T.O. 1F-86E-2

(Formerly AN 01-60JLB-2)

HANDBOOK
MAINTENANCE INSTRUCTIONS

USAF SERIES

F-86E

AIRCRAFT

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INTRODUCTION

This handbook contains instructions for the accomplishment of organizational maintenance on the F-86E airframe, J47-GE-13 engine, and associated accessory equipment. Supplementary information on operation, repair, inspection, and parts listing may be found in the following publications:

AN 01-60JLB-1	Flight Handbook
AN 01-60JL-3	Handbook of Structural Repair
AN 01-60JLB-4	Parts Catalog
AN 01-60JLB-6	Handbook of Inspection Requirements

Section I of this handbook contains general descriptive and dimensional data, instructions for ground handling and servicing, lubrication information, and a list of special airframe tools and equipment.

Sections II through IX include explicit information relative to description, trouble shooting, installation and removal, adjustment, and testing of each system and/or component. Information on hydraulically or electrically operated equipment is included in the paragraphs covering the individual systems affected. For example, all descriptive hydraulic or electrical information relative to the operation of landing gear, wing flap, or surface control systems is included in the paragraphs covering these systems. The hydraulic and electrical system paragraphs contain information on the basic power systems only.

Following is a list of the major components and systems of the airplane and the sections in which they are described:

Section II	Airframe Group
Section III	Hydraulic Utility Power System
Section IV	Utility Systems
Section V	Power Plant and Related Systems
Section VI	Instruments
Section VII	Electrical System
Section VIII	Radio and Radar
Section IX	Armament

Section X contains a simplified schematic of the entire electrical system, as well as detailed electrical and electronic circuit diagrams and isometric diagrams for each individual circuit. These diagrams are arranged in essentially the same order as the systems to which they pertain are covered in the preceding sections of the handbook. The section also includes a symbol chart, a list of items of equipment covered in the wiring diagrams, and an alphabetical index of all wiring diagrams. Relay location and circuit-breaker location diagrams are also provided. For easier reference, Section X may be detached and inserted in a separate cover.

A general table of contents, listing main paragraph headings, will be found on page i. At the beginning of each section is a detailed table of contents, listing the main and secondary paragraph headings of the section. The complete alphabetical index at the end of the handbook lists the page numbers of all subjects and illustrations.

Figure 1-1. View of Airplane

Section I
GENERAL INFORMATION

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1-1. GENERAL DESCRIPTION.

1-2. The North American F-86E Airplane is a single-place, low-wing, high-performance fighter, powered by a single J47 series axial-flow turbojet engine. The airplane has conventional tricycle landing gear and a sliding, bubble canopy. A swept-back wing and empennage distinguish its design. The pilot's cockpit contains a canopy ejection device and a catapult ejection seat. The fuselage is so constructed that the aft section can easily be removed to facilitate engine change. Six .50-caliber machine guns are mounted in the forward sides of the fuselage. Other armament equipment consists of bombs or rockets, which are carried under the wings.

1-3. VARIATIONS OF AIRPLANE CODING.

1-4. Five versions of the F-86E are in operation. The variations of Air Force serial number coding are given in the following chart:

BLOCK NUMBER	AF SERIAL NUMBER
F-86E-1	AF50-579 through -638
F-86E-5	AF50-639 through -689
F-86E-6 (Manufactured under license by Canadair Limited, Montreal, Canada)	AF52-2833 through -2892
F-86E-10	AF51-2718 through -2849
F-86E-15	AF51-12977 through -13069

1-5. PRINCIPAL DIMENSIONS.

(Airplane supported on landing gear at normal weight without pilot and with specified tire inflation and strut extension. See figure 1-2.)

General

Span	37.1 ft
Length (over-all)	37.5 ft
Height	14.7 ft
Design gross weight (approx)	14,625 lb
Maximum alternate gross weight (approx)	
F-86E-1 through F-86E-10 Airplanes	16,750 lb
F-86E-15 Airplanes	17,700 lb

Wing

Type	Low
Airfoil section designation	
Root	NACA-0012-64

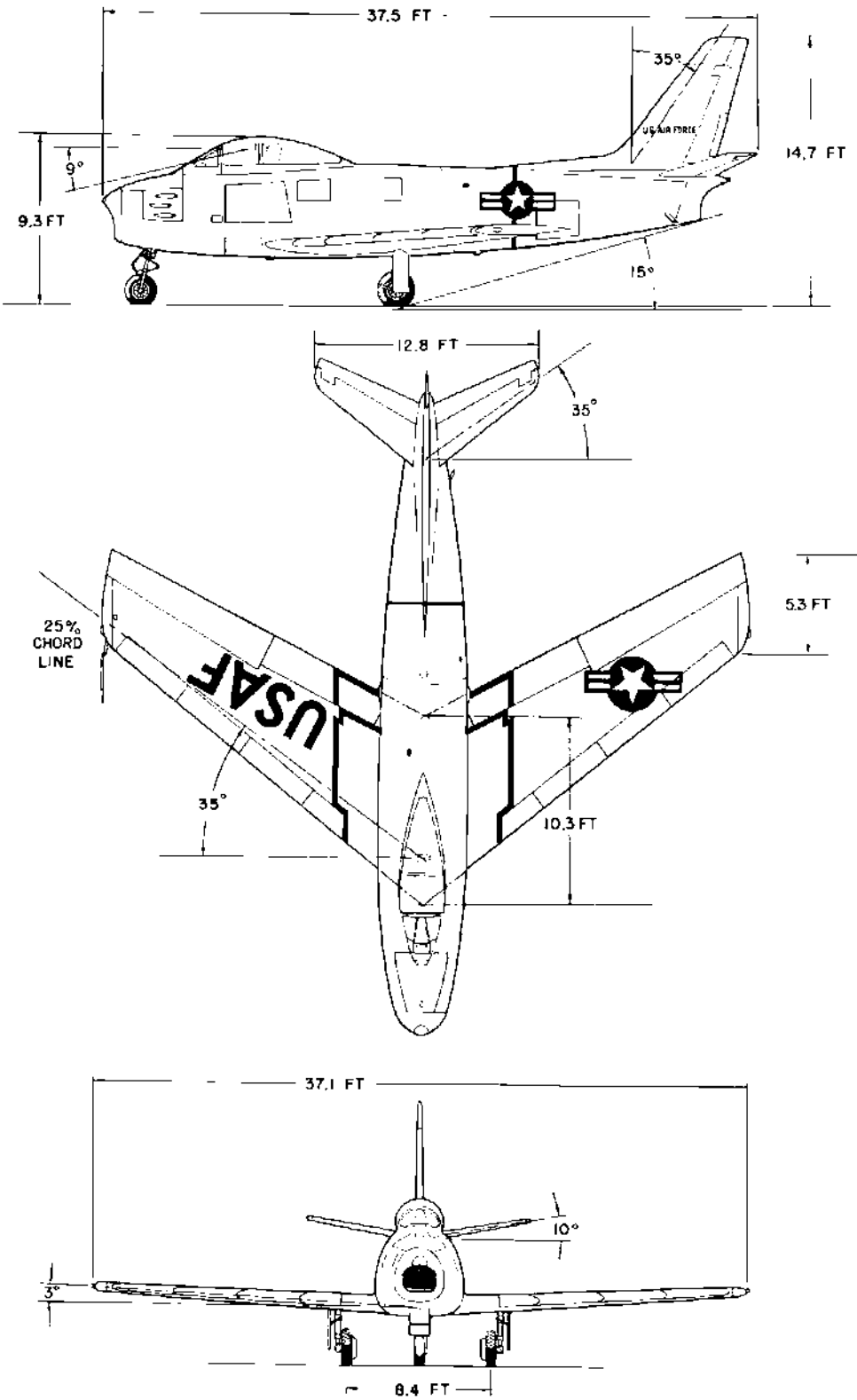


Figure 1-2. Airplane Dimensions

Tip	NACA-0011-64
Chord at root	10.3 ft
Chord at tip	5.3 ft
Incidence at root	+1 deg
Incidence at tip	−1 deg
Dihedral	3 deg
Sweepback (25 percent chord line)	35 deg
Aspect ratio	4.8
Horizontal Stabilizer	
Span	12.8 ft
Chord at root	3.8 ft
Chord at tip	1.7 ft
Incidence	6 deg up, 10 deg down
Dihedral	10 deg
Vertical Fin	
Height (from fuselage reference line)	7.5 ft
Chord at root	6.4 ft
Chord at tip	2.3 ft
Fuselage	
Width	5.0 ft
Height (fuselage bottom to top of canopy)	6.6 ft
Length (without empennage)	35.9 ft
Areas	
Wing (including ailerons, flaps, and slats)	287.9 sq ft
Ailerons (each)	16.4 sq ft
Flaps (both)	32.5 sq ft
Slats (both)	35.4 sq ft
Horizontal stabilizer (including area covered by vertical tail)	24.9 sq ft
Elevators (each)	4.1 sq ft
Fin (including area blanketed by fuselage)	25.3 sq ft
Rudder (including tab)	8.1 sq ft
Rudder trim tab	.9 sq ft
Speed brakes (effective frontal area)	8.6 sq ft

1-6. ACCESS AND INSPECTION PROVISIONS.

1-7. Access and inspection provisions are shown in figure 1-5. Covers in each main wheel well and fuselage access doors on each side of the fuselage provide access to the engine plumbing. The cockpit may be entered from either side of the airplane, where canopy controls and foot steps are installed. The ammunition doors, when opened, serve as lower steps. A kick step is located just forward of each gun bay door. Two buttons, for electrically opening and closing the canopy, are located on each side of the fuselage above the kick step. On F-86E-10 and F-86E-15 Airplanes, there is a ground door control switch in the left-hand main gear shock strut well for ground operation of the main gear doors when external power is connected to the airplane. The switch has two positions: "OPEN" and "CLOSED." The switch may be moved to the "CLOSED" position prior to take-off.

1-8. GROUND HANDLING.

1-9. GROUND HANDLING DOLLIES.

1-10. A cradle (Type A-3) is furnished for ground handling the rear fuselage section, and a dolly (E1186) is provided for ground handling the engine. (See figure 1-6.)

1-11. HOISTING PROVISIONS.

1-12. Four hoisting slings are provided to lift the engine, aft fuselage, wing, and complete airplane. Details of how the slings are attached and the approximate weight of the complete airplane and various portions of the airplane are shown in figure 1-4.

1-13. JACKING PROVISIONS.

1-14. Jacking fittings, except those provided as integral parts of the landing gear struts, are contained in kit E1696. (See figure 1-21.) Jacking restrictions and jack point locations are shown in figure 1-7. The wing and forward fuselage jack points are clearly marked on the airplane. After the fairing plugs are removed, the E882 jack pads are snapped into place and are retained by spring-loaded ball retainers. When a wing panel is to be removed, the rear fuselage jack point on the side of the wing panel to be removed must be used in combination with the forward fuselage and opposite wing jack point. For removal of both wing panels, the forward fuselage jack point is used in combination with both rear fuselage jack points. Jacking points are provided at wing stations 100 for use when auxiliary fuel tanks are installed.

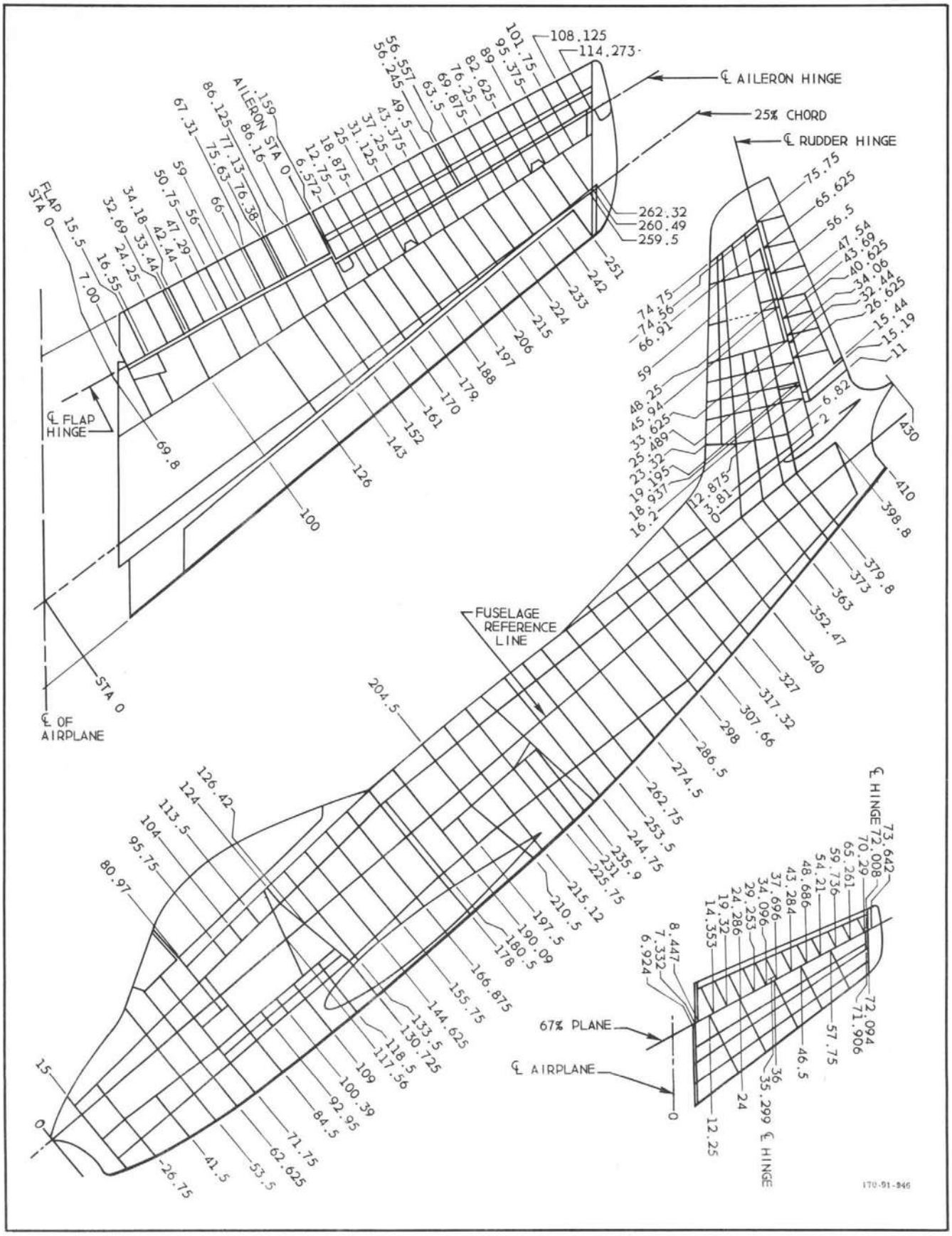


Figure 1-3. Airplane Stations

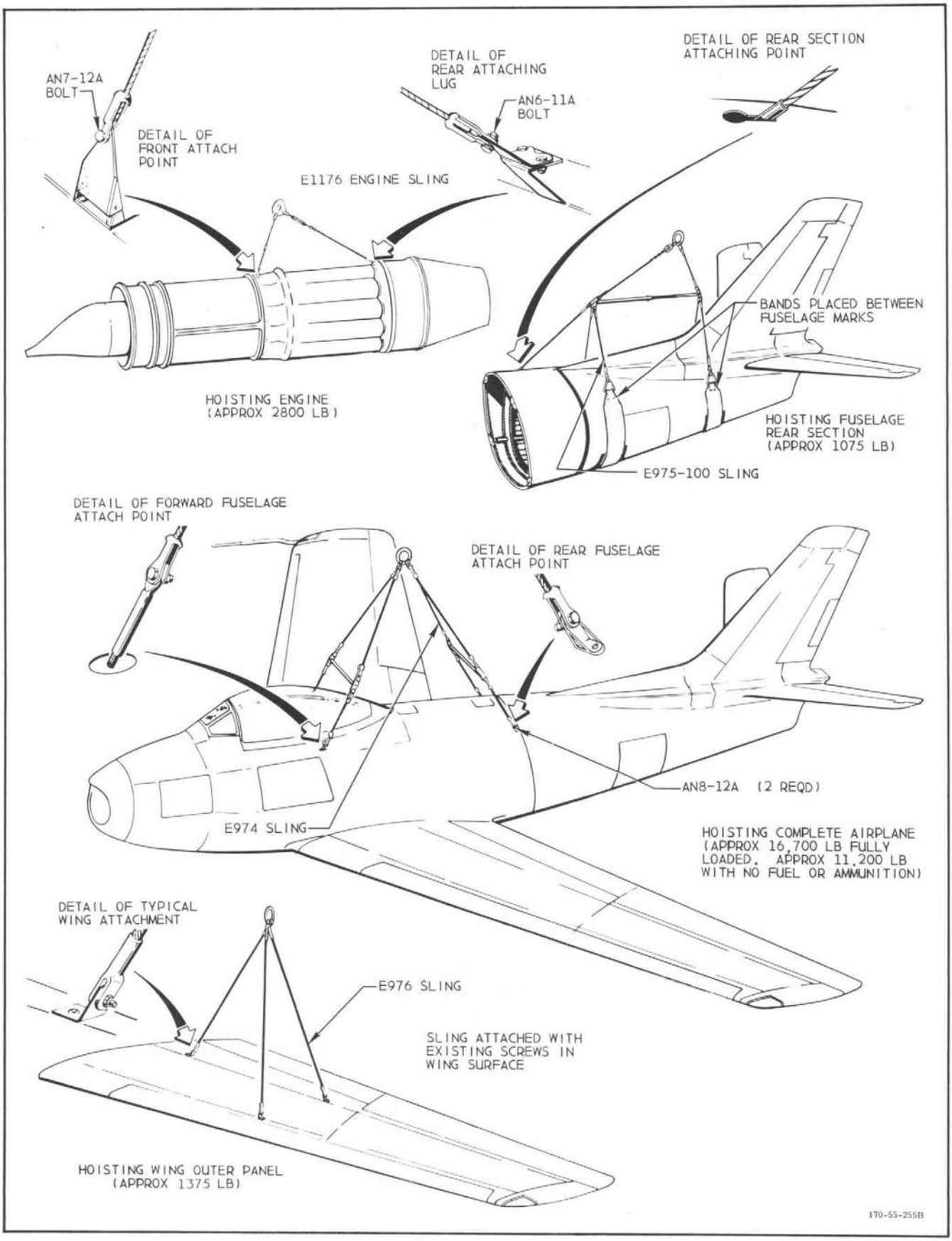


Figure 1-4. Hoisting Slings

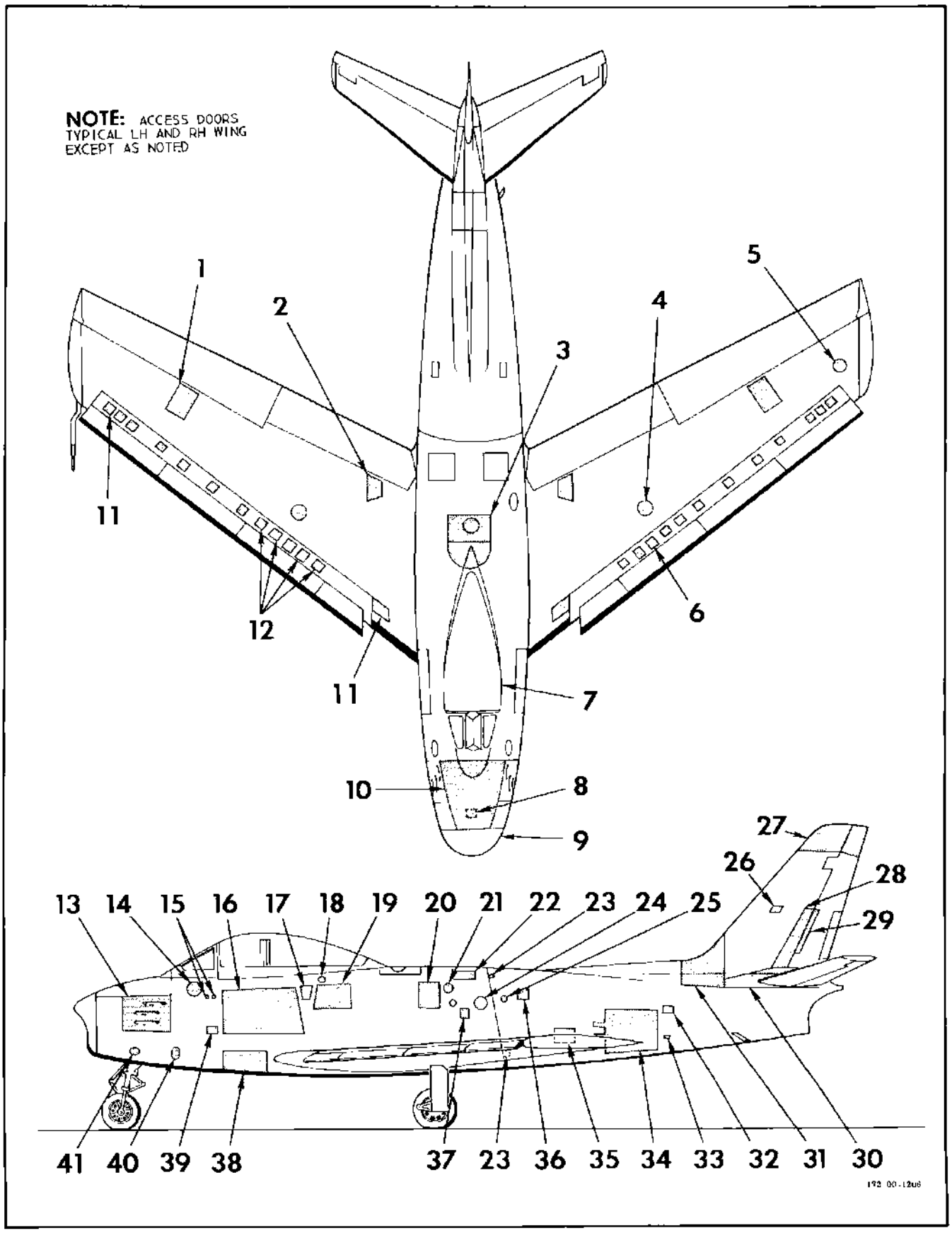


Figure 1-5. Access and Inspection Provisions (Sheet 1 of 2)

CAUTION

- To avoid overloading at either the wing or nose jacking points, jacking should be done simultaneously at all three points.
- Do not remove the fuselage fuel cell bay access door if the airplane is to be put on jacks.

1-15. LEVELING PROVISIONS.

1-16. Lateral leveling lugs are mounted on the nose wheel aft bulkhead. Longitudinal leveling lugs are provided on the nose wheel well left web. A bubble level may be placed on these points for lateral or longitudinal leveling of the airplane. (See figure 1-8.)

1-17. MOORING PROVISIONS.

1-18. Use the following procedure to moor the airplane for extreme weather conditions:

a. Head the airplane into the wind.

b. Lock the rudder control. (Refer to paragraph 1-21.)

c. Chock the wheels front and back.

d. Screw a mooring eye (E1005) into the forward outboard rocket mount attaching holes on each wing. The forward fuselage mooring eye (E1007) screws into the station 87 jack pad fitting, and the rear fuselage mooring eye (E992) screws into a fitting at station 379. Mooring eyes are provided in mooring and jacking kit E1696. (See figure 1-21.)

e. Tie mooring ropes or cables to the mooring eyes and to ground anchors as shown in figure 1-9.

f. Install 170-73071 air intake duct dust plug and the 170-73072 exhaust tail-pipe cover.

WARNING

Allow engine to cool before installing engine air intake dust plug and exhaust tail-pipe cover. Warm air contains more ice-forming moisture than the same volume of cooler air.

g. Install the 140-73060 cockpit enclosure cover, the

1. Aileron Control Valve (2)
2. Main Gear Trunnion Pin (2)
3. Cabin Air Cooling Unit
4. Fuel Filler (Wing 2)
5. Remote Compass Transmitter
6. Drop Tank Connect (2)
7. Cockpit Pressure Regulator
   Compass Antenna
   Gun Sight
   Canopy Actuator and Ejection Gun
   Cockpit Equipment
8. Nose Gear Strut Filler (Access Door in Air Intake Duct)
9. Radar Antenna
10. Radar
    Gun Sight Equipment
    Battery
11. Inspection Plates (16)
12. Rocket Release Mechanism (8)
13. Electrical, Oxygen, and Pitot Lines
14. Hydraulic Brake Cylinder
15. Canopy Control Switches
16. Guns
    Gun Charger
    Ammunition Loading Hook
    Cabin Pressure
    Bore-sight Fixture
17. Artificial Feel and Trim Actuator
18. Emergency Canopy Release
19. Fuel Control Valve
    Radio
    Artificial Feel Actuator
20. Engine Island No. 4
    Engine Control
    Surface Control Hydraulic Filler Pump*
    Bore-sight Fixture
    Fuel Filter Deicing Alcohol Tank
21. Fuel and Oil Pressure Transmitter
22. Surface Control Quick-disconnects
    Antenna Cable Disconnect
    Hydraulic Line Disconnect
    Manual Change-over Disconnect†
    Fuel Level Transmitter
23. Rear Fuselage Disconnect Bolt (2)
24. Fuel Filler
25. Fuel Vent
26. Antenna Disconnect Plug
27. Antenna
28. Stabilizer Actuator
29. Rudder Trim Tab Actuator
30. Horizontal Stabilizer Control Mechanism
31. Control Cable and Pulleys
    Hydraulic and Electrical Lines
32. Surface Control Alternate Hydraulic System Compensator
33. Surface Control Alternate Hydraulic System Compensator
    Fluid Level Indicator
34. Speed Brake Mechanism
    Surface Control Alternate Hydraulic Accumulator Air Filler‡
    Surface Control Alternate Hydraulic Reservoir
    Surface Control Alternate Hydraulic Filter
35. Data Case
    Surface Control Alternate Hydraulic Pump and By-pass Valve
    Engine Drain Disconnects
36. Spark Plug and Fuel Vent Connection
37. External Electrical Power Receptacle
38. Ammunition (Lower Door for Step)
39. Kick Step
40. Oxygen Filler*
41. Nose Gear Trunnion Pin

*F-86E-1, F-86E-5, and F-86E-6 Airplanes
†F-86E-10 and F-86E-15 Airplanes
‡F-86E-5, F-86E-6, F-86E-10, and F-86E-15 Airplanes

Key to Figure 1-5 (Sheet 1 of 2)

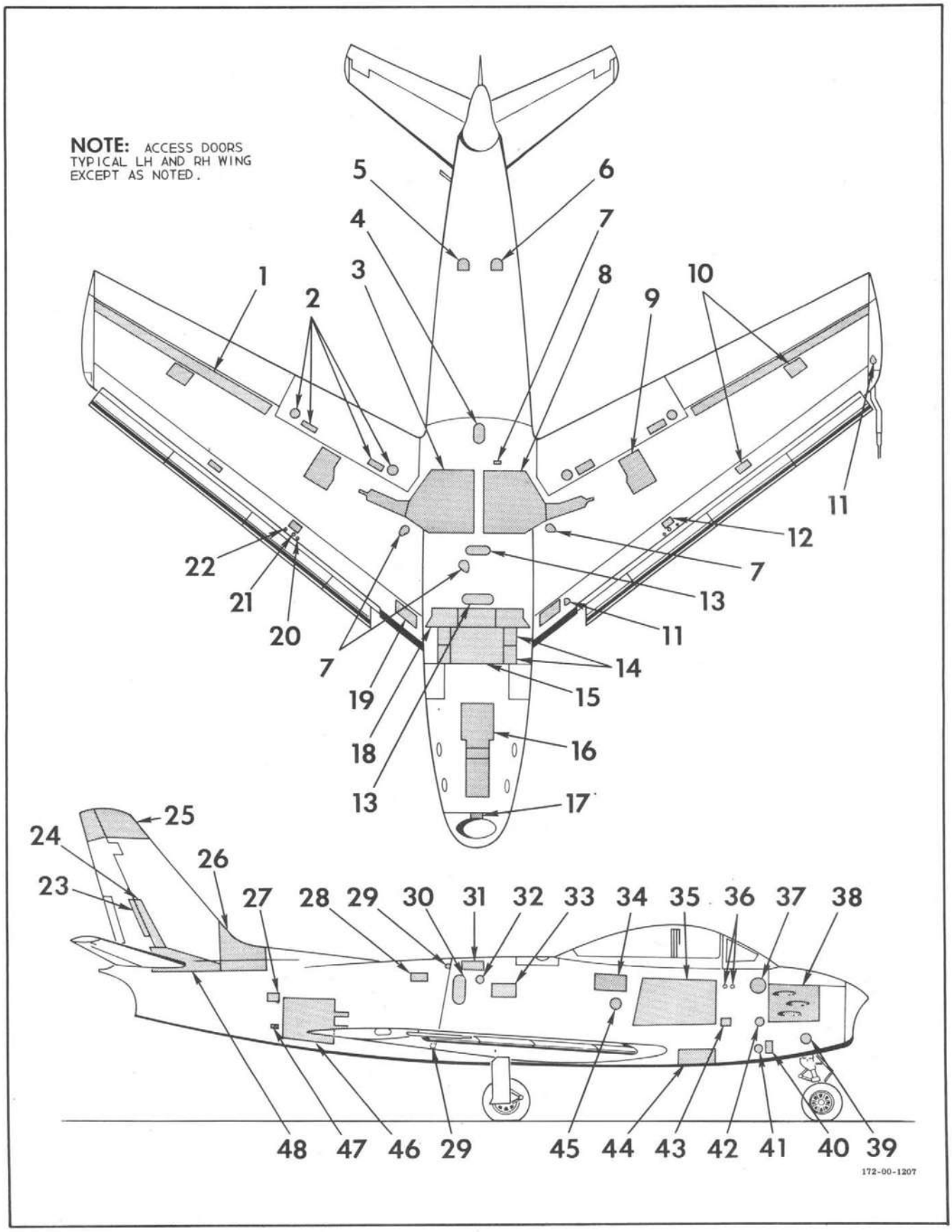


Figure 1-5. Access and Inspection Provisions (Sheet 2 of 2)

170-73073 pitot tube cover, and the 151-73073 wing walkway cover. (See figure 1-9.)

Note

Reinstall plug in rear fuselage mooring eye hole before flight.

1-19. PARKING.

1-20. Park the airplane as follows:

a. Head the airplane into the wind.

b. Set parking brakes. (Refer to paragraph 1-22.)

c. Chock the wheels.

d. Lock surface controls. (Refer to paragraph 1-21.)

e. Install safety locks on nose landing gear and nose gear door. (Refer to paragraph 1-23.)

1-21. LOCKING SURFACE CONTROLS. To lock the rudder, pull out the control lock on the cockpit center pedestal until it catches; then neutralize rudder controls. To release the rudder, lift up on rudder lock and let it slide into the pedestal. (See figure 1-10.) The aileron and elevator move only when power is on; therefore, no lock is required to hold these surfaces when power is off. The control stick will swing to neutral when released.

1-22. SETTING PARKING BRAKES. The parking brake handle is located on the left side of the cockpit, above and outboard of the landing gear control. Operate parking brakes as follows:

a. With utility system hydraulic pressure operating (engine running), set the brakes by pressing hard on the toe of the rudder pedals (approximately 60 pounds) and then (while maintaining this pedal pressure) pull the parking brake handle slowly out to fully extended position. While holding handle all the way out, release pedals; then release handle.

b. With power on, release brakes by depressing pedals. Parking brakes should reset in the off position without assistance. If parking brakes do not release

1. Aileron Seal and Hydraulic Cylinder (2)
2. Flap Rollers (8)
3. Engine Island No. 3
   Fuel Flowmeter Amplifier
   Normal Surface Control Hydraulic System Accumulator Air Filler
   Wheel Door Ground Switch*
   Fuel Booster Pump Test Switches
4. Fuel Transfer Pump
5. Surface Control Alternate Hydraulic System Filler*
6. Surface Control Normal Hydraulic System Filler*
7. Fuel Sump Drain (4)
8. Engine Island No. 2
   Fuel Transfer Pump Test Switch
   Rocket Jettison Ground Test Switch
   Hydraulic System Drain
   Speed Brake Hydraulic Accumulator Air Filler
   Oil System Drain
   Fuel Level Transmitter
9. Flap Actuator
10. Aileron Hydraulic Lines (4)
11. Pitot-Static Line Drain (4)
12. Bomb Rack Electrical Disconnect (2)
13. Fuel Booster Pump (2)
14. Expended Ammunition (4)
15. Command Radio
16. Expended Ammunition
    External Light Flasher
    Leveling Lugs
    Oxygen Cylinder Check Valve and Filler Line
    Hydraulic Emergency Reservoir Drain†
    Hydraulic Emergency Nose Gear Accumulator Air Filler*
17. Gun Camera
18. Aileron Controls
19. Drop Tank Fuel and Pressure Line Drains (2)
20. Drop Tank Pressure Connection (2)
21. Drop Tank Fuel Connection (2)
22. Chemical Tank Connection (2)
23. Rudder Trim Tab Actuator
24. Stabilizer Actuator
25. Antenna
26. Control Cable and Pulleys
    Hydraulic and Electrical Lines
27. Surface Control Normal Hydraulic System Compensator
28. Spark Plug and Engine Duct Disconnect
29. Rear Fuselage Disconnect Bolt (2)
30. Hydraulic Test Stand Connection
31. Surface Control Adjustment
32. Oil Filler*
33. Oil Filler†
    Fuel Flowmeter
    Forward Engine Support
    Engine Island No. 1
    Surface Control Normal Hydraulic Reservoir and Sight Gage*
34. Directional Compass and Amplifier
    Utility Hydraulic Reservoir
    Fuel Level Transmitter
    Fire Detector Relay
    Exhaust Temperature Indicating System Adjustment
35. Guns
    Gun Charger
    Ammunition Loading Hook
36. Canopy Control Switches
37. Hydraulic Brake Cylinder
38. Electrical, Oxygen and Pitot Lines
39. Nose Gear Trunnion Pin
40. Gun Charger Air Compressor‡
    Nose Gear Emergency Control Valve Reset*
41. Gun Charger Air Compressor Drain‡
42. Oxygen Filler*
43. Kick Step
44. Ammunition (Lower Door for Step)
45. Fuel Filler
46. Speed Brake Mechanism
    Alternate Surface Control Hydraulic Accumulator Air Filler
47. Normal Surface Control Hydraulic Compensator Fluid Level Indicator
48. Horizontal Stabilizer Control Mechanism

*F-86E-10 and F-86E-15 Airplanes
†F-86E-1, F-86E-5, and F-86E-6 Airplanes
‡F-86E-5, F-86E-6, F-86E-10, and F-86E-15 Airplanes

Key to Figure 1-5 (Sheet 2 of 2)

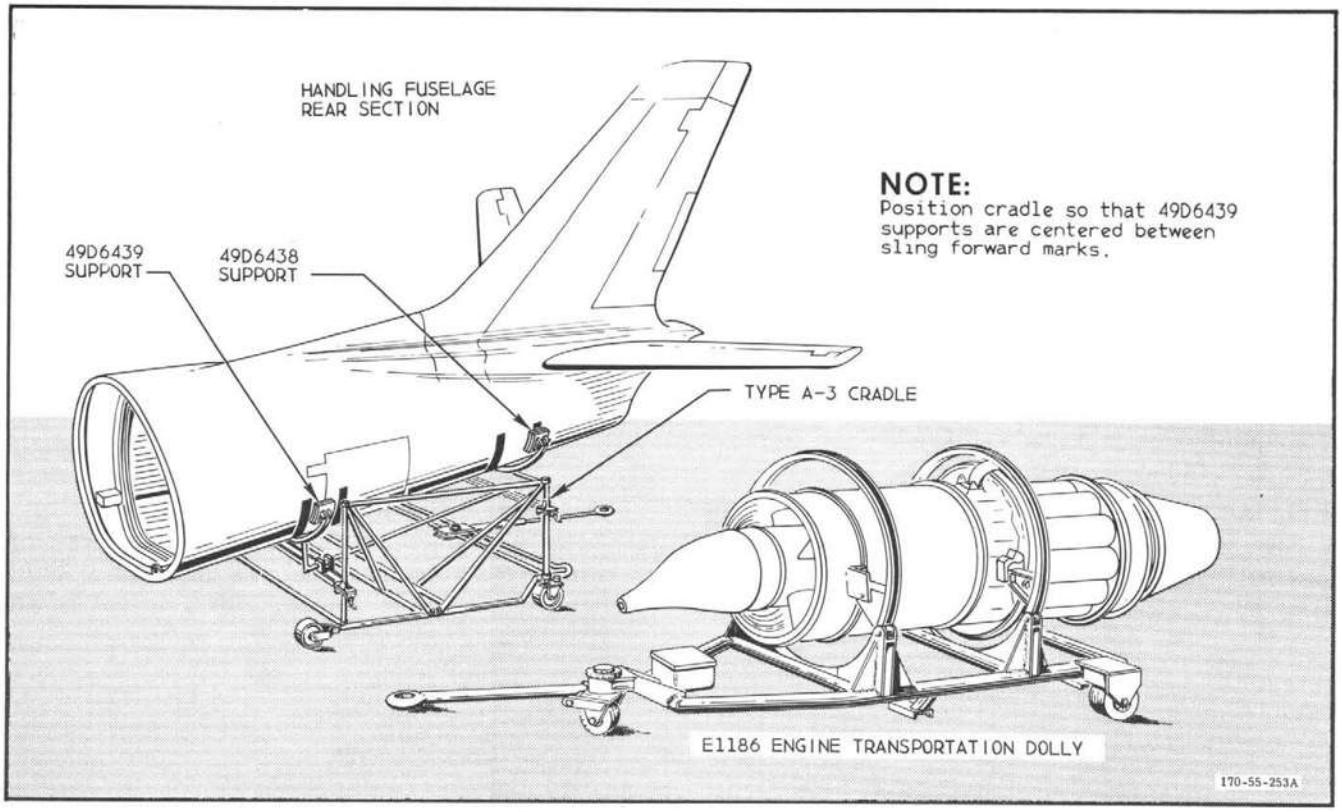


Figure 1-6. Ground Handling Equipment

easily when toe pedals are depressed, push parking brake handle in.

1-23. INSTALLING GROUND SAFETY LOCKS. The E1201 nose landing gear ground safety lock fits in the nose gear drag brace assembly to ensure that the gear is not inadvertently retracted on the ground. (See figure 1-11.) The E1601 nose gear door safety lock assembly is installed from the forward outer edge of the landing gear door to the right side of the door frame, as shown in figure 1-11.

1-24. TOWING PROVISIONS.

CAUTION

- The airplane must not be towed without a wedge installed in the nose gear declutching pin.
- Do not tow or steer airplane when nose wheel strut is fully extended.

1-25. A towing fitting is mounted on the forward face of the nose gear shock strut for attachment of a Government-furnished tow bar, as illustrated in figure 1-12. A spring-loaded steering release pin is located on the side of the shock strut below the torque links and, when disengaged, allows the nose gear fork to free-swivel. The E1209 wedge holds the declutching release pin safely open. F-86E-10 and F-86E-15 Airplanes have a wedge assembly as an integral part of the nose gear. When not in use, the wedge is fastened to a tow bar lug on the strut. If a wedge is not used, the pin may slip back into the nose gear cylinder and seriously damage the steering and nose wheel rotating mechanism while the airplane is being towed. The airplane may be towed and steered over concrete or macadam surfaces by means of the tow bar only. For towing on rough ground, muddy areas, or snow-covered surfaces, towing cables must be attached to the tow lugs on the main shock struts.

CAUTION

After airplane has been towed, make sure nose gear steering pin is engaged and safety cap is installed before airplane is flown.

1-26. SERVICING.

1-27. SERVICING FUEL SYSTEM.

1-28. For cell and tank capacities and the type of fuel used to service the airplane, see figure 1-13. Filler cap locations are shown in figure 1-14.

Note

The type of fuel used to service this airplane is indicated in a notice placed on the instrument panel and on the exterior of the fuselage immediately below existing data.

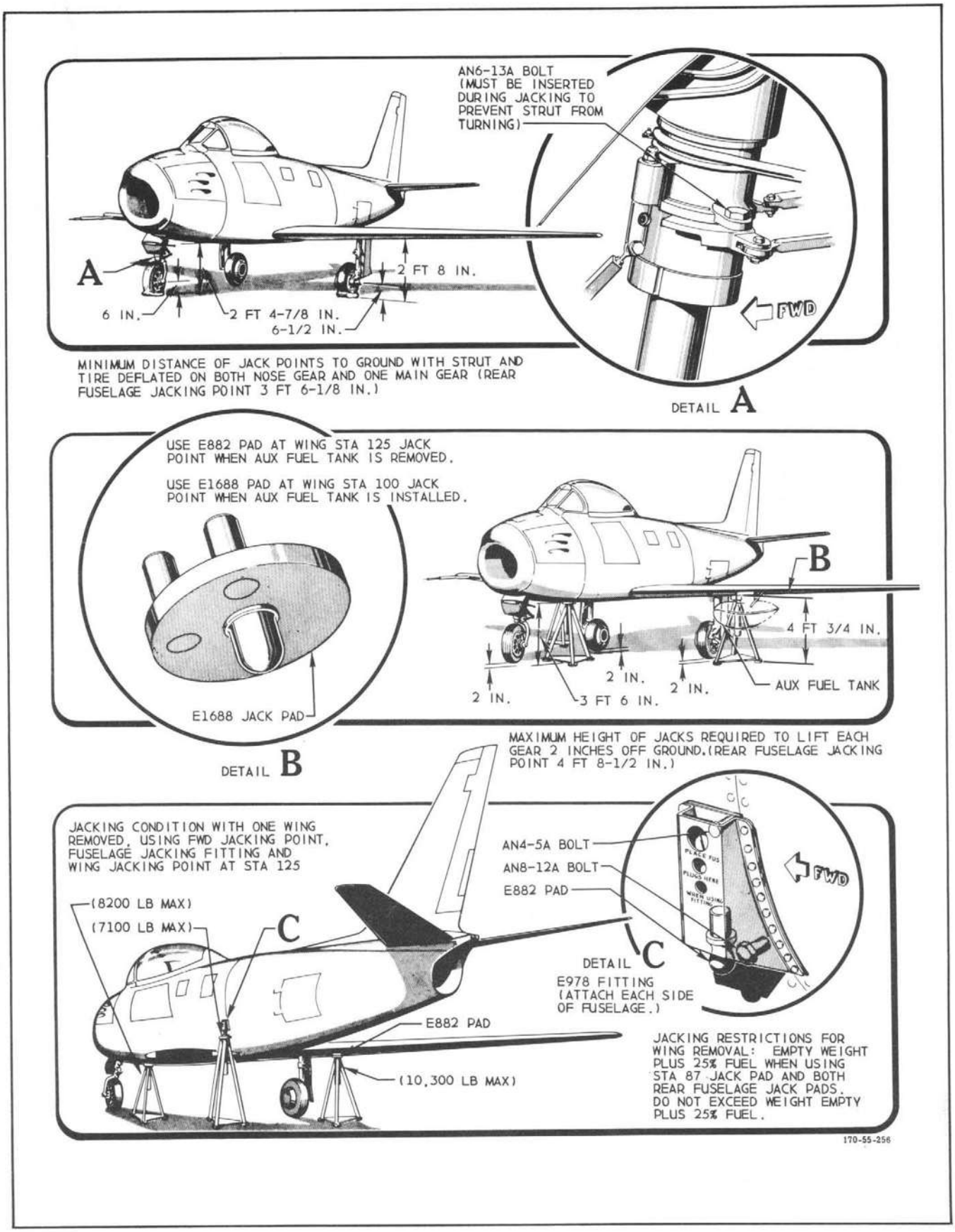


Figure 1-7. Jacking Data

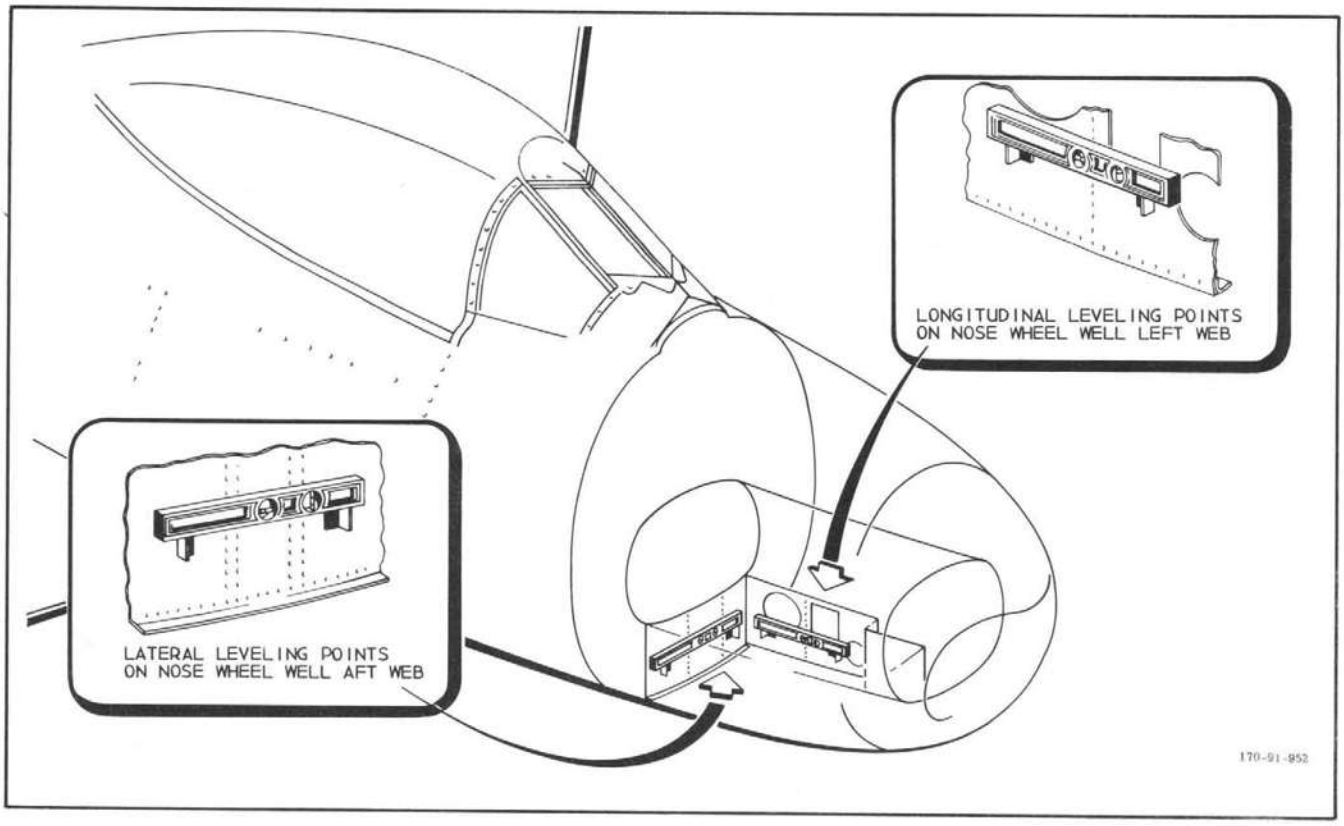


Figure 1-8. Leveling Airplane

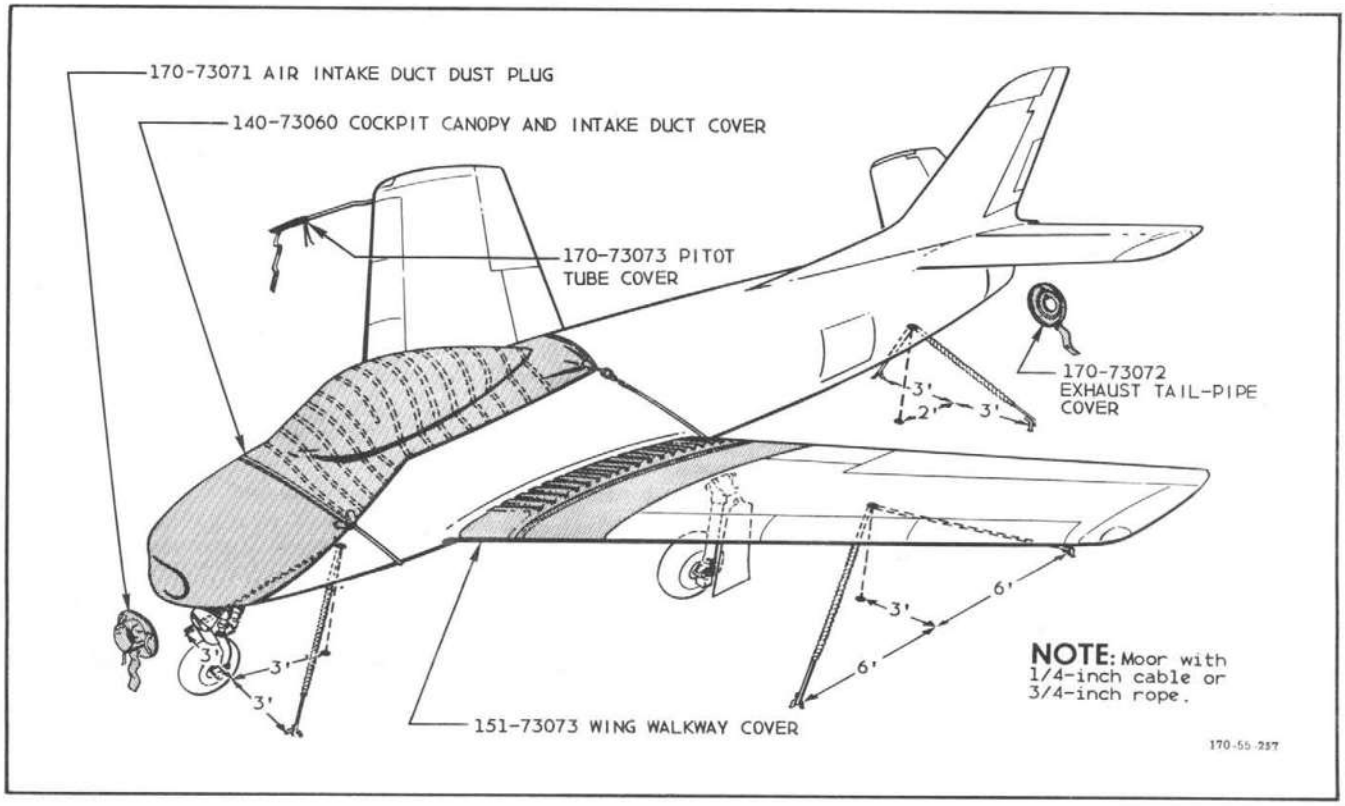


Figure 1-9. Mooring Diagram and Protective Covers

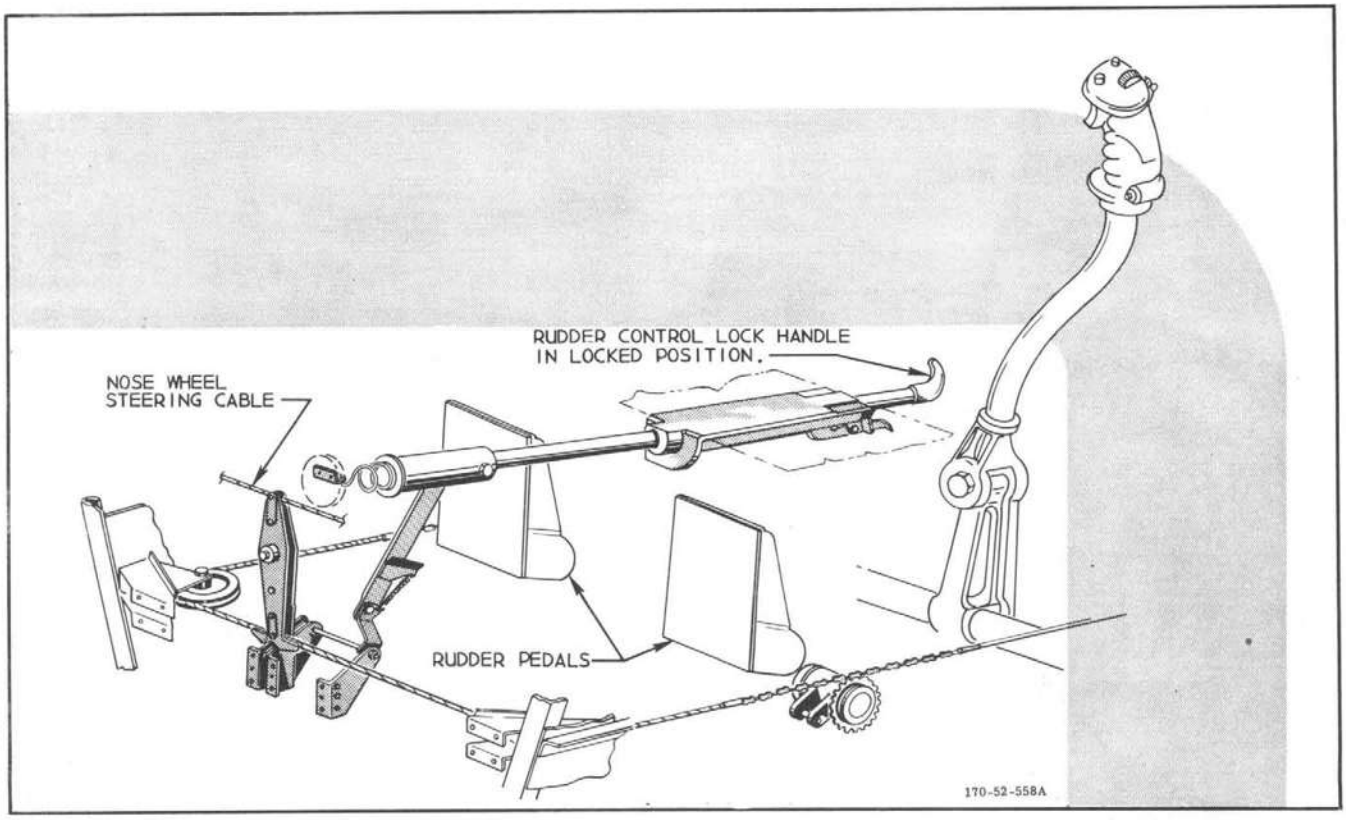


Figure 1-10. Rudder Control Lock

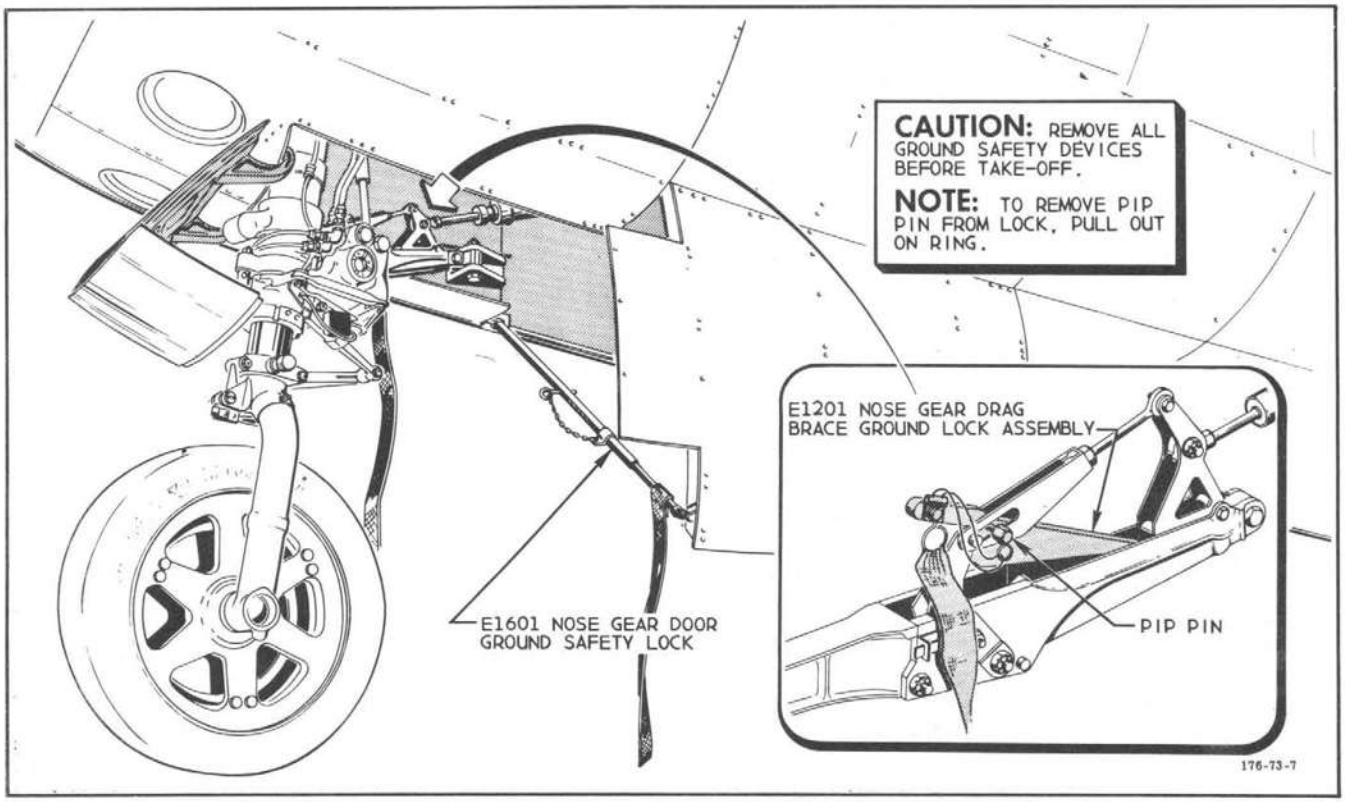


Figure 1-11. Ground Safety Devices

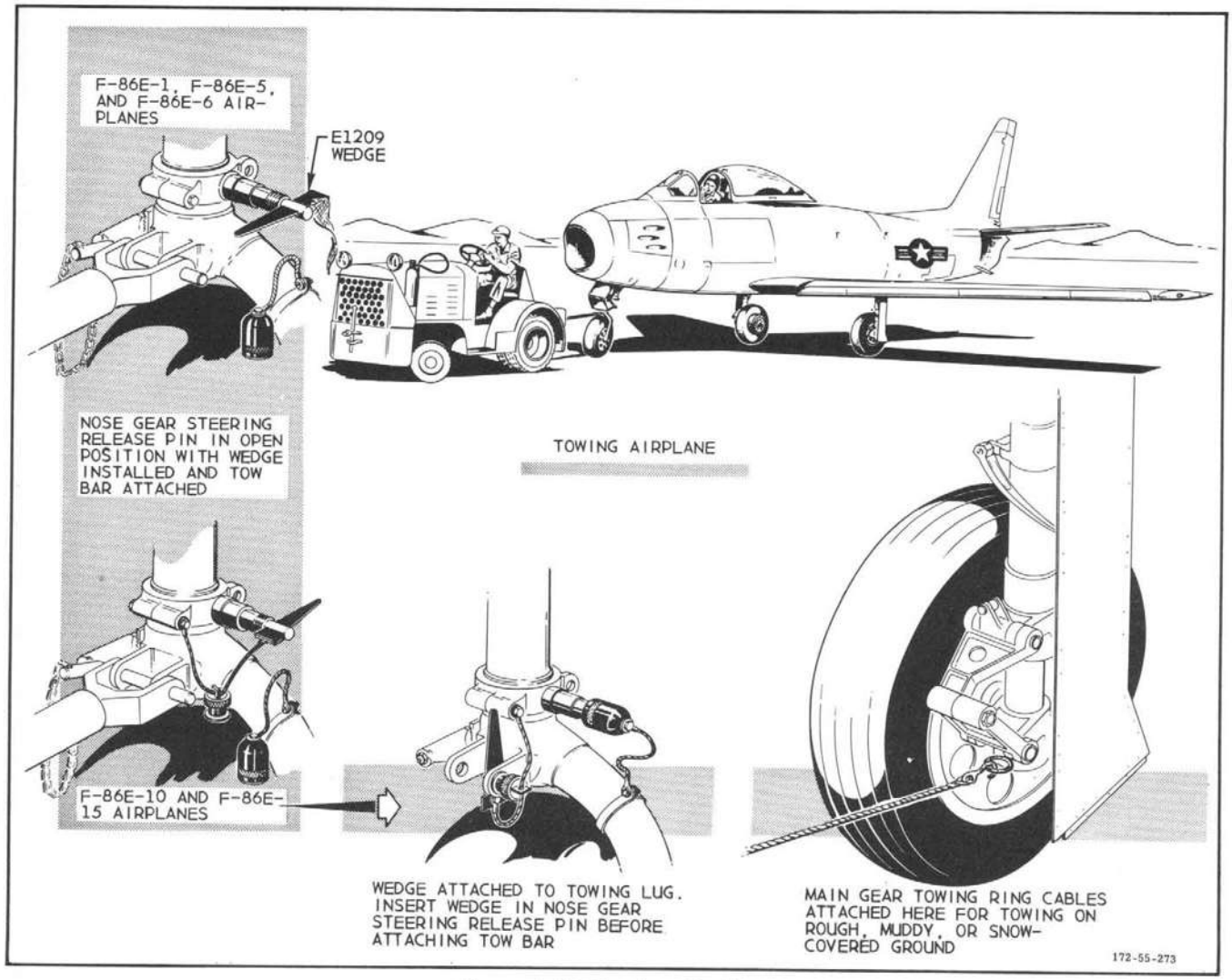


Figure 1-12. Towing Airplane

WARNING

Insofar as possible, fill and drain fuel cells and tanks out of doors, and take care to avoid spillage. Smoking is prohibited within 50 feet of the airplane, and other sources of possible ignition (such as hobnail boots striking against concrete) must be avoided. When fuel trucks are employed, equip them with suitable static chains in contact with the ground or pavement. As an additional safety precaution, if the static chain has become fouled and has not recently touched the ground, dissipate any possible static charge which might have accumulated on the truck or trailer. An electrical charge is imparted to metal particles within the immediate vicinity of radar or high-frequency radio equipment in operation. This constitutes an extremely hazardous condition, since personnel involved may not be aware of the accumulation of the electrical charge from such sources. Do not handle fuel within a radius of 75 feet of such equipment except during the shutdown period. If an emergency requires the handling of fuel during an operating period, request radar operating personnel to remove the plate voltage from all radar transmitting equipment within a radius of 75 feet. Do not service the airplane with fuel while its radio or radar transmitting equipment is in operation.

1-29. ENSURING PURITY OF FUEL. The use of filters in funnels is usually unnecessary when the airplane is being serviced. If, however, presence of dirt in the fuel indicates that emergency filtering is required, use a chamois skin for this purpose. To eliminate the fire hazard that is involved when volatile, flammable liquid is filtered through chamois, observe the following precautions:

a. Attach the chamois securely to the funnel.

SERVICING DATA

FUEL.....MIL-F-5624A, JP-4. Alternate MIL-F-5624, JP-3, MIL-F-5616, JP-1, or MIL-F-5572 (Lowest grade available) .....Below -29°C (-20°F) ambient ground temperatures, do not use MIL-F-5616, JP-1.

TANKS	US. GAL	IMP. GAL	LITERS
OUTER WING (2)	67.0 (each)	55.8 (each)	253.6 (each)
SUMP CAPACITY	1.0 (each)	.8 (each)	3.8 (each)
WING CENTER SECTION AND FRONT FUSELAGE	196.0	163.3	741.9
SUMP CAPACITY	2.0	1.7	7.6
REAR FUSELAGE (1)	105.0	87.4	393.6
SUMP CAPACITY	1.4	1.2	5.3
TOTAL FUEL CAPACITY CARRIED INTERNALLY	435.0	382.4	1646.5
EXPANSION VOLUME (COMPLETE INTERNAL FUEL SYSTEM)	17.0	14.2	64.3
DROPPABLE TANK	120.0 (each)	99.9 (each)	452.2 (each)
DROPPABLE TANK (F-86E-15 AIRPLANES)	200 (each)	166.6 (each)	757 (each)
TOTAL FUEL CAPACITY WITH TWO 120 GAL DROPPABLE TANKS	675.0	562.3	2554.9
TOTAL FUEL CAPACITY WITH TWO 200 GAL DROPPABLE TANKS (F-86E-15 AIRPLANES)	835	689.6	3160.5

OIL.....Above -29°C (-20°F) ambient ground temperatures, MIL-O-6081, Grade 1010

.....Below -29°C (-20°F) ambient ground temperatures, MIL-O-6081, Grade 1005

	US. QT	US. GAL	IMP. GAL	LITERS
F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES				
TANK USABLE CAPACITY	22.8	5.7	4.7	21.6
EXPANSION SPACE	4.4	1.1	.9	4.2
TOTAL CAPACITY	27.2	6.3	5.6	25.7
F-86E-10 AND F-86E-15 AIRPLANES				
TANK USABLE CAPACITY	13.6	3.4	2.8	12.9
EXPANSION SPACE	4.0	1.0	.8	3.8
TOTAL CAPACITY	18.0	4.5	3.7	17.0

HYDRAULIC FLUID (SPECIFICATION MIL-O-5606)

	US. QT	US. GAL	IMP. GAL	LITERS
UTILITY SYSTEM RESERVOIR	8.4	2.1	1.7	7.9
COMPLETE UTILITY SYSTEM	27.0	6.75	5.4	25.5
ALTERNATE SURFACE CONTROL SYSTEM	8.0	2.0	1.7	7.6
NORMAL SURFACE CONTROL SYSTEM	8.0	2.0	1.7	7.6

	US. QT	US. GAL	IMP. GAL	LITERS
FUEL FILTER DEICING FLUID TANK (USE ALCOHOL CONFORMING TO SPECIFICATION MIL-F-5566)	4	1.0	.8	3.8

OXYGEN CYLINDERS

NO.	TYPE	PRESSURE PSI
4	D-2, LOW PRESSURE	425 MAX

172-93-1444

Figure 1-13. Servicing Data

b. Keep the funnel in contact with the metal of the tank or other receptacle to provide a good electrical ground at all times during the process of filtering. In addition, bond the delivery hose to the airplane or tank.

c. Never tie the chamois over the end of the discharge nozzle, and never use it in any manner that will cause the fuel to pass through the chamois under pressure.

1-30. BONDING FUEL HOSE NOZZLE TO AIRPLANE. Permanently attach one end of a flexible bonding wire of suitable length to the discharge nozzle of the fuel delivery hose. On the other end, install a plug and a standard test clip for attachment to the airplane before delivery of any fuel to the airplane fuel cell. Insert the plug into the receptacle installed on the airplane for grounding purposes, or attach the standard test clip to an uninsulated metallic part of the airplane to ensure an electrical bond between the cell and the delivery hose. Do not attach the bonding wire to the filler neck of the cell, but to the bare metal of the airplane. This electrical bond must always be effected before removal of the filler cap and must be left connected until the filler cap has been replaced.

CAUTION

- Do not overflow fuel cells when servicing the airplane.
- Do not utilize fuel to clean the airplane. Only solvents which do not contain petroleum derivatives should be used for cleaning purposes.

1-31. FILLING WING AND FUSELAGE CELLS. Before filling the wing and fuselage cells, bond the fuel nozzle to the airplane as described in paragraph 1-30, and observe the precautions in paragraphs 1-28 and 1-29. Because of the interconnection and check-valve design of the fuel cells within the airplane, it is essential to use the following procedure when filling the fuel system, in order to obtain complete capacity:

a. Fill forward fuselage and center wing cells.

b. Fill outer wing cells.

CAUTION

When refueling outer wing cells, use care to prevent fuel hose nozzle striking bottom of cell. On some refueling units, the hose nozzle may be longer than the depth of the cell.

c. Fill aft fuselage cell.

d. Replace all fuel filler caps after refueling procedure.

Note

The lock indicator angles riveted to each fuel access door and to the leaf handle of each filler cap must be parallel before the door will close. This is to ensure that the fuel filler cap will be locked before take-off.

e. Move the fuel totalizer knob to pounds of fuel aboard the airplane.

Note

- F-86E-1 Airplanes AF50-579 through -613 have fuel quantity indicators calibrated in gallons. On these airplanes, the fuel must be converted to pounds before the totalizer knob is set.
- A small amount of fuel must be drained from the sump drains of each cell, both before and after filling of the cells, in order to eliminate any water present.

1-32. FILLING 120-GALLON AUXILIARY FUEL TANKS. Fill each of the two auxiliary fuel tanks, suspended under the wings, through the filler cap aft on the tank. To eliminate any water present, drain a small amount of fuel from the drain at bottom of tanks both before and after filling.

1-33. FILLING 200-GALLON AUXILIARY FUEL TANKS (F-86E-15 AIRPLANES). The filler cap is on the forward portion of each 200-gallon tank. To eliminate any water present, drain a small amount of fuel from drain at bottom of tanks both before and after filling.

1-34. DRAINING FUEL SYSTEM. Fuel drainage provisions are shown in figure 1-15. When only small quantities of fuel remain in the cells, drain system by opening sump drains for the respective cells. When cells are nearly full, disconnect fuel outlet line at filter; then attach a line from the defueling unit to the filter fuel outlet fitting. Then move engine master switch to "ON" and move throttle outboard from "OFF," which will operate booster pumps until tanks are dry. Open sump and line drains to ensure complete draining.

1-35. DRAINING FUEL FILTER. The fuel filter is located below the fuel filter deicing system alcohol tank and is reached through the engine access door in the left main wheel well. (See figure 1-15.) To drain fuel filter, open petcock on bottom of filter and allow fluid to drain through a line leading out the bottom of the fuselage. Close drain petcock after draining.

1-36. DRAINING AUXILIARY FUEL TANKS. To drain auxiliary tanks, remove either the small or large plug at the bottom of tank. The large plug retains the strainer with the tank.

1-37. SERVICING FUEL FILTER DEICING SYSTEM.

1-38. The fuel filter deicing system alcohol tank is accessible through the left engine accessory door. (See figure 1-14.) Service with alcohol (Specification MIL-F-5566). For tank capacity, see figure 1-13.

1-39. SERVICING OIL SYSTEM.

1-40. FILLING SYSTEM. For tank capacities and the type of oil used to service the airplane, see figure 1-13. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the oil filler is reached through the engine accessory door on the right side of the fuselage. On F-86E-10 and F-86E-15 Airplanes, the oil filler is reached through a small door aft of the engine accessory door on the right side of the fuselage. See figure 1-14 for access provisions. Always service the oil tank within a short period after engine shutdown. When tank is filled after engine has been idle for several hours (during which time a portion of the oil drains from the tank into engine sump), the system will be overfull. Subsequent engine operation will cause the excess oil supply to be thrown out the tank vent over the side of the fuselage and possibly to be blown back through the cooling air intake into the engine compartment. If the airplane has been idle and the need for servicing is questionable, start and run engine at idle for a short time before filling tank. Use the following procedure to fill oil system:

a. Open access door to the filler cap and remove filler cap.

b. Fill tank to the lip of the filler overflow drain.

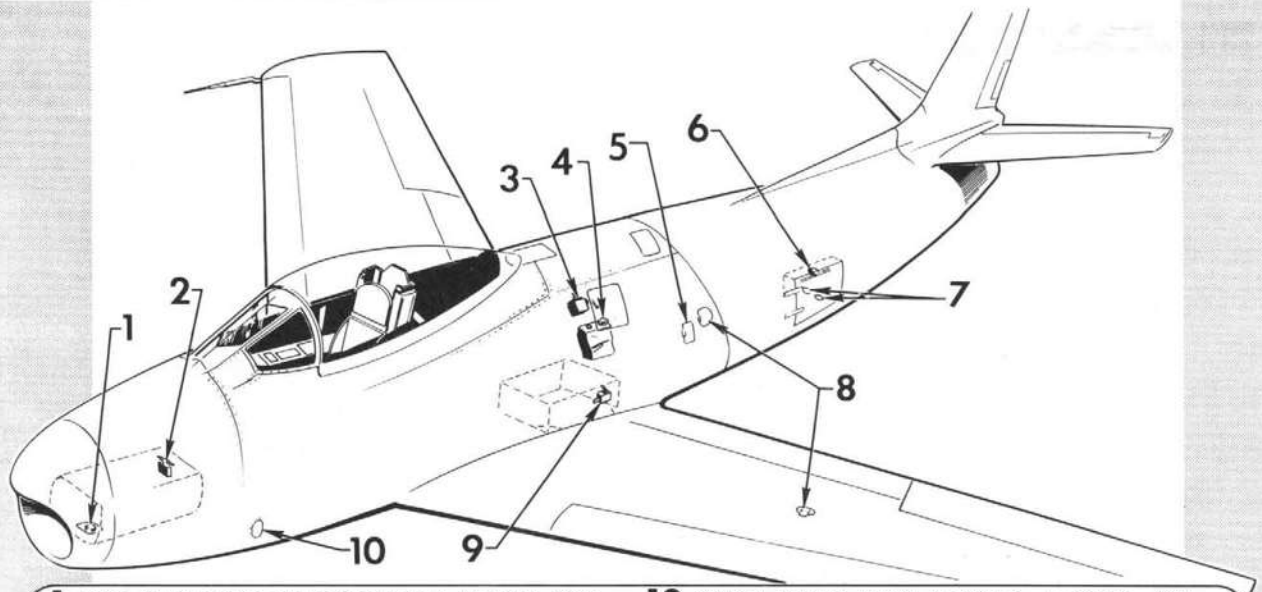
c. Wipe up any spilled oil and replace filler cap.

Note

F-86E-10 and F-86E-15 Airplanes have a removable dip stick mounted in the tank, near the filler cap. The dip stick is marked to indicate one-, two-, and three-gallon levels.

WARNING

The oil tank dip stick must be installed and locked in the "CLOSED" position after servicing, as the oil tank is pressurized.



1 NOSE GEAR SHOCK STRUT SERVICING (ACCESS DOOR IN AIR INTAKE DUCT)

2 NOSE GEAR EMERGENCY HYDRAULIC ACCUMULATOR AIR FILLER (F-86E-10 AND F-86E-15 AIRPLANES)

3 NORMAL AND ALTERNATE SURFACE CONTROL HYDRAULIC POWER SYSTEM FILLERS (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES)

4 FUEL FILTER DEICING ALCOHOL TANK FILLER

5 ELECTRICAL EXTERNAL POWER RECEPTACLE

6 ALTERNATE SURFACE CONTROL HYDRAULIC ACCUMULATOR AIR FILLERS (ON F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES IN LH AND RH SPEED BRAKE WELLS: ON F-86E-10 AND F-86E-15 AIRPLANES, BOTH FILLERS IN RH SPEED BRAKE WELL)

7 NORMAL AND ALTERNATE SURFACE CONTROL HYDRAULIC POWER SYSTEM FILLERS (F-86E-10 AND F-86E-15 AIRPLANES, ON BOTTOM OF FUSELAGE)

8 FUEL FILLER

9 NORMAL SURFACE CONTROL HYDRAULIC POWER SYSTEM ACCUMULATOR AIR FILLER

10 OXYGEN FILLER VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES)

11 ENGINE OIL TANK FILLER (F-86E-10 AND F-86E-15 AIRPLANES)

12 HYDRAULIC EXTERNAL POWER CONNECTORS

13 ENGINE OIL TANK FILLER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES)

14 UTILITY HYDRAULIC SYSTEM RESERVOIR FILLER

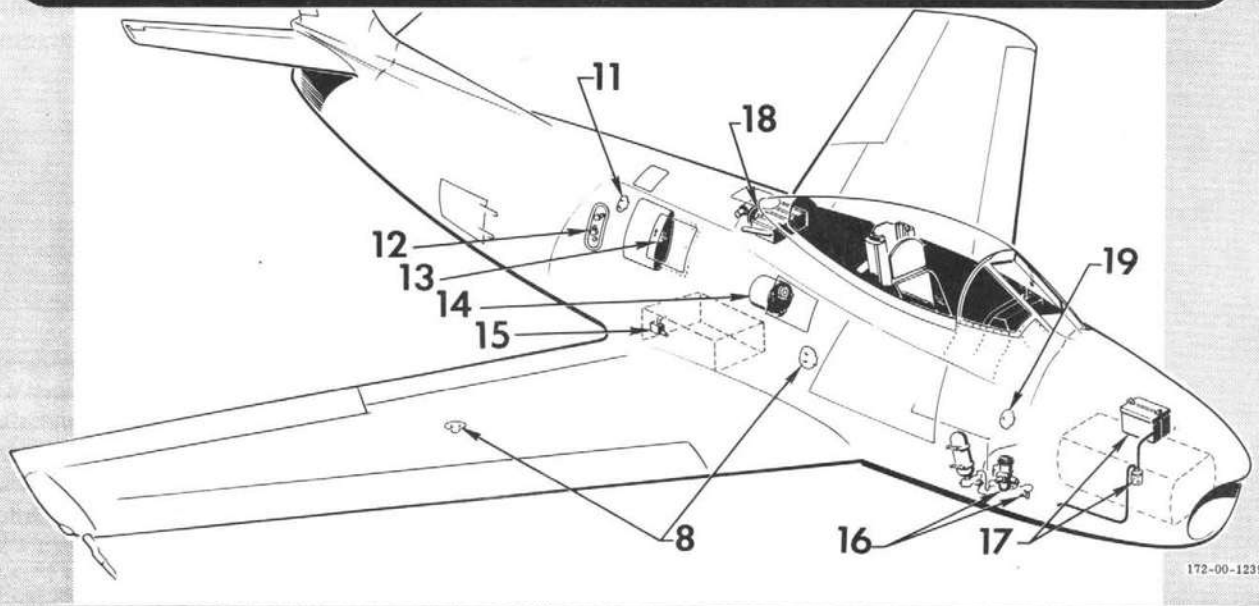
15 SPEED BRAKE HYDRAULIC SYSTEM ACCUMULATOR AIR FILLER

16 GUN CHARGER COMPRESSOR OIL AND AIR FILLERS (F-86E-5, F-86E-6, F-86E-10, AND F-86E-15 AIRPLANES)

17 BATTERY AND SUMP JAR (SERVICED THROUGH RADAR DOOR)

18 AIR COOLING TURBINE OIL FILLER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES)

19 OXYGEN FILLER VALVE (F-86E-10 AND F-86E-15 AIRPLANES)



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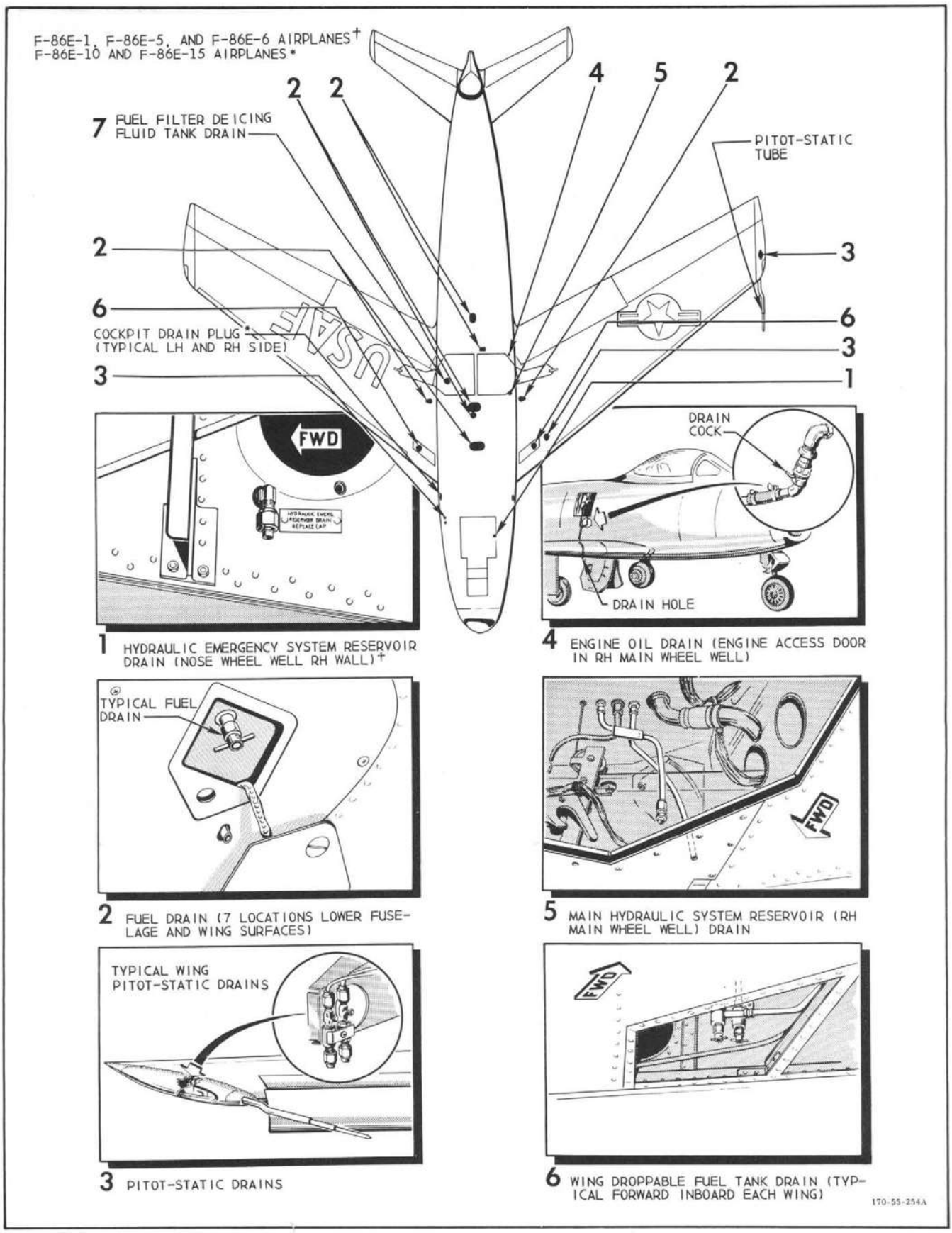


Figure 1-15. Draining Provisions

1-41. DRAINING SYSTEM. With a suitable container handy to catch the oil, remove access cover from inside the right wheel well and open drain valve in main supply line. Then open oil tank sump drain, to drain residual oil. The oil tank drain is shown in figure 1-15.

1-42. SERVICING AUTOMATIC GUN CHARGER AIR COMPRESSOR AND AIR BOTTLE.

1-43. The pneumatic gun charger air compressor and air bottle on F-86E-5 through F-86E-15 Airplanes are serviced through small access doors forward of the ammunition boxes on the right side of the airplane. (See figure 1-14.)

1-44. FILLING AIR COMPRESSOR WITH OIL. The oil level in the cup on the bottom of the air compressor should be checked before every flight. Oil should be changed every 25 hours. Service with Specification MIL-O-6085 oil, as follows:

a. Remove bottom lubricant cup by first unscrewing the lower fastener and then unscrewing cup.

b. Fill lower portion of cup with oil.

CAUTION

Do not fill above lower step in cup.

c. Screw on cup and fasten securely with bottom fastener to finger-tightness.

CAUTION

Excessive tightening will strip threads in the bottom screw fastener.

1-45. FILLING AIR BOTTLE. The filler valve for the gun charger air bottle is located forward in the compressor compartment. Fill the air bottle as follows:

a. Remove filler cap.

b. Charge bottle to 1700 (± 50) psi with compressed air or nitrogen.

c. Replace filler cap.

1-46. DRAINING AIR BOTTLE. The drain for the gun charger air bottle is reached through an access door just aft of the gun charger compressor. To remove moisture, loosen the drain valve on the bottom of the air bottle.

1-47. FILLING AND BLEEDING BRAKE SYSTEM.

1-48. The brake system is filled from the hydraulic utility power system reservoir. For information on filling the reservoir, refer to paragraph 1-60. With the utility reservoir full of fluid and with a bleeder hose and container available, bleed the brake system as follows:

a. Remove dust screw from bleeder fitting on top of left brake. Attach bleeder hose, and place hose end in a container partly filled with fluid.

b. Make provisions for keeping reservoir full of clean fluid. Do not allow the reservoir to be less than half-full of fluid at any time.

c. Back off bleeder fitting, but leave sufficient restriction to actuate brake cylinder.

d. While holding parking brake handle halfway out, push on right brake pedal and hold; at the same time, pump fluid through bleed with left brake pedal. Continue pumping until air bubbles cease and not less than ½ pint of fluid has been bled.

e. Release parking brake handle, and again pump the left brake pedal until there are no air bubbles and until not less than ½ pint of fluid has been bled. Then close bleeder fitting, remove hose, and replace dust screw.

f. Repeat steps a. through e. on right brake, pumping the right pedal and holding the left pedal.

g. After bleeding brakes, replenish reservoir.

1-49. SERVICING LANDING GEAR SHOCK STRUTS.

1-50. The nose gear shock strut is serviced through an access door in the air intake duct. The main gear shock struts are serviced through the main wheel wells. (See figure 1-16.)

1-51. FILLING MAIN AND NOSE GEAR SHOCK STRUTS. Fill shock struts with hydraulic fluid (Specification MIL-O-5606) as follows:

a. Deflate strut, using procedure outlined in paragraph 1-53.

b. After strut is fully compressed, remove filler plug.

c. Fill strut to overflowing with fluid.

d. Replace filler plug and tighten it securely.

1-52. INFLATING MAIN AND NOSE GEAR SHOCK STRUTS WITH AIR. With the airplane fully loaded and resting on landing gear, inflate the struts to obtain the following dimensions (figure 1-16): nose gear strut, 4⅜ inches between center of torque link bolts; main gear struts, 4⅞ inches between center of torque link bolts. The landing gear struts employ AN6287-1 high-pressure air valve assemblies, and the following procedure must be used to inflate the struts:

a. Remove valve cap.

b. Attach air filling chuck.

c. Loosen ⅜-inch hexagon swivel nut to not more than three-fourths of a complete turn. (Turn counterclockwise to loosen.)

CAUTION

- Excessive loosening will allow the stem assembly to drop into the strut.
- Do not loosen ¾-inch hexagon nut. This nut should remain tight against the strut at all times.

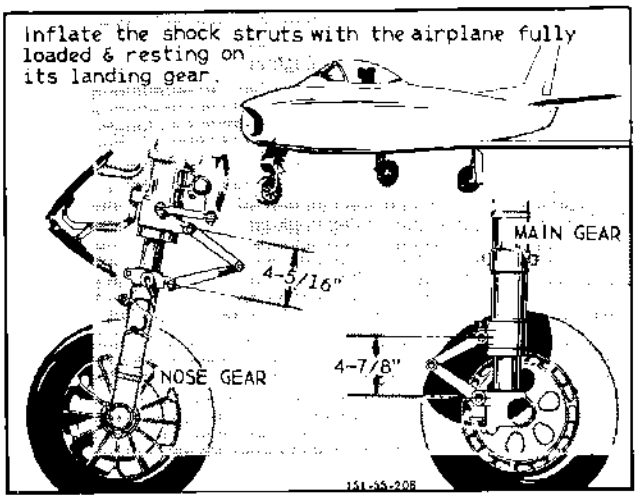


Figure 1-16. Measuring Landing Gear Strut Extension

d. Inflate strut to specified dimensions.

e. Tighten ⅝-inch hexagon swivel nut to 50-70 inch-pounds torque. [Turn right (clockwise) to tighten.]

f. Remove air filling chuck from valve, and replace and tighten valve cap to extreme finger-tightness.

1-53. DEFLATING MAIN AND NOSE GEAR SHOCK STRUTS. Deflate the landing gear shock struts as follows:

WARNING

Because of the relatively high pressure and the small quantity of air in the shock strut, caution must be used in releasing air from strut for servicing. Make sure that personnel are clear of the airplane to prevent the possibility of injury due to landing gear scissors action or too sudden collapse of strut. Also make sure that no jacks or obstructions are under the wings or fuselage which might cause damage when airplane is lowered.

a. Remove valve cap.

b. Loosen ⅝-inch hexagon swivel nut. The amount the swivel nut is loosened (up to three-fourths of one complete turn only) will govern the rate of air discharge.

c. Depress valve core. If only a small amount of air is to be discharged, loosen ⅝-inch hexagon swivel nut about one-tenth of a complete turn and depress valve core.

d. Retighten ⅝-inch hexagon swivel nut to 50-70 inch-pounds torque.

e. Replace and tighten valve cap to extreme finger-tightness.

1-54. SERVICING MAIN AND NOSE WHEEL TIRES.

1-55. Main and nose gear tire inflation pressures are dependent on the gross take-off weight of the airplane. Tire inflation pressures are shown in figure 1-17.

1-56. SERVICING HYDRAULIC SYSTEM.

1-57. For the location of hydraulic units requiring periodic servicing, see figure 1-14. The capacities of the hydraulic reservoir and systems are given in figure 1-13. Service hydraulic system with Specification MIL-O-5606 fluid.

Note

As all air accumulators are equipped with AN6287-1 high-pressure air valve assemblies, follow the procedures described in paragraphs 1-52 and 1-53 for filling or exhausting air pressure.

1-58. FILLING HYDRAULIC UTILITY POWER SYSTEM. Place airplane on jacks to permit operation of landing gear; then fill system as follows:

a. Connect test stand lines to quick-disconnect couplings, accessible through door on right side of forward fuselage section.

CAUTION

- Before filling, exhaust hydraulic pressure in speed brake accumulator.
- Fluid level in reservoir should never be allowed to exceed the full mark on the sight gage with system pressure exhausted.

b. Leave reservoir cap tight.

c. Thoroughly circulate fluid through system; then operate each unit several times to purge system of air.

d. Disconnect hydraulic test stand. Make sure landing gear is down and locked before lowering airplane from jacks.

1-59. DRAINING HYDRAULIC UTILITY POWER SYSTEM. With a container ready into which fluid may drain, remove plug from drain line in right wheel well. This will drain approximately all of the reservoir fluid. To drain fluid from system lines, disconnect lines at several low points in system. To drain nose gear emergency reservoir in F-86E-1, F-86E-5, and F-86E-6 Airplanes, remove plug from drain line in nose wheel well. (See figure 1-15 for drain locations.)

1-60. REPLENISHING HYDRAULIC UTILITY POWER SYSTEM RESERVOIR. The reservoir filler opening is reached through the right-hand radio compartment door. With the landing gear down, landing gear doors closed, speed brakes closed, and accumulators discharged, remove filler cap and fill until fluid is at the full mark on the sight gage. Replace cap and tighten.

Note

On F-86E-1, F-86E-5, and F-86E-6 Airplanes, if reservoir was empty or below the "REFILL" level, wait 2 minutes after initial refilling to

make sure lower compartment of reservoir and nose gear emergency reservoir are full; then repeat filling process.

1-61. FILLING SPEED BRAKE SYSTEM HYDRAULIC ACCUMULATOR WITH AIR. The filler valve for the speed brake accumulator is situated in the right main wheel well. Before filling accumulator, exhaust all the accumulator hydraulic pressure by opening and closing speed brakes until all pressure is exhausted. With all pressure relieved, charge the accumulator with air to 1200 (±50) psi.

1-62. FILLING NOSE GEAR EMERGENCY HYDRAULIC ACCUMULATOR WITH AIR (F-86E-10 AND F-86E-15 AIRPLANES). The air filler valve for the nose gear hydraulic emergency accumulator is located on the aft wall of the nose wheel well. Before and while filling accumulator, open the dump valve to exhaust all hydraulic pressure. Fill with air to 1200 (±50) psi.

1-63. FILLING AND BLEEDING SURFACE CONTROL HYDRAULIC POWER SYSTEMS (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). If compensator rod of respective system protrudes less than ¼ inch, the system must be filled. The alternate hydraulic control system compensator rod is checked through an inspection hole on left side of fuselage, aft of speed brake well. The normal hydraulic control system rod is checked through an inspection hole on opposite side of fuselage. To fill and bleed systems, proceed as follows:

a. Remove left engine access door and place filling selector valve at either "NORMAL CONT." or "ALT. CONT."

b. Remove cap from wobble pump suction line and attach a flexible hose. Place the end of the flexible hose in a container of hydraulic fluid (Specification MIL-O-5606).

c. Operate wobble pump, while moving control stick so that both horizontal stabilizer and aileron will be actuated, until no bubbles are seen in the transparent line next to wobble pump for the normal system and in the left speed brake well for the alternate system.

d. Check compensator rod of respective system. Each system should be filled until compensator rod protrudes a maximum of 1¼ inches.

e. Place filling selector valve in the "OFF" position.

f. Remove flexible hose and cap disconnects.

1-64. FILLING AND BLEEDING SURFACE CONTROL HYDRAULIC POWER SYSTEMS (F-86E-10 AND F-86E-15 AIRPLANES). If compensator rod of respective system protrudes less than ¼ inch, the system must be filled. The alternate hydraulic control system compensator rod is checked through an inspection hole on left side of fuselage, aft of speed brake well. The normal hydraulic control system rod is checked through an inspection hole on the opposite side of fuselage. The normal and alternate surface control hydraulic systems are serviced through two access doors on bottom fuselage, aft of speed brake wells. (See figure 1-14.) The

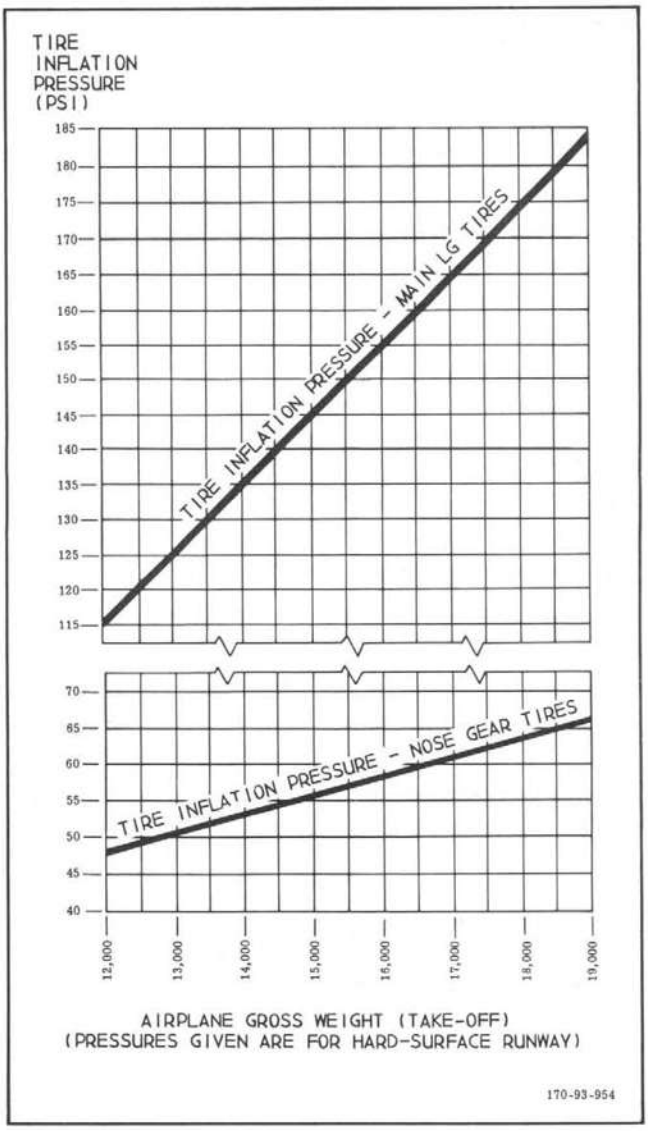


Figure 1-17. Tire Inflation Graph

normal surface control system hydraulic filler is on the right; the alternate system filler is on the left. A hydraulic hand-pump (172-58631) is furnished for servicing the systems. To fill and bleed systems, proceed as follows:

a. Attach hydraulic hand-pump to the bottom fuselage between the filler doors.

b. Remove cap from disconnect coupling of the system to be serviced and attach flexible hose from pump. Place the end of the flexible hose in a container of hydraulic fluid (Specification MIL-O-5606) and operate hand-pump.

c. With external power available, start the alternate power system electrically driven hydraulic pump (when filling alternate system only) and keep adding fluid with hand-pump.

d. Operate hand-pump until no bubbles appear in the reservoir sight gage in the left speed brake well (alternate system) or right engine access (normal system).

e. With the system filled, operate controls through

several cycles; then depress plunger on reservoir relief valve to drain compensator.

f. Refill system and repeat procedure until no air is noted in the overboard drain line when reservoir relief valve is depressed.

g. Check compensator rod of respective system. Each system should be filled until compensator rod protrudes a maximum of 1¼ inches.

h. After filling and bleeding procedure, remove flexible hose and cap disconnects.

1-65. FILLING SURFACE CONTROL NORMAL HYDRAULIC SYSTEM ACCUMULATOR WITH AIR. The filler cap for the normal surface control accumulator is located in the left main wheel well. Use the following procedure for filling:

a. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, connect external power to the electrical receptacle. Turn flight control switch, on the left console of the cockpit, to "ALTERNATE ON," which will energize the normal shutoff valve and allow fluid trapped in the accumulator to return to the reservoir. This exhausts all hydraulic pressure from the system.

Note

On F-86E-10 and F-86E-15 Airplanes, operate surface controls to relieve hydraulic fluid on pressure side of accumulator while it is being filled with air.

On F-86E-1, F-86E-5, and F-86E-6 Airplanes, fill accumulator with 700 (±50) psi of air. On F-86E-10 and F-86E-15 Airplanes, charge the accumulator with 600 (+50/−0) psi of air.

WARNING

The accumulators should never be charged with air without the surface control normal hydraulic system shutoff valve or the surface control alternate hydraulic system shutoff valve being open to return, as fluid would be trapped. This condition would give an erroneous air pressure charge, as the accumulator would not get the required amount of air charge. Without the correct charge of air, serious danger could result in switching to the alternate system in flight.

1-66. FILLING SURFACE CONTROL ALTERNATE HYDRAULIC SYSTEM ACCUMULATORS WITH AIR. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the air filler valves for the surface control alternate hydraulic system accumulators are located in both the left and right speed brake wells. On F-86E-10 and F-86E-15 Airplanes, both filler valves are situated in the right speed brake well. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, manually depress the alternate by-pass valve button and hold it half open while filling accumulator with 700 (±50) psi of air. On F-86E-10 and F-86E-15 Airplanes, dump hydraulic pressure before or during the addition of air by pulling the "EMERG. HYD CONTROL" circuit breaker in the aft fuselage and the "ALT EMERG. HYD CONTROL" circuit breaker in the cockpit, then pushing the manual button on the alternate system transfer valve halfway in. Fill the alternate surface control accumulator with air to 600 (±50) psi.

1-67. EXHAUSTING SURFACE CONTROL NORMAL HYDRAULIC SYSTEM ACCUMULATOR. With no electrical power on airplane, operate surface controls until pressure is bled off normal system.

1-68. EXHAUSTING SURFACE CONTROL ALTERNATE HYDRAULIC SYSTEM ACCUMULATORS. To exhaust the surface control alternate hydraulic system accumulator, pull the "EMERG. HYD CONTROL" circuit breaker in the data case compartment in aft fuselage and the "ALT EMERG. HYD CONTROL" circuit breaker in the cockpit and then push the manual button on the solenoid transfer valve (in the left speed brake well) halfway in until pressure is relieved through the valve.

1-69. SERVICING BATTERY.

1-70. The battery is accessible through the radar compartment door (figure 1-14) and is provided with a conventional cover and quick-disconnect terminal block. To determine condition of battery, remove cover and take hydrometer reading of the electrolyte in each cell. Specific gravity of 1.275 to 1.300 indicates full charge. If readings are 1.240 or below, the battery must be replaced or recharged. (Temperature corrections must be made to ensure accurate readings.)

Note

During cold weather, the battery must be kept as near full charge as possible; if it is not, the electrolyte will freeze. The battery should be removed and stored in a warm place when the airplane is to be parked for more than 4 hours at temperatures below −29°C (−20°F) or for any extended period.

If specific gravity is satisfactory, add distilled water to each cell as necessary, being careful not to overfill cell. Avoid spilling any electrolyte on airplane structure or equipment. If this occurs, however, immediately neutralize the affected area with a water solution of sodium bicarbonate.

CAUTION

Never pour water into the acid, since heat may be generated so rapidly that the acid will be thrown upon the operator.

1-71. SERVICING BATTERY SUMP JAR. The battery sump jar is located on the forward right side of the radar and battery compartment. The sump jar pads should be kept saturated with a solution of trisodium phosphate.

1-72. SERVICING OXYGEN SYSTEM.

1-73. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, a single filler valve for servicing the four Type D-2 cylinders is located forward of the ammunition boxes on the left side of the airplane. On F-86E-10 and F-86E-15 Airplanes, the filler is located forward of the ammunition boxes on the right side of the fuselage. (See figure 1-14.) Normal operating pressure is 400 psi.

1-74. FILLING OXYGEN SYSTEM. Fill the oxygen system as follows:

a. After opening access door, remove filler valve plug by turning handle about one-eighth turn.

b. Turn supply equipment regulator adjustment screw counterclockwise until it turns freely.

c. Open valves on supply cylinders very slowly, one at a time. Note supply pressure.

d. Turn the pressure adjusting screw on the regulator clockwise until the delivery pressure gage registers 150 psi.

e. Open the charging valve at the end of the hose in order to blow out any dirt that may have collected in the adapter. Then close the charging valve.

f. Insert the adapter into filler valve and make sure that it is locked into position.

g. Open the charging valve; as the oxygen flows into cylinders in the airplane, gradually increase the delivery pressure until cockpit pressure indicates 425 psi.

Note

- Charging the cylinders generates heat. After servicing, cylinders will cool, and the resulting drop in pressure will bring the operating pressure down to approximately the required 400 psi.
- A major leak in the oxygen system upstream of the check valves will not be indicated on the pressure gage. The cylinders and lines upstream of the check valves should be visually checked when the system is being filled.

h. After the pressure in the airplane system reaches 425 psi, as indicated by the pressure gage in the cockpit, close the charging valve, release the adapter, recap the filler valve, and replace the access door.

1-75. EXHAUSTING OXYGEN SYSTEM. Turn diluter control handle on Type A-14 pressure breather regulator to "100% OXYGEN"; then turn regulator dial to "45M." Oxygen will exhaust from the end of regulator-to-mask connection tube. The mask-to-regulator hose must be free from obstruction; otherwise, regulator diaphragm will rupture.

WARNING

Make certain there are no flammable materials in the vicinity, as combustion may result, particularly if there is an open flame or sparks nearby.

1-76. SERVICING COCKPIT AIR COOLING UNIT.

1-77. The cockpit air cooling unit is reached through an access door, located on top of the fuselage aft of the canopy. The oil-pack turbine on F-86E-10 and F-86E-15 Airplanes does not require frequent lubrication, but it is removed for overhaul and lubrication at periods not to exceed 250 airplane flight hours. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the cockpit air cooling unit requires that oil be added at intervals of not over 25 hours.

1-78. FILLING COOLING UNIT (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). The oil filler plug is reached through a small door on the fuselage frame, after the outer cockpit cooling unit access door is removed. (See figure 1-18.) There is a sight gage on the unit to ensure complete filling. A red line on the sight gage reveals a low oil level; a green line shows the full oil level. Service the unit with Specification MIL-O-6085 oil. To service the unit, proceed as follows:

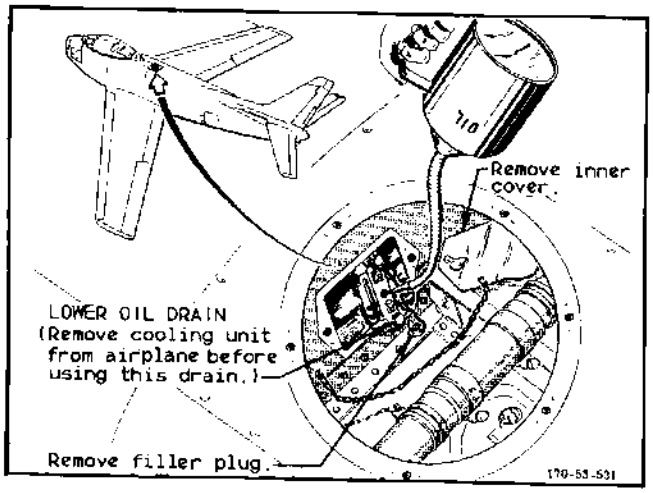


Figure 1-18. Servicing Cockpit Air Cooling Unit—F-86E-1, F-86E-5, and F-86E-6 Airplanes

a. Turn filler plug clockwise to release it from holding clip. Plug is secured to unit by a chain.

b. Fill slowly from an oil can until the gage indicates sufficient oil supply.

CAUTION

The turbine reservoir must not be filled to exceed 45-50 cc. Overfilling may allow oil to leak by the turbine rotor-shaft seals into the cockpit ventilating duct, causing smoke in the cockpit.

c. Replace filler plug and close access doors.

1-79. DRAINING AIR COOLING UNIT (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). Drain the unit every 50 hours. The unit can be easily removed from the airplane and drained by removal of the drain plug below the filler opening. Oil can be siphoned out of the unit or drained with a syringe as follows:

a. Remove filler plug.

b. Insert siphon hose or syringe into the filler opening and draw all oil out of reservoir.

c. Refill unit (paragraph 1-78) with fresh oil and replace plug.

1-80. DRAINING PITOT-STATIC SYSTEM.

1-81. Water-collecting sumps are provided in the pitot-static system drain lines, as shown in figure 1-15. These sumps should be removed, cleaned, and dried every 25 hours, or more often, depending on the humidity.

1-82. DRAINING COCKPIT DRAIN LINES (F-86E-10 AND F-86E-15 AIRPLANES).

1-83. The cockpit drain lines should be emptied before each flight. The drain plugs are located on each side of the fuselage, below the kick step. (See figure 1-15.) To drain lines, remove the plugs with a ¼-inch Allen wrench. After draining, install drain plugs.

1-84. SERVICING ENGINE AUXILIARY GEAR CASE UNIT (ENGINES PRIOR TO ENGINE NO. 046-927).

1-85. The engine auxiliary gear case unit is serviced with oil (Specification MIL-O-6081, Grade 1010). The filler plug is located on the front section of the engine, below and to the right of the hydraulic pump. (See figure 1-19.) Service the unit as follows:

a. Enter engine air intake duct and remove engine auxiliary accessory cover. (Refer to paragraph 5-24.)

b. Check oil level of auxiliary gear case unit by removing lower cap on standpipe. If oil runs out, the oil level is satisfactory. If oil does not run out, the oil level is low.

c. Install lower cap on standpipe.

d. If oil level is low, disconnect vent line from filler plug, remove filler plug, and remove upper cap on standpipe. Add oil through filler opening until oil runs out of upper standpipe opening.

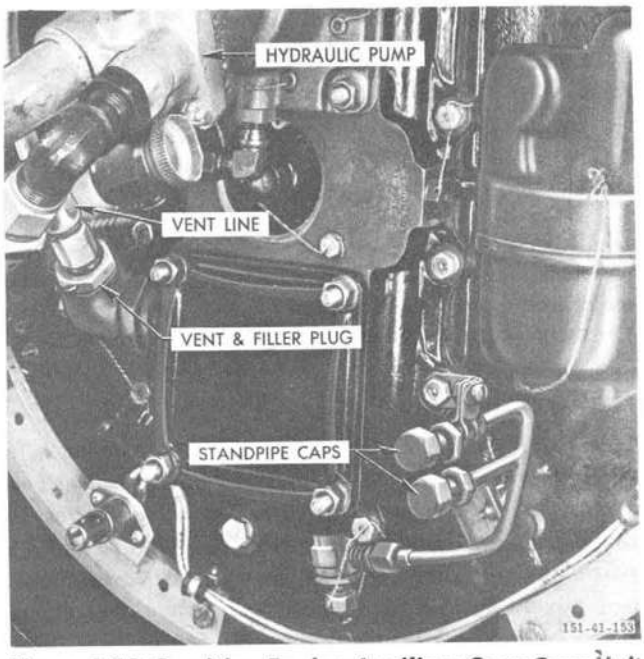


Figure 1-19. Servicing Engine Auxiliary Gear Case Unit (Engines Prior to Engine No. 046-927)

e. Install filler plug, vent line, and upper cap in standpipe.

f. Install engine auxiliary accessory cover. (Refer to paragraph 5-25.)

1-86. EXTINGUISHING GROUND FIRES.

1-87. EXTINGUISHING FIRE WITHIN ENGINE WHEN EXTERNAL POWER IS NOT AVAILABLE.

1-88. If it is not possible to obtain external power to crank engine, introduce CO_2 or dry chemical fire-extinguishing agent into the engine air intake duct and through the engine exhaust tail pipe. Use CO_2 as sparingly as possible, to prevent engine damage as a result of abrupt contraction of metal due to the cooling effect of CO_2.

1-89. EXTINGUISHING FIRE IN AFT FUSELAGE.

1-90. Introduce CO_2 or dry chemical fire-extinguishing agent into the fuselage section through the fire-fighting access door, located on the left forward side of the fuselage section. Direct the extinguishing agent into the compartment *around* the engine; do not allow CO_2 to impinge directly on the engine.

1-91. LUBRICATION REQUIREMENTS.

1-92. Parts requiring periodic lubrication are shown in figure 1-20. Remove all foreign matter from joints, fittings, or bearing surfaces immediately before application of lubricant. Use a clean rag saturated with cleaning solvent (Federal Specification P-S-661). Apply

APPLICATION SYMBOLS

OIL CAN | BRUSH | HAND | GREASE GUN

FREQUENCY SYMBOLS

INTERMEDIATE (25 HOURS) | 2ND INTERMEDIATE (50 HOURS) | MAJOR (100 HOURS)

TABLE OF LUBRICANTS

IDENTIFICATION LETTER	SPECIFICATION	TYPE OF LUBRICANT
GLT	MIL-G-3278	GREASE, LOW-TEMPERATURE LUBRICATING
OGP	MIL-L-644	OIL, GENERAL-PURPOSE LOW-TEMPERATURE LUBRICATING
GP	AN-P-51	PETROLATUM
GG	MIL-G-7187	GREASE; LUBRICATING GRAPHITE
FG	MIL-G-6711	GRAPHITE, LUBRICATING

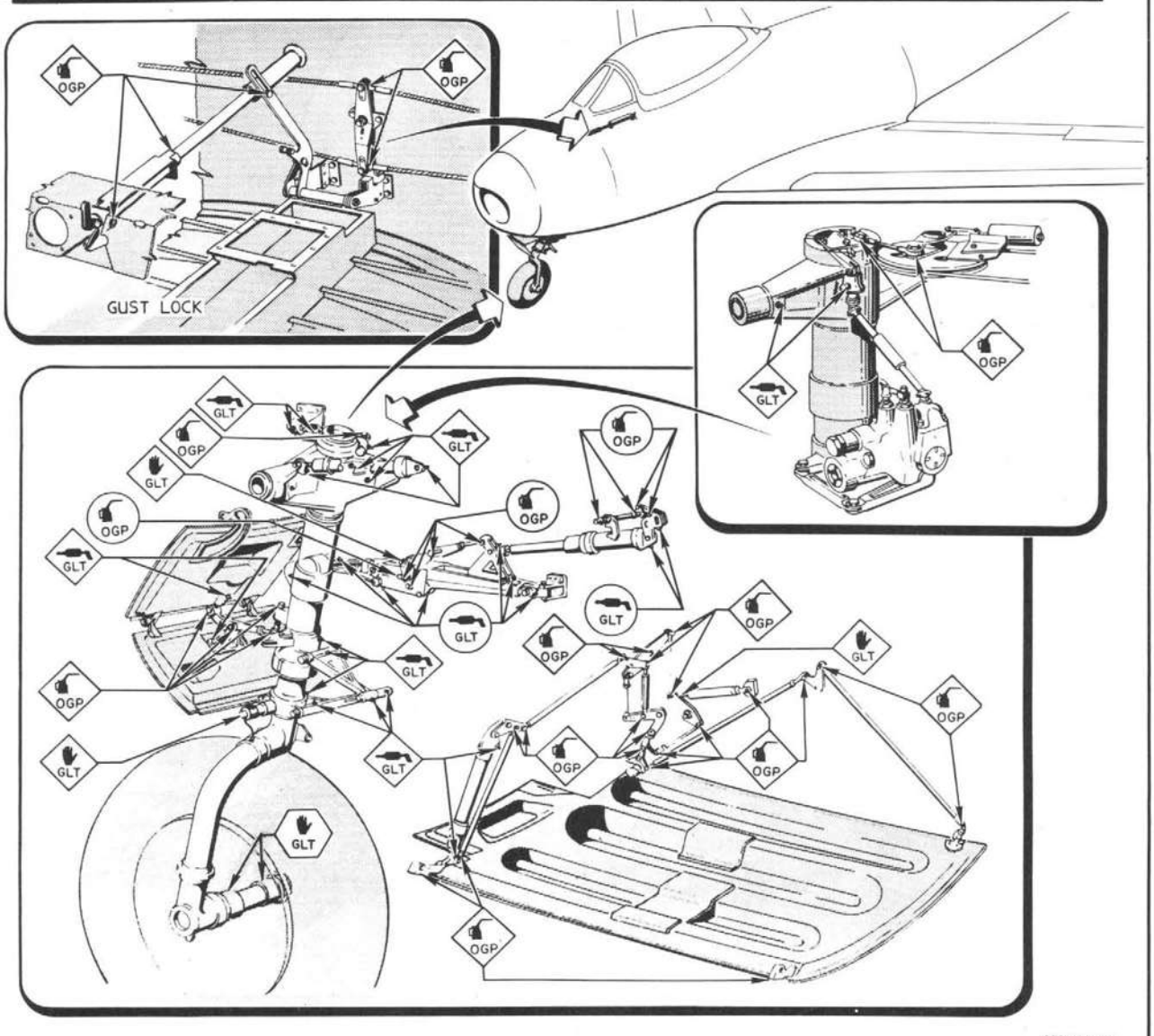


Figure 1-20. Lubrication Chart (Sheet 1 of 5)

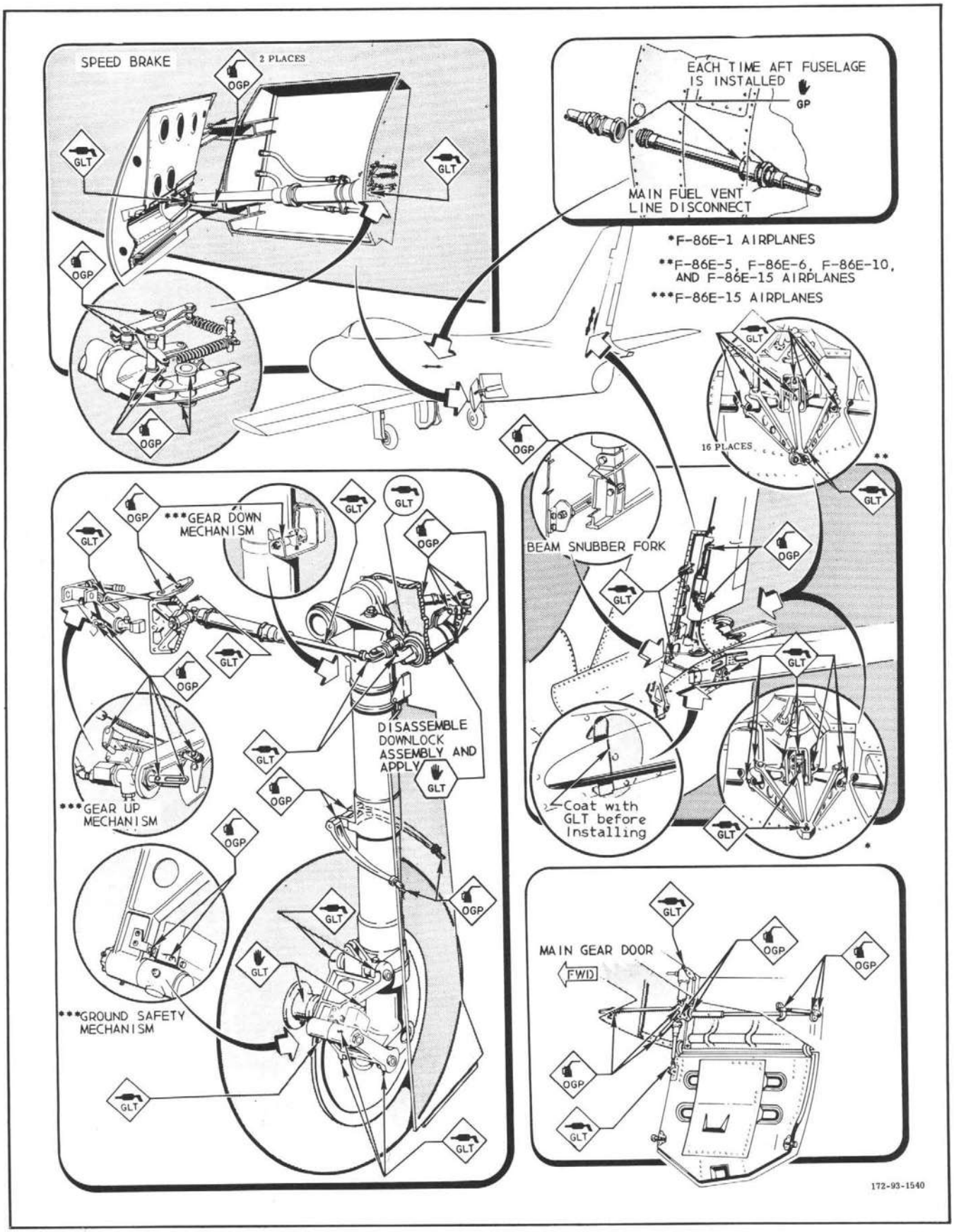
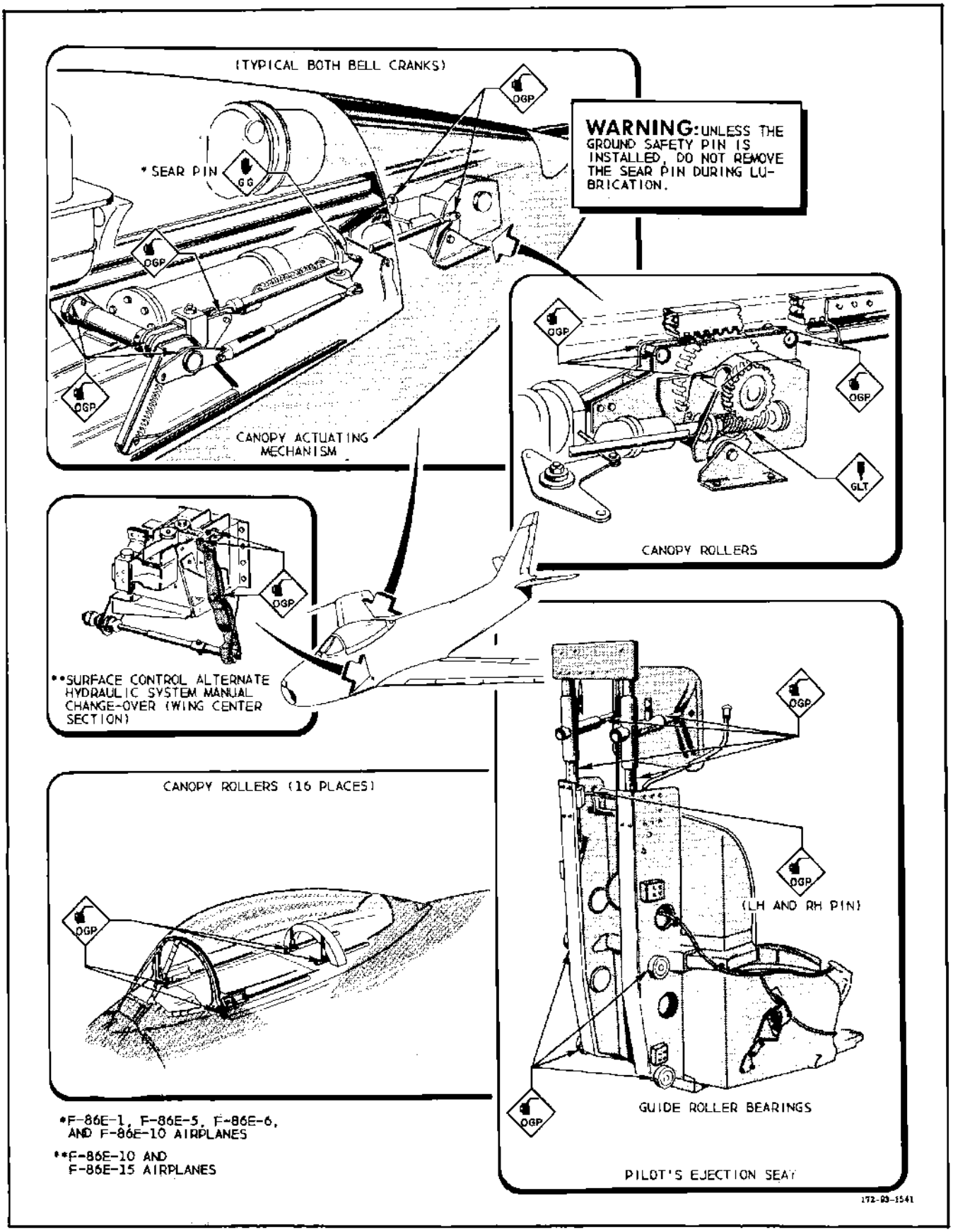


Figure 1-20. Lubrication Chart (Sheet 2 of 5)



*F-86E-1, F-86E-5, F-86E-6, AND F-86E-10 AIRPLANES

**F-86E-10 AND F-86E-15 AIRPLANES

Figure 1-20. Lubrication Chart (Sheet 3 of 5)

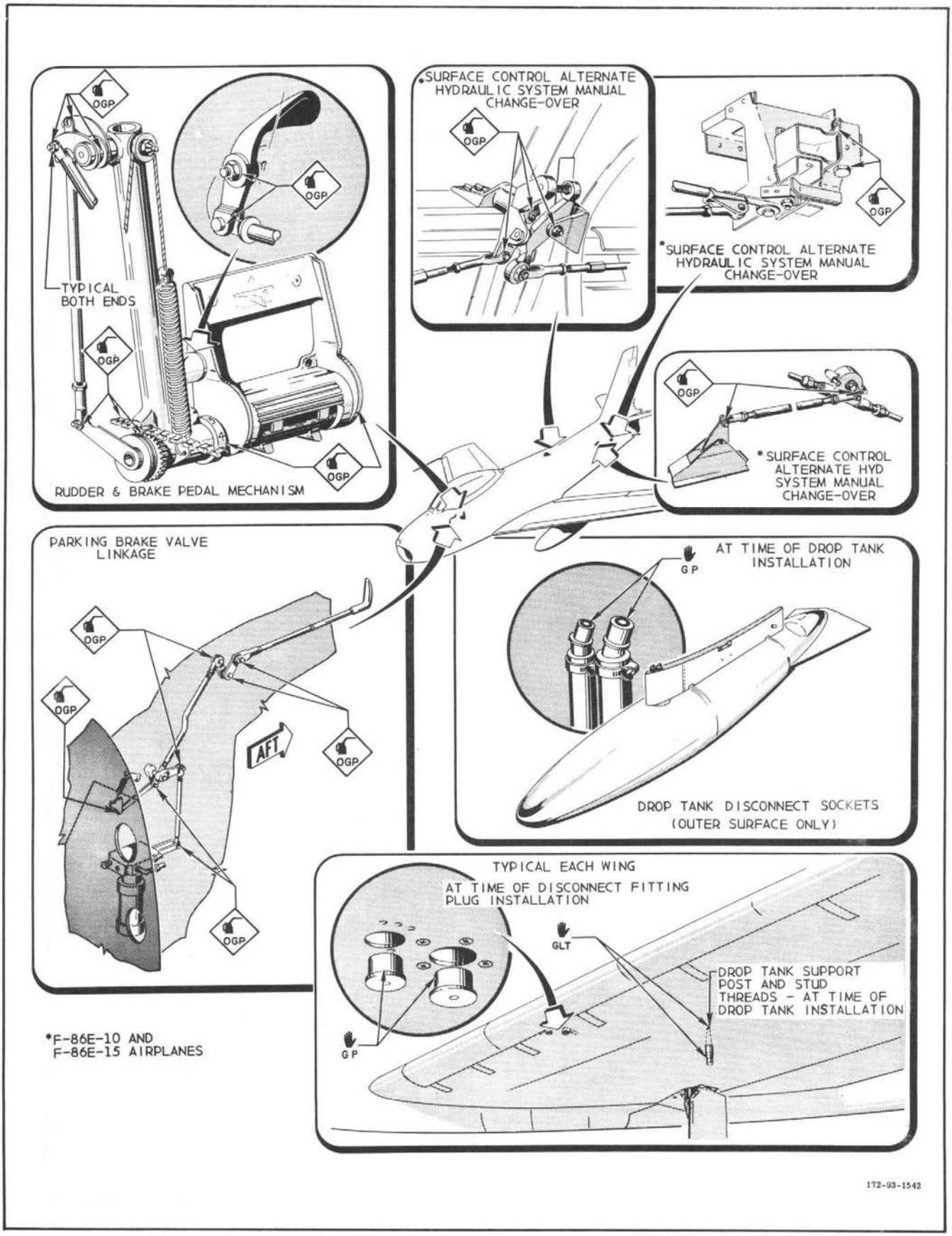


Figure 1-20. Lubrication Chart (Sheet 4 of 5)

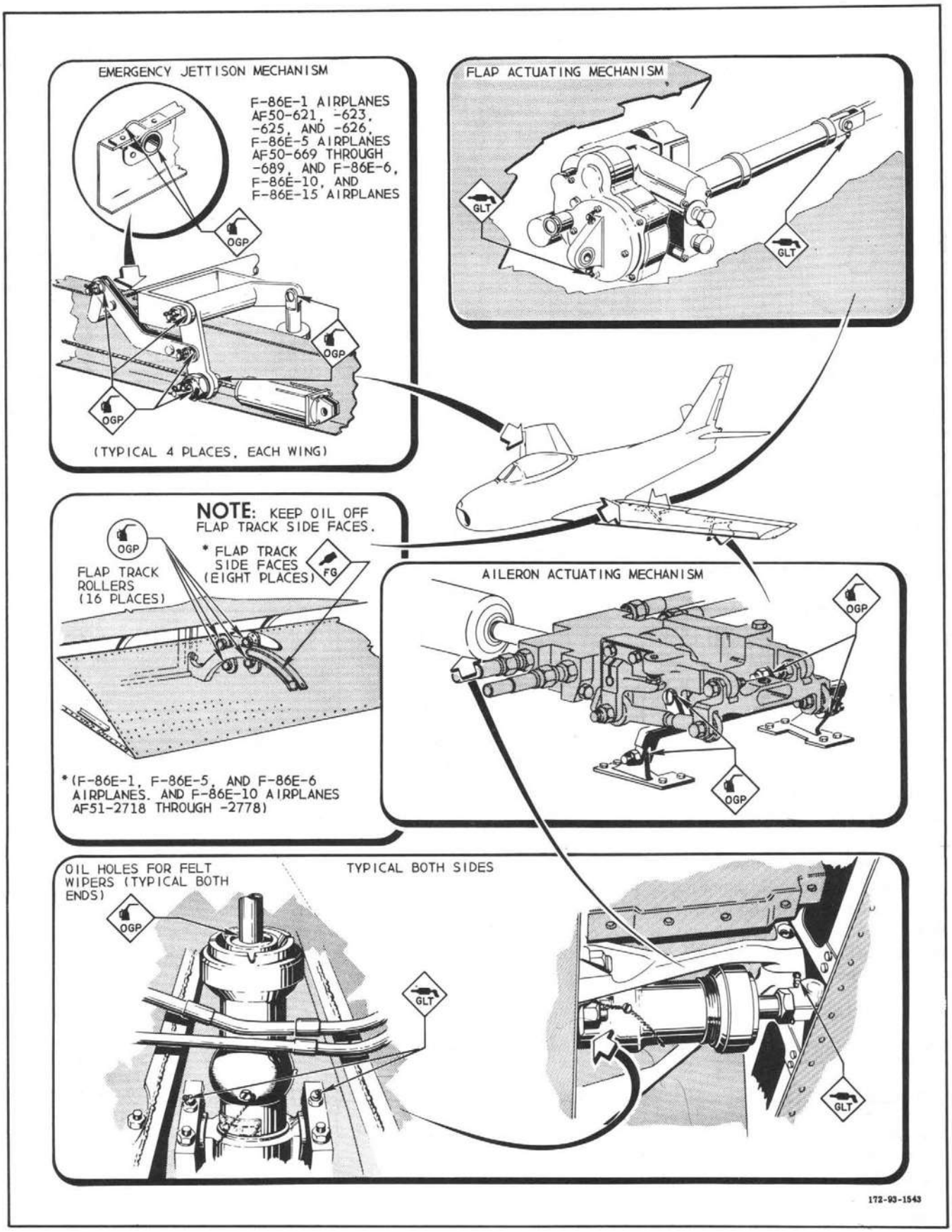
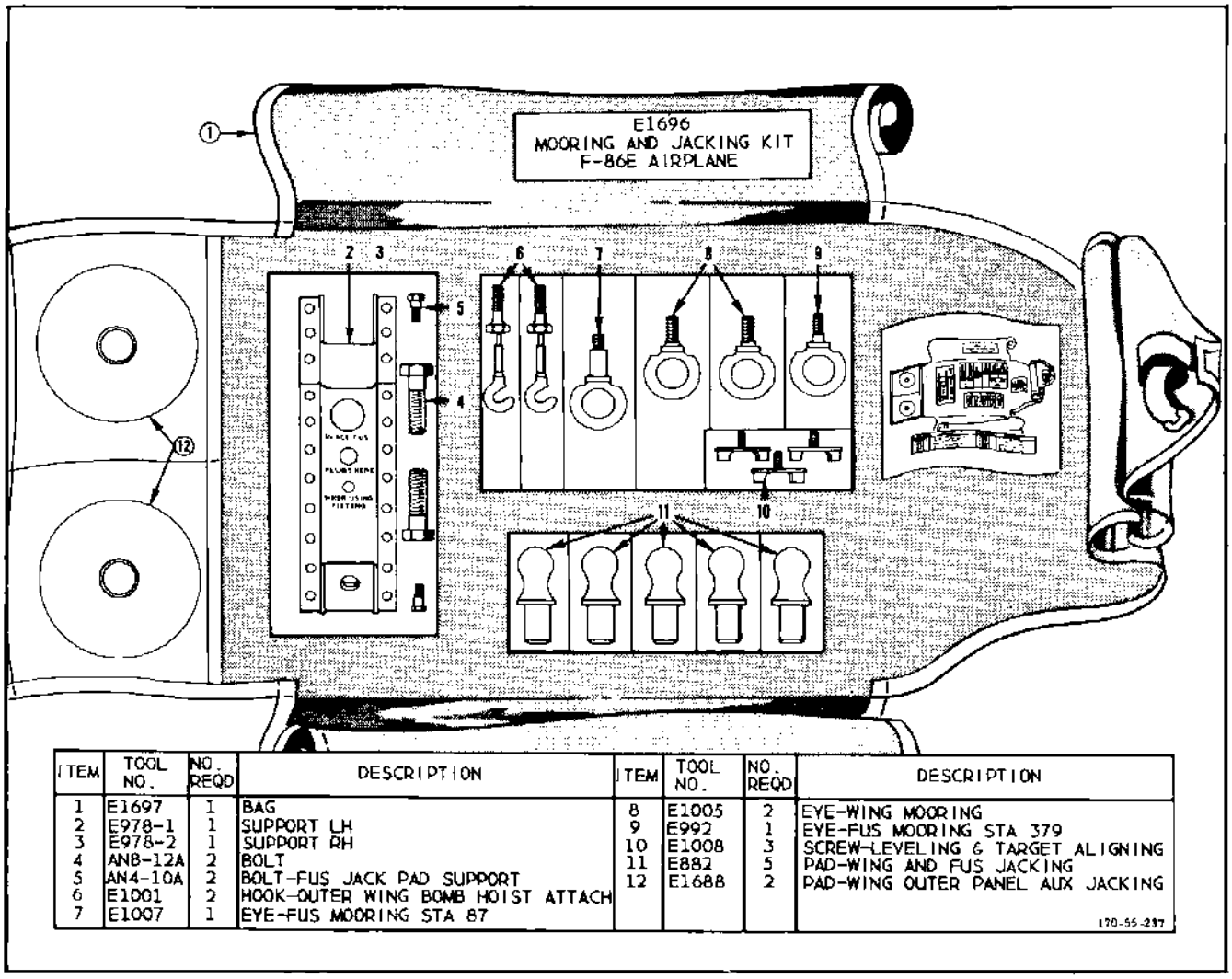


Figure 1-20. Lubrication Chart (Sheet 5 of 5)



ITEM	TOOL NO.	NO. REQD	DESCRIPTION	ITEM	TOOL NO.	NO. REQD	DESCRIPTION
1	E1697	1	BAG	8	E1005	2	EYE-WING MOORING
2	E978-1	1	SUPPORT LH	9	E992	1	EYE-FUS MOORING STA 379
3	E978-2	1	SUPPORT RH	10	E1008	3	SCREW-LEVELING & TARGET ALIGNING
4	AN8-12A	2	BOLT	11	E882	5	PAD-WING AND FUS JACKING
5	AN4-10A	2	BOLT-FUS JACK PAD SUPPORT	12	E1688	2	PAD-WING OUTER PANEL AUX JACKING
6	E1001	2	HOOK-OUTER WING BOMB HOIST ATTACH				
7	E1007	1	EYE-FUS MOORING STA 87				

170-55-237

Figure 1-21. Mooring and Jacking Kit

lubricants sparingly to prevent accumulation of contaminants. When applying lubricants through pressure-type fittings, make certain that lubricant has emerged around bushing, and then wipe off excess. Exposed piston rods of hydraulic actuating cylinders and shock struts should be wiped off daily with oil (Specification MIL-O-5606). A flex hose should be used on the zerk gun to reach hard-to-reach lubrication fittings such as that on the main landing gear downlock fitting.

CAUTION

Specification MIL-G-3278 grease contains special synthetic compounds that may soften paint, natural rubber, neoprene, and electrical material. If any of this lubricant spills on any of these materials, wipe off thoroughly with a clean cloth.

1-93. SPECIAL TOOLS AND EQUIPMENT.

1-94. The following tools are used for general maintenance and overhaul of the airplane:

PART NO.	NOMENCLATURE	FIGURE NO.	PROCURING SERVICE STOCK NO.
140-73060	Cockpit enclosure cover assembly	1-9	2000-884010
151-73073	Wing walkway cover assembly	1-9	2000-800666
170-73071	Jet-engine air intake duct shield assembly	1-9	
170-73072	Jet-engine exhaust duct shield assembly	1-9	
170-73073	Pitot tube cover assembly	1-9	
E974	Complete airplane sling assembly	1-4	8200-855320
E975	Fuselage rear section hoisting sling assembly	1-4	

PART NO.	NOMENCLATURE	FIGURE NO.	PROCURING SERVICE STOCK NO.
E976	Wing outer panel hoisting sling assembly	1-4	8200-85563-3
E1176	Engine sling assembly	1-4	
E1186	Engine transportation dolly assembly	1-6	8200-218000
E1201	Auxiliary landing gear drag brace ground lock assembly	1-11	8200-625053-2
E1561	Fuselage station 235.8 aligner		
E1601	Nose gear door-open position ground safety lock assembly	1-11	8200-825050-2
E1696	Jacking, mooring, and leveling kit	1-21	8200-418715
T49B	Adjustable spanner wrench set		
T71	Surface control checking protractor assembly		
T224	Rear gun mount vertical adjustment wrench		
T254	Fixed gun bore sight target alignment indicator assembly	9-31	
T264	Wing joint upper attach bolt wrench assembly		
T266	Fixed gun bore sight target alignment fixture peep sight assembly	9-31	
T268	Fuselage-to-wing attachment aligning pin	2-35	
T300	Cockpit canopy inflatable seal attaching tool set		
T307	Wing hinge pin installation and removing tool set	2-4	
T365-5	Fuel drop tank support post torque check wrench		
T375	Main alighting gear trunnion pin remover	2-90	

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AIRFRAME GROUP

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2-1. WING.

2-2. The all-metal, flush-riveted, full-cantilever wing has a sweepback of 35 degrees (at 25 percent of chord) and a dihedral of 3 degrees. The wing comprises a center section, two outer panels (with removable tips and leading edge sections), wing flaps, ailerons, and leading edge slats. The center section is of the single-cell box type, made up of front and rear spars and upper and lower skin panels. The skin panels are of sandwich-type construction (skin on both sides of the stringers). A self-sealing fuel cell is installed in the wing center section. The wing outer panels, of two-spar stressed-skin construction, are removable at the wing joint adjacent to the fuselage. A removable leading edge permits access to hydraulic lines, electrical wiring, and aileron valve control cables. A self-sealing fuel cell is installed in the inboard end of each outer panel. The wing outer panels incorporate the main landing gear, wing flaps, and leading edge slats. A remote compass transmitter is installed in the left wing outer panel. The right wing outer panel incorporates an airspeed boom at the tip. Provisions are incorporated for mounting bomb racks, rockets, and auxiliary droppable fuel tanks on the undersurface of the wing outer panels. A center section fairing (figure 2-2) provides access to the fuel cell, boost pumps, and wing-outer-panel-to-center-section lower attaching bolts.

2-3. SEPARATING WING AND FUSELAGE.

2-4. Refer to paragraph 2-146.

2-5. JOINING WING AND FUSELAGE.

2-6. See figure 2-35.

2-7. REMOVING WING OUTER PANEL.

2-8. The parts and components referred to in the following procedure are identified in figure 2-1. Remove the wing outer panel as follows:

Note

It is not necessary to remove the flap when removing the wing outer panel. However, if the flap is to be removed subsequently, it will facilitate the removal of the outer panel to remove the flaps first. (Refer to paragraph 2-40.)

CAUTION

Drain the fuel system before removing the wing outer panel.

a. Remove center section bottom fairing. (Refer to paragraph 2-12.)

b. Remove wing attaching bolt cover at top of inboard end of wing outer panel.

c. Disconnect and cap hydraulic lines at front spar wing attaching joint.

d. Disconnect static and pressure lines at front spar attaching joint (right wing only).

e. Disconnect aileron control rod at front spar wing attaching joint.

f. Disconnect and cap fuel lines at front spar wing attaching joint.

g. Disconnect electrical connector at front spar attaching joint.

h. Disconnect emergency jettison cable at turnbuckle.

i. Disconnect turnbuckle that connects outer panel trailing edge to fuselage.

j. Disconnect flap interconnecting flexible shaft and supporting clips in wheel well.

k. Disconnect hydraulic reservoir overflow line (left wheel well only).

l. Disconnect landing gear emergency uplock release cables (two in the right wheel well, one in the left wheel well).

m. Disconnect and cap fuel lines in wheel well.

n. Disconnect electrical wiring in wheel well.

o. Disconnect and cap brake and hydraulic lines in wheel well.

p. Remove fore and aft fuel booster pumps in wing center section fuel cell. (Refer to paragraph 5-115.)

q. Through fuel pump opening in wing center section, disconnect fuel cell fore and aft interconnectors.

r. Support the fuselage with jacks, sling, or cradle; then remove the bolts that attach outer panel to the center section and remove wing outer panel, which weighs approximately 1325 pounds. (For jacking or hoisting procedure, refer to paragraph 1-12 or 1-14.)

2-9. INSTALLING WING OUTER PANEL.

2-10. See figure 2-1.

2-11. REMOVING WING CENTER SECTION FAIRING.

2-12. The parts and components referred to in the following procedure are shown in figure 2-2. Remove the fairing as follows:

a. Remove antenna.

b. Remove the screws that attach the fairing to the wing center section.

c. Lower fairing enough to gain access to the identification light wiring; then disconnect wiring.

d. Disconnect hydraulic drain line and remove fairing.

2-13. INSTALLING WING CENTER SECTION FAIRING.

2-14. See figure 2-2.

2-15. WING TIP AND WING OUTER PANEL LEADING EDGE.

2-16. Each wing tip incorporates a navigation light. The tips are secured to the outer panel by nonmagnetic screws to minimize magnetic interference with the remote compass transmitter. The all-metal outer panel leading edge sections are attached to the outer panels by a continuous-type hinge and hinge pins. The slat tracks are incorporated in the leading edge.

2-17. REMOVING WING TIP. The parts and components referred to in the following procedure are identified in figure 2-3. Remove the wing tip as follows:

a. Remove screws that attach wing tip to wing outer panel.

b. Move tip outboard far enough to allow access to navigation light wiring; then disconnect wiring and remove tip.

Note

Wing tip must be removed before leading edge can be removed. Leading edge can be removed with or without the wing slats removed.

2-18. REMOVING OUTER PANEL LEADING EDGE. The parts and components referred to in the following procedure are identified in figure 2-3. Remove the leading edge as follows:

a. On right wing only, remove airspeed boom. (Refer to paragraph 6-135.)

b. Remove access doors on the forward outboard corners of the center section fairing and at the inboard end of the leading edge.

c. Disconnect the drop tank fuel and air pressure lines at inboard end of the wing outer panel leading edge.

d. Disconnect and remove fuel and pressure drain lines at inboard end of leading edge.

e. Disconnect electrical wiring at the inboard end of the wing outer panel leading edge.

f. Disconnect remote compass transmitter wiring at inboard end of left wing outer panel leading edge.

g. Support the wing outer panel leading edge section at four points, and remove the plates covering the ends of the hinge pins; then remove hinge pins. Use a T307 hinge pin driver and extractor tool kit to remove hinge pins. (See figure 2-4.) Remove by lowering leading edge ½ inch down, then moving it forward.

CAUTION

Leading edge must not be rotated about either upper or lower edges.

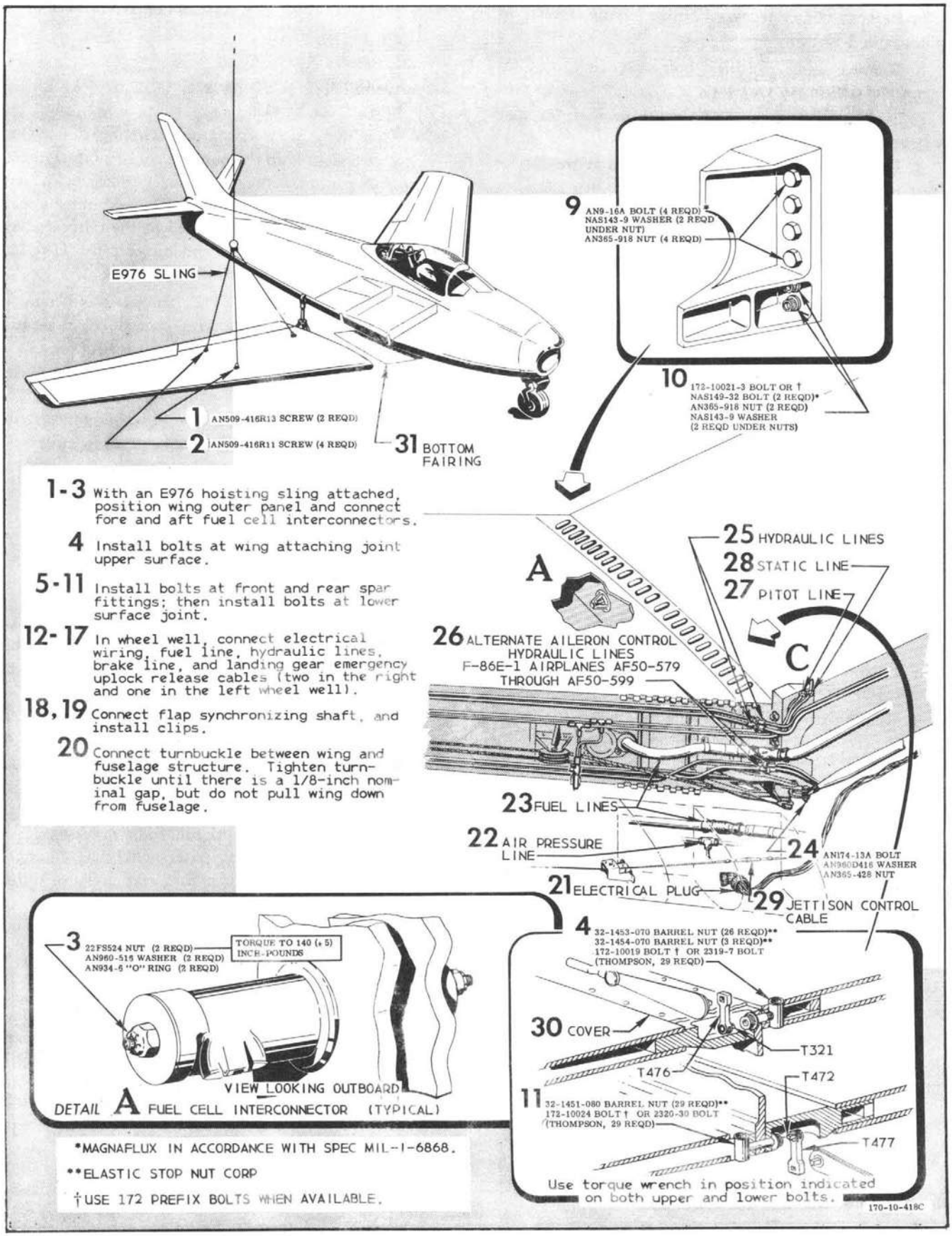
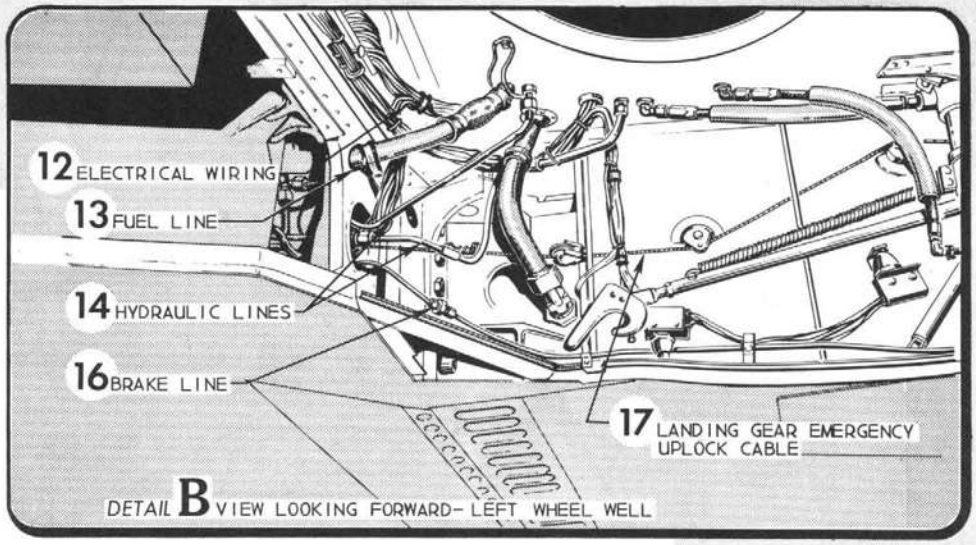


Figure 2-1. Installing Wing Outer Panel (Sheet 1 of 2)

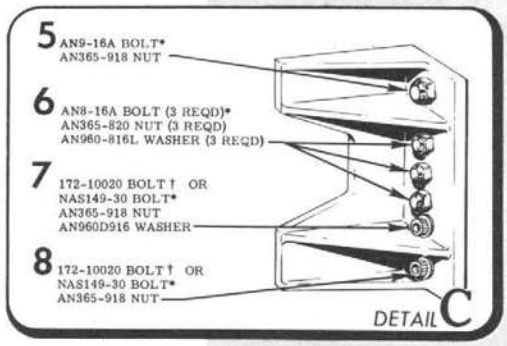


21-28 At front spar, connect electrical plug, air pressure line, fuel lines, aileron control push-pull rod, and hydraulic lines; in right wing only, connect pitot and static lines.

29 On F-86E-5 Airplanes AF50-669 through -689, and F-86E-6 and F-86E-10 Airplanes, connect emergency jettison control cable.

30 Seal aft, outboard, and forward edge of attaching bolt cover with sealing compound (USAF Specification No. 14153) and apply a thin coat of petrolatum to the mating surface; then install cover.

31 Install center section bottom fairing. (Refer to index for page number of applicable procedure.)



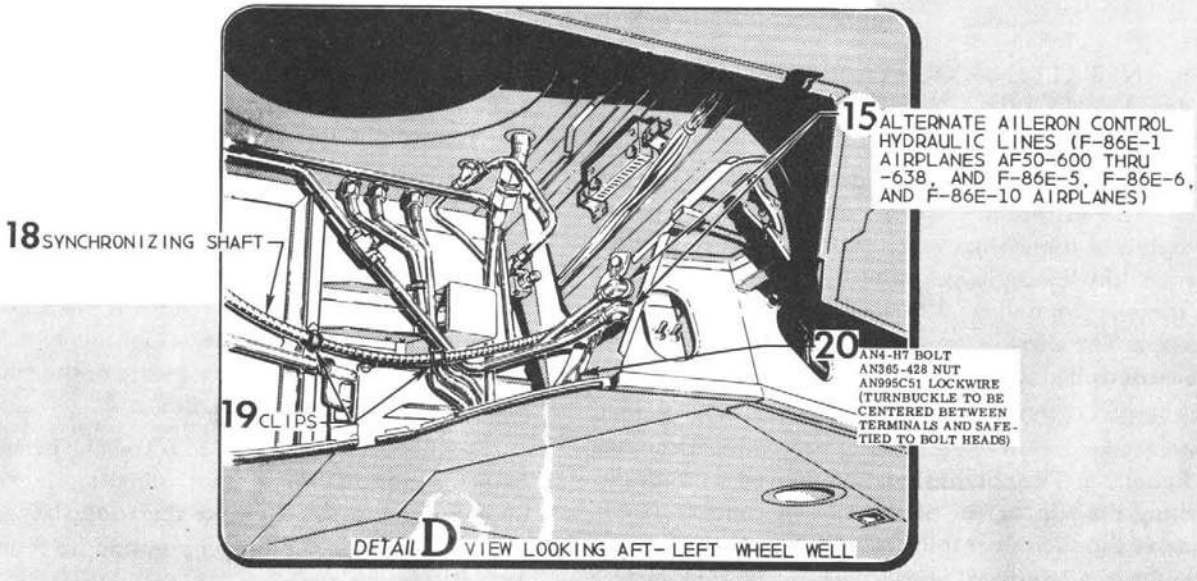


Figure 2-1. Installing Wing Outer Panel (Sheet 2 of 2)

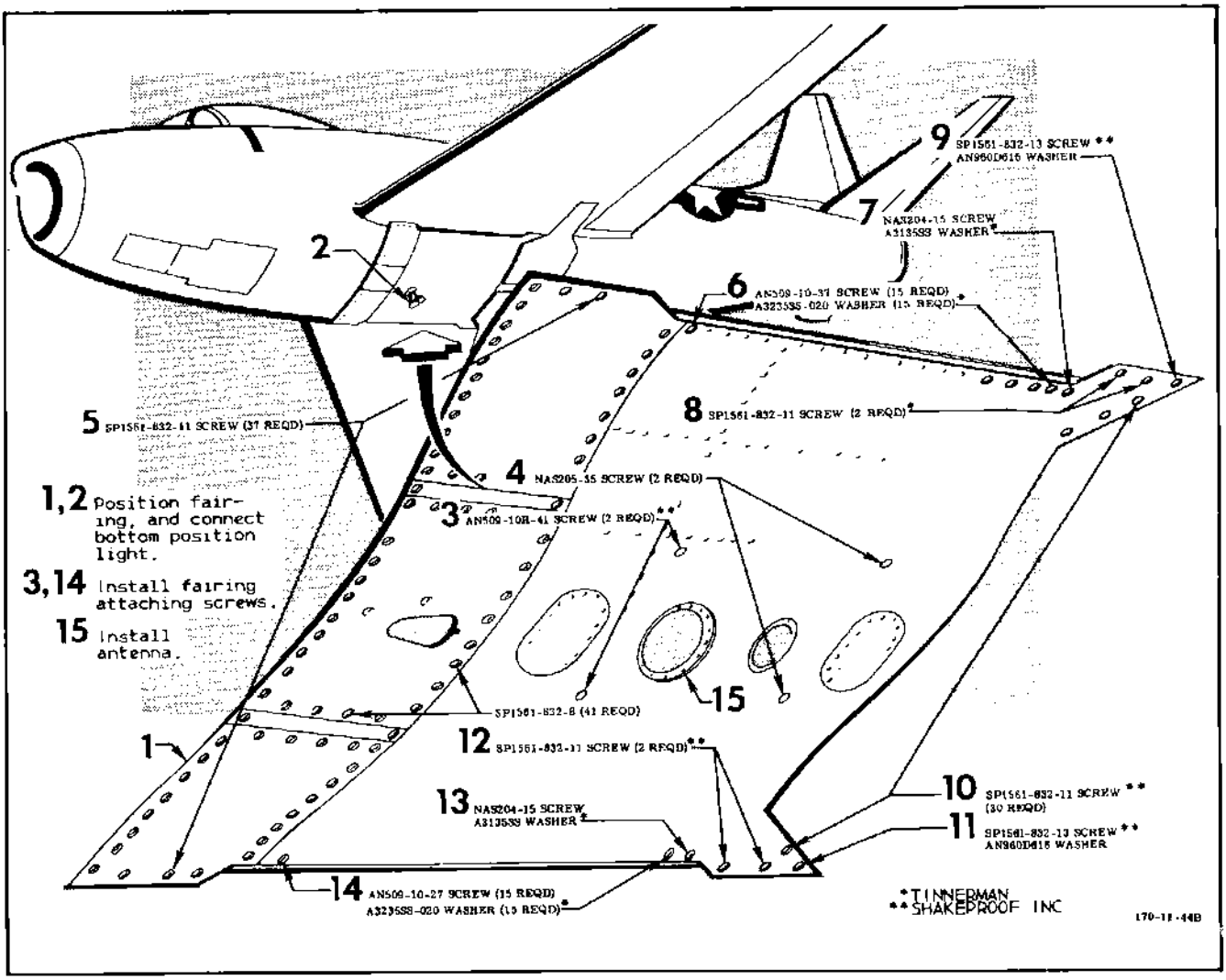


Figure 2-2. Installing Wing Center Section Bottom Fairing

2-19. INSTALLING OUTER PANEL LEADING EDGE AND WING TIP. See figure 2-3.

2-20. AILERONS.

2-21. The all-metal, statically and aerodynamically balanced ailerons are attached to the wing outer panels by means of three hinges each. A fabric seal is installed between the leading edge of the aileron and the aft spar of the wing outer panel to increase the aileron effectiveness. The ailerons are controlled hydraulically with cable-controlled valves.

2-22. REMOVING AILERONS. The parts and components referred to in the following procedure are shown in figure 2-5. The ailerons can be removed without disturbing the adjustment of the aileron control system. Remove the ailerons as follows:

a. Open aileron seal access door on bottom surface of wing, forward of aileron leading edge.

b. Loosen aileron seal retainer bolts on rear spar of wing outer panel enough to detach seal from seal retainer.

c. Disconnect aileron actuator at center hinge.

d. Disconnect aileron hinge bolts and remove aileron. Aileron weighs approximately 65 pounds.

2-23. INSTALLING AILERONS. See figure 2-5.

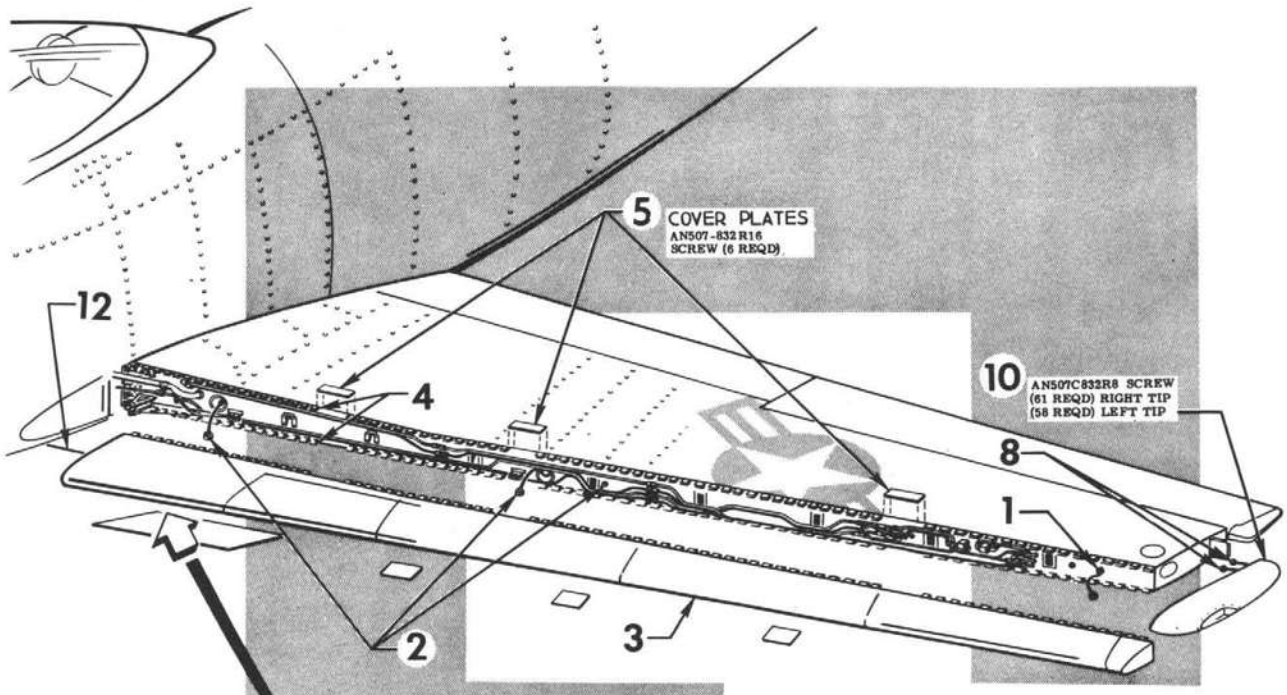
2-24. WING SLATS.

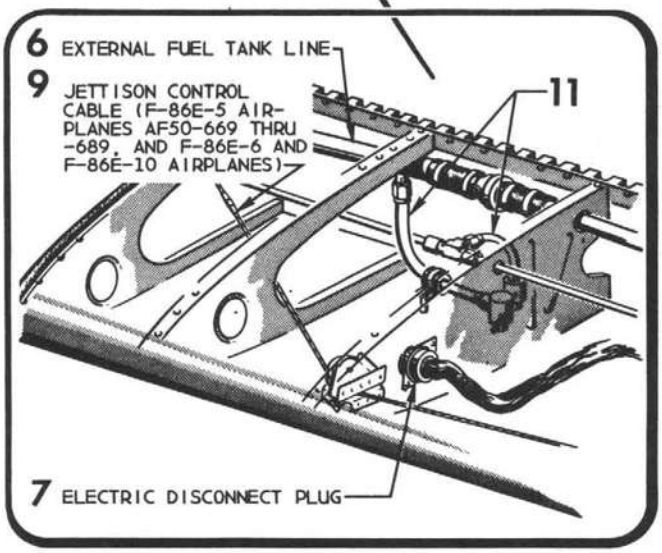
2-25. Four leading edge wing slats are installed on each wing outer panel. (See figure 2-6.) The slats are designed to extend and retract automatically, depending upon aerodynamic forces on the wing for motive power. A bolt and spacer through a fitting at the ends of each slat provide slat interconnection.

2-26. REMOVING WING SLATS. The parts and components referred to in the following procedure are shown in figure 2-6. Remove the wing slats as follows:

a. Remove the slat interconnecting bolts and spacers at end of each slat.

b. Remove the bolts that secure the slats to the slat tracks. Remove the slat as the respective attachment bolts are removed. The slat sections weigh approximately 22 pounds each.





1 With leading edge held in position just forward of the wing, connect remote compass transmitter wiring at the left wing only.

2 Connect fuel level indicator wiring and bomb release wire at center of front spar.

3 Place outer panel leading edge 1/2 inch below wing hinge; then raise leading edge up and align hinge pin holes.

4 Attach handle assembly to T307 hinge pin driving tool, and install hinge pins. *

5 Install hinge pin access cover plates.

6,7 Connect fuel lines and electrical plug at inboard end of leading edge.

NOTE: At right wing outboard end, install airspeed boom.*

8 Connect electrical wires to navigation light in wing tip.

9 Connect fuel tank jettison control cable.

10 Position wing tip and install attaching screws.

NOTE: Lubricate screws with anti-seize compound (Specification No. JAN-A-669).

11 Install and connect air pressure and fuel drain lines.

12 Install wing center section fairing forward access doors and leading edge inboard end access door.*

NOTE: Outer panel leading edge can be installed with or without wing slats installed, but must contain slat tracks.

*Refer to index for page number of applicable procedure.

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Figure 2-3. Installing Wing Outer Panel Leading Edge and Wing Tip

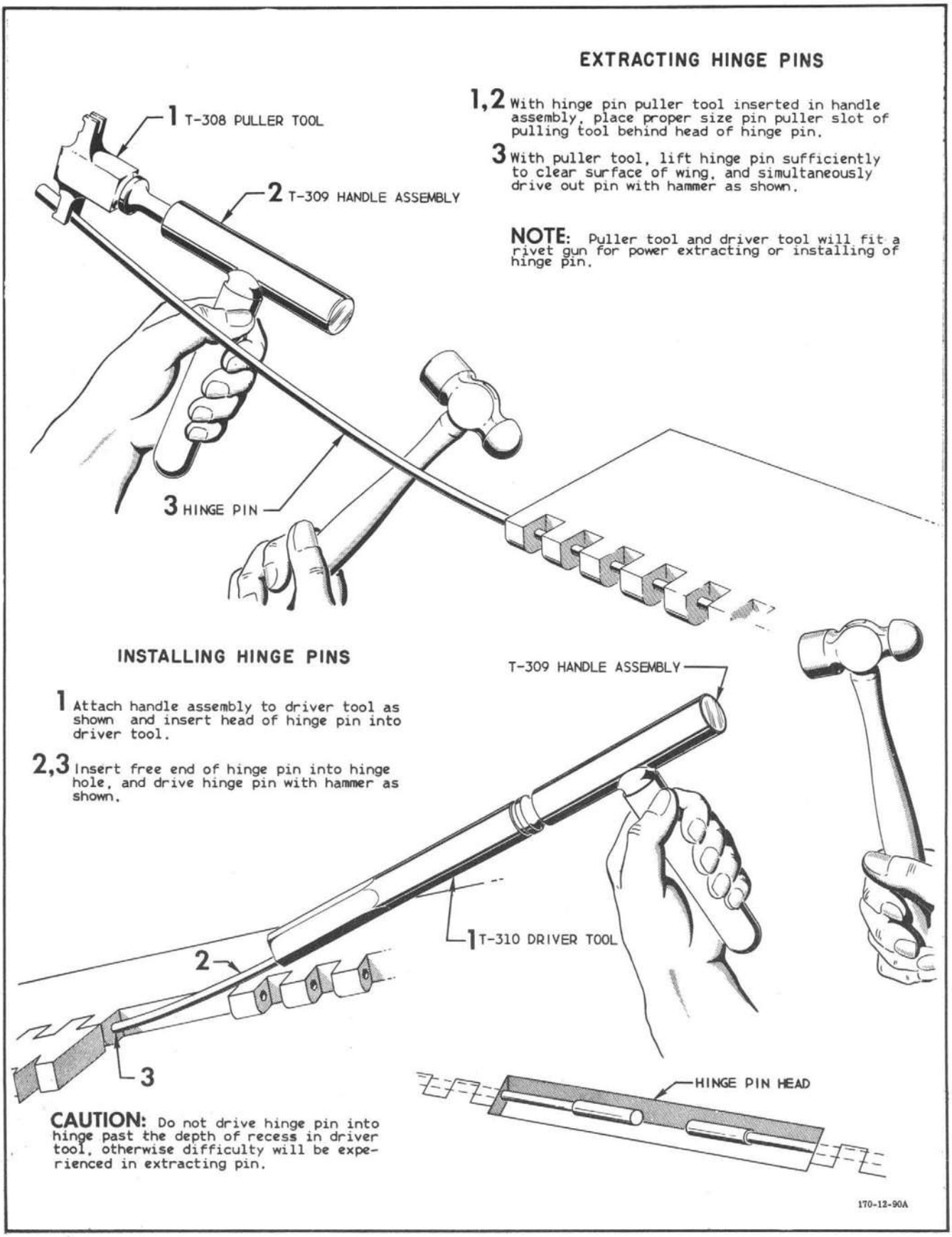


Figure 2-4. Installing and Extracting Hinge Pins

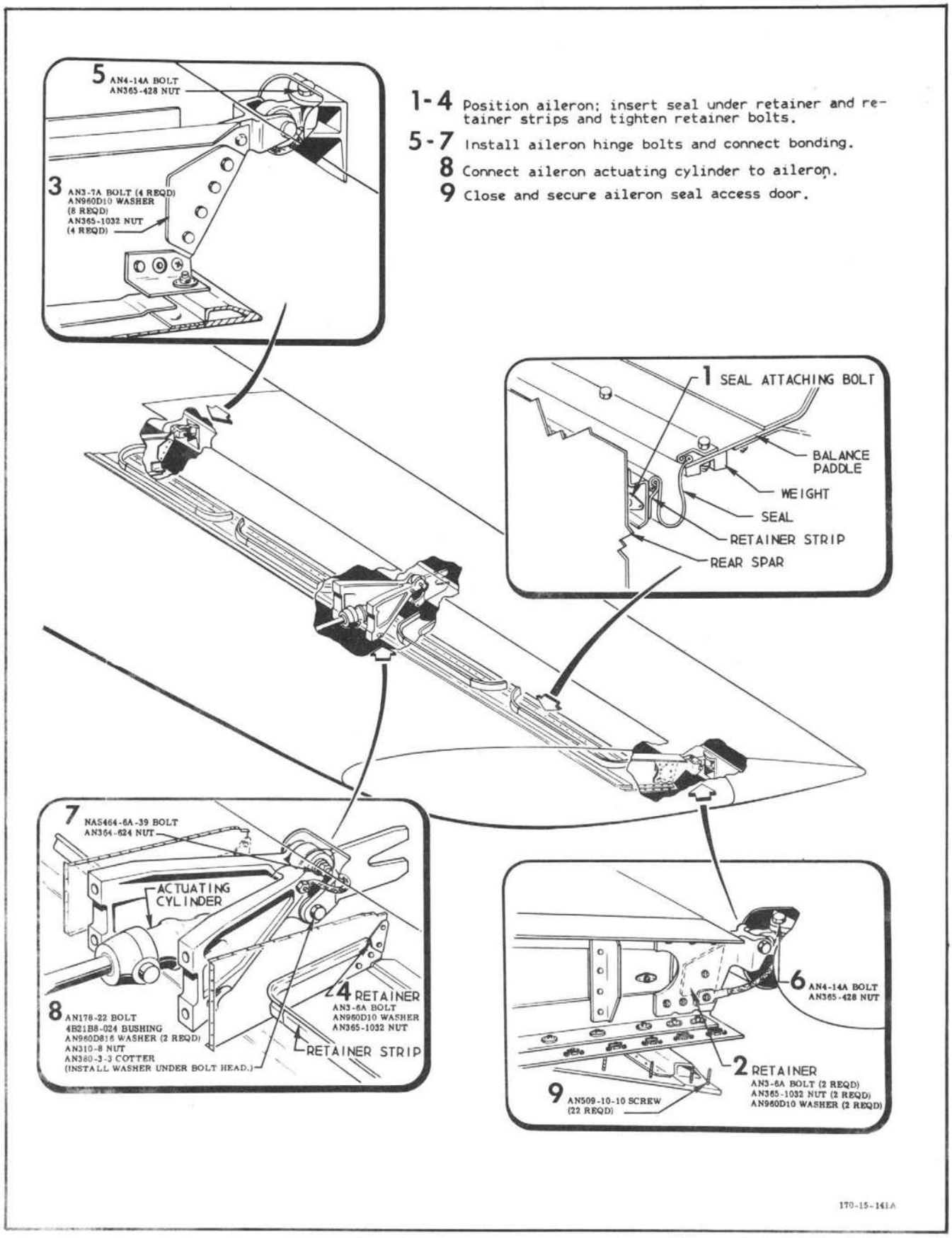


Figure 2-5. Installing Ailerons

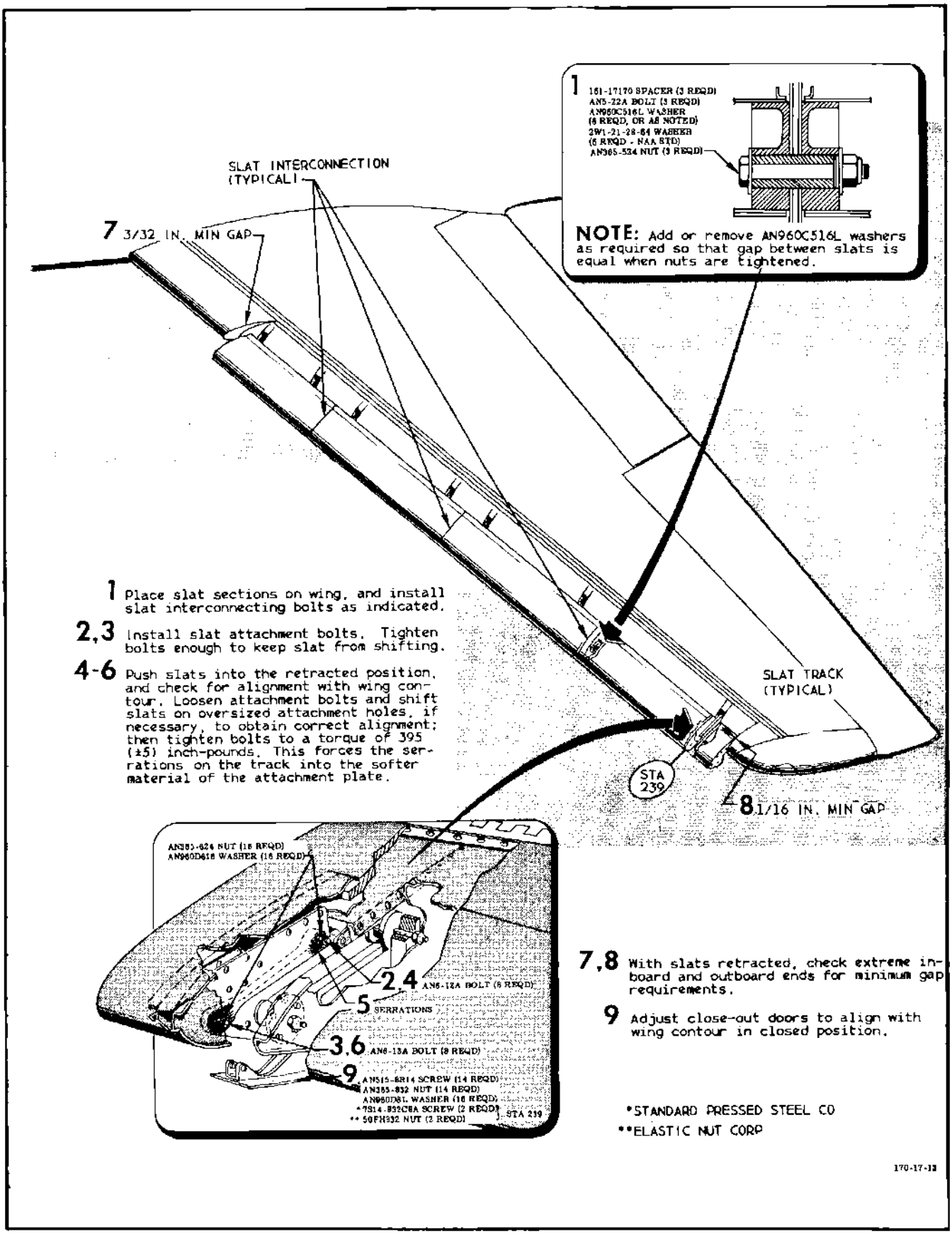


Figure 2-6. Installing and Adjusting Leading Edge Wing Slats

2-27. INSTALLING AND ADJUSTING WING SLATS. See figure 2-6.

2-28. WING FLAP SYSTEM.

2-29. The wing flap system (figures 2-7, 2-8, and 2-9) consists essentially of all-metal, slotted-type wing flaps, electric actuators, and an electrical control circuit. The flaps (figures 2-8 and 2-9) are located in the wing outer panel and extend spanwise from the fuselage to the aileron. A track and rollers near each end of the flap provide means of attachment and permit aft movement of the flaps during lowering. Each track has a stop screw at the aft end to prevent the flap from falling off the track when the actuator is disconnected. Flap down-travel is limited by an extend limit switch in each actuator. Flap up-travel is limited by mechanical stops at the forward end of the tracks. The flap control handle is located on the pilot's left console. On F-86E-1 through F-86E-10 Airplanes and F-86E-15 Airplanes AF51-12977 through -13019, the control switches are located in a cluster in the aft radio compartment and are actuated by means of cables between the handle and the switches. On F-86E-15 Airplanes AF51-13020 through -13069, the switches are located on the throttle quadrant and are actuated by direct contact of the flap control handle. The electrically reversible actuators (Air Associates M3320 or Hoover D-1010) are attached to the center of the respective flap panels and are mechanically interconnected by a flexible shaft to synchronize flap travel. Through the synchronizing shaft, each actuator is able to drive the opposite flap as well as the attached flap. Therefore, in case of electrical failure to one actuator, flap positioning (at a reduced speed) is still obtainable as long as the "D" leads are intact (figure 2-7). In case of mechanical failure of one actuator (resulting in a "frozen" actuator) or electrical failure to one actuator with an "open" in the "D" lead (figure 2-7), the inoperative actuator holds the other actuator through the synchronizing shaft so that neither flap can move. The flap electrical system is protected by two 35-ampere circuit breakers on the right circuit-breaker panel.

2-30. FUNCTION OF WING FLAP SYSTEM.

2-31. Movement of the flap control handle from "HOLD" to either "UP" or "DOWN" closes the respective control switches, and power from the primary bus energizes the actuators. (See figure 2-7.) The extend limit switch, incorporated in each actuator, opens and breaks the circuit to the extend field winding when the flaps reach full-down position of 38 (±1) degrees. A load limit switch in each actuator opens the circuit to the retract field winding when the flaps reach full up and the mechanical up-stops resist actuator operation. Operation against the up-stops results in a tension load of 800 (±100) inch-pounds on the Air Associates M3320 actuator or 500 (±100) pounds on the Hoover D-1010 actuator to preload the flaps in the streamlined position.

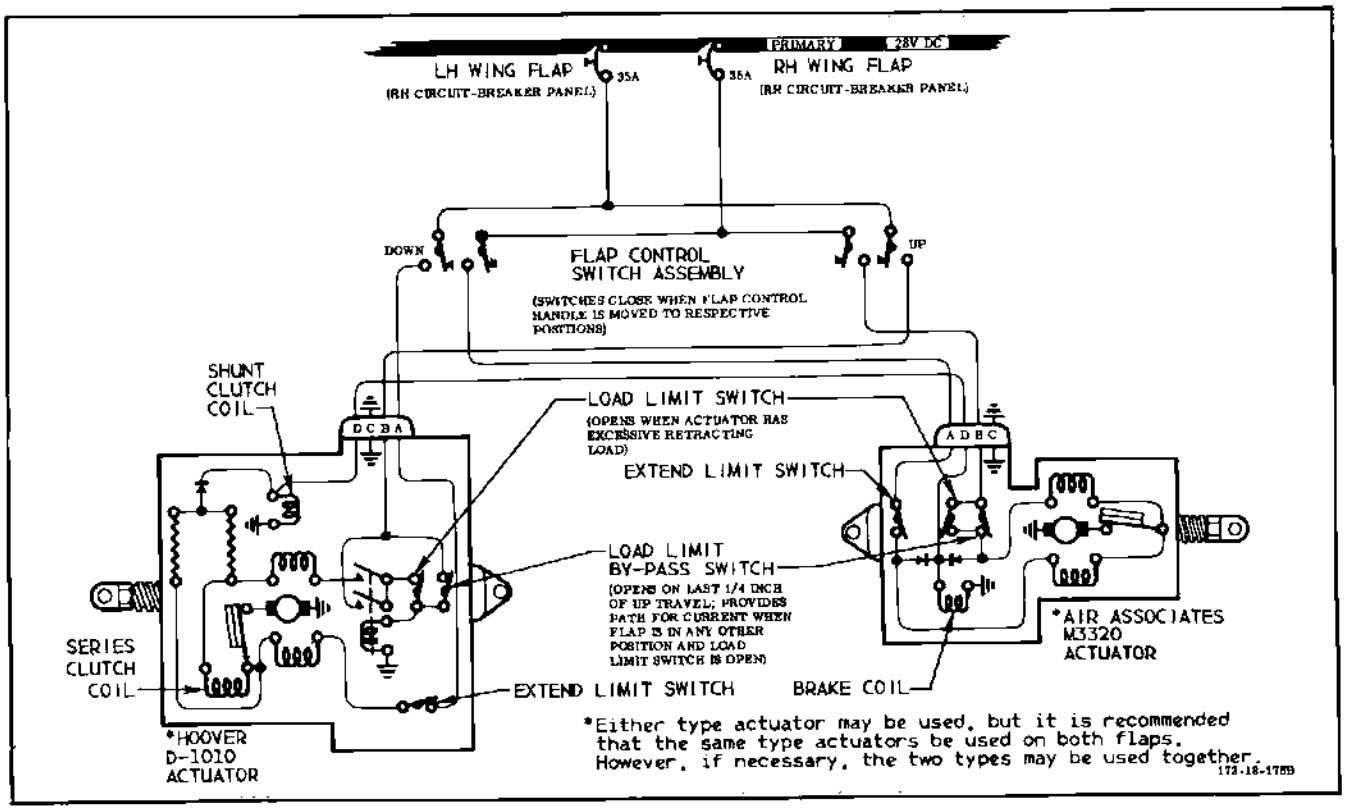


Figure 2-7. Wing Flap Control System

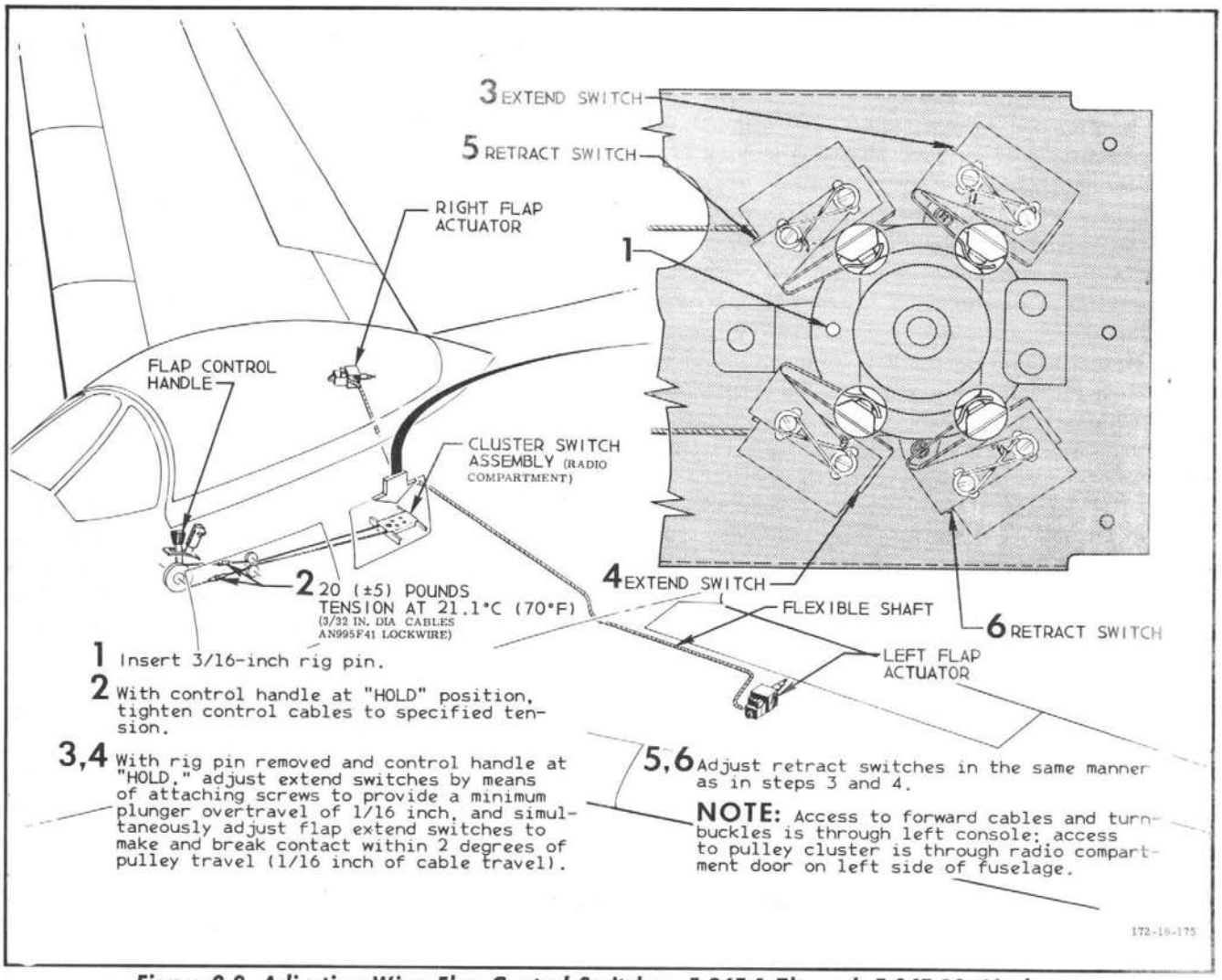


Figure 2-8. Adjusting Wing Flap Control Switches—F-86E-1 Through F-86E-10 Airplanes, and F-86E-15 Airplanes AF51-12977 Through -13019

A load limit by-pass switch in the actuators is wired in parallel with the load limit switch and is closed during all flap operation except the last fraction of up-travel. The load limit by-pass switch provides an alternate path for the current and permits flap raising when high retracting loads open the load limit switch. During ground operation with no load, flap operating time up or down is from 7 to 11 seconds.

2-32. TROUBLE SHOOTING WING FLAP SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Flaps not synchronized.	Synchronizing shaft improperly connected or broken.	
Flaps inoperative.	Open circuits to one or both actuators.	
Full down-travel unobtainable.	Down limit switch improperly adjusted.	
Flaps do not operate at full speed.	One actuator inoperative. One circuit breaker open.	Replace actuator.
Flaps not preloaded against up-stops.	Load limit switch improperly adjusted. Flap improperly adjusted. Actuators not synchronized.	Replace actuator or bench-adjust load limit switch.

TROUBLE	PROBABLE CAUSE	REMEDY
Actuator operates but output shaft does not rotate.	Faulty slip clutch.	Replace actuator.
Actuator does not operate.	Electrical power not available at unit. Open circuit in actuator.	 Replace actuator.
Actuator operates in only one direction or not to full travel of screw jack.	Open circuit in one of the field windings. Faulty limit switch. Faulty limit switch adjustment.	Replace actuator.

2-33. CHECKING WING FLAP SYSTEM.

2-34. Proper functioning of the wing flap system can be verified in the following manner:

a. With one circuit breaker open and synchronizing shaft disengaged at wheel well coupling, position control handle to check for full travel from full-up position to 38 (±1) degrees down (verified with a protractor); then return flap to full up to verify proper operation of actuator and correct adjustment of travel limit switch and mechanical stops.

b. Repeat step a. at opposite actuator. If system operates satisfactorily, connect synchronizing shaft.

c. If one actuator operates in one direction only and the other actuator operates normally, the cause may be one of the following: faulty or maladjusted control switch, faulty supply wire for one direction, or defective rectifier (paragraph 2-36) in either actuator.

d. If one actuator does not operate in either direction and the other operates normally, the cause may be one of the following: circuit breaker open, faulty wiring, or defective rectifier (paragraph 2-36) in either actuator (isolated by individual operation with flexible shaft disconnected).

e. If neither actuator operates system but one actuator moves slightly, winding up the flexible shaft, the trouble is caused by one of the following: locked motor brake on the inoperative actuator [checked by brake coil voltage (paragraph 2-38)], jammed screw jack on the inoperative actuator (checked by disconnecting actuator

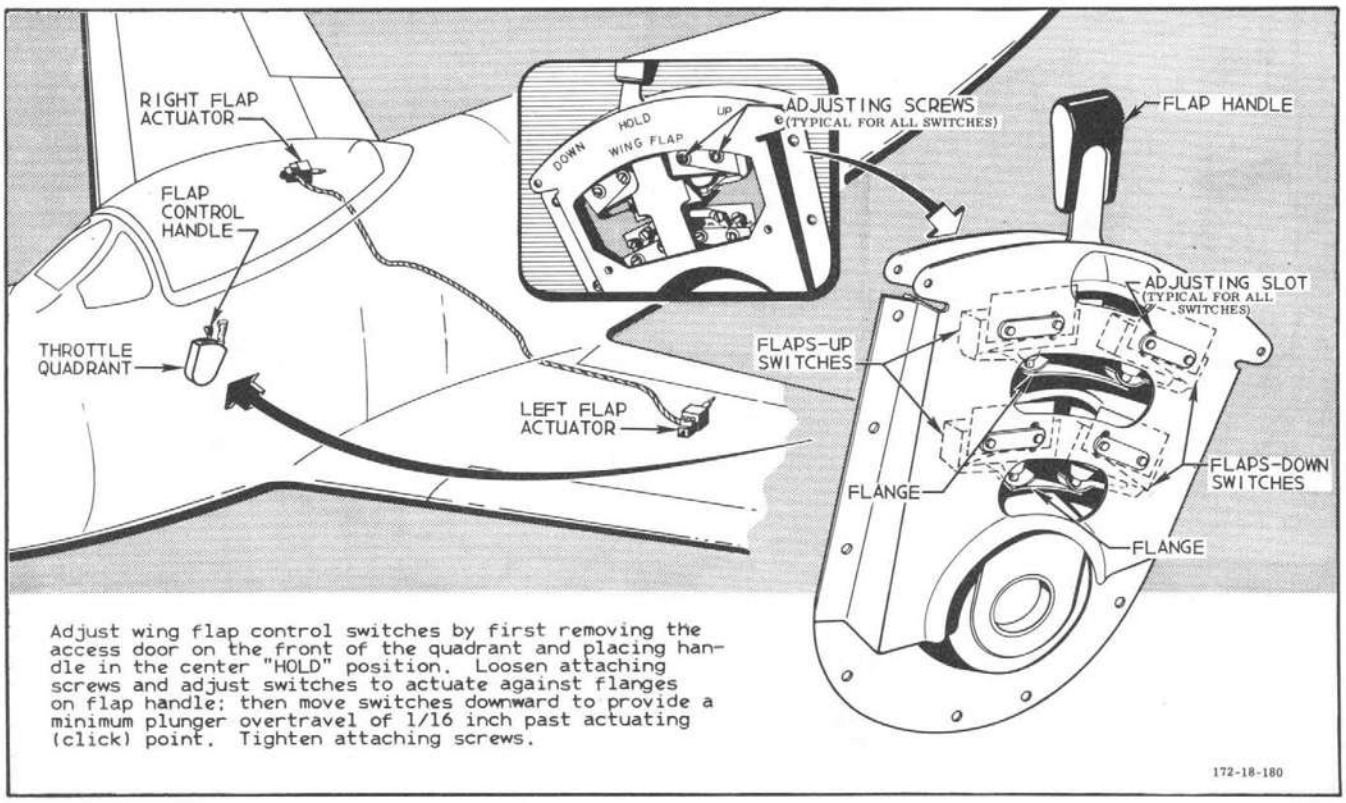


Figure 2-9. Adjusting Wing Flap Control Switches—F-86E-15 Airplanes AF51-13020 Through -13069

1 Attach flap tracks to wing and tighten bolts just enough to hold track in place.

NOTE: Each time flap tracks are adjusted or replaced, shims on each side of track must have a fresh surface to enable the serrations on the flap track to bite into it. Shims may be turned or new ones made of 24ST material.

2 Place flap on track and tighten flap roller lower bolts, securing rollers for both tracks to 160 to 190 inch-pounds.

3,4 Tighten upper (eccentric) bolts at upper flap rollers to approximately 150 inch-pounds; then back off bolts as necessary so that eccentric movement of bolts moves rollers to contact track at the thickest point +.005, -.000 inch. After proper adjustment of upper rollers is accomplished, tighten keeper bolts.

NOTE: Proper flap roller adjustments may be obtained by measuring thickness at a number of places along the track and setting upper and lower rollers to the longest dimension.

5 Adjust rub strips (at forward rollers of outboard track and rear rollers of inboard track) with shims to a normal gap of .000 to .020 inch between rub strips and track on each side of track. (Gap at inboard track is to be measured at forward edge of rub strip with flap fully retracted.)

NOTE: Lateral adjustment of the flaps may produce the following conditions (which are permissible): a zero gap on one side of the outboard track and a .040-inch maximum gap on the other side of the same track, with the flaps fully retracted; and a zero gap on one side of the inboard track and a .040-inch gap on the other side of the same track, with the flap fully retracted. A minimum gap of .020 inch on one side and a maximum gap of .080 inch on the other side of the inboard track is permissible, provided one of the outboard rub strips on the same flap is contacting one side of the outboard track with the flap fully extended. If these conditions cannot be met, the tracks may be deflected at the trailing edge 11/8-inch maximum at the outboard track and 1/16-inch maximum at inboard track) for lateral alignment when adjusting rub strips.

6 Install screws and washers on aft end of each track. These serve as stops to prevent flaps from falling from track when actuating strut is disconnected, but do not act as flap travel stops.

7 Raise flap to wing contour, and check for alignment with movable surface contour fixture at wing station 102 (inboard flap track). After flap track is aligned correctly, tighten track attachment bolts to 1100 inch-pounds so that serrations on the track are forced into the softer material of the shims.

CAUTION: Be sure tracks are aligned with each other; this is to prevent high racking loads, which will twist flap structure. Maximum flap trailing edge misalignment allowable is 1/8 inch from theoretical wing trailing edge. Maximum lateral variation of flaps allowable is 3/32 inch. There should be 5/16 (±1/16) inch gap between flap and aileron with flap up and aileron in a neutral position.

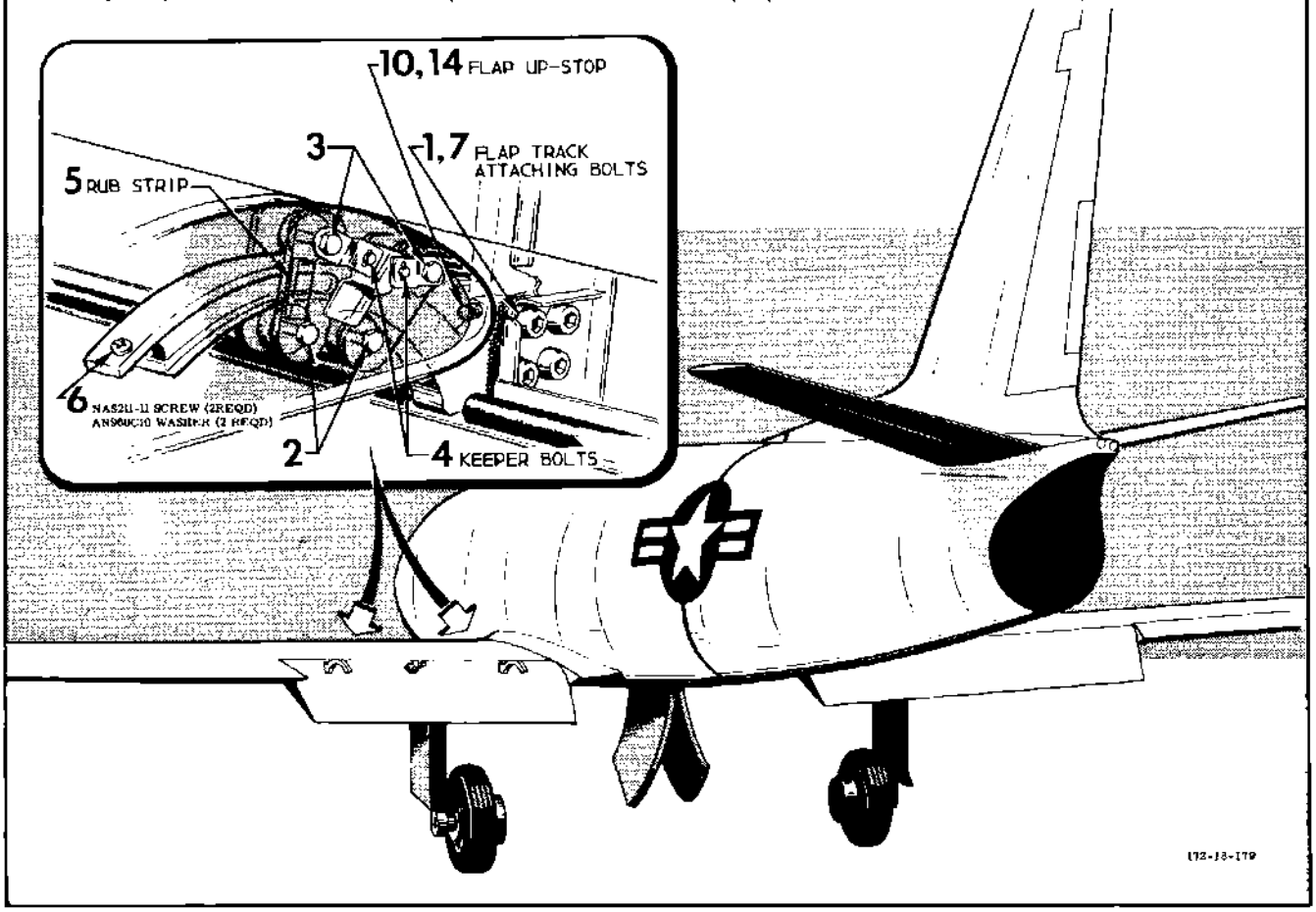


Figure 2-10. Installing and Adjusting Wing Flaps (Sheet 1 of 2)

8,9 Install actuator in wing and connect electrical connector.

CAUTION: Electrically inactivate the opposite flap while rigging the individual actuators.

10-12 With flap up-stops turned in as far as possible, operate the actuator to full flap-up position. Adjust actuator end fitting until flap trailing edge is 1/8 (+1/4, -0) inch above rigged position.*

13 Connect actuator end fitting.

14 Electrically lower flap for access and adjust up-stops so that flap stops at the desired position. (Desired position is within 1/8 inch of theoretical wing trailing edge and not more than 3/16 inch out of alignment with aileron trailing edge.)

15 Operate the flap actuator in the retract direction until motor stops; observe screw-jack end fitting and actuator. If screw jack is bottoming against actuator internal stop, a sharp crack may be heard, and the screw-jack end fitting will spring back. This may be corrected by shortening end fitting in 1/32-inch increments until actuator stops smoothly and quietly.
If screw jack was not bottoming, lengthen end fitting until screw jack bottoms; then adjust in 1/32-inch increments until actuator stops smoothly and quietly.

16 Extend flap full down, and adjust the extended position limit switch to actuate when flap is 38 (±1) degrees down.

17,18 With flap fully extended, remove end fitting bolt and check available counterclockwise travel of screw jack. This must not be less than one-half turn. Revise extended limit switch setting, if necessary, to retain one-half turn.

19 Return screw jack to original position and connect actuator to flap.

NOTE: Adjust each flap individually, if necessary.

20 Electrically actuate both flaps to the full up position and connect synchronizing shaft.

NOTE: When checking flap operation on the ground with only one actuator driving both flaps, the absence of air loads may cause flaps to stop with trailing edge approximately 3/4 inch below contour. During travel, flaps must be within 4 degrees of each other. The ground operating time of the flaps, with no load up or down, is from 7 to 11 seconds.

21 If for any reason the flap trailing edge adjustment of either flap is altered, repeat steps 15 through 19.

* Refer to index for page number of illustration showing proper use of contour fixture.

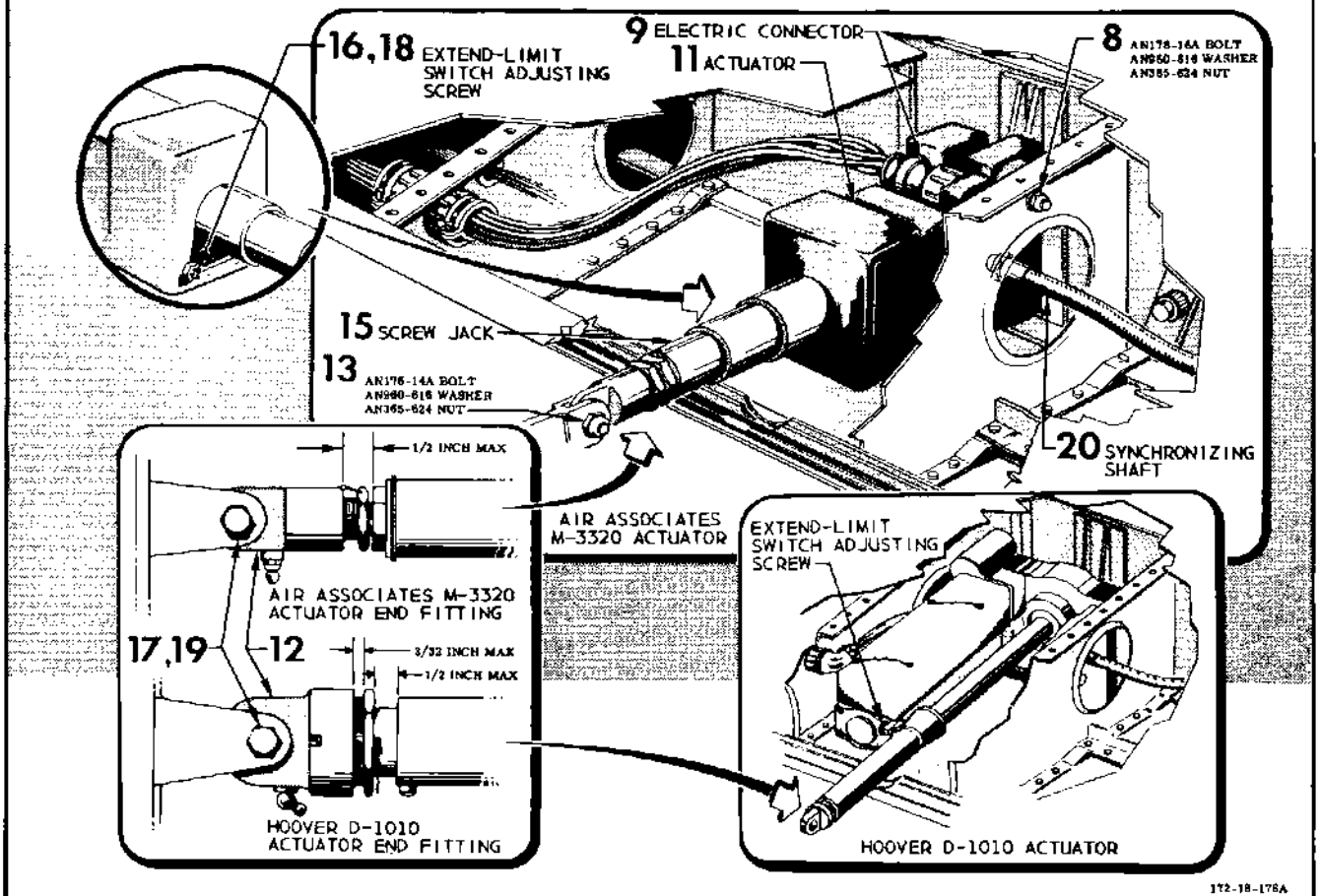


Figure 2-10. Installing and Adjusting Wing Flaps (Sheet 2 of 2)

from flap and manually turning screw jack one full stroke), or discontinuity in pin "D" connecting wire.

2-35. CHECKING WING FLAP ACTUATOR RECTIFIER.

2-36. To check the actuator rectifier, disconnect electrical power (by pulling the circuit breaker) and connect ohmmeter to pin "D" (positive lead to "D," negative lead to structure). If all wiring is connected, the resistance should be from 25 to 40 ohms. When only one actuator is checked with electrical connector disconnected, the resistance should be from 65 to 80 ohms. If the system checks too low, disconnect the "D" lead at the wheel well and check each lead individually. A low resistance indicates a bad rectifier or faulty wiring.

2-37. CHECKING WING FLAP ACTUATOR BRAKE COIL VOLTAGE.

2-38. When the system is operating normally on both actuators, the voltage on pin "D" should be approximately 2 volts less than supply voltage. When the system is operating on only one actuator, the brake coil voltage should be approximately 4 volts less than the supply voltage. A voltage lower than this represents either faulty wiring, defective brake coil, or a faulty rectifier. Any of these conditions would overload the rectifier system and cause excessive voltage drop.

2-39. REMOVING WING FLAPS.

2-40. The parts and components referred to in the following procedure are identified in figure 2-10. Remove the individual flap panels as follows:

Note

If the same flap is reinstalled, the original adjustment of the wing flap system may be left intact if the setting of the tracks, arrangement of track shims, actuator adjustments, and end fitting position are not disturbed.

a. With flaps partially lowered, disconnect actuator at flap, being careful not to rotate the actuator end fitting.

Note

If removing left flap, disconnect the hydraulic drain tube at flap.

b. With flap supported, remove roller stop screw at the end of each respective track; then guide flap off track. Each flap panel weighs approximately 30 pounds.

2-41. INSTALLING AND ADJUSTING WING FLAPS.

2-42. See figure 2-10.

2-43. EMPENNAGE.

2-44. The empennage consists of a vertical stabilizer, rudder, horizontal stabilizer, and two elevators. The 35-degree swept-back vertical stabilizer is all-metal, with the exception of part of the tip, which is plastic. The metal part of the tip is a combination uhf and vhf antenna. The rudder is statically and dynamically balanced and is controlled by a conventional cable system. It incorporates an all-metal, controllable trim tab at the trailing edge. The horizontal stabilizer consists of a left and a right half, permanently interconnected by two crossbeams. It has a 35-degree sweepback and a 10-degree dihedral, and is actuated hydraulically to provide longitudinal control of the airplane. The elevators are statically and dynamically balanced, and are controlled by a linkage arrangement from the horizontal stabilizer. They depend upon the movement of the hydraulically operated horizontal stabilizer for motive power. The linkage mechanism for actuating the elevators is attached to the stabilizer rear crossbeams. The elevators can be removed or installed without disturbing the adjustment of the elevator system. Fairings are used to streamline the vertical and horizontal stabilizers with the fuselage.

2-45. REMOVING VERTICAL STABILIZER.

2-46. The parts and components referred to in the following procedure are identified in figure 2-12. Remove the vertical stabilizer as follows:

Note

It is not necessary to remove the rudder when removing the vertical stabilizer; however, if the rudder is to be removed subsequently, it would facilitate the removal of the vertical stabilizer to remove the rudder first.

a. Exhaust hydraulic system. (Refer to paragraphs 1-67 and 1-68.)

b. Remove fuselage rear section. (Refer to paragraph 2-150.)

c. Remove fairings from base of vertical stabilizer.

d. Uncouple antenna cable connector plug at leading edge of vertical stabilizer.

e. Disconnect rudder trim tab wiring clips at rudder quadrant and deck (left side).

f. Disconnect electrical wiring for rudder trim tab actuator at rudder quadrant and disconnect wiring at navigation light.

g. On F-86E-15 Airplanes, disconnect electrical wiring at horizontal stabilizer trim bungee actuator.

h. Disconnect and remove hydraulic lines that run through front and rear spar fittings of the vertical stabilizer.

i. Remove bolts that hold fairing formers and dust shields to vertical stabilizer.

j. Disconnect rudder control cables at rudder quadrant and unstring cables from pulleys in vertical stabilizer.

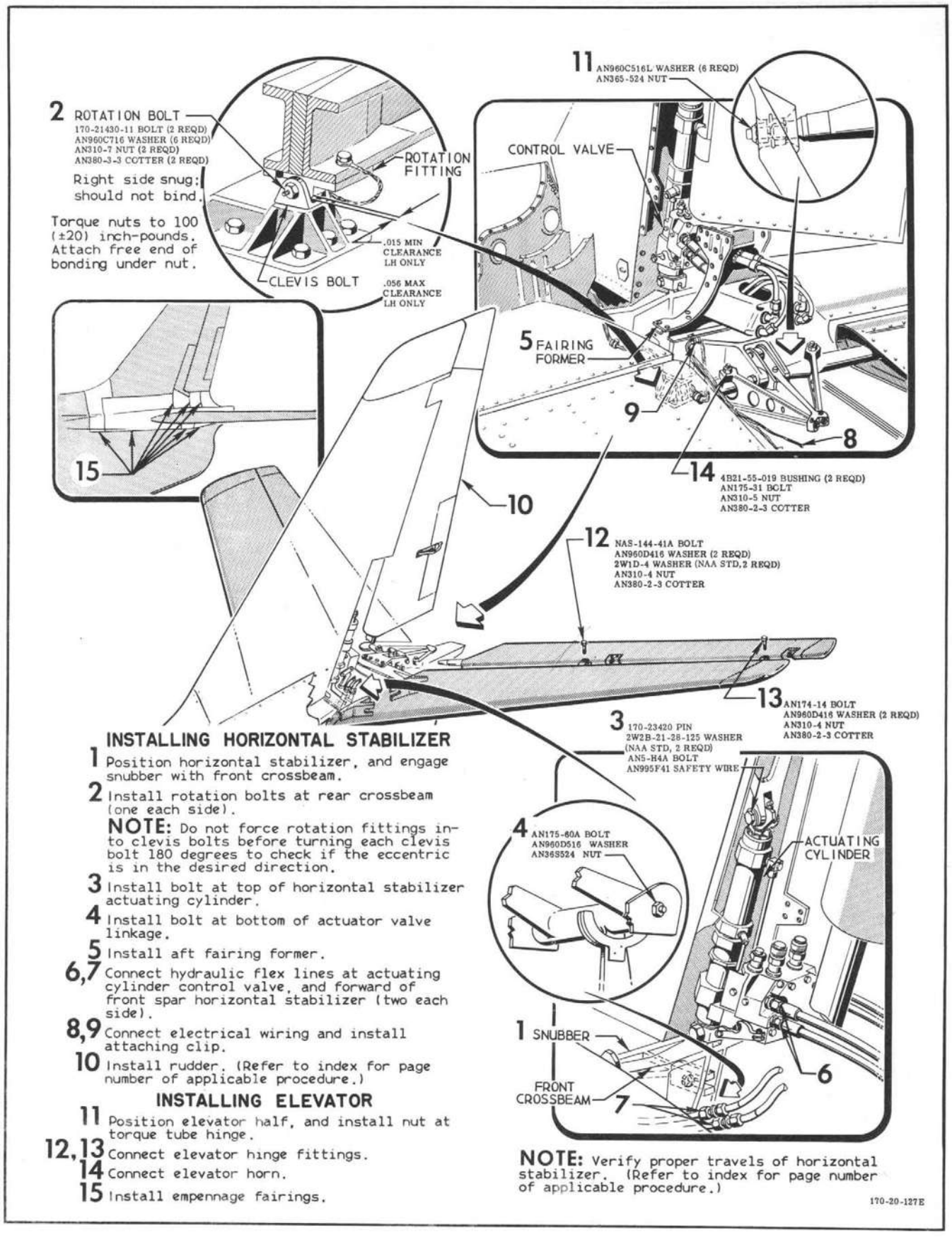
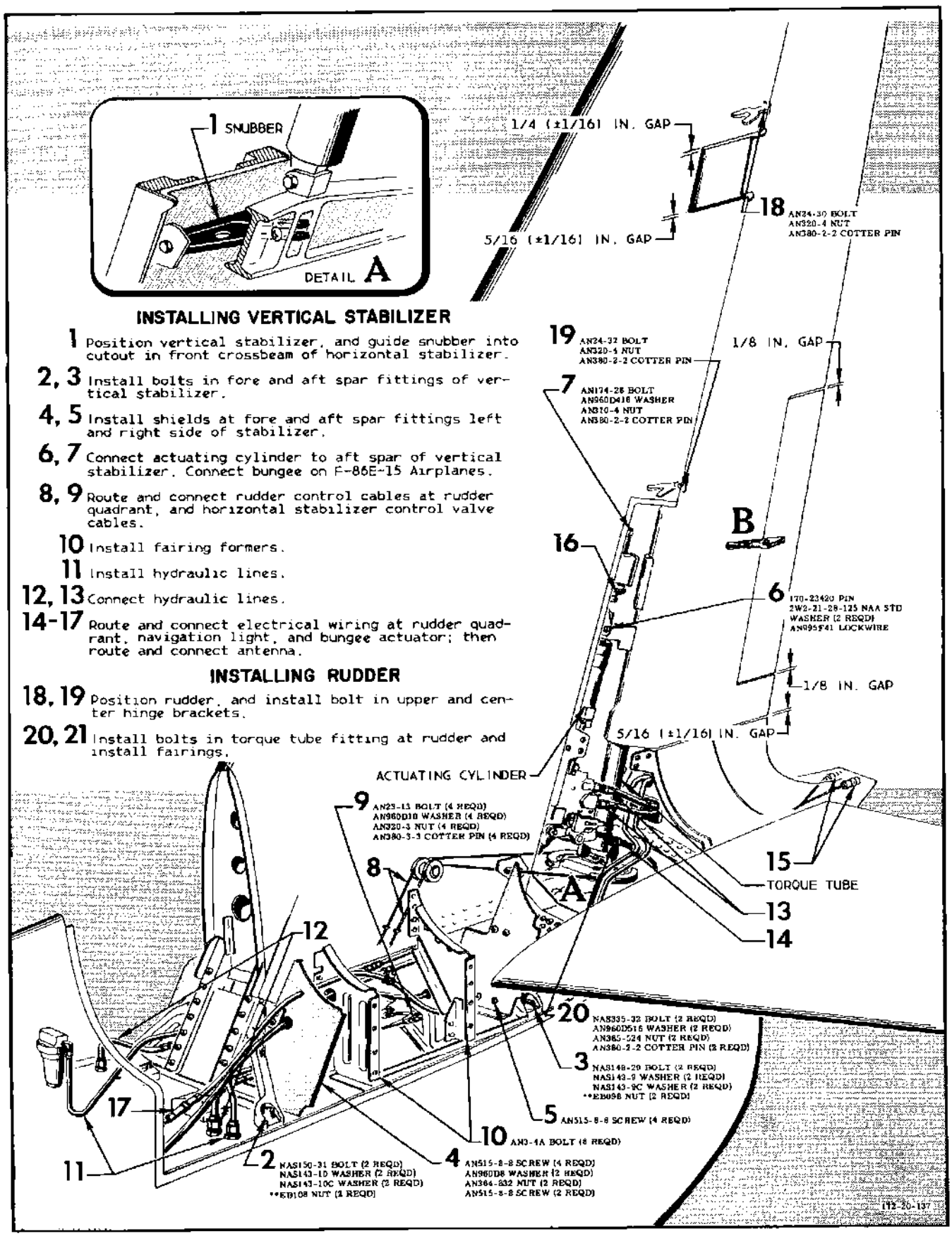


Figure 2-11. Installing Horizontal Stabilizer and Elevator



INSTALLING VERTICAL STABILIZER

1 Position vertical stabilizer, and guide snubber into cutout in front crossbeam of horizontal stabilizer.

2, 3 Install bolts in fore and aft spar fittings of vertical stabilizer.

4, 5 Install shields at fore and aft spar fittings left and right side of stabilizer.

6, 7 Connect actuating cylinder to aft spar of vertical stabilizer. Connect bungee on F-86E-15 Airplanes.

8, 9 Route and connect rudder control cables at rudder quadrant, and horizontal stabilizer control valve cables.

10 Install fairing formers.

11 Install hydraulic lines.

12, 13 Connect hydraulic lines.

14-17 Route and connect electrical wiring at rudder quadrant, navigation light, and bungee actuator; then route and connect antenna.

INSTALLING RUDDER

18, 19 Position rudder, and install bolt in upper and center hinge brackets.

20, 21 Install bolts in torque tube fitting at rudder and install fairings.

Figure 2-12. Installing Vertical Stabilizer, Rudder, and Rudder Trim Tab (Sheet 1 of 2)

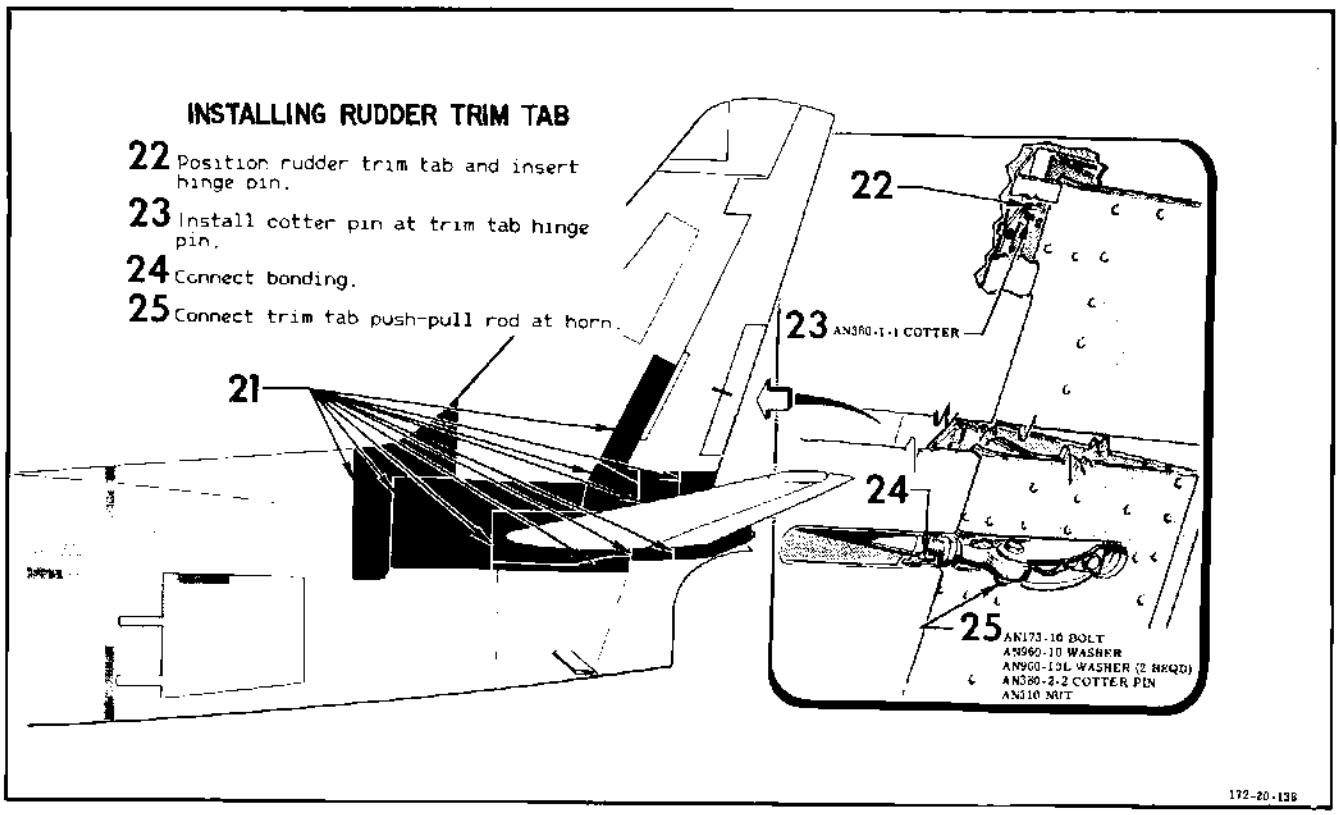


Figure 2-12. Installing Vertical Stabilizer, Rudder, and Rudder Trim Tab (Sheet 2 of 2)

k. Disconnect horizontal stabilizer control valve control cables at quadrant and unstring cables from front spar of vertical stabilizer.

l. Remove bolt that connects top of horizontal stabilizer actuator to aft spar of vertical stabilizer.

m. Remove rudder. (Refer to paragraph 2-50.)

n. Remove the four bolts that attach vertical stabilizer spars to fuselage deck.

o. Remove stabilizer by raising and guiding snubber out of horizontal stabilizer front crossbeam. Stabilizer weighs approximately 100 pounds.

2-47. INSTALLING VERTICAL STABILIZER.

2-48. See figure 2-12.

2-49. REMOVING RUDDER.

2-50. The parts and components referred to in the following procedure are identified in figure 2-12. Remove the rudder as follows:

a. Disconnect electrical plug at bottom of torque tube.

b. Remove the two bolts that hold torque tube to quadrant.

c. Remove hinge bracket bolts at upper and lower rudder hinges, and remove rudder. Rudder weighs 45 pounds.

2-51. REMOVING RUDDER TRIM TAB.

2-52. The parts and components referred to in the following procedure are identified in figure 2-12. Remove the rudder trim tab as follows:

a. Remove bolt that connects actuator push-pull rod to trim tab horn.

b. Deflect trim tab to the extreme right and remove cotter pin that secures hinge pin.

c. Extract hinge pin; then remove trim tab.

2-53. INSTALLING RUDDER AND RUDDER TRIM TAB.

2-54. See figure 2-12.

2-55. REMOVING HORIZONTAL STABILIZER.

2-56. The parts and components referred to in the following procedure are identified in figure 2-11. Remove the horizontal stabilizer as follows:

Note

Horizontal stabilizer can be removed with or without elevators installed.

a. Exhaust hydraulic system. (Refer to paragraphs 1-67 and 1-68.)

b. Remove all empennage fairings.

c. Remove rudder. (Refer to paragraph 2-50.)

d. Disconnect electrical wiring and attaching clips at aft fairing former.

e. Disconnect and cap hydraulic lines at connections forward of rear crossbeam.

f. Disconnect and cap hydraulic flexible lines at actuating cylinder control valve.

g. Disconnect aft fairing former at fuselage deck and remove former.

h. Remove bolt at bottom of actuator valve linkage.

i. Disconnect and remove horizontal stabilizer actuating cylinder assembly.

Note

If the same horizontal stabilizer is being reinstalled, it is not necessary to perform the foregoing steps f. and i., but the actuator must be disconnected at the top only and removed as a unit with the horizontal stabilizer.

j. With the horizontal stabilizer supported, remove rotation bolts at aft crossbeam attaching brackets.

k. Lift horizontal stabilizer and simultaneously guide snubber out of cutout in front of crossbeam. The horizontal stabilizer weighs approximately 95 pounds.

2-57. INSTALLING HORIZONTAL STABILIZER.

2-58. See figure 2-11.

2-59. CHECKING ELEVATORS.

2-60. To ensure firm attachment of the elevators to the elevator control system, proceed as follows:

a. Stand in back of the airplane and face the elevators. Grasp one elevator trailing edge with the left hand and the other with the right hand. Force one elevator up and the other down and then reverse the procedure. If any movement between the elevators can be detected, the cause must be determined prior to further flight.

Note

If the movement results from an accumulation of inherent bearing-race tolerances of the top and bottom elevator horn to torque tube fitting bearings and does not exceed 1/16 inch (measured at the trailing edge of the elevators), the airplane can remain in service.

b. In all cases where movement is found to be the result of defective, worn, or loose parts, correct the condition prior to flight.

c. Replace any deficient or damaged parts found during this check.

2-61. REMOVING ELEVATORS.

2-62. The parts and components referred to in the following procedure are identified in figure 2-11. Remove the elevators as follows:

a. Remove bolt that attaches elevator horn to torque tube.

b. With the respective elevator supported, remove nut at inboard end of torque tube.

c. Remove elevator hinge fitting bolt at outboard hinge, then at inboard hinge, and remove respective elevator, which weighs approximately 25 pounds.

2-63. INSTALLING ELEVATORS.

2-64. See figure 2-11.

2-65. SURFACE CONTROL SYSTEMS.

2-66. The surface controls consist of a conventional rudder system for directional control, a hydraulically operated horizontal stabilizer for longitudinal control, and hydraulically operated ailerons for lateral control. The horizontal stabilizer consists of two sections, a forward control section and an aft section (elevator). The aft section, through mechanical linkage to the forward section, moves in a manner similar to a reverse boost tab. (Refer to paragraph 2-77.) Normal and alternate hydraulic power is provided for the actuation of the ailerons and horizontal stabilizer. Movement of the control stick positions a dual control valve, which directs hydraulic pressure to the cylinder to move the surface. When control movement is stopped, a hydraulic lock is maintained in the cylinders. This lock prevents external forces from moving the surfaces. Since the controls are irreversible, external forces on the surfaces are not transmitted to the pilot's control stick. For this reason, artificial feel is provided. Aileron and horizontal stabilizer system stick loads are simulated by bungees, which load the stick in proportion to surface deflection. An electrically actuated trim tab installed on the rudder provides directional trim. There are no trim tabs on the horizontal stabilizer or ailerons. To trim control stick forces in the aileron and horizontal stabilizer systems, the feel bungee no-load (neutral) position is changed to correspond to that of the control stick, removing the stick load. A rudder gust lock is provided to mechanically lock the rudder in neutral. (See figure 1-10.) The ailerons and horizontal stabilizer, being irreversible, do not require a mechanical lock.

2-67. TROUBLE SHOOTING SURFACE CONTROL SYSTEMS.

TROUBLE	PROBABLE CAUSE	REMEDY
Binding orrubbing control cables.	Pulley bracket out of line.	Check system. Straighten or replace pulley bracket.
	Insufficient lubrication.	
	Cables incorrectly routed.	
	Equipment interfering.	Adjust equipment to provide clearances.

TROUBLE	PROBABLE CAUSE	REMEDY
	Cable off pulley. Defective or dry ball bearing.	Check system; replace pulley if worn. Check alignment of pulley. Check cable guards. Replace bearing.
Obstructed full movement.	Control surface or control stick stops incorrectly set. Interference from ice and other objects.	Adjust stops or rig power cylinders correctly into system. Check system and inspect openings between fixed and movable surfaces.
Rudder travel in excess of limits.	Control stops set incorrectly.	
Surface travel incorrect.	Actuating cylinder length incorrectly set.	
Hydraulic power system chatter.	Air in system. Faulty control valves. Relief valves functioning improperly or restricted with foreign matter.	
Hydraulic power system pressure less than required.	Relief valves faulty. Pumps faulty. Pressure switches faulty. Faulty by-pass or transfer valve.	
Surfaces do not move.	Cable off pulley. Insufficient lubrication. Defective or dry ball bearing. Incorrect rigging. Equipment interfering. Icing conditions.	Check system and replace pulley if worn. Check alignment of pulley. Check cable guard. Replace or lubricate bearing.
Aileron, elevator, or rudder flutter.	Play in system. Incorrect rigging. Excessive play caused by worn or undersize bolts at stick mechanism.	Check and replace faulty unit.
Rudder trim tab flutter.	Worn hinges. Worn parts in actuator. Check for irregularities in airfoil forward of unit.	Replace tab. Replace worn parts or actuator.

2-68. MOVABLE SURFACE CONTOUR FIXTURE.

2-69. During adjustment of the wing flap system or primary surface control systems, a locally fabricated fixture may be utilized to determine trailing edge neutral of the respective surfaces. Dimensions and details necessary for construction of the fixture are shown on figure 2-15.

2-70. AILERON CONTROL SYSTEM.

2-71. The ailerons are controlled by push-pull tubes, sectors, cables, dual control valves, and tandem

SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES

	DEGREES	INCHES	REFERENCE POINT	TOLERANCE DEGREES	TOLERANCE INCHES
AILERON-UP	15	5-15/16	TE AT INBD END	±1/2	±3/16
AILERON-DOWN	15	5-15/16	TE AT INBD END	±1/2	±3/16
ELEVATOR-UP (FROM STREAMLINE WITH STABILIZER)	21	3-29/32	TE AT INBD END	±2	±3/8
ELEVATOR-DOWN (FROM STREAMLINE WITH STABILIZER)	2°50'	17/32	TE AT INBD END	±1/2	±3/32
RUDDER-RIGHT & LEFT	25°30'	8-17/32	TE AT LOWER END	+0,-1/2	+0,-5/32
STABILIZER-UP (FROM NEUTRAL POSITION)	6	7-9/32	INDEX HOLES	±1/2	±11/64
STABILIZER-DOWN (FROM NEUTRAL POSITION)	10	1-3/4	INDEX HOLES	±1/2,-0	+11/64,-0
RUDDER TRIM TAB - RIGHT & LEFT	15	1-1/8	TE AT BOTTOM OF CUTOUT	±1	±1/16

CONTROL SURFACE FREE PLAY

AILERON	*3/32 INCH AT TE
ELEVATOR	*3/32 INCH AT TE (at neutral)
RUDDER	*3/32 INCH AT TE

*MAXIMUM ALLOWABLE

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Figure 2-13. Surface Control Settings and Ranges of Movement

actuating cylinders. (See figure 2-16.) Two independent hydraulic power systems, normal and alternate, are provided to position the ailerons. Movement of the control stick positions the control valve arm. As the actuating cylinder and control valve move, the control valve arm is repositioned, shutting off the flow of hydraulic fluid when the desired position of the aileron is reached. (Refer to paragraph 2-90.) The actuating cylinders, located aft of the wing front spar and attached to the middle of each aileron, limit the degree of aileron travel. An electrically controlled artificial feel and trim system is provided. (Refer to paragraph 2-74.) An artificial feel bungee, located in the wing center section, is used to produce simulated stick forces.

2-72. ADJUSTING AILERON CONTROL SYSTEM. See figure 2-16.

2-73. AILERON ARTIFICIAL FEEL AND TRIM SYSTEM.

2-74. The aileron artificial feel and trim system (figure 2-17) consists of a bungee, an actuator, trim switches, and a neutral indicating light. A normal-operation switch is incorporated in the Type B-8 stick grip. A switch on the left console is used as an alternate in case of failure in

NOTE:

USE .047 ZINC COATED STEEL WIRE

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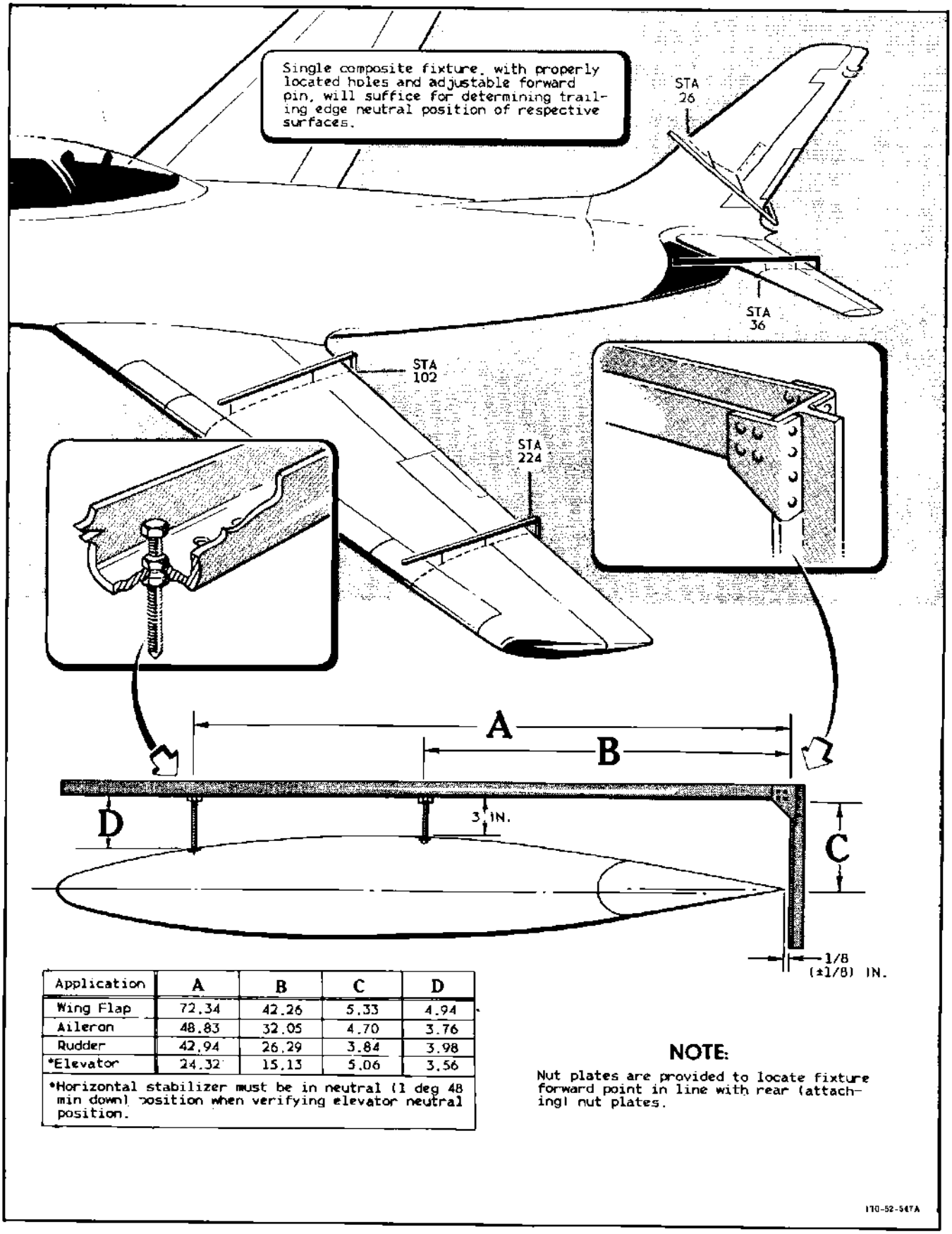
Figure 2-14. Cable Quick-disconnect Safety Detail



Application	A	B	C	D
Wing Flap	72.34	42.26	5.33	4.94
Aileron	48.83	32.05	4.70	3.76
Rudder	42.94	26.29	3.84	3.98
*Elevator	24.32	15.13	5.06	3.56

*Horizontal stabilizer must be in neutral (1 deg 48 min down) position when verifying elevator neutral position.

NOTE:

Nut plates are provided to locate fixture forward point in line with rear (attaching) nut plates.

Figure 2-15. Movable Surface Contour Fixture

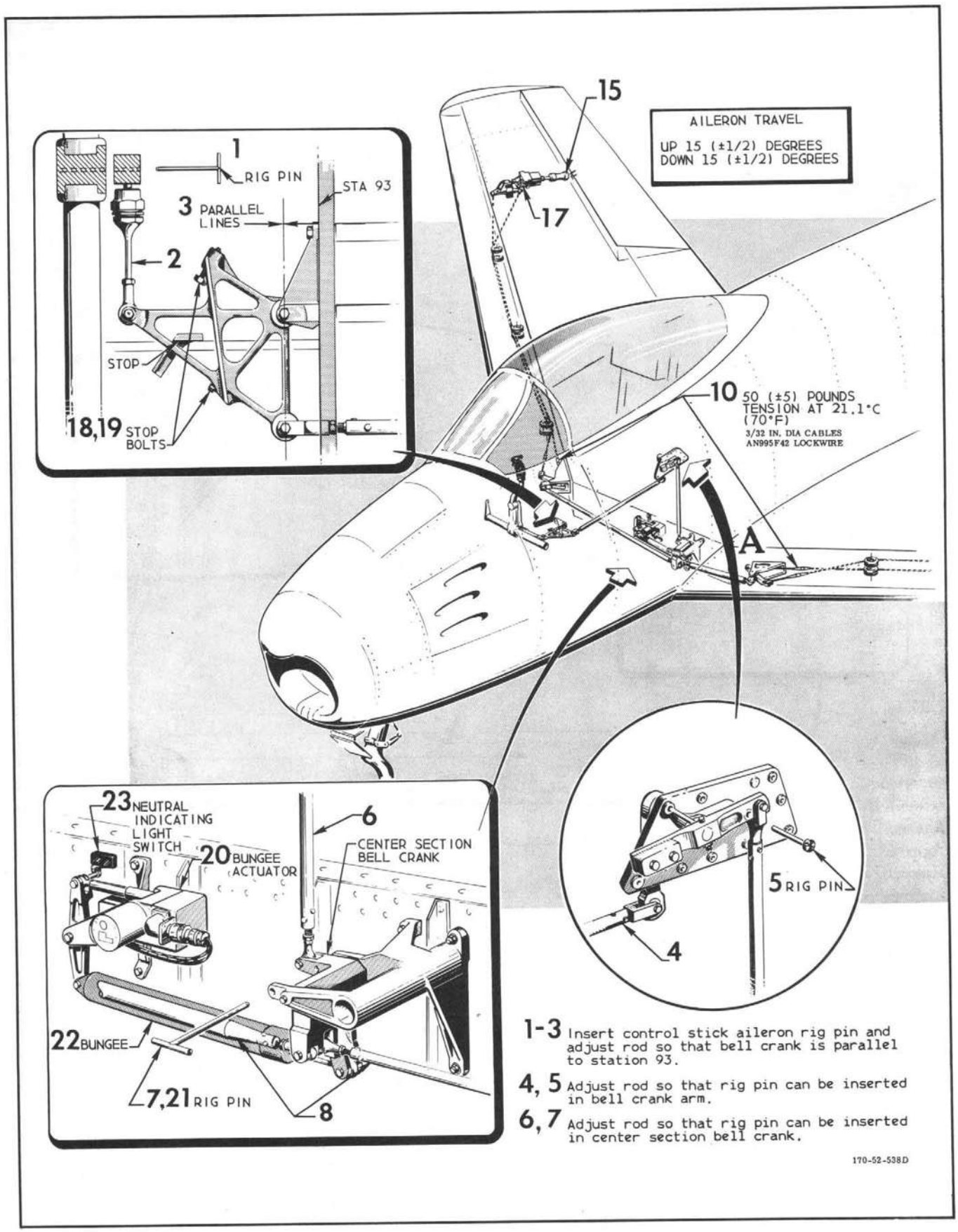
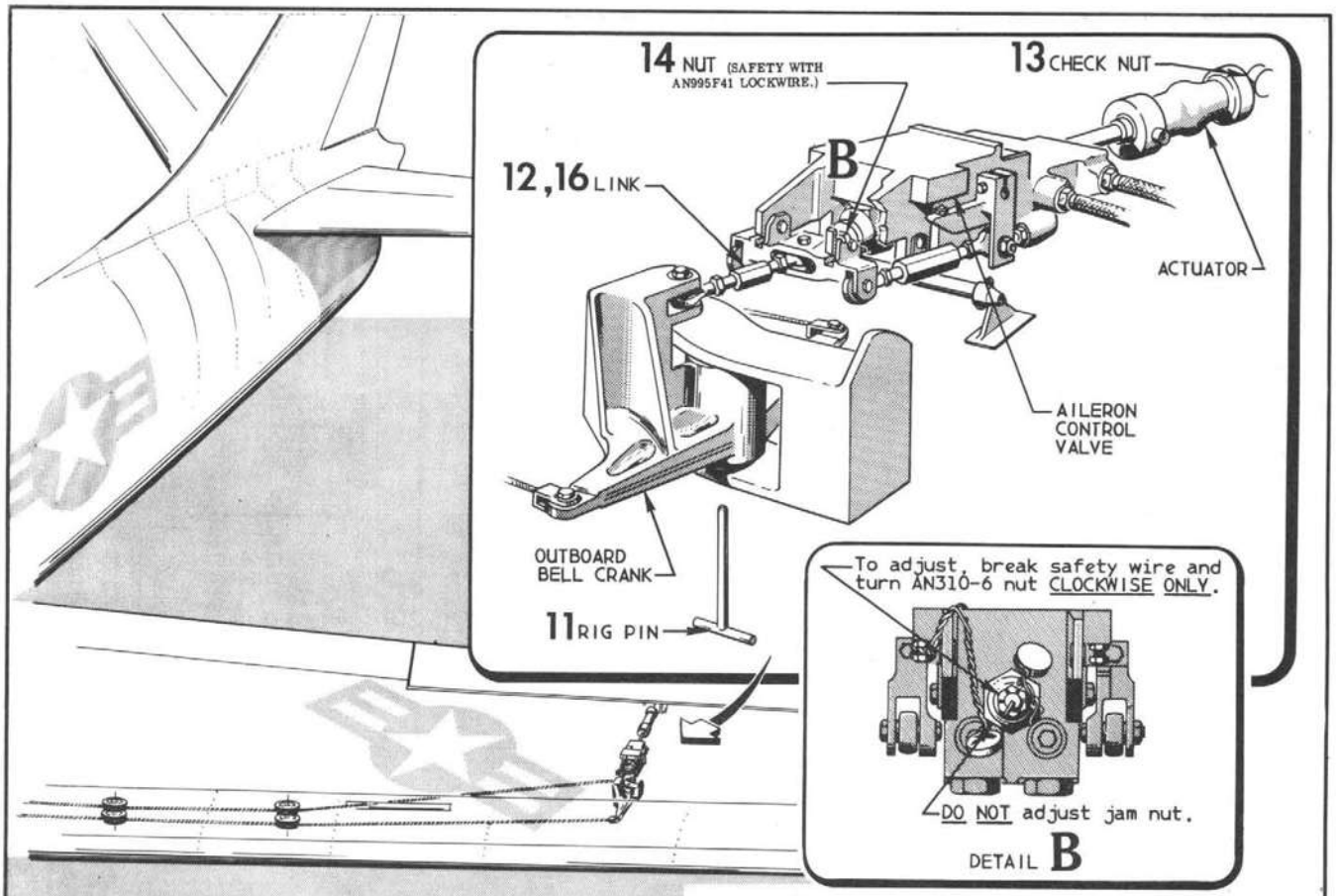
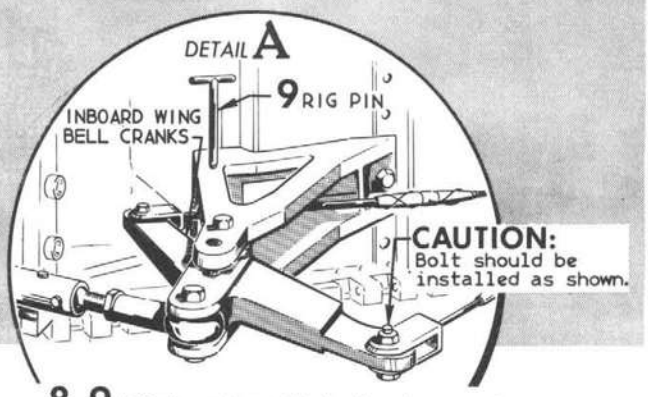


Figure 2-16. Adjusting Aileron Control System (Sheet 1 of 2)





8,9 Adjust rods so that rig pins can be installed in inboard wing bell cranks.

10,11 Adjust turnbuckles so that rig pins can be inserted in outboard bell cranks with cable tension as specified. Then safety turnbuckles with lockwire.

12 Disconnect link between outboard bell crank and aileron control valve.

13,14 With test stand connected to normal system and regulated to 4.5 gpm, move control valve arm to run left aileron up until the piston of the actuator bottoms. Should the total piston travel give more or less aileron travel than required, divide the difference evenly between up and down travel. Piston travel may be equalized by breaking safety wires on forward end of piston rod. (Do not remove cotter pin.) Loosen check nut on aft end of piston rod and rotate piston rod in a clockwise direction. (To shorten, turn forward end of piston rod. To lengthen, turr aft end of piston rod.) Safety nut with lockwire. Secure check nut with tab washer.

NOTE: With electrical power available, reduce test stand pressure to 500 psi; controls should be automatically switched to the emergency system with no more than 1/2-degree movement of ailerons. Should this tolerance be exceeded, replace aileron control valve or valves.

15 Repeat steps 13 and 14 on right aileron.

16,17 Connect and adjust control valve links to position ailerons in neutral.

NOTE: Remove all seven rig pins.

18 With emergency hydraulic power available, apply a load of 30 pounds (measured at center of the stick grip) on the control stick, deflecting stick to the left; adjust stop bolt so that there is 1/32 (±1/64) inch clearance between stop bolt and stop.

19 Repeat step 18, deflecting control stick to the right.

20-22 Operate aileron bungee trim actuator to mid-position (halfway between extreme travels) and insert rig pin. Adjust bungee to fit with no load on bungee.

23 With bungee actuator in mid-position, adjust cockpit neutral indicating light switch so that cockpit indicating light illuminates.

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Figure 2-16. Adjusting Aileron Control System (Sheet 2 of 2)

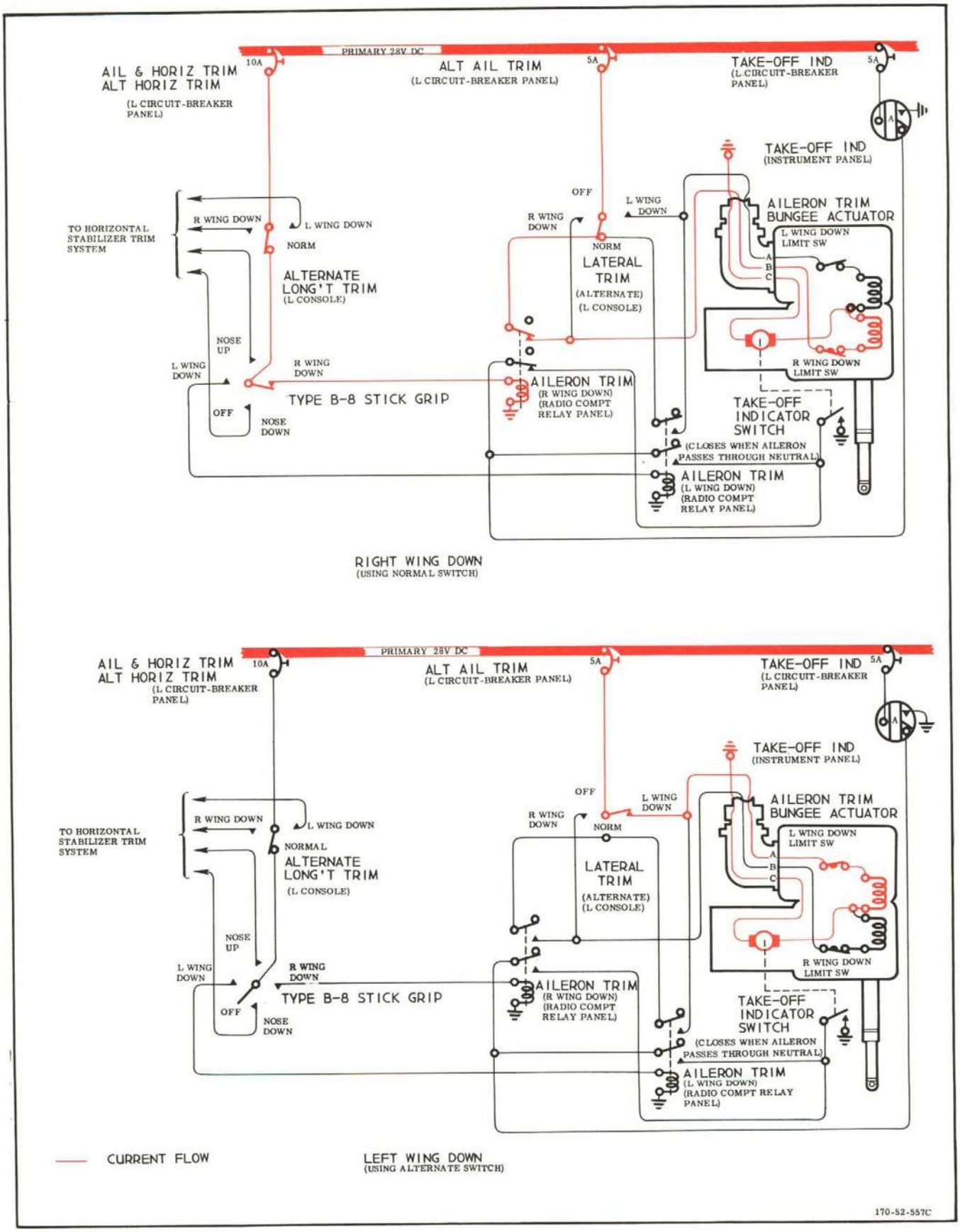


Figure 2-17. Aileron Trim Control System

the control stick grip switch. The electric actuator is mounted on the wing front spar. The actuator is protected by a circuit breaker on the left circuit-breaker panel. Mechanically operated switches, incorporated in the actuator, limit the amount of trim available. A light on the pilot's instrument panel (labeled " 'TAKE-OFF POS.'—IND. LATERAL-DIRECT LONG'T.") is used to indicate aileron neutral trim position when the trim control switch is operated. The light switch is mounted on the trim actuator supporting casting. When energized, the electrical actuator positions the feel bungee to relieve the loads on the control stick. The bungee loads the control system in proportion to stick deflection.

2-75. CHECKING AILERON ARTIFICIAL FEEL AND TRIM SYSTEM. To verify proper operation of the aileron trim system, proceed as follows:

a. Connect external power source to the airplane and turn on the surface control alternate hydraulic system.

b. Run trim actuator to extreme travel each side of neutral; surfaces should move 5 (±1) degrees.

c. With trim actuator in neutral, a force of 14½ (±1) pounds should be required to move the aileron to 13½ degrees deflection.

2-76. HORIZONTAL STABILIZER CONTROL SYSTEM.

2-77. The entire horizontal tail surface is used as a control surface and consists essentially of two sections, the forward section (stabilizer) and the rear section (elevator). The stabilizer is pivoted at the rear spar and positioned by a hydraulic cylinder attached at the front spar. The elevator, connected to the stabilizer by a linkage arrangement, moves in a manner similar to that of a reverse boost tab. The position of the stabilizer is controlled by a conventional stick, push-pull tubes, sectors, and cables connected to a tandem stabilizer actuator. Movement of the control stick positions the control valve arm. As the actuating cylinder and control valve move, the control valve arm is repositioned, shutting off flow of hydraulic fluid when the desired position of the stabilizer is reached. The tandem cylinder is operated by two separate and complete hydraulic systems, one normal and one alternate. (Refer to paragraph 2-90.) An electrically operated artificial feel and trim system is provided. (Refer to paragraph 2-80.) A valve-centering bungee is used to increase the stick deflection forces with an increase in rate of stick movement.

2-78. ADJUSTING HORIZONTAL STABILIZER CONTROL SYSTEM. See figures 2-18, 2-19, and 2-20.

2-79. HORIZONTAL STABILIZER ARTIFICIAL FEEL AND TRIM SYSTEM.

2-80. The horizontal stabilizer artificial feel and trim system (figure 2-21) consists of a bungee actuator, feel bungee, trim switches, and relays. The actuator, located on the left side of the fuselage just aft of the cockpit, actuates a feel bungee torsion bar. On F-86E-15 Airplanes, the actuator is located on vertical stabilizer rear spar. Two trim switches are incorporated, one on the control stick and an alternate on the left console. When either trim switch is operated, current is directed through the trim control relay to the bungee actuator. This action positions the feel bungee to a new no-load (neutral) position, thereby relieving the loads on the control stick. The system is protected by a circuit breaker on the left circuit-breaker panel. A light on the pilot's instrument panel (labeled " 'TAKE-OFF POS.'—IND. LATERAL-DIRECT LONG'T") is used to indicate horizontal stabilizer take-off trim position (stabilizer leading edge 7 degrees down from neutral) when the trim switch is operated.

2-81. CHECKING HORIZONTAL STABILIZER ARTIFICIAL FEEL AND TRIM SYSTEM. To check proper operation of the horizontal stabilizer artificial feel and trim system, proceed as follows:

a. Connect external electric power to airplane and place flight control switch in "ALTERNATE ON" position.

b. To verify proper operation of the feel bungee, place control stick in neutral trim position. On F-86E-1 through F-86E-10 Airplanes, the force required to move the control stick forward (within 1/16 inch of full surface travel) should be 56 (±3) pounds, and the force required to move the stick aft (within 1/16 inch of full surface travel) should be 65 (±3) pounds. On F-86E-15 Airplanes, the force required to move the control stick full forward and full aft (within 1/16 inch of full surface travel) should be 50 (±5) pounds.

c. Using the control stick longitudinal trim switch, check movement of control surface. The actuator should move the horizontal stabilizer leading edge 2 (±½) degrees up and 7 (±½) degrees down from neutral. Take-off light should illuminate at stabilizer full down trim position.

2-82. RUDDER CONTROL SYSTEM.

2-83. The rudder is controlled in a conventional manner by pedals that actuate 1/2-inch diameter cables and position the sector attached directly to the rudder. The rudder pedal positions can be adjusted by the pilot for leg length. An electrically controlled and actuated trim tab is incorporated on the rudder. (Refer to paragraph 2-86.)

2-84. ADJUSTING RUDDER CONTROL SYSTEM. See figure 2-23.

2-85. RUDDER TRIM TAB CONTROL SYSTEM.

2-86. The electrically actuated rudder trim tab control system is remotely controlled from the pilot's compartment. (See figure 2-24.) The rudder trim tab control switch, located on the pilot's left console, is wired directly to the actuator, which is located inside the rudder. The actuator circuit is protected by a circuit breaker on the left circuit-breaker panel. A mechanical

1-4 Install aileron and horizontal stabilizer rig pins, and adjust rod so that rig pin can be inserted in torque tube bell crank.

5, 6 Adjust cable quick-disconnects so that aft sector rig pin can be installed with cable tension as specified. Then safety quick-disconnects with lockwire.

7, 8 Adjust rod so that rig pin can be inserted; then safety rod.

9 Disconnect both valve arm rods.

10,11 With alternate hydraulic power available, actuate left control valve arm to run horizontal stabilizer down until actuating cylinder bottoms. Adjust actuating cylinder length to be as specified in chart.*

12 Hydraulically run horizontal stabilizer up until actuating cylinder bottoms. Verify actuating cylinder length to be as specified in chart.* If it is not, adjust length of actuating cylinder so that both extreme travels are within tolerances.

13 Hydraulically run actuating cylinder to neutral (rigged) position, and adjust elevator link to position elevator in rigged position. (Use movable contour fixture to determine elevator rigged position.)

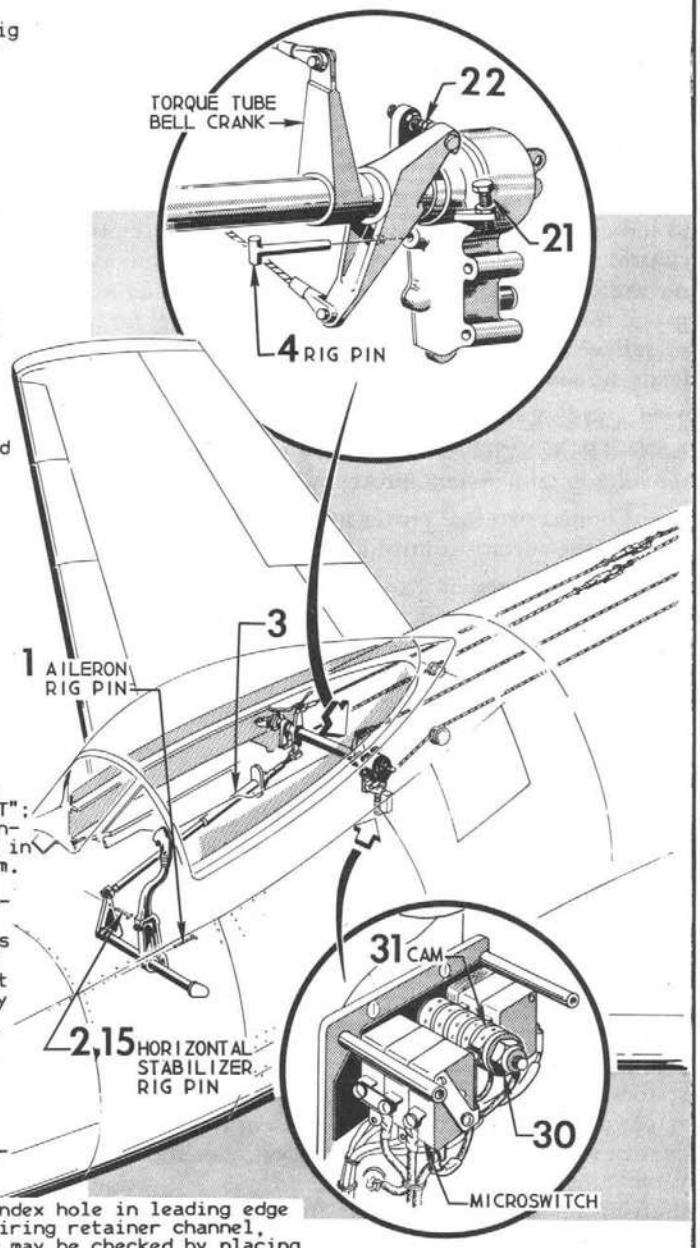
14,15 Adjust and connect alternate control valve rod, and safety. Connect normal control valve rod; do not safety.

NOTE: Remove all seven rig pins.

16,17 With a hydraulic test stand connected and regulated to 4.5 gpm, energize normal power system by operating cockpit switch to "RESET"; then move bell crank until rig pin can be inserted in bell crank. If stabilizer is not in neutral rig position, adjust right valve arm.

18 Remove rig pin and verify proper synchronization of the stabilizer position during change-over from normal to alternate systems and back again. Stabilizer should not move more than 1/32 inch. Should it move, adjust control valve rods as necessary; then safety with lockwire.

19,20 Position control stick aft until horizontal stabilizer actuator bottoms; then adjust stop bolt until there is .015 (±.005) inch clearance between stop and bolt. (Valve arm need not be at full travel.) Repeat procedure with stick full forward and actuator bottomed.



*On airplanes with index hole in leading edge of stabilizer and fairing retainer channel, stabilizer positions may be checked by placing scale in bottom of hole (located on fairing retainer channel) and measuring to center of hole on stabilizer leading edge.

HORIZONTAL STABILIZER AND ELEVATOR TRAVEL

POSITION	ACTUATING CYLINDER LENGTH	TRUE DISTANCE BETWEEN INDEX HOLES	HORIZONTAL STABILIZER POSITION	ELEVATOR POSITION
NEUTRAL STICK POSITION	22.076 IN.	4.612 IN.	1 DEG 48 MIN (±1/4 DEG) DOWN	2 DEG 45 MIN (±1/2 DEG) DOWN
FULL DOWN STABILIZER AND FULL UP ELEVATOR	23.929 (+.090/ -.000) IN.	1.768 IN.	10 (±1/2) DEG DOWN	21 (±2) DEG UP
FULL UP STABILIZER AND FULL DOWN ELEVATOR	20.323 (+.000/ -.090) IN.	7.316 IN.	6 (±1/2) DEG UP	2 DEG 50 MIN (±1/2 DEG) DOWN

Horizontal stabilizer positions are with respect to fuselage reference line.
Elevator positions are with respect to horizontal stabilizer.

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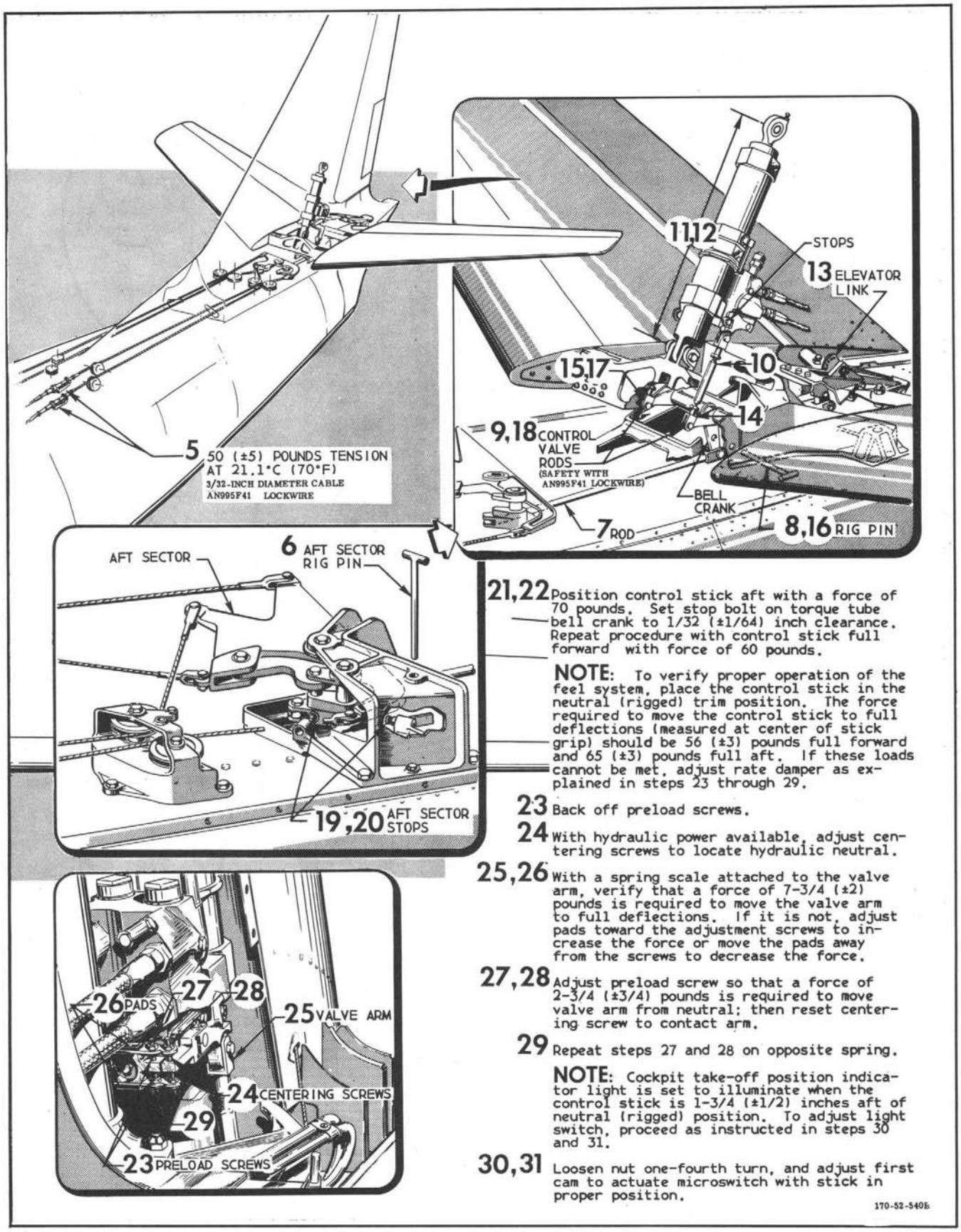
Figure 2-18. Adjusting Horizontal Stabilizer and Elevator Control System— F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)



21,22 Position control stick aft with a force of 70 pounds. Set stop bolt on torque tube bell crank to 1/32 (±1/64) inch clearance. Repeat procedure with control stick full forward with force of 60 pounds.

NOTE: To verify proper operation of the feel system, place the control stick in the neutral (rigged) trim position. The force required to move the control stick to full deflections (measured at center of stick grip) should be 56 (±3) pounds full forward and 65 (±3) pounds full aft. If these loads cannot be met, adjust rate damper as explained in steps 23 through 29.

23 Back off preload screws.

24 With hydraulic power available, adjust centering screws to locate hydraulic neutral.

25,26 With a spring scale attached to the valve arm, verify that a force of 7-3/4 (±2) pounds is required to move the valve arm to full deflections. If it is not, adjust pads toward the adjustment screws to increase the force or move the pads away from the screws to decrease the force.

27,28 Adjust preload screw so that a force of 2-3/4 (±3/4) pounds is required to move valve arm from neutral; then reset centering screw to contact arm.

29 Repeat steps 27 and 28 on opposite spring.

NOTE: Cockpit take-off position indicator light is set to illuminate when the control stick is 1-3/4 (±1/2) inches aft of neutral (rigged) position. To adjust light switch, proceed as instructed in steps 30 and 31.

30,31 Loosen nut one-fourth turn, and adjust first cam to actuate microswitch with stick in proper position.

170-52-540E

Figure 2-18. Adjusting Horizontal Stabilizer and Elevator Control System— F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)

ADJUSTING HORIZONTAL STABILIZER AND ELEVATOR CONTROL SYSTEM

1-4 Install aileron and horizontal stabilizer rig pins and adjust rod so that a rig pin can be inserted in the torque tube bell crank.

5,6 Adjust cable to specified tension so that the aft sector rig pin can be installed; safety quick-disconnects.

7,8 Adjust rod so that a rig pin can be inserted; then safety rod.

9 Disconnect the valve arm rod.

10-12 With hydraulic power available, actuate control valve arm to run stabilizer down with cylinder bottoms. Adjust length of actuating cylinder to obtain specified distance between index holes. (Refer to chart.*)

13-15 Actuate control valve arm to run stabilizer up until cylinder bottoms. Verify distance between index holes to be as specified in chart.* If not, adjust length of actuating cylinder.

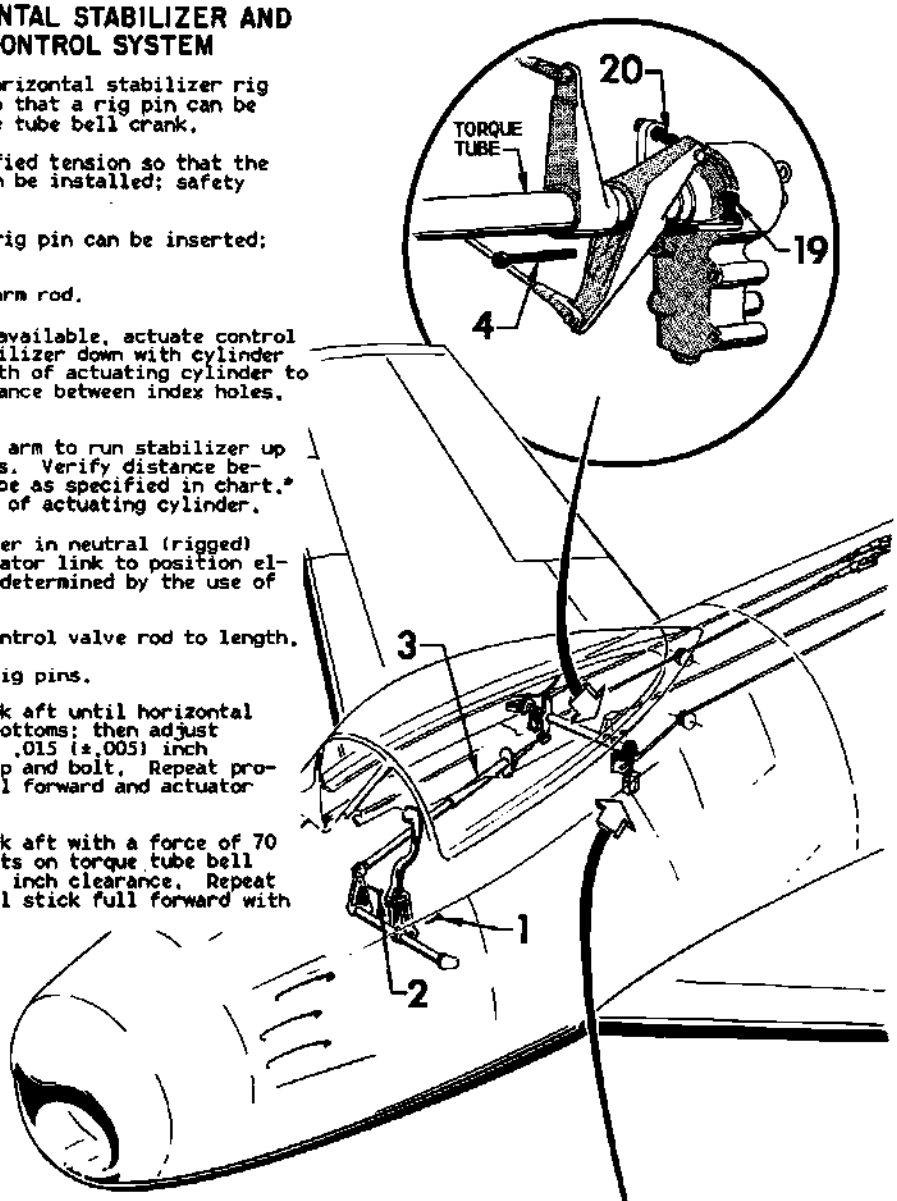
16 With actuating cylinder in neutral (rigged) position, adjust elevator link to position elevator in neutral as determined by the use of the contour fixture.

17 Adjust and connect control valve rod to length.

NOTE: Remove all rig pins.

18 Position control stick aft until horizontal stabilizer actuator bottoms; then adjust stop bolts to provide .015 (±.005) inch clearance between stop and bolt. Repeat procedure with stick full forward and actuator bottomed.

19,20 Position control stick aft with a force of 70 pounds. Set stop bolts on torque tube bell crank to 1/32 (±1/64) inch clearance. Repeat procedure with control stick full forward with a force of 60 pounds.



NOTE: To verify proper operation of the feel system, place the control stick in the neutral (rigged) position. The force required to move the control stick to full deflection (measured at center of stick grip) should be 56 (+3,-5) pounds full forward and 65 (+3,-7) pounds full aft.

ADJUSTING TAKE-OFF POSITION INDICATOR LIGHT

21,22 The take-off position indicator light is set to illuminate when the control stick is 1-3/4 (±1/2) inches aft of neutral (rigged) position by loosening nut one-fourth turn and adjusting first cam to actuate microswitch.

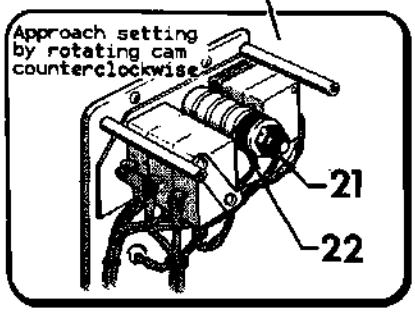


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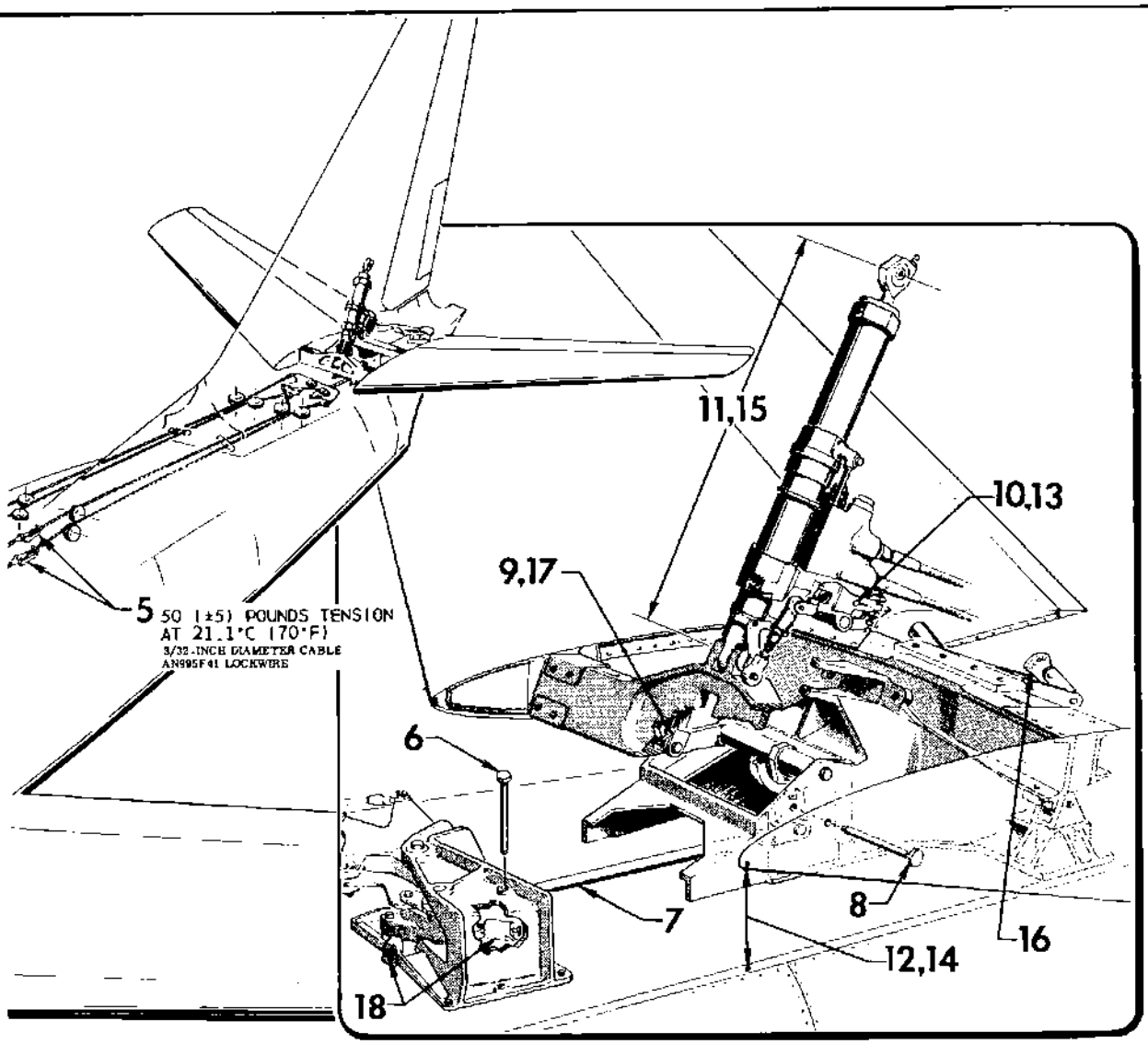
Figure 2-19. Adjusting Horizontal Stabilizer and Elevator Control System—F-86E-10 Airplanes (Sheet 1 of 2)



*HORIZONTAL STABILIZER AND ELEVATOR TRAVEL POSITION				
POSITION	ACTUATING CYLINDER LENGTH (REF)	TRUE DISTANCE BETWEEN INDEX HOLES	HORIZONTAL STABILIZER POSITION	ELEVATOR POSITION
NEUTRAL STICK POSITION	22.076 IN.	4.612 (±.088) IN.	1 DEG 48 MIN (+1/4 DEG) DOWN	2 DEG 45 MIN (±1/2 DEG) DOWN
FULL DOWN STABILIZER AND FULL UP ELEVATOR	23.929 (+.090/ -.000) IN.	1.768 (+.164/-0) IN.	10(+1/2/-0) DEG DOWN	21(±2) DEG UP
FULL UP STABILIZER AND FULL DOWN ELEVATOR	20.323 (+000/ -.090) IN.	7.316(±.174) IN.	6 (±1/2) DEG UP	2 DEG 50 MIN (+1/2 DEG) DOWN

Horizontal stabilizer positions are with respect to fuselage reference line. Elevator positions are with respect to horizontal stabilizer.

Stabilizer positions may be checked by placing scale in bottom of hole (located on fairing retainer channel) and measuring to center of hole on stabilizer leading edge.

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Figure 2-19. Adjusting Horizontal Stabilizer and Elevator Control System—F-86E-10 Airplanes (Sheet 2 of 2)

1 - 4 Install aileron and horizontal stabilizer rig pins and adjust rod so that a rig pin can be inserted in the torque tube bell crank.

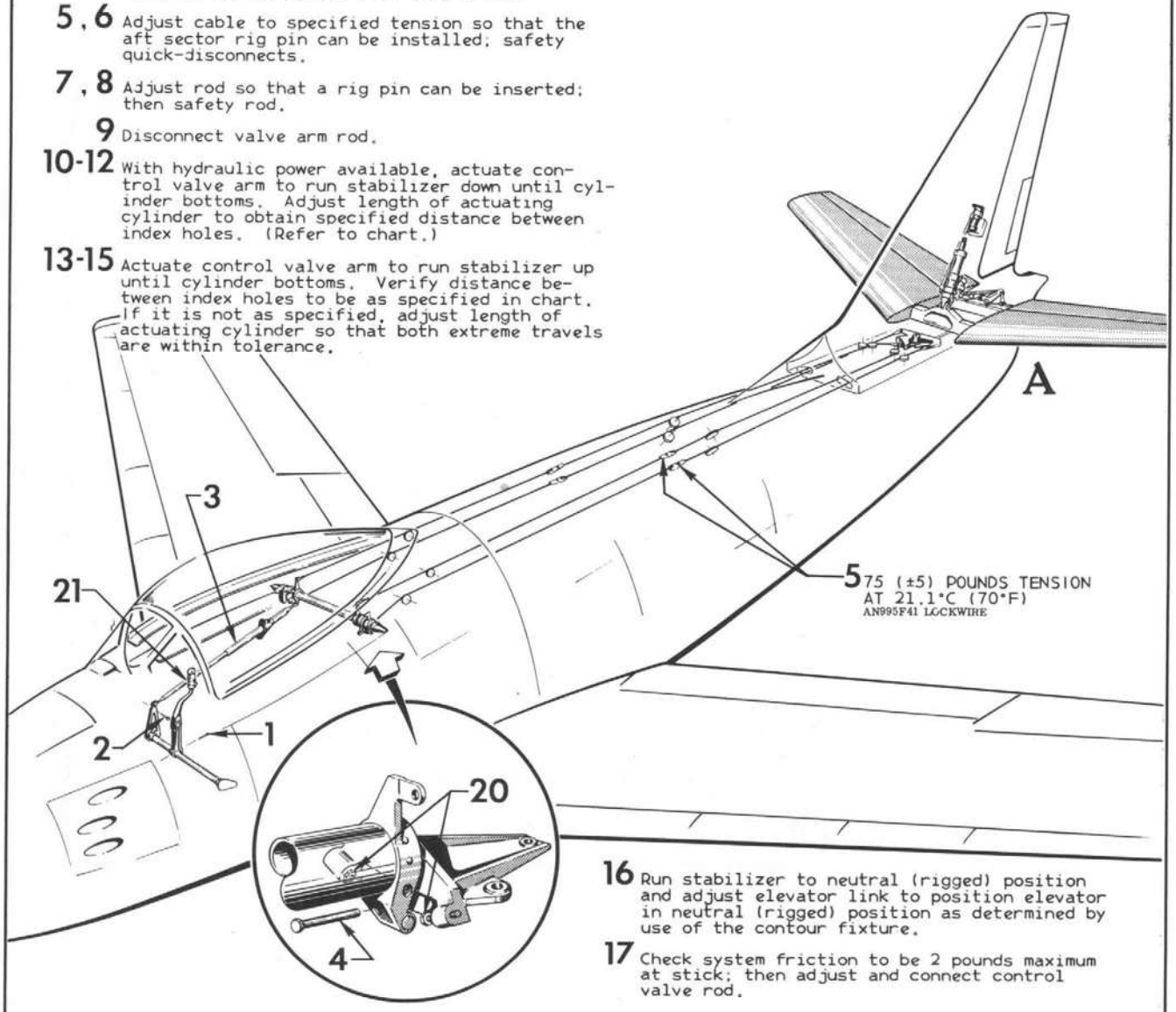
5, 6 Adjust cable to specified tension so that the aft sector rig pin can be installed; safety quick-disconnects.

7, 8 Adjust rod so that a rig pin can be inserted; then safety rod.

9 Disconnect valve arm rod.

10-12 With hydraulic power available, actuate control valve arm to run stabilizer down until cylinder bottoms. Adjust length of actuating cylinder to obtain specified distance between index holes. (Refer to chart.)

13-15 Actuate control valve arm to run stabilizer up until cylinder bottoms. Verify distance between index holes to be as specified in chart. If it is not as specified, adjust length of actuating cylinder so that both extreme travels are within tolerance.



16 Run stabilizer to neutral (rigged) position and adjust elevator link to position elevator in neutral (rigged) position as determined by use of the contour fixture.

17 Check system friction to be 2 pounds maximum at stick; then adjust and connect control valve rod.

HORIZONTAL STABILIZER AND ELEVATOR TRAVEL POSITION

POSITION	ACTUATING CYLINDER LENGTH (REF)	TRUE DISTANCE BETWEEN INDEX HOLES	HORIZONTAL STABILIZER POSITION	ELEVATOR POSITION
NEUTRAL STICK POSITION	22.076 IN.	4.612 (±.088) IN.	1 DEG 48 MIN (+1/4 DEG) DOWN	2 DEG 45 MIN (±1/2 DEG) DOWN
FULL DOWN STABILIZER AND FULL UP ELEVATOR	23.929 (+.090/ -.000) IN.	1.768 (+.164/-0) IN.	10 (+1/2/-0) DEG DOWN	21 (±2 DEG) UP
FULL UP STABILIZER AND FULL DOWN ELEVATOR	20.323 (+.000/ -.090) IN.	7.316 (±.174) IN.	6 (±1/2) DEG UP	2 DEG 50 MIN (+1/2 DEG) DOWN

Horizontal stabilizer positions are with respect to fuselage reference line. Elevator positions are with respect to horizontal stabilizer.

Stabilizer positions may be checked by placing scale in bottom of hole (located on fairing retainer channel) and measuring to center of hole on stabilizer leading edge.

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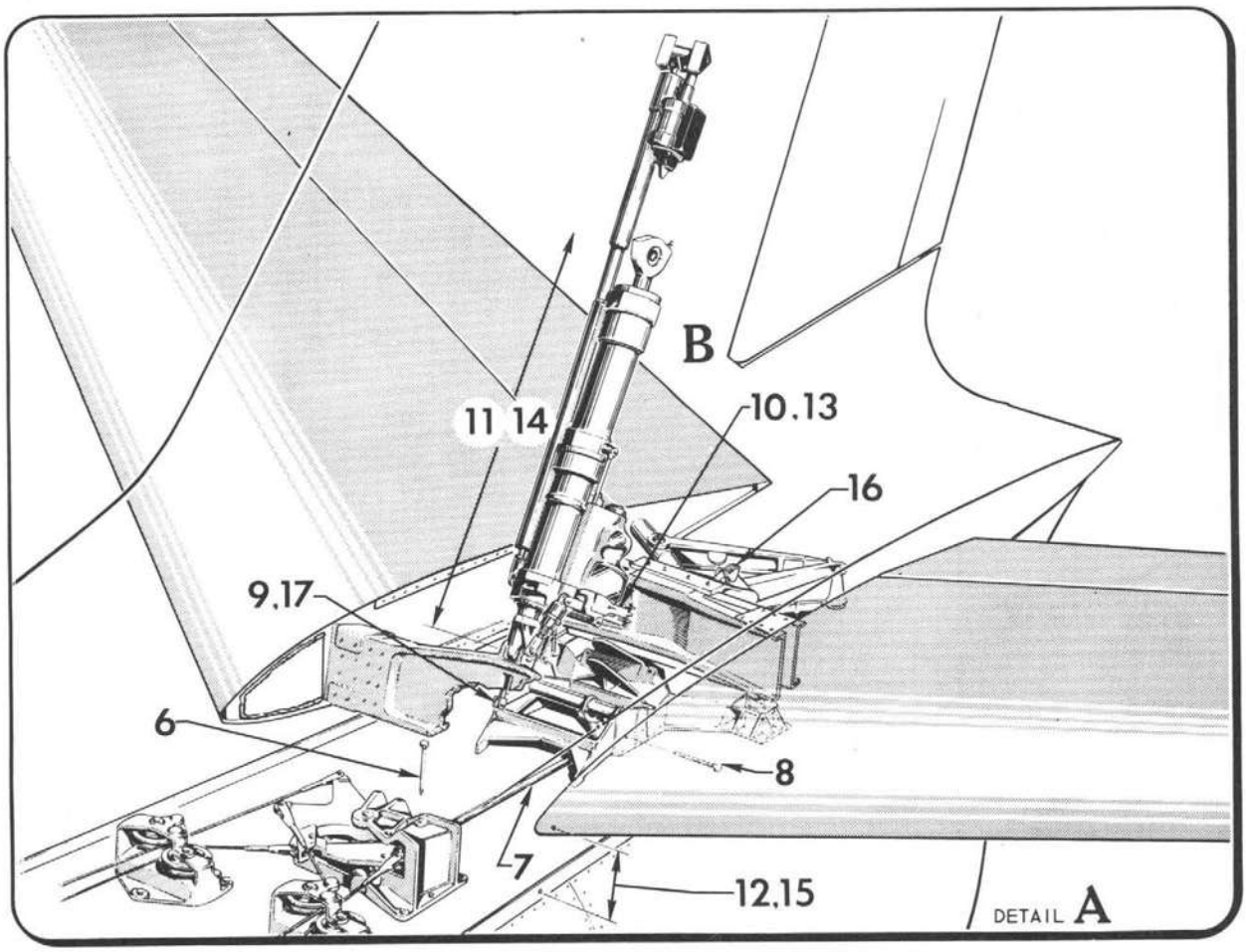
Figure 2-20. Adjusting Horizontal Stabilizer and Elevator Control System—F-86E-15 Airplanes (Sheet 1 of 2)



18 Run trim actuator so that a rig pin can be installed in bell crank.

19 Adjust free length of feel bungee rod and connect; then remove all rig pins.

20 Position control stick aft until stabilizer actuator bottoms, then adjust stop on torque tube bell crank so that there is 1/32 (±1/64) inch clearance. Repeat with full forward stick.

21 With stabilizer trimmed at neutral, the stick force to move the stabilizer up and down to within 1/16 inch full of deflection is between 45 and 55 pounds. (Stick force is applied tangentially at first notch below trigger of stick grip.)

NOTE: Check synchronization of normal and alternate system by changing over from one to the other. Stabilizer should not move more than 1/32 inch at leading edge.

22.23 Operate trim actuator to both extremes and check surface travel to be 2 (±1/2) degrees up and -7 (±1/2) degrees down. Actuator travel cannot be adjusted, but can be shifted about neutral by adjusting the stabilizer bungee rod end. Take-off light should operate at full down trim (-7 degrees) with stick trim switch actuated.

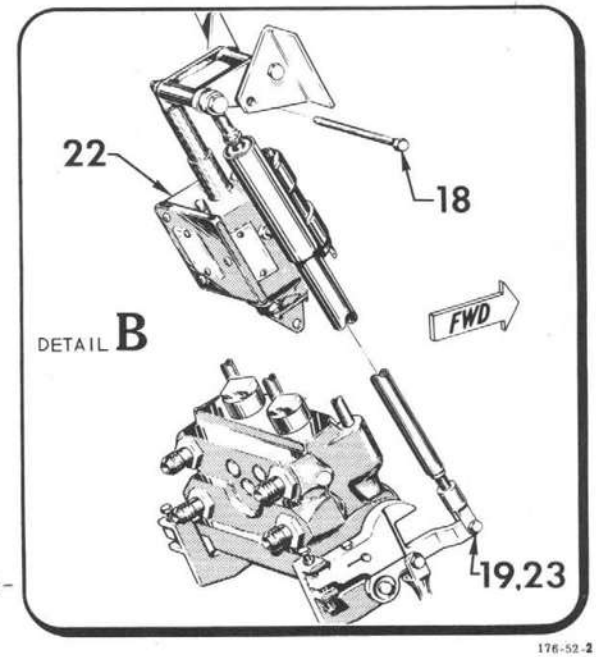


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Figure 2-20. Adjusting Horizontal Stabilizer and Elevator Control System—F-86E-15 Airplanes (Sheet 2 of 2)

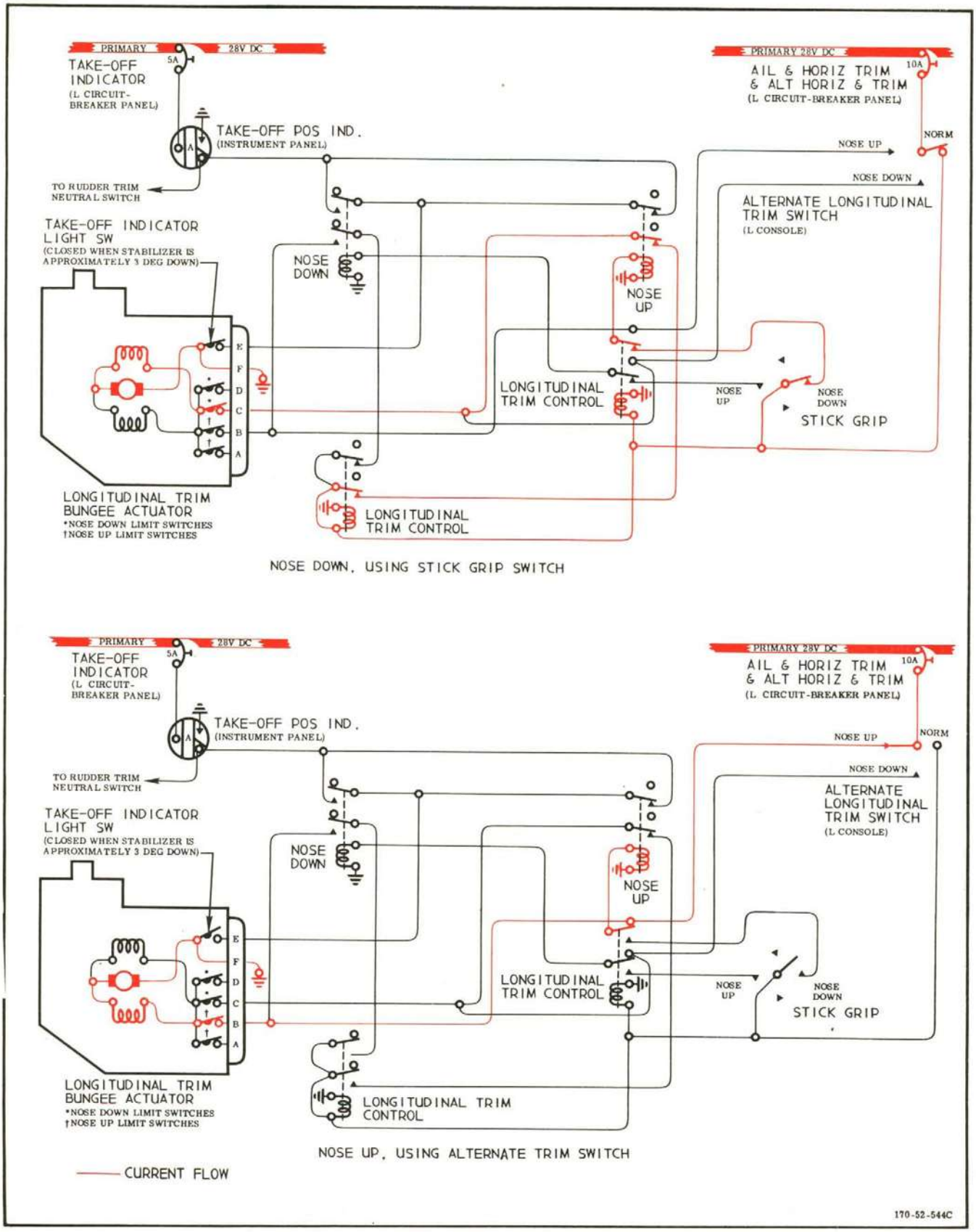


Figure 2-21. Horizontal Stabilizer Trim Control System

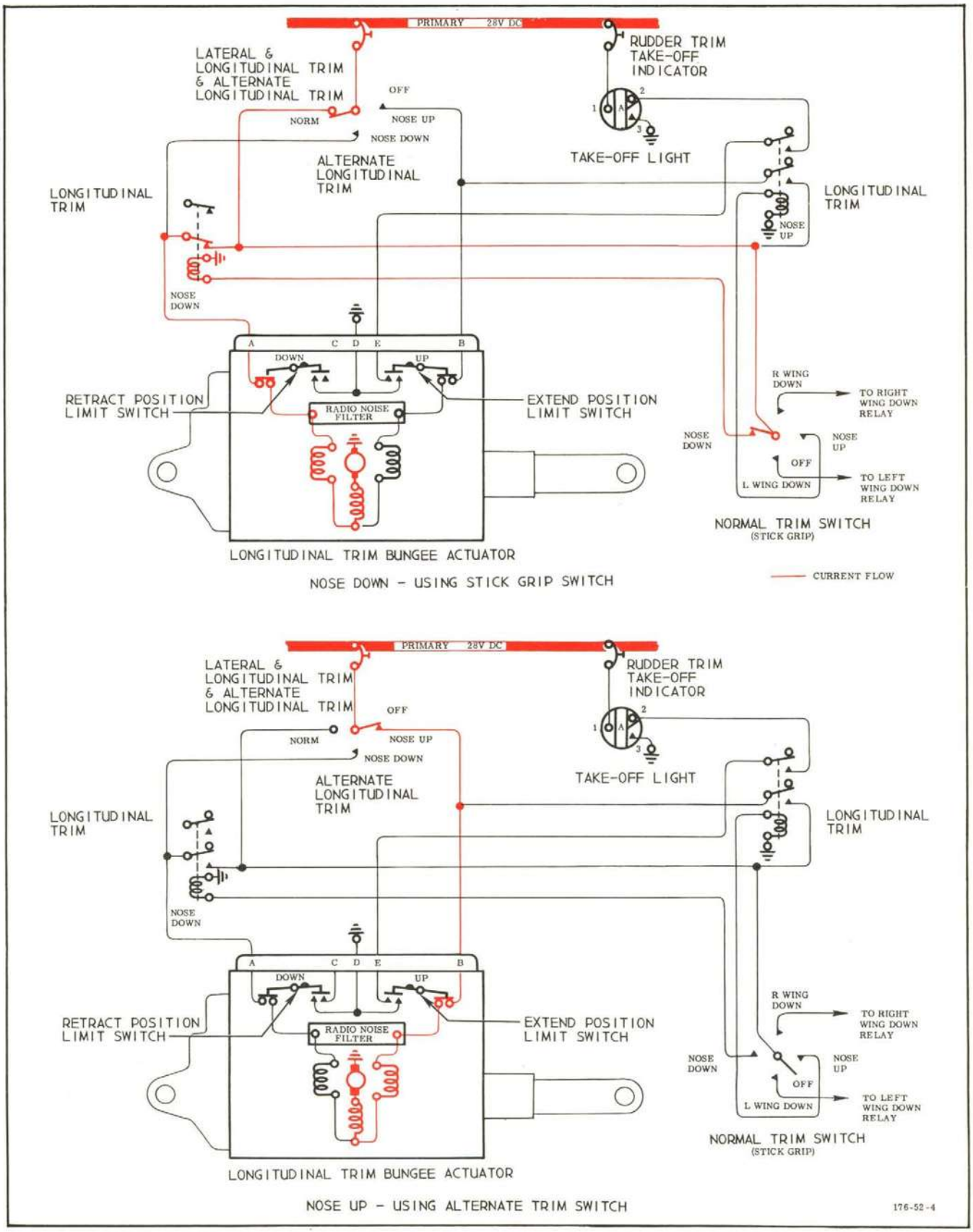


Figure 2-22. Horizontal Stabilizer Trim Control System—F-86E-15 Airplanes

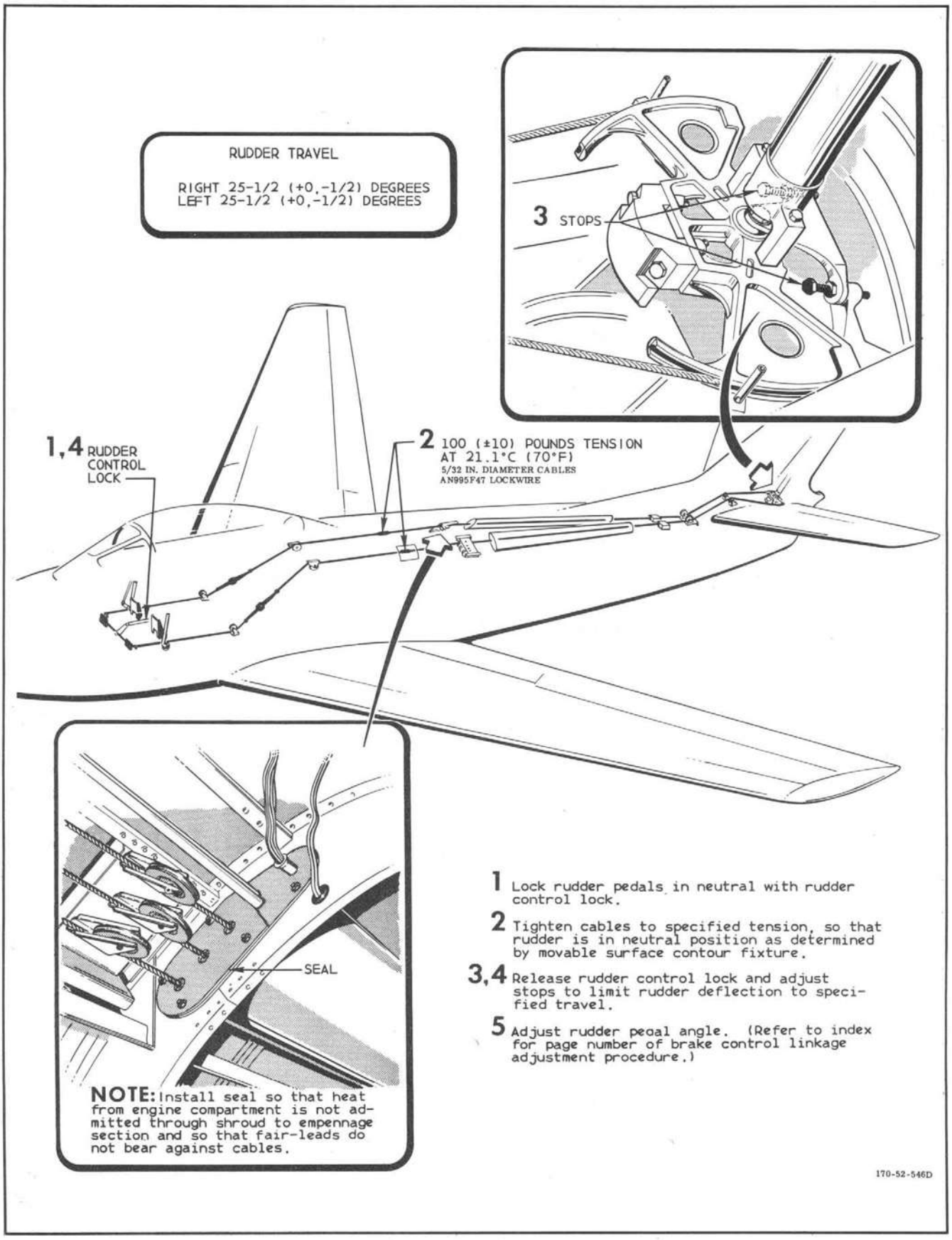


Figure 2-23. Adjusting Rudder Control System

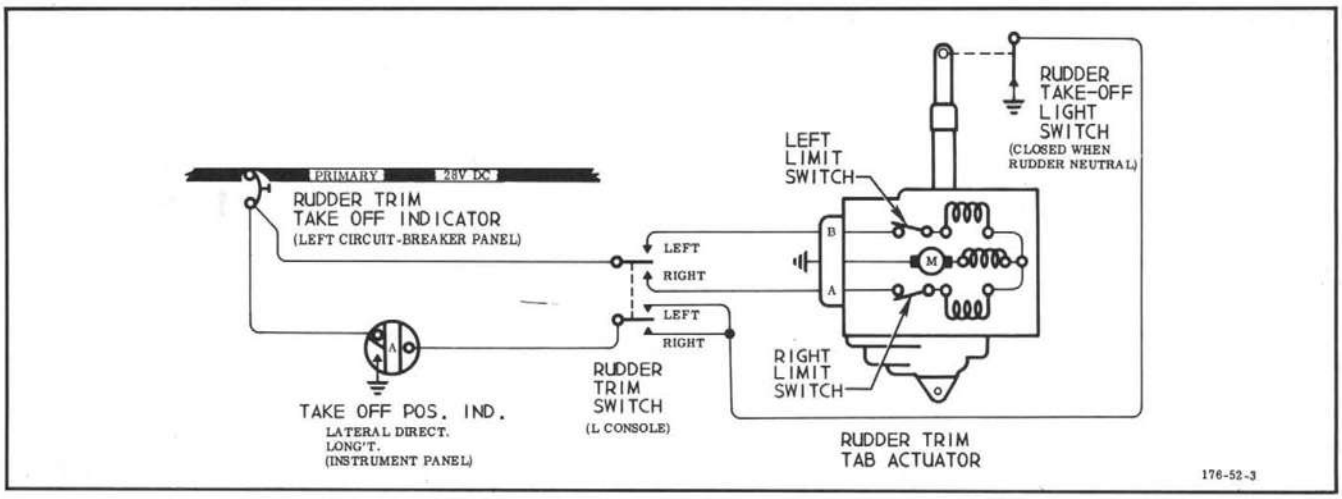


Figure 2-24. Rudder Trim Tab Control System

linkage arrangement transmits motion from the actuator to the trim tab. The trim tab actuator is an electric-motor-driven jack screw assembly that incorporates mechanically actuated switches to limit extreme travel of the tab. Intermediate tab positions are determined only by operation of the control switch. A trim take-off position indicator light, which also serves for lateral and longitudinal trim, is located on the pilot's instrument panel and is wired directly to a switch in the actuator.

2-87. ADJUSTING RUDDER TRIM TAB CONTROL SYSTEM. See figure 2-25.

2-88. SURFACE CONTROL HYDRAULIC POWER SYSTEM.

2-89. The surface control hydraulic power system is a pressure-type (closed-center) system. (See figures 2-26 and 2-27.) Included in the system are the horizontal stabilizer and aileron actuators, relief valves, transfer valves, pressure switches, pressure transmitters, accumulators, reservoirs, pumps, filters, filling selector valve, compensator and pressurizing cylinder, check valves, and restrictors. The system has two complete sets of plumbing, one for normal operation and one for alternate operation. Change-over from the normal system to the alternate system is effected automatically by means of the system pressure switches and two solenoid-operated transfer valves. Change-over can also be accomplished manually by means of a switch in the cockpit. On F-86E-10 and F-86E-15 Airplanes, a manually controlled flexible cable is also provided as an emergency means of positioning the transfer valves to the alernate system and connecting the alternate system pump directly to the battery bus. A gage in the cockpit indicates system pressures in the normal, alternate, and utility hydraulic systems. Readings for each system are controlled by a three-way toggle switch. With the switch in normal position, the pressure gage shows the normal surface control hydraulic power system pressure. Utility or alternate surface control hydraulic power system switch positions are momentary on F-86E-1, F-86E-5, and F-86E-6 Airplanes. As soon as the switch is released from any of these positions, it will return to the normal system pressure reading. On F-86E-10 and F-86E-15 Airplanes, the switch will remain in any one of the three positions.

2-90. FUNCTION OF SURFACE CONTROL HYDRAULIC POWER SYSTEM. During normal operation, fluid is supplied by means of an engine-driven, variable-displacement pump. (See figures 2-28, 2-30, and 2-31.) Fluid from this pump is directed to the accumulator and then through a filter to a pressure transmitter, pressure switch, and solenoid-operated transfer valve to the respective control valves. A relief valve limits the system pressure to 3400 ($\pm$50) psi if the pump fails to regulate pressure. During alternate operation, an electrically driven constant-displacement pump supplies pressure. Operating pressure is maintained in the alternate system accumulator at all times by pressure switches. These switches energize the alternate pump when the alternate system pressure drops blow 2700 ($\pm$100) psi and de-energize the pump when pressure in the accumulator reaches 3000 ($\pm$100) psi. Change-over from normal system to alternate system is effected by means of pressure switches and two solenoid-operated transfer valves, which automatically become energized when the normal system pressure drops below 650 psi. These transfer valves, when energized, shut off normal system pressure and open the alternate system pressure line.

2-91. FILLING AND BLEEDING SURFACE CONTROL HYDRAULIC POWER SYSTEM. Refer to paragraphs 1-63 and 1-64.

2-92. CHECKING SURFACE CONTROL HYDRAULIC POWER SYSTEM. Conduct the functional check of the hydraulic power system as follows:

a. Verify that compensator rods are extended a minimum of ¼ inch up to a maximum of 1½ inches and

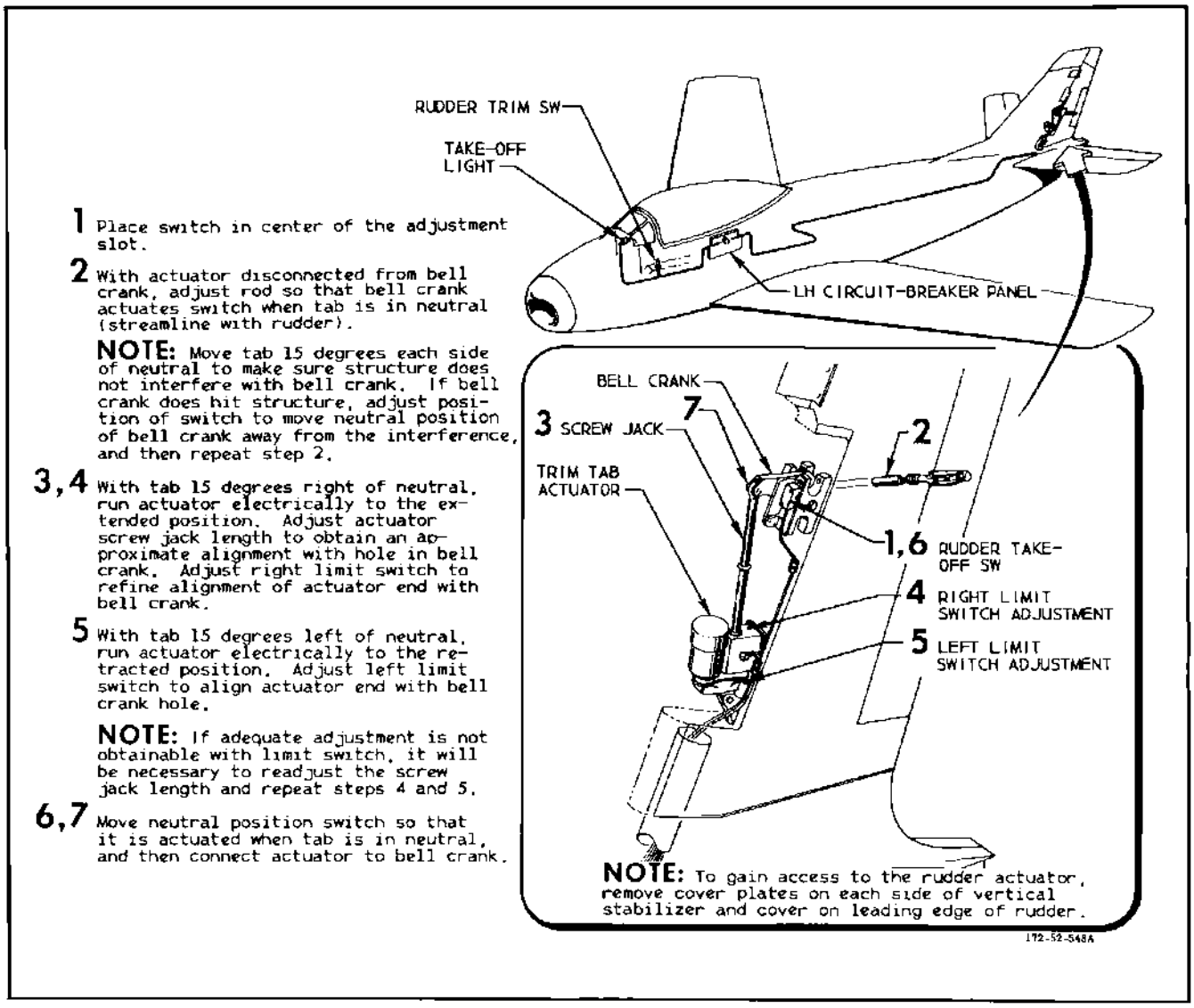


Figure 2-25. Adjusting Rudder Trim Tab System

that accumulators have an air charge of 700 (±50) psi. On F-86E-10 and F-86E-15 Airplanes, the accumulators are precharged to 600 (+50/−0) psi.

b. Connect test stand to airplane with the flow regulated to 4.58 gpm and relief valve set to 3000 psi.

c. Connect external power source and momentarily position the flight control switch to "RESET."

d. To check operation of normal system, move control stick to full deflection to actuate both the aileron and horizontal stabilizer system. The reading on the cockpit hydraulic pressure gage should drop while the surface is being moved and should read 3000 psi when the surface is stationary.

e. To check operation of alternate system, decrease the test stand relief valve setting to 800 psi and repeat step d. with cockpit pressure gage switched to "ALT." The system should automatically change over to alternate system with initial rapid control movement and remain on alternate until manually switched back to normal.

