors adjusted at full throttle, full rich mixture. Metered fuel pressure should not increase more than one-half psi when the auxiliary pump switch is moved from "OFF" to "ON."

6-141. The auxiliary fuel pump resistors on serials 35772 thru 35842 (figure 6-25) are fixed resistors and need no adjustment upon installation.

6-142. Order of removal and replacement of the resistors and auxiliary pump relay are shown in figure 6-25 (serials 35772 thru 35842) and figure 6-26 (serials 35843 and on). The resistors and the relay are secured to the root rib of the wing by screws with nutplates.

6-140. INDEX OF WIRING DIAGRAMS.

MODEL 310 Serials 35000 thru 35546	MODEL 310B Serials 35547 thru 35771	MODEL 310C Serials 35772 thru 39031	MODEL 310D Serials 39032 & on		
		<u>310</u>	<u>310B</u>	<u>310C</u>	<u>310D</u>
Symbols Chart		6-42	6-42	6-42	6-42
Flap Circuit		6-44	6-44	6-44	6-44
Flap Position Indicator Circuit		6-45	6-45	6-45	6-45
Cigar Lighter Circuit		6-46, 6-47	6-46, 6-47	6-47	6-47
Anti-Ice Circuit		6-48	6-48	6-48	6-48
Generator Circuits (35-Amp)		6-51, 6-52	6-53	6-53	6-53
Generator Circuits (50-Amp)		6-50	6-50	6-50	6-50
Flare Circuit		6-54	6-54	6-54	6-54
Fuel Boost and Auxiliary Fuel Pump Circuit		6-55	6-55	6-57	6-57
Fuel Quantity Indicator Circuit		6-58	6-59	6-59	6-59
Heater Circuit		6-60	6-61	6-61	6-61
Dual Tachometer Circuit		6-62	6-62	6-62	6-62
Magneto Ignition Circuit		6-63	6-63	6-63	6-63
Primer and Oil Dilution Circuit		6-64	6-64, 6-65	6-65	6-65
Cylinder Head Temp and Oil Temp Circuit		6-66, 6-67	6-67, 6-68	6-69	6-69
De-Ice Circuit		6-71	6-71	6-71	6-71
Battery and Starter Circuit		6-73	6-73	6-73	6-73
Landing and Taxi Light Circuit		6-75	6-75	6-75	6-75
Turn and Slip and Outside Air Temperature Circuit		6-77	6-77	6-77	6-77
Interior Lights Circuit		6-78	6-79	6-79	6-79
Switch Panel, Fuel Selector, and Compass Light Circuit		6-81	6-81	6-81	6-81
Stall Warning and Pitot Heat Circuit		6-82	6-82	6-82	6-82
Instrument Panel Lighting Circuit		—	6-84	6-84	6-84
Landing Gear Circuit		6-86	6-87, 6-88, 6-89, 6-90	6-90	6-90
Navigation Lights and Rotating Beacon Circuit		6-92, 6-94	6-92, 6-93, 6-94, 6-95	6-94, 6-95, 6-96	6-94, 6-95 6-96
Speed Control Circuit		6-98	6-99	6-99	6-99
Electrical Wire Table		6-100	6-100	6-100	6-100

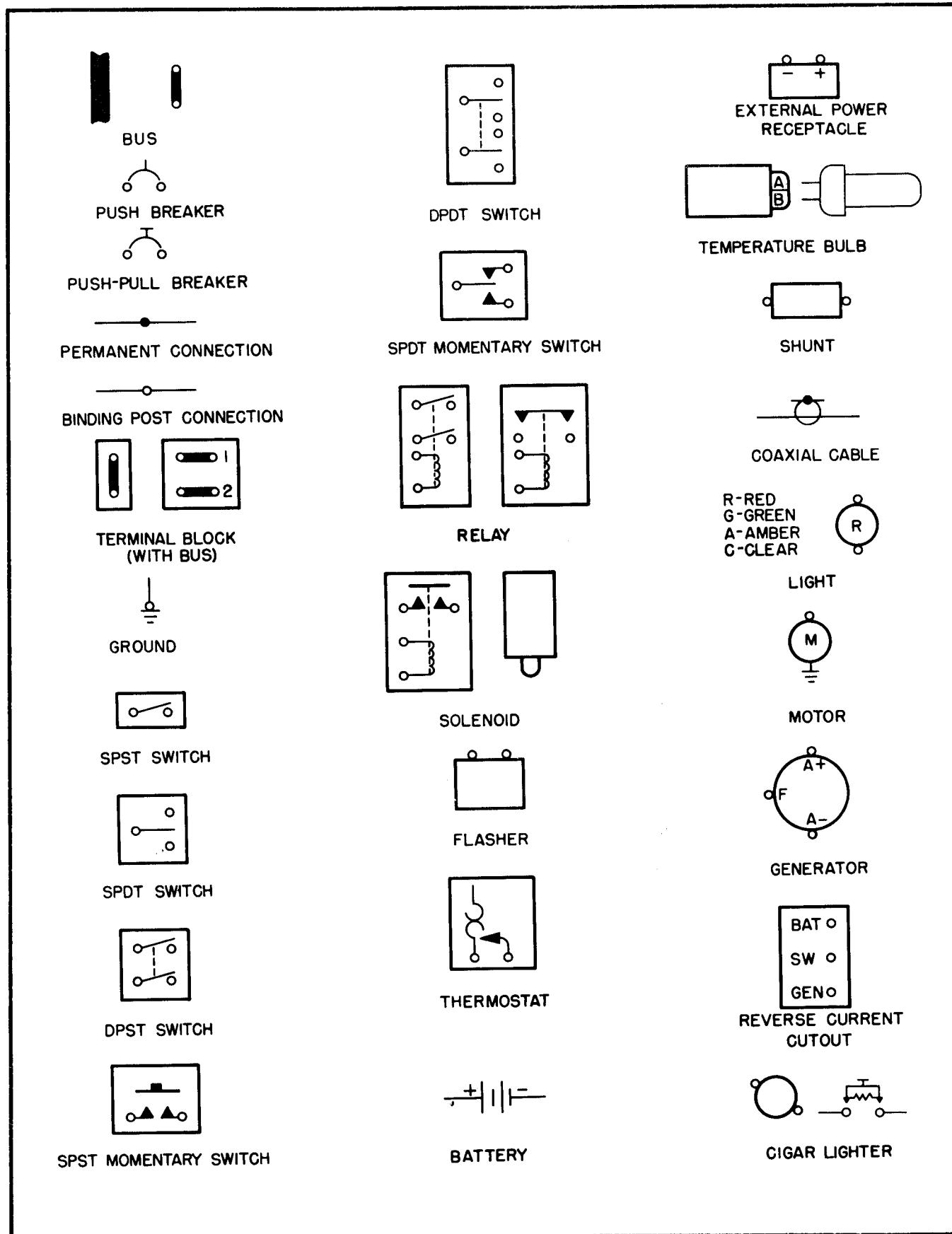


Figure 6-28. Symbols Chart (Sheet 1 of 2)

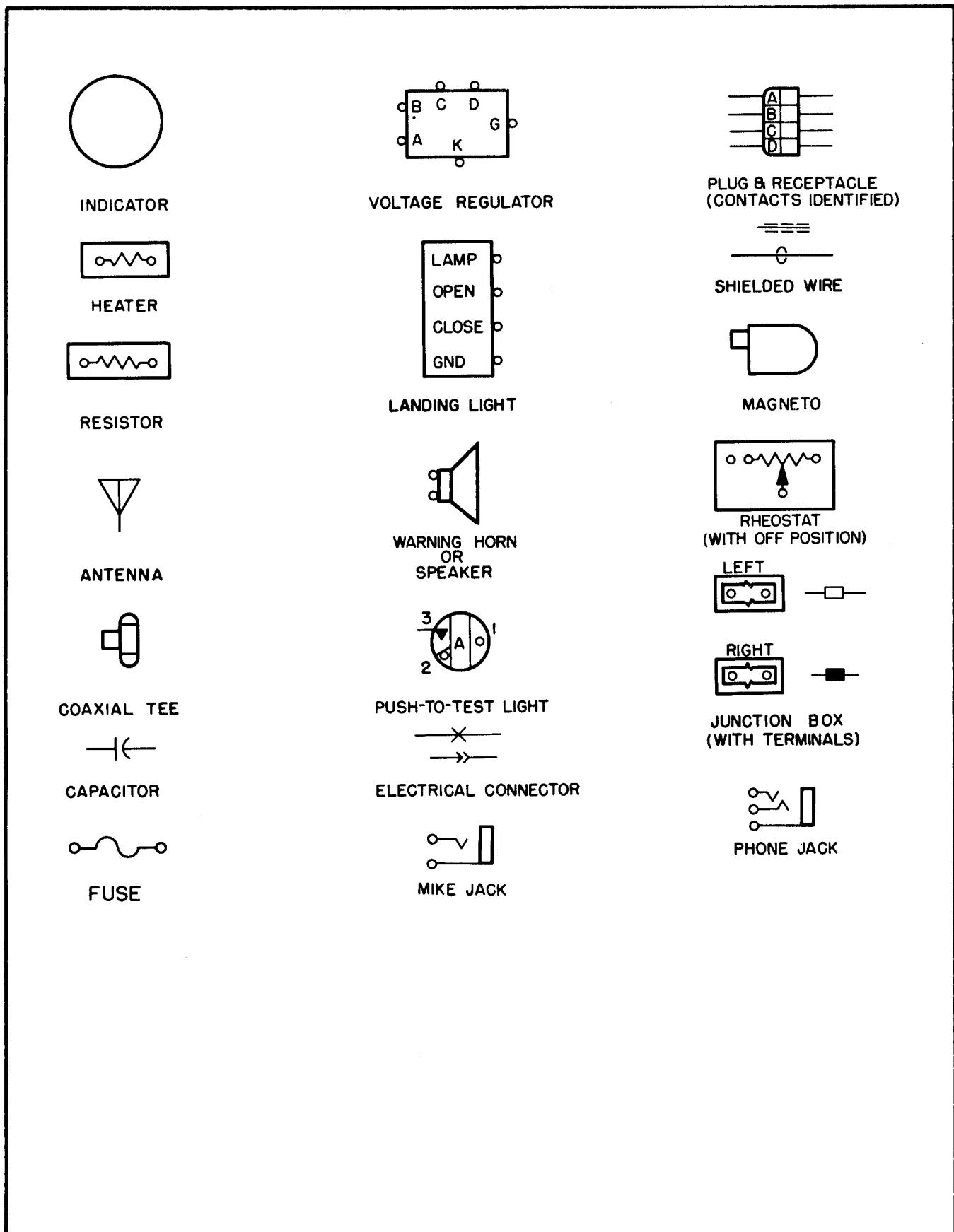


Figure 6-28. Symbols Chart (Sheet 2 of 2)

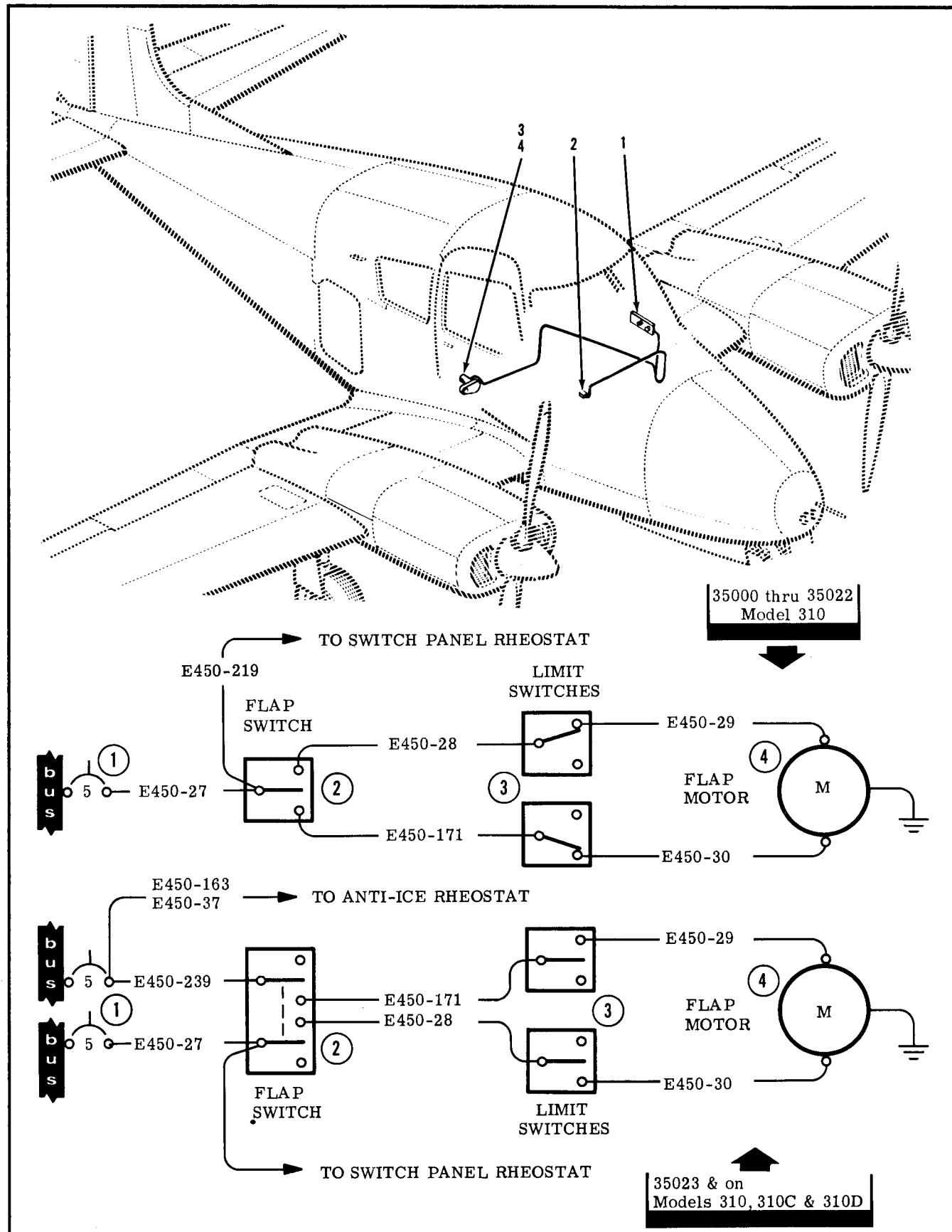


Figure 6-29. Flap Circuit

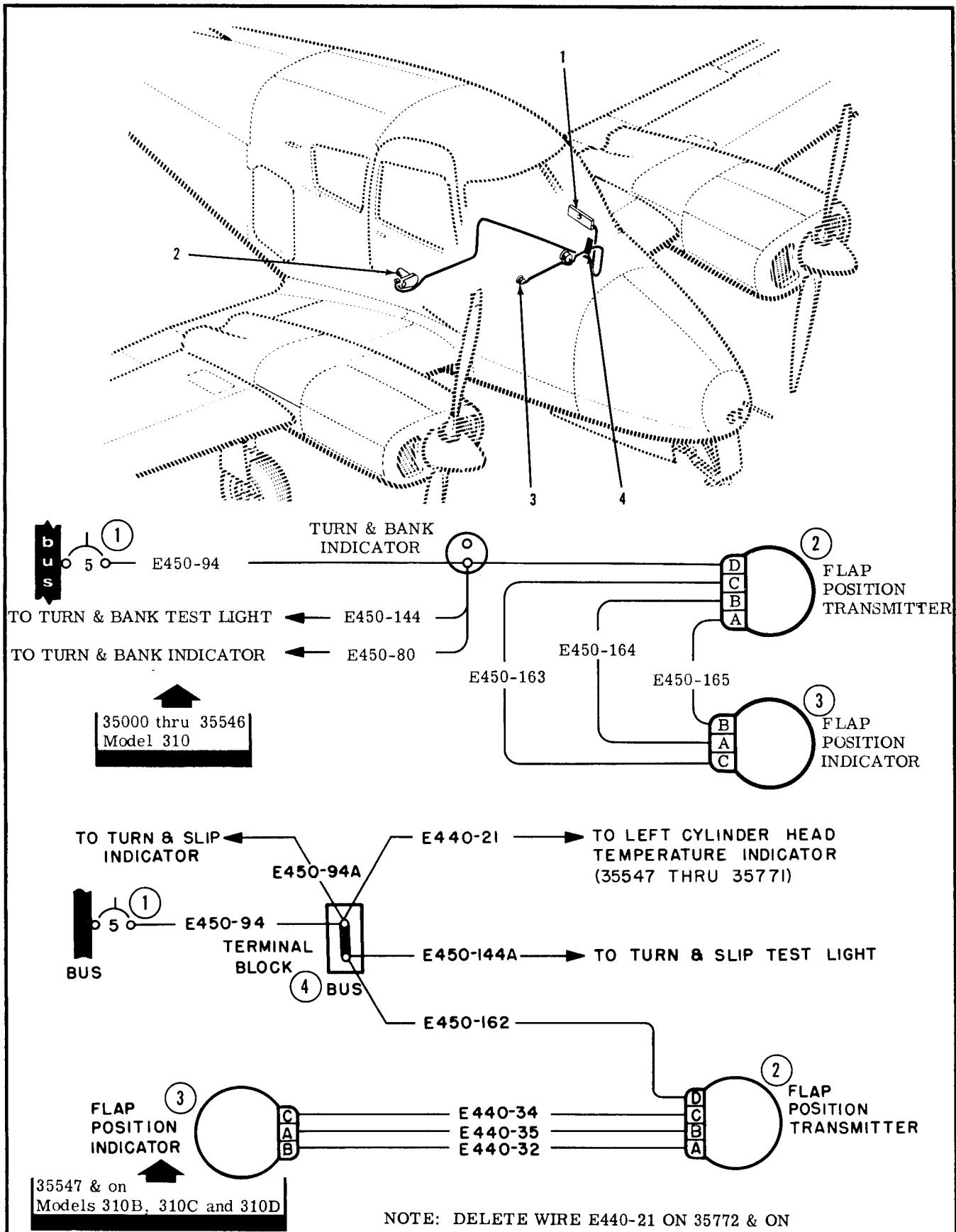


Figure 6-30. Flap Position Indicator Circuit

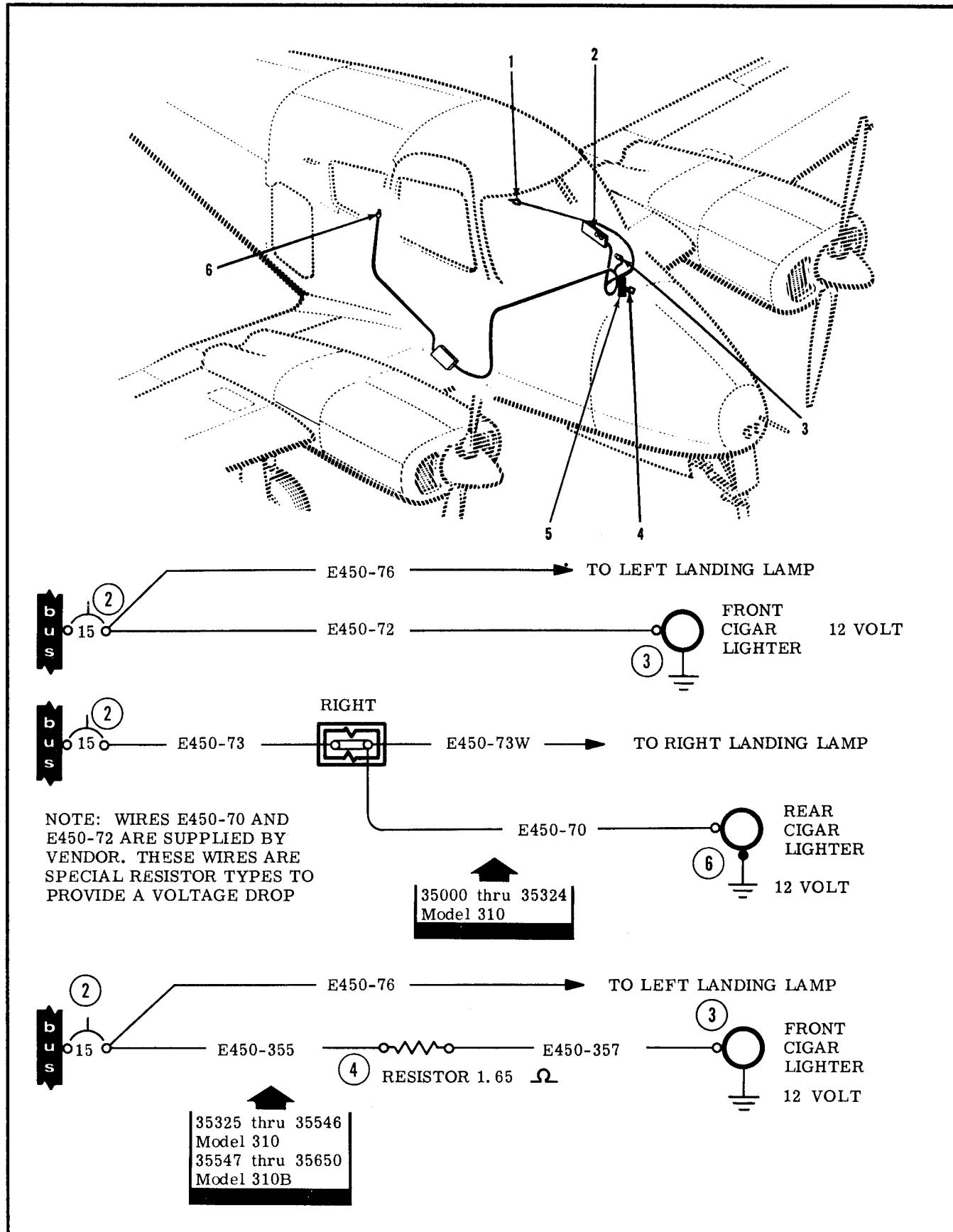


Figure 6-31. Cigar Lighter Circuit (Sheet 1 of 2)

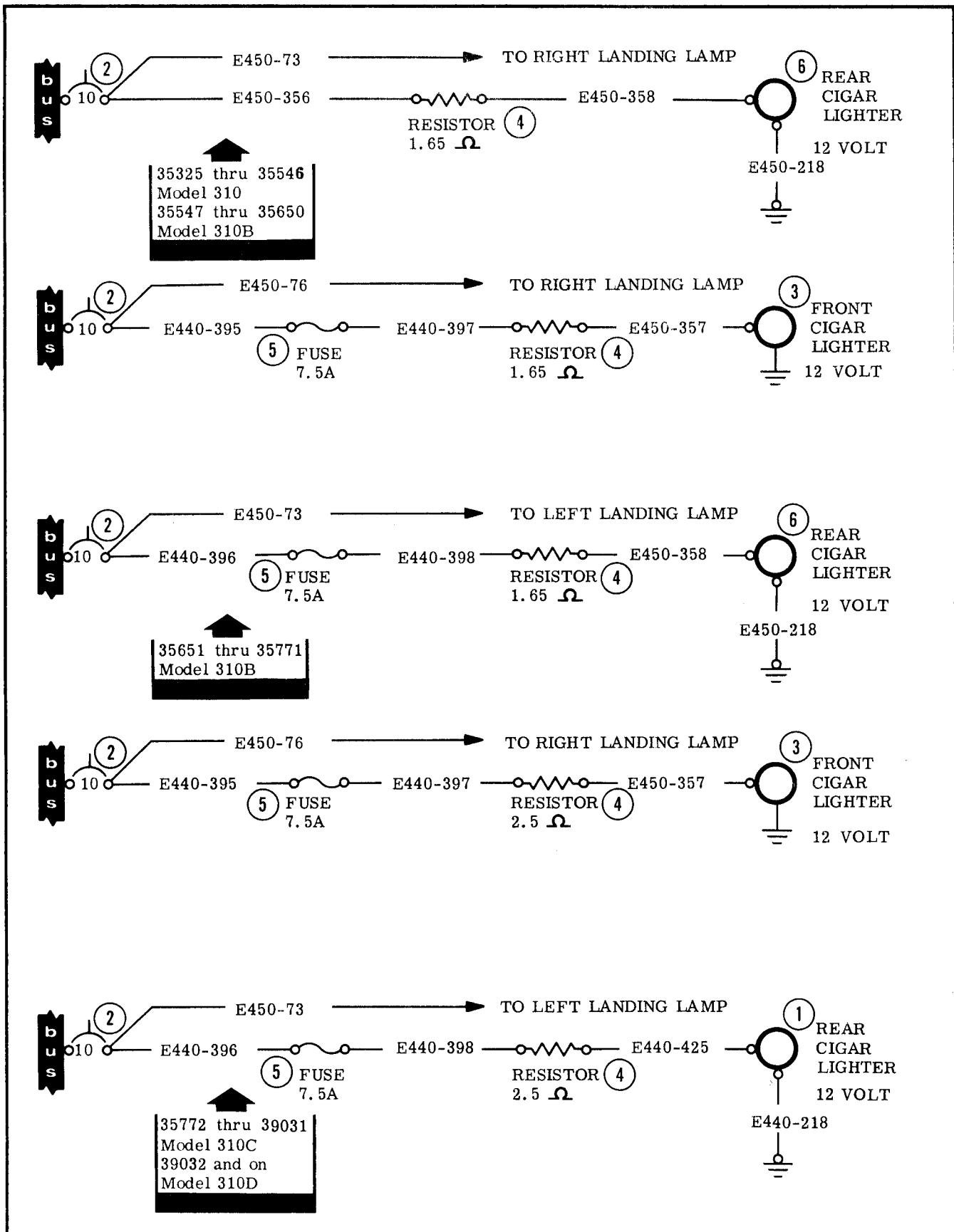


Figure 6-31. Cigar Lighter Circuit (Sheet 2 of 2)

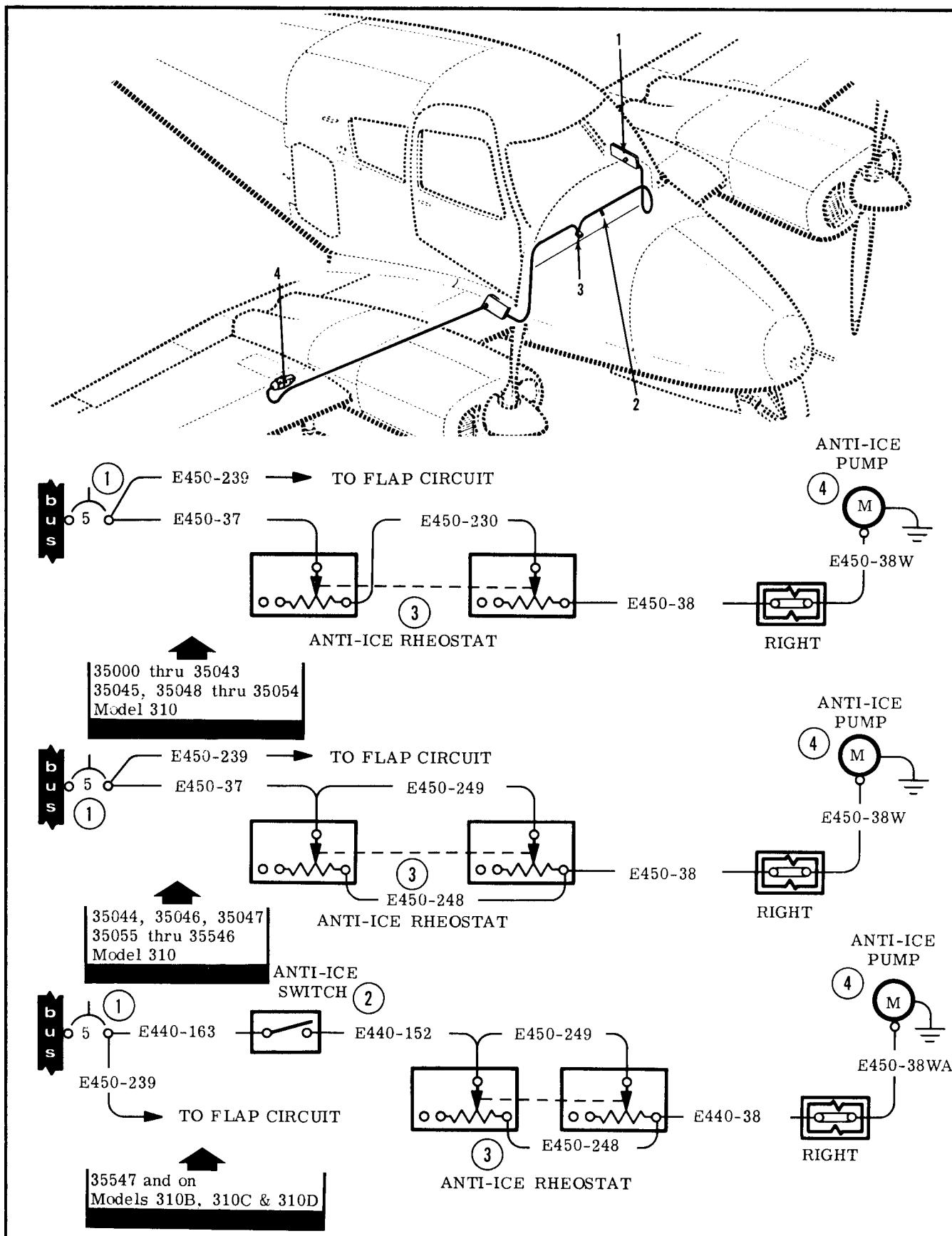


Figure 6-32. Anti-Ice Circuit

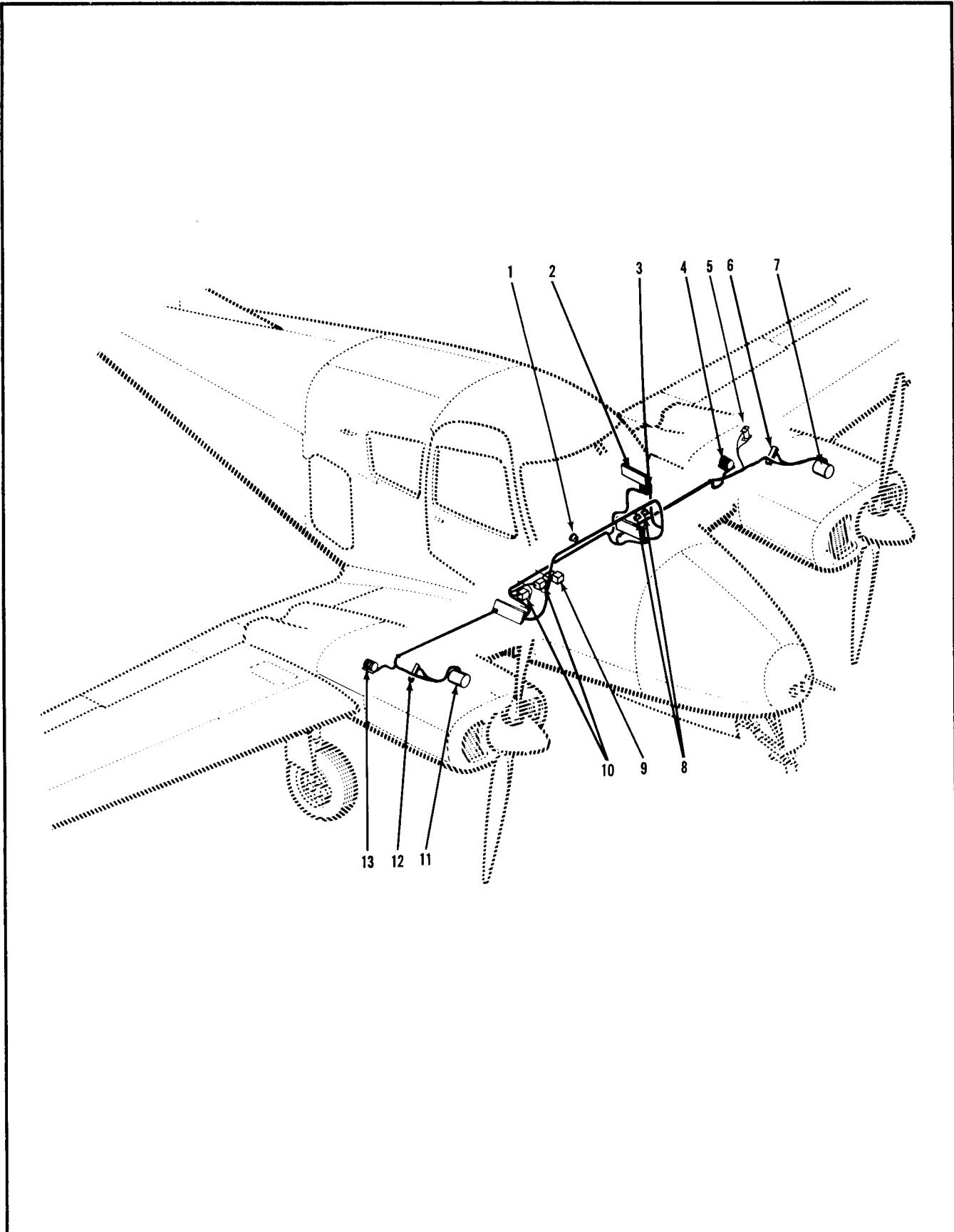


Figure 6-33. Generator Circuits (Sheet 1 of 5)

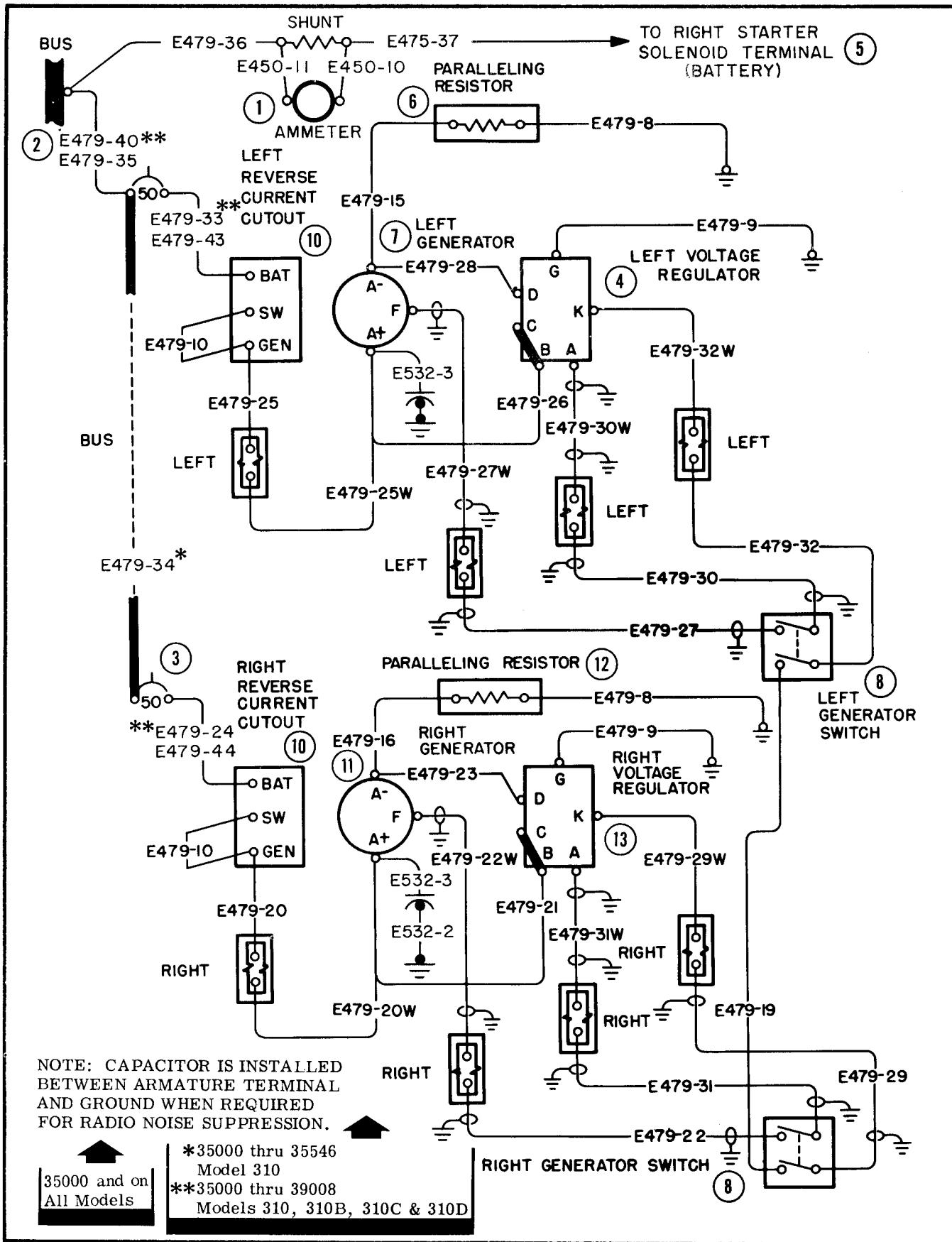


Figure 6-33. 50-Amp Generator Circuits (Sheet 2 of 5)

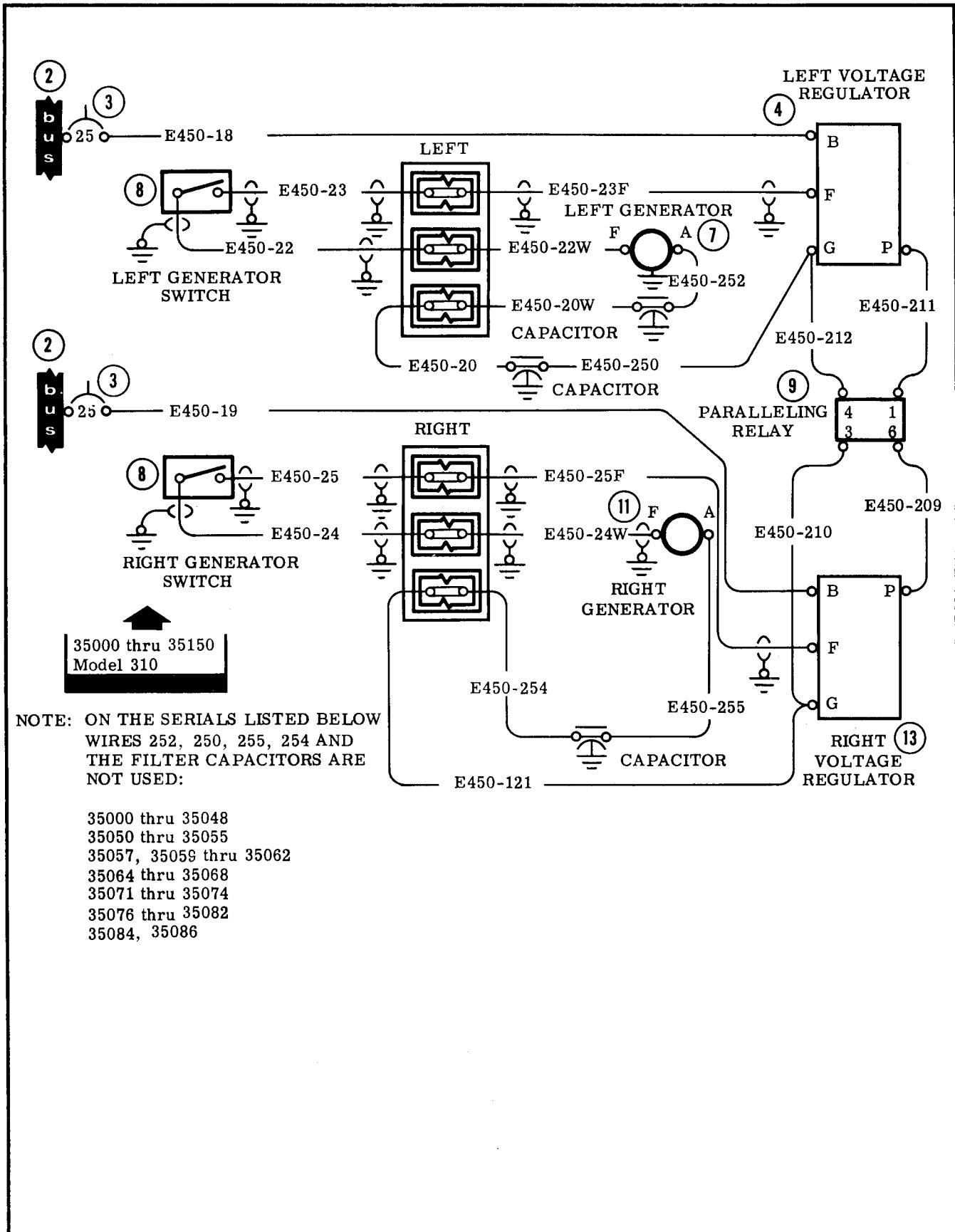


Figure 6-33. 35-Amp Generator Circuits (Sheet 3 of 5)

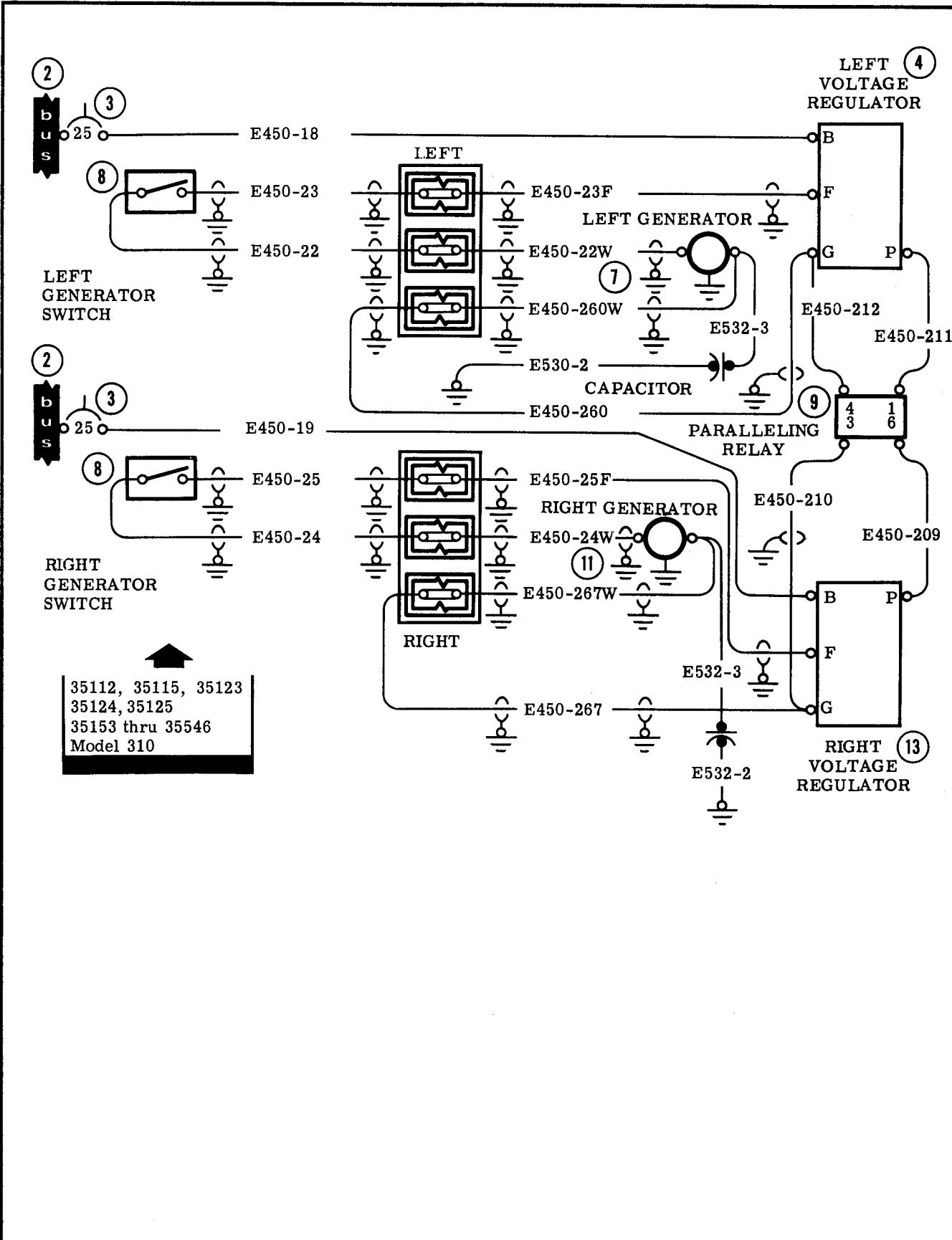


Figure 6-33. 35-Amp Generator Circuits (Sheet 4 of 5)

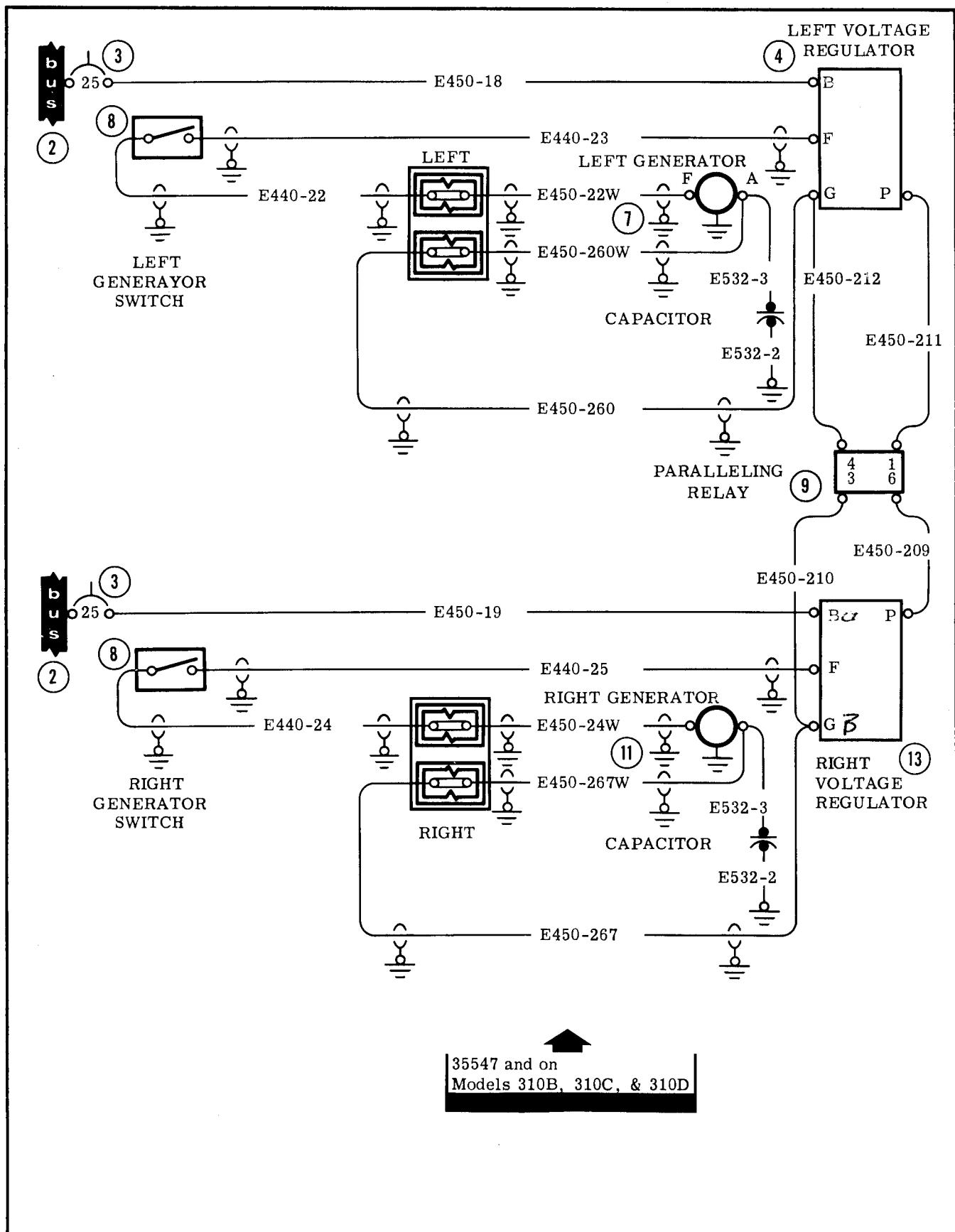


Figure 6-33. 35-Amp Generator Circuits (Sheet 5 of 5)

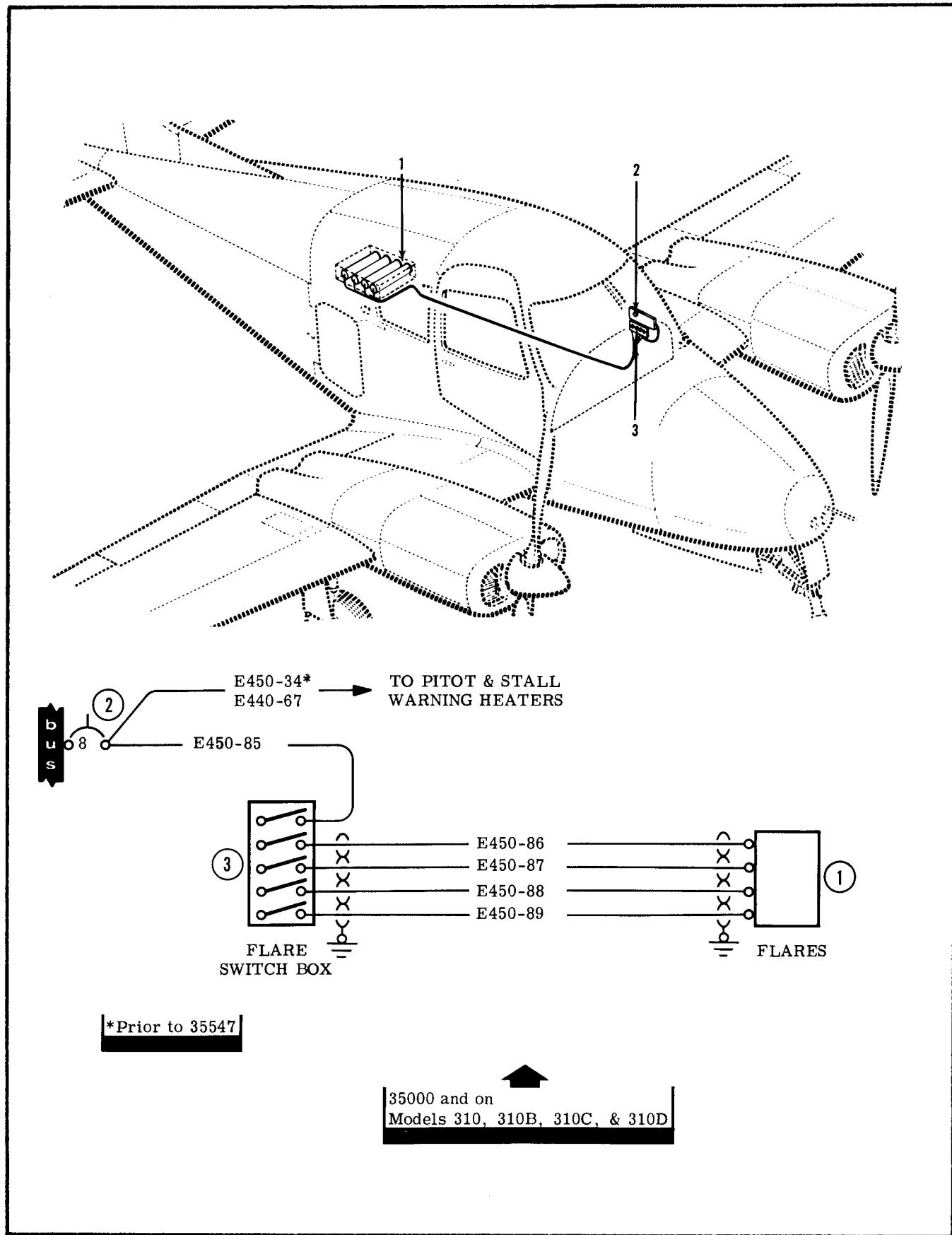


Figure 6-34. Flare Circuit

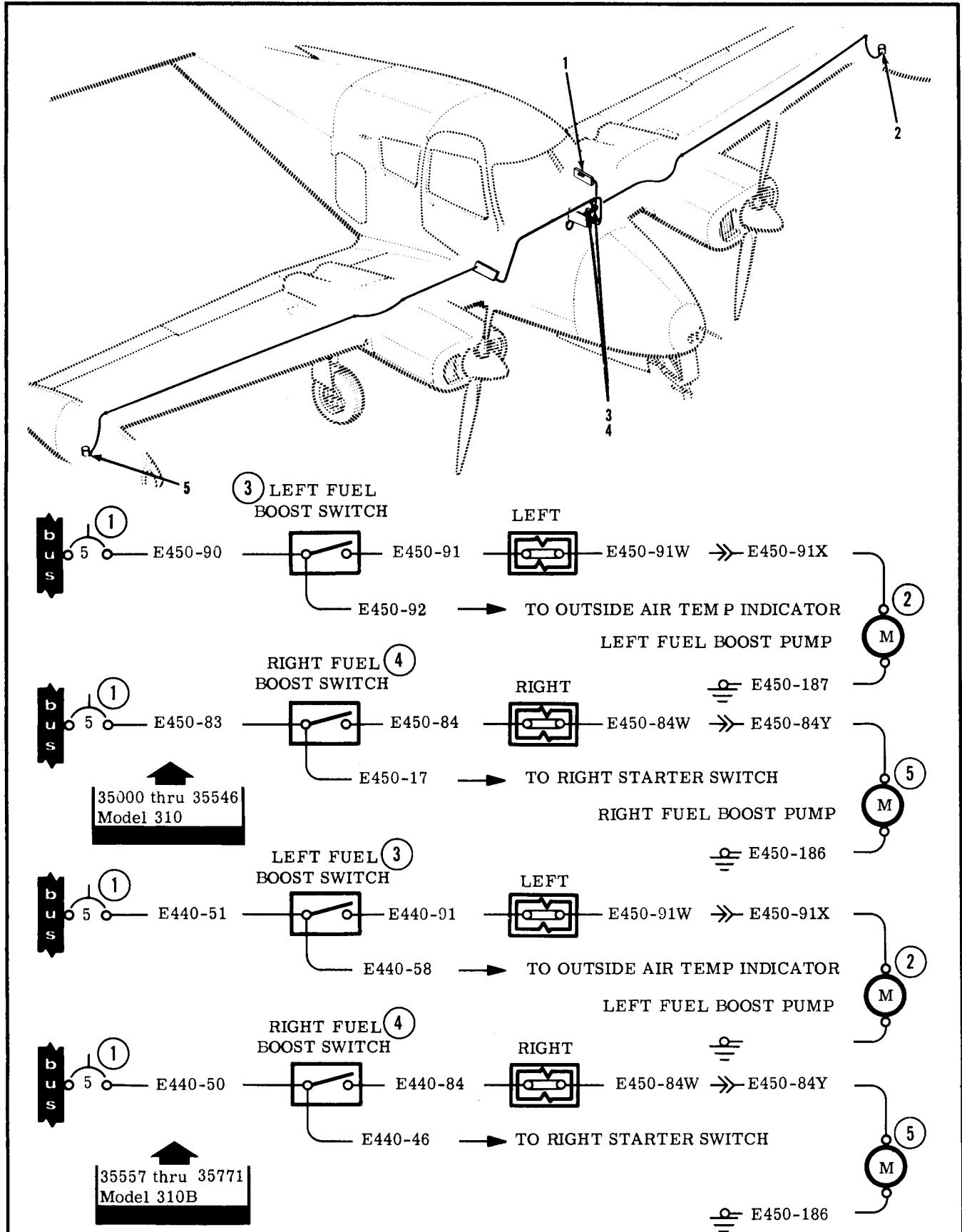


Figure 6-35. Fuel Boost and Auxiliary Fuel Pump Circuit (Sheet 1 of 3)

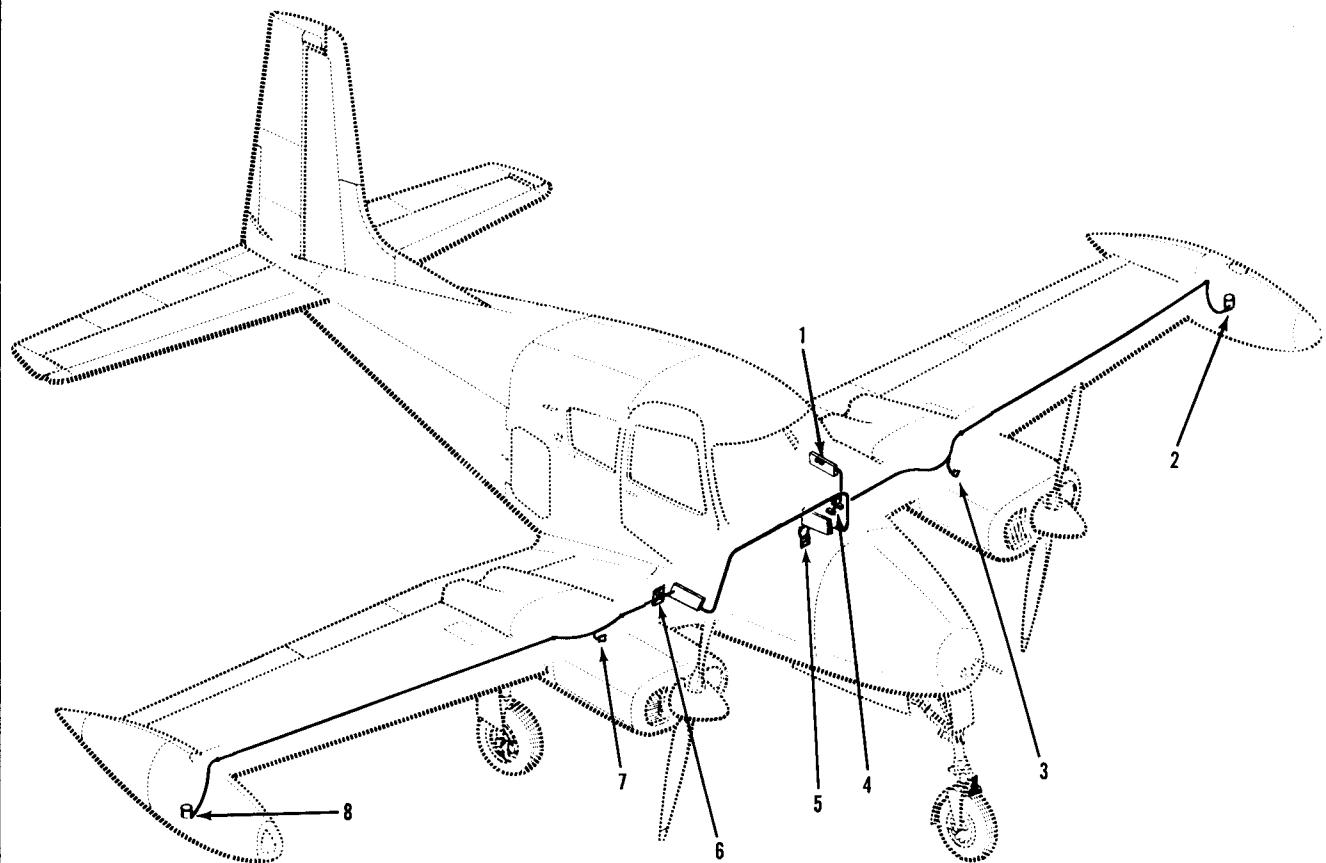


Figure 6-35. Fuel Boost and Auxiliary Fuel Pump Circuit (Sheet 2 of 3)

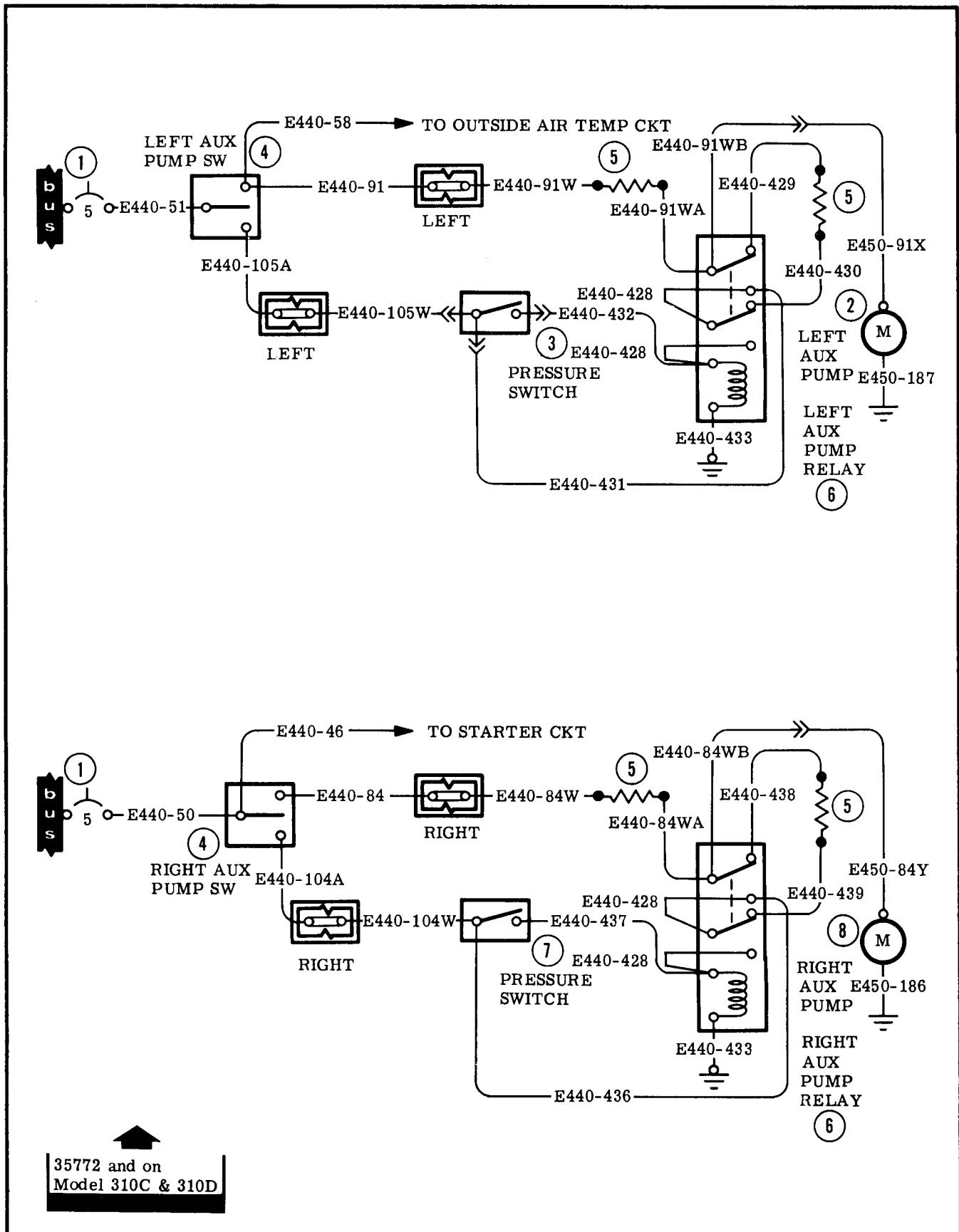


Figure 6-35. Fuel Boost and Auxiliary Fuel Pump Circuit (Sheet 3 of 3)

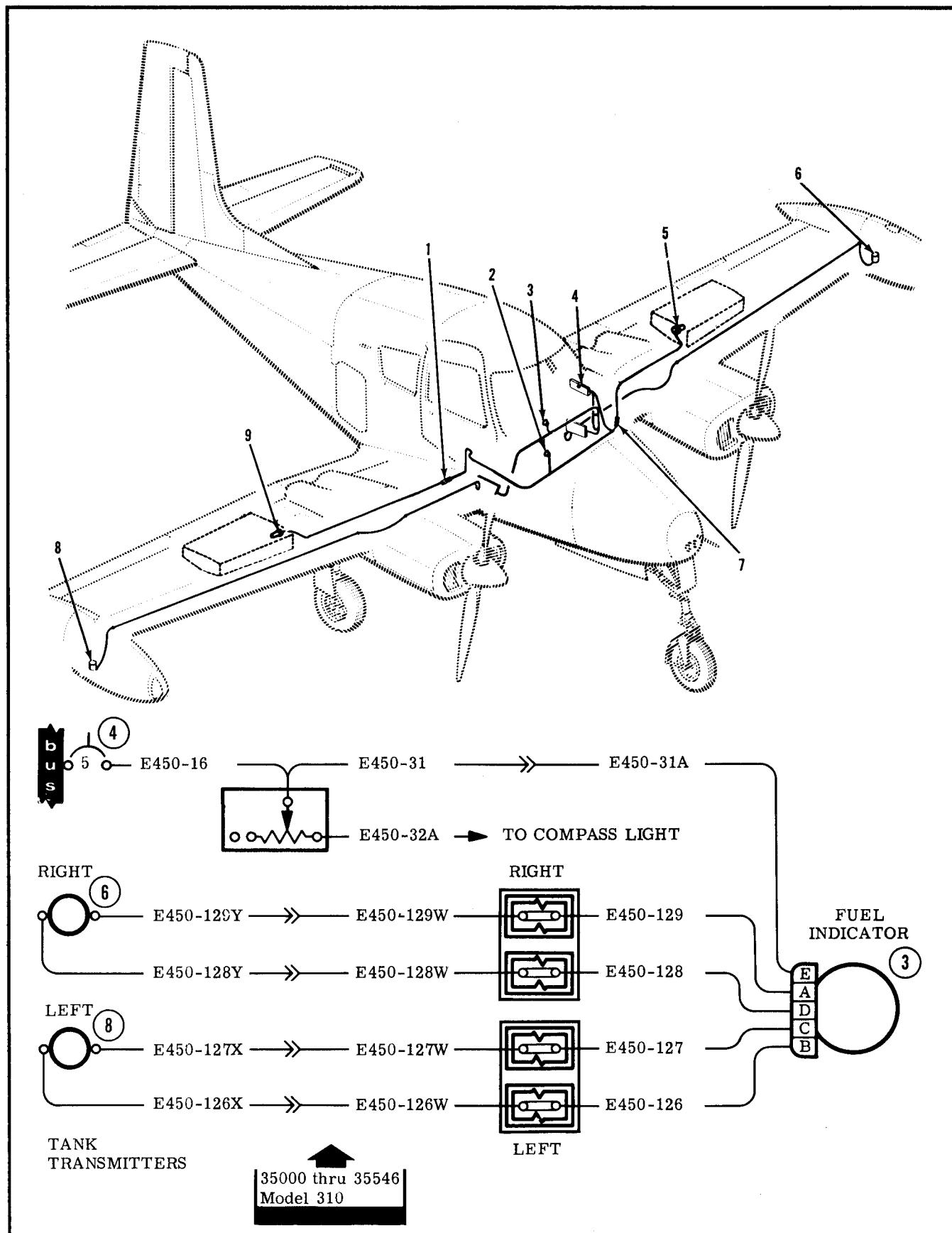


Figure 6-36. Fuel Quantity Indicator Circuit (Sheet 1 of 2)

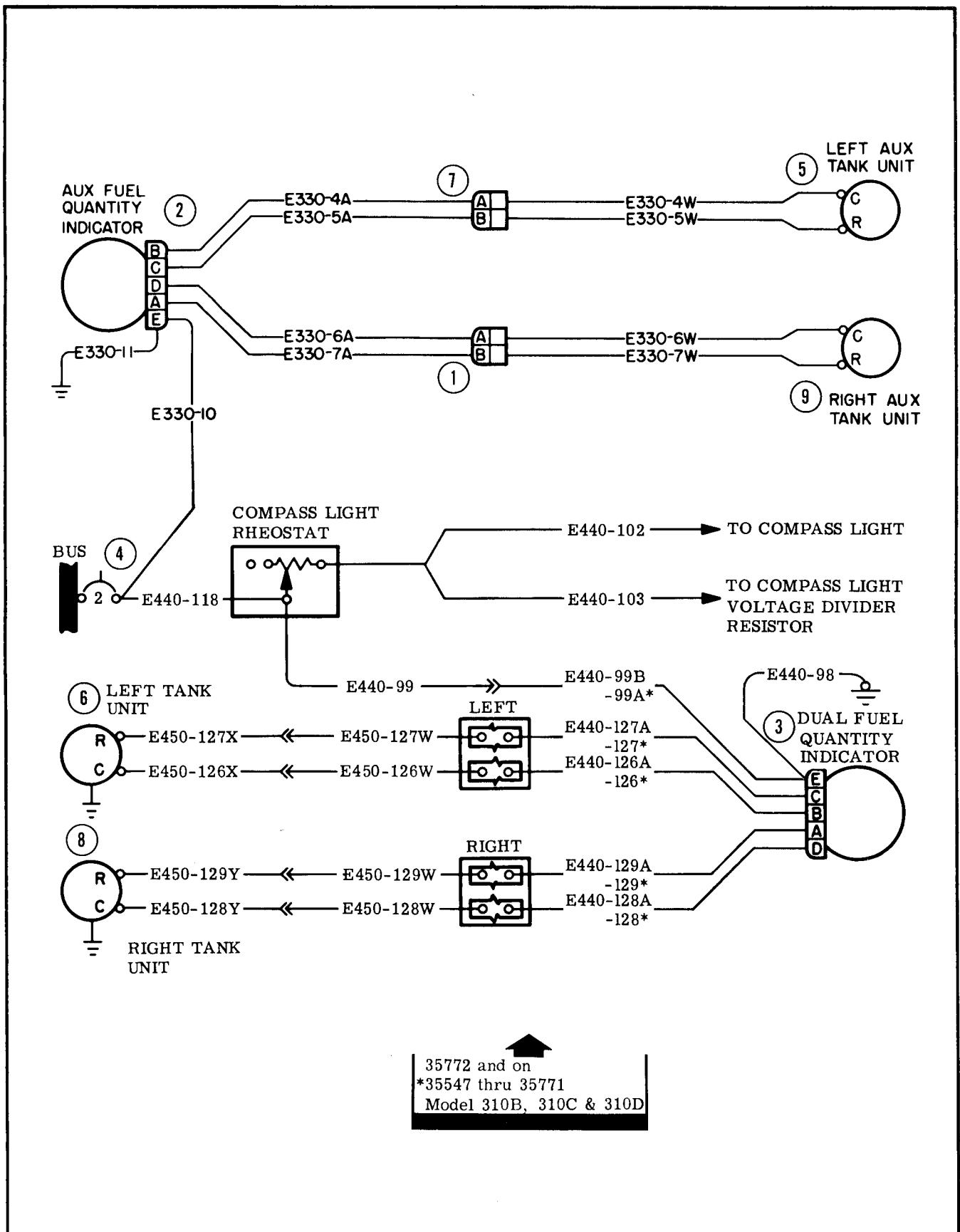


Figure 6-36. Fuel Quantity Indicator Circuit (Sheet 2 of 2)

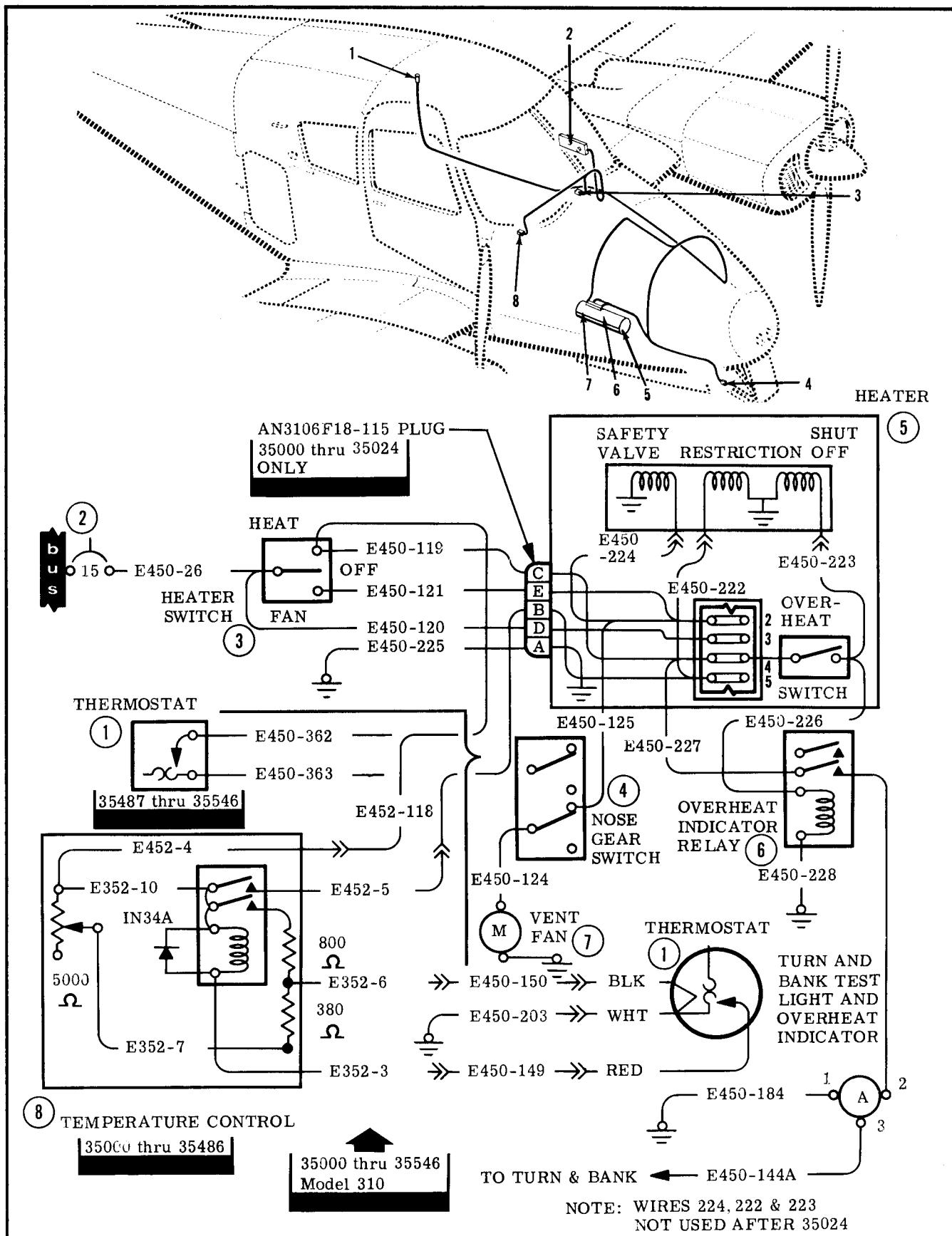
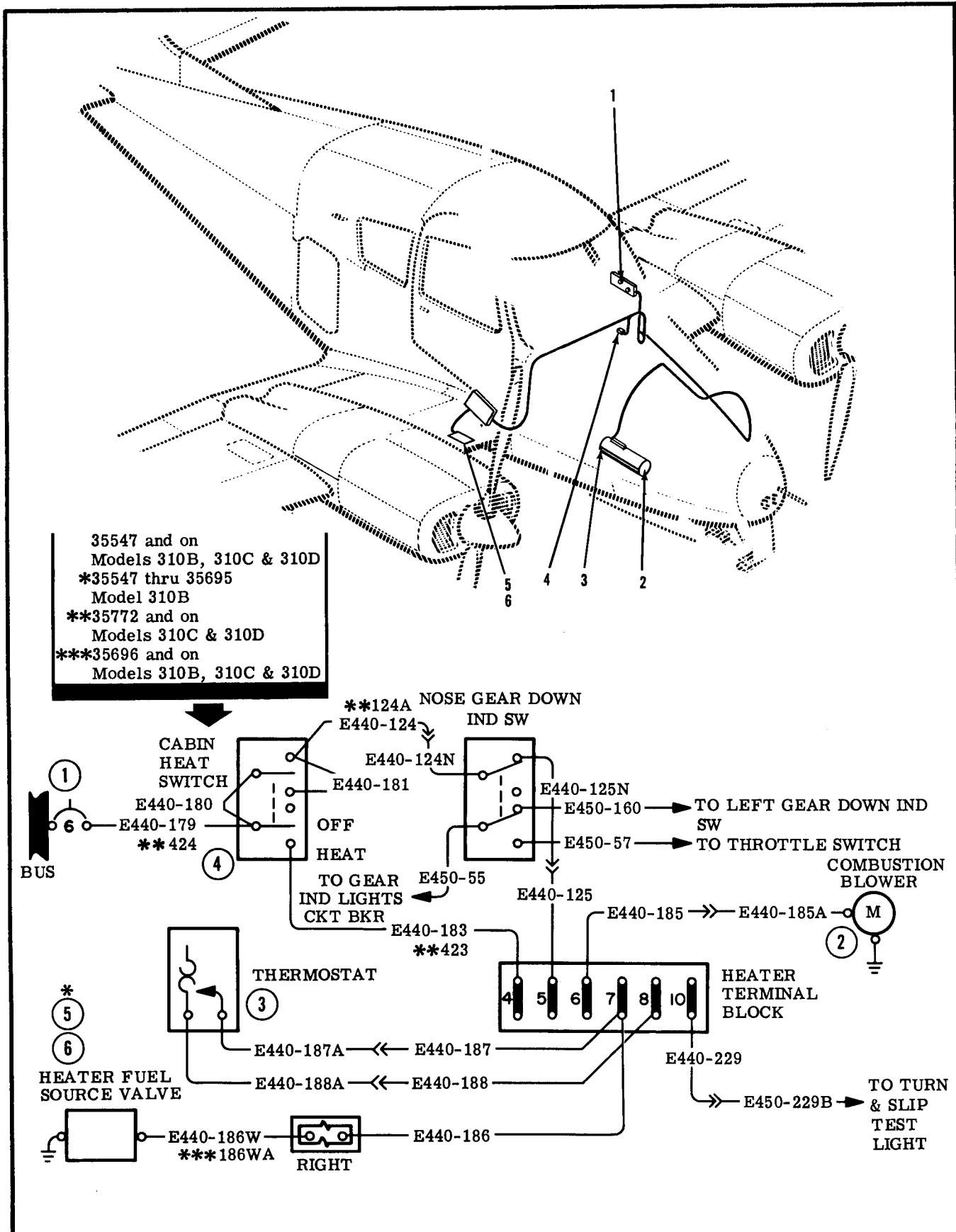
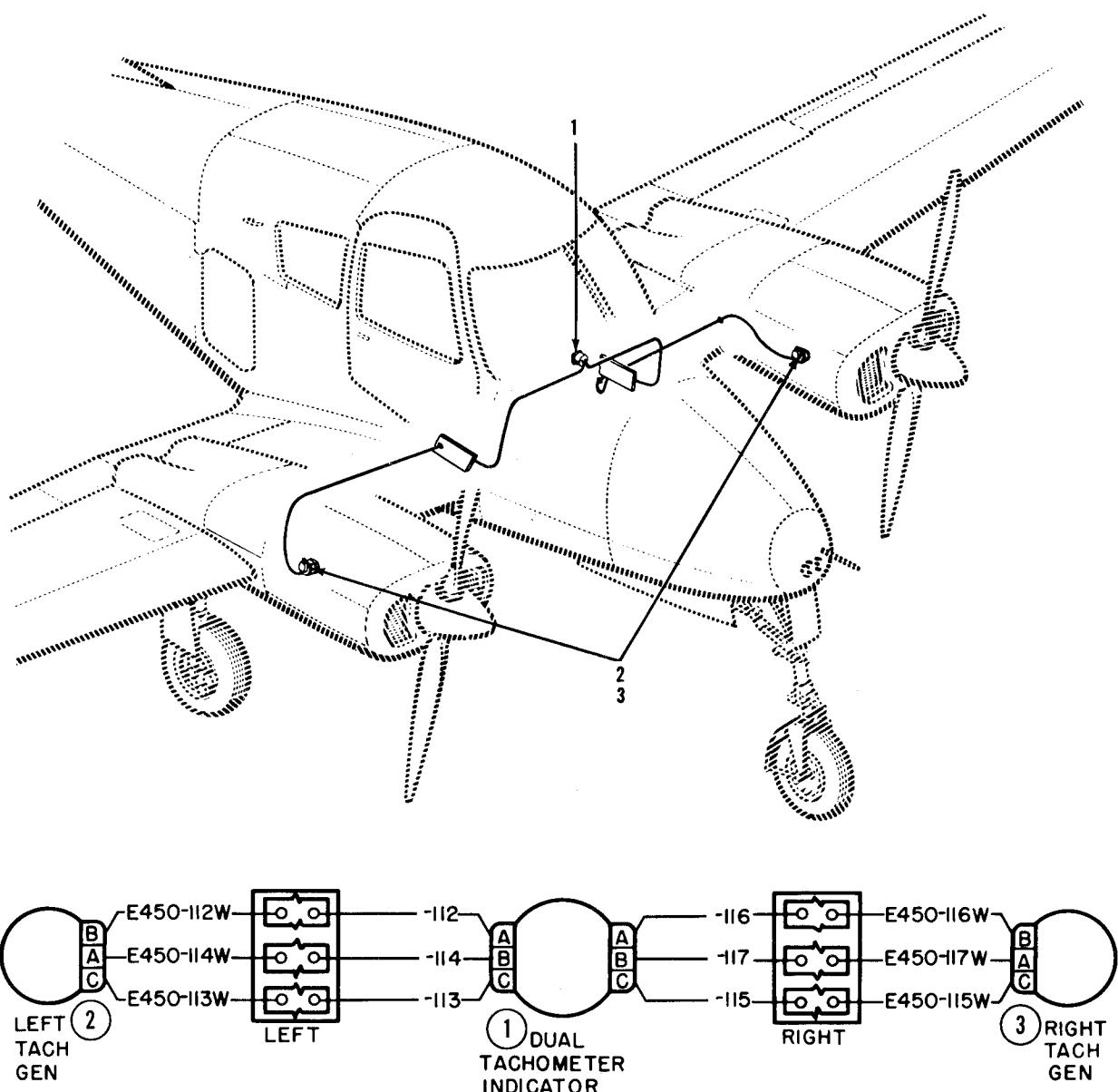


Figure 6-37. Heater Circuit (Sheet 1 of 2)





NOTE: NUMBERS NOT SHOWN WITH PREFIX HAVE E450 PREFIX
PRIOR TO SER 35547 AND E440 PREFIX SER 35547 AND ON.

Figure 6-38. Dual Tachometer Circuit

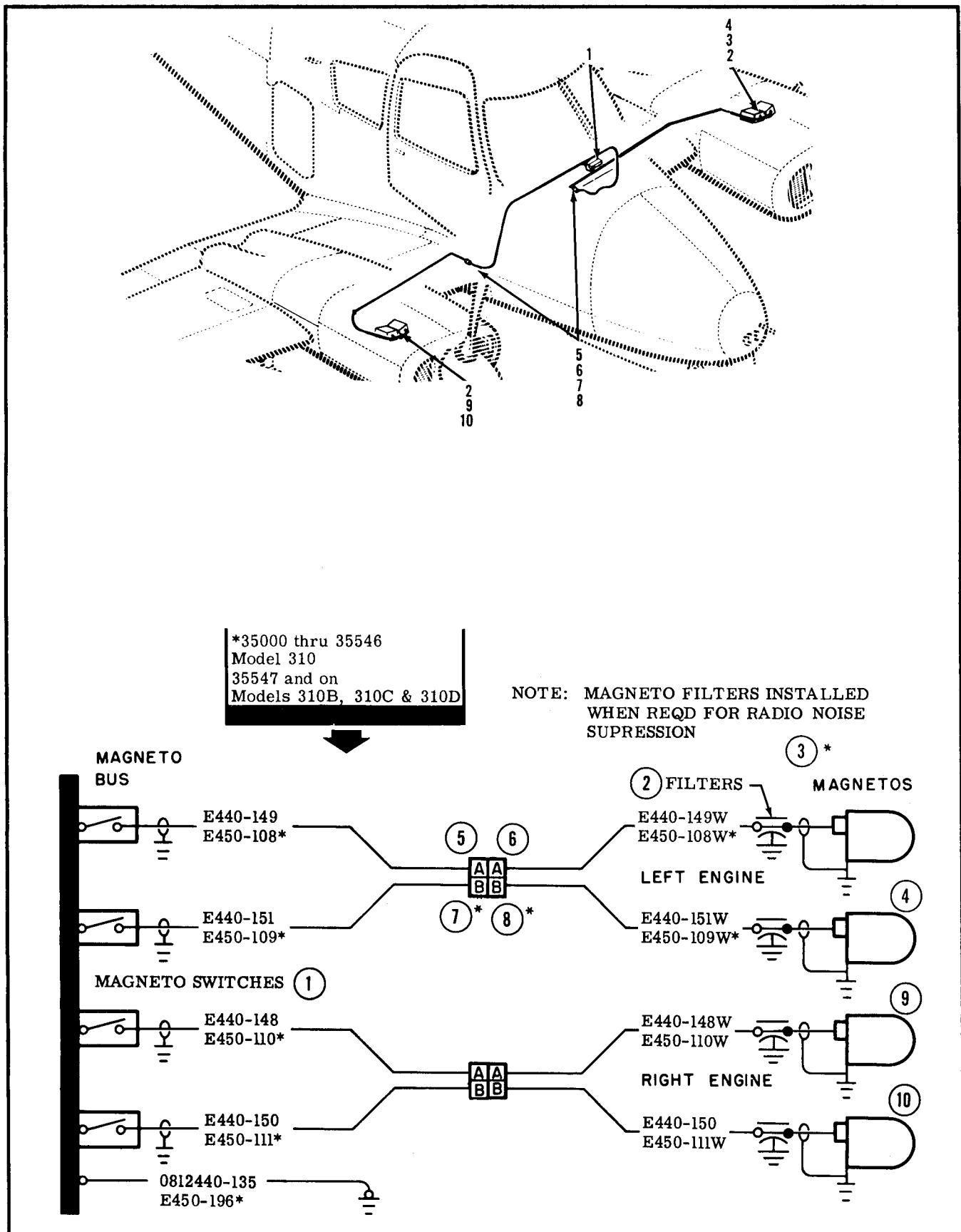


Figure 6-39. Magneto Ignition Circuit

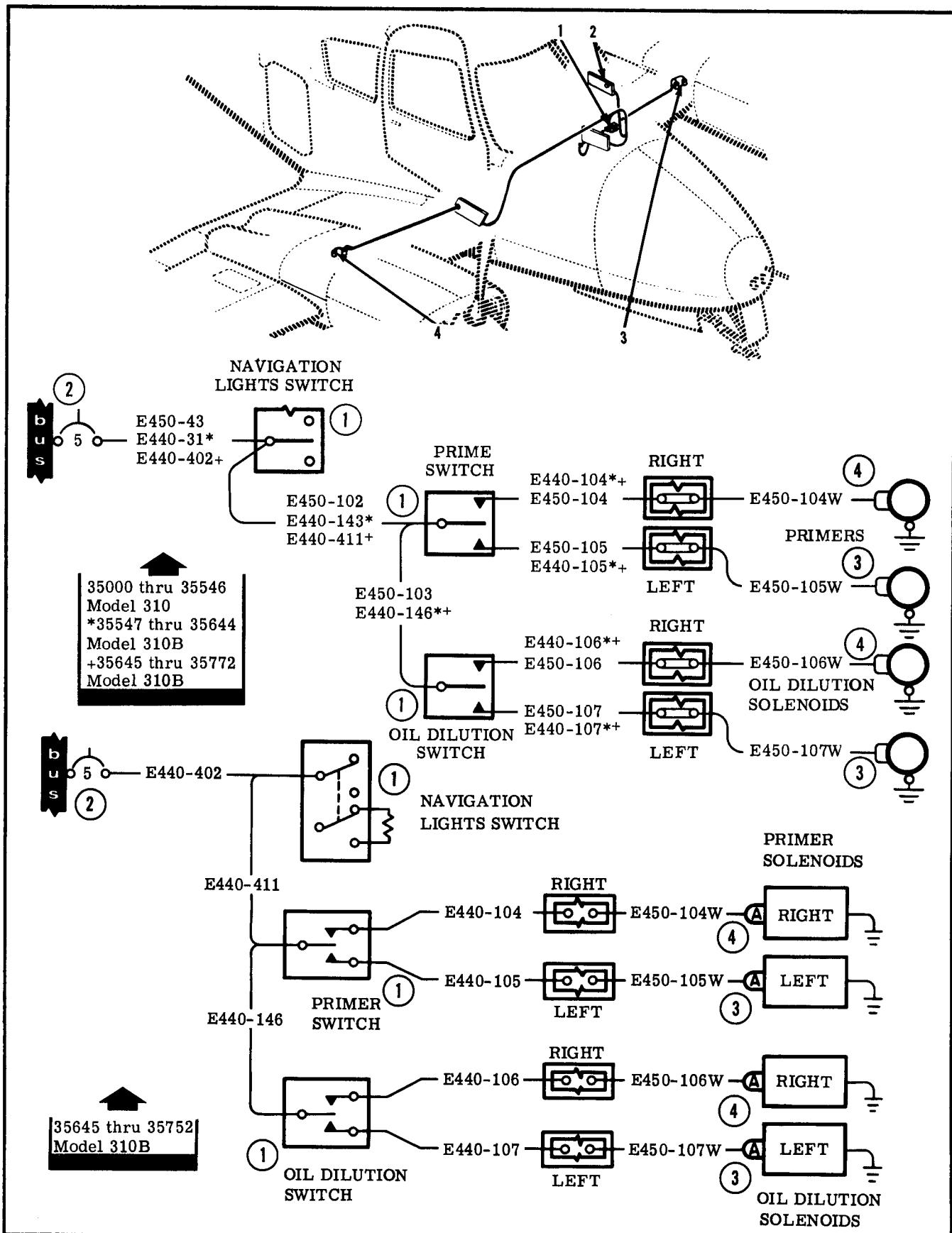
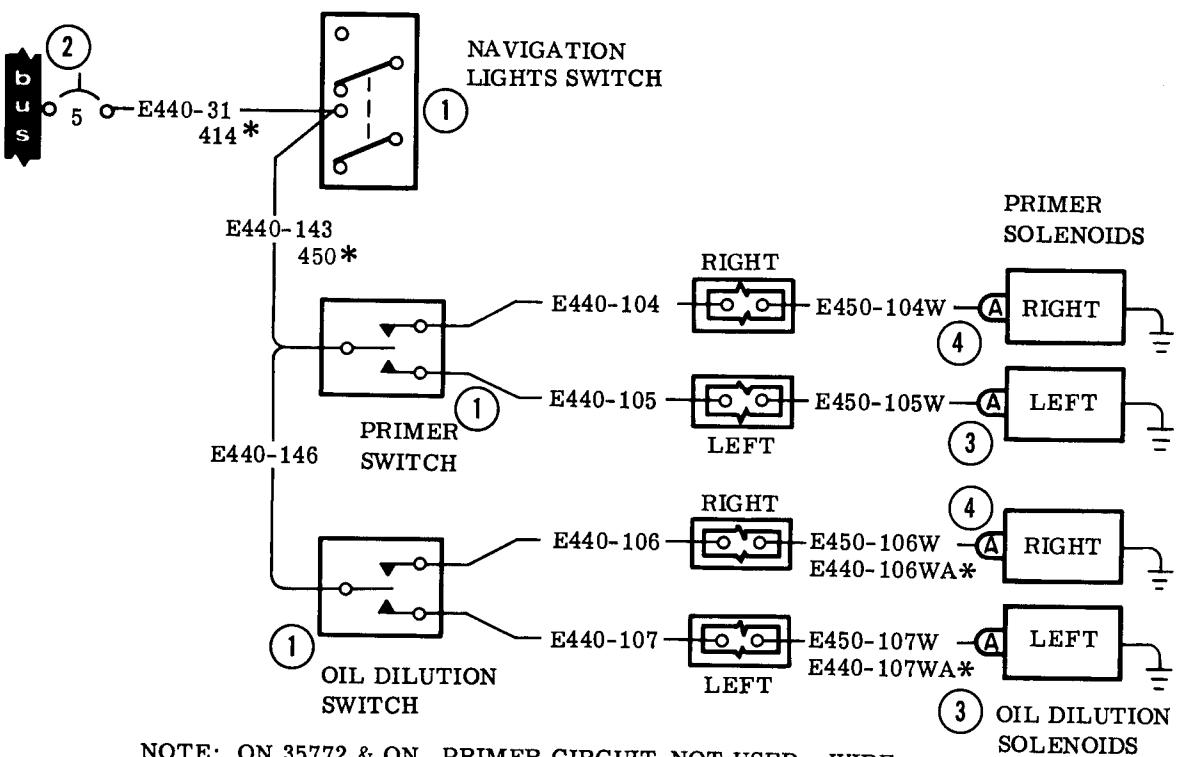


Figure 6-40. Primer and Oil Dilution Circuit (Sheet 1 of 2)



35753 thru 35771
Model 310B
*35772 and on
Model 310C & 310D

Figure 6-40. Primer and Oil Dilution Circuit (Sheet 2 of 2)

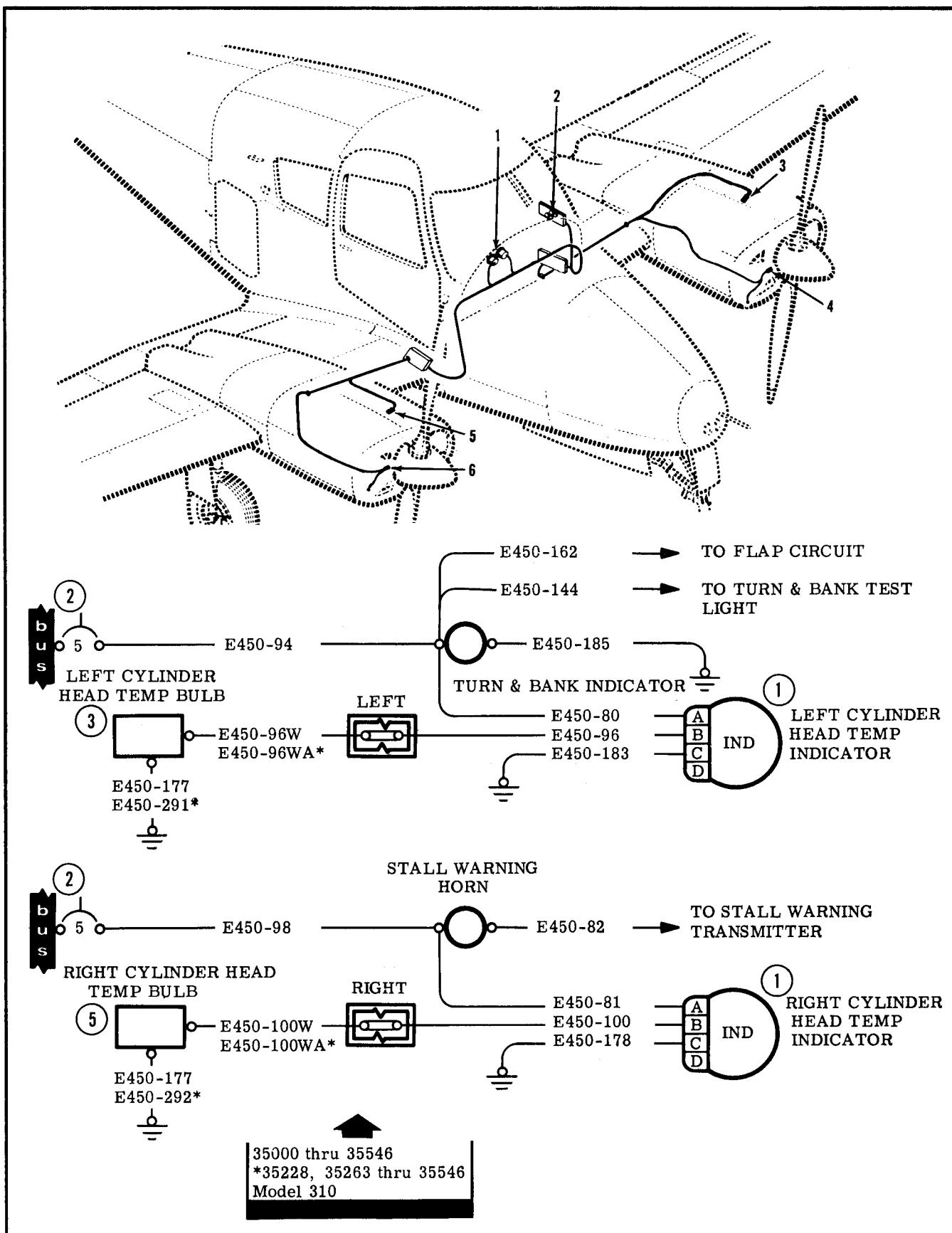


Figure 6-41. Cylinder Head Temp and Oil Temp Circuits (Sheet 1 of 4)

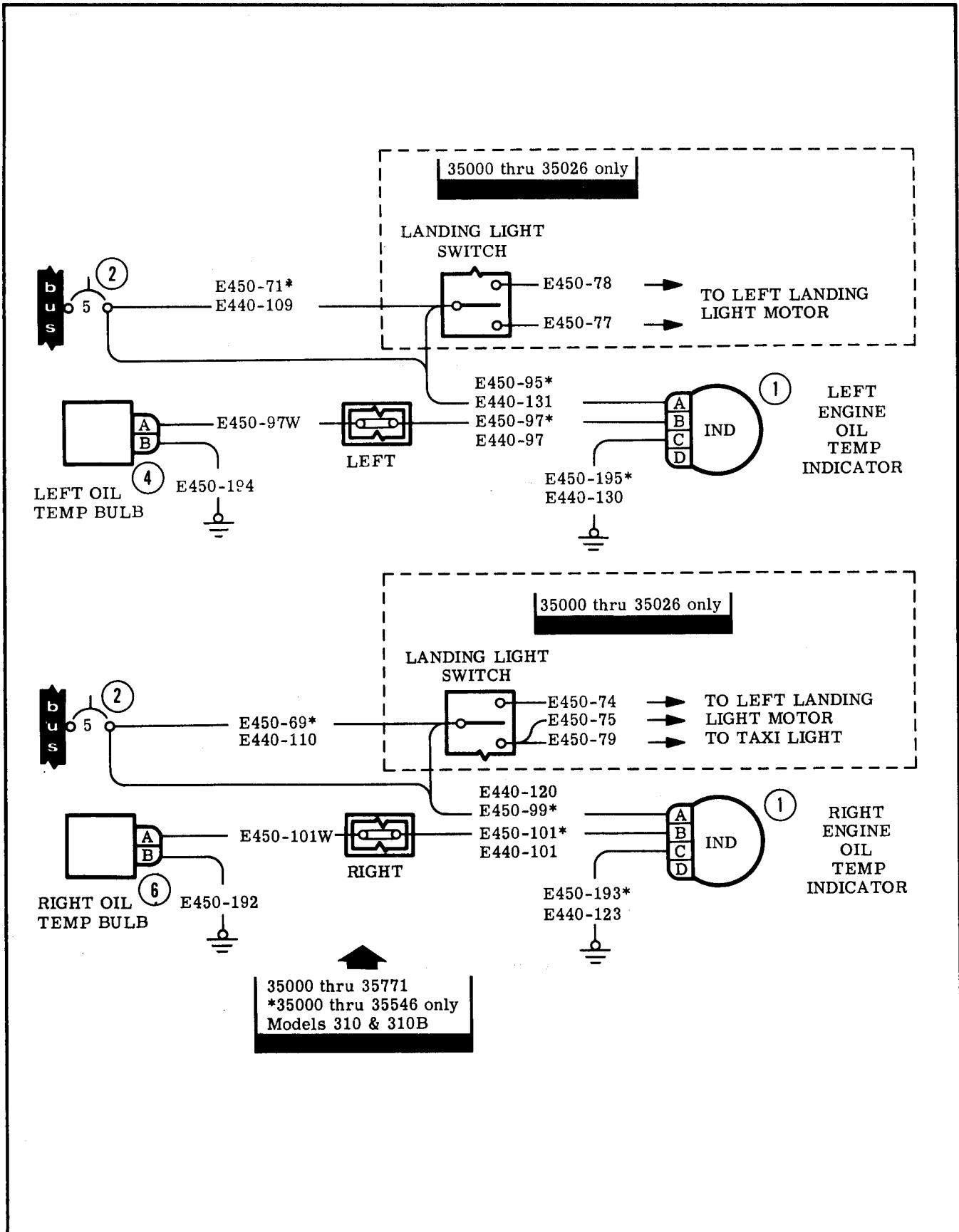


Figure 6-41. Cylinder Head Temp and Oil Temp Circuits (Sheet 2 of 4)

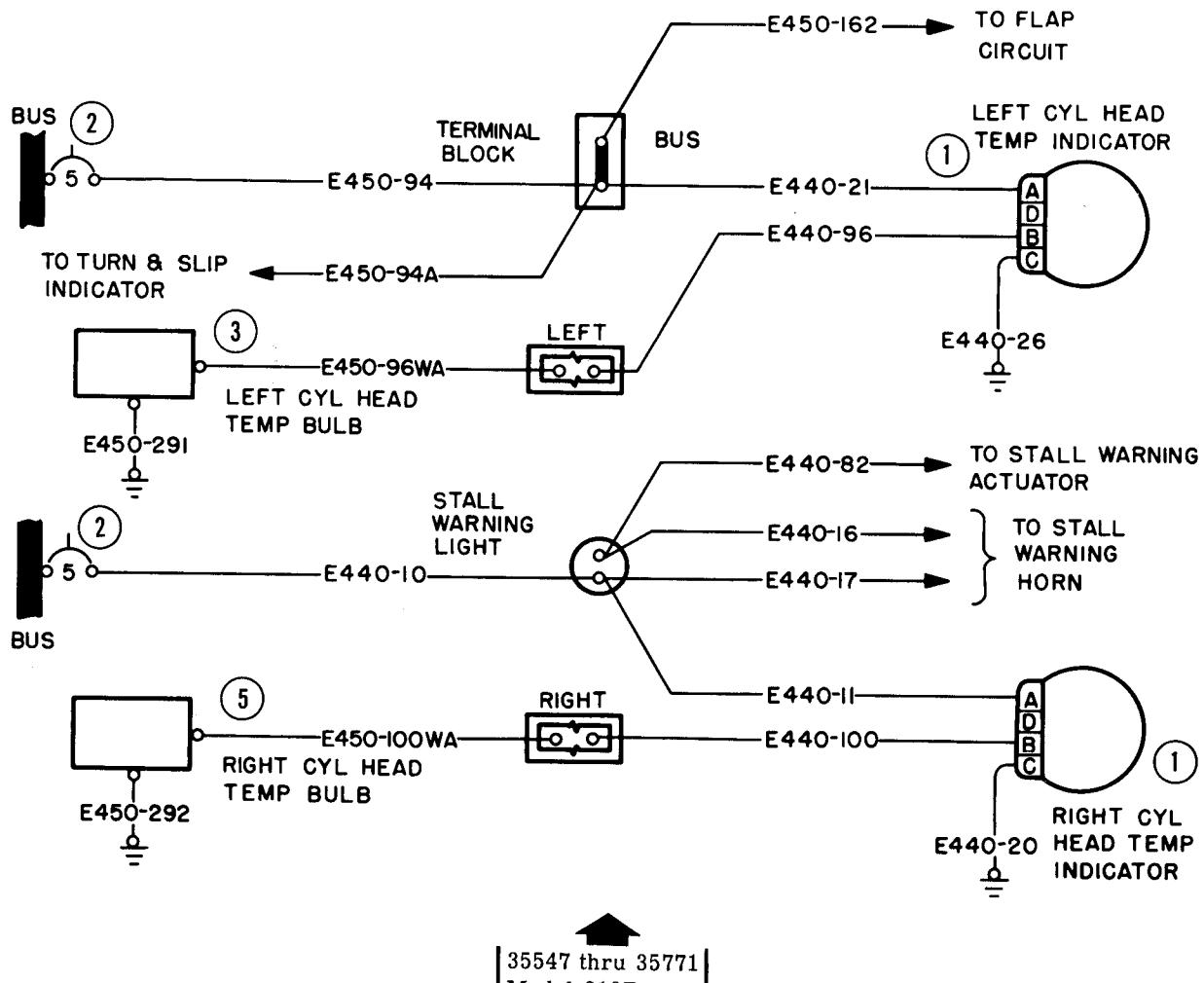


Figure 6-41. Cylinder Head Temp and Oil Temp Circuits (Sheet 3 of 4)

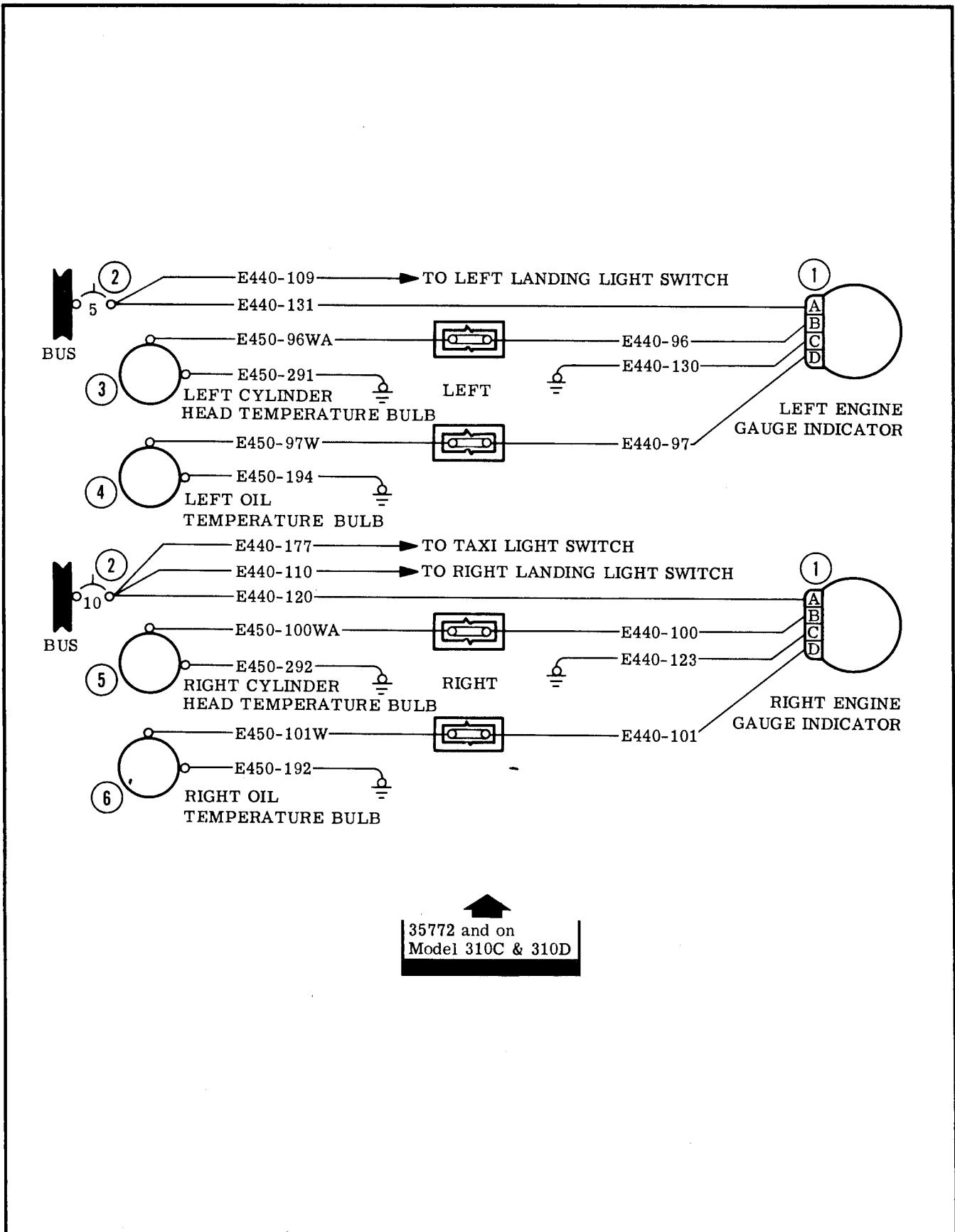


Figure 6-41. Cylinder Head Temp and Oil Temp Circuits (Sheet 4 of 4)

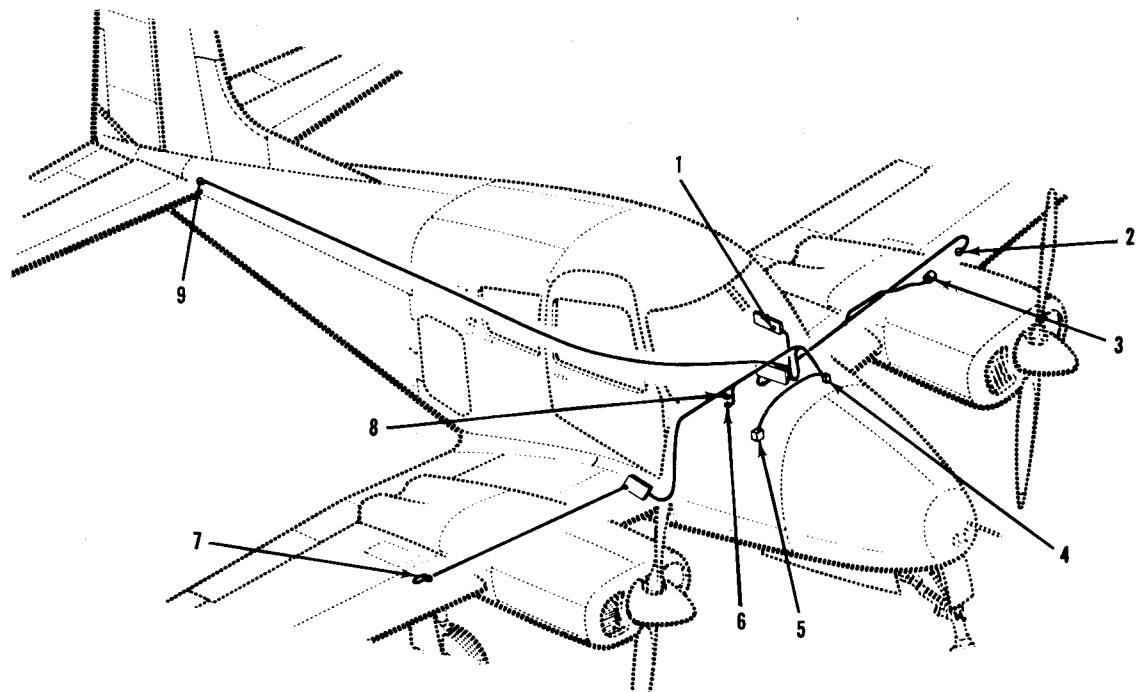


Figure 6-42. De-Ice and Left Wing Light Circuit (Sheet 1 of 2)

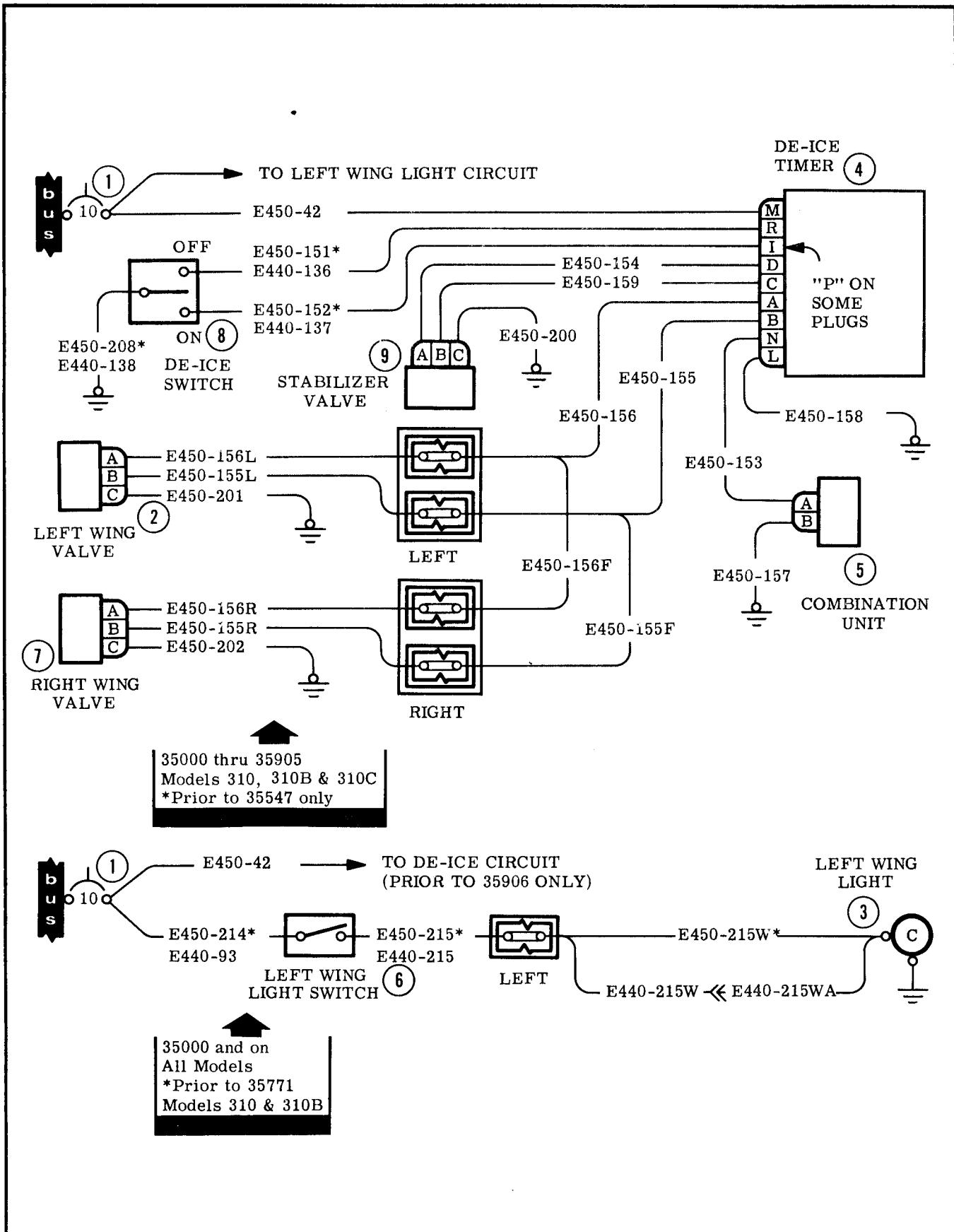


Figure 6-42. De-Ice and Left Wing Light Circuit (Sheet 2 of 2)

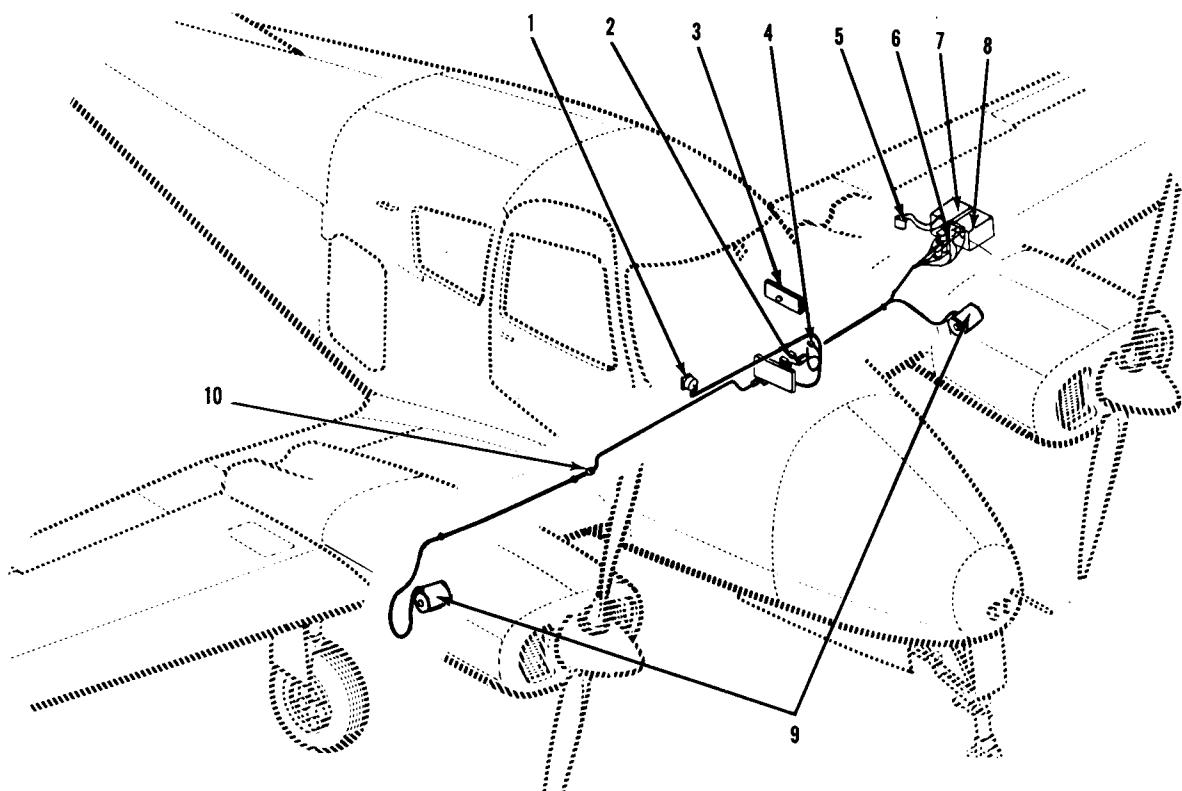


Figure 6-43. Battery and Starter Circuit (Sheet 1 of 2)

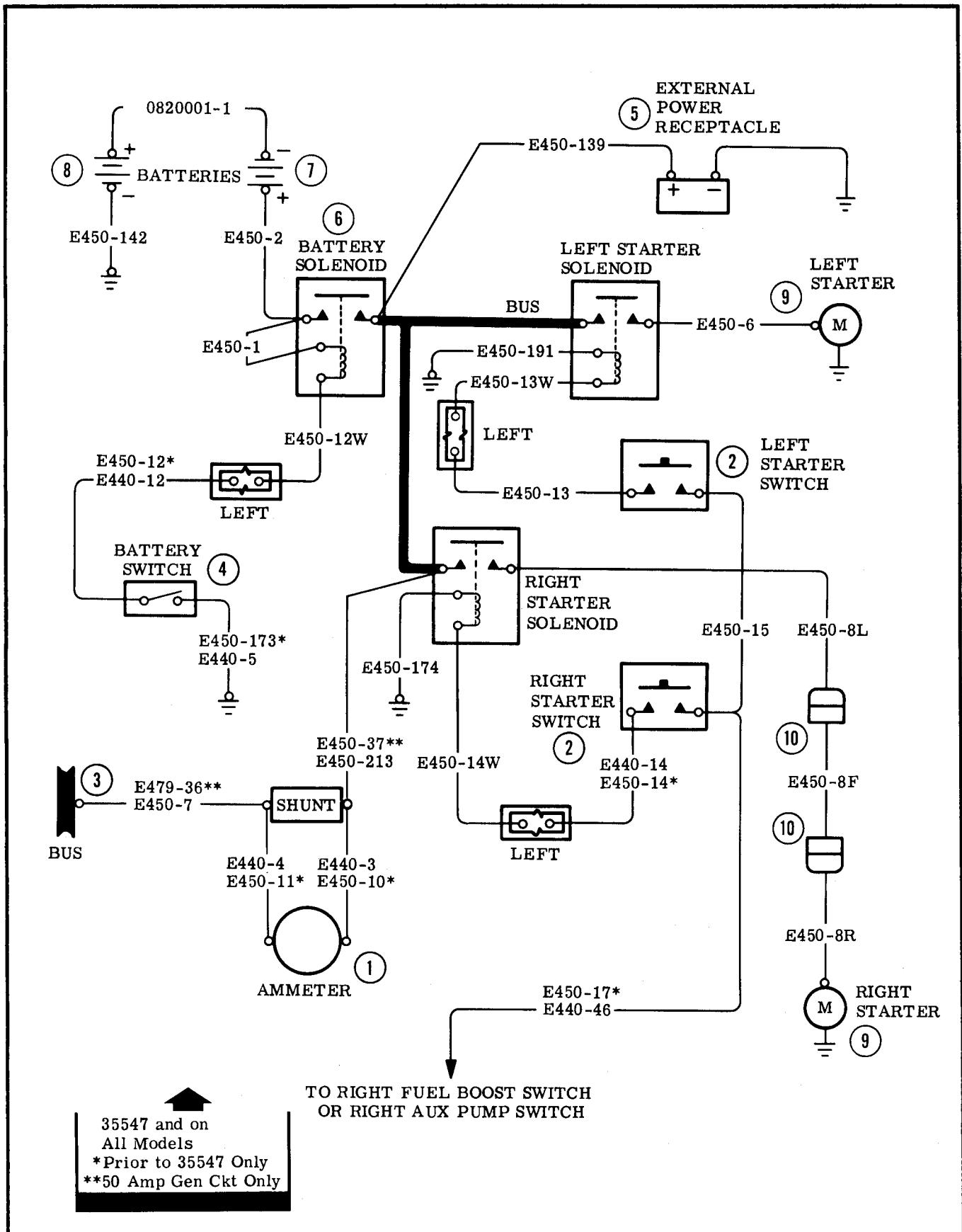


Figure 6-44. Battery and Starter Circuit (Sheet 2 of 2)

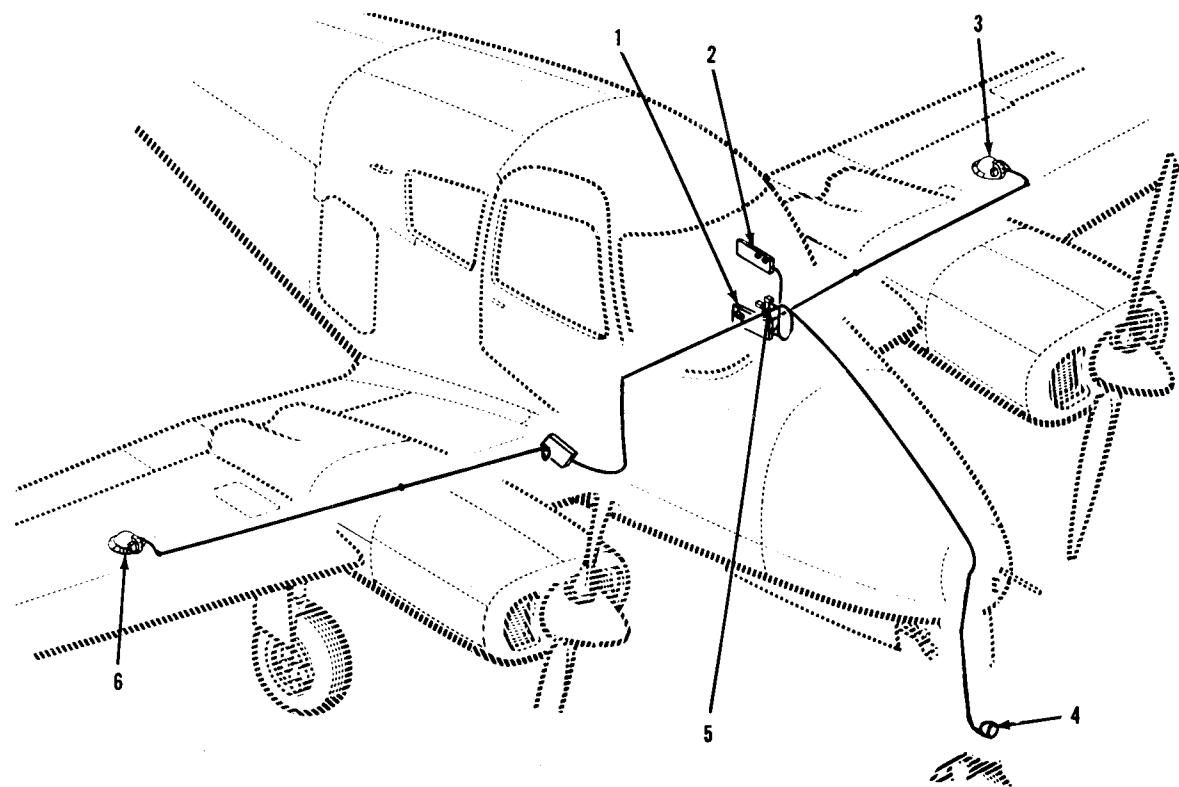


Figure 6-45. Landing and Taxi Light Circuit (Sheet 1 of 2)

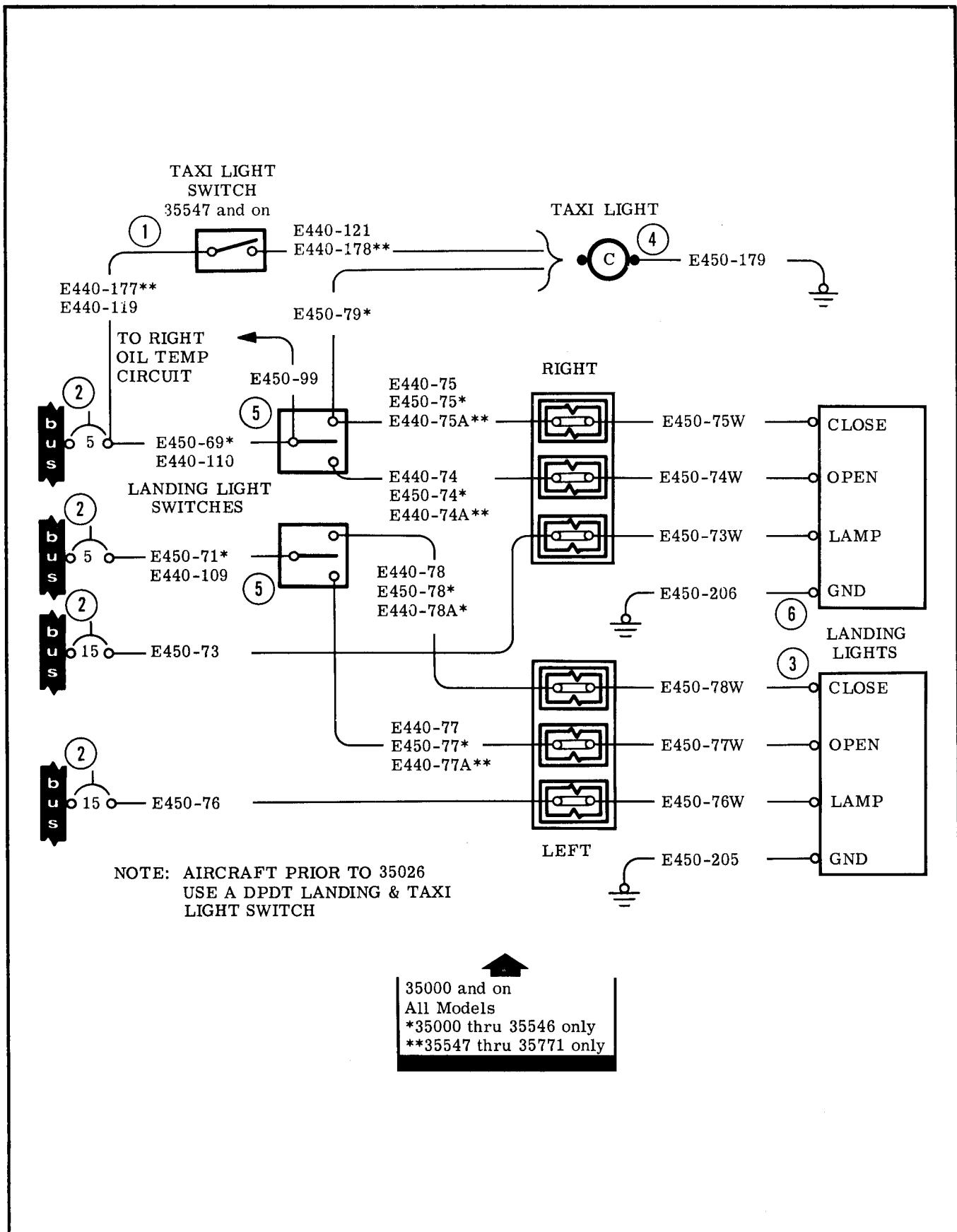


Figure 6-45. Landing and Taxi Light Circuit (Sheet 2 of 2)

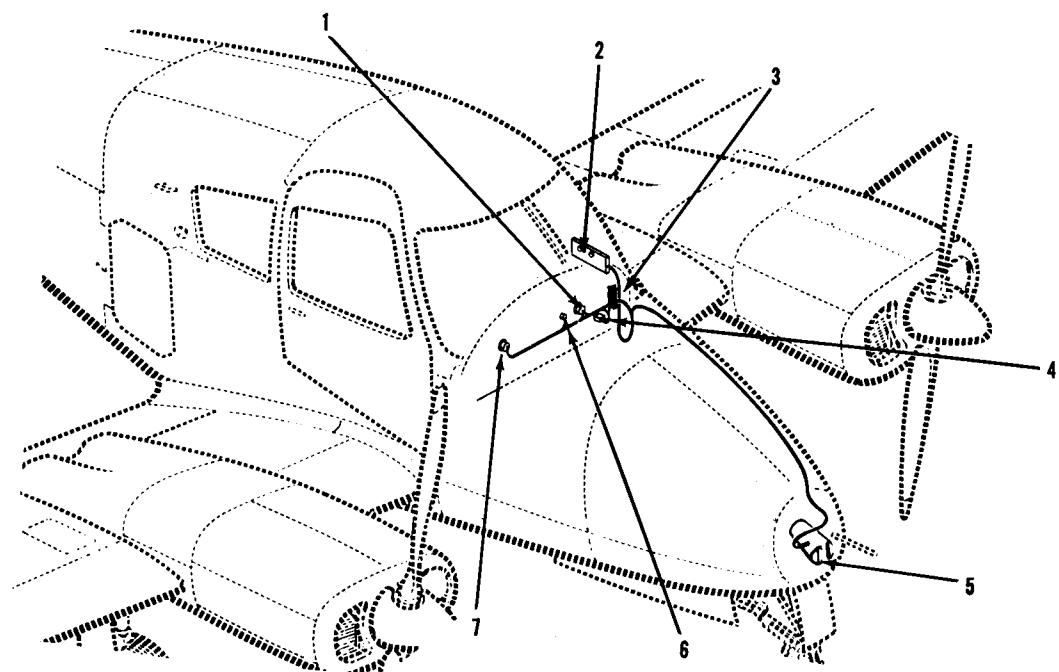


Figure 6-46. Turn and Slip and Outside Air Temperature Circuits (Sheet 1 of 2)

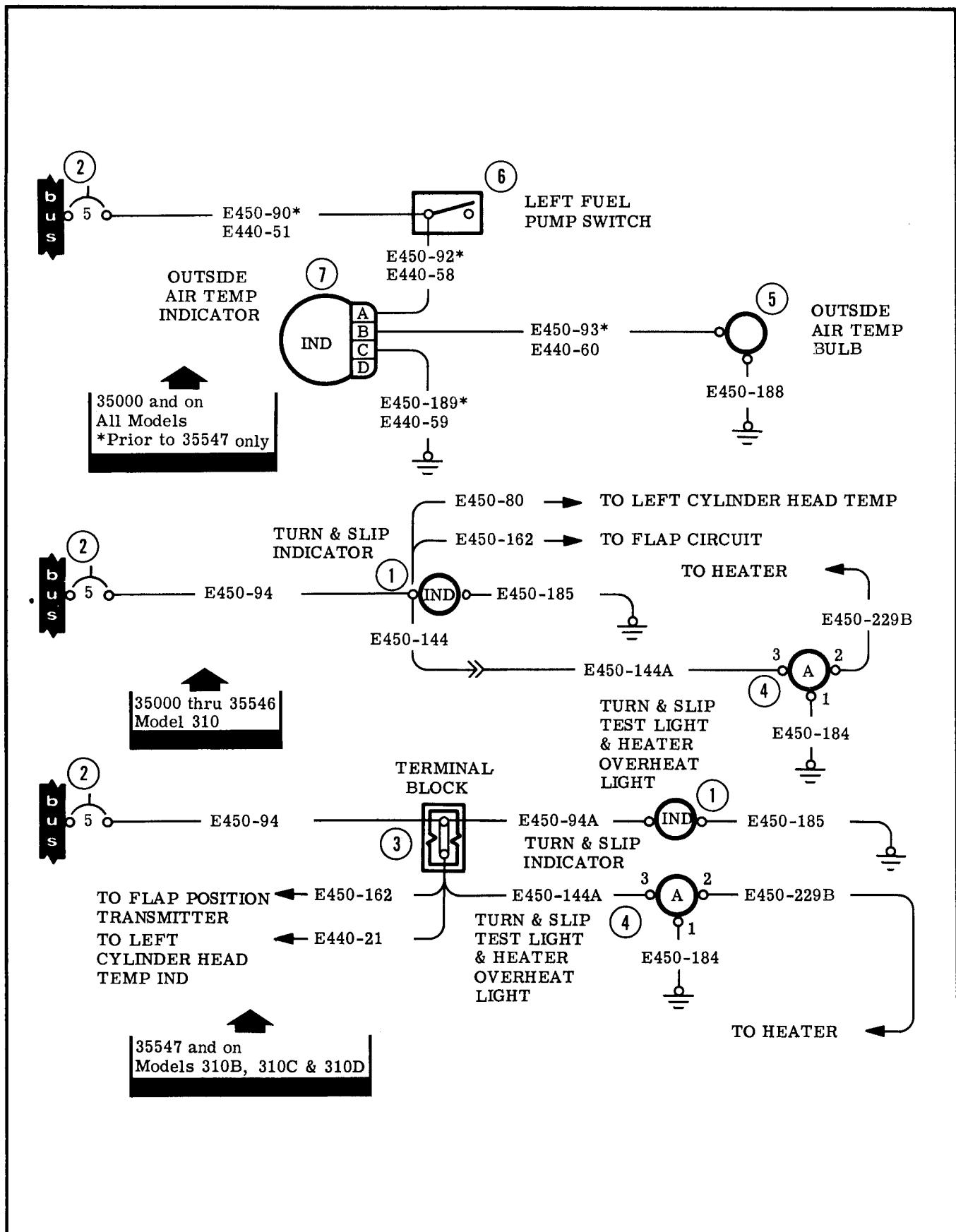


Figure 6-46. Turn and Slip and Outside Air Temperature Circuit (Sheet 2 of 2)

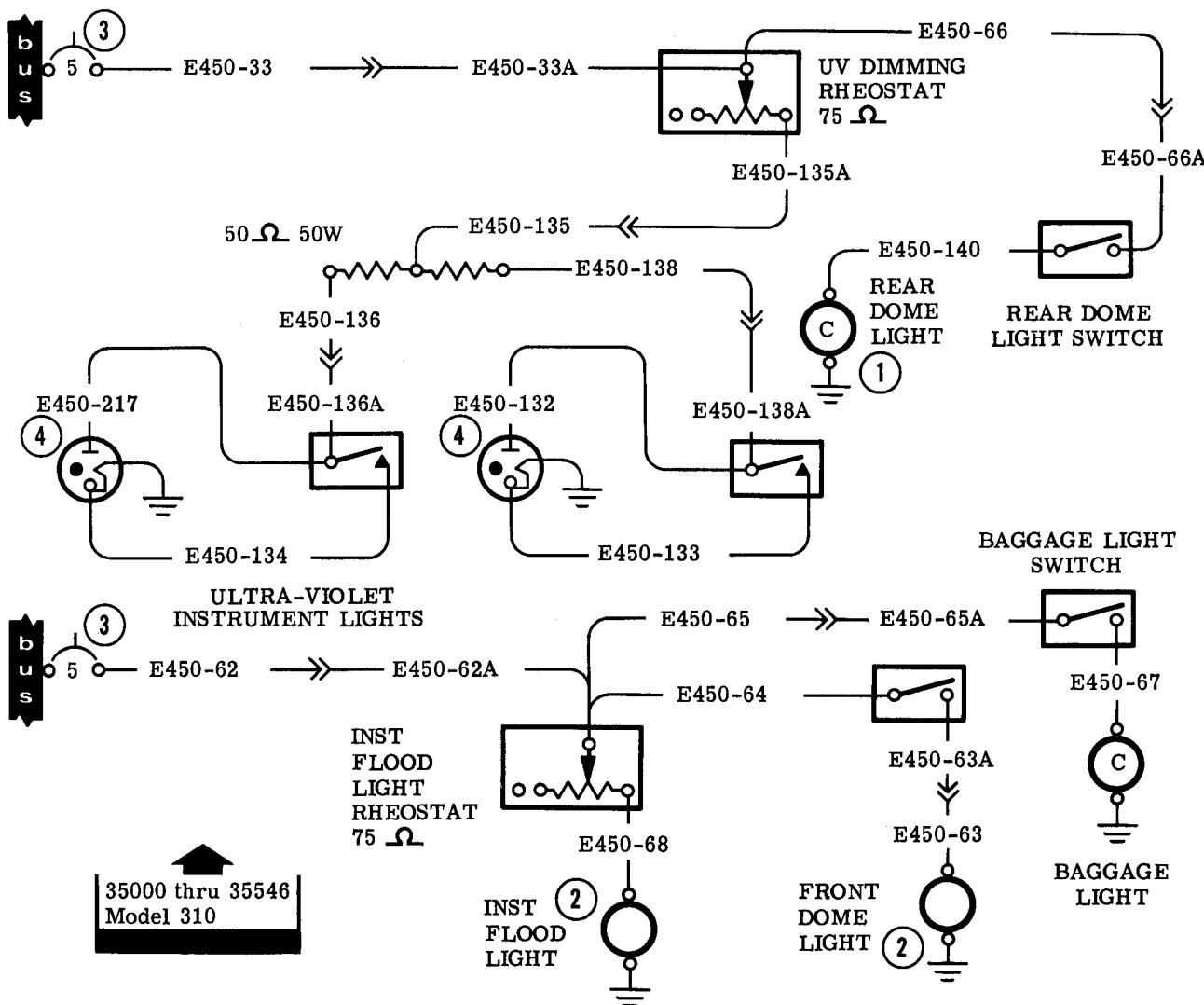
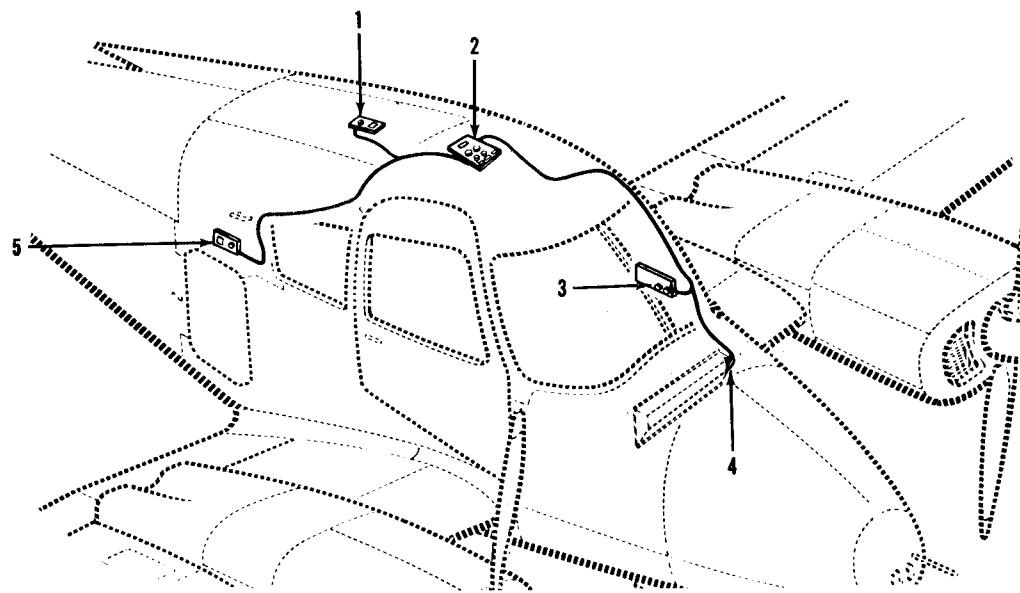


Figure 6-47. Interior Lights Circuit (Sheet 1 of 2)

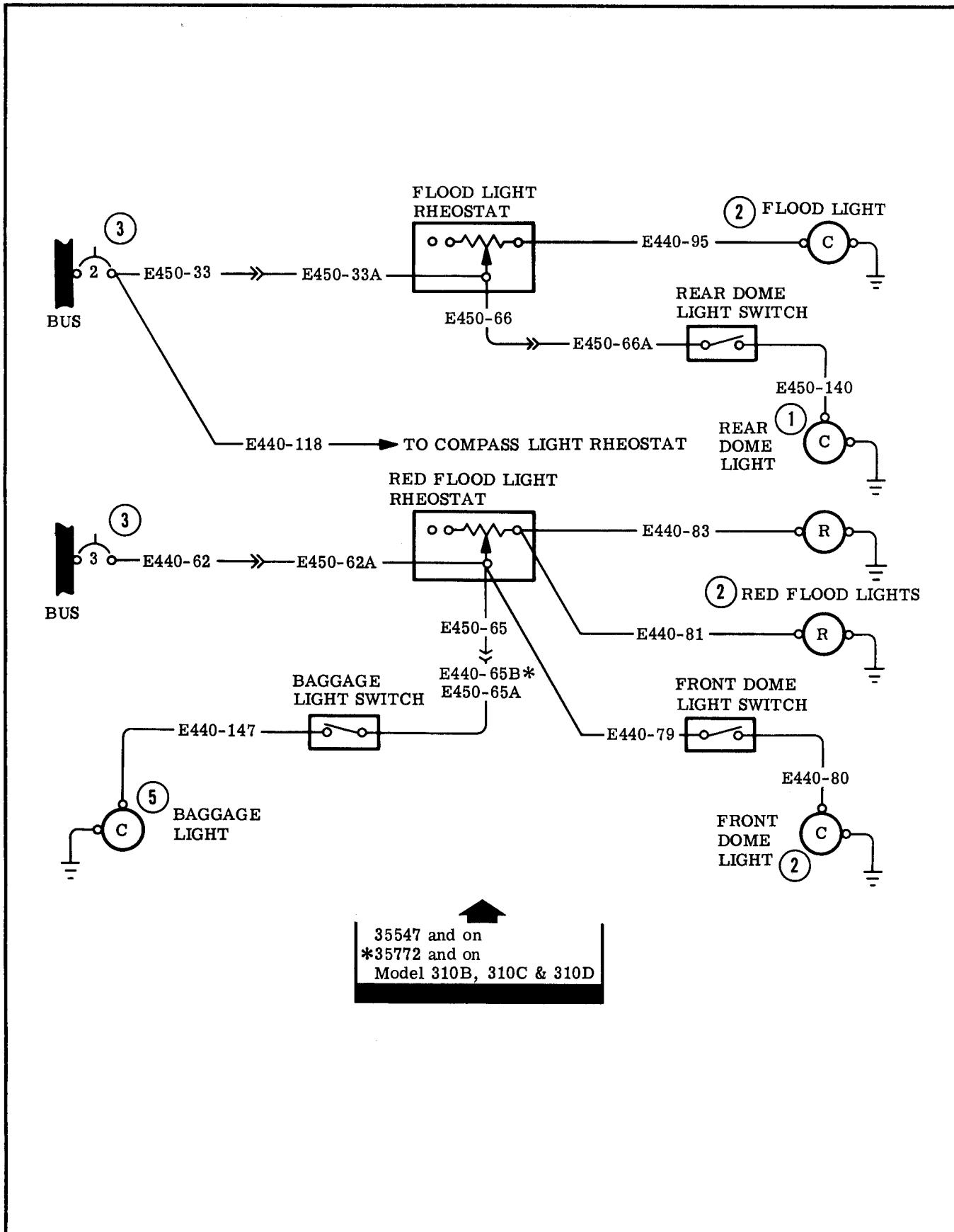


Figure 6-47. Interior Lights Circuit (Sheet 2 of 2)

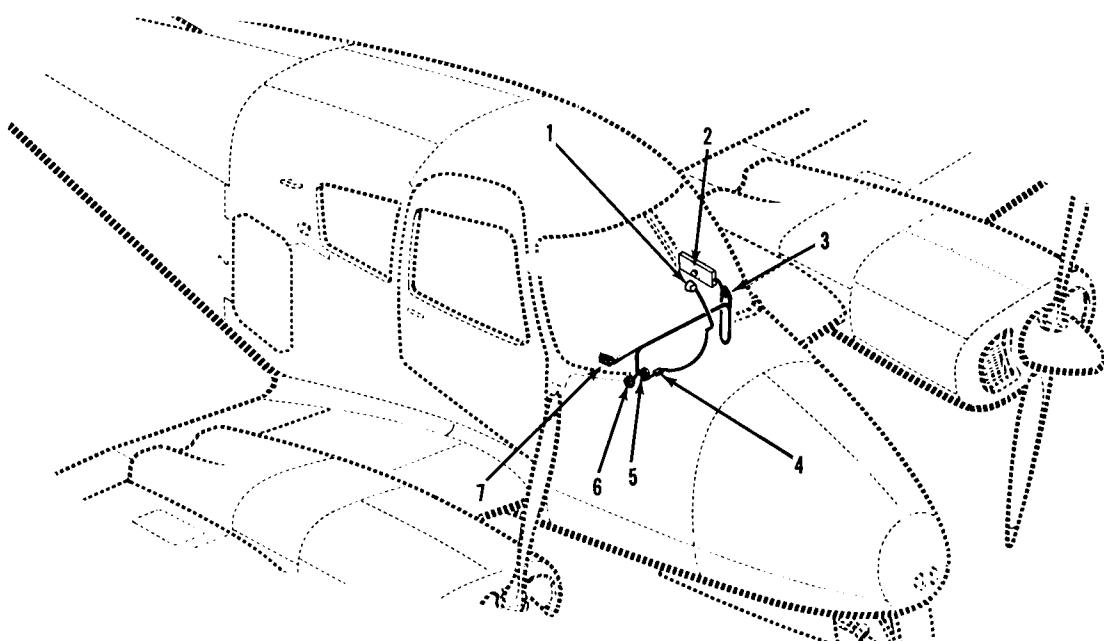


Figure 6-48. Switch Panel, Fuel Selector and Compass Light Circuit (Sheet 1 of 2)

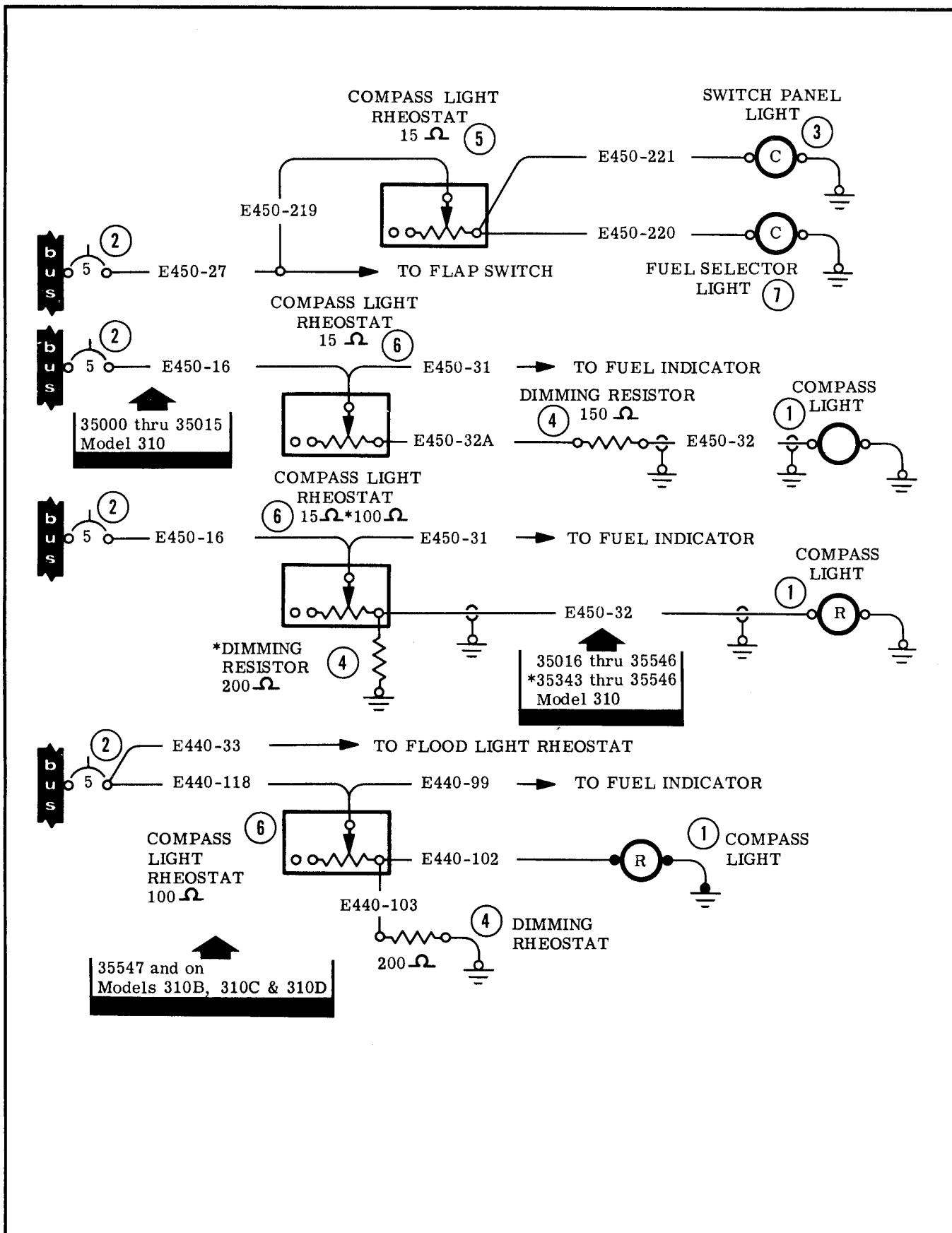


Figure 6-48. Switch Panel, Fuel Selector and Compass Light Circuit (Sheet 2 of 2)

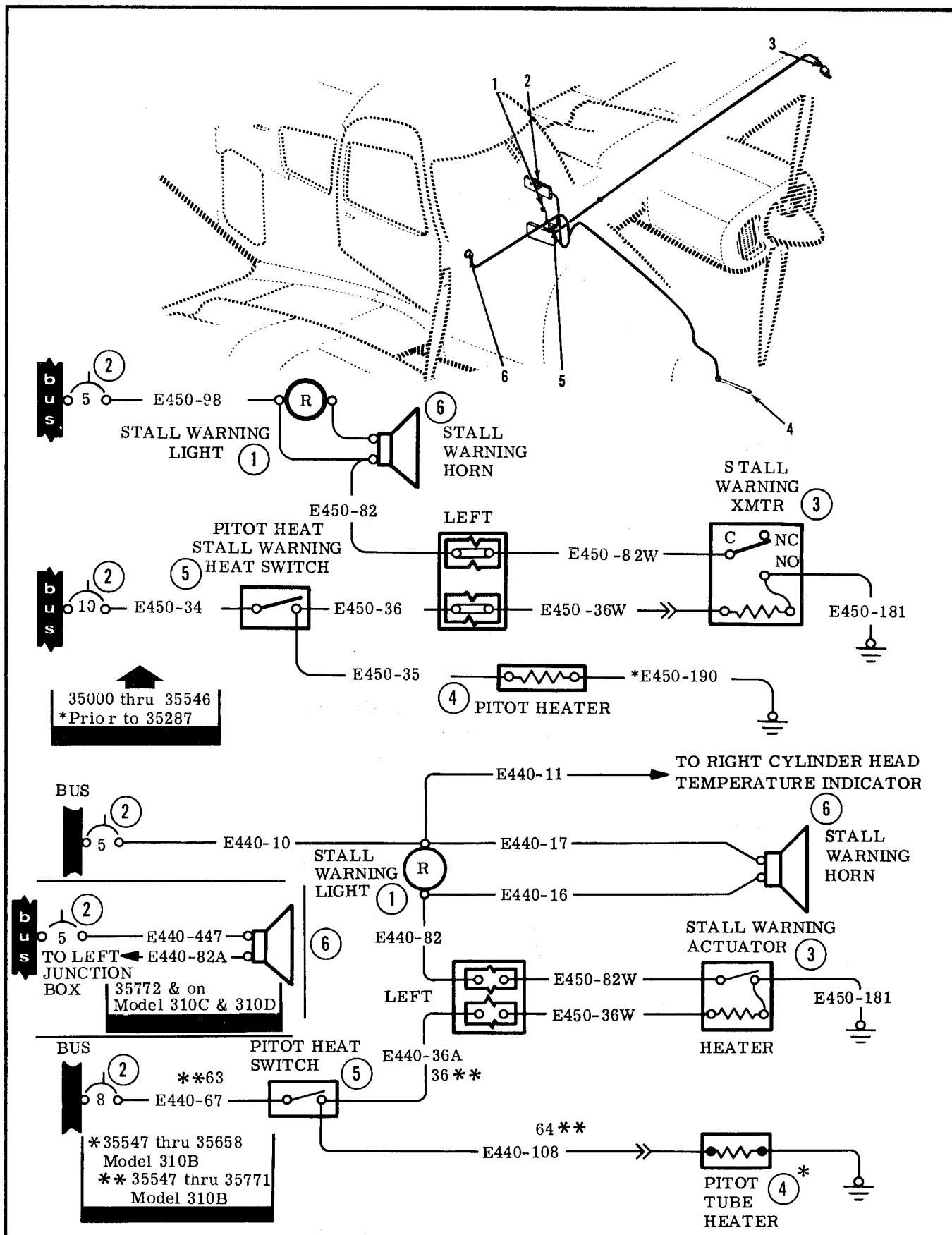


Figure 6-49. Stall Warning and Pitot Heat Circuit

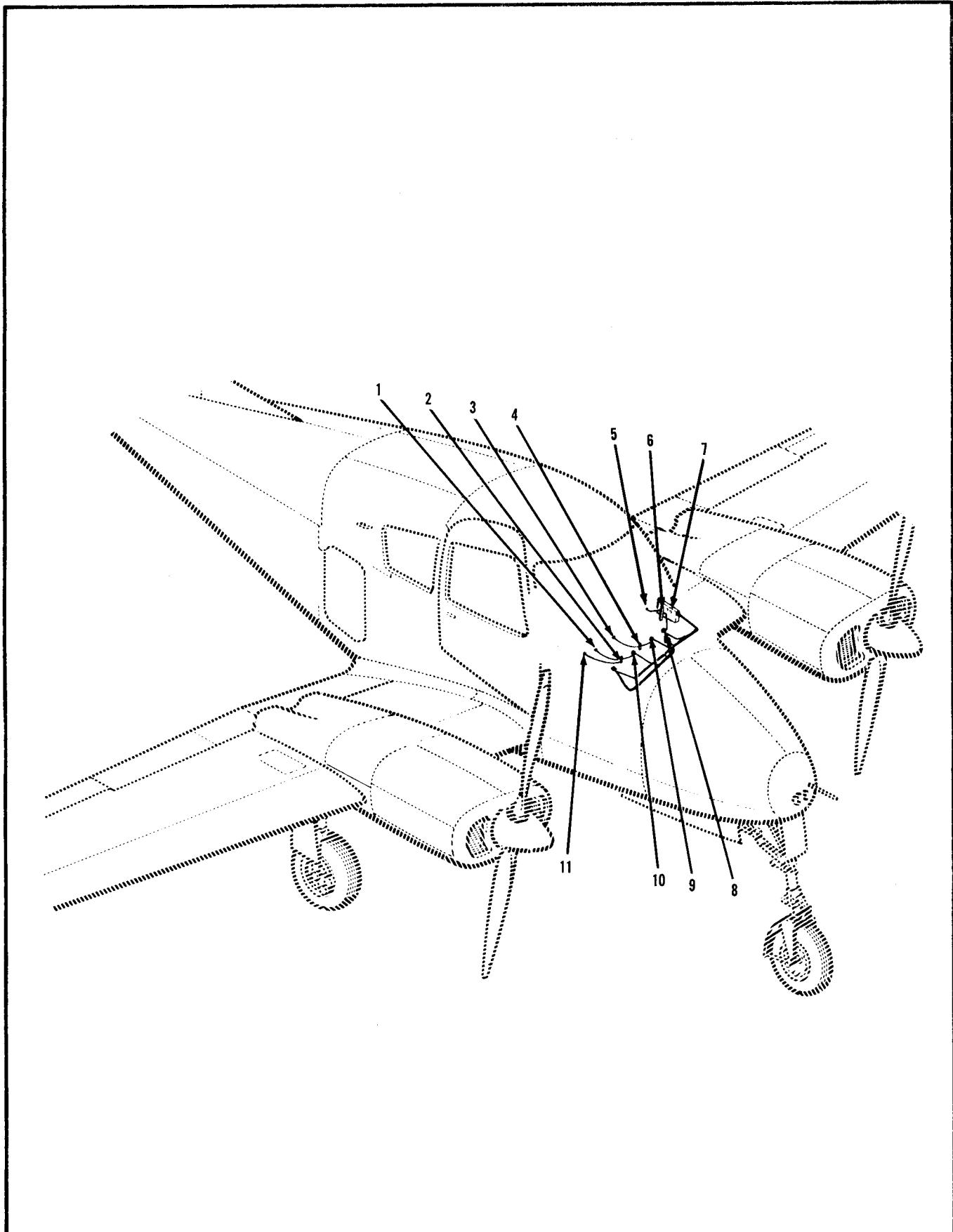


Figure 6-50. Instrument Panel Lighting Circuit (Sheet 1 of 2)

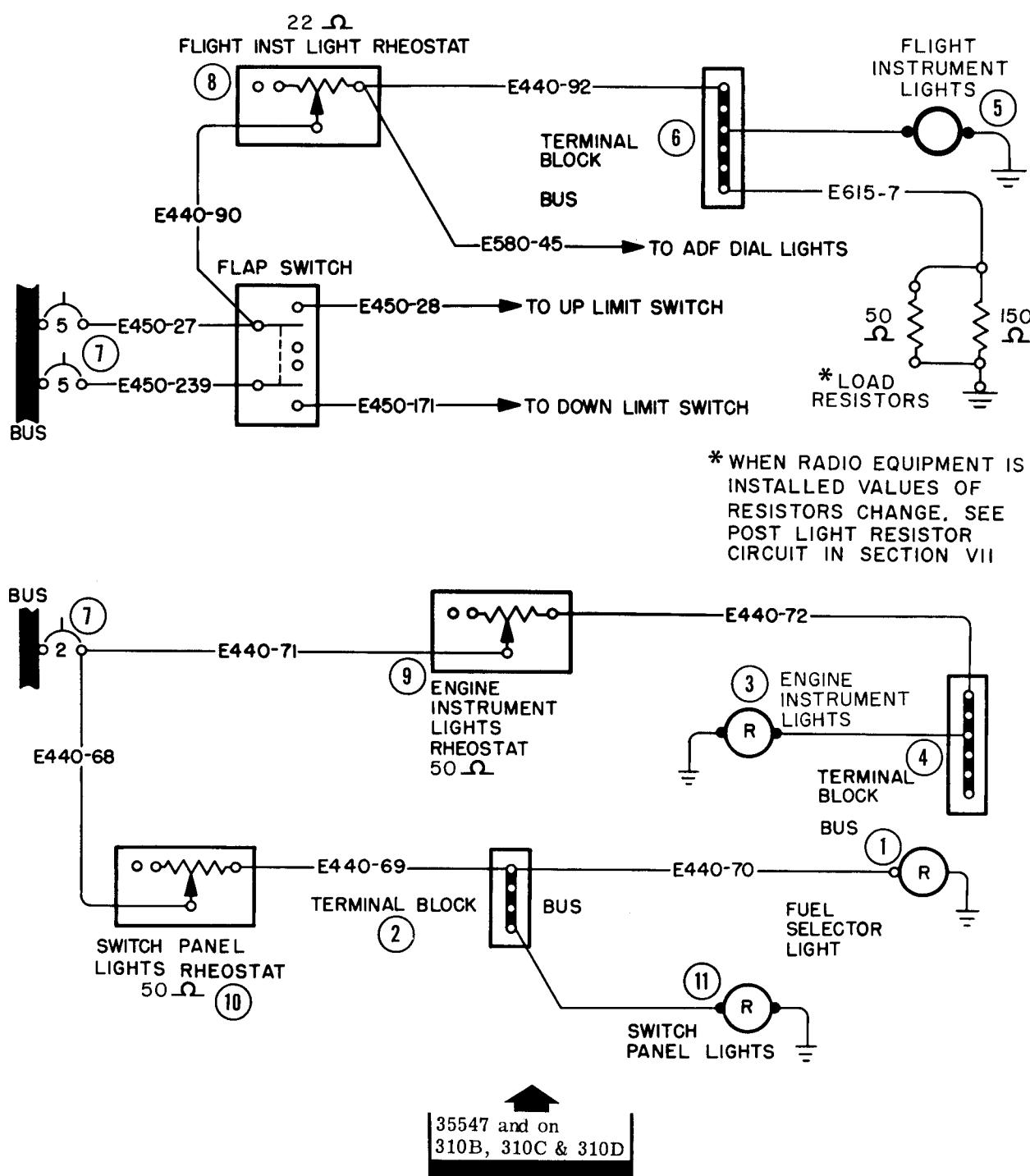


Figure 6-50. Instrument Panel Lighting Circuit (Sheet 2 of 2)

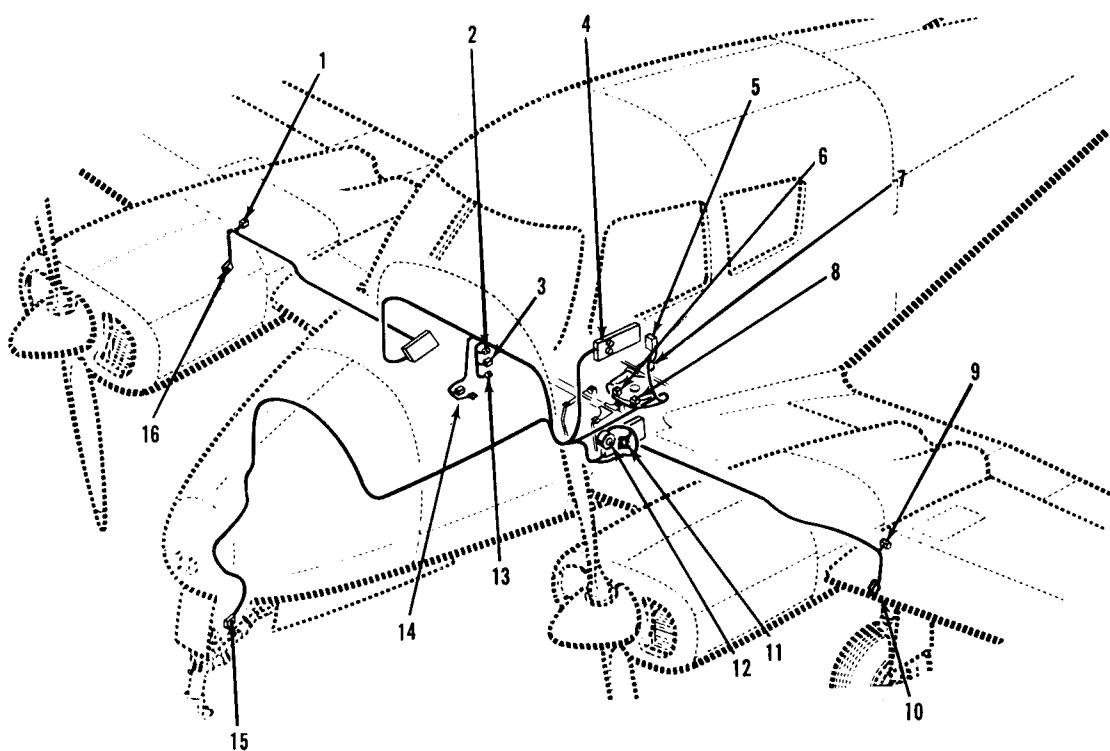


Figure 6-51. Landing Gear Circuit(Sheet 1 of 6)

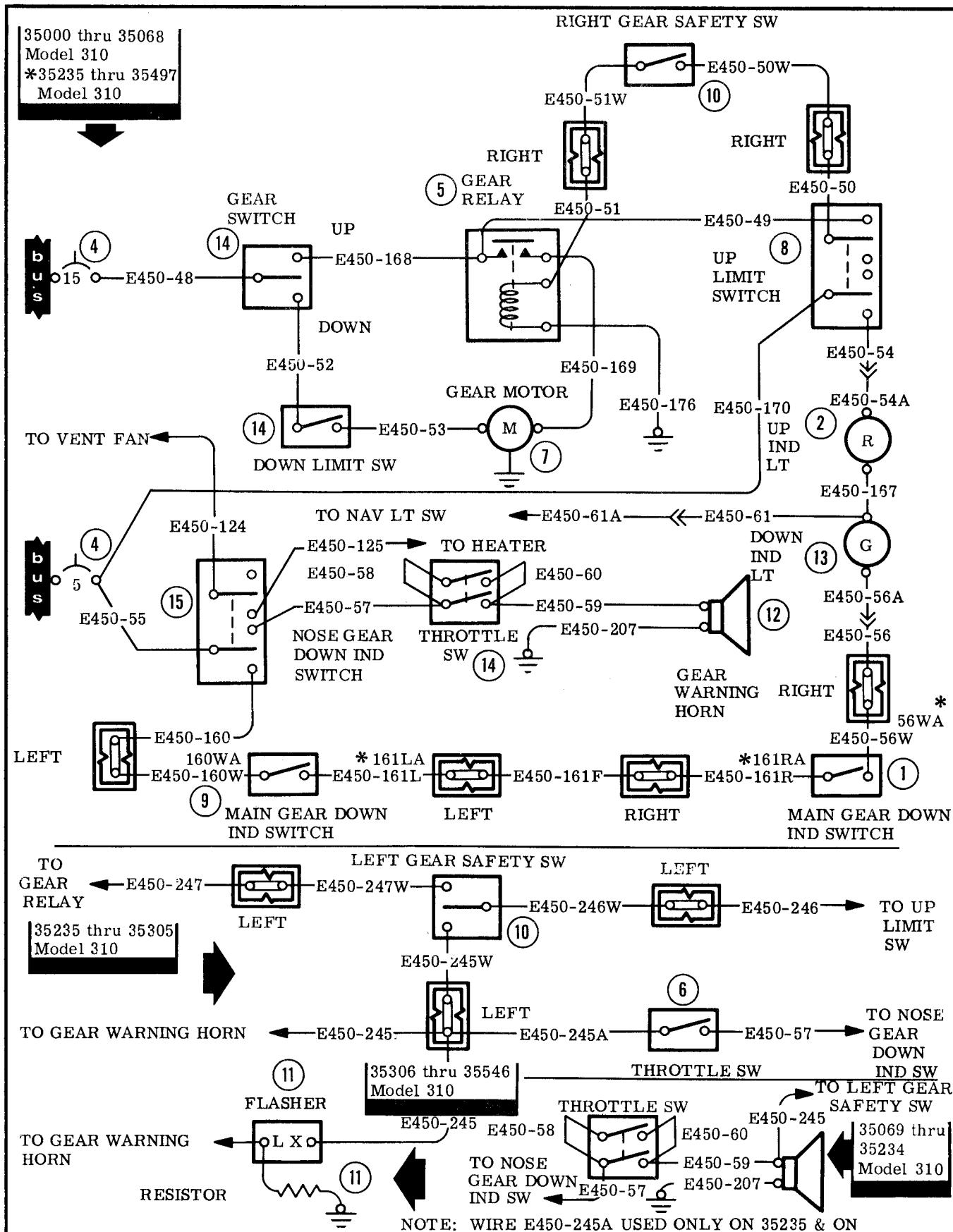


Figure 6-51. Landing Gear Circuit(Sheet 2 of 6)

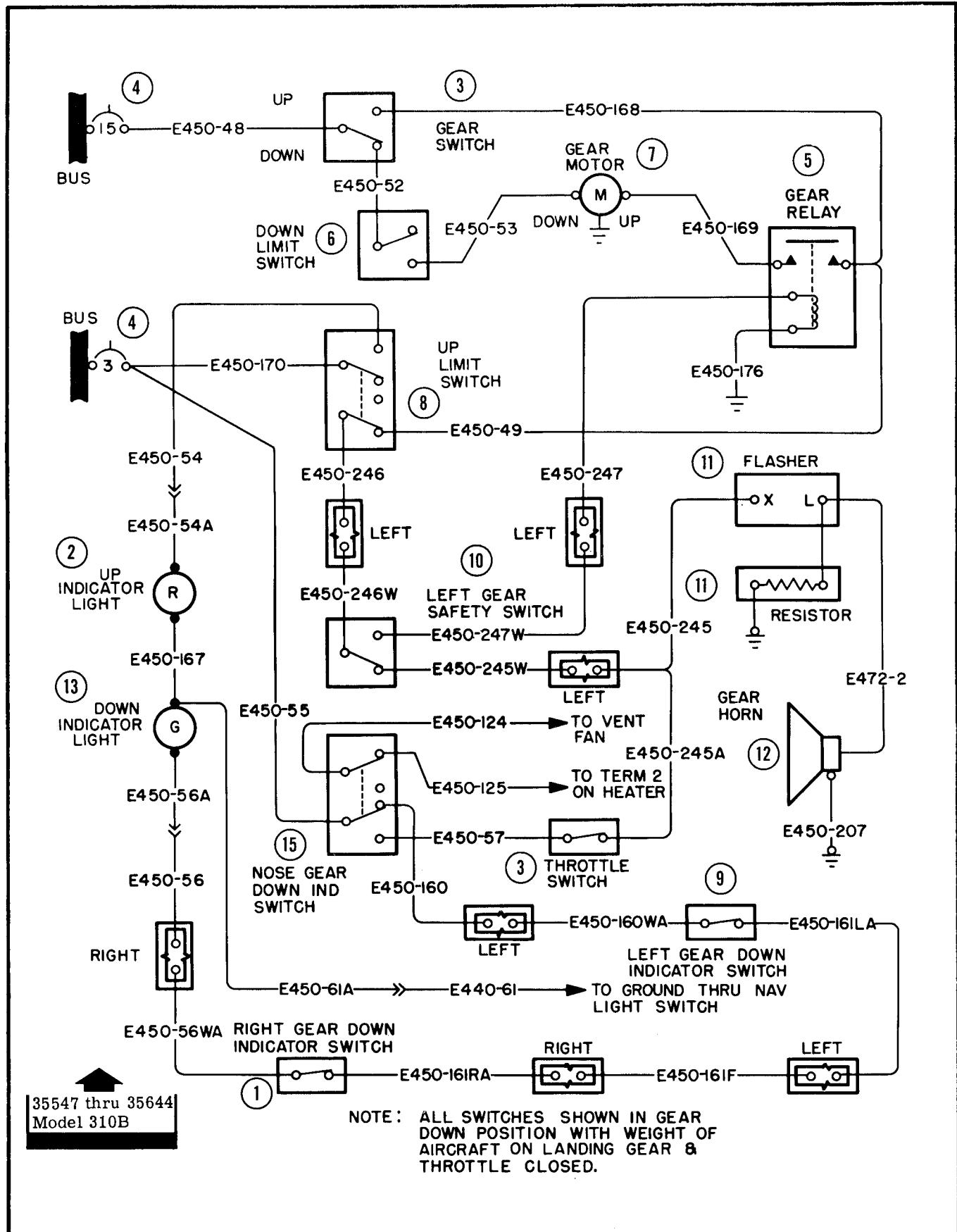


Figure 6-51. Landing Gear Circuit (Sheet 3 of 6)

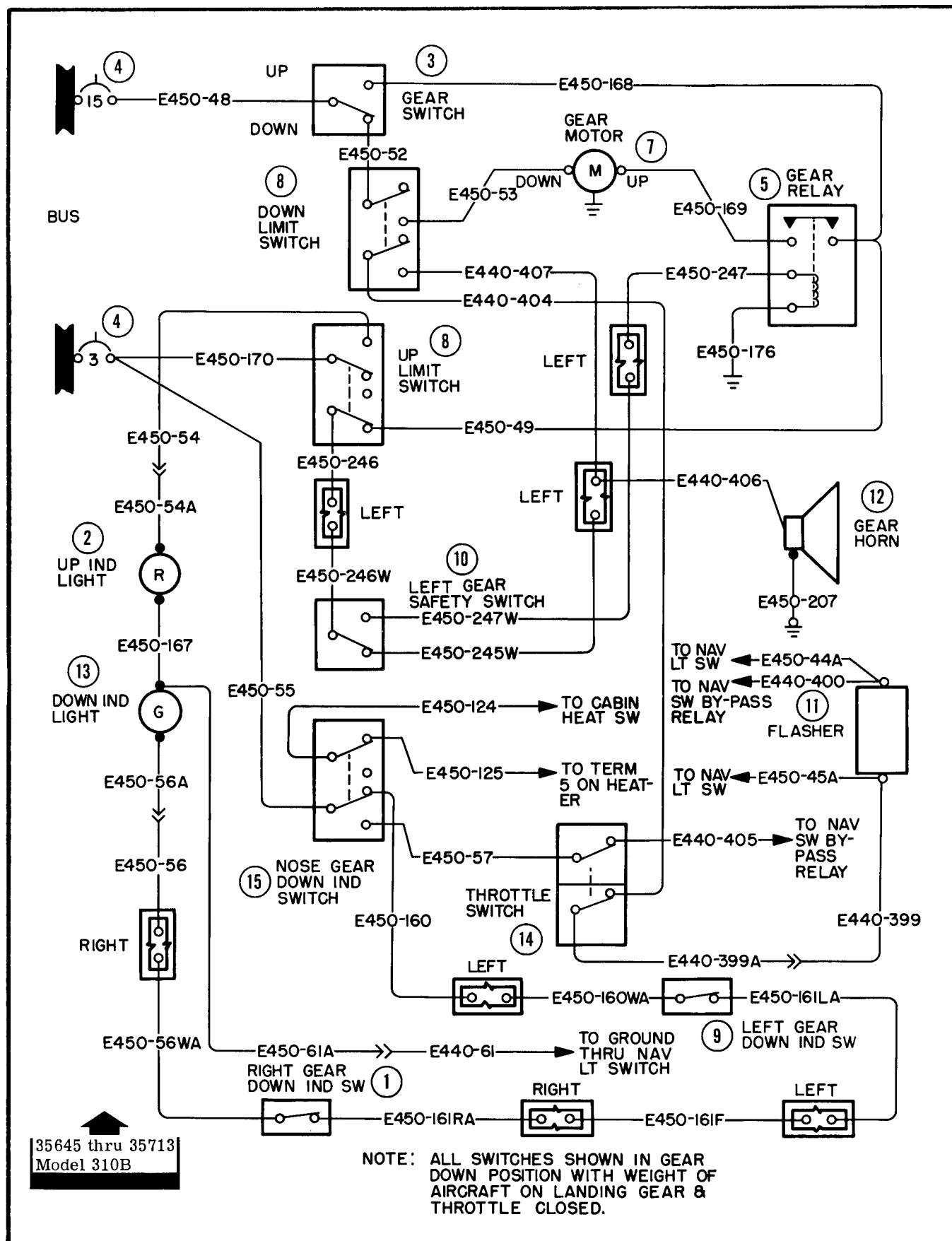


Figure 6-51. Landing Gear Circuit (Sheet 4 of 6)

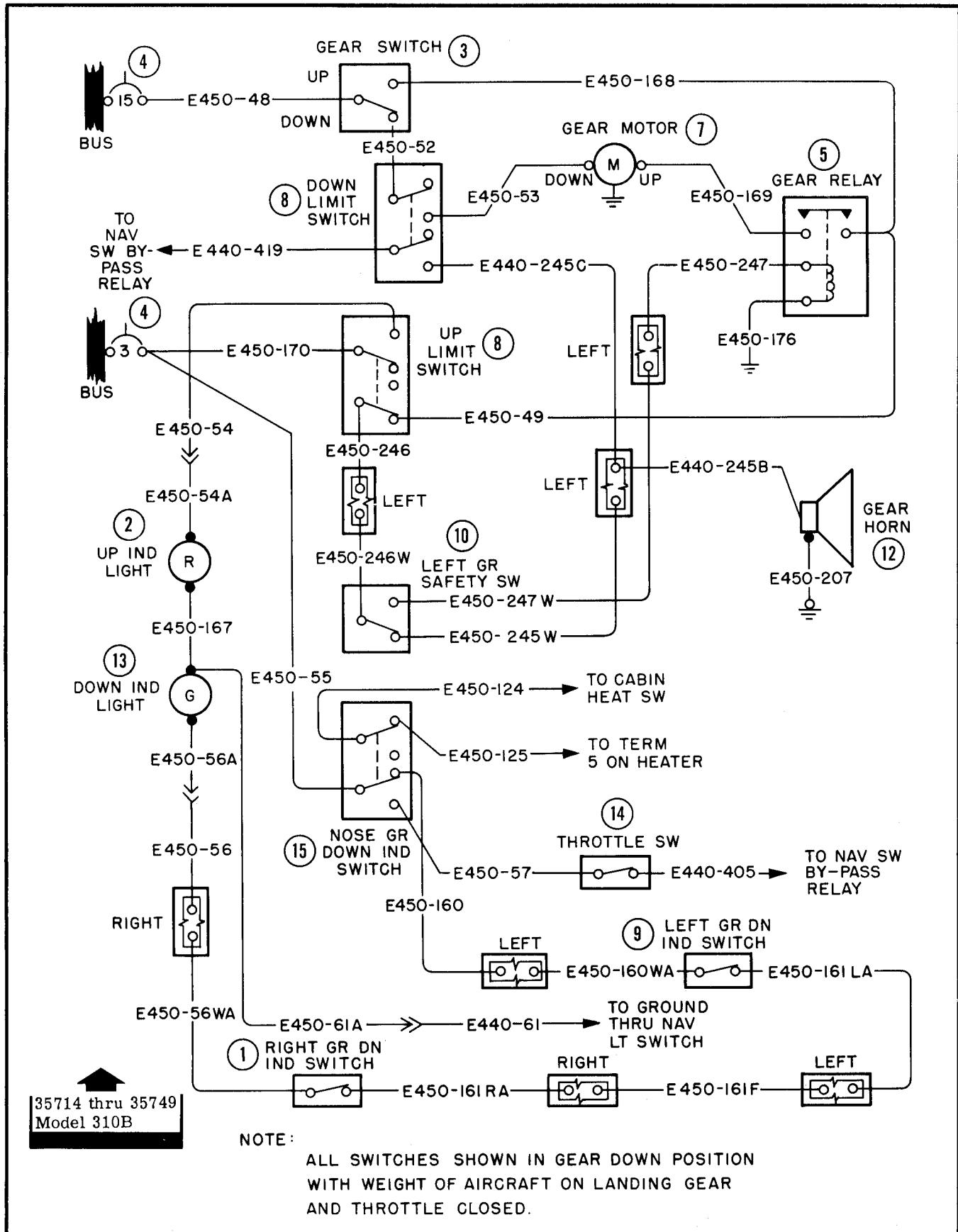


Figure 6-51. Landing Gear Circuit (Sheet 5 of 6)

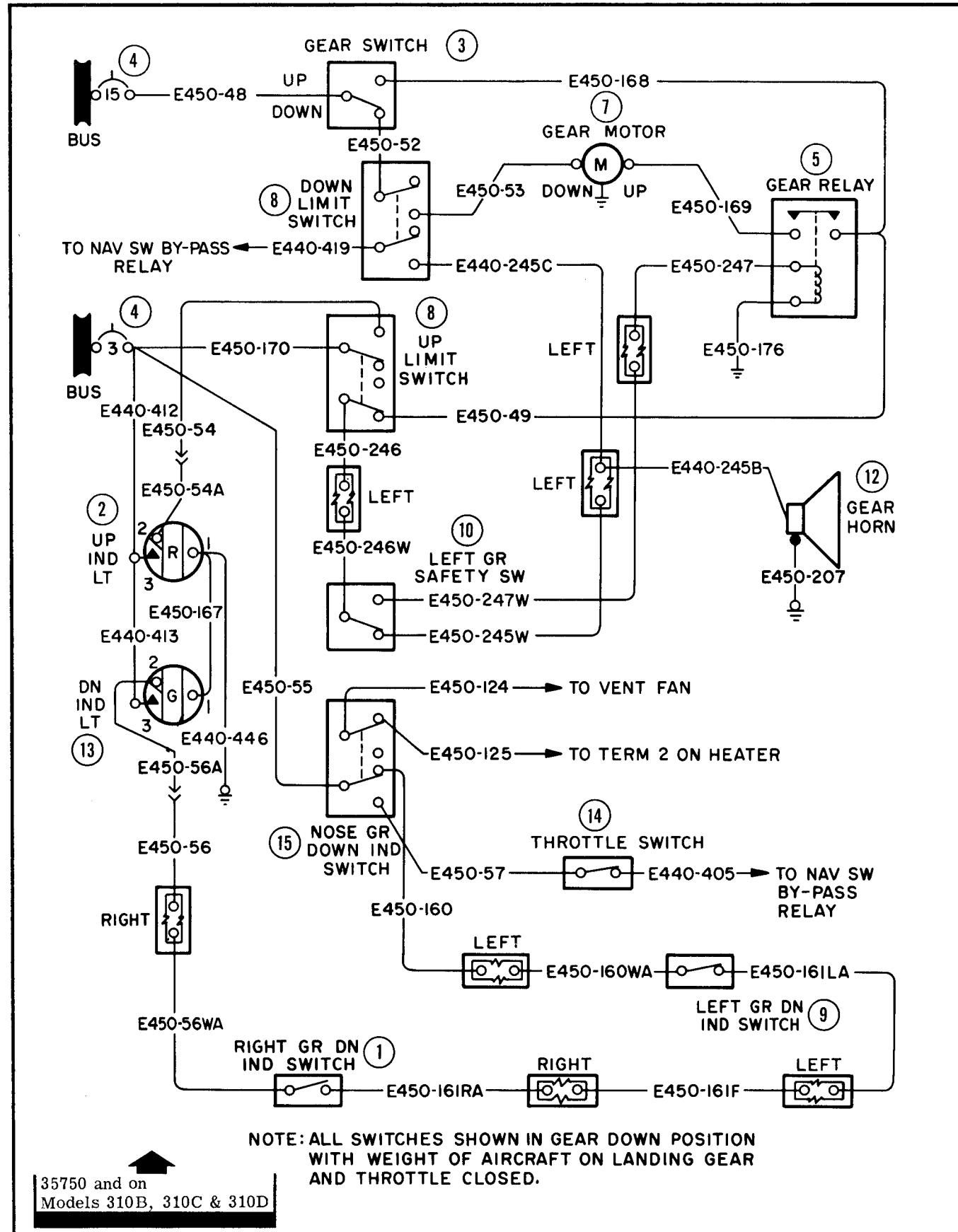


Figure 6-51. Landing Gear Circuit (Sheet 6 of 6)

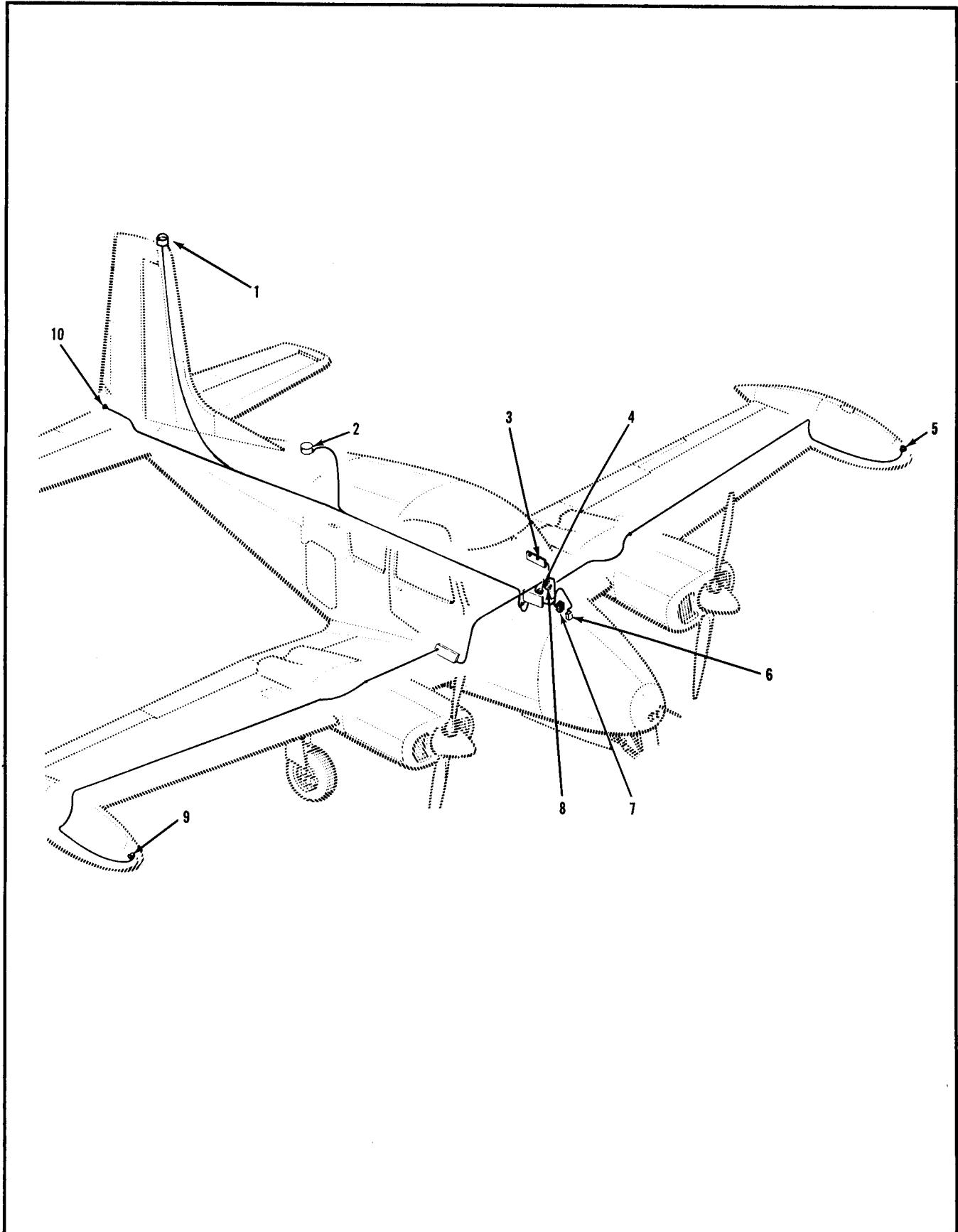


Figure 6-52. Navigation Lights and Rotating Beacon Circuits (Sheet 1 of 6)

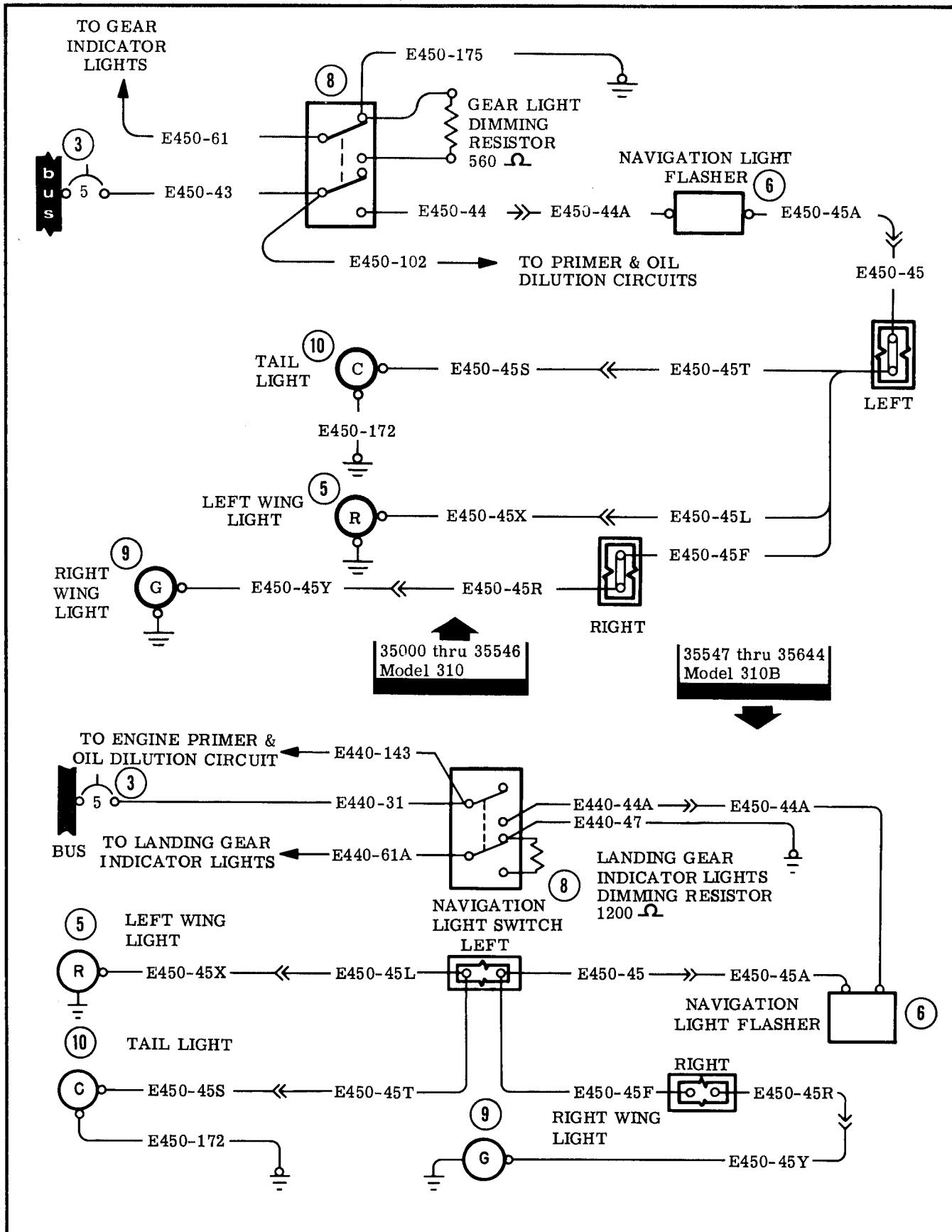


Figure 6-52. Navigational Lights and Rotating Beacon Circuits (Sheet 2 of 6)

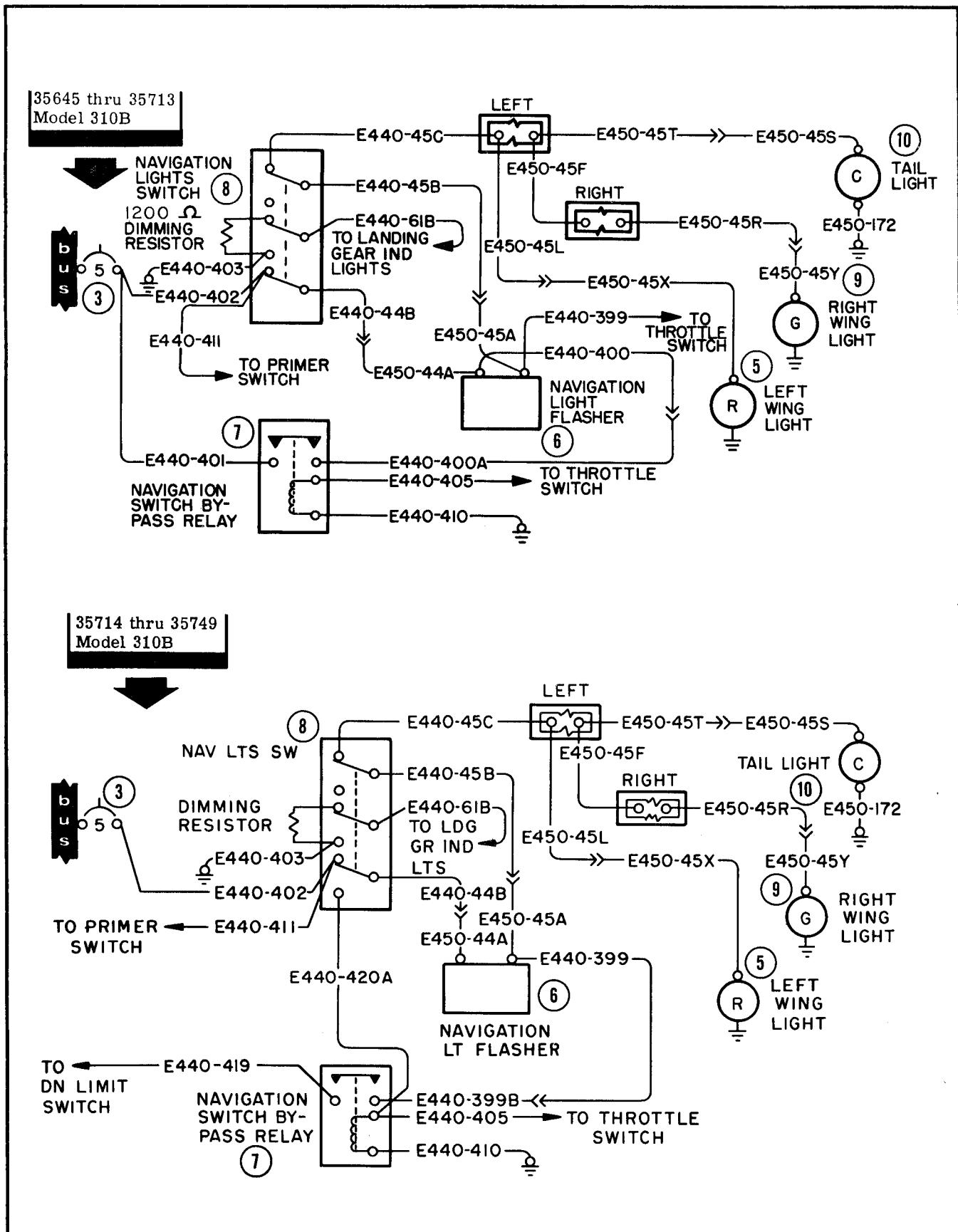
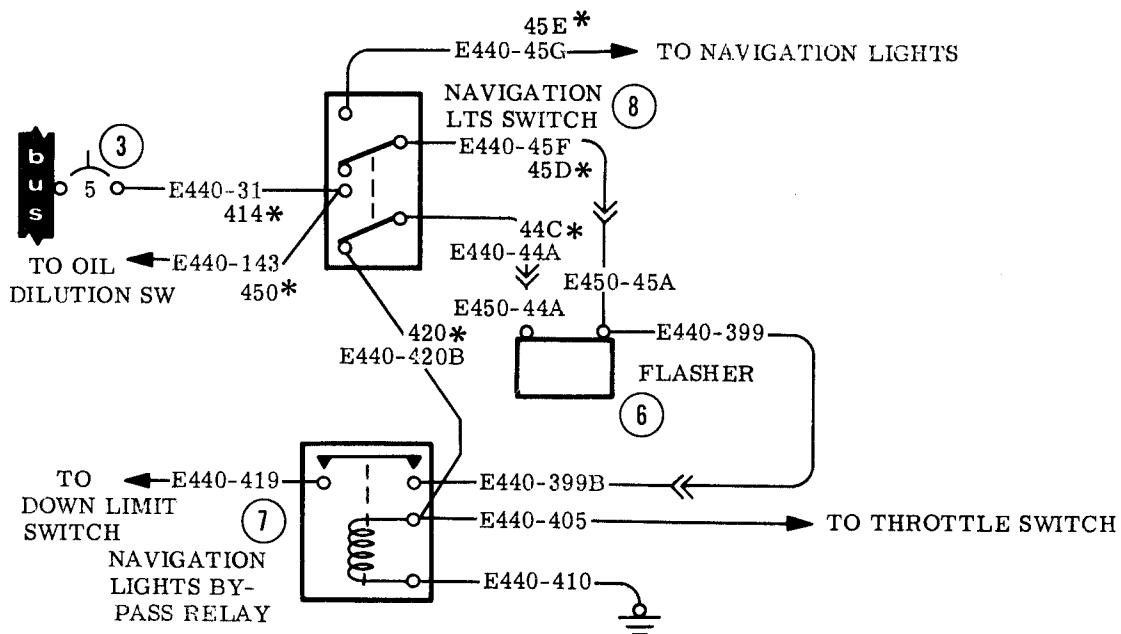


Figure 6-52. Navigation Lights and Rotating Beacon Circuits (Sheet 3 of 6)



35750 thru 35771

Model 310B

*35772 & on

Model 310C & 310D

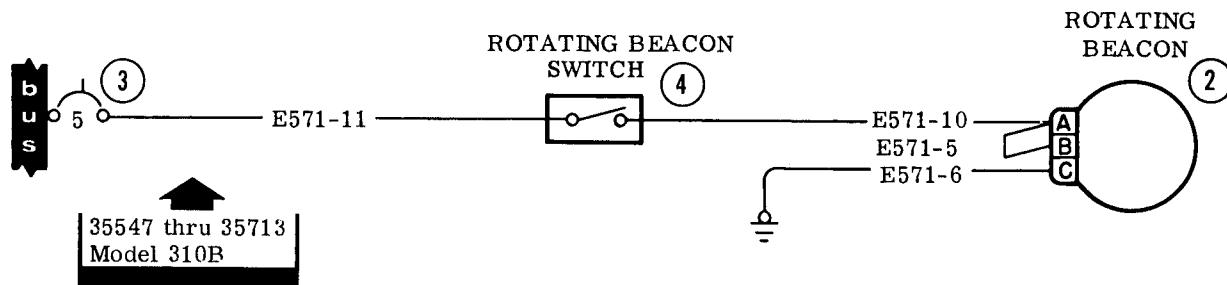
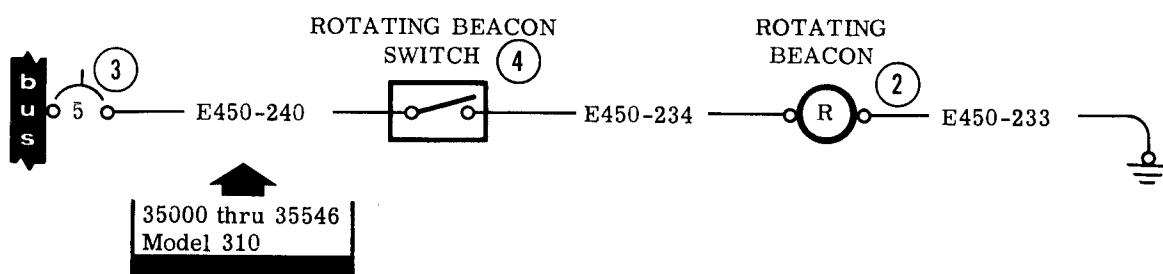


Figure 6-52. Navigation Lights and Rotating Beacon Circuits (Sheet 4 of 6)

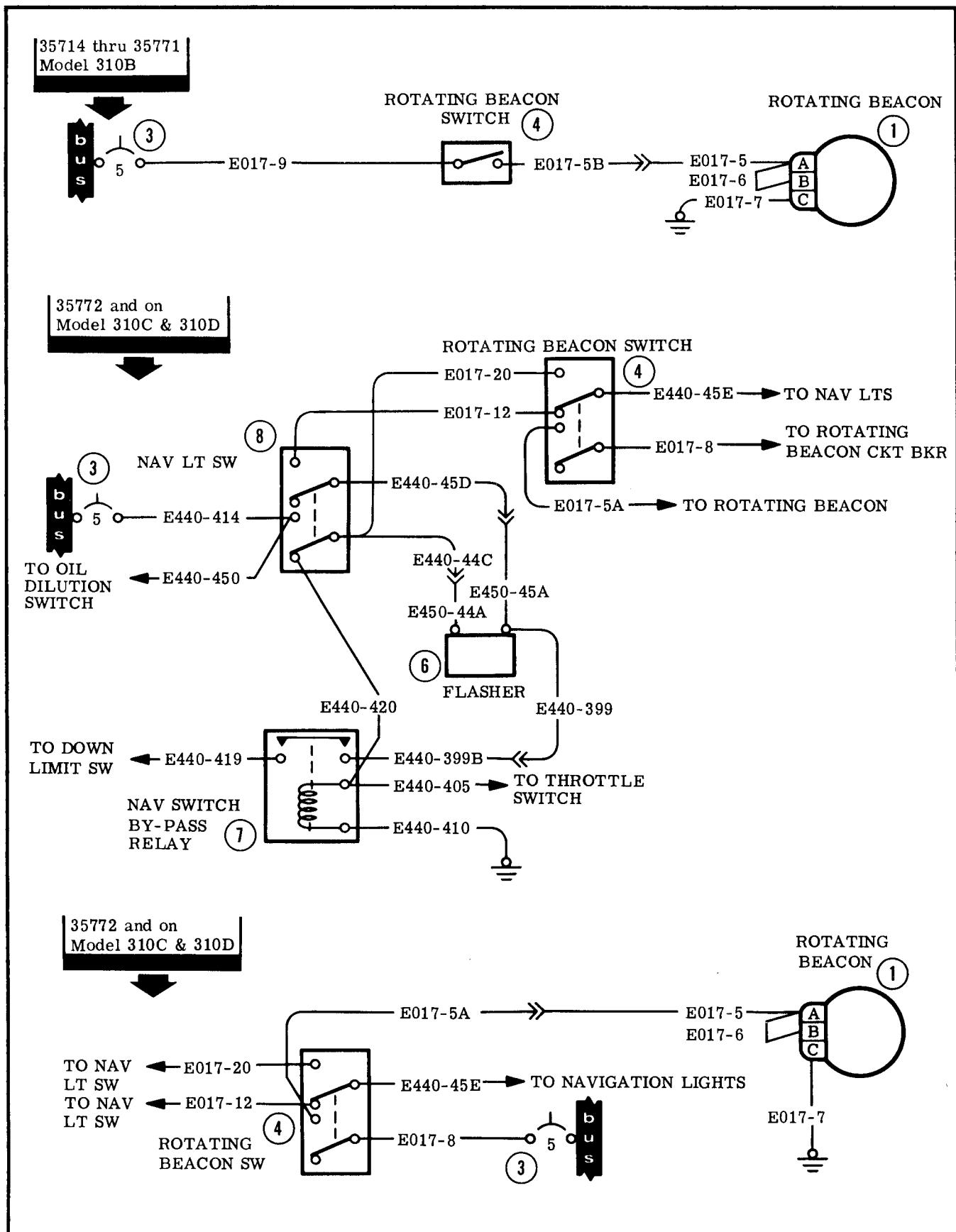


Figure 6-52. Navigation Lights and Rotating Beacon Circuit (Sheet 5 of 6)

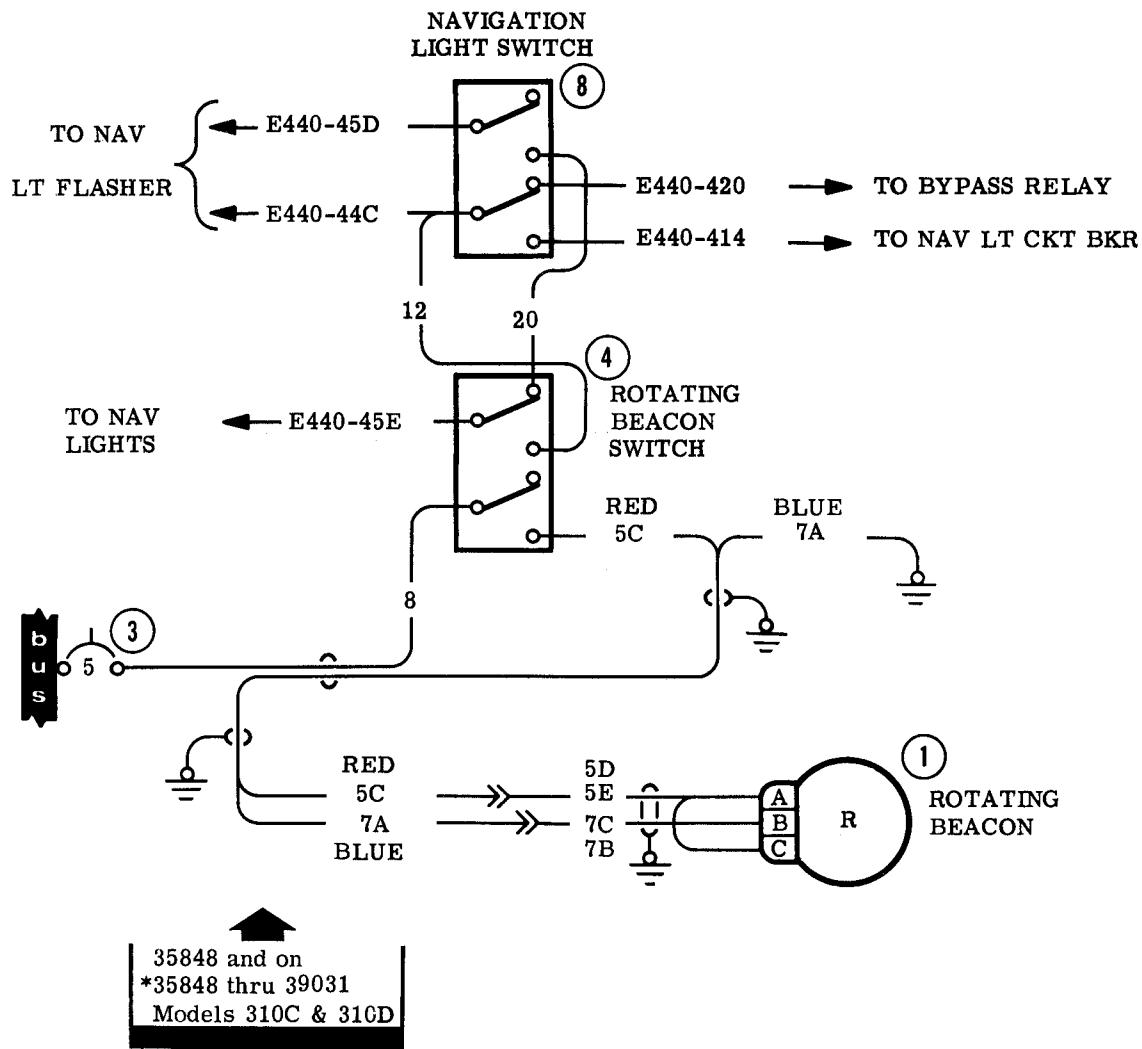


Figure 6-52. Navigation Lights and Rotating Beacon Circuits (Sheet 6 of 6)

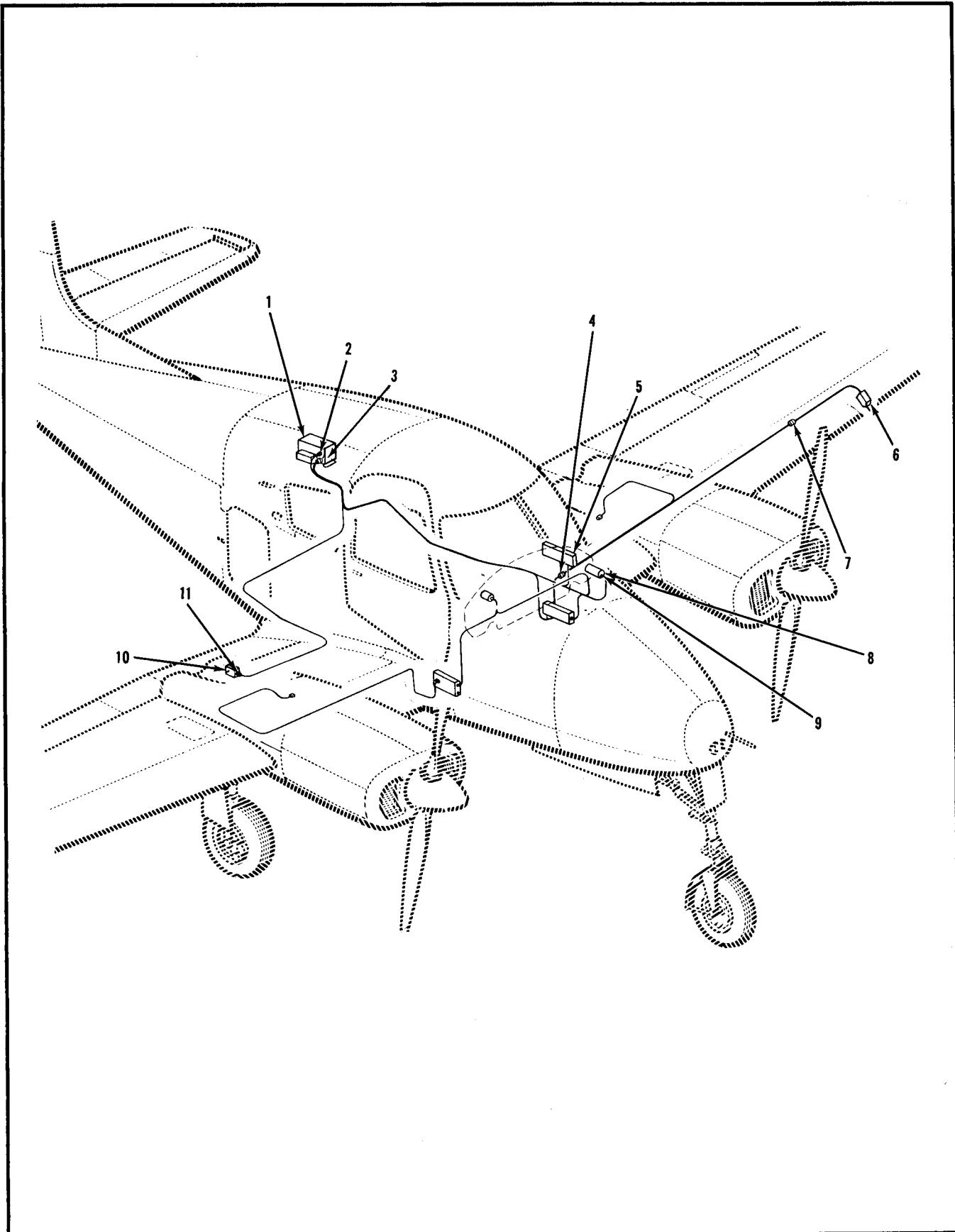


Figure 6-53. Speed Control Circuit (Sheet 1 of 3)

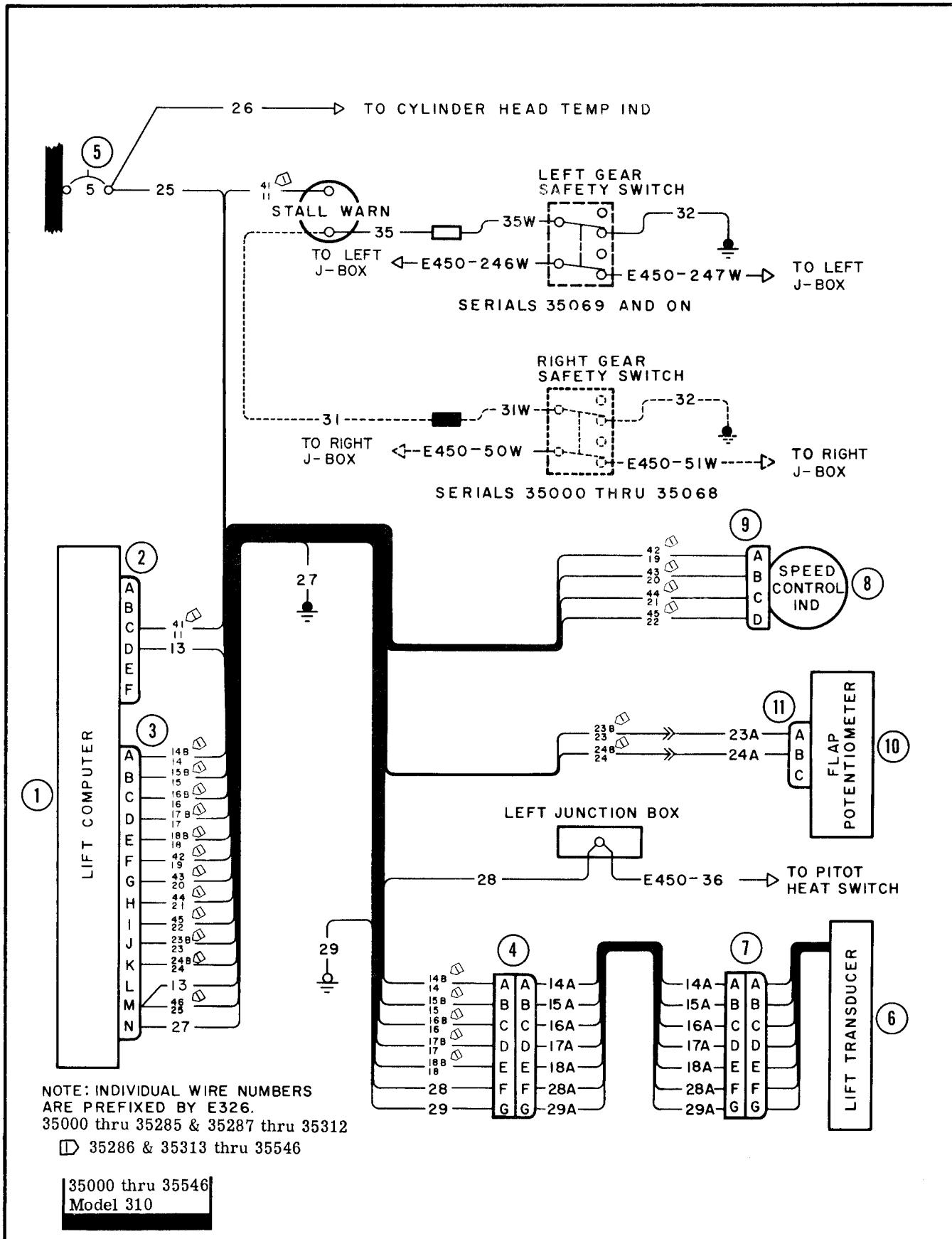


Figure 6-53. Speed Control Circuit (Sheet 2 of 3)

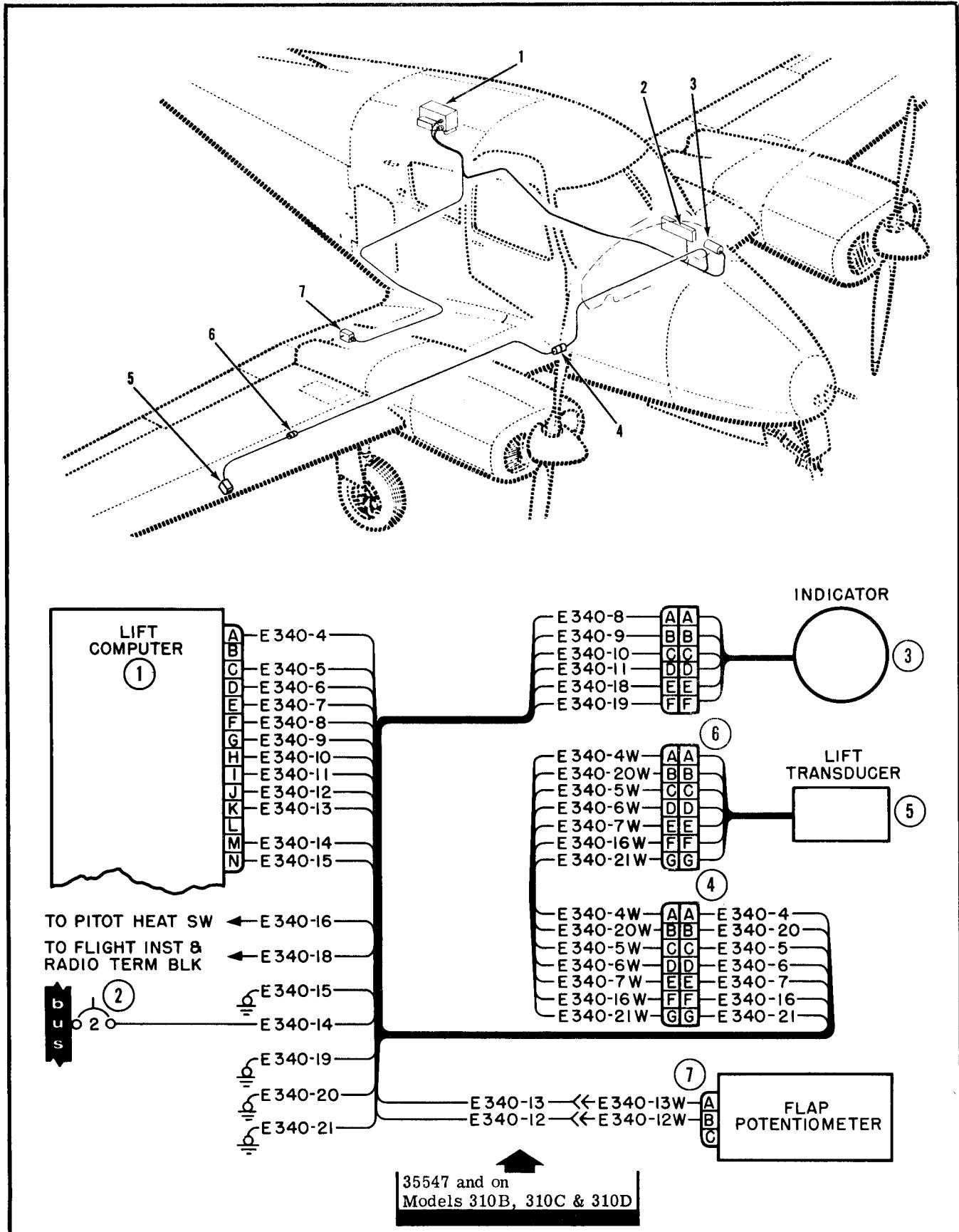


Figure 6-53. Speed Control Circuit (Sheet 3 of 3)

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E017-5	18	50	Rotating Beacon to Disc	MS3106A10SL3S	S341	E017-10
E017-5A	18	219	Switch to Disc	A-31882		E017-3
E017-5B	18	260	Disc to Switch	S341-2	S341-2	E017-4
E017-5C	18		Rotating Bcn Sw to Discon	A-31882	S341-2	E017-23
E017-5D	18		Discon to Rot Bcn	S341-2		E017-24
E017-5E	18		Discon to Rot Bcn	S341-2		E017-26
E017-6	18	AR	Rot Bcn Jumper	MS3106A10SL3S	MS3106A10SL3S	E017-10
E017-7	18	90	Rot Beacon to Gnd	MS3106A10SL3S	A-31882	E017-10
E017-7A	18		Rot Bcn Sw to Discon	A-31882	S341-2	E017-23
E017-7B	18		Discon to Rot Bcn	S-341-2		E017-24
E017-7C	18		Discon to Rot Bcn	S-341-		E017-26
E017-8	18	50	Sw to Circuit Breaker	A-31882	A-31888	E017-3
E017-9	18	90	Sw to Circuit Breaker	A-31882	A-31888	E017-4
E017-12	20	5	Sw to Nav Lt Sw	A-31882	A-31882	E017-14
E017-20	20	5	Sw to Nav Lt Sw	A-31882	A-31882	E017-21
E330-4	18	89	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-3
E330-4A	18	91	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-12
E330-4W	18	115	Conn to Tank Unit	MS3108B10SL4S	RA-333	E330-1
E330-5	18	89	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-3
E330-5A	18	91	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-12
E330-5W	18	115	Conn to Tank Unit	MS3108B10SL4S	RA-333	E330-1
E330-6	18	65	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-3
E330-6A	18	65	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-12
E330-6W	18	115	Conn to Tank Unit	MS3108B10SL4S	RA-333	E330-2
E330-7	18	65	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-3
E330-7A	18	65	Fuel Ind to Conn	MS3106B14S5S	MS3100A10SL4P	E330-12
E330-7W	18	115	Conn to Tank Unit	MS3108B10SL4S	RA-333	E330-2
E330-8	18	82	Circuit Bkr to Ful Ind	A-3188	MS3106B14S5S	E330-3
E330-9	18	9	Fuel Ind to Ground	RA-863		E330-9
E330-10	18	82	Fuel Ind to Ckt Bkr	MS3106B14S5S	A-31888	E330-12

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS	CABLE NO.
E330-11	18	7	Fuel Ind to Ground	A-31888	E330-11
E440-3	18	70	Ammeter to Shunt	A-31888	A-31889 E440-381
E440-4	18	70	Ammeter to Shunt	A-31888	A-31889 E440-381
E440-5	20	5	Bat Sw to Ground	A-31882	A-31882 E440-5
E440-10	18	90	Ckt Bkr to Stall Warn Lt (Serials 35000 thru 35546)		E440-390
E440-10	18	90	Ckt Bkr to Stall Warn Lt (Serials 35547 thru 35771)	A-31888	E440-426
E440-11	18	45	Stall Warn Lt to R Cyl Head Temp Ind		MS3106-14S2S E440-11
E440-12	20	35	LJ-Box to Bat Sw	A-31882	A-31882 E440-381 & -389
E440-13	20	38	LJ-Box to L Starter Sw		A-31882 E440-381 & -389
E440-14	20	41	LJ-Box to R Starter Sw		A-31882 E440-381 & -389
E440-16	18	16	Stall Warn Lt to Horn		A-31882 E440-16
E440-17	18	16	Stall Warn Lt to Horn		A-31882 E440-17
E440-20	18	28	Temp Ind to Ground	MS3106-14S2S	A-31882 E440-20
E440-21	18	21	Term Block to Temp Ind	A-31882	MS3106-14S2S E440-21
E440-22	20S	36	LJ-Box to L Gen Sw	A-31882	A-31882 E440-22
E440-23	20S	110	L Gen Sw to L Regulator	A-31889	A-31882 E440-23
E440-24	20S	117	RJ-Box to R Gen Sw	A-31882	A-31882 E440-24
E440-25	20S	110	R Gen Sw to R Regulator	A-31889	A-31889 E440-25
E440-26	18	25	Temp Ind to Ground	MS3106-14S2S	A-31882 E440-26
E440-31	18	77	Ckt Bkr to Nav Lt Sw	A-31888	A-31882 E440-390
E440-32	20	142	Flap Pos Trans to Ind	MS3106-14S2S	MS3106-10SL3S E440-378
E440-33	20	116	Ckt Bkr to Nav Lt Sw	A-31888	S-341-2 E440-377
E440-34	20	142	Flap Pos Trans to Ind	MS3106-14S2S	MS3106-10SL3S E440-378
E440-35	20	142	Flap Pos Trans to Ind	MS3106-14S2S	MS3106-10SL3S E440-378
E440-36	18	39	LJ-Box to Pitot Heat Sw	A-31882	A-31882 E440-381
E440-36A	18	70	LJ-Box to Pitot Heat Sw	A-31882	A-31882 E440-389
E440-38	18	69	RJ-Box to Anti-Ice Rheo		A-31882 E440-38

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E440-44A	18	66	Nav Lt Sw to Discon	A-31882	S-341	E440-44A
E440-44B	20	66	Nav Lt Sw to Discon		S-341	E440-44B
E440-44C	20	60	Nav Lt Sw to Discon	A-31882	S-341	E440-44C
E440-45B	20	66	Nav Lt Sw to Discon	A-31882		E440-45B
E440-45C	20	60	Nav Lt Sw to L J-Box	A-31882		E440-408
E440-45D	20	60	Nav Lt Sw to Discon	A-31882	S-341	E440-45D
E440-45E	20	60	Nav Lt Sw to L J-Box	A-31882	A-31882	E440-417
E440-45F	20	66	Nav Lt Sw to Discon	A-31882	S-341	E440-45F
E440-45G	20	60	Nav Lt Sw to L J-Box	A-31882	A-31882	E440-435
E440-45S	20	41	Discon to Tail Lt	B-23		E440-455
E440-46	20	7	R Boost Sw to R Starter Sw	A-31882		E440-46
E440-47	18	10	Nav Lt Sw to Ground	A-31882	A-31882	E440-47
E440-50	18	50	Ckt Bkr to R Boost Sw (Serials 35547 thru 35576)	A-31888	A-31882	E440-390
	18	50	Ckt Bkr to R Boost Sw (Serials 35772 & on)	A-31888	A-31882	E440-426
E440-51	18	48	Ckt Bkr to L Boost Sw (Serials 35547 thru 35771)	A-31888	A-31882	E440-390
	18	48	Ckt Bkr to L Boost Sw (Serials 35772 & on)	A-31888	A-31882	E440-426
E440-58	20	56	L Boost Sw to OAT Ind	A-31882	MS3106-14S2S	E440-58
E440-59	20	28	OAT Ind to Ground	MS3106-14S2S	A-31882	E440-59
E440-60	20	139	OAT Bult to OAT Ind	MS3106-14S2S	MS3106-14S2S	E440-60
E440-61A	18	12	Nav Lt Sw to Discon	A-31882	S341-2	E440-61A
E440-61B	20	12	Nav Lt Sw to Discon		S341-2	E440-61B
E440-62	20	116	Ckt Bkr to Disc	A-31882	S341-2	E440-377
E440-63	16	60	Ckt Bkr to Pitot Heat Sw	A-31902	A-32440	E440-426
E440-64	18	92	Pitot Heat Sw to Discon	A-31882	S341	E440-64
E440-65B	20	70	Disc to Baggage Lt Sw	S341-2	A-31879	E440-65B
E440-67	16	80	Ckt Bkr to Pitot Heat Sw	A-31902	A-32440	E440-390
E440-68	20	42	Ckt Bkr to Rheo	A-31888		E440-68
E440-69	20	32	Rheo to Term Block		A-31882	E440-69

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E440-70	20	100	Term Block to Fuel Sel Lt	A-31882	Tinned	E440-70
E440-71	20	42	Ckt Bkr to Rheo	A-31888		E440-71
E440-72	20	36	Rheo to Disc		S341	E440-72
E440-74	18	72	R Ldg Lt Sw to R J-Box	A-31882	A-31882	E440-376
E440-74A	18	70	R Ldg Lt Sw to R J-Box	A-31882	A-31882	E440-387
E440-75	18	72	R Ldg Lt Sw to R J-Box	A-31882	A-31882	E440-376
E440-75A	18	70	R Ldg Lt Sw to R J-Box	A-31882	A-31882	E440-387
E440-77	18	50	L Ldg Lt Sw to L J-Box	A-31882	A-31882	E440-381
E440-77A	18	70	L Ldg Lt Sw to L J-Box	A-31882	A-31882	E440-389
E440-78	18	50	L Ldg Lt Sw to L J-Box	A-31882	A-31882	E440-381
E440-78A	18	70	L Ldg Lt Sw to L J-Box	A-31882	A-31882	E440-389
E440-79	20	6	Rheo to Dome Lt Sw		A-31882	E440-79
E440-80	20	6	Dome Lt Sw to Dome Lt		A-31882	E440-80
E440-81	20	12	Rheo to Red Flood Lt		Tinned	E440-81
E440-82	18	80	Stall Warn Lt to L J-Box		A-31882	E440-381 & -389
E440-82A	20	100	Stall Warn Horn to L J-Box	A-31882	A-31882	E440-49
E440-83	20	9	Rheo to Red Flood Lt		Tinned	E440-83
E440-84	18	92	R Boost Sw to R J-Box	A-31882	A-31882	E440-375
E440-84W	18	25	R J-Box to Resistor	A-31882		E440-444
E440-84WA	18	12	Resistor to R Aux Pump Relay		32065	E440-444
E440-84WB	18	188	R Aux Pump Relay to Disc	32065	S-341-2	E440-455
E440-90	20	37	Flap Sw to Inst Lt Rheo	A-31882		E440-90
E440-91	18	35	L Boost Sw to L J-Box	A-31882	A-31882	E440-381 & -389
E440-91W	18	36	Resistor to L J-Box		A-31882	E440-445
E440-91WA	18	12	Resistor to Pump Relay		32065	E440-445
E440-91WB	18	209	Pump Relay to Discon	32065	S341-2	E440-445
E440-92	20	36	Inst Lt Rheo to Disc		S341	E440-92

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E440-93	20	67	Ckt Bkr to Switch	A-31888	A-31882	E440-93
E440-95	20	6	Flood Lt Rheo to Flood Lt		Tinned	E440-95
E440-96	20	80	LJ-Box to Temp Ind	MS3106-14S2S	A-31882	E440-381 & -389
E440-97	20	77	LJ-Box to Oil Temp Ind	MS3106-14S2S	A-31882	E440-381 & -389
E440-98	20	6	Fuel Ind to Ground		A-31888	E440-98
E440-99	20	60	Compass Rheo to Disc		S341	E440-99
E440-99A	18	6	Discon to Fuel Ind	S341	MS3106-14S5S	E440-99A
E440-99B	20	12	Discon to Fuel Ind	S341-2	AN3106-14S5S	E440-99B
E440-100	20	53	R J-Box to Temp Ind	MS3106-14S2S	A-31882	E440-379
E440-101	20	55	R J-Box to Oil Temp Ind	MS3106-14S2S	A-31882	E440-379
E440-102	20S	55	Compass Rheo to Lt		A-MP31770	E440-102
E440-103	20	30	Compass Rheo to Restr		AA2	E440-103
E440-104	18	80	Primer Sw to R J-Box	A-31882	A-31882	E440-375
E440-104A	18	86	R Aux Pump Sw to R J-Box	A-31882	A-31882	E440-451
E440-104W	18	80	R J-Box to Pres Sw	A-31882	S-341-2	E440-444
E440-105	18	34	Primer Sw to L J-Box	A-31882	A-31882	E440-381 & -389
E440-105A	18	34	L Aux Pump Sw to L J-Box	A-31882	A-31882	E440-448
E440-105W	18	96	L J-Box to Pres Sw	A-31882	S-341-2	E440-445
E440-106	20	79	Oil Dil Sw to R J-Box	A-31882	A-31882	E440-106
E440-106WA	20	54	R J-Box to R Primer	A-31882	AN3106-8S1S	E440-106WA
E440-107	20	39	Oil Dil Sw to L J-Box	A-31882	A-31882	E440-107
E440-107WA	20	65	L J-Box to L Primer	A-31882	AN3106-8S1S	E440-107WA
E440-108	18	120	Pitot Heat Sw to Disc	A-31882	S341	E440-108
E440-109	18	88	Ckt Bkr to L Ldg Lt Sw	A-31888	A-31882	E440-390
E440-110	18	92	Ckt Bkr to R Ldg Lt Sw	A-31888	A-31882	E440-110
E440-111	18	65	Ckt Bkr to Autopilot Sw	A-31888	A-31882	E440-111
E440-112	20	72	L J-Box to Tach Ind	A-31882	MS3106-14S1S	E440-381 & -389

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E440-113	20	70	L J-Box to Tach Ind	A-31882	MS3106-14S1S	E440-381 & -389
E440-114	20	70	L J-Box to Tach Ind	A-31882	MS3106-14S1S	E440-381 & -389
E440-115	20	62	R J-Box to Tach Ind	A-31882	MS3106-14S1S	E440-379
E440-116	20	62	R J-Box to Tach Ind	A-31882	MS3106-14S1S	E440-379
E440-117	20	63	R J-Box to Tach Ind	A-31882	MS3106-14S1S	E440-379
E440-118	20	55	Ckt Bkr to Compass Rhed (Serials 35547 thru 35771)	A-31888		E440-390
	20	55	Ckt Bkr to Compass Rhed (Serials 35772 & on)	A-31888		E440-426
E440-119	18	58	Ckt Bkr to Taxi Lt Sw	A-31888	A-31882	E440-119
E440-120	20	89	Ckt Bkr to R Oil Temp Ind	A-31888	MS3106-14S2S	E440-120
E440-121	18	140	Taxi Lt Sw to Taxi Lt	A-31882	A-31888	E440-121
E440-122	18	58	Ckt Bkr to R Ldg Lt Sw	A-31888	A-31882	E440-122
E440-123	20	30	R Oil Temp Ind to Gnd	MS3106-14S2S	A-31882	E440-123
E440-124	18	130	Heat Sw to Discon	A-31882	S341-2	E440-394
E440-124A	18	110	Heat Sw to Discon	A-31882	S341-2	E440-427
E440-124N	18	35	Discon to Dn Ind Sw	S341-2	A-31882	E440-124N
E440-125	18	61	Heater to Discon (Serials 35547 thru 35771)		S341-2	E440-394
	18	61	Heater to Disconnect (Serials 35772 & on)		S341-2	E440-427
E440-125N	18	82	Dn Ind Sw to Discon	A-31882	S341-2	E440-125N
E440-126	18	67	L J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-381 & -389
E440-126A	20	73	L J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-448
E440-127	18	67	L J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-381 & -389
E440-127A	20	73	L J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-448
E440-128	18	53	R J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-374
E440-128A	20	61	R J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-454
E440-129	18	53	R J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-374
E440-129A	20	61	R J-Box to Fuel Ind	A-31882	MS3106-14S5S	E440-454

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E440-130	20	25	L Oil Temp Ind to Gnd	MS3106-14S2S	A-31882	E440-130
E440-131	20	85	Ckt Bkr to L Oil Temp Ind	A-31888	MS3106-14S2S	E440-131
E440-132	18	60	Ckt Bkr to L Ldg Lt Sw	A-31888	A-31882	E440-426
E440-133	20S	120	Mic Jack (Audio)to Disc		S341	E440-133
E440-134	20	108	Mic Jack (Key) to Disc		S341	E440-134
E440-135	18S	6	Mag Sw Bus to Ground	A-31882	A-31882	E440-135
E440-136	18	100	De-Ice Sw to Timer	A-31882	MS3106-22-14S	E440-373
E440-137	18	100	De-Ice Sw to Timer	A-31882	MS3106-22-14S	E440-373
E440-138	18	20	De-Ice Sw to Gnd	A-31882	A-31882	E440-138
E440-143	18	24	Nav Lt Sw to Primer Sw	A-31882	A-31882	E440-143
E440-146	18	9	Primer Sw to Oil DilSw	A-31882	A-31882	E440-146
E440-147	20	12	Sw to Baggage Lt	A-31882	Tinned	E440-147
E440-148	18DS	78	Mag Sw to Conn	A-31882	MS3100-12S3P	E440-372
E440-148W	18DS	114	Conn to Mag	MS3106E12S3S		E440-386
E440-149	18DS	48	Mag Sw to Conn	A-31882	MS3106E12S3S	E440-385
E440-149W	18DS	107	Conn to Mag	A-31882		E440-385
E440-150	18DS	78	Mag Sw to Conn	A-31882	MS3100-12S3P	E440-372
E440-150W	18DS	110	Conn to Mag	MS3106E12S3S		E440-386
E440-151	18DS	48	Mag Sw to Conn	A-31882	MS3100-12S3P	E440-371
E440-151W	18DS	104	Connector to Mag	MS3106E12S3S		E440-385
E440-152	18	6	Anti-Ice Sw to Rheo	A-31882		E440-152
E440-163	18	70	Ckt Bkr to Anti-ice Sw	A-31888	A-31882	E440-163
E440-177	18	76	Ckt Bkr to Taxi Lt Sw	A-31888	A-31882	E440-177
E440-178	18	165	Taxi Lt Sw to Taxi Lt	A-31882	A-31888	E440-178
E440-179	18	80	Ckt Bkr to Heat Sw	A-31888	A-31882	E440-179
E440-180	18	4	Heater Sw Jumper	A-31882	A-31882	E440-180
E440-181	18	4	Heater Sw Jumper	A-31882	A-31882	E440-181
E440-183	18	130	Heat Sw to Heater	A-31882		E440-394
E440-185	18	30	Heater to Disc (Serials 35547 thru 35771)		S341-2	E440-394

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
	18	36	Heater to Disc (Serials 35772 & on)		S341-2	E440-427
E440-185A	18	AR	Disc to Comb Blower (Vendor Supplied)	S341-2		E440-185A
E440-186	20	200	Heater to R J-Box (Serials 35547 thru 35771)		A-31882	E440-394
	20	200	Heater to R J-Box (Serials 35772 & on)		A-31882	E440-427
E440-186W	20	20	R J-Box to Fuel Valve	A-31882	MS3106-8S1S	E440-186W
E440-186WA	20	20	R J-Box to Fuel Valve	A-31882	S341-2	E440-186WA
E440-187	20	10	Heater to Disc (Serials 35547 thru 35771)		S341-2	E440-394
	20	10	Heater to Disc (Serials 35772 & on)		S341-2	E440-427
E440-187A	20	10	Disconnect to Thermo	S341-2		E440-187A
E440-188	20	10	Heater to Disc		S341-2	E440-394
E440-188A	20	10	Disconnect to Thermo	S341-2		E440-188A
E440-215	20	65	Wing LtSw to L J-Box	A-31882	A-31882	E440-65
E440-215W	18	100	L J-Box to Disc	A-31882	S341-2	E440-104
E440-215WA	20	6	Discon to L Wing Lt	S-341-2		E440-215A
E440-229	20	119	Heater to Disc (Serials 35547 thru 35771)		S341-2	E440-394
	20	119	Heater Disc (Serials 35772 & on)		S341-2	E440-427
E440-245B	20	40	L J-Box to Ldg Wrn Hrn	A-31882	A-31882	
E440-245C	20	75	Dn Lmt Sw to L J-Box	A-31882	A-31888	
E440-395	16	64	Ckt Bkr to Fuse	A-31902	A-32440	E440-395
E440-396	16	64	Ckt Bkr to Fuse	A-31902	A-32440	E440-396
E440-397	16	7	Fuse to Resistor	A-32440	RB-873	E440-397
E440-398	16	5	Fuse to Resistor	A-32440	RB-873	E440-398
E440-399	20	10	Flasher to Disc	A-31882	S341-2	E440-399
E440-399A	20	60	Disc to Throttle Sw	S341-2	A-31882	E440-399A
E440-399B	20	60	Relay to Disc	A-31889	S341-2	E440-399B
E440-400	20	11	Flasher to Disc	A-31882	S341-2	E440-400

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E440-400A	20	70	Disc to Relay	S341-2	A-31889	E440-400A
E440-401	20	100	Ckt Bkr to Relay	A-31882	A-31889	E440-409
E440-402	20	77	Ckt Bkr to Nav Lt Sw	A-31882		E440-409
E440-403	20	9	Nav Lt Sw to Gnd		A-31882	E440-404
E440-404	20	102	Throttle Sw to Dn Lmt Sw	A-31882	A-31882	E440-404
E440-405	20	30	Relay to Throttle Sw	A-31882	A-31882	E440-405
E440-406	20	40	Gear Horn to L J-Box	A-31882	A-31882	E440-406
E440-407	20	75	L J-Box to Dn Lmt Sw	A-31882	A-31882	E440-407
E440-410	20	6	Relay to Ground	A-31882	A-31882	E440-410
E440-411	20	24	Nav Lt Sw to Primer Sw		A-31882	E440-411
E440-412	20	55	Ckt Bkr to Up Ind Lt		A-31888	E440-412
E440-413	20	8	Up Ind Lt to Dn Ind Lt			E440-413
E440-414	20	55	Ckt Bkr to Nav Lt Sw	A-31882	A-31882	E440-418
E440-419	20	130	Relay to Dn Limit Sw	A-31882	A-31889	E440-419
E440-420	20	30	Nav Lt Sw to Relay	A-31882	A-31882	E440-420
E440-420A	20	AR	Nav Lt Sw to Relay		A-31882	E440-420A
E440-420B	20	40	Nav Lt Sw to Relay	A-31882	A-31882	E440-420B
E440-423	18	105	Cabin Heat Sw to Heatr	A-31882		E440-427
E440-424	18	60	Ckt Bkr to Cabin Heat Sw	A-31888	A-31882	E440-426
E440-425	16	90	Resistor to Cigar Ltr	RB-873	RB-873	E440-425
E440-428	18	5	L Aux Pump Relay Jumper	32065	32065	E440-428
E440-429	18	12	L Aux Pump Relay to Resistor	32065		E440-443
E440-430	18	12	Resistor to Aux Pump Relay	32065		E440-443
E440-431	18	90	Press Sw to L Aux Pump Relay	S-341-2	32065	E440-441
E440-432	18	90	Press Sw to L Aux Pump Relay	S-341-2	32065	E440-441

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E440-433	20	8	L Aux Pump Relay to Gnd	32065	A-31882	E440-433
E440-436	18	90	Press Sw to R Aux Pump Relay	S-341-2	32065	E440-440
E440-437	20	90	Press Sw to R Aux Pump Relay	S-341-2	32065	E440-440
E440-438	18	12	R Aux Pump Relay to Resistor	32065		E440-442
E440-439	18	12	R Aux Pump Relay to Resistor	32065		E440-426
E440-446	20	8	Up Ind Lt to Ground		A-31888	E440-446
E440-447	20	110	Ckt Bkr to Stall Warn Horn	A-31882	A-31882	E440-426
E440-450	20	9	Oil Dil Sw to Nav Lt Sw	A-31882	A-31882	E440-450
E440-455	20	41	Tail Lt to Gnd	A-31888	0812453-1	E440-455
E450-1	18	4	Solenoid Jumper	RA-713	RA-333	E450-1
E450-2	4	22	Bat to Bat Sol	F-71	F-71	E450-2
E450-6	4	58	L Starter Sol to L Str	F-71	F-71	E450-6
E450-7	8	29	Shunt to Bus (Serials 35000 thru 35546)	D-71V	D-26	E450-313
	8	29	Shunt to Bus (Serials 35547 & on)	D-71V	D-26	E450-7
E450-8F	4	58	Through Fuselage	0812347-1	0812347-1	E450-8F
E450-8L	4	54	R Starter Sol to Fuselage Conn	F-71	MS3106-16-12S	E450-8L
E450-8R	4	81	R Starter to Fuselage Conn	F-71	MS3106-16-12S	E450-8R
E450-10	18	81	Am to Am Shunt	RA-863	RA-873	E450-311
E450-11	18	81	Am to Am Shunt	RA-863	RA-873	E450-311
E450-12	18	39	Bat Sw to L J-Box	RA-333	RA-333	E450-311
E450-12W	18	78	L J-Box to Bat Sol	RA-333	RA-333	E450-303
E450-13	18	46	L J-Box to L Start Sw	S341	RA-333	E450-311
E450-13W	18	75	L J-Box to L Start Sol	RA-333	RA-333	E450-303
E450-14	18	47	L J-Box to R Start Sw		RA-333	E450-311

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-14W	18	75	LJ-Box to R Start Sol	RA-333	RA-333	E450-303
E450-15	18	9	Jumpr Between Start Sw			E450-15
E450-16	18	64	Ckt Bkr to Comps Lt R Rheo	RA-863		E450-321
E450-17	18	7	Start to R Fuel Boost Sw	RA-333		E450-17
E450-18	12	84	Ckt Bkr to L Volt Reg	RC-863	RC-363	E450-340
E450-19	12	79	Ckt Bkr to R Volt Reg	RC-863	RC-363	E450-340
E450-22	18DS	37	L Gen Sw to L J-Box	RA-333	RA-333	E450-311
E450-22W	18DS	101	L J-Box to L Gen	RA-333	RA-7B	E450-303
E450-23	18DS	106	L J-Box to L Gen Sw	RA-333	RA-333	E450-311
E450-23F	18DS	69	L J-Box to L Reg	RA-333	RA-873	E450-341
E450-24	18DS	117	R J-Box to R Gen Sw	RA-333	RA-333	E450-312
E450-24W	18DS	87	R J-Box to R Gen	RA-333	RA-713	E450-304
E450-25	18DS	110	R J-Box to R Gen Sw	RA-333	RA-333	E450-312
E450-25F	18S	30	R J-Box to R Reg	RA-333	RA-873	E450-342
E450-26	18	53	Ckt Bkr to Heater Sw	RA-863	RA-333	E450-321
E450-27	18	64	Ckt Bkr to Flap Sw (Serials 35000 thru 35771)	RA-863	RA-333	E450-321
	18	65	Ckt Bkr to Flap Sw (Serials 35772 & on)	RA-863	RA-333	E450-426
E450-28	18	150	Flap Sw to Limit Sw	RA-333	RA-333	E450-329
E450-29	18	AR	Flap Motor Lead (Vendor Supplied)	RA-333		E450-29
E450-30	18	AR	Flap Motor Lead (Vendor Supplied)	RA-333		E450-30
E450-31	18	39	Compass Rheo to Disc		S341	E450-31
E450-31A	18	7	Fuel Ind to Disc	S341	MS3106B14S5S	E450-31A
E450-32	18S	55	Compass Lt Rheo to Lt		A-MP31770	E450-32
E450-32A	18	3	Compass Rheo to Restr			E450-32A
E450-33	18	110	Ckt Bkr to Disc	RA-863	S341	E450-323
E450-33A	18	6	UV Lt Rheo to Disc		S341	E450-33A
E450-34	16	58	Ckt Bkr to Pitot Heat Sw	RB-863	RB-333	E450-321
E450-35	18	95	Pitot Heat Sw to Pitot Heater	RA-333	S341	E450-35

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-36	18	45	L J-Box to Pitot Heat Sw	RA-333	RA-333	E450-311
E450-36W	18	153	L J-Box to Stall Warn Heater	RA-333	S341	E450-301
E450-37	18	68	Ckt Bkr to Anti-ice Rheo	RA-863		E450-37
E450-38	18	69	Anti-Ice Rheo to R J-Box		RA-333	E450-38
E450-38WA	18	125	R J-Box to Anti-ice Pump	RA-333	MS3106-10S2S	E450-38W
E450-38WA	18	125	R J-Box to Anti-ice Pump	RA-333	MS3106-10S2S	E450-38WA
E450-42	18	72	Ckt Bkr to Timer	RA-863	MS3106A22-14S	E450-317
E450-43	18	47	Ckt Bkr to Nav Lt Sw	RA-863	RA-333	E450-321
E450-44	18	53	Nav Lt Sw to Disc	RA-333	S341	E450-44
E450-44A	18	9	Disc to Nav Lt Flasher	S341	RA-333	E450-44A
E450-45	18	55	L J-Box to Disc	RA-333	S341	E450-319
E450-45A	18	9	Flasher to Disc	RA-333	S341	E450-45A
E450-45F	18	106	R J-Box to L J-Box	RA-333	RA-333	E450-315
E450-45L	18	207	L J-Box to Disc	RA-333		E450-301
E450-45R	18	186	R J-Box to Disc	RA-333		E450-302
E450-45S	18	33	Disc to Tail Lt	S341		E450-45S
E450-45T	18	230	L J-Box to Disc	RA-333	S341	E450-45T
E450-45X	18	68	L Nav Lt to Disc		S341	E450-45X
E450-45Y	18	68	R Nav Lt to Disc		S341	E450-45Y
E450-48	12	62	Ckt Bkr to Gear Sw (Serials 35000 thru 35340)	RA-863	C-33	E450-321
	12	62	Ckt Bkr to Gear Sw (Serials 35341 & on)	RB-863	A-MP35149	E450-426
E450-49	18	25	Up Lmt Sw to Gear Relay	RA-333	RA-333	E450-49
E450-50	18	138	R J-Box to Up Lmt Sw	RA-333	RA-333	E450-331
E450-50W	18	87	R J-Box to R Safety Sw	RA-333	RA-333	E450-306
E450-51	18	169	R J-Box to Gear Relay	RA-333	RA-333	E450-331
E450-51W	18	86	R J-Box to R Safety Sw	RA-333	RA-333	E450-306

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-52	14	104	Gear Sw to Dn Limit Sw	C-33	RB-863	E450-330
E450-53	14	60	Dn Lmt Sw to Gear Mtr (Serials 35000 thru 35340)	RB-1333	RB-1333	E450-53
	14	60	Dn Lmt Sw to Gear Mtr (Serials 35341 & on)	A-MP32442	RB-863	E450-53
E450-54	18	85	Up Limit Sw to Disc	RA-333	S341	E450-330
E450-54A	18	5	Disc to Up Ind Lt	S341		E450-54A
E450-55	18	141	Ckt Bkr to Nose Gear Dn Ind Sw	RA-863	RA-333	E450-55
E450-56	18	67	R J-Box to Disc	RA-333	S341	E450-314
E450-56A	18	4	Disc to Dn Ind Lt	S341		E450-56A
E450-56W	18	64	R J-Box to Gear Dn Ind Sw (Serials 35000 thru 35068)	RA-333	RA-333	E450-306
	18	64	R J-Box to Gear Dn Ind Sw (Serials 35069 thru 35497)	RA-333	RA-333	E450-344
E450-56WA	18	71	R J-Box to Gear Dn Ind Sw	RA-333	RAA-23	E450-365
E450-57	18	143	Throttle Sw to Nose Gear Dn Ind Sw	RA-333	RA-333	E450-57
E450-58	18	3	Throttle Sw Jumper	RA-333	RA-333	E450-58
E450-59	18	92	Throttle Sw to Gear	RA-333	RA-333	E450-59
E450-60	18	3	Throttle Sw Jumper	RA-333	RA-333	E450-60
E450-61	18	29	Dn Ind Lt to Nav Lt Sw	RA-333	S341	E450-61
E450-61A	18	5	Gear Ind Lt to Disc		S341	E450-61A
E450-62	18	110	Ckt Bkr to Disc	RA-863	S341	E450-323
E450-62A	18	6	Disc to UV Lt Rheo	S341		E450-62A
E450-63	18	5	Dome Lt to Disc	RA-333		E450-63
E450-64	18	3	Dome Lt Sw to Rheo		RA-333	E450-64
E450-65	18	6	Rheo to Disc		S341	E450-65
E450-65A	18	76	Disc to Baggage Lt Sw	S341	RA-333	E450-65A
E450-66	18	7	Rheo to Disc		S341	E450-66
E450-66A	18	60	Disc to Rear Dome Lt Sw	S341	RA-333	E450-66A

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-67	18	8	Baggage Lt to Sw		RA-333	E450-67
E450-68	18	6	Red Lt to Disc			E450-68
E450-69	18	6	Ckt Bkr to R Ldg Lt Sw	RA-863	RA-333	E450-321
E450-69A	18	AR	Ldg Lt Sw Jumper	RA-333	RA-333	E450-69A
E450-70	18	AR	Cigar Ltr to R J-Box (Vendor Supplied)			E450-70
E450-71	18	48	Ckt Bkr to L Ldg Lt Sw	RA-863	RA-333	E450-321
E450-72			L Cigar Ltr to Ckt Bkr (Vendor Supplied)			E450-72
E450-73	16	114	Ldg Lt Ckt Bkr to R J-Box	RB-863	RB-1333	E450-73
E450-73W	16	125	R J-Box to R Ldg Lt	RB-1333	RB-1333	E450-320
E450-73WA	16	128	R J-Box to R Ldg Lt	RB-1333	RB-1333	E450-360
E450-74	18	72	R Ldg Lt Sw to R J-Box	RA-333	RA-863	E450-316
E450-74W	18	125	R J-Box to R Ldg Lt	RA-333	RA-863	E450-302
E450-74WA	18	127	R J-Box to R Ldg Lt	RA-333	RA-333	E450-360
E450-75	18	72	R J-Box to Ldg Lt Sw	RA-333	RA-863	E450-316
E450-75W	18	126	R J-Box to R Ldg Lt	RA-333	RA-863	E450-302
E450-75WA	18	161	R J-Box to R Ldg Lt	RA-333	RA-863	E450-360
E450-76	16	28	Ckt Bkr to L J-Box (Serials 35000 thru 35546)	RB-863	RB-1333	E450-313
	16	28	Ckt Bkr to L J-Box (Serials 35547 & on)	RB-863	RB-1333	E450-76
E450-76W	16	142	L J-Box to L Ldg Lt	RB-1333	RB-863	E450-345
E450-76WA	16	147	L J-Box to L Ldg Lt	RB-1333	RB-863	E450-359
E450-77	18	41	L Ldg Lt Sw to L J-Box	RA-333	RA-333	E450-311
E450-77W	18	142	L J-Box to L Ldg Lt	RA-333	RA-863	E450-345
E450-77WA	18	146	L J-Box to L Ldg Lt	RA-333	RA-863	E450-359
E450-78	18	41	L Ldg Lt Sw to L J-Box	RA-333	RA-333	E450-311
E450-78W	18	142	L J-Box to L Ldg Lt	RA-333	RA-863	E450-345
E450-78WA	18	145	L J-Box to L Ldg Lt	RA-333	RA-863	E450-359

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-79	18	70	R Ldg Lt Sw to Taxi Lt	RA-333	RA-863	E450-79
E450-80	18	39	L Cyl Hd Temp Ind to T & B Term	MS3106-14S2S	RA-863	E450-80
E450-81	18	30	R Cyl Hd Temp Ind to T & B Term	MS3106-14S2S	RA-333	E450-81
E450-82	18	76	Stall Warn Ind Lt to L J-Box	RA-333	RA-333	E450-311
E450-82W	18	155	L J-Box to Stall Warn Act	RA-333	RA-333	E450-301
E450-83	18	50	Ckt Bkr to R Fuel Boost Sw	RA-863	RA-333	E450-321
E450-84	18	88	R J-Box to R Fuel Boost Sw	RA-333	RA-333	E450-312
E450-84W	18	186	R J-Box to Disc	RA-333	S341	E450-302
E450-84Y	18	33	Disconnect to R Fuel Boost Pump	S341	RA-333	E450-84Y
E450-85	18	25	Ckt Bkr to Flare Sw	RA-863	Splice	E450-85
E450-86	18S	127	Flare Sw to Flares	RA-863	Splice	E450-334
E450-87	18S	127	Flare Sw to Flares	RA-863	Splice	E450-334
E450-88	18S	127	Flare Sw to Flares	RA-863	Splice	E450-334
E450-89	18S	127	Flare Sw to Flares	RA-863	Splice	E450-334
E450-90	18S	49	Ckt Bkr to L Fuel Boost Pump Sw	RA-863	RA-333	E450-321
E450-91	18S	37	L Fuel Boost Sw to L J-Box	RA-333	S341	E450-311
E450-91W	18S	207	L J-Box to Disc	RA-333	S341	E450-301
E450-91X	18S	33	Disc to L Fuel Boost Pump	RA-333	S341	E450-91X
E450-92	18	56	L Fuel Boost Sw to OAT Ind	RA-333	MS3106-14S2S	E450-92
E450-93	18	131	OAT Ind to OAT Bulb	MS3106-12S3S	MS3106-14S2S	E450-93
E450-94	18	64	Ckt Bkr to T & B Ind	RA-863	RA-863	E450-321
E450-94A	18	18	Term Blk to T & B Ind	A-31888	A-31888	E450-94
E450-95	18	78	Ckt Bkr to Oil Temp Ind (Serials 35000 thru 35025)	RA-333	MS3106-14S2S	E450-94

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
	18	78	Ckt Bkr to L Oil Temp Ind (Serials 35026 thru 35546)	RA-863	MS3106-14S2S	E450-95
E450-96	18	69	L J-Box to Cyl Hd Temp Ind	RA-333	MS3106-14S2S	E450-311
E450-96W	18	86	L J-Box to Cyl Hd Temp Bulb	RA-333	RA-863	E450-303
E450-96WA	18	96	L J-Box to Cyl Hd Temp Bulb	RA-333	RA-863	E450-348
E450-97	18	74	L J-Box to L Oil Temp Ind	RA-333	MS3106-14S2S	E450-311
E450-97W	18	112	L Oil Temp Bulb to L J-Box	RA-333	MS3106-12S2S	E450-303
E450-98	18	85	Ckt Bkr to Stall Warn Ind	RA-863	RA-333	E450-321
E450-99	18	80	Ckt Bkr to R Oil Temp Ind (Serials 35000 thru 35025)	RA-333	MS3106-14S2S	E450-99
	18	80	Ckt Bkr to R Oil Temp Ind (Serials 35026 thru 35546)	RA-863	MS3106-14S2S	E450-99
E450-100	18	60	R J-Box to Cyl Hd Temp Ind	RA-333	MS3106-14S2S	E450-314
E450-100W	18	82	R J-Box to R Cyl Hd Temp Bulb	RA-333	RA-863	E450-304
E450-100WA	18	80	R J-Box to R Cyl Hd Temp Bulb	RA-333	RA-863	E450-349
E450-101	18	65	R J-Box to R Oil Temp Ind	RA-333	MS3106-14S2S	E450-314
E450-101W	18	65	R J-Box to R Oil Temp Bulb	RA-333	MS3106-12S3S	E450-304
E450-102	18	9	Nav Lt Sw to Primer Sw	RA-333	RA-333	E450-102
E450-103	18	9	Primer Sw to Oil Dil Sw	RA-333	RA-333	E450-103
E450-104	18	91	Primer Sw to R J-Box	RA-333	RA-333	E450-312
E450-104W	18	54	R J-Box to R Primer	RA-333	MS3106-8S1S	E450-304
E450-105	18	44	Primer Sw to L J-Box	RA-333	RA-333	E450-311
E450-105W	18	66	L J-Box to L Primer	RA-333	MS3106-8S1S	E450-303