Note

While the alternate system is on and with no movement of the controls, the electric pump should remain off a minimum of 4 seconds while cycling. An interval of less than 4 seconds indicates a leak in the system or a faulty pressure switch.

2-93. CHECKING SURFACE CONTROL HYDRAULIC POWER SYSTEM ELECTRICAL CIRCUIT (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). The hydraulic power system electrical circuit check is similar to that described in paragraph 2-94 except for the following differences: the four alternate system pressure switches are located in the left speed brake well; the manual emergency change-over control is not incorporated in the system.

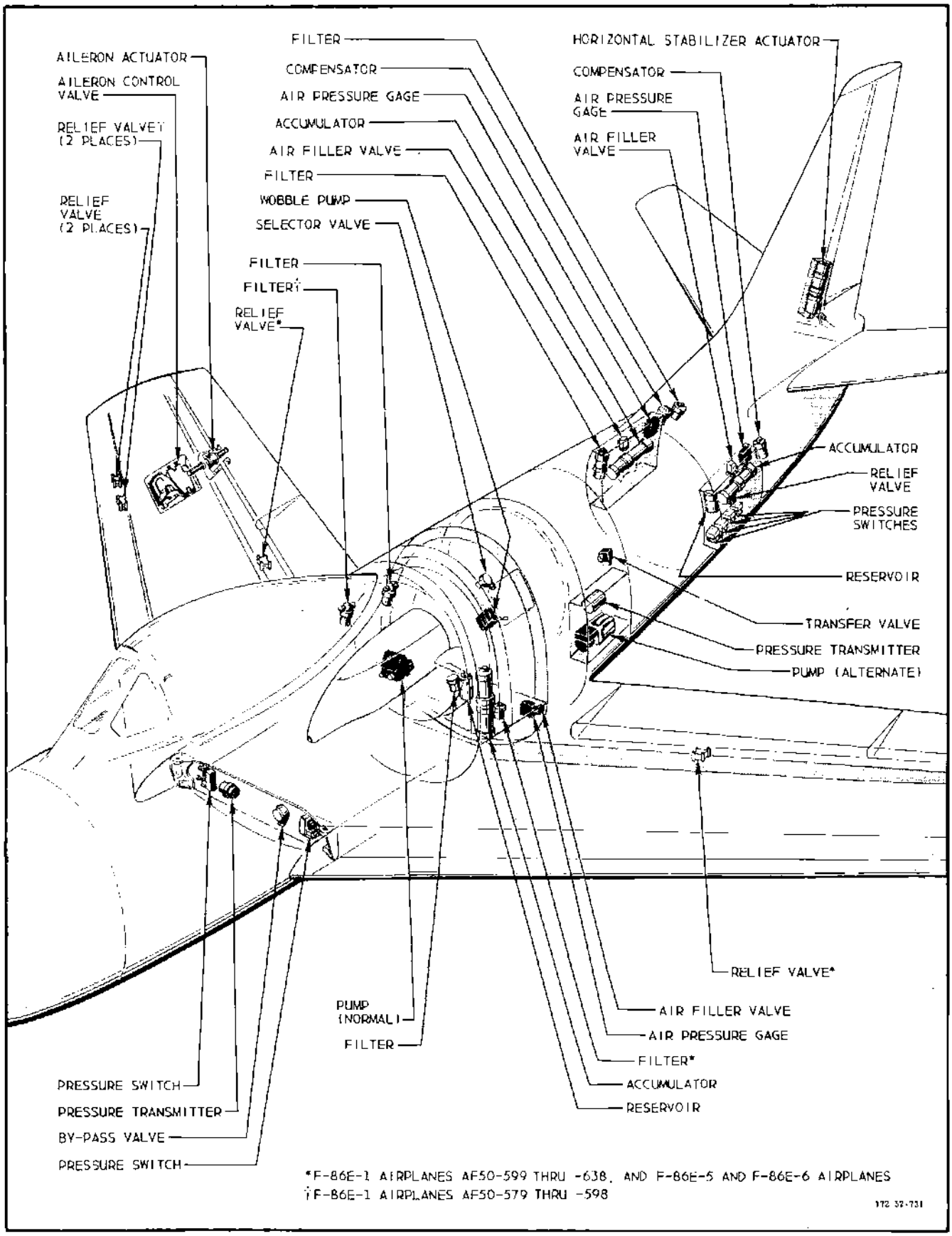
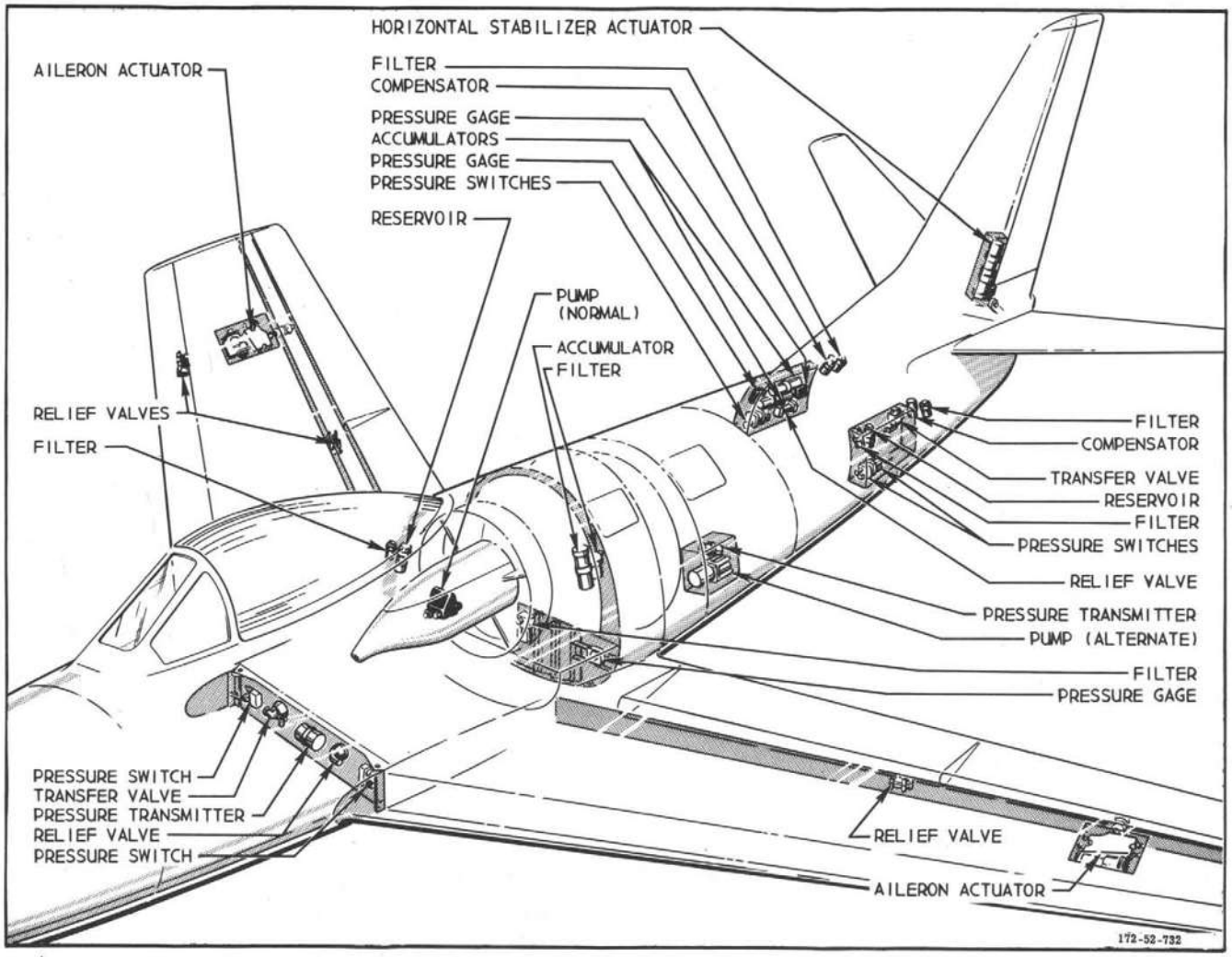


Figure 2-26. Surface Control Hydraulic Power System—F-86E-1, F-86E-5, and F-86E-6 Airplanes



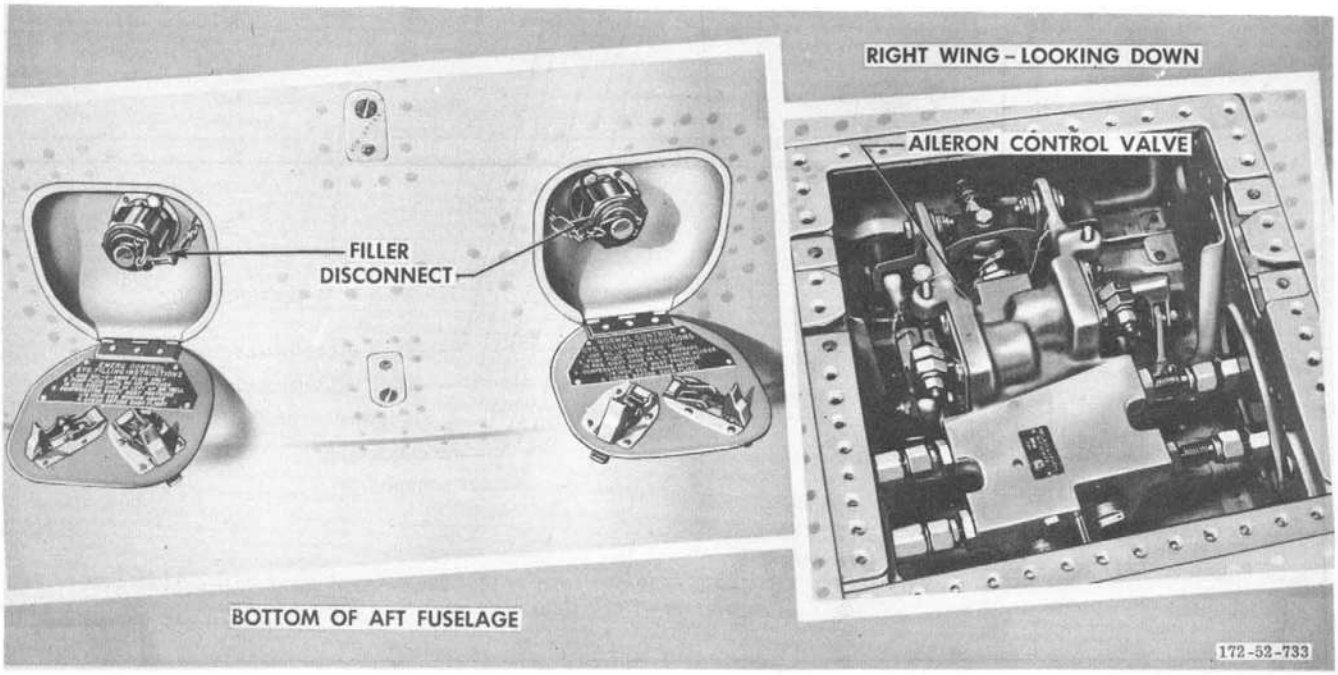


Figure 2-27. Surface Control Hydraulic Power System—F-86E-10 and F-86E-15 Airplanes (Sheet 1 of 3)

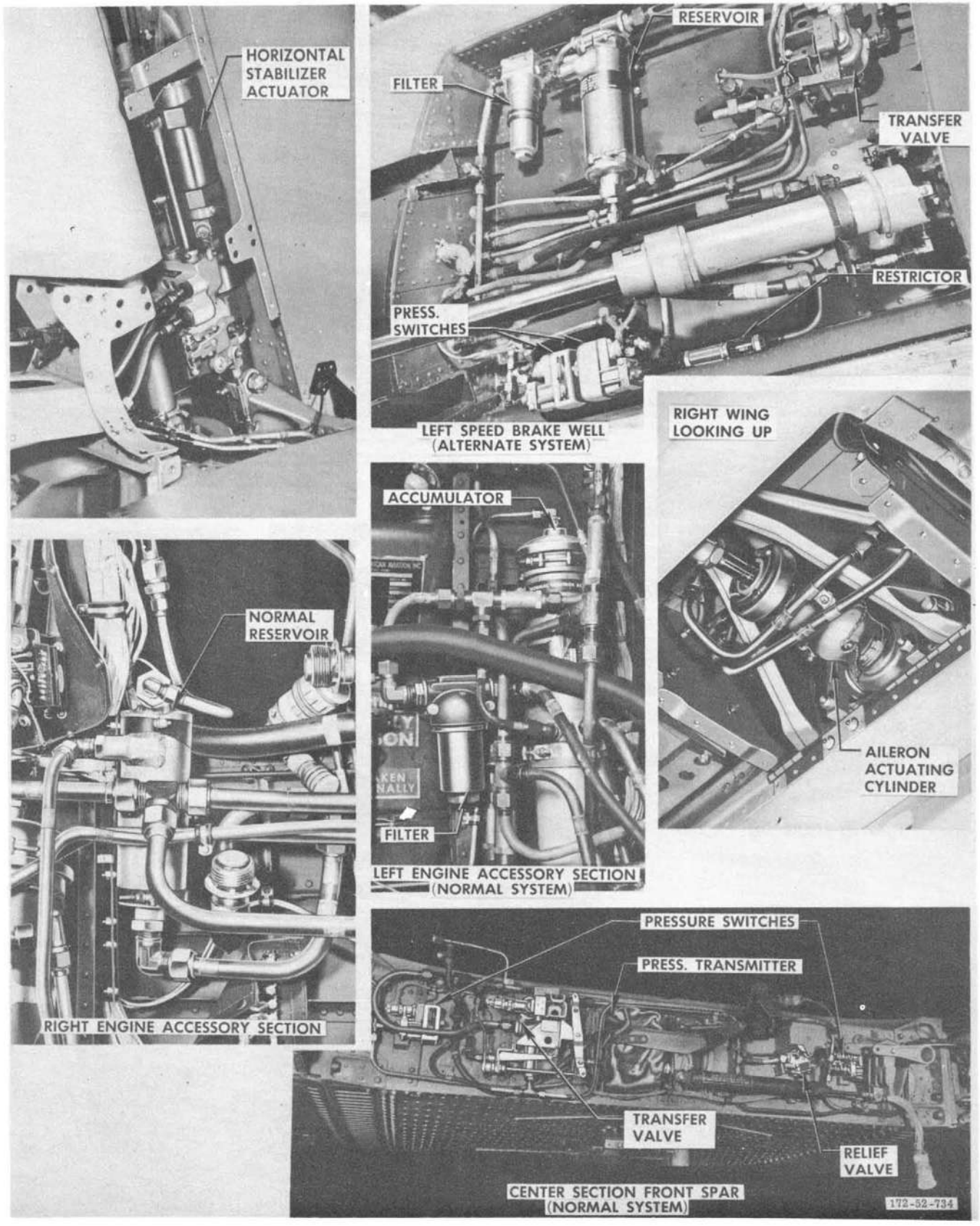


Figure 2-27. Surface Control Hydraulic Power System—F-86E-10 and F-86E-15 Airplanes (Sheet 2 of 3)

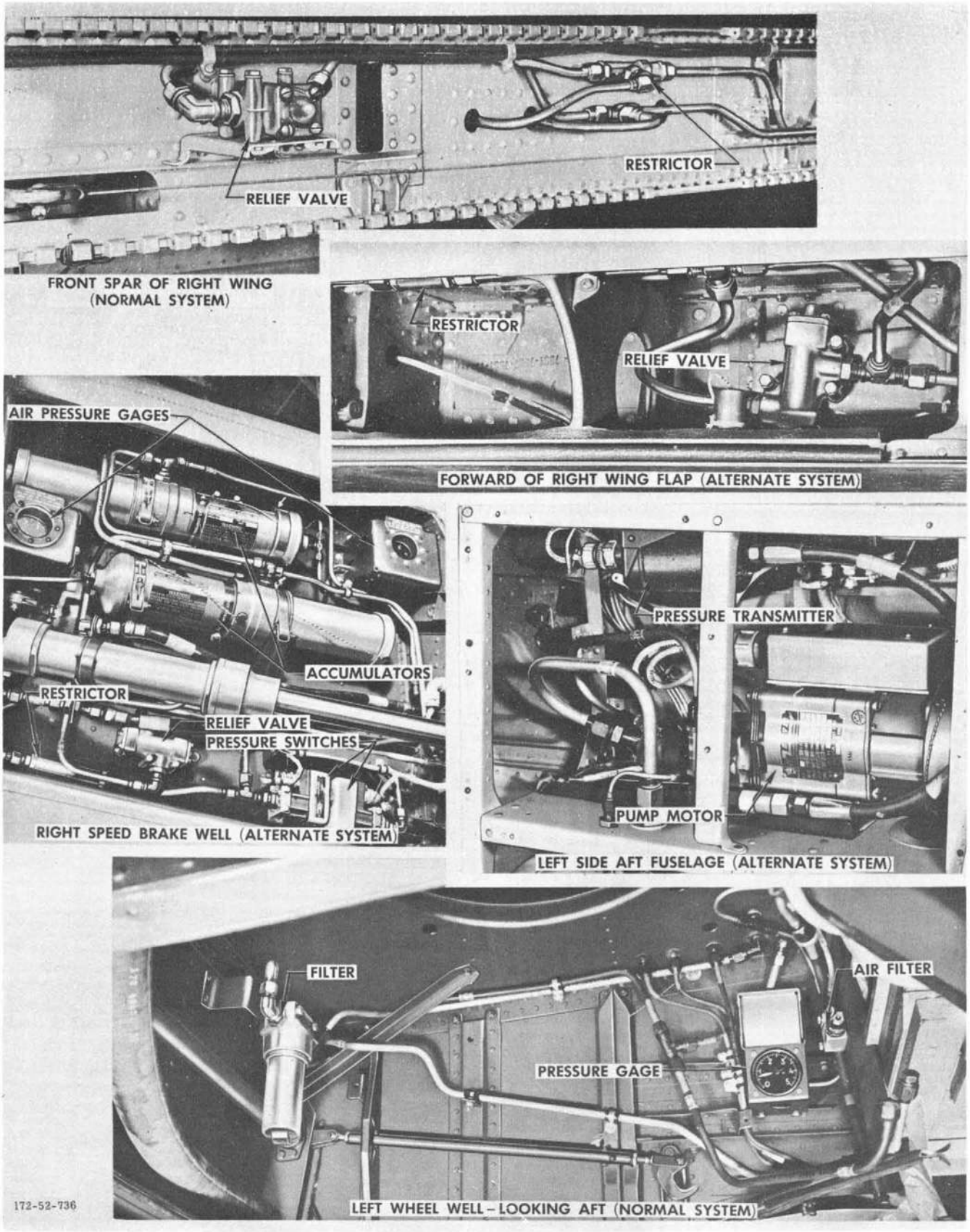


Figure 2-27. Surface Control Hydraulic Power System—F-86E-10 and F-86E-15 Airplanes (Sheet 3 of 3)

2-94. CHECKING SURFACE CONTROL HYDRAULIC POWER SYSTEM ELECTRICAL CIRCUIT (F-86E-10 AND F-86E-15 AIRPLANES). Conduct the functional check of the electrical circuit as follows:

Note

Steps a. through f. make up the check for the alternate pump control pressure switches.

a. With external electrical power off, battery switch "OFF," all circuit breakers in, and hydraulic test stand off, the alternate system pump should not cycle.

b. Place nose wheel steering safety switch in the shock strut extended position. The alternate pump should cycle and maintain alternate system pressure of 2700 to 3000 psi.

c. With external power on and nose wheel steering safety switch in the ground position, disconnect plug from the accumulator pressure switch in the left speed brake well. The alternate pump should continue to cycle.

d. Disconnect plug from the accumulator pressure switch in the right speed brake well. The alternate system pump should stop.

e. Connect plug to the accumulator pressure switch in the left speed brake well. Alternate pump should cycle.

f. Connect plug to accumulator pressure switch in the right speed brake well. Alternate pump should continue to cycle.

Note

Steps g. through k. make up the check for the automatic-return-to-normal-system pressure switches.

g. With hydraulic test stand turned on and regulated to 4.5 gpm flow, operate the cockpit switch to check change-over to normal and back to alternate. Cockpit indicator light should be on when alternate system is operating.

h. With alternate system operating, disconnect plugs from both accumulator pressure switches (one in each speed brake well) and from the automatic-return-to-normal-pressure switch in the left speed brake well. Operate control stick to bleed system pressure 650 psi. At approximately this pressure, the control should automatically transfer to the normal system.

i. Connect accumulator pressure switch in the right speed brake well and the automatic-return-to-normal pressure switch in the left speed brake well. Allow alternate system pressure to build up. Control should return to alternate system when pressure reaches 850 psi.

j. Disconnect both pressure switches in the right speed brake well and bleed system by operating controls. Automatic transfer to the normal system should occur at approximately 650 psi system pressure.

k. Connect the pressure switches in both speed brake wells. Pressure should build up and controls should return to alternate system at approximately 850 psi. Safety pressure switches.

Note

Steps l. through n. make up the check of the normal power control system pressure switches.

l. On F-86E-1 and F-86E-5 Airplanes, disconnect normal pressure switch by disconnecting wire No. CS42B18 from the terminal block. The terminal block is located on the lower left side, forward of the wing center section. Access is through the expended ammunition door. On F-86E-10 and F-86E-15 Airplanes, disconnect plug from normal pressure switch at front spar. Verify proper operation of both normal and alternate systems by operating cockpit control switch.

m. With normal system operating, turn off test stand. Move controls to bleed normal system. Automatic transfer to alternate system should occur when normal system pressure reaches approximately 650 psi.

n. Start test stand and reset controls to the normal system. On F-86E-1 and F-86E-5 Airplanes, connect wire No. CS42B18 and disconnect wire No. CS36E18 at the same terminal block. On F-86E-10 and F-86E-15 Airplanes, connect and disconnect plugs at respective switches. This will put the other normal pressure switch out of the circuit. Repeat steps l. and m.; then connect wire CS36E18 to terminal block or connect plug.

Note

The following step makes up the check for the alternate pump motor power supply.

o. With external electric power on, all circuit breakers in, battery switch "OFF," hydraulic test stand off, and alternate system operating, pull circuit breaker at aft fuselage left fire access door adjacent to pump motor. Alternate pump should continue to operate. Close circuit breaker.

Note

The following step makes up the check for the manual emergency change-over system.

p. With the battery switch "OFF," external electric power off, and test stand off, pull manual change-over handle. The alternate pump should operate continuously at a maximum pressure of approximately 3400 psi. Return handle to normal position. The pump should stop.

CAUTION

Hold duration of this test to a minimum because of the high drain on the airplane battery.

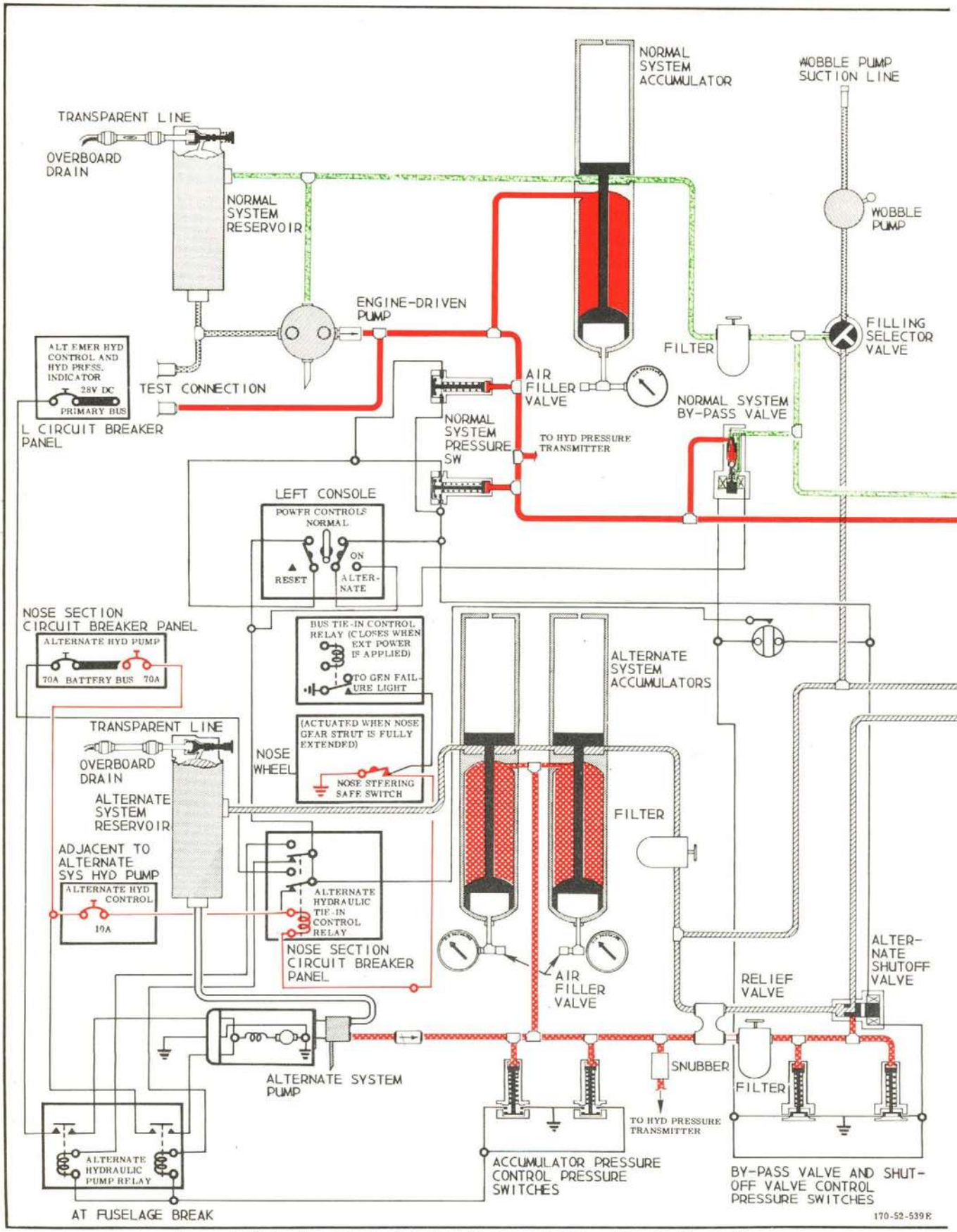


Figure 2-28. Surface Control Hydraulic Power System—Normal Operation—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)

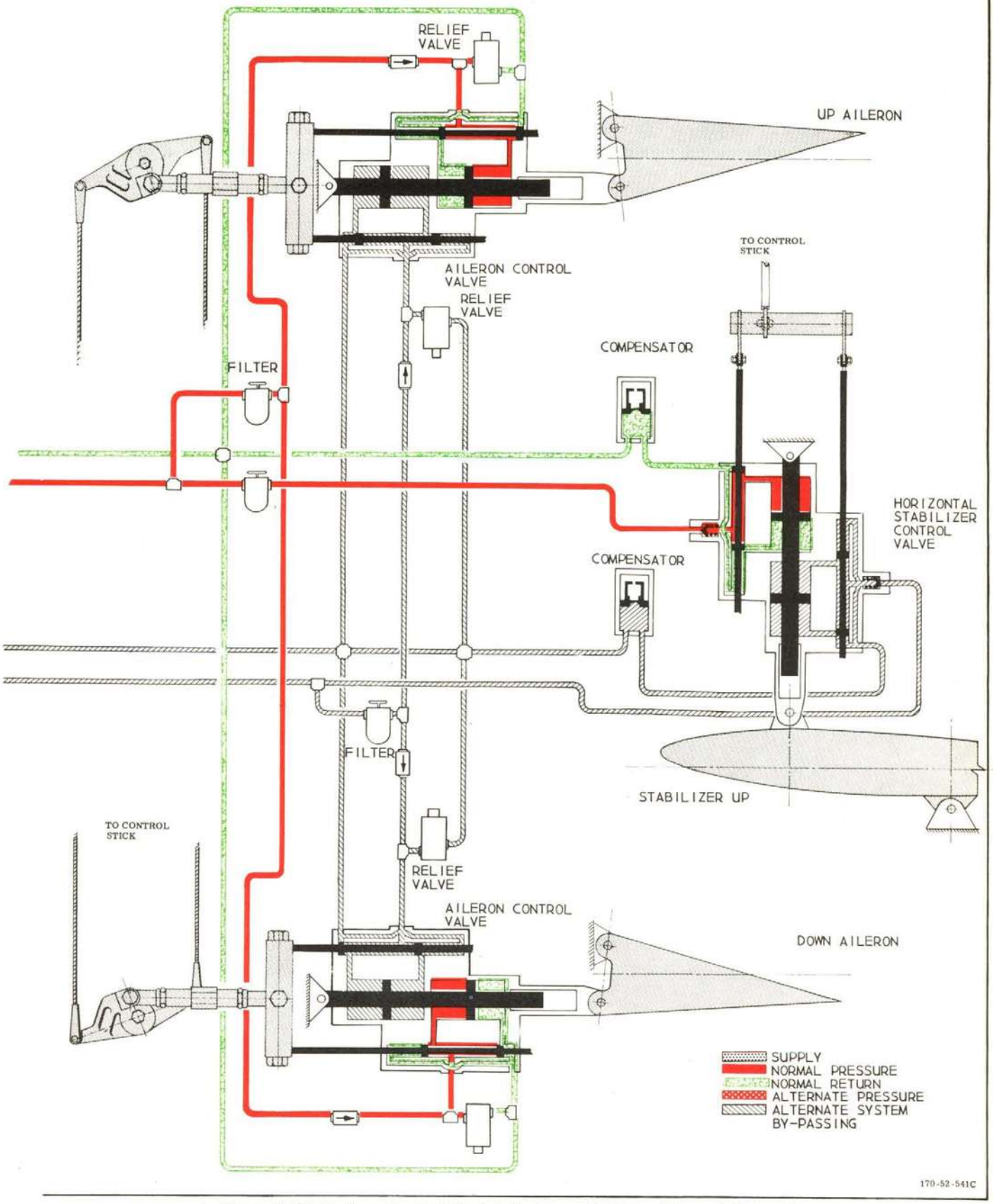


Figure 2-28. Surface Control Hydraulic Power System—Normal Operation—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)

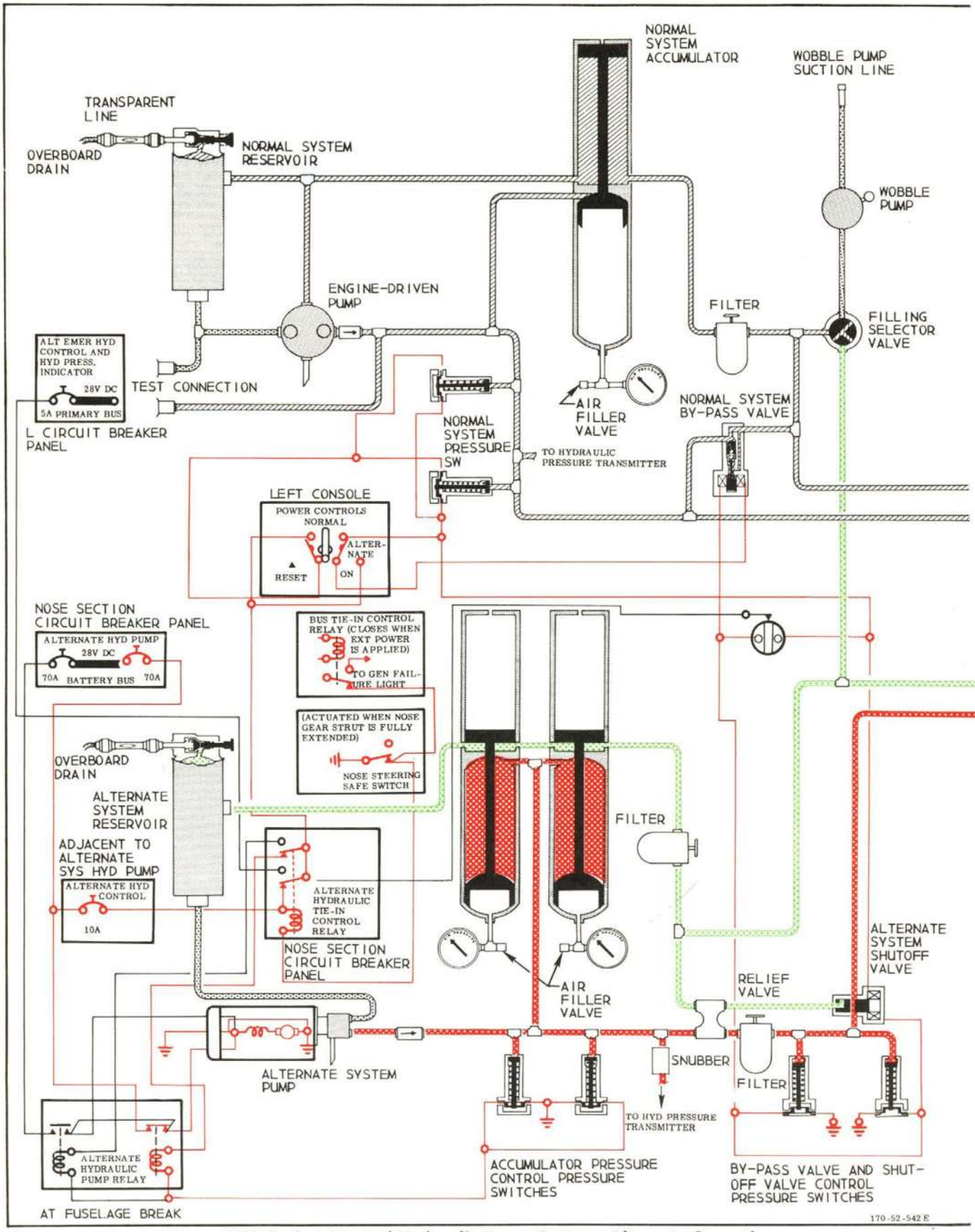


Figure 2-29. Surface Control Hydraulic Power System—Alternate Operation—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)

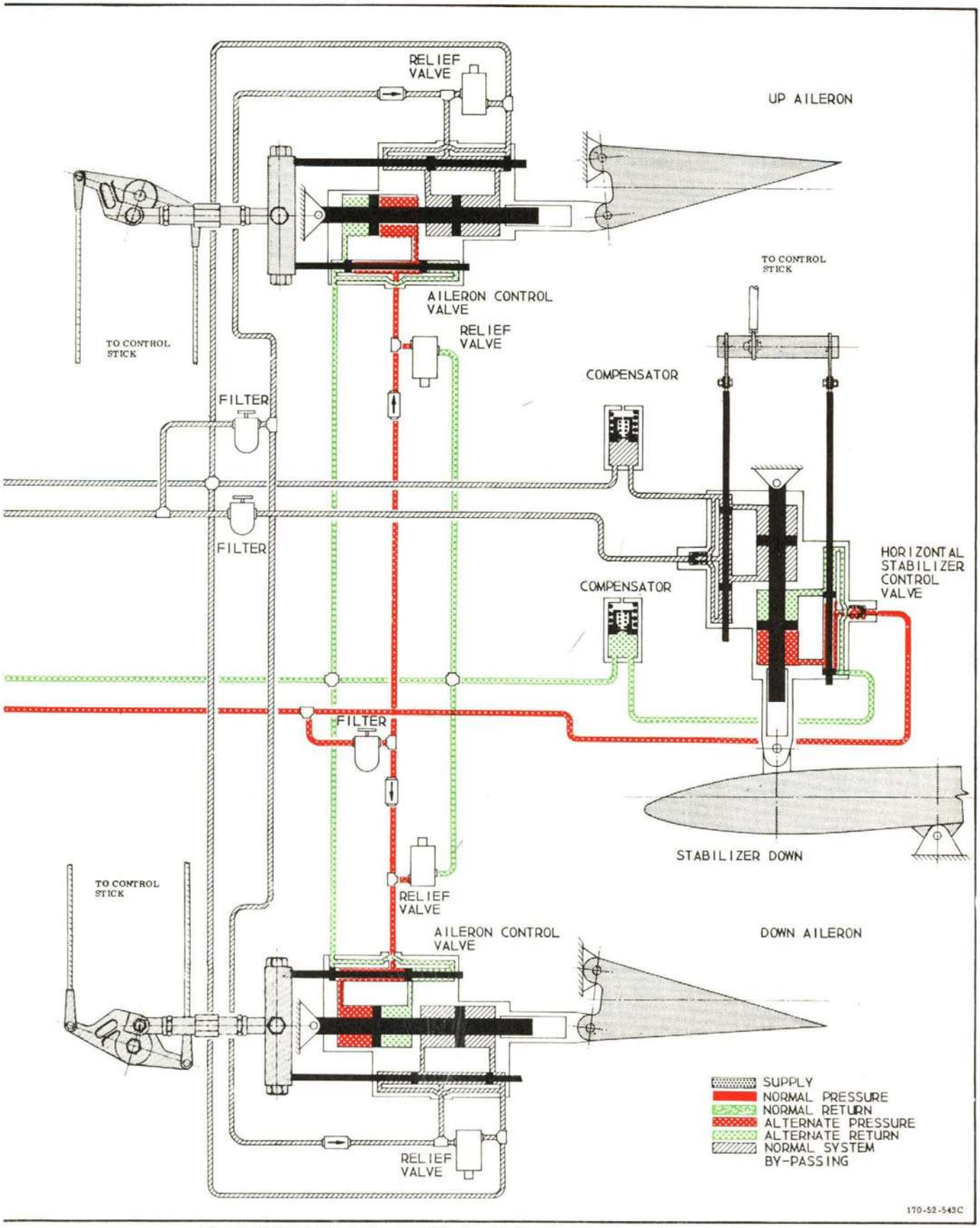


Figure 2-29. Surface Control Hydraulic Power System—Alternate Operation—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)

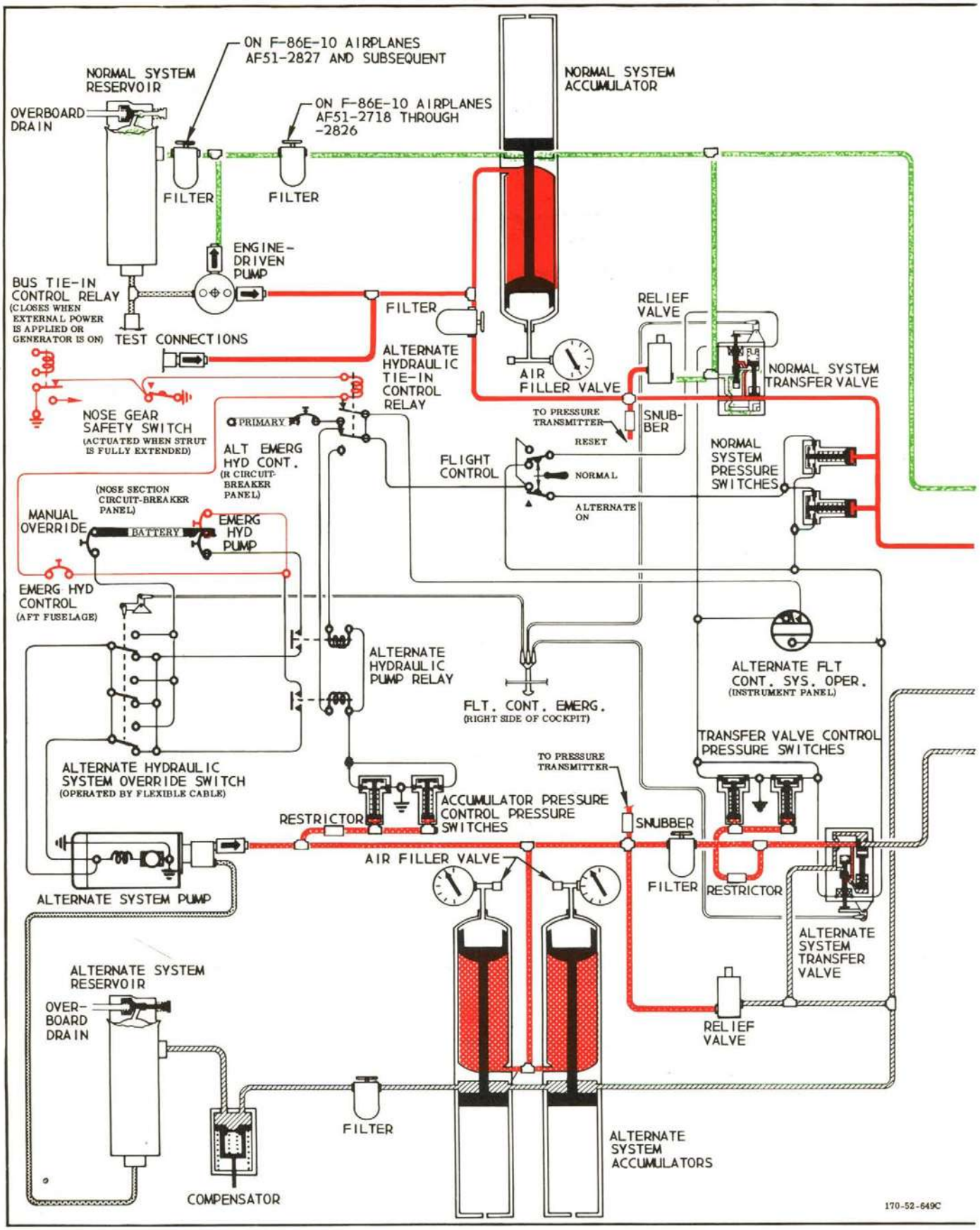


Figure 2-30. Surface Control Hydraulic Power System—Normal Operation—F-86E-10 and F-86E-15 Airplanes (Sheet 1 of 2)

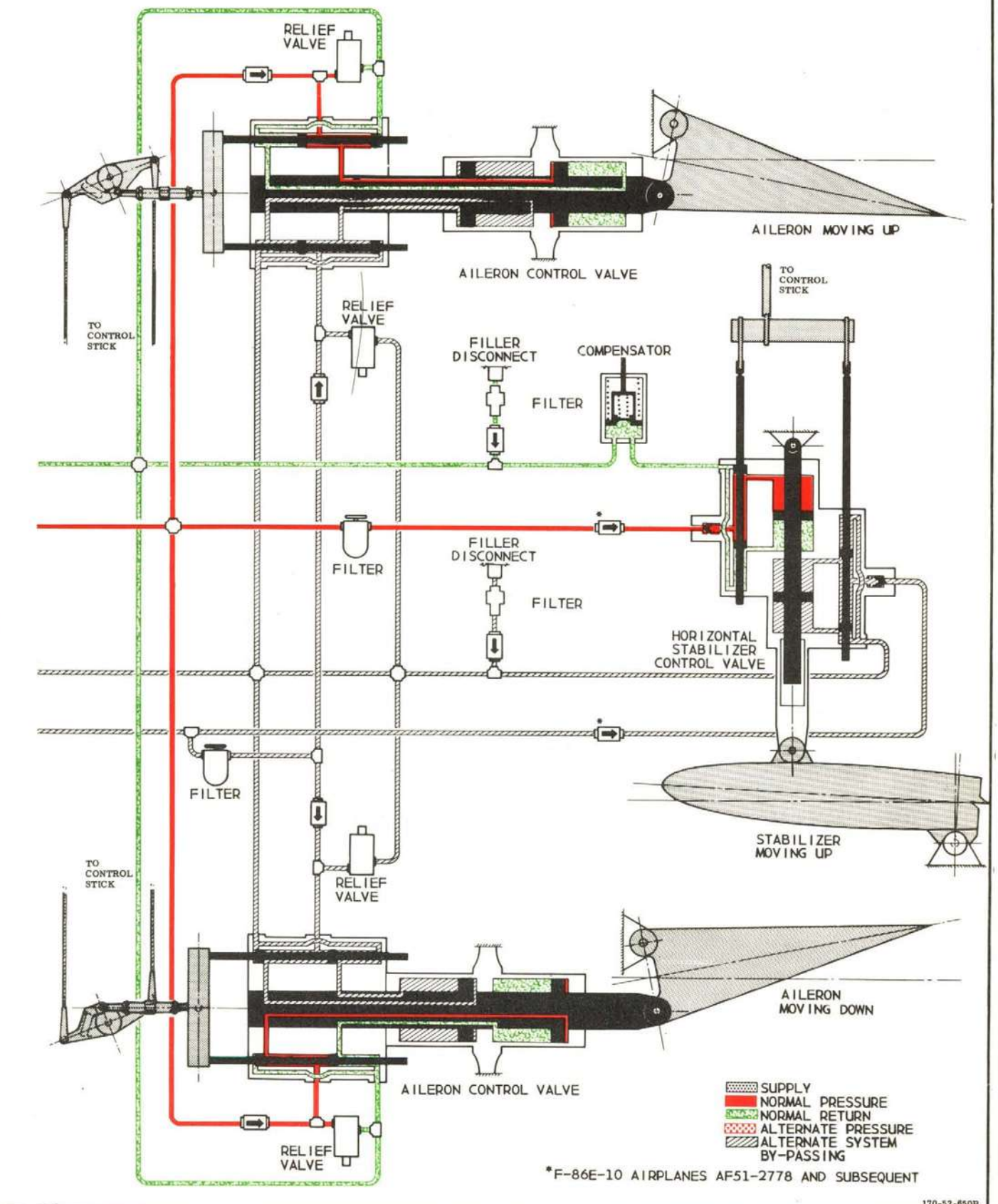


Figure 2-30. Surface Control Hydraulic Power System—Normal Operation—F-86E-10 and F-86E-15 Airplanes (Sheet 2 of 2)

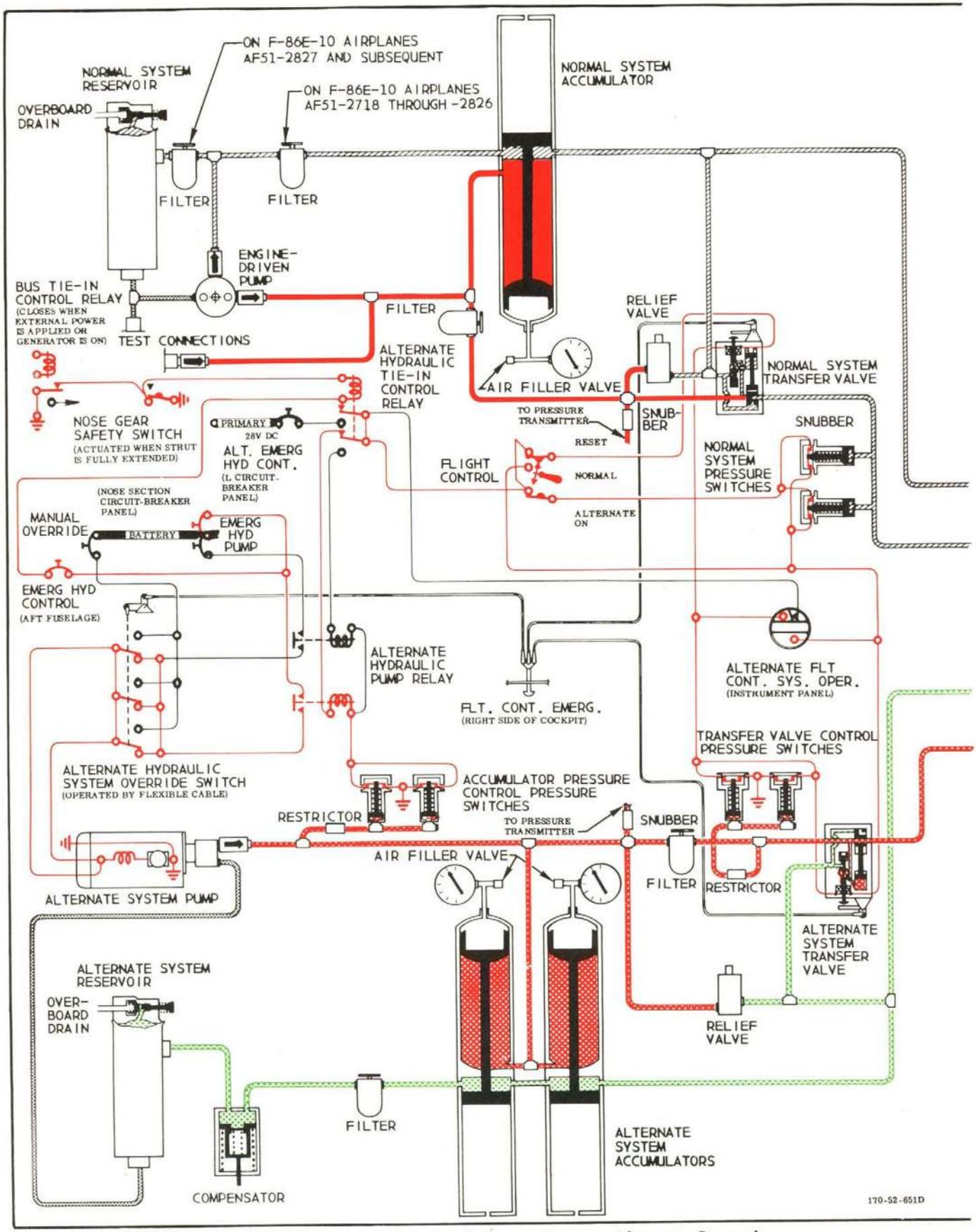


Figure 2-31. Surface Control Hydraulic Power System—Alternate Operation—F-86E-10 and F-86E-15 Airplanes (Sheet 1 of 2)

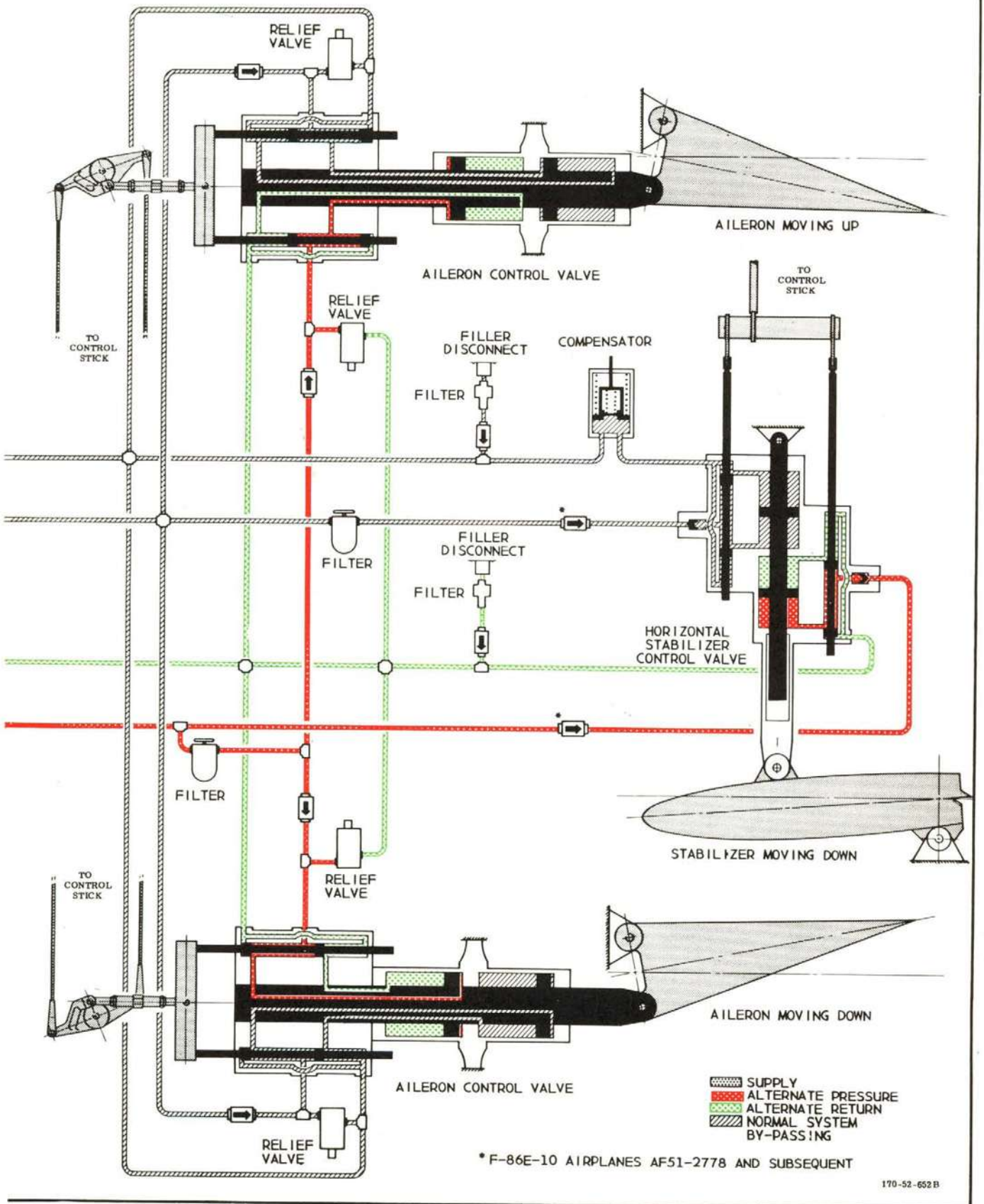


Figure 2-31. Surface Control Hydraulic Power System—Alternate Operation—F-86E-10 and F-86E-15 Airplanes (Sheet 2 of 2)

2-95. SURFACE CONTROL ALTERNATE HYDRAULIC MANUAL CHANGE-OVER SYSTEM (F-86E-10 AND F-86E-15 AIRPLANES).

2-96. The manually actuated hydraulic change-over system consists of an actuating handle, six telescopic units, a switch assembly, and two flexible (teleflex) cables. When the handle, located in the cockpit forward of the right console, is actuated, it positions the transfer valves to the alternate system and actuates the switch to connect the alternate pump directly to the battery bus. This switch is located directly above the alternate system pump in the left side of the aft fuselage.

CAUTION

Extreme care should be exercised to prevent denting and/or kinking the flexible cable tubing, as dents or kinks would cause the cable to bind. Bend radius of the tubing, preferably 5 inches, should never be less than 3 inches.

2-97. ADJUSTING SURFACE CONTROL ALTERNATE HYDRAULIC MANUAL CHANGE-OVER SYSTEM (F-86E-10 AND F-86E-15 AIRPLANES). See figure 2-32.

2-98. SURFACE CONTROL HYDRAULIC POWER SYSTEM PUMP.

2-99. The variable-displacement, engine-driven hydraulic pump (Vickers AA32507-L-2) is used to supply pressure to the normal system. The pump, mounted on the accessory drive section of the engine, is a nine-piston rotary type with a maximum output of 5.65 gpm up to a pressure of 2700 psi. A spring-loaded control unit is incorporated in the pump housing to control pump output. In operation, the swivel yoke allows the cylinder assembly to change angle, causing the pistons to increase or decrease the effective stroke. When the top of the pressure range is reached, the cylinder assembly straightens and reduces the volume of fluid delivered to the system. As the pressure diminishes, the swivel yoke is permitted to return to its normal position and the cylinder assembly resumes delivering fluid in sufficient volume to build up the required pressure once more.

2-100. REMOVING PUMP. Refer to paragraph 3-14.

2-101. INSTALLING PUMP. Refer to paragraph 3-15.

2-102. SURFACE CONTROL ALTERNATE HYDRAULIC POWER SYSTEM PUMP.

2-103. The electric-motor-driven alternate pump consists of a D1000 Hoover electric continuous-duty motor and a Vickers PF24-3906-20BCE-3 constant-displacement pump. This assembly is located on the left side of the aft fuselage and is accessible through the data case access door. The pump is a piston type with an output of ½ gpm at 3000 psi.

2-104. SURFACE CONTROL HYDRAULIC POWER SYSTEM RESERVOIRS.

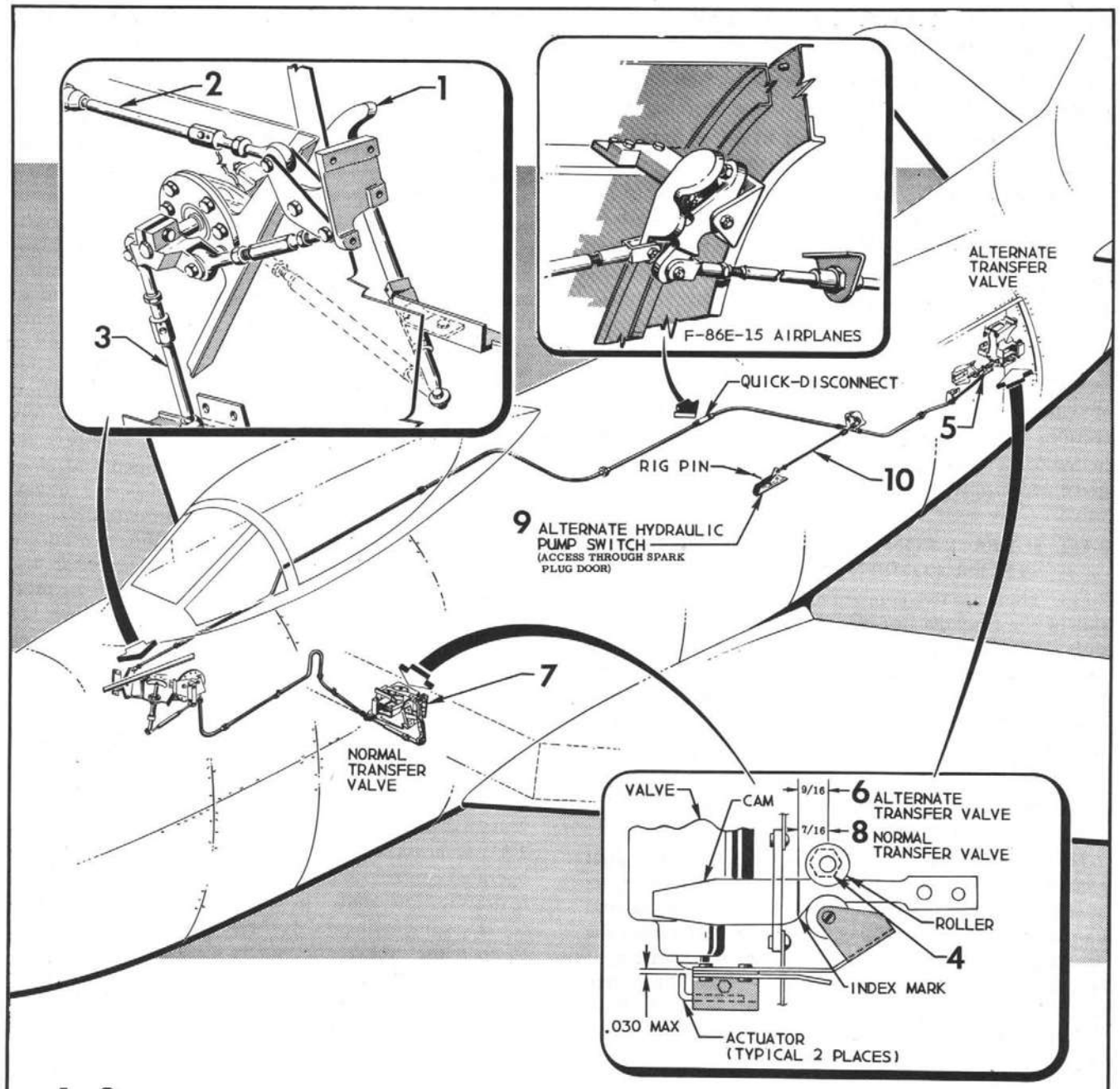
2-105. There are two reservoirs in the surface control hydraulic power system, one for the normal system and one for the alternate system. The two reservoirs are identical, and each has a 50-cubic-inch capacity. A relief valve is mounted on top of each reservoir and opens at 60 (+5/—0) psi. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the alternate system reservoir is located in the left speed brake well, and the normal system reservoir is accessible through the right engine access door. On F-86E-10 and F-86E-15 Airplanes, the alternate system reservoir is located in the left speed brake well and the normal system reservoir is accessible through the left engine access door.

2-106. SURFACE CONTROL HYDRAULIC POWER SYSTEM ACCUMULATORS.

2-107. Three identical self-displacing accumulators are used in the surface control hydraulic power system. The two for the alternate system are located in the right speed brake well, and the one for the normal system is located in the left engine accessory section. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, there is an alternate accumulator in each speed brake well. The accumulators are precharged with air to 700 (±50) psi on F-86E-1, F-86E-5, and F-86E-6 Airplanes and 600 (+50/—0) psi on F-86E-10 and F-86E-15 Airplanes. Incorporated with each accumulator is a pressure gage and an air filling valve. The accumulators have three separate sections: one for air pressure, one for fluid pressure, and one for return fluid. As fluid leaves the pressure section of the accumulator, the air pressure forces the accumulator piston down, allowing fluid to enter the return section.

2-108. SURFACE CONTROL HYDRAULIC POWER SYSTEM TRANSFER VALVES.

2-109. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, two solenoid-operated transfer valves are used in the surface control hydraulic power system: a Weston 8070-1 in the normal system and a Saval 23686 in the alternate system. On F-86E-10 and F-86E-15 Airplanes, the normal system has a Saval 25342 and the alternate system has a Saval 25386. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the valve in the normal system is normally open. During alternate operation the valve by-passes the entire normal system including the accumulator. On F-86E-10 and F-86E-15 Airplanes, during alternate operation, the normal valve shuts off normal pressure but allows the cylinder side of the system to by-pass to return. The valve in the alternate system is normally closed, holding the alternate system accumulators pressurized, but by-passing all alternate system lines to the dual control valves. During alternate operation, the valve opens, allowing pressure to be directed to the dual control valves.



1-3 Place handle in the fully retracted (pushed in) position and adjust telescopic units so that they do not extend beyond the inspection hole in the extended position nor bottom in the retracted position.

4 Adjust eccentric roller to position cam so that a maximum .030 inch clearance exists between actuator and valve plunger.

5, 6 Adjust telescopic rod of alternate transfer valve to position cam as shown.

7, 8 Adjust telescopic rod of normal transfer valve to position cam as shown.

NOTE: Pull out the alternate pump circuit-breaker, located in the nose section circuit-breaker panel.

9,10 Pull handle out and insert rig pin to position electrical switch to the on position. Adjust rod if necessary.

11 Remove rig pin, push handle in, and set the circuit breaker in. Pull handle out and verify that the valves and switches operate. The alternate pump should run continuously. Push handle in and trip reset switch to return valves and pressure switches to normal position. Repeat operation several times to verify that transition always occurs. Operating load on the handle should not exceed 55 pounds.

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Figure 2-32. Adjusting Surface Control Alternate Hydraulic Manual Change-over System— F-86E-10 and F-86E-15 Airplanes

2-110. SURFACE CONTROL HYDRAULIC POWER SYSTEM PRESSURE SWITCHES.

2-111. There are six pressure switches. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the four pressure switches in the alternate system are mounted in the left speed brake well. On F-86E-10 and F-86E-15 Airplanes, two pressure switches for the alternate system are located in each speed brake well. Two of these pressure switches energize the alternate system pump when pressure drops below 2700 (±100) psi. The other two pressure switches de-energize both transfer valves when alternate system pressure drops to 650 (±100) psi, thereby automatically returning the control to the normal system. The pressure switches in the normal system are located on the front spar of the wing center section. When pressure in the normal system drops below 650 (±100) psi, the pressure switches are energized and supply power to the alternate system transfer valve.

2-112. SURFACE CONTROL HYDRAULIC POWER SYSTEM COMPENSATORS.

2-113. There are two compensators, one located on each side of the fuselage just aft of the speed brakes, accessible through small access doors. They are used to take care of any pressure surges and to pressurize the return lines and reservoirs of both the normal and alternate system to 30 psi. When pressurized, the compensator rods should extend a minimum of ¼ inch up to a maximum of 1½ inches.

2-114. SURFACE CONTROL HYDRAULIC POWER SYSTEM ACTUATORS.

2-115. Each of the three actuators consists of a dual control valve and an actuating cylinder. Each is operated by two separate hydraulic systems, one normal and one alternate. The two systems are separated within the actuators to prevent loss of fluid from both systems if one system fails. When the control valve of the system being used is in the neutral position, it blocks both ports of the cylinder to lock fluid in the cylinder and prevent the surface from moving.

Note

Maintenance of this unit is limited to installation, removal, and linkage adjustment. No external or internal leakage is allowed. If actuating cylinders show evidence of leakage, they must be replaced. Under no circumstances should the actuating cylinders and dual control valve be separated or disassembled.

2-116. SPEED BRAKE SYSTEM.

2-117. The speed brake system (figure 2-33) consists of two panel-type speed brakes, a solenoid-operated control valve, a hydraulic accumulator, two hydraulic actuating cylinders, a hydraulic pump, valve, two thermal relief valves, two one-way restrictors, two quantity measuring fuses, check valves, a control switch, and necessary electrical wiring, relays, and plumbing, to make the system operative. The speed brake panels are installed on the airplane, one on each side of the fuselage, at a point midway between the empennage and rear fuselage rear attaching point. The solenoid-operated control valve is located at the lower left side of the fuselage and is accessible through the engine compartment access door or through the left wheel well manhole. The hydraulic accumulator is located on the right side of the airplane and is accessible through the manhole in the right wheel well. A hydraulic actuating cylinder is attached to each speed brake panel and to the panel-locking mechanism. The hydraulic dump valve is located directly behind the pilot's seat and is accessible through the radio compartment door. It is manually operated by a lever located at the left-hand side of the engine throttle. Two thermal relief valves are located adjacent to the dump valve. One-way restrictors installed in the speed brake open and close lines serve to limit the closing time of the speed brakes. The two quantity measuring fuses are incorporated in the system to limit the loss of fluid in event of a failure in the system. The check valve is incorporated in the system at the accumulator to prevent accumulator pressure loss in case of utility system pressure failure. On F-86E-1 Airplanes AF50-600 through -638 and F-86E-5 and subsequent airplanes, two check valves are incorporated in the system. The control switch is located on the top of the power control handle at the left side of the cockpit. The switch has three positions: "OUT," neutral (indicated by a white line), and "IN."

2-118. FUNCTION OF SPEED BRAKE SYSTEM.

2-119. When the speed brake control switch (figure 2-33) is moved to "OUT" (open position), the solenoid-operated control valve is electrically energized to direct hydraulic fluid under pressure to the opening side of the actuating cylinders. As the actuating cylinders move to open the brakes, they operate linkages that release the brake rollers from behind the latch and into the cocked position. The actuating cylinders continue to extend and open the brake panels. When the speed brake control switch is moved to "IN" (closed position), the solenoid-operated control valve is electrically energized to direct hydraulic fluid under pressure to the closing side of the actuating cylinders. As the brake panels close, the latch on each brake panel releases the roller from the hooked position, and the final closing action of the actuating cylinders seats the roller firmly. (See figure 2-34.) In the event of electrical or hydraulic failure, the speed brakes can be closed by positioning the emergency dump valve control handle in the "EMERG CLOSED" position. This opens the emergency dump valve, thus relieving hydraulic pressure and permitting the air loads to close the speed brakes to a trail position in flight. With the hydraulic system disconnected, the speed brake panels may be opened by inserting a screwdriver through the small access hole in the speed brake panel to force the roller into the locked position.

2-120. TROUBLE SHOOTING SPEED BRAKE SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Speed brakes do not operate.	Selector valve inoperative.	Check wiring or replace valve.
Emergency close system does not operate.	Maladjustment of linkage between control handle and dump valve.	
Hydraulic pressure fluctuates with brakes open.	Dump valve partially open.	Replace valve or readjust linkage.
Actuating cylinder end failure.	Restrictor in closing line installed backward or damaged. Improper retract port fitting. Quantity measuring fuse in closing line damaged.	

2-121. CHECKING SPEED BRAKE SYSTEM.

2-122. To check the speed brake system for proper operation, proceed as follows:

a. Open and close speed brakes several times and check to see that locks function properly and that brake panels open and close simultaneously.

Note

The speed brake panels should close in 2 to 4 seconds in flight and in 4¼ to 5½ seconds on the ground.

b. Open the speed brakes, set speed brake control switch in neutral position, and then position emergency dump valve to "EMERG CLOSE." Manual pressure against the side of the speed brake panels should close them.

c. Move speed brake emergency dump valve control to "EMERG CLOSE"; then move speed brake control switch to "OUT" (open position). If quantity measuring fuse is working, fluid will by-pass until fuse shuts off. (Fluid can be heard by-passing while fuse is open.)

d. Check selector valve for sticking by opening speed brakes halfway. Wait 3 minutes; then check brake creep for the next 3 minutes. The sum of the creep of both brake cylinders should not be over ½ inch with brakes in the open position for the 3-minute period.

e. Open speed brakes; then close them halfway. Wait 3 minutes; then check for brake cylinder creep for the next 3 minutes. The sum of the creep of both brake cylinders should not be over one inch for the 3-minute period.

f. Return emergency control handle to "NORMAL" (off position) and safety with .015-inch brass locking wire (Federal Specification QQ-W-321, Grade A, annealed, soft).

2-123. REMOVING SPEED BRAKES.

2-124. The parts and components referred to in the following procedure are identified in figure 2-34. To remove the speed brakes, proceed as follows:

a. Make sure speed brake panels are open; then remove fuselage rear section. (Refer to paragraph 2-150.)

b. Disconnect the actuating cylinder rod end from the speed brake panel.

c. Disconnect bonding strips.

d. Remove speed brake panel hinge bolts and remove panel.

2-125. INSTALLING AND ADJUSTING SPEED BRAKES.

2-126. See figure 2-34.

2-127. SPEED BRAKE SYSTEM CONTROL VALVE.

2-128. The speed brake system control valve is electrically operated by two solenoids, each independently energized by the speed brake system control switch. When either solenoid is energized (switch in "IN" or "OUT" position), it opens a ball check within the valve that releases hydraulic pressure from one end of the valve shaft to the return line. The pressure on the unreleased end operates the shaft, directs pressure to the cylinders, and opens the return lines from the cylinders. When neither solenoid is energized (switch in neutral), the shaft is centered by springs and equal hydraulic pressure on each end, and the lines (pressure and return) to the actuating cylinders are closed. The valve may be operated by hand, when the electrical system is off, by pushing on the knobs at the ends of the valve.

2-129. SPEED BRAKE SYSTEM QUANTITY MEASURING FUSES.

2-130. Two speed brake system quantity measuring fuses are installed in the speed brake lines to protect the hydraulic system from total loss of fluid in the event of a leak, rupture, or damage to the speed brake actuating cylinders or lines. The Waterman 831-8-100 quantity measuring fuse in the speed brake opening line will allow approximately 100 cubic inches of fluid to pass before closing, while the Waterman 831-8-50 quantity

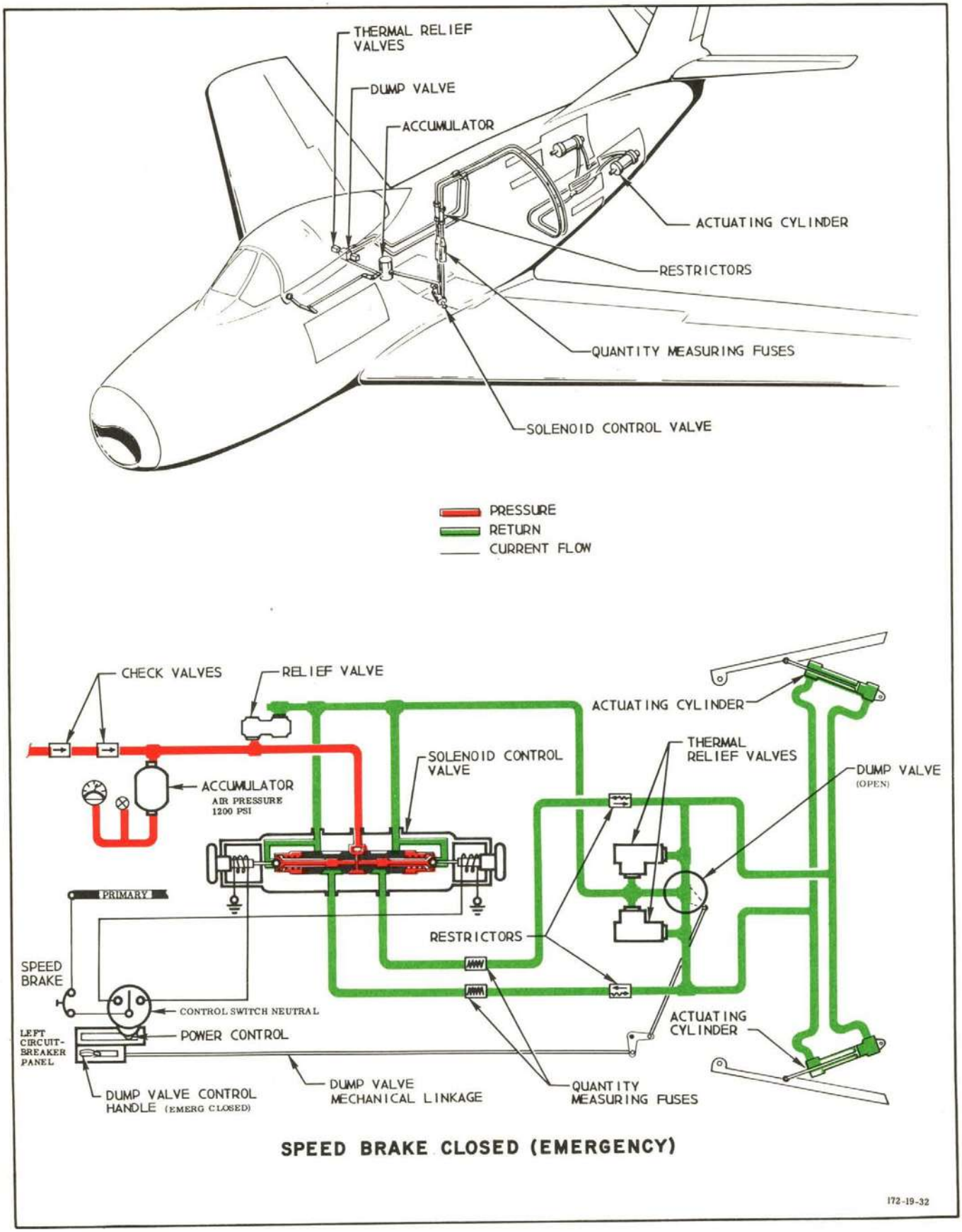


Figure 2-33. Speed Brake System (Sheet 1 of 2)

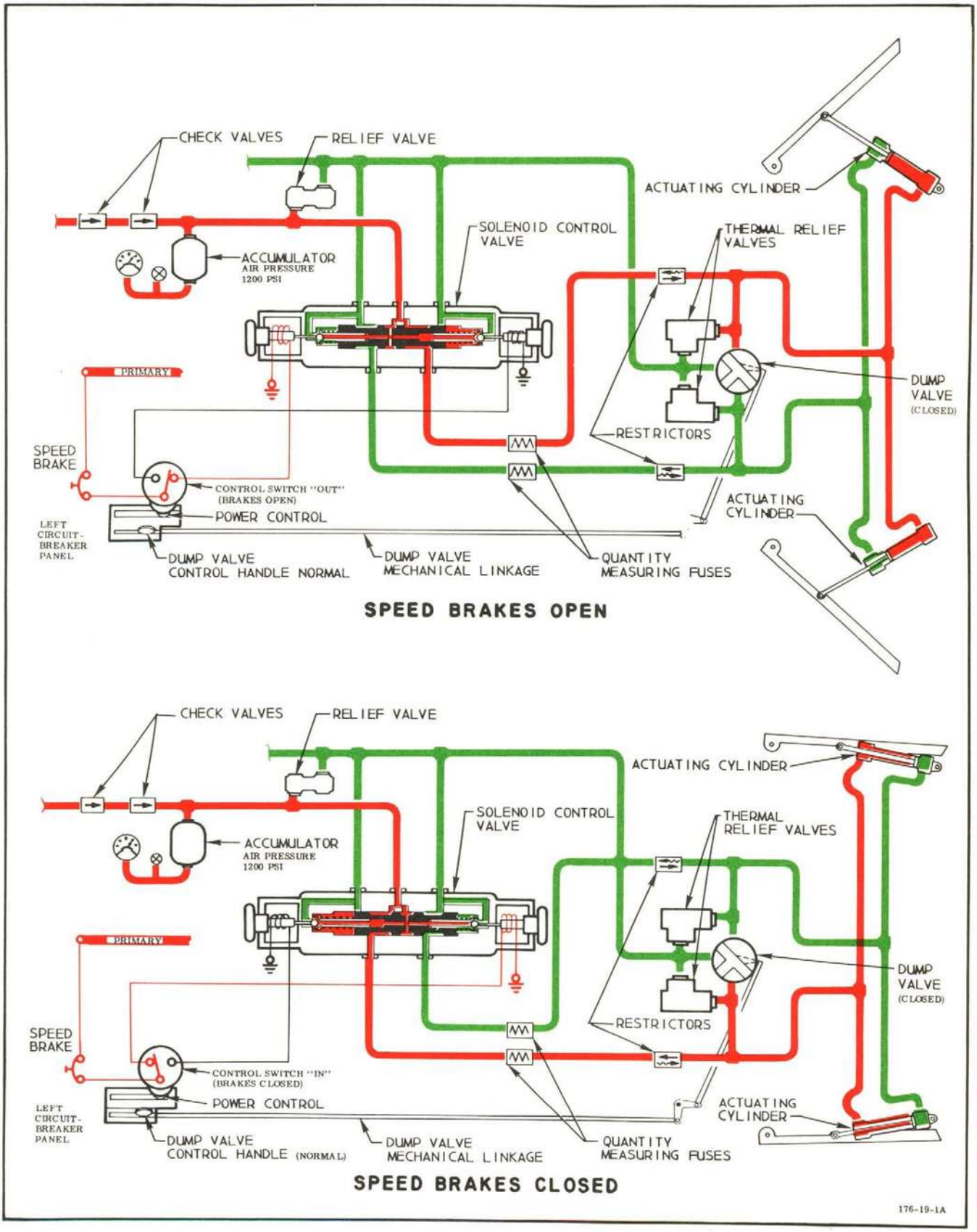


Figure 2-33. Speed Brake System (Sheet 2 of 2)

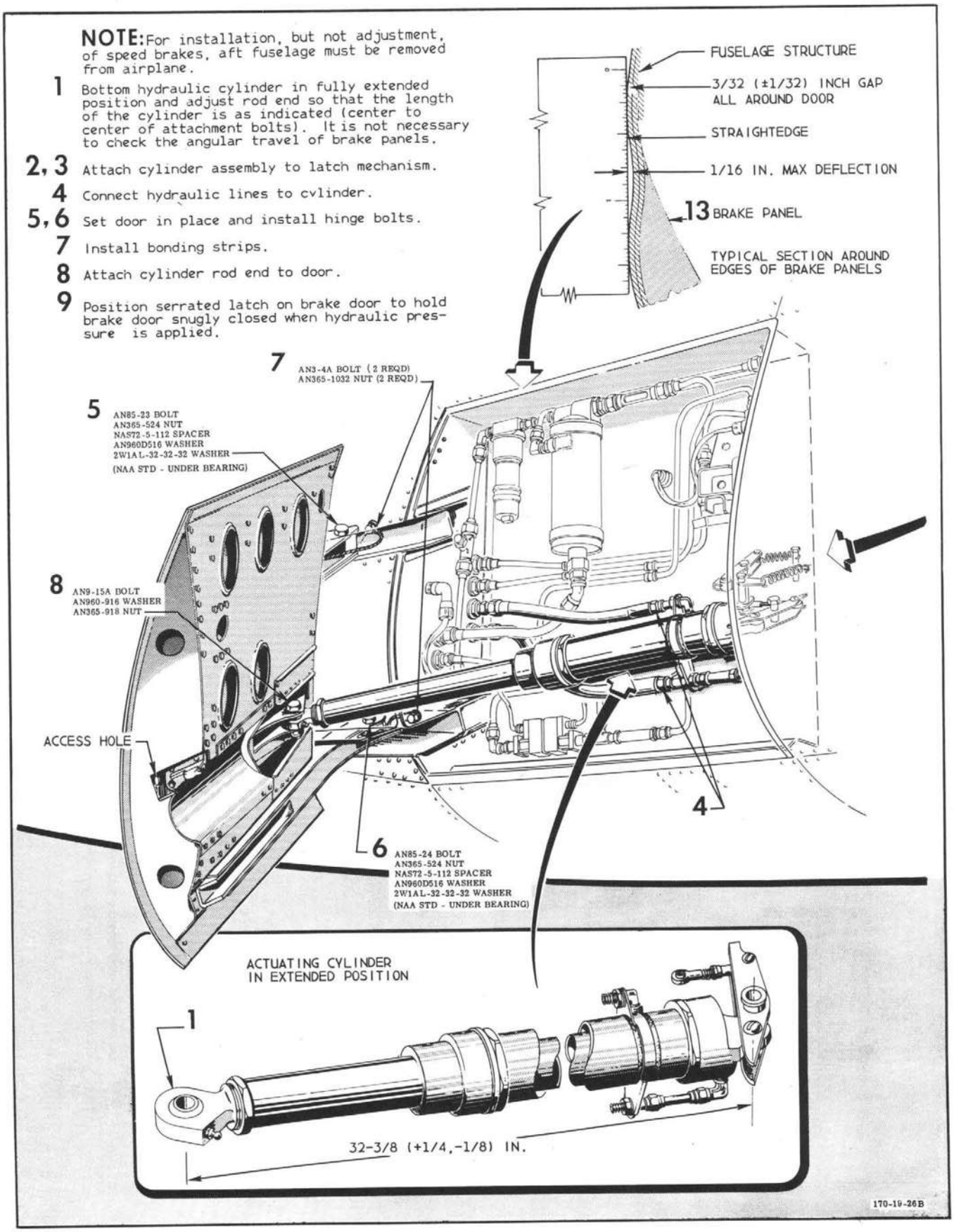


Figure 2-34. Installing and Adjusting Speed Brakes (Sheet 1 of 2)

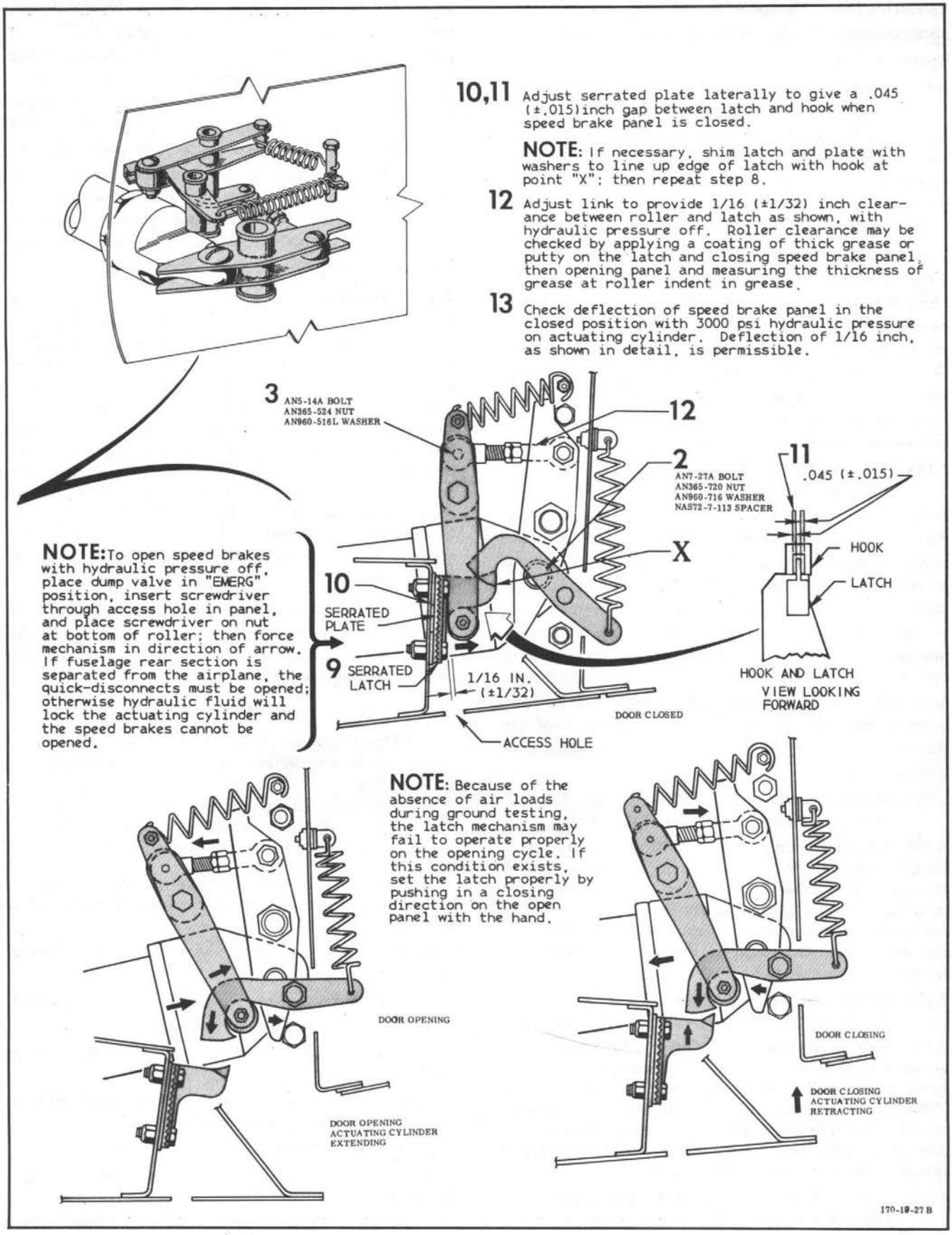


Figure 2-34. Installing and Adjusting Speed Brakes (Sheet 2 of 2)

measuring fuse in the speed brake closing line will allow approximately 50 cubic inches of hydraulic fluid to pass before closing.

2-131. SPEED BRAKE SYSTEM THERMAL RELIEF VALVES.

2-132. Two speed brake system thermal relief valves are incorporated in the system, adjacent to the dump valve, to release excessive pressures due to thermal expansion. Each valve contains a spring that is set to start by-passing fluid at 4000 (±100) psi.

2-133. SPEED BRAKE SYSTEM DUMP VALVE.

2-134. The speed brake system dump valve, located directly behind the pilot's seat, is manually operated by a two-position ("OPEN" and "NORMAL") lever on the pilot's left console, outboard of the engine throttle. The dump valve relieves the pressure from the opening line of the speed brake actuating cylinders, thus allowing the speed brake panels to close under air loads. The released hydraulic fluid is dumped into the return line.

2-135. SPEED BRAKE SYSTEM HYDRAULIC ACCUMULATOR.

2-136. The hydraulic accumulator of 130-cubic-inch fluid capacity is located on the right side of the airplane and is accessible through the access opening in the top of the right-hand wheel well. This accumulator supplies hydraulic fluid under pressure and in volume to prevent depleting the system of pressure and to permit normal operation of the units when the speed brakes are operated. The accumulator also supplies hydraulic fluid under pressure to operate the speed brakes in the event of hydraulic failure. The accumulator is of the piston type and is charged with air at a pressure of 1200 (±50) psi.

2-137. SPEED BRAKE SYSTEM HYDRAULIC ACCUMULATOR AIR FILLER VALVE.

2-138. The speed brake system hydraulic accumulator air filler valve (AN6287-1) is located at the aft end of the right-hand wheel well. A cap protects the valve from dust, oil, and foreign matter. The valve cap should always be kept in place to prevent malfunctioning of the valve due to dirt particles. Refer to paragraph 1-61 for filling instructions.

2-139. SPEED BRAKE SYSTEM HYDRAULIC ACCUMULATOR AIR PRESSURE GAGE.

2-140. The speed brake system hydraulic accumulator air pressure gage is located in the aft end of the right-hand wheel well, and is protected by a red hinged "WARNING" plate. The accumulator air pressure reading should be taken with the hydraulic system pressure discharged. Refer to paragraph 6-109 for detailed information on the air pressure gage.

2-141. SPEED BRAKE SYSTEM HYDRAULIC ONE-WAY RESTRICTORS.

2-142. One-way restrictors are installed in the speed brake system. One of these restrictors, located in the speed brake open line, has a flow capacity of 7.7 (±.5) gpm at 3000 psi. The other restrictor, located in the speed brake close line, has a flow capacity of 2.0 (±.15) gpm at 3000 psi. A wire-type filter element (Purolator 36762) is located in the end of the restrictor. To replace the filter element, exhaust the system pressure; then remove the restrictor from the hydraulic line. Unscrew the free-flow end of the restrictor and remove the filter element. When replacing the filter element, always use new "O" ring seals. Be sure no dirt or foreign objects get into the restrictor.

2-143. FUSELAGE.

2-144. The fuselage is constructed in two main sections to facilitate installation and removal of the engine. The two sections are joined by four special bolts located at quarter points around the fuselage. Quick-disconnects make it possible for the wiring, control cables, hydraulic lines, and fuel lines to be easily separated at the joint. The forward main section incorporates the cockpit, the engine air intake duct, the engine mounts, the radio and radar equipment, and two fuel cells. The burner section of the engine and engine tail pipe are enclosed by the aft main section, which also incorporates the speed brakes. The cockpit is sealed so that it can be pressurized.

2-145. SEPARATING FUSELAGE AND WING.

2-146. The parts and components referred to in the following procedure are identified in figure 2-35. Separate the fuselage and the wing as follows:

Note

- Drain fuel and hydraulic lines and remove the battery before separating fuselage and wing.
- Use E974 sling to support the fuselage, and support the wing at the jack points during separation. (See figures 1-4 and 1-7.)

a. Disconnect rocket launcher electrical cables at connector (access door located on underside of wing leading edge).

b. Remove wing center section bottom fairing. (Refer to paragraph 2-12.)

c. Remove bottom fairing forward attaching panel.

d. Disconnect bungee rod to left aileron sector.

e. Remove hydraulic line from flow regulator to "T" fitting.

f. Disconnect electrical wiring at terminal strip in left wheel well, and disconnect clips.

g. Drain fuel system.

h. Remove fuel-air pressure line and left and right fuel lines at wing front spar.

i. Remove center wing tank fuel booster pumps (paragraph 5-115) and, through access openings,

disconnect both forward-fuselage-to-center-wing-tank interconnectors.

j. Remove brake hydraulic lines under wing center section. At front spar, rotate lines down to clear wing front spar; at rear spar, push fittings through fuselage bulkhead to clear rear spar.

k. Disconnect left and right wing fuel tank vent lines.

l. Disconnect center wing tank vent line.

m. Remove turnbuckles in wheel wells.

n. Disconnect landing gear emergency uplock release cables in left and right wheel wells.

o. Disconnect wires at left and right electrical wiring terminal block.

p. On F-86E-1 Airplanes AF50-579 through -613, disconnect electrical connector to center wing tank fuel level transmitter. On F-86E-1 Airplanes AF50-614 through -638 and F-86E-5 and subsequent airplanes, disconnect liquidensitometer electrical plug, vent line, and elbow.

q. Disconnect landing gear and brake hydraulic lines.

r. Remove attaching bolts, and hoist fuselage clear of wing.

CAUTION

- After fuselage is just clear of wing, it must be pushed as far aft as possible without binding equipment on wing front spar, so that fuselage bulkhead at wing rear spar will clear center wing tank fuel level transmitter.
- During hoisting of fuselage, clearance of all remaining components in each wheel well and along wing front spar must be carefully observed.

2-147. JOINING FUSELAGE AND WING.

2-148. See figure 2-35.

2-149. REMOVING FUSELAGE REAR SECTION.

2-150. The parts and components referred to in the following procedure are identified in figure 2-36. Remove the fuselage rear section as follows:

Note

Use E975 sling or Type A-3 cradle to support rear fuselage during removal. (See figure 1-4.)

CAUTION

Relieve hydraulic system pressure before removing fuselage rear section. (Refer to paragraph 1-61.)

a. Disconnect the hydraulic lines, rudder control cables, horizontal stabilizer valve control cables, teleflex cable, electric wiring, and antenna cable through access doors on upper side of fuselage.

b. Disconnect the mid-frame air leakage line through the right-hand spark plug door.

c. Disconnect the fuel drain lines through the fire extinguisher door.

d. Remove rear fuselage attaching bolts and move rear fuselage off over tail pipe.

e. If rear fuselage is not to be reinstalled within a short time, disconnect latch and place fuel vent line in retracted (stored) position.

2-151. INSTALLING FUSELAGE REAR SECTION.

2-152. See figure 2-36.

2-153. WINDSHIELD.

2-154. The windshield is of a conventional type, including side panels and armor glass. The side panels are made of curved, tempered, laminated plate glass. Pressure sealing is employed around the edges of the panel and at all metal points. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, a center panel is installed, consisting of two tempered glass panels set in a "V." To prevent fogging of the space between the center panel and armor glass, a stream of air from the cockpit air conditioning system is circulated through the space between the windshield and the armor glass. (Refer to paragraph 4-143.) As the space between the armor glass and the windshield is not sealed, periodic cleaning of the inside surface is necessary. On F-86E-10 and F-86E-15 Airplanes, on which there is no "V" panel, a boundary layer of heated air is passed over the outside surface of the windshield to accomplish anti-icing. (Refer to paragraph 4-145.)

2-155. REMOVING WINDSHIELD. The parts and components referred to in the following procedure are identified in figures 2-37 and 2-38. Remove windshield panel as follows:

a. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, remove front panel by loosening Camlock fasteners at bottom of windshield, pulling up on bottom of panel, and then sliding top of panel out of groove.

Note

Step a. is all that is necessary for access to inner surfaces for cleaning on F-86E-1, F-86E-5, and F-86E-6 Airplanes. Use standard methods and materials for cleaning glass.

b. Cut away pressure-sealing compound.

c. Remove side panels.

d. Remove armor glass. (The armor glass weighs approximately 17 pounds.)

2-156. INSTALLING WINDSHIELD. To install a windshield, see figure 2-37 or 2-38.

2-157. RADAR EQUIPMENT AND BATTERY ACCESS DOOR.

2-158. The radar equipment and battery access door is

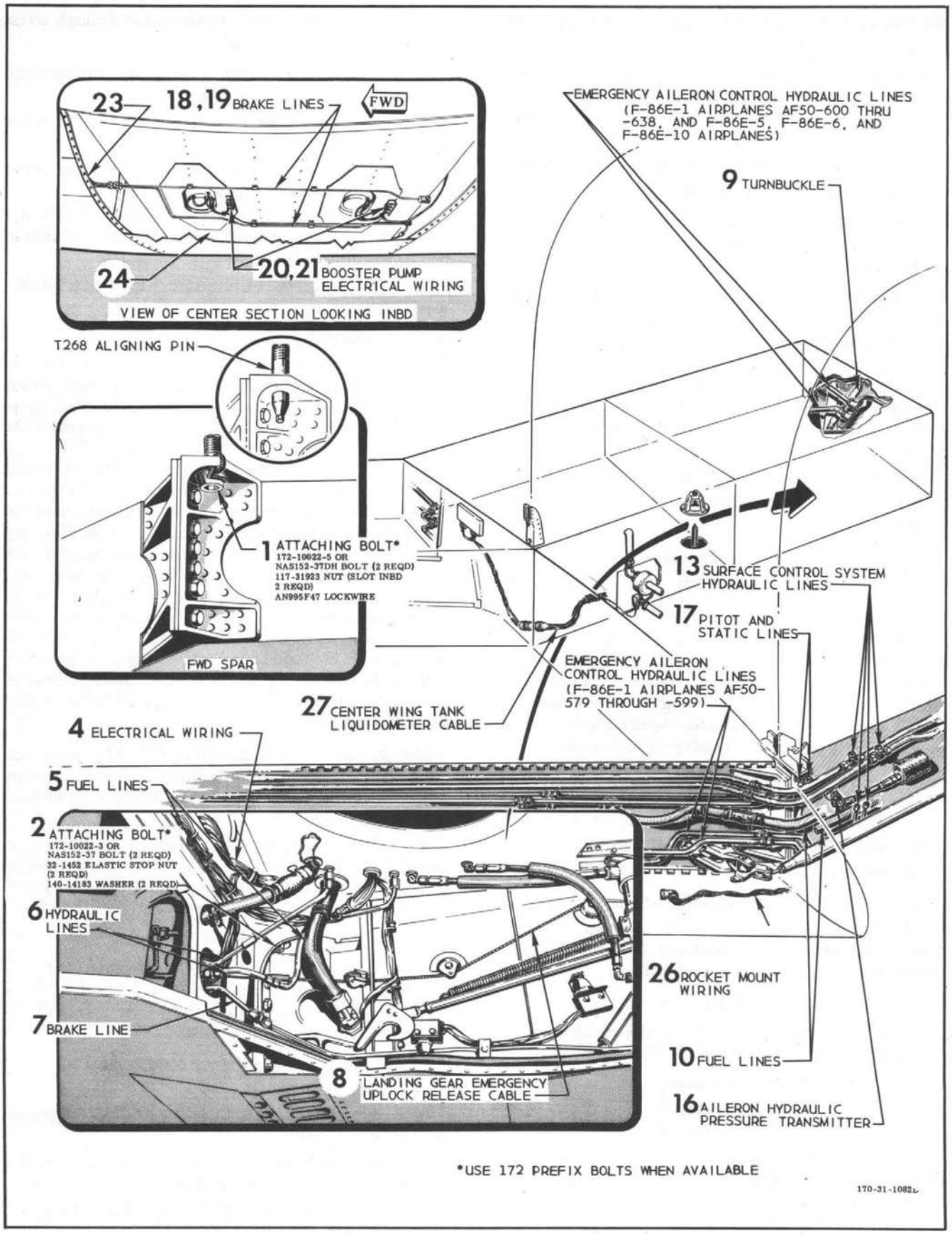


Figure 2-35. Joining Fuselage and Wing (Sheet 1 of 2)

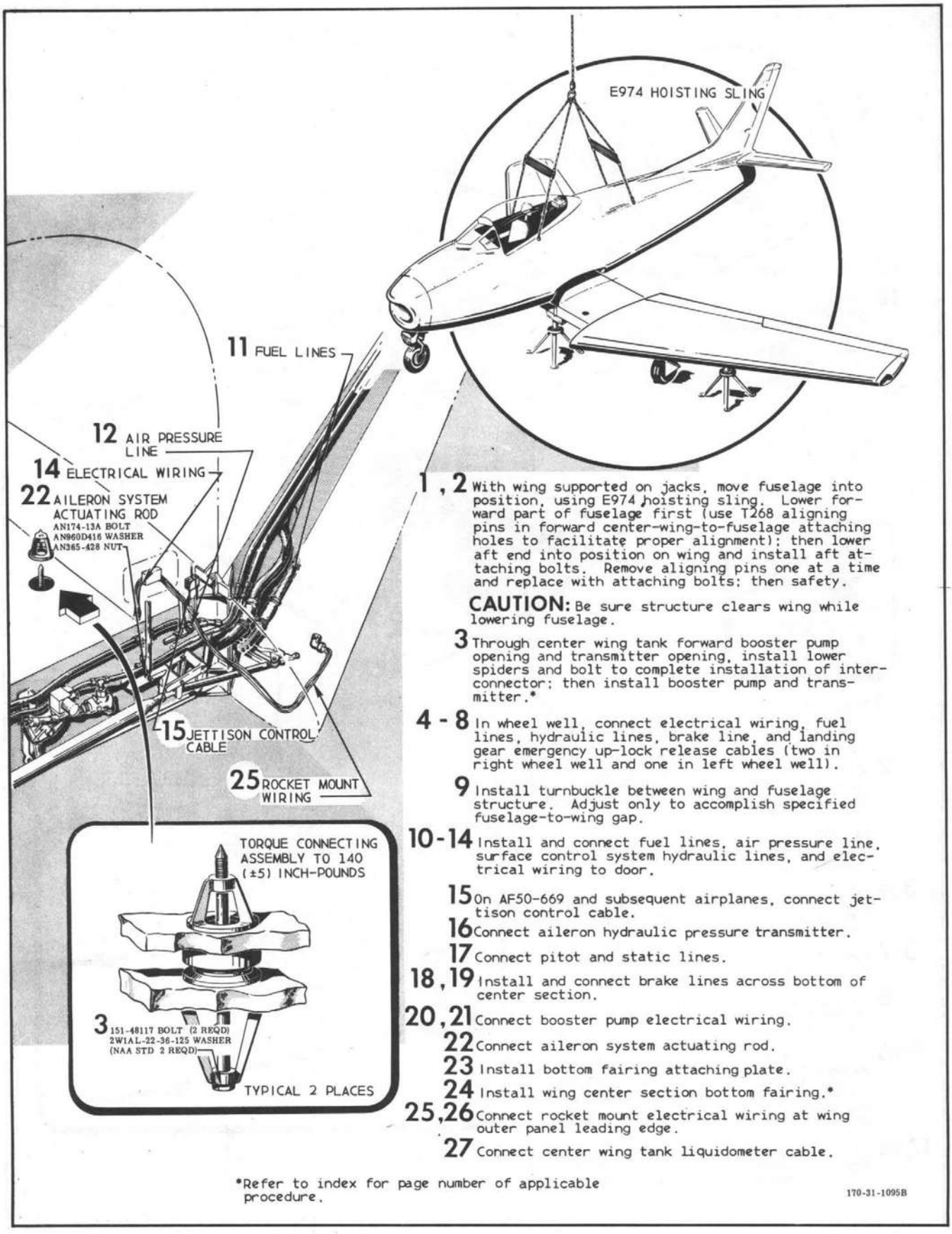


Figure 2-35. Joining Fuselage and Wing (Sheet 2 of 2)

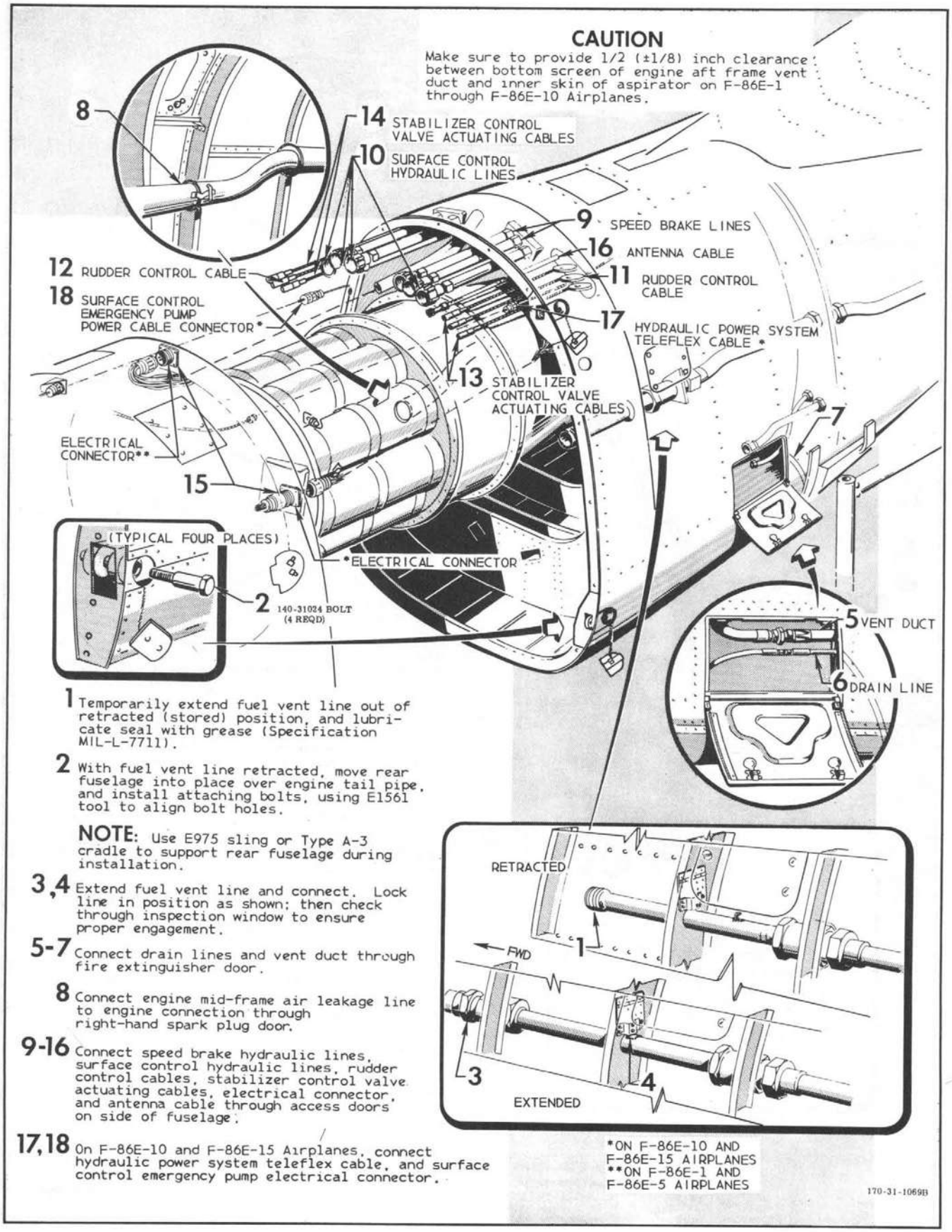


Figure 2-36. Installing Fuselage Rear Section

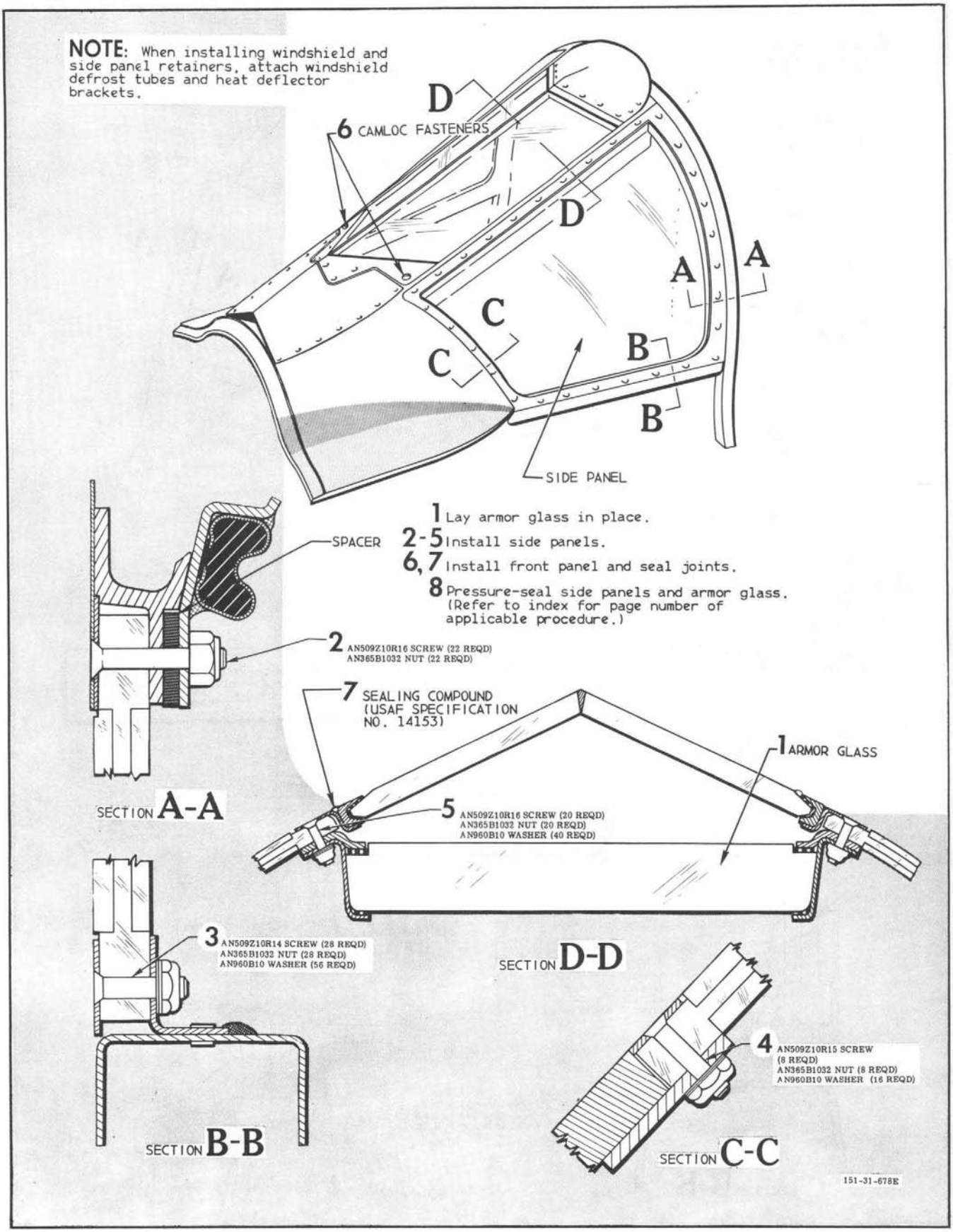


Figure 2-37. Installing Windshield—F-86E-1, F-86E-5, and F-86E-6 Airplanes

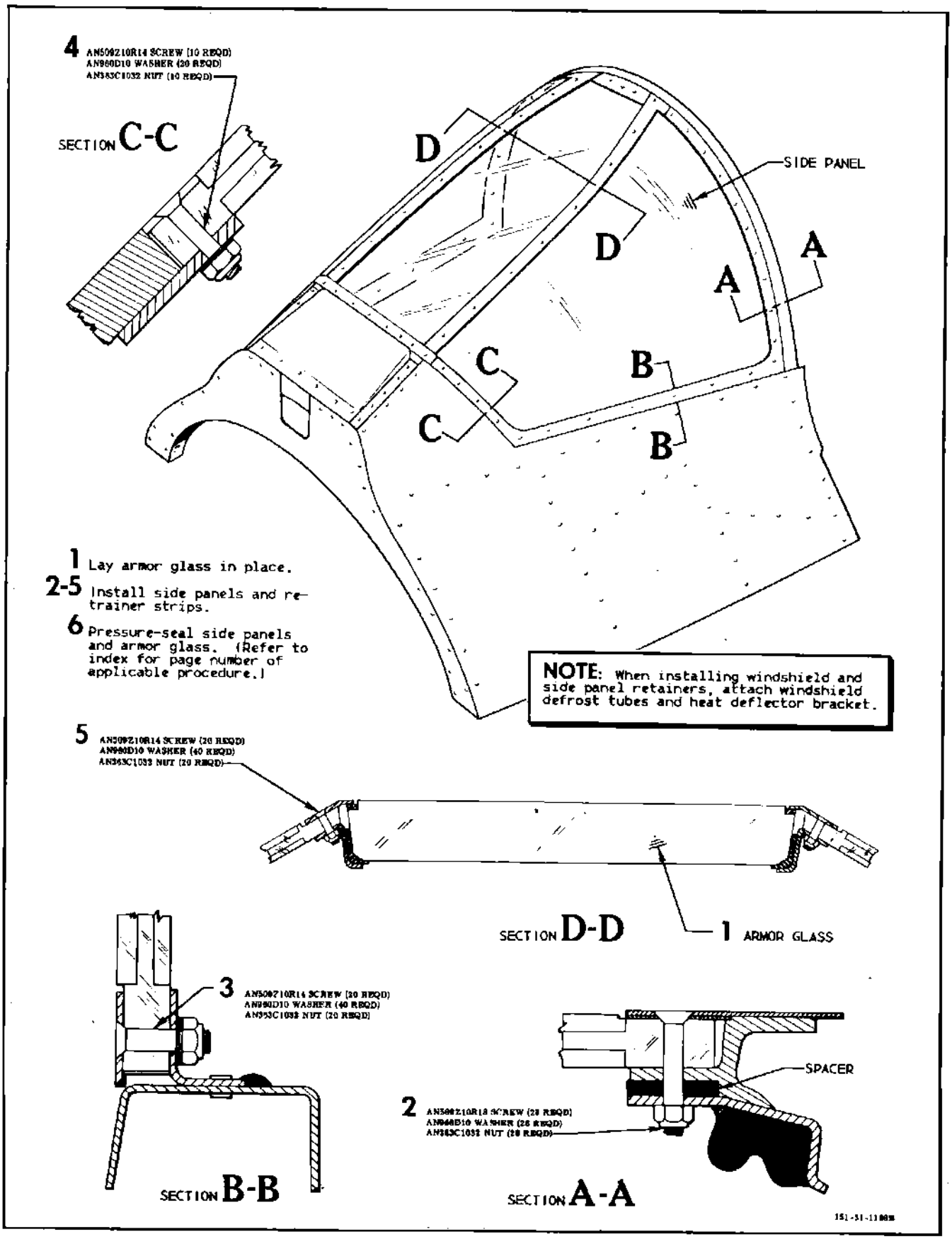


Figure 2-38. Installing Windshield—F-86E-10 and F-86E-15 Airplanes

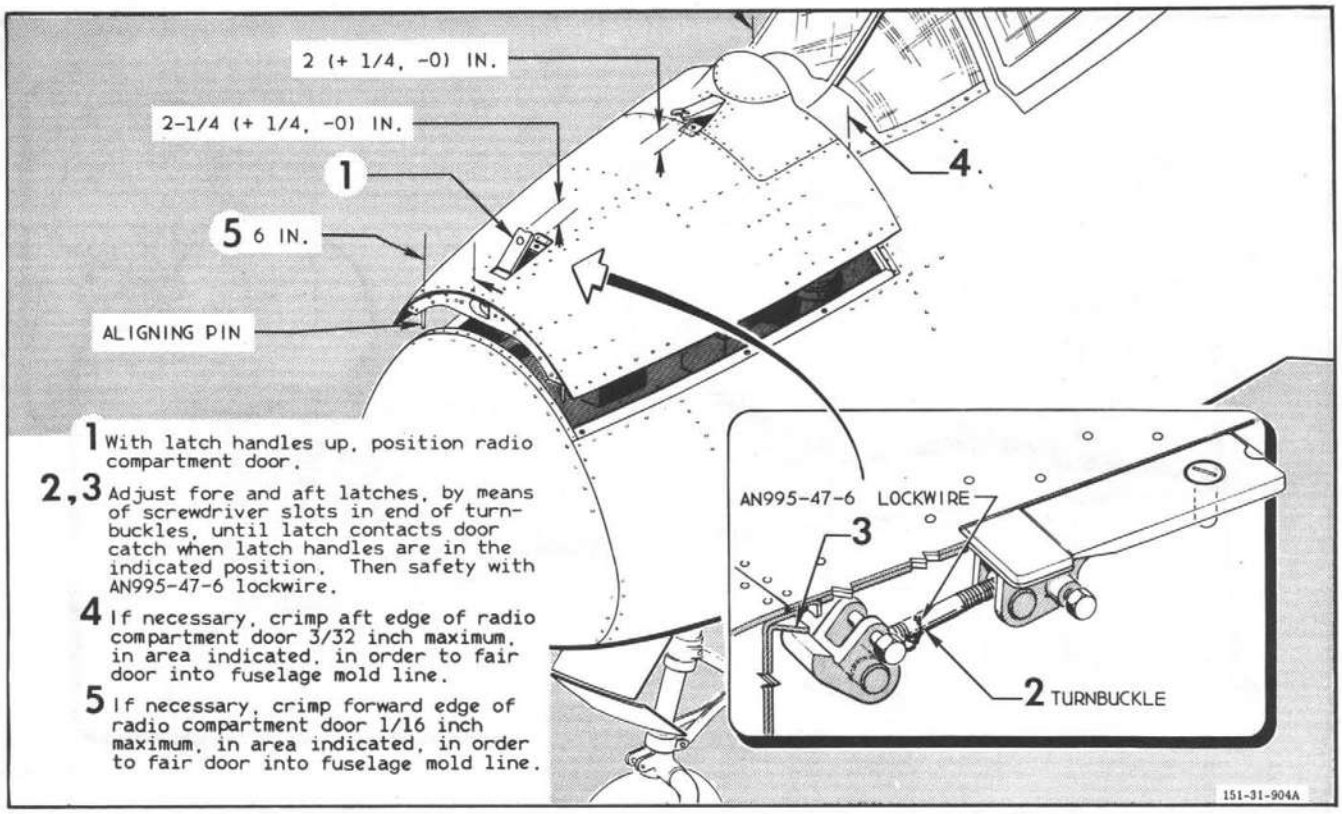


Figure 2-39. Adjusting Radar Equipment and Battery Access Door—F-86E-1, F-86E-5, and F-86E-6 Airplanes

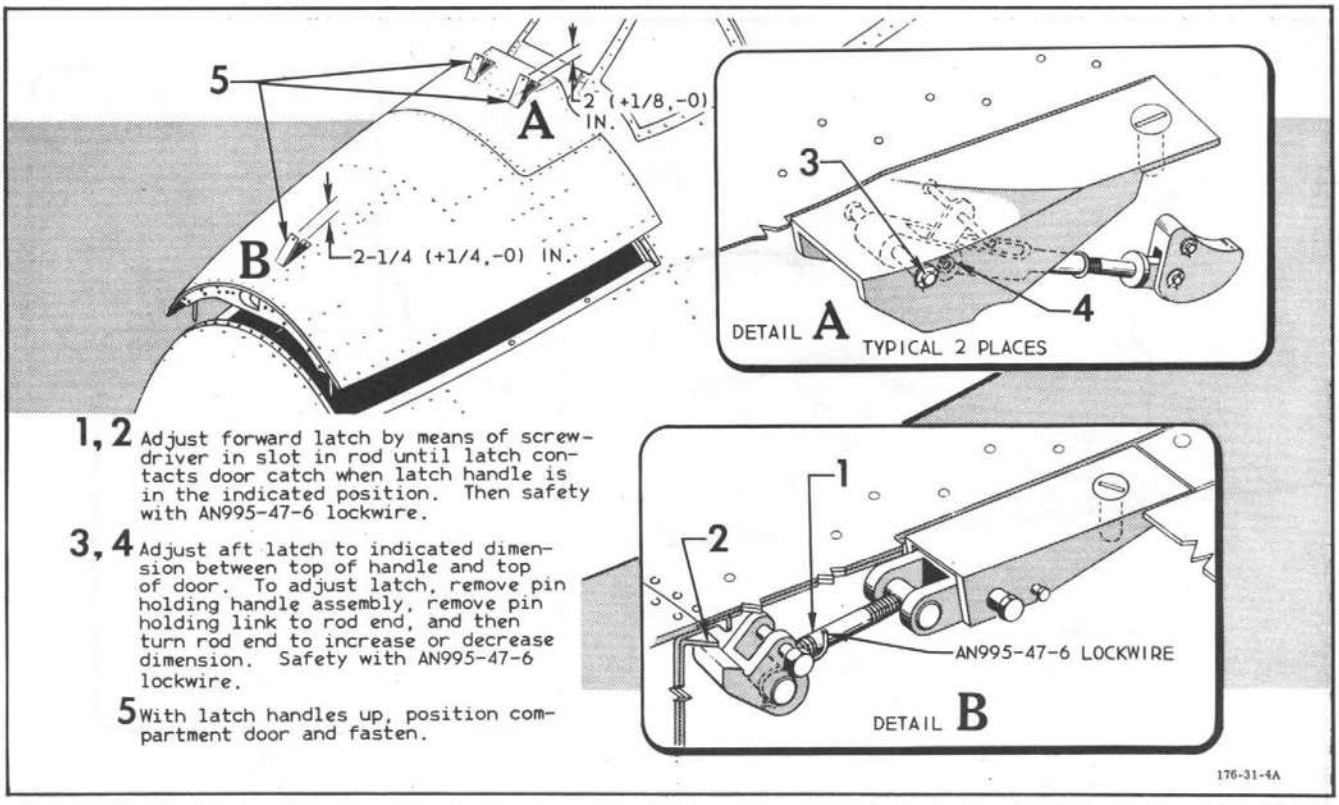


Figure 2-40. Adjusting Radar Equipment and Battery Access Door—F-86E-10 and F-86E-15 Airplanes

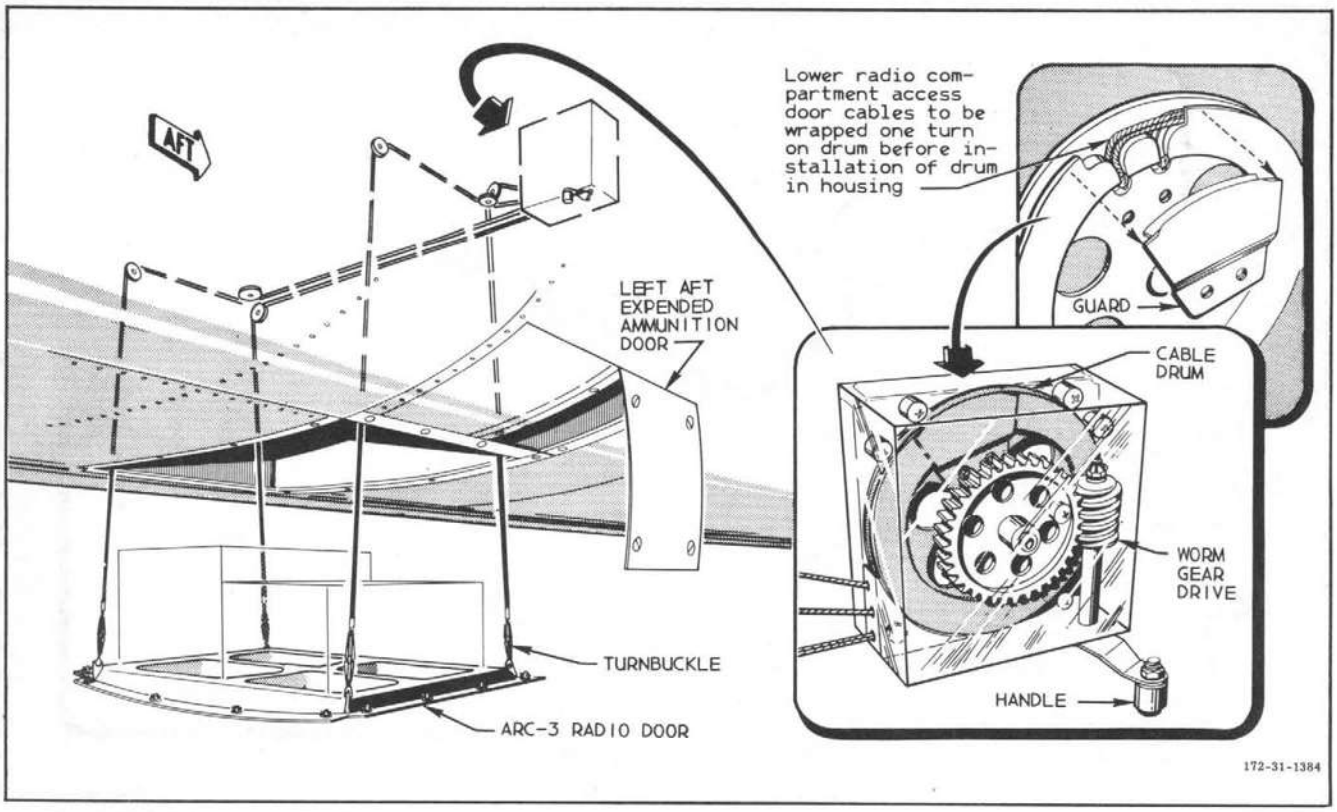


Figure 2-41. Lower Radio Compartment Access Door (AN/ARC-3 Radio)—F-86E-1 Through F-86E-10 Airplanes

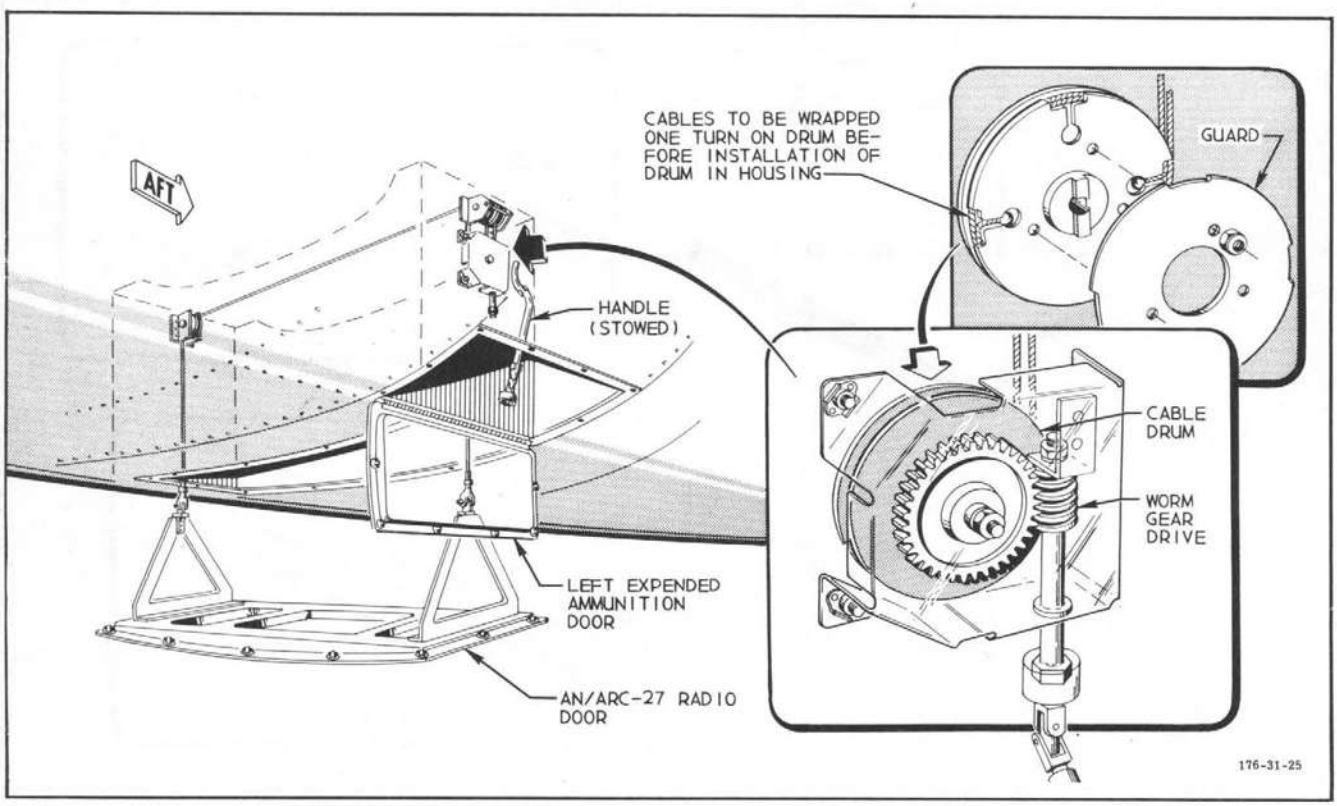


Figure 2-42. Lower Radio Compartment Access Door (AN/ARC-27 Radio)—F-86E-15 Airplanes

located on the top side of the fuselage, forward of the windshield. It is aligned by means of pins and secured by mechanically locked handles.

2-159. ADJUSTING RADAR EQUIPMENT AND BATTERY ACCESS DOOR. See figure 2-39 or 2-40.

2-160. LOWER RADIO COMPARTMENT ACCESS DOOR.

2-161. The lower radio compartment access door (figures 2-41 and 2-42) is installed to permit easy access to the AN/ARC-3 or AN/ARC-27 radio. A hand-cranking mechanism is used to lower and raise the door. Four cables, one at each corner of the door, keep the door level when the radio is lowered. Access to the lower radio compartment access door hoisting mechanism is gained through the rear left expended ammunition door. When raising the radio, it is important that only the handcrank be used, as any assistance such as raising on the door manually will remove the tension on the cables, causing them to become fouled or jump a pulley. If any binding or stiffness is noticed while the radio is being hoisted, it should be investigated immediately, as damage to the mechanism may result. Do not attempt to assist the door by lifting while cranking.

2-162. COCKPIT CANOPY SYSTEM.

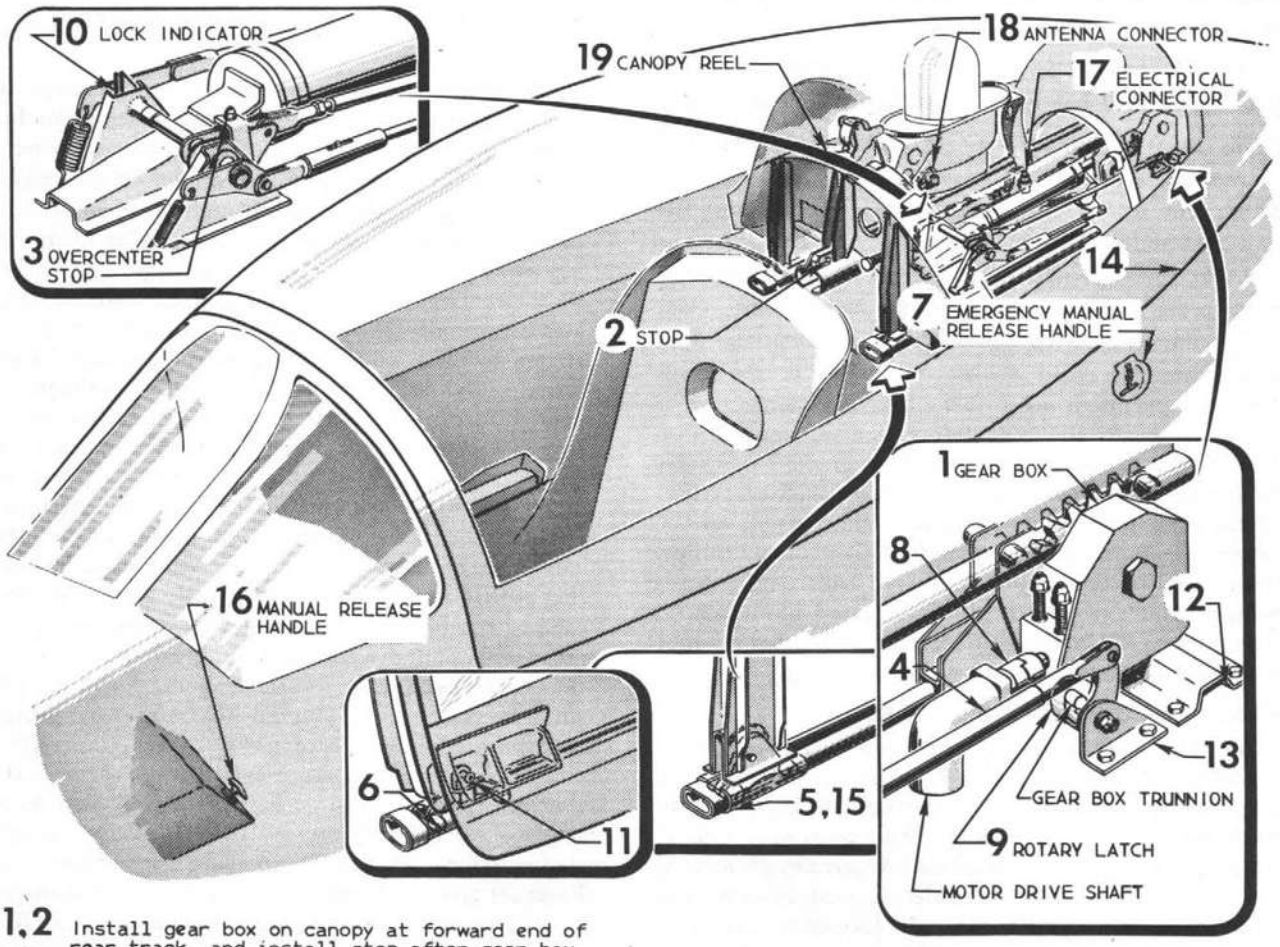
2-163. The electrically operated canopy (figure 2-43) moves fore and aft on tracks and rollers to permit access to the cockpit. The canopy is operated electrically from inside the cockpit by means of a three-position ("OPEN," "CLOSE," and a center off position) toggle switch located above the left forward console. A push-button type ("OPEN" and "CLOSE") switch is located on each side of the fuselage below the windshield bow to permit external opening and closing of the canopy from either side of the airplane. The canopy actuator is wired directly to the battery bus and to the external power receptacle; therefore, the canopy may be operated regardless of the position of the battery-starter switch. Besides the normal (electric) canopy operating system, a manual release handle, located at the bottom of the center pedestal forward of the control stick, unlocks the canopy from the inside. An external emergency manual release handle, located on the left side of the fuselage, permits opening the canopy manually in the event of an electrical power failure while the airplane is on the ground. In addition to, and entirely independent of any of the preceding canopy releases, an emergency system to jettison the canopy in flight is also installed. (For further information regarding the canopy remover, refer to paragraphs 2-194 and 2-199.) Mounted in the canopy and moving with it are the radio loop antenna, the cabin pressure regulator, and the upward identification light.

2-164. FUNCTION OF COCKPIT CANOPY SYSTEM.

2-165. When the three-position internal canopy actuating toggle switch, located on the instrument shroud is moved to "OPEN," electrical power from either the battery or the auxiliary power system (if the engine is not running) is directed through a normally closed limit switch and the canopy opening relay to the opening coil of the canopy actuator. (See figure 2-44.) When the canopy has moved to the full open position, it actuates a normally closed limit switch, causing the limit switch to open and de-energize the actuator. The internal switch will remain in the "OPEN" position; however, returning the switch to the center position will stop canopy movement at any point. When the internal switch is held in the "CLOSED" position, power from either the battery or the auxiliary power system is directed through the canopy closing relay to the closing coil of the canopy actuator. The switch must be held in this position until the canopy is fully closed. When the canopy has fully closed and exerts a force of approximately 300 pounds against the windshield bow, a torque limiter incorporated in the actuator slips, at which time the switch should be released. A thermal protector incorporated in the actuator will open the electrical circuit if the electric motor becomes overheated. If the thermal protector opens, it will be necessary to wait approximately 3 minutes until the actuator motor has cooled before the system will again operate electrically. External electrical operation of the canopy is the same as the internal electrical operation except that "OPEN" and "CLOSE" push buttons are used and pressure must be maintained on the push button throughout canopy operation. As soon as pressure on the push button is released, canopy movement will stop. Operation of any of the push-button type switches overrides the selection of the internal actuating switch in the cockpit, but if the internal actuating switch has been left at "OPEN" and an external switch is used to close the canopy, the canopy will close, but will open again as soon as the external switch is released. Pulling the manual canopy release handle (located inside the cockpit) or the emergency manual canopy release handle (located externally on the left side of the fuselage) disengages the rotary latches near the actuator (figure 2-43) and makes it possible to open or remove the canopy manually in the event of an electrical failure when the airplane is on the ground. For function of the canopy remover, used in connection with the emergency escape system, refer to paragraphs 2-194 and 2-199.

2-166. TROUBLE SHOOTING COCKPIT CANOPY SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Canopy fails to open when switch is actuated.	Battery weak. No power. Defective actuator.	



1,2 Install gear box on canopy at forward end of rear track, and install stop after gear box has been manually positioned aft by rotating drive shaft to enable installation of stop.

3 Adjust overcenter stop (by varying washer arrangement) to align lock indicator pointers.

4 Adjust rotary latch push-pull rods so that slots of rotary latches are aligned vertically when linkage is overcenter against stop.

5,6 Install canopy, engaging trucks at aft end of both intermediate and forward tracks.

7 Open rotary latches by pulling either inside or outside manual release handle.

8,9 Engage motor drive shaft with gear box drive shaft and rotary latches with gear box trunnions.

10 Release manual release handle, and verify proper position of lock indicator.

NOTE: Steps 11, 12, 13, and 15 are to be followed during installation of new canopy, but are unnecessary when reinstalling original canopy.

11 Using washers as necessary, adjust canopy at forward trucks to align with windshield.

12 Using shims as necessary, accomplish proper support of gear box so that gear box drive shaft is aligned with motor drive shaft and aft "free play" of canopy is minimized.

13 Using shims as necessary, adjust rotary latch brackets to align latches properly with gear box trunnions.

14 Check canopy skirt for 1/16-inch minimum clearance in closed position.

15 With eccentric washer, adjust trucks at intermediate track to move freely within track.

16 Close canopy, pull inside manual release, and, from inside airplane, manually check for free movement of canopy along tracks, observing that canopy is clear of inflatable seal. If canopy movement is difficult, repeat steps 12 through 16 as necessary.

NOTE: Pressure-seal bolt heads in deck where gear box support and rotary latch brackets are attached; then check cockpit pressurization. (Refer to index for page number of applicable procedure.) If proper pressurization cannot be maintained, repeat steps 11, 12, 13, and 15 through 17.

17,18 Connect canopy electrical wiring connector and plug in antenna connector.

NOTE: Phenolic lug must face outboard when reinstalled and cap nut securely tightened to prevent lug from turning.

19 Engage canopy reel cable in quick-disconnect fitting.

170-31-1086B

Figure 2-43. Installing Cockpit Canopy

TROUBLE	PROBABLE CAUSE	REMEDY
	Broken screw jack. Defective wiring. Defective or open cockpit canopy circuit breaker. Dirt or foreign object in track. Binding in track or mechanism.	
Canopy moves part way and then stops and actuator is excessively noisy.	Dirt or binding of moving parts causing actuator clutch to slip.	
Canopy closes when external "CLOSE" push button is pressed, but opens when button is released.	Inside toggle switch left at "OPEN."	

2-167. REMOVING COCKPIT CANOPY.

2-168. Parts and components referred to in the following procedure are identified in figure 2-43. Remove canopy as follows:

a. Move canopy to maximum aft position.

b. With manual release handle held out, raise rear of canopy and move canopy aft, disengaging rollers from tracks. Lift canopy a maximum of 8 inches at

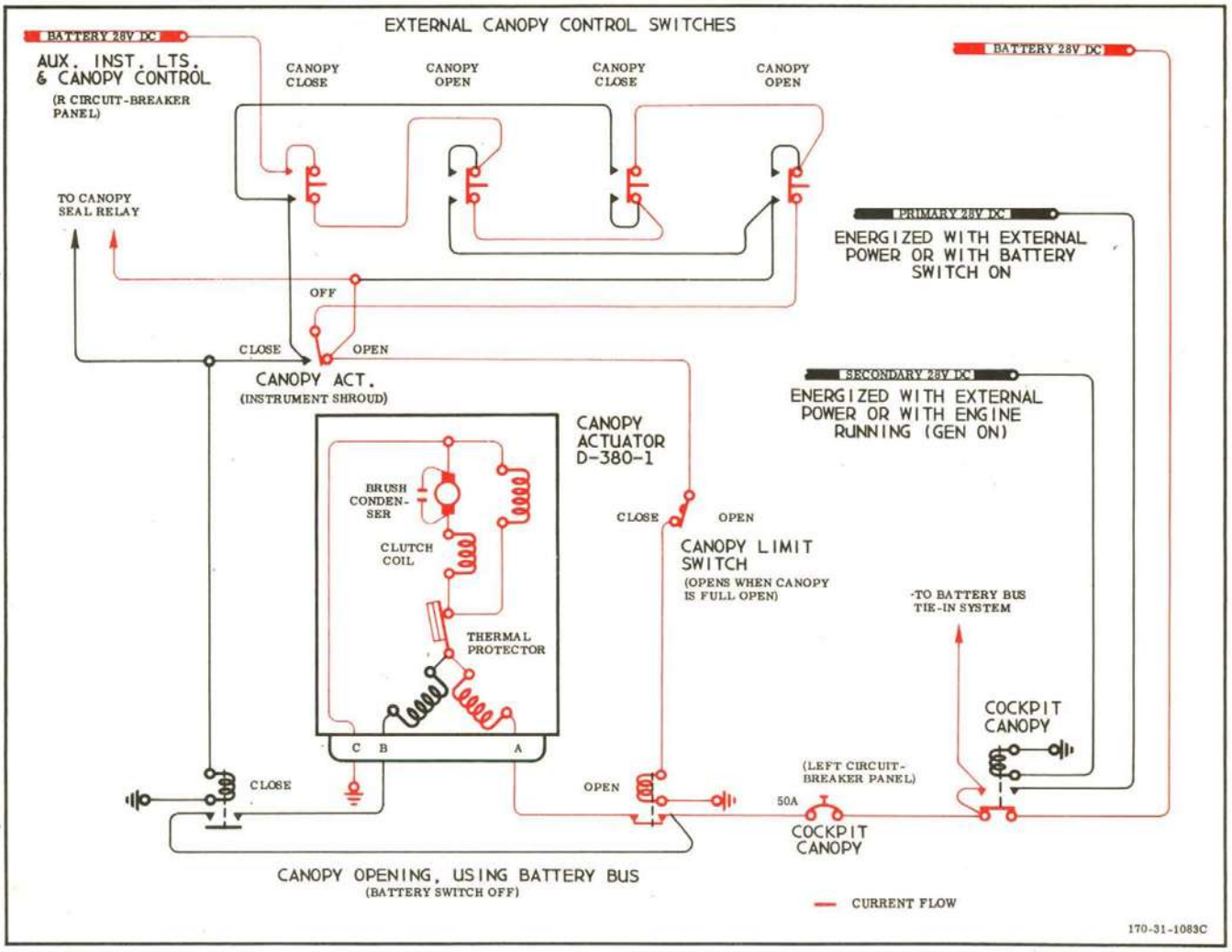


Figure 2-44. Canopy Actuating System

aft end to gain access to the electrical and antenna disconnects.

c. Disconnect electrical and antenna connectors.

d. Disconnect seat catapult sear safety pin at quick-disconnect fitting. (Refer to paragraph 2-210.)

WARNING

- DO NOT remove seat catapult sear safety pin.
- DO NOT pull canopy ejection handle.

e. Lift canopy up and away from airplane. The canopy weighs approximately 115 pounds.

CAUTION

Use extreme care when handling the canopy not to scratch or otherwise damage the Plexiglas and not to damage the pressure seals.

2-169. PREINSTALLATION CHECK OF COCKPIT CANOPY.

2-170. Before installing a cockpit canopy, check for the following: free roller movement; canopy pressure seals not torn, damaged, or loose; track clean and not bent or damaged; and no foreign objects lodged in track.

2-171. INSTALLING AND ADJUSTING COCKPIT CANOPY.

2-172. See figure 2-43.

2-173. COCKPIT CANOPY ACTUATOR.

2-174. The cockpit canopy actuator (Hoover Electric Co, Type D380-1), located beneath the deck in the aft section of the forward fuselage, consists of a 26-volt d-c, reversible-type electric motor, connected through a gear-type reducer to a drive shaft. A thermal protector incorporated in the unit opens the electrical circuit to protect the motor from overheating. A clutch permits the driveshaft to slip whenever a torque exceeds 100 to 140 inch-pounds. Duty cycle for the unit is 10 seconds on, 3 minutes off. The unit is held in place by four bolts. No repairs or adjustments are to be made to the actuator in the field, and any defective units are to be replaced.

2-175. CARE OF COCKPIT CANOPY.

2-176. The cockpit canopy is made of acrylic plastic and is easily scratched. When working around the canopy, use extreme care to prevent belt buckles, buttons, etc, from marring the smooth plastic surface. When cleaning the canopy, use only clear tap water, dry cleaning solvent (Federal Specification P-S-661), or naphtha (Federal Specification TT-N-95). Other type cleaners may cause the surface of the plastic to fog and craze. Do not use harsh or abrasive cleaners.

2-177. MISCELLANEOUS EQUIPMENT.

2-178. Miscellaneous equipment provided with the airplane consists of the following: an ejection seat (paragraph 2-180); a data case, located on the left side of the aft fuselage; a map case, located in the right console; drop message provisions, consisting of a bracket on the left seat guide rail into which a metal tube is placed; a rear-vision mirror, located at the top of the canopy; and a pilot's check-off list (landing and after landing), located beneath the right side of the instrument panel.

2-179. EJECTION SEAT.

2-180. The ejection seat (figure 2-45) is vertically adjustable to a height of 4 inches; during the vertical (up) adjustment, the seat moves aft one inch. Rollers guide the seat within the ejection rails. Bungee springs aid the pilot in making seat adjustments. Locking pins, actuated by a handle located near the pilot's right shoulder, maintain seat adjustment. An adjustable headrest slides on two tubes to provide a forward adjustment of approximately 3 inches. Two latch pins lock the headrest in place. The seat is designed to accommodate a Type C-2A life raft and a ribbon-type parachute. Lightweight blocks are provided to take up seat space when neither the life raft nor the ribbon-type parachute is used. Fixed footrests, armrests, and personal lead disconnects are incorporated in the ejection seat. The left handgrip, hinged to the armrest, actuates the mechanism that locks the inertia reel. The right handgrip incorporates a trigger for firing the seat catapult. Ground safety pins prevent the handgrips being raised inadvertently.

2-181. REMOVING EJECTION SEAT. For location and identification of ejection seat components, see figures 2-50 through 2-52. Remove the ejection seat as follows:

a. Remove ejection seat catapult. Refer to paragraph 2-210 for correct procedure.

b. Disconnect personal lead disconnects at front of seat.

c. Carefully raise and remove seat from tracks.

2-182. INSTALLING EJECTION SEAT. See figure 2-45.

2-183. EMERGENCY ESCAPE PROVISIONS.

2-184. Special equipment and controls are provided to facilitate emergency escape from the airplane. This equipment includes a jettisonable canopy, an ejection seat, and an external and an internal manual canopy release for use on the ground. (See figures 2-46 and 2-47.)

2-185. CANOPY EMERGENCY RELEASE SYSTEM (F-86E-1 THROUGH F-86E-10 AIRPLANES, AND F-86E-15 AIRPLANES AF51-12977 THROUGH -13045).

2-186. The canopy emergency release system employs a Type M-1 canopy remover to forcibly eject the canopy to the rear when the handle, built into the right arm of the ejection seat, is rotated up. As the handle is rotated

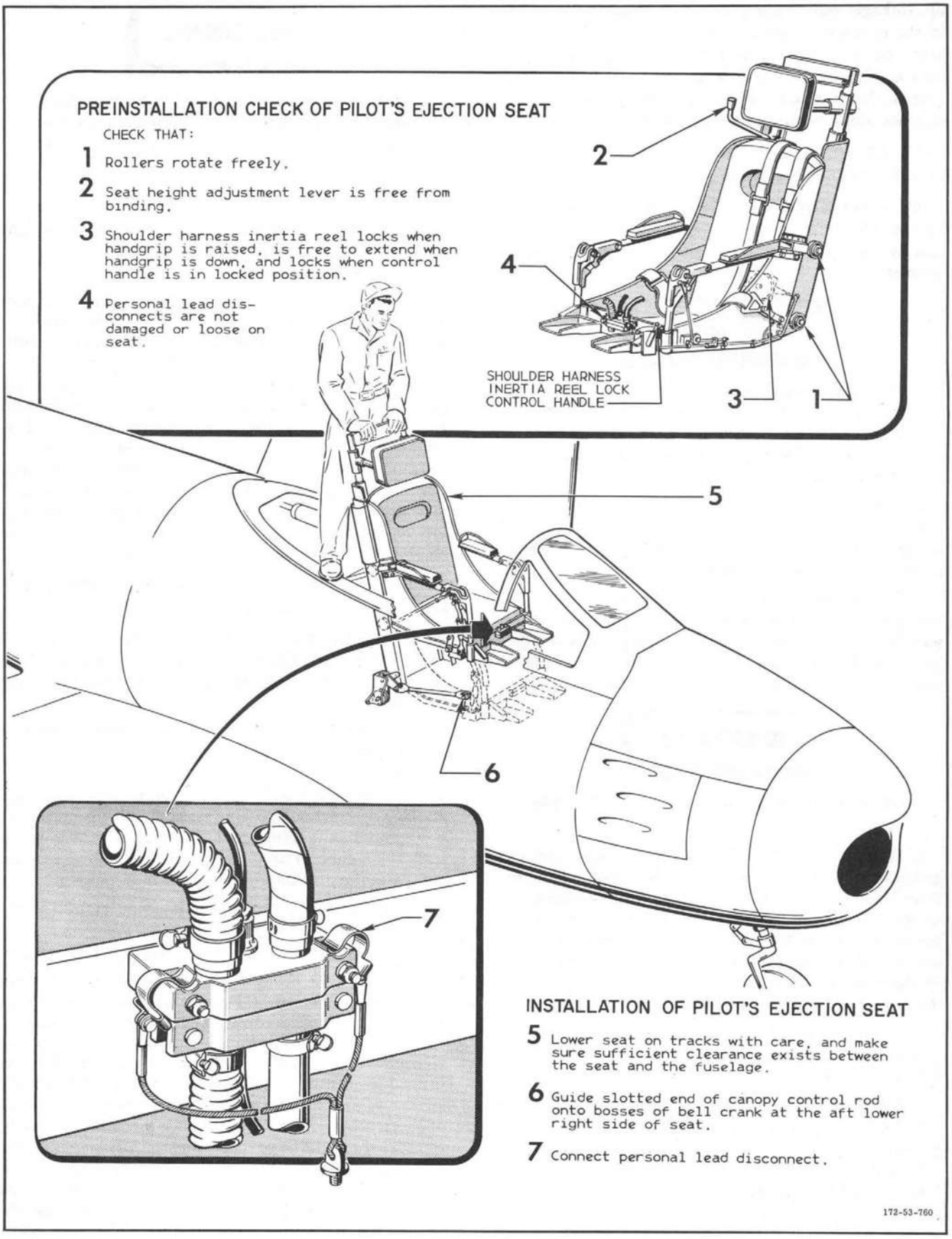


Figure 2-45. Installing Ejection Seat

up, linkages pull a sear pin, which releases the striker in the remover, causing it to fire. When the remover fires, the first movement unlocks the canopy rotary latches. (See figure 2-46.) With the rotary latches unlocked, the gear box and canopy are free to leave the airplane along with the canopy remover.

2-187. ADJUSTING CANOPY EMERGENCY RELEASE SYSTEM. See figure 2-48.

2-188. CHECKING CANOPY EMERGENCY RELEASE SYSTEM. Check proper functioning of the canopy emergency release system in the following manner:

WARNING

Only the canopy remover sear pin or ground safety pin prevents remover from firing. While either pin (ground safety or sear) is removed, DO NOT remove the remaining pin; injury or possible death may result.

a. With both the ground safety pin and sear safety pin installed in the ejection seat catapult and the ground safety pin installed in the canopy remover, remove the canopy as described in paragraph 2-168.

b. Verify that canopy remover sear pin is completely engaged; then remove ground safety pin and replace with 1/16-inch diameter drill rod, approximately 4 inches in length. If 1/16-inch diameter drill rod is not available, welding rod of the same diameter may be substituted.

WARNING

DO NOT use soft wire in ground safety pin hole.

c. With 1/16-inch diameter rod in canopy remover ground safety pin hole (rod should be visible projecting from both sides), rotate right handgrip on ejection seat to the full up-and-locked position. The canopy emergency release mechanism should actuate, causing the sear pin on the canopy remover to pull completely clear of the remover with load not exceeding 45 pounds at the right handgrip on the ejection seat.

d. Examine canopy remover sear pin for evidence of galling and binding. If sear pin is galled or otherwise damaged, replace with new sear pin.

e. Unlock and lower right handgrip on ejection seat.

f. To install canopy remover sear pin, install a tapered pin (approximately 4 inches long) of No. 44 drill rod in the sear pin hole to effect removal of 1/16-inch diameter rod from ground safety pin hole. With tapered pin in sear pin hole, remove 1/16-inch diameter rod and replace with ground safety pin; then remove tapered pin from sear pin hole and reinstall sear pin.

WARNING

To prevent the canopy remover from firing, a pin must be in either the canopy remover sear pin hole or the ground safety pin hole at *all* times.

g. Install canopy. (See figure 2-43.)

2-189. CANOPY EMERGENCY RELEASE SYSTEM (F-86E-15 AIRPLANES AF51-13046 THROUGH -13069).

2-190. The canopy emergency release system employs a Type M1A2 canopy remover to forcibly eject the canopy to the rear when the handle, built into the right arm of the ejection seat, is rotated up. As the handle is rotated up, linkages fire a cartridge-type initiator. The gases created by the firing of the initiator pass through tubing and actuate the piston in the exactor. This extracts a sear pin from the striker of the remover, causing the remover to fire. When the remover fires, the first movement unlocks the canopy rotary latches. (See figure 2-47.) With the canopy rotary latches unlocked, the gear box and canopy are free to leave the airplane along with the canopy remover.

2-191. ADJUSTING CANOPY EMERGENCY RELEASE SYSTEM. See figure 2-49.

2-192. CHECKING CANOPY EMERGENCY RELEASE SYSTEM. Check the proper functioning of the canopy emergency release system in the following manner:

a. Be sure ground safety pin is in initiator; then disconnect linkage at initiator.

b. Attach a scale to initiator end of control rod and exert a 30-pound pull. While maintaining this pull, attach another scale to seat right handgrip and exert a 30-pound pull. Linkage at initiator should move at least 1½ inches. (The 30-pound pull on the upper scale simulates the pull required to fire the initiator.)

2-193. CANOPY REMOVER (F-86E-1 THROUGH F-86E-10 AIRPLANES, AND F-86E-15 AIRPLANES AF51-12977 THROUGH -13045).

2-194. The Type M-1 canopy remover consists of three telescoping aluminum tubes and an explosive cartridge with its firing mechanism. The firing mechanism incorporates a striker which is under pressure from a compressed coil spring, and held in place by the sear firing pin. A ground safety pin is inserted through the striker as a safety device, to prevent accidental firing of the remover. The ground safety pin must always be inserted through the striker when the airplane is on the ground and must be removed prior to flight. A red streamer is attached to the canopy remover ground safety pin to warn the pilot of its presence because the canopy remover cannot be fired while the ground safety pin is in place.

WARNING

The mere presence of the red streamer is not to be taken as an indication that the ground safety pin is in place. Before doing any work or making any adjustments on the canopy or firing linkages, be sure the ground safety pin is in place.

2-195. REMOVING CANOPY REMOVER. For identification of parts and components, see figure 2-48. Remove the canopy remover from airplane as follows:

WARNING

The canopy remover must be handled as an ordnance item and stored as ammunition. Installation or removal must be accomplished in the open, away from any building or hangar.

a. Be sure ground safety pin is in place in remover.

b. Raise rear part of canopy and place on blocks.

c. Disconnect bell crank link from canopy remover sear pin.

d. Remove "U" clamp from around canopy remover.

e. Carefully lift out canopy remover, being sure not to drop, strike, or jar remover.

2-196. PREINSTALLATION CHECK OF CANOPY REMOVER. The following inspections *must* be made and the precautionary measures adhered to before installation of M-1 canopy remover.

a. Make sure lead seal is attached by a safety wire through a diagonally drilled hole in the outer tube trunnion fitting.

WARNING

DO NOT remove the standard cotter pin (used for shipment) or the ground safety pin (with red streamer) that passes through the striker. DO NOT remove the sear safety pin, which prevents the sear from rotating.

b. Check the lower end of the sear safety pin to make sure that the safety wire (bent into an "S" shape) is in place.

WARNING

DO NOT bend sear. The sear (firing lever) MUST NOT be forced in any direction.

c. Make sure the upper trunnion ring and the lower cap are staked to the outer tube.

Note

Any canopy remover minus lead seal, cotter pin, sear safety pin, or safety wire (bent into an "S" shape through the sear safety pin) MUST be returned to the USAF Ordnance Department for disposition.

WARNING

ALWAYS HANDLE THE REMOVER WITH EXTREME CARE.

2-197. INSTALLING CANOPY REMOVER. For identification of parts and components, see figure 2-48. Install canopy remover as follows:

a. Place base of canopy remover in socket on fuselage deck. Body of remover will then lie in bottom half of "U" clamp.

b. Install upper half of "U" clamp.

c. Adjust canopy emergency release system. (See figure 2-48.)

d. Remove blocks and lower canopy.

2-198. CANOPY REMOVER (F-86E-15 AIRPLANES AF51-13046 THROUGH -13069).

2-199. The Type M1A2 canopy remover consists of three telescoping aluminum tubes and an explosive charge with its firing mechanism. The firing mechanism consists of a striker and an exactor. The striker is under constant pressure from a compressed coil spring and is held in place by the sear firing pin. The exactor (secured to the remover by two screws) consists of a cylinder, the sear firing pin, and a piston. The sear firing pin is attached to the piston in such a way that the piston, as it moves back, extracts the sear firing pin. The only safety device is the ground safety pin that is inserted through the initiator when the airplane is on the ground and is removed prior to flight. A red streamer is attached to the ground safety pin to warn the pilot of its presence, because the canopy remover cannot be fired while the ground safety pin is in place.

WARNING

The mere presence of the red streamer is not to be taken as indication that the ground safety pin is in place. Before doing any work or making any adjustments on the canopy or firing linkages, be sure the ground safety pin is in place.

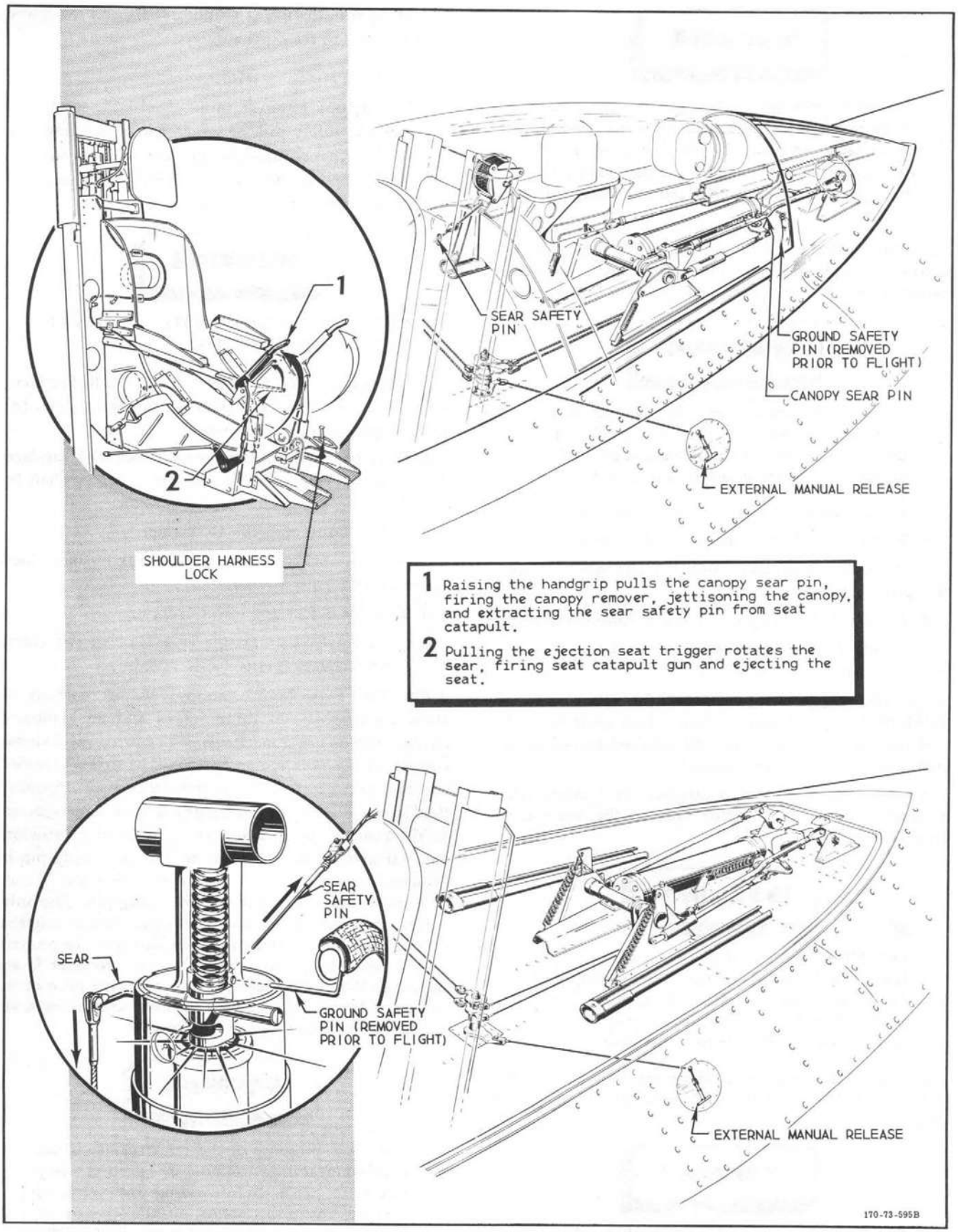


Figure 2-46. Emergency Escape Provisions—F-86E-1 Through F-86E-10 Airplanes, and F-86E-15 Airplanes AF51-12977 Through -13045

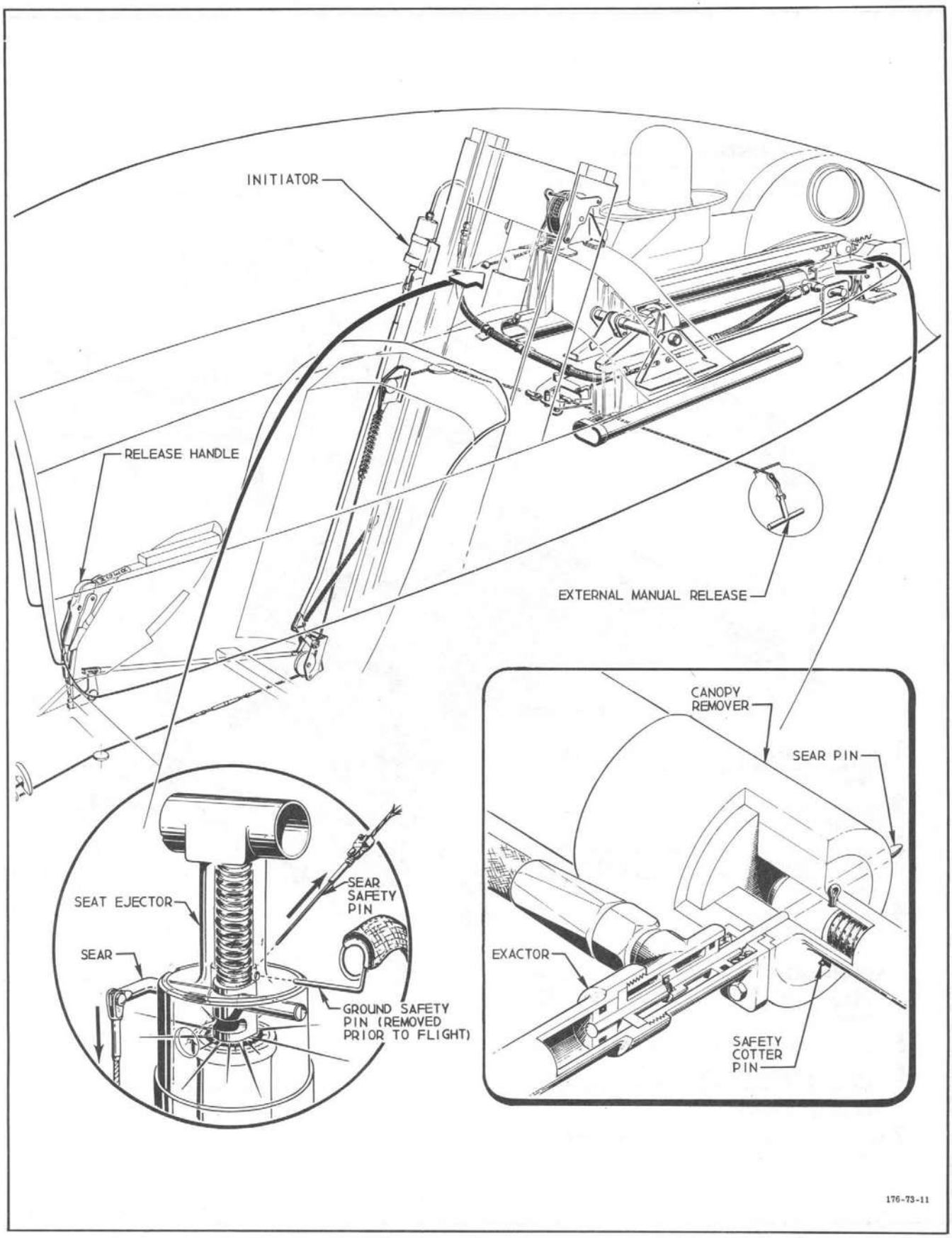
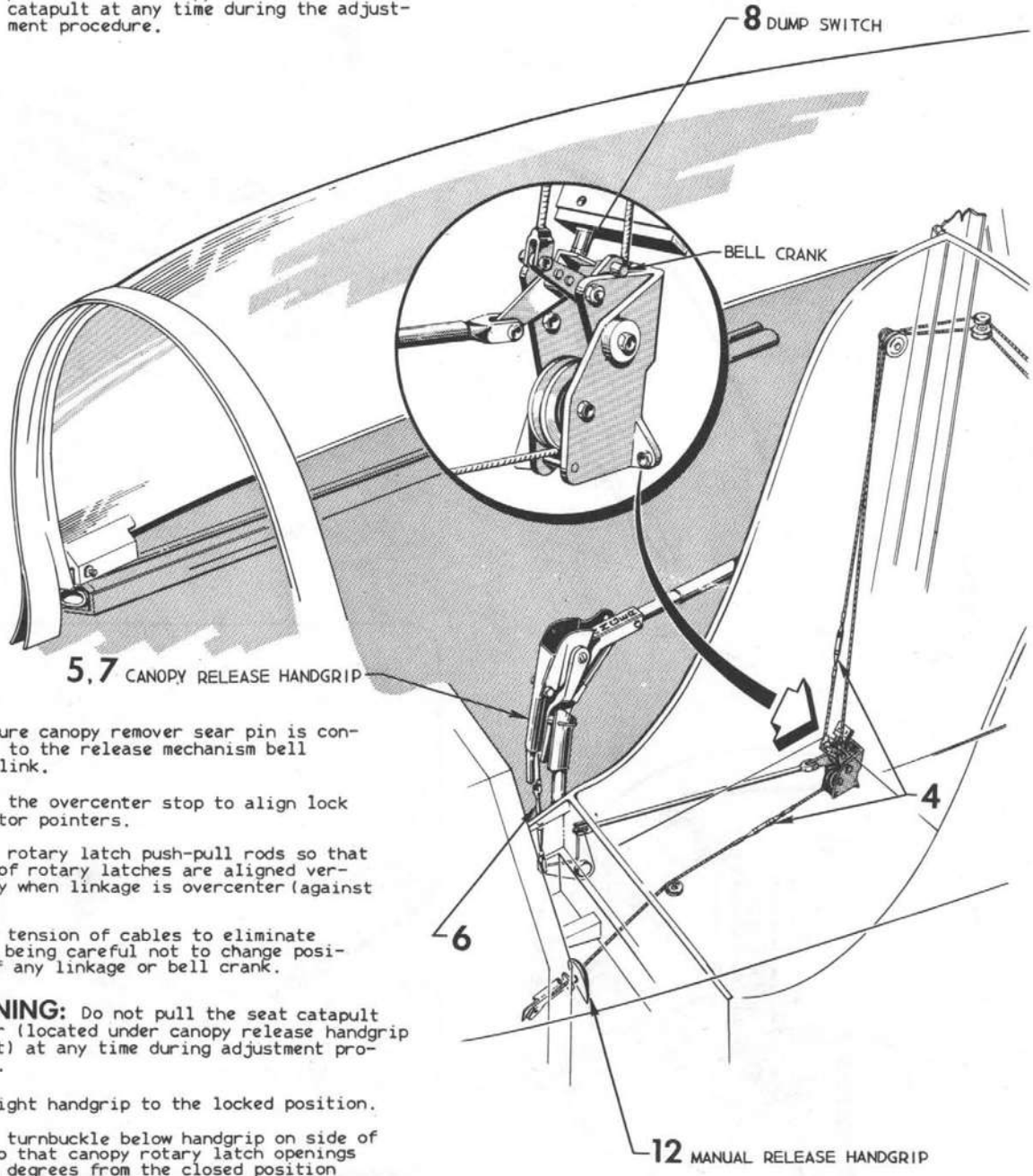


Figure 2-47. Emergency Escape Provisions—F-86E-15 Airplanes AF51-13046 Through -13069

WARNING: Do not remove the safety pins from the canopy remover or seat catapult at any time during the adjustment procedure.



1 Make sure canopy remover sear pin is connected to the release mechanism bell crank link.

2 Adjust the overcenter stop to align lock indicator pointers.

3 Adjust rotary latch push-pull rods so that slots of rotary latches are aligned vertically when linkage is overcenter (against stop).

4 Adjust tension of cables to eliminate slack, being careful not to change position of any linkage or bell crank.

WARNING: Do not pull the seat catapult trigger (located under canopy release handgrip on seat) at any time during adjustment procedure.

5 Pull right handgrip to the locked position.

6 Adjust turnbuckle below handgrip on side of seat so that canopy rotary latch openings are 90 degrees from the closed position (parallel to deck).

7 Return right handgrip to the stowed position.

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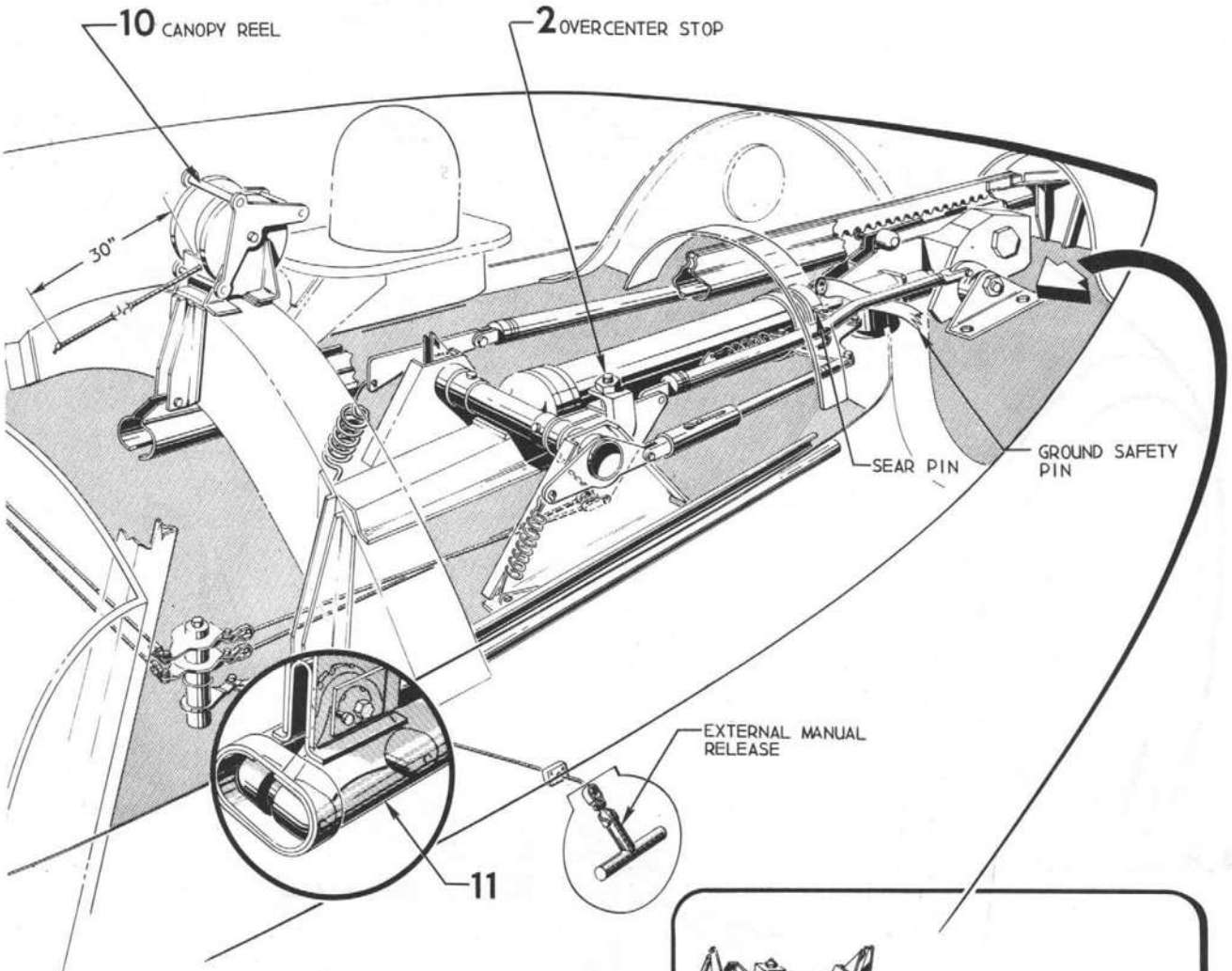
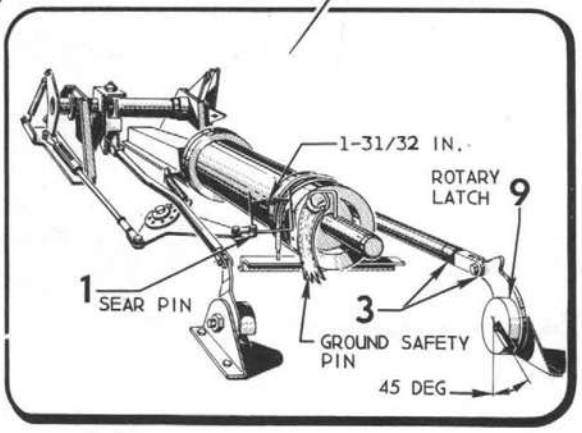
Figure 2-48. Adjusting Canopy Emergency Release System—F-86E-1 Through F-86E-10 Airplanes, and F-86E-15 Airplanes AF51-12977 Through -13045 (Sheet 1 of 2)





8 Adjust canopy seal emergency dump switch to allow approximately 1/16-inch travel before plunger bottoms when bell crank is in full up position.

9 Check that rotary latches rotate at least 45 degrees before the sear pin removal is sufficient to fire the canopy remover (1-31/32 inches).

10 Adjust tension preload of canopy reel to 3/4 pound (minimum) when ball is against stop; then determine that 30 inches of cable is obtainable (measured from the stop) before reel bottoms.

CAUTION: Looking aft from cockpit, be sure cable is threaded to wind from right to left.

11 Check trucks at intermediate track to see that movement is not restricted within the track.

12 With canopy closed, pull manual release from inside airplane to make sure movement of canopy is free on tracks.

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Figure 2-48. Adjusting Canopy Emergency Release System—F-86E-1 Through F-86E-10 Airplanes, and F-86E-15 Airplanes AF51-12977 Through -13045 (Sheet 2 of 2)

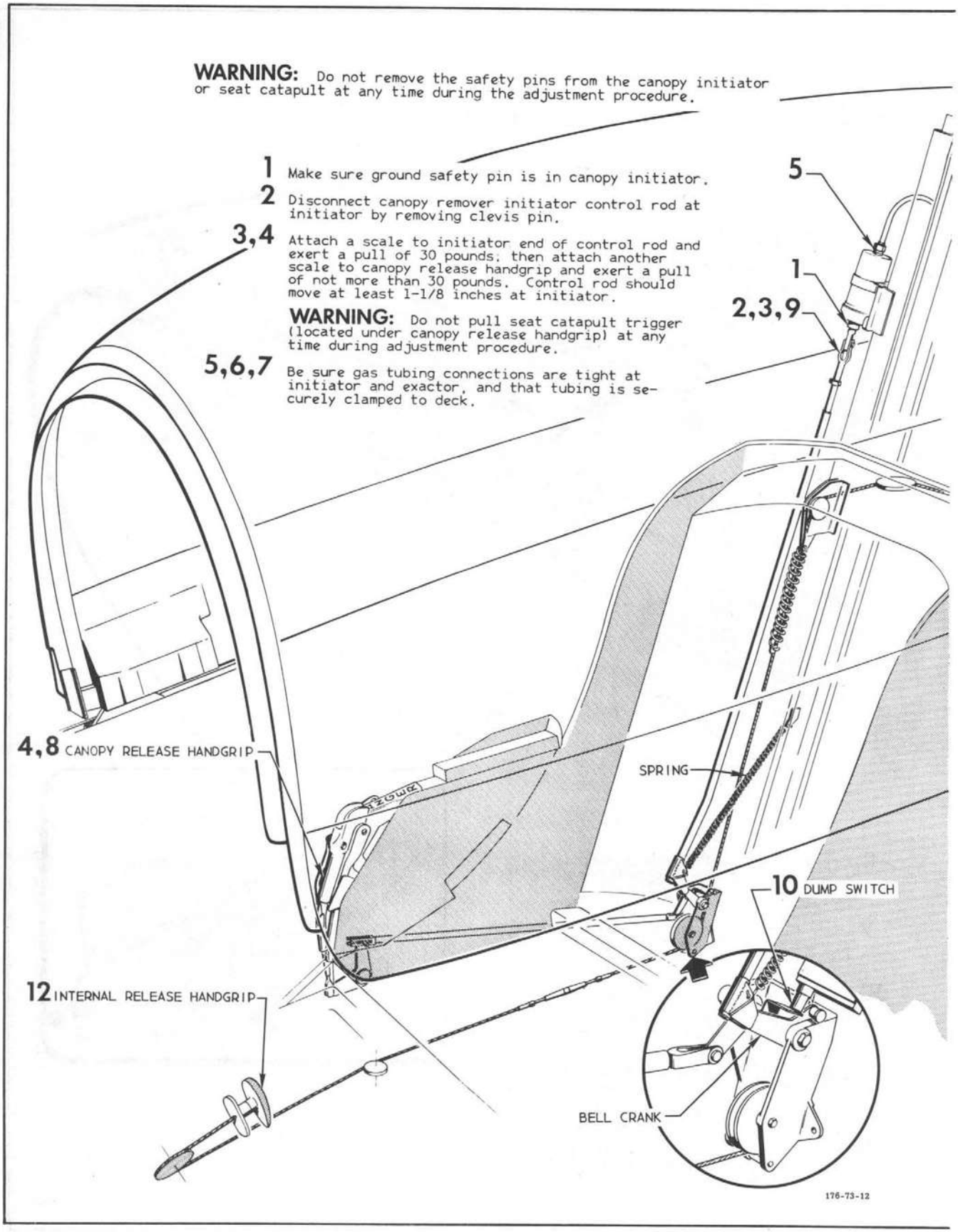
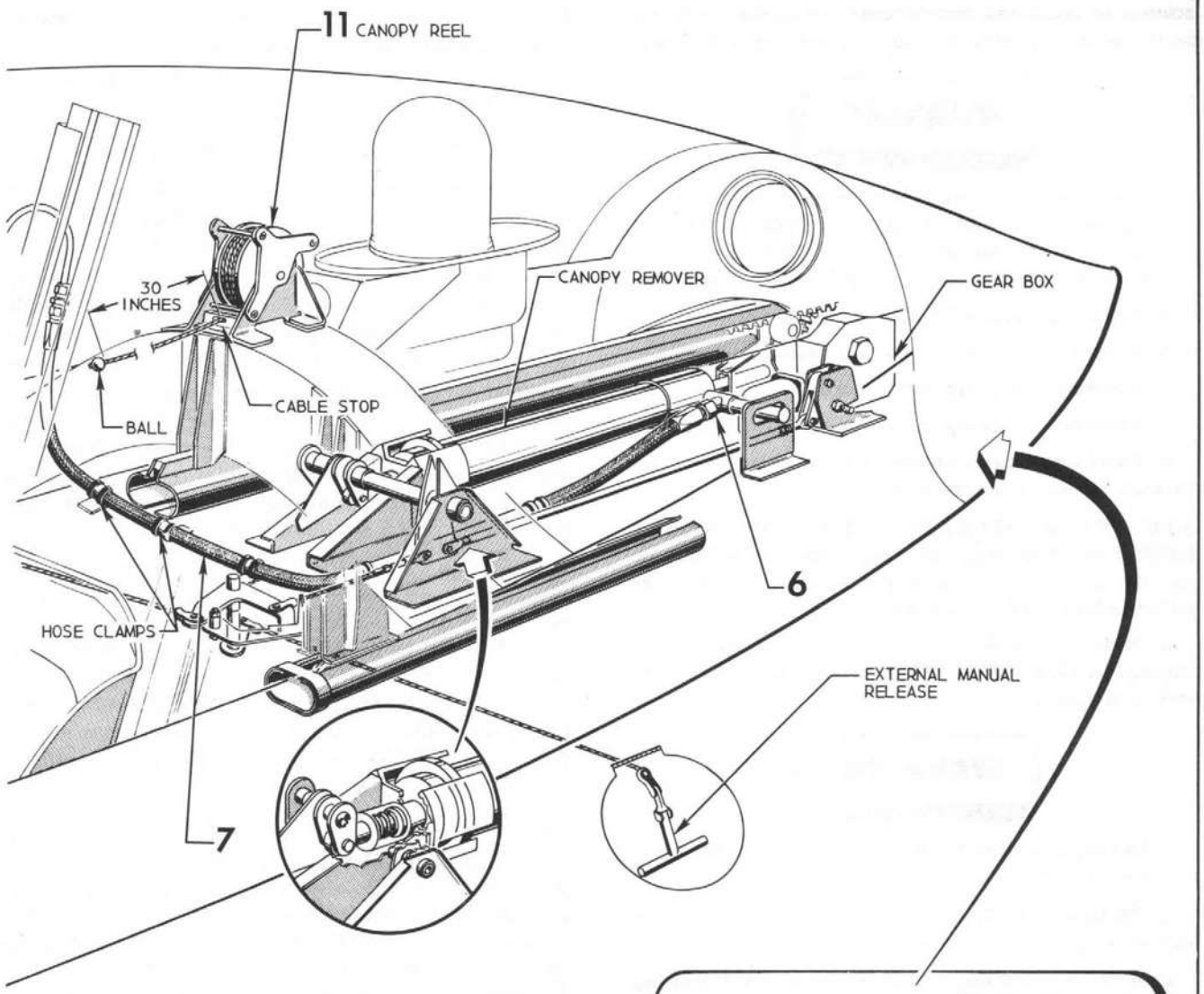
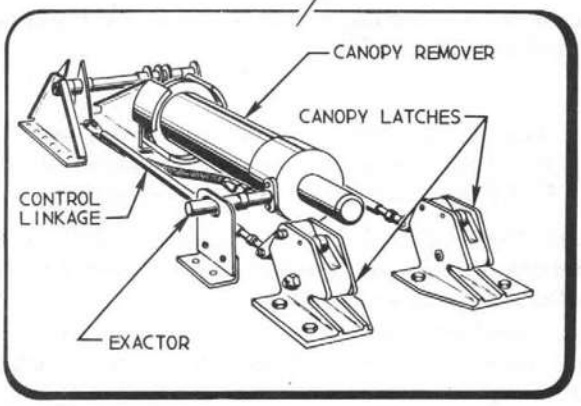


Figure 2-49. Adjusting Canopy Emergency Release System—F-86E-15 Airplanes AF51-13046 Through -13069 (Sheet 1 of 2)





8,9 Lower handgrip, then connect initiator control rod at initiator and safety clevis pin with a cotter pin.

10 Adjust canopy seal dump switch to allow approximately 1/16-inch travel before plunger bottoms when bell crank is in full-up position.

11 Adjust tension preload of canopy reel to 3/4 pound (minimum) when ball is against stop; then determine that 30 inches of cable is obtainable (measured from the stop) before reel bottoms.

CAUTION: Looking aft from cockpit, be sure cable is threaded to wind from right to left.

12 With canopy closed, pull manual release from inside airplane to make sure movement of canopy is free on tracks and latching mechanisms function properly.

176-73-13

Figure 2-49. Adjusting Canopy Emergency Release System—F-86E-15 Airplanes AF51-13046 Through -13069 (Sheet 2 of 2)

2-200. REMOVING CANOPY REMOVER. For identification of parts and components, see figure 2-49. Remove the canopy remover from the airplane as follows:

WARNING

The canopy remover must be handled as an ordnance item and stored as ammunition. Installation or removal must be accomplished in the open, away from any building or hangar.

a. Be sure ground safety pin is in place in initiator.

b. Raise rear part of canopy and place on blocks.

c. Disconnect gas line from exactor.

d. Remove "U" clamp from around canopy remover.

e. Carefully lift out canopy remover, being sure not to drop, strike, or jar remover.

2-201. PREINSTALLATION CHECK OF CANOPY REMOVER. The following inspections *must* be made and the precautionary measures adhered to before installation of M1A2 canopy remover.

a. Make sure lead seal is attached by a safety wire through a diagonally drilled hole in the outer tube trunnion fitting.

WARNING

DO NOT remove the standard cotter pin (used for shipment).

b. Make sure both screws that secure exactor to remover are tight.

c. Make sure the upper trunnion ring and lower cap are staked to outer tube.

Note

Any M1A2 canopy remover minus lead seal, staking, or cotter pin must be returned to the USAF Ordnance Department for disposition.

2-202. INSTALLING CANOPY REMOVER. For identification of parts and components, see figure 2-49. Install canopy remover as follows:

a. Place base of canopy remover in socket on fuselage deck. Body of remover will then lie in bottom half of "U" clamp.

b. Install upper half of "U" clamp.

c. Connect gas line to exactor. (See figure 2-49.)

d. Remove blocks and lower canopy.

2-203. EXTERNAL MANUAL CANOPY RELEASE.

2-204. An external manual canopy release is provided so that the canopy can be released from outside the airplane when the airplane is on the ground. The handle that operates the release mechanism can be reached through an access door on the left side of the fuselage below the canopy frame. Pulling the external manual canopy release disengages the canopy from the drive shaft, allowing the canopy to be moved manually. (See figures 2-46 and 2-47.)

2-205. EJECTION SEAT SYSTEM.

2-206. An ejection seat, using a Type M-1 aircraft personnel catapult, is installed in the airplane. In an emergency the pilot can fire the catapult, which causes the seat to be ejected completely away from the airplane, thus making bail-out safe at speeds up to 600 mph. When the right handgrip is raised, the canopy remover is fired. As the canopy leaves the airplane, it extracts the catapult sear safety pin, making it possible for the pilot to fire the seat catapult. On F-86E-15 Airplanes AF51-13046 through -13069, if the canopy fails to leave the airplane, the pilot can eject himself through the canopy. For detailed information and sequence of ejection seat operation, see figure 2-46 or 2-47.

2-207. ADJUSTING EJECTION SEAT SYSTEM. For the adjustment procedure of the ejection seat system on F-86E-1 Airplanes AF50-579 through -588, see figure 2-50. For the adjustment procedure on F-86E-1 Airplanes AF50-589 through -638, F-86E-5, F-86E-6, and F-86E-10 Airplanes, and F-86E-15 Airplanes AF51-12977 through -13045, see figure 2-51. For the adjustment procedure on F-86E-15 Airplanes AF51-13046 through -13069, see figure 2-52.

2-208. EJECTION SEAT CATAPULT.

2-209. The Type M-1 catapult, used to propel the seat away from the airplane, is a three-tube, telescoping ejector. The ejector consists of an outer tube, an intermediate tube, an inner tube, and a cartridge with its firing mechanism. The upper end of the inner tube incorporates the cartridge and its firing mechanism and a trunnion which attaches to the upper framework of the ejection seat. The upper end of the outer tube has a trunnion attached to the structure of the airplane. When the catapult is fired, the outer and intermediate tubes stay with the airplane; the inner tube goes out with the seat. The catapult is assembled with the cartridge contained in the catapult as a sealed unit. Two safety devices are provided: the catapult sear safety pin, which prevents rotation of the sear; and a ground safety pin that passes through the firing pin, locking the firing pin in place. The catapult sear safety pin is inserted diagonally through the inner tube trunnion, firing pin, and sear, and protrudes from the outer tube. A short length of .015-inch annealed brass wire is installed through a hole in the end of the catapult sear safety pin to indicate whether the sear safety pin has been tampered with. The wire also prevents the canopy reel (which is under tension) from pulling the sear safety pin out of the catapult. The catapult sear safety pin is pulled out of the catapult by the cable on the canopy reel when the canopy leaves the airplane. The ground

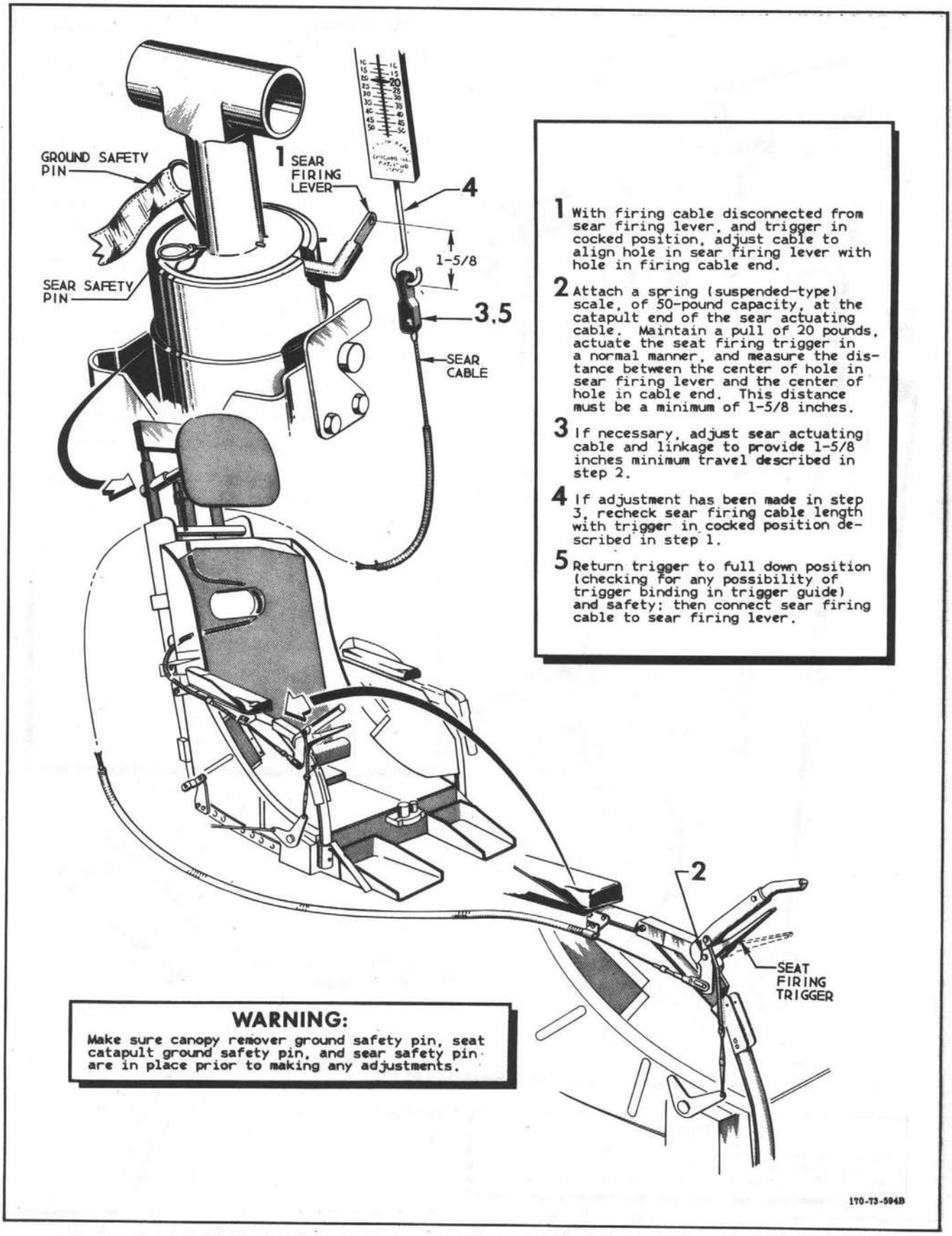
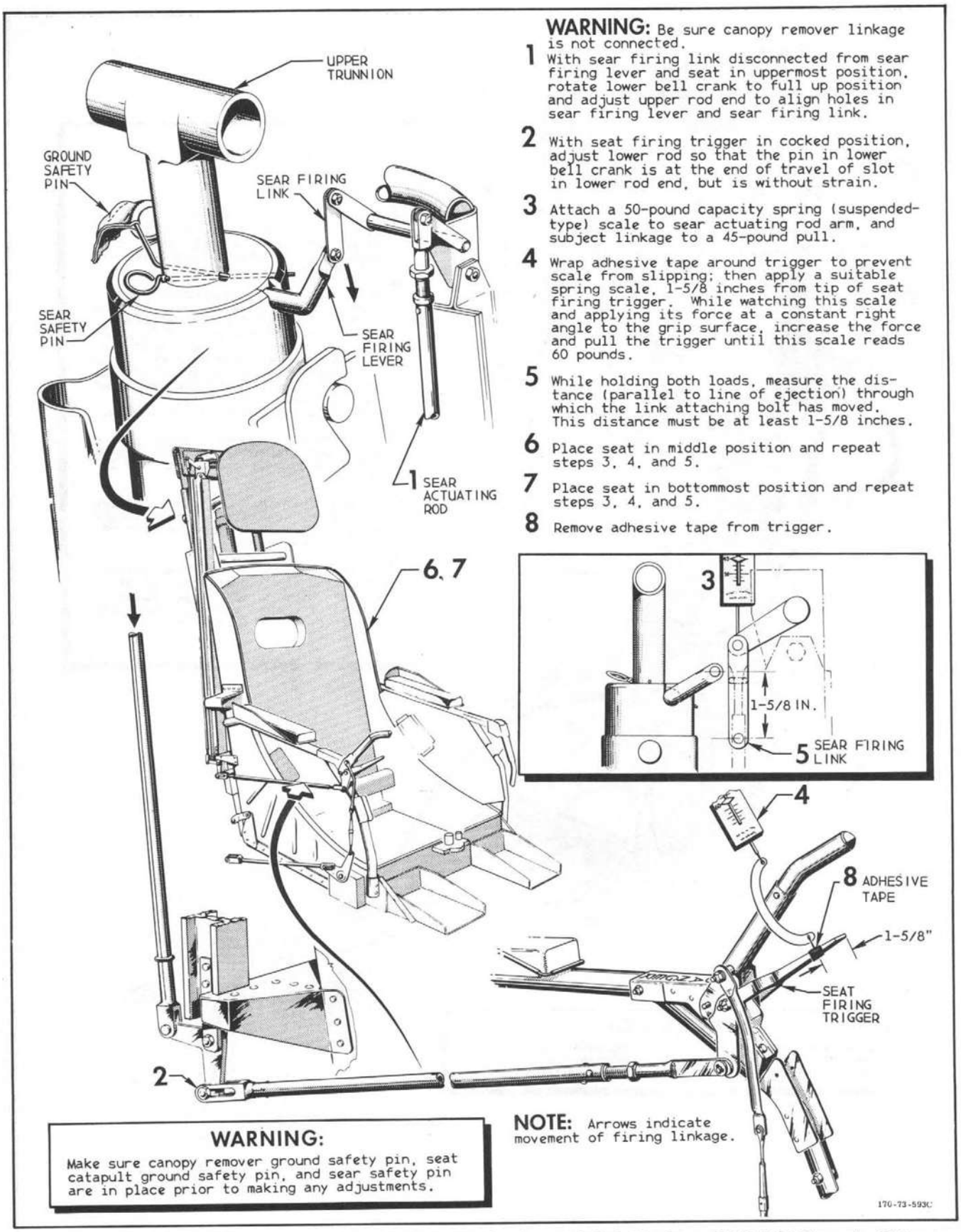


Figure 2-50. Adjusting Seat Emergency Release Mechanism—F-86E-1 Airplanes AF50-579 Through -588



WARNING: Be sure canopy remover linkage is not connected.

1. With sear firing link disconnected from sear firing lever and seat in uppermost position, rotate lower bell crank to full up position and adjust upper rod end to align holes in sear firing lever and sear firing link.
2. With seat firing trigger in cocked position, adjust lower rod so that the pin in lower bell crank is at the end of travel of slot in lower rod end, but is without strain.
3. Attach a 50-pound capacity spring (suspended-type) scale to sear actuating rod arm, and subject linkage to a 45-pound pull.
4. Wrap adhesive tape around trigger to prevent scale from slipping; then apply a suitable spring scale, 1-5/8 inches from tip of seat firing trigger. While watching this scale and applying its force at a constant right angle to the grip surface, increase the force and pull the trigger until this scale reads 60 pounds.
5. While holding both loads, measure the distance (parallel to line of ejection) through which the link attaching bolt has moved. This distance must be at least 1-5/8 inches.
6. Place seat in middle position and repeat steps 3, 4, and 5.
7. Place seat in bottommost position and repeat steps 3, 4, and 5.
8. Remove adhesive tape from trigger.

WARNING:

Make sure canopy remover ground safety pin, seat catapult ground safety pin, and sear safety pin are in place prior to making any adjustments.

NOTE: Arrows indicate movement of firing linkage.

Figure 2-51. Adjusting Seat Emergency Release Mechanism—F-86E-1 Airplanes AF50-589 Through -638, F-86E-5, F-86E-6, and F-86E-10 Airplanes, and F-86E-15 Airplanes AF51-12977 Through -13045

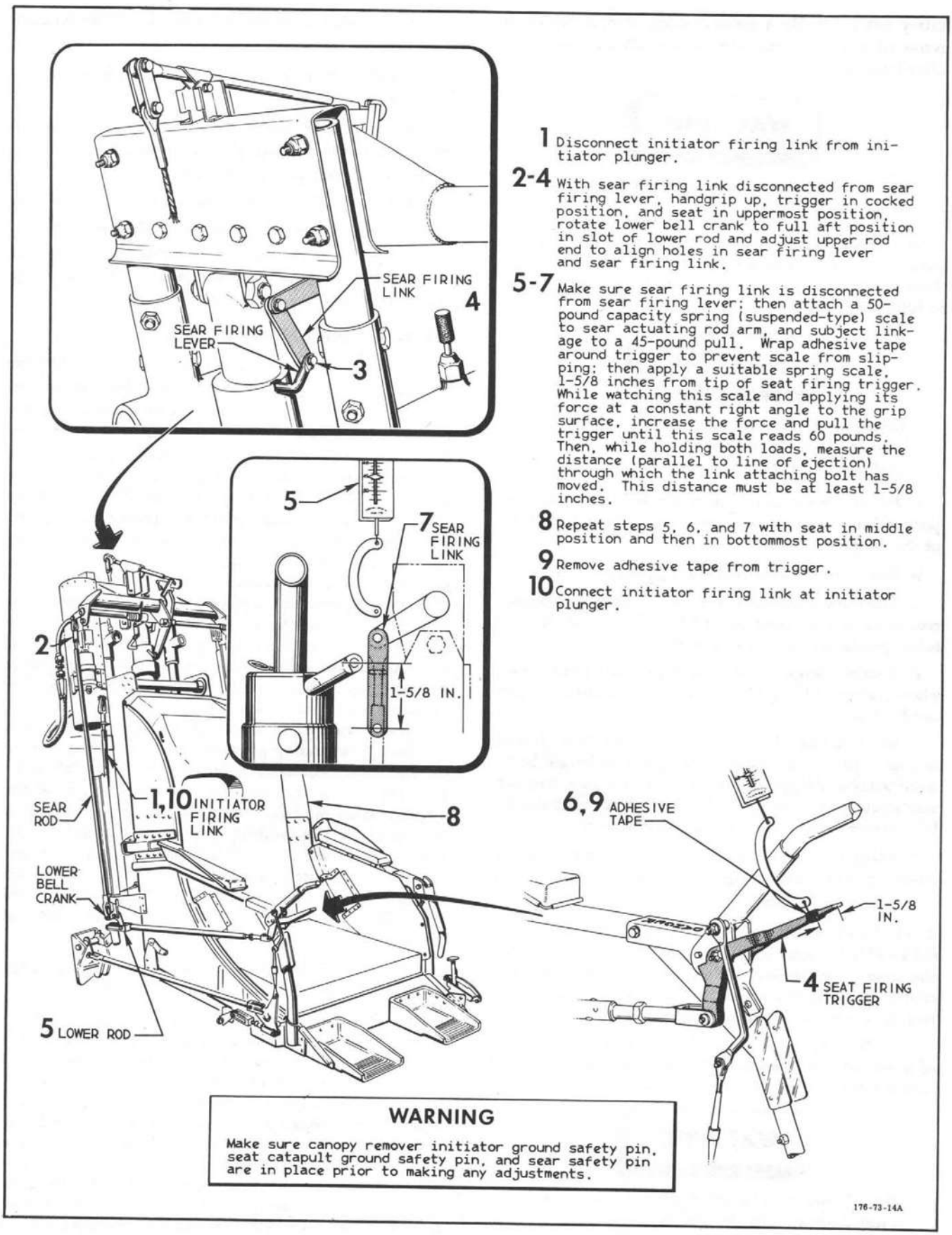


Figure 2-52. Adjusting Seat Emergency Release Mechanism—F-86E-15 Airplanes AF51-13046 Through -13069

safety pin is strictly a ground safety device, which is removed just before take-off and installed immediately after landing.

WARNING

All catapults should be considered loaded and dangerous.

2-210. REMOVING CATAPULT. For identification of parts and components, see figures 2-50, 2-51, and 2-52. Remove the ejection seat catapult from the airplane as follows:

WARNING

Removal of ejection seat catapult must be accomplished in the open, away from any building or hangar.

a. Be sure that ground safety pin is installed in catapult and that it can be seen protruding from both sides of the catapult.

b. Open canopy to its full-back position.

c. Disconnect catapult sear safety pin from canopy reel cable at sear safety pin. DO NOT remove the sear safety pin to perform this operation.

d. Remove screw from strap that holds head armor plate against rails, and hold plate in position so it does not fall back.

e. Remove sear safety pin from catapult through hole in armor plate, and allow armor plate to rotate backward without dropping it until it comes to rest. Replace sear safety pin in catapult. If pin will not go back in, be sure sear firing lever is in correct position.

f. Remove forward bolts, loosen rear bolts in catapult trunnion hooks, and swing hooks open.

g. Lift out catapult.

2-211. PREINSTALLATION CHECK OF LOADED CATAPULT. Refer to paragraphs 2-196 and 2-201 for the inspections which MUST be made and the precautionary measures which should be adhered to before installation of the ejection seat catapult.

2-212. INSTALLING CATAPULT. For identification of parts and components, see figures 2-50, 2-51, and 2-52. Install ejection seat catapult as follows:

WARNING

Installation must be accomplished in the open, away from any building or hangar.

a. Place catapult in position in the airplane.

b. Close catapult trunnion hooks over bosses on catapult.

c. Install forward bolts and tighten rear bolts in catapult trunnion hooks.

d. Remove sear safety pin from catapult. Rotate armor plate forward and, through hole in armor plate, replace sear safety pin in catapult.

e. While holding plate in position, replace screw in strap that holds head armor plate against the rails.

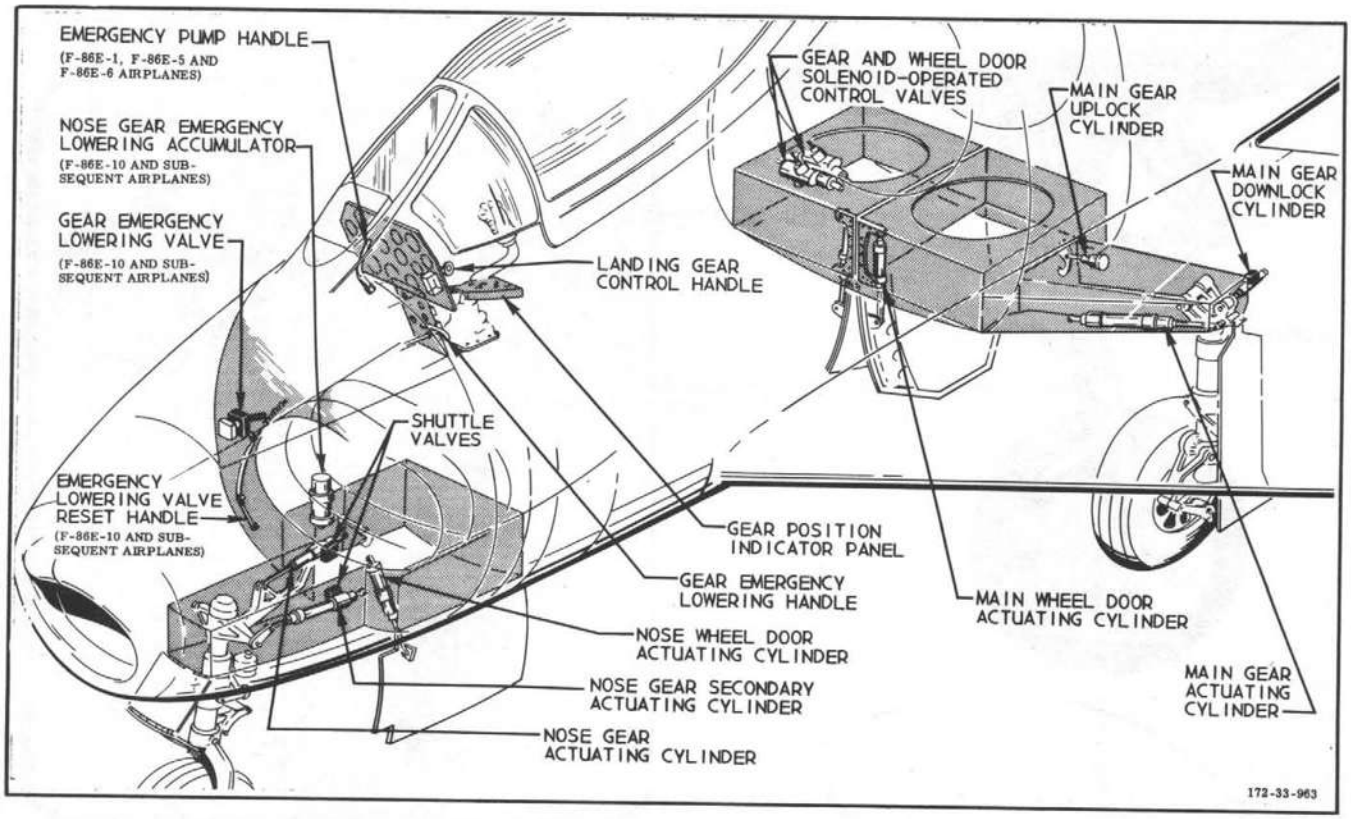
f. Connect catapult sear safety pin to canopy reel cable at sear safety pin. Do not remove the sear safety pin to perform this operation.

2-213. LANDING GEAR SYSTEM.

2-214. The airplane is equipped with a tricycle-type landing gear incorporating air-oil type shock struts and high-pressure pneumatic tires. The gear assemblies can be retracted inside the airplane and are completely faired within the airplane outer surfaces by wheel doors and shock strut fairings. (See figure 2-53.) The landing gear and wheel doors are hydraulically actuated by pressure from the utility hydraulic power system. The pressure to the landing gear hydraulic system is controlled by solenoid-operated control valves. A landing gear control handle, on the left side of the pilot's instrument panel, provides the pilot with a means of selecting gear position. An electric sequencing system properly sequences the gear and door operation after gear-up or gear-down selection has been made. Position indicators and warning indicators indicate to the pilot a gear safe or unsafe condition. An emergency system for extending the gear in case of an electrical or hydraulic failure is operated by a landing gear emergency lowering handle on the center pedestal. A safety switch on the left main gear prevents gear retraction when the weight of the airplane is on the gear unless the emergency retraction button above the landing gear control handle is depressed. On F-86E-10 and F-86E-15 Airplanes, a ground door control switch in the left strut well is provided for opening the wheel doors to gain access to the wheel wells when the airplane is on the ground and external power is connected.

2-215. FUNCTION OF LANDING GEAR SYSTEM (NORMAL RETRACTION CYCLE).

2-216. When the landing gear control handle is moved to the "UP" position to retract the gear, the electric switch, actuated by the control handle, is positioned to direct the current into the sequencing system. (See figures 2-55 through 2-57, figures 2-62 through 2-65, or figures 2-69 through 2-72.) With the gear in the down-locked position and wheel doors closed, the sequence switches are in a position to direct current to the door-open solenoid on the door control valve. As the door-open solenoid is energized, the control valve is positioned to direct hydraulic pressure to the open side of the door actuating cylinders. Initial movement of the



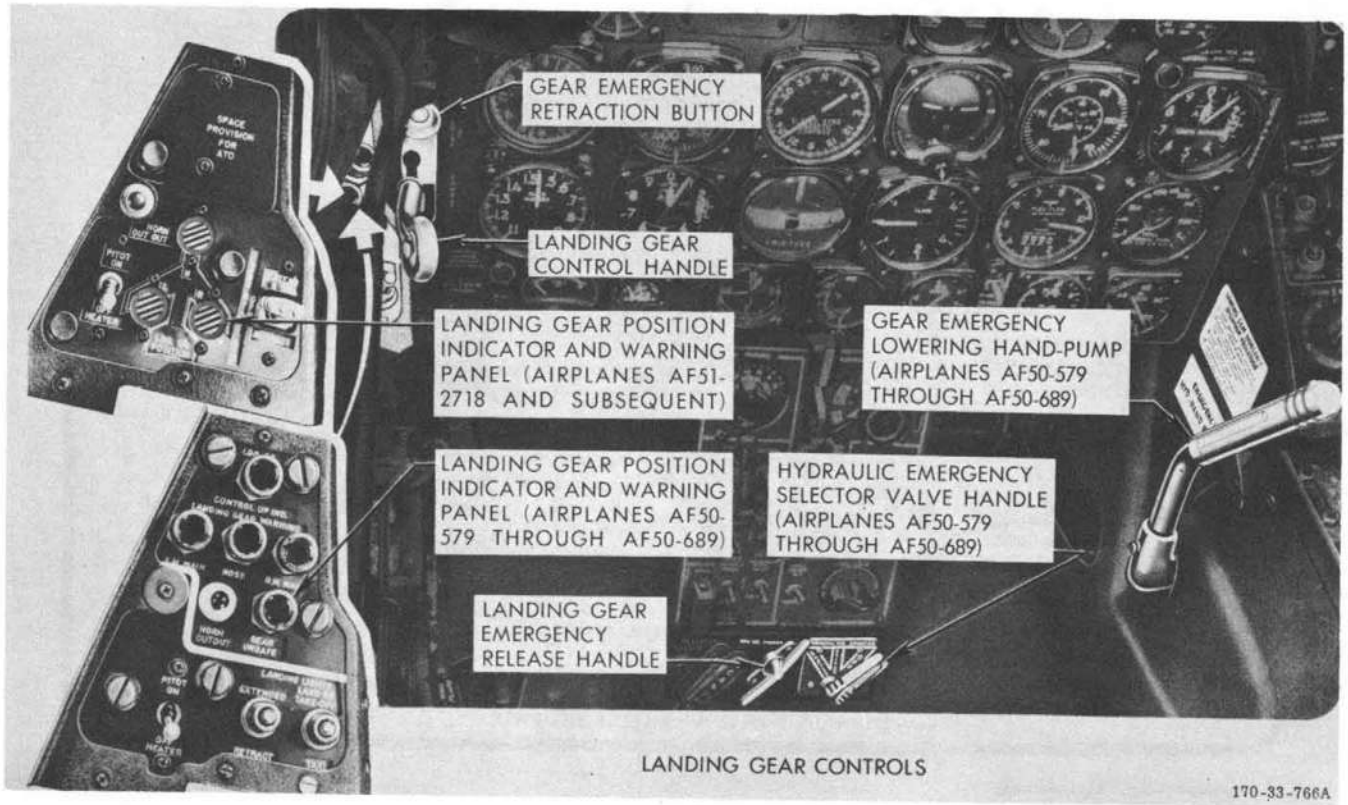


Figure 2-53. Landing Gear System (Sheet 1 of 3)

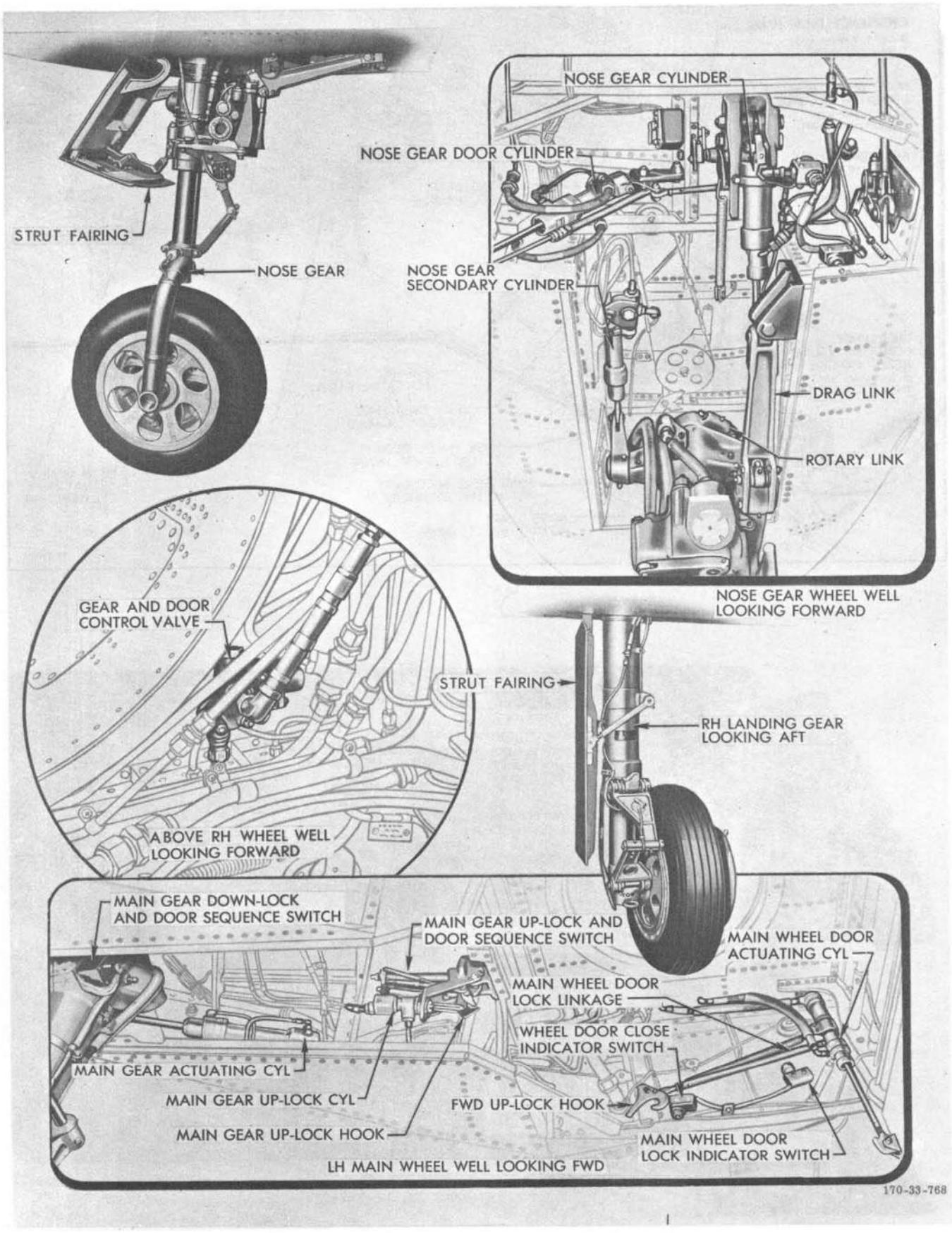


Figure 2-53. Landing Gear System (Sheet 2 of 3)

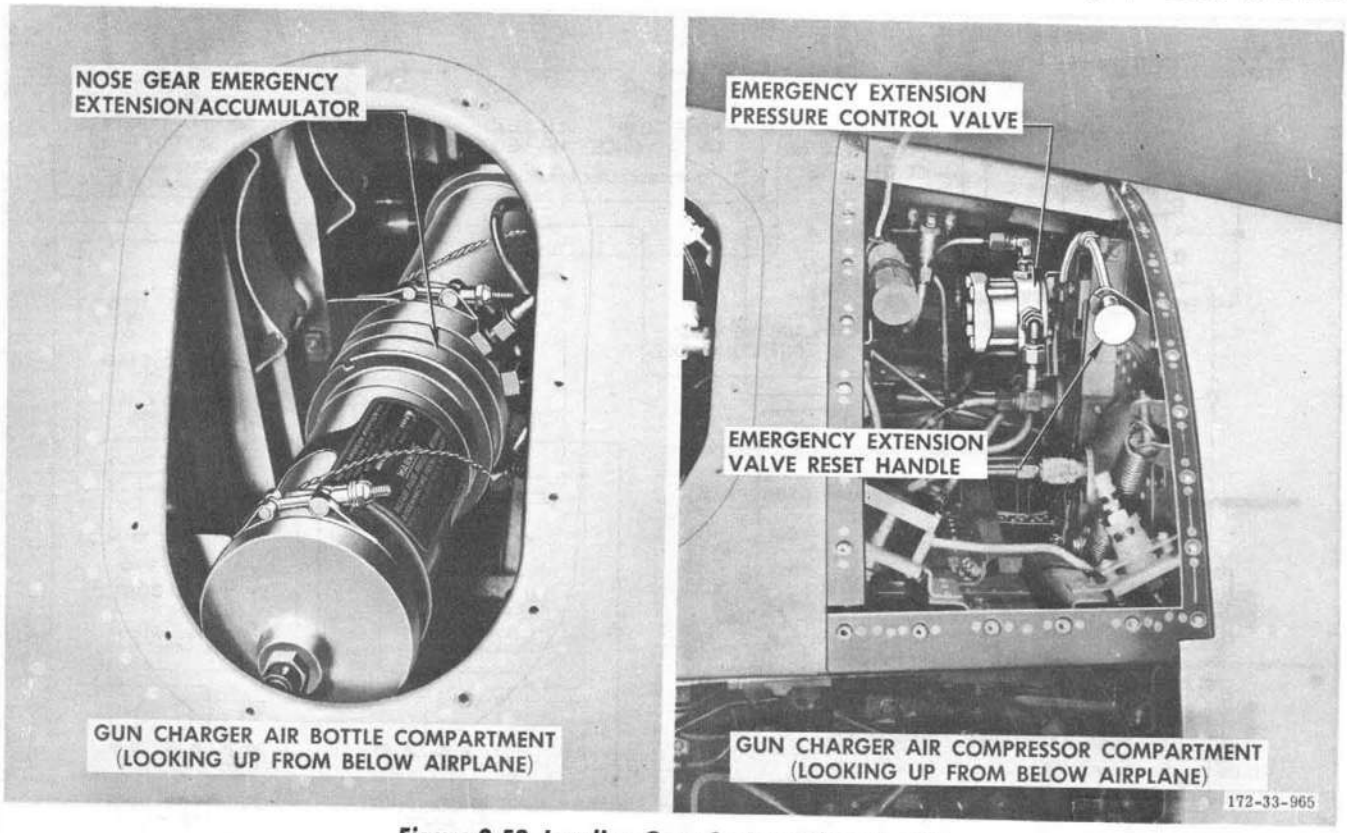


Figure 2-53. Landing Gear System (Sheet 3 of 3)

wheel door actuating cylinders unlocks the door uplocks, and continuing pressure opens the wheel doors. When each door reaches the full open position, a gear sequence switch in the gear-up circuit is actuated (closed); when all doors are full open and the weight of the airplane is off the gear, so that the safety switch makes contact, the circuit is completed to energize the gear-up solenoid on the gear control valve. The gear control valve then shifts and directs pressure to the gear-up side of the nose gear actuating cylinders and to the unlock side of the main gear downlock cylinders. As soon as the main gear downlocks are unlocked, pressure is allowed to pass through the downlock cylinders to the gear-up side of the main gear actuating cylinders and the main gear-up uplock actuating cylinders. As each gear reaches the uplocked position, it contacts a wheel door sequence switch. When all three of the door sequence switches are closed, an electrical circuit is completed, which energizes the door-closed solenoid and de-energizes the door-open solenoid on the wheel door control valve. The gear control valve then shifts and directs pressure to the door-closed side of the door actuating cylinders. As wheel doors move from the full open position, the electrical circuit energizing the gear-up solenoid on the gear control valve is broken and the valve shifts to neutral. When the gear control valve is in neutral, the pressure is stopped at the valve and all lines to the gear actuating units are open to return. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the doors will remain pressurized until the landing gear control handle is placed in the "COMBAT" position. (See figures 2-54 and 2-58.) On F-86E-10 and F-86E-15 Airplanes, when all doors reach the closed-and-locked position, the electrical circuit that energizes the door-closed solenoid on the wheel door control valve is broken, the solenoid is de-energized, and the valve shifts to neutral. When the door control valve is in neutral, the pressure is stopped at the valve and all lines to the door actuating cylinders are open to return.

2-217. FUNCTION OF LANDING GEAR SYSTEM (NORMAL EXTENSION CYCLE).

2-218. When the landing gear control handle is moved to the "DOWN" position to extend the gear, the electric switch actuated by the control handle is positioned to direct current into the sequencing system. (See figures 2-59 and 2-60; figures 2-61, 2-66, and 2-67; or figures 2-68, 2-73, and 2-74.) With the gear in the unlocked position and wheel doors closed, the sequence switches are positioned to direct current to the door-open solenoid on the door control valve and to the gear-down solenoid on the gear control valve. As the solenoids are energized, the respective control valves are shifted to direct pressure to the open side of the door actuating cylinders, to the down side of the gear actuating cylinders, to the unlock side of gear uplocks, and to the locked side of the gear downlocks. As each gear reaches the downlocked position, it contacts a door-closed sequence switch. When all three gear sequence switches are actuated, the electrical circuit energizing the door-open

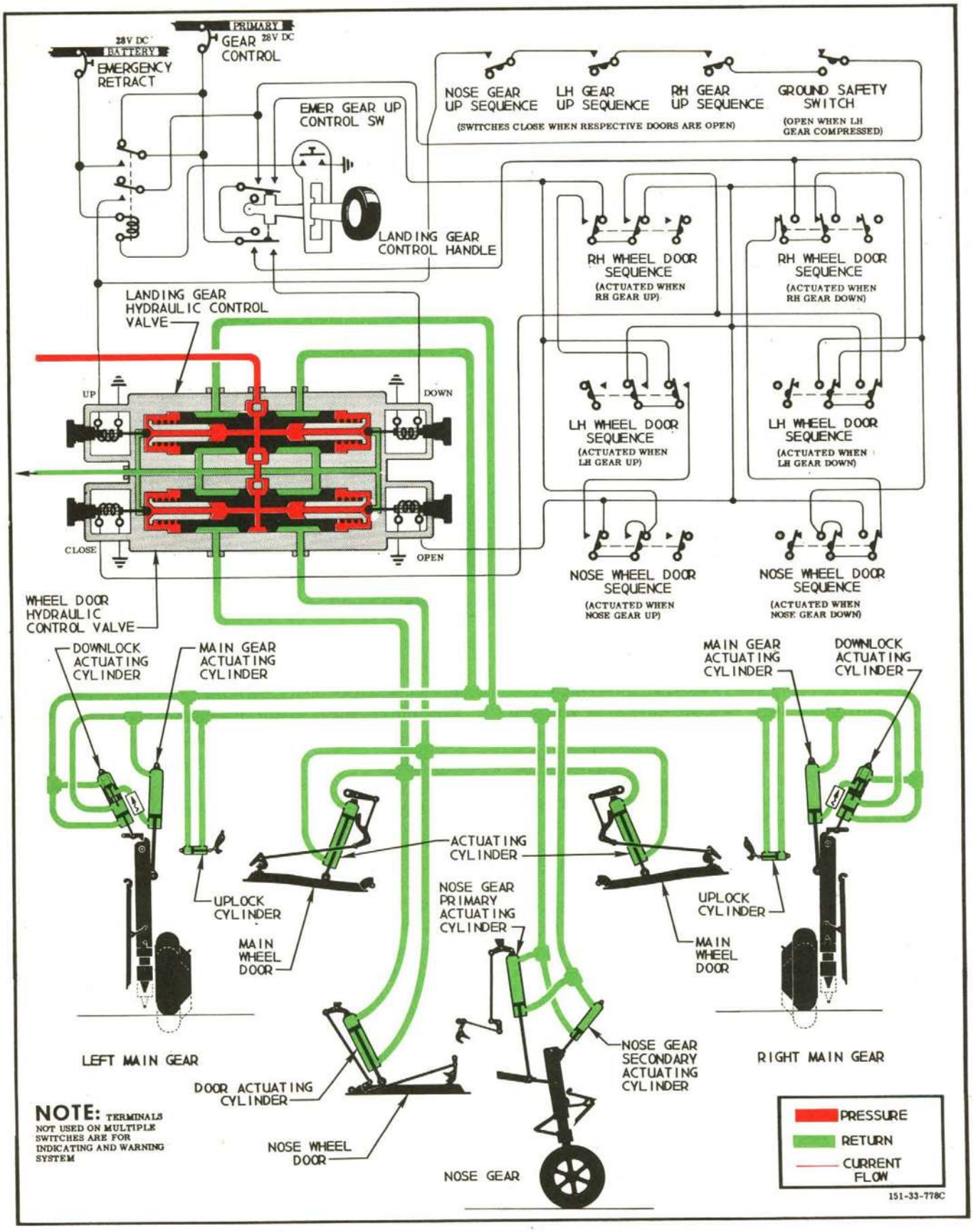


Figure 2-54. Landing Gear System—Control Handle "COMBAT," Gear Down, Doors Closed—F-86E-1, F-86E-5, and F-86E-6 Airplanes

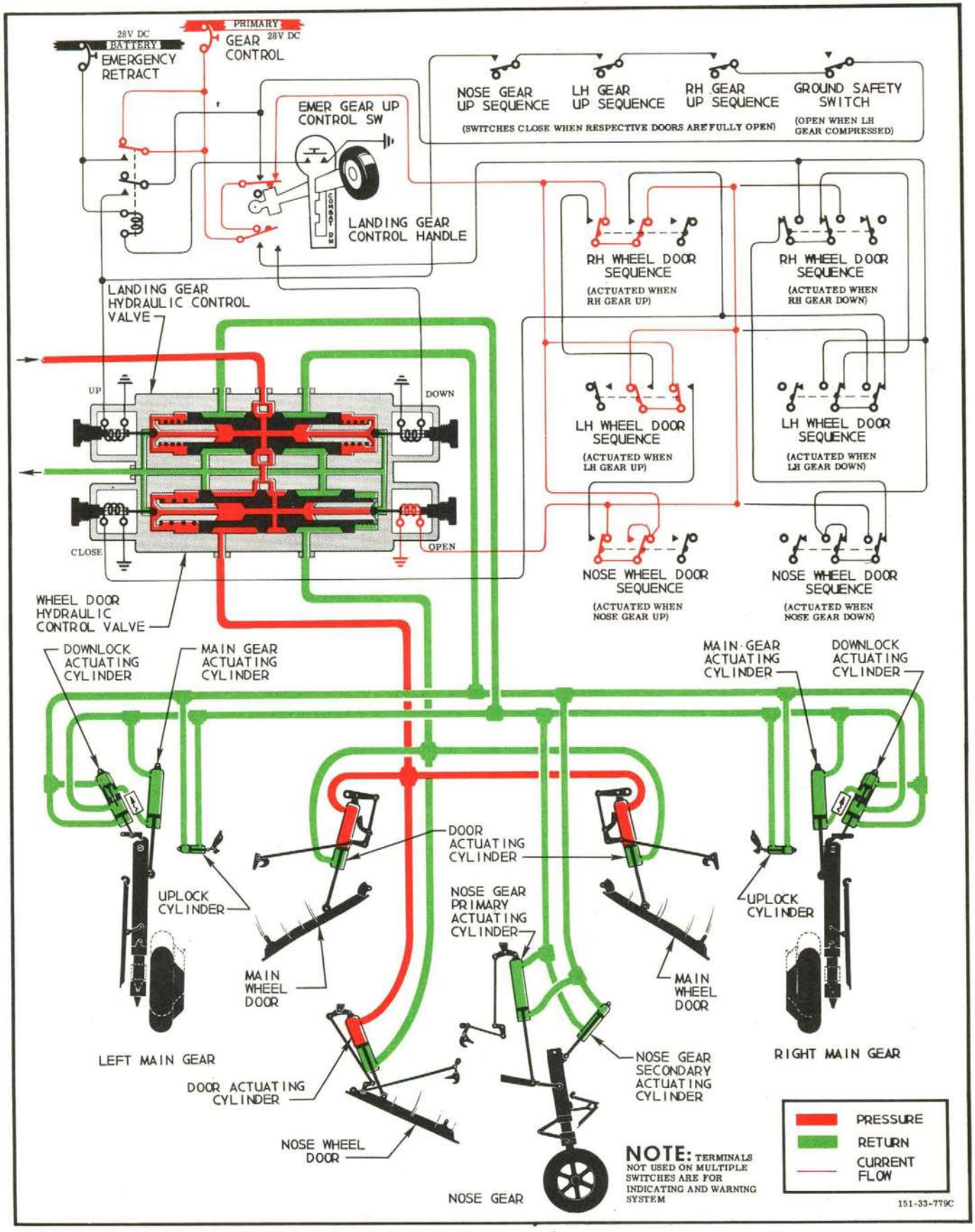


Figure 2-55. Landing Gear System—Control Handle "UP," Gear Down, Doors Opening—F-86E-1, F-86E-5, and F-86E-6 Airplanes

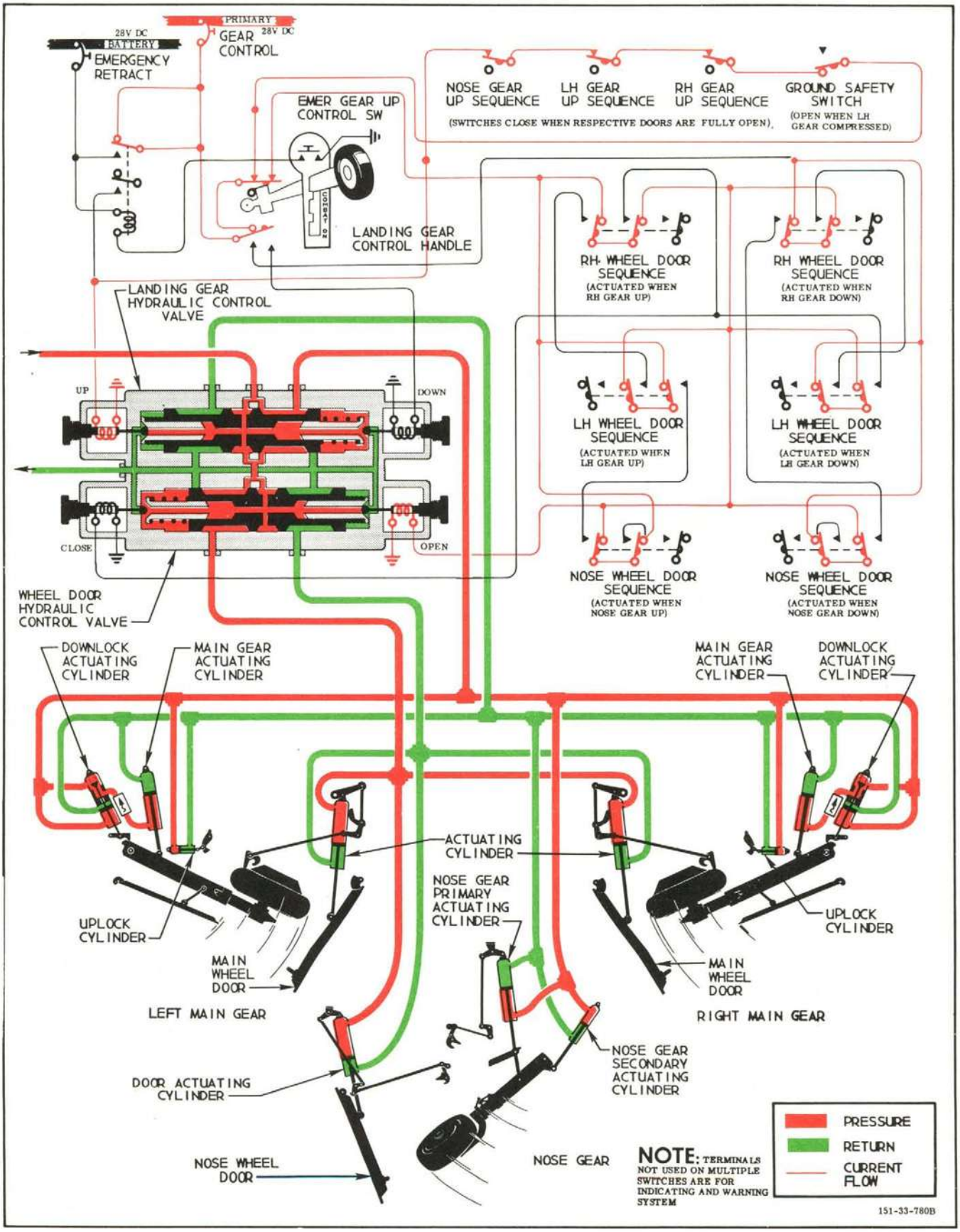


Figure 2-56. Landing Gear System—Control Handle "UP," Doors Open, Gear Retracting F-86E-1, F-86E-5, and F-86E-6 Airplanes

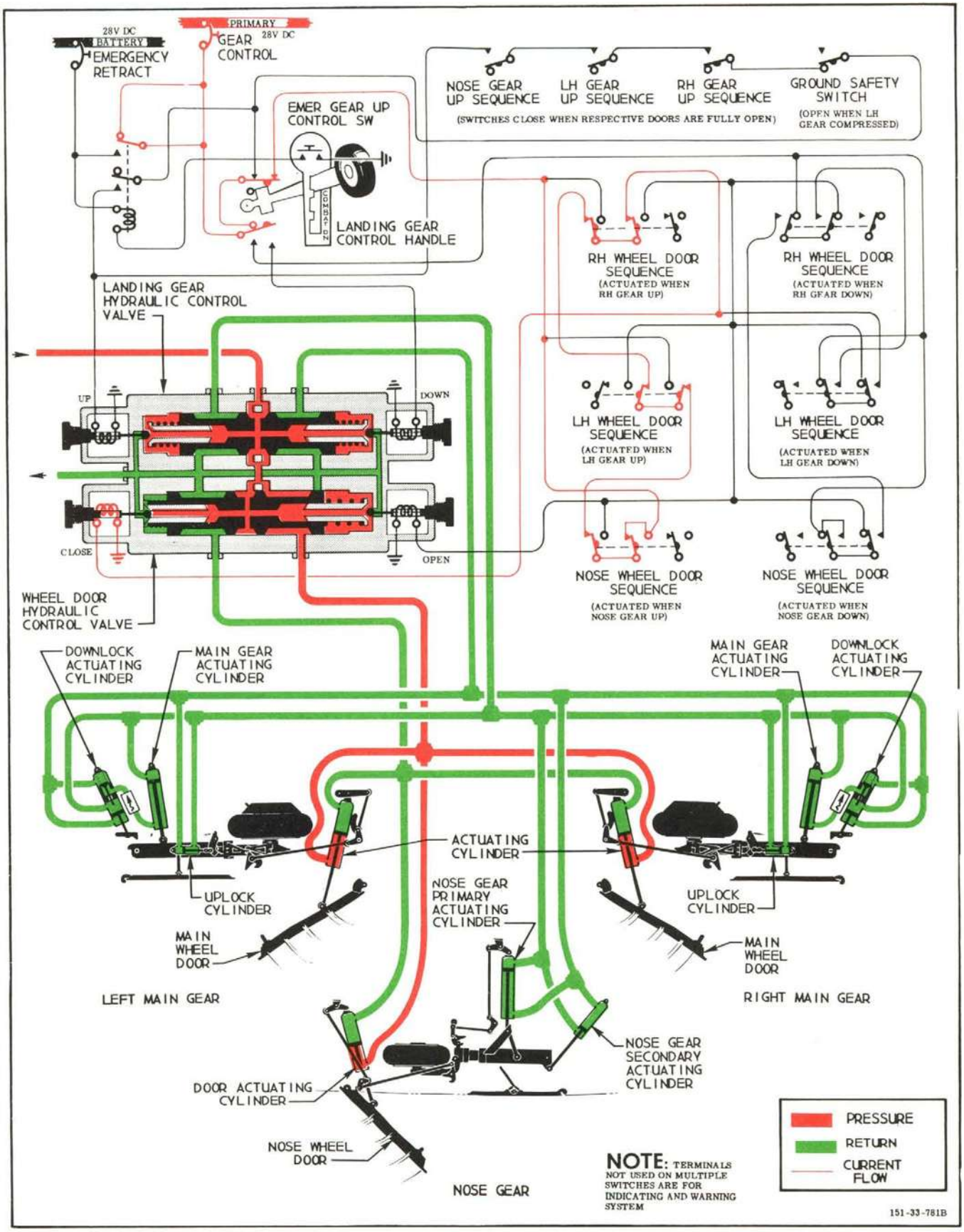


Figure 2-57. Landing Gear System—Control Handle "UP," Gear Up, Doors Closing—F-86E-1, F-86E-5, and F-86E-6 Airplanes

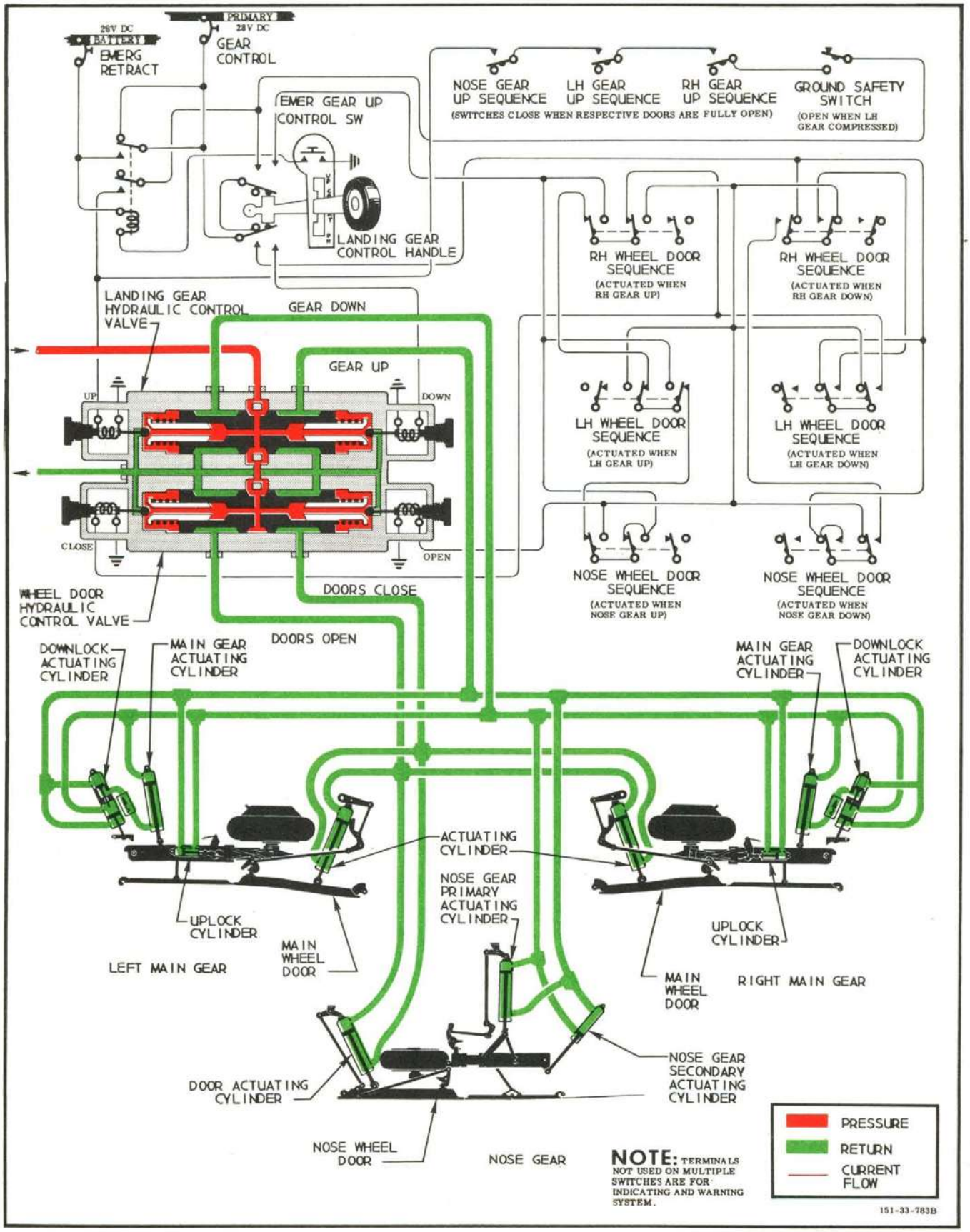


Figure 2-58. Landing Gear System—Control Handle "COMBAT," Gear Up, Doors Closed—F-86E-1, F-86E-5, and F-86E-6 Airplanes

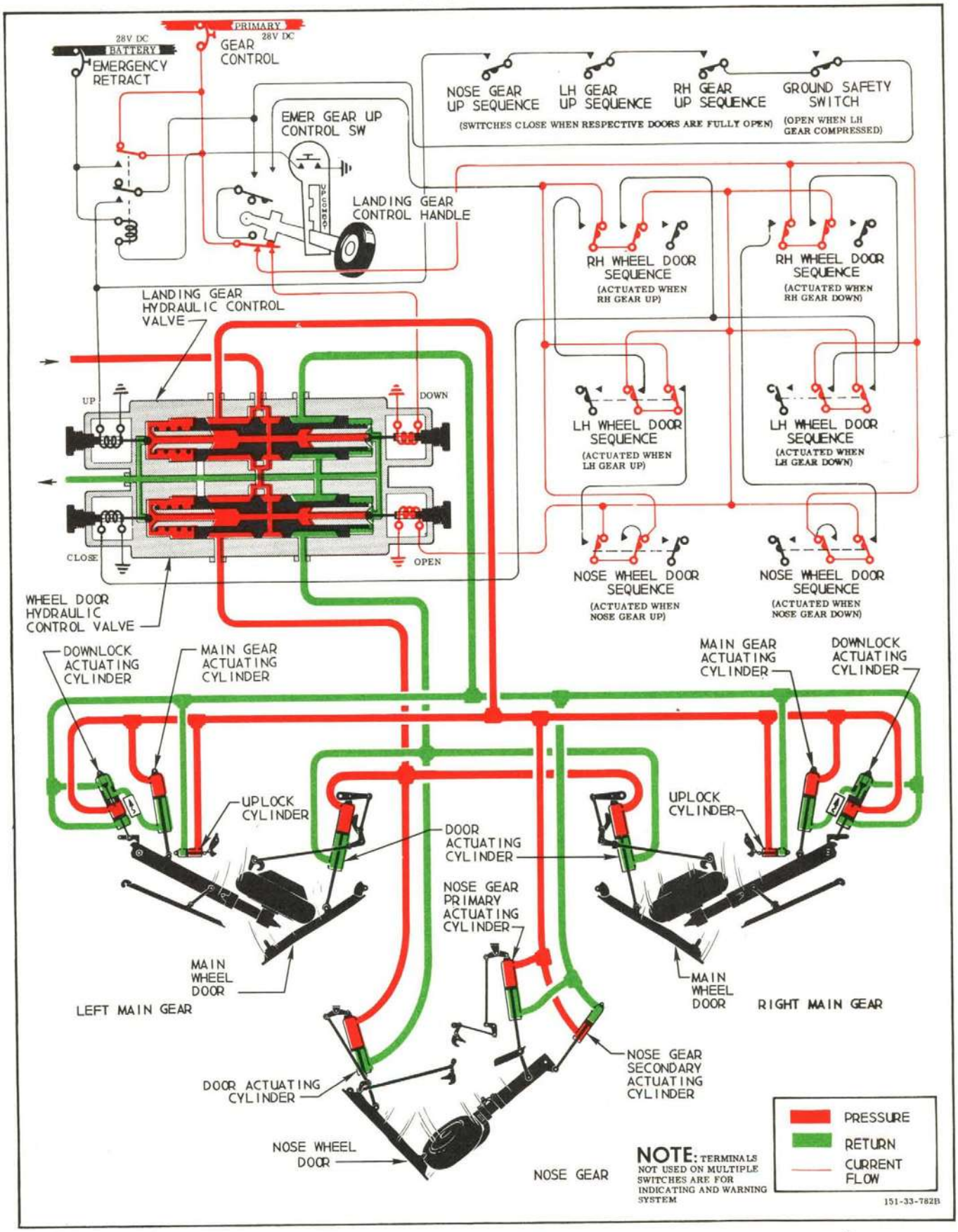


Figure 2-59. Landing Gear System—Control Handle "DOWN," Doors Opening, Gear Extending—F-86E-1, F-86E-5, and F-86E-6 Airplanes

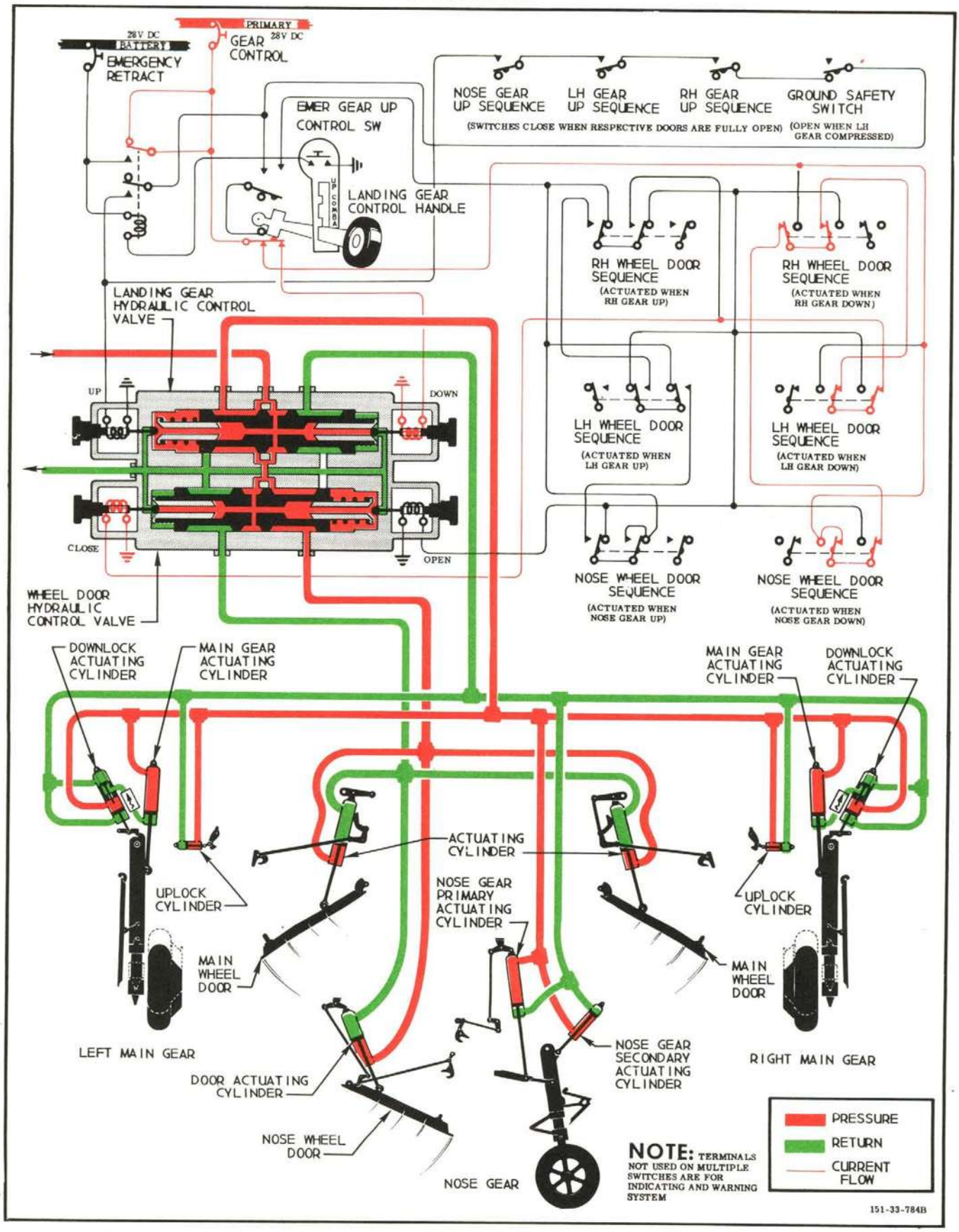


Figure 2-60. Landing Gear System—Control Handle "DOWN," Gear Down, Doors Closing—F-86E-1, F-86E-5, and F-86E-6 Airplanes

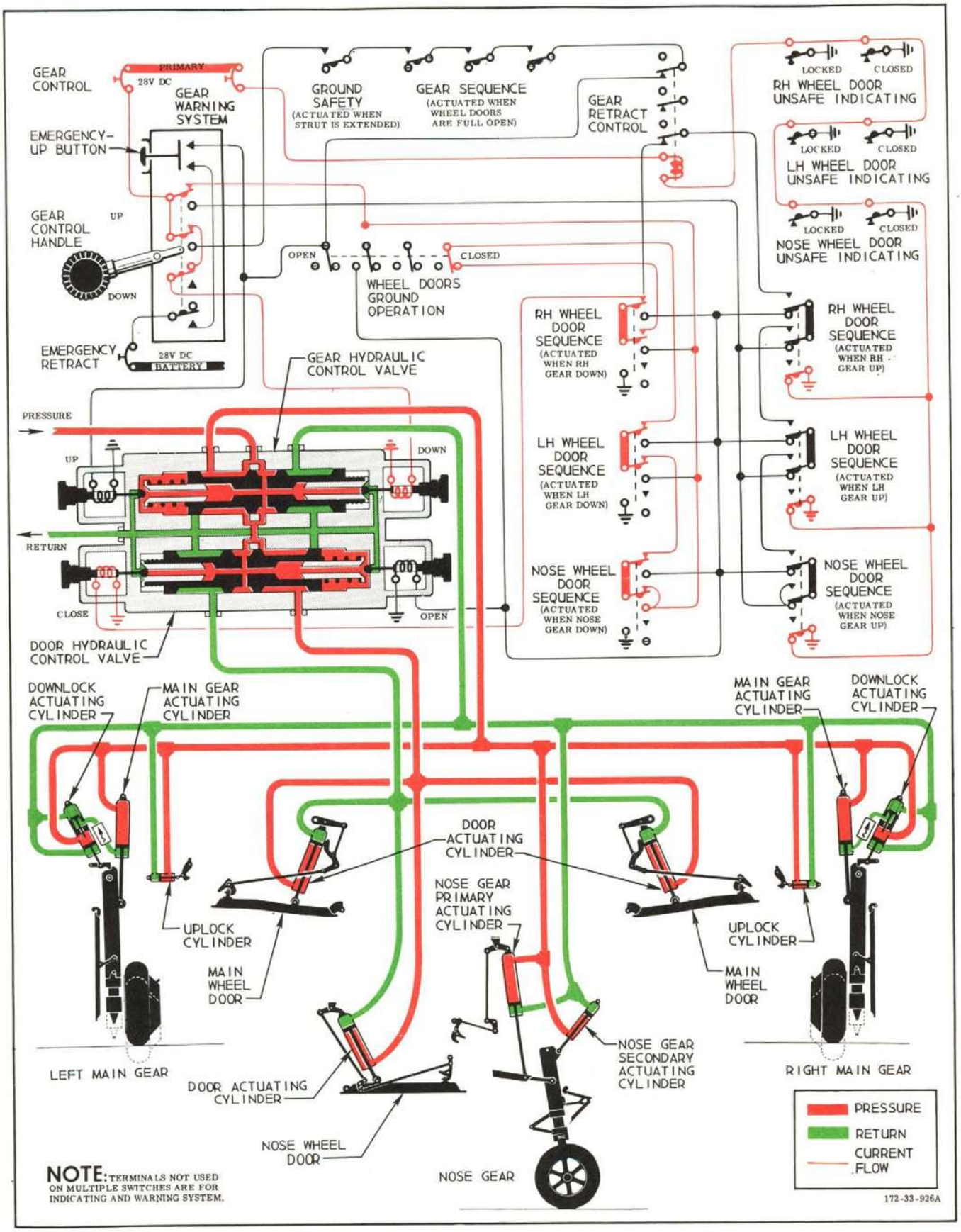


Figure 2-61. Landing Gear System—Control Handle "DOWN," Gear Down, Doors Closed—F-86E-10 Airplanes

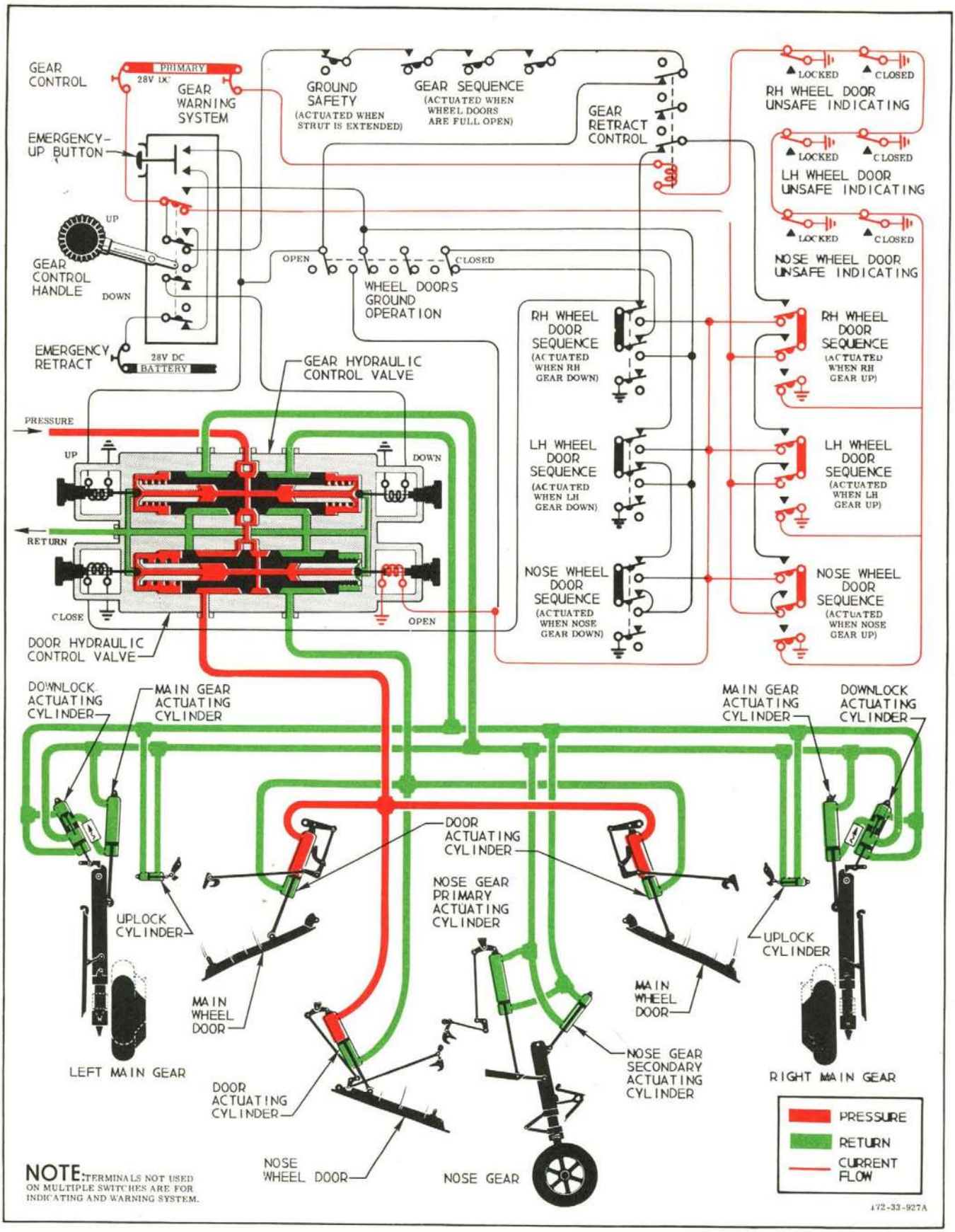


Figure 2-62. Landing Gear System—Control Handle "UP," Gear Down, Doors Opening—F-86E-10 Airplanes

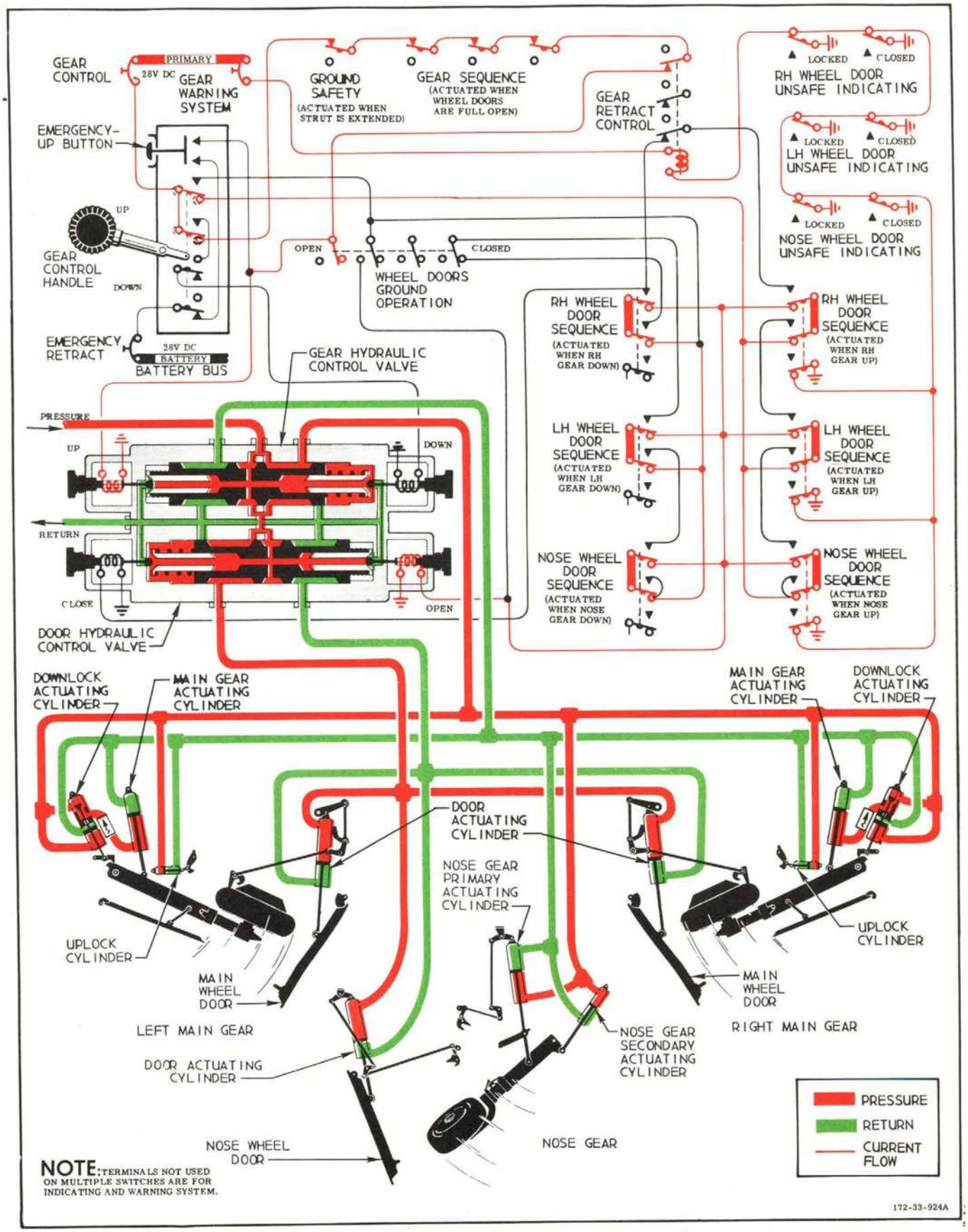


Figure 2-63. Landing Gear System—Control Handle "UP," Gear Retracting, Doors Open—F-86E-10 Airplanes

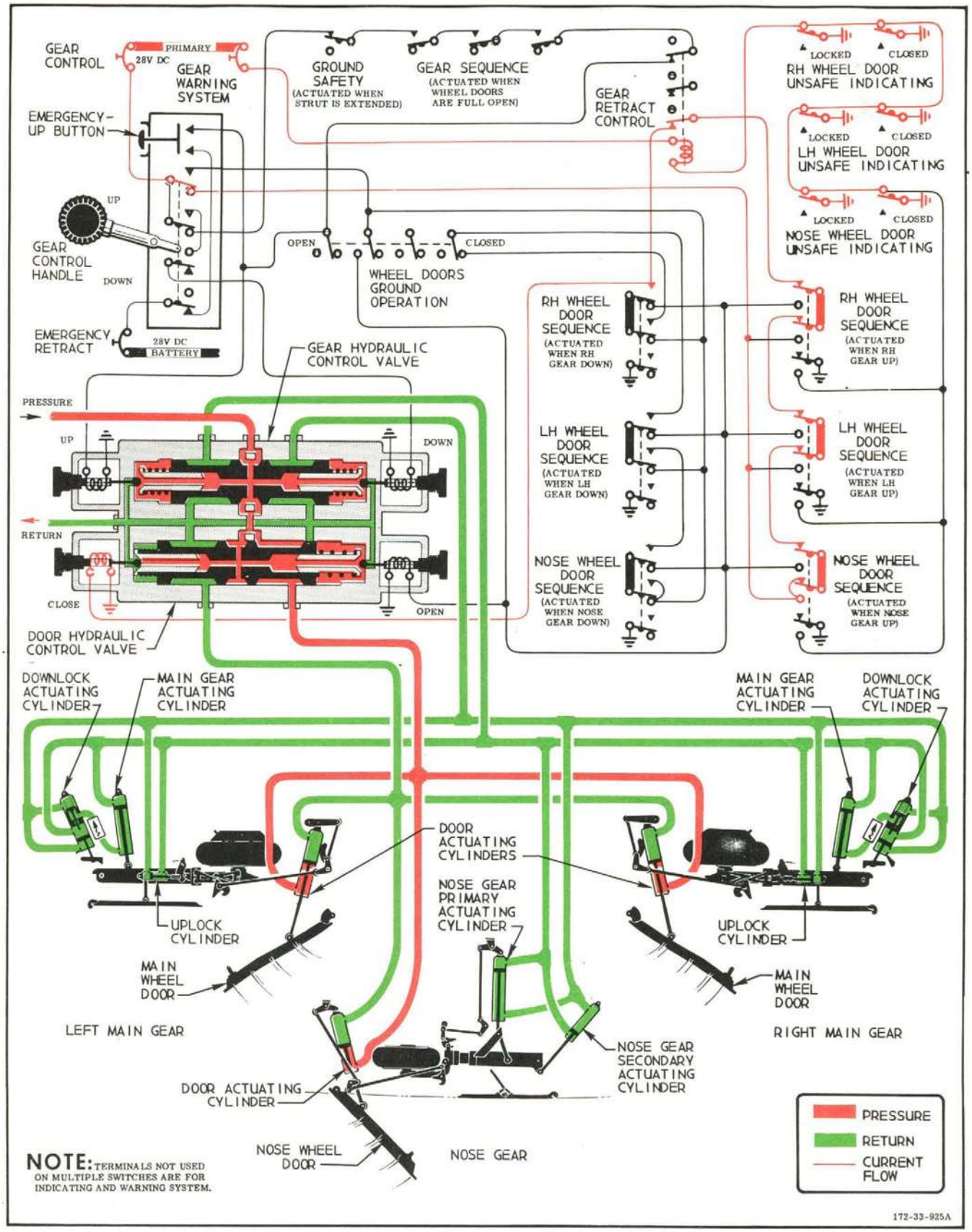


Figure 2-64. Landing Gear System—Control Handle "UP," Gear Up, Doors Closing—F-86E-10 Airplanes

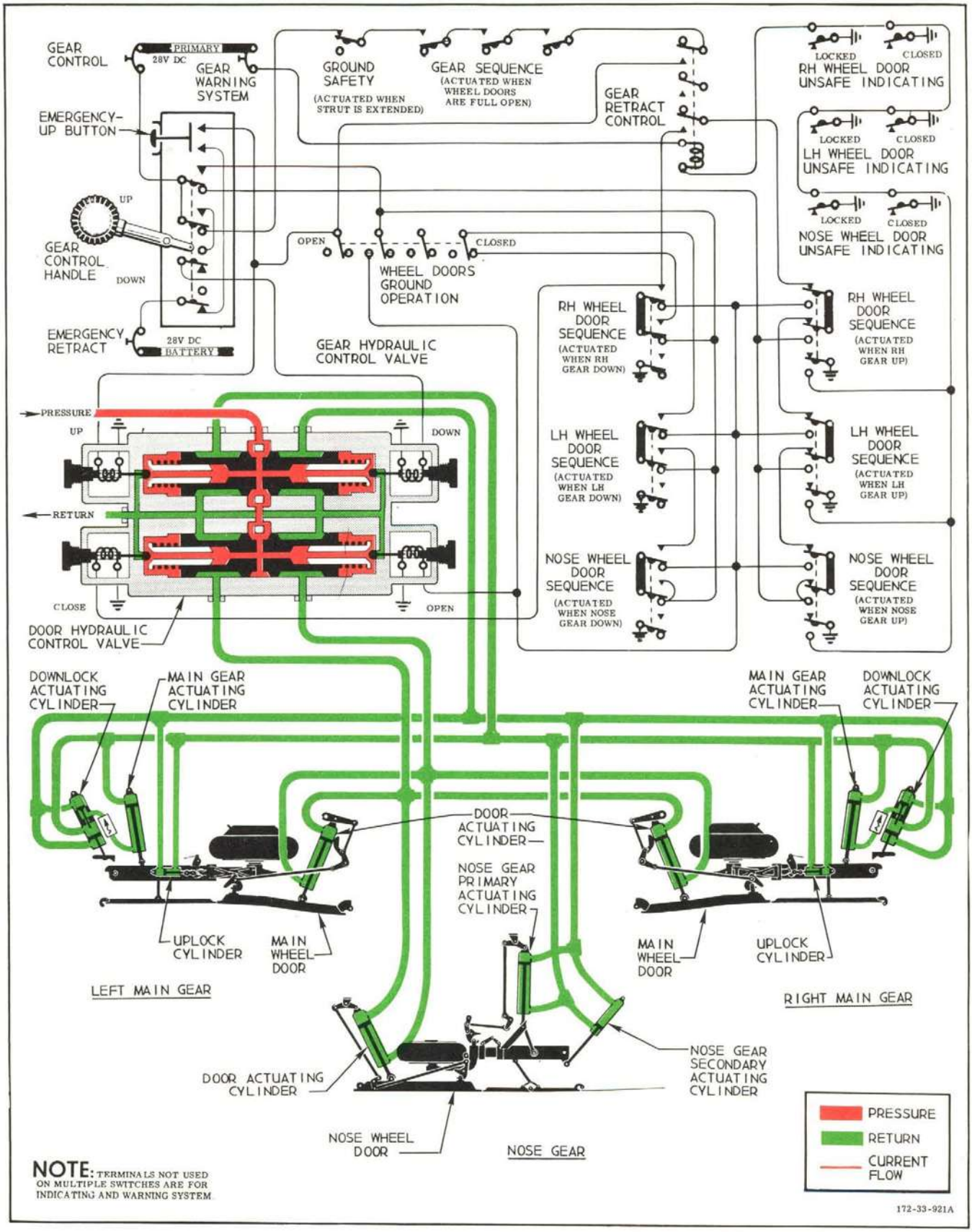


Figure 2-65. Landing Gear System—Control Handle "UP," Doors Closed, Gear Up—F-86E-10 Airplanes

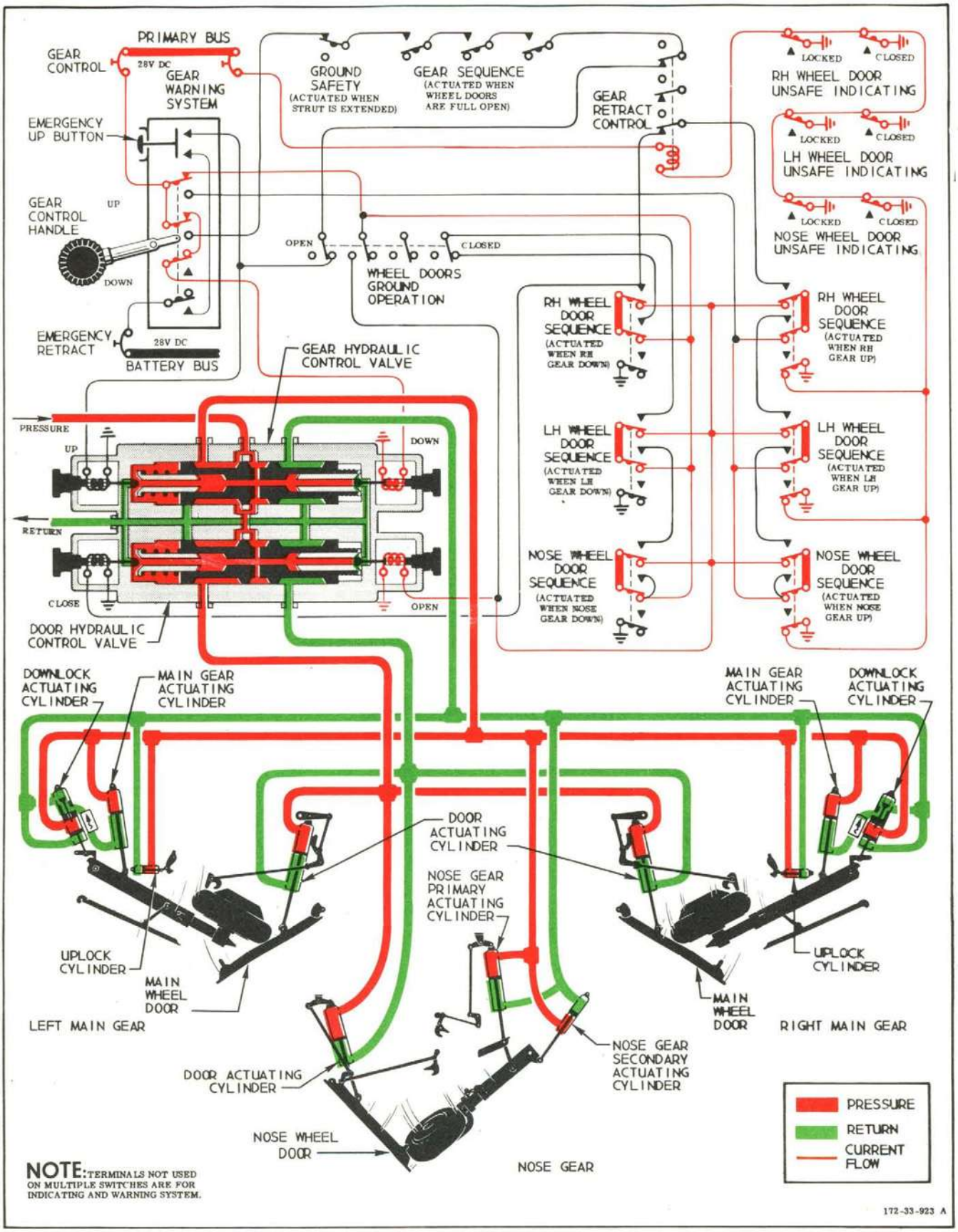


Figure 2-66. Landing Gear System—Control Handle "DOWN," Doors Opening, Gears Extending—F-86E-10 Airplanes

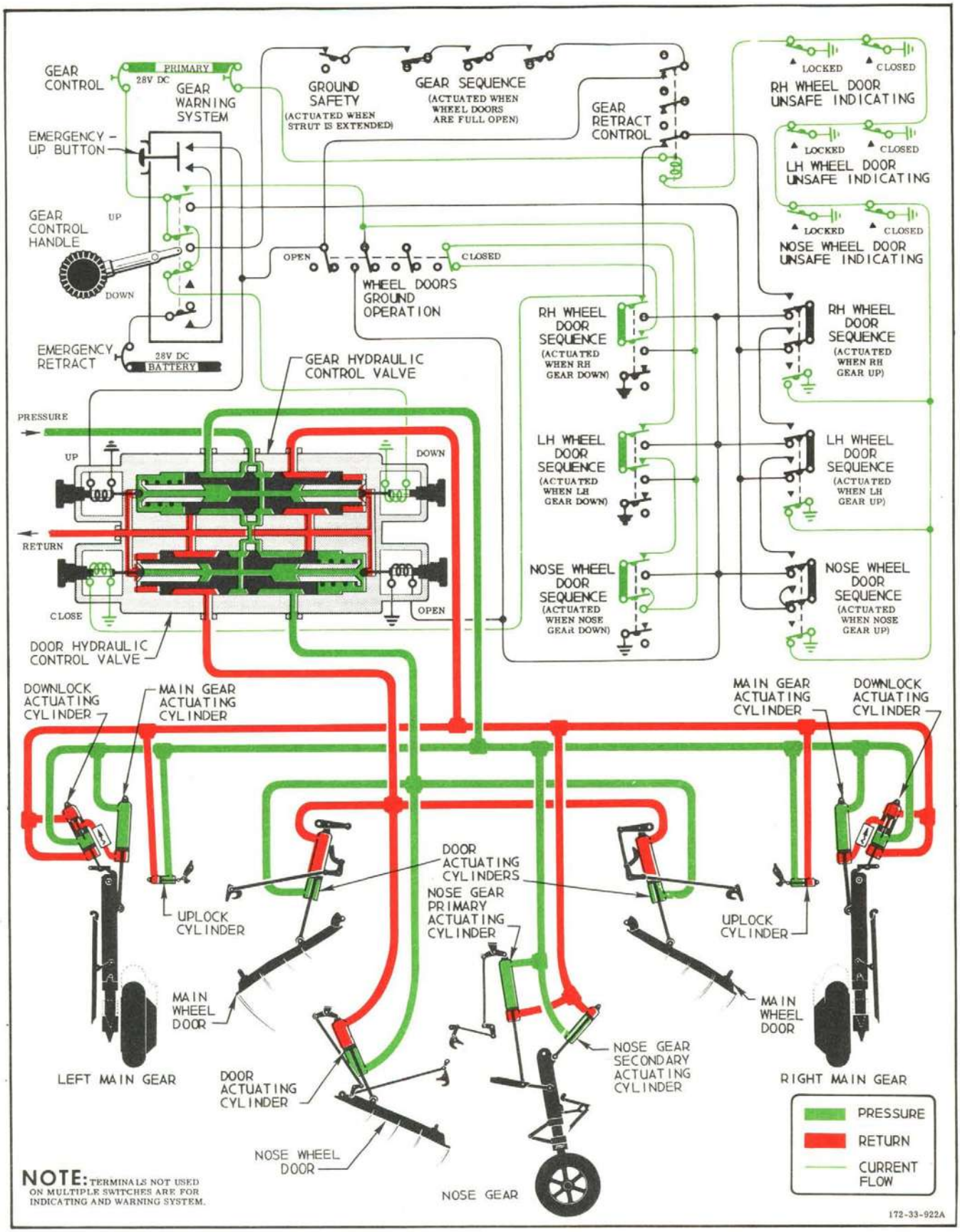


Figure 2-67. Landing Gear System—Control Handle "DOWN," Gear Down, Doors Closing—F-86E-10 Airplanes

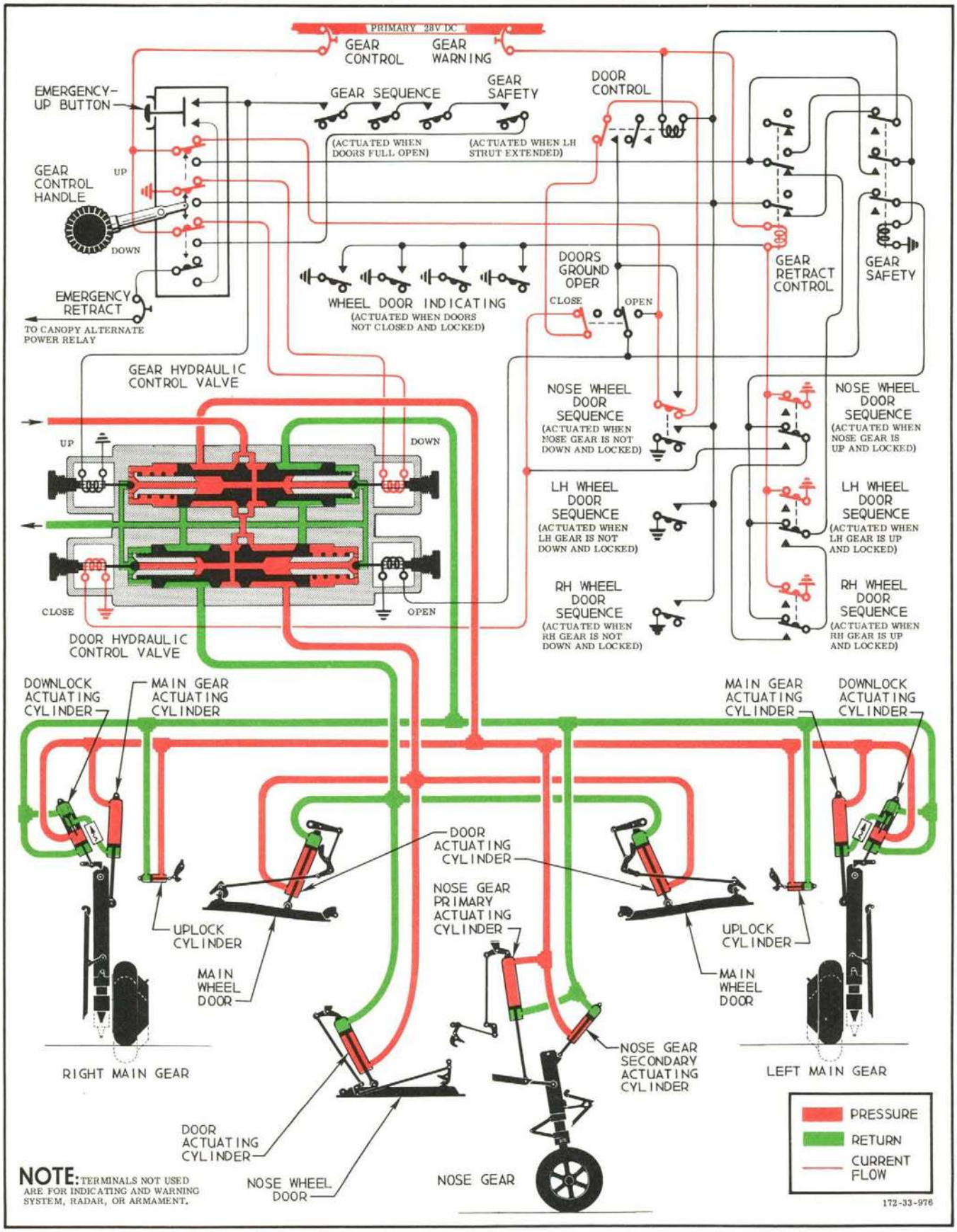


Figure 2-68. Landing Gear System—Control Handle "DOWN," Gear Down, Doors Closed—F-86E-15 Airplanes

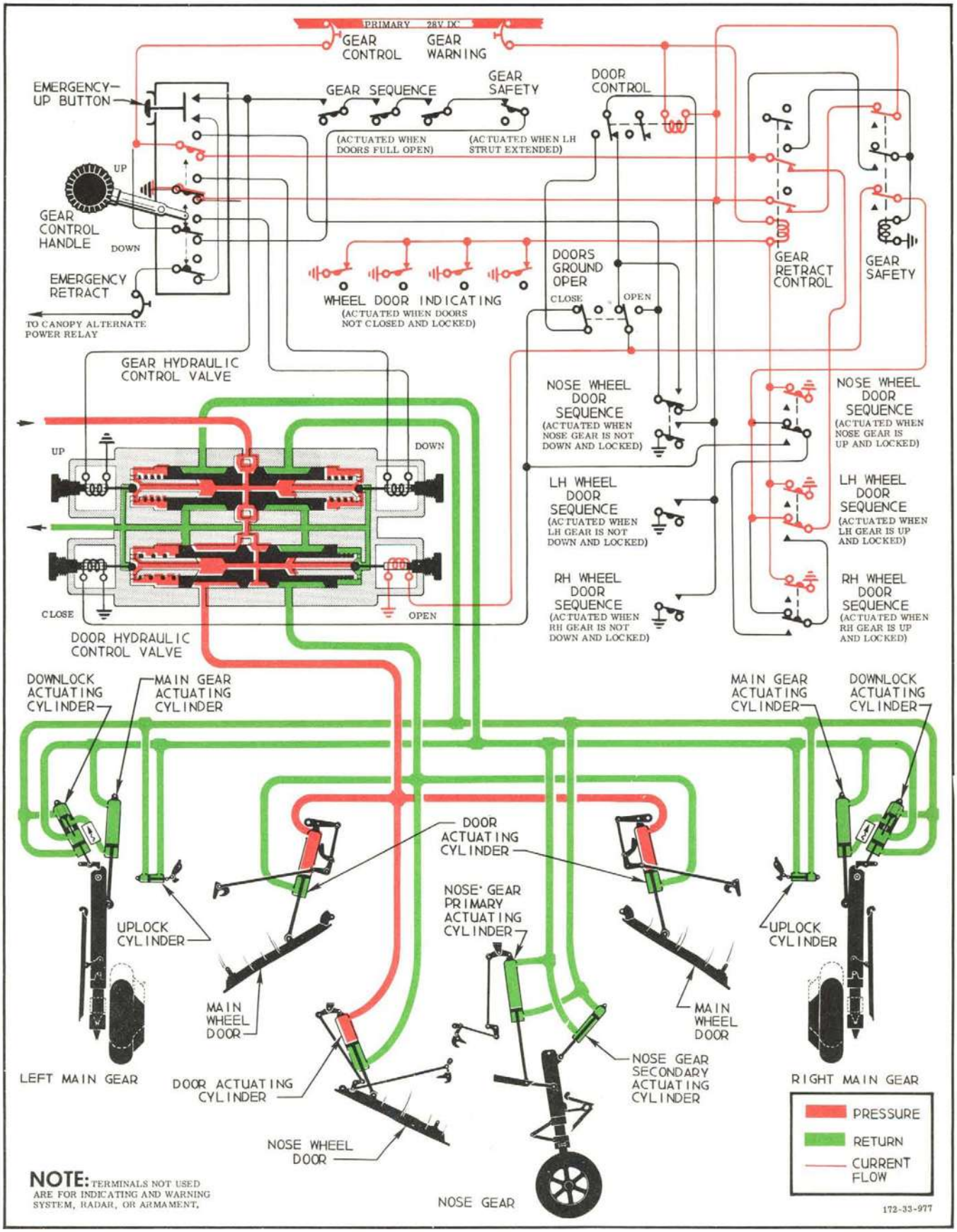


Figure 2-69. Landing Gear System—Control Handle "UP," Gear Down, Doors Opening—F-86E-15 Airplanes

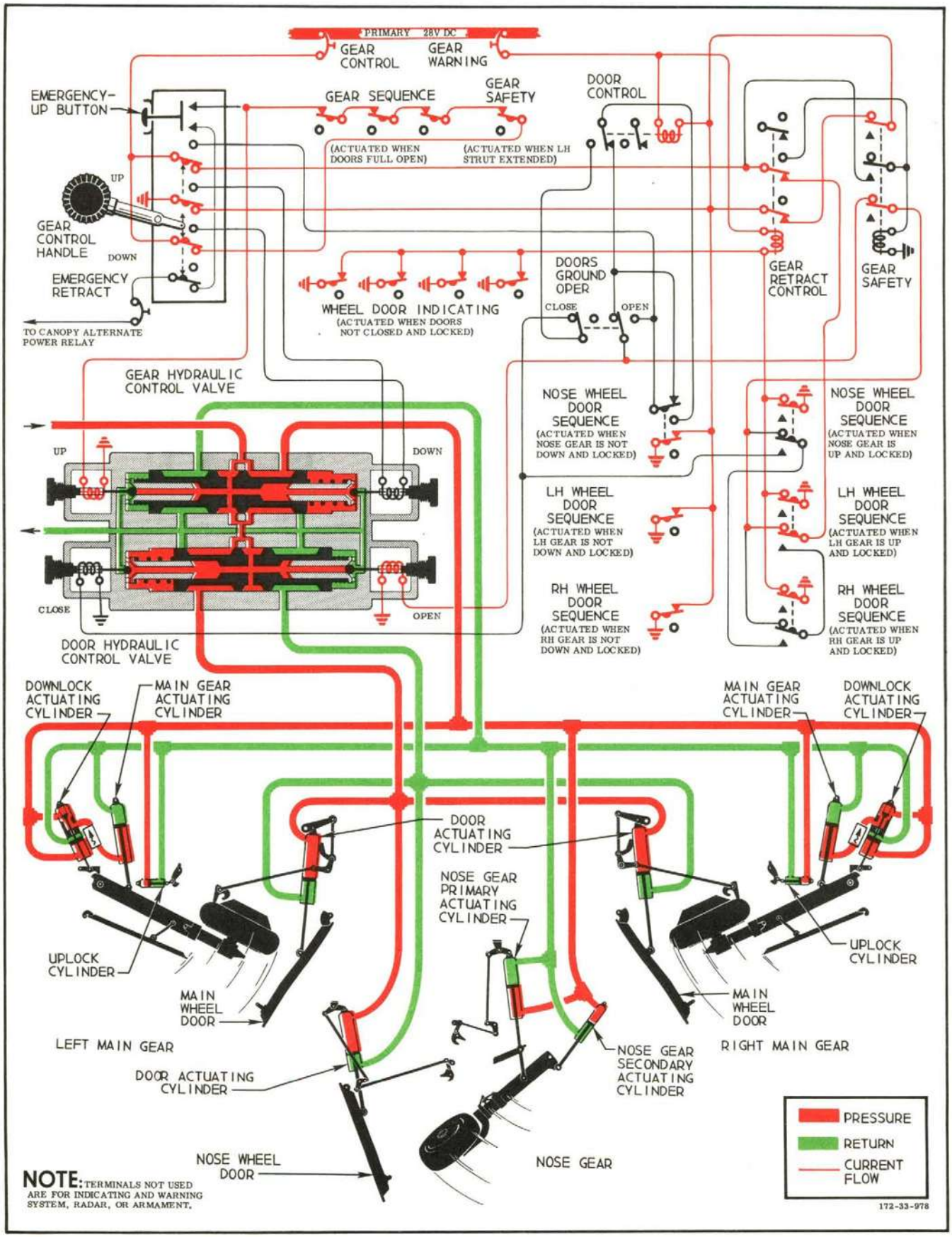


Figure 2-70. Landing Gear System—Control Handle "UP," Doors Open, Gear Retracting—F-86E-15 Airplanes

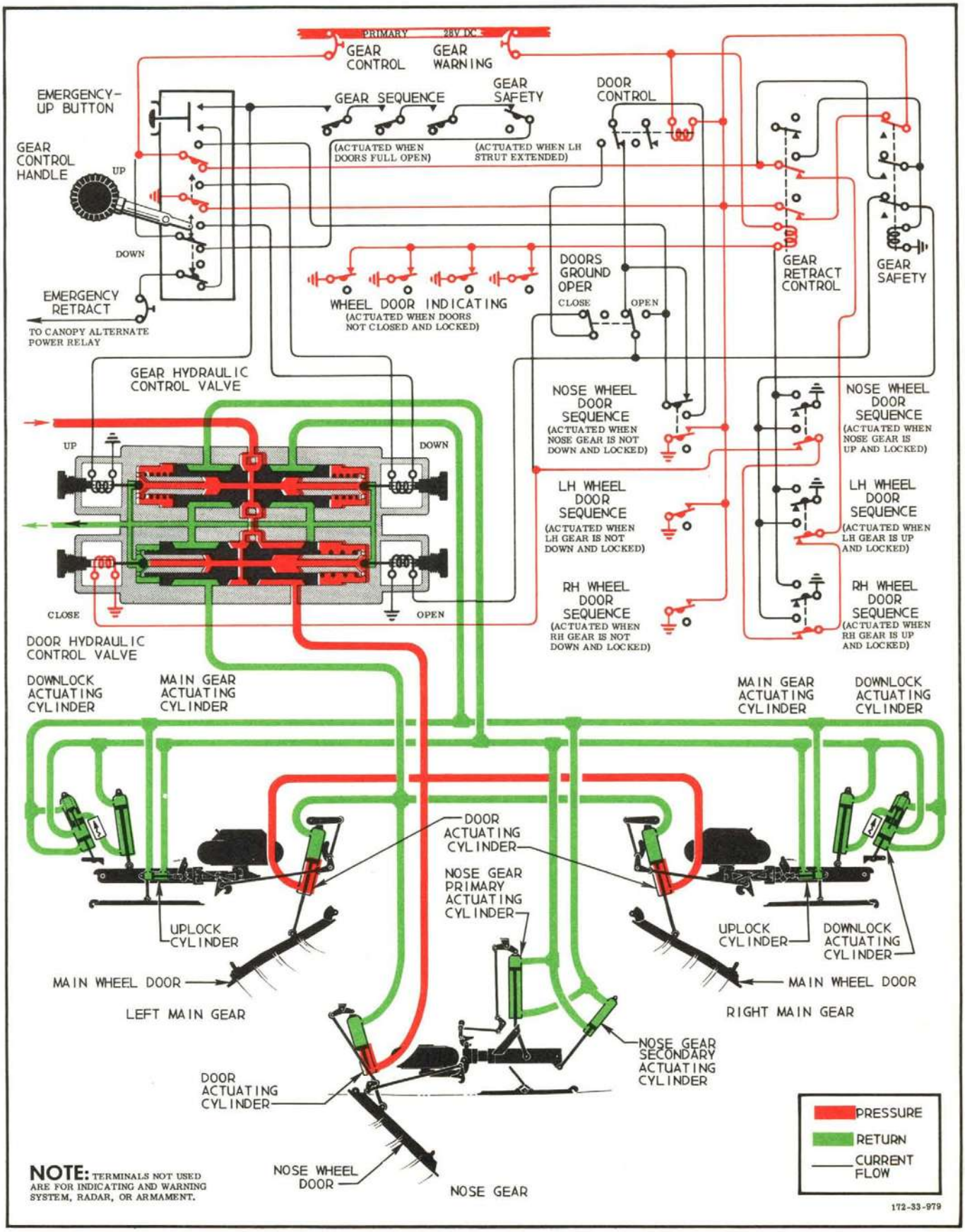


Figure 2-71. Landing Gear System—Control Handle "UP," Gear Up, Doors Closing—F-86E-15 Airplanes

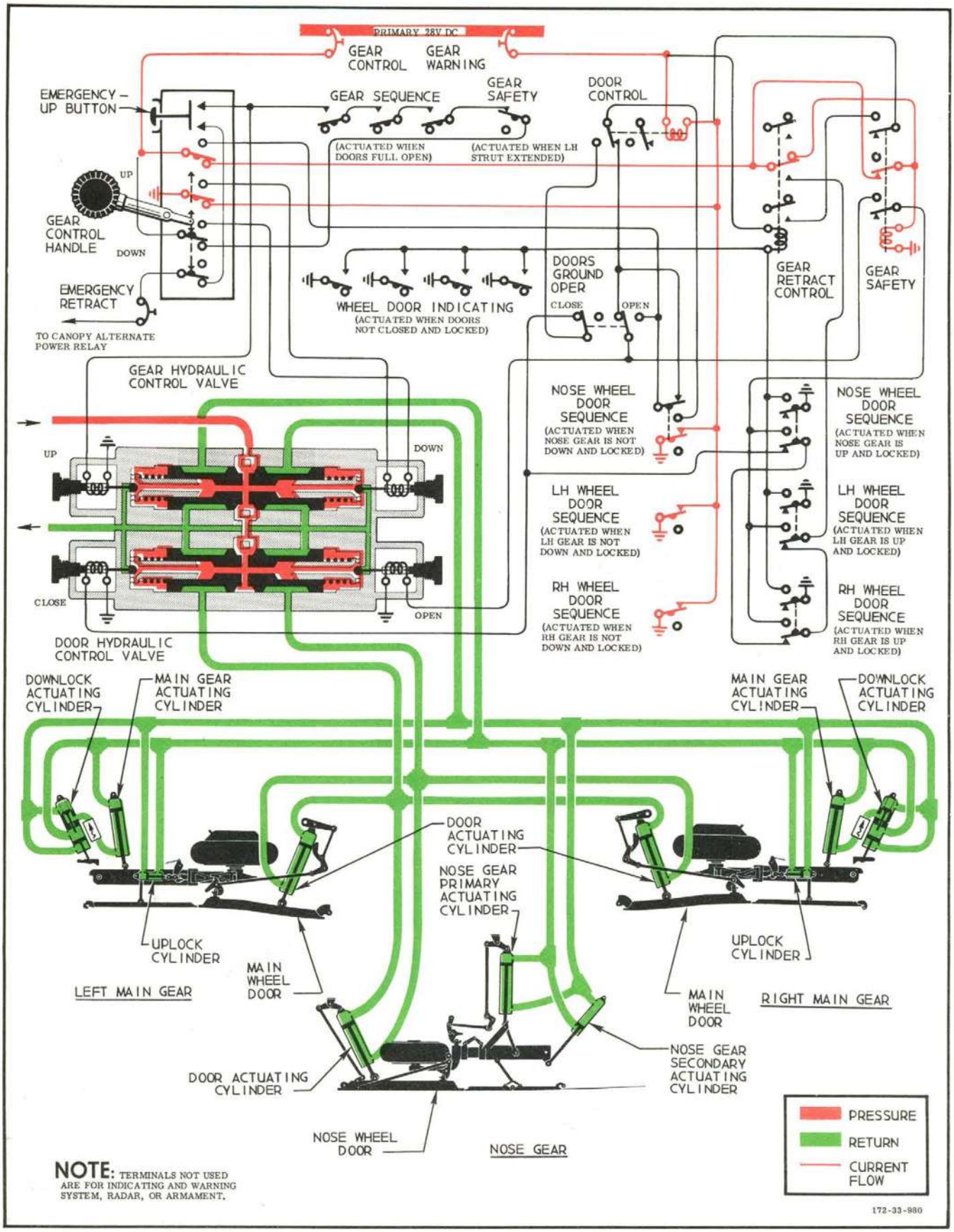


Figure 2-72. Landing Gear System—Control Handle "UP," Gear Up, Doors Closed—F-86E-15 Airplanes

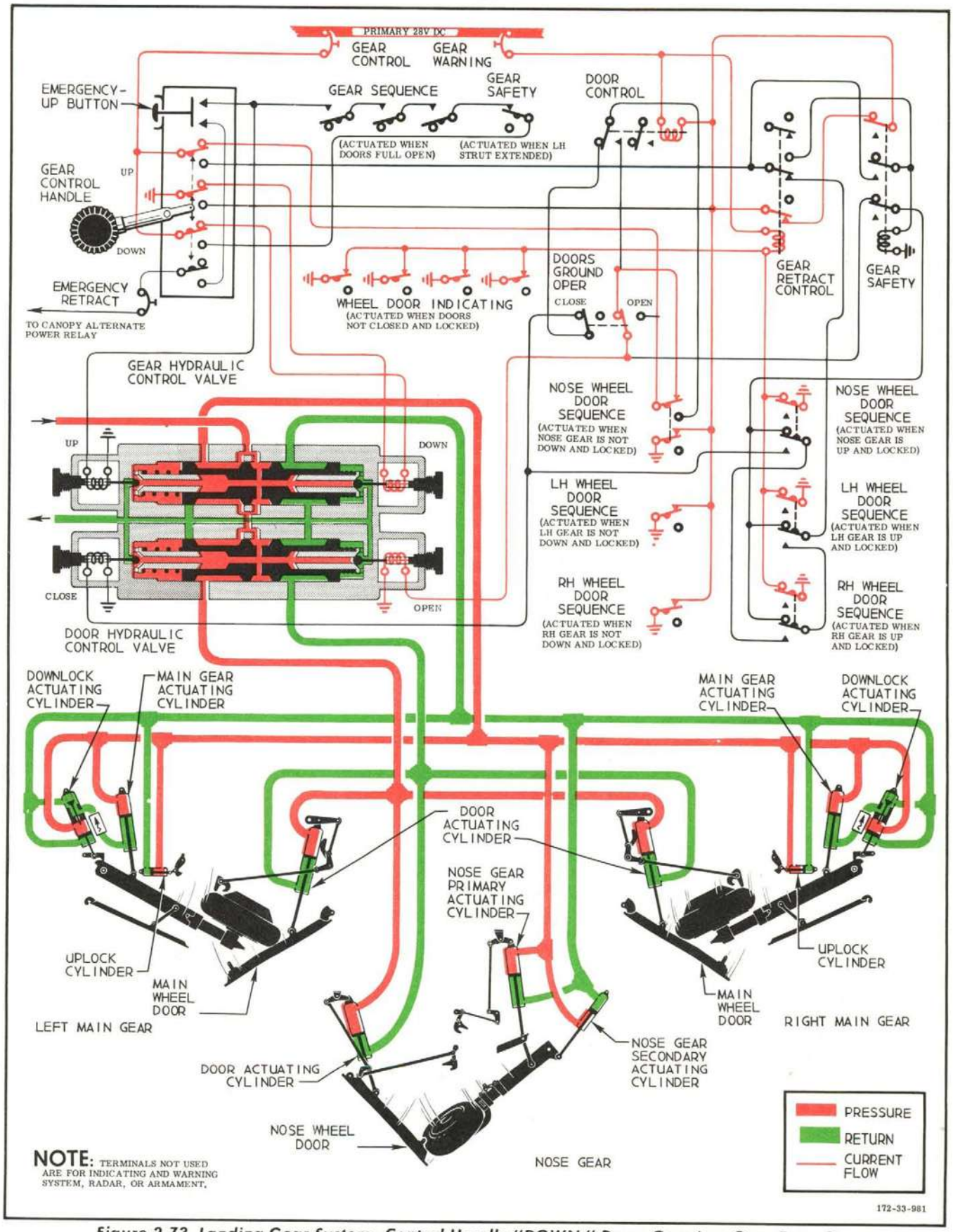


Figure 2-73. Landing Gear System—Control Handle "DOWN," Doors Opening, Gear Extending—F-86E-15 Airplanes

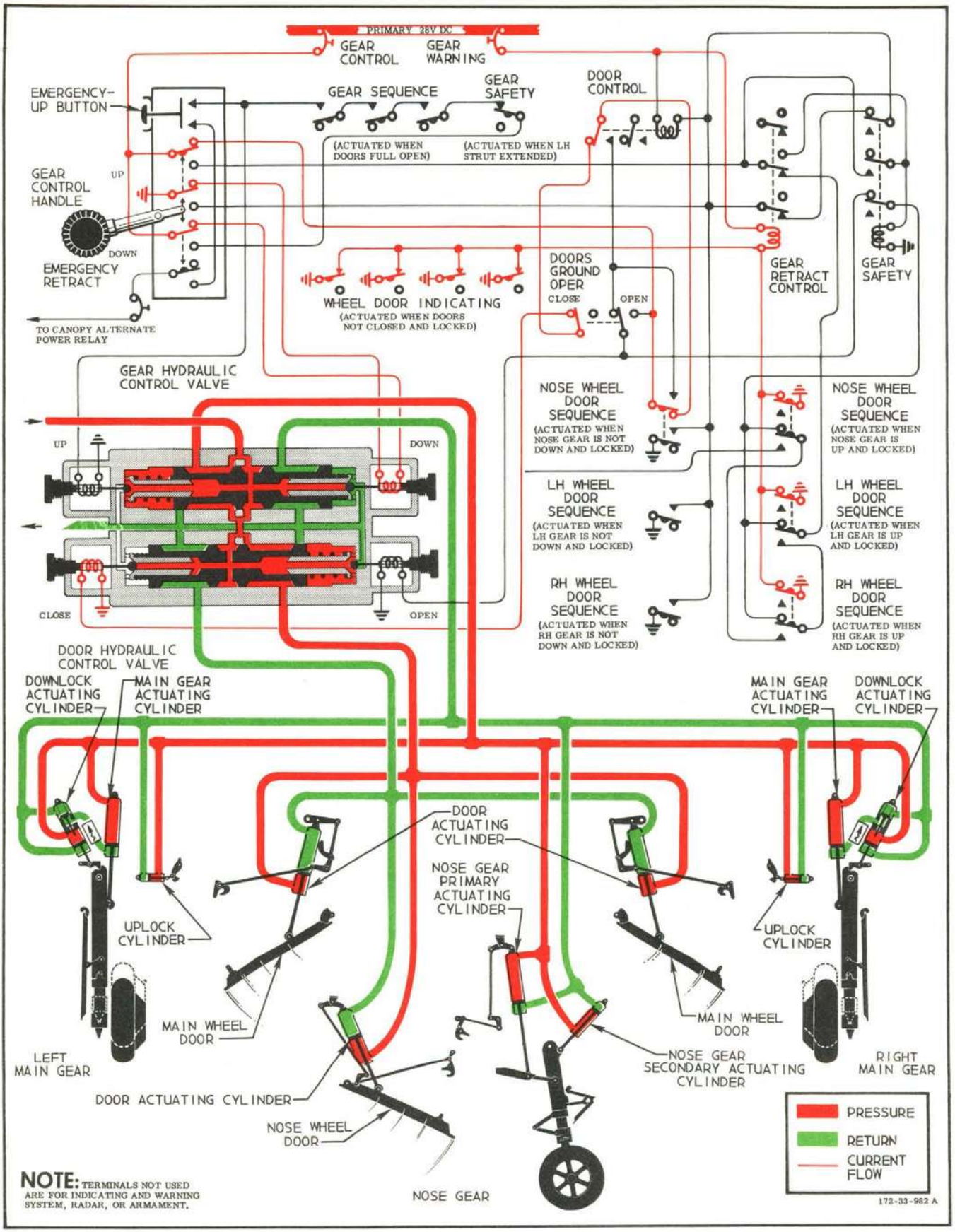


Figure 2-74. Landing Gear System—Control Handle "DOWN," Gear Down, Doors Closing—F-86E-15 Airplanes

solenoid is broken and a circuit is completed that energizes the door-closed solenoid. The control valve then shifts so that pressure is supplied to the door-closed side of the door actuating cylinders to close the doors. Pressure is supplied to the gear-down side of the gear actuating cylinders, the gear downlocks, and the door-closed side of the door actuating cylinders as long as the gear control handle is in the gear-down position and the utility power system is pressurized.