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-106	18	85	Oil Dil Sw to R J-Box	RA-333	RA-333	E450-106
E450-106W	18	59	R J-Box to R Oil Dil	RA-333	MS3106-8S1S	E450-106W
E450-107	18	41	Oil Dil Sw to L J-Box	RA-333	RA-333	E450-107
E450-107W	18	60	L J-Box to L Oil Dil	RA-333	MS3106-8S1S	E450-107W
E450-108	18DS	55	Mag Sw to Conn	RA-333	75MC1M	E450-309
E450-108W	18DS	97	Connector to Mag	75MC1M		E450-108W
E450-109	18DS	55	Mag Sw to Conn	RA-333	75MC1M	E450-309
E450-109W	18DS	94	Connector to Mag	75MC1M		E450-109W
E450-110	18DS	87	Mag Sw to Conn	RA-333	75MC1M	E450-310
E450-110W	18DS	104	Connector to Mag	75MC1M		E450-110W
E450-111	18DS	87	Mag Sw to Conn	RA-333	75MC1M	E450-310
E450-111W	18DS	100	Connector to Mag	75MC1M		E450-111W
E450-112	18	64	L J-Box to Tach Ind	RA-333	MS3106-14S1S	E450-311
E450-112W	18	89	L J-Box to L Tach Gen	RA-333	MS3106-10SL3S	E450-303
E450-113	18	64	L J-Box to Tach Ind	RA-333	MS3106-14S1S	E450-311
E450-113W	18	89	L J-Box to L Tach Gen	RA-333	MS3106-10SL3S	E450-303
E450-114	18	63	L J-Box to Tach Ind	RA-333	MS3106-14S1S	E450-311
E450-114W	18	90	L J-Box to L Tach Gen	RA-333	MS3106-10SL3S	E450-303
E450-115	18	72	R J-Box to Tach Ind	RA-333	MS3106-14S1S	E450-314
E450-115W	18	75	R J-Box to Tach Gen	RA-333	MS3106-10SL3S	E450-304
E450-116	18	74	R J-Box to Tach Ind	RA-333	MS3106-14S1S	E450-314
E450-116W	18	74	R J-Box to Tach Gen	RA-333	MS3106-10SL3S	E450-304
E450-117	18	73	R J-Box to Tach Ind	RA-333	MS3106-14S1S	E450-314
E450-117W	18	74	R J-Box to Tach Gen	RA-333	MS3106-10SL3S	E450-304
E450-118	18	46	Heater Sw to Disc	RA-333	S341	E450-335
E450-119	18	110	Heater Sw to Heater (Serials 35000 thru 35486)	RA-333	MS3106F18-11S or RA-333	E450-333
	18	110	Heater Sw to Heater (Serials 35487 thru 35546)	RA-333	MS3106F18-11S or RA-333	E450-364

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-120	18	110	Heater Sw to Heater (Serials 35000 thru 35486)	RA-333	MS3106F18-11S or RA-333	E450-333
	18	110	Heater Sw to Heater (Serials 35487 thru 35546)	RA-333	MS3106F18-11S or RA-333	E450-364
E450-121	18	109	Heater Sw to Heater (Serials 35000 thru 35486)	RA-333	MS3106F18-11S or RA-333	E450-333
	18	109	Heater Sw to Heater (Serials 35487 thru 35546)	RA-333	MS3106F18-11S or RA-333	E450-364
E450-123	18	129	Heater to Disc	RA-333 or MS3106F18-11S	S341	E450-333
E450-124	18	43	Nose Gr Sw to Vent Fan	RA-333	AA-2	E450-336
E450-125	18	30	Nose Gr Sw to Heater	RA-333	AA-2	E450-336
E450-126	18	77	L J-Box to Fuel Ind	MS3106B14S5S	RA-333	E450-311
E450-126W	18	207	L J-Box to Disc	RA-333	S341	E450-301
E450-126X	18	33	Disc to L Fuel Tank Unit	S341	RA-333	E450-126X
E450-127	18	77	L J-Box to Fuel Ind	RA-333	MS3106B14S5S	E450-311
E450-127W	18	207	L J-Box to Disc	RA-333	S341	E450-301
E450-127X	18	33	Disc to Fuel Tank Unit	S341	RA-333	E450-127X
E450-128	18	54	Fuel Ind to R J-Box	MS3106B14S5S	RA-333	E450-338
E450-128W	18	189	R J-Box to Disc	RA-333	S341	E450-302
E450-128Y	18	33	Disc to R Fuel Tank Uni	S341	RA-333	E450-128Y
E450-129	18	55	Fuel Ind to R J-Box	MS3106B14S5S	RA-333	E450-338
E450-129W	18	189	R J-Box to Disc	RA-333	S341	E450-302
E450-129Y	18	33	Disc to Fuel Tank Unit	S341	RA-333	E450-129Y
E450-130	18	44	Ckt Bkr to AutopilotSw	RA-863	RA-333	E450-321
E450-132	18	AR	UV Start Sw to Disc (Vendor Supplied)			E450-132
E450-133	18	AR	UV Start Sw to UV Lt (Vendor Supplied)			E450-133
E450-134	18	AR	UV Start Sw to Disc (Vendor Supplied)			E450-134
E450-135	18	96	Ballast to Disc		S341	E450-135

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-135A	18	6	Disc UV Lt Rheo	S341		E450-135A
E450-136	18	96	UV Rheo to Disc		S341	E450-136
E450-136A	18	6	Disc to UV Start Sw	S341		E450-136A
E450-138	18	96	Ballast to Disc		S341	E450-138
E450-138A	18	6	Disc to UV Start Sw	S341		E450-138A
E450-139	4	33	Ext Pr Recpt to Bat Sol	F-73	F-71	E450-139
E450-140	18	12	Rear Dome Lt Sw to Lt	RA-333	S341	E450-140
E450-142	4	8	Battery to Ground	F-71	F-73	E450-142
E450-144	18		T & B Ind to Disc	RA-863	A-56	E450-144
E450-144A	18	20	Term Blk to T&B Test Lt	A-31882		E450-144A
E450-149	18	57	Temp Control to Thermo	S341	S341	E450-335
E450-150	18	158	Temp Control to Thermo	S341	S341	E450-335
E450-151	18	76	De-Ice Sw to Timer	RA-333	MS3106A22-14S	E450-328
E450-152	18	76	De-Ice Sw to Timer	RA-333	MS3106A22-14S	E450-328
E450-153	18	17	De-Ice Timer to Comb Unit	MS3106A22-14S	MS3106-14S9S	E450-153
E450-154	18	248	Timer to Rear Valve	MS3106A22-14S	MS3106-14S9S	E450-327
E450-155	18	119	L J-Box to Timer	RA-333	MS3106A22-14S	E450-317
E450-155F	18	110	L J-Box to R J-Box	RA-333	RA-333	E450-325
E450-155L	18	108	L J-Box to L Valve	RA-333	MS3106-14S7S	E450-307
E450-155R	18	108	R J-Box to R Valve	RA-333	MS3106-14S7S	E450-308
E450-156	18	119	Timer to L J-Box	MS3106A22-14S	RA-333	E450-317
E450-156F	18	110	R J-Box to L J-Box	RA-333	RA-333	E450-325
E450-156L	18	108	L J-Box to L Valve	RA-333	MS3106-14S7S	E450-307
E450-156R	18	108	R J-Box to R Valve	RA-333	MS3106-14S7S	E450-308
E450-157	18	10	Comb Unit to Gnd	MS3106-14S9S	RA-333	E450-157
E450-158	18	15	Timer to Ground	MS3106A22-14S	RA-333	E450-158
E450-159	18	282	Timer to Rear Valve	MS3106A22-14S	MS3106-14S7S	E450-327

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-160	18	142	L J-Box to Nose Gear Sw	RA-333	RA-333	E450-319
E450-160W	18	69	L J-Box to L Gear Dn Ind Sw	RA-333	RA-333	E450-305
E450-160WA	18	76	L J-Box to L Gear Dn Ind Sw	RA-333	RA-333	E450-366
E450-161F	18	119	R J-Box to L J-Box	RA-333	RA-333	E450-315
E450-161L	18	69	L J-Box to L Gear Dn Ind Sw	RA-333	RA-333	E450-305
E450-161LA	18	78	L J-Box to L Gear Dn Ind Sw	RAA-23	RA-333	E450-366
E450-161R	18	64	R J-Box to R Gear Dn Ind Sw (Serials 35000 thru 35068)	RA-333	RA-333	E450-306
	18	64	R J-Box to R Gear Dn Ind Sw (Serials 35069 thru 35497)	RA-333	RA-333	E450-344
E450-161RA	18	66	R J-Box to R Gear Dn Ind Sw	RAA-23	RA-333	E450-365
E450-162	18	142	T&B Test Lt to Flap Pos Trans	MS3106B14S2S	RA-333	E450-326
E450-163	18	164	Flap Pos Trans to Ind	MS3106B14S2S	MS3106B10SL3S	E450-326
E450-164	18	164	Flap Pos Trans to Ind	MS3106B14S2S	MS3106B10SL3S	E450-326
E450-165	18	164	Flap Pos Trans to Ind	MS3106B14S2S	MS3106B10SL3S	E450-326
E450-167	18	8	Up to Dn Gear Ind Lt	—————	—————	E450-167
E450-168	18	112	Gear Sw to Gear Relay (Serials 35000 thru 35340)	C-33	RC-863	E450-330
	18	112	Gear Sw to Gear Relay (Serials 35341 & on)	A-MP35149	RC-863	E450-330
E450-169	12	AR	Gear Relay to Motor (Vendor Supplied)	RA-863	—————	E450-169
E450-170	18	65	Ckt Bkr to Up Limit Sw	RA-863	RA-333	E450-170
E450-171	12	150	Flap Sw to Up Limit Sw	RA-333	RA-333	E450-329
E450-172	12	33	Tail Lt to Ground	—————	RA-333	E450-172
E450-173	12	7	Battery Sw to Ground	RA-333	RA-333	E450-173
E450-174	18	4	R Starter Sol to Gnd	RA-333	RA-333	E450-174
E450-175	12	31	Nav Lt Sw to Gnd	RA-333	RA-333	E450-175
E450-176	18	4	Gear Relay to Gnd	RA-333	RA-333	E450-176

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-177	12	25	R Cyl Head Temp Bulb to Ground	RA-863	RA-333	E450-177
E450-178	12	AR	R Cyl Head Temp Ind to Ground	MS3106-14S2S	RA-333	E450-178
E450-179	18	45	Taxi Lt to Gnd	RA-863	RA-333	E450-179
E450-181	18	AR	Stall Warn Act to Gnd (Vendor Supplied)	RA-333	RA-333	E450-181
E450-182	18	25	L Cyl Hd Temp Bulb to Ground	RA-863	RA-333	E450-182
E450-183	18	19	L Cyl Hd Temp Ind to Ground	MS3106-14S2S	RA-333	E450-183
E450-184	18	9	T&B Test Lt to Gnd	—	RA-333	E450-184
E450-185	18	24	T&B Ind to Gnd	RA-863	RA-333	E450-185
E450-186	18	AR	R Boost Pump to Gnd (Vendor Supplied)	Splice	RA-333	E450-186
E450-187	18	AR	L Boost Pump to Gnd (Vendor Supplied)	Splice	RA-333	E450-187
E450-188	18	10	OAT Bulb to Gnd	MS3106-12S3S	RA-333	E450-188
E450-189	18	28	OAT Ind to Gnd	MS3106-14S2S	RA-333	E450-189
E450-191	18	4	L Starter Sol to Gnd	RA-333	RA-333	E450-191
E450-192	18	13	R Oil Temp Bulb to Gnd	MS3106-12S3S	RA-333	E450-192
E450-193	18	24	R Oil Temp Ind to Gnd	MS3106-14S2S	RA-333	E450-193
E450-194	18	13	L Oil Temp Bulb to Gnd	MS3106-14S3S	RA-333	E450-194
E450-195	18	21	L Oil Temp Ind to Gnd	MS3106-14S2S	RA-333	E450-195
E450-196	18S	5	Ignition Sw to Gnd	RC-863	RA-333	E450-196
E450-200	18	15	Rear De-Ice Valve to Gnd	MS3106-14S7S	RA-333	E450-200
E450-201	18	15	L De-Ice Valve to Gnd	MS3106-14S7S	RA-333	E450-201
E450-202	18	15	R De-Ice Valve to Gnd	MS3106-14S7S	RA-333	E450-202
E450-203	18	15	Heater Thermo to Gnd	S341	RA-863	E450-203
E450-205	16	16	L Ldg Lt to Gnd	RB-863	RB-1333	E450-205
E450-206	16	16	R Ldg Lt to Gnd	RB-863	RB-1333	E450-206
E450-207	18	8	Gear Horn to Gnd	RB-863	RA-333	E450-207
E450-208	18	20	De-Ice Sw to Gnd	RA-333	RA-333	E450-208

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-209	18	18	R Reg to Parallel Relay	RA-873	RA-873	E450-209
E450-210	18	20	R Reg to Parallel Relay	RA-873	RA-873	E450-209
E450-211	18	17	L Reg to Parallel Relay	RA-873	RA-873	E450-211
E450-212	18	16	L Reg to Parallel Relay	RA-873	RA-873	E450-212
E450-213	18	72	Starter Contactors to Shunt	D-71	D-71	E450-213
E450-214	18	72	Ckt Bkr to De-Ice Lt Sw	RA-863	RA-333	E450-214
E450-215	18	74	De-Ice Lt Sw to L J-Box	RA-333	RA-333	E450-215
E450-215W	18	100	L J-Box to De-Ice Lt	RA-333	RA-333	E450-215W
E450-217	18	AR	Start Sw to UV Lt	_____	_____	E450-217
E450-218	16	AR	Rear Cigar Ltr to Gnd	_____	RA-863	E450-218
E450-219	18	42	Flap Sw to Panel Lt Rheo	RA-333	_____	E450-219
E450-220	18	120	Fuel Sel Lt to Rheo	_____	Tinned	E450-220
E450-221	18	88	Sw Pnl Lt to Rheo	_____	_____	E450-121
E450-222	18	AR	Disc to Heater	S341	RA-863	E450-339
E450-223	18	AR	Fuel Control to Over-Heat Sw	S341	RA-863	E450-339
E450-224	18	15	Heat Fuel Valve to Fan	S341	RA-863	E450-224
E450-225	18	12	Heater to Ground	MS3106F18S11S	RA-333	E450-225
E450-226	18	9.5	Overheat Relay to Sw	RA-333	_____	E450-226
E450-227	18	5	Overheat Relay to Htr	RA-333	_____	E450-227
E450-228	18	5	Overheat Relay to Gnd	_____	RA-863	E450-228
E450-229	18	109	Disc to Disc (Heater to T&B Test Lt)	S341	S341	E450-333
E450-229A	18	3.5	Overheat Relay to Disc	_____	S341	E450-229A
E450-229B	18	4	T&B Test Lt to Disc	_____	S341	E450-229B
E450-230	18	3	Anti-Ice Rheo Jumper	_____	_____	E450-230
E450-231	22	36	Mic Jack to Disc	_____	S341	E450-231
E450-232	22	36	Mic Jack to Disc	_____	S341	E450-232
E450-233	16	34	Rot Beacon to Ground	MS3106A10SL4S	RB-863	E450-233
E450-234	16	190	Rotating Beacon to Sw	MS3106A10SL4S	RB-1333	E450-234

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-239	18	66	Ckt Bkr to Flap Sw (Serials 35023 thru 35546)	RA-333	RA-863	E450-343
	18	66	Ckt Bkr to Flap Sw (Serials 35547 & on)	RA-333	RA-863	E450-239
E450-240	16	39	Ckt Bkr to Beacon Sw	RB-863	RB-1333	E450-240
E450-245	18	32	Gear Horn to L J-Box (Serials 35069 thru 35275)	RA-333	RA-333	E450-245
	18	32	Gear Horn to L J-Box (Serials 35276 & on)	RA-333	RA-863	E450-245
E450-245A	18	62	Throttle Sw to L J-Box	RA-333	RA-333	E450-354
E450-245W	18	93	L J-Box to L Gear Safety Sw	RA-333	RA-333	E450-345
E450-246	18	66	Up Limit Sw to L J-Box	_____	RB-4	E450-347
E450-246W	18	97	L J-Box to L Gear Safety Sw	RA-333	RA-333	E450-345
E450-247	18	70	Gear Relay to L J-Box	RA-333	RA-333	E450-347
E450-247W	18	98	L Gear Safety Sw to L J-Box	RA-333	RA-333	E450-345
E450-248	18	4	Anti-Ice Rheo Jumper	_____	_____	E450-248
E450-249	18	4	Anti-Ice Rheo Jumper	_____	_____	E450-249
E450-251	12	AR	L Reg to Condenser	RC-363	RC-863	E450-251
E450-253	12	AR	R Reg to Filter Capacitor	RC-363	RC-863	E450-253
E450-256	20S	50	Speaker to Disconnect	_____	S341	E450-256
E450-257	18	6	Speaker to Ground	_____	RA-333	E450-257
E450-260	12S	68	L Reg to L J-Box (Serials 35000 thru 35546)	RC-363	RC-332	E450-350
	12S	68	L Reg to L J-Box (Serials 35547 & on)	RC-363	RC-332	E450-260
E450-260W	12S	104	L J-Box to Generator	RC-713	RC-332	E450-349
E450-267	12S	24	R Reg to R J-Box (Serials 35000 thru 35546)	RC-363	RC-332	E450-352
	12S	24	R Reg to R J-Box (Serials 35547 & on)	RC-363	RC-332	E450-267
E450-267W	12S	85	R J-Box to Generator	RC-332	RC-363	E450-353
E450-275	18	38	R Phone Jack to Disc	_____	S341	E450-275

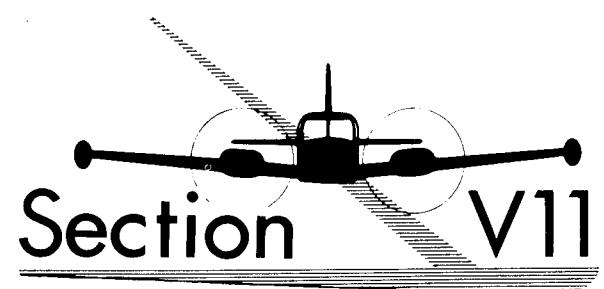
ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E450-276	18	51	L to R Phone Jack	_____	_____	E450-276
E450-291	18	15	L Cyl Head Temp Bulb to Gnd	RA-863	RA-333	E450-291
E450-292	18	20	R Cyl Head Temp Bulb to Gnd	RA-863	RA-333	E450-292
E450-355	16	70	Ckt Bkr to Resistor	RB-863	RB-873	E450-355
E450-356	16	70	Ckt Bkr to Resistor	RB-863	RB-873	E450-356
E450-357	16	32	Resistor to Cigar Ltr	RB-873	RB-873	E450-357
E450-358	16	181	Resistor to Cigar Ltr	RB-873	RB-873	E450-358
E450-361	18	19	Fuel Ind to Gnd	_____	RA-863	E450-361
E450-362	18	8	Thermo to Htr Sw	S341	_____	E450-364
E450-363	18	8	Thermo to Heater (Serials 35000 thru 35546)	S341	_____	E450-364
	18	8	Thermo to Heater (Serials 35547 & on)	S341	_____	E450-364
E479-8	8	8	Parallel Resistor to Gnd	D-71	D-26	E479-8
E479-9	18	8	Voltage Reg to Gnd	RA-873	RA-873	E479-9
E479-10	18	8	Reverse Cur Cutout to Gen	RA-733	RA-873	E479-10
E479-15	8	65	L Gen to Parallel Relay	D-26	D-71	E479-15
E479-16	8	50	R Gen to Parallel Relay	D-26	D-71	E479-16
E479-19	18	10	L Sw to R Sw	RA-333	RA-333	E479-19
E479-20	8	30	Rev Cur Cutout to R J-Box	RC-332	D-73	E479-12
E479-20W	8	90	R J-Box to Gen	D-26	RC-332	E479-14
E479-21	18	105	R Voltage Reg to R Gen	D-26	RA-873	E479-14
E479-22	18S	130	R Sw to R J-Box	RA-333	RA-333	E479-18
E479-22W	18S	95	R J-Box to R Gen	RA-873	RA-333	E479-14
E479-23	18	105	R Voltage Reg to R Gen	RA-873	RA-873	E479-14
E479-24	8	85	Rev Cur Cutout to CB Box	D-71	D-73	E479-12
E479-25	8	85	L Rev Cur Cutout to Lt	RC-332	D-73	E479-11
E479-25W	8	110	L J-Box to L Gen	D-26	RC-332	E479-13

ELECTRICAL WIRE TABLE

WIRE NO.	GAUGE	LENGTH	WIRE ROUTING	TERMINALS		CABLE NO.
E479-26	18	114	L Voltage Reg to L Gen	D-26	RA-873	E479-13
E479-27	18S	42	L Sw to L J-Box	RB-863	RA-333	E479-17
E479-27W	18S	110	L J-Box to L Gen	RA-873	RA-333	E479-13
E479-28	18	114	L Voltage Reg to L Gen	RA-873	RA-873	E479-13
E479-29	18	130	R Sw to R J-Box	RA-333	RA-333	E479-18
E479-29W	18	75	R J-Box to R Voltage Reg	RA-333	RA-873	E479-14
E479-30	18S	42	L Sw to L J-Box	RA-333	RA-333	E479-17
E479-30W	18S	80	L J-Box to L Voltage Reg	RA-873	RA-333	E479-13
E479-31	18S	130	R Sw to R J-Box	RA-333	RA-333	E479-18
E479-31W	18S	75	R J-Box to R Vltg Reg	RA-873	RA-333	E479-14
E479-32	18	42	L Sw to L J-Box	RA-333	RA-333	E479-17
E479-32W	18	80	L J-Box to L Vltg Reg	RA-333	RA-873	E479-13
E479-33	8	114	L Rev Cur Cutout to LCB	D-73	D-71	E479-11
E479-34	8	8	Ckt Bkr to Ckt Bkr	D-71	D-71	E479-34
E479-35	4	15	Bus Bar to Ckt Bkr	F-71	F-26	E479-35
E479-36	4	40	Bus Bar to Shunt	F-26	F-26	E479-36
E479-37	4	80	Shunt to R Starter Sw	F-26	F-71	E479-37
E518-2	18	4	Capacitor to Gnd	RA-873	_____	E518-2
E518-3	18	14	Capacitor to Reg	31889	_____	E518-3
E532-2	16	10	Capacitor to Gnd	RB-713	RB-863	E532-2
E532-3	16	10	Gen to Capacitor	RB-713	RB-863	E532-3
E571-5	16	AR	Plug Jumper	MS3106A10SL3S	MS3106A10SL3S	E571-12
E571-6	16	14	Beacon to Ground	MS3106A10SL3S	A-31902	E571-9
E571-10	16	210	Beacon to Sw	MS3106A10SL3S	A-32440	E571-12
E571-11	16	65	Ckt Bkr to Sw	A-31882	A-31902	E571-12
E615-7	18	30	Terminal Block to Resistor	A-31882	AA-2	E615-7

310 SERVICE MANUAL



ELECTRONIC CIRCUITS & WIRING DATA

1 APRIL 1960

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SECTION VII
ELECTRONICS CIRCUITS AND WIRING DATA

Table of Contents

GENERAL DESCRIPTION	7-1
WIRING CODE	7-1
INDEX OF WIRING DIAGRAMS	7-1

RADIO NOISE ELEMINATION	7-3
RADIO COMBINATION CHARTS	7-4
TABLES OF ELECTRONIC EQUIPMENT LOADING	7-161

MODEL 310 MODEL 310B
Serials 35000 thru 35546 Serials 35547 thru 35771

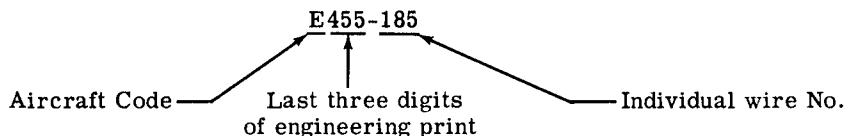
MODEL 310C MODEL 310D
Serials 35772 thru 39031 Serials 39032 & on

7-1. GENERAL DESCRIPTION.

7-2. This section contains wiring diagrams which clearly show the complete wiring of each item of electronic equipment. The interconnection of each audio system is shown on a separate diagram. Isometric diagrams accompany each component diagram to illustrate the location of the units and cabling in the aircraft. Finding the wiring diagrams for a particular aircraft or system is simplified by using the radio combinations Charts. The last portion of the section contains tables that show the loading and location of various electronic components on the shelves and racks in the aircraft.

7-3. WIRING CODE.

7-4. Each wire used in the electronics systems 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 series is shown below.



7-5. INDEX OF WIRING DIAGRAMS.

	Page No.
AUDIO AMPLIFIERS	
ARC F13 & F-13A	310 7-58
ARC F13 & F-13A	310B 7-60
ARC F13 & F-13A	310C 7-60
CA-1	310 7-56
CA-3C	310D 7-146
AUDIO & INTERCONNECTING CIRCUITS	
E452-1	7-85
E452-2	7-86
E452-3	7-87
E452-4	7-88
E452-5	7-88
E452-6	7-89
E452-7	7-89
E452-43	7-91
E452-44	7-91
E452-45	7-89
E452-57	7-93
E452-58	7-93
E452-63	7-94
E452-64	7-94
E452-65	7-94
E452-66	7-95
E452-67	7-95
E452-68	7-95
E452-69	7-95
E452-70	7-95
E452-71	7-95
E452-72	7-95
E471-2	7-96
E471-7	7-96
E471-8	7-96
E471-9	7-97
E471-10	7-97
E583-2	7-98
E583-3	7-98
E583-4	7-98
E583-5	7-98

Page No.		Page No.		
AUDIO & INTERCONNECTING CIRCUITS (Cont)				
E583-7	7-99	L-2 Autopilot	310D	7-135
E583-8	7-99	DIAL LIGHT LOAD RESISTOR		
E583-9	7-99	CIRCUIT	310C	7-151
E583-10	7-99		310D	7-151
E583-11	7-100	LOW FREQUENCY RECEIVERS		
E583-12	7-100	Narco LFR-3B.	310C	7-114
E583-13	7-101	Narco LFR-3B.	310D	7-114
E583-14	7-101	RECEIVER-TRANSMITTERS		
E583-15	7-101	ARC RT-11A	310C	7-72
E583-16	7-101	ARC RT-11A	310D	
E583-55	7-102	LTR-800	310B	7-26
E583-56	7-102	LTR-800	310C	7-26
E583-57	7-102	LTRA-6	310	7-16
E583-58	7-103	LTRA-6	310B	7-16
E583-59	7-103	LTTR-6A	310	7-24
E583-60	7-103	LVTR-36	310	7-14
E583-63	7-104	Narco 1016	310B	7-28
E583-64	7-104	Narco 1016	310C	7-28
E583-70	7-105	Narco 1016	310D	7-133
E583-71	7-105	Narco Mark V	310D	7-116
E583-72	7-105	Narco Simplexer VC-27B	310C	7-112
E583-73	7-106	Narco Simplexer VC-27B	310D	7-112
E583-74	7-105	Sun-Air	310	7-32
E583-75	7-105	Sun-Air	310B	7-32
E583-76	7-105	Sun-Air	310C	7-32
E583-77	7-105	Sun-Air	310D	7-32
E583-78	7-105			
E583-79	7-105	TRANSMITTERS		
E583-80	7-106	ARC T-11B	310	7-30
E583-81	7-105	ARC T-11B	310B	7-30
E583-82	7-105	ARC T-22	310C	7-74
E583-83	7-105	ARC T-25	310D	7-122
E583-84	7-107	UHF NAVIGATION EQUIPMENT		
E583-97	7-108	ARC R-31 Glide Path Receiver	310D	7-125
E583-98	7-108	Dare DGS-20 Glide Path		
E583-99	7-109	Receiver	310C	7-48
E583-100	7-107	R-89 Glide Path Receiver	310	7-44
E583-105	7-156	R-89 Glide Path Receiver	310B	7-44
E583-106	7-156	VHF RECEIVERS & NAVIGATION EQUIPMENT		
E583-115	7-157	A2200 Marker Beacon Receiver	310	7-50
E583-116	7-158	A2200 Marker Beacon Receiver	310B	7-52
E583-117	7-158	ARC CD-1 Course Director	310C	7-78
E583-118	7-159	ARC CD-1 Course Director	310D	7-144
E583-119	7-159	ARC 15D Omnidrange Receiver	310	7-34
E583-120	7-160	ARC 15D Omnidrange Receiver	310B	7-34
E583-121	7-160	ARC 15E Omnidrange Receiver	310C	7-40
AUTOMATIC DIRECTION FINDERS		ARC 15F Omnidrange Receiver	310D	7-138
ADF-12	310	ARC R-33A Marker Beacon		
ADF-12	310B	Receiver	310D	7-125
ADF-12E	310C	DM-3 Marker Beacon Receiver	310D	7-54
ADF-12E-2	310C	VOA-3 VHF Navigation Circuit	310C	7-110
ADF-12E-2	310D			
ADF-12E-2 Gonion	310D			
ADF-14	310			
ADF-21	310B			
ADF-21	310C			
ADF-21	310D			
AUTOPILOT EQUIPMENT				
Dynavia Omni-Autopilot				
Coupler	310D			
L-2 Autopilot	310			
L-2 Autopilot	310B			
L-2 Autopilot	310C			
	7-81			
	7-81			
	7-81			
	7-81			

7-6. RADIO NOISE ELIMINATION.

7-7. 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 generator 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 ground loops. 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 airplane will not necessarily be effective in all cases.

7-8. IGNITION NOISE.

7-9. 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 on 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 harnesses should be replaced if the shielding becomes questionable.

7-10. GENERATOR NOISE.

7-11. One of the most likely noise producing systems is the generator-regulator circuit. The generator, with its rotary motion and arc producing brushes can

instill a whine into a radio system. The frequency of the noise is audible and low enough to be unaffected by radio noise limiter circuits. The whine will change frequency with a change of engine speed and therefore is easily recognized. The generator field circuit is carried to the instrument panel via the junction boxes by shielded wires to prevent radiation of noise to the other electrical wiring. The shield is grounded at both ends and in the junction box. A bathtub type capacitor is connected from the armature terminal to ground.

CAUTION

Never connect a capacitor between the generator field circuit and ground. This will cause excessive arcing and burning of regulator contacts, resulting in reduced generator output. If a capacitor is found in this circuit, remove it at once and check the voltage regulator for oxidized or pitted contacts.

When generator whine appears in the radio system, check the generator circuit for proper grounding of components and shielding. Check the capacitor to see if it has proper capacity and is not open. If the noise persists, generator brush replacement may lessen the problem.

7-12. REGULATOR NOISE.

7-13. Relay type voltage regulators produce staccato noise impulses during operation. The noise pulses are impressed directly upon the aircraft bus voltage. On early models of the 310 much of this noise may be reduced by installing the newer type of voltage regulators and the heavy capacitor across the "Gen" regulator terminal and ground. When regulator noise becomes excessive on aircraft that have these provisions installed, check the regulators for proper ground or excessive wear of the contacts. An open filter capacitor would also allow the noise to become excessive.

7-14. FLAP AND LANDING GEAR MOTOR NOISE.

7-15. During a landing approach an unfiltered motor in the flap or gear circuits can produce a startling volume of noise which is very distracting. There is also the possibility of the noise blanketing a message from the tower during the approach. It is possible that sufficient noise could be created through these circuits to blanket an ILS signal, creating a hazardous situation. For these reasons the circuits have a filter section built into the motor. The filter should be very effective if the unit is properly grounded. If noise becomes excessive with good grounding a motor overhaul or replacement may be necessary.

7-16. AUXILIARY FUEL PUMP NOISE.

7-17. 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 filter 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.

7-18. LIGHTING CIRCUIT NOISE.

7-19. 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. One case of this was found when the ADF loop antenna was installed in the fiber-glas tailcone. The tail navigation light wires had to be twisted together and tied out of the way to avoid noise pickup by the loop.

7-20. The Radio Combination Charts show the standard factory installed radio equipment and the audio and interconnecting systems used for each sales group. To determine which wiring diagrams are applicable

for a certain airplane, obtain the sales group number of the radio equipment. The circuits listed adjacent to the sales group number will correspond with the airplane wiring. If a sales group number is not available, it will be necessary to compare the equipment installed in the airplane with the listings in the combinations chart.

NOTE

Aircraft with serial numbers prior to 35097 are not covered in this section. For information concerning radio systems in these aircraft, write to Cessna Aircraft Company, Wichita, Kansas.

310 RADIO COMBINATIONS CHART										NOTE		
VHF COMM	VHF OMNI LF RCVR	OMNI LOC VHF RCVR	VHF TRANS	G. P. RCVR	ADF	ADF	MKR BCN	AUDIO AMP	FOR AUTO PILOT SEE FIGURE 31			
UNIT IDENTIFICATION & FIG. NO.										AUDIO & INTER-CONNECTING CIRCUITS		
LVTR-36 Fig. 1	LTRA-6 Fig. 3	15D Nav. Fig. 10	T-11B Fig. 8	LR-89 Fig. 13	ADF-12 Fig. 21	ADF-14 Fig. 23	2200 Fig. 15	CA-1 Fig. 18	F-13 Fig. 19	Circuit Number	Figure Number	Sales Group No.
		●	●					●		E452-1	33	4C
		●	●						●	E452-65	40	
	●				●					E452-2	34	5B

310 RADIO COMBINATIONS CHART -- (Cont)

LVTR-36 Fig. 1	LTRA-6 Fig. 3	15D Nav. Fig. 10	T-11B Fig. 8	LR-89 Fig. 13	ADF-12 Fig. 21	ADF-14 Fig. 23	2200 Fig. 15	CA-1 Fig. 18	F-13 Fig. 19	Circuit Number	Fig. No.	Sales Group No.
	●									E452-3	35	5C
		●	●			●		●		E452-4	36	4
		●	●			●			●	E452-63	40	
		●	●		●			●		E452-5	36	4A
		●	●		●				●	E452-64	40	
●	●	●	●		●	●	●	●		E452-6	37	2
●	●	●	●		●	●	●	●		E452-71	41	
●	●	●	●			●		●		E452-6	37	3
●	●	●	●			●			●	E452-68	41	
●	●	●	●	●	●		●	●	●	E452-7	37	2A
●	●	●	●	●	●		●		●	E452-72	41	
●	●	●	●	●	●			●		E452-7	37	3A
●	●	●	●	●	●				●	E452-69	41	
●	●			●						E452-43	38	5
●	●									E452-44	38	5A
		●	●						●	E452-45	37	4B
		●	●						●	E452-70	41	
●	DUAL	●	●		●	●	●	●		E452-57	39	2B
●	DUAL	●	●		●	●	●	●		E452-66	41	
●	DUAL	●	●	●			●	●		E452-58	39	2C
●	DUAL	●	●	●			●		●	E452-67	41	

310 EXPORT RADIO COMBINATIONS CHART

VHF COMM OMNI	ADF	ADF	MARKER BEACON	MEDIUM FREQUENCY TRANSCEIVER	NOTE: FOR AUTOPILOT, SEE FIGURE 7-31.		
UNIT IDENTIFICATION AND FIGURE NUMBER					AUDIO CIRCUITS		
LTTR-6A Figure 5	ADF-12 Figure 21	ADF-14 Figure 23	2200 Figure 15	S5-RTR Figure 9	Circuit Number	Figure Number	Sales No.
●		DUAL See Figs 23 and 24	●	●	E471-2	42	10A

310 EXPORT RADIO COMBINATIONS CHART -- (Cont)

LTTR-6A Fig. 5	ADF-12 Fig. 12	ADF-14 Fig. 23	2200 Fig. 15	S5-RTR Fig. 9	Circuit Number	Figure Number	Sales No.
●	DUAL See Figures 21 and 22			●	E471-7	42	20
●	●			●	E471-8	42	20A
	●			●	E471-9	43	30
●	●				E471-10	43	30A

310B RADIO COMBINATIONS CHART

G. P. RCVR	VHF COMM	VHF XMTR	OMNI LOC	MKR VHF RCVR	ADF	AUDIO	VHF AMP	VHF LF	VHF OMNI LF RCVR	NOTE: FOR AUTOPILOT SEE FIG. 7-31			
										● Serials 35547 thru 35599. ★ Serials 35600 thru 35771.			
UNIT IDENTIFICATION & FIG. NO.													
R-89 Fig.13	LTR- 800 Fig.6	1016 Fig.7	T-11B Fig.8	15D NAV Fig.10	2200 Fig.15	ADF- 12 Fig.21	ADF- 21 Fig.25	F-13A Fig.20	LTRA- 6 Fig.2	LTRA- 6 Fig.3	Circuit Number	Figure Number	Sales Group No.
●	●		●	●	●		●	●			E583-3	44	2
★		★	★	★	★	★		★			E583-59	50	
●	●		●	●	●	●		●			E583-8	45	2A
★	★		★	★	★		★	★			E583-56	49	
★	★		★	★	★		★	★			E583-3	44	2AB
★	★		★	DUAL	★		★	★			E583-2	44	2ABC
●	●		●	DUAL	●		●	●			E583-2	44	2B
★	★		★	★	★	★		★			E583-8	45	2B
★	★		★	DUAL	★	★		★			E583-7	45	2BC
●	●		●	DUAL	●	●		●			E583-7	45	2C
★	★	★	★	DUAL	★	★		★			E583-58	50	
★	★	★	★		★		★	★			E583-55	49	2AC
	●		●	●			●	●			E583-4	45	3
	★	★	★	★	★		★				E583-60	50	

310B RADIO COMBINATIONS CHART — (Cont)

R-89 Fig 13	LTR- 800 Fig 6	1016 Fig 7	T-11B Fig 8	15D Nav Fig 10	2200 Fig 15	ADF- 12E Fig 21	ADF- 21 Fig 25	F-13A Fig 2	LTRA- 6 Fig 3	LTRA- 6 Fig 3	Circuit Number	Figure No.	Sales Group No.
	●		●	●		●		●			E583-9	45	3A
	☆	☆	☆			☆	☆				E583-57	49	
☆		☆	☆			☆	☆				E583-4	44	3AB
☆		☆	☆		☆			☆			E583-9	45	3B
	●	●	●		●		●				E583-10	45	4A
	☆	☆	☆		☆		☆				E583-10	45	
	●	●				●		●			E583-5	44	4C
	☆	☆				☆		☆			E583-5	44	
					●					●	E583-11	46	5B
										☆	E583-12	47	
										●	E583-12	47	5C
					☆			☆		☆	E583-11	46	

310B EXPORT RADIO COMBINATIONS CHART

ADF	VHF - LF	MEDIUM. FREQ. TRANS- CEIVER	AUD- IO AMP	VHF COMM	NOTE: FOR AUTOPILOT SEE FIG. 7-31				
					●	Serials 35547 thru 35599			
					☆	Serials 35600 & on.			
UNIT IDENTIFICATION & FIG. NO.							AUDIO & INTER- CONNECTING CIRCUITS		
ADF-12E Fig. 21	LTRA-6 Fig. 2	LTRA-6 Fig. 4	S5-RTR Fig. 9	F-13A Fig. 20	1016 Fig. 7	LTR-800 Fig. 6	Circuit Number	Figure Number	Sales Group No.
DUAL See Fig. 22			●	●	●	●	E583-13	48	6
☆		☆	☆				E583-16	48	
●			●	●	●	●	E583-14	48	6A
DUAL See Fig. 22		☆	☆				E583-15	48	
			☆	☆	☆		E583-63	51	6AB
			☆			☆	E583-13	48	6AC
		●	●				E583-15	48	6B
☆			☆	☆	☆	☆	E583-64	51	

310B EXPORT RADIO COMBINATIONS CHART - (Cont)

ADF-12E Fig. 21	LTRA-6 Fig. 2	LTRA-6 Fig. 4	S5-RTR Fig. 9	F-13 Fig. 20	1016 Fig. 7	LTR -800 Fig. 6	Circuit Number	Figure No.	Sales Group No.
●		●	●				E583-16	48	6C
☆			☆			☆	E583-14	48	
●	●						E583-15	48	6D
☆	☆						E583-15	48	
	●						E583-16	48	6E
	☆						E583-16	48	

310C RADIO COMBINATIONS CHART													NOTE FOR AUTOPILOT, SEE FIGURE 7-31.			
DIAL LIGHTS	GLIDE PATH RCVR	VHF COMM		VHF NAV CONV	VHF XMTR	OMNI & LOC VHF RCVR	LF RCVR	MKR BCN	ADF	VHF NAV	AUDIO AMP	AUDIO CIRCUITS				
UNIT IDENTIFICATION & FIGURE NO.													Circuit Number	Fig. No.	Sales Group No.	
RESISTOR KIT Fig.	DGS- 20 Fig. 14	LTR- 800 Fig. 6	RT- 11A Fig. 27	VC- 27B Fig. 59	VOA- 3 Fig. 58	T-22 Fig. 28 or Fig. 29	15E Fig. 11 or Fig. 12	LFR- 3B Fig. 60	DM-3 Fig. 17	ADF- 21A Fig. 25	ADF- 12E- 2 Fig. 26	CD-1 Fig. 30	F-13A Fig. 20			
	●		●			●	DUAL		●	●			●	E583-84	54	1
	●		●			●	DUAL		●	●		●	●	E583-84	54	1D
	●		●			●	UNIT NO. 2 ONLY		●	●		●	●	E583-84	54	1E
	●		●			●			●	●		●	●	E583-84	54	1DE
	●					●	●		●		●		●	E583-75	52	2
8	●					●	●		●	●			●	E583-82	52	2A
	●	●				●	●		●		●		●	E583-71	52	2B
	●					●	●		●		●		●	E583-75	52	2D
	●					●	●		●	●			●	E583-78	52	2AB
8	●					●	●		●	●			●	E583-82	52	2AD
	●					●	●		●		●		●	E583-71	52	2BD
	●					●	●		●	●			●	E583-78	52	2ABD
5						●	●				●		●	E583-76	52	3
5						●	●			●			●	E583-83	52	3A
6		●				●	●				●		●	E583-72	52	3B
6		●				●	●			●			●	E583-79	52	3AB

310C RADIO COMBINATIONS CHART - (Cont)

RESISTOR KIT Fig.	DGS-20 Fig. 14	LTR-800 Fig. 6	RT-11A Fig. 27	VC-27B Fig. 59	VOA-3 Fig. 58	T-22 Fig. 28 OR Fig. 29	15E Fig. 11 OR Fig. 12	LFR-3B Fig. 60	DM-3 Fig. 17	ADF-21A Fig. 25	ADF-12E-2 Fig. 26	CD-1 Fig. 30	F-13A Fig. 20	Circuit Number	Fig. No.	Sales Group No.
4						●	●				●		●	E583-73	53	4A
9						●	●						●	E583-80	53	4C
3				●	●			●						E583-99	57	5B
3				●	●						●			E583-100	55	5C

310C EXPORT RADIO COMBINATIONS CHART

DIAL LIGHTS	MEDIUM FREQ TRANS-CEIVER	VHF COMMUNICATION				AUDIO AMPLIFIER	LF RCVR	ADF	AUDIO CIRCUITS			
		UNIT IDENTIFICATION & FIGURE NUMBER										
RESISTOR KIT Fig.	S5-RTR Fig. 9	Narco 1016 Fig. 7	LTR 800 Fig. 6	Narco VC-27B Fig. 59	F-13A Fig. 20	LFR-3B Fig. 60	ADF-12E-2 Fig. 21	Circuit Number	Figure Number	Sales Group No.		
4	●				●			●	E583-98	56	6	
6	●				●			DUAL	E583-97	56	6A	
4	●	●				●		●	E583-64	51	6B	
4	●	●	●					●	E583-14	48	6C	
10					●			●	E583-99	57	6D	
10					●		●		E583-100	55	6E	
6	●	●				●		DUAL SEE Fig. 22	E583-63	51	6AB	
6	●		●						E583-13	48	6AC	

310D RADIO COMBINATIONS CHART																		
DIAL LIGHTS	GLIDE PATH RCVR	VHF COMM				VHF NAV CONV	OMNI & LOC VHF RCVR	LF RCVR	MKR BCN	ADF		VHF NAV	AUDIO AMP	NOTE FOR AUTOPILOT SEE FIGURE 67				
UNIT IDENTIFICATION & FIGURE NUMBER															AUDIO CIRCUITS			
RESISTOR KIT	R-31A	RT-11A	1021	T-25A	MARK V	1016	VOA-3A	15F	LFR-3B	R-33A	ADF-21A	ADF-12E-2	ANC-3	CD-1	CA-3C	Circuit Number	Fig. No.	Sales Group No.
Fig. 71	Fig. 64	Fig. 27	Fig. 66	Fig. 63	Fig. 61	Fig. 65	Fig. 61	Fig. 68 Fig. 69	Fig. 61	Fig. 64	Fig. 73	Fig. 26	Fig. 62	Fig. 70	Fig. 71			
	●	●		●				DUAL		●	●				●	E583-115	7-75	1
	●	●		●				DUAL		●	●				●	E583-115	7-75	1D
	●	●		●				DUAL		●	●			●	●	E583-115	7-75	1E
	●	●		●				DUAL		●	●		●	●	●	E583-115	7-75	1DE
	●		●	●	●	●	●			●		●			●	E583-105	7-74	2
	●		●	●	●	●	●			●		●			●	E583-106	7-74	2A
	●		●	●	●	●	●			●		●		●	●	E583-105	7-74	2D
	●		●	●	●	●	●			●		●		●	●	E583-105	7-74	2F
	●		●	●	●	●	●			●		●		●	●	E583-106	7-74	2AD
	●		●	●	●	●	●			●		●		●	●	E583-105	7-74	2DF
6	●	●		●				●		●		●			●	E583-116	7-76	3
6	●	●		●				●		●		●			●	E583-117	7-76	3A
5	●	●		●		●		●		●		●			●	E583-116	7-76	3B
6	●	●		●				●		●		●			●	E583-116	7-76	3D
6	●	●		●				●		●		●			●	E583-116	7-76	3F
5	●			●		●		●		●		●			●	E583-117	7-76	3AB
6	●	●		●				●		●		●			●	E583-117	7-76	3AD

310D RADIO COMMUNICATIONS CHART - (Cont)

RESISTOR KIT	R-31A	RT-11A	1021	T-25A	MARK V	1016	VOA-3A	15F	LFR-3B	R-33A	ADF-21A	ADF-12E-2	ANC-3	CD-1	CA-3C	Circuit Number	Fig. No.	Sales Group No.
5	●			●		●		●		●		●			●	E583-116	7-76	3BD
5	●			●		●		●		●	●				●	E583-117	7-76	3ABD
5	●			●		●		●		●		●			●	E583-116	7-76	3BF
6	●	●		●				●		●		●			●	E583-116	7-76	3DF
5	●			●		●		●		●		●			●	E583-116	7-76	3BDF
3				●				●				●			●	E583-118	7-77	4A
3				●				●				GONIO*			●	E583-48	7-77	4AG
9				●				●							●	E583-119	7-77	4C
4					●		●		●							E583-100	7-55	5D
4					●		●				●					E583-99	7-57	5E
4					●		●					GONIO*				E583-99	7-57	5EG

*SEE FIGURE 7-72
FOR GONIO DIAGRAM

310D EXPORT RADIO COMBINATIONS CHART												
DIAL LIGHTS	MEDIUM FREQ TRANS.	VHF COMM				AUDIO	LF RCVR	ADF	*SEE FIGURE 7-72 FOR GONIO DIAGRAM			
UNIT IDENTIFICATION & FIGURE NUMBER									AUDIO CIRCUITS			
RESISTOR KIT	S5-RTR	VC-27B	MARK V	RT-11A	1016	Fig. 65	CA-3C	LFR-3B	ADF-12E-2	Circuit Number	Figure Number	Sales Group No.
Fig. 71	Fig. 9	Fig. 59	Fig. 61	Fig. 27			Fig. 71	Fig. 60	Fig. 26			
4	●	●							●	E583-98	7-56	6
6	●	●							DUAL	E583-97	7-56	6A
10		●							●	E583-99	7-57	6D
10		●						●		E583-100	7-55	6E
4	●				●	●			●	E583-121	7-78	6B
3	●			●		●			●	E583-121	7-78	6C
4	●		●						●	E583-98	7-56	6F
8	●				●	●		DUAL		E583-120	7-78	6AB
4	●	●							GONIO*	E583-98	7-56	6G
10		●							GONIO*	E583-99	7-57	6DG
5	●			●		●		DUAL		E583-120	7-78	6AC
-	●		●					DUAL		E583-97	7-56	6AF
4	●				●	●			●	E583-121	7-78	6BG
3	●			●		●			GONIO*	E583-121	7-78	6CG
4	●		●						GONIO	E583-98	7-56	6FG
6	●	●							DUAL GONIO*	E583-97	7-56	6AG
8	●				●	●			DUAL GONIO*	E583-120	7-78	6ABG
5	●			●		●			DUAL GONIO*	E583-120	7-78	6ACG
5	●		●						DUAL GONIO*	E583-97	7-56	6AFG

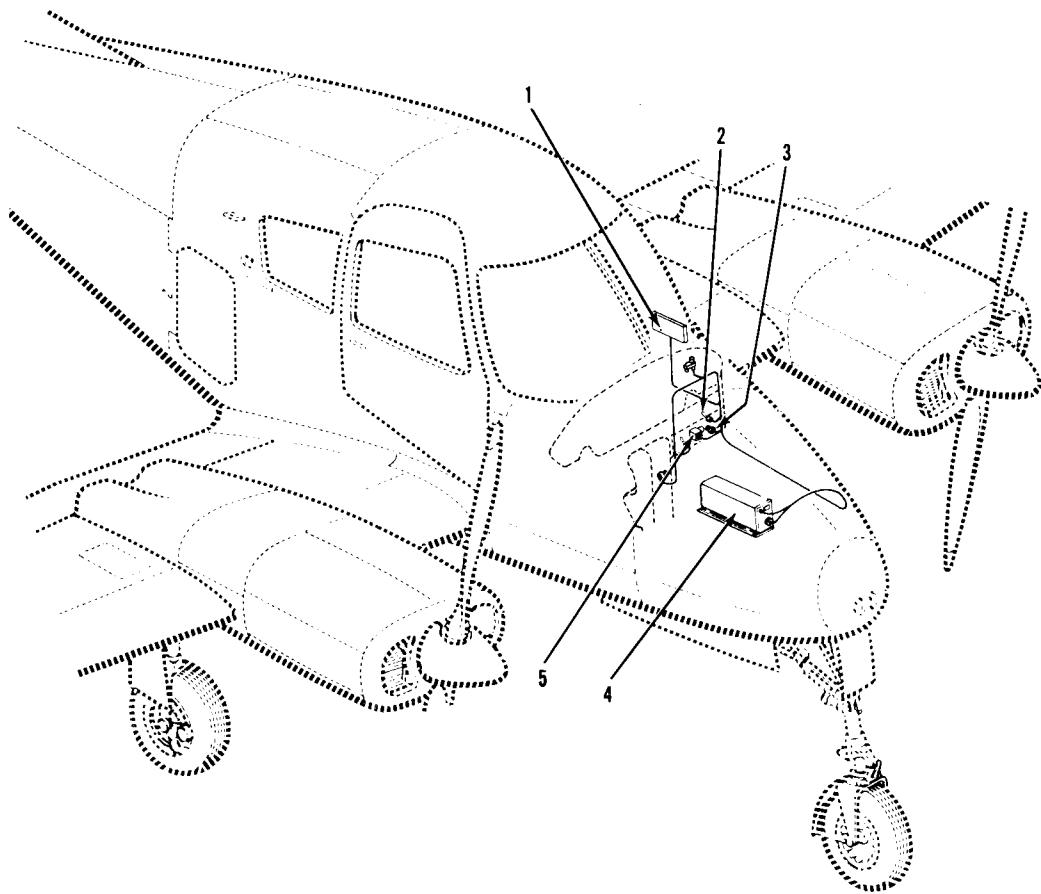


Figure 7-1. LVTR-36 Circuit (Sheet 1 of 2)

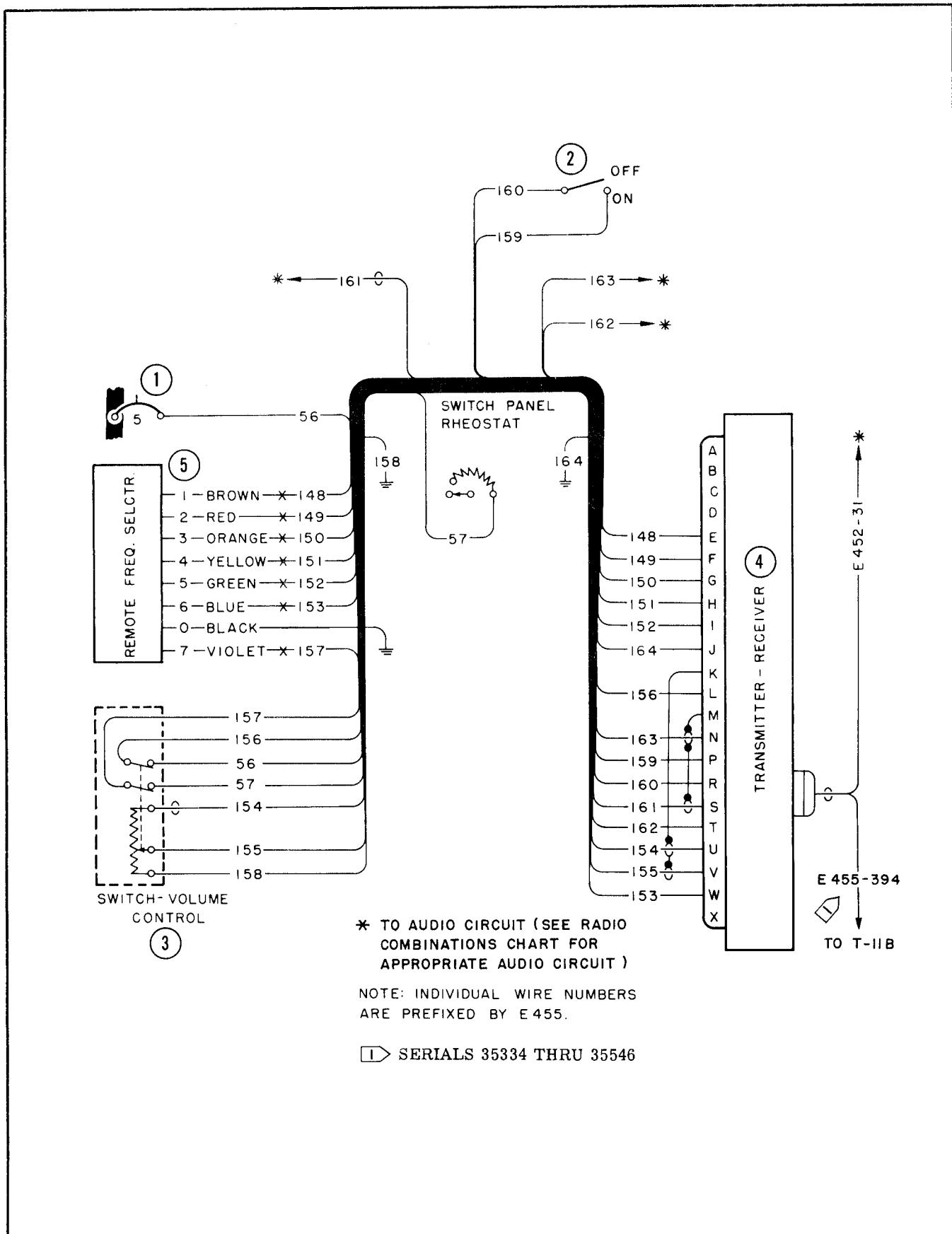


Figure 7-1. LVTR-36 Circuit (Sheet 2 of 2)

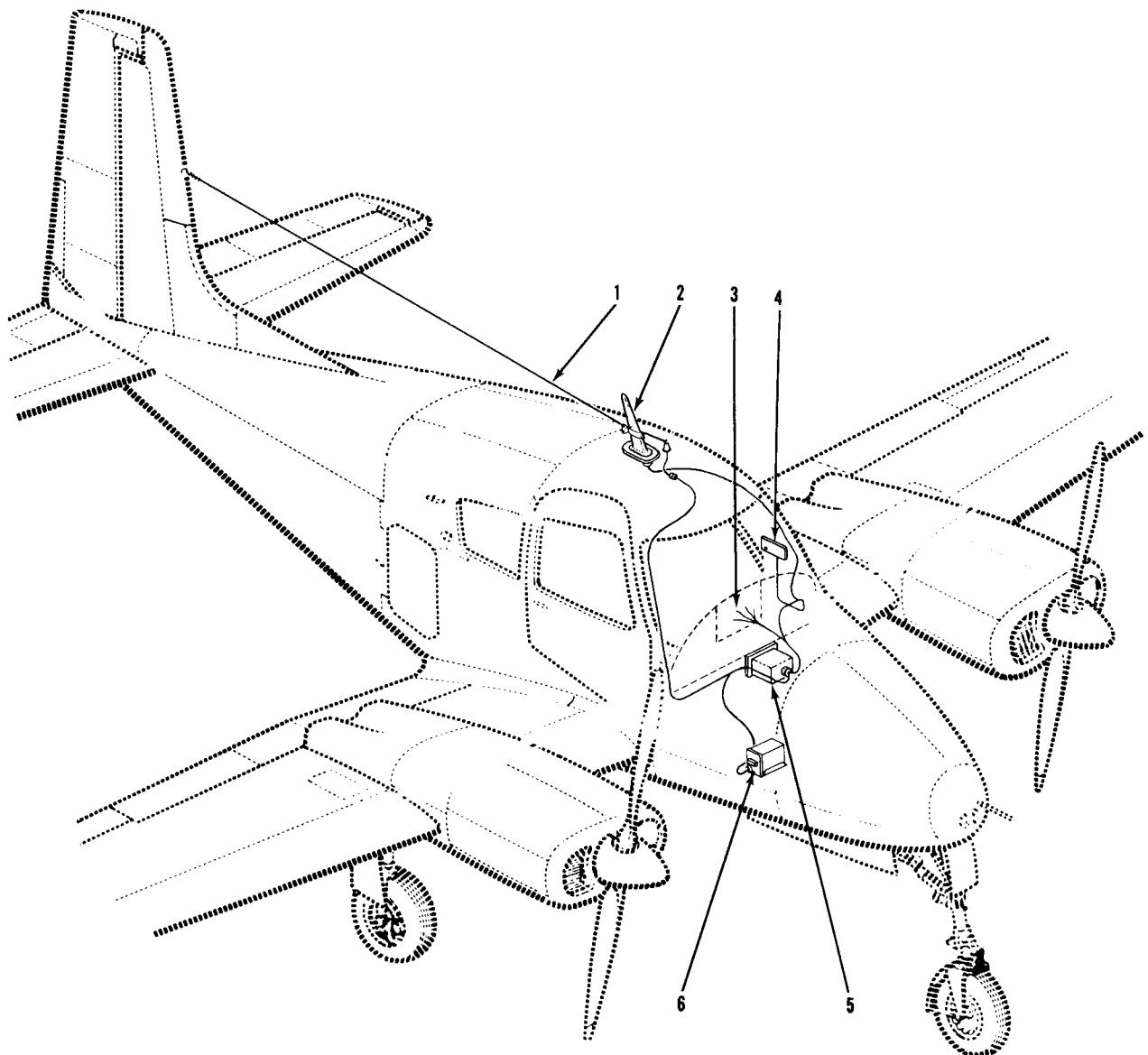


Figure 7-2. LTRA-6 Circuit (Sheet 1 of 2)

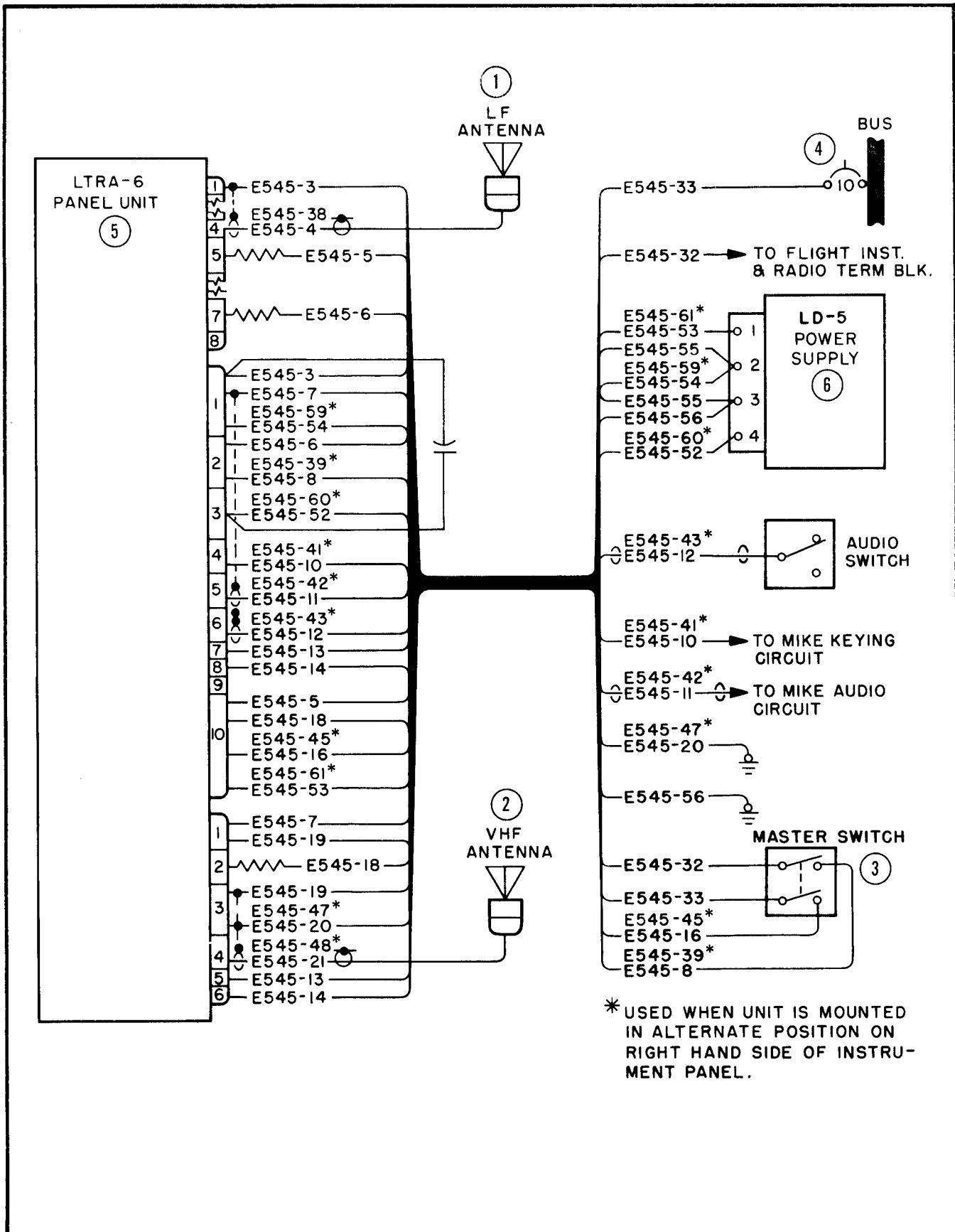


Figure 7-2. LTRA-6 Circuit (Sheet 2 of 2)

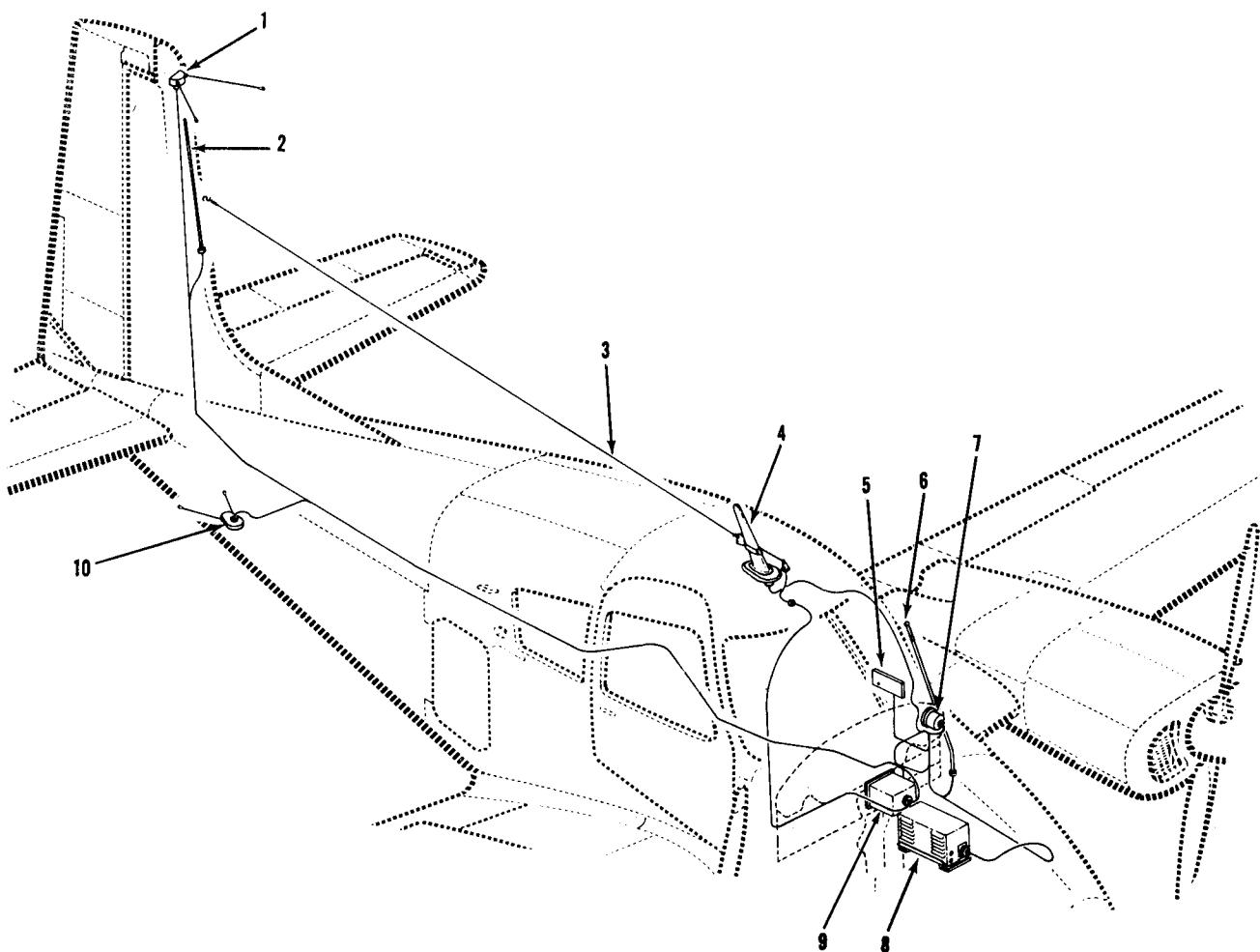


Figure 7-3. LTRA-6 Circuit With Omni (Sheet 1 of 3)

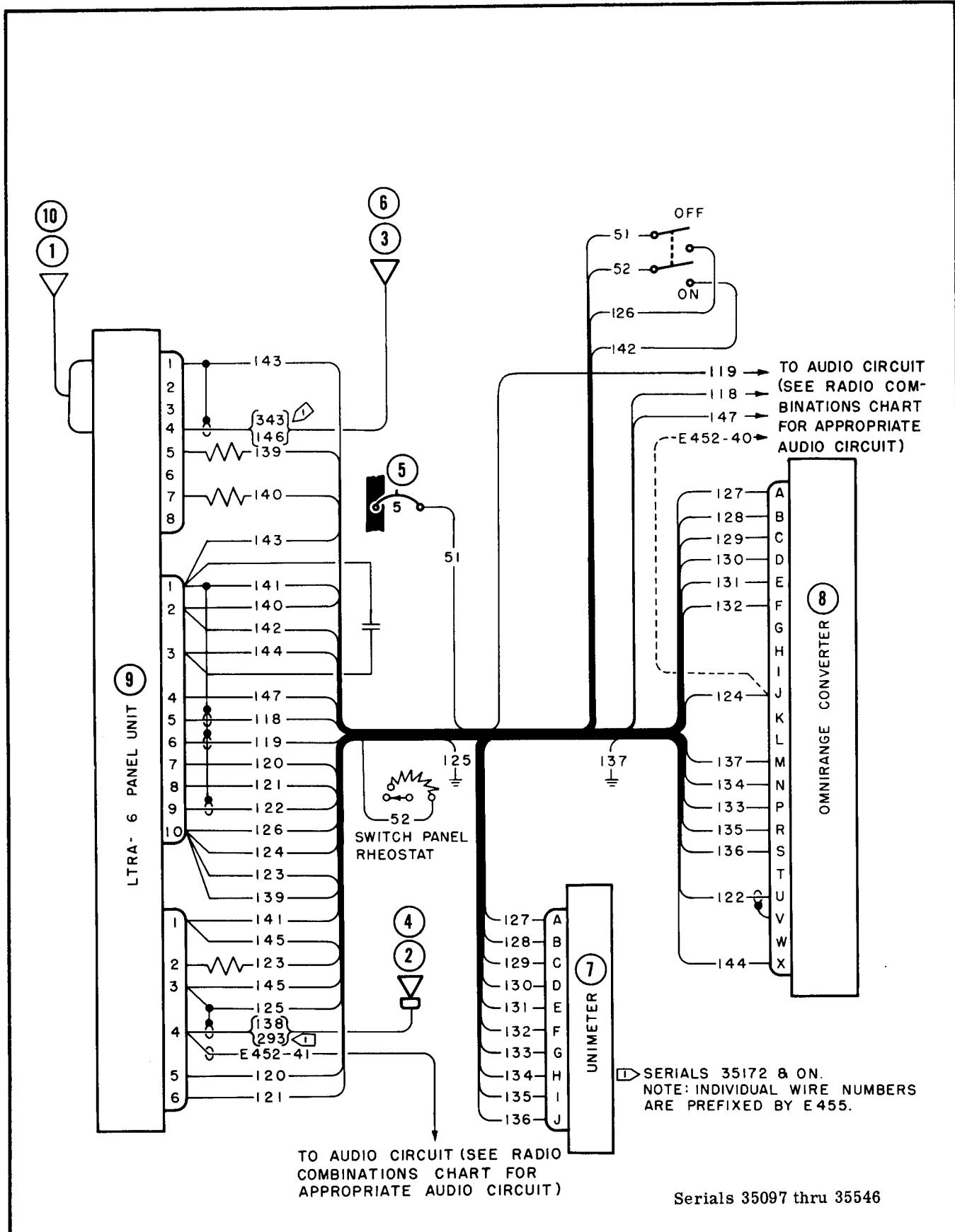
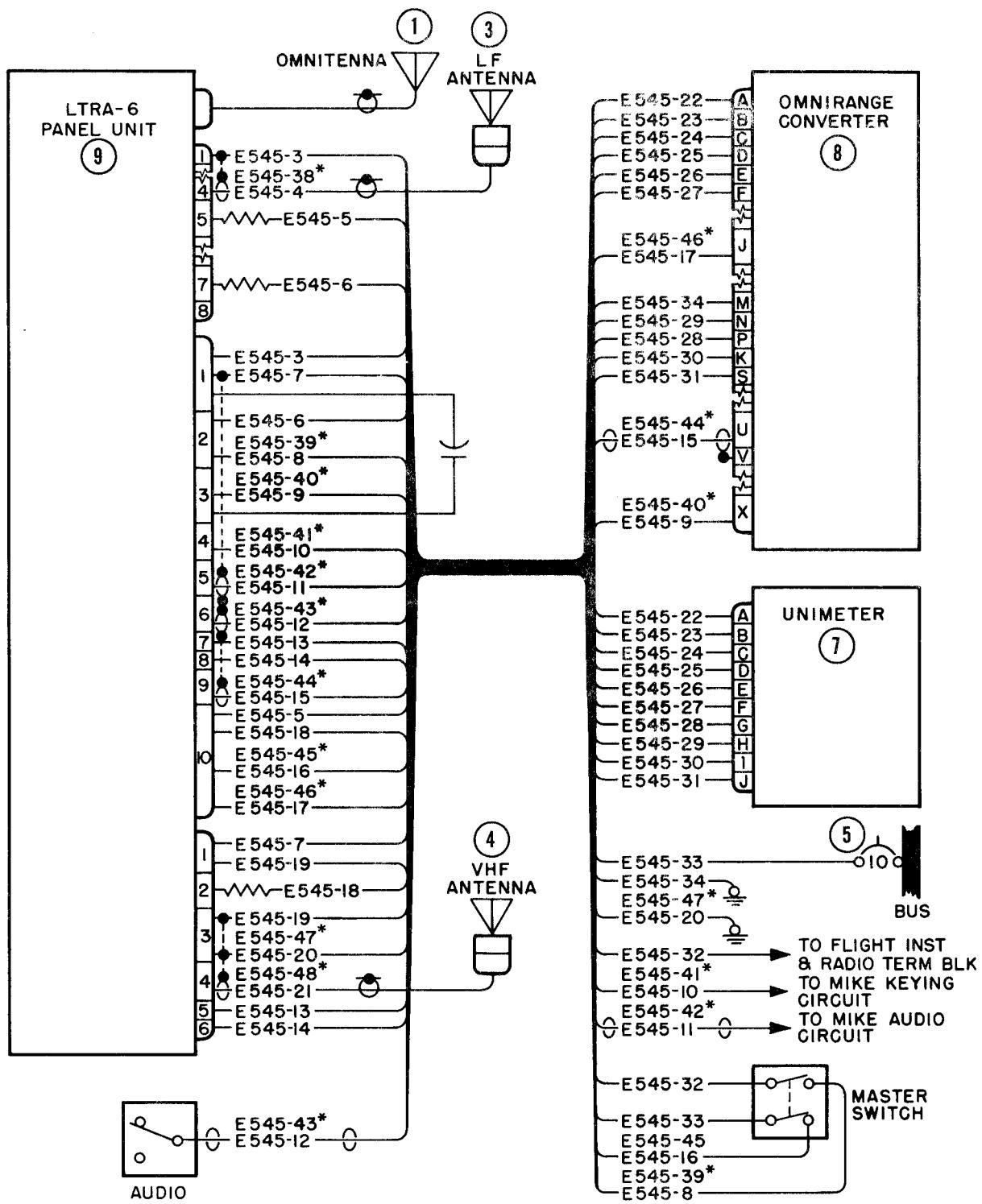


Figure 7-3. LTRA-6 Circuit — With Omni (Sheet 2 of 3)



* USED WHEN UNIT IS
MOUNTED IN ALTERNATE
POSITION ON RIGHT HAND
SIDE OF INSTRUMENT PANEL.

Serials 35547 thru 35772

Figure 7-3. LTRA-6 Circuit — With Omni (Sheet 3 of 3)

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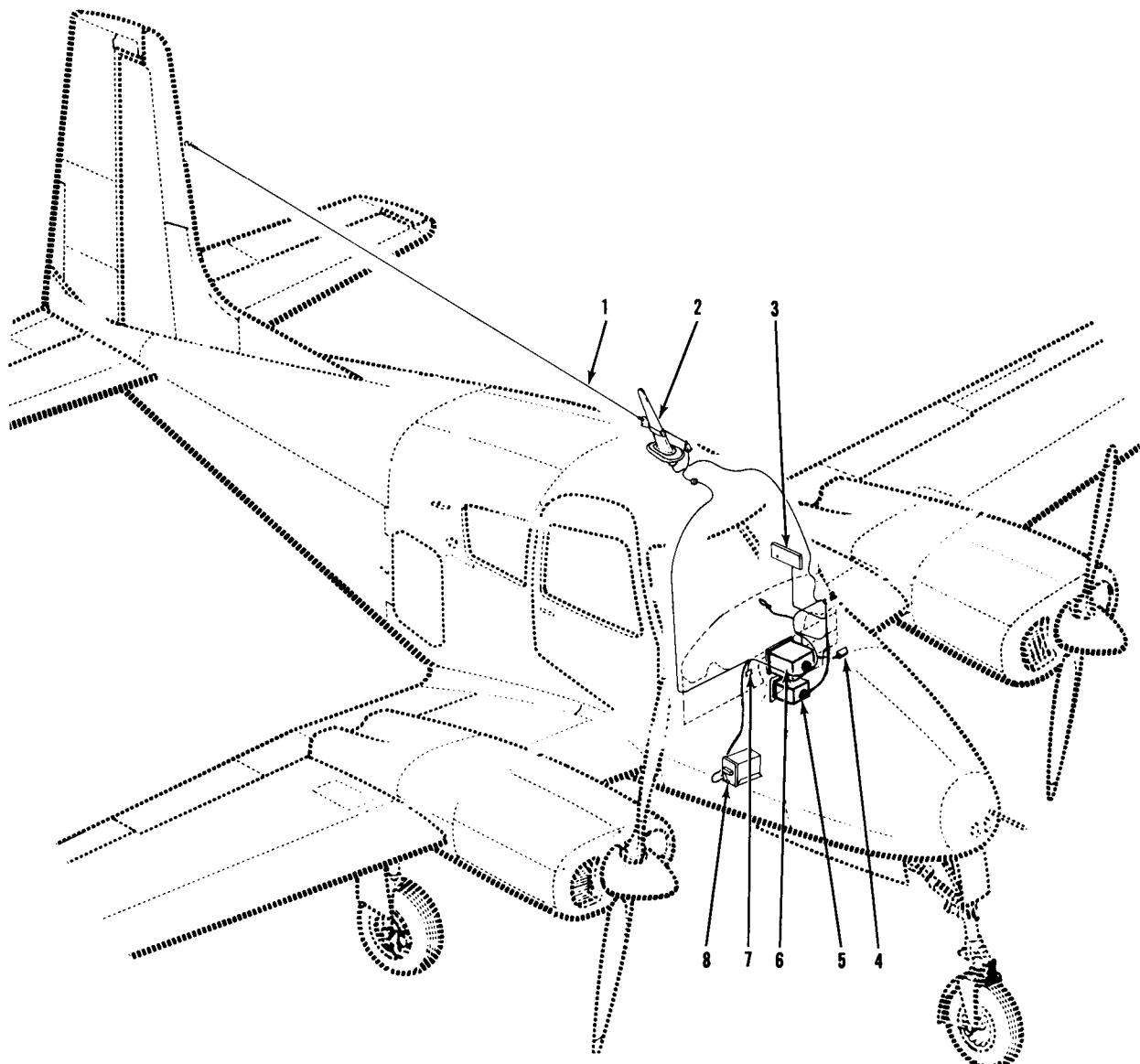


Figure 7-4. LTRA-6 Circuit — With Additional RT-10EP Transmitter (Sheet 1 of 2)

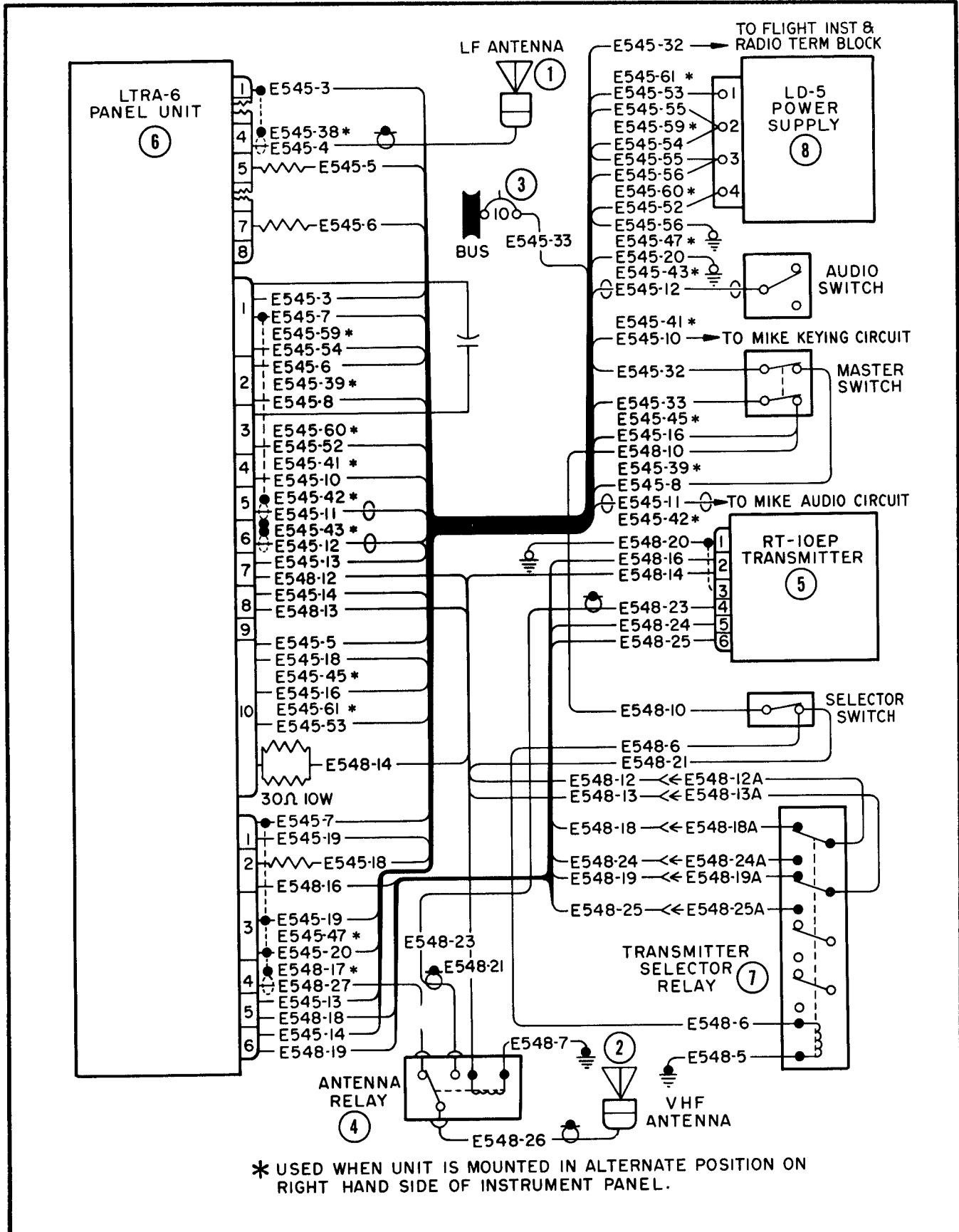


Figure 7-4. LTRA-6 Circuit — With Additional RT-10EP Transmitter (Sheet 2 of 2)

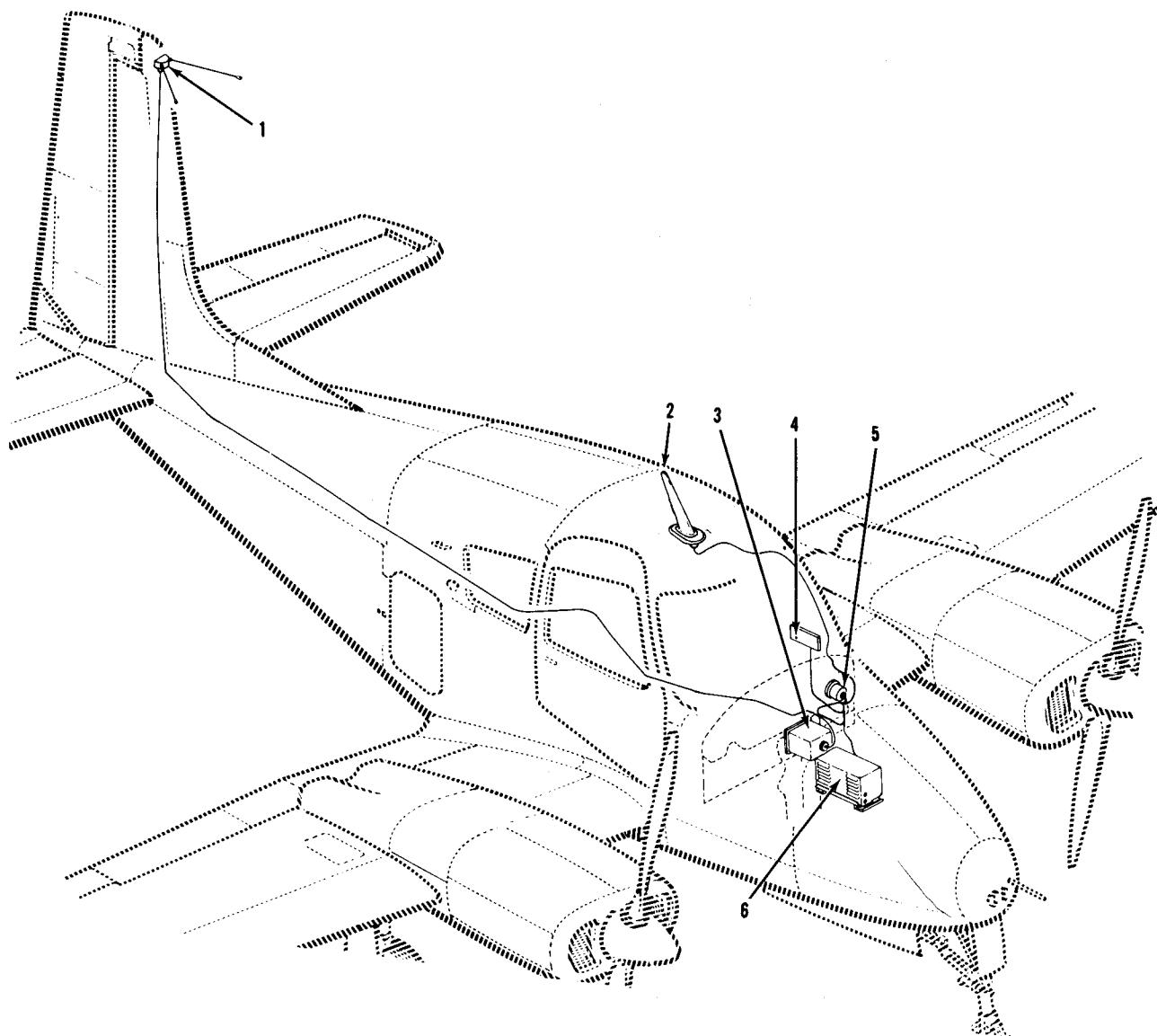


Figure 7-5. LTTR-6A Circuit (Sheet 1 of 2)

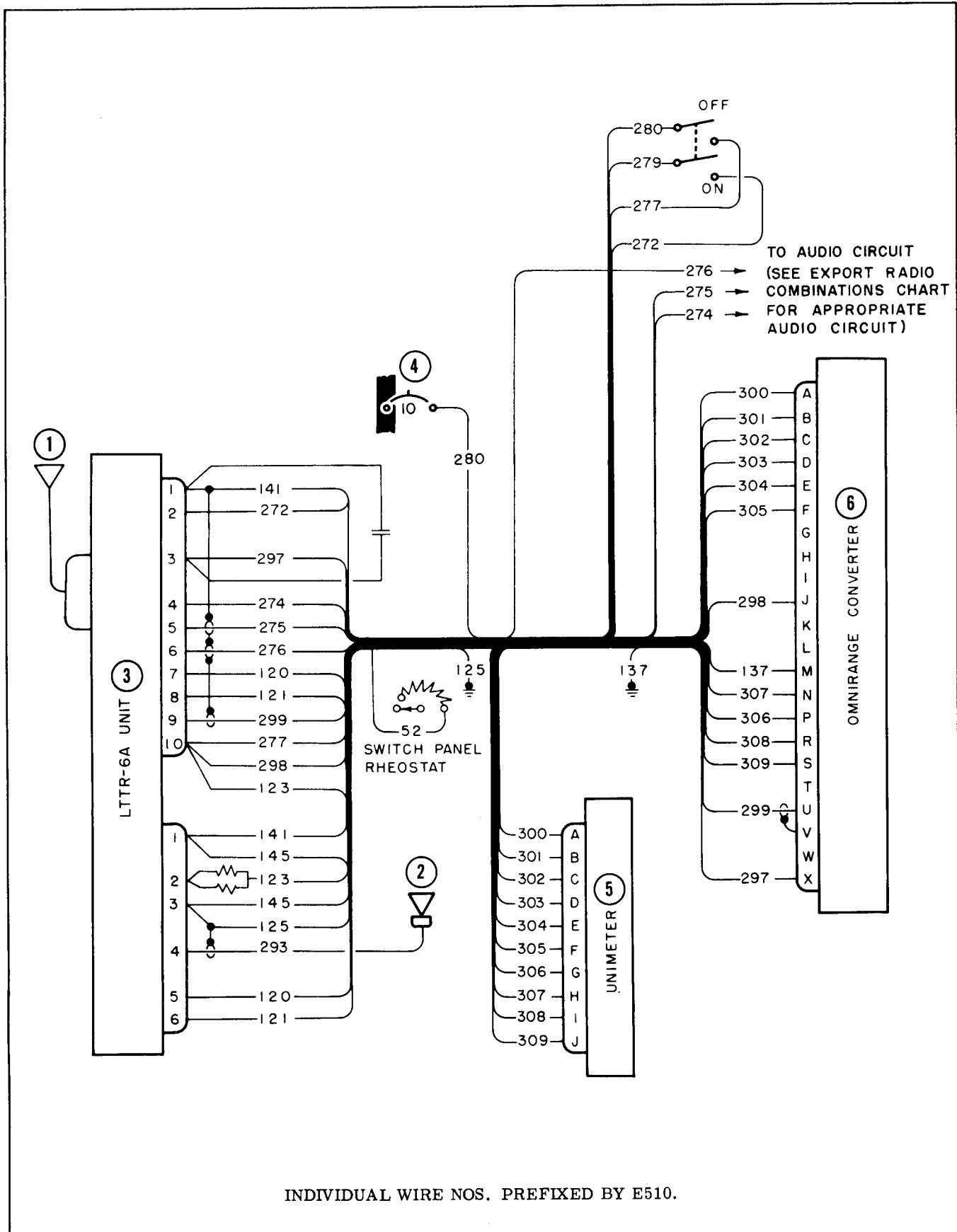


Figure 7-5. LTTR-6A Circuit (Sheet 2 of 2)

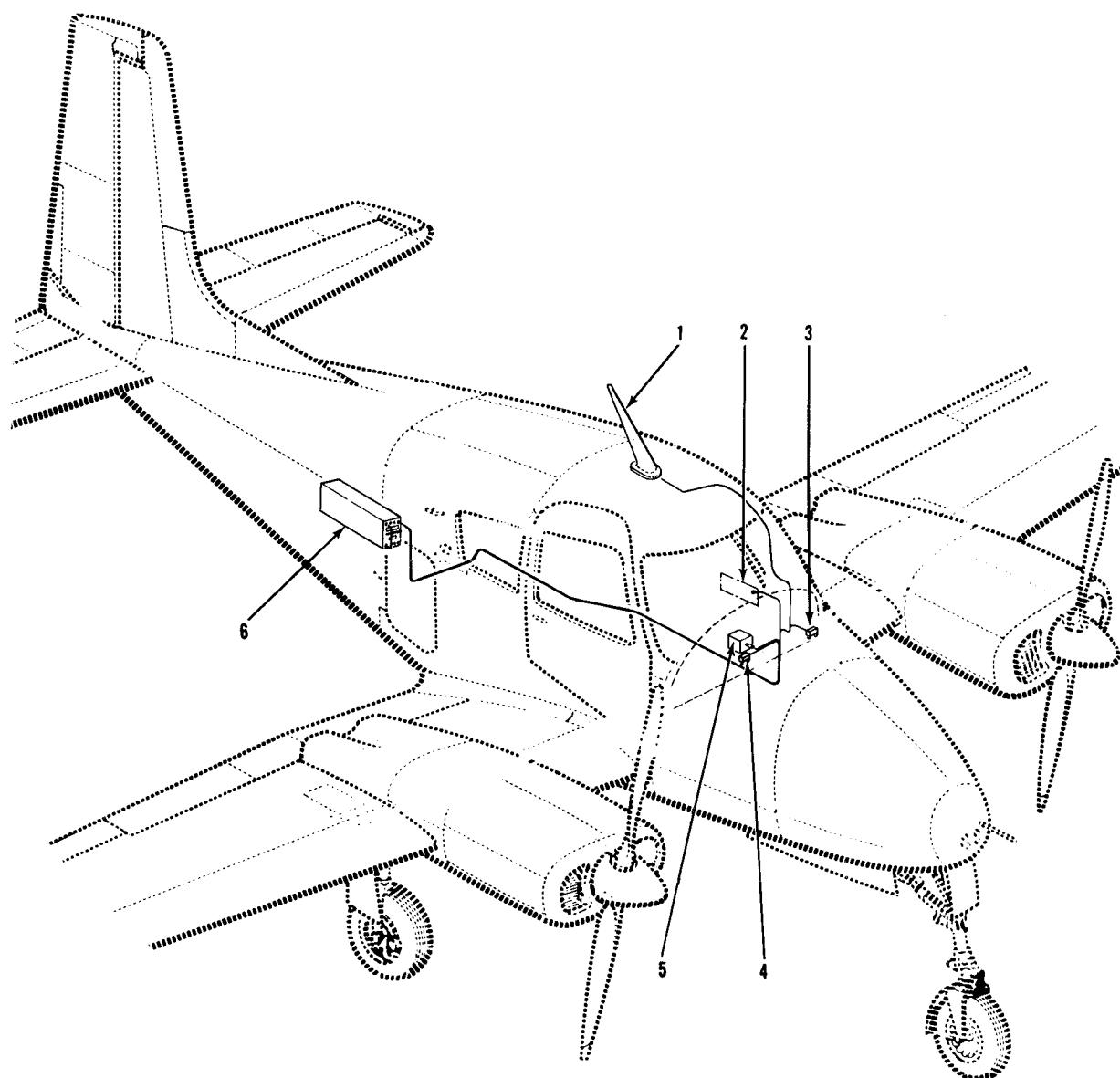


Figure 7-6. LTR-800 Circuit (Sheet 1 of 2)

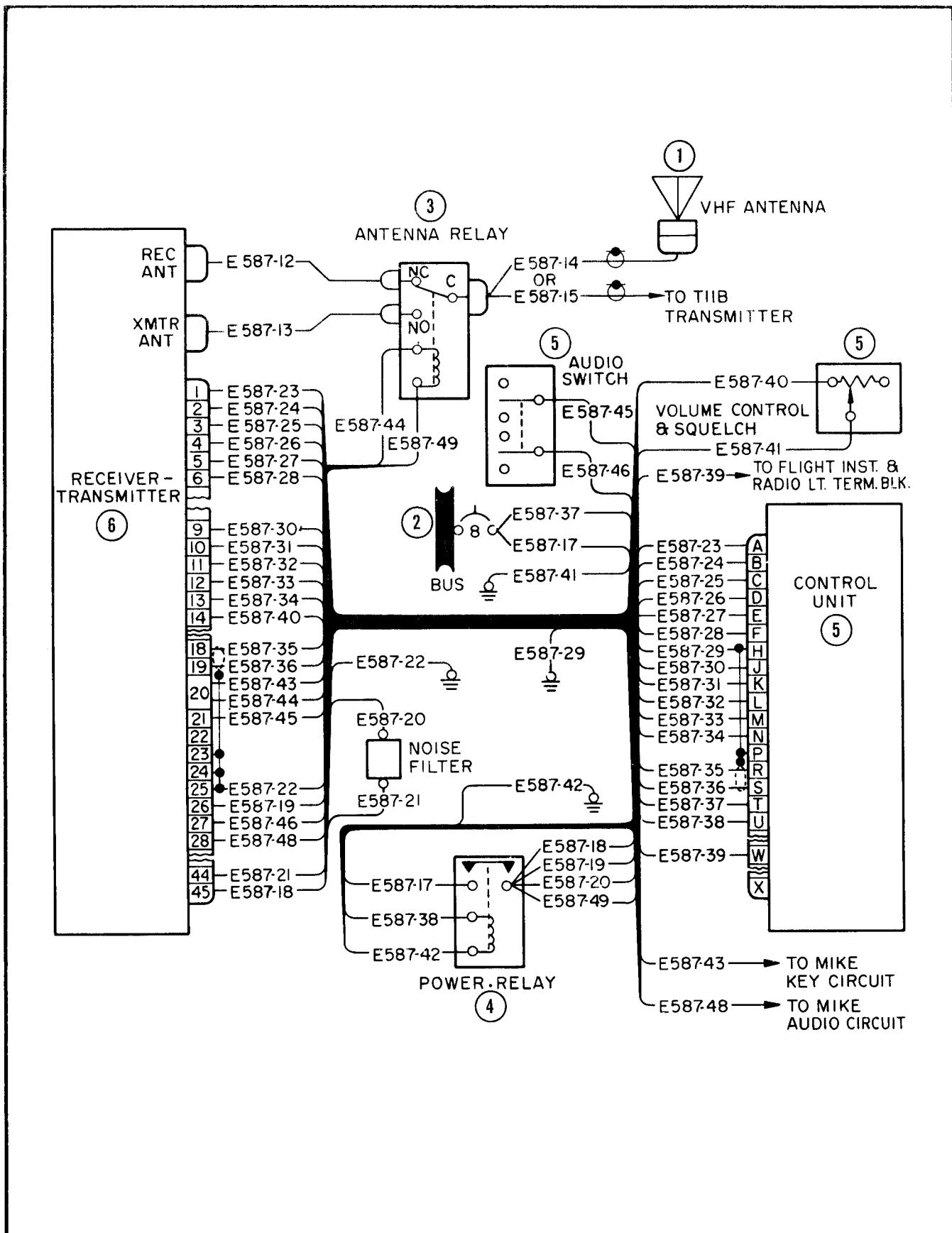
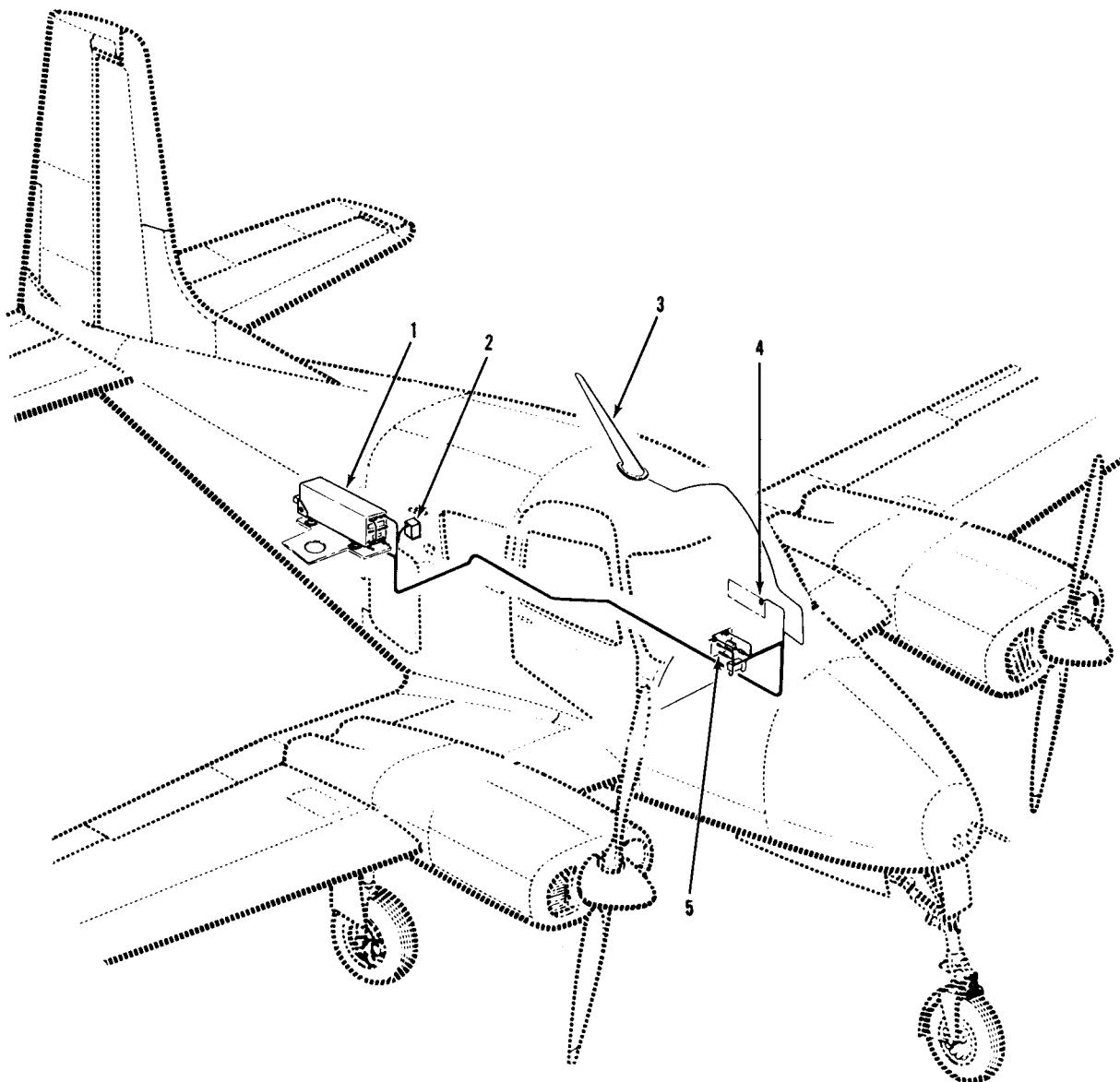


Figure 7-6. LTR-800 Circuit (Sheet 2 of 2)



MODEL 310B & 310C EXPORT

Figure 7-7. Narco 1016 Circuit (Sheet 1 of 2)

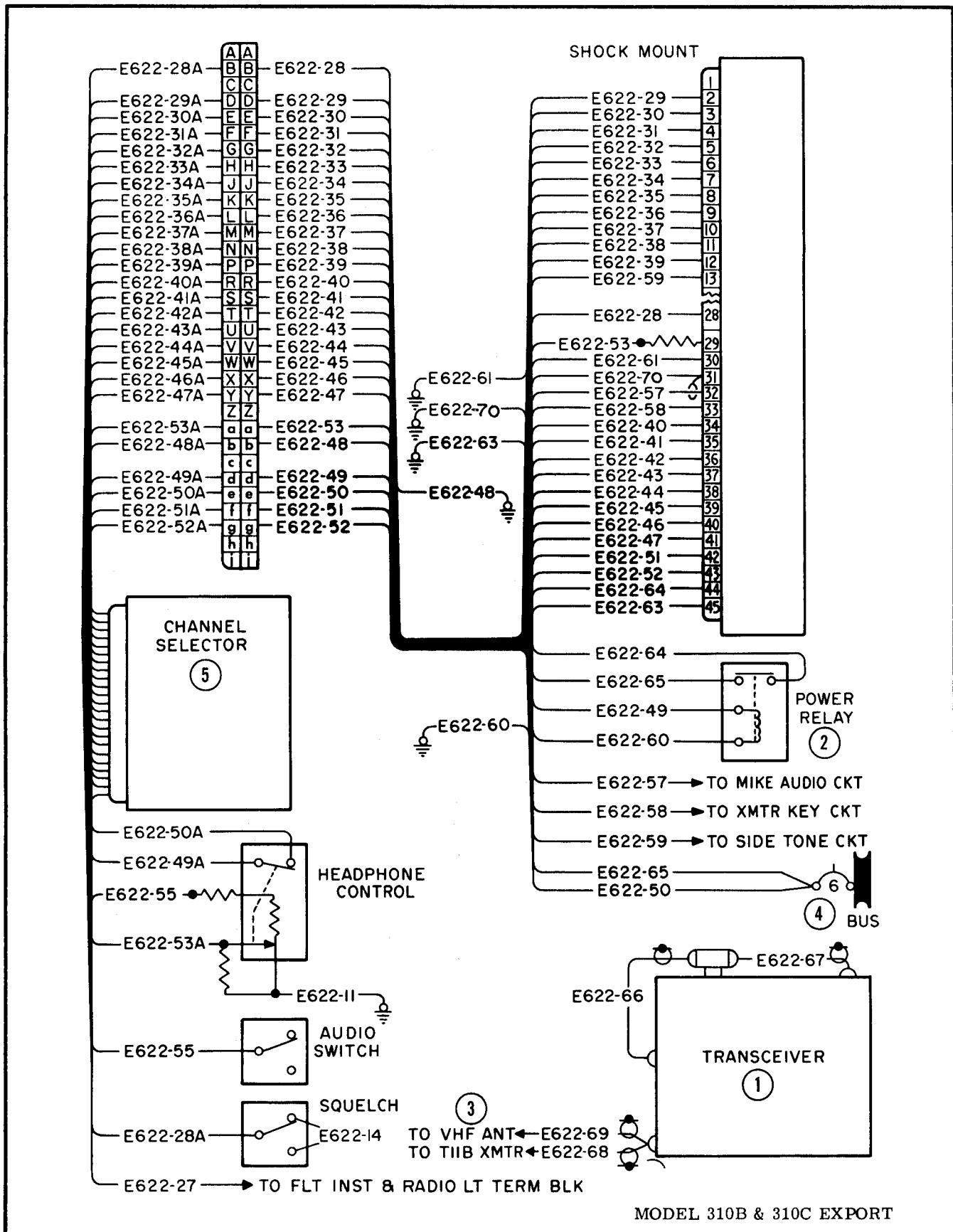


Figure 7-7. Narco 1016 Circuit (Sheet 2 of 2)

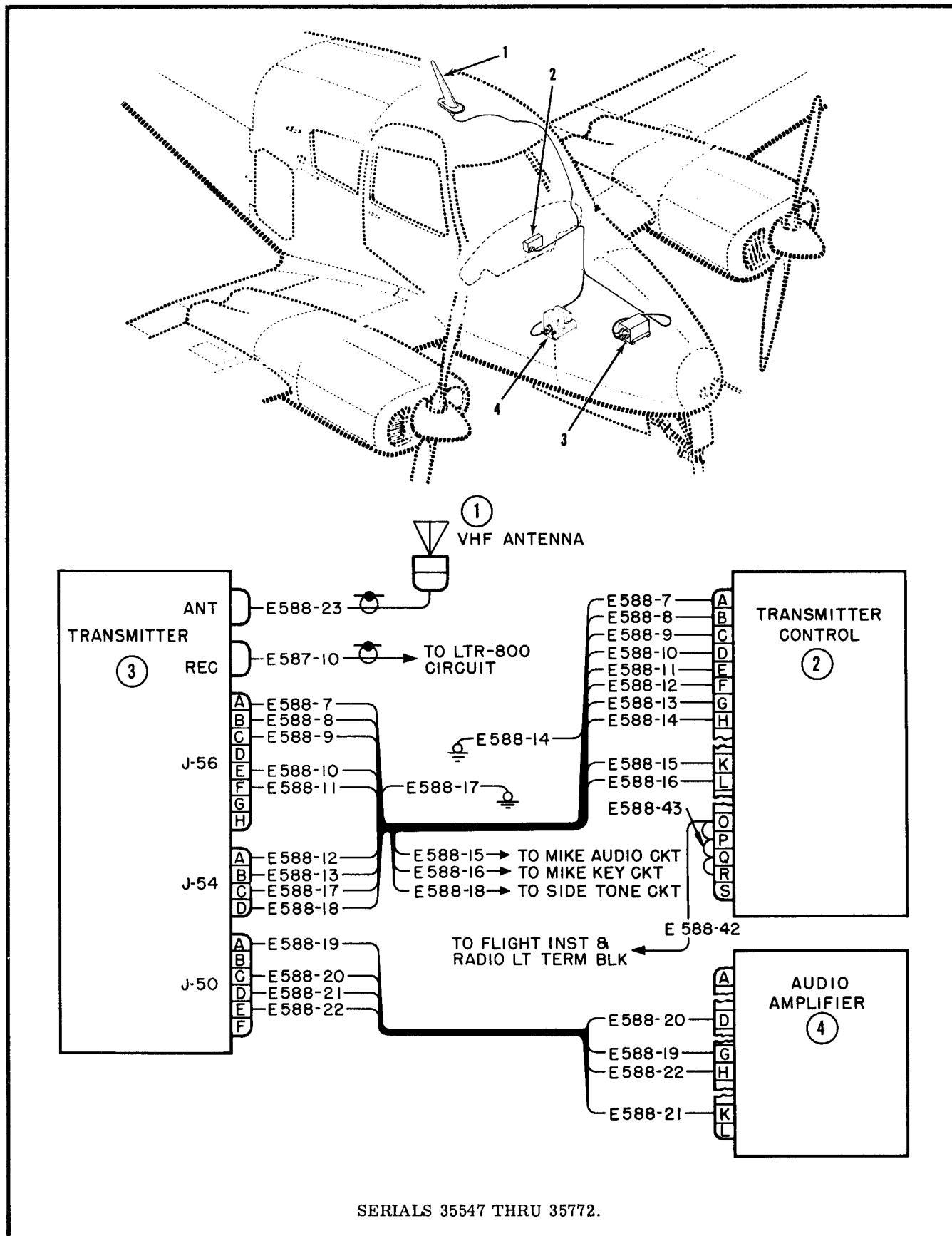


Figure 7-8. T-11B Transmitter Circuit

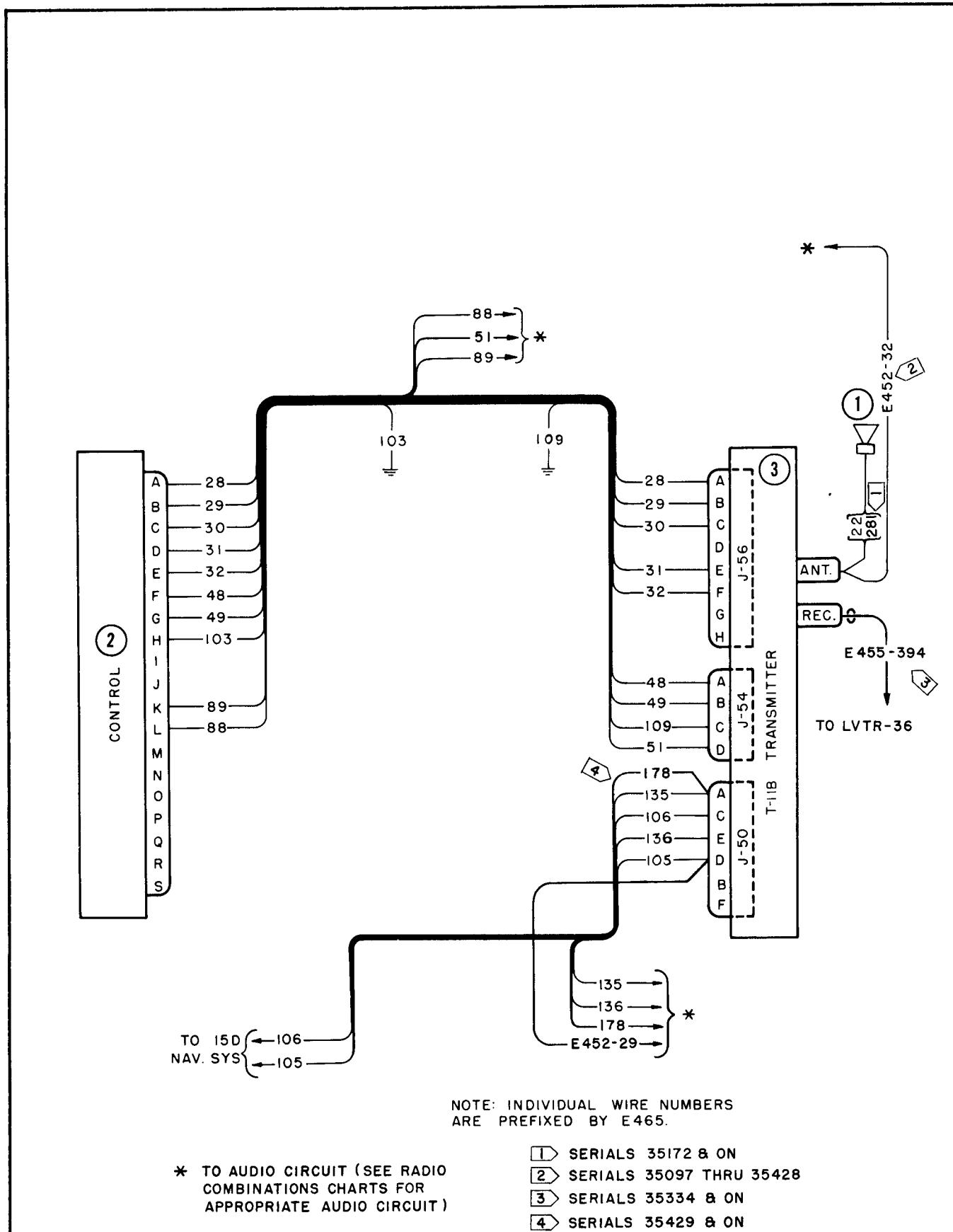


Figure 7-8. T-11B Transmitter Circuit (Sheet 2 of 2)

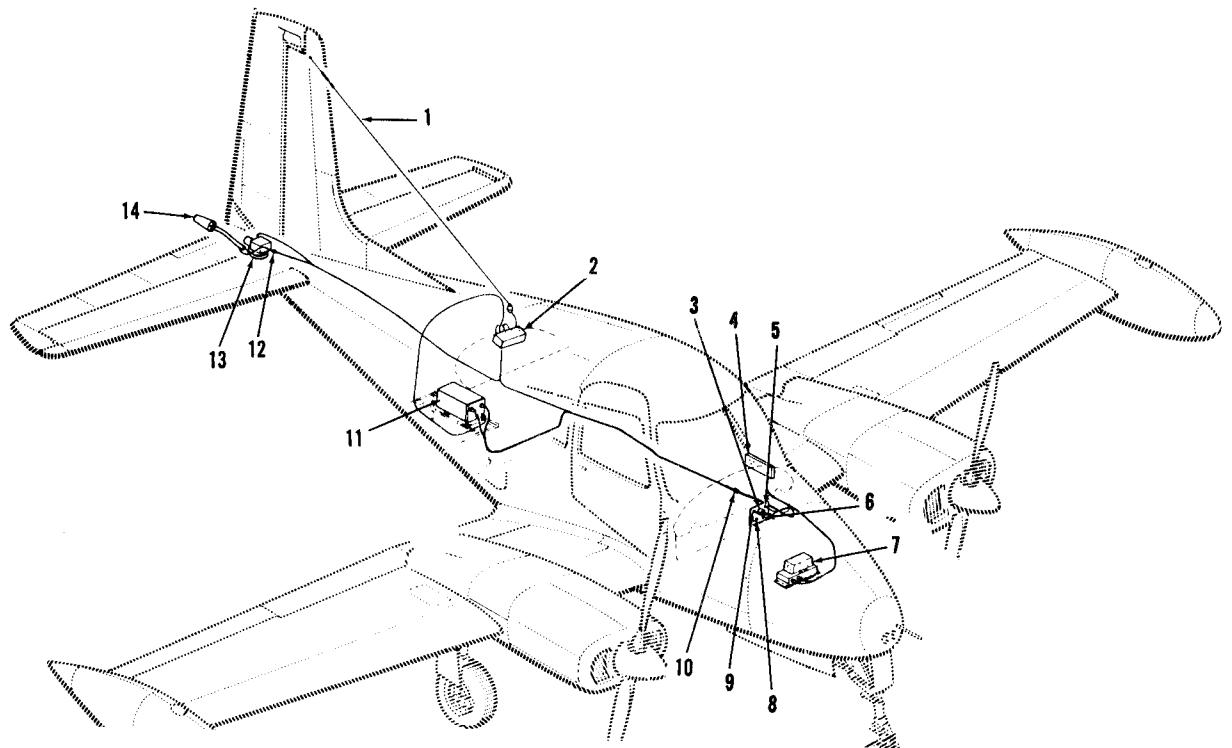


Figure 7-9. Sunair Transceiver Circuit (Sheet 1 of 2)

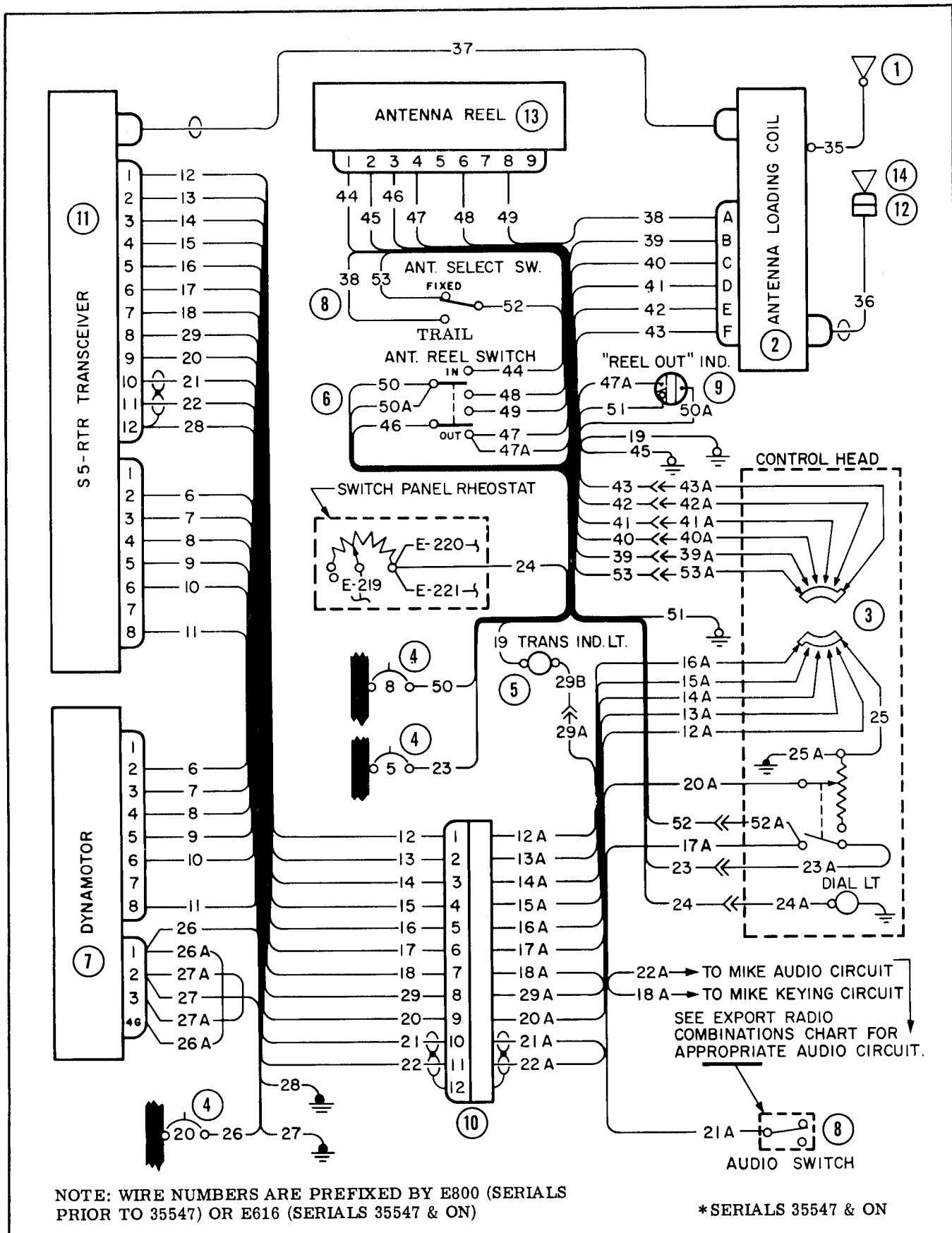


Figure 7-9. Sunair Transceiver Circuit (Sheet 2 of 2)

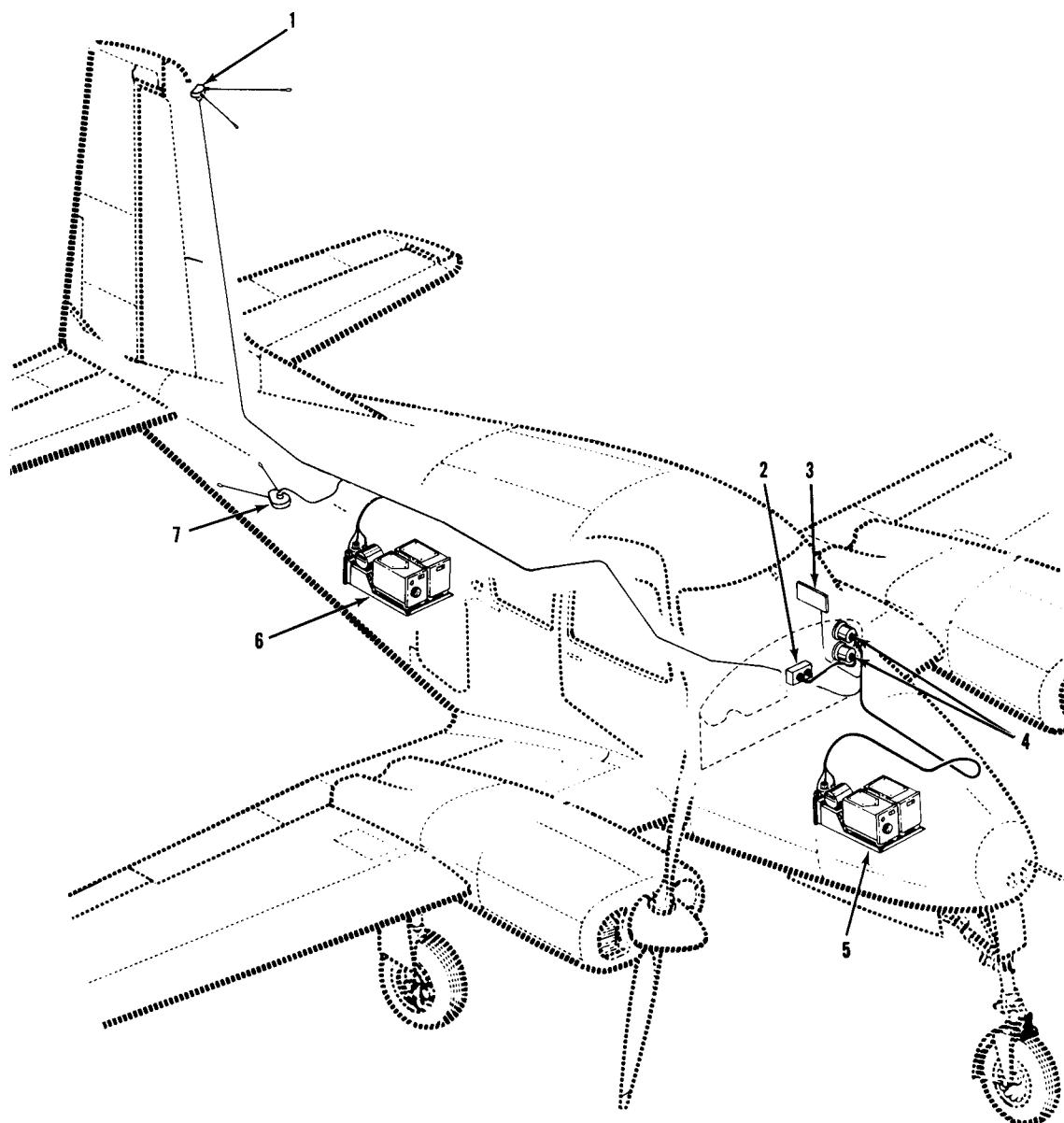


Figure 7-10. 15D Omnidrange Navigation Circuit (Sheet 1 of 5)

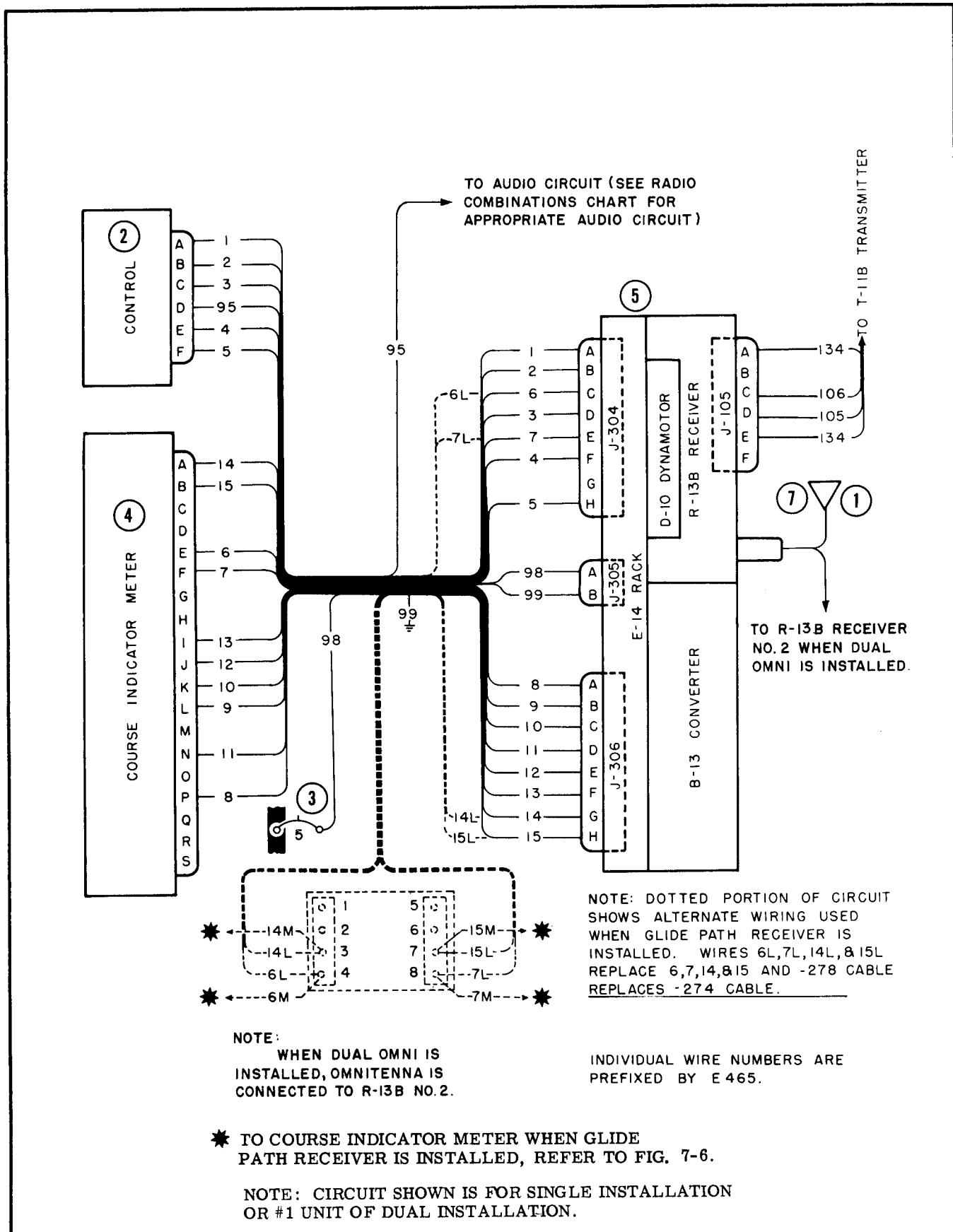
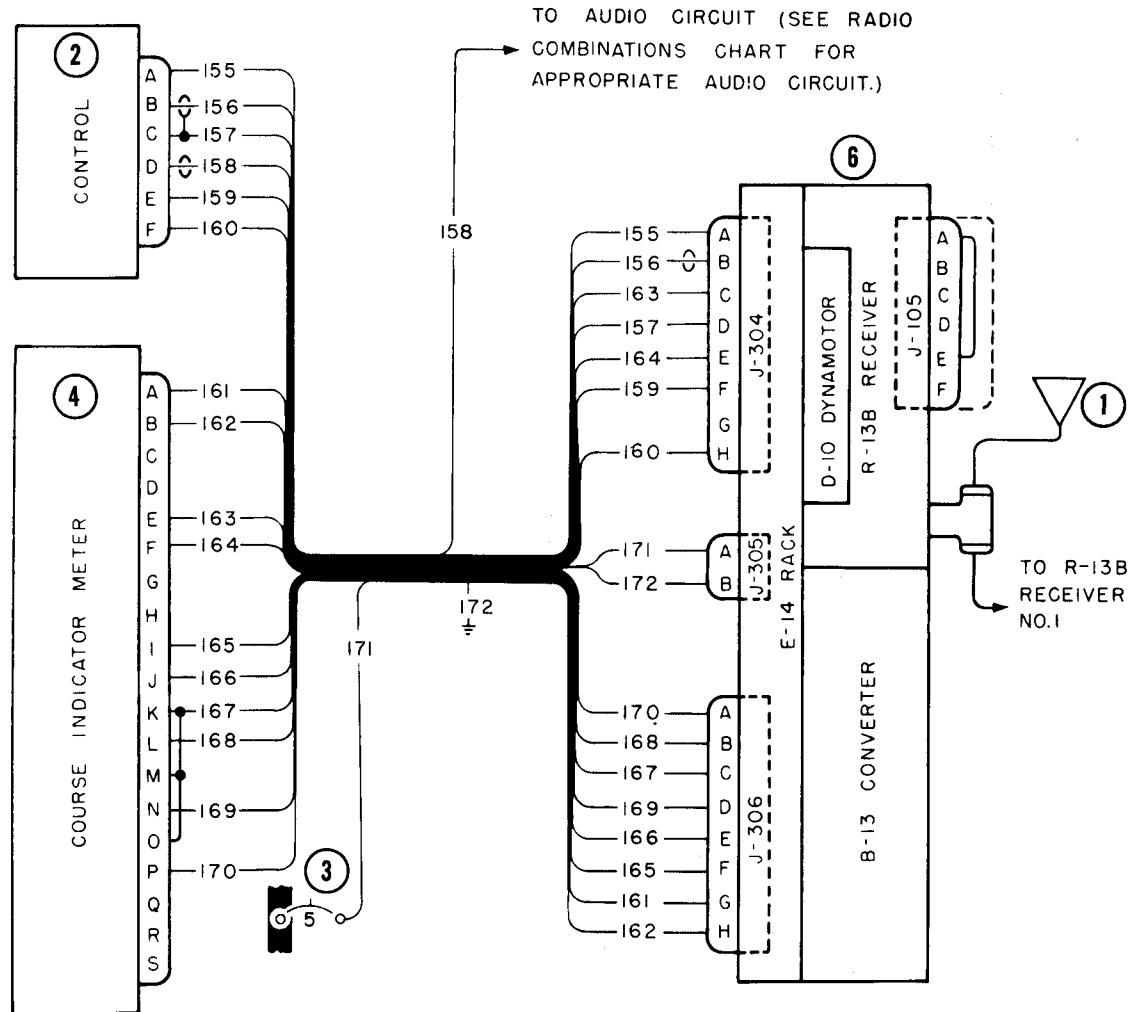


Figure 7-10. 15D Omnidrome Navigation Circuit (Sheet 2 of 5)



NOTE: CIRCUIT SHOWN IS FOR #2 UNIT OF DUAL INSTALLATION. COMBINE THIS CIRCUIT WITH PRECEDING CIRCUIT FOR COMPLETE DUAL OMNI CIRCUIT.