2-219. FUNCTION OF LANDING GEAR SYSTEM (EMERGENCY EXTENSION CYCLE).

2-220. On F-86E-1, F-86E-5, and F-86E-6 Airplanes (figure 2-75), when the gear emergency release handle is pulled, connecting cables release main gear and door uplocks and nose gear door locks, and actuate the gear and door control valve overrides. In the event of electrical failure only, the gear will lower by hydraulic pressure. In case of hydraulic failure, the main gear will fall to the down-locked position, and the nose gear will lower when the emergency hydraulic control valve is positioned at "NOSE GEAR" and the emergency hydraulic hand-pump is operated. (When moving the valve to any position, feel for the detents as the valve goes into position.) On F-86E-10 and F-86E-15 Airplanes (figure 2-76), a hydraulic accumulator is installed in the nose gear lowering system. When the gear emergency lowering handle is pulled, cable linkage releases all door locks and the main gear uplocks and positions a valve to allow accumulator pressure to release the nose gear uplock and lower the nose gear. On these airplanes the emergency hydraulic control valve and the hand-pump are removed.

Note

On F-86E-10 and F-86E-15 Airplanes, if the gear emergency lowering system is used, it will be necessary to manually reset the emergency lowering pressure control valve when the airplane is on the ground. The reset handle is located in the gun charger air compressor compartment on the lower right side of the nose section. The handle resets the valve when pulled to its full extension and released; the handle will automatically return to the in position.

2-221. TROUBLE SHOOTING LANDING GEAR SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Gear and doors not in proper sequence.	Maladjustment of linkage which operates sequence switches, or switches not operating properly.	
Main gear does not indicate a full down-locked position.	Maladjustment of linkage between cylinder and lockpin.	
Main gear uplocks do not lock.	Gear up-stop improperly adjusted.	
Main gear does not downlock in emergency extension.	Pivot bolts too tight, or too many shims.	Loosen bolts enough to permit movement.
Nose gear will not lock in down position.	Dirt in actuating linkage. Operating linkage improperly adjusted.	
Nose wheel door fails to lock with gear up.	Gear retracting linkage out of adjustment. Wheel door locks out of adjustment.	

2-222. CHECKING LANDING GEAR SYSTEM.

2-223. With airplane on jacks and external power source connected, check the landing gear as follows:

a. Operate gear at a minimum pressure and flow.

b. Move landing gear control handle to the "UP" position; door locks should release and wheel doors should open. When all doors have reached the full open position, gear should retract. (Any one door not in the full down position should prevent gear from retracting.)

Note

After the doors are open and the gear has started to retract, apply reasonable manual pressure to the closing side of the nose gear door to simulate air load. If this pressure stops the gear retraction, readjust the nose gear sequence switch (figure 2-77 or 2-78).

When all gears have reached the uplocked position, doors should close. (Any one gear not in the uplocked position should prevent doors from closing.)

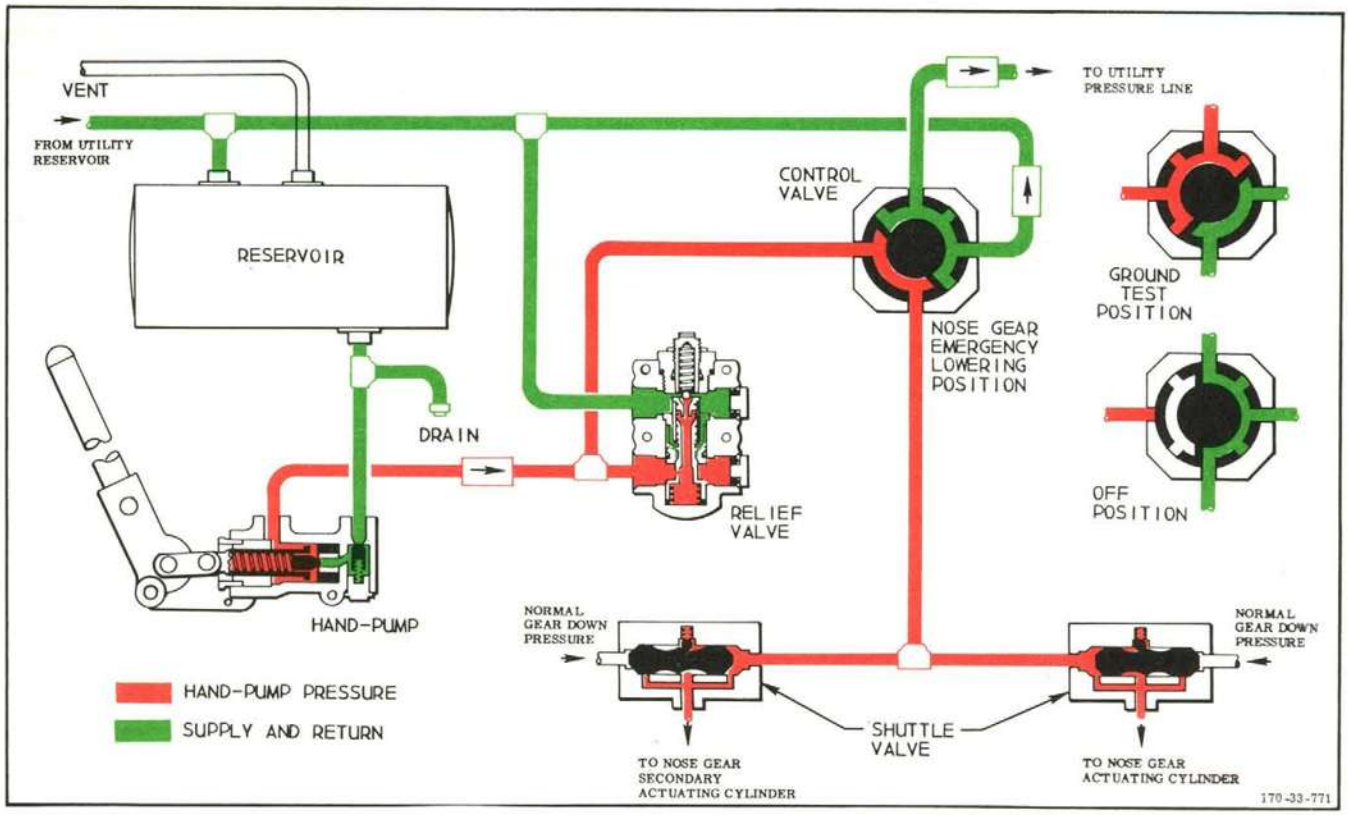


Figure 2-75. Landing Gear Emergency Extension Hydraulic System Schematic— F-86E-1, F-86E-5, and F-86E-6 Airplanes

c. Move landing gear control lever to the "DOWN" position; door and gear locks should release, doors should open, and gear should extend. When all gears have reached the downlocked position, doors should close. (Any one gear not in downlocked position should prevent doors from closing.)

d. Increase test stand flow to approximately 5.7 gpm. At full pressure, retract gear. Complete cycle of gear and door operation should not exceed 8 seconds.

e. Operate test stand at 4.2 gpm. At full pressure, extend gear; complete cycle of gear and door operation should not exceed 10 seconds.

f. After normal operation of gear, check emergency lowering system. First retract gear; then cut off electric power. With hydraulic power on, pull the emergency lowering handle. The doors should open and gear should extend by hydraulic pressure.

g. Again retract gear with normal system; then exhaust hydraulic pressure and cut off electric power.

h. Pull emergency lowering handle. Main gear and all door locks should release, doors should open, and main gear should extend to the downlocked position by gravity.

i. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, release and lower nose gear to full downlocked position by placing the emergency control valve at "NOSE GEAR" and operating the emergency hand-pump.

j. On F-86E-10 and F-86E-15 Airplanes, the nose gear emergency control valve will be positioned to direct accumulator pressure to lower nose gear to full downlocked position.

k. Reset nose gear emergency pressure control valve.

l. To check the emergency-up switch, turn power on and open wheel doors by using the ground door control switch in the left strut well; then open landing gear control circuit breaker (left side of cockpit). Then place gear handle in "UP" and depress emergency-up button. Gear should retract.

CAUTION

Depressing button when handle is "UP" and before doors are full open will retract the gear through the doors.

2-224. ASSEMBLING AND ADJUSTING HERMETICALLY SEALED MICRO-SWITCHES (F-86E-15 AIRPLANES).

2-225. See figure 2-79.

2-226. ADJUSTING LANDING GEAR SEQUENCE SWITCHES.

2-227. See figure 2-77 or figure 2-78.

2-228. ADJUSTING LANDING GEAR EMERGENCY EXTENSION SYSTEM.

2-229. See figure 2-80.

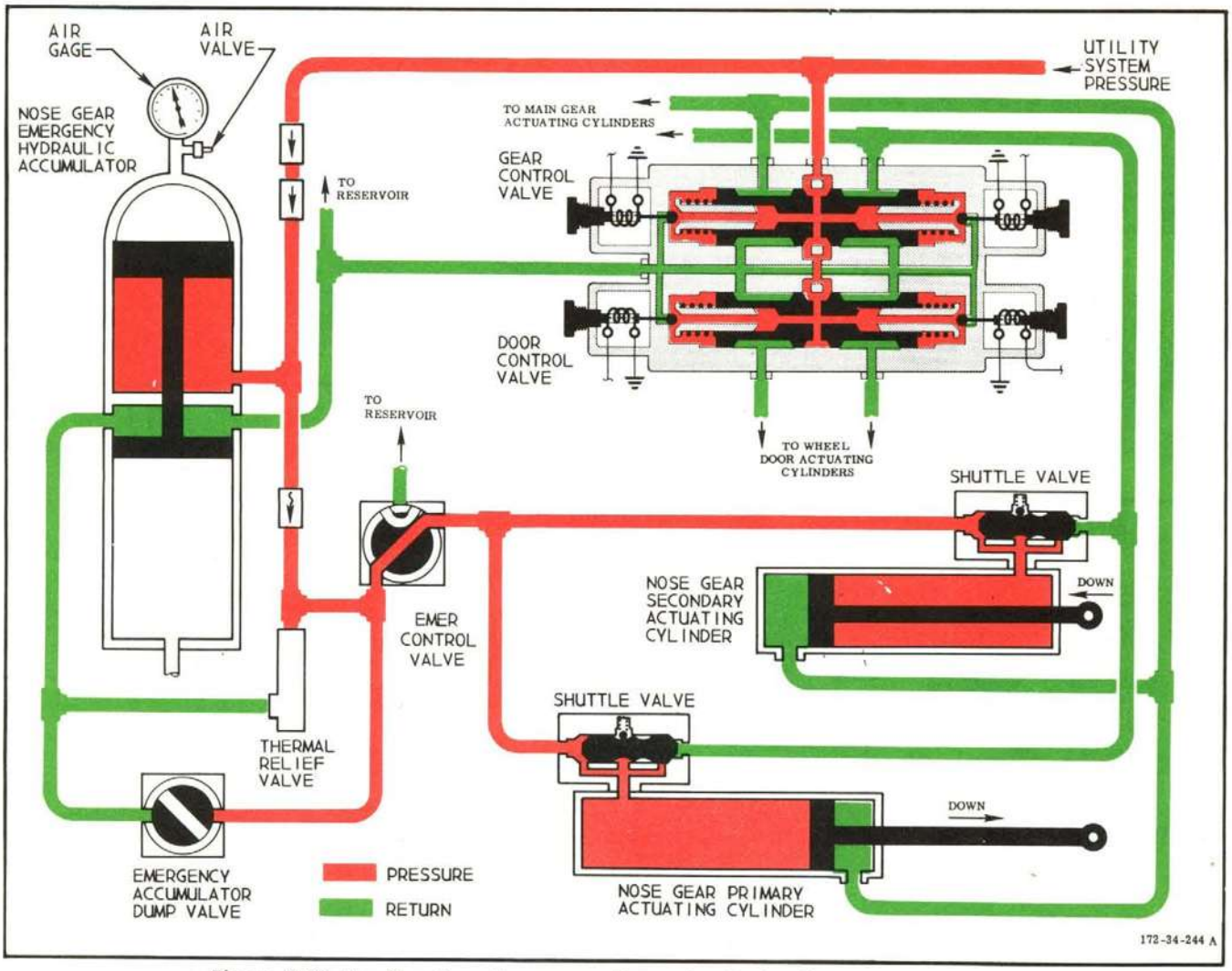


Figure 2-76. Landing Gear Emergency Extension Hydraulic System Schematic— F-86E-10 and F-86E-15 Airplanes

2-230. LANDING GEAR POSITION INDICATING AND WARNING SYSTEM.

2-231. The landing gear position indicating and warning system provides the pilot with visual indication of safe or unsafe gear position at all times, as well as an audible warning of an unsafe landing gear. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, red and green lights are used to indicate the gear positions. (See figures 2-81 through 2-83.) Each green light is connected to a gear downlock switch so that when each gear is down and locked, its related green light will burn. The red light is connected to all three uplock switches and to the three wheel door switches. The red light is on when any one door or all doors are open (except while gear is down and locked), when any one gear is in an unlocked condition, and when the power control is retarded while gear is up. When all gear are up and locked and all doors are closed, no indicator lights will burn. An amber light on instrument panel will burn whenever the gear handle is in the "UP" position to warn the pilot to return the control handle to "COMBAT" position after completion of gear-up cycle. A warning system operates as follows: When the power control is retarded for landing, a microswitch on the engine control quadrant is actuated by the power control closing the circuit to the warning horn. The horn is silenced when a push-button type switch on the left console switch panel is momentarily pushed. Closing this switch actuates a relay which will remain closed as long as the power control microswitch is held closed when gear is in an unsafe condition for landing. Advancing the power control will reset the horn circuit. On F-86E-10 and F-86E-15 Airplanes, a C-1 gear position indicator is installed. (See figures 2-84 through 2-86 or figures 2-87 through 2-89.) This indicator consists of three small round windows on the left forward console. Each of these windows corresponds to one of the gears. When the gear is up and locked, the word "UP" is displayed in the windows. When the gear is locked down, a miniature gear is displayed in the windows. When the gear is

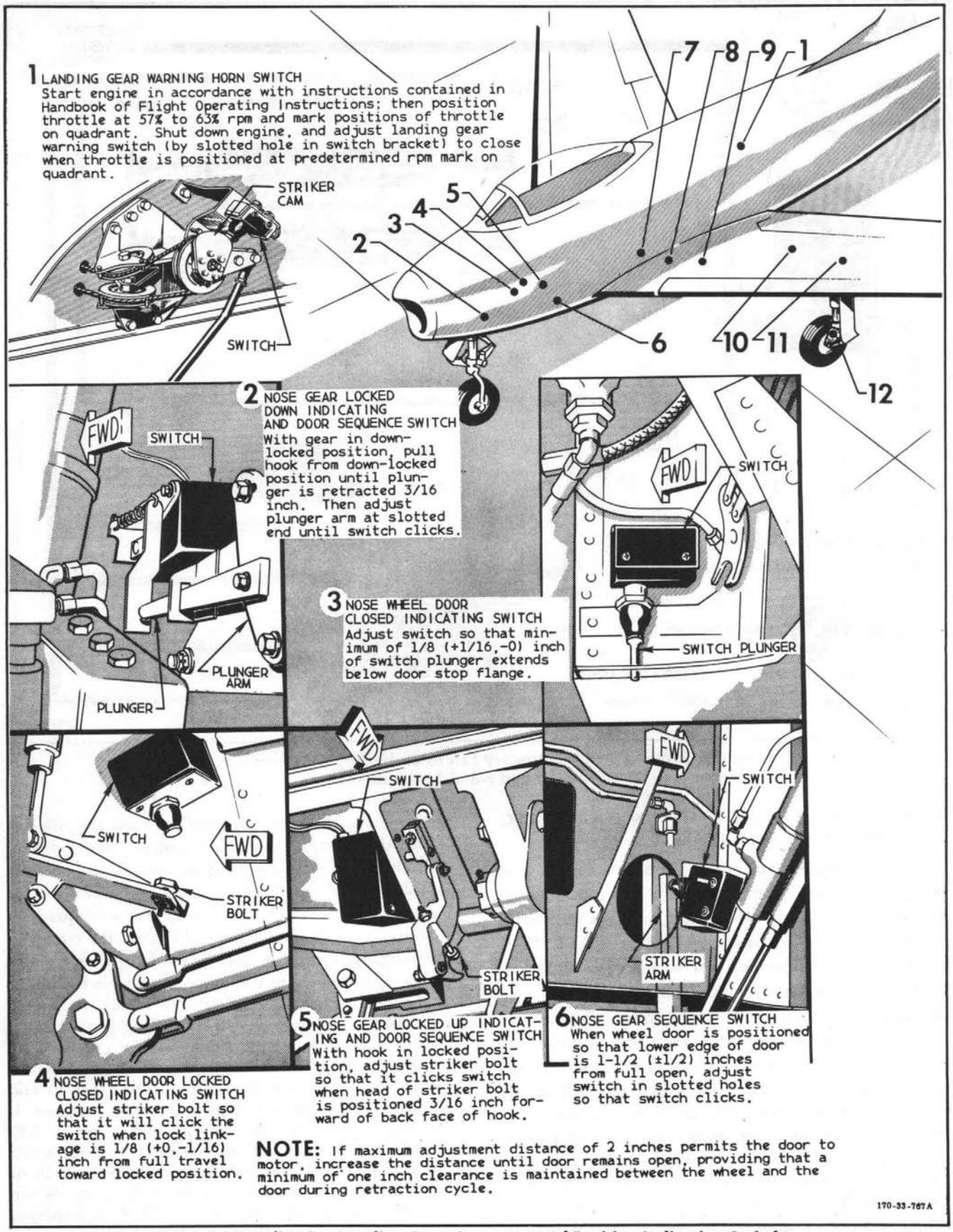


Figure 2-77. Adjusting Landing Gear Sequence and Position Indicating Switches— F-86E-1 Through F-86E-10 Airplanes (Sheet 1 of 2)

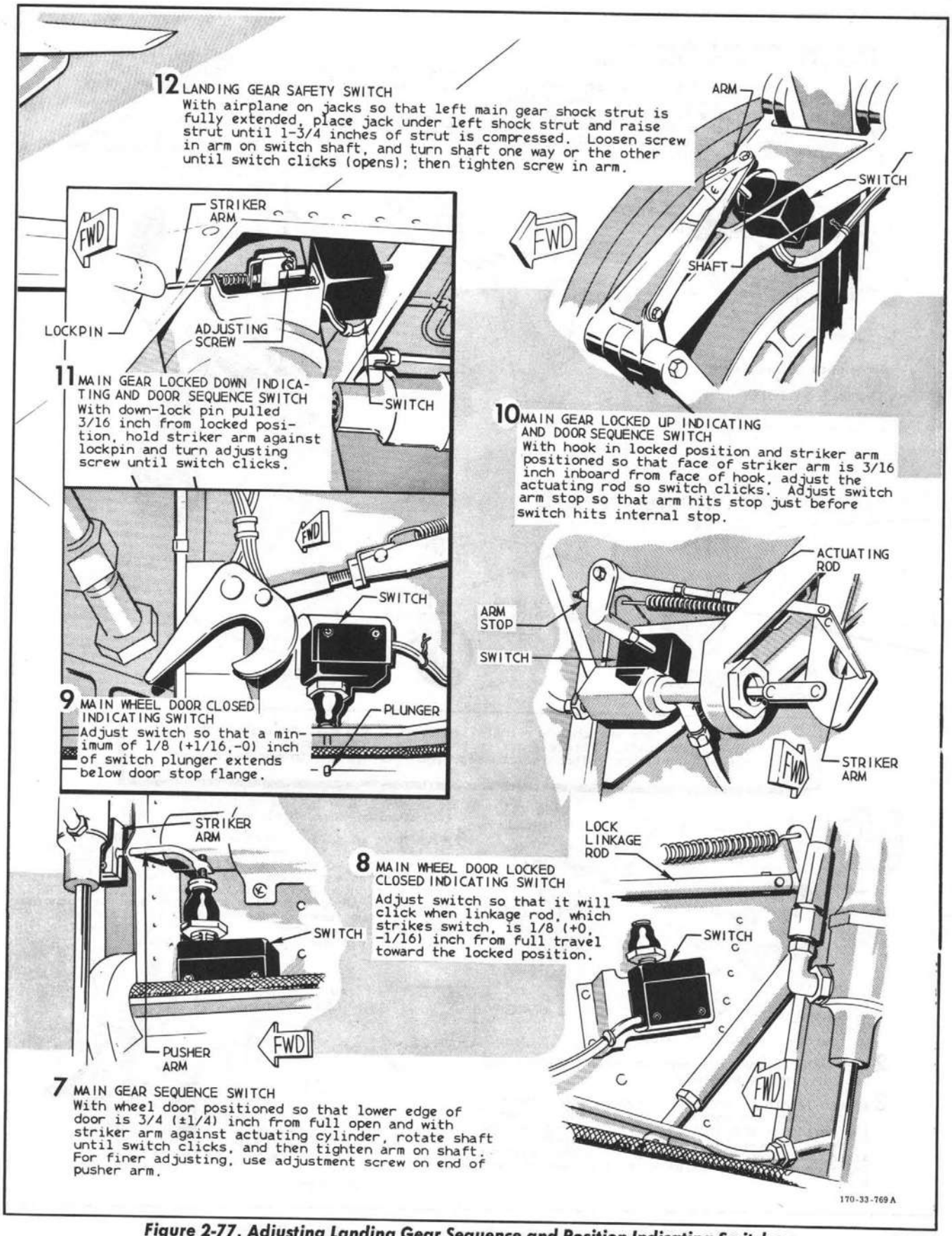


Figure 2-77. Adjusting Landing Gear Sequence and Position Indicating Switches— F-86E-1 Through F-86E-10 Airplanes (Sheet 2 of 2)

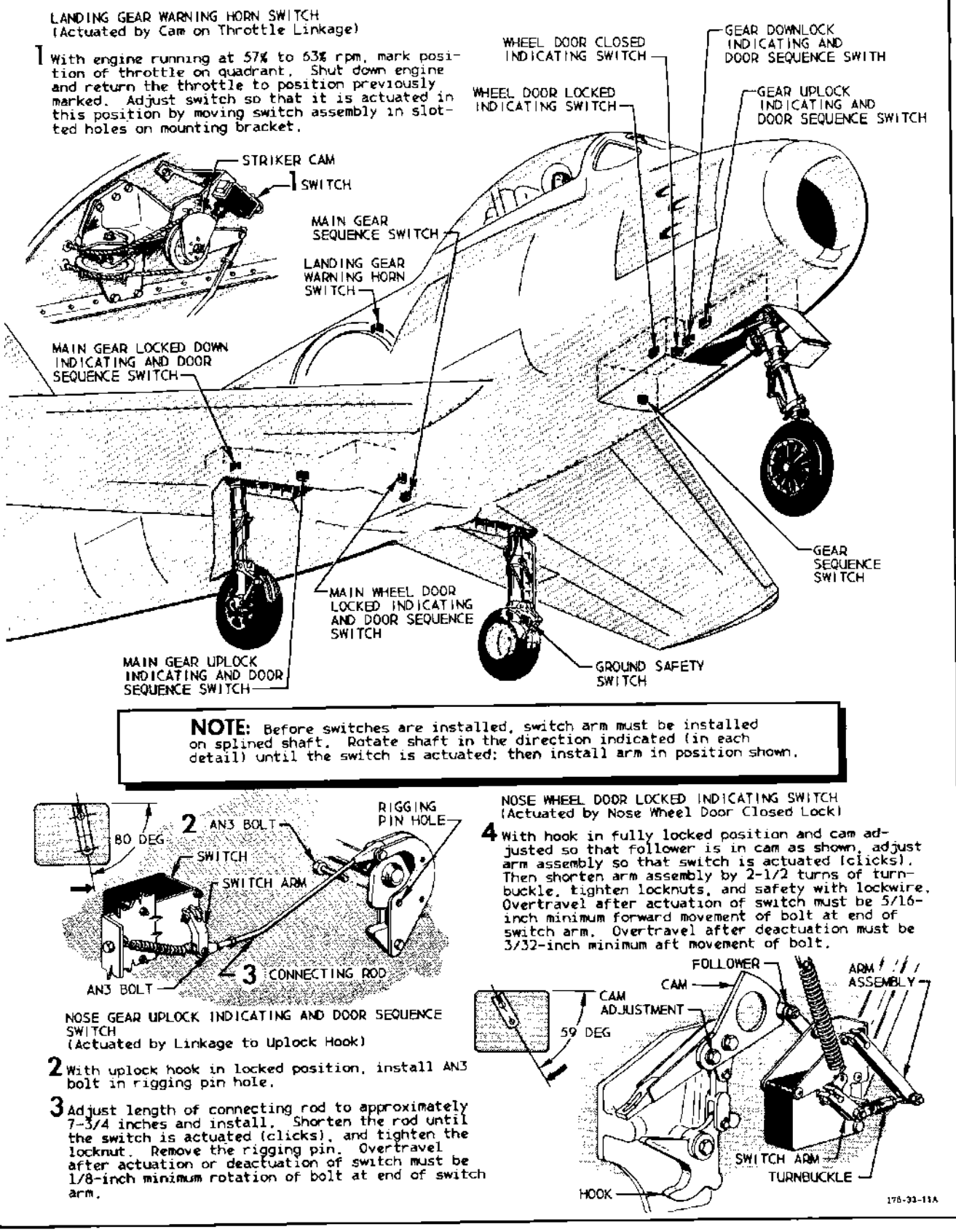


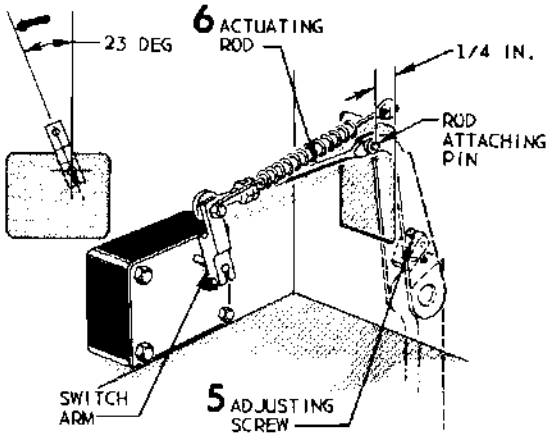
Figure 2-78. Adjusting Landing Gear Sequence and Position Indicating Switches— F-86E-15 Airplanes (Sheet 1 of 3)

NOTE: Before switches are installed, switch arm must be installed on splined shaft. Rotate shaft in the direction indicated (in each detail) until the switch is actuated, then install arm in position shown.

NOSE GEAR SEQUENCE SWITCH
(Actuated by Linkage to Nose Wheel Door)

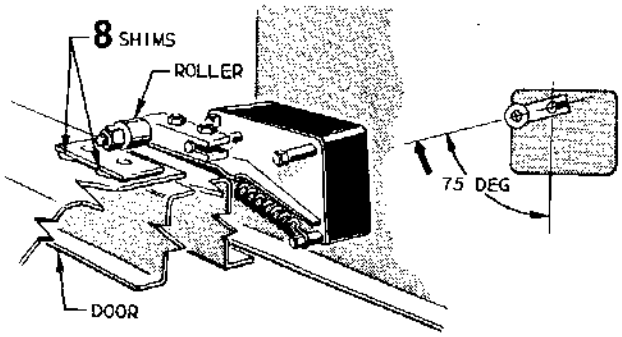
5 Move door to full open position and turn adjusting screw until center of actuating rod attaching pin is 1/4 inch from the web of the structure as shown.

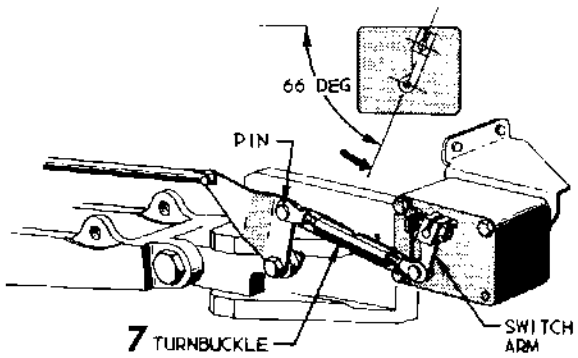
6 Adjust actuating rod to a length of approximately 5-3/4 inches and install. Lengthen rod so that switch is actuated before door is one inch from full open. As door closes, switch should be deactuated before door is 2-1/2 inches from full open. Overtravel after actuation (click) of switch (by counterclockwise rotation of bolt at end of switch arm) must be 1/8-inch minimum. Overtravel after deactuation (click) of switch (clockwise rotation of bolt) must be 1/2-inch minimum.



NOSE WHEEL DOOR CLOSED INDICATING SWITCH
(Actuated by Nose Gear Door)

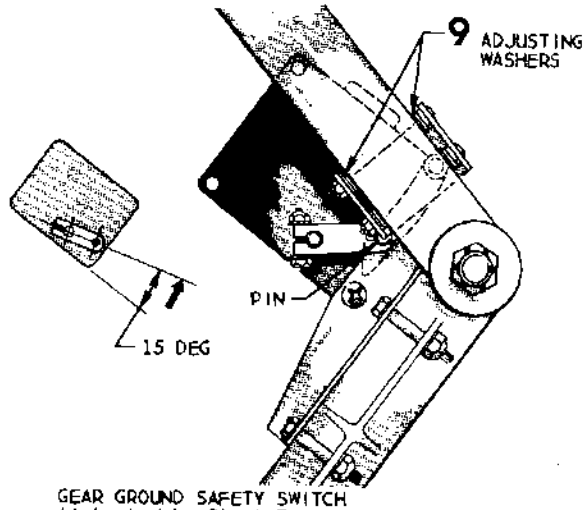
8 Adjust position of shim by adding or removing washers so that the switch is deactuated (clicks) when door is closing and is 1/4 (±1/16) inch from full closed position, measured at the switch. As door opens, switch roller should overtravel 3/32-inch minimum after switch actuation (click).





NOSE GEAR DOWNLOCK INDICATING AND DOOR SEQUENCE SWITCH
(Actuated by Drag Brace Lock Mechanism)

7 With gear down and locked, extend turnbuckle until switch is actuated (clicks) in a counterclockwise direction; then shorten turnbuckle by 9 full turns of the barrel and safety with lockwire. Overtravel after actuation of switch must be 1/2-inch minimum aft movement at pin. Overtravel after deactuation must be 3/16-inch minimum forward movement at pin. If door does not sequence properly, recheck adjustments.



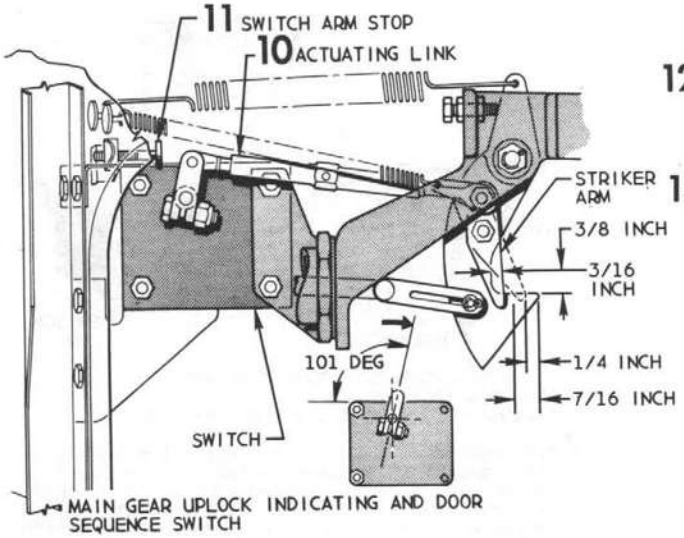
GEAR GROUND SAFETY SWITCH
(Actuated by Strut Torque Links)

9 With airplane on jacks so that left main gear shock strut is fully extended, place a jack under left gear. Raise gear so that the shock strut will be compressed. The switch should be deactuated (click) before the strut has been compressed 1-3/4 inches from its fully extended position. Then slowly extend gear; switch should be actuated (click) by the time strut is within 1/2 inch of fully extended position. When gear is in extended position, pin connecting switch arm and link should be 1/8-inch minimum overcenter. To obtain these conditions, it may be necessary to reposition adjusting washers.

178-53-13A

Figure 2-78. Adjusting Landing Gear Sequence and Position Indicating Switches—F-86E-15 Airplanes (Sheet 2 of 3)

NOTE: Before switches are installed, switch arm must be installed on splined shaft. Rotate shaft in the direction indicated (in each detail) until the switch is actuated; then install arm in position shown.

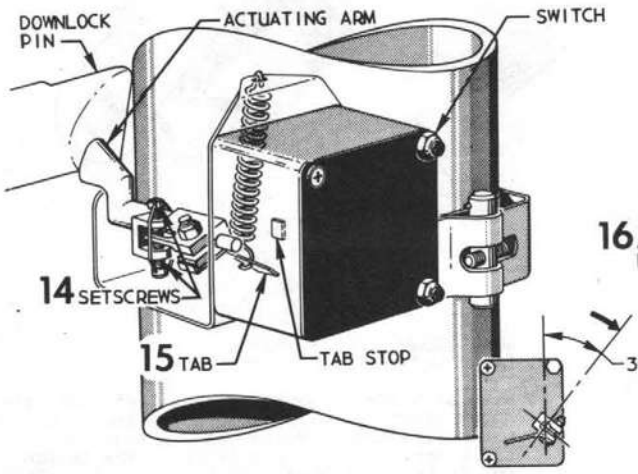


MAIN GEAR UPLOCK INDICATING AND DOOR SEQUENCE SWITCH

(Actuated by Uplock Hook and Roller)

10 Adjust length of actuating link so that the switch will be actuated (click) when the switch arm is in position shown in inset, and face of striker arm is 3/16 inch from face of hook, measured 3/8 inch above hook surface.

11 Adjust switch arm stop so that tip of striker arm is 1/4 inch from tip of hook. (If switch is not deactuated (does not click) before tip of striker arm is 7/16 inch from tip of hook, recheck adjustments.)



MAIN GEAR LOCKED DOWN INDICATING AND DOOR SEQUENCE SWITCH

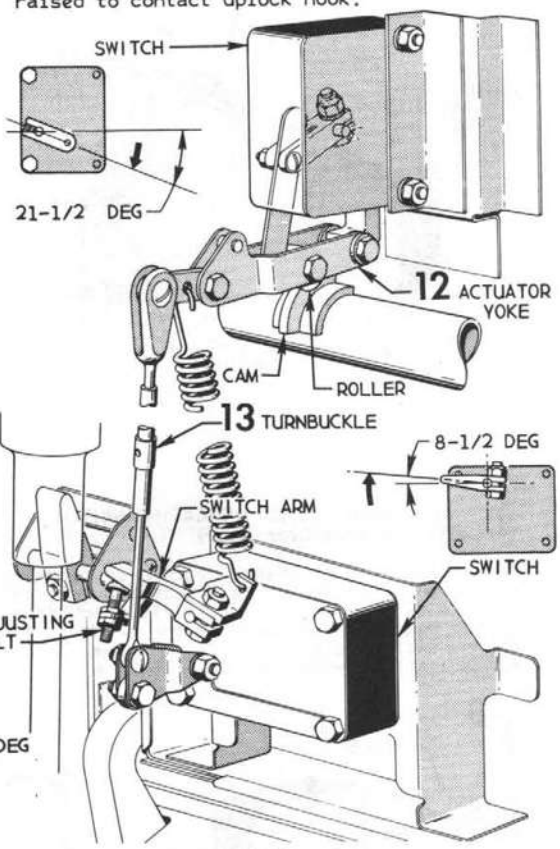
14 With gear down and locked, adjust setscrews so that switch is actuated (clicks) when downlock pin is retracted 3/16 inch and is deactuated before pin is 1/16 inch from locked position.

15 Retract lockpin 9/32 (±1/32) inch; then bend tab against tab stop.

MAIN WHEEL DOOR LOCKED INDICATING AND DOOR SEQUENCE SWITCH (Actuated When Doors Locked Closed)

12 With door hook in full locked position but with door open, move actuator yoke inboard or outboard as required until the roller is resting completely in recess of cam; then tighten bolt to 50-70 inch-pounds torque.

13 With lock mechanism still in locked position, bring door up until the forward door roller is touching the bottom of the hook; then adjust length of turnbuckle until switch is deactuated (clicks). Then decrease length of turnbuckle by 2 turns of the barrel and safety with lockwire. Make sure that turnbuckle has been properly adjusted, by placing a 5/32-inch shim on door at point of contact with switch mechanism. Switch should be deactuated (click) before door roller contacts uplock hook. Replace 5/32-inch shim with 3/32-inch shim. Switch should not be deactuated (should not click) when door roller is raised to contact uplock hook.



MAIN GEAR SEQUENCE SWITCH

16 Adjust bolt so that switch is actuated (clicks) when the outermost edge of door is 2 (±1/4) inches from its maximum opened position. (Overtravel after actuation of switch should be 5/32-inch minimum rotation of switch arm tip in upward direction. Overtravel after deactuation should be 5/32-inch minimum rotation of switch arm tip in downward direction.)

176-33-20A

Figure 2-78. Adjusting Landing Gear Sequence and Position Indicating Switches— F-86E-15 Airplanes (Sheet 3 of 3)

BENCH ADJUSTMENT FOR SINGLE SWITCH UNIT

1 With switch case held in position shown and rear cover in place, install mounting pin.

2 Install switch arm on mounting pin, with holding pins pointed out to receive microswitch.

3 Install microswitch on mounting pin, with actuating arm up in a position to contact camshaft.

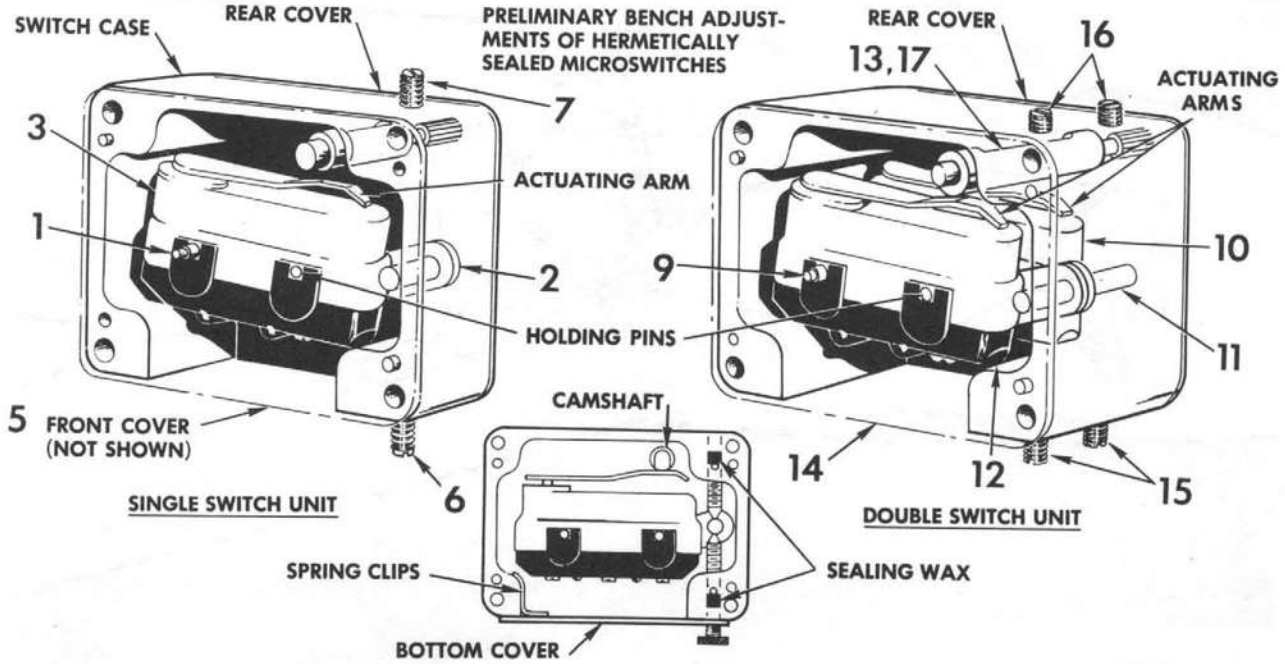
4 Install camshaft in rear cover. (See NOTE.)

5 Install front cover and turn camshaft so that lobe of cam is toward microswitch. The hole in the end of the camshaft indicates the lobe of the cam.

6 Install setscrew and turn in slowly until switch actuates. Then continue three-fourths turn past point of actuation.

7 Install setscrew and tighten securely.

8 Plug setscrew holes with hot sealing wax, leaving enough room to receive bottom cover hold-down screw. Then install bottom cover assembly.



BENCH ADJUSTMENT FOR DOUBLE SWITCH UNIT

9 With switch case held in position shown and rear cover in place, install mounting pin.

10 Slide inner microswitch onto mounting pin, with actuating arm up in a position to contact camshaft.

11 Install inner switch arm on mounting pin, with holding pins toward microswitch. Install outer switch arm backed up against inner switch arm, with holding pins pointed out to receive outer microswitch.

12 Install outer microswitch on mounting pin and holding pin. Then rotate both switches until they rest against case at point shown.

13 Install camshaft in rear cover. (See NOTE.)

14 Install front cover and turn camshaft so that lobe of cam is toward microswitches. The hole in the end of the camshaft indicates the lobe of the cam.

15 Install setscrews and adjust microswitches individually. Turn setscrew in until inner microswitch actuates, and continue for three-fourths turn past point of actuation. Repeat on outer microswitch.

16 Install setscrews and tighten securely.

17 Check microswitches for simultaneous operation, within one degree of camshaft rotation. If microswitches do not actuate within tolerance, readjust setscrews to obtain a condition within allowable limits.

18 Plug setscrew holes with hot sealing wax, leaving enough room to receive bottom cover hold-down screw. Then install bottom cover assembly.

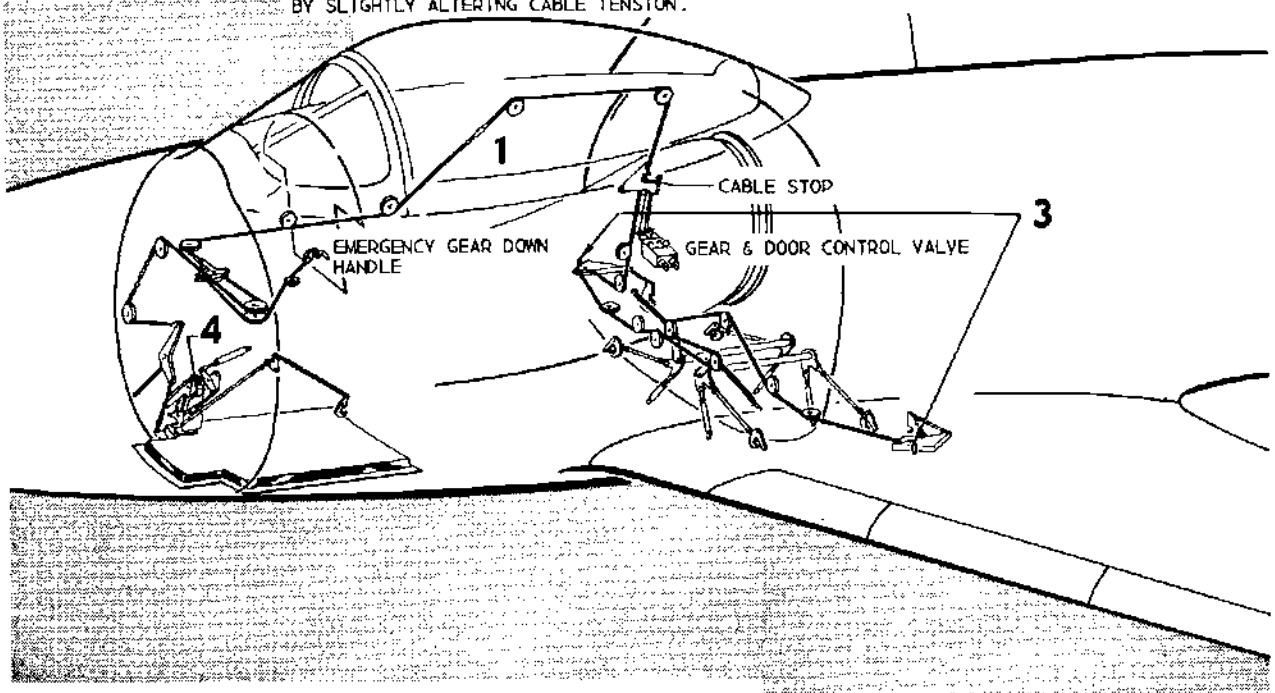
NOTE: Camshaft may be installed with splined end on either side of case. For basic part number, camshaft will be installed with splined end through bushing in rear cover. For —10 part number, camshaft will be installed with splined end through bushing in front cover.

176-33-19

Figure 2-79. Assembling and Adjusting Hermetically Sealed Microswitches

1 TIGHTEN MAIN GEAR CABLE TURNBUCKLE SO THAT CABLES ARE AT APPROXIMATELY 20 POUNDS TENSION. THIS WILL AUTOMATICALLY TENSION THE NOSE GEAR SYSTEM CABLE TO 10 POUNDS. THE MAIN TURNBUCKLE IS AFT OF THE AFT PRESSURE BULKHEAD ON THE RIGHT SIDE OF AIRPLANE. NOSE GEAR TURNBUCKLE IS AFT OF FORWARD PRESSURE BULKHEAD NEAR DUMP VALVE. AFTER TENSIONING CABLE, CHECK POSITION OF THE COMPONENT PARTS OF THE SYSTEM, AS GIVEN IN THE FOLLOWING STEPS.

2 CHECK TO SEE THAT ONE OF THE LEVERS HAS 1/32 INCH CLEARANCE AS SHOWN IN DETAIL A. IT IS NOT NECESSARY TO HOLD THIS DIMENSION ON BOTH LEVERS. IF CLEARANCE IS NOT CORRECT, IT MAY BE OBTAINED BY SLIGHTLY ALTERING CABLE TENSION.



NOTE:

BE SURE CABLE STOP IS LOOSE BEFORE STARTING ADJUSTMENT.

3 MAKE SURE LEVERS CONTROLLING MAIN GEAR UP-LATCHES ARE BARELY CONTACTING STOPS, AND NOT RESTRICTING LOCKING OF HOOKS.

4 CHECK NOSE WHEEL DOOR LOCK TOGGLE LINK ASSEMBLY ON THE RIGHT SIDE OF NOSE WHEEL WELL, AND MAKE SURE LINKAGE IS AGAINST STOP.

5 TEST SYSTEM BY RETRACTING LANDING GEAR AND WHEEL DOORS AND PULLING CONTROL HANDLE. THE NOSE AND MAIN WHEEL DOORS SHOULD OPEN AND THE MAIN GEAR EXTEND. THE NOSE GEAR MUST BE RELEASED AND EXTENDED BY THE EMERGENCY HAND-PUMP.

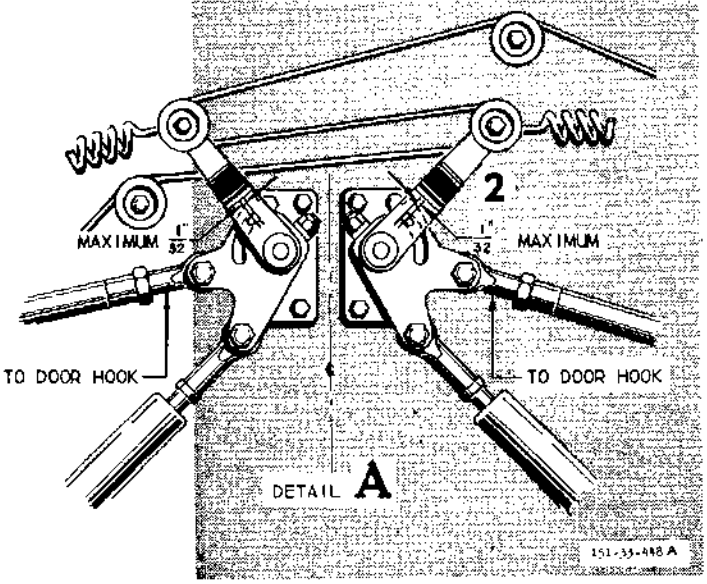


Figure 2-80. Adjusting Landing Gear Emergency Extension System

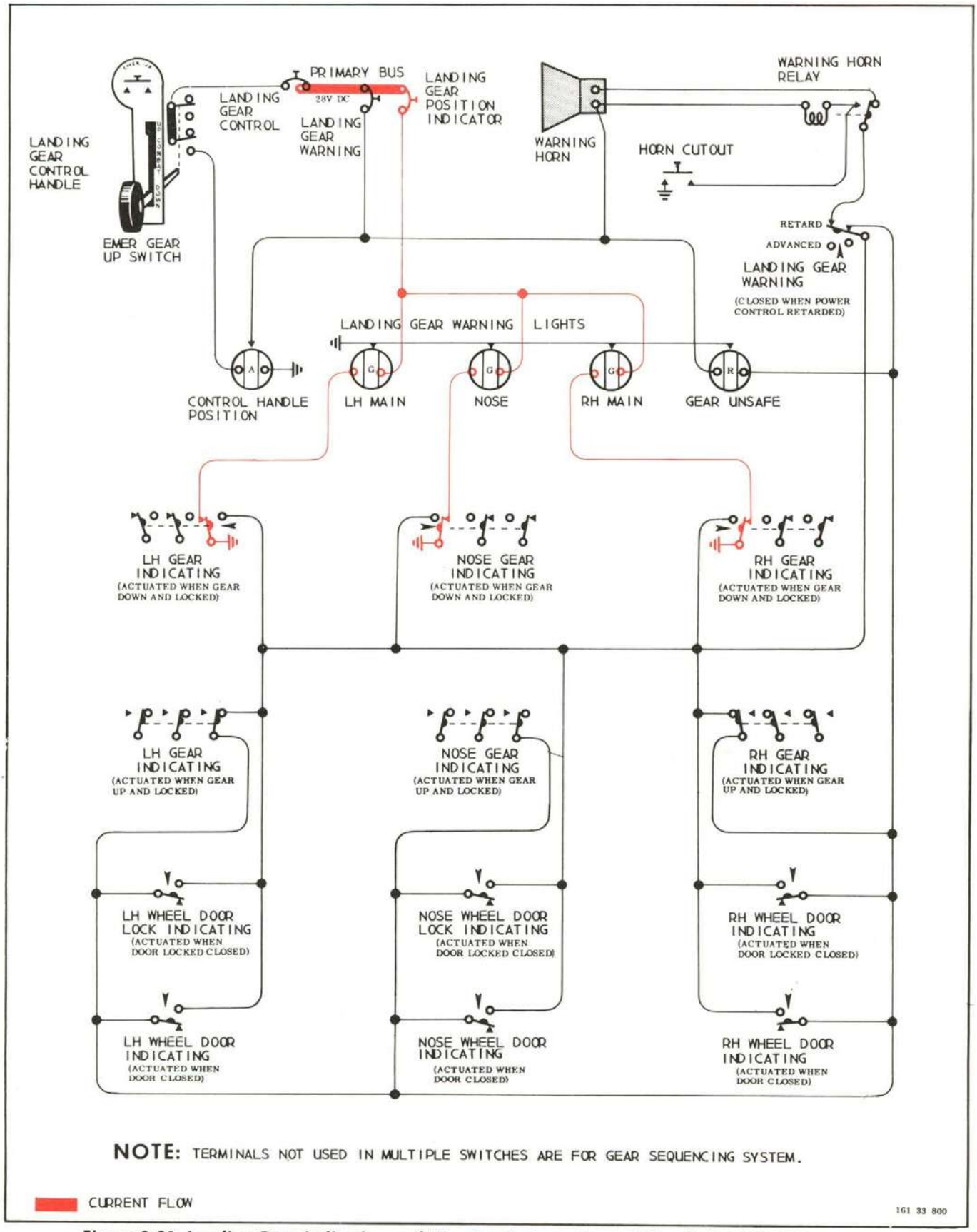


Figure 2-81. Landing Gear Indicating and Warning System—Control Handle "DOWN," Power Control Retarded, Gear Locked Down, Doors Locked Closed—F-86E-1, F-86E-5, and F-86E-6 Airplanes

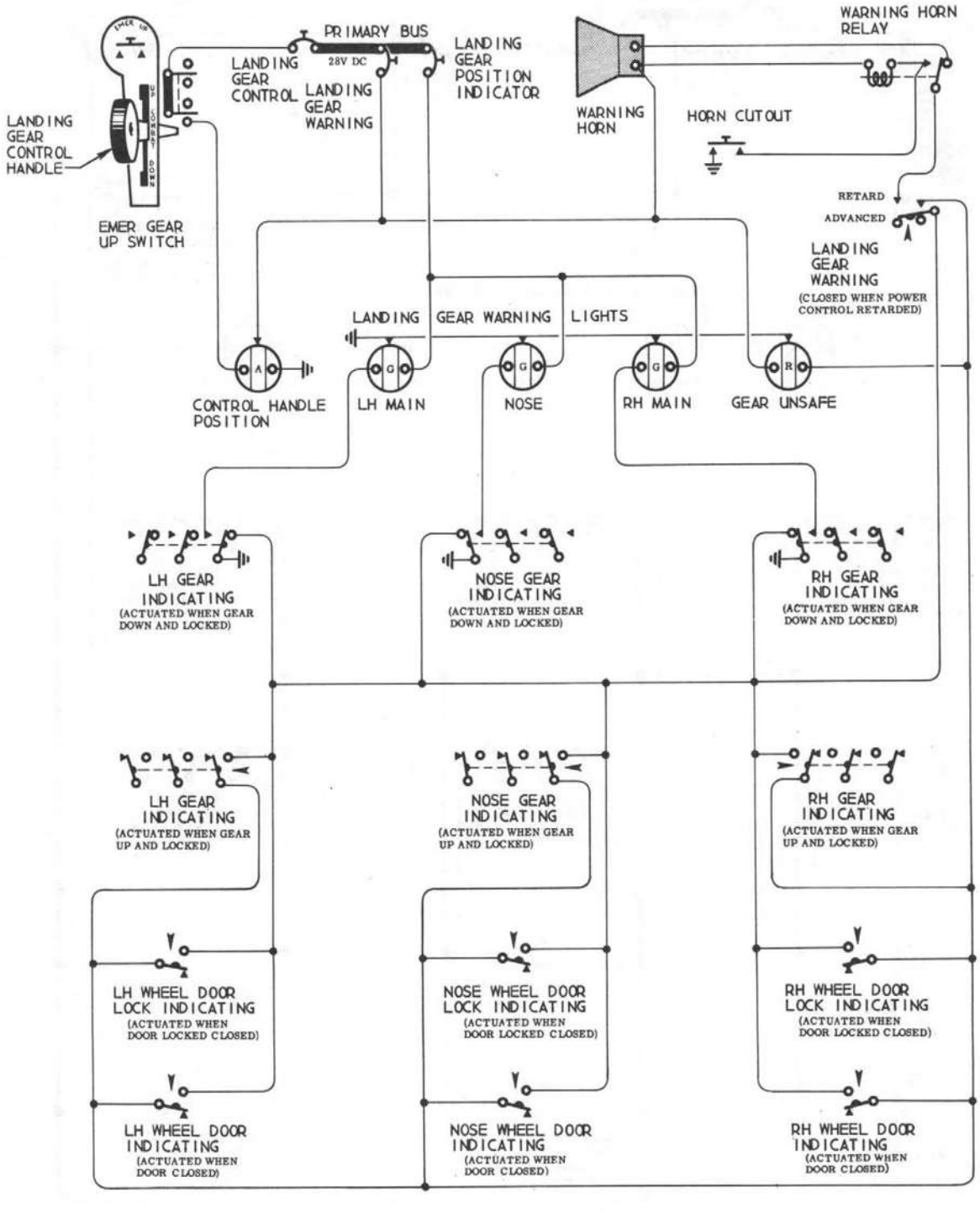


Figure 2-82. Landing Gear Indicating and Warning System—Control Handle "COMBAT," Power Control Advanced, Gear and Doors Up and Locked—F-86E-1, F-86E-5, and F-86E-6 Airplanes

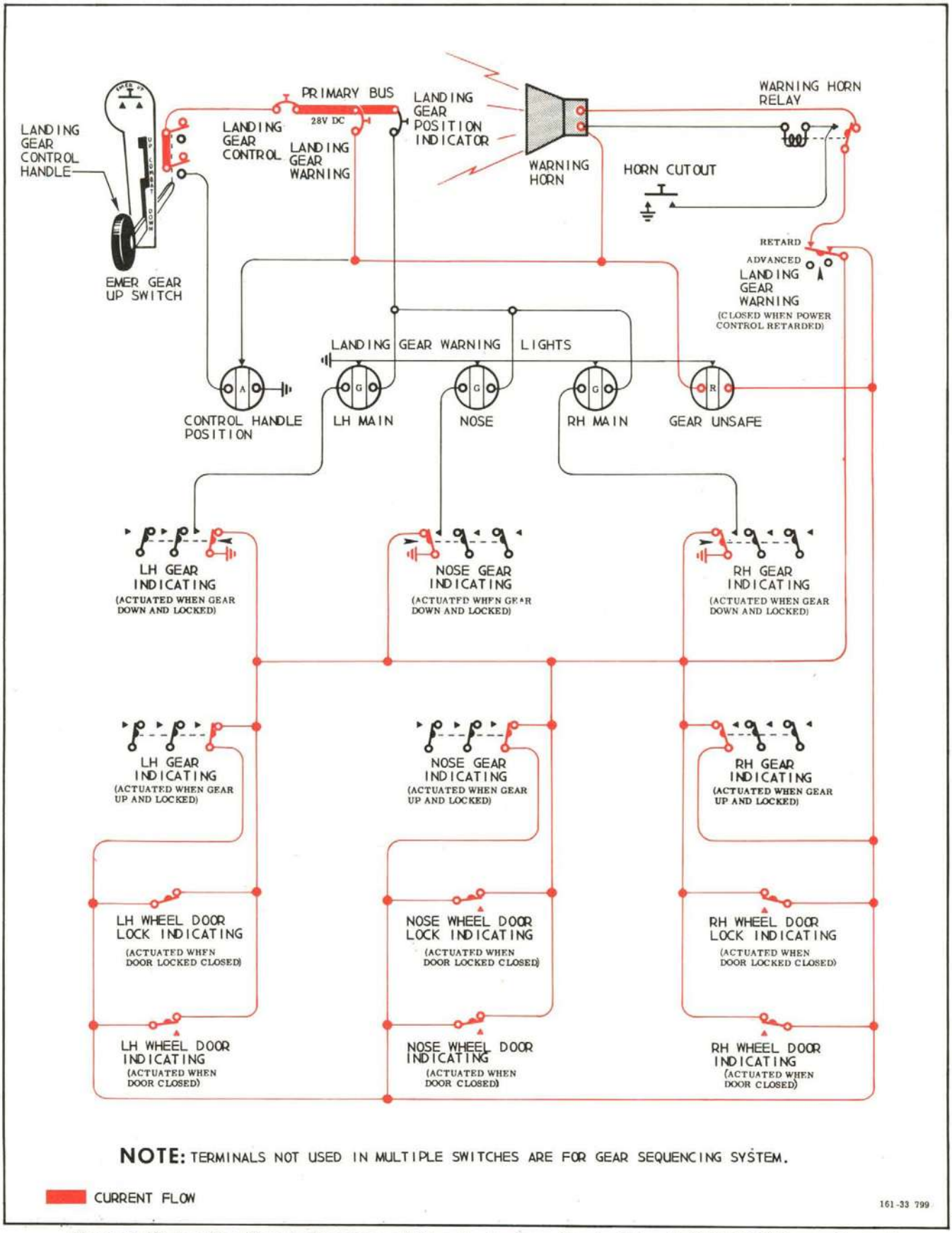


Figure 2-83. Landing Gear Indicating and Warning System—Control Handle "DOWN," Power Control Retarded, Doors Opening, Gear Extending—F-86E-1, F-86E-5, and F-86E-6 Airplanes

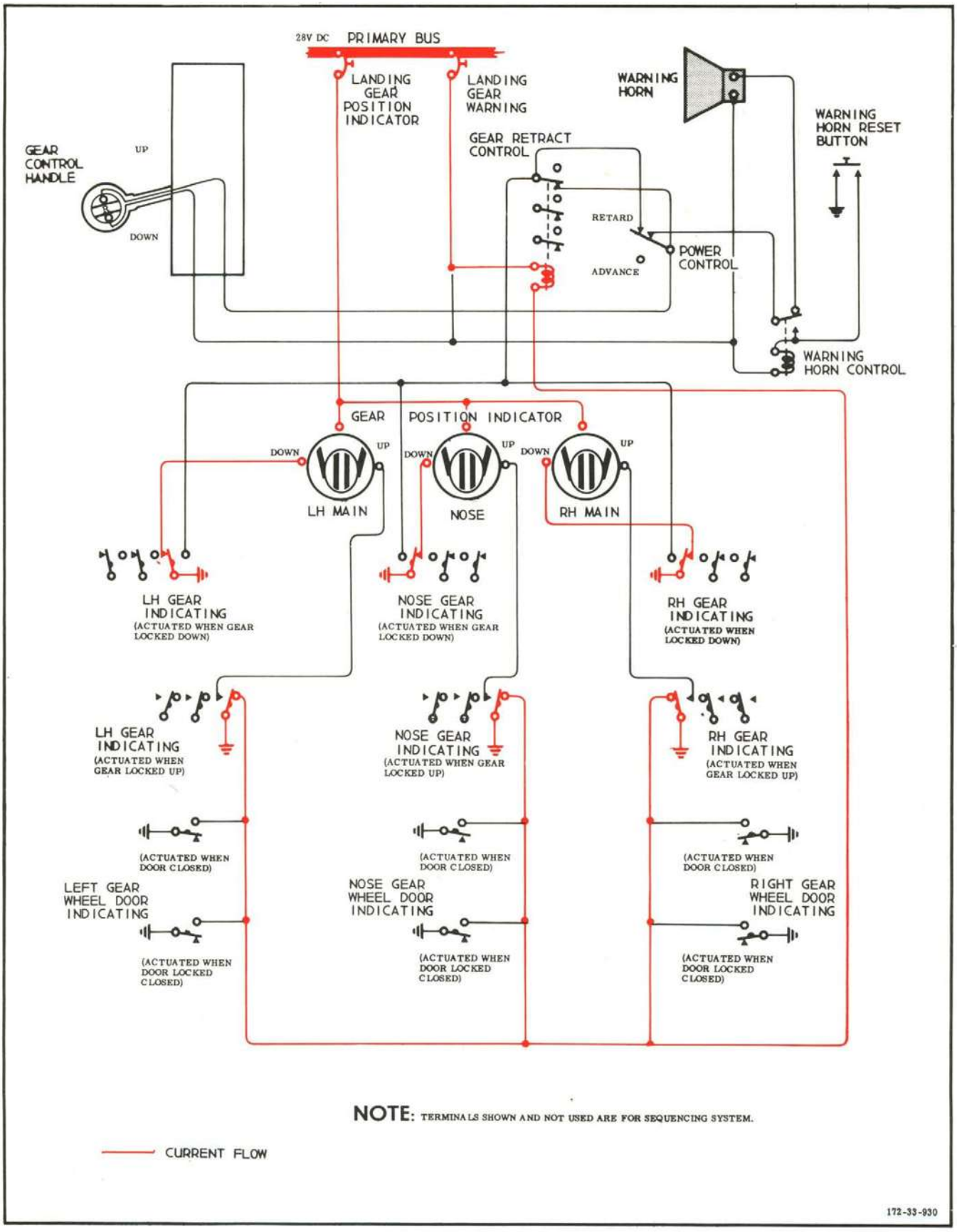


Figure 2-84. Landing Gear Indicating and Warning System—Control Handle "DOWN," Power Control Retarded, Gear Down, Doors Closed—F-86E-10 Airplanes

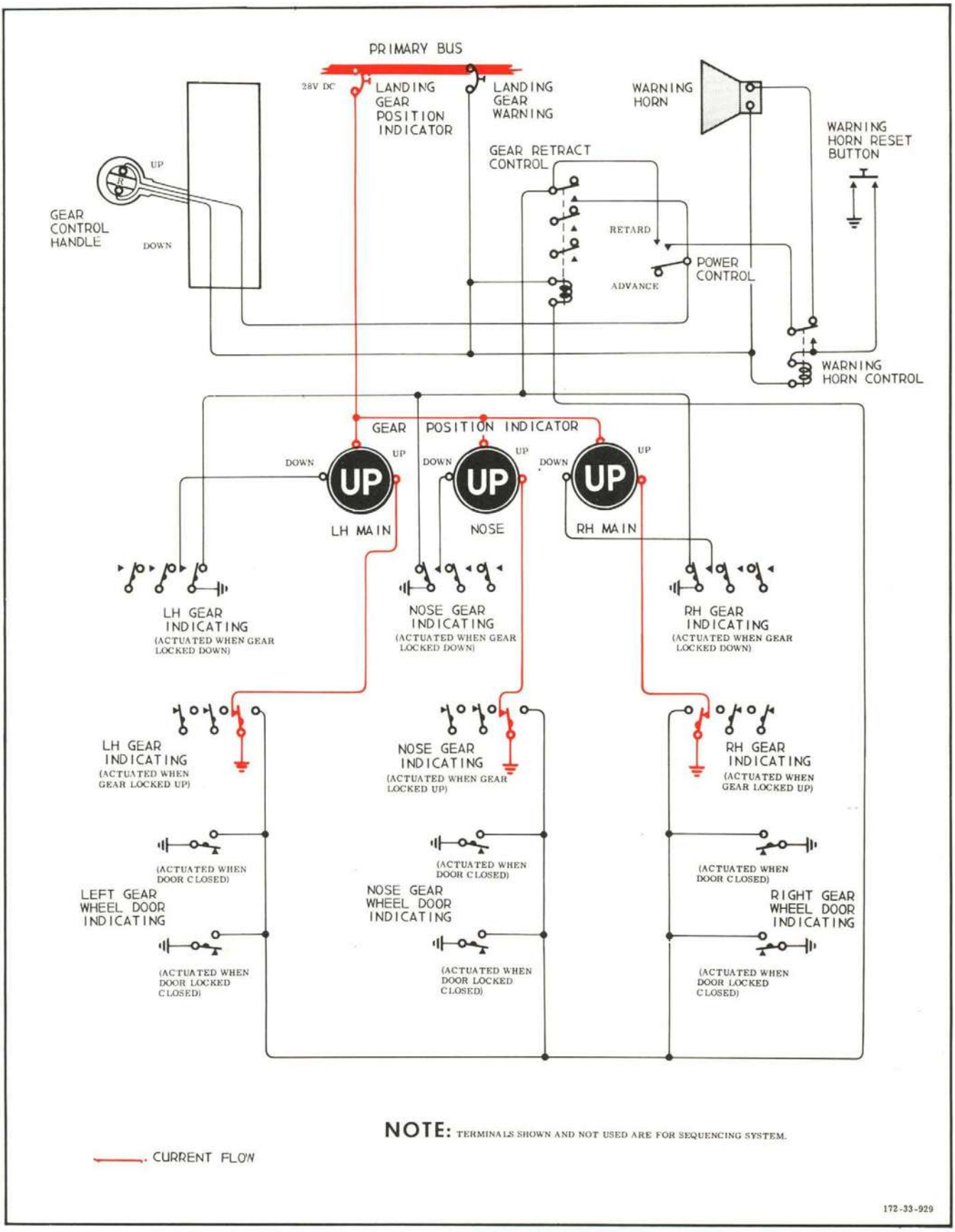


Figure 2-85. Landing Gear Indicating and Warning System—Control Handle "UP," Power Control Advanced, Gear Up, Doors Closed—F-86E-10 Airplanes

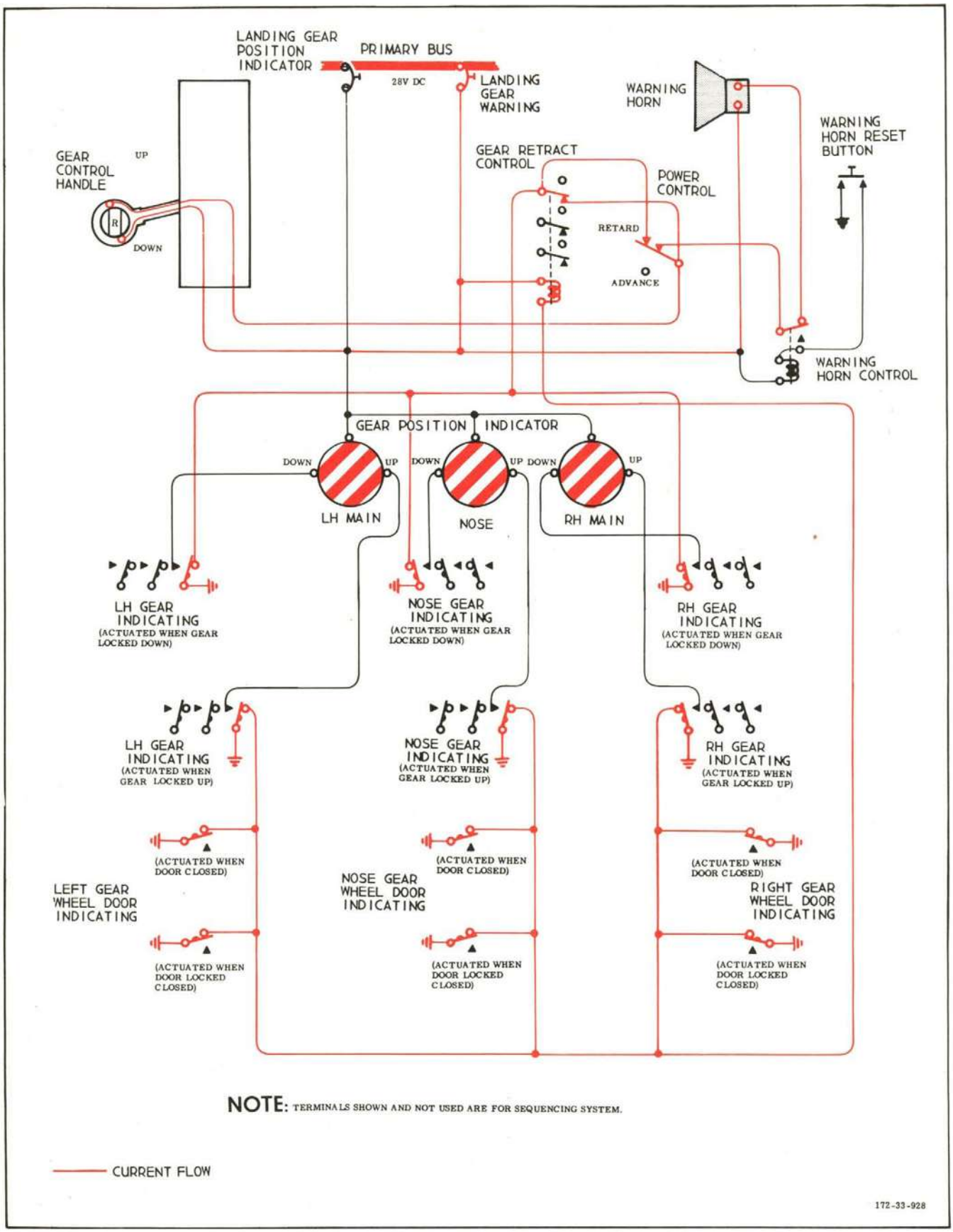


Figure 2-86. Landing Gear Indicating and Warning System—Control Handle "DOWN," Power Control Retarded, Doors Opening, Gear Extending—F-86E-10 Airplanes

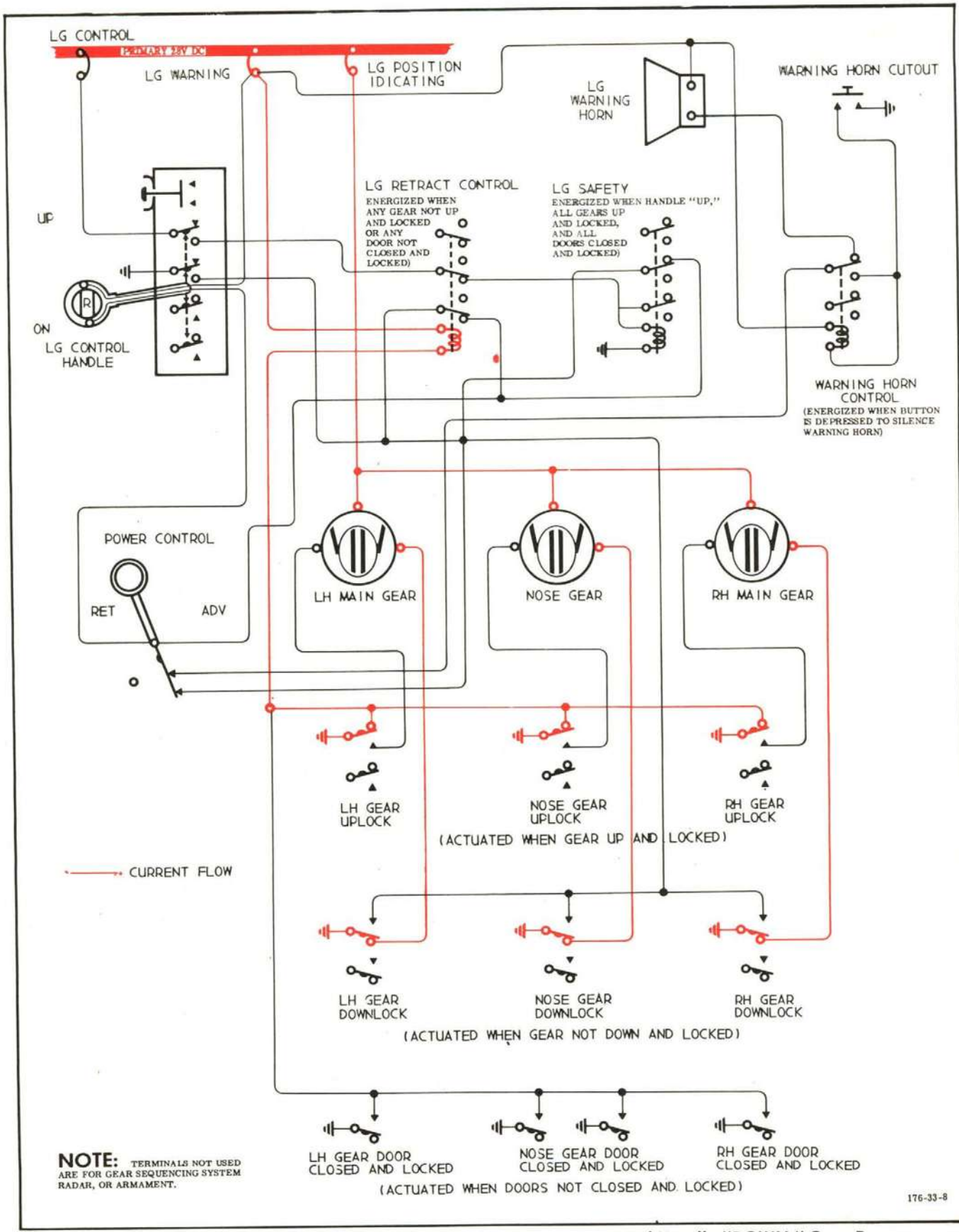


Figure 2-87. Landing Gear Indicating and Warning System—Control Handle "DOWN," Gear Down, Doors Closed, Power Control Retarded—F-86E-15 Airplanes

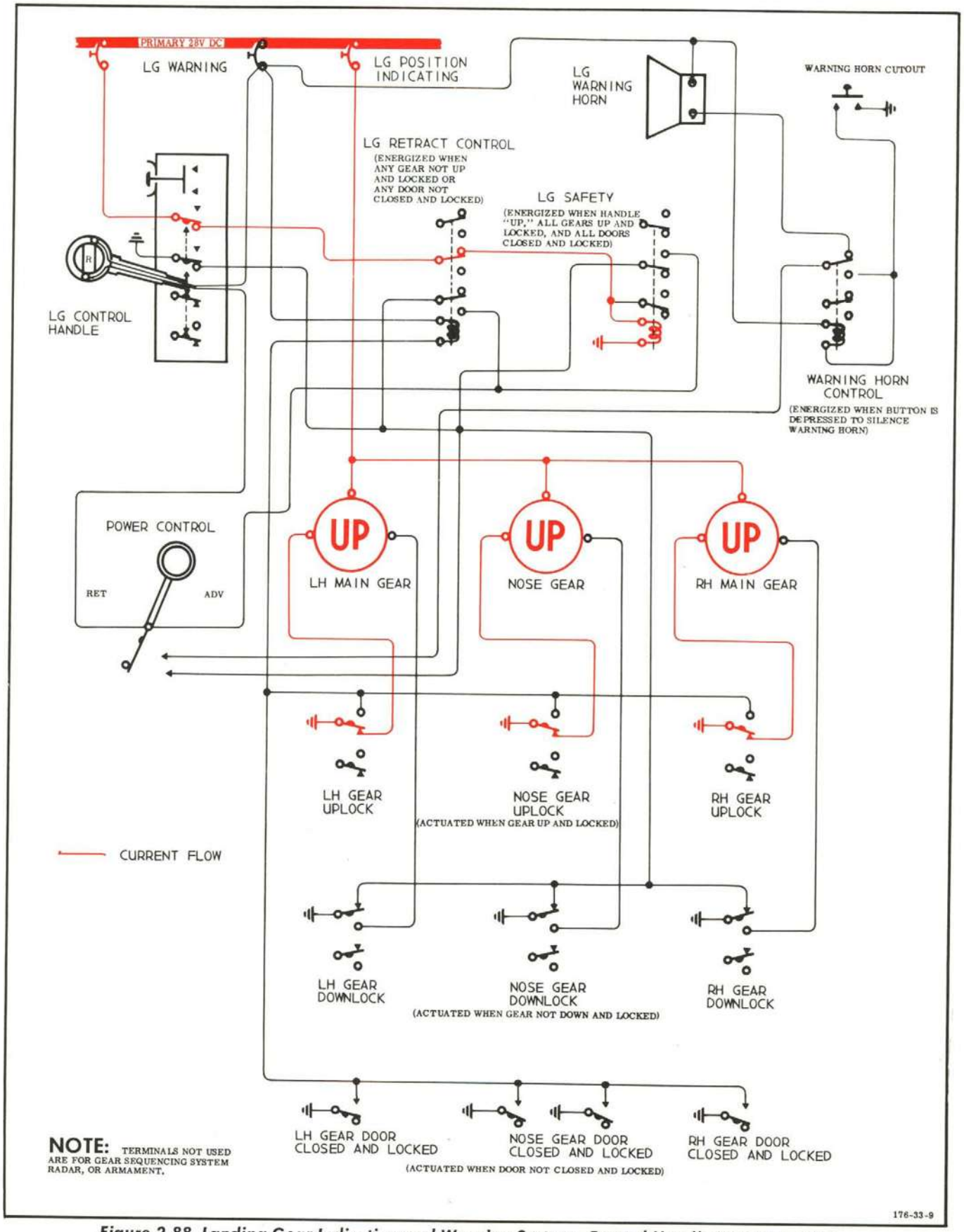


Figure 2-88. Landing Gear Indicating and Warning System—Control Handle "UP," Gear Up, Doors Closed, Power Control Advanced—F-86E-15 Airplanes

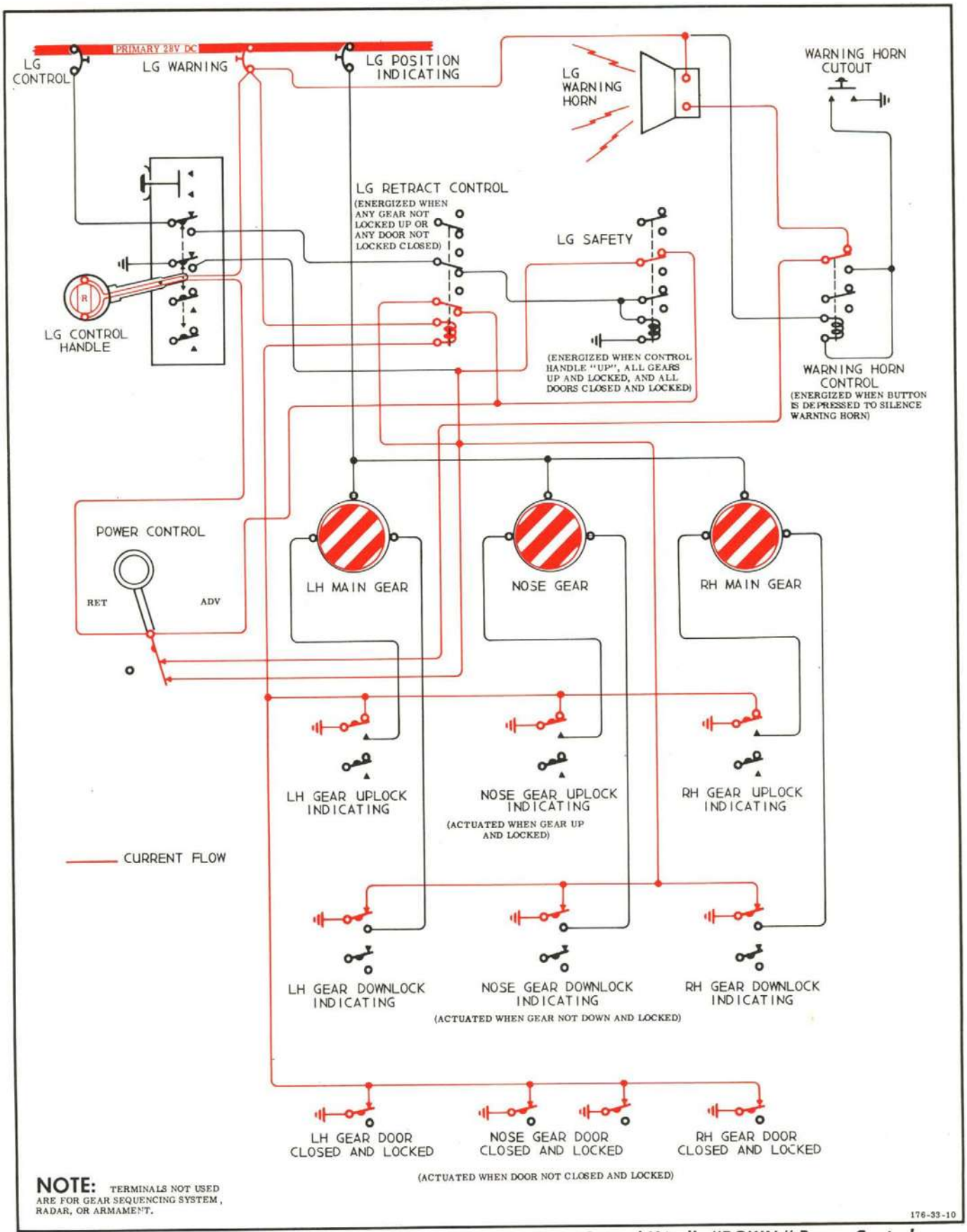


Figure 2-89. Landing Gear Indicating and Warning System—Control Handle "DOWN," Power Control Retarded, Doors Opening, Gear Extending—F-86E-15 Airplanes

neither up and locked nor down and locked, red cross-hatching is shown in the windows. A light inside of the red plastic handle of the landing gear control is illuminated whenever the gear is in an unsafe condition or whenever any wheel door is not locked closed. Inasmuch as there is no "COMBAT" position for the landing gear control handle on these airplanes, there is no warning light to remind the pilot to shift the gear control handle to "COMBAT" after the gear has completed the up cycle. The warning horn system for these airplanes is the same as for the earlier airplanes.

2-232. ADJUSTING LANDING GEAR POSITION INDICATING AND WARNING SWITCHES. See figure 2-77 or figure 2-78.

2-233. MAIN LANDING GEAR ASSEMBLIES.

2-234. Two main landing gear assemblies are mounted in the wing section. Each main gear assembly consists principally of a shock-absorbing strut. The shock strut is mounted on a cantilever trunnion support attached to the wing structure. Mounted on the main gear assemblies are 26-inch wheels with extra-high-pressure 12-ply-rating tires and rotary-multiple-disk hydraulic brakes. The gear is retracted into the fuselage just aft of the wing center section by a hydraulic cylinder attached to the upper part of the shock strut. The gear is downlocked by a lockpin, mounted in the aft face of the trunnion support, which engages a lug on the shock strut. The lockpin is extended and retracted by a hydraulic cylinder and is spring-loaded to the locked position. The gear is uplocked by a spring-loaded, hydraulically actuated hook that engages a roller on the strut.

2-235. REMOVING MAIN LANDING GEAR ASSEMBLIES. To remove a main landing gear assembly, proceed as follows:

a. Place airplane on jacks.
b. Remove shock strut fairing.
c. Disconnect main gear actuating cylinder end.
d. Disconnect and cap hydraulic brake lines.
e. Disconnect electrical leads.
f. With strut supported to take the weight off the trunnion pin, remove trunnion pin and main gear assembly. (See figure 2-90.)

2-236. INSTALLING AND ADJUSTING MAIN LANDING GEAR ASSEMBLIES. See figure 2-91.

2-237. ADJUSTING MAIN LANDING GEAR UPLOCKS AND DOWNLOCKS. See figure 2-91.

2-238. INSTALLING AND ADJUSTING MAIN LANDING GEAR SHOCK STRUT FAIRING. See figure 2-91.

2-239. MAIN LANDING GEAR WHEEL DOORS.

2-240. The two main landing gear wheel doors are hinged at the inboard edges to the fuselage center web. Hydraulic actuating cylinders are attached to the forward inboard corners of each door. The initial movement of the actuating cylinders opens the uplock hooks. The hooks are self-locking as the doors close. (A lip on the forward hook is contacted by the door uplock roller, closing the hooks.) Movement of the doors is controlled by sequence switches, which are mechanically actuated by the main landing gear.

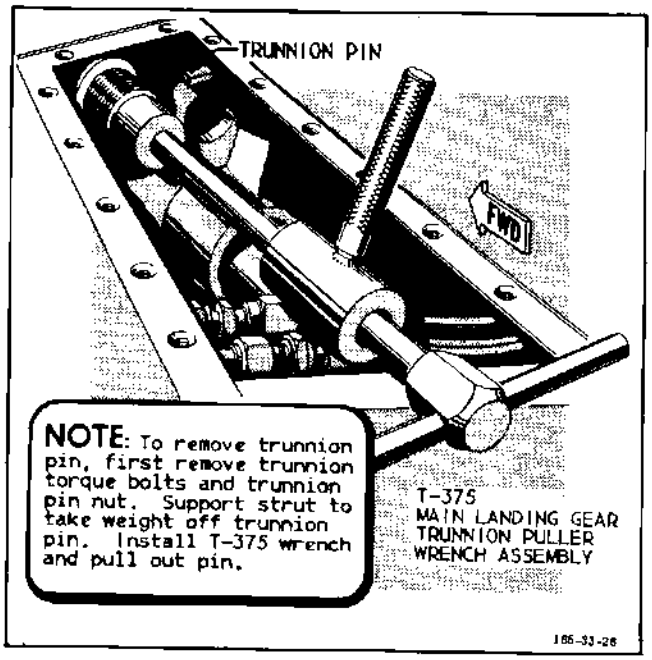


Figure 2-90. Main Landing Gear Trunnion Puller Wrench

2-241. REMOVING MAIN LANDING GEAR WHEEL DOORS. To remove main landing gear wheel door, proceed as follows:

a. Disconnect actuating cylinder from door.
b. Remove hinge bolts and door.

2-242. INSTALLING AND ADJUSTING MAIN LANDING GEAR WHEEL DOORS. See figure 2-93.

2-243. MAIN LANDING GEAR WHEELS.

2-244. The main wheel is a 26 x 6.6-inch cast-magnesium wheel, which carries a 26 x 6.6-inch extra-high-pressure 12-ply-rating tire and tube. The wheel has a removable rim with a split ring retainer.

2-245. REMOVING MAIN LANDING GEAR WHEELS. To remove main landing gear wheels, proceed as follows:

a. Disconnect hydraulic fitting.
b. Remove cotter pin from retaining nut.
c. Unscrew retaining nut.
d. Slide brake and then wheel from axle.

2-246. INSTALLING MAIN LANDING GEAR WHEELS. See figure 2-107.

2-247. MAINTENANCE OF CASINGS AND TUBES.

2-248. If breaks, cuts, large blisters, or other visible damage appears, or if tread pattern has completely disappeared from one or more sections of the casing, the

casing must be removed from service. Weather checking on the casing surface is not considered a hazardous condition, but if the checking has penetrated to the cord, deterioration may occur and the tire should be removed from service. A blister on the sidewall of a recently mounted casing is frequently the result of trapped air between the inner tube and casing and can be prevented during the mounting operation if the tire is inflated, deflated, and reinflated immediately after being mounted. When a casing shows excessive evidence of cupping or uneven wear from camber or toe-in condition, the casing should be removed and reversed on the same wheel and the wheel condition checked and corrected. If there is visible evidence of wheel rim rust or corrosion, thoroughly buff the rim and refinish with a protective coating, allowing the refinished area to dry before remounting the tube and casing. Remove surface oil and grease by washing with a mild soap solution or wiping with a cloth moistened in naphtha or solvent. Nylon casings will stretch upon initial inflation; the stretch is usually taken up within 24 hours. To prevent this condition, mount and inflate new nylon casings as long as possible prior to installation on airplane. In the event a low spot occurs after installation, move the airplane until the low spot is at the top of the casing, and increase normal air pressure 50 percent for 30 minutes. Deflate to normal pressure, and if the condition still exists, repeat the operation. If an airplane is to remain idle for more than 3 days, move airplane or block to sufficient height to change the area of contact of the casings with the supporting surface.

2-249. NOSE LANDING GEAR ASSEMBLY.

2-250. The nose gear assembly attaches to the fuselage nose structure. The assembly consists principally of a shock-absorbing strut. Mounted on the nose gear strut is a 22-inch wheel with low-profile tire. A hydraulically operated steer-damp unit is attached to the aft side of the shock strut outer cylinder. The shock strut pivots on two trunnion supports, mounted in the nose structure. The gear assembly is retracted into the fuselage nose by two hydraulic cylinders. During retraction, the strut spindle rotates 90 degrees in the strut housing so that the nose wheel is horizontal when in the retracted position.

2-251. REMOVING NOSE LANDING GEAR ASSEMBLY. To remove the nose landing gear assembly, proceed as follows:

a. Place airplane on jacks.

b. Remove shock strut fairing.

c. Disconnect electrical leads.

d. Disconnect strut drag brace.

e. With strut supported to take weight of trunnion pin, remove trunnion nuts and torque bolts, and pull trunnion pins.

2-252. INSTALLING AND ADJUSTING NOSE LANDING GEAR ASSEMBLY. See figure 2-92.

2-253. ADJUSTING NOSE LANDING GEAR UPLOCKS. See figure 2-92.

2-254. NOSE LANDING GEAR WHEEL DOOR.

2-255. The nose gear is completely faired, when in the retracted position, by the shock strut fairing and wheel door. The strut fairing is hinged to the fuselage forward of the gear and is opened and closed by the movement of the nose gear assembly to which it is linked. The wheel door is hinged to the left side of the wheel well and is moved by a hydraulic cylinder that is controlled by a hydraulic sequence valve mechanically actuated by the nose gear assembly.

2-256. REMOVING NOSE GEAR LANDING GEAR WHEEL DOOR. To remove the nose wheel door, proceed as follows:

a. Disconnect hydraulic actuating cylinder from door.

b. Disconnect safety link from door.

c. Remove hinge bolts and door.

2-257. INSTALLING AND ADJUSTING NOSE LANDING GEAR WHEEL DOOR. See figure 2-94.

2-258. NOSE LANDING GEAR WHEEL.

2-259. The nose wheel is a 22 x 7.25-1150 inch cast-magnesium wheel, which carries a 22 x 7.25-1150 inch low-profile, six-ply-rating tire with same size tube. The wheel is cast in two sections to facilitate tire mounting.

2-260. REMOVING NOSE LANDING GEAR WHEEL. To remove the nose wheel, proceed as follows:

a. Remove dust cover.

b. Remove cotter pin from retaining nut.

c. Remove retaining nut and pull wheel.

2-261. INSTALLING NOSE LANDING GEAR WHEEL. To install the nose wheel, proceed as follows:

a. With bearing properly greased and installed in wheel, slide wheel onto axle.

b. Install washer and retaining nut. With wheel spinning, tighten retaining nut until wheel binds. Loosen nut until it clears washer; then tighten slowly until sharp drag is felt on the nut and washer. Continue tightening until next safety hole is aligned; then install cotter pin. Spin wheel for drag.

c. Install dust cover.

2-262. LANDING GEAR AND WHEEL DOOR HYDRAULIC CONTROL VALVE.

2-263. The landing gear and wheel door control valve (Bendix 466335 or Weston 4740-2 on F-86E-1, F-86E-5, and F-86E-6 Airplanes and 9610-2 on F-86E-10 and F-86E-15 Airplanes) consists of two identical solenoid valves bolted together as a single unit with common pressure and return ports. The valve assembly is located on the aft side of the engine compartment fire wall just above the "dishpan" in the top of the right wheel well.

1 Make sure trunnion pin and bearings are clean and down-lock pin retracted. Move gear into position and insert trunnion pin. (Use T232 or T375 wrench on trunnion pin.)

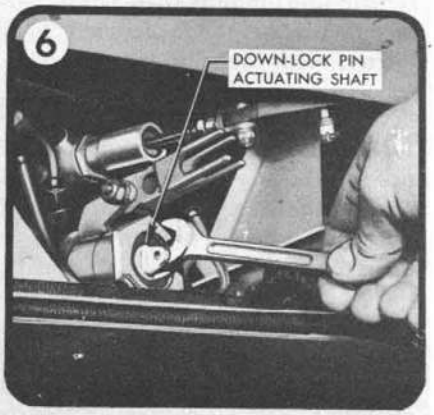
2 Use steel shims to hold fore and aft play to between .004 and .010 inch.

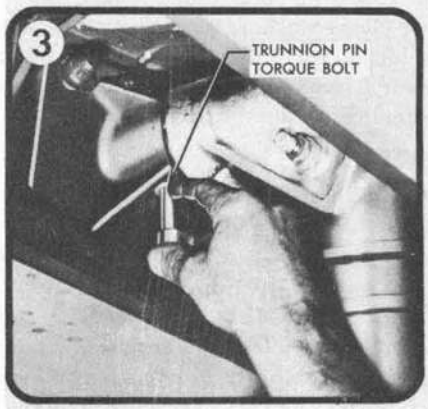
3 Install trunnion pin torque bolt, using the T232 or T375 wrench to help align bolt holes.

4, 5 Install trunnion pin nut snugly, but without high torque, as the gear should swing freely without binding. Back the trunnion pin nut off so nearest slot is aligned with bolt holes in the trunnion pin, and install trunnion pin nut retaining bolt.

6, 7 Adjust the gear down-lock pin by rotating the actuating shaft so the pin protrudes 1-1/16 inches from the inner housing.

8 Install gear down-stop, using shims to obtain a clearance of from .001 to .007 inch between down-lock pin and gear down locking lug (see illustration 7). Install down-stop retaining bolt.





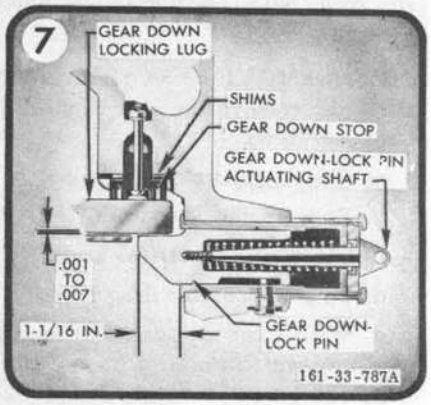


Figure 2-91. Installing and Adjusting Main Landing Gear (Sheet 1 of 2)

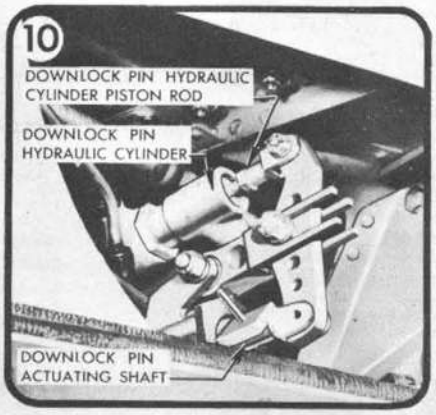
9 Retract downlock pin until inner end is retracted 1/32 inch into the inner housing. Maintain the pin in this position by inserting a small block 1-3/32 inches long between the downlock pin head and the outer housing.

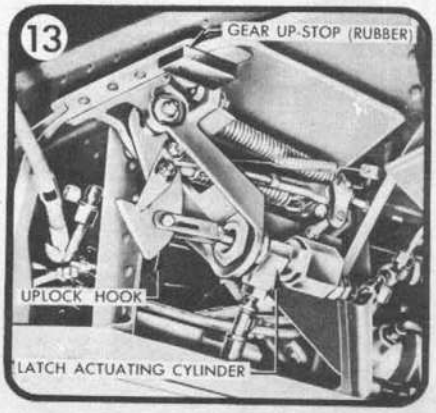
10 Bottom the downlock pin hydraulic cylinder and adjust piston rod to fit; then shorten by one-half turn of the fitting and attach.

11 With the gear down and locked, fully extend gear actuating cylinder piston rod, and adjust to fit; then lengthen by turning end fitting three turns; and attach.

12 Move strut fairing into position and install hinge bolt. Attach strut to fairing links and adjust links so that retracted gear will hold the fairing tightly closed without distortion. If fore and aft adjustment of the fairing is required, change washers at hinge bolt and fairing links as necessary.

13, 14 Adjust the uplock hook-stop so the roller clears the face of the hook by 1/16 inch with the gear up and locked; adjust stop by adding or removing shims until gear just touches stop (maximum clearance 1/16 inch) with gear roller resting on hook.





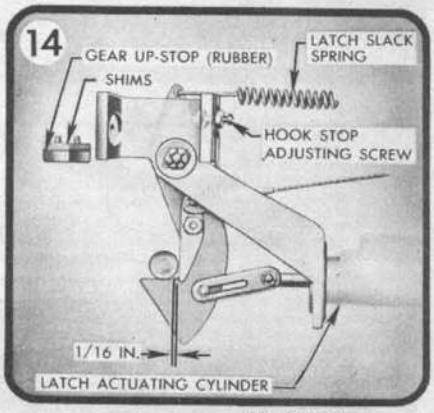


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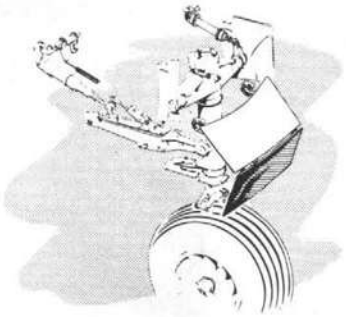
Figure 2-91. Installing and Adjusting Main Landing Gear (Sheet 2 of 2)



1 Before installing nose gear, make sure trunnion pins are clean and insert them as indicated; then install torque bolts.

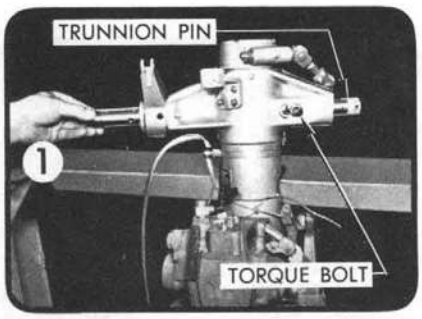
2 Install trunnion bearings, washers, and nuts. Draw trunnion nuts up snug, but not tight enough to hinder free rotation of bearings. Use washers as necessary to align cotter pin holes and still maintain a snug fit.

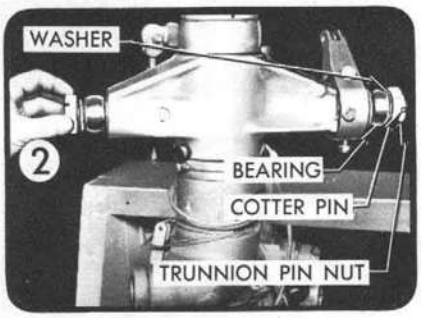
NOTE: Trunnion pins, bearings, washers, and nuts are preinstalled and adjusted before nose gear is moved into position because of the limited space available to work in, once the gear is installed.

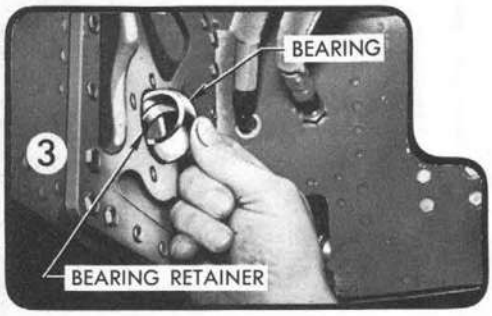
3 Remove torque bolts and trunnion pins, leaving trunnion pin nut installed. Separate bearings and place in bearing retainers.

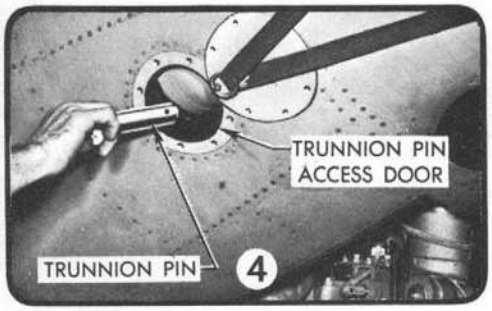
4 Move gear into position for installation. Align trunnion pin holes in nose gear with corresponding holes in fuselage structure. Install trunnion pins through trunnion pin access doors. Make sure that cotter pin heads are in the same position as in step 2, so torque bolt holes will be aligned. Install and tighten torque bolts.

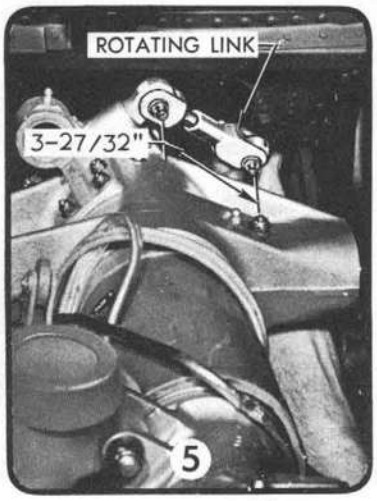
5 Adjust strut-rotating link to a length of 3-27/32 inches between attachment centers. This will cause the wheel to be horizontal when retracted.











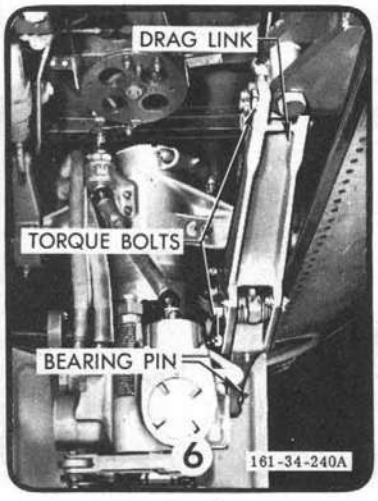


Figure 2-92. Installing and Adjusting Nose Gear (Sheet 1 of 2)

6 To attach drag link, install bearing pin and secure with retaining bolt; then install torque bolts.

7 With drag link hinge shoulders tight together, shim lock stop so that hook fits firmly without binding. With hinged actuating arm down against stop, adjust link rod so that hook attachment bolt is against end of link rod slot.

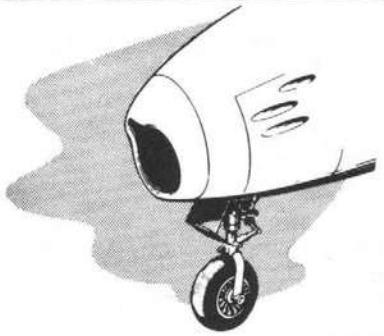
8 Turn up-lock hook adjustment stop so that face of hook will be 2 degrees aft of vertical. Adjust up-latch roller by moving in on serrated base so that face of up-lock hook touches roller when gear is locked up.

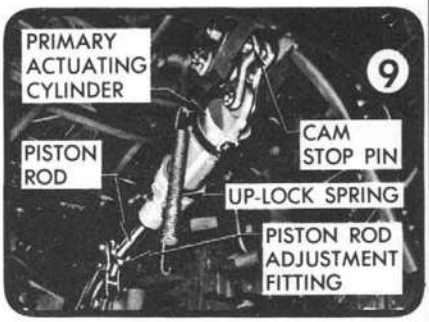
9 Disconnect up-lock spring and hold primary actuating cylinder aft so that cam stop pin is in bottom of cam slot. Extend primary actuating cylinder piston rod until piston is bottomed against cylinder end, and adjust rod to fit attaching point; then lengthen rod by two full turns of rod adjustment fitting and attach.

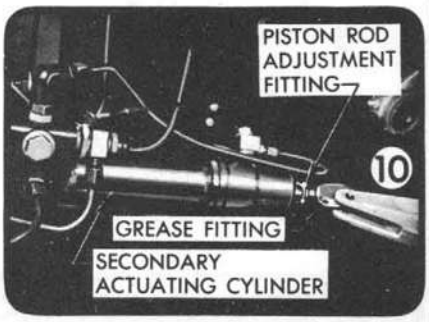
10 With gear full down and secondary actuating cylinder piston bottomed in the retracted position, adjust length of piston rod to fit, then shorten two full turns. Make sure grease fitting on rod end faces down; then attach rod to nose gear fitting.

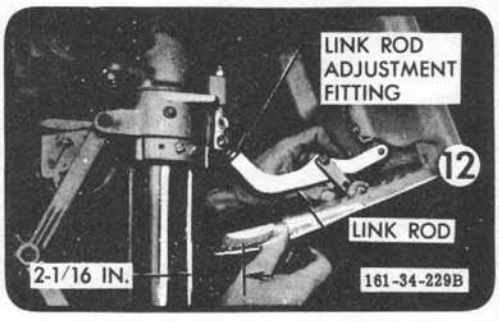
11 Position shock strut fairing and install hinge bolts.

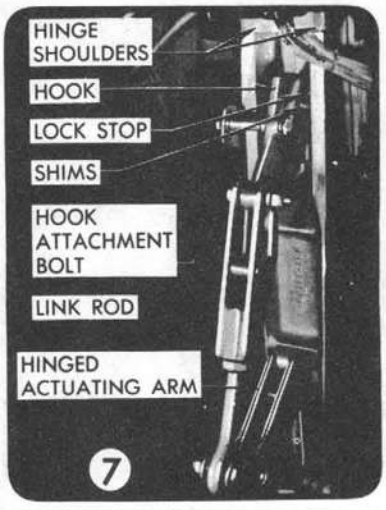
12 Adjust shock strut fairing so lower edge clears strut inner cylinder by 2-1/16 inches. Connect link rod to strut and adjust so that fairing will close firmly, but without distortion when gear is locked up.











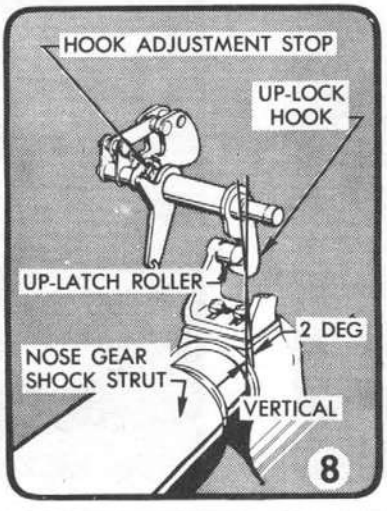
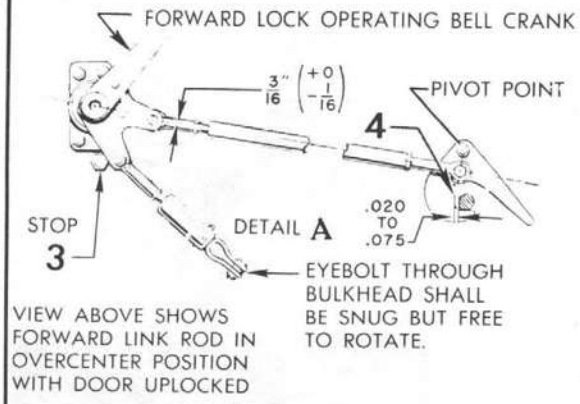
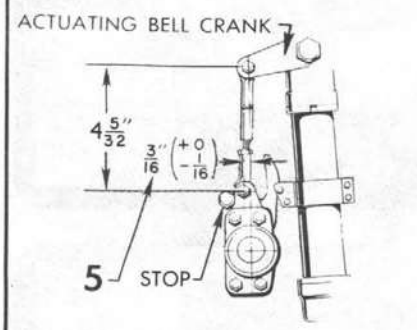


Figure 2-92. Installing and Adjusting Nose Gear (Sheet 2 of 2)



VIEW ABOVE SHOWS FORWARD LINK ROD IN OVERCENTER POSITION WITH DOOR UPLOCKED



DETAIL B
VIEW ABOVE SHOWS VERTICAL LINK ROD IN OVERCENTER POSITION WITH DOOR DOWNLOCKED

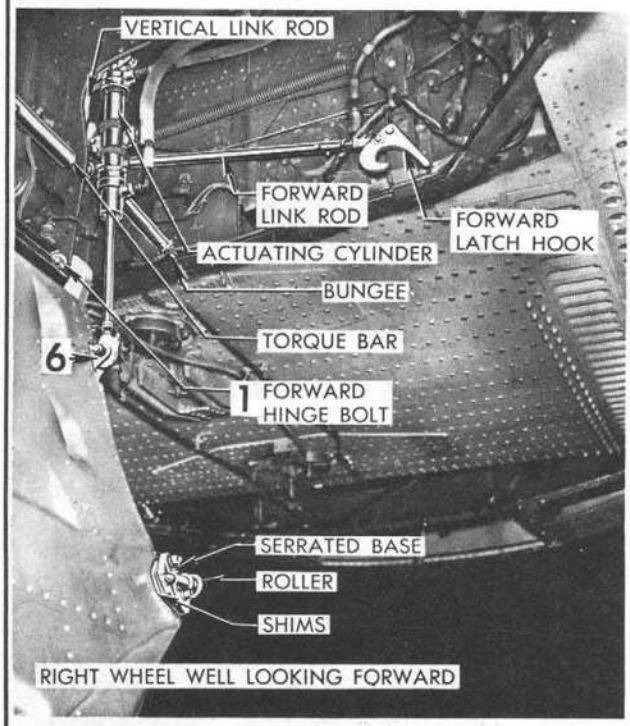
1, 2 Position wheel door and install hinge bolts. Use an AN4-20A bolt in forward hinge and an AN4-17A bolt in the aft hinge (magnetic inspection required).

3 Install forward link rod with 16-15/16 inches between attachment centers, and install aft link rod with 17-17/32 inches between attachment centers. Set forward lock operating bell crank against stop as shown in detail A and check overcenter dimension. If necessary, replace spacer on stop with one of different outside diameter to make bell crank overcenter by 3/16 (+0, −1/16) inch.

4 Close wheel door, and adjust rollers so that they rest in latch hook with .020- to .075-inch clearance between roller and back face of hook. Make this adjustment by loosening attachment bolts and moving roller mounts on serrated bases. Adjust rollers vertically by adding or removing shims so that wheel door will be held tightly closed without distortion of door skin.

5 Set actuating bell crank against stop, and insiall vertical link rod with 4-5/32 inches between attachment centers. Make certain bell crank remains overcenter by 3/16 (0, −1/16) inch, adjusting vertical link rod if necessary. (See detail B.)

6 With the piston bottomed in the retracted position, and the door in the uplocked position, adjust the piston rod end to align with attaching point; then shorten three full turns and attach.



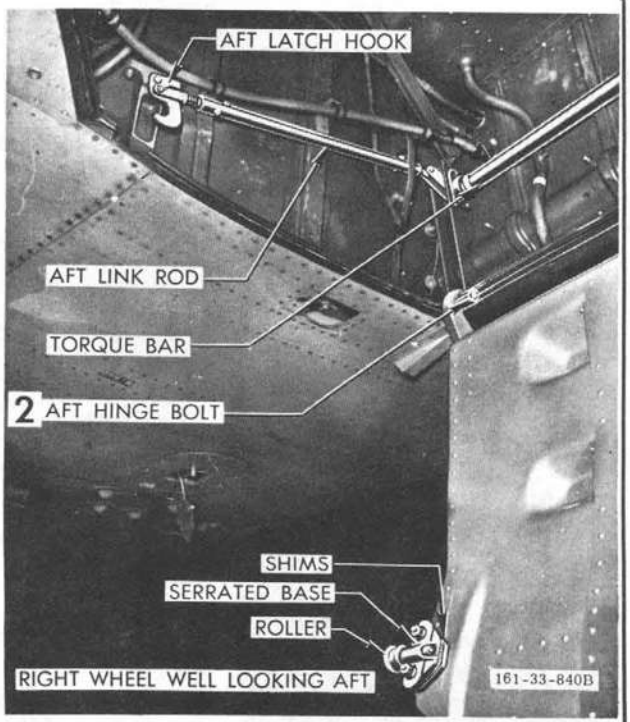


Figure 2-93. Installing and Adjusting Main Landing Gear Wheel Doors

1 Position door on fuselage, and install hinge bolts.

2 Set stops in forward latch linkage so that linkage is positioned as in detail A.

3 With latch hooks closed, install and adjust the forward link rod so that line between pivot point and aft link rod attachment point on the bell crank is vertical.

4 Install and adjust aft link rod so that tip of aft hook is flush with edge of attachment plate as in detail B.

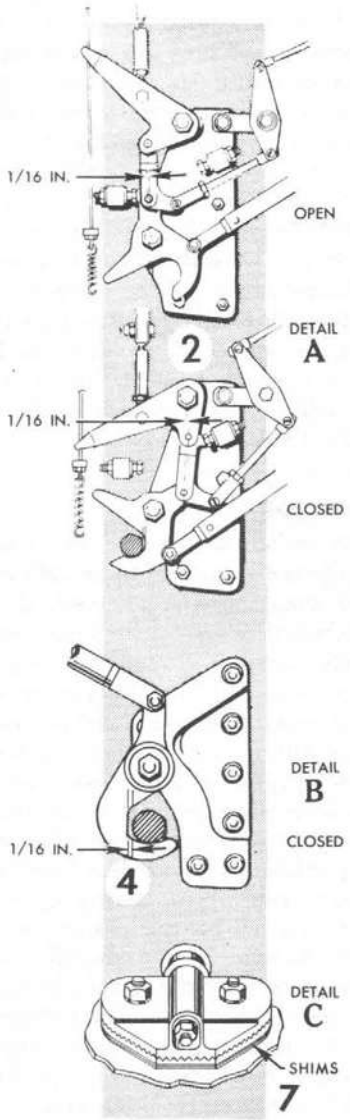
5 Install vertical link rod with 3-9/32 inches between attachment centers.

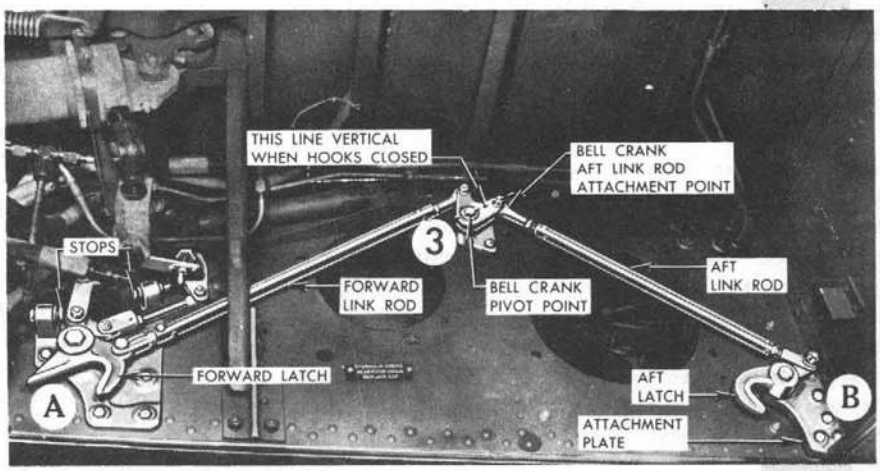
6 Install horizontal link rod with 11-1/16 inches between attachment centers.

7 Place door in up-locked position, and add or subtract shims under the rollers (detail C) until hooks hold door tightly to fuselage without binding. At the same time adjust rollers longitudinally until they clear face of hooks by 1/16 inch as in detail B.

8 With door up-locked, and actuating cylinder bottomed in retracted position, adjust piston rod to fit; then shorten rod by three turns of fitting and attach.

9 Unlock and open door until cylinder piston rod is fully extended. With safety rod fully extended and against internal stop, adjust it to fit; then attach. Make sure locks are open and that safety rod is not adjusted too short, as it is not designed to take any door load.





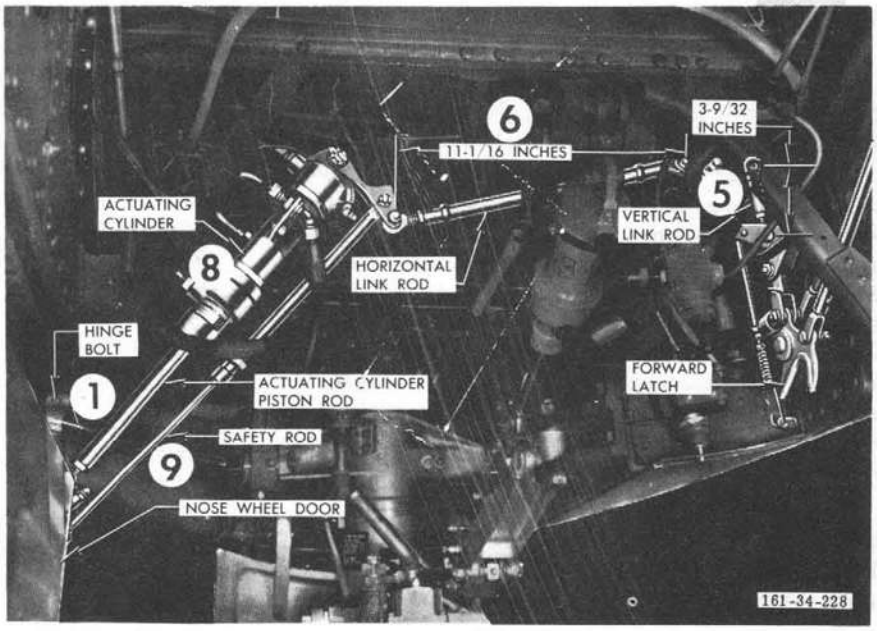


Figure 2-94. Installing and Adjusting Nose Wheel Door

Each valve consists of a housing, sliding piston assembly, springs, and solenoids for piston control. Electrically controlled and hydraulically operated, the valves direct utility pressure to their respective systems when energized by the landing gear electrical sequence system. Utility pressure entering the valve at the pressure port is directed through a drilled passage in the sliding piston to a pressure chamber in the valve housing at each end of the piston. This pressure being equal at either end, together with equal spring tension, positions the piston to a centered, or neutral, condition. Selection of a control setting in the cockpit energizes the solenoid, unseating the ball assembly in the chamber. Pressure in the chamber is then allowed to drain past the unseated ball to the return lines. The sliding piston, being in an unbalanced condition, is positioned by the remaining pressure in the opposite chamber. Utility pressure entering the valve through the pressure port is now connected with an operating port to the system selected for operation by an annular groove on the outside diameter of the piston. The valve will remain in the operating position until de-energized.

2-264. MAIN LANDING GEAR DOWNLOCK ACTUATING CYLINDERS.

2-265. Main gear downlock actuating cylinders are of the double-acting type, consisting of a cylinder, body, piston assembly, plunger, poppet, "O" rings, back-up rings, retainer, and wiper ring. The actuating cylinder is positioned to the locked or unlocked condition by utility system pressure from the landing gear control valve. In the gear-up cycle, the piston assembly is actuated to the unlocked (retracted) condition to mechanically position the plunger and poppet and allow pressure to retract the gear after the downlocks have been released.

2-266. NOSE LANDING GEAR EMERGENCY EXTENSION HYDRAULIC PRESSURE CONTROL VALVE.

2-267. On F-86E-10 and F-86E-15 Airplanes, the emergency pressure control valve (Saval 20176) is located in the gun charger air compressor compartment on the lower right side of the nose section. The valve is a two-position rotary-type incorporating shear seals. The purpose of the valve is to admit emergency gear lowering accumulator pressure to the down side of the nose gear actuating cylinders when the emergency gear lowering handle is pulled. When in the normal position, the valve also vents the emergency pressure line between the shuttle and the control valve to return. Repositioning the control valve back to normal position after emergency operation must be accomplished when airplane is on the ground.

2-268. REMOVING EMERGENCY EXTENSION HYDRAULIC PRESSURE CONTROL VALVE. To remove the emergency control valve, proceed as follows:

a. Remove gun charger air compressor.

b. Remove retaining pins that hold cables in valve arm.

c. Disconnect hydraulic lines from valve.

d. Remove attaching bolts that hold valve mounting bracket; then remove valve and bracket.

2-269. INSTALLING EMERGENCY EXTENSION HYDRAULIC PRESSURE CONTROL VALVE. To install the emergency control valve, proceed as follows:

a. With bracket and arm attached to valve, place valve bracket into position and install attaching bolts.

b. Connect hydraulic lines to valve.

c. Insert cables into proper slots in valve arm; then install and safety retaining pins.

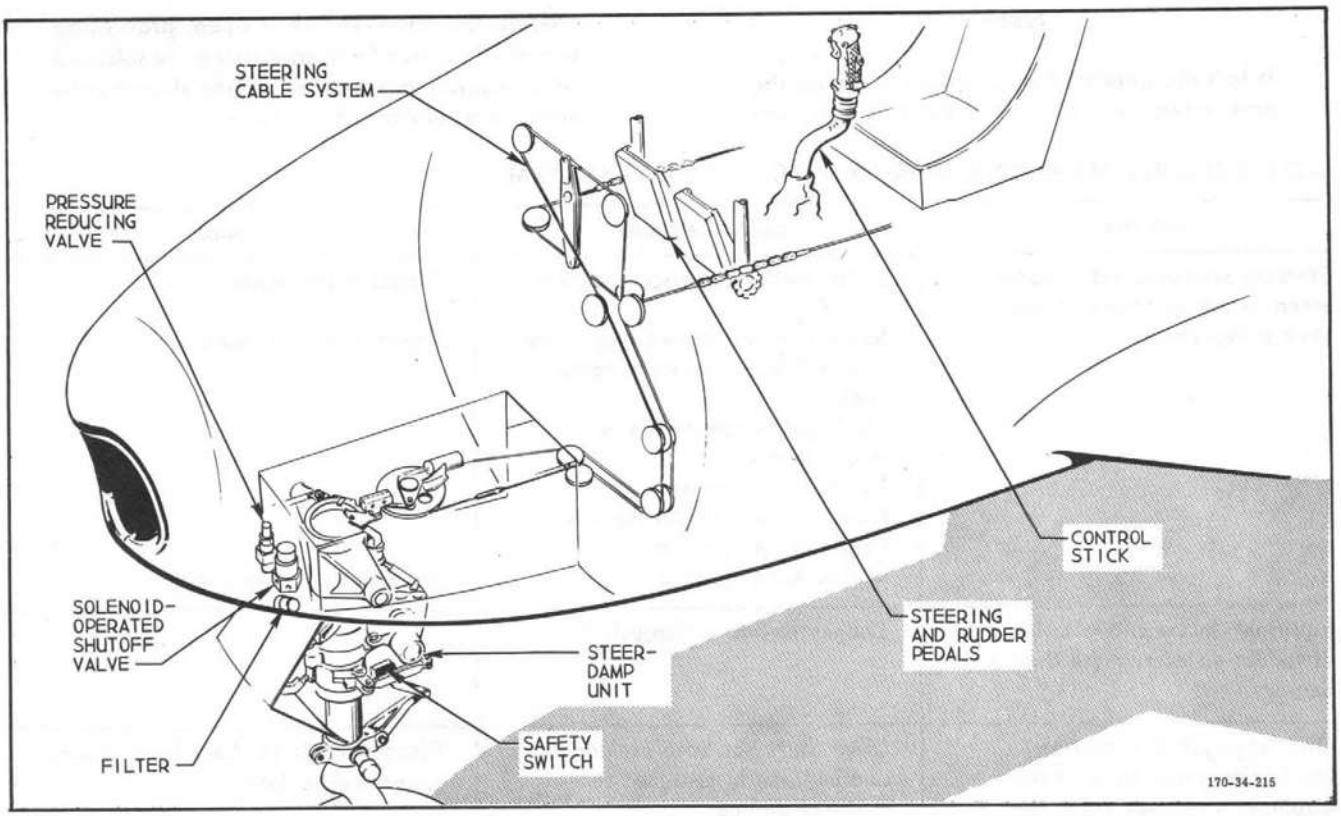
d. Install gun charger air compressor.

2-270. NOSE WHEEL STEERING SYSTEM.

2-271. The nose wheel steering system (figures 2-95 and 2-96) consists of a solenoid-operated shutoff valve, a pressure reducing valve, a filter unit, a steer-damp unit, a control switch, and a nose wheel steering system safety switch. The nose wheel can be steered by means of the steer-damp unit mounted on the nose gear shock strut. Steering is accomplished hydraulically, and is controlled by cable linkage through connection with the rudder cable sector. During steering operation, rotation of the nose gear is limited to 23 (+5/−2) degrees either side of the neutral position. A switch mounted on the control stick actuates a solenoid-operated shutoff valve which, when open, allows hydraulic pressure to enter the nose wheel steering units. A nose wheel steering safety switch mounted on the nose gear allows operation of the steering system only when the weight of the airplane has compressed the nose gear shock strut. Utility system hydraulic pressure is reduced, by a pressure reducing valve, for operation of the steering system.

2-272. FUNCTION OF NOSE WHEEL STEERING SYSTEM.

2-273. When the safety switch on the nose gear shock strut is closed, depressing the switch on the pilot's control stick (figure 2-96) energizes the solenoid of the shutoff valve and directs utility system hydraulic pressure into the nose wheel steering system. Utility pressure of 3000 psi is reduced to 800-1100 psi by the pressure reducing valve, and the hydraulic fluid is transmitted through a special filtering unit to the steer-damp unit. When the system is pressurized, movement of the rudder pedals is transmitted from the cable sector through cable linkage to the steer-damp unit where the clutch is engaged, and fluid under the reduced pressure is ported to the selected side of the power cylinder chamber. Releasing the switch on the pilot's control stick de-energizes the solenoid in the shutoff valve, closing the valve, preventing further pressure from the utility system from entering the nose wheel steering system, and opening the steering system input line to return. With the steering system inoperative, static fluid in the steer-damp unit is displaced from one side of the power cylinder to the other through the restrictor valves, producing a shimmy damper effect upon the nose wheel.



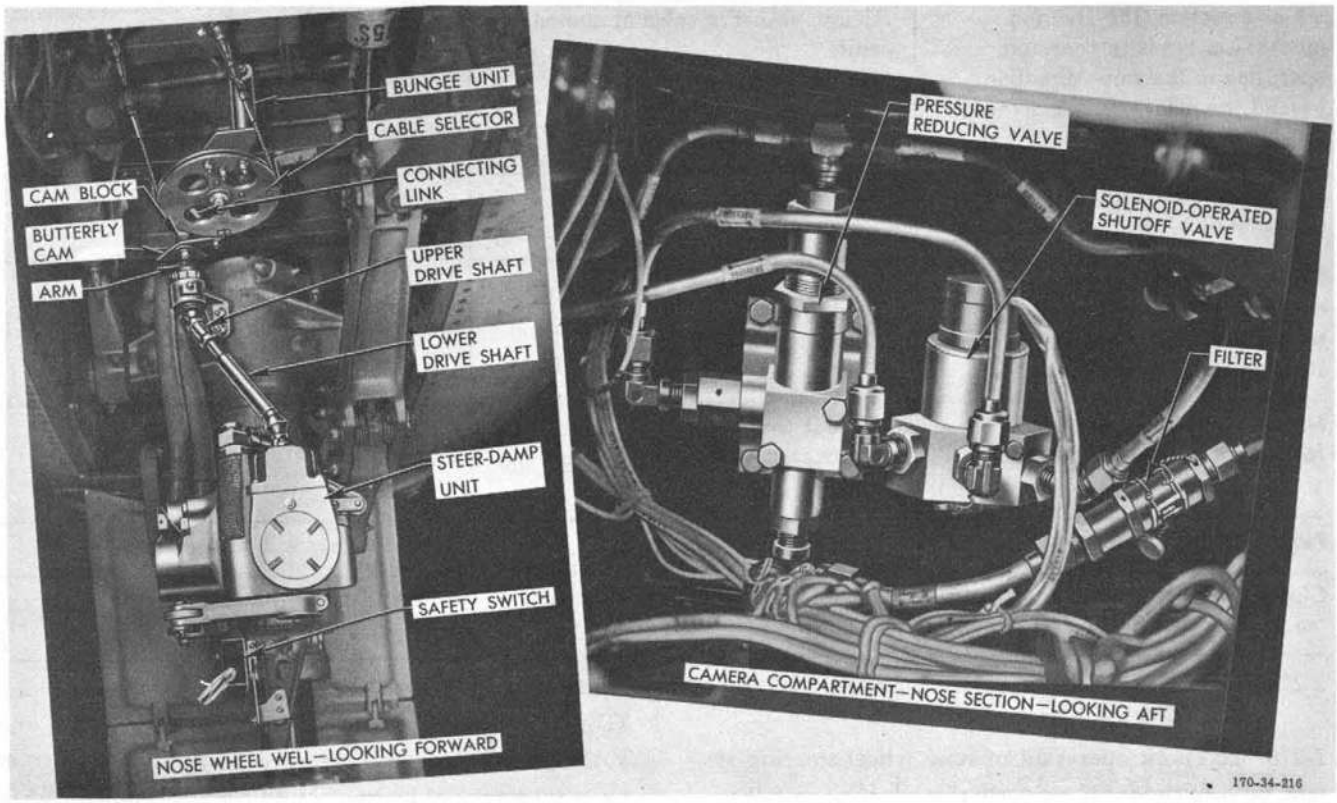


Figure 2-95. Nose Wheel Steering System

Note

When the weight of the airplane is not on the nose wheel and the shock strut is fully extended, the safety switch is open, preventing electrical current from energizing the solenoid of the shutoff valve and rendering the selective steering mechanism inoperative.

2-274. TROUBLE SHOOTING NOSE WHEEL STEERING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Steering system is not engaged when switch on pilot's control stick is depressed.	Safety switch on shock strut not closed.	Adjust safety switch.
	Shutoff valve solenoid inoperative.	Replace shutoff valve.
	Circuit breaker on main panel open.	
	Electrical system otherwise inoperative.	
	Faulty shutoff valve.	
	Faulty pressure-reducing valve.	
	Faulty or clogged filter.	
	Clutch not engaging.	Replace steer-damp unit.
Full right-throw and left-throw of rudder differ by more than 5 degrees.	Connector link maladjusted.	
Once engaged, the steering mechanism tends to steer the airplane to one side (with the rudder pedals in neutral position).	Drive shaft has been preloaded and improperly attached to spline of damper.	Disconnect drive shaft from damper spline and realign.
Once engaged and moved in either direction, the steering mechanism tends to continue operation in the same direction beyond the point corresponding to rudder position.	Sticking or binding of spool in sleeve, or dirt in valve of damper unit.	Replace steer-damp unit.
	Binding of valve or linkage.	Replace steer-damp unit.
Steering system operates in one direction only, then locks.	Dirt in restrictor valve orifice.	Replace steer-damp unit.
Distinct lag between original energizing of shutoff valve solenoid and operation of steering mechanism.	Primer pressure in damper has been lost because of valve leak.	Replace steer-damp unit.
Nose wheel cannot be turned far enough in one direction.	Output shaft follow-up lever mislocated on spline of damper unit.	Replace steer-damp unit.
Play in steering system.	Bungee unit is loose.	Take up slack in bungee unit.
Clutch does not release (in damper unit).	Dirt in clutch or severe distortion of balls.	Replace steer-damp unit.

2-275. CHECKING NOSE WHEEL STEERING SYSTEM.

2-276. To check operation of nose wheel steering system, be sure rudder is properly rigged; then install tow wedge and ⅜-inch rigging pin. Set nose wheel protractor (figure 2-98) to zero; then remove rigging pin. (Disconnect safety switch if airplane is on jacks, and rotate switch arm into actuated position.) Connect an external source of hydraulic and electrical power. With one man in the cockpit to operate the controls and

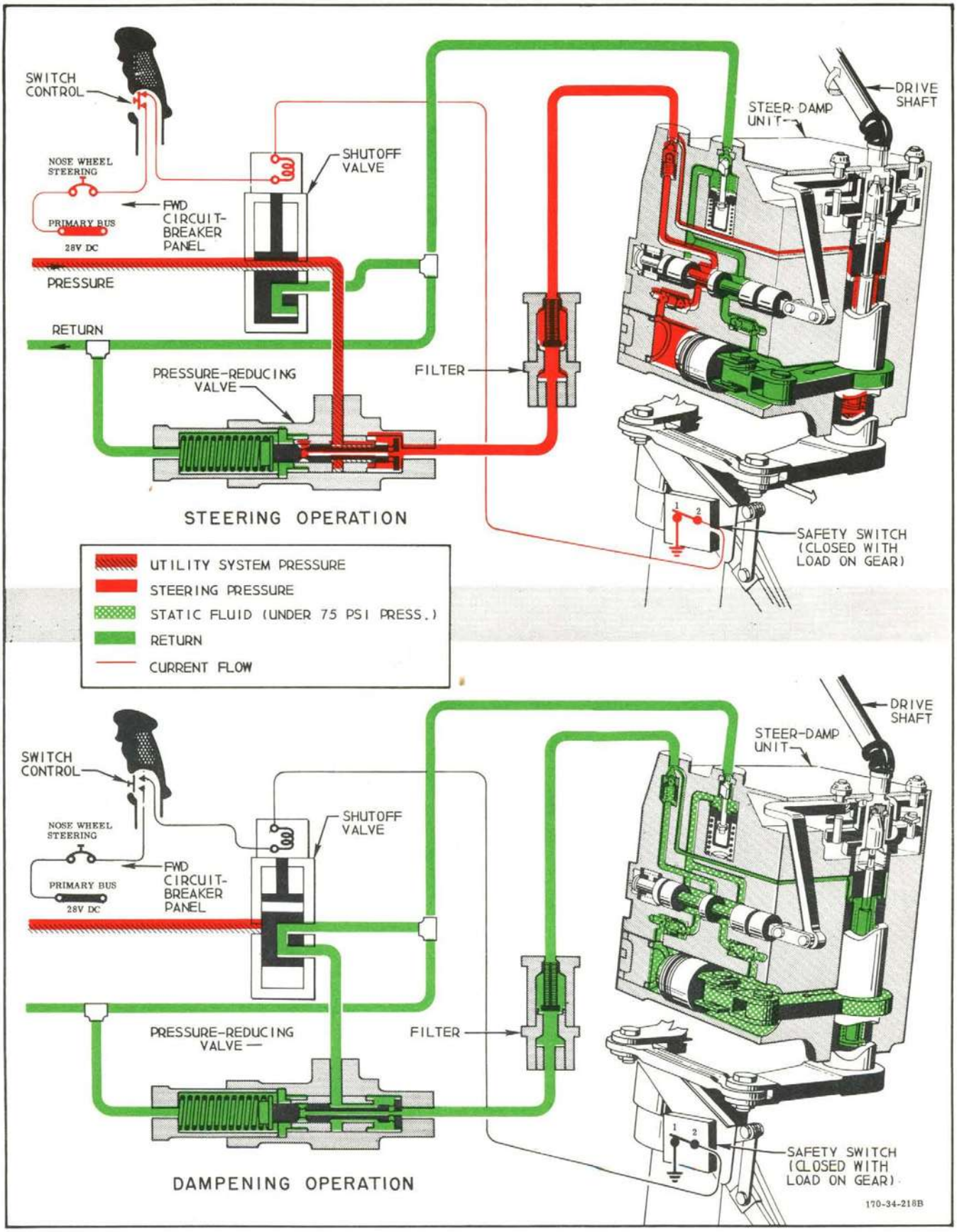


Figure 2-96. Nose Wheel Steering System Operation

1 With rudder pedals locked in neutral and steering cable sector positioned so that a line through the center of cable lock and center of cable sector is parallel to centerline of airplane, adjust steering cable to 50 pounds tension; then safety cable lock to pulley assembly.

2 Install centering spring, bushing, and upper drive shaft in support bracket; then safety with lockscrew. (Be sure spring is properly positioned as shown in detail A.)

3 With upper drive shaft locked in position, twist by hand in both directions to determine whether or not centering spring is correctly positioned and functioning properly.

4 Install cam block, and align (by serrations and shims) so that the vertical centerline of the butterfly cam pivot point is within 1/32 inch of aligning with the vertical centerline of the arm pivot point.

5 Install arm so that centerline through pivot point and engaging pin is parallel to centerline of airplane; then insert screw and tighten on shaft. Turn arm to limits of spring in both directions. If arm will not turn 30 degrees in each direction, or if binding occurs at neutral, add shims under arm as required.

6 Turn nose wheel straight ahead (by aligning jack lock holes on left side of strut). Align point of arrow on top of input shaft with punch or file mark on housing. Apply steering pressure, and then turn input shaft slightly until clutch clicks into place.

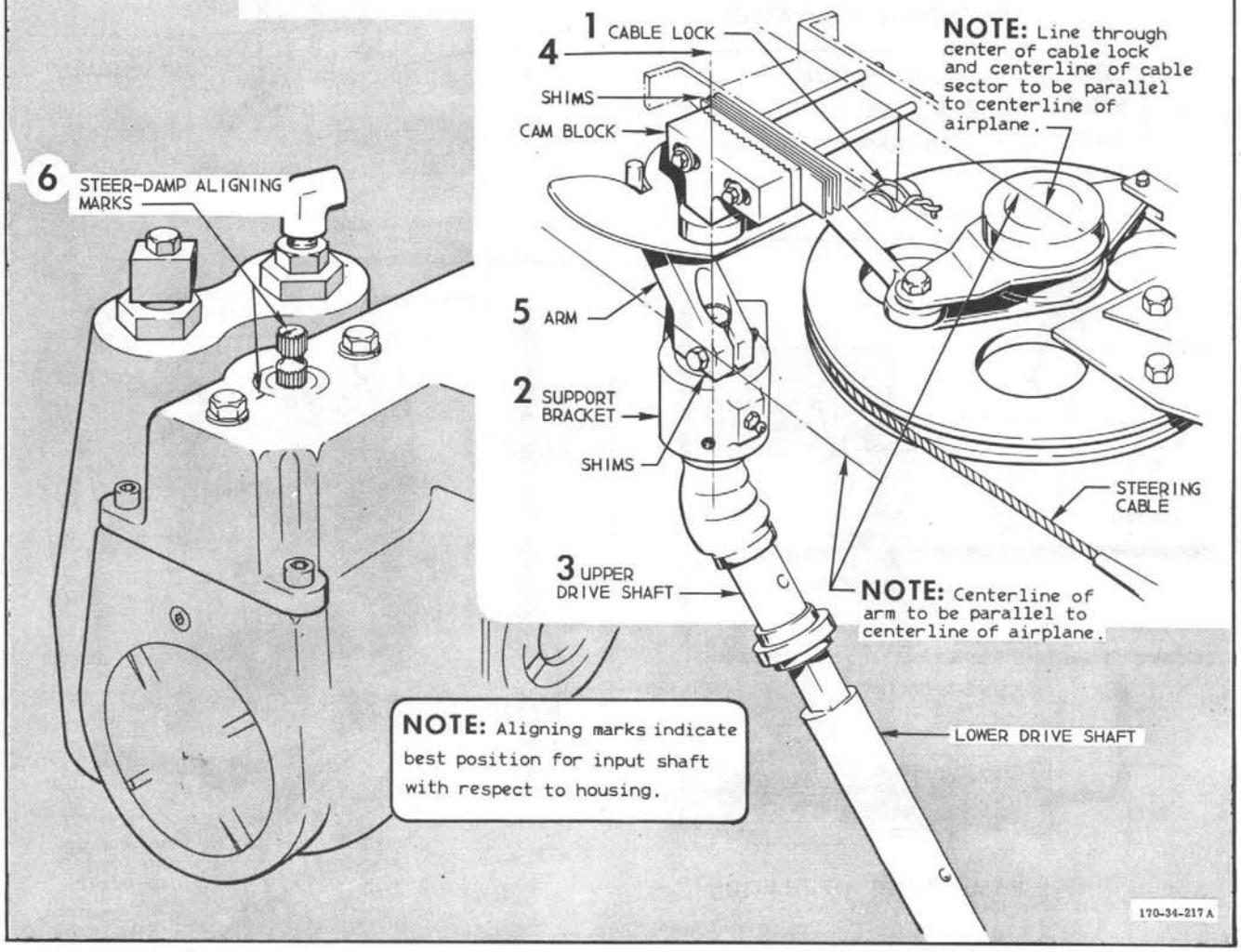


Figure 2-97. Installing and Adjusting Nose Wheel Steering System (Sheet 1 of 2)

7 With unit still pressurized, insert lower drive shaft into upper drive shaft (aligning rivets that run through drive shafts); then place lower drive shaft over input shaft (to nearest spline) and tighten lockscrew.

8 Position butterfly cam with slot around engaging pin, and install on cam block with cam shaft.

9 With steer-damp assembly centered and rudder controls in neutral, adjust the connecting rod to fit between attaching points, and install.

10 Apply pressure on left rudder pedal until steer-damp unit starts to move; then measure amount of rudder deflection. Turn off pressure and return steer-damp unit, nose wheel, and rudder to neutral. Again apply steering hydraulic pressure, and apply pressure on right rudder pedal until steer-damp unit starts to move; then measure amount of right rudder deflection. Left and right rudder deflection must correspond within one inch. If the difference exceeds one inch, adjust connecting link until deflection is within tolerance.

11 Measure the angular travel of nose wheel; travel should be 23 (+5/-2) degrees.

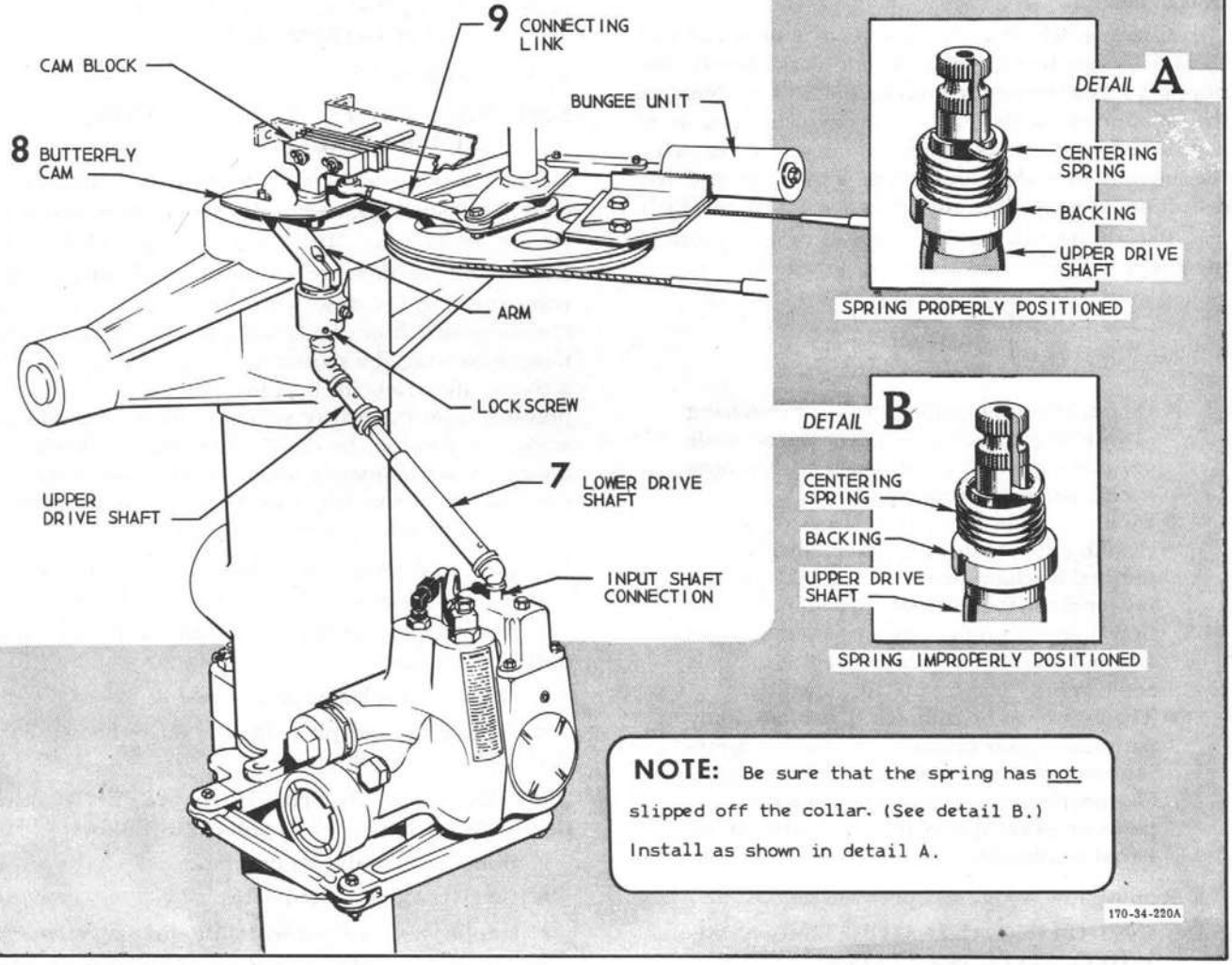


Figure 2-97. Installing and Adjusting Nose Wheel Steering System (Sheet 2 of 2)

another on the ground to observe the results, proceed in the following manner:

a. Depress nose wheel steering switch to energize the solenoid of the shutoff valve, which allows hydraulic pressure to flow into the steer-damp unit. Check operation of clutch in steer-damp unit. Clutch should engage and disengage promptly when steering button is pressed and released.

b. With steering button on control stick depressed, move rudder pedals slowly to either side and observe the results. When the rudder pedals are in full-throw position, the torque links should turn in the same direction a maximum of 23 (+5/−2) degrees. Make sure that torque links will steer satisfactorily in both directions. Return rudder pedals to neutral.

c. Apply either right or left rudder and check operation of follow-up system in steer-damp unit. When torque links reach a position corresponding to that of the rudder pedals, the follow-up mechanism within the steer-damp unit should return the control valve to neutral, cut off the hydraulic pressure supply to the power output arm, and stop the torque links. Return the controls to neutral.

d. Check synchronization between nose wheel and rudder by applying right rudder very slowly and stopping when the torque links begin to move. Measure the amount of rudder deflection. Return controls to neutral and repeat check on left rudder, again measuring the amount of rudder deflection. The right and left deflections of the rudder must coincide within one inch.

e. Return controls to neutral and disconnect external sources of hydraulic and electrical power.

CAUTION

- Do not attempt to adjust stroke or centering of valve itself. Such adjustment can be made only on a hydraulic test bench with proper testing and measuring equipment.
- Do not attempt to repair a "frozen" unit by cleaning dirt, paint, etc, from the valve, the internal mechanism, or the internal restricting orifices. Presence of dirt in such locations shows a probability that there is other internal dirt. In such cases, replace the unit and carefully inspect the airplane filters.
- The unit must be completely masked if any painting, steam cleaning, or similar spraying operation is to be done in its vicinity. Malfunction can be caused by penetration of paint or other sprays into the valve or internal mechanism.

f. Remove tow wedge and protractor.

2-277. INSTALLING AND ADJUSTING NOSE WHEEL STEERING SYSTEM.

2-278. See figure 2-97.

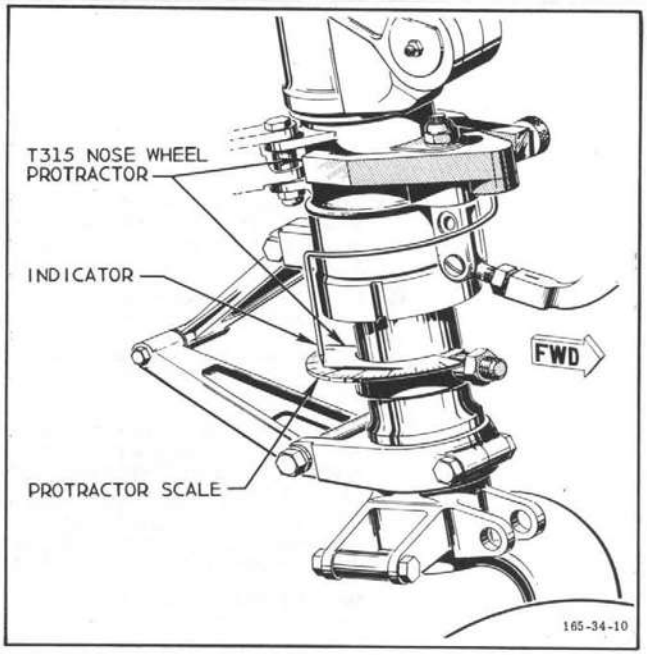


Figure 2-98. Nose Wheel Protractor T315

2-279. ADJUSTING NOSE WHEEL STEERING SYSTEM SAFETY SWITCH.

2-280. See figure 2-99.

2-281. NOSE WHEEL STEERING SYSTEM SHUTOFF VALVE.

2-282. The two-position solenoid-operated shutoff valve (Adel 23569-3) is located in the nose section, below the jet air intake duct. The valve, spring-loaded in the closed or off position, prevents utility hydraulic pressure from entering the nose wheel steering system. When the safety switch on the landing strut is in closed position, depressing the switch on the pilot's control stick activates the solenoid, opening the valve and making pressure from the utility system available for selective steering operation. In the de-energized condition, the shutoff valve completely shuts utility pressure off from the nose wheel steering system and opens the steering system input line to return.

2-283. REMOVING SHUTOFF VALVE. To remove shutoff valve (figure 2-95), proceed as follows:

a. Remove access plate in bottom of jet air intake duct nose section.

b. Disconnect solenoid lead wires.

c. Disconnect and plug lines at valve. Loosen bolts. Remove valve assembly.

2-284. INSTALLING SHUTOFF VALVE. To install shutoff valve (figure 2-95), proceed as follows:

a. Bolt shutoff valve to bulkhead.

b. Connect solenoid lead wires.

c. Unplug and connect hydraulic lines at valve.

d. Install access plate in bottom of jet air intake duct nose section.

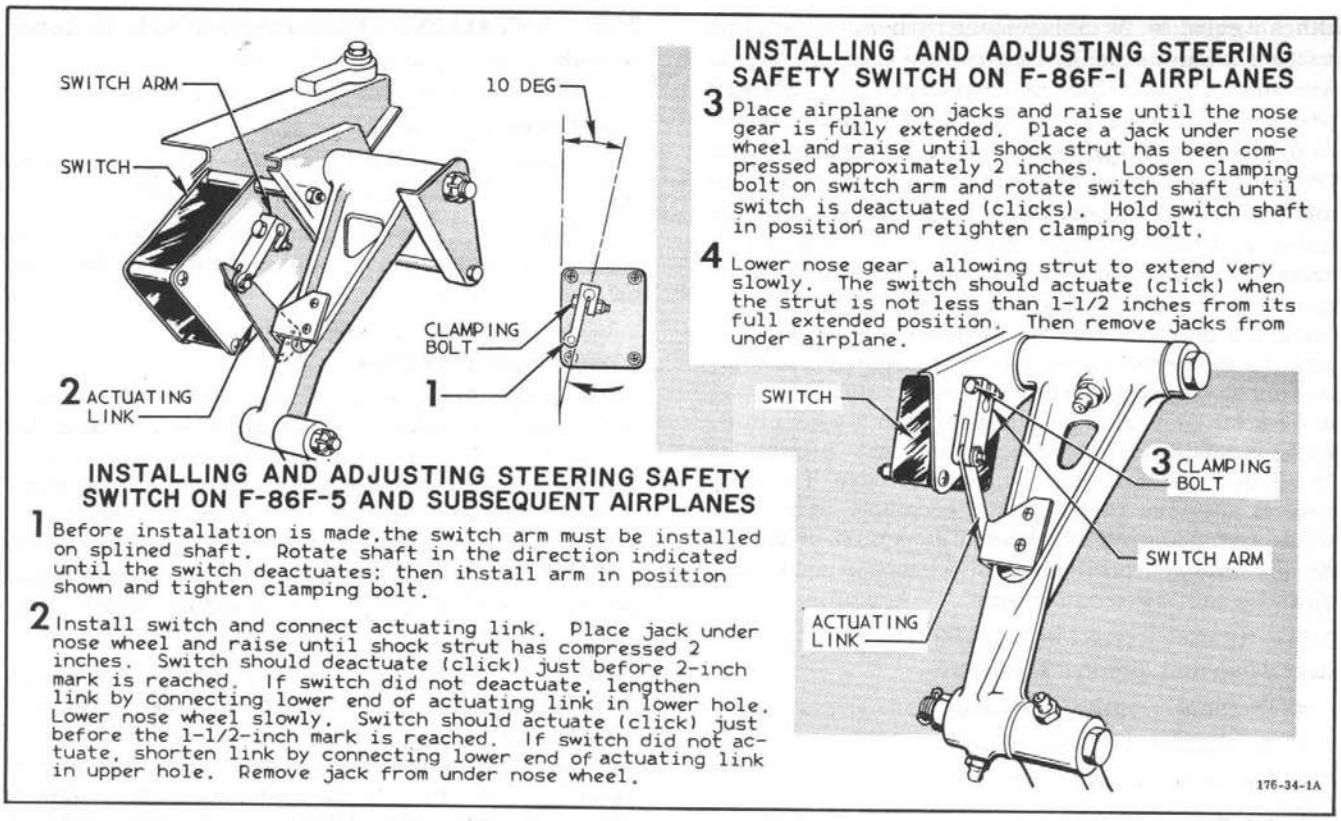


Figure 2-99. Adjusting Nose Wheel Steering System Safety Switch

2-285. NOSE WHEEL STEERING SYSTEM PRESSURE-REDUCING VALVE.

2-286. The pressure-reducing valve reduces the 3000 psi pressure of the utility pressure system to 800-1100 psi, at which the steer-damp unit is designed to operate. The valve is located in the nose section, just below the jet air intake duct. Hydraulic pressure applied at the valve inlet compresses a piston, spring-loaded to 1100 psi. At pressures up to 1100 psi, the valve is open and pressure is transmitted to the steer-damp unit. As pressure builds up to more than 1200 psi, the valve closes, opening the regulated port line to return.

2-287. REMOVING PRESSURE-REDUCING VALVE. To remove a pressure-reducing valve (figure 2-95), proceed as follows:

a. Remove access plate in bottom of jet air intake duct nose section.

b. Disconnect and plug hydraulic lines at valve.

c. Loosen bolts and remove valve.

2-288. INSTALLING PRESSURE-REDUCING VALVE. To install pressure-reducing valve (figure 2-95), proceed as follows:

a. Bolt pressure-reducing valve to bulkhead.

b. Unplug and connect hydraulic lines at valve.

c. Install access plate in bottom of jet air intake duct nose section.

2-289. NOSE WHEEL STEERING SYSTEM FILTERS.

2-290. The nose wheel steering system filter is provided to protect the steer-damp unit from particles of dirt and foreign matter. It is installed in the pressure line between the pressure-reducing valve and the steer-damp unit, and is located in the nose section, just below the jet air intake duct. When the filter element (Purolator 36837) becomes dirty, it must be replaced. To replace the filter element, exhaust the system pressure; then remove the filter from the line. Unscrew the filter and remove the filter element. When replacing the filter element, always use new "O" ring seals and keep element clean.

2-291. REMOVING FILTER. To remove filter (figure 2-95), proceed as follows:

a. Remove access plate in bottom of jet air intake duct nose section.

b. Disconnect hydraulic lines and remove filter.

2-292. INSTALLING FILTER. To install filter (figure 2-95), proceed as follows:

a. Connect hydraulic lines.

b. Install access plate in bottom of jet air intake duct nose section.

2-293. NOSE WHEEL STEERING SYSTEM STEER-DAMP UNIT.

2-294. The steer-damp unit (Haskell 2022), mounted on the nose gear shock strut, incorporates the following construction features: a steering control valve, a clutch, a follow-up mechanism, a piston, two flow restrictor valves, and a spring-loaded compensator valve. Under steering pressure of 800 to 1100 psi, the steer-damp

clutch is engaged; by cable linkage from the rudder cable sector, it positions the steering control valve during the first stage of the follow-up operation. The hydraulic pressure is directed to the desired side of the power piston by the steering control valve. The power output lever arm, thus actuated, is connected to the follow-up mechanism and accomplishes the second stage of the follow-up operation, repositioning the steering control valve to neutral position. Minimum inlet pressure required to engage the clutch is 600 psi. At lower pressures, the selective-steering mechanism is inoperative, and the steer-damp unit acts as an effective shimmy damper by means of two flow restrictor valves operating in the return flow lines on both sides of the power piston. Fluid is retained in the damper unit, at a pressure of 75 psi, by a spring-loaded compensator valve. The valve ensures adequate priming of the damper unit at all times, compensating for thermal expansion of the hydraulic fluid and preventing air-oil separation at high altitudes and low temperatures.

2-295. REMOVING STEER-DAMP UNIT. To remove steer-damp unit, proceed as follows:

a. Disconnect upper and lower drive shafts.

b. Disconnect and plug lines.

c. Disconnect power output arm.

d. Loosen bolts.

e. Remove assembly.

CAUTION

The steer-damp unit is filled with hydraulic fluid under 75 psi pressure at all times. Do not depress either of the two check valves which are part of the steer-damp unit.

2-296. INSTALLING STEER-DAMP UNIT. To install steer-damp unit, proceed as follows:

a. Bolt steer-damp assembly to shock strut.

b. Connect power output arm.

c. Connect lines, making sure that they are full of hydraulic fluid and contain no trapped air.

d. Before connecting lower drive shaft to upper drive shaft, align arrow on input shaft with punch mark on clutch housing.

e. Adjust system as shown in figure 2-97.

2-297. BRAKE SYSTEM.

2-298. Rotor-disk hydraulic brakes are mounted on each main axle. The brakes are actuated by toe pedals on the rudder bars. Included in the brake hydraulic system are the master brake boost cylinders, parking brake valve, brake units, and disconnect couplings. (See figure 2-100.) The master brake boost cylinders are supplied with fluid from the utility system reservoir, and brake boost pressure is supplied from the utility power system.

2-299. FUNCTION OF BRAKE SYSTEM.

2-300. When brake pedal load is applied, the master cylinder piston directs pressure to the brake unit at the wheel. This load, through linkage between the pedal and the cylinder, also exerts an upward pull on a lever assembly. The lever, being offset, tends to straighten itself with the upward pull. When the brake pedal load reaches approximately 20 pounds, a spring on the lever depresses the boost valve shaft. This mechanical action meters the boost pressure from the main hydraulic system to assist the pilot in the actuation of the master brake piston. The greater the load applied at the brake pedal, the more pull there is to straighten the lever; therefore, the spring exerts more force on the end of the boost valve shaft and increases the amount of boost pressure. See figures 2-101 and 2-102.

2-301. TROUBLE SHOOTING BRAKE SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Uneven brake action with equal pedal pressure.	Oil on linings. Brakes not adjusted evenly. Linings worn excessively. Scored, pitted, or galled rotors. Brake control valve out of adjustment.	Wash or replace linings. Equalize adjustment of return springs. Replace linings. Replace rotors. Adjust brake control valve.
Grabbing of brakes.	Stator plates warped. Rotors warped, scored, or galled. Grease- or oil-soaked linings.	Replace stator assembly. Replace rotors. Drag brakes to burn off grease or oil; wash or replace linings.
Insufficient braking.	Hydraulic pressure too low. Boost control valve sticking in master cylinder. Arm of master cylinder binding.	Check hydraulic system, including brake control valve. Repair or replace valve. Correct if possible; if arm is bent, replace.

TROUBLE	PROBABLE CAUSE	REMEDY
	Friction in rudder pedal rigging.	Check for binding and correct to proper clearances.
	Insufficient pedal travel.	Adjust pedals for full travel.
	Glazed linings.	Replace linings.
	Sticking automatic brake adjusters.	Correct or replace automatic adjusters.
Violent braking or locking of wheels.	Damp linings.	Dry linings by dragging brakes.
	Corroded rotors.	Taxi slowly with light brake applications, or replace rotors.
	Loose bolts attaching brake to torque flange.	Tighten bolts.
	Dust, grit, or sand in brake.	Disassemble and clean.
Screeching brakes.	Cracked carrier or loose bolts.	Replace carrier, or tighten bolts.
	Loose or broken brake blocks.	Tighten or replace brake blocks.
Brake drag or overheating.	Insufficient brake clearance.	Adjust clearance of automatic adjusters.
	Dished or warped stators.	Replace stators.
	Dished or warped rotors.	Replace rotors.
	Brake return springs exert insufficient force.	Replace defective springs.
	Automatic adjuster slippage.	Reset friction load of adjuster clamps near high limit.
	Slight warpage or swelling of new lining.	Wear in lining with light energy stops.
	Erratic adjuster action.	Check pins and blocks for corrosion, presence of excessive cadmium plate, or scoring. Check pins for taper or bend. Replace or adjust unserviceable parts.
Brake assembly hydraulic leakage.	Damaged piston cup.	Replace piston cup.
	Dirty hydraulic fluid.	Drain, flush, and refill hydraulic system.
	Scored cylinder walls.	Replace assembly.

2-302. CHECKING BRAKE SYSTEM.

2-303. With brakes properly bled and a pressure gage in each brake line, make the following brake check:

a. With the main hydraulic system pressurized, gradually push on brake pedals; the boost pressure should cut in at approximately 20 pounds pedal load. Increase load to 65-70 pounds; the brake pressure at the wheel should be a minimum of 325 psi.

b. With the hydraulic system pressure exhausted (without boost), apply brakes at 100 pounds pedal load. The brake pressure at the wheel should not be less than 130 psi. Brakes should release immediately with or without the boost.

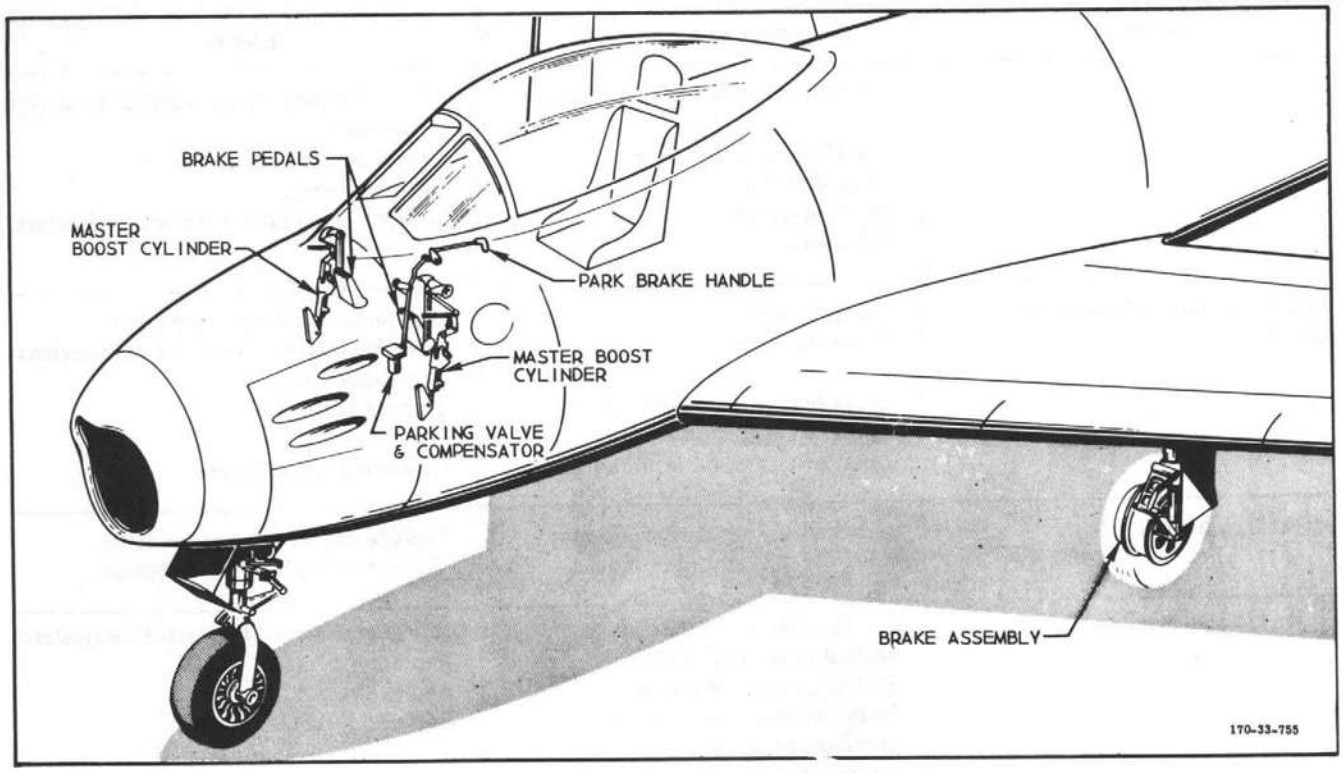
c. With boost pressure operating, park the brakes by pressing hard on the pedals (approximately 60 pounds minimum) and pulling the parking handle slowly out to the fully extended position while maintaining this pedal pressure. While holding the handle all the way out, release the pedals; then release the handle. Release the parking brake by depressing pedals. Parking brake valve should reseat in the off position without any necessity for pushing the handle. If valve does not reseat, check linkage for binding.

d. Set the parking brakes again; then exhaust system boost pressure and check to see that just pushing parking handle will release brakes.

e. Again set the parking brakes; brakes should hold for a minimum of one hour.

Note

The parking brake compensator is inoperative at brake pressure below 170 psi; therefore, when airplane is parked, sufficient pedal loads must be exerted to displace compensator to at least half its normal travel (approximately 300 psi brake pressure). It is unnecessary to check this pressure with a gage. If, on initial check, brakes do not hold, repeat check at a higher pedal load.



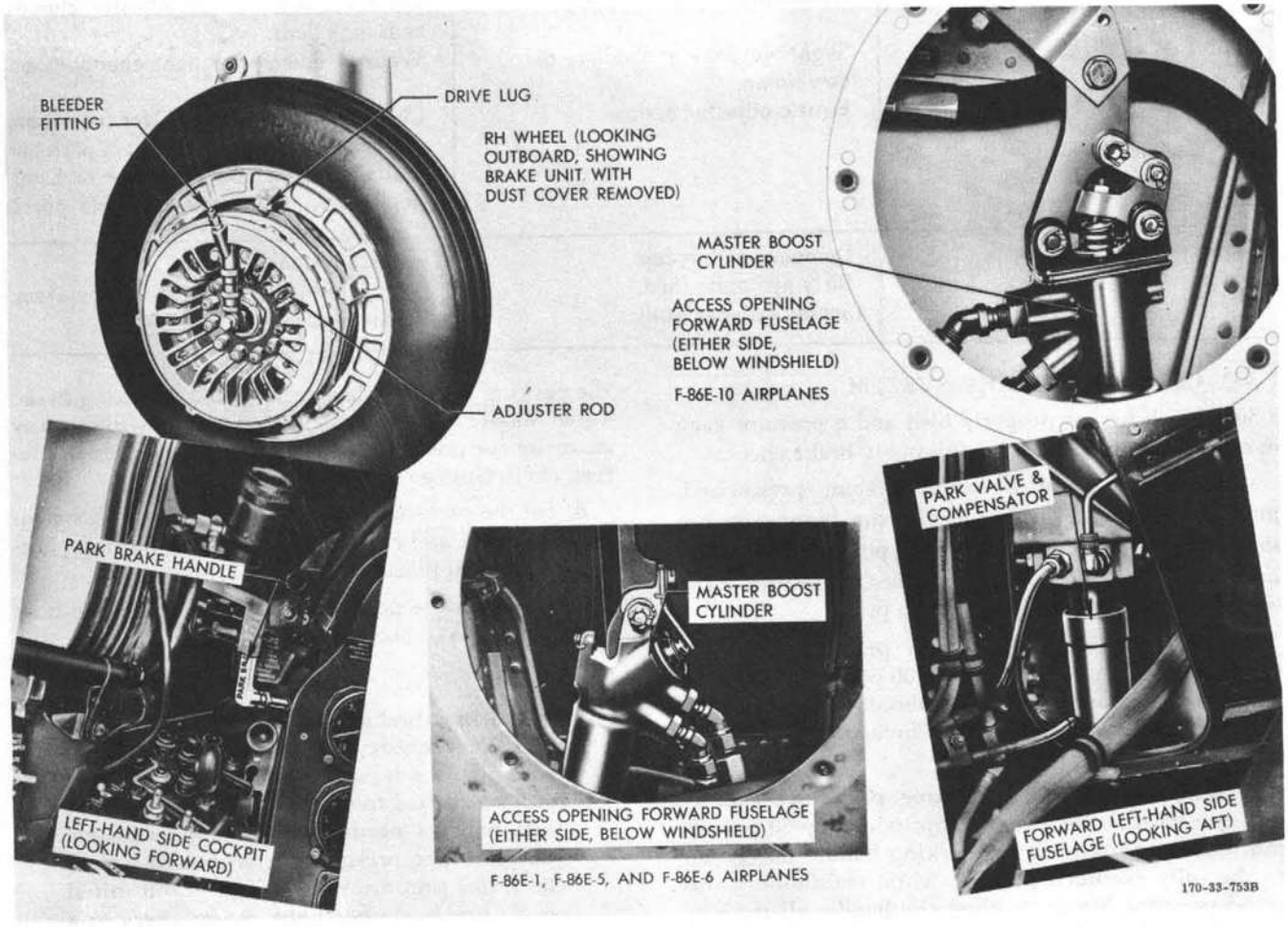


Figure 2-100. Brake System

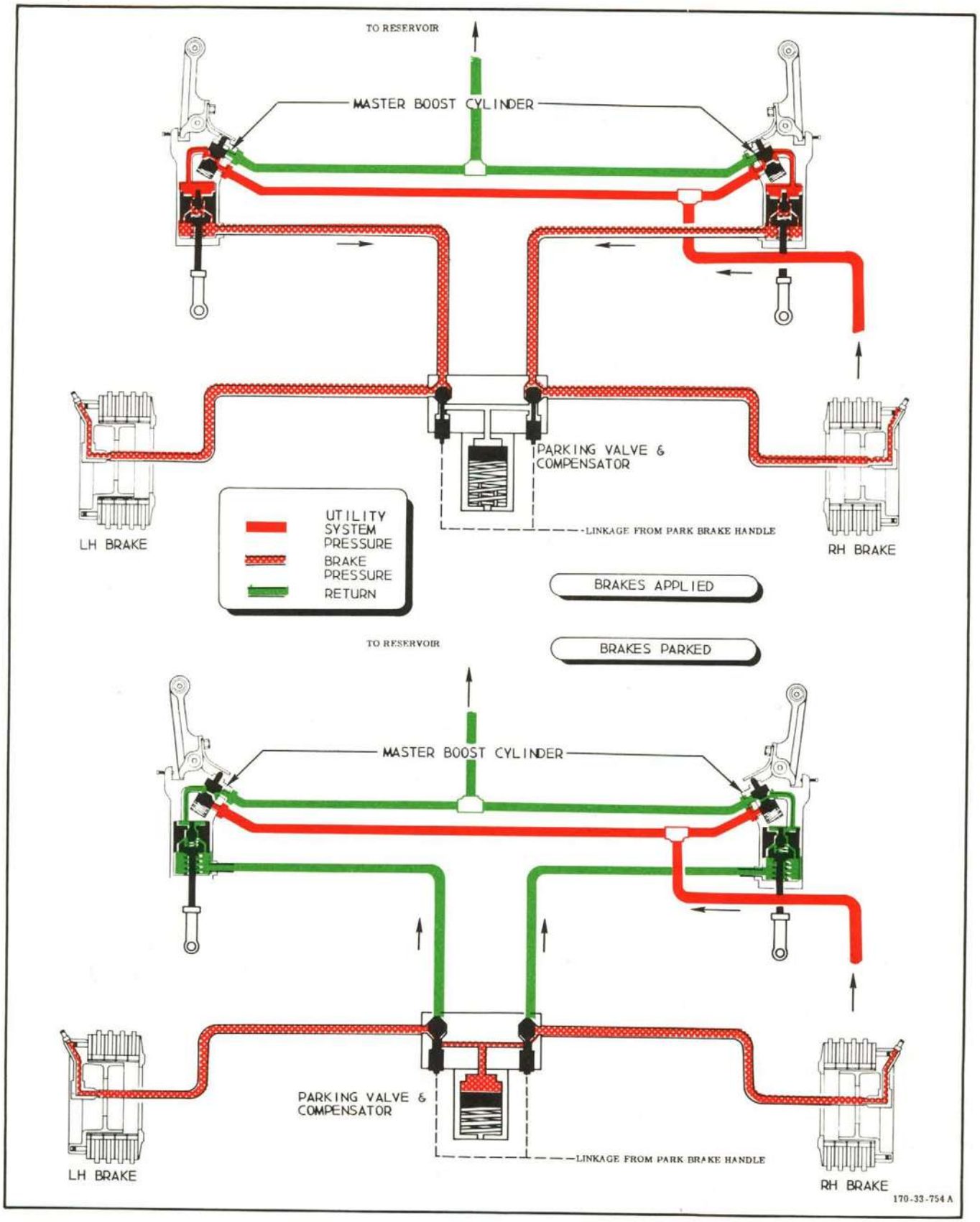


Figure 2-101. Brake System Operation—F-86E-1, F-86E-5, and F-86E-6 Airplanes

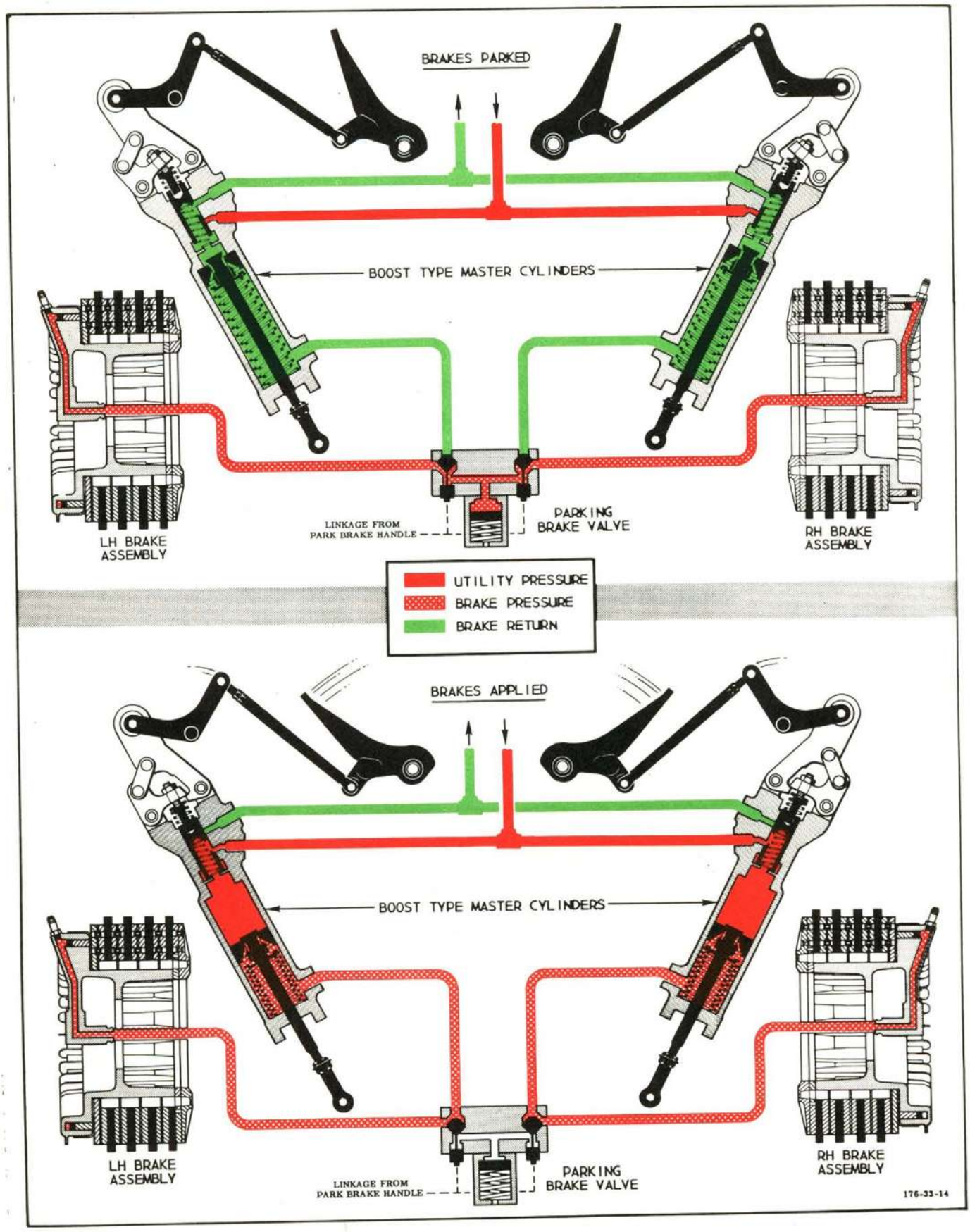


Figure 2-102. Brake System Operation—F-86E-10 and F-86E-15 Airplanes

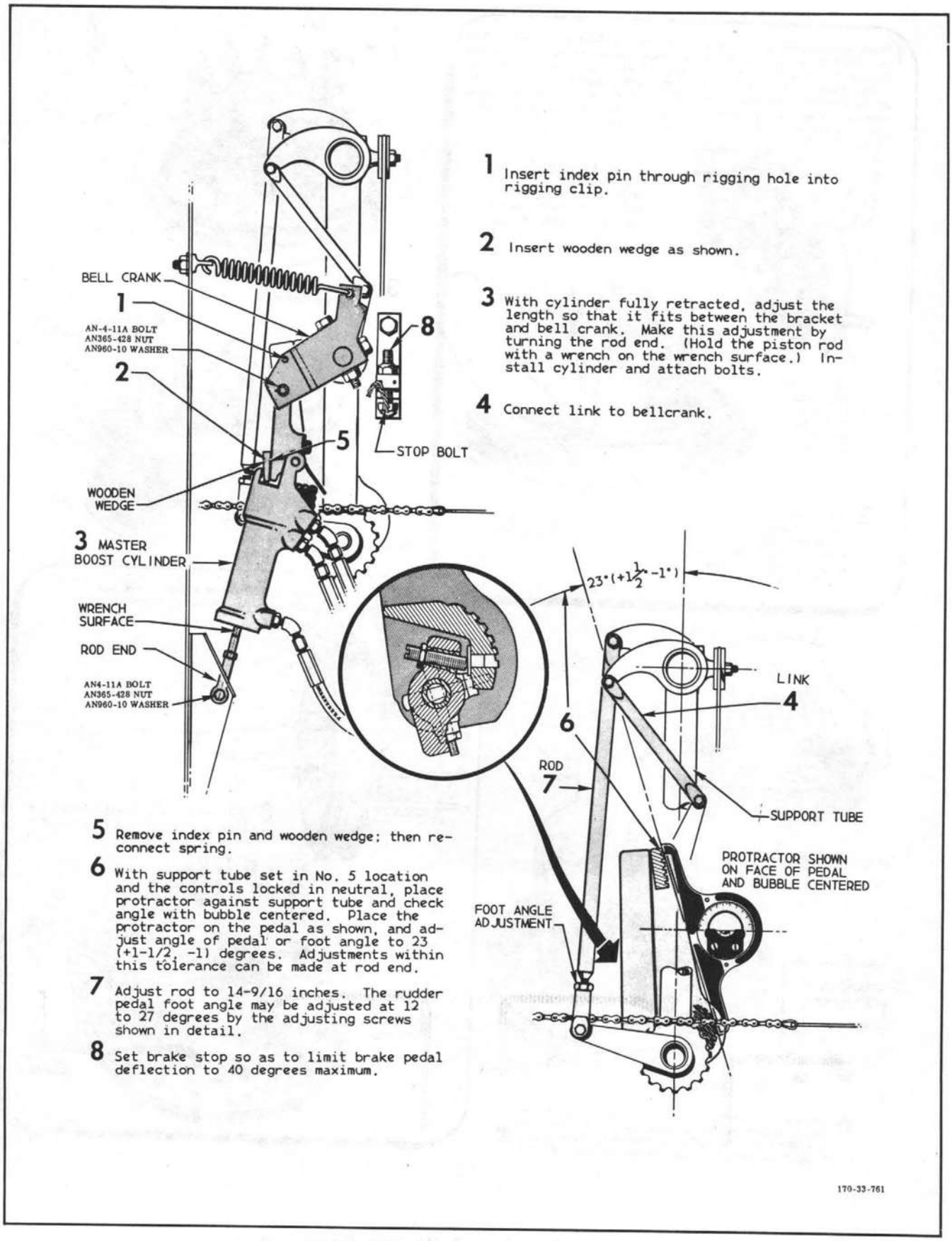


Figure 2-103. Adjusting Brake Control Linkage—F-86E-1, F-86E-5, and F-86E-6 Airplanes

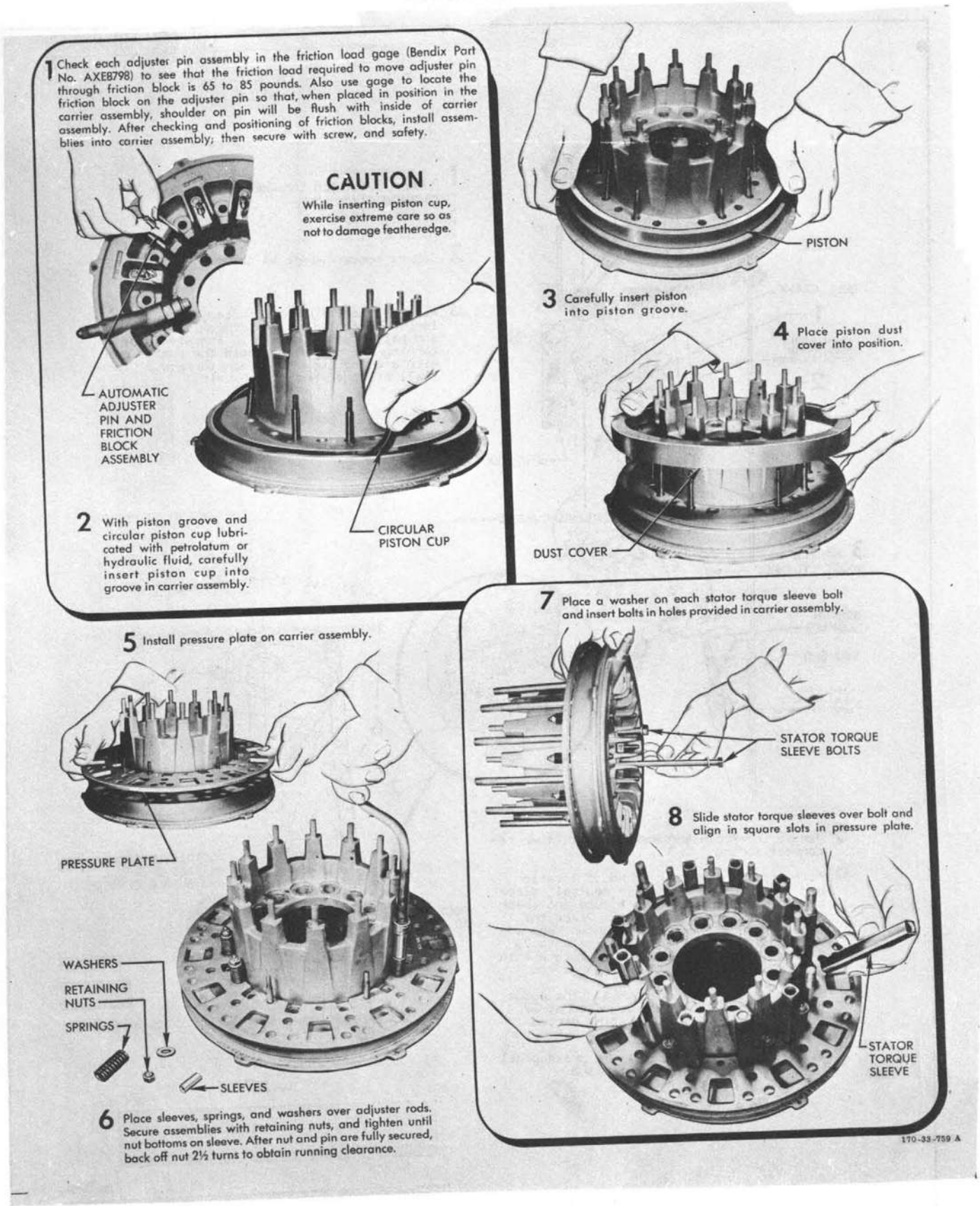


Figure 2-104. Assembling Brake Units (Sheet 1 of 2)

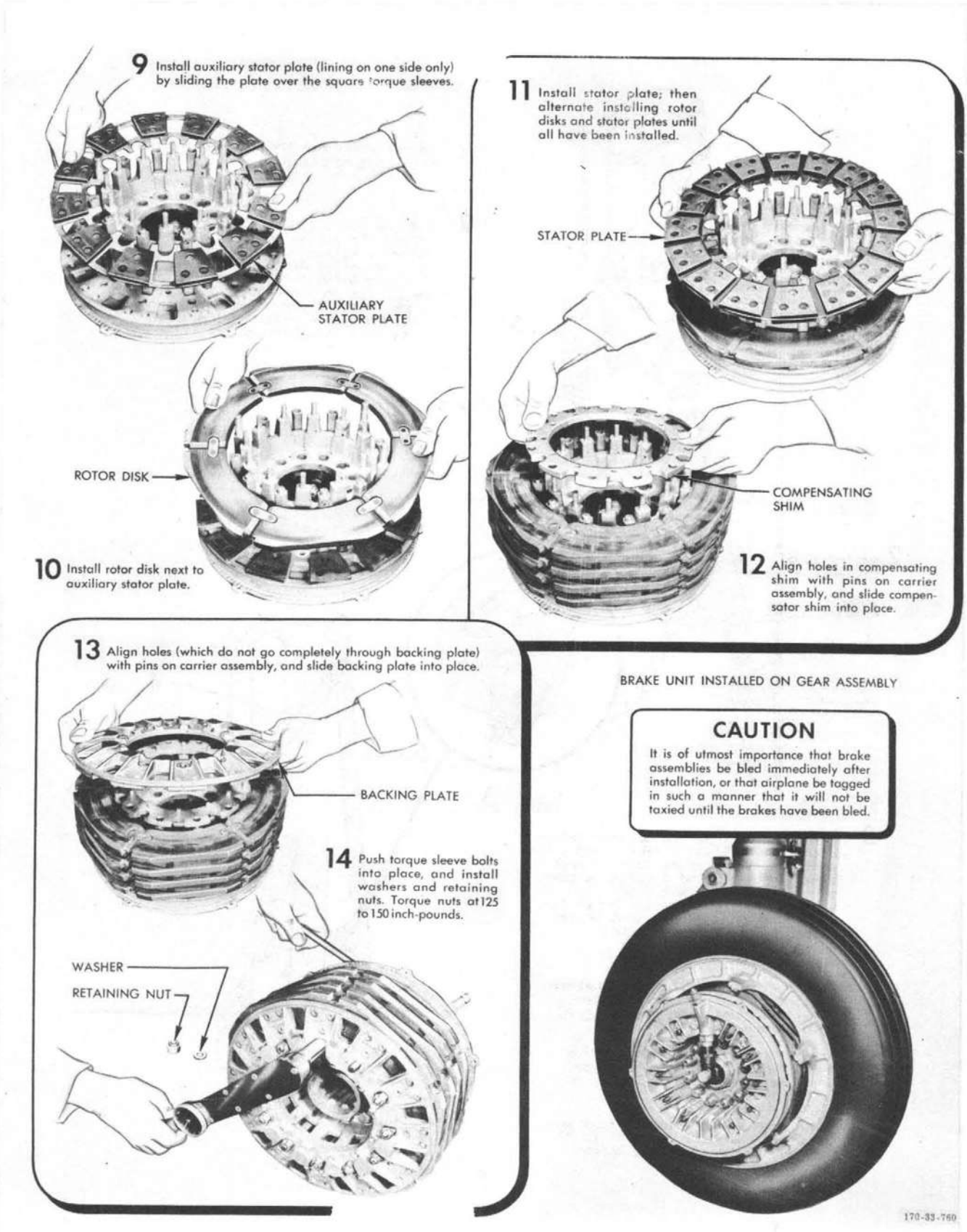


Figure 2-104. Assembling Brake Units (Sheet 2 of 2)

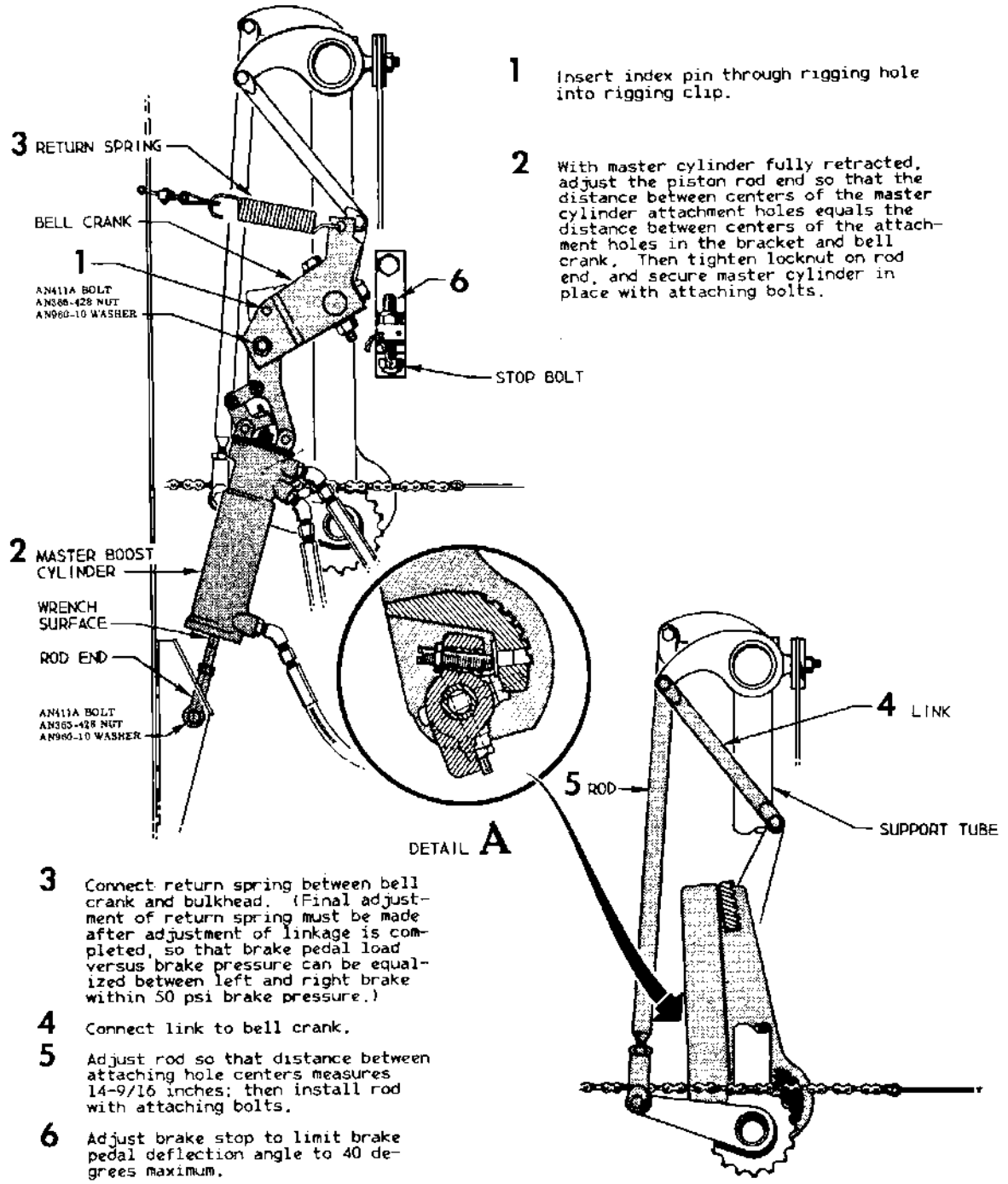


Figure 2-105. Adjusting Brake Control Linkage—F-86E-10 and F-86E-15 Airplanes

CHECKING BRAKE WEAR

With new brake linings, adjuster rods should extend approximately 25/32 inch from friction blocks. To determine the amount of lining wear, check this dimension. If lining is worn so that the adjuster rod extends only 11/32 to 3/32 inch, the brake wear compensating shim must be removed and adjuster rod reset.

When checking brake wear after removal of compensating shim, measure adjuster rods. If they extend only 11/32 to 3/32 inch, the brakes must be relined.

CAUTION:

Brakes should not be used if extension of adjuster rod is 3/32 inch or less.

RELINING BRAKES

To reline brakes, remove backing plate, and pull out stator plates and rotor discs. Reset adjuster rods and clearance nuts; then install new lined stator plates and backing plate. Be sure to get stator plates and rotor plates in proper position and to reinstall compensating shim. (Refer to index for page number of assembling procedure.)

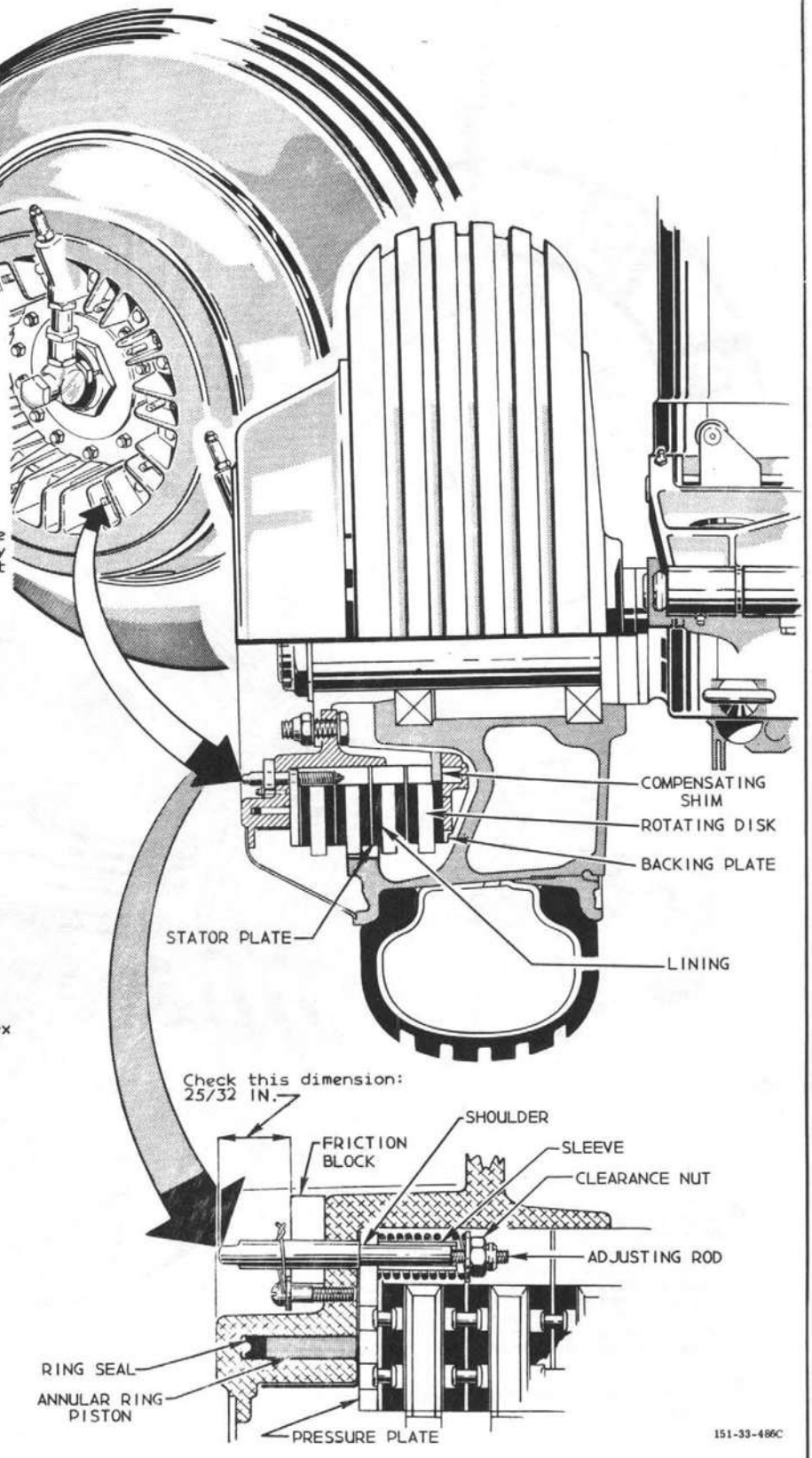


Figure 2-106. Relining and Resetting Brakes

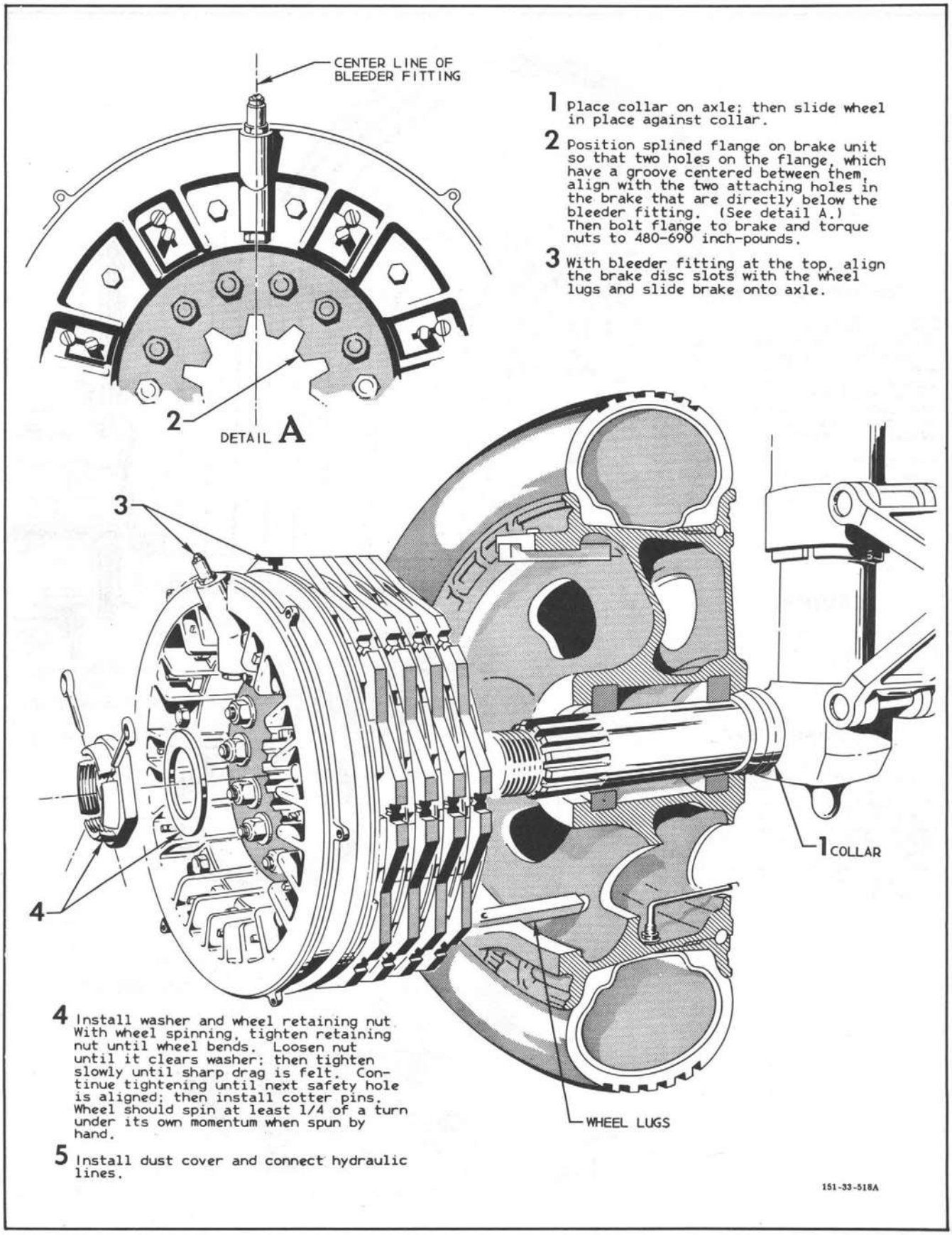


Figure 2-107. Installing Wheels and Brakes

2-304. FILLING AND BLEEDING BRAKE SYSTEM.

2-305. Refer to paragraph 1-48.

2-306. ADJUSTING BRAKE SYSTEM CONTROL LINKAGE.

2-307. See figures 2-103 and 2-105.

2-308. BRAKE ASSEMBLIES.

2-309. A segmented rotor-type brake assembly (Bendix 146250) is mounted on each main landing gear wheel axle. Each assembly consists of a carrier, pressure plate, stator plates, rotor disks, backing plate, automatic adjusters, piston, piston seal, and a compensating shim. Utility power pressure, metered to each brake assembly by its respective master brake cylinder, forces the piston outward from the carrier assembly. The piston then forces the pressure plate in contact with the auxiliary stator plate, which in turn is forced against the rotating rotor disks. The pressure plate is prevented from rotating by the stator torque sleeves. The brake block linings attached to the auxiliary stator plate push against the first rotor disk, which in turn moves the next stator plate into contact with the second rotating rotor disk. When stationary brake linings have been forced into contact with rotating segments, the energy created by the moving airplane is converted into heat and dissipated. Multiple brake blocks increase the rate of this heat dissipation and prevent brake seizures if rotor disks warp because of high brake temperatures.

2-310. REMOVING BRAKE ASSEMBLIES. To remove the brake assembly, proceed as follows:

a. Raise wheel off ground.

b. Disconnect hydraulic fitting.

c. Remove cotter pin from retaining nut.

d. Unscrew retaining nut and pull brake assembly from axle.

2-311. DISASSEMBLING BRAKE ASSEMBLIES. Brake may be removed as a unit from the airplane and disassembled, or it may be disassembled while still mounted to the strut torque flange. Care should be exercised in either event to keep dirt out of the piston grooves in the carrier. The brake assembly should be disassembled as follows:

a. Remove the torque sleeve bolt and nuts, and lift off the washers.

b. Lift off the backing plate.

c. Lift off the compensating shim.

d. Lift out the complete rotor disk, consisting of the rotor segments and the links. Keep the complete rotor disk as a unit. Do not intermix segments among different rotor disks.

e. Use a fiber or brass drive punch to gently tap out the torque sleeve bolts and lift out the stator torque sleeves.

f. Lift all stator plates and rotor disks out of the carrier.

g. Remove the automatic adjuster assemblies.

h. Lift out the pressure plate.

i. Remove the dust shield.

j. Place 10-32 screws in the holes provided in pistons, and remove pistons from groove.

k. Apply a short burst of air pressure into the inlet adapter in the carrier to remove the piston cups from the grooves.

l. Remove screws that hold the dust covers to the carrier, and remove dust shield screws and dust shield.

2-312. ASSEMBLING BRAKE ASSEMBLIES. See figure 2-104.

2-313. RELINING AND RESETTING BRAKES. See figure 2-106.

2-314. INSTALLING WHEELS AND BRAKES. See figure 2-107.

2-315. MASTER BRAKE CYLINDERS.

2-316. Two master brake cylinders are used in the brake system. The Douglas 3254121 cylinders are used on F-86E-1, F-86E-5, and F-86E-6 Airplanes, and the Gladden 311706 cylinders are used on F-86E-10 and F-86E-15 Airplanes. They are located forward of and above the rudder pedals on either side and are attached to the pedals by linkage. Access to the cylinders may be gained through doors located just below the forward part of the canopy on both sides of the airplane. The cylinders convert pedal force on a moving piston to hydraulic pressure in the brake lines. An internal valve meters system pressure for added boost.

2-317. PARKING BRAKE VALVE AND COMPENSATOR.

2-318. The parking brake valve and compensator is mounted on the left side just forward of the master brake cylinder. (See figure 2-100.) The valve is operated when a pedal load is applied to the brake pedals and the parking brake handle in the cockpit is pulled. This handle, through cable linkage, moves a lever on the valve and shifts the poppets to lock the fluid under pressure in the brakes. This locked-in pressure will keep the brakes applied after the pedals are released. The parking brake valve also incorporates a compensator to provide a small storage space for locked fluid under pressure when the brakes are parked and also to provide relief for thermal expansion.

Section III
HYDRAULIC UTILITY POWER SYSTEM

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3-1. HYDRAULIC UTILITY POWER SYSTEM.

Note

Paragraphs 3-2 through 3-36 cover only the information pertaining to the utility power system. The subsystems (landing gear, nose wheel steering, speed brakes, and landing brakes) that receive their pressure supply from the utility power system are covered in their respective paragraphs. The surface control hydraulic power system, a completely separate system, is also covered in its respective paragraph.

3-2. The utility power system is a 3000 psi pressure-type (closed-center) system. The power system includes an engine-driven, variable-displacement pump, which provides the fluid pressure output and controls the system pressure; a pressurized hydraulic fluid reservoir, which supplies fluid to the pump; an air pressure storage tank for supplying air pressure to the reservoir; an air pressure regulating valve for controlling the air pressure in the reservoir; an air filter for cleaning the air before it enters the storage tank; a system relief valve for preventing excessive pressure caused by surges in the system or by thermal expansion; fluid filters for cleaning the hydraulic fluid before it is returned to the reservoir; check valves to prevent reverse flow in the lines; and a snubber, a pressure transmitter, and a remote-reading pressure gage for indicating system hydraulic pressure. Quick-disconnect fittings in the pump lines facilitate removal of the pump without loss of fluid. On F-86E-10 and F-86E-15 Airplanes, a hand-pump supplied as loose equipment for making ground operational checks of the hydraulic power system can be attached to the external connections provided for that purpose. On F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes, an air purging valve is installed to bleed the air from the pump pressure and supply lines to the return line, preventing cavitation of the pump.

3-3. FUNCTION OF HYDRAULIC UTILITY POWER SYSTEM.

3-4. Fluid supply from the reservoir, which is pressurized by air from the engine compressor section, is routed to the engine-driven, variable-displacement pump. On F-86E-1, F-86E-5, and F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 through -2826, the air pressure range is from 10.3 to 15.3 psi. On F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes, the pressure range is from 6.8 to 11.8 psi. The pump controls the pressure between 2600 and 3000 psi and supplies fluid to the different subsystems operated from the power system. Return fluid from an operating system is routed through a filter before entering the reservoir. A small amount of fluid, used for lubricating and cooling the pump, is routed back to the reservoir through a separate line. A system relief valve connected between the power system pressure line and the return line prevents excessive pressure in the system. On F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes, an air purging valve bleeds air from the pressure supply line to the return line to prevent pump cavitation.

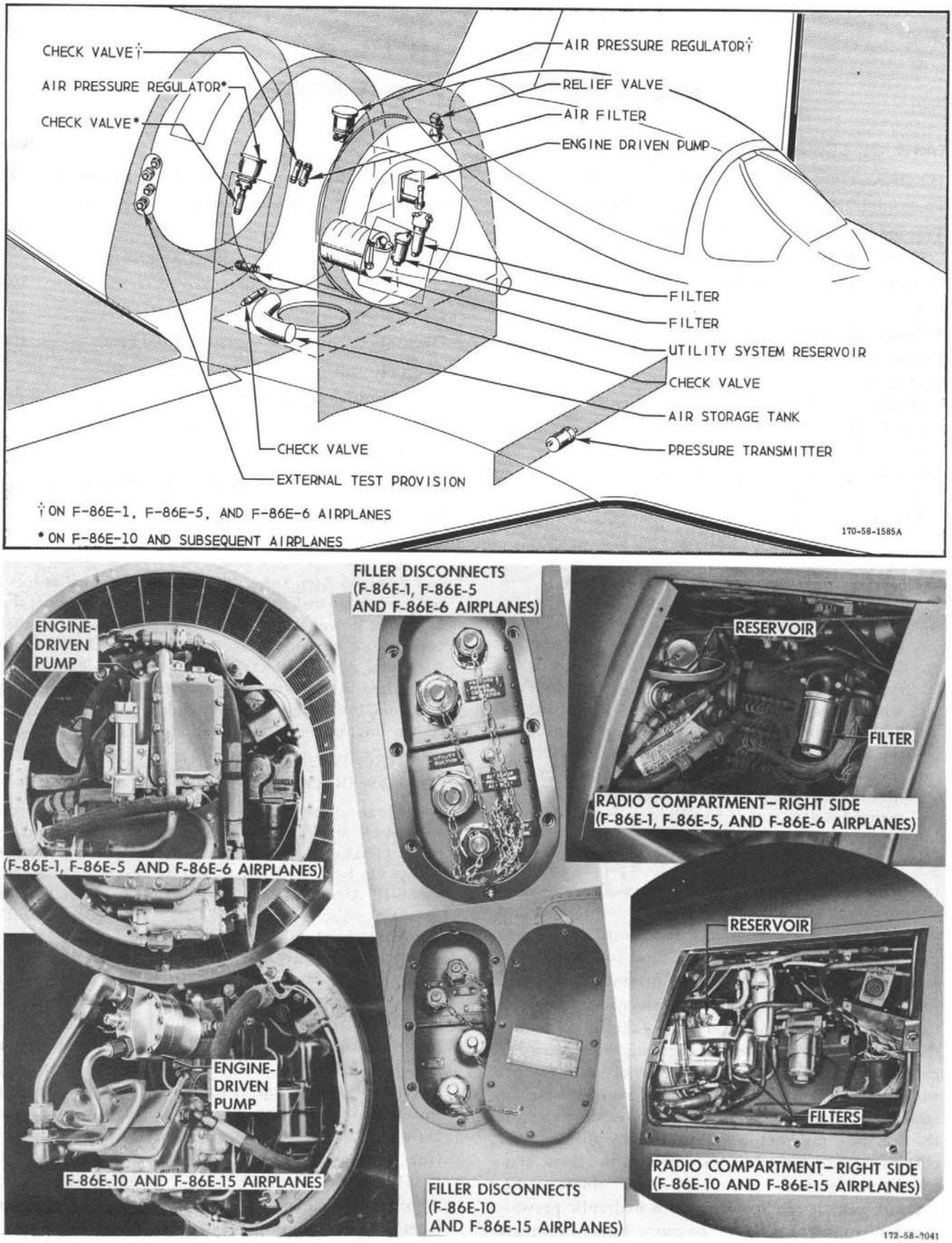

Figure 3-1. Hydraulic Utility Power System (Sheet 1 of 2)

Figure 3-1. Hydraulic Utility Power System (Sheet 2 of 2)

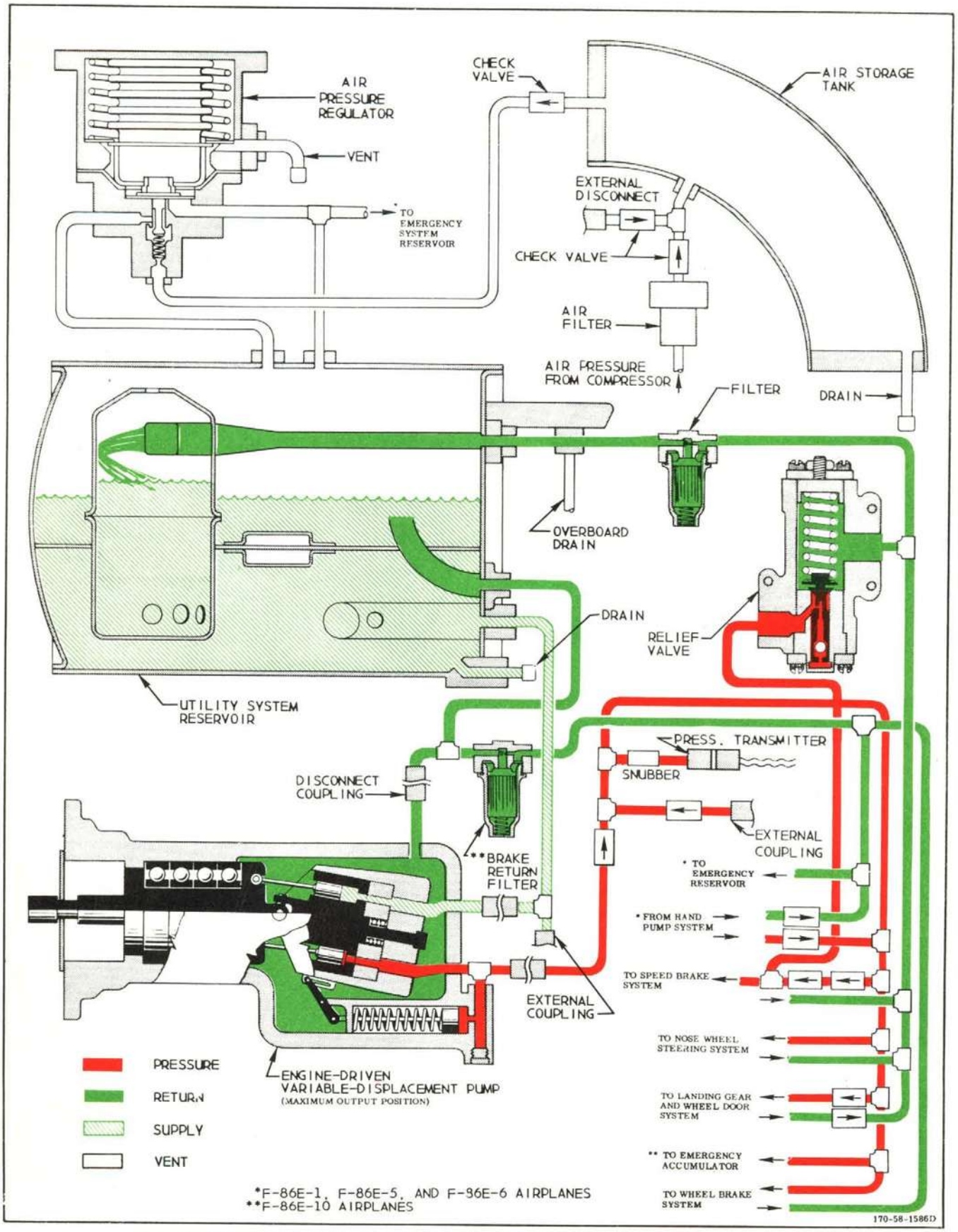

Figure 3-2. Hydraulic Utility Power System—F-86E-1, F-86E-5, and F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 Through -2826

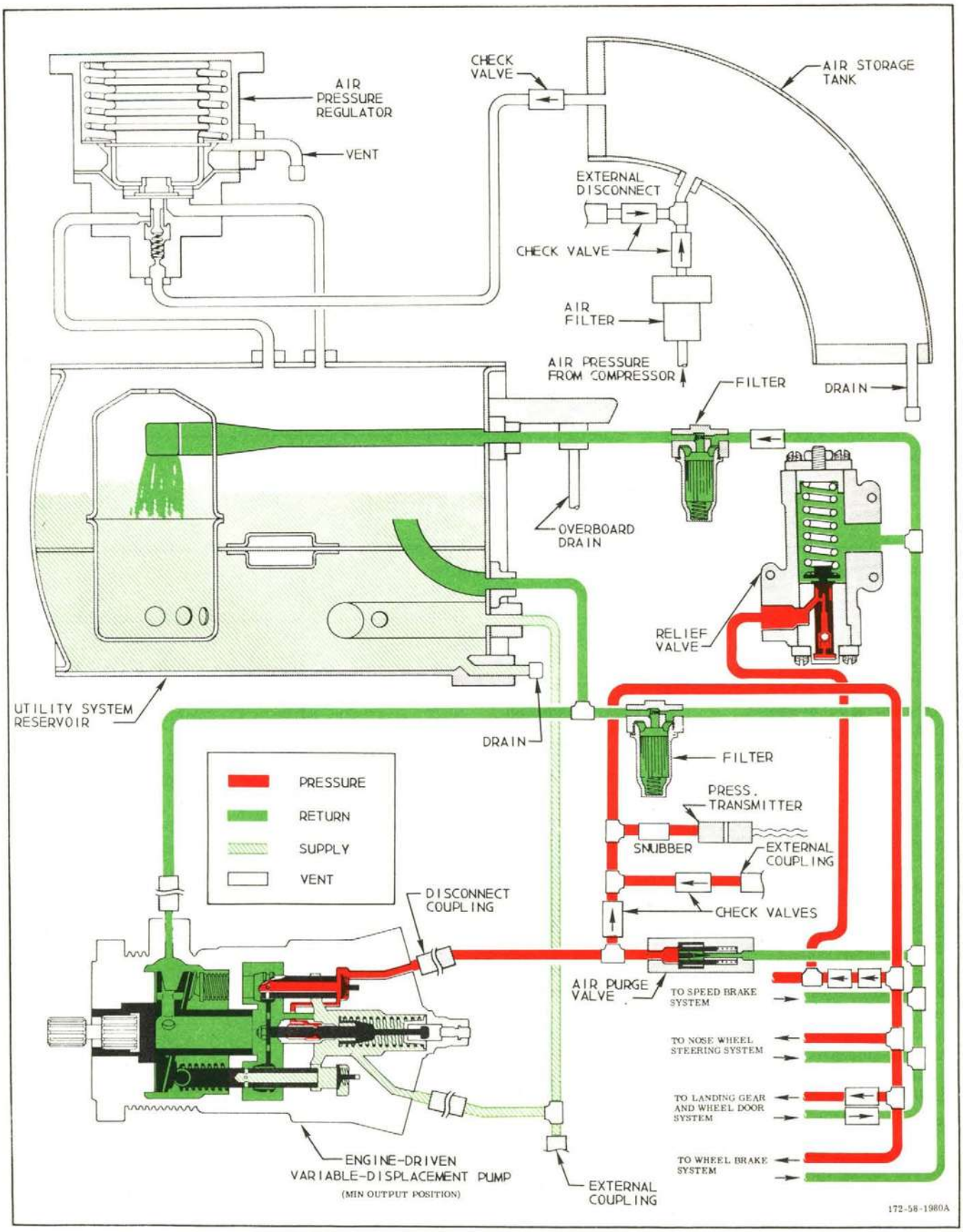

Figure 3-3. Hydraulic Utility Power System—F-86E-10 Airplanes AF51-2827 Through -2849 and F-86E-15 Airplanes

3-5. TROUBLE SHOOTING HYDRAULIC UTILITY POWER SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
System will not build up pressure.	Faulty engine-driven pump. Insufficient fluid in reservoir. External or internal leakage in system. Faulty purge valve.	
System will not build up correct pressure.	Faulty relief valve. Air in engine-driven pumps. Control unit in engine-driven pump not operating properly.	Bleed pumps. Replace pumps.
Overheating of engine-driven pump.	Air in engine-driven pump. By-pass line from engine-driven pump clogged or restricted.	Bleed pumps. Replace line.
Engine-driven pump cavitation.	Faulty filling of pump on installation. Improper pressurization of fluid reservoir.	Bleed pump. Replace air pressure regulator.
System will not indicate correct pressure.	Faulty pressure transmitter. Faulty pressure gage.	
Improper fluid reservoir pressurization.	Faulty air pressure regulator.	
Fluid draining out of engine pump case drain.	Leaky pump seal.	

3-6. HYDRAULIC UTILITY POWER SYSTEM GROUND TEST PROVISIONS.

3-7. External test connectors are provided for ground-testing the hydraulic system. The connectors are accessible through a door on the right side of the engine compartment. If the proper test equipment is not available, it is possible to supply pressure to the utility power system by use of the ground test hand-pump. On F-86E-10 and F-86E-15 Airplanes, place the hand-pump on mount at external test panel and connect pressure and suction hoses to utility test connections. Operate hand-pump to direct pressure into the utility power system. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, place the emergency hand-pump pressure control valve in "GROUND TEST" position and operate the emergency gear-lowering hand-pump.

3-8. FILLING HYDRAULIC UTILITY POWER SYSTEM.

3-9. For filling instructions, refer to paragraph 1-58.

3-10. CHECKING HYDRAULIC UTILITY POWER SYSTEM.

3-11. The system is checked after it has been filled, bled of air, and adjusted and when the engine can be run so that the utility pressure will be supplied by the engine-driven pump. With pump operating, the pressure (as indicated on the pilot's gage) should be 3000 (±100) psi with no system operating. The pressure will drop off during operation of a system, but should immediately build up after the system has completed operation. If a system does not operate properly and it is necessary to make readjustments other than those given in paragraph 3-5, refer to the paragraph on the particular system involved.

3-12. HYDRAULIC UTILITY POWER SYSTEM PUMP (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES AND F-86E-10 AIRPLANES AF51-2718 THROUGH -2826).

3-13. The variable-displacement pump (Vickers AA32507-L-2) is mounted to the engine accessory drive section. The pump is a nine-piston rotary type, with an engine-to-pump ratio of 1 to .473 and a maximum output of 5.75 gpm up to a pressure of 2700 psi. A spring-loaded control unit in the pump housing controls pump output when system pressure is above 2700 psi and regulates maximum pressure at 3000 psi. When

the utility power system pressure reaches 2700 psi, the spring pressure against the control unit is overcome and the control unit starts moving. As the control unit moves against spring pressure, it rotates the cylinder group, reducing the angle between piston and drive shaft. This reduces the effective output stroke of the pistons. Consequently, the higher the pressure above 2700 psi, the smaller the angle between the cylinder group and drive shaft and the shorter the effective output stroke until 3000 psi pressure is reached, at which time the pump output is 0 gpm. A small by-pass line from the pump housing to the system reservoir prevents pressure build-up in the housing and allows a small amount of fluid to circulate through the housing for cooling and lubricating.

3-14. REMOVING PUMP. The removal of the utility hydraulic pump may be accomplished through the engine air intake duct as follows:

Note

Before undertaking the removal of the utility hydraulic pump, be sure to exhaust the reservoir air pressure by loosening the reservoir filler cap. Drain utility reservoir.

a. Remove the engine accessory cover.

b. Remove the pump hold-down bolts.

c. Pull pump out of auxiliary accessory section gear case far enough to free the splined shaft.

d. Disconnect and cap hydraulic lines at the pump.

e. Complete the removal of pump from the engine.

3-15. INSTALLING PUMP. The installation of the utility hydraulic pump may be accomplished through the engine air intake duct as follows:

a. Fill pump with hydraulic fluid.

b. Connect utility hydraulic lines.

c. Place pump in position on the auxiliary accessory gear case and install hold-down bolts, settling pump so that the splined shaft engages freely.

d. Refill utility hydraulic reservoir.

e. Run up engine and check pump for leaks.

f. Replace engine auxiliary accessory cover.

3-16. HYDRAULIC UTILITY POWER SYSTEM PUMP (F-86E-10 AIRPLANES AF51-2827 THROUGH -2849 AND F-86E-15 AIRPLANES).

3-17. The variable-displacement pump (New York Air Brake 67WA200) is mounted to the engine accessory drive section. The pump is a nine-piston rotary type, with an engine-to-pump ratio of 1 to .473 and a maximum output of 5.25 gpm up to a pressure of 2700 psi. A spring-loaded control unit in the pump housing controls pump output when system pressure is above 2700 psi and regulates maximum pressure at 3000 psi. When the utility power system pressure reaches 2700 psi, the spring pressure against the control unit is overcome and the control unit starts moving. As the control unit moves against spring pressure, it reduces the effective output stroke of the pistons. Consequently, the higher the pressure above 2700 psi, the shorter the effective output stroke until 3000 psi pressure is reached, at which time the pump output is 0 gpm. A small by-pass line from the pump housing to the system reservoir prevents pressure build-up in the housing and allows a small amount of fluid to circulate through the housing for cooling and lubricating.

3-18. REMOVING PUMP. Refer to paragraph 3-14.

3-19. INSTALLING PUMP. Refer to paragraph 3-15.

3-20. BLEEDING PUMP. To bleed pump, proceed as follows:

a. With both pump suction and pressure lines connected in the normal manner and the case drain line disconnected at the quick-disconnect fitting, depress the check valve in the quick-disconnect fitting. (Press in on the annular ring between the outer body and the center plug.)

b. Turn engine over slowly with starter until bubble-free fluid flows from the case drain line.

c. Reconnect case drain line and check the reservoir for proper fluid level.

3-21. HYDRAULIC UTILITY POWER SYSTEM FLUID RESERVOIR.

3-22. The utility power system fluid reservoir is located in the radio compartment on the right side just aft of the access door. Incorporated in the reservoir are an air separator, fluid level gage, filler cap, and ports for pump supply, system return, emergency reservoir supply, pressurizing and ventilating, and drain. The reservoir fluid capacity is approximately 2 US. gallons.

3-23. REMOVING RESERVOIR. To remove the utility reservoir, proceed as follows:

a. Release air pressure by loosening filler cap.

b. Drain reservoir through drain cock located in the right main wheel well.

c. Remove single-channel amplifier and fire-warning control box from their respective shock-mounted supports.

d. On F-86E-10 and F-86E-15 Airplanes, remove the brake return line and filter and the utility return line between filter and nearest "T" fitting, including the check valve.

e. Remove utility return line and filter.

f. Disconnect suction and drain lines at front of reservoir.

g. Disconnect vent and air pressure lines at top of reservoir.

h. Loosen reservoir hold-down strap bolts.

i. Remove reservoir from airplane.

3-24. INSTALLING RESERVOIR. To install the utility reservoir, proceed as follows:

a. Place reservoir in position, making sure that the hold-down straps and buffer straps are correctly installed.

b. Connect and tighten reservoir hold-down straps.

c. Connect air pressure and vent lines on top of reservoir.

d. Connect suction and drain lines at front of reservoir.

e. Install utility return line and filter.

f. On F-86E-10 and F-86E-15 Airplanes, install the utility return line including the check valve between filter and "T," and install the brake return line and filter.

g. Install the amplifier and fire-warning control box.

h. Fill the reservoir with specified hydraulic fluid. (Refer to paragraphs 1-57 and 1-60.)

i. Pressurize reservoir through air pressure fitting, and check reservoir and fittings for leaks.

3-25. HYDRAULIC UTILITY POWER SYSTEM AIR PRESSURE STORAGE TANK.

3-26. The air pressure storage tank is located in the equipment compartment above the right wheel well. The purpose of the tank is to store a volume of air under pressure. This air is received from the engine compressor for pressurization of the utility reservoir, and is under approximately 100 psi. The air is filtered before entering the storage tank. A drain plug is provided in one end of the tank for draining fluid which might collect.

3-27. HYDRAULIC UTILITY POWER SYSTEM RESERVOIR AIR PRESSURE REGULATOR.

3-28. The air pressure regulator (Gladden 311781 on F-86E-1, F-86E-5, and F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 through -2826; Gladden 312022-1 on F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes) is located on the right side of the fuselage just aft of the utility reservoir. The regulator controls the air pressure in the reservoir so that fluid will be supplied to the utility hydraulic pump at a positive pressure at all times. (The Gladden 311781 regulator controls pressure between 10.3 and 15.3 psi at sea level, and the Gladden 312022-1 regulator controls pressure between 6.8 and 11.8 psi.) The regulating valve will dump overboard any air pressure in excess of the preset pressure. In the event of air pressure failure, the regulator will allow air at atmospheric pressure to enter the reservoir when the reservoir pressure has dropped to –0.1 to –0.25 psi.

3-29. HYDRAULIC UTILITY POWER SYSTEM RELIEF VALVE.

3-30. The pressure relief valve is located on the left side of the fuselage in the engine accessory compartment. The relief valve is incorporated in the system between the power system pressure supply line and the return line to relieve excessive pressure in the system due to thermal expansion, surges, or possible failure of the pump to control pressure. The valve is adjusted to open (cracking pressure) when the system pressure reaches 3450 (±50) psi.

3-31. HYDRAULIC UTILITY POWER SYSTEM FLUID FILTER.

3-32. On F-86E-10 and F-86E-15 Airplanes, two filters (AN6234-3 and AN6234-2) are located on the right side of the fuselage, just forward of the utility reservoir. To filter all fluid before it is returned to the reservoir, one filter is connected in the utility system return line and the other is connected in the brake return line. (On F-86E-1, F-86E-5, and F-86E-6 Airplanes, there is no brake return filter.) Incorporated in the filter is a by-pass valve, set to open at 50 (±5) psi, so that fluid may be ported directly to the reservoir in the event of a clogged filter. The filter cartridge can be removed and cleaned or replaced.

3-33. HYDRAULIC UTILITY POWER SYSTEM PRESSURE TRANSMITTER AND INDICATOR.

3-34. The pressure transmitter is located on the forward center of the main spar. The transmitter is connected into the utility pressure line and is electrically connected to a pressure gage in the cockpit. For information on pressure transmitter and indicator, refer to paragraphs 6-105 and 6-107.

3-35. HYDRAULIC UTILITY POWER SYSTEM AIR PURGING VALVE.

3-36. On F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes, an air purging valve (Parker 1116-517126) is installed between the pump pressure line and the utility return line. The valve purges the pump pressure and supply lines of air and aids the pump in priming itself when operating at low pressures. Normally open, the valve by-passes fluid from the pressure line to the return line until the pump builds up sufficient pressure to close the valve.

3-37. PREPARING HYDRAULIC TUBING FOR INSTALLATION.

3-38. Before installing tubing, observe the following precautions:

a. Make sure all hydraulic tubing assemblies have the correct identification markings, including color banding and part number.

b. Before assembly, inspect tube flares for cracks, burrs, and sharp edges. Make sure flares are concentric with sleeves. The flare thickness on new tubing must be at least 82 percent of the original wall thickness. The tight sleeves should not be cause for rejection. Nuts, however, should turn freely on the sleeves.

c. Make sure the tip of the sleeve and the outer edge of the tube flare are separated by not more than .060 inch nor less than .045 inch.

d. Blow all dirt from inside tubing assembly with clean, dry compressed air.

e. Prior to installation, lubricate outside of sleeves at shoulder with small quantity of petrolatum.

f. Steel fittings and nuts must be used with steel lines in ¼- and ⅜-inch sizes. Aluminum alloy fittings and nuts are to be used with aluminum lines and with steel lines larger than ⅜ inch.

3-39. INSTALLING HYDRAULIC TUBING.

3-40. Observe the following precautions when installing hydraulic tubing:

Note

During installation, it is *absolutely necessary* that open ends of *tubing* and all fittings on units remain capped until they are connected into the system. If they are disconnected at any time, they should be capped at once. Many expensive units will be permanently damaged by dirt and chips if this is not done.

a. Immediately prior to installation, lubricate the first two male threads of fittings by rubbing on a thin coating of petrolatum. Do not allow this material to coat the inside of the tube.

b. Place tube in position, making certain that it is not scratched during installation, and see that the tube flares or tube ends meet the fittings squarely and fully. *Never use nut to draw tube flare to fitting, as flare might be easily spun off or damaged.*

c. Using fingers only, start nuts on fittings and turn until flares or sleeves are firmly seated. Never use a wrench until the nut is finger-tight.

d. After nut is firmly in place, tighten nut with a torque wrench, using the minimum torques shown in the AN. torque table. Use a wrench on flats of body to counteract torque of torque wrench on nut.

e. If fitting leaks, tighten nut to maximum torque in table. If it still leaks, correct defects if possible or replace fitting if necessary.

f. When installing bulkhead fittings, use 1/16-inch thick AN960 washer between flange of fitting and bulkhead for -6 size and smaller. Use 3/32-inch thick washer for fittings larger than -6. Washer is unnecessary where fitting has hexagonal shape.

Section IV
UTILITY SYSTEMS

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4-1. COCKPIT AIR CONDITIONING AND PRESSURIZING SYSTEMS.

4-2. The air conditioning and pressurizing systems provide temperature control of cockpit air; supply air for defrosting the windshield and canopy, anti-icing the windshield, and heating the ammunition compartment; and provide pressurization of the cockpit and canopy seal. Refer to paragraphs 4-140 and 4-141 for the windshield anti-icing system and paragraph 4-165 for the ammunition compartment heating system. Pressurized air is also supplied to the anti-G suit, drop tanks, and the hydraulic utility power system reservoir. The systems utilize air from a common source, the final stage of the engine compressor, but they are independently controlled from the cockpit and are fully automatic in operation. System air taken from one of the upper engine air extraction ports is at a relatively high temperature and pressure and requires cooling before being delivered to the cockpit. This cooling is accomplished by a heat exchanger and an expansion turbine-type cooling unit. If additional heating is required before the air enters the cockpit, an electric heater is cycled on and off to maintain selected cockpit temperatures. A temperature control system regulates the flow of air through the various system units. F-86E-1, F-86E-5, and F-86E-6 Airplanes have a different temperature control system than F-86E-10 and F-86E-15 Airplanes, as shown in figures 4-5 and 4-8. Because of this difference, some of the system units vary as shown in figures 4-1 and 4-2. A pressure regulator and a combination pressure relief and emergency dump valve control cockpit pressurization according to the selected pressure schedule. In an emergency, cockpit pressure can be dumped and ram air admitted to the cockpit through a ram-air supply duct. A cabin pressure control lever controls the system on F-86E-1, F-86E-5, and F-86E-6 Airplanes, while a pressure control switch and a pressure selector switch control the system on F-86E-10 and F-86E-15 Airplanes. Cockpit air is distributed through side and floor outlets.

4-3. FUNCTION OF COCKPIT AIR CONDITIONING AND PRESSURIZING SYSTEMS (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-4 Hot air taken from the engine compressor section is routed through the primary heat exchanger for initial cooling and then through a pressure ratio-flow control valve which limits the pressure of supply air to the system shutoff valve by means of a pressure-limiting unit. (See figure 4-1.) Placing the cabin pressure control lever at either of the "ON" positions ("2.75" or "5.00" differential pressure) closes the ram-air shutoff valve and opens the electric-actuated system shutoff valve, admitting air to an air mixing valve. The duct leading to the air mixing valve is divided into two separate ducts; one routes air from the mixing valve to the cooling unit, the other by-passes the cooling unit. The air by-passing the cooling unit remains relatively hot, utilizing the heat gained during engine compression. The mixing valve proportions the amount of air entering each duct in accordance with demands of the temperature control system. (Refer to paragraph 4-13.) The hot-air duct joins with the cool-air duct downstream of the cooling unit to a single duct. Supply air is then routed through the electric heater, where the air is reheated, if necessary, to meet temperature control system requirements. The conditioned air is then delivered to the cockpit side outlets and the floor outlet. Airflow from the floor outlet may be diverted to three windshield defrost outlets by means of a windshield defrost control valve. Air supply for canopy defrosting and windshield auxiliary defrosting is extracted from the main supply duct downstream of the system shutoff valve. A manual control lever, along the left longeron in the cockpit, controls the defrosting system. The cockpit pressure regulator maintains an inside-outside air pressure differential of 2.75 psi or 5.00 psi, depending upon the pressure differential selected by the pilot and the altitude of the airplane. Air pressure in excess of these differential pressures is relieved through the pressure relief valve to outside atmosphere. Placing the cabin pressure control lever "OFF" ("RAM AIR ON — DUMP OPEN") manually opens a pneumatic valve that dumps the cockpit air pressure through the emergency dump valve to outside air, energizes the ram-air shutoff valve to the open position, and closes the system shutoff valve. Ram air then enters the cockpit. The ram air may be heated by the cockpit heater. (Refer to paragraph 4-72.)

4-5. FUNCTION OF COCKPIT AIR CONDITIONING AND PRESSURIZING SYSTEMS (F-86E-10 AND F-86E-15 AIRPLANES).

4-6. System air taken from the engine compressor

section is routed through a flow limiting nozzle to restrict the amount of air discharged from the air extraction port in the event of a supply line rupture. The air is then routed through the primary heat exchanger for initial cooling and then to the system shutoff valve. Placing the pressure control switch at "PRESS" closes the ram-air shutoff valve and opens the system shutoff valve. Downstream of the system shutoff valve, the duct is divided; one duct routes supply air through the cooling unit, the other routes supply air around the cooling unit through a cooling unit by-pass valve. Air passing through the cooling unit by-pass valve is relatively hot. The position of the by-pass valve, which is regulated by the temperature control system, determines the amount of air routed to the cooling unit and the amount of hot air routed to the cockpit. When the by-pass valve is open (system demanding hot air), a flow limiting restrictor nozzle located downstream of the system shutoff valve, limits system airflow. The hot-air duct joins the cool-air duct downstream of the cooling unit, and the air then passes through the cockpit heater, which operates as required to meet cockpit temperature demands. The conditioned air then is delivered to cockpit side outlets and the floor outlet. Airflow from the floor outlet can be diverted to the windshield for defrosting by means of a windshield defrost control valve. Air supply for canopy defrosting and windshield auxiliary defrosting is extracted from the main supply duct upstream of the system shutoff valve, allowing the defrost system to operate regardless of the position of the system shutoff valve. A manual control lever, on the left longeron in the cockpit, controls the canopy and windshield auxiliary defrost system. Temperature of the air reaching the surfaces for defrosting is controlled by the temperature control system (paragraph 4-16). The cockpit pressure regulator maintains an inside-outside air pressure differential of 2.75 psi or 5.00 psi, depending upon the pressure selected by the pilot and the altitude of the airplane. Air pressure in excess of these differential pressures is relieved through the pressure relief valve to outside atmosphere. Placing the pressure control switch at "RAM" closes the system shutoff valve and opens the dump valve and the ram-air shutoff valve. This action shuts off incoming pressurized air, releases cockpit pressure, and allows ram air to enter the cockpit. The ram air may be heated by the cockpit heater. (Refer to paragraph 4-72.)

4-7. TROUBLE SHOOTING COCKPIT AIR CONDITIONING AND PRESSURIZING SYSTEMS.

TROUBLE	PROBABLE CAUSE	REMEDY
Supply air not available for cockpit pressurization or ventilation.	*Defective pressure ratio-flow control valve. *Defective pressure-limiting unit. Defective system shutoff valve.	 Check electrical circuit. Replace valve.
Cooled air not available for cockpit air conditioning.	Cooling unit inoperative.	*Check position of air mixing valve to ensure full flow through cooling unit. †Check position of system shutoff valve to ensure full flow through cooling unit. Remove and replace cooling unit.
	*Air mixing valve inoperative or damaged.	Check electrical circuit. Check operation of valve actuator; if operable, check for shaft-to-crank-arm slippage. If actuator is operable and valve does not function correctly, remove valve from airplane and check for linkage or shaft failure. Replace air mixing valve.
	†Primary heat exchanger modulating valve stuck in closed position.	Check electrical circuit. Replace valve.
	†Cooling unit by-pass valve stuck in open position.	Check electrical circuit. Replace valve.

TROUBLE	PROBABLE CAUSE	REMEDY
Heated air not available for cockpit air conditioning.	†Primary heat exchanger modulating valve stuck in open position.	Check electrical circuit. Replace valve.
	†Cooling unit by-pass valve stuck in closed position.	Check electrical circuit. Replace valve.
	Cockpit heater inoperative or damaged.	Check electrical circuit. Replace heater.
	Cockpit heater air pressure switch inoperative or damaged.	Check electrical circuit. Replace defective unit.
	*Air mixing valve inoperative or damaged.	Check electrical circuit. Check operation of valve actuator; if operable, check for shaft-to-crank-arm slippage. If actuator is operable and valve does not function correctly, remove valve from airplane and check for linkage or shaft failure. Replace air mixing valve.
Cockpit temperature fluctuates.	*Anticipating thermostat or cockpit thermostat damaged or cockpit temperature control box malfunctioning.	Check electrical circuit by positioning the manual temperature control switch to "HOT" and then to "COLD," and observe operation of air mixing valve. If the air mixing valve actuator operates, inspect anticipating thermostat by checking resistance across pins A to B and C to D. If resistance across both of these sets of pins is approximately 100 ohms (depending upon temperature), then check cockpit thermostat. Otherwise replace unit. Check cockpit thermostat by checking the resistance across pins A to B and C to D. If the resistance of these points is approximately 230 ohms (depending on temperature), then check cockpit temperature control box. Otherwise replace this unit. (Since the cockpit temperature control box unit is very complex, it is recommended that the control box be replaced and check made with new unit.) If the trouble still exists, run the air mixing valve actuator fully clockwise (by manual control) and check resistance pins B to C. The resistance reading should be approximately 10 ohms. Then run the actuator fully counterclockwise (manual control) and check to see if resistance across pins B to C is approximately zero. If these readings are obtained, the trouble probably is due to an intermittent connection in the wiring of the airplane. Replace thermostat.

TROUBLE	PROBABLE CAUSE	REMEDY
	†Cockpit duct pickup thermostat damaged or cockpit temperature control box not functioning properly.	Check electrical circuit by positioning the cockpit temperature selector rheostat to "HOT & HEATER ON" and then to "COLD," and observe operation of primary heat exchanger cooling air modulating valve. If the modulating valve operates, inspect pick-up thermostat by checking circuit for correct resistance values. If the resistance values are correct (depending upon temperature), check or replace cockpit temperature control box. (Since the cockpit temperature control box is very complex, it is recommended that the box be replaced and the check made with a new unit.)
	Defective wire shielding.	Replace damaged or missing shielding.
Cockpit ram air not available.	Ram-air shutoff valve inoperative.	Check electrical circuit.
	Ram-air duct clogged.	Operate ram switch to both open and closed positions to ensure open valve. Clean out duct to remove obstruction.
	Ram-air shutoff valve inoperative or damaged.	Check electrical circuit. Remove and replace valve.
Cockpit air dump system inoperative.	*Dump valve or pneumatic control valve either damaged or inoperative.	Check ¼-inch ambient bleed line for tight connection to pneumatic control valve and for freedom from stoppage at ambient end in left gun bay. Check connections on the ¼-inch connecting line between pneumatic control valve and dump valve.
	†Emergency dump valve solenoid damaged or inoperative.	Check electrical circuit. Replace dump valve.
	Dump valve diaphragm damaged or inoperative.	Check freedom of dump valve by manually depressing dump valve diaphragm. Replace defective unit.
Cockpit pressure differential cannot be changed.	Cockpit pressure regulator inoperative.	
	Differential pressure control switch defective.	Check electrical circuit. Replace switch.
	Differential control unit solenoid inoperative or damaged.	
Cockpit pressure (altitude) not maintained.	Leaks in cockpit pressure sealing.	
	Canopy seal inoperative.	Check electrical circuit and settings or pertinent limit switches. Replace canopy seal regulator.
	Cockpit pressure regulator inoperative.	
	Cockpit vacuum-pressure relief and dump valve defective.	

TROUBLE	PROBABLE CAUSE	REMEDY
	†Cockpit vacuum-pressure relief and dump valve in the dump position because of faulty electrical continuity.	Check electrical circuit. Replace cockpit pressure control switch.
Canopy seal system inoperative.	Seal ruptured. Canopy seal pressure regulator defective. Emergency dump and canopy seal limit switches defective or adjusted incorrectly.	Check electrical circuit. Replace switches.

*F-86E-1, F-86E-5, and F-86E-6 Airplanes
†F-86E-10 and F-86E-15 Airplanes

4-8. TESTING COCKPIT AIR CONDITIONING AND PRESSURIZING SYSTEMS.

4-9. TESTING AIR CONDITIONING AND PRESSURIZING SYSTEM DUCTS. The duct system test provides a procedure for checking the tightness of the ducting, duct joints, and equipment. (See figures 4-3 and 4-4.)

4-10. TESTING COCKPIT PRESSURE. Prior to the initial pressurized flight after any repair work to the pressurized surfaces of the cockpit, the cockpit must be checked for pressure-tightness. Ground pressurization for testing is accomplished by the introduction of air pressure from an external source into the cockpit through an air line connector fitting located on the left side of the cockpit pressure bulkhead at station 117. Access to the connector fitting is through an access door in the outer skin of the fuselage. Use cabin pressure tester (Type V-3) or equivalent. If rate-of-flow loss during pressure test exceeds 52 cubic feet per minute, refer to paragraph 4-137 for repair method. See figures 4-3 and 4-4 for testing procedure. Observe warnings given in paragraph 4-134 before testing cockpit pressure.

4-11. TESTING AIR CONDITIONING AND PRESSURIZING SYSTEMS WITH ENGINE OPERATING. With the canopy closed, test the cockpit air conditioning system as follows:

a. Position windshield anti-icing control handle to "OFF."

b. Pull ammunition compartment heating system shutoff valve control knob to full up position. (The valve controlled by this knob is to be reset to the open position after completion of test.)

c. Position windshield defrost selector handle at "FLOOR."

d. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, position cabin pressure control lever at either of the "ON" positions.

e. On F-86E-10 and F-86E-15 Airplanes, position pressure selector switch at "2.75 P.S.I." or "5 P.S.I." and pressure control switch at "PRESS."

f. Position cockpit air temperature control switch at "AUTO."

g. Place cockpit air temperature selector rheostat at "COLD" on F-86E-10 and F-86E-15 Airplanes and at "60" on F-86E-1, F-86E-5, and F-86E-6 Airplanes.

h. With the preceding control settings, start engine and set it at 5000 to 5500 rpm.

i. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, rotate the cockpit air temperature selector rheostat between 40 and 80. This will cause the air mixing valve to supply air at a decreased or increased temperature. Note the temperature change by feeling the outlet air being discharged to the cockpit. If the cockpit temperature exceeds 26.7°C (80°F), the test will be of no value, since the air mixing valve will then remain in the full cooling position regardless of any setting of the temperature selector rheostat.

j. On F-86E-10 and F-86E-15 Airplanes, rotate the cockpit air temperature selector rheostat between "COLD" and "HOT & HEATER ON." This will cause the primary heat exchanger air modulating valve and the cooling unit by-pass valve to supply air at an increased or decreased temperature. Note the temperature change by feeling the outlet air being discharged to the cockpit.

k. Change the windshield defrost selector handle from "FLOOR" to "DEFROST" and then to "BOTH," and feel the amount of air issuing from the various air outlets.

4-12. COCKPIT AIR TEMPERATURE CONTROL SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-13. The cockpit air temperature control system regulates the temperature of the air for cockpit air conditioning by mixing the hot and cold supply air to maintain a preselected temperature. The system is controlled

from the cockpit by a cockpit air temperature control switch and a cockpit air temperature selector rheostat. The system also includes the following units: a cockpit air temperature control box, cockpit thermostat, an anticipating thermostat, an air mixing valve, and a mixing valve actuator. The cockpit air temperature control switch allows selection of either manual or automatic control. When automatic control is selected, a Wheatstone bridge circuit maintains the cockpit temperature selected by the cockpit air temperature selector rheostat. Temperatures ranging from 4.4°C to 26.7°C (40°F to 80°F) may be selected. The selected temperature establishes a cockpit temperature control point. The anticipating thermostat, the cockpit thermostat, the cockpit air temperature selector rheostat, the cockpit air temperature control box, and the mixing valve actuator make up the bridge circuit which determines the position of the air mixing valve to satisfy the requirements of the rheostat setting. When the air mixing valve is in the full hot position and further heat is required, the cockpit heater is cycled on and off to maintain the selected temperature. In case of malfunction or failure of the automatic control system, the cockpit air temperature control switch can be positioned to "HOT" or "COLD" to directly control the air mixing valve.

4-14. FUNCTION OF TEMPERATURE CONTROL SYSTEM. With the cockpit air temperature control switch at "AUTO," 28-volt direct current is supplied to the cockpit air temperature selector rheostat and the temperature control box. The temperature control box energizes the "HEAT" or "COLD" winding of the mixing valve actuator, whichever is necessary to meet cockpit temperature demands. To understand the function of the temperature control system, it is necessary to understand the operation of a bridge circuit. All thermostatic elements that make up the bridge circuit possess a temperature coefficient of resistance. When the ratio of resistances of the upper and lower legs of the *left* side of the bridge are equal to the ratio of resistances of the upper and lower legs of the *right* side of the bridge, the circuit is balanced; no current flows through the micropositioner in the temperature control box, and the mixing valve actuator is not energized. (See figures 4-5 through 4-7.) As air temperature changes occur, the resistance values of the thermostatic elements vary, causing bridge circuit unbalance. A change in supply air temperature detected by the anticipating thermostat, a change in cockpit temperature detected by the cockpit thermostat, or a change in the selector rheostat setting causes resistance values to vary and unbalance the bridge. Current then flows through the micropositioner to either the heat or cold winding of the mixing valve actuator, whichever is needed to correct cockpit temperature to that demanded by the rheostat setting. The bridge circuit always attempts to assume a balanced condition, which can exist only when cockpit temperature meets cockpit temperature demands and when the air through which the airplane is moving remains at a constant temperature and density. The anticipating thermostat, cockpit thermostat, and cockpit temperature control box function together to keep the bridge circuit balanced. For function of these units refer to paragraphs 4-23, 4-25, and 4-27. When the temperature control system demands more hot air and the air mixing valve is in the full hot position, the 4-kilowatt electric heater is energized and is cycled on and off to maintain the selected cockpit temperature. Placing the cockpit air temperature control switch at either "HOT" or "COLD" by-passes automatic temperature control units and energizes the related winding of the mixing valve actuator. With the cockpit air temperature control switch "OFF," air enters the cockpit at the prevailing supply air temperature.

4-15. COCKPIT AIR TEMPERATURE CONTROL SYSTEM (F-86E-10 AND F-86E-15 AIRPLANES).

4-16. The cockpit air temperature control system regulates the temperature of air for cockpit air conditioning and windshield and canopy auxiliary defrosting. The system is controlled from the cockpit by a cockpit air temperature control switch, a cockpit air temperature selector rheostat, and a canopy auxiliary defrost control. The cockpit air temperature control system also includes the following units: a cockpit air temperature regulator, a cockpit air duct thermistor, a cooling unit by-pass valve, an auxiliary temperature regulator, an auxiliary system thermistor, and a primary heat exchanger air modulating valve. (See figure 4-2.) The cockpit air temperature control switch allows selection of either manual or automatic control. When automatic control is selected, the temperature selected by the temperature selector rheostat is maintained by means of the cockpit air temperature regulator and the cockpit air duct thermistor. Operation of these units through an a-c Wheatstone bridge circuit controls the positioning of the cooling unit by-pass valve and the primary heat exchanger air modulating valve to admit more or less heated air into the cockpit, depending on the temperature setting. In the event the automatic control system components do not function correctly, the cockpit air temperature control switch can be placed at either "HOT" or "COLD" to directly control the positioning of the by-pass valve and the modulating valve. Heat for the windshield anti-icing system (paragraph 4-141) and the ammunition compartment heating system (paragraph 4-165) is also regulated by the cockpit temperature control system.

4-17. FUNCTION OF TEMPERATURE CONTROL SYSTEM. With the cockpit air temperature control switch at "AUTO" position and the canopy auxiliary defrost control "OFF," the cockpit air temperature regulator positions the cooling unit by-pass valve and the

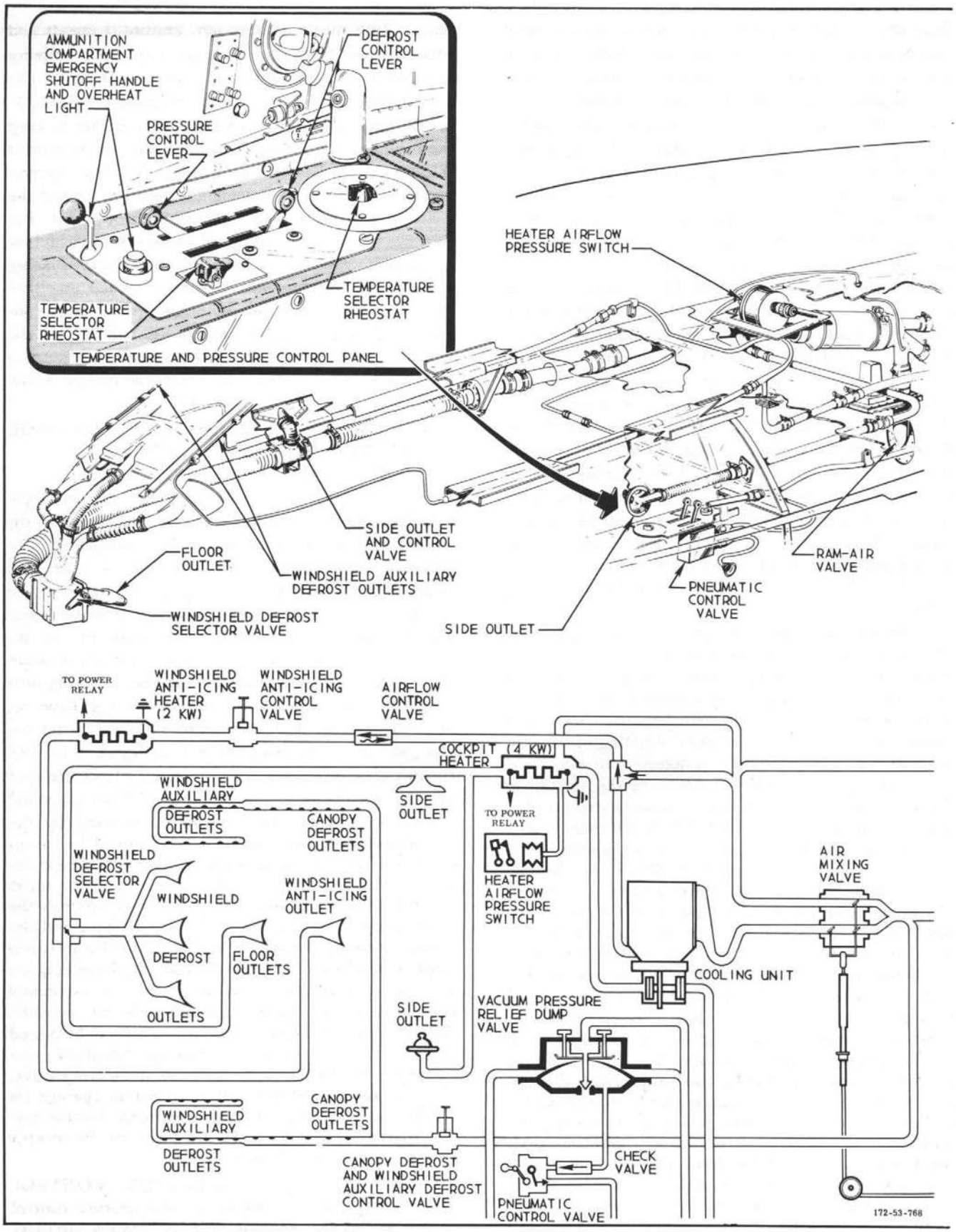


Figure 4-1. Cockpit Air Conditioning and Pressurizing Systems—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)

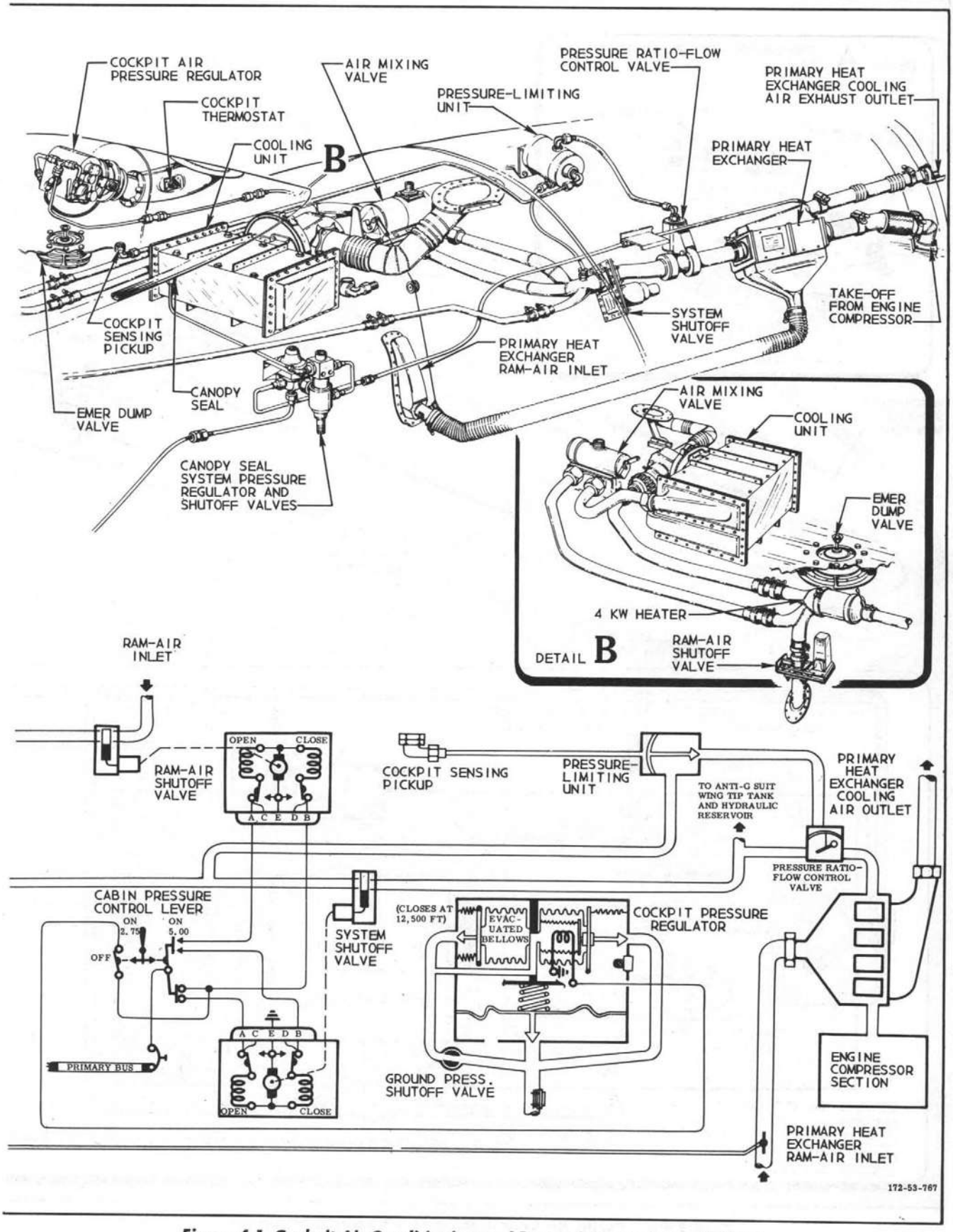


Figure 4-1. Cockpit Air Conditioning and Pressurizing Systems—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)

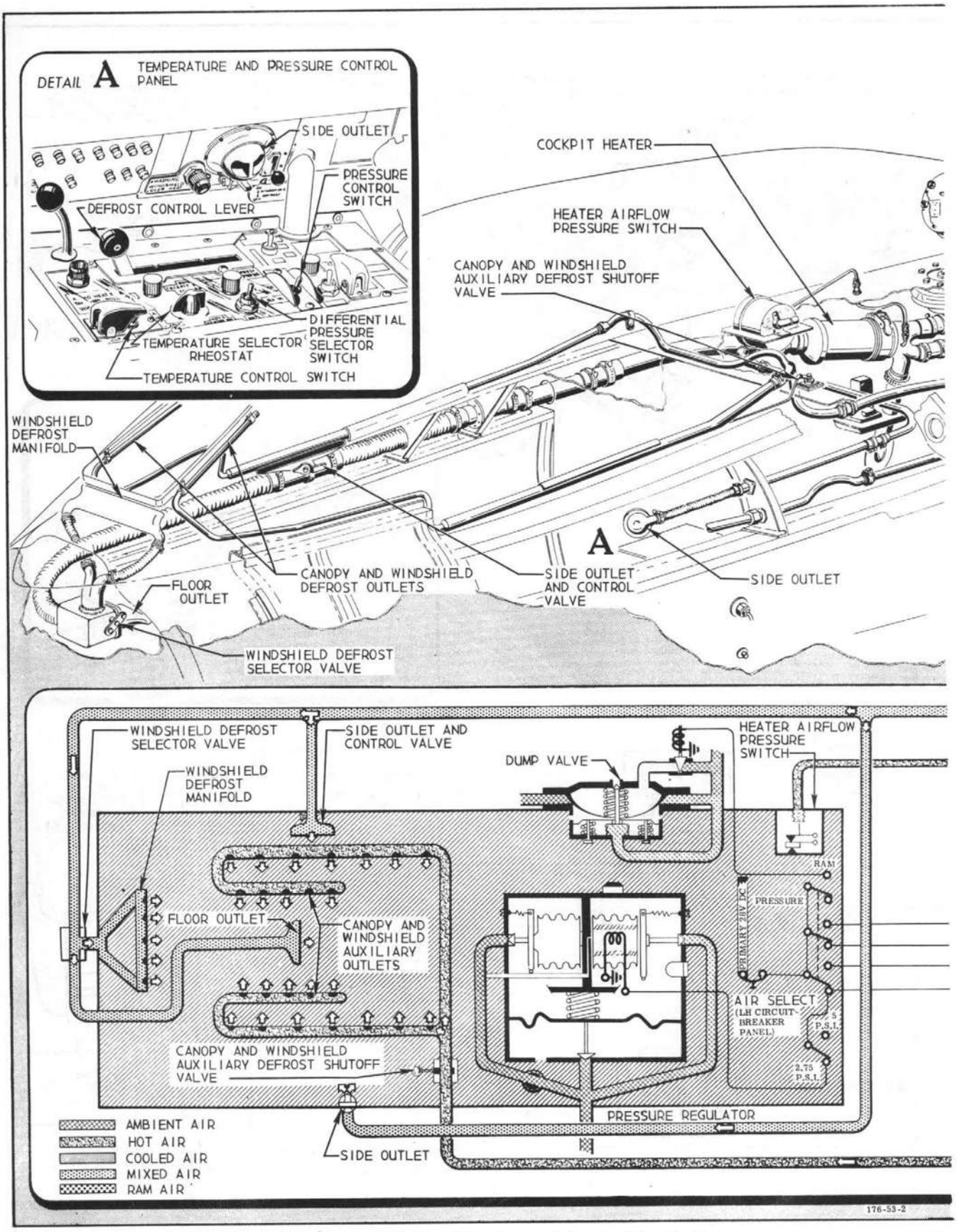


Figure 4-2. Cockpit Air Conditioning and Pressurizing Systems— F-86E-10 and F-86E-15 Airplanes (Sheet 1 of 2)

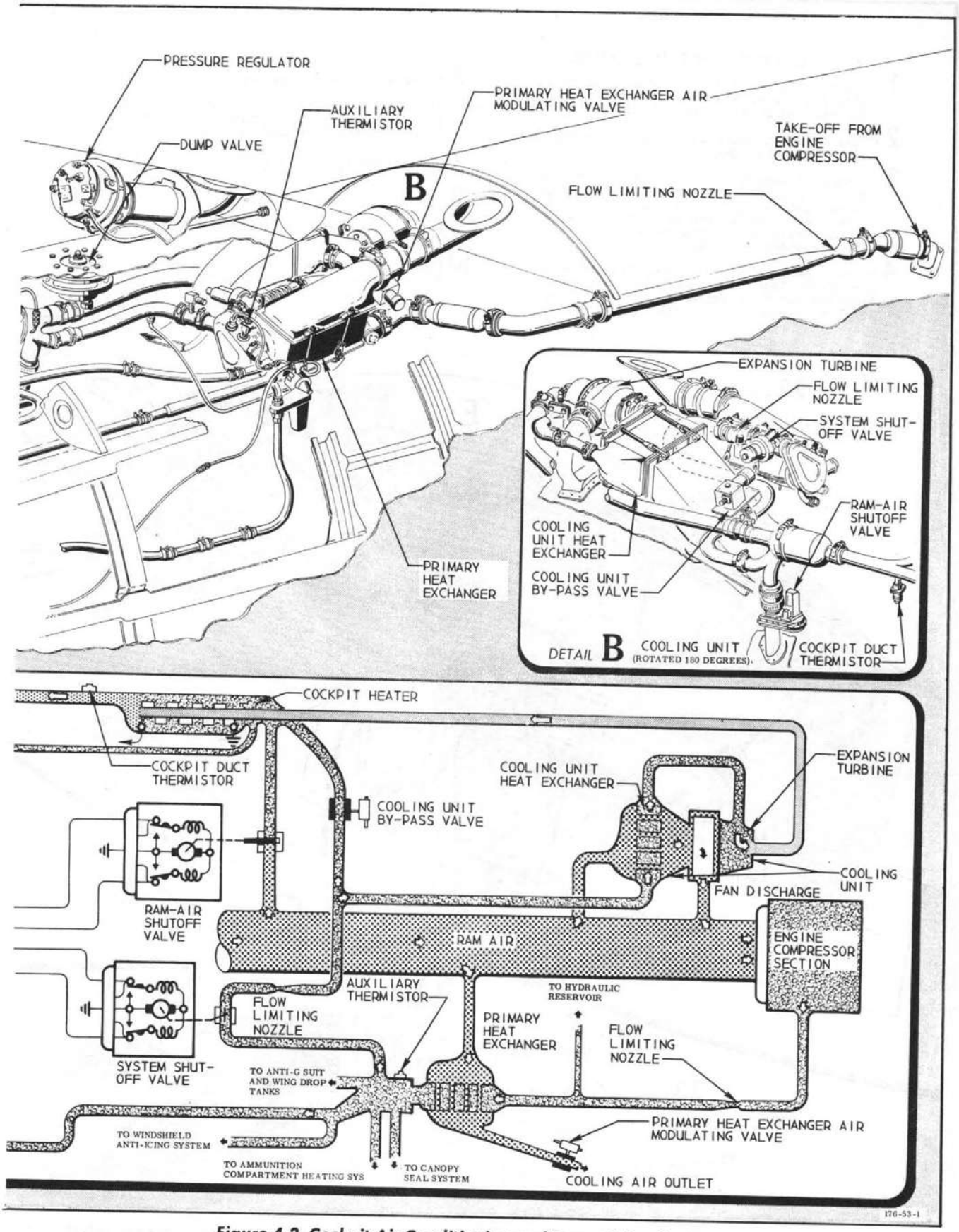


Figure 4-2. Cockpit Air Conditioning and Pressurizing Systems— F-86E-10 and F-86E-15 Airplanes (Sheet 2 of 2)

TESTING DUCT PRESSURE

1 Insert a solid, .032-inch metal disk in flange connection between engine compressor supply manifold and primary heat exchanger.

2 Close system shutoff valve by moving cockpit control knob to "OFF."

3 Disconnect anti-G suit air supply line and connect air pressure line to duct side. Apply 115 psi gage air pressure and check for leaks in the main duct system between the system shutoff valve and engine connector flange; make necessary repairs.

4 By-pass ammunition low-temperature thermostat electrical lead to ground; then move ammunition and gun heat switch to "ON" and check airflow to ammunition compartment.

5 Close windshield anti-icing control valve.

6 Disconnect windshield air supply duct and connect air supply line; then apply approximately 50 psi to the duct and examine for leakage.

7 Open windshield anti-icing control valve and check flow of air at top of windshield bow.

8 Connect anti-G suit supply line.

9 Remove air pressure line and connect windshield supply duct.

10 Remove metal disk from engine compressor supply line and reconnect line to primary heat exchanger.

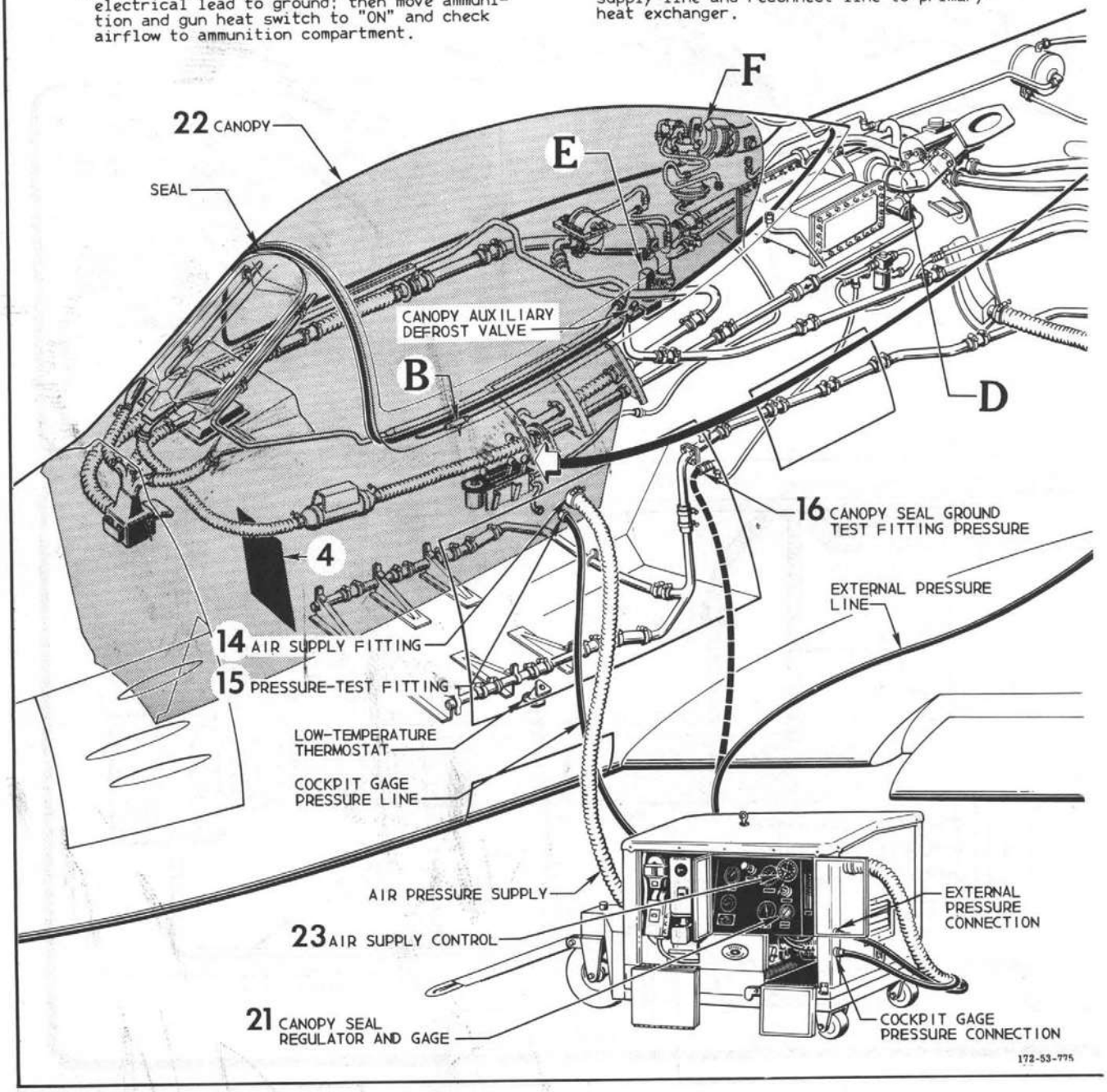
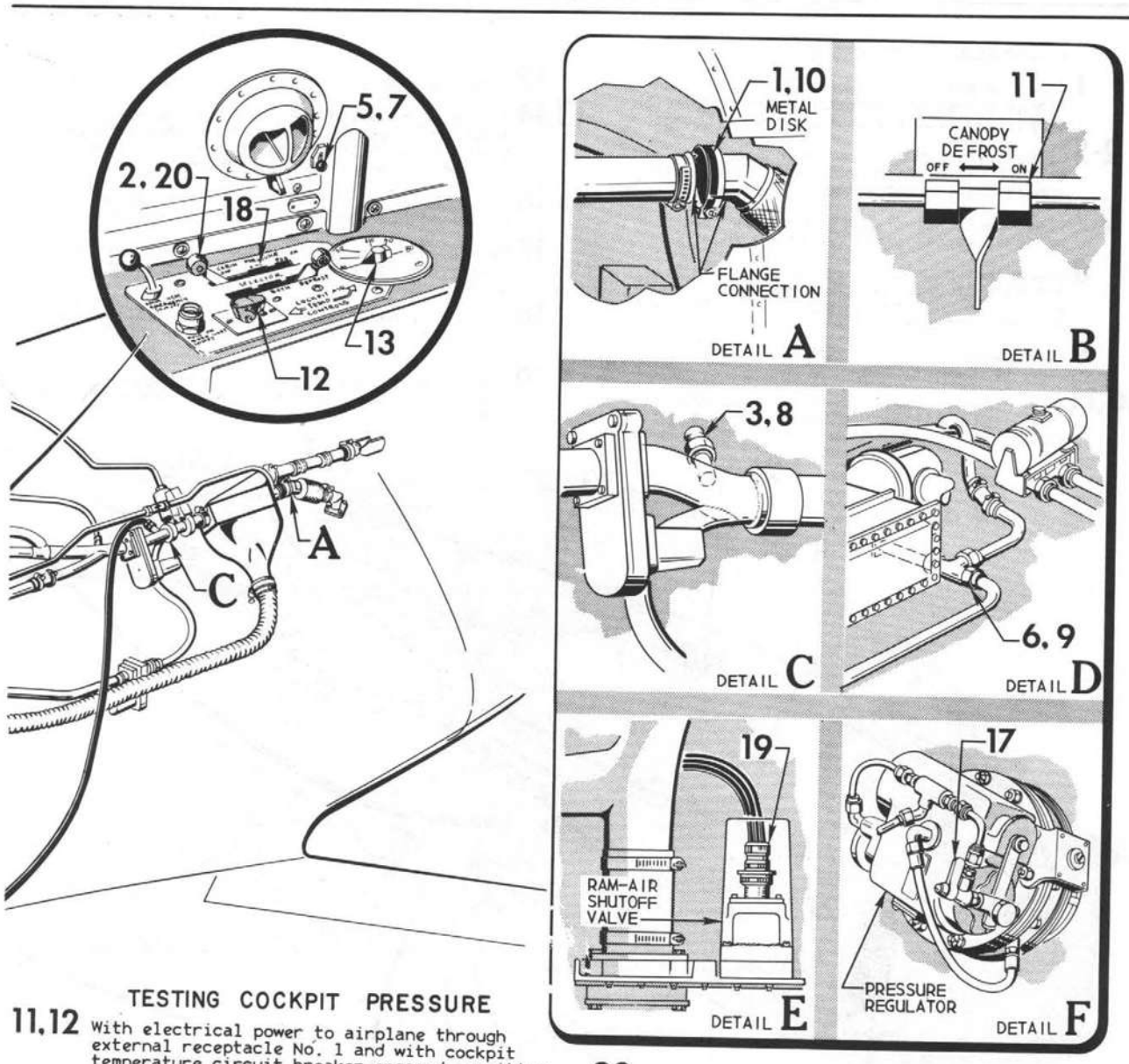


Figure 4-3. Testing Cockpit and Duct Pressure—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)



TESTING COCKPIT PRESSURE

11,12 With electrical power to airplane through external receptacle No. 1 and with cockpit temperature circuit breaker engaged, position selector handle to "DEFROST" and temperature control switch to "AUTOMATIC."

13 Position temperature control knob to "40°."

14 Connect air supply line to external pressurization fitting.

15 Connect cockpit gage pressure line to pressure test fitting.

16 Connect pressure line to canopy seal ground test fitting.

17 Move the ground test valve on pressure regulator to ground test position (90 degrees from safetied position).

18 Position cabin pressure control handle to the "ON-2.75" position. (This will position the ram-air valve to closed position.)

19 Disconnect the Cannon plug from the ram-air valve.

20 Move cabin pressure handle to "OFF." This positions the system shutoff valve closed; then pull (disengage) cockpit temperature circuit breaker (nose section circuit-breaker panel).

21 Adjust pressure to canopy seal to 15 psi gage (25 psi gage maximum).

22 Close canopy. Canopy seal should inflate when canopy is closed.

23 Slowly open air pressure supply control until cockpit pressure gage reads 5 psi. Maximum allowable reading on rate-of-flow indicator is 39 cubic feet per minute. (This value includes 5 cubic feet per minute allowable cockpit pressure regulator leakage. Rate-of-climb indicator should never indicate more than 1000 feet per minute.)

24 Check dump valve operation and test canopy seal pressure. (Refer to index for page number of applicable procedure.

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Figure 4-3. Testing Cockpit and Duct Pressure—F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)

HIGH-PRESSURE DUCT TESTING

1 Insert a solid .032-inch metal disk in flange connection between engine compressor supply manifold and primary heat exchanger.

2-5 Close system shutoff valve, canopy auxiliary defrost valve, windshield anti-icing valve, and ammunition compartment heat shutoff valve.

6,7 Disconnect anti-G suit and canopy seal high-pressure supply lines, and plug ends.

8 Disconnect hydraulic reservoir supply line and connect external pressure line. Then pressurize duct to 115 psi. Check for leaks and make necessary repair.

9 Move canopy auxiliary defrost control to "ON" to check airflow.

10,11 Return canopy auxiliary defrost control to "OFF" and position windshield anti-icing control to "ON." Check airflow to windshield.

12 Return windshield anti-icing control to "OFF."

13,14 By-pass ammunition heat control thermostat electrical lead to ground; then move ammunition and gun heat switch to "ON" and check airflow to ammunition compartment.

15,16 Turn "OFF" ammunition and gun heat switch, and disconnect ground lead to thermostat.

17 Remove plugs from anti-G suit and canopy seal lines, and connect lines to high-pressure outlets.

18 Disconnect external pressure line and connect hydraulic reservoir line to high-pressure outlet.

19 Remove metal disk from engine compressor supply line and reconnect line to primary heat exchanger.

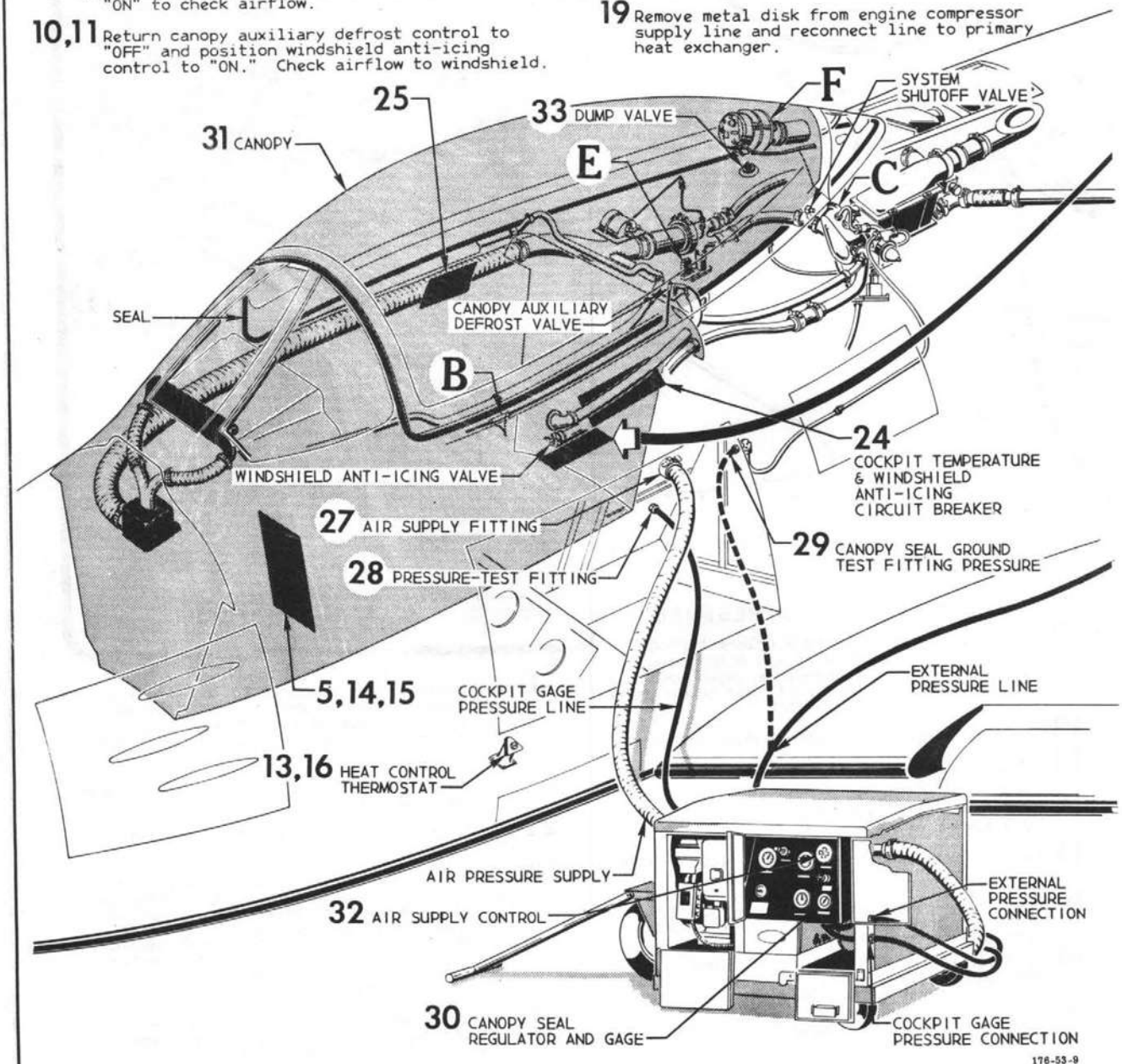
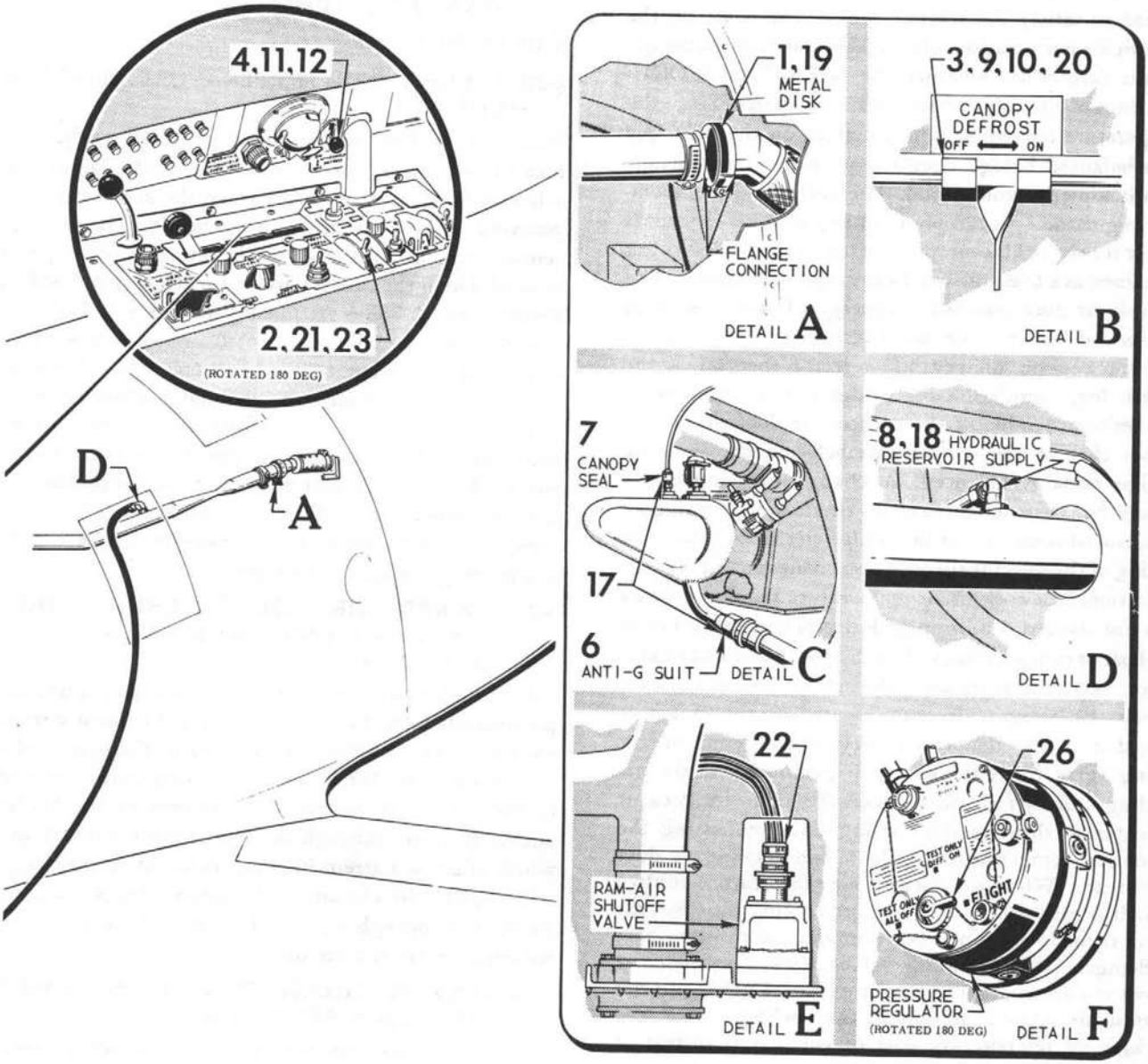


Figure 4-4. Testing Cockpit and Duct Pressure—F-86E-10 Airplanes (Sheet 1 of 2)



TESTING COCKPIT PRESSURE

20,21 Turn canopy auxiliary defrost control "OFF"; position cockpit pressure control switch to "PRESS."

22 Disconnect plug from ram-air shutoff valve.

23 Position cockpit pressure control switch to "RAM."

24 De-energize air selector circuit breaker and cockpit temperature and windshield anti-icing circuit breaker on station 26 relay panel.

25 Energize bomb selector and canopy seal circuit breakers.

26 Move selector handle on pressure regulator to "OFF" position.

27 Connect air supply line to external pressurization fitting.

28 Connect cockpit gage pressure line to pressure test fitting.

29 Connect pressure line to canopy seal ground test fitting.

30 Adjust pressure to canopy seal to 30 psi.

31 Close canopy. Canopy seal should inflate.

32 Slowly open air pressure supply control until cockpit pressure gage reads 5 psi. Maximum allowable reading on rate-of-flow indicator is 57 cubic feet per minute. (This value includes 5 cubic feet per minute allowable cockpit pressure regulator leakage. Rate-of-climb indicator should never indicate more than 1000 feet per minute.)

33 Check dump valve operation and test canopy seal pressure. (Refer to index for page number of applicable procedure.)

170-53-10

Figure 4-4. Testing Cockpit and Duct Pressure—F-86E-10 Airplanes (Sheet 2 of 2)

primary heat exchanger air modulating valve as required to satisfy the temperature demands set by the cockpit air temperature selector rheostat. The a-c bridge circuit determines whether the "HEAT" or "COOL" windings of the valve actuators are energized. Since the temperature control system functions on the principle of a balanced bridge circuit, operation of the bridge circuit must be understood. The cockpit air temperature regulator (paragraph 4-36) serves as an electronic center for the bridge circuit, one leg of the bridge being contained as a fixed resistor in the regulator circuit. The cockpit air duct thermistor (paragraph 4-40) serves as the second leg, its calibrating resistor as the third leg, and the cockpit temperature selector rheostat as the fourth leg, completing the bridge circuit. As long as the resistance value of the cockpit air duct thermistor equals that of the temperature selector rheostat, the bridge remains balanced. A change in temperature affects the resistance value of the thermistor, creating an unbalanced condition of the bridge circuit. A change in setting of the selector rheostat also creates an unbalanced condition. The cockpit air temperature regulator senses this unbalanced condition and directs current to either the heat or cool windings of the by-pass valve and modulating valve actuators until the system attains balance. When the cockpit air temperature control switch is placed at "COLD," the primary heat exchanger air modulating valve turns to full open position and the air cooling unit by-pass valve closes. All air to the cockpit then passes through the cooling unit, by-passing the automatic temperature regulator and cockpit air duct thermistor. When the cockpit air temperature control switch is placed at "HOT," the air cooling unit by-pass valve turns to full open position and the primary heat exchanger air modulating valve closes. Air then bypasses the automatic temperature control units, and the hottest air possible is sent to the cockpit. When the cockpit air temperature selector rheostat is turned to "HOT & HEATER ON," the cockpit heater will be energized whenever the system demands hot air in either manual or automatic operation. When the canopy auxiliary defrost control is "ON," air extracted from the primary heat exchanger high-pressure outlet manifold is ducted directly to the windshield and canopy auxiliary defrost outlets and a microswitch is actuated which de-energizes the cockpit air control relay. When the cockpit air control relay is de-energized, cockpit air temperature with the system in either manual or automatic operation is controlled by the cooling unit by-pass valve only. The auxiliary temperature regulator and auxiliary system thermistor automatically control the temperature of the air for windshield and canopy auxiliary defrosting by properly positioning the primary heat exchanger air modulating valve. (See figures 4-8 through 4-11.) When the cockpit air temperature control switch is "OFF," air enters the cockpit at the prevailing supply air temperature.

4-18. ADJUSTING COCKPIT AIR TEMPERATURE SYSTEM CONTROLS.

4-19. See figure 4-12.

4-20. COCKPIT AIR TEMPERATURE SELECTOR RHEOSTAT.

4-21. The cockpit air temperature selector rheostat, located on the left console (figures 4-1 and 4-2), permits selective temperature control when the automatic temperature control system is in operation. The selected temperature establishes a temperature control point around which the bridge circuit functions. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the rheostat has division markings numbered from 40 to 80 corresponding to cockpit air temperatures in Fahrenheit. On F-86E-10 and F-86E-15 Airplanes, the rheostat has two extreme positions, "COLD" and "HOT & HEATER ON." No specific temperature division markings are stenciled on the control knob, as the rheostat merely causes the cockpit air duct thermistor to demand a certain temperature and therefore does not reflect the temperature that will exist in the cockpit at any given time.

4-22. COCKPIT AIR TEMPERATURE CONTROL BOX (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-23. The temperature control box houses various components of the automatic temperature control circuit, such as relays, resistors, a calibrating rheostat, and a micropositioner. When automatic temperature control of cockpit air is selected, all elements of the bridge circuit function through the temperature control box, where effective current flow moves the micropositioner to complete the circuit to the mixing valve actuator. Refer to paragraph 4-16 for function of the automatic temperature control circuit.

4-24. COCKPIT THERMOSTAT (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-25. The cockpit thermostat, located in the pressure regulator discharge duct, rapidly senses changes in cockpit temperature. As a temperature change is detected, the resistance value of the thermostat changes and unbalances the bridge circuit. Since the cockpit thermostat has a negative coefficient of resistance, a drop in cockpit temperature causes an increase in thermostat resistance. An increase in resistance of the bridge circuit legs containing the cockpit thermostat elements causes current flow through the micropositioner as shown in figure 4-5, energizing the heat winding of the mixing valve actuator. More heated air is then delivered to the cockpit until the system is balanced. An increase in cockpit temperature causes a decrease in thermostat resistance and in similar fashion the cold winding of the mixing valve actuator is energized to admit more cold air to the cockpit. The cockpit thermostat works in conjunction with the anticipating thermostat. (Refer to paragraph 4-27.)

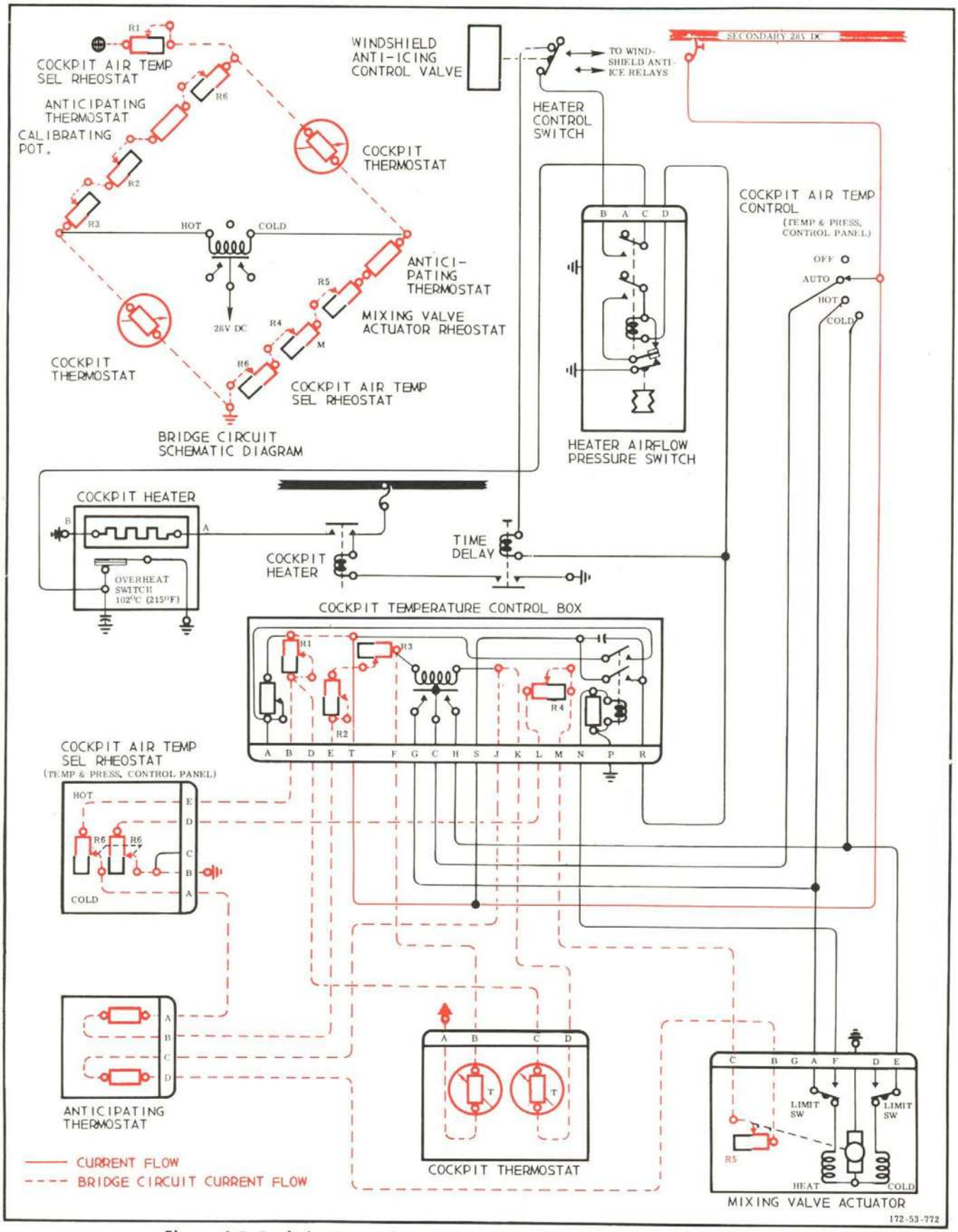


Figure 4-5. Cockpit Air Conditioning Temperature Control—System Balanced—F-86E-1, F-86E-5, and F-86E-6 Airplanes

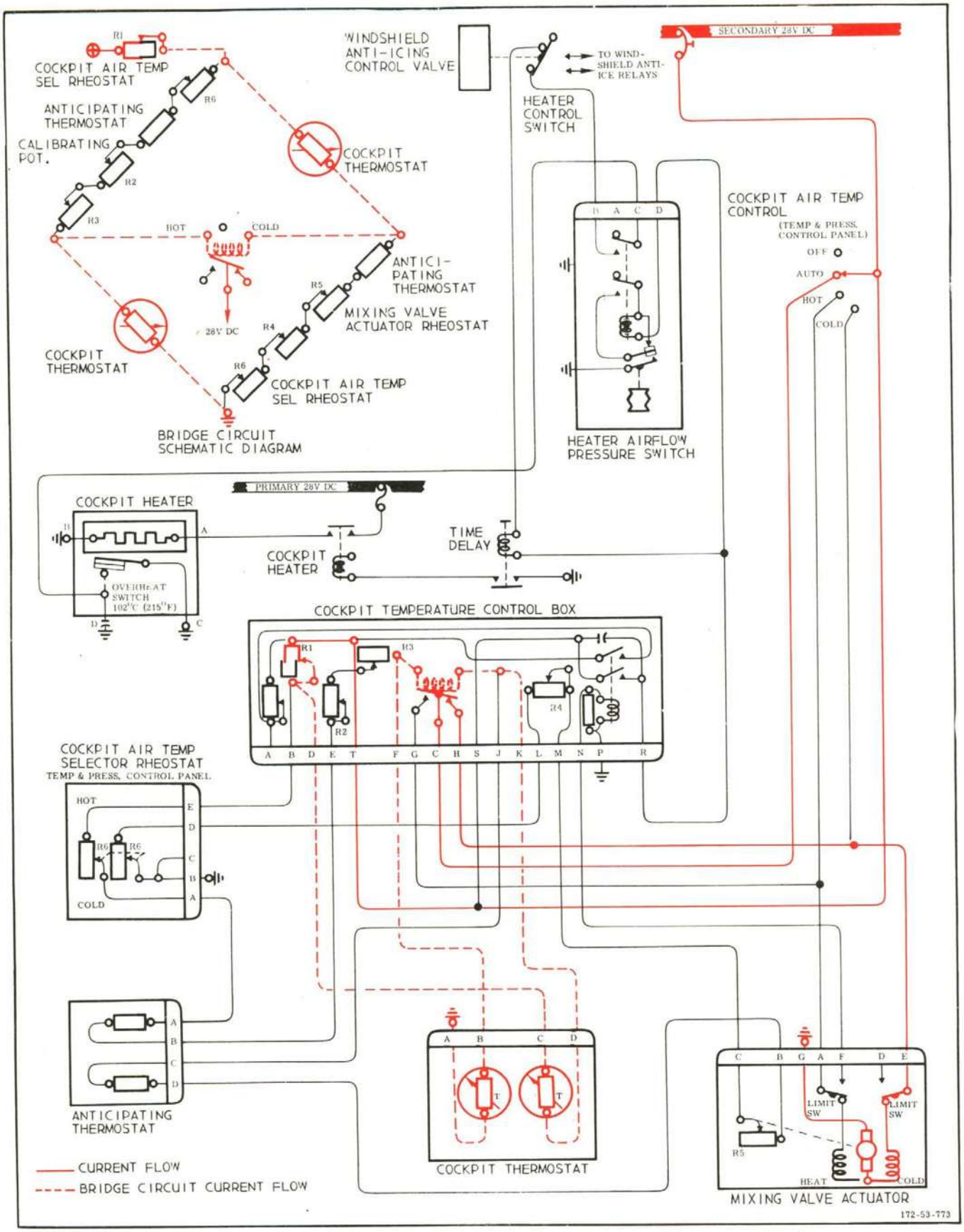


Figure 4-6. Cockpit Air Conditioning Temperature Control—System Demanding Cool Air—F-86E-1, F-86E-5, and F-86E-6 Airplanes

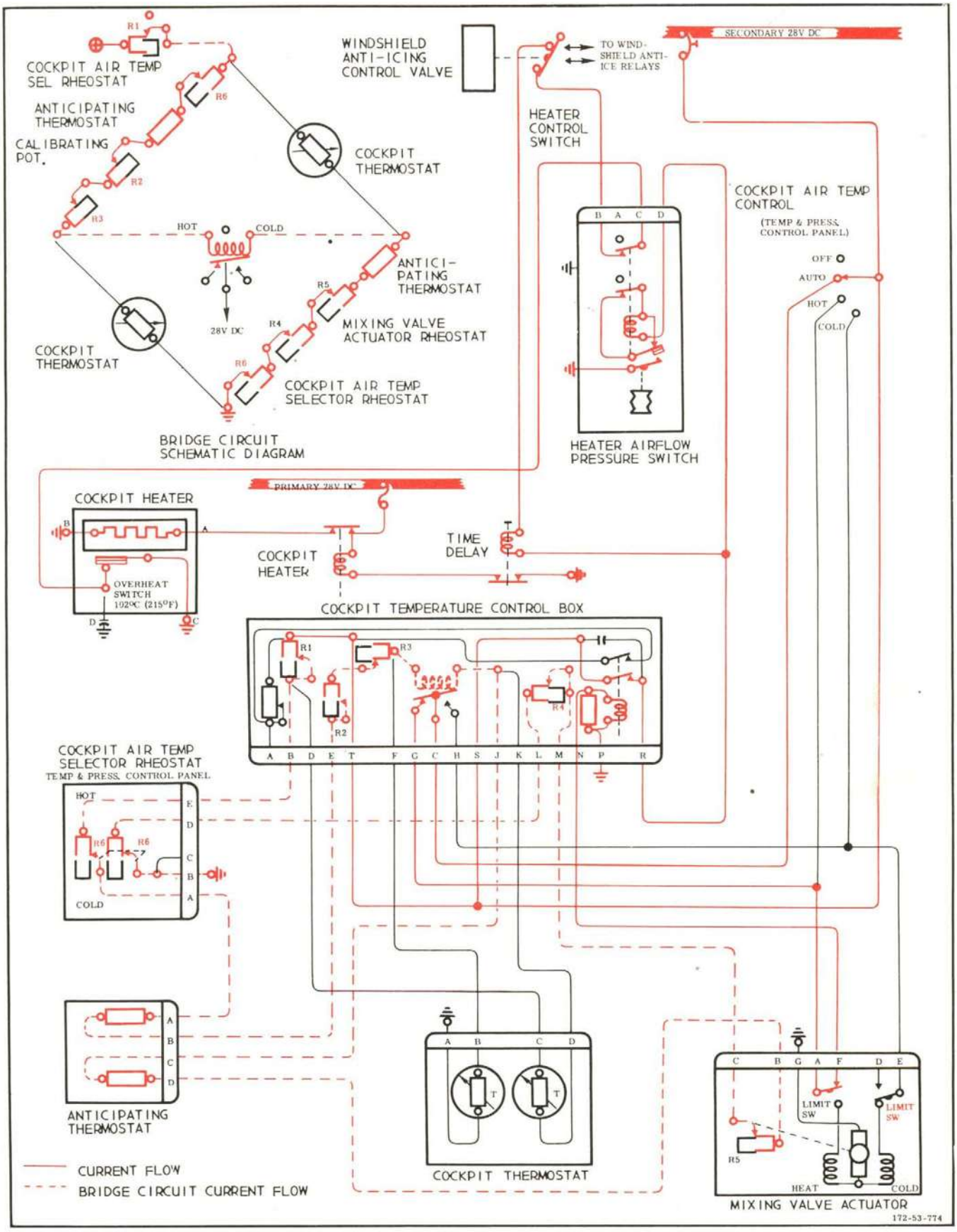


Figure 4-7. Cockpit Air Conditioning Temperature Control—System Demanding More Hot Air—F-86E-1, F-86E-5, and F-86E-6 Airplanes

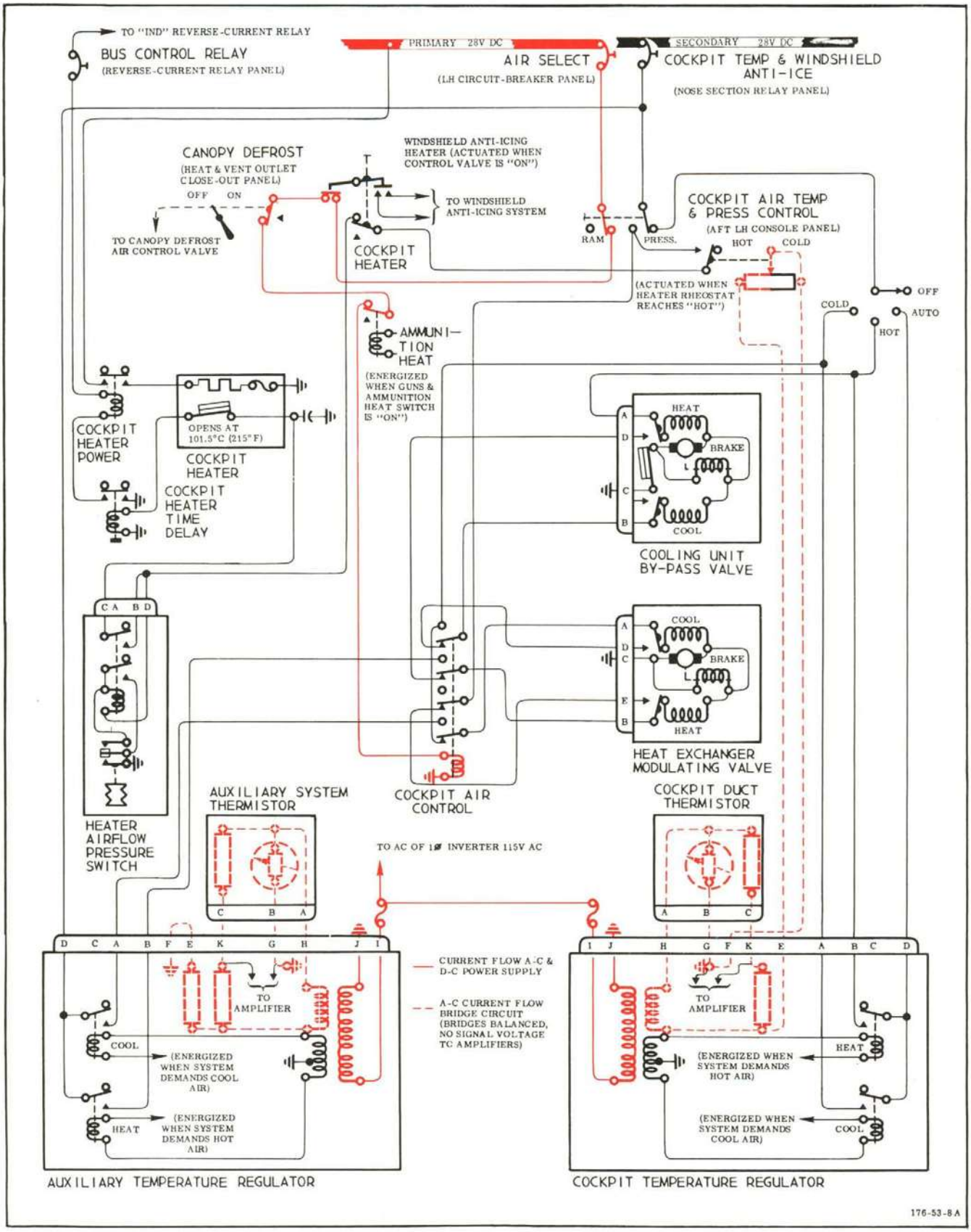


Figure 4-8. Cockpit Air Conditioning Temperature Control—System Balanced—Canopy Auxiliary Defrost Control "OFF"—F-86E-10 and F-86E-15 Airplanes

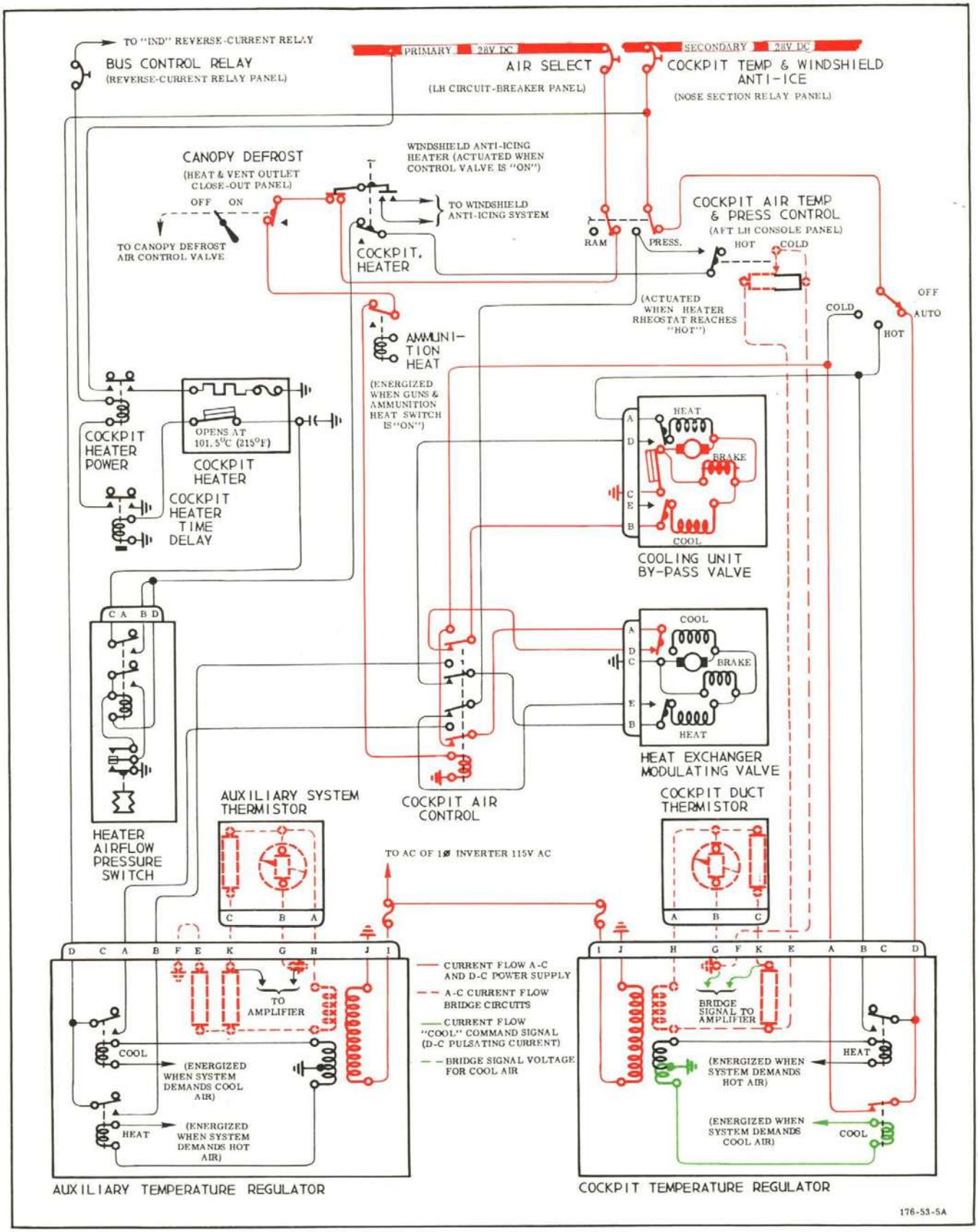


Figure 4-9. Cockpit Air Conditioning Temperature Control—System Demanding Cool Air—Canopy Auxiliary Defrost Control "OFF"—F-86E-10 and F-86E-15 Airplanes

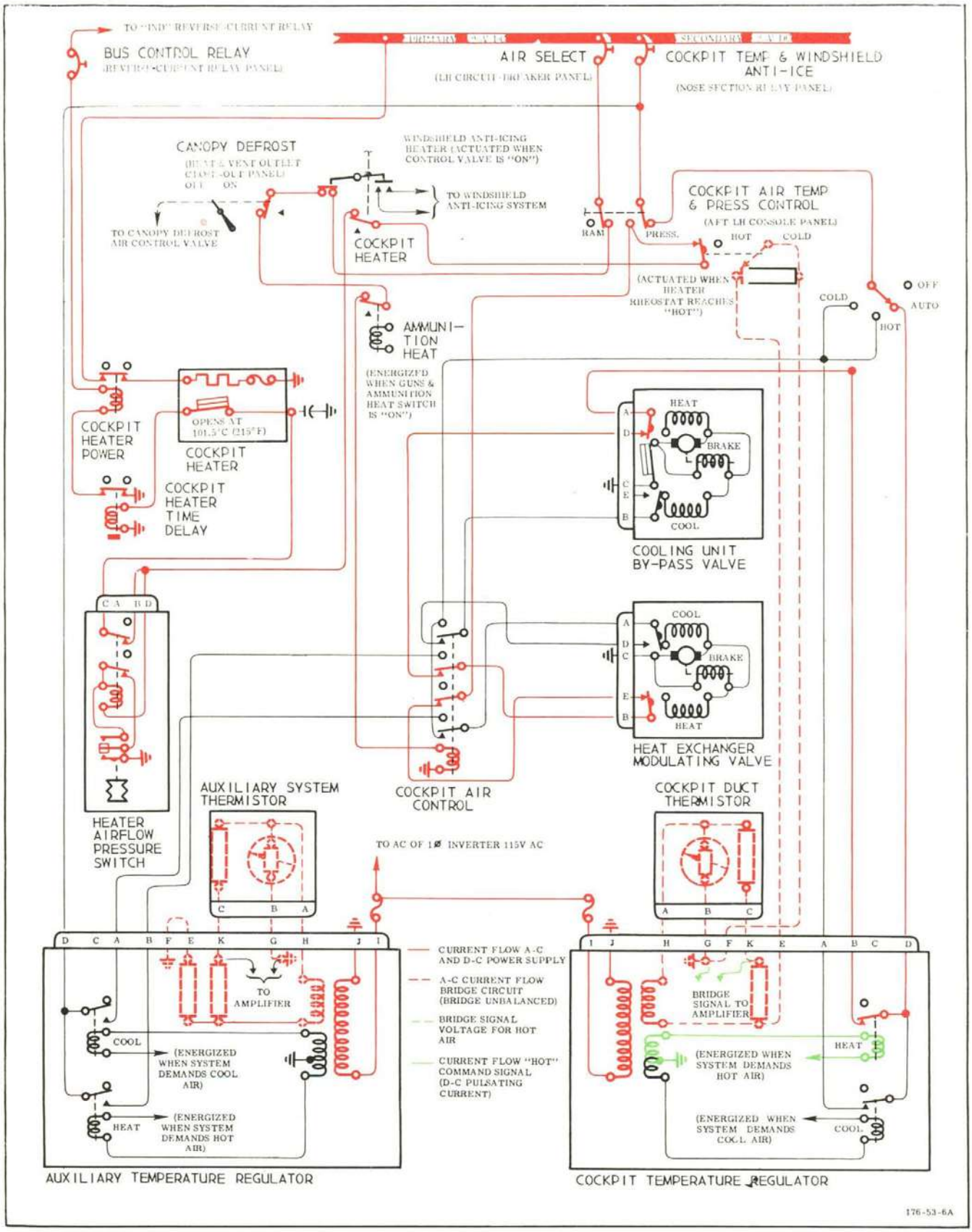


Figure 4-10. Cockpit Air Conditioning Temperature Control—System Demanding Hot Air—Canopy Auxiliary Defrost Control "OFF"—F-86E-10 and F-86E-15 Airplanes

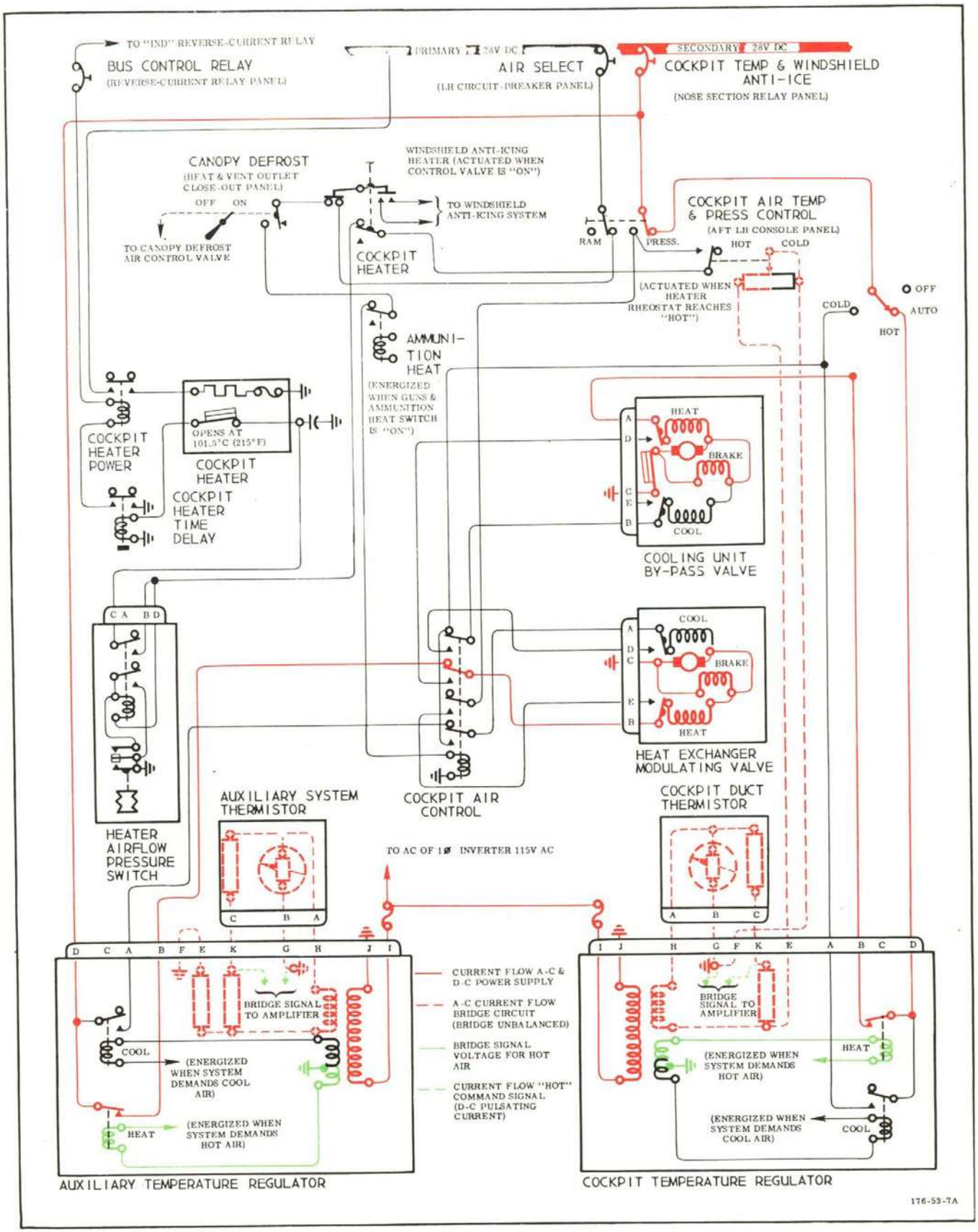


Figure 4-11. Cockpit Air Conditioning Temperature Control—System Demanding Hot Air—Canopy Auxiliary Defrost Control "ON"—F-86E-10 and F-86E-15 Airplanes

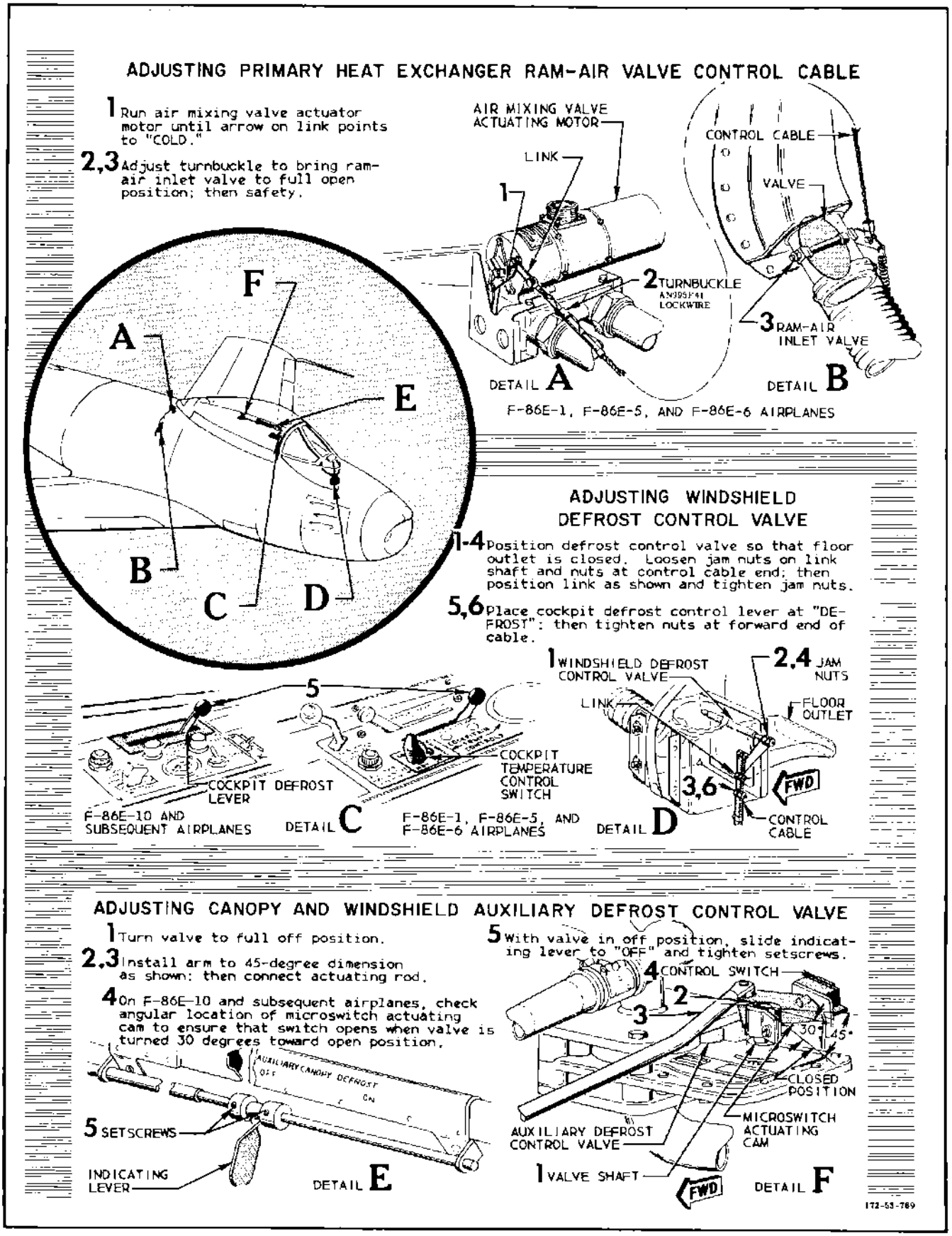


Figure 4-12. Adjusting Canopy Air Temperature System Controls

4-26. ANTICIPATING THERMOSTAT (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-27. The anticipating thermostat, located downstream of the cockpit heater, rapidly senses changes in supply air temperature before the air reaches the cockpit outlets. As a temperature change is detected, the resistance value of the thermostat changes; a decrease in temperature causes a decrease in resistance, an increase in temperature causes an increase in resistance. These resistance changes unbalance the bridge circuit and cause current to flow through the micropositioner in the direction necessary to energize either the heat or cold winding of the mixing valve actuator to correct the temperature condition and attain a balanced bridge. Ordinarily, the anticipating thermostat will take care of changes in outside air temperature rapidly enough that the cockpit thermostat will remain constant. However, if the cockpit temperature does change, the cockpit thermostat will function with the anticipating thermostat in this manner. Since the anticipating thermostat elements cannot actually rebalance the circuit, but can only tend to rebalance it, the mixing valve actuator will operate toward the desired position in steps until the cockpit thermostat is satisfied. This prevents an abrupt change in cockpit temperature and brings a more gradual change into effect.

4-28. AIR MIXING VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-29. The main system supply duct downstream of the shutoff valve is divided into two separate ducts, which supply air to the inlet side of a remotely controlled, electric-motor-actuated air mixing valve. The air mixing valve provides regulation of the cabin air supply temperature by proportioning the amounts of cooled or hot air to be mixed for use in the cockpit. The valve is remotely controlled through the cockpit air temperature control box. When maximum cockpit cooling is required, the valve routes all supply air through the cooling unit, where the expansion turbine cooling fan unit passes a maximum of 11.95 pounds per minute. When maximum cockpit heating is required, the mixing valve routes all supply air around the cooling unit, thus utilizing the full heat gained through engine compression. The maximum hot-air flow is 13.5 pounds per minute.

Note

A .090-inch orifice in the cold side of the valve permits airflow through the cooling unit under maximum heating conditions. This keeps the expansion turbine rotating as protection against excessively rapid turbine accelerations that might otherwise be obtained when high upstream pressure is applied to a nonrotating turbine.

4-30. REMOVING AIR MIXING VALVE. To remove the air mixing valve, proceed as follows:

a. Remove cooling unit access door behind canopy and disconnect electrical receptacle from top of mixing valve actuator.

b. Disengage the cable from the link at the forward end of mixing valve actuator.

c. Disconnect ducts from both sides of valve.

d. Remove mixing valve supporting bracket (right side of valve) and remove mixing valve.

4-31. INSTALLING AIR MIXING VALVE. Install the air mixing valve as follows:

a. Hold the mixing valve in position and install the supporting bracket.

b. Connect ducts at both sides of the valve.

c. Connect cable to link at forward end of valve actuator. (Verify proper engagement of cable on pulley.)

d. Connect electrical receptacle to valve actuator and install cooling unit access door.

4-32. PRIMARY HEAT EXCHANGER RAM-AIR INLET VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-33. The amount of ram air admitted to the primary heat exchanger as the coolant medium is controlled by a butterfly-type valve mounted in the primary heat exchanger ram-air inlet duct. The valve is linked by a cable to the mixing valve actuating linkage so that when more cold air is demanded by the temperature control system, the ram-air inlet valve opens to allow a greater flow of coolant through the primary heat exchanger. When more hot air is demanded, the valve starts to close.

4-34. ADJUSTING RAM-AIR INLET VALVE. See figure 4-12 for adjusting primary heat exchanger ram-air inlet valve.

4-35. COCKPIT AIR TEMPERATURE AND AUXILIARY TEMPERATURE REGULATORS (F-86E-10 AND F-86E-15 AIRPLANES).

4-36. The cockpit air temperature regulator, in conjunction with the cockpit air temperature selector rheostat and the cockpit air duct thermistor, automatically maintains cockpit temperature at a preselected value. The regulator is an electronic device that has a temperature regulating range (cockpit duct temperature) of –6.7°C (20°F) to 116°C (240°F). The auxiliary temperature regulator, in conjunction with the auxiliary system thermistor, maintains a temperature of 107°C (±6°C) [225°F (±10°F)] at the outlet of the primary heat exchanger during windshield and canopy auxiliary defrosting. Windshield anti-icing (paragraph 4-141) and ammunition compartment heating (paragraph 4-165) are also controlled by the auxiliary temperature regulator. (See figures 4-8 through 4-11.)

4-37. FUNCTION OF COCKPIT AIR TEMPERATURE REGULATOR. The cockpit air temperature regulator, acting as the electronic center for the automatic temperature control system, receives signal voltages from the cockpit air duct thermistor as well as

from the cockpit air temperature selector rheostat. When an unbalanced bridge circuit exists, signals from this unbalanced condition are amplified and passed through a phase discriminator circuit, which recognizes the direction of bridge circuit unbalance. The heat or cool relay within the regulator is then energized, and current is directed to the cooling unit by-pass valve and the primary heat exchanger air modulating valve. If the unbalance is large, the electrical impulses delivered to the valves are long and frequent, diminishing in length and frequency as the amount of unbalance decreases until the bridge circuit is functioning in balance. The sequence of operation of the cooling unit by-pass valve and the primary heat exchanger air modulating valve is the same in automatic operation as manual operation. (Refer to paragraph 4-17.)

4-38. FUNCTION OF AUXILIARY TEMPERATURE REGULATOR. The auxiliary temperature regulator functions in the same manner as the cockpit air temperature regulator (paragraph 4-37), except that temperature control range for the auxiliary system is set by adjustment of a resistor in the regulator. This internal adjustable resistor serves the same purpose as the cockpit air temperature selector rheostat. When the canopy auxiliary defrost control, the windshield anti-icing control, or the ammunition compartment heat control is "ON," the auxiliary temperature regulator automatically controls the position of the primary heat exchanger air modulating valve. This valve controls the amount of cooling air (from the engine ram-air scoop) that passes through the primary heat exchanger. (See figure 4-11.)

4-39. COCKPIT AIR DUCT AND AUXILIARY SYSTEM THERMISTORS (F-86E-10 AND F-86E-15 AIRPLANES).

4-40. The cockpit air duct and auxiliary system thermistors serve as the temperature sensing units of the air temperature control system. Each thermistor consists of a highly temperature-sensitive resistor and an adjustable resistor used to set the temperature control range of the unit. The cockpit air duct thermistor is located in the air supply duct, upstream of the cockpit heater. The auxiliary system thermistor is located in the duct, upstream of the primary heat exchanger. (See figure 4-2.) Refer to paragraph 4-17 for function of the thermistors.

4-41. COOLING UNIT BY-PASS VALVE (F-86E-10 AND F-86E-15 AIRPLANES).

4-42. The cooling unit by-pass valve is installed in the cockpit air duct between the take-off to the cooling unit and the cockpit heater. The valve supplements the primary heat exchanger air modulating valve in conditioning the cockpit air to meet the temperature demands of the cockpit air duct thermistor. When the thermistor senses the need for more hot air, the cooling unit by-pass valve opens and the primary heat exchanger cooling air modulating valve closes. When cold air is demanded, the modulating valve opens and the by-pass valve closes. The cooling unit by-pass valve provides the sole means of cockpit air temperature regulation (by proportioning the relative amounts of air to be routed through the heater and cooling unit) when any or all of the auxiliary heating systems are in operation. The by-pass valve has an opening and closing time of 5 to 10 seconds, a maximum operating inlet pressure of 125 psi, and a maximum inlet air temperature of 338°C (640°F). (See figure 4-2.)

4-43. REMOVING BY-PASS VALVE. To remove the cooling unit by-pass valve, disconnect clamps at each end of valve and detach electrical plug.

4-44. INSTALLING BY-PASS VALVE. To install the cooling unit by-pass valve, connect valve to air ducts and tighten clamps. Then attach electrical plug.

4-45. TESTING BY-PASS VALVE. To test the cooling unit by-pass valve, proceed as follows:

a. Disconnect clamps from valve flanges, and lift valve away from air ducts far enough to observe inside of valve.

b. Place cockpit air temperature control switch at "HOT" and observe that the valve moves to full open.

c. Place cockpit air temperature control switch at "COLD" and observe that the valve moves to full closed.

d. Connect by-pass valve to air ducts and tighten clamps.

4-46. PRIMARY HEAT EXCHANGER AIR MODULATING VALVE (F-86E-10 AND F-86E-15 AIRPLANES).

4-47. The primary heat exchanger air modulating valve, located in the heat exchanger cooling air outflow duct, serves to increase or decrease the amount of cooling air that passes through the heat exchanger. This valve is closed when full hot air is demanded by the temperature control system. The modulating valve, which is operated by an actuator, has an opening and closing time of 7 to 10 seconds, a maximum air inlet pressure of 25 psi, and a maximum operating temperature of 177°C (350°F). The valve operates in conjunction with the cooling unit by-pass valve to regulate the temperature of the air. (See figure 4-2.)

4-48. REMOVING MODULATING VALVE. To remove modulating valve, disconnect the two attaching clamps at each end of the valve and detach the actuator plug.

4-49. INSTALLING MODULATING VALVE. To install the modulating valve, attach clamp to flanges of cooling air duct and valve at upstream end of valve, and connect hose and clamp to downstream end. Then attach actuator plug.

4-50. TESTING MODULATING VALVE. To test the modulating valve for proper function, place the cockpit air temperature control switch at "HOT" and observe that the valve shuts off the airflow through the primary

heat exchanger cooling air outflow duct. To check the valve for open position, place the cockpit air temperature control switch at "COLD" and observe the free flow of air through the duct.

4-51. COCKPIT AIR COOLING AND HEATING SYSTEM.

4-52. The cockpit air cooling and heating system consists of a primary heat exchanger, a cooling unit, a cockpit heater, and a cockpit heater airflow pressure switch. The flow of air through the various units is regulated by the cockpit temperature control system. (See figures 4-1 and 4-2.)

4-53. PRIMARY HEAT EXCHANGER.

4-54. The primary heat exchanger receives air directly from the engine compressor section and reduces the temperature of the air to a safe value before the air enters the remainder of the system. The heat exchanger utilizes ram air, obtained from a port in the engine air intake duct, as a cooling medium. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the amount of ram air available is regulated by a butterfly valve in the ram-air duct. The butterfly valve is automatically controlled by a cable attached to the air conditioning system air mixing valve actuating linkage (figure 4-1). As the air mixing valve selects more air for the cold side of the air conditioning system, more ram air is admitted to the heat exchanger. On F-86E-10 and F-86E-15 Airplanes, the volume of ram-air flow through the heat exchanger is regulated by a modulating valve in the heat exchanger cooling air outflow duct. The modulating valve is automatically controlled by demands of the temperature control system. In this way, cockpit air temperature can be either increased or decreased by action of the valve.

4-55. REMOVING PRIMARY HEAT EXCHANGER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). To remove the primary heat exchanger, proceed as follows:

a. Remove the engine. (Refer to paragraph 5-6.)

b. Disconnect canopy seal line at rear of heat exchanger.

c. Remove the four duct clamps and collars at both ends of heat exchanger.

d. Remove both bolts from heat exchanger support bracket; then remove the heat exchanger.

4-56. INSTALLING PRIMARY HEAT EXCHANGER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). The primary heat exchanger is installed as follows:

a. Bolt heat exchanger to support bracket and install the four duct clamps with the necessary collars.

b. Connect canopy seal line to rear of heat exchanger; then install engine. (See figure 5-6.)

4-57. REMOVING PRIMARY HEAT EXCHANGER (F-86E-10 AND F-86E-15 AIRPLANES). To remove primary heat exchanger, proceed as follows:

a. Remove primary heat exchanger access door.

b. Remove the three duct clamps at each end of heat exchanger.

c. Loosen toggle nuts and remove four toggles from cooling air inlet duct.

d. Remove heat exchanger.

4-58. INSTALLING PRIMARY HEAT EXCHANGER (F-86E-10 AND F-86E-15 AIRPLANES). To install primary heat exchanger, proceed as follows:

a. Install four toggles and nuts to cooling air inlet duct.

b. Install clamps to ducts at both ends of heat exchanger.

c. Install primary heat exchanger access door.

4-59. COCKPIT AIR COOLING UNIT.

4-60. The cooling unit is composed of an air-to-air heat exchanger and an air-driven expansion turbine. The cooling unit receives air that has been discharged from the engine compressor section at 328°C (622°F) and cooled to approximately 163°C (325°F) by the primary heat exchanger. This preconditioned air then flows through the cooling unit (secondary) heat exchanger at approximately 20 pounds per minute and enters the expansion turbine at 116°C (240°F). The low-speed expansion turbine then discharges the air into the cockpit air conditioning duct at 4.4°C (40°F). The turbine is composed of a vaned rotor and a fan connected by a common shaft. Preconditioned air from the engine compressor section turns the rotor, which in turn drives the fan. The fan draws cooling air from an inlet in the upper section of the engine air intake duct, routes it through the cooling unit heat exchanger and turbine, and exhausts it back into the engine air intake duct. The use of ram cooling air ensures more efficient fan operation by boosting the flow of air through the fan blades. (See figures 4-1 and 4-2.) Refer to paragraph 1-77 for servicing instructions for the cooling unit installed in F-86E-1, F-86E-5, and F-86E-6 Airplanes. The cooling unit installed in F-86E-10 and F-86E-15 Airplanes requires no servicing, as it is lubricated by an oil pack, which is renewed at time of overhaul or replacement.

4-61. REMOVING COOLING UNIT TURBINE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). To remove the cooling unit turbine from the cooling unit heat exchanger, proceed as follows:

a. Remove canopy. (Refer to paragraph 2-168.)

b. Remove engine accessory and cooling unit access door. (See figure 1-5.)

c. Remove flange from top of frame behind turbine.

d. Disconnect the two small chains attached to turbine oil reservoir screws at bulkhead.

e. Disconnect air lines at both outlets of turbine.

f. Loosen clamp that attaches turbine to heat exchanger, and remove turbine.

4-62. INSTALLING COOLING UNIT TURBINE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). Install the cooling unit turbine as follows:

Note

If the turbine is being replaced with a new or overhauled turbine, or if the airplane has been in extended storage, fill the turbine oil sump to green line on sight gage, and install filler plug. Shake the turbine, turning it frequently to allow oil to penetrate the seals, bearings, and oil wicks. Then drain out the oil.

a. To prevent gasket slippage, install a new gasket on the turbine, using silicone cement (Dow-Corning DC804).

b. Position turbine at heat exchanger so that guide pin on turbine engages with slot at top of heat exchanger. Use care in fitting turbine to heat exchanger to prevent damaging gasket.

c. Tighten clamp that attaches turbine to heat exchanger.

d. Attach the two small chains on the turbine to the bulkhead.

e. Tighten hose clamps at both outlets of turbine.

f. Install flange on top of frame behind turbine.

4-63. REMOVING COOLING UNIT TURBINE (F-86E-10 AND F-86E-15 AIRPLANES). To remove cooling unit expansion turbine, proceed as follows:

a. Remove turbine access door.

b. Remove 10 bolts from air conditioning air intake duct attachment fitting.

c. Disconnect wire clamps from cooling air outlet duct connection.

d. Remove clamp from air conditioning air outlet at downstream side of turbine and fan inlet side of turbine.

e. Remove turbine.

4-64. INSTALLING COOLING UNIT TURBINE (F-86E-10 AND F-86E-15 AIRPLANES). To install cooling unit turbine, proceed as follows:

a. Connect cooling air intake duct to inlet side of turbine and install clamp.

b. Connect cockpit air conditioning duct to attachment fitting on turbine and install 10 bolts.

c. Attach cooling air outlet connection and install wire clamp.

d. Connect cockpit air conditioning duct to downstream turbine outlet and install clamp.

e. Install turbine access door.

4-65. REMOVING COOLING UNIT HEAT EXCHANGER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). Remove the cooling unit heat exchanger as follows:

a. Remove the cooling unit turbine. (Refer to paragraph 4-61.)

b. Remove air line between heat exchanger and air mixing valve.

c. Remove power unit (J-68/ARC-3).

d. Remove canopy electric actuator.

e. Remove four bolts that secure heat exchanger to mounting bracket, and remove heat exchanger through left access door.

4-66. INSTALLING COOLING UNIT HEAT EXCHANGER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). Install the cooling unit heat exchanger as follows:

a. Guide heat exchanger through radio and electrical system unit left access door, and position on mounting bracket.

b. Install four bolts that secure heat exchanger to mounting bracket, but do not tighten bolts.

c. Install canopy electric actuator, and seal bolts with sealing compound (USAF Specification No. 14153).

d. Install power unit (J-68/ARC-3).

e. Install line between heat exchanger and air mixing valve; then torque "B" nuts to 600-900 inch-pounds.

f. Tighten heat exchanger mounting bolts.

g. Install the cooling unit turbine. (Refer to paragraph 4-62.)

4-67. REMOVING COOLING UNIT HEAT EXCHANGER (F-86E-10 AND F-86E-15 AIRPLANES). To remove cooling unit heat exchanger, proceed as follows:

a. Remove cooling unit heat exchanger access door.

b. Loosen toggle nuts from heat exchanger flanges.

c. Remove heat exchanger inlet duct.

d. Remove duct clamps from each end of heat exchanger at duct connections.

e. Remove heat exchanger.

4-68. INSTALLING COOLING UNIT HEAT EXCHANGER (F-86E-10 AND F-86E-15 AIRPLANES). To install cooling unit heat exchanger, proceed as follows:

a. Insert heat exchanger between heat exchanger flanges and attach toggle nuts.

b. Connect air conditioning ducts to outlets at each end of exchanger and tighten clamps.

c. Install cooling unit heat exchanger access door.

4-69. REPLACING TURBINE AND/OR 100-MESH SCREEN BETWEEN TURBINE AND HEAT EXCHANGER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). The turbine and manifolds may be removed from the cooling unit to replace the turbine and/or the gasket which incorporates the 100-mesh screen. Proceed as follows:

a. Disconnect cabin air and cooling air exhaust ducts from turbine.

b. Remove bolts securing turbine to the turbine inlet and fan inlet manifolds, and lift off turbine.

c. Remove bolts securing fan inlet manifold to heat exchanger, and lift off manifold.

d. Remove bolts securing turbine inlet manifold to heat exchanger, and lift off manifold.

e. Discard 100-mesh screen gasket between turbine inlet manifold and heat exchanger.

f. Install new 100-mesh screen gasket and any other gaskets that appear deteriorated. Flanges must be cleaned before gaskets are installed.

g. Install turbine inlet manifold on heat exchanger.

h. Install fan inlet manifold on heat exchanger.

i. Position turbine on fan and turbine manifolds over the gaskets.

j. Tighten the bolts on the fan inlet flange to 5-7 inch-pounds torque so that the holes on the turbine inlet flange match those of its attaching manifold.

k. Tighten the bolts on the turbine inlet flange securely.

l. Lockwire all bolts not secured by self-locking nuts.

m. Fill turbine oil reservoir, using procedure outlined in paragraph 1-78.

4-70. REPLACING TURBINE INLET SCREEN (F-86E-10 AND F-86E-15 AIRPLANES). To replace turbine inlet screen, proceed as follows:

a. Remove turbine access door.

b. Remove 10 bolts from air conditioning air intake duct attachment fitting.

c. Disconnect second clamp on downstream side of air intake duct.

d. Remove screen.

e. Clean screen with brush dipped in cleaning solvent (Federal Specification P-S-661).

f. Dry with compressed air and replace.

4-71. COCKPIT HEATER.

4-72. An auxiliary electrical resistance-type heater of 4-kilowatt input capacity is installed in the ducting system between the cockpit and the junction between the hot- and cold-air ducts. (See figures 4-1 and 4-2.) This heater is provided to add heat to the system whenever the system air temperature is insufficient to satisfy the heating requirements of the cockpit. Since this heater is installed downstream of the ram-air inlet, it will supply heat to the cockpit during ram-air operation if required.

4-73. REMOVING HEATER. To remove cockpit heater, proceed as follows:

a. Remove aft radio equipment access doors from both sides of fuselage.

b. Remove gyrosyn compass amplifier and slaved gyro through right access door.

c. Remove electronic equipment through left access door.

d. Remove phenolic cover from left side of heater and disconnect wiring.

e. Loosen hose clamps and remove the section of ducting immediately behind heater.

f. Remove clamp from forward end of heater and remove heater.

4-74. INSTALLING HEATER. To install cockpit heater, proceed as follows:

a. Support heater in position and install clamp at forward end; then install the section of ducting behind heater.

b. Connect electrical wiring to heater and install phenolic cover.

c. Install electronic equipment, gyrosyn compass amplifier, and slave gyro.

d. Install aft radio equipment access doors to both sides of fuselage.

4-75. COCKPIT HEATER AIRFLOW PRESSURE SWITCH.

4-76. The cockpit heater airflow pressure switch is provided to prevent heater operation when there is insufficient airflow through the heater. The switch is mounted on the deck aft of the pilot's seat, within the pressurized area. (See figure 4-2.) An air line from the switch is connected to the heater inlet air supply duct. The switch senses airflow to the heater by the differential between heater inlet duct air pressure and cockpit air pressure. The switch is factory-adjusted to make contact at 2.50 inches of water and to break contact at 1.75 inches of water; no further adjustment is recommended.

4-77. COCKPIT AIR PRESSURE REGULATOR.

4-78. The cockpit air pressure regulator maintains cockpit pressure at a predetermined schedule by controlling the outflow of pressurized air from the cockpit. Excess air is relieved by the regulator through an outflow valve that discharges air directly to outside atmosphere. The pressure regulator controls cockpit pressure through unpressurized, isobaric, high-differential (5.00 psi) and low-differential (2.75 psi) stages of operation. The pressure regulator on F-86E-10 and F-86E-15 Airplanes also controls cockpit pressure through a pressure changeover operation. High- and low-differential operation is manually controlled by the cockpit pressure selector. The other stages of operation are automatic. A manually operated shutoff valve, located on the forward end of the regulator, is provided to render the regulator inoperative during ground pressurization checks. The valve must be safetied in the open position during normal operation. On the regulator installed in F-86E-10 Airplanes, a third position of the shutoff valve is provided for testing differential pressure. An internal filter excludes foreign material from the regulator. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, three screws secure the filter to the housing. On F-86E-10 and F-86E-15 Airplanes, a screw cap on the forward end of the regulator

holds the filter in place and can be removed for cleaning the filter. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the cockpit air pressure regulator is controlled when the cabin pressure control lever is placed at either "ON" position ("2.75" or "5.00"). A solenoid, which is energized when the cabin pressure control lever is placed at "ON—2.75," is incorporated in the regulator to enable the selection of the two different pressure schedules. On F-86E-10 and F-86E-15 Airplanes, the regulator is controlled when the cockpit pressure selector switch is placed at either "2.75 P.S.I." or "5 P.S.I.," and the control switch is in the "PRESSURE" position.

4-79. FUNCTION OF REGULATOR. When the shutoff valve on the regulator is in the open position, the pressure regulator is in normal operation. In the unpressurized stage of operation, cockpit pressure is substantially the same as atmospheric pressure up to 12,000 feet, regardless of the pressure schedule selected. In the isobaric stage of operation, with a 2.75 psi pressure schedule selected, cockpit pressure is maintained at a 12,500-foot altitude from 12,500 feet to 21,200 feet. With a 5.00 psi pressure schedule selected, cockpit pressure is maintained at a 12,500-foot altitude from 12,500 feet to 31,000 feet. In the low-differential stage of operation (2.75 psi pressure schedule selected), the cockpit pressure regulator maintains a 2.75 psi differential between cockpit air pressure and atmospheric pressure at all altitudes above 21,200 feet. In the high-differential (5.00 psi selected) stage of operation, the regulator maintains a 5.00 psi differential between cockpit pressure and atmospheric pressure at all altitudes above 31,000 feet. On F-86E-10 and F-86E-15 Airplanes, the pressure change-over control limits the rate of cockpit pressure increase to 1 psi per minute maximum during a dive, when the cockpit pressure control is changed from ram-air operation to 2.75 or 5.00 psi differential operation, or when changing from 2.75 psi to 5.00 psi differential operation. When changing from 5.00 to 2.75 psi differential operation, or from 5.00 psi differential operation to ram-air operation, rate of change is between ¼ to 1 psi per second.

4-80. REMOVING REGULATOR (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). The pressure regulator is removed as follows:

a. Remove the canopy (paragraph 2-168); then disconnect the hose at the canopy rear web and disengage the electrical connector.

b. Remove the six mounting bolts from behind the regulator (forward of canopy rear web), and carefully remove the regulator to prevent damage to plastic canopy or regulator.

4-81. INSTALLING REGULATOR (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). Install the pressure regulator by bolting to adapter on canopy rear web, connecting electrical receptacle, and connecting hose to fitting on canopy rear web. Then install the canopy. (See figure 2-44.)

4-82. REMOVING REGULATOR (F-86E-10 AND F-86E-15 AIRPLANES). To remove the pressure regulator, disconnect the atmosphere connection at the "T" on the forward side of the regulator body and remove the clamp that attaches the regulator to the outflow duct.

4-83. INSTALLING REGULATOR (F-86E-10 AND F-86E-15 AIRPLANES). To install the pressure regulator, attach the regulator body to front end of outflow duct, tighten attaching clamp, and then connect atmosphere line to "T" on front of regulator body.

4-84. CLEANING REGULATOR FILTER. The filter assembly is located on the side of the control chamber housing. Remove the filter assembly by cutting the lockwire and remove the three screws securing it to the housing. On F-86E-10 and F-86E-15 Airplanes, remove the screw cap that secures the filter in place. Wash the filter assembly in trichlorethylene (Specification MIL-T-7003) and dry with compressed air. Do not remove the copper ribbon. After cleaning, position the filter assembly, secure, and safety.

4-85. CLEANING REGULATOR OUTFLOW VALVE FACE AND SEAT. The outflow valve face and seat can be cleaned with a soft, clean cloth if inspection shows the presence of dirt or foreign material. Do not use compressed air.

4-86. COCKPIT AIR PRESSURE EMERGENCY DUMP VALVE.

4-87. Cockpit pressure relief, vacuum (or negative-pressure) relief, and pressure dumping are provided by one unit, the emergency dump valve. Vacuum relief is automatic and consists of the pressure actuation of a poppet-type diaphragm valve, which opens to equalize the internal-external cockpit pressures. The positive-pressure relief valve is set to operate at a differential of 10.8 ($\pm$0.3) in. Hg between cockpit air pressure and atmospheric pressure, and the vacuum (or negative-pressure) relief valve setting is 0.5 in. Hg (maximum). Positive-pressure relief is required if the cockpit air pressure regulator fails, and negative-pressure relief is required during a rapid descent of the airplane whenever the pressure regulator fails to provide the necessary reduction rate in pressure differential change. All cockpit air pressure can be dumped instantaneously by the emergency dump feature of the valve. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, placing the cabin pressure control, located on the left console in the cockpit, at the "OFF" position opens a pneumatic valve to dump the pressure. (See figure 4-1.) On F-86E-10 and F-86E-15 Airplanes, placing the cockpit pressure control switch at "RAM" energizes a solenoid valve in the air outlet of the emergency dump valve to dump the pressure. (See figure 4-2.)

4-88. REMOVING EMERGENCY DUMP VALVE. To remove emergency dump valve, proceed as follows:

a. Remove aft radio equipment access door from fuselage left side and remove the electronic equipment.

b. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, disconnect line to pneumatic valve from bottom of dump valve.

c. On F-86E-10 and F-86E-15 Airplanes, disconnect electrical plug from emergency dump valve solenoid.

d. Raise back end of canopy and remove the valve mounting bolts (above canopy deck); then remove dump valve.

4-89. INSTALLING EMERGENCY DUMP VALVE. To install emergency dump valve, proceed as follows:

a. Place valve on bottom side of canopy deck under mounting holes, raise back end of canopy, and insert bolts through deck and valve flange.

b. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, connect air line at bottom of dump valve.

c. On F-86E-10 and F-86E-15 Airplanes, connect electrical plug to emergency dump valve solenoid.

d. Install electronic equipment, and close aft radio equipment access door.

4-90. TESTING EMERGENCY DUMP VALVE PRESSURE RELIEF (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES. Upon completion of the cockpit pressure test (paragraph 4-10), check operation of the pressure relief function of the emergency dump valve. Increase cockpit test pressure until there is between 5.8 and 6.4 in. Hg (2.85 and 3.15 psi) differential between cockpit pressure and atmospheric pressure. The relief valve should operate.

CAUTION

Under no circumstances should the applied differential pressure exceed 6.4 in. Hg (3.15 psi).

Lower cockpit pressure slowly to one psi. Have man assisting in cockpit place cabin pressure control lever "OFF" ("RAM AIR ON—DUMP OPEN"). Valve should dump cockpit air.

Note

Upon completion of this test, safety pressure regulator bleed valve in the open position and remove the blocking disk from supply duct at the engine manifold.

4-91. TESTING EMERGENCY DUMP VALVE PRESSURE RELIEF (F-86E-10 AND F-86E-15 AIRPLANES). On completion of the cockpit pressure test (paragraph 4-10), check pressure relief operation of the emergency dump valve. De-energize air selector circuit breaker; then increase cockpit test pressure until there is a 10.5 to 11.1 in. Hg differential between cockpit pressure and atmospheric pressure. This should cause the valve to operate.

CAUTION

Under no circumstances should the applied differential pressure exceed 11.2 in. Hg (5.51 psi).

Lower cockpit pressure slowly to one psi. Place cockpit pressure control switch at "RAM"; then energize air selector circuit breaker. Valve should then dump cockpit air. (See figure 4-4.)

Note

On completion of this test, safety pressure regulator bleed valve in the on position and remove the blocking disk from supply duct at the engine manifold.

4-92. SYSTEM SHUTOFF VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-93. A remotely controlled, electrically actuated shutoff valve is provided in the main system supply duct, downstream of the primary heat exchanger. The valve is a two-position (open-close) shutoff unit, so situated that all airflow from the engine source can be shut off in event the air becomes contaminated, except airflow to the ammunition compartment and to the anti-G suit, wing tip tanks, and hydraulic reservoir. The take-off ducts to these units are upstream of the shutoff valve. (See figure 4-1.) When the cabin pressure control lever is placed at either "ON" position, the shutoff valve opens; when the lever is placed at "OFF," the valve closes.

Note

The shutoff valve is designed to open in 12 seconds, thus preventing excessive cooling turbine acceleration, when the mixing valve is in a position to allow full flow to the turbine and the shutoff valve is opened.

4-94. REMOVING SYSTEM SHUTOFF VALVE. To remove the system shutoff valve, proceed as follows:

a. Remove the primary heat exchanger and the pressure ratio-flow control valve. (Refer to paragraphs 4-55 and 4-109.)

b. Remove the duct from rear side of shutoff valve.

c. Disconnect electrical receptacle and remove valve mounting bolts; then remove shutoff valve.

4-95. INSTALLING SYSTEM SHUTOFF VALVE. The system shutoff valve is installed as follows:

a. Bolt valve to fuselage former and connect electrical receptacle.

b. Install the duct behind the shutoff valve.

c. Install the pressure ratio-flow control valve and the primary heat exchanger. (Refer to paragraphs 4-56 and 4-110.)

4-96. TESTING SYSTEM SHUTOFF VALVE. To test the system shutoff valve, place the cabin pressure control lever at "ON" (either "2.75" or "5.00") and audibly check that the valve opens. Place the cabin pressure control lever at "OFF" and audibly check that the valve closes.

4-97. SYSTEM SHUTOFF VALVE (F-86E-10 AND F-86E-15 AIRPLANES).

4-98. The system shutoff valve is attached to the downstream side of the primary heat exchanger outlet assembly in the cockpit air conditioning duct. The valve is so situated that all the air for cockpit air conditioning can be shut off without interrupting the flow of air to the windshield anti-icing, windshield and canopy defrosting, ammunition heating, anti-G suit, or canopy seal systems. When the cockpit pressure control switch is placed at "RAM," the valve closes; when the switch is moved to "PRESS," the valve opens. This arrangement permits the use of all the auxiliary heating systems during ram-air operation. The valve is a two-position (off-on) shutoff unit designed for unidirectional flow with an operating range of 18°C (65°F) through 107°C (225°F) at altitudes up to 55,000 feet. It is powered by a 26-volt d-c actuator with an opening and closing time of 5 seconds. (See figure 4-2.)

4-99. REMOVING SYSTEM SHUTOFF VALVE. To remove system shutoff valve, detach electrical plug and disconnect clamp at upstream side of valve. Then remove bolts from flange at downstream end.

4-100. INSTALLING SYSTEM SHUTOFF VALVE. To install system shutoff valve, insert bolts in flange at downstream end of valve, attach a clamp, and then install electrical plug.

4-101. TESTING SYSTEM SHUTOFF VALVE. To test the system shutoff valve, place cockpit pressure control switch at "RAM" and observe that the valve closes. Then place the switch at "PRESS" and check that the valve opens.

4-102. RAM-AIR SHUTOFF VALVE.

4-103. Ram air is introduced from the engine air supply duct into the main cockpit supply duct when the ram-air shutoff valve is open. The electrically actuated shutoff valve is controlled from the cockpit by the cabin pressure control lever on F-86E-1, F-86E-5, and F-86E-6 Airplanes and by the cockpit pressure control switch on F-86E-10 and F-86E-15 Airplanes.

4-104. REMOVING RAM-AIR SHUTOFF VALVE. To remove ram-air shutoff valve, proceed as follows:

a. Remove aft radio equipment access door on fuselage right side.

b. Remove gyrosyn compass amplifier and slaved gyro.

c. Disconnect electrical receptacle from valve motor.

d. Remove shutoff valve upper and lower mounting bolts from duct flanges and remove valve.

4-105. INSTALLING RAM-AIR SHUTOFF VALVE. To install ram-air shutoff valve, proceed as follows:

a. Position valve between duct flanges (motor forward) and install mounting bolts.

b. Connect electrical receptacle to valve motor.

c. Install gyrosyn compass amplifier and slaved gyro.

d. Install aft radio equipment access door.

4-106. PRESSURE RATIO-FLOW CONTROL VALVE AND PRESSURE-LIMITING UNIT (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-107. The pressure ratio-flow control valve serves to limit the supply pressure at the system shutoff valve to a maximum of 120 in. Hg. The pneumatically actuated pressure-limiting unit senses the difference between cockpit pressure and supply pressure. The unit controls the pressure ratio-flow valve so that the supply pressure ratio (with respect to the cockpit pressure) is limited to a maximum predetermined value of 4.02 at sea level and gradually decreases to a minimum of 3.82 at 5000 feet. The ratio between supply pressure and cockpit pressure remains constant at 3.82 above 5000 feet.

4-108. CHECKING PRESSURE RATIO-FLOW CONTROL VALVE AND PRESSURE-LIMITING UNIT. To check for proper functioning of the valve and limiting unit, disconnect the sensing line immediately downstream of the system shutoff valve (figure 4-1) and apply 60 psi air pressure through the sensing line to the pressure-limiting unit. The pressure ratio-flow control valve should close completely.

CAUTION

Do not apply air pressure in excess of 78 psi during check procedure.

4-109. REMOVING PRESSURE RATIO-FLOW CONTROL VALVE. The pressure ratio-flow control valve can be removed after the primary heat exchanger has been removed. (Refer to paragraph 4-55.) Disconnect the sensing line and remove the clamp from the support bracket; then remove valve.

4-110. INSTALLING PRESSURE RATIO-FLOW CONTROL VALVE. To install the pressure ratio-flow control valve, install the clamp (engaging the support bracket), connect the sensing line, and finally install the primary heat exchanger. (Refer to paragraph 4-56.)

4-111. REMOVING PRESSURE-LIMITING UNIT. The pressure limiting unit can be removed after the engine has been removed. (Refer to paragraph 5-7.) Disconnect the three air lines from the unit and remove the two bolts from the mounting bracket; then remove pressure-limiting unit.

4-112. INSTALLING PRESSURE-LIMITING UNIT. To install the pressure-limiting unit, bolt the unit to the

mounting bracket and connect the three air lines. Then install the engine. (See figure 5-6.)

4-113. ANTI-G SUIT, TIP TANK, AND HYDRAULIC RESERVOIR DUCTS.

4-114. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the pressure duct to these three units is incorporated in the main pressure supply duct, immediately upstream of the system shutoff valve. (See figure 4-1.) This branch duct supplies heated air (at main system pressure) to a reducer valve, which provides air at the pressure required for use in the pilot's anti-G suit and also provides air for pressurizing the wing tip tanks and the main hydraulic system reservoir. On F-86E-10 and F-86E-15 Airplanes, these units are supplied with pressurized air from two different ducts; the one leading to the hydraulic reservoir is immediately upstream of the primary heat exchanger, while the one leading to the tip tanks and the anti-G suit is immediately upstream of the system shutoff valve. (See figure 4-2.)

4-115. COCKPIT AIR OUTLETS.

4-116. Air to the cockpit is distributed through side and floor outlets. The outlet at the left side of the pilot can be manually adjusted to direct air in any direction from the face of the outlet, or it can be shut off. The outlet at the right side of the pilot is not adjustable, but it incorporates a shutoff valve and directs air to the canopy for partial defrosting. The floor outlet is directed downward, through a nozzle-type outlet, to the pilot's feet. Airflow through the floor outlet may be entirely or partially diverted to the windshield for defrosting. A manual control, on the left console control panel, operates a valve by push-pull control to divert the forward air duct supply into the windshield defrost manifold. The windshield defrost control has three positions. When the control is placed at "FLOOR," all the ventilating air is diverted to the floor outlet. When the control is placed at "DEFROST," all the ventilating air is diverted to the windshield defrosting manifold. And when the defrost control is placed at "BOTH," the ventilating air is divided between the floor outlet and the windshield defrosting outlets.

4-117. ADJUSTING WINDSHIELD DEFROST CONTROL VALVE. See figure 4-12.

4-118. CANOPY AND WINDSHIELD AUXILIARY DEFROSTING SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-119. Heated air is supplied to the canopy and windshield through a separate duct connected to the cockpit air conditioning and pressurizing supply duct at a point just downstream of the cockpit air conditioning system shutoff valve. (See figure 4-1.) Perforated tubes alongside the canopy tracks and windshield direct air across the canopy and under the windshield from this defrosting supply duct. A manual control on the left side of the cockpit is mechanically linked to a control valve, which opens and closes to admit heated air to the defrost tubes. Inasmuch as the duct take-off is downstream of the air conditioning system shutoff valve, the air supply to the defrosting system is also shut off when the air conditioning system shutoff valve is closed.

4-120. CANOPY AND WINDSHIELD AUXILIARY DEFROSTING SYSTEM (F-86E-10 AND F-86E-15 AIRPLANES).

4-121. Heated air is supplied to the canopy and windshield through a separate duct connected to the primary heat exchanger high-pressure outlet. Perforated tubes alongside the canopy tracks and windshield direct air across the canopy and under the windshield for defrosting. These tubes are connected to the outlet assembly through a manual shutoff valve that is mechanically linked to a manual control on the left side of the cockpit. By means of this defrost control, heated air is admitted to the canopy and windshield surfaces for defrosting. Air supply for the system is available at the control valve regardless of the position of the air conditioning system shutoff valve. (See figure 4-2.) Temperature variations in the defrost system are accomplished by action of the primary heat exchanger air modulating valve, which controls the amount of cooling air that passes through the heat exchanger. The auxiliary system thermistor in the high-pressure outlet senses the rate of air temperature change and controls the modulating valve through action of the auxiliary temperature regulator, thereby cooling or heating the supply air being routed to the defrost system.

4-122. ADJUSTING CANOPY AND WINDSHIELD AUXILIARY DEFROST CONTROL VALVE. See figure 4-12.

4-123. COCKPIT PRESSURE-SEALING.

4-124. As the cockpit is pressurized, care must be taken to maintain a seal at all possible points of air leakage. (See figure 4-15.) Three methods of sealing are ordinarily used: rubber seals are located at all points where frequent breaking of the seal is necessary (such as canopy and access doors); sealing compounds are used at points where no breaking of the seal is expected except for structural maintenance or part replacement (such as lap and butt joints, and drill or other holes); and special seals are used at points where cables, tubing, mechanical linkages, and wiring must be passed out of the pressurized area. Wiring and tubing are passed through the pressure bulkheads by the use of bulkhead fittings which are sealed to the bulkhead and to which the wires and tubes are fastened from each side. The flight controls are passed through the bulkheads by three different methods: cable seals are used for the rudder; torque tube bearing seals are used for the aileron; and push-rod seals are used for the elevator. All seals of moving components are subject to wear; therefore, they should be carefully installed and should be checked regularly.

4-125. CANOPY SEAL.

4-126. An inflatable canopy seal is installed around the entire perimeter of the canopy for the purpose of forming a more nearly perfect seal between the canopy and the fuselage. Supply air pressure for the seal is taken from the cockpit pressurizing system supply line downstream of the primary heat exchanger (high-pressure outlet on F-86E-10 and F-86E-15 Airplanes). An air pressure regulator maintains the proper air pressure in the seal. A pressure relief valve, downstream of the regulator, is adjusted to relieve at 25 psi as a protection for the system in event the regulator does not function properly. A solenoid-operated shutoff valve provides a rapid means of deflating the seal whenever it becomes necessary to open or remove the canopy. On F-86E-10 and F-86E-15 Airplanes, the pressure regulator combines the functions of regulator, relief valve, and shutoff valve. A spring-loaded ball check valve, upstream of the regulator, permits ground pressurizing of the seal as well as enables the supply line downstream of the check valve to act as an accumulator when engine pressure falls below seal pressure. A ground pressurizing fitting, installed in the left gun bay, is provided for pressurizing the canopy seal on the ground. See figures 4-13 and 4-14 for location of equipment in the airplane and a schematic diagram of the system.

4-127. FUNCTION OF CANOPY SEAL. Air from the pressure supply line is first routed through the check valve to the pressure regulator, which regulates the downstream pressure to 20 psi. The air is then routed through the relief valve to the solenoid-operated shutoff valve. Power for operation of the shutoff valve is taken from the primary bus and routed through a canopy seal emergency dump switch (located on the outboard side of the pilot's right seat rail), through a canopy seal limit switch (located on the left aft side of the pilot's seat back), and through the canopy seal relay (located in the left gun bay). When the valve is energized, it opens and allows the seal to be pressurized. An interruption of the electrical circuit to the solenoid closes the valve and vents the air in the seal, depressurizing the seal. Actuation of any canopy "OPEN" or "CLOSE" switch, emergency canopy ejection, or electrical circuit failure will result in de-energizing the solenoid. Emergency depressurizing of the seal is accomplished by a microswitch on the ejection seat rails. When the right handgrip on the ejection seat is pulled up, the microswitch is actuated (to the open position) by canopy ejection linkage, de-energizing the pressure regulator solenoid. (See figures 4-13 and 4-14.)

4-128. ADJUSTING CANOPY SEAL REGULATOR. The canopy seal regulator is set and sealed at the factory and should require no further adjustment. If adjustment should become necessary, however, apply 60 psi inlet pressure and adjust discharge pressure to 20 psi (at no flow). To make this adjustment, turn the slotted screw at the top of the unit. After adjusting the unit, safety the adjustment screw with lockwire.

4-129. ADJUSTING EMERGENCY DUMP SWITCH. See figures 2-48 and 2-49 for procedure used in adjusting the emergency canopy seal dump switch.

4-130. ADJUSTING CANOPY CLOSED LIMIT SWITCH. Slotted holes are provided in the mounting bracket to which the canopy closed limit switch is attached to make adjustment of the switch position possible. Adjust the switch to actuate when the canopy is ¼ ($\pm\frac{1}{8}$, −0) inch from the full closed position.

4-131. TESTING CANOPY SEAL. (See figures 4-3 and 4-4.) With the canopy closed and electrical power on, test the canopy seal as follows:

a. Connect a pressure gage and air pressure supply to canopy seal ground test fitting. Pressurize to 25 psi; then cut off pressure supply.

b. Allow canopy seal to be pressurized for 5 minutes. Maximum leakage should be .25 psi.

4-132. CHECKING SECURITY OF CANOPY SEAL. The canopy pressurized seal should be firmly cemented to the canopy deck to prevent damage to the seal in the event it becomes wrinkled when the canopy is operated and also to prevent the possibility of the seal fouling the canopy or the seat during emergency ejection. The canopy pressurized seal should be checked as follows:

a. With the canopy removed and the seal deflated, use a smooth table knife, spatula, or other similar instrument and visually inspect to see that canopy seal is firmly cemented to canopy deck.

Note

If canopy seal is firmly cemented, proceed with steps e., f., and g.

b. Clean the bottom and side surfaces of the loose portions of the seal with a rag moistened with toluene cleaner (Federal Specification TT-T-548). Allow cleaner to dry for a minimum of 10 minutes.

c. Brush bottom and side surfaces with a thin uniform coat of Vulcabond V-36 cement and allow to dry for at least 30 minutes.

d. Apply a thin uniform coat of sealing compound EC-801 on the bottom and inner side surfaces of the seal retainer; then press the seal firmly into place.

e. Clean the section of the seal that passes through the aft retainer channel in the opening between the seal and the inner side surfaces of the seal retainer, using a rag moistened with toluene (Federal Specification TT-T-548). Allow to dry for 10 minutes.

f. Brush the cleaned surfaces of the seal with a thin uniform coat of Vulcabond V-36 and allow to dry for 30 minutes.

g. Apply a bead of EC-801 on both sides of the seal in the aft retainer. The bead should fill the space between

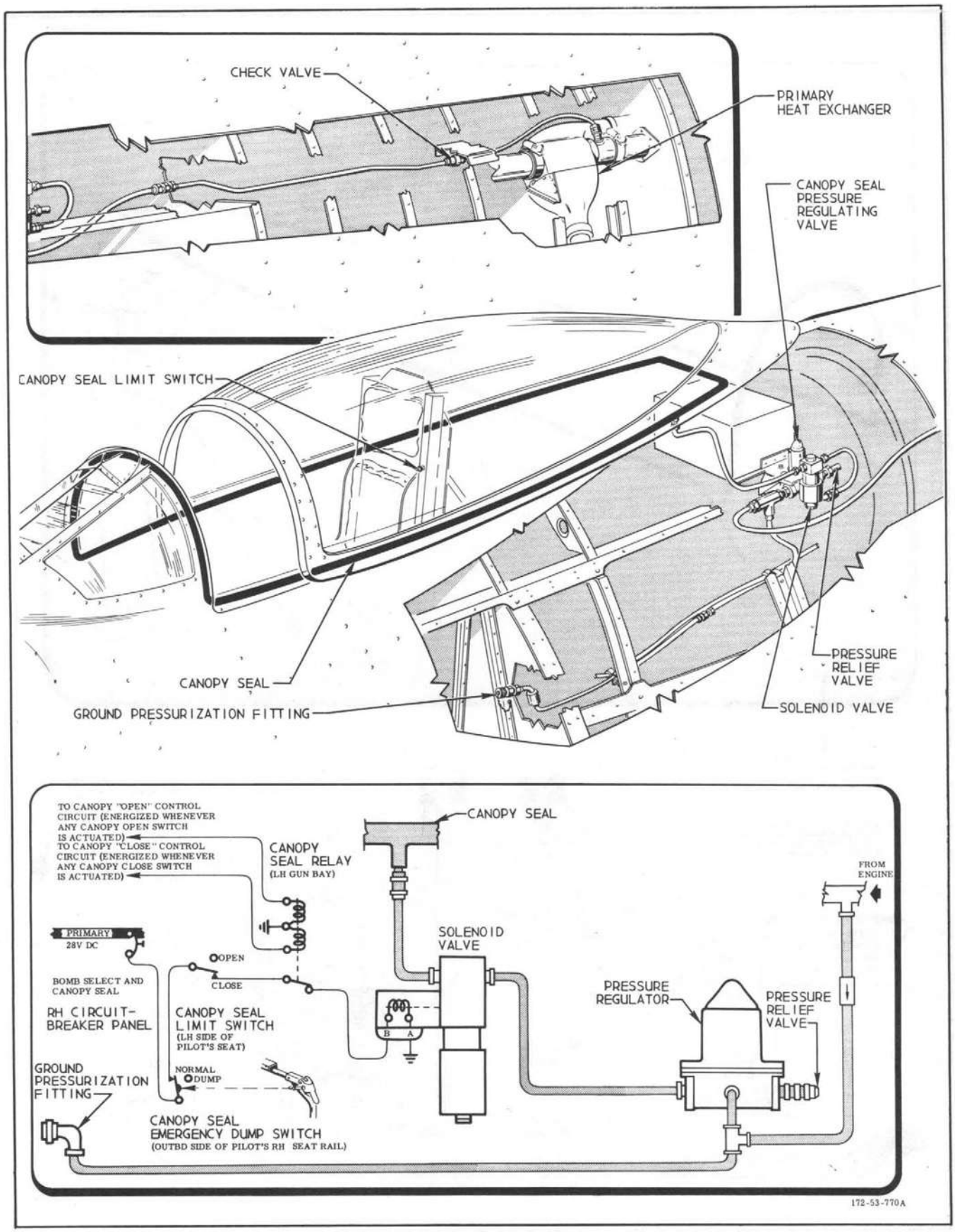


Figure 4-13. Canopy Seal System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

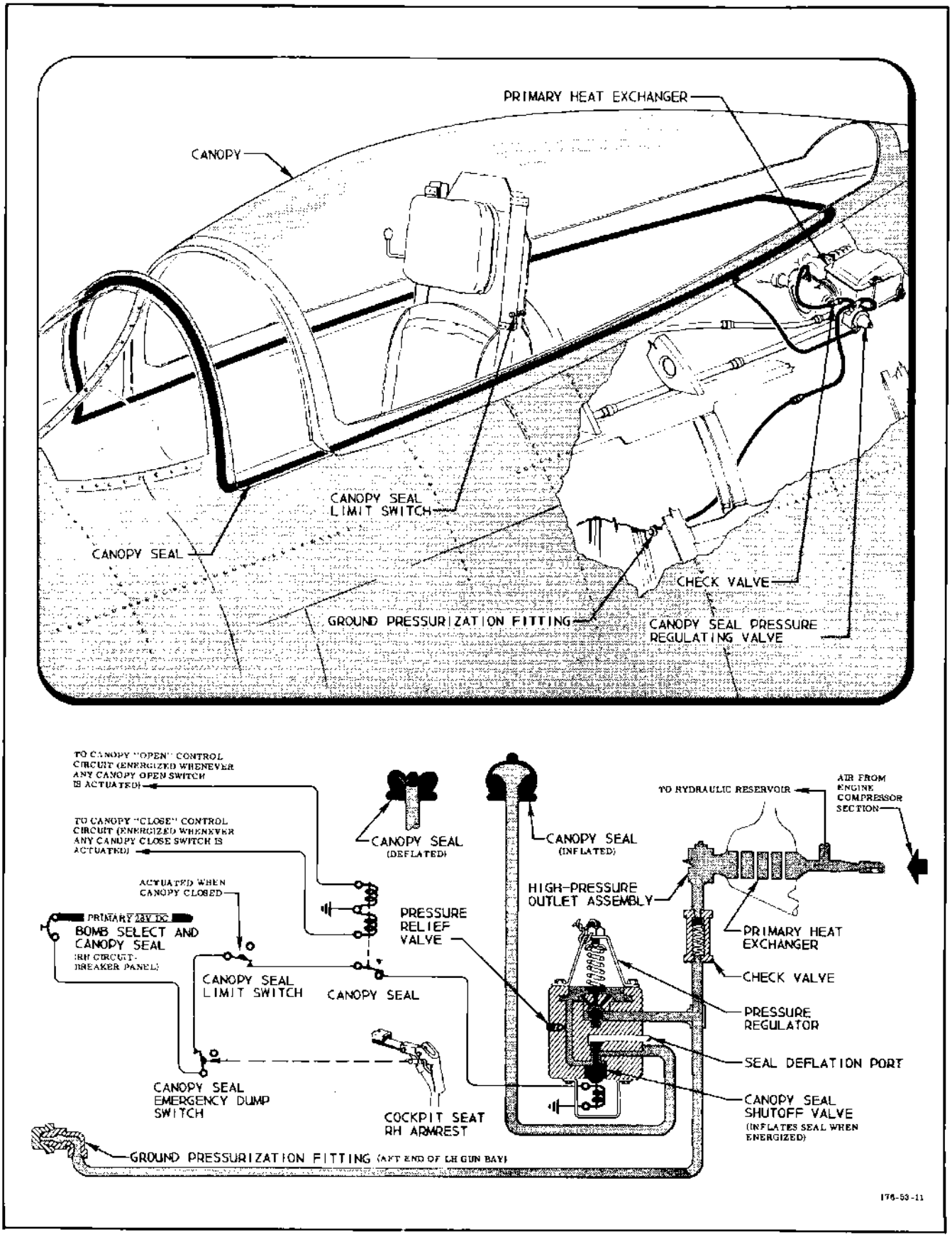


Figure 4-14. Canopy Seal System—F-86E-10 and F-86E-15 Airplanes

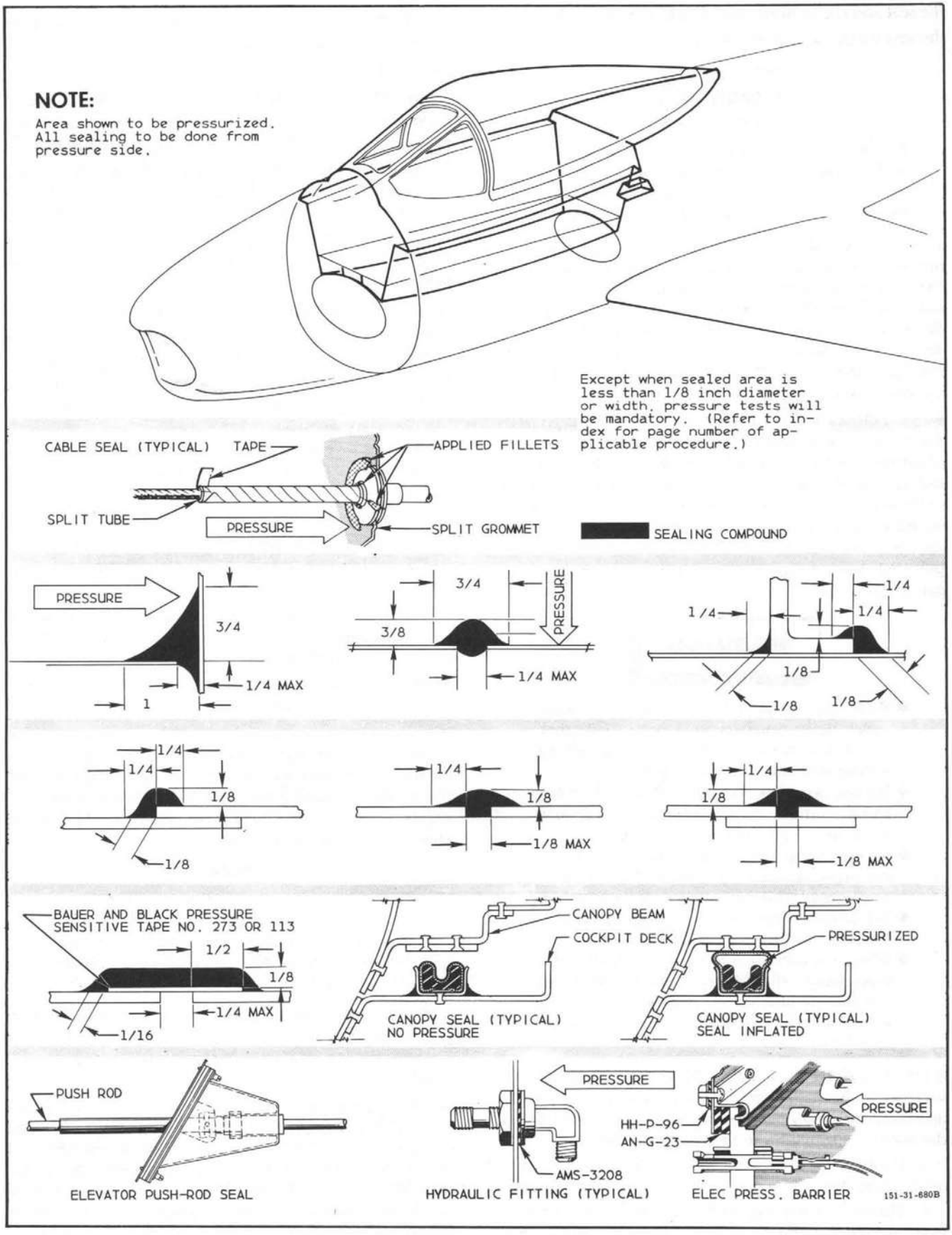


Figure 4-15. Pressure-sealing Cockpit

the seal and the retainer, but should not protrude above the seal when the seal is deflated.

CAUTION

Extreme care should be taken to prevent the sealing compound from extending over the outer envelope of the seal into the space between the envelope and the central tube.

4-133. WEATHERPROOFING CANOPY SEAL. To prolong the life of the canopy inflatable seal, a protective coating of weather-coating compound (B.F. Goodrich and Co A56B) is applied to the surface of the seal. Whenever a section of the seal requires resurfacing, the defective area must first be cleaned with solvent (Federal Specification No. P-S-661); then the weatherproofing compound is applied by brush.

4-134. LOCATING LEAKS UNDER PRESSURE. With the cockpit pressurized, locate leaks on outside of airplane with a soap solution. Isolate the source of leakage on the inside by running the free end of a stethoscope or piece of rubber tubing along the seams in the leakage area. (The leak can be detected by the change in sound when the tube is passed over it.) Repair the leak, following the procedure outlined in paragraph 4-137.

WARNING

- With personnel inside, the cockpit must *never* be pressurized to a pressure higher than has been previously established during testing with the cockpit empty.
- No one who has recently had a cold or has had his sinuses impaired in any way should work in the cockpit under pressure.
- An experienced operator should be present at the pressurization equipment control panel at all times while the cockpit is pressurized.
- While the cockpit is under pressure, all personnel should stay clear of the canopy.
- While the cockpit is being pressurized, pressure change should *never* exceed 2000 feet per minute altitude change as indicated on a rate-of-climb indicator. (See figures 4-3 and 4-4.)

4-135. CLEANING SURFACES TO BE SEALED. All surfaces to be sealed must first be cleaned to ensure maximum adhesion between the sealing compound and the surface. Clean area to be sealed as follows:

a. Using a vacuum hose, thoroughly clean surface of all loose dirt.

b. Moisten a clean rag with trichlorethylene (Specification MIL-T-7003) or solvent (Federal Specification P-S-661), and clean area around spot to be sealed.

c. Repeat step b. as often as necessary to clean thoroughly. Never use a dirty rag, and discard any rag as soon as it becomes soiled.

4-136. APPLYING SEALING COMPOUNDS. Application of sealing compounds must always be on the pressure side. A second coat of sealing compound may be applied after the first coat has been allowed to cure completely. If applicator guns are used to apply the sealant, they should be cleaned as soon as possible with cleaning solvents (paragraph 4-135); otherwise, any sealant that cures inside the gun must be cleaned out manually.

4-137. REPAIRING LEAKS UNDER PRESSURE. Leaks can be repaired from inside while the cockpit is pressurized. Repairing under pressure is recommended because it is faster and the results can be checked immediately. When leaks are located, repair them until it is not possible to detect any change in sound when the stethoscope or rubber tubing is passed over the location or until the person on the outside indicates that the leak has stopped. Use sealing compound (USAF Specification 14153) as follows:

a. Seal holes and gaps up to 1/16 inch in width with a fillet of sealing compound. No backing strip is necessary.

b. Seal holes and gaps from 1/16 inch to 3/16 inch in width with a backing strip of pressure-sensitive tape (Specification JAN-P-127, Type 2, Grade B) applied over the opening on the pressure side and a fillet of sealing compound applied over the tape.

c. Plug holes and gaps larger than 3/16 inch in width by first plugging with balsa wood, metal, caps, plugs, etc on the pressure side of the area and then applying the pressure-sensitive tape and sealing compound as in step b. Sealing compound is best applied to the leaking area with a spatula or metal strip.

Note

When applying sealing compound, do not pick it up after wetting the fingers in water, soapy water, or protective hand cream, as a film of any of these will cause poor adhesion of the mixture.

d. After the repairs under pressure have been completed, depressurize the cockpit at a rate not to exceed a rate of ascent of 2000 feet per minute, using rate-of-climb indicator.

4-138. CLEANING EQUIPMENT USED IN COCKPIT PRESSURE-SEALING. Within one hour after use, equipment should be cleaned by use of toluene (Federal Specification TT-T-548) or trichlorethylene (Specification MIL-T-7003). If the cleaning is not done within one hour (unless compound and equipment are held at subzero temperatures), the compound will set and can be removed only by mechanical means.

Note

It is recommended that gloves be worn by personnel coming in continual contact with the afore-mentioned cleaning compounds, as repeated contact of the hands with these cleaners can cause dermatitis.

4-139. WINDSHIELD ANTI-ICING SYSTEM.

4-140. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, heated air is circulated through the interspace formed by the windshield outer panel and the inner armor glass panel. The heated air is obtained from take-offs in the hot-air duct just downstream of the air mixing valve, and in the cool-air duct at a point between the cooling unit heat exchanger and the turbine. These take-off lines are joined into a single supply duct. A swing check valve is installed at this junction. The air is then routed through a flow control valve and a system control valve to the bottom of the windshield, circulates through the interspace, and is exhausted to atmosphere at the top of the windshield. The system is controlled by a windshield anti-icing control lever, mounted on the left side of the cockpit. A 2-kilowatt electric heater is installed in the duct downstream of the system control valve for additional heating of the air, if required. See figure 4-16 for location of units and system schematic.

4-141. On F-86E-10 and F-86E-15 Airplanes, a boundary layer of heated air is passed over the outside surface of the windshield. Air for the windshield anti-icing system is extracted from the air conditioning and pressurizing system through a take-off in the primary heat exchanger high-pressure outlet assembly. (See figure 4-17.) The heated air then passes through a manually operated windshield anti-icing control valve and an electric heater to a fan-shaped outlet at the outside base of the windshield. A water drain line, incorporating a check valve and a drain sump, provides an outlet for moisture condensation. An overheat thermostat, located in the air outlet duct, operates an overheat warning light that indicates temperatures in excess of 135°C (275°F). The system is controlled by a windshield anti-icing control lever, mounted on the left side of the cockpit. See figure 4-17 for location of units and system schematic.

4-142. FUNCTION OF WINDSHIELD ANTI-ICING SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-143. When the windshield anti-icing control lever is "ON," the windshield anti-icing control valve is open and the circuit to the electric heater is energized to reheat the air, if necessary. An overheat switch in the heater automatically breaks the circuit when temperatures exceed 102°C (±8°C) [215°F (±15°F)].

Note

The electric heater is so wired (through the engine generator and main air shutoff valve circuits) that it will not operate unless airflow from the engine is available.

Inasmuch as the windshield anti-icing take-off ducts are downstream of the air conditioning system shutoff valve, air for windshield anti-icing is not available when the shutoff valve is closed.

4-144. FUNCTION OF WINDSHIELD ANTI-ICING SYSTEM (F-86E-10 AND F-86E-15 AIRPLANES).

4-145. When the windshield anti-icing control is "ON," hot air extracted from the primary heat exchanger outlet is ducted through the windshield anti-icing control valve and heater to the windshield anti-icing outlet. The control valve, when moved to "ON" position, also actuates a microswitch that modifies the operation of the cockpit temperature control system. (See figure 4-17.) The temperature of the supply air is then controlled in the same manner as for canopy and windshield auxiliary defrosting. (Refer to paragraph 4-121.) The windshield anti-icing heater is energized and continues to operate until a thermostat in the heater outlet cuts off heater power when temperature exceeds 102°C (215°F). The check valve in the drain line, spring-loaded to the open position, is forced closed by pressure when the system is in operation. (See figure 4-17.)

4-146. TROUBLE SHOOTING WINDSHIELD ANTI-ICING SYSTEM.

4-147. Refer to paragraph 4-7.

4-148. AIRFLOW CHECK VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-149. A check valve is located at the junction of the hot- and cool-air lines to prevent air from flowing back through either of the lines.

4-150. REMOVING AIRFLOW CHECK VALVE. To remove the check valve, proceed as follows:

a. Remove the canopy and the cooling unit access door. (Refer to paragraph 2-168.)

b. Disconnect the three ducts at the check valve.

c. Remove radio and electrical system unit access door at fuselage left side.

d. Disconnect duct at rear of airflow control valve.

e. Remove airflow check valve.

4-151. INSTALLING AIRFLOW CHECK VALVE. To install the airflow check valve, proceed as follows:

a. Connect the three ducts to the check valve, and connect the forward end of the left duct to the airflow control valve.

b. Install the radio and electrical system unit access door.

c. Install the cooling unit access door; then install the canopy. (See figure 2-43.)

4-152. AIRFLOW CONTROL VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-153. The airflow control valve is located downstream of the check valve and serves to limit the airflow to 6

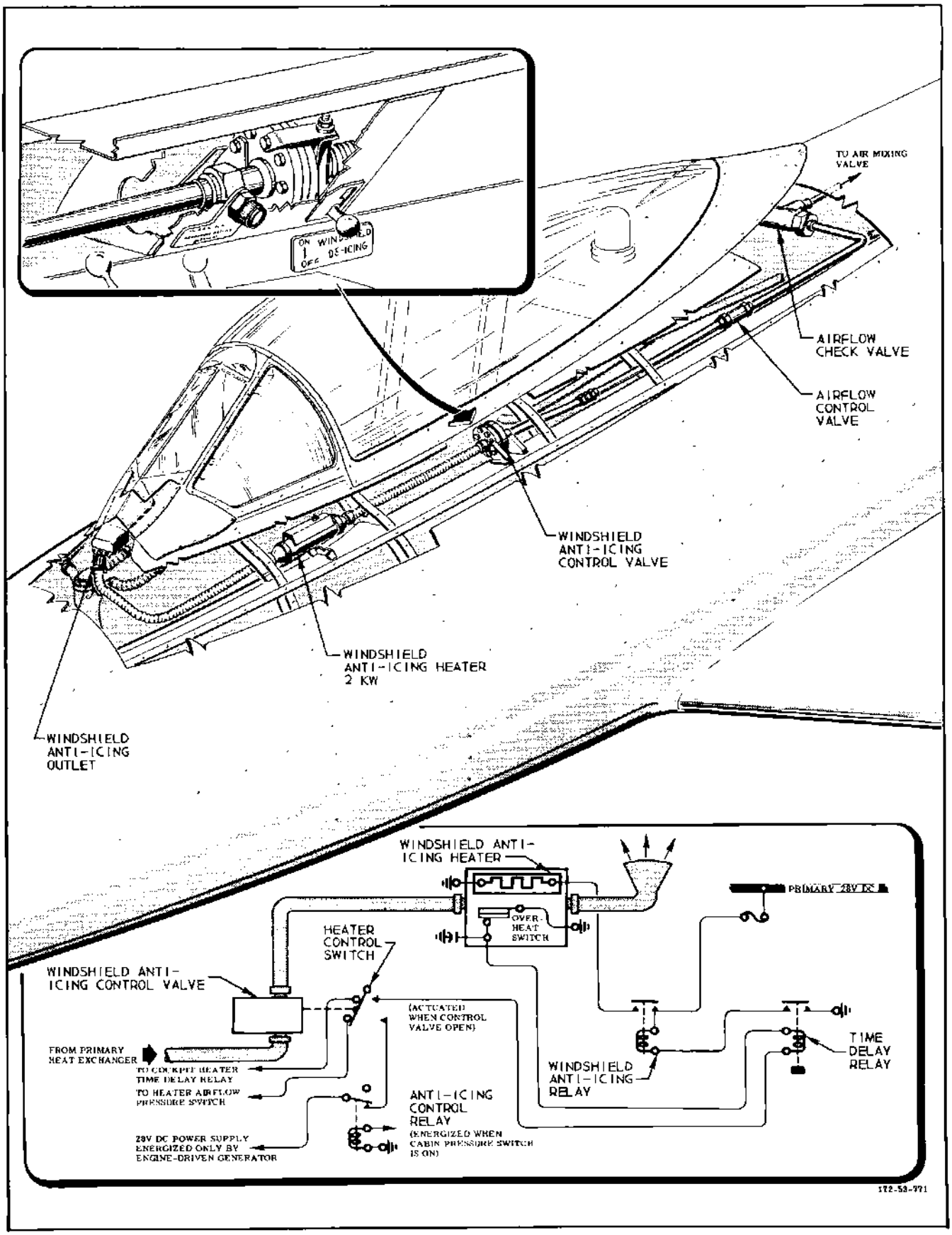


Figure 4-16. Windshield Anti-icing System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

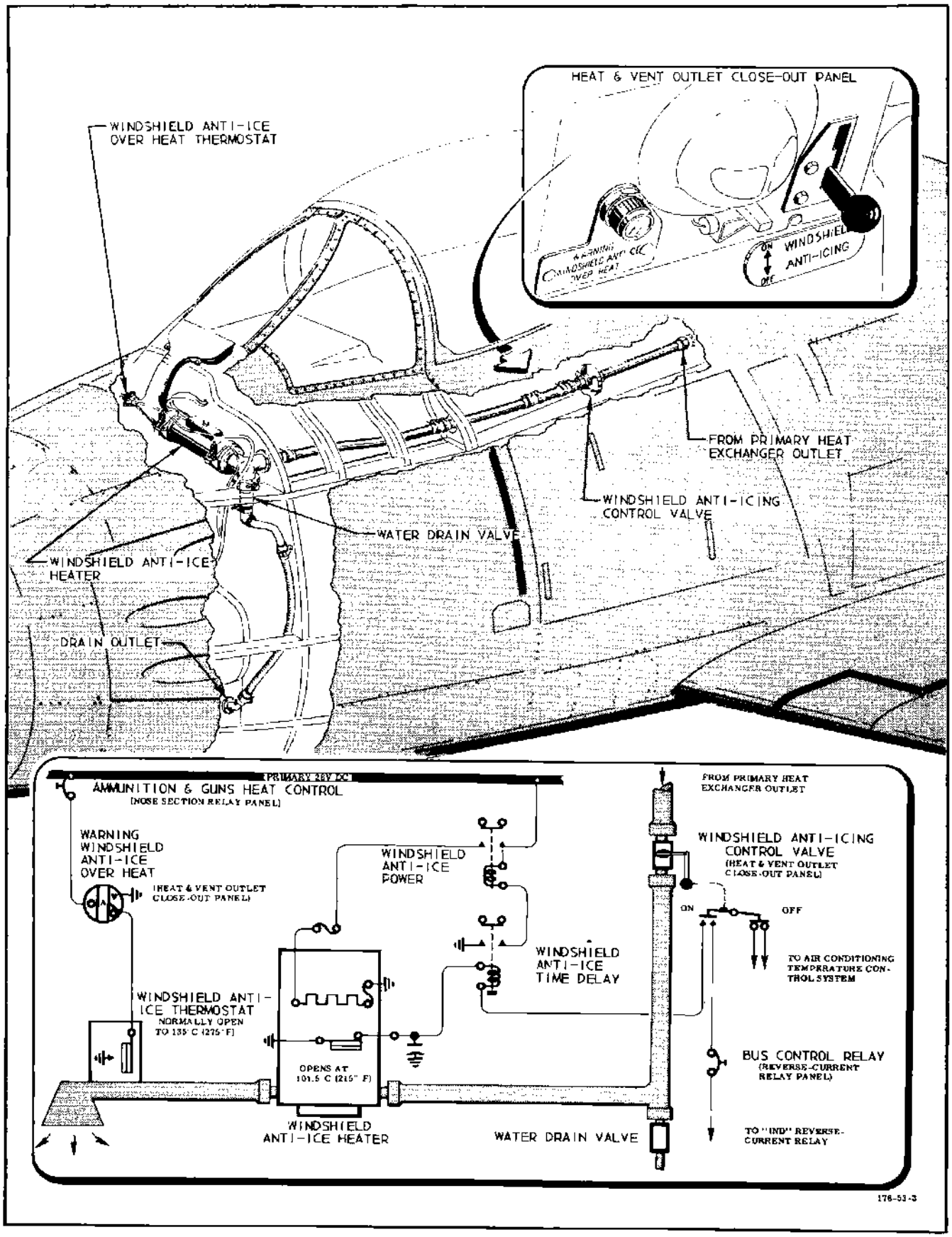


Figure 4-17. Windshield Anti-icing System—F-86E-10 and F-86E-15 Airplanes

pounds per minute, thus affording protection against excessive duct air pressures and preventing damage to the windshield outer panel.

4-154. REMOVING AIRFLOW CONTROL VALVE. To remove the airflow control valve, remove the radio and electrical system unit access door, disconnect duct from both ends of valve, and then remove valve.

4-155. INSTALLING AIRFLOW CONTROL VALVE. To install the airflow control valve, connect the duct to both ends of valve and then install the radio and electrical system unit access door.

4-156. WINDSHIELD ANTI-ICING CONTROL VALVE.

4-157. The manually actuated windshield anti-icing control valve is located at the left side of the cockpit. The valve control lever is located in the side panel above the left console in the cockpit.

4-158. REMOVING WINDSHIELD ANTI-ICING CONTROL VALVE. To remove the valve, proceed as follows:

a. Remove the left forward circuit-breaker panel.

b. Disconnect defrosting duct and remove cockpit air side outlet.

c. Disconnect duct at rear of anti-icing control valve.

d. Remove both mounting bolts.

e. Partially remove valve to facilitate removal of duct (at front of valve), and disconnect wiring to incorporated switch; then remove valve.

4-159. INSTALLING WINDSHIELD ANTI-ICING CONTROL VALVE. To install the valve, proceed as follows:

a. Connect the wiring to the switch incorporated on the valve.

b. Connect duct to front of valve, and bolt valve to mounting bracket.

c. Connect duct at rear of valve; then connect defrosting duct to cockpit air side outlet.

d. Install cockpit air side outlet and left forward circuit-breaker panel.

4-160. WINDSHIELD ANTI-ICING HEATER.

4-161. The windshield anti-icing heater is an electrical resistance-type duct heater of 2-kilowatt input capacity. The heater provides an auxiliary means of heating the air when the heat of compression is insufficient to provide the required temperature.

4-162. REMOVING WINDSHIELD ANTI-ICING HEATER. To remove heater, proceed as follows:

a. Remove instrument panel. (Disconnect all lines and wiring.)

b. Remove scuff panel (outboard of left rudder pedal).

c. Remove phenolic cover and disconnect electrical wiring at heater.

d. Remove heater after disconnecting hose clamps at both ends.

4-163. INSTALLING WINDSHIELD ANTI-ICING HEATER. To install the heater, connect the hose clamps, which engage with the support bracket, at both ends. Then connect the electrical wiring to the heater and install the phenolic cover. Finally, install the scuff panel and instrument panel.

Note

Test pitot and static lines (paragraphs 6-137 and 6-138), and check all instruments for response during operation of related equipment.

4-164. AMMUNITION COMPARTMENT HEATING SYSTEM.

4-165. Air for heating the ammunition compartment is taken from the main air-conditioning supply duct. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the take-off lead is located just downstream of the pressure ratio-flow control valve. On F-86E-10 and F-86E-15 Airplanes, the take-off lead is located at the primary heat exchanger high-pressure outlet. The supply air is routed through a motorized modulating shutoff valve and a manually operated emergency shutoff valve. The duct is then divided into two branch ducts, which are routed into the ammunition boxes on each side of the airplane. The system is controlled from the cockpit by the gun heater switch on the armament control panel. After the system is put into operation, it is basically controlled by two thermostats on F-86E-1, F-86E-5, and F-86E-6 Airplanes and by one thermostat on F-86E-10 and F-86E-15 Airplanes. A warning system, consisting of an overheat warning thermostat and a warning light, is provided to indicate an unsafe overheat condition in the ammunition compartment. The emergency shutoff valve is controlled by an emergency shutoff control, located on the left aft console in the cockpit.

4-166. FUNCTION OF AMMUNITION COMPARTMENT HEATING SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-167. When the gun heater switch is positioned to "HEATER," the modulating shutoff valve is energized, admitting air to the ammunition boxes. If the supply air temperature is such that the ammunition box temperature exceeds 93°C (±6°C) [200°F (±10°F)], the high-temperature thermostat, located in the duct inlet to the center ammunition box, energizes and positions the modulating shutoff valve to provide reduced flow to the ammunition boxes. If the temperature of air at the discharge point of the center ammunition box is less than 7.2°C (±3°C) [45°F (±5°F)], the low-temperature thermostat opens the shutoff valve, allowing more heated air to enter the compartment. When the overheat warning light illuminates, indicating failure of the modulating shutoff valve or thermostatic units, manually closing the emergency shutoff valve stops

flow of air to the compartment. See figure 4-18 for location of units and a schematic showing system operation.

4-168. FUNCTION OF AMMUNITION COMPARTMENT HEATING SYSTEM (F-86E-10 AND F-86E-15 AIRPLANES).

4-169. When the gun heater control switch is in the "HEATER" position, the coil of the ammunition heat control relay is energized if the low-temperature control thermostat is closed. When energized, the relay closes the circuit to the open side of the system shutoff valve actuator, causing the shutoff valve to open and allow hot air to enter the ammunition compartment. (At the same time, the coil of the gun heater relay is energized and closes the circuit to six electrical resistance-type gun heaters.) Hot air is then routed through the ammunition compartment heating system shutoff valve and the system emergency shutoff valve to the ammunition compartment heat outlets, which are located directly above the ammunition boxes. The low-temperature control thermostat, located in the ammunition compartment, then modulates the heating system shutoff valve. When the compartment outgoing air temperature reaches 7.2°C (45°F), the low-temperature control thermostat breaks the circuit to the coil of the ammunition heat control relay. The valve then moves toward the closed position, restricting the flow of air to the ammunition compartment. When ammunition compartment heat is on, the temperature of the supply air is controlled by the auxiliary temperature control system in the same manner as auxiliary canopy defrosting. (Refer to paragraph 4-121.) See figure 4-19 for location of units and schematic of system operation.

4-170. TROUBLE SHOOTING AMMUNITION COMPARTMENT HEATING SYSTEM.

4-171. Refer to paragraph 4-7.

4-172. AMMUNITION COMPARTMENT HEATING SYSTEM SHUTOFF VALVE.

4-173. A thermostatically controlled, motorized shutoff valve is located in the ammunition compartment heating system air supply duct. (See figures 4-18 and 4-19.) The valve has an open and a closed position and is modulated to provide the required amount of heated air to maintain a minimum ammunition powder temperature of 1.7°C (35°F). When the system is in operation, the valve electrical circuit is controlled by the low-temperature control thermostat on F-86E-10 and F-86E-15 Airplanes and by both the high- and low-temperature control thermostats on F-86E-1, F-86E-5, and F-86E-6 Airplanes.

4-174. AMMUNITION COMPARTMENT HEATING SYSTEM EMERGENCY SHUTOFF VALVE.

4-175. The ammunition compartment heating system emergency shutoff valve is located in the supply duct, downstream of the motorized shutoff valve. The valve is spring-loaded to open position, so that it remains open unless actuated by the cockpit control. In the closed position, a spring-loaded dog engages the valve actuating lever and prevents the valve from opening until the dog is manually disengaged. The valve mechanism is not accessible from the cockpit; therefore, when the valve is closed by the cockpit manual emergency control in flight, it cannot be opened again until the airplane is on the ground.

4-176. ADJUSTING EMERGENCY SHUTOFF VALVE CONTROL. See figures 4-18 and 4-19.

4-177. AMMUNITION COMPARTMENT HEATING SYSTEM CONTROL THERMOSTATS (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

4-178. There are two (series-connected) ammunition compartment control thermostats: one located in the compartment, and the other located in one of the compartment supply duct outlets. (See figure 4-18.) The thermostat located in the compartment acts as a cycling switch and completes the circuit to the shutoff valve relay when the compartment temperature falls below 7.2°C (±3°C) [45°F (±5°F)]. The thermostat located in the compartment supply duct outlet acts as a high-temperature control switch and breaks the circuit to the open side of the shutoff valve when the outlet duct air supply temperature exceeds 93°C (±6°C) [200°F (±10°F)]. When either of the thermostat switches is open, the shutoff valve relay is de-energized and the circuit is completed to the closed side of the shutoff valve.

4-179. AMMUNITION COMPARTMENT HEATING SYSTEM CONTROL THERMOSTAT (F-86E-10 AND F-86E-15 AIRPLANES).

4-180. The low-temperature control thermostat is located in the ammunition compartment outbound air duct. The thermostat acts as a cycling switch, controlling the modulating system shutoff valve. When compartment temperature is higher than 7.2°C (±3°C) [45°F (±5°F)], the thermostat closes the shutoff valve. When the temperature falls below 7.2°C (±3°C) [45°F (±5°F)], the circuit from the thermostat to the shutoff valve relay is completed, energizing the open winding of the shutoff valve actuator, so that more heated air can enter the compartment. When the temperature control thermostat switch is open, the shutoff valve relay is de-energized.

4-181. AMMUNITION COMPARTMENT OVERHEAT THERMOSTAT.

4-182. The overheat thermostat, located in the compartment air supply duct outlet, closes a circuit to the warning light on the armament control panel in the cockpit when the air supply temperature exceeds 127°C (±6°C) [260°F (±10°F)] and thus indicates an unsafe condition in the compartment. This thermostat does not, however, turn off the ammunition compartment

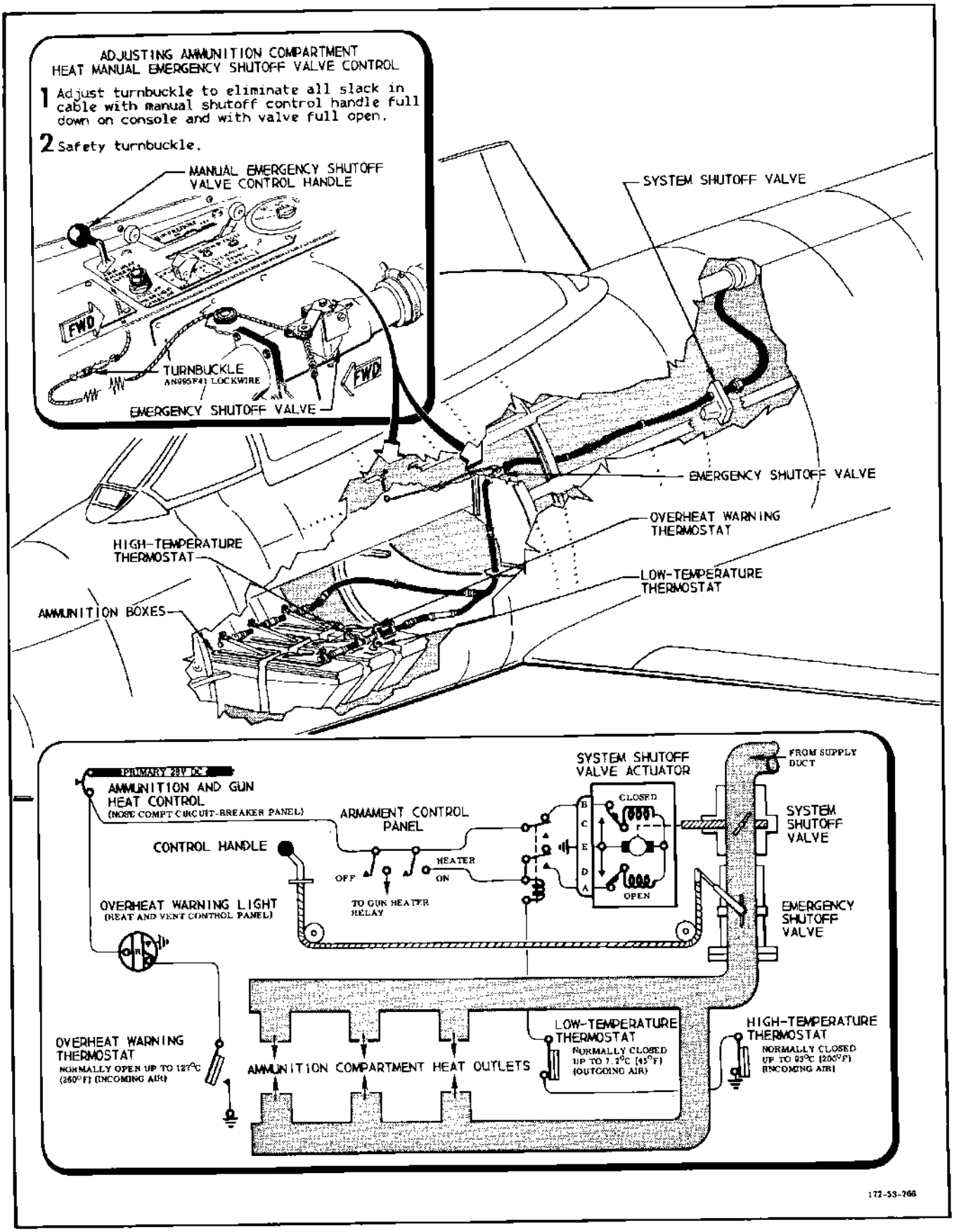


Figure 4-18. Ammunition Compartment Heating System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

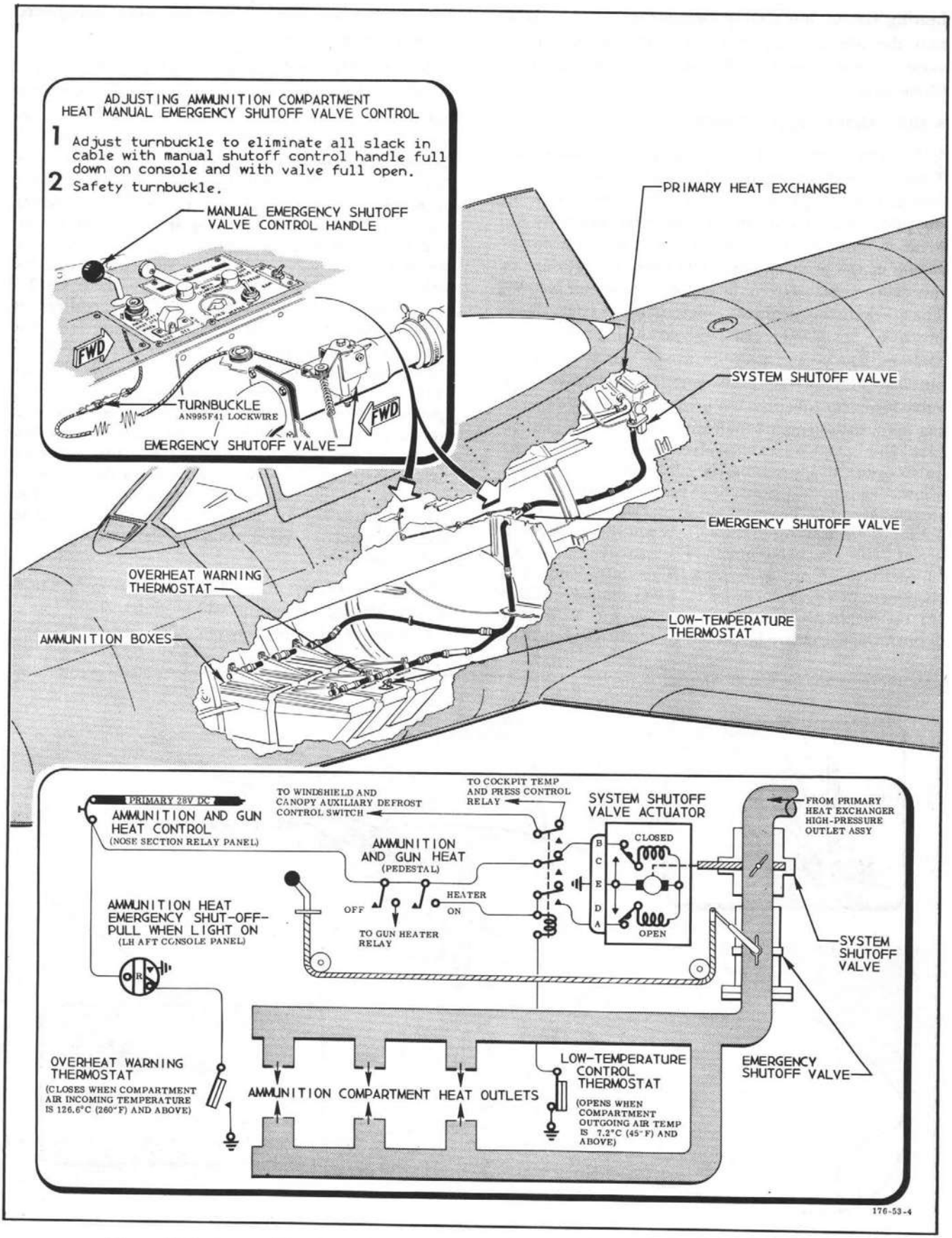


Figure 4-19. Ammunition Compartment Heating System—F-86E-10 and F-86E-15 Airplanes

heating system, but merely indicates an unsafe condition; the pilot must pull the manual emergency shutoff valve control handle if the warning light remains illuminated.

4-183. ANTI-G SUIT SYSTEM.

4-184. The anti-G suit system (figure 4-20) consists of a Type M-4 pressure-regulating valve, a suit-attachment fitting, a connecting hose, a quick-disconnect block on the pilot's seat, and a line to supply the necessary air pressure. This line is connected into a duct just downstream of the primary heat exchanger. Air pressure in this duct originates from the engine compressor section. The quick-disconnect block is installed as a safety measure to ensure proper seat removal during emergency ejection. The system pressure to the suit is regulated automatically by the pressure-regulating valve. The valve begins to function at a predetermined G, depending upon the setting of the valve cap, which is marked "HI" and "LO." When the valve cap is set at "LO," the valve opens at approximately 1.8 G and subsequently allows one psi of air pressure to pass to the suit for each increment of 1 G. For example, at 3 G the valve delivers 1.2 psi of air pressure to the suit. When the valve cap is set at "HI," the valve opens at approximately 1.6 G, but delivers 1.5 psi of air pressure to the suit for each increment of 1 G. For example, at 3 G the valve allows 2.1 psi of air pressure to pass to the suit. When the accelerations decrease below 1.6 G, the valve closes and exhausts the suit pressure into the cabin atmosphere, allowing the suit to deflate.

4-185. M-4 PRESSURE-REGULATING VALVE.

4-186. The M-4 pressure-regulating valve, located to the left of the pilot's seat, regulates the pressurized air received from the primary heat exchanger to provide the proper pressure for operation of the anti-G suit. The valve assembly contains a filter, which ensures a clean air supply to the valve body; a limit valve, which acts as a safety device by limiting air pressure to the suit in case of valve failure; a manual cap to facilitate inspection of the valve operation; and two connection fittings, one marked "IN," the other marked "OUT." (The connection fitting marked "IN," on the filter side of the valve, receives the inlet air pressure from the engine compressor section; the fitting marked "OUT," on the limit side of the valve, delivers outlet pressure to the anti-G suit.) There are three additional screened openings in the valve that do not serve as connection points. They are the discharge outlet, the suit vent, and the limit valve opening. The air from these openings must be discharged into the cockpit atmosphere in order to maintain proper differential pressures in the suit. The valve requires no maintenance, and no repairs can be made. A defective valve assembly should be replaced with a new unit.

4-187. REMOVING VALVE. To remove an M-4 pressure-regulating valve, proceed as follows:

a. Remove left console panel.

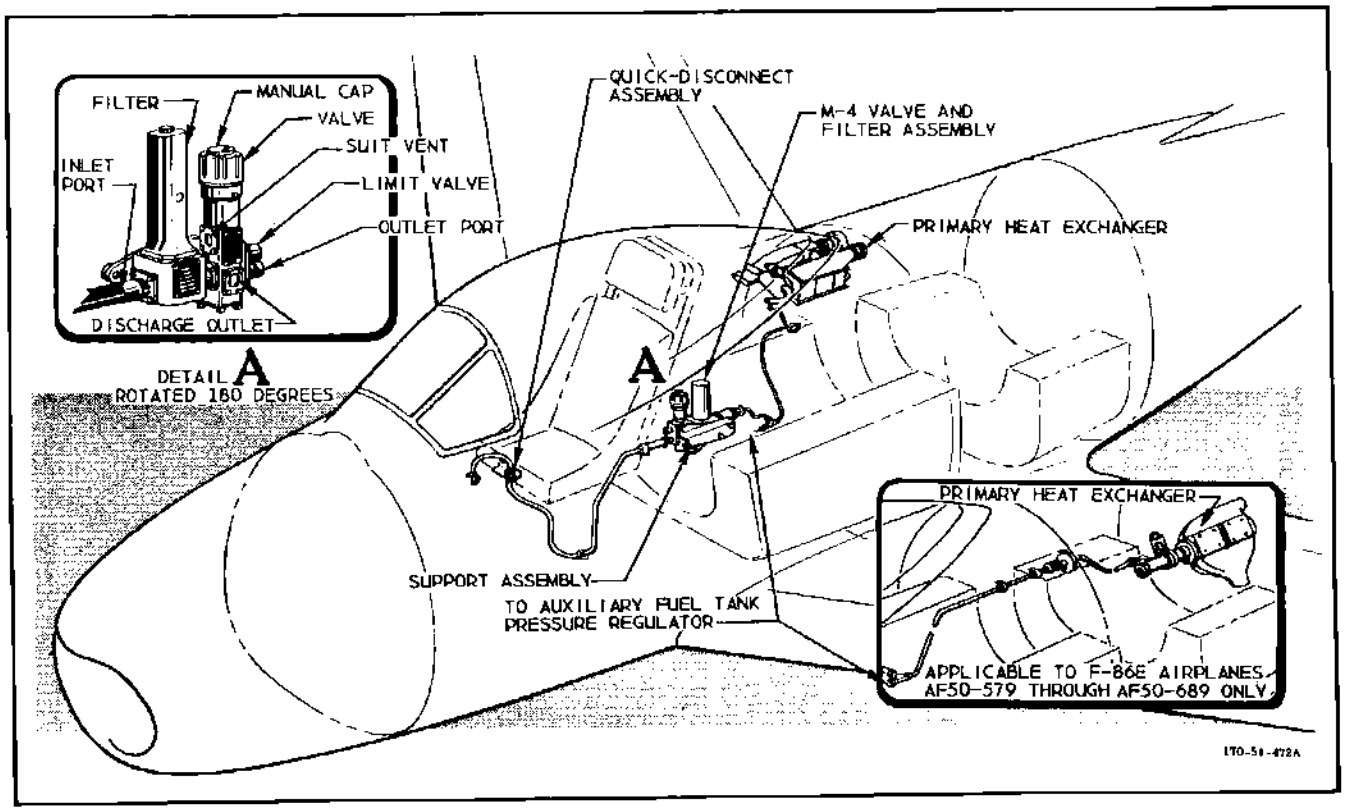


Figure 4-20. Anti-G Suit System

b. Loosen clamps and hose at inlet connection on filter side of valve.

c. Loosen clamp and hose on outlet connection.

d. Remove nuts from support assembly.

e. Lift valve assembly off support bolts.

4-188. PREINSTALLATION CHECK OF VALVE. Before the M-4 pressure-regulating valve is installed, it should be given the following tests to ensure its satisfactory performance in the airplane:

a. Turn valve cap to "LO."

b. Give valve a sudden, severe, downward shake while holding it in the vertical position. The piston and lower weight should drop and return to their original position. (This movement can easily be felt and heard.)

c. Turn valve cap to "HI."

d. Repeat downward shake. The piston, lower weight, upper weight, and manual cap should drop. (The manual cap can be seen to move downward and upward.)

4-189. INSTALLING VALVE. To install an M-4 pressure-regulating valve, proceed as follows:

a. Be sure valve functions properly. (Refer to paragraph 4-188.)

b. Fit valve and bracket assembly to valve support assembly, and secure with nuts.

c. Attach hose to outlet connection, and clamp into place.

d. Connect tubing hose to inlet opening, and secure with clamps.

e. Install console panel.

4-190. TESTING VALVE. To test the valve for operation with the engine running, remove the plug from the disconnect assembly and press the manual button on top of the valve. The volume and pressure of air delivered through the disconnect should be substantial and in proportion to the pressure on the manual test button. Flow should stop when the manual test button is released.

4-191. M-4 PRESSURE-REGULATING VALVE FILTER.

4-192. To prevent foreign matter, dust, and abrasives from being blown through the pressure-regulating valve and into the anti-G suit, an AN6235-2A filter element is installed in the filter housing. When the filter element becomes clogged or dirty, it must be replaced.

4-193. REMOVING FILTER. To remove the M-4 pressure-regulating valve filter, proceed as follows:

a. Remove the safety wire that secures the filter housing to the filter cap.

b. Unscrew the filter housing and remove the rubber "O" ring and filter.

4-194. INSTALLING FILTER. To install the M-4 pressure-regulating valve filter, proceed as follows:

a. Replace the filter in the filter cap and the rubber "O" ring on the filter housing.

b. Replace the filter housing and screw it down tightly, using the hands only.

CAUTION

Do not use a wrench to tighten the filter housing into the filter cap.

c. Safety the filter housing to the filter cap with AN995F020 safety wire.

4-195. OXYGEN SYSTEM.

4-196. The oxygen system (figure 4-21) consists of four Type D-2 cylinders, a Type A-14 regulator, a blinker-type flow indicator, and necessary lines and check valves connecting the units of the system. Check valves are located throughout the system to protect the supply from total loss in case of plumbing leaks or cylinder ruptures. Because of this feature, the cylinders have to be checked individually for leaks when being filled. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, a single filler valve for the system is located on the left side of the fuselage, aft of the gun-muzzle door. On F-86E-10 and F-86E-15 Airplanes, the oxygen filler valve (figure 4-21) is on the right side of the fuselage. The demand-type oxygen system delivers oxygen automatically in response to the suction of the user's breath. The oxygen is diluted in the regulator with suitable amounts of atmospheric air, depending on the altitude. The amount of oxygen being delivered increases with increasing altitude, becoming 100 percent at an altitude of approximately 34,000 feet.

4-197. TROUBLE SHOOTING OXYGEN SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Oxygen pressure drop.	After filling, a normal loss of approximately 25 psi because of system cooling.	Fill system to 25 psi in excess of desired pressure.
No pressure reading.	Leak in system. Pressure gage defective. Lines clogged. Leak in system plumbing.	Replace pressure gage.

TROUBLE	PROBABLE CAUSE	REMEDY
Cylinders not warm during filling.	Restriction in lines. One or more check valves sticking.	Examine and replace check valve if necessary.
Leaks around oxygen fittings.	Broken flares on tubing. Irregular fitting.	
Regulator fails to deliver oxygen.	Clogged screens. Failure of demand valve to operate. Dirt in oxygen inlet orifice.	Replace regulator. Replace regulator. Replace regulator.
Regulator delivers only pure oxygen or improper mixture.	Broken aneroid assembly. Maladjustment of aneroid and throttling plate assembly.	Replace regulator.

4-198. MAINTAINING OXYGEN SYSTEM.

4-199. Keep all fittings tight, since loose connections waste oxygen. Use only approved combination anti-seize and sealing compound (Specification MIL-C-5542). Keep all oxygen equipment and lines free from grease, dirt, oil, and leaks. Use anti-icing fluid (Specification MIL-F-5566) for external cleaning of metal parts, and use a mild soap solution to clean rubber parts. Make sure oxygen hoses are connected to the personal lead disconnect block. (See figure 2-45.)

CAUTION

Apply the sealing compound to only the first three threads of the male joint of connections having pipe threads. Apply compound sparingly to prevent any from running over the end of the fitting where it may get inside the oxygen system and injure equipment. Do not use sealing compound on straight threads (threads on flared-tube fittings), unless experience shows that the threads are seizing. Never apply the compound on the flare to prevent leakage. Do not permit pressure in the oxygen system to drop below 50 psi while the airplane is on the ground or in storage, as water may accumulate in the system and freeze when the airplane is again flown at high altitude, thus plugging the oxygen lines and valves.

WARNING

Improper treatment of oxygen equipment can result in a serious explosion, because spontaneous combustion results when oxygen under pressure comes in contact with oil or grease. Handle oxygen equipment carefully.

4-200. TESTING OXYGEN SYSTEM FOR LEAKS.

4-201. Filling procedure for the oxygen system is given in paragraph 1-74. After filling the oxygen system, allow system to cool for one hour or until it reaches ambient air temperature; then proceed as follows:

Note

The following procedure will not indicate a major leak in the oxygen system upstream of the check valves, because the check valves will seat when a pressure differential is present. A major leak will have to be detected either visually or by sound when the system is being filled.

a. Ascertain that the oxygen regulator is functioning properly and does not leak. (Refer to paragraph 4-214.)

b. Record the oxygen gage pressure reading by drawing a line on the cover glass over the gage pointer with a grease pencil.

c. Record the ambient air temperature.

d. *Wait 24 hours.*

e. Read the gage pressure again and subtract the second reading from the first reading. This gives the 24-hour gage drop on scale A. (See figure 4-22.)

f. Read the temperature again, and note whether it has gone up (+) or down (—) and how much. This gives the 24-hour change in temperature on scale B.

g. Lay a straightedge so that it intersects the 24-hour gage drop on scale A and the 24-hour change in temperature on scale B.

h. Read the 24-hour leak on scale C.

i. If the 24-hour leak is 25 psi or more, the airplane should not be cleared for flights above 10,000 feet until the leak has been corrected and the oxygen system recharged to 400 psi. Even though the 24-hour leak is

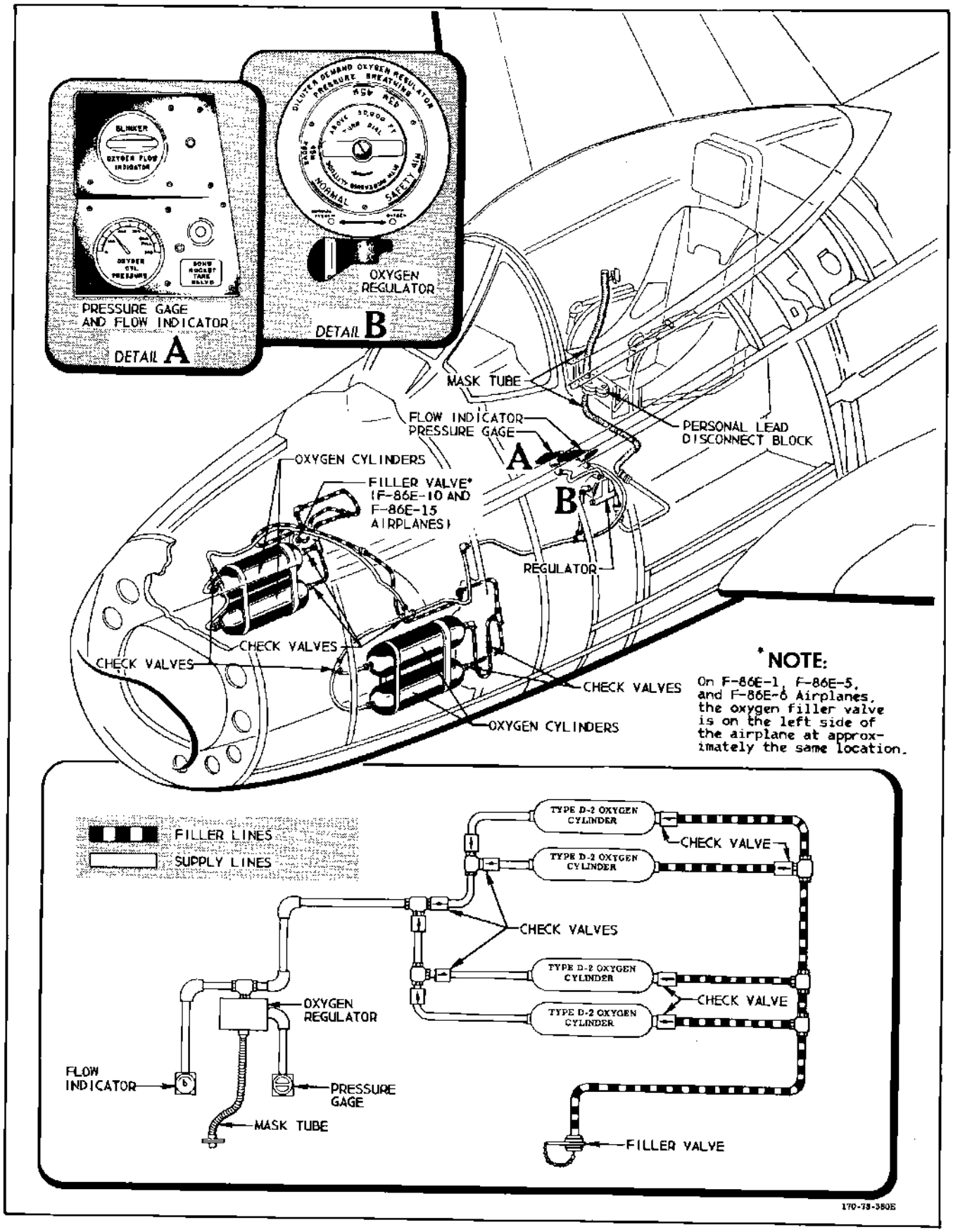


Figure 4-21. Oxygen System

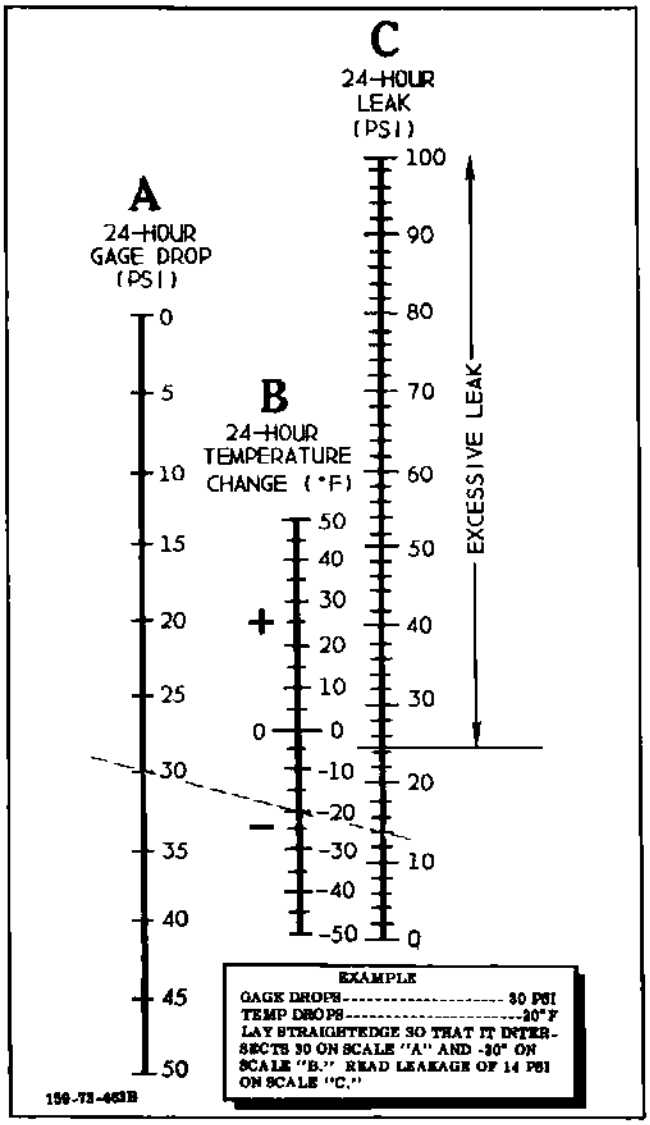


Figure 4-22. Oxygen System Leak Chart

within permissible limits, the system should be recharged to 400 psi.

j. A shorter interval may be used in increments of 6 hours, if desired. If a shorter interval is used for the system leak test, multiply the observed gage pressure drop by 24/H, where H is the number of hours between readings. This gives the 24-hour gage drop on scale A. Then repeat steps f. through i.

k. To locate a leak, paint all connections with a soap and water solution made with a mild soap (preferably castile). Immediately after test, take special precautions to wipe all parts clean and dry.

l. Place the open end of the mask-to-regulator tubing against the mouth and blow gently into tubing. There should be positive and continued resistance to blowing. If there is only slight resistance, the diaphragm (part of the metering system) or the mask-to-regulator tubing may be leaking.

Note

Double-lap flaring is used on oxygen tubing connections. Normal torque on new connections is 100 to 125 inch-pounds. When leaky connections are being tightened, torque up to 200 inch-pounds is permissible; however, increase torque only in increments of 25 inch-pounds at a time, to permit further tightening if a leak should develop later.

4-202. FILLING OXYGEN SYSTEM.

4-203. Refer to paragraph 1-74.

4-204. OXYGEN CYLINDERS.

4-205. The four Type D-2 oxygen cylinders, which have approximately 2000 cubic inches total capacity, are installed within the nose section, two on each side of the air intake duct below the gun-muzzle door panels. The filler-line system is routed from the filler valve to the oxygen cylinders on one side of the airplane and then to the cylinders on the other side of the airplane. A single supply line from all four cylinders leads to the oxygen regulator.

4-206. MAINTAINING OXYGEN CYLINDERS. The oxygen cylinders, when installed, require no maintenance other than being kept clean and dry. Blow any moisture out of the empty cylinders and the system by exhausting the supply of oxygen and disconnecting the supply lines at the "T" fitting near the regulator. Apply a source of dry air at the filler valve and pump the air through the cylinders. Replace cylinders that are weakened, dented, or suspected of being dirty on the inside.

4-207. REMOVING OXYGEN CYLINDERS. *Do not* remove oxygen cylinders unless they are damaged or believed to be contaminated. If the check valves or fittings in the spuds can be easily removed from damaged cylinders, they should be removed and re-used if they are not damaged or contaminated. Cap all lines left open by removal of any cylinder, and close cylinder openings with AN913-2 plugs. Handle the cylinders with great care, because even a small dent will weaken a cylinder. The parts and components referred to in the following procedure are identified in figure 4-23. Remove the oxygen cylinders as follows:

WARNING

Do not remove any cylinder unless you are certain that the oxygen system has been exhausted. (Refer to paragraph 1-75.)

a. Remove radar equipment and battery access door. Loosen straps, disconnect wiring, and remove range power unit and outboard support. Remove gun blast panels (paragraph 9-99) and the two lower panel supports from door area. Remove guns (paragraph 9-72)

and blast tubes. Disconnect or remove oxygen instrument, air, and hydraulic lines that interfere with removal of cylinders.

b. Loosen terminal strip from right side of airplane and relay panel from left side of airplane; then loosen clips holding wire bundles and secure wire bundles as far out of the way as possible.

c. Disconnect supply line from top left cylinder. Through external access hole, above and aft of left cylinders, disconnect top filler line. Loosen top strap turnbuckles and lift out top left cylinder.

d. Through access hole in nose wheel well, disconnect filler line from bottom left cylinder. Through external access hole, disconnect bottom supply line. Unbolt support and rotate it enough to disconnect bottom left cylinder from support.

e. Remove support and the bottom left cylinder.

f. Through external access hole, on right side of airplane, disconnect filler line from both cylinders. Disconnect supply line from top right cylinder, loosen top strap turnbuckles, and lift out cylinder.

g. Through forward external access hole, on right side of airplane, disconnect supply line from bottom right cylinder. Unbolt support and rotate it enough to disconnect bottom right cylinder from support.

h. Remove support and the bottom right cylinder.

4-208. PREINSTALLATION CHECK OF OXYGEN CYLINDERS. Check cylinders for cleanliness. Clean spuds with a stiff, dry brush. Examine cylinders for chipped, scarred, or corroded areas. If necessary, refinish with zinc-chromate primer (Specification MIL-P-6889). If the oxygen cylinder supports are replaced or repadded in service, be sure that the padding is fireproof and chemically clean.

4-209. INSTALLING OXYGEN CYLINDERS. See figure 4-23.

4-210. OXYGEN SYSTEM CHECK VALVES.

4-211. Check valves are installed at each oxygen cylinder in the filler line and in the supply line near the oxygen regulator to prevent excessive or total loss of oxygen if any cylinder is ruptured or any length of tubing is punctured. Each check valve permits a rapid flow of oxygen in one direction only, as indicated by an arrow on the valve casing. The check valves will allow a slow backflow under slight pressure differential; however, a large and sudden fall of pressure on the upstream side will seat the valves. Always connect the oxygen lines to each check valve with the arrow pointing in the direction of normal oxygen flow. (See figure 4-21.)

Note

If the check valve is installed incorrectly, a cylinder may not fill or oxygen may be kept from flowing out of the cylinder to the oxygen regulator.

4-212. OXYGEN REGULATOR.

4-213. The Type A-14 regulator has two manual controls, a diluter lever and a pressure dial. When diluter lever is set at "NORMAL OXYGEN" and pressure dial is set at "NORMAL," an aneroid controls the mixture of oxygen and air automatically. The percentage of oxygen being delivered increases with increasing altitude, becoming 100 percent at approximately 34,000 feet. Below 34,000 feet, 100 percent oxygen can be obtained by movement of the diluter lever to "100% OXYGEN." Adjustment of the pressure dial provides 100 percent oxygen under pressure to the mask for altitudes over 30,000 feet, as indicated on the dial. Keep the regulator clean and fixed firmly in position.

WARNING

In storage, oxygen regulators normally have plugs at the elbow to keep out dust and foreign matter. Before installing a new regulator, be sure to remove this dust plug.

4-214. TESTING OXYGEN REGULATOR. The Type A-14 oxygen regulator can be tested for operation and freedom from leaks by use of an oxygen pressure source as follows:

CAUTION

All parts of the instrument and all equipment used for testing the oxygen system must be absolutely free from oil, grease, or any other material that is not approved for use around oxygen under pressure.

a. Attach a regulator leak tester over the outlet elbow of the regulator.

b. Make certain that the emergency valve is tightly closed and that the oxygen system pressure is approximately 400 psi.

c. Draw a soap film across the outlet of the leak tester.

d. If the soap film expands outward, check the time of its expansion to the pointer at the outlet of the leak tester.

e. If the soap bubble reaches the pointer and bursts in less than 10 seconds, the regulator outlet leakage is in excess of the allowable 0.01 liter per minute, and the regulator can be considered unsatisfactory.

f. With 150 psi oxygen pressure in the system and the pressure dial set at "NORMAL," gradually turn the pressure dial clockwise to the indicated setting "ABOVE 45M"; then return dial to "NORMAL." Oxygen should flow continuously from the outlet of the regulator during this operation, increasing in volume as the pressure

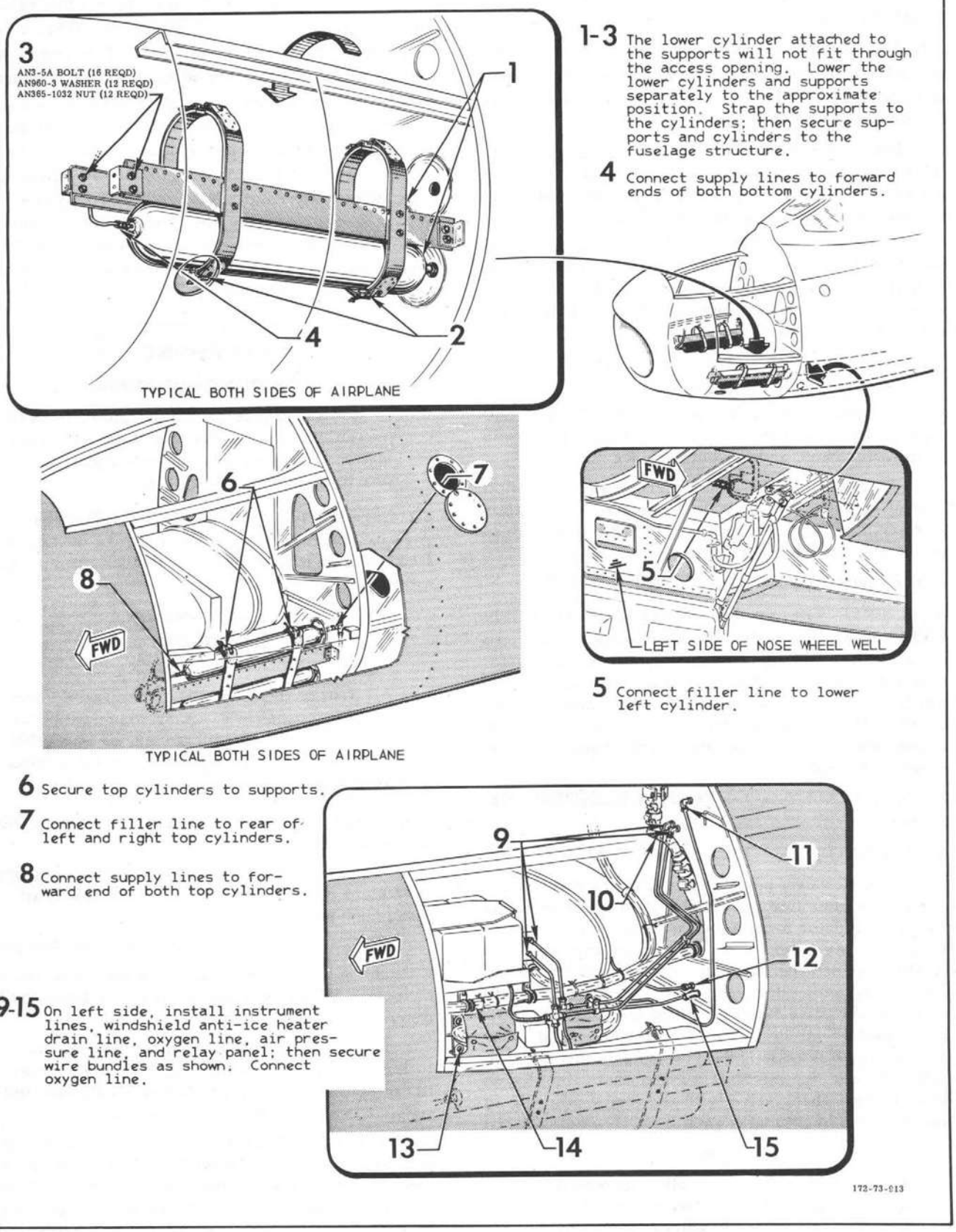
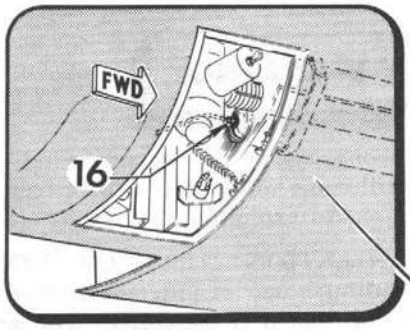
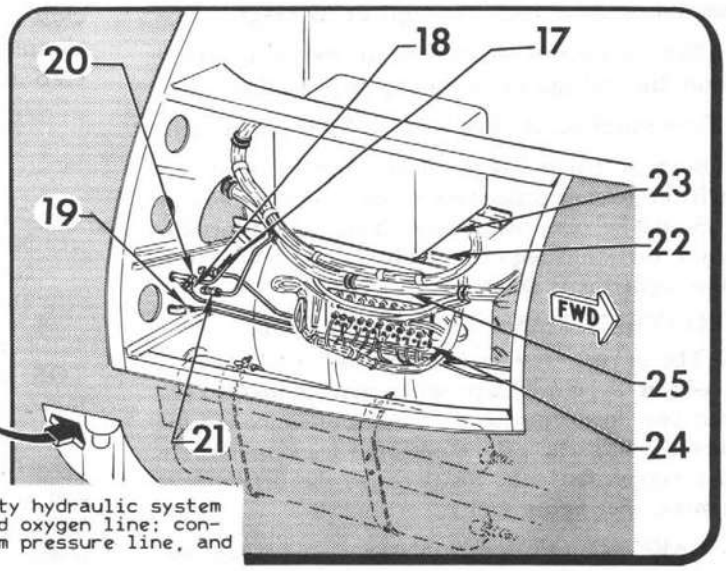


Figure 4-23. Installing Oxygen Cylinders (Sheet 1 of 2)

16 Connect filler line to rear of lower right-hand cylinder.

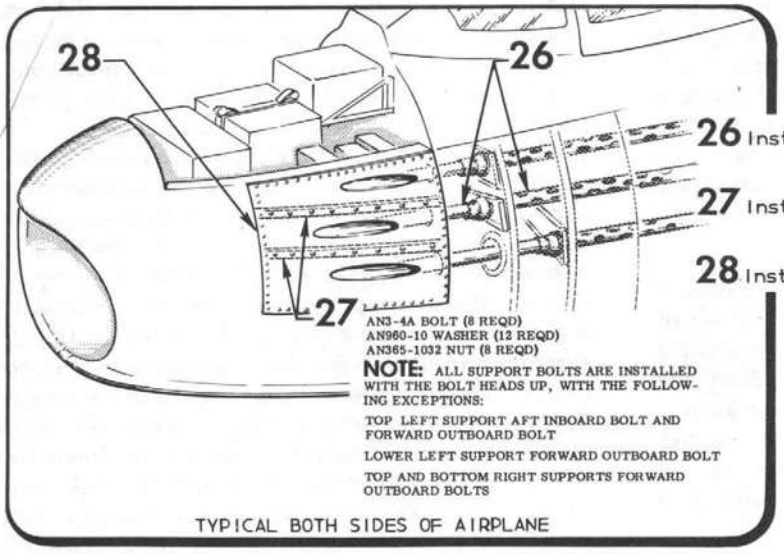




17- 21 On right side, install utility hydraulic system return and pressure line, and oxygen line; connect utility hydraulic system pressure line, and air pressure line.

22, 23 Install range power unit support and power unit.*

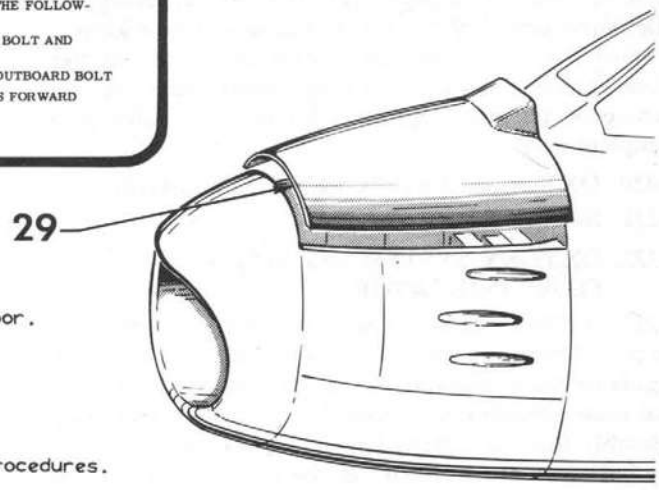
24, 25 Install terminal strip; then secure wire bundles as shown.



26 Install guns and gun blast tubes.*

27 Install gun blast panel supports.

28 Install gun blast panels.*



29 Install radar equipment and battery access door.

*Refer to index for page numbers of applicable procedures.

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Figure 4-23. Installing Oxygen Cylinders (Sheet 2 of 2)

dial is turned clockwise and decreasing as the dial is returned to "NORMAL." During this test, the pressure dial should operate freely throughout its range.

g. After the control is returned to "NORMAL," retest regulator for leakage by repeating steps a. through e.

h. Turn regulator diluter lever to "100% OXYGEN."

i. Using a demand-type mask, breathe normally through the tubing connected to the regulator outlet. Flow should be obtained freely; if an uncomfortable amount of suction is required to obtain the flow of oxygen, the regulator is defective.

4-215. OXYGEN MASK AND MASK TUBES.

4-216. The oxygen system is designed for use with a Type A-13 or Type A-13A pressure-demand mask. Tubing and two low-pressure tube assemblies, connected together through the pilot's personal lead disconnect, conduct oxygen from the regulator to the intake tube of the mask. (See figure 4-21.)

4-217. CARE OF OXYGEN MASK. To prevent deterioration, keep the mask out of direct sunlight as much as possible. At the end of each day of use, wash the oxygen mask with a mild soap and water solution, rinse in clean water, and dry. To disinfect the oxygen mask, swab it carefully and thoroughly with a gauze pad that has been soaked in a water solution of merthiolate. The clean merthiolate solution should be prepared with one gram of merthiolate (Medical Supply Stock No. 1-285-675) to 1000 cc of water. Surgical sponges (Medical Supply Stock No. 2-038-420) may be used as sterile swabs. Spray the inner crevices to be sure that the disinfectant penetrates thoroughly. Wipe the mask with a clean cloth, and let mask dry before it is used.

4-218. OXYGEN SYSTEM FILLER VALVE.

4-219. The oxygen filler valve is located to the rear of the cylinders, on the right side of the airplane, aft of the gun-muzzle door panel. It is protected by a cover plate marked "OXYGEN FILLER INSIDE." Keep the filler valve clean. When it is not in use, always keep it covered with the valve cap to prevent foreign matter from entering the valve. Except when replacing the handle or the cap, replace a faulty filler valve as a complete unit.

4-220. OXYGEN SYSTEM PRESSURE GAGE.

4-221. Refer to paragraph 6-123.

4-222. OXYGEN SYSTEM BLINKER FLOW INDICATOR.

4-223. A blinker-type oxygen flow indicator, mounted on the left forward console, is connected to the oxygen regulator. Each time the user of the mask breathes, oxygen under pressure is admitted to a bellows and body assembly through a threaded connection in the rear of the indicator, and a shutter in the indicator face opens and closes to show that oxygen is flowing through the regulator. No maintenance is required for the flow indicator. Check operation of the shutters by inserting the eraser end of a pencil through the large threaded hole in the back of the indicator; press gently against bellows and release. Failure of the shutters to open and close indicates a weak or broken spring or a defective shutter assembly. If the instrument is faulty in its operation, replace the entire unit.

WARNING

Never use oil or grease on any part of the indicator that will come in contact with oxygen under pressure. An explosion may result.

4-224. PREINSTALLATION CHECK OF INDICATOR. Before installing a new or different blinker flow indicator, make sure that it is the correct type and is approved for use. To test for leakage, connect the indicator to an oxygen supply line, raise pressure to 10 psi, and shut off supply. If, after 10 minutes, the shutters have not begun to close, there is no leakage. Replace a leaking instrument; *do not* attempt field repair.

4-225. ENGINE FIRE DETECTOR SYSTEM.

4-226. The airplane is provided with two Edison Type A, rate-of-rise, three-circuit engine fire detector systems. The systems (figure 4-24) automatically detect and indicate the presence of fire in either the forward or the aft engine compartment or in both. The systems consist of 19 thermocouples (placed throughout the engine and engine compartments), a relay panel (located in the fuselage radio compartment), and two red fire-warning lights and a circuit test switch (mounted on the right side of the cockpit on the instrument panel shroud). The forward and aft engine compartment systems are separated by the transverse fire wall at the engine mid-frame. Each system consists of a loop of fire detector thermocouples, a sensitive relay, a slave relay, a thermal test unit, and a red fire-warning light. The three circuits of each fire detector system comprise a fire detector circuit, a fire-warning circuit, and a test circuit. The fire detector circuit is a permanently closed circuit through which no battery current ever flows. In this circuit are the fire detector thermocouples and a thermal test unit, connected in series with the coils of a sensitive relay. The fire-warning circuit receives d-c power from the primary bus of the airplane and is energized by the fire detector circuit. The fire-warning circuit consists of the electrical contacts of the sensitive relay, a slave relay, and the fire-warning lights. The test circuit (common to both systems) is composed of a momentary-contact switch that interconnects the airplane power supply to the heating elements of both thermal test units. Both fire detector systems can be checked simultaneously with the test switch.

4-227. FUNCTION OF ENGINE FIRE DETECTOR SYSTEM.

4-228. When a thermocouple in a system is exposed to a rapid temperature rise (as in the case of fire), an electromotive force is generated. This electromotive force

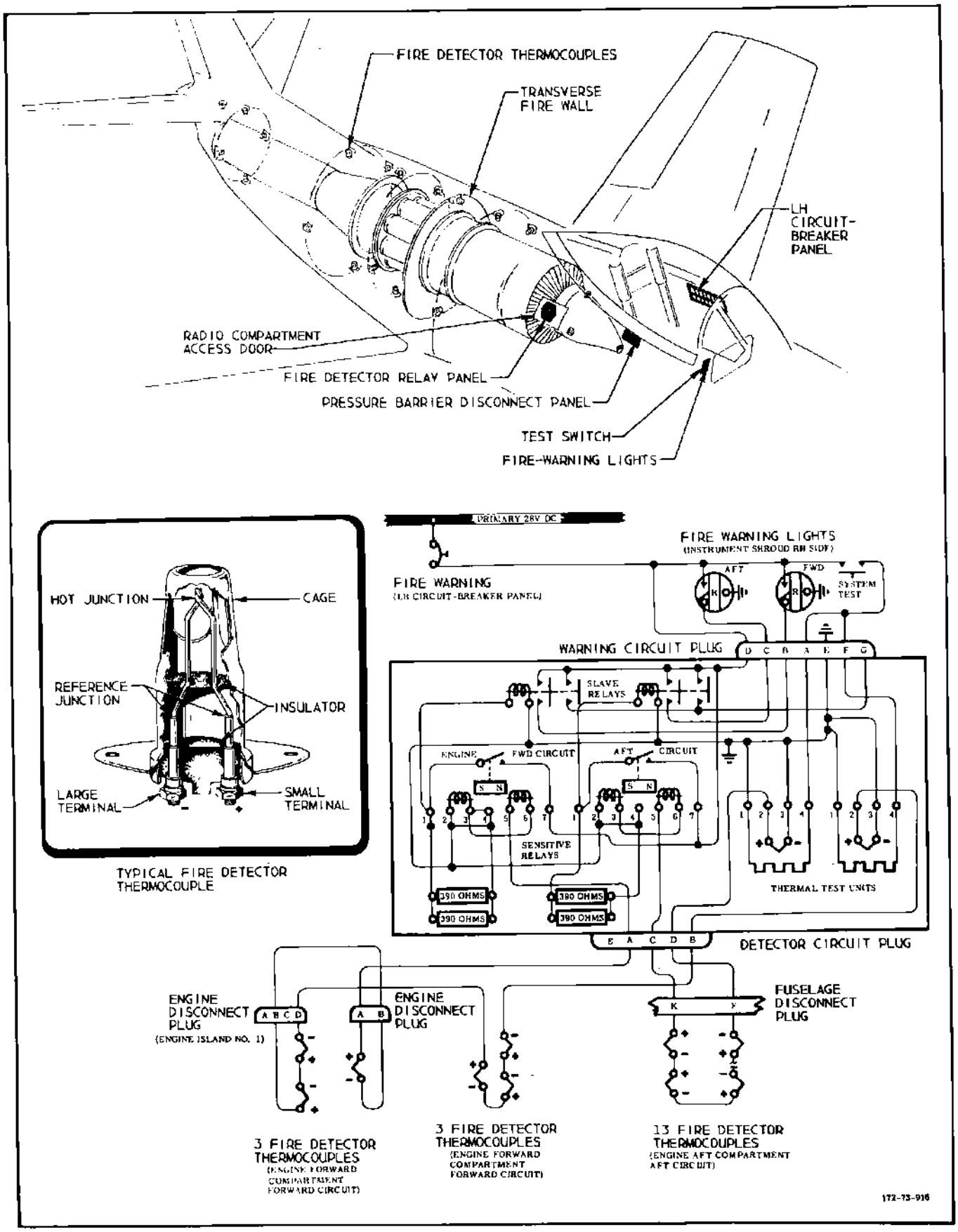

Figure 4-24. Engine Fire Detector System

energizes a sensitive relay. (See figure 4-24.) The energized sensitive relay closes a circuit to the slave relay. When the slave relay is energized, an electrical circuit is completed between the primary bus of the airplane and the respective red fire-warning light in the cockpit. The light illuminates to indicate to the pilot the presence of extreme heat or fire. When the fire has been extinguished, the thermocouple will no longer generate an electromotive force of sufficient intensity to keep the sensitive relay energized. The de-energized sensitive relay opens the circuit to the slave relay. The de-energized slave relay in turn opens the circuit to the fire-warning light, which will be extinguished. The fire detector thermocouples are not destroyed by a fire of short duration; therefore, the lights will again be illuminated if a subsequent fire occurs. When the system test switch is closed (figure 4-24), the electrical power of the airplane is connected to the heating elements of both thermal test units. This electrical power heats the thermocouple in each test unit, thus energizing the fire detector circuit in the same way any other thermocouple would energize it during an actual fire. If the fire detector systems are not defective, both fire-warning lights will illuminate.

4-229. TROUBLE SHOOTING ENGINE FIRE DETECTOR SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Fire detector indicating lights fail to illuminate during light or continuity check.	Power supply off.	
	Grounded detector circuit wire or terminal.	
	Loose or broken detector circuit wire.	
	Defective thermocouple.	Replace thermocouple. (Refer to paragraph 4-238.)
	Battery low.	
	Loose or broken warning signal circuit wire.	
	Defective warning light bulb.	
	Defective relay panel.	
	Defective thermal test unit.	Replace thermal test unit. (Refer to paragraph 4-235.)
	Defective test switch circuit.	
	Defective sensitive relay.	Replace sensitive relay. (Refer to paragraph 4-235.)
Spasmodic false fire warnings.	Defective sensitive relay.	Replace sensitive relay. (Refer to paragraph 4-235.)
	Defective test switch.	
	Defective warning signal circuit wire insulation.	
	Defective relay panel.	
False fire warning during starts.	Defective sensitive relay.	Replace sensitive relay. (Refer to paragraph 4-235.)

4-230. TESTING ENGINE FIRE DETECTOR SYSTEM.

4-231. Check the push-to-test type fire-warning lights for bulb illumination independent of system operation. Press the momentary-contact switch to "ON" and hold. Within 15 seconds, a red warning light will illuminate for each system that is completely operative. Using fire detector test set [Stock No. 7800-808125 (Edison 140-9)] or alternate test set (Stock No. 7800-801847), perform the tests in paragraphs 4-232, 4-233, and 4-236 if an inoperative system is indicated.

4-232. TESTING DETECTOR CIRCUITS. If system test (paragraph 4-231) indicates an inoperative system, test the defective system detector circuit as follows:

a. Remove the detector circuit plug (figure 4-24) from the fire detector relay panel. In its place, insert a detector circuit test plug. If no test plug is available, short the two contact pins ("A" and "B" for forward circuit, or "C" and "D" for aft circuit) in the relay panel detector receptacle of the inoperative system. If the red warning lights now illuminate, the detector circuit is the defective portion of the system.

b. While the detector circuit plug is removed from the relay panel, connect an ohmmeter between any thermocouple terminal and the airframe. Resistance less than 5000 ohms indicates a grounded condition. To locate a ground, connect the positive lead ("A" for forward circuit or "C" for aft circuit) of the detector circuit in question to the positive (left-hand) test binding post of the fire detector test set, or an equivalent meter, and ground the other meter binding post to the airframe.

CAUTION

Be sure tester is disconnected from 28-volt power source. With a large electric soldering iron fitted with a special copper tip, or an equivalent arrangement, heat each thermocouple in turn, noting the meter deflection.

Note

Check polarity of thermocouple first. If pointer movement is in the positive direction, the polarity is correct.

When two adjoining thermocouples in a circuit are heated but only one causes the meter to deflect, the ground exists between them. As an alternate method, disconnect leads from the thermocouples until location of the grounded wire is determined.

c. Check the circuit resistance by connecting an ohmmeter across the detector circuit plug sockets ("A" and "B" for forward circuit, or "C" and "D" for aft circuit) serving the detector circuit in question. Resistance exceeding 6 ohms after airplane has been allowed to stabilize at ambient temperature indicates an open circuit condition. Locate open circuits with the detector circuit energizer of the test set as follows: Replace the detector circuit plug in the relay panel receptacle; then connect the negative terminal clip of the fire detector test set to the airframe and touch the test prod to the hot junction (figure 4-24) of each thermocouple in turn. When only one of two adjoining thermocouples causes the red warning light to illuminate, the open circuit is between them. As an alternate method, disconnect the detector circuit plug from the relay panel, and then connect one lead of an ohmmeter to either of the detector circuit plug sockets of the defective circuit and the other lead to the airframe. Successively short each thermocouple to ground by inserting a jumper wire from the tip of the thermocouple to ground. When only one of two adjoining thermocouples gives continuity to ground, the open circuit is between them.

4-233. TESTING WARNING CIRCUITS. If system test (paragraph 4-231) indicates an inoperative system, test the defective system warning circuit as follows: Remove the warning circuit plug from the relay panel receptacle and plug it into the alarm circuit test receptacle of the fire detector test set. Note whether the circuit is energized, by observing the fire-warning light on the test set. Press the test switch of the airplane. Lack of response by either red warning light indicates trouble in that particular fire-warning circuit, while lack of all response shows a defective test circuit.

4-234. ENGINE FIRE DETECTOR SYSTEM RELAY PANEL.

4-235. The relay panel (figure 4-24), mounted on vibration insulators in the aft radio compartment on the right-hand side of the fuselage, houses a sensitive relay, a slave relay, and a thermal test unit for each system. The sensitive relay is an entirely enclosed unit with a seven-pin base for plug-in mounting in the panel to facilitate replacement. Since the load-carrying ability of the sensitive relay is necessarily limited, a slave relay is employed. The thermal test unit consists of a thermocouple with a pair of heating coils adjacent to its hot junction sealed within a glass bulb. To facilitate replacement, the unit is provided with a four-pin base for plug-in mounting in the panel.

4-236. TESTING RELAY PANEL. With both detector and warning circuit plugs connected to the relay panel, successively check the thermal test unit and the sensitive relay by replacing them with spares and operating the test switch. If the system still fails to operate after the preceding tests have been performed and the system has been tested in accordance with paragraphs 4-232 and 4-233, the trouble is a defective relay panel.

4-237. ENGINE FIRE DETECTOR THERMOCOUPLES.

4-238. The fire detector thermocouples (Edison No. 35534-2 series) contain two wires of dissimilar metals with their outer ends twisted and welded together. The thermocouple wires are mounted in a heat-resistant insulator and are surrounded by a stainless steel cage. (See figure 4-24.) The cage is provided with openings to permit heat to reach the exposed hot junction with minimum interference, while furnishing maximum mechanical protection. The reference junctions, or points where the thermocouple wires are attached to the terminal studs, lie within the heat-resistant insulator. Two different-sized terminal studs are used to lessen the possibility of accidental reversal of thermocouple polarity during replacement. Output from reversed thermocouples not only will fail to operate the system, but will tend to counteract the output of the other thermocouples. The six fire detector thermocouples of the forward system are located in the engine forward compartment as follows: two in the engine accessory section; one on the engine, aft of the top compressor leakage air duct; and three on the fuselage structure around the forward section of the engine. The 13 fire detector thermocouples of the aft system are located in the engine aft compartment and are mounted on the fuselage structure around the aft portion of the engine and the exhaust tail pipe. Each group of thermocouples is connected in a series with a thermal test unit and the coils of a sensitive relay. When a thermocouple is exposed to a critical temperature, the hot junction of the thermocouple is heated suddenly, while the reference (cold) junction, being insulated, remains somewhat cooler than the hot junction. This sudden rise in temperature at the hot junction causes an abnormal temperature differential between the two junctions, and sufficient electromotive force is generated to energize a sensitive relay.

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POWER PLANT AND RELATED SYSTEMS

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5-1. ENGINE.

5-2. The airplane is powered by a Model J47-GE-13 turbojet engine. (See figures 5-1 and 5-2.) The engine is divided into the following sections: auxiliary accessory drive section (paragraph 5-21), air-guide section and compressor front frame (paragraph 5-29), compressor section (paragraph 5-31), turbine section (paragraph 5-33), and exhaust section (paragraph 5-40). Engine support within the airplane is accomplished by two horizontal trunnion-type mounts bolted to each side of the compressor rear frame and a top steady-support that connects the compressor front frame to the fuselage. During engine removal or installation, the top steady-support rolls in a fuselage-mounted engine guide rail. Engine loads are transmitted to the fuselage through the two side mounts. These side mounts incorporate spherical balls which are held by fuselage-attached clamps. For further information regarding the engine trunnions and their adjustment, refer to paragraph 5-15. Fuselage and wheel well access covers are provided for servicing, inspection, and maintenance of the engine forward section. For access to the aft portion of the engine (turbine and exhaust sections), the fuselage rear section must be removed. (Refer to paragraph 2-150.) A transverse stainless-steel fire wall on the compressor rear frame divides the engine compartment into two compartments: the relatively cool forward compartment, and the hot aft compartment. (See figure 5-1.) This fire wall prevents leaking combustible liquids or fumes from coming in contact with the hot aft portions of the engine or in direct contact with exhaust gases. To reduce heat radiation, the tail pipe and exhaust cone are wrapped with heat-insulating blankets. To further protect the fuselage structures by maintaining safe structural temperatures, each compartment has a separate ventilating airflow system. The forward compartment of F-86E-1 through F-86E-10 Airplanes is cooled by air which enters through two inlet ducts in the bottom of the fuselage. This air circulates over the engine and is expelled overboard, by the aspirator action of the compressor seal leakage air, through a duct at the top of the fuselage. During flight, the air is also expelled through an outlet duct incorporated in each of the two engine access doors on the sides of the fuselage. The forward compartment of F-86E-15 Airplanes is cooled during flight by air which enters through 12 holes in the air inlet duct. This air circulates over the engine and is expelled overboard through five outlet ducts located in the fuselage rear section: two in the bottom, two on the sides, and the compressor seal leakage duct at the top. During normal ground operation, the reverse condition exists, in that cooling air enters the compartment through the normal outlet ducts and is drawn through the 12 holes in the air inlet duct and into the engine. The aft compartment of all airplanes is cooled by air entering two inlet ducts (one duct is located on each side of the fuselage) forward of the speed brakes. This air circulates over the combustion chambers, exhaust cone, and tail pipe, and is expelled overboard, by the aspirator action of the exhaust jet stream, through the annular venturi-like opening formed by the exhaust tail-pipe nozzle at the rear of the fuselage.

5-3. ENGINE DATA, AUXILIARY COMPONENTS, AND ACCESSORIES.

5-4. The following chart contains engine data and general information on auxiliary components and accessories. All auxiliary components and accessories are incorporated as parts of the engine to form a self-contained unit. (See figure 5-2.) For detailed information concerning the auxiliary components and accessories, refer to applicable paragraphs listed.

Engine weight (before build-up)	Approximately 2600 lb
Engine length (less tail pipe)	147.42 (±.13) in. cold 148.25 (±.13) in. hot
Engine width (across trunnion pads)	32.0 in. cold 32.25 in. hot
Engine thrust	Approximately 5200 lb
Engine oil consumption	Maximum, 2.5 lb/hr Minimum, 0 lb/hr Normal, 0.5-1.5 lb/hr

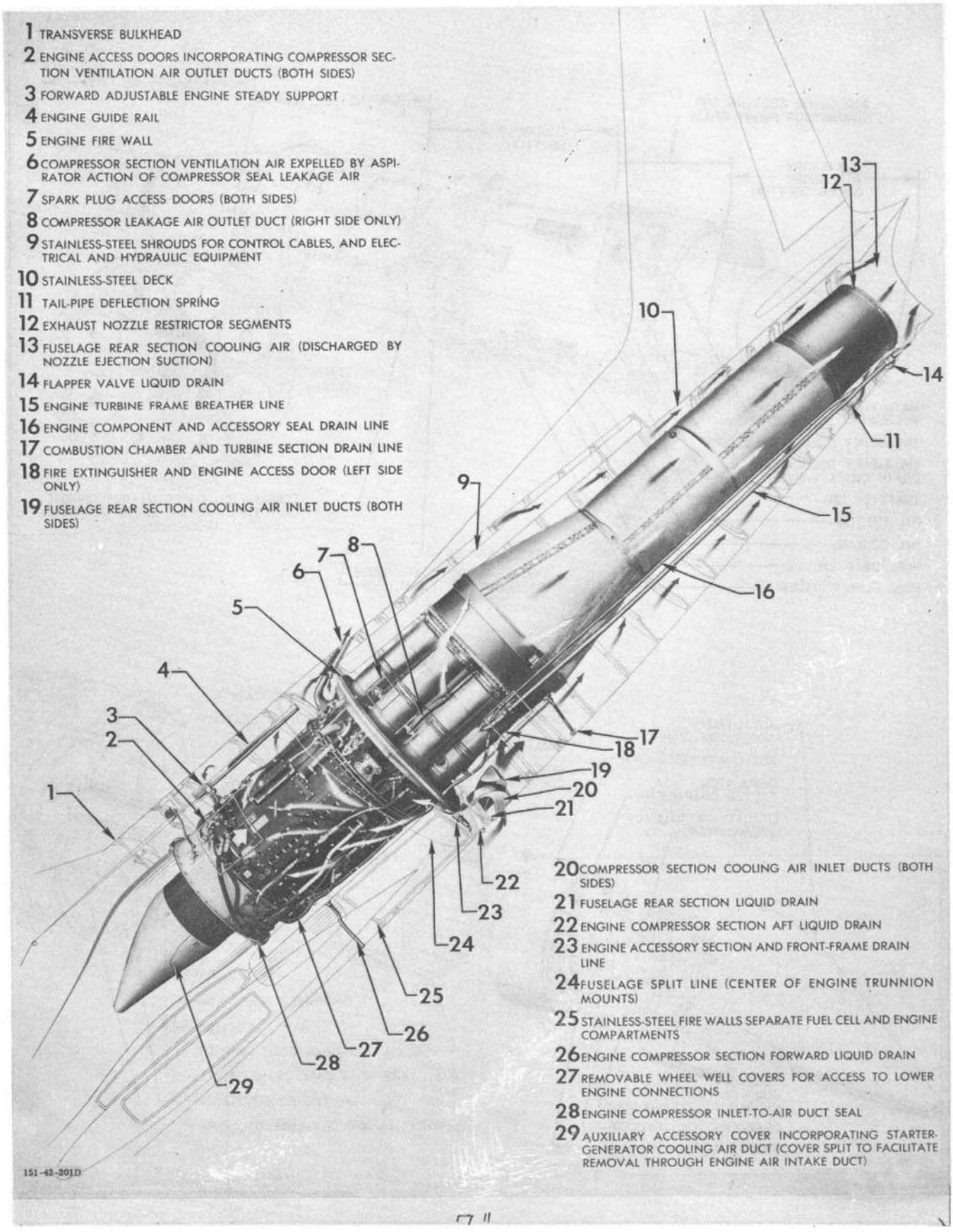


Figure 5-1. Engine Installation Details—F-86E-1 Through F-86E-10 Airplanes

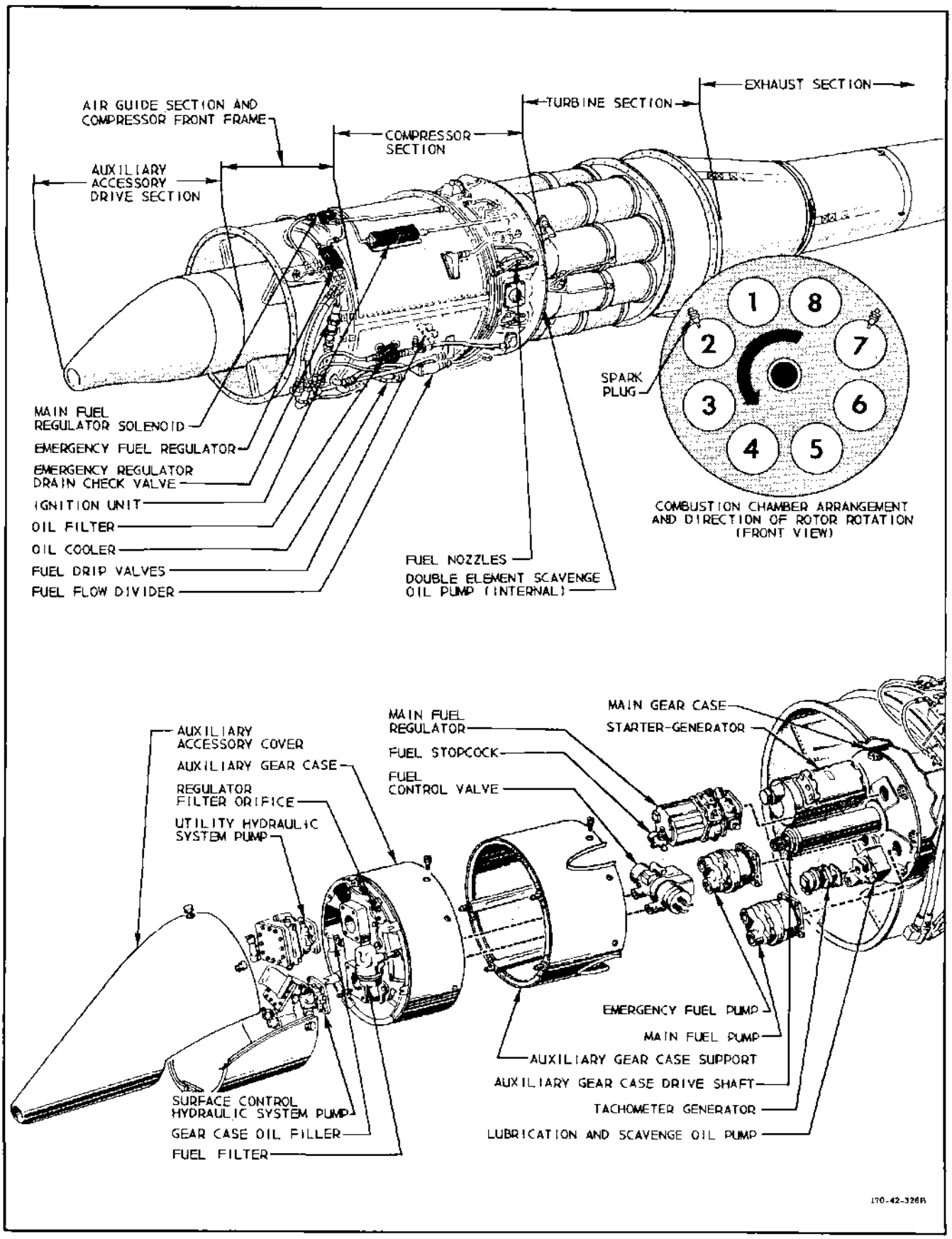


Figure 5-2. Engine Auxiliary Components and Accessories

AUXILIARY COMPONENT OR ACCESSORY	MODEL OR DWG NO.	MFR	PARAGRAPH NO.
Main fuel pump	2P739-F	Pesco	5-65
Emergency fuel pump	2P739-F	Pesco	5-65
Fuel filter	03S12166D	Air Maze Co	5-77
	3639	Hydro-Aire Co	
Fuel flow divider	8481801B	G.E. Co	5-95
Fuel control valve	021098-030-02	Pesco	5-75
Fuel stopcock	8992757	G.E. Co	5-90
Fuel manifold drain valves	K-2450	Kohler Co	5-97
Fuel nozzles	8482535	G.E. Co	5-99
Fuel check valve	12-1048-1	Parker Appliance Co	5-85
	K-1304-13	Kohler Co	
Main fuel regulator	VS2-6900G5	Chandler-Evans Co	5-69
	VS2-6900G6		
Emergency fuel regulator	EC2-8300F2	Chandler-Evans Co	5-87
	EC2-8300F3		
	EC2-8300F4		
	EC2-8300H3		
	EC2-8300H4		
Main fuel regulator air solenoid valve	V5-5350	Skinner Chuck Co	5-61
	5-1948-6	Parker Appliance Co	
Fuel regulation oil orifice and filter	0S12223G	Air Maze Co	5-61
	3857	Hydro-Aire Co	
Lubricating and scavenge oil pump	NC-221A	Nichols Pump Co	5-234
Oil filter	C15575J	Air Maze Co	5-244
	3690	Hydro-Aire Co	
Oil cooler and control valve	B42686	Clifford Mfg Co	5-230 and 5-232
	48185		
	86270	AiResearch Mfg Co	
	86566		
Aft bearing oil scavenge pump	NC-193-1F	Nichols Pump Co	5-238
Auxiliary gear case oil scavenge pump	GB-693	Nichols Pump Co	5-242
Starter-Generator	2CM77B2-A	G.E. Co	5-253
	2CM77B-8A		
Spark plugs	785J	B.G. Corp	5-266
	F52	A.C. Corp	
	AA49-245	Auburn	
	F6-A12	Champion	
Ignition vibrator units	9791277	G.E. Co	5-264
Tachometer generator	A-1		6-53
Surface control hydraulic power system pump	AA32507-L-2	Vickers	2-99
Hydraulic utility power system pump (F-86E-1, F-86E-5, and F-86E-6 Airplanes, and F-86E-10 Airplanes AF51-2718 through -2826)	AA32507-L-2	Vickers	3-13
Hydraulic utility power system pump (F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes)	67WA200	N.Y. Air Brake	3-17

5-5. TROUBLE SHOOTING ENGINE.

TROUBLE	PROBABLE CAUSE	REMEDY
Insufficient or no rpm when attempt is made to start engine.	If power from external source is satisfactory yet starter motor is straining to turn engine rotor, the trouble is mechanical and probably caused by:	

TROUBLE	PROBABLE CAUSE	REMEDY
	a. Icing in compressor.	Direct hot air into compressor inlet.
	b. Shroud ring seizure.	Allow engine to cool, provided seizure was caused by a too-sudden shutdown of engine at previous operation. When testing after cooling, turn turbine with wooden pole or with an external air pressure source through compressor. If shroud ring still rubs, remove tail pipe and exhaust cone to check bucket tip clearance. Replace shroud ring, after making sure that any recently replaced bucket is not too long.
	c. Air and oil seat rub.	If cooling engine does not relieve trouble, replace engine. (Refer to paragraphs 5-7 and 5-13.)
	d. Compressor or other type of seizure.	Make an extensive investigation; replace engine if necessary.
	If compressor rotor turns freely, trouble can be assumed to be electrical, as follows:	
	a. Starter-generator leads reversed.	
	b. Open circuit breakers in electrical system.	
	c. Faulty external power source or connections.	
	d. Worn or defective starter-generator brushes or commutator.	Repair or replace starter-generator.
	e. Starter control not functioning properly.	Repair or replace defective electrical equipment.
Combustion does not occur during an attempted start.	If fuel pressure is normal (20 to 40 psi) and no firing of spark plugs can be heard, ignition trouble is indicated, probably caused by the following:	
	a. Ignition relay not functioning properly.	Check with voltmeter, turning on flow of electricity with ignition test switch. If spark plugs fire, relay is not functioning properly. Replace relay.
	b. Incorrect voltage at electrical junction box (24 volts).	
	c. Faulty cable leading to ignition units.	
	d. Failure within ignition units.	Replace ignition units.
	e. Grounded or broken high-voltage cable.	Fill cable with Dow-Corning No. 4 compound. Replace cable.
	f. Faulty spark plugs.	Check for carbon, insulation cracks, and improper electrode gaps, or replace spark plugs.

TROUBLE	PROBABLE CAUSE	REMEDY
	If fuel pressure is low and spark plugs can be heard firing, trouble is in the fuel system. If start was attempted with both systems operating, trouble must be common to both systems, as follows:	
	a. Fuel supply inadequate.	
	b. Booster pumps not functioning properly.	
	c. Shutoff valve not functioning properly.	
	d. Low-pressure fuel filter dirty or clogged.	Clean filter. (Refer to paragraph 5-112.)
	e. Stopcock stuck.	Check by disconnecting fuel line at oil cooler, turning to 3% to 4% rpm with starter. If no fuel appears, check linkage to stopcock (figure 5-22) or replace stopcock.
	f. Flow divider not operating properly.	Disconnect large-slot hoses at fuel nozzles, and cap end of hoses and fuel nozzle large-slot connections. If engine now starts, replace flow divider.
	g. Drip valve clogged and stuck open, and fuel pressure over 5 psi.	Cap discharge line from drip valve. If engine starts, replace drip valve. Note that if fuel is pouring from overboard drain, drip valve must be stuck open.
	If start was attempted on main fuel system alone, trouble is in that system and is probably from the following causes:	Attempt a start on the emergency system. If start is accomplished, trouble is in main fuel system. Attempting start will also correct unprimed condition of main fuel regulator.
	a. Emergency check valve stuck open.	Replace check valve.
	b. Linkage to main regulator disconnected or jammed.	
	c. Main fuel regulator or fuel control valve not functioning properly.	Check by inserting gage in variable control oil pressure line. Attempt start. If pressure is below 23 psi, fuel regulator is faulty; if pressure is above 23 psi, fuel control valve must be replaced. Regulator may need priming with oil in cases where a replacement regulator has been installed.
	d. Variable control oil pressure and regulator-oil-to-gear-case lines crossed.	
	e. Main fuel pump not functioning properly.	Replace fuel pump. (Refer to paragraphs 5-66 and 5-67.)
	If ignition system is in order and fuel pressure at 6% rpm is normal, probable cause is faulty fuel nozzles.	Install a replacement set of fuel nozzles in chambers No. 3 and 7 to determine whether the trouble is a faulty spray pattern.
Engine unable to reach 100% rpm with full throttle setting.	Faulty tachometer indicator reading.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Run engine alternately on main and emergency systems. If same trouble persists in both systems, the trouble is probably one of the following, common to both systems:	
	a. Inadequate fuel supply.	
	b. Flow divider not functioning properly.	Replace fuel flow divider.
	c. Stopcock not functioning properly.	Adjust linkage (figure 5-22) or replace stopcock.
	d. Engine control system improperly adjusted.	Adjust control linkage. (Refer to paragraph 5-53.)
	Run engine on main system alone (emergency fuel switch "OFF"); if rpm is slightly under 100%, the trouble is probably in linkage setting or the following:	Reset high-speed setscrew located on island No. 4. Disconnect emergency system linkage. Check main system linkage. (See figure 5-22.)
	a. Governor incorrectly set or not functioning properly.	Replace main fuel regulator. (Refer to paragraphs 5-70 and 5-71.)
	b. Fuel filter clogged.	Clean filter (paragraphs 5-78 and 5-79) or replace filter.
	c. Fuel control valve not functioning properly.	Replace fuel control valve.
	Run engine on main system alone; if rpm is approximately 55% to 60%, the trouble is possibly in air sensing line to the main fuel regulator, with the probable cause in the following:	
	a. Air lines and connections between island No. 4 and rear of compressor.	Check by disconnecting air line at island No. 4. With engine running on emergency fuel system, a strong pressure can be felt (approximately 80 psi).
	b. Faulty solenoid in line.	
	c. Loose, ruptured, or clogged air line from island No. 4 to regulator.	
	Run engine on main system alone; if rpm is considerably below 80%, the trouble could be:	
	a. Main system linkage not properly adjusted.	Adjust linkage. (See figure 5-22.)
	b. Main fuel regulator or control valve not functioning properly.	Insert a gage in variable control oil line. Attempt to reach top speed. Variable control oil pressure should equal approximately one-third of fuel pressure plus 15 psi. If pressure is high, replace fuel control valve; when pressure is low, replace regulator only.
	c. Fuel filter dirty.	Clean filter (paragraphs 5-78 and 5-79) or replace filter.
	d. Main fuel pump not operating properly.	Replace pump. (Refer to paragraphs 5-66 and 5-67.)

TROUBLE	PROBABLE CAUSE	REMEDY
	If engine is running on emergency system alone (emergency fuel switch at "TEST") and speed is lower than it should be according to the outside air temperature, the trouble is in the following:	
	a. Emergency system linkage not properly adjusted.	Adjust linkage. (See figure 5-24.)
	b. Emergency regulator not functioning properly.	Replace emergency regulator.
	c. Emergency fuel pump not functioning.	Replace fuel pump. (Refer to paragraphs 5-66 and 5-67.)
Engine exceeds 100% rpm at full throttle position.	This could be caused by the emergency fuel system overriding the main fuel system. Check to see whether trouble is in emergency system by turning switch to "OFF." If speed drops to normal, the overspeed is probably caused by:	
	a. Emergency system linkage not properly adjusted.	Adjust linkage. (See figure 5-24.)
	b. Emergency regulator not functioning properly.	Replace emergency regulator.
	c. Engine control system improperly adjusted.	Adjust control linkage. (See figure 5-20.)
	d. Air sensing line to emergency regulator open.	
	If main system alone is overspeeding, the engine trouble can be attributed to:	
	a. Faulty rpm indication.	Check tachometer indicator and tachometer generator, replace if necessary.
	b. High rpm stop adjusted incorrectly.	Reset high-speed screw on island No. 4.
	c. Faulty fuel regulator.	Replace regulator. (Refer to paragraphs 5-70 and 5-71.)
Engine surges or hunts with fixed throttle setting.	Alternately run engine on main and emergency fuel systems. If surge continues:	
	a. Fuel shutoff valve may be stuck in partially open position.	
	b. Booster pump not functioning properly.	Replace pump. (Refer to paragraphs 5-115 and 5-116.)
	c. Low-pressure filter clogged.	Clean filter. (Refer to paragraph 5-112.)
	d. Faulty fuel flow divider.	Replace flow divider.
	If surging occurs when main system alone is running the engine, the trouble is in:	
	a. Main fuel regulator.	Prime regulator (paragraph 5-72) and/or replace regulator (paragraphs 5-70 and 5-71).

TROUBLE	PROBABLE CAUSE	REMEDY
	b. Engine fuel control valve. If surging occurs while emergency system alone is running engine, the trouble is in the emergency fuel regulator.	Replace fuel control valve. Replace emergency fuel regulator.
Exhaust gas temperatures over maximum.	Jet nozzle area too small.	Remove resistrictor segments as required. (Refer to paragraph 5-44.)
	Gage or thermocouple at fault.	Check by calibrating gage and measuring thermocouple resistance. (Refer to paragraph 6-21.)
	Clogged compressor inlet.	Remove obstruction from compressor inlet.
	Faulty fuel nozzle.	Replace nozzle. (Refer to paragraphs 5-36 and 5-38.)
	Worn combustion chamber liners.	Replace liners. (Refer to paragraphs 5-36 and 5-38.)
	Shroud ring clearance large.	Replace shroud ring. (Refer to paragraph 5-43.)
	Nozzle diaphragm area large. (Blade ballooned.)	Replace engine. (Refer to paragraphs 5-7 and 5-13.)
Low exhaust temperatures.	Large jet nozzle area.	Add restrictor segments as required. (Refer to paragraph 5-44.)
	Cage or thermocouple at fault.	Check by calibrating gage and measuring thermocouple resistance. (Refer to paragraph 6-21.)
Fuel mixing with lubricating oil.	Ruptured diaphragm in fuel control valve.	Check by disconnecting hydraulic return line at fuel control valve and turning on booster pump. If necessary, replace valve.
	Internal break in oil cooler.	Check by removing drain plug and looking for fuel, turning on booster pump to give some fuel flow; if necessary, replace oil cooler.
	Excessive fuel from fuel pump getting into gear case, possibly because of back pressure in drain system.	Check by breaking fuel drain lines at island No. 3 and measuring for excessive leakage with engine running. Also look for restrictions in drainage system. Lines reversed on flow divider would result in abnormal drainage from overboard drain.
Low or no lubricating oil pressure.	Empty oil tank.	
	Clogged oil filter.	Clean filter. (Refer to paragraphs 5-245 and 5-246.)
	Clogged or broken oil lines.	
	Oil pressure gage reading incorrect.	Calibrate gage. If necessary, replace gage.
	Lubricating and scavenge oil pump failure.	Replace pump. (Refer to paragraphs 5-235 and 5-236.)
	Aft bearing oil scavenge pump failure.	Replace pump if trouble is failure of scavenge pump. (Refer to paragraphs 5-239 and 5-240.)

TROUBLE	PROBABLE CAUSE	REMEDY
		If any of the scavenge lines are at fault, the oil tank will quickly empty and oil will pour out at aft-frame vents. Replace pump. (Refer to paragraphs 5-235 and 5-236.)
	If engine speed indicator is registering zero with engine running, trouble is inoperative lubricating and scavenge oil pump.	
Low oil pressure at altitude.	Clogged oil pressure transmitter vent.	
High oil pressure.	Generally due to restrictions: pieces of rubber, crimped oil jets, or excessive weld metal aft of pressure tap.	Make positive check by attaching a shop air line containing a pressure gage just aft of oil filter. Compare pressure maintained at pressure tap with that which would be normal for system at given shop air pressure (e.g., approximately 25 psi with shop air of 80 psi). If pressure is above normal, check the following probable causes.
	Clogged line after pressure tap.	
	Restricted oil jets.	May require replacement engine.
	Faulty check valve aft of pressure tap.	
Fluctuating oil pressure.	Partially clogged line from oil tank to main lubricating and scavenge oil pump.	
	Faulty oil pressure gage or transmitter.	
	Faulty main oil filter.	
Unusual noises detected while engine is coasting after shutdown or during a dry run.	Light clicking in vicinity of damper or aft bearings. (Shifting of rollers and retainer in bearings, or the normal and acceptable turbine-bucket looseness.)	No adjustment or repair necessary.
	Scraping sounds.	Adjust turbine shroud ring; then, if necessary, investigate further.
	Harsh clicking, rattling, or thumping caused by dry, misaligned, or faulty bearings.	Replace engine. (Refer to paragraphs 5-7 and 5-13.)
	Faulty starter-generator bearings.	Replace starter-generator. (Refer to paragraphs 5-254 and 5-255.)
	Fuel pump squeals as engine stops.	Acceptable.

5-6. REMOVING ENGINE.

5-7. See figure 5-6 for location and identification of the various disconnects. To remove the engine, proceed as follows:

a. Make sure all switches are "OFF"; then remove fuselage engine access doors and main landing gear wheel well covers.

b. Remove fuselage rear section. (Refer to paragraph 2-150.)

c. Drain oil system. (Refer to paragraph 1-41.)

d. Make the following disconnects, identified and located in figure 5-6.

CAUTION

Secure all the disconnected and hanging lines, hoses, ducting, and electrical wiring with cord to prevent damage or interference during engine removal.

Exhaust temperature electrical plug at jumper receptacle near engine island No. 1.

Ignition, tachometer, and fuel system solenoid electrical plug at jumper receptacle near engine island No. 1.

Starter-generator leads and fire detector plug at terminals of engine plumbing island No. 1.

Hydraulic hoses at fuselage quick-disconnect fittings.

Oil inlet hose at fitting of engine plumbing island No. 2.

Inlet and outlet fuel hoses at fuel flowmeter.

Engine control rod at arm on engine plumbing island No. 4.

Fire detector electrical coupling near engine compressor leakage air duct.

Compressor discharge air supply duct at top left side of engine.

Heat exchanger exhaust duct at fire wall on left side of engine (F-86E-1, F-86E-5, and F-86E-6 Airplanes only).

Engine front-frame drain line at fuselage separation bulkhead.

Fuel and oil pressure hoses at transmitters on left side of fuselage.

Oil return hose at disconnect fitting.

Main fuel inlet hose at fitting of engine plumbing island No. 3.

e. Connect engine hoist sling (E1176) to engine fittings and relieve engine weight from airplane.

f. Disengage engine front support mount by removing safety pin and retaining pin.

Note

Jiggling aft end of tail pipe will simplify removal of retaining pin.

g. Loosen and open engine main trunnion mounts.

h. Make sure that all engine-to-fuselage disconnects have been accomplished and are clear; then carefully and slowly roll fuselage front section forward away from engine or pull engine from fuselage. Lower engine into transportation dolly (E1186) or suitable shipping container mounting. If engine is to be sent to overhaul, remove all engine-to-airplane adapting parts shown in figures 5-3, 5-4, and 5-5, and retain them for installation on replacement engine.

CAUTION

To prevent bursting hydraulic pump casings, *do not motor engine* unless quick-disconnect fittings of all hydraulic pump lines are opened or connected to hydraulic source.

5-8. PREPARING ENGINE FOR BUILD-UP.

5-9. Prepare the engine for build-up as shown in figure 5-3.

5-10. ENGINE BUILD-UP.

5-11. Numerous adapting items must be installed on the engine prior to its installation in the airplane. These additions and changes are listed and shown in figures 5-4 (F-86E-1 through F-86E-10 Airplanes) and 5-5 (F-86E-15 Airplanes).

CAUTION

To prevent bursting hydraulic pump casings, *do not motor engine* unless quick-disconnect fittings of all hydraulic pump lines are opened or connected to hydraulic source.

5-12. INSTALLING ENGINE.

5-13. Prepare and build up engine according to procedure in figure 5-3 and paragraph 5-11; then see figure 5-6 for engine installation procedure.

CAUTION

Make sure that engines equipped with Vickers AA32507-L-2 hydraulic utility power system pump are installed in F-86E-1, F-86E-5, and F-86E-6 Airplanes, and F-86E-10 Airplanes AF51-2718 through -2826 only. F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes require engines with N.Y. Air Brake 67WA200 hydraulic utility power system pump.

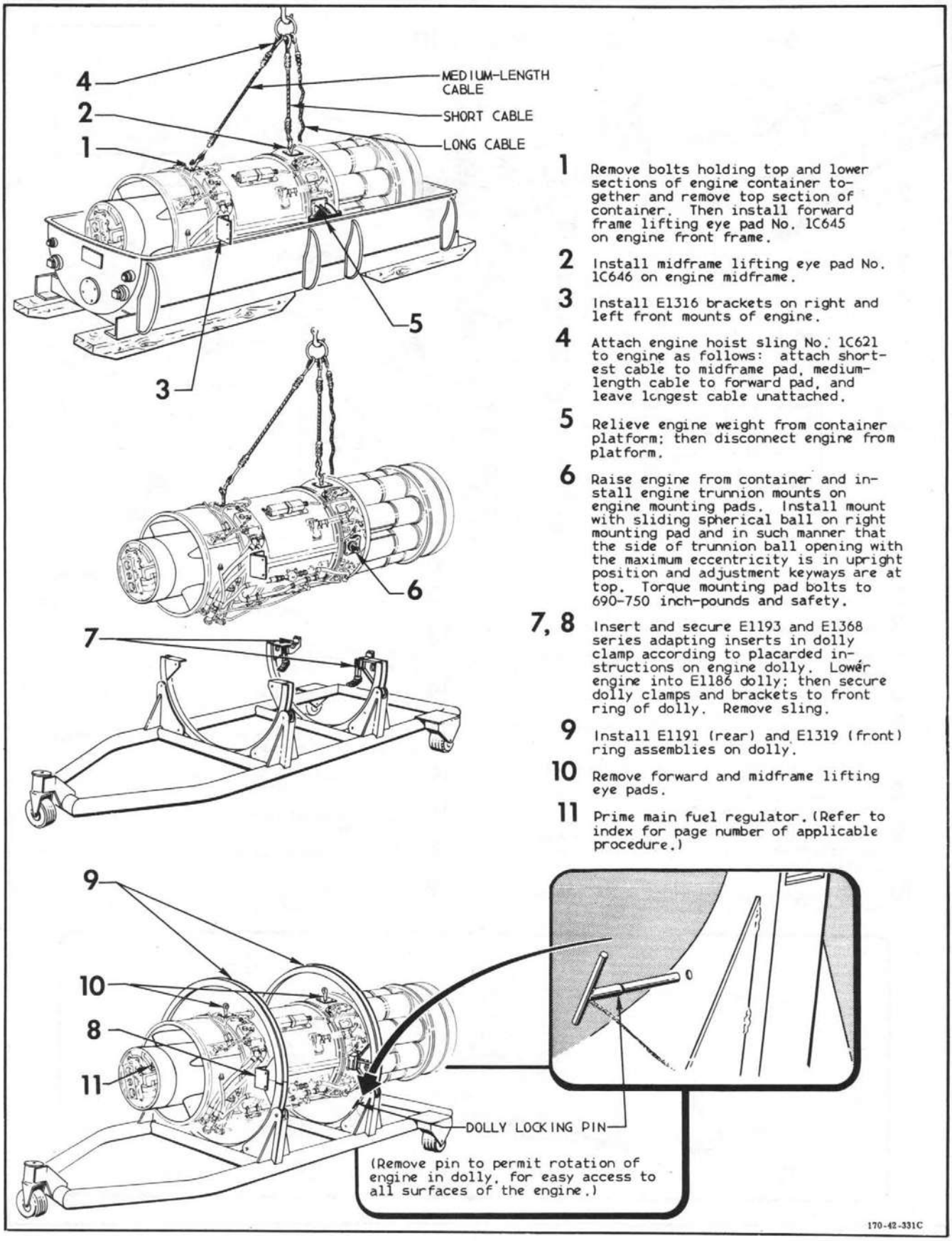
5-14. ALIGNING ENGINE AND FUSELAGE.

5-15. Engine-fuselage alignment is accomplished by adjustment of the right trunnion mount and the top steady-support. The ball of the right trunnion mount is eccentric and keyed to the trunnion shaft. Five keyways provide adjustment of the eccentric ball to obtain proper lateral alignment of the engine. The top steady-support is adjustable and provides engine vertical alignment. The engine-fuselage alignment procedure (figure 5-7) is normally accomplished during engine installation procedure (paragraph 5-13).

5-16. PREOPERATIONAL TEST OF NEWLY INSTALLED ENGINE.

5-17. After installing a new or overhauled engine, and before attempting operation, test engine as follows to determine that installation is operable:

a. Check engine-fuselage alignment. (Refer to paragraph 5-15.)



1 Remove bolts holding top and lower sections of engine container together and remove top section of container. Then install forward frame lifting eye pad No. 1C645 on engine front frame.

2 Install midframe lifting eye pad No. 1C646 on engine midframe.

3 Install E1316 brackets on right and left front mounts of engine.

4 Attach engine hoist sling No. 1C621 to engine as follows: attach shortest cable to midframe pad, medium-length cable to forward pad, and leave longest cable unattached.

5 Relieve engine weight from container platform; then disconnect engine from platform.

6 Raise engine from container and install engine trunnion mounts on engine mounting pads. Install mount with sliding spherical ball on right mounting pad and in such manner that the side of trunnion ball opening with the maximum eccentricity is in upright position and adjustment keyways are at top. Torque mounting pad bolts to 690-750 inch-pounds and safety.

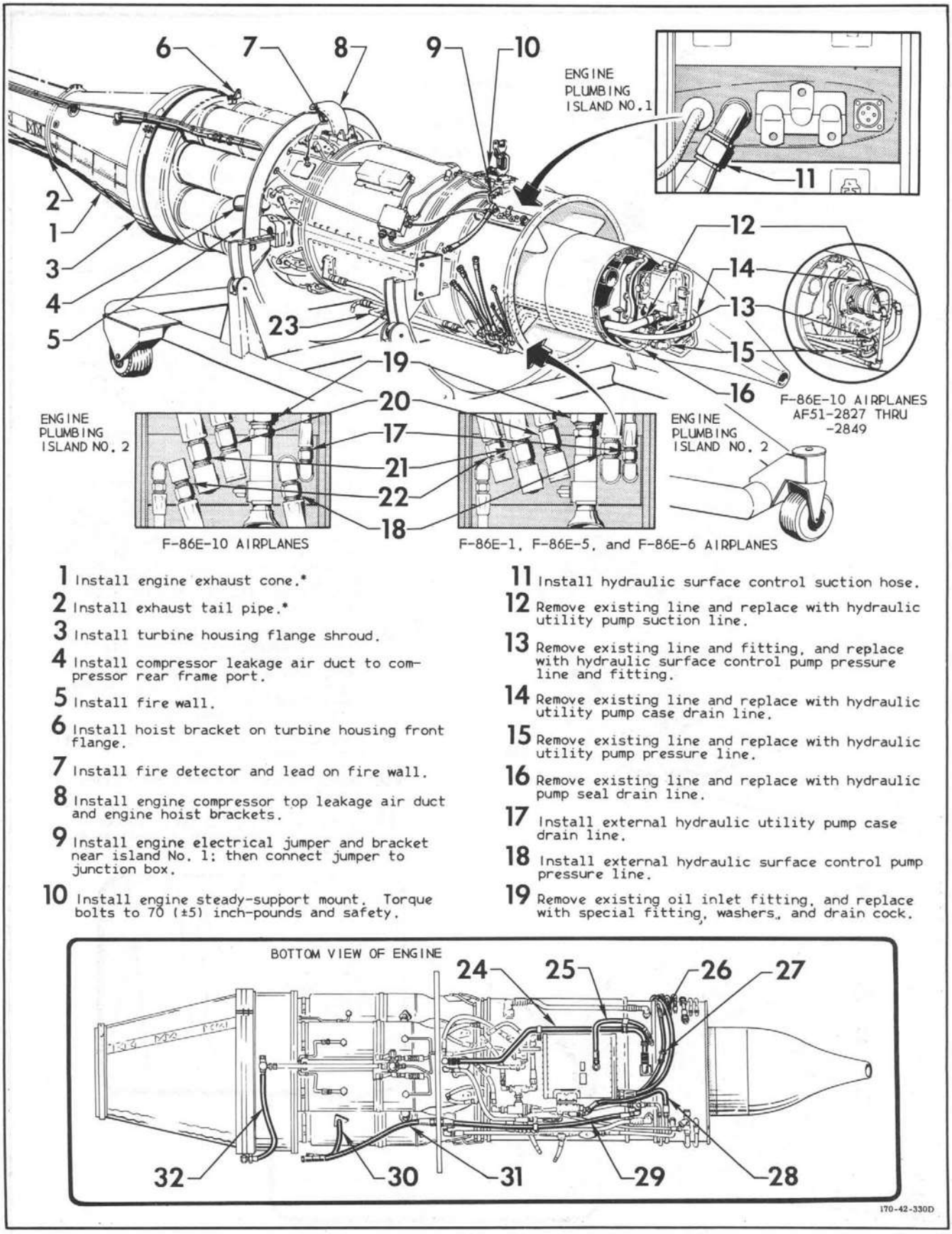
7, 8 Insert and secure E1193 and E1368 series adapting inserts in dolly clamp according to placarded instructions on engine dolly. Lower engine into E1186 dolly; then secure dolly clamps and brackets to front ring of dolly. Remove sling.

9 Install E1191 (rear) and E1319 (front) ring assemblies on dolly.

10 Remove forward and midframe lifting eye pads.

11 Prime main fuel regulator. (Refer to index for page number of applicable procedure.)

Figure 5-3. Preparing Engine for Build-up



1 Install engine exhaust cone.*

2 Install exhaust tail pipe.*

3 Install turbine housing flange shroud.

4 Install compressor leakage air duct to compressor rear frame port.

5 Install fire wall.

6 Install hoist bracket on turbine housing front flange.

7 Install fire detector and lead on fire wall.

8 Install engine compressor top leakage air duct and engine hoist brackets.

9 Install engine electrical jumper and bracket near island No. 1; then connect jumper to junction box.

10 Install engine steady-support mount. Torque bolts to 70 (±5) inch-pounds and safety.

11 Install hydraulic surface control suction hose.

12 Remove existing line and replace with hydraulic utility pump suction line.

13 Remove existing line and fitting, and replace with hydraulic surface control pump pressure line and fitting.

14 Remove existing line and replace with hydraulic utility pump case drain line.

15 Remove existing line and replace with hydraulic utility pump pressure line.

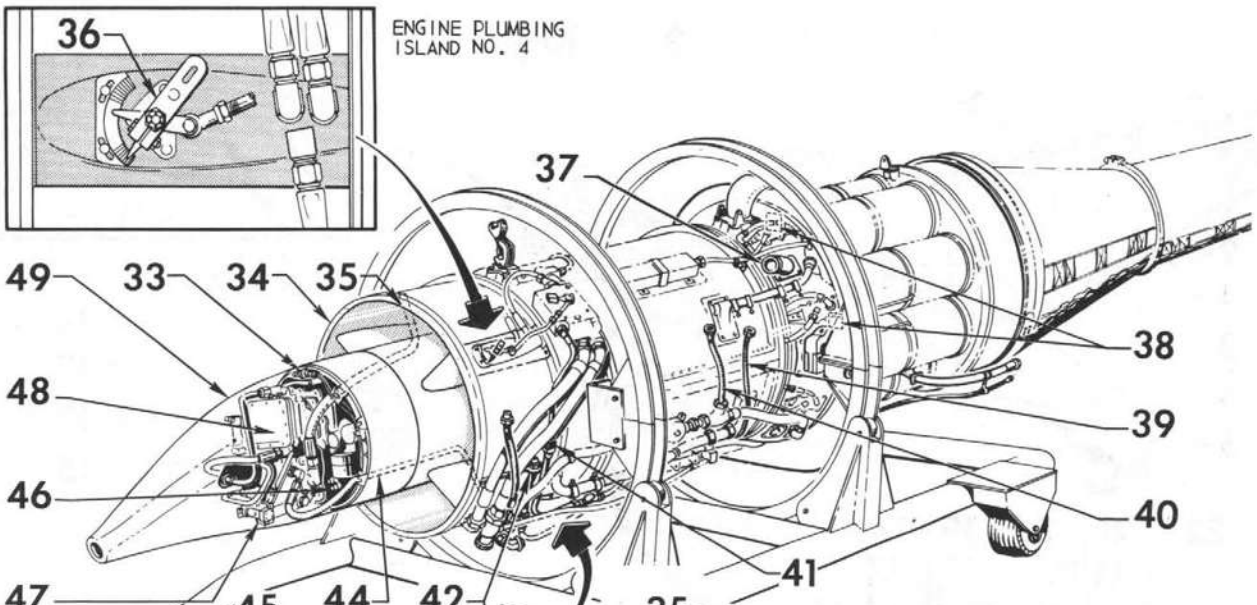
16 Remove existing line and replace with hydraulic pump seal drain line.

17 Install external hydraulic utility pump case drain line.

18 Install external hydraulic surface control pump pressure line.

19 Remove existing oil inlet fitting, and replace with special fitting, washers, and drain cock.

Figure 5-4. Build-up of Engine—F-86E-1 Through F-86E-10 Airplanes (Sheet 1 of 2)



20 Rotate fitting as shown, and connect engine-to-fuel-flowmeter fuel hose.

21 Install external hydraulic utility pump suction line.

22 Install external hydraulic utility pump pressure line.

23,24 Install front frame drain fitting and line.

25 Install oil cooler drain fitting, line, and drain cock.

26 Replace existing line with fuel-flowmeter-to-oil-cooler line.

27 Connect hydraulic pump seal drain hoses and check valve from island No. 2 to four-way fitting.

28 Reroute existing oil return line as shown.

29 Connect drain hose to top of four-way fitting and fire wall fitting.

30 Install engine turbine frame breather tube.

31 Install drain line to fire wall fitting.

32 Connect drain hose to combustion chamber and turbine housing rear drain fitting. Secure drain line to stowage clip on turbine housing shroud (item 3).

33 Install fire detector and accessory cover support brackets, fire detectors, and electrical wiring. Connect fire detector electrical plug.

34 Install air seal on compressor inlet flange.

35 Remove conduit, and replace with hydraulic surface control pump suction line and fitting.

36 Install control arm on engine control shaft.*

37 Install compressor discharge air supply duct.

38 Install plates on top and left rear frame ports.

39 Install fuel pressure fitting and hose.

40 Install oil pressure fitting and hose.

41 Replace existing emergency fuel regulator drain hose with new hoses and check valve.

42 Install oil return line, fitting, and bracket.

43 Install main fuel inlet fitting.

44 Remove existing line and fitting, and replace with hydraulic surface control pump case drain line, first enlarging island hole to 19/32-inch diameter. Tie hydraulic utility pump pressure and hydraulic surface control pump case drain lines together with plastic cord.

45 Install external hydraulic surface control pump case drain hose.

46 Drain auxiliary accessory gear case of corrosion-preventive compound and fill to proper level with oil on engines prior to No. 046-927.*

47 Install hydraulic surface control system pump and connect hydraulic pressure, suction, and drain lines.

48 Install hydraulic utility system pump and connect hydraulic utility pressure, suction, and drain lines.

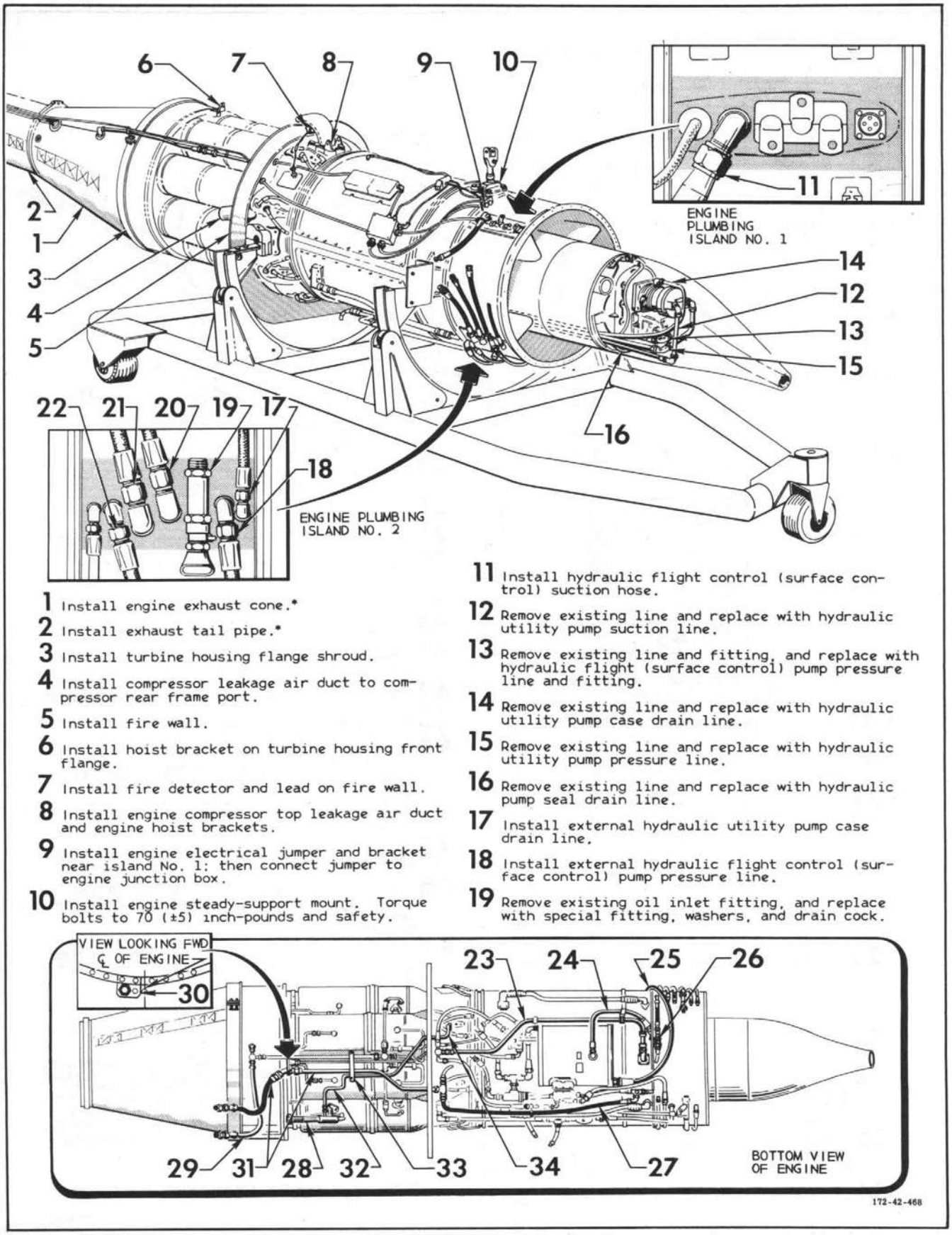
CAUTION: Use Vickers A32-57-L-2 hydraulic utility system pump on engines to be installed in F-86E-1, F-86E-5, and F-86E-6 Airplanes, and F-86E-10 Airplanes AF51-2718 through AF51-2826. Use N.Y. Air Brake 67WA200 hydraulic utility system pump on engines to be installed in F-86E-10 Airplanes AF51-2827 and subsequent.

49 Install auxiliary accessory cover.*

*Refer to index for page number of applicable procedure.

170-42-332C

Figure 5-4. Build-up of Engine—F-86E-1 Through F-86E-10 Airplanes (Sheet 2 of 2)



1 Install engine exhaust cone.*

2 Install exhaust tail pipe.*

3 Install turbine housing flange shroud.

4 Install compressor leakage air duct to compressor rear frame port.

5 Install fire wall.

6 Install hoist bracket on turbine housing front flange.

7 Install fire detector and lead on fire wall.

8 Install engine compressor top leakage air duct and engine hoist brackets.

9 Install engine electrical jumper and bracket near island No. 1; then connect jumper to engine junction box.

10 Install engine steady-support mount. Torque bolts to 70 (±5) inch-pounds and safety.

11 Install hydraulic flight control (surface control) suction hose.

12 Remove existing line and replace with hydraulic utility pump suction line.

13 Remove existing line and fitting, and replace with hydraulic flight (surface control) pump pressure line and fitting.

14 Remove existing line and replace with hydraulic utility pump case drain line.

15 Remove existing line and replace with hydraulic utility pump pressure line.

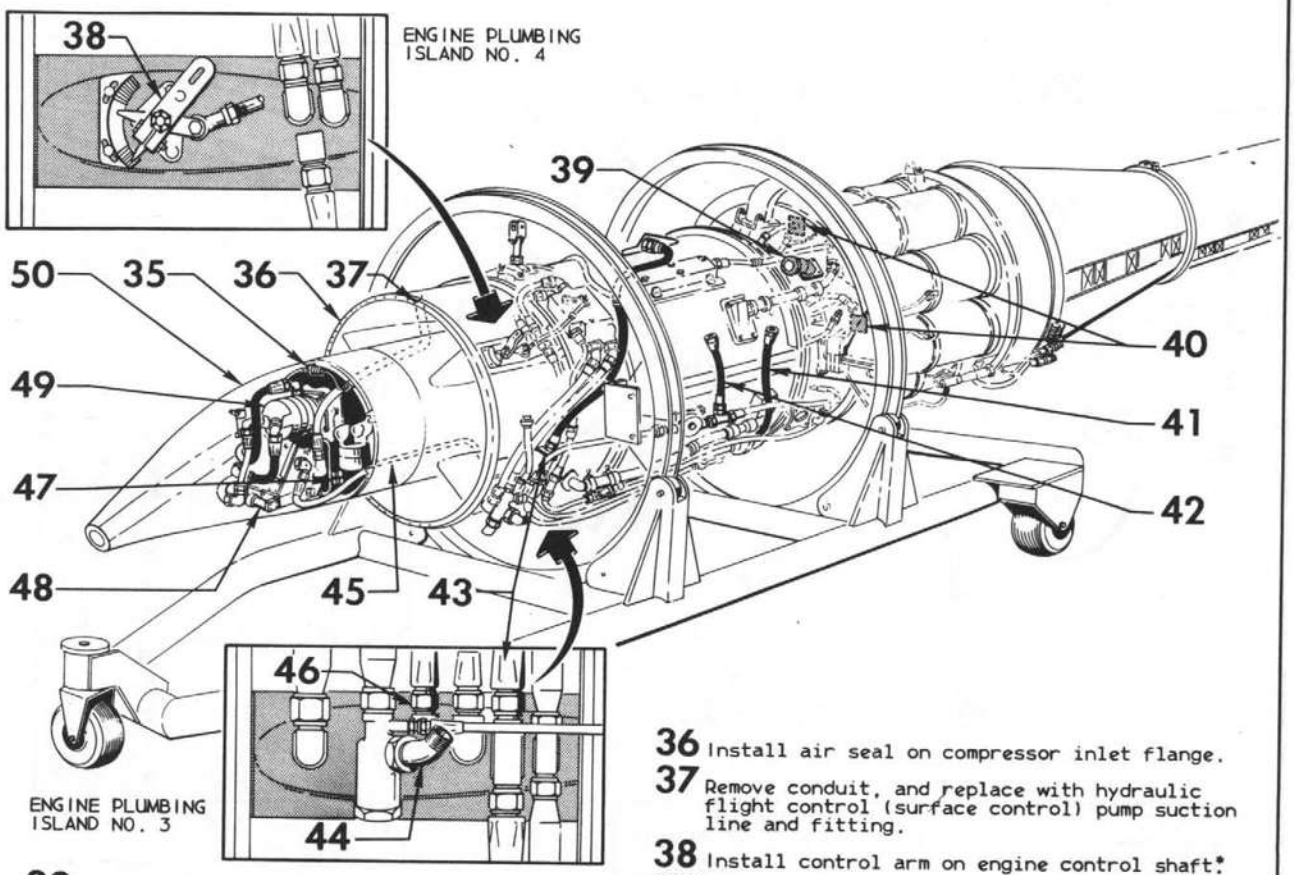
16 Remove existing line and replace with hydraulic pump seal drain line.

17 Install external hydraulic utility pump case drain line.

18 Install external hydraulic flight control (surface control) pump pressure line.

19 Remove existing oil inlet fitting, and replace with special fitting, washers, and drain cock.

Figure 5-5. Build-up of Engine—F-86E-15 Airplanes (Sheet 1 of 2)



20 Rotate fitting as shown, and connect engine-to-fuel-flowmeter fuel hose.

21 Install external hydraulic utility pump suction line.

22 Install external hydraulic utility pump pressure line.

23 Install front frame drain fitting and line.

24 Install oil cooler drain fitting, line, and drain cock.

25 Replace existing line with fuel-flowmeter-to-oil-cooler line.

26 Install hydraulic pump seal drain hose and check valve.

27 Connect drain hose to top of four-way fitting and fire wall fitting.

28 Install engine turbine frame aspirator.

29 Install turbine casing drain line.

30 Install drain line bracket.

31 Install fuel drain line and hose.

32 Install aspirator line.

33 Install line support.

34 Install aspirator adapter and line.

35 Install fire detector and accessory cover support brackets, fire detectors, and electrical wiring. Connect fire detector electrical plug.

36 Install air seal on compressor inlet flange.

37 Remove conduit, and replace with hydraulic flight control (surface control) pump suction line and fitting.

38 Install control arm on engine control shaft.*

39 Install compressor discharge air supply duct.

40 Install plates on top and left rear frame ports.

41 Install fuel pressure fitting and hose.

42 Install oil pressure fitting and hose.

43 Install oil return line, brackets, and hose.

44 Install main fuel inlet fitting.

45 Remove existing line and fitting, and replace with hydraulic surface control pump case drain line, first enlarging island hole to 19/32-inch diameter. Tie hydraulic utility pump pressure and hydraulic surface control pump case drain lines together with plastic cord.

46 Install external hydraulic surface control pump case drain hose.

47 Drain auxiliary accessory gear case of corrosion-preventive compound and fill to proper level with oil on engines prior to No. 046-927.*

48 Install hydraulic flight control (surface control) system pump and connect hydraulic pressure, suction, and drain lines.

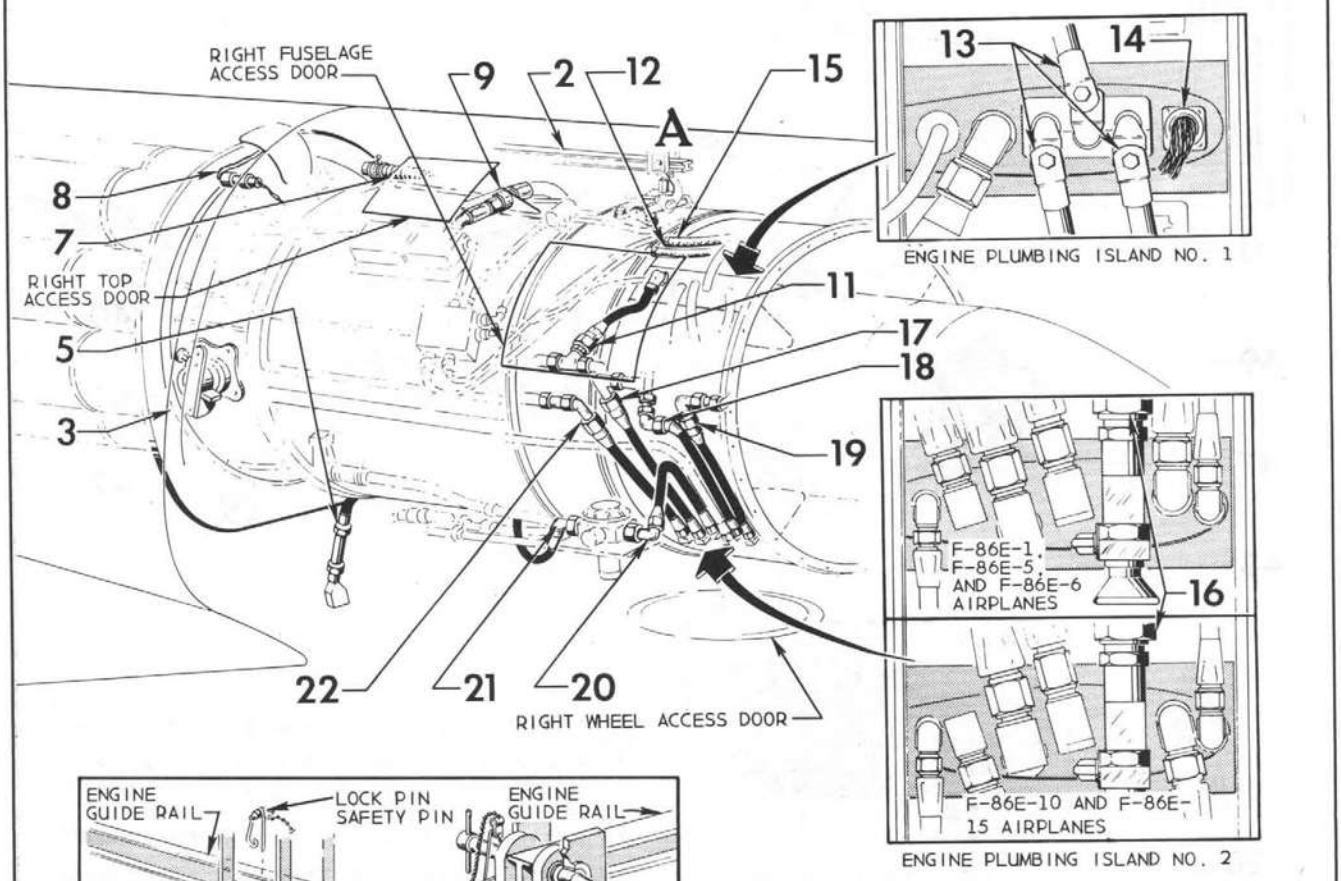
49 Install hydraulic utility system pump and connect hydraulic utility pressure, suction, and drain lines.

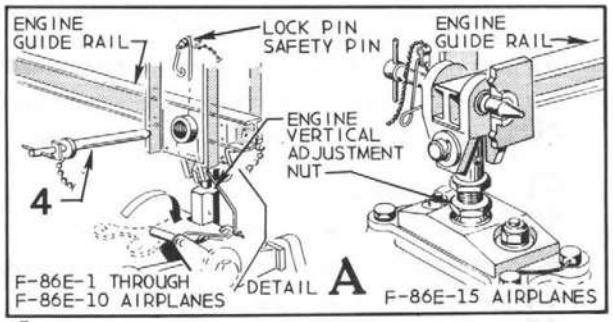
50 Install auxiliary accessory cover.*

*Refer to index for page number of applicable procedure.

172-42-469

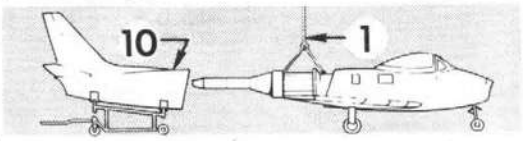
Figure 5-5. Build-up of Engine—F-86E-15 Airplanes (Sheet 2 of 2)





1 Build up engine,* attach engine sling (E1176), and lift and align engine with fuselage front section. Lash all lines, hoses, and wiring to engine to prevent interference during installation of engine.

2 Roll fuselage front section over engine or move engine forward into fuselage, engaging forward steady support rollers in fuselage guide track.



3 Secure engine main trunnion mounts. Torque engine mount clamps to 160-190 inch-pounds and safety.

4 Lock forward steady support with retaining pin and safety pin; then remove engine sling. Jiggling aft end of tail pipe will simplify installation of retaining pin.

NOTE: Accomplish steps 5 through 8 through aft end of the fuselage forward section.

5 Connect engine front frame drain line to fuselage.

6 Connect two halves of compressor discharge air supply duct.

7 Connect heat exchanger exhaust duct to fire wall fittings (F-86E-1, F-86E-5, and F-86E-6 Airplanes).

8 Connect aft fire detector electrical plug.

NOTE: Accomplish step 9 through right top access door.

9 Connect oil return hose to quick-disconnect at top of compressor case (F-86E-15 Airplanes).

10 Install fuselage rear section,* leaving hoses, cables, and electrical disconnects loose until after engine alignment; then align engine to fuselage.*

NOTE: Accomplish steps 11 through 15 through fuselage right access door.

11 Connect flight control (surface control) hydraulic system suction hose to fuselage quick-disconnect.

12 Connect exhaust temperature electrical plug to jumper receptacle near island No. 1; then make engine exhaust temperature resistance check.*

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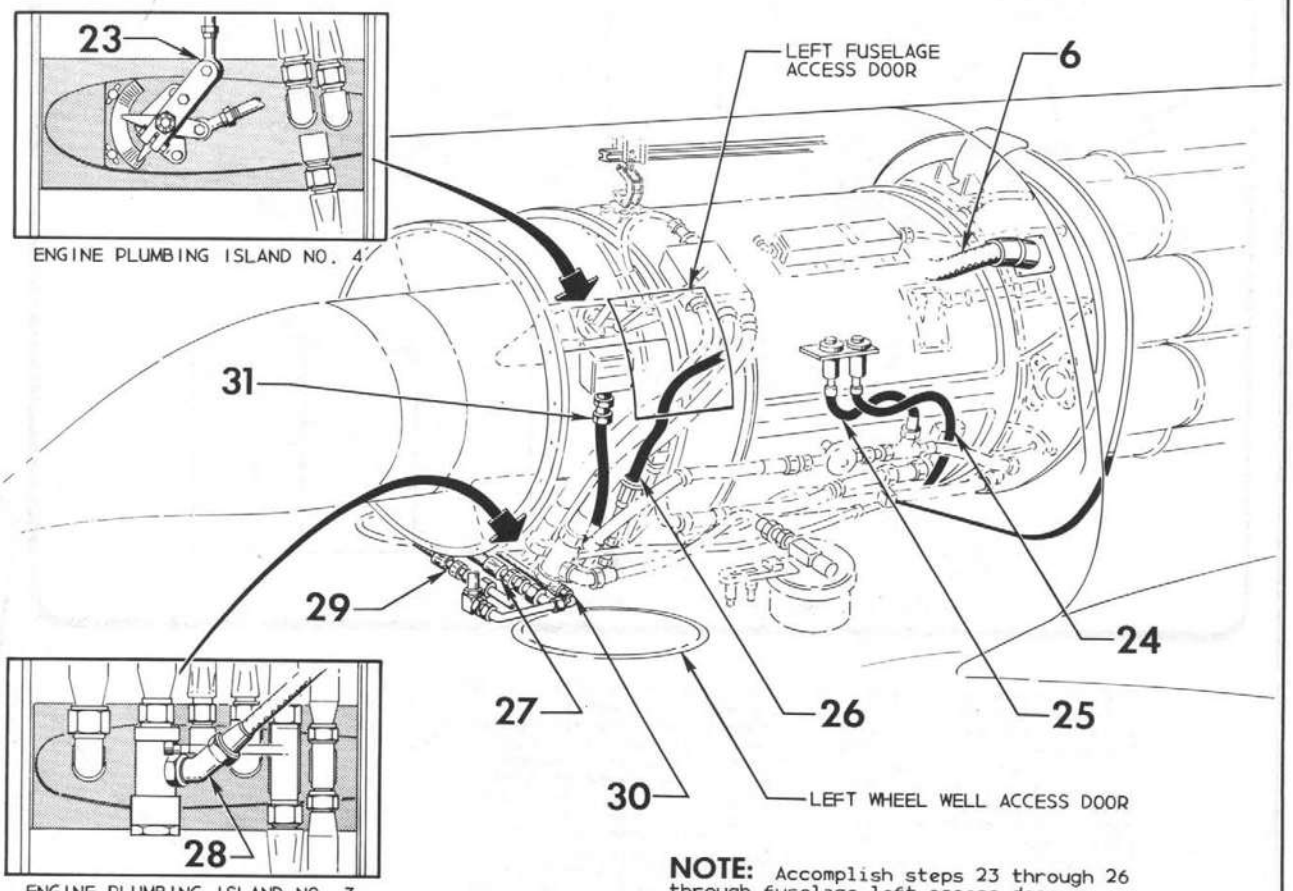
Figure 5-6. Installing Engine (Sheet 1 of 2)



13 Attach starter-generator electrical leads (three) to engine lugs (No. 1 island).

14 Attach generator field and fire detector electrical plug to receptacle (No. 1 island).

15 Connect ignition, tachometer, and fuel system solenoid electrical plug to jumper receptacle near island No. 1.

NOTE: Accomplish steps 16 through 22 through right wheel well access door.

16 Connect oil inlet hose to engine disconnect fitting (No. 2 island).

17 Connect hydraulic utility system suction hose to fuselage quick-disconnect.

18 Connect flight control (surface control) hydraulic system pressure hose to fuselage quick-disconnect (F-86E-1, F-86E-5, and F-86E-6 Airplanes).

19 Connect hydraulic utility system case drain hose to fuselage quick-disconnect.

20 Connect engine-to-flowmeter fuel hose to flowmeter.

21 Connect flowmeter-to-cooler fuel hose to flowmeter.

22 Connect hydraulic utility system pressure hose to fuselage quick-disconnect (F-86E-1, F-86E-5, and F-86E-6 Airplanes).

NOTE: Accomplish steps 23 through 26 through fuselage left access door.

23 Attach engine control rod to control arm (No. 4 island). Adjust engine controls.*

24 Connect fuel pressure hoses to transmitter.

25 Connect oil pressure hose to transmitter.

26 Connect engine oil return hose to engine quick-disconnect (F-86E-1 through F-86E-10 Airplanes).

NOTE: Accomplish steps 27 through 31 through left wheel well access door.

27 Connect flight control (surface control) hydraulic system pressure hose to fuselage quick-disconnect (F-86E-10 and F-86E-15 Airplanes).

28 Connect main fuel inlet hose to engine fitting.

29 Connect hydraulic utility system pressure hose to fuselage quick-disconnect (F-86E-10 and F-86E-15 Airplanes).

30 Connect hydraulic pump seal drain hose to fuselage line (F-86E-15 Airplanes).

31 Connect surface control hydraulic system case drain hose to fuselage quick-disconnect.

32 Perform preoperational test* and initial engine run-up.*

*Refer to index for page number of applicable procedure.

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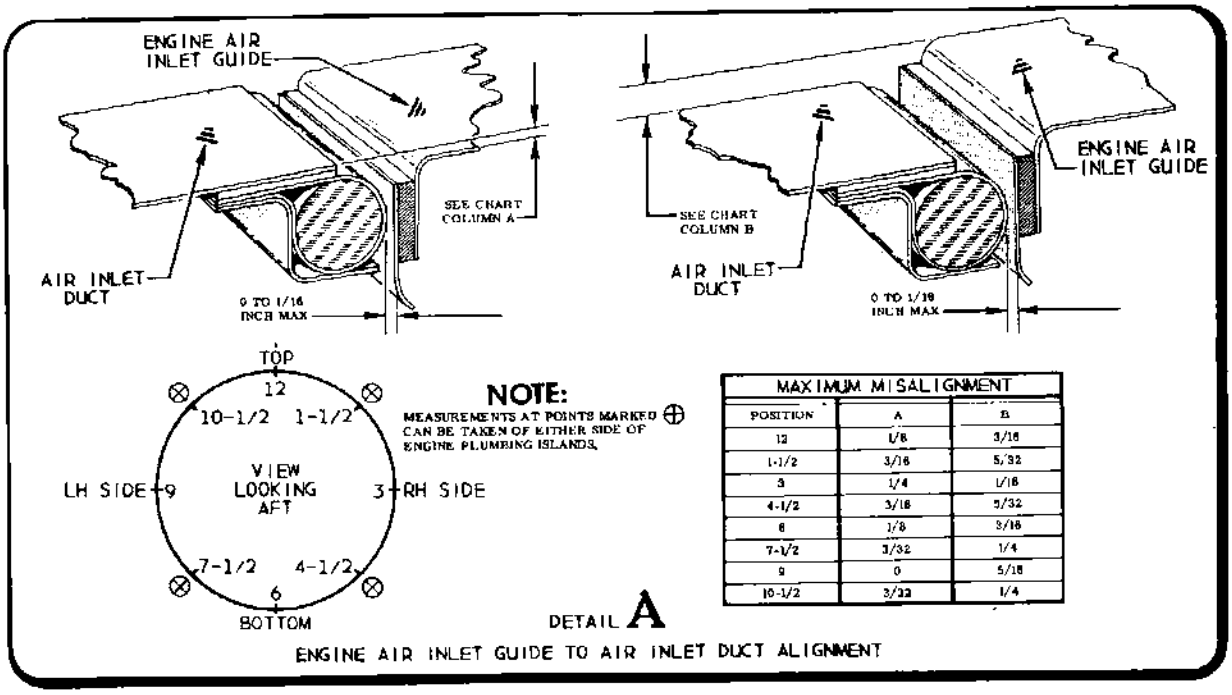
Figure 5-6. Installing Engine (Sheet 2 of 2)

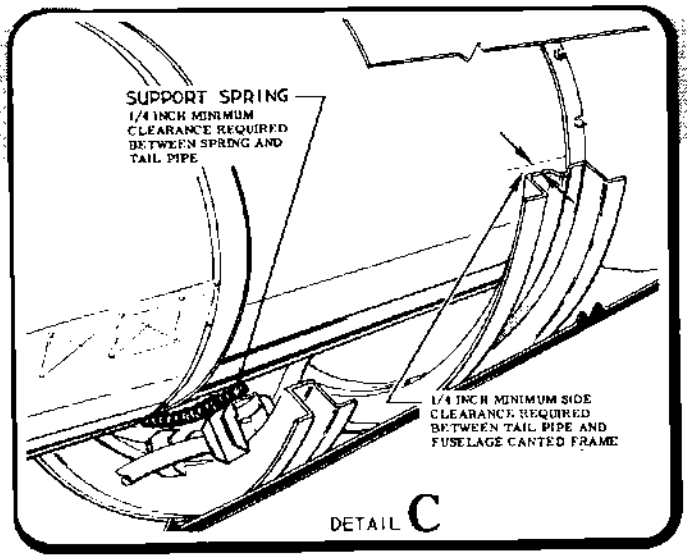


MAXIMUM MISALIGNMENT		
POSITION	A	B
12	1/8	3/16
1-1/2	3/16	5/32
3	1/4	1/16
4-1/2	3/16	5/32
6	1/8	3/16
7-1/2	3/32	1/4
9	0	5/16
10-1/2	3/32	1/4

ENGINE AIR INLET GUIDE TO AIR INLET DUCT ALIGNMENT

The engine must be aligned to the fuselage to obtain proper fit and clearances after the fuselage rear section is attached and before the system connections are accomplished. The engine must be aligned at the following: air inlet guide to air inlet duct (detail A); top midframe air leakage duct to fuselage overboard duct (detail B); and exhaust tail pipe to fuselage rear section (detail C). To obtain the required clearances and alignment, adjust forward steady support (detail D), or remove engine and relocate eccentric trunnion ball on right side of engine (detail E), or do both. If relocating eccentric trunnion ball will not provide sufficient adjustment, remove trunnion mount and reinstall mount so that keyways are on bottom of mount.

CAUTION: Aligning of engine must be accomplished with cold engine to allow for expansion when hot.



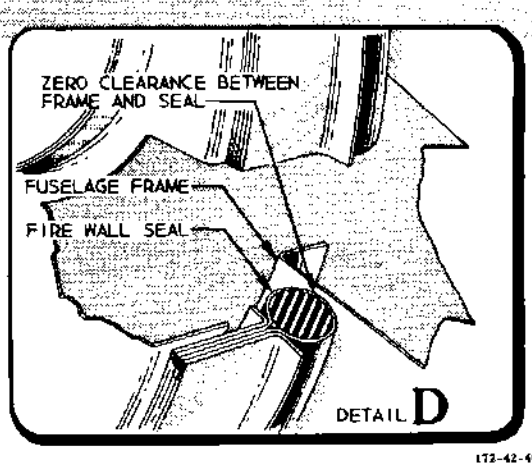


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Figure 5-7. Aligning Engine to Fuselage (Sheet 1 of 2)

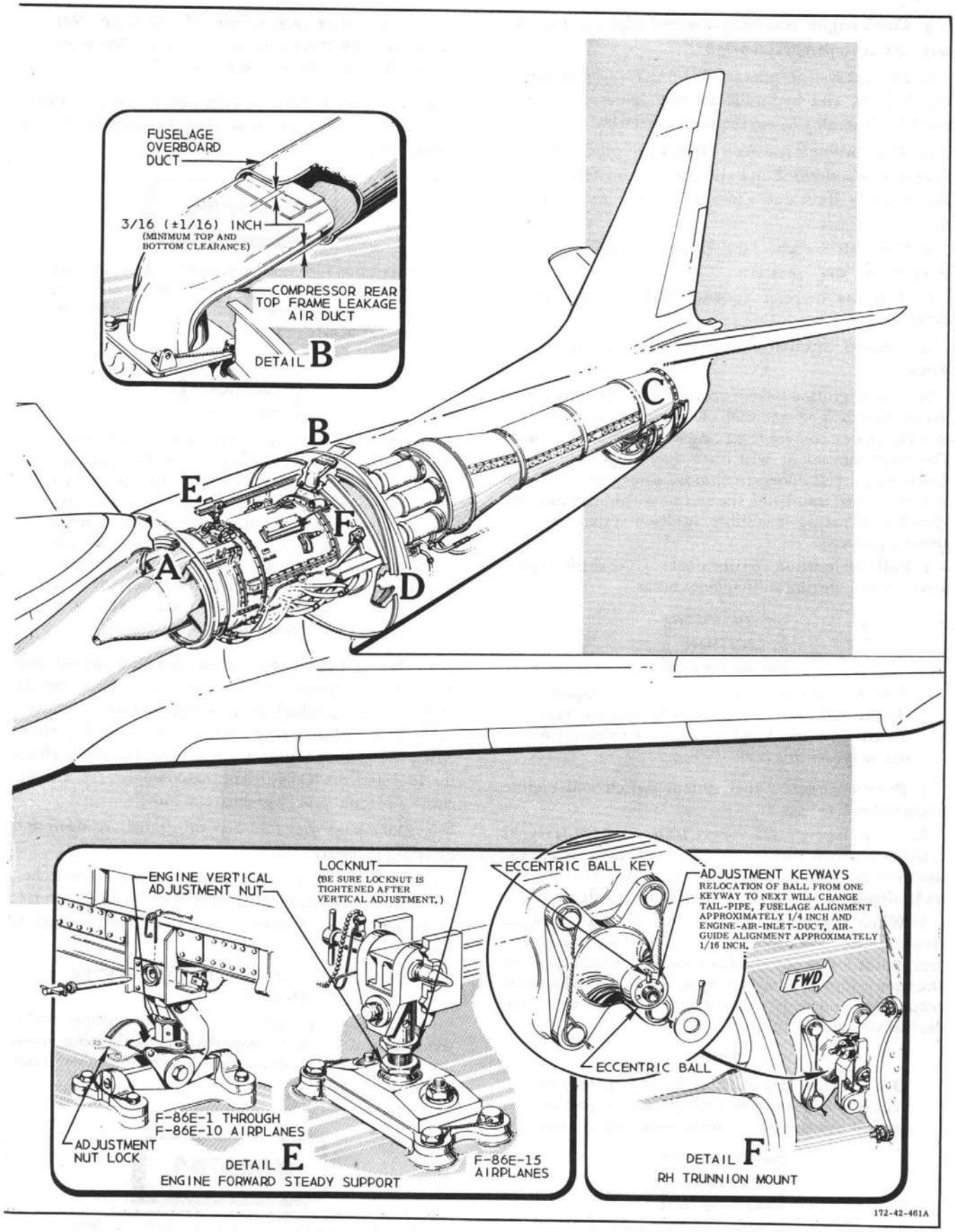


Figure 5-7. Aligning Engine to Fuselage (Sheet 2 of 2)

b. Check engine control system and adjust it if necessary. (Refer to paragraph 5-53.)

c. Fill fuel system (paragraph 1-31), oil system (paragraph 1-40), and hydraulic systems (paragraphs 1-58 and 1-63 through 1-66) to required capacities.

d. After oil tank has been filled, open oil drain cock at engine island No. 2 and allow approximately ½ gallon of oil to drain out. Close drain cock and refill oil tank.

e. Place all switches and power control (throttle) lever in the "OFF" position.

f. Test fire detector system. (Refer to paragraph 4-231.)

g. Connect external electrical power supply to airplane.

h. Check ignition system operation by placing engine master switch "ON" and then closing ignition switch by moving power control lever outboard but *not* forward. (Forward movement will open fuel stopcock.) Open spark plug access doors; then move emergency ignition switch to "ON" and listen for arcing within combustion chamber. If arcing is audible, ignition system is functioning properly.

i. Pull out ignition circuit breaker in cockpit to prevent ignition during subsequent checks.

CAUTION

The foregoing is necessary, as subsequent checks will cause raw fuel to be sprayed into the combustion chambers and it is imperative not to ignite this fuel.

j. Place emergency fuel system switch and engine master switch at "ON."

k. Hold battery-starter switch momentarily at "STARTER"; then move switch to "BATTERY." If engine does not reach approximately 7% rpm within 30 seconds, depress stop-starter button and investigate cause.

l. When approximately 7% rpm is reached, open power control lever about halfway. If positive fuel pressure indication is not obtained within 20 seconds or by the time approximately 9% rpm is reached, whichever occurs first, move power control lever to "OFF" and depress stop-starter button.

Note

One or more "dry runs" or false starts may be required to prime the fuel regulation and injection system on a newly installed engine.

CAUTION

In order to prevent starter-generator overheating, a 3-minute cooling period must be allowed after each minute of operation. Not more than three one-minute starts should be made in any 30-minute period.

m. After fuel pressure is obtained, move power control lever to "OFF" and note that fuel pressure immediately drops to zero.

WARNING

If fuel pressure does not immediately drop to zero, it is an indication that the stopcock is not shutting off the fuel flow and that the engine is not safe to start.

CAUTION

During the time that the power control lever is not in the "OFF" position, raw fuel is being sprayed into the combustion chambers. This fuel should drain from the combustion chambers within 3 minutes after power control lever is moved to "OFF." Therefore, always wait a minimum of 3 minutes before attempting to operate the engine; otherwise, excessive exhaust temperatures (hot start) may result, with serious consequences to the engine.

n. During period that engine is being turned over with starter, investigate any unusual engine noises. Heavy rubbing, which may be due to turbine buckets rubbing on shroud ring and which noticeably slows down the rotor, should be eliminated. Carefully check for fuel and oil leaks in engine compartment and accessory section, and over entire engine.

o. Make sure that fuel and oil drains are open and draining properly.

p. After checks have been made, open all switches, make sure power control lever is "OFF," and disconnect external electrical power source. Close ignition circuit breaker.

5-18. INITIAL START OF ENGINE AFTER INSTALLATION.

5-19. Make preoperational check (paragraph 5-17); then open aft engine compartment fire-fighting access door and have fire-fighting equipment available. Then proceed as follows:

a. Start engine.

WARNING

- Do not approach closer than 12 feet to engine air intake, and carefully avoid a wide

area of about 200 feet behind exhaust outlet during engine run.

- If engine should catch fire during starting procedure, immediately move power control lever to "OFF" and turn off all switches. If fire does not go out, combat fire as explained in paragraph 1-88.

b. After engine start, idle engine at 34% to 38% rpm for approximately 10 minutes and check the following:

Vibration: If vibration of forward frame of the turbine housing exceeds .005-inch peak-to-peak displacement at engine rpm frequency, it is not safe to continue engine operation.

CAUTION

Nominal vibration may be noticeable between 26% and 90% rpm. If vibration peaks at a particular frequency other than engine rpm frequency, this condition is the result of certain speed phenomena and is not critical unless it exceeds .008 inch maximum.

Drip valves: At idle speed, little or no leakage should occur.

Exhaust gas temperature: 626°C (1159°F) maximum.

Fuel pressure: 40 to 100 psi.

Oil pressure: 2 to 40 psi.

Engine: Free of fuel, oil, and exhaust leaks.

Idle stop adjustment: See figure 5-20.

c. When engine has stabilized and operation appears normal at 34% to 38% rpm, accelerate slowly to 70% to 75% rpm for approximately 5 minutes and check the following:

Exhaust gas temperature: 400°C to 450°C (752°F to 842°F).

Vibration: Refer to step b.

Fuel pressure: 100 to 150 psi.

Oil pressure: 5 to 50 psi.

Operate hydraulic system to check operation of engine-driven hydraulic pumps.

d. After completion of operational checks at 70% tc 75% rpm, slowly advance power control lever to the full forward position or until 101% rpm is reached. Do not allow engine to exceed 101% rpm. Check and adjust the following:

CAUTION

Overspeed operation exceeding 104% rpm requires that engine be removed and sent to overhaul base.

Engine rpm: 99.5% to 100.5% rpm. (See figure 5-20 for high rpm adjustment.)

Exhaust gas temperature: 675°C to 690°C (1247°F to 1274°F). (Refer to paragraph 5-44 for temperature adjustment.)

Vibration: Refer to step b.

Fuel pressure: 300 to 400 psi.

Oil pressure: 5 to 50 psi (10 to 25 psi desired).

e. Check emergency fuel regulator operation. (Refer to paragraph 5-88.)

f. Adjust landing gear indicating switches. (See figures 2-77 and 2-78.)

g. After completion of 100% rpm checks, make the following acceleration checks on engines equipped with G-5 or later main fuel regulators.

h. Make sure emergency fuel system switch is in "OFF" position.

i. Stabilize engine speed consecutively at the following: 75% rpm, 50% rpm, and idle rpm. From each stabilized rpm position, advance the power control lever as rapidly as possible to full "OPEN" position. When Grade JP-3 fuel is used, the maximum time allowable from 50% rpm is 12 seconds. Note the tail-pipe temperature during each acceleration.

WARNING

If acceleration stall (identifiable by severe rumble and rapid increase in exhaust temperature without appreciable change in rpm) or exhaust temperature over 870°C (1598°F) is encountered during any one of the three accelerations, retard power control lever immediately. Disconnect emergency regulator linkage and repeat acceleration check.

Note

- If acceleration stall or excessive exhaust temperature is not encountered with emergency regulator disconnected, it is likely that this unit or its rigging is faulty.
- If stall or excessive exhaust temperature is again encountered with the emergency regulator disconnected, check main regulator linkage. (See figure 5-22.) Rerig linkage if necessary or replace main regulator if rigging is found to be correct. Once an engine and main regulator combination has successfully passed the acceleration test, the test need not be repeated unless the main regulator is subsequently changed.

j. Stop engine. Carefully check entire engine installation for leaks, looseness, or the existence of other undesirable conditions; then install access doors and panels.

5-20. ENGINE AUXILIARY ACCESSORY DRIVE SECTION.

5-21. The auxiliary accessory drive section consists of the auxiliary drive gear case, drive gears, auxiliary gear case support, and the auxiliary accessory cover. The front face of the gear case has two pads for mounting two engine-driven hydraulic pumps. Gear case gearing on engines prior to Engine No. 046-927 is lubricated by the splash method from a separate oil supply contained in the gear case. (Refer to paragraph 5-220.) On Engines No. 046-927 and subsequent, an auxiliary gear case scavenge pump, mounted on the rear face of the case, scavenges the oil furnished by the main oil system for gear case lubrication. (Refer to paragraph 5-242.) Power is supplied to the auxiliary drive gears through a drive shaft directly coupled to the main gear case. Completely enclosing the space occupied by the engine-driven accessories, mounted on the main gear case, is the auxiliary gear case support. This support forms the inner shell of the inlet air guide and supports the auxiliary drive gear case. The auxiliary drive gear case is streamlined by a two-piece auxiliary accessory cover. (Refer to paragraph 5-23.)

5-22. ENGINE AUXILIARY ACCESSORY COVER.

5-23. The accessory cover consists of two doweled pieces of sheet metal, supported by lugs on the front face of the auxiliary gear case. When disconnected from the gear case lugs, the cover will divide into two pieces to permit removal of the cover through the air intake duct. Removal of the cover provides access to the hydraulic pumps, fuel filters, accessory section fire detectors, and the auxiliary gear case oil filler.

5-24. REMOVING ACCESSORY COVER. To remove cover, proceed as follows:

a. If engine is installed in airplane, enter at front of engine air intake and crawl back to accessory cover.

b. Unfasten and remove top portion of cover; then remove lower portion of cover. The cover can be removed from the airplane through the air duct.

CAUTION

Do not remove cover retainer bolts. It is necessary to loosen cover retainer bolts only slightly to free cover from brackets.

5-25. INSTALLING ACCESSORY COVER. To install cover, proceed as follows:

a. If engine is installed in airplane, insert portions of cover into front of air duct.

b. Fasten bottom portion of cover to gear case lugs; then fasten top portion of cover in place, being sure to engage starter-generator air duct properly. Torque cover retainer bolts to 35-50 inch-pounds.

5-26. REMOVING ACCESSORY GEAR CASE. For access to the engine-driven accessories, the auxiliary gear case must be removed. The gear case can be removed from inside the air duct with the engine installed. Gear case removal is exactly the same with the engine in or out of the fuselage. To remove gear case, proceed as follows:

a. Remove auxiliary accessory cover. (Refer to paragraph 5-24.)

b. Disconnect hydraulic pump hoses at pumps (pressure, utility, suction, and drain).

c. Disconnect fire detector electrical plug.

d. Disconnect gear case vent hose on engines prior to Engine No. 046-927.

e. Disconnect gear case oil inlet hose on Engines No. 046-927 and subsequent.

f. Disconnect gear case oil outlet hose at rear of case on Engines No. 046-927 and subsequent.

g. Disconnect main fuel regulator oil orifice and filter and its bracket from gear case strut.

h. Disconnect fuel filter from bracket on front of gear case.

i. Disconnect fuel control valve from gear case by removing the two bolts from front face of gear case.

j. Disconnect fire extinguisher tube clamp from gear case.

k. Cut lockwire and remove the nine Allen-head locking bolts securing gear case to gear case support.

l. Remove gear case by slapping gear case with palm of hand or a soft rubber mallet until it is disengaged from support dowels. Remove gear case slowly and evenly to prevent binding and damaging of lines in the housing. When case is disengaged from dowels, look between case and support to determine that shaft will remain with case or in shaft housing and that drive shaft will not drop when case is removed; then remove case.

Note

For ease of installation, observe and note routing of hoses through gear case before case is removed.

m. Remove the four air-guide island covers.

CAUTION

Use extreme caution to prevent foreign materials or objects from entering the compressor.

n. Cut lockwire and remove the nine Allen-head locking bolts securing gear case support; then remove support, first slapping it with palm of hand to disengage dowels.

CAUTION

Pull support straight forward to prevent damage to the accessories, wiring, or lines.

5-27. INSTALLING ACCESSORY GEAR CASE. To install gear case, proceed as follows:

a. Inspect engine-driven accessories, lines, and electrical leads for proper installation, security, and safetying; then carefully install gear case support in place, engaging dowels and being sure to align cutout in support with starter-generator air outlet. (See figure 5-8.)

b. Secure support to main gear case, with nine Allen-head locking bolts. Tighten Allen-head bolts to 170 inch-pounds; then check that bolt heads are ⅛ inch below surface of gear case support. If necessary to obtain proper bolt head depth, apply progressive torque up to a maximum of 300 inch-pounds. (See figure 5-9.) Lockwire each bolt to each adjacent rivet, using .032-inch stainless-steel lockwire.

c. Inspect drive shaft for possible defects and uncleanliness; then insert shaft into drive shaft housing and engage shaft in main gear case female spline. Pull drive shaft forward approximately ½ inch while still retaining shaft and spline engagement. This will permit manual engagement of shaft with auxiliary gear case spline before gear case engages dowels on support. (See figure 5-10.)

d. Raise gear case into position; then pass lines, flexible conduit, electrical leads, and fuel and oil filters through gear case casting holes as shown in figure 5-11. Move gear case aft. Rotate gear case gearing by rotating spline coupling or hydraulic pump drive coupling to align gear splines. When alignment is accomplished, carefully push gear case into engagement with support. Secure gear case with nine Allen-head locking bolts. Tighten bolts to 170 inch-pounds; then check that bolt heads are ⅛ inch below the surface of gear case. If necessary to obtain proper bolt head depth, apply progressive torque up to a maximum of 300 inch-pounds. Safety each bolt to adjacent rivet, using .032-inch stainless-steel lockwire.

e. Connect gear case vent hose on engines prior to Engine No. 046-927 and service gear case with oil. (Refer to paragraph 1-85.)

f. Connect gear case oil "in" and "out" lines on Engines No. 046-927 and subsequent.

g. Secure fuel regulator oil orifice and filter, fuel control valve, and fuel filter to gear case.

h. Install the four plumbing island air guides. (See figure 5-12.) Guides are interchangeable.

i. Connect fire detector electrical plug. If pumps were removed, install surface control hydraulic power system pump on top mounting pad of gear case and hydraulic utility power system pump on lower pad; then connect surface control hydraulic system and hydraulic utility power system lines to their respective pumps.

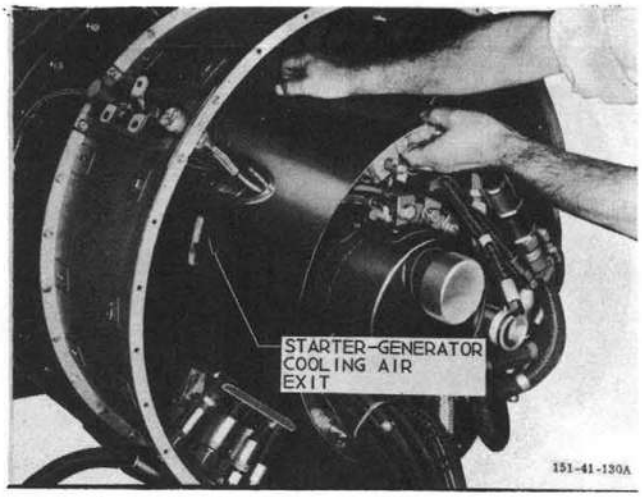


Figure 5-8. Installing Auxiliary Accessory Gear Case Support

j. Install auxiliary accessory cover. (Refer to paragraph 5-25.)

5-28. ENGINE AIR-GUIDE SECTION AND COMPRESSOR FRONT FRAME.

5-29. The air-guide section consists of island covers, island fairings, and air-guide sectors. This section guides air into the compressor inlet. The islands are used as junction points for fuel, oil, throttle linkage, and electrical connections. The connecting lines are brought across the inlet air stream through the removable streamlined fairings. Four air-guide sectors are located between the island covers to form the outer shell of the inlet air guide. The compressor front frame includes the main gear case and accessory drive mechanism, support for the No. 1 bearing, inlet guide vanes, and the balance piston chamber. The frame consists of an inner and an outer section, connected by eight streamlined struts to form an annular passage for the air inlet. Support for the drive gears, shaft housing, No. 1 bearing housing, and allied parts is provided by the inner section. The inlet guide vanes, made up of hollow blades

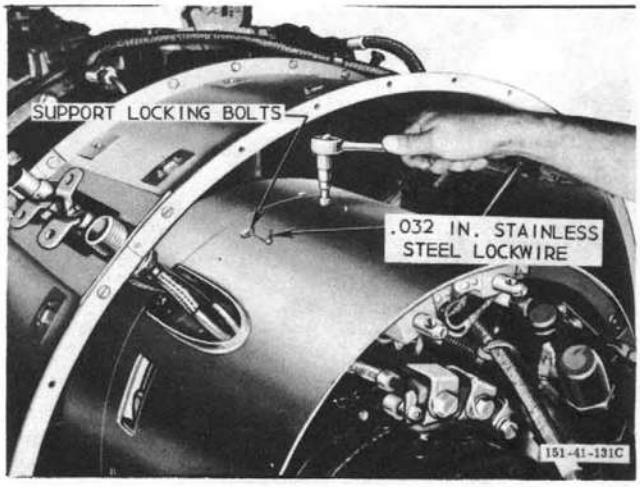


Figure 5-9. Securing Auxiliary Accessory Gear Case Support

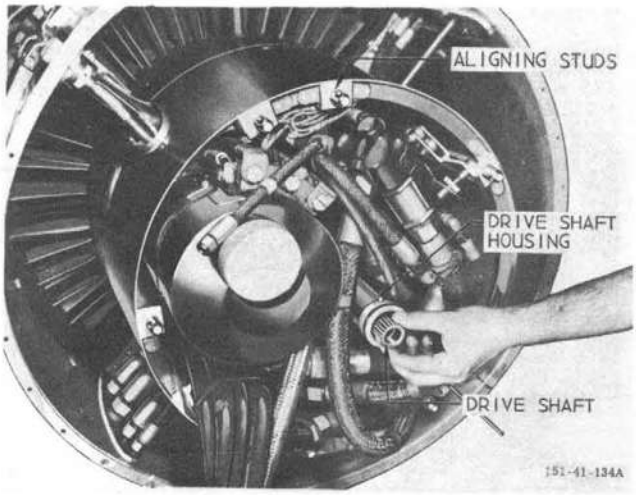


Figure 5-10. Installing Auxiliary Accessory Gear Case Drive Shaft

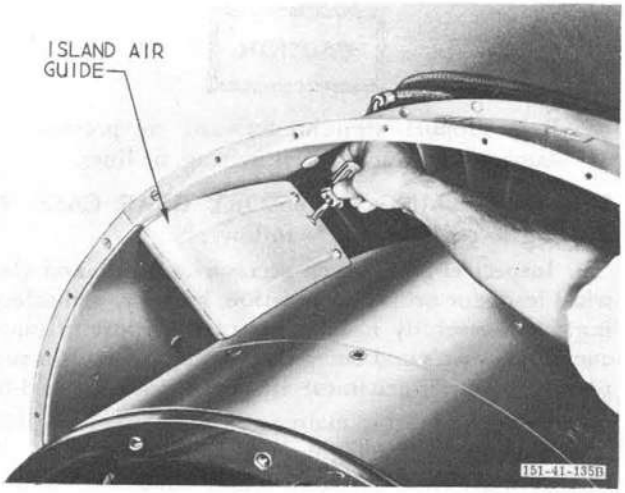


Figure 5-12. Installing Plumbing Island Air Guides

mounted between two concentric rings, are attached to the rear side of the frame inner section, along with an oil and air seal. An air seal is located along the edge of the first-stage wheel of the compressor rotor, and another seal is at the hub of the compressor rotor. The area between these two seals forms the balance piston chamber, which is supplied with 12th-stage air through the hollow inlet guide vanes. This air, acting against the forward end of the compressor rotor, counteracts some of the forward thrust of the rotor. The compressor front frame contains four engine mount pads, two on the horizontal and two on the vertical.

5-30. ENGINE COMPRESSOR SECTION.

5-31. The engine compressor section is composed of the compressor rotor, stator, and rear frame. The compressor is a 12-stage, axial-flow type and discharges air compressed to approximately five atmospheres. The compressor rotor consists of 12 wheels shrunk onto a steel shaft, each wheel having stainless-iron compressor blades dovetailed into its outer ring. The first nine wheels are made of aluminum alloy, and the last three of steel alloy. The compressor stator is a split cylindrical

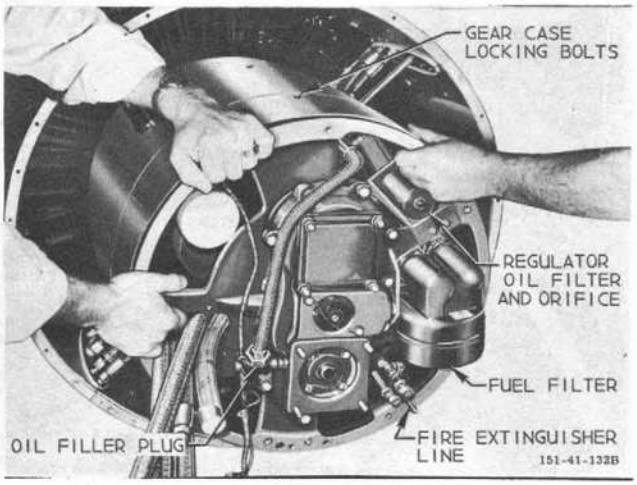
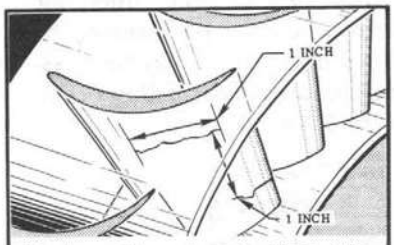


Figure 5-11. Installing Auxiliary Accessory Gear Case

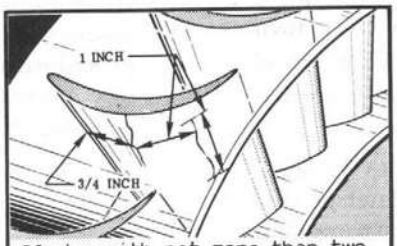
aluminum casing into which 13 rows of blades are dovetailed. The outer side of the casing provides a mount for some of the engine accessories. At its forward face, the compressor rear frame supports the stator; at its rear face, the combustion chambers; and at its center, the No. 2 bearing. Equally spaced around the rear frame shell are the eight diffuser passages through which air from the compressor flows to the combustion chambers. Eight duplex fuel nozzles are circumferentially mounted on pads, around the rear frame. The nozzles extend directly into diffuser passages, with their tips extending into the combustion chambers. The compressor rear frame contains four engine mount pads, two on the horizontal and two on the vertical.

5-32. ENGINE TURBINE SECTION.

5-33. The turbine section consists of eight combustion chambers, a turbine frame, a turbine casing, a nozzle diaphragm, a turbine wheel and shaft, and a turbine shroud. The turbine section supports the No. 3 and No. 4 bearings inside the turbine frame housing. The combustion chambers are of the direct-flow type. Each chamber consists of a double-walled cylindrical assembly attached to the compressor rear frame and to the turbine frame by means of quick-disconnect clamps. Air from the compressor, entering the combustion chamber, passes into annular spaces between the outer casings and the inner liners, and from there through perforations into the inner liners, where it is mixed with fuel sprayed from the fuel nozzles and burned. The combustion chambers are interconnected by cross-firing tubes, making possible the starting of all burners with the use of spark plugs mounted in chambers 2 and 7 only. Each combustion chamber incorporates a front and a rear fuel drain so that regardless of airplane attitude, excess fuel will drain overboard. The hot gases leaving the combustion chambers pass through transition liners and through the stationary nozzle diaphragm to impinge upon the turbine wheel buckets, where sufficient energy is extracted from the gases to drive the compressor and accessories.

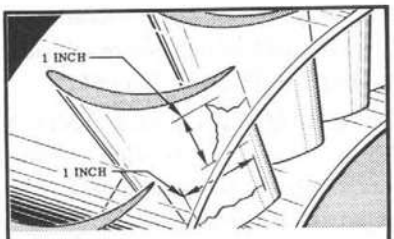


Blades with not more than two circumferential cracks up to one inch in length, which may or may not terminate at the leading edge or the trailing edge, are acceptable. Cracks which approach each other closer than one inch are cause for blade replacement.

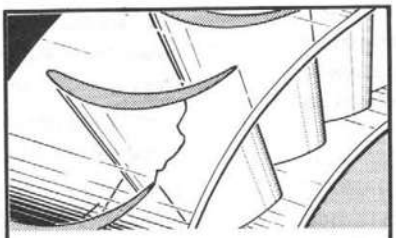


Blades with not more than two radial cracks, up to one inch in length, that are at least one inch apart are acceptable. A radial crack shall not be located within 3/4 inch of the blade leading edge. A radial crack may or may not terminate at the blade inner or outer edge.

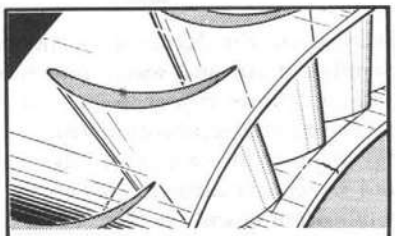
Blades with not more than two converging cracks are serviceable, provided they do not approach each other closer than 3/4 inch and there is no danger of a section breaking loose.



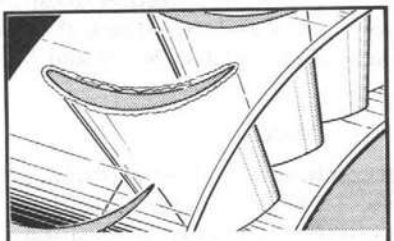
Merging radial and circumferential cracks shall not exceed one inch in length either radially or circumferentially.



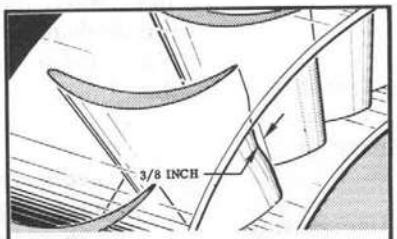
Nozzle band cracks from the trailing edge of one slot to the next blade slot are permissible, provided there is not more than one crack per section of eight blades.



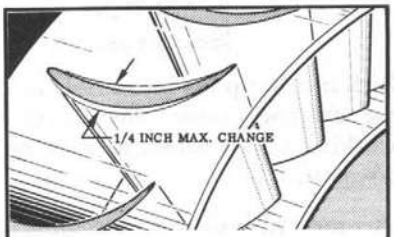
Inner band cracks are allowable for further service, provided they do not go beyond a line joining the trailing edge of the blade slots.



Cracks in blade welds are acceptable, provided such cracks do not exceed 50 percent of the weld area around the blade at either inner or outer end of the blade.



No blade shall have distortion or warpage on the trailing edge exceeding 3/8 inch from original contour.



No blade shall have "ballooning" exceeding 1/4 inch overall contour change.

NOTES:

Heat check cracks (surface cracks) on inner nozzle band are permissible.

A turbine nozzle that has all its blades heat checked (surface cracks), even though open cracks are not visible, must be replaced.

Nicks and dents in the outer band are permissible, provided they have not started cracks longer than 3/32 inch.

Dents in the blades are permissible, provided they do not exceed 1/16 inch displacement.

153-41-151C

Figure 5-13. Turbine Nozzle Crack and Distortion Limits

5-34. TURBINE NOZZLE CRACK AND DISTORTION LIMITS. Remove fuselage rear section (paragraph 2-150) and exhaust cone (paragraph 5-41); then (while viewing nozzle blades between turbine wheel blades) inspect nozzle blades for crack and distortion limits shown in figure 5-13.

5-35. TURBINE WHEEL BLADE AND COMPRESSOR BLADE REPAIR LIMITS. Remove fuselage rear section (paragraph 2-150) and exhaust cone (paragraph 5-41); then inspect blades for repair limits shown in figure 5-14.

5-36. REMOVING COMBUSTION CHAMBERS AND FUEL NOZZLES. To remove the combustion chambers and nozzles, first remove the engine (paragraph 5-7); then proceed as follows:

Note

Because of the location of the combustion chamber drain and water injection manifold lines, a definite sequence must be followed in removing the combustion chambers. The removal procedure for the individual chambers and nozzles is identical. Remove the bottom combustion chambers (No. 4 and 5) first, then the combustion chambers above them (No. 3 and 6), followed by No. 2 and 7, and finally No. 1 and 8.

a. Disconnect fuel manifold lines at fuel nozzle, cut lockwire, and remove bolts, fuel nozzle, and gaskets.

CAUTION

Each nozzle tip fits into a hole in the dome of the chamber inner liner. Exercise care in working nozzle loose, to prevent damage to nozzle tip.

b. Remove turbine wheel cooling air line passing over chambers No. 1 and 2.

c. Unclamp exhaust thermocouple harness to provide clearance during removal of chambers.

d. Disconnect spark plug leads and remove spark plugs (chambers No. 2 and 7).

e. Remove the three Allen-head screws securing flanges of each cross-ignition tube between chambers; then remove each tube, including its bellows guard, gaskets, and connecting tubes.

f. Disconnect drain lines at bottom of chamber and water injection feed line.

g. Loosen and remove clamps at front and rear flanges of chamber.

h. Remove chamber by inserting a finger into cross-ignition tube opening and moving inner liner forward. In order to move inner liner, it is necessary to remove bolt, at aft end of chamber, which secures inner and outer chambers together.

Note

If, because of distortion of inner liner, the combustion chamber cannot be removed by procedure outlined in step h., it may be necessary to use combustion chamber bellows compressing clamp (tool No. 3270).

CAUTION

When each combustion chamber and fuel nozzle is removed, and before progressing to the succeeding one, cover openings (left by the removal of the chamber and fuel nozzle) with suitable cover to prevent entry of foreign objects into the engine.

i. Remove inner chamber from outer chamber and clean by scrubbing with stiff-bristled brush dipped in cleaning solvent (Federal Specification P-S-661).

5-37. COMBUSTION CHAMBER CRACK AND DISTORTION LIMITS. To inspect combustion chambers, first remove chambers. (Refer to paragraph 5-36.) Outer chambers must be repaired or replaced if any cracks are apparent. For inner chamber limits, see figure 5-15.

5-38. INSTALLING COMBUSTION CHAMBERS AND FUEL NOZZLES. To install the chambers and nozzles, proceed as follows:

a. Compress combustion chamber bellows slightly and install chambers. Install chambers No. 1 and 8 first, and connect their drain and water injection lines; then install chambers No. 2 and 7 and their lines, chambers No. 3 and 6 and their lines, and last No. 4 and 5 and their lines.

Note

If necessary, use combustion bellows expanding clamp (tool No. 3271). To properly position the inner liner, insert fingers into cross-ignition tube openings and move liners so that cross-ignition tubes may be installed.

b. Install bolt at aft end of combustion chamber to secure the inner and outer chambers together. Torque bolt to 36-70 inch-pounds.

c. Install combustion chamber clamps, leaving clamp adjustment loose.

d. Carefully install fuel nozzle and gasket, aligning combustion chamber until nozzle tip enters inner liner dome hole. It may be necessary to shift chamber slightly to align nozzle and combustion chamber.

CAUTION

Do not use force in attempting to install nozzle. When combustion chamber is properly

aligned, nozzle will seat on mounting flange without force or strain and without being damaged.

e. Secure nozzle to compressor rear frame; then torque bolts to 30-60 inch-pounds and safety.

f. Rotate combustion chamber slightly to align ignition tube connectors; then install ignition tube, torquing Allen-head bolts to 30-60 inch-pounds.

g. After all drain lines, fuel nozzles, and ignition tubes have been properly secured, tighten combustion chamber flange clamps to a torque of 50 to 60 inch-pounds if standard nuts and lockwire are used, or 40 to 50 inch-pounds if self-locking nuts are used.

h. Connect fuel hoses to nozzles. Torque small-slot hose nuts to 35-45 inch-pounds. Torque large-slot hose nuts to 70-80 inch-pounds.

i. Install spark plugs on combustion chambers No. 2 and 7; then connect ignition leads to spark plugs.

j. Secure exhaust thermocouple lead to engine.

k. Install and connect turbine cooling air line.

5-39. ENGINE EXHAUST SECTION.

5-40. The exhaust section consists of a constant-area exhaust cone and an exhaust tail pipe. The exhaust cone (figure 5-17) consists of an inner and an outer cone; the inner cone is supported by four radial struts, which transmit the loads to the outer cone. The exhaust gases from the turbine wheel are collected in an annular space between the inner and outer cones and are directed into the tail pipe and then overboard. Air to cool the aft surface of the turbine wheel is bled from the compressor and piped through one of the cone struts to flow into a chamber formed by the turbine wheel and the forward end of the inner exhaust cone. This cooling air flows across the rear face of the wheel and then is discharged into the exhaust gas stream. The exhaust tail pipe (figure 5-19) is clamped to the engine exhaust cone flange to form a cantilever structure and terminates just forward of the opening in the rear fuselage. The tail pipe, like the exhaust cone, is covered by insulating blankets. The aft end of the tail pipe is normally unsupported; however, a coil spring incorporated in the fuselage, near the aft portion of the pipe, is provided to contact the pipe when the engine deflects under maximum G-load conditions. Removable restrictors are provided on the aft flange to obtain desired exhaust temperatures. Bosses are provided near the front of the tail pipe to accommodate the exhaust temperature thermocouples and harness. (Refer to paragraph 6-17.) The complete tail pipe is made accessible by the removal of the fuselage rear section.

5-41. REMOVING EXHAUST CONE. To remove cone, first remove fuselage rear section (paragraph 2-150); then proceed as follows:

a. Remove exhaust tail pipe. (Refer to paragraph 5-46.)

b. Disconnect and remove aft portion of turbine wheel cooling air line.

c. Remove turbine housing shroud.

d. If exhaust cone is to be replaced, carefully remove insulating blanket.

e. Support exhaust cone; then remove the 80 retaining bolts and nuts. Carefully pull exhaust cone aft, being sure to hold turbine shroud ring against turbine housing. Carefully place exhaust cone on clean platform to prevent damaging mating flanges; then remove shroud ring.

5-42. EXHAUST CONE CRACK AND DISTORTION LIMITS. See figure 5-16.

5-43. INSTALLING EXHAUST CONE. To install exhaust cone, first check cone-to-turbine-wheel clearances by either of the two methods shown in figure 5-17; then proceed as follows:

Note

Exhaust-cone-to-turbine-wheel clearance check is necessary only when a new or different cone is being installed.

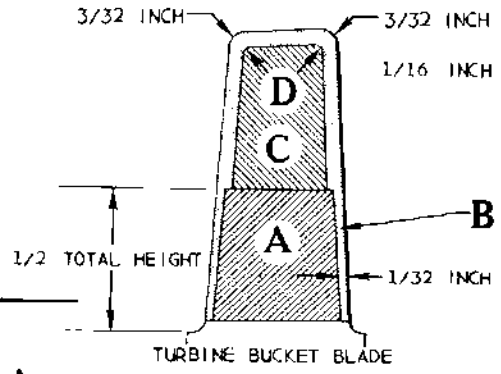
a. Install turbine wheel shroud ring over wheel with tapered end facing aft. Align cooling air line groove on outer edge of shroud ring with groove on turbine casing.

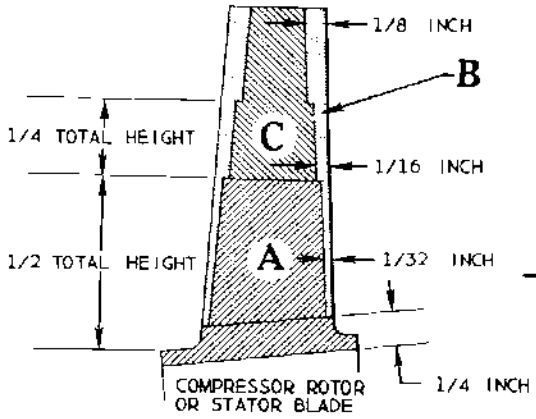
b. Install shims between turbine wheel bucket blades and shroud ring until an average clearance (0.058 to 0.090 inch for a new 8496911 shroud ring, or 0.070 to 0.140 inch for a new 124D103 shroud ring) is obtained in six to eight equally spaced positions around the circumference of the turbine wheel bucket blades. If a used shroud ring (of either part number) is being installed, the minimum clearance at any position is 0.045 inch, while the maximum average clearance, taken at eight equally spaced positions, is 0.090 inch. This is done to guarantee that the required clearances will be present after the exhaust cone is installed.

Note

A "pinch fit" is not required during shroud ring assembly as long as proper clearances are maintained, since the ring will tend to conform to contour of nozzle rabbet during engine operation. If ring is loose, operate engine for approximately 15 minutes and recheck clearances given in step b.; if clearances are within limits, allow engine to remain in service.

c. Install exhaust cone and tighten a sufficient number of the 80 bolts and nuts to hold the shroud ring and exhaust cone snugly in place; then insert hand through open end of exhaust cone and remove shims. Check clearances between turbine wheel blades and shroud ring with a feeler gage to determine that radial clearance at all points is within desired limits.





A Nicks in A areas of blades may be benched (stoned) and blended (burnished) out, provided a depth of .010 inch and a diameter of 1/8 inch are not exceeded.

B Nicks in B areas of blades may be benched (stoned) and blended (burnished) out, provided the depth does not exceed shown limits with respect to blade edges and not more than 25% of the buckets require repair.

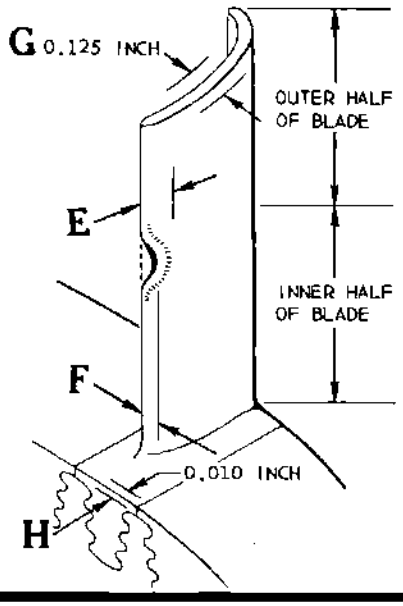
C Nicks in C areas of blades may be benched (stoned) and blended (burnished) out, provided a depth of .020 inch and a diameter of 1/4 inch are not exceeded.

D Tip end burring resulting from shroud ring rubs may be removed. Curling on tip corners may be benched (stoned) off up to 3/32 inch.

NOTE: Repair of burring and curling may be done providing such damage has not resulted from overtemperature operation of the engines.

NOTES

- Any distinct break or crack in the surface of the blade or in the leading or trailing edge of blade is cause for blade replacement.
- No attempt should be made to straighten out any dent since this procedure may aggravate the injury.
- A nick is a sharp edged gouge or furrow with V-shaped bottom and may be repaired within specified limits.
- In repairng injury other than dents, the entire injury must be removed and the surface smoothly blended. The number of repairs or dents per blade shall not exceed four. Repairs on opposite sides of a blade which may coincide so as to reduce the cross section by more than the maximum depth of one repair shall not be allowed.
- If more than 25% of the blades show grain separation (minute surface cracking) or compound "S" curvature, it may be assumed that the turbine wheel has been subjected to adverse operating conditions and should be cause for turbine wheel replacement.



E Dents extending inward from leading or trailing edges shall not exceed limits shown in B areas of blades.

F Dents that displace the leading or trailing edge of blades shall not exceed 1/32 inch in inner half of blade or 1/16 inch in outer half of blade.

G Maximum circumferential tip movement (shake) is 0.125 inch. A minimum tip movement of zero is allowable.

H Maximum axial movement of the dovetail base in the wheel is 0.010 inch.

170-13-4218

Figure 5-14. Turbine Wheel Blade and Compressor Blade Repair Limits

The following conditions will require replacement of inner combustion chamber:

Severe buckling of more than 1/2 inch above or below the original contour. (Buckled chambers are not to be straightened.)

Pieces broken out of the main structure of the chamber.

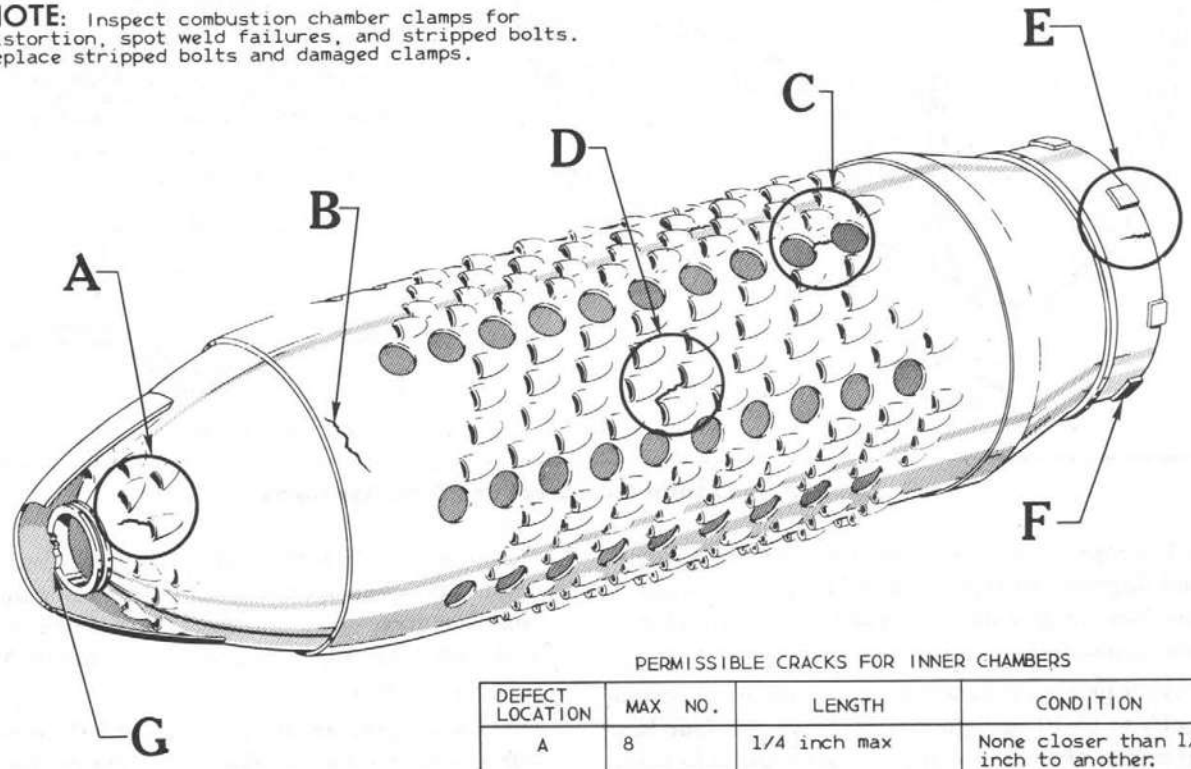
Severe burning where the material's strength or original characteristics have been destroyed or reduced to negligible proportions.

NOTE: Inspect combustion chamber clamps for distortion, spot weld failures, and stripped bolts. Replace stripped bolts and damaged clamps.

Material thickness reduced to less than 50% of the original thickness by wear, burning, or erosion.

Cracking when a combination of permissible cracks endanger a whole section of the chamber.

Cracking when in excess of the following permissible limits.



No cracks permitted in bellows of cross ignition tubes adjacent to seam weld and on inside of tubes.

Inspect ignition tubes for gas leakage around gaskets, as evidenced by discoloration or burning of flange.

NOTE: Inner chambers with cracks in excess of permissible limits may be welded if welding does not cause excessive distortion. The following is the proper type of welding rod.

Part name .... Inner combustion chamber
Part material .... Inconel
Welding process .... Inert arc oxyacetyl
Welding rod .... AMS 5683

If AMS 5683 is not available, rod may be obtained by stripping the coating from AMS 5684 welding rod.

PERMISSIBLE CRACKS FOR INNER CHAMBERS

DEFECT LOCATION	MAX NO.	LENGTH	CONDITION
A	8	1/4 inch max	None closer than 1/2 inch to another.
B	No limit	3/8 inch max	None closer than 1 inch to another.
	4	3/8 to 1 inch max	None closer than 1 inch to another. No crack within 1/2 inch of water injection hole.
C and D	No limit	1/2 inch max	None closer than 1 inch to another.
	5	1/2 to 1-1/2 inch max	None closer than 1 inch to another.
E	4	1/2 inch max	None closer than 1 inch to another and no cracks allowed within 1 inch of support lugs without repair.
F	Wear Lugs		All must be in place and remaining thickness must be 0.02 inch or more.
G	Nozzle Opening		May be worn down to 0.015 inch metal thickness or edge broken or worn up to 25 percent of its circumference.

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Figure 5-15. Inner Combustion Chamber Crack and Distortion Limits

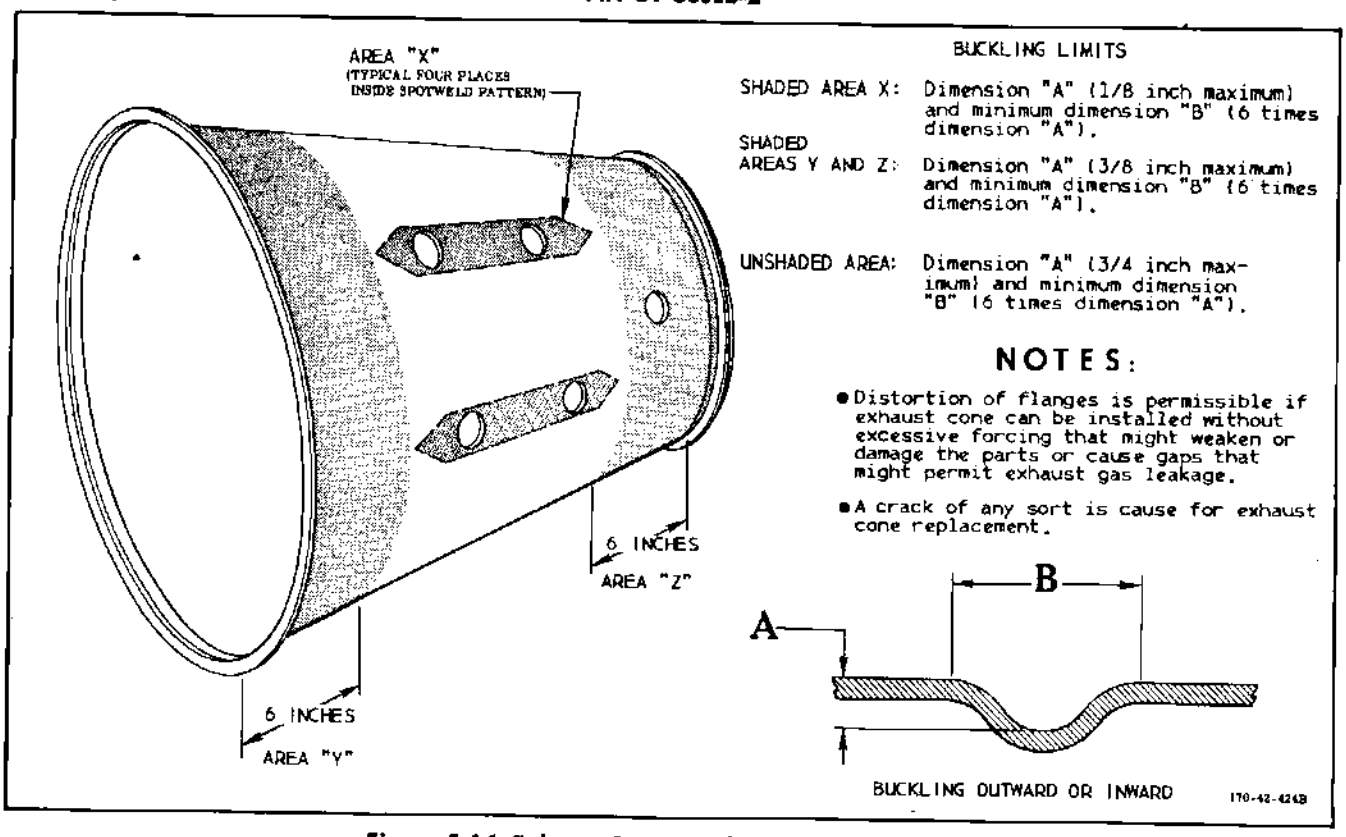


Figure 5-16. Exhaust Cone Crack and Distortion Limits

d. If proper clearances cannot be obtained, rotate shroud ring to another position and try procedure again. If this does not give desired results, a new shroud ring should be installed.

e. After proper clearances have been obtained, torque all bolts to 65-70 inch-pounds. Tighten the four boss plugs at rear of exhaust cone, and safety plugs in pairs.

f. Install and secure insulating blanket.

g. Install turbine casing shroud and connect cooling air line.

h. Install exhaust tail pipe (figure 5-19) and connect thermocouple leads (figure 6-5).

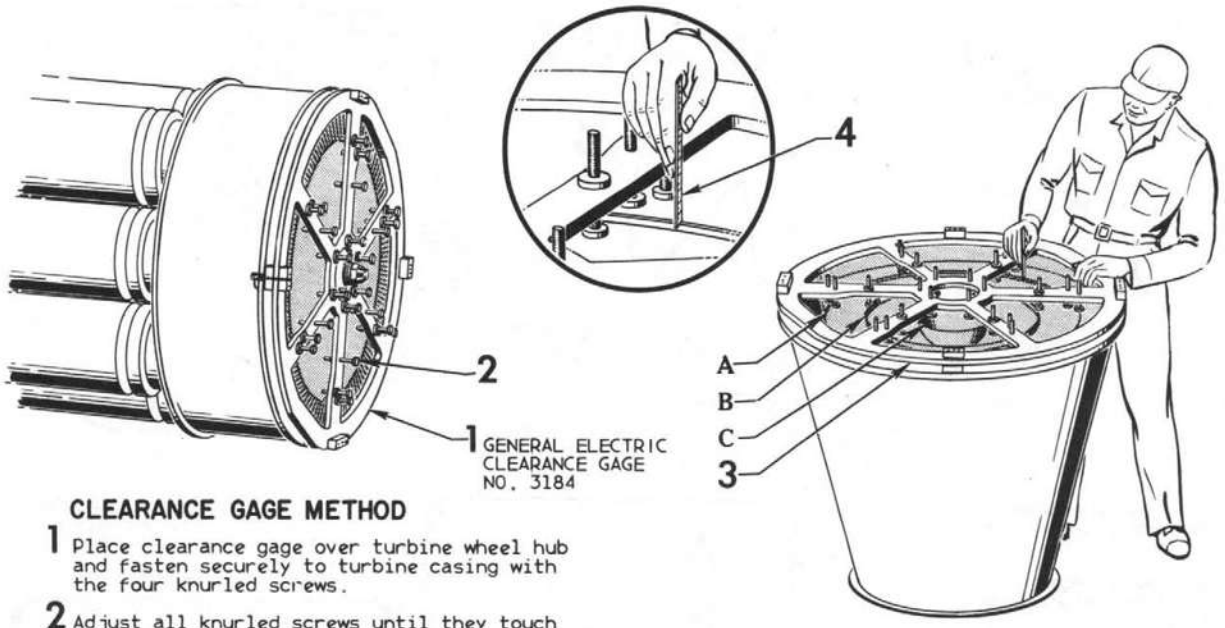
5-44. ADJUSTING EXHAUST TAIL-PIPE EXIT AREA TO OBTAIN MAXIMUM ENGINE TEMPERATURE. The velocity of the exhaust gas stream leaving the tail-pipe nozzle is the actuating force that results in the reaction thrust; thus, the engine thrust will be affected by variations in the size of the nozzle area. The smaller the nozzle area, the higher the exhaust gas stream velocity, the exhaust gas temperature, and the engine reaction thrust. As is readily apparent, the limiting factor controlling the smallness of the nozzle area is the maximum exhaust temperature at which the engine is permitted to operate. As tail pipes are made with a nozzle area of a predetermined size and as it is known that operating characteristics will vary between engines, seven removable segment-type nozzle restrictor segments are provided for temperature adjustment. The segments provide a means of varying the nozzle area to obtain maximum operating engine exhaust temperature and, therefore, maximum thrust on all like engine installations. To adjust segments, see figure 5-18 and proceed as follows:

a. Run engine up to 100% rpm and allow engine to stabilize for at least 5 minutes; then note engine exhaust temperature reading. Exhaust temperature reading should be 675°C to 690°C (1247°F to 1274°F).

CAUTION

If maximum allowable exhaust gas temperature of 690°C (1274°F) is reached at engine speeds of less than 100% rpm, hold engine at these lower speeds until the temperature is stabilized, to permit further increase in speed to 100% rpm without exceeding 690°C (1274°F). On some engines, this will require 5 to 10 minutes of operation between 96% and 100% rpm.

b. If exhaust temperature is not within operating limits, shut down engine. To increase temperature, install segments inside tail pipe, starting with bottom segments. To decrease temperature, remove segments, starting with top segments inside tail pipe. Install removed segments on outside of tail pipe as shown in figure 5-18. Again run engine and note temperature.



CLEARANCE GAGE METHOD

1 Place clearance gage over turbine wheel hub and fasten securely to turbine casing with the four knurled screws.

2 Adjust all knurled screws until they touch turbine wheel; then lock screws with jam nuts.

3 Remove gage and place it on front flange of exhaust cone. The knurled screw points that were touching the turbine wheel must now be pointed out and away from exhaust cone as shown.

4 Measure clearances between knurled screw heads and edges of inner cone and the two air baffles. These are the turbine-wheel-to-exhaust-cone axial clearances and must be within limits shown on chart.

EXHAUST CONE CLEARANCES	IN. MIN	IN. MAX
A Turbine wheel to inner exhaust cone	0.130	0.408
B Turbine-wheel-to-exhaust-cone outer baffle	0.307	0.577
C Turbine-wheel-to-exhaust-cone inner baffle	0.344	0.718

CLAY CHECK METHOD

1 Place dabs of clay on exhaust cone surfaces as shown, on inner exhaust cone ring edge, and on edges of exhaust air baffles. Cover dabs of clay with talc.

2 Install shroud ring if removed.

3 Install cone on engine, using a few bolts to draw cone up tight against turbine case.

4 Remove exhaust cone, and measure clearances indicated between contour flats of clay dabs and surface edges of inner cone and the two air baffles. These are the turbine-wheel-to-exhaust-cone axial clearances and must be within limits shown on chart.

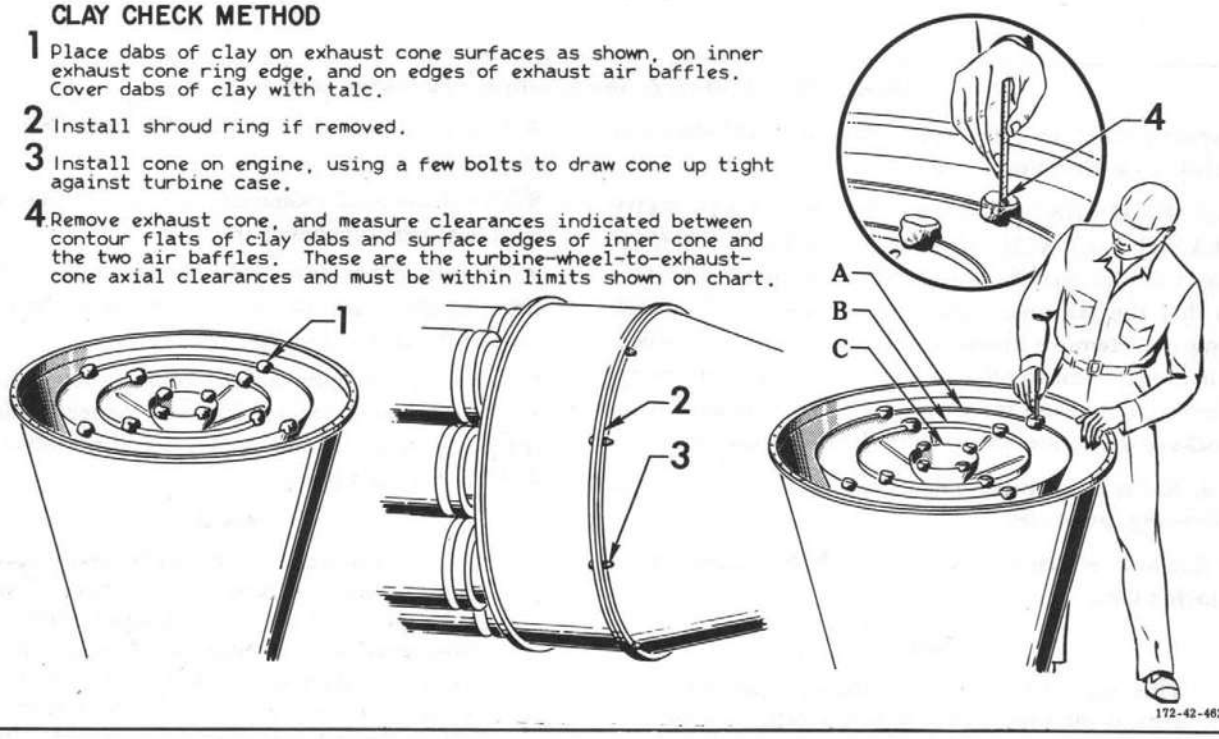


Figure 5-17. Checking Turbine-wheel-to-exhaust-cone Clearances

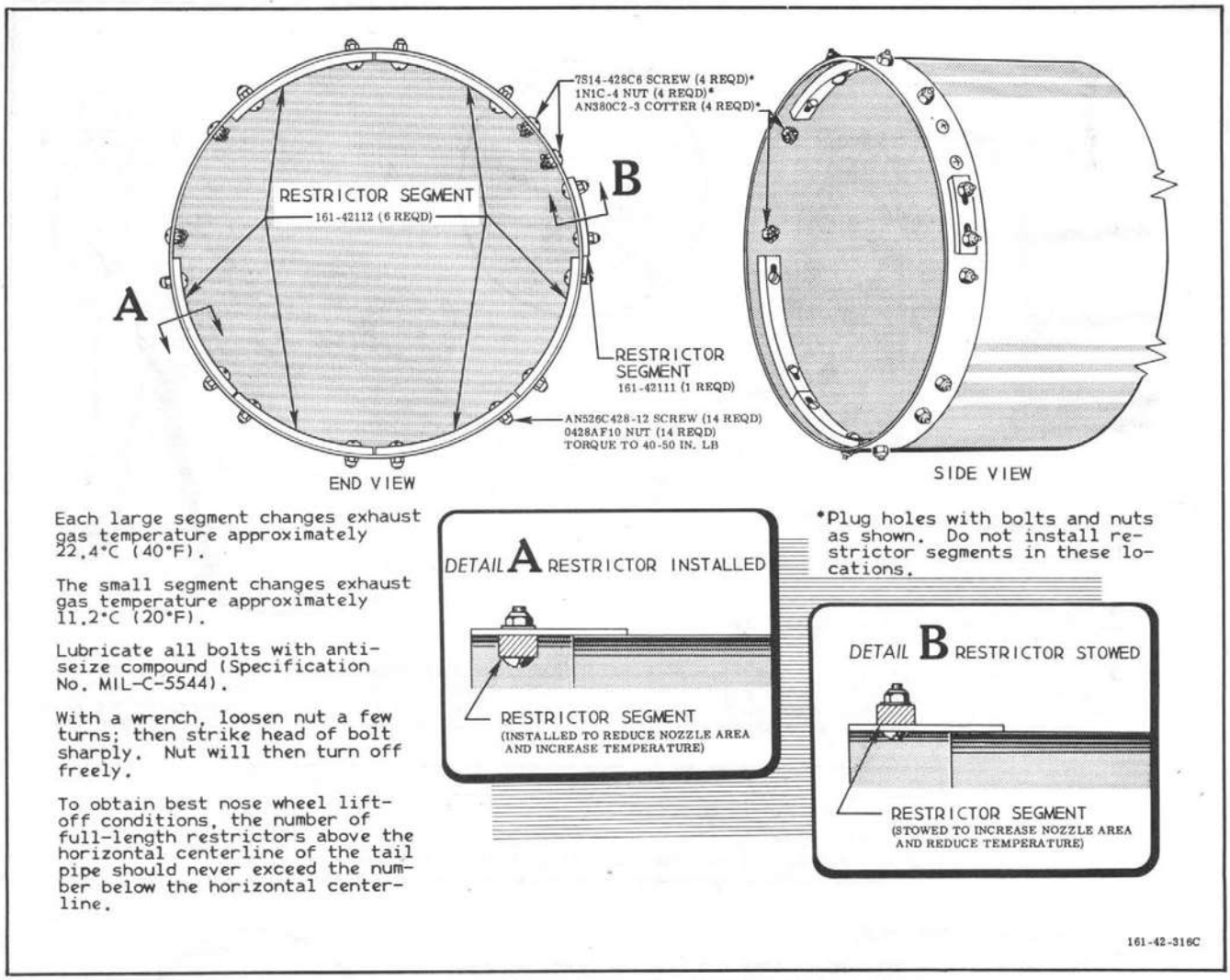


Figure 5-18. Adjusting Exhaust Tail-pipe Restrictor Segments

Repeat procedure until temperature is established and stabilized within limits.

5-45. EXHAUST TAIL-PIPE AND TAIL-PIPE BLANKET CRACK AND DISTORTION LIMITS. The tail pipe may be inspected on its interior surface so that the tail-pipe insulating blankets need not be removed. Remove blankets only if the internal inspection clearly indicates that an external check is necessary. Corrective measure for various extents of damage from cracks or distortion are given in the following steps.

a. Replace tail pipe if dents fall into any one of the following categories:

- A dent in which the bottom straight line is more than 7 inches long.

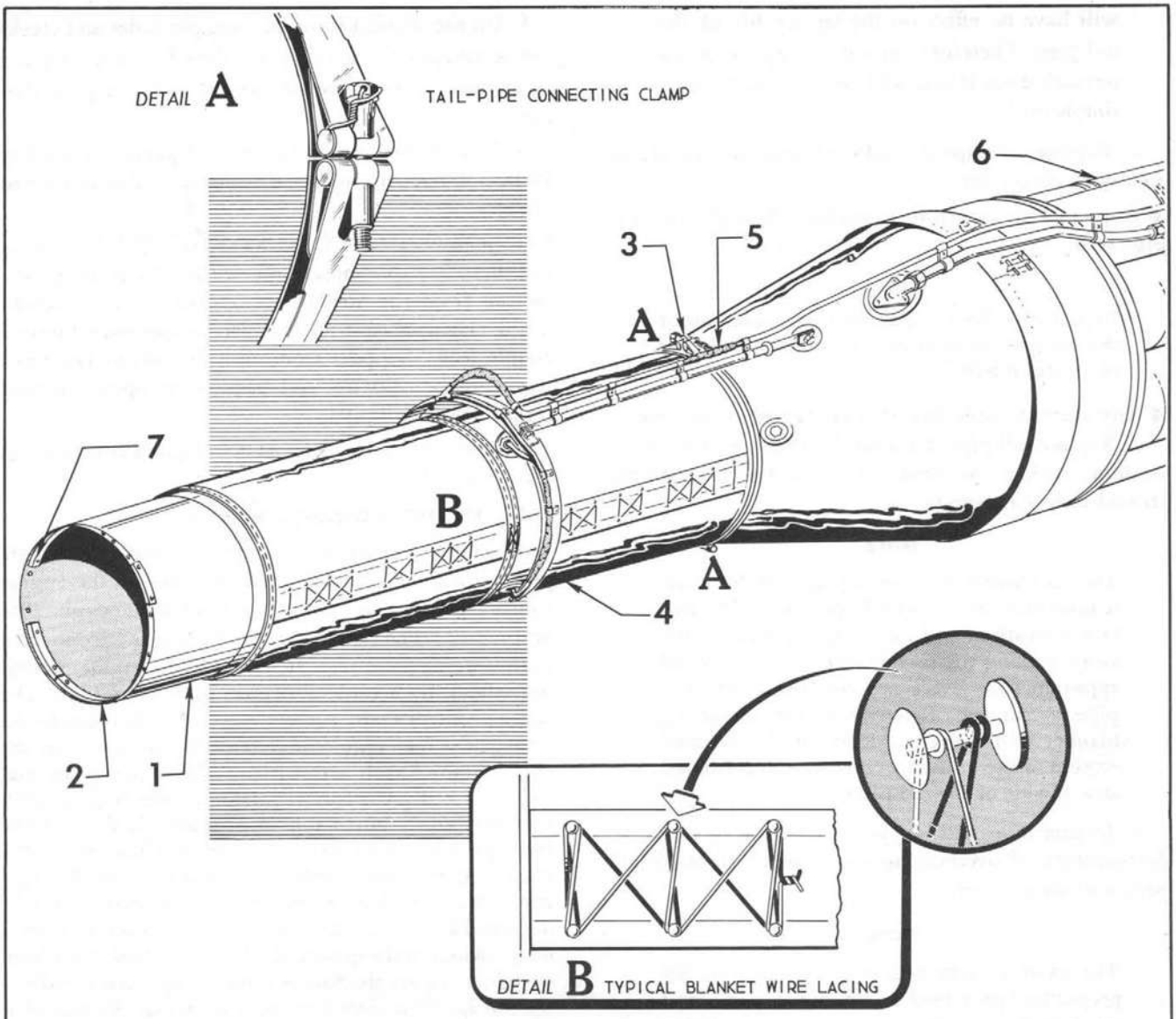
Note

This type dent decreases the cross-sectional area of the pipe. For instance, a dent 7 inches long protrudes ⅝ inch into the exhaust stream.