Serials 35097 thru 35546

Figure 7-10. 15D Omnidrome Navigation Circuit (Sheet 3 of 5)

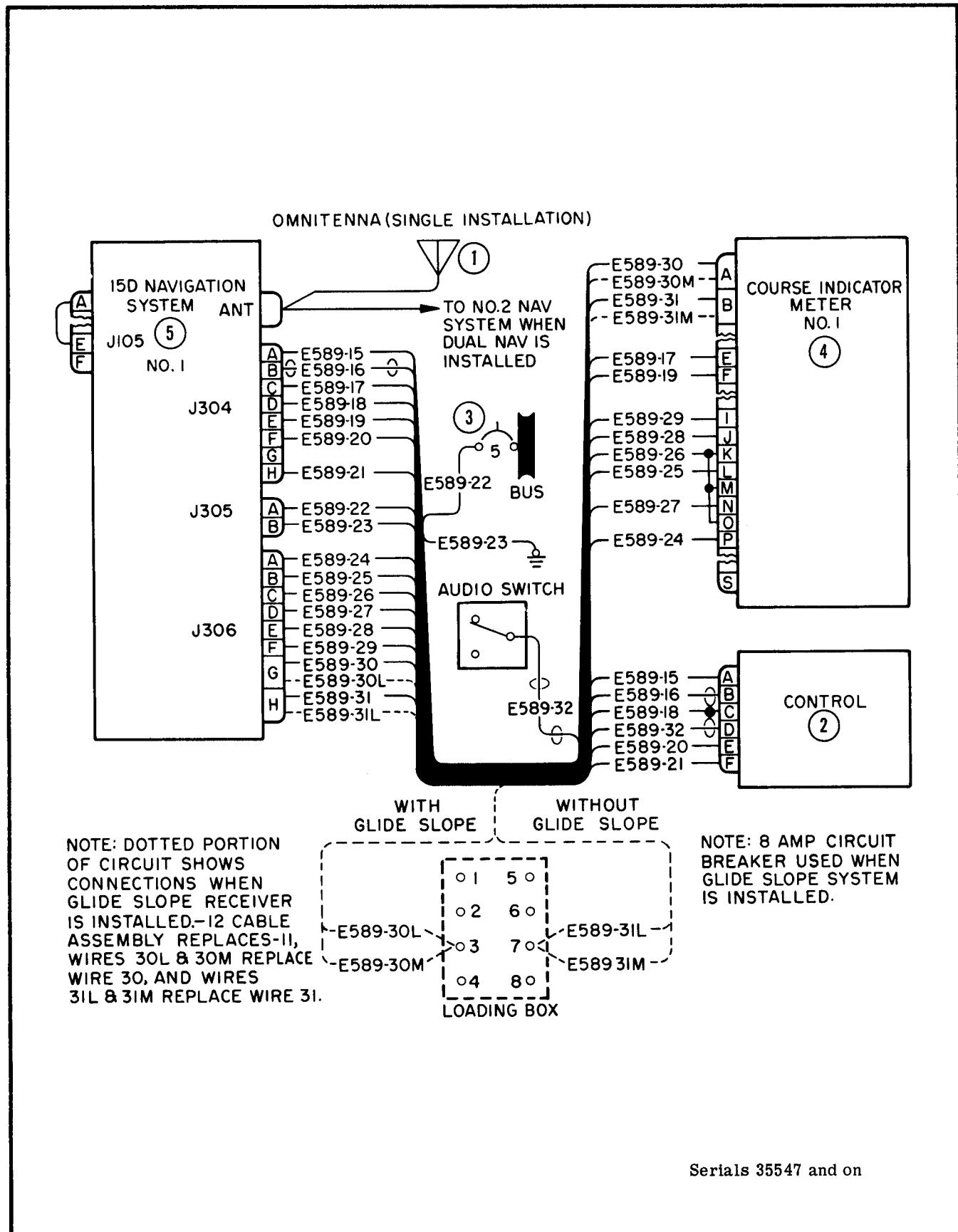
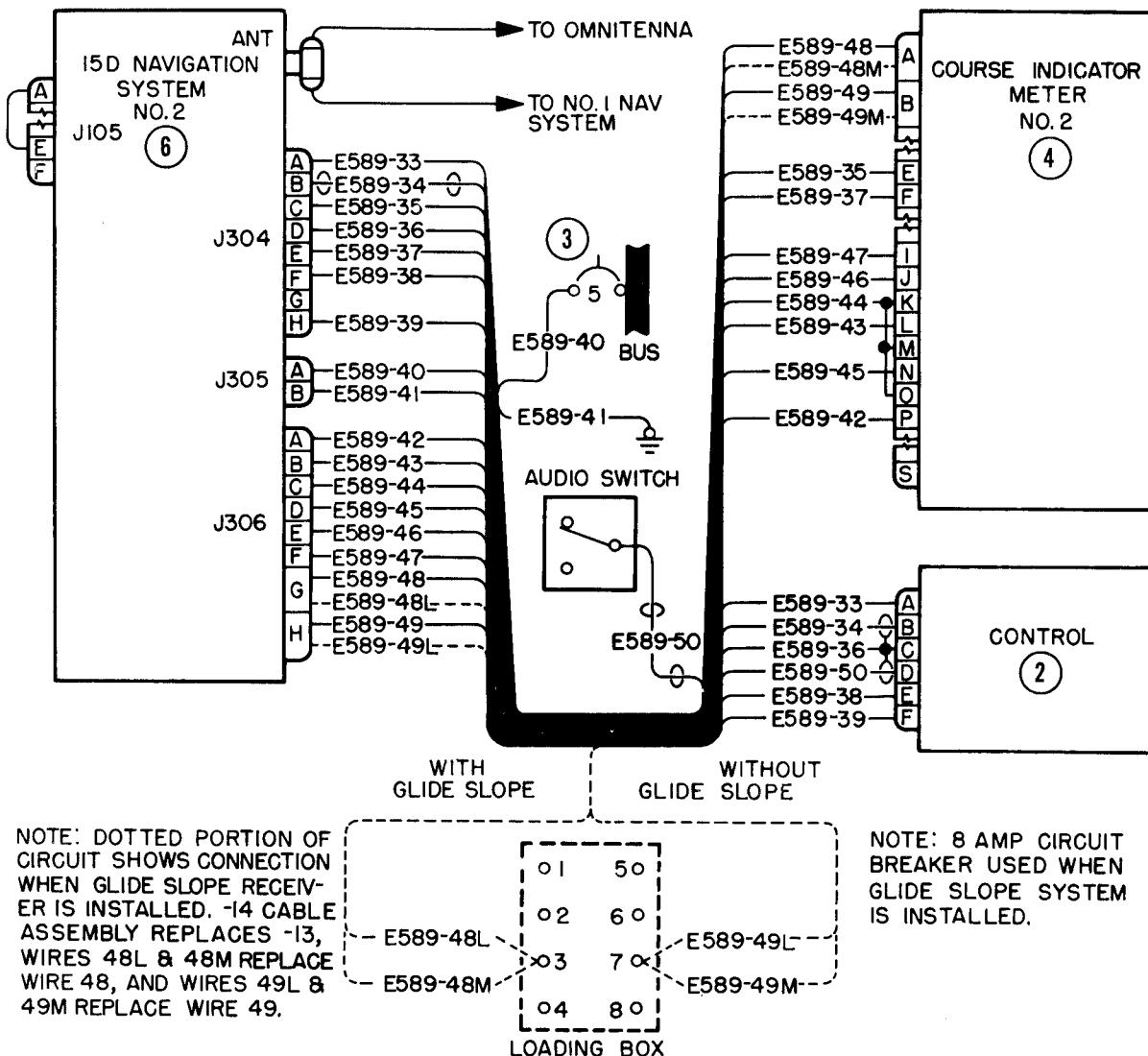


Figure 7-10. 15D Omnidrange Navigation Circuit (Sheet 4 of 5)



Serials 35547 and on

Figure 7-10. 15D Omnidrange Navigation Circuit (Sheet 5 of 5)

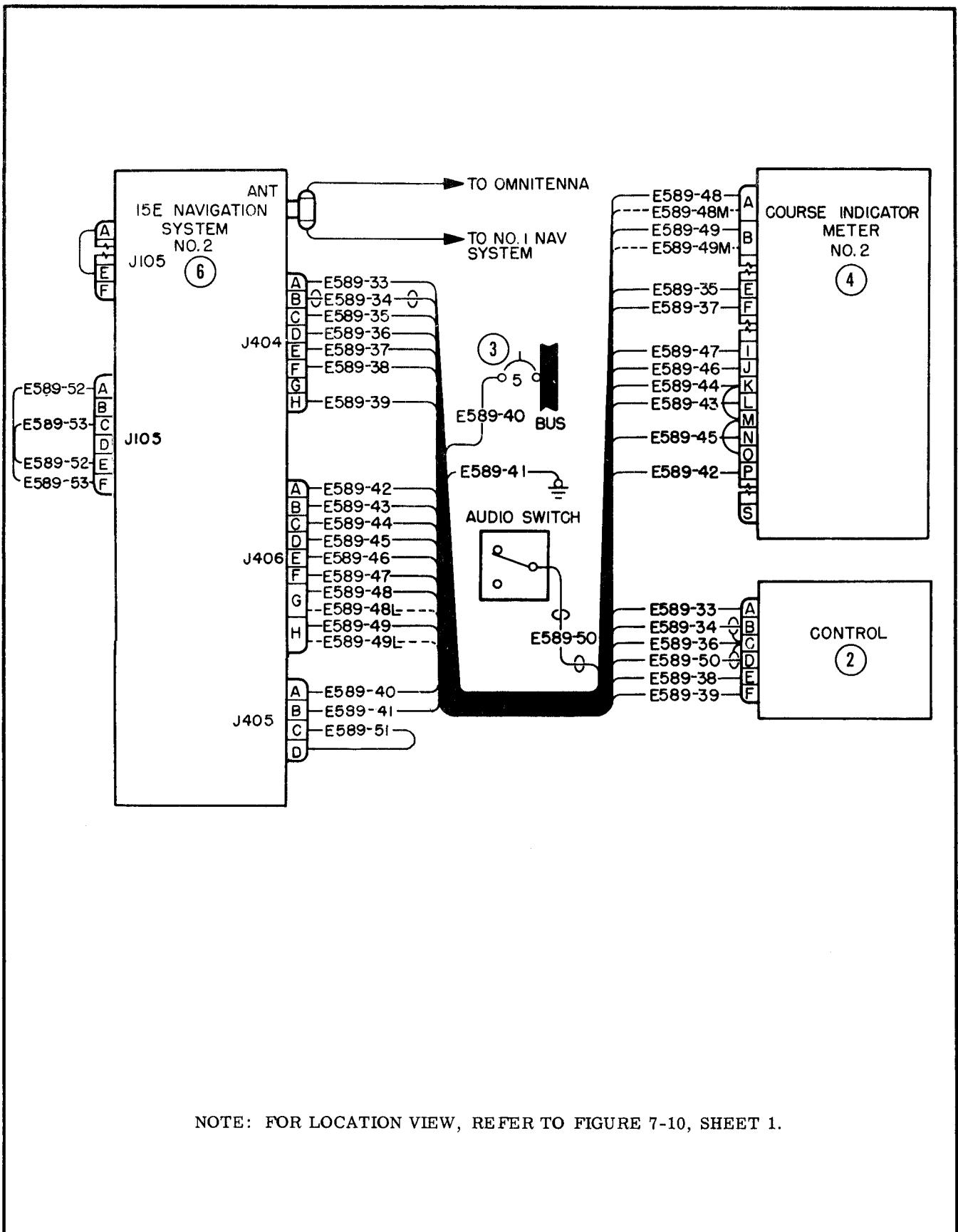


Figure 7-11. 15E Omnidirectional Navigation Circuit (Sheet 1 of 2)

OMNITENNA (SINGLE INSTALLATION)

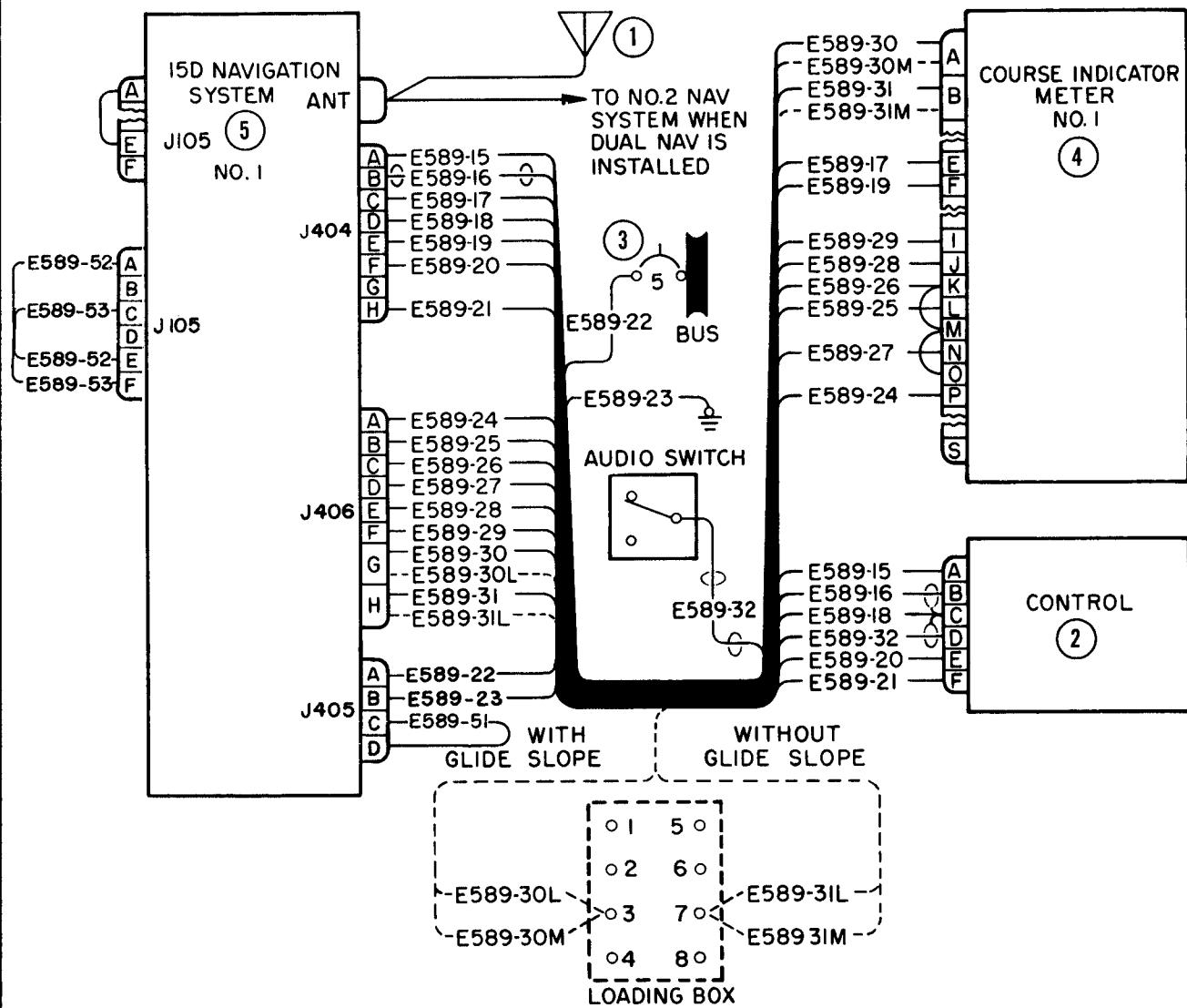


Figure 7-11. 15E Omnidrange Navigation Circuit (Sheet 2 of 2)

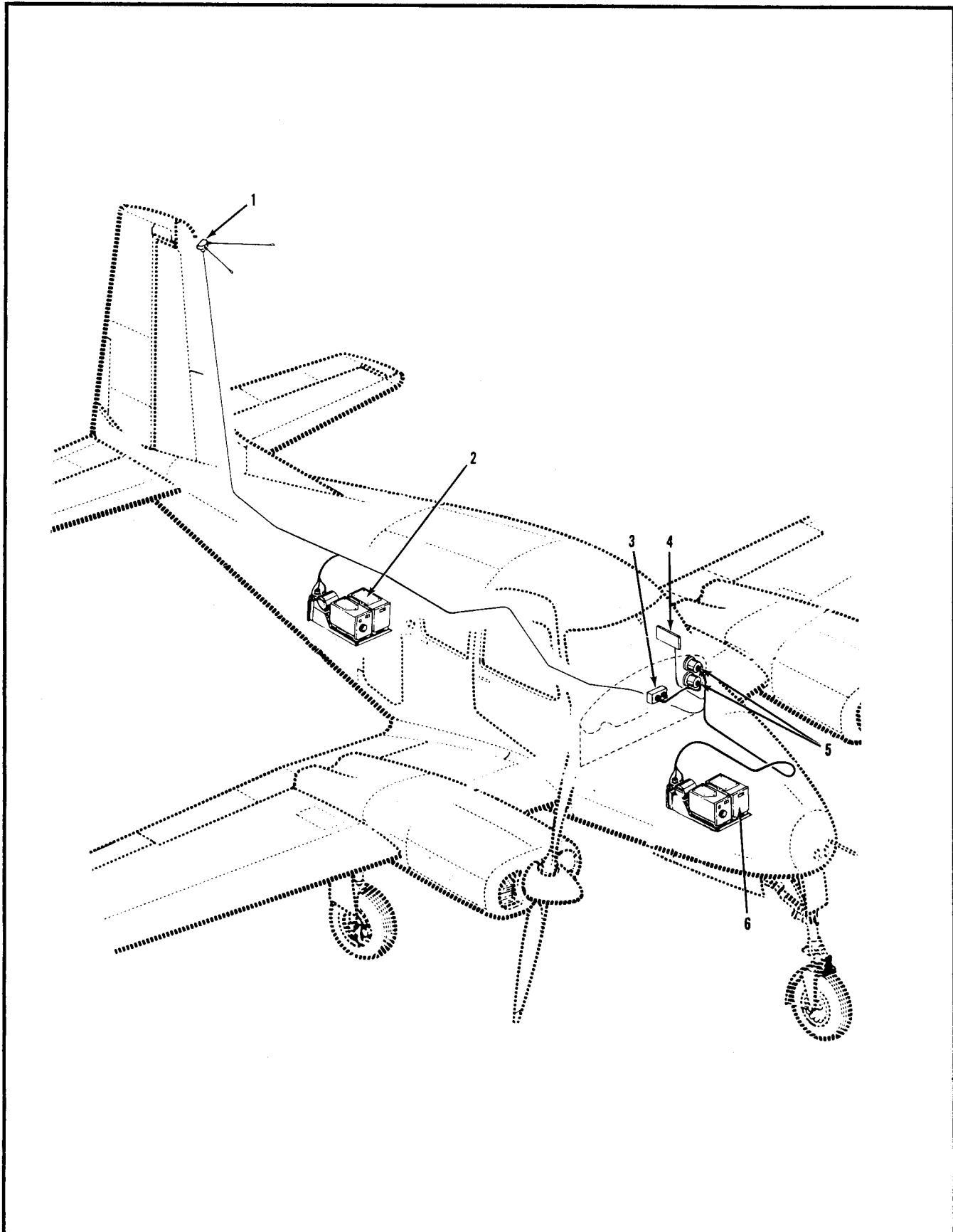


Figure 7-12. 15E Omnidrome Navigation Circuit — With C-77A Control Unit (Sheet 1 of 3)

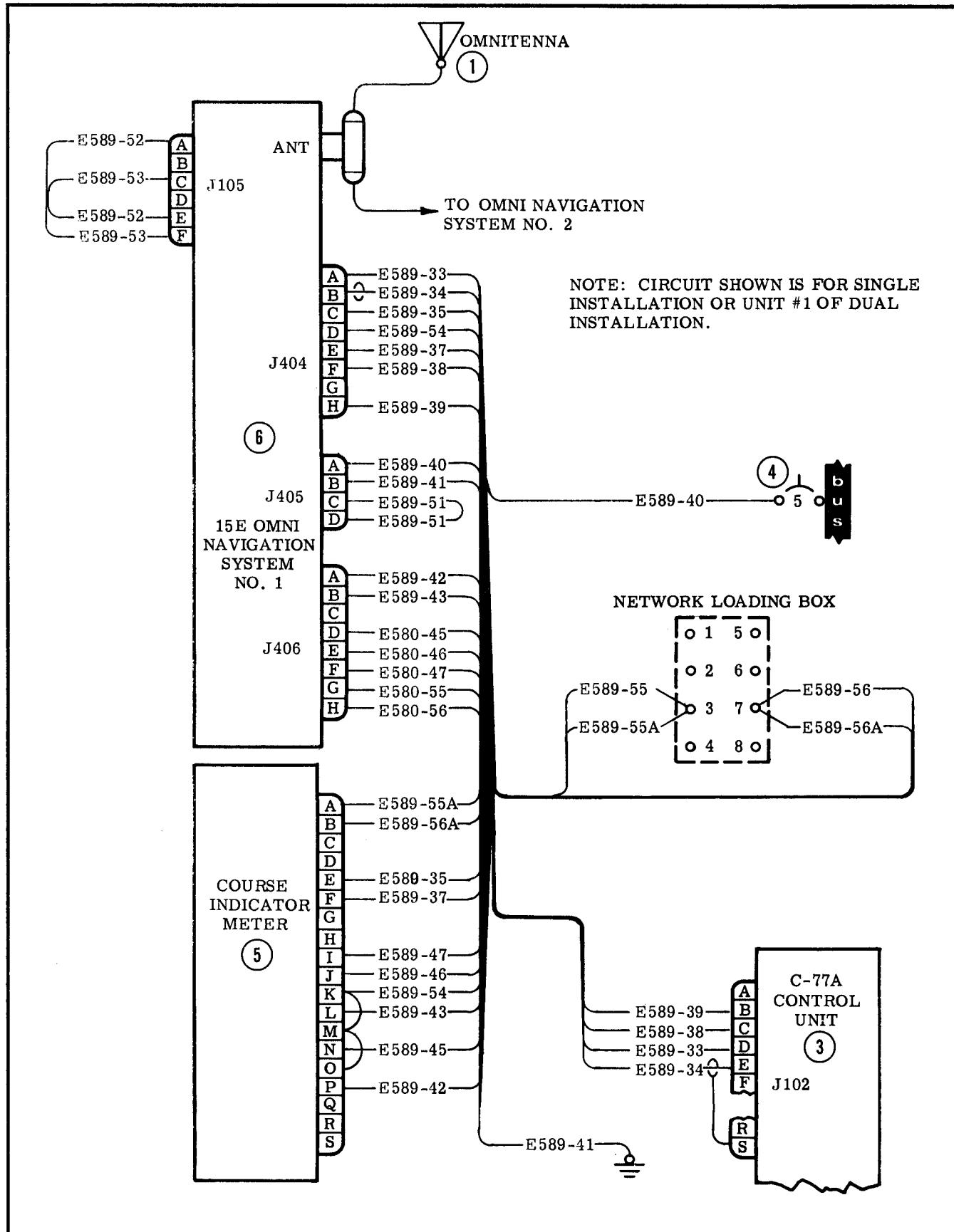


Figure 7-12. 15E Omnidirectional Navigation Circuit (Sheet 2 of 3)

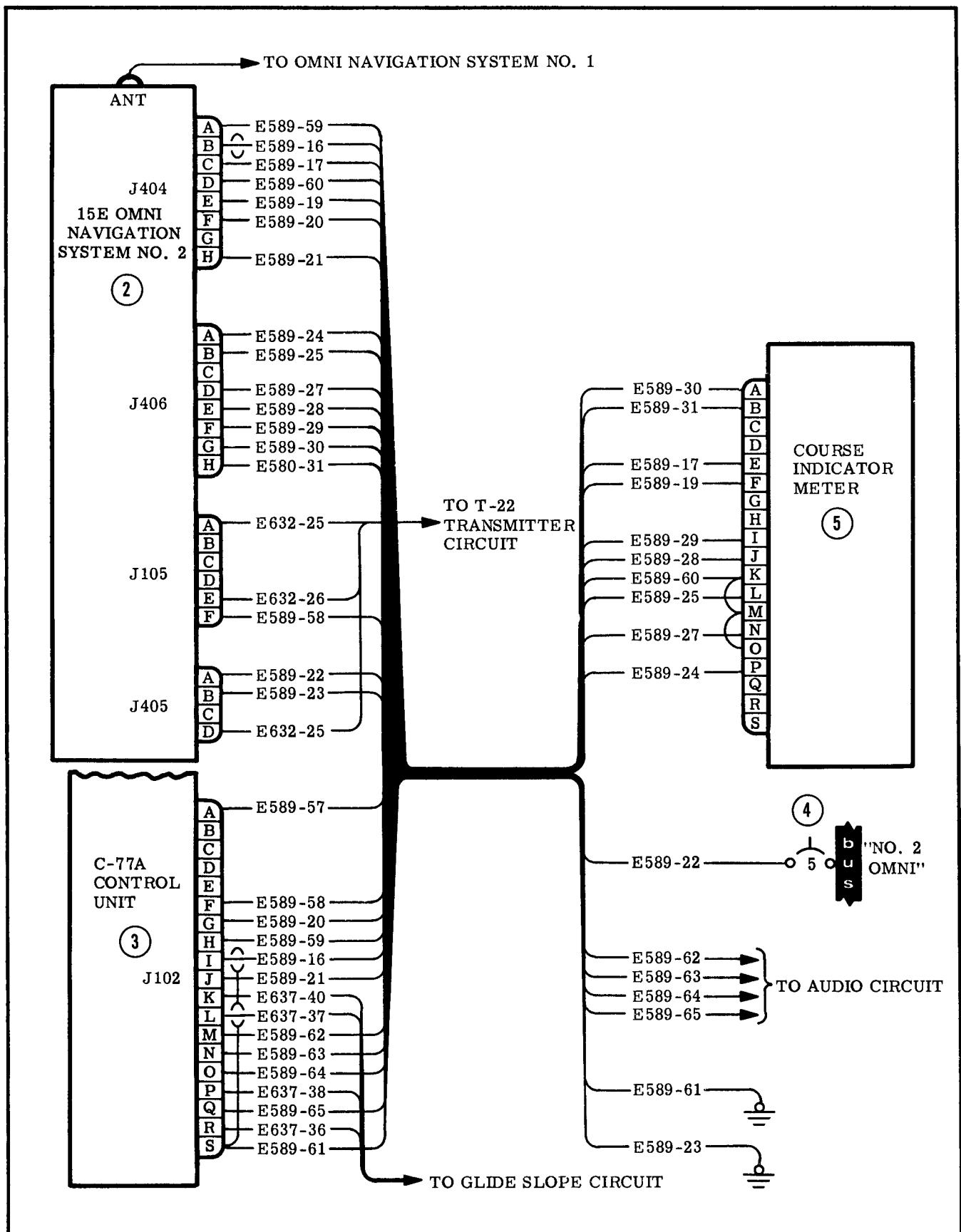


Figure 7-12. 15E Omnidirectional Navigation Circuit (Sheet 3 of 3)

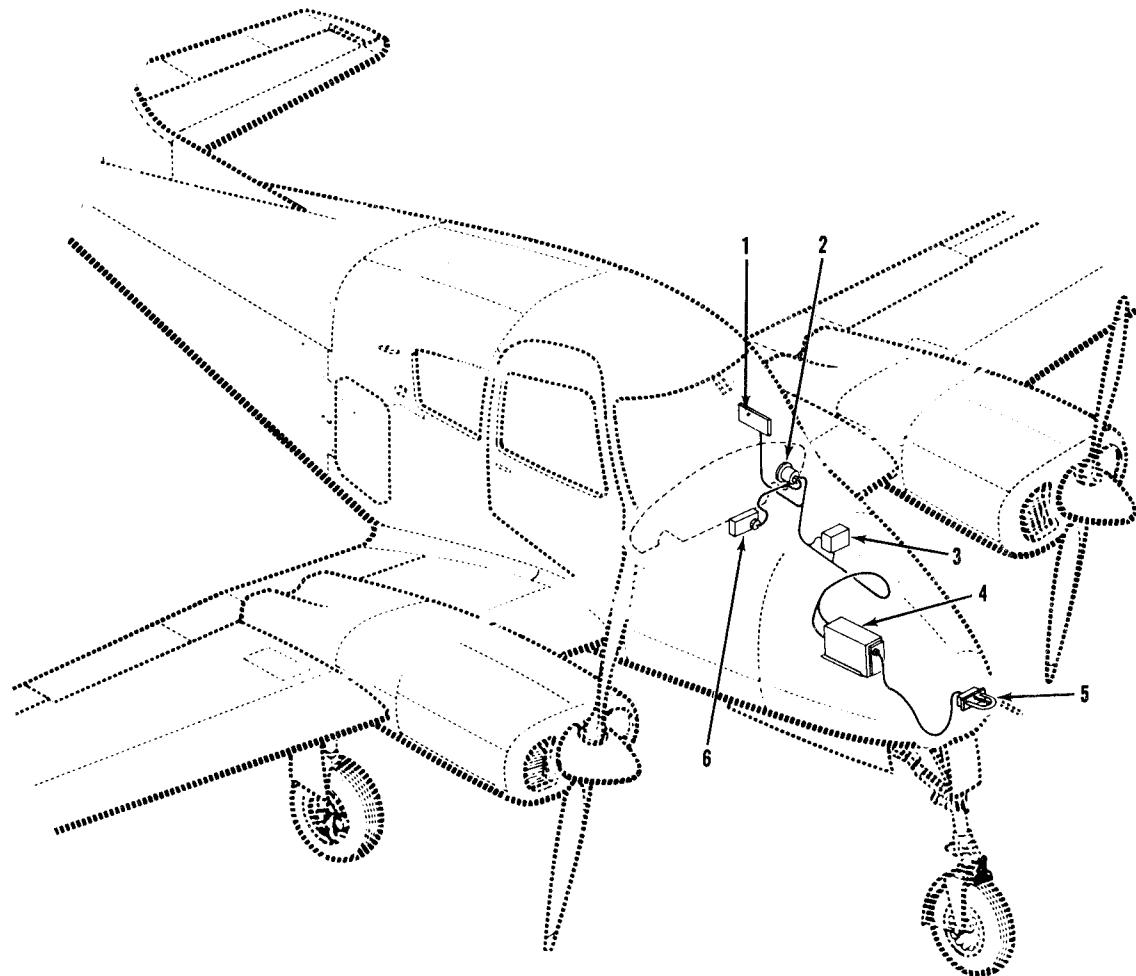


Figure 7-13. R-89 Glide Path Receiver Circuit (Sheet 1 of 3)

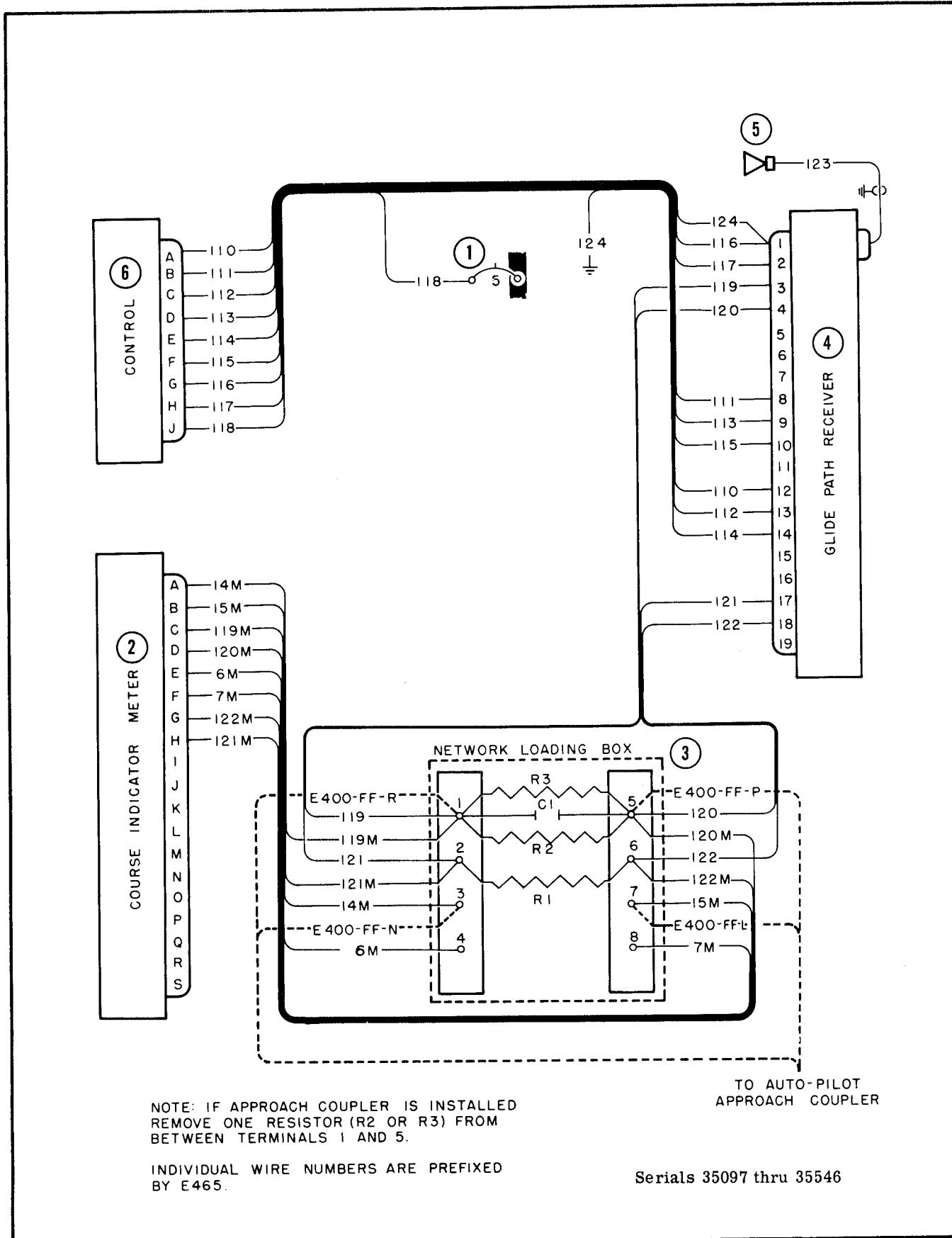
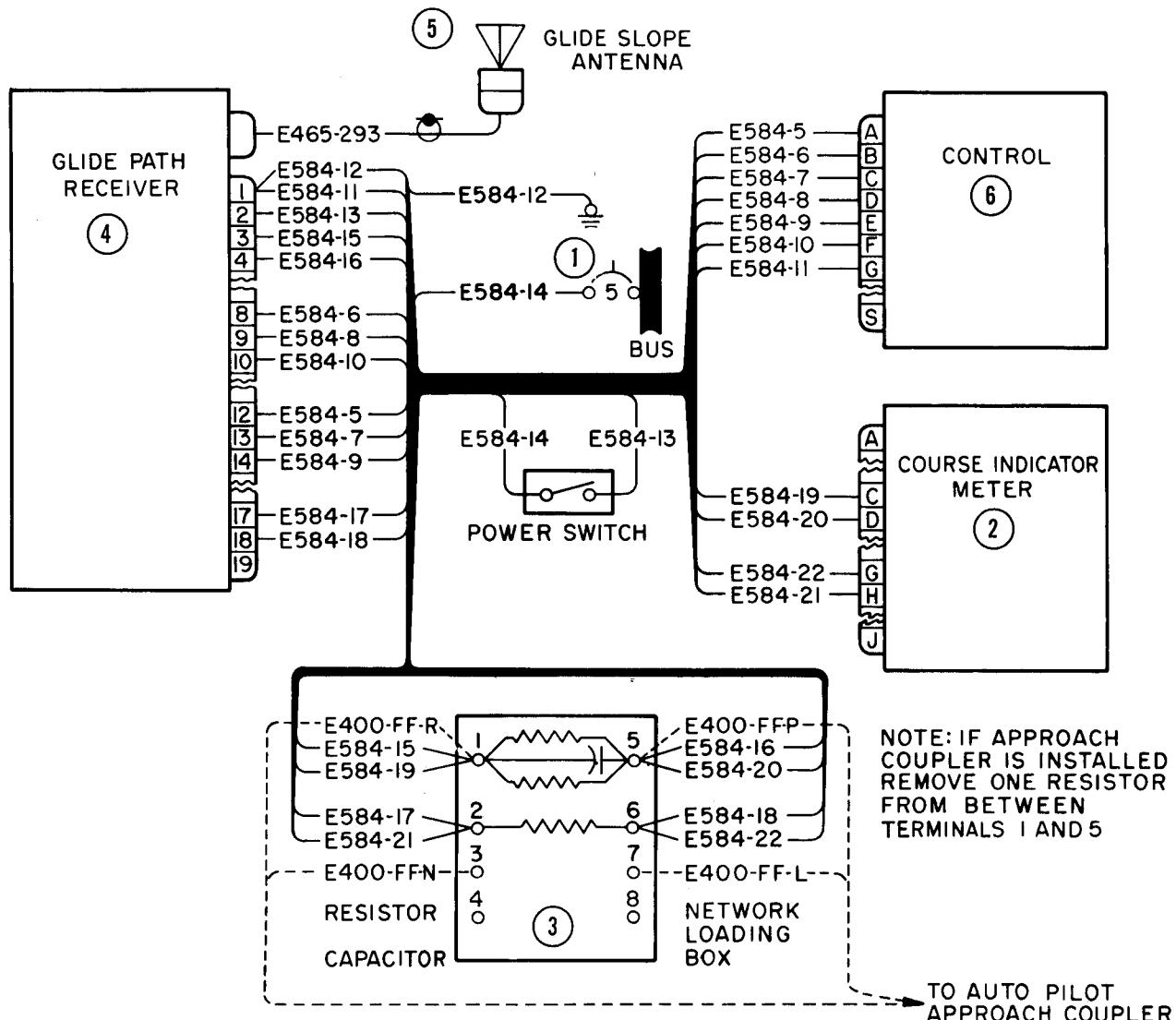


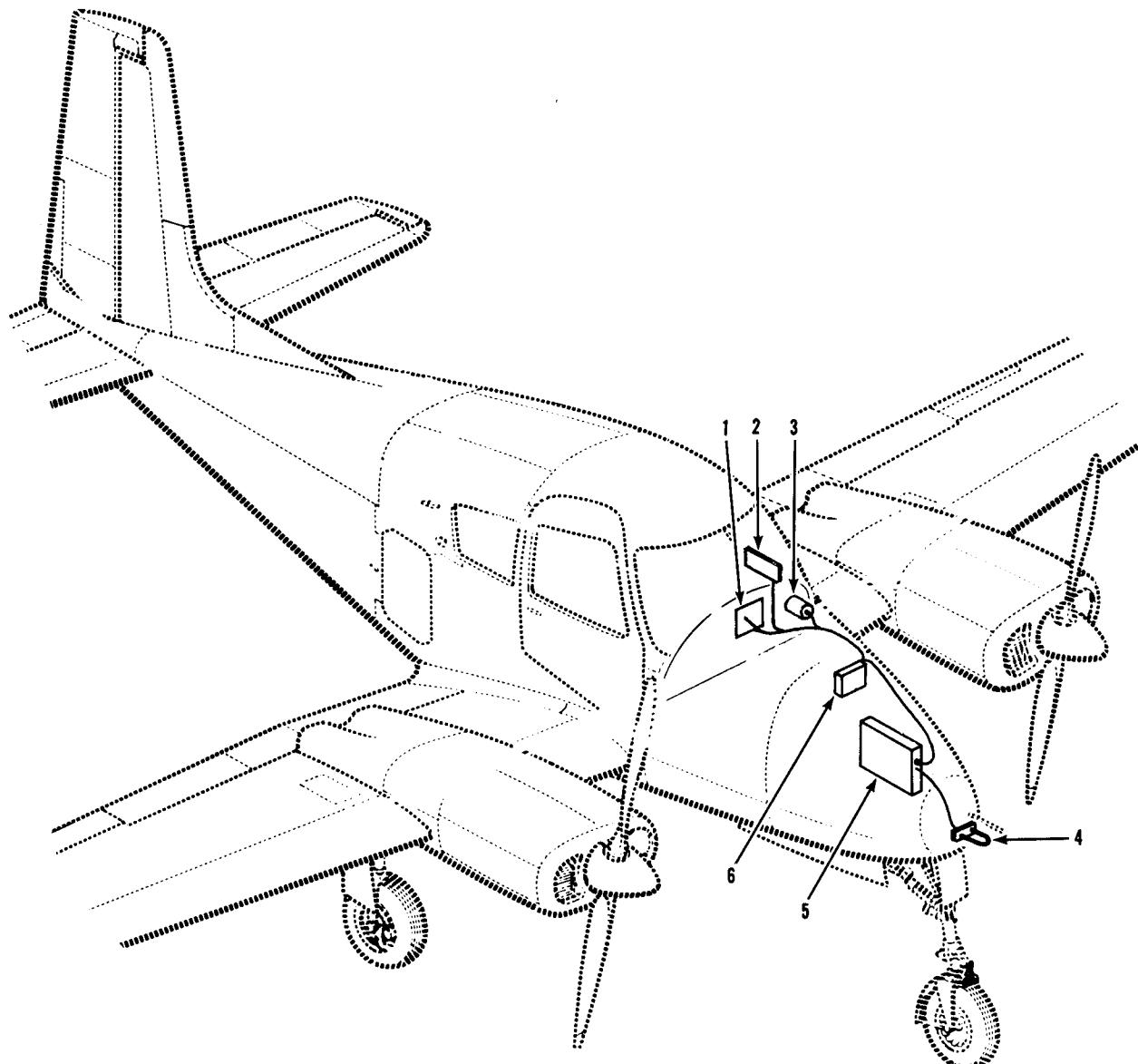
Figure 7-13. Glide Path Receiver Circuit (Sheet 2 of 3)



Serials 35547 and on

Figure 7-13. R-89 Glide Path Receiver Circuit (Sheet 3 of 3)

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MODEL 310C

Figure 7-14. Dare DGS-20 Glide Path Receiver Circuit (Sheet 1 of 2)

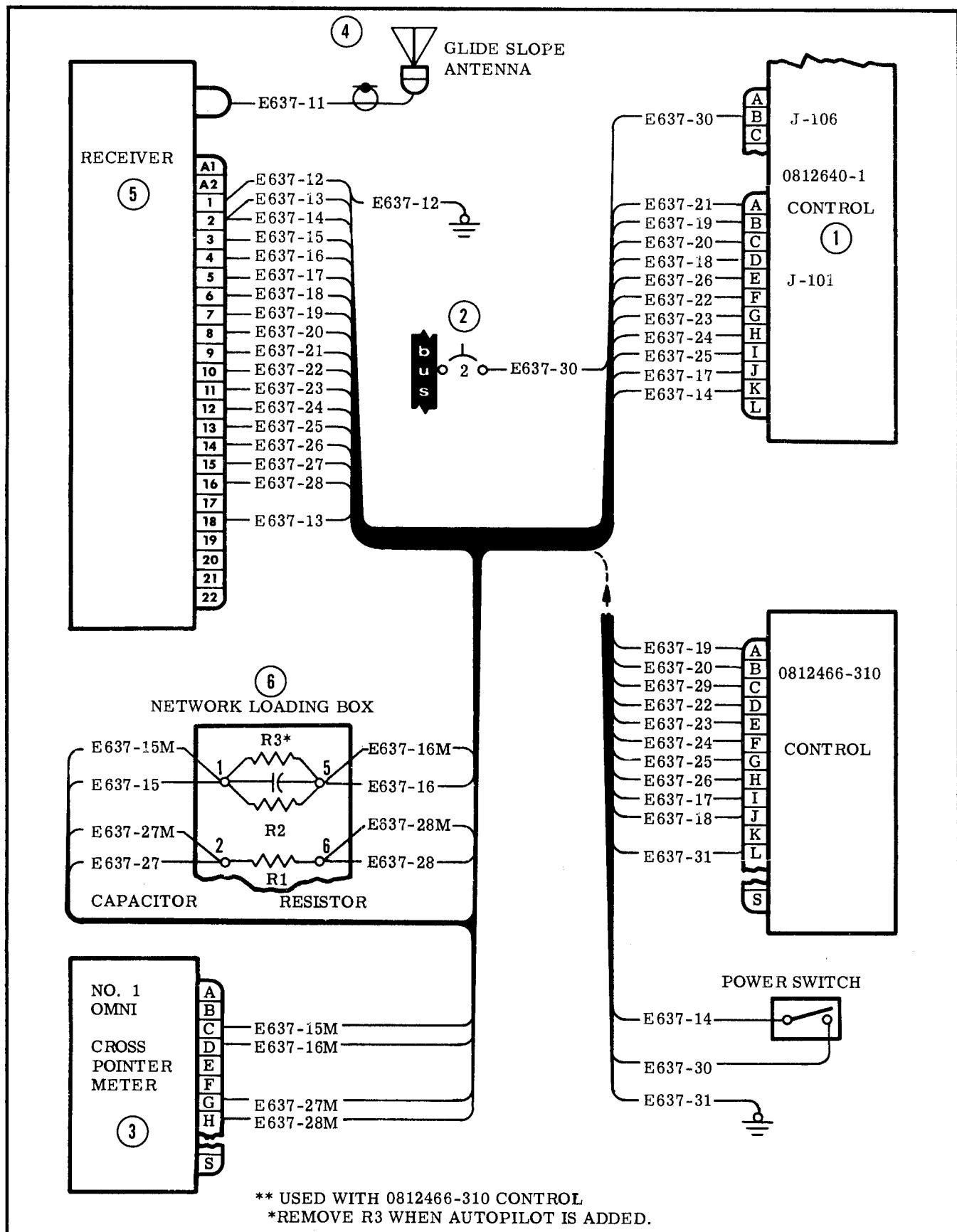


Figure 7-14. Dare DGS-20 Glide Path Receiver Circuit (Sheet 2 of 2)

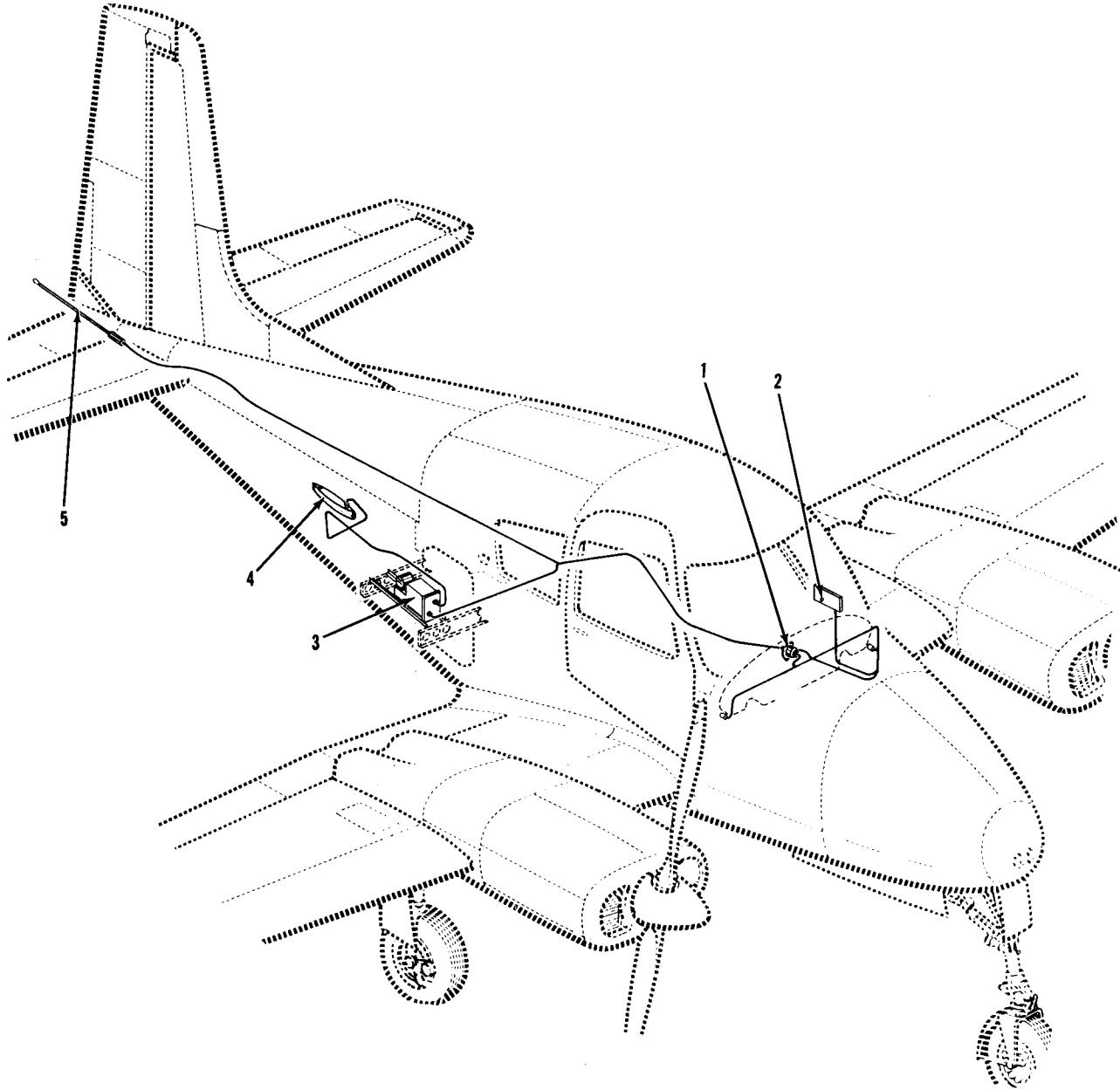


Figure 7-15. 2200 Marker Beacon Circuit — Model 310 (Sheet 1 of 2)

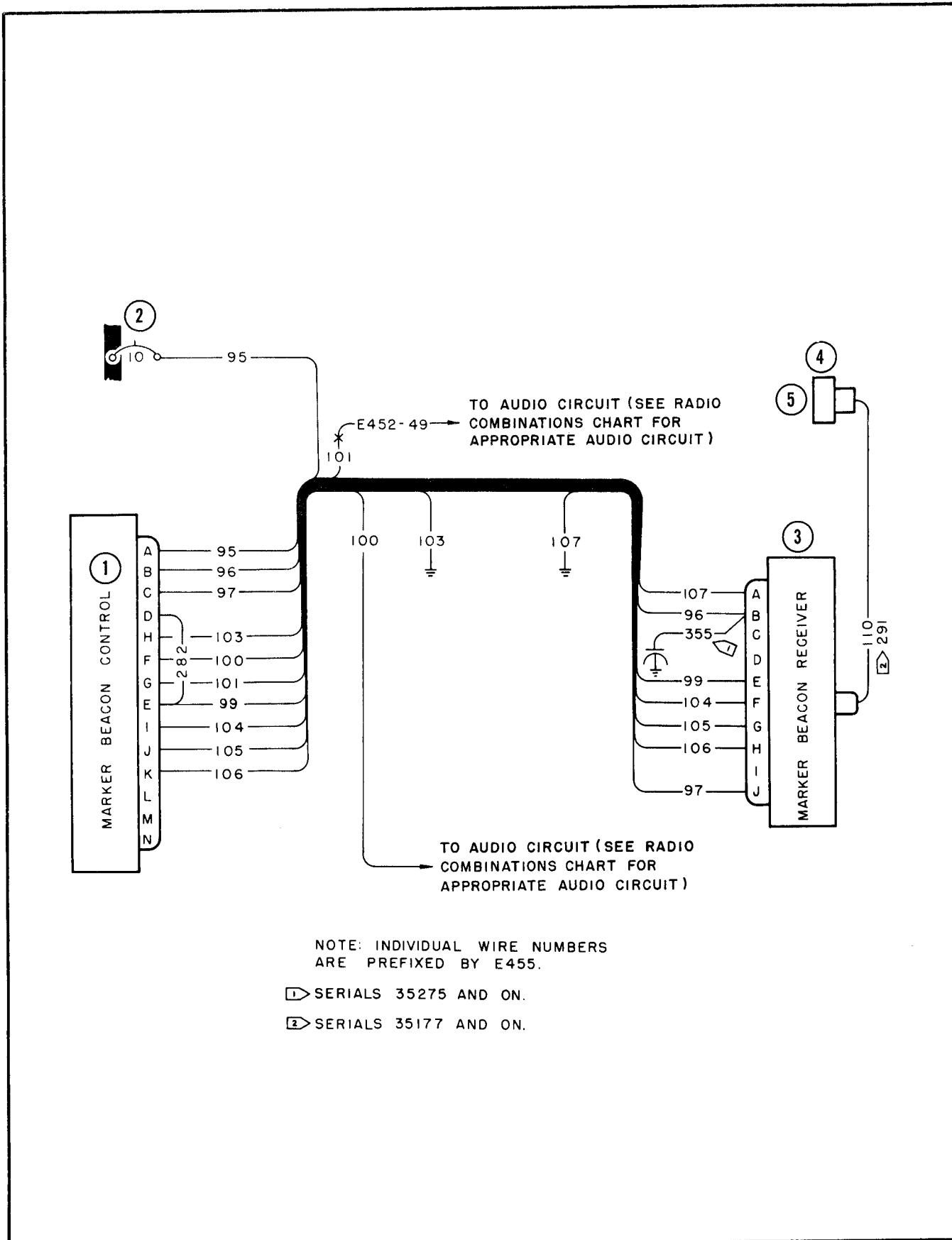


Figure 7-15. 2200 Marker Beacon Circuit — Model 310 (Sheet 2 of 2)

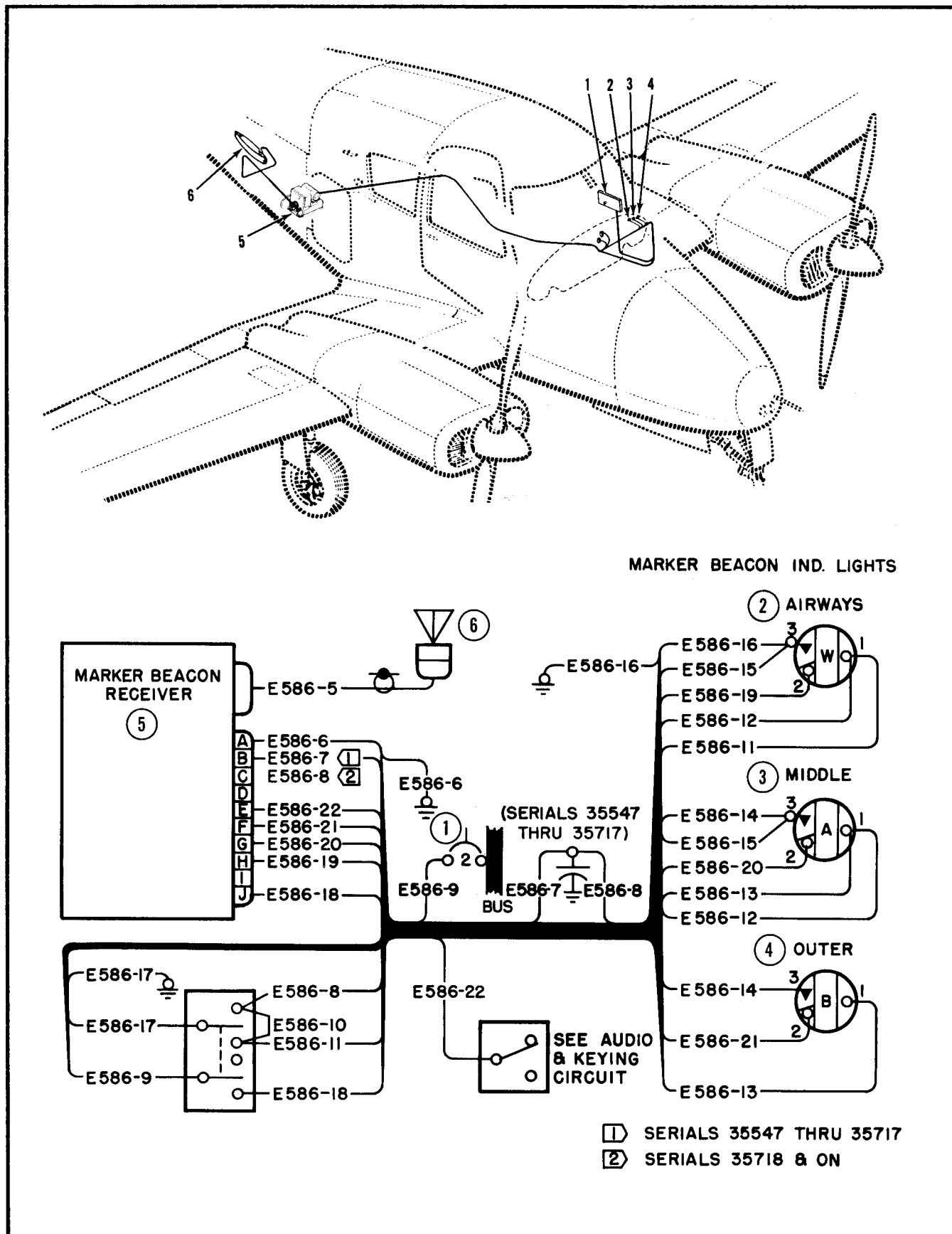


Figure 7-16. 2200 Marker Beacon Circuit — Models 310B

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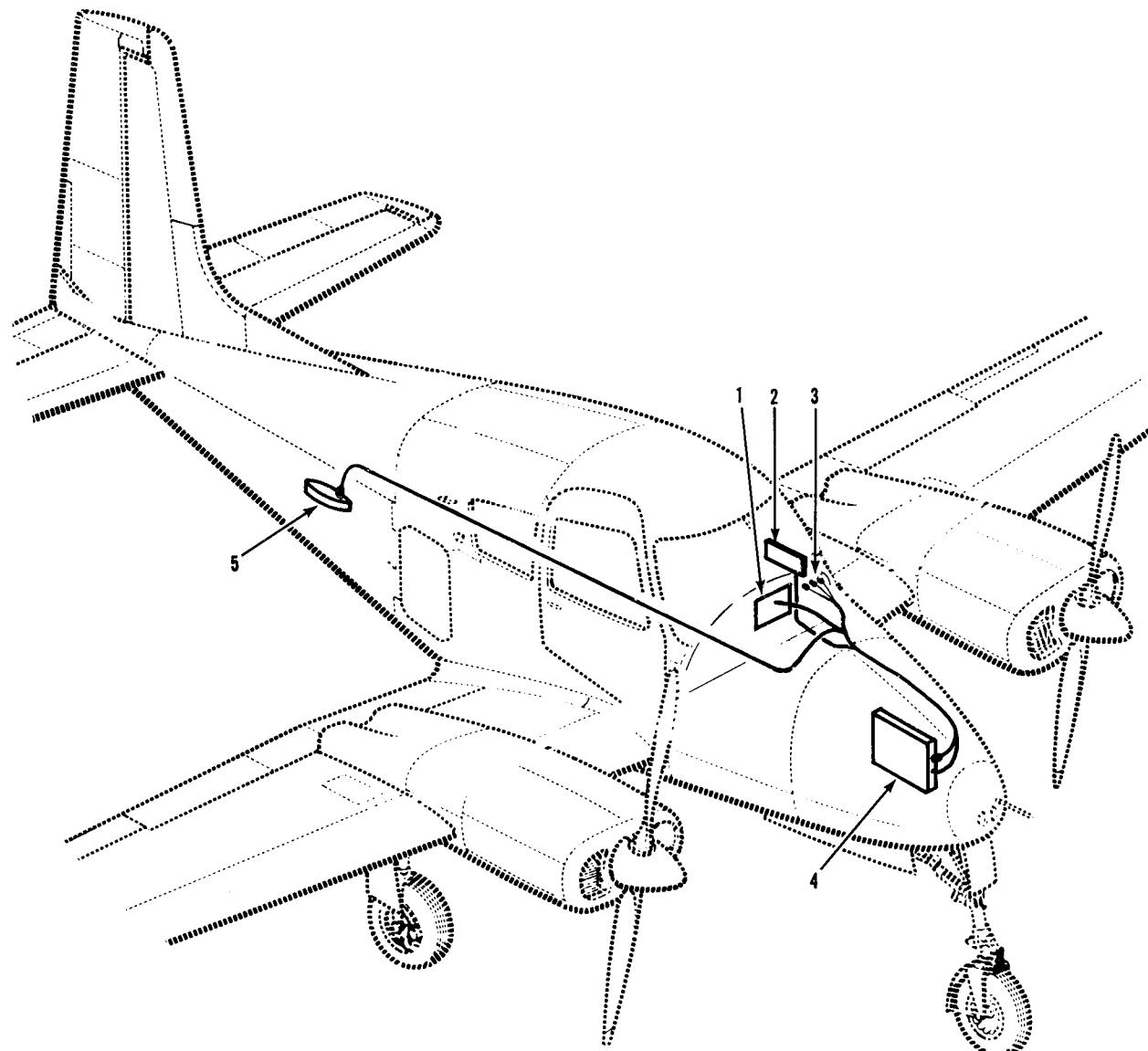


Figure 7-17. Dare DM-3 Marker Beacon Receiver Circuit (Sheet 1 of 2)

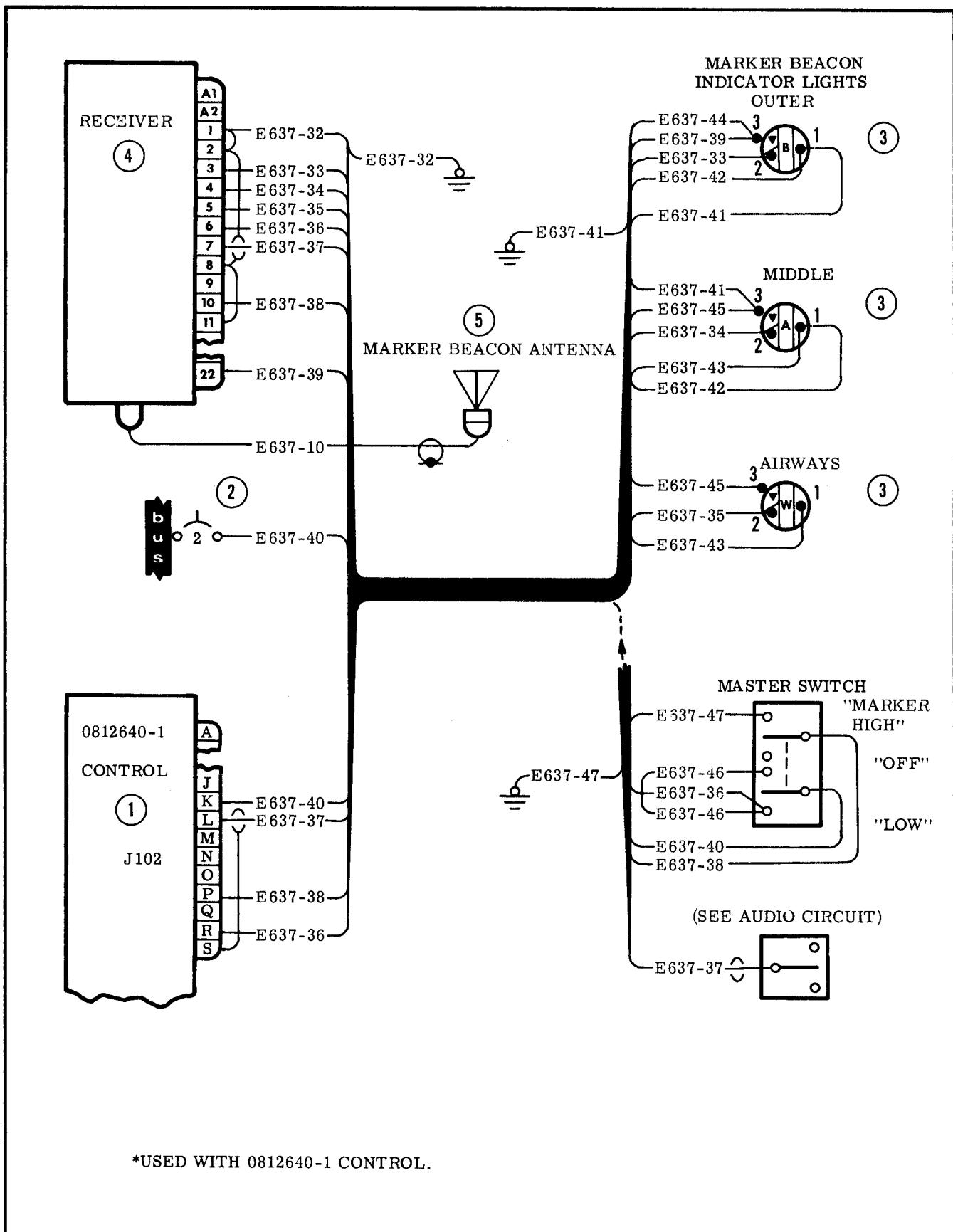


Figure 7-17. Dare DM-3 Marker Beacon Receiver Circuit (Sheet 2 of 2)

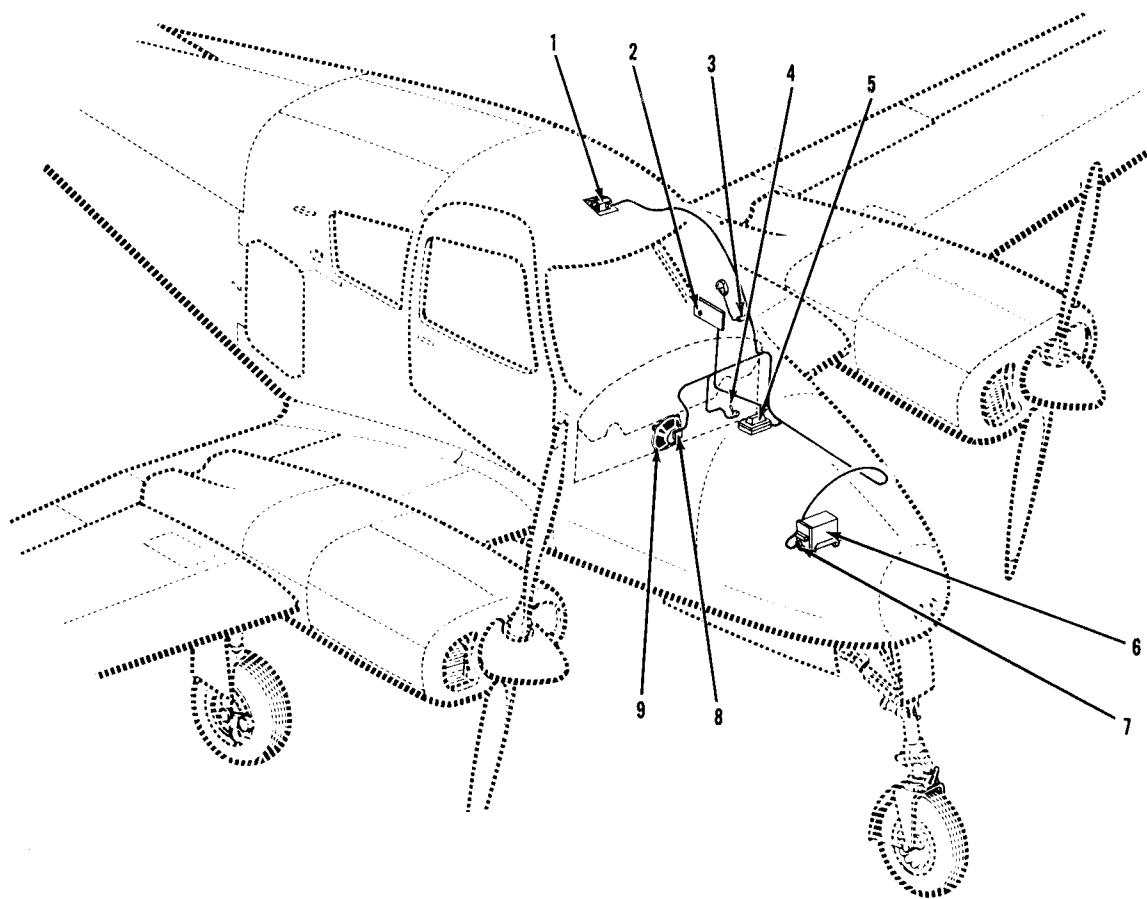


Figure 7-18. CA-1 Audio Amplifier Circuit (Sheet 1 of 2)

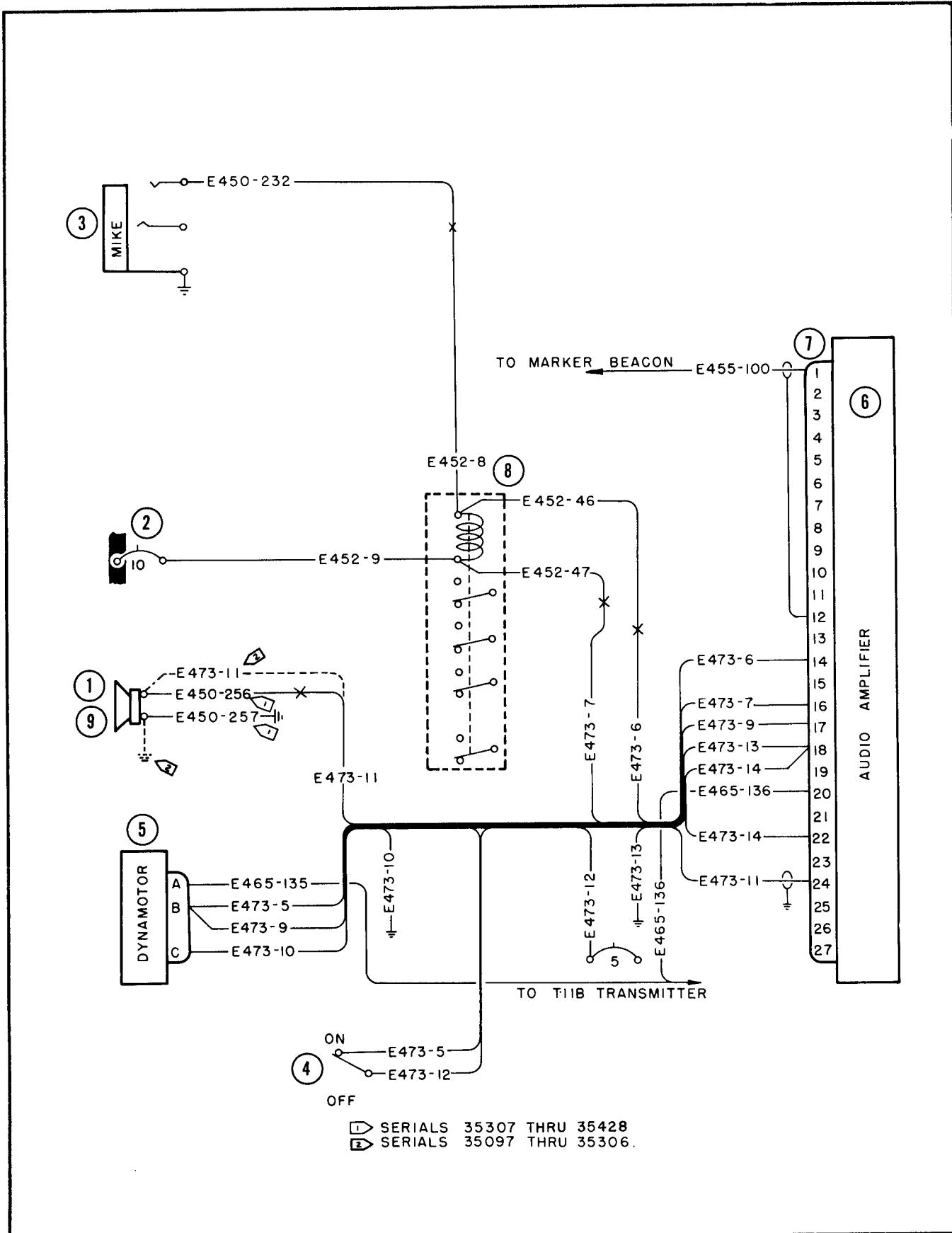


Figure 7-18. CA-1 Audio Amplifier Circuit (Sheet 2 of 2)

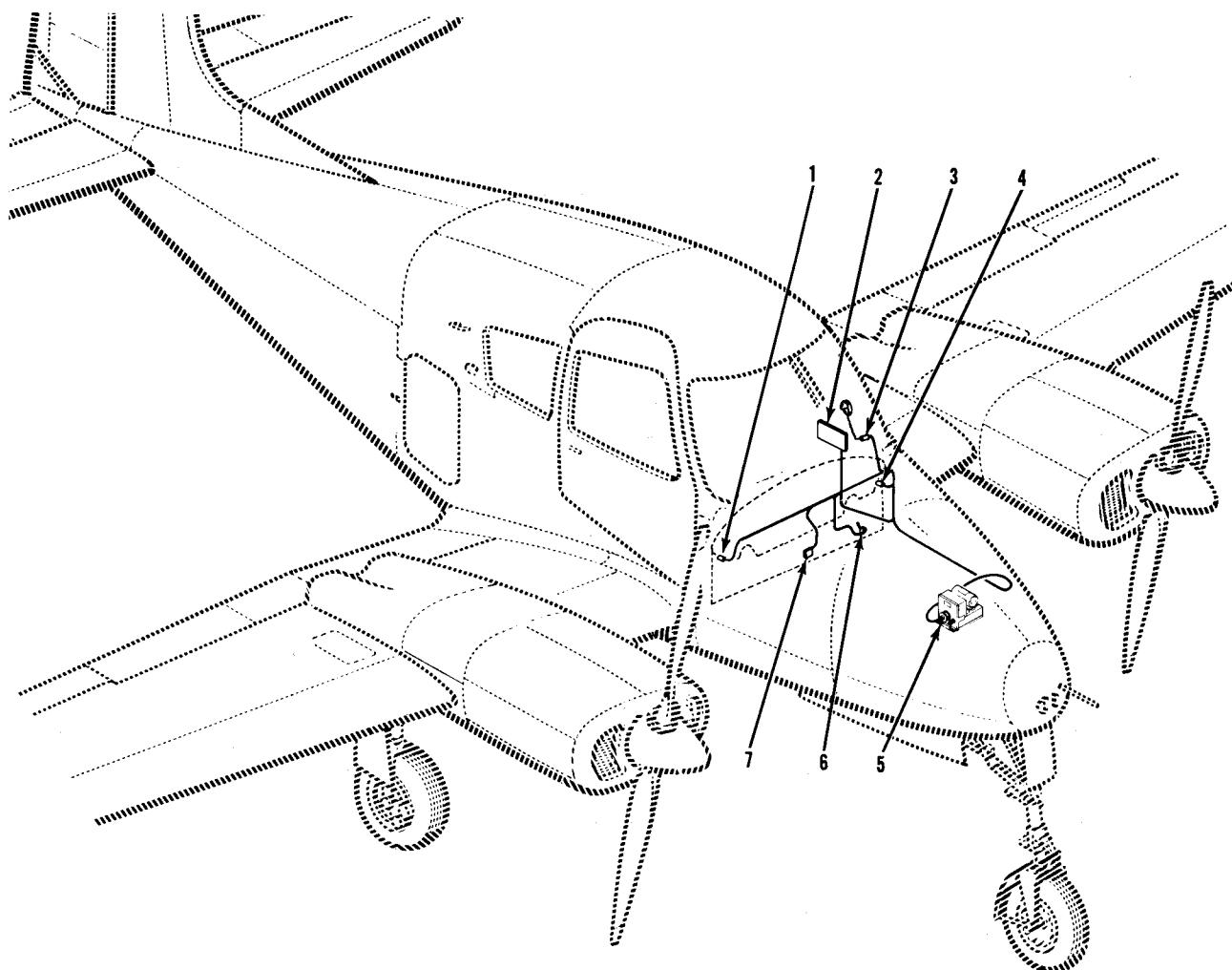


Figure 7-19. F-13 and F-13A Audio Amplifier Circuits — Model 310 (Sheet 1 of 2)

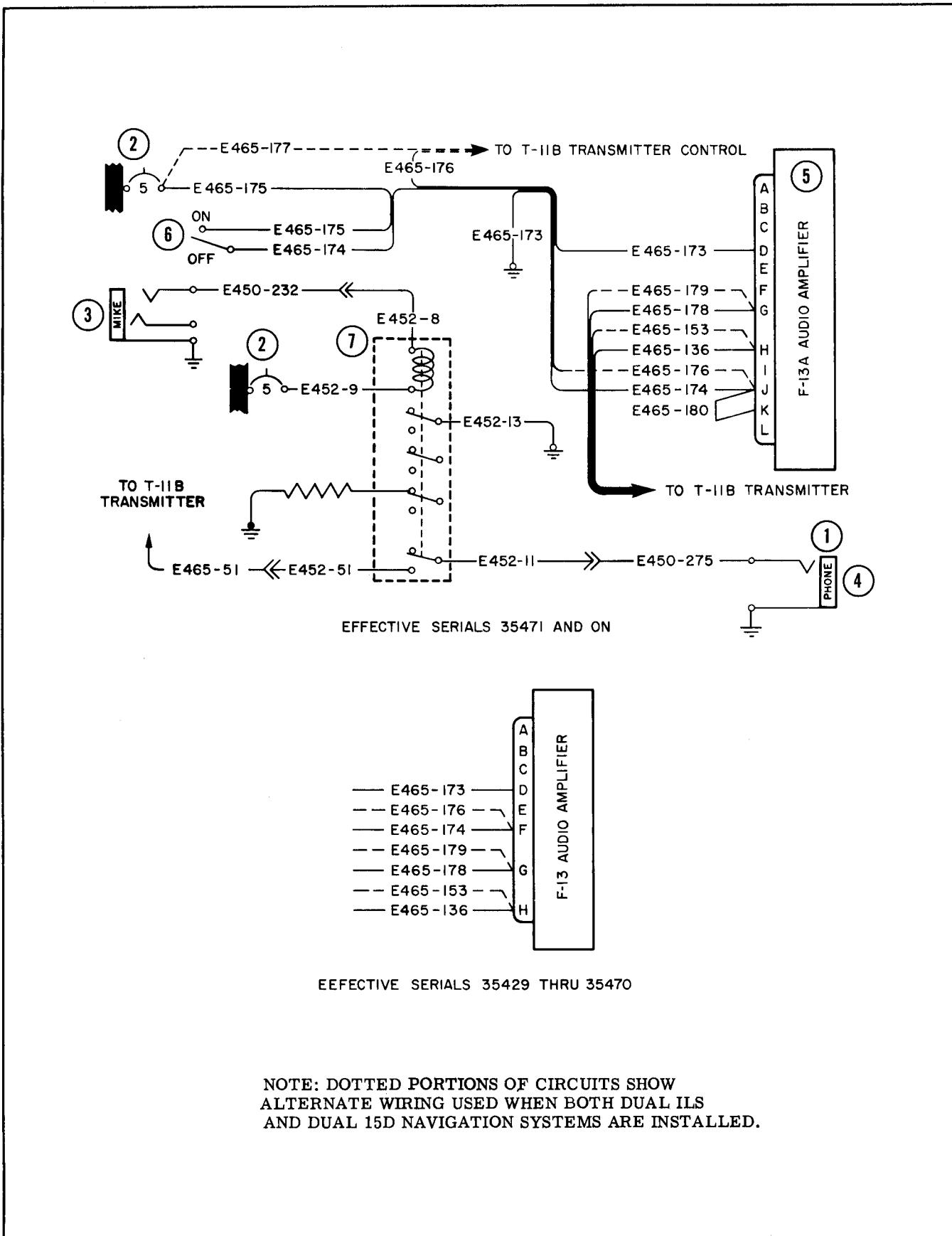
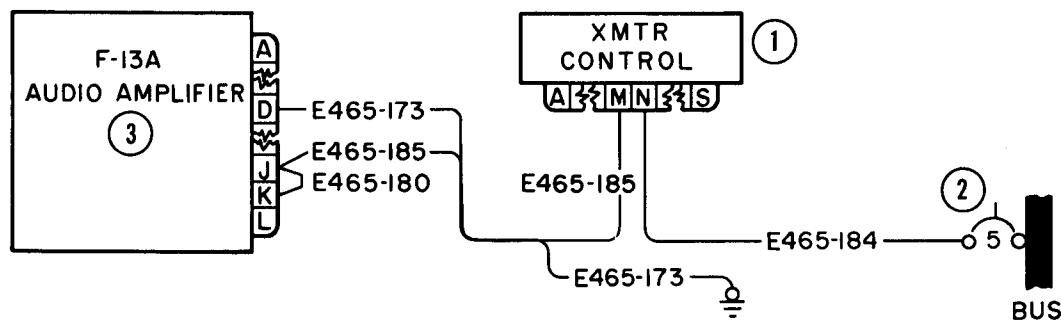
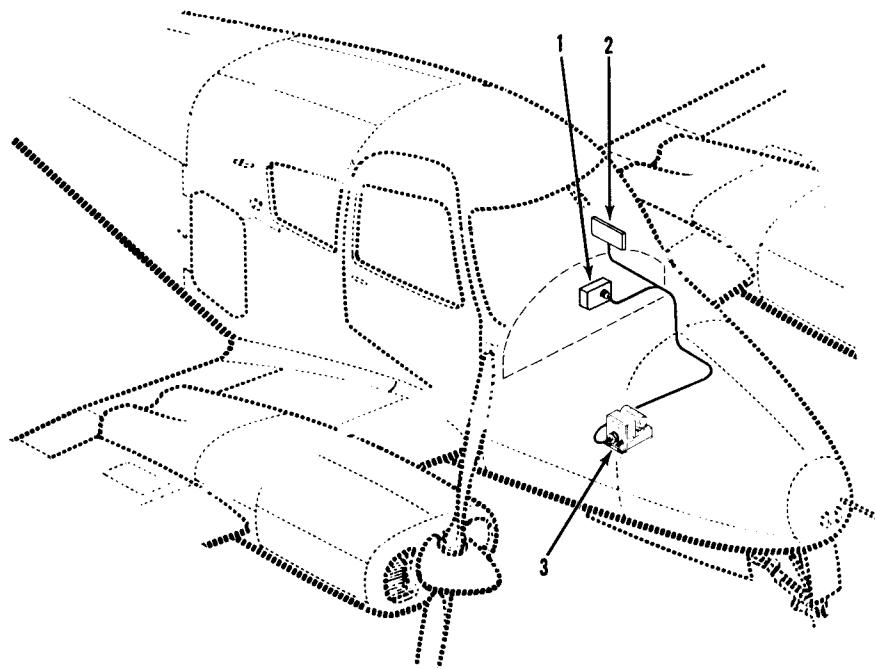
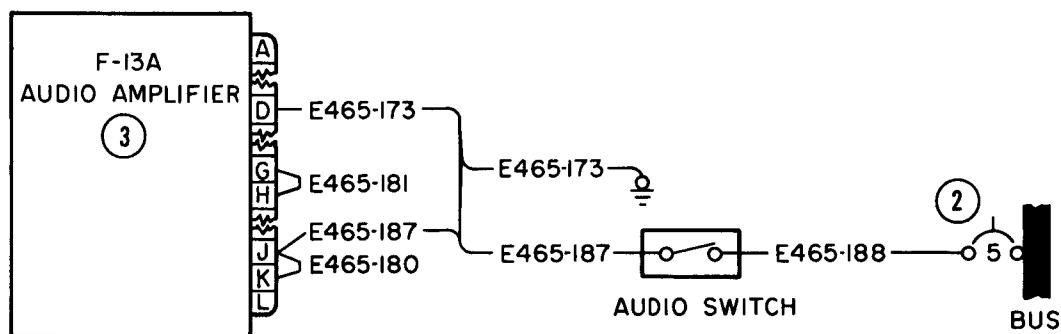


Figure 7-19. F-13 and F-13A Audio Amplifier Circuits — Model 310 (Sheet 2 of 2)



NOTE: CIRCUIT SHOWS AUDIO AMPLIFIER
MOUNTED IN STANDARD POSITION.



NOTE: CIRCUIT SHOWS AUDIO AMPLIFIER
MOUNTED IN ALTERNATE POSITION.

Figure 7-20. Audio Amplifier Circuit — Models 310B and 310C

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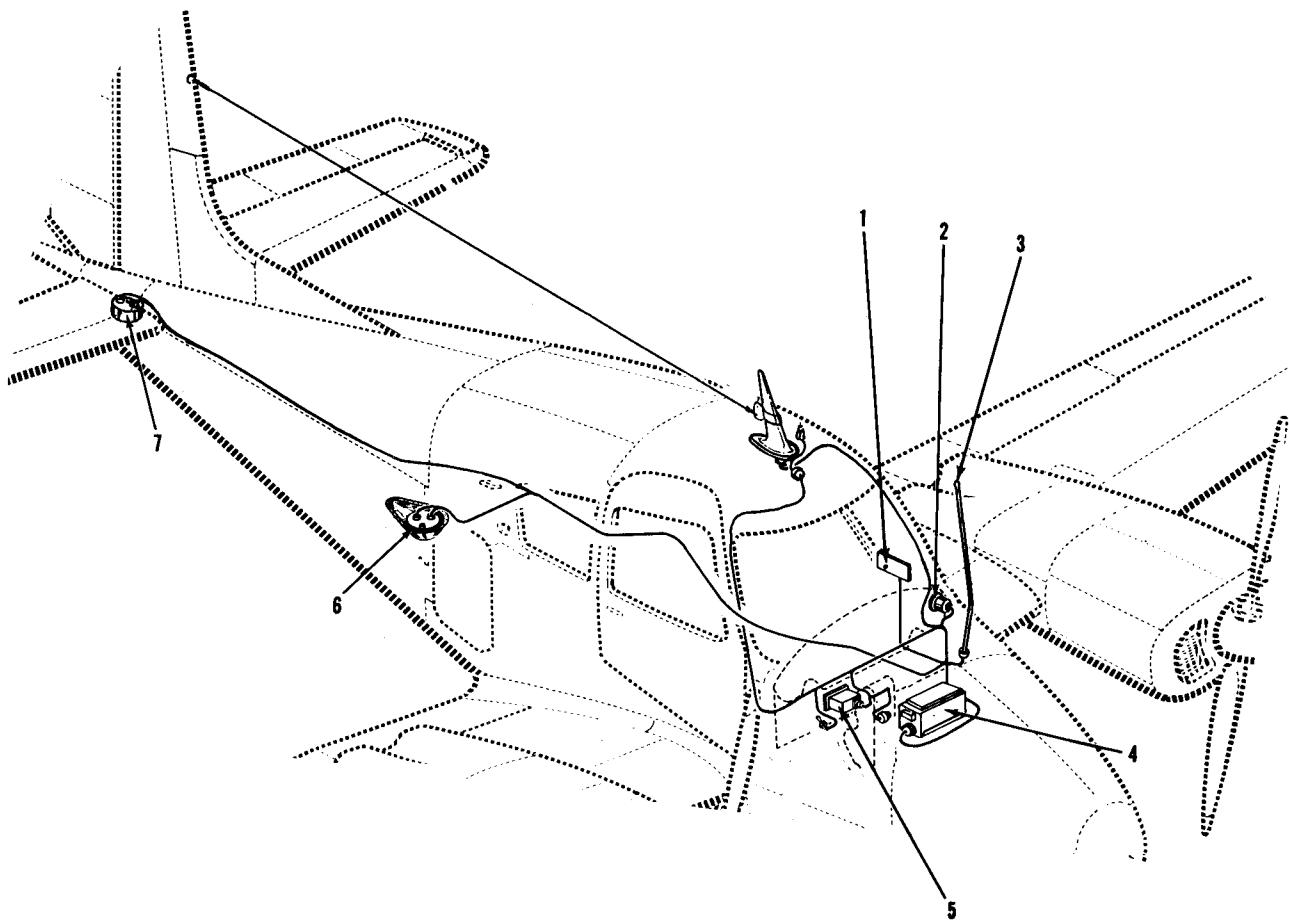


Figure 7-21. ADF-12 No. 1 Circuit (Sheet 1 of 2)

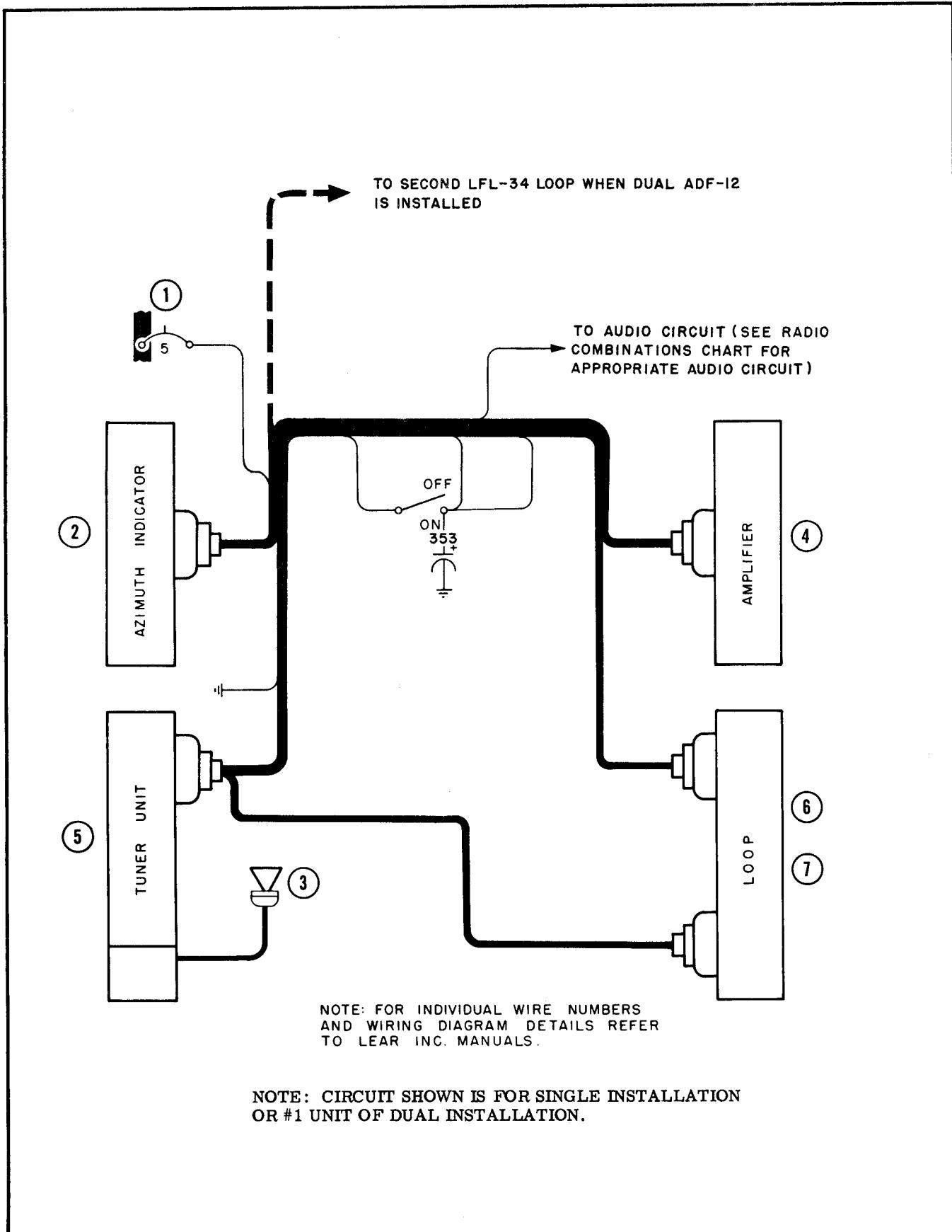


Figure 7-21. ADF-12 No. 1 Circuit (Sheet 2 of 2)

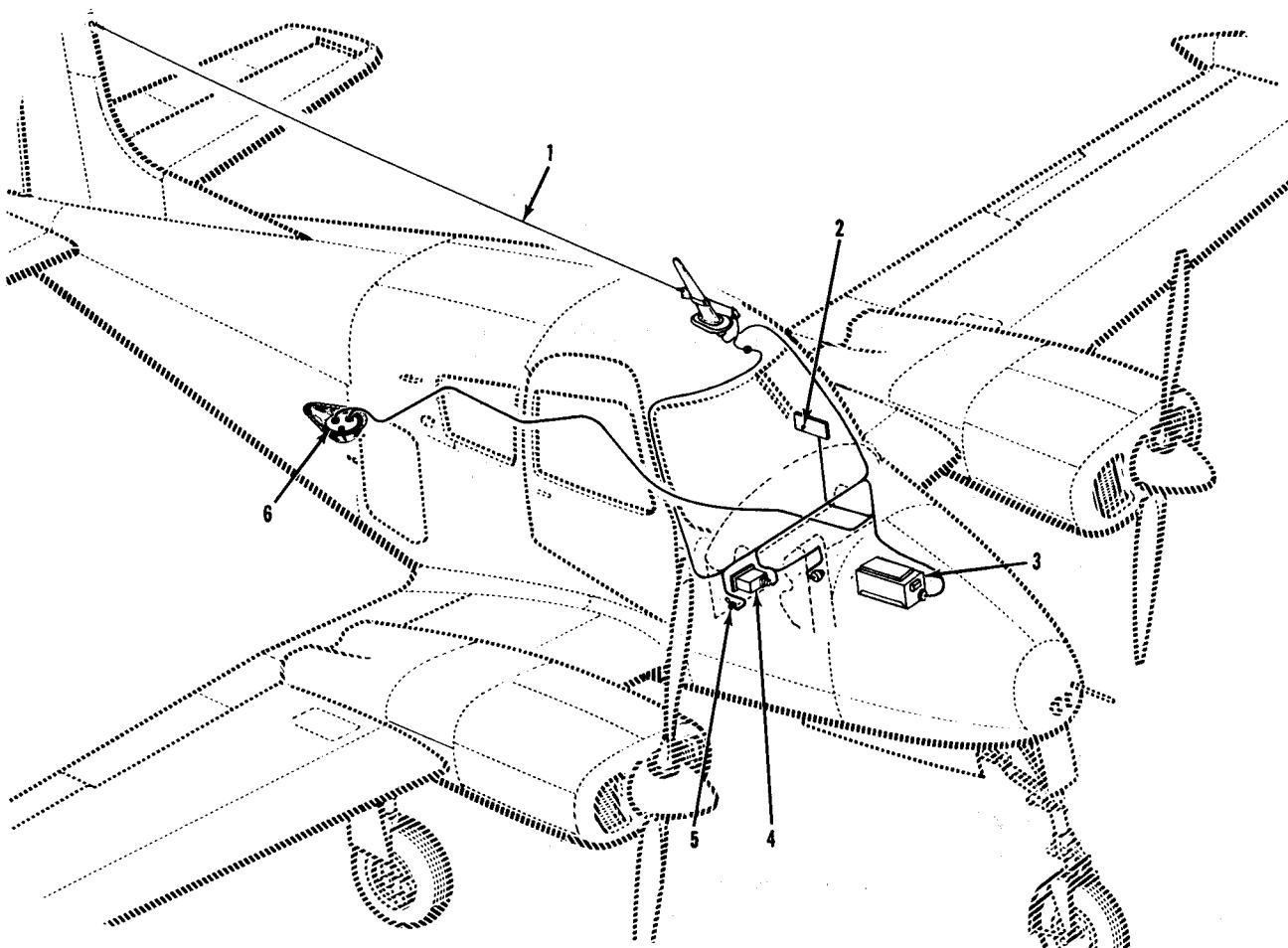


Figure 7-22. ADF-12 No. 2 Circuit (Sheet 1 of 2)

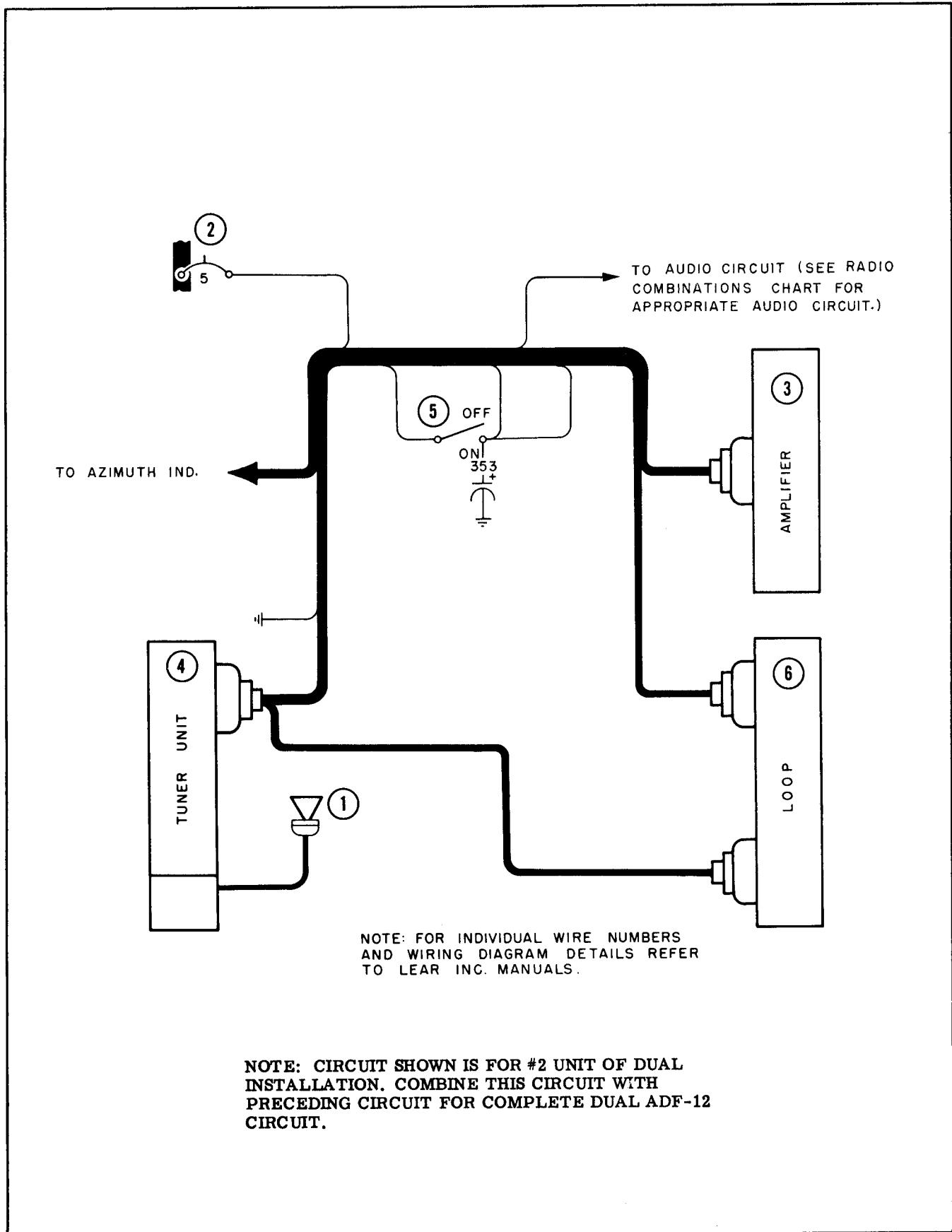
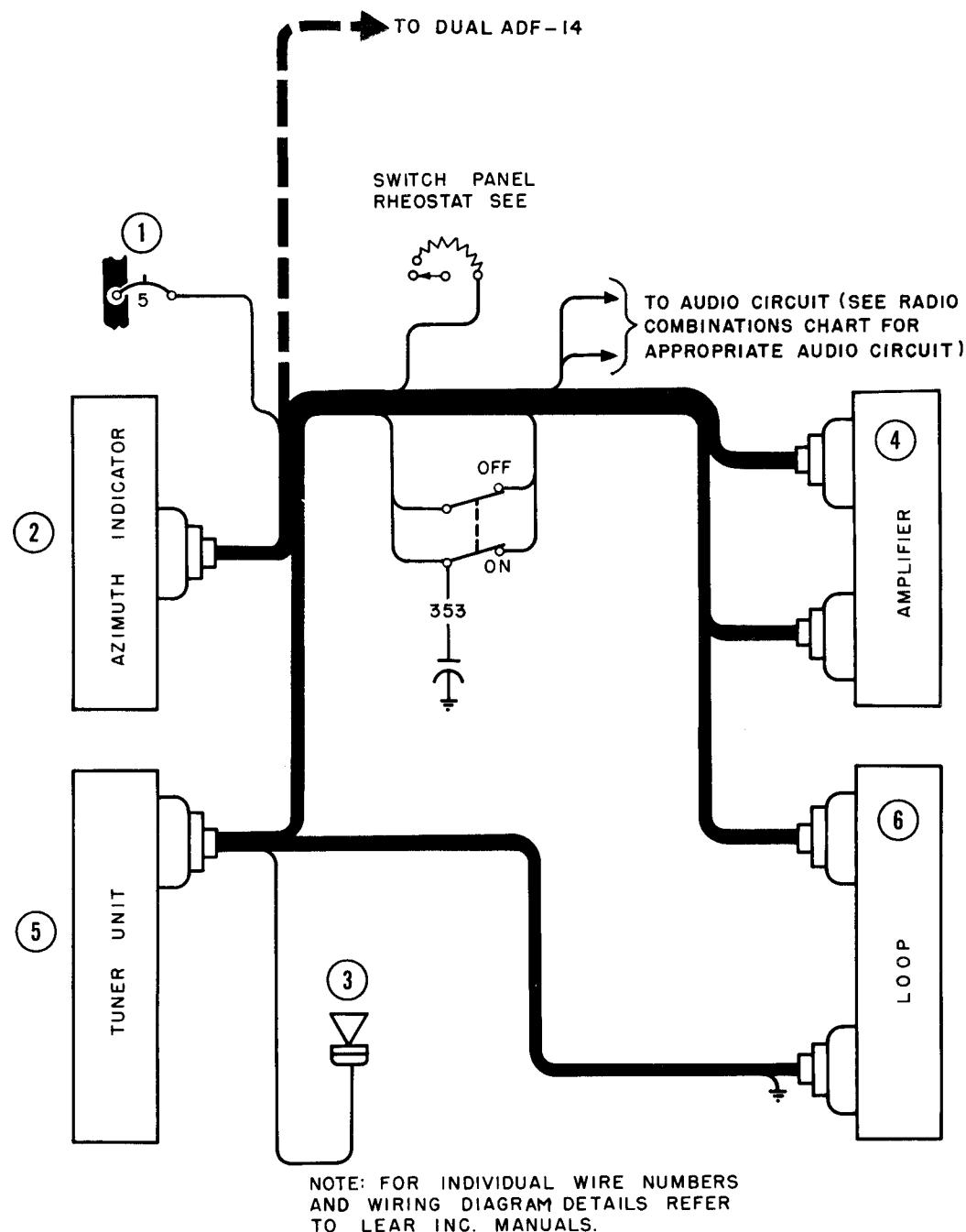


Figure 7-22. ADF-12 No. 2 Circuit (Sheet 2 of 2)



NOTE: CIRCUIT SHOWN IS FOR SINGLE INSTALLATION
OR #1 UNIT OF DUAL INSTALLATION. FOR LOCATION
VIEW, SEE FIGURE 7-21.

Figure 7-23. ADF-14 No. 1 Circuit

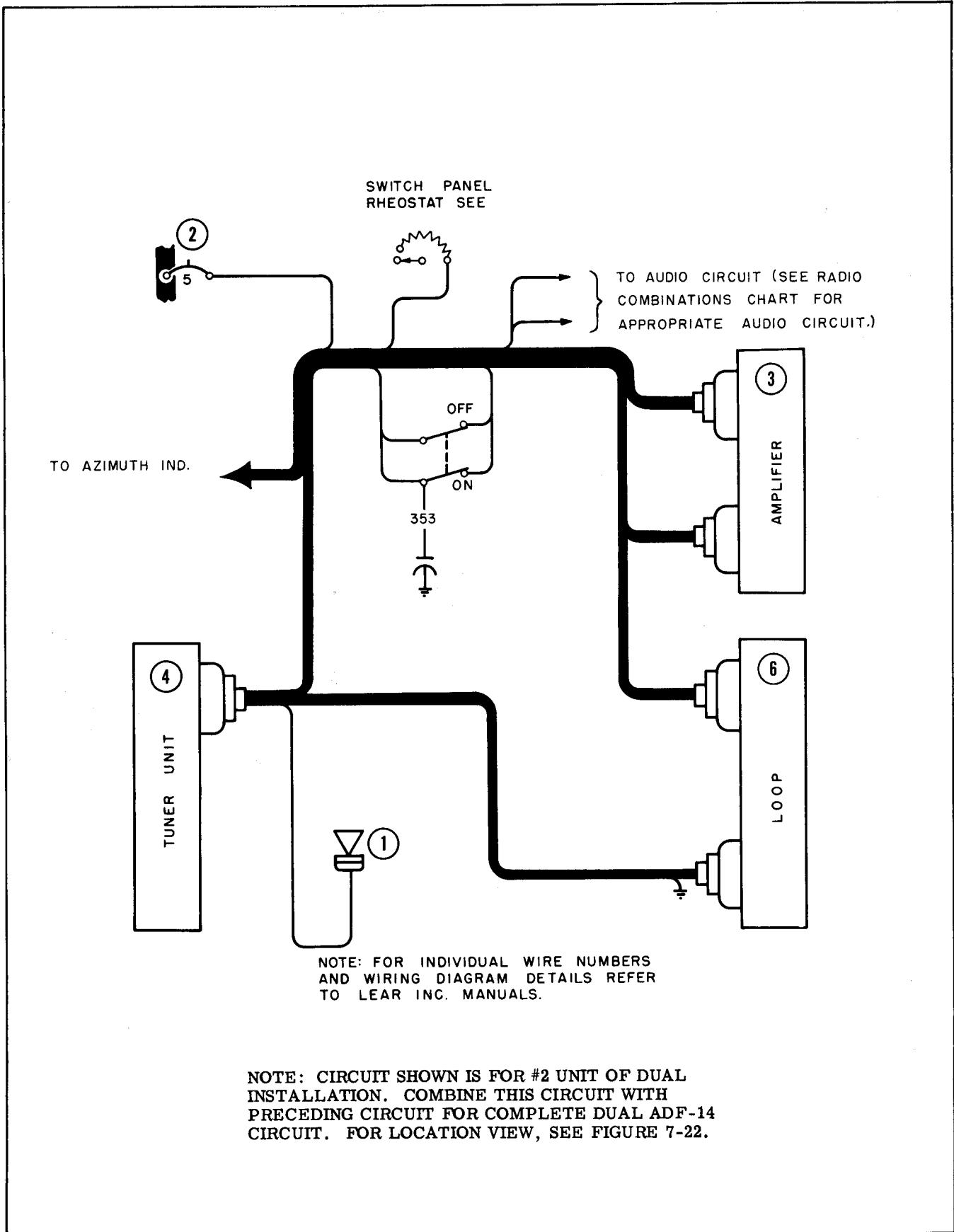
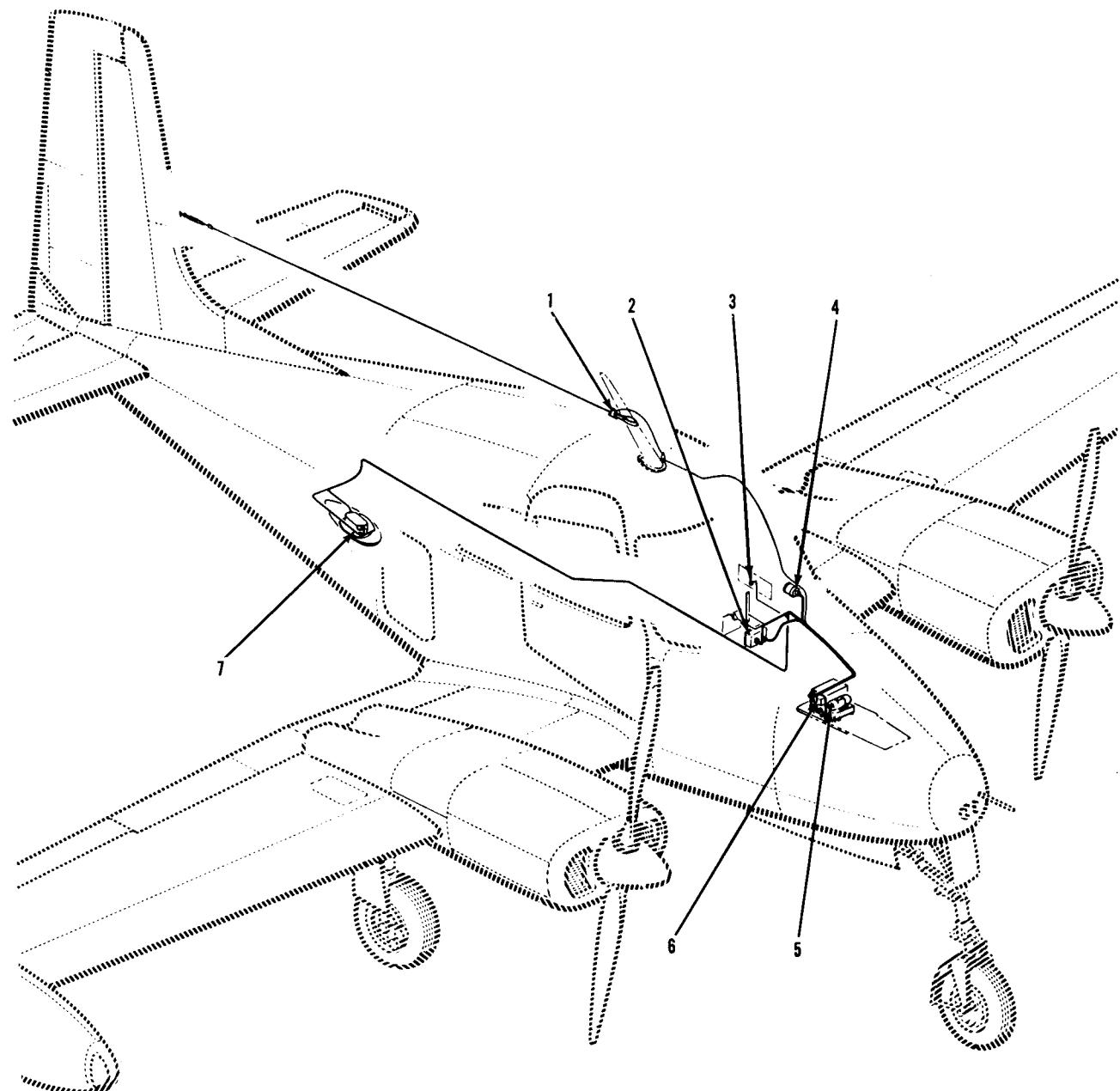


Figure 7-24. ADF-14 No. 2 Circuit



MODELS 310B & 310C

Figure 7-25. ADF-21 Circuit (Sheet 1 of 2)

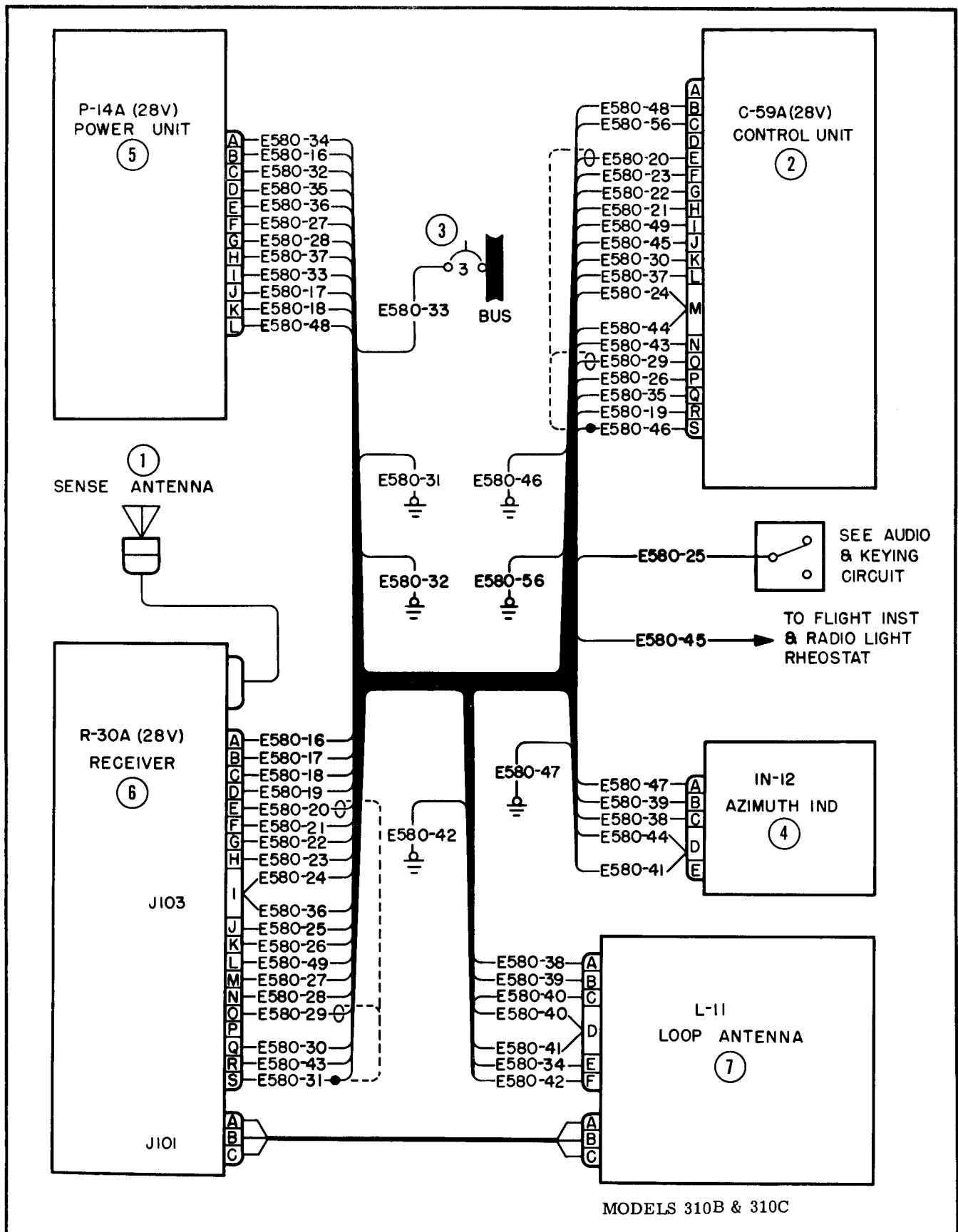
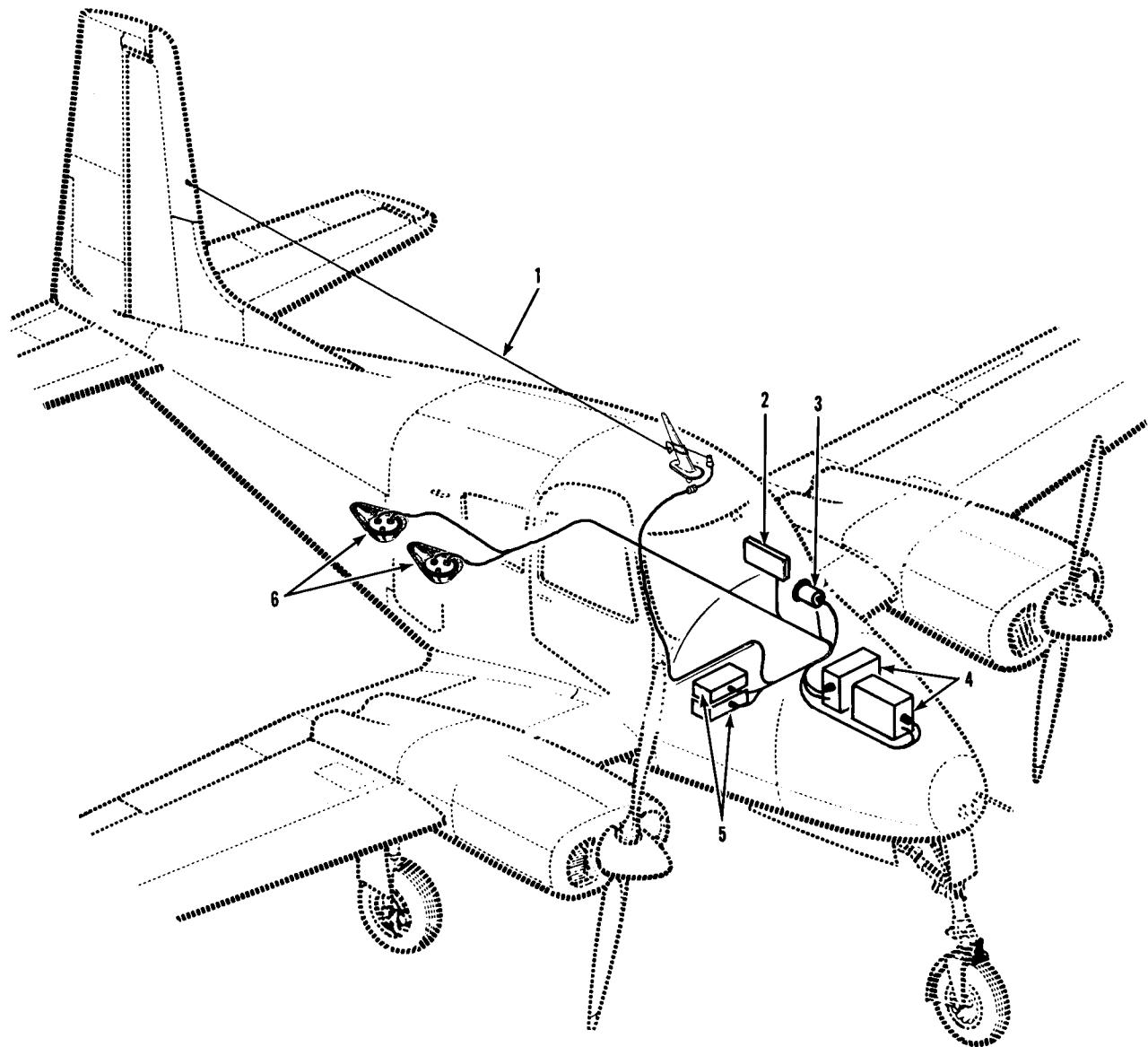


Figure 7-25. ADF-21 Circuits (Sheet 2 of 2)



MODELS 310C & 310D

Figure 7-26. ADF-12E-2 Circuit (Sheet 1 of 2)

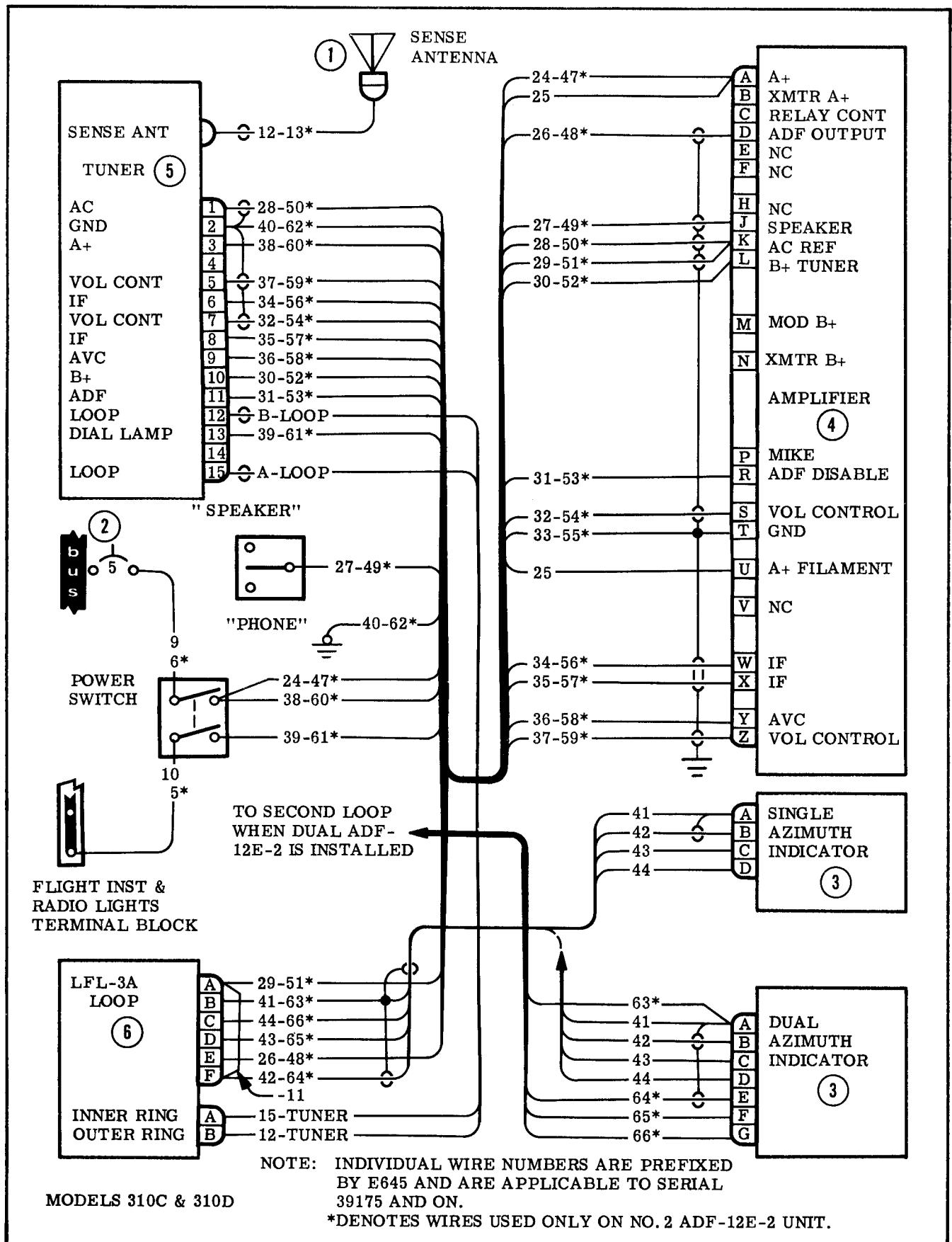


Figure 7-26. ADF-12E-2 Circuit (Sheet 2 of 2)

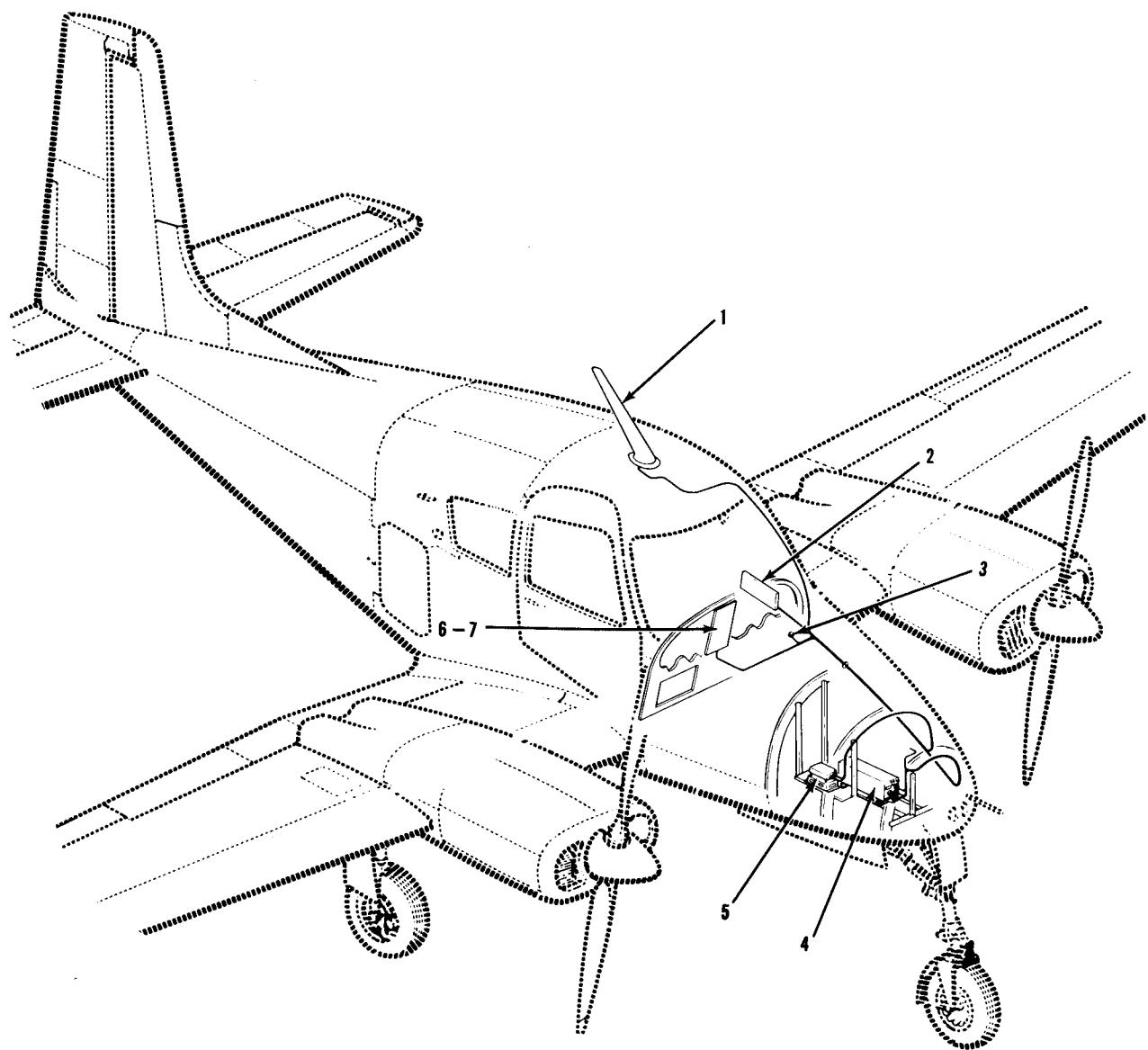


Figure 7-27. RT-11A Transceiver Circuit (Sheet 1 of 2)