- A dent shorter than 7 inches, but with sharp corners at the ends.
- Two dents on the same circumferential line, with the ends less than 2 inches apart.
- Two dents not exactly on the same circumferential line but close enough to cause the metal between the ends of the dents to be "pinched."
- A pattern of dents which occurs closely adjacent to a circumferential weld. This dent pattern reduces the column strength of the tail pipe, and permits tail-pipe deflection at that point.

Note

A number of dents or creases normally appear after the first few runs on every new tail pipe and remain relatively unchanged thereafter. These appear at random anywhere on the cylindrical surface of the tail pipe and are the result of a process in which the stresses resulting from fabrication are relieved. Unless the dents are sharp in contour or large, they



1 Inspect tail pipe for proper condition.

2 Raise tail pipe into position so that scupper drain at aft end of tail pipe is on bottom centerline.

3 Place clamp over exhaust cone and tail-pipe flanges. Torque clamp bolt to 140 inch-pounds; then back off to slightly below 90 inch-pounds and retorque to 90 inch-pounds. Safety bolt with AN995N40 lockwire.

NOTE: Do not retighten clamp bolt after engine has been run. Normally, the torque will fall off to approximately zero inch-pounds after a few hours operation. However, the clamp will tighten sufficiently to provide a satisfactory joint during engine operation because of differential thermal expansion of the clamp exhaust cone and pipe. Constant retorquing would subject the clamp to repeated stretching and possible ultimate failure.

4 Cover tail pipe with insulating blankets.

5 Install thermocouple harness on tail pipe and connect thermocouple lead to engine.*

6 Install engine and/or install fuselage rear section.*

7 Install and adjust tail-pipe exhaust nozzle area restrictor segments.*

*Refer to index for page number of applicable procedure.

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Figure 5-19. Installing Exhaust Tail Pipe

will have no effect on the service life of the tail pipe. Therefore, do not attempt to bump out such dents if they will not "can out" with a simple push.

b. Replace tail pipe if cracks fall into any one of the following categories:

- Any crack or puncture extending through the tail-pipe skin.

Note

Repair of cracks is not permitted because of the extreme difficulties entailed in effecting a successful repair.

- Any thermocouple boss that is cracked or broken.

c. Replace tail pipe if a severely eroded area is found on inner surface. An eroded area can be identified by its acid-etched appearance.

Note

This condition is normally caused by over-temperature or overspeed operation. The surface is oxidized and the resulting scale blown away, leaving the surface with an acid-etched appearance. A severe case could cause the tail pipe to rupture. Removal of the insulating blanket will reveal evidence of the internal erosion in the form of a corresponding colored area outside of the tail pipe.

d. Inspect internal swirl pattern of soot in tail pipe for evidence of overheating and erosion. Replace tail pipe if erosion is severe.

Note

The swirl pattern will give evidence of improper fuel distribution, which can cause local overheating and erosion even though neither hot start nor overspeeding has been noted.

e. Replace tail-pipe insulating blanket if any of the following conditions occur:

- Any cracks, punctures, or gouge marks in excess of ½ inch penetrating the outer foil.

Note

Pin holes (1/16 inch in diameter or less), dents, or gouges on the outer surface are acceptable unless they form a pattern which would encourage cracking or failure of the foil.

- More than two lacing hooks broken on the same edge.
- Two broken lacing hooks side by side.
- Two broken lacing hooks in the two end positions.

Note

Lacing can be rearranged slightly to by-pass individual broken hooks.

f. On the blanket inner surface, pin holes and cracks are acceptable if cracks are less than 3 inches long and if adjacent edges of two cracks are more than 6 inches apart.

g. The blanket outer foil should present a shining surface. Scour any surface discoloration due to burned oil, etc.

5-46. REMOVING EXHAUST TAIL PIPE. To remove tail pipe, first disconnect and remove the fuselage rear section from the airplane as explained in paragraph 2-150. Then disconnect exhaust temperature thermocouple leads. Support front and aft ends of tail pipe; then break lockwire and remove tail-pipe support clamp. Lower tail pipe.

5-47. INSTALLING EXHAUST TAIL PIPE. See figure 5-19.

5-48. ENGINE CONTROL SYSTEM.

5-49. Engine power is manually selected by a single power control (throttle) lever, mounted in the engine control quadrant on the left side of the cockpit. (See figure 5-20.) The power control lever is interconnected to the engine control shaft, at the No. 4 engine plumbing island, by a cable and push-pull rod system. The engine control shaft is interconnected by linkage to the emergency fuel regulator, mounted externally on the engine immediately aft of island No. 4, and to the fuel stopcock and main fuel regulator in the engine accessory section. An adjustable stop, accessible through the fuselage left engine access door, is provided externally at the engine control shaft for adjustment of the high rpm setting. When the power control lever is moved outboard from the "OFF" position, the lever actuates a microswitch in the quadrant. When actuated, the microswitch energizes the fuel booster pump circuit and sets up the ignition circuit to turn on when the starter is energized. Initial forward motion of the power control lever opens the stopcock. Subsequent forward motion of the lever actuates the linkage connected to the manual control shaft of the fuel regulator to select increasingly higher rpm settings. In addition, when the power control lever is retarded, a second microswitch, mounted on the engine control pulley bracket, is actuated at a predetermined point of travel for the landing gear warning system. (See figure 2-77 or 2-78 for adjustment procedure of the landing gear warning microswitch.)

5-50. TROUBLE SHOOTING ENGINE CONTROL SYSTEM.

5-51. Refer to paragraph 5-5.

5-52. ADJUSTING ENGINE CONTROL SYSTEM.

5-53. Before attempting adjustments, carefully inspect the control quadrant, bell cranks, and pulleys throughout the system for free movement, proper alignment, and full travel. To adjust the engine control linkage between the engine control quadrant in the cockpit and

the engine control shaft on island No. 4 of the engine, see figure 5-20. To adjust the engine control linkage between the engine control shaft and the emergency fuel regulator, stopcock, and main fuel regulator, see figures 5-22 and 5-24.

5-54. ENGINE CONTROL QUADRANT.

5-55. The control quadrant includes the engine power control lever, flap control lever, ignition and booster pump microswitch, and the manual range potentiometer. The power control lever grip incorporates the microphone, gun sight caging, and speed brake switches. The grip portion of the lever rotates to drive the gun sight manual ranging control. A wedge-type friction lock is provided for the power control lever to prevent creeping. Engine idling speed is set by an adjustable stop near the "OFF" position on the quadrant.

5-56. ENGINE FUEL REGULATION SYSTEMS.

5-57. The engine fuel regulation is accomplished by a dual system (figure 5-21), in which the major supply and control units are duplicated, so that if any of the major units fail, engine operation will continue. The dual system is divided into a main system and an emergency system, with feed and injection units that are common to both. The main system consists of the main fuel pump, a fuel filter, a check valve, a fuel control valve, a regulator oil orifice and filter, and the main fuel regulator. The emergency system consists of the emergency fuel pump, the emergency fuel regulator, and a check valve. The emergency system is used to maintain engine operation if the main system fails. Common to both the main and emergency system are the fuel inlet, stopcock, fuel flowmeter, fuel flow divider, drip valves, fuel manifolds (small- and large-slot), and eight fuel injection nozzles. This portion of the system directs and distributes the fuel in equal quantities and with the proper spray pattern for effective combustion. The stopcock, main regulator, and emergency regulator input shafts are manually controlled through interconnecting linkage by the power control lever (throttle). The main and emergency systems are interconnected by a fuel pressure sensing line which connects the emergency regulator fuel pressure sensing diaphragm to the main fuel line upstream of the stopcock. An autosyn-type fuel pressure indicating system (paragraph 6-37) is connected to the fuel regulation system at the fuel flow divider. The flowmeter is part of the fuel flow indicating system. (Refer to paragraph 6-27.)

5-58. FUNCTION OF MAIN FUEL REGULATION SYSTEM.

5-59. During normal engine operation, all fuel is supplied to the engine by the main fuel system. (See figure 5-21.) Fuel under booster pump pressure from the airplane fuel system (paragraph 5-105) is routed to the main fuel pump inlet. The fuel from the main fuel pump is directed through the fuel filter. From the filter, the fuel is directed into two lines. One line carries the excess fuel through the control valve and back to the main fuel pump inlet, and the other line directs the proper amount of fuel through the main check valve, stopcock, fuel flowmeter, oil cooler, flow divider, and fuel manifolds to the fuel nozzles. The amount of fuel directed to the nozzles by the main system is regulated by the fuel control valve, which, in turn, is controlled by the main fuel regulator. The main fuel regulator controls the fuel control valve by means of variable control oil pressure, which is varied according to the power control lever setting, compressor discharge air pressure, and engine rpm. The regulator automatically increases the variable control oil pressure to cause the fuel control valve to feed more fuel to the engine and by-pass less to the pump inlet when the altitude decreases, the power control lever is advanced, or the engine rpm decreases without power control change. Conversely, the regulator decreases the variable control oil pressure to feed less fuel to the engine when the altitude increases, the power control lever is retarded, or the engine rpm increases without power control change. In the main system, the fuel pressure is maintained at approximately three times the pressure of the variable control oil, the fuel pressure ranging from approximately 40 to 600 psi, and the variable control oil from approximately 20 to 220 psi.

5-60. FUNCTION OF EMERGENCY FUEL REGULATION SYSTEM.

5-61. A three-position emergency fuel system switch is provided for dual system control and is located on the left side of the cockpit. (See figure 5-21.) During normal engine operation, with the emergency fuel system switch "OFF," the total output of the emergency fuel pump is continuously by-passed through the emergency regulator back to the engine fuel inlet line. The "OFF" position of the switch energizes the emergency fuel regulator solenoid valve, rendering the emergency system inoperative. Automatic emergency system takeover is not possible with the switch in the "OFF" position unless you have an electrical failure; however, this position is used for all normal flight operation in order that the wide-range, engine-speed governing of the main fuel regulator can be utilized without any possible interference from the emergency system. The emergency system is of the prescheduled, altitude-compensated, by-pass type, which will regulate fuel flow in accordance with the power control lever setting and the altitude (compressor inlet pressure). The emergency system, unlike the main system, does not use engine rpm as one of its regulating factors. Engine overspeeding will occur with the emergency system in operation when the power control is fully advanced and the outside air temperature exceeds 37.8°C (100°F). The "ON" position of the emergency fuel system switch de-energizes the emergency fuel regulator solenoid valve and frees the emergency regulator to maintain a fuel pressure slightly below the main regulator schedule. If the

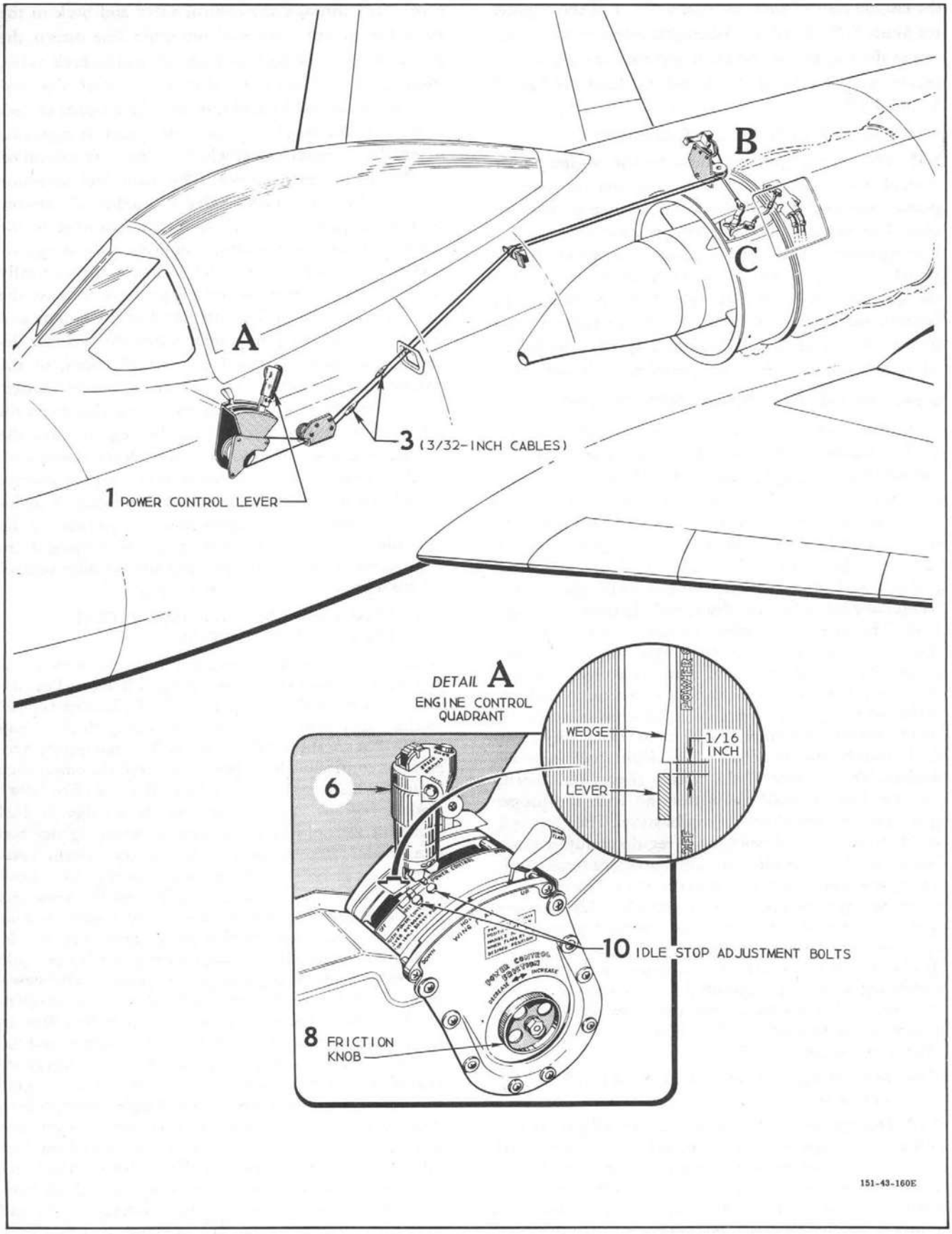
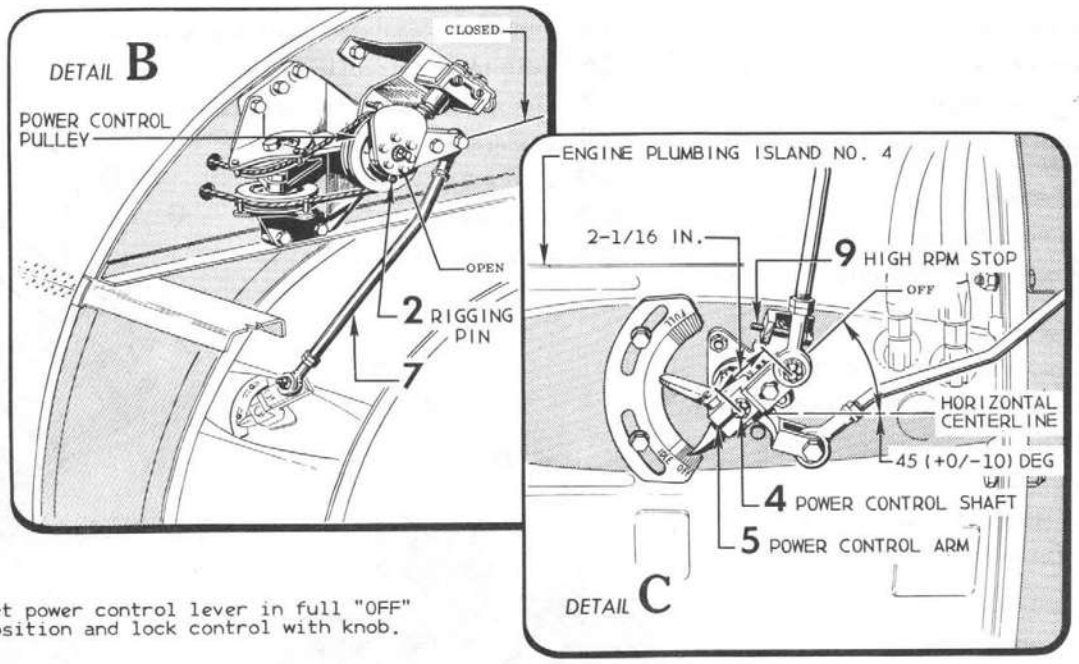


Figure 5-20. Adjusting Engine Control System (Sheet 1 of 2)



1 Set power control lever in full "OFF" position and lock control with knob.

2 Through left engine access door rotate power control pulley to align pulley and bracket rigging holes, and insert rigging pin.

3 With turnbuckles in left console, adjust cables evenly to 45 (±5) pounds tension and until rigging pin can be removed and installed without binding.

4 Rotate engine power control shaft (No. 4 engine plumbing island) counterclockwise to the full "OFF" position.

5 Install and secure power control arm on shaft approximately 45 (+0/-10) degrees above engine horizontal centerline. Adjust power control arm length to dimension shown.

6 Remove rigging pin; then move power control lever forward from full "OFF" position to within 1/16 inch of rear face of wedge. (Wedge prevents forward movement of power control lever until control lever is moved outboard.)

7 Adjust power control rod to fit, and attach to power control arm and pulley.

8 Loosen friction knob and operate power control lever. Check for equal spring-back at both ends of lever travel (approximately 1/4 inch); then check for stop-to-stop travel at engine control shaft arm. Adjust power control rod and/or power control arm to obtain desired results.

9 Start engine and adjust high rpm stop at engine control shaft to limit rpm at 100% rpm.

NOTE: Each time high rpm stop is adjusted, it will be necessary to check adjustment of the emergency fuel regulator linkage. If stop has been turned within one turn of its limit of adjustment and proper rpm is still not obtained, adjust stopcock and main fuel regulator linkage and/or replace fuel regulator.*

10 With engine running, adjust quadrant idle stop so that a stabilized idle speed of 34-38% rpm can be obtained when the power control lever is moved smoothly back against the idle stop from a stabilized speed of 55 to 65% rpm. Do not jerk the power control lever. Accomplish the lever movement within a period of approximately 1/2 second.

NOTE: If the idle stop is properly set, the engine idle speed should stabilize at 34-38% rpm when the power control lever is retarded from 100% rpm position to idle position. Power control lever should be retarded to idle position within approximately one or two seconds.

*Refer to index for page number of applicable procedure.

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Figure 5-20. Adjusting Engine Control System (Sheet 2 of 2)

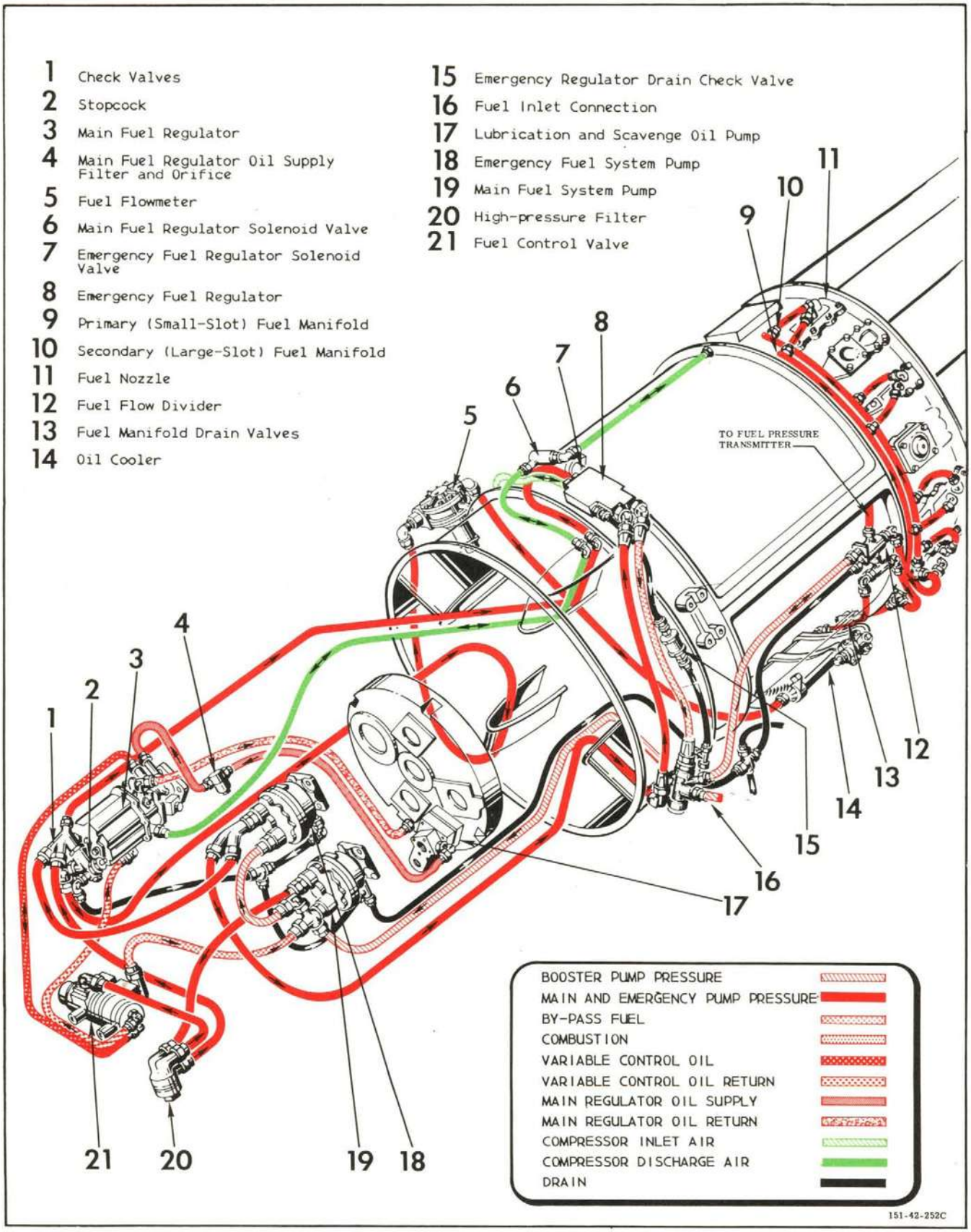


Figure 5-21. Fuel Regulation and Injection System (Sheet 1 of 2)

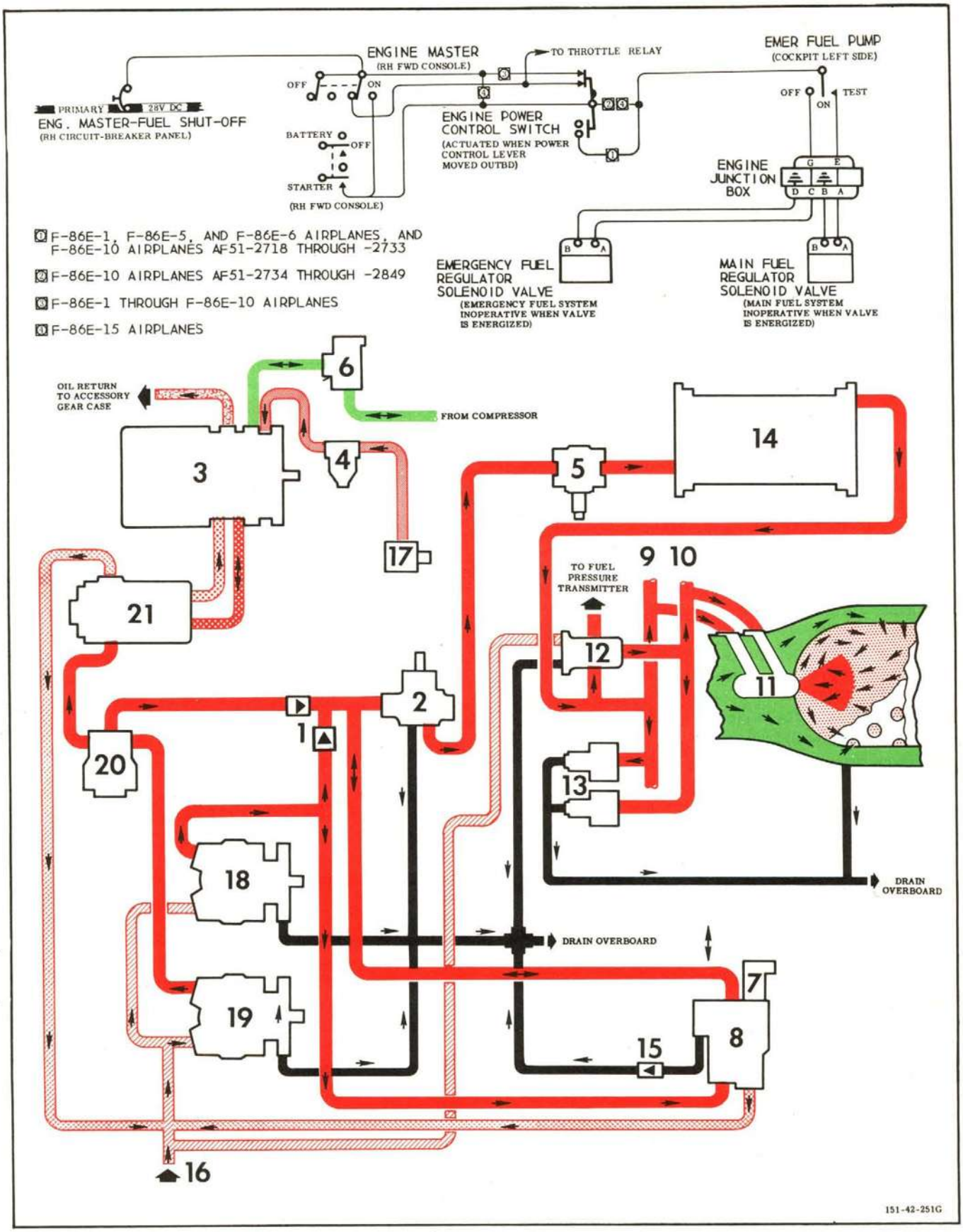


Figure 5-21. Fuel Regulation and Injection System (Sheet 2 of 2)

main fuel system fails during take-off when the switch is "ON," the emergency system will automatically direct a sufficient output of fuel to the engine to maintain the proper engine rpm relative to power setting, altitude, and inlet air temperature. Through the fuel pressure-sensing line, installed in the system between the main and emergency check valves, the emergency regulator can sense any appreciable drop in pressure and will react to a pressure drop by closing its by-pass valve. The emergency fuel pressure will then build up enough so that fuel can enter the emergency check valve and begin supplying the engine. Because of the lower scheduling of the emergency system, engine speed will be slightly lower during emergency fuel system operation than during main fuel system operation. The momentary "TEST" position of the emergency fuel system switch is used to check the emergency fuel system operation by rendering the main fuel system ineffective. The switch "TEST" position energizes a solenoid-operated valve, located on top of the engine compressor in the main fuel regulator compressor air sensing line. Energizing the valve closes the compressor end of the sensing line and vents the regulator side of the line to atmosphere, making the main fuel system ineffective. Engine rpm will drop to the value of the emergency fuel system engine rpm corresponding to the day temperature, or it may momentarily drop to a value below that corresponding to the day temperature and then increase to the correct value. The emergency system rpm varies from approximately 93% rpm on a −23°C (−10°F) day to approximately 99% rpm on a 37.8°C (100°F) day. If the engine is operating with the emergency fuel system switch "ON," the "OFF" position can be used to determine whether the main or emergency system is maintaining engine operation.

5-62. TROUBLE SHOOTING ENGINE FUEL REGULATION SYSTEMS.

5-63. Refer to paragraph 5-5.

5-64. ENGINE MAIN AND EMERGENCY FUEL PUMPS.

5-65. The main and emergency fuel pumps (paragraph 5-4) are identical. The pumps are of conventional, positive-displacement, single-element, gear type. They are mounted on the accessory gear case and driven at a .455:1 gear ratio. Each pump is capable at 3600 rpm of delivering 25 gallons per minute with a discharge pressure of 600 psi. No pressure relief valve is incorporated in either pump.

5-66. REMOVING FUEL PUMPS. The fuel pumps can be removed from inside the air duct with the engine installed. Removal of the pumps is exactly the same with the engine in or out of the fuselage. To remove the pumps, proceed as follows:

a. Remove auxiliary accessory cover. (Refer to paragraph 5-24.)

b. Remove auxiliary gear case. (Refer to paragraph 5-26.)

c. Disconnect fuel hoses at pump.

d. Remove pump and gasket from gear case by removing the four self-locking nuts.

5-67. INSTALLING FUEL PUMPS. To install fuel pumps, proceed as follows:

a. Install pump and gasket on gear case. Torque attaching nuts to 130-180 inch-pounds.

b. Attach fuel hoses to pump.

c. Install auxiliary gear case. (Refer to paragraph 5-27.)

d. Install auxiliary accessory cover. (Refer to paragraph 5-25.)

f. Install engine if removed. (Refer to paragraph 5-13.)

5-68. ENGINE MAIN FUEL REGULATOR.

5-69. The main fuel regulator (paragraph 5-4), mounted on the accessory gear case and driven at a .455:1 gear ratio, controls the fuel control valve which by-passes the main fuel pump output not needed by the engine for the particular operating condition. (See figure 5-21.) The main fuel regulator controls the fuel control valve by means of a variable hydraulic pressure known as variable control oil pressure. No fuel enters or passes through the main fuel regulator. The main fuel regulator controls the pressure of the variable control oil as a function of power control lever setting, compressor discharge air (altitude, temperature, and ram), and engine rpm. The regulator comprises a closed case containing a built-in oil pump and three combined governing components (manual, altitude, and rpm) to control the pressure of the variable control oil. The main fuel regulator is fed regular engine oil from the engine oil system. This oil passes through a filter and orifice before entering the regulator case. The orifice restricts the oil flow into the regulator to a low-pressure flow rate of 1½ quarts per minute at a maximum pressure of 3 psi. The oil entering the fuel regulator serves two purposes: it supplies the regulator charging oil pump, and it maintains an oil flow through the regulator as a cooling agent. The cooling oil leaving the regulator is returned to the engine accessory gear case to again become a part of the engine lubrication oil supply. The charging oil pump, within the main fuel regulator, boosts the low-pressure oil supply to a constant pressure of 260 psi, as controlled by a ball-type pressure relief valve on the outlet side of the pump. The boosted pressure oil (constant control oil pressure), when affected by a change in power setting, altitude, or engine rpm will upset the balance of the main fuel regulator servo system, causing a change in the pressure of the variable control oil controlling the fuel control valve. The fuel control valve will in turn assume a new position to by-pass less or more fuel to the pump inlet, allowing more or less fuel to be directed to the engine. When the variable control oil pressure is correct for maintaining the proper operating condition, the regulator servo system balance is

regained and maintained until again upset by a change in engine operating condition. The regulator will effectively maintain steady rpm at sea level over the upper 30% of its speed range, with a high setting between 100.5% and 103% rpm. The high rpm setting of the regulator is the maximum safety setting made at time of manufacture. The normal high rpm operating setting of the engine of 100% (± .5%) is accomplished by adjustment of the linkage high rpm stop on engine island No. 4. Maintenance of the regulator is limited to installation, removal, and linkage adjustment. If the unit is defective, it should be replaced.

5-70. REMOVING REGULATOR. The regulator can be removed from inside the air duct, with the engine installed. Removal of the regulator is exactly the same with the engine in or out of the fuselage. To remove the regulator, proceed as follows:

a. Remove auxiliary accessory cover. (Refer to paragraph 5-24.)

b. Remove auxiliary gear case. (Refer to paragraph 5-26.)

c. Remove control rods and control clevis arms from main fuel regulator and stopcock.

d. Tag all hoses and fittings for aid in reinstallation of units; then disconnect lines from stopcock and regulator. Cap all openings as soon as lines are disconnected.

e. Remove regulator and gasket from gear case by removing the four self-locking nuts and washers.

Note

Main fuel regulator weighs approximately 16 pounds when filled with oil.

f. Remove stopcock from regulator by removing attaching bolts and washers. Remove and tag all regulator fittings for installations on replacement unit.

5-71. INSTALLING REGULATOR. To install main fuel regulator, proceed as follows:

a. Install tagged fittings on regulator, and attach stopcock to regulator with two bolts and washers. Torque bolts to 36-70 inch-pounds.

b. Install new, clean gasket on main fuel regulator mounting pad.

c. Install regulator assembly on gear case studs, and secure with four washers and self-locking nuts. Torque nuts to 130-180 inch-pounds.

d. Attach tagged fuel and air hoses to regulator and stopcock.

e. Install and adjust stopcock and main fuel regulator linkage. (See figure 5-22.)

f. Prime main fuel regulator. (Refer to paragraph 5-72.)

g. Install auxiliary gear case (paragraph 5-27) and auxiliary accessory cover (paragraph 5-25) on engine.

h. Install engine in airplane if removed. (Refer to paragraph 5-13.)

5-72. PRIMING REGULATOR. The regulator must be primed before a newly installed engine is started or before an engine on which the fuel control valve or the main fuel regulator has been replaced is started. To prime the main fuel regulator, proceed as follows:

a. Remove engine auxiliary accessory cover. (Refer to paragraph 5-24.)

b. Disconnect oil outlet line from main fuel regulator oil supply filter and orifice.

c. Connect a clean supply of regular engine oil to the oil outlet line; then pump 10 pounds of oil, under a pressure of no more than 6 to 8 psi, into the main fuel regulator. Disconnect priming oil supply and connect line to main fuel regulator oil supply filter and orifice.

d. Install engine auxiliary accessory cover. (Refer to paragraph 5-25.)

5-73. ADJUSTING REGULATOR. See figure 5-22.

5-74. ENGINE FUEL CONTROL VALVE.

5-75. The fuel control valve (paragraph 5-4) is a variable by-pass valve controlled by the main fuel regulator by means of variable control oil pressure. (See figure 5-21.) The valve, located in the accessory section, is essentially a ported housing that contains a piston-type valve, a diaphragm, a pilot valve, and a spring. The fuel control valve provides a scheduled fuel flow to the engine by maintaining a fuel pressure that is approximately three times variable control oil pressure. When the main fuel regulator calls for a greater fuel flow, variable control oil pressure is increased and tends to close the fuel control valve and restrict the amount of by-pass fuel to the main fuel pump inlet. Thus, an increased portion of main fuel pump output is directed to the fuel nozzles to increase engine speed. When the regulator calls for less fuel, variable control oil pressure is decreased and allows the fuel control valve to open to by-pass more fuel to the pump inlet. This results in a corresponding decrease in the amount of fuel reaching the engine nozzles. The fuel control valve will be stabilized whenever approximately 3:1 differential between fuel and variable control oil pressure is obtained. The control valve also acts as a pressure relief valve to prevent system surge and will relieve differential pressure in excess of 650-800 psi. Variable control oil that leaks past the pilot valve loses pressure and is returned to the main fuel regulator. Access to the fuel control valve is obtained by removing the auxiliary accessory cover (paragraph 5-24) and the auxiliary gear case (paragraph 5-26).

5-76. ENGINE MAIN FUEL REGULATION SYSTEM FILTER.

5-77. The fuel filter (paragraph 5-4) is a multiple-screen, full-flow high-pressure type filter, mounted on the front side of the auxiliary gear case. (See figure 5-21.) It is located in the discharge line of the main fuel pump, so that all main fuel pump output is filtered. No filtering is provided for the emergency fuel pump output.

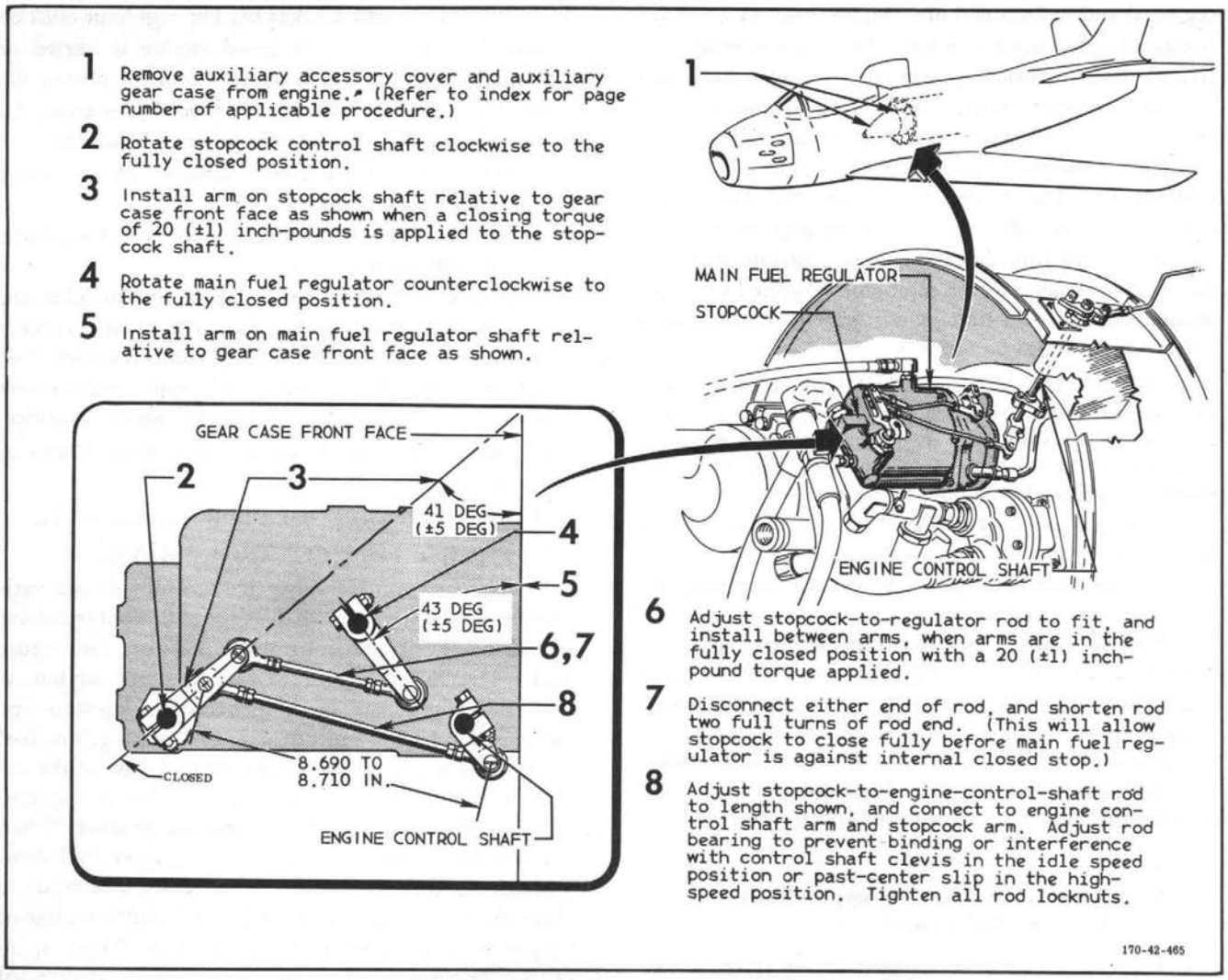


Figure 5-22. Adjusting Stopcock and Main Fuel Regulator Linkage

The filter has two outlet ports, one going directly to the stopcock, and the other to the fuel control valve. The fuel filter incorporates a pressure relief valve set to relieve at from 12 to 15 psi differential pressure.

5-78. CLEANING AIR MAZE FUEL FILTER. To clean filter, see figure 5-23 and proceed as follows:

a. Remove engine auxiliary accessory cover. (Refer to paragraph 5-24.)

b. Cut safety wire and unscrew filter sump from main body.

c. Unscrew filter element from body and remove "O" ring.

d. Remove nut and retainer cup from end of filter element; then remove filter packs and spacer(s).

e. Immerse all parts *except the filter packs* in cleaning solvent (Federal Specification P-S-661). If necessary, use a brush to clean parts thoroughly. Allow parts to drain; then dry parts with a lint-free cloth.

f. Clean filter packs with a soft-hair brush dipped in cleaning solvent (Federal Specification P-S-661).

CAUTION

Do not use a wire brush on any part of the filter element.

g. Dry filter element parts with dry compressed air.

h. Reassemble filter packs and spacer(s) on element body; then secure with retainer cup and nut.

i. Install "O" ring on filter body; then screw filter element into body, and torque.

j. Apply lubricating grease (Specification MIL-L-6032) on fuel sump threads; then screw sump on filter body. Torque and safety sump.

k. Install engine auxiliary accessory cover. (Refer to paragraph 5-25.)

5-79. CLEANING HYDRO-AIRE FUEL FILTER. To clean filter, see figure 5-23 and proceed as follows:

a. Remove engine auxiliary accessory cover. (Refer to paragraph 5-24.)

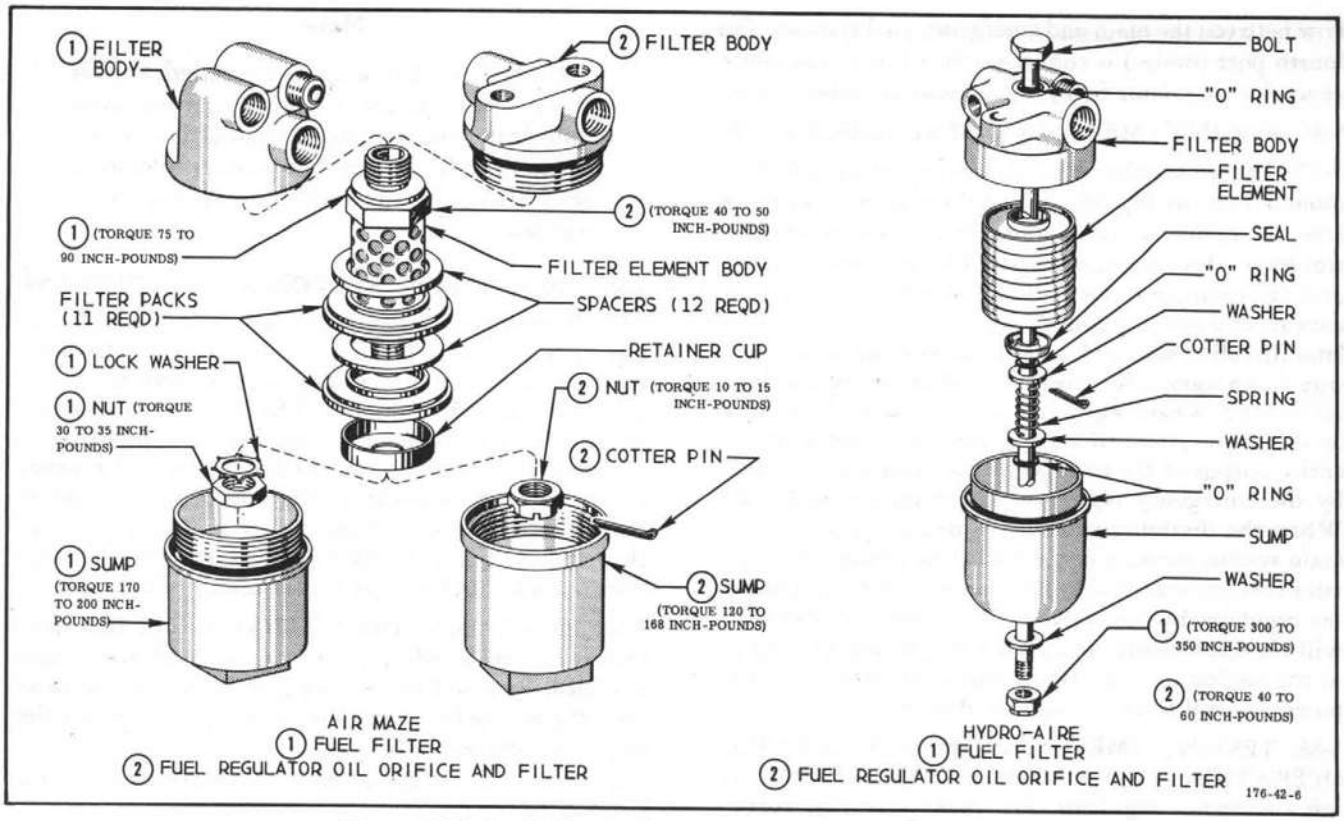


Figure 5-23. Fuel Filter and Regulator Oil Orifice and Filter

b. Remove nut and washer at bottom of sump; then remove filter sump.

c. Remove "O" ring, washer, and spring from filter sump.

d. Remove washers, "O" ring, seal, and filter element from bolt by removing cotter pin.

e. Remove bolt and "O" ring from filter body.

f. Immerse all parts *except filter element* in cleaning solvent (Federal Specification P-S-661). If necessary, use brush to clean parts thoroughly. Allow parts to drain; then dry parts with a clean lint-free cloth.

g. Clean filter element with a soft-hair brush dipped in cleaning solvent (Federal Specification P-S-661).

CAUTION

Do not use a wire brush on any part of the filter element.

h. Thoroughly dry filter element with dry compressed air.

Note

Replace any "O" ring showing wear or deterioration.

i. Reassemble filter element to filter body by inserting a bolt and "O" ring through body and installing filter element, seal, "O" ring, and washer on bolt; then install cotter pin in bolt.

j. Install spring, washer, and "O" ring on bolt.

k. Attach and torque sump to filter body, using washer and nut.

l. Install engine auxiliary accessory cover. (Refer to paragraph 5-25.)

5-80. ENGINE FUEL REGULATION SYSTEM OIL ORIFICE AND FILTER.

5-81. The oil orifice and filter (paragraph 5-4) is a multiple screen, restricted-flow, low-pressure type filter, mounted on the auxiliary accessory gear case. The orifice and filter meters and filters the main fuel regulator oil supply at the rate of one to 1½ quarts per minute.

5-82. CLEANING AIR MAZE OIL ORIFICE AND FILTER. The cleaning procedure for the Air Maze oil orifice and filter is the same as for the Air Maze fuel filter. (Refer to paragraph 5-78.)

5-83. CLEANING HYDRO-AIRE OIL ORIFICE AND FILTER. The cleaning procedure for the Hydro-Aire oil orifice and filter is the same as for the Hydro-Aire fuel filter. (Refer to paragraph 5-79.)

5-84. ENGINE FUEL CHECK VALVE.

5-85. The fuel check valve (paragraph 5-4) consists of a four-port housing and two check valves. The valve outlet port is threaded to the inlet port of the fuel stopcock. The two check valves are in the two fuel inlet ports; one port is connected by a fuel hose to the fuel filter outlet, and the other is connected to the emergency fuel pump outlet. The check valves prevent reverse fuel

flow between the main and emergency fuel systems. The fourth port (outlet) is connected by a line to the emergency fuel regulator fuel pressure sensing bellows port.

5-86. ENGINE EMERGENCY FUEL REGULATOR.

5-87. The emergency fuel regulator (paragraph 5-4), mounted on the top left side of the engine compressor case, is a hydraulic valve controlled by the power control lever (throttle), compressor inlet pressure, altitude, and the emergency fuel system switch. The regulator consists of a housing containing a by-pass valve, a regulator disabling solenoid, an altitude bellows, a fuel pressure diaphragm, a fuel strainer, and necessary mechanical linkage. When engine operation is being maintained by the main system (disabling solenoid energized), the entire output of the emergency fuel pump is by-passed by the emergency regulator to the engine fuel inlet. When the disabling solenoid is de-energized and the main system pressure drops below the emergency regulator fuel pressure, the fuel pressure diaphragm actuates the regulator by-pass valve. The actuated by-pass valve will close sufficiently to divert enough emergency fuel to the engine to maintain engine rpm with respect to power control lever setting and altitude.

5-88. TESTING EMERGENCY FUEL REGULATOR OPERATION AND LINKAGE ADJUSTMENT. To test emergency regulator, first make sure that correct exhaust temperature has been obtained at full throttle when operating on the main system; then proceed as follows:

a. Check linkage adjustment by operating system as explained in figure 5-24.

b. After it has been determined that linkage adjustment is correct and that desired rpm (relative to outside air temperature) can be obtained with the emergency system, the emergency regulator can be time-lag-checked as follows:

Note

The time-lag check must be accomplished during test run of a new or overhauled engine or when a new emergency fuel regulator has been installed.

c. Run engine up to 80% rpm; then place emergency fuel switch in the "ON" position.

d. Advance power control lever to full open and allow rpm to stabilize at 100%.

e. Move emergency fuel switch to "TEST," and note time lapse from the positioning of switch at "TEST" to the stabilization of the engine rpm at the rpm air temperature value obtained in step a. If rpm does not drop below value obtained in step a., the regulator time-lag operation is considered satisfactory regardless of any time interval. However, if rpm does drop below and then returns to stabilized rpm air temperature rpm, the time lag before stabilization must not exceed 2½ seconds.

f. Return emergency fuel switch to "OFF."

Note

If preceding tolerance is exceeded, repeat check several times to ensure that excessive rpm drop (and/or recovery time) is not due to improperly primed regulator. If tolerances are still exceeded, replace emergency fuel regulator.

5-89. ENGINE FUEL STOPCOCK.

5-90. The stopcock (paragraph 5-4) is a simple, manually operated fuel shutoff valve mounted on the main fuel regulator in the main fuel line between the check valves and fuel flow divider. The stopcock is operated through linkage interconnecting the main fuel regulator, stopcock, and emergency fuel regulator to the power control lever in the cockpit. The stopcock gives a throttling effect from 0 to 8 degrees of shaft rotation and then is fully open. An overboard drain from the stopcock prevents fuel leakage past its control shaft.

5-91. REMOVING FUEL STOPCOCK. The fuel stopcock can be removed inside the air duct with the engine installed. Removal of the stopcock is exactly the same with the engine in or out of the fuselage. To remove the stopcock, proceed as follows:

a. Remove auxiliary accessory cover. (Refer to paragraph 5-24.)

b. Remove auxiliary gear case. (Refer to paragraph 5-26.)

c. Disconnect mechanical linkage and fuel hoses at stopcock.

d. To remove stopcock from main fuel regulator, remove two attaching bolts and washers.

5-92. INSTALLING FUEL STOPCOCK. To install fuel stopcock, proceed as follows:

a. Attach stopcock to main fuel regulator with two bolts and washers. Torque bolts to 36-70 inch-pounds and safety.

b. Connect fuel hoses to stopcock.

c. Connect and adjust stopcock linkage (figure 5-22).

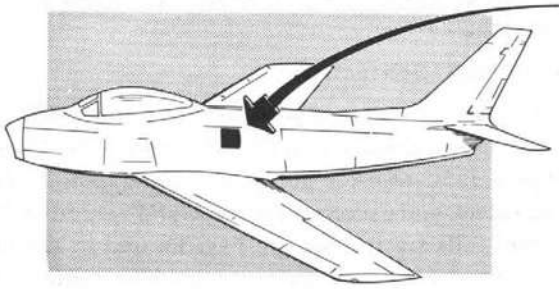
d. Install auxiliary gear case (paragraph 5-27) and auxiliary accessory cover (paragraph 5-25).

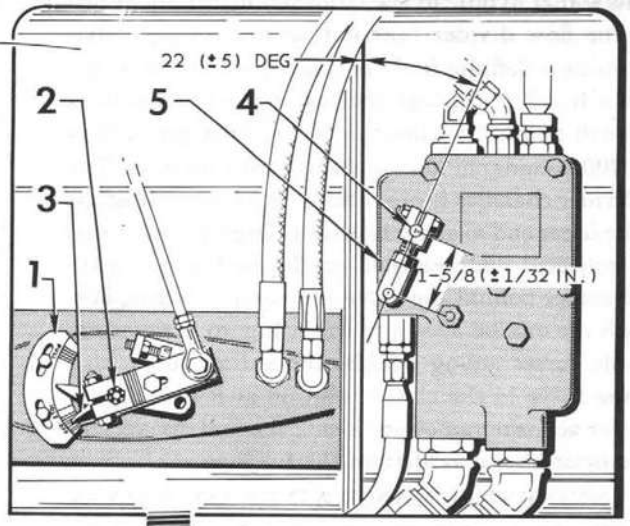
e. Install engine if removed. (Refer to paragraph 5-13.)

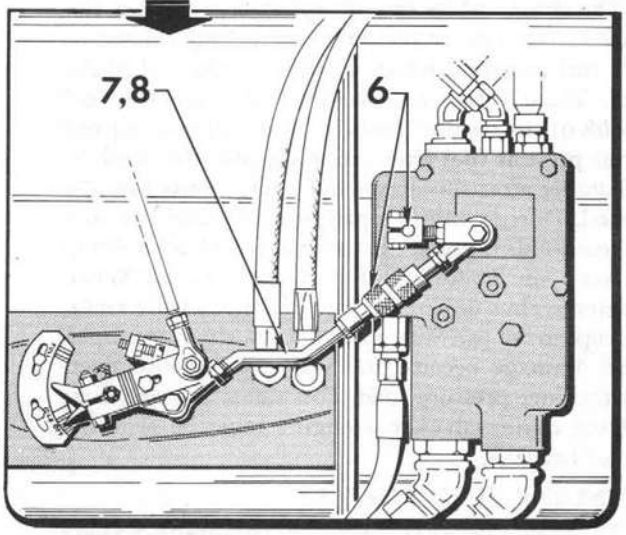
5-93. ADJUSTING FUEL STOPCOCK LINKAGE. See figure 5-22.

5-94. ENGINE FUEL FLOW DIVIDER.

5-95. The fuel flow divider (paragraph 5-4) consists of a spring-loaded valve which passes fuel to the secondary (large-slot) fuel manifold which directs fuel to the fuel nozzles. The unit is bolted to the bottom of the compressor casing directly aft of the oil cooler by-pass valve. While fuel pressure remains below approximately 40 psi, the flow divider is closed and the total amount of fuel passes directly to the primary (small-slot) manifold and from there to the fuel nozzles. Pressures above 40







1 Adjust graduated plate (on engine island No. 4) to locate screws centrally in plate slots.

2 Rotate engine control shaft counterclockwise to the full closed position.

3 Check that emergency control clevis arm pointer is approximately on center of the "OFF" sector on the graduated plate.

4 Rotate emergency regulator control shaft clockwise (against internal stop).

5 Check or reindex clevis arm on emergency regulator control shaft relative to engine front frame flange as shown. Adjust clevis arm to length shown.

6 Rotate emergency regulator control shaft counterclockwise against stop; then adjust control rod to fit and install between clevis arms. Shorten rod by five full turns of rod end. Rod adjustment may be made at quick-disconnect incorporated in rod.

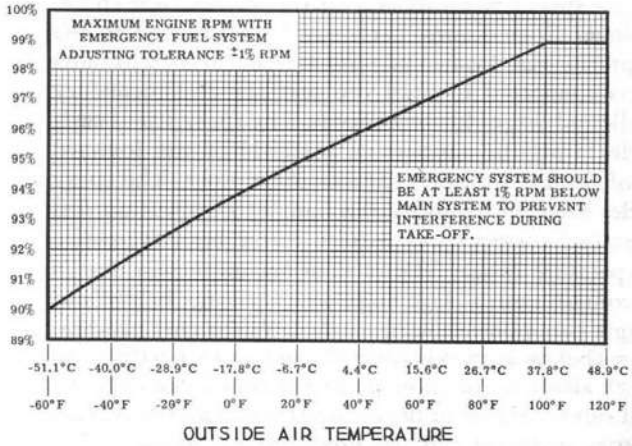
NOTE: Shortening rod allows fuel stop-cock to close fully before emergency regulator internal stop is encountered.

7 Operate linkage and check for full travel and freedom of movement. The linkage should move freely with no evidence of binding.

NOTE: Start engine and, with the emergency fuel system switch in the "OFF" position, advance power control lever to the top rated speed to ensure that 100% rpm is available, when operating with the main system. Move the power control lever to "IDLE"; then accelerate engine to 80% rpm. Hold emergency fuel system switch in the momentary "TEST" position, slowly advance power control lever to maximum stabilized rpm (not to exceed 100% rpm, high rpm stop), and record engine rpm obtained and outside air temperature.

WARNING: If acceleration is extreme, immediately move emergency fuel system switch "OFF" and retard power control lever to prevent engine overspeeding.

8 Shut down engine. If emergency regulator linkage is correctly adjusted, maximum rpm obtained (relative to outside air temperature) will be within 1% rpm of desired rpm listed on chart. If necessary, adjust control rod to obtain desired rpm. Lengthening rod by one full turn of rod end decreases engine speed by approximately 2%. If desired rpm cannot be obtained by adjusting rod, it is an indication that regulator may be at fault and should be replaced with one known to be correct.



170-42-340C

Figure 5-24. Adjusting and Testing Emergency Fuel Regulator Linkage

psi force open a spring-loaded valve in the flow divider and allow fuel to flow to the large-slot manifold. When open, the flow divider functions as a metering valve, establishing a definite fuel-flow, fuel-pressure ratio system. The fuel flow through the flow divider ranges from 700 to 850 pounds per hour at 60 psi inlet pressure to 6600-7700 pounds per hour at 400 psi inlet pressure. The flow divider chamber is provided with an annular access near the inner end to allow leakage of high-pressure fuel to be collected and returned to the fuel pump inlet. The chamber behind the valve is vented to atmosphere through the engine accessory drain line to prevent undesirable forces acting against the spring forces that hold the valve in the closed position at low fuel pressures. For access to remove or install the fuel divider, the engine must be removed from the fuselage.

5-96. ENGINE FUEL MANIFOLD DRAIN VALVES.

5-97. The drain valves (paragraph 5-4), installed immediately to the rear of fuel flow divider, are connected to each fuel manifold which distributes the fuel to the nozzles. These valves are provided to drain the fuel manifolds of any residual fuel after the engine is stopped and thus prevent fuel from dripping into the combustion chamber after shutdown and being ignited by the hot metal. During engine operation, the fuel pressure in the manifolds is greater than the spring load holding the valves open. Therefore, the valves are closed. When the engine is shut down, the fuel pressure in the manifolds drops to 5-2 psi. When this occurs, the valves open for fuel drainage because the valve spring load overcomes the fuel pressure load. For access to remove or install the drain valves, the engine must be removed from the fuselage.

5-98. ENGINE FUEL NOZZLES.

5-99. The eight duplex fuel nozzles (paragraph 5-4) are mounted in the eight compressor rear frame air passages with the spray tips projecting into the combustion chamber inner liner domes. Each nozzle is attached to the compressor rear frame pad with a gasket and eight bolts and is connected to both the primary and secondary (small- and large-slot) manifolds. The spray tip of each nozzle forms the supporting member of the forward end of the combustion chamber inner liner. The spray nozzles filter and atomize the fuel for combustion and maintain a correct spray pattern throughout the entire fuel pressure range. The nozzles are duplex in design and contain both a large and a small passage or slot and a single common discharge orifice. When fuel pressure is low (below approximately 40 psi), as in starting and at high altitudes, the flow divider is closed and only the small slot feeds fuel to the combustion chamber. As fuel pressure increases and the flow divider opens, fuel is supplied to the large slot as well. The proper spray angle is maintained by the small slot at low flows and by both the small and large slots throughout the rest of operating range. The nozzle incorporates two filters, one for large-slot fuel and one for small-slot fuel.

5-100. REMOVING FUEL NOZZLES. Refer to paragraph 5-36.

5-101. INSTALLING FUEL NOZZLES. Refer to paragraph 5-38.

5-102. FUEL SYSTEM.

5-103. The fuel system (figures 5-25, 5-26, and 5-27) consists of five self-sealing fuel cells, two B-5C booster pumps, a B-5C transfer pump, a filter, a shutoff valve, check valves, and necessary fuel feed and vent lines. The five fuel cells are installed in bays located in the fuselage, center wing, and outer wings. The center wing cell, which contains the booster pumps, is connected to each of the other cells, thus providing a single source of fuel. Normally, fuel from the outer wing and both fuselage cells flows by gravity to the center wing cell. In addition, fuel from the aft fuselage cell is automatically transferred by the transfer pump when the fuel in the center wing is reduced to approximately 56 gallons. Check valves in the fuel cell interconnectors and transfer lines prevent back flow of fuel to the outer wing cell and aft fuselage cell. If the transfer pump and/or booster pump fails, fuel is available by suction feed to maintain engine operation. All fuel cell bays are lined to protect the cells from chafing and to assist in proper cell support. Climb and dive vent lines with a common vent outlet on the fuselage aft left side maintain the proper cell internal pressure during all flight conditions. The fuel shutoff valve is motor-actuated and controlled by the engine master switch. The airplane has provisions for mounting two external droppable metal fuel tanks to supplement the internal fuel supply. (Refer to paragraph 5-140.) A totalizing fuel quantity indicating system (paragraph 5-189) and a fuel filter deicing system (paragraph 5-171) are also provided.

5-104. FUNCTION OF THE FUEL SYSTEM.

5-105. When the engine master switch is moved to the "ON" position (figure 5-28), the fuel shutoff valve is opened. Advancing the power control lever actuates a switch to energize the two booster pumps and the fuel quantity transmitter transfer pump switch. The two energized booster pumps supply fuel to the engine fuel regulation system (paragraph 5-57) through the fuel shutoff valve and filter. When the quantity of fuel in the center wing drops to approximately 56 gallons, the float-actuated transfer pump switch is closed and the aft fuselage cell transfer pump is energized to force fuel into the center wing cell. If the fuel transfer rate exceeds the fuel consumption rate, the fuel level transmitter opens the transfer pump switch when the fuel reaches a predetermined level and de-energizes the transfer pump. If the fuel transfer rate is less than the fuel consumption rate, the transfer pump will remain energized. When the power control lever is retarded to the "OFF" position, the transfer pump switch and both booster pumps are de-energized. When the engine master switch is moved to "OFF," the fuel shutoff valve is energized to close.

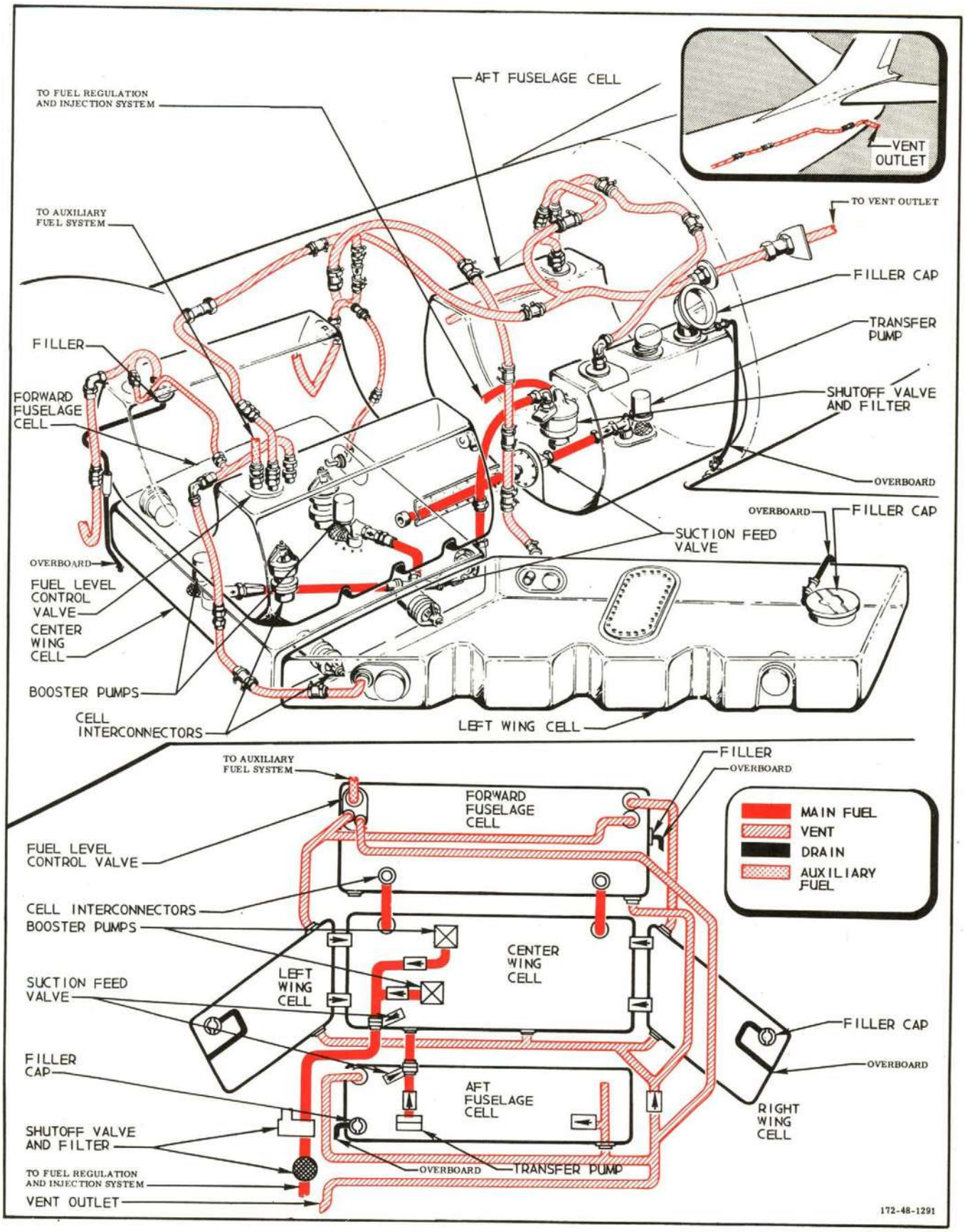


Figure 5-25. Fuel System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

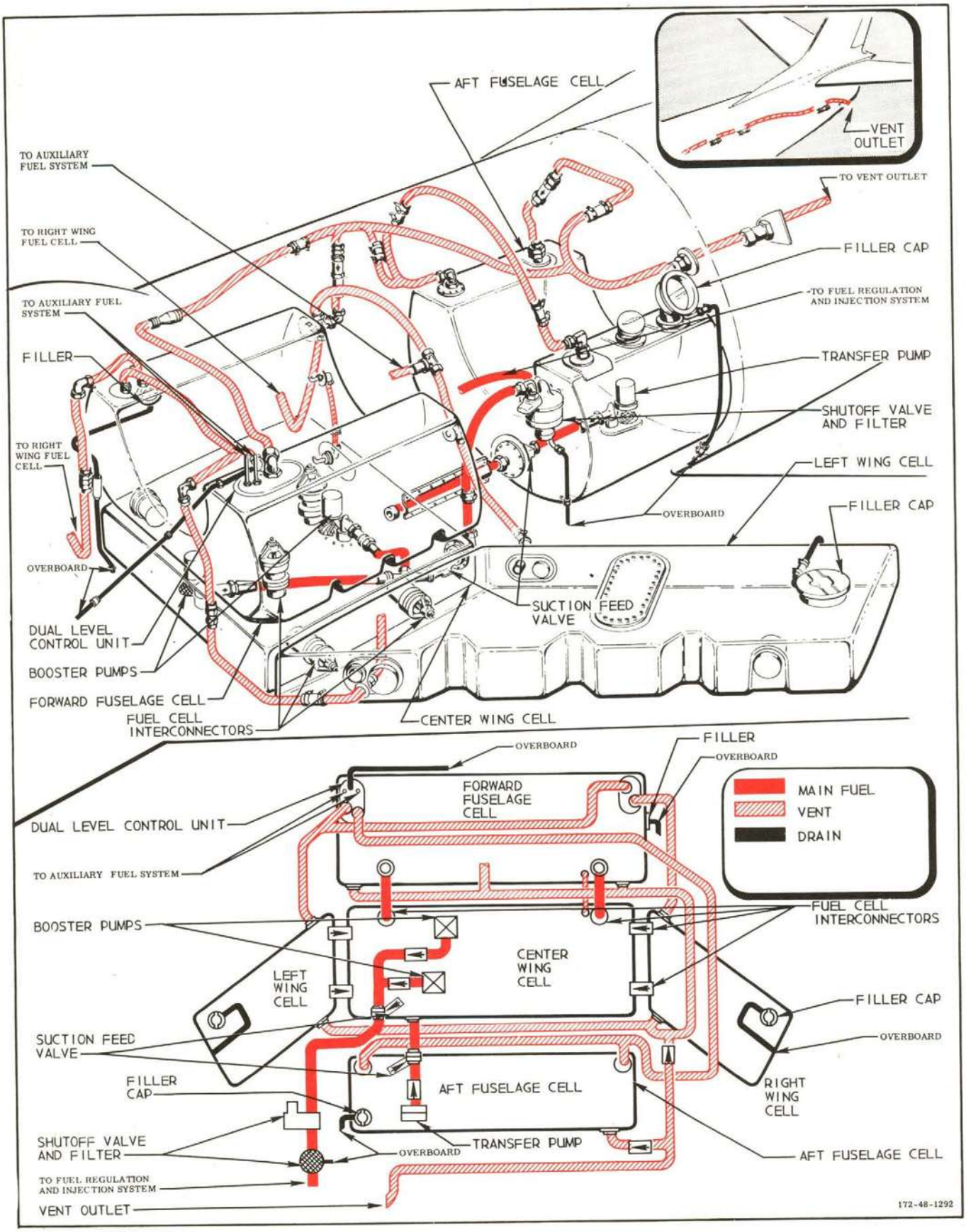


Figure 5-26. Fuel System—F-86E-10 Airplanes AF51-2718 Through -2757

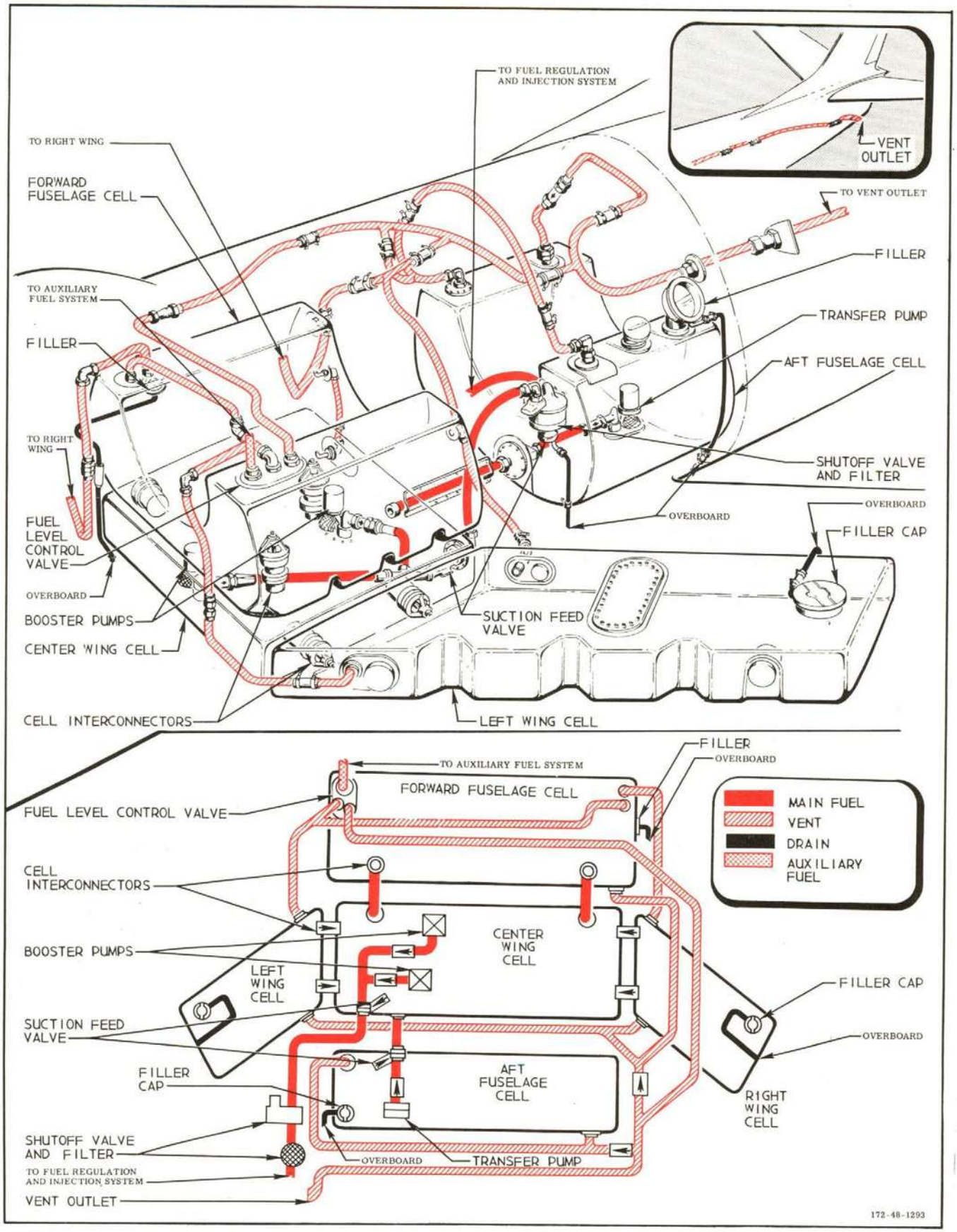


Figure 5-27. Fuel System—F-86E-10 Airplanes AF51—2758 Through—2849 and F-86E-15 Airplanes

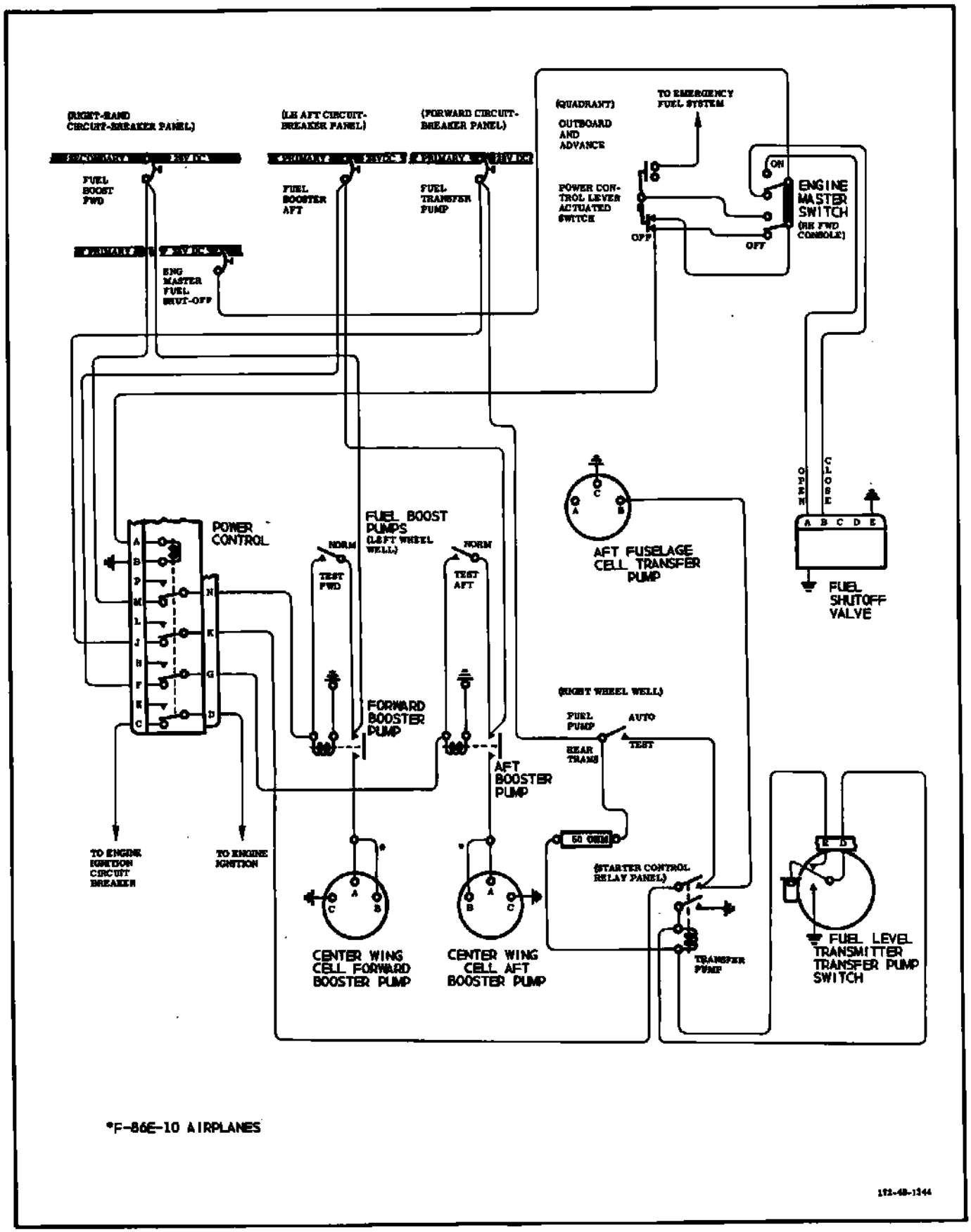


Figure 5-28. Fuel System Schematic

5-106. TROUBLE SHOOTING FUEL SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Fuel leakage around cell access door and unit attachments.	Overtorque or undertorque of attaching bolts. Fuel tank inner liner cracked at corners and around openings. Separation of cell laminations. Cells deteriorated from long use.	Repair or replace fuel cell. Check units for security of fittings and cells for cracks. Repair or replace cells.
Blisters on interior of cell.	Defects in lining, or separation of lining from body of cell. (Possible if cell is left empty for prolonged period.)	Puncture blisters and apply patches. Replace cell if necessary.
Swollen or soft areas.	Gasoline penetrating to sealant through cracks.	Repair or replace cell. Replace cell if swollen area exceeds 25 square inches.
Black or grayish-white particles on fuel filter element.	Defective fuel cells.	Replace filter element. Inspect cells and replace if necessary.
Leakage from fuel lines.	Clamps too tight or too loose. Weather cracks in hose.	Check proper torque for clamps. Replace hose if necessary. Replace hose if threads are visible in cracks.
Booster or transfer pump fails to operate.	Pump brushes worn out. Wiring not properly connected. Loose connection or high resistance in connections.	Replace or repair pump. Clean and tighten all connections.
Transfer pump fails to operate.	Maladjusted or broken float switch.	Adjust or replace switch.
Booster or transfer pump burned out.	Clogging of seal chamber drain line. Deficient bearings or failure of pump seals.	Replace pump. Replace pump.
Fuel leaking from pump seal drain.	Failure of seal or dirt on seal.	Replace pump.
Fuel leaking from pump motor vent.	Fuel leaking into motor through motor cover gasket.	Replace pump.
Pump is noisy.	Loose mounting. Worn bearings.	Tighten mounting bolts and connecting lines. Replace pump.
Unsteady or erratic pump pressure.	Loose connection. Voltage variation. Pump screen clogged. Seizing bearings. Poor commutation.	Remove pump and clean screen. Replace pump. Replace pump.

TROUBLE	PROBABLE CAUSE	REMEDY
Pump pressure is too low.	Low voltage.	Repair or replace pump.
	Worn brushes.	Run pump under load until pressure reaches normal.
	Brushes not seated properly after replacement.	Wire pump for specified duty.
	Pump wired incorrectly.	Replace pump.
	Armature shaft binding.	Check for fuel leakage at vent plug.
	Fuel in motor, indicating possible bearing failure.	If leakage is noted, replace pump.

5-107. TESTING FUEL SYSTEM.

a. Disconnect ignition system by pulling "IGNITION" circuit breaker in cockpit.

b. With airplane in level ground position, open drain in center wing tank.

c. Check the gravity flow lines connecting center wing cell to outer wing cells and to aft fuselage cell as described in steps d., e., and f.

d. Place 5 gallons of fuel in left wing cell. Approximately one gallon should drain from center wing cell.

e. Place 2 gallons of fuel in right wing cell. Approximately one gallon should drain from center wing cell.

f. Place 2 gallons of fuel in aft fuselage cell. Approximately ½ gallon should drain from center wing cell.

g. Close center wing cell drain.

h. Open drains in left and right wing cells and in aft fuselage cell, and drain cells.

i. Place 56 gallons of fuel in forward fuselage cell.

j. Wait at least 3 minutes to permit check valves to seat; then measure fuel flow from the drain of each outer wing cell and aft fuselage cell. Fuel flow from either outer wing cell should not exceed 6 ounces per minute, and from the aft fuselage cell, 8 ounces per minute.

Note

Some leakage will always occur at the aft fuselage cell drain because of a small moisture drain hole through the check valve seat.

k. Completely fill center wing and forward fuselage cells. Fuel flow from the drain of either outer wing cell should not exceed 2 ounces per minute, and from the aft fuselage cell, 14 ounces per minute. Close all drains.

l. Place airplanes in 3¾-degree nose-up position.

m. Place 6 gallons of fuel in aft fuselage cell, and adjust amount of fuel in center wing cell to 56 gallons.

n. With master switch "ON," advance power control lever. Boost pumps in center wing cell and transfer pump in aft fuselage cell should turn on.

o. If transfer pump in aft fuselage cell does not turn on, drain fuel from center wing tank until pump does turn on. If more than 2 gallons drains before pump turns on, adjust transfer pump switch. (Refer to paragraph 5-123.)

p. Permit fuel transfer pump in aft fuselage cell to operate until it automatically turns off. The pump should run approximately one minute.

q. Move power control lever to the "OFF" position.

r. Drain and measure fuel remaining in aft fuselage cell. This fuel should measure approximately 3 gallons.

Note

Transfer pump in aft fuselage cell should turn on when fuel level in center wing tank has been reduced to approximately 56 gallons and should turn off when sufficient fuel has been transferred to raise the level to approximately 59 gallons.

5-108. FUEL SHUTOFF VALVE.

5-109. The motor-actuated shutoff valve (Hydro-Aire 3224 or Whittaker WE451-2D) is located in the left side of the forward engine compartment and is mounted on the fuel filter body. The valve is controlled solely by the engine master switch; moving the switch to "ON" opens the valve, and moving the switch to "OFF" closes the valve. A removable cover in the top of the left wheel well provides access to the shutoff valve.

5-110. FUEL FILTER.

5-111. The fuel filter (Hydro-Aire 3656, Weatherhead 600-76170, or Aero Supply 84821), which utilizes an AN6236-2 micronic filter element, is located in the left side of the forward engine compartment and is accessible through the removable door in the left wheel well. The filter incorporates a relief valve set for 5 (±¼) psi to by-pass the filter element if the element becomes clogged. The 5 psi setting is provided to prevent interference with the ice-indicating pressure switch that operates on a 3½ (±¼) psi pressure differential.

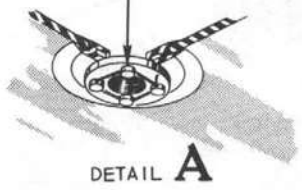
5-112. CLEANING FILTER. To clean the fuel filter, refer to paragraph 5-111, see figures 5-25, 5-26, and 5-27 for location of unit, and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

1 Install drain valve adapter on cell.

AN4H4A BOLT (4 REQD)
AN960D416 WASHER (4 REQD)

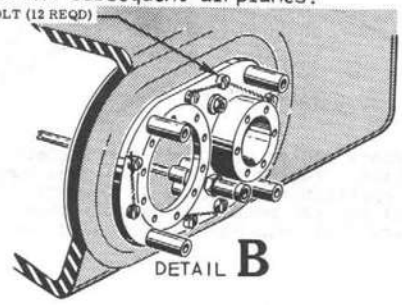


DETAIL A

2 Install adapter (fuel level transmitter and vent) on cell.

NOTE: Adapter with liquidensitometer electrical lead connector is used on F-86E-1 Airplanes AF50-614 through -638, and on F-86E-5 and subsequent airplanes.

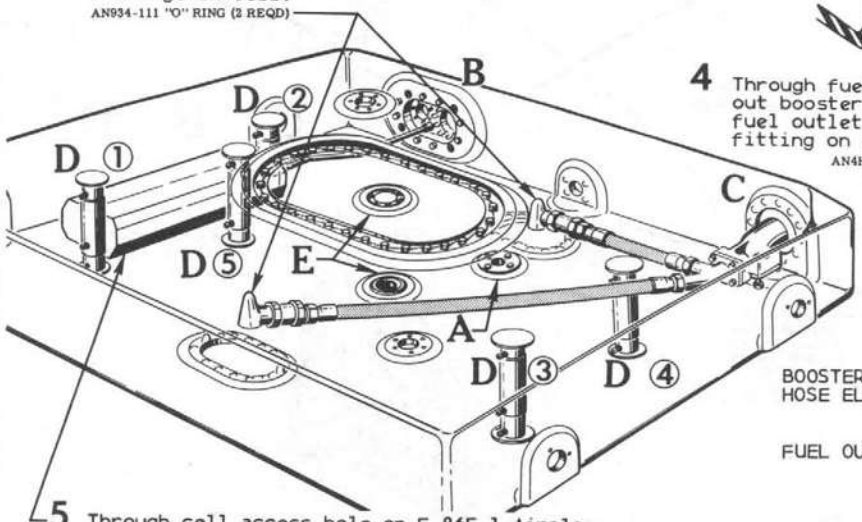
AN4H4A BOLT (12 REQD)



DETAIL B

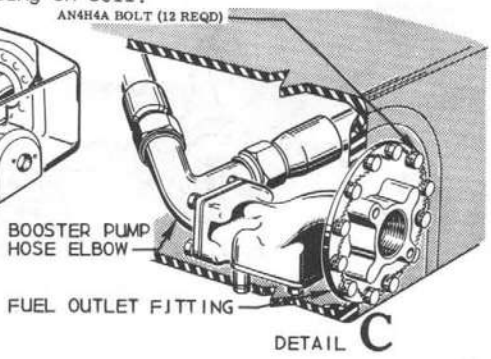
3 Through cell access hole, lay booster pump hoses, check valves, and booster pump outlet fittings in cell.

AN934-111 "O" RING (2 REQD)



4 Through fuel outlet fitting access hole, pull out booster pump hose elbow and connect to fuel outlet fitting; then install fuel outlet fitting on cell.

AN4H4A BOLT (12 REQD)



DETAIL C

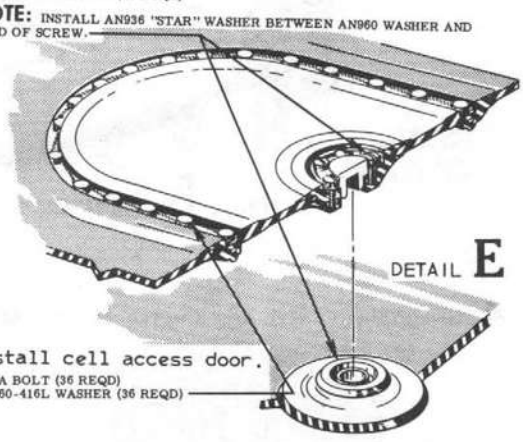
5 Through cell access hole on F-86E-1 Airplanes AF50-614 through -638, and F-86E-5 and subsequent airplanes, install liquidensitometer between support posts and connect electrical lead to adapter (fuel level transmitter and vent).

170-51104-1 AND -2 SUPPORTS
AN515-8R8 SCREW (2 REQD)
AN363C428 NUT (4 REQD)
AN960C416 WASHER (4 REQD)

6 Install structural post adapters on cell and access door.

AN501-416-10 SCREW (12 REQD)
AN936B416B WASHER (12 REQD)
AN960D416L WASHER (12 REQD)

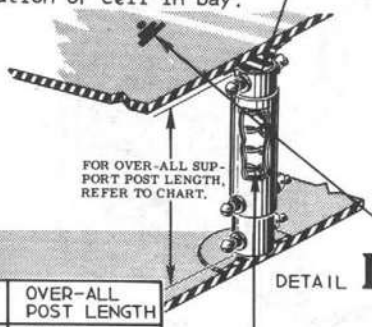
NOTE: INSTALL AN936 "STAR" WASHER BETWEEN AN960 WASHER AND HEAD OF SCREW.



DETAIL E

7 Through cell access hole, secure cell support posts to adapters.

NOTE: Be sure support posts do not slide apart before installation of cell in bay.



DETAIL D

CELL POST POSITION	OVER-ALL POST LENGTH
NO. D1 AND D4	7 INCHES
NO. D2 AND D3	7-3/16 INCHES
NO. 5	7-1/8 INCHES

151-48177-7 SPRING (INSTALLED WITH NO. 5 SUPPORT POST ONLY)

8 Install cell access door.

AN4A BOLT (36 REQD)
AN960-416L WASHER (36 REQD)

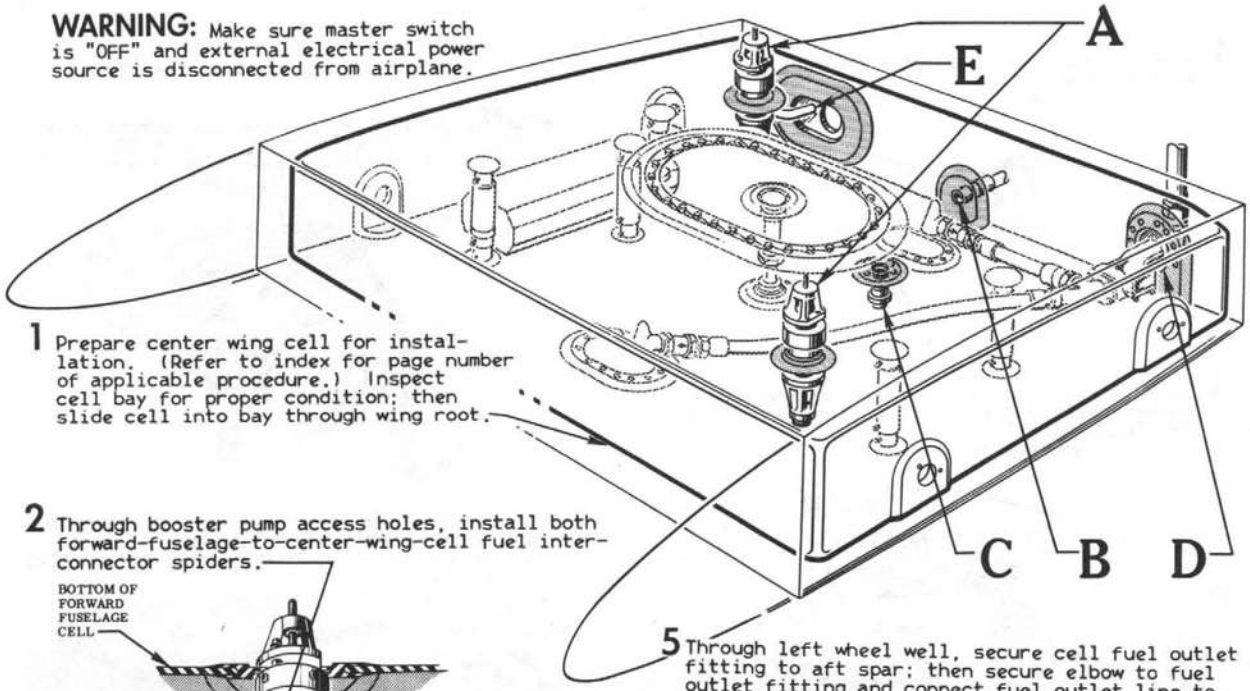
9 Cover cell with talcum powder.

NOTE: Torque bolts and screws evenly and successively to 35 (±5) inch-pounds. Use AN995F32 lockwire where necessary. AN74-3 bolts may be substituted for AN4H4A bolts.

172-48-1294

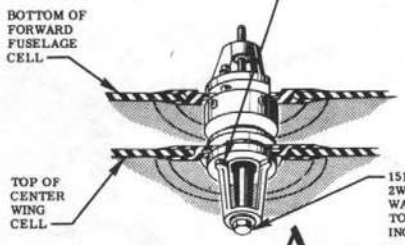
Figure 5-29. Build-up of Center Wing Fuel Cell

WARNING: Make sure master switch is "OFF" and external electrical power source is disconnected from airplane.



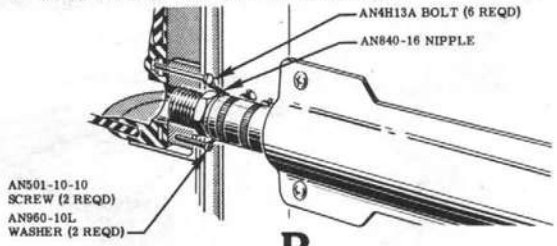
1 Prepare center wing cell for installation. (Refer to index for page number of applicable procedure.) Inspect cell bay for proper condition; then slide cell into bay through wing root.

2 Through booster pump access holes, install both forward-fuselage-to-center-wing-cell fuel interconnector spiders.



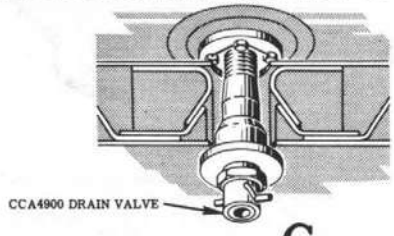
DETAIL A (TYPICAL 2 PLACES)

3 Through left wheel well, connect fuel interconnector to center wing cell.



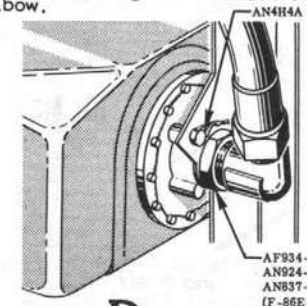
DETAIL B ROTATED 90 DEGREES

4 Secure drain valve and adapter to cell adapter.



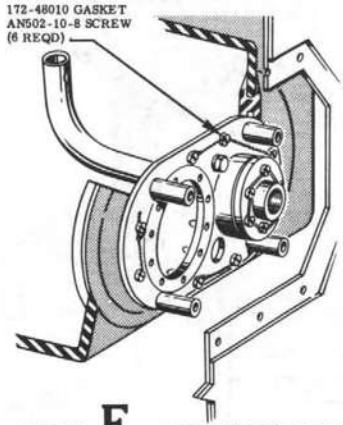
DETAIL C

5 Through left wheel well, secure cell fuel outlet fitting to aft spar; then secure elbow to fuel outlet fitting and connect fuel outlet line to elbow.



DETAIL D ROTATED 90 DEGREES

6 Through right wheel well, install cell vent assembly to adapter.



DETAIL E ROTATED 90 DEGREES

172-48-1295 A

Figure 5-30. Installing Center Wing Fuel Cell (Sheet 1 of 2)

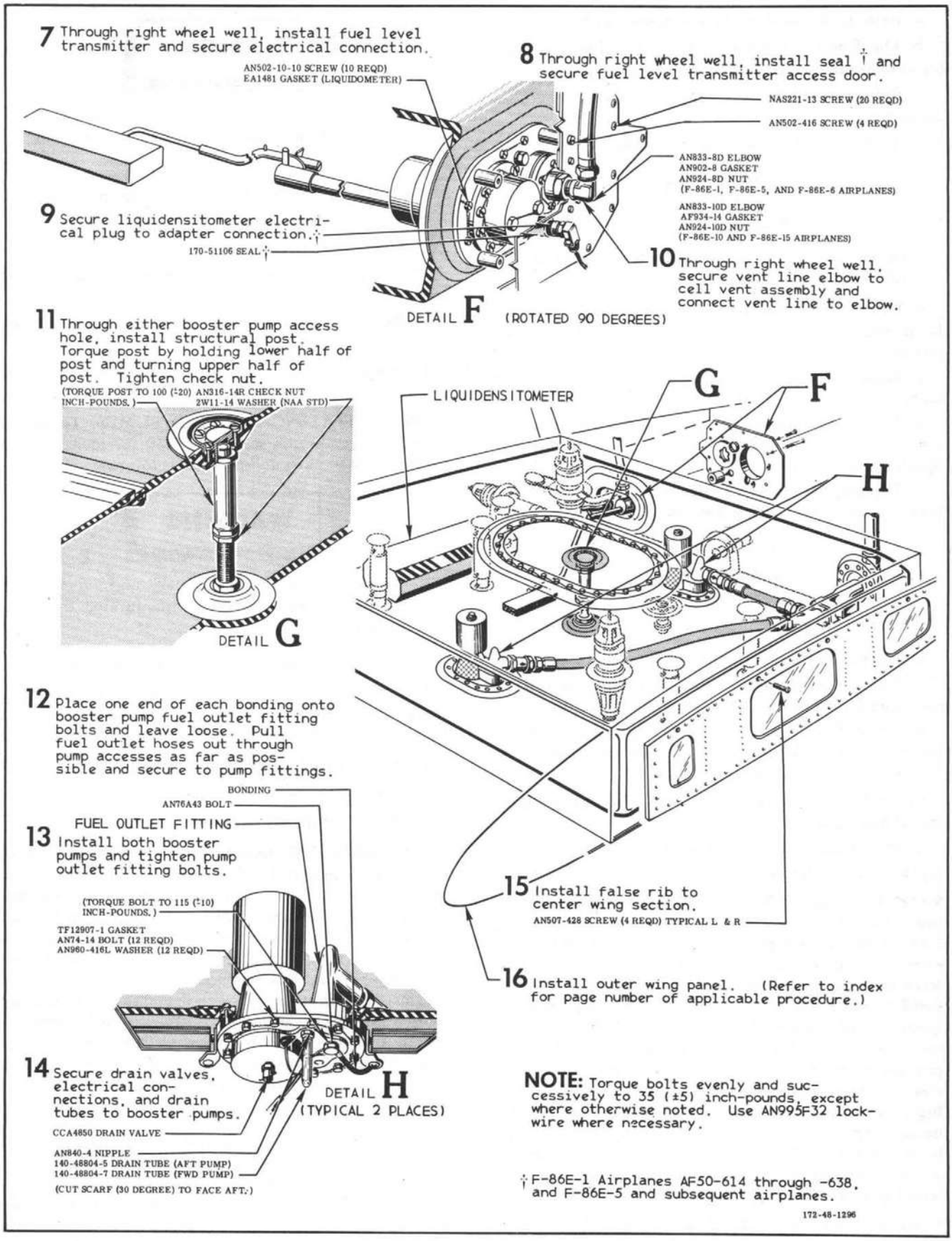


Figure 5-30. Installing Center Wing Fuel Cell (Sheet 2 of 2)

a. Remove access door in left wheel well.

b. On F-86E-1 Airplanes AF50-590 through -599, bleed hydraulic utility system and remove line.

c. Release band from around filter bowl; then remove bowl.

d. Withdraw filter element from bowl.

CAUTION

Do not turn either adjusting bolt on pressure relief valve.

e. Discard filter element if a new element is available. In an emergency, the element may be cleaned for further service.

f. Mask or plug open ends of element to prevent entry of dirt.

g. Using a soft-hair brush, wash all parts, except "O" rings and gaskets, with dry-cleaning solvent (Federal Specification P-S-661).

h. Dip soft-hair brush in solvent and wash filter base; then dry filter base with a lint-free cloth.

CAUTION

Do not use a wire brush on any part of filter.

i. Place filter element in filter bowl.

j. Install "O" rings and top gasket. Use new ones if used ones show evidence of wear or deterioration.

k. Secure filter bowl to filter base by torquing retaining bolt (120 inch-pounds) at bottom center of bowl.

l. Secure band around filter bowl.

m. On F-86E-1 Airplanes AF50-590 through -599, reinstall hydraulic line.

n. Install access door in left wheel well.

5-113. FUEL BOOSTER PUMPS.

5-114. Two Type B-5C submerged booster pumps are installed, one forward and one aft, in the center wing fuel cell. These pumps operate continuously when the engine master switch is "ON" and the power control lever is moved from the "OFF" position. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the booster pumps are wired for high-speed duty operation. These constant-speed centrifugal-type pumps maintain 17 to 23 psi pressure at the booster pump outlet. On F-86E-10 and F-86E-15 Airplanes, the booster pumps are wired so both high- and low-speed windings are energized simultaneously. Speed and pressure are slightly below that of high-speed duty alone. Two single-pole, single-throw, momentary-type toggle switches, located in the left wheel well, are used to ground check the pumps.

5-115. REMOVING BOOSTER PUMPS. To remove a fuel booster pump, see figure 5-30 for identification and location of parts and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Drain fuel system. (Refer to paragraph 1-34.)

b. Remove pump access cover.

c. Disconnect electrical leads.

d. Remove bolt securing fuel outlet fitting to pump base.

e. Remove bolts securing pump to cell mounting flange; then remove pump.

f. Protect mounting flange opening with suitable cover.

5-116. INSTALLING BOOSTER PUMPS. To install a fuel booster pump, see figure 5-30 for identification and location of parts and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Remove protective covering from opening.

b. Lift pump into place and guide fuel outlet fitting inside the cell to pump base; then secure bonding and fuel outlet fittings with attaching bolt.

c. Install bolts securing pump to cell flange.

d. Connect electrical wiring.

e. Install pump access cover.

5-117. CHECKING BOOSTER PUMPS FOR SEAL LEAKAGE. Leakage from the pump seal drain line may indicate a worn or defective pump, or a pump seal that is "lifting off" because of dirt or foreign matter under the seal. If fuel leakage past the pump seal is 8 drops per minute or greater, the pump can be considered defective and must be replaced. If leakage is less than 8 drops per minute, attempt to dislodge dirt or foreign matter and seat the seal by operating pump for approximately one minute. After allowing sufficient time for previous leakage to dissipate, examine pump for seal leakage. If excessive leakage persists, replace pump.

5-118. FUEL TRANSFER PUMP.

5-119. A Type B-5C submerged fuel transfer pump is installed in the aft fuselage cell. The operation of the pump is entirely automatic and is controlled by a transfer pump switch in the fuel quantity transmitter of the center wing cell. The transfer pump switch closes and energizes the pump when the fuel in the center wing cell is reduced to 56 (+1/−3) gallons, and the pump

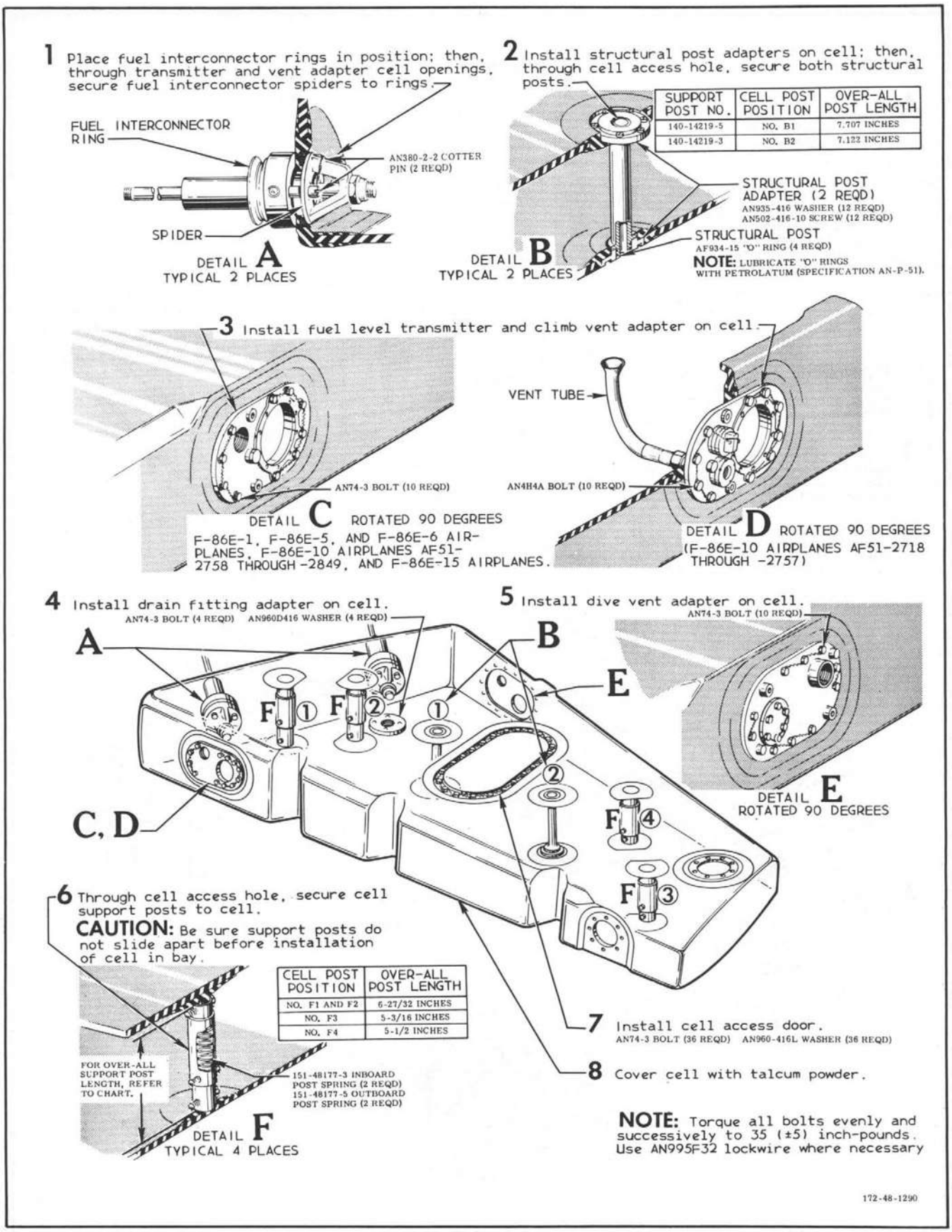


Figure 5-31. Build-up of Outer Wing Fuel Cell

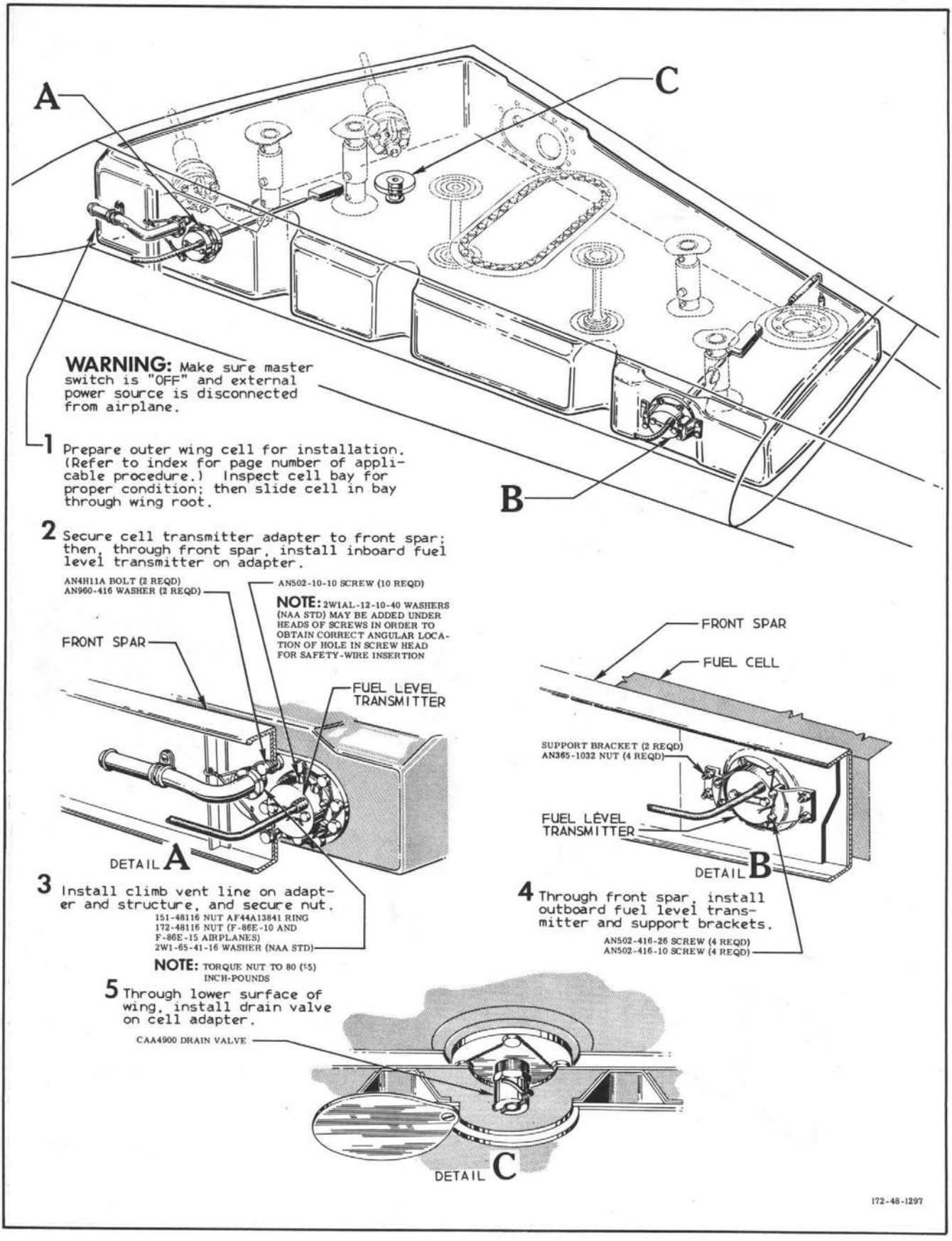


Figure 5-32. Installing Outer Wing Fuel Cell (Sheet 1 of 2)

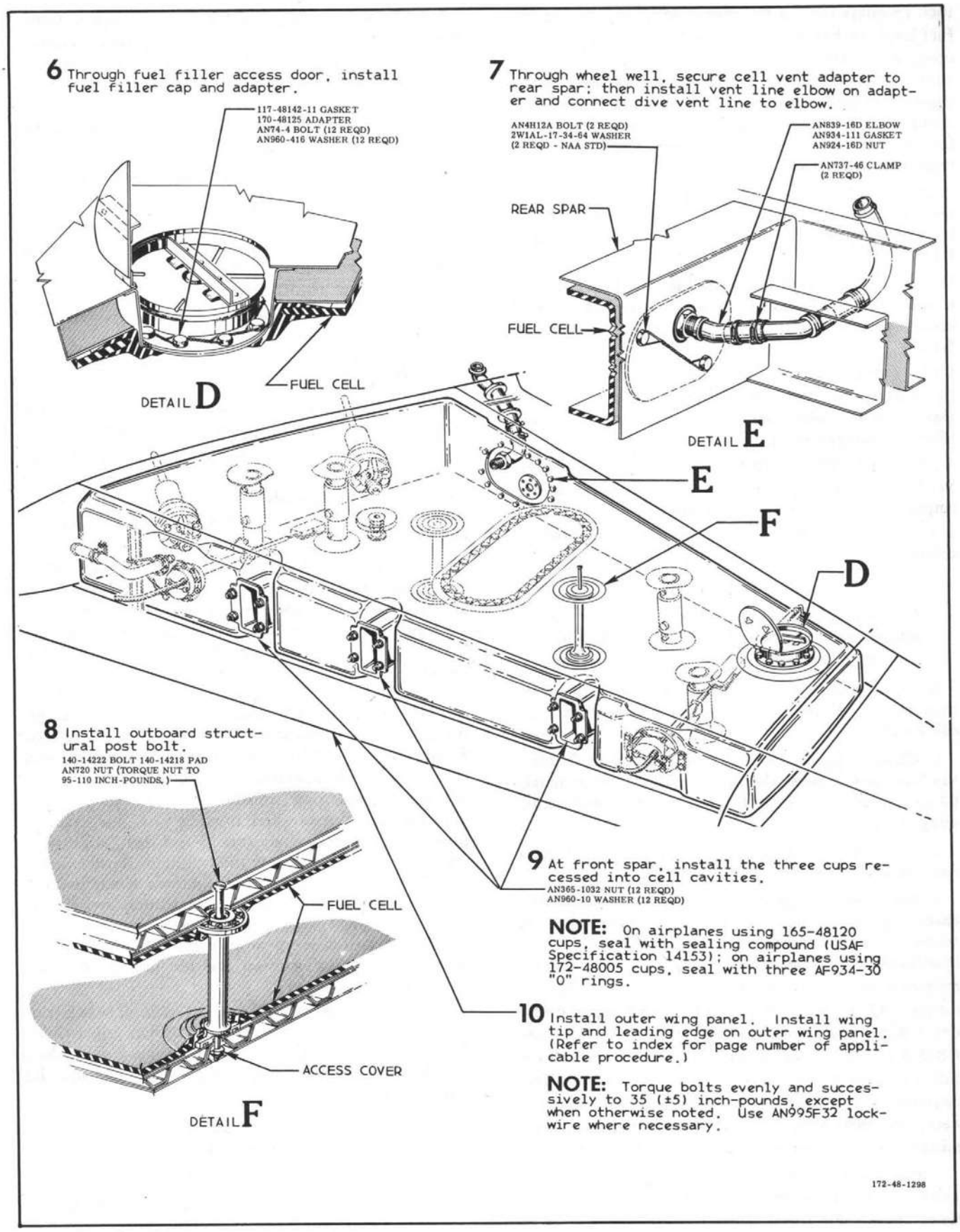


Figure 5-32. Installing Outer Wing Fuel Cell (Sheet 2 of 2)

then transfers fuel to the center wing cell. When the fuel level reaches approximately 59 gallons, the switch opens and de-energizes the pump. A single-pole, single-throw, momentary-type toggle switch, located in the right wheel well, is used to ground check the pump. The pump is of the constant-speed centrifugal type, wired for low-speed duty operation to sustain 9 to 13 psi at the transfer pump outlet.

5-120. REMOVING TRANSFER PUMP. The fuel transfer pump is removed in the same manner as a fuel booster pump. (See figure 5-36 and refer to paragraph 5-115.)

5-121. INSTALLING TRANSFER PUMP. The fuel transfer pump is installed in the same manner as a fuel booster pump. (See figure 5-36 and refer to paragraph 5-116.)

5-122. CHECKING TRANSFER PUMP FOR SEAL LEAKAGE. The fuel transfer pump is checked for seal leakage in the same manner as a fuel booster pump. (Refer to paragraph 5-117.)

5-123. ADJUSTING TRANSFER PUMP SWITCH. With the airplane leveled and all transmitters in the empty position, proceed as follows:

a. Add 86 gallons of fuel through forward fuselage cell filler.

Note

If a new center wing fuel cell has been installed, wait one hour for fuel to settle sufficiently in cell before proceeding to next step.

b. Open both outer wing drains and rear cell drain; then collect all fuel that may have leaked through check valves.

c. Close all drains and add collected fuel to forward fuselage cell. There should now be approximately 80 gallons of fuel in the forward fuselage and center wing cells.

d. Tap center wing transmitter head; then remove transmitter head.

e. On F-86E-1 Airplanes AF50-579 through -613, check and record full B-C resistance of center wing transmitter. This resistance must be 28.6 (±.5) ohms. If adjustment is necessary, move shoe "Y" of the outer resistance strip of transmitter in relation to Bakelite support "Q" to give proper reading. (See figure 5-45.) On F-86E-1 Airplanes AF50-614 through -638 and F-86E-5 and subsequent airplanes, check and record the full A-B resistance of the center wing transmitter. This resistance must be 28.6 (±.9) ohms. If adjustment is necessary, move shoe "Y" on resistance strip of transmitter to give proper reading. (See figure 5-47.)

f. Place airplane in normal cruise attitude of 3¾ degrees nose up, transverse axis level. Slowly drain fuel from center wing cell until remaining fuel is 56 (+1/−3) gallons.

g. If necessary, adjust transfer pump switch in transmitter head by loosening transfer pump switch contact segment adjusting screw (figures 5-47 and 5-48) and moving transfer pump switch contact segment either right or left until transfer pump switch contact arm indicates that transfer pump is "ON." Then tighten contact segment adjusting screw.

h. Add approximately 15 gallons of fuel to aft fuselage cell.

i. With a 28-volt external power supply connected to airplane, pull both booster pump circuit breakers out (off) and move engine master switch to "ON." (This action opens the fuel shutoff valve.)

j. Move and hold power control lever outboard. (This action de-energizes throttle holding relay.)

k. Place engine master switch to "OFF" and allow time for fuel shutoff valve to close (3 to 5 seconds); then pull engine master switch circuit breaker and allow power control lever to move inboard to "OFF."

l. Set transfer pump circuit breaker in (on); this will start transfer pump operating. Operate transfer pump until transmitter transfer pump switch automatically turns pump off. Do not tap transmitter during this operation.

m. On F-86E-1 Airplanes AF50-579 through -613, pull fuel level circuit breaker out (off); then check B-C resistance of center wing transmitter in "OFF" position. This value must be at least 3.6 ohms less than "full" B-C resistance value of 28.6 (±.5) ohms. On F-86E-1 Airplanes AF50-614 through -638 and F-86E-5 and subsequent airplanes, pull fuel level circuit breaker out (off) and check A-B resistance of center wing transmitter in "OFF" position. This value must be at least 8 ohms less than "full" A-B resistance value of 28.6 (±.9) ohms. If it is necessary, this adjustment is accomplished by loosening transfer pump switch carriage adjustment lockscrew and moving *only* the transfer pump switch carriage adjustment arm (full) slightly to the right for correct value; then tighten transfer pump switch carriage adjustment lockscrew. When making this adjustment, be sure that transfer pump switch carriage adjustment arm (empty) does not vary from original position, since adjustment arm must be far enough from switch contact arm not to cause binding during operation.

n. Install transmitter head cover, making sure not to tighten cover retaining screws more than finger-tight. In no case should the screws be torqued more than 2½ inch-pounds; excessive torque may damage the internal parts.

CAUTION

Be sure all internal wiring is clear of both switch segments before installing center wing cell transmitter head cover.

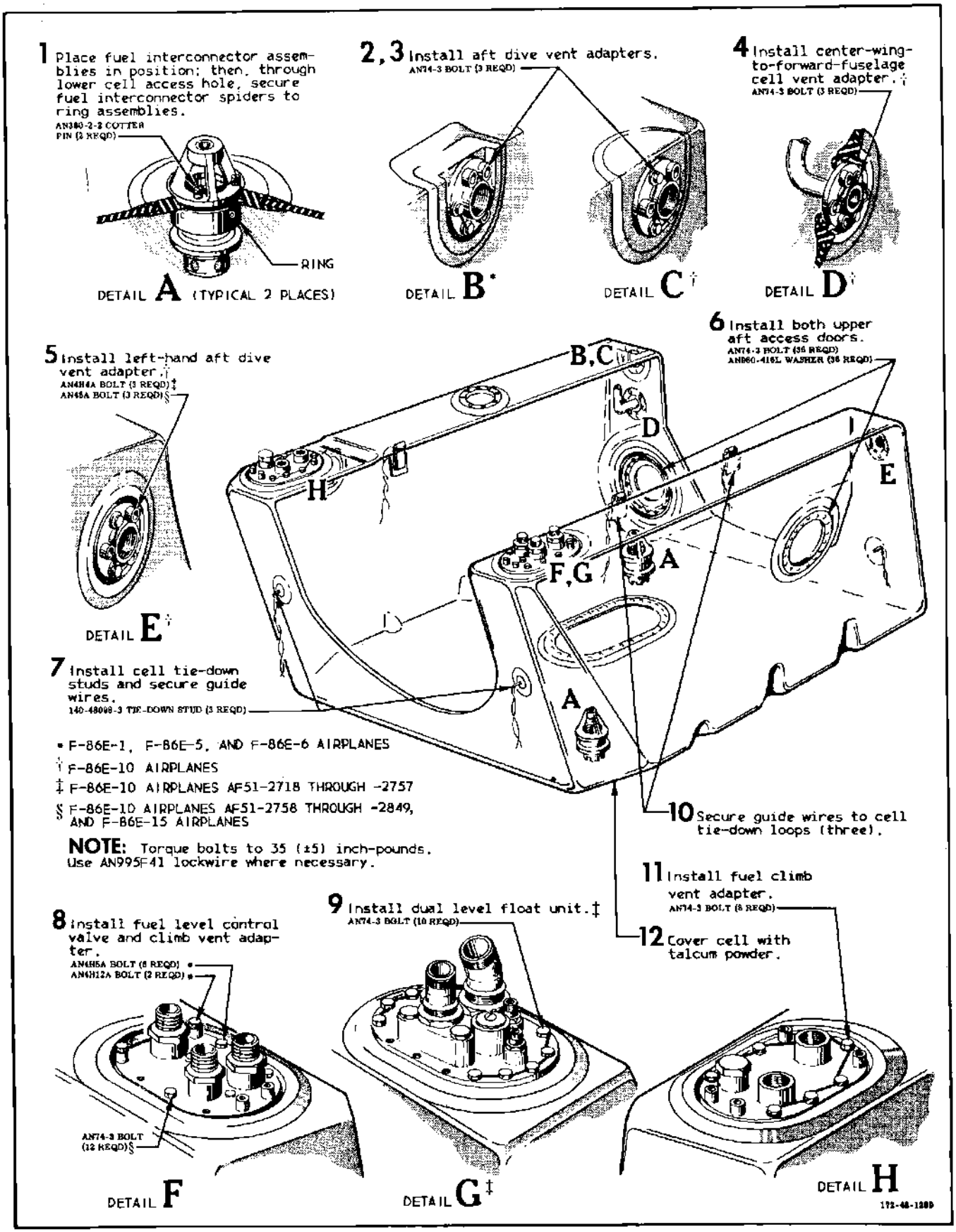


Figure 5-33. Build-up of Forward Fuselage Fuel Cell

WARNING: Make sure master switch is "OFF" and external electrical power source is disconnected from airplane.

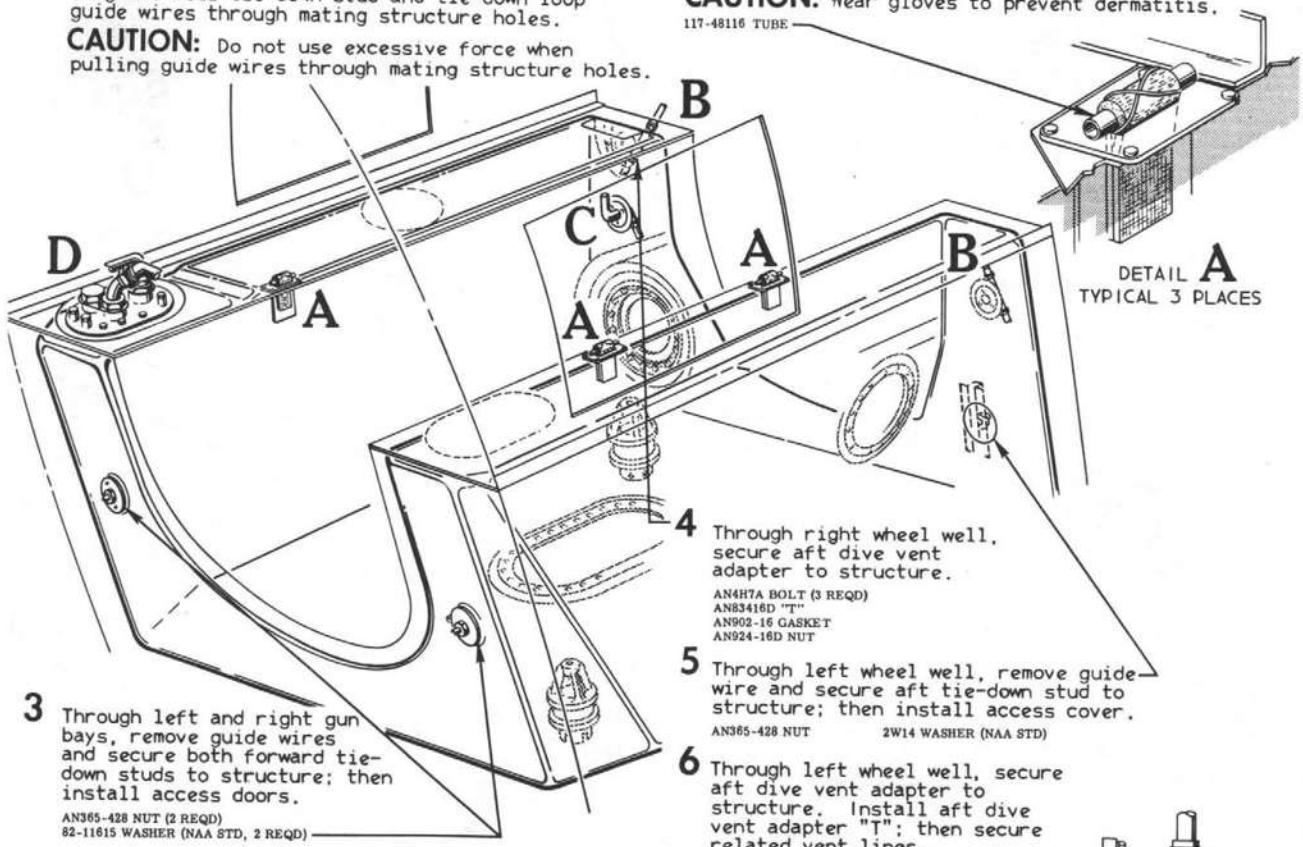
1 Prepare forward fuselage cell for installation.* Inspect cell bay for proper condition; be sure butt joint of upper liner is covered with Specification NA2-4117 tape to prevent chafing of fuel cell. Install cell in bay, being careful to guide cell tie-down stud and tie-down loop guide wires through mating structure holes.

CAUTION: Do not use excessive force when pulling guide wires through mating structure holes.

2 Through left and right radio bays, remove guide wires and secure tie-down loops. Clean area around tie-down loops and apply sealing compound (USAF Specification 14153) over connections.

CAUTION: Wear gloves to prevent dermatitis.

117-48116 TUBE



DETAIL A
TYPICAL 3 PLACES

3 Through left and right gun bays, remove guide wires and secure both forward tie-down studs to structure; then install access doors.

AN365-428 NUT (2 REQD)
82-11615 WASHER (NAA STD, 2 REQD)

4 Through right wheel well, secure aft dive vent adapter to structure.

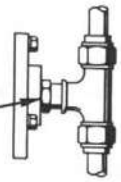
AN4H7A BOLT (3 REQD)
AN83416D "T"
AN902-16 GASKET
AN924-16D NUT

5 Through left wheel well, remove guide wire and secure aft tie-down stud to structure; then install access cover.

AN365-428 NUT
2W14 WASHER (NAA STD)

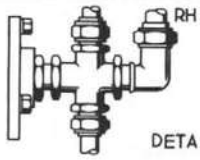
6 Through left wheel well, secure aft dive vent adapter to structure. Install aft dive vent adapter "T"; then secure related vent lines.

AN4H6A BOLT (3 REQD LH SIDE ONLY)
AN4H7A BOLT (3 REQD RH SIDE ONLY)
AN960416L WASHER (3 REQD LH SIDE ONLY)
AN834-16D "T"
AN924-16D NUT
AN934-111 "O" RING



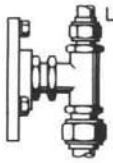
DETAIL B ¶

7 Through right wheel well, secure aft dive vent adapter to structure. Install aft dive vent adapter "T" or cross as specified; then secure related vent lines.



RH SIDE

DETAIL B §



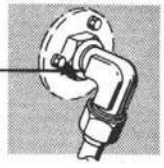
LH SIDE

AN832-16D UNION
AN815-16D UNION (2 REQD)
AN925-16D CROSS
AN833-16D ELBOW
AN924-16D NUT (2 REQD)
AN924-111 "O" RING (5 REQD)
AN4H7A BOLT (3 REQD)

AN832-16D UNION
AN815-16D UNION
AN924-16D NUT
AN926-16D "T"
AN919-27D REDUCER
AN934-111 "O" RING (4 REQD)
AN4H6A BOLT (3 REQD)
AN960D416L WASHER (3 REQD)

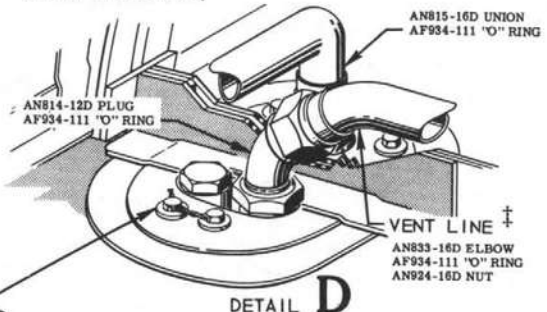
8 Through wheel well, secure center-wing-to-forward-fuselage fuel vent adapter to structure. Install adapter elbow and secure vent line to elbow.

AN960D416 WASHER (3 REQD)
AN4H10A BOLT (3 REQD)
AN833-12D ELBOW
AN924-12D NUT
AF934-107 "O" RING



DETAIL C

9 Install union and climb vent elbow to related fittings and secure related vent lines to union and elbow.



DETAIL D

10 Through right radio bay, secure right-hand climb vent adapter to structure.

AN4H113A BOLT (4 REQD)
2W14 WASHER (NAA STD, 4 REQD)

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Figure 5-34. Installing Forward Fuselage Fuel Cell (Sheet 1 of 2)

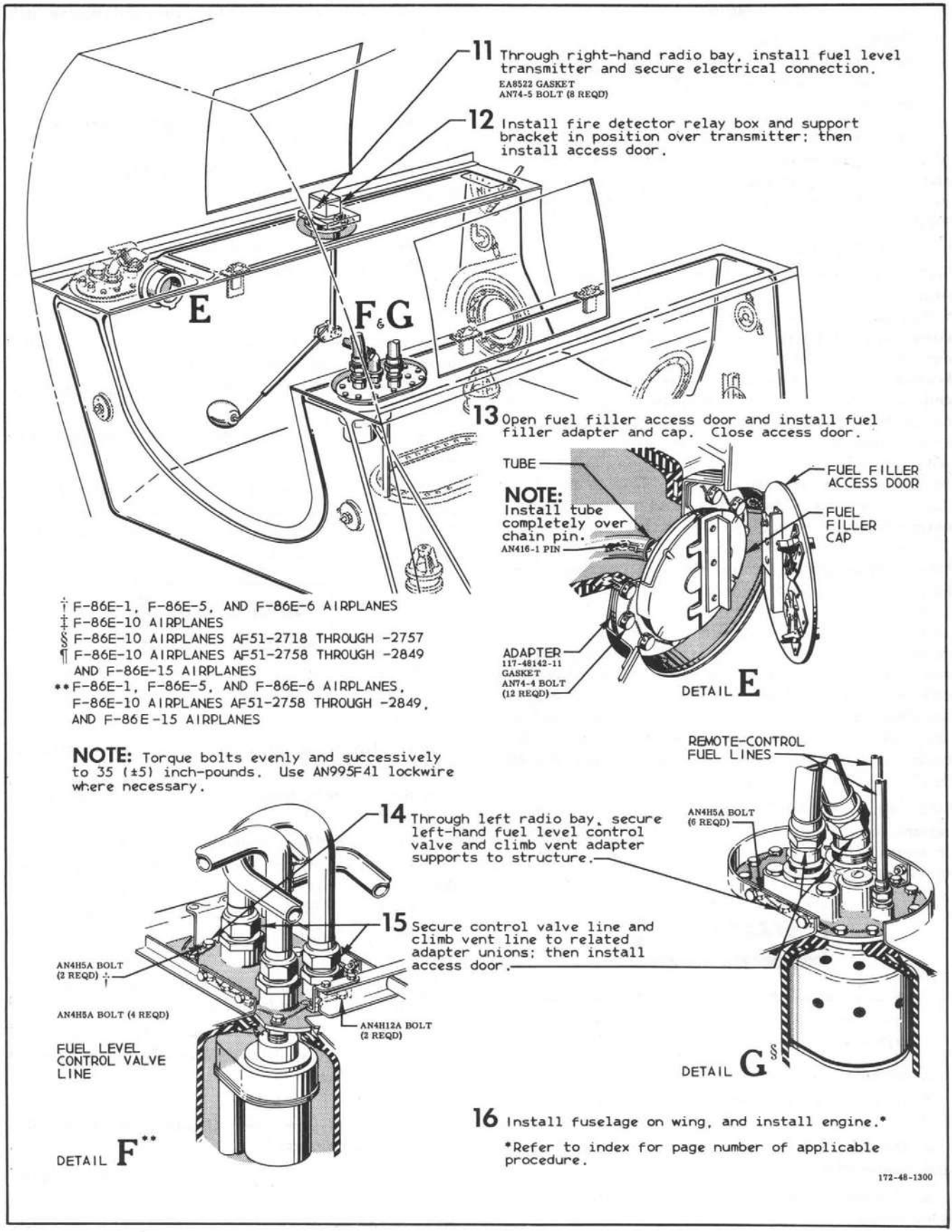


Figure 5-34. Installing Forward Fuselage Fuel Cell (Sheet 2 of 2)

Note

Conduct test in the least possible time to prevent flapper valve leakage from exceeding the allowable tolerance specified for the 56-gallon setting.

o. After adjustment, return airplane to level position, placing engine master switch circuit breaker in (on) and booster pump and transfer pump circuit breakers in (on); then disconnect external electrical power supply.

5-124. FUEL CELLS.

5-125. All internal fuel cells are self-sealing and are suitable for use with aromatic fuel. (See figures 5-25, 5-26, and 5-27.) The cells are supported and held securely in place by various cell fittings, posts, and tiedown fittings. The center wing cell, which contains the booster pump, is connected to all of the other internal cells. All internal fuel feeds into the center wing cell by gravity. A transfer pump in the aft fuselage cell is used to increase the flow when the level in the center wing cell falls to approximately 56 gallons. Filler necks for the fuselage cells are accessible through the flush doors in the sides of the fuselage, and those for the two outer wing cells, through the top surface of the wings. The center wing cell is filled by gravity feed from the forward fuselage cell through the interconnectors. The filler cap and flush access door are designed to prevent complete closing of the door unless the cap is locked in place. Because of design features of the outer and center wing fuel cell interconnector and check valves, and to ensure capacity filling of the outer wing fuel cells, it is essential that the airplane be filled in proper sequence, as follows: The combined forward fuselage and center wing fuel cells must be filled first; the two outer wing fuel cells must be filled next; and the aft fuselage fuel cell must be filled last.

5-126. REMOVING CENTER WING CELL. The parts referred to in the following procedure are identified in figure 5-30. To remove fuel cell, drain fuel system (paragraph 1-34) and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Remove lower center wing fairing.

b. Remove booster pumps. (Refer to paragraph 5-115.)

c. Disconnect fuel line to fuel outlet fitting elbow and remove elbow.

d. Disconnect vent line to fuel vent elbow, and remove elbow.

e. Remove transmitter access door.

f. Disconnect electrical connections and remove fuel level transmitter.

g. Remove fuel vent.

h. Remove drain valve.

i. Remove aft-fuselage-to-center-wing interconnector from center wing cell.

j. Remove lower halves of forward-fuselage-cell-to-center-wing-cell interconnectors.

k. Remove structure post.

l. Remove rib from center wing root.

m. Remove wing outer panel. (Refer to paragraph 2-8.)

n. Remove cell from bay through wing root.

o. Remove adapting parts shown on figure 5-29 for installation on replacement cell.

5-127. BUILD-UP OF CENTER WING CELL. See figure 5-29.

5-128. INSTALLING CENTER WING FUEL CELL. See figure 5-30.

5-129. REMOVING OUTER WING FUEL CELL. The parts referred to in the following procedure are identified in figure 5-32. To remove fuel cell, drain fuel system (paragraph 1-34) and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Remove wing outer panel. (Refer to paragraph 2-8.)

b. Remove outer panel leading edge of wing. (Refer to paragraph 2-18.)

c. Remove outboard structural post bolt.

d. Disconnect aft vent line and remove mating elbow; then remove both bolts securing adapter to rear spar.

e. Disconnect forward vent line and remove nut.

f. Remove fuel filler cap and adapter.

g. Remove drain valve.

h. Remove outboard fuel level transmitter support brackets; then remove transmitter.

i. Remove inboard fuel level transmitter.

j. From forward spar, remove three spar cups recessed into cell cavities.

k. Remove cell from bay.

l. Remove adapting parts (figure 5-31) for installation on replacement cell.

5-130. BUILD-UP OF OUTER WING CELL. See figure 5-31.

5-131. INSTALLING OUTER WING CELL. See figure 5-32.

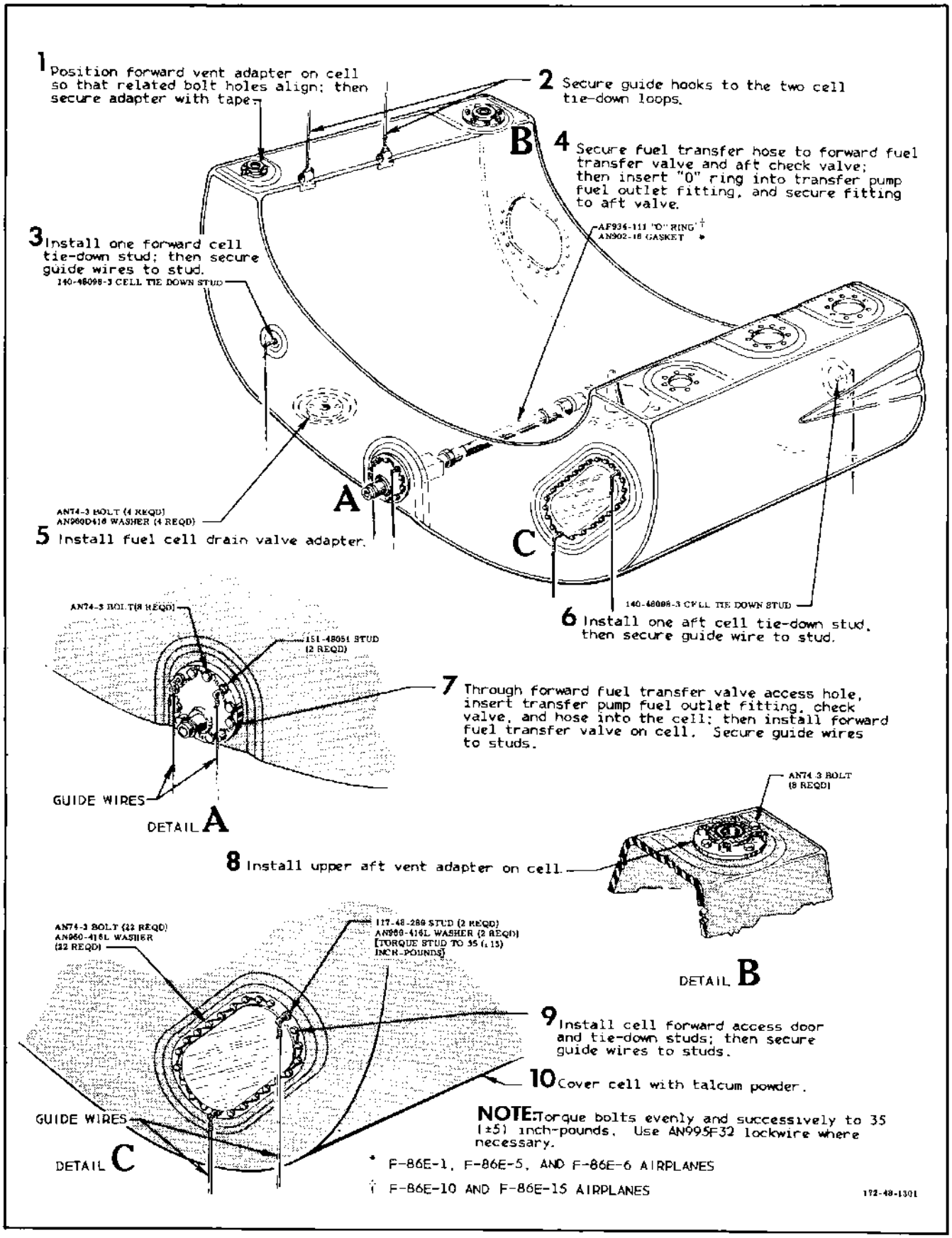


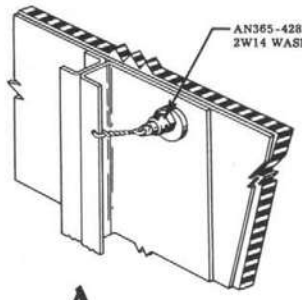
Figure 5-35. Build-up of Aft Fuselage Fuel Cell

WARNING: Make sure master switch is "OFF" and external electrical power source is disconnected from airplane.

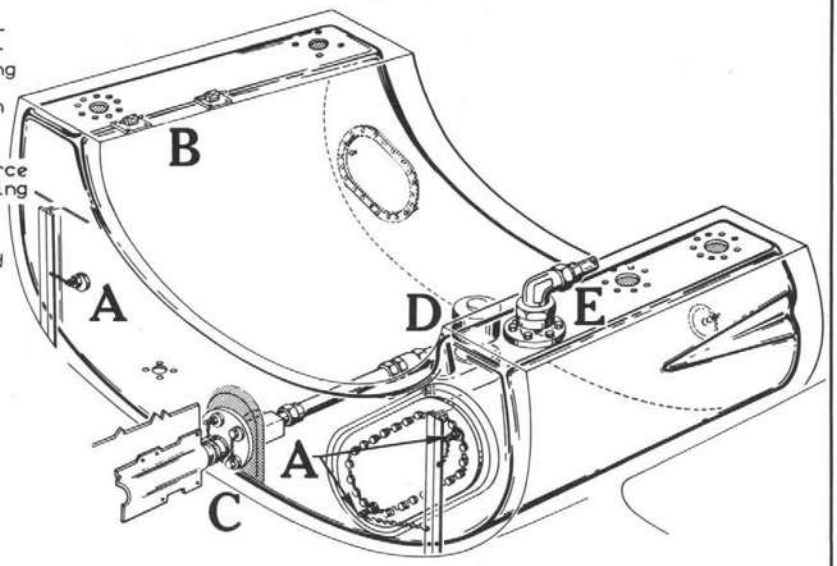
1 Prepare aft fuselage cell for installation.* Inspect cell bay for proper condition. Install cell in bay, being careful to guide cell tie-down stud and tie-down loop guide wires through mating structure holes.

CAUTION: Do not use excessive force when pulling guide wires through mating structure holes.

2 Through left and right wheel wells, remove guide wires and secure forward tie-down studs to structure.

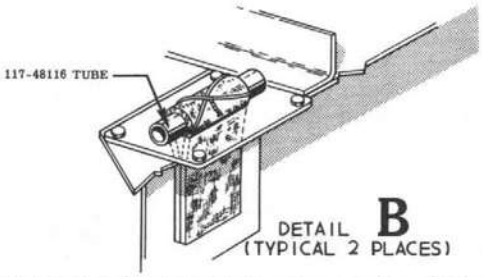


DETAIL **A** (TYPICAL 3 PLACES)



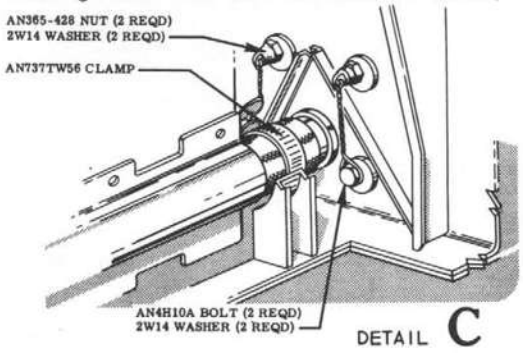
3 Through aft end of fuselage, remove guide wires and secure the two tie-down loops. Clean area and apply sealing compound (USAF Specification 14153) over tie-down loop connections.

CAUTION: Use gloves as a preventive against dermatitis.



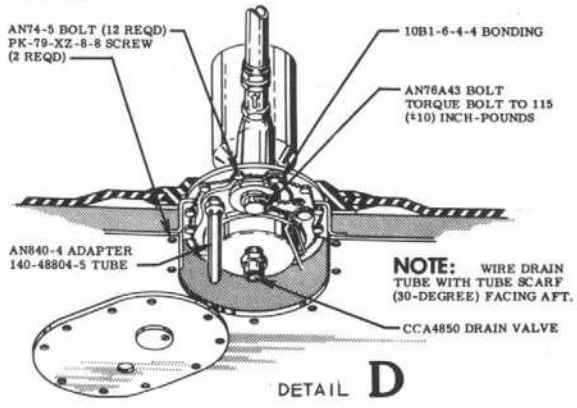
DETAIL **B** (TYPICAL 2 PLACES)

4 Through left and right wheel wells, secure forward fuel transfer valve to structure; then connect center-wing-cell-to-aft-fuselage-cell hose at fuel transfer valve.



DETAIL **C**

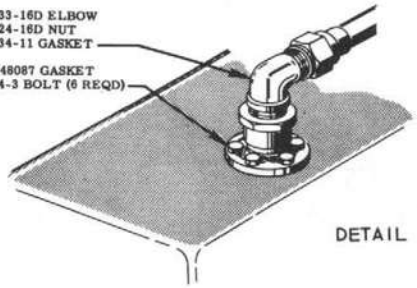
5 Through lower fuselage access hole, install transfer pump, one end of bonding, and support brackets; then secure electrical connections to pump.



DETAIL **D**

6 Through cell aft access hole, align transfer pump fuel outlet fitting to transfer pump base; then, through lower fuselage transfer pump access hole, install fuel outlet fitting bolt and other end of bonding. Install transfer pump access cover plate.*

7 Through aft end of fuselage, install forward vent adapter and elbow; then secure vent line to elbow.



DETAIL **E**

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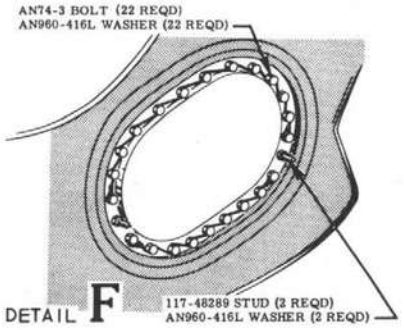
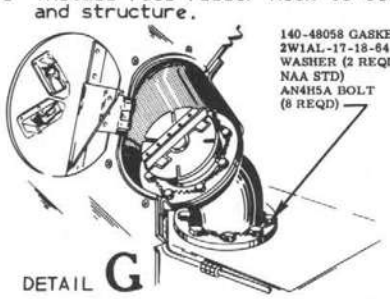
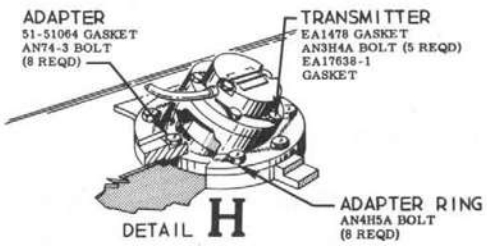
Figure 5-36. Installing Aft Fuselage Fuel Cell (Sheet 1 of 2)

8 Install fuel cell access door and tie-down studs.



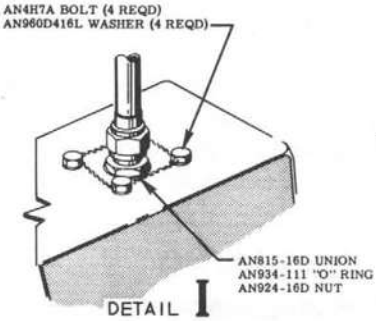
9 Install fuel filler neck to cell and structure.

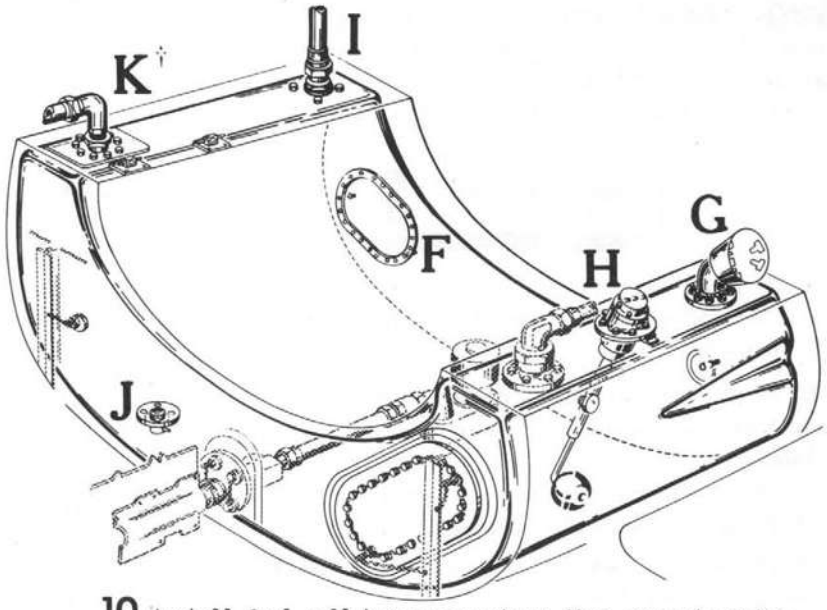




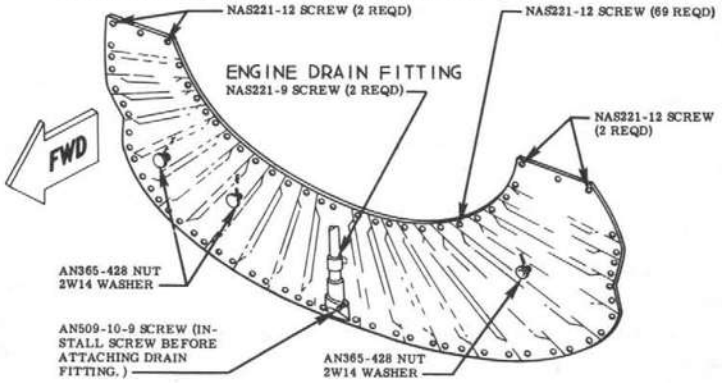
12 Through aft end of fuselage, secure adapter ring to fuel cell; then install fuel level transmitter and adapter to adapter ring. Secure electrical connections.

13 Through aft end of fuselage, secure aft vent adapter to structure; then secure union to adapter and vent line to union.





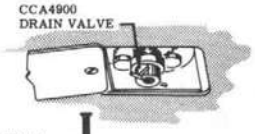
10 Install fuel cell bay access door; then connect engine drain fitting and hose to access door.



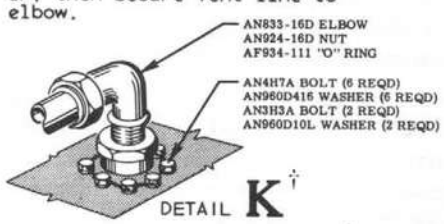
11 Secure the three aft tie-down studs to cell bay access door; then clean area around any tie-down stud where a gap occurs and apply sealing compound (USAF Specification 14153) over stud connection.

CAUTION: Use gloves as a preventive against dermatitis.

14 Through fuselage drain valve access hole, install drain valve; then secure drain valve access cover.



15 Through aft end of fuselage, secure forward climb vent adapter to cell and structure. Secure elbow to forward climb vent adapter; then secure vent line to elbow.



16 Install engine.*

NOTE: Torque bolts evenly and successively to 35 (±5) inch-pounds, unless otherwise specified. Use AN995F32 lockwire where necessary.

*Refer to index for page number of applicable procedure.

†F-86E-10 and subsequent airplanes

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Figure 5-36. Installing Aft Fuselage Fuel Cell (Sheet 2 of 2)

5-132. REMOVING FORWARD FUSELAGE CELL (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES). The parts referred to in the following procedure are identified in figure 5-34. To remove fuel cell, drain fuel system (paragraph 1-34) and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Remove engine. (Refer to paragraph 5-7.)

b. Separate fuselage and wing. (Refer to paragraph 2-146.)

c. Remove fuel cell lower access door.

d. Disconnect both vent lines at aft vent adapter.

e. Remove "T" and disconnect aft vent connection adapter from structure.

f. Remove fire detector unit over transmitter; then disconnect electrical connection and remove fuel level transmitter.

g. Remove fuel filler cap and adapter.

h. Through cell lower access hole, remove fuel level control valve from bottom of fuel level control valve and vent adapter.

i. Disconnect fuel level control and vent lines from fuel level control valve and vent adapter.

j. Disconnect fuel level control valve and vent adapter from structure.

k. Remove forward inboard plug at right vent adapter.

l. Disconnect vent line and union from right vent adapter.

m. Disconnect right vent adapter from structure.

n. Disconnect aft tie-down stud from structure.

o. Disconnect both forward tie-down studs.

p. Remove sealing compound and disconnect three tie-down loops.

q. Remove cell from bay.

r. Remove adapting parts (figure 5-33) for installation on replacement cell.

5-133. REMOVING FORWARD FUSELAGE CELL (F-86E-10 AND F-86E-15 AIRPLANES). The parts referred to in the following procedure are identified in figure 5-34. To remove fuel cell, drain fuel system (paragraph 1-34) and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Remove engine. (Refer to paragraph 5-7.)

b. Separate fuselage and wing. (Refer to paragraph 2-146.)

c. Remove fuel cell lower access door.

d. Disconnect both vent lines from left and right aft vent adapter.

e. Remove left and right aft vent fittings; then disconnect aft vent adapters from structure.

f. Remove fire detector unit over transmitter; then disconnect electrical connection and remove fuel level transmitter.

g. Remove fuel filler cap and adapter.

h. On F-86E-10 Airplanes AF51-2718 through -2757, disconnect climb vent and remote control fuel lines from dual level float unit.

i. On F-86E-10 Airplanes AF51-2758 through -2849 and F-86E-15 Airplanes, disconnect fuel level control and vent lines from fuel level control valve and vent adapter.

j. On F-86E-10 Airplanes AF51-2718 through -2757, disconnect dual level float unit from structure.

k. On F-86E-10 Airplanes AF51-2758 through -2849 and F-86E-15 Airplanes, disconnect fuel level control valve from structure.

l. Disconnect vent lines and unions from right vent adapter.

m. Disconnect right vent adapter from structure.

n. Disconnect aft tie-down stud from structure.

o. Disconnect both forward tie-down studs from structure.

p. Disconnect center-wing-to-forward-fuselage-cell vent line from upper right elbow.

q. Remove elbow; then disconnect center-wing-to-forward-fuselage-cell vent adapter from structure.

r. Remove sealing compound and disconnect three tie-down loops.

s. Remove cell from bay.

t. Remove adapting parts (figure 5-33) for installation on replacement cell.

5-134. BUILD-UP OF FORWARD FUSELAGE CELL. See figure 5-33.

5-135. INSTALLING FORWARD FUSELAGE CELL. See figure 5-34.

5-136. REMOVING AFT FUSELAGE CELL. The parts referred to in the following procedure are identified in figure 5-36. To remove fuel cell, drain fuel system (paragraph 1-34) and proceed as follows:

WARNING

Be sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Remove engine. (Refer to paragraph 5-7.)

b. Remove aft vent line and union from related adapter.

c. Disconnect aft vent adapter from structure.

d. Disconnect electrical connections and remove fuel level transmitter.

e. Disconnect fuel level transmitter adapter from cell.

f. Disconnect fuel filler neck from cell.

g. Remove drain valve.

h. Disconnect cell bay access door tie-down studs. Remove engine drain fitting from fuel cell bay access door; then remove door.

i. Remove fuel cell aft access door.

j. Disconnect vent line from left-hand forward vent adapter elbow; then remove elbow and vent adapter.

k. Remove fuel transfer pump. (Refer to paragraph 5-120.)

l. Disconnect center-wing-cell-to-aft-fuselage-cell hose from forward fuel transfer valve.

m. Disconnect forward fuel transfer valve from structure.

n. On F-86E-10 and F-86E-15 Airplanes, disconnect vent line from right-hand forward vent adapter elbow; then remove elbow and vent adapter retaining bolts.

o. Remove sealing compound and disconnect tie-down loops.

p. Disconnect forward tie-down studs from structure.

q. Remove cell from bay.

r. Remove adapting parts (figure 5-35) for installation on replacement cell.

5-137. BUILD-UP OF AFT FUSELAGE CELL. See figure 5-35.

5-138. INSTALLING AFT FUSELAGE CELL. See figure 5-36.

5-139. AUXILIARY FUEL SYSTEM.

5-140. In addition to the normal internal fuel supply, an auxiliary fuel system (figures 5-37 and 5-38) is provided. The system comprises the following major components: droppable auxiliary fuel tanks, one mounted under each wing outer panel (on F-86E-1, F-86E-5, F-86E-6, and F-86E-10 Airplanes, 120-gallon tanks only may be used; on F-86E-15 Airplanes, either 120-gallon tanks or 200-gallon tanks may be used); an air pressure regulator valve (on F-86E-1, F-86E-5, and F-86E-6 Airplanes only); an air pressure filter and double restrictor (on F-86E-10 and F-86E-15 Airplanes only); a manual air pressure shutoff valve; a fuel level control valve; tank pressure and thermal relief valves; and tubing to pressurize the tanks and transfer fuel from the tanks to the normal fuel system. The tanks are pressurized by compressed air derived from the cockpit air conditioning and pressurizing system. On F-86E-1, F-86E-5, and F-86E-6 Airplanes (figure 5-37), the air pressure into the tanks is reduced by a pressure regulator valve; on F-86E-10 and F-86E-15 Airplanes (figure 5-38), this reduction is accomplished by means of a filter and a double restrictor. On all airplanes, a pressure relief valve maintains the pressure in each tank at approximately 4.5 psi. The airflow is controlled by the two-position manual air pressure shutoff valve, located on the left console of the cockpit. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, F-86E-10 Airplanes AF51-2758 through -2849, and F-86E-15 Airplanes, the fuel level control valve, located in the forward fuselage fuel cell, automatically controls fuel flow from the auxiliary tanks to the normal fuel system. On F-86E-10 Airplanes AF51-2718 through -2757, a line-mounted, remote-controlled dual level control valve, located near the left-hand aft corner of the forward fuselage cell, automatically controls fuel flow from the auxiliary tanks to the normal fuel system. The tanks are supported by sway braces and the tank shackles. The tanks may be released by use of the normal electrical bomb release system (paragraph 9-4) or by means of a bomb-rocket-tank salvo switch located on the left console. In addition, on F-86E-6, F-86E-10, and F-86E-15 Airplanes, the mechanical bomb release system (paragraph 9-12) may be used to release the tanks.

5-141. FUNCTION OF AUXILIARY FUEL SYSTEM.

5-142. With the engine operating and the air pressure shutoff valve "ON," both tanks are pressurized. When approximately 5 gallons of fuel is consumed from the fuselage forward cell, the fuel level control valve opens, allowing both pressurized tanks to feed into the fuselage forward cell simultaneously. When sufficient auxiliary fuel is transferred to refill the fuselage forward cell, the fuel level control valve closes, shutting off the incoming auxiliary fuel flow. The cycle is repeated until all auxiliary fuel is transferred to the normal fuel system.

5-143. TROUBLE SHOOTING AUXILIARY FUEL SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Fuel fails to transfer from auxiliary tank or tanks.	Air pressure shutoff valve closed.	Refer to paragraph 5-152.
	Clogged air filter.	Refer to paragraph 5-144 or 5-146.
	Restriction or loose connection in air pressure lines.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Air pressure line drain valves open.	
	Tank dive vent valve stuck open.	Clean or replace valve.
	Faulty air pressure relief valve.	Refer to paragraph 5-144 or 5-146.
	Faulty fuel level control valve.	
	Air leak in auxiliary tank.	Pressure-check tank. (See figure 5-40.)

5-144. PRESSURE-CHECKING AUXILIARY FUEL SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

5-145. Pressure-check the system by using an external dry air supply or with the engine in operation as follows:

a. If an external air supply is used, disconnect heating and ventilating air pressure line from pressure regulator and connect an external 20 psi air pressure supply to the regulator inlet.

b. Connect 0 to 25 psi air pressure gages to air outlet connections in bottom of wing outer panels.

c. If external air supply is not used, start and operate engine at 60% (±5%) rpm.

d. Move manual drop tank air shutoff valve to "ON." Both pressure gages at wing air outlet connections should read 4.5 (+1, –½) psi. The pressure differential between the left and right tank should not exceed 1.0 psi. Also note that air comes out of relief valve air discharge openings.

e. Block the relief valve air discharge openings and check pressure gage reading for 10 to 18 psi.

f. Close drop tank air pressure shutoff valve in cockpit.

g. If used, disconnect external air pressure source and connect engine compressor air supply line at regulator. Unblock relief valve discharge air openings.

h. Remove air pressure gages.

5-146. PRESSURE-CHECKING AUXILIARY FUEL SYSTEM (F-86E-10 AND F-86E-15 AIRPLANES).

5-147. Pressure-check the system by using an external dry air supply or with the engine in operation as follows:

a. If an external air supply is used, disconnect heating and ventilating air pressure line from air pressure filter and connect an external 20 psi air pressure supply to filter inlet.

b. Connect 0 to 25 psi air pressure gages to air outlet connections in bottom of wing outer panels.

c. If an external air supply is not used, start and operate engine at 60% (±5%) rpm.

d. Move manual drop tank air shutoff valve to "ON." Both pressure gages at wing outlet connections should read 4.5 (+2, –½) psi. The pressure differential between the left and right should not exceed 1.0 psi. Also note that air comes out of relief valve air discharge openings.

e. Close drop tank air pressure shutoff valve in cockpit.

f. If used, disconnect external air pressure source and connect engine compressor air supply line at filter.

g. Remove air pressure gages.

5-148. AUXILIARY FUEL SYSTEM AIR PRESSURE REGULATOR VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

5-149. The air pressure regulator valve (Binks Mfg Co No. PR100, Type 83A) is installed in the drop tank air pressure line located in the aft end of the left gun compartment. The valve automatically regulates the airflow pressure to the tanks to 5 psi at a flow rate of 5 cubic feet per minute at sea level. The valve is factory adjusted and sealed, which limits maintenance of the unit to removal and replacement.

5-150. AUXILIARY FUEL SYSTEM AIR PRESSURE FILTER (F-86E-10 AND F-86E-15 AIRPLANES).

5-151. The air pressure filter (figure 5-38) is located in the left gun compartment. The filter consists of a single cadmium-plated brass screen housed in the filter body and retainer.

5-152. CLEANING AIR PRESSURE FILTER. To clean an air pressure filter screen, proceed as follows:

a. Remove left gun compartment access door.

b. Remove retainer and "O" ring from aft side of filter.

c. Withdraw filter screen from body.

d. Thoroughly rinse air filter screen in cleaning solvent (Federal Specification P-S-661).

e. Dry filter screen thoroughly with compressed air,

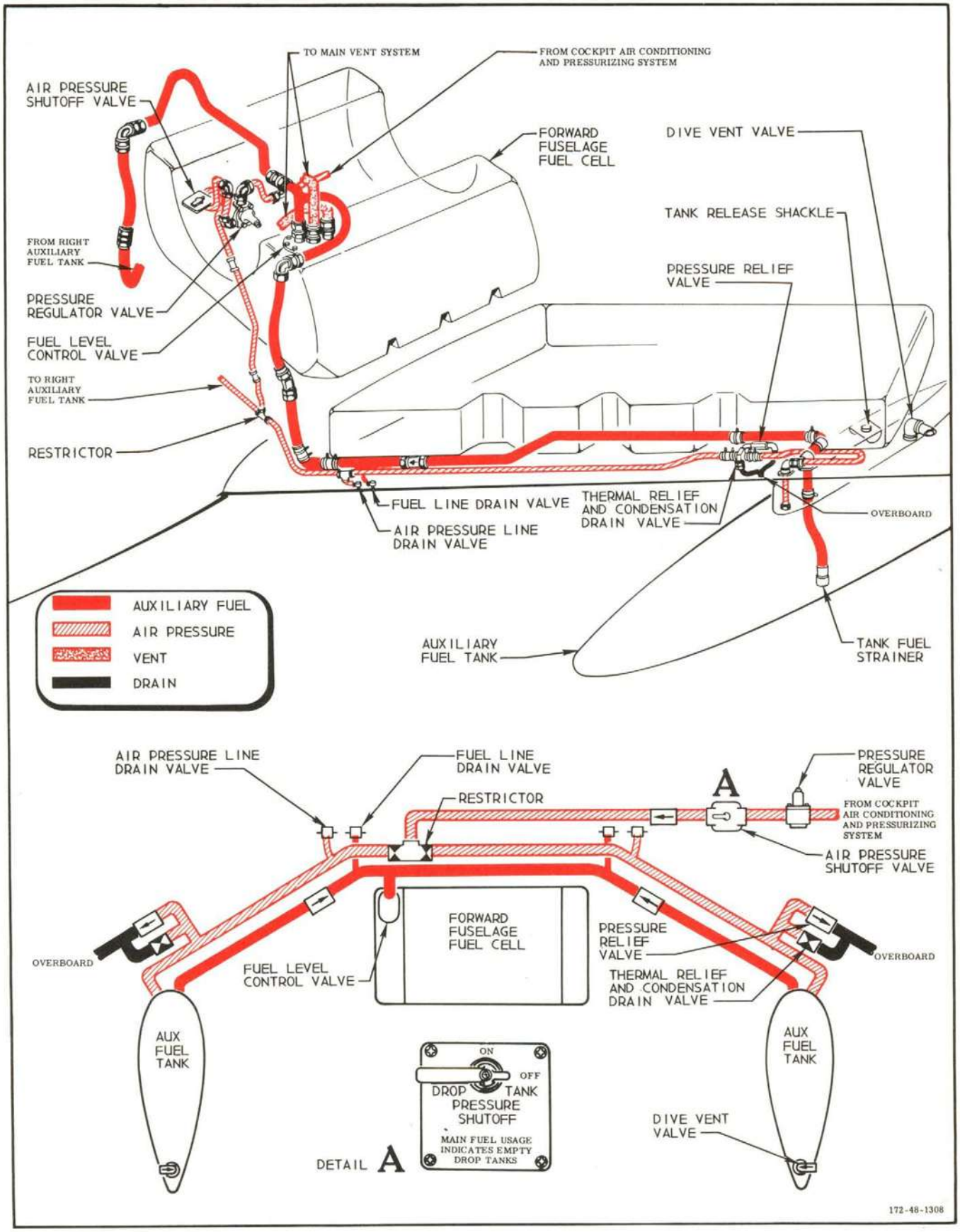


Figure 5-37. Auxiliary Fuel System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

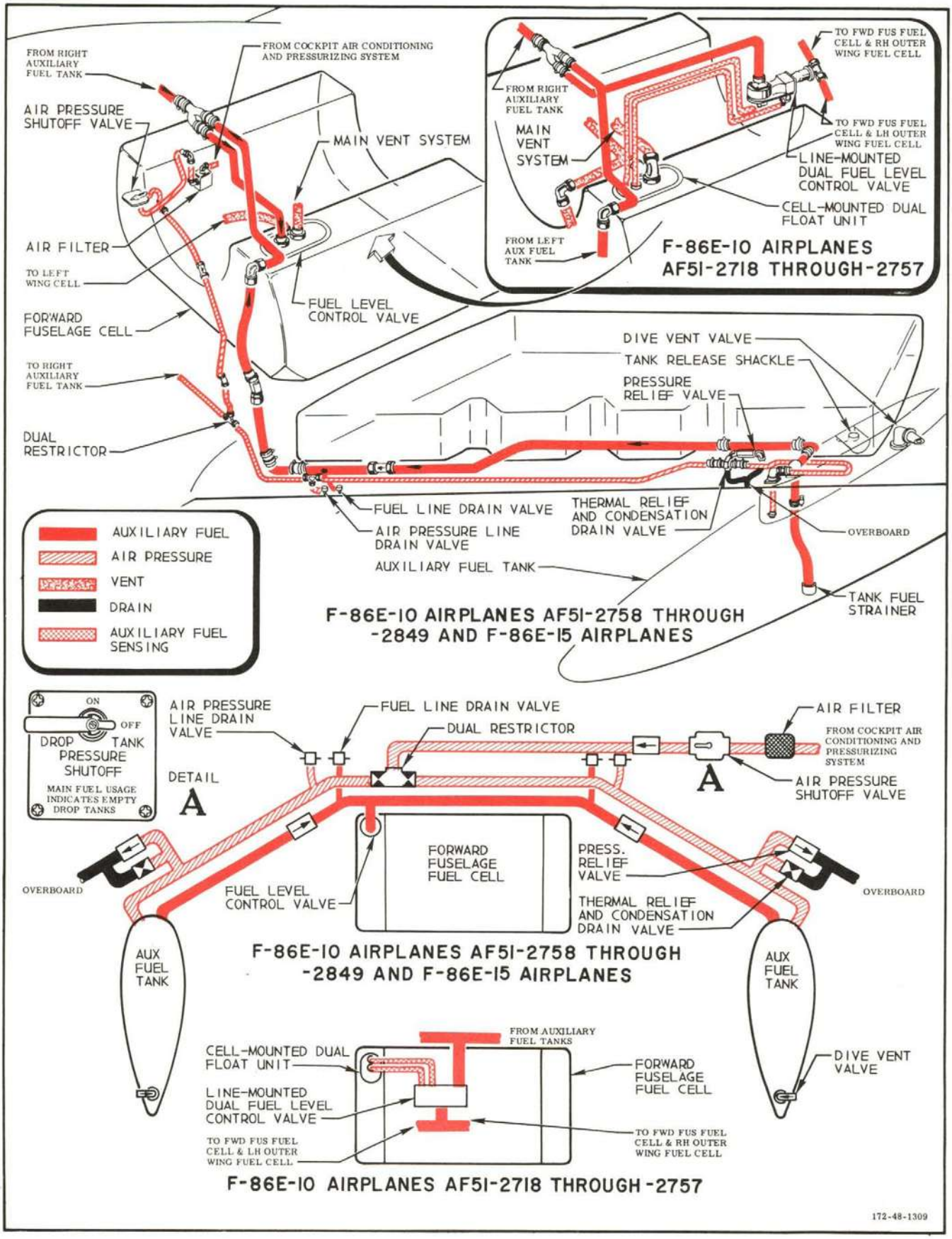


Figure 5-38. Auxiliary Fuel System—F-86E-10 and F-86E-15 Airplanes

being careful not to damage screen with too strong a blast of air.

f. Apply petrolatum (Specification AN-P-51) to new "O" ring; then slip "O" ring on retainer.

g. Check to be sure screen is clean; then insert screen into filter retainer.

h. Screw filter retainer with screen into filter body until metal-to-metal contact is made.

i. Install left gun compartment access door.

5-153. AUXILIARY FUEL LEVEL CONTROL VALVE (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES, F-86E-10 AIRPLANES AF51-2758 THROUGH -2849, AND F-86E-15 AIRPLANES).

5-154. A fuel level control valve (Koehler Aircraft Products Co No. K-1880 D) is installed in the forward fuselage fuel cell. The bottom of the valve consists of a float chamber provided with a float, a float-operated needle valve, and openings to the fuel in the fuel cell. The needle valve seat is located above the float in a partition which forms the bottom of another chamber. A spring-loaded diaphragm seal with a bleed hole in the center forms the upper portion of this chamber. The diaphragm seal seats against the bottom of the fuel inlet screened orifice when the valve is closed. When approximately 5 gallons of fuel is consumed, the float is lowered sufficiently to unseat the needle valve in the partition, thereby causing a pressure drop in the upper chamber. This pressure drop allows the auxiliary fuel feed pressure to force the diaphragm seal down, thus forming a fuel inlet between the screened orifice and the diaphragm seal where the fuel dumps into the fuel cell. When the fuel level in the cell raises the float, the needle valve closes. As fuel enters through the bleed hole, pressure develops in the upper chamber. This larger pressure area under the diaphragm seal, together with spring compression, is sufficient to force the diaphragm seal into place to shut off the fuel flow from the auxiliary fuel system. Whenever the fuel level drops to where the needle valve is opened, the pressure in the chamber is relieved and the valve is ready for another cycle of operation.

5-155. REMOVING CONTROL VALVE. To remove fuel level control valve, proceed as follows:

a. Open aft left radio equipment access door.

b. Disconnect fuel feed line and two vent lines from valve adapter; then disconnect fuel feed line that passes over valve adapter.

c. Disconnect valve adapter from forward fuselage fuel cell; then remove valve adapter with collector and fuel level control valve.

d. Cover opening to forward fuselage fuel cell and cap all lines.

e. Break safety wires and remove angle clip from fuel level control valve; then unscrew valve from collector.

5-156. INSTALLING CONTROL VALVE. To install fuel level control valve, proceed as follows:

a. Apply petrolatum (Specification AN-P-51) to new "O" ring and place "O" ring on valve inlet fitting; then screw valve into collector until metal-to-metal contact is made.

b. Install clip on screw nearest the collector standpipe; then safety-wire to standpipe.

c. Remove cover from valve opening in forward fuselage fuel cell; then install valve adapter with collector and valve.

d. Connect fuel feed line and two vent lines to valve adapter; then connect fuel feed line passing over valve adapter.

e. Install aft left radio equipment access door.

5-157. LINE-MOUNTED DUAL LEVEL CONTROL VALVE AND CELL-MOUNTED DUAL LEVEL FLOAT UNIT (F-86E-10 AIRPLANES AF51-2718 THROUGH -2757).

5-158. The line-mounted dual level control valve (Koehler Aircraft Products Co No. 98105), which controls the fuel level in the forward fuselage cell, center wing cell, and outer wing cells, is located near the aft left corner of the forward fuselage cell. This valve, consisting of two float and diaphragm shutoff valves, is connected by two remote-control fuel lines to the forward fuselage cell-mounted dual level float unit (Koehler Aircraft Products Co No. 98005), which responds to fuel level in the forward fuselage cell to shut off the line-mounted dual level control valve. The primary valve shuts off the incoming fuel at the valve inlet when the forward fuselage cell is full. (This signifies that center wing cell and outer wing cells are also filled to capacity.) If the primary valve should fail, the secondary valve will shut off the incoming fuel.

5-159. REMOVING CONTROL VALVE. To remove line-mounted dual level control valve, proceed as follows:

a. Drain fuel system. (Refer to paragraph 1-34.)

b. Remove left radio bay access door.

c. Disconnect main fuel lines, including both remote-control fuel level transmitter lines, from line-mounted dual level control valve.

d. Break safety wire and remove line-mounted dual level control retaining bolts; then remove valve.

5-160. INSTALLING CONTROL VALVE. To install line-mounted dual level control valve, proceed as follows:

a. Through left radio bay access hole, position line-mounted dual level control valve; then secure and safety attaching bolts.

b. Connect main fuel lines, including both remote-control fuel level transmitter lines, to dual level control valve.

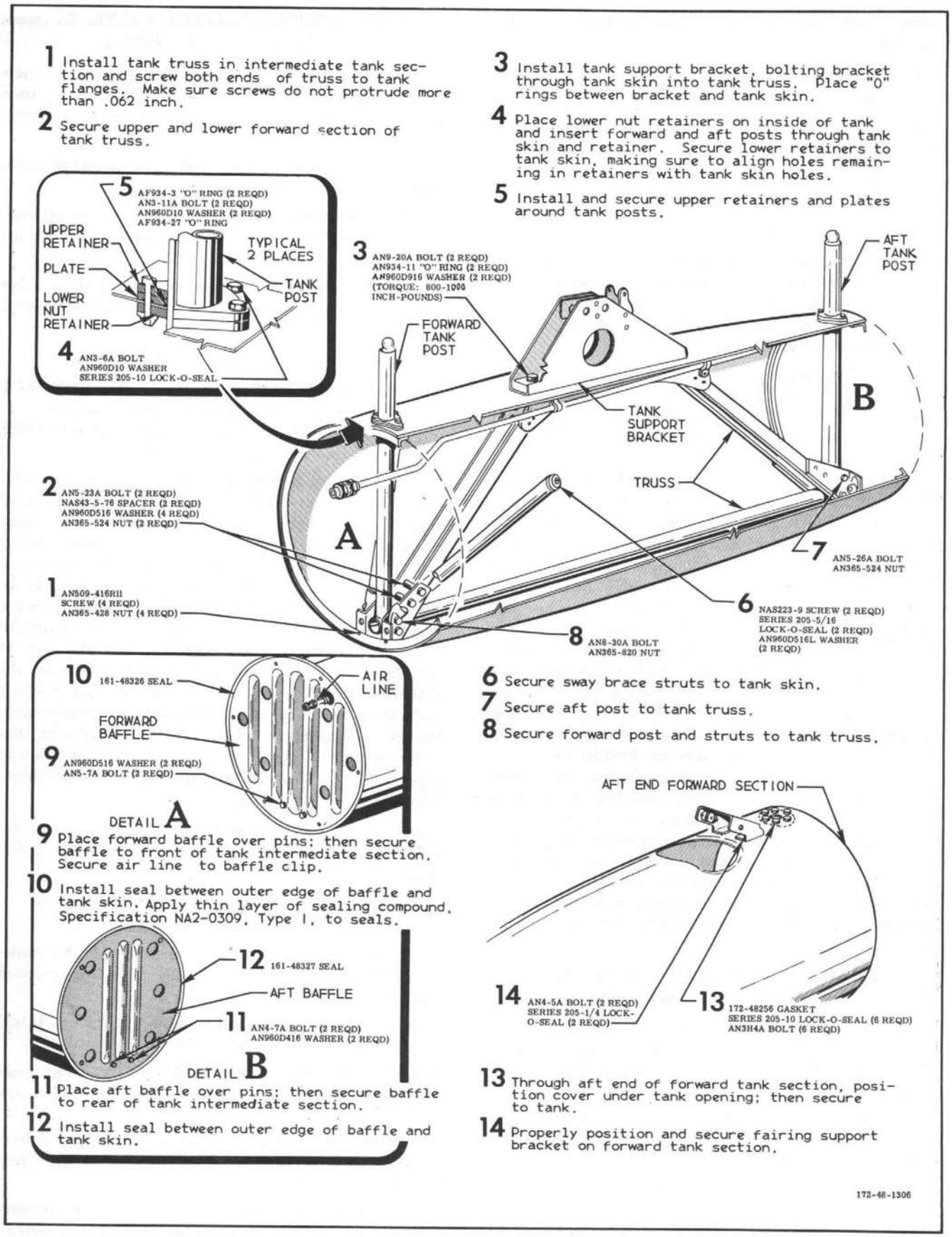


Figure 5-39. Build-up of 120-gallon Auxiliary Fuel Tanks (Sheet 1 of 2)

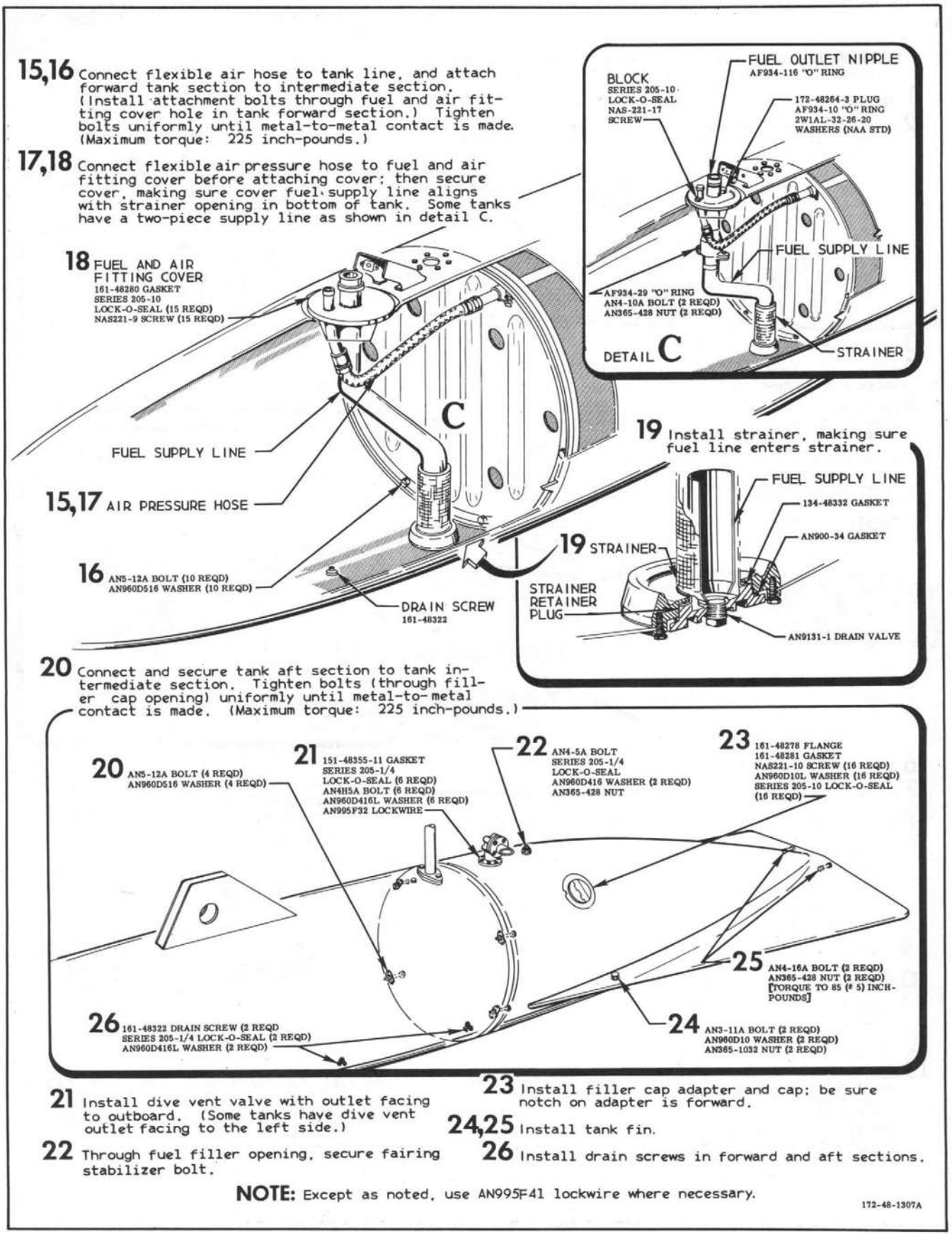


Figure 5-39. Build-up of 120-gallon Auxiliary Fuel Tanks (Sheet 2 of 2)

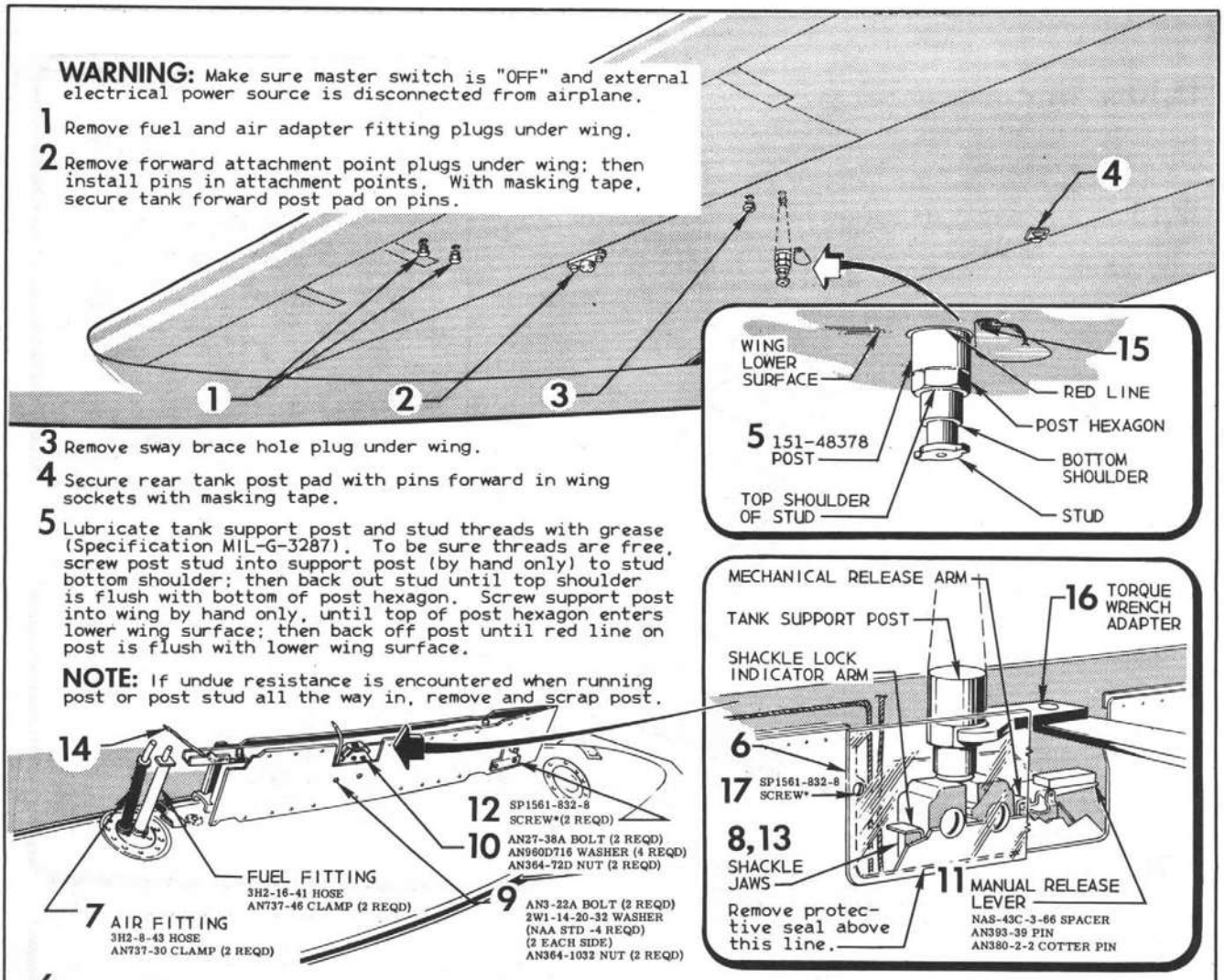
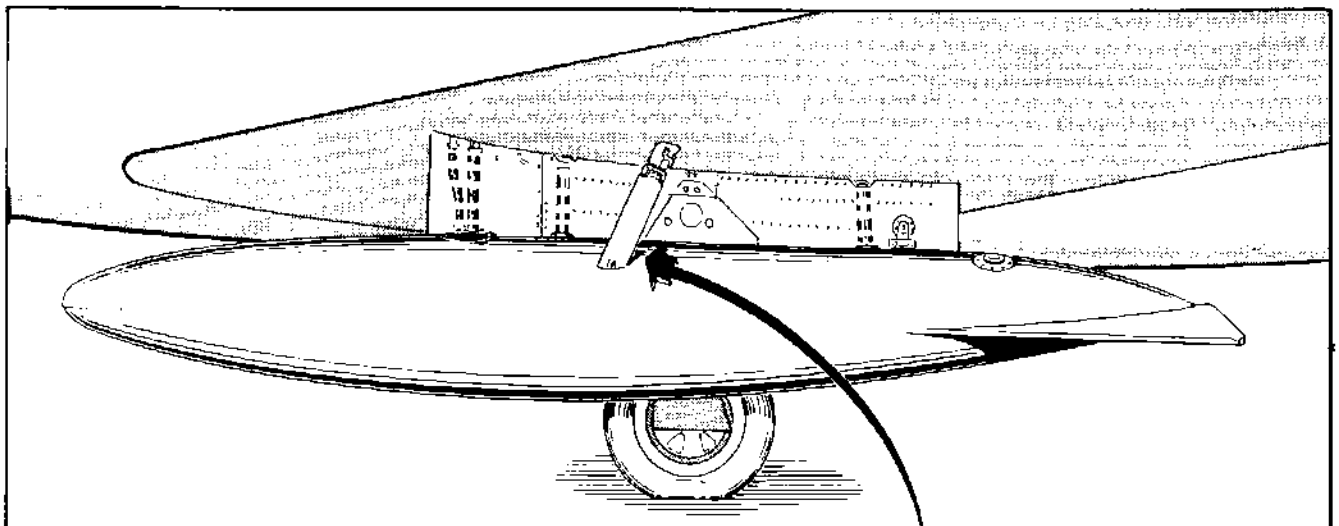


Figure 5-40. Installing 120-gallon Auxiliary Fuel Tanks (Sheet 1 of 2)



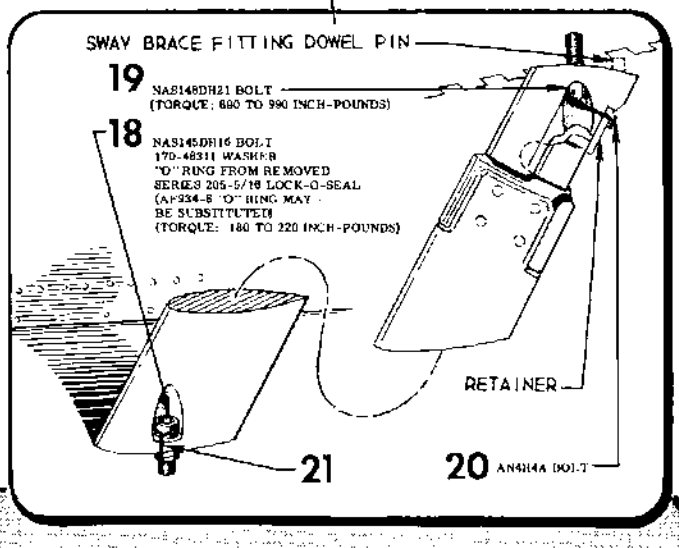
18 Remove tank internal strut screw, washer, and Lock-O-Seal (on outboard front of both wing tanks), and install sway brace on tank. With 170-48311 washer under brace, leave bolt loose.

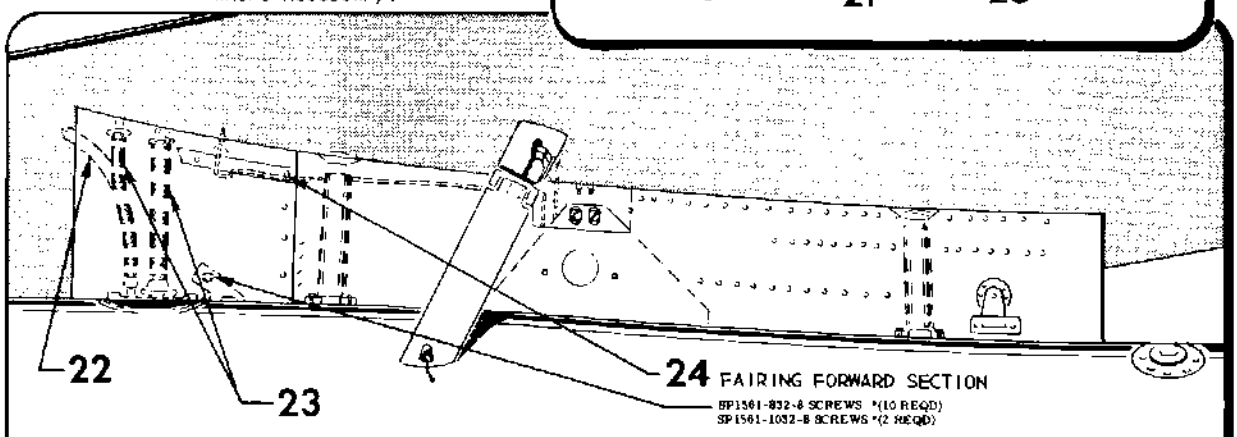
19 Locate tank sway brace fitting by engaging dowel pin into lower wing skin; then tighten wing-fitting-internal-wrenching bolt.

20 Engage sway brace into fitting and install retainer so that ears of sway brace and retainer engage; then tighten retainer bolt. Safety wing-fitting-internal-wrenching bolt to retainer bolt.

21 Safety sway brace to tank.

NOTE:
Use AN995F32 lockwire where necessary.





22 Close all tank openings and apply 8-psi air pressure to tank through air pressure inlet line. Check that no air leakage occurs by applying liquid soap over entire tank mating surfaces and connections.

23 Lubricate pullaway fittings with petrolatum (Specification AN-P-51); then connect fuel and air hoses and pullaway fittings to wing fittings. Make sure pullaway fittings enter fully into wing fittings. Make sure clamps will clear fairing when installed.

24 Install front section of tank fairing.

* Manufactured by Shakeproof Inc

172-48-1311

Figure 5-40. Installing 120-gallon Auxiliary Fuel Tanks (Sheet 2 of 2)

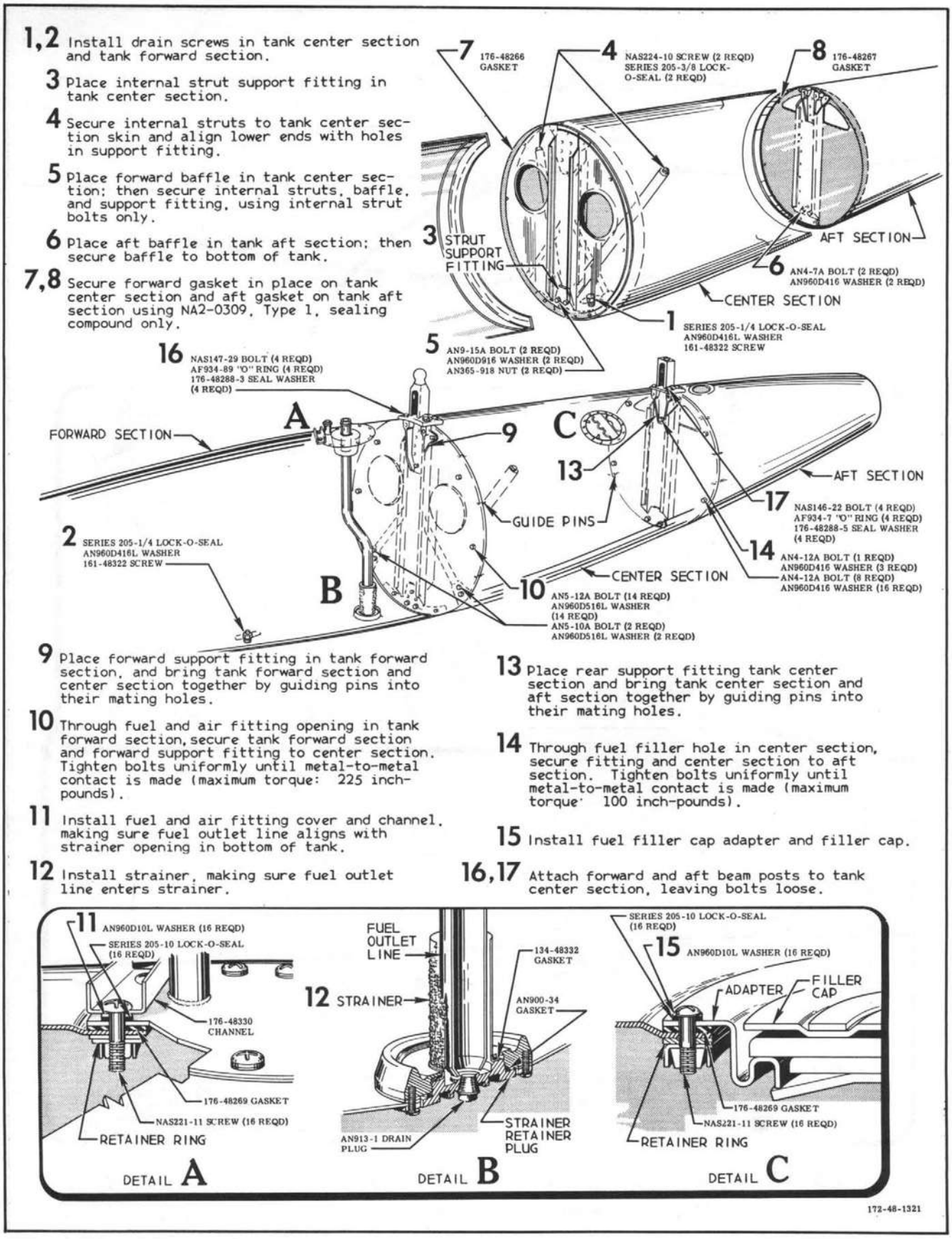


Figure 5-41. Build-up of 200-gallon Auxiliary Fuel Tanks (Sheet 1 of 2)

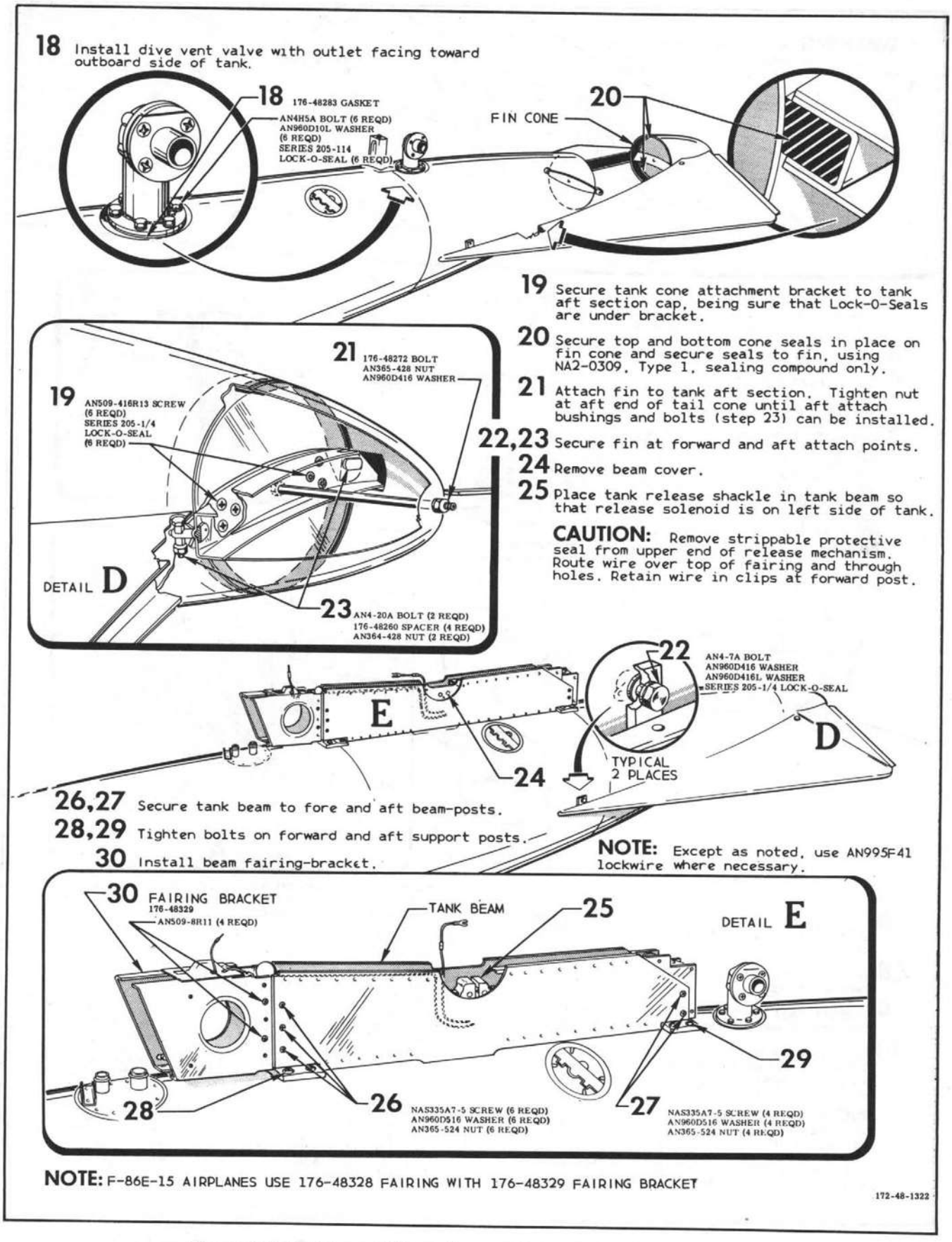


Figure 5-41. Build-up of 200-gallon Auxiliary Fuel Tanks (Sheet 2 of 2)

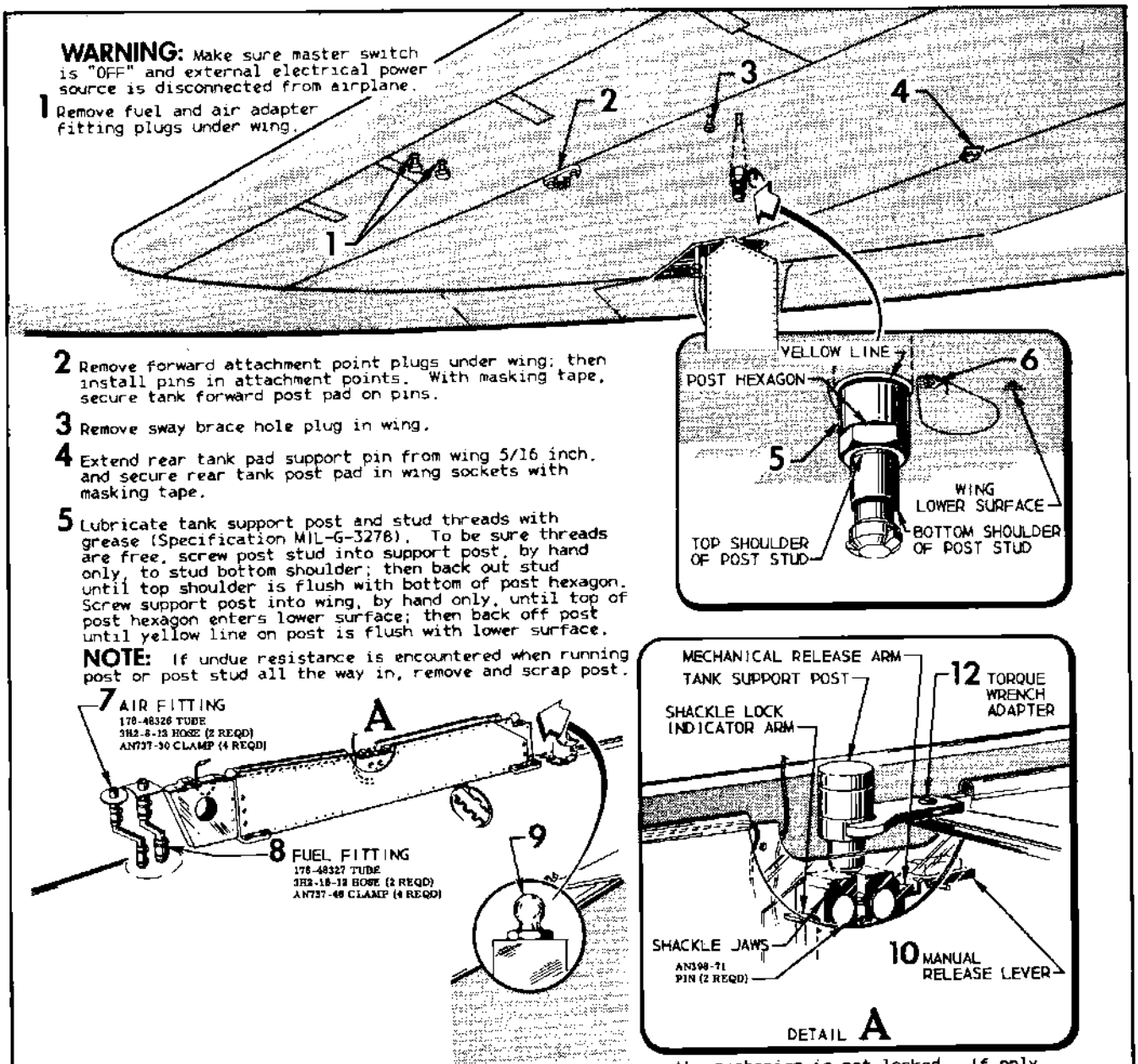


Figure 5-42. Installing 200-gallon Auxiliary Fuel Tanks—F-86E-15 Airplanes (Sheet 1 of 2)

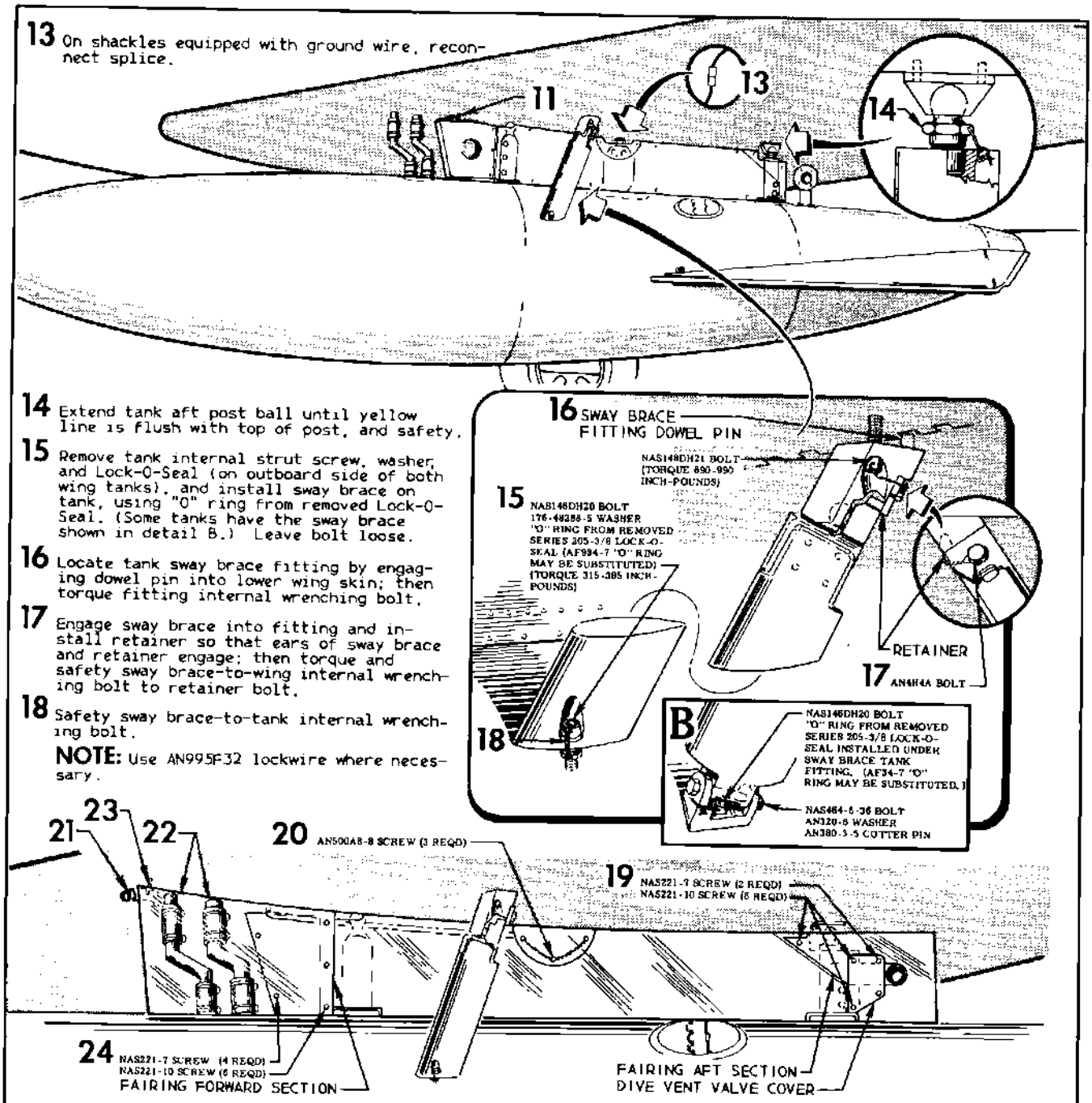


Figure 5-42. Installing 200-gallon Auxiliary Fuel Tanks—F-86E-15 Airplanes (Sheet 2 of 2)

c. Secure left radio bay access door to related fuselage access hole.

5-161. REMOVING FLOAT UNIT. To remove cell-mounted dual level float unit, proceed as follows:

a. Drain fuel system. (Refer to paragraph 1-34.)

b. Remove left radio bay access door.

c. Cut safety wire and remove float unit retaining bolts and support brackets.

d. Disconnect vent lines, refueling manifold drain line, and remote-control fuel level transmitter lines from dual level float unit; then carefully remove float unit from bay.

5-162. INSTALLING FLOAT UNIT. To install cell-mounted dual level float unit, proceed as follows:

a. Through left radio bay access hole, place dual level float unit onto forward fuselage cell mating access hole; then install and safety bolts securing related support brackets and float unit.

5-163. AUXILIARY FUEL TANKS.

5-164. The droppable auxiliary fuel tanks are of aluminum construction and are faired and supported under the wing outer panels by single sway braces and by release shackles. The tanks may be disassembled to facilitate storage and may be interchanged between wing panels, with only relocation of the sway braces necessary. The tank fairings are not interchangeable. Drain plugs are located in the bottom of each tank. Each strainer retainer plug is also provided with a drain plug.

5-165. REMOVING AUXILIARY FUEL TANKS. The tanks may be removed simultaneously by use of the electrical bomb release system. On F-86E-6, F-86E-10, and F-86E-15 Airplanes, the tanks may be released by means of the manual bomb release system or individually when each tank shackle mechanical release arm is actuated by use of a screwdriver through the access opening in the right side of the tank fairing. To remove tanks, proceed as follows:

WARNING

Before any attempt is made to handle or remove a fuel tank, electrically ground each tank in addition to grounding the airplane. Make sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Drain tanks by removing drain plug at bottom of each tank.

b. Remove tank nose fairing and release shackle access door.

c. Disconnect sway brace at wing fitting attachment.

d. Station a man on each end of both tanks, or position suitable stand or pad under tanks.

e. Release both tanks simultaneously by actuating electrical bomb release system or mechanical bomb release system, or individually by actuating each tank shackle release arm.

f. After tanks are removed, install cover plugs over air pressure and fuel feed line connections under wing; then remove tank support post, outboard sway brace fitting, and post pads and pins.

g. If required, disassemble tanks for more compact storage.

5-166. BUILD-UP OF 120-GALLON AUXILIARY FUEL TANKS. See figure 5-39.

5-167. INSTALLING 120-GALLON AUXILIARY FUEL TANKS. See figure 5-40.

5-168. BUILD-UP OF 200-GALLON AUXILIARY FUEL TANKS. See figure 5-41.

5-169. INSTALLING 200-GALLON AUXILIARY FUEL TANKS (F-86E-15 AIRPLANES). See figure 5-42.

5-170. FUEL FILTER DEICING SYSTEM.

5-171. A fuel filter deicing system (figures 5-43 and 5-44) is provided to warn the pilot of the presence of ice accumulation in the fuel system filter and to inject alcohol into the filter inlet. The system consists of an alcohol tank, an electric alcohol pump, a pressure differential switch, a thermal relief valve, an electric shutoff valve, an amber warning light, and a momentary push-type deicer switch. The major components of the system are located in the left side of the fuselage, above and outboard of the left wheel well. The icing warning light and deicer switch are located on the left side of the instrument shroud.

5-172. FUNCTION OF FUEL FILTER DEICING SYSTEM.

5-173. When ice forms within the fuel filter, a pressure differential is created across the filter element. When this pressure differential reaches a value of 3½ (±¼) psi, it is sensed by the pressure differential switch. The switch closes and illuminates the warning light in the cockpit, denoting the presence of ice in the filter. The pilot then holds closed the fuel filter deicer switch. This energizes the alcohol shutoff valve and starts the alcohol pump. Alcohol is injected into the fuel filter inlet line at an approximate flow rate of one gallon per minute at 30 to 35 psi. When the ice formation is dissolved, the pressure differential across the filter falls below the set value of the pressure switch, and the pressure switch opens the circuit to the warning light, causing the light to be extinguished. The extinguished light denotes that the ice has melted and flow of alcohol can be discontinued. The fuel deicer switch is released, shutting off the alcohol pump and closing the shutoff valve.

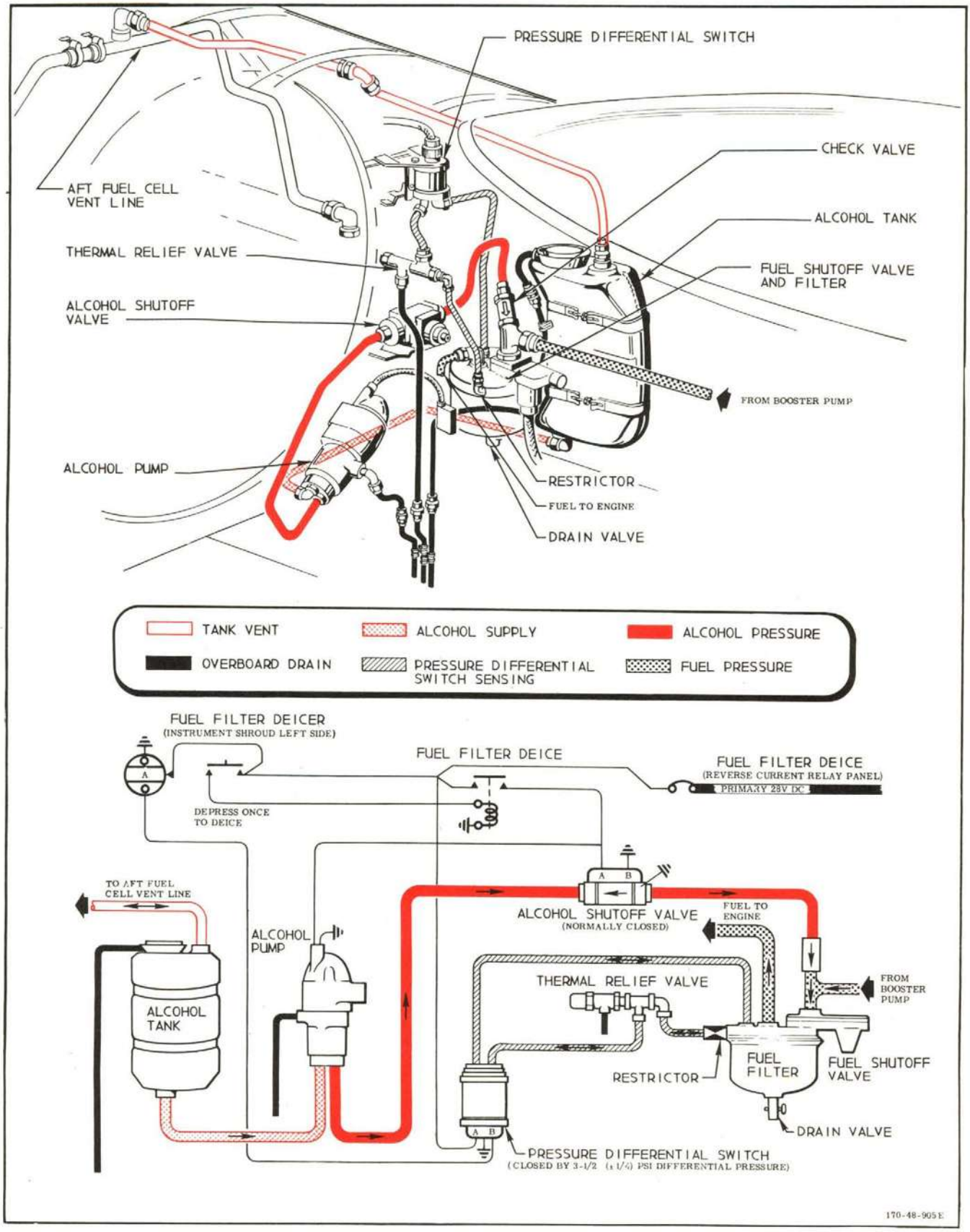


Figure 5-43. Fuel Filter Deicing System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

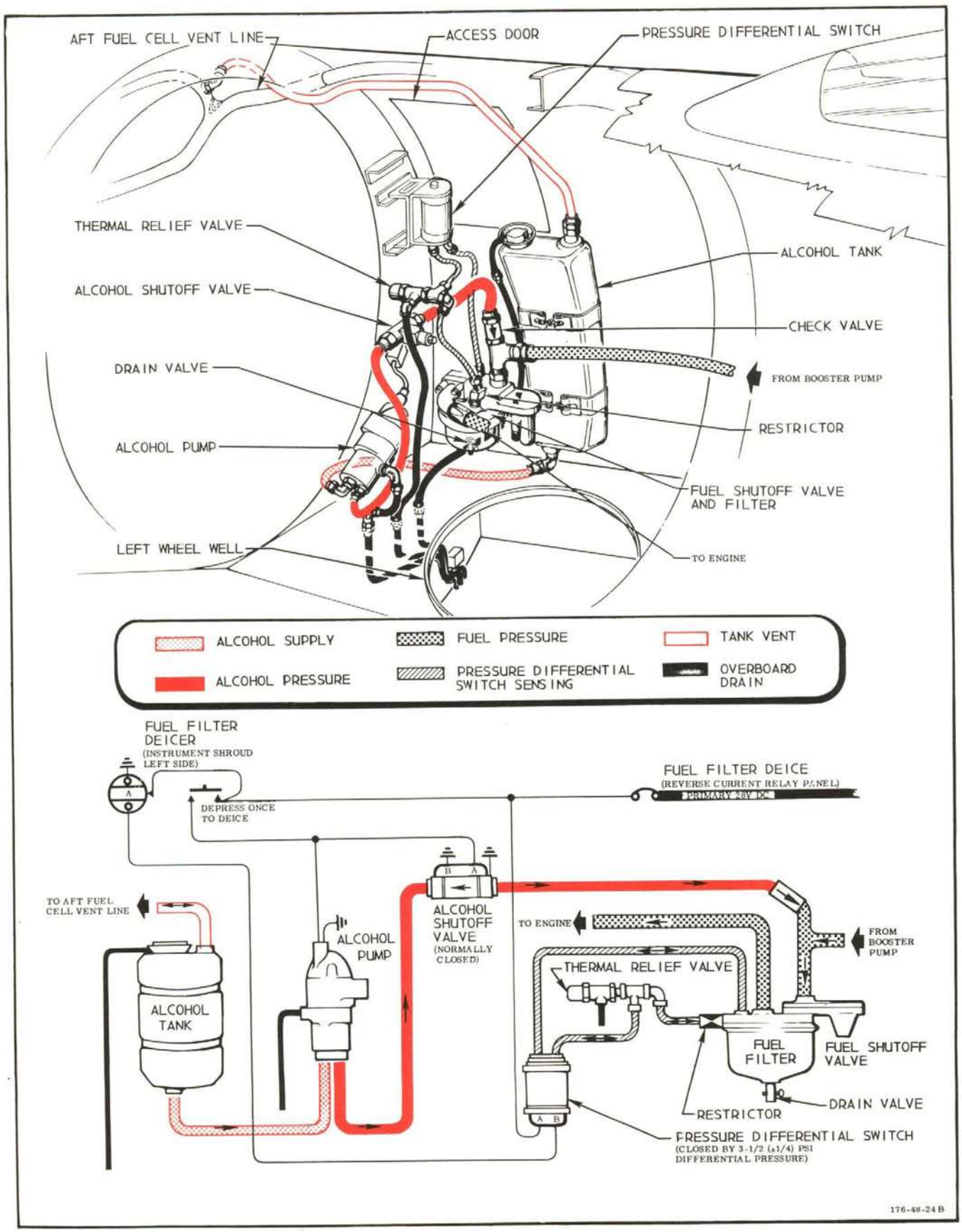


Figure 5-44. Fuel Filter Deicing System—F-86E-10 and F-86E-15 Airplanes

5-174. TROUBLE SHOOTING FUEL FILTER DEICING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Alcohol not entering filter.	No alcohol. Restriction in pump. Check valve reversed. Shutoff valve failure. Alcohol pump failure.	Replace.
Alcohol pump inoperative.	Faulty switch. No power. Open circuit. Faulty relay.* Pump motor failure (burned out).	
Alcohol pump operates intermittently.	Faulty switch. Open circuit. Pump motor failure (burned out).	
Warning light inoperative.	Faulty bulb. Open circuit. Differential switch inoperative.	
Warning light operates intermittently.	Open circuit. Differential switch improperly adjusted. Restrictor omitted.	Replace.
Warning light goes on too soon.	Differential switch improperly adjusted. Restriction in fuel filter element. Restrictor omitted.	Replace.
Warning light will not go off.	Differential switch improperly adjusted. Restriction in fuel filter element.	Replace.
Alcohol shutoff valve inoperative.	Faulty switch. Faulty relay.* No power. Open circuit. Solenoid burned out.	
Differential switch too sensitive or not sensitive enough.	Switch improperly adjusted.	Replace.

***F-86E-1, F-86E-5, and F-86E-6 Airplanes only**

5-175. TESTING FUEL FILTER DEICING SYSTEM.

5-176. A test of the fuel filter deicing system may be made with the fuel tanks full or empty. To test the system, proceed as follows:

a. Add one pint of alcohol to alcohol tank. (Refer to paragraph 1-38.)

b. Place a suitable container under fuel filter to catch alcohol or fuel and alcohol when the alcohol pump is started.

c. Open fuel filter drain valve.

d. Depress fuel filter deicer switch for approximately 10 seconds. This will simultaneously open the alcohol shutoff valve and start the alcohol pump. A 10-second period should be sufficient to transfer one pint of alcohol from tank to fuel filter.

e. Approximately one pint of alcohol should drain from filter if fuel system was drained prior to test. If

fuel system was not drained, make sure that alcohol tank is empty by disconnecting line at bottom of alcohol tank.

5-177. FUEL FILTER DEICING SYSTEM ALCOHOL TANK.

5-178. The alcohol tank, supported by two straps in the left side of the fuselage, has a capacity of 1.0 US. gallon, all of which is usable. A filler at the top of the tank is accessible through the left engine access door. The tank is vented to the fuselage aft fuel cell vent line. No drain is provided for the tank; for draining, the alcohol feed line at the bottom of the tank may be disconnected. Access to the tank may be gained through the engine left access door and the left wheel well cover.

5-179. REMOVING ALCOHOL TANK. To remove tank, remove engine left access door and wheel well cover; then proceed as follows:

a. Disconnect engine oil "out" hose at fuselage.

b. Disconnect fuel hoses (two) at emergency fuel regulator.

c. Disconnect vent line at top of tank.

d. Disconnect tank filler neck drain line at filler neck.

Note

Removal of check valve at fuel shutoff valve may be necessary to provide access to filler neck drain line connection.

e. Disconnect alcohol line at bottom of tank.

f. Disconnect turnbuckles and open tank straps.

g. Slide tank up until bottom of tank clears shutoff valve; then move tank inboard and down until tank can be removed through fuselage access door.

CAUTION

Pulling fuel shutoff valve inboard by hand while tank is being removed will prevent gouging of tank on some installations.

5-180. INSTALLING ALCOHOL TANK. To install tank, proceed as follows:

a. Inspect tank for general condition; make sure it is clean internally.

b. Inspect tank straps for proper condition and security.

c. Through fuselage access door, carefully work tank down into position.

CAUTION

Pulling fuel shutoff valve inboard by hand while tank is being slid into place will prevent gouging of tank on some installations.

d. Secure tank straps, making sure that straps are properly positioned on tank. Tighten strap turnbuckles until straps are snug and are supporting tank firmly; then safety turnbuckles.

e. Connect alcohol outlet line at bottom of tank.

f. Connect tank filler neck drain line and install check valve, if removed.

g. Connect tank vent line.

h. Connect fuel hoses (two) at emergency fuel regulator.

i. Connect oil "out" hose at fuselage.

j. Service filter deicing system tank. (Refer to paragraph 1-38.)

5-181. FUEL FILTER DEICING SYSTEM PUMP.

5-182. The electrically driven pump (Adel 20386-9), mounted in the fuselage above the left wheel well, receives the alcohol by gravity from the tank. The pump forces alcohol under 30 to 35 psi pressure at an approximate flow rate of one gallon per minute into the inlet side of the fuel filter. The pump is secured to the fuselage structure by a bracket and four cap screws. Access to the pump is through the left wheel well access cover. The pump is energized by the momentary push-type deicer switch.

5-183. FUEL FILTER DEICING SYSTEM PRESSURE DIFFERENTIAL SWITCH.

5-184. The pressure differential switch (Minneapolis-Honeywell G20A11) is mounted in the fuselage above the fuel filter. The switch consists of two bellows that act upon a normally open switch. Two pressure-sensing lines interconnect the switch to the fuel filter. One line senses the filter inlet pressure, while the other senses the filter outlet pressure. A fuel pressure differential of 3½ (±¼) psi between the inlet and outlet sides of the filter will close the switch to illuminate the amber warning light in the cockpit. The switch is accessible through the left engine access door.

5-185. TESTING PRESSURE DIFFERENTIAL SWITCH. To test the switch, proceed as follows:

a. Disconnect the two pressure differential lines at switch.

b. Connect separate air pressure lines and pressure gages to the two pressure differential switch fittings.

c. Simultaneously apply air pressure of 20 psi to both pressure switch fittings.

CAUTION

Under no condition is the pressure differential switch to be subjected to a pressure differential greater than 8 psi.

d. While maintaining 20 psi at the thermal relief

valve side of the pressure switch, slowly reduce air pressure to opposite fitting until the warning light illuminates. The warning light should illuminate when the reduced air pressure is at 16.5 (± .25) psi.

e. Continue to maintain 20 psi air pressure at the thermal relief valve side of the pressure switch; slowly increase air pressure at the opposite pressure switch fitting until cockpit warning light goes out. When light goes out, air pressure should not exceed 17.5 (± .25) psi.

f. Disconnect air pressure lines and reconnect filter lines to pressure switch.

5-186. FUEL FILTER DEICING SYSTEM THERMAL RELIEF VALVE.

5-187. The thermal relief valve (Parker Appliance 2-2850-76) is installed in the fuel differential pressure line between the pressure differential switch and the inlet side of the fuel filter. The valve is set to open at 50 (±5) psi and relieve excess pressure that would be detrimental to the pressure differential switch.

5-188. FUEL QUANTITY INDICATING SYSTEM.

5-189. Two types of fuel quantity indicating systems are used on F-86E Airplanes. The voltage-compensating fuel totalizing system (figure 5-45) used on F-86E-1 Airplanes AF50-579 through -613 measures the total quantity of fuel in the airplane by volume in gallons of fuel. The fuel liquidensitometer system (figure 5-46) used on F-86E-1 Airplanes AF50-614 through -638 and F-86E-5 and subsequent airplanes differs from that of the earlier airplanes in that the volume of fuel is density-corrected and measured in pounds.

5-190. TROUBLE SHOOTING FUEL QUANTITY INDICATING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Erroneous reading.	Sticking transmitter fulcrum. Bent float arm.	Replace transmitter. Replace float arm.
Pointer at center of indicator scale.	Electrical connections improperly crimped. Rivets securing transmitter resistance strip shorting to case in transmitter head.	Properly secure connecting lugs. Replace transmitter.
Erratic reading.	Rivets securing transmitter resistance strip shorting to case in transmitter head. Loose connection in wiring from transmitter to indicator. Sticking transmitter float. Transmitter cover gasket not correctly installed, resulting in dirty resistance strips.	Replace transmitter. Where possible, remove filler cap and move float with suitable object; otherwise, remove transmitter and free float. (Refer to paragraphs 5-199 and 5-211.) Clean transmitter and install new gasket.
Erratic reading because of moisture in transmitter.	Transmitter cover screws over-torqued, resulting in cracked or distorted cover. Transmitter cover screws under-torqued, resulting in poor gasket seal.	Replace cover if necessary. Replace gasket and torque screws finger-tight not to exceed 2½ inch-pounds. Clean transmitter, replace gasket, and torque finger-tight not to exceed 2½ to 3 inch-pounds.
Above full scale reading.	"D" lead in transmitter grounded, caused by corrosion due to steam-cleaning process in which Turco is used.	Replace defective transmitter.
Center wing cell transmitter arm sticking at low position and fuel transfer pump energized, causing fuel to spew from fuel vent line.	Improper setting of fuel transfer pump switch.	Refer to paragraph 5-125, and see figures 5-47 and 5-48.

TROUBLE	PROBABLE CAUSE	REMEDY
Full scale fluctuation.	Open circuit between "A" and "D" pins of indicator circuit.	Locate and tighten loose connection.
Constant full scale reading.	Transmitter shorted out.	Locate and replace defective transmitter.

5-191. FUEL QUANTITY INDICATING SYSTEM (F-86E-1 AIRPLANES AF50-579 THROUGH -613).

5-192. The fuel quantity indicating system (figure 5-45) gives a single indication of the total fuel supply measured in gallons of fuel for all cells except the auxiliary tanks. The system consists essentially of an indicator, mounted on the instrument panel; seven transmitters, one in the forward fuselage cell, one in the fuselage aft cell, one in the wing center cell, and two in each outer wing cell; and an adjustment panel, located on the inner side of the right-hand pressure barrier cover. The transmitter units in each cell transmit readings to the indicator, which totalizes the quantity of fuel in all five cells.

5-193. FUNCTION OF FUEL QUANTITY INDICATING SYSTEM. The seven transmitters in the totalizing system are connected to a single voltmeter-type indicator. The 28-volt power source is connected to a voltage compensator unit through a 20-ohm series resistor. The 20-ohm resistor reduces the voltage so that the voltage across the compensator will be between 11 and 15 volts. The voltage compensator maintains a constant voltage of 4.1 volts across the seven transmitters and the external stroke adjustment panel. The voltmeter-type indicator is connected in parallel with the resistances between the two movable contact arms of the inner and outer resistance strips in the transmitters. Therefore, the indicator will register an indication proportional to the total voltage drop across the potentiometer inner resistance strips. Since the voltage drop of the inner resistance strips is directly proportional to the float level, the indication will be the sum of the fuel levels in the cells. It is essential that the stroke of the movable contact shoes in the transmitters be set to a resistance value (figure 5-47) proportional to the capacity of the fuel measured by the transmitters.

5-194. ADJUSTING FUEL QUANTITY INDICATING SYSTEM. To adjust the fuel quantity indicating system, proceed as follows:

WARNING

Make sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Drain fuel system. (Refer to paragraph 1-34.)

b. Remove transmitters (paragraph 5-199) and plugs from mounting. (See figures 5-30, 5-32, 5-34, and 5-36 for location and accessibility of transmitters.)

c. Install double string on float arm in loop provided, and thread string through removed plug hole.

d. Replace transmitters in mounting, and connect an external power source of 28 volts to airplane.

e. With all floats in full down position, check indicator to read "EMPTY."

f. If indicator pointer calibration appears incorrect, remove right-hand pressure barrier cover where adjustment panel is located; then loosen locknut and, with a screwdriver, turn "R+" adjustment screw either left or right until indicator reads "EMPTY." Tighten adjustment screw.

g. Raise all transmitter floats to full up position by pulling the strings, and secure floats in this position; then check the indicator to read "FULL." If indicator pointer calibration appears incorrect, loosen locknut and turn "R–" adjustment screw either left or right until indicator reads "FULL." Tighten adjustment screw.

h. Cut and remove transmitter float strings; then install parts removed for access.

5-195. FUEL QUANTITY INDICATOR (F-86E-1 AIRPLANES AF50-579 THROUGH -613).

5-196. The fuel quantity indicator (figure 5-45) is calibrated to measure the total volume of fuel in the airplane (excluding that in the auxiliary fuel tanks). It is a voltmeter-type indicator, consisting of two permanent magnets, two pole pieces, and a moving element. A 6000-microfarad condenser is connected in parallel with the coil to reduce pointer oscillation at high speeds in rough air. As the float at the cell unit moves upward in position, power transmitted to the coil creates a torque to rotate the coil clockwise to indicate gallons of fuel available. The coil is restrained by the hairsprings and stops moving when the torque of the springs equals the torque in the coil.

5-197. FUEL QUANTITY TRANSMITTERS (F-86E-1 AIRPLANES AF50-579 THROUGH -613).

5-198. Each fuel level transmitter (figure 5-45) consists of a float, connecting linkage, and a potentiometer. The potentiometer units are sealed from the cell by a bellows to eliminate a fire hazard. Movements of the float are transmitted through the linkage to the contact arm of the potentiometer, thus causing the contact shoes to move across resistance strips. This initiates a voltage,

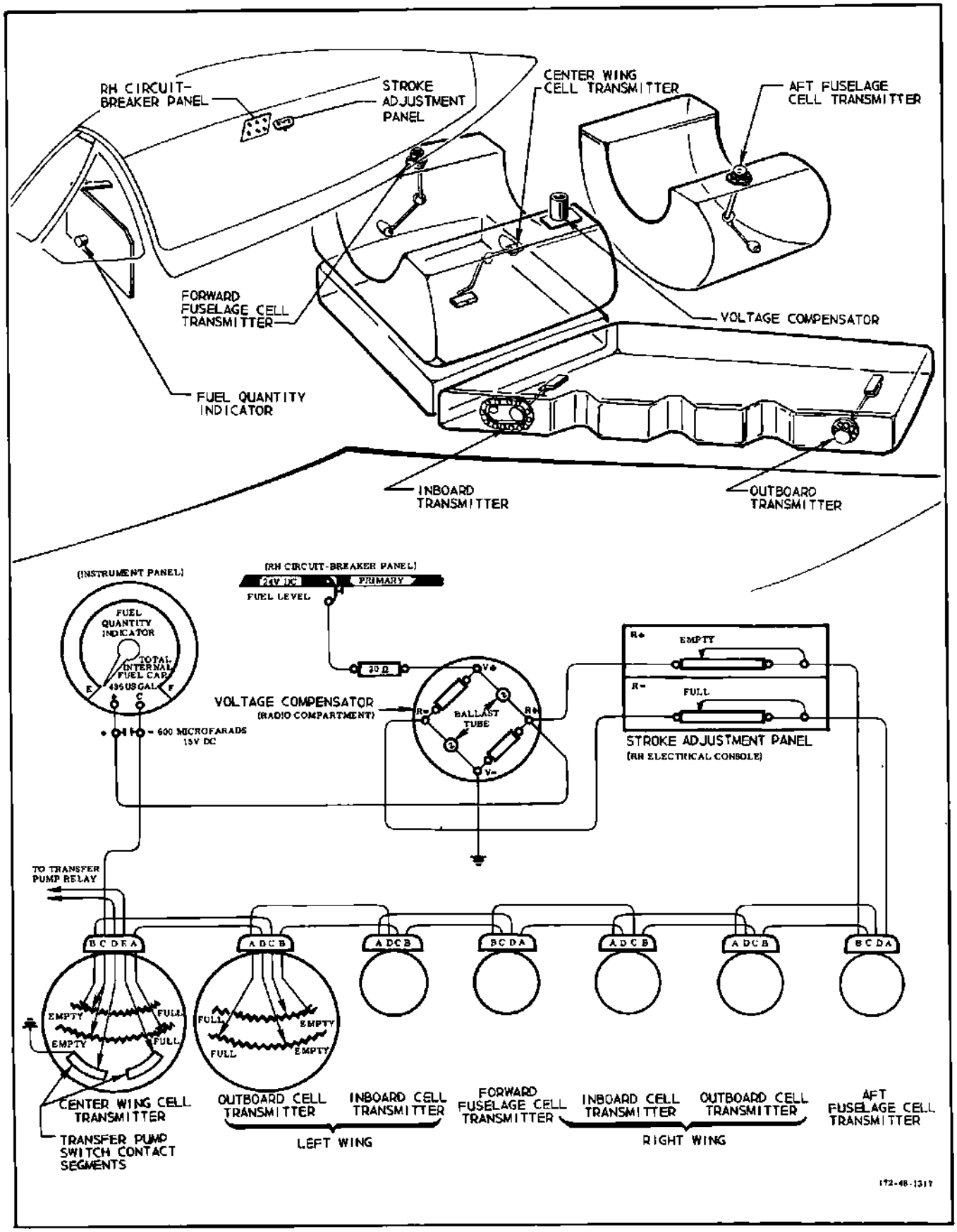


Figure 5-45. Fuel Quantity Indicating System—F-86E-1 Airplanes AF50-579 Through -613

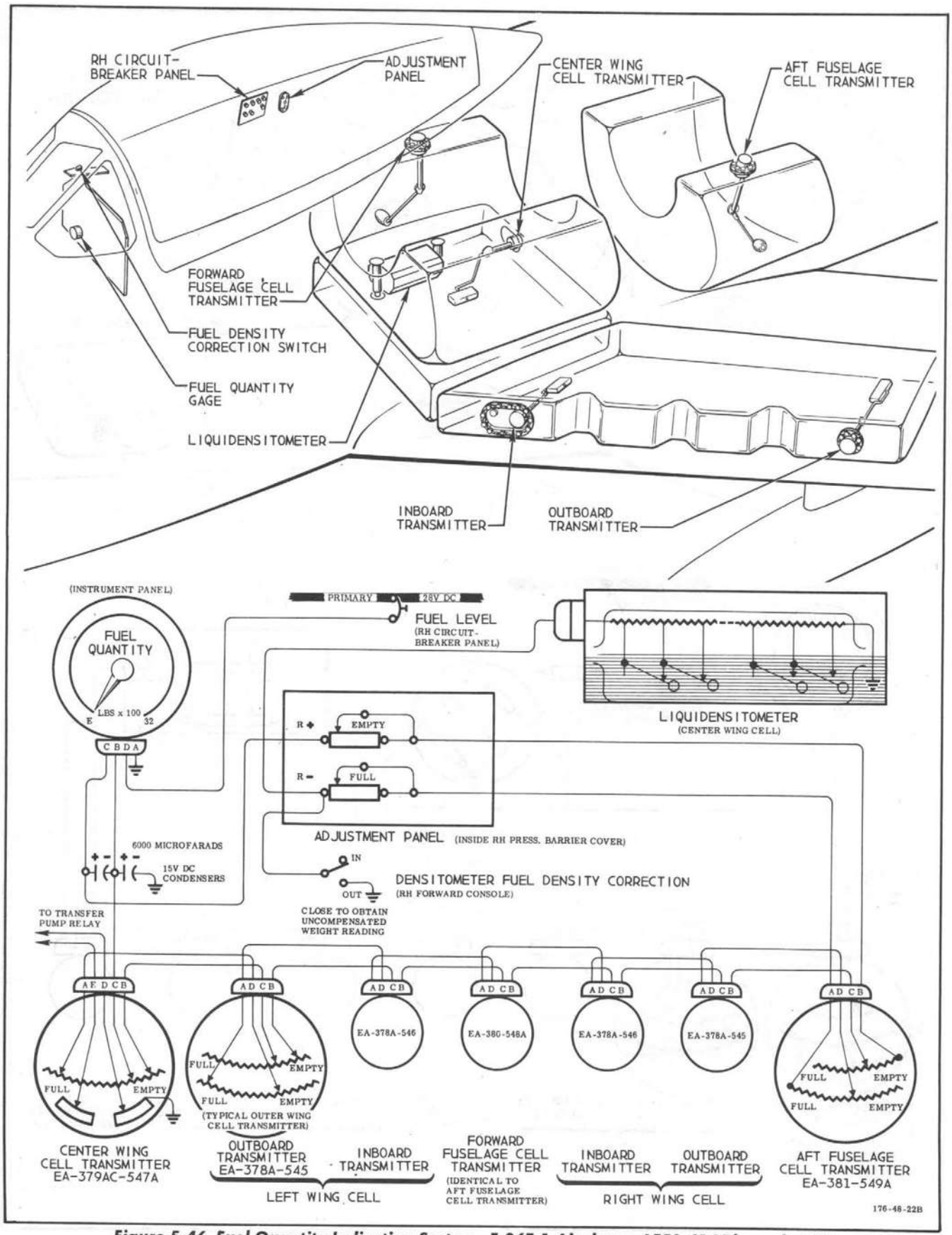


Figure 5-46. Fuel Quantity Indicating System—F-86E-1 Airplanes AF50-614 Through -638 and F-86E-5 and Subsequent Airplanes

proportional to the voltage drop across the potentiometer inner resistance strips, to the fuel quantity indicator. An adjustable contact is installed at each end of the resistance strip for making empty and full adjustments.

5-199. REMOVING TRANSMITTERS. To remove fuel level transmitters, proceed as follows:

WARNING

Make sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Drain fuel system. (Refer to paragraph 1-34.)

b. Gain access to fuel transmitters in the following manner:

UNIT	ACCESSIBLE BY
Wing cell transmitters (two in each cell).	Removing wing leading edges. (Refer to paragraph 2-18 and see figure 5-32.)
Center wing cell transmitter.	Removing wing aft spar transmitter access door through right wheel well. (See figure 5-30.)
Aft fuselage cell transmitter.	Removing engine. (Refer to paragraph 5-7 and see figure 5-36.)
Forward fuselage cell transmitter.	Removing right-hand radio and electrical compartment access door and fire detector relay panel. (See figure 5-34.)

c. Disconnect electrical lead to transmitter; then remove retaining bolts. Carefully remove unit from cell to prevent damage to float linkage.

5-200. ADJUSTING TRANSMITTER LINKAGE. See figure 5-47.

5-201. CHECKING AND ADJUSTING TRANSMITTER RESISTANCE. The transmitters can be checked and adjusted on airplane or on a bench. Before checking and adjusting transmitters on the airplane, drain fuel system and disconnect transmitter electrical connectors. Remove transmitters (paragraph 5-199), except outboard transmitters in outer wing panel, and attach double string on float arm loop. Thread string through removed string access plug holes (on fuselage cells, thread string through filler neck). Install transmitters. (Refer to paragraph 5-202.)

Note

Outer wing cell outboard unit floats are raised by hand through the filler neck opening.

To check and adjust transmitters on the airplane or on the bench, remove transmitter head covers and proceed as follows:

a. With floats in full down position, check resistance between electrical receptacle pins for values as designated on resistance table of figure 5-47. If necessary, move shoe "W" of inner resistance strip in relation to support "Q" to obtain proper reading.

Note

All resistance measurements should be carefully taken with an accurate ohmmeter.

b. Raise floats to full up position and check resistance between receptacle pins as designated. If necessary, move shoe "Y" of outer resistance strip in relation to support "Q" to obtain proper reading.

c. Place floats alternately in full down and full up positions and check resistances between receptacle pins. If resistance measured is greater than proper value, adjust screw "S" away from center of rotation of contact shoes "W" and "Y." If resistance measured is less than proper value, adjust screw "S" toward center of rotation of contact shoes "W" and "Y."

Note

After making the preceding adjustments, recheck the resistance values as described in steps a. and b. Make slight adjustments as necessary.

If inaccuracy of transmitter is evident after checking and adjusting transmitter resistance values, adjust transmitter linkage (figure 5-47) and repeat steps a. through c.

5-202. INSTALLING TRANSMITTERS. To install fuel level transmitters, proceed as follows:

a. Install outer wing fuel cell inboard fuel transmitter and outboard fuel transmitter (figure 5-32) and connect electrical lead; then install wing leading edge (figure 2-3).

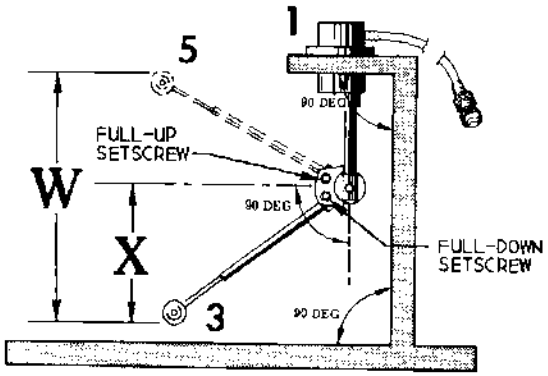
b. Through right wheel well, install center wing cell fuel transmitter (figure 5-30); then connect electrical lead.

c. Install aft fuselage cell transmitter (figure 5-36); then connect electrical lead. Install engine. (Refer to paragraph 5-13.)

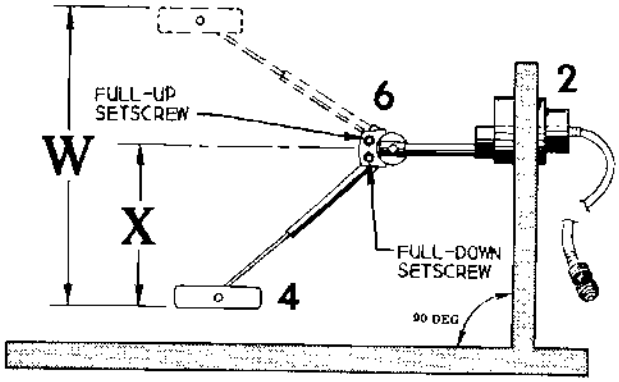
d. Install forward fuselage cell transmitter (figure 5-34); then connect electrical lead. Install fire detector relay panel and right-hand radio and electrical compartment access door.

5-203. FUEL QUANTITY INDICATING SYSTEM (F-86E-1 AIRPLANES AF50-614 THROUGH -638 AND F-86E-5 AND SUBSEQUENT AIRPLANES).

5-204. The fuel quantity indicating system (figure 5-46) consists of an indicator, mounted on the instrument panel; a liquidensitometer, located in the center wing cell; seven float-operated transmitters, one in the forward fuselage cell, one in the aft fuselage cell, one in the center wing cell, and two in each outer wing cell;



(TYPICAL FOR UNITS NO. 1 AND 4)



(TYPICAL FOR UNITS NO. 2, 3, AND 5)

1,2 Secure respective fuel quantity transmitter unit in a suitable support so that the vertical support is at 90-degree true relationship to the base as shown.

3,4 Place the transmitter float in the full-down position (dimension X) and adjust the full-down setscrew so that the adjusting bracket will maintain the applicable dimension (X) shown on the reference chart.

5,6 Place the transmitter float in the full-up position (dimension W) and adjust the full-up setscrew so that the adjusting bracket will maintain the applicable dimension (W) shown on reference chart. Check and adjust transmitter resistance values designated on OHM Resistance Table. (Refer to index for page number of applicable procedure.)

REFERENCE CHART AND OHM RESISTANCE TABLE

	EMPTY - FULL DOWN				FULL - FULL UP			
	POSITION X INCHES	B-C	A-D	A-C	POSITION W INCHES	A-D	A-C	B-C
1 EA-381-549	11-7/16	0-1.0	39.5 (±1.0)		25-3/8	0-1.0		39.5 (±1.0)
2 EA-378A-546	3-3/8	0- .5	14.0 (± .5)		7-5/16	0- .5		14.0 (± .5)
3 EA-378A-545	2-1/4	0- .5	14.0 (± .5)		6-3/16	0- .5		14.0 (± .5)
4 EA-380-548	11-11/32	0-1.0	48.0 (±1.0)		18-3/8	0-1.5		48.0 (± .5)
5 EA-379AC-547 (CENTER WING UNIT)	3-1/32	0- .5		28.6 (±.5)	7-17/32		0- .5	28.6 (± .5)

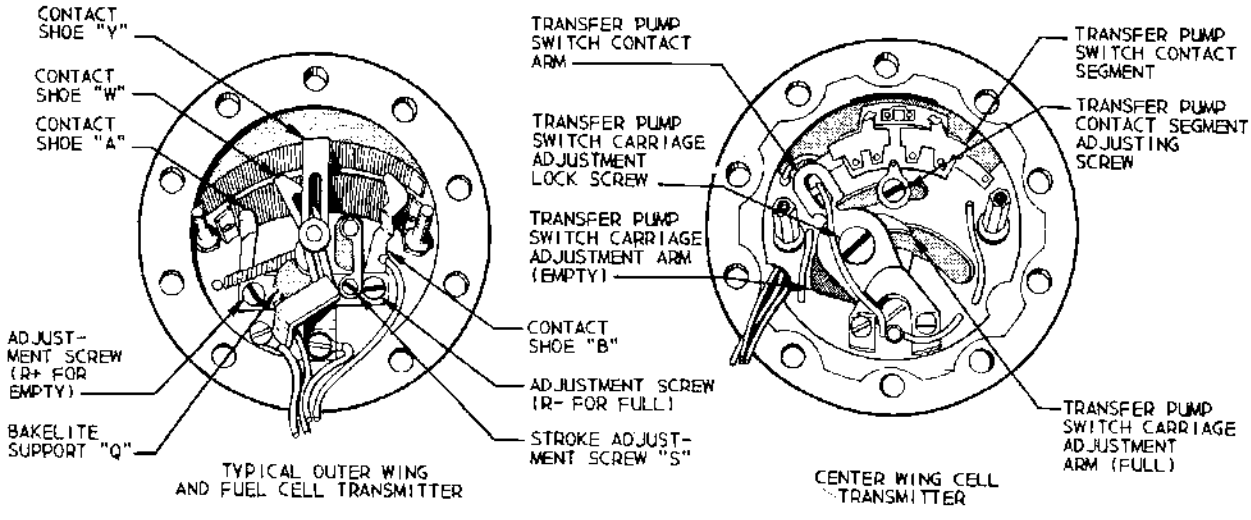


Figure 5-47. Adjusting Fuel Quantity Transmitters—F-86E-1 Airplanes AF50-579 Through -613

a liquidensitometer switch; and an adjustment panel, located in the right pressure barrier cover. The transmitters, connected in series, totalize the volume of the fuel in the cells. The liquidensitometer, which is connected in series with the transmitters, corrects readings to the indicator for indications in pounds of fuel. The normal "IN" position of the liquidensitometer switch causes the indicator to give a density-corrected reading in pounds of fuel, whereas the "OUT" position of the fuel density correction switch causes the indicator to give an uncorrected reading in pounds of fuel.

5-205. FUNCTION OF FUEL QUANTITY INDICATING SYSTEM. When the 28-volt bus is energized, direct current is applied across the seven fuel quantity transmitters and the density-sensitive liquidensitometer to the fuel quantity indicators. With the fuel cells full, the float-actuated mechanical linkage of each transmitter maintains the transmitter wiper arms at the extreme right on the two resistance strips. (See figure 5-46.) This causes the resistance value of the transmitter inner resistance strip to be less than that of the outer resistance strip. Thus, more current will flow through the indicator "FULL" coil than through the "EMPTY" coil, and the resultant electromagnetic force will maintain the indicator pointer at the true full quantity indication. As the fuel is consumed, the transmitter outer and inner wiper arms will be simultaneously moved to the left across the resistance strips by float action. When the fuel cell is half full, the current through the indicator full and empty coils is equalized to maintain the pointer of the indicator at the center of the dial. With all fuel consumed, the resistance value of the transmitter outer resistance strip is less than that of the inner resistance strip. Thus, more current will flow through the indicator empty coil than through the full coil, and the resultant electromagnetic force will move the indicator pointer to the empty reading. As each of the nine liquidensitometer floats becomes less buoyant with decreasing fuel density, a greater resistance is progressively added into the circuit by the liquidensitometer; thus, the indicator pointer is prevented from moving to an erroneous reading due to the greater fuel quantity. Conversely, as each of the nine liquidensitometer floats becomes more buoyant with increasing fuel density, a section of the liquidensitometer resistance strip is "switched out" of the circuit to compensate for the lessening of fuel quantity due to the increase in fuel density. When the liquidensitometer switch is moved to the "OUT" position (used when the system is being adjusted), the liquidensitometer is completely cut out of the circuit so that the system will respond only to volume with respect to the transmitter float position. When the switch is moved to the "IN" position (normal after tanks are filled), the liquidensitometer is cut in and system indication will be corrected to include the density factor of the fuel.

5-206. ADJUSTING FUEL QUANTITY INDICATING SYSTEM. To adjust the fuel quantity indicating system, proceed as follows:

a. Drain fuel system. (Refer to paragraph 1-34.)

b. Make sure that liquidensitometer switch is at the "IN" position.

c. Remove all transmitters (paragraph 5-199) except outer wing cell outboard transmitters and remove string access plugs.

d. Secure double string to each float arm loop, and thread string through string access hole.

e. Install transmitters (paragraph 5-202) and connect an external power source of 28 volts to airplane.

f. With all floats in full down position, check indicator to read empty.

Note

Always read indicator by sighting on the same horizontal plane as the indicator.

g. If indicator pointer calibration appears incorrect, remove cover from right pressure barrier for access to adjustment panel; then loosen locknut and turn "R+" adjustment screw either left or right until indicator reads empty. Tighten adjustment screw.

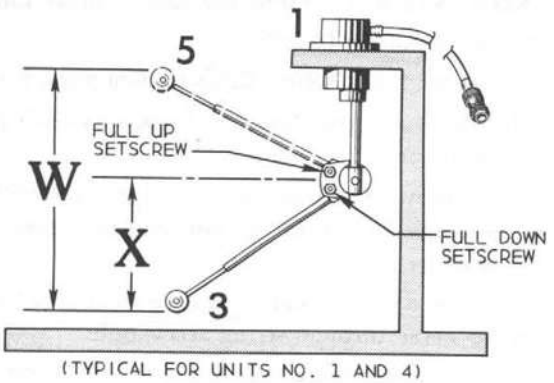
h. Place liquidensitometer switch in the "OUT" position.

i. Raise all transmitter floats to top of their travel by pulling strings, and secure floats in this position; check to see that indicator reads 3200 pounds. If indicator pointer calibration appears incorrect, loosen locknut and turn "R—" adjustment screw either left or right until indicator reads 3200 pounds. Tighten adjustment screw.

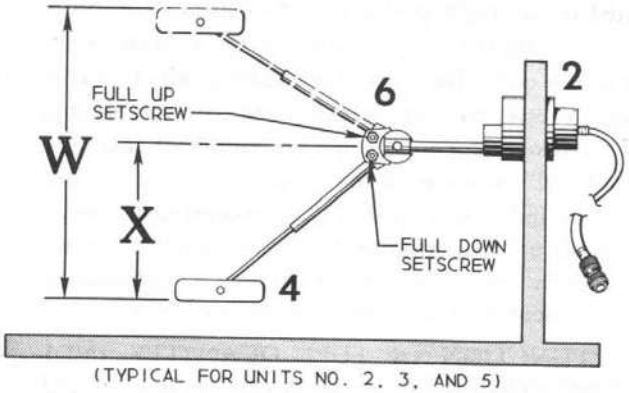
j. Cut and remove transmitter float strings; then install parts removed for access.

5-207. FUEL QUANTITY INDICATOR (F-86E-1 AIRPLANES AF50-614 THROUGH -638 AND F-86E-5 AND SUBSEQUENT AIRPLANES).

5-208. The fuel quantity indicator (figure 5-46), located on the instrument panel, is basically of the ratiometer type (with a dial calibrated to indicate pounds of fuel) and is essentially independent of line voltage fluctuations. The indicator consists of a field coil, a moving element, and a core. The moving element consists of two ratiometer coils, hairsprings, and the pointer. The position of the moving element depends entirely on the ratio of current in the two coils. As the variable resistance in the transmitters and liquidensitometer changes, the current flowing in the two coils is changed, causing the pointer to move across the indicator dial. The system has two 6000-microfarad condensers connected in parallel with the indicator ratiometer coils to reduce pointer oscillation due to fuel



(TYPICAL FOR UNITS NO. 1 AND 4)



(TYPICAL FOR UNITS NO. 2, 3, AND 5)

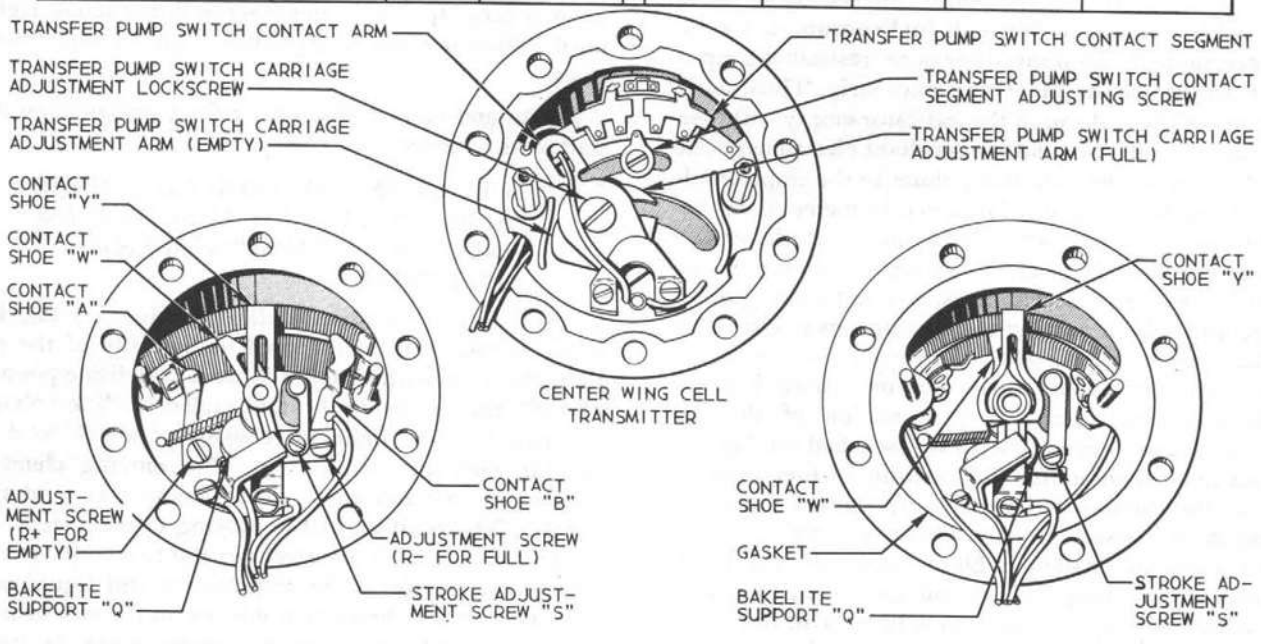
1,2 Secure respective fuel quantity transmitter unit in a suitable support so that the vertical support is at a 90-degree true relationship to the base as shown.

3,4 Place the transmitter float in the full down position (dimension X) and adjust the full down setscrew so that the adjusting bracket will maintain the applicable dimension (X) shown on the reference chart.

5,6 Place the transmitter float in the full up position (dimension W) and adjust the full up setscrew so that the adjusting bracket will maintain the applicable dimension (W) shown on reference chart. Check and adjust transmitter resistance values designated on Ohm Resistance Table. (Refer to index for page number of applicable procedure.)

REFERENCE CHART AND OHM RESISTANCE TABLE

	EMPTY - FULL DOWN			FULL - FULL UP				
	POSITION X INCHES	B-C	A-D	POSITION W INCHES	A-D	A-C	A-B	B-C
1 EA-381-549A	11-7/16	0-1.0	45.1 (±1.0)	25-3/8	0-1.0			45.1 (±1.0)
2 EA-378A-546	3-3/8	0-.5	14.0 (±5)	7-5/16	0-.5			14.0 (±5)
3 EA-378A-545	2-1/4	0-.5	14.0 (±5)	6-3/16	0-.5			14.0 (±5)
4 EA-380-548A	11-11/32	0-1.0	43.9 (±1.0)	18-3/8	0-1.0			43.9 (±1.0)
5 EA-379AC-547A (CENTER WING UNIT)	3-1/32	0-.5		7-17/32		0-.5	28.6 (±.9)	



TYPICAL OUTER WING CELL TRANSMITTER

TYPICAL FUSELAGE TRANSMITTER

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Figure 5-48. Adjusting Fuel Quantity Transmitters—F-86E-1 Airplanes AF50-614 Through -638 and F-86E-5 and Subsequent Airplanes

slosh. For indicator removal, refer to paragraphs 6-8 and 6-9; for installation procedures, see figure 6-3.

5-209. FUEL QUANTITY TRANSMITTERS (F-86E-1 AIRPLANES AF50-614 THROUGH -638 AND F-86E-5 AND SUBSEQUENT AIRPLANES).

5-210. Refer to paragraph 5-198 and see figure 5-46.

5-211. REMOVING TRANSMITTERS. The transmitter removal procedures are identical for both systems. (Refer to paragraph 5-199.)

5-212. ADJUSTING TRANSMITTER LINKAGE. The transmitter linkage adjustment procedures are identical for both systems. (See figure 5-48.)

5-213. CHECKING AND ADJUSTING TRANSMITTER RESISTANCE. The transmitter resistance checking and adjusting procedures for both systems are covered in paragraph 5-201. (See figure 5-48.)

Note

Adjustment of fuselage transmitters is limited to the adjustment in step c.

5-214. INSTALLING TRANSMITTERS. The transmitter installations for both systems are identical. (Refer to paragraph 5-202.)

5-215. FUEL QUANTITY LIQUIDENSITOMETER (F-86E-1 AIRPLANES AF50-614 THROUGH -638 AND F-86E-5 AND SUBSEQUENT AIRPLANES).

5-216. The fuel quantity liquidensitometer (figure 5-46), located in the center wing fuel cell, is essentially a density-sensitive rheostat and is connected in series with the float-actuated transmitters (potentiometers). The density-sensitive rheostat is composed of a series of resistance elements, each shunted by a float switch designed to be actuated at a specific predetermined fuel gravity. Nine floats, with accompanying float switches, are used to cover the range of fuel gravities likely to be encountered in service. The liquidensitometer is a sealed unit and not adjustable. A dry check can be made of the unit to determine whether it is functioning properly. The resistance with all floats down must be 65 to 70.2 ohms. With all floats up (unit inverted), the resistance must be 1.1 to 4.9 ohms.

5-217. REMOVING LIQUIDENSITOMETER. To remove the fuel quantity liquidensitometer, proceed as follows:

WARNING

Make sure master switch is "OFF" and external electrical power source is disconnected from airplane.

a. Drain fuel system. (Refer to paragraph 1-34.)

b. Remove center wing cell forward fuel booster pump. (Refer to paragraph 5-115.)

c. Through right wheel well, remove aft spar fuel level transmitter access door and disconnect electrical leads; then remove transmitter. (Refer to paragraph 5-199.)

d. Through transmitter access door and through booster pump access door, disconnect and remove liquidensitometer.

5-218. INSTALLING LIQUIDENSITOMETER. To install the fuel quantity liquidensitometer, proceed as follows:

a. Through transmitter access door, secure liquidensitometer to center wing cell posts and attaching supports. (See figure 5-29 for location and identification of attaching parts.)

b. Install transmitter and vent adapter on cell and connect liquidensitometer electrical leads to adapter. Install fuel level transmitter. (Refer to paragraph 5-202.)

c. Install fuel booster pump. (Refer to paragraph 5-116.)

5-219. OIL SYSTEM.

5-220. On engines preceding engine No. 046-927, the auxiliary accessory gear case is lubricated by a wet-sump, splash-type oil system from an oil reservoir contained within the auxiliary gear case, while the remainder of the engine is lubricated by a dry-sump, pressure-type oil system. (See figure 5-49.) On engines No. 046-927 and subsequent, the complete engine is lubricated by the dry-sump, pressure-type oil system. (See figure 5-49.) The system furnishes oil to lubricate and cool all engine bearings and gears, and also furnishes the main fuel regulator with variable control and cooling oil. (Refer to paragraph 5-69.) The engine oil system consists of an oil tank (mounted in the right side of the fuselage) and the following units (mounted on the engine): a gerotor-type lubricating and scavenge pump; a double-element aft-bearing scavenge pump; an oil filter; an oil cooler; an oil cooler control valve; and on engines No. 046-927 and subsequent, an auxiliary accessory gear case scavenge pump. Static leakage is minimized by three check valves: one in the oil supply line to the fuel regulator, one in the supply line to the aft bearings, and one in the discharge line from the aft scavenge pump. No oil temperature indicating system is provided. Refer to paragraph 6-42 for description of the oil pressure indicating system.

5-221. FUNCTION OF OIL SYSTEM.

5-222. Oil flows from the oil tank by gravity feed and pump suction to the lubricating and scavenge pump. From the No. 2 element of the pump, oil is pumped into the engine gear case, past a pressure relief valve which requires no adjustment and which is set to maintain 45 psi. After passing the relief valve, the oil flows through a small gear case filter to the accessory gears,

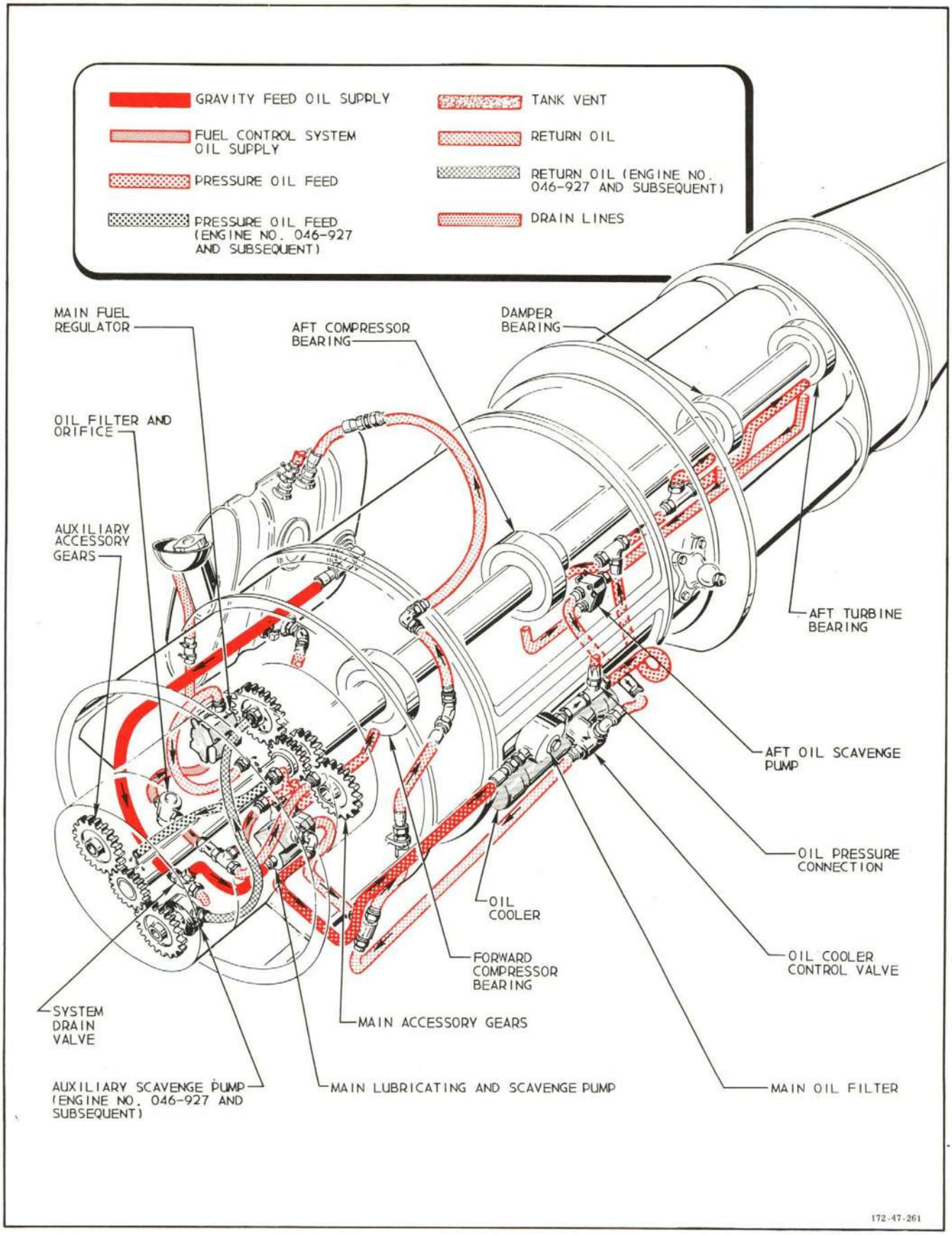

Figure 5-49. Engine Oil System (Sheet 1 of 2)

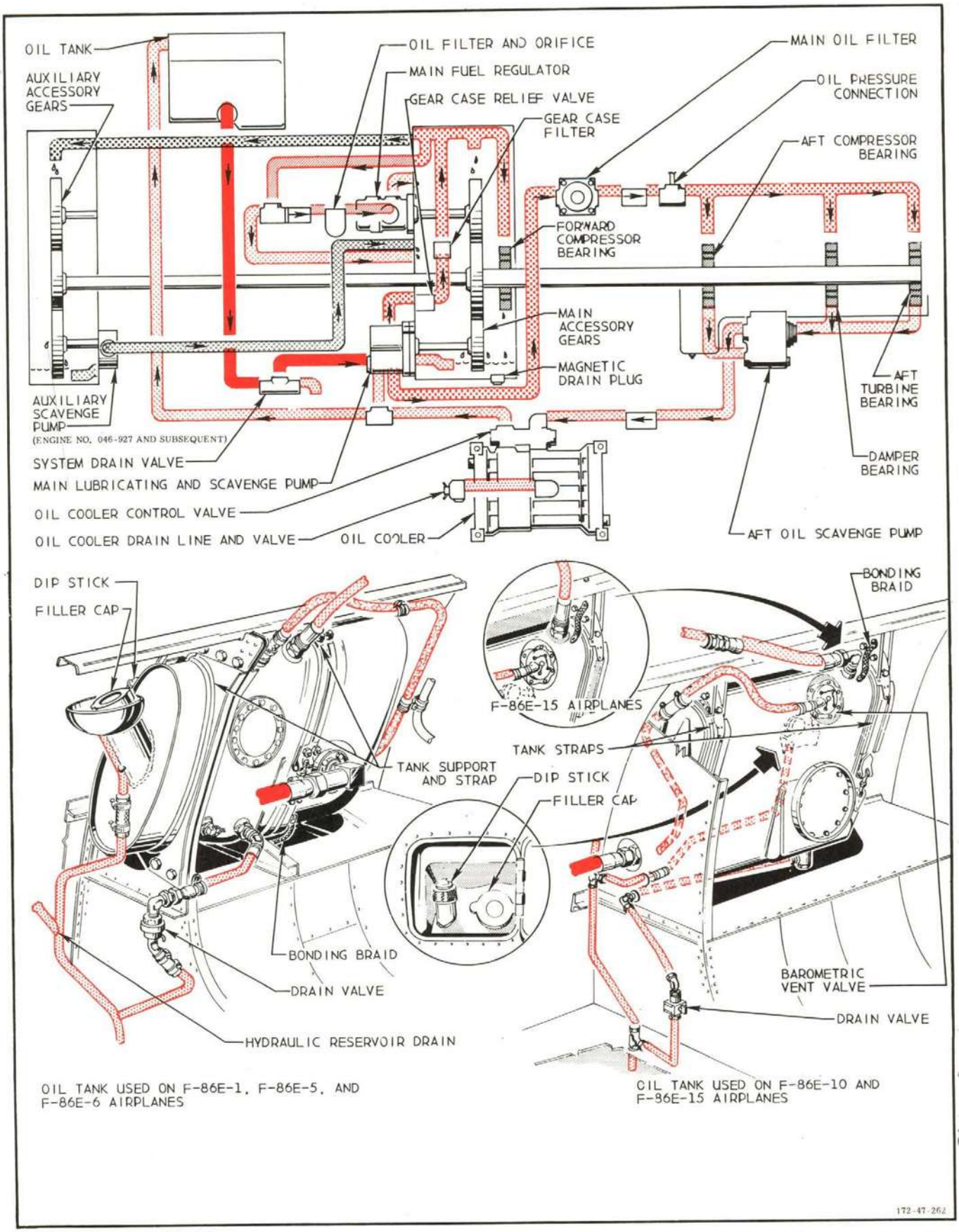

Figure 5-49. Engine Oil System (Sheet 2 of 2)

and front compressor bearing lubricating jets. After lubricating the bearings and gears, the oil drops to the gear case sump, where it is scavenged and sent back to the oil tank by the scavenge element of the lubricating and scavenge pump. From the gear case oil supply, control oil is furnished for the main fuel regulator. On engines No. 046-927 and subsequent, oil is tapped off downstream of the gear case filter to flow to the auxiliary accessory gear case. This oil, after lubricating the auxiliary gear case gears, is scavenged by the auxiliary gear case scavenge pump and returned to the main gear case sump. The No. 1 element of the lubricating and scavenge pump forces oil through the main oil filter to the jets lubricating the rear compressor bearing, the damper bearing, and the turbine bearing. The oil from these bearings is then scavenged by the rear scavenge pump and pumped to the oil cooler control valve. The control valve allows oil under 15°C (59°F) or exceeding 65 to 75 psi differential pressure to by-pass the oil cooler. The oil from the control valve or the oil cooler flows to the scavenge manifold line on the No. 3 engine plumbing island and then to the oil tank.

5-223. TROUBLE SHOOTING OIL SYSTEM.

5-224. Refer to paragraph 5-5.

5-225. OIL SYSTEM TANK.

5-226. The oil tank (figure 5-49) is attached in the right side of the fuselage structure. The maximum filling capacity of the oil tank, for F-86E-1, F-86E-5, and F-86E-6 Airplanes, is approximately 5.67 US. (4.72 Imperial) gallons, with an expansion space of approximately 1.13 US. gallons. The oil tank for F-86E-10 and F-86E-15 Airplanes has a maximum filling capacity of approximately 3.52 US. (2.93 Imperial) gallons, with an expansion space of approximately .99 US. gallon. The tank filler overflow and sump drain lines are manifolded and drain overboard, through the right wheel well. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, the tank is vented to atmosphere at all altitudes. On F-86E-10 and F-86E-15 Airplanes, mounted at the top of the tank is a barometric valve (figure 5-49) which allows the tank to be vented to the atmosphere up to approximately 10,000 feet altitude. Above this altitude, the valve automatically closes, allowing the oil scavenge pump to build up a maximum of 3½ (±¼) psi gage pressure inside the tank for high-altitude flying. Return oil flows against a baffle with tangential contact to the wall to minimize aeration. On some tanks, an immersion-type oil heater may be inserted through the filler neck flange to prewarm the oil. Cover plates on the side of the tank are provided for internal inspection and for cleaning when the tank is removed from the airplane.

5-227. REMOVING OIL TANK. To remove the oil tank, remove engine (paragraph 5-7) and proceed as follows:

a. Disconnect all oil, drain, and vent lines at oil tank.

b. Disconnect bonding braid at oil tank.

c. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, remove the three upper bolts, nuts, and washers, and the two lower bolts, nuts, and washers; then remove forward tank support.

d. Disconnect tank strap turnbuckle(s) securing oil tank; then remove tank.

5-228. INSTALLING OIL TANK. To install the oil tank, see figure 5-49 and proceed as follows:

a. Make sure tank strap chafing pads are in good condition.

b. Carefully position tank in cradle.

c. Connect tank strap(s) and check for proper alignment.

d. Tighten turnbuckle(s) until tank is secure; then safety turnbuckle(s).

e. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, install forward tank support with the three upper bolts, nuts, and washers, and the two lower bolts, nuts, and washers.

f. Connect bonding braid at oil tank.

g. Connect all oil, drain, and vent lines at oil tank.

h. Install engine (paragraph 5-13) and fill oil system (paragraph 1-40).

5-229. OIL COOLER.

5-230. The oil cooler (paragraph 5-4) is an oil-to-fuel tubular heat exchanger of the crossflow, counterflow type and is mounted on the lower case of the compressor. Fuel (the cooling agent) enters the front left side of the cooler, makes several passes through small-diameter tubes, and leaves the cooler at the rear right port. Scavenged oil from the aft scavenge pump enters the control valve (paragraph 5-232); if the oil is above allowable temperature limits, it enters the oil cooler and makes several passes counter to the fuel flow. After passing through the oil cooler, the cooled oil re-enters the control valve and flows out its discharge port. The engine must be removed from the fuselage for access to the oil cooler.

5-231. OIL COOLER CONTROL VALVE.

5-232. The oil cooler control valve (paragraph 5-4), flange-mounted to the left side of the cooler, regulates the flow of engine oil through the cooler. The valve is a combination thermostatic temperature valve and relief valve. A poppet valve is set to close the oil by-pass port between 26°C (80°F) and 32°C (90°F), while a disk valve will close the oil inlet port to the cooler between 15°C (59°F) and 21°C (70°F). Thus, at oil temperatures below 15°C (59°F), the oil is completely by-passed, while at temperatures above 32°C (90°F), all oil is directed through the cooler. The control valve functions also as a relief valve; scavenged oil pressures greater than 65 to 75 psi overpower a spring in the cap and force the poppet valve to open, allowing the oil to by-pass the cooler.

5-233. LUBRICATING AND SCAVENGE OIL PUMP.

5-234. The lubricating and scavenge oil pump (paragraph 5-4) is of the gerotor type, located on the lower part of the accessory gear case and incorporating two pressure elements and one scavenge element. A mounting pad and two external bosses are provided to facilitate installation of piping to the pump inlet and the outlet port of the No. 1 pressure element. The inlet and outlet ports of the other elements are internal and located within the gear case. The No. 1 lubricating element supplies oil to the rear compressor bearing, the damper bearing, and the turbine bearing. The No. 2 lubricating element supplies oil to the front compressor bearing, accessory gear case, and (on engines No. 046-927 and subsequent) the auxiliary gear case. The No. 2 element also supplies the main fuel regulator with cooling and control oil. The scavenge element of the pump returns the front compressor bearing and the accessory gear case oil to the oil system tank. The pump is driven counterclockwise at a gear ratio of .528:1 through gearing from the compressor rotor shaft.

5-235. REMOVING PUMP. To remove the pump, proceed as follows:

a. Remove auxiliary accessory cover (paragraph 5-24) and auxiliary accessory gear case (paragraph 5-26).

b. Disconnect fuel regulator oil drain line at gear case.

c. Disconnect cable and supporting clip from tachometer generator.

d. Disconnect hoses from lubricating and scavenge oil pump.

e. Remove bolts attaching lubricating and scavenge oil pump to gear case; then slide pump out.

Note

Observe method of lockwiring the attaching bolts. This will facilitate reinstallation of the pump.

f. Remove the tachometer generator from pump pad for installation on replacement pump.

5-236. INSTALLING PUMP. To install the pump, proceed as follows:

a. Attach tachometer generator to lubricating and scavenge oil pump. Leave mounting nut in front of outlet port loose for cable supporting clip.

b. Attach lubricating and scavenge oil pump to engine gear case by inserting attaching bolts. Torque bolts to 80-130 inch-pounds and lockwire in pairs.

c. Connect and secure cable and cable support to tachometer generator.

d. Attach oil hoses to lubricating and scavenge oil pump.

e. Connect fuel regulator oil drain hose to gear case fitting.

f. Install auxiliary accessory gear case (paragraph 5-27) and auxiliary accessory cover (paragraph 5-25).

5-237. AFT-BEARING SCAVENGE OIL PUMP.

5-238. The aft-bearing scavenge pump (paragraph 5-4), on the aft side of the compressor rear frame between combustion chambers No. 4 and No. 5, is a double-element gear type, constant-displacement hydraulic pump. It is installed in the compressor rear frame and is driven by the compressor rotor through a series of reduction gears. The two pumping elements are of equal capacity, with a constant displacement at any given speed. The pump capacity is 10 gallons per minute, minimum, with an inlet pressure of 6 in. Hg and with a discharge pressure of 60 psi at a speed of 3665 rpm. Rotation of the pump drive is counterclockwise as viewed facing the pump shaft. The pump scavenges oil from the rear compressor bearing, damper bearing, and turbine bearing.

5-239. REMOVING PUMP. To remove scavenge pump, proceed as follows:

a. Remove fuselage rear section. (Refer to paragraph 2-150.)

b. Remove No. 4 combustion chamber (paragraph 5-36) and remove forward clamp from the No. 5 combustion chamber.

Note

It is not necessary to remove engine for access to these combustion chambers.

c. Disconnect scavenge oil lines at pump.

d. Remove bolts that secure pump and carefully work pump free from pad.

5-240. INSTALLING PUMP. To install scavenge pump, proceed as follows:

a. Examine gasket and be sure it is in good condition; then install gasket and pump.

b. Install bolts and secure pump. Tighten all bolts evenly to a torque of approximately 60 inch-pounds; then continue to increase torque of each bolt in turn approximately 15 to 25 inch-pounds until a torque of 115 inch-pounds is reached.

c. Safety all bolts with AN995N32 safety wire.

d. Install No. 4 combustion chamber (paragraph 5-38); then install forward clamp on No. 5 combustion chamber.

e. Install fuselage rear section. (See figure 2-36.)

5-241. AUXILIARY ACCESSORY GEAR CASE SCAVENGE OIL PUMP (ENGINES NO. 047-927 AND SUBSEQUENT).

5-242. The auxiliary accessory gear case scavenge oil pump (paragraph 5-4) is a single-element, gerotor-type pump mounted at the lower aft side of the auxiliary accessory gear case. The pump will scavenge oil from the gear case at 0.45 gpm at 3800 pump rpm with a 15 psi inlet pressure. Pump rotation is clockwise as viewed facing the splined end of the pump drive shaft.

5-243. OIL FILTER.

5-244. The oil filter (paragraph 5-4) is a multiple-screen type filter, located in the aft-bearing oil supply line. It is mounted with four bolts on the lower left side of the compressor case, and it filters the oil flowing to the rear compressor bearing, damper bearing, and turbine bearing. Oil enters the filter and passes through three bronze-mesh screens into the chamber at the center. An opening at the bottom of the chamber connects with the filter outlet. In case the screens become clogged and the differential pressure reaches 15 to 20 psi, a spring-loaded relief valve will open and admit oil directly into the chamber, by-passing the screens. The maximum pressure drop through the filter is 5 psi with a flow of 3 gpm.

5-245. CLEANING AIR MAZE OIL FILTER. To clean the Air Maze oil filter, remove left wheel well engine access cover and proceed as follows:

a. Cut safety wire securing sleeve nut and remove sleeve nut; then remove "O" ring from sleeve nut.

b. Remove cover and gasket from filter body.

c. Unscrew seal nut and remove relief valve seat, relief valve, and relief valve spring.

d. Lift filter cartridge from body.

e. Dip all parts, except filter cartridge and gasket, in cleaning solvent (Federal Specification P-S-661). If necessary, in order to clean parts thoroughly, use a brush. Allow parts to drain; then dry parts with a lint-free cloth.

f. Blow through openings in body with dry compressed air.

g. Clean filter cartridge with a soft-haired brush dipped in cleaning solvent.

Note

Do not use a wire brush on any part of filter.

h. Carefully blow through filter cartridge, from the center outward, with dry compressed air.

i. Seat filter cartridge evenly in circular groove of filter body.

j. Place relief valve spring over stud; then place relief valve over stud with projecting collar down.

k. Place relief valve seat over relief valve, with recessed surface upward.

l. Place seal nut on stud so that projecting sleeve of seal nut fits into center opening of relief valve seat; then turn seal nut down until valve seat bears firmly on center section of filter cartridge. Torque seal nut to 25-30 inch-pounds.

m. Install gasket in filter body recess.

n. Place cover on body, replace "O" ring, and secure with sleeve nut.

Note

Replace any gaskets or "O" rings showing evidence of deterioration or wear.

o. Torque sleeve nut to 70-80 inch-pounds and safety with AN995N32 safety wire.

p. Install left wheel well engine access cover.

5-246. CLEANING HYDRO-AIRE OIL FILTER. To clean Hydro-Aire oil filter, remove left wheel well engine access cover and proceed as follows:

a. Cut safety wire securing valve hexagon; then unscrew and remove filter group from filter body.

Note

Pull filter group straight out, to avoid dropping loose valve parts.

b. Catch shim, spring, and poppet.

c. Remove retaining ring farthest from valve hexagon, and successively remove baffle support, baffle, spacer, filter cartridge, collar, and retaining ring nearest the valve hexagon.

d. Remove cover; then remove cover packing gasket and valve packing gasket.

e. Dip all parts except filter cartridge and gasket in cleaning solvent (Federal Specification P-S-661). If necessary, in order to clean parts thoroughly, use a brush. Allow parts to drain; then dry parts with a lint-free cloth.

f. Blow through openings in body with dry compressed air.

g. Clean filter cartridge with a soft-haired brush dipped in cleaning solvent.

CAUTION

Do not use a wire brush on any part of the filter.

h. Carefully blow through filter cartridge, from the center outward, with dry compressed air.

i. Install packing gasket on valve and packing gasket on cover; then place cover on valve.

Note

Replace any gasket showing evidence of deterioration or wear.

j. Install retaining ring nearest the valve hexagon; then successively install collar, filter element, spacer, baffle, baffle support, and retaining ring farthest from valve hexagon.

k. Properly seat popper in valve; then insert spring and shim in valve.

l. Place filter group evenly in filter body and screw valve hexagon to a torque of 90-110 inch-pounds; then safety valve hexagon to filter body with AN995N32 safety wire.

m. Install left wheel well engine access cover.

5-247. STARTING SYSTEM.

5-248. The starting system (figure 5-50) consists of the following units: stop-starter switch, starter-generator, starter controller, and battery-starter switch. Associated equipment consists of an engine master switch and two external power relays. Starter operation, through use of the starter controller, is entirely automatic once the battery-starter switch has been momentarily placed in the starter position. To de-energize the automatic starting circuit, it is necessary to depress the stop-starter switch, which de-energizes the starter controller relay and thereby disconnects power to the starter-generator. The starting system is wired so the starter cannot be energized from the battery of the airplane. The system should be powered by a 28-volt d-c external power source capable of handling a 1500-ampere surge current and a continuous operating current of 600 amperes. An emergency ignition switch, located on the right-hand forward console, is used to obtain an air start, at which time ram air turns the engine.

5-249. FUNCTION OF STARTING SYSTEM.

5-250. With external power connected to the airplane, the starter system functions as follows: Momentarily placing the battery-starter switch in the "STARTER" position with engine master switch "ON" causes current to flow through the starter controller relay, closing its contacts. The relay in turn connects the external power source to the starter winding through the series coil of the undercurrent relay. The initial surge of power energizes the undercurrent relay (in the starter controller), which keeps the starter relay in an energized condition until such time as the current flowing through the undercurrent relay falls off enough for spring tension to snap the undercurrent relay contacts open. When undercurrent relay contacts open (at approximately 23% engine rpm), power is removed from starter relay and, consequently, power is removed from starter winding. The starter-generator then operates as a generator and provides rated output voltage when engine reaches approximately 51% rpm. For an air start, the emergency ignition switch on the right-hand forward console is used. Operation of this switch (normally safetied with a red guard) places primary bus voltage directly on the ignition vibrators and thereby energizes the plugs, which fire and reignite the jet flame.

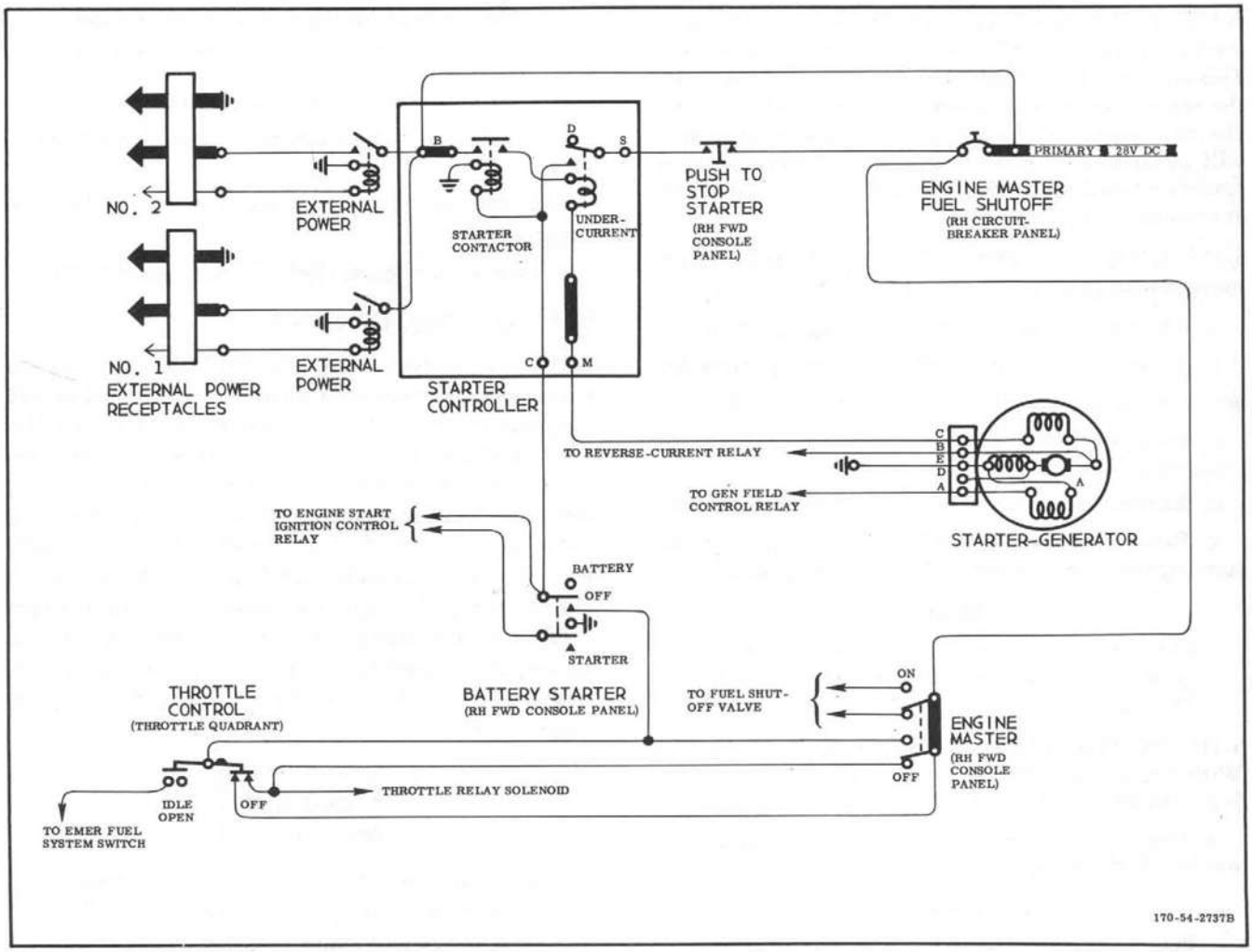

Figure 5-50. Starting System

CAUTION

Do not keep power on starter longer than one minute during any start, as damage to starter will result from overheating. Operation of the engine starter is limited to three runs of one-minute maximum duration during any 30-minute period.

5-251. TROUBLE SHOOTING STARTING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Starter will not operate.	Defective starter switch.	
	Defective wiring.	
	Defective starter relay.	
	Defective starter.	
	Loose or high-resistance connections.	
	Dirty commutator.	Replace starter.
	Rough or pitted commutator.	Replace starter.
	Shorted, grounded, or open armature.	Replace starter.
	Brushes not properly seated.	Replace brushes.

5-252. STARTER-GENERATOR.

5-253. A 400-ampere, General Electric, combination starter-generator (2CM77B8A) is driven by the engine. This unit performs a twofold purpose; it is used to crank the engine and also to provide primary power for the electrical system of the airplane. The starter-generator will commence to produce power when engine rpm reaches approximately 23% and will deliver rated power at approximately 51% rpm.

5-254. REMOVING STARTER-GENERATOR. To remove starter-generator, proceed as follows:

a. Remove the engine. (Refer to paragraph 5-7.)

b. Remove the engine auxiliary accessory cover for access to the starter. (Refer to paragraph 5-24.)

c. Remove engine auxiliary gear case. (Refer to paragraph 5-26.)

d. Remove electrical wiring from starter-generator.

e. Remove the six self-locking nuts, and slide the starter-generator forward and out of the engine.

Note

Care should be taken in removing starter-generator, as the unit weighs approximately 75 pounds.

5-255. INSTALLING STARTER-GENERATOR. With engine auxiliary gear case removed (paragraph 5-26), install starter-generator in the following manner:

a. Position starter-generator on the mounting pad, and install the six self-locking nuts.

Note

Before electrical wiring is connected to starter-generator, make certain the attaching screws on starter-generator brush cover will be clear of the cables and easily accessible. If necessary, rotate brush cover to provide this accessibility.

b. Connect electrical wiring to starter-generator.

c. Install engine auxiliary gear case. (Refer to paragraph 5-27.)

d. Install engine auxiliary accessory cover. (Refer to paragraph 5-25.)

e. Install the engine. (Refer to paragraph 5-13.)

5-256. STARTER CONTROLLER.

5-257. The starter controller (AN3391-1), mounted within the engine compartment, connects the electrical system to the starter for engine starting. The controller consists of two relays within one unit: a starter contactor relay and an undercurrent relay. The latter relay serves as a locking relay for the starter contactor during the automatic starting of the engine. This type of starting eliminates the necessity of holding the starter switch closed during the cranking period. After engine rpm reaches approximately 23%, the starter controller is automatically de-energized and disconnected electrically from the starter. (For function of the unit, refer to paragraph 5-250.)

CAUTION

When connecting or disconnecting hydraulic lines in the vicinity of the starter controller, exercise extreme caution to prevent short circuit on starter controller terminals.

5-258. IGNITION SYSTEM.

5-259. The ignition system (figure 5-51) is utilized for both normal ground starts and windmilling air starts. During a ground start, the system functions only during the starting sequence and is automatically de-energized by the undercurrent relay when the engine attains operating speed. The ignition system consists of two spark plugs, two direct-current ignition vibrator units, and an ignition control relay.

5-260. FUNCTION OF IGNITION SYSTEM.

5-261. The ignition system is energized through contacts on the ignition control relay and the power control relay when external power is available on the primary bus, provided the battery-starter switch is placed in the "STARTER" position, the engine master switch is in the "ON" position, and the power control (throttle) lever is advanced to the "IDLE" position. When energized, the ignition control relay connects the ignition system to the power control relay. Placing the power control lever in the "IDLE" position actuates the power control microswitch, which disconnects the power control relay from the primary bus. When de-energized, the power control relay connects the ignition system to the primary bus and current flows to the ignition vibrators, which provide the high-tension voltage (approximately 8000 volts) for the two spark plugs installed in chambers 2 and 7. Ignition is maintained through the starter controller terminals S and C during operation of the starter. When the starter controller cuts out automatically above 23% engine rpm, the ignition control relay is de-energized, which disconnects the ignition system from the primary bus power. An emergency ignition switch, wired in parallel with the ignition control relay contacts, is provided for making a windmilling air start. This switch is manually operated and must not remain on any longer than necessary to start engine.

5-262. TROUBLE SHOOTING IGNITION SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
No ignition.	Circuit breaker open.	Reset circuit breaker. If it pops out, investigate cause.
	Defective ignition unit.	Replace unit.
	Voltage from external power source too low.	Adjust external power source to restore voltage, if possible, or obtain a reliable external power source.
	Defective starter switch.	Replace starter switch.
	Defective throttle switch.	Replace throttle switch.

5-263. IGNITION VIBRATOR UNITS.

5-264. Two ignition vibrator units, mounted on the compressor case near the top of the engine, supply engine ignition during the starting sequence. These units convert the 28-volt d-c input into a high-tension voltage of approximately 8000 volts, which is applied directly to the ignition plugs. Each vibrator unit has a nominal continuous rating of 3 minutes on and 30 minutes off and is rated for 150 hours of normal engine operation. Each unit draws approximately 2 amperes (75 watts nominal and 100 watts maximum power). The output leads are radio-shielded and filtered.

CAUTION

Do not continuously energize vibrator units longer than 15 minutes at any time or damage to the unit will result. Ignition vibrator input voltage must be maintained above 18 volts minimum to develop sufficient high-tension voltage for a successful engine start.

5-265. SPARK PLUGS.

5-266. Two spark plugs are used to ignite the fuel in the combustion chambers: one for combustion chamber No. 2, and one for combustion chamber No. 7. The ceramic-type spark plugs have long electrodes extending into the inner liner of the combustion chambers. The operating gap between electrodes is between .090 and .110 inch. Spark plug reset gap is .100 (±.005) inch.

5-267. REMOVING SPARK PLUGS. To gain access to the spark plugs, remove the spark plug access door on each side of the fuselage aft of the fuselage split line. To remove spark plugs, proceed as follows:

CAUTION

Do not attempt to remove spark plugs by applying a wrench to visible wrench pad, as this will change the gap settings. To prevent breaking spark plug terminal insulator in plug well, loosen coupling between sheath tube sections to provide the necessary lead flexibility to remove spark plugs.

a. Disconnect and remove spark plug lead.

b. Break lockwire on the two spark plug supporting screws.

c. Remove screws.

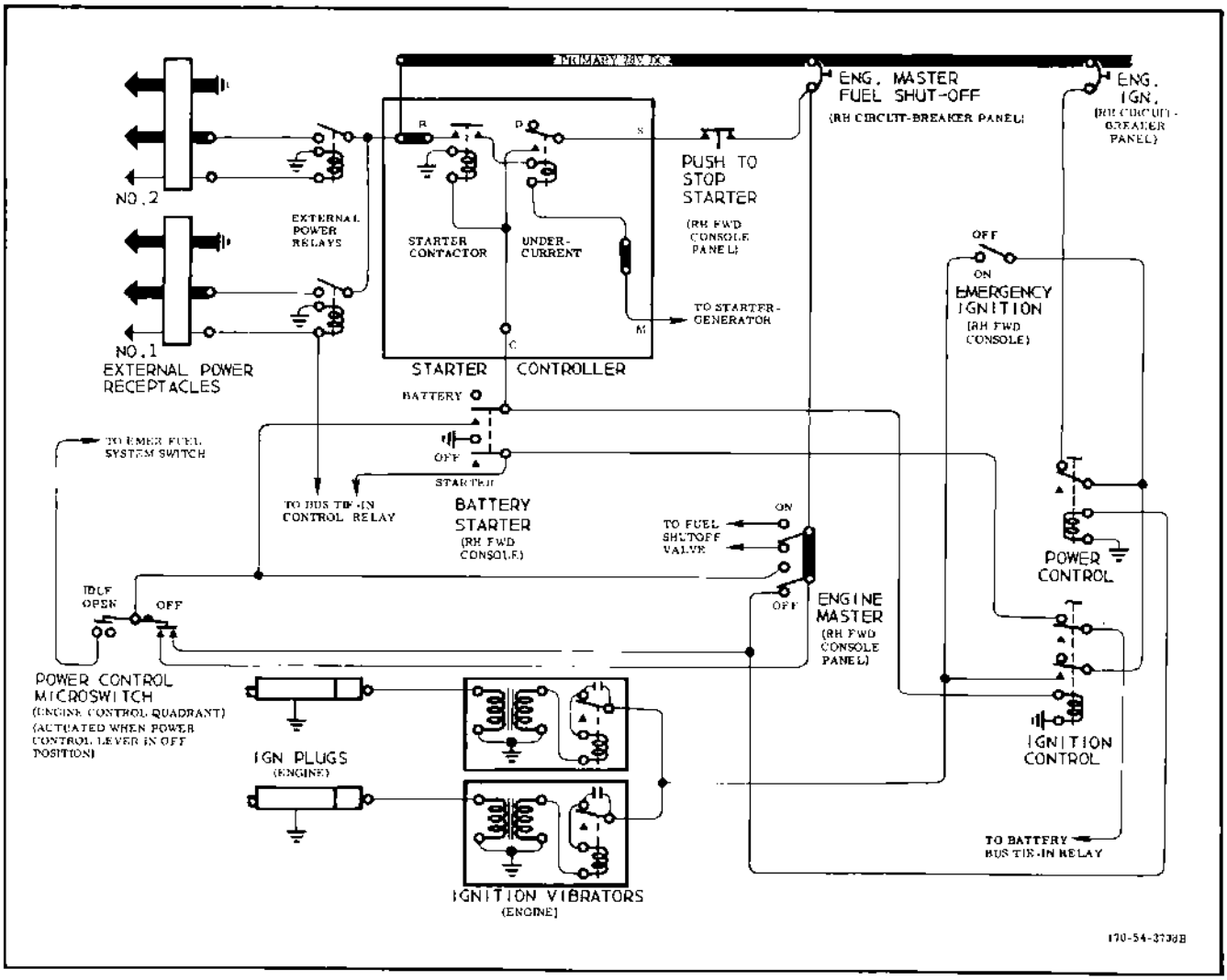

Figure 5-51. Ignition System

d. Lift out spark plug, using caution not to damage the long electrode.

e. Remove gasket, and cover spark plug hole to prevent entry of foreign matter.

5-268. INSTALLING SPARK PLUGS. To install spark plugs with spark plug access doors removed, proceed as follows:

a. Install spark plug and new gasket to mounting pad.

b. Secure spark plug with two fillister-head screws; then torque screws from 23 to 27 inch-pounds.

c. Safety screws with lockwire.

d. Install and tighten spark plug lead, and tighten lead coupling.

e. Install spark plug access door.

5-269. IGNITION DISCONNECT JUMPER.

5-270. An ignition disconnect jumper is provided between the engine ignition disconnect junction box and a disconnect point to facilitate removal and installation of the engine. The ignition disconnect junction box is mounted on the right side between the oil tank and the engine. The disconnect point consists of a bracket and receptacle assembly, mounted on the right side at engine island No. 1, and is readily accessible through the right engine access door. The ignition disconnect jumper is safety-wired at both ends.

Section VI
INSTRUMENTS

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6-1. INSTRUMENTS.