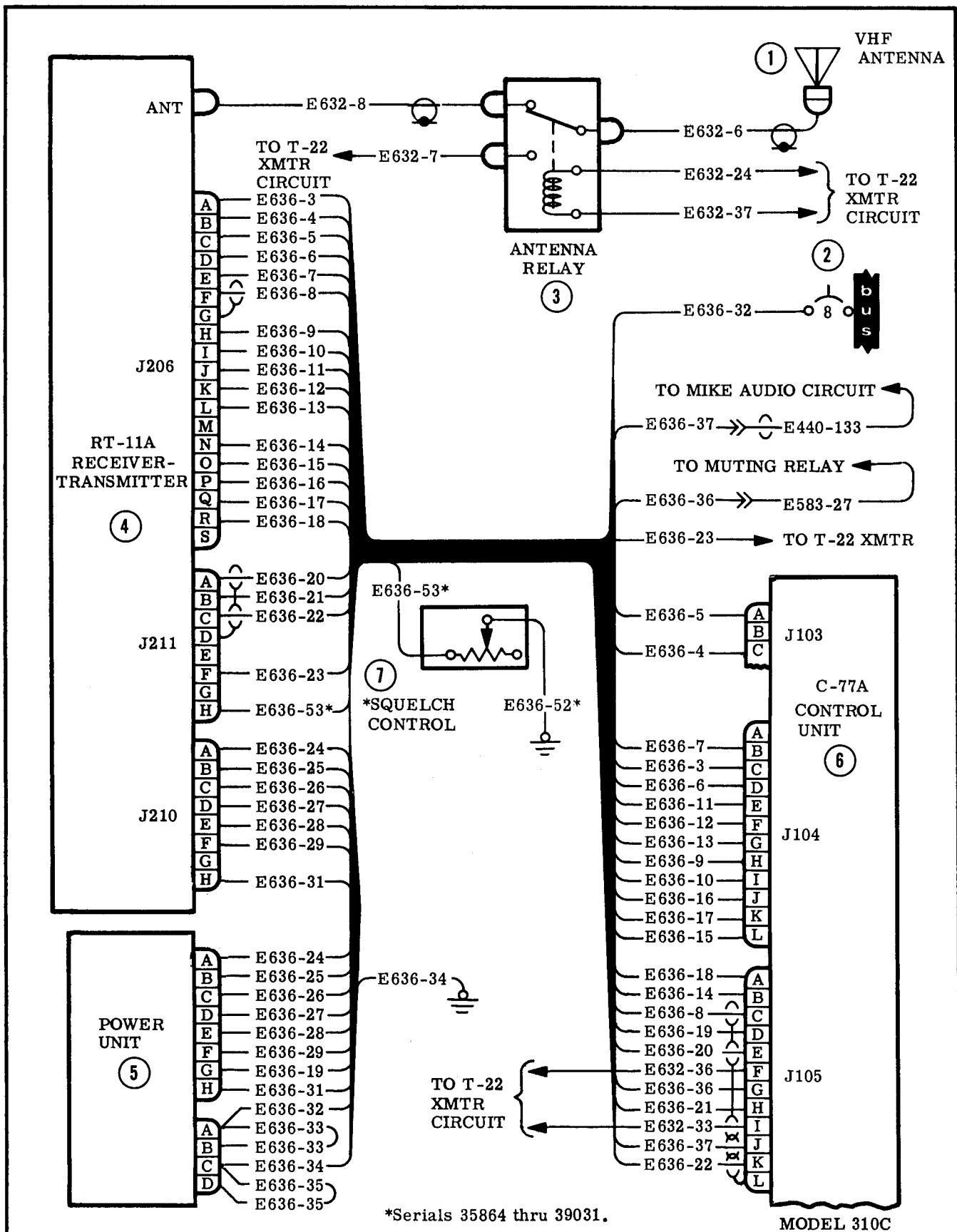


Figure 7-27. RT-11A Receiver-Transmitter Circuit (Sheet 2 of 2)

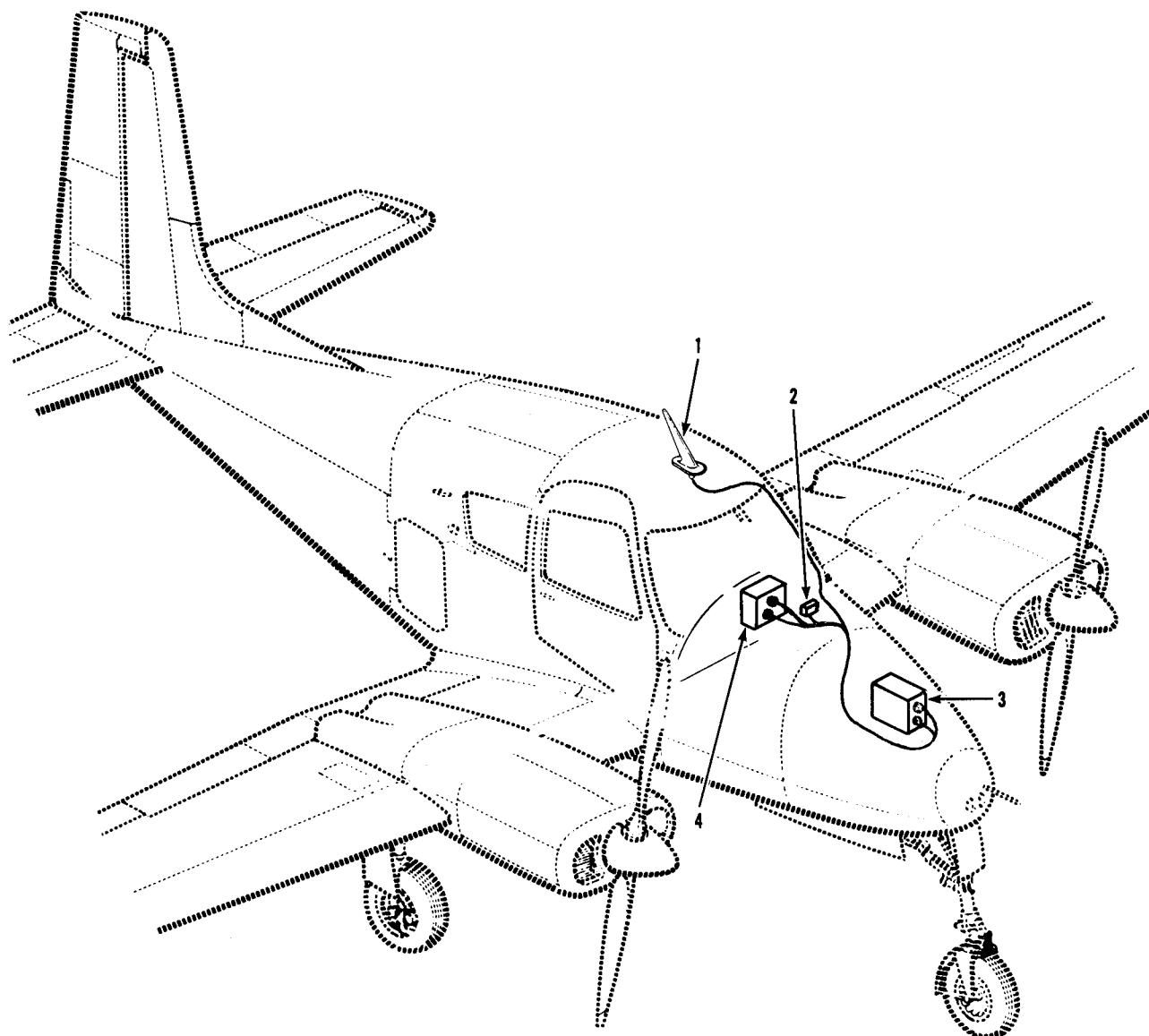


Figure 7-28. T-22 Transmitter Circuit (Sheet 1 of 2)

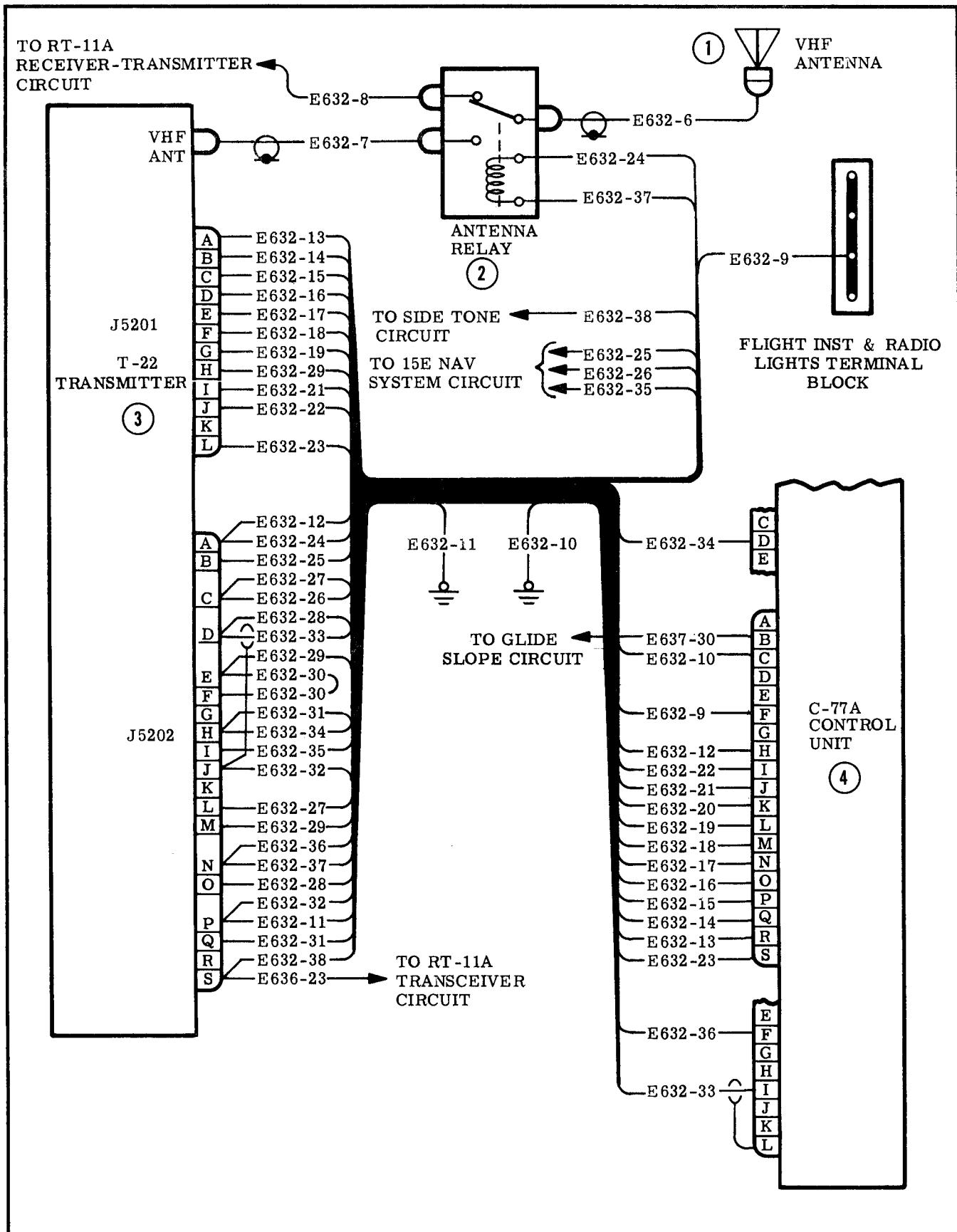


Figure 7-28. T-22 Transmitter Circuit (Sheet 2 of 2)

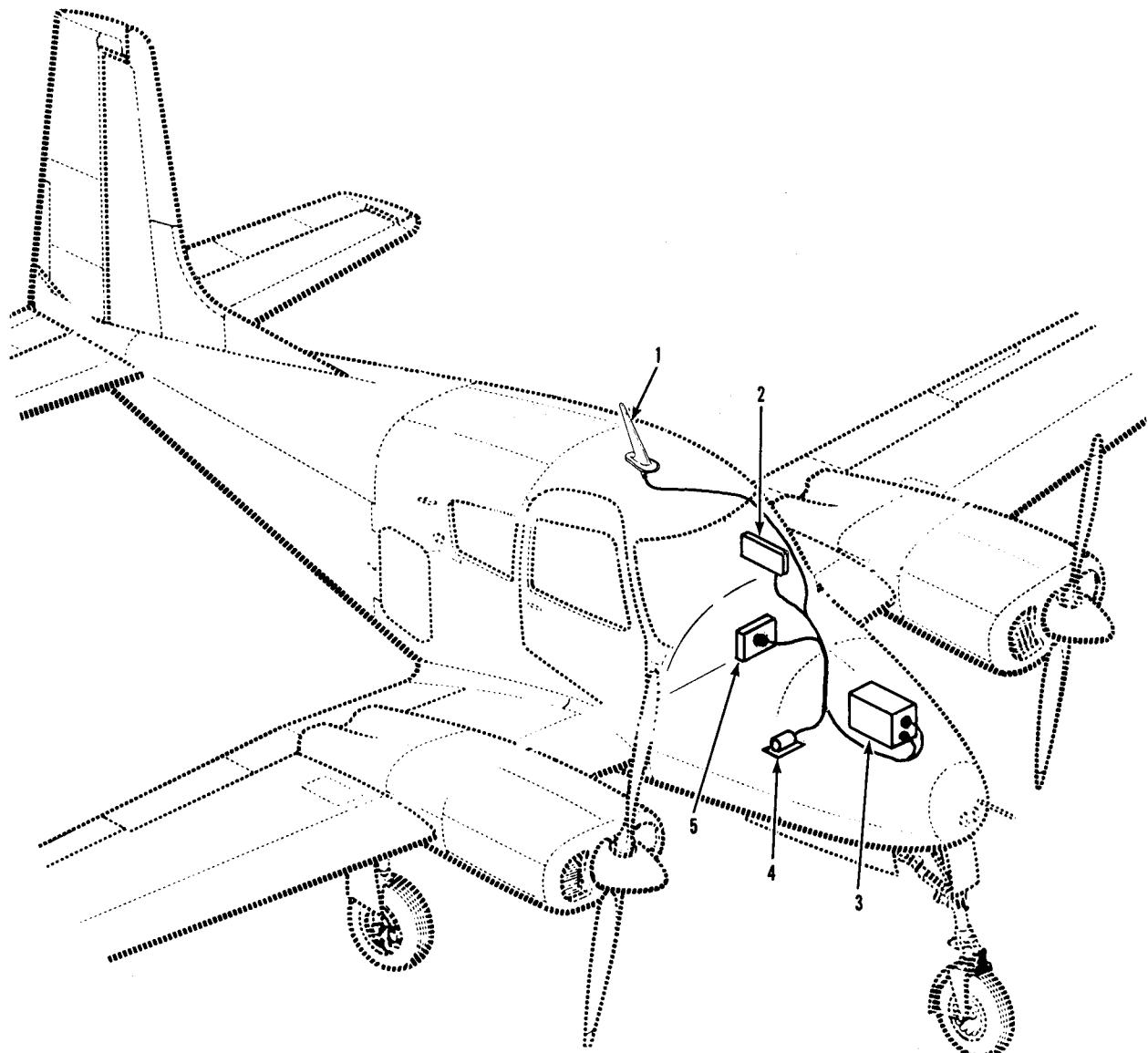


Figure 7-29. T-22 Transmitter Circuit Without Omni (Sheet 1 of 2)

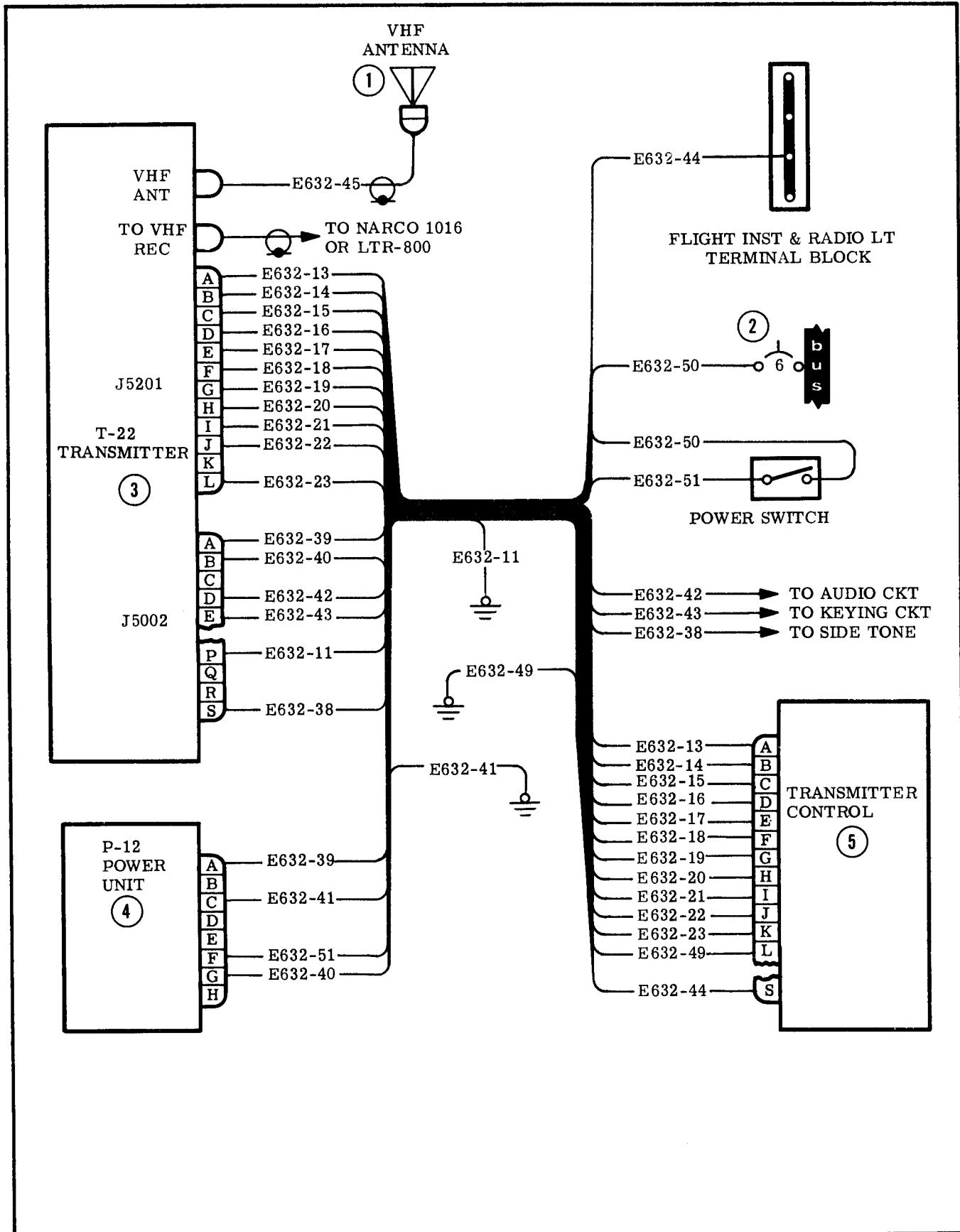


Figure 7-29. T-22 Transmitter Circuit Without Omni (Sheet 2 of 2)

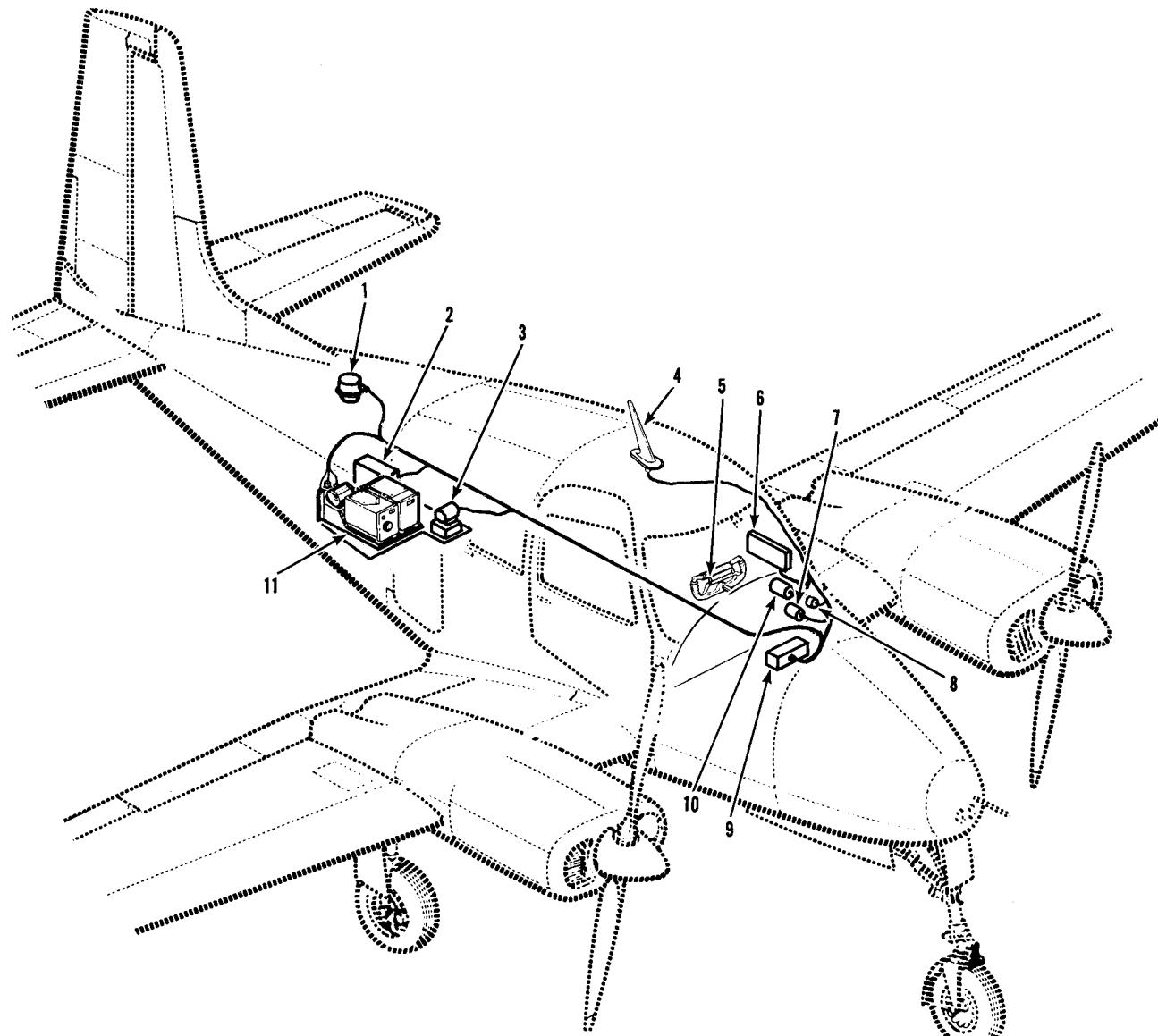


Figure 7-30. CD-1 Course Director Circuit (Sheet 1 of 3)

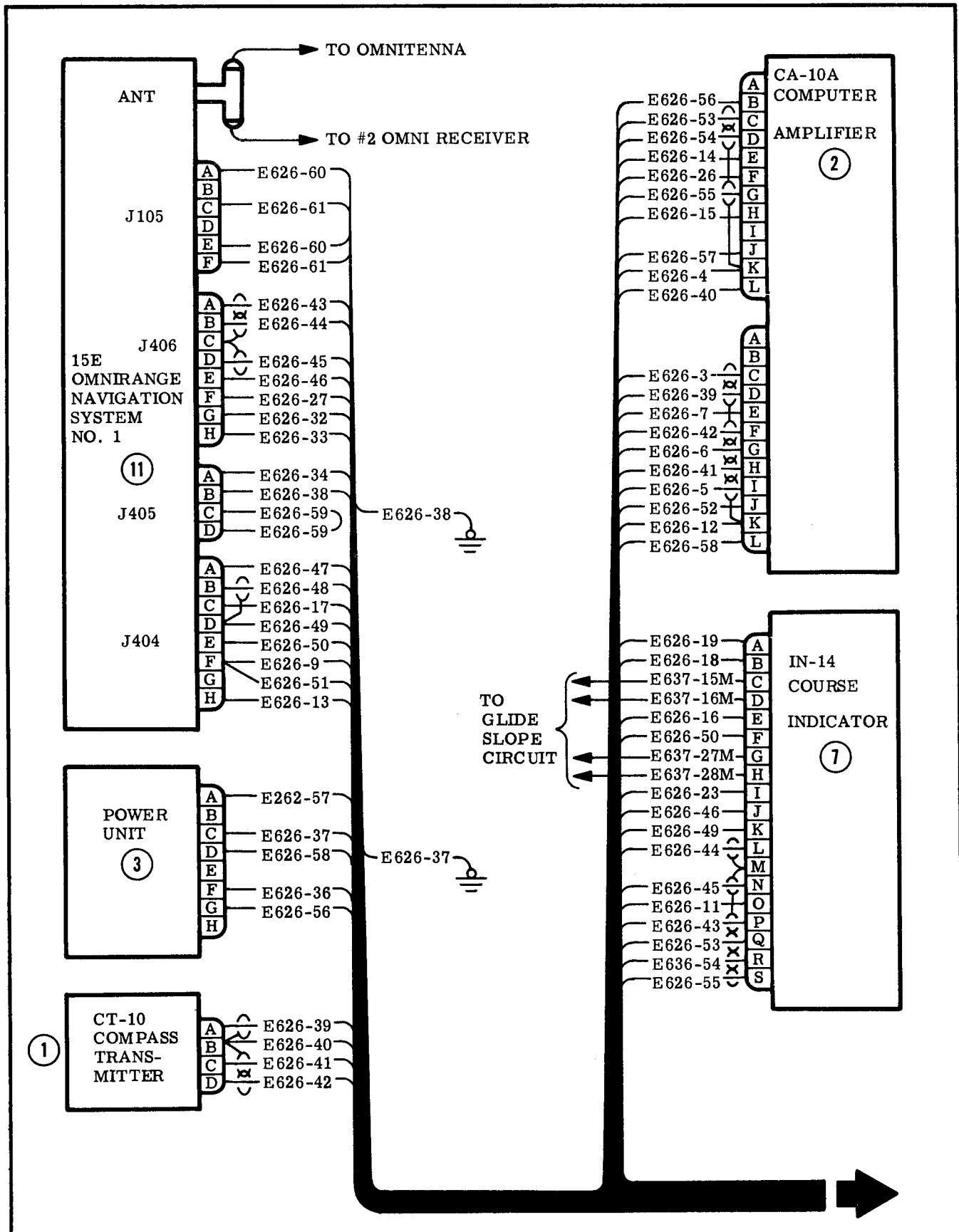


Figure 7-30. CD-1 Course Director Circuit - Model 310C (Sheet 2 of 3)

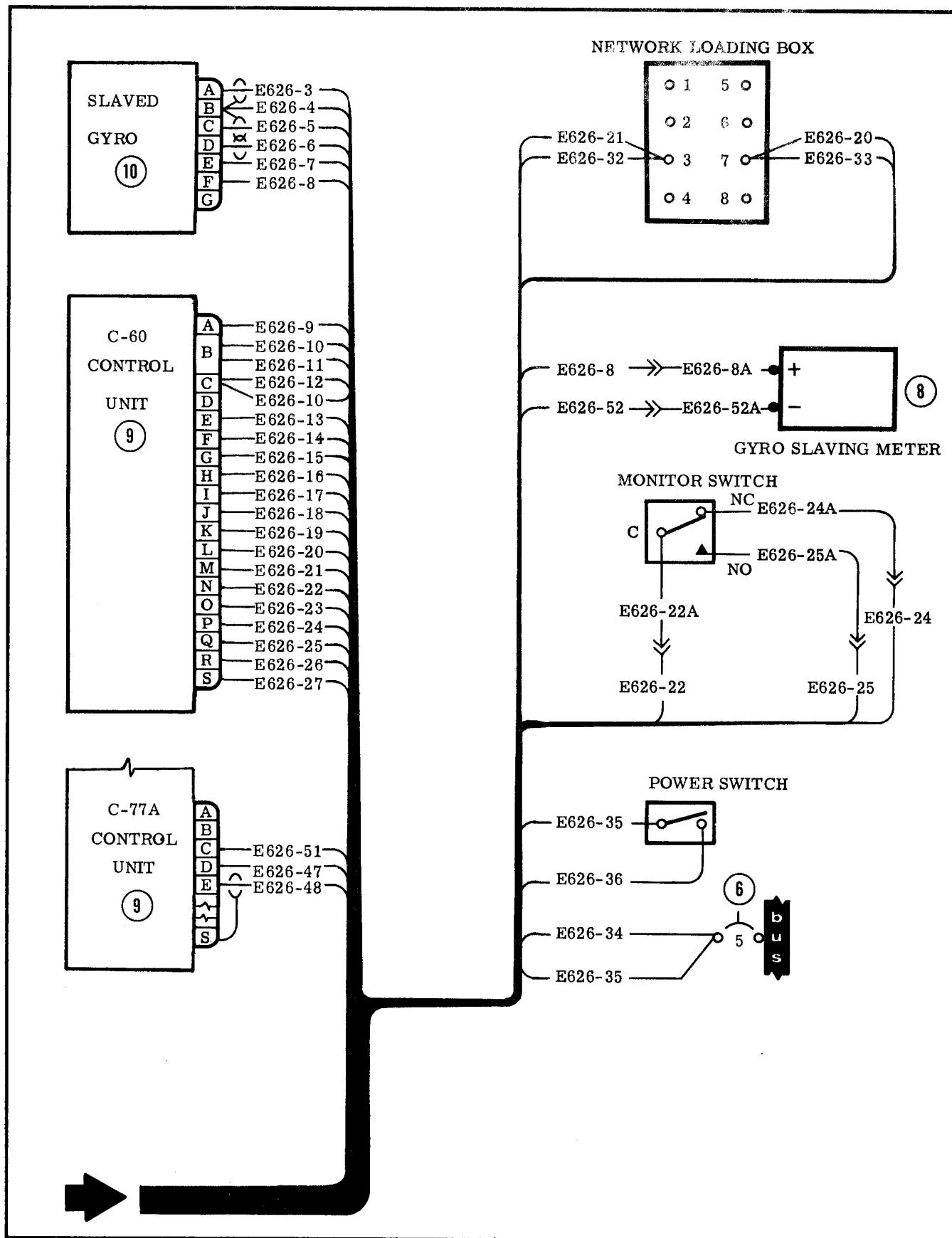


Figure 7-30. CD-1 Course Director - Model 310C (Sheet 3 of 3)

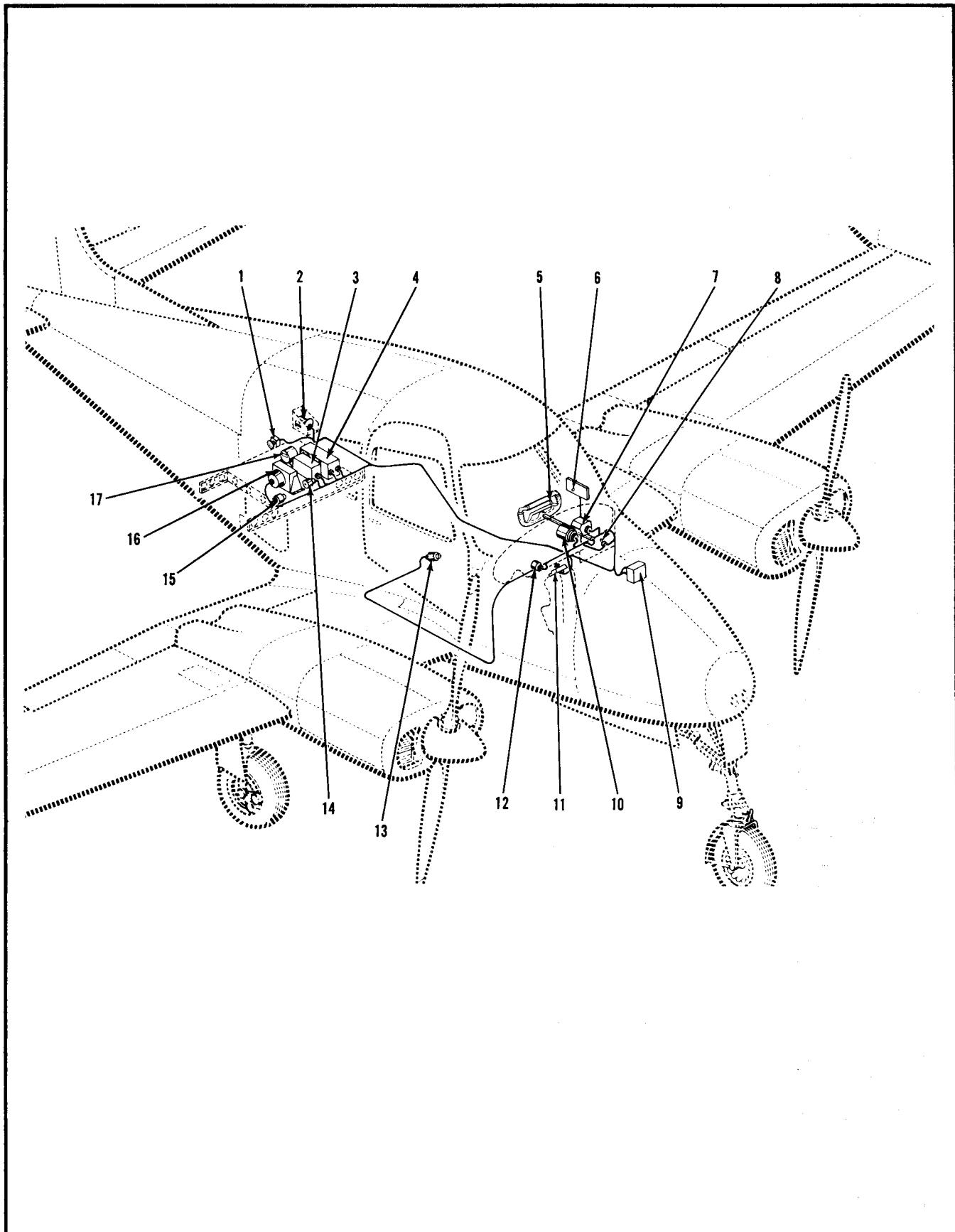


Figure 7-31. L-2 Autopilot Circuit (Sheet 1 of 3)

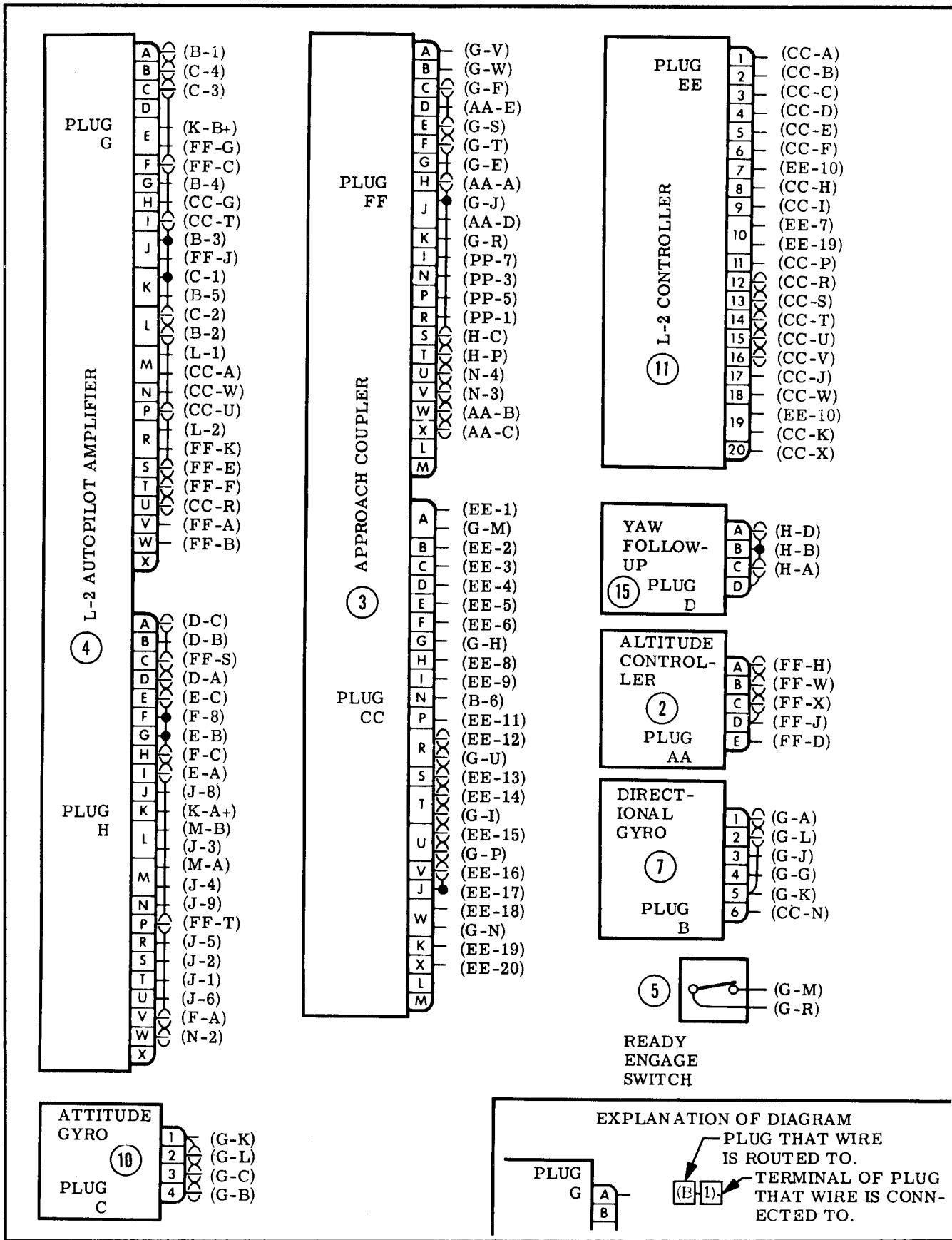


Figure 7-31. L-2 Autopilot Circuit (Sheet 2 of 3)

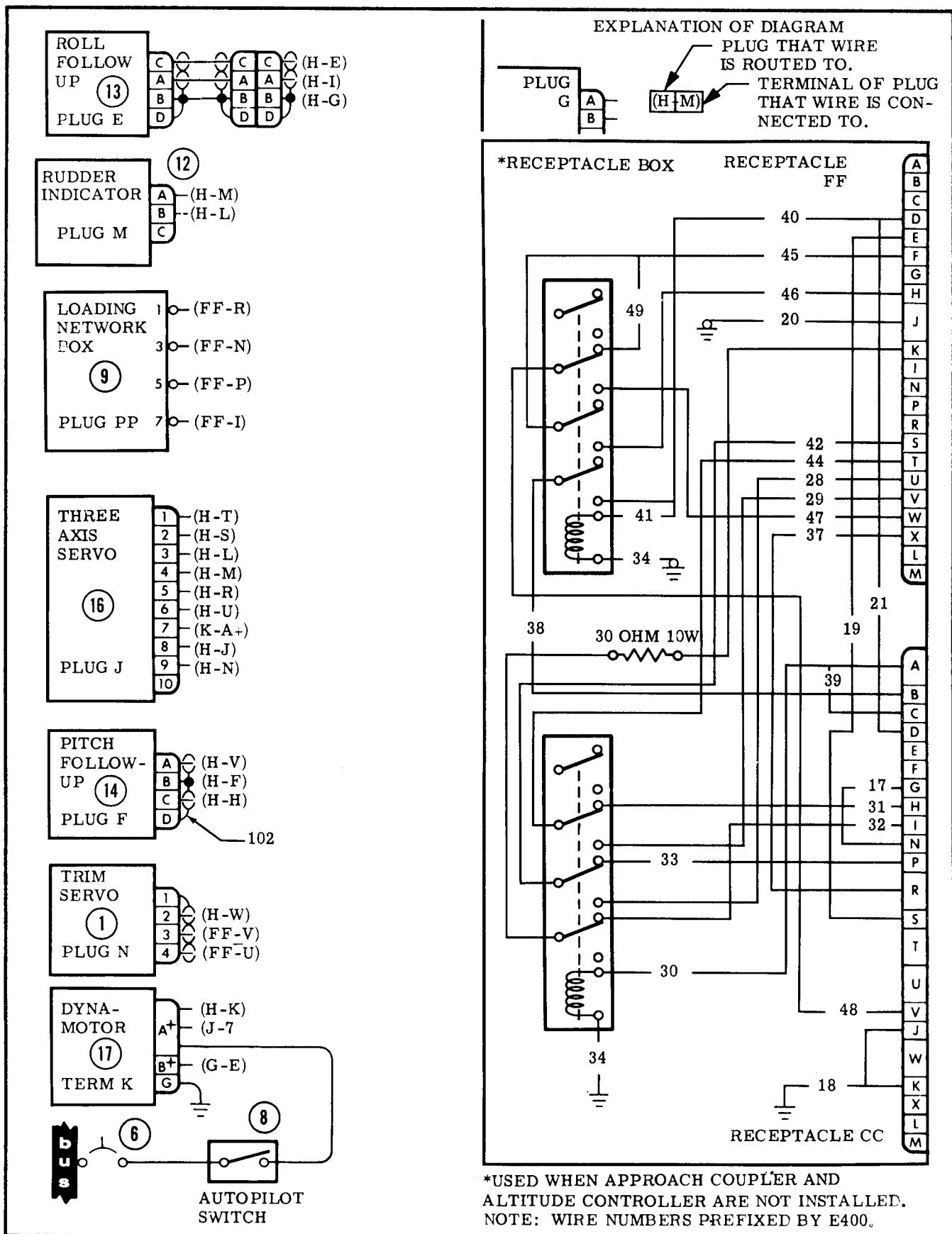
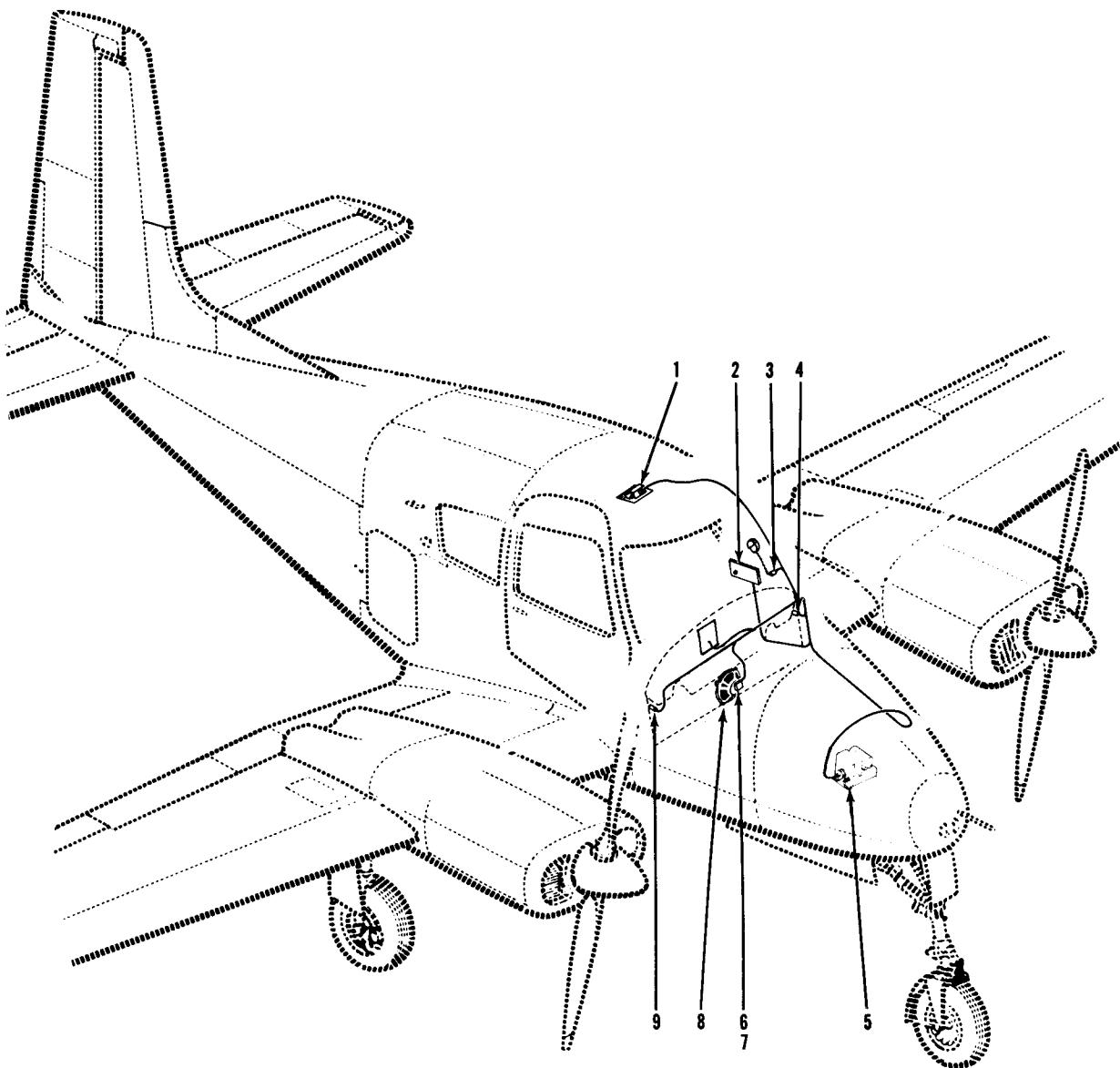


Figure 7-31. L-2 Autopilot Circuit (Sheet 3 of 3)



- 1. Speaker
- 2. Bus and Circuit Breaker
- 3. Mike Jack

- 4. Phone Jack
- 5. Audio Amplifier
- 6. Relay

- 7. Transformer
- 8. Speaker
- 9. Phone Jack

Figure 7-32. Audio and Interconnecting Circuits

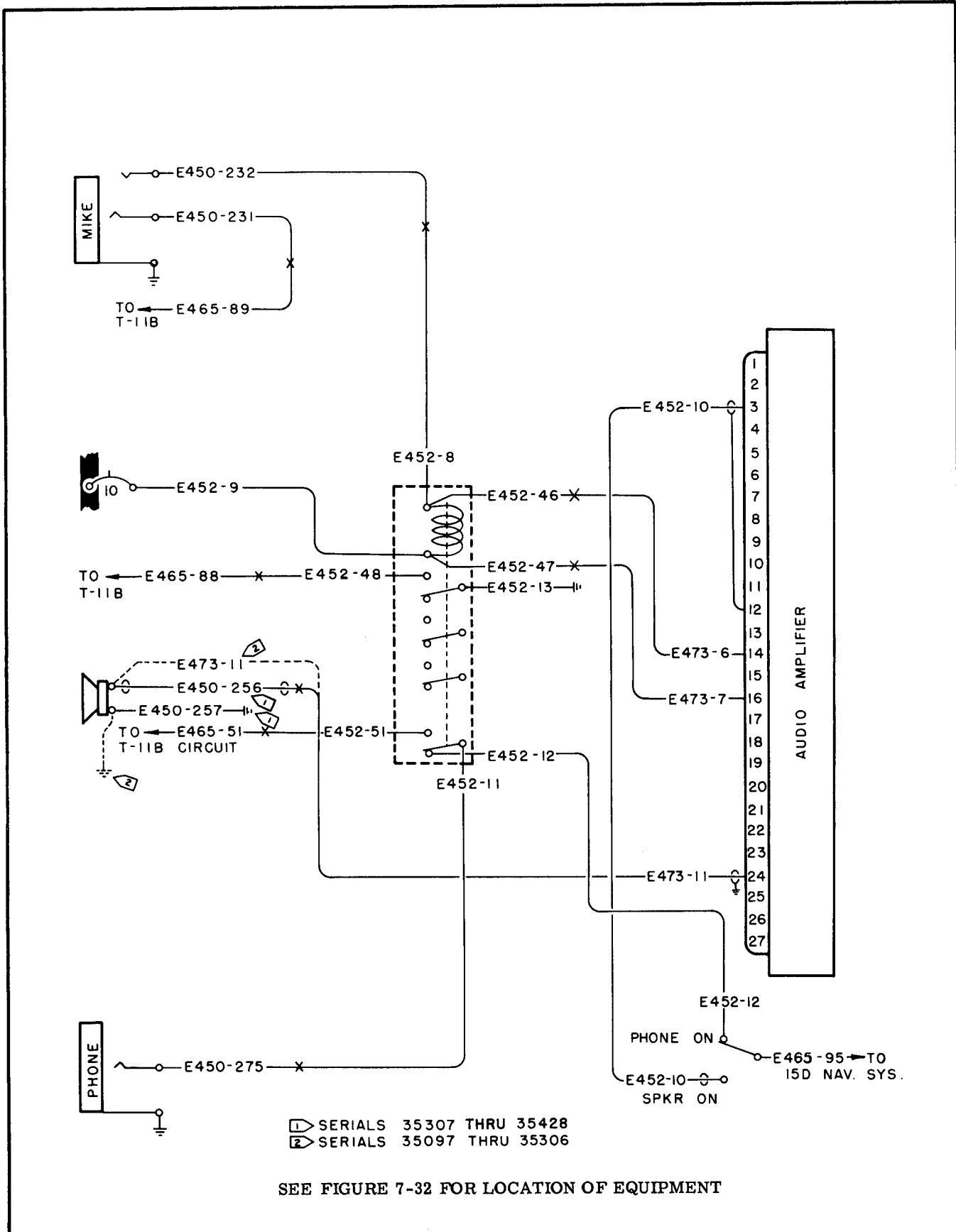
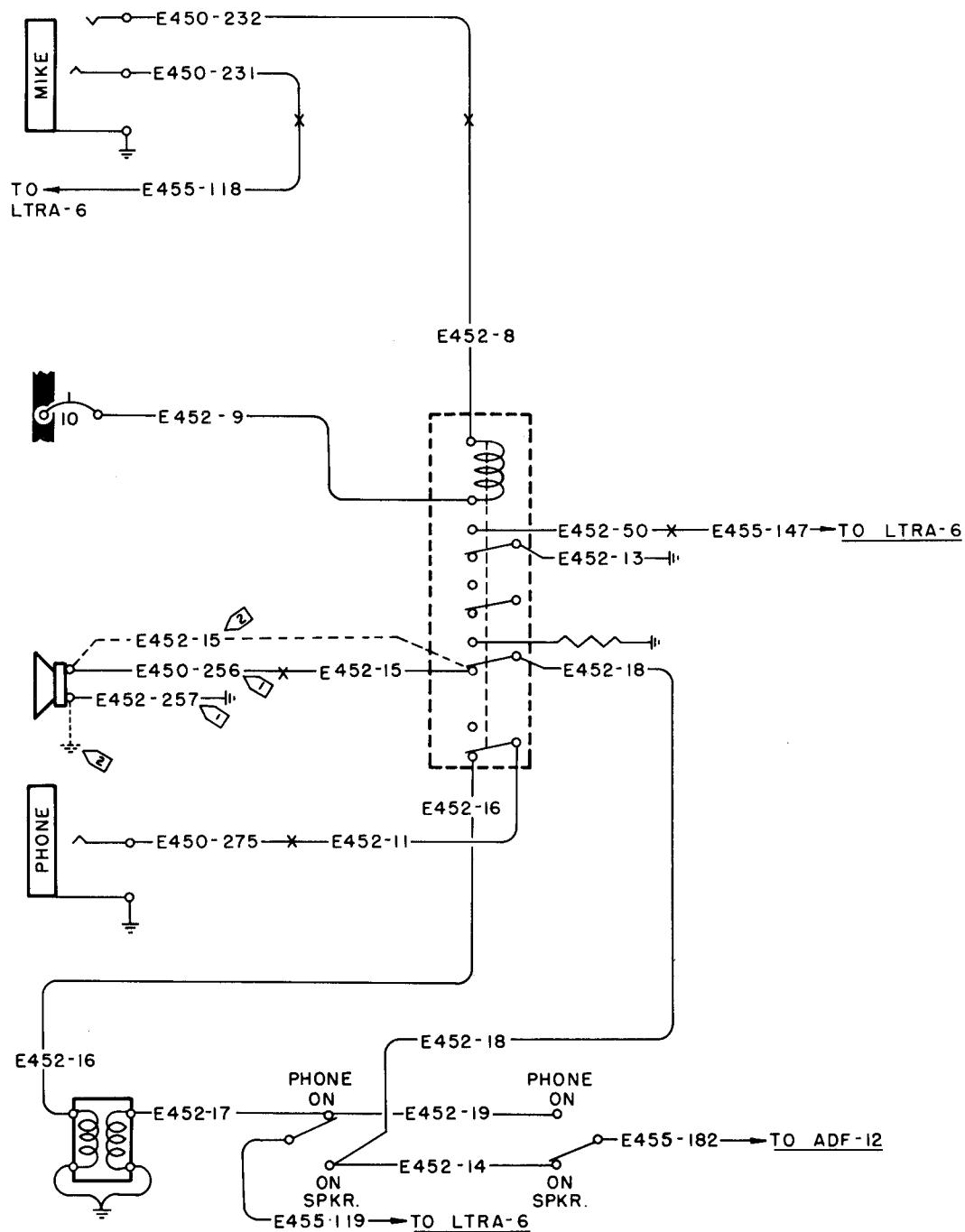


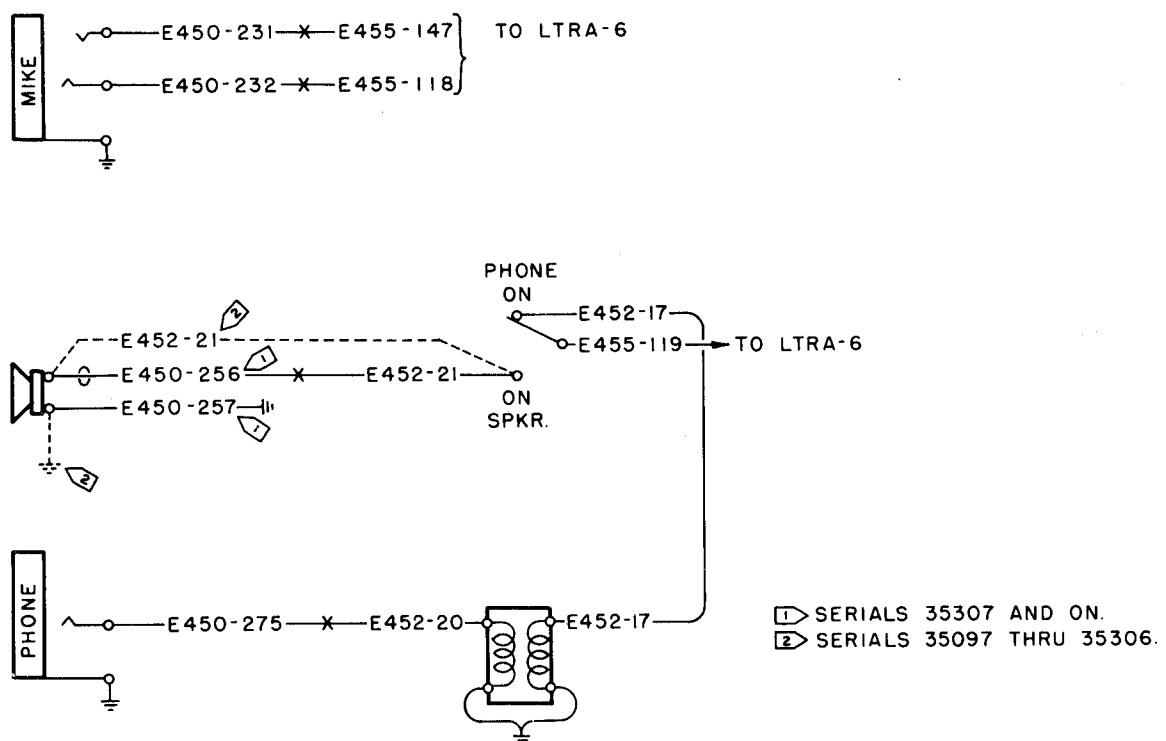
Figure 7-33. Audio and Interconnecting Circuit #E452-1



① SERIALS 35307 AND ON.
 ② SERIALS 35097 THRU 35306.

SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-34. Audio and Interconnecting Circuit #E452-2

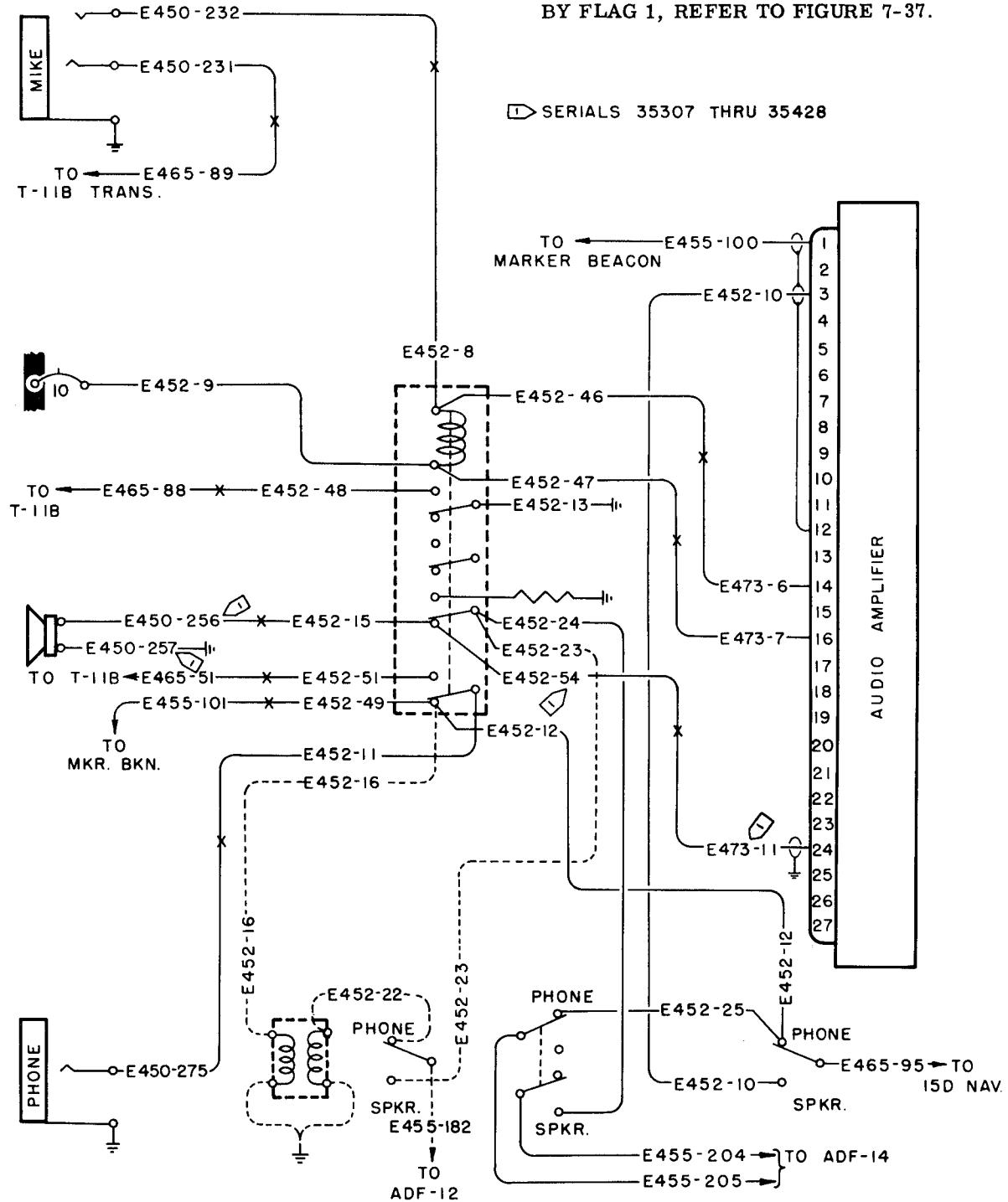


SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-35. Audio and Interconnecting Circuit #E452-3

SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

NOTE: FOR DETAILS OF WIRING INSTALLED PRIOR TO SERIALS SHOWN BY FLAG 1, REFER TO FIGURE 7-37.



NOTE: DOTTED PORTION OF CIRCUIT SHOWS WIRING USED WHEN ADF-12 REPLACES ADF-14.

NOTE: AUDIO CIRCUIT #4 SHOWN.
AUDIO CIRCUIT #5 SAME AS #4 EXCEPT
ADF-12 USED IN PLACE OF ADF-14.

Figure 7-36. Audio and Interconnecting Circuits #E452-4 and -5

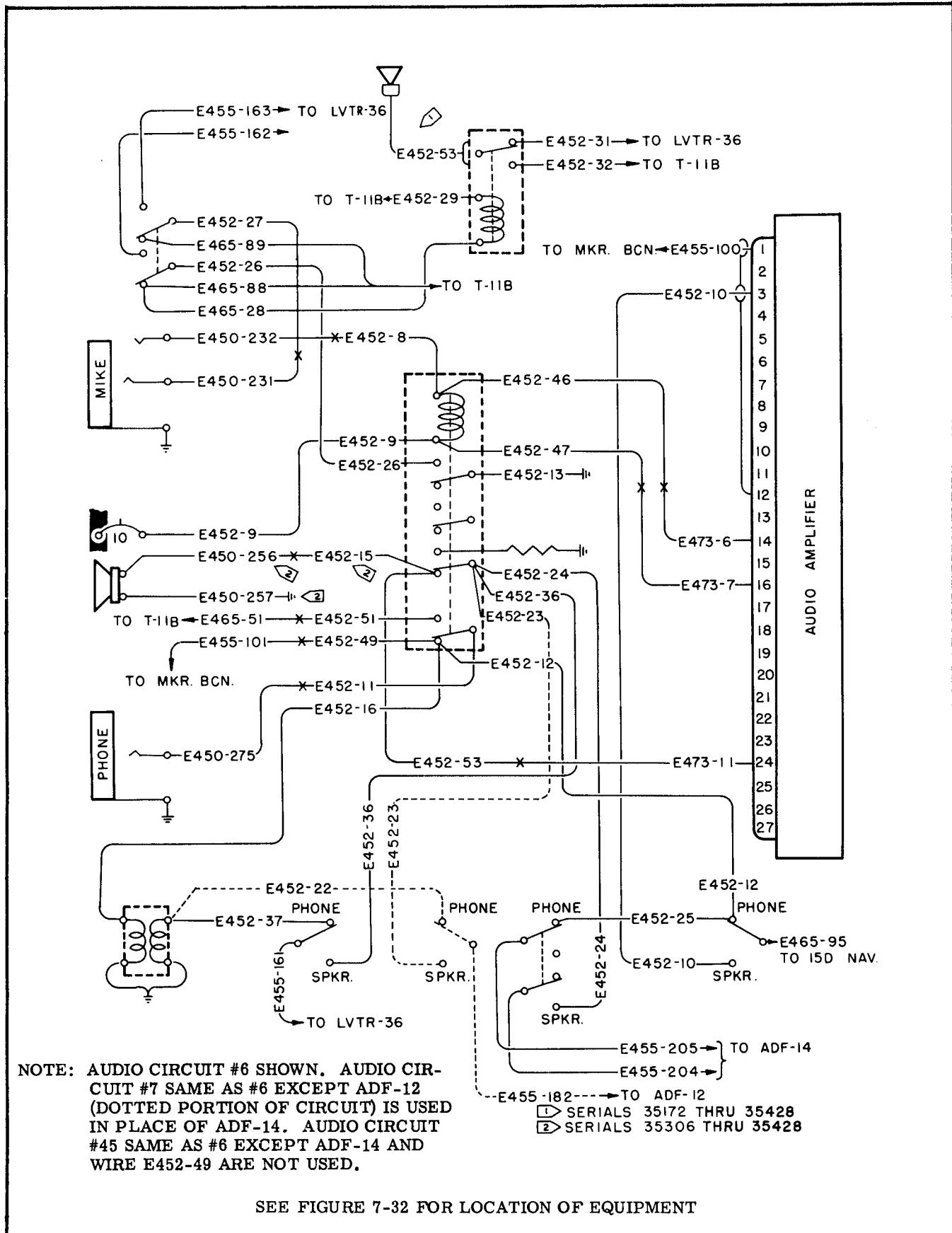
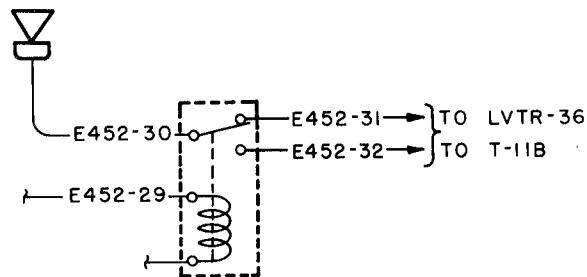
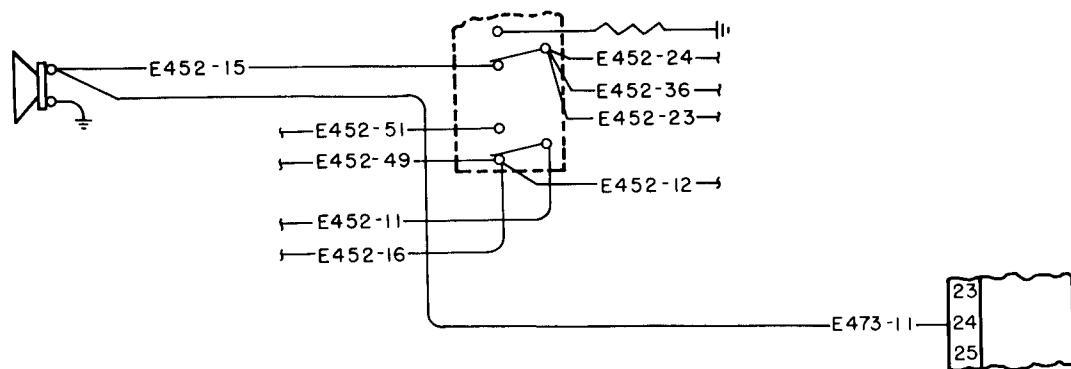


Figure 7-37. Audio and Interconnecting Circuits #E452-6, -7 and -45 (Sheet 1 of 2)



SERIALS 35097 THRU 35171



SERIALS 35097 THRU 35306

SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-37. Audio and Interconnecting Circuits #E452-6, -7 and -45 (Sheet 2 of 2)

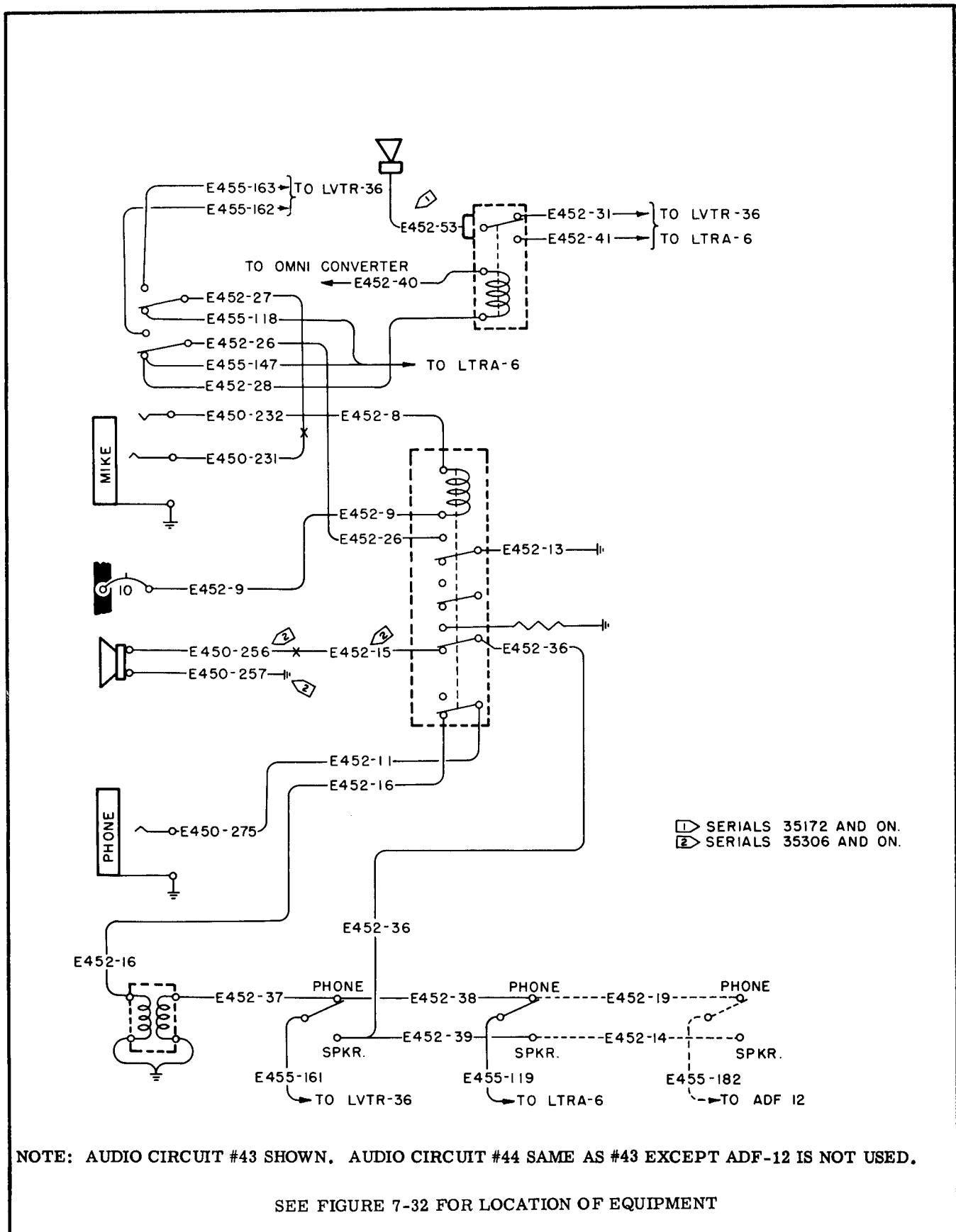
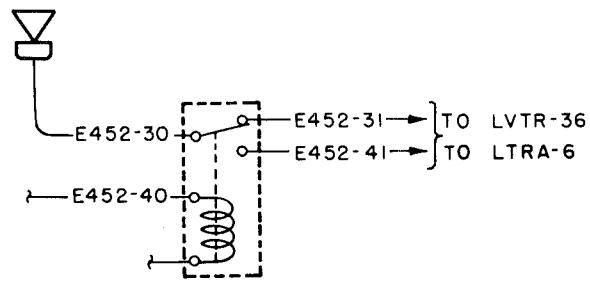
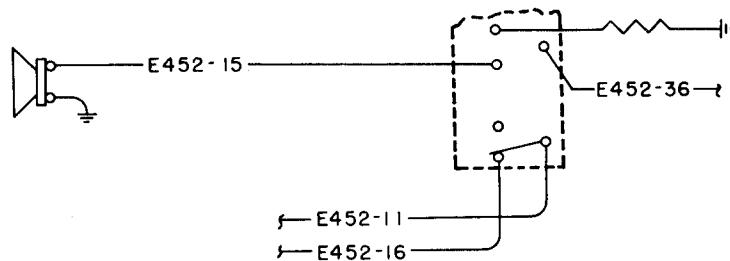


Figure 7-38. Audio and Interconnecting Circuits #E452-43 and -44 (Sheet 1 of 2)



SERIALS 35097 THRU 35171



SERIALS 35097 THRU 35306

Figure 7-38. Audio and Interconnecting Circuits #E452-43 and -44 (Sheet 2 of 2)

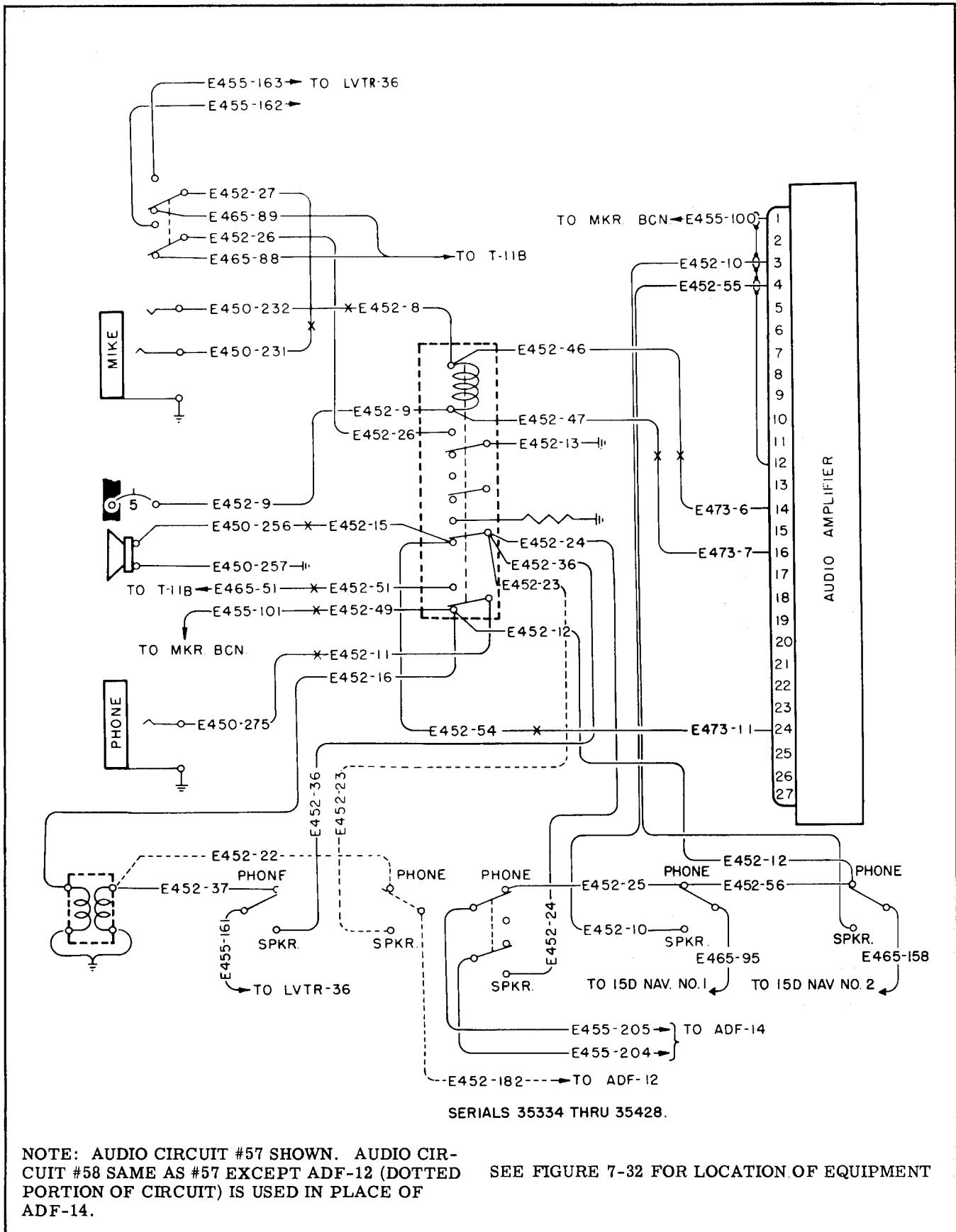
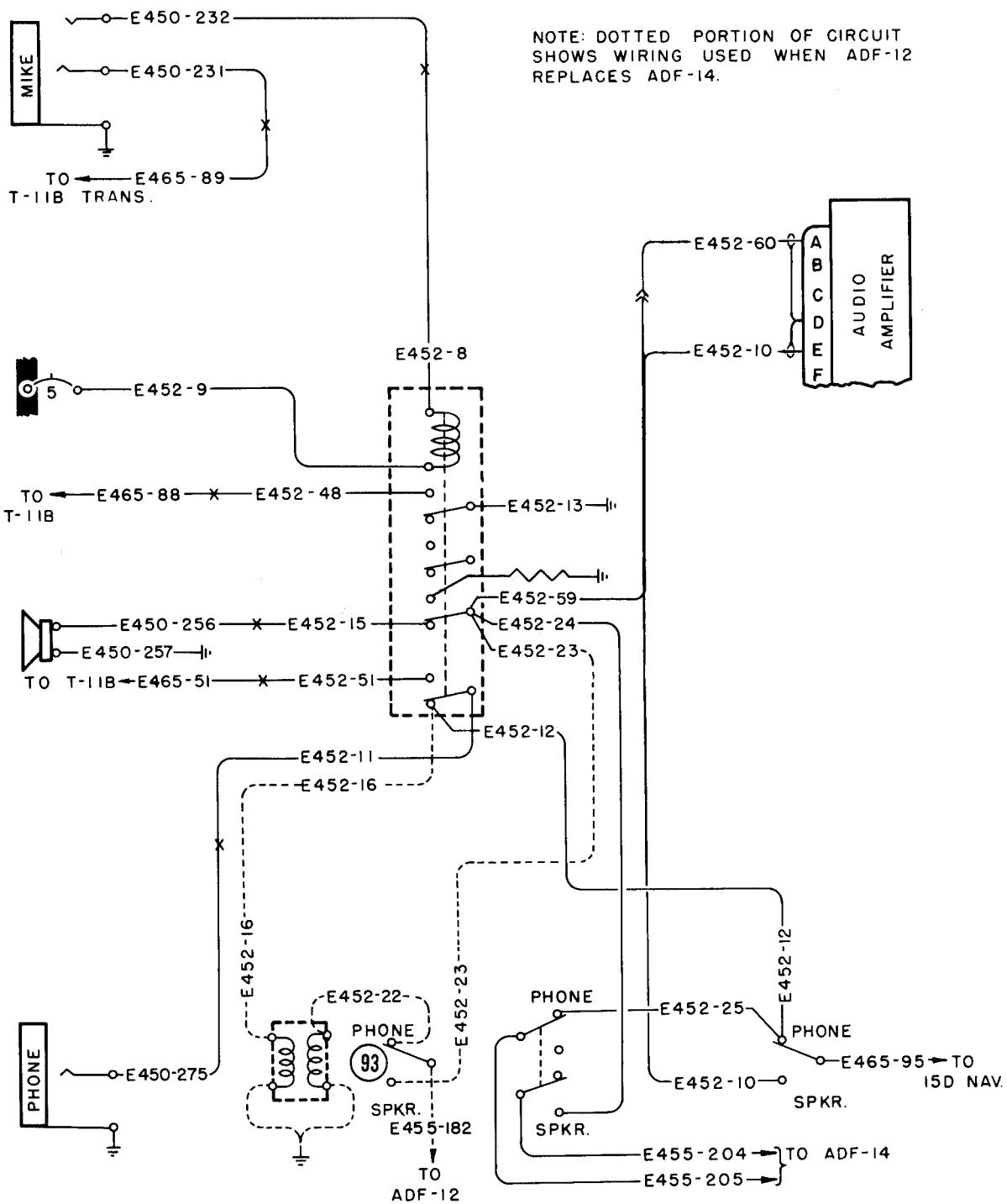


Figure 7-39. Audio and Interconnecting Circuits #E452-57 and -58



SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-40. Audio and Interconnecting Circuits #E452-63, -64 and -65

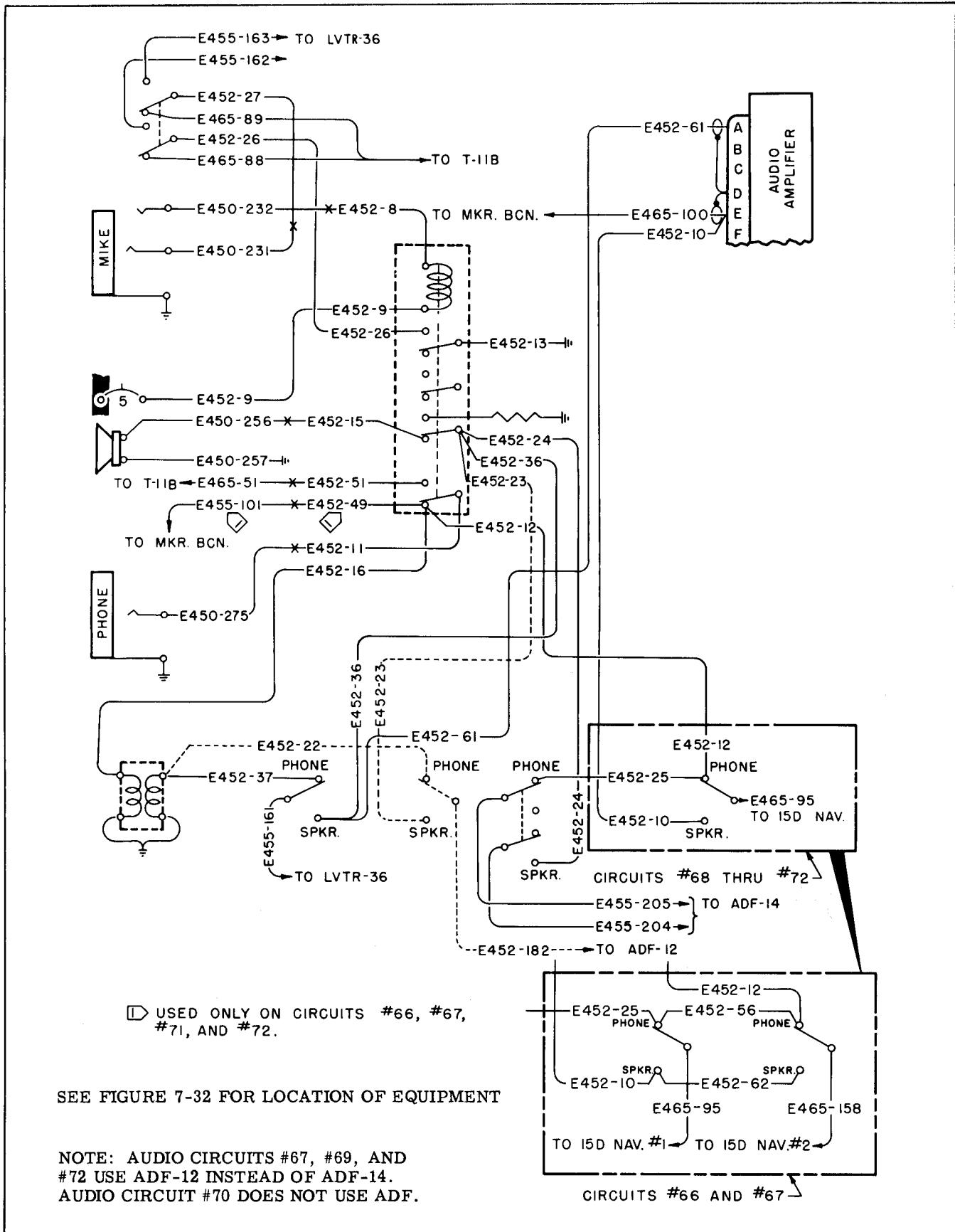


Figure 7-41. Audio and Interconnecting Circuits #E452-66 thru -72

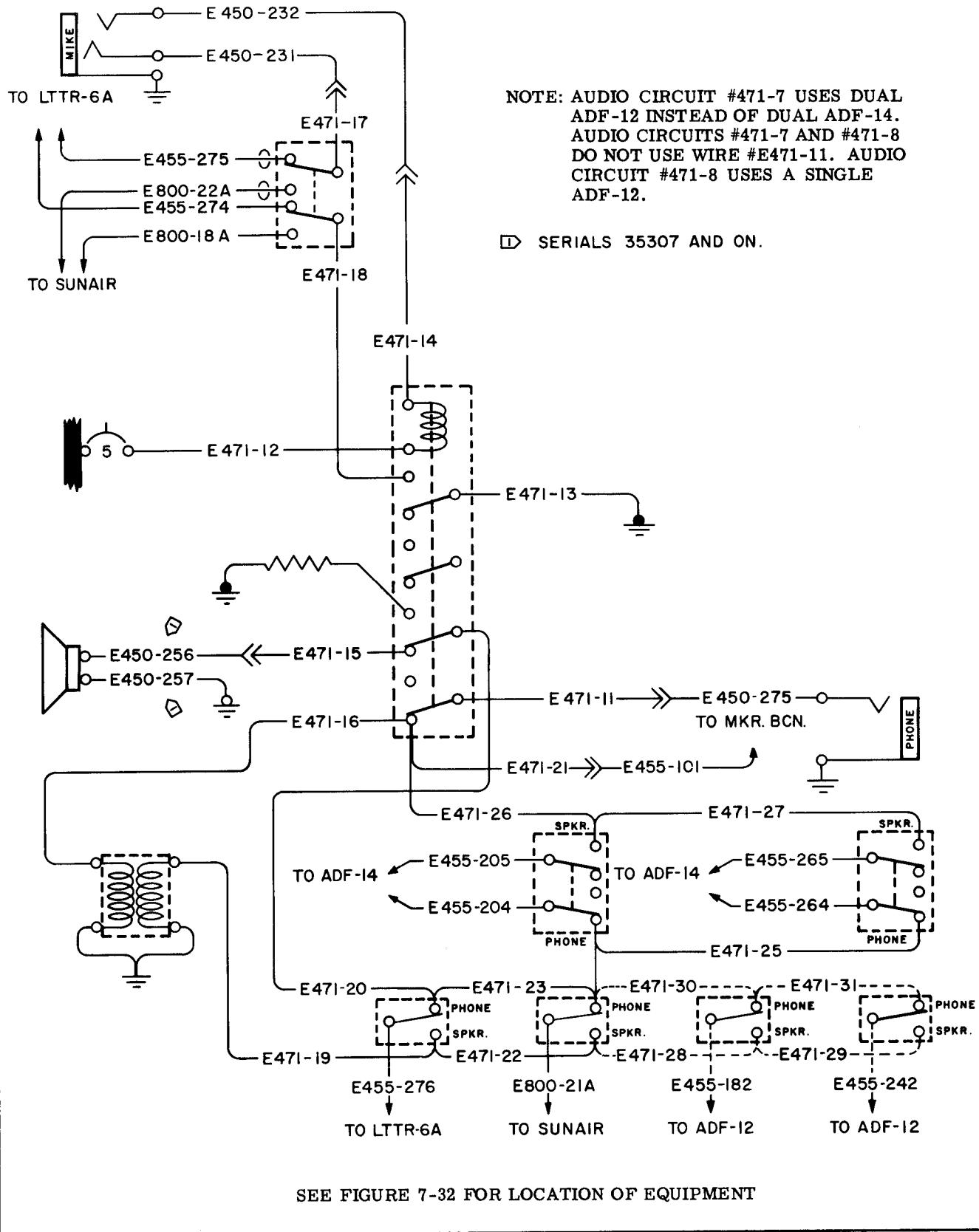


Figure 7-42. Audio and Interconnecting Circuits #E471-2, -7 and -8

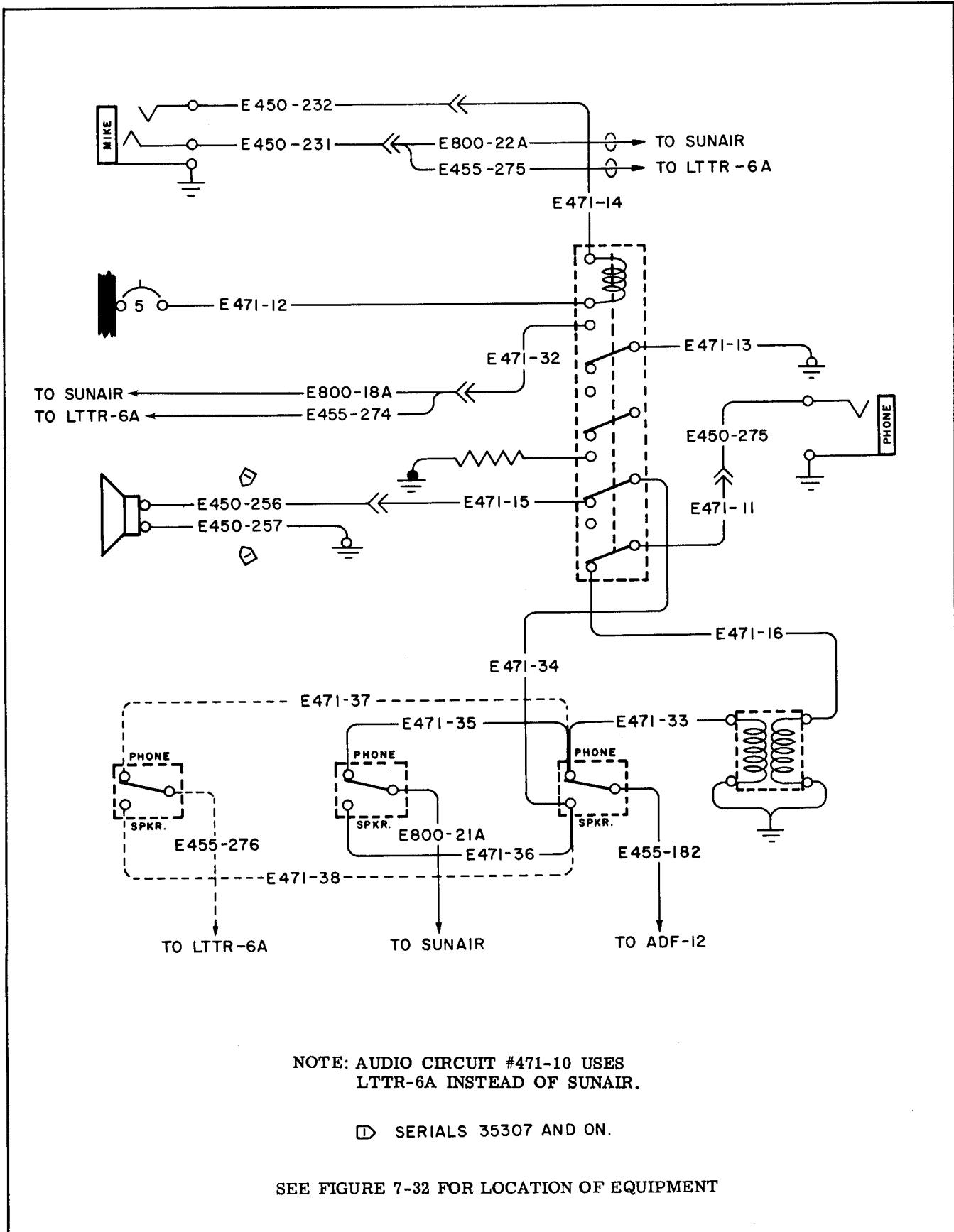
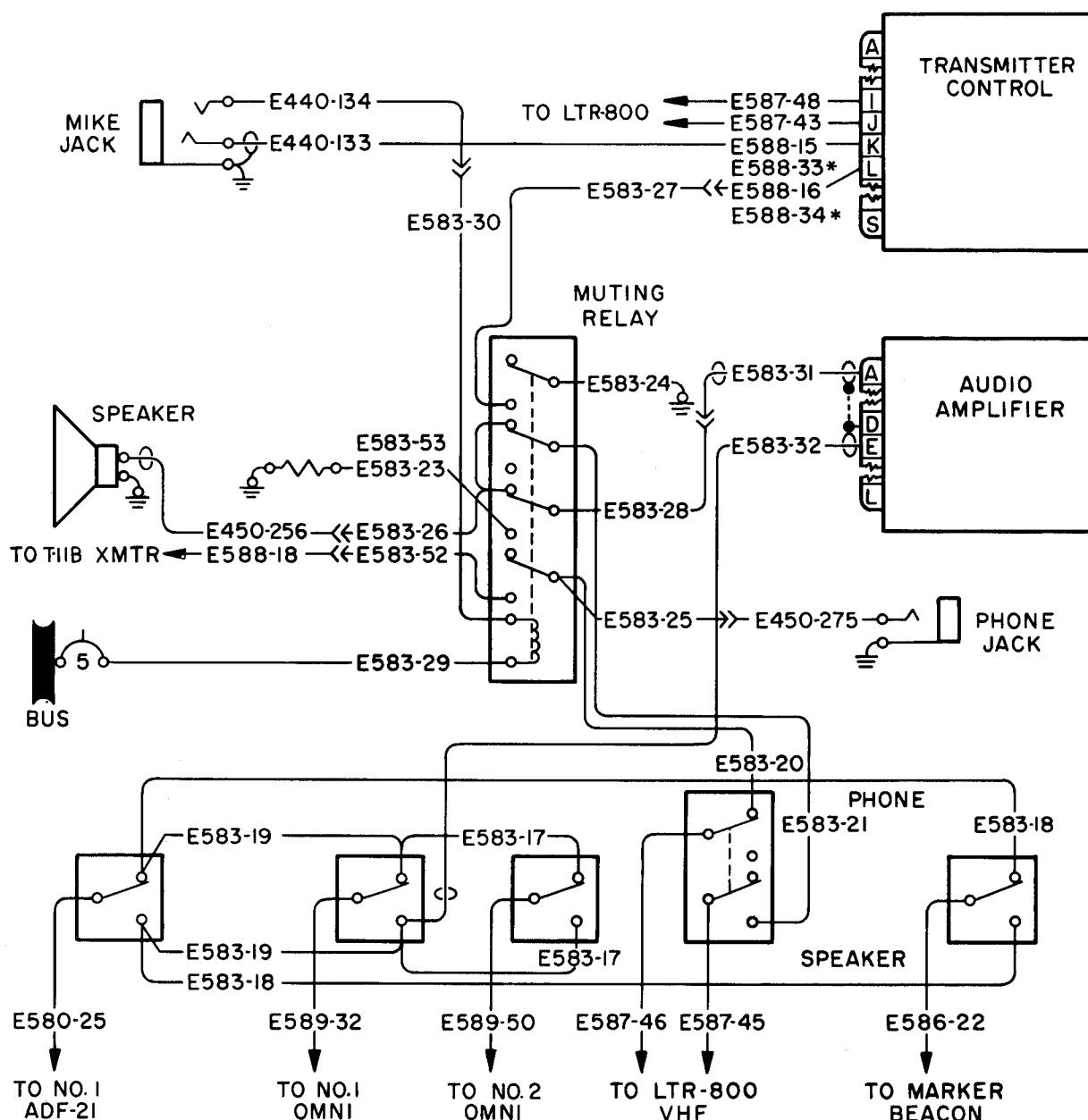


Figure 7-43. Audio and Interconnecting Circuits #E471-9 and -10



* USED WHEN UNIT IS MOUNTED IN ALTERNATE POSITION ON
RIGHT HAND SIDE OF INSTRUMENT PANEL.

SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-44. Audio and Interconnecting Circuits #E583-2 thru -5

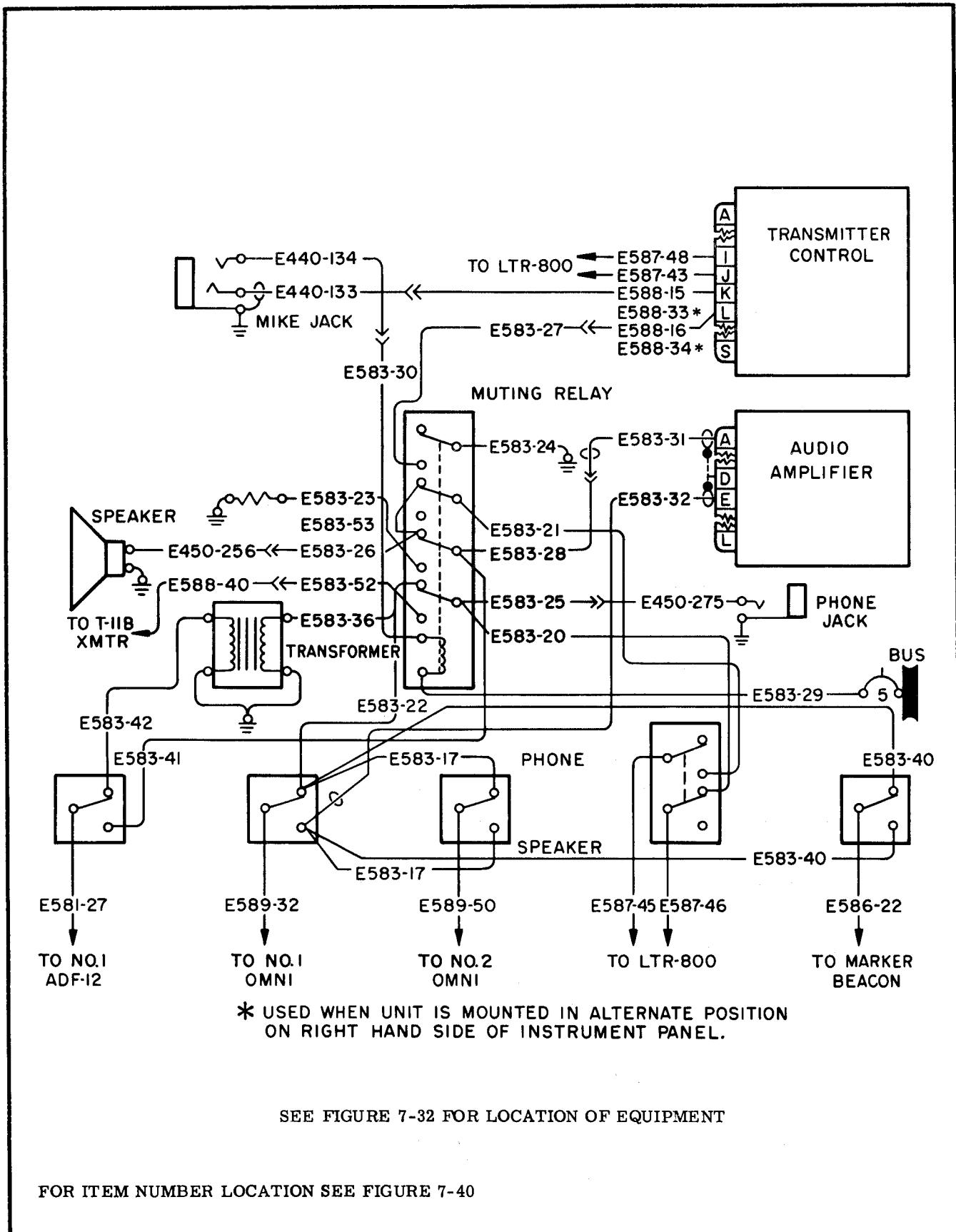
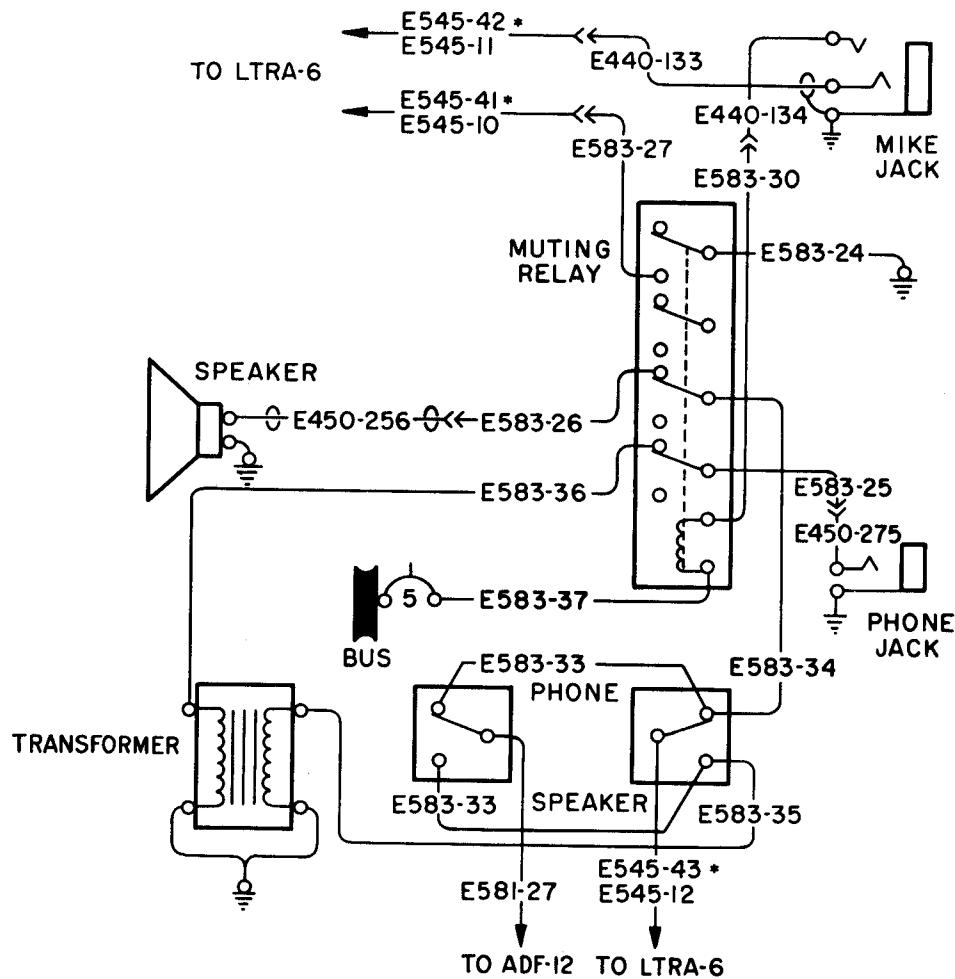
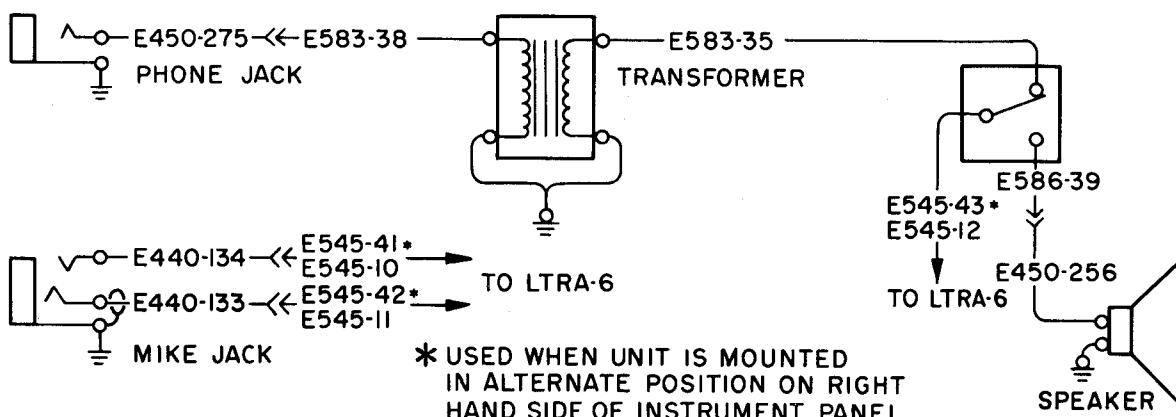


Figure 7-45. Audio and Interconnecting Circuits #E583-7 thru -10



SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-46. Audio and Interconnecting Circuit #E583-11



SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-47. Audio and Interconnecting Circuit #E583-12

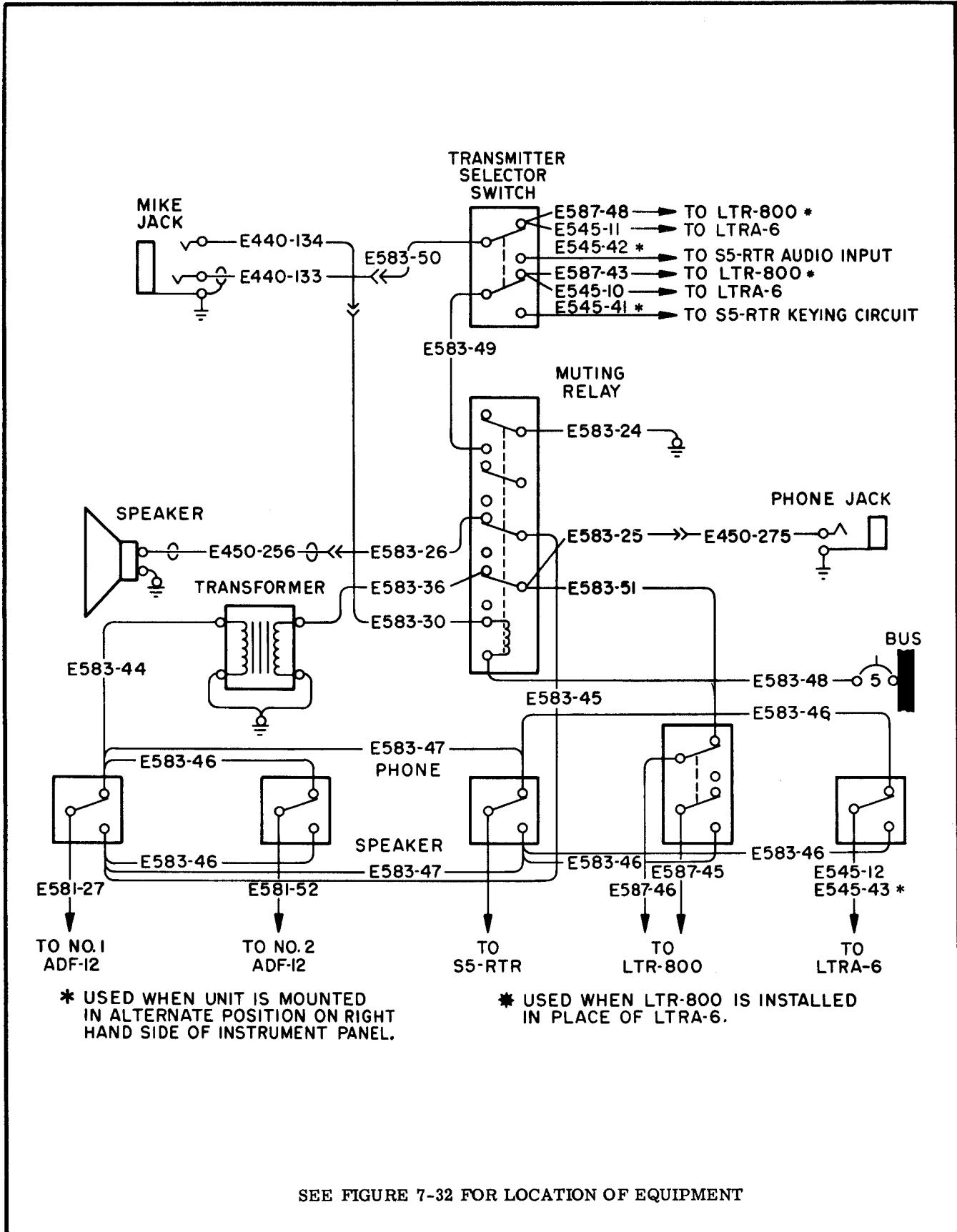
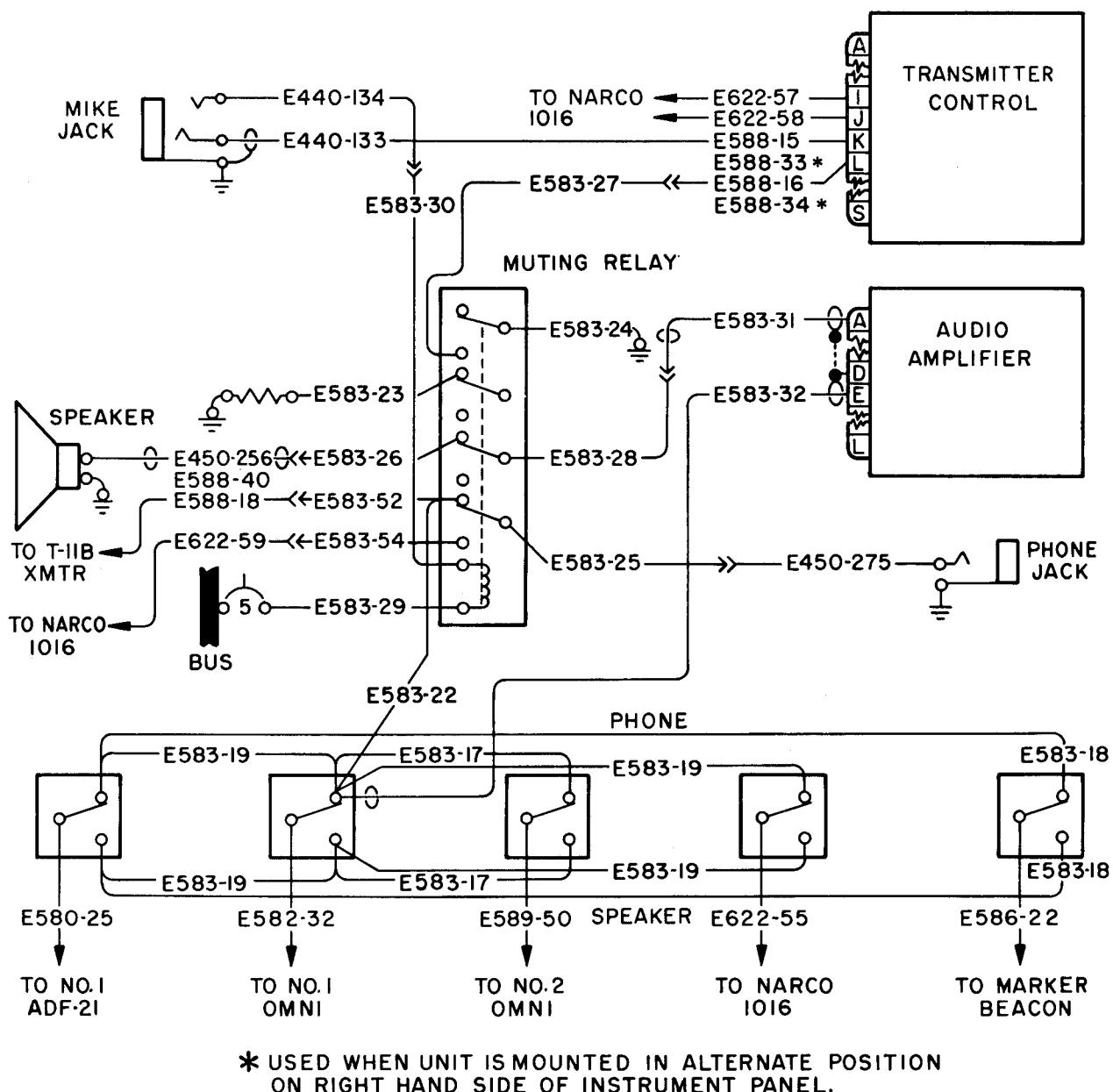


Figure 7-48. Audio and Interconnecting Circuits #E583-13 thru -16



SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-49. Audio and Interconnecting Circuits #E583-55 thru -57

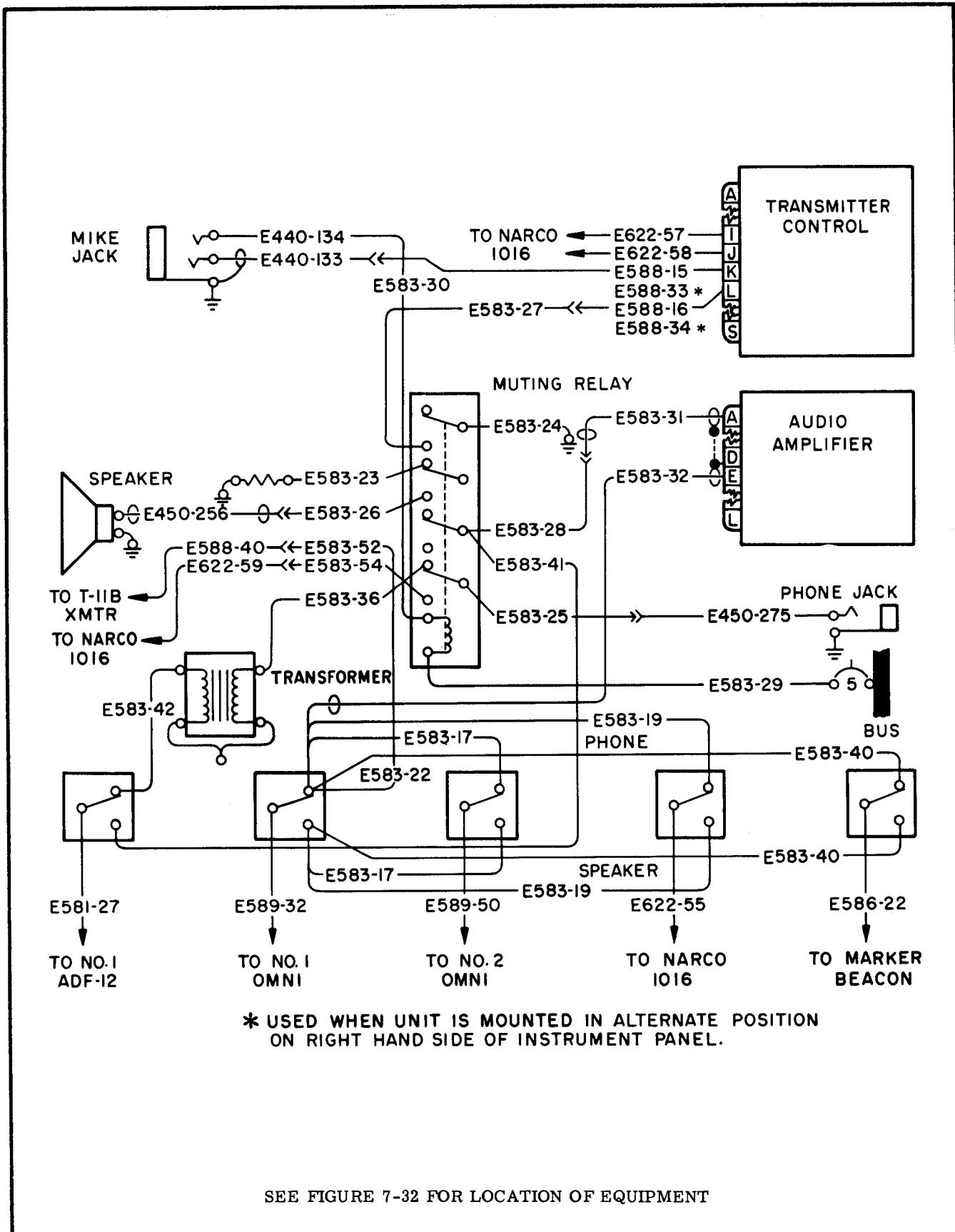
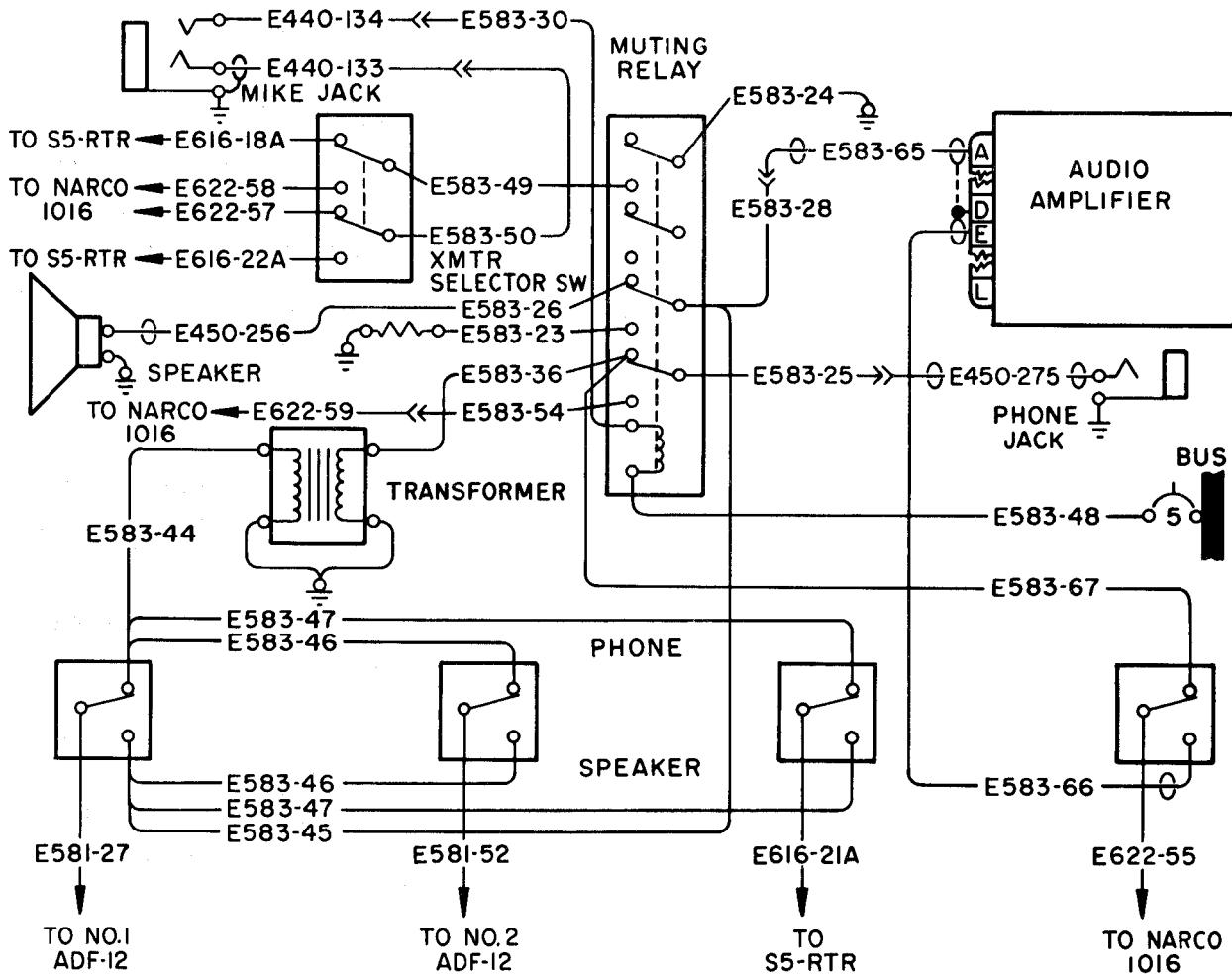


Figure 7-50. Audio and Interconnecting Circuits #E583-58 thru -60



SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-51. Audio and Interconnecting Circuits #E583-63 and -64

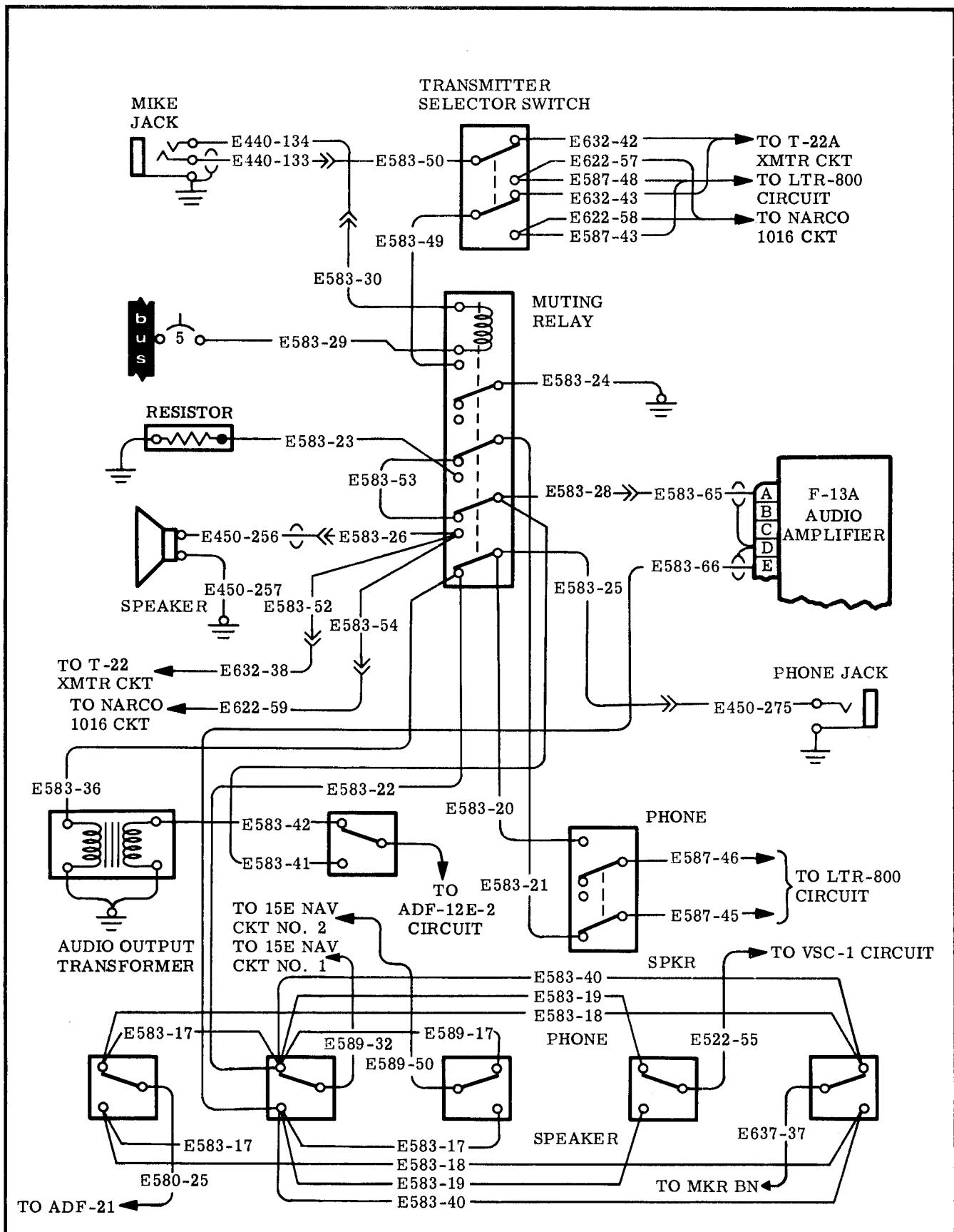


Figure 7-52. Audio and Interconnecting Circuits #E583-70 thru -72, -74 thru -79 and -81 thru -83