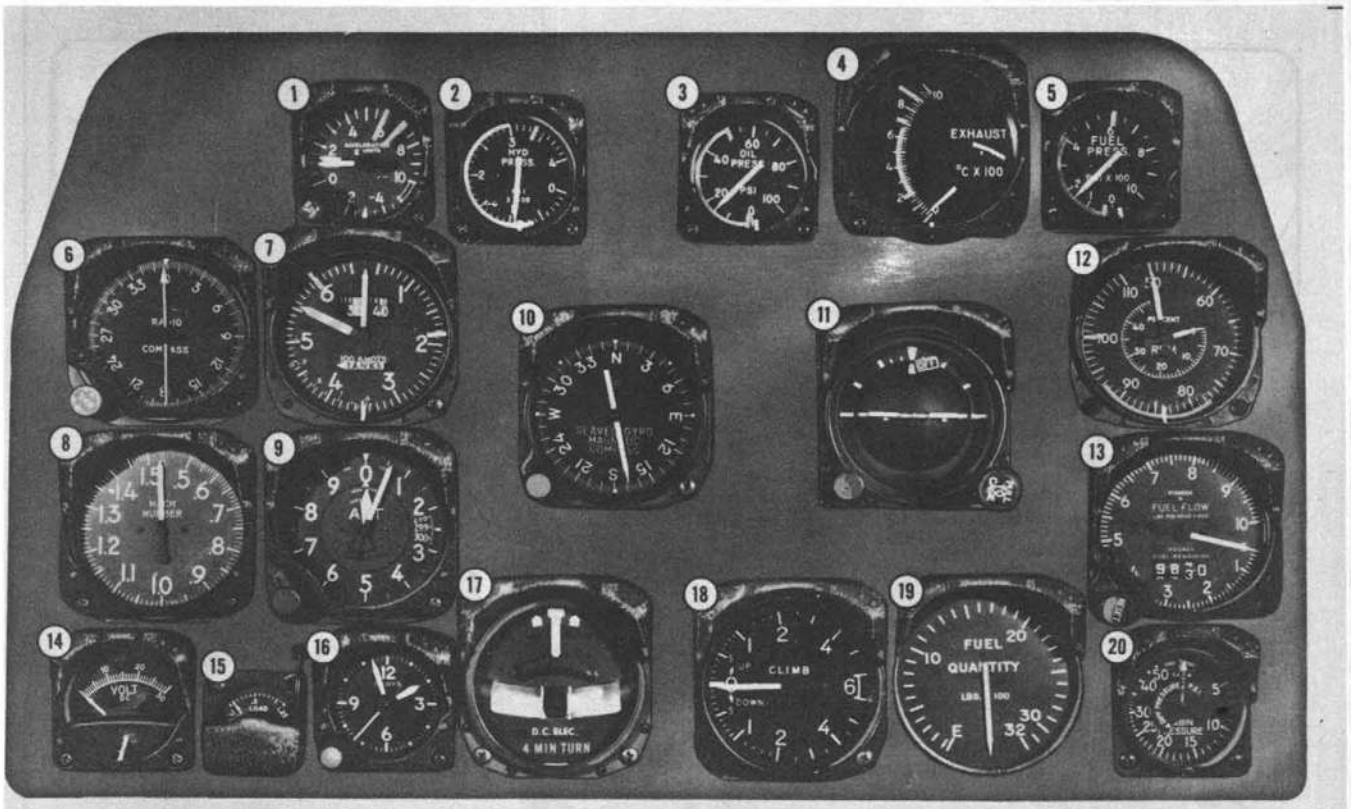
6-2. The instruments are grouped as follows: engine, flight, navigation, hydraulic, and miscellaneous. All individually lighted instruments are located on the pilot's instrument panel, with the exception of those shown in figure 6-2. All instruments employ either a clamp- or bezel-type front mounting. (See figure 6-3.) An instrument panel vibrator, mounted on the back of the instrument panel, prevents intermittent sticking of the instrument pointers. Because certain instruments were not available, substitute instruments were installed in some airplanes; a white label on the case identifies each substitute instrument and tells for what it is a substitute. The following instrument types or substitutes are installed on the airplane:

INSTRUMENTS	SPECIFIED TYPE	SUBSTITUTE TYPE	OPERATING SOURCE
ENGINE INSTRUMENTS			
Exhaust temperature indicator	K-7		G
Fuel flow indicator	36700		D
Fuel level indicator	EA31-150*		
	EA721-G-1A†		A
Fuel pressure indicator	C-30‡		
	C-34§		B
Oil pressure indicator	B-20		B
Tachometer indicator	E-32		G
FLIGHT INSTRUMENTS			
Accelerometer	B-6	B-4	F
Airspeed indicator	L-7 or L-7A	L-6	E
Altimeter	AN5760T2A	C-12	E
Cabin altimeter	A-1¶		E
	MIL-I-5099**		F
Machmeter	A-2	A-2A, A-2B	E
Rate-of-climb indicator	AN5825T5	AN5825T3	E
Turn-and-bank indicator	C-5	C-6	A
NAVIGATION INSTRUMENTS			
Attitude gyro	J-8		C
Directional gyro	V-3, V-8††		
	V-7A‡‡		C
Radio compass	ID-90/ARN-6	ID-90A/ARN-6, ID-91A/ARN-6	A
Stand-by compass	AN5766-3		F
HYDRAULIC INSTRUMENTS			
Hydraulic system pressure indicator	E-1		E
Hydraulic system air pressure indicator	AN5771T7A		E
MISCELLANEOUS INSTRUMENTS			
Ammeter	J-1		A
Clock	AN5743T1A		F
Gun charger air compressor indicator	AN5771T7A		E
Oxygen pressure gage	AN6021-1A		E
Panel vibrator	C-10FA-543, C-10FA-548		A
Voltmeter	AN3203V30		A

OPERATING SOURCE CODE

A—28-volt direct current
B—26-volt alternating current
C—115-volt alternating currrent (three-phase)
D—115-volt alternating current (single-phase)
E—Pressure
F—Self-contained
G—System-generated

***F-86E-1 Airplanes AF50-579 through -613**
†F-86E-1 Airplanes AF50-614 through -638 and F-86E-5 and subsequent airplanes
‡F-86E-1, F-86E-5, and F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 through -2821
§F-86E-10 Airplanes AF51-2822 through -2849 and F-86E-15 Airplanes
¶F-86E-1, F-86E-5, F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 through -2792
****F-86E-10 Airplanes AF51-2793 through -2849 and F-86E-15 Airplanes**
††F-86E-1, F-86E-5, and F-86E-6 Airplanes, F-86E-10 Airplanes AF51-2718 through -2756 and -2769 through -2849, and F-86E-15 Airplanes
‡‡F-86E-10 Airplanes AF51-2757 through -2768



1. ACCELEROMETER INDICATOR
2. HYDRAULIC PRESSURE INDICATOR
3. OIL PRESSURE INDICATOR
4. EXHAUST TEMPERATURE INDICATOR
5. FUEL PRESSURE INDICATOR
6. RADIO COMPASS INDICATOR
7. AIRSPEED INDICATOR
8. MACHMETER INDICATOR
9. ALTIMETER INDICATOR
10. DIRECTIONAL COMPASS INDICATOR
11. ATTITUDE INDICATOR
12. TACHOMETER INDICATOR
13. FUEL FLOW INDICATOR
14. VOLTMETER
15. AMMETER
16. CLOCK
17. TURN-AND-BANK INDICATOR
18. RATE-OF-CLIMB INDICATOR
19. FUEL LEVEL INDICATOR
20. CABIN ALTIMETER

Figure 6-1. Instrument Panel

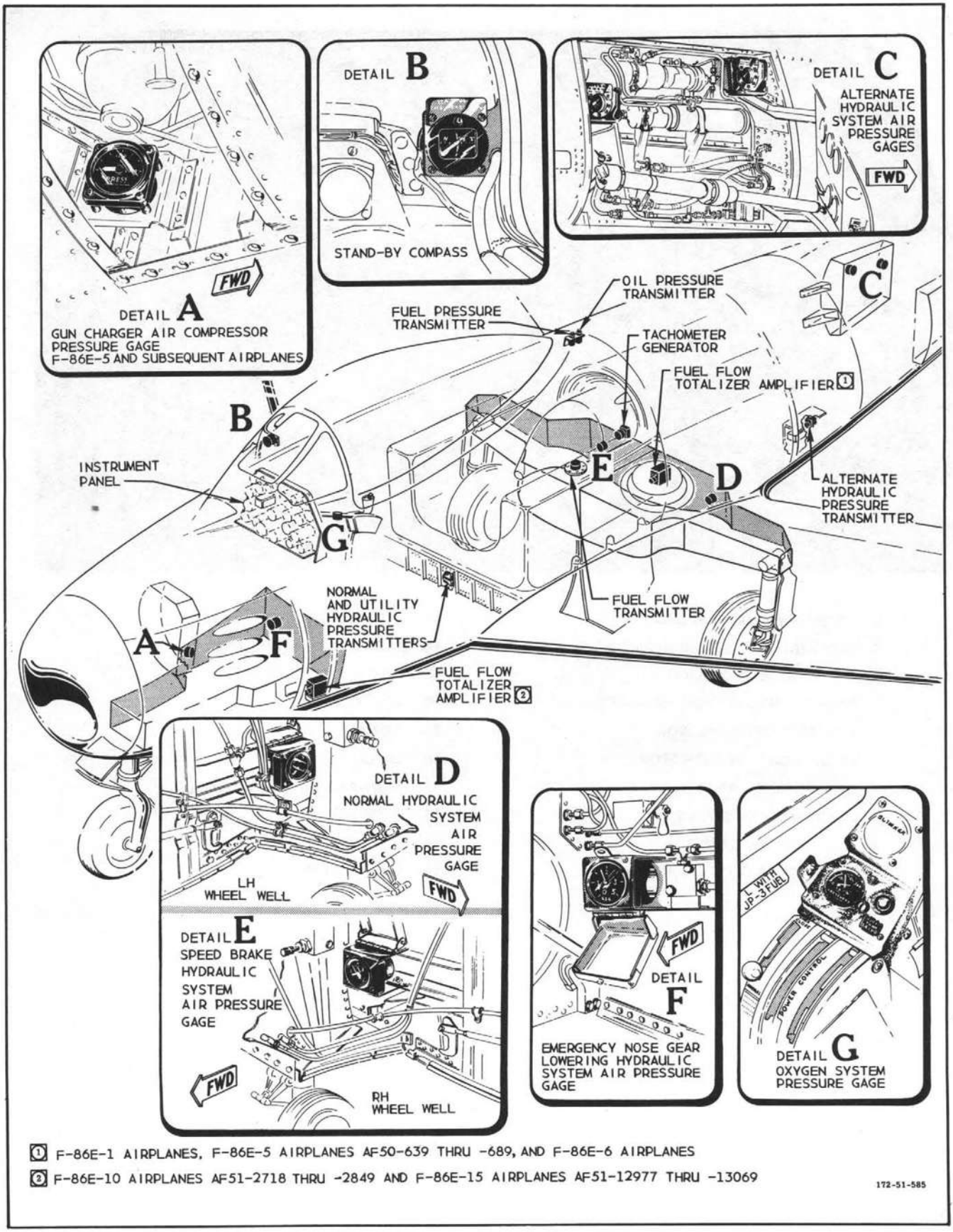


Figure 6-2. Instrument and Equipment Location Chart

6-3. TROUBLE SHOOTING INSTRUMENTS.

TROUBLE	PROBABLE CAUSE	REMEDY
ACCELEROMETER		
Indicating hand appears locked in place.	Vibration of instrument less than required minimum.	Examine instrument panel for restriction. Gently tap instrument.
Hand vibrates.	Excessive vibration.	Inspect instrument for worn mounting. If instrument is damaged, replace.
Scale error greater than allowable tolerance of ±0.2 G.	Loosened fit on main shaft. Mass string loosened. Dirt in bearings.	Replace instrument. Replace instrument. Replace instrument.
AIRSPEED INDICATOR		
Indicated airspeed hand fails to respond.	Pressure line improperly connected. Pressure line clogged.	
Maximum allowable airspeed hands fail to respond.	Static line not connected properly. Static line clogged.	
Indicated airspeed hand indicates incorrectly.	Leak in pressure line. Leak in instrument.	Replace instrument.
Maximum allowable airspeed hand indicates incorrectly.	Leak in static line. Leak in instrument.	Replace instrument.
Indicated airspeed hand does not set on zero unless airplane is in motion.	Defective indicator.	
Pointers vibrate.	Excessive vibration of instrument panel.	Replace shock mounts if necessary.
Pointers oscillate.	Leak in lines. Leak in case.	Replace instrument.
Erratic movement of maximum allowable airspeed hand.	Friction within instrument.	Replace instrument.
ALTIMETER		
Hand fails to respond.	Static line clogged. Static line connections improperly made or loose.	
Hand indicates incorrectly.	Loose hand. Shock which has shifted mechanism. Leaks in case or tubing.	Replace altimeter. Attempt to correct by resetting barometric pressure scale. If readings cannot be corrected, replace instrument.
Incorrect barometric pressure reading.	Shock which has shifted mechanism parts.	Attempt to correct by resetting barometric pressure scale. If readings cannot be corrected, replace instrument.

TROUBLE	PROBABLE CAUSE	REMEDY
Hand vibrates.	Excessive vibration of instrument panel.	Inspect instrument panel and, if excessive vibration is apparent, correct locally by replacement of worn or deteriorated shock mounts or by other adjustments. If this does not remedy trouble, replace instrument.
	Excessive vibration of tubing.	Make certain straps that secure tubing are in place and firmly secured.
Erratic movement of hands.	Friction.	Replace instrument.
	Broken jewels.	Replace instrument.
AMMETER		
Pointer gives reverse reading.	Leads on back of ammeter reversed.	
Pointer fails to indicate.	Broken wire or loose connection.	
Jerky pointer action.	Dirt inside instrument.	Replace ammeter.
Pointer does not return to zero.	Defective instrument.	
TURN-AND-BANK INDICATOR		
Indicator fails to operate or operates intermittently.	Incorrect power source.	Check power supply. It must be 26-volt (±10 percent), 400-cycle (±10 percent), three-phase.
	Poor electrical connections or broken wire.	
	Internal mechanism damaged.	
Pointer deflection reversed; that is, the pointer moves to the left for a right turn and to the right for a left turn.	Phase rotation incorrect.	Check power supply. Phase rotation must be A, C, B.
	Lead reversal.	
	Loose pointer.	Replace indicator.
	Indicator out of calibration.	Replace indicator.
Pointer fails to respond.	Poor electrical connection.	
	Operating voltage too low.	
	Open circuit to instrument.	Replace instrument.
Deflection too short.	Operating voltage too low.	
	Sensitive adjustment screw turned in too far.	Replace instrument.
Deflection too long.	Sensitive adjustment screw not turned in far enough.	Replace instrument.
Excessive pointer oscillation.	Damper adjustment screw out of adjustment.	Replace instrument.
Vibrating pointer.	Excessive vibration of instrument panel.	
Pointer does not zero (returns to same position each time gyro is stopped).	Gyro assembly out of balance.	Replace instrument.
	Out-of-zero adjustment.	Replace instrument.

TROUBLE	PROBABLE CAUSE	REMEDY
	CABIN ALTIMETER	
Instrument fails to operate.	Cabin pressure vent clogged. Static line clogged.	
Incorrect indication.	Slow leak in diaphragm.	Replace instrument.
Pointer oscillates.	Leak in instrument case.	Replace instrument.
Erratic pointer movement.	Loose pointer. Sticky pointer. Defective instrument.	Replace instrument.
	EXHAUST TEMPERATURE INDICATOR	
No indication.	Broken lead. Loose or dirty connection. Faulty indicator.	
Variable reading.	Loose or dirty connection. Faulty indicator.	
Friction.	Faulty indicator.	
Low reading.	Resistor set too high. Faulty indicator.	Adjust resistor.
Intermittent reading.	Poor connection. Short circuit in leads. Broken leads. Faulty indicator.	Replace leads.
	FUEL LEVEL INDICATOR	
No indication.	No power. Loose connection at indicator or tank unit. Open circuit in indicator. Binding in indicator. Open circuit in tank unit.	 Replace indicator. Replace indicator. Replace tank unit.
Low or high reading.	Bad junction head. Short circuit. Poor connection at tank unit or indicator. Binding in indicator. Poor connection in tank unit.	Replace tank unit. Replace indicator.
	FUEL PRESSURE INDICATOR	
No rotation of indicator pointer.	No power.	
Reverse rotation of indicator pointer.	Leads reversed.	
Erratic movement of indicator pointer.	Intermittent open in leads. Internal defect.	Replace indicator.

TROUBLE	PROBABLE CAUSE	REMEDY
Sluggish movement of indicator pointer.	Leak in connecting lines or connection fittings.	Replace gaskets; check for tight connection fittings.
Excessive friction.	Internal defect.	Replace indicator.
	STAND-BY COMPASS	
Discolored liquid.	Deterioration.	Replace compass.
Fading or illegible card markings.	Deterioration of luminescent marking material.	Replace compass.
Card does not rotate freely when airplane is in normal flying position. Sluggish.	Broken pivot; broken or cracked jewel.	Replace compass.
Compass is erratic or does not respond to compensation.	Magnets demagnetized, or compensating gear magnets demagnetized.	Replace compass.
Loss of liquid.	Filling screw gasket damaged. Window gasket damaged. Bowl cracked.	Replace compass. Replace compass. Replace compass.
	OIL PRESSURE INDICATOR	
No rotation of indicator pointer.	No power.	
Reverse rotation of indicator pointer.	Leads reversed.	
Erratic movement of indicator pointer.	Intermittent open in leads. Internal defect. Broken or leaking oil lines.	Replace unit.
Sluggish movement of indicator pointer.	Leak in connecting lines or connection fittings.	Replace gasket; check for tight connections and fittings.
Excessive friction.	Internal defect.	Replace unit.
	RATE-OF-CLIMB INDICATOR	
Pointer fails to respond.	Obstruction in static line.	
Pointer indicates inaccurately.	Leak in static line. Leak in instrument case.	Replace instrument.
Pointer oscillates.	Leak in static line.	
	TACHOMETER INDICATOR	
Indicator does not register.	Faulty electrical connection. Defective indicator. Broken generator drive shaft. Generator rotor weak or demagnetized.	Replace generator. Replace generator.
Indicator oscillates.	Defective indicator.	

TROUBLE	PROBABLE CAUSE	REMEDY
Engine running, indicator not operating.	Wiring or connections between tachometer generator and indicator defective or improperly connected.	
	Faulty tachometer generator.	
	Connections to stator open or short-circuited.	
	Stator open or short-circuited.	Replace generator.
	Bent pinion, jammed gear, or broken jewel.	Replace generator.
Readings not accurate.	Indicator magnet partly demagnetized.	Replace indicator.
	Excessive friction in mechanism.	Replace indicator.
	Broken jewel.	Replace indicator.
	Bent hand.	Replace indicator.
	Broken hairspring.	Replace indicator.
	Bent pinion or gear and shaft assembly.	Replace indicator.
	Defective stator winding.	Replace indicator.
VOLTMETER		
No indication.	Loose connections.	
	Broken lead.	
	Loose or broken internal wiring.	Replace voltmeter.
	Internal defect.	Replace voltmeter.
	Dirt in unit.	Replace voltmeter.

6-4. REMOVING INSTRUMENT PANEL.

6-5. To remove instrument panel, position battery-starter switch in "OFF" position; then proceed as follows:

a. Unlatch the eight quick-disconnect type fasteners around outside edge of instrument panel and tilt panel aft.

b. Disconnect all instruments from power source.

c. Disconnect the two instrument panel forward electrical disconnects.

d. Remove the two hydraulic pressure switch mounting screws.

e. Cover all power source disconnects.

f. Carefully remove instrument panel from airplane.

CAUTION

When disconnected, all pressure lines, electrical connectors, and instrument receptacles must be covered with suitable covers to prevent entry of foreign materials, especially metal particles, that may render the instruments inoperative.

6-6. INSTALLING INSTRUMENT PANEL.

6-7. To install instrument panel, position battery-switch in "OFF" position; then proceed as follows:

a. Place instrument panel on panel support.

b. Remove covers from all power source disconnects.

c. Connect instruments to power sources.

d. Connect instrument panel forward disconnects.

e. Install hydraulic pressure switch on panel.

f. Latch the eight quick-disconnect type fasteners.

6-8. REMOVING CLAMP-TYPE INSTRUMENTS.

a. Push upper hinged light fixture downward.

b. Lift hinged bulbs outward to gain access to upper mounting screws.

c. Remove upper right mounting screw.

d. Loosen upper left mounting screw.

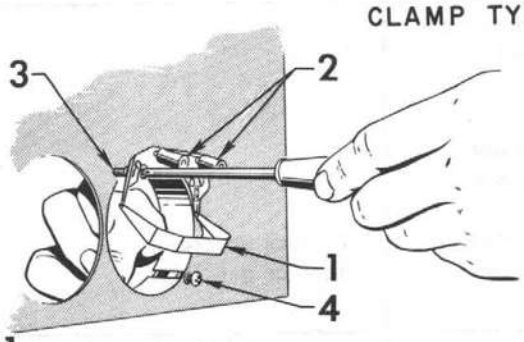
e. Loosen lower right mounting screw.

f. Pull instrument from panel to expose power connections.

g. Disconnect instrument power source, and cover disconnects with suitable covers.

h. Remove instrument from panel.

CLAMP TYPE MOUNTING

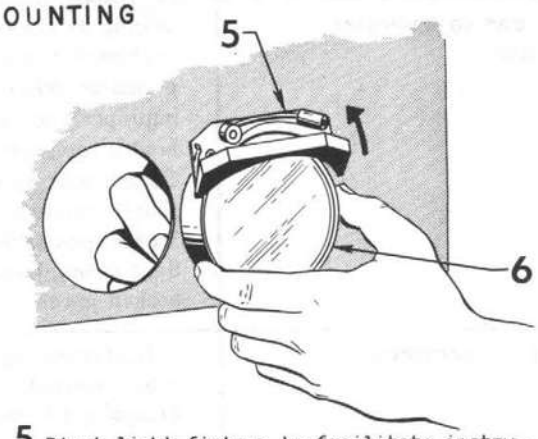


1 Open hinged bulb cover.

2 Lift hinged bulbs to gain access to mounting holes.

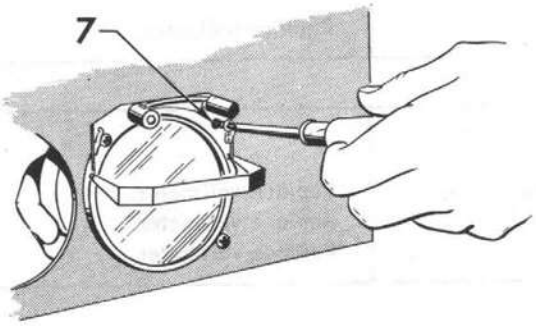
3 Align clamp and light fixture with panel mounting holes, and install upper left mounting screw.

4 Install lower right clamp screw-jack screw.

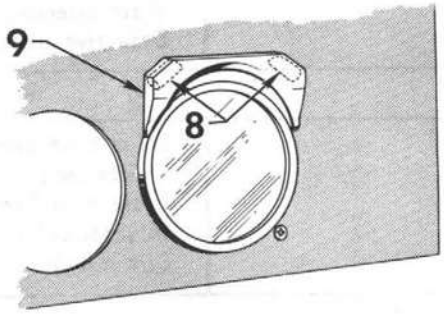


5 Pivot light fixture to facilitate instrument installation.

6 Connect instrument power source and insert instrument in panel.



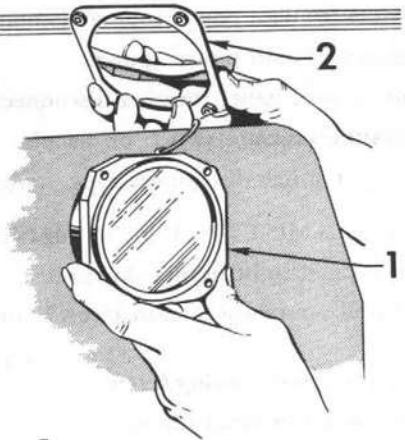
7 Install light fixture mounting screw and tighten all three screws.



8 Push hinged bulbs in place.

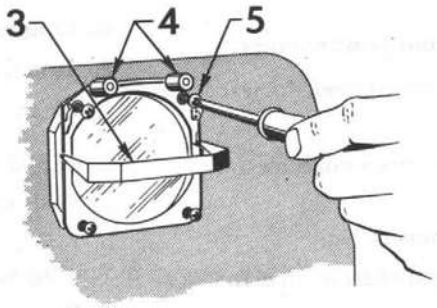
9 Close hinged bulb cover.

BEZEL TYPE MOUNTING



1 Connect instrument power source and insert instrument in panel.

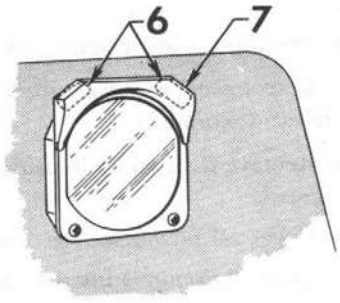
2 Align light fixture over instrument.



3 Open hinged bulb cover.

4 Lift hinged bulbs to gain access to mounting holes.

5 Install four mounting screws and tighten.



6 Push hinged bulbs in place.

7 Close hinged bulb cover.

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Figure 6-3. Installing Instruments

6-9. REMOVING BEZEL-TYPE INSTRUMENTS.

a. Pull down upper hinged flange of light fixture.

b. Lift hinged bulbs to gain access to upper mounting screws.

c. Remove the four mounting screws from instrument bezel.

d. Pull instrument from panel to expose connections.

e. Disconnect instrument power sources.

f. Cover disconnects with suitable covers.

g. Remove instrument from panel.

6-10. INSTALLING CLAMP-TYPE AND BEZEL-TYPE INSTRUMENTS.

6-11. See figure 6-3.

6-12. REMOVING INSTRUMENT PANEL VIBRATOR.

a. Unlatch the eight quick-disconnect type fasteners around outside edge of instrument panel, and tilt panel aft.

b. Disconnect vibrator power source.

c. Remove the two vibrator mounting screws; then remove vibrator.

6-13. INSTALLING INSTRUMENT PANEL VIBRATOR.

a. Align vibrator mounting holes with instrument panel mounting holes from forward side of panel.

b. Install the two vibrator mounting screws.

c. Connect vibrator power source.

d. Tilt instrument panel forward, and latch the eight quick-disconnect type fasteners.

6-14. ENGINE INSTRUMENTS.

6-15. The engine instruments (figure 6-4), located on the instrument panel, consist of the following: exhaust temperature indicator, fuel flow totalizer indicator, fuel pressure indicator, fuel level indicator, oil pressure indicator, and the tachometer indicator.

6-16. EXHAUST TEMPERATURE INDICATING SYSTEM.

6-17. The exhaust temperature indicating system consists of a thermocouple-type temperature indicator, resistance spools, necessary chromel-alumel leads, and four bayonet-type thermocouples. When heated, these thermocouples generate an electromotive force to operate the indicator. The indicator indicates the mean exhaust temperature of the engine.

6-18. EXHAUST TEMPERATURE INDICATOR.

6-19. The exhaust temperature indicator is a thermocouple-type instrument located on the instrument panel. The indicator scale is calibrated in degrees centigrade to indicate the temperature of the engine. The indicator operates from the electrical energy generated when its related thermocouples are heated by the exhaust gases of the engine.

WARNING

Do not "zero" temperature indicator, as the pointer is normally suppressed below zero scale reading by spring tension. Replace indicator if any doubt exists of indicator accuracy.

6-20. EXHAUST TEMPERATURE THERMOCOUPLES.

6-21. Each exhaust temperature thermocouple consists of two wires of dissimilar metal (one of chromel, the other of alumel) formed into leads and joined at one end. Four parallel-connected thermocouples are installed in the engine exhaust tail pipe. Exhaust gases heat the thermocouples to generate electrical energy, which is transmitted to the indicator.

6-22. REMOVING EXHAUST TEMPERATURE THERMOCOUPLES. To remove the exhaust temperature thermocouples, remove fuselage rear section (paragraph 2-150), and proceed as follows:

a. Remove safety wire from thermocouple mounting nuts, and remove nuts.

b. Remove wrapping from intermediate harness lead connection and disconnect thermocouple leads from harness leads.

c. Remove thermocouple from tail-pipe flange.

Note

This procedure does not apply on some engine thermocouple installations when the four thermocouple dual leads are silver-soldered to the engine harness ring leads as one unit. Therefore, in order to remove a thermocouple from these engines, the engine harness ring and four thermocouples must be removed as one unit at the engine harness intermediate lead connection.

6-23. INSTALLING EXHAUST TEMPERATURE THERMOCOUPLES. See figure 6-5.

6-24. ADJUSTING EXHAUST TEMPERATURE INDICATING SYSTEM.

6-25. See figure 6-6.

6-26. FUEL FLOW INDICATING SYSTEM.

6-27. The fuel flow indicating system consists of a fuel flow totalizer indicator, transmitter, and amplifier, which indicate the rate of fuel flow and the quantity of fuel remaining. System power is furnished by the single-phase, 115-volt a-c inverter.

6-28. FUEL FLOW TOTALIZER INDICATOR.

6-29. The fuel flow totalizer indicator, located on the instrument panel, indicates the rate of fuel flow and the quantity of fuel remaining. The fuel flow scale is calibrated in pounds per hour. The fuel remaining

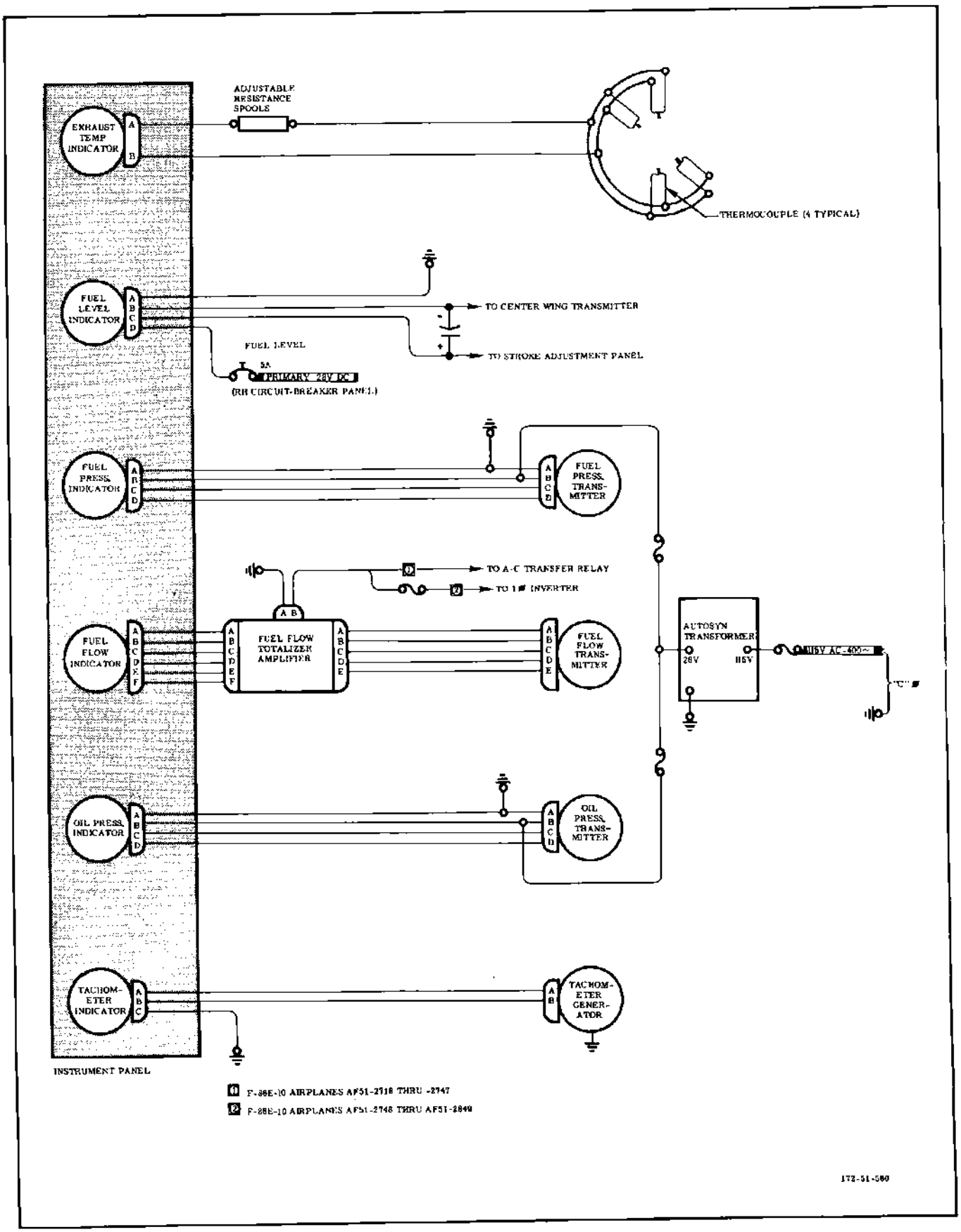
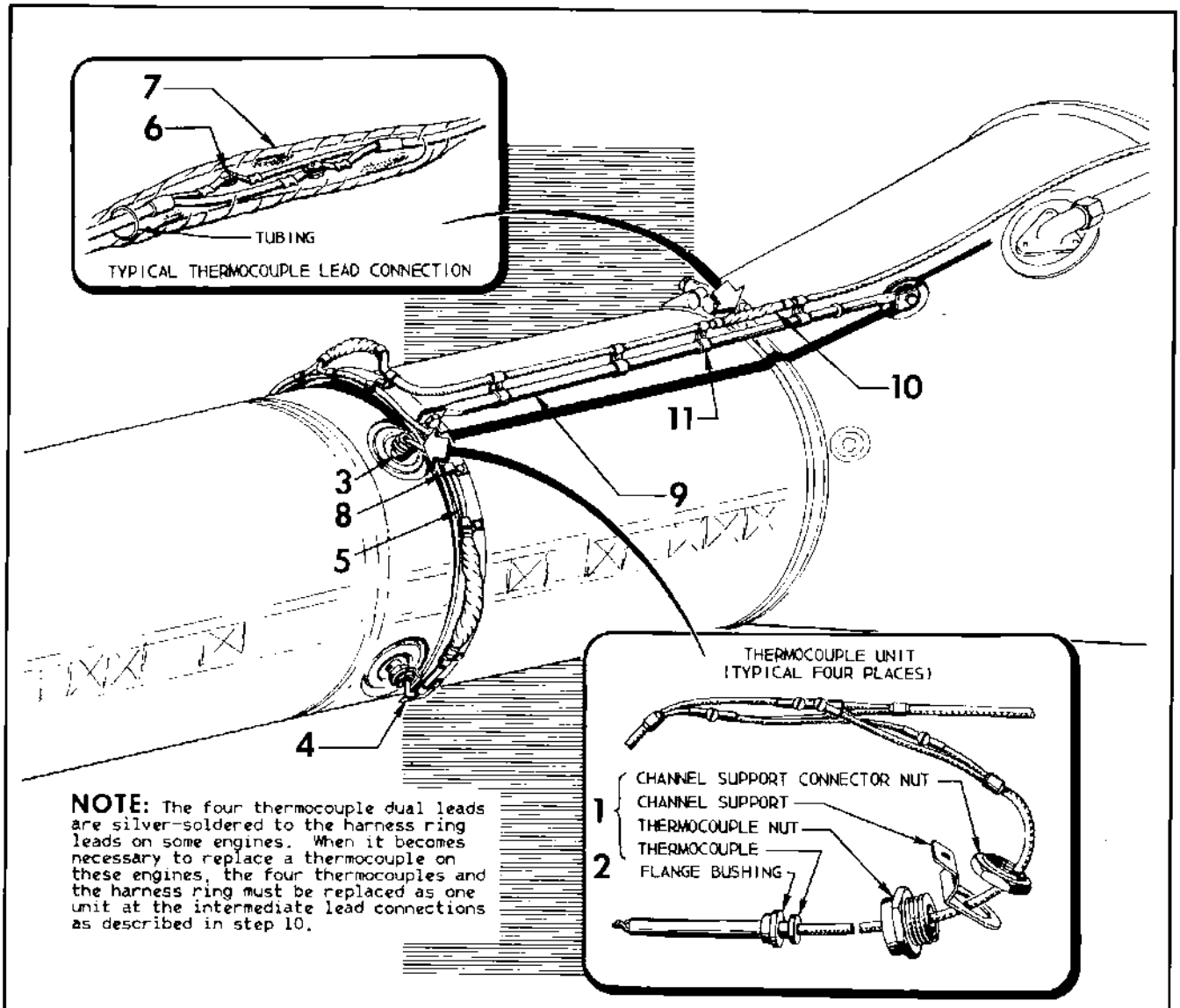


Figure 6-4. Engine Instruments



NOTE: The four thermocouple dual leads are silver-soldered to the harness ring leads on some engines. When it becomes necessary to replace a thermocouple on these engines, the four thermocouples and the harness ring must be replaced as one unit at the intermediate lead connections as described in step 10.

1 Install thermocouple nut, channel support, and channel support connector nut over each thermocouple as shown.

2 Slip thermocouple flange bushing over each thermocouple.

3 Insert thermocouples into tail-pipe flanges, and tighten thermocouple nuts. The channel supports must point forward.

4 Connect channel supports to harness ring, using four AN3C3A bolts. Tighten the channel support connector nuts, and safety tail-pipe flange lug to both nuts of each thermocouple unit, using AN995C32 lockwire.

5 Lay thermocouple harness ring over tail-pipe with intermediate lead connection forward.

6 Slip a 3-1/4 inch section of NA2-3036 tubing over one end of harness leads and connect leads of each thermocouple to harness connector leads, using an AN936B4 lock washer between lead connections.

7 Slide tubing over connections and wrap connections with two layers of Fiberglas tape (.750x.007 inch, G.E. Specification A2L181. Secure ends of wrapping with AN995C32 lockwire. Apply three heavy coats of silicone resin solution (G.E. No. SR80) to wrapping, allowing 10 minutes between coats.

8 Clamp thermocouple and harness leads to harness ring, using Fiberglas tape under clamps to ensure a tight fit. Coat tape as in step 7.

9 Install intermediate lead support tube between exhaust cone and harness ring clips.

10 Connect intermediate lead to engine lead, wrapping as described in step 7.

11 Clamp intermediate lead to support tube as shown.

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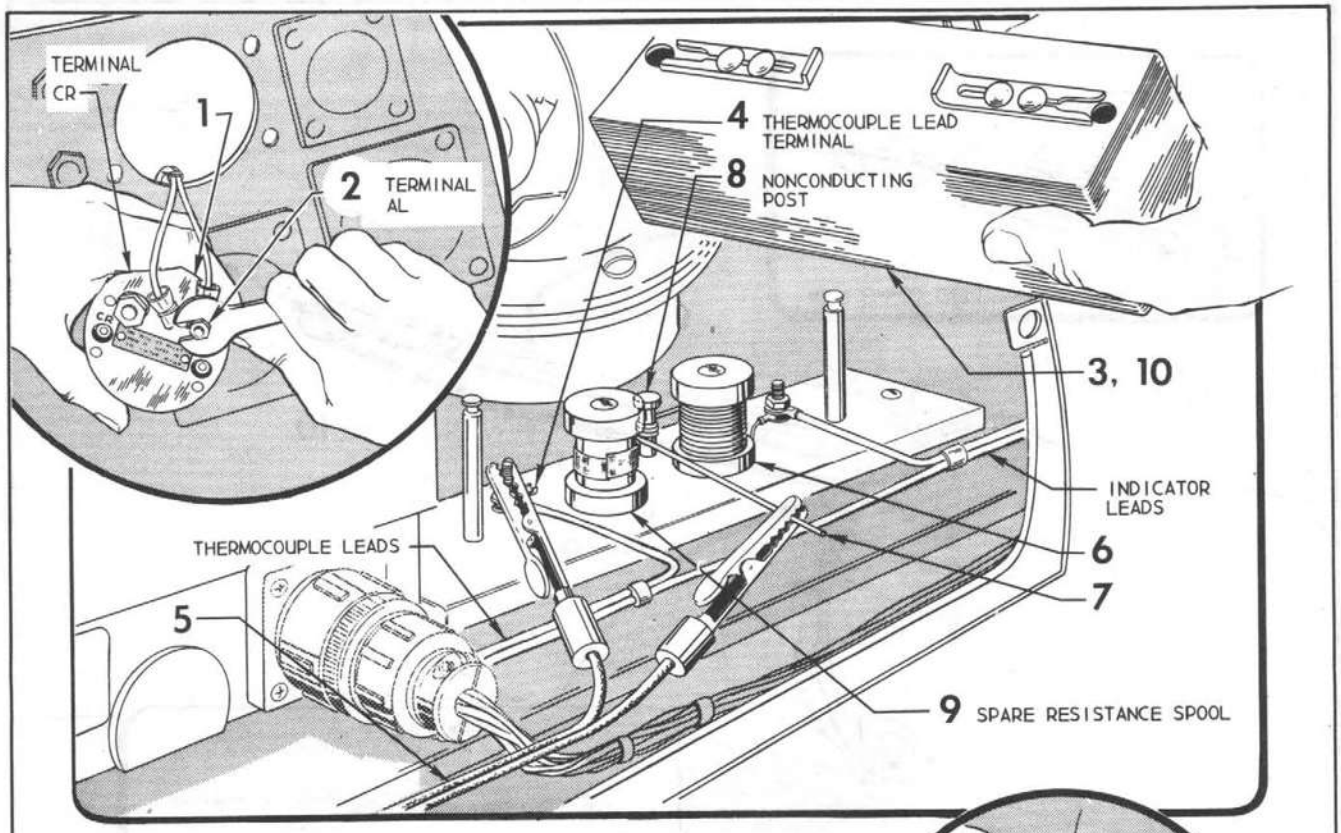
Figure 6-5. Installing Exhaust Temperature Thermocouples



1 Remove exhaust temperature indicator. (Refer to index for page number of instrument removal procedure.)

2 Disconnect indicator lead from terminal CR and connect leads together on terminal AL.

3 Remove cover from adjustable resistance spools (AN5534-1) located in the right-hand aft equipment bay.

4 Unsolder resistance spool lead from thermocouple lead terminal.

5 Connect Wheatstone bridge leads between resistance spool lead and thermocouple lead, and measure resistance.

6 Unwind one coil of wire at a time from resistance spool measuring resistance as each turn is removed until resistance is slightly greater than 8 ohms.

CAUTION: If total resistance is reduced to less than 8 (±.05) ohms, the spool can no longer be used. A spare spool is provided in case this happens.

7 Remove short lengths of wire from spool to obtain total resistance of 8 (±.05) ohms; then remove Wheatstone bridge leads.

8 Wrap several turns of wire around nonconducting post provided for that purpose (to prevent unwinding); then solder resistance wire to thermocouple lead terminal.

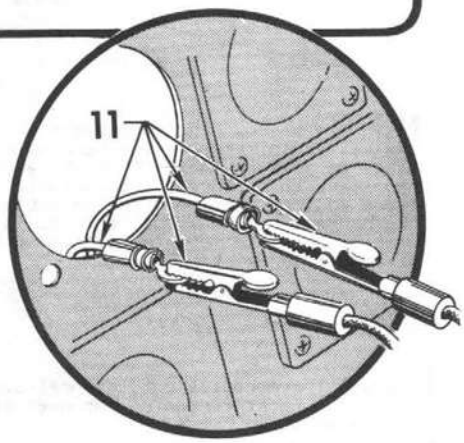
9 If spare spool is used, use vinyl tape to secure resistance wire on unused spool.

10 Replace resistance spool cover and secure with safety wire.

11 Remove thermocouple leads from indicator; connect Wheatstone bridge between leads and check for correct resistance of 8 (±.05) ohms.

12 Reconnect thermocouple leads to indicator terminals.

13 Install exhaust temperature indicator. (Refer to index for page number of instrument installation procedure.)



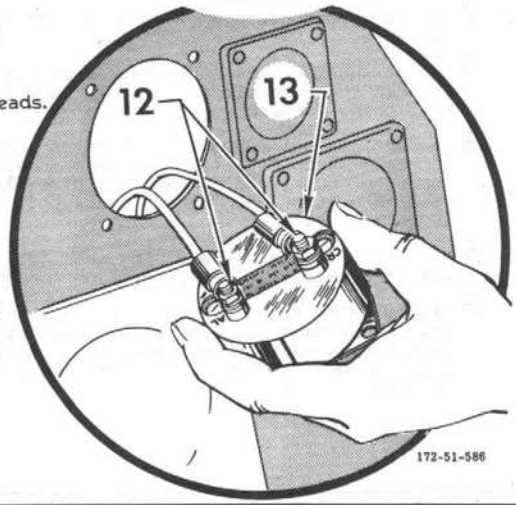


Figure 6-6. Adjusting Exhaust Temperature Indicating System

counters, inset in the fuel flow scale, indicate the number of pounds of fuel remaining. The fuel remaining counters are reset to show total pounds of fuel available when the "RESET" knob is pulled out and turned. As fuel is consumed, it is automatically subtracted from the original setting, thus indicating the quantity of fuel remaining and the rate of fuel flow.

6-30. FUEL FLOW TOTALIZER TRANSMITTER.

6-31. The fuel flow totalizer transmitter, located in the lower right aft section of the forward fuselage (figure 6-2), consists of a metering mechanism and an autosyn unit. Impact of fuel entering the transmitter metering chamber causes the metering mechanism vane to move against the restricting action of a calibrated spring. The vane stops moving when the two forces balance each other. This vane position represents a measure of the rate of fuel flow through the metering chamber. The vane shaft is magnetically coupled to the autosyn unit shaft. Therefore, the vane movement and autosyn movement are synchronous. The autosyn unit output voltage is transmitted to the fuel flow totalizer amplifier and then to the indicator.

6-32. FUEL FLOW TOTALIZER AMPLIFIER.

6-33. The fuel flow totalizer amplifier, located in the lower left aft section of the forward fuselage on F-86E-1, F-86E-5, and F-86E-6 Airplanes and in the lower left side of cockpit on F-86E-10 and F-86E-15 Airplanes (figure 6-2), electronically amplifies the voltage supplied by the autosyn unit and transmits this voltage as a control signal to the indicator motor, which drives the indicator pointer and counters.

6-34. FUEL QUANTITY INDICATING SYSTEM.

6-35. Refer to paragraphs 5-192 and 5-204.

6-36. FUEL PRESSURE INDICATING SYSTEM.

6-37. The fuel pressure indicating system consists of a fuel pressure indicator and transmitter operating synchronously to indicate fuel system pressure. The fuel pressure indicating system power is furnished by the 26-volt a-c step-down transformer, which operates from the three-phase 115-volt a-c inverter.

6-38. FUEL PRESSURE INDICATOR.

6-39. The fuel pressure indicator, located on the instrument panel, is an autosyn-type indicator with a motor-driven pointer. The indicator scale is calibrated in pounds per square inch.

6-40. FUEL PRESSURE TRANSMITTER.

6-41. The fuel pressure transmitter located in the lower left aft section of the forward fuselage (figure 6-2), consists of a pressure chamber in which is mounted a pressure-operated diaphragm connected through linkage to an autosyn shaft. Differential pressure moves the diaphragm. Each position of the diaphragm represents a quantity of pressure in the system. The diaphragm linkage operates the autosyn unit whose output voltage drives the motor-driven pointer of the indicator.

6-42. OIL PRESSURE INDICATING SYSTEM.

6-43. The oil pressure indicating system consists of an autosyn-type oil pressure indicator and transmitter. The system power is supplied by the 26-volt a-c step-down transformer, which operates from the three-phase, 115-volt a-c inverter.

6-44. OIL PRESSURE INDICATOR.

6-45. The oil pressure indicator, located on the instrument panel, is an autosyn-type indicator, whose scale is calibrated in pounds per square inch.

6-46. OIL PRESSURE TRANSMITTER.

6-47. The oil pressure transmitter, located in the lower left aft section of the forward fuselage (figure 6-2), consists of a pressure chamber and a diaphragm connected to an autosyn unit shaft. Differential pressure causes the diaphragm to move. When this movement ceases, the position of the diaphragm represents a quantity of pressure in the system. The diaphragm operates the autosyn unit, whose output voltage is transmitted to the motor-driven indicator pointer.

6-48. TACHOMETER INDICATING SYSTEM.

6-49. The tachometer indicating system consists of a synchronous-type generator and indicator. The system primary power source is supplied by a geared-down mechanical outlet of the engine.

6-50. TACHOMETER INDICATOR.

6-51. The tachometer indicator, located on the instrument panel, is a synchronous-type indicator operated by the tachometer generator. The tachometer indicator motor revolves at a rate directly proportional to the engine speed. The indicator motor is magnetically coupled to the indicator pointer. The indicator scale is calibrated in percentage of the rated revolutions per minute of the engine.

6-52. TACHOMETER GENERATOR.

6-53. The tachometer generator is located in the engine accessory section (figure 6-2) and is connected mechanically to the engine. The tachometer generator produces an alternating current that is transmitted to the indicator motor.

6-54. FLIGHT INSTRUMENTS.

6-55. The flight instruments (figure 6-7), located on the instrument panel, consists of the following: accelerometer, airspeed indicator, altimeter, cabin altimeter, turn-and-bank indicator, Machmeter, and rate-of-climb indicator.

6-56. ACCELEROMETER.

6-57. The accelerometer, located on the instrument panel, indicates the load on the airframe in terms of gravitational (G) units. The accelerometer incorporates three pointers (one main and two auxiliary). The main pointer indicates existing acceleration. The two auxiliary pointers, until reset, indicate the maximum positive and negative G-load imposed on the airplane.

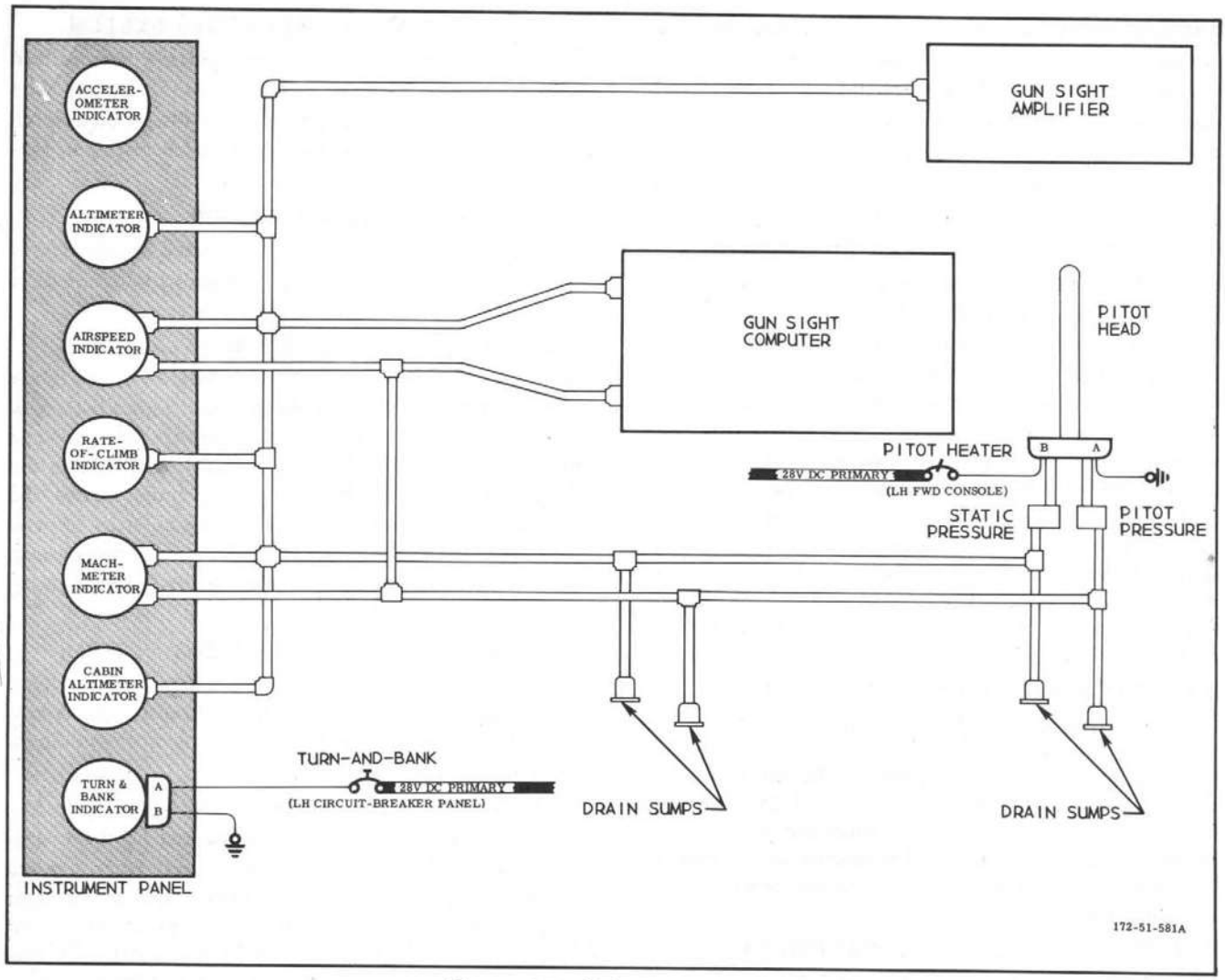


Figure 6-7. Flight Instruments

6-58. AIRSPEED INDICATOR.

6-59. The airspeed indicator, located on the instrument panel, incorporates two pointers. One pointer indicates the speed of the airplane. The other pointer is automatically positioned by any change in altitude to indicate maximum allowable airspeed at that altitude. The indicator scale is calibrated in knots per hour.

6-60. ALTIMETER.

6-61. The altimeter, located on the instrument panel, is an evacuated diaphragm-type instrument operated by barometric pressure. The altimeter scale is calibrated in feet to indicate the height of the airplane above sea level. The barometric pressure scale (inset in the altimeter scale) is calibrated in inches of mercury and is manually adjusted for the correct altitude by a knob located on the lower left front corner of the instrument case.

6-62. CABIN ALTIMETER.

6-63. The cabin altimeter, located on the instrument panel, operates on static pressure to convert cabin pressure to equivalent altitude of the cabin.

6-64. TURN-AND-BANK INDICATOR.

6-65. The turn-and-bank indicator, located on the instrument panel, incorporates an inclinometer and an electrical gyro turn indicator to provide reference for the direction of turn and the angle of bank.

6-66. MACHMETER.

6-67. The Machmeter, located on the instrument panel, operates on pitot-static pressure to indicate the ratio of true airspeed to the speed of sound. The indicator scale is calibrated in Mach numbers.

6-68. RATE-OF-CLIMB INDICATOR.

6-69. The rate-of-climb indicator, located on the instrument panel, operates on pitot-static pressure. The indicator measures the ascent or descent rate of change in altitude. The indicator scale is calibrated in feet per minute.

6-70. NAVIGATION INSTRUMENTS.

6-71. The navigation instruments (figure 6-8) consist of the following: attitude indicator, directional compass indicator, radio compass indicator, and stand-by

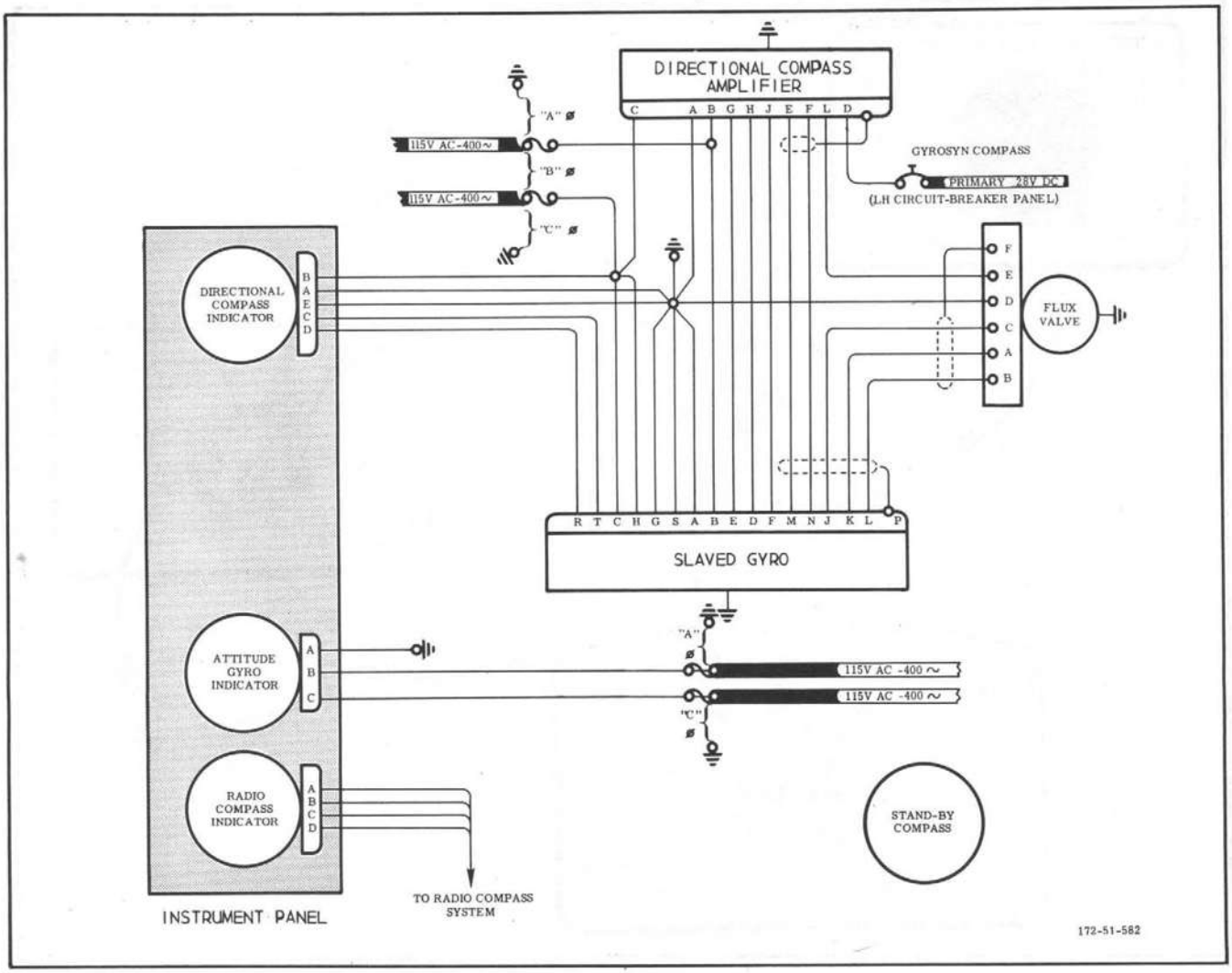


Figure 6-8. Navigation Instruments

compass. All navigation instruments are located on the instrument panel, with the exception of the stand-by compass, which is mounted on the lower right side of the windshield.

6-72. ATTITUDE GYRO INDICATOR.

6-73. The attitude gyro indicator, located on the instrument panel, operates electrically to provide a visual indication of flight attitude in pitch and roll maneuvers.

6-74. DIRECTIONAL COMPASS INDICATING SYSTEM.

6-75. The directional compass indicating system (figure 6-9) is composed of four principal units: a flux valve transmitter, an amplifier, directional gyro control, and a repeater-type indicator. The system receives electrical power from a three-phase, 115-volt a-c inverter. The directional compass is basically a gyro that is automatically kept on a true magnetic north heading by a flux valve transmitter in the wing outer panel of the airplane. The flux valve transmitter utilizes the south-north flow of the earth's magnetic flux over selsyn-type windings to electrically control the electromagnetic precessing coil in the gyro through the use of a signal transformer and electronic amplifier.

6-76. FUNCTION OF DIRECTIONAL COMPASS SYSTEM. The gyro rotor is started when the battery-starter switch is placed "ON." One to 2 minutes after the switch is placed "ON," the rotor will be up to normal speed. For the first 3 to 4 minutes, the gyro will precess at a rate of 60 to 90 degrees per minute, after which it will change to the slow slaving of 4 to 5 degrees per minute. The gyro should align with the magnetic heading while on the fast slaving cycle.

6-77. DIRECTIONAL COMPASS INDICATOR.

6-78. The directional compass indicator shows the magnetic heading. Because the compass is gyro-synchronized to the earth's magnetic meridian, the magnetic heading indications are without northerly turning error, oscillation, or swinging. The setting knob, identified as "SET COURSE," controls a course index, which can be rotated to a preselected heading. The indicator is free to

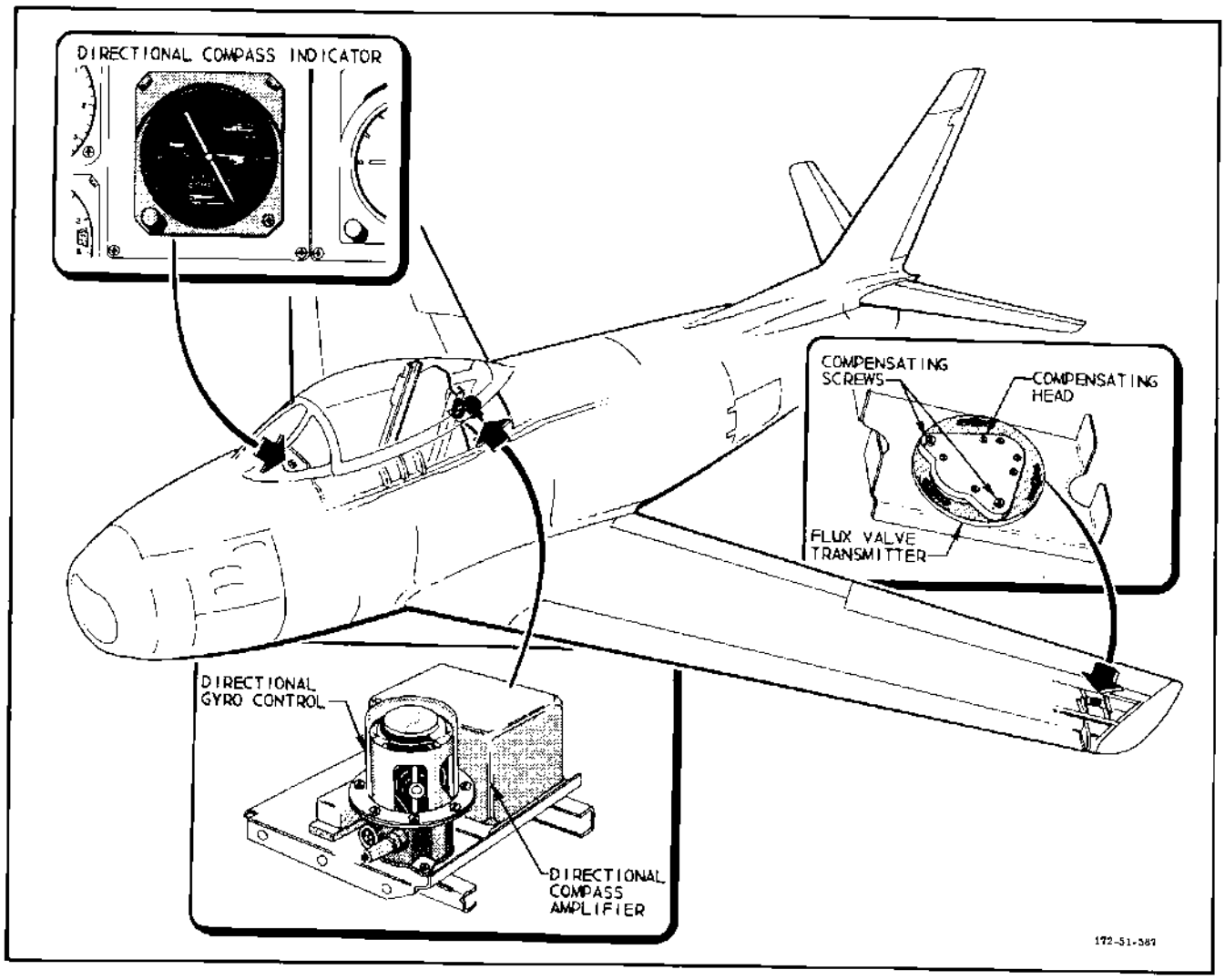


Figure 6-9. Directional Compass System

operate within 85 degrees of climb or dive (from level flight) and within 85 degrees of right or left bank. If these operating limits are exceeded, the indications will be incorrect.

6-79. DIRECTIONAL COMPASS SYSTEM FLUX VALVE TRANSMITTER.

6-80. The flux valve transmitter in the directional compass system senses the magnetic north. The transmitter is mounted in the left wing. It is hemispherical in shape, has a mounting flange with calibrations, and has accessible lugs to which are fastened the indicator leads. The functioning element is pendulously mounted on a universal joint so that, within limits, it continuously responds to gravity; the element is immersed in damping fluid to prevent excessive swinging in flight.

6-81. DIRECTIONAL COMPASS ERROR AND CORRECTION.

6-82. Compass error may result from either of two causes: incorrect indexing of the flux valve transmitter to the airplane, or magnetic disturbance from some structural part or electrical unit of the airplane. The amount of index error or magnetic deviation is determined by swinging the compass. Index error is corrected by rotation of the flux valve in its calibrated mounting base. Deviation from magnetic disturbances is corrected by adjustment of the flux valve transmitter compensator head.

6-83. DIRECTIONAL COMPASS SYSTEM COMPENSATOR HEAD.

6-84. When compass compensation is required, the compensator head can be used to correct the flux valve transmitter for excessive deviation. When compass compensation is required and the compensator head is not installed, the flux valve transmitter cover plate is removed and replaced with a compensator head (paragraph 6-85). The compensator head, located on the top of the flux valve transmitter (figure 6-9), contains two magnets that are positioned by the two adjusting shafts.

The shafts are coded by the letters "NS" (to correct north and south error) and "EW" (to correct east and west error).

6-85. INSTALLING DIRECTIONAL COMPASS COMPENSATOR HEAD. To install a directional compass compensator head, proceed as follows:

a. Remove top cover plate on flux valve and replace with compensator head.

b. Align dots on compensator with EW and NS holes in mounting flange.

c. Secure compensator with six 4.40 x 5/16-inch binding-head brass screws. Set compensator to neutral by aligning dots on shafts with dots on cover.

6-86. DIRECTIONAL COMPASS SYSTEM AMPLIFIER.

6-87. The directional compass system amplifier amplifies the signal from the signal transformer selsyn and detects its direction before transmitting it to the precession coil of the gyro.

6-88. STAND-BY COMPASS.

6-89. The direct-reading, vertically mounted-type compass, called the stand-by compass since it is for emergency use only, is located on the lower right corner of the windshield. It consists of a metal bowl filled with compass fluid and a semifloat-type card calibrated in 5-degree divisions. For correcting card deviations that result from magnetic disturbances, a permanent magnet compensator is attached to the compass. This type compass should be compensated every 100 hours, or at least once in each three-month period, and at times when equipment likely to affect the instrument is changed. For compensating procedure, refer to paragraph 6-95.

6-90. COMPASS SWINGING (STAND-BY OR DIRECTIONAL).

6-91. The compass swinging procedure for either the stand-by or the directional compass is essentially the same, except that the directional compass requires that the airplane electrical system be turned on. Compensating magnets are used to compensate the compass. The stand-by compass contains the magnets within the case, whereas the directional compass contains the magnets in the compensator head. The swinging procedure consists of positioning the airplane to actual magnetic headings and comparing headings with compass readings. Differences, recorded on Form AN5803-1 (figure 6-10) for stand-by compass only, are algebraically calculated to provide compensating values so that compass correction values entered on the form are at a minimum. Either of two methods, the sighting compass method or the compass rose method, may be used to determine actual magnetic headings.

6-92. COMPASS SWINGING—SIGHTING COMPASS METHOD. The sighting compass method requires the use of a standard aircraft compass (Pioneer Type B-16) that has had its compensating assembly removed and replaced by a swinging compass sight (Stock No. 7800-725200). To determine the magnetic heading of the airplane, stand at least 50 feet behind the airplane with the swinging compass in cupped hands and align the sight with the longitudinal axis of the airplane by reference to a suitable line or pair of objects on the airplane. When the sight hairline and the object sighted are aligned, the heading on the compass will indicate the magnetic heading of the airplane. If the reading is taken from in front of the airplane, obtain the magnetic heading by adding or subtracting 180 degrees.

	Compensating Swing			Residual Swing		Aircraft Comp. C to M		Date 4-25-52 M to C
	Actual Head (M)	Aircraft Comp.		Actual Head (M)	Aircraft Comp.			
N 000	000	004	-4	000	000	0	000	0
NE 045				045	045	0	045	0
E 090	090	088	+2	090	090	0	090	0
SE 135				135	135	0	135	0
S 180	180	178	+2	180	179	+1	180	-1
SW 225				225	225	0	225	0
W 270	270	274	-4	270	270	0	270	0
NW 315				315	316	-1	315	+1
	COLUMN (1)	COLUMN (2)	COL (1) MINUS COL (2)	COLUMN (3)	COLUMN (4)	COL (3) MINUS COL (4)		COL (4) MINUS COL (3)

If swinging compass used ahead of aircraft add or subtract 180 degrees.

Coeff. C = $\frac{N-S}{2} = \frac{(+4)-(+2)}{2} = \frac{-6}{2} = -3$

Coeff. B = $\frac{E-W}{2} = \frac{(+2)-(-4)}{2} = \frac{+6}{2} = +3$

Coeff. A = $\frac{N+E+S+W}{4} = \frac{(+4)+(+2)+(+2)+(-4)}{4} = \frac{-4}{4} = -1$

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Figure 6-10. Compass Correction Card

6-93. COMPASS SWINGING—COMPASS ROSE METHOD. The compass rose is a circular area permanently marked off in degrees from magnetic north. The compass rose method of compensating consists of placing the airplane on the base with its longitudinal axis parallel to the radial line of the desired magnetic heading and subsequently swinging the airplane to parallel the other cardinal and quadrantal radial lines.

6-94. COMPASS PRESWINGING PREPARATIONS AND PRECAUTIONS. For accurate compensation, observe the following precautions:

a. The airplane must be at least 100 yards from automobiles, tractors, steel buildings, or other aircraft.

b. Tools used in compensating transmitter must be nonmagnetic.

c. Personnel who will be close to transmitter or sighting compass must remove from their person all articles made partly or wholly of iron or steel.

d. The airplane must be placed on an area free of ferrous material or magnetic influences such as underground pipes and electric transmission wires. The area can be tested if compass bearings are taken from different portions of the area; deviation should be less than one degree.

e. All equipment customarily with the airplane that may have magnetic influence must be secured in flight position.

f. If the sighting campass method is used (paragraph 6-92), the area should be reasonably level. Because of the pendulous mounting of the flux valve, it is not necessary to have the airplane level.

Note

Flux valve compasses not needing compensation are more accurate without the compensator head.

6-95. COMPASS GROUND SWINGING AND COMPENSATING. This procedure is primarly applicable to a newly installed compass. When swinging compass at the 100- to 120-hour inspection period to check correct headings, only steps a. through e. need be followed unless compass headings are not in agreement with those shown on compass correction card (Form AN5803-1) in cockpit. If headings do not agree, the complete procedure must be accomplished as follows:

a. Select a relatively level area to park airplane or position airplane on compass rose.

b. Start inverter that supplies power to gyrosyn compass by turning on battery switch, or connect external power supply. If external source is used, keep service unit as far from left wing tip as possible.

c. Wait 2 minutes for compass gyro rotors to reach normal speed, and then wait until direction hand on indicator stops moving, indicating that flux valve in wing has precessed gyro to the compass heading.

d. Note compass reading and start engine; if there is no change in the reading with engine running, compass swinging may be accomplished with engine not running.

e. Using either the sighting compass or compass rose method, head the airplane to east, south, west, and magnetic north. Allow time for compass to precess at each heading. Enter the actual magnetic headings and airplane compass readings in their respective columns under "Compensating Swing" on Form AN5803-1.

Note

To simplify this explanation, assume the readings obtained will be as recorded in figure 6-10.

f. Subtract the airplane compass readings from the corresponding magnetic readings, and record the results in "Dev'n" column of card. (Example: Magnetic heading 000 minus compass reading of 004 equals deviation of –4.)

g. Using the recorded deviations, calculate coefficients A, B, and C according to the algebraic formula on the bottom of the card. (Refer to examples in paragraph 6-96.)

Note

If deviation is not greater than plus or minus one degree, omit steps h. and i. and continue compass swinging at j.

h. With the airplane on magnetic north, add coefficient C *algebraically* to the airplane compass reading on this heading to determine what the instrument should indicate when compensated. (Example: 004 plus –3 = 001.) Make the compass indicate this compensated value by adjusting the NS shaft on the flux valve compensator head.

i. With the airplane on east, add coefficient B algebraically to the airplane compass reading on this heading to determine what the instrument should indicate when compensated. (Example: 088 plus +3 = 091.) Adjust the EW shaft on the flux valve compensator head to make compass indicate this compensated value.

j. With the airplane on any heading, add coefficient A algebraically to the compass reading on that heading to determine what the instrument should read when compensated. (Example: 001 plus –1 = 000.) Make the compass indicate this compensated value by loosening the flux valve wing mounting and rotating valve in a direction opposite to the sign of the coefficient, using the calibrated index scale on the mounting. Then secure the flux valve.

k. Position the airplane on the cardinal and quadrantal magnetic headings, and record the magnetic headings and the corresponding compass readings in their proper columns on Form AN5803-1 (figure 6-10) under "Residual Swing."

l. On Form AN5803-1, fill out column "C to M" by subtracting column (4) "Aircraft Comp." from column (3) "Actual Head (M)," and column "M to C" by subtracting column (3) from column (4). Then fill in blanks on back of card. Tear off the compass card and place in compass card holder in cockpit. File remainder of card as a permanent record.

6-96. CALCULATING COMPASS SWINGING COEFFICIENTS. Calculate coefficients A, B, and C on bottom of Form AN5803-1 (figure 6-10) algebraically as follows:

a. Coefficient A: To add deviations having the same sign, all (+) or all (–), merely add the deviations and use the same sign. To add deviations having different signs, some (+) and some (–), add the deviations having the same signs and subtract the smaller total from the larger total; then use the sign of the larger total.

Example:

$$(-4) + (+2) + (+2) + (-4) = (-8) - (+4) = -4$$

b. Coefficients B and C: To subtract deviations having the same or different signs, change the sign of the deviation to be subtracted, and then add as explained in step a.

Example:

$$B = (+2) - (-4) = (+2) + (+4) = +6$$
$$C = (-4) - (+2) = (-4) + (-2) = -6$$

Note

Examples are calculated using assumed deviations from figure 6-10.

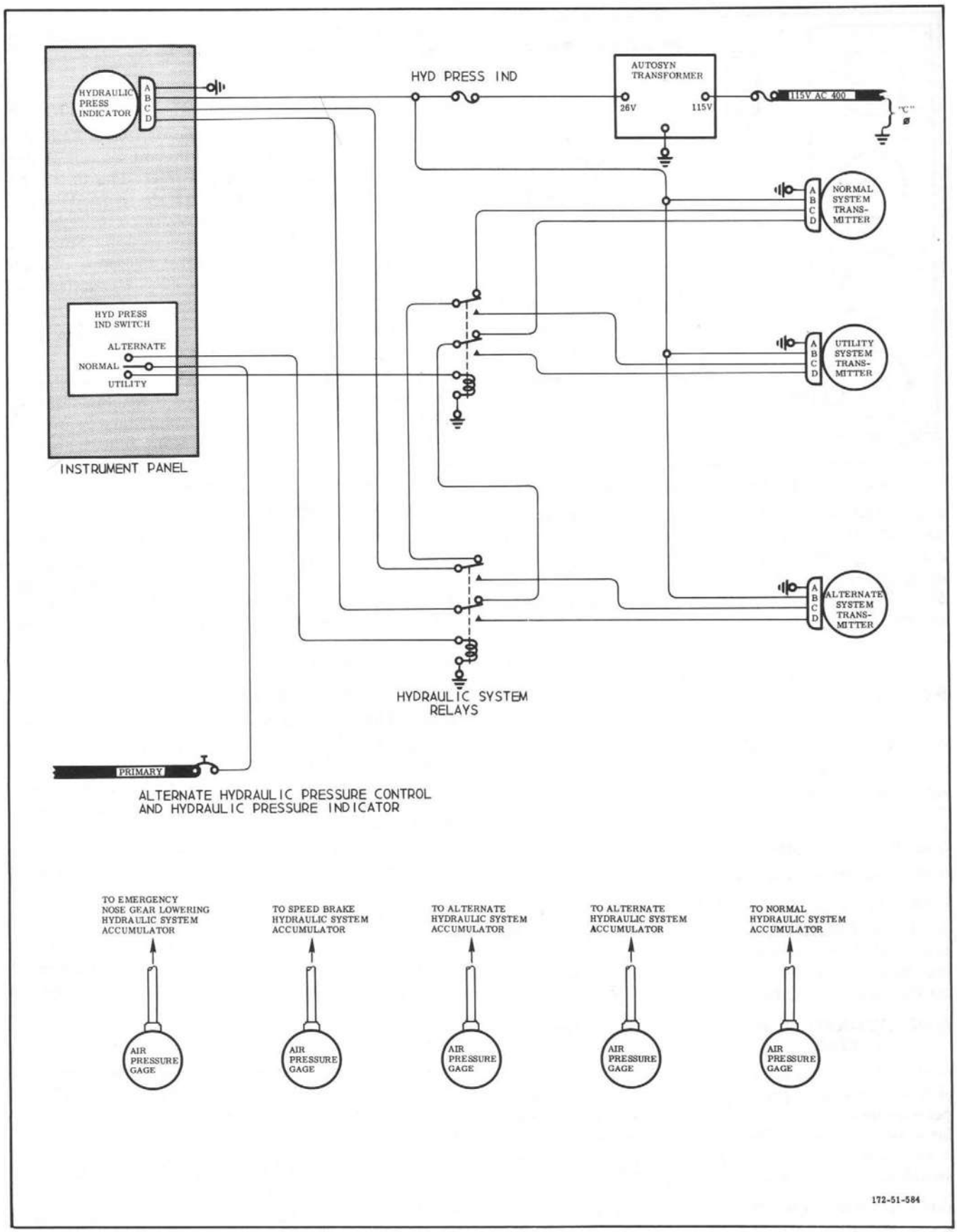

Figure 6-11. Hydraulic Pressure Instruments

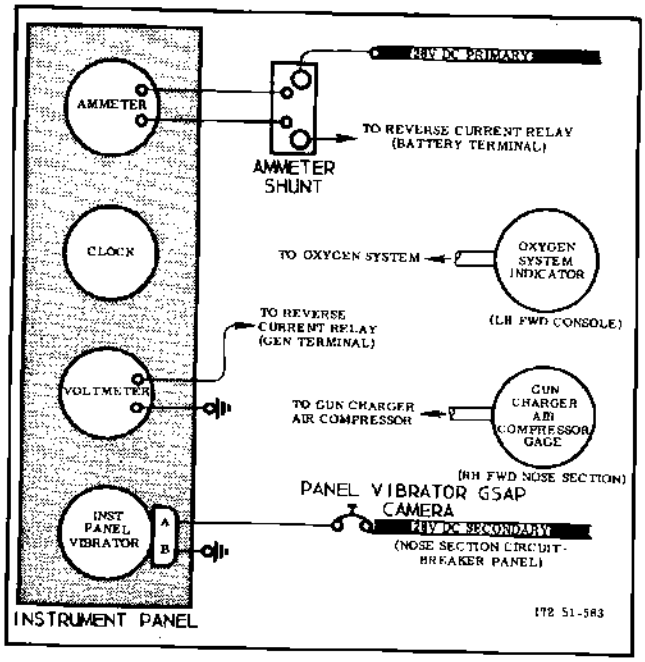

Figure 6-12. Miscellaneous Instruments

6-97. ALGEBRAIC TEST OF COMPASS COMPENSATION. Proper compensation of the compass can be checked algebraically if new coefficients C, B, and A are made up from deviations shown in either column "C to M" or "M to C"; the result must not be more than 1. In this example:

$$C = \frac{N - S}{2} = \frac{(0) - (+1)}{2} = \frac{-1}{2} = -\frac{1}{2}$$

$$B = \frac{E - W}{2} = \frac{(0) - (0)}{2} = \frac{0}{2} = 0$$

$$A = \frac{N + E + S + W}{4} =$$

$$\frac{(0) + (0) + (+1) + (0)}{4} = \frac{+1}{4} = \frac{1}{4}$$

6-98. RADIO COMPASS SYSTEM.

6-99. Refer to paragraphs 8-17 and 8-24.

6-100. HYDRAULIC PRESSURE INSTRUMENTS.

6-101. The hydraulic pressure instruments (figure 6-11) consist of the following: hydraulic pressure indicator, and hydraulic system accumulator air pressure indicators. See figure 6-2 for location.

6-102. HYDRAULIC PRESSURE INDICATING SYSTEM.

6-103. The hydraulic pressure indicating system consists of a hydraulic pressure indicator, three hydraulic pressure transmitters, and five hydraulic system accumulator air pressure indicators. Pressure is selected separately from each transmitter by means of a selector switch located on the instrument panel.

6-104. HYDRAULIC PRESSURE INDICATOR.

6-105. The hydraulic pressure indicator is an autosyn-type indicator located on the instrument panel. The indicator is operated by its related pressure transmitters. The indicator scale is calibrated in pounds per square inch.

6-106. HYDRAULIC PRESSURE TRANSMITTERS.

6-107. The hydraulic pressure transmitters are autosyn-type transmitters operating on 26-volt a-c power supplied by the instrument transformer. The utility hydraulic pressure transmitter and the normal surface control hydraulic pressure transmitter are located on the front spar of the wing center section. (See figure 6-2.) The alternate surface control hydraulic pressure transmitter is located in the lower left aft fuselage and is accessible through the data compartment access door.

6-108. HYDRAULIC SYSTEM ACCUMULATOR AIR PRESSURE INDICATORS.

6-109. The hydraulic system accumulator air pressure indicators (figure 6-2) are located throughout the airplane near each of the five accumulators to indicate pounds per square inch of air pressure in each accumulator.

6-110. HYDRAULIC PRESSURE SYSTEM SELECTOR SWITCH.

6-111. The hydraulic pressure system selector switch is located near the hydraulic pressure indicator on the instrument panel. With the switch in normal position, the hydraulic pressure indicator shows the normal surface control hydraulic system pressure. Utility and alternate surface control hydraulic system switch positions are momentary.

6-112. MISCELLANEOUS INSTRUMENTS.

6-113. The miscellaneous instruments (figure 6-12) consist of the following: ammeter, clock, gun charger air compressor indicator, landing gear position indicator, and the oxygen system pressure indicator. The miscellaneous instruments are located on the instrument panel, with the exception of the landing gear position indicator and the oxygen system pressure indicator, which are located on separate panels on the left forward console.

6-114. AMMETER.

6-115. The ammeter, located on the instrument panel, automatically measures direct current in the electrical system of the airplane. The indicator scale is calibrated in amperes.

6-116. CLOCK.

6-117. The clock, located on the instrument panel, has an 8-day movement and a sweep second hand. A knob, located on the lower left front of the clock case, serves to wind and set the clock mechanism.

6-118. GUN CHARGER AIR COMPRESSOR INDICATOR.

6-119. The gun charger air compressor indicator location is shown in figure 6-2. The indicator is installed on F-86E-5 and subsequent airplanes to indicate the air

pressure in the gun charger air compressor system. The indicator scale is calibrated in pounds per square inch.

6-120. LANDING GEAR POSITION INDICATING SYSTEM.

6-121. Refer to paragraph 2-231.

6-122. OXYGEN SYSTEM PRESSURE GAGE.

6-123. The oxygen system pressure gage is a direct-reading type gage calibrated in pounds per square inch. The pressure gage is located on the left forward console.

6-124. VOLTMETER.

6-125. The voltmeter, located on the instrument panel, indicates the regulated output of the engine-driven generator.

6-126. PITOT-STATIC SYSTEM.

6-127. The pitot-static system (figure 6-13) consists of an electrically heated pitot-static system head, a static-pressure manifold distribution block, three pitot-pressure line sump drains, three static-pressure line sump drains, and tubing leading to flight instruments, cabin altimeter, and accessory gun sight equipment. The pitot-static system head is installed in the forward end of a tubular boom, which is attached to the outboard rib of the right wing tip. A static-pressure and a pitot-pressure line connect to the airspeed indicator, Machmeter, and gun sight computer. A static-pressure line connects to the cabin altimeter, rate-of-climb indicator, altimeter, and gun sight amplifier. Pitot-pressure tubing is so installed that moisture will drain from the pitot-static system head. Additional moisture in the pitot- or static-pressure tubing will drain into sumps located at the right wing tip, the right lower side of wing approximately 2 feet from the wing root, and the left side of the fuselage nose section under the gun port forward of the armor plate bulkhead. The drain sump accesses are marked "AIRSPEED LINES DRAIN." To facilitate proper connection of the lines, the instrument case fittings are stamped with the letters "S" (static) and "P" (pitot).

CAUTION

Cover all pitot-static ports while airplane is parked. Instruments will not function properly unless ports are kept clear of dirt and debris.

6-128. TROUBLE SHOOTING PITOT-STATIC SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Pitot-static system does not heat or clear itself of ice with pitot heater switch turned on.	Circuit-breaker type switch defective. Break in wiring. Heating element in head burned out.	Check for battery voltage at head. If there is voltage at this point, the element is probably burned out. Replace entire head.
Instrument pointers give inaccurate readings.	Leak in individual instrument case. Leak in pitot- or static-pressure lines.	Replace instrument.

6-129. PITOT-STATIC SYSTEM HEAD.

6-130. The pitot-static system head (AN5816-2) provides both pitot and static pressure sources with air pressure and contains a resistance-type anti-icing heater unit. The head is installed at a −5-degree attitude with respect to the fuselage reference line. It provides the accurate value of impact (pitot) pressure caused by the motion of the airplane through the air. The forward port of the head receives the full force of impact pressure. The aft ports (top and bottom) provide a source of quiet (static) air pressure, which varies with barometric pressure. The resistance-type heater, installed in the forward end of the head, prevents the formation of ice at the ports which would cause erroneous indications of airspeed. A toggle switch, marked "PITOT HEATER," is located on the pilot's left forward console.

CAUTION

The pitot heater switch must be in the "OFF" position while the airplane is on the ground, to prevent burning out the heater element.

6-131. REMOVING HEAD. The parts referred to in the following procedure are identified in figure 6-14. To remove the pitot-static system head, proceed as follows:

a. Remove the four screws and lock washers that secure head to forward end of the boom sleeve.

b. Remove the four screws and lock washers that secure sleeve to boom.

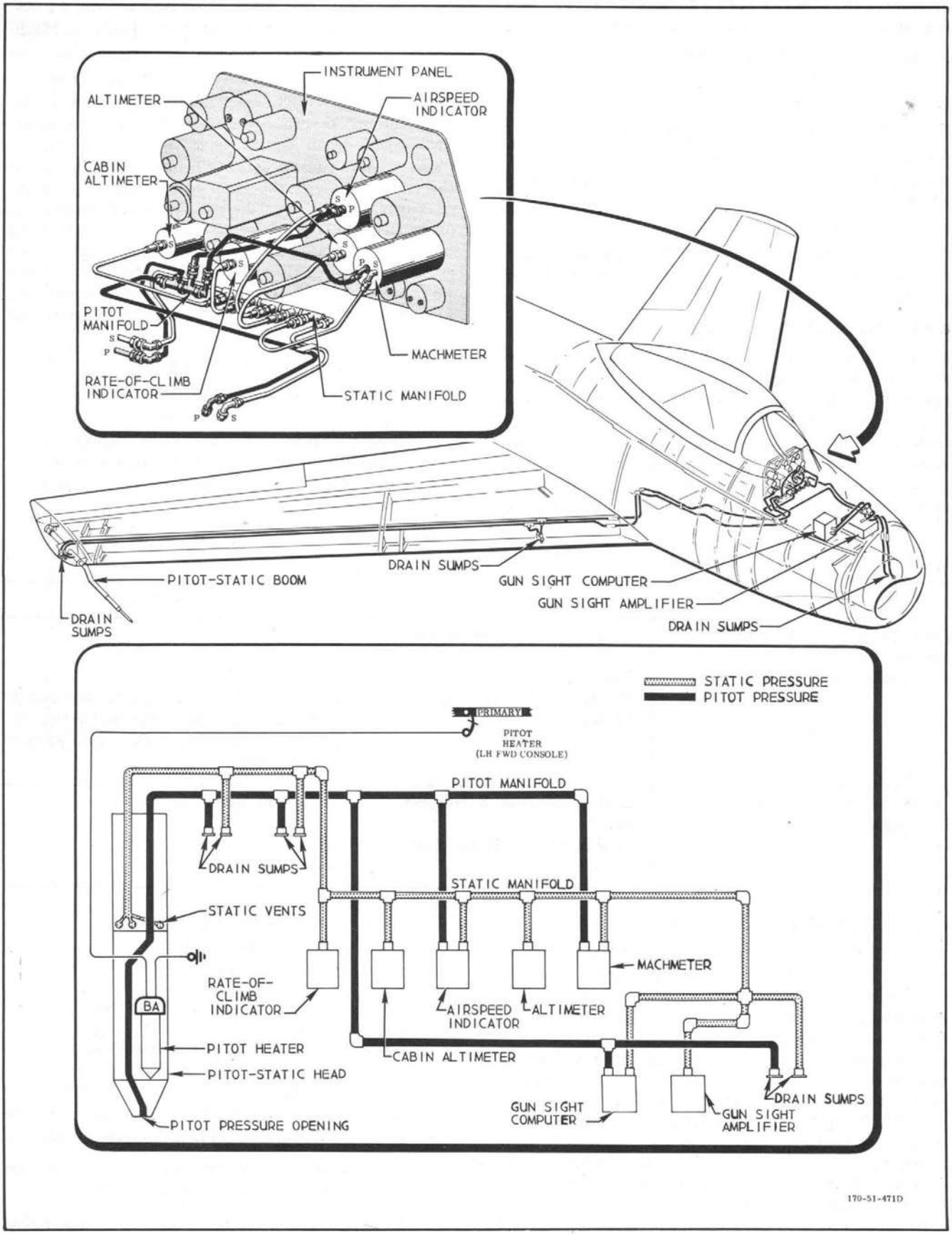

Figure 6-13. Pitot-Static System

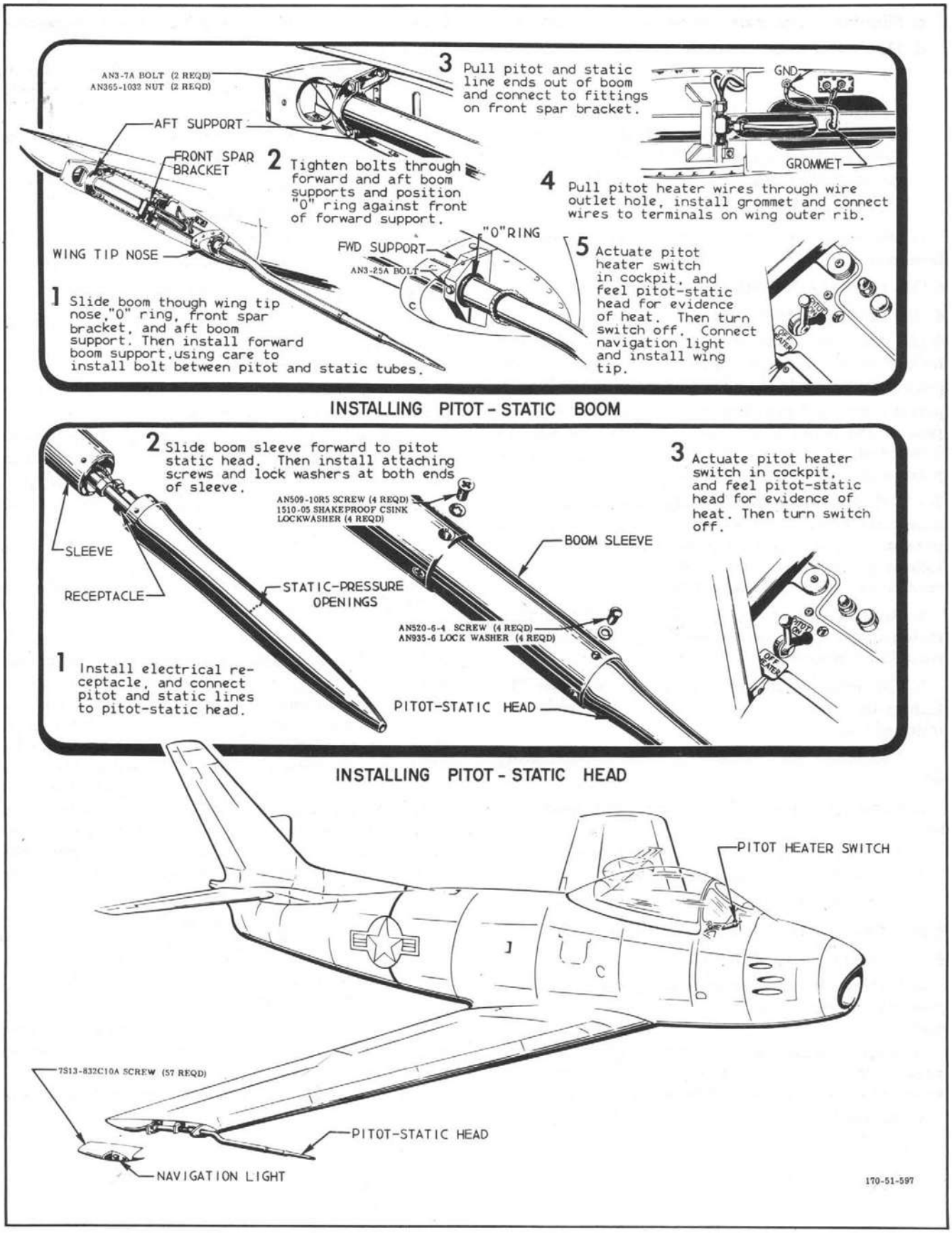

Figure 6-14. Installing Pitot-Static Head and Boom

c. Slide boom sleeve aft approximately 6 inches.

d. Disconnect pitot and static lines from head.

Note

It is important that the forward coupling nut be held rigid to prevent shearing the forward airspeed line when the "B" nut is being loosened. This procedure must be adhered to when both lines are being disconnected.

e. Disconnect electrical receptacle and remove head from boom.

6-132. INSTALLING HEAD. See figure 6-14.

6-133. PITOT-STATIC SYSTEM BOOM.

6-134. The pitot-static system boom, consisting of a hollow metal tube and a sleeve insert, supports the pitot-static system head and houses the pitot- and static-pressure lines and pitot heater leads. The primary purpose of the boom is to mount the head far enough forward of the right wing leading edge to permit the pitot-static system to receive undisturbed air.

6-135. REMOVING BOOM. The pitot-static system boom may be removed without prior removal of the pitot-static system head. The parts referred to in the following procedure are identified in figure 6-14. To remove the boom, proceed as follows:

a. Remove right wing tip (disconnect wire to navigation light) for access to boom supports and pitot-static line connections.

b. Disconnect boom pitot and static lines from "T" fittings on front spar bracket. (Press line ends into inside of boom.)

c. Disconnect pitot heater wires from outer wing tip rib connector.

d. Remove rubber grommet and push wires into boom.

e. Loosen bolts through aft boom support.

f. Remove forward boom support bolt.

g. Slide boom forward and remove from wing.

6-136. INSTALLING BOOM. See figure 6-14.

6-137. TESTING PITOT-PRESSURE LINES.

a. Connect source of pressure to opening in nose of pitot-static system head. Seal drain hole with masking tape.

b. Apply pressure slowly until airspeed indicator reads three-fourths of full range; then "pinch off" source of pressure and secure with a suitable clamp.

c. Airspeed indication must not drop more than 5 knots after one minute. Tap indicator to keep pointer swinging freely.

d. If airspeed indicator drops more than 5 knots, locate line leak with soap and water solution, and repair connection or replace lines.

e. After test is completed, remove drain hole masking tape from pitot-static system head.

CAUTION

Do not apply suction to pitot-pressure line.

6-138. TESTING STATIC-PRESSURE LINES.

a. Seal static-pressure openings on each side of pitot-static system head with masking tape.

b. Attach source of suction to static drain sump at right wing tip.

c. Set altimeter pointer to "0."

d. Slowly apply suction within range of the rate-of-climb indicator until altimeter reads 10,000 feet; then "pinch off" tube and secure it with a suitable clamp.

e. Tap altimeter to keep pointer swinging freely for one minute.

Note

The altimeter must not indicate less than 7000 feet after one minute.

f. If altimeter reads less than 7000 feet, a line leak is indicated. Slowly remove source of suction, taking care to prevent rate of pressure drop from exceeding range of rate-of-climb indicator; then disconnect static line fittings from gun sight computer, gun sight amplifier, altimeter, rate-of-climb indicator, cabin altimeter, Machmeter, and airspeed indicator. Then attach source of pressure to one tube of lines and plug all other ends. Apply pressure and use a soap and water solution to locate leak. Tighten or repair faulty connection or replace damaged lines; then retest. Remove line plugs and pressure source; then reconnect lines to respective units.

CAUTION

Do not apply pressure to static lines with instruments connected.

g. If altimeter does not read less than 7000 feet, negligible leakage is indicated. Slowly remove static-pressure source.

h. Remove masking tape from static-pressure openings.

Section VII
ELECTRICAL SYSTEM

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7-1. ELECTRICAL POWER SUPPLY.

Note

Paragraphs 7-2 through 7-83 include only the information pertaining to the electrical power supply, electrical power distribution, and lighting systems. The electrical subsystems are covered in their respective paragraphs.

7-2. A 400-ampere, dual-purpose, engine-driven starter-generator (G.E. 2CM77B8A) supplies primary d-c power for the electrical system. A 24-volt, 34-ampere-hour battery supplies the secondary d-c power for the electrical system. When generator output is less than battery voltage, the battery powers all electrical equipment except the starter and units connected to the secondary bus. Through the external power receptacles, an external source of d-c power may be connected to the primary and secondary busses for engine starting and ground checking of equipment connected to these busses. The metallic structure of the airplane serves as the common ground for the single-wire type electrical system. D-C power distribution is made through a three-bus system. An overvoltage protection system protects the electrical equipment from damage due to an overvoltage condition in the electrical generator system. Static charges, accumulated on the metallic structure of

the airplane, are discharged through a grounding wire connected to the left landing gear strut. On F-86E-1, F-86E-5, and F-86E-6 Airplanes, and F-86E-10 Airplanes AF51-2718 through -2747, a-c power for operation of engine and flight instrument equipment is supplied by one AN3499-1, three-phase, 115-volt, 400-cycle, 100-volt-ampere inverter with a 1500-volt-ampere, one-phase inverter acting as main through a phase inverter. On F-86E-10 Airplanes AF51-2748 through -2849 and F-86E-15 Airplanes, two AN3499-1 inverters supply the power to these instruments. Wiring is grouped in open bundles except in local areas where conditions require additional protection. Shielded wire and filter networks are used in some circuits for functional reasons. All controllable major electrical units are controlled from three panels (right and left console and center pedestal switch panels) in the cockpit. Practically all control and distribution circuits are protected either by circuit breakers or circuit-breaker type toggle switches. For circuit-breaker and relay charts and detailed wiring diagrams, see Section X.

7-3. TROUBLE SHOOTING ELECTRICAL SYSTEM.

7-4. When trouble shooting, remove the wires from the unit affected, and check the power lead with a voltmeter for the correct voltage. If there is power to this point, the trouble is in the unit, and an attempt should be made either to adjust the unit or to replace it with one known to be serviceable. If there is no indication of power at the unit, check wiring back to the power source.

WARNING

In trouble shooting the complete electrical system, it is necessary to remove various plugs and terminal block covers to make circuits accessible. Extreme care must be taken in testing, as "hot" points are thus exposed. Whenever such testing is necessary, remove all power from the equipment, make necessary circuit changes or meter connections, and then apply the power.

TROUBLE	PROBABLE CAUSE	REMEDY
	BATTERY	
Electrolyte consistently below top of plates.	Leakage. Boiling over because of high generator voltage.	Seal case, or replace battery. Adjust or replace voltage regulator.
Freezing.	Exposure to low temperature and not properly charged. Specific gravity of electrolyte too low.	Thaw slowly in a warm room. Charge battery.
Discharged battery.	Loss of electrolyte. Low temperature. External short circuit. Overcharging for long periods. Internal short circuits. Length of service. Reverse-current relay improperly adjusted. Load left on, or external short. Voltage regulator improperly adjusted.	Seal case, or replace battery. Thaw in warm room. Charge battery. Repair short. Replace battery if necessary. Replace battery. Adjust or replace voltage regulator, if necessary. Replace battery. Replace battery. Adjust relay. Check switches and wiring. Adjust regulator.
Reversal of polarity.	Battery charged in wrong direction.	Replace battery, or charge with proper polarity.
	EXTERNAL POWER RELAY	
Relay inoperative.	Discharged battery. Improper connection. Defective wiring.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Relay holding coil is shorted, burned out, or grounded.	
STARTER-GENERATOR 2CM77B8A		
Ammeter—no current; voltmeter—no voltage.	Bad bearings, broken inner shaft, or failure in the vibration dampener.	Replace generator.
Ammeter—no current; voltmeter—no voltage or low voltage.	Grease, dirt, or oil on brushes or commutator. Insufficient spring pressure. Loose connections at brush terminal screws or elsewhere in generator. Grounded, shorted, or open shunt field or armature.	Replace generator. Replace generator. Replace generator. Replace generator.
Ammeter—rapidly fluctuating current; voltmeter—fluctuating voltage.	Incorrect brush setting or internal failure of generator.	Replace generator.
Ammeter—abnormally different currents; voltmeter—normal or low voltage.	Overheating due to dirty or clogged ventilating tube, or dirty internal air passage; loose connections at the brush terminal screws, poor brush contact with commutator, or internal failure.	Clean air inlet tube. Tighten loose connections. Check brushes for correct fit to commutator. If faulty generator, remove for repair.
AN3025-2 REVERSE-CURRENT RELAY		
Relay will not close at regulated voltage.	Generator control switch open. Generator voltage too low. Reversed generator polarity. Improperly adjusted or defective relay.	Check generator voltage, determine cause, and correct as necessary. Replace relay.
Relay will not open on reverse current.	Improperly adjusted or defective relay.	Replace relay.
Reverse current required to open relay is too high.	Improperly adjusted relay.	Replace relay.
GENERATOR FIELD RELAY—TYPE M-2		
Relay does not trip.	Resistor R-1 is open. Loose connections from pin G or I to ground.	Replace.
Relay remains tripped.	Condenser C-2 shorted.	
Relay will not reset electrically.	Reset coil is open. Loose connections from pin B to ground.	Replace.
Relay will not reset manually.	Latching device is inoperative.	Adjust.

TROUBLE	PROBABLE CAUSE	REMEDY
	E-2 GENERATOR OVERVOLTAGE RELAY	
False tripping (operating under 31 volts).	Defective relay.	
	AN3515-1 SINGLE-PHASE INVERTER	
Inverter fails to start.	No voltage at terminals. Starting contactor open or shorted. Open filter choke coil 7-1346. Open interpole winding or series field winding. Open armature.	Make necessary repairs to power supply. Repair contactor coil SWI-288. Replace inverter. Replace inverter. Replace inverter.
No voltage.	No d-c excitation to alternator rotor. Relay SWI-234 defective. Open resistor RES-284. Brushes worn. Starting contactor SWI-228 contacts not closed properly. Open circuit from stator to 115-volt a-c terminal. Open filter choke coil 7-1346. Alternator stator open or grounded. Alternator rotor open or grounded. Stator output grounded. Broken connection between 28-volt d-c terminal and control chassis.	Replace thyratrons T-5, T-6, T-7, and T-8. Replace 6 x 4 rectifier T-9. Replace inverter. Replace inverter. Replace inverter. Replace inverter. Replace inverter. Replace inverter. Remove ground.
Low voltage output.	Voltage regulator not adjusted properly. Voltage regulator not operating properly. Potentiometer RES-293 shorted. High-resistance rotor brush contact. Alternator rotor shorted or grounded. Alternator stator shorted or grounded. High-resistance contacts on starting contactor. High-resistance short across a filter capacitor. High-resistance ground connections.	Replace tubes T-2, T-5, T-6, T-7, T-8, T-9, and T-10. Replace inverter. Replace inverter. Replace brushes or springs where necessary. Replace inverter. Replace inverter. Replace inverrer. Replace inverter.
High voltage output.	Voltage regulator not adjusted properly.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Defective voltage regulator.	Replace tubes T-2, T-5, T-6, T-7, T-8, T-9, and T-10. Replace inverter.
	Inverter operating above rated speed.	Same as for high-frequency trouble.
	Alternator rotor grounded.	Replace inverter.
No voltage control.	Voltage adjustment potentiometer defective.	Replace inverter.
Low frequency.	Frequency regulator not adjusted properly.	
	Defective frequency regulator.	Replace tubes T-1,T-3, and T-4.
	Defective frequency control potentiometer.	Replace inverter.
	Input voltage below specified limits.	Make necessary repairs to power supply.
	Shunt field resistors shorted or grounded.	Replace inverter.
High frequency.	Frequency regulator not adjusted properly.	
	Frequency regulator defective.	Replace tubes T-1, T-3, and T-4.
	Defective frequency control potentiometer.	Replace inverter.
	Motor control field shorted or grounded.	Replace inverter.
	Shunt field resistor open.	Replace inverter.
	D-C voltage input above specified limits.	Check power supply.
	Open connection between motor control field and alternator winding marked "C-G."	
	Shunt field resistors not grounded properly.	
	Frequency adjustment potentiometer defective.	Replace inverter.
	Frequency regulator defective.	Replace tubes T-1, T-3, and T-4. Replace inverter.
Rotary unit hunts.	D-C brush holder bracket assembly loose.	Tighten mounting screws.
	Brushes not seated 100 percent in direction of rotation and 75 percent of brush width.	Replace inverter. "Run in" unit for 4 hours.
Machine draws excessive current while running.	Motor armature grounded.	Replace inverter.
	Motor shunt field grounded.	Replace inverter.
	Alternator rotor grounded.	Replace inverter.
	Alternator stator grounded.	Replace inverter.
Motor brushes sparking or arcing.	Brushes worn or broken.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Motor armature grounded. Raised bar on commutator. Brushes not seated 100 percent in direction of rotation and 75 percent of brush width. Brushes sticking.	Replace inverter. Replace inverter. "Run in" unit at least 4 hours.
Alternator brushes arcing.	Brushes worn or broken. Alternator rotor grounded. Brushes sticking. Slip rings out of round.	Replace inverter. Replace inverter.
Machine noisy or rough.	Bearing failure. Rotor unbalanced. Mechanical interference.	Replace inverter. Replace inverter.
Radio noise level too high.	Filter failure. New brushes not seated. Parts of machine poorly bonded together.	Replace inverter. "Run in" for 4 hours.
Overheating.	Fan rubbing. Shorted or grounded windings. Insufficient ventilating area around inverter. Air intakes blocked.	Replace inverter. Replace inverter.

7-5. ELECTRICAL POWER SOURCES.

7-6. BATTERY SYSTEM.

7-7. The battery system consists of a 24-volt, 34-ampere-hour battery (AN3150-A), the battery bus tie-in relay, the battery-starter switch, and associated equipment. (See figure 7-10.) The battery is connected directly to the battery bus, which is connected to the battery bus tie-in relay. When energized, the battery bus tie-in relay connects the battery bus to the primary bus. The battery bus tie-in relay coil ground-return circuit is controlled in two ways: automatically through contacts on the external bus tie-in relay when external power is applied to No. 1 external power receptacle, and manually when the battery-starter switch is placed in the "BATTERY" position. Contacts on the ignition control relay disconnect the battery bus tie-in relay coil ground-return circuit when the battery switch is placed in the "STARTER" position. This prevents starting the engine from the battery, since the capacity of the battery is inadequate to withstand the engine starting load. All connections to the battery are of the quick-disconnect type.

7-8. REMOVING BATTERY. To remove the battery, proceed as follows:

a. Remove the radar compartment access door, forward of the windshield, for access to the battery.

b. Remove quick-disconnect plug from battery.

c. Free tie-down rods from slots in battery cover.

d. Disconnect battery vent tubes.

e. Lift battery out of airplane.

7-9. INSTALLING BATTERY. To install battery, proceed as follows:

a. Position battery on mounting pad after making certain that battery is fully charged and that there is a 3/16-inch thick sponge rubber gasket between the battery lid and the battery.

b. Connect battery vent tubes

c. Position tie-down rods into battery cover slots and snap down cam snaps. Check for a tight fit of battery cover. If necessary, release cam snaps and adjust for proper fit.

d. Install quick-disconnect battery plug.

e. Install radar compartment access door.

7-10. TESTING BATTERY BUS TIE-IN RELAY. To test the battery bus tie-in relay, proceed as follows:

a. Disconnect external power from airplane.

b. Place all switches in the "OFF" position.

c. Place battery-starter switch in the "BATTERY" position.

d. Check generator red warning light for illumination (light will be illuminated from battery power), which will indicate proper function of battery bus tie-in relay.

e. Place battery-starter switch in the "OFF" position.

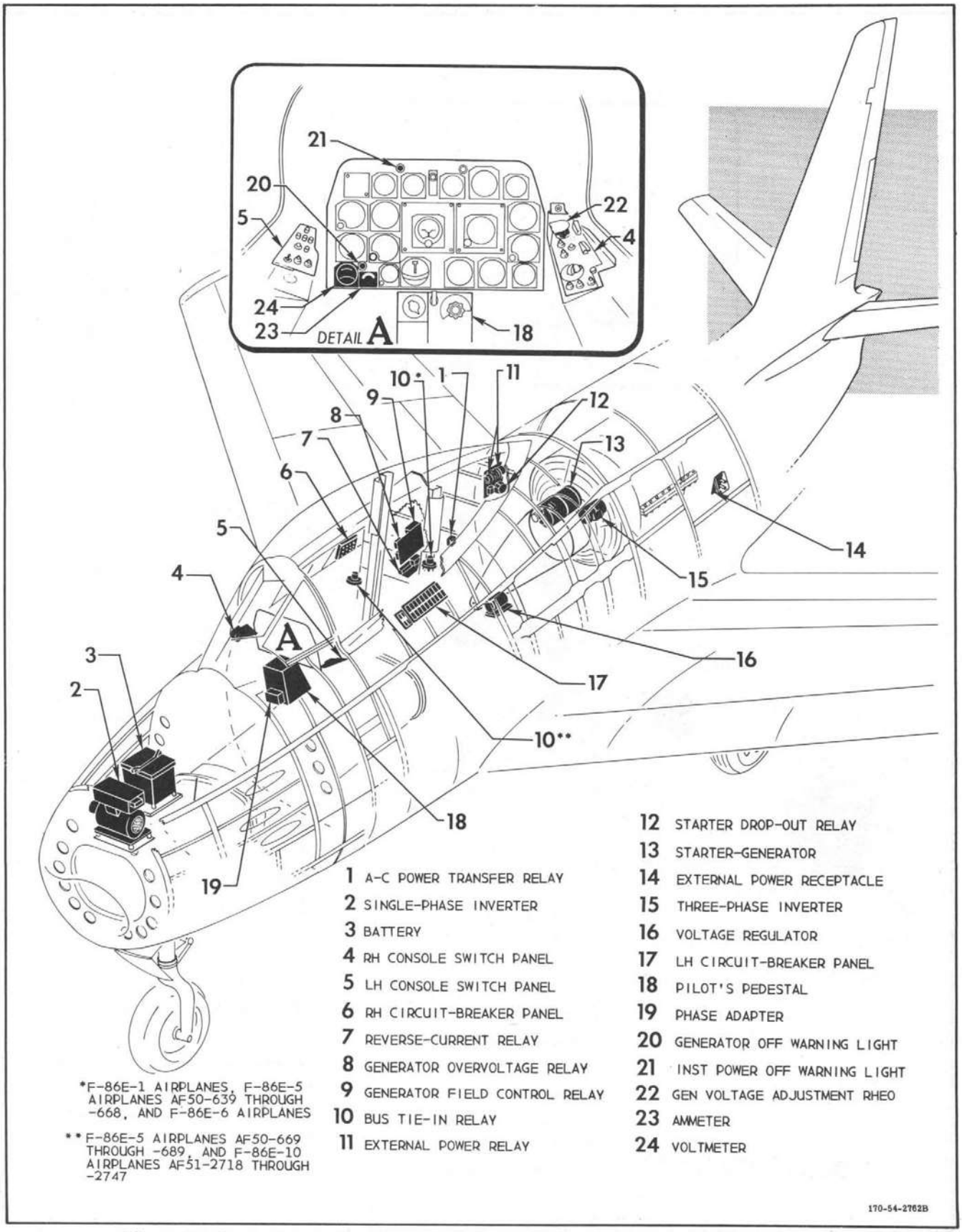


Figure 7-1. Power System Equipment Location—F-86E-1, F-86E-5, and F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 Through -2747

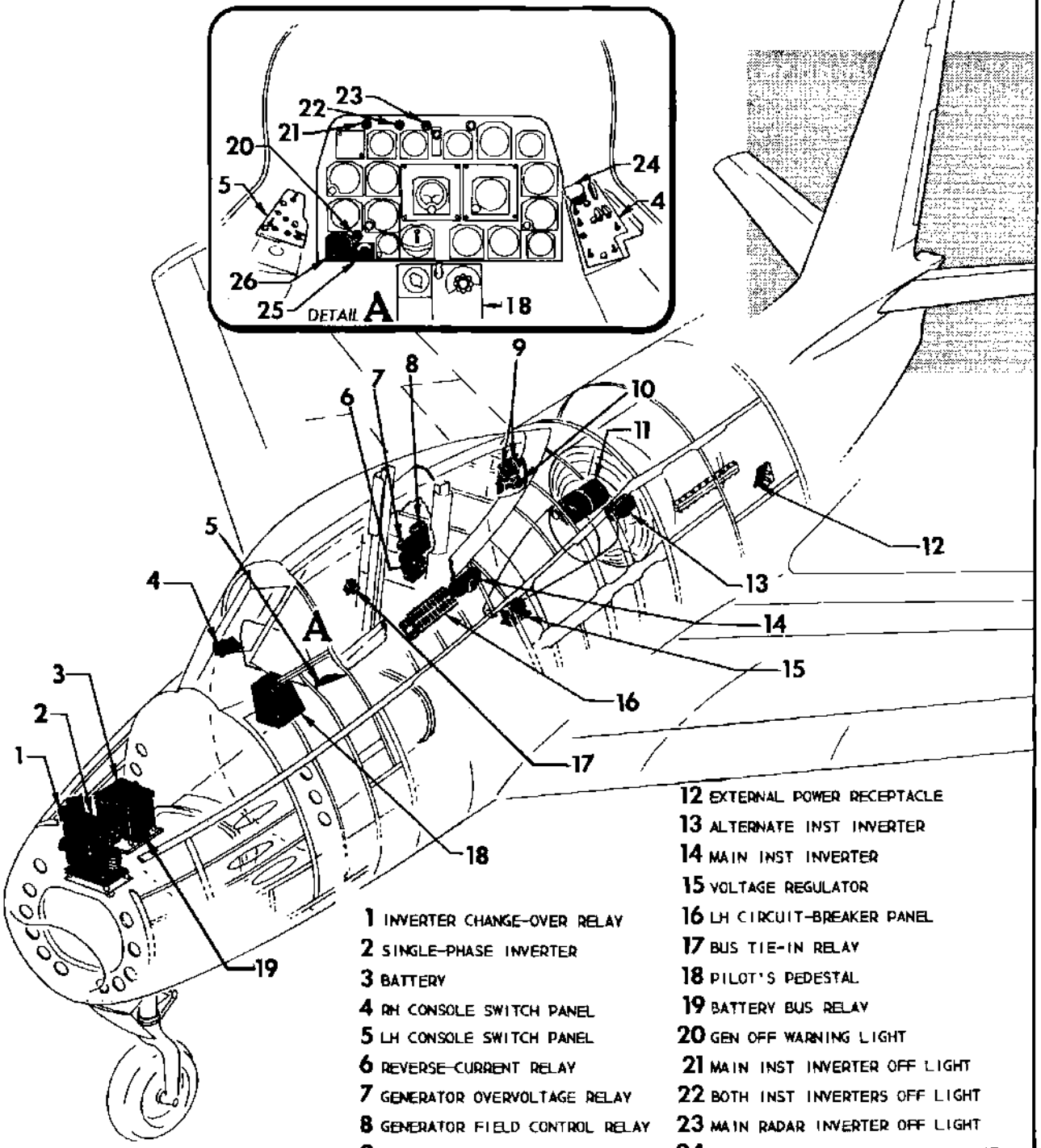


Figure 7-2. Power System Equipment Location—F-86E-10 Airplanes AF51-2748 Through -2849 and F-86E-15 Airplanes

f. Check that generator red warning light is out, indicating proper function of battery bus tie-in relay.

Note

An operational test on the battery bus tie-in relay should be performed at every 25-hour inspection to make sure that the battery bus is being connected to the primary bus when the battery-starter switch is placed in the "BATTERY" position (taxi, take-off, and air-borne conditions).

7-11. GENERATOR SYSTEM.

7-12. The generator system (figure 7-3) consists of the following: a dual purpose starter-generator, a voltage regulator, a reverse-current relay, an ammeter, a voltmeter, a red warning light, an overvoltage relay, and a generator field control relay. The starter-generator (operating as an engine-driven generator) supplies power to the primary bus, which in turn is connected to the secondary and battery busses through bus tie-in relays. The reverse-current relay connects or disconnects the generator output from the electrical system, depending on the operating condition of the generator. The relay connects the generator output to the electrical system when the voltage exceeds the bus voltage by at least .35 volt and disconnects the generator from the system when a reverse-current of 25 to 35 amperes occurs. When there is no generator power available, a circuit from the primary bus through the two de-energized bus tie-in relays is completed to the red warning light. Illumination of this light, by battery power, indicates either generator failure or insufficient generator output to close the reverse-current relay and prevent the generator from being on the line. When the generator is operating normally, the generator bus tie-in relay breaks this lamp circuit. In the event of an overvoltage condition, the overvoltage relay and the generator field control relays prevent damage to units in the electrical system. The voltage regulator holds the generator system voltage between 27.5 and 28 volts. The generator is cooled by air blast.

7-13. STARTER-GENERATOR.

7-14. A 28-volt, 400-ampere starter-generator (G. E. 2CM77B8A) is installed on the front end of the engine. The generator supplies the primary power for the electrical system of the airplane when the engine is operating under normal conditions. The starter-generator acts as a starter for cranking the engine until the engine attains approximately 23% rpm and then starts to function as a generator. The starter-generator is cooled by blast air entering the air intake duct and passing through the generator into the engine accessory section.

7-15. REMOVING STARTER-GENERATOR. Refer to paragraph 5-254.

7-16. INSTALLING STARTER-GENERATOR. Refer to paragraph 5-255.

7-17. REPLACING STARTER-GENERATOR BRUSHES. Brushes that are worn to within ⅛ inch from rivets or have lost their treatment (indicated by white deposit on commutator) must be replaced as follows:

a. Remove starter-generator as explained in paragraph 5-254.

b. Remove brush inspection band and cooling cap.

c. Cut safety wire, loosen brush terminal screw, and remove terminal.

d. Pull brush spring back as far as necessary and remove brushes.

e. Inspect commutator for grooved or burned condition. If burned or grooved, commutator is unfit for further use without corrective measures. Inspect commutator for proper condition of lubricating film. This film reduces friction and brush wear and, when satisfactory, is a flat brown color, unsplotched, and even in appearance.

f. If commutator has a good lubricating film, tie a piece of very fine sandpaper around commutator (sand side of paper toward brushes). Install new brushes and rotate armature by hand to fit brushes properly; then carefully remove sandpaper and blow out dust. Then run starter-generator as a motor for 24 hours at no load, or as a generator for 3 or 4 hours at one-half to full load with aid of air blast, to seat the brushes properly.

g. If lubricating film is splotched or very thin and showing the natural copper color, or if new commutator has been installed, use brush seating compound. This procedure will destroy any remaining lubricating film, but will seat brushes very quickly. Run starter-generator 3 to 4 hours at one-half to full load with air blast, or until a good film has developed.

Note

Brushes must be run in on the same commutator on which they are to be operated.

h. Install brush inspection band and cooling cap and install starter-generator as described in paragraph 5-255.

7-18. TESTING STARTER-GENERATOR BRUSH HOLDER SPRING TENSION. Test brush holder spring tension in the following manner:

a. Remove the brush inspection plate.

b. Using a spring-type hand scale, insert the scale hook under the spring brush. Lift the scale until the brush spring just leaves the brush. The scale should read approximately 25 ounces minimum for a worn brush, 50 ounces for a new brush.

Note

If brush holder springs have a blue appearance, replace them, as this condition indicates overheating and consequently a loss of temper.

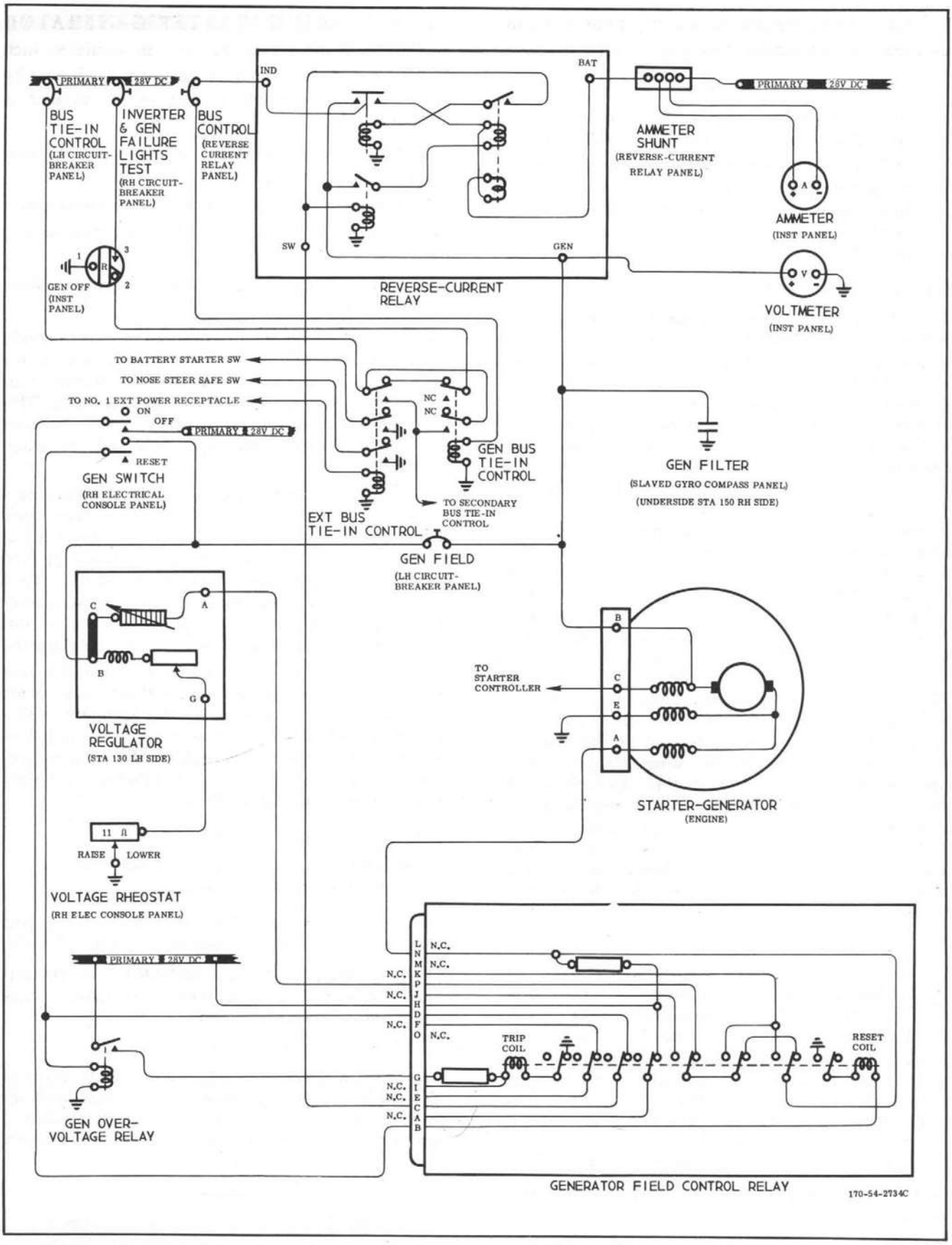
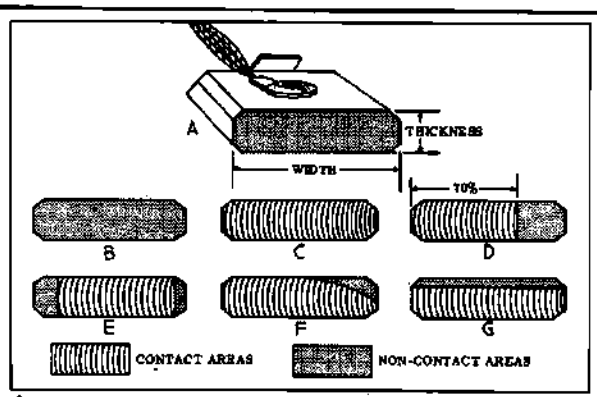


Figure 7-3. Generator System



A BRUSH THICKNESS AND WIDTH
B NEW AND UNUSED BRUSH
C BRUSH SHOWING 100 PERCENT CONTACT ACROSS THICKNESS AND 100 PERCENT ACROSS WIDTH
D, E BARELY SATISFACTORY — BRUSH SHOWING 100 PERCENT CONTACT ACROSS THICKNESS AND 70 PERCENT ACROSS WIDTH
F BARELY SATISFACTORY
G INCORRECT BRUSH FIT

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Figure 7-4. Correctly and Incorrectly Fitted Brush

7-19. OVERVOLTAGE PROTECTION SYSTEM.

7-20. The overvoltage protection system (figure 7-3) consists of an overvoltage relay, a generator field control relay, and a red warning light. When an overvoltage condition (31 volts or above) occurs, the overvoltage relay closes and trips the generator field control relay. When tripped, the generator field control relay simultaneously performs the following changes: illuminates the generator red warning light on the instrument panel, de-energizes the reverse-current relay (thereby disconnecting the generator from the distribution system), and opens the generator shunt field circuit. To reconnect the generator to the distribution system, it is necessary to place the generator switch momentarily in the "RESET" position or to manually depress the reset button, located on the generator field control relay unit. Either method energizes the reset coil inside the generator field control relay, which resets the generator field control relay and thereby reconnects the generator to the distribution system, extinguishes the red warning light, and completes the generator shunt field circuit.

7-21. CHECKING OVERVOLTAGE PROTECTION SYSTEM. To check out the overvoltage protection system, proceed as follows:

a. Place all switches in the "OFF" position.

b. Install temporary jumper between "A" and "B" terminals on the voltage regulator.

c. Connect a 0- to 50-volt d-c voltmeter of known accuracy between "B" terminal on the voltage regulator and ground.

d. Connect external power to airplane and start engine.

e. Remove external power source.

f. Place generator switch in the "ON" position.

g. Place battery switch in the "ON" position.

h. Gradually increase engine rpm while maintaining a continuous visual check of voltmeter indication.

i. Note voltage at which overvoltage relay disconnects generator from bus (31 to 33 volts normal operation).

Note

If voltage exceeds the 33-volt limit or system fails to operate, check units in overvoltage protection system and replace defective units.

CAUTION

Do *not* permit generator voltage to rise above 35 volts maximum. Shut off engine *immediately* if voltage exceeds this value.

j. Check generator-off warning light for proper operation.

k. Note voltage as indicated by voltmeter on instrument panel (approximately 2 volts normal condition).

l. Shut off engine.

m. Place all switches in the "OFF" position.

n. Remove jumper between "A" and "B" terminals on voltage regulator.

o. Disconnect 0- to 50-volt d-c voltmeter.

p. Start engine.

q. Make operational check of generator system (normal 28-volt operation).

7-22. VOLTAGE REGULATOR.

7-23. A carbon pile voltage regulator (Specification 17R21), mounted on the left side of the radio compartment, is accessible through the radio compartment door on the left side of the airplane. The voltage regulator controls the amount of carbon pile resistance inserted into the field circuit of the generator to automatically maintain a 28-volt, direct-current electrical system, regardless of variations of generator speed and conditions of varying electrical load. When the generator output voltage drops below 28 volts, the carbon pile is compressed (resistance reduced). This increases the generator shunt field current and creates a corresponding increase in generator voltage. When the generator voltage rises above 28 volts, the carbon pile is decompressed (resistance increased). This decreases the generator shunt field current and consequently decreases the generator voltage.

7-24. ADJUSTING VOLTAGE REGULATOR (FLIGHT-LINE ADJUSTMENT). To make a flight-line adjustment of the voltage regulator, proceed as follows:

a. Place all switches in the "OFF" position and remove external power, if connected.

NO. REQD	EQUIPMENT	MAX AMP	MAX POWER
	ARMAMENT		
6	Ammunition boost motor at 17.5 amperes	105.0	2940.0
6	Bolt release charger (B-1) at 3.5 amperes ⑤	21.0	588.0
6	Bolt retract charger (B-1) at 2.2 amperes ⑤	13.2	369.6
4	Bomb-arming solenoids (S-2) at 0.5 ampere	2.0	56.0
2	Bomb release solenoids (S-2) at 6.0 amperes	12.0	336.0
2	Drop tank release solenoids (R-3) at 8.4 amperes	16.8	470.4
1	GSAP Camera (AN-N6)	2.0	56.0
1	Gun charger compressor ⑥	20.0	560.0
6	Gun-firing solenoid (G-9) at 6.2 amperes ①	37.2	1041.6
1	Gun sight (A-1CM)	27.5	770.0
6	Gunfire charger (B-1) at 1.9 amperes ⑥	11.4	319.2
2	Parachute framentation release solenoids (R-3) at 15.5 amperes	31.0	868.0
16	Rocket-arming solenoids (A-2) at 0.5 ampere ②	8.0	224.0
16	Rocket-arming solenoids (F-1) at 0.3 ampere ③	4.8	134.4
8	Rocket jettison solenoid at 8.4 amperes	67.2	1882.0
1	Rocket release (A-3)	1.5	42.0
	DEICING AND ANTI-ICING		
1	Fuel filter deice pump	8.5	238.0
1	Fuel filter deice valve	0.63	17.6
1	Pitot heater	7.5	210.0
1	Windshield anti-ice heater	71.5	2002.0
	ENGINE INSTRUMENTS		
1	Fuel level indicator system	0.8	22.4
	FLIGHT CONTROLS		
1	Aileron trim bungee actuator	3.5	98.0
1	Alternate flight control system hydraulic pump	48.5	1358.0
1	Alternate flight control system return and supply valve	0.7	19.6
1	Horizontal trim bungee actuator	3.5	98.0
1	Normal system by-pass valve	0.7	19.6
1	Rudder trim actuator	3.5	98.0
1	Speed brake valve solenoid ②	1.4	39.2
1	Speed brake valve solenoid ③	0.9	25.2
2	Wing flap actuator at 11.0 amperes	22.0	616.0
	FLIGHT INSTRUMENTS		
1	Gyro compass amplifier (A-2)	0.6	16.8
1	Turn-and-Bank indicator	0.15	4.2
	FUEL		
1	Emergency fuel system regulator valve	1.0	28.0
1	Fuel shutoff valve	2.9	81.2
1	Fuel transfer pump	8.9	249.2
2	Main fuel booster pump at 16.0 amperes	32.0	896.0
1	Main fuel system regulator valve	1.0	28.0
	HEAT AND VENT		
1	Ammunition heat actuator ②	0.5	14.0
1	Cockpit heat control ②	0.2	5.6
1	Cockpit heater	143.0	4004.0
1	Cockpit mixing-valve actuator ③	1.0	28.0
1	Cockpit pressure regulator	0.5	14.0
1	Dump valve ③	0.25	7.0
6	Gun heater (AN-J4) at 4.17 amperes	25.02	700.5
1	Heat exchange valve ③	1.0	28.0
1	Hot air by-pass valve ③	1.0	28.0
1	Pressure air shutoff valve ②	0.7	19.6
1	Cockpit air shutoff valve ③	1.1	30.8
1	Ram-air shutoff valve	0.8	22.4

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Figure 7-5. D-C Loading Chart (Sheet 1 of 2)

NO. REQD	EQUIPMENT	MAX AMP	MAX POWER
	IGNITION		
2	Ignition vibrator at 3.7 ampere	7.4	207.2
	LANDING GEAR		
1	Fairing door solenoid valve [1]	0.88	22.6
1	Fairing door solenoid valve [3]	0.9	25.2
1	Nose steering solenoid valve	0.2	5.6
1	Strut solenoid valve [2]	0.88	22.6
1	Strut solenoid valve [3]	0.9	25.2
	LIGHTING		
2	Auxiliary instrument lights at 0.3 ampere	0.6	16.8
1	Cockpit utility light (C-4A) [3]	0.17	4.7
2	Console floodlights at 0.17 ampere	0.34	9.52
16	Console and pedestal lights at 0.04 ampere [2]	0.64	17.92
17	Console and pedestal lights at 0.04 ampere [3]	0.68	19.04
1	Extension light (B-7) [2]	0.2	5.6
2	Fuselage code lights at 2.7 amperes [3]	5.4	151.2
2	Fuselage lights at 0.3 ampere	0.6	16.8
2	IFF destructor lights at 0.04 ampere	0.08	2.24
43	Instrument ring lights at 0.04 ampere [2]	1.72	48.16
41	Instrument ring lights at 0.04 ampere [3]	1.64	45.92
2	Landing and taxi lights at 8.9 amperes	17.8	498.40
2	Landing and taxi light motor at 2.14 amperes	4.28	119.84
1	Position lights flasher [2] (Type C-1) [3] (Type C-2)	0.6	16.8
1	Stand-by compass light [3]	0.19	5.32
2	Tail position lights at 0.8 ampere	1.6	44.80
2	Wing position lights at 0.75 ampere	1.5	42.0

NO. REQD	EQUIPMENT	MAX AMP	MAX POWER
	MISCELLANEOUS		
1	Canopy actuator	15.5	434.0
1	Canopy seal valve [2]	0.08	2.24
1	Canopy seal valve [3]	0.3	8.4
1	Fire detector relay	1.2	33.6
1	Instrument panel vibrator	0.3	8.4
61	Miscellaneous power and control relays at 0.2 ampere average	12.2	341.6
	POWER		
1	Single-phase main inverter [2]	72.5	2030.0
1	Single-phase main inverter [4]	73.9	2069.2
1	Single-phase radar inverter [3]	63.9	1789.2
1	Three-phase spare inverter	5.92	165.76
2	Three-phase instrument inverters at 5.92 amperes [3]	11.84	331.52
	RADAR		
1	IFF transpondor AN/APX-6	1.0	28.0
1	Radar search AN/APG-30	3.0	84.0
	RADIO		
1	Radio Compass AN/ARN-6	4.5	126.0
1	VHF command receiver AN/ARC-3	5.5	154.0
1	VHF command transmitter AN/ARC-3	12.0	336.0
	WARNING DEVICES		
1	LG handle "UP" indicator light [3]	0.17	4.76
3	LG safe indicator light at 0.17 ampere [2]	0.51	14.28
1	Landing gear warning horn	1.0	28.0
8	Miscellaneous indicator lights at 0.17 ampere [2]	1.36	38.0
10	Miscellaneous indicator lights at 0.17 ampere [3]	1.70	47.6

[1] F-86E-1

[2] F-86E-1, F-86E-5, and F-86E-6 Airplanes

[3] F-86E-10 Airplanes

[4] F-86E-10 Airplanes AF51-2718 through -2747

[5] F-86E-10 Airplanes AF51-2748 through -2849

[6] F-86E-5 and subsequent Airplanes

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Figure 7-5. D-C Loading Chart (Sheet 2 of 2)

b. Move voltage regulator rheostat to the extreme counterclockwise position.

c. Connect the positive lead of a portable precision voltmeter to "B" terminal of the voltage regulator and the negative lead of the voltmeter to the metal structure of the airplane.

Note

Precision voltmeters retained for checking aircraft instruments and aircraft electrical system voltages must be checked against an instrument of known accuracy (a standard) every 90 days or sooner if the instrument has been subject to abuse.

WARNING

When adjusting or testing components of the electrical system, it is necessary to remove terminal block covers to make circuits accessible. Extreme care must be taken in testing, as "hot" points are thus exposed. Whenever such testing is necessary, remove all power from the equipment, make necessary circuit changes or meter connections, and then apply the power.

d. Start engine.

e. Place generator switch in the "ON" position.

f. Operate generator between 50% and 90% engine rpm.

Note

Because of heavy fuel consumption while engine is operating on the ground, a close generator voltage regulator adjustment should be made on the ground prior to a short flight and a fine adjustment made when the airplane returns to the ground after approximately 20 minutes.

g. Adjust remote (pilot's) rheostat on right console panel in cockpit area until the precision voltmeter indicates 28.0 volts. *Do not vary the rheostat on voltage regulator.*

Note

If airplane is operating in areas where average temperatures are high, causing considerable bailing of the electrolyte, the regulated voltage may be set as low as 27.75 volts, *never lower.*

h. Stop engine.

i. Disconnect precision voltmeter from "B" terminal on voltage regulator and metal structure of airplane.

j. Make operational check of generator system.

7-25. REVERSE-CURRENT RELAY.

7-26. The reverse-current relay connects the generator to the primary bus when the generator switch is placed in the "ON" position, when the generator voltage exceeds the bus voltage by at least .35 to .65 volt, and when there is an electrical load on the primary bus (distribution system). The reverse-current relay disconnects the generator from the distribution system when a reverse current of 25 to 35 amperes tends to drive the generator as a d-c motor. This relay will not connect the generator to the primary bus (distribution system) until there is an electrical load on the system.

7-27. ALTERNATING-CURRENT SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES, AND F-86E-10 AIRPLANES AF51-2718 THROUGH -2747).

7-28. The alternating-current system (figure 7-6) consists of an AN3515-1 or a Jack & Heintz 3185-1 (F-35) 400-cycle, single-phase, 1500-volt-ampere inverter; a 400-cycle, three-phase, 100-volt-ampere AN3499-1 inverter; a phase adapter transformer; an autotransformer; and a gun sight inverter. When using the Type F-35 inverter, wires to this unit must be lengthened. When the instrument power switch is placed in the "NORMAL" position, the single-phase inverter supplies power to the AN/APX-6 IFF set, gun sight power relay, fuel flow totalizer system, a phase adapter, and to the heat and vent electronic amplifier on F-86E-10 Airplanes AF51-2718 through -2747. The adapter transforms the single-phase input to three-phase output, which is connected to the phase busses from which the attitude gyro, gyrocompass system, and autotransformer receive their power. The autotransformer steps the voltage down to 26 volts for use with the oil, fuel, and hydraulic pressure instruments. The three-phase inverter, which serves as an alternate for the single-phase inverter, goes into operation automatically when the d-c generator fails or manually when the instrument power switch is moved to the "ALTERNATE" position. For information regarding transfer of power from the spare inverter to load, refer to paragraph 7-40.

7-29. SINGLE-PHASE INVERTER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES, AND F-86E-10 AIRPLANES AF51-2718 THROUGH -2747).

7-30. An AN3515-1 or a Jack & Heintz 3185-1 (F-35) single-phase, 400-cycle, 1500-volt-ampere inverter is installed in the forward end of the nose section. The inverter is a grounded-type motor alternator with a laminated yoke assembly. The armature and rotor are on a common shaft. The Type F-35 unit employs two carbon pile regulators, which furnish automatic voltage and frequency regulation by controlling the current in the a-c rotor winding (for voltage control) and in the shunt field of the rotor (for frequency control). The

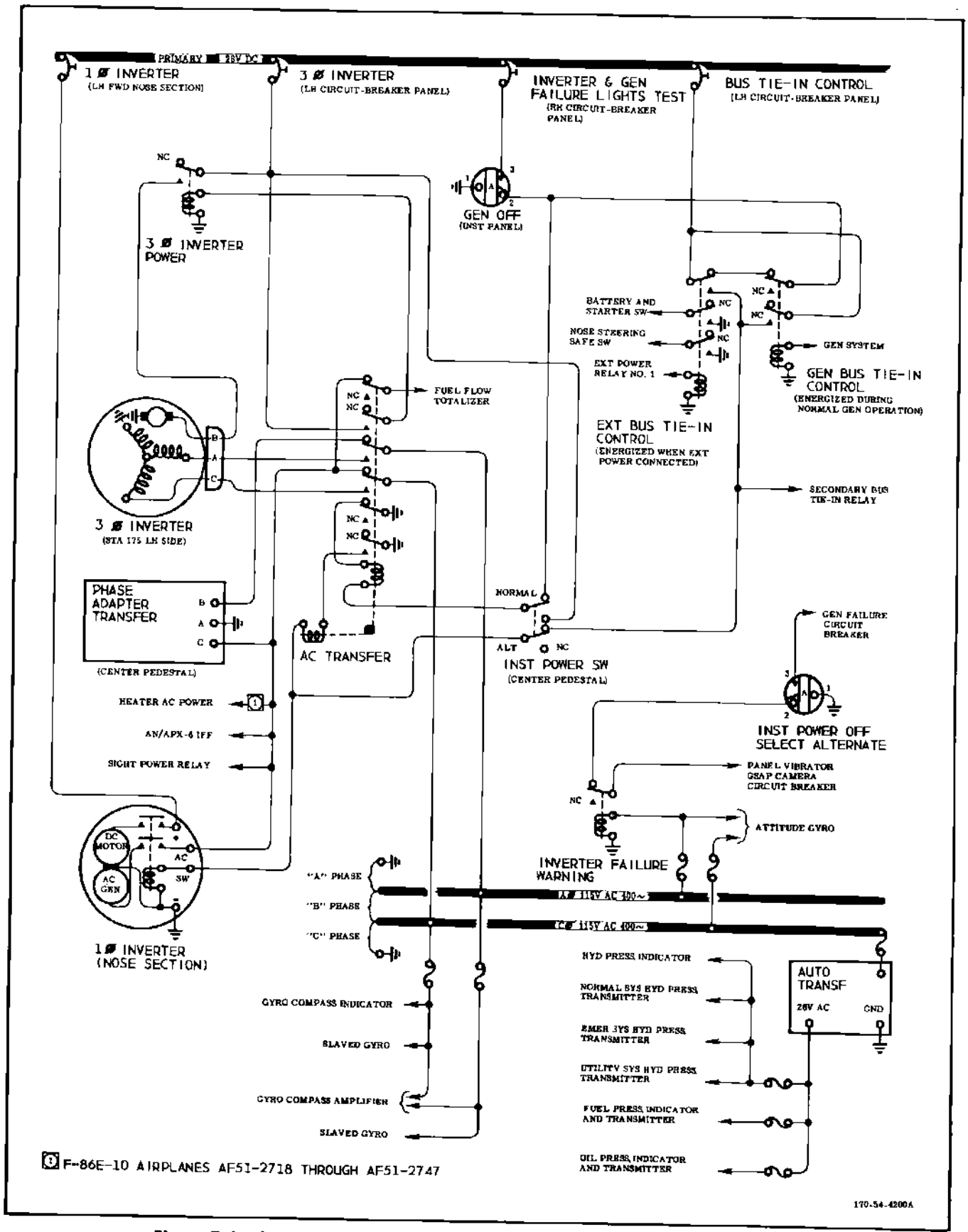

Figure 7-6. Alternating-current System—F-86E-1, F-86E-5, and F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 Through -2747

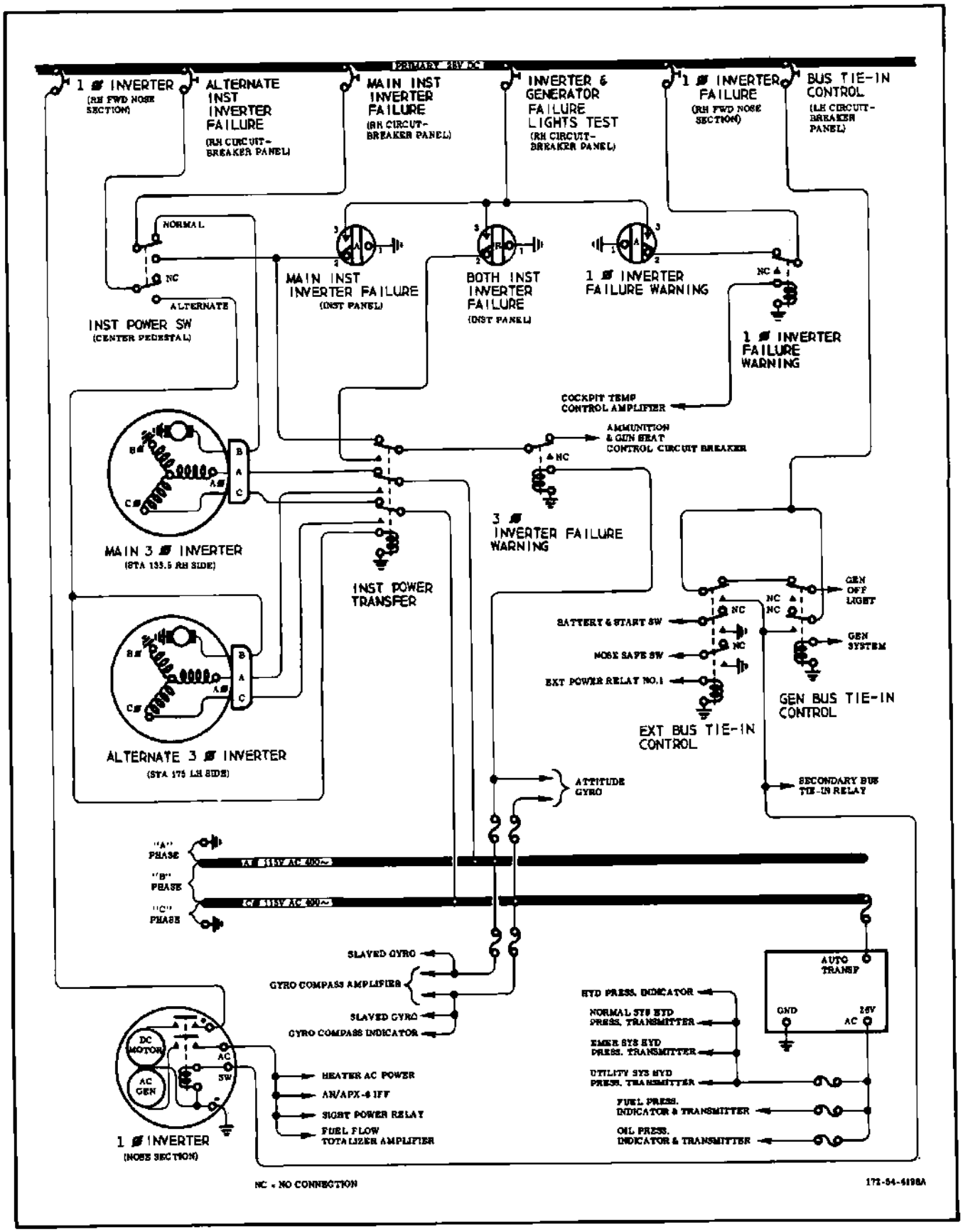

Figure 7-7. Alternating-current System—F-86E-10 Airplanes AF51-2748 Through -2849 and F-86E-15 Airplanes

AN3515-1 inverter is electronically regulated. An externally adjustable rheostat is also provided to permit manual setting of the a-c output voltage. An integral relay is provided to close the d-c input line and the a-c output line. This relay prevents the inoperative inverter from being motorized and its output circuit from being paralleled with the load when the inverter control relay is closed. The d-c input and a-c output lines are equipped with radio noise filters.

7-31. THREE-PHASE INVERTER (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES, AND F-86E-10 AIRPLANES AF51-2718 THROUGH -2747).

7-32. An AN3499-1, three-phase, 400-cycle, 100-volt-ampere inverter is installed on the left side of the aft radio bay. This inverter serves as an alternate to the single-phase inverter should the single-phase inverter fail. The three-phase inverter is placed into operation automatically when the d-c generator fails or manually when the instrument power switch is placed in the "ALTERNATE" position.

7-33. ALTERNATING-CURRENT SYSTEM (F-86E-10 AIRPLANES AF51-2748 THROUGH -2849 AND F-86E-15 AIRPLANES).

7-34. The alternating-current system (figure 7-7) consists of an AN3515-1, single-phase, 400-cycle, 1500-volt-ampere inverter; two AN3499-1, three-phase, 400-cycle, 100-volt-ampere inverters; and an autotransformer. The single-phase inverter (AN3515-1 on F-86E-10 Airplanes AF51-2748 through -2849, Type F-35 on F-86E-15 Airplanes) supplies power directly to the heat and vent electronic amplifiers, AN/APX-6 IFF set, gun sight power relay, and fuel flow amplifier. Direct-current switch voltage for the single-phase inverter is routed through momentary contacts of the external or generator bus tie-in control relays. The single-phase inverter operates continuously whenever external or generator power is available and becomes inoperative whenever a loss of generator or external power occurs.

Note

The F-35 (Jack & Heintz 3185-1) single-phase inverter can be installed in lieu of the AN3515-1 inverter, provided the shock mounts are properly deactivated as shown in figure 7-8.

The main instrument three-phase inverter supplies power to the a-c bus whenever the instrument power switch is in the "NORMAL" position and power is applied to the primary bus. The alternate three-phase inverter powers the a-c bus when the instrument power switch is in the "ALTERNATE" position and power is applied to the primary bus. The instrument inverters can be powered from the battery in the event of a generator failure, provided the battery-starter switch is placed in the "BATTERY" position. The autotransformer steps down one phase ("C") of the three-phase, 115-volt, instrument power to 26 volts (single-phase) to power the engine instruments.

7-35. SINGLE-PHASE INVERTER (F-86E-10 AIRPLANES AF51-2748 THROUGH -2849 AND F-86E-15 AIRPLANES).

7-36. An AN3515-1 or an F-35 (Jack & Heintz 3185-1) single-phase, 400-cycle, 1500-volt-ampere inverter is installed in the forward end of the nose section. The Type F-35 unit employs two carbon pile regulators for automatic voltage and frequency regulation. The AN3515-1 inverters are electronically regulated. The regulators control the current in the a-c rotor winding to stabilize voltage and control the current in the shunt field of the rotor to regulate the frequency. The a-c output voltage may be set manually by means of an externally adjustable rheostat. A relay inside the inverter is provided to complete the circuit connections for the d-c input and a-c output lines. When the single-phase inverter fails, the related failure warning relay is de-energized, connecting primary bus voltage to the single-phase inverter failure warning light. The warning light is located on the instrument panel.

7-37. THREE-PHASE INVERTERS (F-86E-10 AIRPLANES AF51-2748 THROUGH -2849 AND F-86E-15 AIRPLANES).

7-38. The original three-phase inverter installed on the left side of the aft radio bay serves as the alternate inverter. The main three-phase inverter is installed in the radio compartment left door aft of the cockpit. (See figure 7-2.) When the instrument power switch is placed in the "NORMAL" position, the main inverter is energized and produces three-phase a-c power. This power is fed through the "at-rest" contacts of the instrument power relay directly to the a-c bus. The bus distributes the a-c power to the gyrocompass, slaved gyro, attitude gyro, and autotransformer. Placing the instrument power switch in the "ALTERNATE" position energizes the alternate inverter and the instrument power transfer relay. This relay connects the alternate inverter a-c output to the three-phase a-c bus. The autotransformer steps down the a-c voltage on the "C" phase from 115 volts to 26 volts to power the engine instruments.

7-39. ALTERNATING-CURRENT TRANSFER SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES, AND F-86E-10 AIRPLANES AF51-2718 THROUGH -2747).

7-40. The alternating-current transfer system (figure 7-6) consists of a multiple-contact, double-coil relay, an amber warning light, and a manually controlled instrument power switch marked "NORMAL" and "ALTERNATE." When the instrument power switch is in the "NORMAL" position, all a-c operated equipment except the gun sight power relay and the phase adapter is

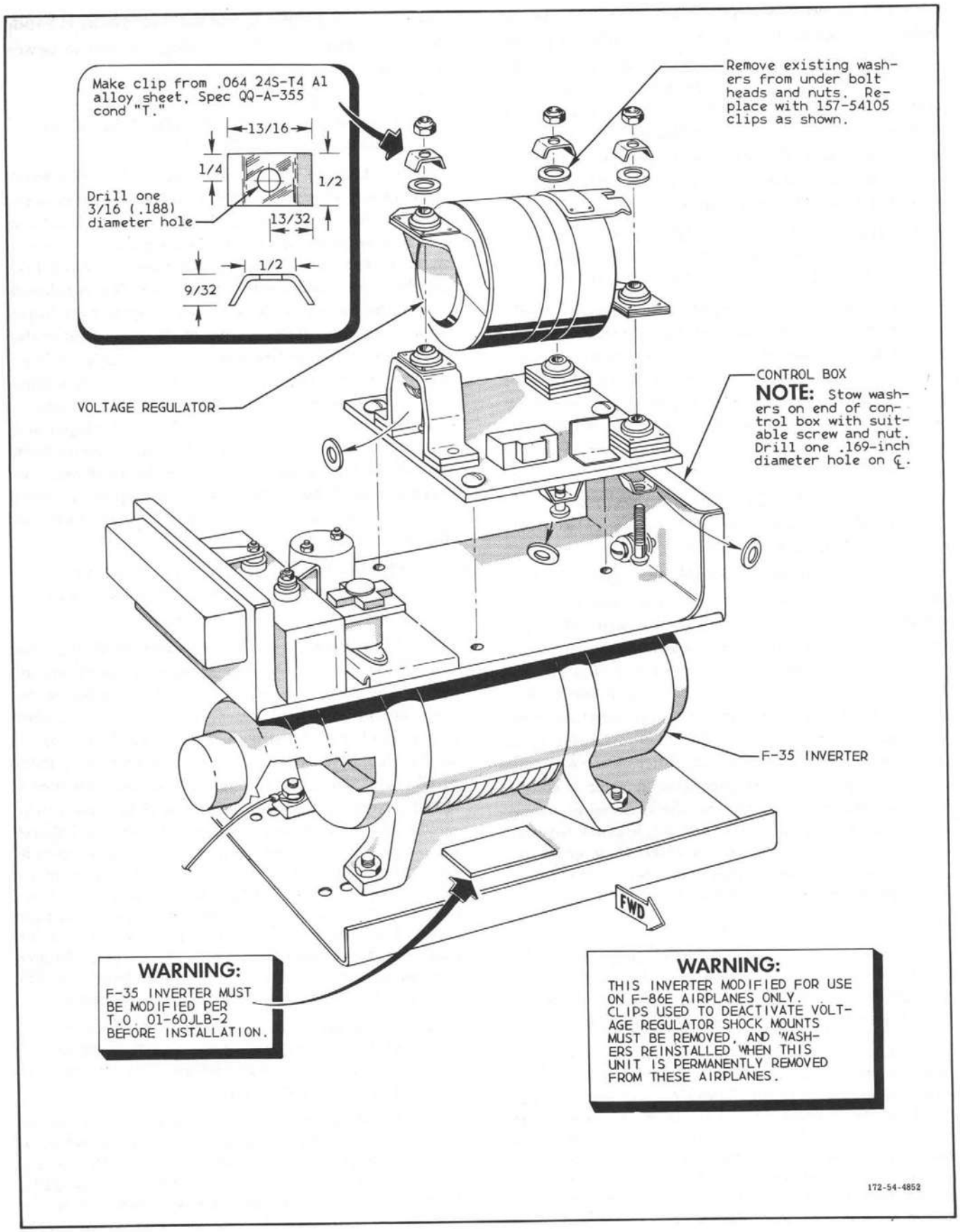

Figure 7-8. Jack & Heintz 3185-1 Inverter Installation

NO. REQD	EQUIPMENT	VA	WATTS	POWER FACTOR	VA REACT-ANCES
	SINGLE-PHASE INVERTER				
1	A-1CM gun-bomb-rocket sight	242.5	121.25	.5	210.0
1	AN/APG-30 radar equipment	375.0	334.0	.89	171.0
1	AN/APX-6 IFF equipment	225.0	198.0	.88	107.0
1*	Cockpit temperature control amplifier	6.7	6.4	.95	2.1
1	Fuel flow totalizer	28.0	22.4	.8	16.8
1†	Inverter failure warning relay	5.63	2.87	.51	4.84
1*	Windshield anti-ice control amplifier	6.7	6.4	.95	2.1
	THREE-PHASE INVERTER				
1	Attitude gyro	34.0	17.0	.5	29.4
1	Fuel pressure indicator	3.21	0.6	.187	3.2
1	Fuel pressure transmitter				
1	Gyrocompass amplifier	32.20	22.4	.7	22.8
1	Gyrocompass indicator				
1	Hydraulic pressure indicator	3.21	0.6	.187	3.2
3	Hydraulic pressure transmitter				
1*	Inverter failure warning relay	5.63	2.87	.51	4.84
1	Oil pressure indicator	3.21	0.6	.187	3.2
1	Oil pressure transmitter				
1	Remote compass transmitter	32.0	22.4	.7	22.8
1	Slaved directional gyro control				

*F-86E-1, F-86E-5, and F-86E-6 Airplanes, and F-86E-10 Airplanes AF51-2718 thru -2747

†F-86E-10 Airplanes AF51-2748 thru -2849

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Figure 7-9. A-C Loading Chart

powered by the single-phase inverter through the transfer relay contacts. The gun sight power relay and phase adapter are connected directly to the single-phase inverter output. The d-c power for the transfer relay coil is routed from the primary bus through contacts on the generator-controlled bus tie-in control relay to the transfer relay coil. If the single-phase inverter fails, no a-c power is available to energize the inverter failure warning relay and the inverter failure warning relay contacts connect d-c power to the warning light. Since there is no automatic transfer system, the instrument power switch must be moved to the "ALTERNATE" position to route d-c power from the primary bus to the transfer relay coil and shift the relay to the second set of contacts. When the instrument power switch is placed in the "ALTERNATE" position, the following circuit changes take place: the three-phase inverter relay is energized and connects d-c power to the three-phase inverter; power from the three-phase inverter (output power) is connected to the a-c busses; and power is disconnected from the AN/APX-6 IFF set and fuel flow totalizer systems. The latter two systems, as well as the gun sight relay, phase adapter, and heat and vent amplifiers on F-86E-10 Airplanes AF51-2718 through -2747, are dropped when the single-phase inverter fails, as the three-phase inverter cannot supply the load required by these entire systems. In the event of a generator failure with the instrument power switch in the "NORMAL" position, the generator failure light will illuminate and the generator-powered bus tie-in control relay will open, allowing current to flow from the primary bus (provided the battery switch is in the "BATTERY" position) through the externally powered bus tie-in control relay, through the second set of contacts on the generator-controlled bus tie-in control relay, and through the instrument power switch to the a-c transfer relay. When the transfer relay closes to the second set of contacts, operation of the a-c system is the same as if the transfer were made manually.

7-41. ALTERNATING-CURRENT TRANSFER SYSTEM (F-86E-10 AIRPLANES AF51-2748 THROUGH -2849 AND F-86E-15 AIRPLANES).

7-42. The alternating-current transfer system (figure 7-7) consists of an instrument power switch, marked "NORMAL" and "ALTERNATE," an instrument power transfer relay, and an amber and a red inverter failure light. When the instrument power switch is manually placed in the "NORMAL" position, all equipment tied to the a-c bus is powered by the main three-phase inverter. Failure of the main three-phase inverter de-energizes the three-phase inverter failure warning relay. The "at-rest" contacts on the failure warning relay and the instrument power transfer relay apply d-c voltage to the amber main inverter failure warning light, causing it to illuminate. Placing the instrument power switch in the "ALTERNATE" position extinguishes the main inverter failure warning light and energizes the alternate three-phase inverter and the instrument power transfer relay. The instrument power transfer relay connects the alternate inverter output to the a-c busses. Failure of the alternate three-phase inverter de-energizes the failure warning relay. The failure warning relay in turn routes voltage through the momentary contacts on the instrument power transfer relay to the red indicator light. Illumination of this light indicates that both instrument inverters have failed.

7-43. EXTERNAL POWER RECEPTACLES.

7-44. Two external power receptacles (No. 1 and 2) are installed on the left side of the fuselage above the trailing edge of the wing. Each receptacle is equipped with three contact pins, two large and one small. Each receptacle is connected to the primary bus through a relay classified as an external power relay. Each relay coil is connected to the small contact pin of the respective receptacle and becomes energized whenever an external power source is connected to the small pin. The small contact pin of the No. 1 receptacle also is connected to the coil of the externally powered bus tie-in relay so that the primary and secondary busses are connected together when external power is connected to the electrical system. The No. 1 receptacle should be used in all cases when an operational check of electrical equipment is made or when an external power unit employing one plug is used. Application of external power to No. 1 receptacle operates all bus tie-in relays (figure 7-10), electrically connecting the primary bus to the secondary and battery busses. Once external power is applied, busses will remain electrically connected as long as an external power plug remains in No. 1 receptacle, regardless of whether the external power unit fails or is intentionally turned off. Failure to remove the external power plug from No. 1 receptacle provides a path for battery current to flow through the "+" jumper wire (inside the external power plug) to the external bus tie-in relay. Since the external bus tie-in relay remains energized, all busses remain electrically connected and the entire d-c load falls directly on the battery. No connections are made between the No. 2 receptacle and the bus tie-in control system. External power must be applied to both receptacles for engine starting because of the heavy load required for this operation.

CAUTION

Both external power plugs must be removed from the receptacles *before* the external power unit is turned off. This prevents a tie-in between the battery bus and the other loaded busses through the connection in the external power plugs between the positive pin and the small pin. Failure to follow this procedure will result in serious damage to the airplane battery.

7-45. ELECTRICAL INDICATORS AND TRANSMITTERS.

7-46. The electrically operated instruments operate from two sources of power: 28-volt direct current, and 26- and 115-volt, 400-cycle alternating current. Instruments operating from the 28-volt d-c source are the turn-and-bank indicator and the fuel level indicator. Instruments operating from a 115-volt a-c source are the fuel flowmeter, attitude gyro, and gyrosyn compass. An autotransformer steps the a-c voltage down to 26 volts for use with the following instruments: fuel pressure indicator (paragraph 6-39), oil pressure indicator (paragraph 6-45), and hydraulic pressure indicator (paragraph 6-105). The tachometer indicator (paragraph 6-51) receives power from the tachometer generator.

7-47. ELECTRICAL POWER DISTRIBUTION.

7-48. Electrical power is distributed through a divided bus system consisting of the battery, primary, and secondary busses. The battery is connected directly to the battery bus, which in turn is connected through the battery bus tie-in relay to the primary bus. The battery bus will power the primary bus when no other source of power is available. (See figure 7-10.) The primary bus, powered by an external source or by the generator system, powers equipment essential to flight. The secondary bus powers equipment not considered essential to flight. This bus is connected to the primary bus through contacts on the secondary bus tie-in relay, which is controlled by either the external or generator bus tie-in control relay. The external bus tie-in control relay is energized by external power connected to the No. 1 external power receptacle. The generator bus tie-in control relay is energized by the generator system. In either case, primary bus power energizes the secondary bus tie-in relay and connects the primary and secondary busses. When there is no generator or external power available, a circuit is completed from the primary bus through the two bus tie-in control relay contacts to a red warning light on the instrument panel. Illumination of this light indicates there is no generator power available to operate the generator bus tie-in control relay. In a de-energized condition, the generator bus tie-in control relay disconnects d-c power from the secondary bus tie-in relay which disconnects the secondary

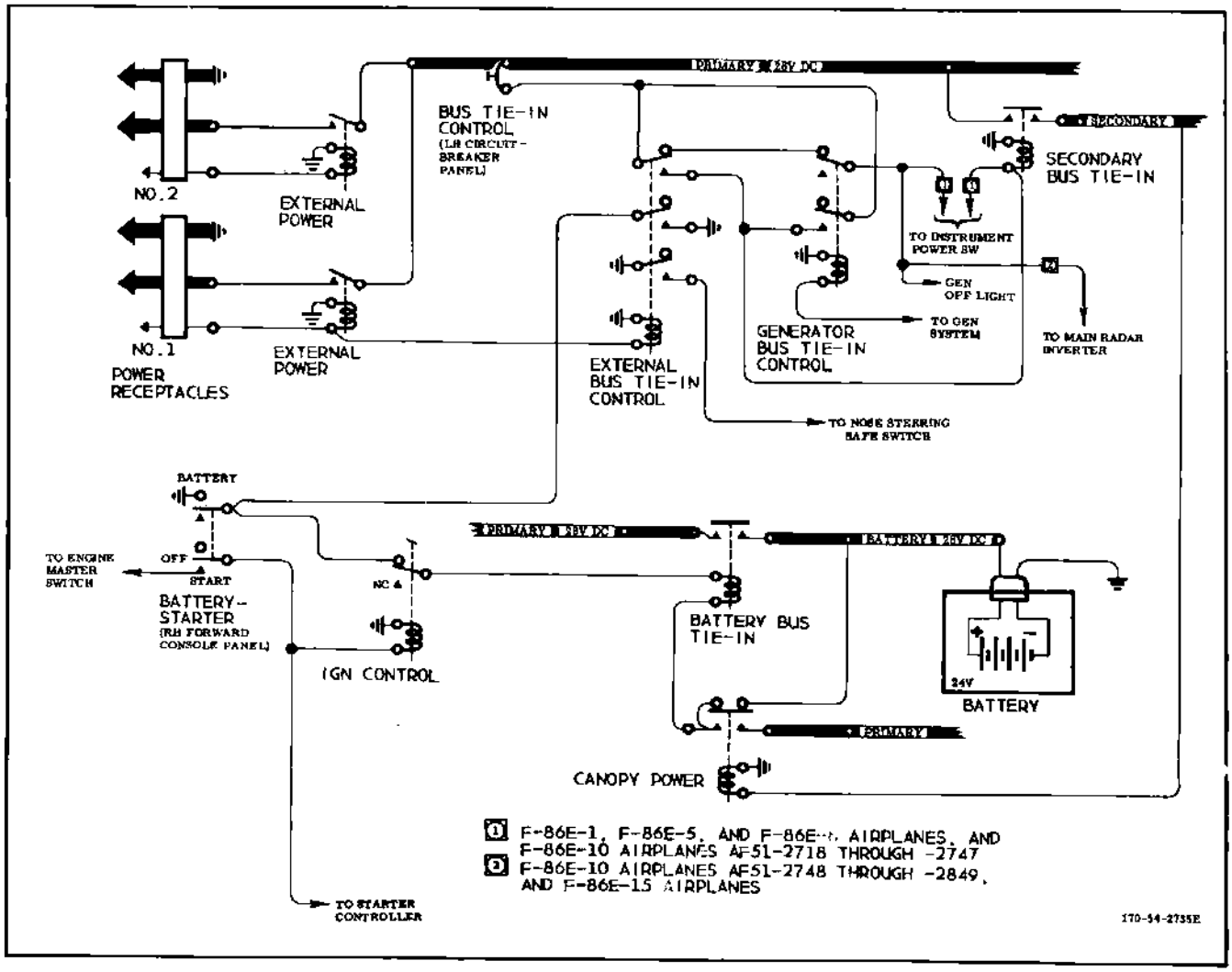

Figure 7-10. Electrical Power Distribution

bus from the primary bus. The busses and the equipment they power are as follows:

BATTERY BUS

Landing gear emergency up (F-86E-5 Airplanes)
Auxiliary instrument lights
Alternate hydraulic control (F-86E-15 Airplanes)
Canopy control relays
Alternate surface control hydraulic pumps (F-86E-15 Airplanes)
AN/APX-6 destructor switch
Bomb and rocket arming
Canopy actuator
Manual override (F-86E-10 and subsequent airplanes)
Emergency hydraulic pumps
Rocket-bomb-tank salvo
Rocket jettison power (F-86E-5 and subsequent airplanes)

PRIMARY BUS

Inverter failure light (test)
Canopy seal (F-86E-10 and F-86E-15 Airplanes)
Generator failure light (test)
Bus tie-in control
Single-phase inverter failure warning light (F-86E-10 Airplanes AF51-2748 through -2849 and F-86E-15 Airplanes)
Single-phase inverter
Three-phase inverter (F-86E-1, F-86E-5, and F-86E-6 Airplanes and F-86E-10 Airplanes AF51-2718 through -2747)
Generator field control relay
Main three-phase inverter (F-86E-10 Airplanes AF51-2748 through -2849 and F-86E-15 Airplanes)
Engine ignition
Fuel transfer pump
Alternate three-phase inverter (F-86E-10 Airplanes AF51-2748 through -2849 and F-86E-15 Airplanes)
Engine master and fuel shutoff switches
Aft booster pump
Fuel filter deicing system
Landing light control
Landing lights
Pitot heater
Console, pedestal, and instrument ring lights
Gyrosyn compass
Fuel level system
Navigation and extension lights
Position light flasher
Position lights
AN/APX-6 IFF set
AN/ARC-3 vhf radio
Fire-warning system
Sight control
Gun-firing solenoids
Nose wheel steering system
Automatic gun charger (F-86E-5 through F-86E-15 Airplanes)
Ammunition and gun heat control
Manual gun charger (F-86E-5 through F-86E-15 Airplanes)
Lateral and longitudinal trim and alternate longitudinal trim
Alternate lateral trim
Rudder trim and take-off indicator
Left wing flap
Right wing flap
Speed brakes
Alternate hydraulic control
Hydraulic pressure indicator switch (F-86E-1, F-86E-5, and F-86E-10 Airplanes)
Hydraulic pressure indicator switch
Bomb selector
Landing gear control
Bomb release
Landing gear warning
Landing gear position indicator
Rocket jettison power (F-86E-1 Airplanes)
All-bomb release
Canopy actuator
Turn-and-Bank indicator
Panel vibrator (F-86E-1 and F-86E-5 Airplanes)
GSAP camera (F-86E-1 and F-86E-5 Airplanes)
Cockpit heater
Windshield anti-ice heater
Windshield anti-ice control (F-86E-1 and F-86E-5 Airplanes)
Cockpit air selector
Gun charger system (F-86E-5 and subsequent airplanes)

SECONDARY BUS

Forward booster pump
Canopy seal (F-86E-1, F-86E-5, and F-86E-6 Airplanes)
AN/ARN-6 radio compass
Gun sight heater
Gun sight a-c power
Gun sight d-c power
Gun sight computer (F-86E-15 Airplanes)
Gun sight head (F-86E-15 Airplanes)
Radar power
Gun heaters
Ammunition boost motors
Cockpit temperature
Windshield anti-ice control (F-86E-10 and F-86E-15 Airplanes)
Gun charger compressor (F-86E-5 and subsequent airplanes)
Panel vibrator (F-86E-10 and subsequent airplanes)
GSAP camera (F-86E-10 and subsequent airplanes)

7-49. LIGHTING EQUIPMENT.

7-50. The lighting equipment consists of the exterior and interior lighting systems. The exterior lighting system provides fuselage lights, position lights, and

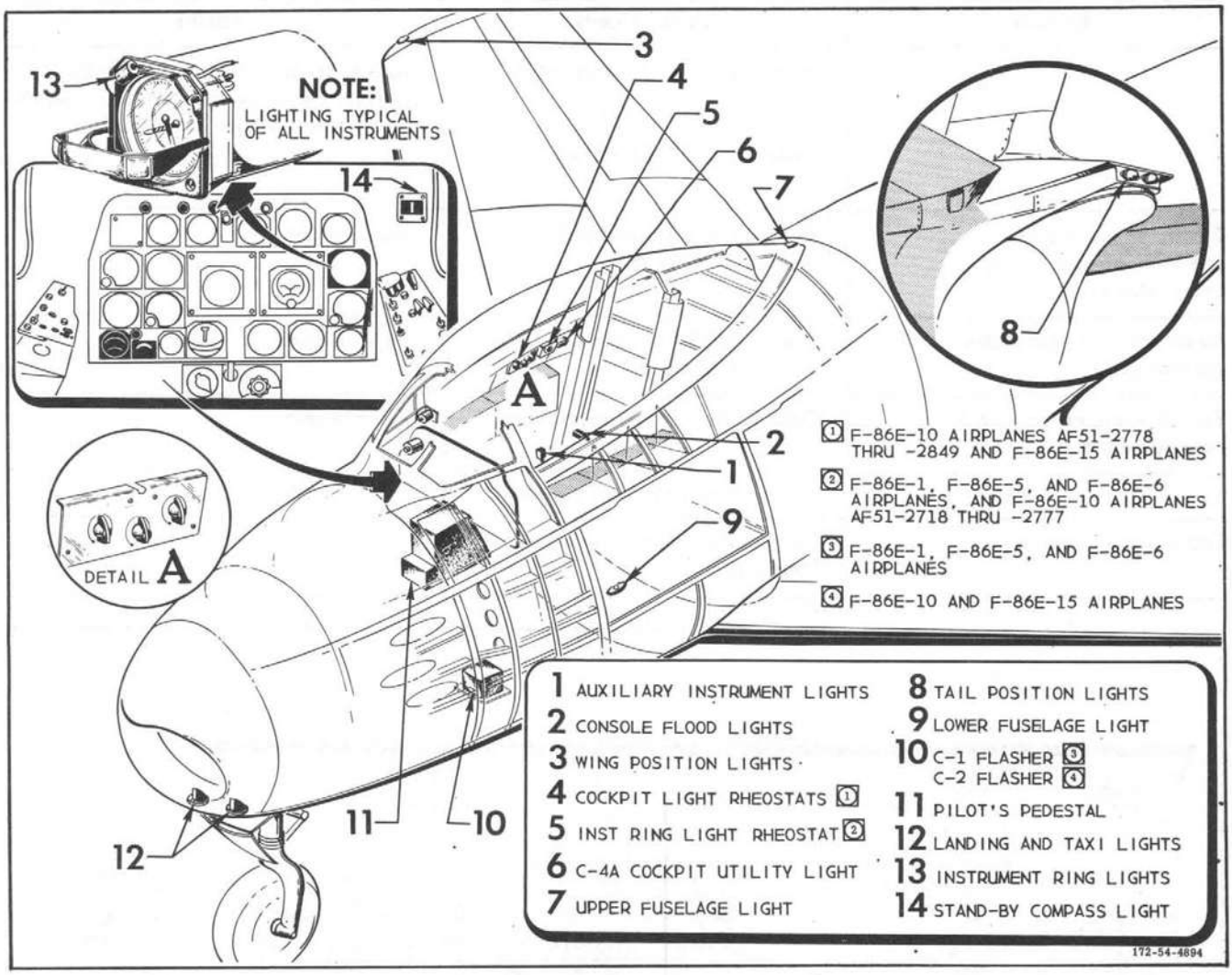

Figure 7-11. Lighting Equipment Location

landing and taxi lights with the associated control switches located on the left and right consoles. The interior lighting system consists of such lights as are necessary to illuminate the instrument panel, left and right consoles, stand-by compass, and pilot's pedestal. An extension light is also provided as an additional light source that can be directed anywhere in the cockpit area as required. Switches, located on the left and right consoles, provide the means for selecting the desired lighting arrangement.

7-51. TROUBLE SHOOTING LIGHTING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
	C-1 POSITION LIGHT FLASHER	
Motor fails to start.	Defective circuit breaker. Defective wiring in external circuits. Open motor coil or pitted running contacts. Motor shifted with respect to reed magnet. Noise filter short-circuited.	 Replace. Replace.
Erratic or intermittent operation of code lights.	Contacts worn on relay or switches.	Replace with new units.

TROUBLE	PROBABLE CAUSE	REMEDY
	Switches not properly adjusted. Loose or corroded terminals on receptacle.	Adjust space between the switch contact points by raising or lowering the upper switch finger as required.
Erratic or overlapping operation of wing lights and taillights.	Switches on wing and tail cam pitted or bent.	Replace unit.
Motor runs but lights burn continuously.	Relay 72-205 has open coil or pitted contacts.	Replace unit.
Excessive arcing at motor running contacts.	Open resistor across motor coil.	Replace unit.
	LANDING AND TAXI LIGHTS	
Lamps will not extend.	Dirty switch contacts in lamp assembly.	

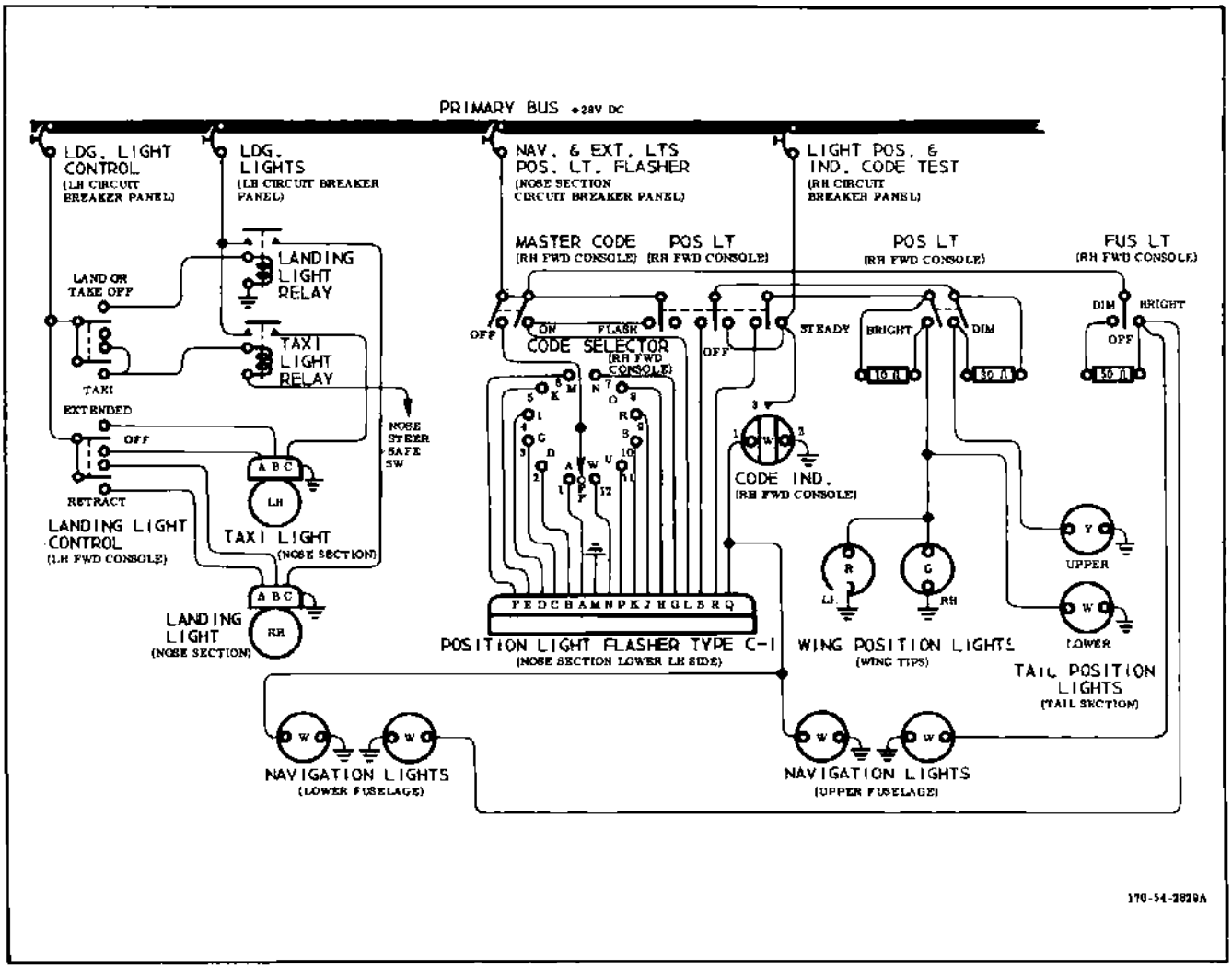

Figure 7-12. Exterior Lighting System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

7-52. EXTERIOR LIGHTING SYSTEM (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

7-53. The exterior lighting equipment consists of two fuselage lights, four position lights, one taxi light, one landing light, and a Type C-1 flasher unit. (See figure 7-12.) The flasher unit provides two separate flashing sequences. One sequence is for the wing lights and taillights, to indicate the position of the airplane during flight. The second sequence enables the pilot, through the medium of a selector switch on the right console, to automatically flash Morse code signals with the large bulb in the fuselage lights. The small bulbs in the fuselage light assemblies burn steadily when the fuselage light switch is placed in the "DIM" or "BRIGHT" position. Both flashing operations are accomplished by a constant-speed, 28-volt, d-c motor that drives a cam shaft on which is mounted a train of cams. Rotation of the cams actuates switches that operate the lights. The normal flashing sequence operates through two lighting circuits. One circuit is open while the other circuit is closed. Flashing is accomplished at the rate of 40 cycles per minute. The code flashing sequence operates through a single light circuit and, through this circuit, any of the following code letters can be flashed in Morse code: A, D, G, I, K, M, N, O, R, S, U, and W. A white indicator light on the right console is connected into the flashing circuit to indicate when flashing system is operating. In the event of motor failure, the wing lights and taillights will automatically light and burn steadily when power is applied to the lights. The fuselage lights, the wing lights, and the tail position lights can be dimmed by means of a switch on the right console. The switch cuts a resistor in or out of each circuit.

7-54. FUSELAGE LIGHTS (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

7-55. Each fuselage light assembly, one in the aft portion of the canopy and one on the underside of the fuselage below the cockpit, contains a large and a small white lamp. The large lamps in both assemblies are wired in parallel and are lighted simultaneously by the C-1 flasher. (See figure 7-12.) These lamps cannot be turned on by any other switch, nor can they be dimmed. The small lights are connected in parallel and controlled by a single-pole, double-throw switch shunted by a 50-ohm, 10-watt resistor. The resistor is cut in or out for a dim or a bright light by this switch. The master code switch must be placed to the "ON" position when Morse code signals are to be flashed. The circuit operates from the primary bus and is protected by a 10-ampere circuit breaker on the nose circuit-breaker panel. For large bulb replacement, use an AN3120-1047 (Type RP11) bulb. Replace small bulb with an AN3131-303 (Type G6) bulb.

7-56. POSITION LIGHTS (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

7-57. The position light system consists of two wing tip lights and two taillights. A triple-pole, double-throw, toggle-type selector switch with three positions, "STEADY," "FLASH," and "OFF," controls the lights. When the selector switch is in the "FLASH" position, an intermittent direct current flows from the flasher to the brilliancy control switch, which has a resistor shunted across each set of poles. The yellow taillight is connected to the pole of the brilliancy control switch that is shunted with a 30-ohm, 10-watt resistor. The white taillight and two wing tip lights are connected to the pole of the switch that is shunted with a 10-ohm, 20-watt resistor. When the brilliancy control switch is in the "DIM" position, the resistors are connected into the circuit. These resistors are shorted out when the brilliancy control switch is placed in the "BRIGHT" position. When the switch is in the "STEADY" position and the brilliancy control switch is in the "DIM" position, current flows through the resistors to the position lights. All lights are dimmed simultaneously and cannot be dimmed separately, nor can the brilliancy of the light be varied. All lights are inoperative when selector switch is in the "OFF" position. For wing tip bulb replacement, use an AN3122-1524 (Type GG10) bulb. For taillight bulb replacement, use AN3124-307 bulb.

7-58. LANDING AND TAXI LIGHTS (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

7-59. Two 250-watt (AN3095-7) retractable lights (figure 7-11) are mounted on the underside of the fuselage for use in landing and taxiing. The light left of the fuselage centerline is known as the taxi light, and the one on the right is called the landing light. Power for each light is handled by a relay controlled by the landing light control switch on the left forward console. (See figure 7-12.) When the nose wheel is on the ground, the taxi light will illuminate provided the control switch is in either the "TAXI" or "LAND" position. When the nose wheel is off the ground, the taxi light will not illuminate, since the taxi light relay is wired to ground through the nose wheel steering switch. The landing light relay is wired directly to ground and will allow the light to illuminate when the control switch is in the "LAND" position. When the control switch is in the "TAXI" position, only the taxi light will illuminate. Another switch on the same console controls the extension and retraction of the lamps. The switch is marked "EXTEND," "OFF," and "RETRACT" and allows the lights to be stopped in any desired position. Limit switches within each lamp assembly cut the power to the motor when the lamp reaches the end of its travel in either direction.

7-60. REMOVING LANDING AND TAXI LIGHTS. To remove the landing or taxi light assembly, proceed as follows:

a. Remove six screws securing fairing ring to lamp assembly.

b. Remove five screws securing light assembly to nut plate retainer ring.

c. Remove nut plate retainer ring.

CAUTION

Weight of lamp assembly must be supported during removal of nut plate retainer ring to avoid possible injury to screen covering on motor drive mechanism.

d. Drop lamp assembly free of fuselage, break safety wire on plug connector, and disconnect.

CAUTION

Landing and taxi light assemblies should be sprayed with a plastic coating (Specification MIL-P-3038) prior to installation in the airplane. The plastic coating is applied to reduce the possibility of explosion resulting from arcing contacts in the presence of gas vapor.

WARNING

- Care should be exercised to keep the compound away from flame as it is highly flammable in the liquid state.
- When spraying plastic compound (Specification MIL-P-3038), a mask should be worn as the compound is extremely toxic.

7-61. INSTALLING LANDING AND TAXI LIGHTS. To install landing or taxi light assembly, proceed as follows:

a. Connect wiring to lamp assembly and safety-wire plug.

b. Install nut plate retainer ring.

c. Secure lamp assembly to nut plate retainer ring with five screws.

d. Secure fairing ring to lamp assembly with six screws.

e. Make an operational check of lamp assembly.

7-62. ADJUSTING LANDING LIGHT. To adjust landing light, proceed as follows:

a. Level airplane.

b. Place target board 15 feet in front of landing light (right light).

c. Place landing light control switches in the "LAND OR TAKEOFF" and "EXTENDED" positions.

d. Check landing light position in the extended position. Light should extend 64 degrees from fully retracted position.

e. Adjust landing light extended limit switch contact points so that the center of the beam strikes the target board at a point 63 inches below the projected fuselage reference line and 5 inches to the right of the projected centerline of the airplane.

f. Make an operational check.

7-63. ADJUSTING TAXI LIGHT. To adjust taxi light, proceed as follows:

a. Level airplane.

b. Place target board 15 feet in front of taxi (left) light.

c. Place landing light control switches in "TAXI" and "EXTENDED" positions.

d. Check position of taxi light in the extended position. Light should extend 80 degrees from the fully retracted position.

e. Adjust taxi light extended limit switch contact points so that the center of the beam strikes the target board at a point 30 inches below the projected fuselage reference line and 8 inches to the left of the projected centerline of the airplane.

f. Make an operational check.

7-64. CLEANING LANDING OR TAXI LIGHT SWITCH POINTS. Clean switch points as follows:

a. Remove light cover assembly for access to switches.

b. Locate the switch to be cleaned. (The upper switch controls the extend cycle; the lower switch, the retract cycle.)

c. Dress the contact points with a burnishing tool, being careful not to remove too much of the point material.

d. Blow all foreign material from contacts and assembly.

e. Install cover, and check lamp for operation.

7-65. EXTERIOR LIGHTING EQUIPMENT (F-86E-10 AND F-86E-15 AIRPLANES).

7-66. The exterior lighting system consists of two fuselage lights, four position lights, one landing and taxi light, one landing light, and a Type C-2 flasher unit. (See figures 7-11 and 7-13.) The flasher unit provides one flashing sequence for the wing lights and one taillight and the opposite sequence for the remaining taillight. The flashing operation is controlled by two thermal switches. The switches are so arranged as to intermittently energize a relay inside the flasher; the relay connects the lights to the power source. One circuit is open when the other circuit is closed. Intensity of the navigation and fuselage lights is controlled by the external lighting switch, located on the right console. Placing the external lighting switch in the "BRIGHT" position "shorts out" the dimming resistors. Placing this switch in the "DIM" position removes the short from across the dimming resistors, causing the lights to dim.

7-67. FUSELAGE LIGHTS (F-86E-10 AND F-86E-15 AIRPLANES).

7-68. On F-86E-10 Airplanes AF51-2718 through -2826, the large lamps in the fuselage light assemblies, located

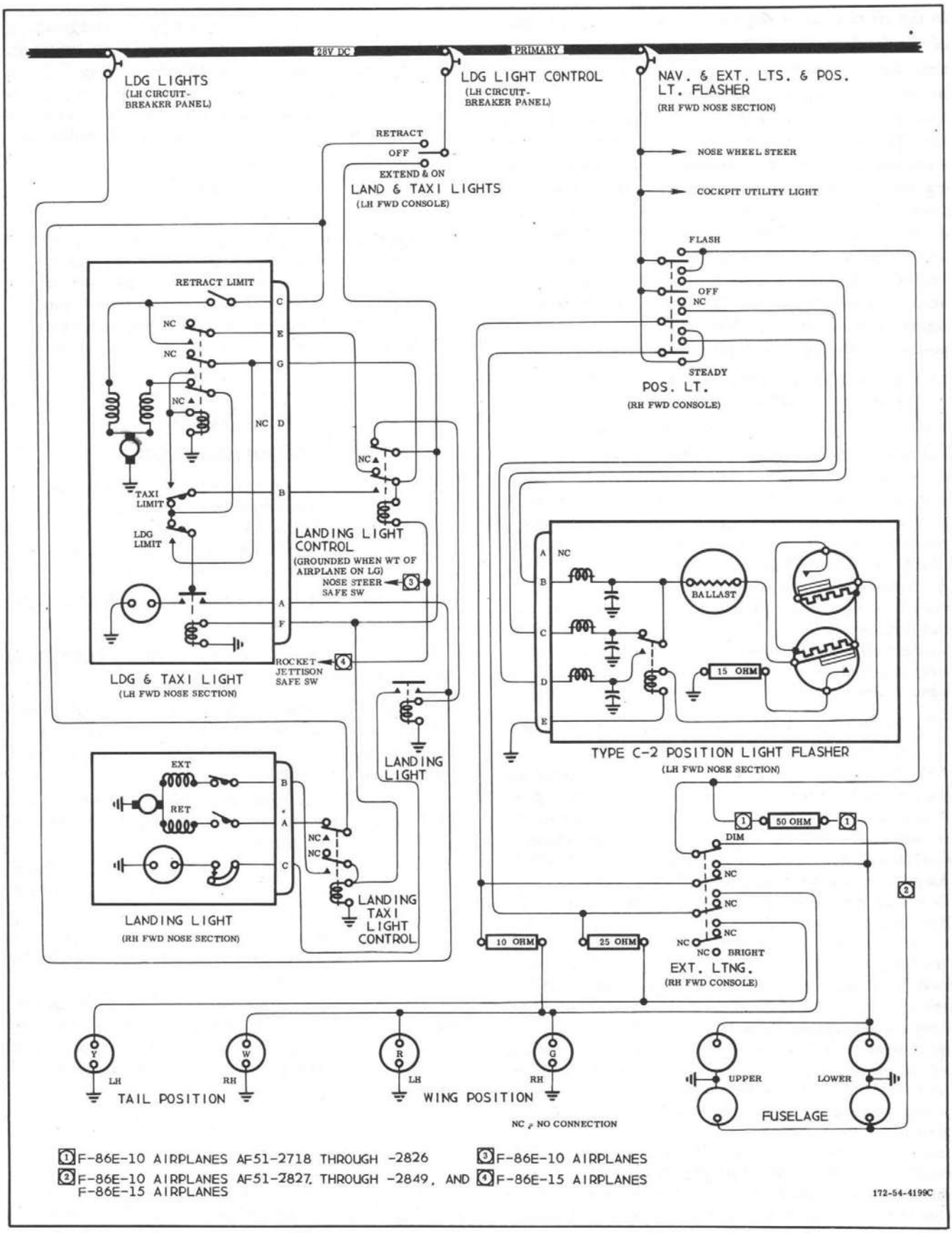

Figure 7-13. Exterior Lighting System—F-86E-10 and F-86E-15 Airplanes

in the aft portion of the canopy and on the underside of the fuselage below the cockpit, are removed. The small lights are connected in parallel and are controlled by the position light switch. The small fuselage lights burn steadily whenever the position light switch is in the "FLASH" or "STEADY" position. Dimming of the small fuselage lights is controlled by the external lighting switch, which cuts in or out a 50-ohm resistor for a dim or bright light. On F-86E-10 Airplanes AF51-2827 through -2849 and F-86E-15 Airplanes, the large fuselage lights are connected to the "BRIGHT" position of the external lighting switch, and the small fuselage lights are connected to the "DIM" position. The fuselage lights burn steadily in either the "DIM" or "FLASH" position of the position light switch. (See figure 7-13.)

7-69. POSITION LIGHTS (F-86E-10 AND F-86E-15 AIRPLANES).

7-70. A four-pole, double-throw, toggle-type position light selector switch has three positions: "OFF," "FLASH," or "STEADY." (See figure 7-13.) When the selector switch is in the "FLASH" position, the Type C-2 flasher transmits intermittent direct current to the tail and wing position lights through the external lighting switch, which has a resistor shunted across each set of poles. A 25-ohm resistor is shunted across the poles to the yellow taillight and dims the light when the external lighting switch is in the "DIM" position. The white taillight and the two wing tip position lights are similarly dimmed by a 10-ohm resistor. All lights are off when the position light switch is in the "OFF" position.

7-71. LANDING AND TAXI LIGHTS (F-86E-10 AND F-86E-15 AIRPLANES).

7-72. Two retractable landing lights are mounted on the underside of the fuselage forward of the nose gear. (See figure 7-11.) The landing light to the left of the centerline is a 250-watt landing and taxi light (Grimes G-4710 on F-86E-10 Airplanes and G-4710A on F-86E-15 Airplanes). The landing light to the right of the centerline is an AN3095-7, 250-watt light. (See figure 7-13.) Both lights are controlled by the landing and taxi light switch, located on the left forward console. In the "EXTEND & ON" position, the landing and taxi light switch connects power to the Grimes G-4710 landing and taxi light relay coil and the AN3095-7 landing light relay coil, energizing these two relays. When energized, these relays connect primary bus power to the landing lights, causing the landing lights to illuminate and extend to the landing position. On touchdown, the nose wheel steering safety switch on F-86E-10 Airplanes is actuated (by weight of the airplane on the nose gear), completing the ground circuit for the landing light control relay. On F-86E-15 Airplanes, the rocket jettison safety switch completes the ground return circuit. When this relay is energized, power is routed to the Grimes unit, which further extends to the taxi position; simultaneously, the landing light control relay removes power from the AN3095-7 landing light, extinguishing the light. Placing the landing and taxi light switch in the "RETRACT" position turns off the landing light in the Grimes unit and retracts both landing lights simultaneously. Limit switches within each landing light assembly control the extent of travel in either direction.

CAUTION

Landing and taxi light assemblies are sprayed with a protective plastic compound (Specification MIL-P-3038) to reduce the possibility of explosion resulting from arcing contacts in the presence of gas vapor. Lamp replacements must, therefore, be sprayed prior to installation.

WARNING

- Care should be exercised to keep the plastic spraying compound away from flame, as it is highly flammable in the liquid state.
- A mask should be worn during spraying, as the compound is extremely toxic.

7-73. REMOVING LANDING AND TAXI LIGHTS. Refer to paragraph 7-60.

7-74. INSTALLING LANDING AND TAXI LIGHTS. Refer to paragraph 7-61.

7-75. ADJUSTING GRIMES G-4710 LANDING LIGHT (LEFT LIGHT ASSEMBLY). To adjust landing light portion of Grimes G-4710 landing and taxi light, proceed as follows:

a. Level airplane with nose wheel off the ground (F-86E-10 Airplanes) or with left main gear off the ground (F-86E-15 Airplanes).

b. Place target board 15 feet in front of *left* light.

c. Place landing and taxi light switch in the "EXTEND & ON" position.

d. Check position of light in the landing position. Light should extend to a position of 64 degrees from the fully retracted position.

e. Adjust landing limit switch contact points so that the center of the beam strikes the target board at a point 63 inches below the projected fuselage reference line and 8 inches to the left of the projected centerline of the airplane.

f. Make an operational check.

Note

Weight of airplane must be off the nose wheel gear for F-86E-10 Airplanes during landing light adjustments and off the left main gear wheel for F-86E-15 Airplanes during adjustments.

7-76. ADJUSTING AN3095-7 LANDING LIGHT (RIGHT LIGHT ASSEMBLY). To adjust landing light AN3095-7, proceed as follows:

a. Level airplane with nose wheel off the ground (F-86E-10 Airplanes) or with left main gear off the ground (F-86E-15 Airplanes).

b. Place target board 15 feet in front of right light assembly.

c. Place landing and taxi light switch in the "EXTEND & ON" position.

d. Check landing light position. Light should extend to a position of 64 degrees from the fully retracted position.

e. Adjust extend limit switch contact points so that center of the beam strikes the target board at a point 63 inches below the projected fuselage reference line and 5 inches to the right of the projected centerline of the airplane.

f. Make an operational check.

7-77. ADJUSTING TAXI LIGHT. To adjust the taxi light portion of the Grimes G-4710 landing and taxi light, proceed as follows:

a. Level airplane with nose wheel gear *on* the ground (F-86E-10 Airplanes) or with left main gear *on* the ground (F-86E-15 Airplanes).

b. Place target board 15 feet in front of taxi (left) light.

c. Place landing and taxi light switch in the "EXTEND & ON" position.

d. Check position of taxi light. Light should extend to a position of 80 degrees from the fully retracted position.

e. Adjust taxi limit switch contact points so that the center of the beam strikes the target board at a point 30 inches below the projected fuselage reference line and 8 inches to the left of the projected centerline of the airplane.

f. Make an operational check.

Note

On F-86E-10 Airplanes, weight of the airplane must be on nose wheel during taxi light adjustments, or the nose steer safe switch must be held in the actuated position to energize the landing light control relay. On F-86E-15 Airplanes, weight of the airplane must be on the left main gear during this adjustment, or the rocket jettison safe switch must be held in the actuated position to energize the landing light control relay. (See figure 7-13.)

7-78. CLEANING LANDING OR TAXI LIGHT SWITCH POINTS. Refer to paragraph 7-64.

7-79. INTERIOR LIGHTING EQUIPMENT (F-86E-1, F-86E-5, AND F-86E-6 AIRPLANES).

7-80. The interior lighting equipment (figure 7-14)

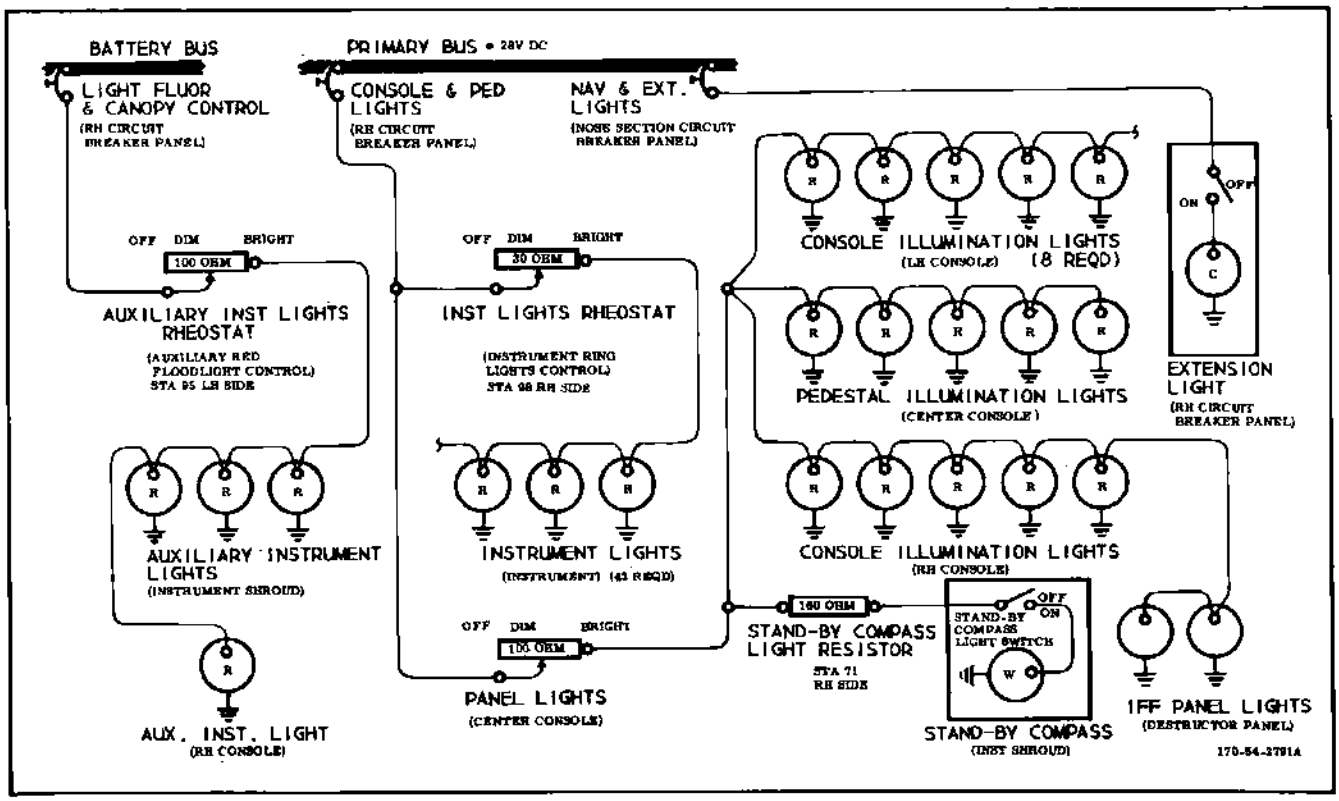

Figure 7-14. Interior Lighting System—F-86E-1, F-86E-5, and F-86E-6 Airplanes

consists of two instrument panel floodlights, one floodlight for each side of the cockpit for the console panels; 43 ring-type instrument lights; 16 console lights for edge illumination of the left console, right console, and pedestal panels; two IFF destructor panel lights; an extension light; and a stand-by compass light. A 100-ohm rheostat above the right console panel and a 30-ohm rheostat above the left console panel control the brilliancy of the two instrument panel floodlights and instrument ring-type lights, respectively. One of the instrument panel floodlights is attached on the left side of the cockpit, and the other is attached to the forward end of the right console panel. The ring-type light assembly for each instrument consists of a hood with two bulbs installed within. The upper portion of the hood can be dropped forward for access to the bulbs for replacement.

7-81. FUNCTION OF INTERIOR LIGHTING EQUIPMENT. The instrument panel floodlights are wired in parallel and powered directly from the battery bus through a 5-ampere circuit breaker. These lights will illuminate without the necessity of placing the battery switch in the "BAT ON" position. However, if no battery is installed and an external source of power is available, it will be necessary to position the battery switch in order to close the battery-disconnect relay. Once this relay is closed, current can flow to the battery bus. A 100-ohm rheostat at the lower right side of the pedestal controls the degree of brilliancy of the console lights, destructor panel lights, and stand-by compass light simultaneously. Light, transmitted edgewise through the Lucite control panels, provides indirect lighting to the identification plates on the panels. A 140-ohm resistor is connected between the rheostat arm and a compass light control switch mounted on the compass indicator mount. This switch allows the compass light to be turned off or on. The console, instrument ring, and compass lights are powered from the primary bus and protected by a 5-ampere circuit breaker. The extension light is on the right aft side of the cockpit, with the control mounted adjacent. The console lights, which are replaceable from the front of the panels, are of the AN3140-327 type.

7-82. INTERIOR LIGHTING EQUIPMENT (F-86E-10 AND F-86E-15 AIRPLANES).

7-83. The interior lighting equipment (figure 7-15) consists of two auxiliary instrument panel floodlights; two console floodlights, one over each console panel; 40 ring-type instrument lights; 17 console lights for edge illumination of the left console, right console, and pedestal panels; two lights for the illumination of the IFF destructor panel; and a stand-by compass light. The C-4A extension light is stowed over the right console on F-86E-10 Airplanes and on the left console on F-86E-15 Airplanes. A 100-ohm rheostat above the left console controls brilliancy of the two auxiliary instrument panel floodlights, normally powered from the battery bus. If a battery is not available, these lights can be illuminated if the battery-start switch is placed in the "BATTERY" position. The lights then receive power from

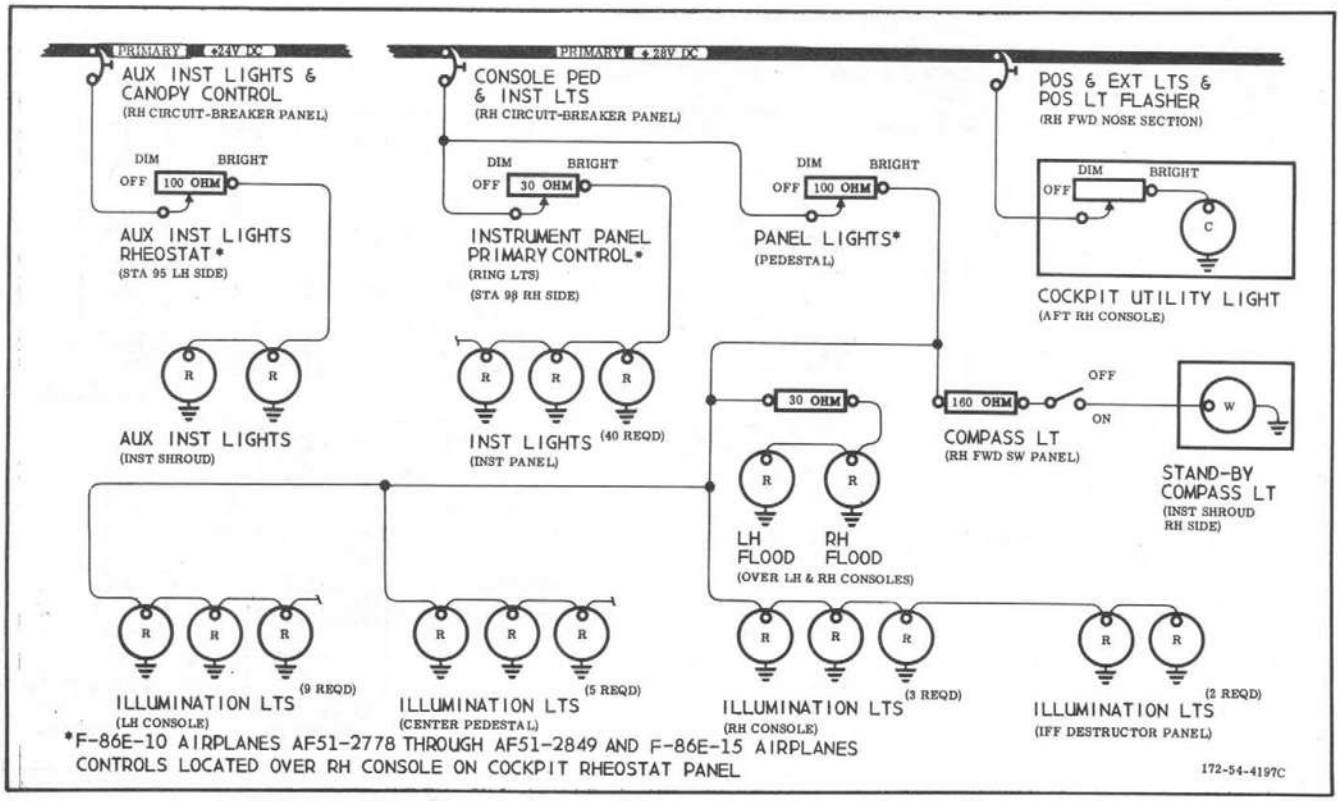

Figure 7-15. Interior Lighting System—F-86E-10 and F86E-15 Airplanes

the primary bus when external or generator power is available. A 100-ohm rheostat located on the center pedestal controls the brilliancy of the left console, pedestal, right console, and IFF destructor panel illumination lights and the console floodlights. A 30-ohm rheostat, located on the right console, controls the brilliancy of the instrument ring lights. On F-86E-10 Airplanes AF51-2778 through -2849 and F-86E-15 Airplanes, these controls are relocated over the right console (figure 7-11) on the cockpit light rheostat panel. The ring-type light assembly is of the same construction as on previous airplanes. The stand-by compass light switch is located on the right forward switch panel and controls the stand-by compass light located inside the compass, which is located on the instrument panel shroud. Brilliancy of the stand-by compass light is controlled through the console light rheostat, located on the center pedestal.

Section VIII
RADIO AND RADAR

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8-1. RADIO EQUIPMENT.

8-2. The radio equipment (figures 8-1 and 8-2) consists of the following:

EQUIPMENT	FUNCTION
AN/ARC-3 COMMAND SET Transmitter (T-67A/ARC-3) Receiver (R-77B/ARC-3) Power junction box (J-68/ARC-3) Dynamotor—receiver (DY-22/ARC-3) Dynamotor—transmitter (DY-21/ARC-3) Control panel (C-404A/A)	Airplane-to-airplane and airplane-to-ground-station communication.
AN/ARN-6 RADIO COMPASS Compass receiver (R-101A/ARN-6) Loop antenna (AS-313B/ARN-6) Indicator (ID-90/ARN-6) Remote-control panel (C-403/A)	Orientation and direction finding.

Note

For detailed information concerning each item of equipment, consult the handbooks for the equipment or components involved, as listed in the current issue of the AF Index of Technical Publications and Confidential Orders.

8-3. TROUBLE SHOOTING RADIO EQUIPMENT.

TROUBLE	PROBABLE CAUSE	REMEDY
T-67A/ARC-3 TRANSMITTER		

WARNING

Always turn off power before attempting to burnish relay contacts, as the high voltage can cause serious injury to personnel.

Transmission but no side tone; tuning system stops at proper frequency.	Contacts on relay K-406 (in power junction box) dirty.	

TROUBLE	PROBABLE CAUSE	REMEDY
No modulation or side tone; tuning system stops at proper frequency.	Defective tube V-106 or V-109, or dirty contacts on relay K-106.	
No transmission or side tone; tuning system stops at high-frequency end of band.	Defective crystal, defective tube V-101, V-102, V-103, V-104, V-107, or V-108, or dirty contacts in crystal relay.	
No transmission; motor does not stop.	Burned-out transmitter fuse in power junction box. Defective tube V-105. Dirty contacts on relay K-102. Dirty contacts on power junction box relays K-403 and K-404.	Replace transmitter fuse. If fuse continues to blow, battery polarity may be reversed.
No transmission; dynamotor does not stop.	Low battery or battery cart. Defective plug in relay K-103. Dirty contacts on relay K-104.	
No transmission; dynamotor does not run.	Dirty contacts on relay K-106. Dirty contacts on relay K-104. Dirty contacts on power junction relay K-402.	
No transmission; motor does not start. (If top cover is removed, button S-102, located at top of case at the front, must be pushed to make motor run.)	Circuit breakers open. Dirty circuit-breaker connections. Dirty crystal relay contacts. Dirty contacts on relays K-107 and K-108. Dirty contacts on relay K-104.	
No reception; tuning system stops at proper frequency.	Defective tube V-208, V-209, V-210, V-211, V-212, V-213, V-214, V-215, V-216, or V-217. Dirty relay (K-406) contacts.	
Receiver does not stop or goes to high end of band.	Low battery or battery cart.	
No reception; tuning system stops at high-frequency end of band.	Defective crystal. Defective tube V-201, V-202, V-203, V-204, V-205, V-206, V-208, or V-209. Dirty contacts on crystal relay. Dirty contacts on relay K-204 or K-205.	
No reception; tuning system stops at wrong frequency.	Incorrect setting of thumbwheel for inoperative channel. Dirty crystal relay contacts (inoperative channel). Dirty contacts on relay K-204 or K-205.	

TROUBLE	PROBABLE CAUSE	REMEDY
No reception; motor will not stop.	Blown receiver fuse (on power junction box). Defective tube V-207 or V-210. Dirty contacts on relays K-204 and K-405 in power junction box. Defective plug in relay K-201. Dynamotor brushes worn.	

Note

Proper operation of electronic equipment is dependent upon keeping to a minimum the radio interference produced within the airplane. Therefore, if any electrical or electronic equipment is changed, care must be taken to ensure interference-free operation to the radio receiving equipment. If trouble is encountered, refer to applicable Technical Orders for information to remedy this situation.

8-4. MAINTAINING RADIO EQUIPMENT.

8-5. The only maintenance requirements are checking the battery voltage, testing the vacuum tubes, and checking the dynamotor brushes. Do not attempt to service any item of electronic equipment unless suitable shop and testing facilities are available.

8-6. TESTING VACUUM TUBES. The best check for a receiving or transmitting tube is to compare it, in its own socket under actual operating conditions, with a new tube of known quality. A visual filament check of individual glass tubes can be made by looking for failure of filaments to light or, in the case of metal tubes, feeling for failure of heat. As the filaments of some tubes are connected in series with several other tubes, all tubes in that group will be out. In order to find which tube is defective, replace the tubes in that group, one at a time, until defective tube is found. In glass tubes, the appearance of an abnormal blue haze on the inside of the glass envelope, a blue haze or white glowing spots between the tube elements, or red spots on the plate is an indication of one of three things: a defective tube, abnormal circuit conditions, or overloading. If all tubes appear to operate normally during malfunction of the particular piece of equipment, refer to trouble shooting chart for further information.

CAUTION

Do not operate any set using miniature tubes on voltage higher than 28-volt direct current any longer than necessary, because such practice will shorten the life of the tubes.

8-7. MAINTAINING DYNAMOTOR. Any brush that has worn down to a length of less than ⅜ inch must be replaced with a new one. When installing new brushes, do any "sanding in" required with a strip of No. 000 sandpaper wrapped around the surface of the commutator with the sand surface out. Install new brush, and rotate armature back and forth until the full width of the brush face contacts the sandpaper, as indicated by sanding marks. If necessary, sand the sides of the brush for a free fit in the holder. Never apply oil or grease to brush holder or to commutator.

8-8. AN/ARC-3 COMMAND SET.

8-9. The command set (figures 8-1 and 8-2) operates on eight crystal-controlled frequencies within the 100- to 156-megacycle range; no separate coils are necessary for either transmitter or receiver for frequency change. The transmitter and receiver, mounted on an access door between the spent-ammunition compartments, are controlled from the radio console to the right of the pilot. The power output of the transmitter is approximately 8 watts. The power junction box, installed in the equipment compartment, consists of two dynamotor units powered by the 28-volt d-c system. The larger dynamotor supplies plate and screen voltages for the transmitter, and the smaller dynamotor provides plate and screen voltages for the receiver. Filament power for the series-parallel-wired filaments of the receiver and transmitter is taken directly from the 28-volt system. The entire AN/ARC-3 equipment is protected by a circuit breaker on the right circuit-breaker panel.

8-10. REMOVING T-67A/ARC-3 TRANSMITTER AND R-77B/ARC-3 RECEIVER. Remove the transmitter and receiver in the following manner:

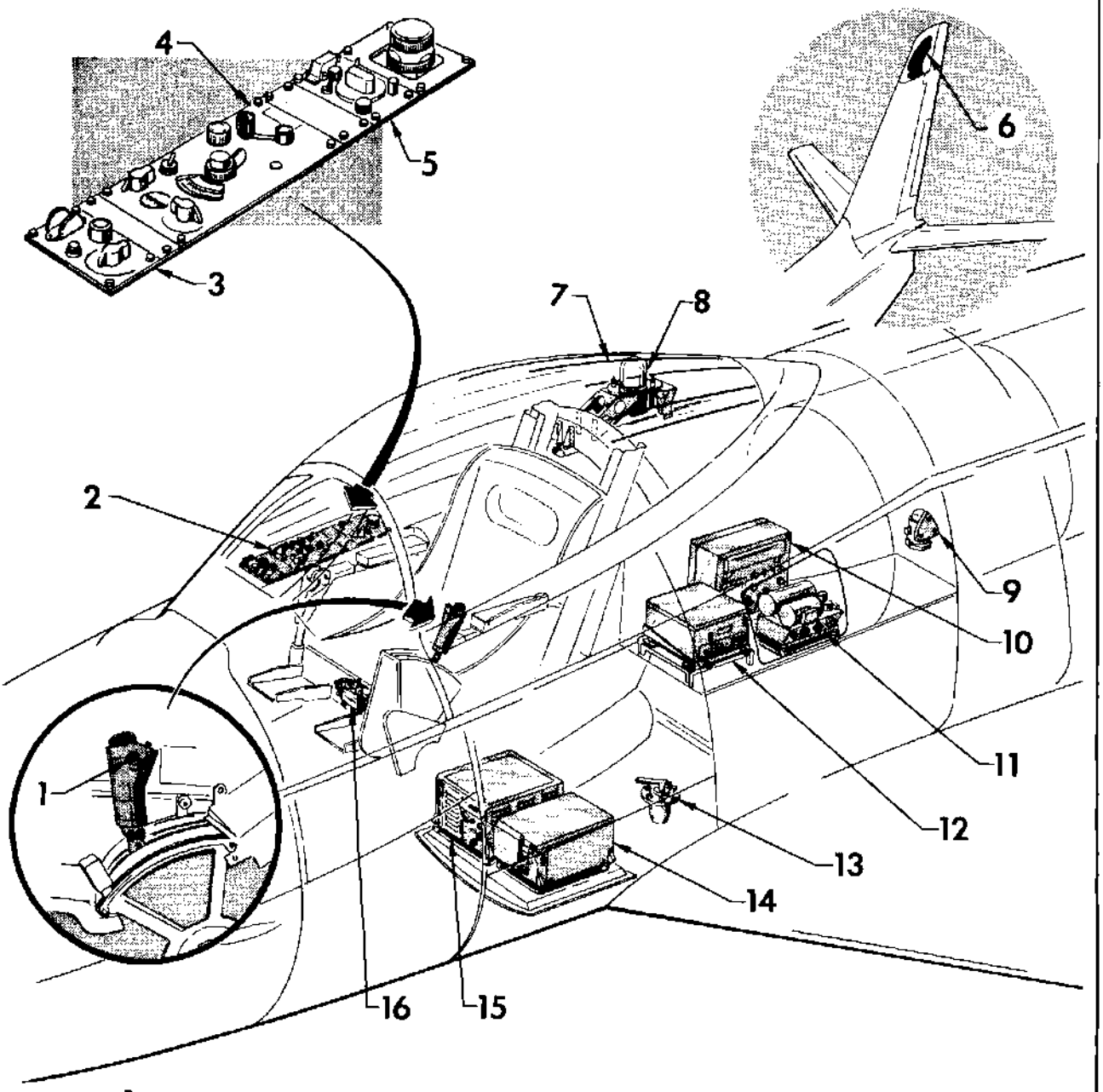
a. First open left spent-ammunition compartment door and make sure radio access door operating mechanism cables are taut; then release fasteners on access door.

b. Turn crank until receiver and transmitter on door reach a favorable position for detachment of cables.

c. Detach the four cables from the door.

Note

The door with equipment installed is bulky and heavy; use extreme care during removal to prevent dropping door.



1 PUSH-TO-TALK MICROPHONE SWITCH
2 CONSOLE PANELS
3 CONTROL PANEL C-404/A (AN/ARC-3)
4 CONTROL PANEL C-403/A (AN/ARN-6)
5 CONTROL PANEL (C-629/APX-6)
6 ANTENNA ASSEMBLY (151-71012-101)
7 RADIO COMPASS SENSE ANTENNA
8 RADIO COMPASS LOOP (AS-313B/ARN-6)
9 IFF DETONATOR SWITCH (SA-3A/A)
10 IFF RECEIVER-TRANSMITTER (RT-82/APX-6)
11 JUNCTION BOX (J-68/ARC-3)
12 RADIO COMPASS RECEIVER (R-101A/ARN-6)
13 ANTENNA ASSEMBLY (AT-234/APX)
14 VHF RECEIVER (R-77B/ARC-3)
15 VHF TRANSMITTER (T-67A/ARC-3)
16 PILOT'S EQUIPMENT DISCONNECT BLOCK

170-71-823

Figure 8-1. Electronic Equipment Location—F-86E-1 and F-86E-5 Airplanes

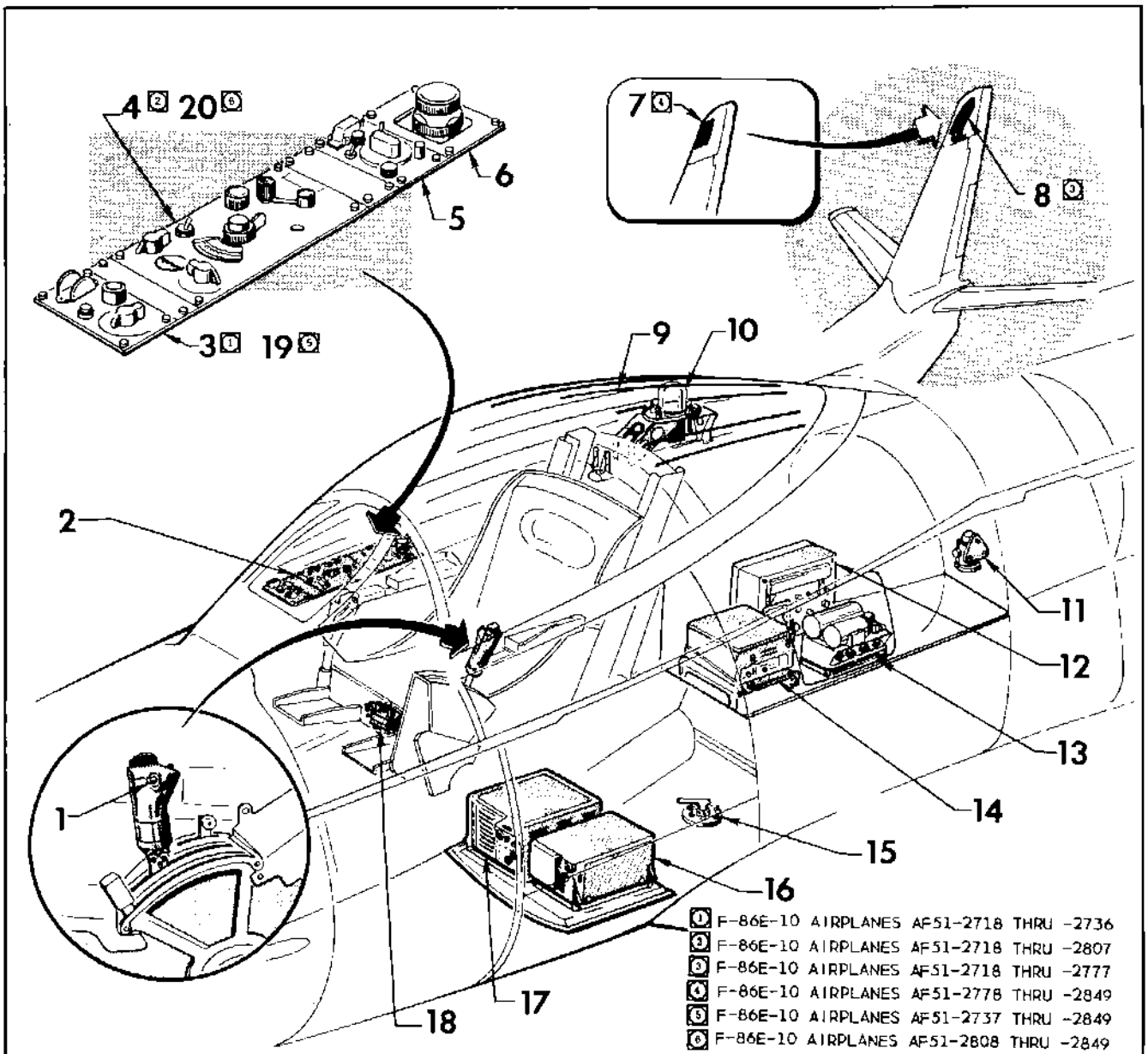


Figure 8-2. Electronic Equipment Location—F-86E-6, F-86E-10, and F-86E-15 Airplanes

8-11. INSTALLING T-67A/ARC-3 TRANSMITTER AND R-77B/ARC-3 RECEIVER. Install transmitter and receiver as follows:

a. Place transmitter and receiver on mounting and secure in place. If mounting and door were removed from airplane, attach four cables to access door.

b. Reach in through left spent-ammunition access door and turn crank until door pulls up snug with fuselage. Lock fasteners.

c. Close left spent-ammunition door.

Note

When raising the radio access door into place, do not assist it; allow the weight of the equipment on the door to keep the cables taut. For details regarding radio access door operating mechanism, refer to paragraph 2-158.

8-12. OPERATIONAL CHECK OF AN/ARC-3 COMMAND SET. To check AN/ARC-3 command set, proceed as follows:

a. Turn battery-disconnect switch "ON" or connect external power source to airplane.

b. Insert headset and microphone into respective jacks.

c. Start equipment by selecting any one of the eight channels on the C-404A/A control panel. This action turns on the transmitter and receiver, which then automatically tune to the selected channel.

d. Allow 30 to 45 seconds for tubes in equipment to reach operating temperature. During the latter portion of this warm-up period, an audio tone will be heard in the headset. When this tone stops, the receiver and transmitter have been tuned to the selected channel; receiver output should be heard in headset immediately afterward.

e. Push press-to-talk microphone button on engine power control quadrant and speak into microphone. Speech side tone which modulates the transmitter should be audible in the headset. If none is heard, check to make sure a crystal has been inserted for that channel of the transmitter. Release press-to-talk button to restore receiver operation.

f. Establish two-way radio communication with control tower on field as a final check on operation of the equipment.

g. Adjust squelch control for desired background noise level consistent with operating conditions. (Refer to paragraph 8-13.)

h. Check mcw operation by pressing d/f tone button on control panel.

i. Select each of the other set-up channels, and check operation of each as directed in procedures d. through h.

Note

The transmitter and receiver tune to the selected channel simultaneously. Approximately 2 seconds is required to select channels. An audio tone will be heard in the headset while the equipment is tuning.

j. Turn equipment off by placing toggle switch, on control panel, at rear position.

Note

If either receiver or transmitter has tuned incorrectly, select any other channel, and then select desired channel again. Repeated mistuning indicates a defective crystal, incorrect setting of thumbwheels, or other defects in the equipment.

8-13. ADJUSTING AUDIO SQUELCH CONTROL. Background noise in the receiver may be reduced effectively by the audio squelch control, which is adjustable. Access to the screwdriver adjustment of the squelch circuit control is provided by the sliding cover marked "SQUELCH," located just to the right of the frequency indicating dial on front panel. Adjust squelch circuit as follows:

a. Rotate control shaft in a counterclockwise direction to increase squelch action. Increasing squelch action decreases background noise level and at the same time requires a stronger signal to "trip" squelch action and permit normal reception.

b. To decrease squelch action, rotate control shaft in a clockwise direction. Decreasing squelch action increases background noise level and also increases receiver sensitivity to weak signals.

Note

Increase squelch action no more than necessary to reduce background noise to a tolerable level, as a decided increase in squelch action prevents signal reception.

8-14. TESTING T-67A/ARC-3 TRANSMITTER. To test transmitter, proceed as follows:

Note

When lid of transmitter is removed, depress motor control switch S-102 while selecting channels, to ensure proper operation.

a. Connect phantom transmitter antenna TS-78/U to the receptacle marked "ANTENNA" on front of transmitter.

b. Connect microphone T-17 to the proper jack.

c. Connect test unit TS-178/ARM-1 to receptacle marked "PL-152" on front of transmitter, and turn switch to "A+" position. The cable between junction box (dynamotor unit) and receiver is not needed for this test.

d. Insert crystal units of the following frequencies in channels indicated.

CHANNEL	CRYSTAL FREQUENCY	TRANSMITTING FREQUENCY
A	7550 kc	135.9 mc
B	7010 kc	126.18 mc
C	7660 kc	137.88 mc
D	6750 kc	121.50 mc
G	7600 kc	136.80 mc
H	7450 kc	134.10 mc

e. Select channel A on control panel C-404A/A. If tuning motor does not stop after one minute, turn switch of test unit TS-178/ARM-1 to "B" position. If no voltage is indicated, check transmitter high-voltage fuse on power junction box J-68/ARC-3. If motor stops but no power output is obtained, as shown by lamps of phantom antenna TS-78/U, it will be necessary to check crystal unit and vacuum tubes. All tubes except the JAN-832-A are listed in the lid of the transmitter.

f. Check modulation of transmitter by noting an increase in brightness of lamps in phantom antenna TS-78/U when microphone is spoken into.

g. The reading on test unit TS-178/ARM-1 should be within the following limits when push-to-talk button is depressed.

POSITION	LIMITS
OSC	More than 20
1	More than 25
2	More than 25
3	More than 25
4 TRANS.	40 to 85

If readings on positions "1," "2," "3," and "4" TRANS. are not within these limits, a change of tubes or realignment is indicated. Check to make sure power source is between 27 and 29 volts before replacing tubes or attempting to align the set. A reading of 54 to 58 on the A+ scale of test unit TS-178/ARM-1 indicates a satisfactory voltage.

h. Check channels B, C, and D. Check meter readings in the positions indicated in procedure g. Check for power output on the remaining five channels. The antenna loading is adjusted at the factory for an average value that will give the best results regardless of frequency used. This antenna loading adjustment should not be changed.

i. Remove test crystals and insert proper crystals for the installation.

Note

Absence of power output on one or two channels is usually caused by defective crystal units or dirty relay contacts. The phantom antenna TS-78/U indicates only relative power output at a particular frequency. More or less light, as indicated by lamps of this phantom antenna, on another frequency does not necessarily mean a change in power output.

8-15. TESTING R-77B/ARC-3 RECEIVER. To test receiver, proceed as follows:

Note

When lid of receiver is removed, switch S-203 must be depressed while channels are being selected, to secure proper operation. Hold switch until tuning motor stops running.

a. Connect test unit TS-178/ARM-1 to socket PL-152, which is located under cover on right side of receiver, and set test unit switch at "A+" position. Connect headphones to their proper receptacle.

b. Insert crystal units and set receiver thumbwheels on channels listed.

CHANNEL	CRYSTAL FREQUENCY	THUMBWHEEL
A	8200.00 kc	135.90
B	8155.71 kc	126.18
C	8392.00 kc	137.88
D	8423.08 kc	121.50
G	8320.00 kc	136.80
H	8140.00 kc	134.10

c. Set channels E and F on frequencies that will be used in airplane.

d. Select channel A on control panel C-404A/A. If motor does not stop in about one minute, turn switch of test unit TS-178/ARM-1 to "B" position. If no voltage is indicated, check transmitter high-voltage fuse on power junction box J-68/ARC-3. The frequency indicating dial at the extreme right of the receiver should stop at 140.58 megacycles plus or minus one percent. If the word "END" appears, select channel B and immediately return to channel A. Switch S-203 must be depressed during shifting operations. If the word "END" appears this time, the crystal unit and tubes should be checked. It is not necessary to make any alignment adjustments after any of the receiver tubes are replaced.

e. On channel A, the meter reading with test unit switch in position 1 should be between 40 and 60.

f. Select channel B. The meter reading with test unit switch in position 1 should be more than 8; with switch in position 3, reading should be more than 25.

g. Select channel C. The meter reading with test unit switch in position 1 should be more than 8; with switch in position 2, reading should be more than 5.

h. Select channel D. The meter with test unit switch in position 3 should be more than 30.

i. Remove test unit TS-178/ARM-1 and replace receiver cover. Check to see that squelch is full off.

j. Check intermediate frequency and audio stages by listening in phones for a hiss, which indicates that receiver is operating. The antenna connection may be tapped gently with a metallic object. A click should be heard in headset, indicating proper operation of receiver.

k. Check remaining four channels to make sure receiver tunes to frequency determined by crystal unit and proper setting of thumbwheel.

Note

If signal generator I-130A (part of test equipment IE-19A) is available, it can be used to compare a questionable receiver with one known to be in good operating condition. Crystal control of this signal generator, using a transmitter crystal, should be utilized. Entirely acceptable receivers may have a variation in sensitivity for a given frequency of 3 to 1 from receiver to receiver. This fact should be kept in mind to avoid rejecting usable receivers.

l. When relay contact is questionable, burnish contact with tool provided in radio test set AN/ARM-1. Never burnish contact with an abrasive tool such as a file.

8-16. AN/ARN-6 RADIO COMPASS.

8-17. The AN/ARN-6 radio compass is an air-borne, automatic navigational instrument that indicates the direction of any desired transmitting station when the radio compass is set for compass operation. The receiver, in the radio compartment aft of the cockpit, covers four frequency bands: band one, 100 to 200 kilocycles; band two, 200 to 410 kilocycles; band three, 410 to 850 kilocycles; and band four, 850 to 1750 kilocycles. Primary power is supplied by the electrical system of the airplane; a vibrator and filter circuit within the compass receiver supplies the high voltage to the receiver. The compass loop, installed in the aft portion of the canopy, is automatic in its operation. The CG-556/ARN-6 compass loop cable connects the loop antenna to the compass receiver when the canopy is in the forward position. This is accomplished through the contacts of two junction boxes, one mounted on the canopy beam and the other located on the canopy deck. The spring-loaded brushes on the canopy junction box make sliding contact with three mating contacts on the canopy deck junction box. These contacts maintain positive connection between loop antenna and compass receiver, even when canopy is opened approximately 2⅜ inches. The sense antenna is attached inside the top portion of the canopy. A radio compass indicator is installed on the instrument panel. Controls are on the right radio console. The circuit breaker for the system is installed on the left circuit-breaker panel.

8-18. REMOVING R-101A/ARN-6 RECEIVER. When removing receiver from airplane, proceed as follows:

a. Remove radio access door on the left side, aft of pilot's compartment.

b. Disconnect cables from junction box J-68/ARC-3 and remove junction box from mounting.

c. Remove junction box mounting bracket MT-236/ARC-3.

d. Remove D-2 converter plug.

e. Remove RT-82/APX-6 receiver-transmitter, after disconnecting control cables. (Refer to paragraph 8-33.)

f. Remove carbon-pile voltage regulator (immediately outboard from R-101A/ARN-6 receiver).

g. Disconnect receiver tuning shaft, antenna transmission line, ground, and loop cable connector plugs.

h. Loosen locking knobs on mount MT-274A/ARN-6.

i. Remove receiver R-101A/ARN-6 by pulling it outboard toward access door until pins in mounting rack clear receiver, then tipping receiver and sliding it aft and out access door.

8-19. INSTALLING R-101A/ARN-6 RECEIVER. Install receiver in the following manner:

a. Position receiver on mounting rack slightly outboard; then slide inboard to engage pins on mounting rack with corresponding holes at rear of receiver chassis.

b. Tighten locking knobs on mount MT-27A/ARN-6.

c. Connect receiver tuning shaft, antenna transmission line, ground, and loop cable connector plugs.

d. Install carbon-pile voltage regulator.

e. Install RT-82/APX-6 receiver-transmitter, and connect associated control cables. (Refer to paragraph 8-34.)

f. Replace D-2 converter plug.

g. Install junction box mounting bracket MT-2361/ARC-3.

h. Install junction box J-68/ARC-3 and connect associated cables.

i. Install radio access door.

8-20. OPERATIONAL CHECK OF AN/ARN-6 RADIO COMPASS. To check out system, proceed as follows:

a. Connect an external source of power to airplane, or turn "ON" battery-disconnect switch.

b. Turn function switch on control panel to "COMP."

c. Using headset, check operation of volume control to see that it properly controls headset volume.

d. While listening, jar radio compass receiver to check possible noise or intermittent reception.

e. Place function switch in "ANT" position and check operation of equipment on all four bands. Switch "CW VOICE" switch to "CW" and check operation of the beat frequency oscillator.

f. Switch to "LOOP" and check reception on all bands. Check operation of "LOOP L-R" switch. Direction and speed of loop rotation, as indicated by the indicator pointers, are controlled by direction and amount, respectively, of "LOOP L-R" switch rotation.

g. Park airplane in an area at least 200 feet away from metallic frame buildings, hills, power lines, railroads, or other large electrically conductive objects.

Swing heading of airplane so that it points exactly toward a transmitting station. Turn function switch to "COMP" and tune equipment to this station. The indicator pointer should swing to the zero index within 2 degrees.

Note

The accuracy of this zero heading will depend upon the following:

- The accuracy with which the fore-and-aft line of the airplane was aligned with the direction of the transmitting station.
- The accuracy with which the loop mounting base was aligned with the fore-and-aft line of the airplane.
- The amount of distortion in the direction of arrival of radio waves caused by unsymmetrical location of the loop in relation to the physical make-up of the airplane and accessories. If an error of less than 5 degrees is detected, it can be corrected when radio compass quadrantal error correction is made to the compensator.

8-21. REMOVING MT-274A/ARN-6 RADIO COMPASS MOUNT. Remove radio compass mount in the following manner:

a. Remove R-101A/ARN-6 receiver. (Refer to paragraph 8-18.)

b. Remove the four check nuts and lock washers from shock mount studs. Retain nuts and washers for reinstallation of tray.

c. Lift off tray; then remove shock mount assemblies if desired.

8-22. INSTALLING MT-274/ARN-6 RADIO COMPASS MOUNT. Install radio compass mount as follows:

a. Install shock mount assemblies.

b. Place tray on shock mount studs and install lock washers and check nuts.

c. Install R-101A/ARN-6 receiver. (Refer to paragraph 8-19.)

8-23. AN/ARN-14 RADIO COMPASS.

8-24. Space provisions only have been made for installation of AN/ARN-14 equipment, which replaces the AN/ARN-6 equipment.

8-25. ANTENNA SYSTEM.

8-26. The antenna system consists of five antennas installed as follows: the AN/ARC-3 command set antenna installed in the vertical stabilizer tip; the AN/APX-6 receiver-transmitter antenna on the underside of the fuselage; the AN/ARN-6 radio compass sense antenna on the inside top of the canopy; the AN/ARN-6 radio compass loop antenna aft of the pilot's seat inside the canopy; and the AN/APG-30 radar ranging antenna in the forward section of the airplane. All antennas are enclosed within the fuselage.

CAUTION

Should the airplane be painted, finish the vertical stabilizer tip, which encloses the command set antenna, with lacquer (Specification MIL-L-7178).

8-27. RADAR SYSTEM.

8-28. The radar equipment (figure 8-4) consists of the following:

Note

AN/APX-6 IFF equipment is shown installed in figure 8-1. The A-1CM sight, associated with the AN/APG-30 radar set, is covered in paragraphs 9-130 through 9-178.

EQUIPMENT	FUNCTION
AN/APX-6 IFF RADAR Receiver-transmitter (RT-82/APX-6) Control panel (C-629/APX-6) Antenna (AT-234/APX) Inertia switch (SA-3A/A) Bracket assembly	Aircraft identification.
AN/APG-30 RADAR Receiver-transmitter (RT-181/APG-30) Range power supply (PP-493/APG-30) Indicator (ID-270A/APG-30) Horn antenna (AT-223/APG-30) Voltage regulator (CN-112/APG-30)	Ranging.

8-29. TROUBLE SHOOTING RADAR SYSTEM.

8-30. AN/APX IFF SET. If at any time the IFF equipment fails to operate, check for burned-out fuses on the receiver-transmitter and see that all cable connections are tight. If trouble is not caused by power source failure or if fuses repeatedly burn out, isolate the trouble by replacing each IFF unit (including cables) until the defective unit is located.

8-31. AN/APX-6 IFF RADAR.

8-32. AN/APX-6 IFF equipment is installed in the radio compartment aft of the cockpit. This equipment operates in conjunction with permanently installed associated equipment consisting of an inertia switch (detonator switch) and indicator lights. This transpondor identifies the airplane in which it is installed when it is correctly challenged by an interrogator-respondor associated with shore, shipboard, or air-borne radar equipment. The AN/APX-6 equipment receives challenges initiated by an interrogator-respondor and transmits replies back to the interrogator-respondor, where they are displayed on the radar indicators. When a radar target is accompanied by proper IFF reply, that target is considered friendly. The antenna, AT-234/APX, is located on the underside of the fuselage at station 152 on the centerline.

8-33. REMOVING RT-82/APX-6 RECEIVER-TRANSMITTER. Remove the RT-82/APX-6 receiver-transmitter in the following manner:

a. Remove aft radio equipment access door on left side of fuselage. Remove power junction box, J-68/ARC-3, and mount.

b. Disconnect cables from IFF receiver-transmitter.

c. Stow all radio cables and bundles out of the way.

d. Loosen the knurled retaining nuts on mounting racks so that receiver-transmitter will be free to slide from the rack.

e. Screw out forward knurled retaining nut half the distance on screw.

f. Slide unit forward and off the rack; then tilt unit inboard to face-up position and draw unit outboard, rotating it where necessary to miss any obstructions.

g. Remove unit through access door.

8-34. INSTALLING RT-82/APX-6 RECEIVER-TRANSMITTER. Install receiver-transmitter in the following manner:

a. Remove the two top screws from face of receiver-transmitter.

b. Make sure all loose cables and wire bundles are clear of the area through which IFF unit must travel.

c. Screw out the forward knurled retaining nut half the distance on screw.

d. With the unit in face-up position, slide it through the access door and onto the mounting rack.

e. Draw unit outboard, forward, and off the rack; then drop forward outbroad end of unit slightly so that upper aft corner of unit is forward of frame at station 144⅝. (See detail A, figure 8-3.)

f. Rotate unit so that upper forward corner of unit is forward and outboard of bonding terminal on frame at station 133½ and upper aft corner is still forward of frame station 144⅝. (See detail B, figure 8-3.)

g. With left hand under forward end of unit and right hand on upper end of unit, rotate unit to upright position and push lower edge of unit inboard until it rests on the forward knurled retaining nut on mounting rack. (See detail C, figure 8-3.)

h. Place both hands on face of unit, and push unit onto the rack over knurled nut. (See detail D, figure 8-3.)

Note

While the unit is being maneuvered on the rack, the unit must remain centered between frames at stations 133½ and 144⅝.

i. Secure unit to mounting rack with knurled retaining nuts.

j. Connect cables to receiver-transmitter, and install the two screws removed in procedure a. to the face of the unit.

k. Install power junction box J-68/ARC-3 and mount.

l. Replace and secure radio equipment access door.

8-35. OPERATIONAL CHECK OF AN/APX-6 IFF RADAR EQUIPMENT. Check out the IFF equipment as follows:

a. Connect external power source to airplane, and turn on equipment.

b. Place switches labeled "MODE 2" and "MODE 3" on IFF control panel in their "OUT" positions, unless otherwise directed by proper authority.

c. Rotate master selector to "NORM" position.

d. Request ground radar control for a check on proper reception of IFF transpondor signals.

e. Rotate master selector to the "OFF" position.

CAUTION

Destructors will be fired if the destructor switch is turned to the "ON" position or if the impact switch is tripped, regardless of the setting of the master selector.

8-36. CHECKING IFF DESTRUCTOR SYSTEM. To check out the IFF system, proceed as follows:

CAUTION

Destructors will be fired if the destructor switch is turned on or if the impact switch is tripped, regardless of the setting of the master selector.

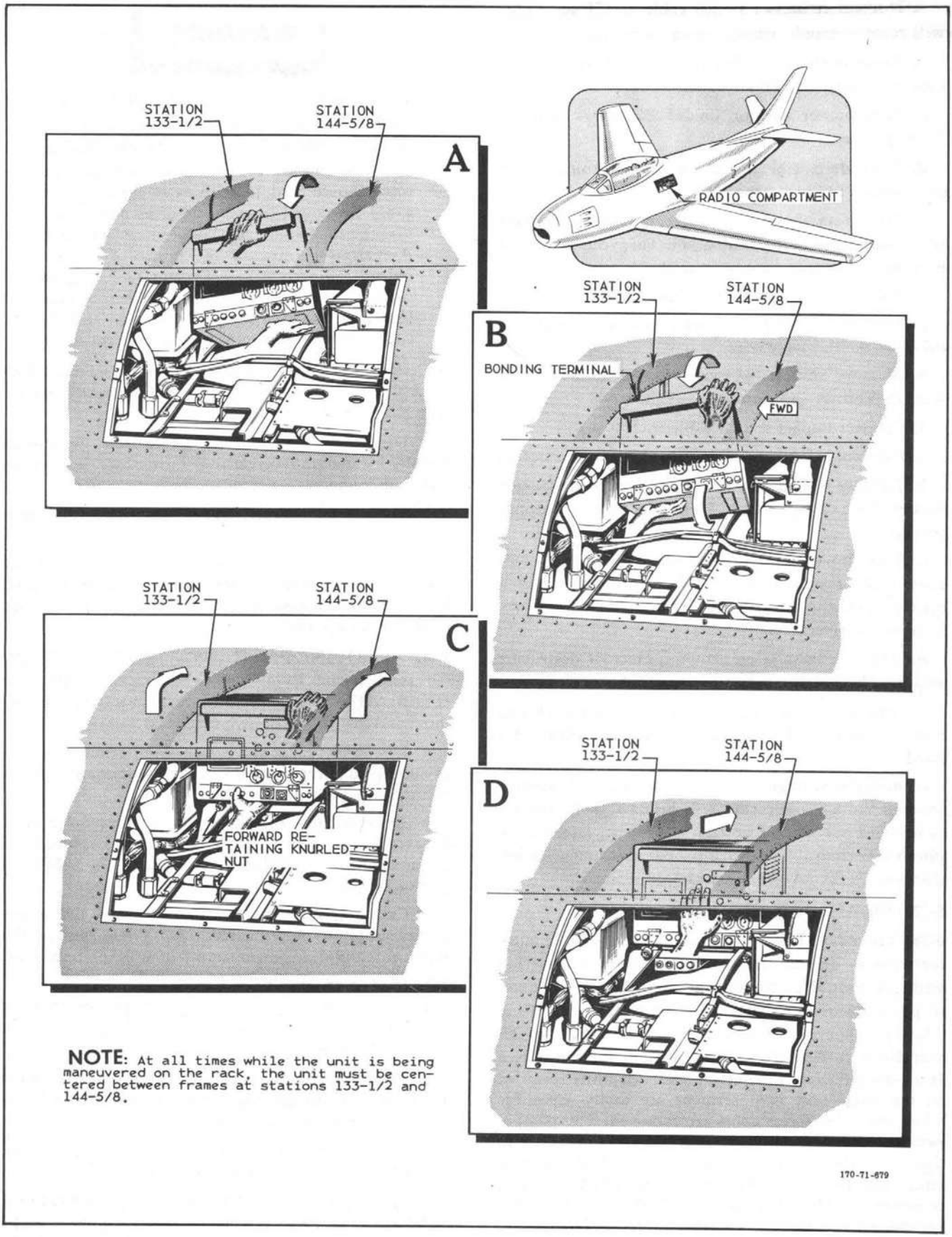


Figure 8-3. Installing RT-82/APX-6 Receiver-Transmitter

a. Disconnect impact switch cable at IFF set. (This will remove supply voltage from destructors.)

b. Remove the three destructors from destructor sockets, located on IFF set panel.

c. Place master selector, on IFF control console, in "OFF" position.

d. Raise destructor guard on control console and place switch in "ON" position.

e. Using a suitable d-c voltmeter, measure voltage on center contact of destructor socket. This voltage should be within .5 volt of supply voltage.

f. Place destructor switch in "OFF" position.

g. Safety-wire destructor switch in down position, using breakable safety wire.

h. Measure voltage on center contact of destructor sockets. Voltage indication should be *zero.*

i. Connect impact switch cable to IFF set.

j. Displace pendulum arm until a sharp snap is heard.

k. Measure voltage on center contact of destructor sockets. This voltage should be within .5 volt of supply voltage.

l. Reset impact switch by inserting a screwdriver in front side of switch casing and turning screw in a counterclockwise direction to the stop; then slowly release screwdriver.

m. Measure voltage on center contact of destructor sockets. This voltage indication should be *zero.*

n. Test impact switch for resistance to minor jars and vibration by slapping side of impact switch with hand.

o. Measure voltage on center contact of destructor sockets. Voltage indication will be *zero* if the impact switch did not trip. If voltage is present, refer to applicable Technical Orders for proper adjustment of impact switch SA-3A/A, and make adjustment.

8-37. AN/APG-30 RADAR.

8-38. The AN/APG-30 radar set is an air-borne, automatic, range-determining device for use in conjunction with the A-1CM gun-bomb-rocket sight. Two sources of power are required for operation of the set: 110- to 120-volt, 400-cycle alternating current; and 24- to 28-volt direct current. The circuit breaker for the system is on the left circuit-breaker panel. All units installed in the radar nose compartment are easily accessible when the radar access doors are removed. The components of the AN/APG-30 radar set are illustrated in figure 8-4. Use extreme caution when working on radar equipment because of the presence of high voltages in some circuits. Do not apply 115-volt alternating current for more than 5 minutes unless the internal blowers are running.

WARNING

Tubes V105 (1B24A) and V106 (1B35) used in the RT-181/APG-30 receiver-transmitter may be sufficiently radioactive to be classified as dangerous. Removal and replacement of these tubes should be done with extreme caution to avoid breakage. In event of accidental breakage, the immediate area should be regarded as dangerous because of the possibility of inhaling radioactive gas. Do not handle glass particles or tube elements. In the event of tube breakage, the area should be cleared and decontamination procedures should be initiated.

8-39. REMOVING RT-181/APG-30 RECEIVER-TRANSMITTER. Remove the RT-181/APG-30 receiver-transmitter as follows:

a. Disconnect flexible wave guide from directional coupler located on receiver-transmitter by releasing the quick-disconnect.

b. Disconnect power, trigger, and i-f cables from transmitter.

c. Remove the securing bolt from the top of each of the four shock mounts. After these have been removed, lift entire mount assembly and receiver-transmitter out of its mounting area.

8-40. REMOVING PP-493/APG-30 POWER SUPPLY. To remove the PP-493/APG-30 power supply, the RT-181/APG-30 receiver-transmitter must first be removed. After this is done, proceed as follows:

a. Disconnect radar and battery compartment circuit-breaker panel brace assembly from the forward support channel for the transmitter.

b. Remove the transmitter forward support channel by removing the two bolts at each end of the support channel. Disconnect all cables from the PP-493/APG-30 power supply.

c. Cut safety wires from the two wing nuts that secure power supply to mount. After this is done, unscrew the wing nuts and slide power supply forward on its mount; then lift it from its mount.

8-41. REMOVING CN-112/APG-30 VOLTAGE REGULATOR. To remove the CN-112/APG-30 voltage regulator, proceed as follows:

a. Disconnect the two cables from the unit. Cut the safety wire from the wing nut located on the lower front of the voltage regulator.

b. Loosen the wing nut; then slide the voltage regulator forward and lift it from its mount.

8-42. INSTALLING PP-493/APG-30 POWER SUPPLY. The PP-493/APG-30 power supply must be installed in the airplane before the RT-181/APG-30

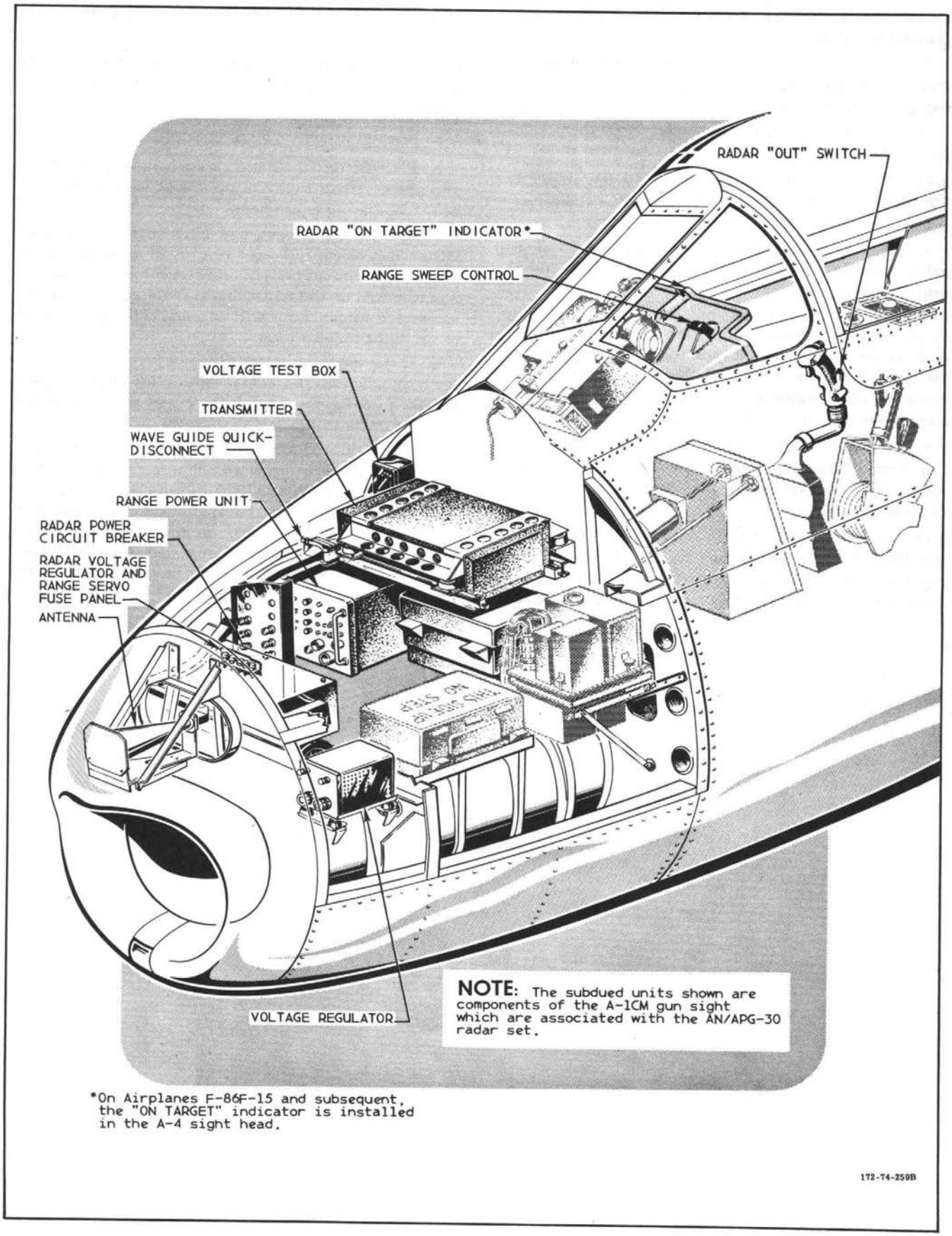


Figure 8-4. AN/APG-30 Radar System

transmitter is installed. To install the power supply, proceed as follows:

a. Place power supply in its mount, making certain that the two securing pins on rear of mount are fully engaged in power supply unit.

b. Tighten the wing nuts, and safety-wire them. Connect electrical cables to unit.

8-43. INSTALLING RT-181/APG-30 RECEIVER-TRANSMITTER. Install the RT-181/APG-30 receiver-transmitter as follows:

a. Install receiver-transmitter forward support channel by fastening the two mounting bolts at each end of support channel.

b. Place receiver-transmitter, along with its mount, in its mounting space. Install the four bolts through receiver-transmitter mount mounting holes and secure the bolts in the shock mounts. Make certain bonding straps on shock mounts are secured between receiver-transmitter mount and shock mount.

c. Connect electrical plugs to receiver-transmitter.

d. Secure brace assembly between battery compartment circuit-breaker panel and lateral support for the receiver-transmiter.

8-44. INSTALLING CN-112/APG-30 VOLTAGE REGULATOR. To install the CN-112/APG-30 voltage regulator, place it in its mount. Tighten the wing nut until the unit is held securely in place. Safety-wire the wing nut and connect the two electrical plugs to the unit.

8-45. OPERATIONAL CHECK OF AN/APG-30 RADAR. To check out AN/APG-30 radar set, proceed as follows:

a. Place gun safety switch in "GUNS" position.

b. Place battery-disconnect switch in "ON" position, and allow system to warm up for at least 20 minutes before operating equipment.

c. Aim guns at target, and note range indicator of sight when target indicator lamp is illuminated. If the range indicator accurately brackets the target, the system is locked on the target that is centered in the circle, and range information will automatically be supplied to the sight for this target.

d. If the range indicator does not accurately bracket the target, depress the "OUT" button (or target selector switch) to enlarge or shrink the range indicator of the sight in order to bracket the target.

e. If it is desired to track a new target, optically aim the guns at the new target and depress the "OUT" button (or target selector switch) to cause the range indicator of the sight to accurately bracket the target. The system is accurately locked on the target when the target indicator becomes illuminated and the target centered in the sight circle is accurately bracketed by the range indicator of the sight.

Section IX
ARMAMENT

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9-1. BOMBING SYSTEM.

9-2. The bombing system is all-electric and consists of a normal bomb release circuit, an emergency bomb release circuit, an arming circuit, a fragmentation bomb release circuit, a chemical tank discharge circuit, and a removable bomb rack on the underside of each wing outer panel. The system may be arranged to accommodate the external bombing stores listed in figure 9-3. In addition, the system is utilized to drop the auxiliary fuel tanks electrically. The system provides normal or emergency release of the external bombing stores. Normal electrical release may be accomplished automatically or manually, with bombs released either singly or simultaneously. Automatic release is accomplished by the A-1CM or A-4 sight system. (Refer to paragraphs 9-130 through 9-190, respectively.) The bombing system control switches are located on the center pedestal, the left forward console, and the control stick grip. On F-86E-1 Airplanes AF50-621, -623, -625, and -626, F-86E-5 Airplanes AF50-669 through -689, and F-86E-6 and subsequent airplanes, a mechanical emergency release is provided to simultaneously jettison all external load (bombs or rockets unarmed, chemical tanks, or auxiliary fuel tanks) in the event of electrical failure. Mechanical release is accomplished through the emergency release handle (recessed in the left forward console) and an automatically actuated arming safety switch. The handle is connected by cables to a plunger-type release mechanism in each wing.

9-3. FUNCTION OF BOMBING SYSTEM— ELECTRICAL NORMAL MANUAL RELEASE.

9-4. Positioning the bomb arming switch at either "ARM NOSE & TAIL" or "TAIL ONLY" arms the bombs for normal manual release. This allows current from the battery bus to energize the selected arming solenoids in the two bomb racks. If it is desired to drop the bombs singly, the bomb train selector switch is positioned to "SINGLE"; then, with the bomb release selector switch in "MANUAL RELEASE," depressing the bomb-rocket release button energizes the bomb release power control relay. The closed relay results in closing the bomb release power relay, that in turn directs current through the bomb train selector switch to energize the left bomb rack release solenoid, releasing the bomb. When the bomb is released, switching within the left bomb rack is actuated that completes the circuit to the right bomb rack; then to release the right bomb, the bomb-rocket release button is depressed again to route current to the right bomb rack release solenoid. If it is desired to drop all bombs simultaneously, the bomb train selector switch is placed in "ALL"; then when the bomb-rocket release button is depressed, the all-bombs release relay is energized to direct power to both bomb racks simultaneously. Although the chemical tanks and the auxiliary fuel tanks are normally dropped by use of the electrical emergency jettison release procedure (paragraph 9-8), they may be dropped by use of the electrical normal manual release; however, the bomb train selector switch must be at "ALL" instead of "SINGLE" so that all tanks are released simultaneously.

9-5. FUNCTION OF BOMBING SYSTEM— ELECTRICAL NORMAL AUTOMATIC RELEASE.

9-6. The function of the bombing system automatic release closely parallels that of the manual release, with one exception: the initiating impulse for the system comes from the gun-bomb-rocket sight rather than through the bomb-rocket release button. However, the bomb-rocket release button must be held closed during automatic operation. For description of the A-1CM gun-bomb-rocket sight, refer to paragraph 9-131; for operation of the A-4 gun-bomb-rocket sight, refer to paragraph 9-180.

9-7. FUNCTION OF BOMBING SYSTEM— ELECTRICAL EMERGENCY JETTISON RELEASE.

9-8. The electrical emergency jettison system, when energized by the closing of the bomb-rocket-tank salvo (jettison) switch, jettisons all external loads (bombs, rockets, auxiliary fuel tanks, or chemical tanks). Bomb release is accomplished when the salvo (jettison) switch is closed. This routes current from the battery bus to the coil of the bomb-rocket-tank salvo relay, closing the relay. The closing of this relay allows power to flow from the battery bus to the right and left racks, tripping the racks. (See figure 9-1.)

9-9. FUNCTION OF BOMBING SYSTEM— FRAGMENTATION BOMB RELEASE.

9-10. The fragmentation bomb release circuit provides a means of releasing fragmentation bombs in a train when the Type R-3 fragmentation bomb racks are installed. (See figure 9-1.) With the fragmentation bomb selector switch in the "SINGLE TRAIN" position, the bomb release selecor switch in "MANUAL RELEASE," and the bomb-rocket release button held down, current is routed to the left fragmentation bomb rack to trip the three fragmentation bomb channels (each channel contains six fragmentation bombs that are released in train); then the current is routed to the right fragmentation bomb rack to trip the three fragmentation bomb channels subsequently for a train release. A momentary depression of the bomb-rocket release button will release only one channel of six bombs. Approximately 1½ seconds is required to release the second channel; the third channel of the rack will release when the bomb-rocket release button is depressed for approximately 3½ seconds. When the fragmentation bomb selector switch is moved to the "ALL TRAIN" position and the bomb-rocket release button is held down, current is routed to both fragmentation bomb racks to drop bombs simultaneously from both fragmentation bomb racks in a

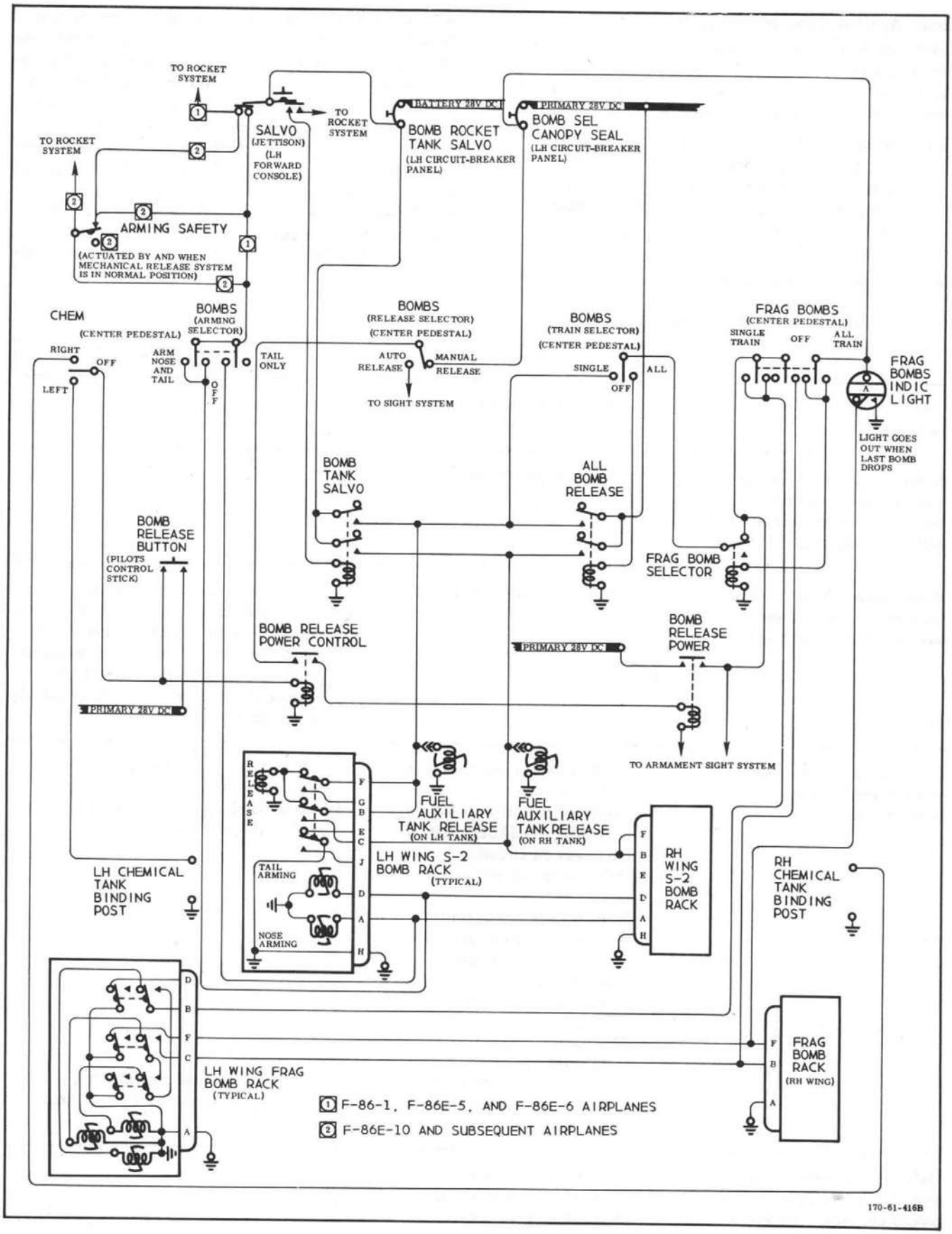


Figure 9-1. Bombing System

train. Again it is possible to release single channels from each rack by depressing the bomb-rocket release button momentarily as described. The fragmentation bomb indicator light is automatically extinguished when the last fragmentation bomb has been dropped.

9-11. FUNCTION OF BOMBING SYSTEM—MECHANICAL EMERGENCY RELEASE (F-86E-1 AIRPLANES AF50-621, -623, -625, AND -626, F-86E-5 AIRPLANES AF50-669 THROUGH -689, AND F-86E-6 AND SUBSEQUENT AIRPLANES).

9-12. A single release handle, recessed in the left forward console, controls the release of all external stores. When the handle is pulled out of the detent, one plunger for bomb or fuel tank release and four plungers for rocket release extend beyond the skin of the wing to actuate the release mechanism in the rocket mounts and bomb racks or fuel tanks. (See figure 9-2.) An arming safety switch, located on the manual release linkage in the left gun bay, is incorporated in the mechanical release. Initial movement of the emergency release handle removes pressure from the arming safety switch actuating pin. This cuts power from all arming circuits, so that all bombs or rockets will be dropped in a safe condition.

9-13. TROUBLE SHOOTING BOMBING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Bomb rack mechanism does not lock.	Dirty or defective rack.	
Bomb carrying hooks fail to open, or open sluggishly when bomb rack is released electrically with bomb installed.	Internal friction caused by dirt or grit.	
Bomb carrying hooks fail to open when rack is released without bomb weight installed.	Internal friction caused by dirt or grit.	When hooks do not open without help of weight or other assistance, the rack is not necessarily defective; however, this condition may indicate excessive friction or dirt. The bomb rack should be disassembled, cleaned, and inspected by authorized personnel.
Bomb racks do not release when manual-all release is attempted.	Bomb train selector switch in "OFF" position. Bomb release selector switch in "AUTO RELEASE" position. No power on circuit. Defective bomb-rocket release button. Bomb release power control relay stuck open or defective. Defective bomb release power relay. Defective bomb train selector switch. "All-bombs" release relay defective. Low or no voltage at rack, causing faulty operation of release solenoid.	Move bomb train selector switch to "ALL." Move bomb release selector switch to "MANUAL RELEASE." Check circuit. Locate defective wiring; repair or replace as required.
Only one rack releases when bomb train selector switch is placed on "ALL" and bomb-rocket release button is pressed.	Defective wiring between bomb train selector switch and inoperable bomb rack.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Defective bomb rack wiring or release Solenoid. Defective wiring in salvo circuit. Defective bomb rack.	
Bomb racks do not release when bomb-rocket-tank salvo (jettison) switch is actuated.	No power. Defective bomb-rocket-tank salvo (jettison) switch on relay.	
With bomb arming switch at either "ARM NOSE & TAIL" or "TAIL ONLY," respective arming wire is not held when bomb rack is tripped.	No voltage at rack. Low voltage at rack causing faulty operation of arming solenoids. Arming solenoid inoperative.	Correct voltage supply. Make sure there are no poor terminal connections, defective wiring, etc. Replace rack.
With bomb arming switch "OFF" and bomb rack locked, arming wire is held.	Wire retaining slide held in up position by dirt or grit.	
Fragmentation bombs are not tripped when system is set for a manual-train release and bomb-rocket release button is pressed.	No power. Defective bomb release power control, bomb release power, and fragmentation bomb selector relays. Defective fragmentation bomb selector switch.	Check power source and correct.
Fragmentation bombs release from left rack only when system is set for a manual-train release and bomb-rocket release button is pressed.	Defective fragmentation bomb rack. Defective wiring between left fragmentation bomb racks.	
Fragmentation bombs release from left rack only when system is set for an all-train release and bomb-rocket release button is pressed.	Defective wiring between fragmentation bomb selector switch and bomb rack. Defective bomb rack.	

9-14. TESTING BOMBING SYSTEM.

9-15. First check the bomb rack installation for security of attachments and safetying; then make sure the bomb release selector switch is in "MANUAL RELEASE" position. To test the bombing system (before loading bombs), proceed as follows:

a. Cock the bomb racks.

b. Connect an external electrical power source.

c. Place arming wire loop in each arming unit and position bomb arming switch at "ARM NOSE & TAIL." Arming loops should be held firmly by arming solenoids. Actuate bomb-rocket-tank salvo button; both bomb racks should trip simultaneously, and all arming loops should release.

d. Cock racks and place bomb arming wire loops in each arming unit (if loops are not already installed). Place bomb train selector switch on "ALL" and press bomb-rocket release button; both bomb racks should trip, and nose and tail arming wires should be retained.

e. Cock bomb racks and place bomb arming wire loops in each arming unit. Place bomb train selector switch on "SINGLE" and bomb arming switch at "OFF." Press bomb-rocket release button; the left bomb rack should trip and drop the arming wires. Press bomb-rocket release button once more; the right bomb rack should trip and drop its arming wires.

f. Load bomb racks with dummy bombs or weights of not less than 25 pounds each. Place bomb train selector switch on "OFF." Repeatedly press bomb-rocket release button; the bomb racks should not trip.

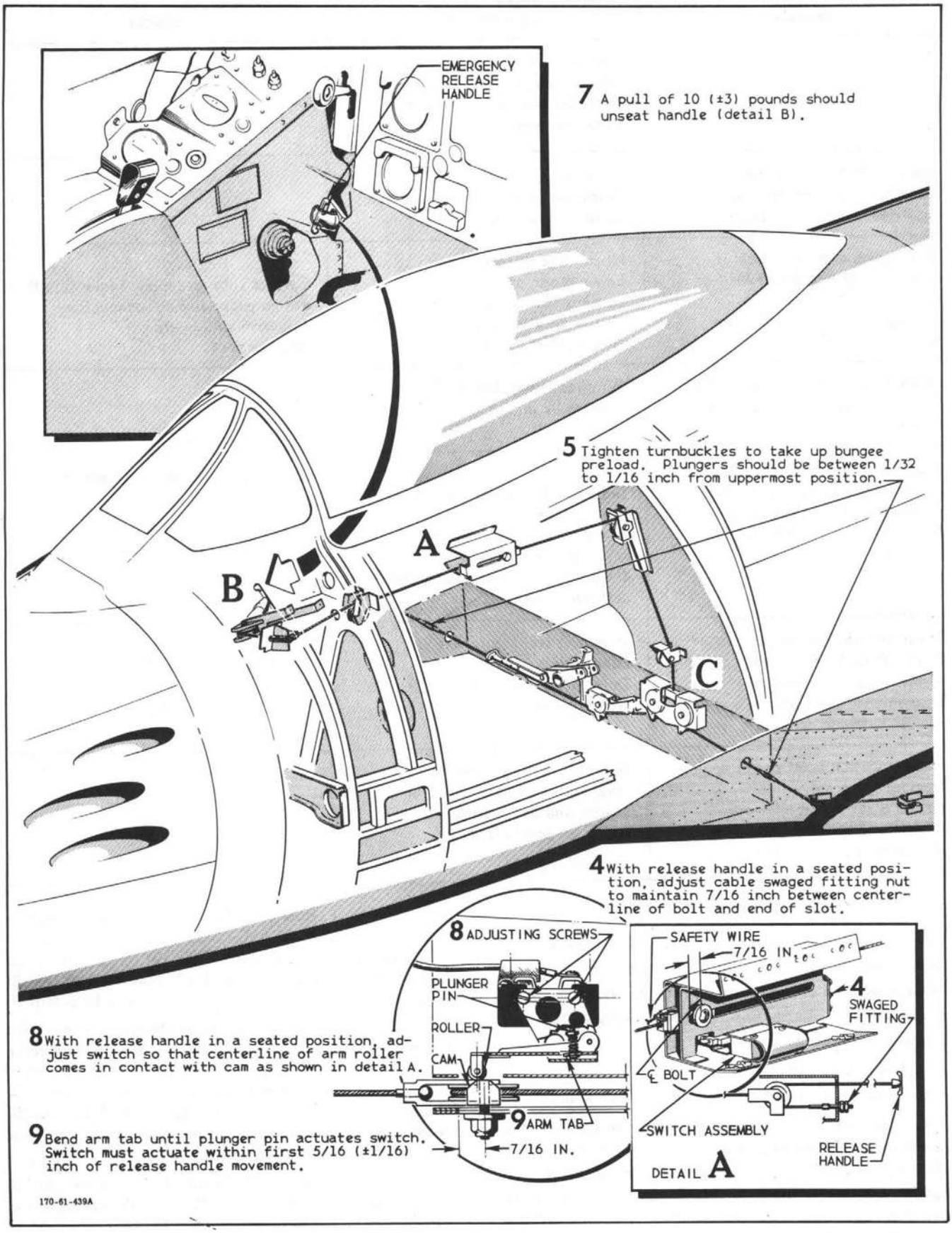


Figure 9-2. Adjusting Bombing System Mechanical Emergency Release (Sheet 1 of 2)

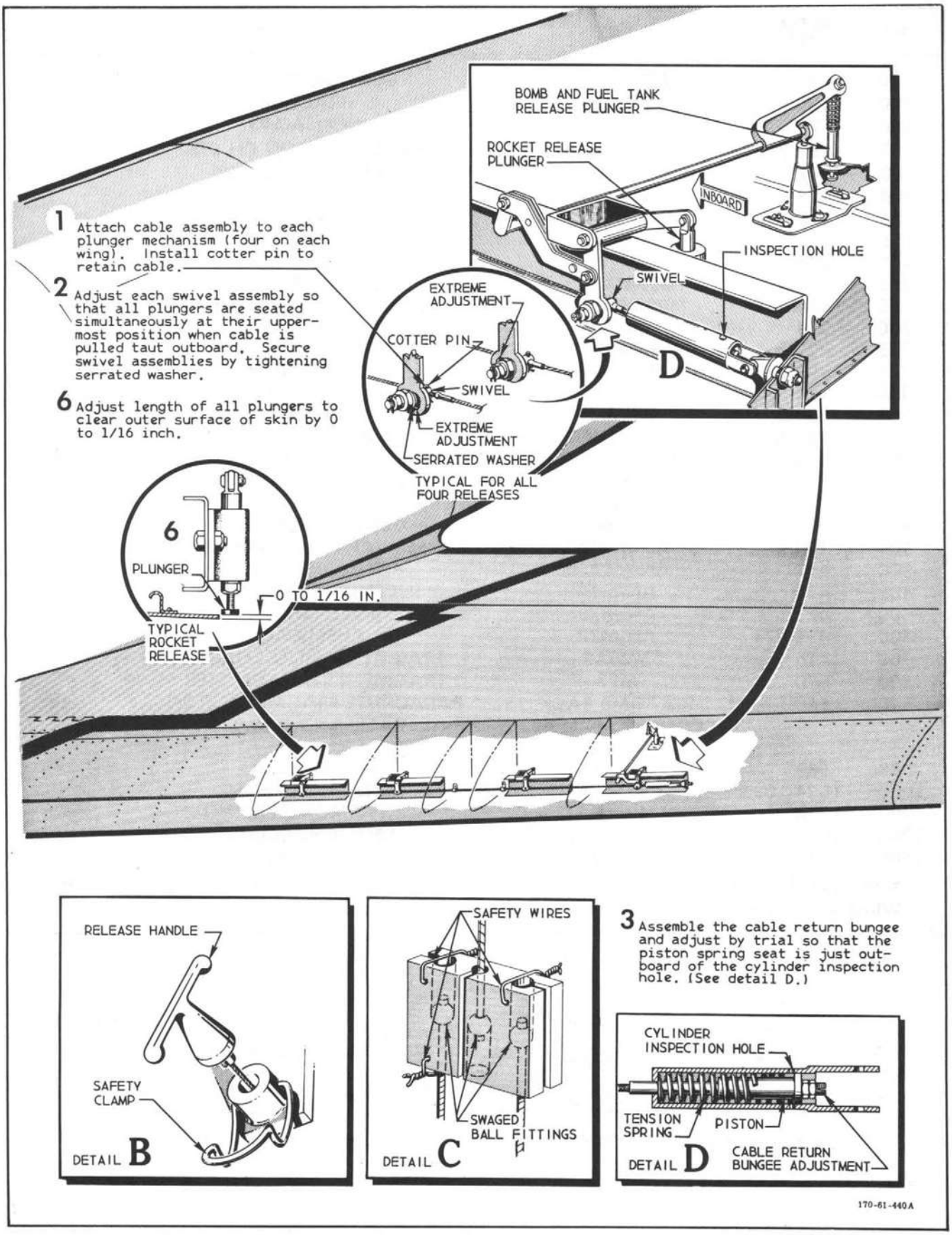
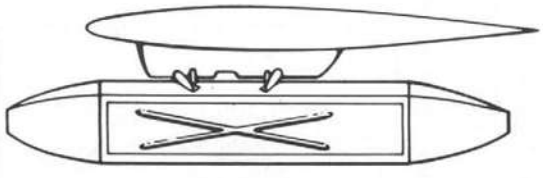


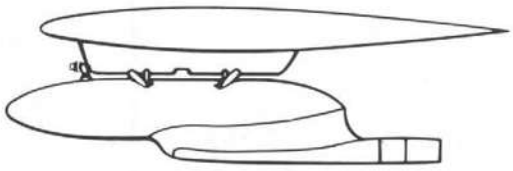
Figure 9-2. Adjusting Bombing System Mechanical Emergency Release (Sheet 2 of 2)

WT	ACTUAL WT	TYPE	DESCRIPTION	
100	106.1	AN-M30A1	GENERAL PURPOSE	
100	100	M38A2	PRACTICE	
100	72	AN-M47A3	INCENDIARY	
100	87.2	AN-M4A2	FRAGMENTATION CLUSTER	
100	87	M-5	PRACTICE CLUSTER	
100	128	AN-M2A2	PRACTICE CLUSTER	
100	128	AN-M1A2	FRAGMENTATION CLUSTER	
115	125	M70	CHEMICAL	
220	216.2	M88	FRAGMENTATION	
250	254.7	AN-M57A1	GENERAL PURPOSE	
250	234-265	M89-M90-M98	TARGET IDENTIFICATION	
260	263	AN-M81	FRAGMENTATION	
325	329.5	AN-MK41	AIRCRAFT DEPTH	
325	323.8	AN-MK53, MOD 1	AIRCRAFT DEPTH	
350	368	AN-MK44	AIRCRAFT DEPTH	
350	354.5	AN-MK47	DEPTH	
350	348.6	AN-MK54, MOD 1	AIRCRAFT DEPTH	
482	482	R-3 BOMB RACK WITH 18 AN-M-41 BOMBS	PARACHUTE-FRAGMENTATION RACK AND BOMBS	*
500	535-545	AN-M64A1	GENERAL PURPOSE	
500	499.2	AN-M58A2	SEMI-ARMOR-PIERCING	
500	463	AN-M17A1	INCENDIARY CLUSTER	
500	463	AN-M14	INCENDIARY CLUSTER	
500	473	AN-M76	INCENDIARY	
500	438-471	AN-M78	CHEMICAL	
500	416	M26A2	FRAGMENTATION CLUSTER	
500	590	M27	FRAGMENTATION CLUSTER	
540	540	R-3 BOMB RACK WITH 18 AN-M-40 BOMBS	PARACHUTE-FRAGMENTATION RACK AND BOMBS	*
588	588	M10	SMOKE TANK	
1000	1024-1035	AN-M65A1	GENERAL PURPOSE	
1000	1024	AN-M59A1	SEMI-ARMOR-PIERCING	
1000	1008	AN-MK33	ARMOR-PIERCING	
1000	717-937	AN-M79	CHEMICAL	

*One Type R-3 parachute-fragmentation rack can be installed on each wing bomb rack. When empty, the R-3 rack weighs 126 pounds.



R-3 FRAGMENTATION BOMB RACK



M-10 SMOKE TANK

172-63-500

Figure 9-3. Bombing System Loads and Hoisting (Sheet 1of 2)

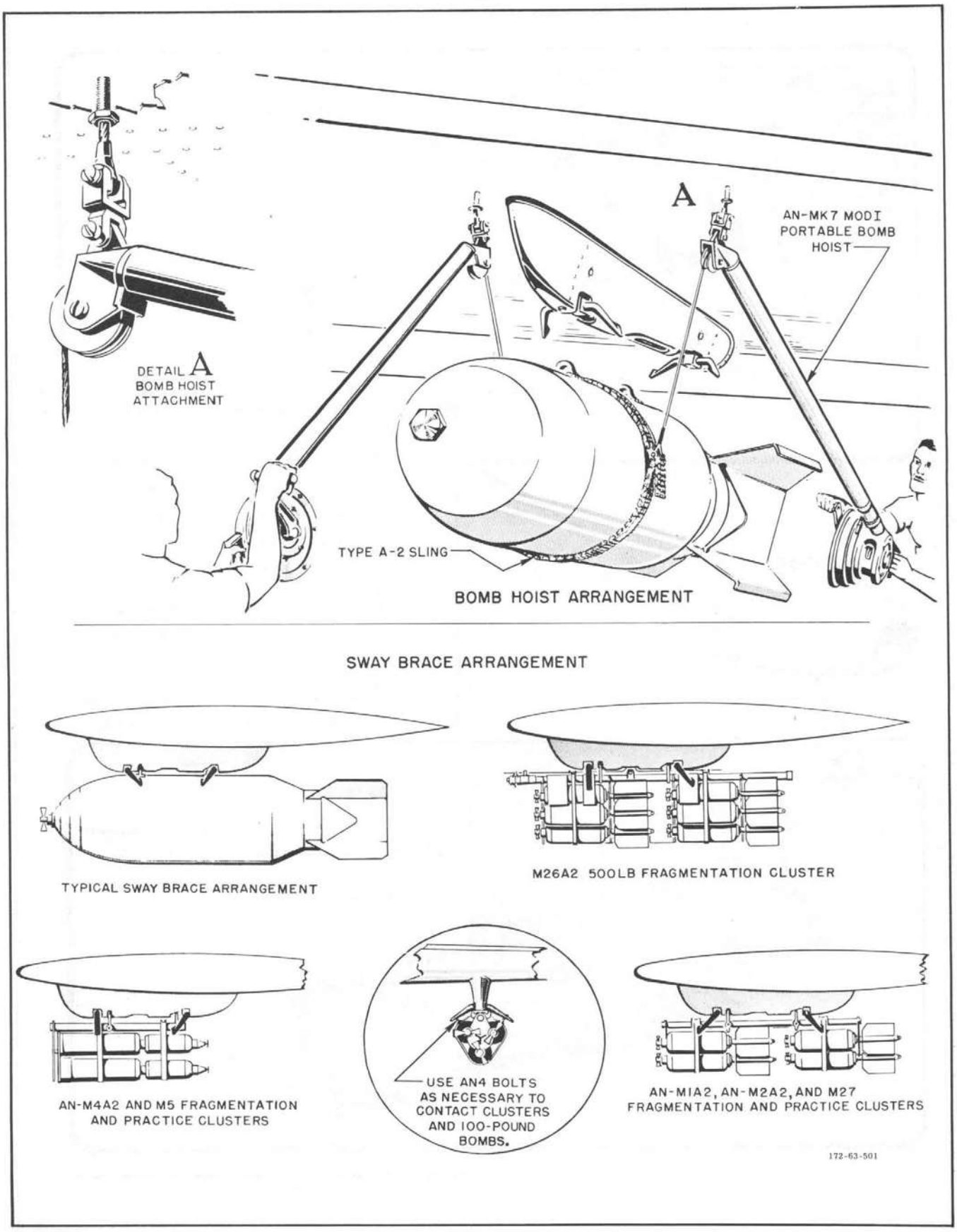


Figure 9-3. Bombing System Loads and Hoisting (Sheet 2 of 2)

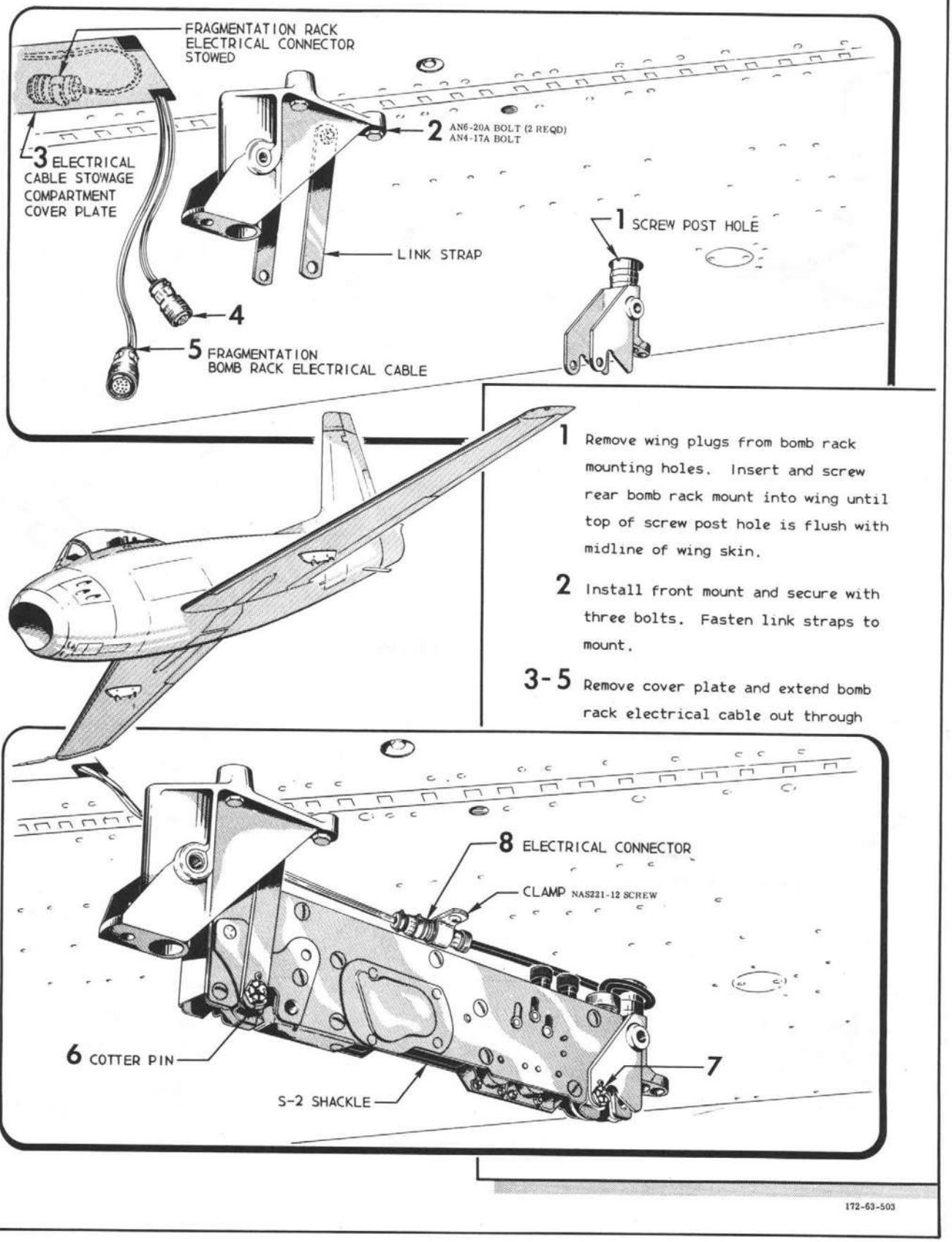
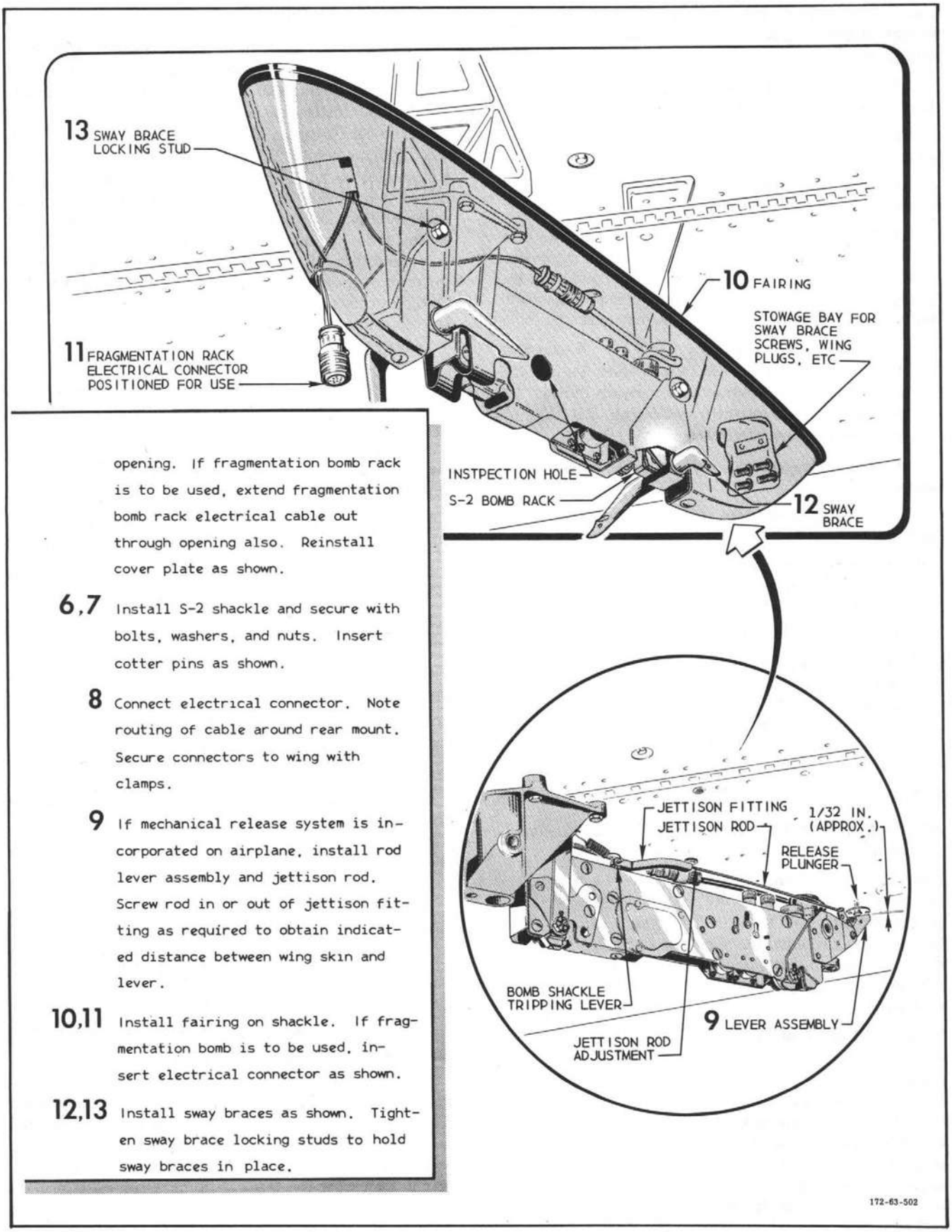


Figure 9-4. Installing Bomb Racks (Sheet 1 of 2)



opening. If fragmentation bomb rack is to be used, extend fragmentation bomb rack electrical cable out through opening also. Reinstall cover plate as shown.

6,7 Install S-2 shackle and secure with bolts, washers, and nuts. Insert cotter pins as shown.

8 Connect electrical connector. Note routing of cable around rear mount. Secure connectors to wing with clamps.

9 If mechanical release system is incorporated on airplane, install rod lever assembly and jettison rod. Screw rod in or out of jettison fitting as required to obtain indicated distance between wing skin and lever.

10,11 Install fairing on shackle. If fragmentation bomb is to be used, insert electrical connector as shown.

12,13 Install sway braces as shown. Tighten sway brace locking studs to hold sway braces in place.

Figure 9-4. Installing Bomb Racks (Sheet 2 of 2)

g. Repeat steps c. through f. with dummy bombs or weights in carrying hooks. (It is not necessary to install arming wires.)

h. If fragmentation bomb racks are to be used, install them as explained in paragraph 9-29.

i. Place fragmentation bomb selector switch at "SINGLE TRAIN."

j. Load fragmentation bomb racks with dummy bombs.

k. Hold down bomb-rocket release button. The first, second, and third channels of the left fragmentation bomb rack should be tripped successively, and then the circuit should be automatically transferred to the right fragmentation bomb rack to release its three channels.

Note

The bomb-rocket release button must be depressed until the fragmentation bomb indicator light is extinguished, indicating that the last bomb has been released.

l. Again load fragmentation bomb racks with dummy bombs.

m. Move fragmentation bomb selector switch to "ALL TRAIN."

n. Depress bomb-rocket release button. The left and right fragmentation racks should simultaneously release their channels of bombs in rapid succession.

o. Turn all switches "OFF."

9-16. ADJUSTING BOMBING SYSTEM MECHANICAL EMERGENCY RELEASE (F-86E-1 AIRPLANES AF50-621, -623, -625, AND -626, F-86E-5 AIRPLANES AF50-669 THROUGH -689, AND F-86E-6 AND SUBSEQUENT AIRPLANES).

9-17. See figure 9-2.

9-18. TESTING BOMBING SYSTEM MECHANICAL EMERGENCY RELEASE SYSTEM.

9-19. To test mechanical emergency release system before loading bombs, first make certain that bomb release selector switch is in "MANUAL RELEASE" position. Cock bomb racks. Pull emergency release handle; both bomb racks should trip simultaneously. If bomb racks do not trip simultaneously, see figure 9-2 for adjustment instructions.

9-20. LOADING BOMBING SYSTEM.

9-21. Each bomb rack will accommodate single bombs from 100 to 1000 pounds, bomb clusters up to 500-pound size, one AN-M10 chemical tank, or one Type R-3 fragmentation bomb rack. (See figure 9-3 for complete list of bombs carried.) The bomb loading procedure is standard; no special methods are required. However, make sure the bomb release system has been tested thoroughly before loading bombs. The methods for hoisting and sway-bracing various types of bombs are shown on figure 9-3.

9-22. BOMB RACKS.

9-23. Each bomb rack installation consists of a front and a rear bomb rack support assembly, a streamlined fairing, and two sets of bomb sway braces (for single bombs and cluster-type bomb combinations). The sway braces in each support assembly are adjustable for various diameter bombs. Wiring for the bomb rack and the fragmentation bomb rack, stowed inside the wing, can be reached through an access door just forward of the front bomb rack support fitting. A door is provided in the front of the bomb rack fairing to permit the fragmentation rack electrical connector plug to drop through the bomb rack fairing and connect to the socket on top of the fragmentation bomb rack. The mechanical release lever on the top of the bomb rack is provided to facilitate tests and loading procedures; this lever can be actuated by use of a screwdriver through the hole provided on the right side of the bomb rack fairing. A second hole is provided in the fairing on the left side to permit inspection of the bomb rack lock mechanism. A Type R-3 fragmentation bomb rack can be installed on each bomb rack on the lower surface of each wing. (Refer to paragraph 9-29.)

9-24. REMOVING BOMB RACKS. See figure 9-4. Then remove the bomb rack in the following manner:

a. Loosen sway-brace lockscrews and pull sway braces from housing in racks.

b. Loosen front and rear fairing supporting screws and drop fairing from rack.

c. Disconnect and stow bomb rack wiring in wing; then install access cover.

d. Remove the two bolts supporting bomb rack.

e. Rotate rear support assembly counterclockwise until assembly is free to be removed.

f. Remove the three mounting bolts from front support assembly.

g. Install wing plugs in bomb rack mounting holes.

CAUTION

Screw plugs into wing so that they are flush with wing skin. Do not screw them in any farther.

9-25. INSTALLING BOMB RACKS. See figure 9-4.

9-26. FRAGMENTATION BOMB RACKS.

9-27. A Type R-3 fragmentation bomb rack can be installed on each bomb rack on the lower surface of each wing. Each fragmentation bomb rack can be loaded with eighteen AN-M40 fragmentation bombs. The fragmentation bomb racks can be jettisoned in an emergency, by use of the normal bomb salvo (jettison) release. There are no provisions for arming or safetying individual fragmentation bombs. It is impossible to release individual bombs mechanically or to release

individual bombs safe from the bomb rack. For completion of a safe salvo, the rack and bombs can be dropped in their entirety from the airplane. Six individual bomb groups are stacked three deep in two tandem compartments. Each channel of bombs may be released separately, or all three groups may be released in a train of 18 bombs. The bomb release sequence is as follows: the tripping solenoid, located in the rear of the rack, operates and trips the bomb retaining door in the rear bomb compartment; the three bombs in this channel are released; as the third bomb falls, a follower comes down; this follower, through a mechanical linkage, trips the bomb retaining door in the front section; as the top bomb falls, the follower in this channel transfers the current to the next channel.

9-28. REMOVING FRAGMENTATION BOMB RACK. The fragmentation bomb rack can be removed by an electrical emergency jettison release (paragraph 9-8) or a mechanical emergency release (paragraph 9-12). Be prepared to catch the rack as it is released. The rack weighs 126 pounds empty and 540 pounds loaded.

9-29. INSTALLING FRAGMENTATION BOMB RACK. Before installing fragmentation bomb rack, check rack for cleanliness and make sure all moving parts operate freely without binding. To install rack, proceed as follows:

a. Close bottom door in bomb rack rear compartment and make sure that door will lock and that latch does not bind during travel.

b. Close bottom door of bomb rack front compartment and force follower in rear compartment up against top of rack. Make sure that door is locked, allow follower to come down, and then check to see that door is unlocked.

c. Force follower in bomb rack front compartment up against top of rack, and check continuity of circuit through skip switch.

d. Remove wing bomb rack fairing, remove fragmentation bomb rack connector plug from stowage clip in wing, and drop plug out access hole in wing skin.

e. Install bomb rack fairing with leading edge door open and with fragmentation bomb rack connector plug through the opening.

f. Install empty fragmentation bomb rack in the same manner in which a bomb is loaded, engaging electrical connectors as rack is brought into position.

g. Install fragmentation bomb rack on opposite wing as explained in steps a. through f.

h. Temporarily fix followers in each front bomb rack compartment in the up position, latch rear bomb rack compartment doors, and make sure that fragmentation bomb indicator light is illuminated.

i. Set control and make sure that fragmentation bomb rack release solenoids operate; when they do, check that rear bomb rack compartment doors are unlatched. Then release front compartment followers.

9-30. MAINTAINING BOMB RACKS.

9-31. The bomb racks should require no maintenance or adjustment under normal use; however, the design is such that the side plate can be readily removed for cleaning or replacement of parts. If a bomb rack cannot pass the test preliminary to bomb loading, or if it has been known to have a slow release or to have failed to release, it should be disassembled, cleaned, and inspected. Defective units should be returned to the nearest depot for inspection.

Note

To prevent adherence of dust and grit, do not lubricate any bombing equipment. Frequent cleaning will ensure trouble-free operation. Clean racks with cleaning solvent (Federal Specification P-S-661 or similar) and dry with moisture-free air under high pressure. Do not allow cleaning fluids to contact solenoids located within bomb rack.

9-32. ROCKET SYSTEM.

9-33. Eight removable, zero-rail rocket launchers may be installed on the lower surface of each wing outer panel (four on each side) to provide mounting for 5-inch HVAR rockets. Each launcher carries two rockets, one mounted directly below the other. Arming, firing, salvo, and jettison release are accomplished electrically; a manual external store emergency release system (paragraph 9-12), installed on F-86E-1 Airplanes AF50-621, -623, -625, and -626, F-86E-5 Airplanes AF50-669 through -689, and F-86E-6 and subsequent airplanes, may be used to jettison the rockets in the event of electrical failure. The rockets are aimed by the use of the gun-bomb-rocket sight system. (Refer to paragraphs 9-131 and 9-180.)

9-34. FUNCTION OF ROCKET-FIRING CIRCUIT—AUTOMATIC RELEASE.

9-35. When an automatic release of the rocket-firing circuit is desired, the projector release control is set on "0," the rocket selector switch is placed on "AUTO," and the rocket jettison selector switch is moved to "OFF." Closure of the bomb-rocket release button directs power from the primary bus to the projector release control which in turn distributes firing impulses to predetermined rocket stations at $\frac{1}{10}$-second intervals. (See figures 9-5 and 9-6.) Upon release of the bomb-rocket release button, the firing action will cease.

9-36. FUNCTION OF ROCKET-FIRING CIRCUIT—SINGLE RELEASE.

9-37. When a single release of rockets is desired, the controls are set in the same positions as in paragraph 9-35, except that the rocket selector switch must be set on "SINGLE" instead of "AUTO." Each closure of the bomb-rocket release button will fire one rocket in the same firing order as shown on figures 9-5 and 9-6.

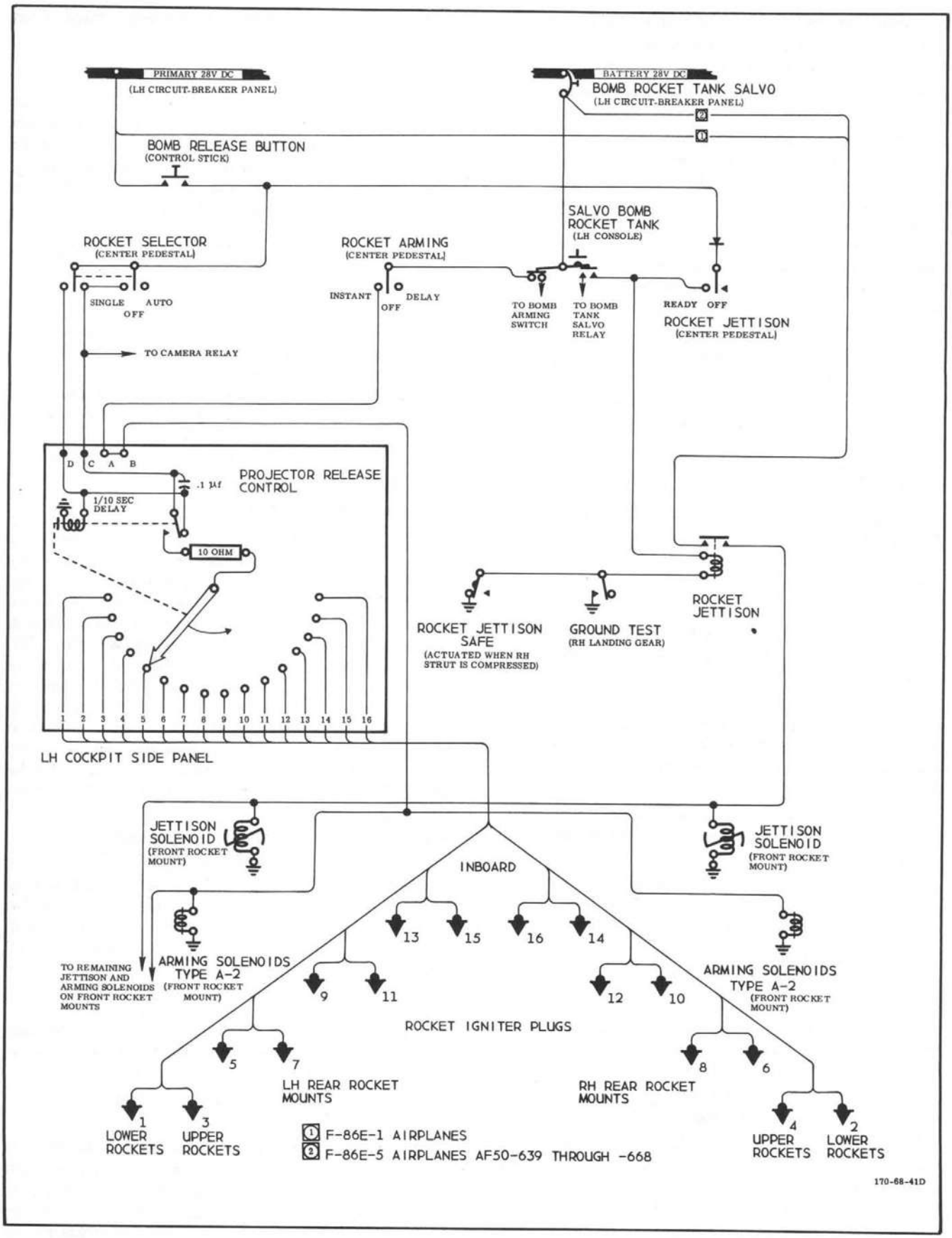


Figure 9-5. Rocket System—F-86E-1 Airplanes and F-86E-5 Airplanes AF50-639 Through -668

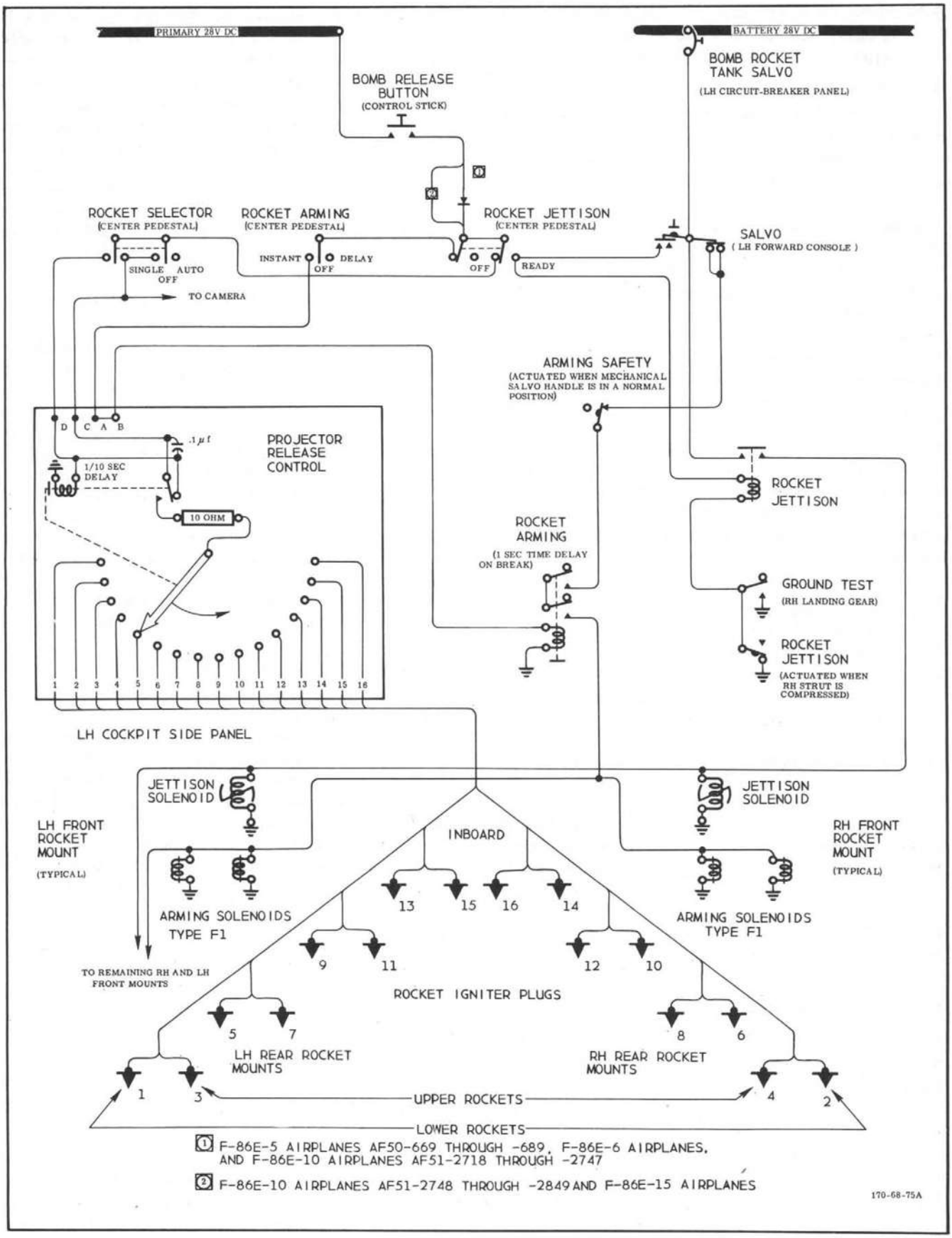


Figure 9-6. Rocket System—F-86E-5 Airplanes AF50-669 Through -689, and F-86E-6 and Subsequent Airplanes

9-38. FUNCTION OF ROCKET-ARMING CIRCUIT (F-86E-1 AIRPLANES AND F-86E-5 AIRPLANES AF50-639 THROUGH -668).

9-39. When the rocket-arming selector switch is placed on "INSTANT," the rocket-arming circuit is set so that rockets will detonate instantaneously upon impact. Power is routed from the battery bus through normally closed contacts of the bomb-rocket-tank salvo switch and through the rocket-arming selector switch to energize the rocket-arming solenoids. The arming circuit is then set so that when the rockets are fired, the energized arming solenoids retain the rocket nose fuse arming wire, thus setting the rocket nose fuse arming mechanism for instantaneous detonation. (See figure 9-5.) It should be noted that when the bomb-rocket-tank salvo button is pressed instead of the bomb-rocket release button, the rocket-arming circuit is automatically de-energized. To set the rocket-arming circuit so that rockets when fired are armed for delayed detonation, the rocket-arming switch is placed on "DELAY" instead of on "INSTANT." When the switch is on "DELAY," power is automatically disconnected from the rocket-arming solenoids so that when the rocket is fired the nose fuse arming wire remains with the rocket and therefore only the pressure fuse within the rocket will be in effect.

9-40. FUNCTION OF ROCKET-ARMING CIRCUIT (F-86E-5 AIRPLANES AF50-669 THROUGH -689 AND F-86E-6 AND SUBSEQUENT AIRPLANES).

9-41. When the rocket jettison selector is placed on "OFF" and the rocket-arming selector switch is placed on "INSTANT," the rocket-arming circuit is set so that rockets will detonate instantaneously upon impact. When the bomb-rocket release button is pressed, power from the primary bus is routed through the above switches to energize the rocket-arming relay. This relay then permits power from the battery bus to be directed through the normally closed contacts of the bomb-rocket-tank salvo switch, through the actuated arming safety switch (provided the mechanical salvo handle is in the normal position), and through the contacts of the previously closed rocket-arming relay to energize the rocket-arming solenoids. The rocket-arming solenoids in turn set the rocket nose fuses for instantaneous detonation. It should be noted that a $\frac{1}{10}$-second time delay on break is provided by the rocket-arming relay. To set the rocket-arming circuit so that rockets when fired are armed for delayed detonation, the rocket-arming selector switch is placed on "DELAY" instead of "INSTANT." When the switch is on "DELAY," power is automatically disconnected from the rocket-arming relay to prevent the rocket-arming solenoids from being energized when the bomb-release button is closed.

9-42. FUNCTION OF ROCKET JETTISON CIRCUIT.

9-43. When a jettison release of rockets is desired, the rocket jettison selector switch is placed on "READY" and the bomb-rocket release button is depressed. Power is then routed from the primary bus through the closed contacts of the jettison selector switch and the release button to actuate the rocket jettison relay, provided the landing gear strut is not compressed. (See figures 9-5 and 9-6.) Power from the battery bus is then directed through the contacts of the rocket jettison relay to actuate the rocket jettison solenoids, which in turn jettison all rockets. It should be noted that on F-86E-1 Airplanes and F-86E-5 Airplanes AF50-639 through -668 it is possible to jettison rockets while the nose fuse solenoids are energized; on all subsequent airplanes, it is not possible.

9-44. FUNCTION OF ROCKET SALVO CIRCUIT.

9-45. When the bomb-rocket salvo switch button, recessed in the left forward console ahead of the power control, is depressed, 28-volt power from the battery bus energizes the rocket jettison solenoid. Then power from the battery bus (except as noted on figure 9-5) is routed to release the rockets by energizing the jettison solenoid in each forward mount. (See figures 9-5 and 9-6.) Unarmed release is accomplished automatically as power to the arming circuit is interrupted when the salvo button is actuated.

9-46. TROUBLE SHOOTING ROCKET SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Rocket does not fire when selector switch is on "SINGLE" and bomb-rocket release button is pressed.	No power on circuit.	
	Defective bomb-rocket release switch.	
	Defective rocket release selector switch.	
	Projector release control reset knob not set.	
	Snap switch within projector release control not closing contact.	Tighten snap switch mounting screws, position adjustment screw until switch closes contact, or bend upper or lower spring assemblies to adjust.

TROUBLE	PROBABLE CAUSE	REMEDY
	Projector release control snap spring broken. Projector release control resistor burned out. Projector release control coils not energized or not activating armature. Projector release control finger contacts of finger assembly not touching disk contacts.	 Check power source. Replace contact finger assembly if broken.
Improper sequence of rocket firing.	Projector release control not functioning properly. Projector release control not set correctly, thereby not firing correct rocket first.	Replace control.
Rocket-arming solenoids are not energized when arming switch is placed on "INSTANT" position.	No power at rocket-arming switch. Rocket jettison switch defective. Rocket-arming switch defective. Defective wiring between rocket-arming switch and arming solenoids.	Check power source.
Rockets do not fire when selector switch is on "AUTO" and bomb-rocket release button is pressed.	No power on circuit. Defective bomb-rocket release switch. Defective rocket-release selector switch. Snap switch out of adjustment. Snap spring broken. Resistor burned out. Armature return spring broken or out of position. Finger contacts of finger assembly not touching disk contacts. Pawl out of adjustment.	 Position adjustment screw until snap switch operates. Replace or position spring as required. Replace if broken.
Rocket "stations" dial will not reset to number desired or will not center numeral under window.	Dial loose. Ratchet assembly loose on shaft. Pawl not releasing ratchet. Pawl spring broken.	Remove panel assembly, position dial properly, and tighten screws. Position and tighten screw. Replace projector release control.
Rocket jettison solenoids trip when airplane is on ground and rocket jettison switch is actuated.	The rocket jettison solenoids should not trip while on the ground unless rocket jettison test switch is actuated; therefore, rocket jettison safety switch is defective, rocket jettison test switch contacts are closed, or relay control circuit is shorted to ground.	Repair or replace defective switch or wiring.

TROUBLE	PROBABLE CAUSE	REMEDY
When airplane is on ground and while rocket jettison test switch is actuated, rocket jettison solenoids fail to trip when rocket jettison switch is actuated.	No power on circuit. Defective rocket jettison switch. No power at rocket jettison relay. Defective rocket jettison relay. Defective wiring between rocket jettison relay and rocket jettison solenoids.	

9-47. TESTING ROCKET SYSTEM.

9-48. Refer to step g. of paragraph 9-52.

9-49. BORE SIGHTING ROCKET SYSTEM.

9-50. The rear rocket mounts have provisions for adjusting the rockets in elevation. (See figure 9-8.) No provisions are incorporated for making adjustments in azimuth. Rocket bore-sighting information is given in figure 9-31.

9-51. LOADING ROCKET SYSTEM.

9-52. Prior to installing rockets, inspect front and rear mounts for cracks and damage. Make sure mounts are firmly secured. Then, with front mount jettison clamps open, insert a front rocket support band pin into position and make sure that support pin will slide downward freely in the same manner as if rocket were jettisoned. (See figure 9-7.) If binding is apparent, remedy it by removing burrs and other obstructions. Test operation of arming, release, and jettisoning circuits. Make sure a thorough continuity check (using a Type 680A continuity tester) has been accomplished on each rocket circuit. Rocket loading will proceed inboard to outboard on each wing, with the lower rounds secured prior to loading adjacent stations. First make sure that metal shipping container is over nozzle and igniter cable, and then load rockets as follows:

CAUTION

Only authorized personnel are to be permitted near airplane during and subsequent to rocket loading.

a. Make sure all rocket control switches are off and projector release control knob is on "1."

b. Cock each front rocket launcher by depressing cocking button on right side of each front rocket launcher. (See figure 9-9.) Then check launcher for a cocked condition by inserting a rocket shear wire into hole in fairing just aft of cocking button; full length of the wire should insert into this hole. Should hole be obstructed, mechanism of launcher is not locked.

c. Loosen front rocket lug band and set fins as shown in figure 9-7.

d. Lift rocket into position and engage igniter plugs with fin receptacles as shown on figure 9-7. (Make sure fin clamp bolts are on sides of rockets.) Slide front rocket lug band as required until the lug is engaged with front rocket mount. Make sure that zero clearance exists between aft face of igniter sockets on fins and stop shoulder at aft end of post igniter plugs. If both blades of fin will not stay in contact with shoulders of both igniter plugs when rocket is secured to front mount, a maximum gap of ⅛ inch is permissible at one blade of fin when the other blade is in contact. When rocket is installed properly, tighten bolts of front rocket lug band.

e. Secure rocket by inserting shear wire (furnished with lug band) in rocket support pin aft of front mount, and bend ends as shown in figure 9-7.

CAUTION

Use only shear wire spot-tacked to rocket lug band.

f. Mount second rocket by engaging lug band pin and fins with lug band and fins of upper rocket as shown in figure 9-7. Install shear wire.

g. Using a modified Type B-2 electrical circuit tester (modification consists of the addition of lead No. 8), plug leads into the lower sockets of upper rounds (right-hand socket fires first). Then, while holding the tester in position visible to man placed in the cockpit, signal man in cockpit to energize each successive rocket circuit (by depressing bomb rocket release button) at both single (with 2-second minimum duration of impulse) and automatic rate. Proper release sequence is shown on figures 9-5 and 9-6. Upon any glow, even slight or momentary, from a lamp out of proper sequence, mission must be cancelled until the malfunction is rectified. After testing one wing, remove tester leads and repeat procedure on opposite wing.

h. Complete arming and fusing of rockets in usual manner.

i. After engine is started prior to taxiing, and while the airplane is pointed toward an uninhabited area containing no buildings, first remove metal shipping container from the nozzle and igniter cable. Connect rocket

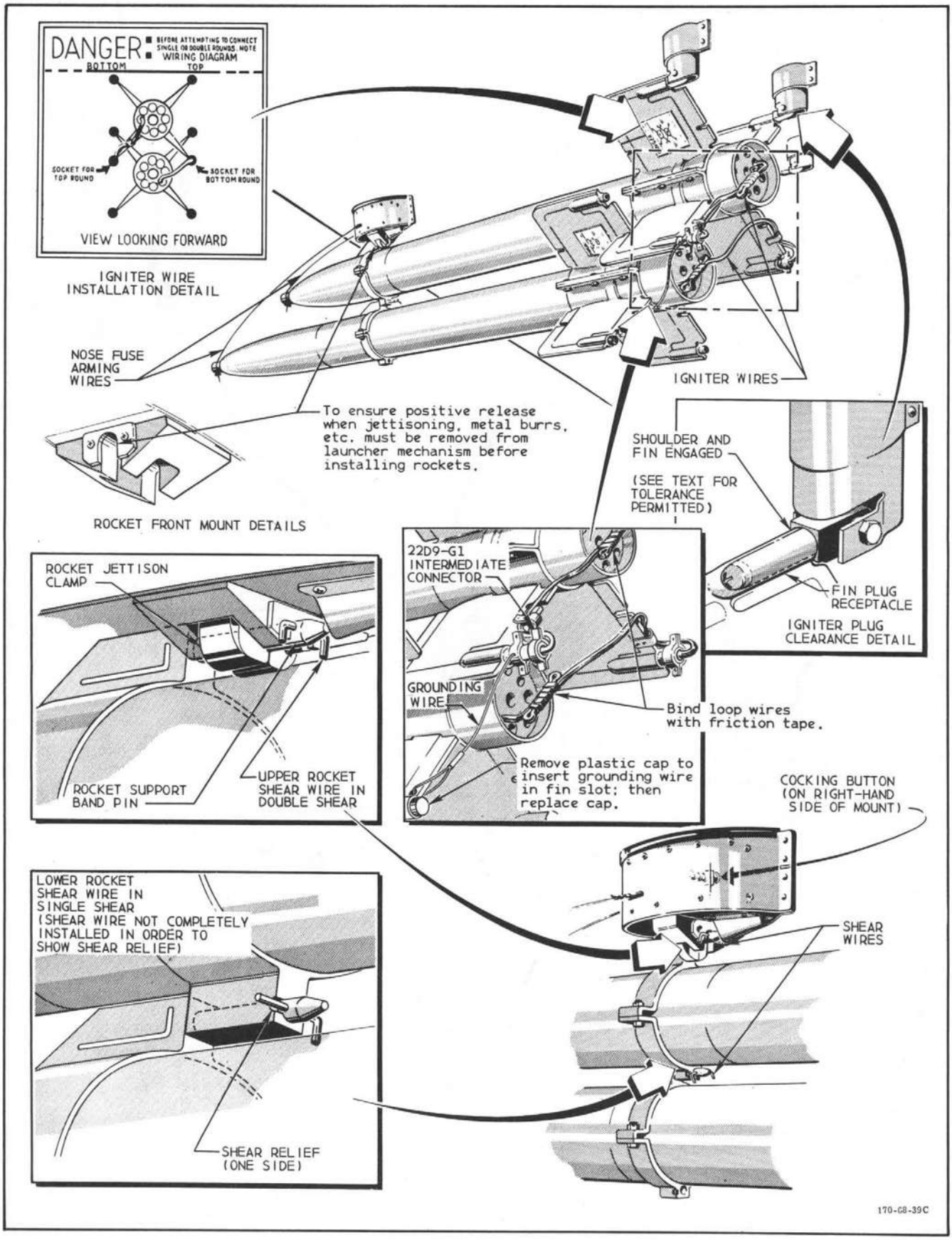
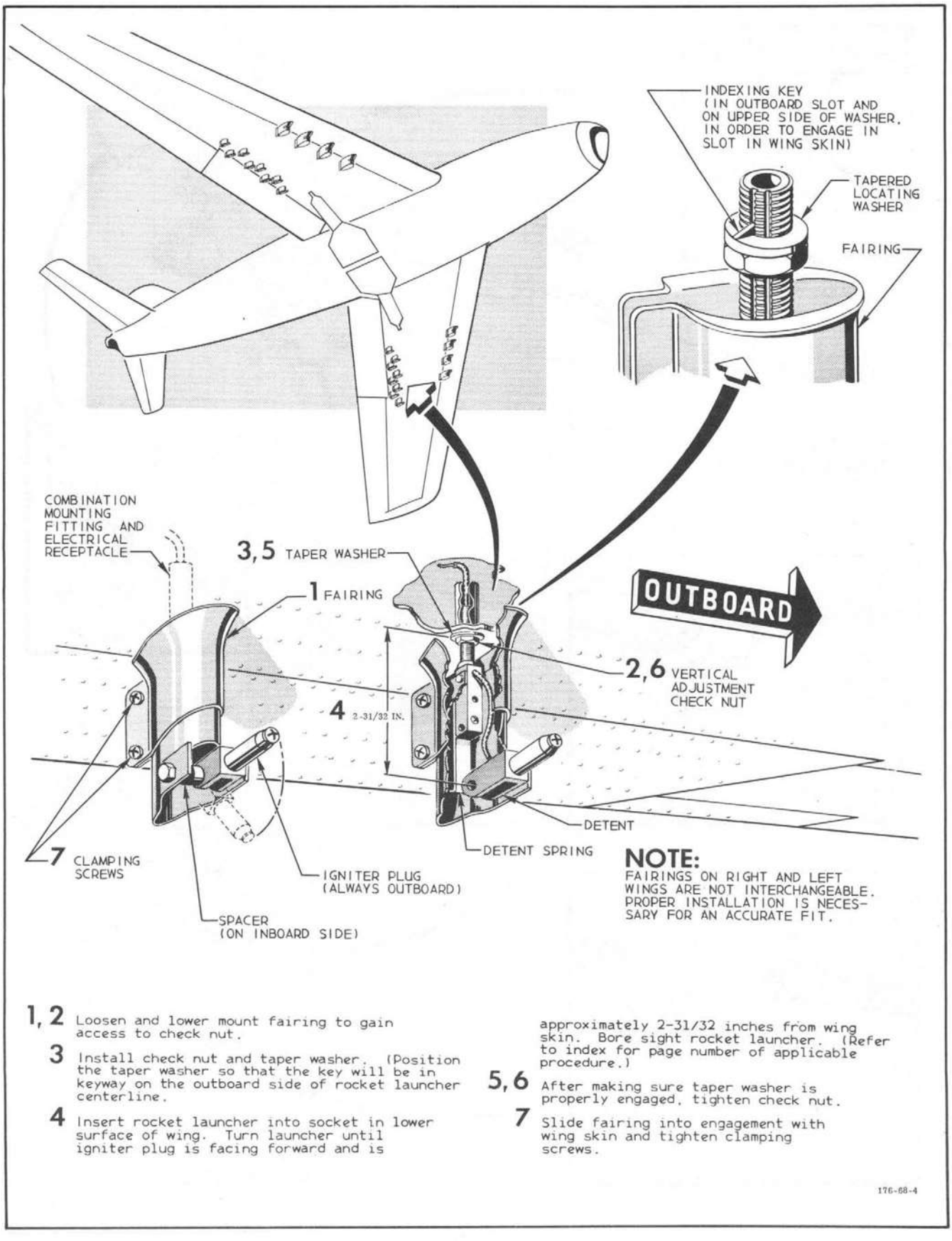


Figure 9-7. Rocket Loading Details



1, 2 Loosen and lower mount fairing to gain access to check nut.

3 Install check nut and taper washer. (Position the taper washer so that the key will be in keyway on the outboard side of rocket launcher centerline.

4 Insert rocket launcher into socket in lower surface of wing. Turn launcher until igniter plug is facing forward and is approximately 2-31/32 inches from wing skin. Bore sight rocket launcher. (Refer to index for page number of applicable procedure.)

5, 6 After making sure taper washer is properly engaged, tighten check nut.

7 Slide fairing into engagement with wing skin and tighten clamping screws.

176-68-4

Figure 9-8. Installing Rear Rocket Launchers

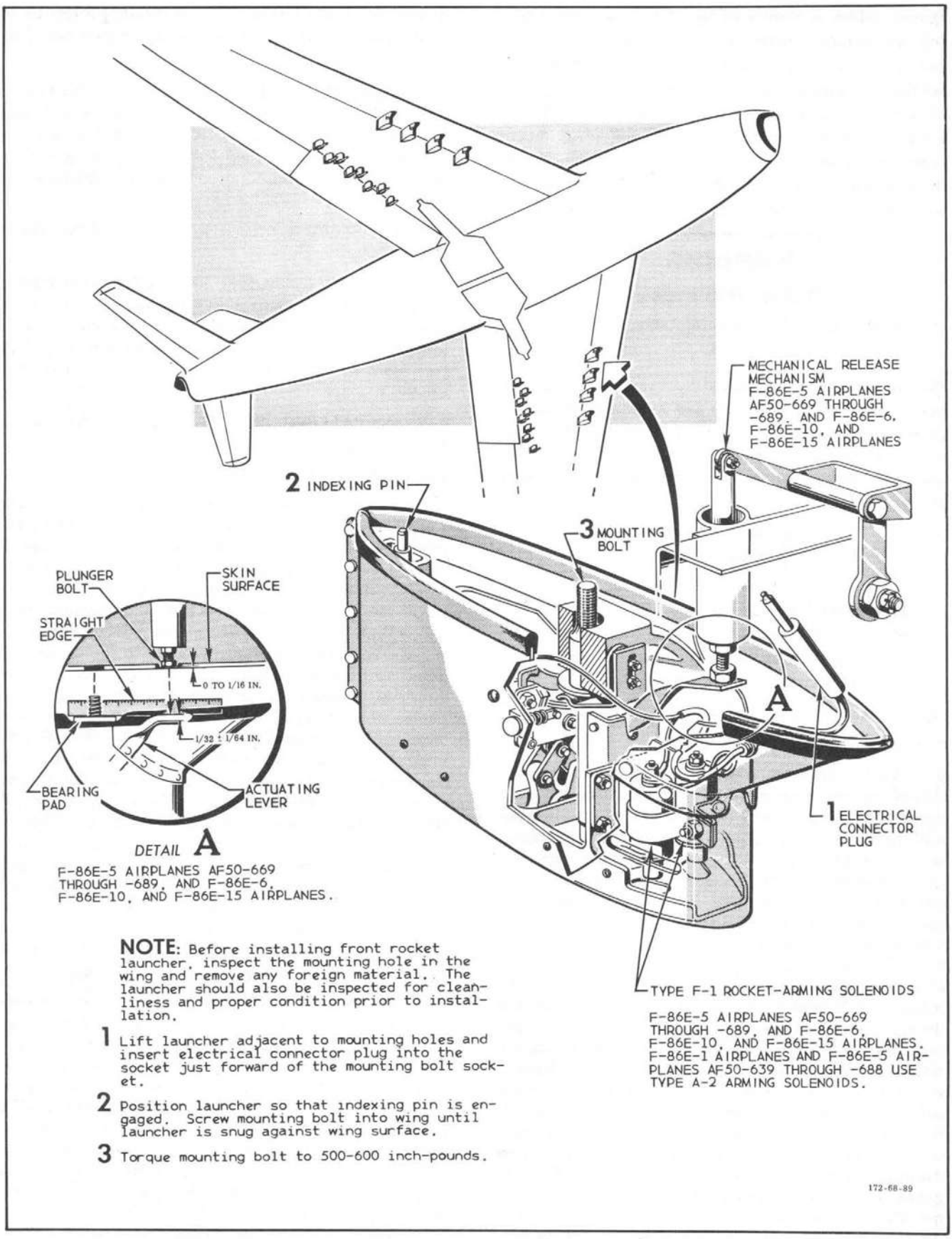


Figure 9-9. Installing Forward Rocket Launchers

igniter cables as shown in figure 9-7. (In every case, left rear mount is wired to fire bottom rocket. Rocket pin plug receptacles are cross-wired; therefore, connection of igniter plugs will always be the same as shown on diagram on fin.) Plugging in must be accomplished at either outboard station and must proceed completely across all launcher stations, armorer passing under fuselage after completing inboard station on one side and then to other wing, inboard to outboard.

WARNING

As engine will be running, stay away from nose and tail of airplane.

Plug-in is to be accomplished by a predesignated man upon a signal from the pilot and in an area cleared of personnel. Armorer must stand at arm's length at side of and *never behind rocket being plugged in* nor *immediately behind or in front of any rocket already plugged in.*

CAUTION

To prevent lower rocket from blasting upper rocket igniter cable loose, thereby leaving a dead upper rocket on rack, make sure igniter leads are secured as shown in figure 9-7.

Signal pilot when plug-in operations are completed.

9-53. ROCKET LAUNCHERS.

9-54. Each removable rocket launcher assembly consists of two rear mounts and a single front mount. (See figures 9-8 and 9-9.) The rear mounts, which incorporate the rocket igniter plug, have electrical connections within the mount post that make contact with an electrical receptacle in the wing when the mount is installed. The front mount houses the rocket jettison unit and two arming solenoids. The rocket jettison unit consists mainly of a rotary solenoid, a rotary sear, a lock, and a supporting clamp. The supporting clamp is held closed by the lock, which engages a shoulder on the rotary sear. Whenever the rotary solenoid is energized during salvo (jettison) release, it rotates, lifting the lock from engagement with the sear. This permits the weight of the rocket, in conjunction with a booster spring, to open the supporting clamp, causing the rocket to be released. Once the mechanism has been tripped, it is easily reset when the cocking button (on the right side of front rocket launcher) is pressed. This action manually rotates the rotary sear until the lock is engaged. The locked condition of the front mount can be quickly checked by insertion of a rocket shear wire into the hole in the mount fairing just aft of the cocking button. If the full length of the wire cannot be inserted, the mechanism is not locked. The two arming solenoids in each forward rocket mount accomplish rocket nose fuse arming.

9-55. REMOVING REAR ROCKET LAUNCHERS. Rear rocket mount fairing must be loosened and then lowered to remove rear rocket launcher. Vertical adjustment check nut is then loosened, indexing washer lowered, and mount unscrewed from its socket in wing. See figure 9-8.

9-56. INSTALLING REAR ROCKET LAUNCHERS. See figure 9-8.

9-57. REMOVING FRONT ROCKET LAUNCHERS. Launcher mounting bolt must be unscrewed from wing to remove front rocket launcher. The launcher is then lowered until electrical connector plug can be pulled free from socket in lower surface of wing. (See figure 9-9.)

9-58. INSTALLING FRONT ROCKET LAUNCHERS. See figure 9-9.

9-59. GUNNERY SYSTEM.

9-60. The gunnery system (figure 9-10) consists of six Type M-3 .50-caliber machine guns and related equipment. Three guns are installed in each gun compartment, located below and on each side of the cockpit. Ammunition compartments containing the ammunition boxes are located below the gun bays. Flexible feed chutes, equipped with quick-release attachments, convey the ammunition from the boxes to the individual guns. Ammunition boost motors, located between the guns and ammunition boxes, are provided. F-86E-1 Airplanes are equipped with G-9 gun-firing solenoids mounted on each gun. F-86E-5, F-86E-6, F-86E-10, and F-86E-15 Airplanes are equipped with automatic gun chargers containing gun-firing sear pin solenoids, thus eliminating the gun-firing solenoids. The gun charger air compressor and air bottle, located forward and below the ammunition compartment on the right side, provides the air pressure for the electropneumatic gun charger operation. Gunnery system electrical control switches are located on the center pedestal and the control stick. All F-86E Airplanes are equipped with a manual gun charging system and electric gun heaters.

9-61. FUNCTION OF GUNNERY SYSTEM.

9-62. To fire guns on F-86E-1 Airplanes, it is first necessary to manually charge the guns prior to flight. (See figure 9-11.) Placing gun-firing safety switch in "GUNS" position and depressing the gun-firing trigger simultaneously energizes the gun-firing solenoid relay, gun-firing solenoids, and ammunition boost motors. To fire guns on F-86E-5, F-86E-6, F-86E-10, and F-86E-15 Airplanes, it is necessary to place the gun-firing safety switch in "GUNS" position. Depressing the gun-firing trigger simultaneously energizes the gun-firing relay, gun charger return relay, and the 5-second time delay relay. Energizing the gun-firing relay routes current through pin "C" of the gun charger, energizing the

charger sear solenoid and opening the sear valve to permit compressed air to extend the sear actuator pin. Extension of the charger sear actuator pin engages the gun sear and fires the round as the gun bolt returns to the forward fire position. Simultaneously, the gun charger relay routes current to pin "B" on the gun charger and to the ammunition boost motor relay. Current entering pin "B" on the charger energizes the charger timer solenoid through switch (3, figure 9-11), pulling the lock bar, allowing the solenoid valve plunger to return to normal position, closing the inlet air valve, exhausting the charger, and permitting the gun bolt to return to the retracted position. The time delay relay, being energized simultaneously, "locks in" electrically and energizes the gun charging relay to route current to pin "A" on the charger. The time delay relay maintains current at pin "A" on the charger for 5 seconds after release of the gun-firing trigger. Release of the gun-firing trigger de-energizes the gun charger return relay and routes current to pin "K" on the time delay relay. Current entering pin "K" is dissipated in heat by the resistance type heater element within the time delay relay. Because of the rise in temperature, the thermal type switch (adjacent to the heater element) closes in 5 seconds to "short out" the time delay relay coil which allows the relay contacts to open and remove current from pin "A" on the charger. The current entering pin "A" on the charger energizes the timer solenoid through switch (1, figure 9-11). The solenoid plunger, when retracted, unlocks the timer mechanism and closes switch (2, figure 9-11). The timer mechanism drives the impact arm slowly forward from switch (3, figure 9-11) to the position where switch (4, figure 9-11) is closed and current flows through switches (2 and 4, figure 9-11) to the valve solenoid. Energizing the valve solenoid causes the spring-loaded solenoid plunger to retract, permitting the inlet valve to open and compressed air to enter the cylinder. The motion of the plunger also opens switch (1, figure 9-11), cutting off the current to the timer solenoid. When the timer solenoid plunger returns to its normal position, it drives the lock bar to the rear and the bar latches the valve solenoid plunger in its retracted position, allowing the inlet valve to remain open. The motion of the lock bar opens switch (2, figure 9-11), cutting off current to the valve solenoid. Thus the charger piston and bolt are moved to the rear by the air pressure, and no further current is consumed. The gun bolt stud, moving to the rear position, pushes the impact arm to the rear and closes switch (3, figure 9-11). During gunfire, pins "A" and "B" on the charger both carry current, but the impact arm cannot travel to its forward switching position because it is continuously driven to the rear by the gun bolt stud. This condition exists until a jam occurs, which allows enough time for the impact arm to travel forward; the charger then goes into operation. If ammunition is exhausted and the firing relay remains closed, the gun charger will continue to retract and return the gun bolt for as long as the air supply is sufficient. The gun chargers may be operated directly by use of the manual electric gun charger switch. Ammunition boost motor operation is intermittent, depending upon the amount of friction or pull required to feed the ammunition into the gun during gun firing. The gun charger return relay is simultaneously energized with the gun-firing relay when the gun-firing trigger is depressed and routes current to pin"D" on the boost motor and through the ammunition overfeed and last-round microswitches to energize the ammunition boost motor relay. The boost motor will operate continuously provided an ammunition overfeed condition does not open the overfeed switch. The last-round microswitch contacts open and stop the boost motor as the last round passes through the boost motor. The electric gun heaters are turned on and off when the switch is positioned as desired.

9-63. TROUBLE SHOOTING GUNNERY SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
GUNS, AMMUNITION BOOST MOTORS, AND GUN HEATERS		
One or more guns fail to fire.	Gun not loaded, charged, timed, or headspaced. Defective gun. Faulty ammunition or links. Ammunition is jammed between boost motor and gun. Boost motor assembly not functioning properly during high G. Damaged boost motor housing.	 Lift release wire connected to anti-rollback switch, and pull ammunition back over sprocket. Check ammunition chutes for bulges. Check last round switch and overfeed switch; if motor still does not operate, replace motor.
Boost motor fails to operate.	Faulty external wiring and connections.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Faulty internal wiring, or brush and commutator worn.	Replace boost motor.
Excessive current consumption.	Short circuit within motor.	Replace boost motor.
Antirollback not operating.	Antirollback spring malfunctioning.	Replace boost motor.
Sprocket will not free-wheel easily.	Boost motor mounting screws too long. Worn gear clutch or binding of felt seals.	Replace boost motor.
All guns fail to fire.	No power supply. Gun-firing safety switch not on "GUNS." Defective gun-firing switch. Gunfire time delay relay is defective. Gun-firing relay is defective. Open circuit caused by loose connections or defective wiring.	Replace control stick grip.
Ammunition fails to feed.	Defective gun-firing switch.	Replace control stick grip.
Gun heaters do not operate.	Gun heater switch not turned on. No power to heaters. Open circuit caused by loose connections or defective wiring.	
	AUTOMATIC GUN CHARGERS	
Leakage at inlet valve plunger when valve solenoid is energized.	Improper plunger adjustment. Foreign matter between ball and upper valve seat. Damaged upper valve seat. Defective steel ball.	Replace charger. Replace charger. Replace charger.
Leakage at inlet valve plunger when valve is closed.	Valve solenoid plunger adjustment screw out of adjustment. Foreign matter between ball and lower valve seat. Damaged lower valve seat. Defective solenoid plunger spring.	Replace charger. Replace charger. Replace charger.
Inlet valve does not open when valve solenoid is energized or when timer mechanism has completed its cycle.	Faulty wiring connections. Worn or damaged contacts. Damaged valve solenoid wiring. Excessive gap in solenoid. Improper solenoid plunger adjustment.	Replace charger. Replace charger. Replace charger. Replace charger.

TROUBLE	PROBABLE CAUSE	REMEDY
Inlet valve does not close during electrical operation.	Excessive timer solenoid air gap.	Replace charger.
Timer mechanism does not operate when timer solenoid is energized.	Faulty wiring connections. Damaged timer solenoid wiring. Damaged timer spring. Foreign matter between timer mechanism gear teeth causing jam. Lack of lubrication. Improper clearance of escapement interference arm.	 Replace charger. Replace charger. Lubricate. Replace charger.
Leakage at sear valve when solenoid is energized.	Foreign matter between ball and upper valve seat. Damaged upper valve seat. Defective steel ball. Solenoid plunger out of adjustment.	 Replace charger. Replace charger. Replace charger.
Leakage at sear valve when valve is closed.	Foreign matter between ball and lower seat. Damaged lower seat. Damaged solenoid plunger spring. Defective steel ball.	 Replace charger. Replace charger. Replace charger.
Leakage through parts of the charger other than valves.	Defective "O" ring packings. Scratched or nicked "O" ring packing seating surfaces. Lack of lubrication. Damaged parts or cracked silver-soldered joints.	Replace charger. Replace charger. Apply 20 drops of low temperature oil into the pressure inlet and operate the charger. Operate the sear valve first in order to prevent the oil being blown out. Replace charger.
Sluggish discharge.	Insufficient exhaust check lubrication. Chips or scratches in the exhaust valve bore. Chips or foreign matter inside the exhaust check. Damaged "O" ring packing on the air tube.	Apply oil through pressure inlet and operate the charger. Replace charger. Replace charger.
Poor mounting on gun.	Worn disconnect spider.	Replace spider.

9-64. BORE SIGHTING GUNS.

9-65. The guns may be adjusted ¼ degree in both azimuth and elevation during bore-sighting operation by adjustment of the rear gun mounts. To make mount elevation adjustment, use tool T224. (See figure 9-12.) Detent springs in the mount adjustment knob lock the adjustment screw. To align the airplane to the target board, refer to paragraph 9-194 or 9-196; then using a breech-type bore-sighting tool, align the guns to their respective sighting marks on the target board.

9-66. LOADING AMMUNITION.

9-67. Each gun (figure 9-13) is fed normally by 267 rounds of .50-caliber ammunition stowed in a removable container directly below the gun bay. (Each container

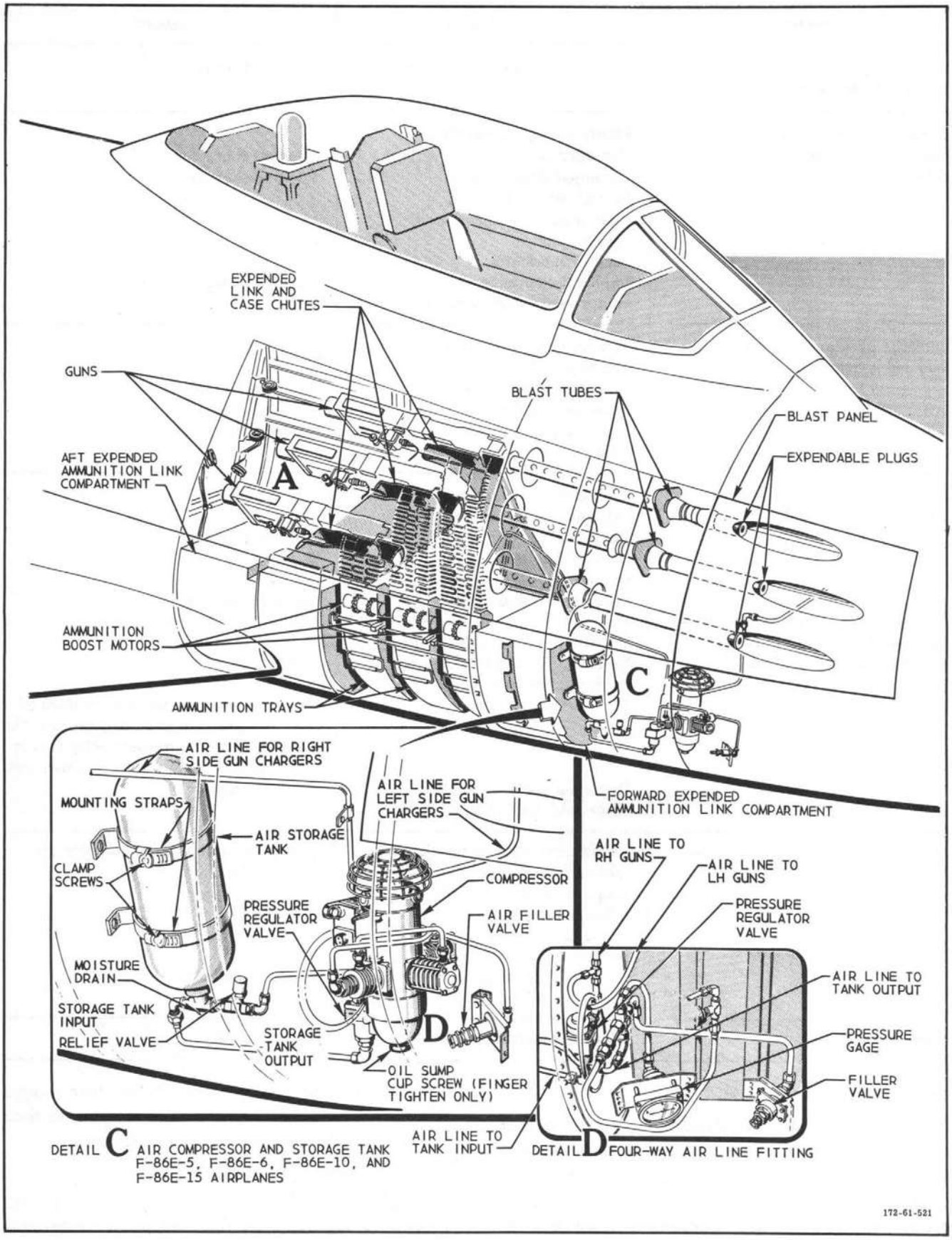


Figure 9-10. Gunnery System (Sheet 1 of 2)

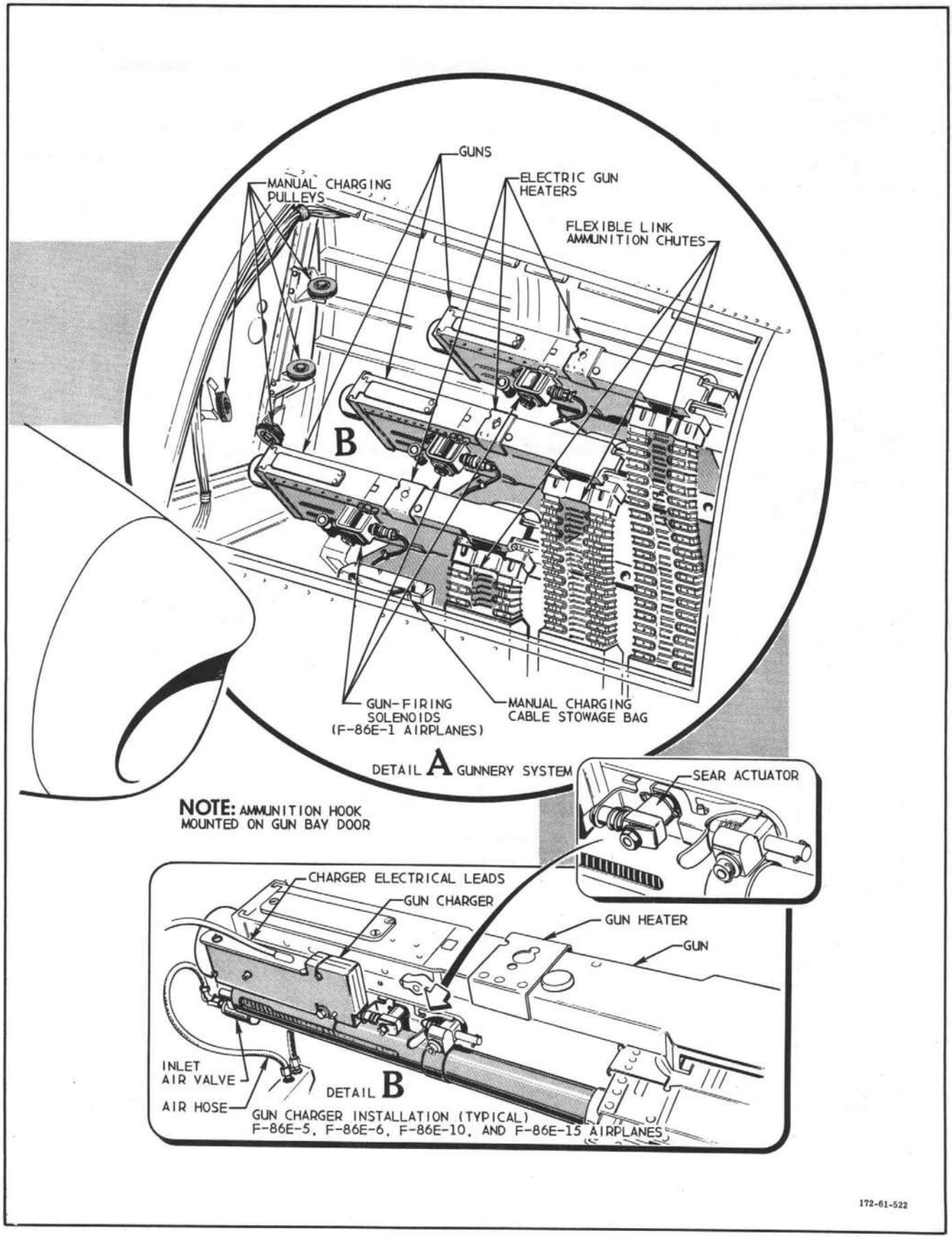


Figure 9-10. Gunnery System (Sheet 2 of 2)

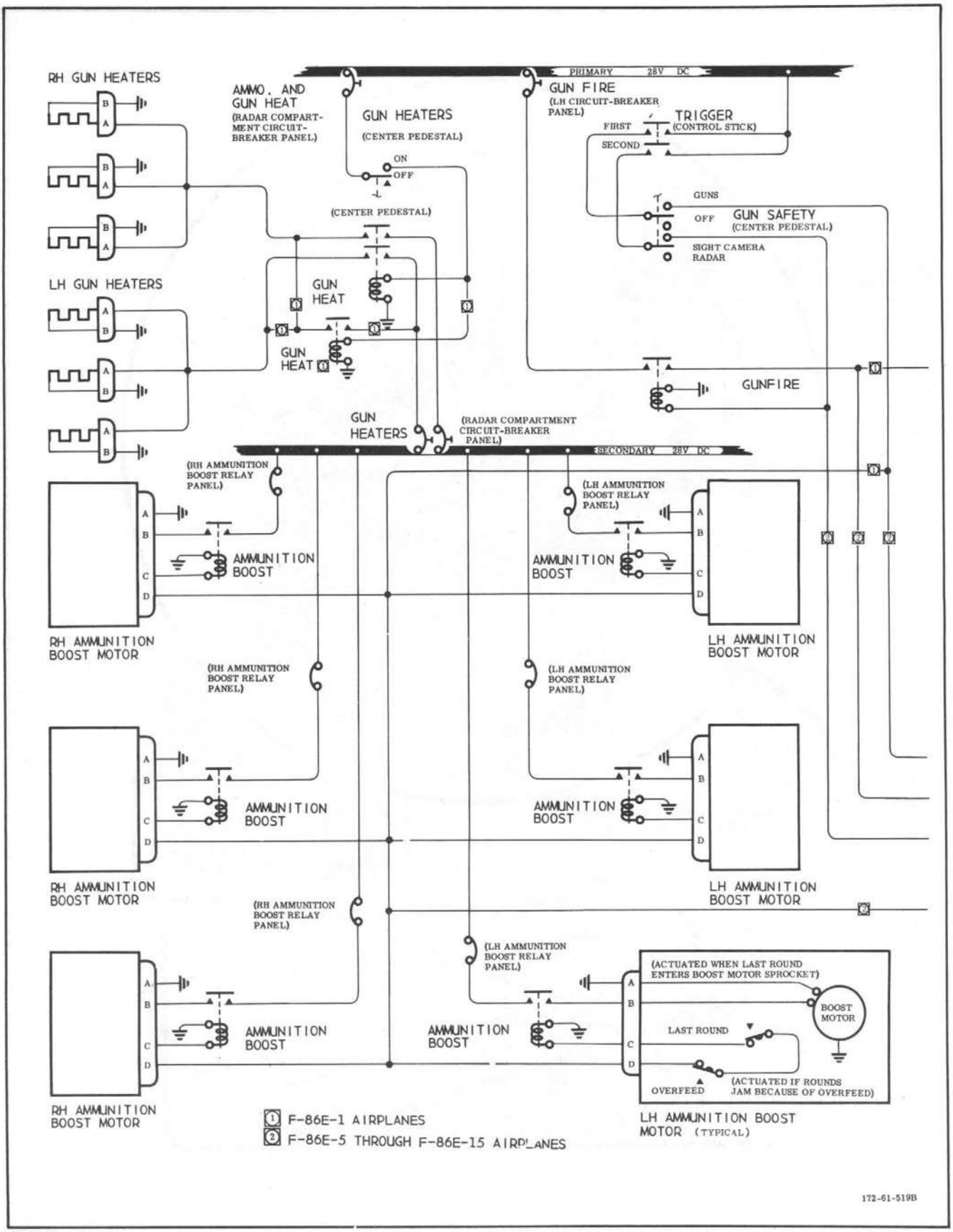


Figure 9-11. Gunnery System Electrical Schematic (Sheet 1 of 2)

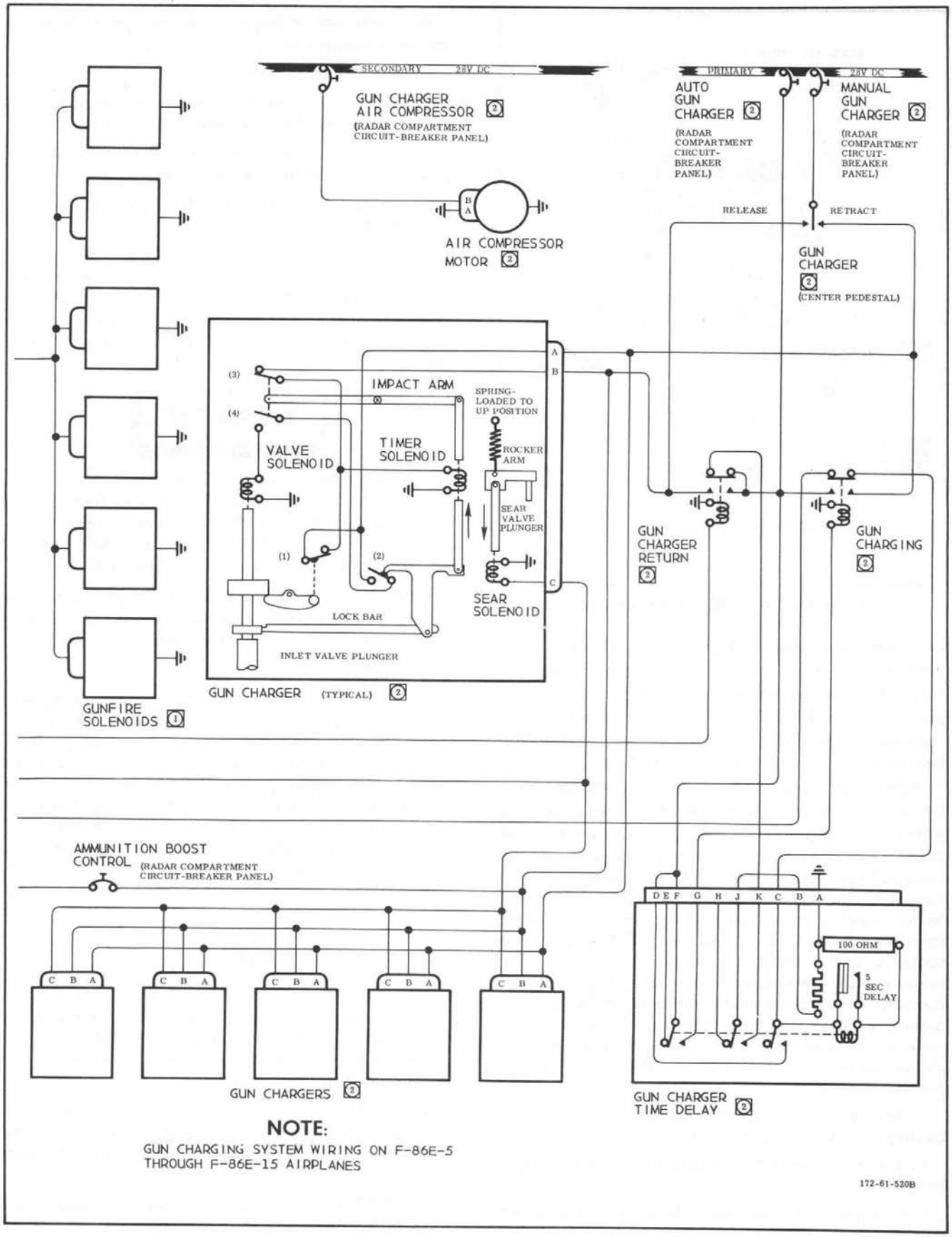


Figure 9-11. Gunnery System Electrical Schematic (Sheet 2 of 2)

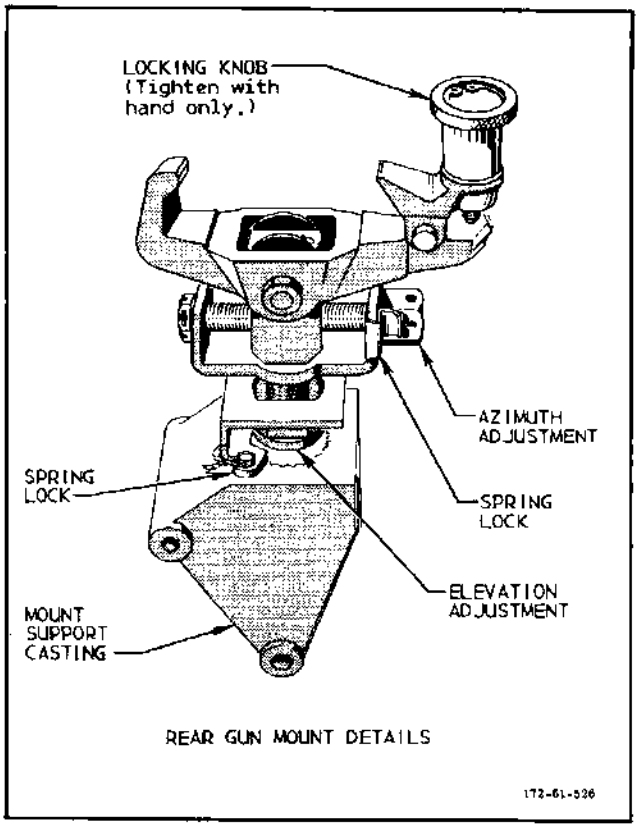


Figure 9-12. Gun Mount Adjustments

has a maximum capacity of 300 rounds.) Gun bay doors provide quick access to each bank of guns. A separate access door on each side of the fuselage just below the gun bay is provided to remove and load the ammunition containers. A hook is provided to lift the ammunition belt from the container through the boost motor and flexible feed chute. The ammunition compartment access doors, when support cables are properly engaged, provide support for ammunition containers while they are being engaged with their respective tracks. Ejected cases and links are retained in special compartments in the front and rear of the ammunition compartment. Before loading ammunition, make sure all armament switches are off. Open the gun bay and ammunition access doors (set the ammunition access doors in the semilowered position), and make sure guns have been inspected for proper headspace, timing, and security of mounting. Make sure feed chutes are aligned with the ammunition containers and gun feedways and all feed chutes are secured; then load the ammunition in the following manner:

a. Remove ammunition containers and load them according to instructions on each container.

b. Install ammunition containers in their proper bays.

c. Using ammunition loading hook, lift ammunition past the boost motors, making sure double end of link enters gun first.

d. Charge one or more rounds through each gun to test functioning, feeding, and ejection.

e. Stow loading equipment.

f. Make sure ejected link and case compartments are empty and access doors are installed and secured.

g. Close and secure gun and ammunition bays. Install gun muzzle expendable rubber plugs.

9-68. REMOVING EXPENDED BELT LINKS AND CASES.

9-69. The expended belt links and cases (figure 9-13) are routed from the guns through fixed chutes to stowage compartments. Access to the forward expended belt link and case stowage compartment is through an access door on each side of the auxiliary landing gear wheel well.

WARNING

Before entering the nose wheel well area, be certain that hydraulic system pressure has been exhausted and that the landing gear selector handle is in the "DOWN" position. Refer to paragraph 1-7 to open nose wheel well door.

The belt links and cases are removed from the aft compartments when access covers just aft of the ammunition compartment doors are opened.

9-70. GUNS.

9-71. The six Type M-3 .50-caliber machine guns (figure 9-10) installed in F-86E Airplanes are automatic, recoil-operated, air-cooled machine guns having a high rate of fire. The guns may be removed and replaced without bore sighting, provided the rear gun mount azimuth and elevation adjustments are not disturbed. The guns must be cleaned, adjusted, serviced, and checked for operation prior to installation. The front gun mount casting mounting bolts must have stainless steel washers under bolt heads and nuts, and they must be torqued to 430 inch-pounds.

CAUTION

Gun firing may loosen gun mount casting mounting bolts not torqued to 430 inch-pounds and damage could result. Therefore, periodic tightening is necessary.

The gun muzzles must be smooth and the front barrel bearing screws should be flush with the surface to prevent the gun muzzle locking with the blast tube snap ring seal.

9-72. REMOVING GUNS. To remove the guns, open the gun bay doors and proceed as follows:

a. Remove gun heaters. (Refer to paragraph 9-86.)

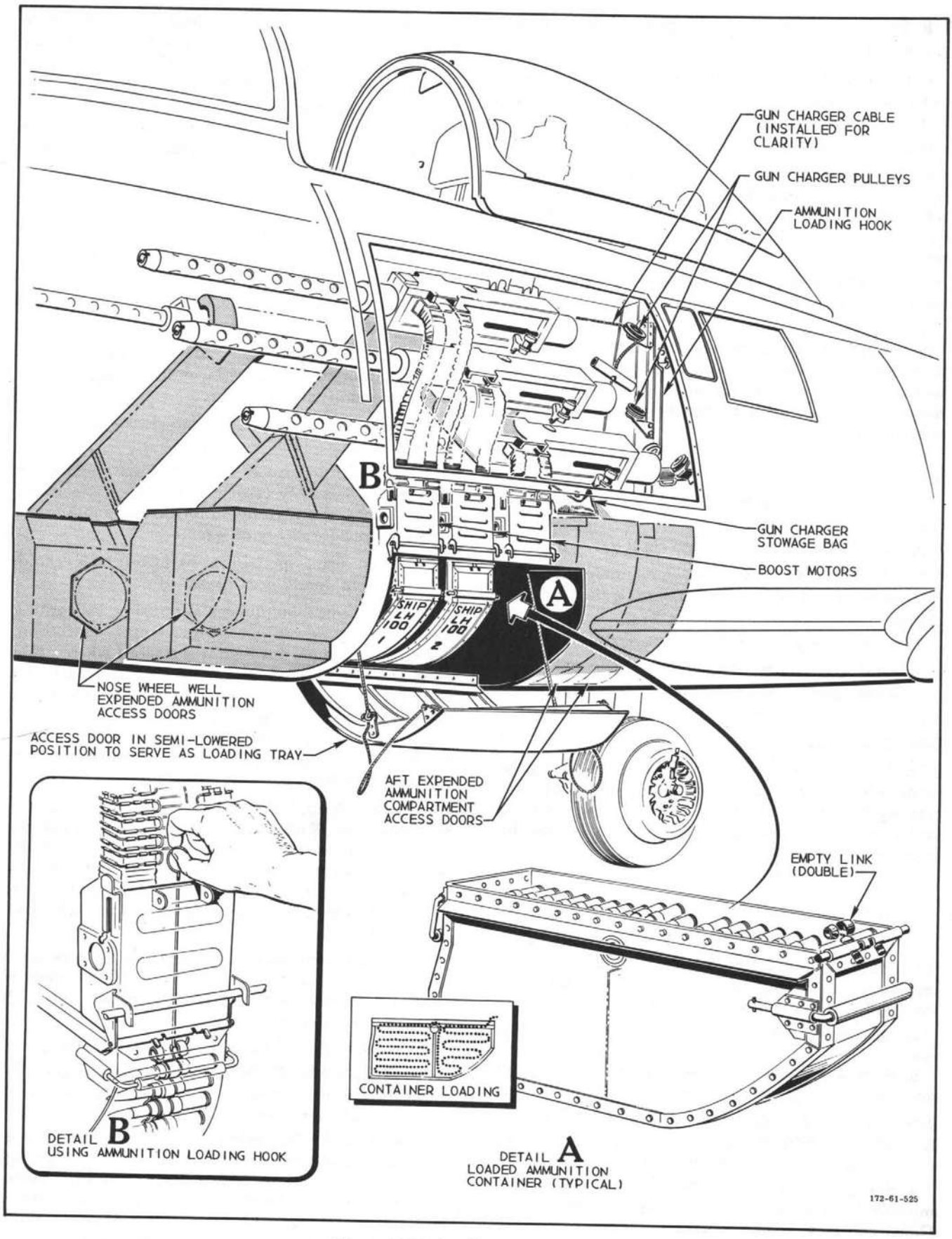


Figure 9-13. Loading Ammunition

b. Remove automatic gun chargers. (Refer to paragraph 9-82.)

c. Open gun cover and remove ammunition feed and link ejection chutes.

d. Loosen rear mount clamp by pulling out and turning locking knob.

e. Pull out on front mount pin, while turning it to overcome binding, and lift guns from mounts. The blast tubes, through which the gun barrels are inserted, incorporate sufficient flexibility to permit the guns to be removed.

9-73. INSTALLING GUNS. To install the guns, open the gun bay doors and proceed as follows:

a. Insert gun barrel carefully into applicable blast tube. Align gun for mounting; the weight of the gun or a slight additional pressure will engage the front mount. Pull on rear mount locking knob and turn *finger-tight*. The gun will then be firmly secure; no safetying is required.

b. Bore sight guns if necessary. (Refer to paragraph 9-65.)

c. Install gun chargers and gun heaters. (Refer to paragraphs 9-83 and 9-85.)

d. Install link ejection and feed chutes.

9-74. MAINTAINING GUNS. To maintain the guns, refer to paragraph 9-72 for gun removal; then proceed as follows:

a. Disassemble gun and clean all parts thoroughly.

b. Make necessary repairs or replace defective parts.

c. Service and lubricate working parts as required.

d. Refer to paragraph 9-73 for gun installation.

9-75. GUN-FIRING SOLENOIDS.

9-76. F-86E-1 Airplanes are equipped with G-9 gun-firing solenoids with a removable adjustment cap, retaining flange, and locking levers so the solenoid armature and plunger may be disassembled from the solenoid.

Note

All G-9 gun-firing solenoids that do not have the afore-mentioned parts are not to be used.

9-77. REMOVING GUN-FIRING SOLENOIDS. To remove the gun-firing solenoids from the guns, open the gun bay doors and proceed as follows:

a. Disconnect electrical gun-firing plug from solenoid.

b. Remove cotter pin and securing shear nut from solenoid attaching bolt, and lift solenoid free of gun.

9-78. INSTALLING AND ADJUSTING GUN-FIRING SOLENOIDS. Before installing the gun-firing solenoid on gun, make adjustments as follows:

a. Energize solenoid with 28-volt direct current and measure from tip of plunger to solenoid base plate. Dimension must not be less than 0.322 inch, and not more than 0.337 inch.

b. De-energize solenoid and measure sear plunger in same manner as in preceding step a. Dimension must not exceed 0.212 inch. The minimum allowable amount of adjustment is 0.100 inch. When the solenoid is energized, with the sear plunger adjusted to the fully extended position, the measurement is 0.337 inch. The plunger adjustment must be capable of being adjusted down to 0.237 inch or less.

Note

Gun-firing solenoids not meeting these dimension requirements must be removed and replaced.

c. Place solenoid on side plate of gun with electrical connector plug pointing to front of gun.

d. Fasten solenoid to gun side plate with solenoid mounting bolt, and install shear nut; then tighten bolt shear nut and install cotter pin.

e. Rotate solenoid adjustable cap clockwise to maximum position.

f. Cock gun and insert the "NO-FIRE" 0.116-inch gage of gage assembly (Part No. 41G201-175) between barrel extension and trunnion block, and allow barrel extension to close slowly on gage.

g. Release firing mechanism by operating solenoid. The firing pin should not be released.

h. Adjust solenoid plunger protrusion by turning solenoid adjusting cap in a counterclockwise direction, one notch at a time, until point is reached where firing mechanism is just consistently released with the "NO-FIRE" gage inserted between trunnion block and barrel extension. The adjustment must be made with the driving spring assembled in the gun. The gun must be charged each time the solenoid is energized, whether the firing mechanism is released or not.

i. Rotate solenoid adjusting cap one notch in a clockwise direction. With this setting, the gun will not fire at 0.116 inch out of battery, but will fire prior to 0.020 inch out of battery. The setting may be checked with the "FIRE" 0.020-inch and "NO-FIRE" 0.116-inch gages. This check must be made with the back plate assembled on the gun.

j. Tighten solenoid adjusting cap locking screws and secure all four screws with safety wire, then apply a spot of red paint on the adjustable cap and solenoid base for adjustment reference.

k. Connect gun-firing solenoid electrical plug.

9-79. CLEANING GUN-FIRING SOLENOIDS. To clean the gun-firing solenoids, refer to paragraph 9-77 for solenoid removal, and proceed as follows:

a. Remove the four fillister head screws and remove adjusting cap clamping washer, adjusting cap retaining flange, spring washer, and plunger assembly. These parts may then be placed in carbon tetrachloride (Federal Specification O-C-141) for cleaning. After cleaning, thoroughly dry all parts before reinstallation.

b. Clean out inside of brass cylinder and plunger operating hole.

Note

Do not allow cleaning fluid to enter the solenoid coil. If cleaning fluid does contact the coil, dry with compressed air.

c. Reassemble the solenoid and safety-wire four fillister head screws.

Note

The gun-firing solenoids should be removed and replaced after 10,000 rounds of ammunition have been fired.

d. Install gun-firing solenoids. (Refer to paragraph 9-78.)

9-80. AUTOMATIC GUN CHARGERS.

9-81. Automatic gun chargers are installed on each of the six M-3 machine guns. The charger units are driven by compressed air and utilize 28-volt direct current for operation of control circuits. The charger performs the following functions: charges the guns by remote electrical control from the cockpit, holds the gun in retracted position for purposes of safety and to permit cooling of the gun (there is no electrical circuit demand while the gun is being held in the retracted position), automatically charges the gun during gunfire when a failure to fire occurs, and fires the gun by the use of an electro-pneumatic sear actuator contained in the charger. The charger consists of a timer mechanism operated by a timer solenoid, which releases the mechanism; a solenoid-operated inlet valve, used in conjunction with a piston and cylinder and a double-acting exhaust valve; and a sear actuator pin, contained in the bracket and sear actuator assembly and controlled by the sear valve and solenoid. Both the piston and sear actuator pin are operated by pneumatic pressure when the proper circuits are energized. Front and rear tabs are provided on the top of the charger for manual operation of the timer and valve solenoids. A button is also provided on top of the sear solenoid for manual operation of sear actuator pin when the charger is connected to the compressed air source. The piston is retracted when the rear tab is lifted and is released when the front tab is lifted. The bracket and sear actuator assembly provide the means of mounting the charger on the gun, and the sear actuator pin controls the firing action of the gun. The inlet valve solenoid, inlet valve, piston and cylinder, and double-action exhaust valve provide the means for retracting and releasing the gun bolt.

9-82. REMOVING AUTOMATIC GUN CHARGERS. To remove the automatic gun charger unit, disconnect the electrical connector plug and the air pressure line from the gun charger. Pull the disconnect spider arm forward to release the gun charger from the gun.

9-83. INSTALLING AUTOMATIC GUN CHARGERS. To install the gun charger, place it in its proper mounting position next to the gun. (See figure 9-10.) Pull the disconnect spider arm forward, and position the gun charger so that the wedge bolt engages in its mount. Release the disconnect spider. Prior to installing the air pressure hose, carefully inspect hose disconnects for dirt, grease or grit. If necessary, clean disconnects and then connect the electrical plug to the automatic gun charger.

9-84. ELECTRIC GUN HEATERS.

9-85. The Type J-4 electric gun heaters installed on the guns consist of a 100-watt, 28-volt d-c copper-faced heating element. The heating element is enclosed in a spring steel case designed to clamp on the gun breech. A rubber-covered electric cord is provided to connect the heater to the airplane electric system.

9-86. REMOVING ELECTRIC GUN HEATERS. To remove the electric gun heaters, disconnect the electrical plug and pull the heater off the gun breech by forcing the spring steel case.

9-87. INSTALLING ELECTRIC GUN HEATERS. To install the electric gun heaters, proceed as follows:

a. Place gun heater on gun breech with cord toward gun barrel.

b. Use force to press spring steel case over gun breech and slide heater until hole in case fits over rivet on gun breech; connect electrical plug.

c. Open gun breech door after heater installation to determine heater cord and gun breech door clearance.

Note

Make certain that the heater element firmly mates to the gun breech; otherwise, the absence of sufficient metal surface (for proper heat dissipation) will burn the heater element out.

9-88. AMMUNITION BOOST MOTORS.

9-89. Hughes 110-2100 and -1 or AiResearch 29492-1 and -2 boost motors (figure 9-14) may be installed. In function and interchangeability, they are identical. The .50-caliber boost motor assembly, consisting primarily of an ammunition boost motor and switches, is mounted in a housing and installed directly above each ammunition container. The motor assists the guns in lifting ammunition from containers. The motor drives a double sprocket which engages the ammunition-filled belt links. The boost motor is equipped with an antirollback device to prevent ammunition from creeping backward. In case of an ammunition belt jam between the boost and the gun, a lift of approximately ¼ pound (effecting a total travel of no more than ¼ inch) must be exerted on the wire at the top forward face of the housing to release the antirollback mechanism before the ammunition can be pulled back through the sprockets. Lifting this wire does not cause the boost motor to free-wheel. A 30- to 35-pound pull is required

on the ammunition belt to overcome the force of the 120-to-1 gear ratio between the sprocket and boost motor.

9-90. REMOVING AMMUNITION BOOST MOTORS. Remove the ammunition boost motors as follows:

a. Open gun compartment door.

b. Disconnect ammunition feed chute.

c. Disconnect electrical connector from boost motor.

d. Open ammunition compartment door, and disengage latch connecting boost motor to ammunition container; then lift ammunition boost motor from airplane.

9-91. INSTALLING AMMUNITION BOOST MOTORS. Prior to installing ammunition boost motor assembly, inspect the boost motor housing for distortion or similar damage. Make sure all parts operate freely and are adjusted correctly. (See figure 9-14.) Determine that the wiring has no abrasions, kinks, or loose connections. The antirollback release wire should be straight and must operate freely in its guides. Install each ammunition boost motor as follows:

a. Open gun bay and ammunition compartment doors.

b. Position ammunition boost motor so that support hooks engage on support rod, and then engage upper latch with holes in flange at top of boost motor.

c. Engage latch on ammunition container with holes in flange on boost motor.

d. Secure electrical connector to boost motor.

9-92. ADJUSTING AMMUNITION BOOST MOTOR MICROSWITCHES. To adjust the ammunition boost motor microswitches, see figure 9-14.

9-93. GUN CHARGER AIR COMPRESSOR AND AIR BOTTLE.

9-94. The air compressor and air bottle (figure 9-10) are located on the right side of the airplane just forward of and below the guns. The compressor consists of a motor-driven, three-stage air pump and an air bottle. A water drain is provided on the bottom of the air bottle to

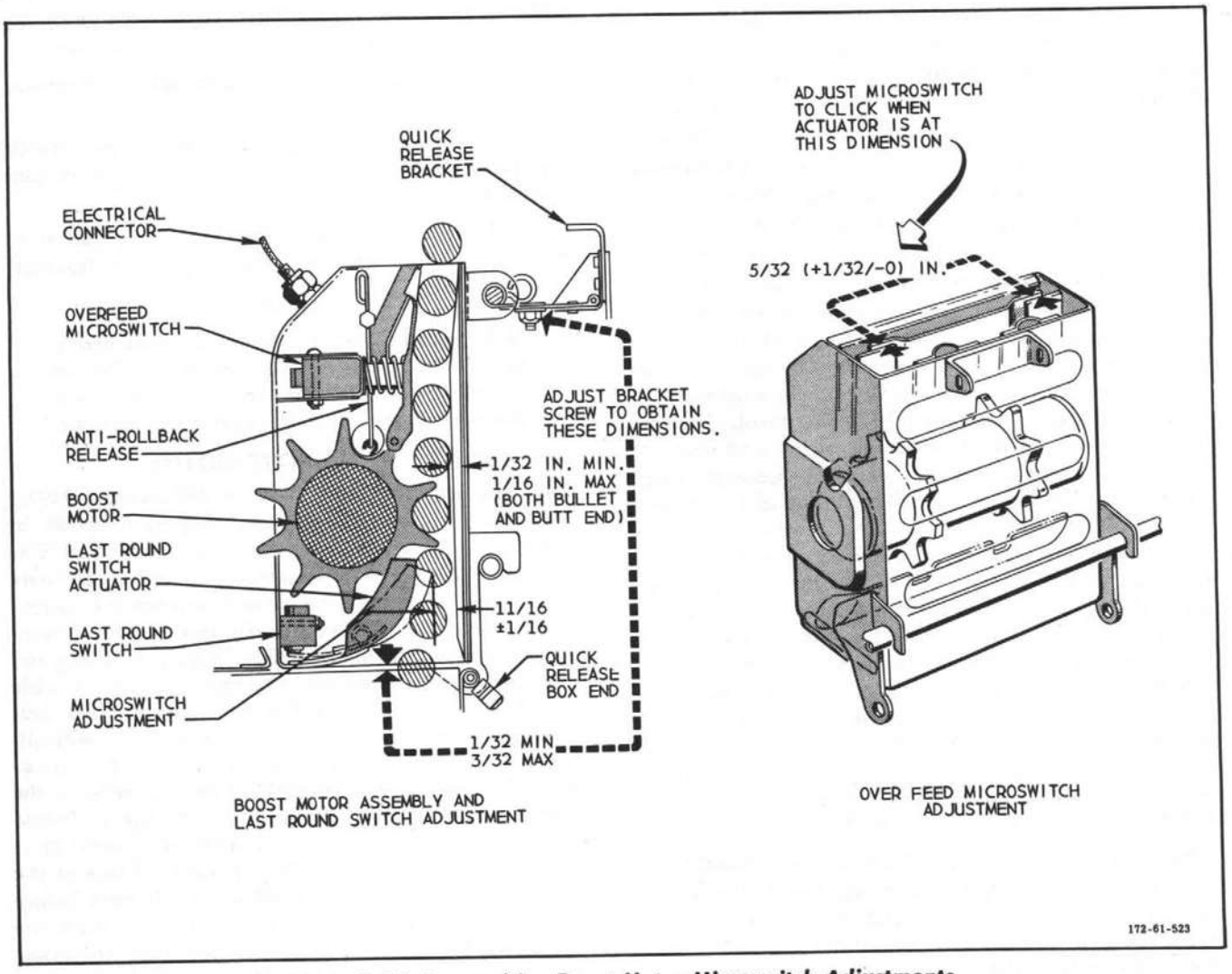


Figure 9-14. Ammunition Boost Motor Microswitch Adjustments

allow accumulated moisture to be removed. The pump maintains a pressure of approximately 1700 psi in the air bottle for operation of the automatic gun charger. A relief valve is incorporated in the system to relieve air bottle pressure if it becomes too high because of altitude and temperature changes. Preliminary charging of the air bottle is possible when an external high-pressure air line is connected to the filler valve. This eliminates the necessity of waiting for the compressor to charge the air bottle to the required 1700 psi preceding operation of the chargers.

9-95. REMOVING AIR COMPRESSOR AND AIR BOTTLE. To remove the air compressor and air bottle (figure 9-10), first disconnect the following interconnecting air lines: the air line interconnecting the air compressor and air bottle, the air line connected to the air bottle to supply the pressurized air to the automatic gun chargers, and the air line from the air compressor which terminates at the four-way junction. After removing these air lines, disconnect the electrical connector plug from the air compressor. The air compressor can be released after the four mounting bolts securing it to its mount have been removed. To remove the air bottle, loosen the wing screws on the two mounting straps that secure the air bottle to its mount.

9-96. INSTALLING AIR COMPRESSOR AND AIR BOTTLE. To install the air compressor, hold it in mounting position next to its mount and insert the four mounting bolts as shown in figure 9-10. Secure the mounting bolts. To install the air bottle, position it within its mounting straps and tighten the wing screws to secure the air bottle in place. Connect the air lines to the air compressor and air bottle and the electrical connector to the air compressor.

9-97. GUN BLAST PANELS AND TUBES.

9-98. Open-port gun blast panels (figure 9-15), gun blast tubes, and expendable rubber plugs are provided. The expendable rubber plugs provide a seal to prevent dust and moisture from entering the gun compartment and

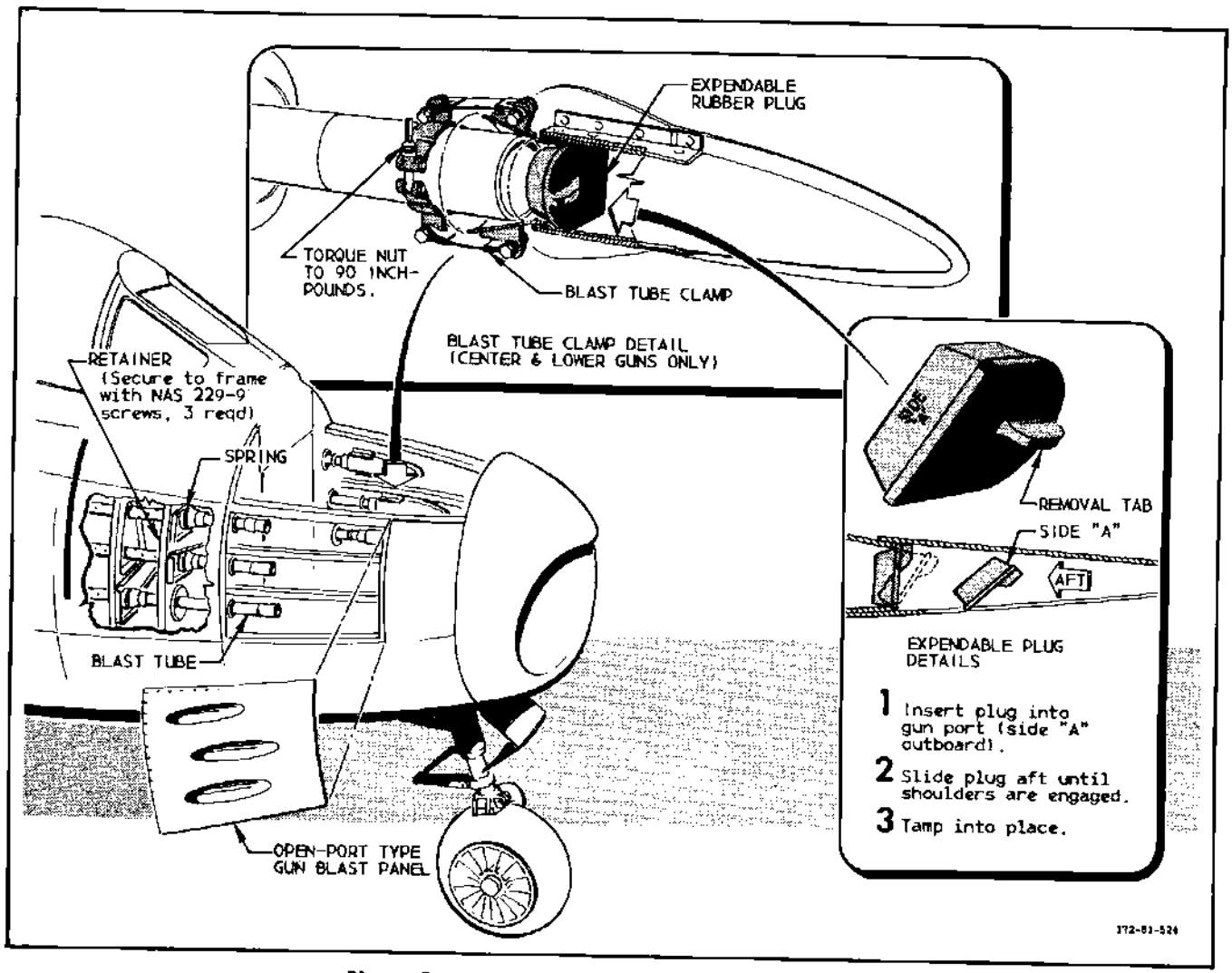


Figure 9-15. Open-port Gun Blast Panels and Tubes

are blown free by the first burst of gunfire. New rubber plugs must be installed after each gunfire operation.

9-99. REMOVING GUN BLAST PANELS AND TUBES. To remove the gun blast panels and tubes, see figure 9-15 and proceed as follows:

a. Open radar compartment access door.

b. Disconnect clamps that secure blast tubes to blast panel at the two lower guns. The upper blast tube is not clamped to the blast panel.

c. Remove panel mounting screws, and slide panel forward and out to permit disengagement of blast tubes from blast panel.

9-100. INSTALLING GUN BLAST PANELS AND TUBES. To install the gun blast panels and tubes, see figure 9-15 and proceed as follows:

a. Open radar compartment access door.

b. Lift blast panel into alignment with mounting holes and install screws.

c. Slide each blast tube through applicable hole in forward end of gun bay and engage with respective flange on blast door. Secure aft end of each blast tube to bulkhead, using three screws.

d. Secure the two lower blast tubes on each side, using clamps provided.

e. Reinstall radar compartment access door.

9-101. GUN CAMERA SYSTEM.

9-102. The gun camera system (figure 9-16), provided to record gun firing, rocket firing, and bombing, consists of an electrically operated gun camera, a shock mount, and an adjustable camera mount. Two camera doors, located on the lower section of the engine air inlet duct, provide access to the camera and camera mounts. The camera may be operated with or without gun firing (either in flight or on the ground). The camera is operated (independent of gun firing) when the gun safety switch is placed in the "SIGHT CAMERA RADAR" position and the control stick switch is depressed. The camera is operated for recording gun firing when the gun safety switch is placed in the "GUNS" position and the control stick switch is depressed. The Type C-1 camera mount permits azimuth and elevation adjustments and also permits removal of the camera without disturbing the bore-sight adjustments.

9-103. TROUBLE SHOOTING GUN CAMERA SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Motor fails to operate.	Motor brushes worn out. No voltage at camera plug.	
Motor runs; camera fails to operate.	Speed setting knob in neutral position.	Set shutter speed knob to desired speed. (Refer to paragraph 9-108.)
Gear train stops; clutch on motor slips.	Magazine jams, causing motor cutout to open motor circuit.	Allow motor cutout to cool. Replace magazine.
Magazine jams.	Magazine driving spline not properly engaged. Damaged magazine. Improper operation of film claw. Improper operation of magazine driving spline.	Replace magazine. Replace magazine. Replace camera. Replace camera.
Film image blurred (film moves, shutter opens).	Improper timing of shutter and film claw. Improper operation of film claw.	Replace camera. Replace camera.
Negatives out of focus.	Lens assembly securing nuts loose. Dirty filter.	Use lens nut wrench to tighten three lens securing nuts.

9-104. GUN CAMERA.

9-105. The magazine-type AN-N6 gun camera (figure 9-17) with the adjustable 35 mm focal lens and filter is equipped with a constant-speed electric motor and cutout switch, a gear train drive mechanism and clutch, a camera speed selector, an overrun control, a camera film footage indicator, a magazine film footage indicator, and a camera body heater. The camera motor speed is controlled by means of the speed knob. Marks on the camera case, "16," "32," and "64," are indexed to the knob. The various positions of the camera speed knob select different gear ratios of the gear train drive

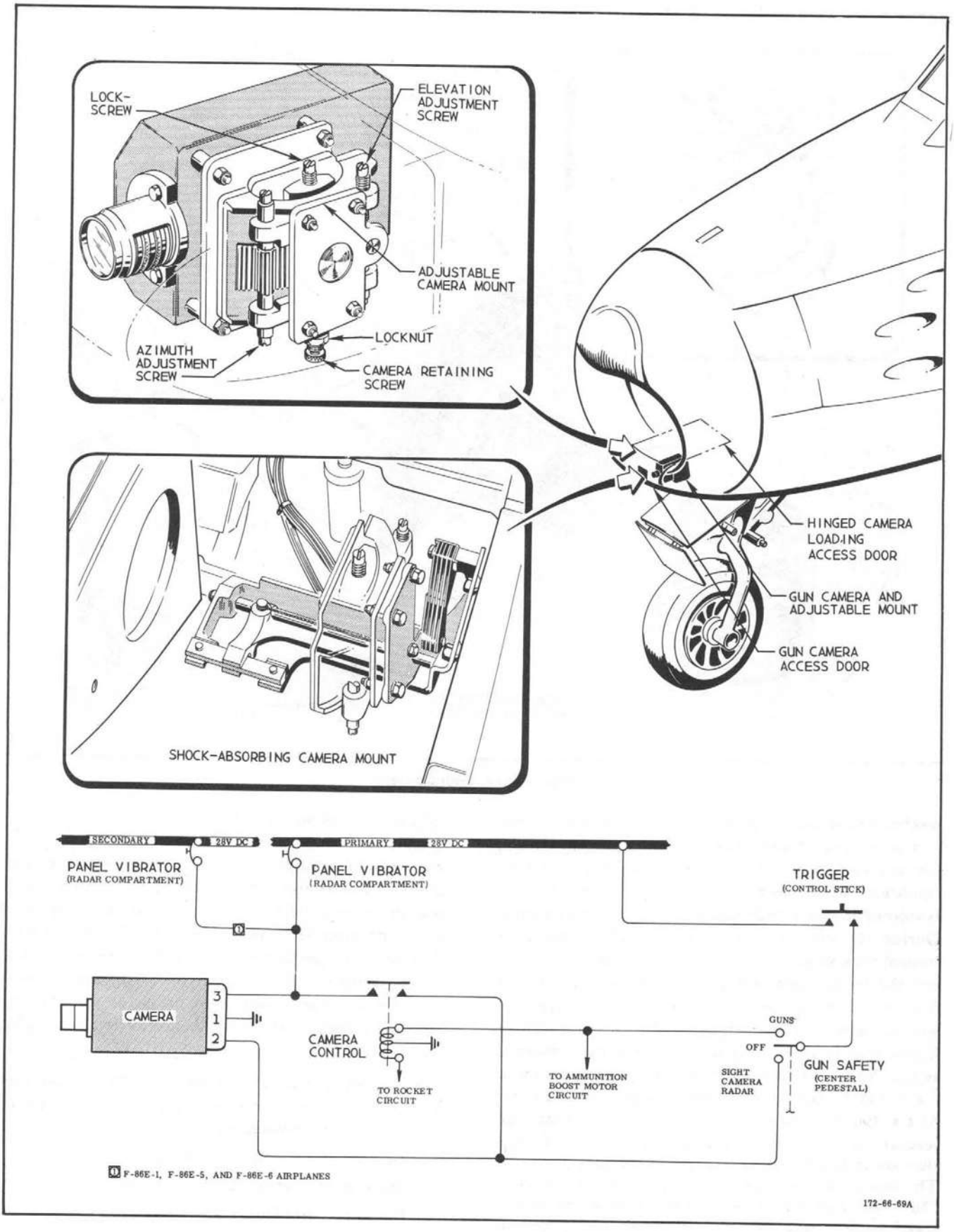


Figure 9-16. Gun Camera System

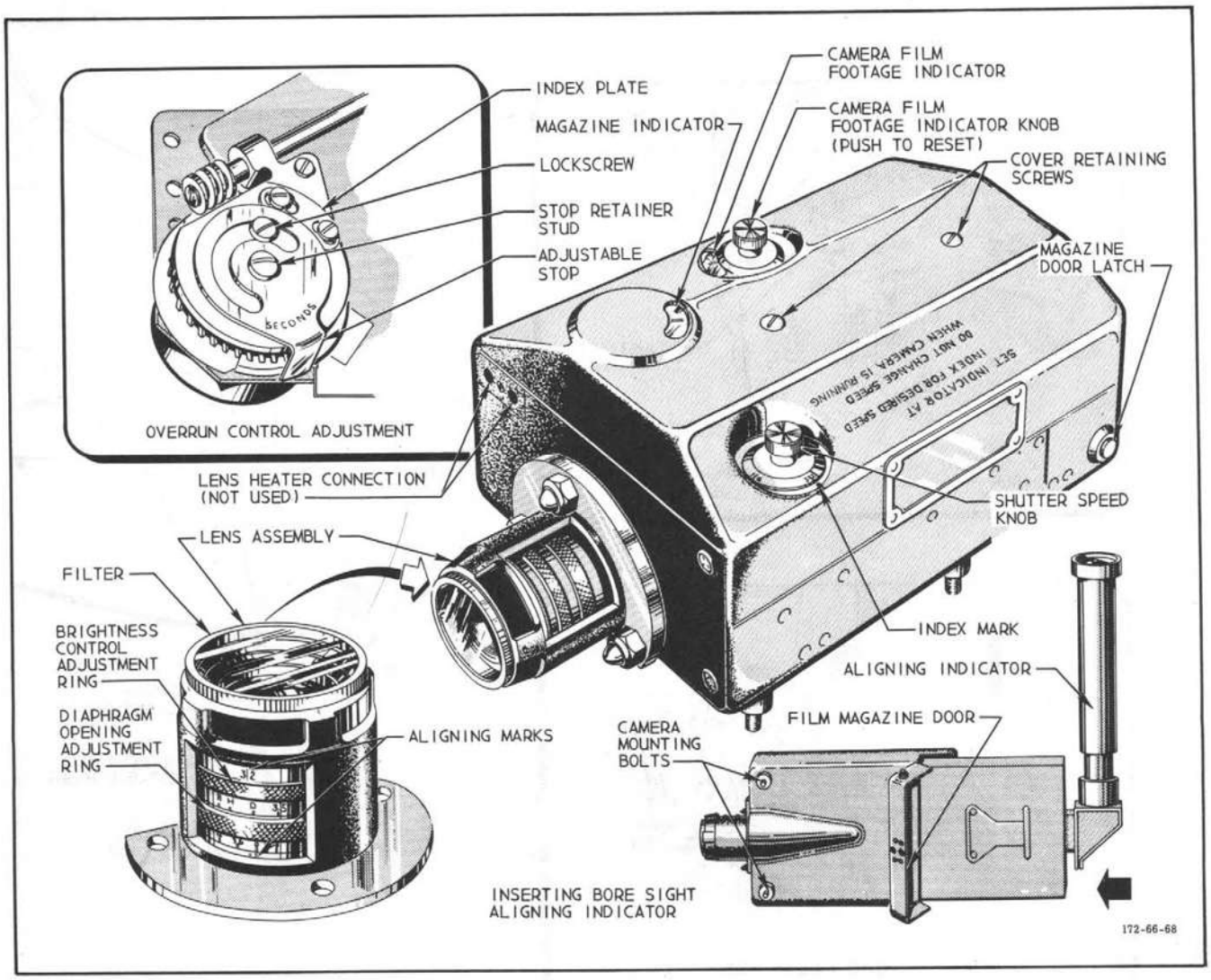


Figure 9-17. Gun Camera

mechanism. A spring clutch, located between the motor and gear train, plus an electric overload cutout switch, prevents camera damage during a film jam or overload condition. The camera overrun time of 0 to 5 seconds is adjustable and is calibrated in one-second increments. During the camera overrun period (after release of control stick switch), a plunger is electrically projected into the camera view and is photographed to provide a film record of the camera overrun time. Camera heat within the camera case is provided by a 40-watt resistor heater that is automatically controlled by a thermal switch. The heater operates when temperature drops to 7.2°C (45°F) and cuts off when temperature exceeds 32.2°C (90°F). The camera lens is provided with two separate adjustments consisting of two knurled rings that are indexed with markings on the lens assembly. The lens diaphragm opening adjustment ring, marked "16," "32," and "64," is set to conform with the camera speed knob setting of "16," "32," or "64." The lens brightness control adjustment ring is set for anticipated light conditions and is indexed for "B" (bright), "H" (hazy), "D" (dull), and f/3.5 (maximum opening for adverse light conditions). All normal photography requires a shutter speed of 16 frames per second. Slow motion requires 64 frames per second, and semislow motion requires 32 frames per second. The camera lens filter provides protection for the lens and is not removed, except for cleaning. A Type AN-1 aligning indicator fits into the camera film magazine to properly align the camera to the target board during bore-sight adjustments.

9-106. REMOVING GUN CAMERA. To remove the gun camera without disturbing the elevation and azimuth adjustment, proceed as follows:

a. Remove and open camera access doors.

b. Disconnect electrical lead at camera.

c. Cut safety wire from camera retaining screw.

d. Loosen camera retaining screw locknut.

e. Hold camera firmly; then loosen camera retaining screw and remove camera.

f. Remove adapter mounting plate from camera. Unload the camera. (Refer to pargraph 9-113.)

9-107. INSTALLING GUN CAMERA. To install the gun camera, proceed as follows:

a. Clean the camera (paragraph 9-111) and set camera overrun control (paragraph 9-109).

b. Install adapter mounting plate on the camera; then position camera so that mounting plate is engaged with mount in airplane and tighten retaining screw and locknut. Lockwire retainer screws and locknut.

Note

Tighten retaining screw finger-tight only.

c. If the camera mount adjustments were disturbed, bore sight the camera. (Refer to paragraph 9-114.)

d. Connect electrical connector plug to camera.

e. Load and prepare the camera for use. (Refer to paragraph 9-112.)

f. Install and close the camera access doors.

9-108. SETTING GUN CAMERA SHUTTER SPEED AND LENS. To set the camera shutter speed and lens, remove the camera access door (figures 9-16 and 9-17), and proceed as follows:

a. Turn the shutter speed knob on the side of the camera to coincide with index mark "16," "32," or "64" frames per second.

CAUTION

Do not change the shutter speed knob setting while camera is in motion, and make certain knob is aligned exactly with camera case index mark.

b. Rotate the lens diaphragm opening adjustment ring to index mark "16," "32," or "64" on the lens barrel. Be sure that lens diaphragm setting conforms with the camera speed knob setting selected in step a.

c. Rotate the brightness control adjustment ring to the index mark "B" (bright), "H" (hazy), "D" (dull), or f/3.5 (maximum aperture for adverse light conditions). The following camera shutter speed and lens settings provide the necessary information for adjustments.

SHUTTER SPEEDS	"B" (Bright)	"H" (Hazy)	"D" (Dull)
64	f/8	f/5.6	f/4
32	f/11	f/8	f/5.6
16	f/16	f/11	f/8

d. Replace the camera access door.

9-109. SETTING GUN CAMERA OVERRUN CONTROL. To set the gun camera overrun control, see figures 9-16 and 9-17; then proceed as follows:

a. Remove the camera. (Refer to paragraph 9-106.)

b. Raise the side of the camera cover opposite the cable socket to avoid damaging the socket opening, and remove the top camera cover.

c. Loosen the stop retainer stud and lockscrew; then rotate the adjustable stop so that the desired overrun index line is set against the line on the index plate. Setting the stop on the index line "0" will eliminate the overrun period. Tighten the stop retainer stud and lockscrew, one at a time, after first dipping their threads in orange shellac (Federal Specification TT-S-271). Install the camera. (Refer to paragraph 9-107.)

9-110. SETTING GUN CAMERA FOOTAGE INDICATOR. To set the camera film footage indicator, see figure 9-17; then proceed as follows: When the loaded camera contains a full film magazine, push in and turn the film footage indicator knob until the camera film footage indicator setting is "0." If the film magazine is partially used, set the camera film footage indicator to correspond with the figure on the magazine film footage indicator. Henceforth, during the film run, the camera film footage indicator will indicate the amount of film still remaining unexposed.

9-111. CLEANING GUN CAMERA. The lens and filter should be cleaned with a soft brush or with special cleaning tissue; if neither brush nor tissue is available, use a soft lint-free cloth. Do not allow dust or finger marks to remain on the exposed surface of the filter or lens. Remove dust from inside camera case and from the mechanism with high-pressure dry air. Use a clean, soft lint-free cloth for dusting surfaces that can be easily reached, and for removing particles of dust-contaminated lubricant. If necessary, moisten this cloth with a solvent conforming to Federal Specification P-S-661.

CAUTION

Do not use water, alcohol, cleaning fluid, solvent, or any kind of liquid to clean lens, as liquid will seep through to the lens elements.

9-112. LOADING AND PREPARING GUN CAMERA FOR USE. To load and prepare the gun camera for use (figures 9-16 and 9-17), open and remove the camera access doors and proceed as follows:

a. If mount adjustments were disturbed, bore sight camera. (Refer to paragraph 9-114.)

b. Open the film loading door by depressing the door latches, and retract the magazine drive gear arm out of the magazine chamber; then insert the film magazine in place with the aperture toward the camera lens and the magazine film footage indicator toward the mount side

of the camera. Move the magazine drive gear engagement arm over the magazine end to engage the magazine driving gears; then close the magazine access door.

Note

The camera door will not close unless the magazine drive gear arm is extended and the drive gears are properly engaged. The magazine film opening opens automatically when the magazine is inserted into the magazine chamber.

c. Set camera film footage indicator. (Refer to paragraph 9-110.)

d. Set camera shutter speed and lens. (Refer to paragraph 9-108.)

e. Clean camera filter and camera access door window. (Refer to paragraph 9-111.)

f. Install and close camera access doors.

9-113. UNLOADING GUN CAMERA. To unload the gun camera, see figures 9-16 and 9-17 and proceed as follows:

a. Open and remove the camera access doors.

b. Press both ends of the camera door latch and open door.

c. Retract the magazine drive gear engagement lever and pull the film magazine out.

9-114. BORE SIGHTING GUN CAMERA. To bore sight the gun camera, align the airplane to target board (paragraph 9-194 or 9-196), and proceed as follows:

a. Open and remove camera access doors.

b. Electrically operate camera intermittently to stop the camera shutter in the open position. The alternate method to open the shutter is to turn the shutter speed knob to a neutral position midway between any two of the shutter speed settings (recognized when a slight stop is felt). Open the magazine access cover by pressing the door lock knobs forward toward the camera body, and push the magazine access cover toward the camera mount, making certain the magazine latch is toward the camera mount as far as it will go. This will position the magazine driving spline all the way into the magazine chamber. Then rotate the spline by hand to open the camera shutter.

c. Move the magazine latch away from the camera mount and retract the magazine driving spline from magazine chamber.

d. Insert the AN-1 aligning indicator, making certain the side containing the spring is toward the camera mount.

e. Set the lens diaphragm opening adjustment ring index mark to "64" and the brightness control ring to "D."

f. Sight through the aligning indicator to check that camera is aligned with camera sighting mark on target board. (Refer to paragraph 9-192.) If camera does not align properly to target board, loosen adjustment jam nut (figure 9-17) and make elevation and azimuth corrections by adjusting the adjustable camera mount. Lock and safety-wire the mount adjustments after the camera is properly aligned to the target.

g. Remove the aligning indicator; then load and prepare the camera for use. (Refer to paragraph 9-112.)

9-115. SIGHT RETICLE CAMERA SYSTEM.

9-116. F-86E-15 Airplanes AF51-13036 through -13069 are equipped with an AN-N6 camera (figure 9-18), mounted on the sight head, to provide a film record of the sight reticle image during operation of the sight system with the sight selector unit in "GUN" and "BOMB" positions. The camera projector glass, mounted between the sight head and sight glass, reflects the reticle image to the camera erector assembly. The erector assembly permits the sight reticle camera to be mounted well below the pilot's line of vision and still allows the camera to maintain full view of the sight reticle image. The sight reticle camera is electrically connected in parallel with the normal gun camera system. Both cameras operate simultaneously when the gun safety switch is properly positioned and the control stick trigger is depressed.

9-117. TROUBLE SHOOTING SIGHT RETICLE CAMERA SYSTEM.

9-118. Refer to paragraph 9-103.

9-119. SIGHT RETICLE CAMERA.

9-120. Refer to paragraph 9-105 for information on the AN-N6 camera.

9-121. REMOVING SIGHT RETICLE CAMERA. To remove the sight reticle camera, proceed as follows:

a. Disconnect camera electrical connector. (See figure 9-18.)

b. Cut camera retaining screw lockwire.

c. Hold camera firmly; then loosen camera retaining screw and lift camera from mount.

9-122. INSTALLING SIGHT RETICLE CAMERA. See figure 9-18.

9-123. SETTING SIGHT RETICLE CAMERA SHUTTER SPEED AND LENS. The camera speed and lens setting contained in paragraph 9-108 may be used; however, a wider lens aperture must be used to compensate for light loss due to the increased number of glass-to-air and glass-to-glass surfaces involved in the camera erector assembly installation. This may be accomplished by rotating the lens brightness adjustment ring to the next lower "f" number appearing on the camera and lens setting chart.

9-124. SETTING SIGHT RETICLE CAMERA OVERRUN CONTROL. Refer to paragraph 9-109.

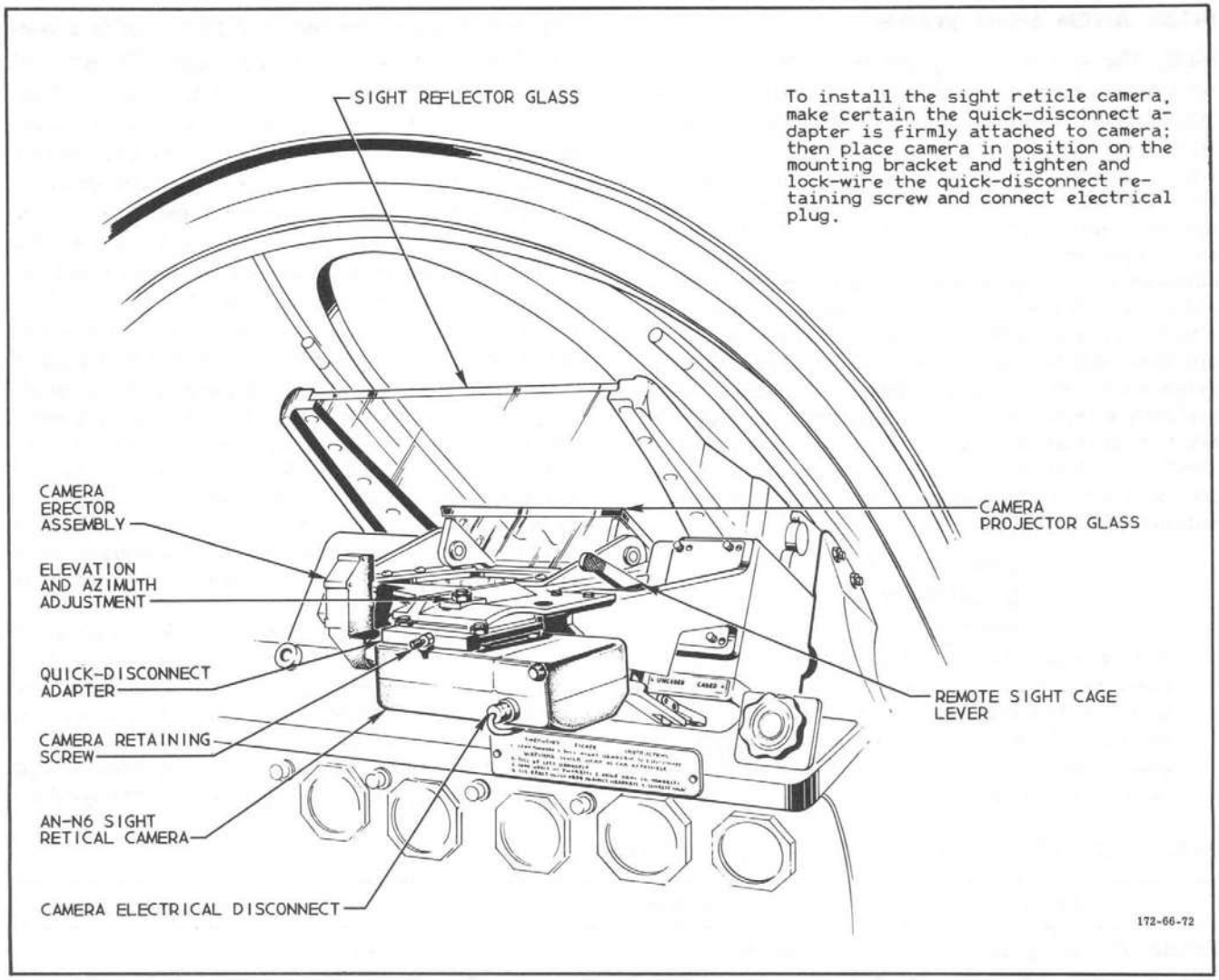


Figure 9-18. Installing Sight Reticle Camera

9-125. SETTING SIGHT RETICLE CAMERA FOOTAGE INDICATOR. Refer to paragraph 9-110.

9-126. CLEANING SIGHT RETICLE CAMERA. Refer to paragraph 9-111.

9-127. LOADING AND PREPARING SIGHT RETICLE CAMERA FOR USE. To load and prepare the sight reticle camera for use, remove camera from mount by use of the quick-disconnect and refer to paragraph 9-112. (See figure 9-18.)

9-128. UNLOADING SIGHT RETICLE CAMERA. To unload the sight reticle camera, remove camera from mount by use of the quick-disconnect and refer to paragraph 9-113. (See figure 9-18.)

9-129. BORE SIGHTING SIGHT RETICLE CAMERA. To bore sight the sight reticle camera, remove the camera from mount by use of the quick-disconnect. Insert the bore-sighting fixture, and reinstall the camera on the camera mount. (See figure 9-18.) Harmonize the camera as explained in paragraph 9-192. Loosen the combination camera elevation and azimuth adjustment bolt, and rotate camera in either direction for proper alignment to the target board reticle camera mark; then tighten the adjustment bolt and recheck for proper alignment. The sight reticle camera may be properly aligned without use of the target board; with camera bore-sighting fixture installed and camera in place, operate the sight system with the sight function selector lever (on the sight selector unit) in "GUN" and in "BOMB" positions. Adjust the camera azimuth and elevation adjustment bolt so that the camera bore-sight aligning fixture, vertical cross hair, is in direct alignment with the sight reticle image dot during sight system operation.

9-130. A-1CM SIGHT SYSTEM.

9-131. The A-1CM sight system (figure 9-19) installed on F-86E-1, F-86E-5, F-86E-6, and F86E-10 Airplanes automatically computes leads as a gun, bomb, or rocket sight. It consists of five principal units and two accessory units. The sight head, the computer, the sight amplifier, the rocket setting unit, and the range servo unit are the principal units, while the dimmer control and bomb-target wind unit are accessories. The A-1CM sight obtains automatic range information from the AN/APG-30 radar system (paragraph 8-38) for gunnery and rocketry. The tie-in is accomplished by means of the Type RS105 armament sight range servo mechanism. (Refer to paragraph 9-156.) The sighting system is calibrated to automatically compute leads for ranges between 6000 and 600 feet. Manual ranging can be used from sea level to 40,000 feet; however, automatic radar ranging can be used only above 5000 feet. As a bombsight, the system will operate up to 10,000 feet.

CAUTION

The principal components of the sight installation are not interchangeable with other like units (within the limits of first and second echelon adjustments); therefore, all sight components should be removed, stored, and installed as a unit.

The A-1CM gun-bomb-rocket sight system is a two-gyro, lead and ballistic computing sight. The required leads are computed in the computing unit and relayed by means of microsyns, a sight amplifier, and drive motors to a movable mirror in the sight head, which deflects a collimated circle-and-dot reticle image on to the sight reflector glass to supply the required lead for gunnery and rocketry. When the sight is used for bombing operations, the line of sight is depressed approximately 10 degrees, requiring the pilot to fly a downward path which becomes tangent to a bomb trajectory. The point of tangency is the bomb release point and is indicated to the pilot by extinction of the reticle image circle. With the controls set for an automatic release, bombs are dropped automatically if the release button is closed; a red flashing light (reflected on the reflector glass) indicates bomb release. The pilot can manually control the release of bombs if desired. Range input is not required for the sight as a bombsight. Used with the AN/APG-30 radar ranging equipment, the A-1CM gun-bomb-rocket sight is completely automatic in operation. The radar system will lock on the target and feed correct range to the sight when the target is within the radar radiation pattern. All other inputs are derived from the attitude and angular rate of turn of the airplane, the density altitude, and the indicated airspeed. All that is required is that the center dot be kept on the target and that the target be tracked smoothly.

9-132. TROUBLE SHOOTING A-1CM SIGHT SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Reticle does not appear.	No power.	Check power source.
Fixed reticle does not appear in "CAGE" position.	Fixed reticle cover not operating.	Check for 28-volt direct current.
No stiffness current on tester G-1A.	Defective fuse in 300-volt supply.	
	AMPLIFIER	
No stiffness current.	Faulty sensitivity amplifier tubes.	Replace defective tubes among the following: V5, V6, V7, V8, V9.
Reticle image does not move during damping temperature inspection.	Faulty elevation and deflection amplifier tubes.	Replace defective tubes among the following: V1, V2, V3, V4.
Reticle circle size does not change when manual range control is turned and mechanical caging lever is at "UNCAGE."	Faulty range amplifier tubes.	Replace defective tubes among the following: V10, V11, V12.
Stiffness current does not vary with range in gunfire position or does not decrease in rocket-fire position.	Faulty tubes in sensitivity channel V5, V6, V7, V8, V9. Open resistor in sensitivity channel.	Replace faulty tubes and resistors. If none are found faulty, replace R47 and R34 with carbon resistors.

TROUBLE	PROBABLE CAUSE	REMEDY
Reticle goes to stop in either deflection of elevation.	Faulty tube or open resistor in deflection or elevation channel.	Replace faulty tubes and resistors.
	COMPUTER	
No reappearance of the reticle circle when the bomb-target wind scale is at "BOMB."	Gyro damping fluid not up to temperature.	Wait 5 to 20 minutes until heater lights on tester cycle.
No stiffness current during tester checks.	P102 removed.	
Sight inoperative because of damaged computer.	Moisture condensation in computer due to heater circuit breaker being open.	The heater circuit breaker will be closed at all times during all flights to prevent this damage.
Reticle does not move during operation.	Mechanical caging lever at "CAGE."	Place mechanical caging lever at "UNCAGE."
Reticle circle does not change diameter as target range changes.	Mechanical caging lever at "CAGE."	Place mechanical caging lever at "UNCAGE."
Dot pipper does not appear.	Faulty dot pipper bulb I202.	
Reticle circle image does not appear with mechanical caging lever at "CAGE."	Faulty dot pipper bulb I203.	
Reticle circle image does not appear with mechanical caging lever at "UNCAGE."	Faulty circle bulb I203.	
Bombs-away flasher bulb does not light.	Faulty bombs-away flasher bulb I201 or flasher unit.	
Fixed and variable reticle appear in "UNCAGE" position.	Sticky fixed reticle cover.	Examine reticle cover for mechanical bind.
Fixed reticle does not appear in "CAGE" position.	Fixed reticle cover not operating.	Check solenoid for continuity.
Circle does not reappear when bomb-target wind scale knob is turned to bombing function.	Sight head stop nut not adjusted.	Adjust sight head bomb stop.

9-133. TESTING A-1CM SIGHT SYSTEM.

9-134. Before testing the sight system, inspect the components, making sure that the connector plugs are tight in their sockets and that all wiring connectors are correctly and firmly joined. Testing of the sight system is accomplished as follows:

a. Connect an external power source to airplane. When external power source is connected, the sight and radar thermostatic heaters are automatically energized. Twenty minutes minimum at normal ambient temperatures must be allowed before the sight will operate properly.

b. Open sight and radar compartment access cover.

c. Check all circuit breakers and fuses. These are shown in figure 9-19.

d. Remove dummy plug from the field test unit receptacle (figure 9-19) and connect field test unit cable to the test receptacle. Then place field test unit in cockpit. As soon as the field test unit is plugged in, the

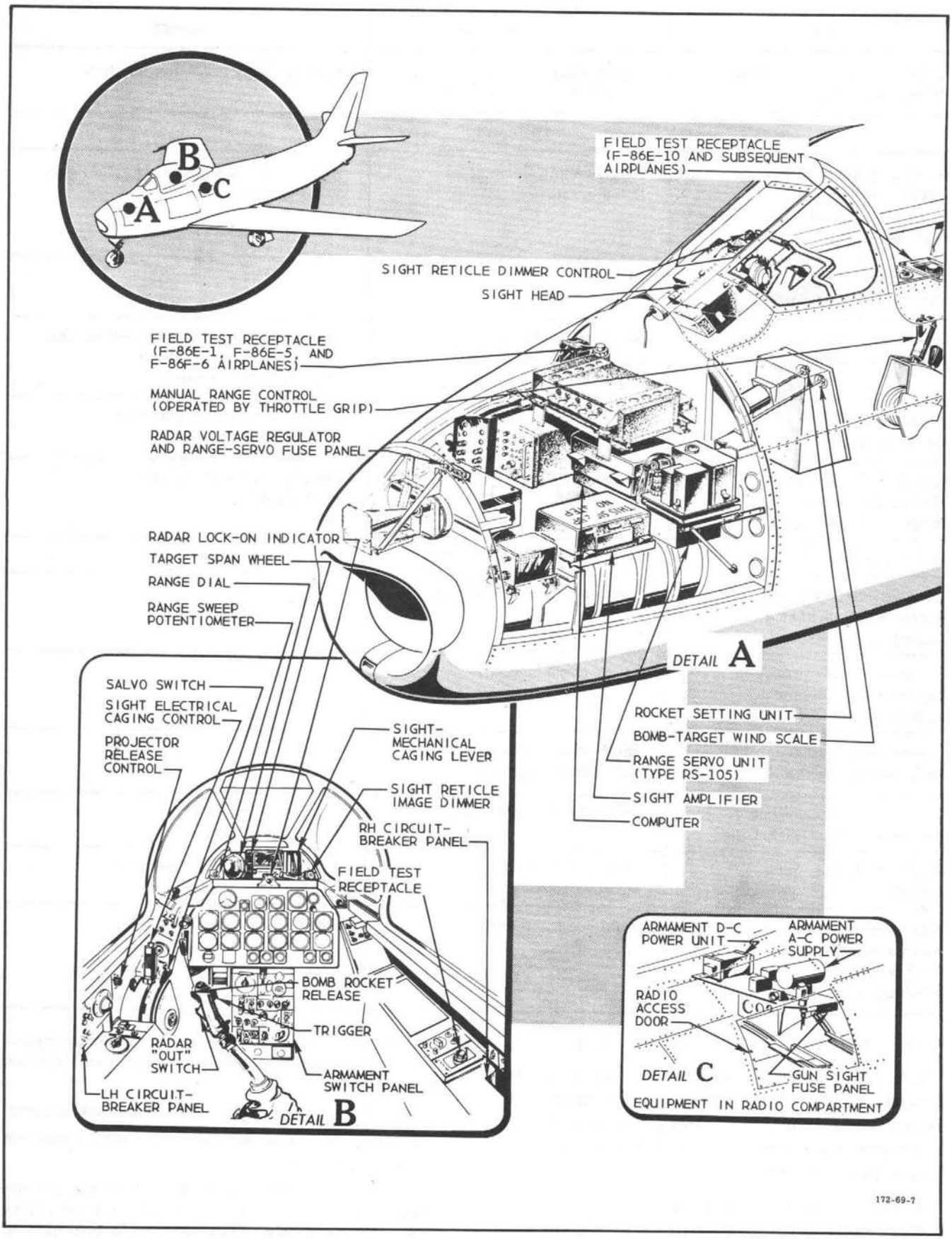


Figure 9-19. A-1CM Sight System

heater indicator lamps on the field test unit should glow, indicating that the heaters in the computer are on.

e. Place bomb-target wind dial pointer on "ROCKET GUN" position.

f. Place pointer of rocket setting unit on "GUN BOMB" detent position.

g. Place bomb release selector switch on "MANUAL RELEASE."

h. After the required warm-up period, the thermostatic heaters should start their indicator lamps on field test unit cycling (in other words, the lamps go off and on).

i. Move gun safety switch to "SIGHT RADAR CAMERA." Gyros should start to rotate (as indicated by movement of reticle image when azimuth and elevation deflection is introduced into the field test unit), and amplifier tubes should glow.

CAUTION

Keep "GUN FIRE" circuit breaker in "OFF" position.

j. Place mechanical caging switch in the "UNCAGE" ("UNCAGED") position.

k. Set field test unit circuit selector on "METER" and density selector on "DENSITY UNIT." By means of the meters, make sure that the following power supply requirements are met: 300 (±3) volt direct current; 28 (±1.5) volt direct current; 28 (±3) volt (measured between phases A and B, A and C, and B and C), 400 (±4) cycle, three-phase alternating current.

l. Check to see that reticle image (a circle with a dot at its center) appears. It may be necessary to rotate the dimmer knob slightly to make the image brighter or dimmer.

m. The circle and dot patterns are illuminated by separate bulbs. Each bulb is provided with two filaments so that, if one filament is burned out, the other filament may be brought into operation by means of the proper switch. Both switches for both filaments should be operated; if the circle or dot pattern does not appear, or appears in only one position of the switch, the defective bulb should be replaced.

n. Move mechanical caging lever back and forth from "CAGE" ("CAGED") to "UNCAGE" ("UNCAGED") position, and check to see that the reticle image (both circle and dot) flickers as the lever is moved. Leave the mechanical caging lever in the "UNCAGE" ("UNCAGED") position.

o. Rotate the target span dial, and check to see that the diameter of the reticle image circle also changes. When the circle is at its greatest diameter, the target span dial should also indicate the maximum figure.

p. With the manual range control turned fully counterclockwise, the diameter of the circle should be the smallest. Clockwise movement of control should increase the diameter of the reticle image circle.

q. Rotate the "DIM-BRIGHT" knob back and forth from one extreme to the other, and note that the intensity of the reticle illumination varies correspondingly.

r. Disconnect radar by removing connector plug from range servo unit.

s. Check the sensitivity current (the current through the stiffness motor coils) versus range by setting the following ranges into the sight. First remove the cover from the range servo unit and manually set the range dial until the desired reading is indicated. Observe that corresponding elevation and azimuth (deflection) stiffness currents are as indicated in the following table. To make these readings on the field test unit, it is first necessary to move the d-c milliampere selector switch to "100 MA" and the circuit selector switch pointer to stiffness current "DEFLECTION." The deflection stiffness current reading for the range setting will be indicated on the d-c milliampere scale. Before changing the range, switch the circuit selector switch to stiffness current "ELEVATION" and read the milliampere scale.

RANGE DIAL SETTING—FEET	ELEVATION & DEFLECTION STIFFNESS—MILLIAMPERES DC
5400	16 (±2)
4800	18 (±2)
3600	22 (±2)
2400	29 (±2)

Note

These calculations are approximate and are based on the assumption that the density ratio is one. The density ratio is a number obtained by dividing the barometric pressure at sea level by the barometric pressure at the location where the test is being conducted.

CAUTION

Use extreme caution when working on servo mechanism, as high voltages are present.

t. Make sure the sight heaters are cycling (flashing of lamps on field test unit) which indicates that the damping fluid in the elevation and deflection assembly dampers and the space heater has reached proper operating temperature. Check the characteristic time measurement by setting the field test circuit selector switch pointer to "CHAR TIME-DEFL" position and setting a range of 5400 feet (1800 yards) into the sight by means of the range dial in the servo mechanism. This setting should give a reading of 16 milliamperes. If the exact setting of 5400 feet does not result in an indication of 16 milliamperes, rotate range dial until the 16-milliampere reading is indicated.

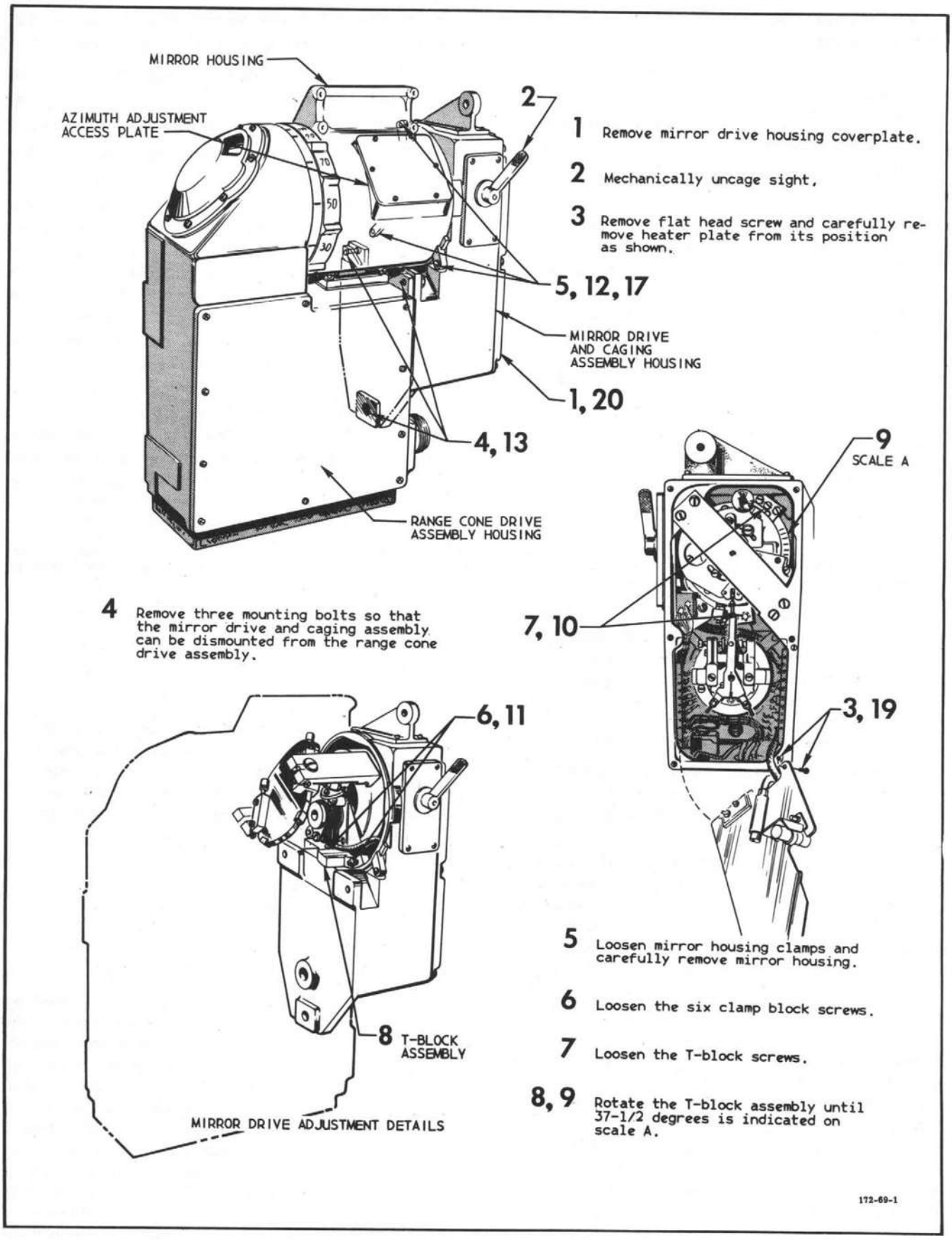
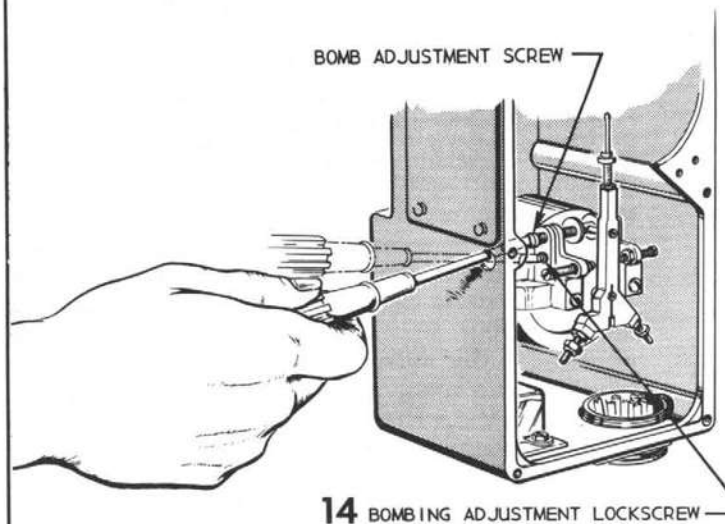


Figure 9-20. Adjusting A-1CM Sight System (Sheet 1 of 2)



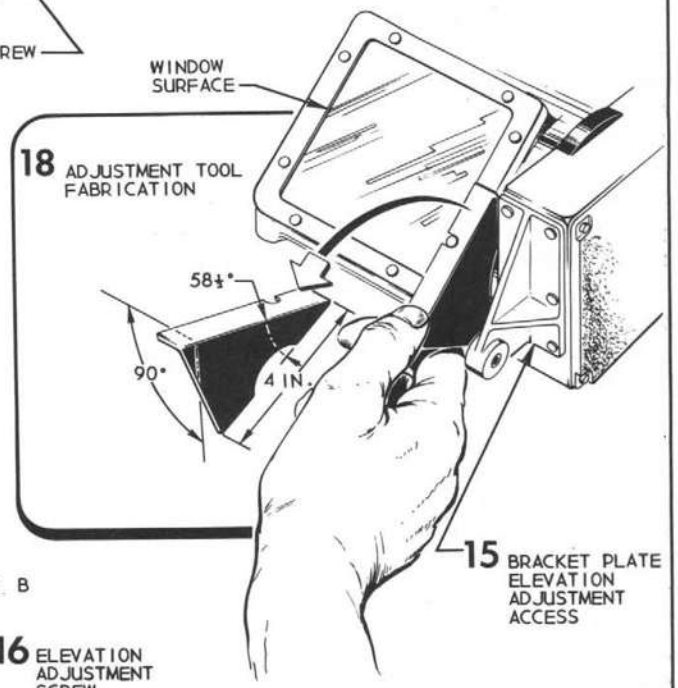
10, 11 Tighten the clamp block and T-block screws.

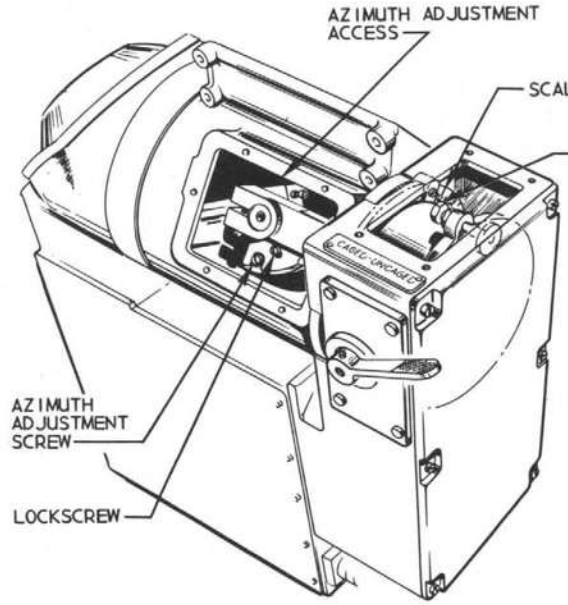
12 Install mirror housing and tighten clamps.

13 Install mirror drive and caging assembly onto the range cone drive assembly.

14 Tighten bombing stop lockscrew if it is loose. It is important that the bombing stop not be moved during tightening.

15, 16 Remove bracket plate and loosen locknut. Turn elevation adjustment screw until the 37-1/2 degree mark on scale B is aligned with indexing line. Tighten locknut and replace bracket plate.





17, 18 Loosen mirror housing clamps. Using locally fabricated tool, rotate barrel housing until window surface makes a 58-1/2 degree angle with surface of sight body at elevation adjustment access. Tighten barrel housing lock lugs.

19, 20 Install heater plate assembly. Replace mirror drive housing cover plate. Install sight head. (Refer to index for page number of applicable procedure.)

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Figure 9-20. Adjusting A-1CM Sight System (Sheet 2 of 2)

9-135. BORE SIGHTING A-1CM SIGHT.

9-136. To harmonize the A-1CM sight system, proceed as follows:

a. Prepare the airplane for harmonization as described in paragraph 9-192.

b. Open sight and radar access door, and level the computer. (See figure 9-23.)

c. Connect an external power source to the airplane.

d. Place bomb-target wind dial pointer on "ROCKET GUN."

e. Place pointer of rocket setting unit on "GUN BOMB."

f. Move gun safety switch to "SIGHT CAMERA RADAR."

g. Move mechanical caging lever to "UNCAGE" ("UNCAGED").

h. Rotate dimmer control to proper reticle brilliance.

i. Install sight line fixture on sight head.

j. Press the electrical caging switch and, while looking through sighting hole in sight line fixture, make sure that sight reticle image dot appears superimposed on the respective gun sight mark on the target board. Should the dot be to the right or left of the sight mark, adjust sight head to move the dot of the reticle image in azimuth. (See figure 9-20.) If the reticle image is above or below the target mark, adjust the sight head to move the dot of the reticle image in elevation. (See figure 9-20.)

k. Turn pointer of the rocket setting unit to "5" HVAR ROCKET—N" on the dial. Then, while viewed through rocket sighting hole in sight line fixture, the reticle image should deflect downward and come to rest upon the respective rocket sight mark on the target board. If it does not, adjust rocket setting unit as instructed in figure 9-26. Then return rocket setting dial to "GUN BOMB" position.

l. Remove sight line fixture from sight head.

m. Move bomb-target wind control to "0." Observe the reticle image just over the nose of the airplane. If the circle does not go out during the downward travel of the reticle and reappear within 10 seconds after the reticle stabilizes at the bottom of its travel, the sight head bombing stop must be adjusted. (See figure 9-20.) If the reticle circle does not go out as the reticle travels down and then reappear after reticle stabilizes (with the caging button both depressed and released), again readjust sight head bombing stop as outlined in figure 9-20. The circle must come on after the reticle has fallen to bomb position and must stay on when the electrical cage button is depressed.

n. Return sight controls to the inoperative positions and disconnect external power source.

9-137. A-1CM SIGHT SYSTEM HEAD.

9-138. The sight head consists of the optical system, the mirror drive system, and the sight head case and mounting lugs. (See figure 9-20.) A 3½-inch collimating lens is employed in the sight to afford adequate eye freedom with long eye-to-sight distances. The reticle image is produced by means of a conical reflecting device in the sight head. The maximum diameter of the circle is 170 sight mils, and the minimum diameter is 17 sight mils. A wing span wheel, located on the sight head, may be adjusted to the span of the target to be attacked. Attached to the instrument panel shroud is the radar on-target light, which indicates to the pilot that the radar ranging equipment is locked on the target during tracking. The mechanical caging lever, located to the right toward the bottom side of the sight head, is for emergency use in the event that the sight ceases to compute correctly and to prevent damage to gyros and motors during taxi, take-off, landing, and violent maneuvers. The mirror drive system consists of the follow-up microsyns, torque motors, and viscous dampers. Mechanical linkage to the mirror positions the mirror in relation to the position of the computer shaft in the computer unit. The reticle image is collimated before being reflected to the windshield by the moving mirror, thus eliminating collimating errors due to sight line shift.

9-139. REMOVING A-1CM SIGHT HEAD. To remove the A-1CM sight head, proceed as follows:

a. Lower the instrument panel and remove the instrument panel shroud.

b. Disconnect electrical plugs.

c. While supporting the sight head, loosen the adapter locking screw enough to release the forward part of the sight head.

d. Slide sight head up and aft, releasing the sight head from the adapter.

9-140. INSTALLING A-1CM SIGHT HEAD. See figure 9-21.

9-141. ADJUSTING A-1CM SIGHT HEAD BOMBING STOP. To adjust the sight head bombing stop, lower the instrument panel and remove the bombing stop access hole cover plate from the sight head. See figure 9-20.

Note

The dummy plug must be in place in the field test socket in the airplane.

After the foregoing has been done, make the adjustments as follows:

a. Insert a thin-bladed screwdriver in the bombing stop adjustment access hole and engage with the adjustment screw.

b. Rotate the B-TW pointer from "ROCKET GUN" to "0" graduation in the "BOMB" position; the reticle pattern will begin to drop. When it has reached the limit of its downward displacement, adjust the bombing stop adjustment screw until the circle just lights up (with caging button either depressed or released). Mark the position of the adjustment screw.

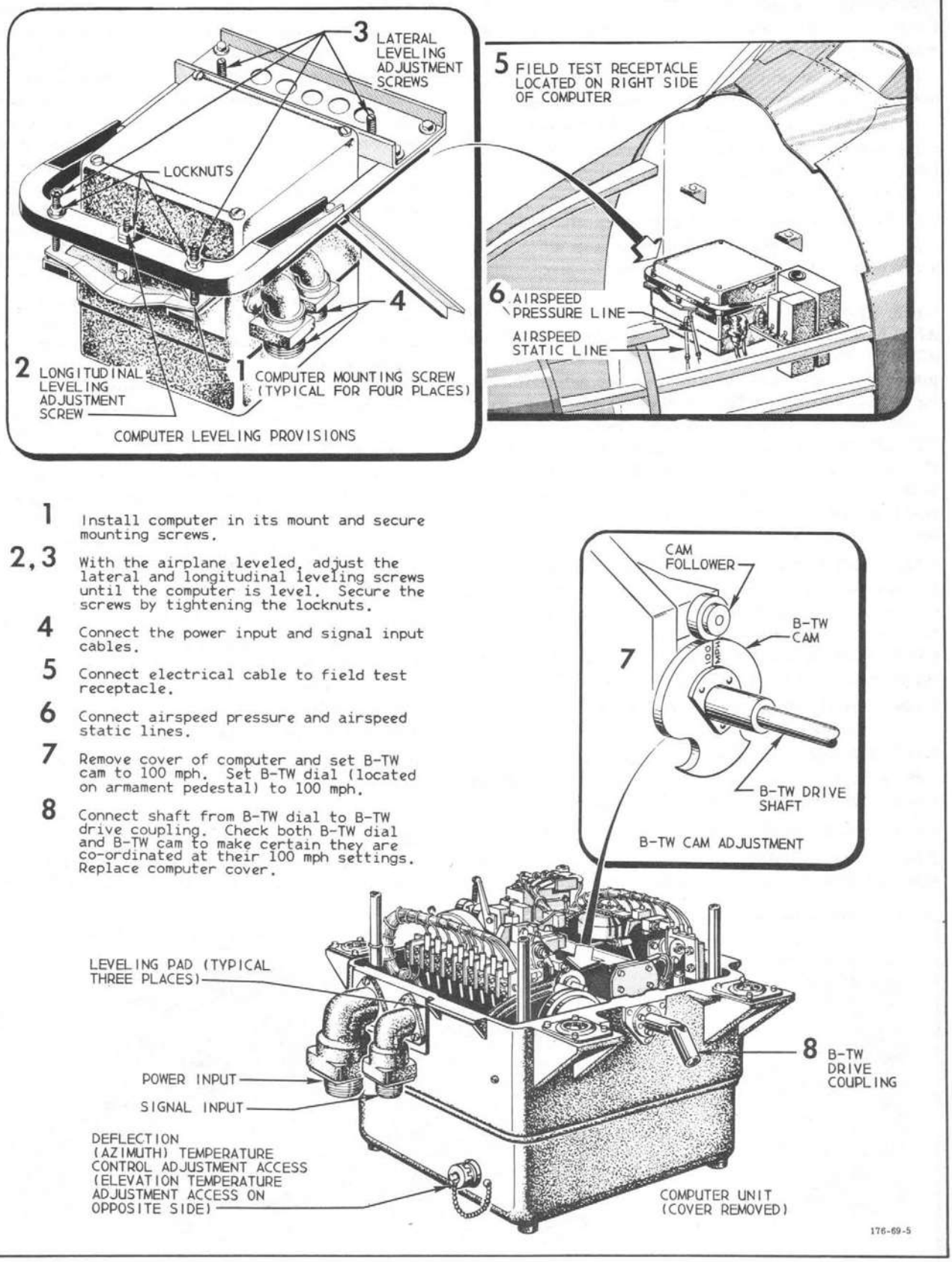


Figure 9-21. Installing A-1CM Sight Head

c. Turn adjustment screw counterclockwise through approximately ⅛ turn where the circle remains lighted. Continue to turn until the circle light goes out, then mark this position.

d. Rotate the adjusting screw clockwise until the midway point between the two marks is reached.

e. Return the B-TW pointer to "GUN" position and again turn the B-TW pointer to "BOMB," "0" graduation; the reticle should function as outlined in step m. of paragraph 9-136.

f. Return control to the inoperative positions.

g. Install cover plate on bombing stop adjustment access hole and secure instrument panel in place.

9-142. REPLACING A-1CM SIGHT HEAD RETICLE AND FLASHER BULBS. The reticle bulbs or "BOMBS AWAY" flasher bulb in the sight head should be replaced if inspection reveals that they are defective. The light transmitting surface of the dot pipper bulb is frosted and the surface of the circle bulb is clear. The "BOMBS AWAY" bulb is red, frosted. To replace either the circle, dot pipper, or "BOMBS AWAY" flasher bulb, remove the large rectangular cover plate on the rear lower portion of the sight head (figure 9-22) to gain access to the bulbs.

9-143. REPLACING SIGHT HEAD DESICCATOR. If inspection shows the color of the desiccant to be pink instead of blue, the desiccator must be replaced. To do this, lay the sight head on its side and remove the six screws securing the desiccator to the sight head. (See figure 9-22.) Install new desiccator unit.

9-144. A-1CM SIGHT SYSTEM RETICLE DIMMER CONTROL.

9-145. The sight reticle dimmer control, located on the right side of the instrument panel shroud, controls the illumination intensity of the reticle image.

9-146. A-1CM SIGHT SYSTEM COMPUTER.

9-147. The computing unit is composed of the deflection and elevation computing sections, which may be called the "brains" of the sighting system. (See figure 9-23.) All required inputs to the system are fed directly into the computer, with the exception of the air density, which enters the system through the sight amplifier. The computer consists of the gyros, stiffness motors, thermostatically regulated dampers, airspeed correction unit, gunnery and bombing accelerometers, and the microsyn pick-off system. The angular rate of the airplane in a tracking curve causes the gyros to precess, while the range input to the computer is in the form of an opposing torque to the precession of the gyros, the torque being an inverse function of the range. Such a torque is created when a varying current is supplied to the stiffness motors. As the current increases, the stiffness of the motors increases, thus reducing the precession of the gyros for a given angular rate. The thermostatically controlled dampers give the sight stability during tracking by controlling the temperature of the dampening fluid. Without dampening, it would be extremely difficult to keep the reticle on the target. The airspeed correction unit feeds data to the bombing accelerometer only. The bombing accelerometer in turn applies an opposing torque to the elevation gyro during computing for bombing. The microsyn positioning system may be compared with the a-c selsyn system, in that there are two units which always maintain the same relative position with each other to within ±½ sight mil.

9-148. REMOVING COMPUTER. Remove the RT-181/APG-30 transmitter, located directly above the computer. Disconnect B-TW shaft, pitot and static air lines, and electrical plugs from the computer. Remove the mounting screws and lift the computer from its mount. (See figure 9-23.)

9-149. INSTALLING AND LEVELING COMPUTER. See figure 9-23.

9-150. ADJUSTING COMPUTER. The temperature of the damping fluid in the deflection damper and/or elevation damper must be changed if the deflection and/or elevation characteristic time is not satisfactory. The

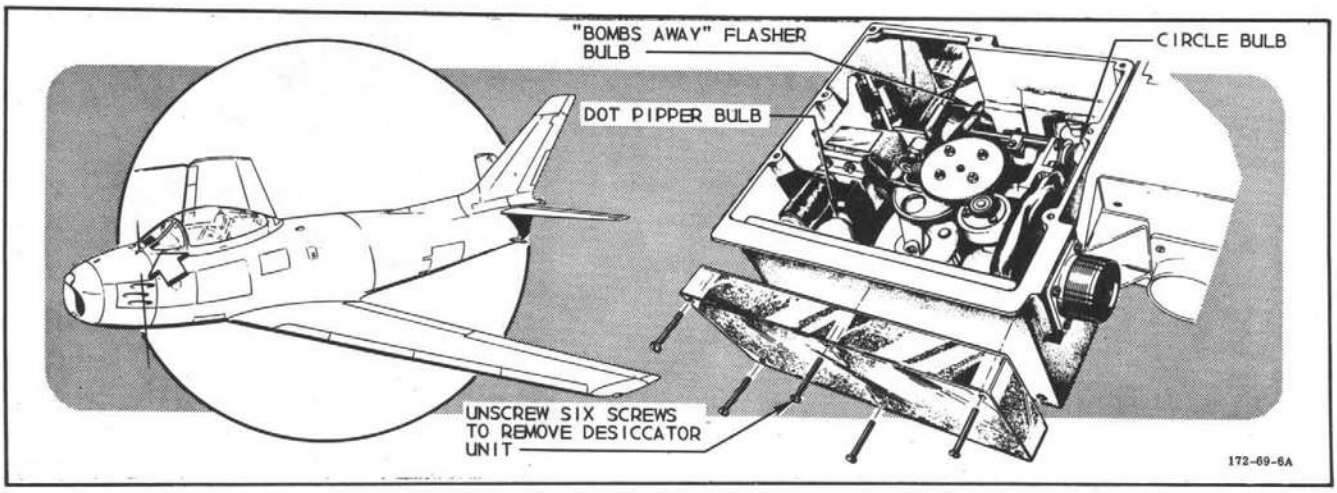


Figure 9-22. Replacing A-1CM Sight Head Bulbs and Desiccant

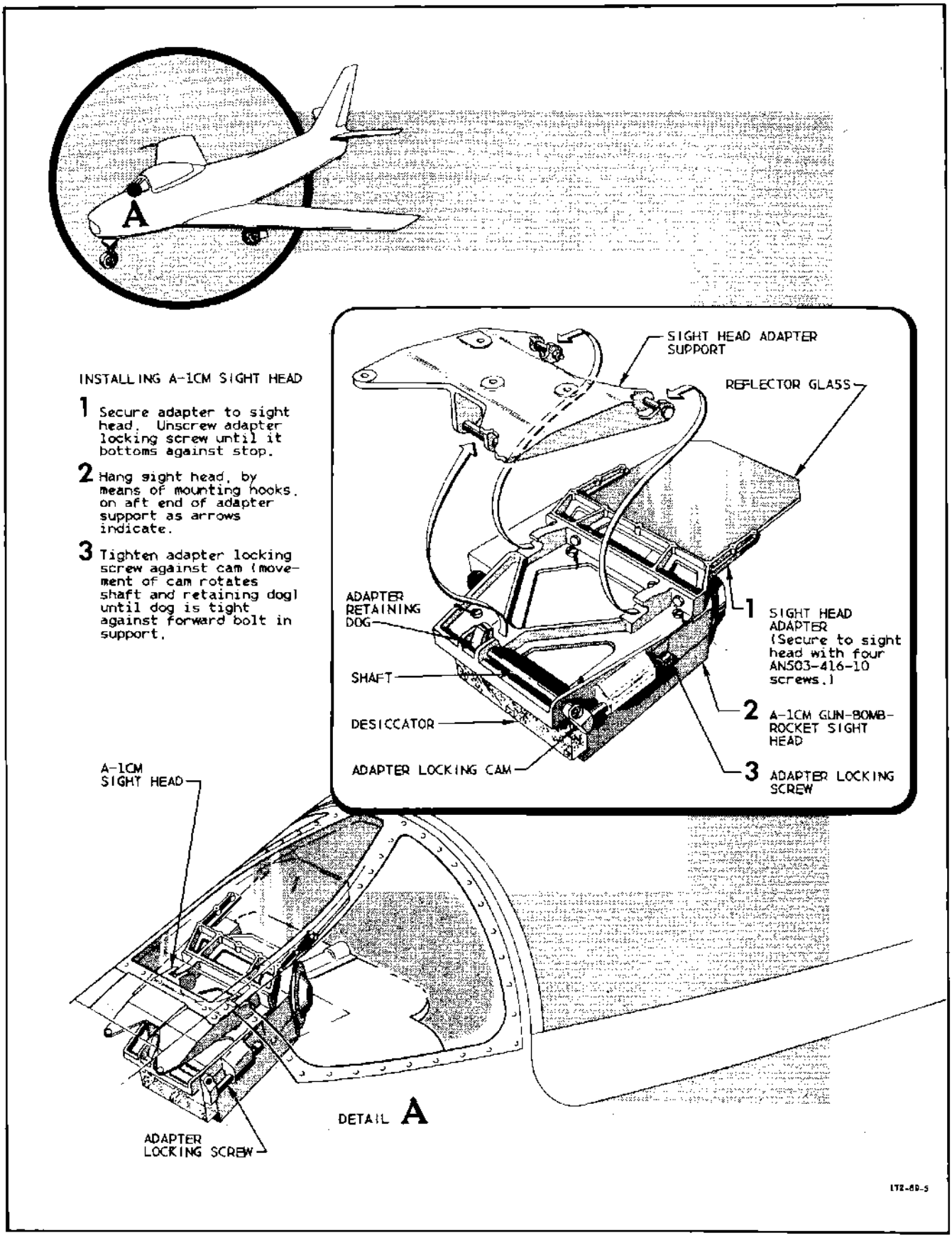


Figure 9-23. Installing, Leveling, and Adjusting A-1CM Sight System Computer

deflection temperature control adjustment is accessible after the cap marked "D" on the lower cover of the computer is removed, and the elevation temperature control adjustment is accessible after the cap marked "E" is removed. Insert special wrench (figure 9-23) into the opening and engage it with the temperature control adjustment. If the average time during the deflection characteristic time check was less than 3.3 seconds but not less than 2 seconds, turn the tool from 5 to 10 degrees (depending upon the amount of error) in a clockwise direction. If the average time was more than 4 seconds but not more than 5.5 seconds, turn the adjustment tool in a counterclockwise direction. After adjustments have been accomplished, replace temperature control adjustment plugs, and wait the necessary time for the telltale lights of the field test unit to begin cycling; then accomplish deflection and elevation characteristic time check.

9-151. A-1CM SIGHT SYSTEM AMPLIFIER.

9-152. The amplifier contains the elevation channel, deflection channel, range channel, and sensitivity channel amplifiers. The sensitivity channel operates from range data and air density data. Range data is obtained from the AN/APG-30 radar or from the manual ranging circuit. The air density data is supplied by a sealed air density unit mounted on the amplifier chassis.

9-153. REMOVING AMPLIFIER. The sight amplifier is located in the radar and battery compartment. (See figure 9-19.) To remove the amplifier, proceed as follows:

a. Remove the quick-disconnect from the battery.

b. Remove the amplifier cover.

c. Disconnect the static air line and electrical cables from the amplifier.

d. Remove the four mounting bolts from the Lord mounts and lift the amplifier from its mounting position.

9-154. INSTALLING AMPLIFIER. Install the amplifier as follows:

a. Remove the quick-disconnect from the battery.

b. Remove the amplifier cover.

c. Position the amplifier on its mount (static air connector facing outboard) and install and secure mounting bolts in the Lord mounts.

d. Connect electrical plugs and air static line. Install amplifier cover and install quick-disconnect on battery.

9-155. A-1CM SIGHT SYSTEM RANGE SERVO.

9-156. The range servo, located to the left of the computer (figure 9-19), converts radar or manual range data into suitable electrical characteristics required by the sight system.

9-157. REMOVING RANGE SERVO. To remove the range servo, first disconnect the electrical plugs; then loosen the securing screws on the adapter, modulator, and range units (four screws on each) and remove them from the base assembly in that order. Loosen the two knurled nuts on the forward side of the mount. Lift forward end of range servo up, and then remove it from its mount.

9-158. INSTALLING RANGE SERVO. To install the range servo, place the unit on its mount and tighten the two knurled nuts on the forward side of the unit. Install sub units (range, modulator, and adapter units) and secure by means of the four screws on each unit. Connect electrical plugs.

9-159. A-1CM SIGHT SYSTEM MANUAL RANGING CONTROL.

9-160. The manual ranging control is supplied for use on overland targets at altitudes of less than 5000 feet where radar ranging with the AN/APG-30 radar unit is impossible. This installation consists of a potentiometer, mounted at the base of the power control lever. The power control twist grip, by means of shafting, drives the potentiometer. The potentiometer feeds voltages to an amplifier in proportion to the amount of rotation of the handle. Movement of the twist grip clockwise reduces the range signal; counterclockwise movement increases the range signal. When the twist grip reaches the maximum range (full counterclockwise) position, linkage within the electrical unit actuates a microswitch that transfers the range signal from manual ranging to radar ranging control. A detent and spring are provided in the twist grip to hold the handle in this position.

9-161. ADJUSTING MANUAL RANGING CONTROL. After the AN/APG-30 radar unit and gun sight installation have been checked out, turn on sighting system and allow a 15-minute warm-up period. Then adjust the manual range control installation as follows:

a. Remove friction wheel from quadrant center shaft by loosening locknut and then rotating wheel counterclockwise until wheel disengages from the shaft.

b. Remove quadrant access cover plate.

c. Adjust the minimum range potentiometer so that, when the twist grip is rotated to the full clockwise position, the range dial on the sight head will read 1200 feet. (See figure 9-24.)

d. Adjust the maximum range potentiometer so that, when the twist grip is rotated clockwise just beyond the microswitch tripping position, the range dial on the sight head will read 2700 feet.

e. Again check the twist grip throws in both positions. Make sure the adjustments accomplished during procedures c. and d. are still in effect.

f. Install electrical unit access cover.

g. Install quadrant access door.

h. Install friction wheel on quadrant center shaft and then secure with locknut.

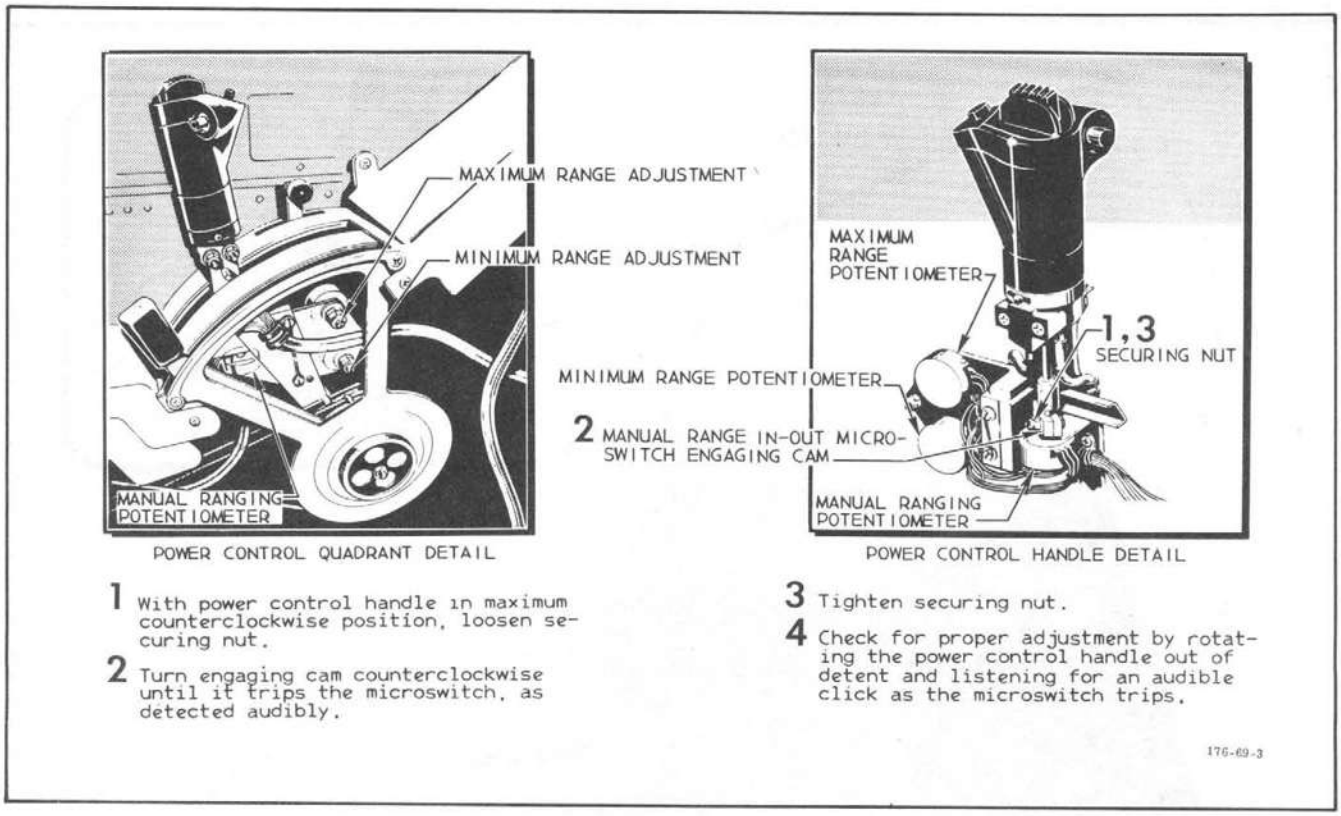


Figure 9-24. Adjusting A-1CM Sight System Manual Range Control

9-162. A-1CM SIGHT SYSTEM ROCKET SETTING UNIT.

9-163. The rocket setting unit (figure 9-25) is a pilot's control for setting into the sight the information concerning the type of rocket and angle of dive so that the computer can derive the correct lead angle. This unit also includes a setting for gunnery and dive bombing.

9-164. REMOVING ROCKET SETTING UNIT. To remove the rocket setting unit, proceed as follows:

a. Remove instrument panel. (Refer to paragraph 6-5.)

b. Disconnect AN. connector from rear of unit, and release the bottom attaching bracket by sliding unit to the right.

c. Rotate locking handle clockwise through its full arc; then twist the body of rocket setting unit clockwise approximately 10 degrees and pull unit forward.

9-165. INSTALLING ROCKET SETTING UNIT. See figure 9-25.

9-166. ADJUSTING ROCKET SETTING UNIT. See figure 9-26.

9-167. A-1CM SIGHT SYSTEM D-C POWER STATIC CONVERTER.

9-168. The static converter (figure 9-19) is an electronically regulated power supply capable of delivering regulated 300-volt direct current at 400 milliamperes with 115-volt a-c single-phase input.

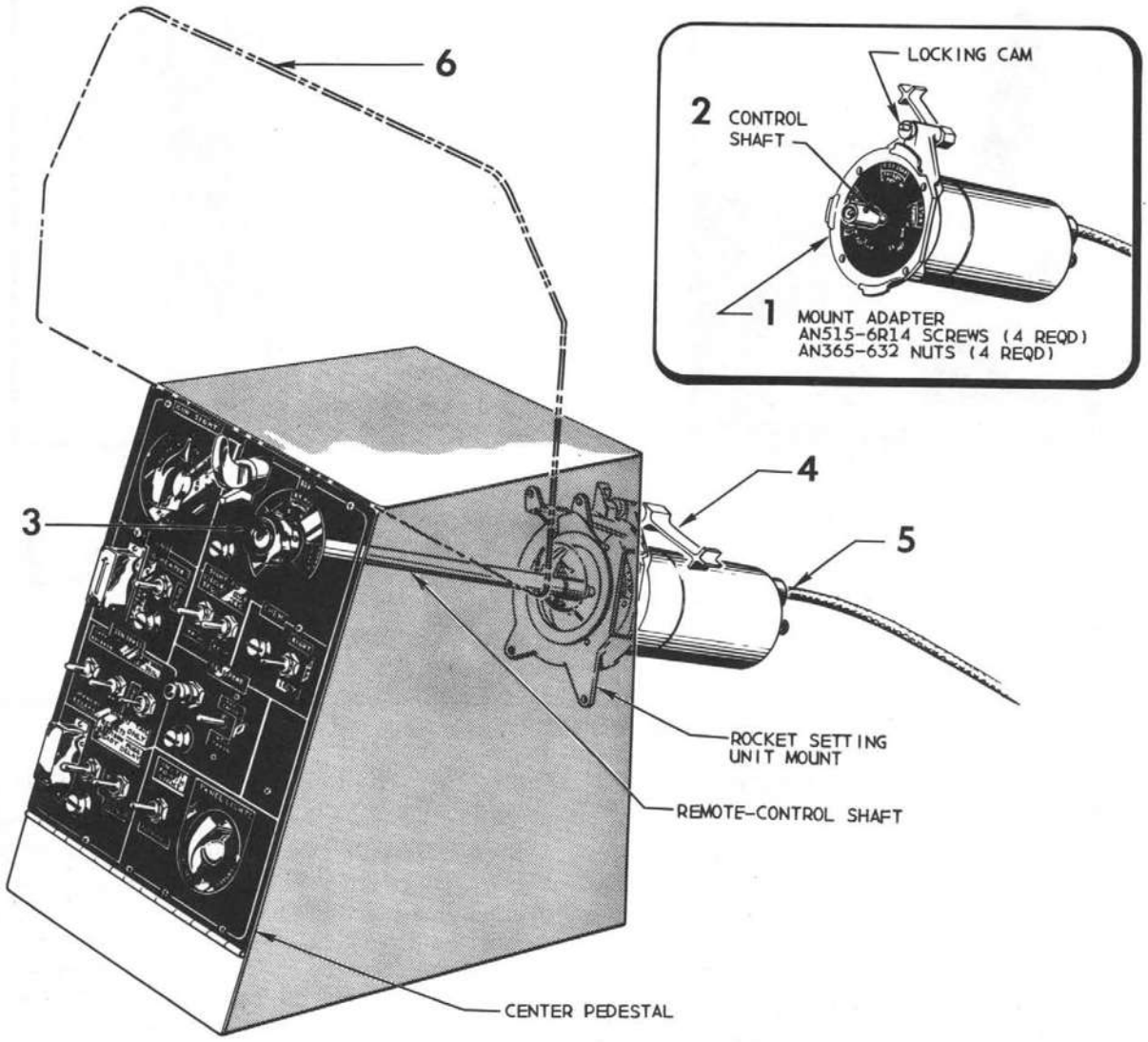
9-169. REMOVING D-C POWER STATIC CONVERTER. Before the static converter can be removed, the RT-82/APX-6 IFF set and the J-68/ARC-3 junction box must be removed. (See index for page number of applicable procedure.) After these units have been removed, disconnect the bonding strap and the four electrical leads from the front of the static converter. Loosen the two wing nuts on the static converter front panel and withdraw the entire unit from its case.

9-170. INSTALLING D-C POWER STATIC CONVERTER. Install the static converter into its case. Secure the two wing nuts on the front panel. Connect the four electrical leads to the front panel terminals and replace bonding strap. Install RT-82/APX-6 IFF set and J-68/ARC-3 junction box.

9-171. A-1CM SIGHT SYSTEM A-C POWER CONVERTER.

9-172. The a-c power converter (figure 9-19) installed on F-86E-1 Airplanes AF50-579 through -638 and F-86E-5 Airplanes AF50-639 through -646 furnishes three-phase alternating current to the armament sight system. The converter requires an input of 300-volt direct current (furnished by the armament sight d-c power static converter) and 28-volt direct current (furnished by the airplane d-c power system).

9-173. REMOVING A-C POWER CONVERTER. To remove the a-c power converter, disconnect the electrical plug, and remove the two bolts on the outboard



1 If a new rocket setting unit is being installed, remove unit dial pointer; then install mount adapter on unit, making sure that locking cam is installed above the "2.25" SCAR" position of the unit dial.

2 Turn rocket setting unit control shaft clockwise as far as possible.

3 Set rocket setting unit remote-control dial pointer (on aft face of center pedestal) to "5" ARN" position.

4 Through instrument panel access, engage rocket setting unit control shaft and remote-control shaft; then twist unit counterclockwise to engage unit and mount. Turn locking handle counterclockwise to engage locking cam. Operate remote-control dial to see that dial pointer and unit operation is coordinated.

5 Connect electrical lead to unit.

6 Install instrument panel. (Refer to index for page number of applicable procedure.)

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Figure 9-25. Installing A-1CM Sight System Rocket Setting Unit

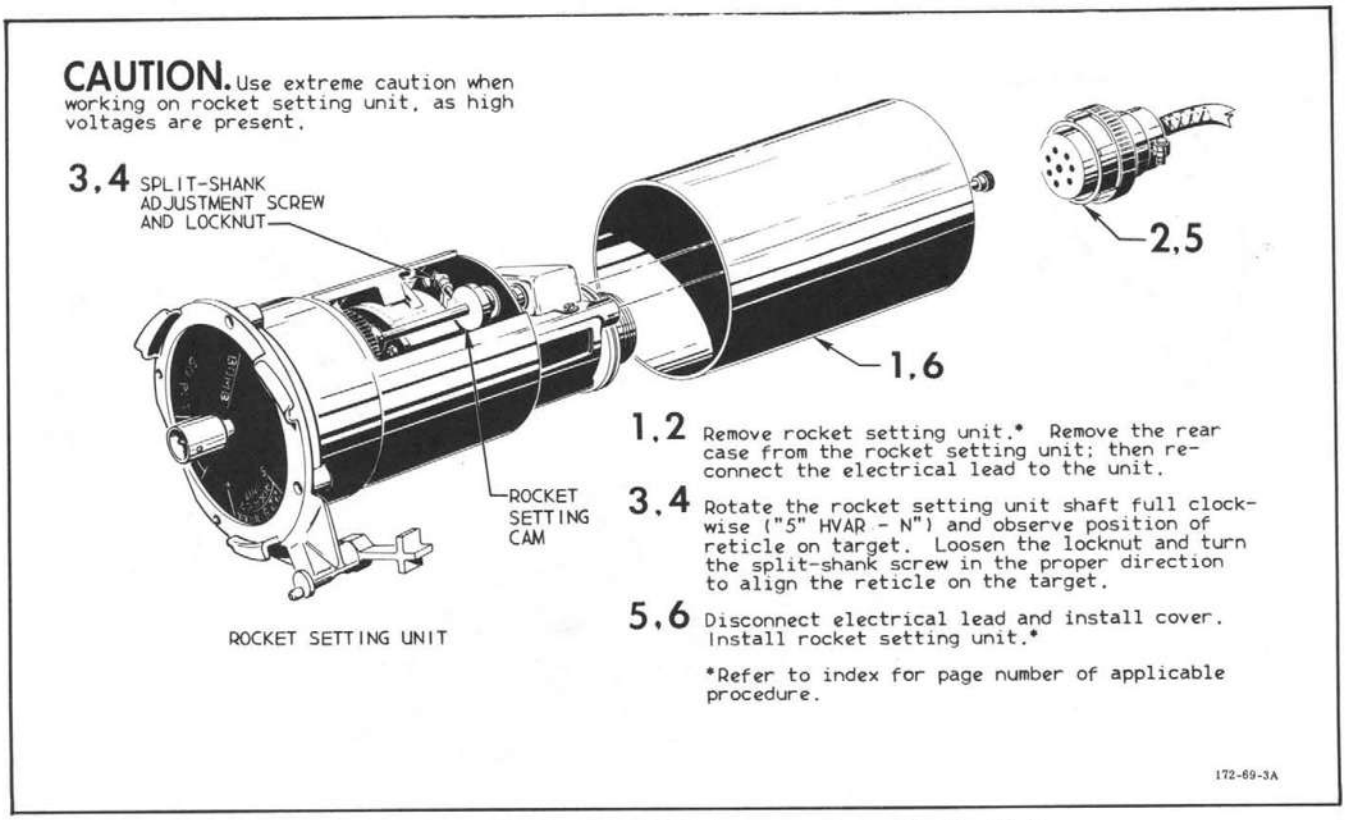

Figure 9-26. Adjusting A-1CM Sight System Rocket Setting Unit

side of the shock mount. After this has been done, the converter and mount can be removed from the mounting base.

9-174. INSTALLING A-C POWER CONVERTER. To install the a-c power converter, set it on its mounting base in the airplane and slide it inboard until the slot on the back side of the converter mount engages around the mounting base pin. Install and secure the two mounting bolts on the outboard side of the mount.

9-175. A-1CM SIGHT SYSTEM A-C POWER INVERTER.

9-176. The a-c power inverter (figure 9-19) installed on F-86E-5 Airplanes AF50-647 through -689, and F-86E-6 and subsequent airplanes utilizes a three-phase inverter instead of the a-c power converter. A step-down transformer is used to reduce the 115-volt output from the inverter to 28 volts.

9-177. REMOVING A-C POWER INVERTER. Removal of the a-c power inverter is identical to the procedure required for removing the a-c power converter. (Refer to paragraph 9-173.)

9-178. INSTALLING A-C POWER INVERTER. Refer to paragraph 9-174.

9-179. A-4 SIGHT SYSTEM.

9-180. The A-4 sight system installed on F-86E-15 Airplanes (figure 9-27) comprises the following units: sight head, sight selector unit, sight amplifier, sight computer, range servo unit, sight dimmer unit, and bomb-target wind scale. The A-4 sight system units utilize the A-1CM sight system mounting space provisions and function essentially the same as the A-1CM sight system units. (Refer to paragraph 9-131.) However, the sight selector unit, located in the center pedestal, replaces the rocket setting unit. The selector unit enables the pilot to select "GUN," "BOMB," or "ROCKET" position as desired. The sight function selector lever on the sight selector unit automatically moves to the "GUN" position when the radar-out switch on the B-8 stick grip is depressed. Also, when the A-4 sight is used in bombing, the circle of diamond-shaped dots that form the reticle image is extinguished and immediately reappears when the bombs release. No red bombs-away flasher light is provided.

9-181. BORE SIGHTING AND TESTING A-4 SIGHT SYSTEM.

9-182. To bore sight and test the system, a G-1A or G-2 field test unit may be utilized if a locally manufactured adapter cable is used between the tester and the A-4 sight system field test receptacle. See figure 9-28 for circuit diagram of adapter cable. To test the system, prepare the airplane for harmonization (paragraph 9-192) and proceed as follows:

Note

The cable adaptation of the G-1A or G-2 field test unit will cause the test unit "DEFLECTION CTM" switch to operate in reverse and prevent connection of the "SPACE HEAT" cycling light, also on the test unit.

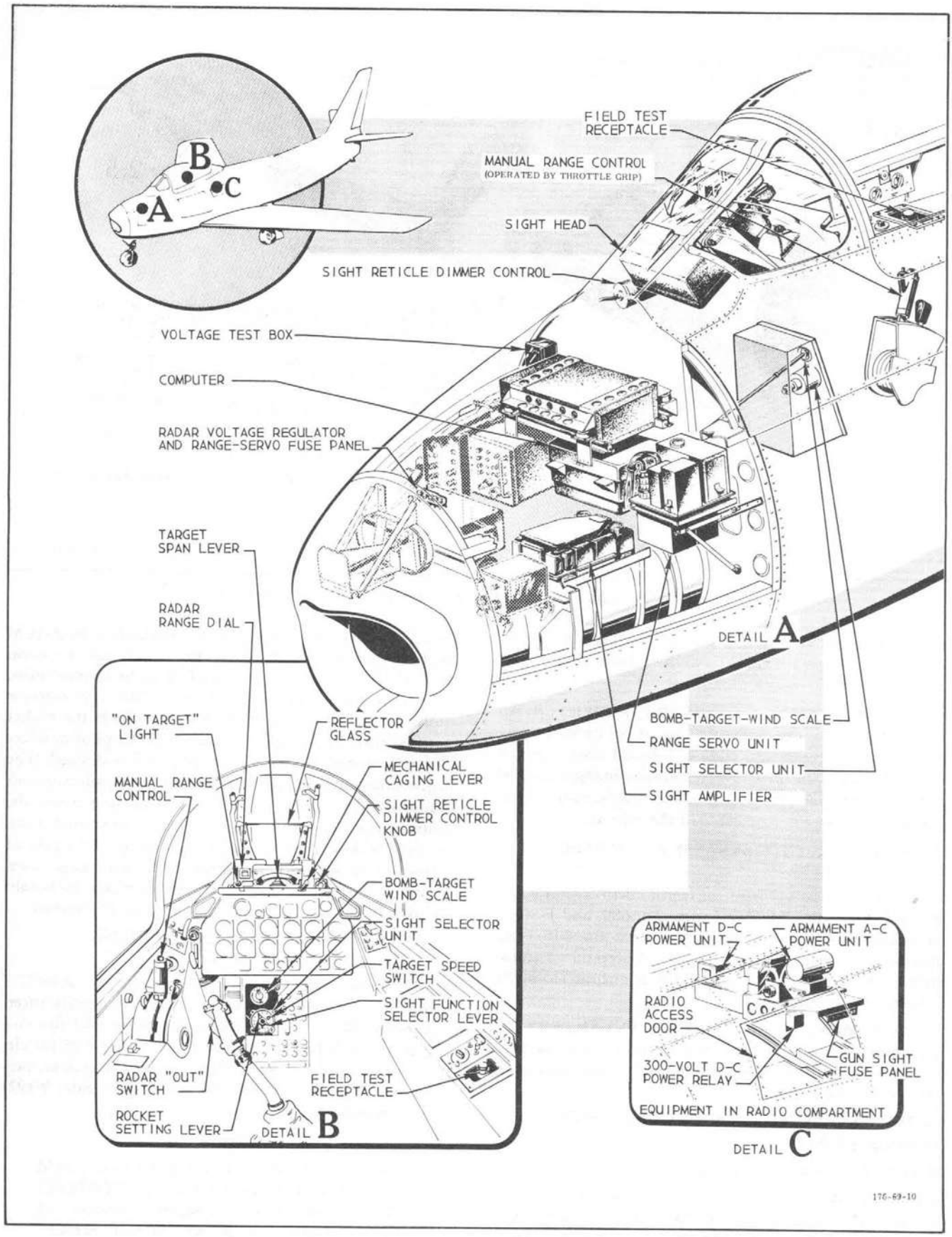

Figure 9-27. A-4 Sight System

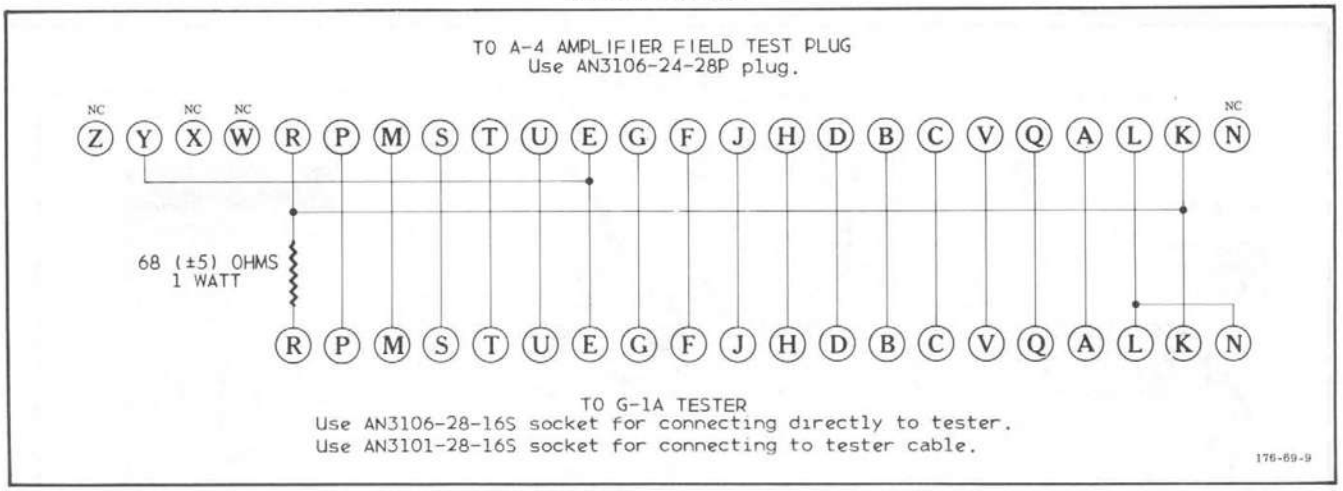

Figure 9-28. A-4 Sight System and Tester Adapter Cable

a. Remove radar-battery-gun sight access door shown in figure 1-5.

b. Connect external 28-volt d-c power source to the airplane; then close a-c system circuit breakers and set instrument power (a-c) switch to "NORMAL."

c. With the proper test equipment, check the availability of proper voltages and frequencies at the voltage test box. The a-c voltage between phases A and B, A and C, and B and C should be 28 (±3) volts, and the frequency should be 400 (±4) cycles. The 28-volt d-c supply should be 28 (±1.5) volts. The 300-volt d-c power supply (from static inverter) should be 300 (±3) volts.

d. Through the computer cover window, observe that elevation gyro is rotating counterclockwise. Accomplish this by watching gyro when it is stopped and then turning on the 28-volt, 3-phase, 400-cycle voltage.

e. When the correct operating temperatures are reached (after about 15 minutes or after heater lights on test units begin cycling), electrically cage the sight and observe that the target index dot is superimposed on the sight mark of the target board.

f. If target index dot is not on the target mark, remove sight head elevation and deflection (azimuth) adjustment cover plates. (See figure 9-29.) Mechanically cage the sight by moving the mechanical lever to the "CAGED" position. This will prevent damage to the mirror drive linkage when adjustments are made. To align the target index dot to target board arming mark, loosen the deflection adjustment lockscrews; then turn the deflection (azimuth) adjustment screw left or right until index dot is superimposed on aiming point on target board. (See figure 9-29.) For elevation correction, push in on socket wrench to unlock adjustment (figure 9-29) and then turn nut in direction required. Replace deflection cover plate as soon as possible to prevent entry of dirt or moisture.

g. Turn caging lever to "UNCAGE" to free mirror drive mechanism, and wait until index dot stabilizes. (Speedier stabilization will result if electrical caging button is pressed.)

h. Move caging lever repeatedly from "CAGE to "UNCAGE" position and check that index dot movement is restricted to a circled area of 3 mils caged or uncaged.

i. Using a milliameter (500-milliampere full scale) or observing that there is no sensitivity current to elevation or deflection stiffness motors, verify that 300-volt d-c power supply is interrupted when sight is mechanically caged.

j. See that reticle illumination does not flicker on and off when sight head is caged and that sight returns to gun function when radar "OUT" switch is depressed.

k. Set bomb-gun-rocket selector to "BOMB" position and bomb-target wind scale to "0" knots. Measure distance reticle moves from bomb stop to point where lamp circuit is opened when mirror motor is manually rotated away from bomb stop. This distance must be 4 (±1) mils.

l. Move the bomb-gun-rocket selector to the various rocket-type positions and measure that the index dot depression relative to the target board mark is as follows:

SELECTOR SETTING		TARGET INDEX DEPRESSION
2.75" FFAR	S	13 (±4) mils
	N	22 (±4) mils
5" HVAR	S	42 (±5) mils
	N	51 (±5) mils
2.25" SCAR	S	54 (±5) mils
	N	68 (±5) mils

Check that the total sensitivity currents for the various rockets agree with the sight factory test sheet figures plus or minus 2 milliamperes.

m. Electrically cage sight and check that index dot is superimposed on target board mark; then set range servo unit for a range of 5400 feet and bomb-gun-rocket selector train-high-low knob to "TR." See that correct deflection and elevation temperatures are reached (noted when lights cycle).

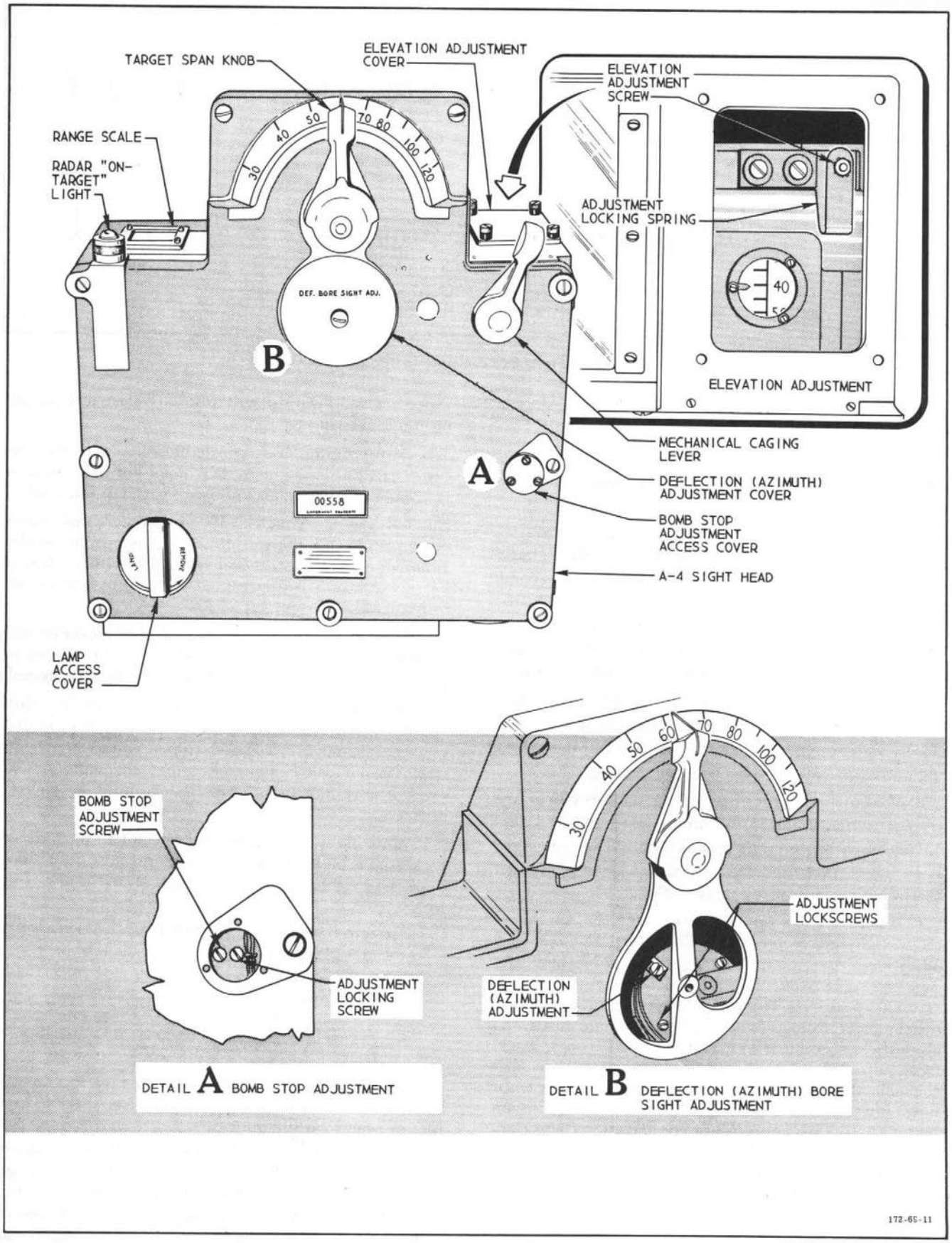

Figure 9-29. A-4 Sight System Bore-sighting Adjustments (Sheet 1 of 2)

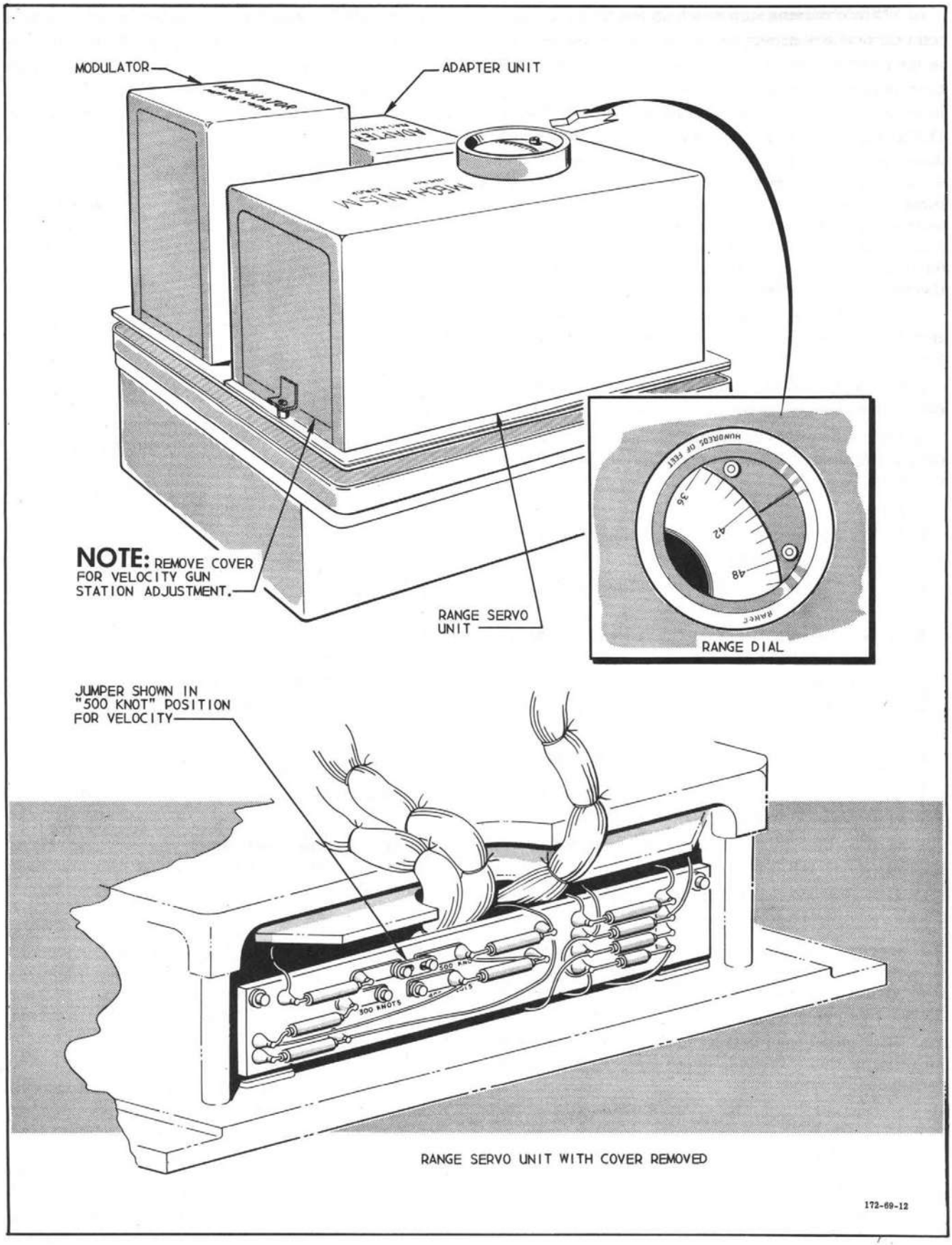

Figure 9-29. A-4 Sight System Bore-sighting Adjustments (Sheet 2 of 2)

n. While observing stop watch on test unit and using test unit switches, deflect target index dot to the left and to the right at least 175 mils; then release switch. Each time switch is released, measure the time of travel of index dot on the target board between 150 and 55 mils. Deflect the target index dot in elevation (both up and down) and measure the time of travel between 100 and 37 mils. The average characteristic time (for at least three successive deflections) should be 4.55 (±.6) seconds for a sight having a density ratio of 1.0 (0 feet altitude) and 2.9 (±.5) seconds when density ratio is 0.6 (16,175 feet altitude). Do not adjust computer heater thermal switches on basis of this test.

o. Check dimmer control to see that reticle brightens and dims when knob is turned in corresponding direction.

p. Check that reticle image is obtained in both primary and secondary position of filament switch.

q. Check the following voltages and currents, which can be measured at P-302 on the amplifier deck. Pin L is ground.

PINS	
L to K	28-volt, 400-cycle alternating current A phase to B phase
L to W	28-volt, 400-cycle alternating current A phase to C phase
K to W	28-volt, 400-cycle alternating current B phase to C phase
J to L	28-volt direct current in computer
Z to L	300-volt d-c supply from E-1 static computer
D to L	300-volt d-c supply from sight head
K to R	Microsyn excitation current (ACMA)
Y to E	Total sensitivity current (CDMA)
V to A	Elevation sensitivity motor current (DCMA)
Q to A	Deflection sensitivity motor current (DCMA)

r. Set target span dial on sight to 60 feet. When sight is in mechanical caged position, range dial should drive to 600-foot range and then stop. At these settings reticle diameter should be 100 (±4) mils.

s. With target span dial set to 90 feet, setting servo unit dial to the following ranges should produce the corresponding ranges.

RANGE	TOLERANCES
600 ft	± 60 ft
1200 ft	± 60 ft
2400 ft	± 70 ft
3600 ft	± 70 ft
4500 ft	± 80 ft
5400 ft	±120 ft
6000 ft	±120 ft

t. Set velocity gun station jumper in servo unit to 500 knots as shown in figure 9-29. With following ranges, target speed ratios, and density imputs, the sight system should reproduce sensitivity motor currents noted on manufacturer's test sheet within tolerance of ±2 milliamperes.

DEFLECTION STIFFNESS CURRENT

DENSITY RATIO	TARGET SPEED RATIO	RANGE (feet)
0.6	1.0 TR.	4500
0.6	1.0 TR.	3600
0.6	1.0 TR.	2400
0.6	1.0 TR.	1200
* 1.0	1.0 TR.	3600
0.6	0.8 HI.	3600
* 1.0	0.8 HI.	3600
0.6	1.2 LO.	3600
* 1.0	1.2 LO.	3600

ELEVATION STIFFNESS CURRENT

DENSITY RATIO	RANGE (feet)
0.6	5400
0.6	4500
0.6	3600
0.6	2400
0.6	1200
* 1.0	3600

Note

Items noted by an asterisk are for sight systems having density units installed. Density ratio of 1.0 is equivalent to 29.26 in. Hg (0 feet altitude). Items not so noted are for sight systems not having density units, but having equivalent networks corresponding to 0.6 density ratio or 15.56 in. Hg (16,175 feet altitude).

SENSITIVITY AMPLIFIER IDEAL TOTAL CURRENT

RANGE	DENSITY RATIO	TOTAL CURRENT VELOCITY GUN STATION 500 KNOTS	400 KNOTS	300 KNOTS
1200	1.0	50.2 ma	50.0 ma	49.9 ma
2400	1.0	33.2 ma	32.9 ma	32.5 ma
3600	1.0	24.5 ma	24.1 ma	23.6 ma
4500	1.0	19.9 ma	19.5 ma	18.9 ma
5400	1.0	16.5 ma	16.2 ma	16.0 ma
1200	0.6	50.7 ma	50.5 ma	50.4 ma
2400	0.6	34.8 ma	34.5 ma	34.2 ma
3600	0.6	27.3 ma	26.9 ma	26.4 ma
4500	0.6	23.6 ma	23.1 ma	22.6 ma
5400	0.6	20.6 ma	20.4 ma	20.1 ma

u. With range set at 3600 feet, depress characteristic time switch on test unit until target index dot is deflected to the right at least 100 mils; then release switch. Allow 30 seconds for target index dot to return and settle to zero and note dot position on target scale. Repeat the foregoing procedure except deflecting dot to left. Total spread between position of target index in returning to zero from left and from right must not exceed 3 mils.

v. Deflect target index dot up and down from zero with settling point approximately 8 mils below zero. The total spread between position of target index in returning to rest from up and down position should not exceed 3 mils.

w. To check gravity drop, set range at 3600 feet, electrically cage sight, and check that index dot is on target zero. Uncage sight and measure target index dot depression. For sight system having density ratio of 1.0, value should not exceed 8 (±1) mils. For system not having density units (density ratio of 0.6), value should not exceed 6 (±1) mils.

x. With sight electrically caged, move bomb-gun-rocket selector to "BOMB" position. Target index dot should drop 177 (±8) mils from electrical caged position. During this test, target index dot light will be extinguished until computer bomb stop is reached, at which time light will again illuminate. Press electrical caging button to speed dot settling. If necessary, remove sight head bomb stop adjustment access cover and loosen adjustment lockscrew (figure 9-29); then turn adjustment screw in either direction until reticle image appears and mark adjustment screw position. Turn screw in opposite direction until image is extinguished and mark screw position. Turn adjustment screw until midway between two marked positions. Recheck setting then tighten lockscrew.

9-183. A-4 SIGHT SYSTEM HEAD.

9-184. The function of the A-4 sight head is essentially the same as the A-1CM sight head except for the method of the reticle image projection. In the A-1CM sight head, the conical tube and two dual-filament bulbs are used for reticle image projection; in the A-4 sight head, a single dual-filament bulb is used for this purpose. The sight reticle image consists of a circle of diamond-shaped dots with a center target index dot. The radar lock-on light is mounted on the sight head. (See figure 9-29.)

9-185. REMOVING SIGHT HEAD. To remove sight head, proceed as follows:

a. Lower instrument panel.

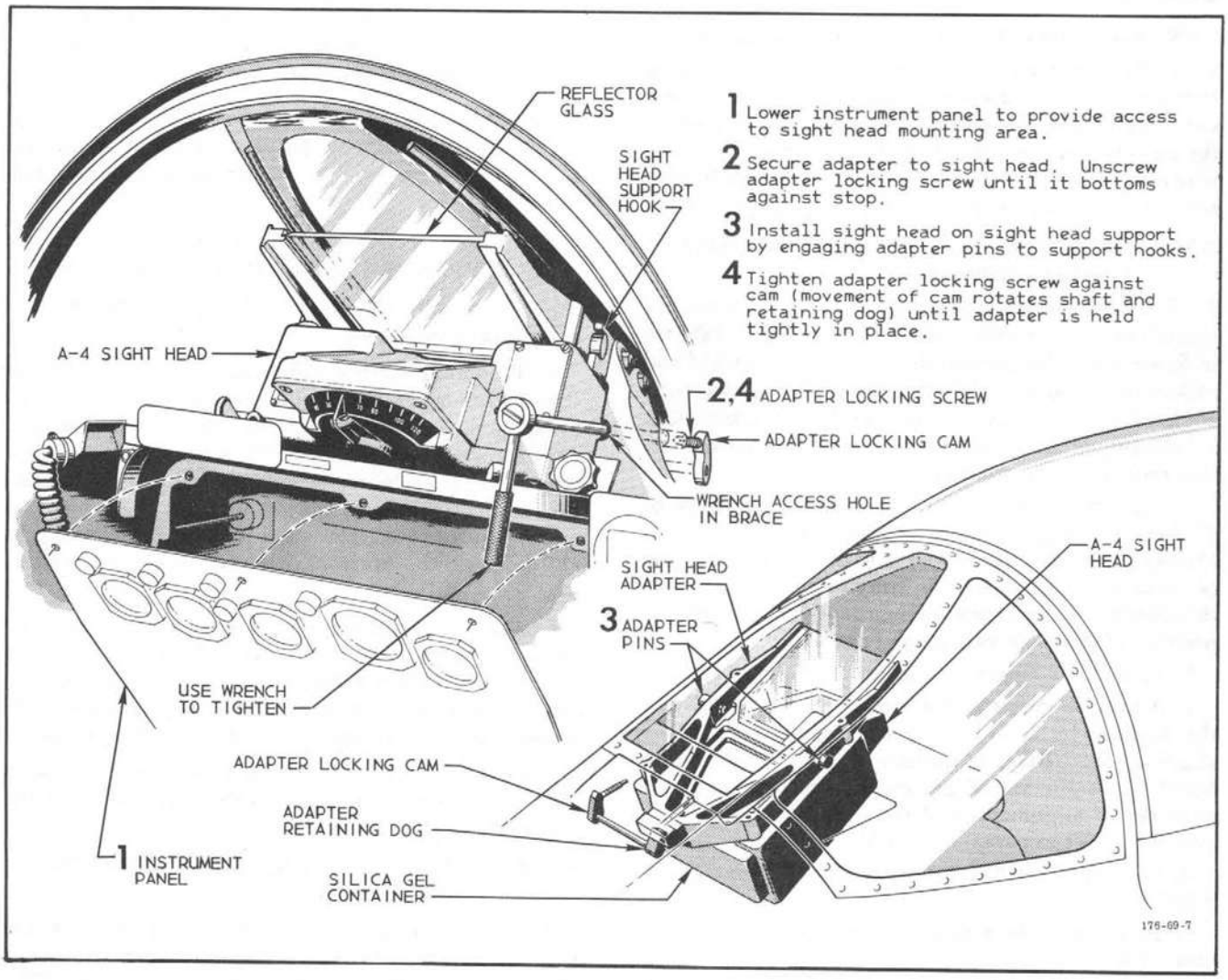

Figure 9-30. Installing A-4 Sight System Head

b. Unscrew adapter locking screw until it bottoms against stop. (See figure 9-30.)

c. Disconnect electrical leads from sight.

d. Prepare to support the sight head while pulling directly aft to disengage the sight head from the mount attachment.

9-186. INSTALLING SIGHT HEAD. See figure 9-30.

9-187. A-4 SIGHT SYSTEM SELECTOR UNIT.

9-188. The sight selector unit, mounted in the center pedestal, enables the pilot to position the sight function selector lever to "GUN," "BOMB," or "ROCKET" as desired. The sight correction for the type of rockets being carried can be selected by use of the rocket selector lever. The "TR.," "HI.," and "LO." target speed selector is provided for use during gunnery missions; the selection is determined by the rate of closure of airplane to target. A solenoid rotates the sight function selector lever back to "GUN" from either "BOMB" or "ROCKET" position when the radar-out button on the B-8 stick grip is depressed.

9-189. A-4 SIGHT SYSTEM RETICLE DIMMER.

9-190. The sight reticle dimmer is provided for reticle image control. The dimmer consists of a variable rheostat controlled by the dimmer control knob, located on the right side of the sight head. (See figure 9-27.) Clockwise rotation of the rheostat increases the reticle brightness; counterclockwise rotation decreases brightness.

9-191. HARMONIZATION OF GUNS, ROCKETS, CAMERA, AND SIGHT.

9-192. Bore sight information necessary for harmonization of the guns, rockets, camera, and gun sight is shown in figure 9-31. The information includes bore-sight and rocket-firing configuration, spiral path bomb trajectory, angle of attack versus altitude graph, and dimensions for local manufacture of a target board. The harmonization procedure is as follows:

a. Position the bore-sight target board a distance of 77 feet, 7½ inches directly in front of the airplane. Measure from the nose wheel axle centerline (airplane on jacks and nose wheel strut fully extended) to obtain this dimension. This measurement represents the proper position of the 1000-inch target board.

b. Level the airplane as outlined in paragraph 1-16.

c. Align the target board vertically and laterally to the airplane by use of the peep sight and cross-hair aligning tools. (Refer to paragraph 9-194.) If the target board bore-sight tool alignment fixtures are suspected to be out of alignment or if the sighting tools are not available, refer to paragraph 9-196.

d. Bore sight the rocket system. (Refer to paragraph 9-50.)

e. Bore sight the gunnery system. (Refer to paragraph 9-65.)

f. Bore sight the gun camera system and sight reticle camera system. (Refer to paragraphs 9-114 and 9-129.)

g. Bore sight the A-1CM sight system and A-4 sight system. (Refer to paragraphs 9-136 and 9-182.)

9-193. ALIGNING TARGET BOARD AND AIRPLANE USING BORE-SIGHT TOOLS.

9-194. Remove the left gun bay door and left engine access door; then proceed as follows:

a. Install the forward and aft bore-sight tools. (See figure 9-31.)

b. Sight from the rear peep sight tool, through the forward cross-hair tool, to the aligning mark on the target board.

c. Move the target board horizontally or vertically until the forward bore-sight tool cross hair is superimposed on the target board aligning mark. A white border of equal width must appear around the forward bore-sight tool cross hair for proper alignment of the target board.

Note

Do not use bore-sight tools for handholds or steps. Misalignment of the bore-sight tools or mounting fixtures makes them ineffective for target board alignment.

If the bore-sight tools are damaged or the airplane bore-sight tool mounting fixtures are out of alignment, refer to paragraph 9-196 for transit and plumb bob method.

9-195. ALIGNING TARGET BOARD AND AIRPLANE USING TRANSIT METHOD.

9-196. Level the airplane as outlined in paragraph 1-16 and proceed as follows:

a. To obtain vertical alignment, position transit so that the fuselage reference line markers (on the left side of the airplane) and the target board can be viewed. (The transit should be at least 20 feet from the airplane.) Align the transit with the reference line markers, and then sight on the target board. Move the target board up or down until the target board reference line marker is aligned with the horizontal reference in the transit.

b. If a transit is not available, it is possible to align the target board vertically with the airplane (provided the airplane has been leveled and a level apron or hanger is available) if the distance to the ground from the fuselage reference line is measured and the target board reference line is set an equal distance from the ground.

c. Suspend plumb bobs from plumb bob points on bottom of fuselage to align target laterally with the centerline of the fuselage.

9-197. ARMOR PLATE AND BULLET-RESISTANT GLASS INSTALLATION.

9-198. Armor plate and bullet-resistant glass (figure 9-32) is provided to protect the pilot and vulnerable sections of the airplane from injury or damage. The forward section armor protection consists of a 24S-T

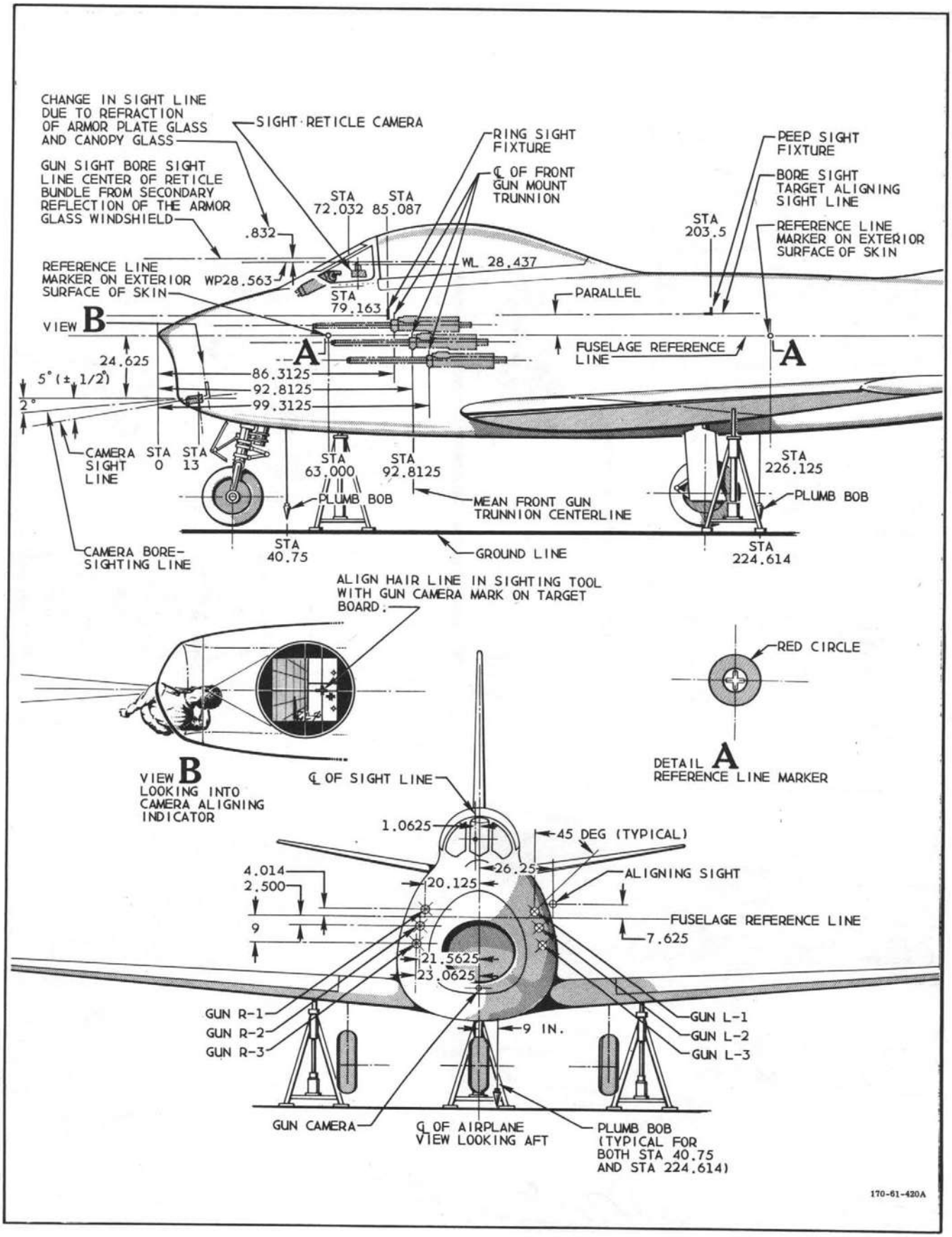

Figure 9-31. Harmonizing Charts (Sheet 1 of 3)

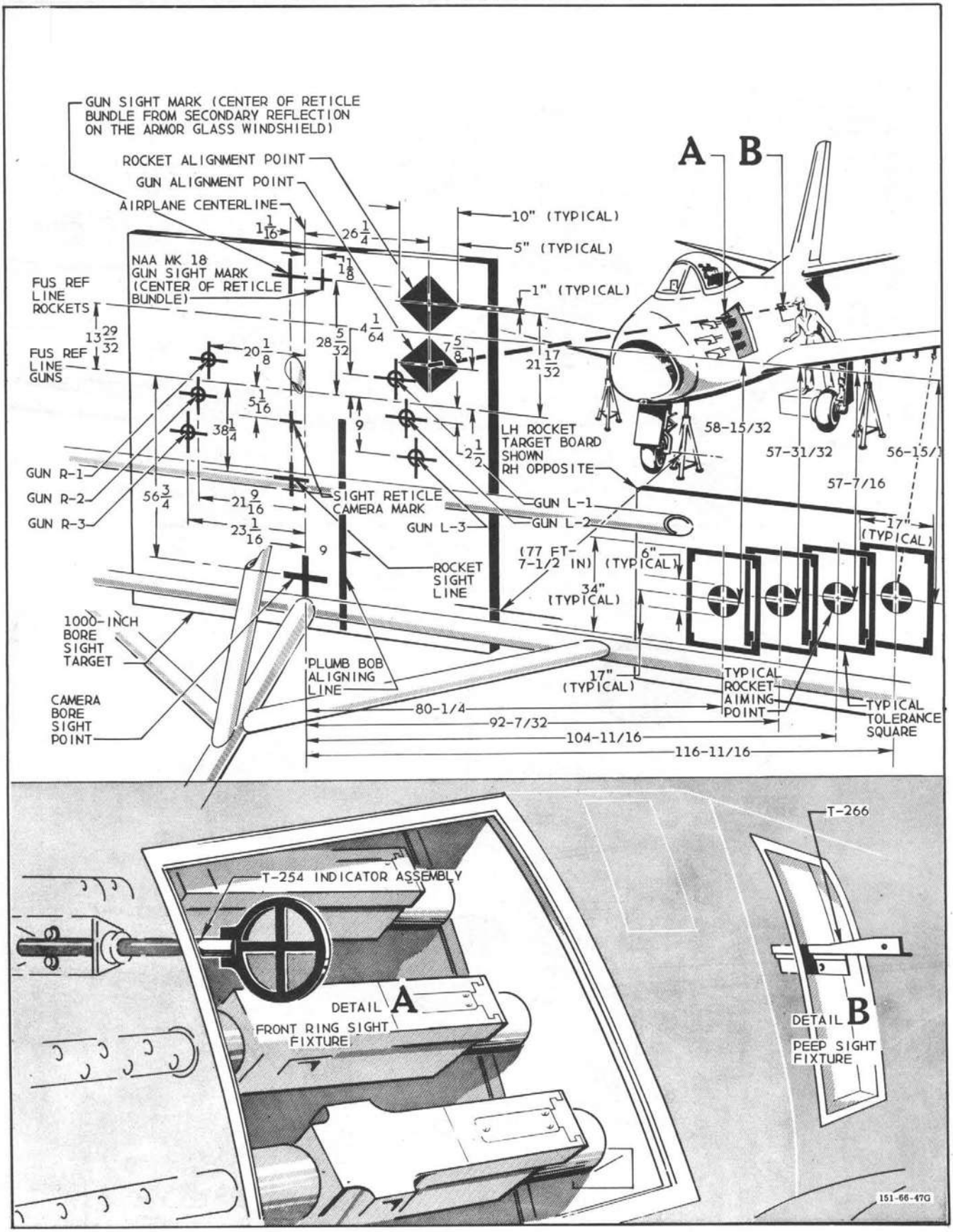

Figure 9-31. Harmonizing Charts (Sheet 2 of 3)

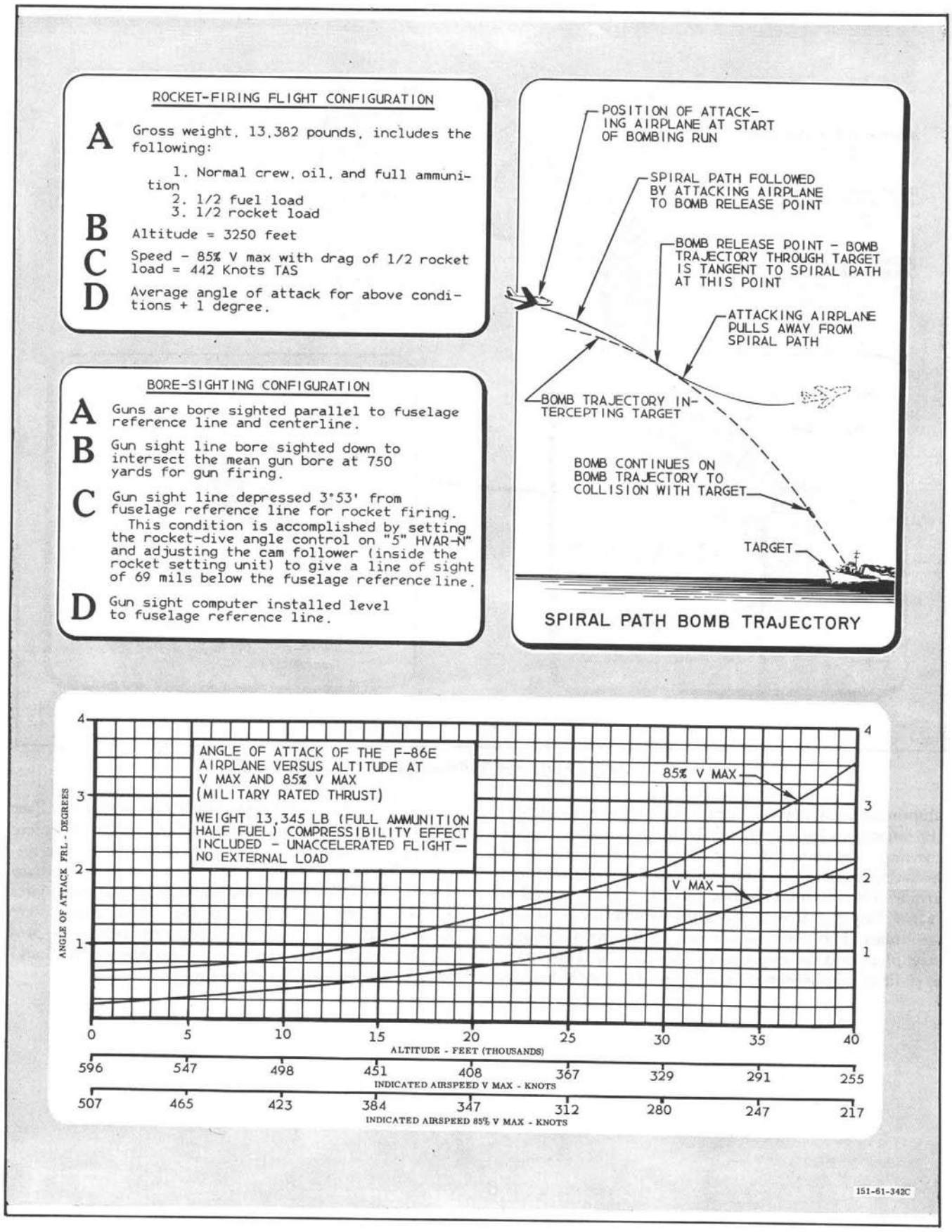

Figure 9-31. Harmonizing Charts (Sheet 3 of 3)

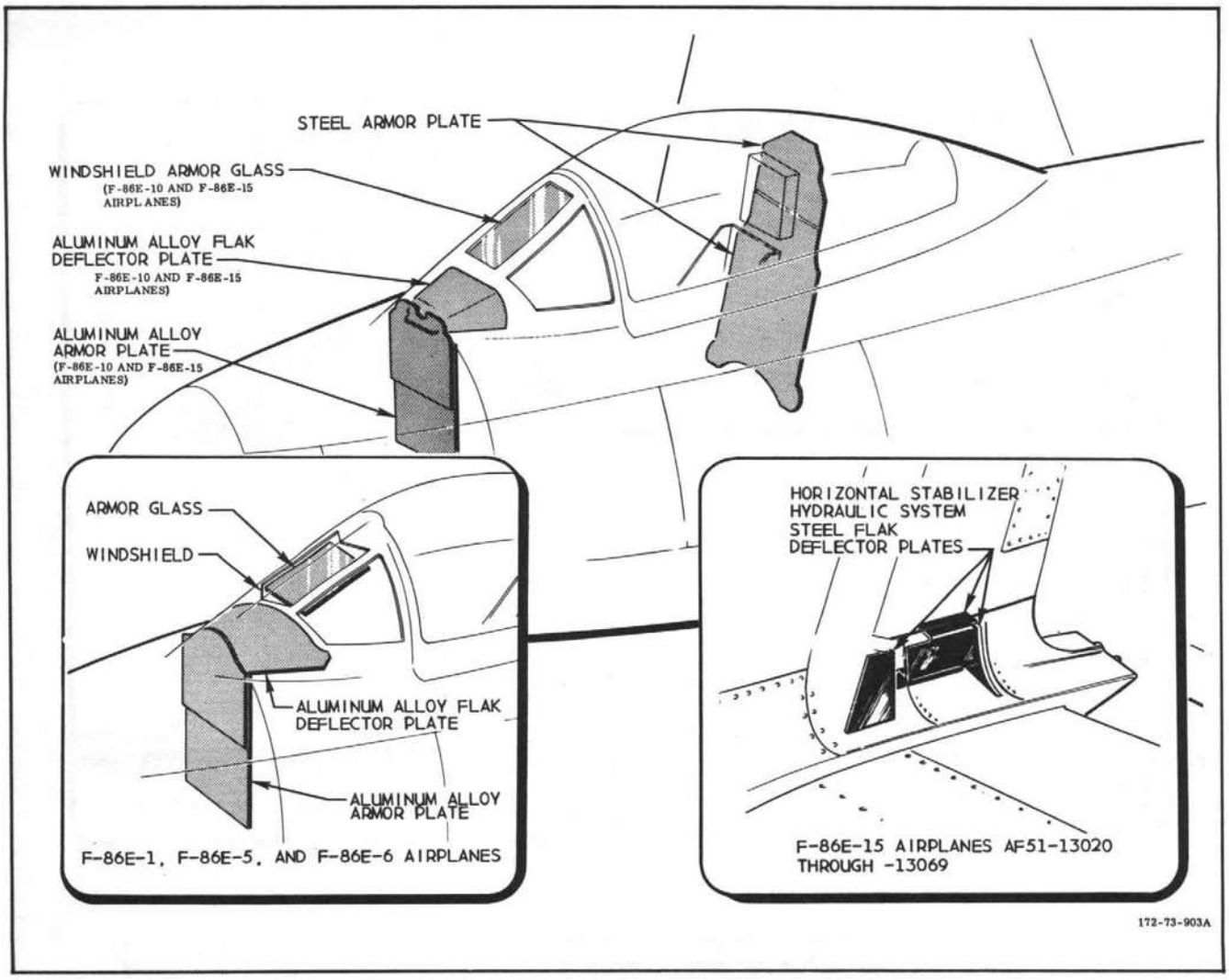

Figure 9-32. Armor Plate and Bullet-resistant Glass Installation

aluminum alloy plate 7/8 inch at the top and 1/2 inch at the bottom and a 3/8-inch 24S-T aluminum alloy (upper cowling) deflector plate. A 1 1/4-inch flat laminated bullet-resistant glass plate constitutes the windshield armor. The aft intermediate section armor protection (aft of the pilot's seat) consists of a 5/16-inch face-hardened steel plate. The lower section is a 1/4-inch homogeneous steel plate, and the upper section (pilot's head armor) is a 3/8-inch face-hardened steel plate. On F-86E-15 Airplanes AF51-13020 through -13069, horizontal stabilizer flak protection plates are provided to prevent complete loss of the normal and alternate hydraulic power systems. The armor plates are so arranged that the systems are divided into two separate groups. All armor plates are removable and (excluding the pilot's armor plate head protection and the horizontal stabilizer flak protection plates) serve as structural members and should be properly installed prior to flight.

Section X

WIRING DATA

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10-1. WIRING DATA.

10-2. This section of the book contains pertinent electrical data necessary for electrical and electronic maintenance technicians to understand the make-up and function of each intercomponent power and control circuit, to trace each such circuit, to make continuity checks, and to accomplish specific trouble-shooting on inoperative and improperly functioning circuits. This data contains wiring diagrams, both simplified and detailed, for the electrical and electronic systems of the airplane. The simplified diagrams (figure 10-4) present an over-all working knowledge of the various circuits. The detailed diagrams furnish all wiring details necessary for the checking-out of electrical circuits. Isometric illustrations accompany each detailed electrical and electronic diagram to show actual location of all major items. The item numbers of the items shown on the isometric diagrams are circled on the schematic diagrams. An alphabetical index (paragraph 10-11) lists and gives the figure numbers of all wiring diagrams, which are arranged essentially in the same order as the systems to which they pertain in the preceding sections of the handbook. Relay location charts and circuit-breaker location charts (figures 10-2 and 10-3) supply detailed information regarding these panels. Item lists showing item number, description, and part number are supplied. The item list appearing in paragraph 10-10 serves as the master list. The item list included with each wiring diagram covers only those items on the respective wiring diagram. The electrical symbol charts (figure 10-1) contain the symbols used in the wiring diagrams throughout the book. The information supplied in this section may be used in conjunction with the detailed information on operation and maintenance supplied in previous sections.

10-3. WIRING IDENTIFICATION.

10-4. To facilitate wiring installation, each wire is identified by a letter-number combination stamped on the wire at approximately 8-inch intervals throughout its entire length. Reading from left to right, the first number is to differentiate between cables having the same cable identification; the first letter identifies the function of the circuit; the second letter designates the circuit in which the wire belongs; the next number identifies the wire number in the circuit; the next letter identifies the segment of that wire size and the last two numbers indicate wire size. The following is the identification code for wiring as used in these airplanes. This code does not apply to internal wiring of equipment.

A. ALL ARMAMENT AND BOMBING CIRCUITS.
- AB – Bombing
- AC – Cameras
- AG – Guns
- AK – Chemical
- AR – Rockets
- AS – Sights

C. FLIGHT CONTROL CIRCUITS.
- CB – Diving Brakes
- CS – Surface Booster
- CT – Trim Tabs
- CW – Wing Flaps

D. DEICING OR ANTI-ICING CIRCUITS.
- DD – Deicing Control (Mechanical or Heat)
- DP – Pitot Heater

E. ENGINE INSTRUMENT CIRCUITS.
- ED – Fuel Flow
- EF – Fuel Quantity
- EG – Oil Pressure
- ES – Tachometer
- EU – Fuel Pressure
- EV – Hydraulic Pressure

F. FLIGHT INSTRUMENT CIRCUITS.
- FB – Turn-and-Bank Indicator
- FH – Gyro Horizon
- FR – Remote Compass

G. LANDING GEAR CIRCUITS.
- GA – Actuator and Retraction
- GC – Wheel Steering

H. HEATING AND VENTILATION CIRCUITS.
- HC – Cabin Heater
- HG – Gun Heater
- HV – Ventilation Control

J. IGNITION CIRCUITS.
- JD – Ignition Vibrator

K. ENGINE CONTROL CIRCUITS.
- KS – Starter

L. LIGHTING CIRCUITS.
- LB – Blinker
- LE – Extension
- LJ – Instrument
- LL – Landing
- LN – Navigation

M. MISCELLANEOUS.
- MR – Enclosure Operation Release, Locks, etc
- MW – Wing Folding

N. GROUND NETWORK WIRING.

Any wire that completes the circuit to the ground network from an equipment item is designated with the letter "N."

In explanation, it may be said that any wire with an "N" circuit function letter could be connected to the aircraft ground network without malfunctioning of the circuit.
- NA – Ground, Armament
- NC – Ground, Flight Control
- ND – Ground, Deicing or Anti-icing
- NE – Ground, Engine Instruments
- NF – Ground, Flight Instruments
- NG – Ground, Landing Gear
- NH – Ground, Heating and Ventilating
- NJ – Ground, Ignition
- NK – Ground, Engine Control
- NL – Ground, Lighting
- NM – Ground, Miscellaneous
- NP – Ground, Power
- NQ – Ground, Fuel and Oil
- NR – Ground, Radio Navigational and Communication Equipment
- NS – Ground, Radio Operated Equipment
- NV – Ground, Inverter
- NW – Ground, Warning Devices

P. POWER.

All wiring of battery, generator, voltage regulator, alternator field, field supply, rectifier output, generator load equalizer resistor and their controls, etc, has the "P" classification. All d-c power wiring for more than one circuit is identified by the letter "P" with no additional circuit designation letter. This includes feeders from reverse-current relays to busses, from batteries to busses, etc. All d-c feeders or d-c power wiring up to the protector for an individual circuit (other than ground network) is identified by two letters: the letter "P" and a circuit designation letter as shown in the following table.
- PA – Power, Armament
- PC – Power, Flight Controls
- PD – Power, Deicing or Anti-icing
- PG – Power, Landing Gear
- PH – Power, Heating and Ventilating
- PP – Power, Generator Control, Battery Control
- PQ – Power, Fuel and Oil
- PV – Power, Inverter

Q. FUEL AND OIL.
- QB – Fuel Booster Pump Motor
- QF – Fuel Transfer Pump Motor and Control
- QT – Throttle Control, Fuel Pump Motor

R. RADIO NAVIGATIONAL AND COMMUNICATION EQUIPMENT.
- RN – Radio Navigation
- RV – VHF Command

S. RADAR OPERATED EQUIPMENTS.
- SG – Gun Laying Radar
- SX – Recognition Radar

V. INVERTER CONTROL.
- VX – Inverter A-C Control

W. WARNING DEVICES.
- WA – Armament Warning
- WD – Deicing or Anti-icing Warning
- WF – Flight Instrument Warning
- WG – Landing Gear Warning
- WH – Heating, Ventilation, and Pressurization Warning
- WM – Miscellaneous Warning, Wing Folding
- WP – Power Warning
- WV – Inverter Warning

X. A-C POWER.

All a-c feeders or a-c power wiring up to an individual circuit (such as protectors) other than the ground network is designated by the letter "X." All external wiring of alternators, inverters, and control equipment has the "X" classification.
- XA – "A" phase of three-phase power
- XB – "B" phase of three-phase power
- XC – "C" phase of three-phase power
- XN – Neutral or grounded wire of three-phase power
- XV – Inverter (single phase)

10-5. WIRING REFERENCES.

10-6. In order to facilitate tracing one wire or a group of wires from one wiring diagram to another, three methods of referencing are utilized.

10-7. FROM ONE WIRING DIAGRAM TO ANOTHER SYSTEM DIAGRAM CONTAINING ONLY ONE SHEET. The following example (————LT36A20——→286, LANDING LIGHT SYS) indicates that wire LT36A20 is routed to an item of equipment (item number 286) shown on the wiring diagram for another system (landing light system). The reader merely has to refer to the wiring diagram index (paragraph 10-11) for the airplane model and/or serial numbers and the figure number of the referenced system diagram. On this illustration, the item reference (286) can be found and the wiring can be completed.

10-8. FROM ONE WIRING DIAGRAM TO ANOTHER SYSTEM DIAGRAM CONTAINING TWO OR MORE SHEETS. In the following example [————LT36A20——→286, LANDING LIGHT SYS (SHEET 3)], the procedure of tracing the wire is the same as explained in paragraph 10-7, except that reference is made to only one sheet of the diagram. The sheet number is included in the figure title below the diagram.

10-9. FROM ONE SHEET OF A WIRING DIAGRAM TO ANOTHER SHEET OF THE SAME DIAGRAM. The following example (————AB4E16——→SHEET 3) indicates that the wiring circuit is continued on another sheet of the same diagram, and no reference to the wiring diagram index is necessary.

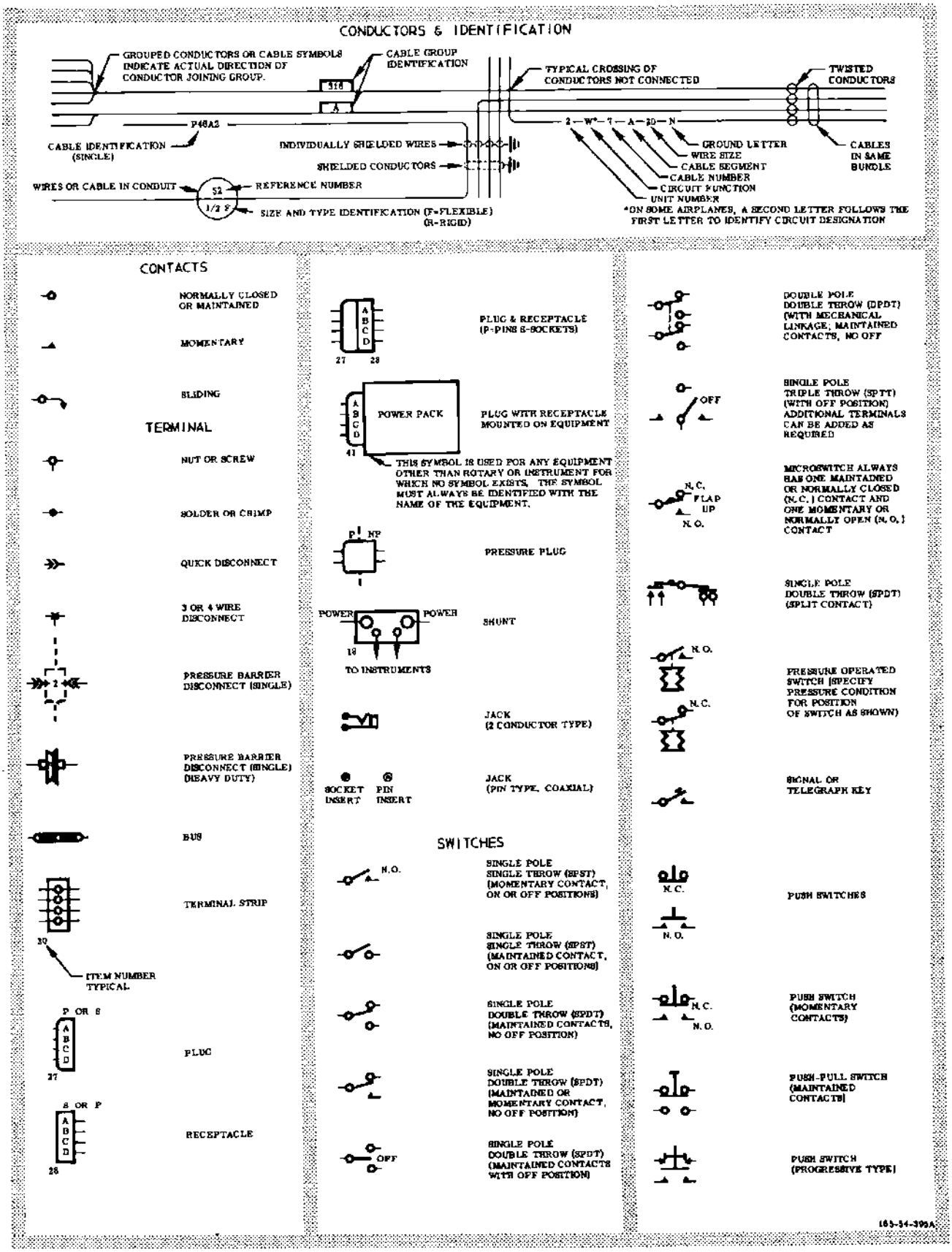

Figure 10-1. Electrical Symbol Chart (Sheet 1 of 4)

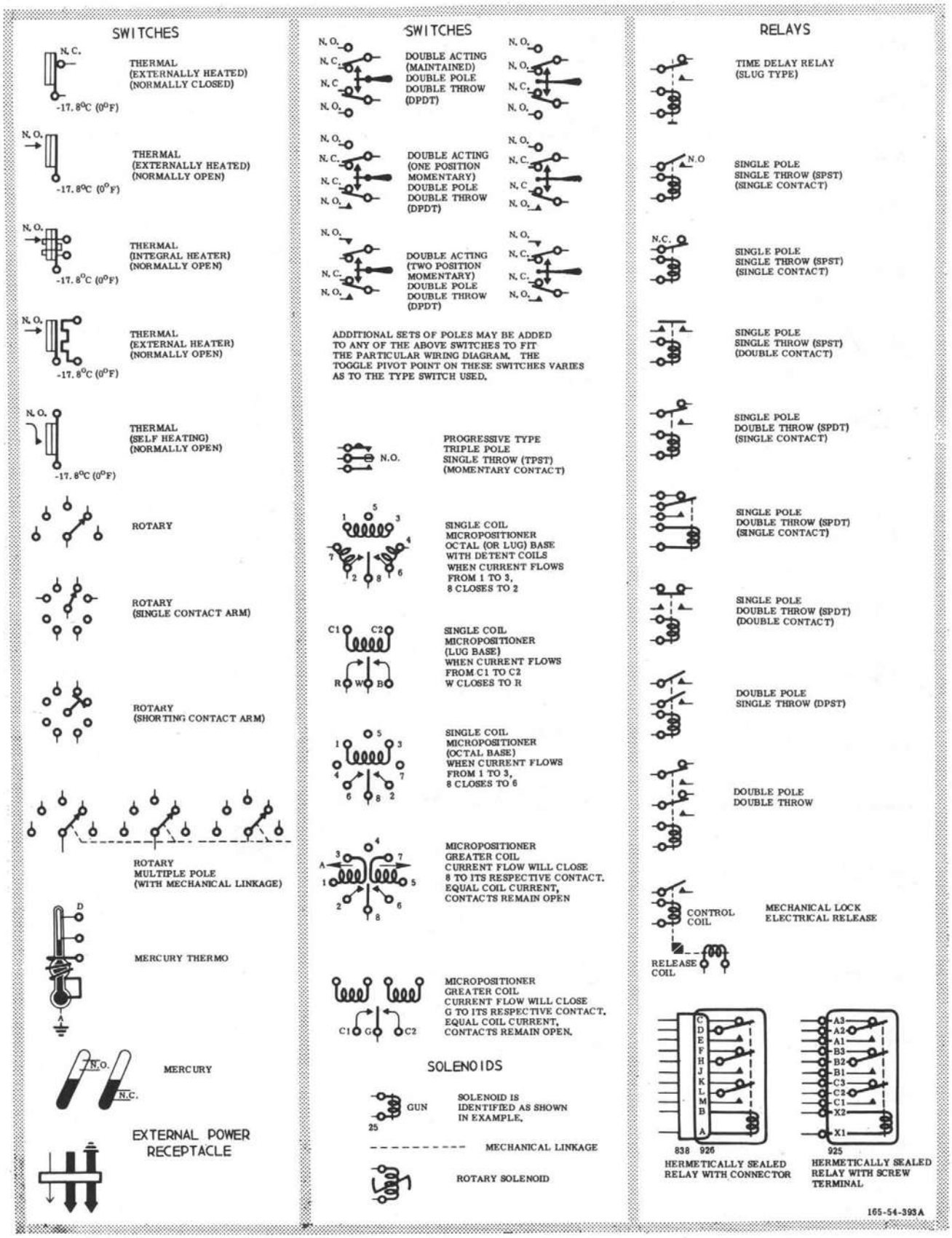

Figure 10-1. Electrical Symbol Chart (Sheet 2 of 4)

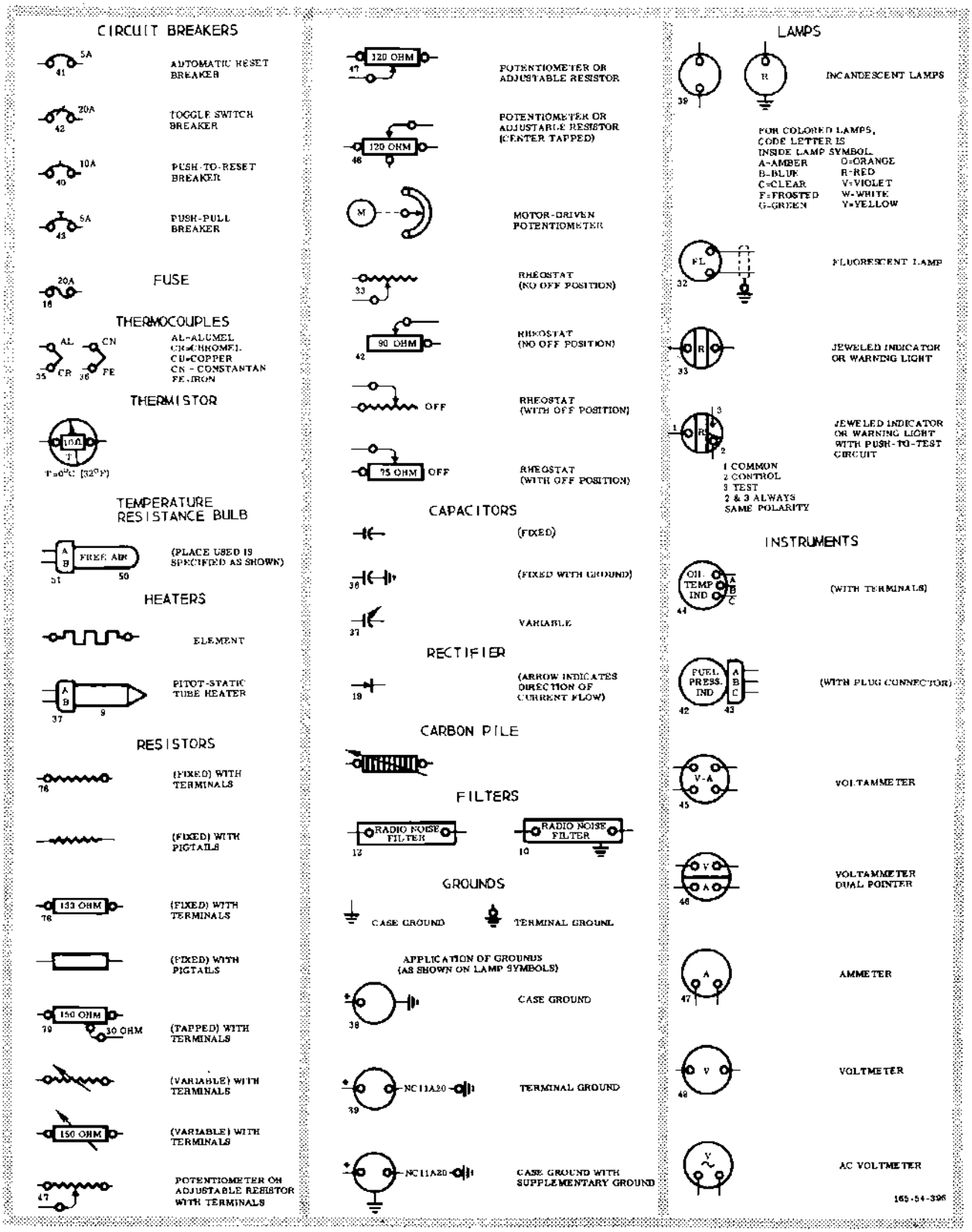

Figure 10-1. Electrical Symbol Chart (Sheet 3 of 4)

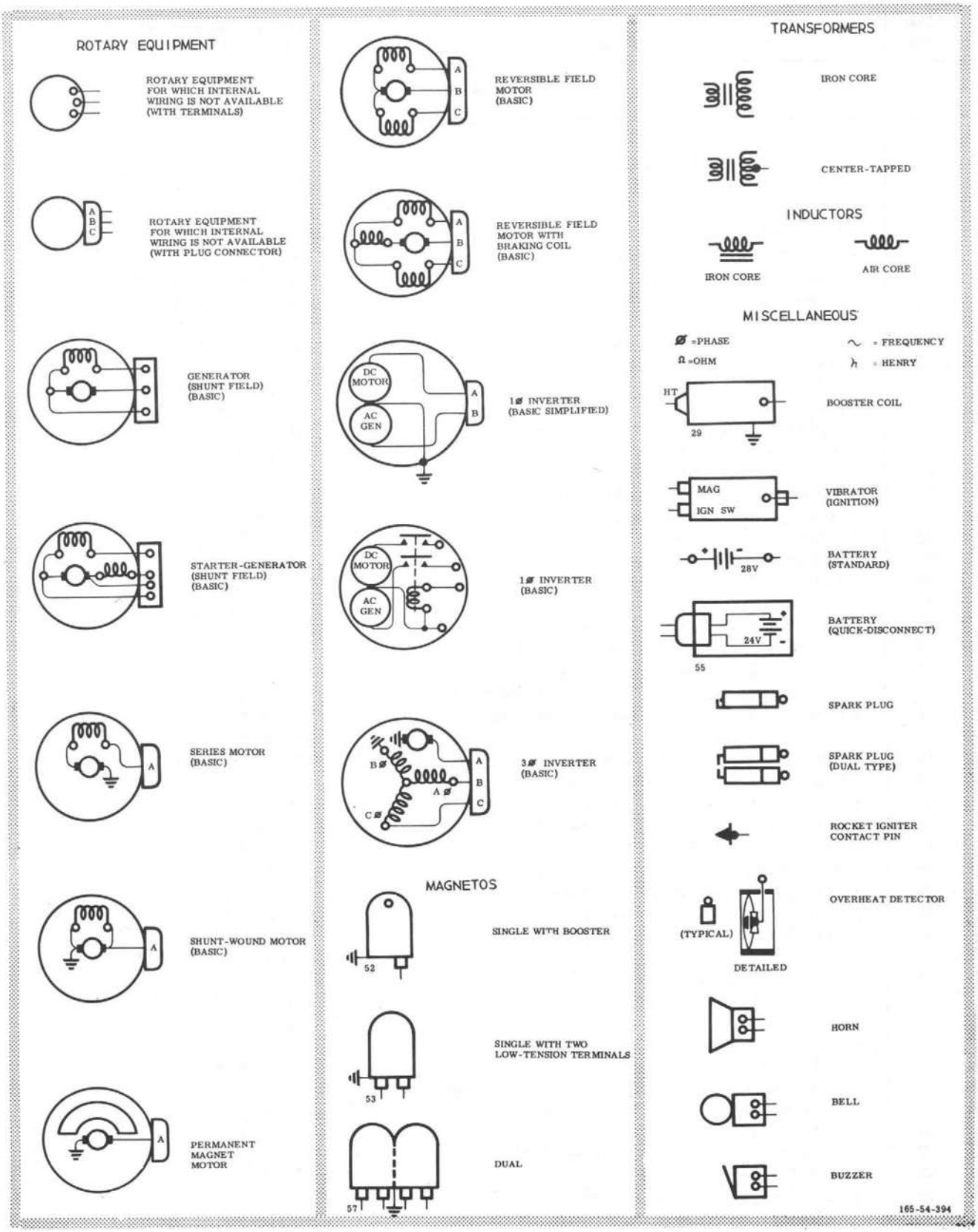

Figure 10-1. Electrical Symbol Chart (Sheet 4 of 4)

10-10. EQUIPMENT ITEM LIST.

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
	ELECTRICAL	
1	Actuator—Ammunition Heat	WE443-10DM (Whittaker)
2	Actuator—Canopy	151-54176 (NAA) {Reworked D-380-1 (Hoover)}
3	Actuator—Lateral Bungee	396-H (Lear)
4	Actuator—Longitudinal Bungee Trim	D-1040 (Hoover)
*5	Actuator—Mixing Valve	33800G-4 (Pacific Airmotive)
6	Actuator—Rudder Trim Tab	31296 (AiResearch)
8	Actuator—Wing Flap	M3320 (Air Associates)
†9	Actuator—Longitudinal Bungee Trim	29656-6 (AiResearch)
†10	Actuator—Engine Anti-icing Valve	Furnished With Engine (GFP)
†11	Actuator—Inlet Screen	Furnished With Engine (GFP)
14	Ammeter—50-millivolt	32529, Type J-1
†15	Amplifier—Cockpit Temperature Control	30058 (AiResearch)
16	Amplifier—Fuel Totalizer	16501-1-A (Pioneer)
17	Amplifier—Gyrosyn Compass	21125, Type A-2
†18	Amplifier—Windshield Anti-icing Control	30058 (AiResearch)
20	Battery—24-volt 34-ampere-hour	AN3150-2
22	Bracket—Relay and Shunt	151-54099 (NAA)
*24	Bus Bar—Bus Tie-in Relay	172-54020 (NAA)
†25	Camera—Sight GSAP	75-366, AN-N6 (GFP)
26	Camera—GSAP	75-366, AN-N6 (GFP)
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
30	Circuit Breaker—Alternate Aileron Trim	AN3161P5
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P10* AN3161P5†
33	Circuit Breaker—Ammunition Boost	PDA-35 (Klixon)
34	Circuit Breaker—AN/ARN-6 Radio	AN3161P5
35	Circuit Breaker—AN/ARC-3 Radio	AN3161P20
36	Circuit Breaker—AN/APX-6 Destructor	AN3161P10
37	Circuit Breaker—AN/APX-6 IFF	AN3161P5
38	Circuit Breaker—Turn-and-Bank Indicator	AN3161P5
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
41	Circuit Breaker—Bus Control Relay	PSA-10* (Klixon) PSA-5† (Klixon)
42	Circuit Breaker—Bus Tie-in	AN3161P5
43	Circuit Breaker—Cockpit Canopy	AN3161P50* AN3161P35†
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-icing	AN3161P10* AN3161P5†
45	Circuit Breaker—Console, Pedestal, and Instrument Light, and Stabilizer Rate Damper	AN3161P5
46	Circuit Breaker—Engine Ignition	AN3161P10
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P15
48	Circuit Breaker—Fire-warning	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
50	Circuit Breaker—Air Selector	AN3161P5

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
51	Circuit Breaker—Forward Fuel Booster	AN3161P20* AN3161P25†
52	Circuit Breaker—Aft Fuel Booster	AN3161P25
53	Circuit Breaker—Fuel Filter Deicing	PSA-15* (Klixon) PSA-5† (Klixon)
54	Circuit Breaker—Fuel Level Indicating System	AN3161P5
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
56	Circuit Breaker—Generator Field	AN3161P20
57	Circuit Breaker—Gunfire	AN3161P35* AN3161P15†
58	Circuit Breaker—Gun Heater	AN3161P35* AN3161P15†
59	Circuit Breaker—Automatic Gun Charger	AN3161P25
60	Circuit Breaker—Manual Gun Charger	AN3161P25
61	Circuit Breaker—Gun Charger Compressor	AN3161P25
62	Circuit Breaker—Gyrosyn Compass	AN3161P5
63	Circuit Breaker—Alternate Hydraulic Control	AN3161P10
64	Circuit Breaker—Alternate Hydraulic Pump	PDLM-70 (Klixon)
65	Circuit Breaker—Three-phase (Spare) Inverter	AN3161P15
66	Circuit Breaker—One-phase Inverter	PDLM-105 (Klixon)
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
68	Circuit Breaker—Landing Gear Control	AN3161P5
69	Circuit Breaker—Landing Light	AN3161P20
70	Circuit Breaker—Landing Light Control	AN3161P5* AN3161P10†
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
73	Circuit Breaker—Navigation and External Light and Position Light Flasher*	AN3161P10
	Circuit Breaker—Generator Field†	AN3161P20
74	Circuit Breaker—Code Indicator Test and Position Light*	AN3161P5
	Circuit Breaker—Engine Anti-icing and Screen†	AN3161P15
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
76	Circuit Breaker—Pitot Heater	AN3160-10
77	Circuit Breaker—Radar Power	AN3161P5
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
79	Circuit Breaker—Speed Brake	AN3161P5
80	Circuit Breaker—Sight A-C Power Unit	AN3161P20
81	Circuit Breaker—Sight Control	AN3161P10* AN3161P5†
82	Circuit Breaker—Sight Heater	AN3161P25
83	Circuit Breaker—Sight Power	AN3161P10
†84	Circuit Breaker—Sight Power	AN3161P15
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
86	Circuit Breaker—Left Wing Flap	AN3161P35
87	Circuit Breaker—Right Wing Flap	AN3161P35
88	Circuit Breaker—Landing Gear Emergency Retraction	AN3161P10* AN3161P5†
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
†90	Circuit Breaker—Hydraulic Pump Manual Emergency Override	PDLM-70 (Klixon)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
†91	Circuit Breaker—Sight Heater	AN3161P15
†92	Circuit Breaker—Main Instrument Inverter	AN3161P10
†93	Circuit Breaker—Alternate Instrument Inverter	AN3161P10
†94	Circuit Breaker—One-phase Inverter Failure	AN3161P5
†95	Circuit Breaker—AN/ARC-33 Radio	AN3161P25
107	Compressor—Gun Charger Air	32R-500 (Cornelius)
109	Condenser—Fuel Level Indicator	HC1560 (Mallory)
110	Condenser—Liquidensitometer	HC1560 (Mallory)
114	Connector—Chemical Tank Binding Post	117-54241 (NAA)
*115	Connector—Drop Tank Release	336 (American Radio)
116	Connector—Engine Generator Power	Furnished With Engine (General Electric)
117	Connector—Pressure Block	140-54008 (NAA)
*119	Connector—Post	151-54038 (NAA)
125	Control Box—Cabin Temperature	CYLZ-2640 (Barber-Colman)
126	Control Box—Hi-Lo Element Heat*	AYLF-3001-1 (Barber-Colman)
	Control Box—Cockpit Air Pickup†	33500-05 (AiResearch)
127	Control Box—Rocket Projectile Release	24975, Type A-3
129	Control Box—Windshield Air Pickup	33500-05 (AiResearch)
134	Controller—Starter	AN3391-1
140	Current Limiter—Windshield Anti-icing Heater 80-ampere	FLLB (Burndy)
141	Current Limiter—Cockpit Heater 150-ampere	FLLE (Burndy)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
†148	Filter—Camera Radio Noise	JX-55F (Sprague)
†149	Filter—Ammunition Boost	172-54110 (NAA)
150	Filter—Ammunition Boost	12270 (AiResearch)
151	Filter—Ammunition Compartment Heat Actuator	C-330-L (Potter)
152	Filter—Cockpit and Windshield Heater	CP53B2EB405K
153	Filter—Generator Bus	CP53B2EB405K
154	Filter—Camera Radio Noise	EA-125 (Solar)
†155	Filter—Heating and Ventilating Radio Noise	12288 (AiResearch)
†156	Filter—Alternate Flight Control Pump	CP53B2EB405K
†157	Filter—Gun Charger Air Compressor	CP53B2EB405K
158	Flasher—Position Light	32573,* Type C-1 32660,† Type C-2
161	Flux Valve—Gyrosyn Compass	27635, Type C-2
162	Gyro Unit—Gyrosyn Compass	21098, Type S-1
164	Fuse—Attitude Gyro	AGC ½ (Bussmann)
165	Fuse—Autosyn Transformer	AGC 1 (Bussmann)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC ½ (Bussmann)
168	Fuse—Gyrosyn Compass	AGC 1½ (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
†170	Fuse—Cockpit Temperature Control Amplifier	AGC 1 (Bussmann)
†171	Fuse—Windshield Anti-icing Control Amplifier	AGC 1 (Bussmann)
172	Charger—Gun	159006, Type B-1 (Kidde)
175	Generator—Starter	32550, Type A-1 (General Electric 2CM77B8)
176	Generator—Tachometer	21135, Type A-1
179	Grip—Control Stick	AFX50C4064, Type B-8
181	Gyro—Attitude	21278, Type A-1
183	Heater—Cockpit 4-kilowatt	D-312* (Cole) C-885† (Cole)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
184	Heater—Gun	24946, Type AN-J-4
185	Heater—Pitot	AN5816-2
186	Heater—Windshield Anti-icing Boost	C-553* (Cole)
	2-kilowatt	C-883† (Cole)
190	Horn—Landing Gear Warning	32462, Type J-2
192	Indicator—Turn-and-Bank	21106, Type C-5
193	Indicator—Fuel Flow Totalizer	36700-1A-1-A1 (Pioneer)
*194	Indicator—Fuel Level	151-51006 (NAA)
195	Indicator—Fuel Pressure	MIL-I-6301, Type C-34
196	Indicator—Directional Gyro	MIL-I-5126A, Type V-7A
197	Indicator—Hydraulic Pressure	21311, Type E-1
198	Indicator—Liquidensitometer	EA-721-G-1 (Liquidometer)
199	Indicator—Oil Pressure	21319, Type B-20
*200	Indicator—Navigation Light Code	AN3157-1
201	Indicator—Tachometer	27144, Type E-32
†202	Indicator—Landing Gear Position	21250A, Type C-1
†205	Inverter—One-phase 1500-volt-ampere	
	115-volt 400-cycle	F-35 (Jack & Heintz)
206	Inverter—One-phase 1500-volt-ampere	
	115-volt 400-cycle	AN3515-1
207	Inverter—Three-phase 100-volt-ampere	
	115-volt 400-cycle Alternate	AN3499-1
†208	Inverter—Three-phase 100-volt-ampere	
	115-volt 400-cycle Main	AN3499-1
210	Lamp—Cockpit Extension‡	AN3142-302
	Lamp—Cockpit Utility Light§	AN3121-313
211	Lamp—Fuselage Signal*	AN3120-1047
	Lamp—Fuselage†	AN3133-311
212	Lamp—Fuselage	AN3131-303
213	Lamp—Indirect Lighting Panel	AN3140-327*
		GE-327†
214	Lamp—Landing	AN3129-4523
216	Lamp—Console Floodlight	AN3121R313
217	Lamp—Instrument Panel Ring Light	AN3140-327
218	Lamp—Auxiliary Instrument Floodlight	AN3131R303*
		AN3131-303†
219	Lamp—Tail Position	AN3124-307
220	Lamp—Warning	AN3121-313
221	Lamp—Wing Position	AN3122-1524
222	Lamp—Stand-by Compass	AN3136-323
		(Furnished With Compass)
†223	Lamp—Landing Gear Unsafe	AN3140-327
†224	Lamp—Warning	AN3121-313
†226	Lamp—Landing Gear Unsafe	AN3136R323
228	Light Assembly—Ammunition Overheat Warning	AN3157-2
229	Light Assembly—Pedestal	1617C-2 (Wemac)
230	Light Assembly—Cockpit Utility	140-54070‡ (NAA)
		94-32294D, Type C-4A§
231	Light Assembly—Fire Detector Warning	AN3157-6
232	Light Assembly—Fuel Filter Deicing	AN3157-4
233	Light Assembly—Parafragmentation Bomb Indicator	AN3157-4
234	Light Assembly—Fuselage Upper	AN3177-3*
		AN3177-9†
235	Light Assembly—Fuselage Lower	AN3177-1*
		AN3177-9†

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
236	Light Assembly—Generator Failure Warning	AN3157-4* AN3157-2†
237	Light Assembly—Auxiliary Instrument Floodlight	A-4255A5 (Grimes)
238	Light Assembly—Alternate Flight Control Indicator	AN3157-4
239	Light Assembly—Inverter Failure Warning	AN3157-4
240	Light Assembly—Landing Gear Handle Warning‡	AN3157-4
	Light Assembly—Indirect Panel Illumination§	AN3502-2A
241	Light Assembly—Landing Gear Safe*	AN3157-3
	Light Assembly—Main Instrument Inverter Failure Warning†	AN3157-4
242	Light Assembly—Landing Gear Unsafe*	AN3157-2
	Light Assembly—Landing and Taxi†	G-4710 (Grimes)
243	Light Assembly—Left-hand and Right-hand Console Floodlight	AN3034-1
244	Light Assembly—Retractable Landing	AN3095-7
245	Light Assembly—Instrument Panel Ring	170-51005 (NAA)
246	Light Assembly—White Tail Position	AN3158-1
247	Light Assembly—Yellow Tail Position	AN3158-2
248	Light Assembly—Take-off Indicator	AN3157-4
249	Light Assembly—Green Wing Position	AN3033-8
250	Light Assembly—Red Wing Position	AN3033-7
251	Light Assembly—IFF Control Panel	AN3502
†252	Light Assembly—Windshield Overheat Warning	AN3157-4
‡253	Light Assembly—Both Instrument Inverter Failure Warning	AN3157-6
†254	Light Assembly—Retractable Landing	D-5530 (Grimes)
†255	Light Assembly—Empty Outboard Drop Tank	AN3157-4
256	Liquidensitometer	EA-909-C-1 (Liquidometer)
258	Motor—Ammunition Boost	29492-1 (AiResearch) 29492-2 (AiResearch)
†259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
260	Panel—Aft Radio Compartment Relay*	151-54122-40 (NAA)
	Panel—Forward Fuselage Circuit-breaker†	172-54078 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-30* (NAA) 151-54122-60† (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057* (NAA) 172-54040† (NAA)
264A	Panel—Right Console Circuit-breaker	172-54021 (NAA)
265	Panel—Fuel Level Adjustment	AC134A5-5A
266	Panel—Gun Charger Relay	170-54034 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
268A	Panel—Center Pedestal	170-54104 (NAA)
269	Panel—Station 155 Left Side Relay	170-54065 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
271	Panel—Windshield Anti-icing and Battery Relay	170-54085 (NAA)
272	Panel—Instrument	170-51005 (NAA)
273	Panel—Left Forward Console	161-54028-10‡ (NAA) 172-54028 (NAA)
274	Panel—Left Aft Console	151-53050-30‡ (NAA) 172-54065 (NAA)
275	Panel—Right Forward Console	161-54005-10‡ (NAA) 172-54095 (NAA)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
277	Panel—Ammunition Boost Relay	161-54037 (NAA)
†278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
280	Plug—Ammunition Boost Motor	AN3106B14S-2S
281	Plug—Ammunition Heat Filter	AN3106B14S-5S
282	Plug—Attitude Gyro	AN3106A10SL13S
283	Plug—S-2 Bomb Rack	AN3106B18-1P (Furnished With Rack)
284	Plug—Cabin Heater Rheostat*	AN3106B14S-5S
	Plug—Engine Harness Disconnect†	AN3106B28-11S
285	Plug—Canopy Deck Disconnect	AN3108B20-29S
286	Plug—Canopy Actuator	AN3106B14S-7S
287	Plug—Canopy Pullaway	AN3107B20-29S
288	Plug—Canopy Seal Valve*	AN3106B12S-3S
	Plug—Center Wing Hydraulic Pressure†	AN3106B22-14S
289	Plug—Cockpit Center Disconnect*	AN3106B24-5S
	Plug—Pedestal Disconnect†	AN3106B32-7S
290	Plug—Cockpit Pressure Regulator	AN3106B10SL-4S
291	Plug—Cockpit Temperature Control*	AN3106B20-29S
	Plug—Cockpit Temperature Control Amplifier†	AN3106B20-27S
292	Plug—Cockpit Temperature Mixing Valve*	AN3106B16S-1S
	Plug—Cockpit Air Shutoff Valve†	AN3106B14S-5S
293	Plug—Gyrosyn Compass Amplifier	AN3106B20-27S
294	Plug—Compass Flux Gate	AN3106B18-12S
295	Plug—Compass Indicator	AN3106B14S-5S
296	Plug—Control Stick Grip	AN3108B20-27P
297	Plug—Door and Strut Hydraulic Solenoid Valve	AN3106B14S-2S
298	Plug—Engine Intermediate Disconnect	AN3106B18-1S
299	Plug—Engine Large Disconnect	AN3106B18-1S
300	Plug—Engine Small Disconnect	AN3106B18-13S
301	Plug—Engine Fire Detector	AN3106B14S-2P
302	Plug—Alternate Return and Supply Valve	AN3108B10SL-4S
†303	Plug—Fuel Shutoff Level Control Valve	AN3108B10SL-4S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
305	Plug—Fire-warning Relay	AN3106B14S-5S
306	Plug—Fire-warning Relay (Position X)*	AN3106B14S-5S
	Plug—Fire-warning Relay†	AN3106B16S-1S
307	Plug—Fuel Filter Deicing Pressure Switch	AN3106B14S-9S
308	Plug—Fuel Filter Deicing Valve	AN3106B12S-3S
309	Plug—Fuel Totalizer Amplifier	AN3106B14S-12S* AN3106B14S-9S†
310	Plug—Fuel Totalizer Amplifier	AN3106B18-12P
311	Plug—Fuel Totalizer Amplifier	AN3106A14S-5P
312	Plug—Fuel Flow Totalizer Indicator	AN3106B18-12S
313	Plug—Fuel Flowmeter	AN3106B14S-5S
314	Plug—Fuel Pressure Indicator	AN3106B14S-2S
315	Plug—Fuel Pressure Transmitter	AN3108B14S-2S
316	Plug—Fuel Shutoff Valve Solenoid	AN3106B14S-5S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
320	Plug—Generator Field Control Relay	AN3106B24-7S
†321	Plug—Engine Disconnect	AN3106B28-12S
322	Plug—Gun Charger Air Compressor	AN3106B16-11S
†323	Plug—Gun Bay Pressure	AN3106B24-28S
324	Plug—Gunfire Solenoid*	AN3106B10S-2S
	Plug—Pedestal Left-hand Inboard Disconnect†	AN3106B28-11S
325	Plug—GSAP Camera	102 (Burton)
326	Plug—Cockpit Heater Pressure Switch	AN3106B18-10S
327	Plug—Hi-Lo Heat Element*	AN3106B14S-2S
	Plug—Hydraulic Pump Manual Override†	AN3106B16-12P
328	Plug—Horizontal Stabilizer Bungee Trim Actuator	AN3108B18-12S
329	Plug—Normal Hydraulic By-pass Valve	AN3106B10SL-4S
330	Plug—Hydraulic Pressure Indicator	AN3106B14S-2S
331	Plug—Alternate Hydraulic Pressure Switch	AN3106B12S-3S
332	Plug—Normal Hydraulic Pressure Switch	AN3106B12S-3S
333	Plug—Alternate Hydraulic Pressure Transmitter	AN3106B14S-2S
334	Plug—Normal Hydraulic Pressure Transmitter	AN3106B14S-2S
335	Plug—Utility Hydraulic Pressure Transmitter	AN3106B14S-2S
336	Plug—Alternate Hydraulic Pump	AN3106B20-19S
337	Plug—Instrument Panel Vibrator	AN3106B10SL-4S
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
341	Plug—Alternate (Spare) Three-phase Inverter	AN3108B14S-7S
342	Plug—Landing Gear Control*	AN3106B16S-1P
	Plug—Main Three-phase Inverter†	AN3108B14S-7S
343	Plug—Landing Light	AN3106B18-5S
344	Plug—Lateral Bungee Trim Actuator	AN3106B14S-7S
345	Plug—Liquidensitometer Indicator	AN3106B14S-2S
346	Plug—Liquidensitometer	412266F (Minneapolis-Honeywell)
347	Plug—Oil Pressure Indicator	AN3106B14S-2S
348	Plug—Oil Pressure Transmitter	AN3108B14S-2S
349	Plug—Parafragmentation Bomb Rack	AN3107B18-12S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
352	Plug—Position Light Flasher	AN3106B36-13S*
		AN3106B16S-8S†
353	Plug—Pressure Air Solenoid Valve*	AN3106B14S-5S
	Plug—Instrument Panel Light Disconnect†	AN3106B20-27P
354	Plug—Ram-air Solenoid Valve	AN3106B14S-5S
*355	Plug—Rocket-arming Solenoid	AN3106B10S-2S
356	Plug—Rocket-firing	PL68 (Henry)
357	Plug—Rocket Pod	PL68 (Henry)
358	Plug—Rudder Disconnect	AN3106A14S-5P
360	Plug—Gyrosyn Compass	AN3106B20-29S
361	Plug—Speed Brake	AN3106B14S-2S
362	Plug—Speed Brake Well	AN3106B24-5P
†363	Plug—Speed Brake Well	AN3108B14S-6P
†364	Plug—Speed Brake Well	AN3106B14S-6P
365	Plug—Stand-by Compass Light	270-8 (Cannon)
366	Plug—Tachometer Indicator	AN3106A10SL-3S
*367	Plug—Thermistor	AN3106B14S-2S
368	Plug—Turn-and-Bank Indicator	AN3106A10SL-3S
370	Plug—Wing Light Disconnect	1071 (Littelfuse)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
372	Plug—Throttle Disconnect	AN3106B16S-1P
†373	Plug—Landing Gear Position Indicator	AN3106B10SL-3S
†374	Plug—Landing and Taxi Light	AN3106B18-9S
†375	Plug—Cockpit Air Pickup Control	AN3106B10SL-3S
†376	Plug—Cockpit Dump Valve	AN3108B10SL-4S
†377	Plug—Cockpit Hot-air By-pass Valve	AN3106B14S-5S
†378	Plug—Heat Exchanger Modulating Valve	AN3106B14S-5S
†379	Plug—Heating and Ventilating Radio Noise Filter	AN3106B12S-3P
†380	Plug—Windshield Anti-icing Amplifier	AN3106B20-27SX
†381	Plug—Windshield Air Pickup Control	AN3106B10SL-3S
†382	Plug—Drop Tank Disconnect	207 (American Radio)
†383	Plug—GSAP Camera	102 (Burton)
386	Pump—Fuel Filter Deicing	20386-9 (Adel)
387	Pump—Fuel Transfer	TFD31400-3, Type B-5C (Thompson)
388	Pump—Main Fuel Booster	TFD31400-3, Type B-5C (Thompson)
389	Pump—Alternate Hydraulic	D-1000 (Hoover)
392	Rack—Right-hand Bomb Release	24993, Type S-2
393	Rack—Left-hand Bomb Release	24993, Type S-2
394	Rack—Left-hand Parafragmentation Bomb Release	24938, Type R-3
395	Rack—Right-hand Parafragmentation Bomb Release	24938, Type R-3
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
398	Receptacle—Ammunition Boost	AN3102A14S-2P
399	Receptacle—S-2 Bomb Rack	AN3101A18-1S
400	Receptacle—Canopy Deck Disconnect	AN3100C20-29P
401	Receptacle—Canopy Pullaway	AN3100A20-29P
402	Receptacle—Cockpit Center Disconnect*	AN3100A24-5P
	Receptacle—Center Wing Hydraulic Pressure†	AN3101A22-14P
403	Receptacle—Compass Flux Gate	AN3100A18-12P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
406	Receptacle—Engine Accessory Fire Detector	AN3100A14S-7P
407	Receptacle—Engine Fire Detector	AN3101A14S-2S
408	Receptacle—External Power	AN2552A3
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
410	Receptacle—Fuel Level Transmitter	AN3101A14S-2S
411	Receptacle—Fuel Level Transmitter	AN3101A14S-5S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
415	Receptacle—Gun Heater	AN3102A12S-3S
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
419	Receptacle—Landing Gear Control*	AN3102A16S-1S
	Receptacle—Instrument Power Transfer Relay†	2044-84 (Cannon)
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
422	Receptacle—Rocket-firing	140-54110 (NAA)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
423	Receptacle—Rocket Pod	JK33A (Henry)
424	Receptacle—Rudder Disconnect	AN3101A14S-5S
425	Receptacle—Speed Brake Well	AN3100A24-5S
426	Receptacle—Throttle Relay	AN3102A22-19S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
428	Receptacle—Throttle Disconnect	AN3101B16S-1S
429	Receptacle—Wing Flap Actuator	AN3100A18-10S*
		AN3100-18-10S†
430	Receptacle—Gun Charger	AN3101A14S-2S
431	Receptacle—Gun Charger Time Delay Relay	AN3100A22-19SW
†432	Receptacle—Landing Gear Retraction Control Relay	2044-84 (Cannon)
†433	Receptacle—Cockpit Air Control Relay	AN3102A22-19S
†434	Receptacle—Drop Tank Disconnect	336 (American Radio)
†435	Receptacle—Engine Disconnect	AN3100A28-12P
†436	Receptacle—Hydraulic Pump Manual Override	AN3100A16-12S
†437	Receptacle—Gun Bay Pressure	AN3100C24-28P
†438	Receptacle—Speed Brake Well	AN3100A14S-6S
†439	Receptacle—Engine Forward Fire Detector	97-3100K18-3S
†440	Receptacle—Engine Anti-icing Thermostat	AN3100A10SL-4P
†441	Receptacle—Landing Gear Retraction Control Relay	2044-84 (Cannon)
†442	Receptacle—Pedestal Disconnect	AN3102A32-7P
443	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3102A28-11P
444	Relay—A-C Transfer	9014 (Leach)
445	Relay—Ammunition Boost	AN3350-1
446	Relay—Ammunition Heat Control	237EAU* (Leach)
		AN3316-1†
447	Relay—All Bombs	237EAU (Leach)
448	Relay—Battery	AN3370-1
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
451	Relay—Bomb-Rocket-Tank Salvo	237EAU (Leach)
452	Relay—Bus Tie-in	AN3370-1
453	Relay—Bus Tie-in Control	AN3316-1
454	Relay—Bus Tie-in Control	237EAU (Leach)
455	Relay—Canopy Actuator	AN3350-1
456	Relay—Canopy Alternate Power	AN3353-1
457	Relay—Canopy Seal	233-51A (Leach)
458	Relay—Cockpit Heater Power	AN3370-1
459	Relay—Cockpit Heater Time Delay	32439, Type B-9-A
460	Relay—Engine Starter Ignition Control	2069-25D* (Leach)
		9048-26F† (Leach)
461	Relay—External Power	AN3380-1
462	Relay—Parafragmentation Bomb Selector	237EAU (Leach)
463	Relay—Aft Fuel Booster Pump	AN3350-1
464	Relay—Forward Fuel Booster Pump	AN3350-1
465	Relay—Fuel Transfer Pump Control	1264-938 (Leach)
466	Relay—Fuel Filter Deicing*	AN3350-1
	Relay—Engine Screen Actuator Control†	AN3353-1
467	Relay—GSAP Camera	233-51A (Leach)
468	Relay—Gun Charger Time Delay	650-3029 (Cook)
469	Relay—Gun-firing	AN3350-1
470	Relay—Gun Heater	1227-893* (Leach)
		AN3352-1†
471	Relay—Gun Sight Power	G-39989A (Guardian)
472	Relay—Generator Field Control	32603, Type M-2

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
473	Relay—Gun Charger Retraction	AN3353-1
474	Relay—Gun Charging Return	AN3353-1
475	Relay—Hydraulic Pressure Indicator	237EAU (Leach)
476	Relay—Alternate Hydraulic Pump	AN3370-1
477	Relay—Alternate Hydraulic Tie-in Control	AN3312-1
478	Relay—Three-phase Inverter Power	237EAU (Leach)
479	Relay—Inverter Failure Warning	44B18574, Type 32471
480	Relay—Lateral Trim	237EAU (Leach)
481	Relay—Longitudinal Trim	237EAU (Leach)
482	Relay—Longitudinal Trim Control	237EAU (Leach)
483	Relay—Landing Gear Warning Horn	237EAU (Leach)
484	Relay—Landing Light	1227-893 (Leach)
485	Relay—Nose-up "Q" Control Time Delay*	32439, Type B-9-A
	Relay—Landing and Taxi Light Control†	237EAU (Leach)
486	Relay—Nose-down "Q" Control Time Delay*	32439, Type B-9-A
	Relay—Longitudinal Trim Control†	G-54329-A (Guardian)
487	Relay—Overvoltage	32591, Type E-2
488	Relay—Panel Fire Detector	161-54116 (NAA)
489	Relay—Reverse-current	AN3025-2
490	Relay—Rocket Jettison	AN3370-1
491	Relay—Throttle	AN3310-1
*492	Relay—Windshield Anti-icing Control	237EAU (Leach)
493	Relay—Windshield Anti-icing Power	AN3370-1
494	Relay—Windshield Anti-icing Time Delay	32439, Type B-9-A
495	Relay—Landing Gear Emergency Retract*	237EAU (Leach)
	Relay—Bomb Release Power†	AN3350-2
496	Relay—Rocket-arming Control	G-54226 (Guardian)
†497	Relay—Landing Gear Safety Control	AN3308-1
†498	Relay—Landing and Taxi Light Control	237EAU (Leach)
†499	Relay—Cockpit Air Control	AN3310-1
†500	Relay—Instrument Power Transfer	AN3308-1
†501	Relay—Inverter Failure Warning	44B18574
†502	Relay—Landing Gear Warning Control	AN3308-1
†503	Relay—Alternate Hydraulic Control	AN3311-1
†504	Relay—Alternate Hydraulic Tie-in Control	AN3312-1
†505	Relay—Gun Sight Power	AN3312-1
†506	Relay—Landing Lights	AN3350-2
†507	Relay—GSAP Camera	233-51A (Leach)
†508	Relay—Bus Tie-in Control	237EAU (Leach)
509	Rectifier—Rocket Jettison	C2H1WTA (International Rectifier)
514	Regulator—Cockpit Pressure	14840-12.5-5.00-2.75 (AiResearch)
515	Regulator—Fuel Level Voltage*	EA-40-B-1 (Liquidometer)
	Regulator—Cockpit Pressure†	102002-12.5-5.00-2.75 (AiResearch)
516	Regulator—Generator Voltage	Spec 17R21
*526	Resistor—Fuel Level Voltage	EA-4121 (Liquidometer)
527	Resistor—Fuel Transfer Relay	B10F50 (Clarostat)
528	Resistor—Fuselage Light Dimmer	B10F50 (Clarostat)
529	Resistor—Stand-by Compass Light	RW16J141
530	Resistor—Tail Position Light Dimmer	B10F30* (Clarostat)
		B20K25† (Clarostat)
531	Resistor—Wing Position Light Dimmer	A25K10 (Clarostat)
532	Resistor—Console Floodlight	B10F30 (Clarostat)
†535	Resistor—Fire Detector Warning	RW30J2R0
		RW30

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
537	Rheostat—Console Light*	AN3155-50-100
	Rheostat—Indirect Illumination†	AN3155-50-100
538	Rheostat—Instrument Panel Floodlight	AN3155-25-100
539	Rheostat—Pilot's Voltage Control	AN3155-25-11
540	Rheostat—Tandem*	BYLZ-2292-1 (Barber-Colman)
	Rheostat—Cockpit Temperature†	30088 (AiResearch)
541	Rheostat—Instrument Panel Ring Light	31873A (Ohmite)
543	Shunt—Ammeter	120814 (Weston)
*545	Solenoid—Gunfire	93-24706, Type G-9
546	Solenoid—Rocket-arming	43B9887,* Type A-2
		X50C26144, Type F-1
547	Solenoid—Rocket Jettison	C-8001-3 (Leland)
548	Solenoid—Rocket-arming*	X50C26144
	Solenoid—Drop Tank Jettison†	C-8001-1 (Leland)
		175-48320 (NAA)
†549	Solenoid—Rocket-arming	X50C26144, Type F-1
552	Spark Plug—Ignition	Furnished With Engine
†553	Switch—Left Gear Downlock	175-54332 (NAA)
554	Switch—Air Selector*	AN3234-1
	Switch—Landing Gear Control†	60681 (Carma)
555	Switch—Alternate Lateral Trim	8749K11 (Cutler-Hammer)
556	Switch—Alternate Longitudinal Trim	8749K11 (Cutler-Hammer)
557	Switch—Ammunition Last-round	AN3210-1
558	Switch—Ammunition Overfeed	AN3210-1
559	Switch—Battery-Starter	AN3027-8
560	Switch—Bomb-arming	AN3021-1
561	Switch—Bomb Release Selector	AN3021-3
562	Switch—Parafragmentation Bomb Selector	AN3226-1
563	Switch—Bomb Train Selector	AN3021-1
564	Switch—Bomb Salvo	AN3216-1
565	Switch—Cockpit Temperature Control	45A7400-2 (Cutler-Hammer)
566	Switch—Canopy Open Limit	AN3210-1
567	Switch—External Canopy Open	BZ-3YST (Micro Switch)
568	Switch—External Canopy Close	BZ-3YST (Micro Switch)
569	Switch—Pilot's Canopy Operating	AN3022-5
570	Switch—Canopy Seal Limit	AN3215-1
571	Switch—Canopy Seal Dump	BZ-7RQ1T (Micro Switch)
572	Switch—M-10 Chemical Tank Selector	AN3021-1
573	Switch—Densitometer*	AN3021-2
	Switch—Engine Anti-icing and Screen†	1AT3 (Micro Switch)
574	Switch—Engine Master	AN3027-3
575	Switch—Fairing Door Open	BZ-7RQ1T (Micro Switch)
576	Switch—Fire Detector Test	138187 (Ucinite)
577	Switch—Fuel Filter Deicing	C-1006 (Hetherington)
578	Switch—Fuel Filter Deicing Pressure	G20AX11 (Minneapolis-Honeywell)
579	Switch—Fuel System Emergency	AN3021-5
580	Switch—Fuel Level Transmitter and Main Pump Test	AN3022-8
581	Switch—Fuselage Light Control*	AN3021-1
	Switch—Gun and Ammunition Heater†	AN3027-8
582	Switch—Generator Control	AN3027-8
583	Switch—Ground Sequence Safety	AN3234-1
584	Switch—Gun and Ammunition Heater	AN3027-3
585	Switch—Gun Charger	AN3021-7
586	Switch—Gun Safety	AN3226-1
587	Switch—Alternate Flight Control	1AT5 (Micro Switch)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
588	Switch—Hydraulic Pressure Indicator	AN3021-7* AN3021-1†
589	Switch—Normal Hydraulic Pressure	170-58615* (NAA) 172-58620† (NAA)
590	Switch—Alternate Hydraulic Pressure	172-58624-3 (NAA)
591	Switch—Alternate Hydraulic Pressure	172-58624-5 (NAA)
592	Switch—Alternate Hydraulic Pressure	172-58624-7* (NAA) 172-58624-3† (NAA)
†593	Switch—Normal Hydraulic Pressure	172-58615 (NAA)
594	Switch—Emergency Ignition	AN3021-2
595	Switch—Instrument Power	AN3027-3
596	Switch—Lateral Trim Neutral	AN3234-1
597	Switch—Pilot's Landing Gear Control	BZ-3YQ1T* (Micro Switch) NA5-7733,† Types A and B (Carma)
598	Switch—Landing Gear Warning Throttle	AN3216-1 (Micro Switch), MD8721 Actuator
599	Switch—Landing Lamp Control	AN3027-1* AN3022-15B†
600	Switch—Landing Light Motor Control*	AN3027-1
	Switch—Nose Wheel Door Close†	175-54332 (NAA)
†601	Switch—Main Landing Gear Uplock	152-54201 (NAA)
602	Switch—Master Code*	AN3027-2
	Switch—Main Landing Gear Downlock†	152-54201 (NAA)
603	Switch—Left Main Landing Gear Downlock	152-54201 (NAA)
604	Switch—Right Main Landing Gear Downlock	152-54201 (NAA)
605	Switch—Left Main Landing Gear Uplock	152-54201 (NAA)
606	Switch—Right Main Landing Gear Uplock	152-54201 (NAA)
607	Switch—Main Landing Gear Door Lock	BZ-7RQ1T (Micro Switch)
608	Switch—Main Landing Gear Fairing Door	BZ-7RQ1T (Micro Switch)
609	Switch—Nose Wheel Door Lock	BZ-7RQ1T (Micro Switch)
610	Switch—Nose Wheel Fairing Door	BZ-7RQ1T (Micro Switch)
611	Switch—Nose Wheel Downlock	152-54201 (NAA)
612	Switch—Nose Wheel Uplock	152-54201 (NAA)
613	Switch—Nose Wheel Door Open	AN3215-1
614	Switch—Nose Wheel Steering Safety	AN3234-1
615	Switch—Navigation Light Code Selector*	32265 (Pollack)
	Switch—Rocket Jettison†	AN3021-3
616	Switch—Pilot's Ground Safety Override	C-8100 (Hetherington)
617	Switch—Position Light Control*	AN3226-1
	Switch—Position and Fuselage Light†	AN3227-1
618	Switch—Position Light Dimmer*	AN3027-3
	Switch—Position and Fuselage Light Dimmer†	AN3227-3
619	Switch—Heater Pressure	PGZ08A52, Series 4 (Minneapolis-Honeywell)
620	Switch—Ram Pressure Selector	BZ-3YDT* (Micro Switch) AN3227-3†
621	Switch—Rocket-arming	AN3021-1
622	Switch—Rocket Jettison	AN3021-5* AN3027-3†
623	Switch—Rocket Jettison Safety	AN3234-1
624	Switch—Rocket Jettison Test	AN3022-8* AN3021-8†
625	Switch—Rocket Selector	AN3027-1
626	Switch—Rudder Trim Tab Control	AN3021-7

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
627	Switch—Rudder Trim Neutral	AN3234-1
628	Switch—Speed Brake Control	AN3021-1
†629	Switch—Right Gear Downlock	175-54332 (NAA)
630	Switch—Stand-by Compass Light	AN3021-2
631	Switch—Stop-starter	D-800 (Hetherington)
632	Switch—Throttle Engine Control	BZ-3YDT (Micro Switch)
633	Switch—Windshield Anti-icing Heater	AN3216-1
*634	Switch—Windshield Overheat	Part of Heater
635	Switch—Warning Horn Cutout	C-1400*
		A-401B2† (Hetherington)
636	Switch—Wing Flap	WA-3SBT-1 (Micro Switch)
†637	Switch—Fuel Density Correction	AN3021-2
638	Switch—Arming Safety*	AN3210-1
	Switch—Manual Jettison Arming†	AN3210-1
639	Switch—Rocket Jettison Ready*	AN3027-3
	Switch—Cockpit Heater†	AN3234-1
†640	Switch—Cockpit Heater Cutout	AN3234-1
†641	Switch—Cockpit Pressure Regulator	AN3021-2
†642	Switch—Defrost	BZ-7RQ1T (Micro Switch)
†643	Switch—Alternate Hydraulic Pump Manual Override	8905K784 (Cutler-Hammer)
†644	Switch—Ground Door Control	AN3227-3
†645	Switch—Hydraulic Pressure Indicator	4AT3 (Micro Switch)
†646	Switch—Left Strut Downlock	175-54331 (NAA)
†647	Switch—Nose Strut Downlock	175-54331 (NAA)
†648	Switch—Right Strut Downlock	175-54331 (NAA)
†649	Switch—Left Strut Uplock	175-54331 (NAA)
†650	Switch—Nose Strut Uplock	175-54331 (NAA)
†651	Switch—Right Strut Uplock	175-54331 (NAA)
652	Terminal Block—Ammeter	AN3436-2-2
653	Terminal Block—Ammunition Boost	AN3436-2-1
654	Terminal Block—Ammunition Compartment	AN3436-2-3
655	Terminal Block—Bomb Salvo	AN3436-2-2
656	Terminal Block—Compass	AN3436-2-7
657	Terminal Block—Gyrosyn Compass	AN3436-2-6
658	Terminal Block—Right Wing Forward	AN3436-2-10
659	Terminal Block—Fuel Booster and Transfer Pump	AN3436-2-1
660	Terminal Block—Parafragmentation Bomb	AN3436-2-2
661	Terminal Block—Left Gun Bay	AN3436-6-3*
		NAS45-416-2†
662	Terminal Block—Right Gun Bay	AN3436-6-1*
		NAS45-416-1†
663	Terminal Block—Right Gun Bay	AN3436-2-10
664	Terminal Block—Alternate Hydraulic Pump	NAS45-416-2*
		AN3436-6-3†
		NAS45-416-1
665	Terminal Block—Alternate Hydraulic System	NAS45-6-9
666	Terminal Block—Landing Gear Lower Connector*	AN3436-2-12
	Terminal Block—Hydraulic System Emergency Override†	NAS45-416-2
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
671	Terminal Block—Overvoltage Relay	AN3436-2-8

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
672	Terminal Block—Pitot Heater	AN3436-2-2
673	Terminal Block—Pressure	151-54037 (NAA)
674	Terminal Block—Radio	
675	Terminal Block—Battery	NAS45-416-1
676	Terminal Block—Wing Flap	NAS45-8-2
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
*681	Terminal Block—Left Wing Center	AN3436-2-7
682	Terminal Block—Wing Disconnect	NAS45-8-2
†683	Terminal Block—Wing Flap Actuator	AN3436-4-3
684	Terminal Block—Windshield Heater Switch	AN3436-2-4* NAS45-6-6†
685	Terminal Block—Right Primary Bus	NAS45-416-1* NAS45-416-3†
686	Terminal Block—Left Primary Bus*	NAS45-416-1
	Terminal Block—Rocket Pod†	AN3436-2-2
687	Terminal Block—Instrument Ring Light	AN3436-2-6
688	Terminal Block—Horizontal Stabilizer Actuator*	AN3436-2-2
	Terminal Block—Left Wing Forward†	AN3436-2-12
689	Terminal Block—Arming Safety Switch‡	AN3436-2-4
	Terminal Block—Cockpit Utility Light§	AN3436-2-1
†690	Terminal Block—Landing Gear Control Disconnect	AN3436-2-( ) AN3436-2-10
†691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
§692	Terminal Block—Speed Brake Well	AN3436-2-2
†693	Terminal Block—Generator Output	140-54035 (NAA)
†694	Terminal Block—Auxiliary Instrument Light	AN3436-2-1
*701	Thermistor—Cabin Temperature	AYLF-2970 (Barber-Colman)
704	Thermocouple—Fire Detector	35534-2 (T.A. Edison)
*708	Thermostat—Cabin High-heat Limit	18420-200 (Fenwal)
709	Thermostat—Cabin Low-heat Limit	18420-45 (Fenwal)
710	Thermostat—Ammunition Overheat	18423-260 (Fenwal)
†711	Thermostat—Windshield Overheat	18423-275 (Fenwal)
†712	Thermostat—Engine Anti-icing	18423-0-42 (Fenwal)
715	Transformer—26- to 115-volt 10-volt-ampere A-C Auto	C-124 (Frampton)
716	Transformer—Phase Adapter (One-phase to Three-phase)	661102, Type P-1 (Sperry)
720	Transmitter—Fuel Pressure	21163, Type E-5
721	Transmitter—Aft Fuselage Fuel Level	EA-381-549A (Liquidometer)
722	Transmitter—Forward Fuselage Fuel Level	EA-380-548A (Liquidometer)
723	Transmitter—Center Wing Fuel Level	EA-379AC-547A (Liquidometer)
724	Transmitter—Wing Outer Panel Inboard Fuel Level	EA-378A-546 (Liquidometer)
725	Transmitter—Wing Outer Panel Outboard Fuel Level	EA-378A-545 (Liquidometer)
726	Transmitter—Alternate Hydraulic Pressure	21323, Type N-1
727	Transmitter—Normal Hydraulic Pressure	21323, Type N-1
728	Transmitter—Utility Hydraulic Pressure	21323, Type N-1
729	Transmitter—Oil Pressure	21117, Type R-2
730	Transmitter—Fuel Flowmeter	9106-12A1 (Pioneer)
†735	Valve—Cockpit Air Shutoff	WB008-1½ (Whittaker)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
†736	Valve—Cockpit Dump	550120 (Pacific Airmotive)
†737	Valve—Cockpit Hot-air By-pass	93750-3 (AiResearch)
738	Valve—Canopy Seal	20794-2* (Saval) 10211† (Carma)
739	Valve—Landing Gear Strut and Fairing Door Hydraulic Solenoid	466335* (Bendix) 9610† (Weston)
740	Valve—Fuel Filter Deicing Solenoid	40R855C (General Controls)
741	Valve—Main Fuel Pump Solenoid	Furnished With Engine
742	Valve—Emergency Fuel Pump Solenoid	Furnished With Engine
743	Valve—Fuel Shutoff	3224 (Hydro-Aire)
744	Valve—Alternate Hydraulic Return and Supply	170-58625* (NAA) 172-58625† (NAA)
745	Valve—Normal Hydraulic By-pass	170-58616* (NAA) 172-58616-3† (NAA)
746	Valve—Nose Wheel Steering Hydraulic Solenoid	23569-3 (Adel)
*747	Valve—Air Pressure Shutoff	WE441-2D (Whittaker)
748	Valve—Ram-air Shutoff	W7946-2D (Whittaker)
749	Valve—Speed Brake Hydraulic Solenoid	466325* (Bendix) 9600† (Weston)
†750	Valve—Heat Exchanger Modulating	94510-2 (AiResearch)
757	Vibrator—Ignition	Furnished With Engine
758	Vibrator Assembly—Instrument Panel	C-10FA-543 (Globe)
†759	Vibrator—Ignition	Furnished With Engine
761	Voltmeter—0- to 30-volt D-C	AN3203V30
†763	Wire—Starter-Generator (Ground "E")	80012 (Airtron)
†764	Wire—Starter-Generator (Starter "C")	80011 (Airtron)
†765	Wire—Starter-Generator (Generator "B")	80010 (Airtron)
†766	Box Assembly—Electrical Gun-firing Capacitor and Resistor	172-54434 (NAA)
†767	Capacitor—Gun-firing 4-microfarad 600-volt	CP40C2EF405K
†768	Circuit Breaker—Ammunition Boost	PDLA-150 (Klixon)
†769	Circuit Breaker—Left Gun Charger	AN3161P5
†770	Circuit Breaker—Gunfire	AN3161P5
†771	Circuit Breaker—Gun Heater	AN3161P25
†772	Contact—Gunfire Primer	
†774	Heater—Gun	
†775	Motor—Left Ammunition Boost	31738-1 (AiResearch)
†776	Motor—Right Ammunition Boost	31738-2 (AiResearch)
†777	Panel—Ammunition Boost Relay	172-54435-1 (NAA)
†778	Panel—Ammunition Boost Relay	172-54435-2 (NAA)
†779	Panel—Electrical Gun-firing Relay	172-54432 (NAA)
†780	Plug—Ammunition Boost Motor	AN3106B20-24S
†781	Plug—Gun-firing Contact	AN3108B10S-2S
†782	Plug—Gun Bay Purging	AN3106B10S-2S
†783	Receptacle—Ammunition Boost Motor	AN3102A20-24P
†784	Receptacle—Gun Heater	
†785	Receptacle—Gun Bay Purging	AN3100A22-19SW
†786	Rectifier—Gun-firing	BB33ZT (Fansteel)
†787	Relay—Ammunition Boost Motor	AN3380-2
†788	Relay—Gun Charger Control	237EAU (Leach)
†789	Relay—Gun-firing Control	237EAU (Leach)
†790	Relay—Gun-firing Power	9565H1 (Cutler-Hammer)
†791	Relay—Gun Bay Purging Door	237EAU (Leach)
†792	Relay—Gun Bay Purging Time Delay	650-3029 (Cook)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
†793	Resistor—Gun-firing	RW14E802
†794	Switch—Ammunition Last-round	AN3234-1
795	Switch—Ammunition Overfeed	AN3234-1
796	Switch—Gun Safety	AN3227-1
797	Transformer—Gun-firing	T-115-.5 (H)1447 (Industrial Electronics)
798	Valve—Gun Bay Purging Solenoid	870428 (Kidde)
799	Valve—Gun Charger Solenoid	870625 (Kidde)
800	Switch—Left Fairing Door	175-54332 (NAA)
801	Switch—Nose Fairing Door	175-54332 (NAA)
802	Switch—Right Fairing Door	175-54332 (NAA)
803	Switch—Left Fairing Door Open	175-54332 (NAA)
804	Switch—Nose Fairing Door	175-54332 (NAA)
805	Switch—Right Fairing Door Open	175-54332 (NAA)
806	Switch—Left Strut Safety	175-54332 (NAA)
807	Switch—Ground Door Control	AN3023-3
808	Switch—Rocket Jettison Safety	175-54332 (NAA)
809	Switch—Nose Steering Safety	175-54332 (NAA)
810	Switch—Hydraulic Pump Emergency Manual Override	S23-3B-1 (Cam-Stat)
811	Circuit Breaker—Gun Bay Purging	AN3161P5
812	Circuit Breaker—Right Gun Charger	AN3161P5
813	Plug—Gun Charger Limit Switch	AN3106B10SL-4S
814	Plug—Gun Charger Solenoid Valve	AN3106B10S-2S
815	Camera—GSAP	75-368
816	Receptacle—Gun Charger Limit Switch	AN3101B10SL-4P
817	Switch Assembly—Anti-double-charging	172-61315 (NAA)
818	Relay—Gun Sight Power	AN3311-1
819	Switch—Gun Charger	AN3021-7
820	Switch—Gun Charger Limit	AN3234-2
821	Relay—Bus Tie-in Control	AN3312-1
822	Receptacle—Instrument Panel Light Disconnect	AN3100A20-27S
823	Plug—Anti-double-feed Charger	AN3108B10SL-4S
824	Receptacle—Instrument Panel Disconnect	AN3100A22-14S
825	Plug—Instrument Panel Disconnect	AN3106B22-14P
826	Filter—Camera Radio Noise	JX-55F (Sprague)
827	Plug—GSAP Camera	102 (Burton)
828	Switch—Gun-firing and Purging Safety	1HS1 (Micro Switch)
¶1299M	Plug—Engine Disconnect Large	AN3106B18-1S
¶1300M	Plug—Engine Disconnect Small	AN3106B18-13S
¶1301M	Plug—Engine Fire Detector	AN3106B14S-2P
¶1313M	Plug—Fuel Flowmeter	AN3108B14S-5S
¶1406M	Receptacle—Engine Accessory Fire Detector	AN3100A14S-7P
¶1407M	Receptacle—Engine Fire Detector	AN3101A14S-2S
¶1435M	Receptacle—Engine Harness Disconnect	AN3100A28-12P
¶1730M	Transmitter—Fuel Flowmeter	9102-12A1
	RADIO	
1	Control Panel—VHF	C-404/A
2	Junction Box—Power	J-68/ARC-3
3	Plug	PL-148-A
4	Plug	U-16/U
5	Plug	U-15/U
6	Plug	PL-153-A
7	Transmitter	T-67/ARC-3

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
9	Plug	PL-151-A
10	Receiver	R-77A/ARC-3
11	Plug	PL-259-A
12	Adapter	M-359
13	Cable (RG-9/U)	151-71044-20 (NAA)
14	Cable (RG-9/U)	151-71044-18 (NAA)
15	Adapter	AN3057-6
16	Cable (RG-9/U)	151-71044-16 (NAA)
†17	Control Panel—VHF	C-404A/A
†21	Control Panel—Radio Compass	C-403A/A
22	Control Panel—Radio Compass	C-403/A
24	Cable—Sense Antenna	CG-405/ARN-6
25	Mounting—Receiver	MT-274/ARN-6
26	Loop	AS-313A/ARN-6
27	Adapter	UG-212A/U
28	Indicator	ID-90/ARN-6
29	Plug	AN3106-14S-2S
30	Receiver Unit—Compass	R-101/ARN-6
31	Control—Radar Set	C-629/APX-6
32	Indicator Box	BC-727
33	Switch Box	SA-3/A
34	Receiver-Transmitter	RT-82/APX-6
35	Antenna Assembly	AT-234/APX
†37	Cable (RG-8/U)	172-71004-10 (NAA)
†38	Cable (RG-8/U)	172-71004 (NAA)
†39	Cable (RG-87A/U)	172-71004-4 (NAA)
†40	Cable (RG-87A/U)	172-71004-6 (NAA)
†41	Cable (RG-8/U)	172-71004-8 (NAA)
†42	Plug	UG-21C/U
†43	Connector	UG-23C/U
†44	Adapter—Right-angle	UG-27B/U
†45	Adapter—Right-angle	UG-202/U
†46	Adapter	M-359
†47	Plug	PL-259-A
†50	Plug	UG-21/U
52	Bus	AN3433-2-2
†53	Connector—Butt	35203 (Aircraft-Marine Products)
*54	Connector—Butt	35203 (Aircraft-Marine Products)
55	Plug	AN3106B20-27S
56	Antenna—Combination VHF and IFF	151-71012-10 (NAA)
57	Connector	UG-23/U
58	Adapter	AN3057-12
59	Antenna—AN/ARN-6 Sense	151-71026 (NAA)
60	Circuit Breaker	AN3161P20
61	Circuit Breaker	AN3161P5
62	Circuit Breaker	AN3161P10
63	Resistor—150-ohm ½-watt	
64	Plug	AN3108-24-5S
65	Receptacle—Pressure-tight	AN3100PR24-5P
66	Plug	AN3107-16S-1S
67	Circuit Breaker	AN3161P5
68	Plug	AN3108-28-12S
69	Receptacle—Pressure-tight	AN3100PR28-12P
70	Receptacle—Pressure-tight	AN3102PR14S-1P
71	Receptacle	AN3102-14S-1P

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
72	Plug	AN3108B20-27S
73	Receptacle—Pressure-tight	AN3100PR20-27P
74	Connector—Feed-through	PL-274
75	Cable—"Teflon" High-temperature	151-71044-4 (NAA)
76	Cable—"Teflon" High-temperature	170-71012 (NAA)
77	Terminal Strip	NAS45-6-( )
78	Insert Assembly	14S-2P
79	Insert Assembly	14S-2S
80	Cable—Compass Loop	CG-556/ARN-6
81	Adapter	AN3057-8
82	Adapter	AN3057-12
83	Adapter	AN3057-16
84	Cable—Compass Loop	CG-555/ARN-6
85	Switch—Microphone Throttle	138106 (Ucinite)
86	Jack—Radio Frequency	UG-61A/U
87	Cord—Kellogg Koiled	151-71023 (NAA)
88	Plug	AN3108B18-1P
89	Adapter	AN3057-10
90	Plug	AN3108B8S-1P
91	Adapter	AN3057-3
92	Plug	AN3108B14S-5S
93	Adapter	AN3057-6
94	Plug—Radio Frequency	UG-59A/U
95	Base Assembly—Loop Disconnect	151-71084 (NAA)
96	Brush Holder—Loop Disconnect	151-71097-12 (NAA)
97	Plug	AN3103-20-29S
98	Receptacle	AN3100PR20-29P
99	Plug	AN3107-20-29S
100	Receptacle	AN3100-20-29P
101	Adapter	AN3057-16
102	Receptacle	AN3100-24-5P
103	Plug	AN3106-24-5S
104	Jack	U-61/U
105	Cordage	WF-5/U
106	Fuse—5-ampere	AGC 5 (Bussmann)
107	Support Assembly	161-74044 (NAA)
108	Cable	RG-8/U
†109	Adapter	AN3057-16
†110	Connector—Feed-through	PL-274
†113	Antenna Assembly—UHF	161-23310 (NAA)
372	Plug	AN3106B16S-1P
428	Receptacle	AN3101B16S-1S
	RADAR	
1	Head—Sighting	665096 (Sperry)
2	Control—Dimmer	665087 (Sperry)
3	Rocket Setting Unit	665097 (Sperry)
4	Light—On-target Indicator	ID-270/APG-30
5	Switch—Filament	AN3021-3
6	Potentiometer—Range Sweep 75,000-ohm 2-watt	
7	Switch—Radar-out	
8	Control Unit—Manual Range	170-43059 (NAA)
9	Switch—Caging	138106 (Ucinite)
11	Test Box—Voltage	151-74083 (NAA)
12	Computer	654086 (Sperry)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
13	Amplifier	654931 (Sperry)
14	Transmitter—Radar	RT-181/APG-30
15	Mounting—Radar Transmitter	MT-709/APG-30
16	Power Unit—Range	PP-493/APG-30
17	Mounting—Range Power Unit	MT-739/U
18	Servo Unit—Range	102527, Type RS-105
19	Jack Assembly	171-74052 (NAA)
21	Converter—Static D-C	32617, Type E-1
22	Power Unit—Armament A-C	Type D-2
25	Regulator—Voltage	CN-112/APG-30
26	Mounting—Voltage Regulator	MT-708/APG-30
27	Relay—Radar Servo	237EAU (Leach)
29	Antenna	AT-223/APG-30
30	Mount—Antenna	AB-171/APG-30
31	Wave Guide—Rigid	LC-19288 (Airtron)
32	Wave Guide—Flexible	CG-179A/U(24") (Airtron)
33	Coupler	LC-19287 (Airtron)
34	Circuit Breaker—Radar Power	AN3161P5
35	Circuit Breaker—Sight Power	AN3161P10
36	Circuit Breaker—Sight A-C Power	AN3161P20
37	Circuit Breaker—Sight Heater	AN3161P25
38	Circuit Breaker—Sight Heater AN3161P15	
39	Circuit Breaker—Sight Power AN3161P15	
40	Panel—Fuse	170-74014 (NAA)
41	Fuse—D-2 D-C Power 300-volt 125-milliampere	
42	Fuse—Amplifier D-C Power 300-volt 500-milliampere	
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
44	Fuse—Amplifier and A-C Power 28-volt 3-ampere	
45	Fuse—Voltage Regulator 115-volt A-C 5-ampere	
48	Terminal Strip	NAS45-6-( )
49	Terminal Strip	6-140 (H. B. Jones)
50	Plug	AN3106-20-27P
51	Plug	P302-CCT-L (H. B. Jones)
52	Plug	P303-CCT-L (H. B. Jones)
53	Plug	P304-CCT-L (H. B. Jones)
54	Plug	P306-CCT-L (H. B. Jones)
55	Plug	P308-CCT-L (H. B. Jones)
56	Plug	P312-CCT-L (H. B. Jones)
57	Plug	P315-CCT-L (H. B. Jones)
58	Plug	P318-CCT-L (H. B. Jones)
59	Plug	
60	Plug	
61	Plug	AN3106B14S-2P
62	Plug	AN3106B14S-2S
63	Plug	AN3106B14S-5P
64	Plug	
65	Plug	AN3106B18-8S
66	Plug	AN3108B20-15S
67	Plug	AN3106B20-18S
68	Plug	AN3108B20-18P
69	Plug	AN3106B20-27P
70	Plug	AN3106B24-28S
71	Plug	AN3106B22-19S
72	Plug	AN3106B22-24S
73	Plug	AN3106B28-16P
74	Plug	AN3106B28-16S

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
75	Plug	AN3106B28-17P
76	Plug	AN3106B28-16P
77	Plug	AN3106B28-12P
78	Plug	AN3107-18-8S
79	Plug	AN3108B32-13P
80	Plug	AN3106B32-13S
81	Plug	AN3108B22-14S
82	Cable Assembly	170-74013 (NAA)
83	Cable Assembly	170-74013 (NAA)
85	Socket	S304-CCT-L
86	Socket	S306-CCT-L
87	Socket	S308-CCT-L
88	Socket	S404-CCT-L
91	Receptacle	AN3100PR28-12S
92	Receptacle	AN3100-28-16S
93	Receptacle	AN3100-20-27S
94	Plug	80MC-2F1
96	Plug	UG-260/U
98	Connector—Butt	35203 (Aircraft-Marine Products)
99	Clamp—Cable	AN3057-16A
100	Clamp—Cable	AN3057-10A
101	Clamp—Cable	AN3057-6
102	Clamp—Cable	AN3057-8
103	Clamp—Cable	AN3057-10A
104	Clamp—Cable	AN3057-12A
105	Clamp—Cable	AN3057-16A
106	Clamp—Cable	AN3057-20A
107	Receptacle	AN3100C24-28P
108	Plug	AN3108B24-28S
110	Potentiometer—1000-ohm	A4509-A (Chicago Telephone Supply)
111	Potentiometer—3500-ohm	A4510 (Chicago Telephone Supply)
112	Potentiometer—10,000-ohm	Y4321-A (Chicago Telephone Supply)
113	Microswitch	BZ-3YDT (Micro Switch)
209	Plug	AN3108B20-27P
263	Plug	AN3106B32-7P
264	Plug	AN3106B28-11P
265	Plug	AN3106B28-12P
273	Plug	AN3106B32-7P
280	Receptacle	AN3100-32-7S
287	Receptacle	AN3102-20-27S
304	Receptacle	AN3100PR32-7S
305	Receptacle	AN3100PR28-11S
306	Receptacle	AN3100PR28-12S
329	Relay—Gun Sight and Radar Power	G-39989-A (Guardian)
372	Plug	AN3106B16S-1P
428	Receptacle	AN3101B16S-1S

* F-86E-1, F-86E-5, and F-86E-6 Airplanes
† F-86E-10 and F-86E-15 Airplanes
‡ F-86E-1 and F-86E-5 Airplanes
§ F-86E-6, F-86E-10, and F-86E-15 Airplanes
¶ F-86E-15 Airplanes

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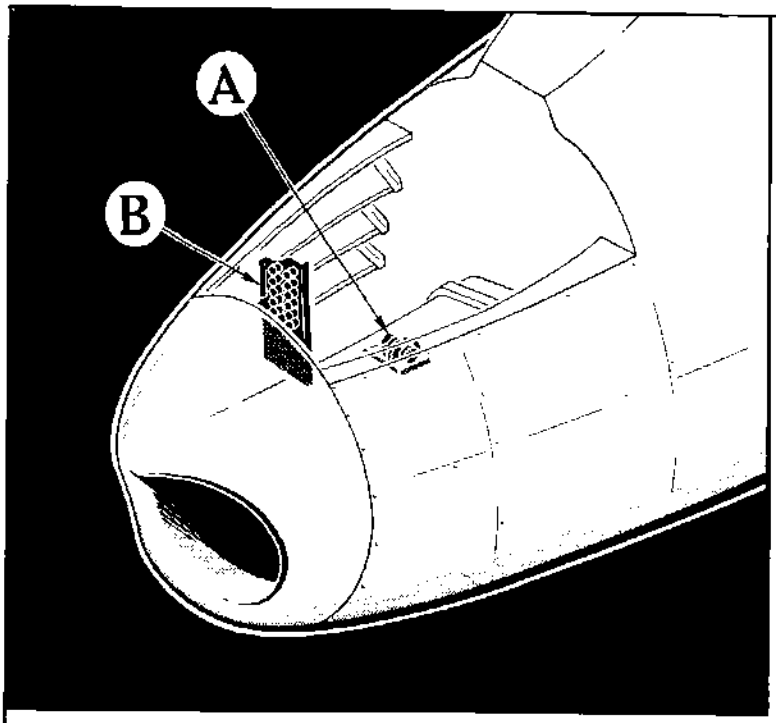

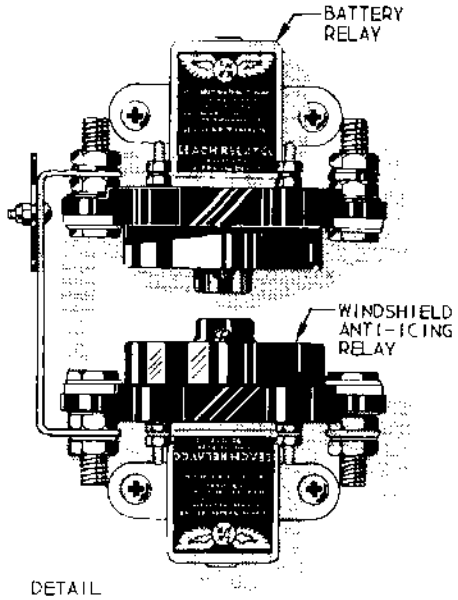

DETAIL A — WINDSHIELD HEATER AND BATTERY RELAY PANEL

RELAY LOCATION CHART

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172-54 4857

Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 1 of 9)