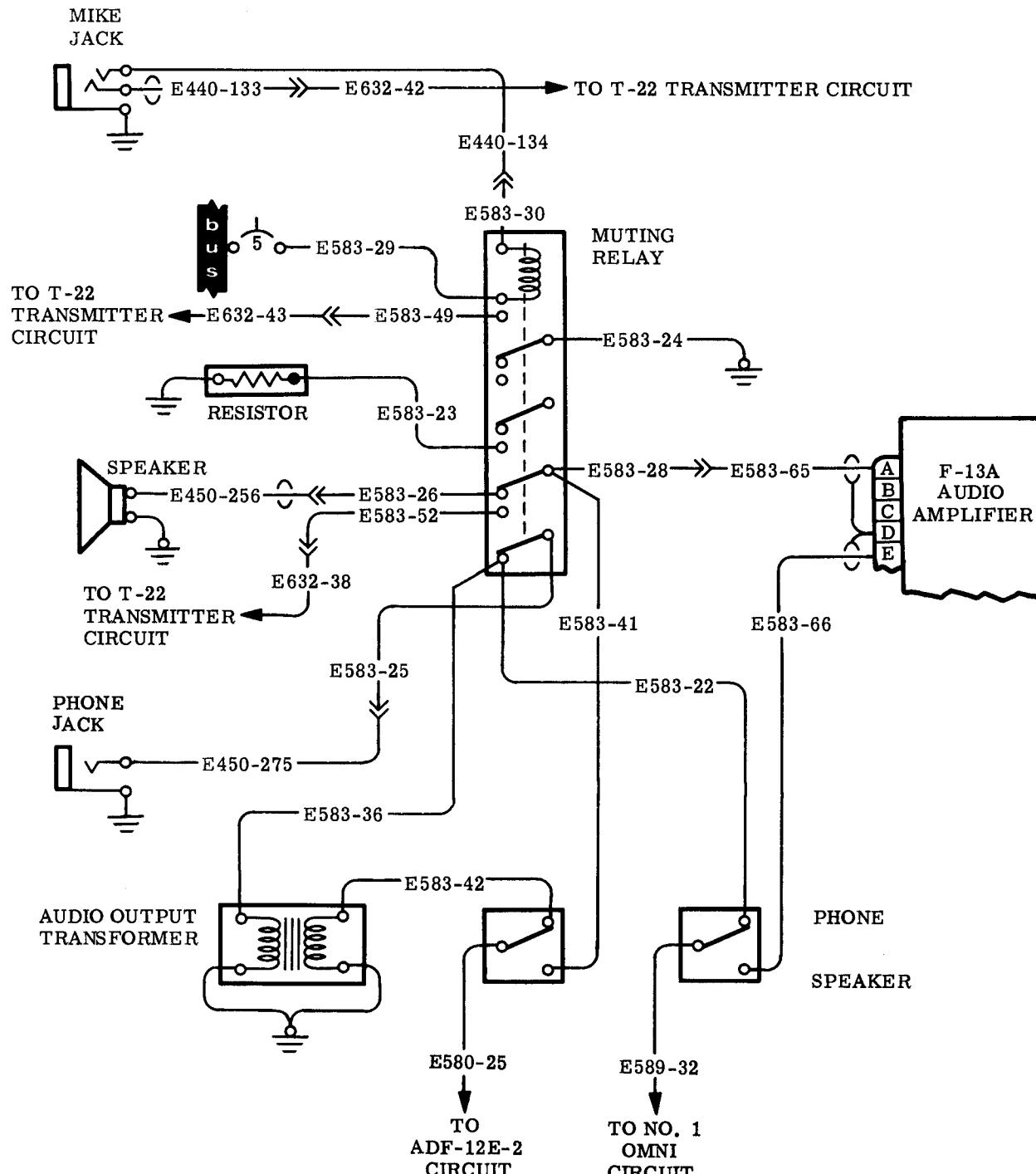


Figure 7-53. Audio and Interconnecting Circuits #E583-73 and -80

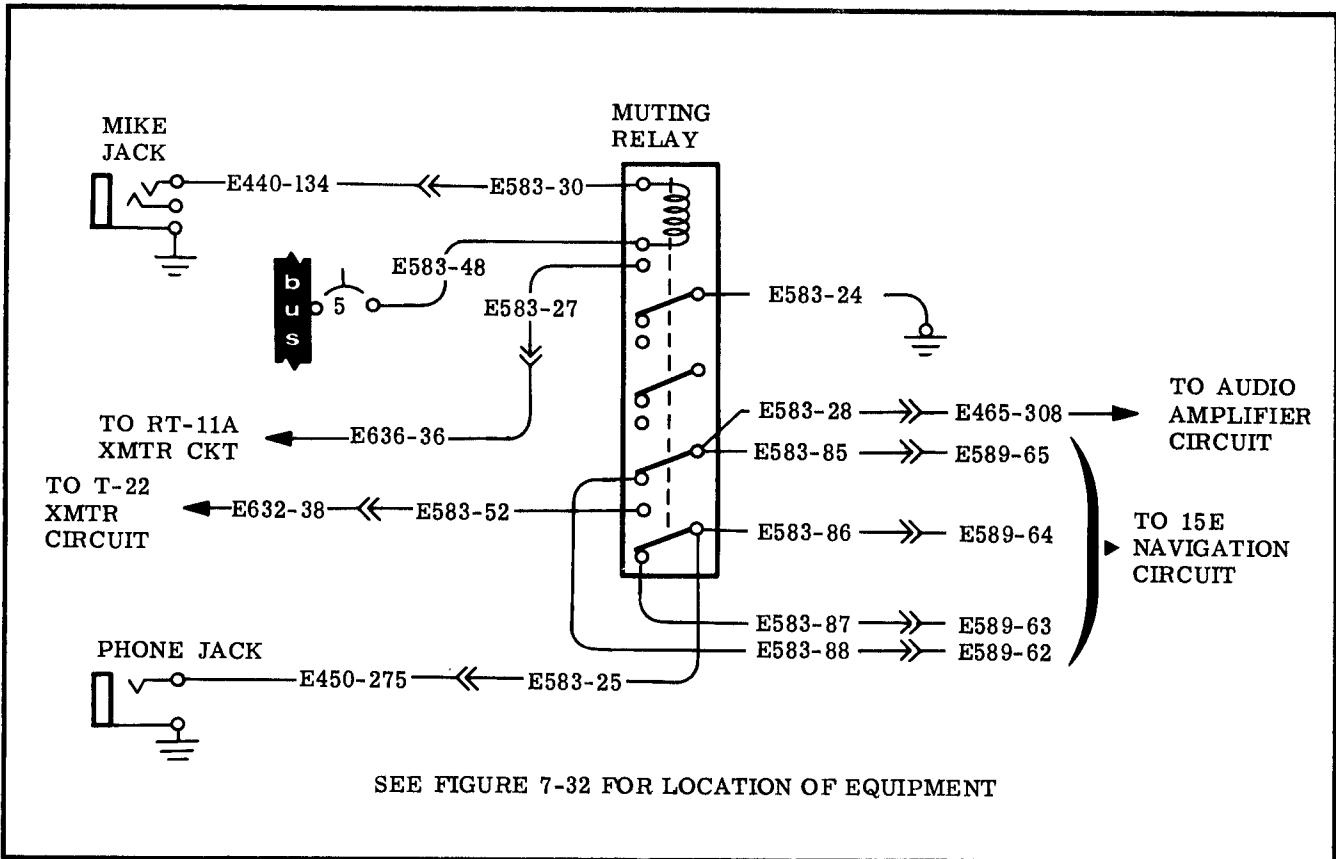


Figure 7-54. Audio and Interconnecting Circuit #E583-84

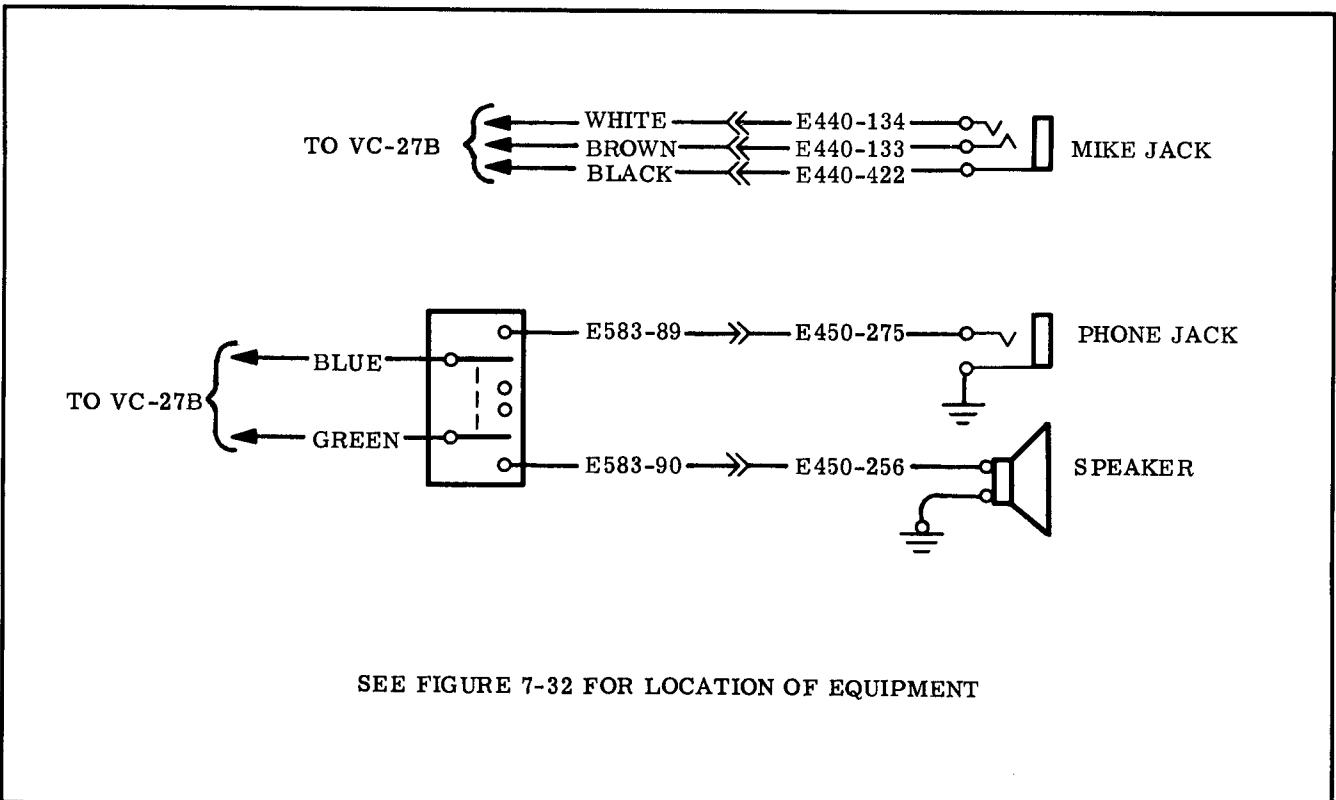
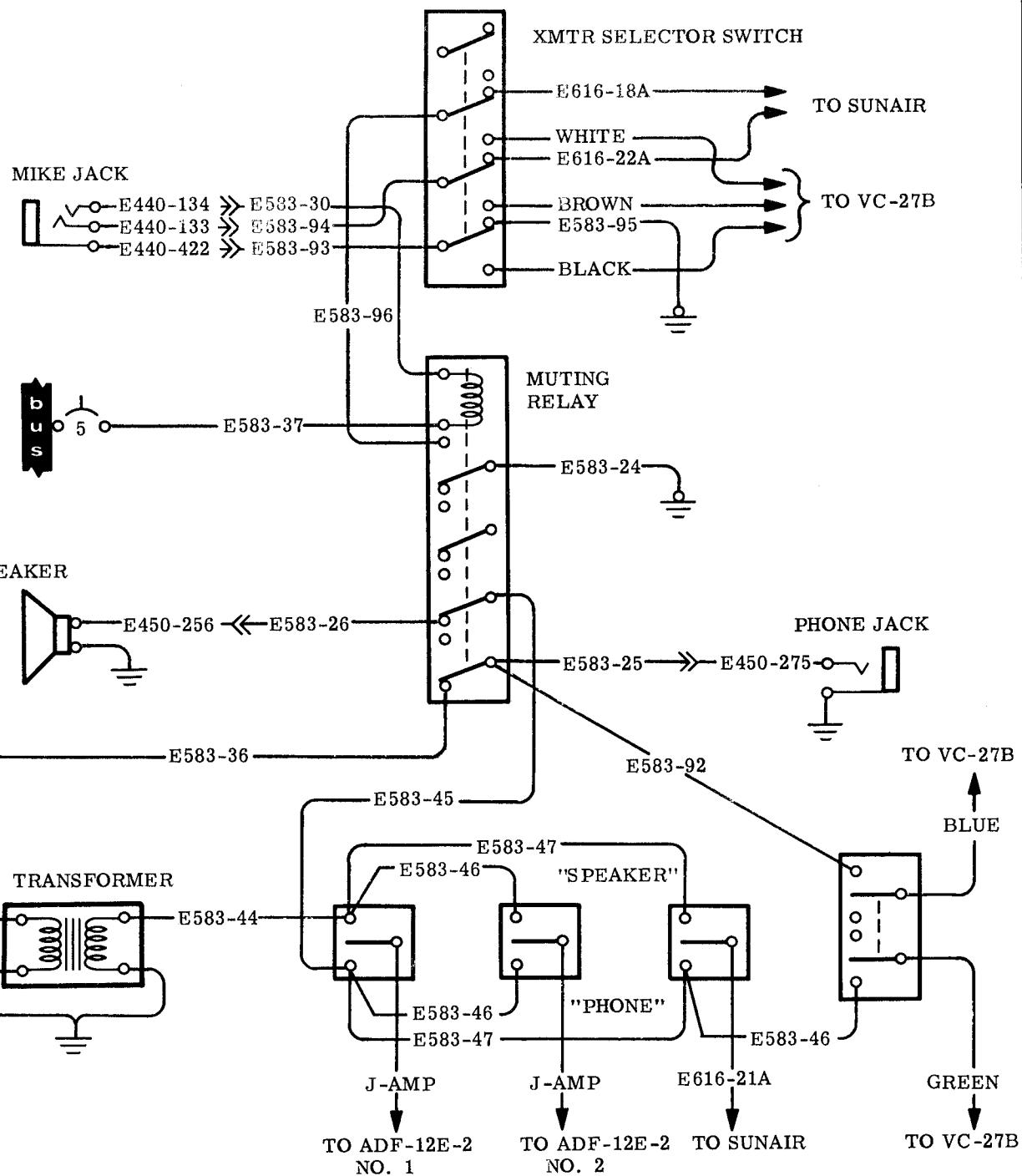


Figure 7-55. Audio and Interconnecting Circuit #E583-100



SEE FIGURE 7-32 FOR LOCATION OF EQUIPMENT

Figure 7-56. Audio and Interconnecting Circuits #E583-97 and -98

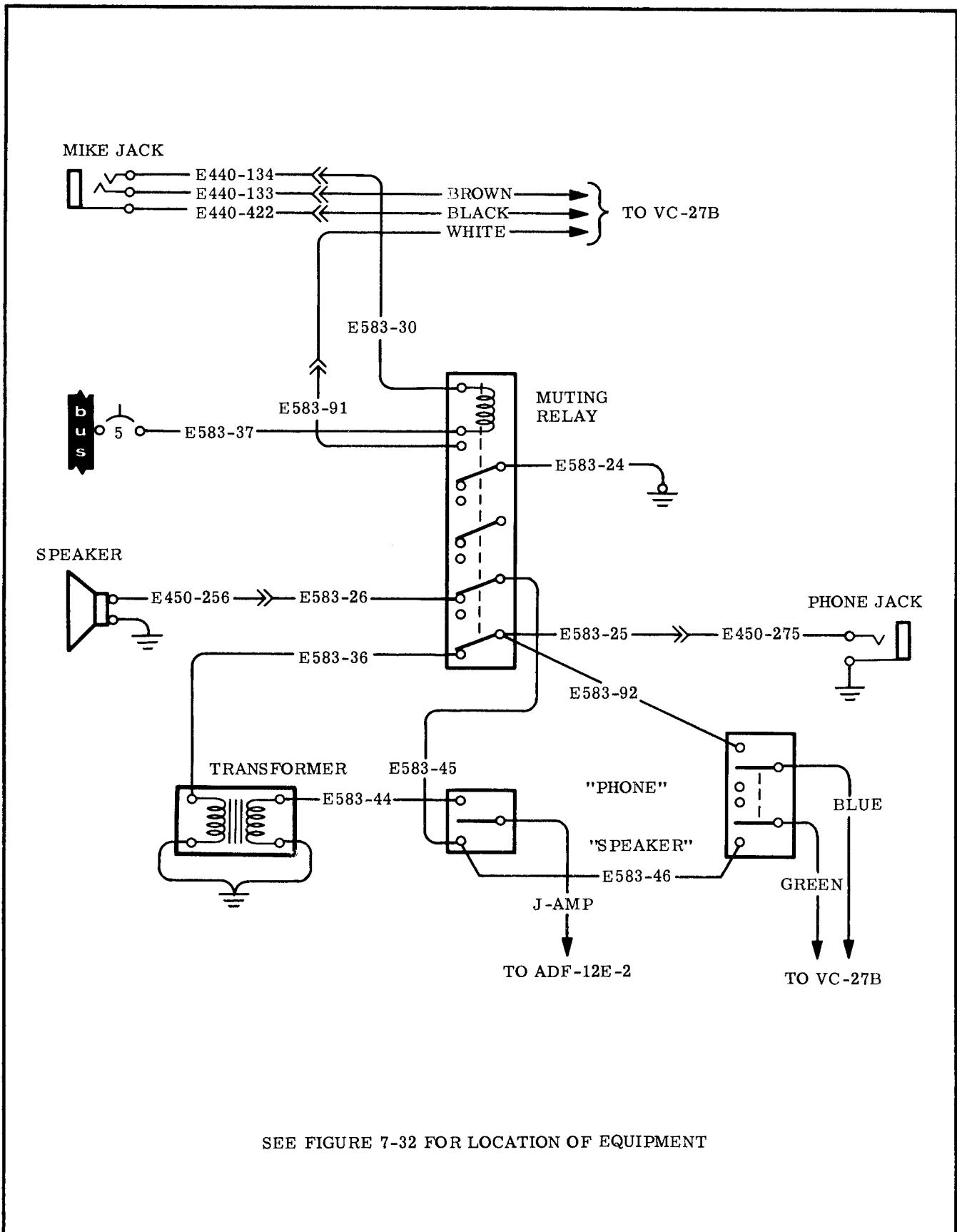


Figure 7-57. Audio and Interconnecting Circuit #E583-99

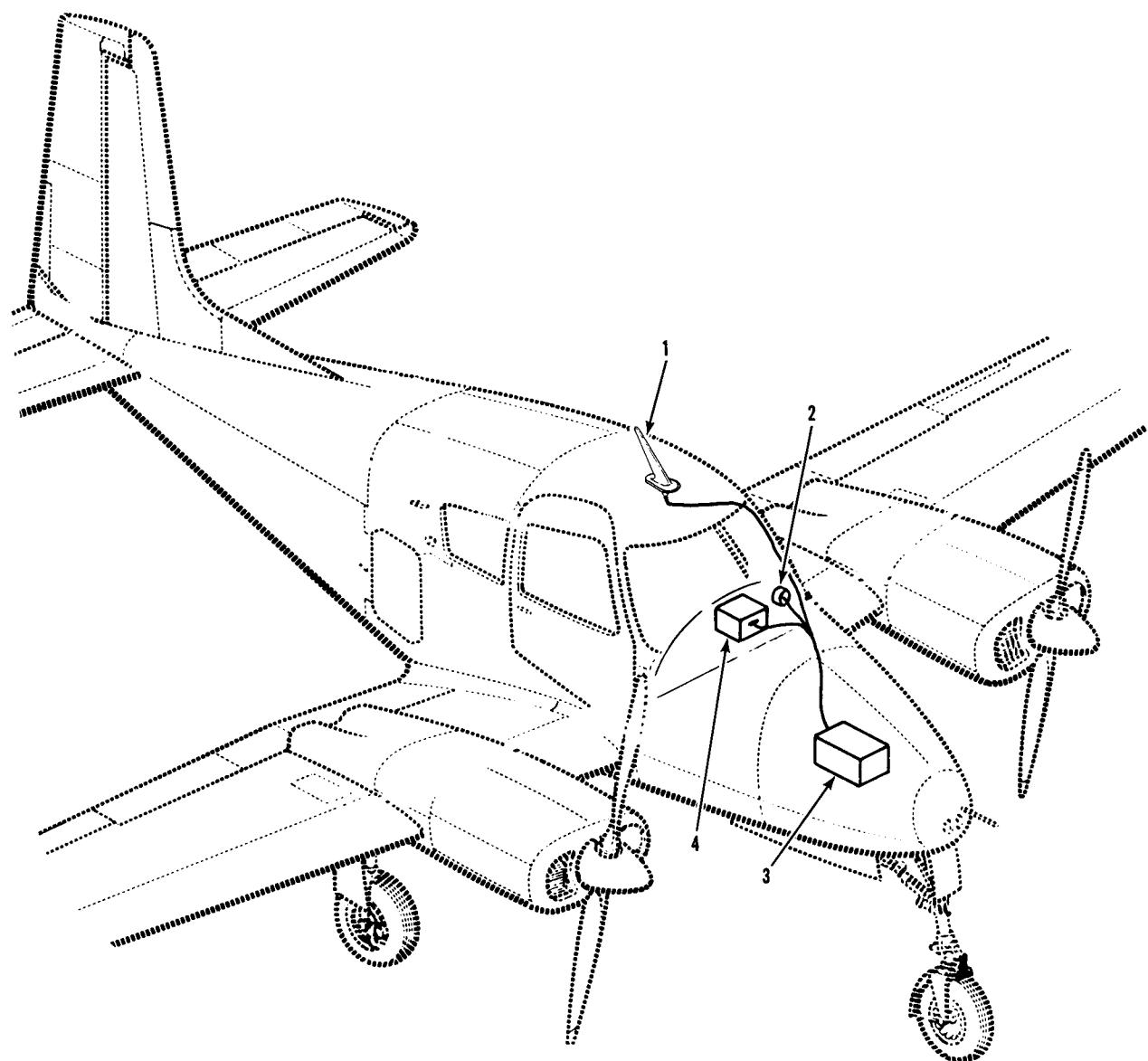


Figure 7-58. VOA-3 VHF Navigation Circuit (Sheet 1 of 2)

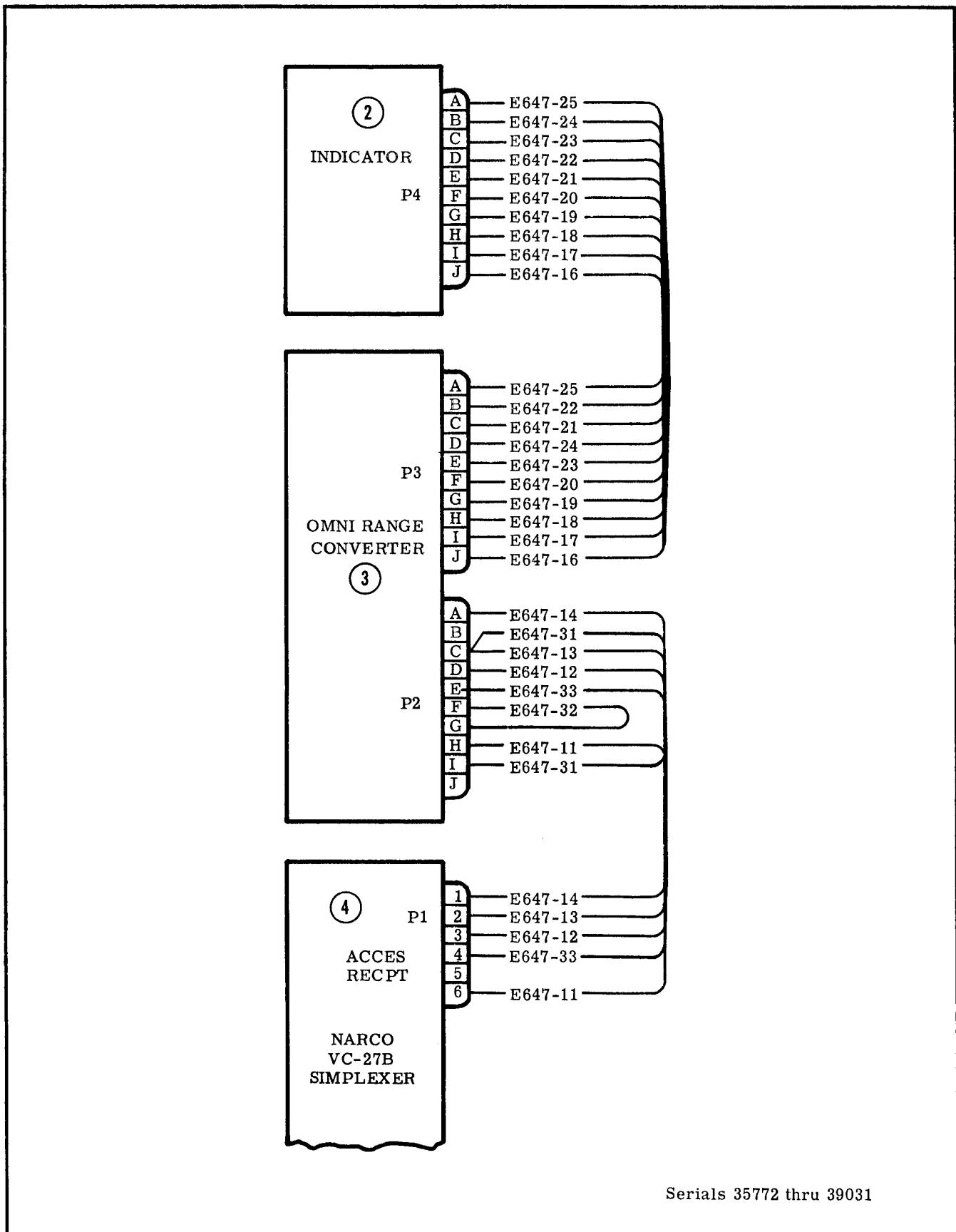


Figure 7-58. VOA-3 VHF Navigation Circuit (Sheet 2 of 2)

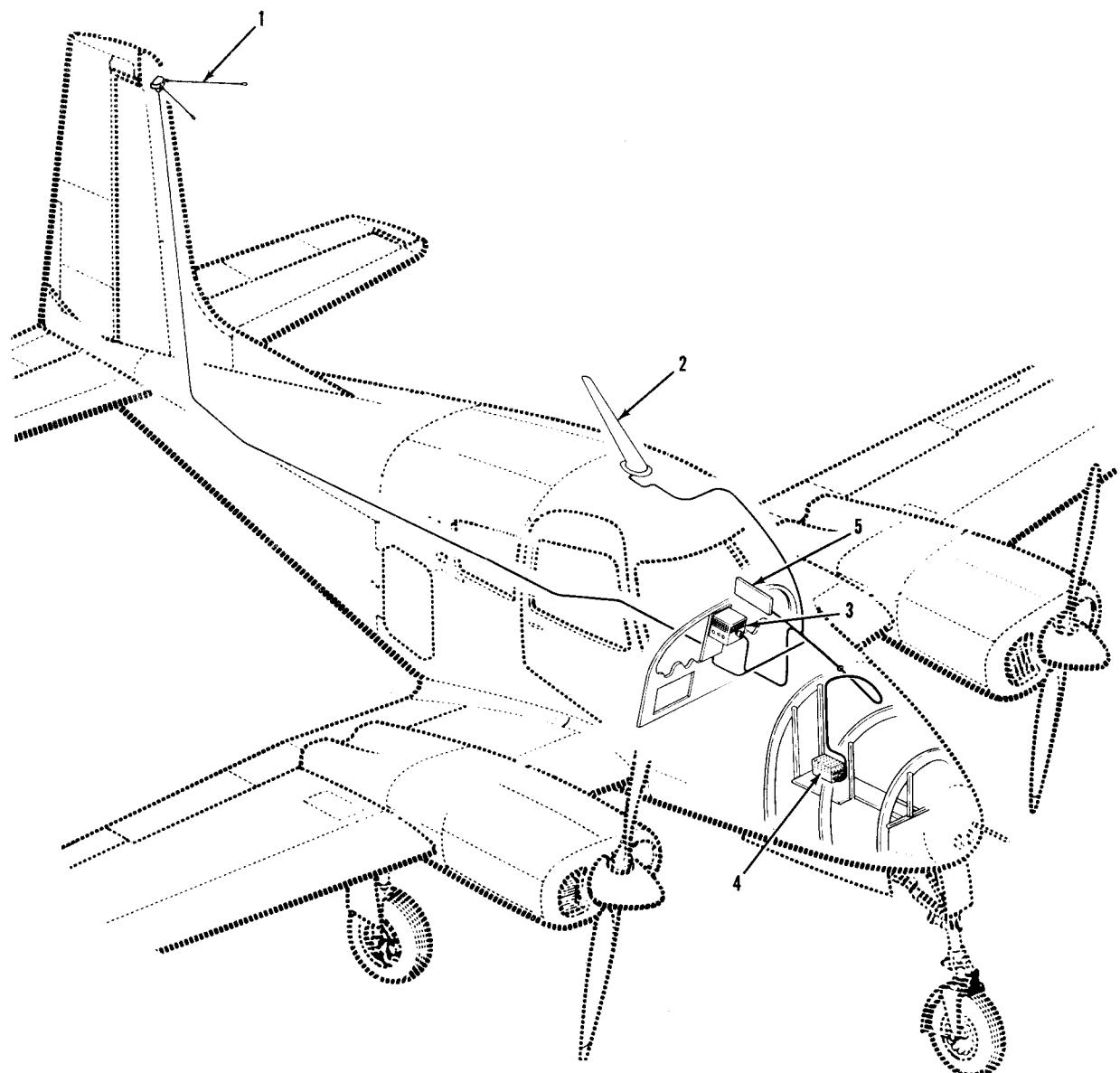


Figure 7-59. VC-27B Simplexer Circuit (Sheet 1 of 2)

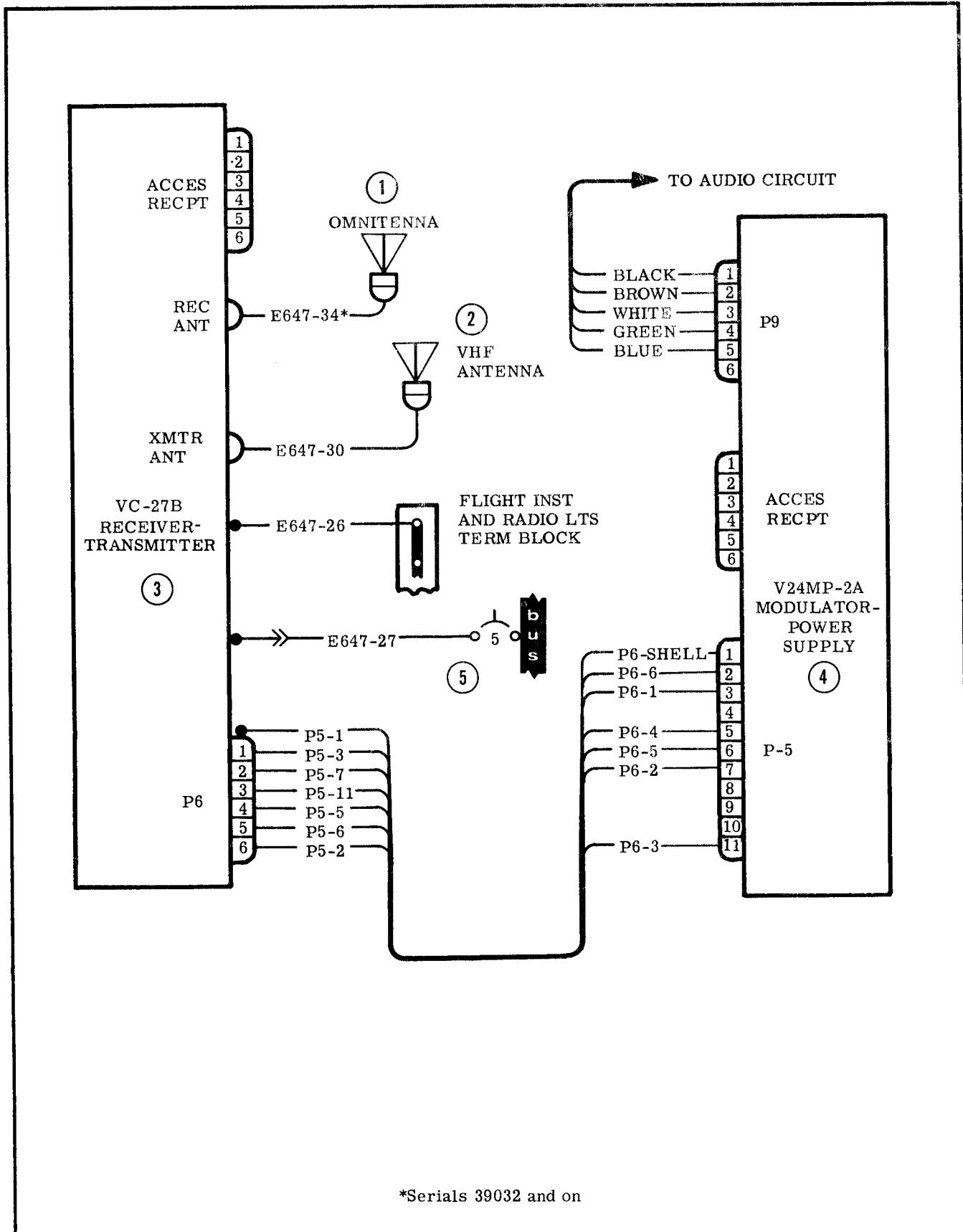


Figure 7-59. VC-27B Simplexer Circuit (Sheet 2 of 2)

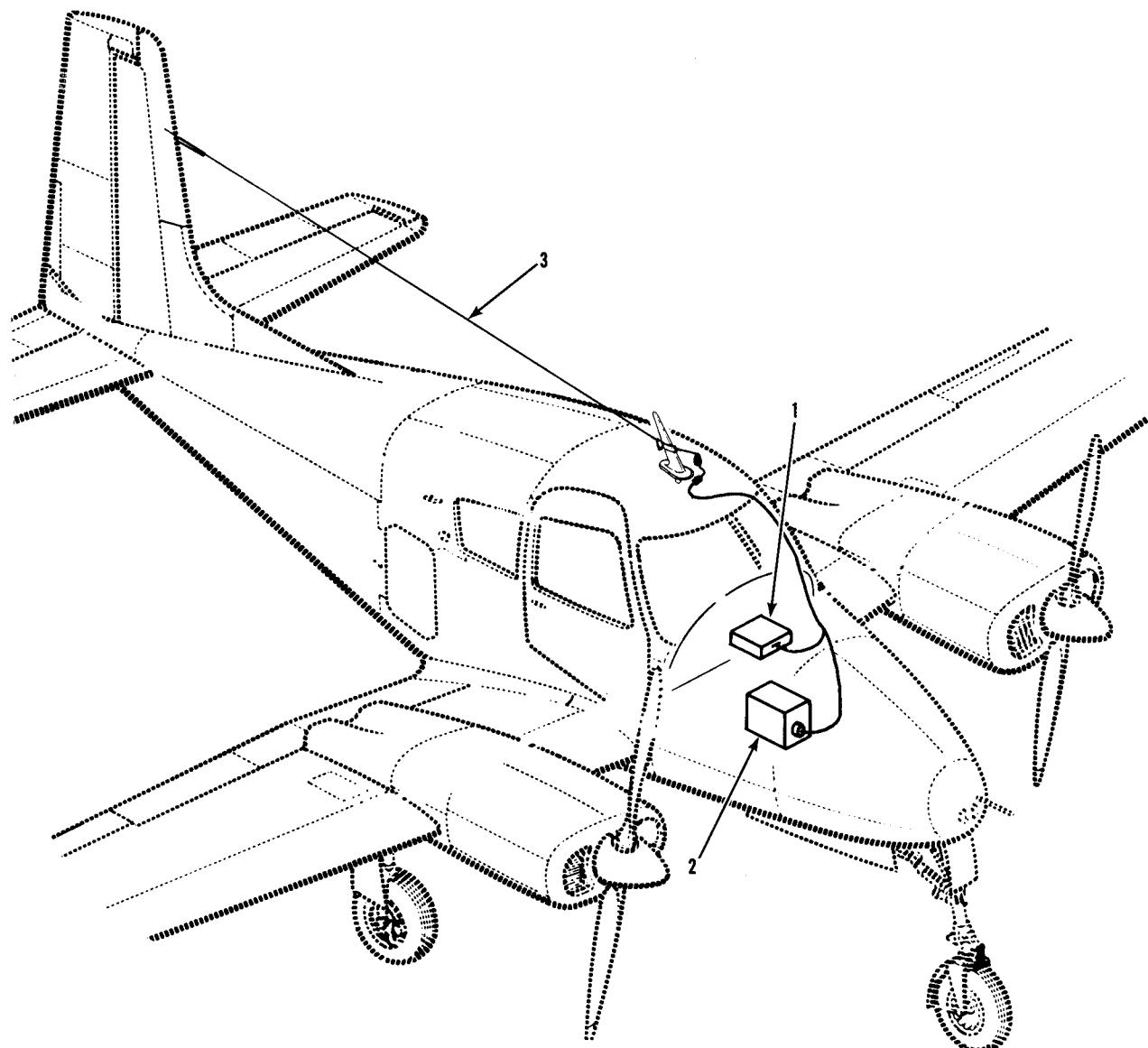


Figure 7-60. LFR-3B Low Frequency Receiver Circuit (Sheet 1 of 2)

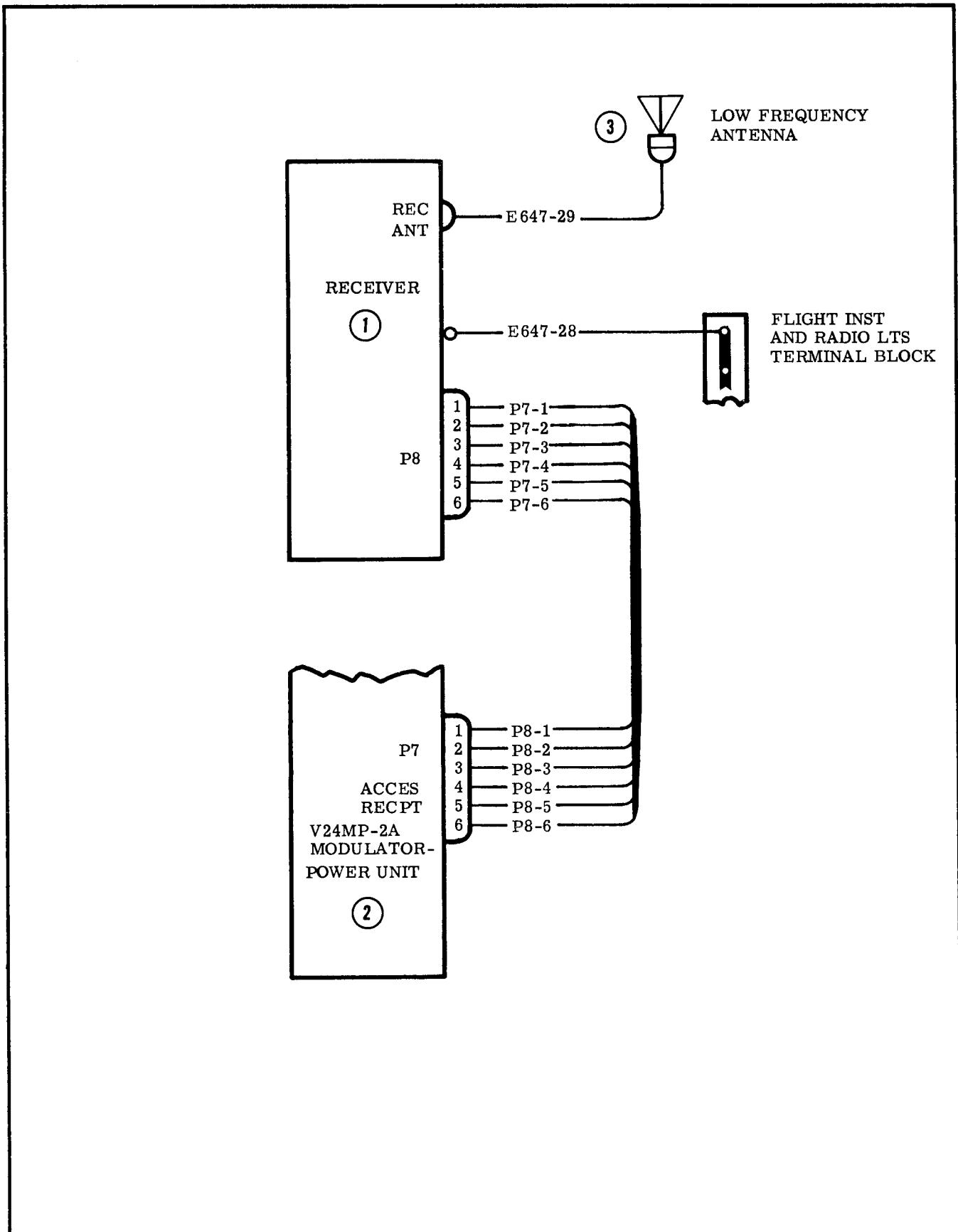


Figure 7-60. LFR-3B Low-Frequency Receiver Circuit (Sheet 2 of 2)

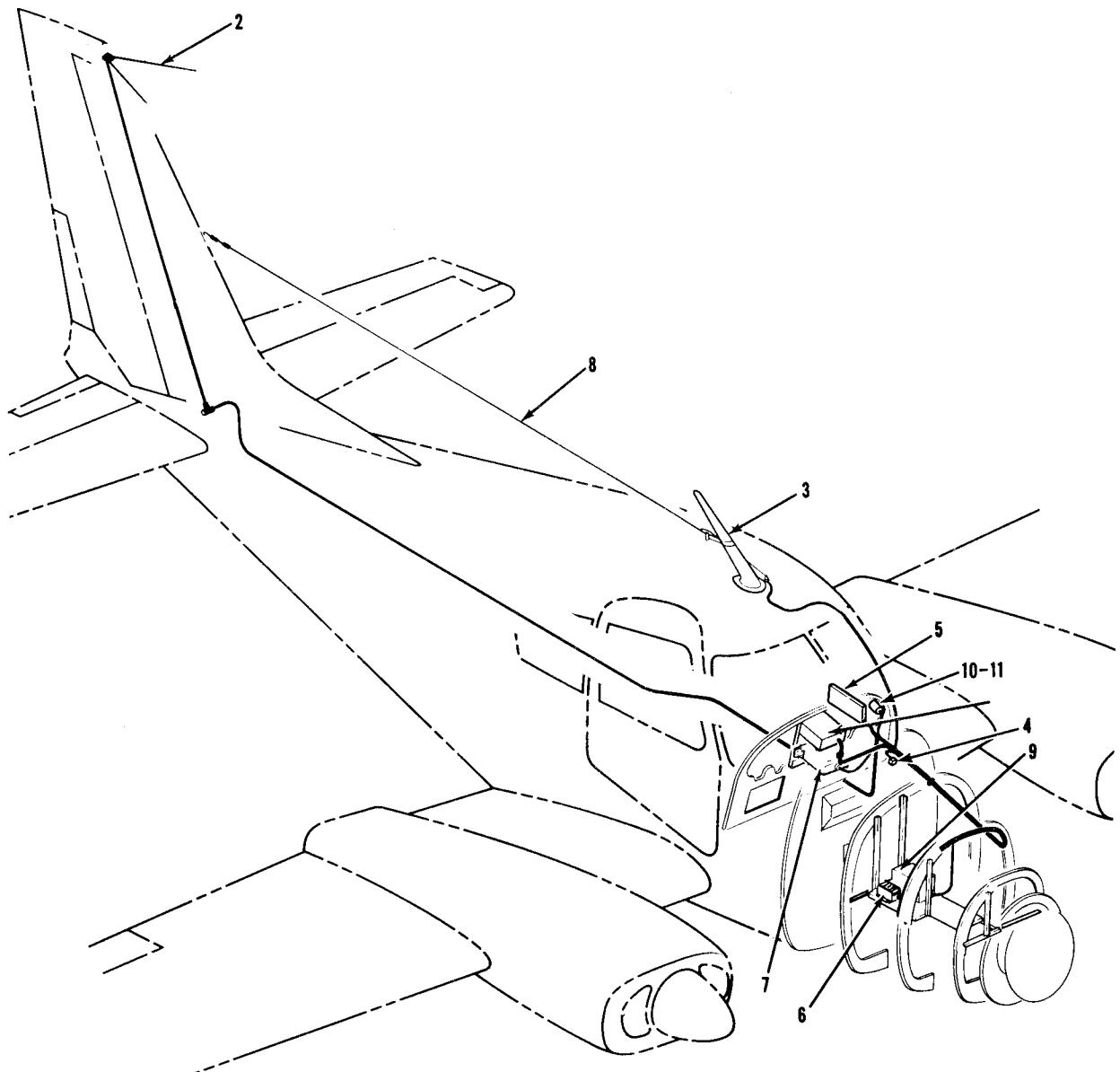


Figure 7-61. Narco Mark V Circuits (Sheet 1 of 4)

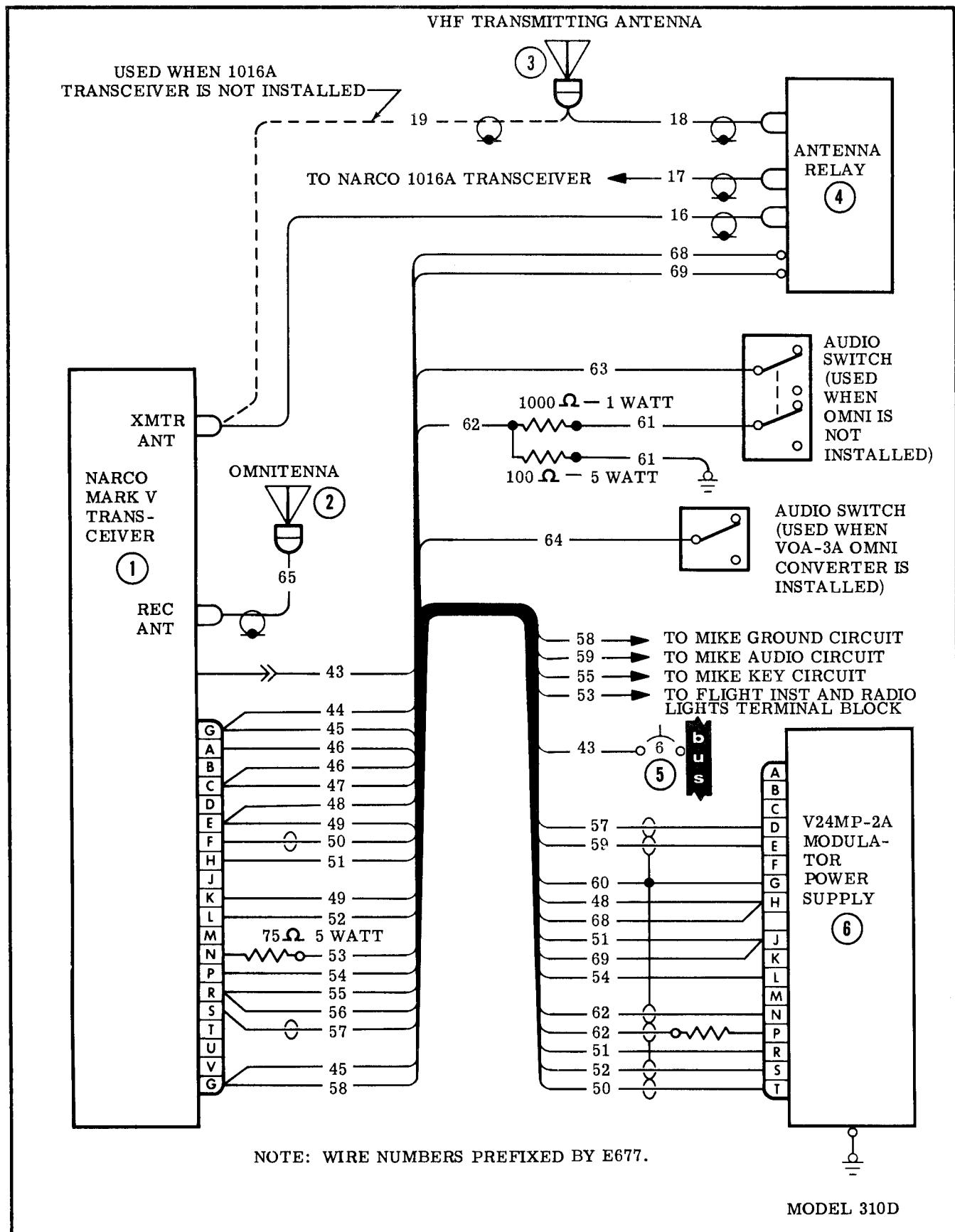
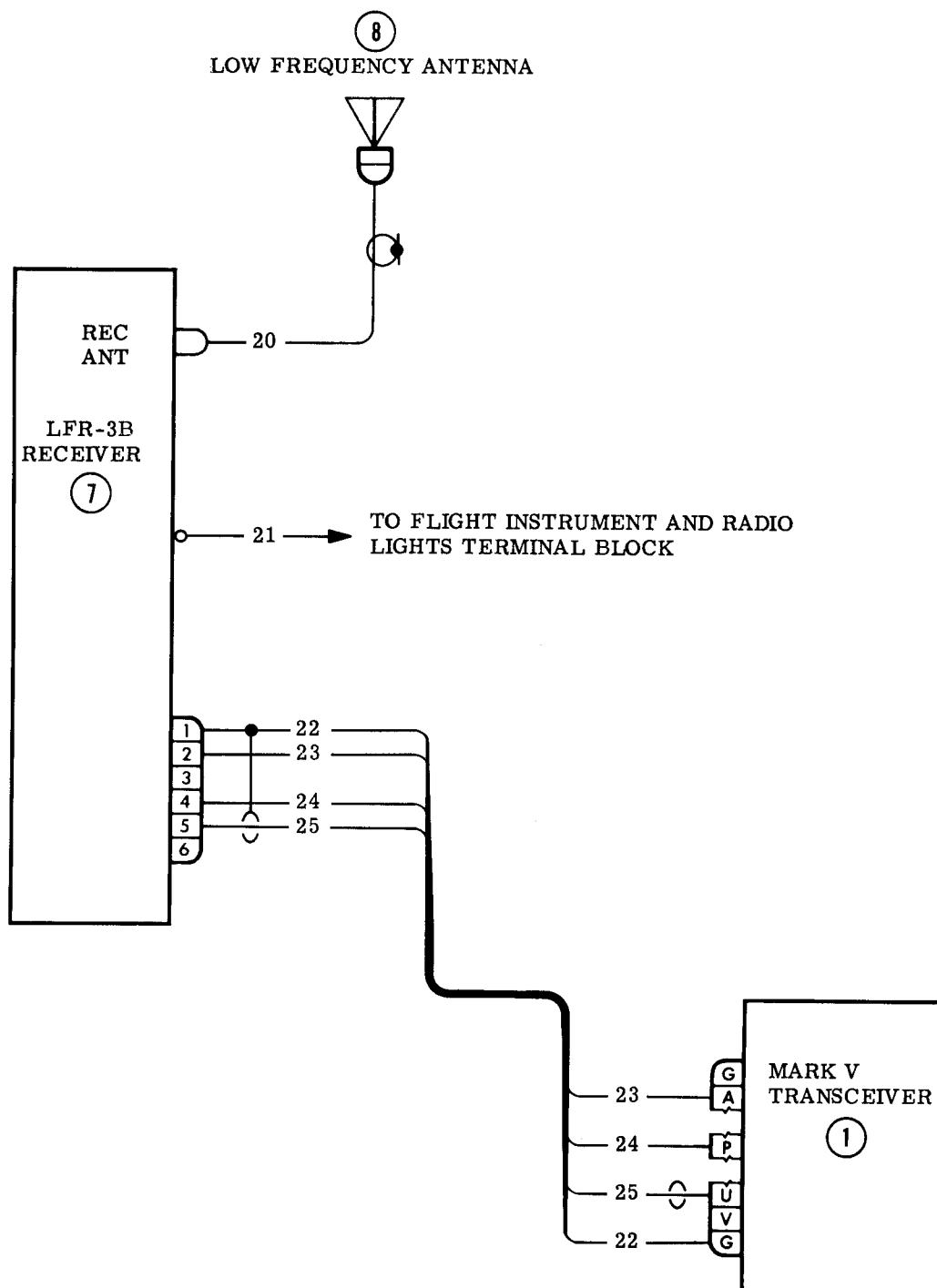


Figure 7-61. Narco Mark V Circuits (Sheet 2 of 4)



NOTE: INDIVIDUAL WIRE NUMBERS
ARE PREFIXED BY E677.

MODEL 310D

Figure 7-61. Narco Mark V Circuits (Sheet 3 of 4)

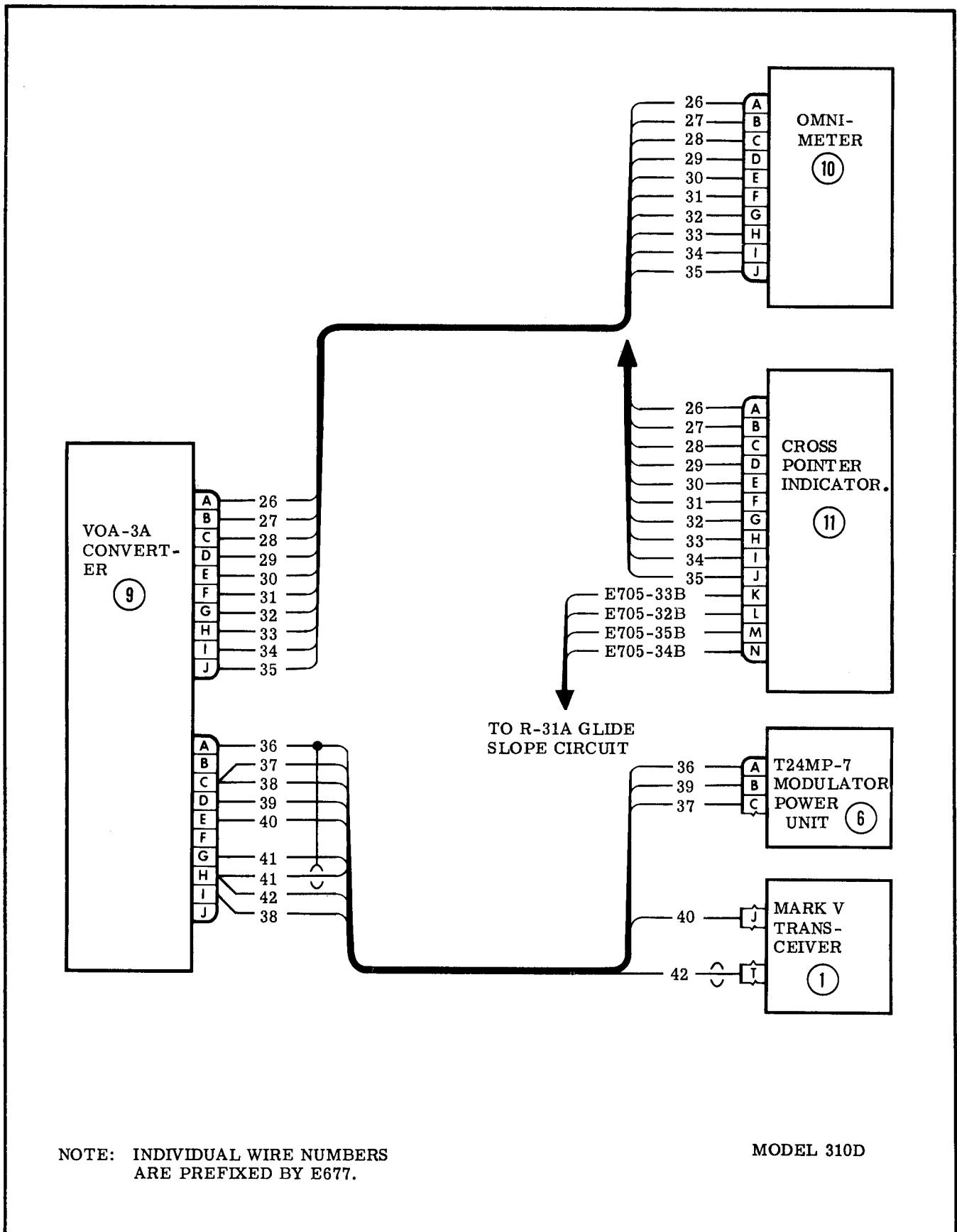


Figure 7-61. Narco Mark V Circuits (Sheet 4 of 4)

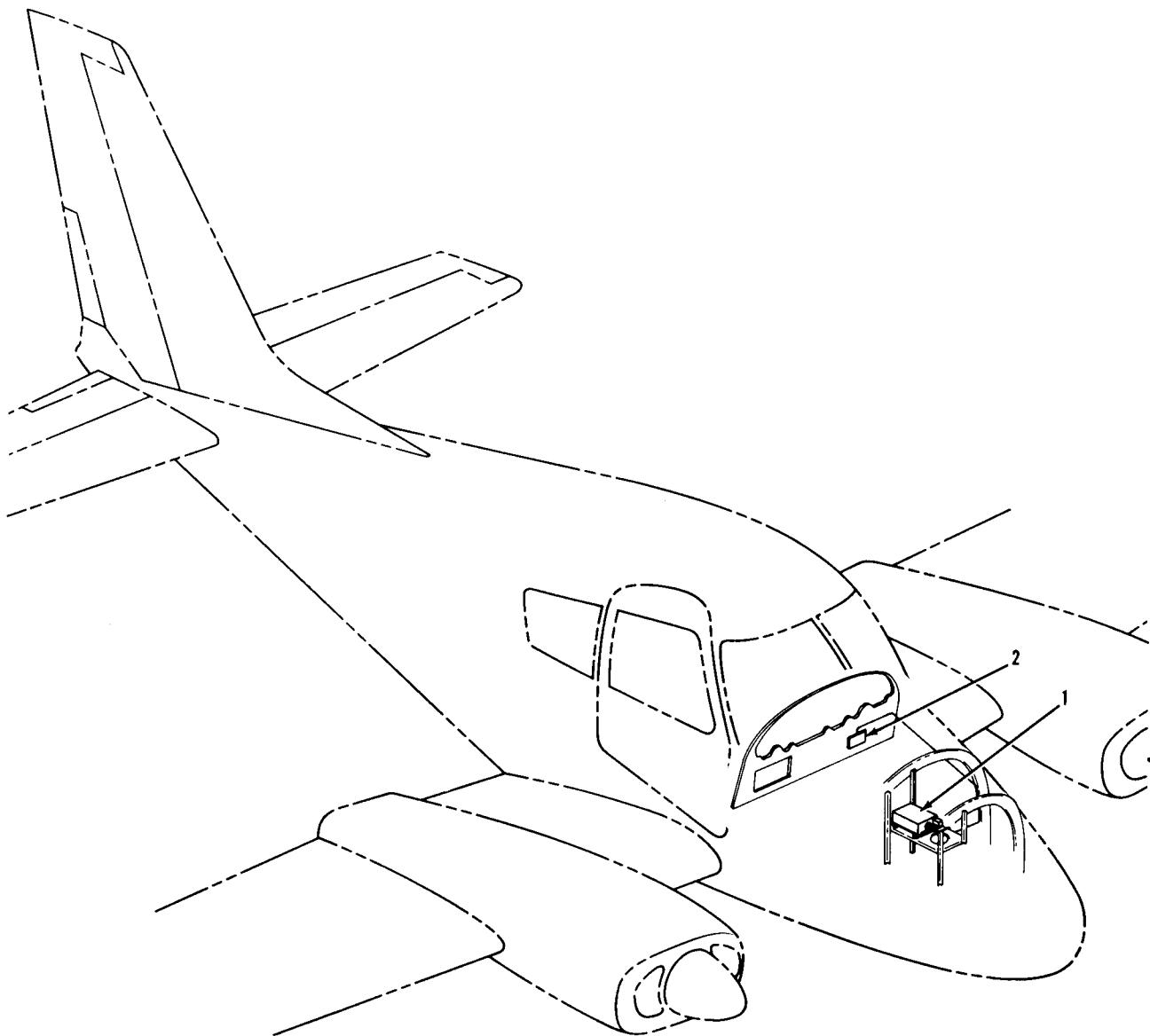


Figure 7-62. Dynavia Autopilot-Omni Coupler Circuit (Sheet 1 of 2)

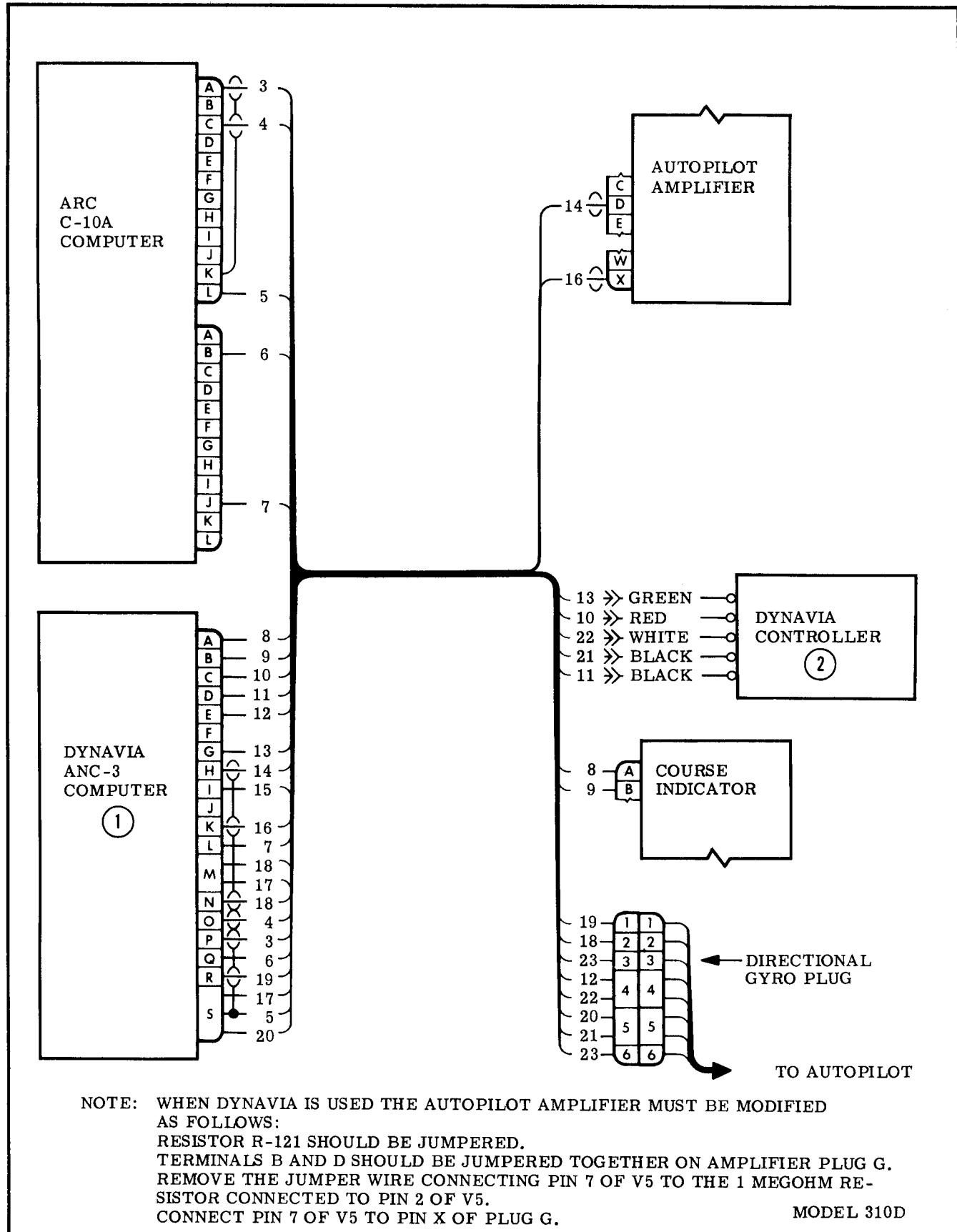


Figure 7-62. Dynavia Autopilot-Omni Coupler Circuit (Sheet 2 of 2)

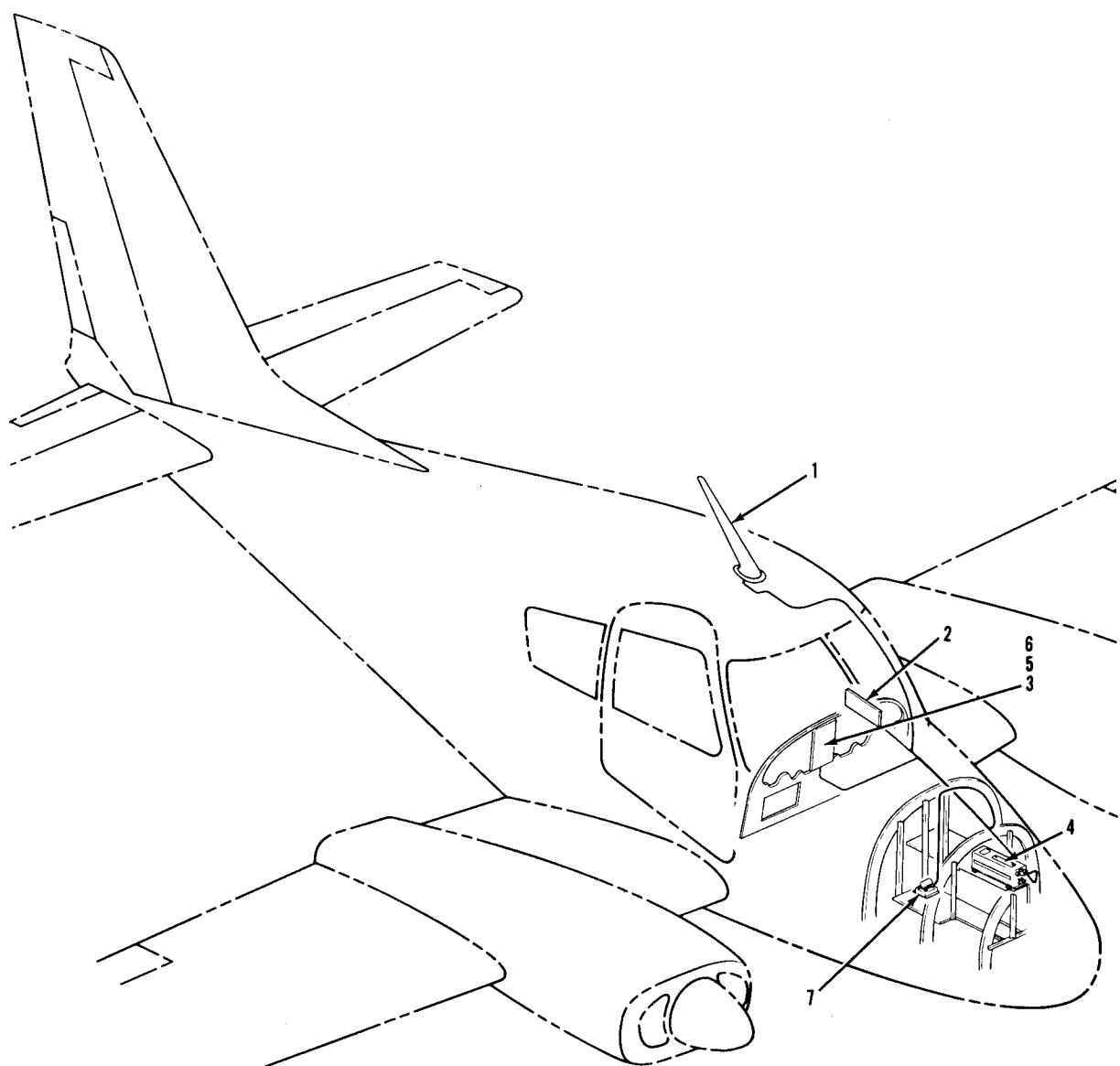


Figure 7-63. T-25A Transmitter Circuits (Sheet 1 of 3)

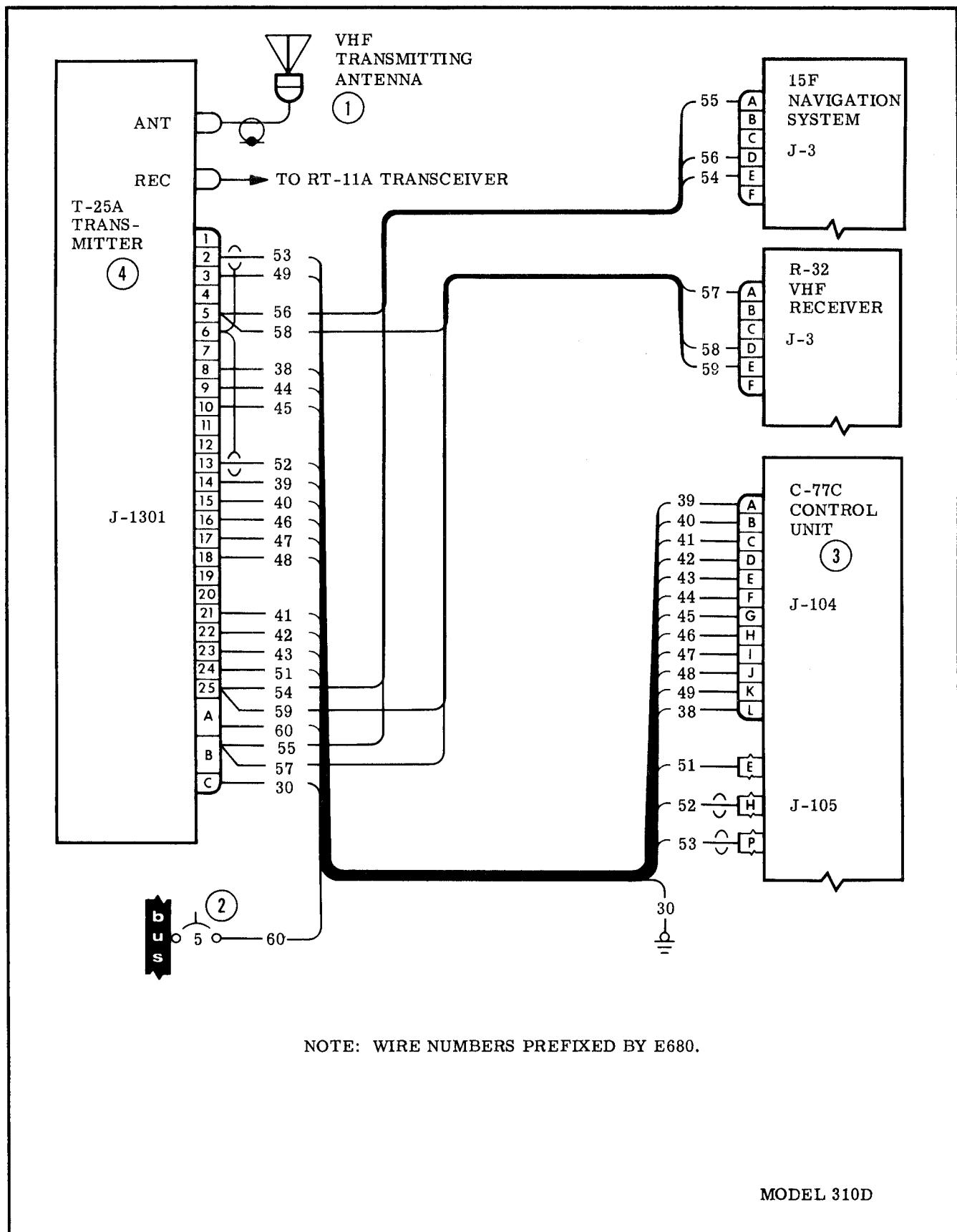


Figure 7-63. T-25A Transmitter Circuits (Sheet 2 of 3)

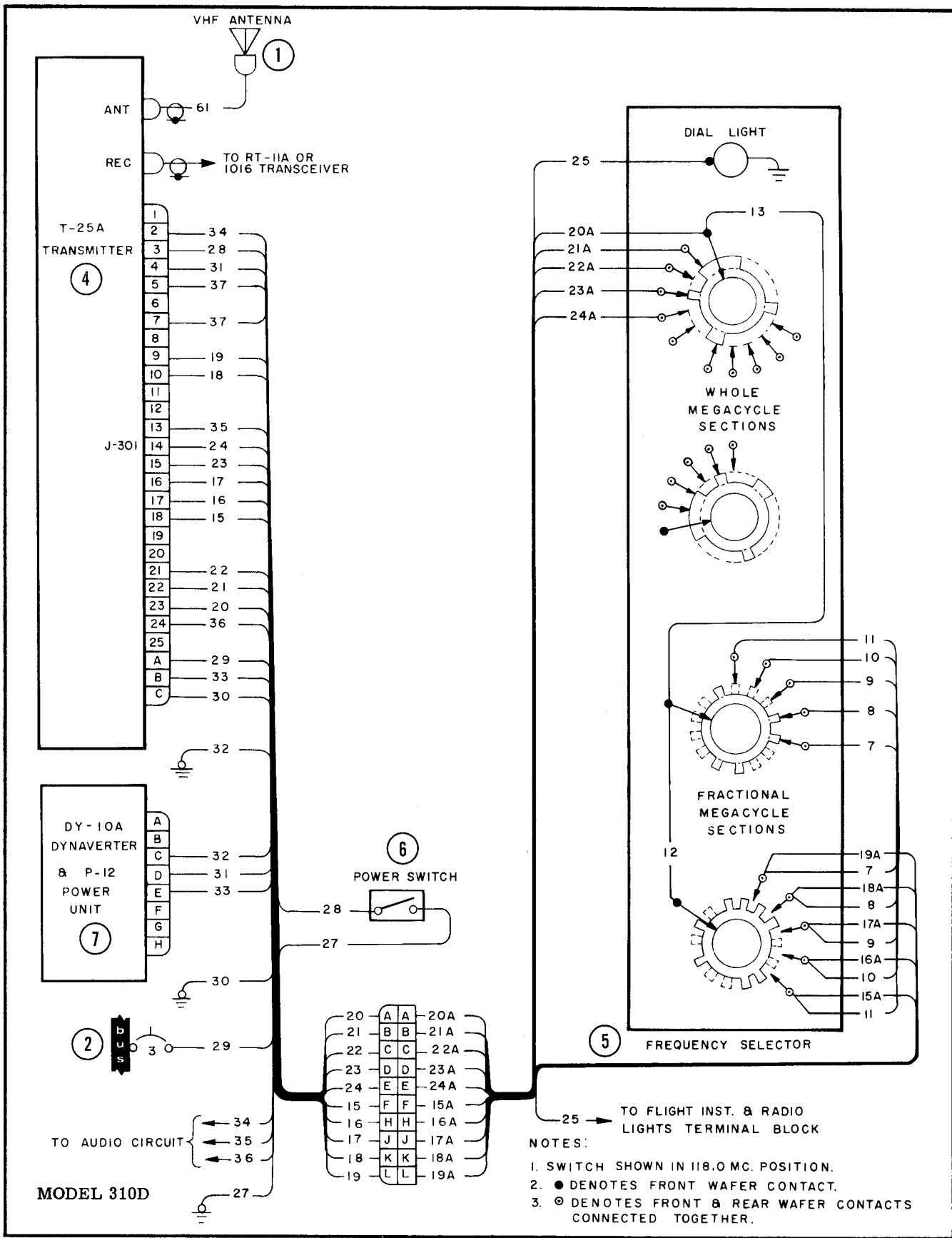


Figure 7-63. T-25A Transmitter Circuits (Sheet 3 of 3)

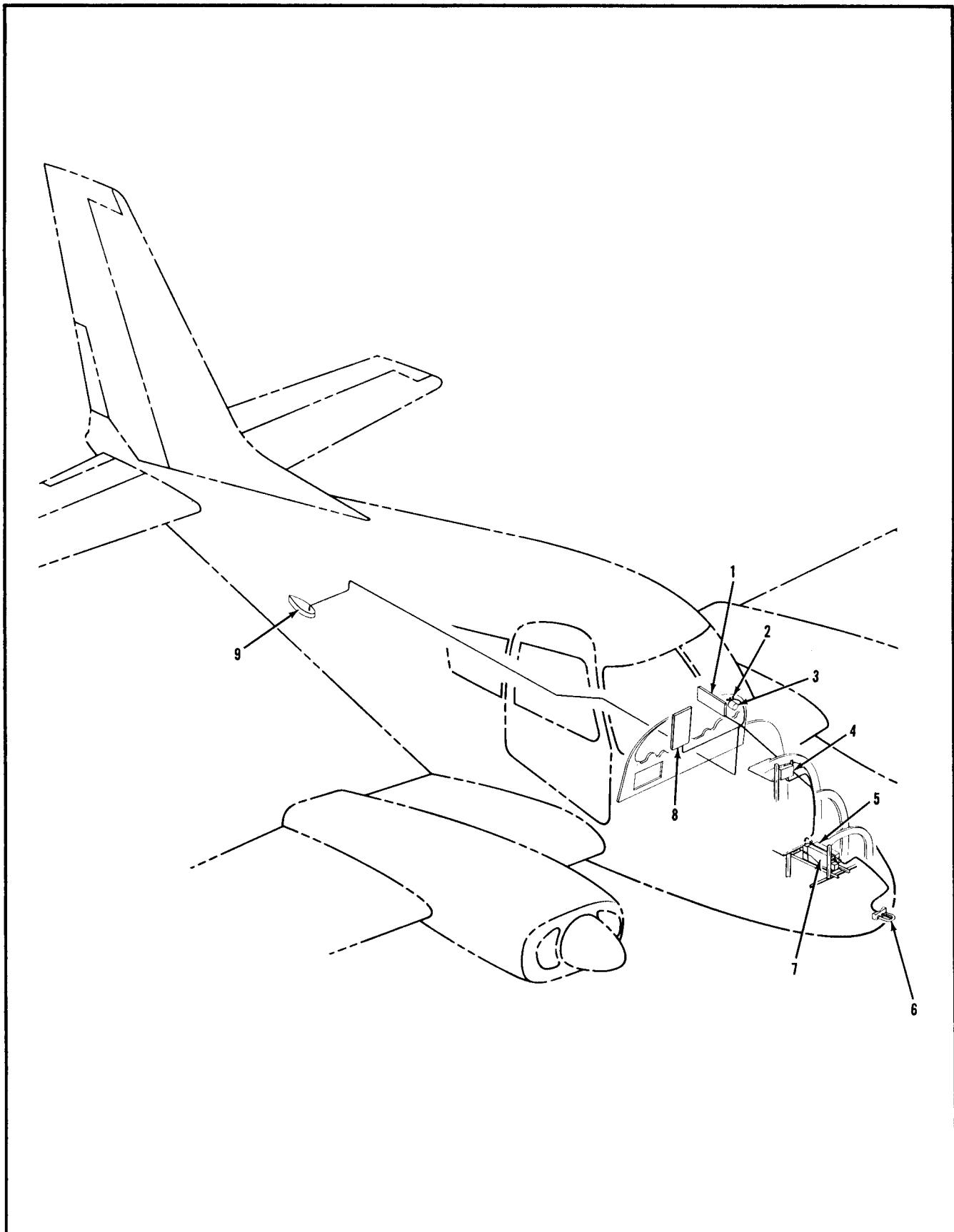


Figure 7-64. R-31A Glide Slope & R-33A Marker Beacon Receivers (Sheet 1 of 4)

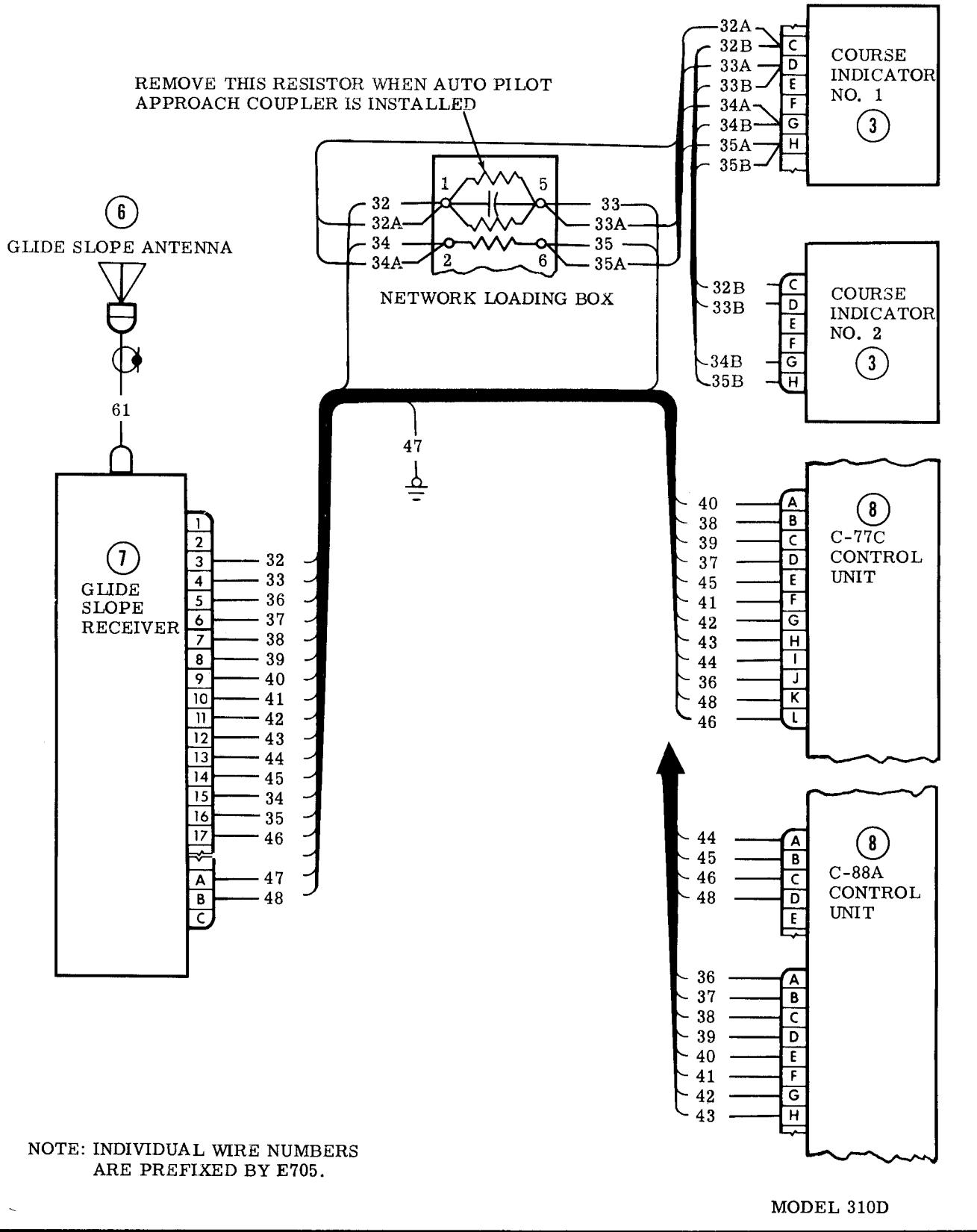


Figure 7-64. R-31A Glide Slope & R-33A Marker Beacon Receiver (Sheet 2 of 4)

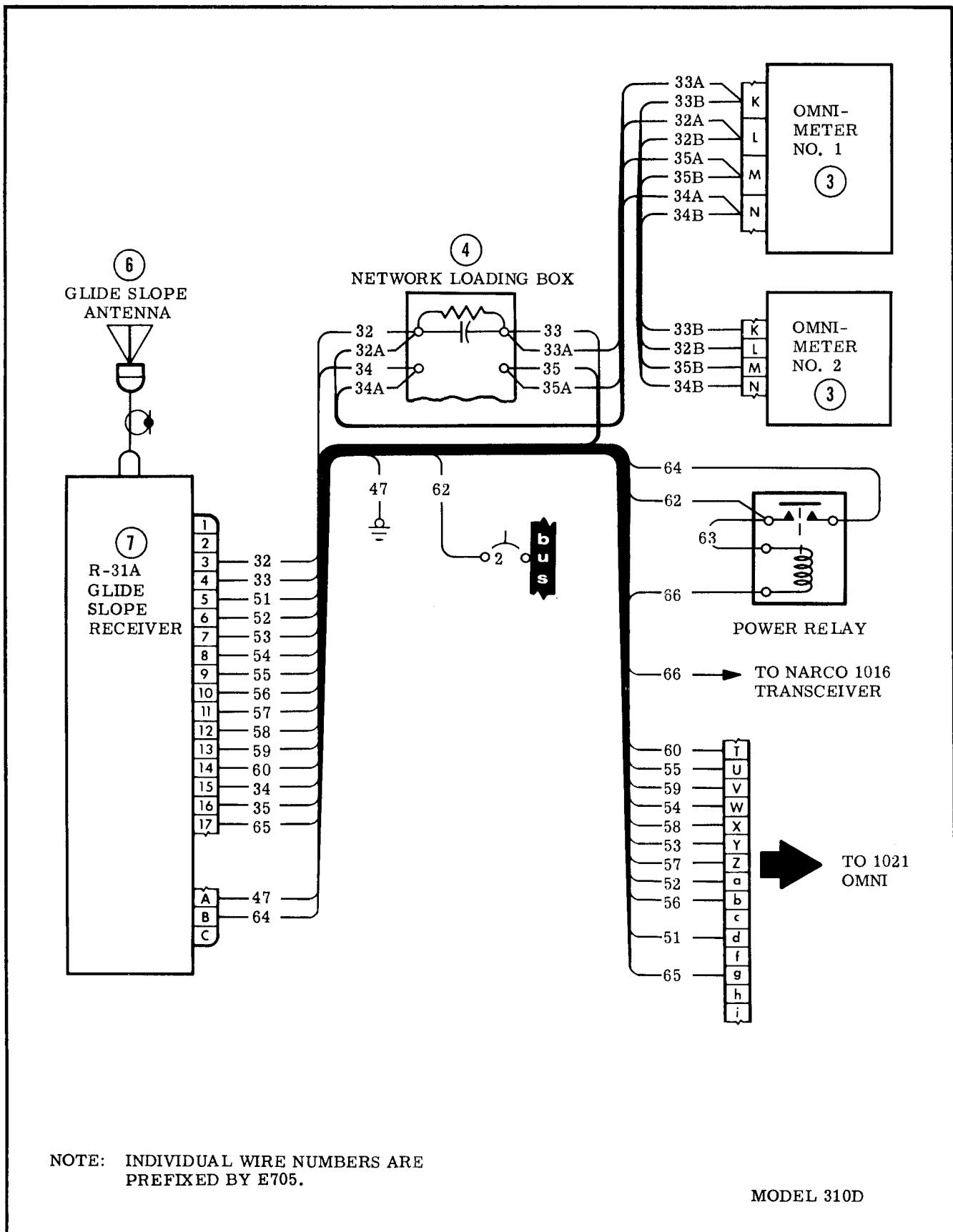


Figure 7-64. R-31A Glide Slope & R-33A Marker Beacon Receiver (Sheet 3 of 4)

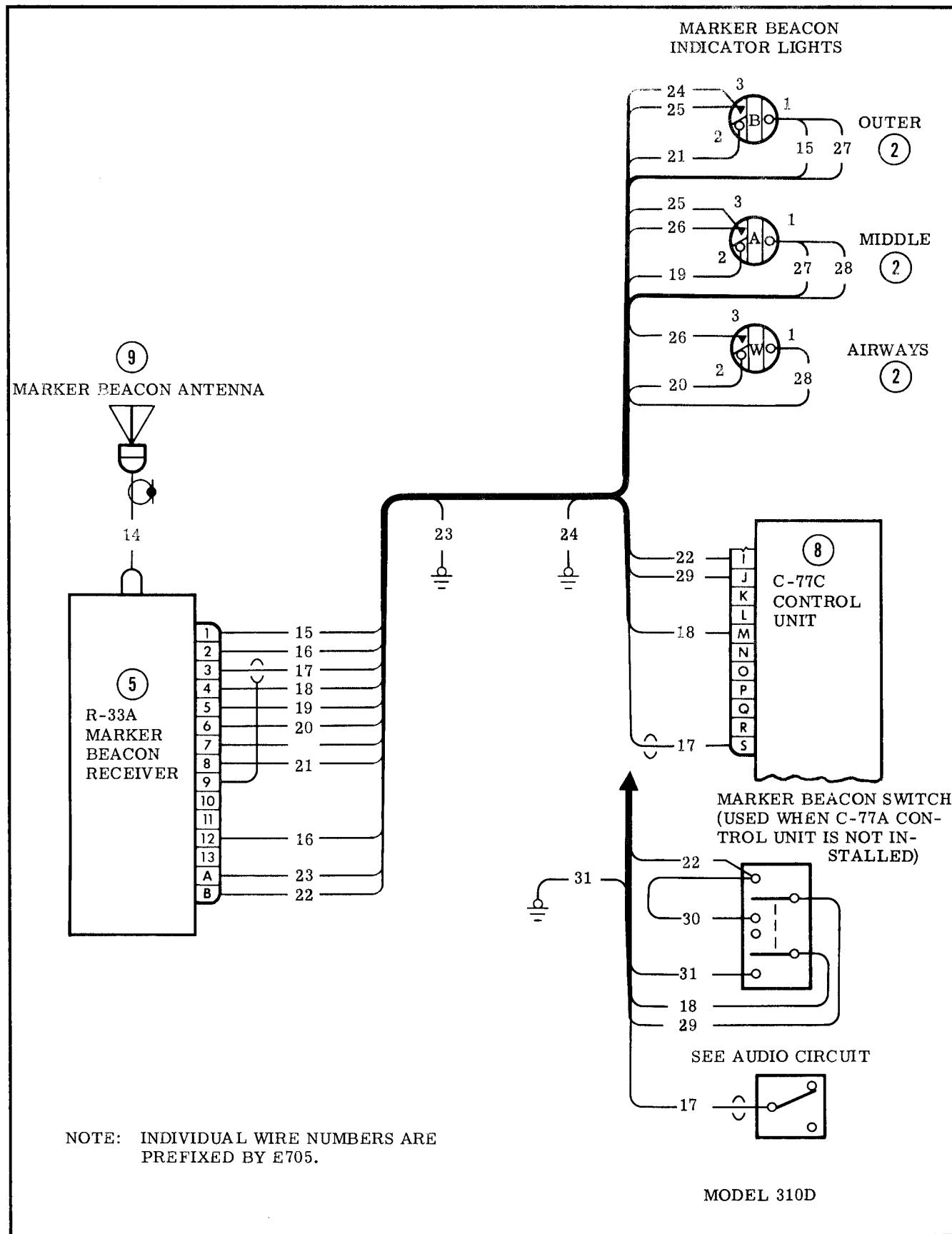


Figure 7-64. R-31A Glide Slope & R-33A Marker Beacon Receiver (Sheet 4 of 4)

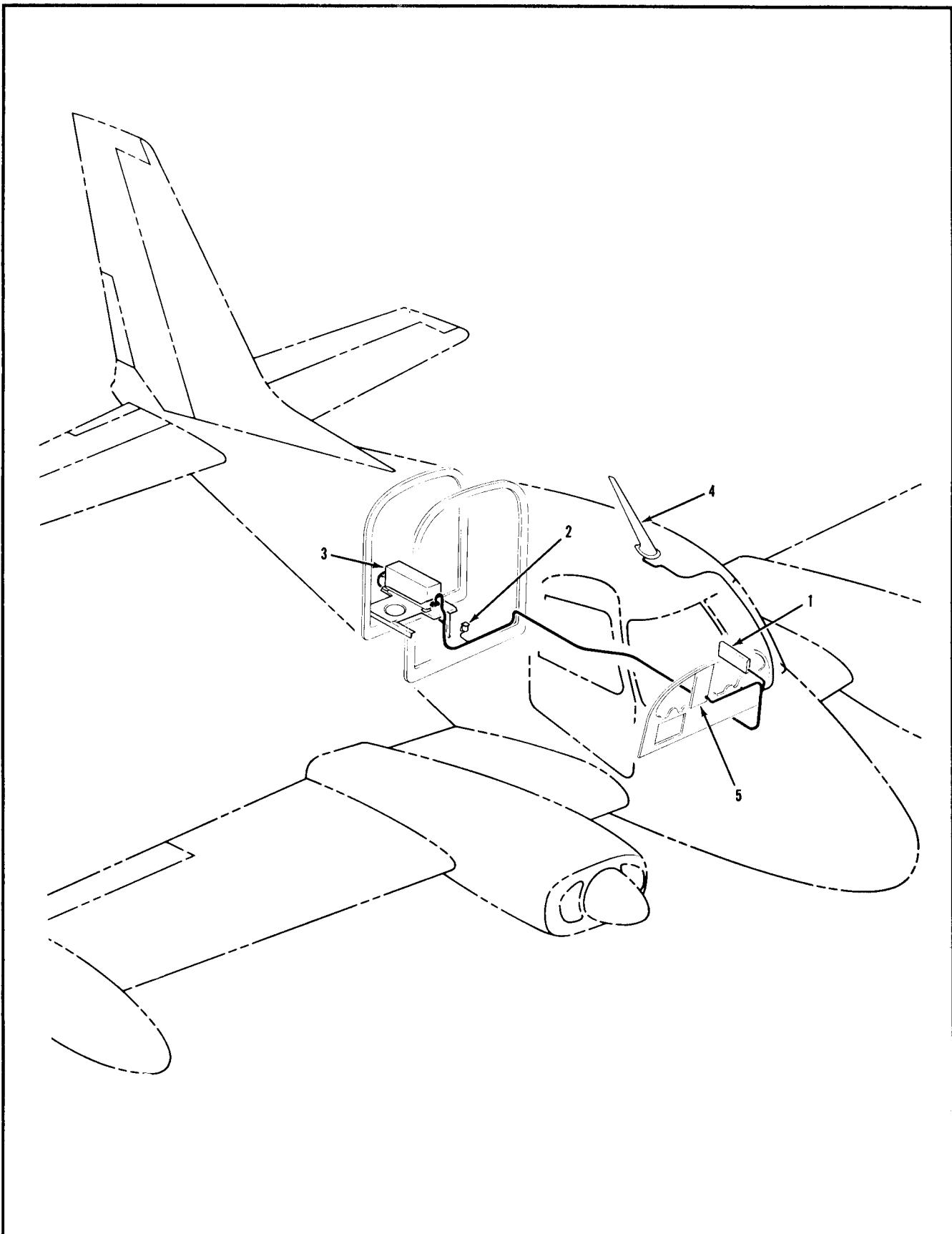


Figure 7-65. 1016 Transceiver Circuit (Sheet 1 of 3)

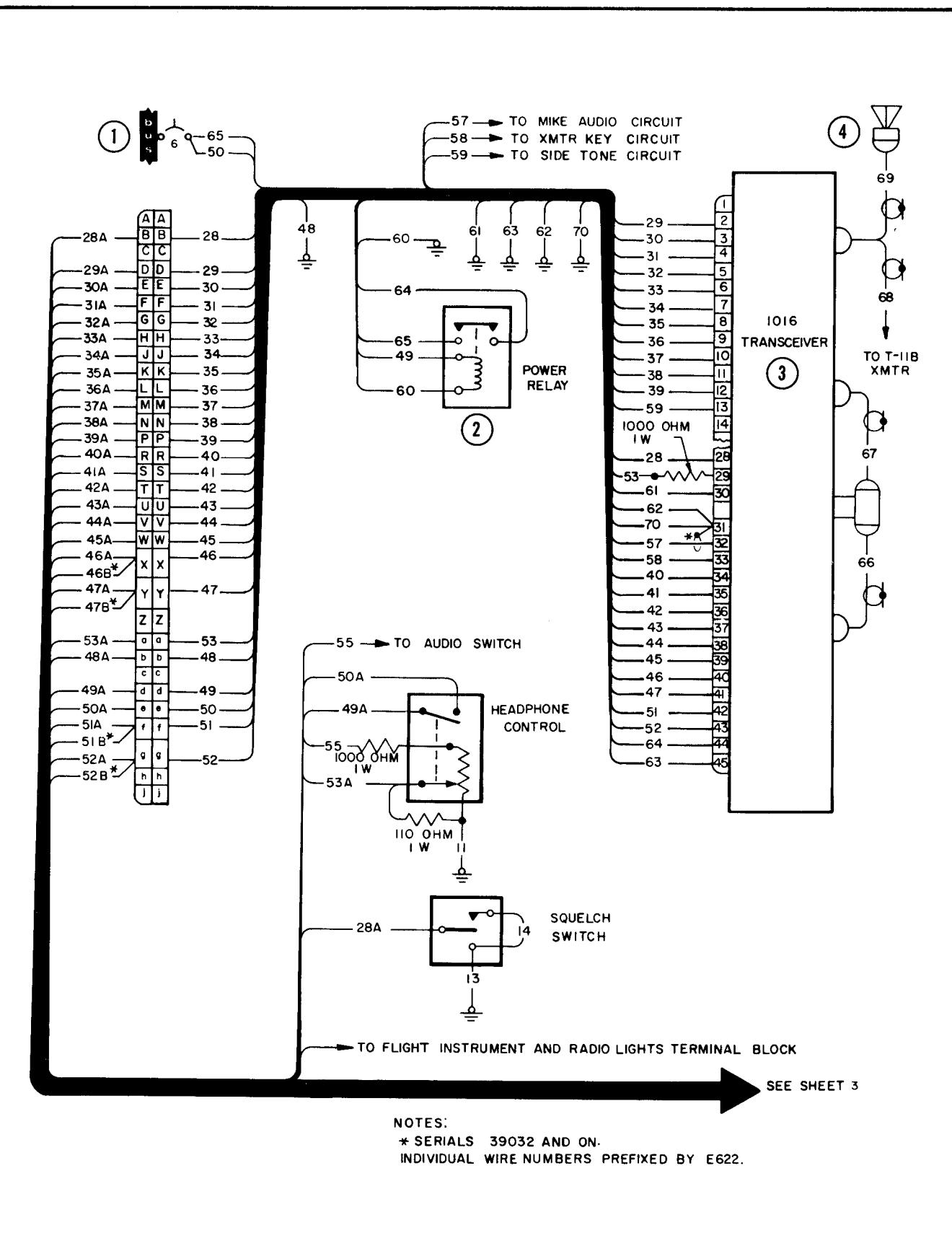


Figure 7-65. 1016 Transceiver Circuit (Sheet 2 of 3)

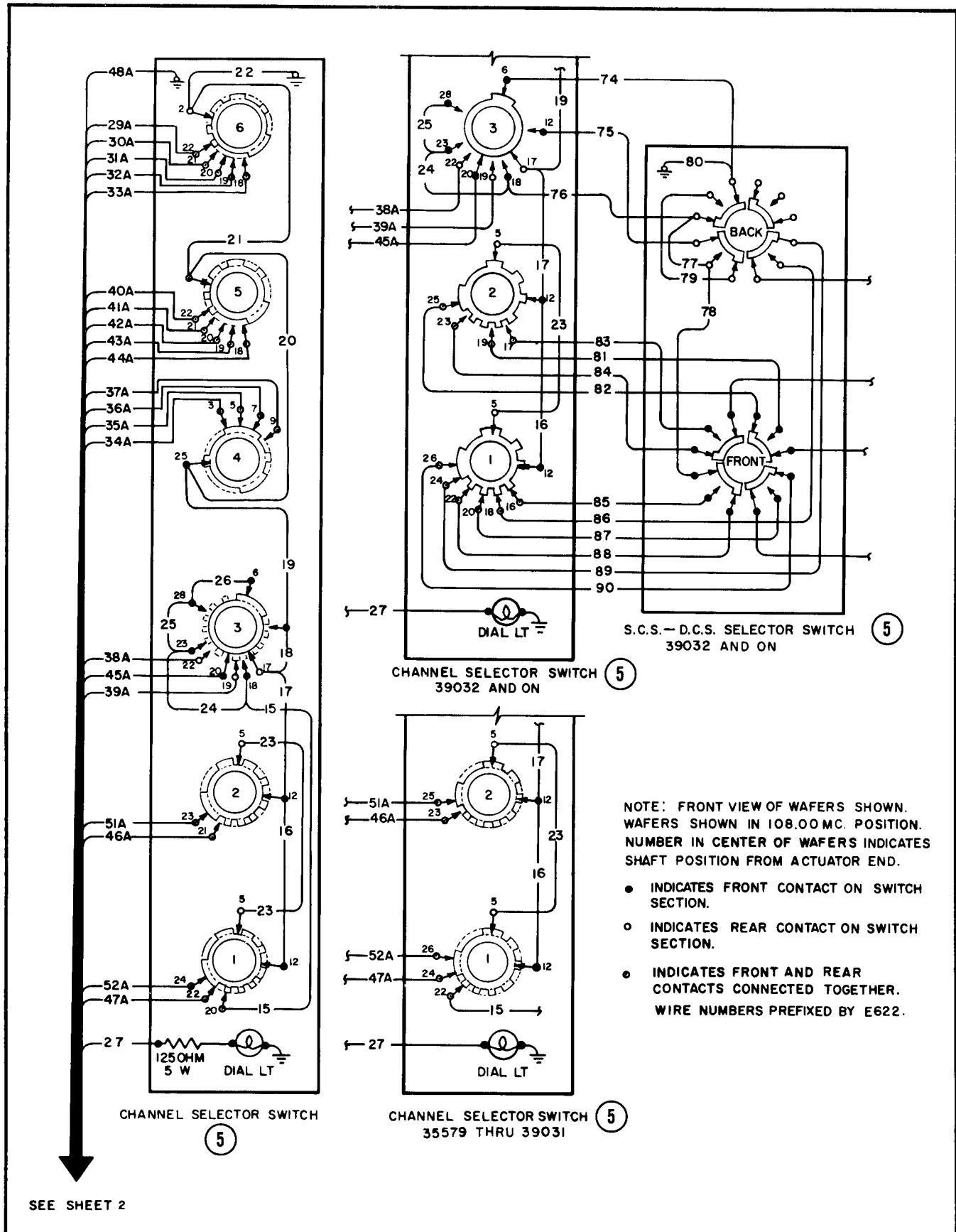


Figure 7-65. 1016 Transceiver Circuit (Sheet 3 of 3)

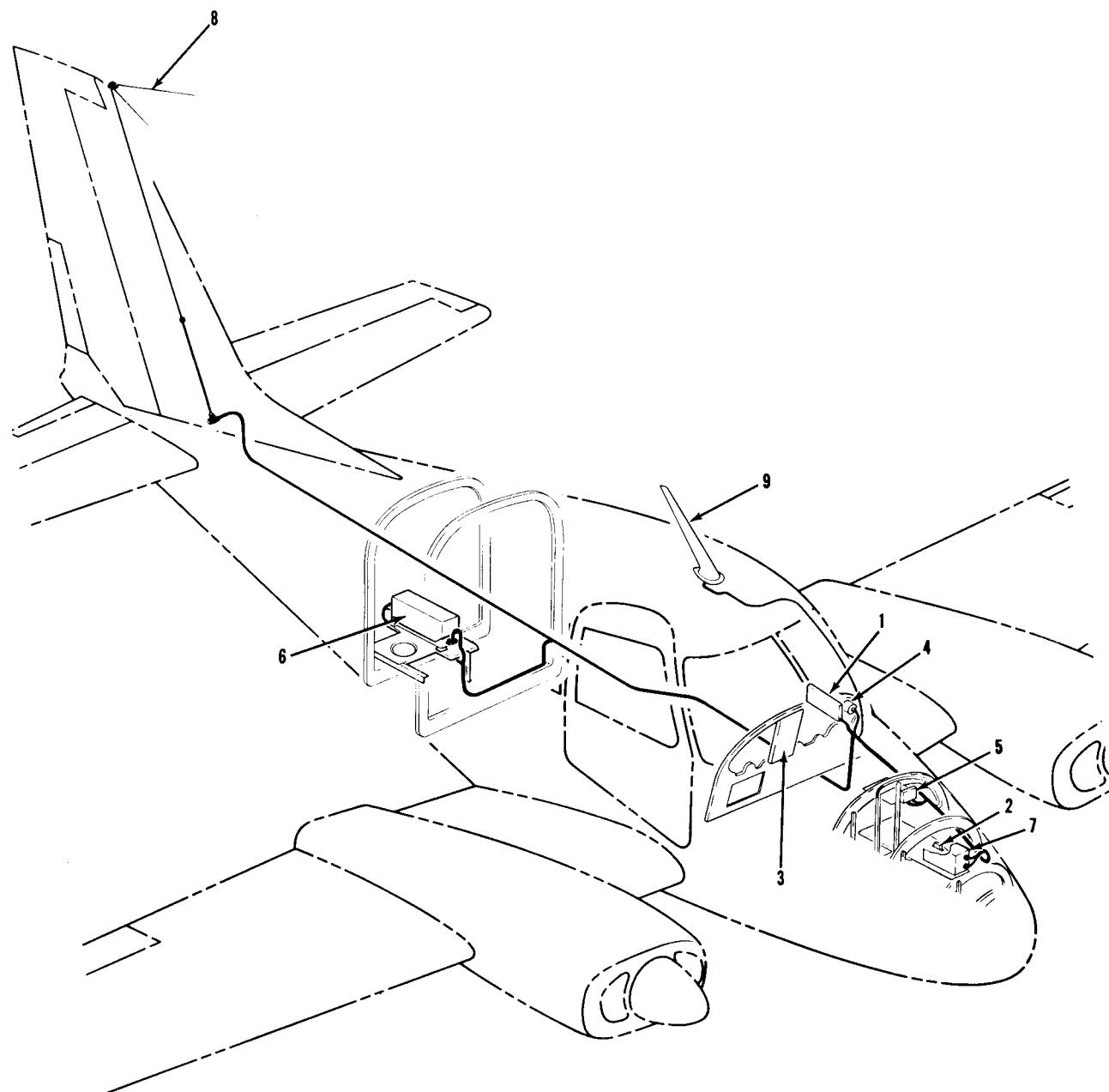


Figure 7-66. 1016 Transceiver Circuit - With 1021 Omni Converter (Sheet 1 of 3)

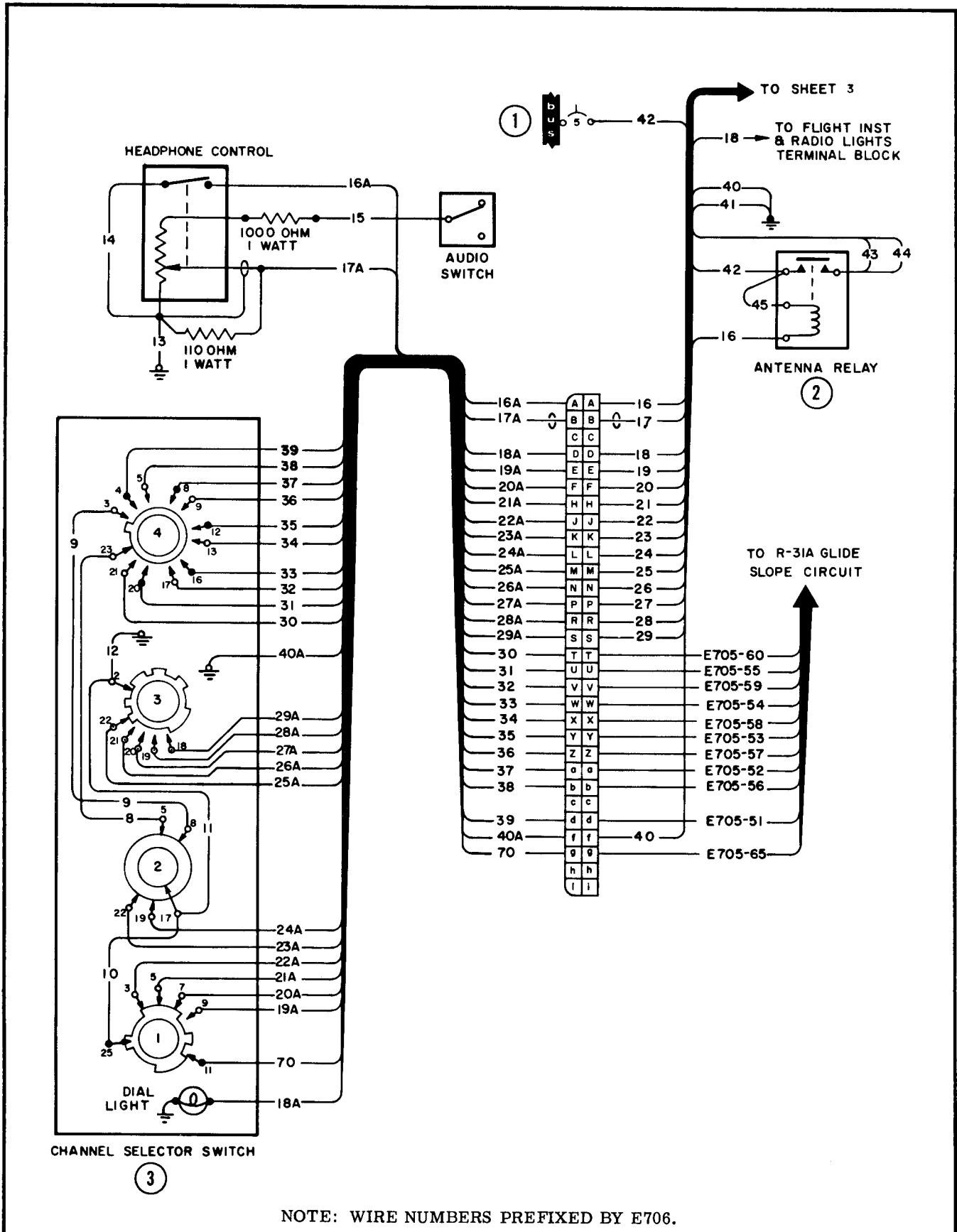
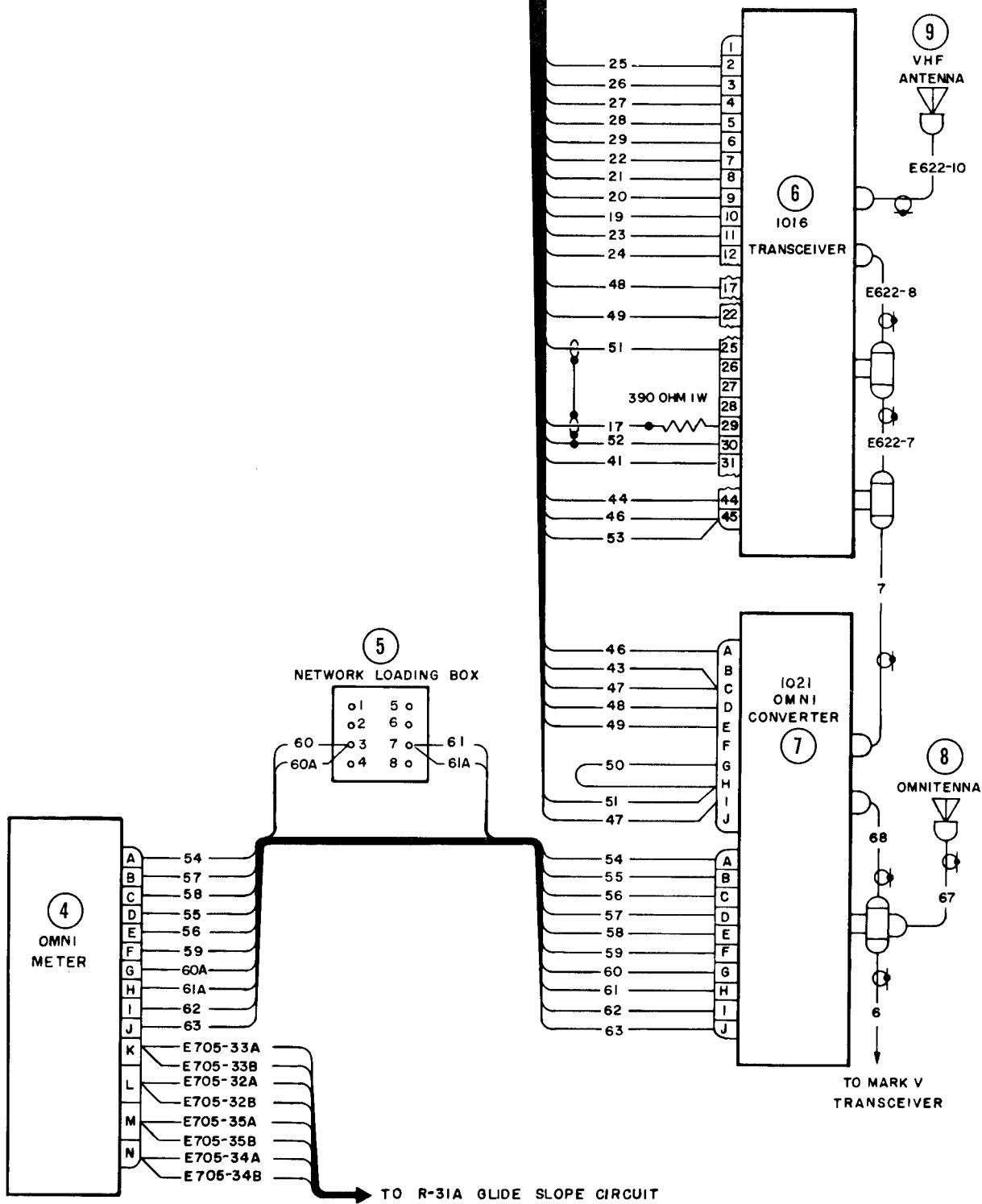


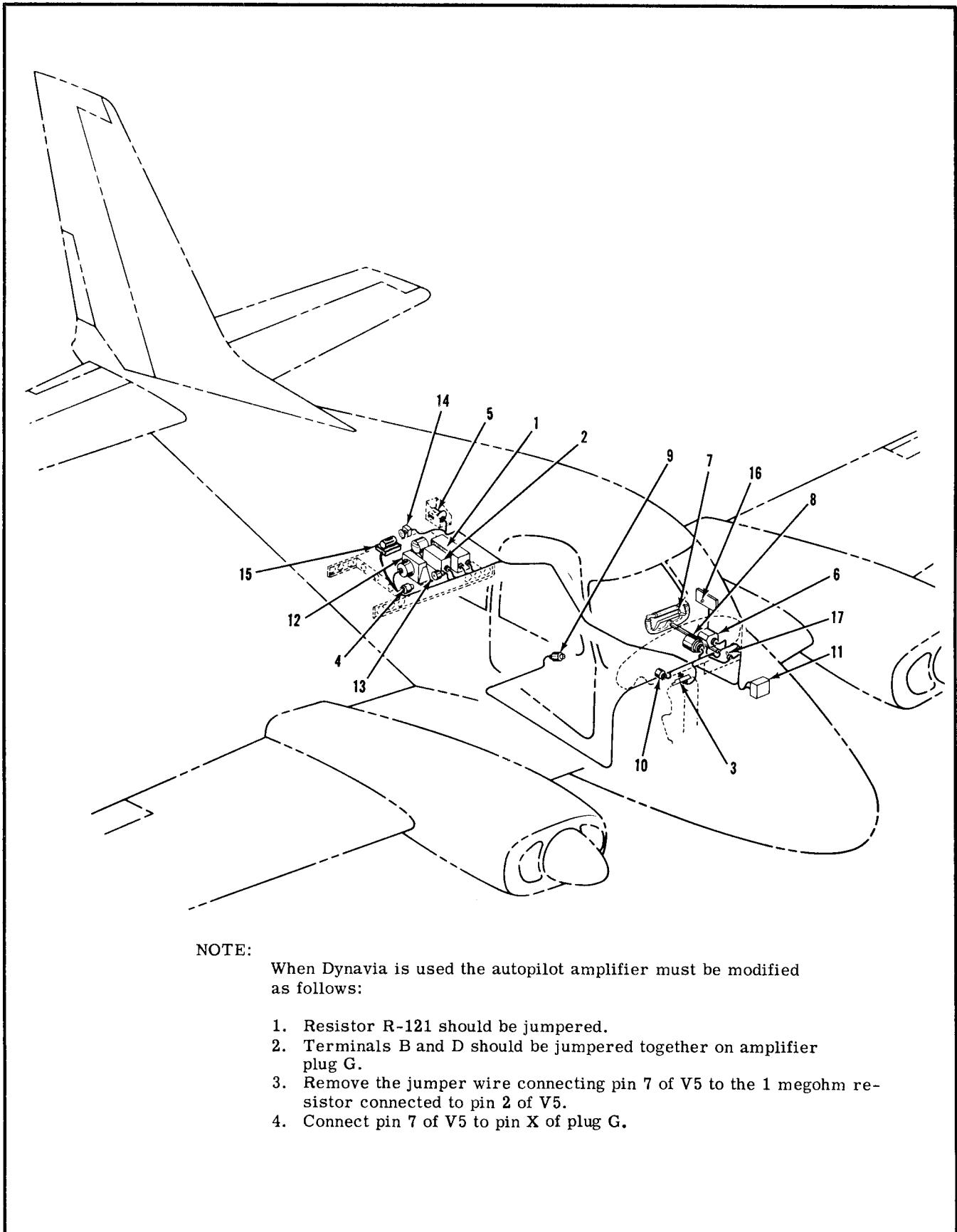
Figure 7-66. 1016 Transceiver Circuit - With 1021 Omni Converter (Sheet 2 of 3)

TO SHEET 2



NOTE: WIRE NUMBERS PREFIXED BY E706.

Figure 7-66. 1016 Transceiver Circuit - With 1021 Omni Converter (Sheet 3 of 3)

**NOTE:**

When Dynavia is used the autopilot amplifier must be modified as follows:

1. Resistor R-121 should be jumpered.
2. Terminals B and D should be jumpered together on amplifier plug G.
3. Remove the jumper wire connecting pin 7 of V5 to the 1 megohm resistor connected to pin 2 of V5.
4. Connect pin 7 of V5 to pin X of plug G.

Figure 7-67. L-2 Autopilot Circuits (Sheet 1 of 3)

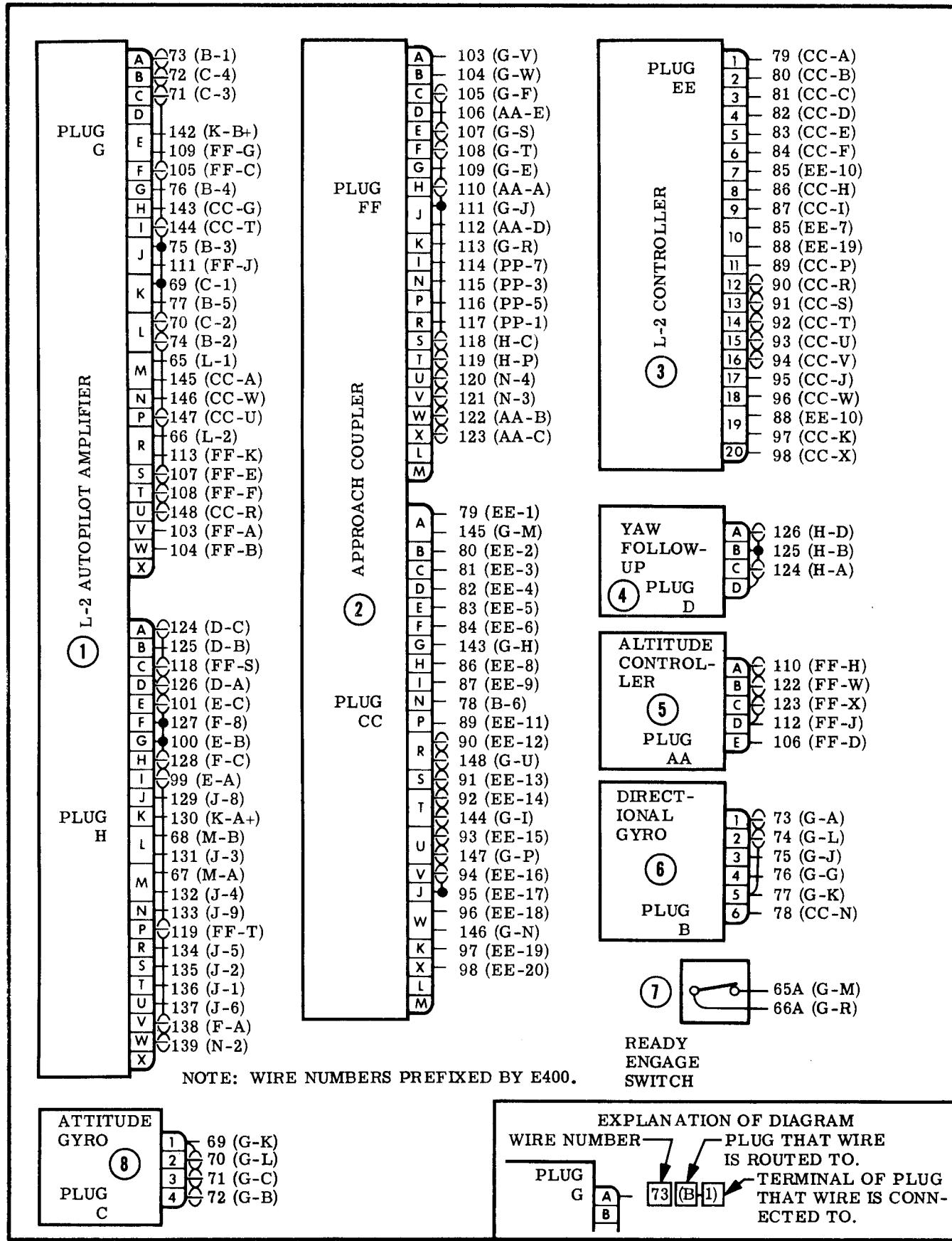


Figure 7-67. L-2 Autopilot Circuit (Sheet 2 of 3)

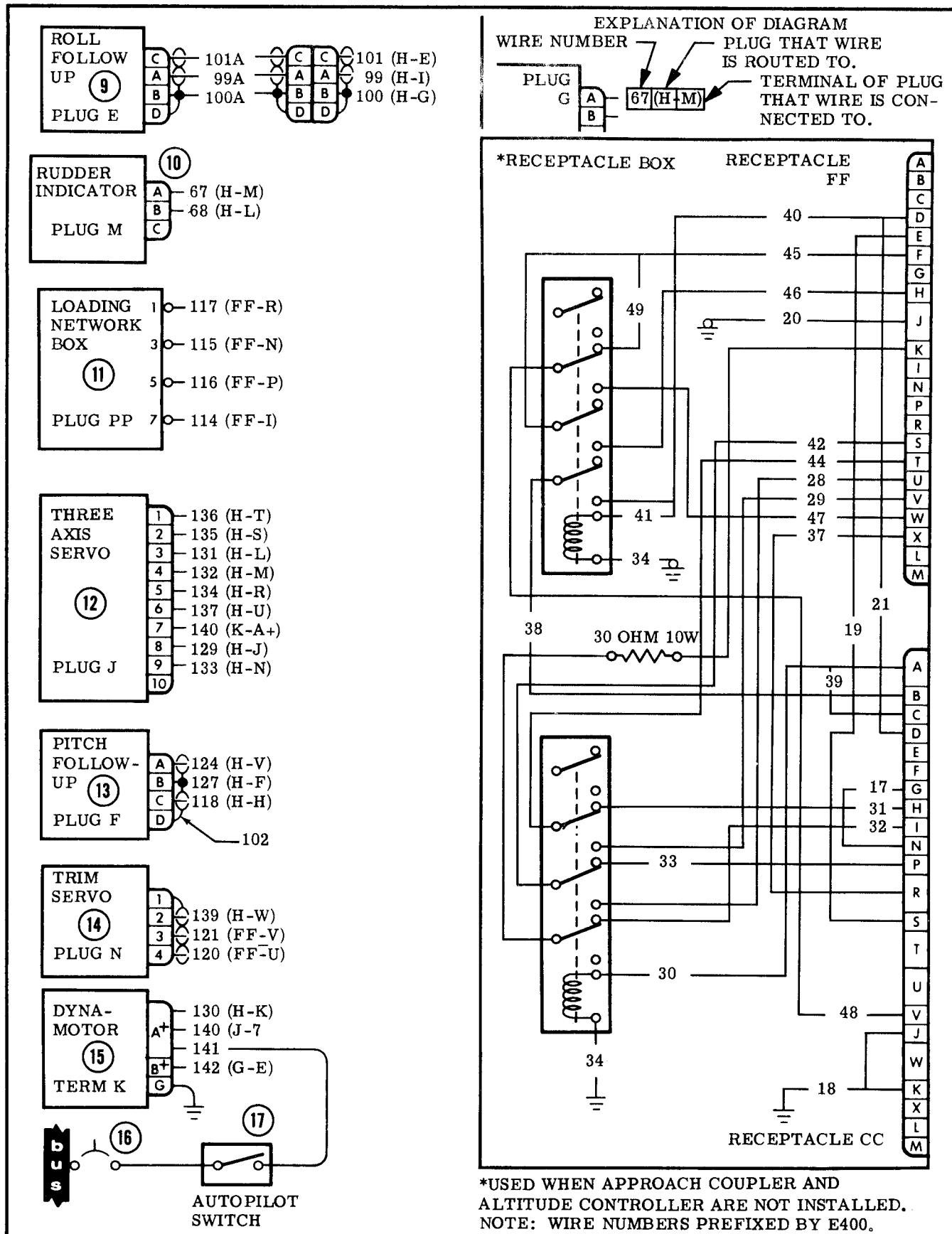


Figure 7-67. L-2 Autopilot Circuit (Sheet 3 of 3)

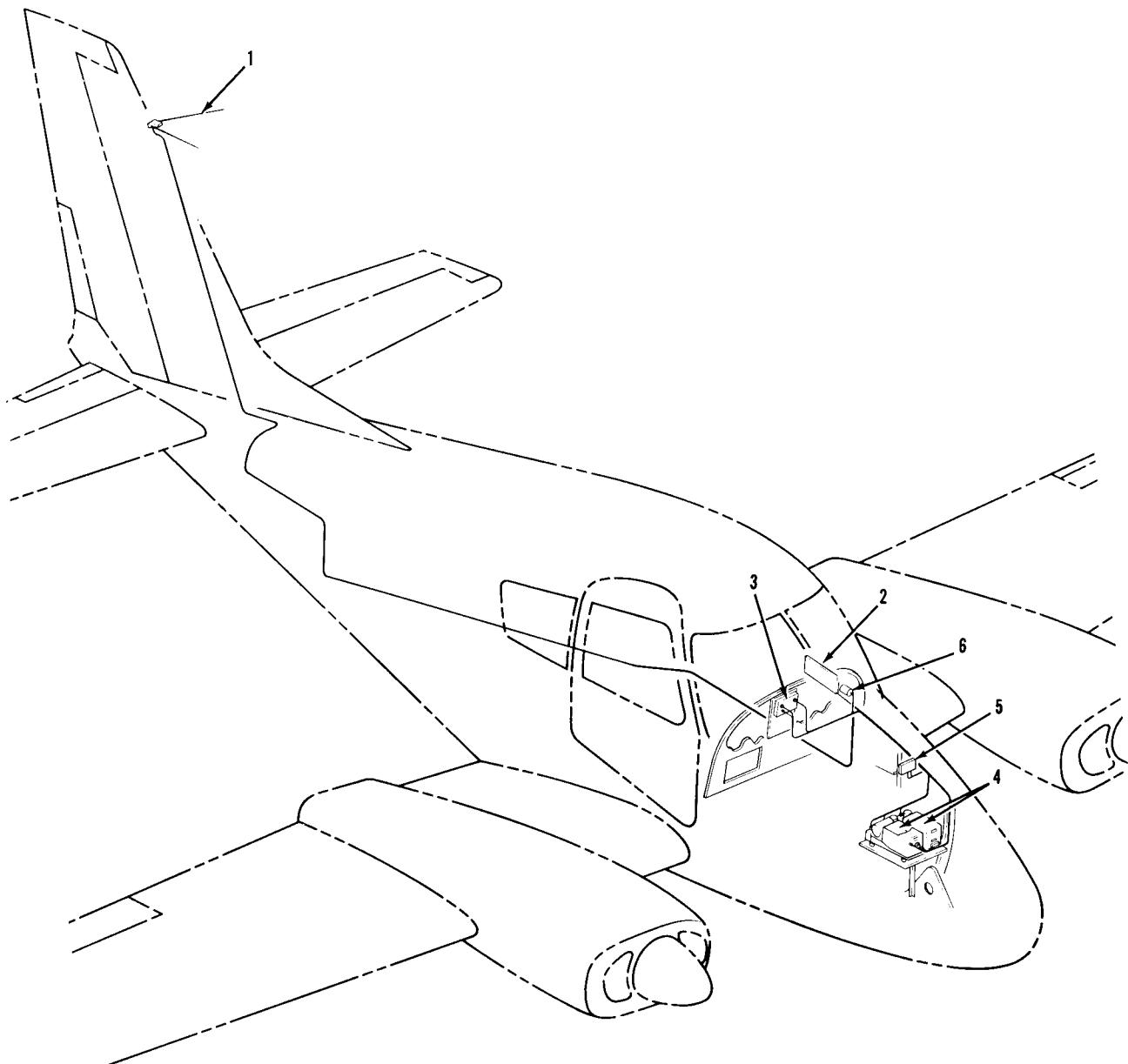


Figure 7-68. 15F Omnidrome Navigation Circuit (Sheet 1 of 2)

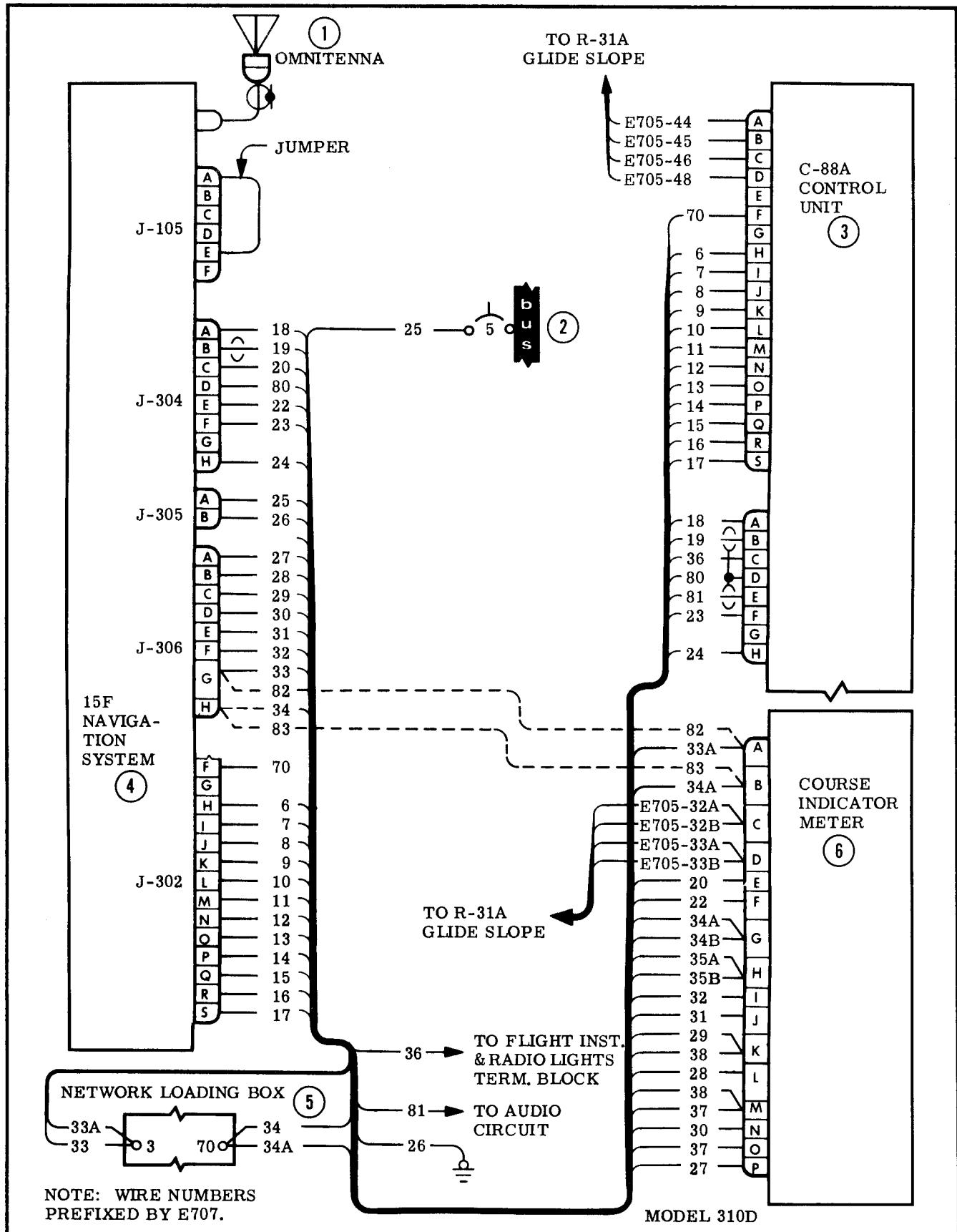


Figure 7-68. 15F Omnidirectional Navigation Circuit (Sheet 2 of 2)

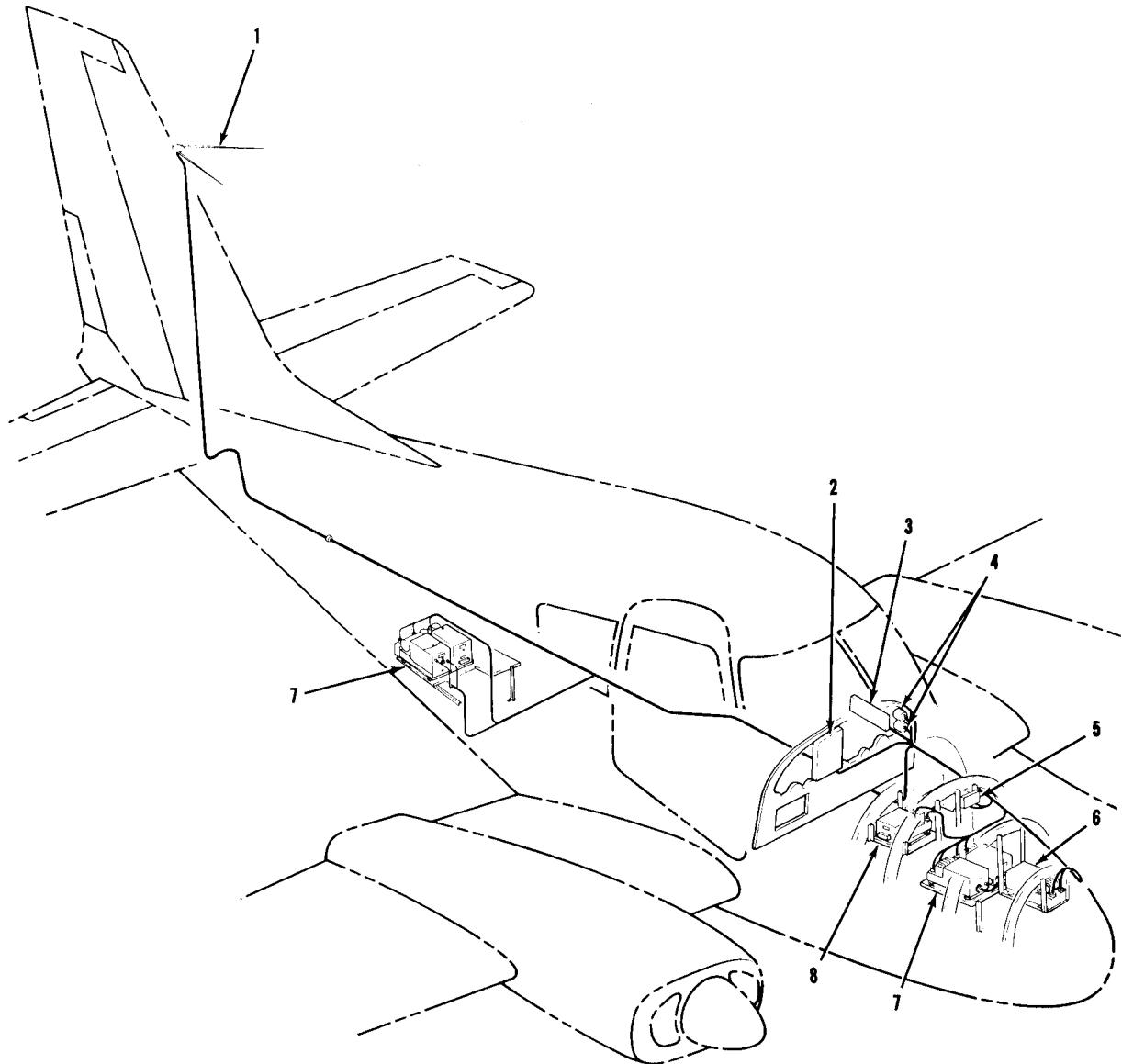


Figure 7-69. 15F Omnidrange Navigation System (Sheet 1 of 4)

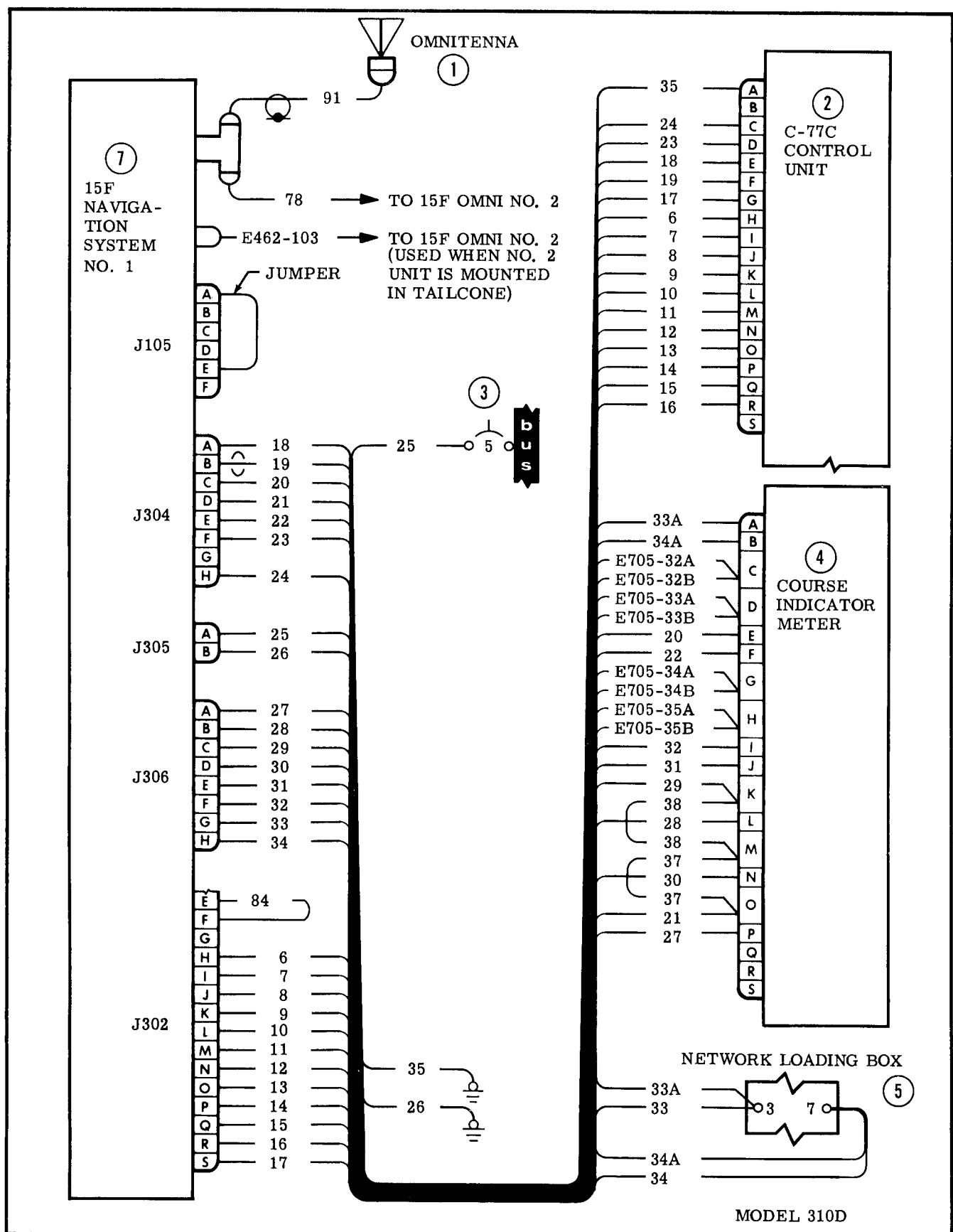


Figure 7-69. 15F Omnidirectional Navigation System (Sheet 2 of 4)

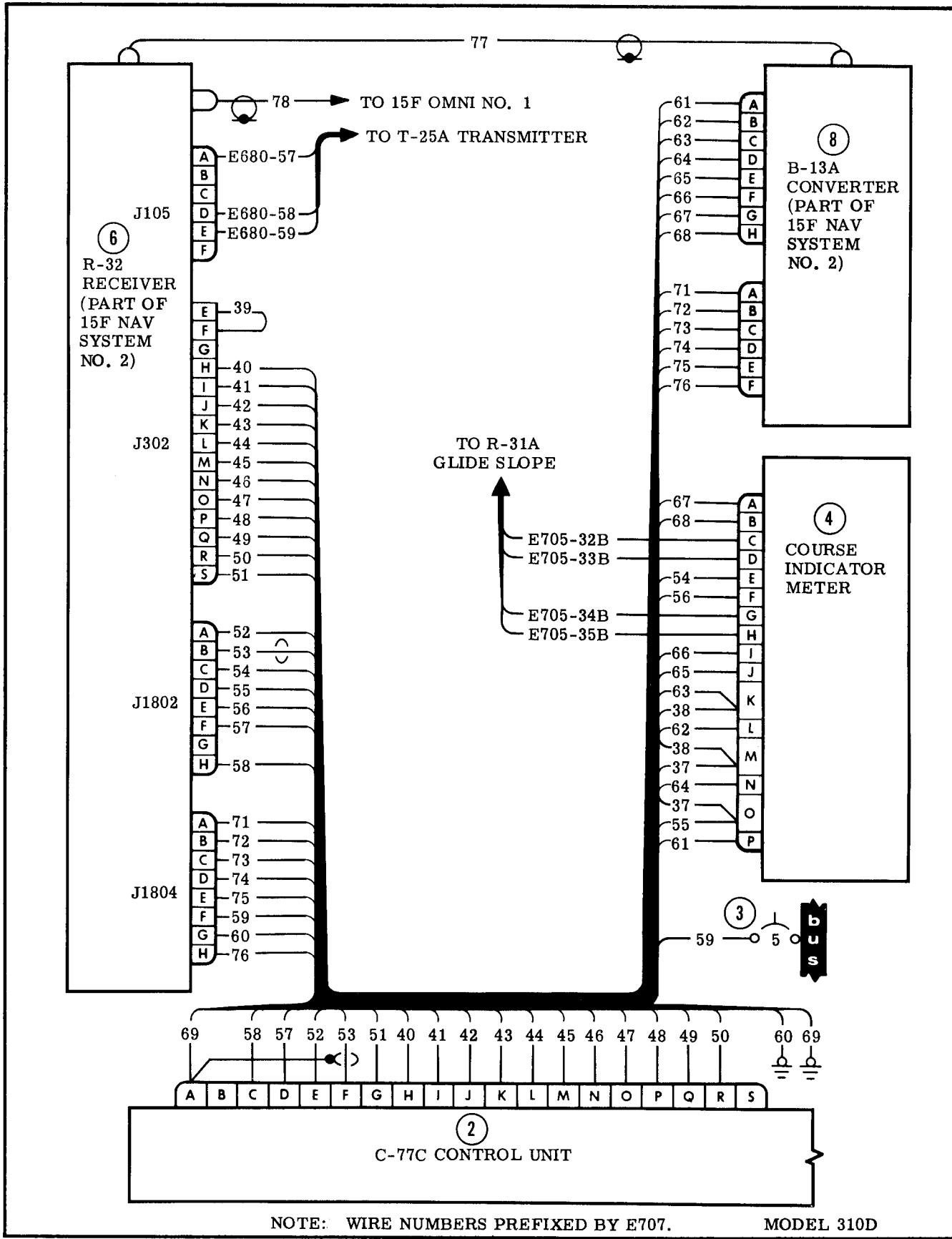


Figure 7-69. 15F Omnidirectional Navigation System (Sheet 3 of 4)

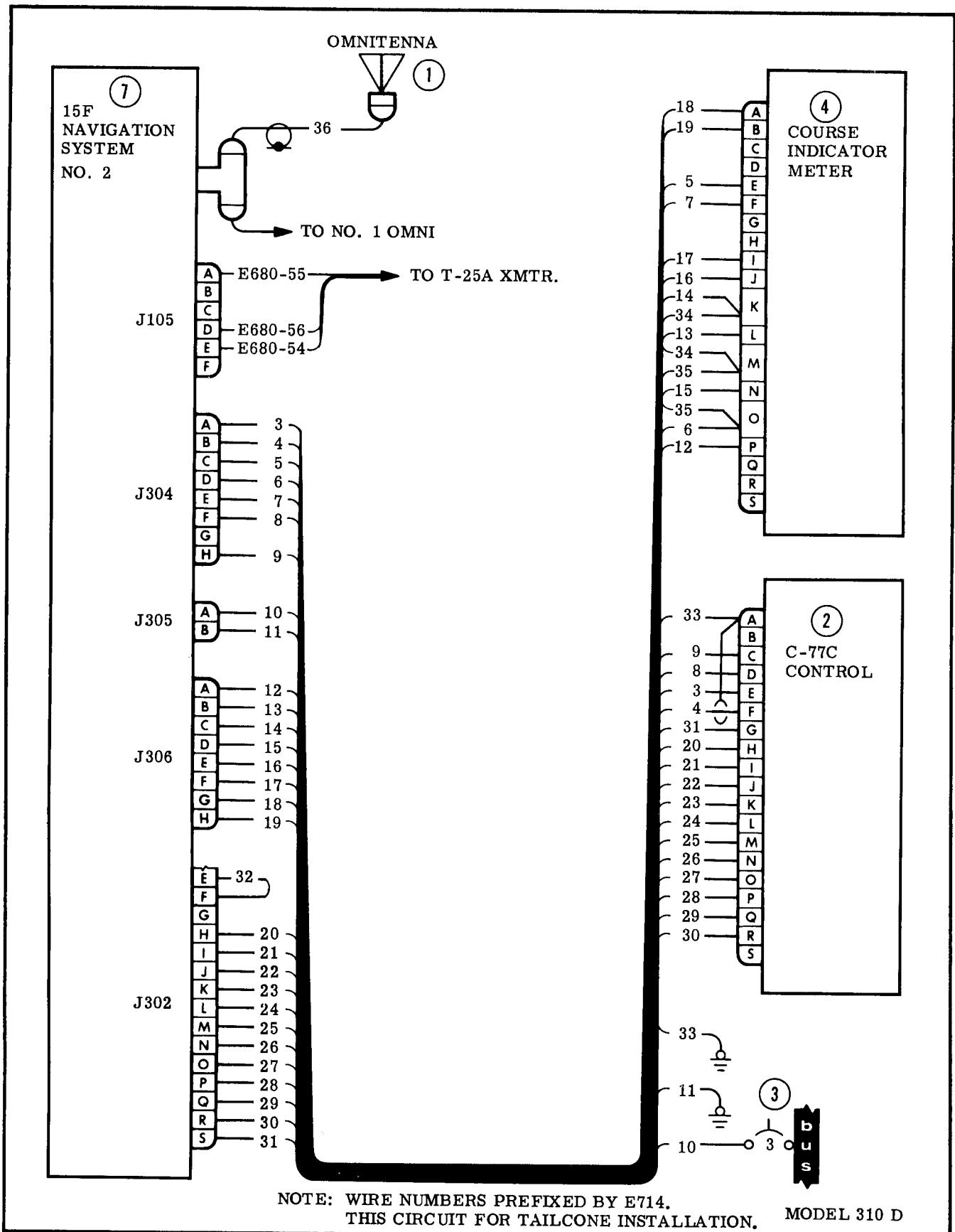


Figure 7-69. 15F Omnidome Navigation System (Sheet 4 of 4)

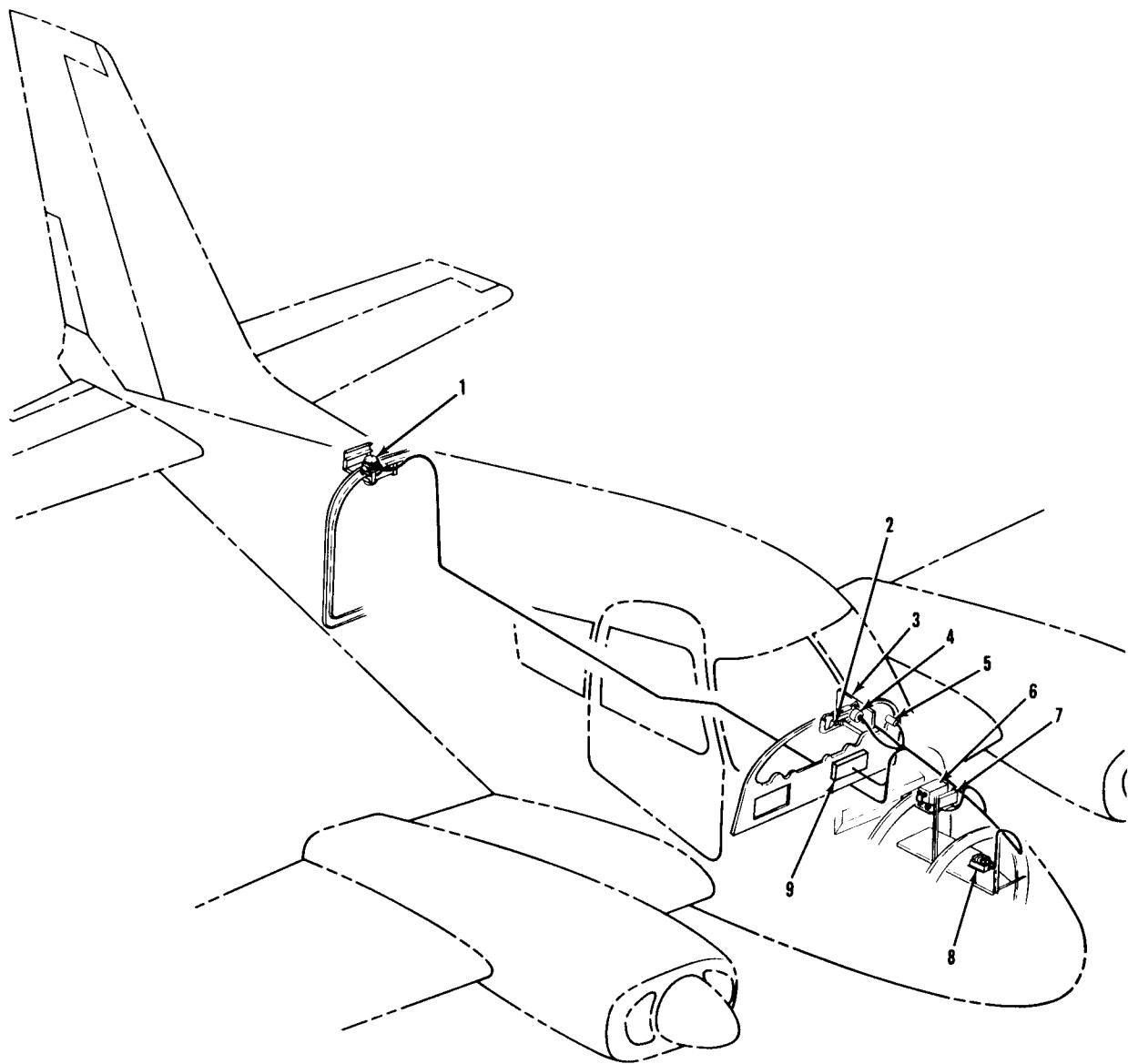


Figure 7-70. CD-1 Course Director Circuit (Sheet 1 of 2)

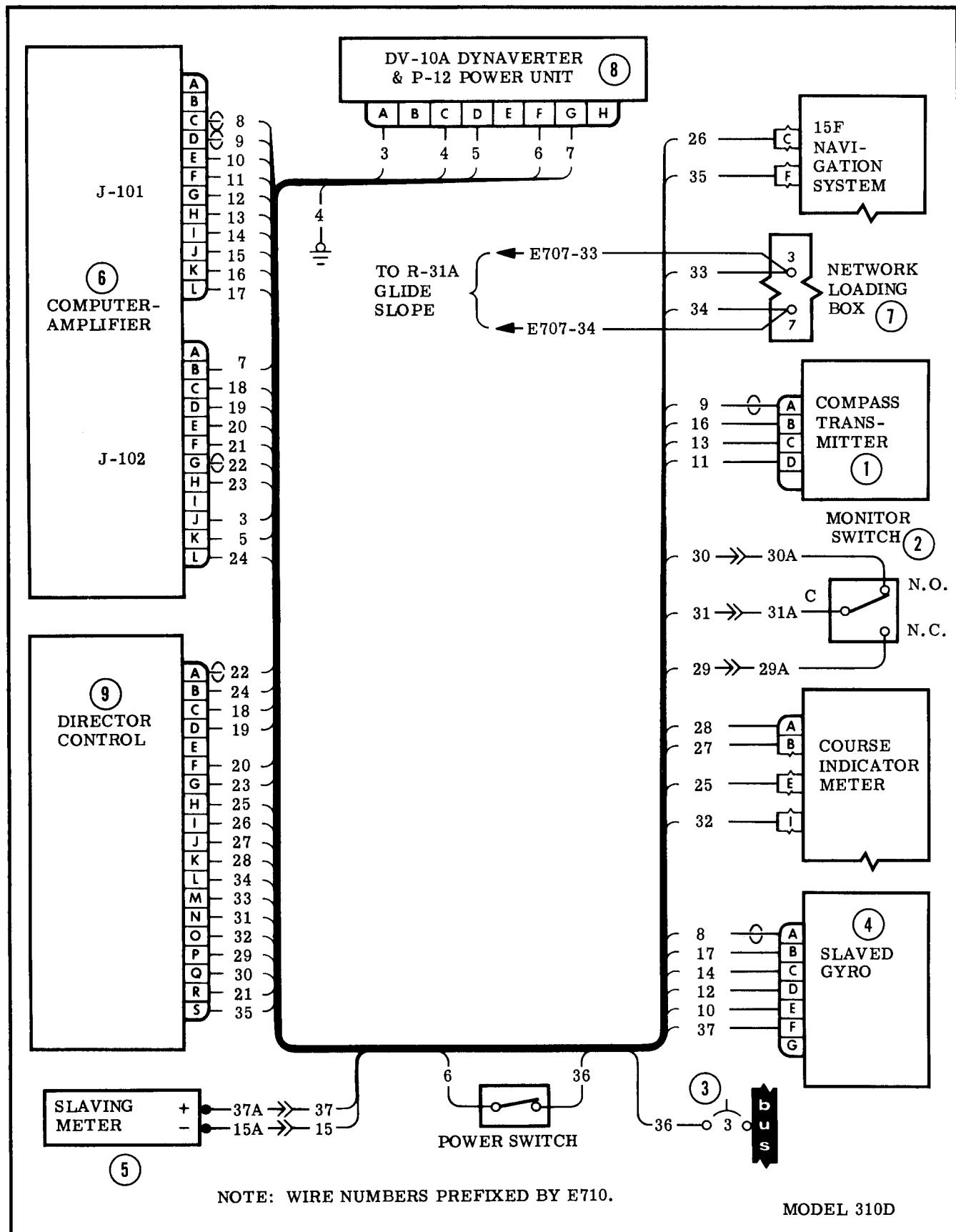


Figure 7-70. CD-1 Course Director Circuit (Sheet 2 of 2)

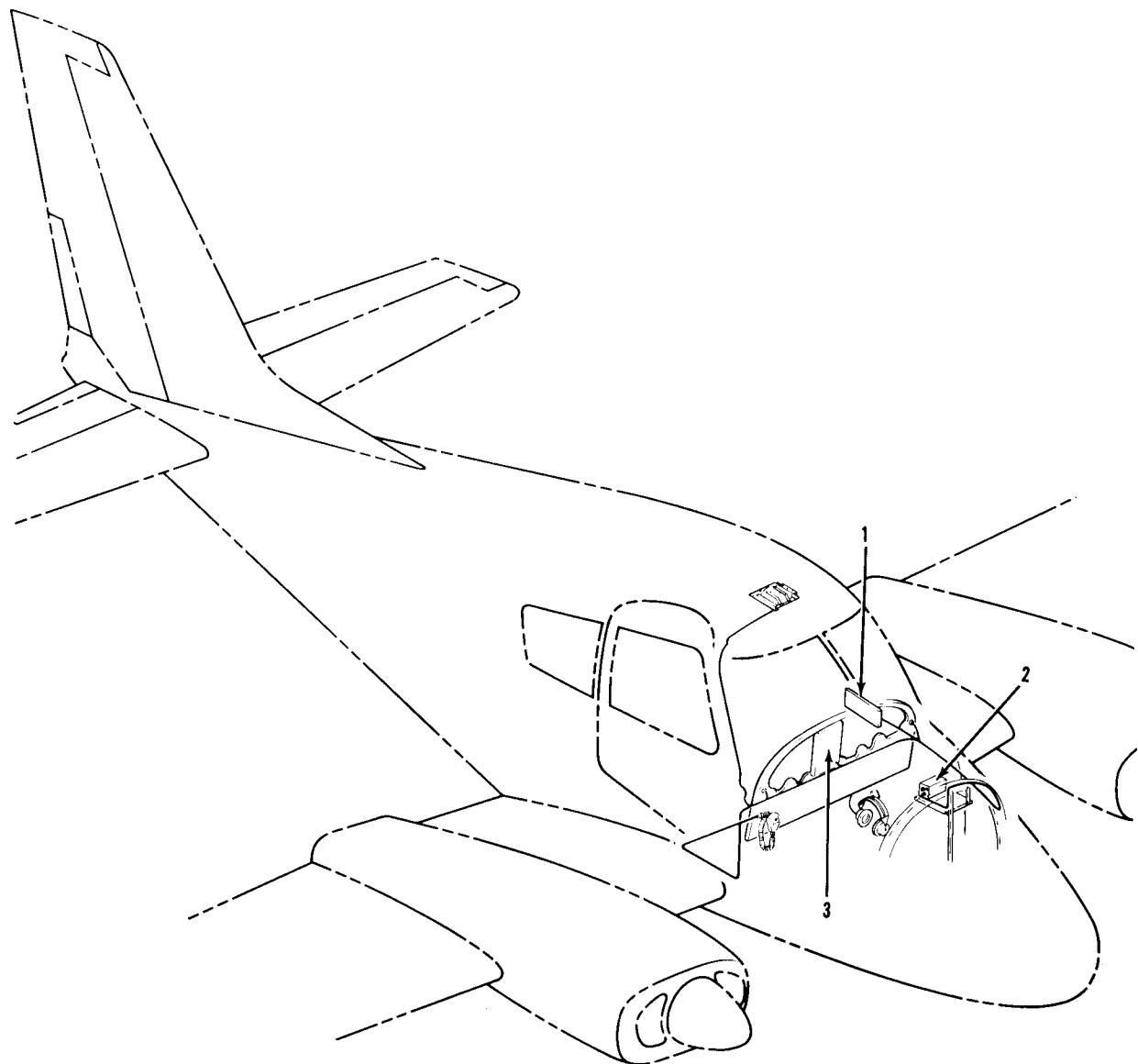
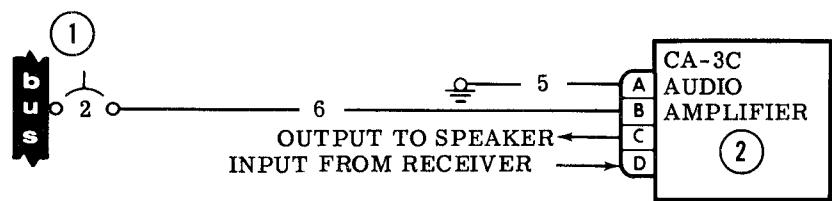


Figure 7-71. CA-3C Audio Amplifier Circuit (Sheet 1 of 2)



THIS CIRCUIT USED WITH ARC C-77 CONTROL

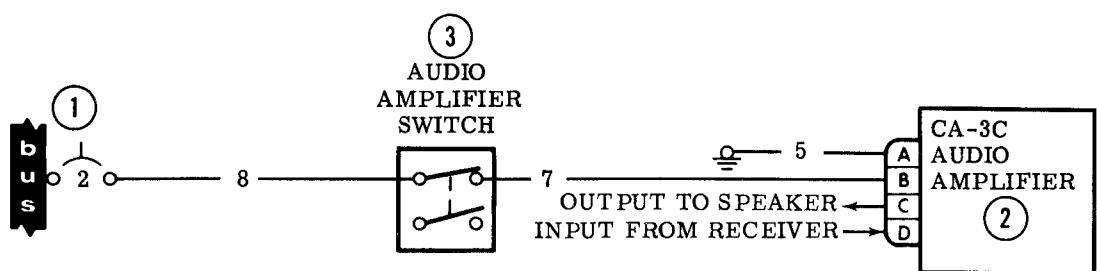


Figure 7-71. CA-3C Audio Amplifier Circuit (Sheet 2 of 2)

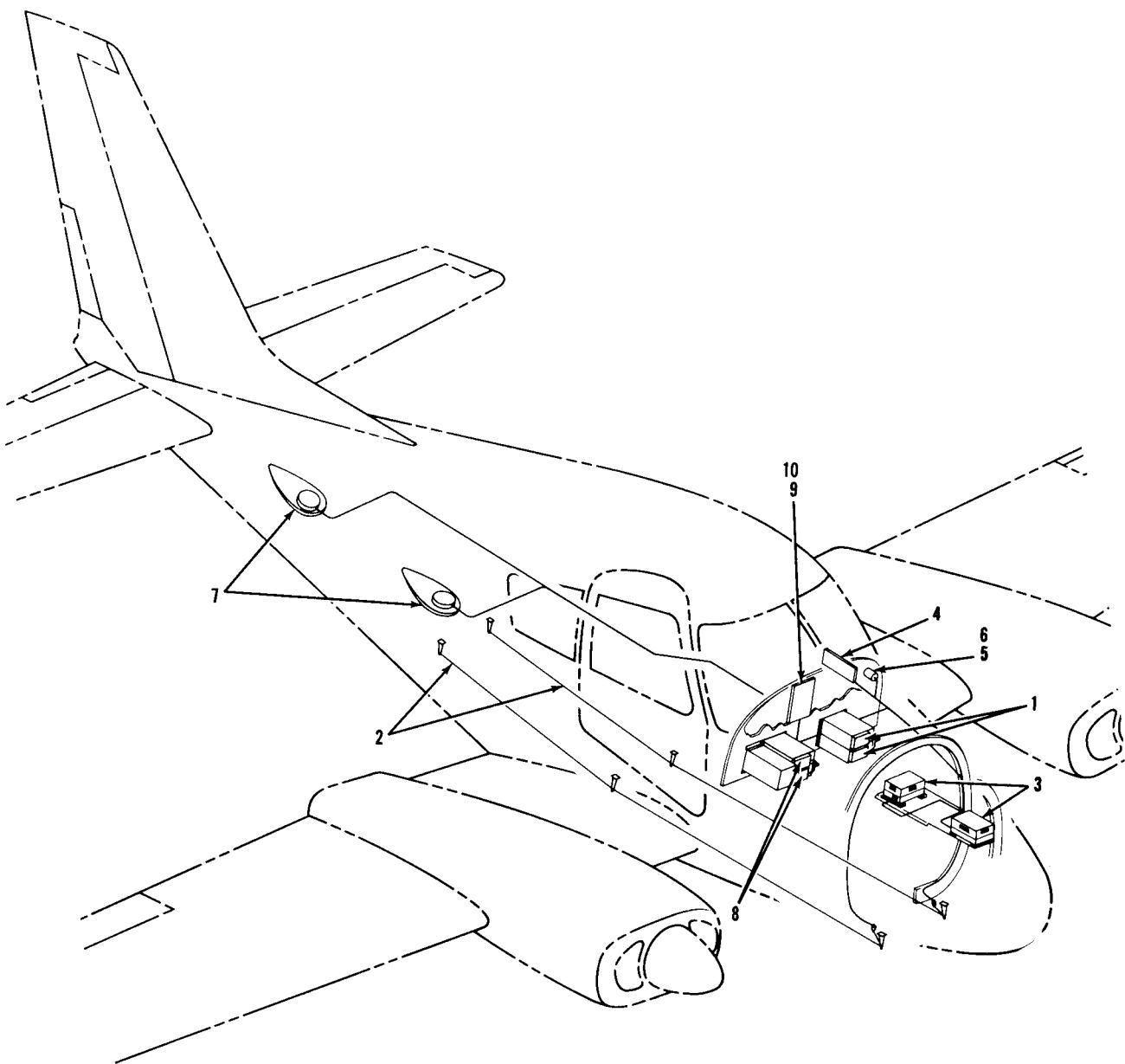


Figure 7-70. ADF-12E Circuit (Sheet 1 of 3)

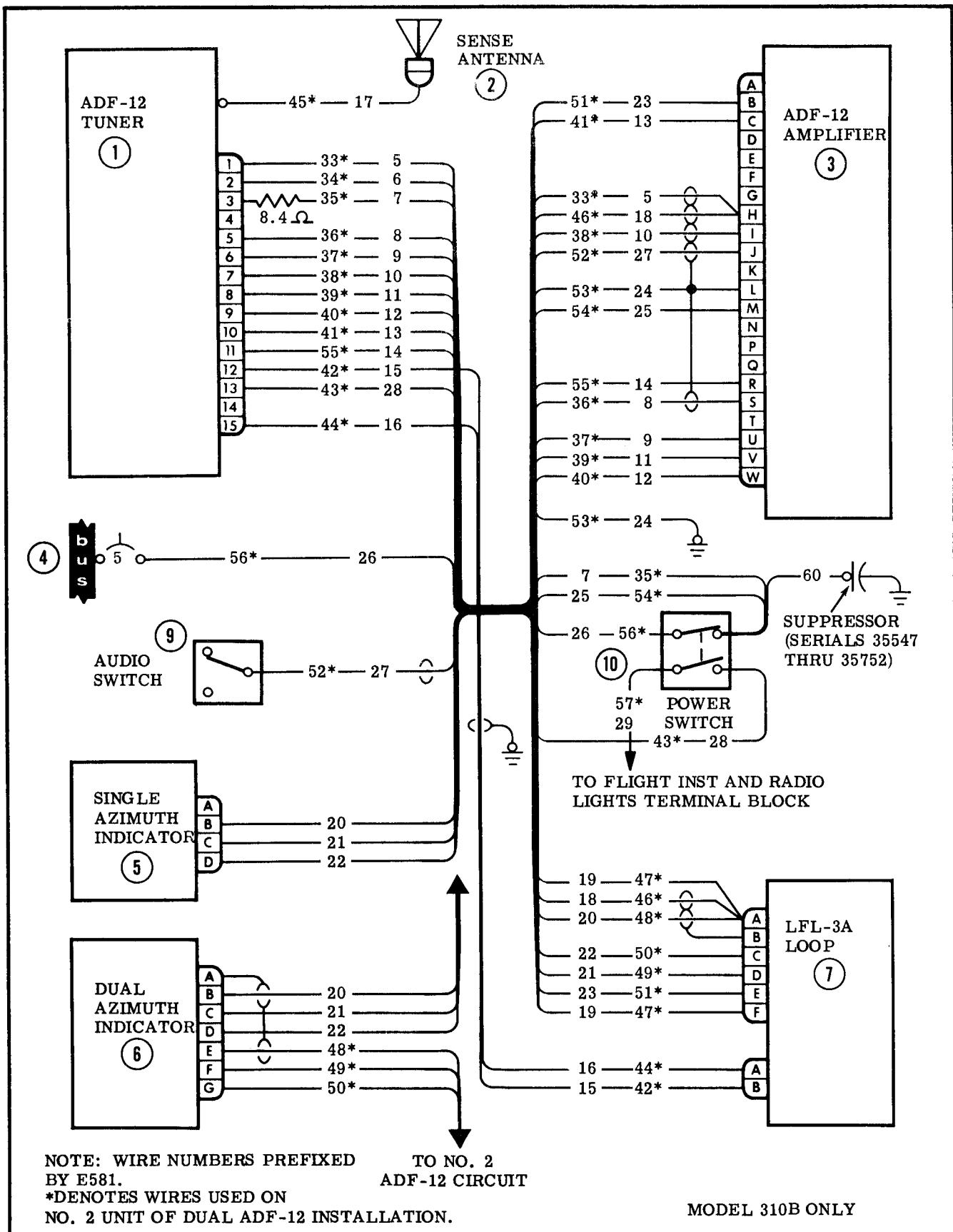


Figure 7-70. ADF-12E Circuit - Standard Location (Sheet 2 of 3)

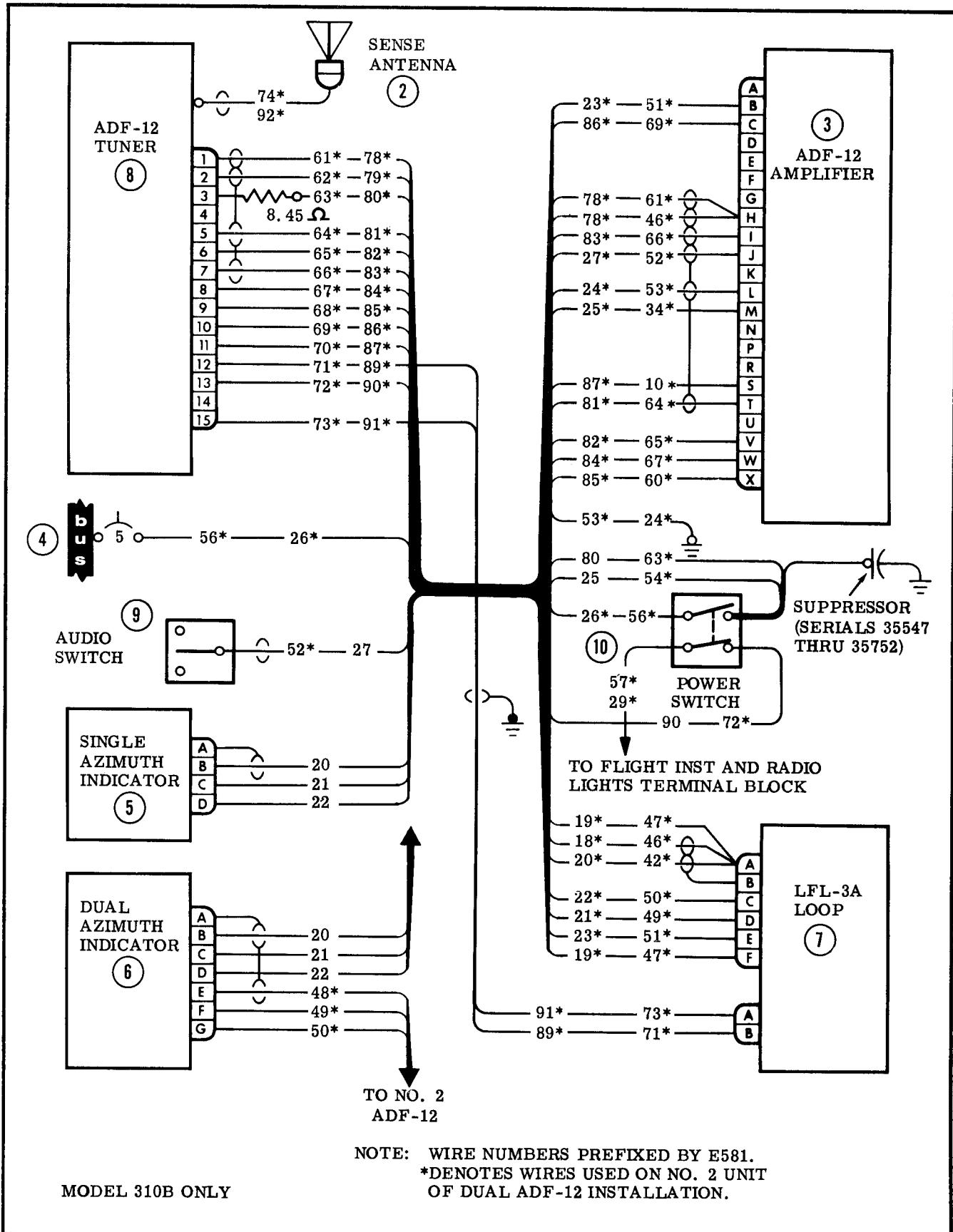


Figure 7-70. ADF-12E Circuit - Alternate Location (Sheet 3 of 3)

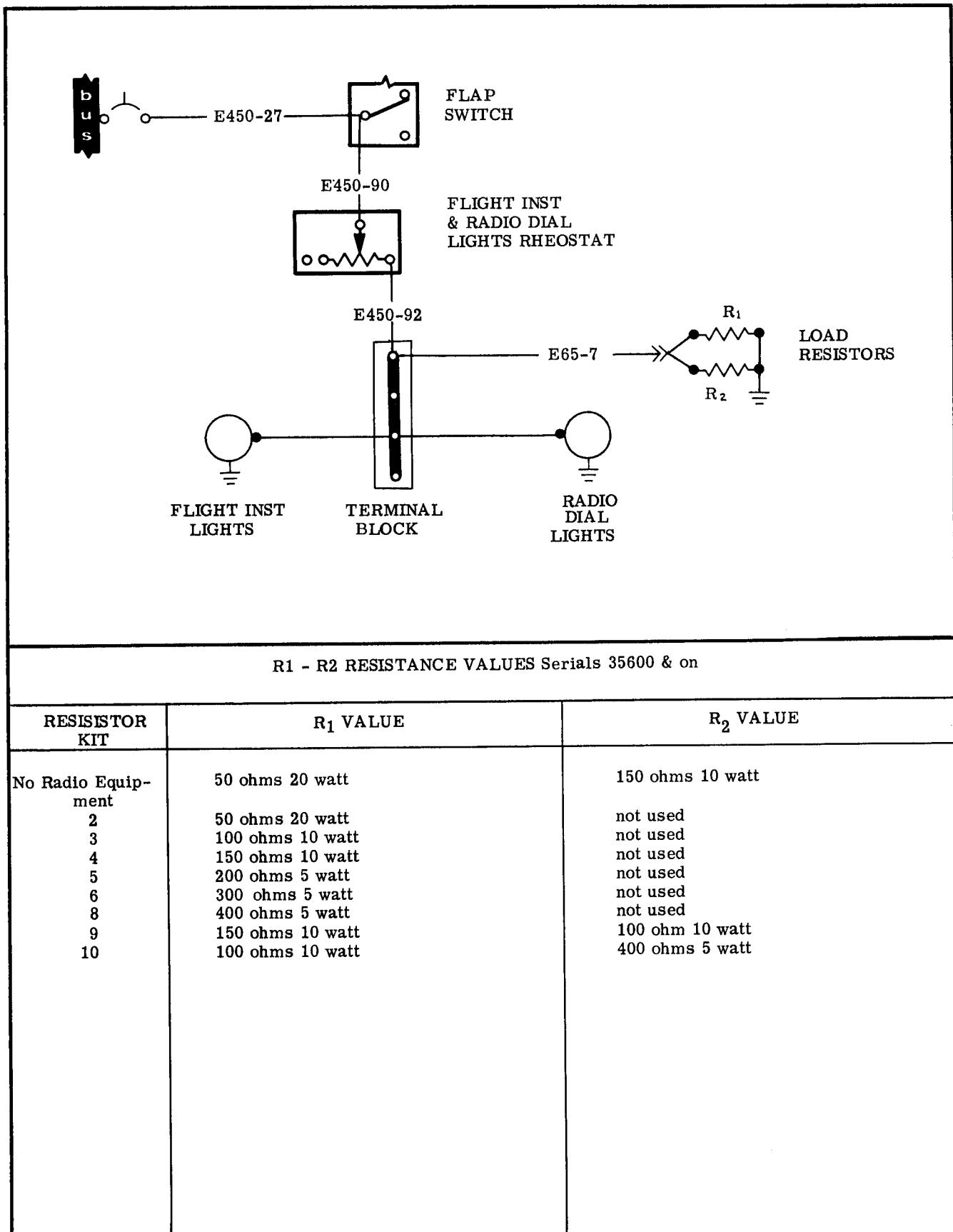


Figure 7-71. Dial Light Load Resistor Circuit

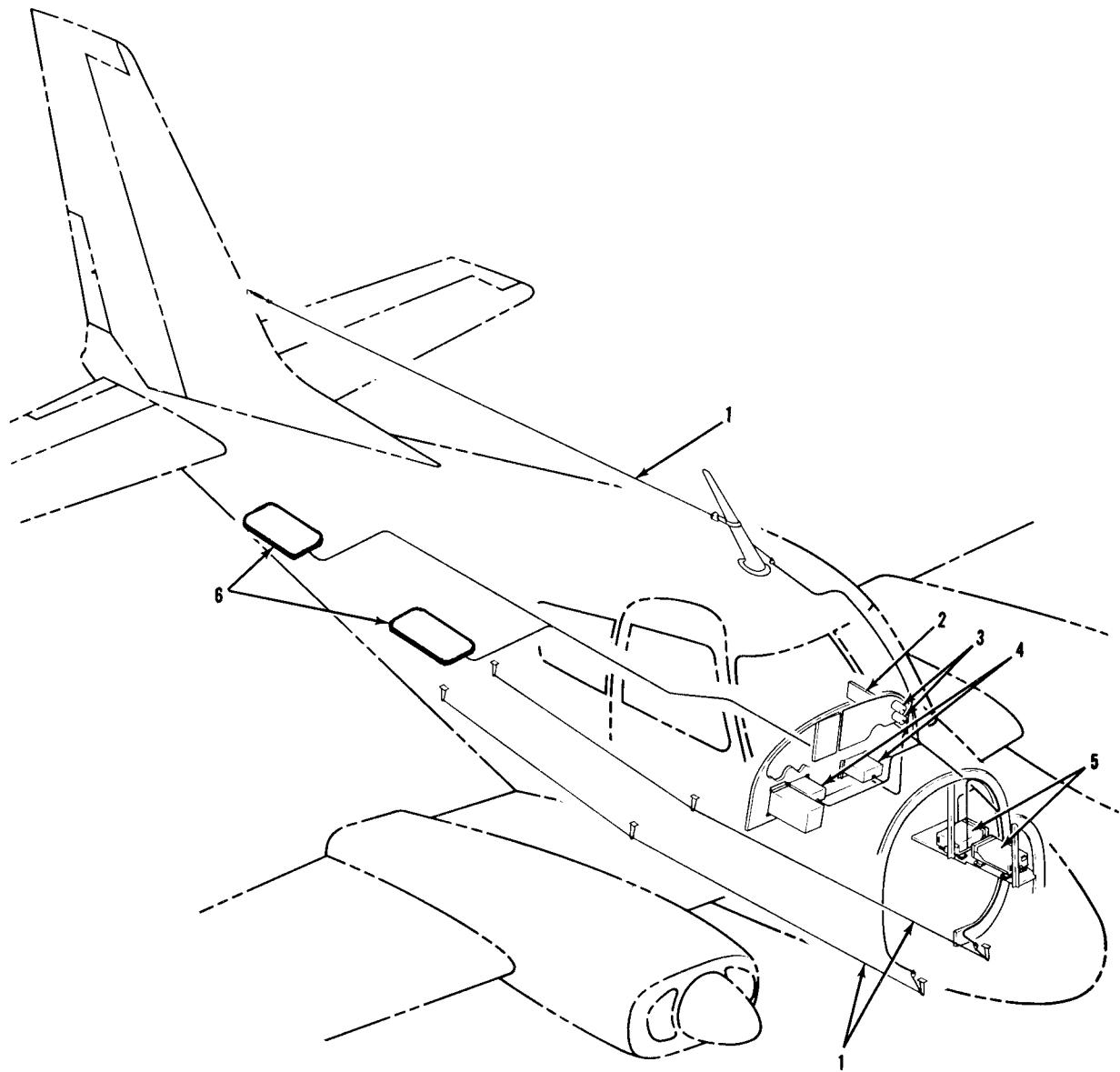


Figure 7-72. ADF-12E-2 with Gonio (Sheet 1 of 2)

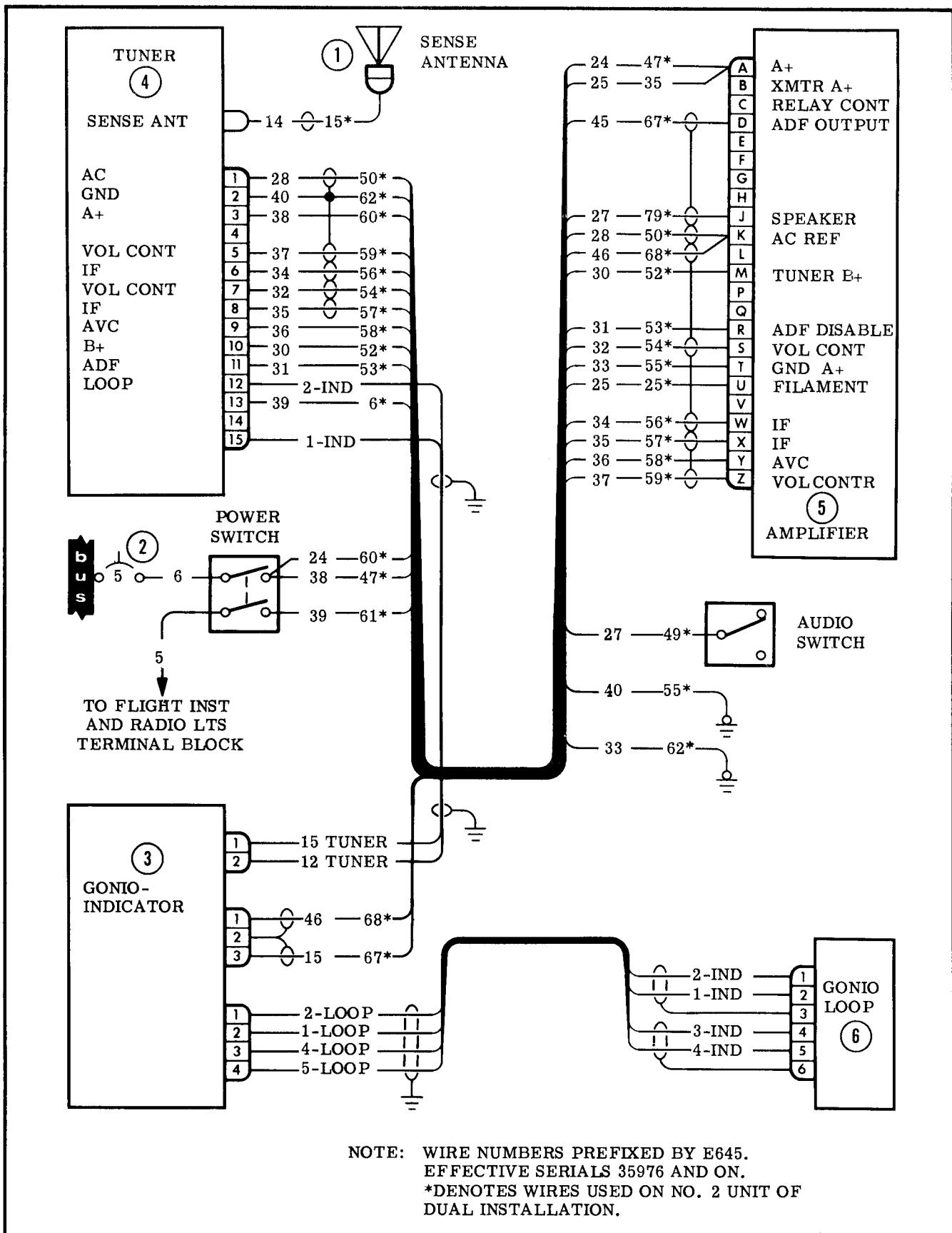


Figure 7-72. ADF-12E-2 with Gonio (Sheet 2 of 3)

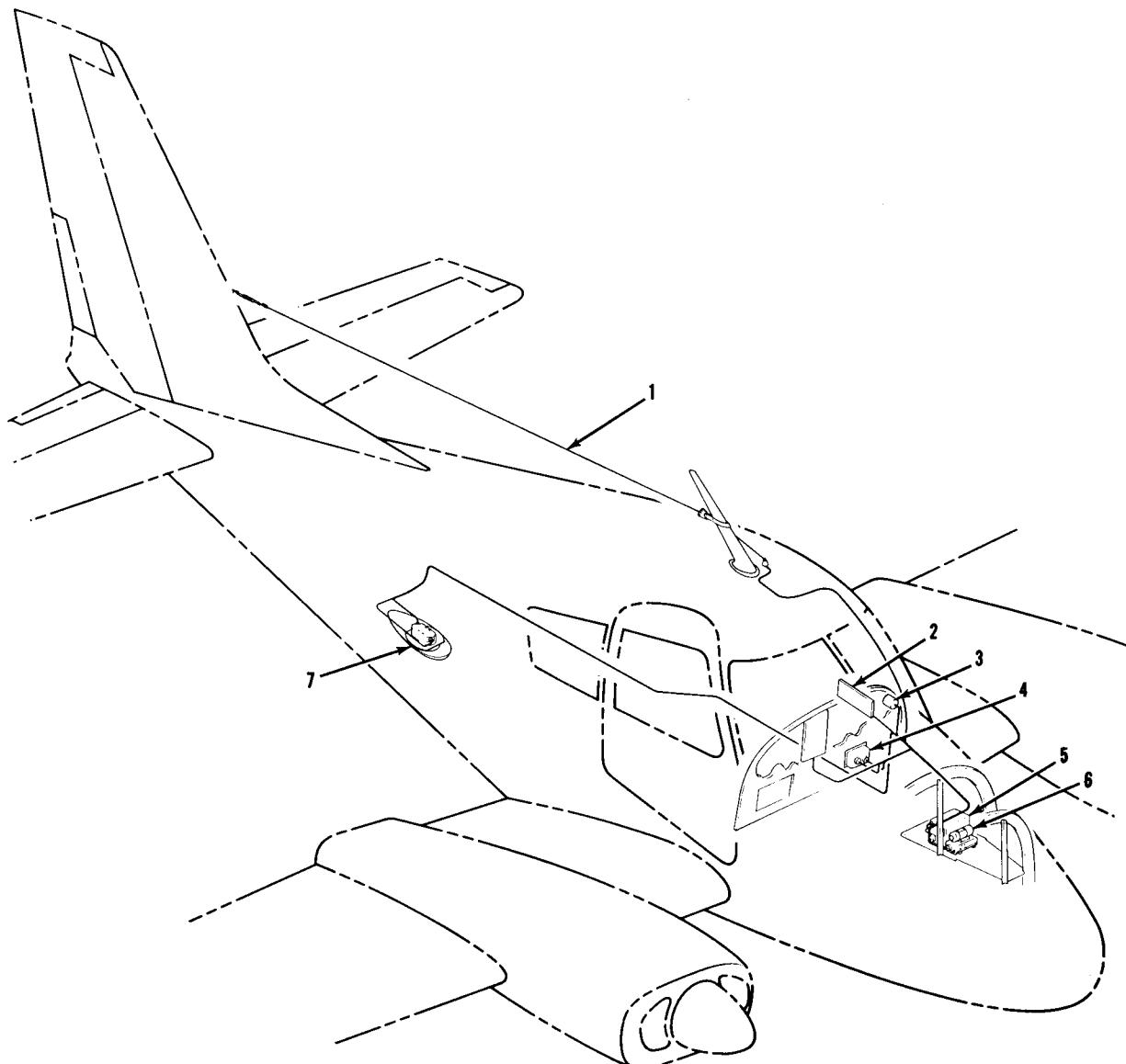


Figure 7-73. ADF-21 Circuit (Sheet 1 of 2)

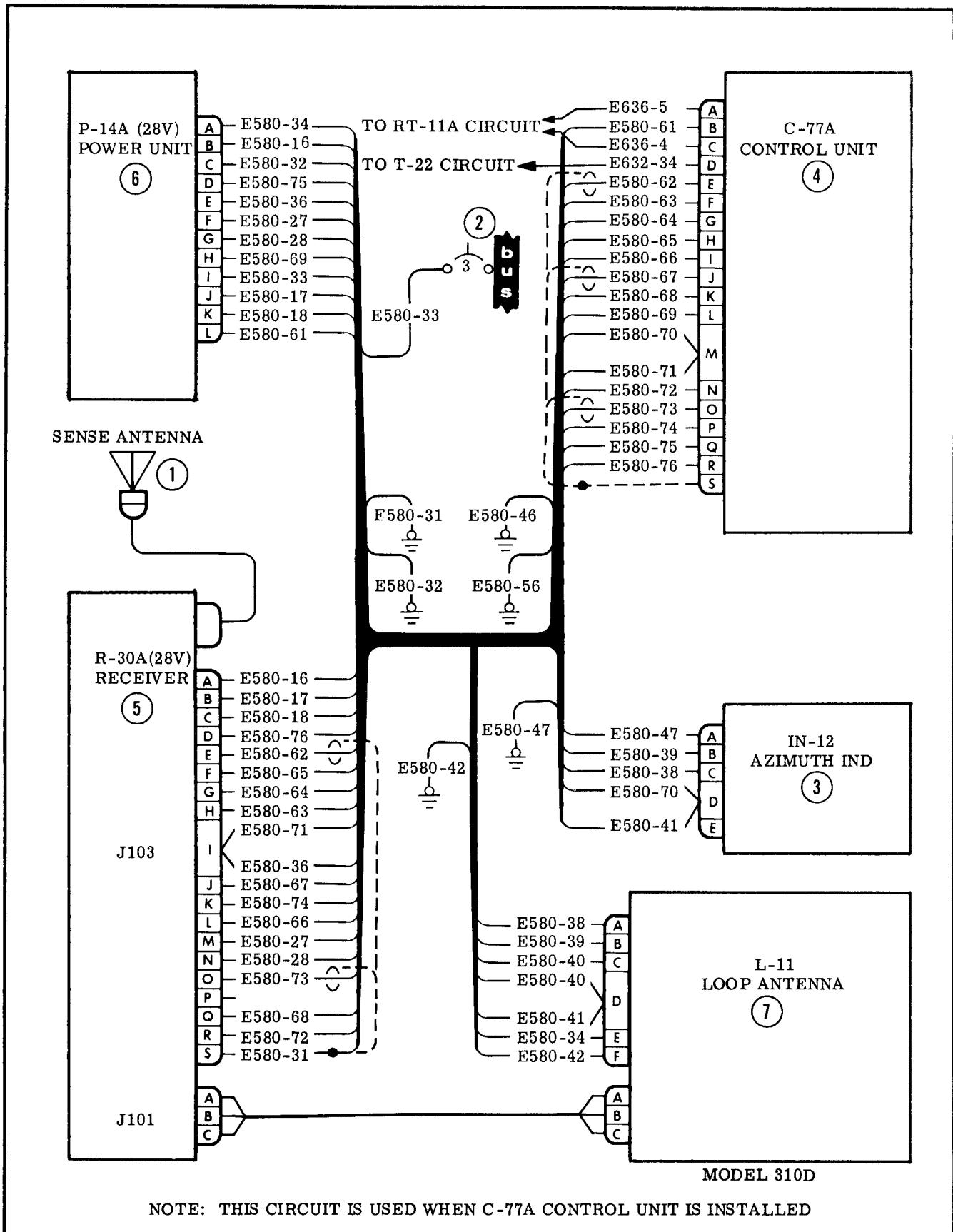


Figure 7-73. ADF-21 Circuit (Sheet 2 of 2)

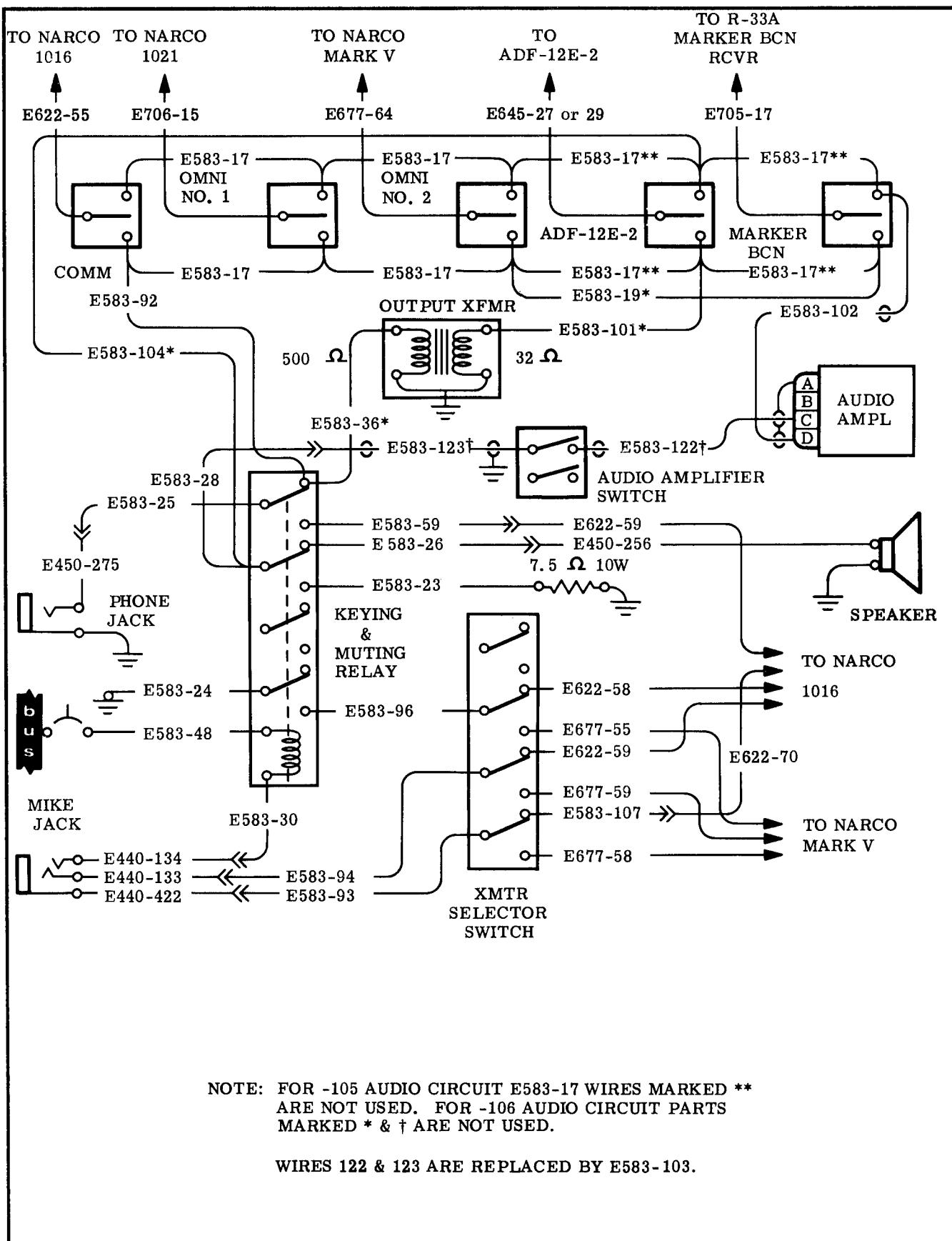


Figure 7-74. E583-105 & -106 Audio & Interconnecting Circuits

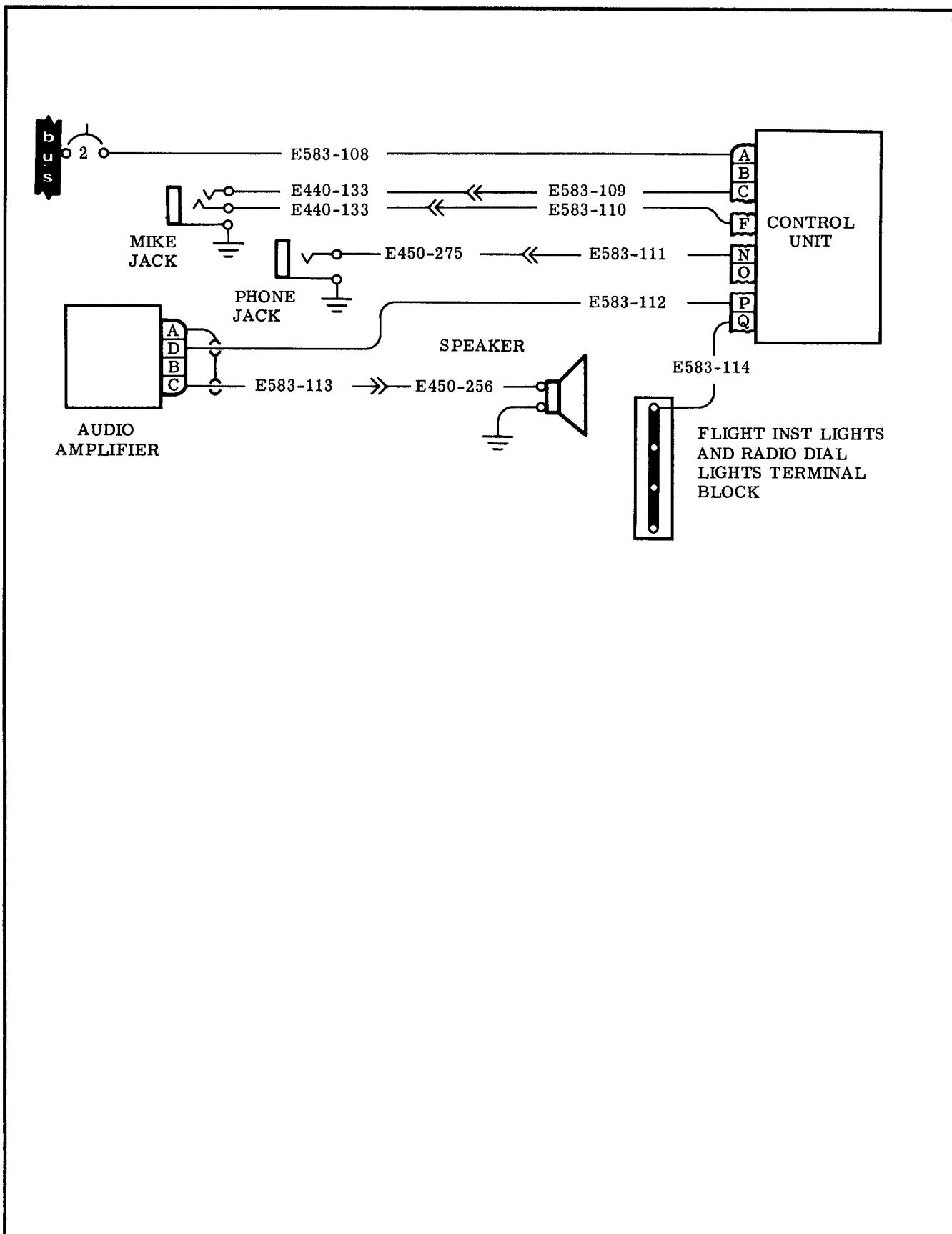


Figure 7-75. E583-115 Audio & Interconnecting Circuit

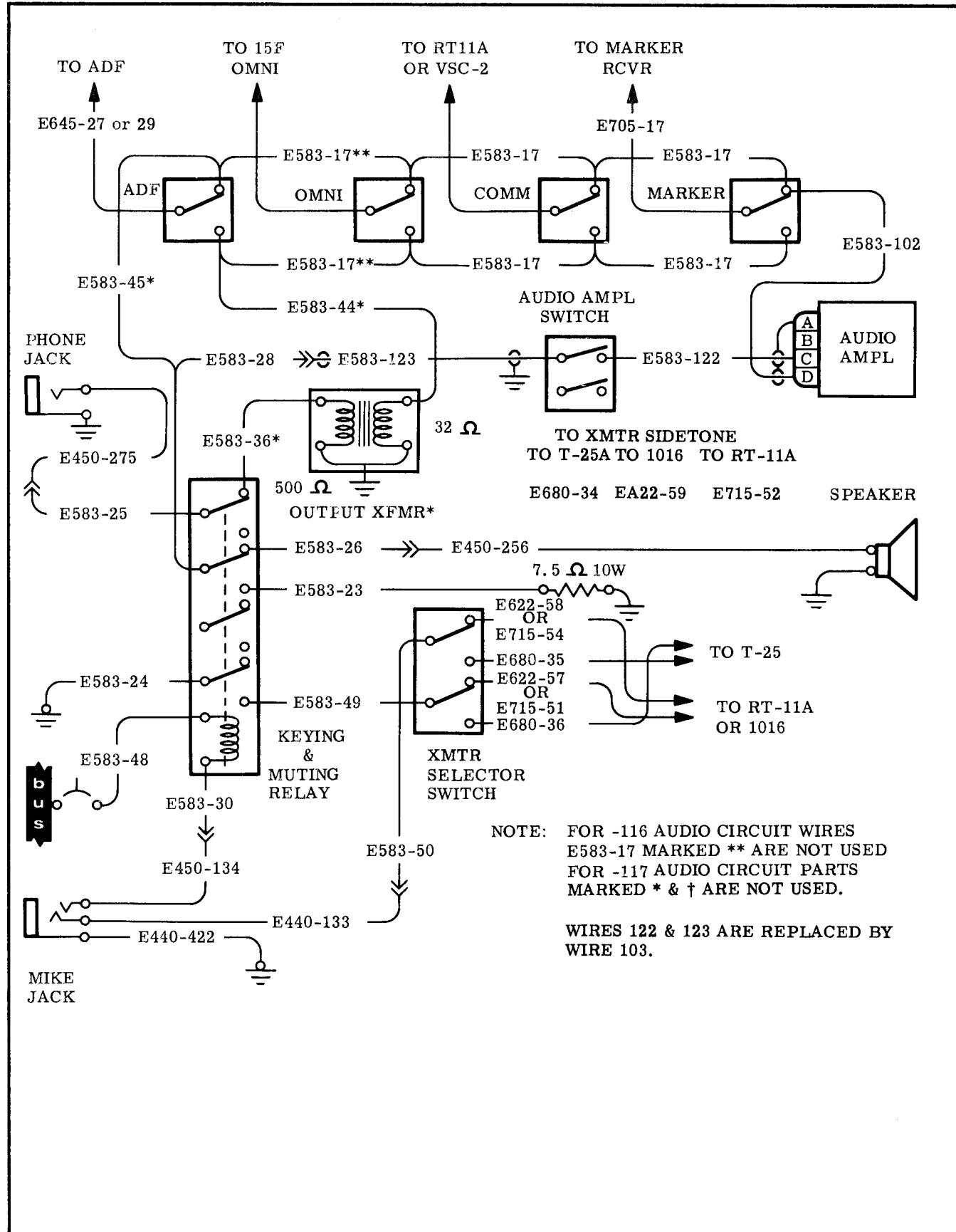


Figure 7-76. E583-116 & -117 Audio & Interconnecting Circuits

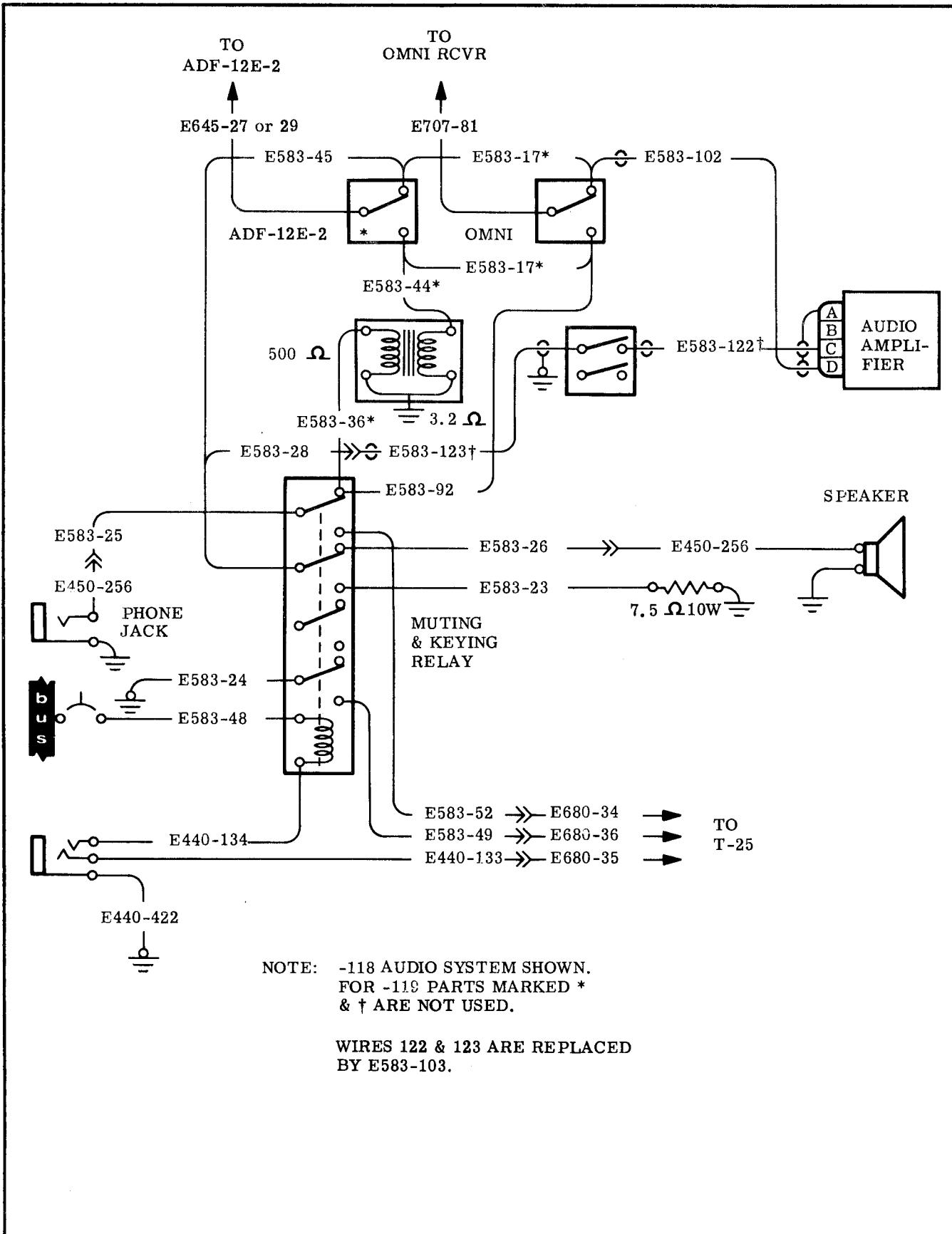


Figure 7-77. E583-118 & -119 Audio & Interconnecting Circuits

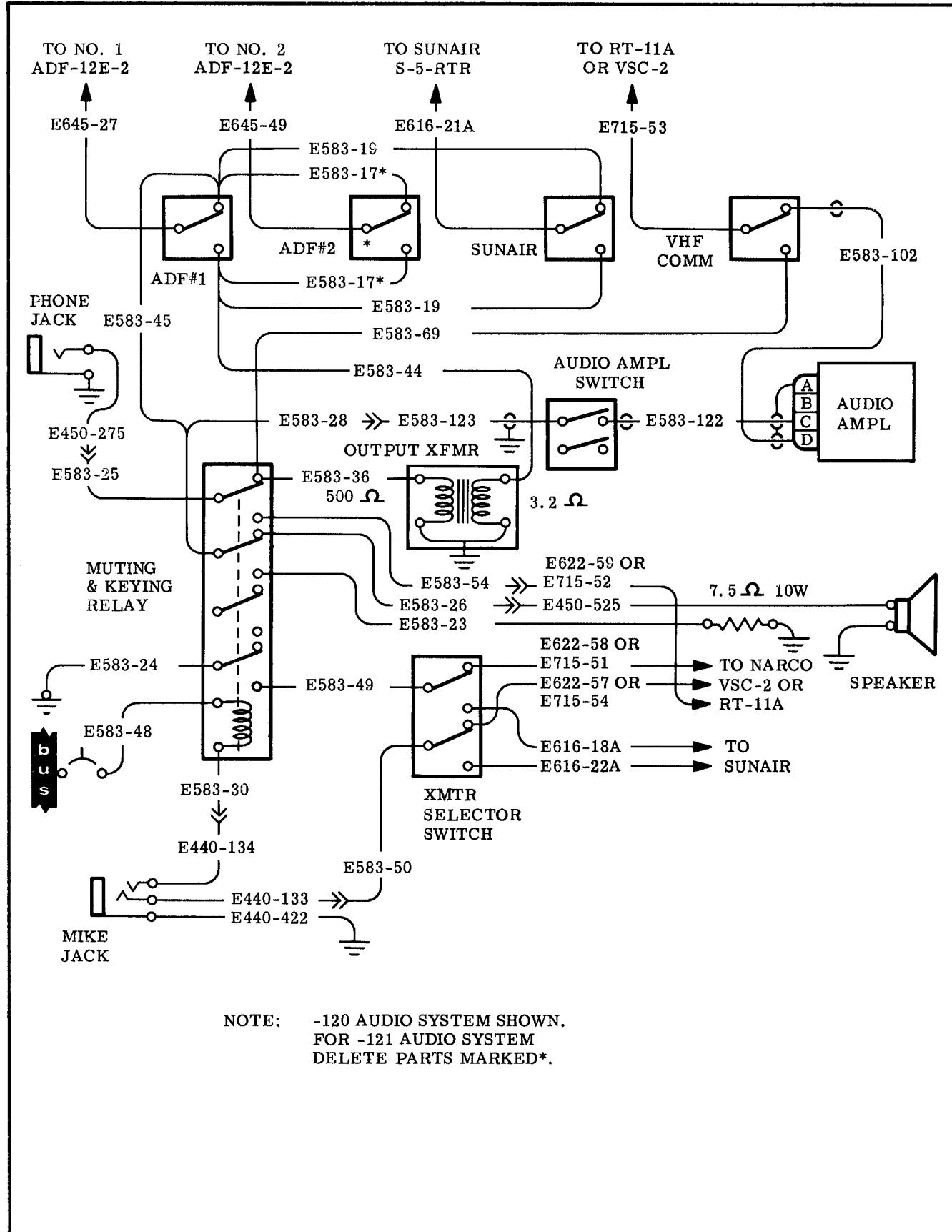
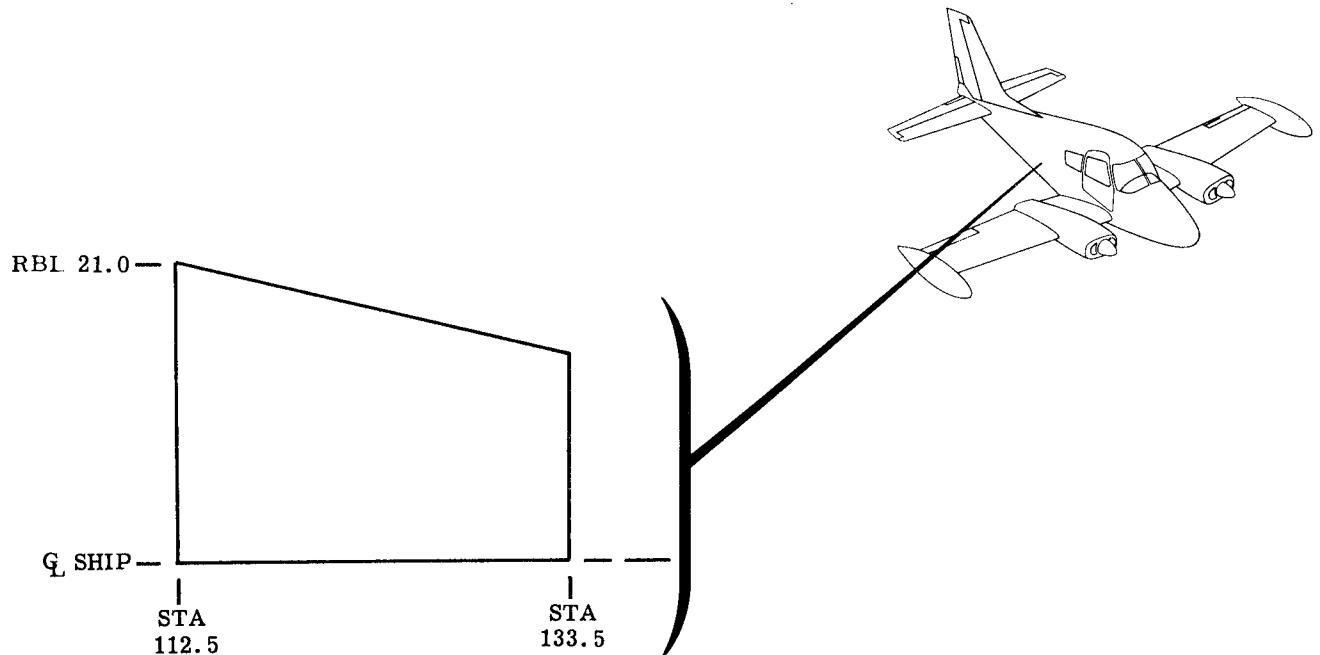


Figure 7-78. E583-120 & -121 Audio & Interconnecting Circuits

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

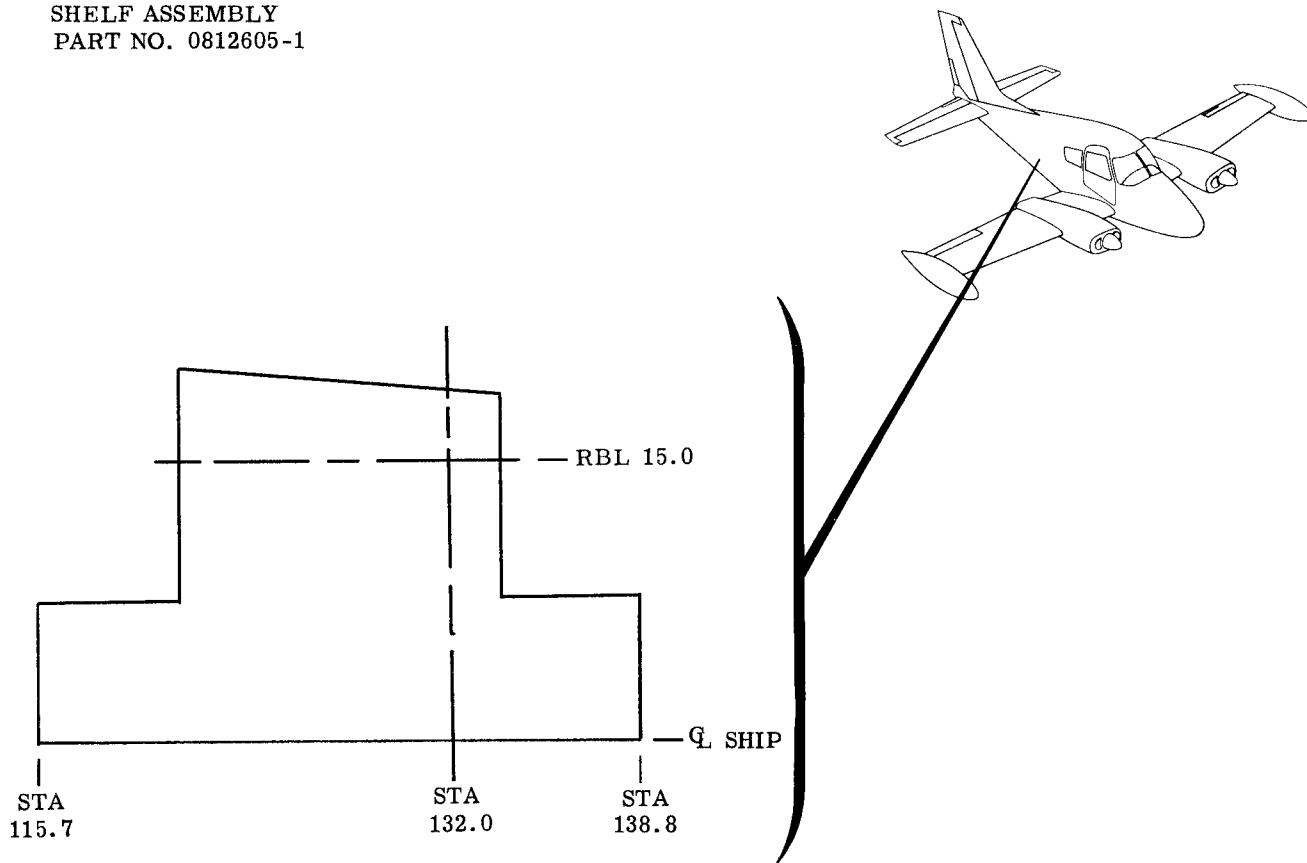
FOR
SHELF ASSEMBLY
PART NO. 0812529-1



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
15D Omni No. 2	122.9	7.1(R)	130.2	7.1(R)	18.2 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

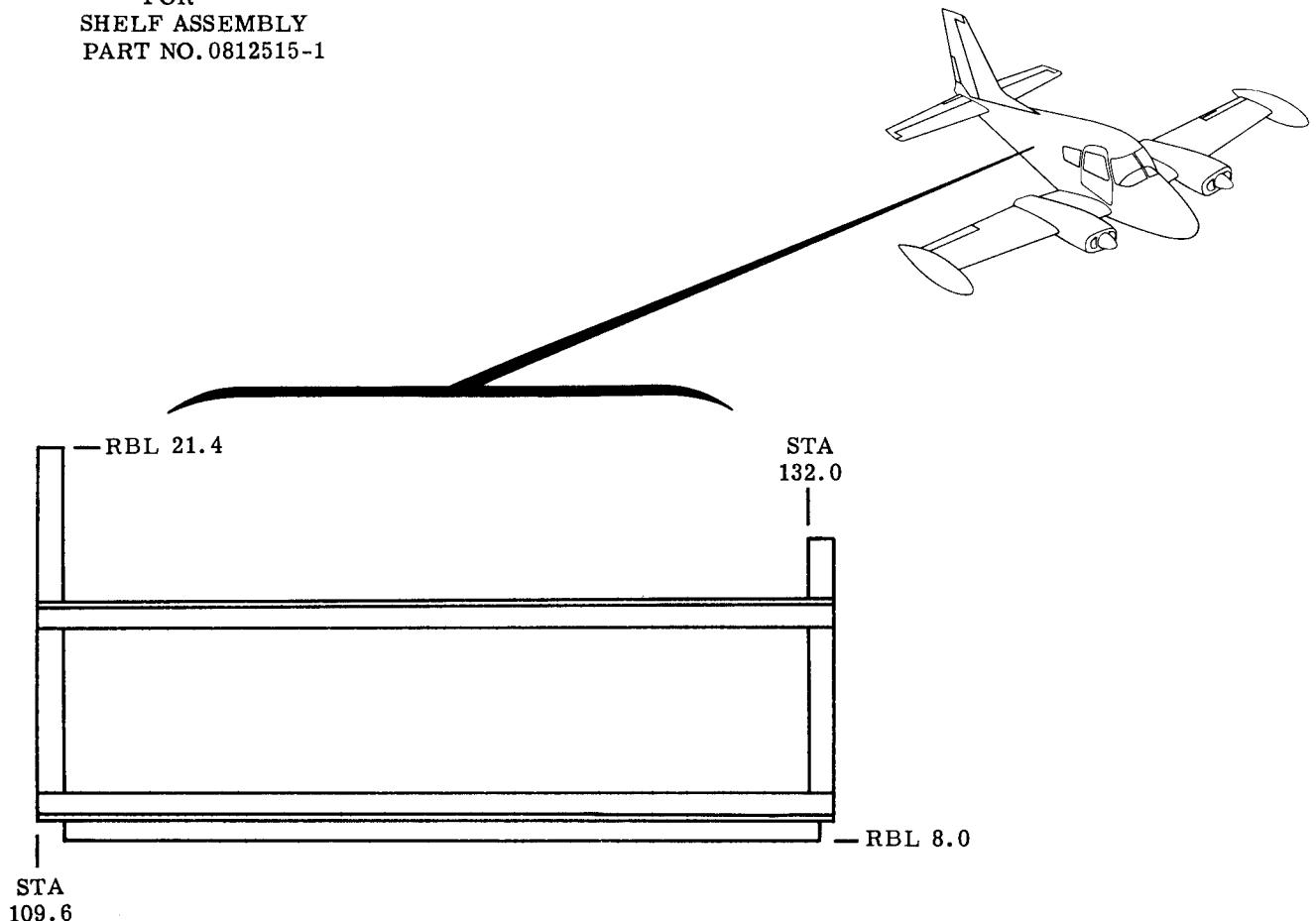
FOR
SHELF ASSEMBLY
PART NO. 0812605-1



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
15D and 15F Omni System	130.4	7.2(R)	123.0	7.2(R)	17.8 lbs.	
F-13A Audio Amplifier	127.8	1.3(R)	123.0	1.3(R)	5.7 lbs.	
P-12 Power Unit with DV-10A Dynaverter	119.5	1.5(R)	116.7	1.5(R)	2.5 lbs.	
CA-10A Computer Amplifier	132.6	1.3(R)	137.0	1.3(R)	3.5 lbs.	
LTR-800 Receiver-Transmitter	135.5	0.4(R)	120.5	0.4(R)	26.5 lbs.	
1016 Transceiver	138.5	0.4(R)	120.4	0.4(R)	28.8 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

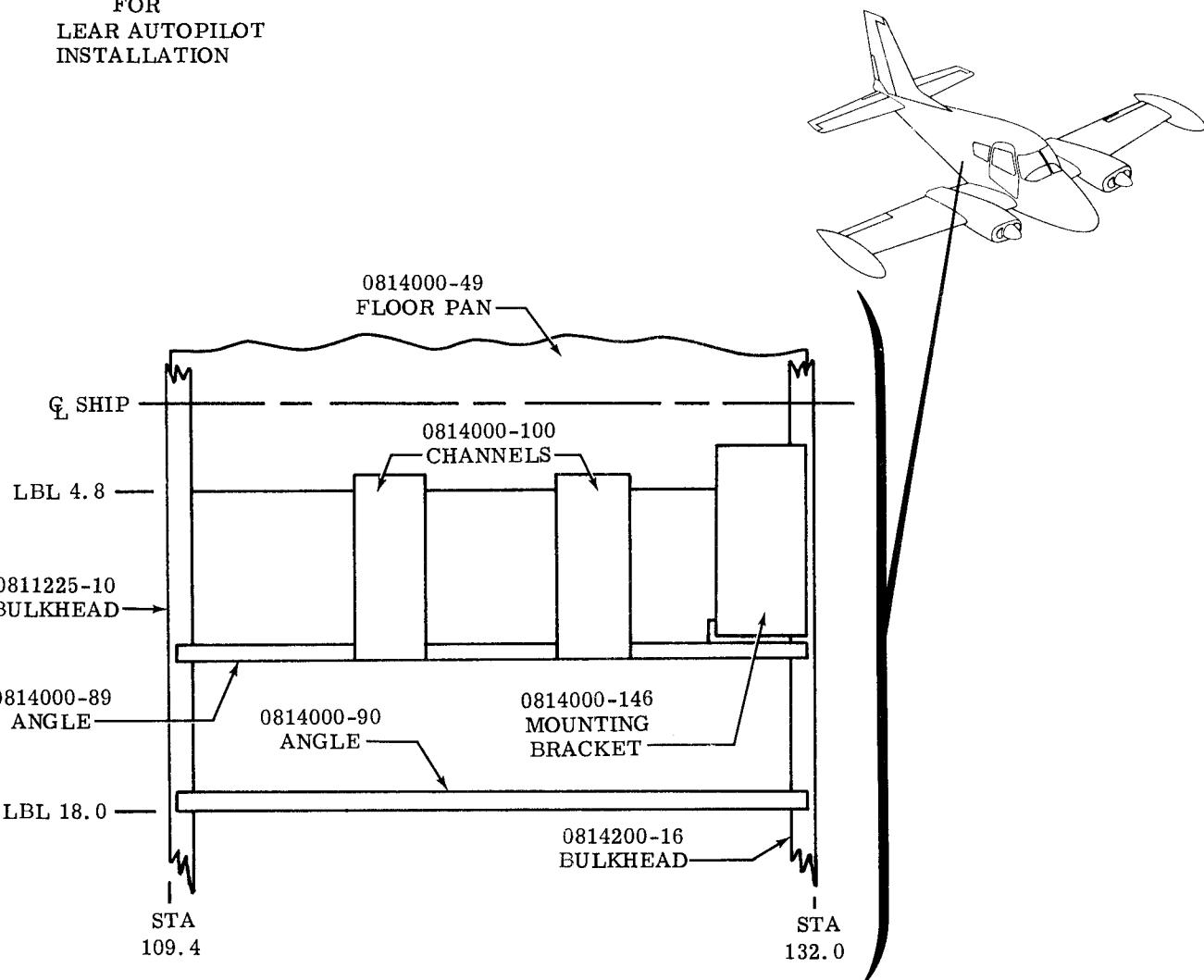
FOR
SHELF ASSEMBLY
PART NO. 0812515-1



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
Sunair S5-RTR Receiver	115.6	9.0(R)	125.0	9.0(R)	9.2 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

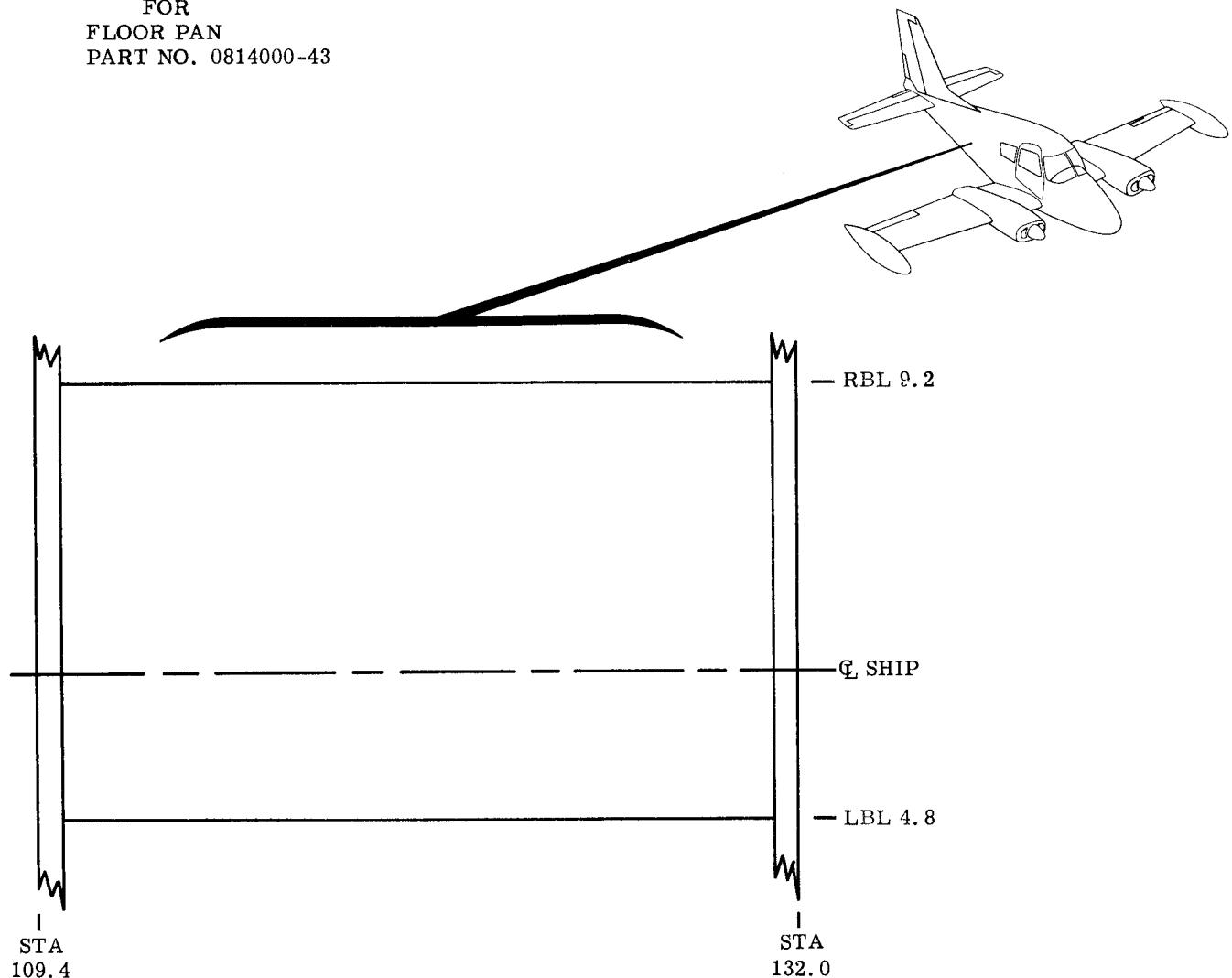
FOR
LEAR AUTOPILOT
INSTALLATION



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
0861400-11 Approach Coupler	115.6	5.4(L)	125.2	5.2(L)		
0861400-9 Dynamotor	128.8	3.7(L)	131.4	3.6(L)		
0861400-27 Amplifier	111.2	11.8(L)	127.4	11.4(L)		

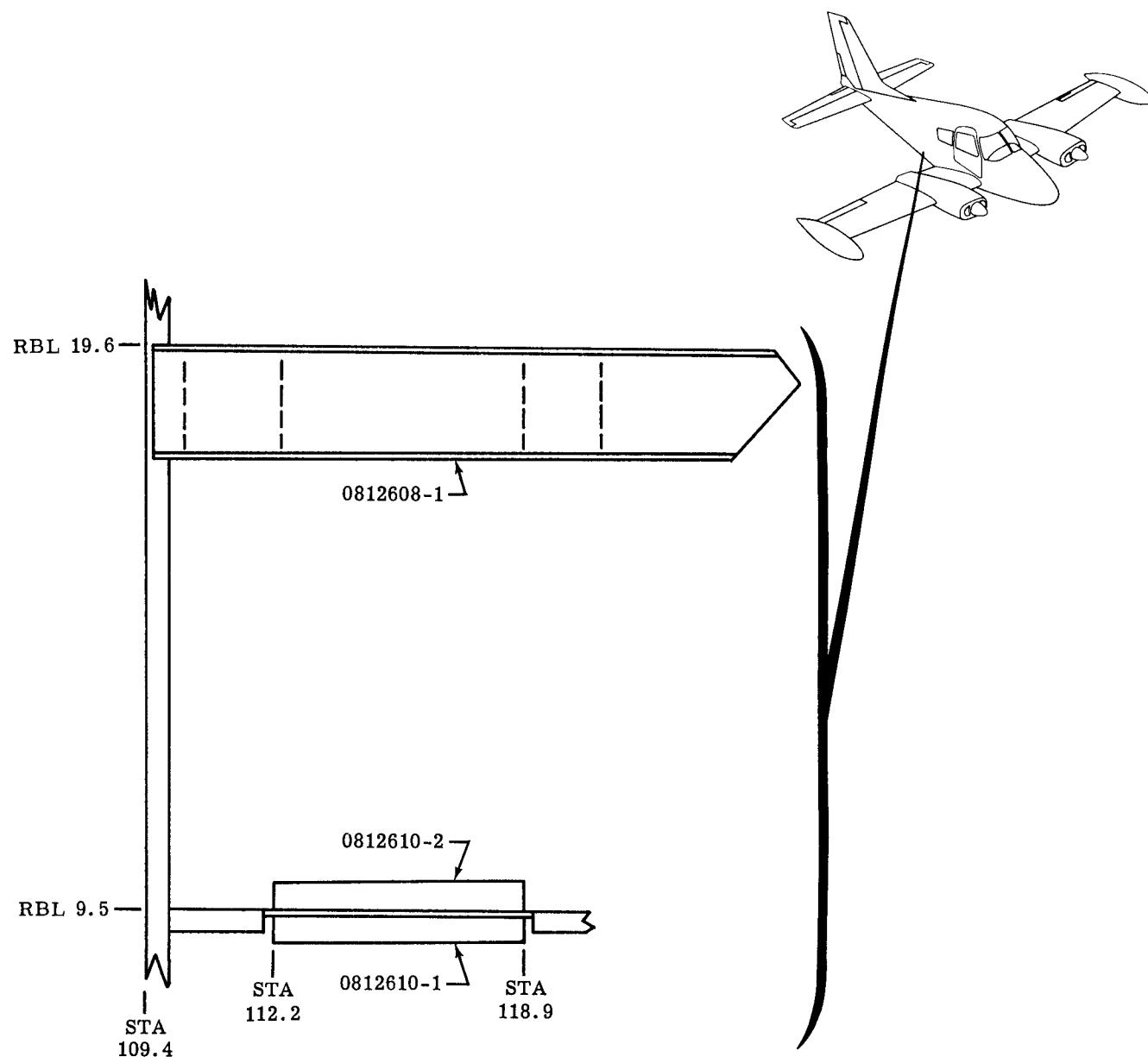
TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

FOR
FLOOR PAN
PART NO. 0814000-43



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
0861400-4 Three-Axis Servo	117.1	1.8(R)	129.6	1.8(R)	12.4 lbs.	
Elevator Follow-Up	114.0	1.1(R)	116.0	1.0(R)	0.5 lbs.	
Rudder Follow-Up	113.0	4.2(R)	114.9	4.1(R)	0.5 lbs.	

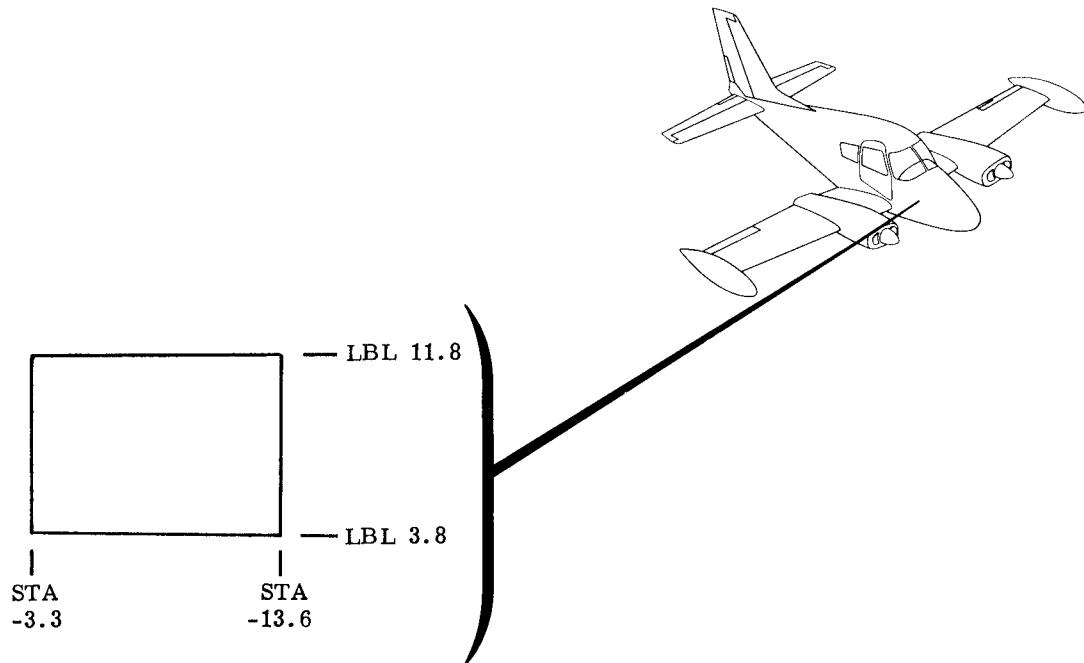
TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
2200 Marker Beacon	112.4	8.4(R)	118.2	8.4(R)	10.5 lbs.	

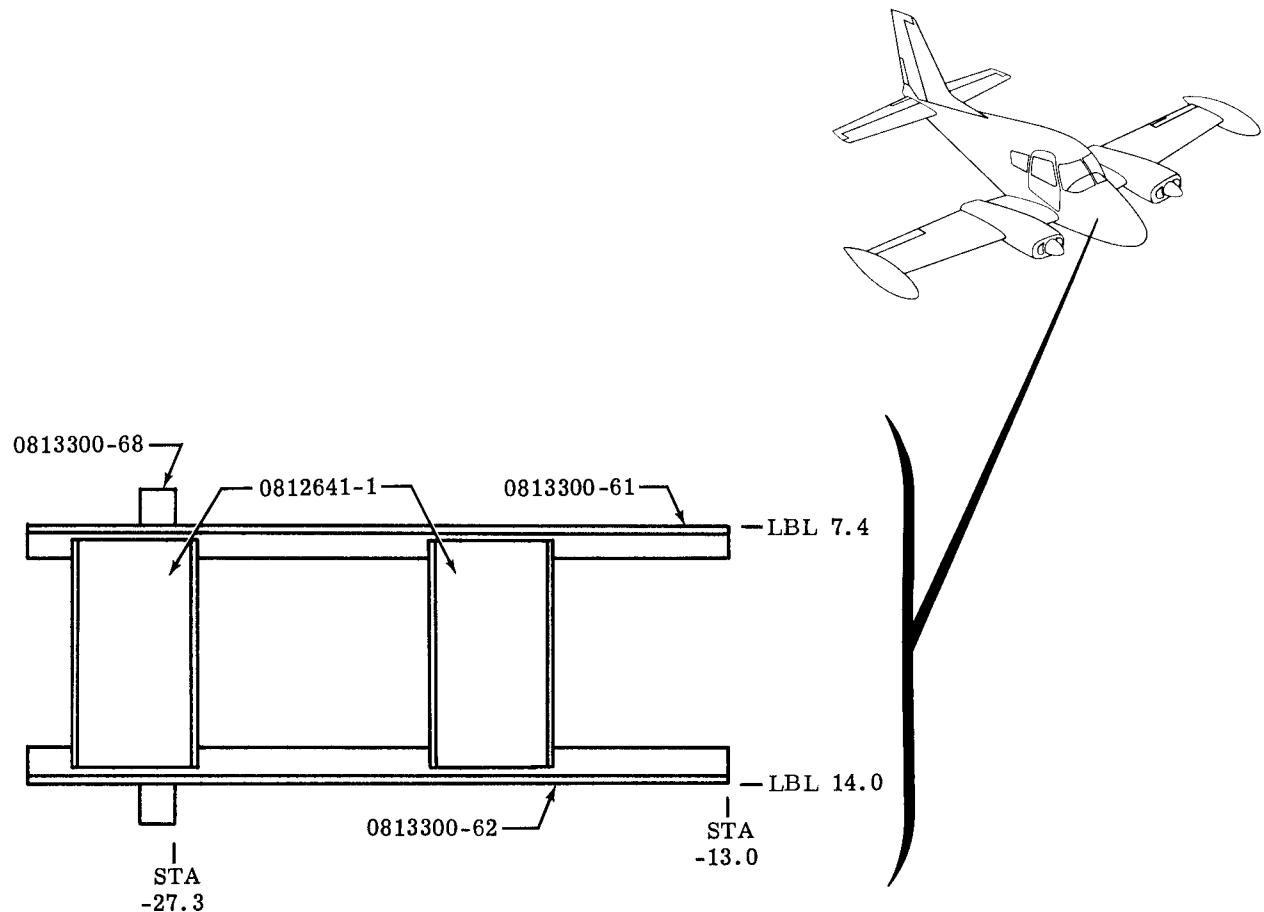
TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

FOR
SHELF ASSEMBLY
PART NO. 0813300-57



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
CA-3A Audio Amplifier	-4.6	4.3(L)	—	—	1.7 lbs.	
CA-3C Audio Amplifier	-3.9	4.8(L)	-5.3	4.8(L)	1.7 lbs.	
CA-10A Computer-Amplifier	-9.7	5.6(L)	-6.2	5.6(L)	3.5 lbs.	
Flite-Tronics PU-3-24V Dynamotor	-12.8	5.6(L)	-10.8	5.6(L)	3.4 lbs.	

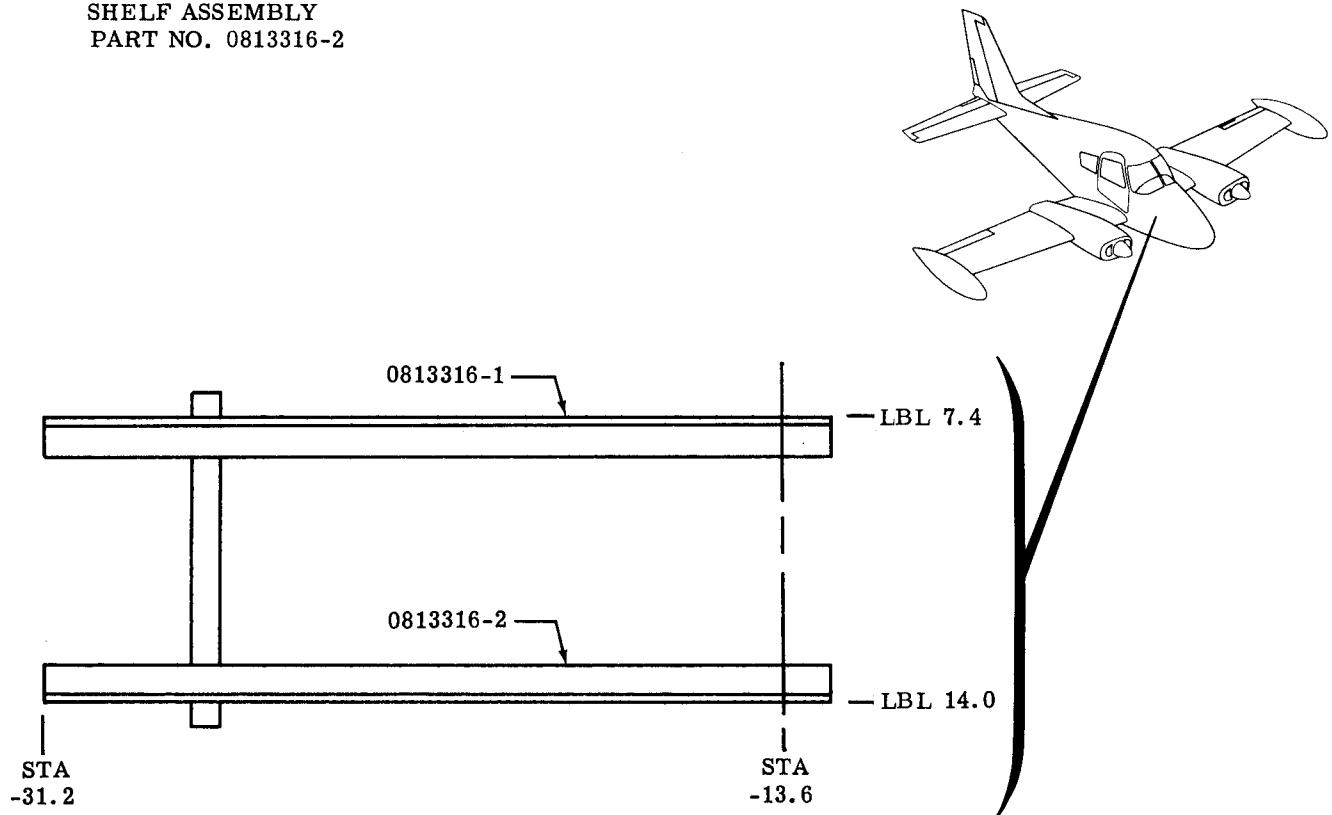
TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
DM-3 Marker Beacon and DGS-20 Glide Slope	-27.0	8.0(L)	-19.8	8.0(L)	16.0 lbs.	

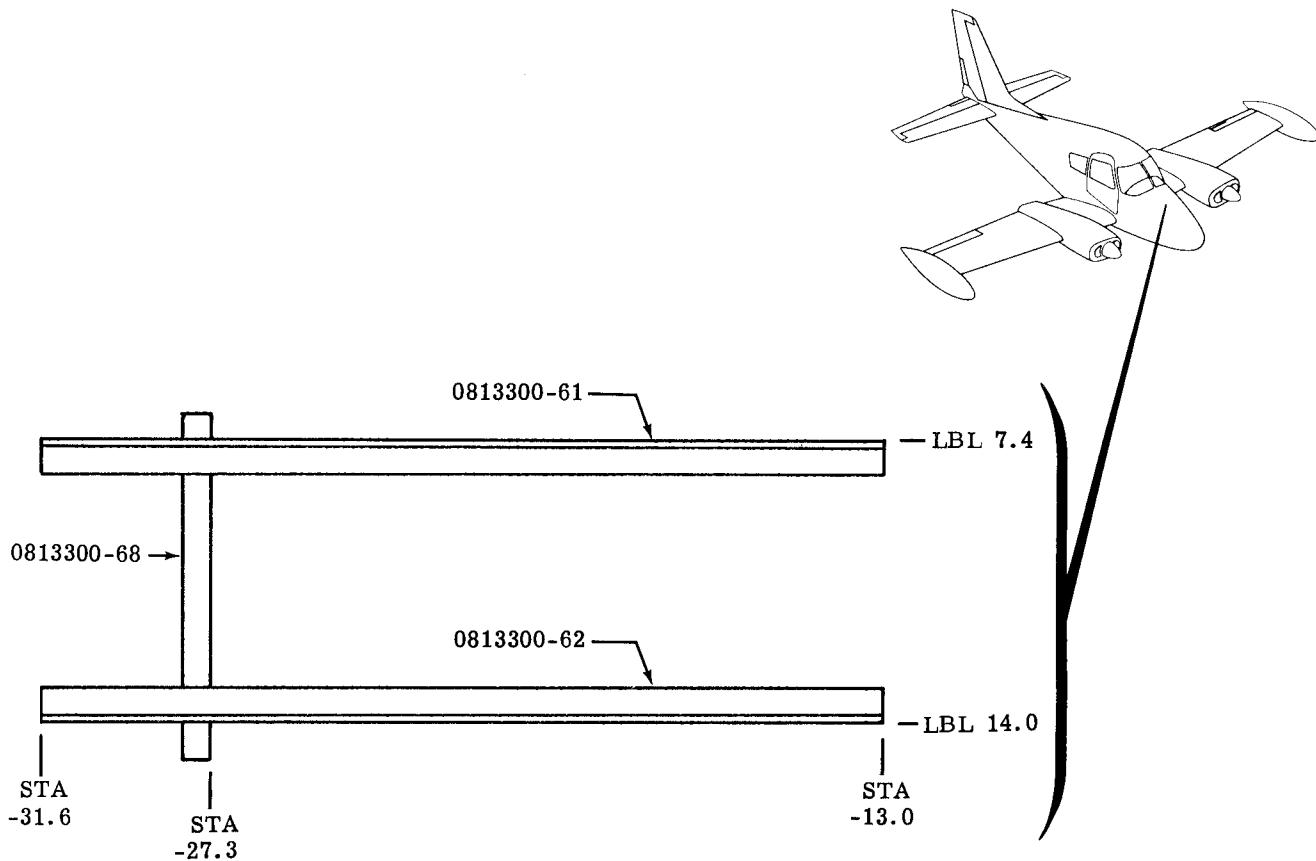
TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

FOR
SHELF ASSEMBLY
PART NO. 0813316-2



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
DM-3 Marker Beacon and DGS-20 Glide Slope	-26.7	8.0(L)	-17.6	8.0(L)	16.0 lbs.	
R-31A Glide Slope and R-34A Marker Beacon	-27.6	7.8(L)	-20.7	7.8(L)	11.6 lbs.	

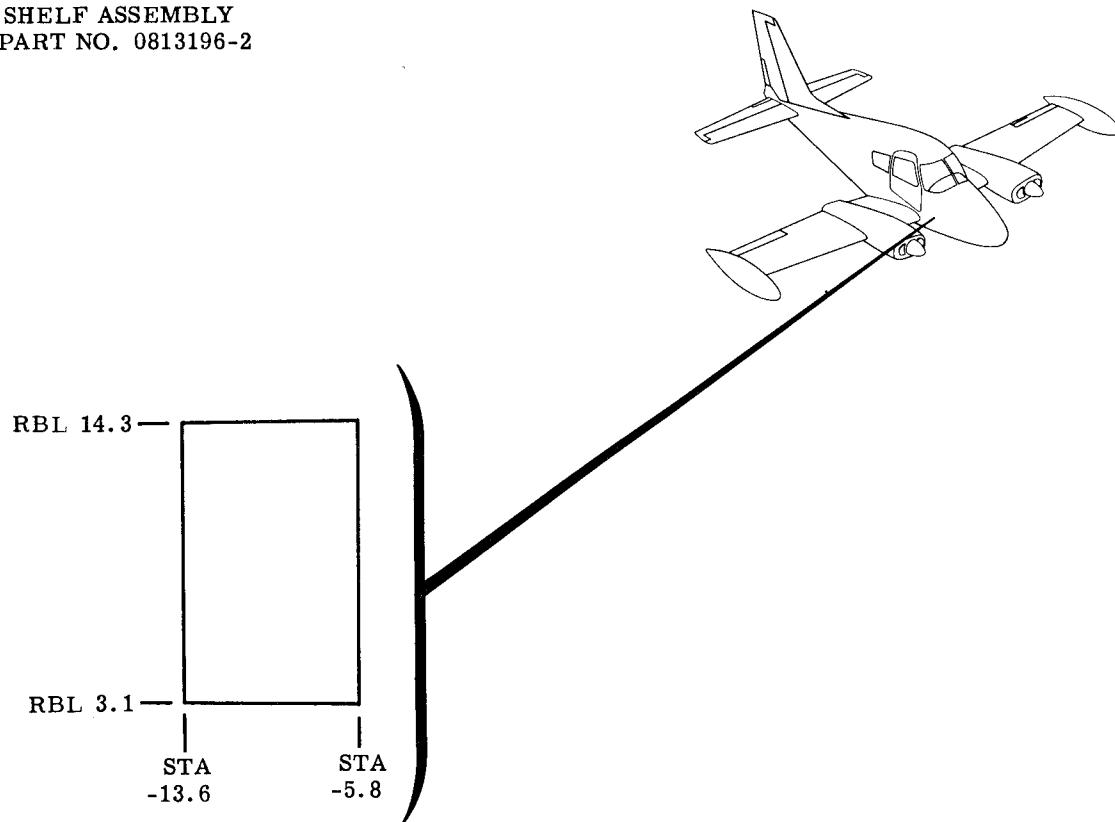
TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
R-89 Glide Slope	-28.6	8.0(L)	-19.0	8.0(L)	14.2 lbs.	
VOA-3A Omni Converter	-31.2	7.9(L)	-22.9	7.9(L)	4.1 lbs.	
DM-3 Marker Beacon and DGS-20 Glide Slope	-28.4	8.0(L)	-17.9	8.0(L)	16.0 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

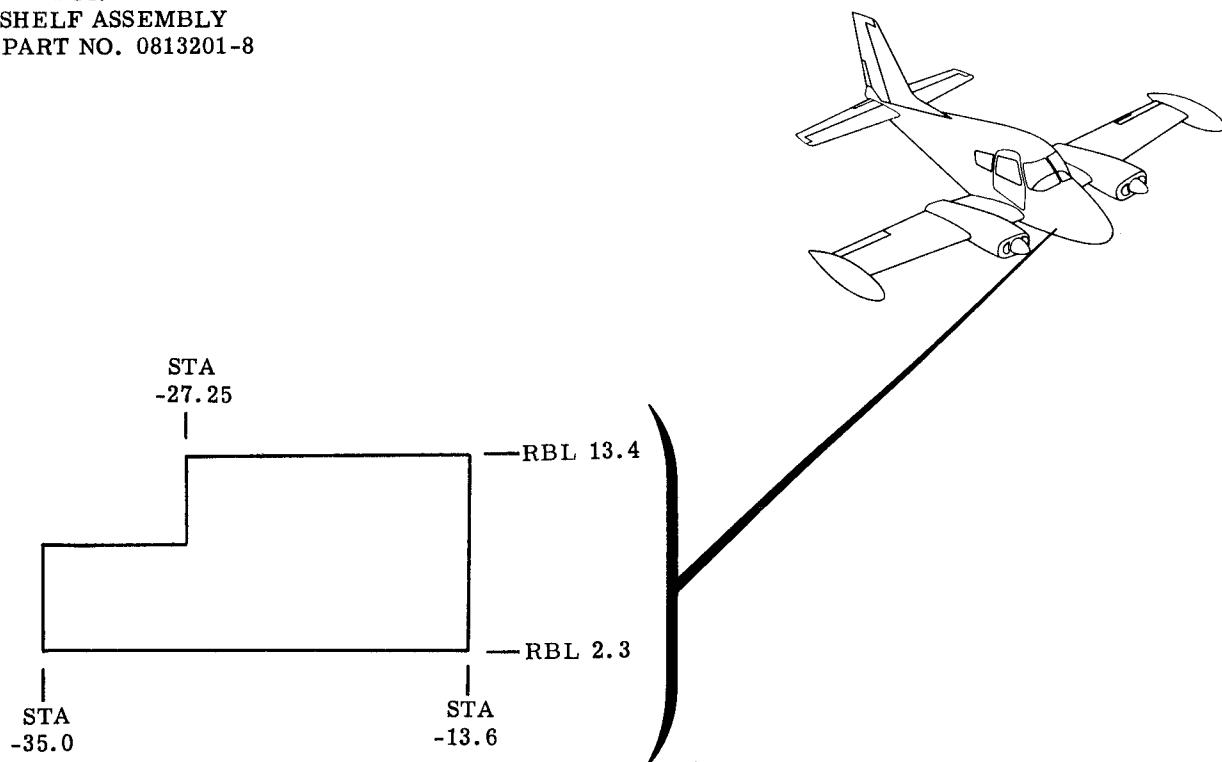
FOR
SHELF ASSEMBLY
PART NO. 0813196-2



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA.	BL	STA.	BL		
B-13A Omni Converter	-11.2	4.0(R)	-7.9	4.0(R)	10.7 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

FOR
SHELF ASSEMBLY
PART NO. 0813201-8



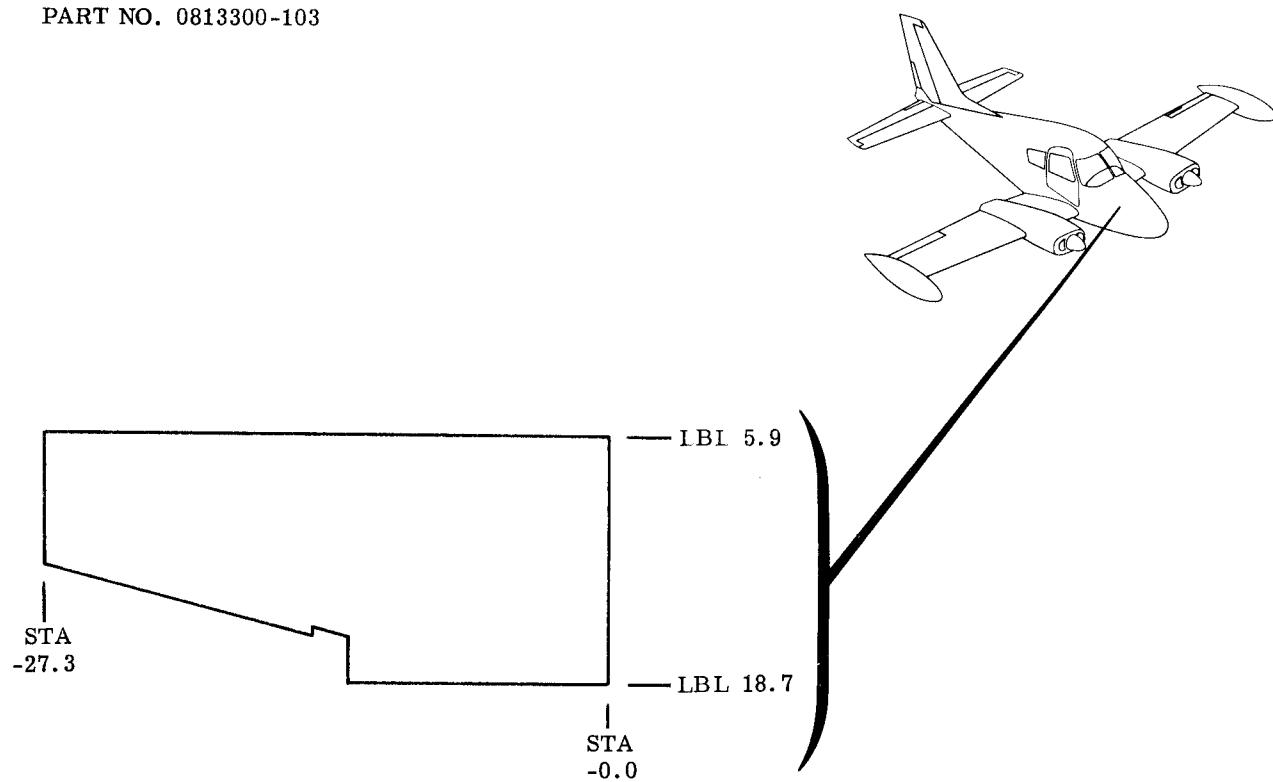
EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
LVTR-36 Receiver-Transmitter	-32.8	2.8(R)	-14.8	2.8(R)	22.4 lbs.	
F-13 & F-13A Audio Amplifier	-20.9	9.5(R)	-16.6	9.5(R)	5.7 lbs.	Includes D-10A
T-11B Transmitter	-33.5	3.8(R)	-29.2	3.8(R)	3.2 lbs.	
2214 Omni Converter	-29.0	2.8(R)	-19.5	2.8(R)	10.4 lbs.	
LD-5 Power Unit	-24.6	3.8(R)	-22.2	3.8(R)	7.1 lbs.	
NARCO V24MP2A Modulator-Power Supply	-16.3	3.3(R)	-22.9	3.3(R)	6.9 lbs.	
P-12 Power Unit with D-10A Dynamotor	-18.2	4.0(R)	-14.4	4.0(R)	3.9 lbs.	
P-15A Power Unit	-16.6	11.1(R)	-19.6	11.1(R)	6.8 lbs.	
RT-11A Receiver-Transmitter	-34.7	3.3(R)	-19.1	2.8(R)	13.8 lbs.	
VSRP-1 Receiver	-31.5	2.8(R)	-18.2	2.8(R)	12.0 lbs.	

ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS FOR SHELF ASSEMBLY PART NO. 0813201-8 (Cont)

EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
CA-1 Audio Amplifier	-21.5	7.7(R)	-16.6	7.7(R)	4.0 lbs.	
T24MP-7 Modulator Power Supply	-22.2	9.2(R)	-16.6	9.2(R)	3.5 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

FOR
SHELF ASSEMBLY
PART NO. 0813300-103



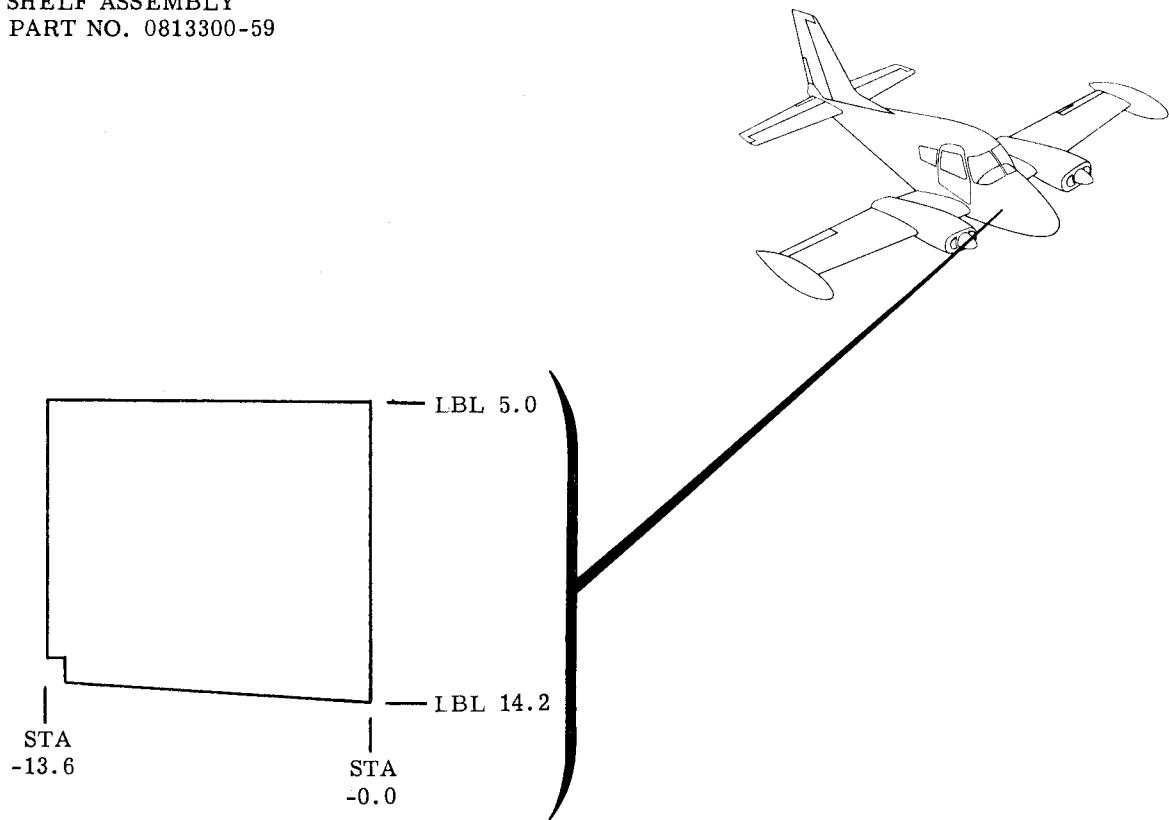
EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
T-11B Transmitter	-22.1	8.2(L)	-26.5	8.2(L)	3.5 lbs.	
F-13 & F-13A Audio Amplifier	-15.4	9.5(L)	-19.2	9.5(L)	5.7 lbs.	
T-22 Transmitter	-17.5	8.3(L)	-26.5	8.3(L)	6.0 lbs.	
ADF-12 Amplifier	-13.4	6.3(L)	-24.2	6.3(L)	10.0 lbs.	
ADF-12 Amplifier	-4.0	6.3(L)	-11.4	6.3(L)	10.0 lbs.	
ADF-14 Amplifier	-13.3	7.4(L)	-24.2	7.4(L)	10.0 lbs.	
ADF-14 Amplifier	-6.7	7.3(L)	-11.9	7.3(L)	10.0 lbs.	
ADF-14C Amplifier	-7.1	6.3(L)	-11.6	10.7(L)	10.0 lbs.	
ADF-14C Amplifier	-14.5	9.9(L)	-23.9	7.7(L)	10.0 lbs.	
ADF-12E-2 Amplifier	-6.4	6.3(L)	-10.9	6.3(L)	10.0 lbs.	
ADF-12E-2 Amplifier	-14.8	7.0(L)	-24.3	7.0(L)	10.0 lbs.	

ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS FOR SHELF ASSEMBLY PART NO. 0813300-103(Cont)

EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
R-30A Receiver	-5.6	10.7(L)	-8.7	10.7(L)	7.3 lbs.	
P-14A Power Unit	-10.7	10.7(L)	-13.1	10.7(L)	5.4 lbs.	
R-30A Receiver	-4.7	10.1(L)	-9.5	10.1(L)	7.3 lbs.	
P-14A Power Unit	-10.1	9.7(L)	-13.9	9.7(L)	5.4 lbs.	
ARC P-12/DV-10A Power Unit Assembly	-15.2	15.1(L)	-19.0	15.1(L)	2.5 lbs.	
VOA-3A Omni Converter	-16.2	6.7(L)	-25.8	6.7(L)	4.1 lbs.	
AN3320-1 Relay	-15.6	14.4(L)	-18.2	14.4(L)	.3 lbs.	
T-25A Transmitter	-17.2	8.3(L)	-26.9	8.3(L)	7.7 lbs.	
ARC R-12/DV-10A Power Unit Assembly	-15.2	11.3(L)	-19.0	11.3(L)	2.5 lbs.	
CA-1 Audio Amplifier	-15.6	6.9(L)	-19.4	6.9(L)	4.0 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

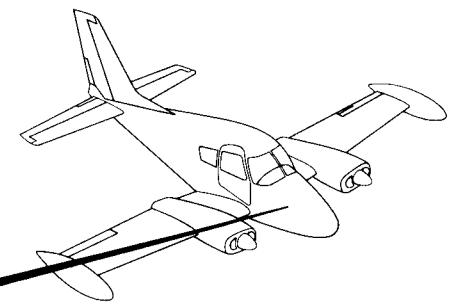
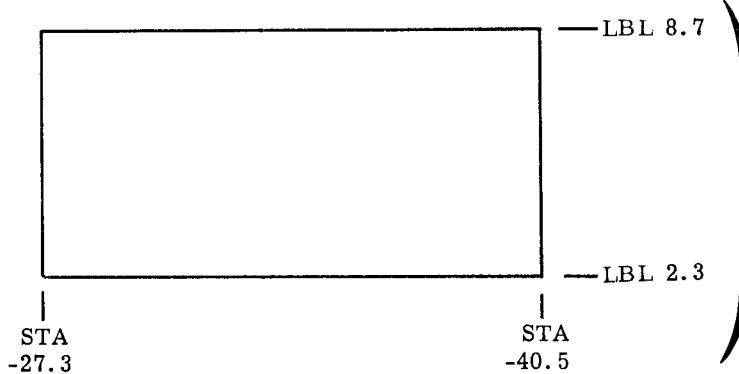
FOR
SHELF ASSEMBLY
PART NO. 0813300-59



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
Sunair Dynamotor	-2.2	5.7(L)	-5.5	5.7(L)	13.0 lbs.	
Type 15 Omni	-3.8	5.7(L)	-11.0	5.7(L)	17.8 lbs.	
VOA-3A Omni Converter	-0.8	5.7(L)	-10.4	5.7(L)	4.1 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

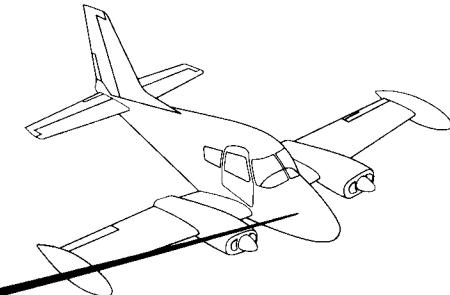
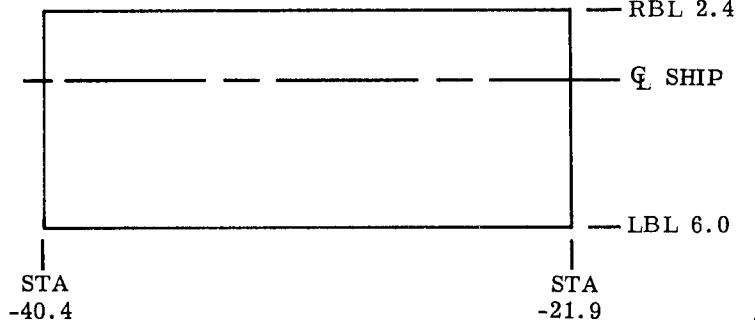
FOR
SHELF ASSEMBLY
PART NO. 0812468-12



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
Dynavia ANC-3 Computer	-39.2	3.7(L)	-43.9	3.7(L)	2.5 lbs.	

TABLE OF ELECTRONIC EQUIPMENT LOADING ARRANGEMENTS

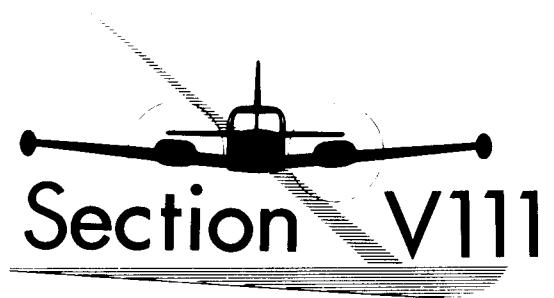
FOR
SHELF ASSEMBLY
PART NO. 0813190-1



EQUIPMENT	FWD INB ATTACH POINT		AFT INB ATTACH POINT		COMPONENT WEIGHT	REMARKS
	STA	BL	STA	BL		
R-34A Omni Receiver	-23.9	4.5(L)	-31.2	4.5(L)	8.0 lbs	

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310 SERVICE MANUAL



STRUCTURAL REPAIR

1 APRIL 1960

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SECTION VIII

STRUCTURAL REPAIR

Table of Contents

	Page
GENERAL	8-1
Type of Construction	8-1
Ground Handling	8-1
Investigation of Damage	8-1
Definition of Damage	8-1
Preparing Damaged Area for Repairs	8-2
Control Surface Rebalancing Data	8-2
WING	8-2
Access Openings	8-2
WING SKIN	8-2
Negligible Damage	8-2
Repairable Damage	8-2
Damage Necessitating Replacement of Parts	8-2
WING RIBS	8-2
Negligible Damage	8-2
Repairable Damage	8-2
Damage Necessitating Replacement of Parts	8-2
FLAPS AND AILERONS	8-3
Negligible Damage	8-3
Repairable Damage	8-3
Damage Necessitating Replacement of Parts	8-3
WING SPARS	8-3
TAIL GROUP	8-3
VERTICAL FIN AND DORSAL GROUP	8-3
Negligible Damage	8-3
Repairable Damage	8-3
Damage Necessitating Replacement of Parts	8-3
RUDDER	8-3
Negligible Damage	8-3
Repairable Damage	8-3
Damage Necessitating Replacement of Parts	8-3
HORIZONTAL STABILIZER	8-3
Negligible Damage	8-3
Repairable Damage	8-3
Damage Necessitating Replacement of Parts	8-3
ELEVATORS	8-3
Negligible Damage	8-3
Repairable Damage	8-3
Damage Necessitating Replacement of Parts	8-3
FUSELAGE	8-3
Negligible Damage	8-4
Repairable Damage	8-4
Damage Necessitating Replacement of Parts	8-4
BULKHEADS	8-4
Cracked Bulkhead Ribs or Flanges	8-4
Severely Bent, Kinked or Torn Channels	8-4
LANDING GEAR	8-4
Repairs of Landing Gear	8-4
ENGINE MOUNT	8-4
Engine Mount Repair	8-4
ENGINE COWLING	8-4
Repair of Skins	8-4
Repair of Reinforcement Angles	8-4
FIBERGLAS	8-4
Repairable Damage	8-5
Damage Necessitating Replacement of Parts	8-5

8-1. GENERAL.

8-2. TYPE OF CONSTRUCTION. The Model 310 is an all-metal aircraft of semi-monocoque 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.

8-3. GROUND HANDLING. Leveling, jacking, and other ground handling details are covered in Section I.

8-4. 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 distortion. 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.

8-5. 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 airplane 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 airplane.

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.

8-6. 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. Apply two coats of zinc-chromate primer to all internal surfaces and edgeslapping one another.

NOTE

Damage adjacent to a previous repair requires removal of the old repair and inclusion of the entire area in the new repair.

8-7. CONTROL SURFACE REBALANCING DATA.

The control surfaces of the Model 310 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.

8-8. WING.

8-9. The wings are all-metal, full cantilever, semi-monocoque 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.

8-10. 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.

8-11. WING SKIN. All wing, aileron, and flap skin thickness and temper are listed in figure 8-5.

8-12. 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 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.

8-13. 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 8-10. 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.

8-14. 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.

8-15. 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 capstrips 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.

8-16. NEGLIGIBLE DAMAGE. Refer to paragraph 8-12.

8-17. REPAIRABLE DAMAGE. Repairs for wing rib webs and flanges are shown in figure 8-19 and 8-20. 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.

8-18. 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.

8-19. FLAPS AND AILERONS.

8-20. NEGLIGIBLE DAMAGE. Minor skin dents and nicks are considered negligible and can be worked out by burnishing.

8-21. 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.

8-22. 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.

8-23. 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 the section.

8-24. TAIL GROUP.

8-25. 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.

8-26. VERTICAL FIN AND DORSAL GROUP.

8-27. 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.

8-28. NEGLIGIBLE DAMAGE. Refer to paragraph 8-12.

8-29. 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.

8-30. 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.

8-31. RUDDER.

8-32. NEGLIGIBLE DAMAGE. Minor skin dents and nicks are considered negligible and will be worked

out by burnishing.

8-33. 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.

8-34. 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.

8-35. HORIZONTAL STABILIZER.

8-36. NEGLIGIBLE DAMAGE. Refer to paragraph 8-12.

8-37. 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.

8-38. 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.

8-39. ELEVATORS.

8-40. NEGLIGIBLE DAMAGE. For a description of negligible damage refer to paragraph 8-12. 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 over-hanging tip rib, in the area at the front spar intersection with the web of the rib, also cannot be considered negligible.

8-41. 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.

8-42. 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 elevators will require replacement of the elevators.

8-43. FUSELAGE.

8-44. The fuselage is of semi-monocoque construction consisting of formed bulkheads, 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.

8-45. NEGLIGIBLE DAMAGE. Refer to paragraph 8-12.

8-46. REPAIRABLE DAMAGE.

8-47. Mild wrinkles occurring in the upper or lower skin panels in the bay forward of the horizontal stabilizer and which extend through the corners (shoulder areas) may be repaired by the addition of a stringer. A wrinkle, which is hand removable, should be reinforced by a $1/2 \times 1/2 \times .050$ -inch 2024-T4 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.

8-48. DAMAGE NECESSITATING REPLACEMENT OF PARTS.

8-49. 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 wrenching 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 on the original sheet is required. In effect, this flange is a structural member, carrying specific loads across the open areas.

8-50. BULKHEADS.

8-51. Bulkheads are composed of formed "U" channel sections. The principle material of construction is 2024-O alclad aluminum alloy, which after forming is heat treated to a 2024-T4 condition. All bulkheads in the fuselage are of the formed sheet metal or the reinforced formed sheet metal type.

8-52. 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.

8-53. 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.

8-54. LANDING GEAR.

8-55. 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.

8-56. 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 reinstalled there must be no distortion that will prevent perfect operation.

8-57. ENGINE MOUNT.

8-58. The engine mount is built up primarily of clad 2024-T4 aluminum channel sections, formed and bolted to the main spar of the wing. Brackets made from 2024-T4 clad aluminum secure the engine to the mount.

8-59. ENGINE MOUNT REPAIR. Because of the critical nature of the engine mounts, no repairs should be attempted without the approval of the factory.

8-60. ENGINE COWLING.

8-61. REPAIR OF SKINS. Skins, 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.

8-62. 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. However, on the 310C it may be more practical to repair the pan type reinforcement.

8-63. FIBERGLAS PARTS.

8-64. The fuel tank tips, tail stinger, tail surface tips, fairings, heater ducts, and other parts of the 310 series aircraft are made of fiberglass.

8-65. REPAIRABLE DAMAGE.

8-66. Damaged fiberglass parts may be repaired by the methods shown in figure 8-1. Cut and trim the area just beyond the noticeable damage. If the parts are painted, remove paint and sand clear an area at least two inches beyond the edge of the cutout. Prepare the necessary size and number of patches of glass cloth. Mix a sufficient amount of resin in accordance with the manufacturer's instructions.

WARNING

Always follow the manufacturer's mixing instructions carefully as the mixing of peroxide and cobalt together will result in a spontaneous fire.

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 the 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.

8-67. DAMAGE NECESSITATING REPLACEMENT OF PARTS.

8-68. 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 should be removed and replaced.

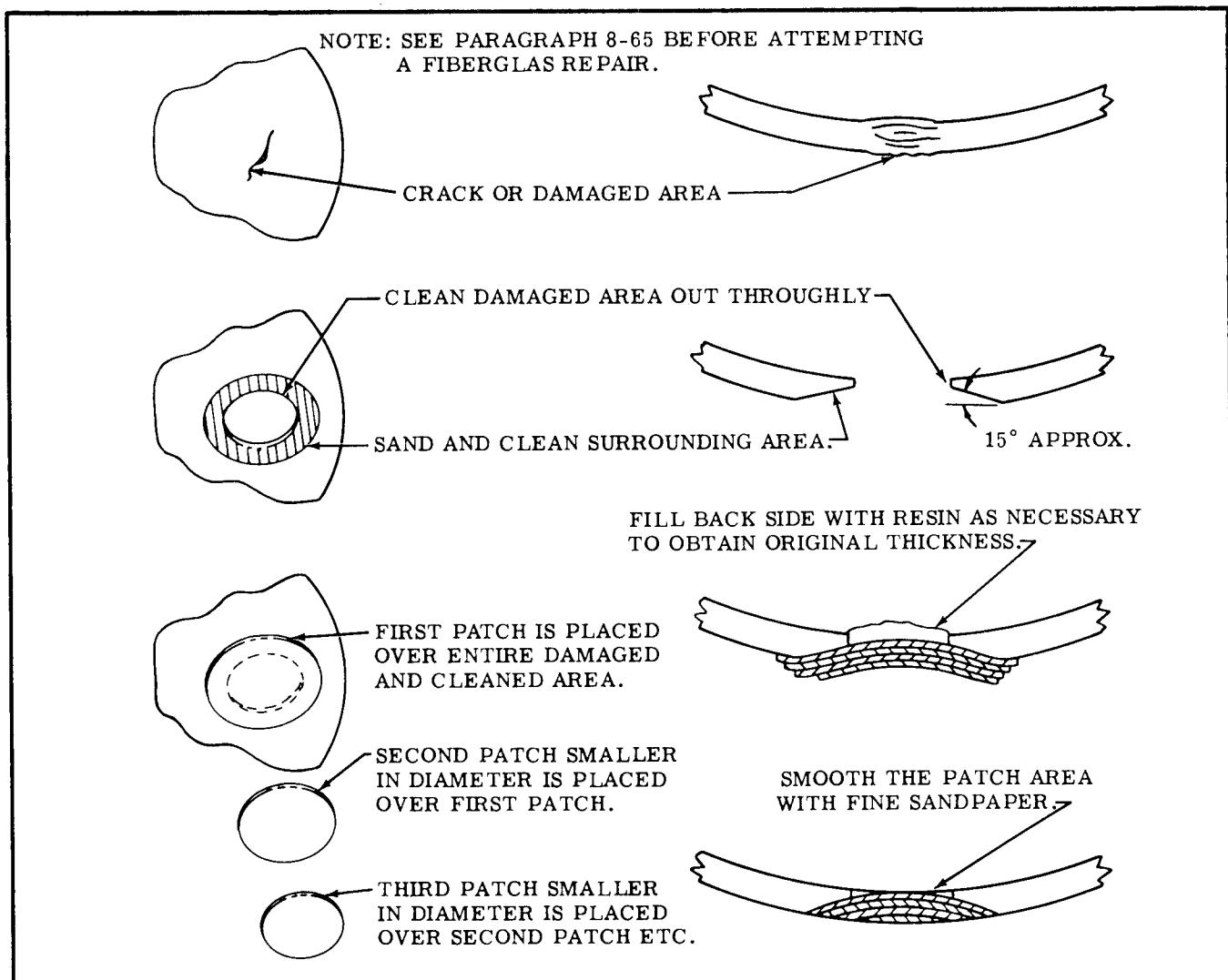


Figure 8-1. Fiberglas Repair

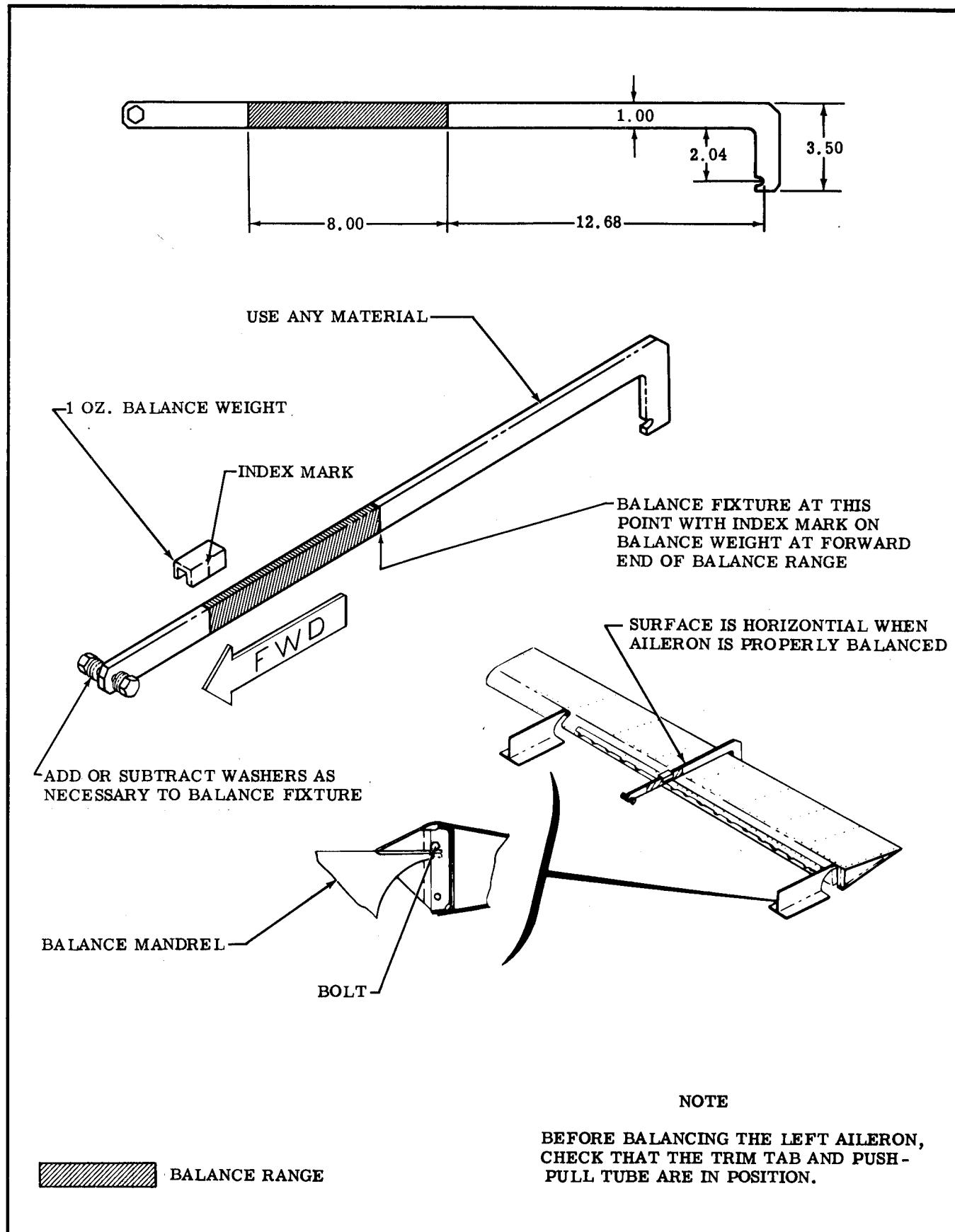


Figure 8-2. Aileron Balancing Fixture

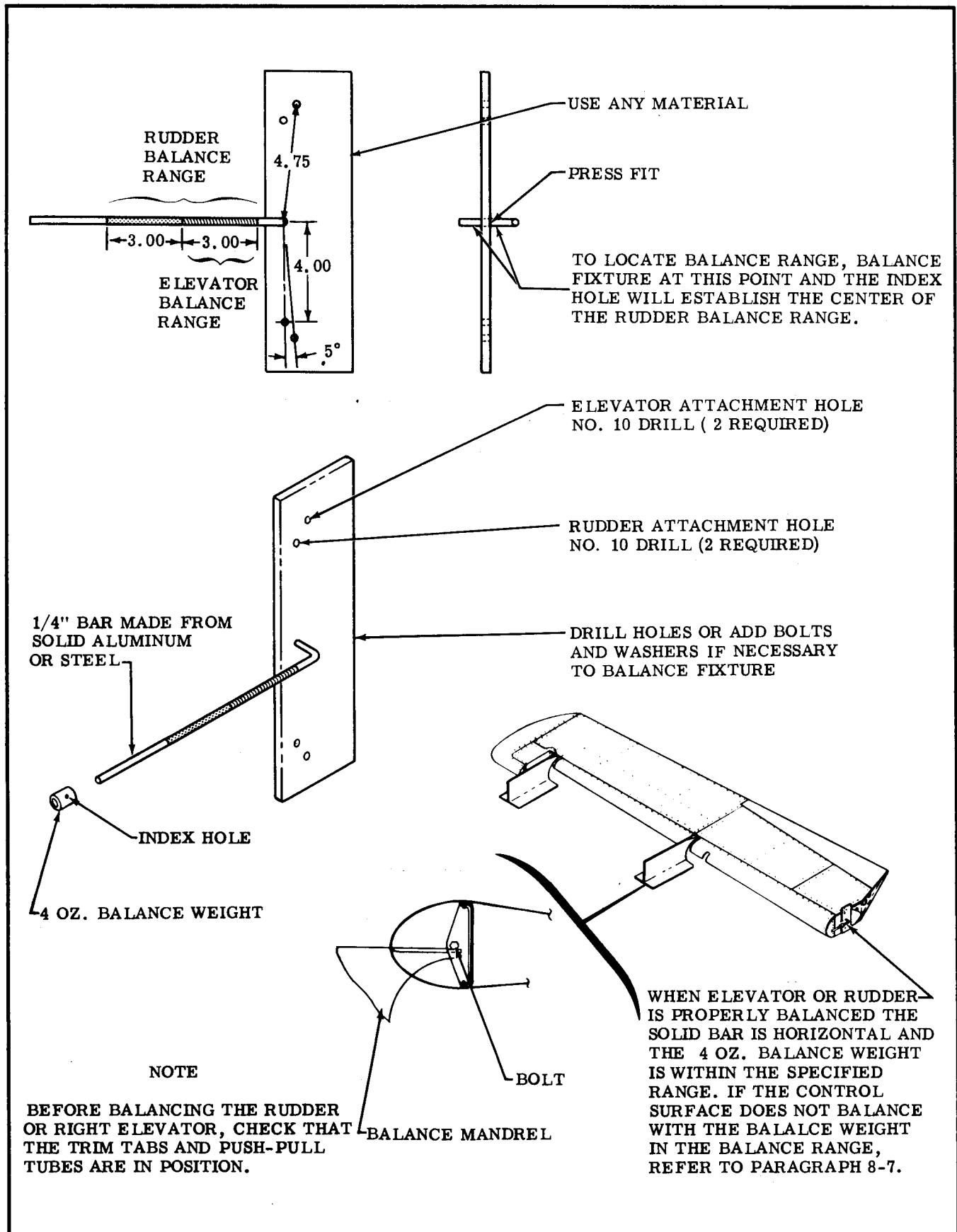
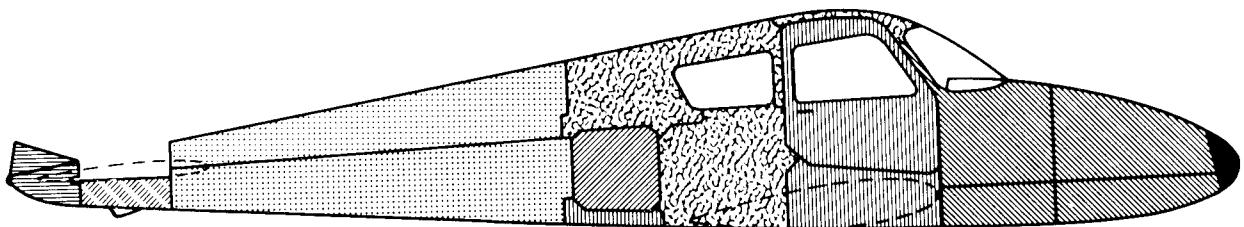
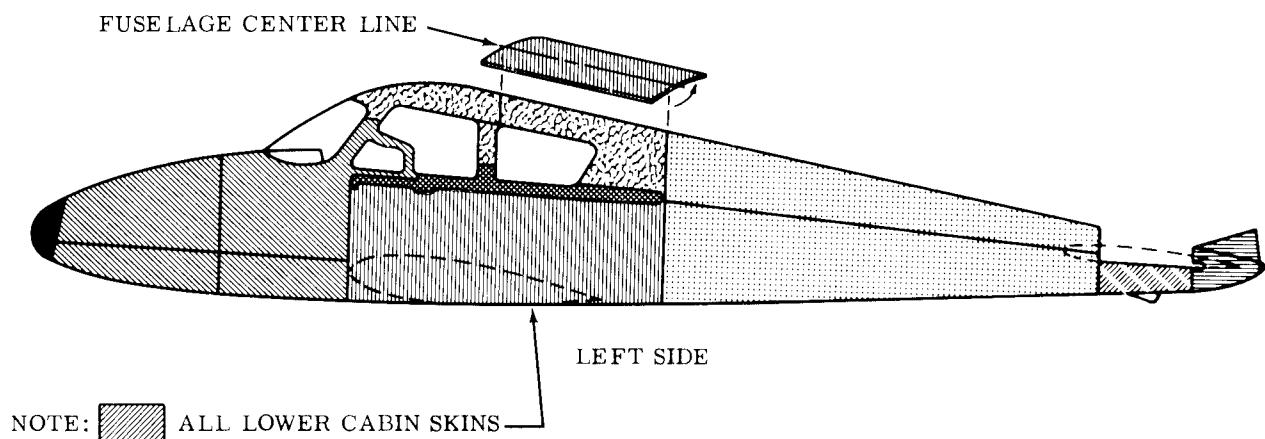


Figure 8-3. Rudder and Elevator Balancing Fixture

.016 INCH 2024 T3 ALCLAD	.032 INCH 2024 T4 ALCLAD
.025 INCH 2024 T3 ALCLAD	.051 INCH 2024 T3 ALCLAD
.025 INCH 2024 T4 ALCLAD	.040 INCH 6061-O ALCLAD
.032 INCH 2024 T3 ALCLAD	FIBERGLAS
.040 INCH 2024 T3 ALCLAD	



RIGHT SIDE



LEFT SIDE

NOTE: ALL LOWER CABIN SKINS

Figure 8-4. Fuselage Skin

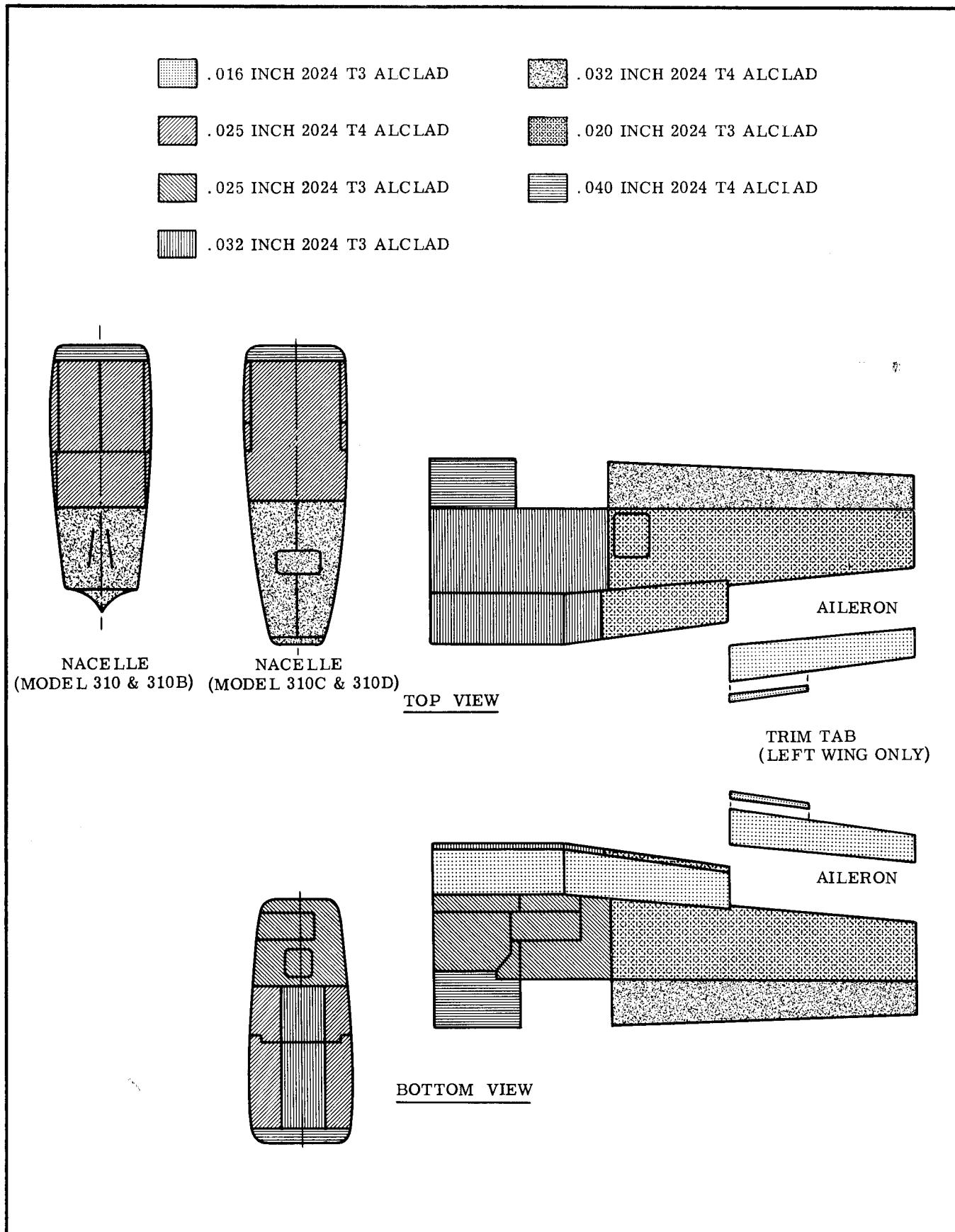
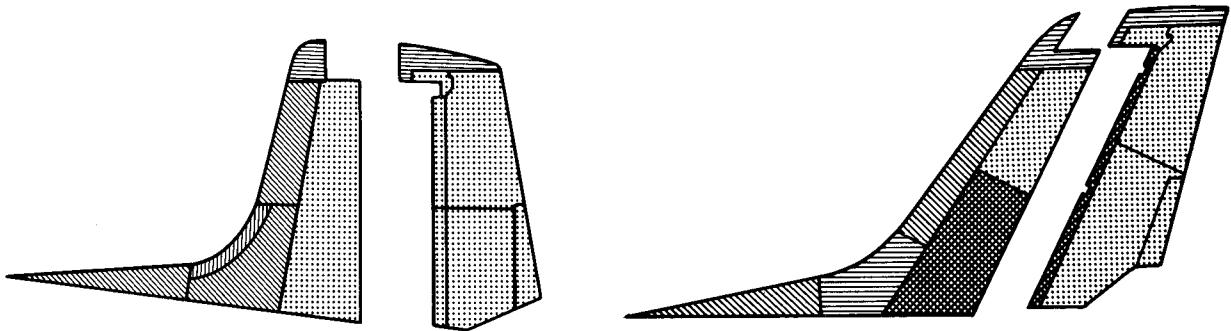
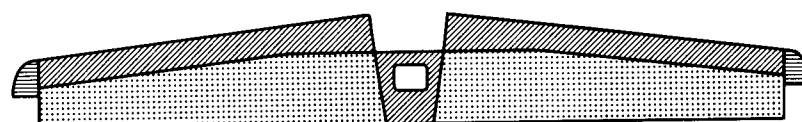


Figure 8-5. Wing Skin

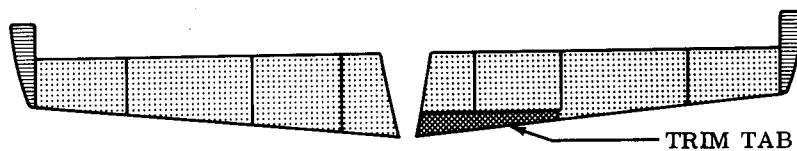
.016 INCH 2024 T3 ALCLAD	.040 INCH 2024 T4 ALCLAD
.025 INCH 2024 T3 ALCLAD	FIBERGLAS
.025 INCH 2024 T4 ALCLAD	.020 INCH 2024 T3 ALCLAD



VERTICAL FIN AND RUDDER



HORIZONTAL STABILIZER



ELEVATORS

Figure 8-6. Empennage Skin

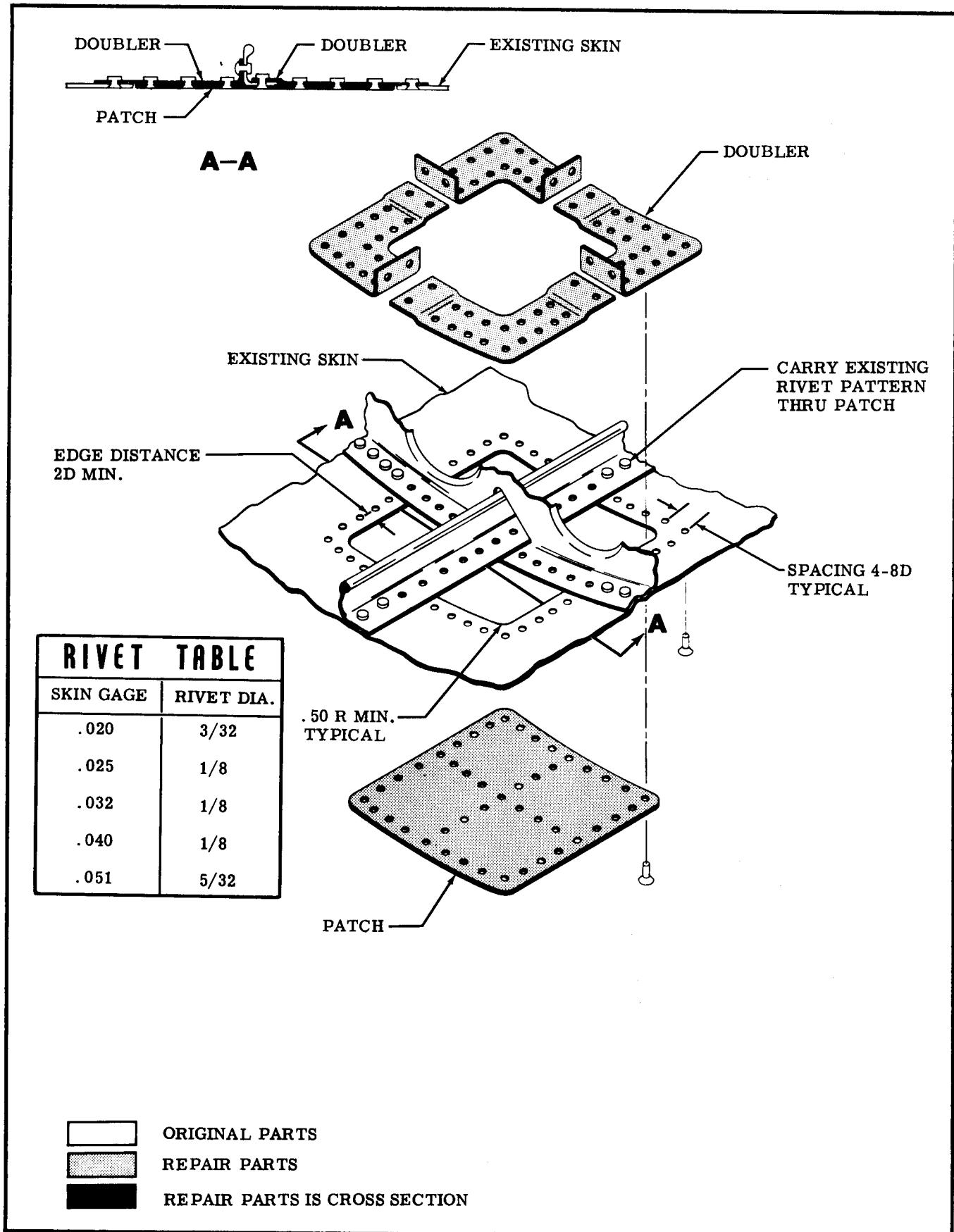


Figure 8-7. Over-Structure Skin Repair (Sheet 1 of 2)

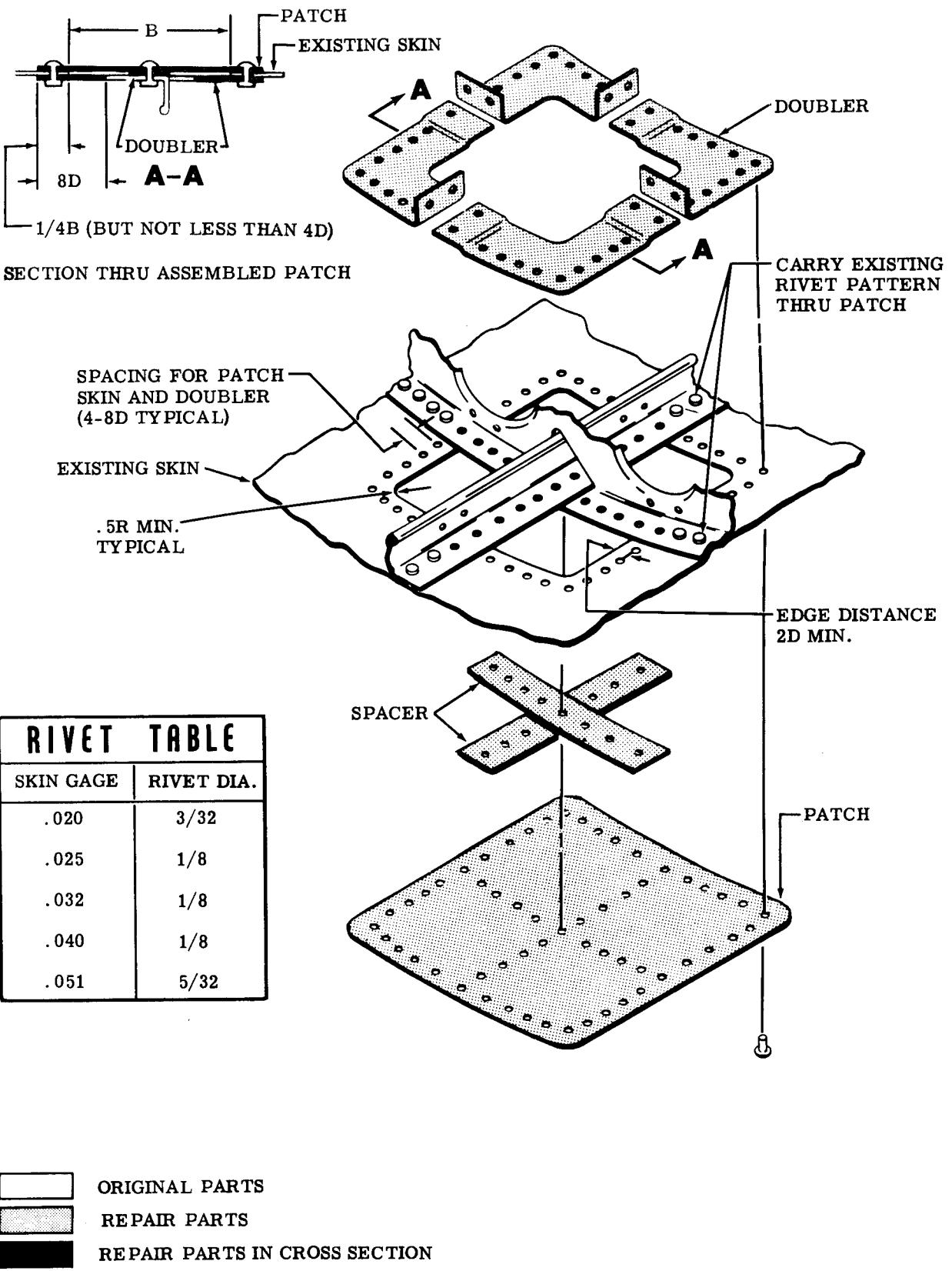


Figure 8-7. Over-Structure Skin Repair (Sheet 2 of 2)

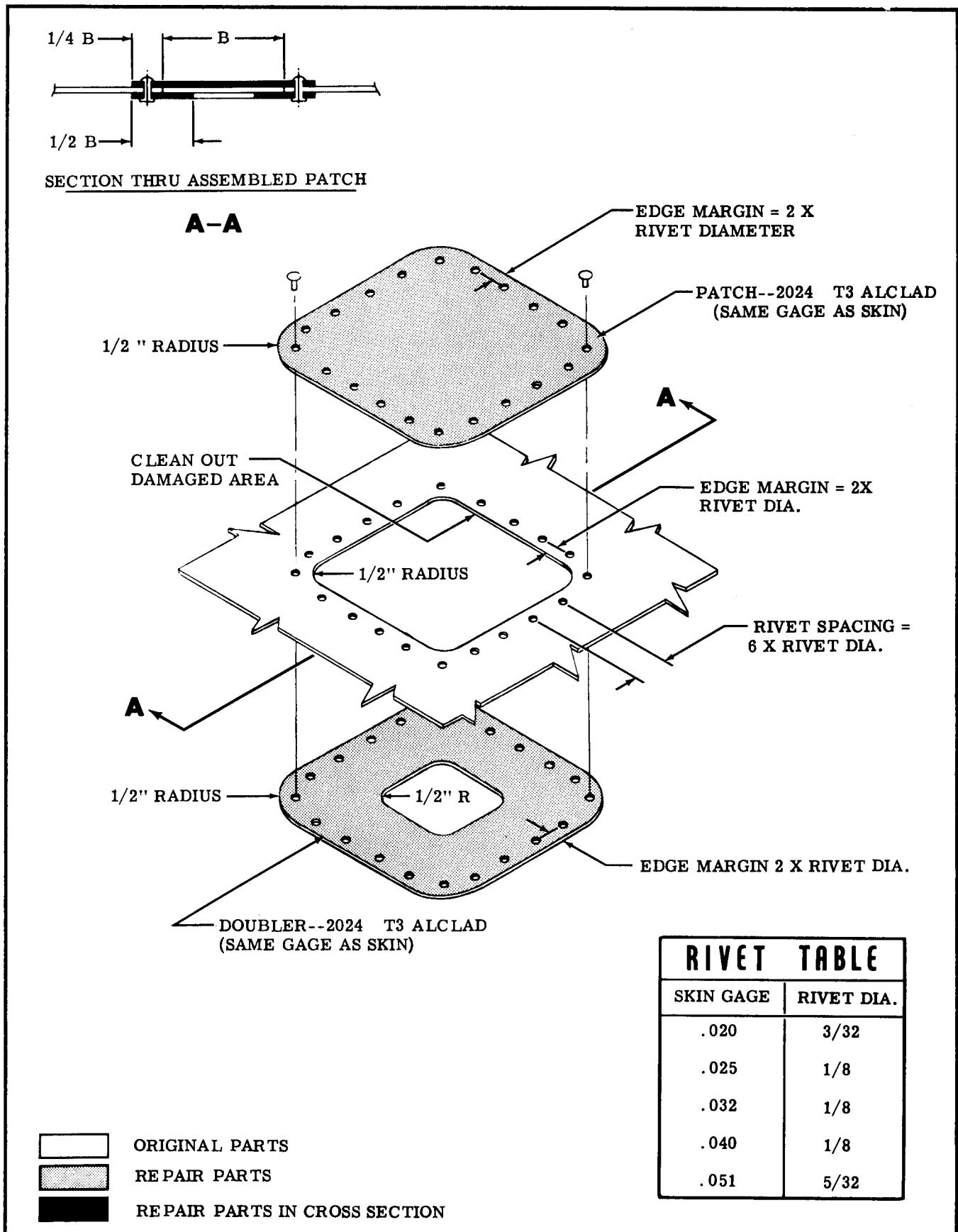


Figure 8-8. Clear-of-Structure Skin Repair

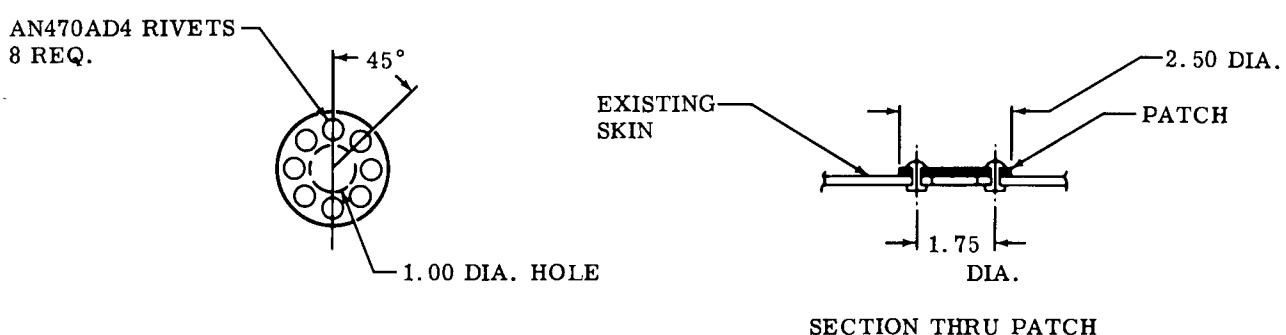
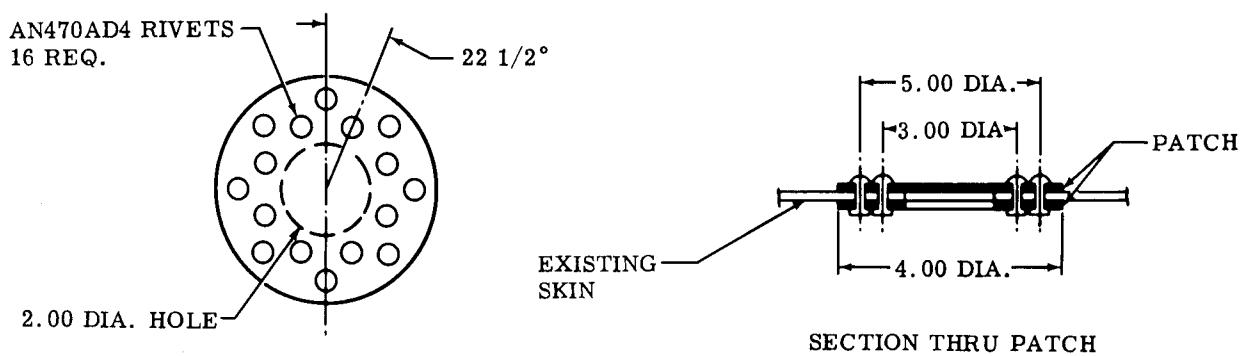
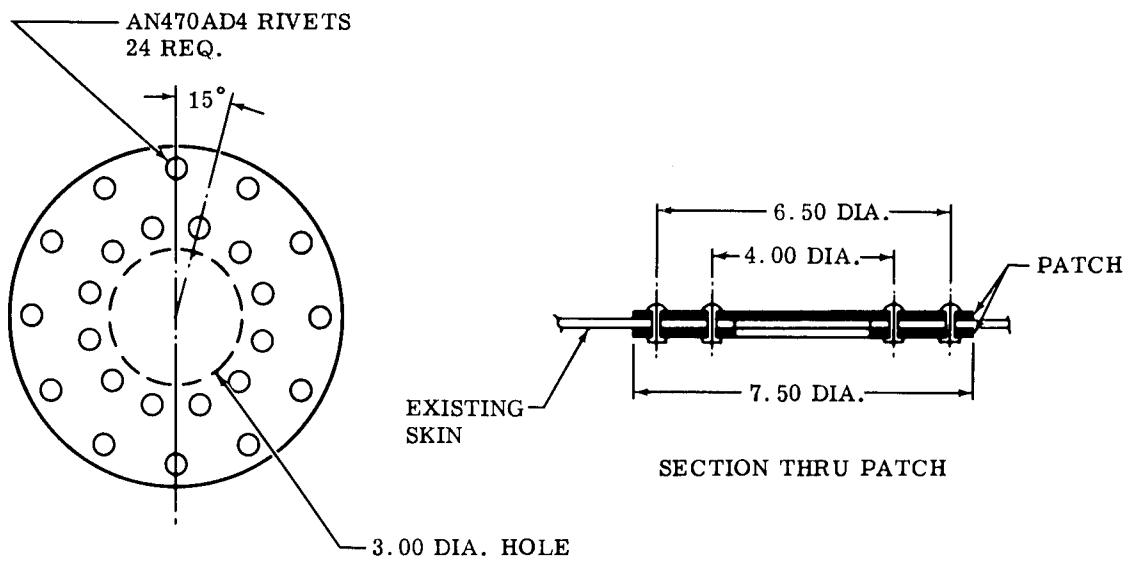


Figure 8-9. Patch Repair of Circular Holes

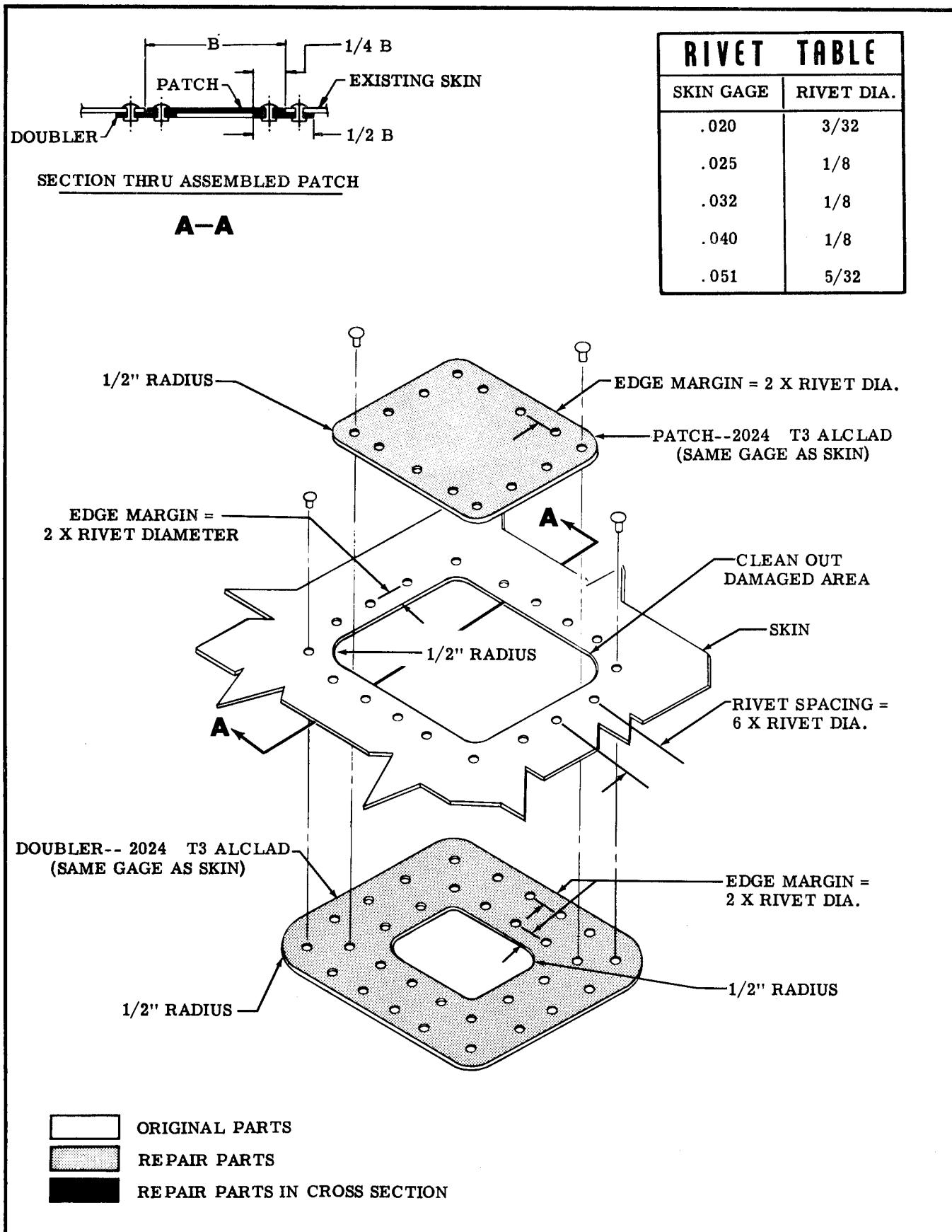


Figure 8-10. Insert Patch

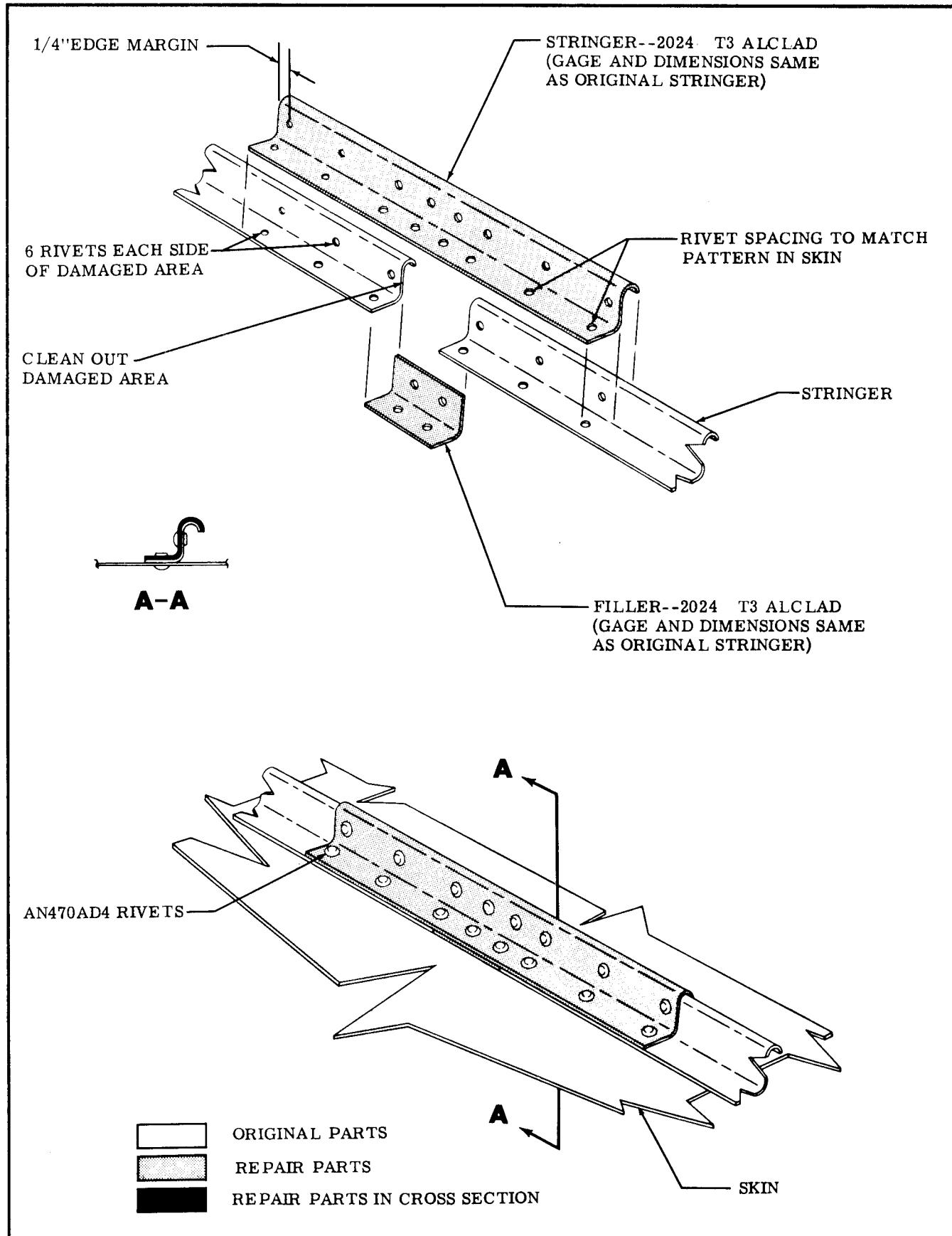


Figure 8-11. Fuselage Stringer Repair (Sheet 1 of 2)

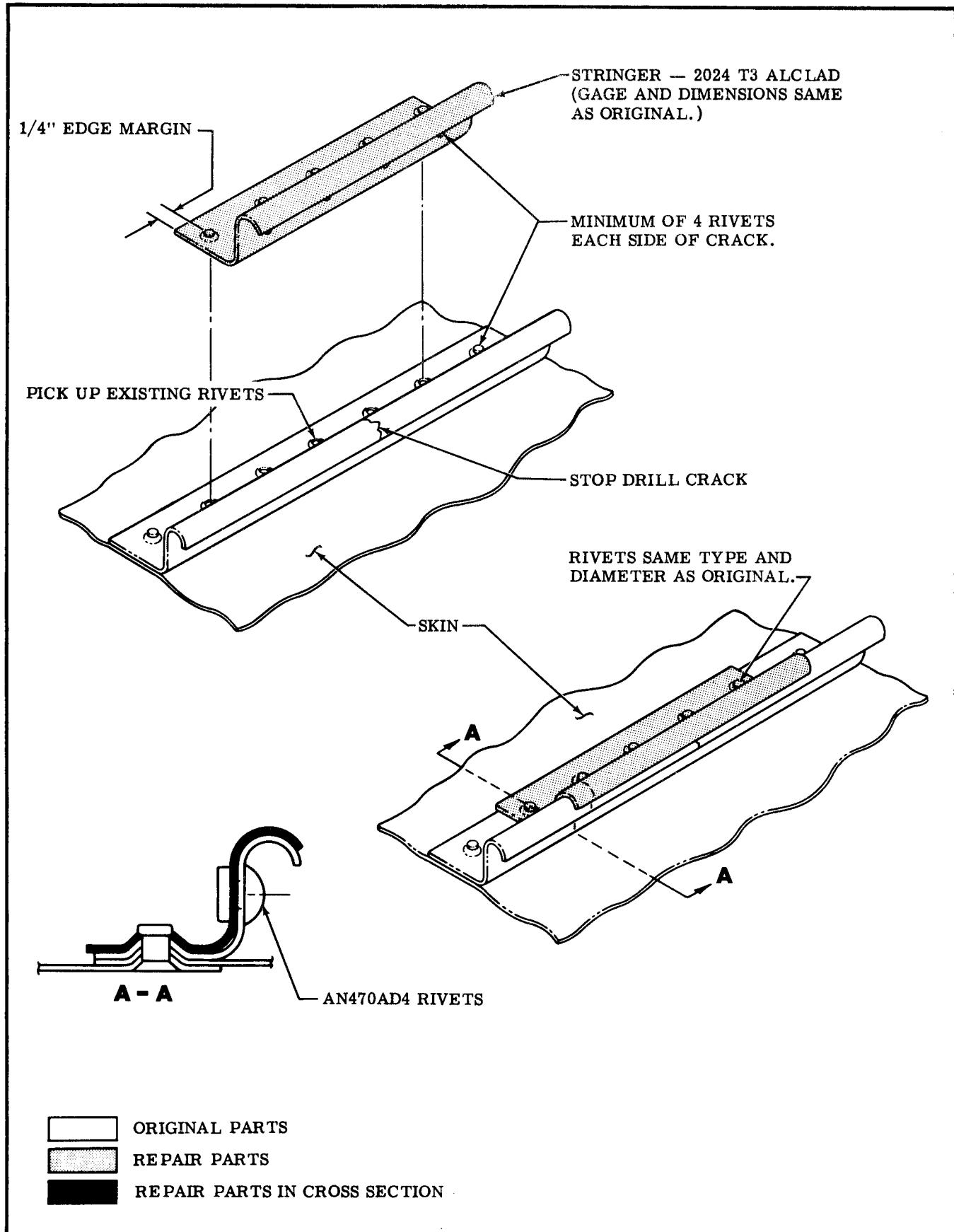


Figure 8-11. Fuselage Stringer Repair (Sheet 2 of 2)

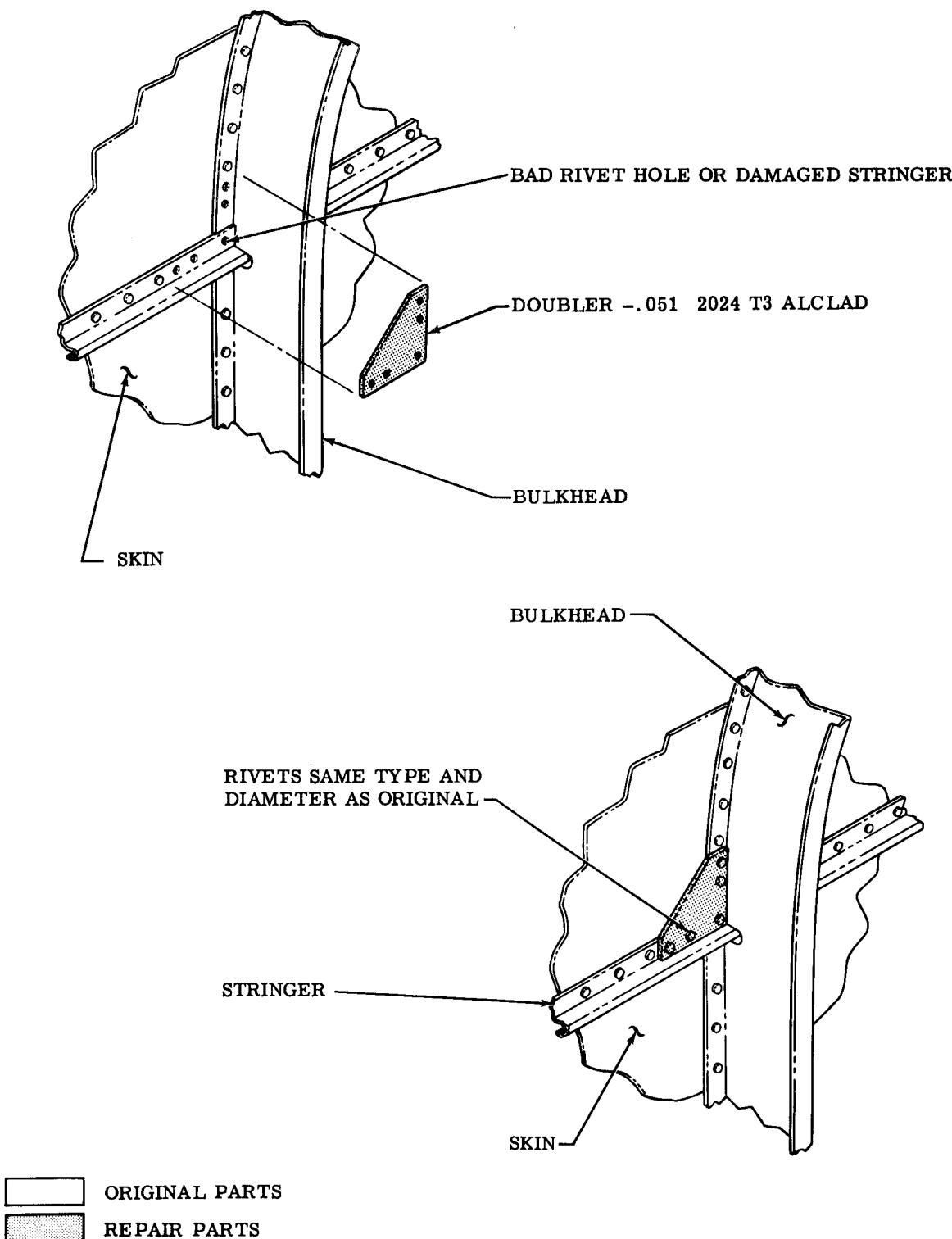


Figure 8-12. Stringer to Bulkhead Repair

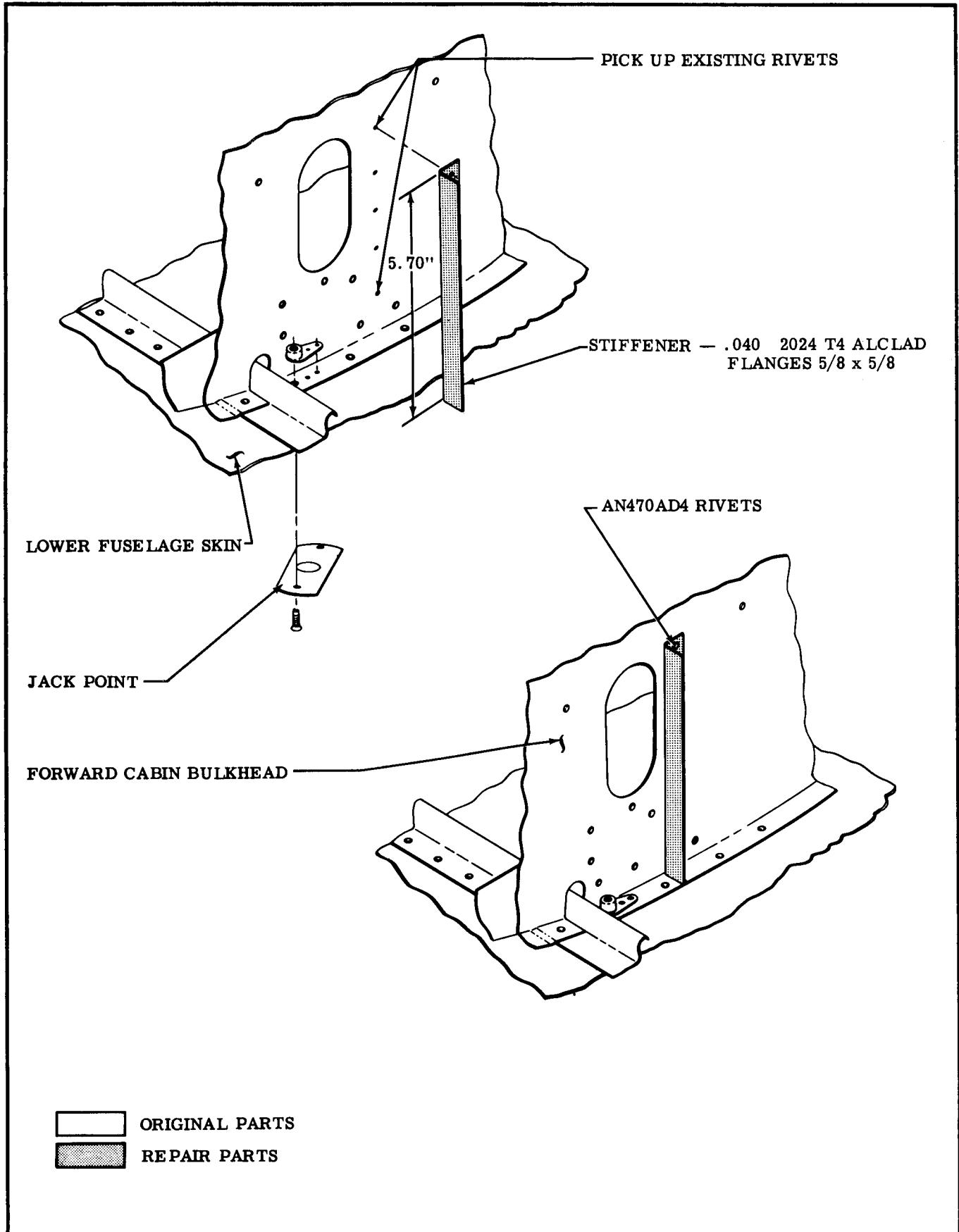


Figure 8-13. Jacking Point Reinforcement (Sheet 1 of 2)

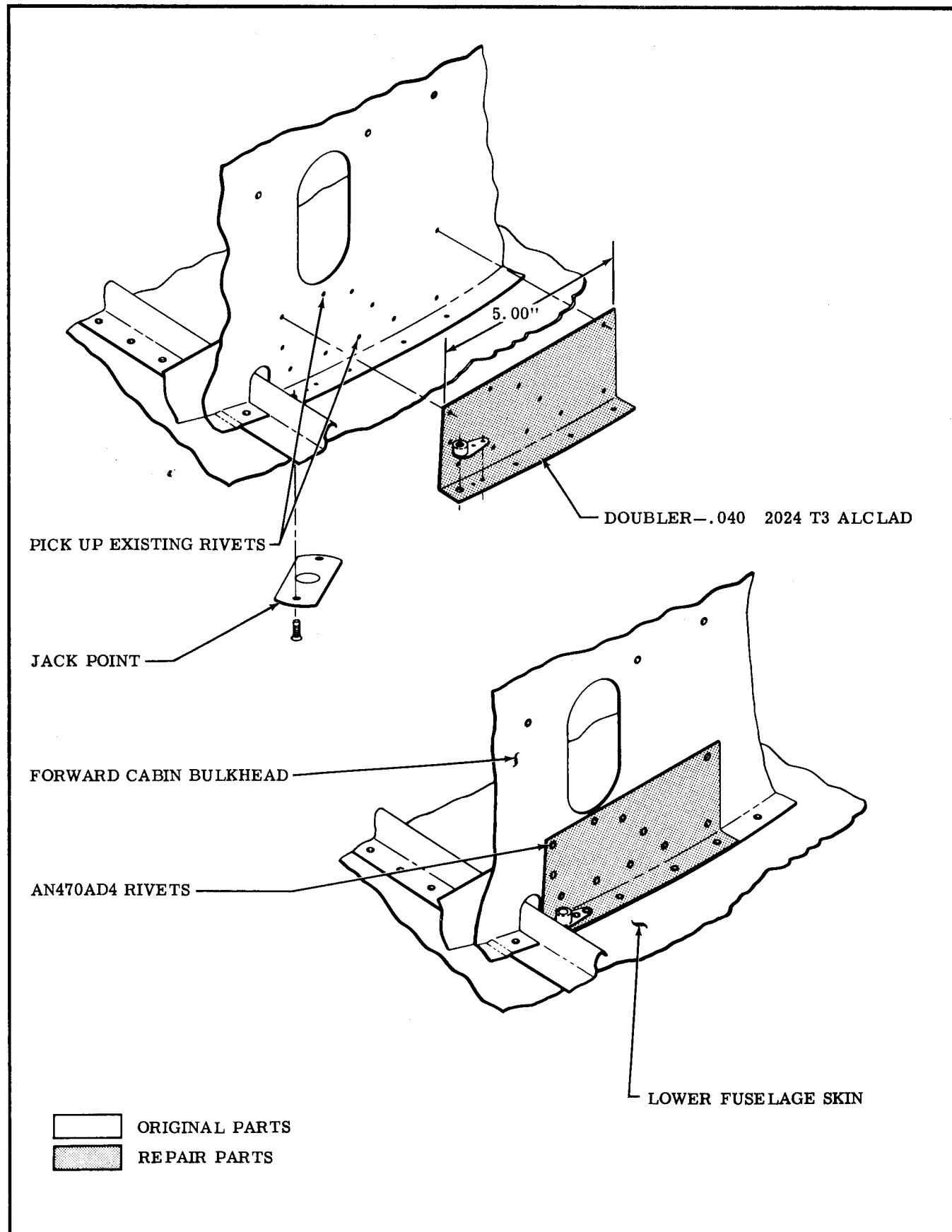


Figure 8-13. Jacking Point Reinforcement (Sheet 2 of 2)

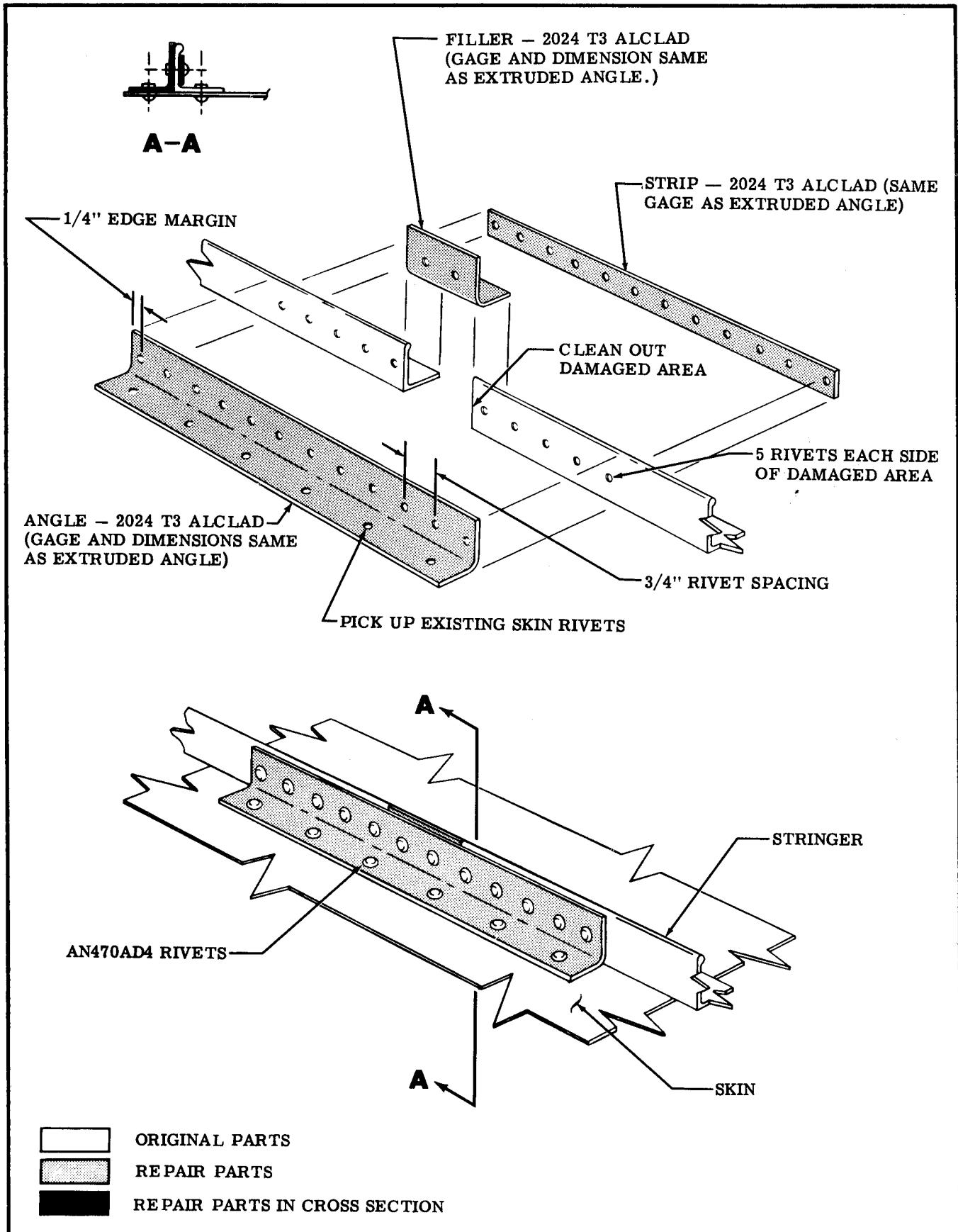


Figure 8-14. Stringer Repair

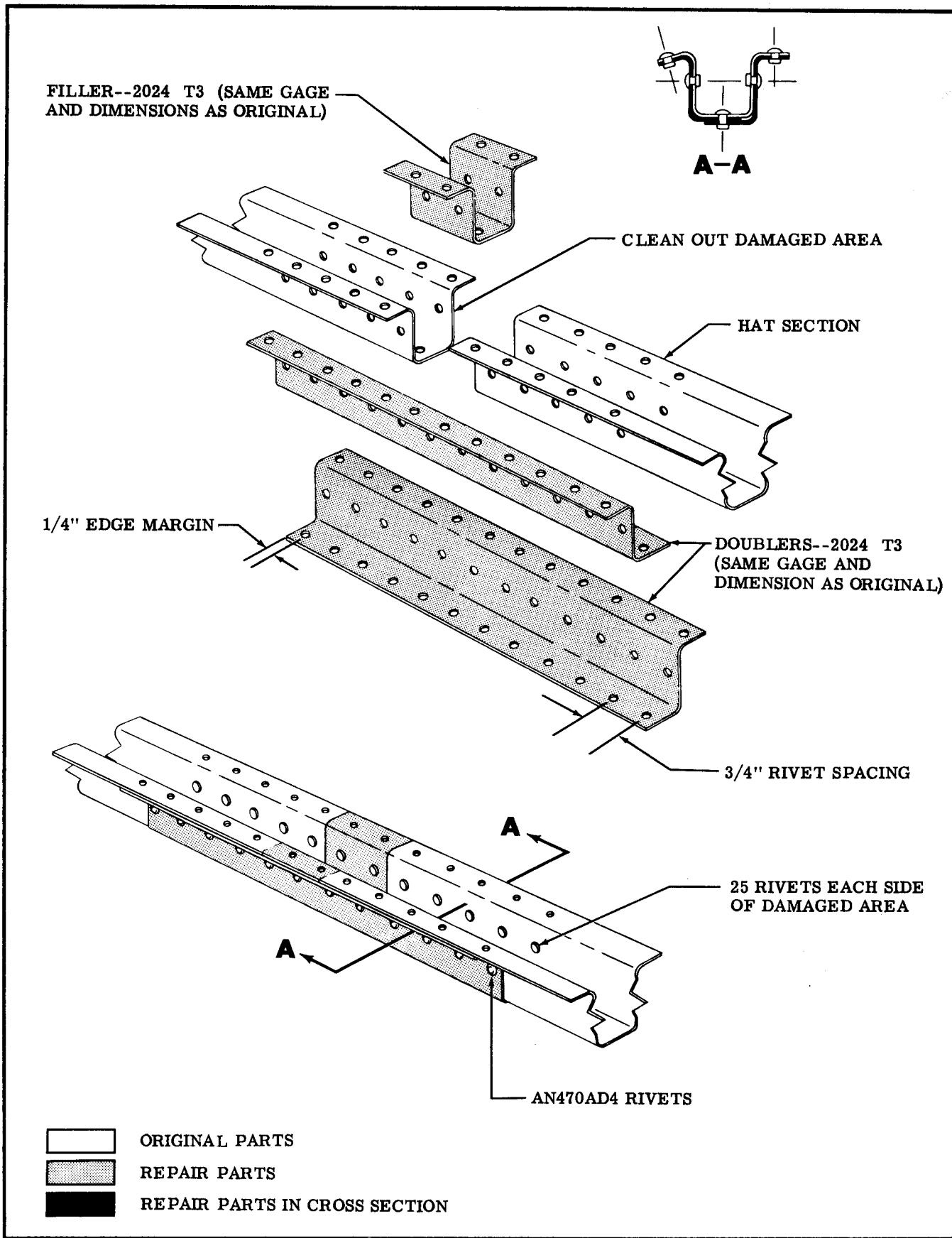


Figure 8-15. Hat Section Repair

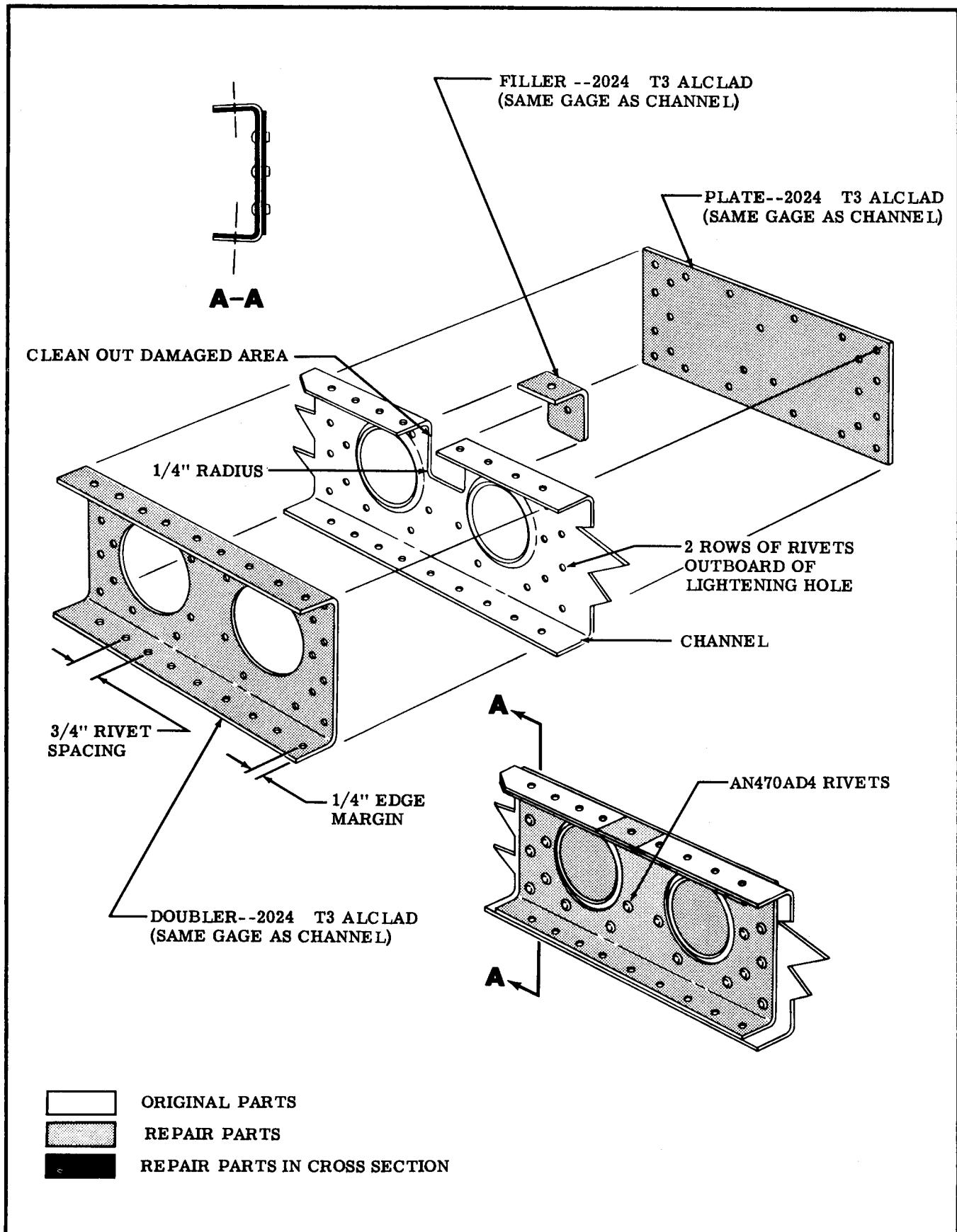


Figure 8-16. Channel Flange Repair

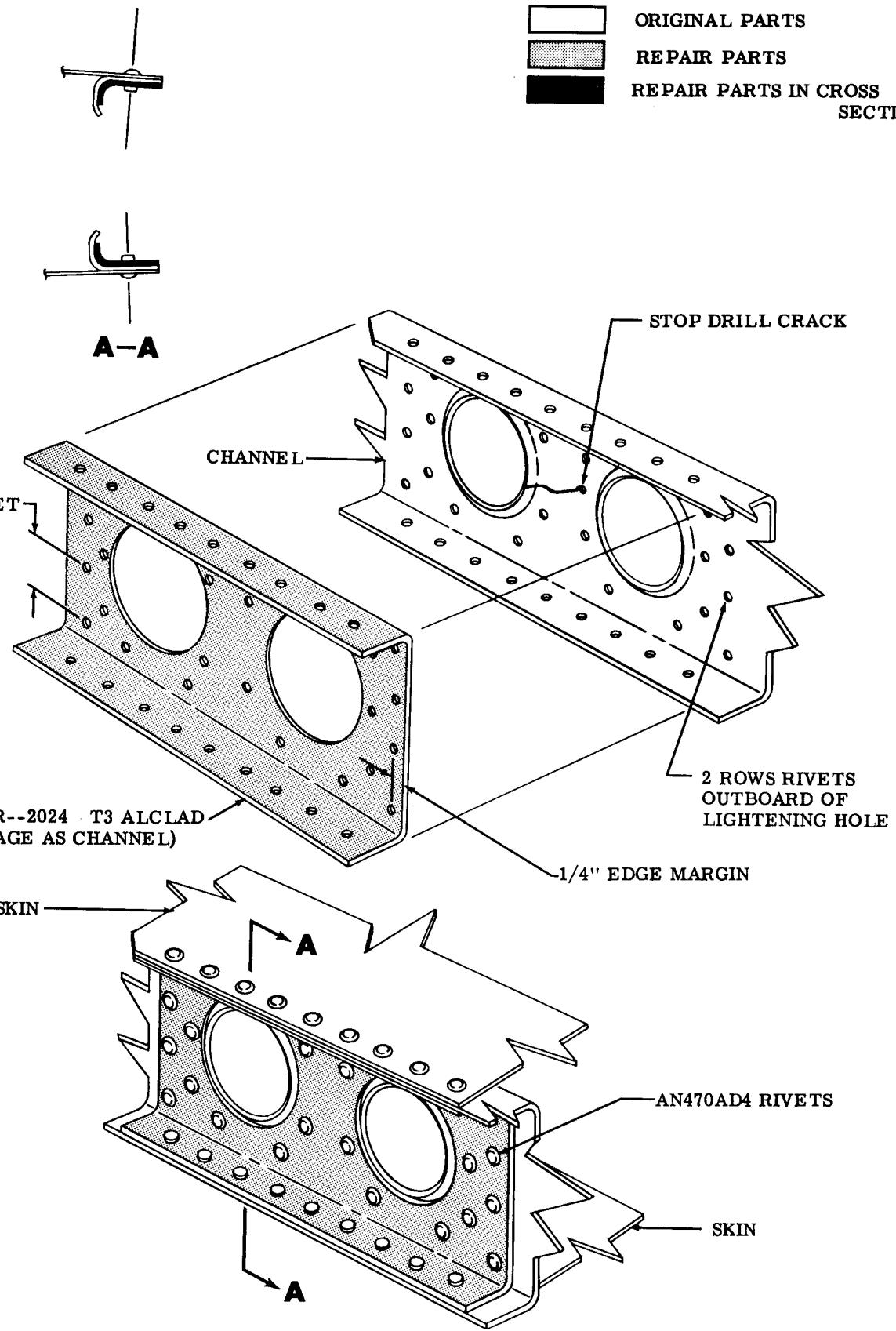


Figure 8-17. Channel Repair

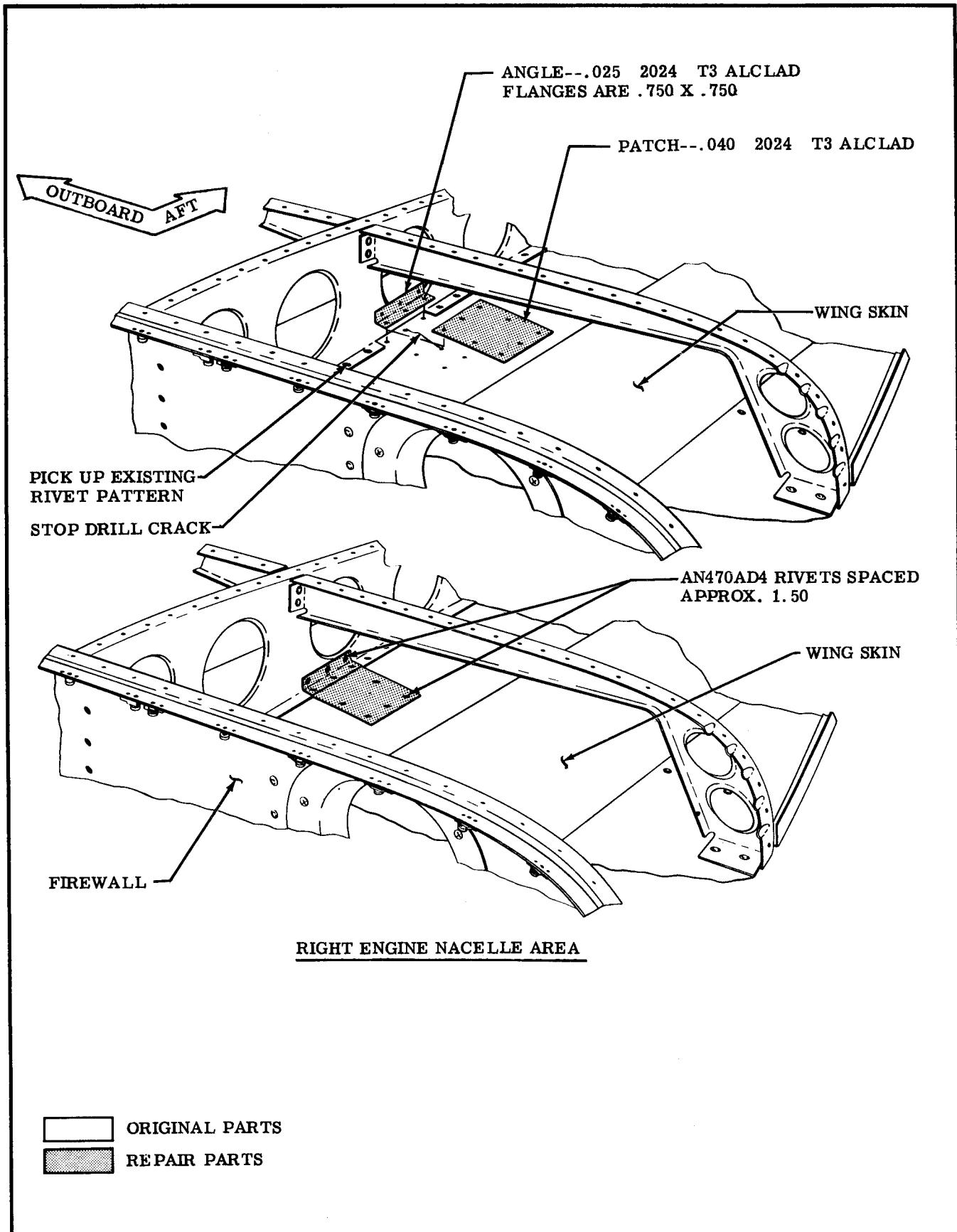


Figure 8-18. Wing Skin Repair-Nacelle Area

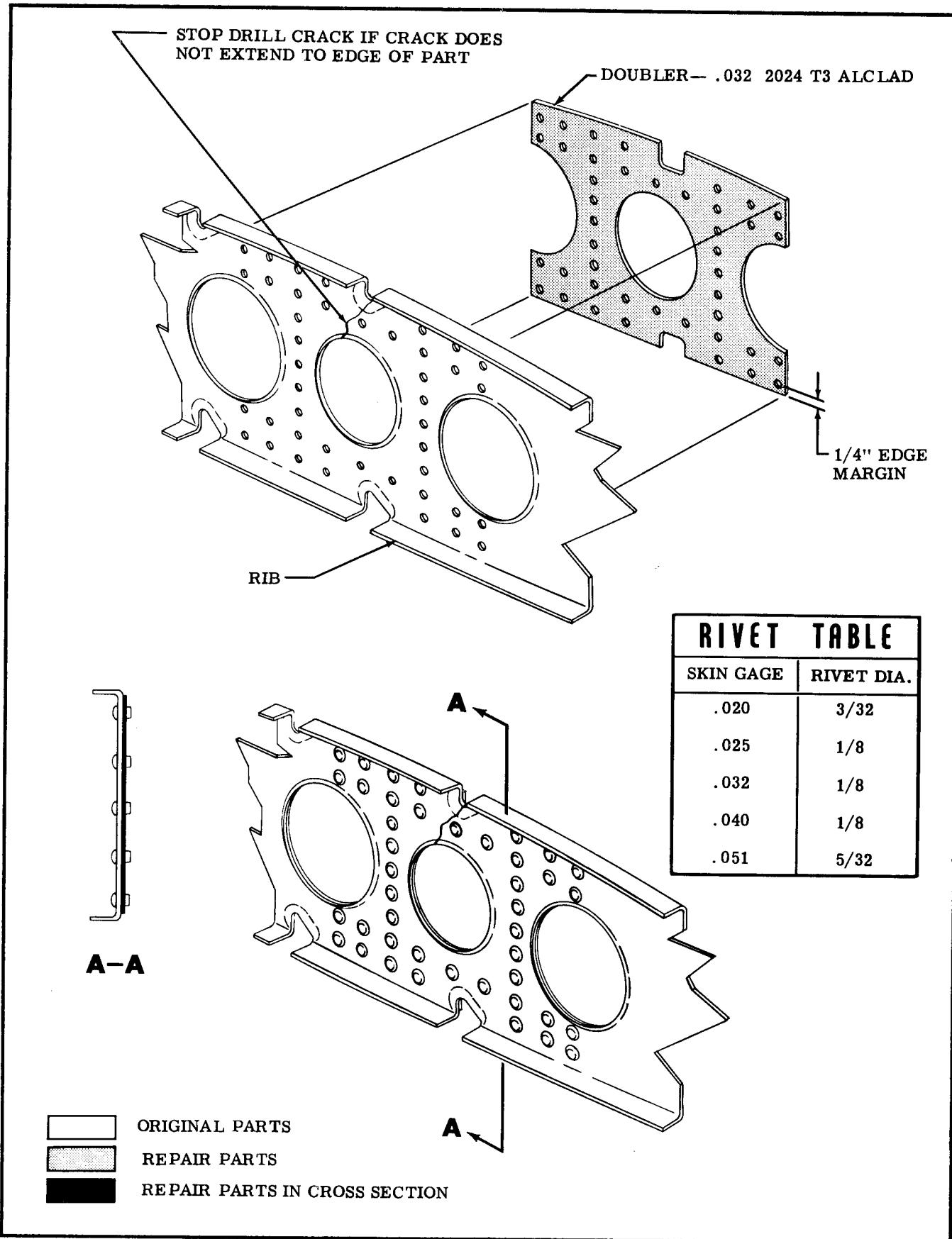


Figure 8-19. Typical Rib Web Repair

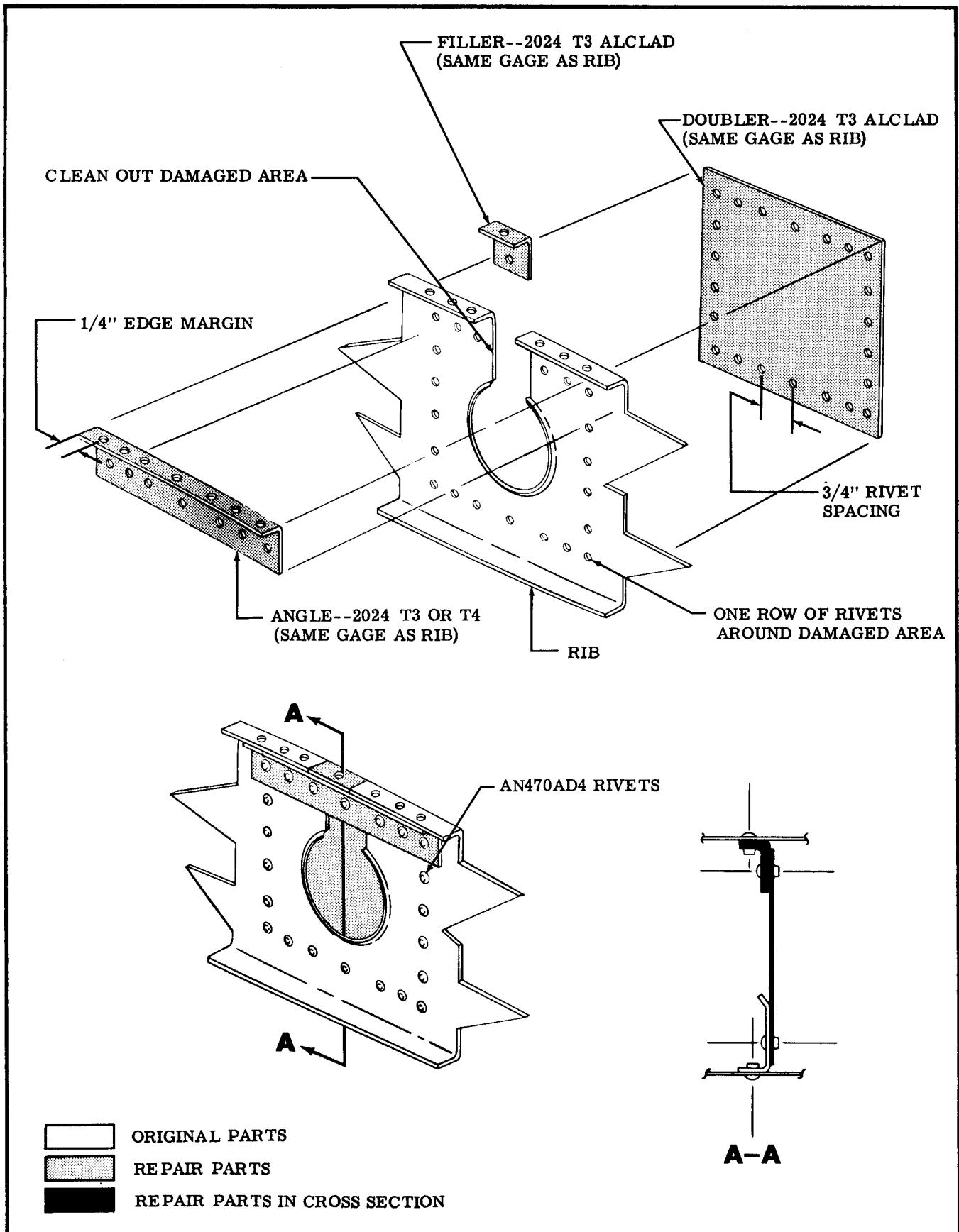


Figure 8-20. Typical Rib Flange Repair

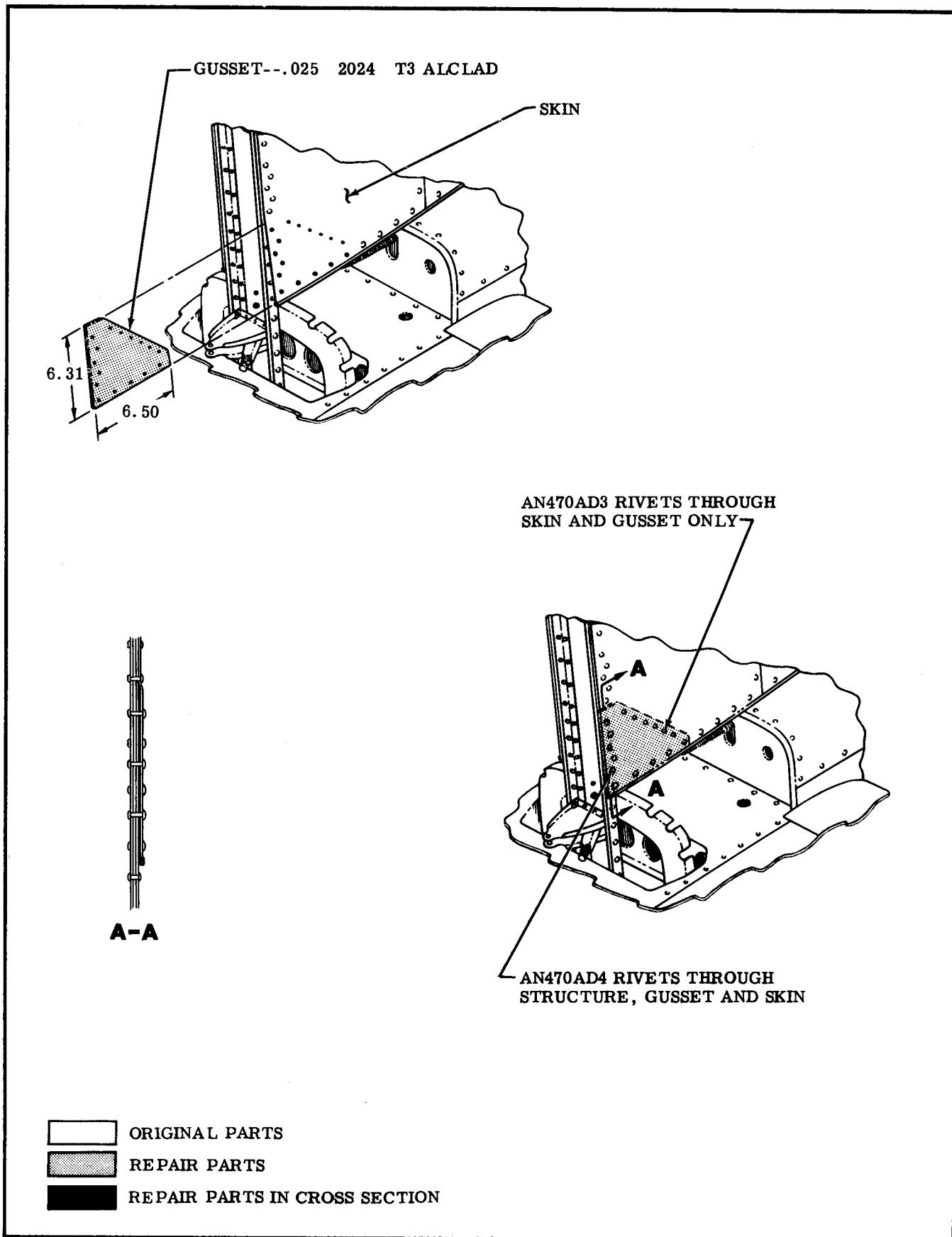


Figure 8-21. Vertical Fin

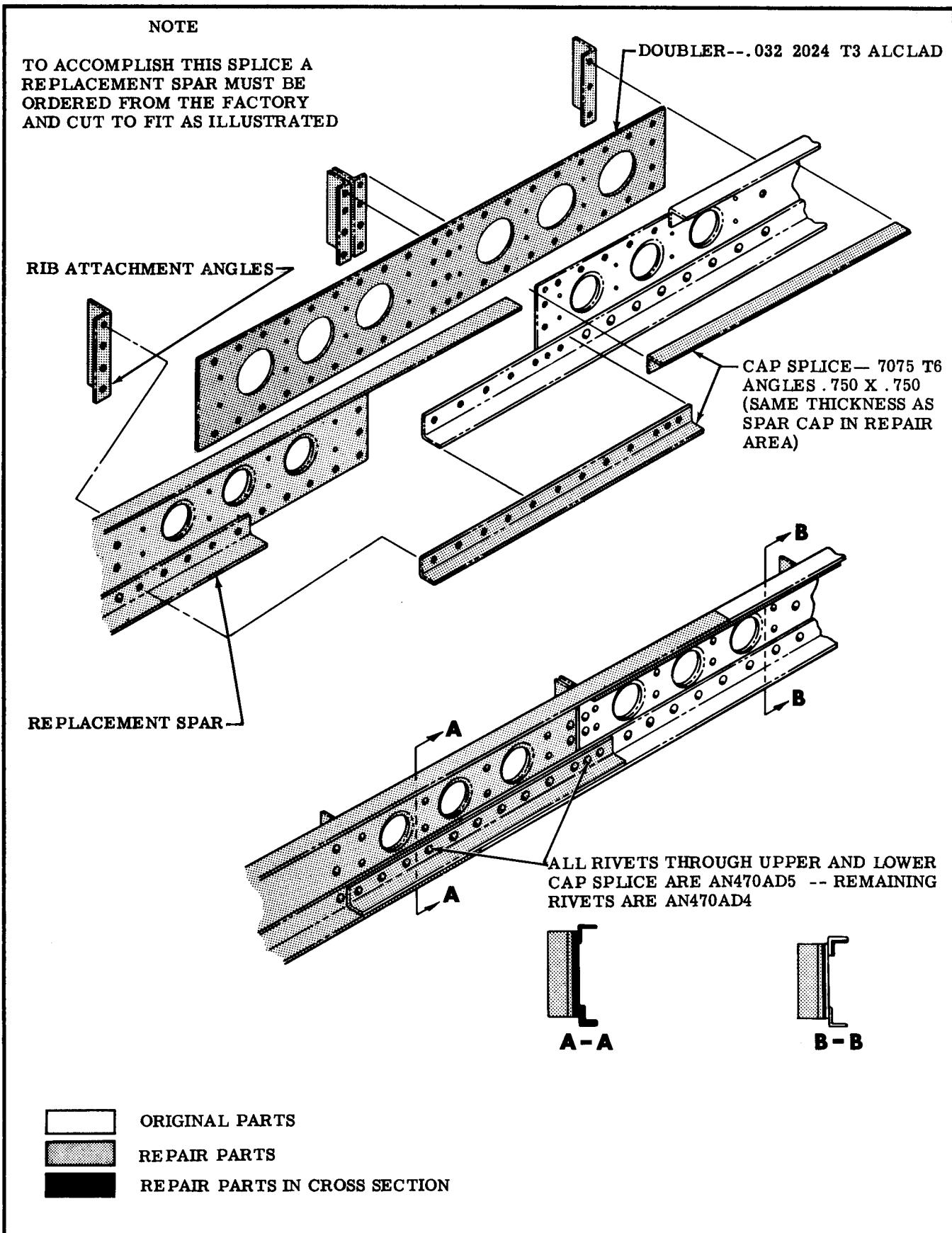


Figure 8-22. Rear Spar Repair (Station 111.12 and outboard)

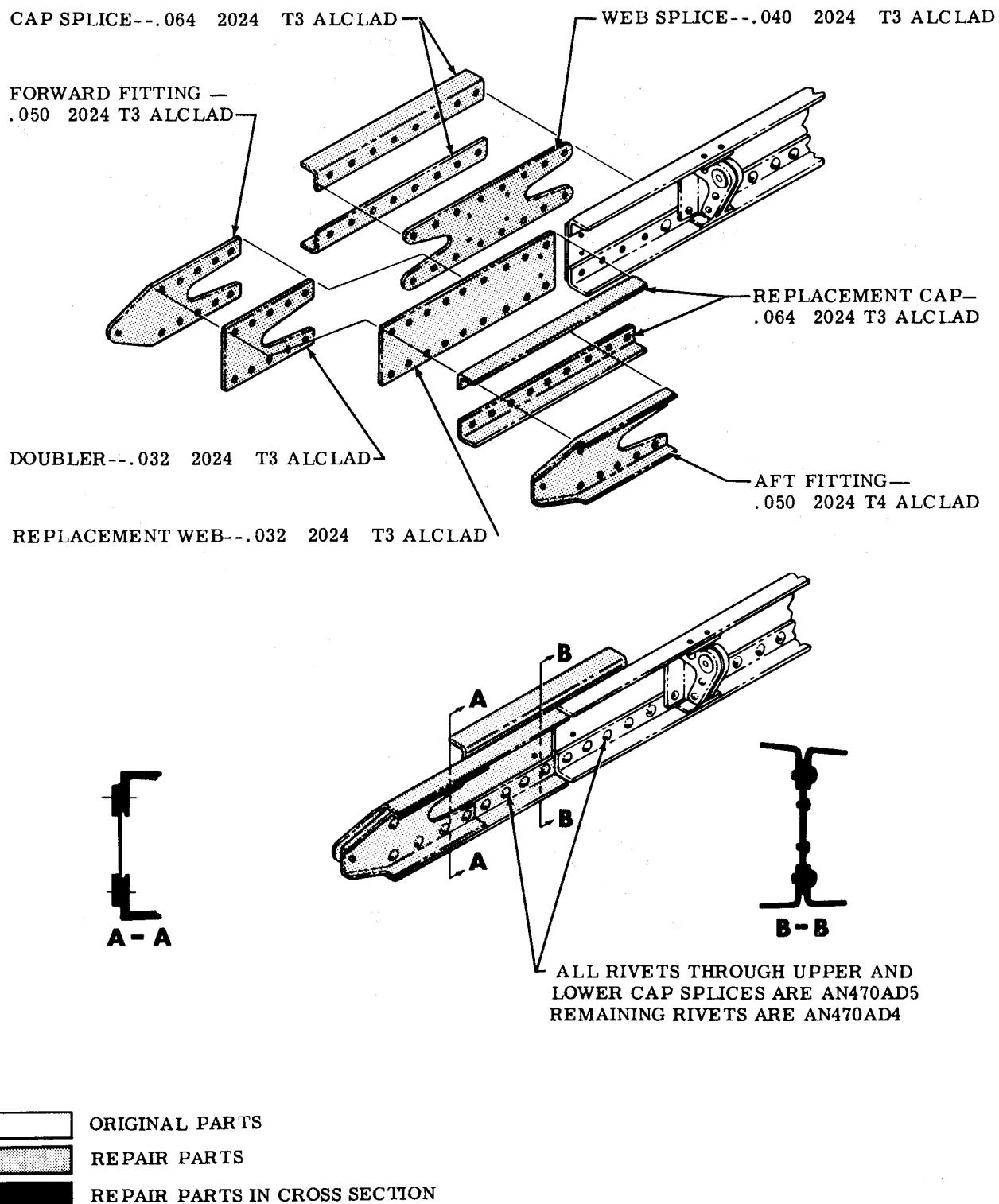


Figure 8-23. Rear Spar Repair (Station 189.20 and outboard)

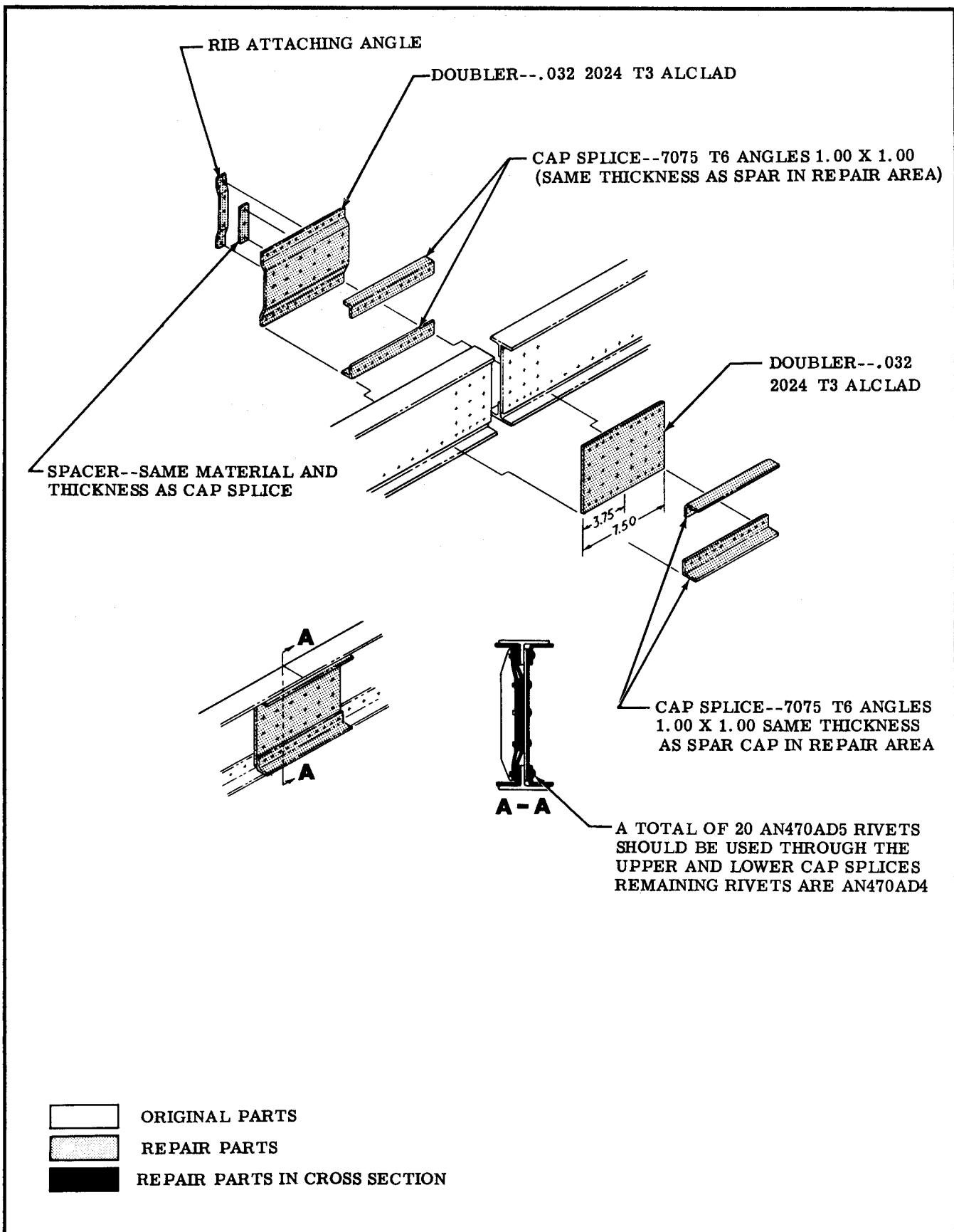


Figure 8-24. Front Spar Repair (Station 168.75 and outboard)

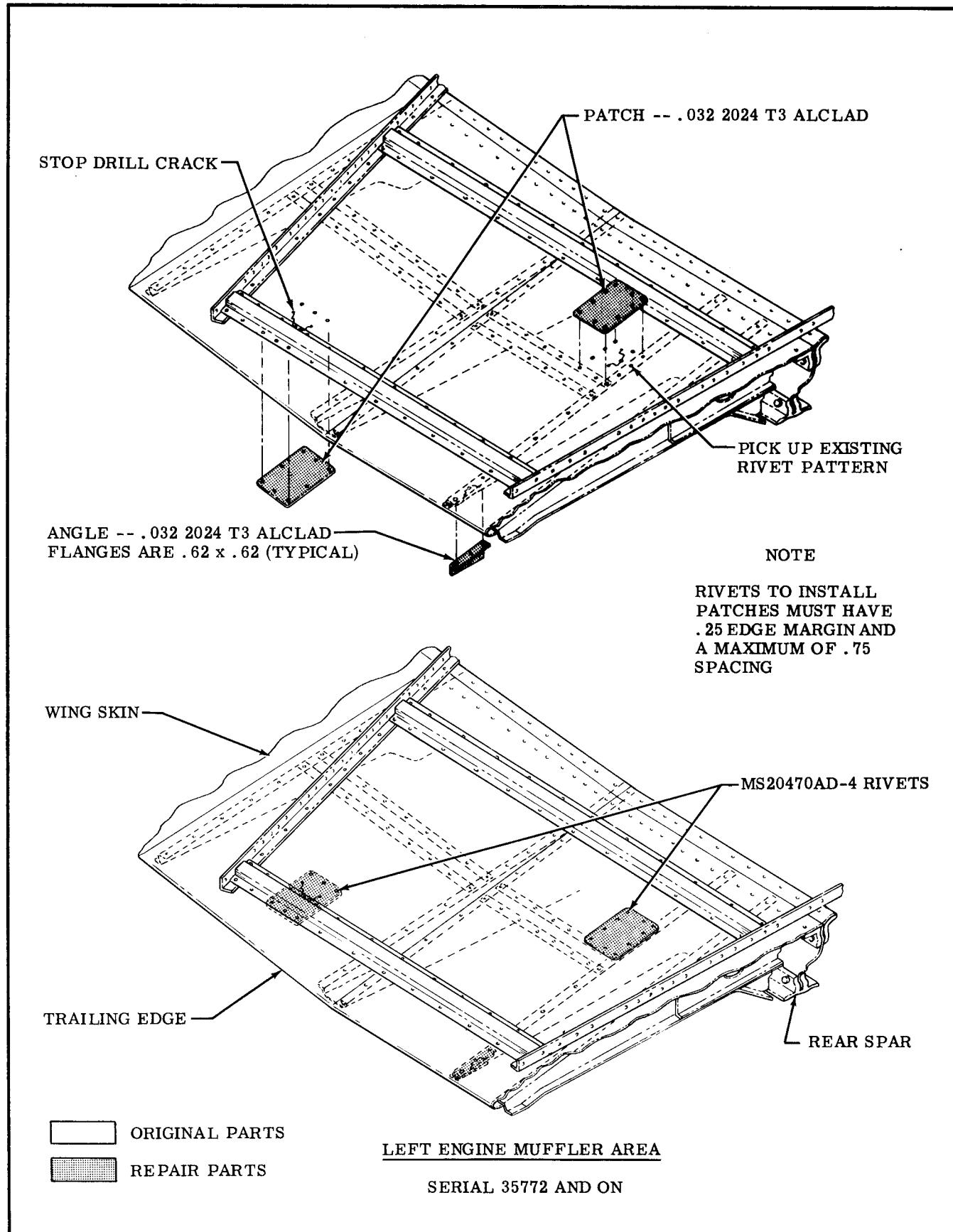


Figure 8-25. Wing Skin Repair - Muffler Area

ALPHABETICAL INDEX

A

Access and Inspection Provisions, 1-3
 Ailerons, 2-6, 2-7*
 Aileron Control System, 2-18, 2-21*
 Aileron Trim Control System, 2-22, 2-24*
 Aileron Trim Tab, 2-6, 2-7*
 Airflow Controls, 3-7*, 3-10
 Air Induction System (fuel injection), 4-76
 Air Intake Box (fuel injection), 4-77*, 4-78
 Air-Oil Separators, 4-63, 4-64*
 Airspeed Indicator, 5-10
 Air Spill Vent, 3-7*, 3-10, 3-16*, 3-17*
 Altimeter, Sensitive, 5-10
 Ammeter, 5-13
 Assist Handle, 1-3
 Assist Step, 1-3
 Attitude Indicator, 5-6

B

Baffles, Engine, 4-27, 4-28*
 Baggage Compartment, 2-57
 Baggage Compartment Upholstery, 2-64D*, 2-66A, 2-67*, 2-68*, 2-69*
 Baggage Door, 2-57, 2-59*
 Batteries, 1-9, 6-3, 6-4*, 6-5*
 Battery Boxes, 6-4*, 6-5*, 6-7
 Battery Master Switch, 6-8, 6-21*, 6-24*
 Bleeding of Brake System, 2-145
 Brake Assemblies, 2-144
 Brake Master Cylinders, 1-8
 Brake System, 2-134D
 Brake System Plumbing, 2-140, 2-141*

C

Cabin Cool Air Vents and Ducting, 3-7*, 3-9, 3-15
 Cabin Door, 2-54, 2-55*
 Cabin Door Latch Assemblies, 2-56, 2-58*
 Cabin Step System, 2-133, 2-134*, 2-134A, 2-134C*
 Cabin Warm Air Vents and Ducting, 3-7*, 3-8, 3-15, 3-16*
 Cabin Windows, 2-72, 2-73*, 2-75*, 2-77*
 Carburetors, 4-32, 4-56*
 Carburetor Air Box Assemblies, 4-25, 4-25*
 Carburetor Air Filter, 1-9, 4-25*, 4-27
 Carpet, 2-68, 2-69*
 Check and Inspection Requirements, 1-9
 Circuit Breaker Panel, 6-18, 6-19*
 Clock, 5-13
 Combination Gages, 5-13

Compass, Magnetic, 5-13*, 5-14
 Control Column System, 2-15, 2-16*
 Control Pedestal, 2-52, 2-52A*
 Controls, Engine, 4-49, 4-50*
 Cowling, Engine, 4-2A, 4-2B*
 Cylinder Head Temperature Gage, Engine, 5-12

D

Decals, Metalcals, and Placards, 2-79*, 2-80
 Defrosting, Heating, Ventilating, 3-1, 3-3*, 3-10, 3-16*
 De-Ice Light, 6-36*
 De-Ice System, 3-30, 3-31*, 3-32*, 3-33*
 Directional Indicator, 5-6
 Drain Valves and Drain Plugs, 1-6, 1-7*
 Dual Fuel Quantity Indicator, 5-12
 Dual Manifold Pressure Gage, 5-13
 Dual Tachometer, 5-11
 Ducting, 3-7*, 3-8, 3-15, 3-16*

E

Electrical Instruments, 5-11, 5-20
 Electrical Power Distribution, 6-18
 Electrical Power Supply, 6-3
 Electrical Systems and Wiring Data, 6-1
 Elevators, 2-12, 2-14*
 Elevator Trim Control System, 2-48, 2-50*
 Elevator Trim Tab, 2-14*, 2-15
 Emergency Exit Window, 2-72, 2-75*
 Emergency Exit Window Release, 2-74, 2-75*
 Empennage Group, 2-8
 Engine Air Filter (fuel injection), 4-77*, 4-78
 Engine Assemblies, 4-2B, 4-6*, 4-7*
 Engine Assemblies (fuel injection), 4-70, 4-72*, 4-73*
 Engine Baffles, 4-27, 4-28*
 Engine Baffles (fuel injection), 4-80, 4-83*
 Engine Controls, 4-49, 4-50*
 Engine Controls (fuel injection), 4-90, 4-91*
 Engine Control System, 4-49, 4-50*, 4-56*
 Engine Control Quadrant, 4-51, 4-52*, 4-54*
 Engine Control Quadrant (fuel injection), 4-93*, 4-94
 Engine Cowling, 4-2A, 4-2B*
 Engine Cylinder Head Temperature Gage, 5-12
 Engine Exhaust System, 4-26*, 4-27
 Engine Exhaust System (fuel injection), 4-79, 4-79*
 Engine Ignition System, 4-20, 4-23*
 Engine Mounts, 4-9*
 Engine Oil System, 4-17, 4-18*
 Engine Priming System, 4-48K
 Exhaust Ejector and Muffler (fuel injection), 4-80, 4-81*
 Exterior Lighting, 6-29
 External Power Receptacle, 1-9, 6-8, 6-9*

(Page numbers followed by * denotes illustrations)

F

Fuel, 1-6, 1-7*
Fuel Air Control Unit (fuel injection), 4-86, 4-73*
Fuel Boost Pumps, 4-43
Fuel Discharge Nozzle (fuel injection), 4-72*, 4-88
Fuel Drain Valves and Plugs, 1-6, 1-7*
Fuel Injection Pump, 4-73*, 4-89
Fuel Injection System, 4-85, 4-87*
Fuel Line Drain Plugs, 1-7*, 1-8
Fuel Lines and Vents, 4-46*, 4-47, 4-48A*, 4-48B
Fuel Manifold (fuel injection), 4-72*, 4-88
Fuel Pressure System (indicating), 4-45, 4-48
Fuel Pumps, 4-35
Fuel Quantity Sending Units, 4-48C
Fuel Selector Valve Light, 6-28
Fuel Selector Valves, 4-38*, 4-39, 4-41*
Fuel Selector Valve Control System, 4-38*, 4-39
Fuel Strainers, 4-36A, 4-37*
Fuel Strainers (fuel injection), 4-89
Fuel Strainer Drain Valves, 1-7*, 1-8
Fuel System, 4-30, 4-32*, 4-46*
Fuel System (fuel injection), 4-83, 4-84*
Fuselage, 2-52
Fuselage Stinger, 2-78, 2-80*

G

General Description, 1-1, 1-2*, 1-2A*
Generator, 6-8, 6-14, 6-17*
Generator Regulators, 6-13*
Generator Switch, 6-13, 6-24*
Glove Compartment, 2-70, 2-70*
Ground Handling, 1-3

H

Handle, Assist, 1-3
Heater, 3-2, 3-5*, 3-13, 3-14*
Heater Safety Valve, 3-4, 3-5*
Heater Switch, 3-9, 3-15
Heating, Ventilating, and Defrosting, 3-1, 3-3*, 3-10, 3-12*
Hoisting, 1-3
Horizontal Stabilizer, 2-12, 2-13*

I

Ignition Harness, 4-22, 4-23*
Ignition Switches, 4-22
Ignition System, Engine, 4-20, 4-23*
Induction System, 4-25
Induction System, (fuel injection), 4-76
Inspection Provisions, Access and, 1-3
Instruments, 5-4, 5-5*, 5-14*
Instrument Panel, 5-4, 5-5*, 5-15, 5-16*
Interior Lighting, 6-23

J

Jacking, 1-3, 1-5*
Jacking Provisions, 1-5*
Junction Boxes, 6-19, 6-20*

L

Landing Gear, 2-81
Landing Gear Actuator, 2-115, 2-116*
Landing Gear Safety Switch, 2-128
Landing Gear Warning System, 2-121
Landing Lights, 6-32*, 6-33*
Left Hand Switch Panel, 6-21*, 6-22
Leveling, 1-6
Light Weight De-Ice System, 3-30, 3-31*, 3-32*, 3-33*
Lubrication Requirements, 1-9, 1-13*

M

Magnetic Compass, 5-13*, 5-14
Magnetos, 4-21, 4-23*
Main Landing Gear, 2-86, 2-87*, 2-88*, 2-90*
Main Landing Gear Doors, 2-91, 2-92*
Main Landing Gear Retracting Linkage, 2-107, 2-108*, 2-110*
Main Wheel Alignment, 2-129*, 2-130
Main Wheel and Tire Assembly, 2-93, 2-94*
Manifold Pressure Gage, Dual, 5-13
Manifold Pressure System, 4-68*, 4-69
Manual Extension System, 2-118, 2-120*
Master Cylinder, 2-137, 2-137*, 2-138*
Miscellaneous Electrical Equipment, 6-36
Miscellaneous Instruments, 5-13

N

Navigation Lights, 6-29*, 6-31*
Navigation Lights Flasher Unit, 6-31
Nose Gear, 2-96, 2-97*, 2-98*, 2-100*
Nose Gear Doors, 2-101, 2-103*
Nose Gear Retracting Linkage, 2-112*, 2-113
Nose Gear Shimmy Dampener, 2-104, 2-105*
Nose Wheel and Tire Assembly, 2-102, 2-104*
Nose Wheel Steering System, 2-130, 2-131*

O

Oil, 1-8
Oil Dilution System, 4-19, 4-20*
Oil Dilution System (fuel injection), 4-76
Oil Pressure System, 4-17, 4-18*
Oil Temperature Bulbs, 4-19

(Page numbers followed by * denotes illustrations)

P

Paralleling Relay, 6-13*, 6-14
 Parking and Tie-down, 1-6*
 Parking Brake System, 2-145, 2-146*
 Pitot Static System Instruments, 5-8, 5-9*, 5-20
 Pitot Tube Assembly, 5-9*, 5-11, 5-17*, 5-20
 Plenum Chamber, 3-6, 3-7*, 3-15
 Preparation for Inspection, 1-10
 Principal Dimensions, 1-2*, 1-2A*, 1-2B
 Propellers, 4-57, 4-58*
 Propeller Governor, 4-56*, 4-61*, 4-62

T

Tachometer, 5-11
 Tail Navigation Light, 6-31*
 Taxi Light, 6-34*
 Temperature Control, 3-7*, 3-9, 3-15, 3-16*
 Tires, 1-9
 Torque Link Assemblies, 2-106, 2-106*
 Towing, 1-3
 Turn-and-Slip Indicator, 5-11

R

Rear Dome and Baggage Light, 6-26*, 6-29
 Recommended Fuels, 1-6, 1-7*
 Rigging Engine Controls, 4-53, 4-56*
 Rigging Engine Controls (fuel injection), 4-94, 4-97*
 Rigging Of Landing Gear, 2-122, 2-123*, 2-124*,
 2-125*
 Rigging of Nose Gear, 2-126, 2-127*, 2-128*
 Rotating Beacon Light, 6-35*
 Rudder, 2-10, 2-11*
 Rudder Control System, 2-34, 2-36*
 Rudder Trim Control System, 2-38, 2-42*
 Rudder Trim Tab, 2-11*, 2-12

S

Safety Belts, 2-63
 Seat Assemblies, 2-57, 2-60*, 2-62*, 2-62A,
 2-62B*, 2-62D*, 2-63*
 Sensitive Altimeter, 5-10
 Servicing, 1-6, 1-7*
 Servicing Shock Struts, 1-20*, 1-21*
 Shimmy Dampener, 1-8
 Simplified Electrical Wiring Diagram, 6-2*
 Spark Plugs, 4-24
 Special Tools and Equipment, 1-9
 Stall Warning Indicator and Transmitter, 5-12*
 Station and Frames Diagram, 1-4*
 Step Assist, 1-3
 Surface Control System, 2-15
 Switch Panel and Map Light, 6-25

U

Upholstery, 2-64*, 2-64A, 2-64B*, 2-64D
 Upholstery Trim, 2-64A, 2-66*, 2-66B*

V

Vacuum Air Filter, 4-65, 4-66*
 Vacuum Gage, 5-8
 Vacuum Pumps, 4-63, 4-64*
 Vacuum Relief Valve, 4-65, 4-66*
 Vacuum System, 4-62, 4-64*
 Vacuum System Instruments, 5-6, 5-7*, 5-20
 Vacuum System Instrument Maintenance, 5-8
 Vacuum System Plumbing, 4-64*, 4-65, 4-66*
 Vacuum Test Valve, 5-7*, 5-8, 5-20
 Ventilating, Heating, Defrosting, 3-1, 3-3*, 3-10,
 3-12*
 Vertical Fin, 2-8, 2-10*
 Vertical Velocity Indicator, 5-10

W

Windshield, 2-70, 2-71*
 Wind Velocity Chart, 1-6*
 Wing, 2-2A, 2-2B*
 Wing Flaps, 2-8, 2-9*, 2-30*
 Wing Group, 2-2A, 2-2B*
 Wing Navigation Lights, 6-29*, 6-31
 Wing Tip Tanks, 4-41, 4-42*
 Wing Twist and Location of Thrust Line, 2-4, 2-5*
 Wing Walk and Wing Walk Areas, 1-3

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