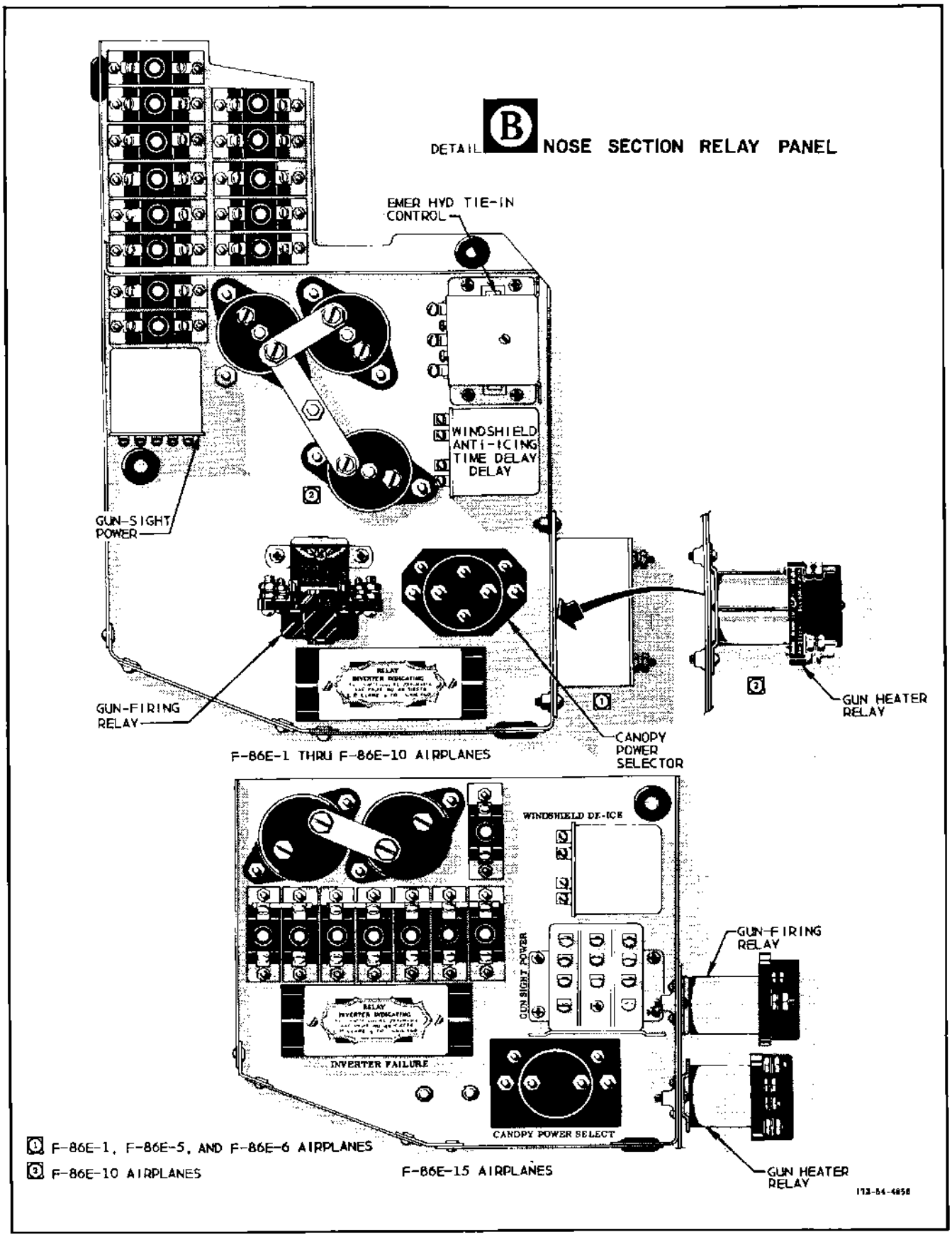


Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 2 of 9)

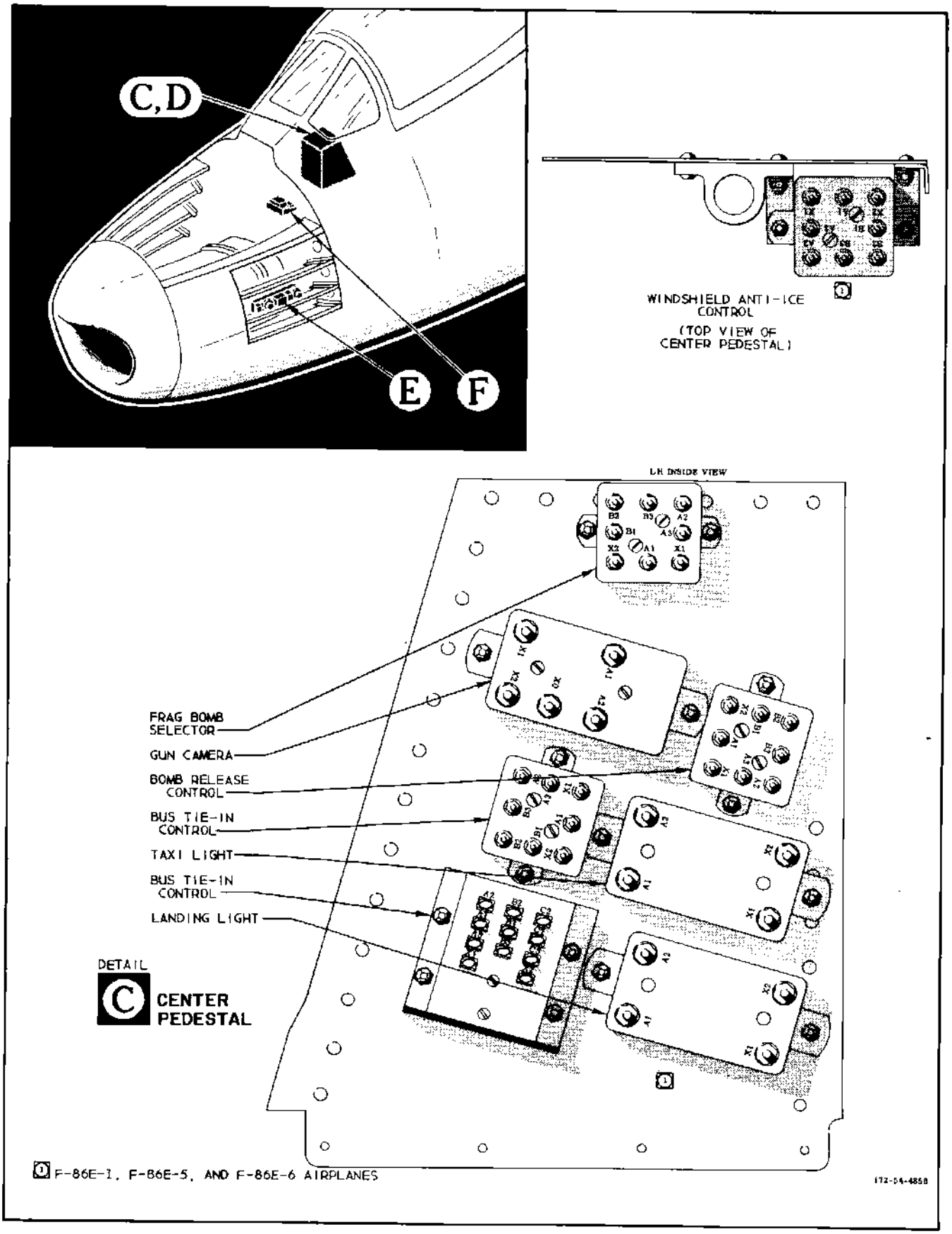


Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 3 of 9)

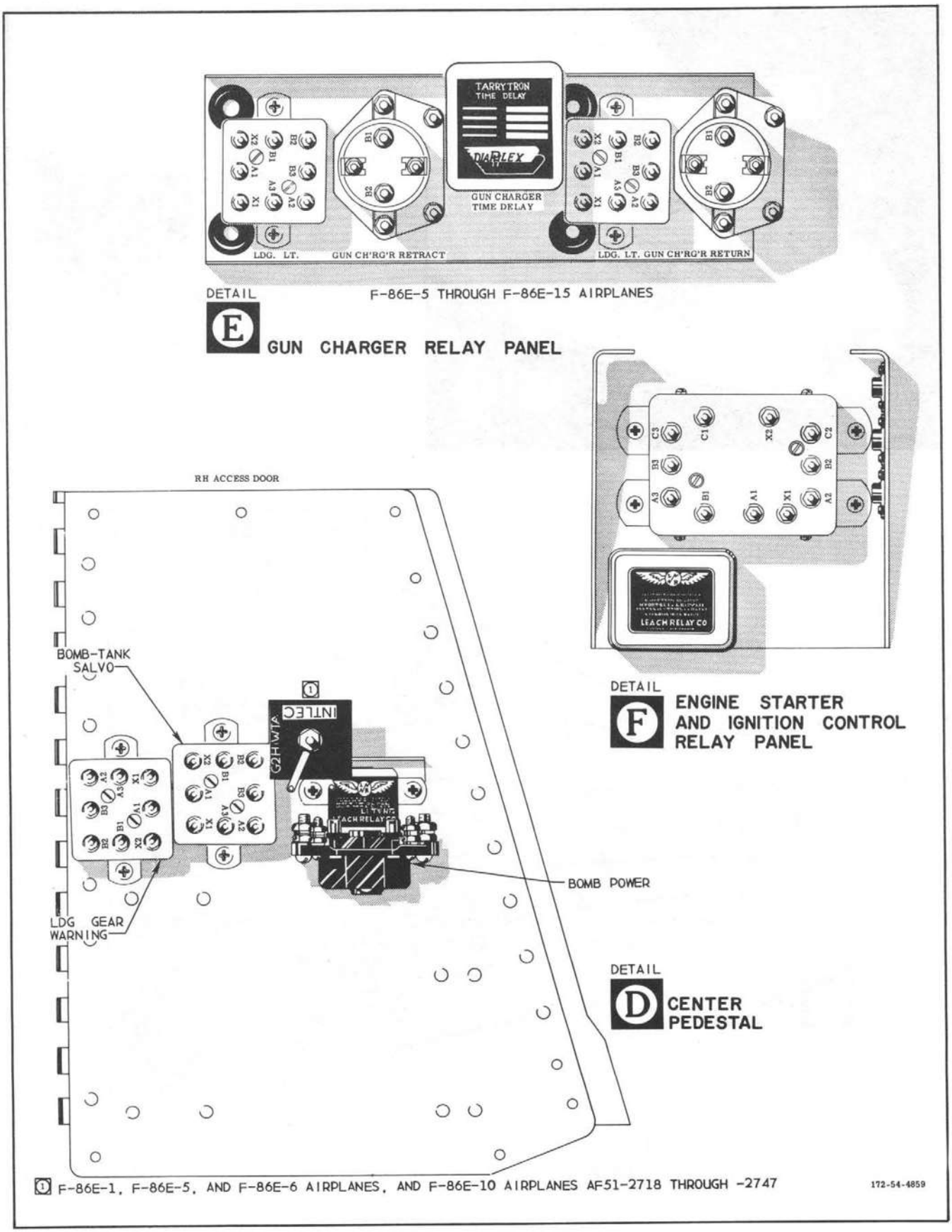


Figure 10-2. Relay Location Chart—F-86E- Airplanes (Sheet 4 of 9)

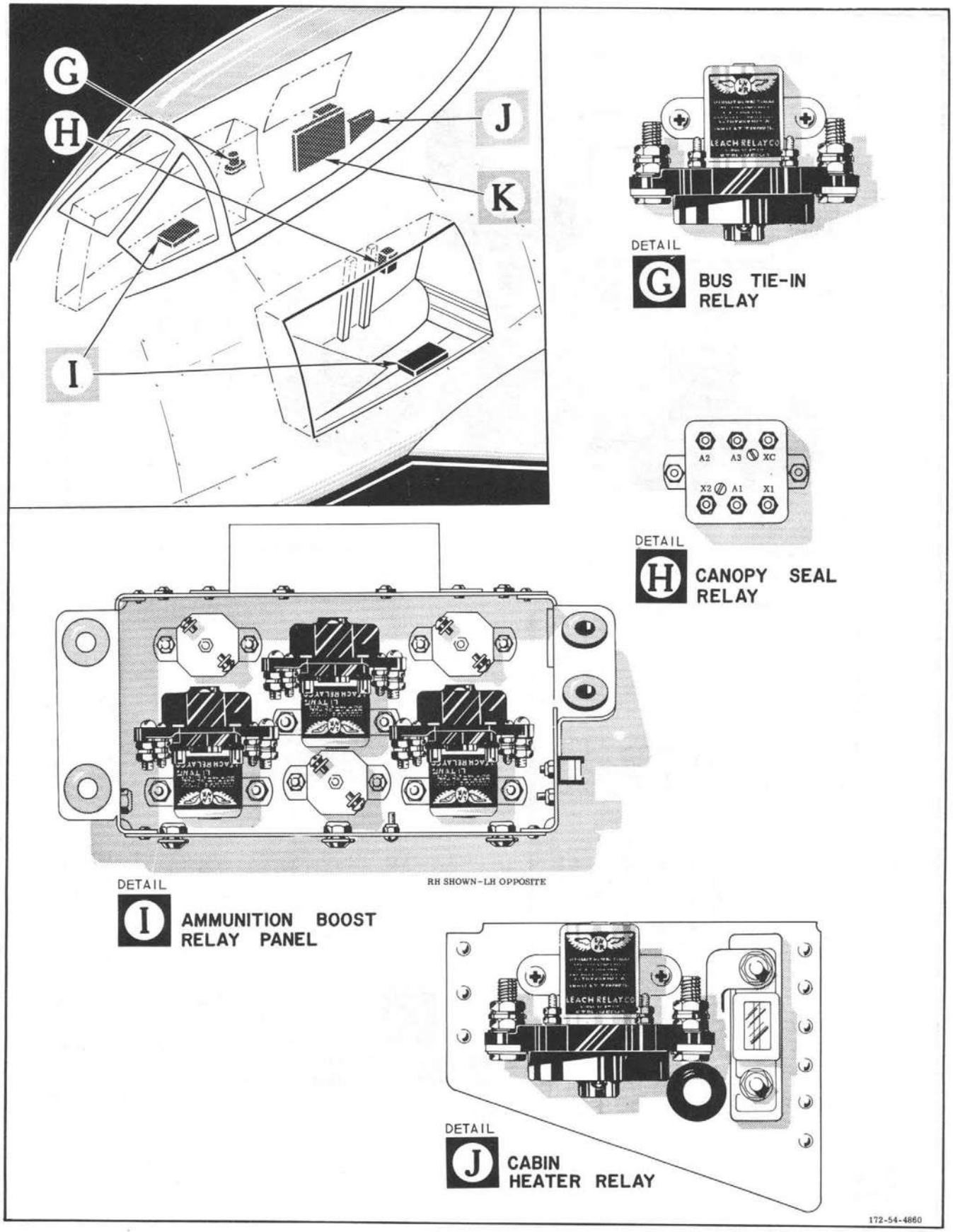


Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 5 of 9)

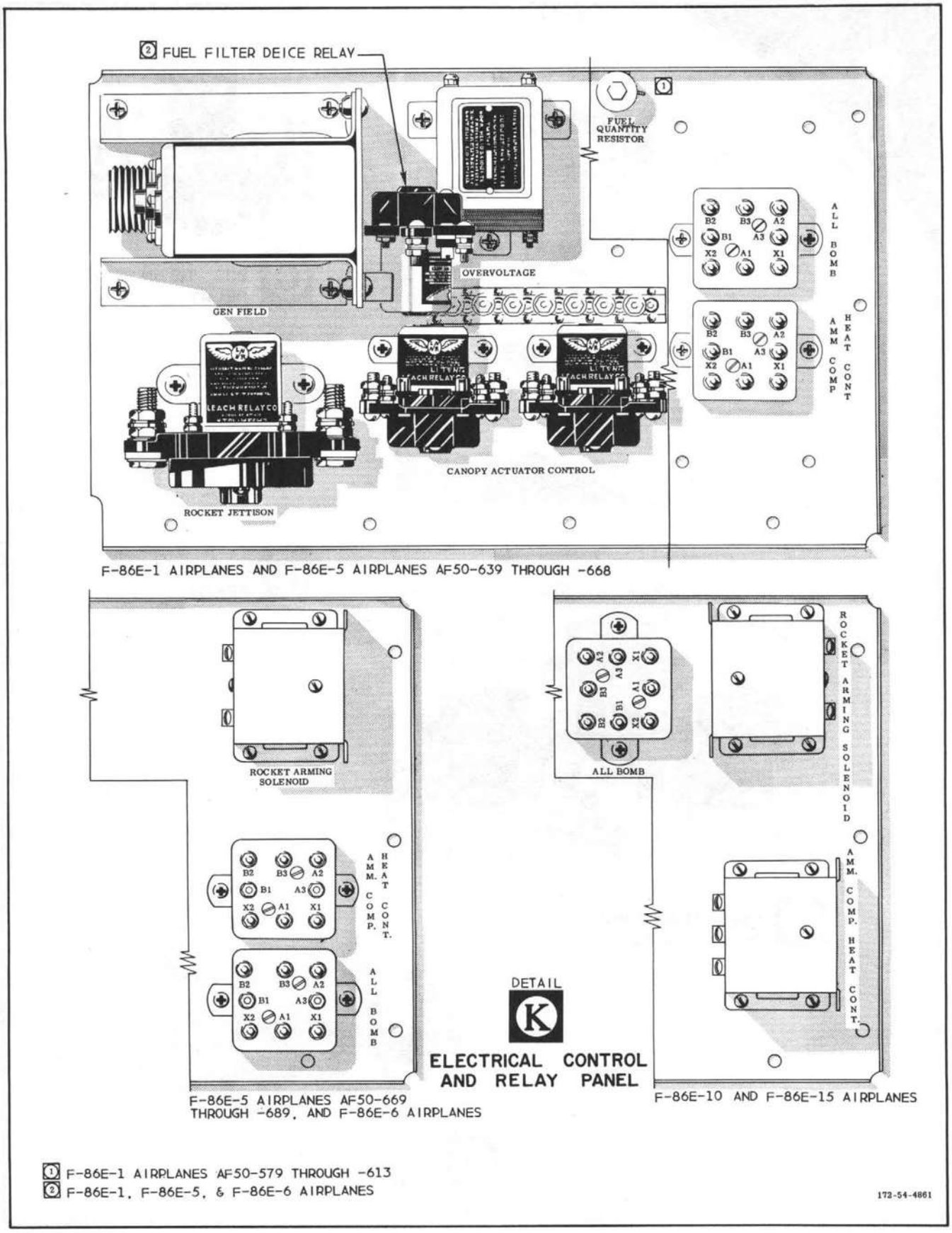


Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 6 of 9)

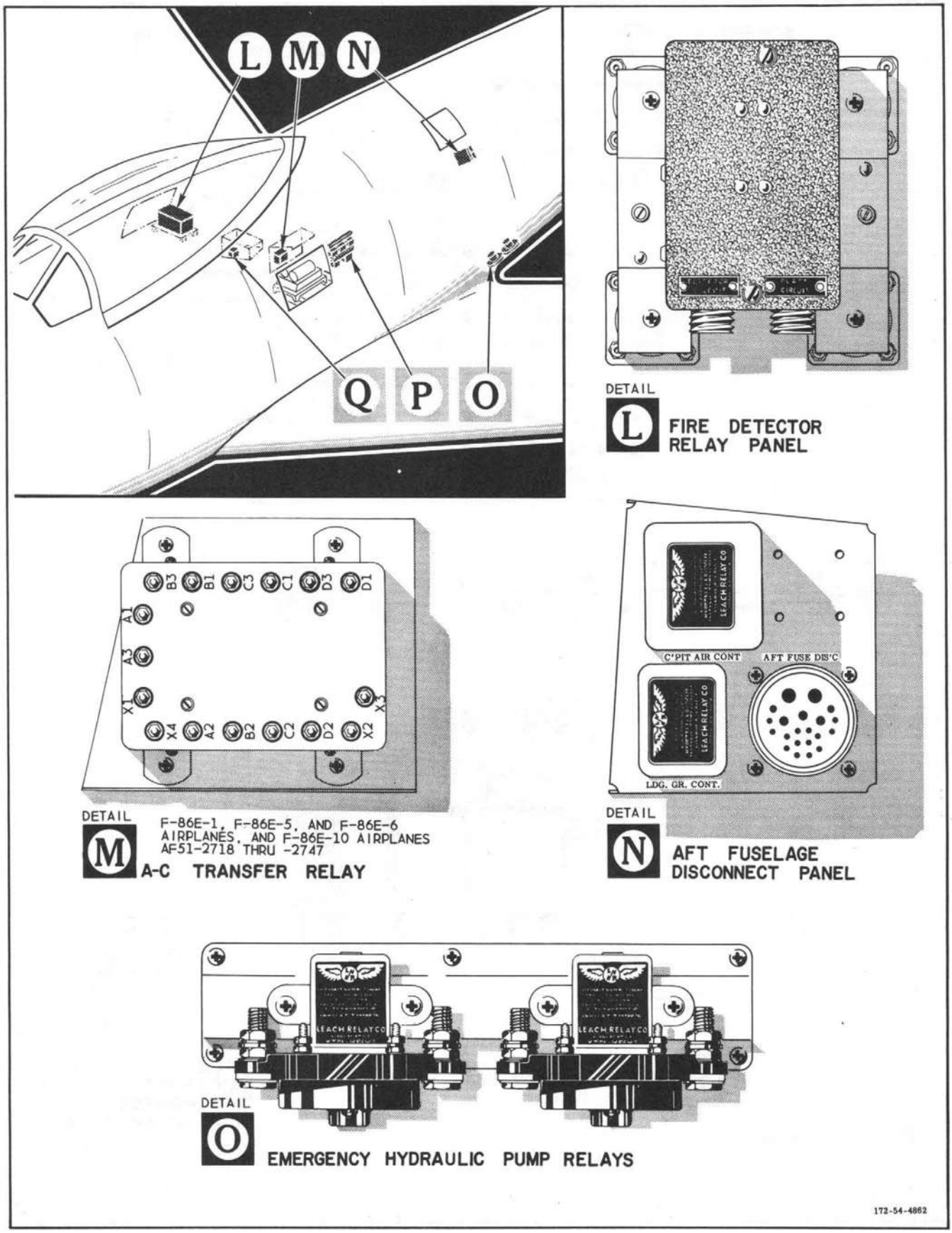


Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 7 of 9)

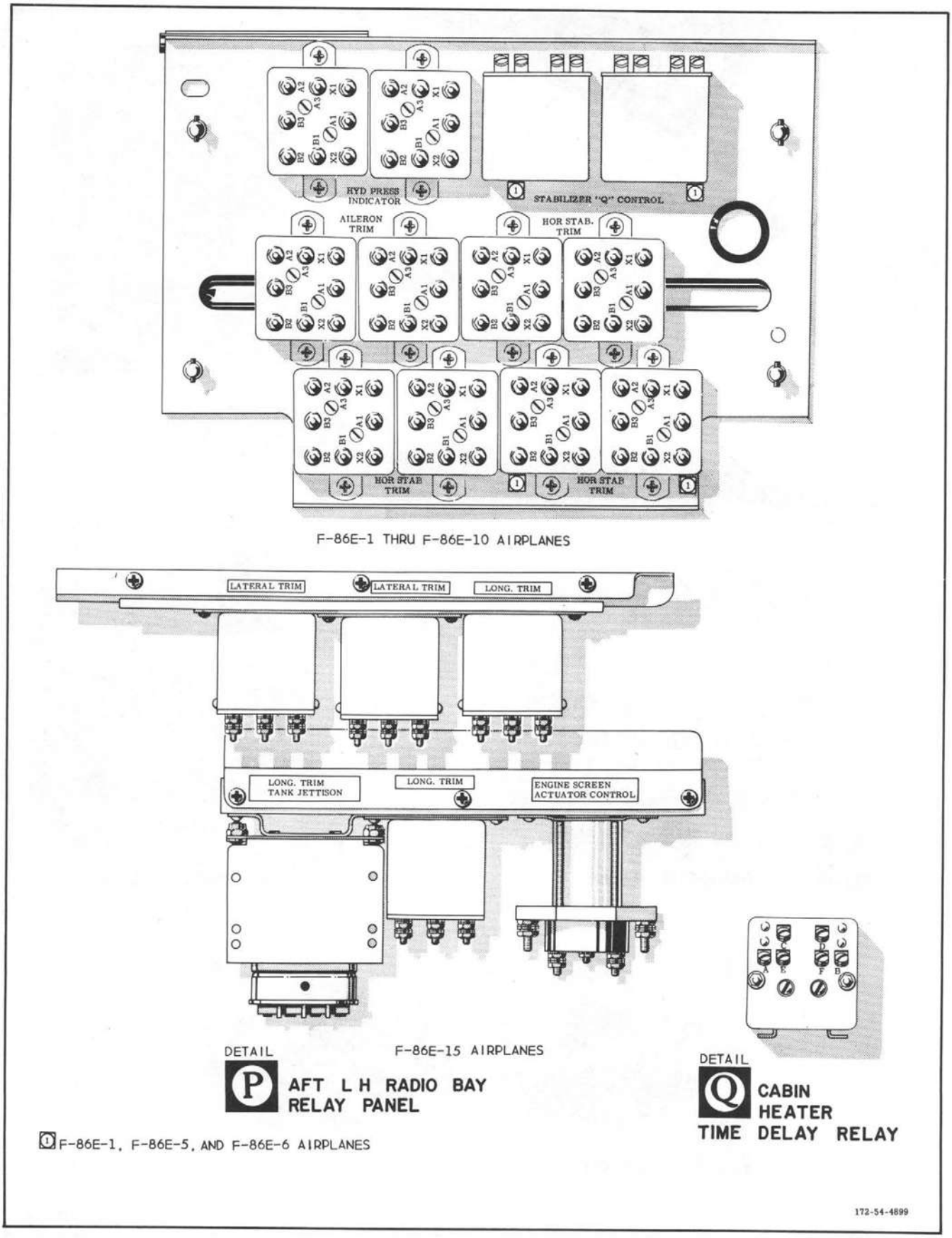


Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 8 of 9)

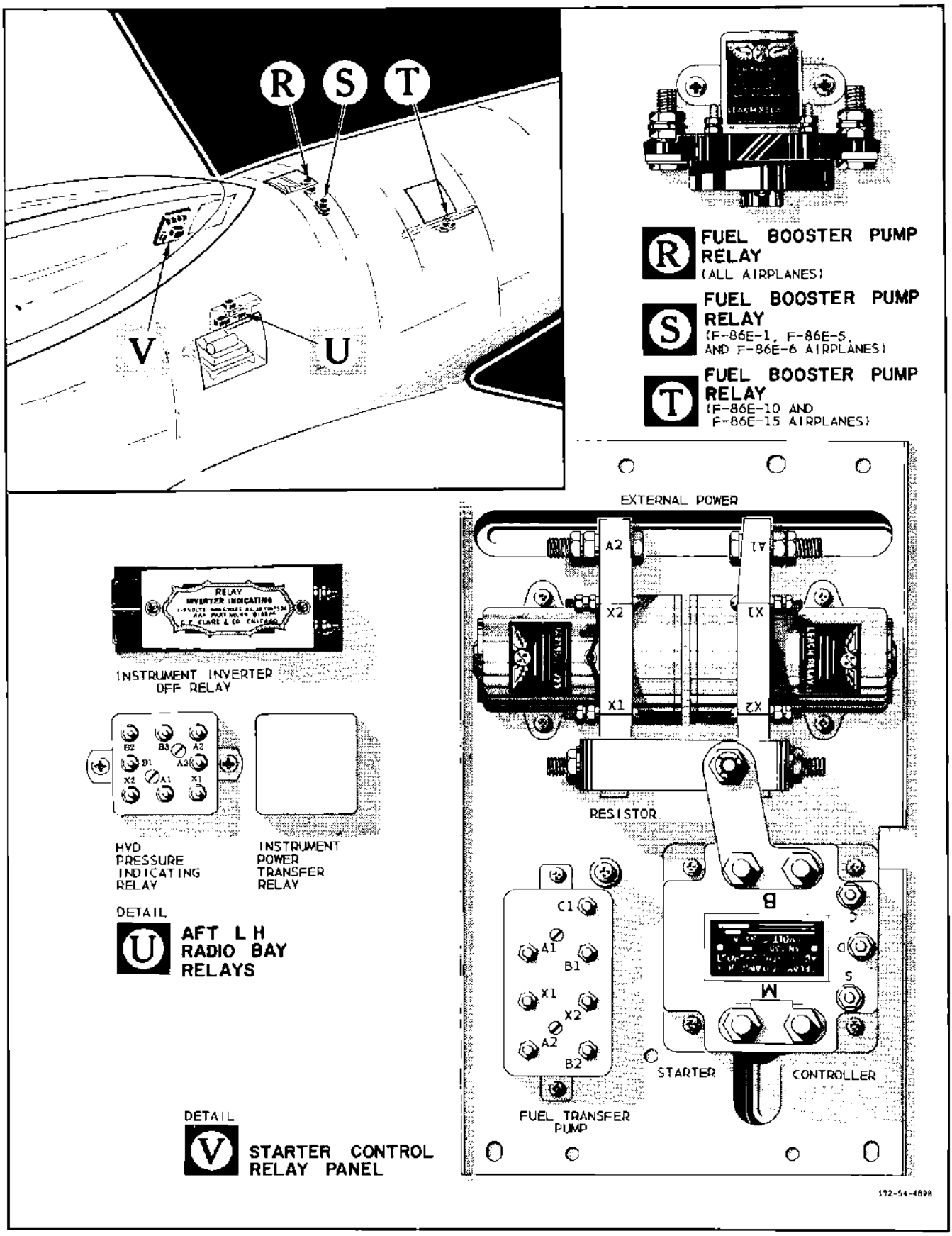


Figure 10-2. Relay Location Chart—F-86E Airplanes (Sheet 9 of 9)

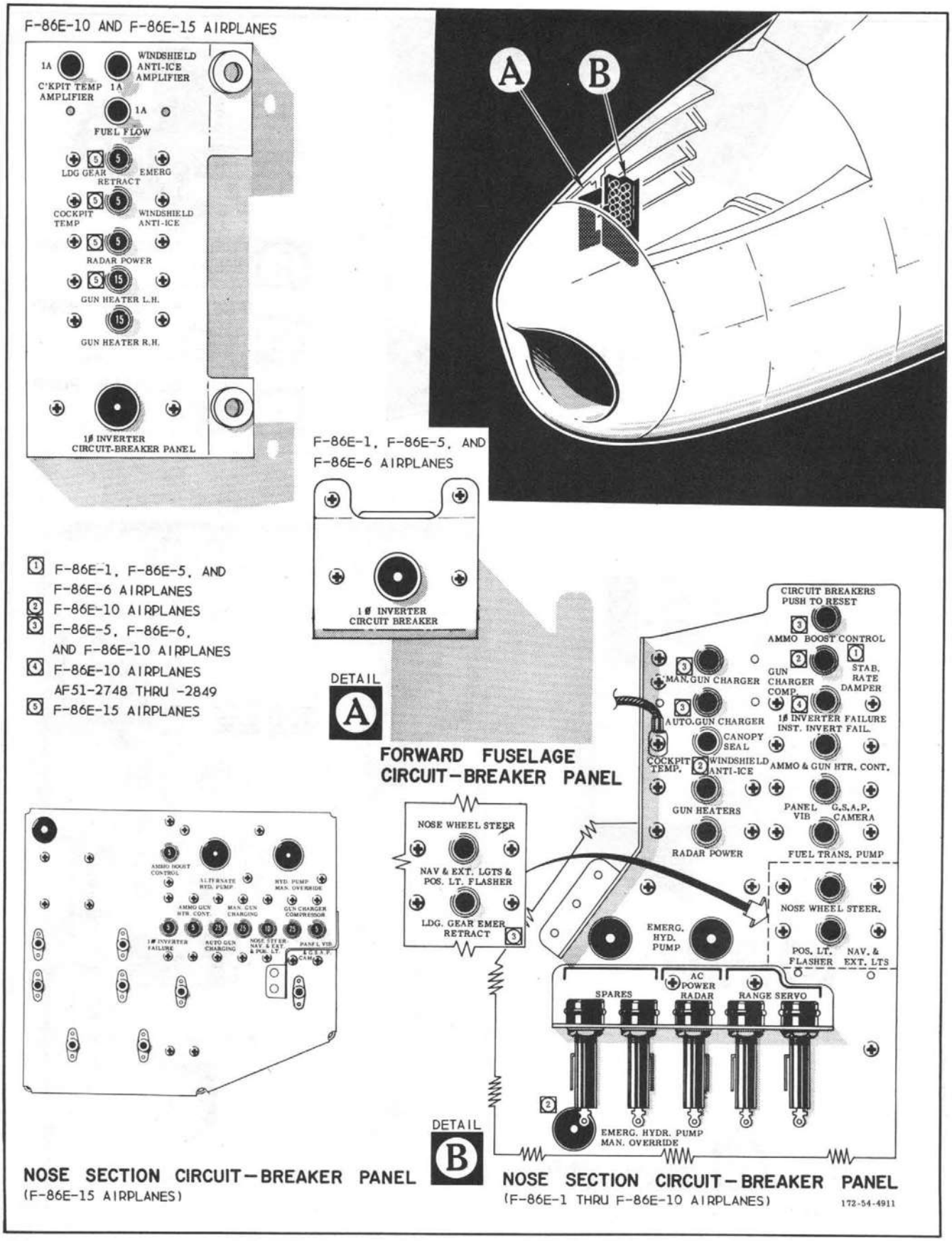


Figure 10-3. Circuit-breaker Location Chart—F-86E Airplanes (Sheet 1 of 3)

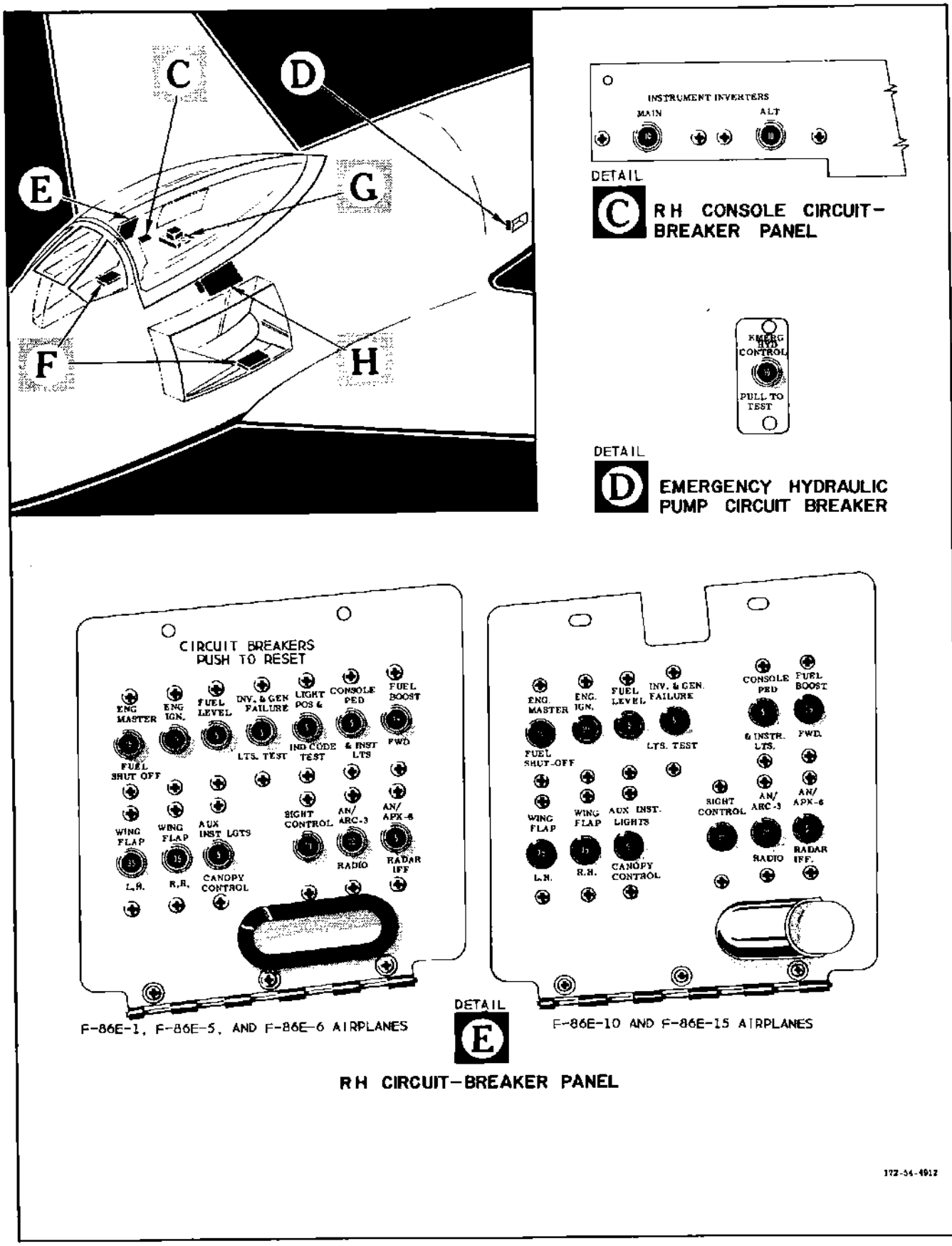


Figure 10-3. Circuit-breaker Location Chart—F-86E Airplanes (Sheet 2 of 3)

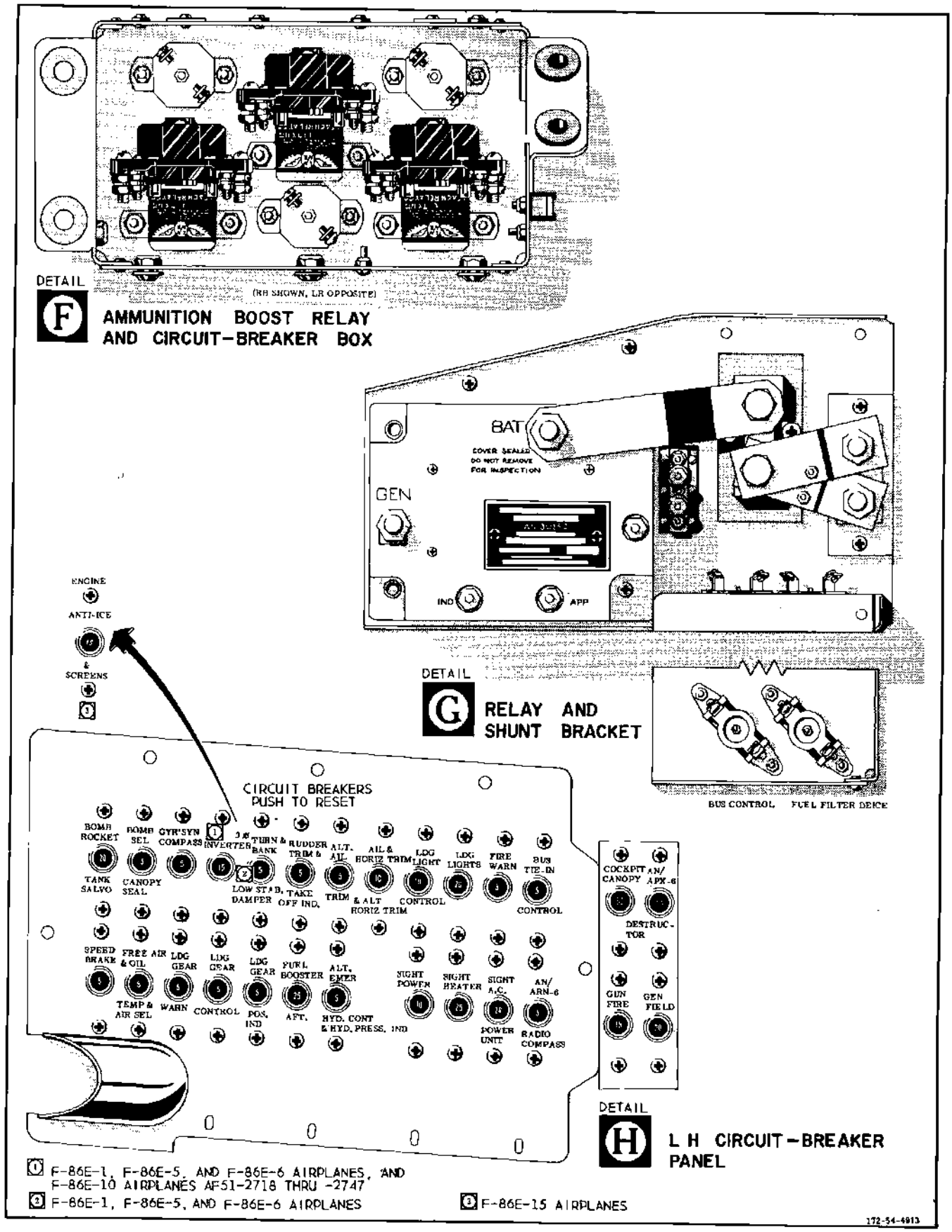


Figure 10-3. Circuit-breaker Location Chart—F-86E Airplanes (Sheet 3 of 3)

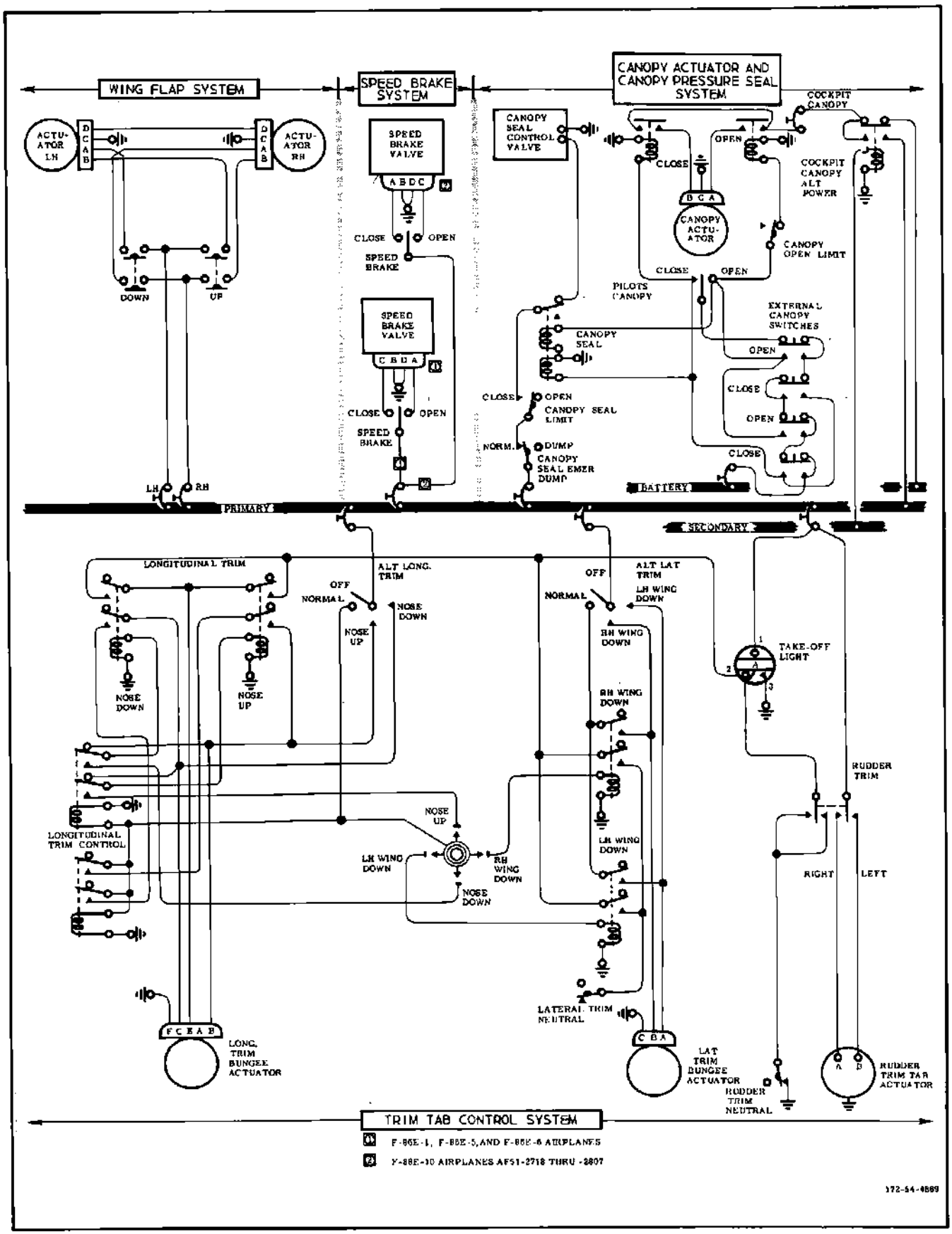
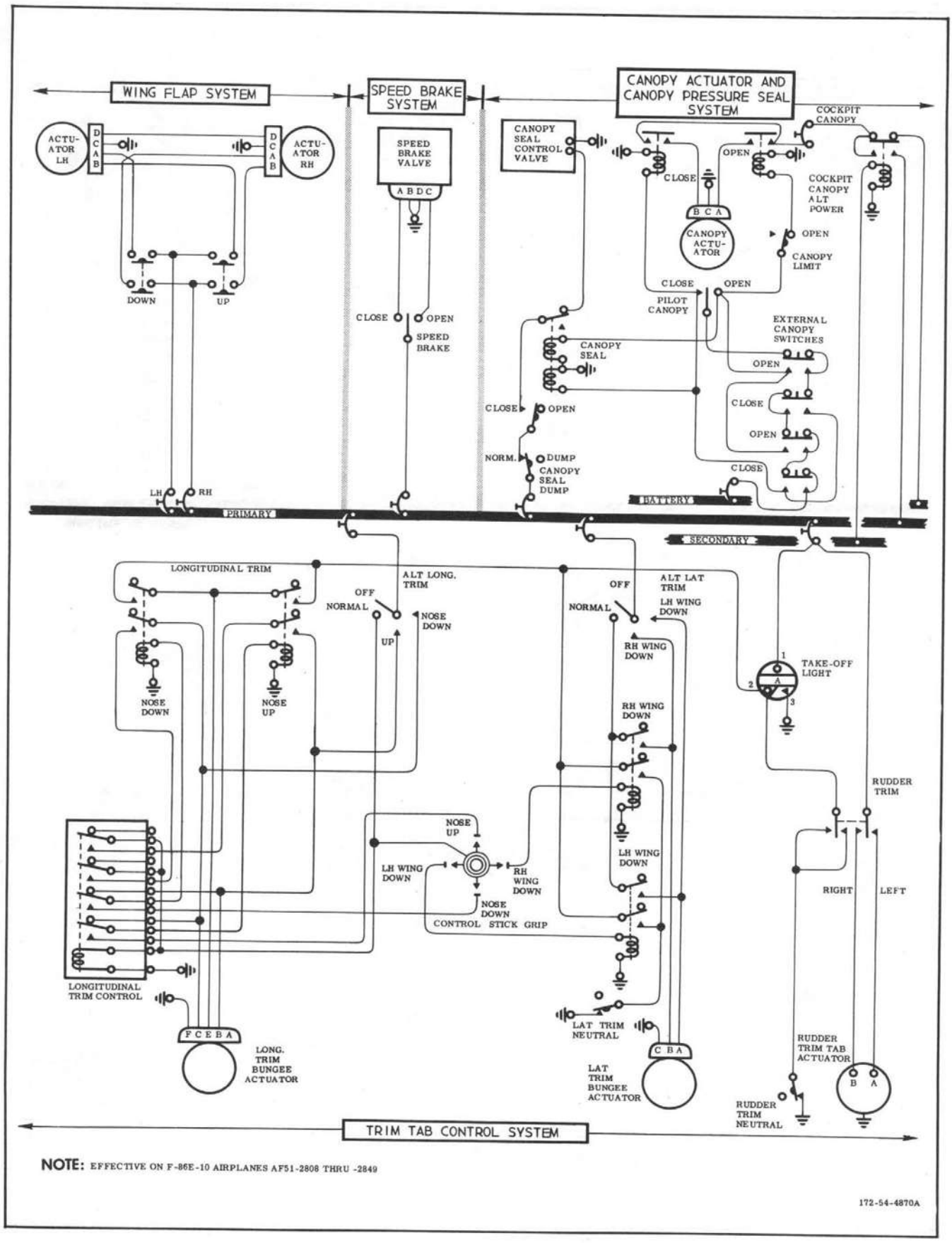


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 1 of 21)



NOTE: EFFECTIVE ON F-86E-10 AIRPLANES AF51-2808 THRU -2849

172-54-4870A

Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 2 of 21)

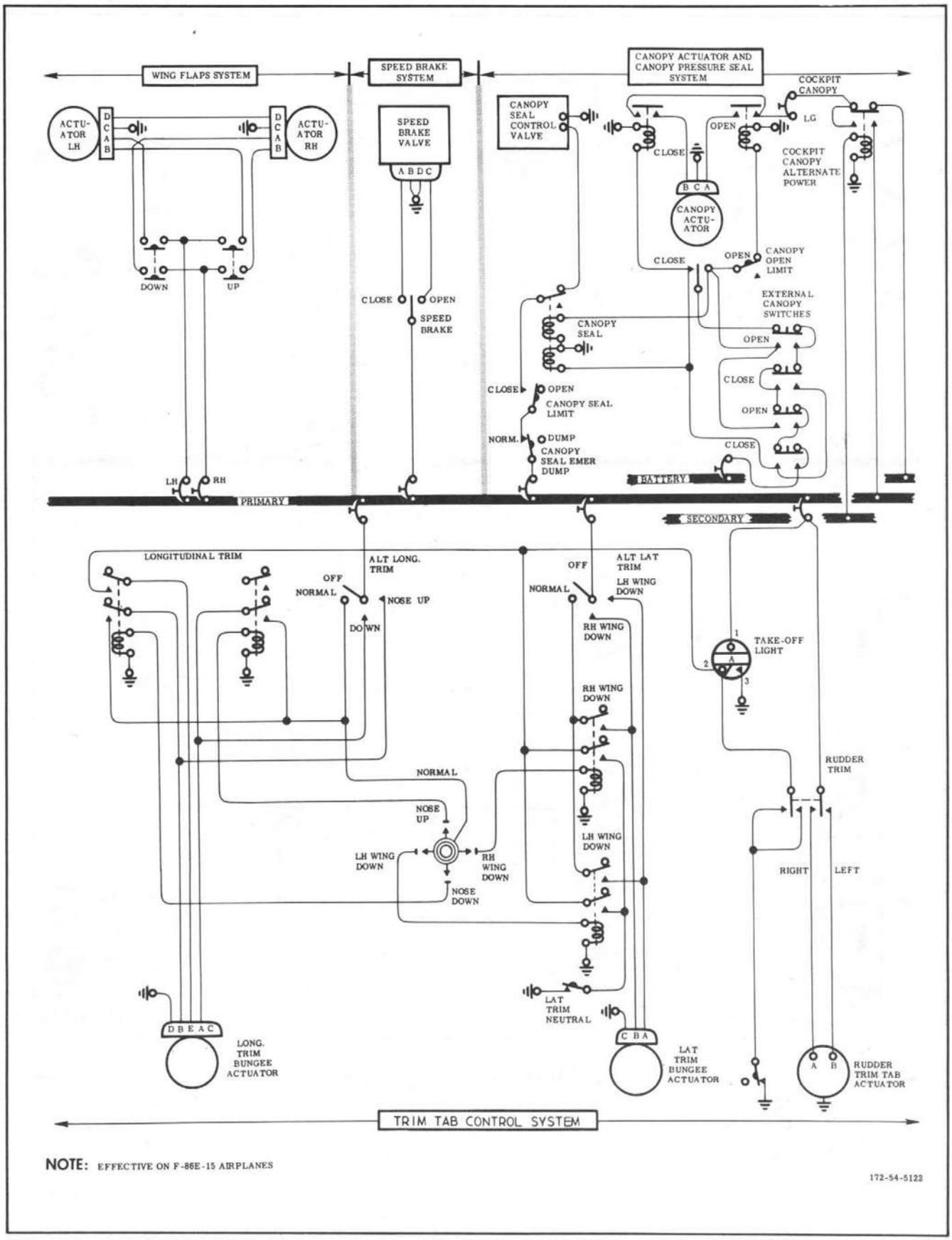


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 3 of 21)

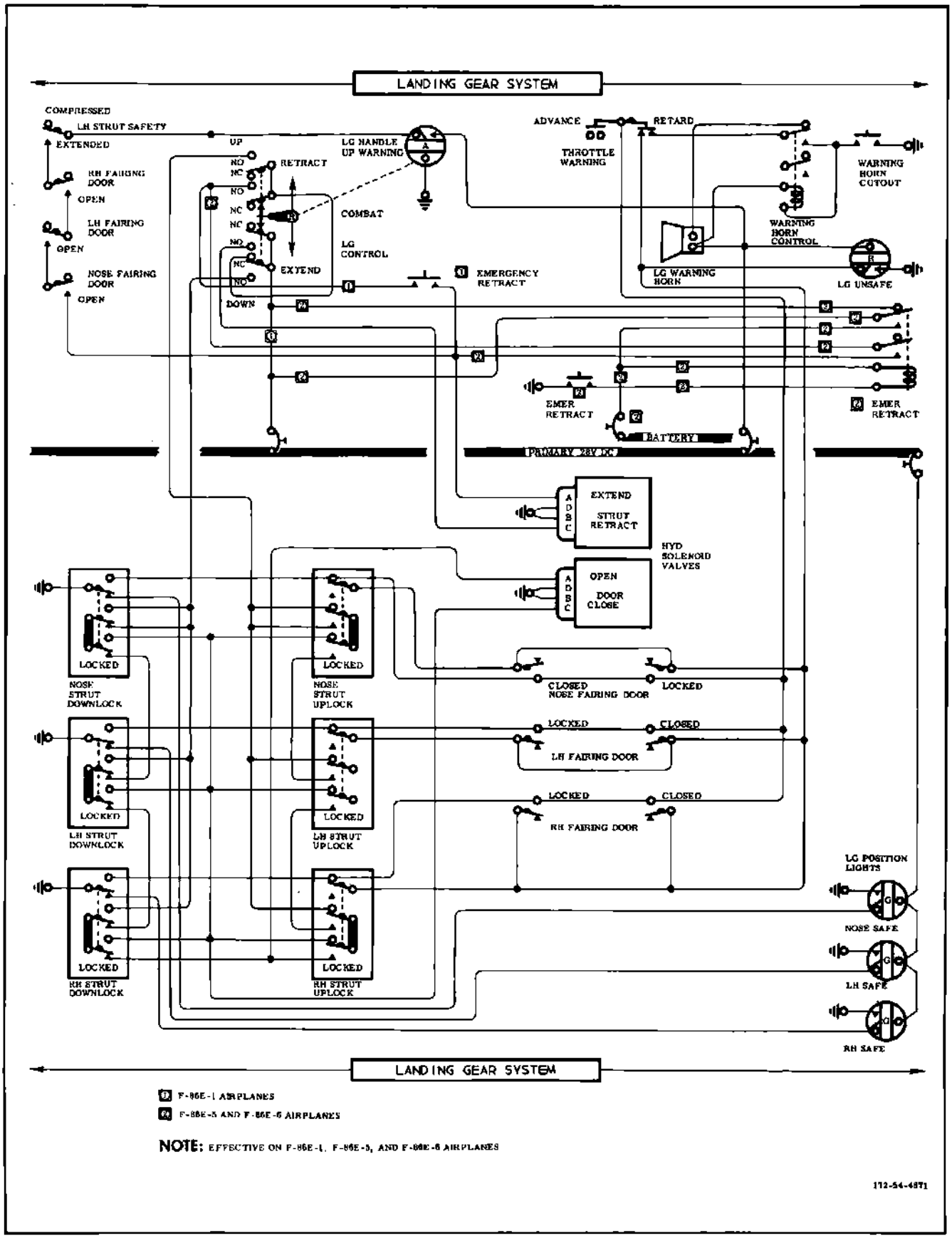


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 4 of 21)

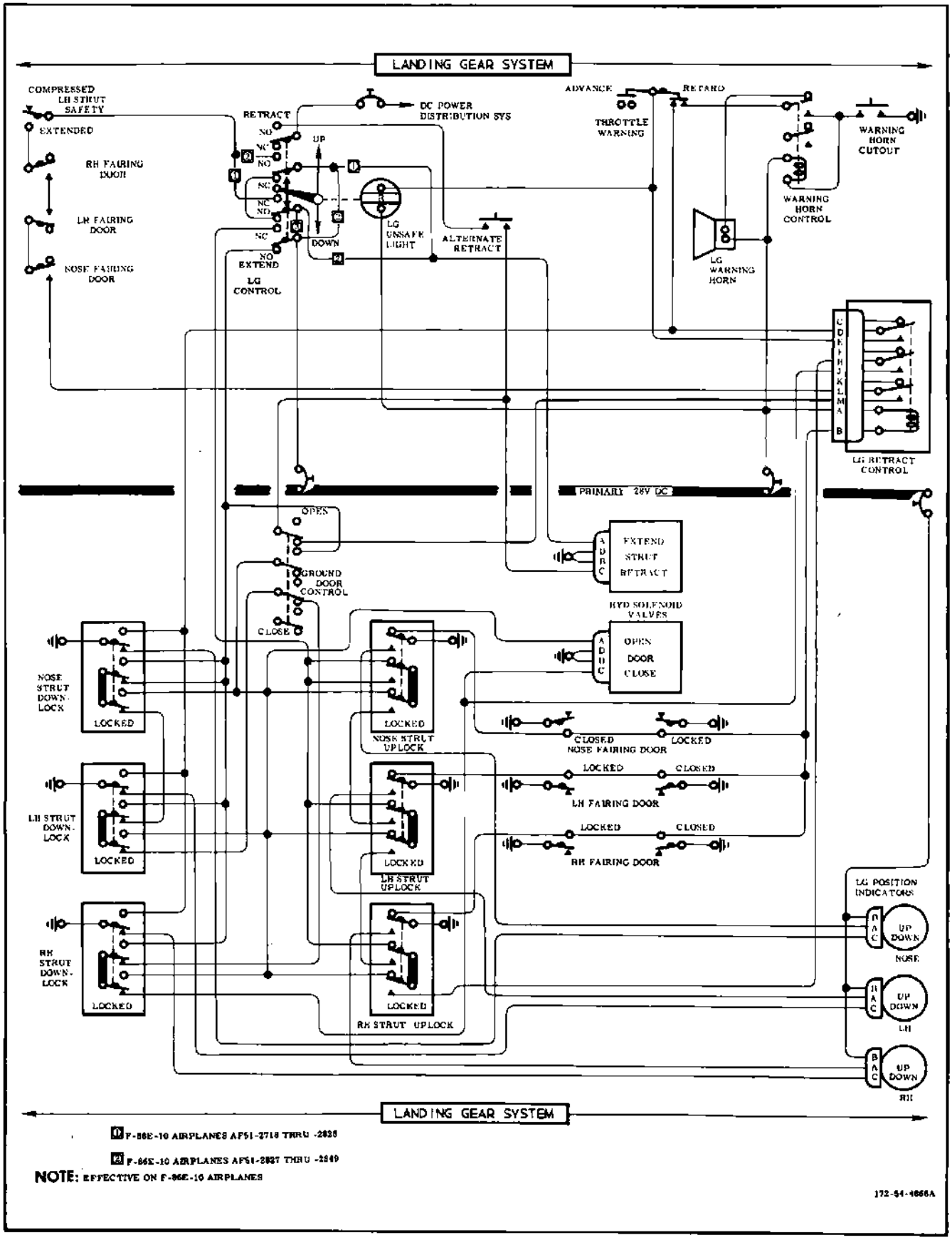


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 5 of 21)

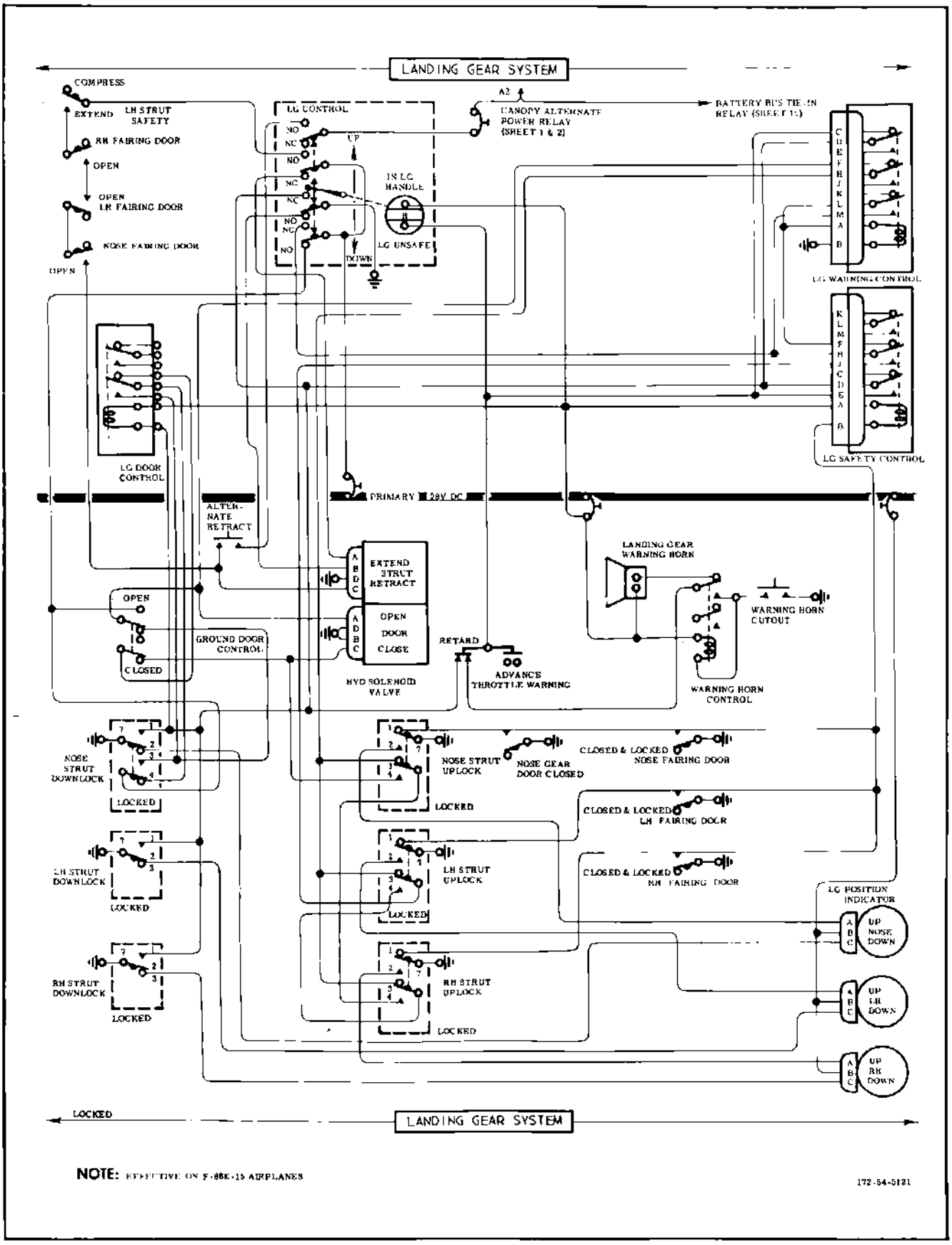


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 6 of 21)

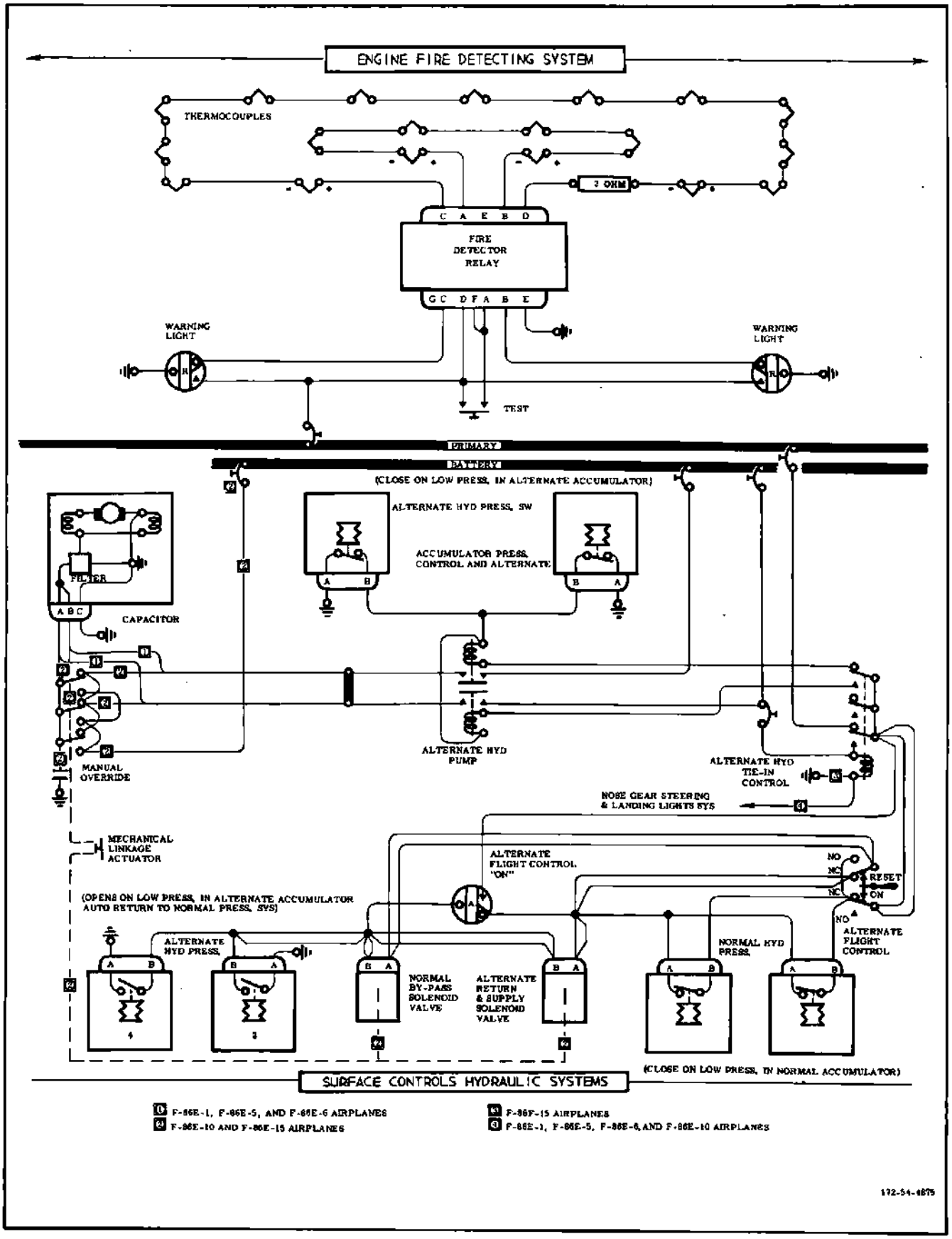


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 7 of 21)

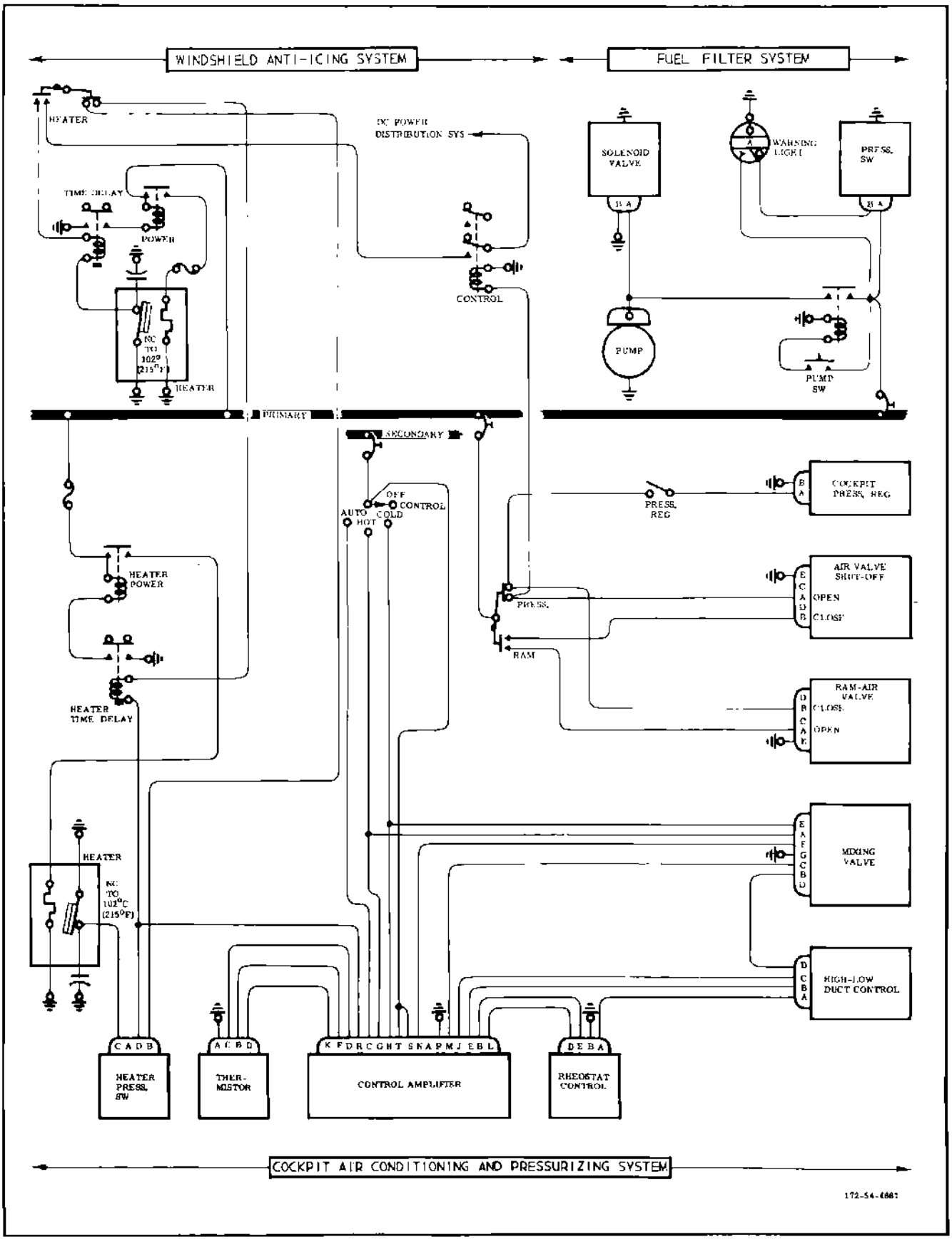


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 8 of 21)

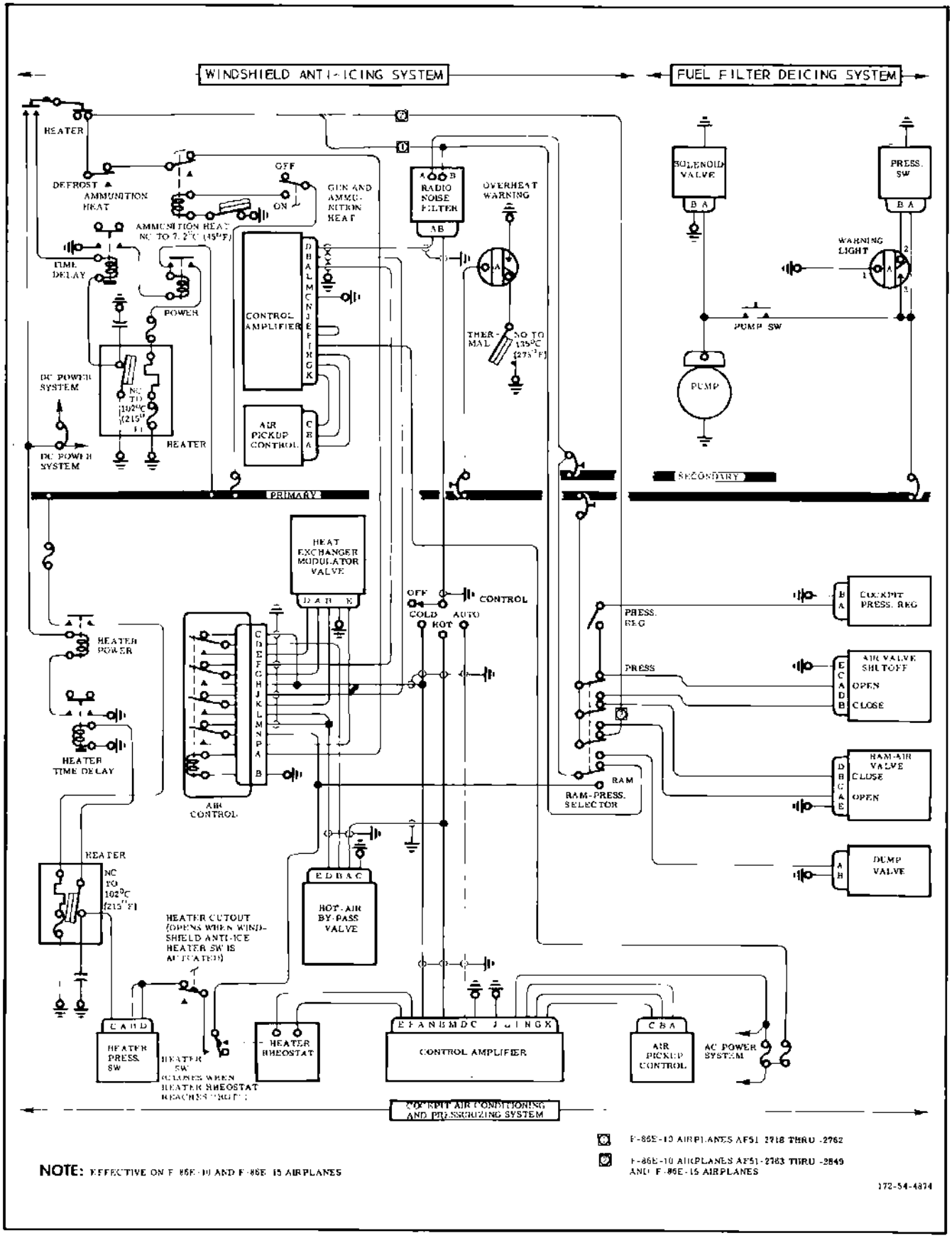


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 9 of 21)

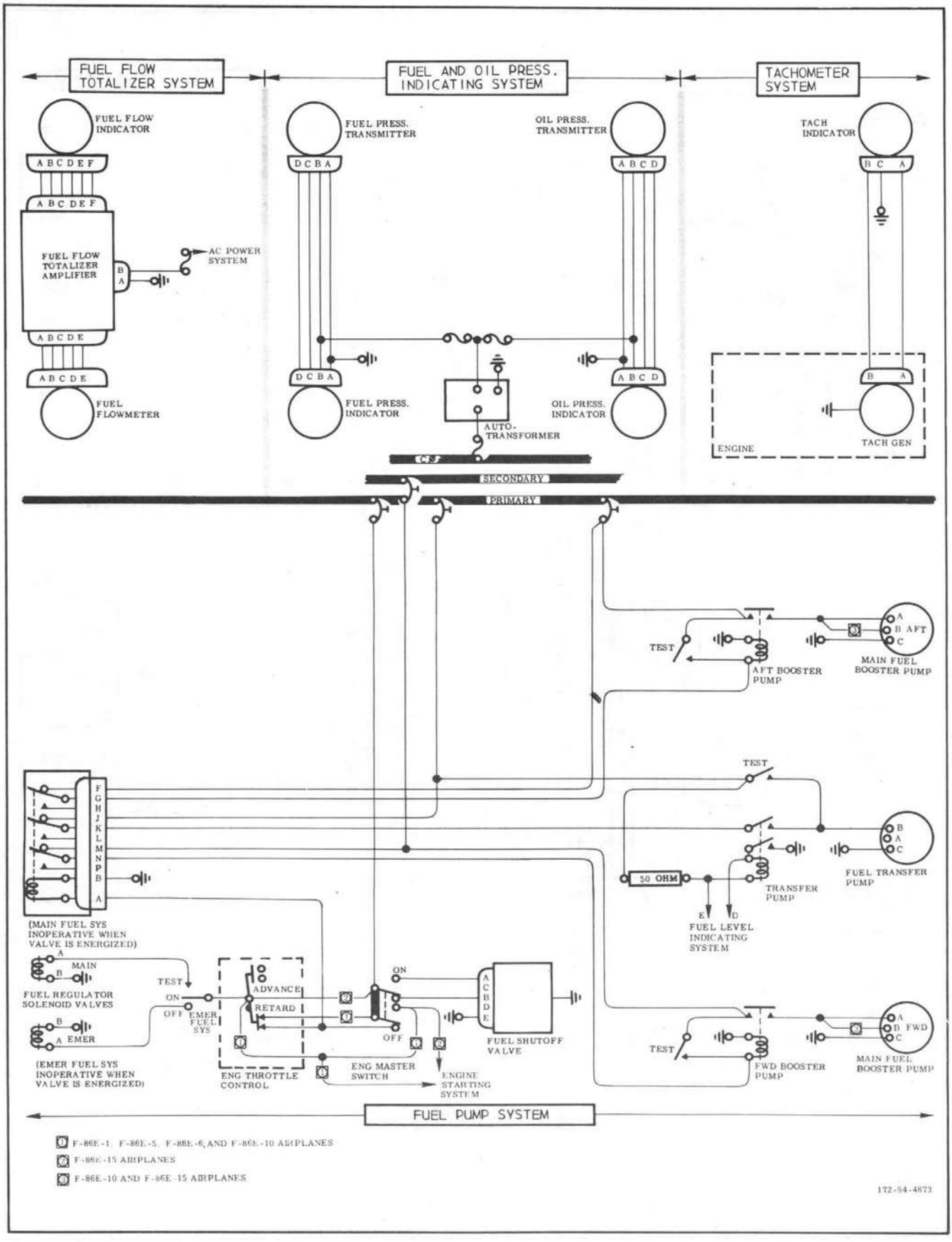


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 10 of 21)

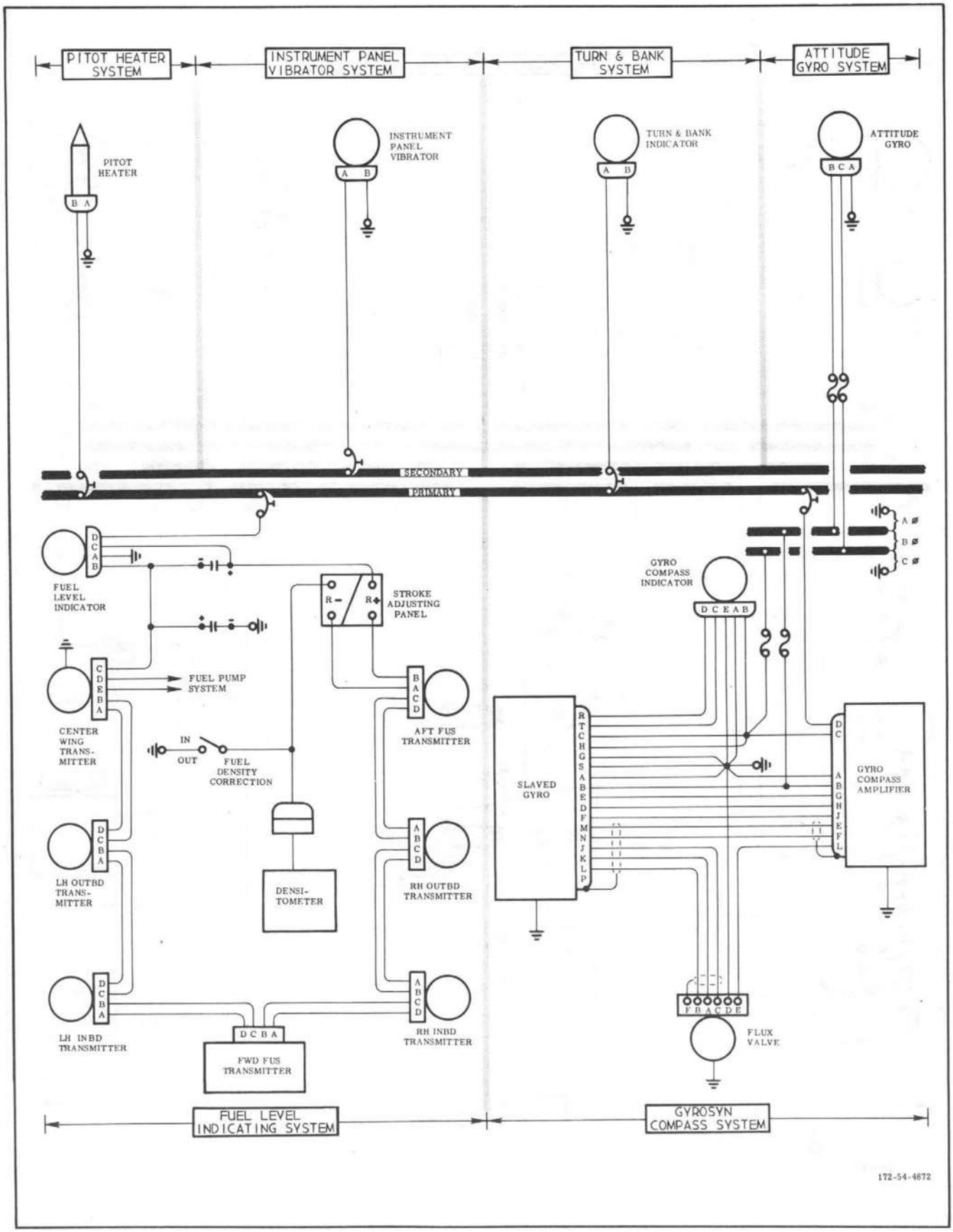


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 11 of 21)

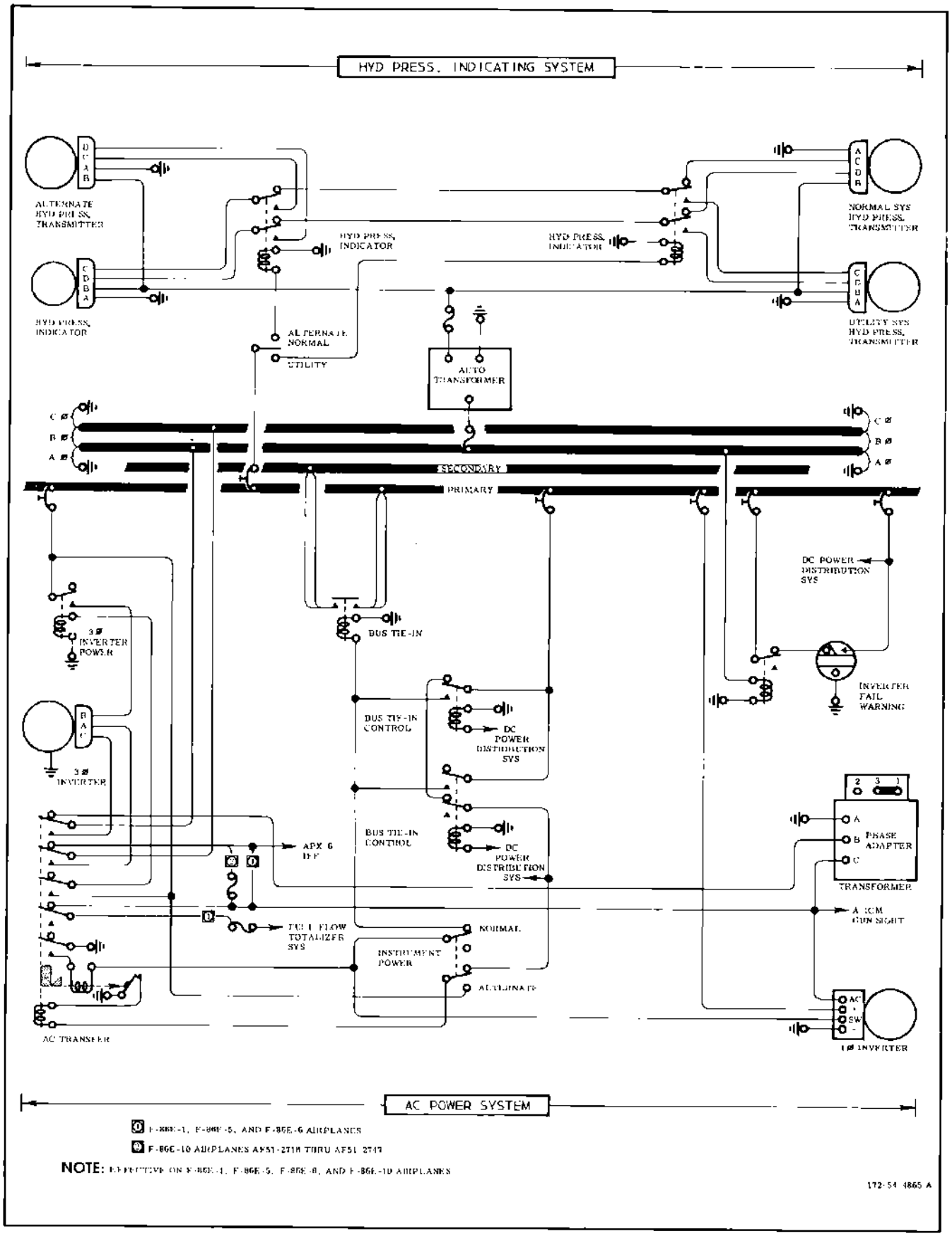
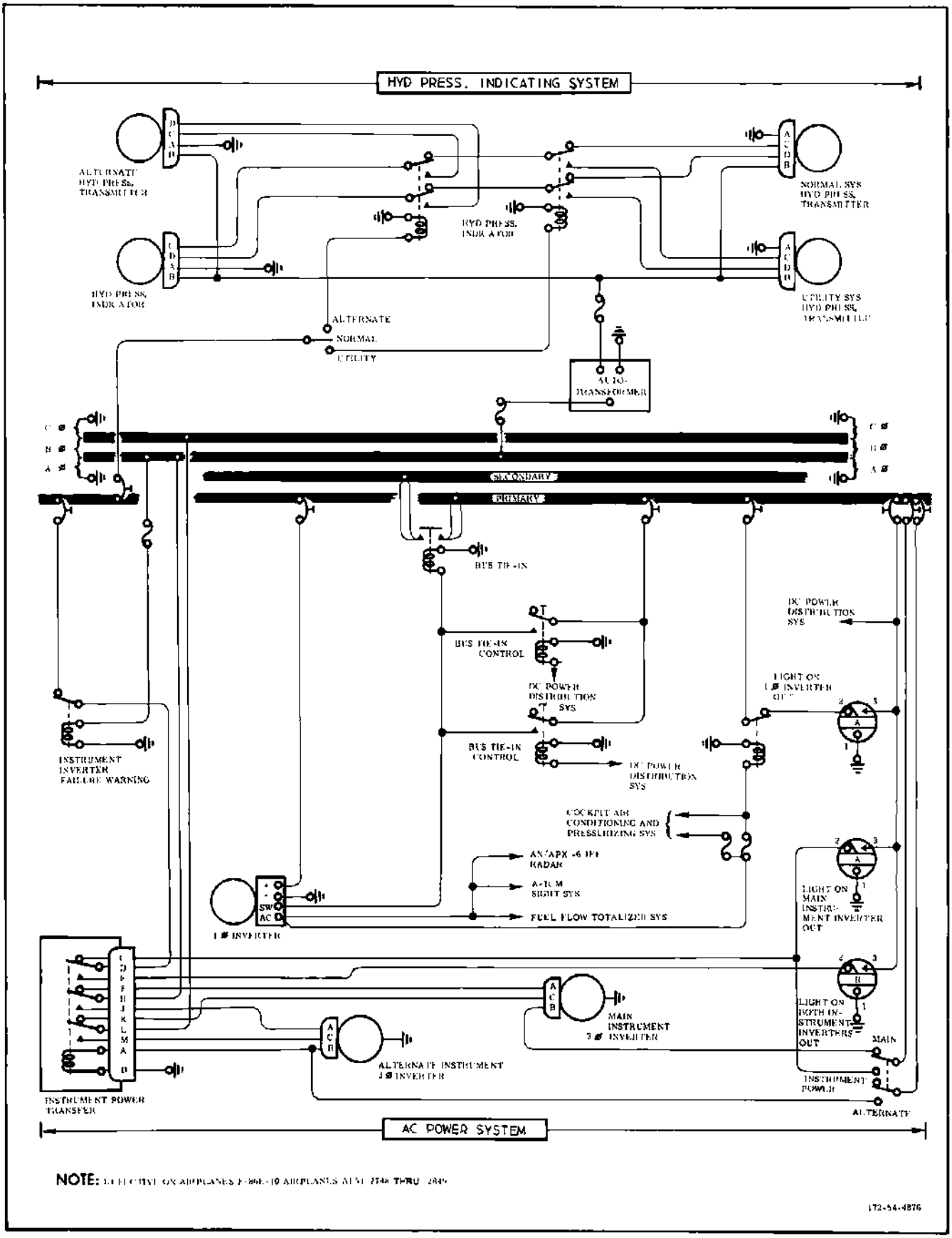


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 12 of 21)



NOTE: EFFECTIVE ON AIRPLANES F-86E-10 AIRPLANES AF 51-2748 THRU 2849

Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 13 of 21)

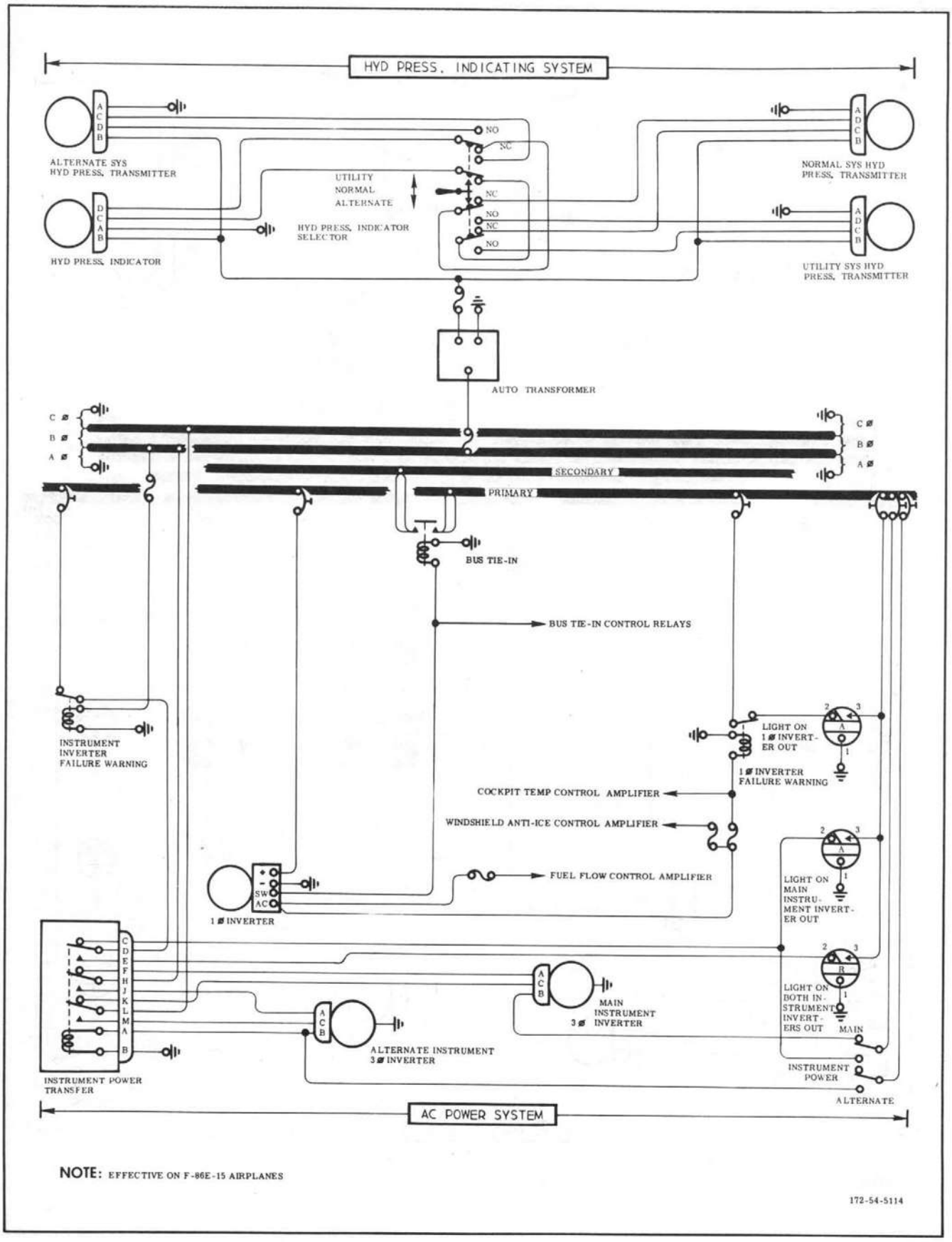


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 14 of 21)

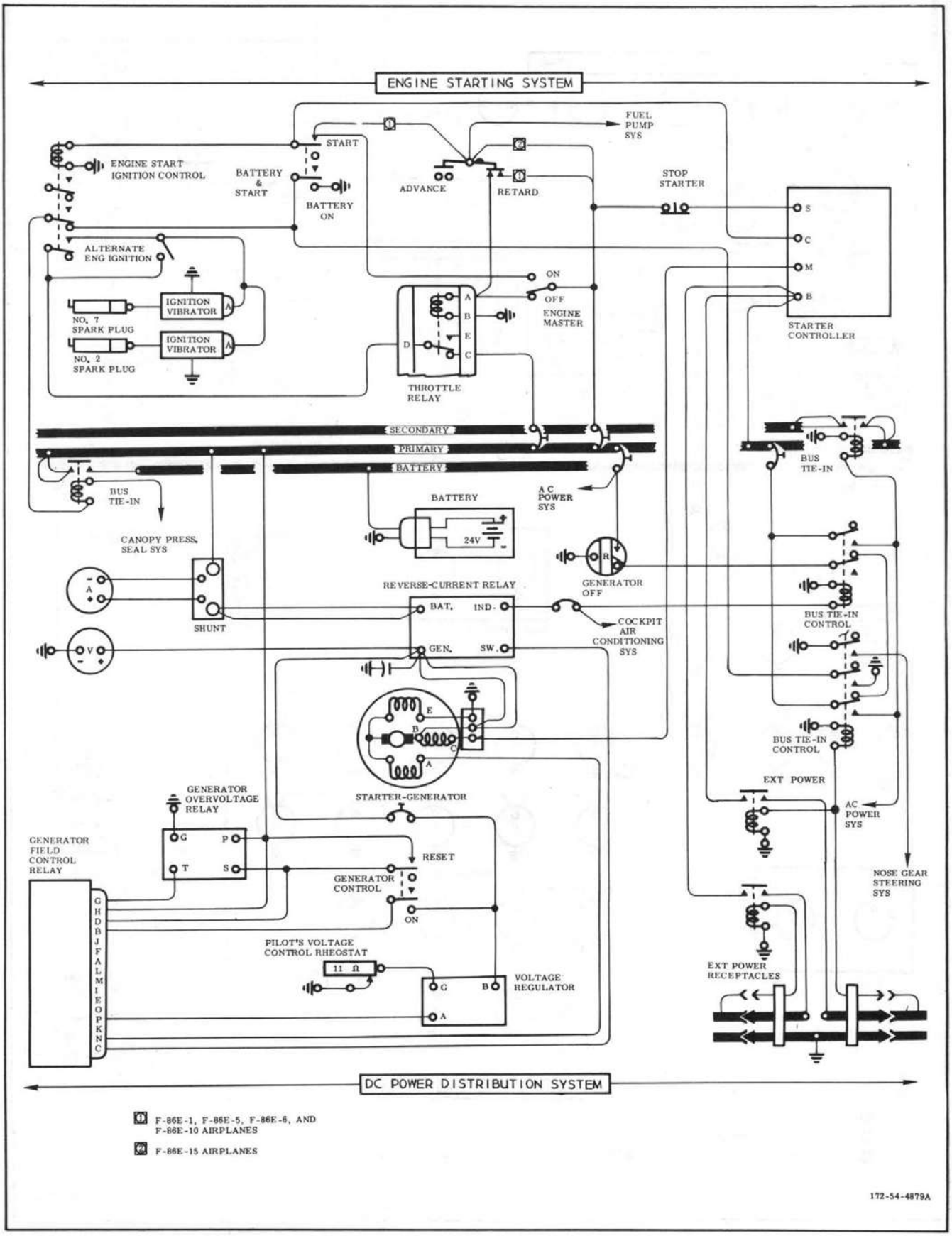


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 15 of 21)

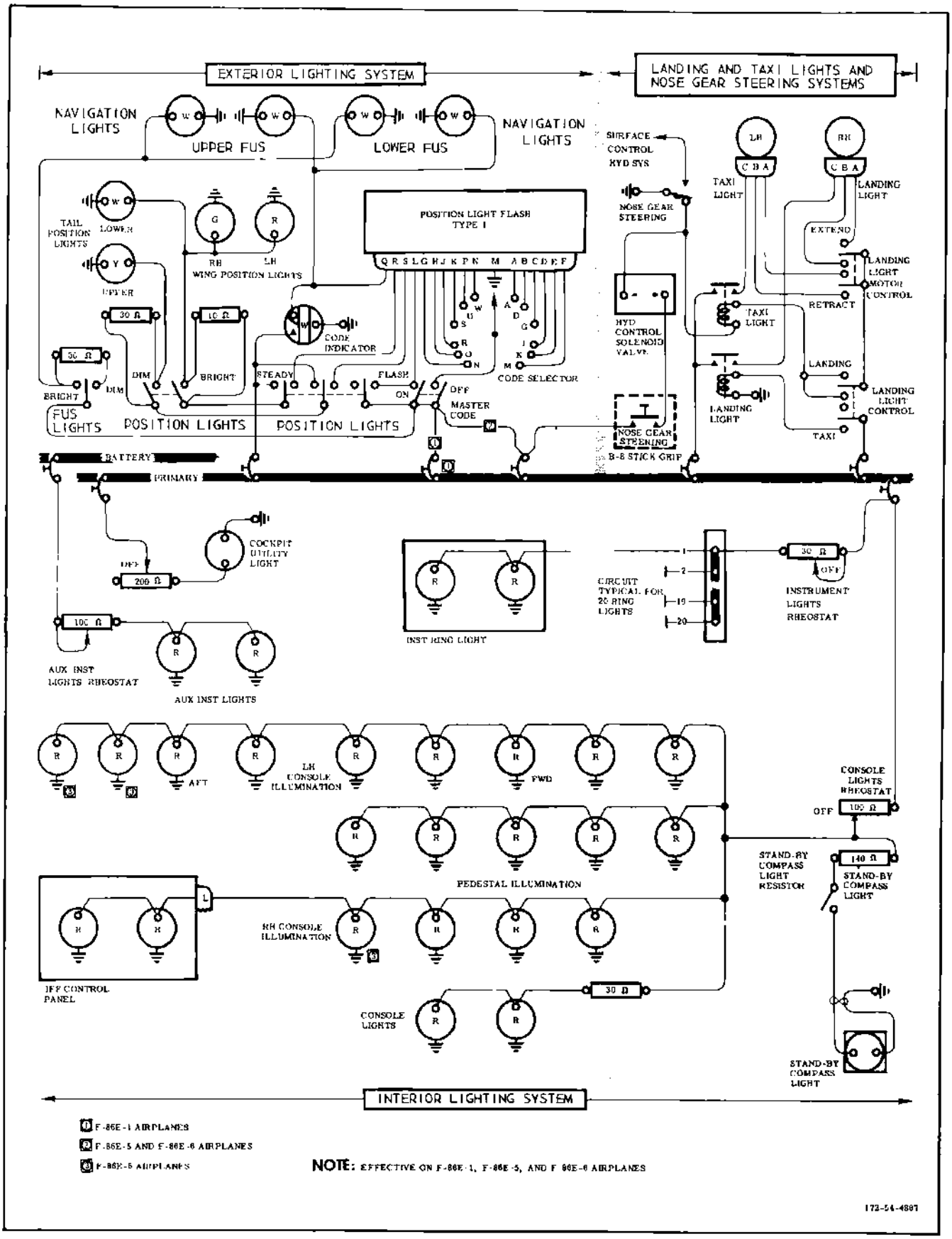


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 16 of 21)

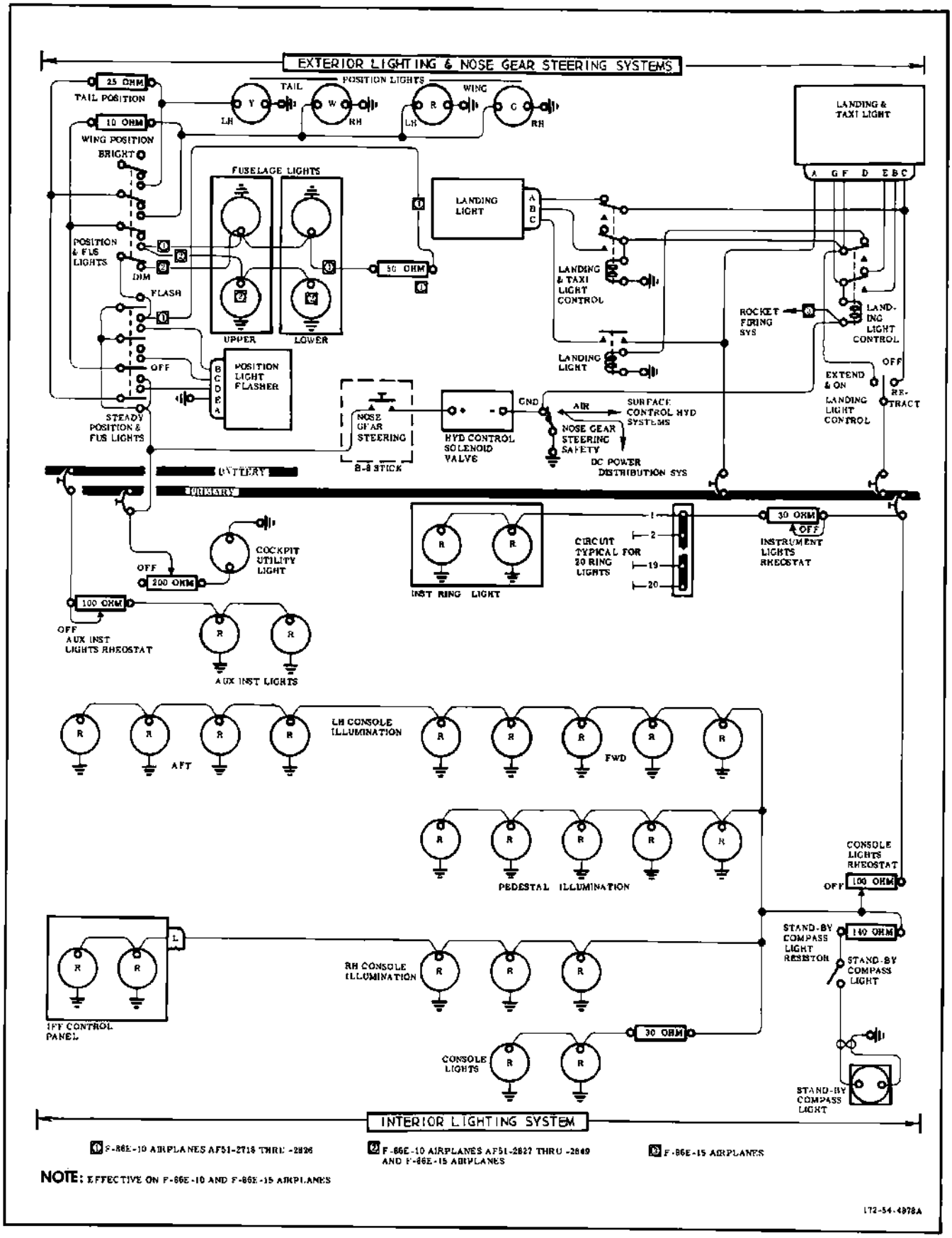


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 17 of 21)

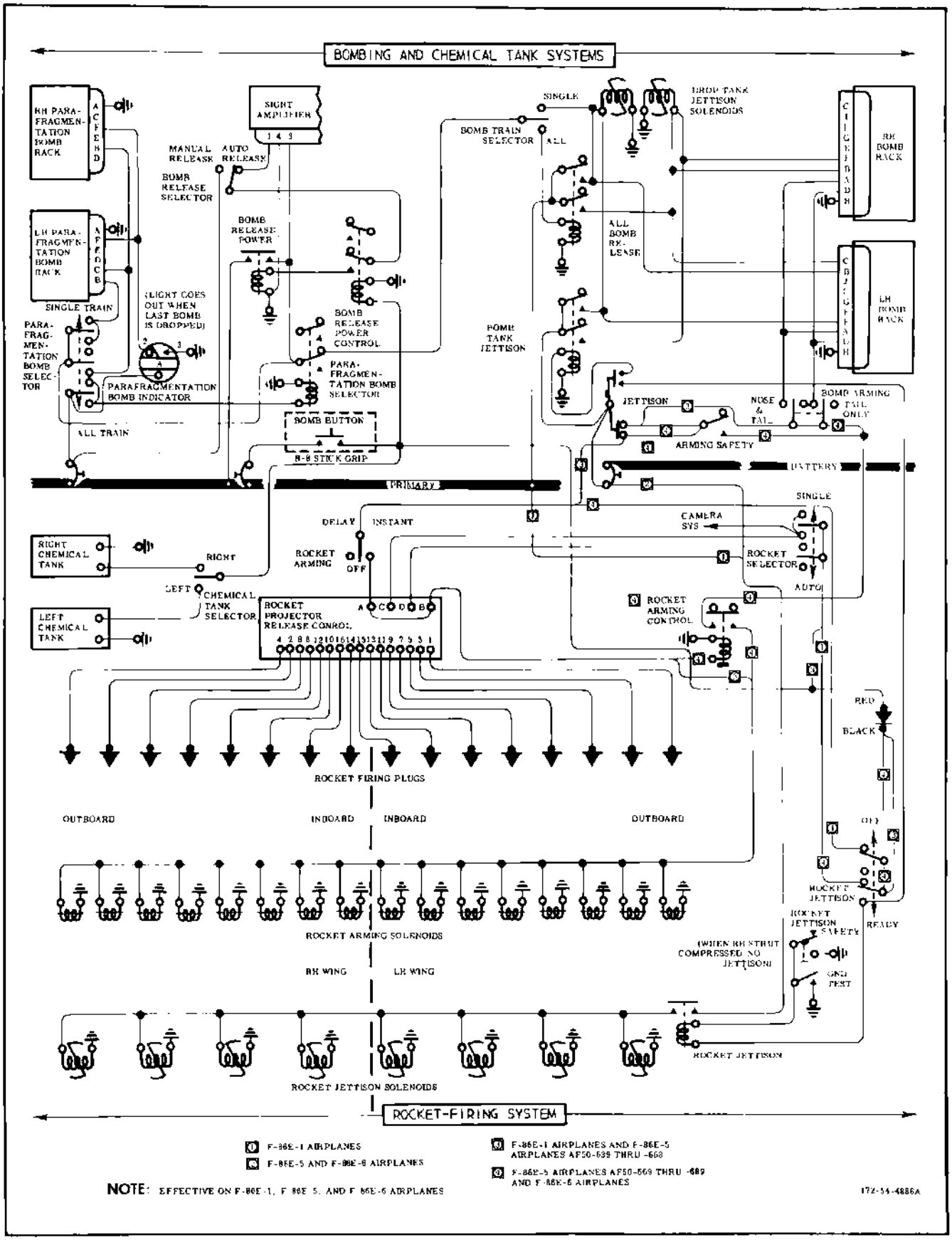


Figure 10-4. Simplified Schematic--Electrical System--F-86E Airplanes (Sheet 18 of 21)

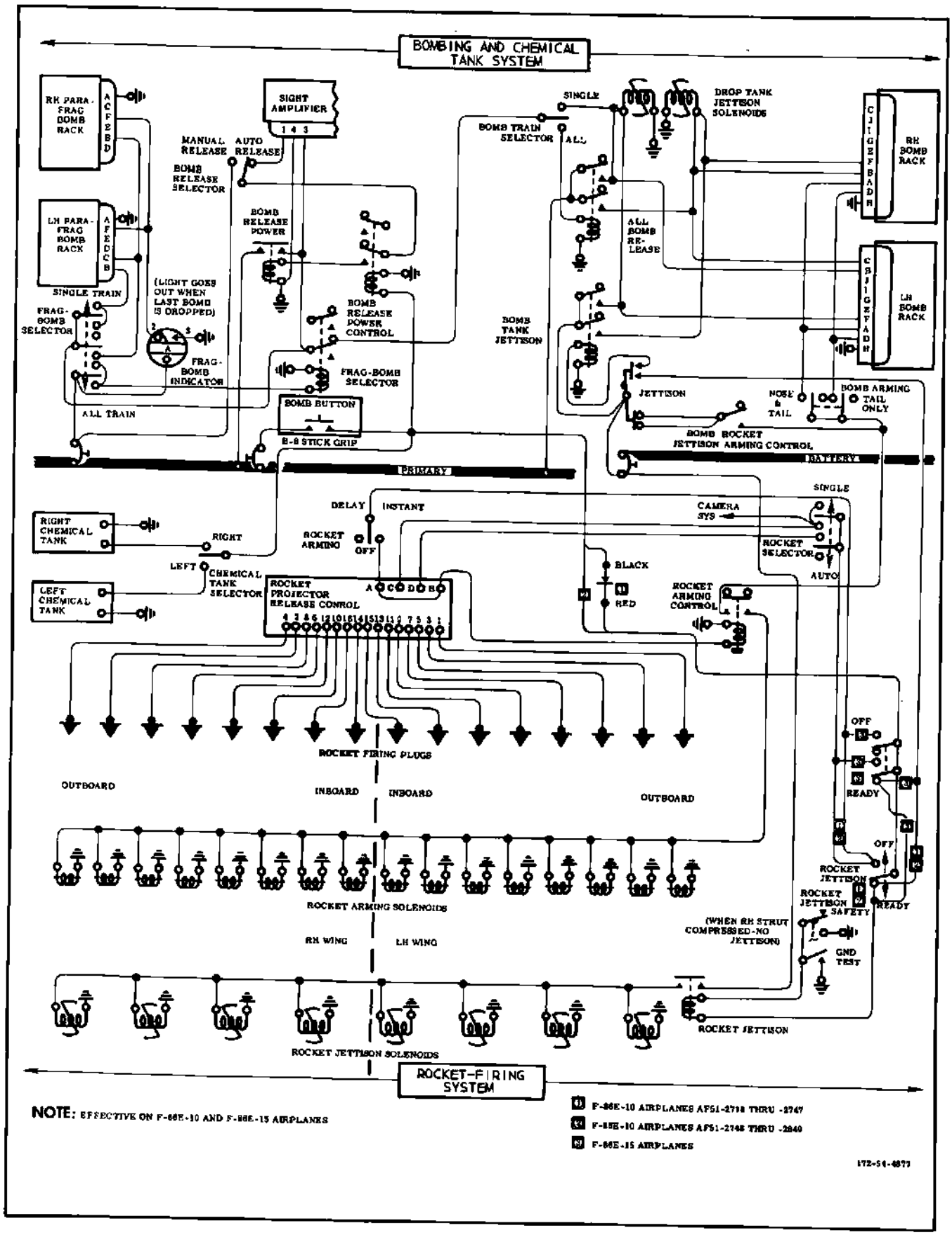


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 19 of 21)

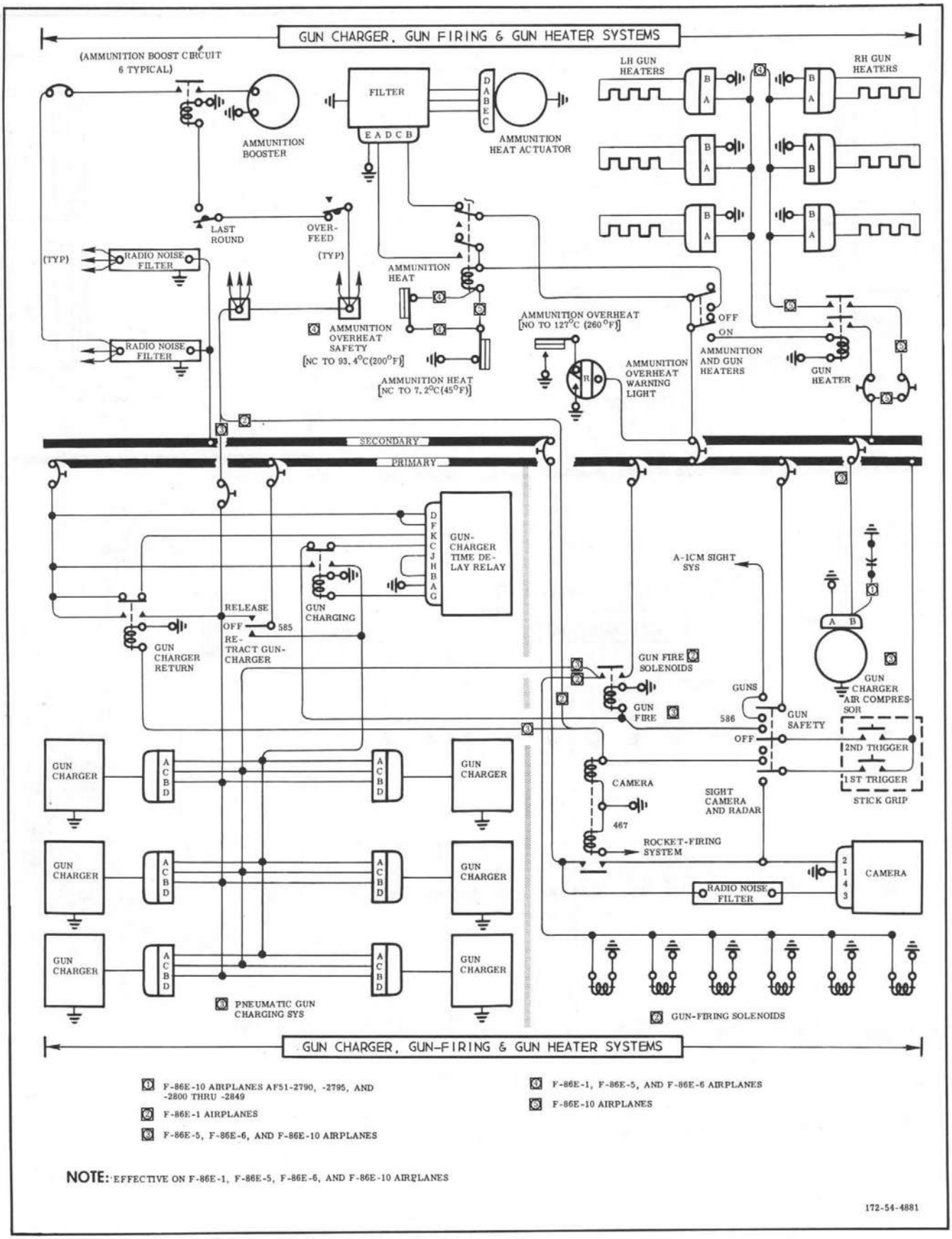


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 20 of 21)

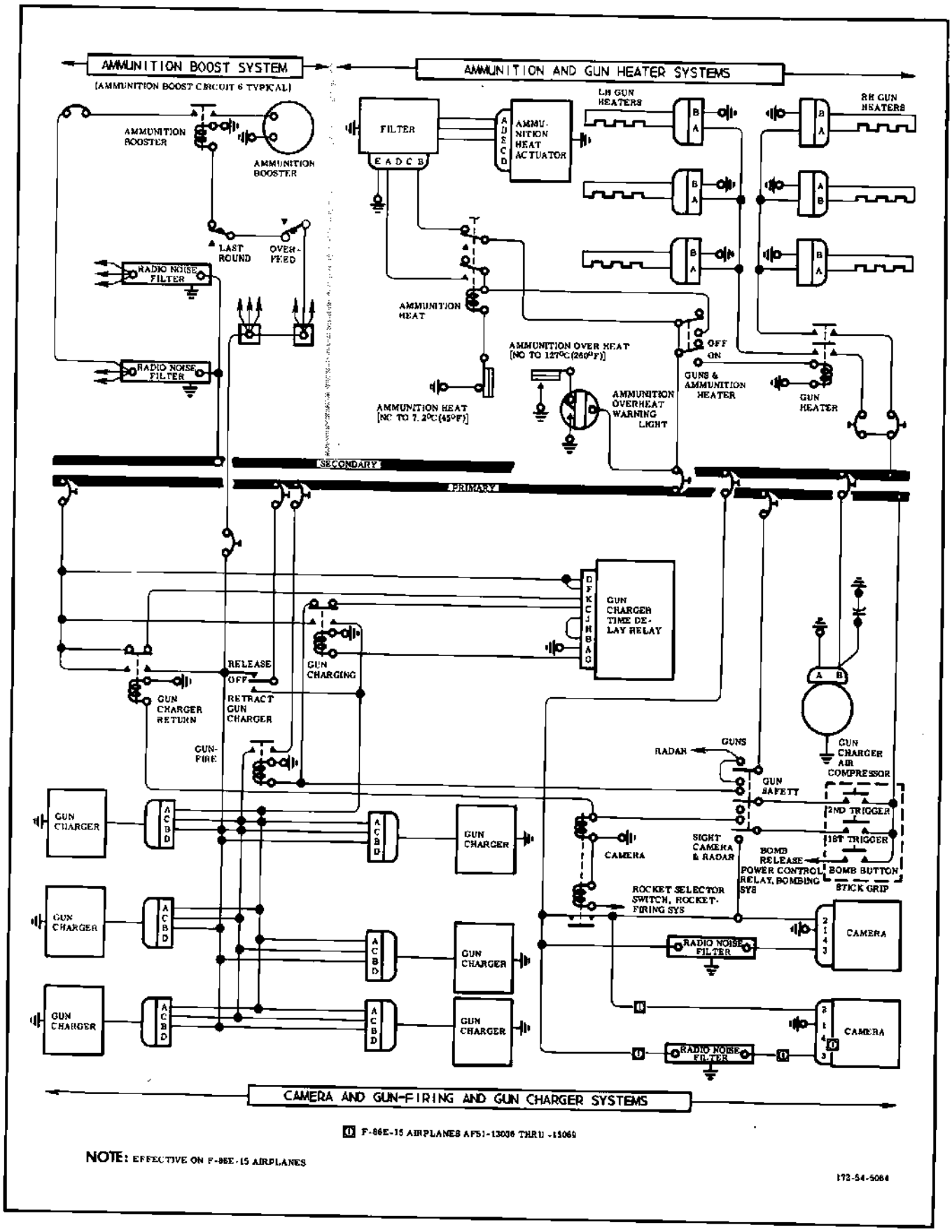
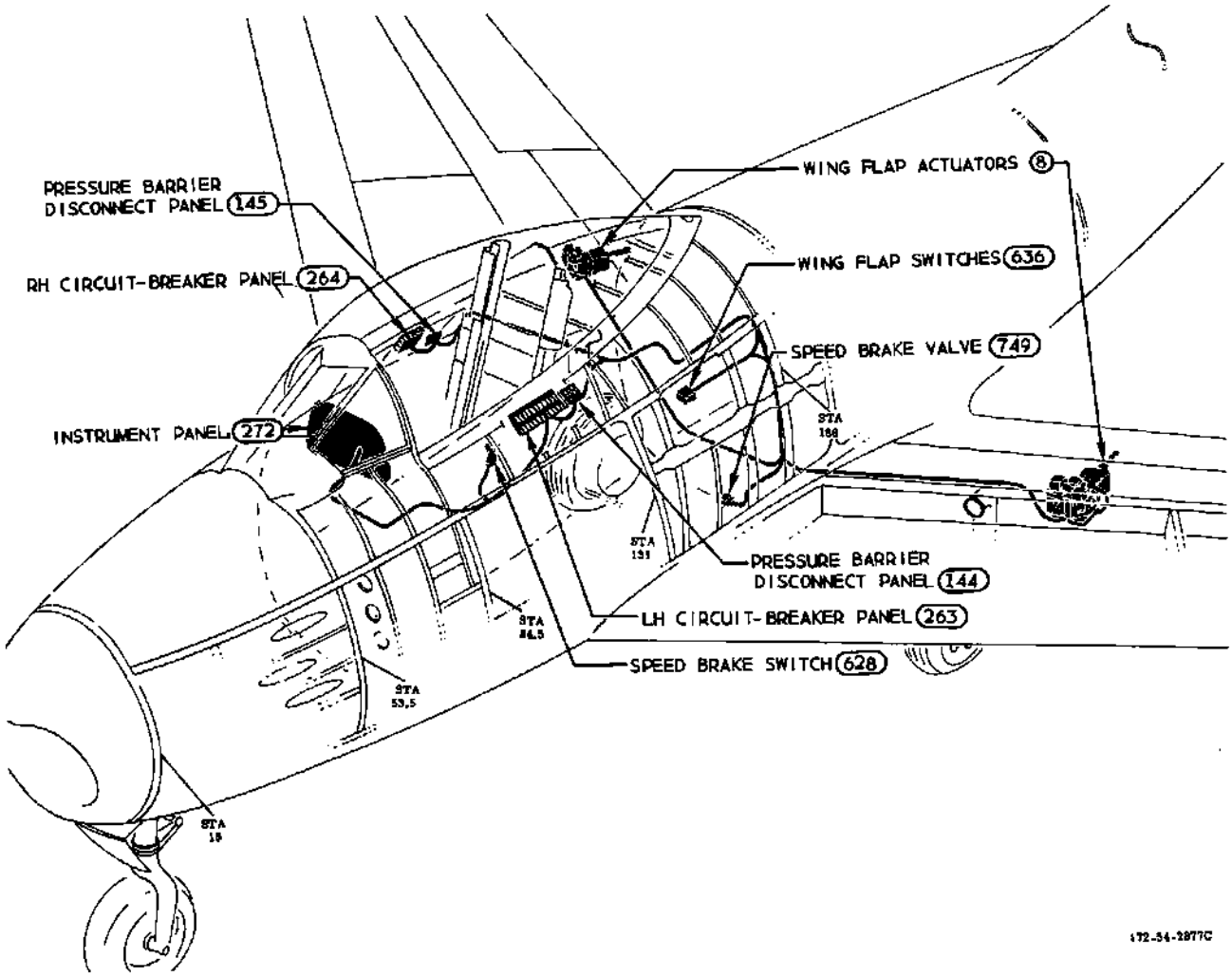


Figure 10-4. Simplified Schematic—Electrical System—F-86E Airplanes (Sheet 21 of 21)

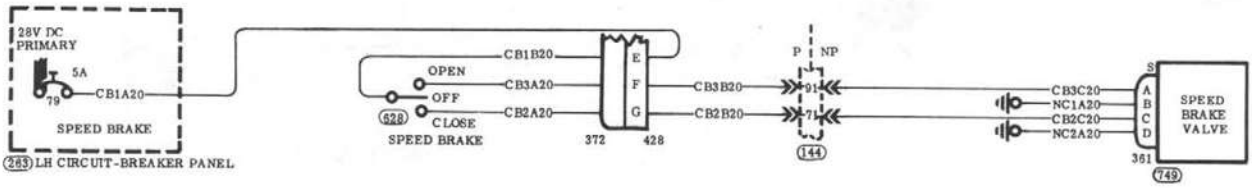


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
8	Actuator—Wing Flap	M3320 (Air Associates)
38	Circuit Breaker—Turn-and-Bank Indicator	AN3161P5
79	Circuit Breaker—Speed Brake	AN3161P5
86	Circuit Breaker—Left Wing Flap	AN3161P35
87	Circuit Breaker—Right Wing Flap	AN3161P35
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
192	Indicator—Turn-and-Bank	21106, Type C-5
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
272	Panel—Instrument	170-51005 (NAA)
361	Plug—Speed Brake	AN3106B14S-2S
368	Plug—Turn-and-Bank Indicator	AN3106A10SL-3S

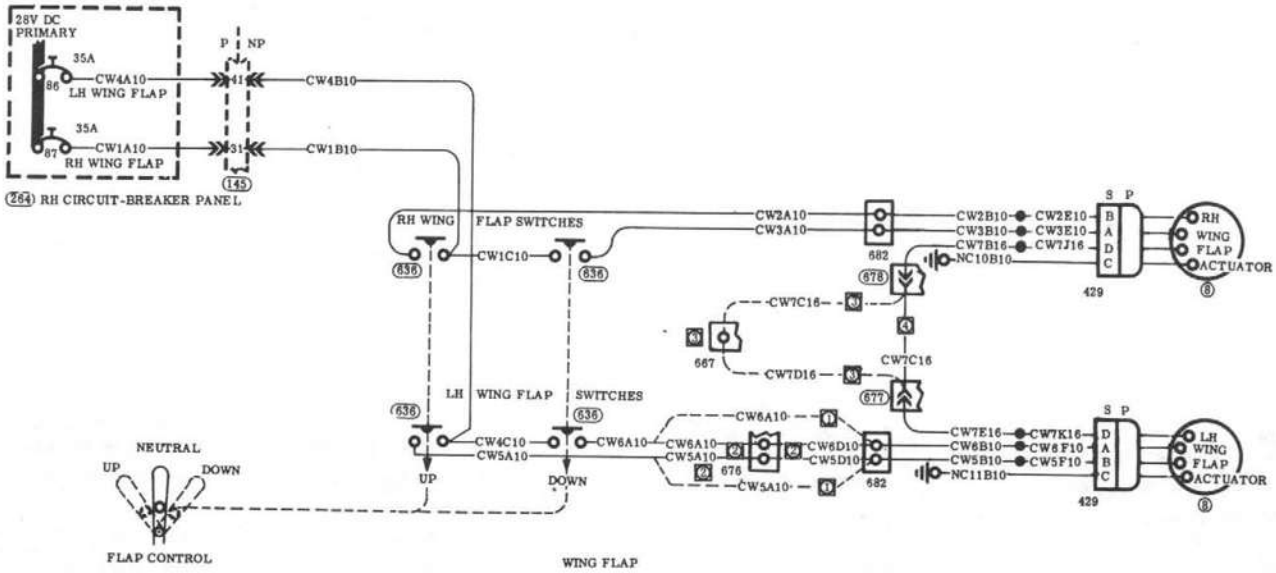
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
372	Plug—Throttle Disconnect	AN3106B16S-1P
428	Receptacle—Throttle Disconnect	AN3101B16S-1S
429	Receptacle—Wing Flap Actuator	AN3100A18-10S
628	Switch—Speed Brake Control	AN3021-1
636	Switch—Wing Flap	WA-3587-1 (Micro Switch)
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
676	Terminal Block—Wing Flap	NAS45-8-2
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
682	Terminal Block—Wing Disconnect	NAS45-8-2
749	Valve—Speed Brake Hydraulic Solenoid	466325 (Bendix)

Figure 10-5. Speed Brake, Turn-and-Bank Indicator, and

TURN-AND-BANK



SPEED BRAKES

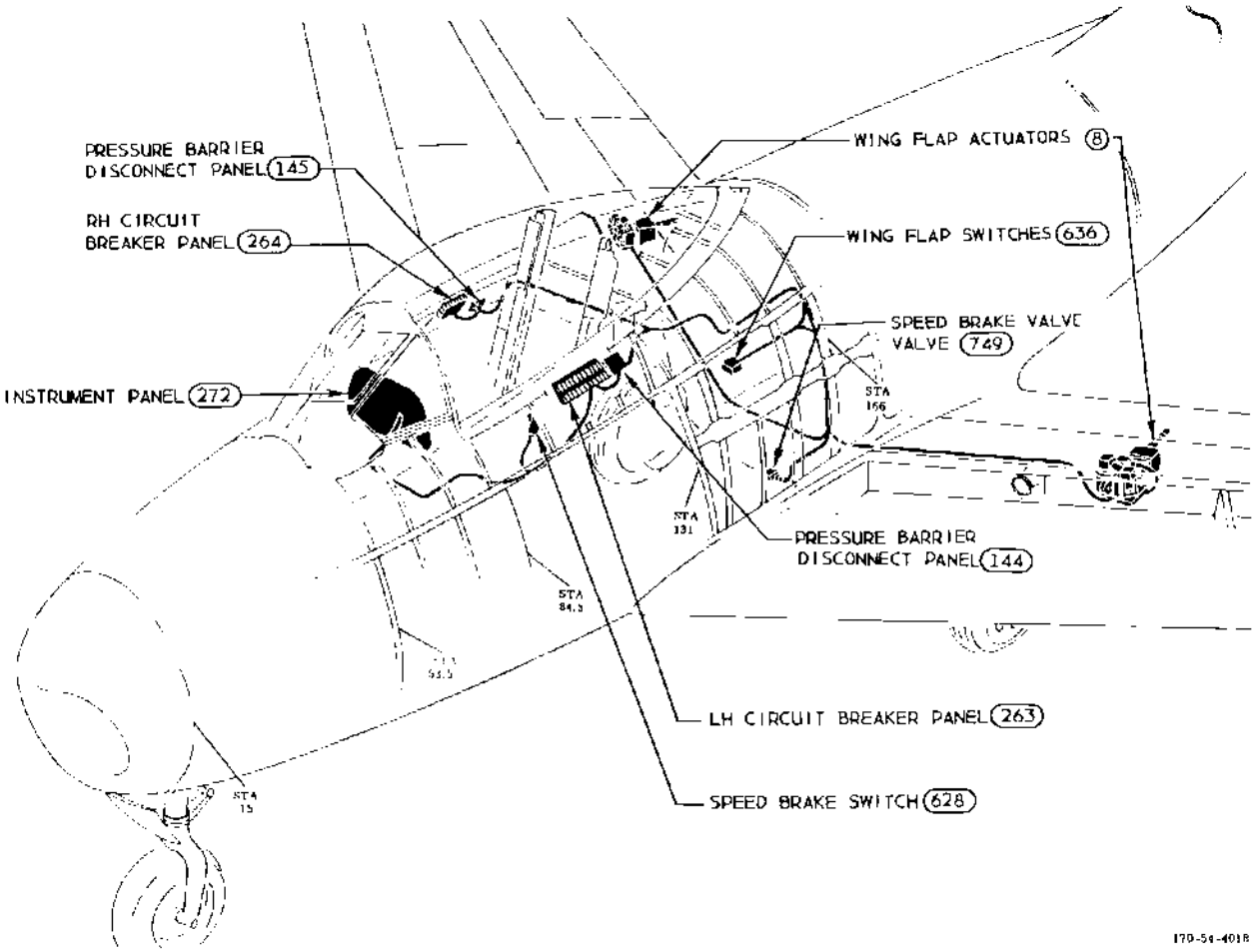


WING FLAP

1 F-86E-1 AIRPLANES AF50-579 AND -580
2 F-86E-1 AIRPLANES AF50-581 THRU -638, F-86E-5 AND F-86E-6 AIRPLANES
3 F-86E-1 AIRPLANES AF50-579 THRU -598
4 F-86E-1 AIRPLANES AF50-599 THRU -638, F-86E-5 AND F-86E-6 AIRPLANES

170-54-2800F

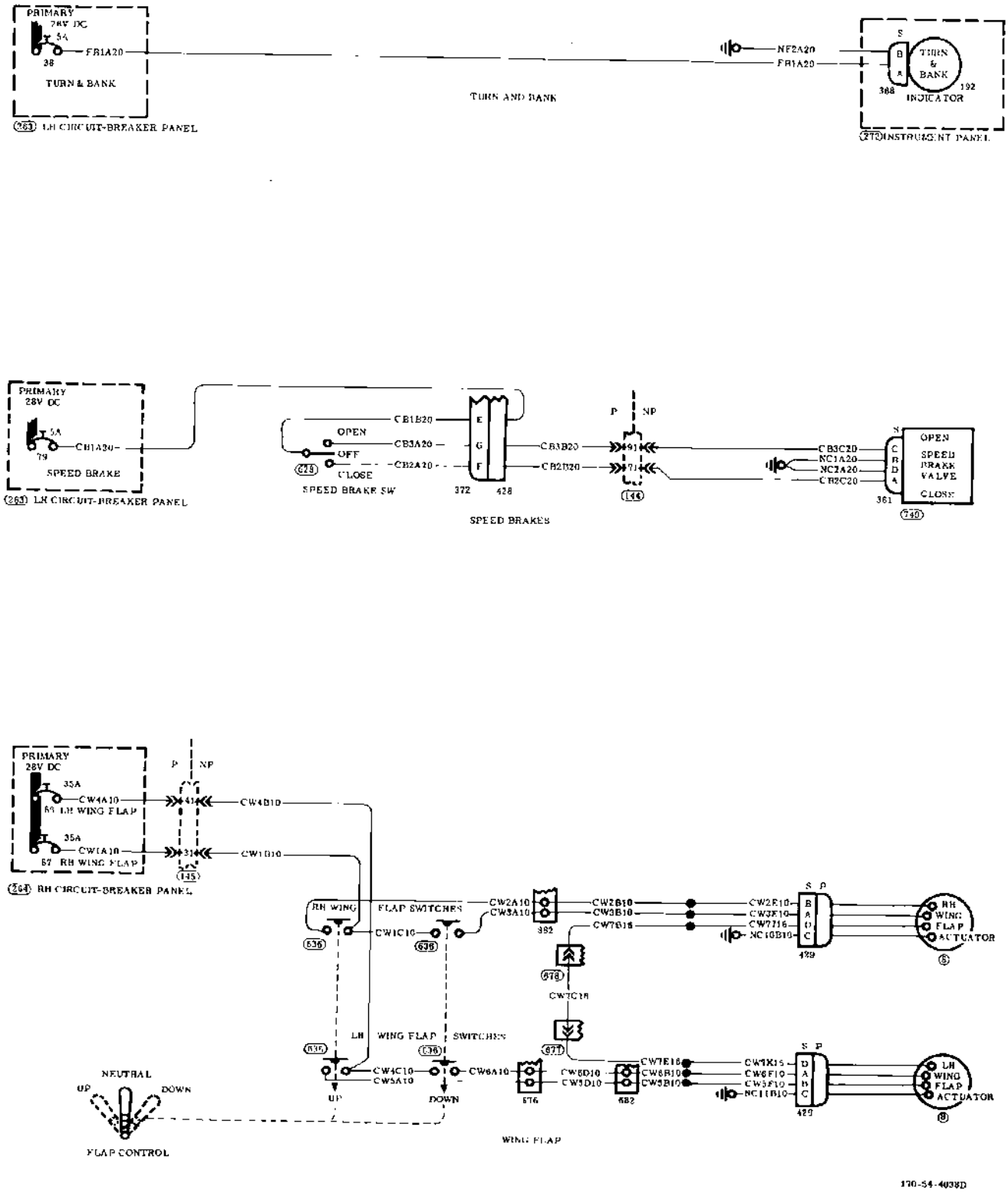
Wing Flap Systems—F-86E-1, F-86E-5, and F-86E-6 Airplanes



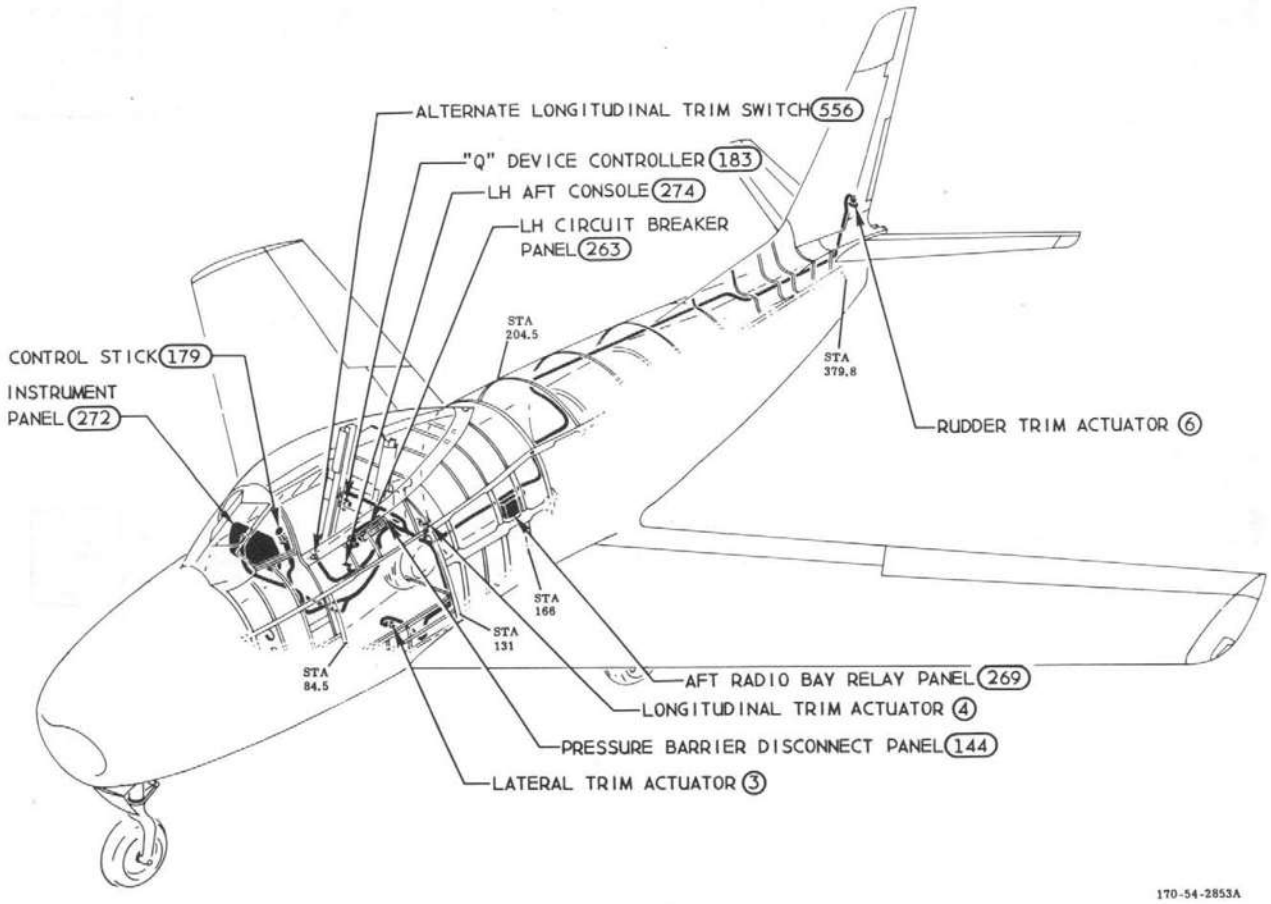
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
8	Actuator—Wing Flap	M3320 (Air Associates)
38	Circuit Breaker—Turn-and-Bank Indicator	AN3161P5
79	Circuit Breaker—Speed Brake	AN3161P5
86	Circuit Breaker—Left Wing Flap	AN3161P35
87	Circuit Breaker—Right Wing Flap	AN3161P35
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
192	Indicator—Turn-and-Bank	21106, Type C-5
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
272	Panel—Instrument	170-51005 (NAA)
361	Plug—Speed Brake	AN3106B14S-2S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
368	Plug—Turn-and-Bank Indicator	AN3106A10SL-3S
372	Plug—Throttle Disconnect	AN3106B16S-1P
428	Receptacle—Throttle Disconnect	AN3101B16S-1S
429	Receptacle—Wing Flap Actuator	AN3100A18-10S
628	Switch—Speed Brake Control	AN3021-1
636	Switch—Wing Flap	WA-3SBT-1 (Micro Switch)
676	Terminal Block—Wing Flap	NAS45-8-2
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
682	Terminal Block—Wing Disconnect	NAS45-8-2
749	Valve—Speed Brake Hydraulic Solenoid	9600 (Weston)

Figure 10-6. Speed Brake, Turn-and-Bank Indicator, and



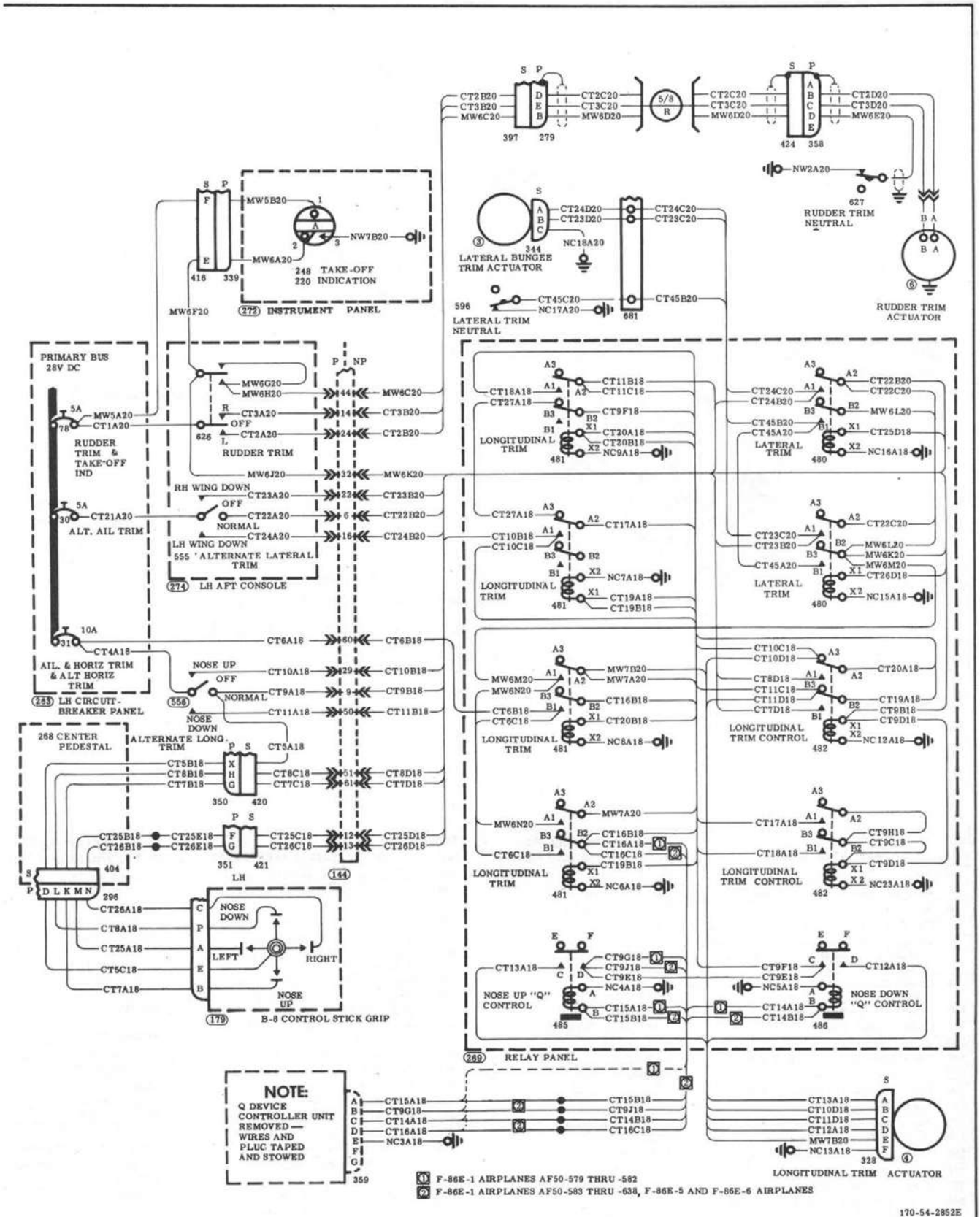
Wing Flap Systems—F-86E-10 and F-86E-15 Airplanes

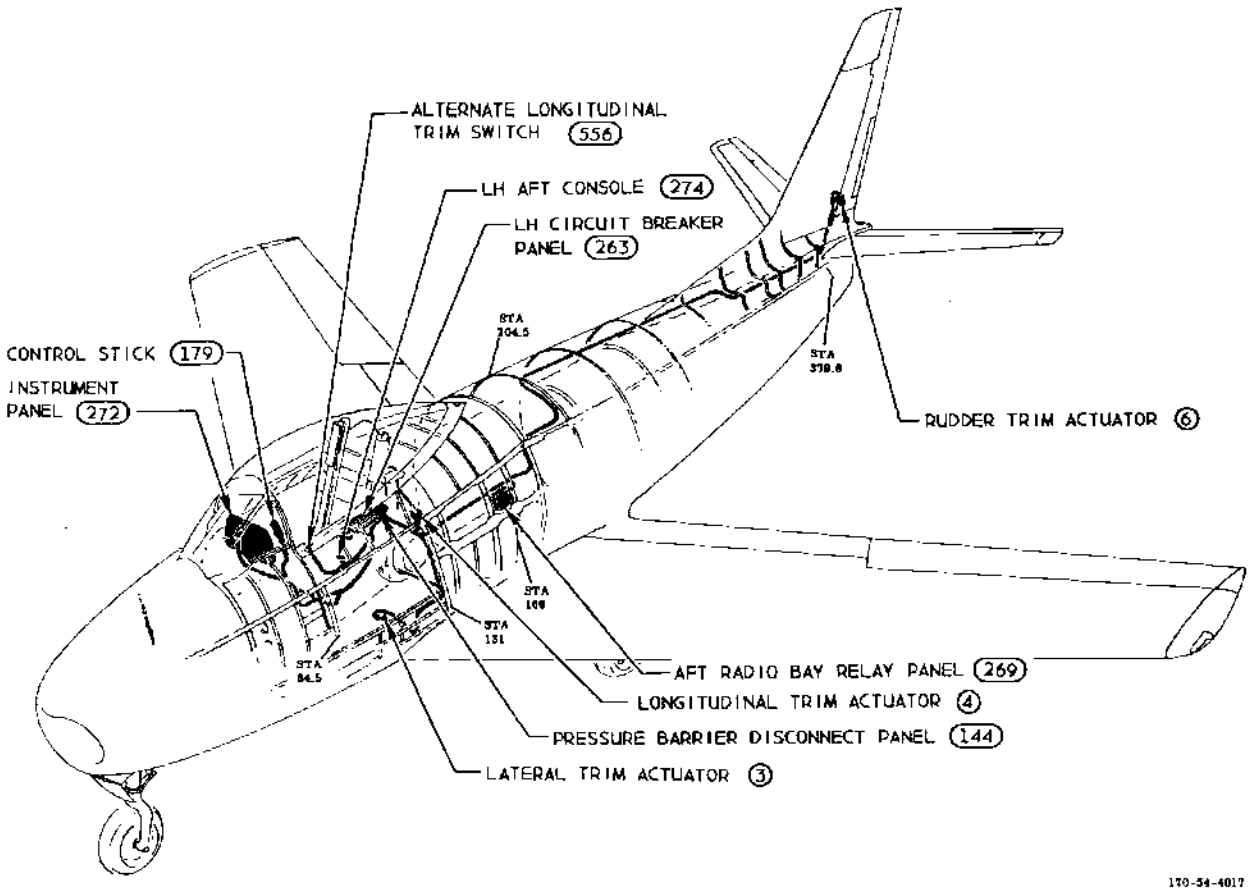


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
3	Actuator—Lateral Bungee	396-H (Lear)
4	Actuator—Longitudinal Bungee Trim	D-1040 (Hoover)
6	Actuator—Rudder Trim Tab	31296 (AiResearch)
30	Circuit Breaker—Alternate Aileron Trim	AN3161P5
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
220	Lamp—Warning	AN3121-313
248	Light Assembly—Take-off Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
269	Panel—Station 155 Left Side Relay	170-54065 (NAA)
272	Panel—Instrument	170-51005 (NAA)
274	Panel—Left Aft Console	151-53050-30 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
296	Plug—Control Stick Grip	AN3108B20-27P
328	Plug—Horizontal Stabilizer Bungee Trim Actuator	AN3108B18-12S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
344	Plug—Lateral Bungee Trim Actuator	AN3106B14S-7S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
358	Plug—Rudder Disconnect	AN3106A14S-5P
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
420	Receptacle—Left-hand Inboard Pedestal Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
424	Receptacle—Rudder Disconnect	AN3101A14S-5S
480	Relay—Lateral Trim	237EAU (Leach)
481	Relay—Longitudinal Trim	237EAU (Leach)
482	Relay—Longitudinal Trim Control	237EAU (Leach)
485	Relay—Nose-up "Q" Control Time Delay	32439, Type B-9-A
486	Relay—Nose-down "Q" Control Time Delay	32439, Type B-9-A
555	Switch—Alternate Lateral Trim	8749K11 (Cutler-Hammer)
556	Switch—Alternate Longitudinal Trim	8749K11 (Cutler-Hammer)
596	Switch—Lateral Trim Neutral	AN3234-1
626	Switch—Rudder Trim Tab Control	AN3021-7
627	Switch—Rudder Trim Neutral	AN3234-1
681	Terminal Block—Left Wing Center	AN3436-2-7

Figure 10-7. Horizontal Stabilizer and Trim Tab Control

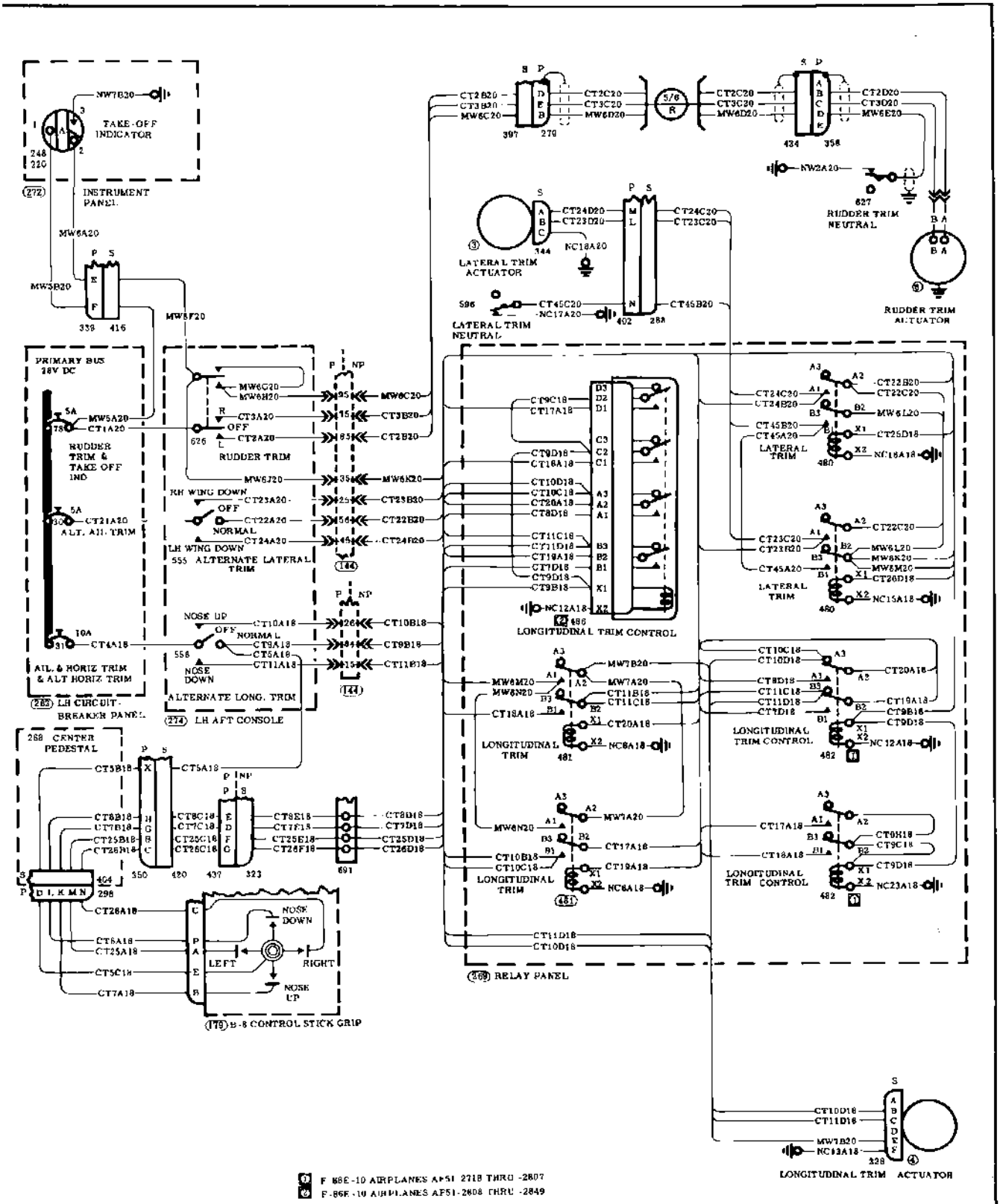

PRIMARY BUS 28V DC
RUDDER TRIM & TAKE-OFF IND
ALT. AIL TRIM
AIL. & HORIZ TRIM & ALT HORIZ TRIM
263 LH CIRCUIT-BREAKER PANEL
RUDDER TRIM
RH WING DOWN
LH WING DOWN
555 ALTERNATE LATERAL TRIM
274 LH AFT CONSOLE
NOSE UP
NOSE DOWN
556
268 CENTER PEDESTAL
ALTERNATE LONG. TRIM
LH
144
NOSE DOWN
LEFT
RIGHT
NOSE UP
179 B-8 CONTROL STICK GRIP
272 INSTRUMENT PANEL
TAKE-OFF INDICATION
LATERAL BUNGEE TRIM ACTUATOR
LATERAL TRIM NEUTRAL
RUDDER TRIM NEUTRAL
RUDDER TRIM ACTUATOR
LONGITUDINAL TRIM
LATERAL TRIM
LONGITUDINAL TRIM CONTROL
NOSE UP "Q" CONTROL
NOSE DOWN "Q" CONTROL
269 RELAY PANEL
LONGITUDINAL TRIM ACTUATOR
NOTE:
Q DEVICE CONTROLLER UNIT REMOVED — WIRES AND PLUG TAPED AND STOWED
359
F-86E-1 AIRPLANES AF50-579 THRU -582
F-86E-1 AIRPLANES AF50-583 THRU -638, F-86E-5 AND F-86E-6 AIRPLANES
170-54-2852E



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
3	Actuator—Lateral Bungee	396-H (Lear)
4	Actuator—Longitudinal Bungee Trim	D-1040 (Hoover)
6	Actuator—Rudder Trim Tab	31296 (AiResearch)
30	Circuit Breaker—Alternate Aileron Trim	AN3161P5
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
144	Disconnect—Left-hand Pressure	YH5100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
220	Lamp—Warning	AN3121-313
248	Light Assembly—Take-off Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
269	Panel—Station 155 Left Side Relay	170-54065 (NAA)
272	Panel—Instrument	170-51005 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
288	Plug—Center Wing Hydraulic Pressure	AN3106B22-14S
296	Plug—Control Stick Grip	AN3108B20-27P
323	Plug—Gun Bay Pressure	AN3106B24-28S
328	Plug—Horizontal Stabilizer Bungee Trim Actuator	AN3108B18-12S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P

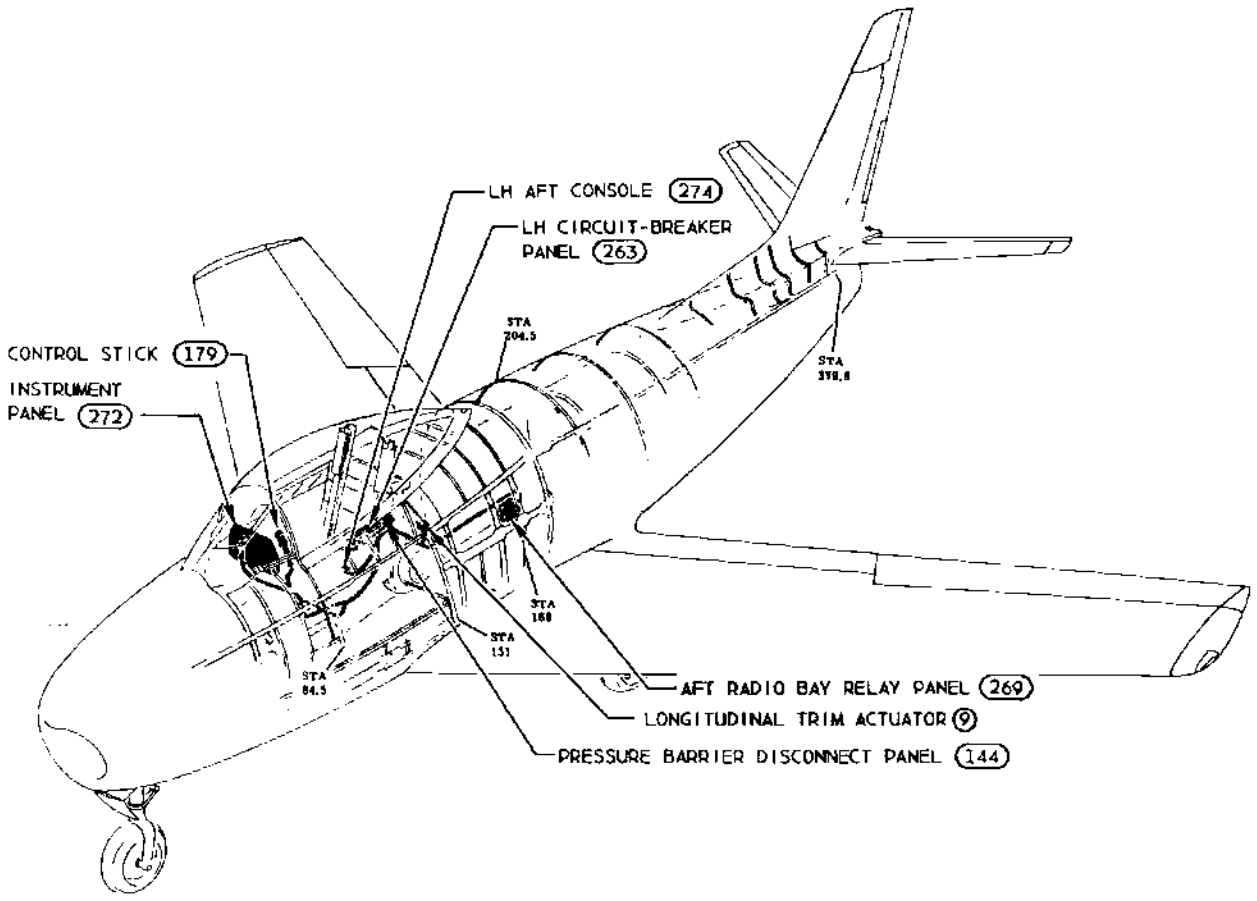
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
344	Plug—Lateral Bungee Trim Actuator	AN3106B14S-7S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
358	Plug—Rudder Disconnect	AN3106A14S-5P
397	Receptacle—Aft Fuselage Disconnect	AN3102A32-6S
402	Receptacle—Center Wing Hydraulic Pressure	AN3101A22-14P
404	Receptacle—8-8 Control Stick Grip	AN3102A20-27S
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
424	Receptacle—Rudder Disconnect	AN3101A14S-5S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
480	Relay—Lateral Trim	237EAU (Leach)
481	Relay—Longitudinal Trim	237EAU (Leach)
482	Relay—Longitudinal Trim Control	237EAU (Leach)
486	Relay—Longitudinal Trim Control	G54329A (Guardian)
555	Switch—Alternate Lateral Trim	8749K11 (Cutler-Hammer)
556	Switch—Alternate Longitudinal Trim	8749K11 (Cutler-Hammer)
596	Switch—Lateral Trim Neutral	AN3234-1
626	Switch—Rudder Trim Tab Control	AN3021-7
627	Switch—Rudder Trim Neutral	AN3234-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-8. Horizontal Stabilizer and Trim



① F-86E-10 AIRPLANES AFSI 2718 THRU -2807
② F-86E-10 AIRPLANES AFSI-2808 THRU -2849

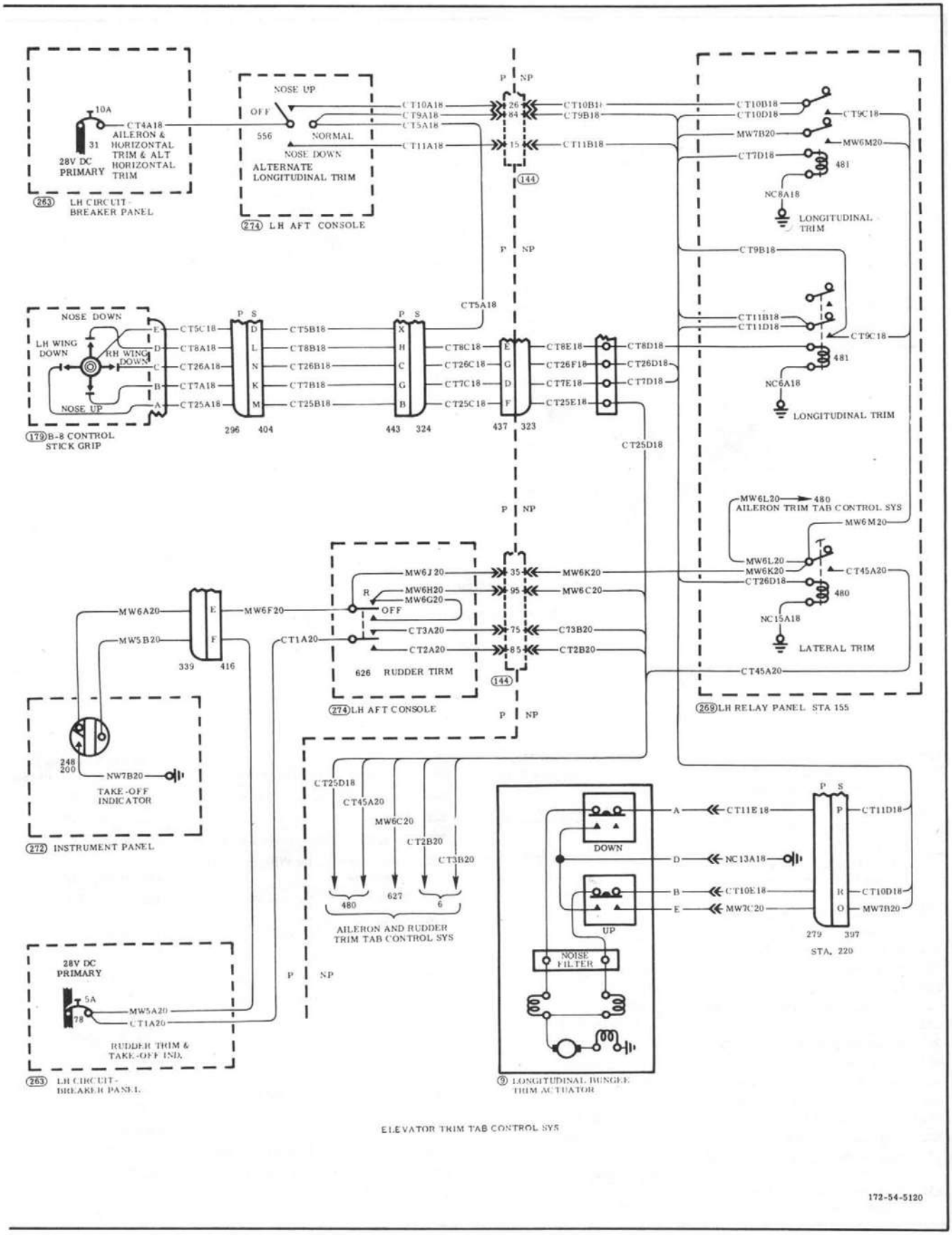
170-54-4041D

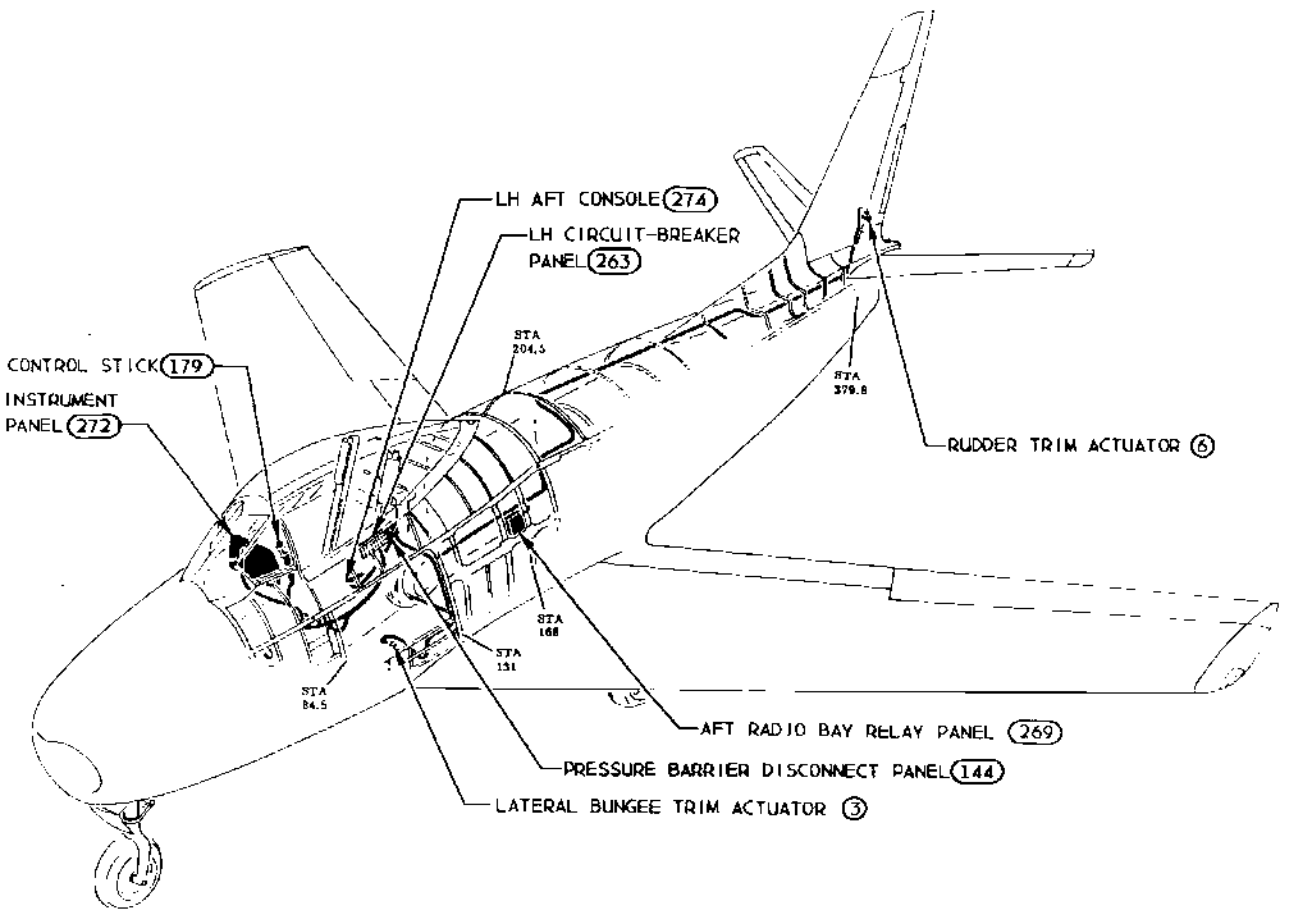


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
9	Actuator—Longitudinal Bungee Trim	29656-6 (AiResearch)
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
144	Disconnect—Left-hand Pressure	YH5100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
220	Lamp—Warning	AN3121-313
248	Light Assembly—Take-off Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
269	Panel—Station 155 Left Side Relay	170-54065 (NAA)
272	Panel—Instrument	170-51005 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
296	Plug—Control Stick Grip	AN3108B20-27P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
323	Plug—Gun Bay Pressure	AN3106B24-28S
324	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
443	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3102A28-11P
480	Relay—Lateral Trim	237EAU (Leach)
481	Relay—Longitudinal Trim	237EAU (Leach)
556	Switch—Alternate Longitudinal Trim	B749K11 (Cutler-Hammer)
626	Switch—Rudder Trim Tab Control	AN3021-7

Figure 10-9. Elevator Trim Tab Control

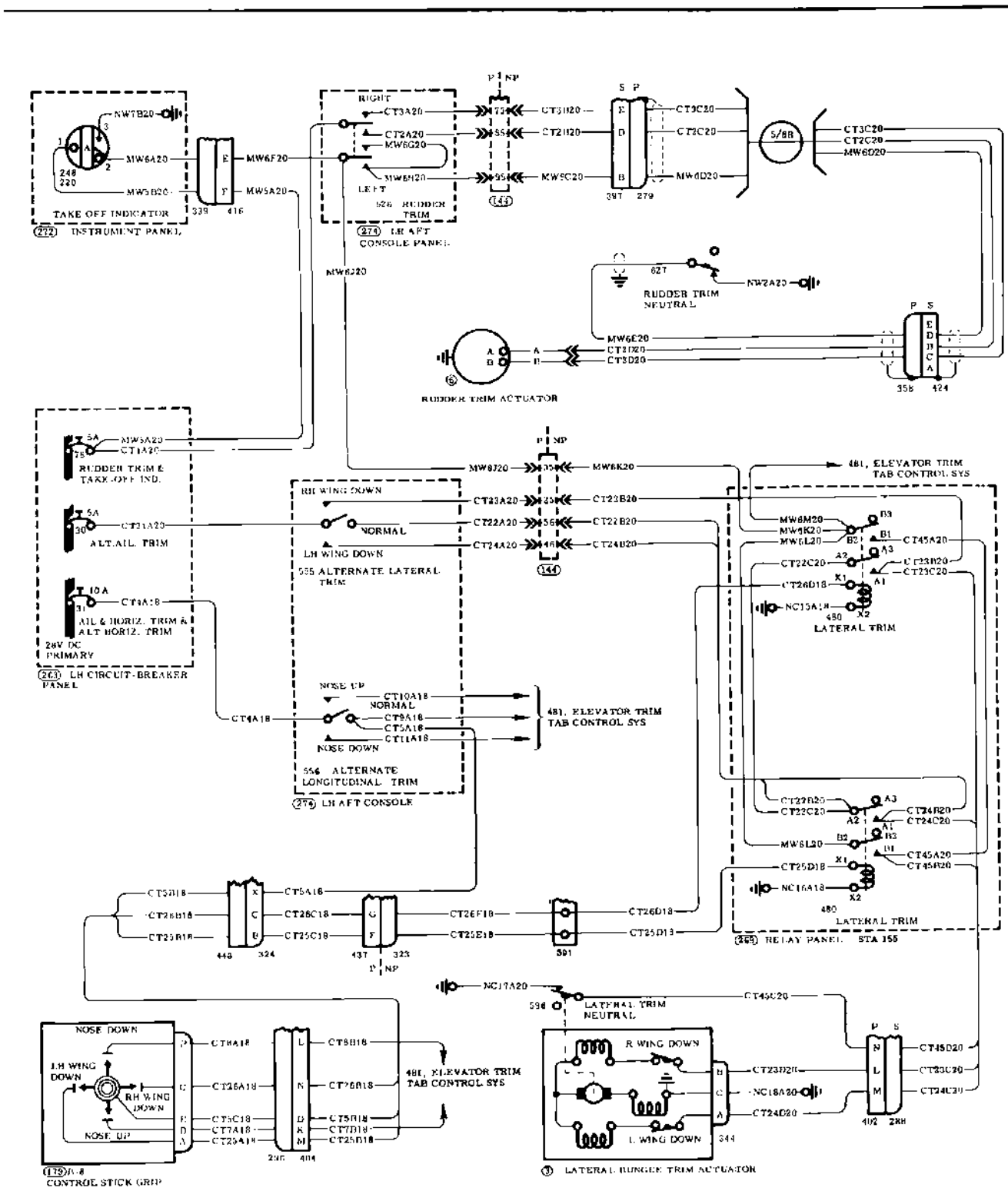

10A
31
28V DC PRIMARY
CT4A18
AILERON & HORIZONTAL TRIM & ALT HORIZONTAL TRIM
263 LH CIRCUIT-BREAKER PANEL
NOSE UP
OFF
556
NORMAL
NOSE DOWN
ALTERNATE LONGITUDINAL TRIM
274 LH AFT CONSOLE
CT10A18
CT9A18
CT5A18
CT11A18
P NP
26
84
15
144
CT10B18
CT9B18
CT11B18
CT10D18
CT9C18
MW7B20
MW6M20
CT7D18
481
NC8A18
LONGITUDINAL TRIM
CT9B18
CT11B18
CT11D18
CT9C18
481
NC6A18
LONGITUDINAL TRIM
NOSE DOWN
LH WING DOWN
RH WING DOWN
NOSE UP
E
D
C
B
A
CT5C18
CT8A18
CT26A18
CT7A18
CT25A18
P S
D
L
N
K
M
CT5B18
CT8B18
CT26B18
CT7B18
CT25B18
296
404
X
H
C
G
B
CT8C18
CT26C18
CT7C18
CT25C18
443
324
CT5A18
E
G
D
F
CT8E18
CT26F18
CT7E18
CT25E18
437
323
CT8D18
CT26D18
CT7D18
CT25D18
179 B-8 CONTROL STICK GRIP
MW6L20 → 480
AILERON TRIM TAB CONTROL SYS
MW6M20
MW6L20
MW6K20
CT26D18
CT45A20
480
NC15A18
LATERAL TRIM
269 LH RELAY PANEL STA 155
MW6J20
MW6H20
MW6G20
OFF
R
35
95
75
85
MW6K20
MW6C20
CT3B20
CT2B20
CT3A20
CT2A20
626 RUDDER TIRM
274 LH AFT CONSOLE
MW6A20
MW5B20
E
F
MW6F20
339
416
CT1A20
248
200
NW7B20
TAKE-OFF INDICATOR
272 INSTRUMENT PANEL
CT25D18
CT45A20
MW6C20
CT2B20
CT3B20
480
627
6
AILERON AND RUDDER TRIM TAB CONTROL SYS
28V DC PRIMARY
5A
78
MW5A20
CT1A20
RUDDER TRIM & TAKE-OFF IND.
263 LH CIRCUIT-BREAKER PANEL
DOWN
UP
NOISE FILTER
A
D
B
E
CT11E18
NC13A18
CT10E18
MW7C20
P S
P
R
O
CT11D18
CT10D18
MW7B20
279
397
STA. 220
9 LONGITUDINAL BUNGEE TRIM ACTUATOR
ELEVATOR TRIM TAB CONTROL SYS
172-54-5120



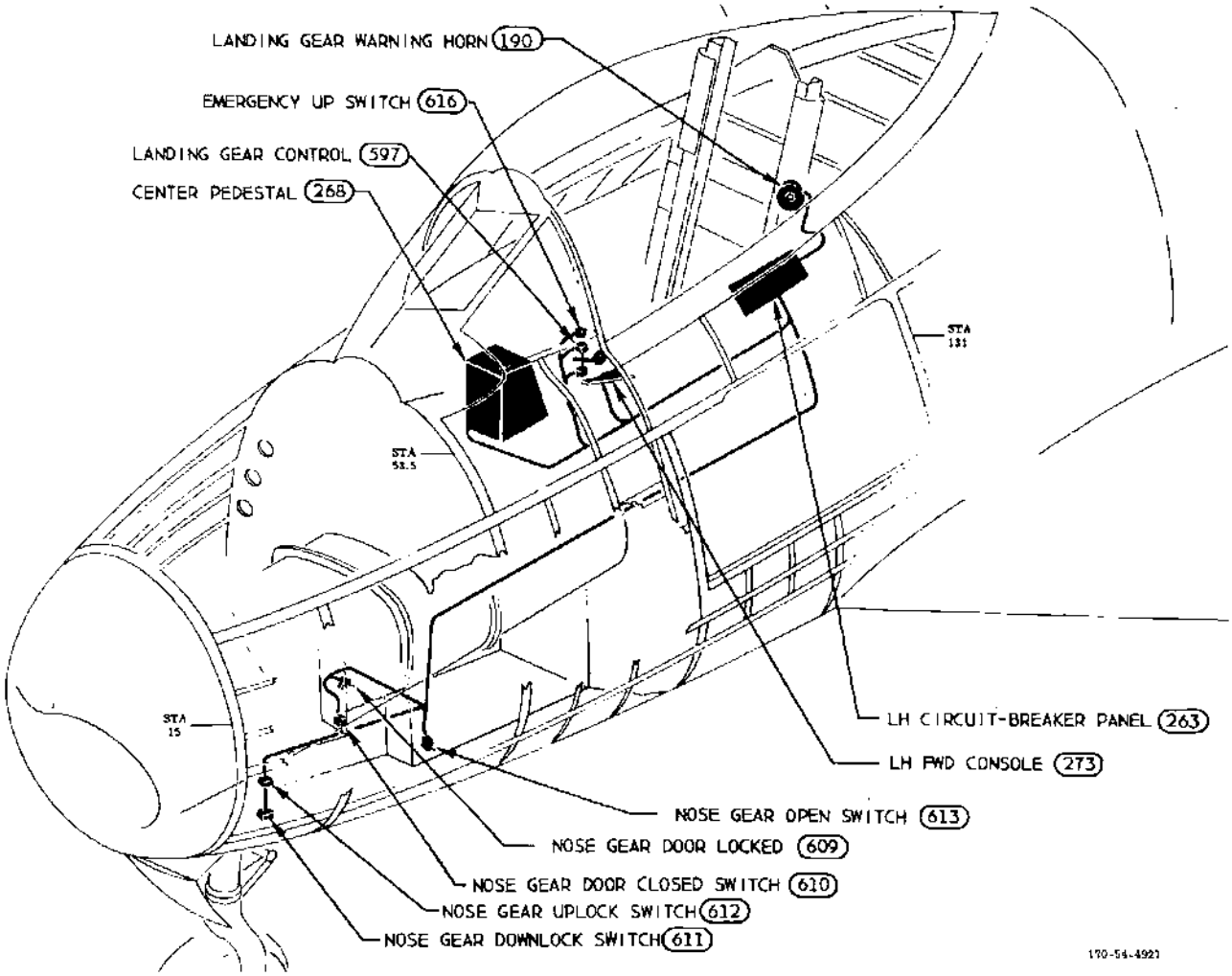
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
3	Actuator—Lateral Bungee	396-H (Lear)
6	Actuator—Rudder Trim Tab	31296 (AiResearch)
30	Circuit Breaker—Alternate Aileron Trim	AN3161P5
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
220	Lamp—Warning	AN3121-313
248	Light Assembly—Take-off Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
269	Panel—Station 155 Left Side Relay	170-54065 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
288	Plug—Center Wing Hydraulic Pressure	AN3106B22-14S
296	Plug—Control Stick Grip	AN3108B20-27P
323	Plug—Gun Bay Pressure	AN3106B24-28S
324	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
344	Plug—Lateral Bungee Trim Actuator	AN3106B14S-7S
358	Plug—Rudder Disconnect	AN3106A14S-5P
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
402	Receptacle—Center Wing Hydraulic Pressure	AN3101A22-14P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
424	Receptacle—Rudder Disconnect	AN3101A14S-5S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
443	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3102A28-11P
480	Relay—Lateral Trim	237EAU (Leach)
555	Switch—Alternate Lateral Trim	8749K11 (Cutler-Hammer)
556	Switch—Alternate Longitudinal Trim	8749K11 (Cutler-Hammer)
596	Switch—Lateral Trim Neutral	AN3234-1
626	Switch—Rudder Trim Tab Control	AN3021-7
627	Switch—Rudder Trim Neutral	AN3234-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-10. Aileron and Rudder Trim Tab


TAKE OFF INDICATOR
(272) INSTRUMENT PANEL
RIGHT
LEFT
526 RUDDER TRIM
(274) LH AFT CONSOLE PANEL
RUDDER TRIM NEUTRAL
RUDDER TRIM ACTUATOR
RUDDER TRIM & TAKE-OFF IND.
ALT. AIL. TRIM
AIL & HORIZ. TRIM & ALT HORIZ. TRIM
28V DC PRIMARY
(263) LH CIRCUIT-BREAKER PANEL
RH WING DOWN
NORMAL
LH WING DOWN
535 ALTERNATE LATERAL TRIM
NOSE UP
NOSE DOWN
556 ALTERNATE LONGITUDINAL TRIM
(276) LH AFT CONSOLE
481, ELEVATOR TRIM TAB CONTROL SYS
LATERAL TRIM
(265) RELAY PANEL STA 355
LATERAL TRIM NEUTRAL
L WING DOWN
(3) LATERAL BUNGEE TRIM ACTUATOR
CONTROL STICK GRIP

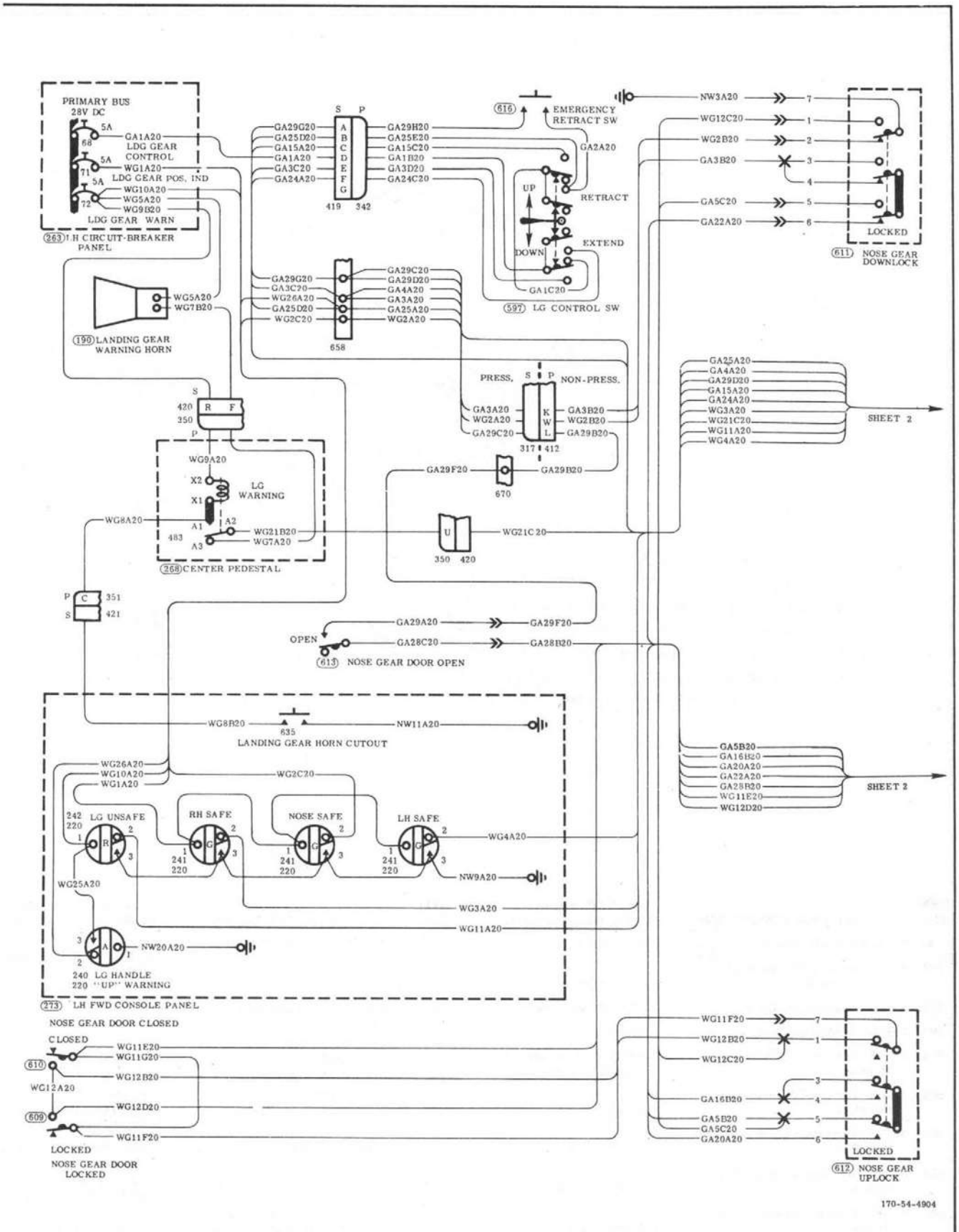
172-54-5119



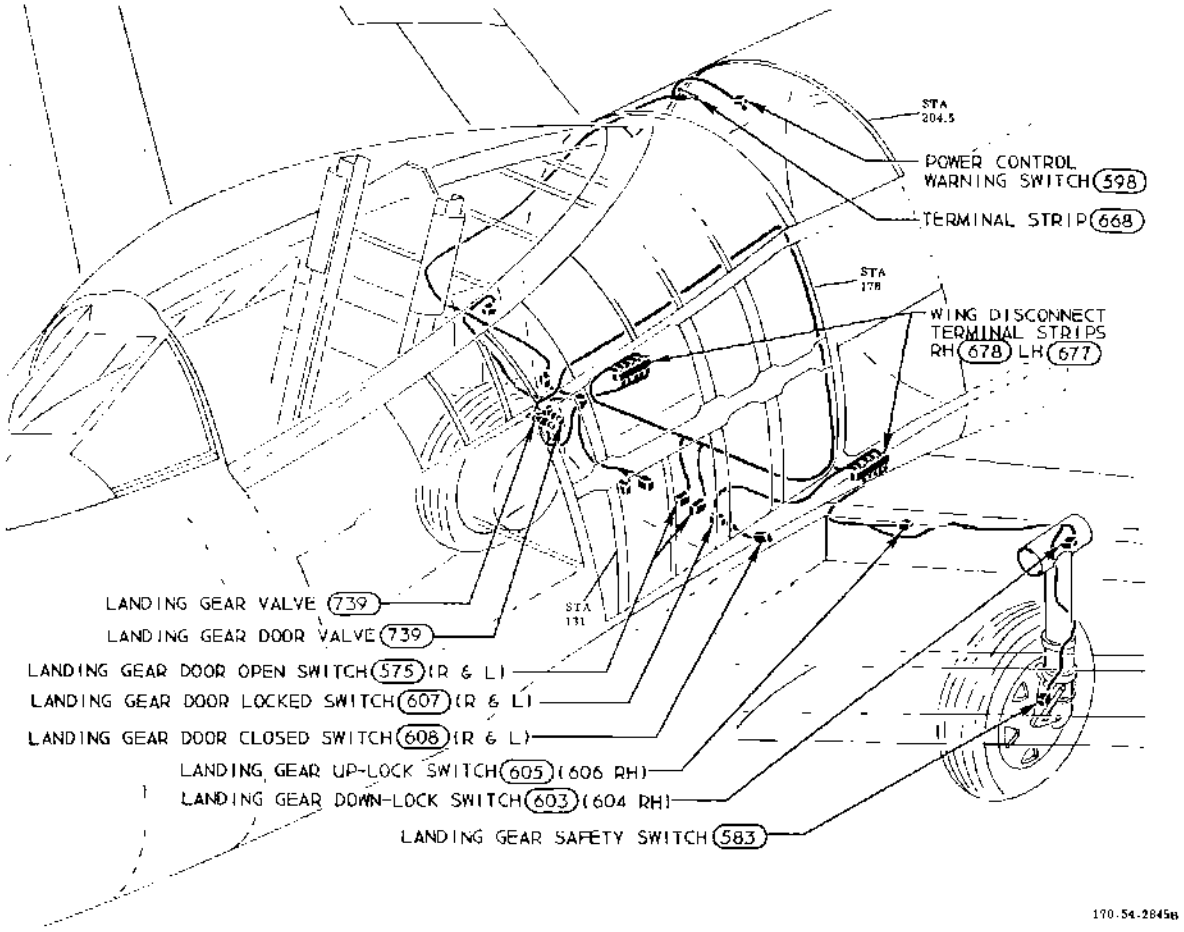
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
297	Plug—Door and Strut Hydraulic Solenoid Valve	AN3106B14S-2S
575	Switch—Fairing Door Open	BZ-7RQ1T (Micro Switch)
583	Switch—Ground Sequence Safety	AN3234-1
598	Switch—Landing Gear Warning Throttle	AN3216-1 (Micro Switch), MD8721 Actuator
603	Switch—Left Main Landing Gear Downlock	152-54201 (NAA)
604	Switch—Right Main Landing Gear Downlock	152-54201 (NAA)
605	Switch—Left Main Landing Gear Uplock	152-54201 (NAA)
606	Switch—Right Main Landing Gear Uplock	152-54201 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
607	Switch—Main Landing Gear Door Lock	BZ-7RQ1T (Micro Switch)
608	Switch—Main Landing Gear Fairing Door	BZ-7RQ1T (Micro Switch)
666	Terminal Block—Landing Gear Lower Connector	AN3436-2-12
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
739	Valve—Landing Gear Strut and Fairing Door Hydraulic Solenoid	466335 (Bendix)

Figure 10-11. Landing Gear System—F-86E-1



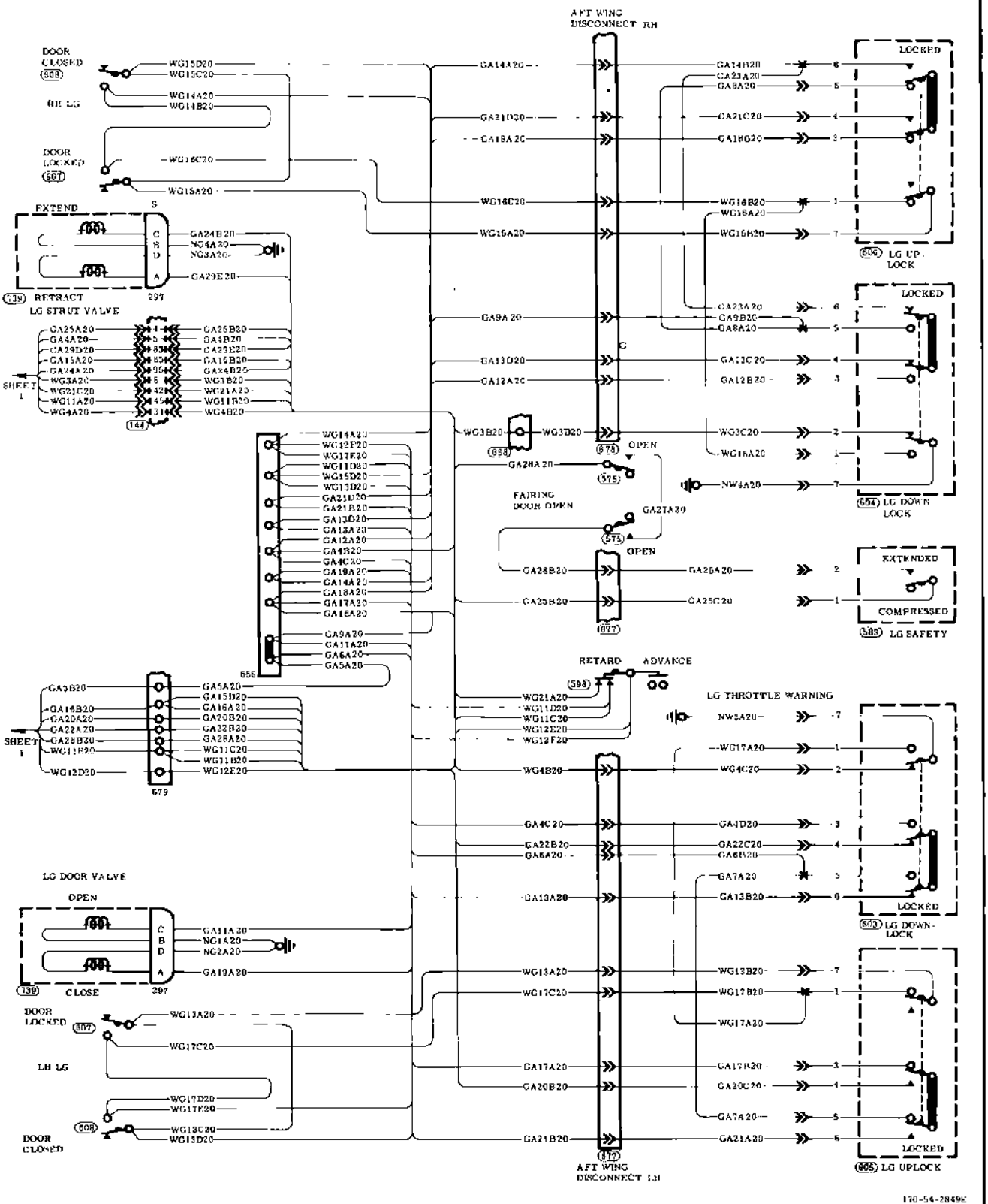
Airplanes AF50-579 Through -598 (Sheet 1 of 2)



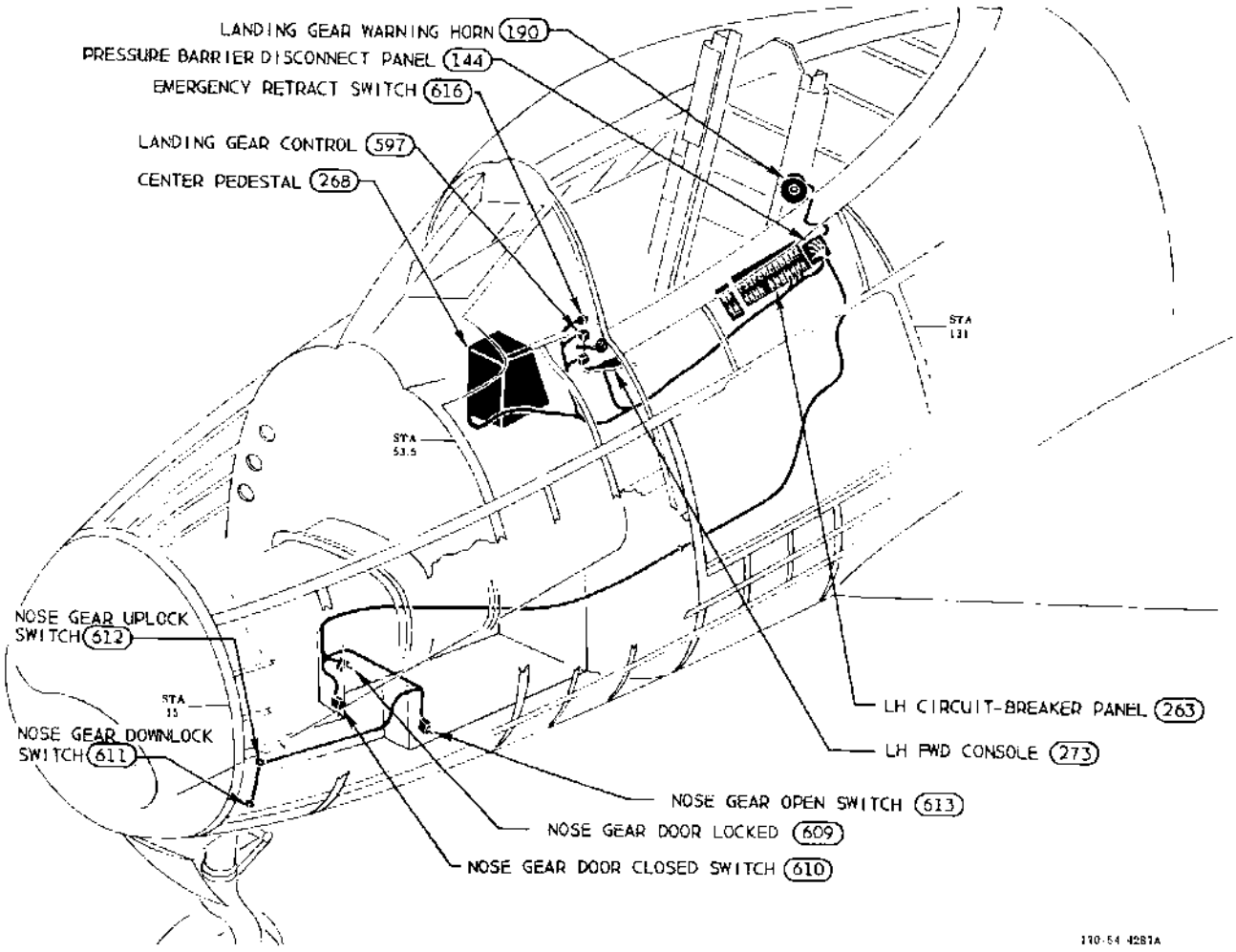
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
297	Plug—Door and Strut Hydraulic Solenoid Valve	AN3106B14S-2S
575	Switch—Fairing Door Open	BZ-7RQ1T (Micro Switch)
583	Switch—Ground Sequence Safety	AN3234-1
598	Switch—Landing Gear Warning Throttle	AN3216-1 (Micro Switch), MD8721 Actuator
603	Switch—Left Main Landing Gear Downlock	152-54201 (NAA)
604	Switch—Right Main Landing Gear Downlock	152-54201 (NAA)
605	Switch—Left Main Landing Gear Uplock	152-54201 (NAA)
606	Switch—Right Main Landing Gear Uplock	152-54201 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
607	Switch—Main Landing Gear Door Lock	BZ-7RQ1T (Micro Switch)
608	Switch—Main Landing Gear Fairing Door	BZ-7RQ1T (Micro Switch)
666	Terminal Block—Landing Gear Lower Connector	AN3436-2-12
667	Terminal Block—Landing Gear Connector Lower	AN3436-2-8
668	Terminal Block—Landing Gear Connector Upper	AN3436-2-12
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
739	Valve—Landing Gear Strut and Fairing Door Hydraulic Solenoid	466335 (Bendix)

Figure 10-11. Landing Gear System—F-86E-1



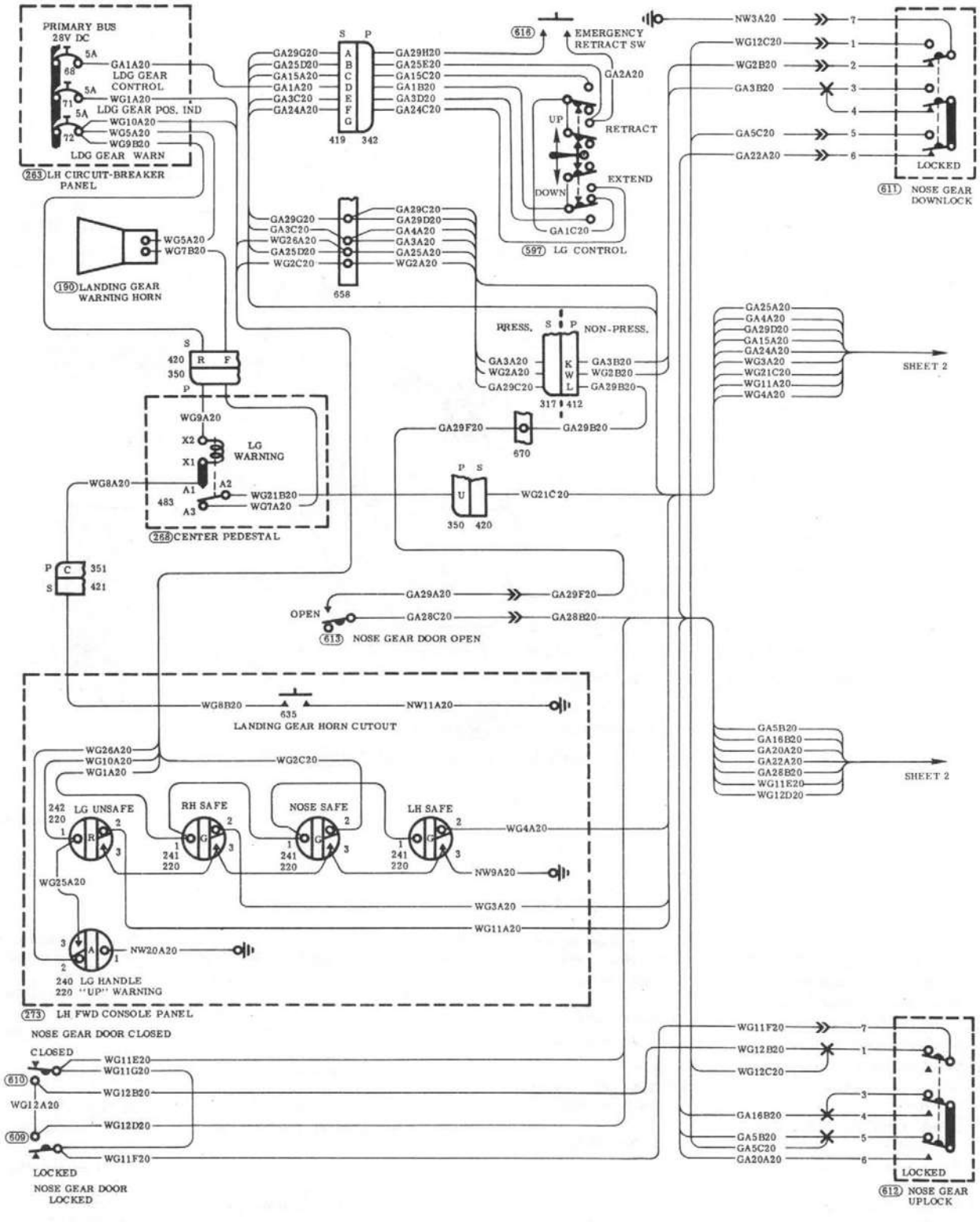
Airplanes AF50-579 Through -598 (Sheet 2 of 2)



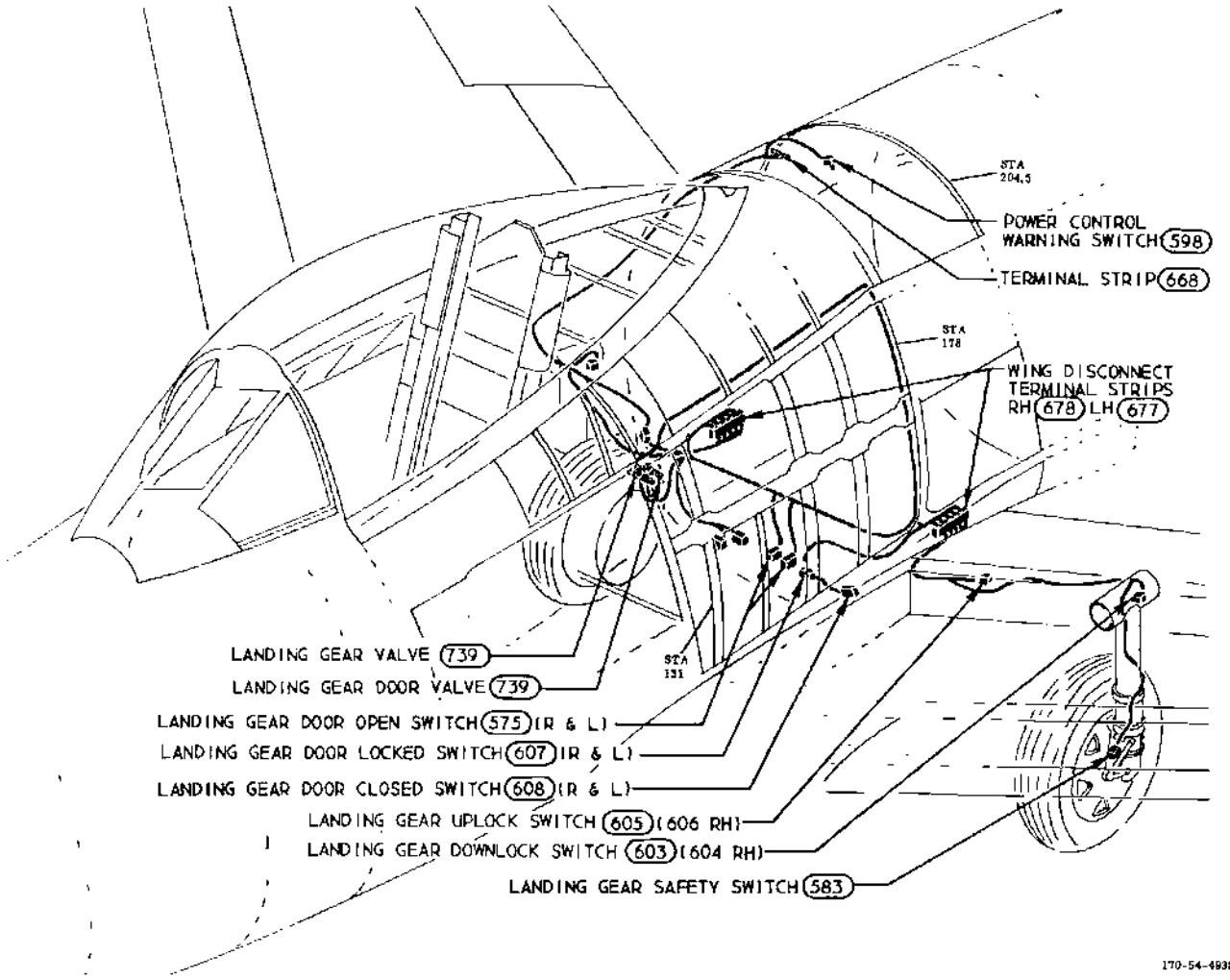
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
68	Circuit Breaker—Landing Gear Control	AN3161P5
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
190	Horn—Landing Gear Warning	32462, Type J-2
220	Lamp—Warning	AN3121-313
240	Light Assembly—Landing Gear Handle Warning	AN3157-4
241	Light Assembly—Landing Gear Safe	AN3157-3
242	Light Assembly—Landing Gear Unsafe	AN3157-2
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	161-54028-10 (NAA)
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
342	Plug—Landing Gear Control	AN3106B16S-1P
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
351	Plug—Pedestal Disconnect	AN3106A32-7P
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
419	Receptacle—Landing Gear Control	AN3102A16S-1S
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
483	Relay—Landing Gear Warning Horn	237EAU (Leach)
597	Switch—Pilot's Landing Gear Control	BZ-3YQ1T (Micro Switch)
609	Switch—Nose Wheel Door Lock	BZ-7RQ1T (Micro Switch)
610	Switch—Nose Wheel Fairing Door	BZ-7RQ1T (Micro Switch)
611	Switch—Nose Wheel Downlock	152-54201 (NAA)
612	Switch—Nose Wheel Uplock	152-54201 (NAA)
613	Switch—Nose Wheel Door Open	AN3215-1
616	Switch—Pilot's Ground Safety Override	C-8100 (Hetherington)
635	Switch—Warning Horn Cutout	C-1400 (Hetherington)
658	Terminal Block—Right Forward Wing	AN3436-2-10
670	Terminal Block—Nose Wiring	AN3436-4-14

Figure 10-12. Landing Gear System—F-86E-1

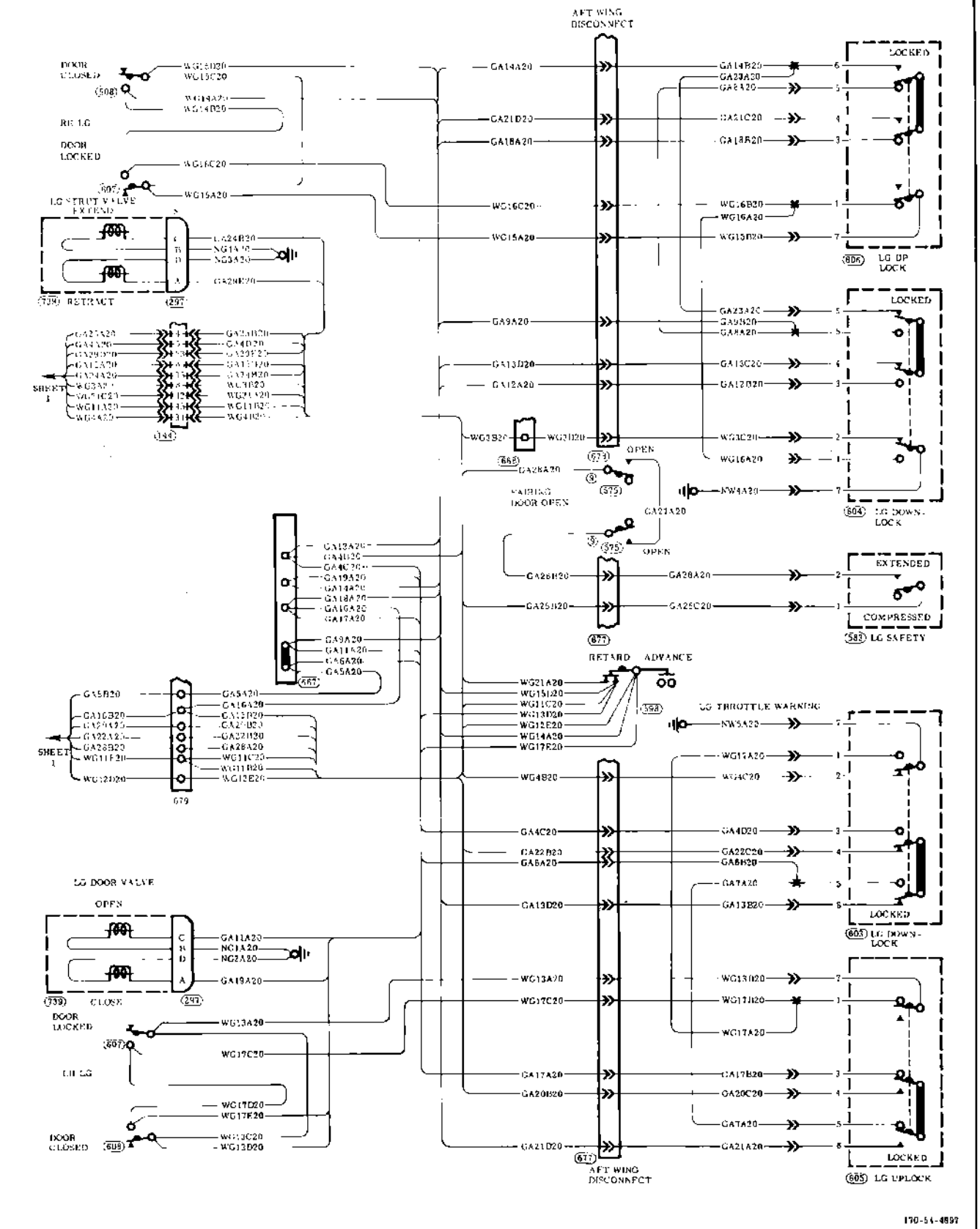


Airplanes AF50-599 Through -638 (Sheet 1 of 2)

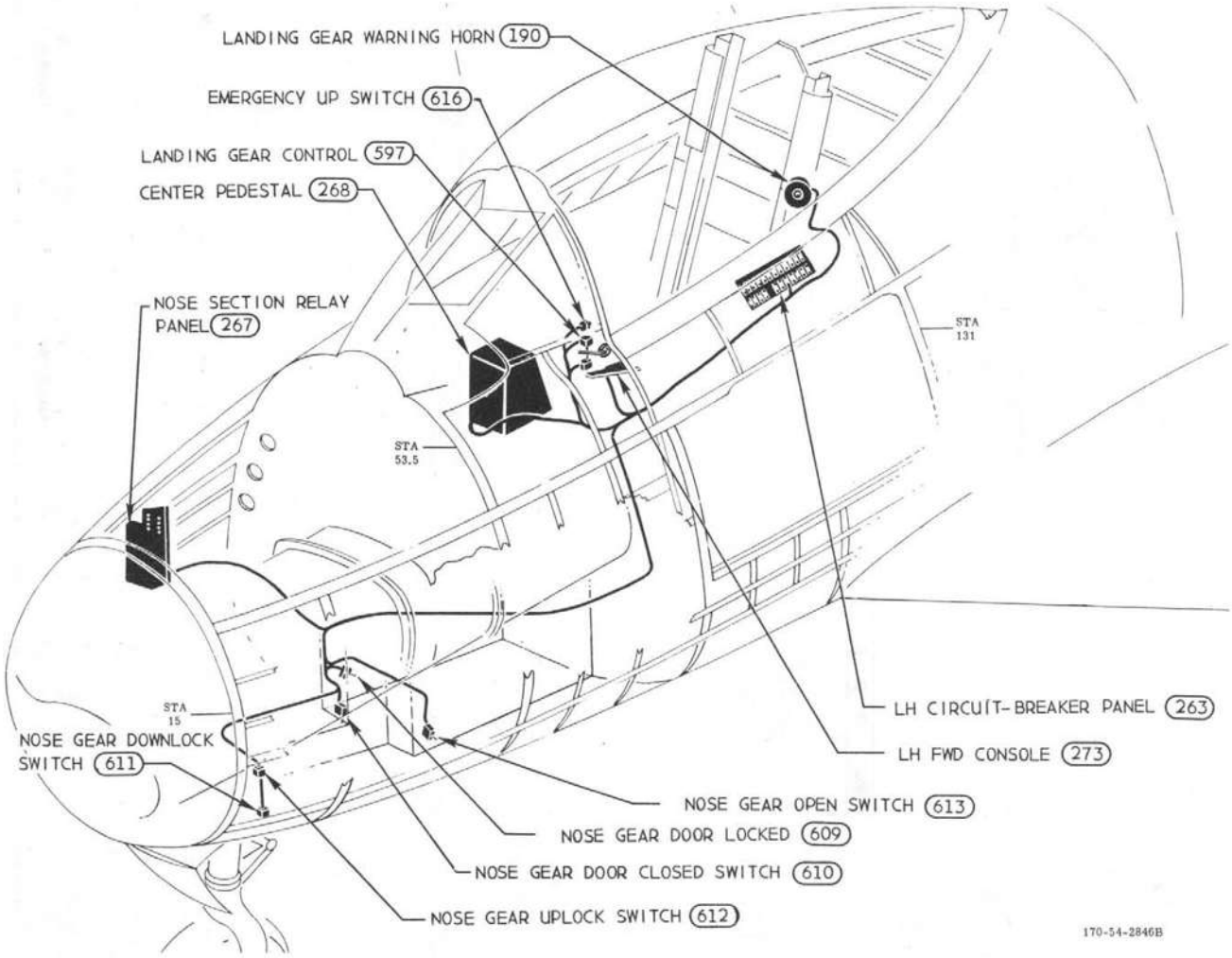


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
297	Plug—Door and Strut Hydraulic Solenoid Valve	AN3106B14S-2S
575	Switch—Fairing Door Open	BZ-7RQ1T (Micro Switch)
583	Switch—Ground Sequence Safety	AN3234-1
598	Switch—Landing Gear Warning Throttle	AN3216-1 (Micro Switch), MD8721 Actuator
603	Switch—Left Main Landing Gear Downlock	152-54201 (NAA)
604	Switch—Right Main Landing Gear Downlock	152-54201 (NAA)
605	Switch—Left Main Landing Gear Uplock	152-54201 (NAA)
606	Switch—Right Main Landing Gear Uplock	152-54201 (NAA)
607	Switch—Main Landing Gear Door Lock	BZ-7RQ1T (Micro Switch)
608	Switch—Main Landing Gear Fairing Door	BZ-7RQ1T (Micro Switch)
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
739	Valve—Landing Gear Strut and Fairing Door Hydraulic Solenoid	466335 (Bendix)

Figure 10-12. Landing Gear System—F-86E-1



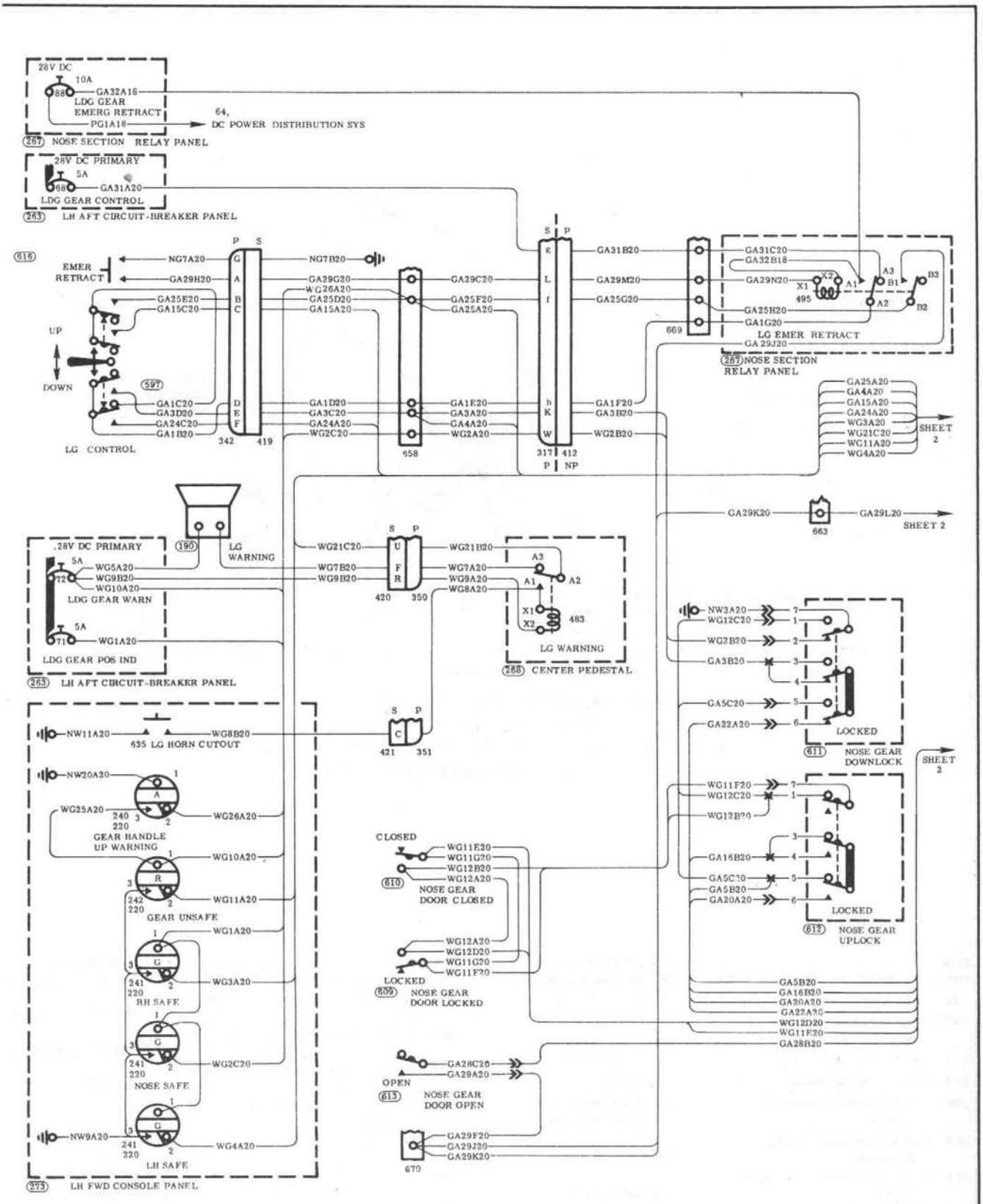
Airplanes AF50-599 Through -638 (Sheet 2 of 2)



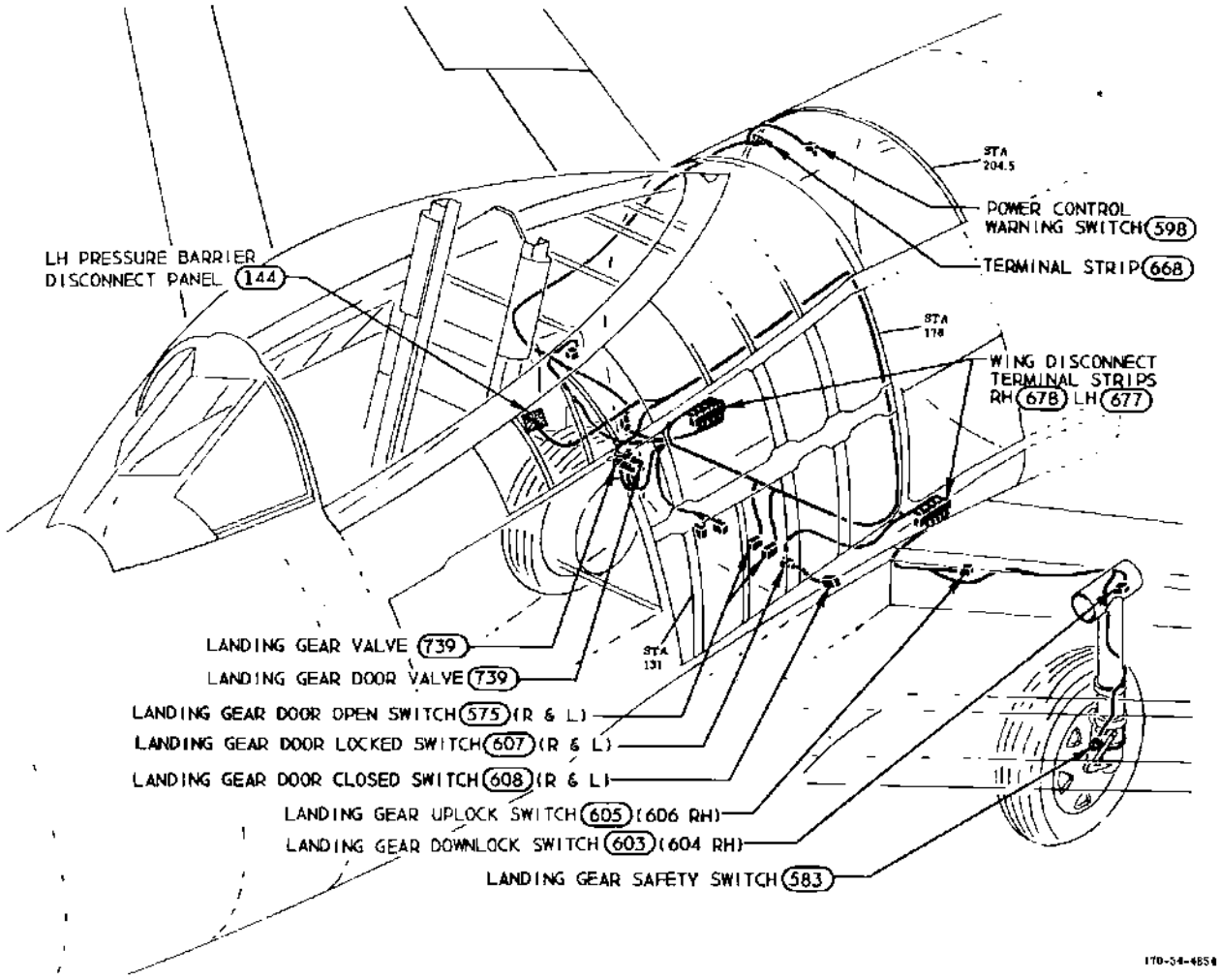
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
68	Circuit Breaker—Landing Gear Control	AN3161P5
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
88	Circuit Breaker—Landing Gear Emergency Retraction	AN3161P10
190	Horn—Landing Gear Warning	32462, Type J-2
220	Lamp—Warning	AN3121-313
240	Light Assembly—Landing Gear Handle Warning	AN3157-4
241	Light Assembly—Landing Gear Safe	AN3157-3
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	161-54028-10 (NAA)
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
342	Plug—Landing Gear Control	AN3106B16S-1P
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
351	Plug—Pedestal Disconnect	AN3106A32-7P
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
419	Receptacle—Landing Gear Control	AN3102A16S-1S
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
483	Relay—Landing Gear Warning Horn	237EAU (Leach)
495	Relay—Landing Gear Emergency Retract	237EAU (Leach)
597	Switch—Pilot's Landing Gear Control	BZ-3YQ1T (Micro Switch)
609	Switch—Nose Wheel Door Lock	BZ-7RQ1T (Micro Switch)
610	Switch—Nose Wheel Fairing Door	BZ-7RQ1T (Micro Switch)
611	Switch—Nose Wheel Downlock	152-54201 (NAA)
612	Switch—Nose Wheel Uplock	152-54201 (NAA)
613	Switch—Nose Wheel Door Open	AN3215-1
635	Switch—Warning Horn Cutout	C-1400 (Hetherington)
658	Terminal Block—Right Forward Wing	AN3436-2-10
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14

Figure 10-13. Landing Gear System—F-86E-5 and

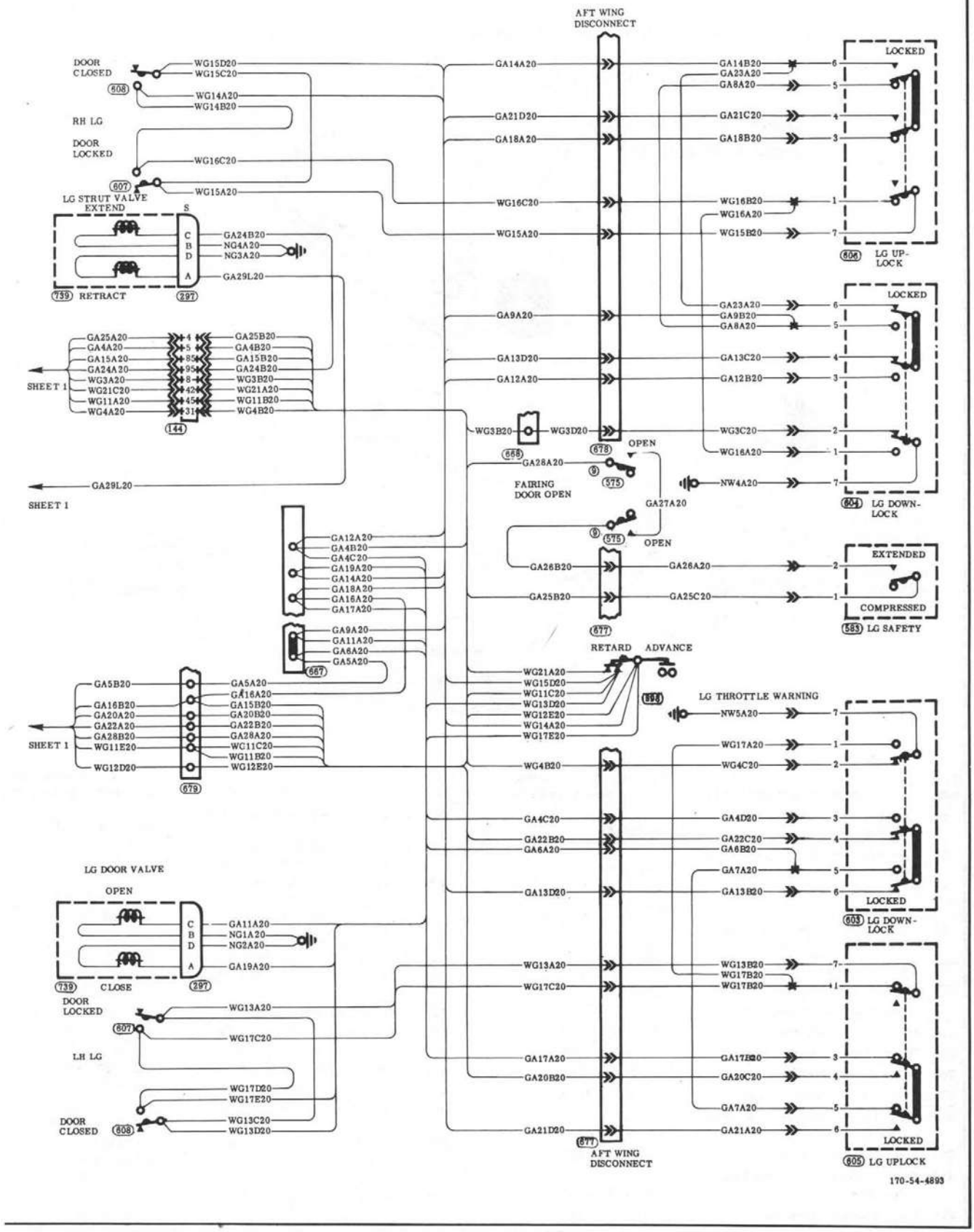


F-86E-6 Airplanes (Sheet 1 of 2)

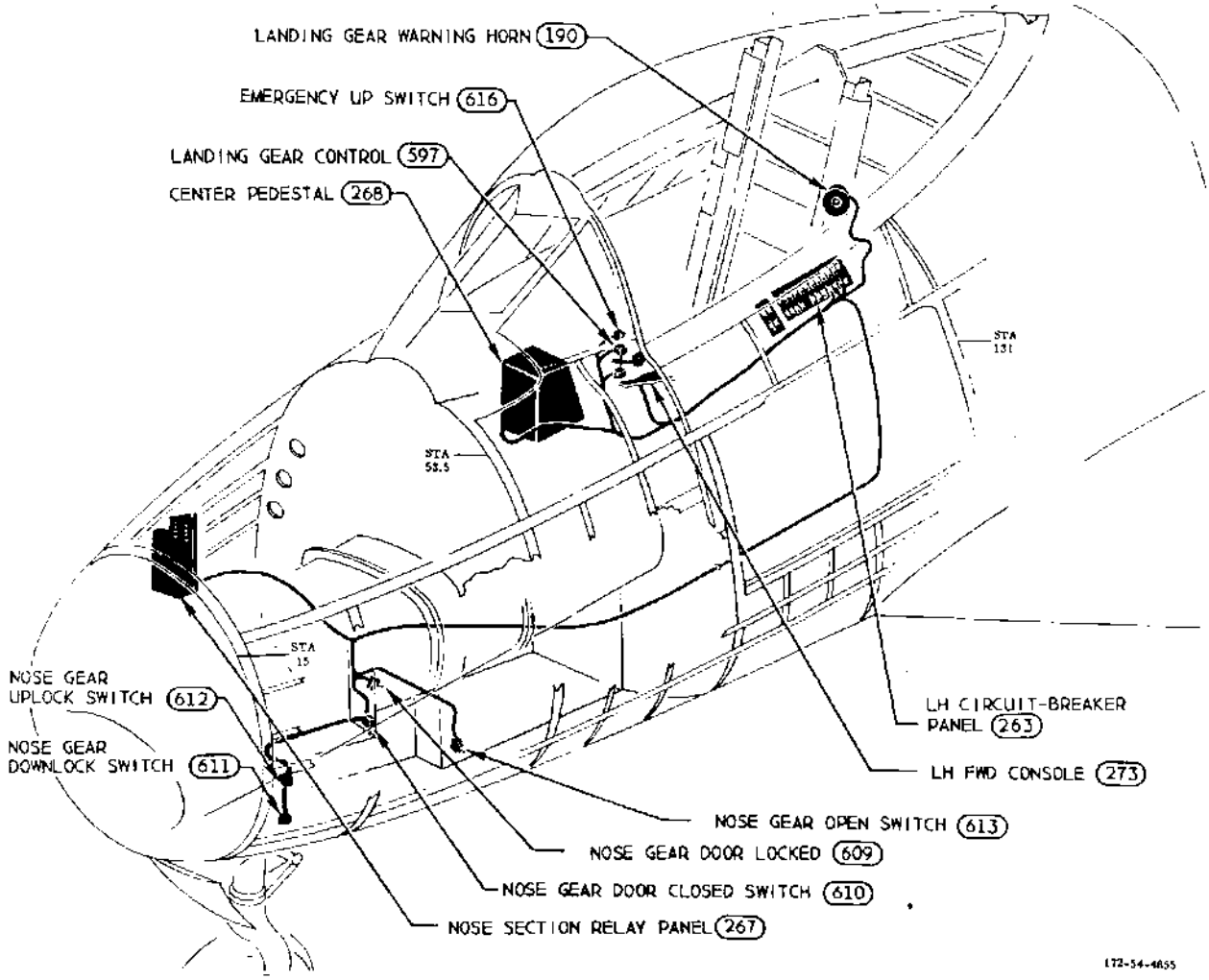


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
297	Plug—Door and Strut Hydraulic Solenoid Valve	AN3106B14S-2S
575	Switch—Fairing Door Open	BZ-7RQ1T (Micro Switch)
583	Switch—Ground Sequence Safety	AN3234-1
598	Switch—Landing Gear Warning Throttle	AN3216-1 (Micro Switch), MD8721 Actuator
603	Switch—Left Main Landing Gear Downlock	152-54201 (NAA)
604	Switch—Right Main Landing Gear Downlock	152-54201 (NAA)
605	Switch—Left Main Landing Gear Uplock	152-54201 (NAA)
606	Switch—Right Main Landing Gear Uplock	152-54201 (NAA)
607	Switch—Main Landing Gear Door Lock	BZ-7RQ1T (Micro Switch)
608	Switch—Main Landing Gear Fairing Door	BZ-7RQ1T (Micro Switch)
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
739	Valve—Landing Gear Strut and Fairing Door Hydraulic Solenoid	466335 (Bendix)

Figure 10-13. Landing Gear System—F-86E-5



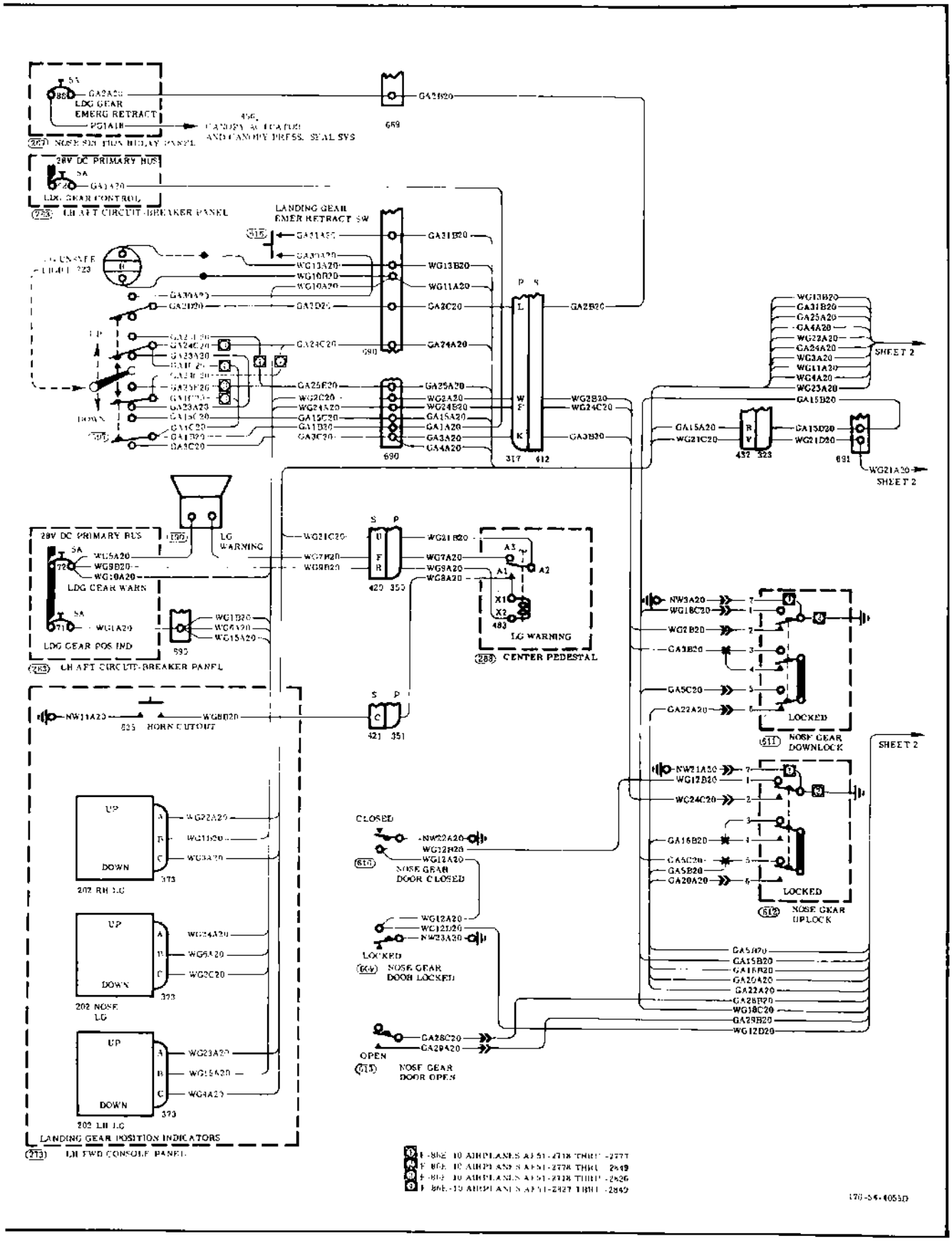
and F-86E-6 Airplanes (Sheet 2 of 2)



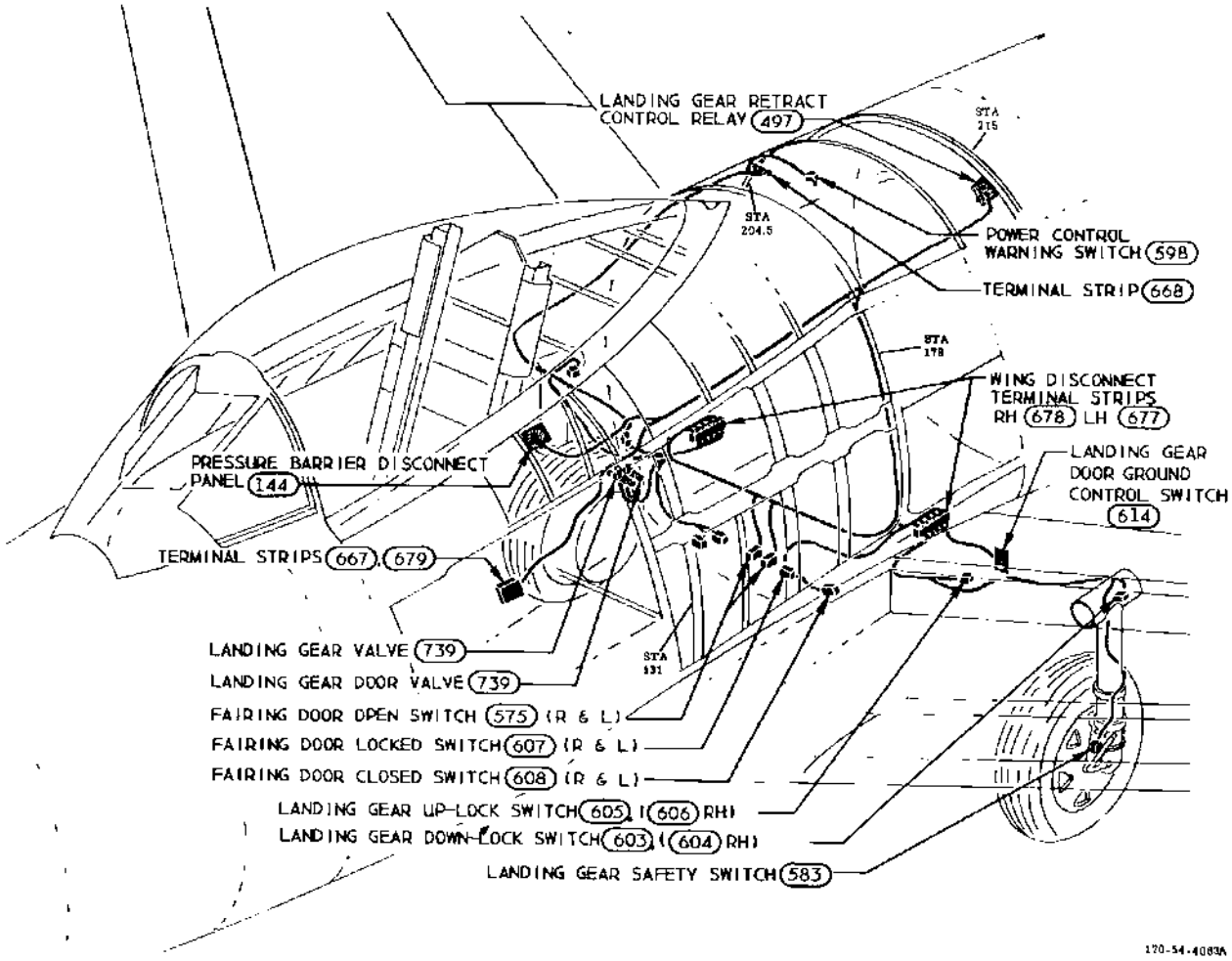
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
68	Circuit Breaker—Landing Gear Control	AN3161P5
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
88	Circuit Breaker—Landing Gear Emergency Retraction	AN3161P5
190	Horn—Landing Gear Warning	32462, Type J-2
202	Indicator—Landing Gear Position	21250A
223	Lamp—Landing Gear Unsafe	AN3140-327
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
323	Plug—Gun Bay Pressure	AN3106B24-28S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
373	Plug—Landing Gear Position Indicator	AN3106B10SL-3S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
483	Relay—Landing Gear Warning Horn	237EAU (Leach)
597	Switch—Pilot's Landing Gear Control	NA5-7733, Types A and B (Carma)
609	Switch—Nose Wheel Door Lock	BZ-7RQ1T (Micro Switch)
610	Switch—Nose Wheel Fairing Door	BZ-7RQ1T (Micro Switch)
611	Switch—Nose Wheel Downlock	152-54201 (NAA)
612	Switch—Nose Wheel Uplock	152-54201 (NAA)
613	Switch—Nose Wheel Door Open	AN3215-1
616	Switch—Pilot's Ground Safety Override	C-8100 (Hetherington)
669	Terminal Block—Nose Junction Box	AN3436-2-18
690	Terminal Block—Landing Gear Control Disconnect	AN3436-2-6 AN3436-2-7
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-14. Landing Gear System—

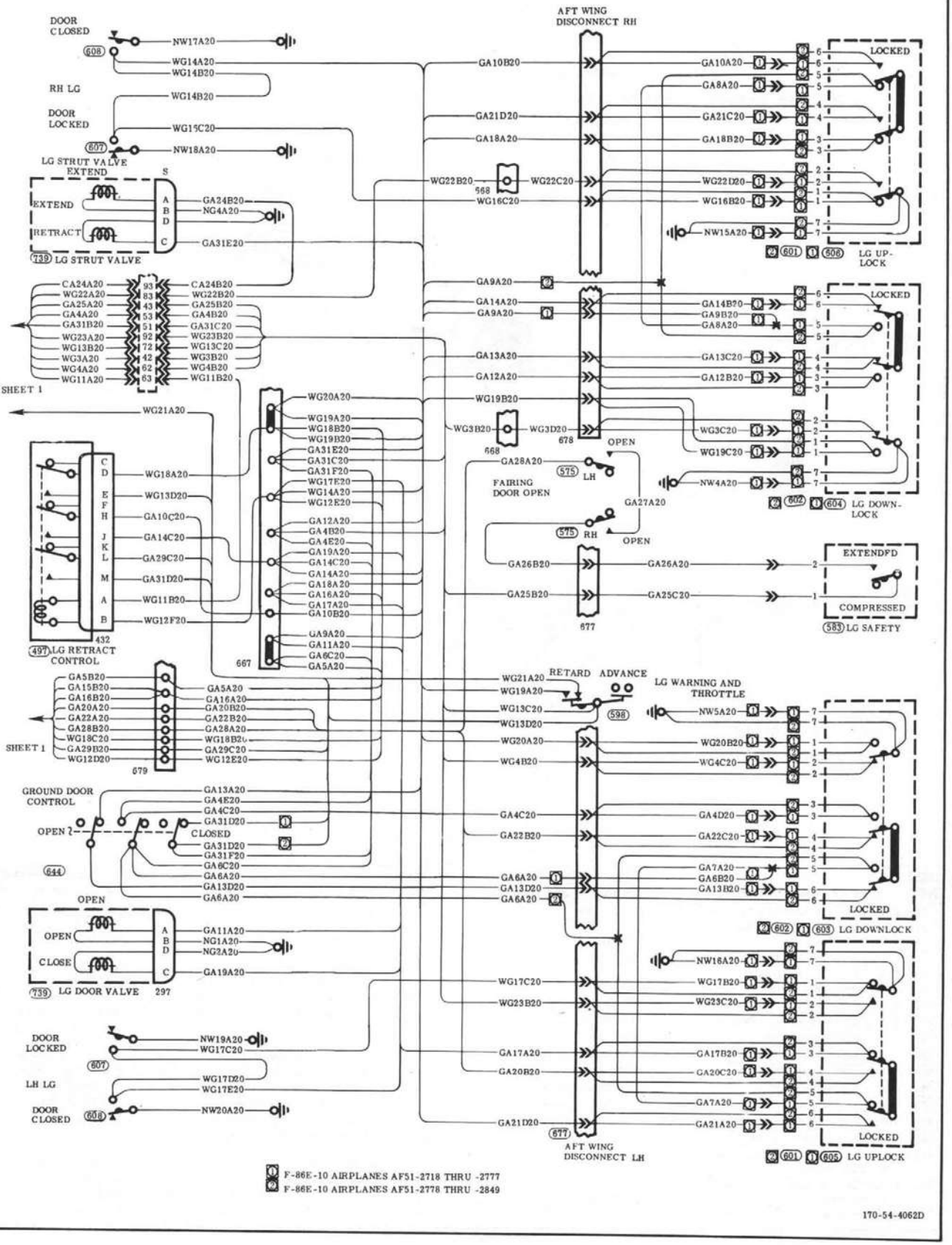


F-86E-10 Airplanes (Sheet 1 of 2)

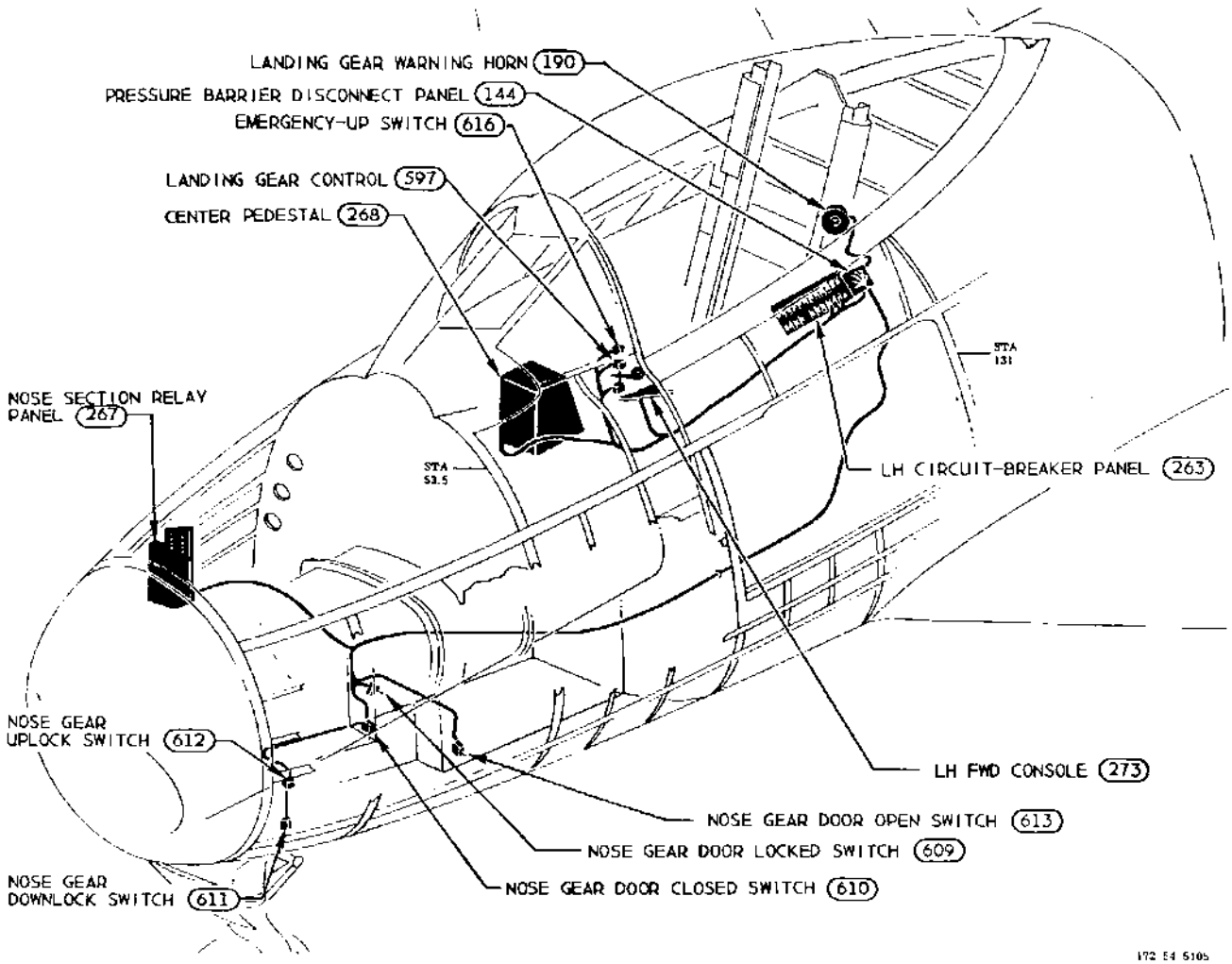


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
297	Plug—Door and Strut Hydraulic Solenoid Valve	AN3106B14S-2S
432	Receptacle—Landing Gear Retraction Control Relay	2044-84 (Cannon)
497	Relay—Landing Gear Safety Control	AN3308-1
575	Switch—Fairing Door Open	BZ-7RQ1T (Micro Switch)
583	Switch—Ground Sequence Safety	AN3234-1
598	Switch—Landing Gear Warning Throttle	AN3216-1 (Micro Switch), MD8721 Actuator
601	Switch—Main Landing Gear Uplock	152-54201 (NAA)
602	Switch—Main Landing Gear Downlock	152-54201 (NAA)
603	Switch—Left Main Landing Gear Downlock	152-54201 (NAA)
604	Switch—Right Main Landing Gear Downlock	152-54201 (NAA)
605	Switch—Left Main Landing Gear Uplock	152-54201 (NAA)
606	Switch—Right Main Landing Gear Uplock	152-54201 (NAA)
607	Switch—Main Landing Gear Door Lock	BZ-7RQ1T (Micro Switch)
608	Switch—Main Landing Gear Fairing Door	BZ-7RQ1T (Micro Switch)
614	Switch—Nose Wheel Steering Safety	AN3234-1
644	Switch—Ground Door Control	AN3227-3
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
739	Valve—Landing Gear Strut and Fairing Door Hydraulic Solenoid	9610 (Weston)

Figure 10-14. Landing Gear System—



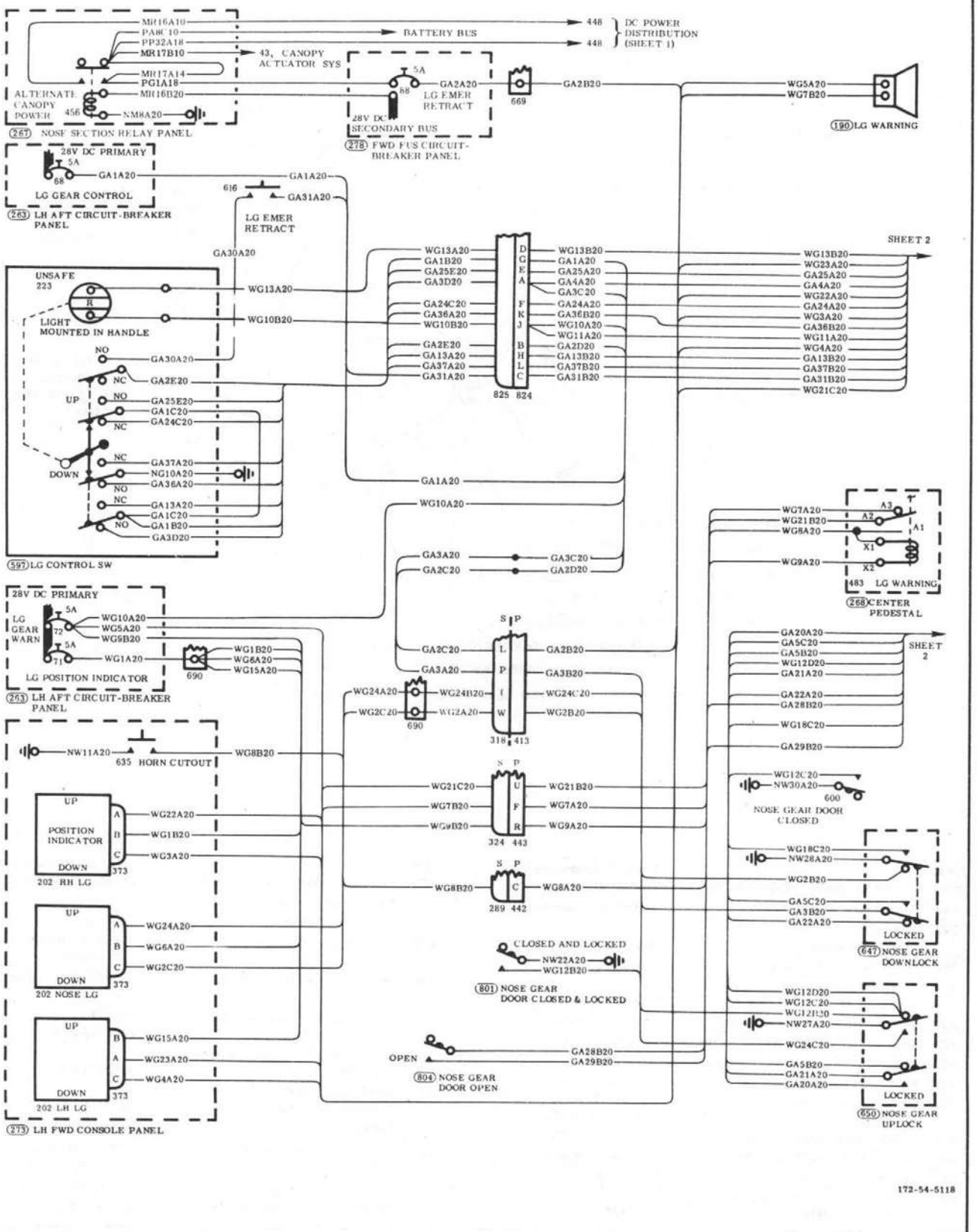
F-86E-10 Airplanes (Sheet 2 of 2)



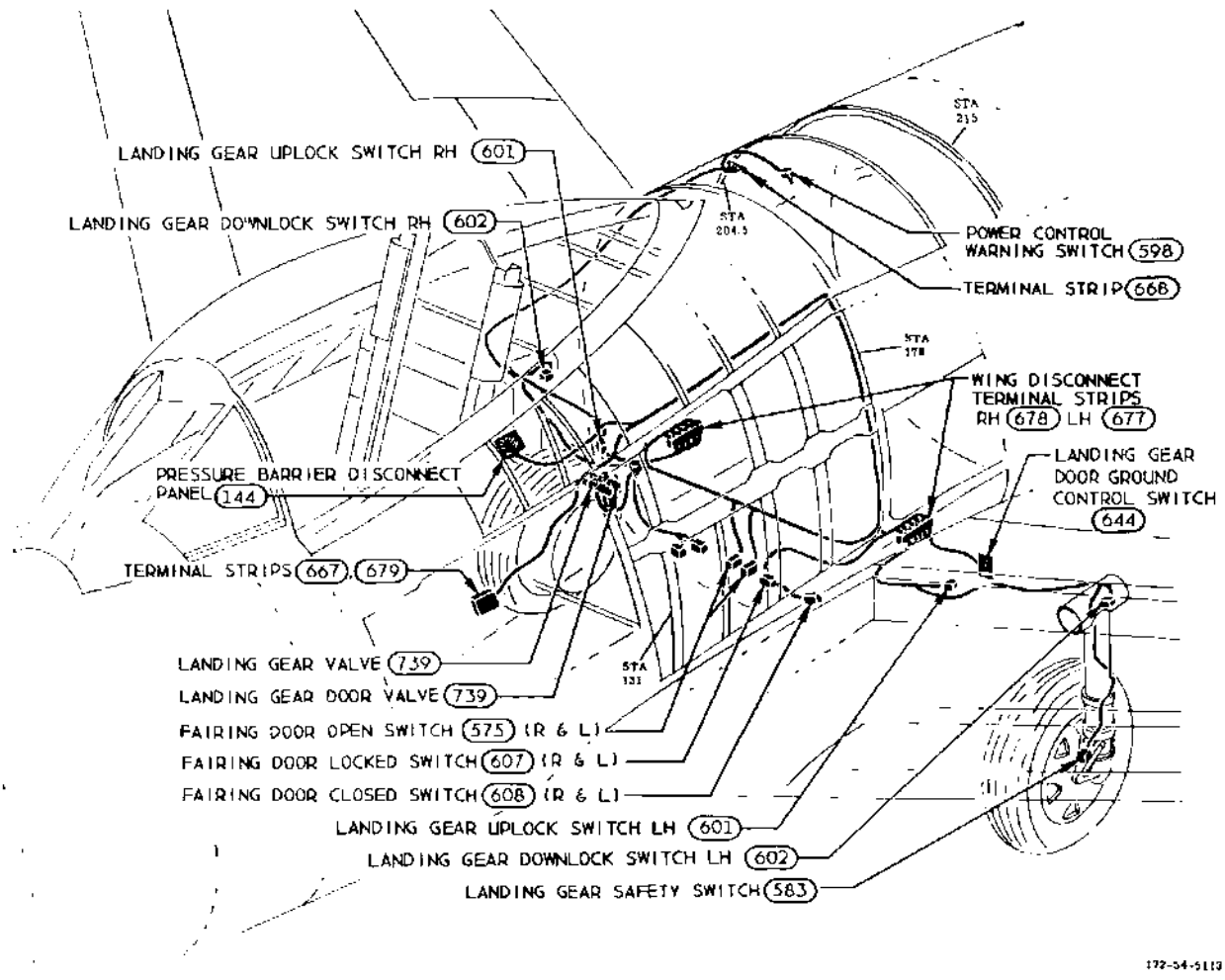
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
68	Circuit Breaker—Landing Gear Control	AN3161P5
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
88	Circuit Breaker—Landing Gear Emergency Retraction	AN3161P5
190	Horn—Landing Gear Warning	32462, Type J-2
202	Indicator—Landing Gear Position	21250A, Type C-1
223	Lamp—Landing Gear Unsafe	AN3140-327
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
324	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11S
373	Plug—Landing Gear Position Indicator	AN3106B10SL-3S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
443	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3102A28-11P
456	Relay—Canopy Alternate Power	AN3353-1
483	Relay—Landing Gear Warning Horn	237EAU (Leach)
597	Switch—Pilot's Landing Gear Control	NA5-7733, Types A and B (Carma)
600	Switch—Nose Wheel Door Close	175-54332 (NAA)
616	Switch—Pilot's Ground Safety Override	C-8100 (Hetherington)
635	Switch—Warning Horn Cutout	A-40182 (Hetherington)
647	Switch—Nose Strut Downlock	175-54331 (NAA)
650	Switch—Nose Strut Uplock	175-54331 (NAA)
669	Terminal Block—Nose Junction Box	AN3436-2-18
690	Terminal Block—Landing Gear Control Disconnect	AN3436-2-10
801	Switch—Nose Fairing Door	175-54332 (NAA)
804	Switch—Nose Fairing Door	175-54332 (NAA)
824	Receptacle—Instrument Panel Disconnect	AN3100A22-14S
825	Plug—Instrument Panel Disconnect	AN3106B22-14P

Figure 10-15. Landing Gear System—



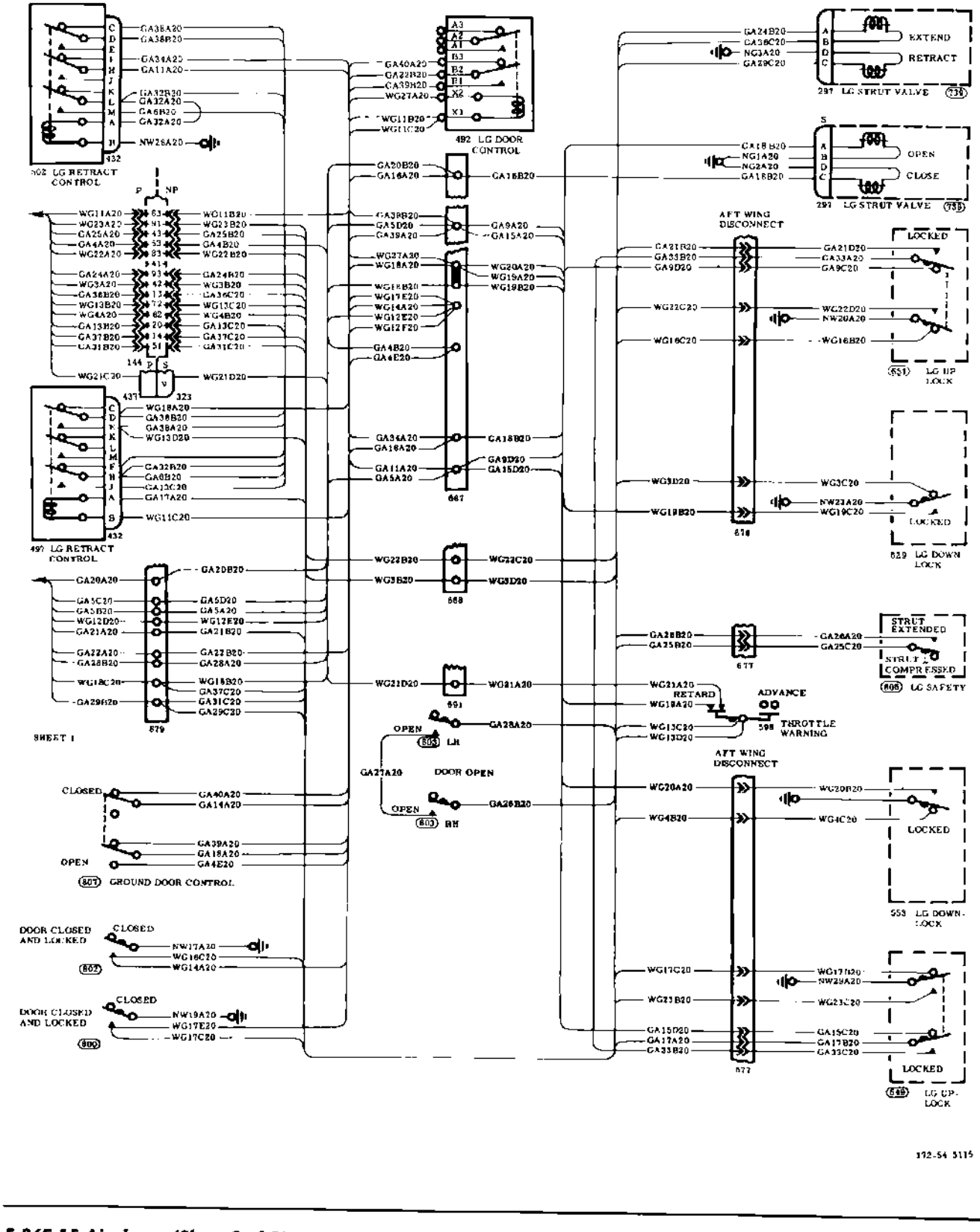
F-86E-15 Airplanes (Sheet 1 of 2)



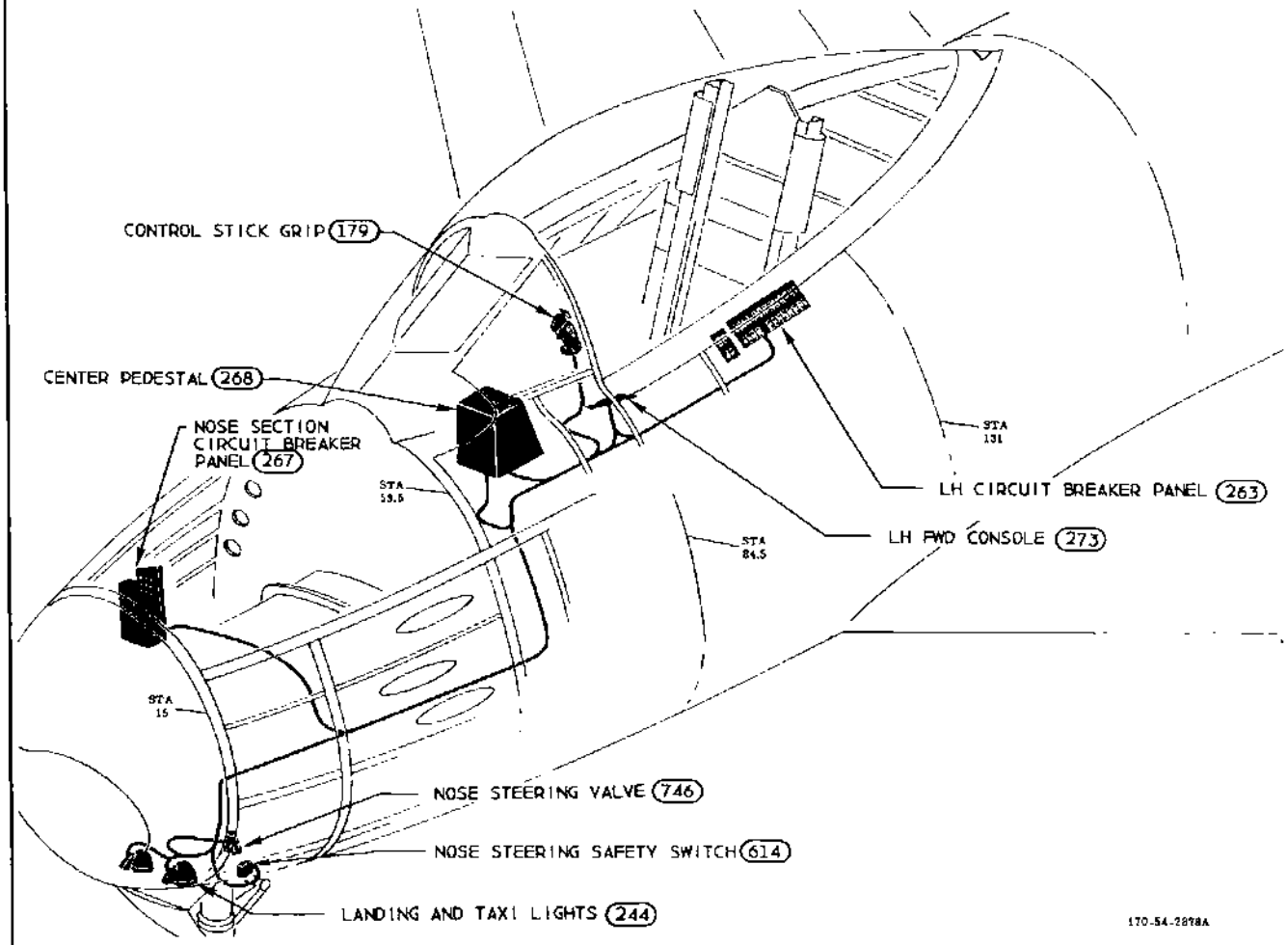
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
144	Disconnect—Left-hand Pressure	YH5100S-6 (Burndy)
297	Plug—Door and Strut Hydraulic Solenoid Valve	AN3106B14S-2S
323	Plug—Gun Bay Pressure	AN3106B24-28S
432	Receptacle—Landing Gear Retraction Control Relay	2044-B4 (Cannon)
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
497	Relay—Landing Gear Safety Control	AN3308-1
502	Relay—Landing Gear Warning Control	AN3308-1
553	Switch—Left Gear Downlock	175-54332 (NAA)
598	Switch—Landing Gear Warning Throttle	AN3216-1 (Micro Switch), MD8721 Actuator
629	Switch—Right Gear Downlock	175-54332 (NAA)
649	Switch—Left-hand Strut Uplock	175-54331 (NAA)
651	Switch—Right Strut Uplock	175-54331 (NAA)
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
739	Valve—Landing Gear Strut and Fairing Door Hydraulic Solenoid	9610 (Weston)
800	Switch—Left Fairing Door	175-54332 (NAA)
802	Switch—Right Fairing Door	175-54332 (NAA)
803	Switch—Left Fairing Door Open	175-54332 (NAA)
806	Switch—Left Strut Safety	175-54332 (NAA)
807	Switch—Ground Door Control	AN3023-3

Figure 10-15. Landing Gear System—



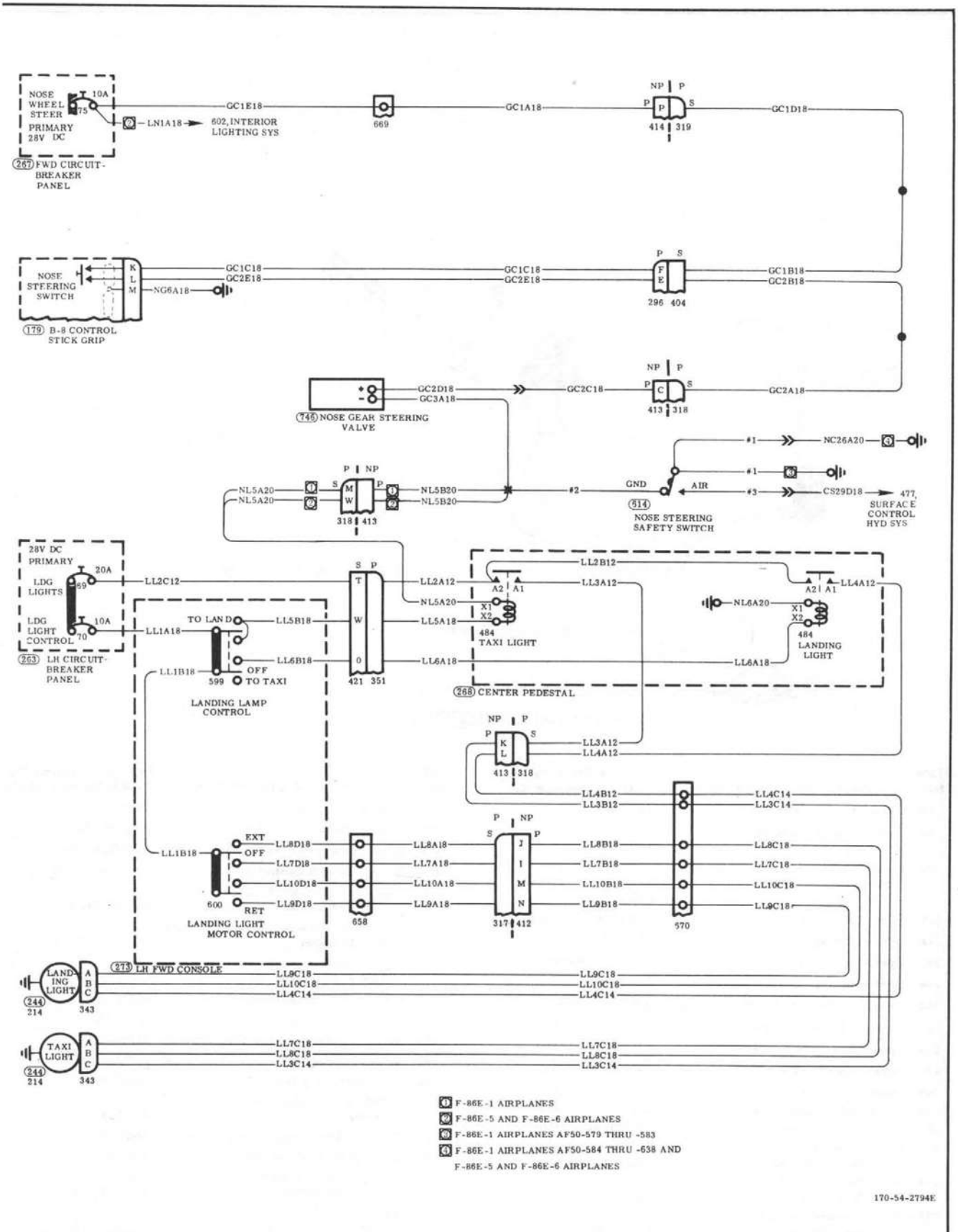
F-86E-15 Airplanes (Sheet 2 of 2)

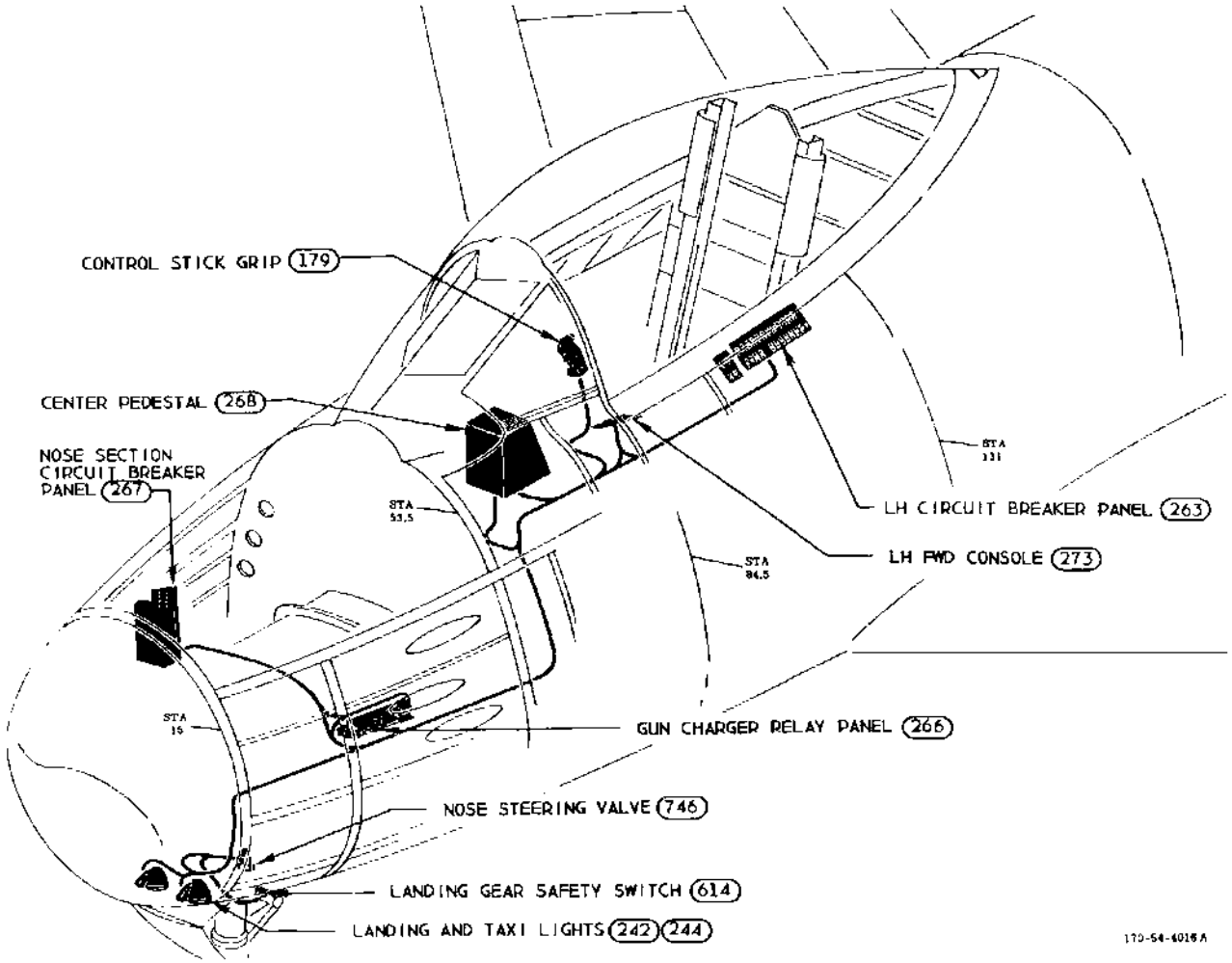


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
69	Circuit Breaker—Landing Light	AN3161P20
70	Circuit Breaker—Landing Light Control	AN3161P5
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
179	Grip—Control Stick	AFX50C4064, Type B-8
214	Lamp—Landing	AN3129-4523
244	Light Assembly—Retractable Landing	AN3095-7
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	161-54028-10 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
343	Plug—Landing Light	AN3106B18-5S
351	Plug—Pedestal Disconnect	AN3106A32-7P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
484	Relay—Landing Light	1227-893 (Leach)
599	Switch—Landing Lamp Control	AN3027-1
600	Switch—Landing Light Motor Control	AN3027-1
614	Switch—Nose Wheel Steering Safety	AN3234-1
658	Terminal Block—Right Forward Wing	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
746	Valve—Nose Wheel Steering Hydraulic Solenoid	23569-3 (Adel)

Figure 10-16. Landing and Taxi Lights and Nose Gear Steering

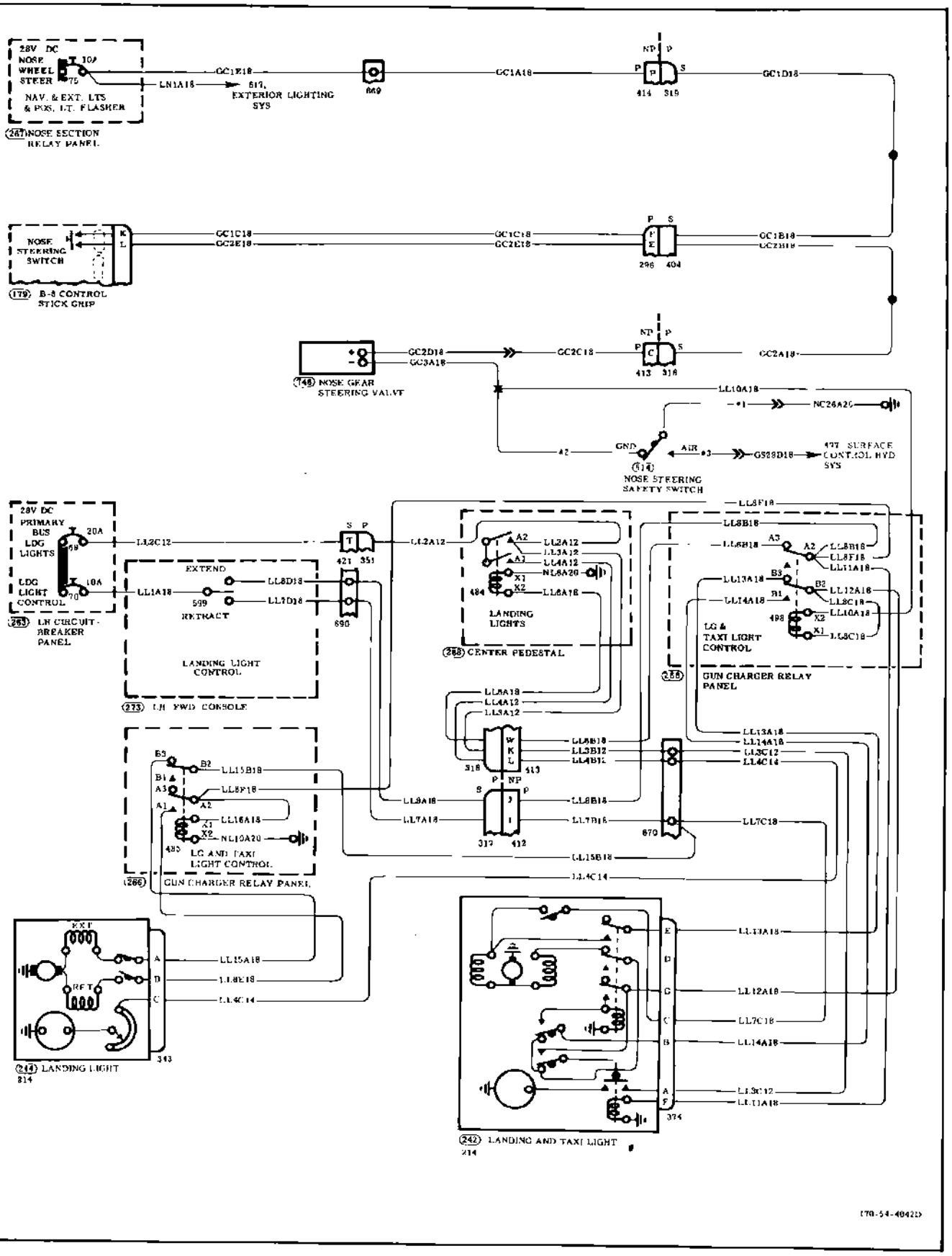

NOSE WHEEL STEER PRIMARY 28V DC
10A
75
(267) FWD CIRCUIT-BREAKER PANEL
LN1A18
602, INTERIOR LIGHTING SYS
GC1E18
669
GC1A18
NP P
P P S
414 319
GC1D18
NOSE STEERING SWITCH
K L M
NG6A18
(179) B-8 CONTROL STICK GRIP
GC1C18
GC2E18
GC1C18
GC2E18
P S
F E
296 404
GC1B18
GC2B18
(746) NOSE GEAR STEERING VALVE
GC2D18
GC3A18
GC2C18
NP P
P C S
413 318
GC2A18
#1
NC26A20
#1
#2
GND
AIR
#3
CS29D18
477, SURFACE CONTROL HYD SYS
(514) NOSE STEERING SAFETY SWITCH
NL5A20
NL5A20
P NP
S M W P
318 413
NL5B20
NL5B20
28V DC PRIMARY
LDG LIGHTS
20A
69
LDG LIGHT CONTROL
10A
70
(263) LH CIRCUIT-BREAKER PANEL
LL2C12
LL1A18
TO LAND
OFF
TO TAXI
LL1B18
599
LANDING LAMP CONTROL
S P
T W 0
421 351
LL2A12
NL5A20
LL5A18
LL6A18
LL5B18
LL6B18
LL2B12
A2 A1
LL3A12
X1 X2
484 TAXI LIGHT
NL6A20
LL6A18
A2 A1
LL4A12
484 LANDING LIGHT
(268) CENTER PEDESTAL
NP P
P K L S
413 318
LL3A12
LL4A12
LL4B12
LL3B12
LL4C14
LL3C14
EXT
OFF
RET
LL1B18
LL8D18
LL7D18
LL10D18
LL9D18
600
LANDING LIGHT MOTOR CONTROL
658
LL8A18
LL7A18
LL10A18
LL9A18
P NP
S J I M N P
317 412
LL8B18
LL7B18
LL10B18
LL9B18
570
LL8C18
LL7C18
LL10C18
LL9C18
(273) LH FWD CONSOLE
LANDING LIGHT
A B C
(244) 214
343
LL9C18
LL10C18
LL4C14
TAXI LIGHT
A B C
(244) 214
343
LL7C18
LL8C18
LL3C14
1 F-86E-1 AIRPLANES
2 F-86E-5 AND F-86E-6 AIRPLANES
3 F-86E-1 AIRPLANES AF50-579 THRU -583
4 F-86E-1 AIRPLANES AF50-584 THRU -638 AND F-86E-5 AND F-86E-6 AIRPLANES
170-54-2794E



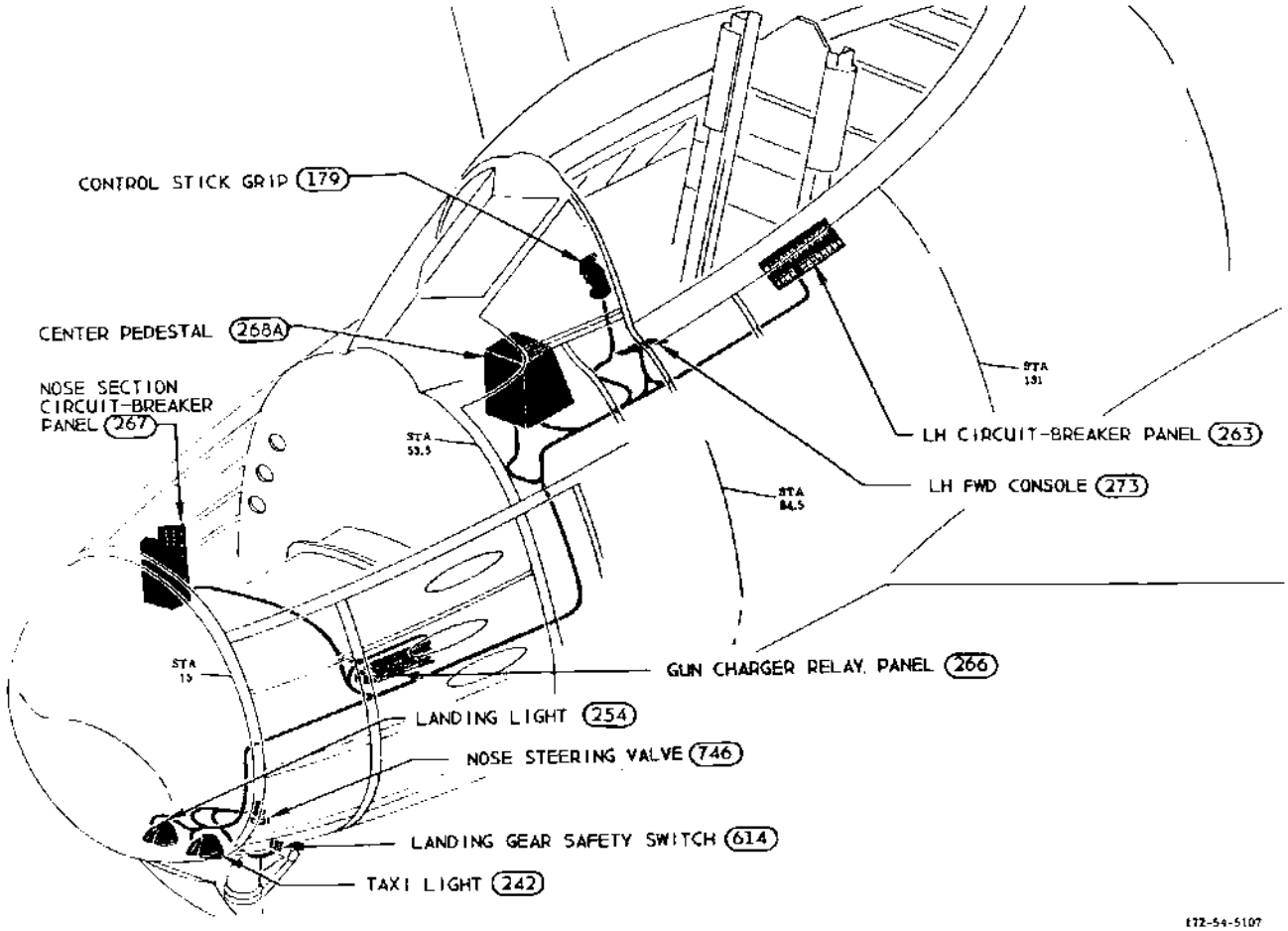
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
69	Circuit Breaker—Landing Light	AN3161P20
70	Circuit Breaker—Landing Light Control	AN3161P10
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
179	Grip—Control Stick	AFX50C4064, Type B-8
214	Lamp—Landing	AN3129-4523
242	Light Assembly—Landing and Taxi	G-4710A (Grimes)
244	Light Assembly—Retractable Landing	AN3095-7
254	Light Assembly—Retractable Landing	D-5530 (Grimes)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
266	Panel—Gun Charger Relay	170-54034 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
343	Plug—Landing Light	AN3106B18-5S
351	Plug—Pedestal Disconnect	AN3106A32-7P
374	Plug—Landing and Taxi Light	AN3106B18-9S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	A3100A32-7S
484	Relay—Landing Light	1227-893 (Leach)
485	Relay—Landing and Taxi Light Control	237EAU (Leach)
498	Relay—Landing and Taxi Light Control	237EAU (Leach)
599	Switch—Landing Lamp Control	AN3022-15B
614	Switch—Nose Wheel Steering Safety	AN3234-1
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
690	Terminal Block—Landing Gear Control Disconnect	AN3436-2-6 AN3436-2-10
746	Valve—Nose Wheel Steering Hydraulic Solenoid	23569-3 (Adel)

Figure 10-17. Landing and Taxi Lights and Nose



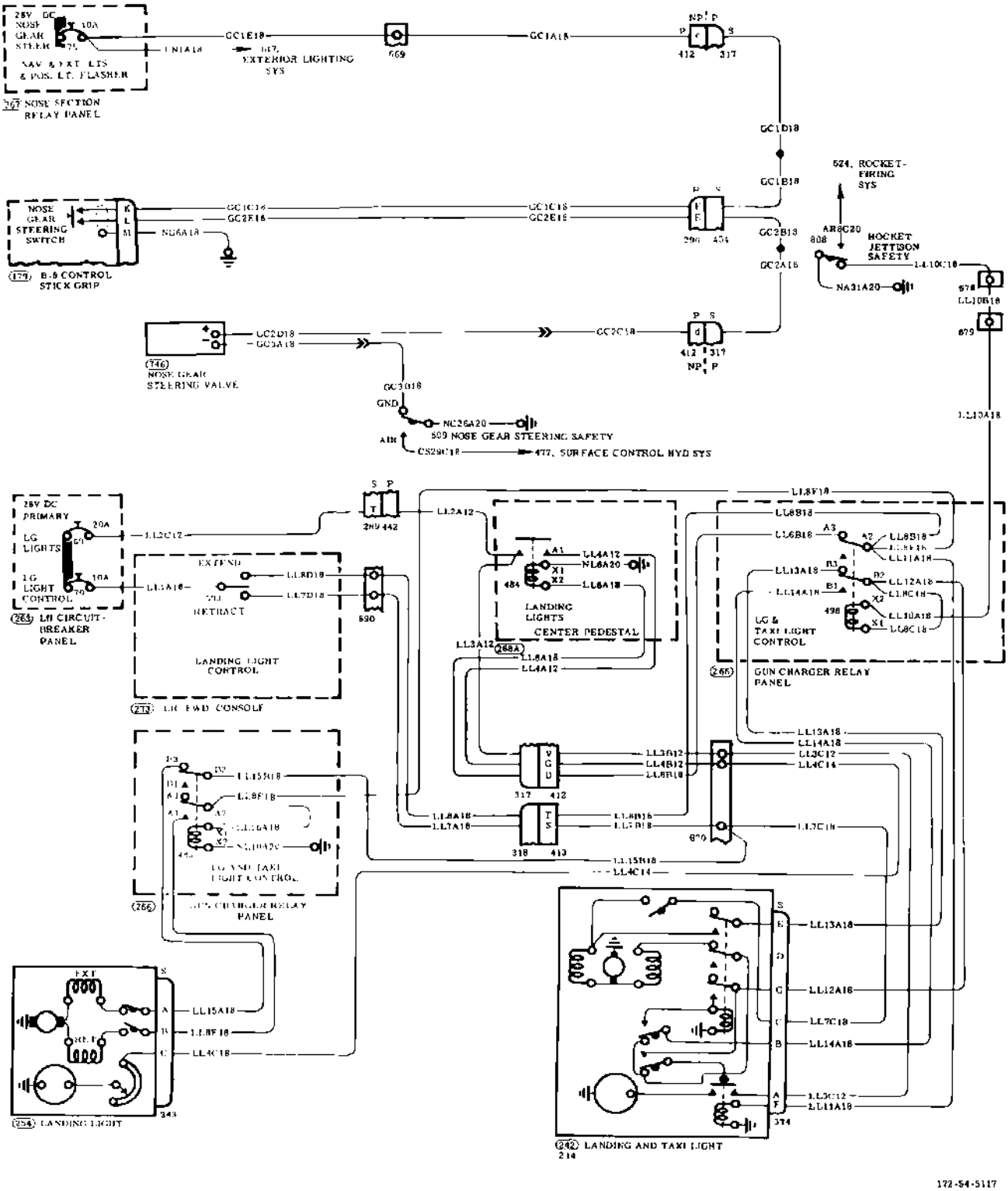
Gear Steering Systems—F-86E-10 Airplanes

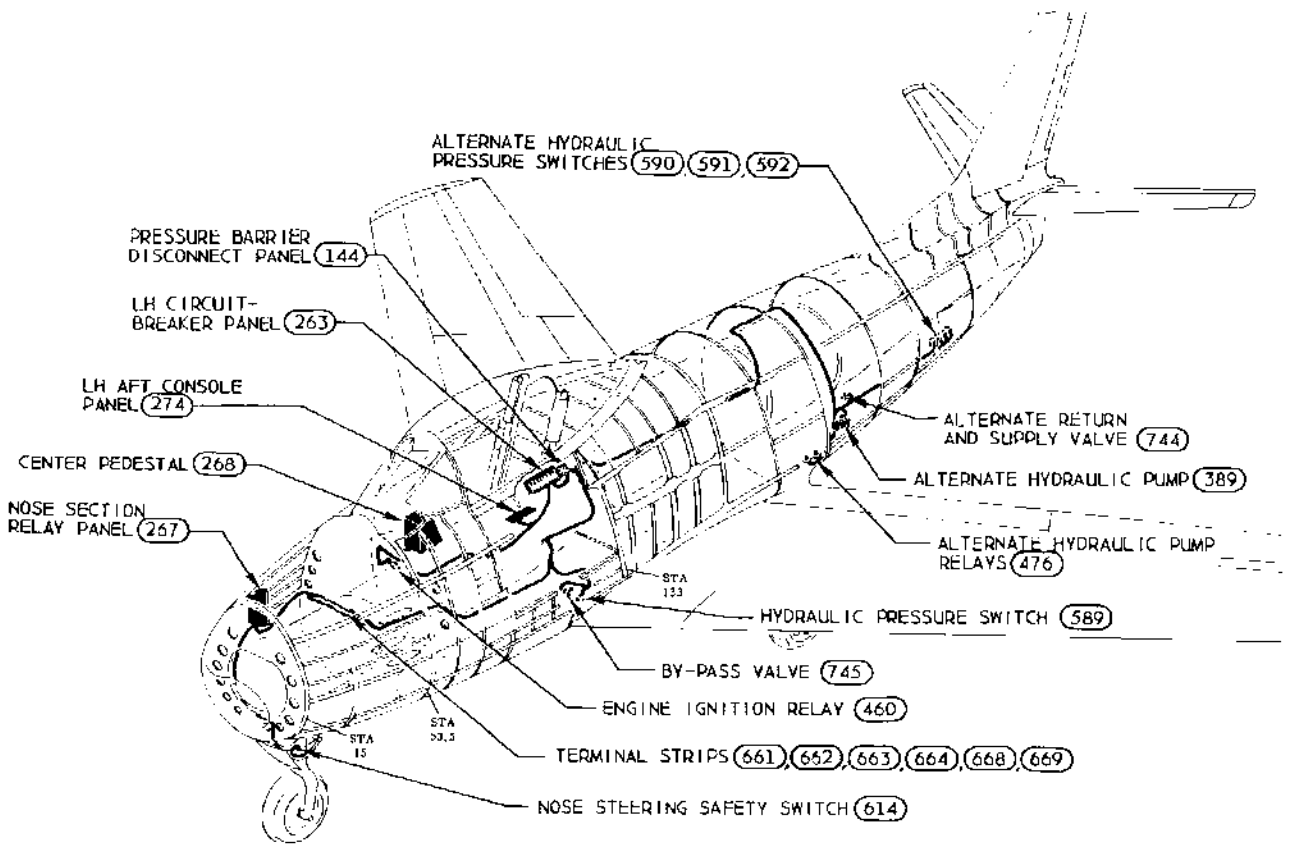


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
69	Circuit Breaker—Landing Light	AN3161P20
70	Circuit Breaker—Landing Light Control	AN3161P10
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
179	Grip—Control Stick	AFX50C4064, Type B-8
242	Light Assembly—Landing and Taxi	G-4710A (Grimes)
254	Light Assembly—Retractable Landing	D-5530 (Grimes)
266	Panel—Gun Charger Relay	170-54034 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
296	Plug—Control Stick Grip	AN3108B20-27P
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
343	Plug—Landing Light	AN3106B18-5S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
374	Plug—Landing and Taxi Light	AN3106B18-9S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
484	Relay—Landing Light	1227-893 (Leach)
485	Relay—Landing and Taxi Light Control	273EAU (Leach)
498	Relay—Landing and Taxi Light Control	273EAU (Leach)
599	Switch—Landing Lamp Control	AN3022-15B
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
746	Valve—Nose Wheel Steering Hydraulic Solenoid	23569-3 (Adel)
808	Switch—Rocket Jettison Safety	175-54332 (NAA)
809	Switch—Nose Steering Safety	175-54332 (NAA)

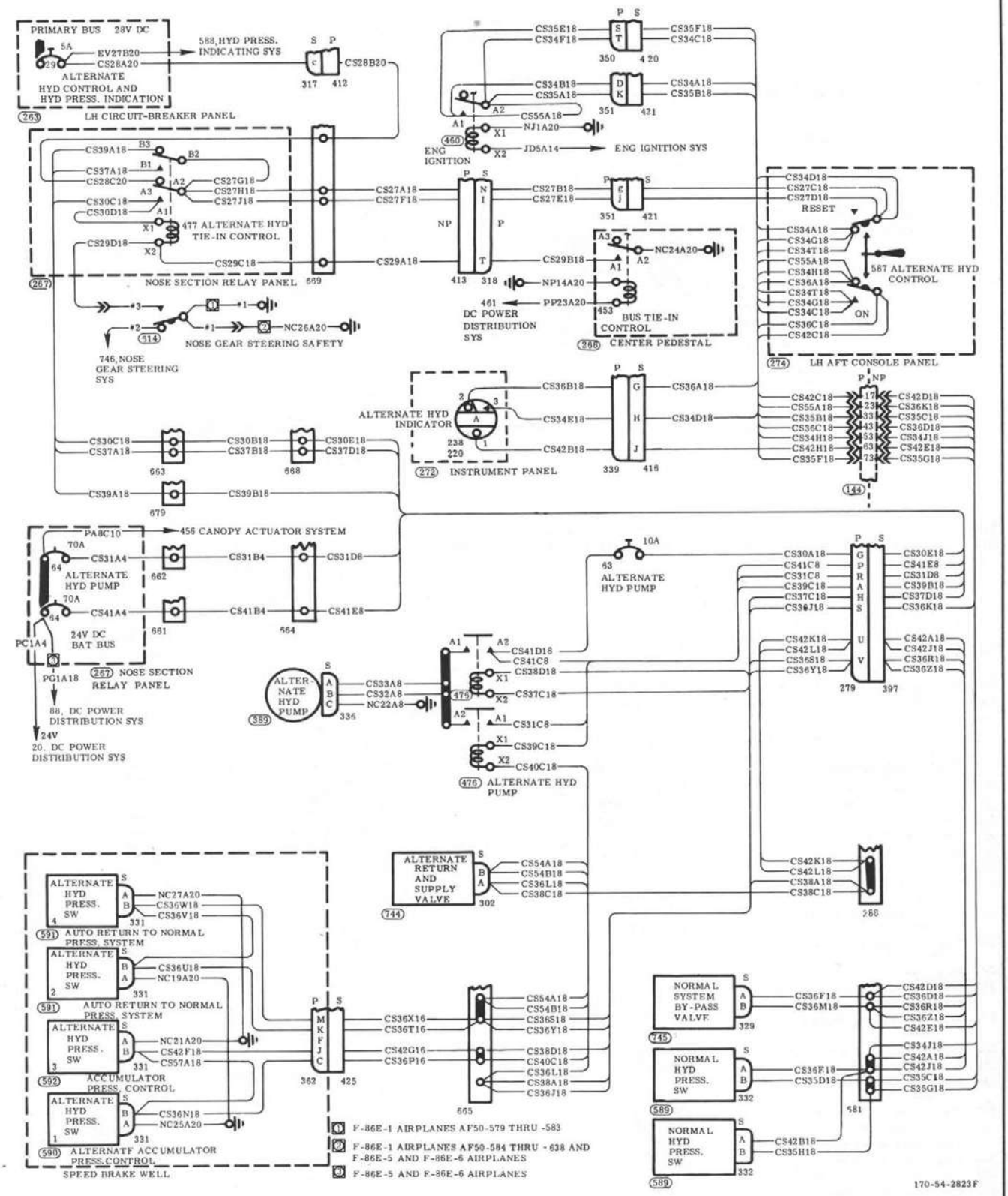
Figure 10-18. Landing and Taxi Lights and Nose


28V DC NOSE GEAR STEER
10A
NAV & EXT LTS & POS LT FLASHER
367 NOSE SECTION RELAY PANEL
GC1E18
LN1A18
667, EXTERIOR LIGHTING SYS
669
GC1A18
NP1 P
412
317
GC1D18
GC1B18
524, ROCKET-FIRING SYS
NOSE GEAR STEERING SWITCH
K
L
M
ND6A18
GC1C18
GC2E18
GC2B18
AR8C20
808
ROCKET JETTISON SAFETY
NA31A20
LL10C18
678
LL10B18
679
179 B-8 CONTROL STICK GRIP
GC2D18
GC3A18
GC2C18
746 NOSE GEAR STEERING VALVE
GC3D18
GND
NC26A20
509 NOSE GEAR STEERING SAFETY
A18
CS29C18
477, SURFACE CONTROL HYD SYS
LL10A18
28V DC PRIMARY
LG LIGHTS
20A
LG LIGHT CONTROL
10A
LL2C12
263 LH CIRCUIT-BREAKER PANEL
LL3A18
EXTEND
RETRACT
LL8D18
LL7D18
LANDING LIGHT CONTROL
212 LH FWD CONSOLE
LL2A12
289 442
630
LL8F18
LL4A12
NL6A20
LL6A18
LANDING LIGHTS CENTER PEDESTAL
484
LL3A12
268A
LL8A18
LL6B18
LL8B18
LL11A18
LL13A18
LL12A18
LL8C18
LG & TAXI LIGHT CONTROL
498
265 GUN CHARGER RELAY PANEL
LL3B12
LL4B12
LL6B18
317
412
LL13A18
LL14A18
LL3C12
LL4C14
LL8A18
LL7A18
318
413
680
LL15B18
LL15A18
LL7C18
LL14A18
LL4C14
LG AND TAXI LIGHT CONTROL
266 LH CIRCUIT-BREAKER PANEL
EXT
RET
LL15A18
LL8F18
LL4C18
343
254 LANDING LIGHT
LL12A18
LL3C12
LL11A18
374
242 LANDING AND TAXI LIGHT
214
172-54-5117

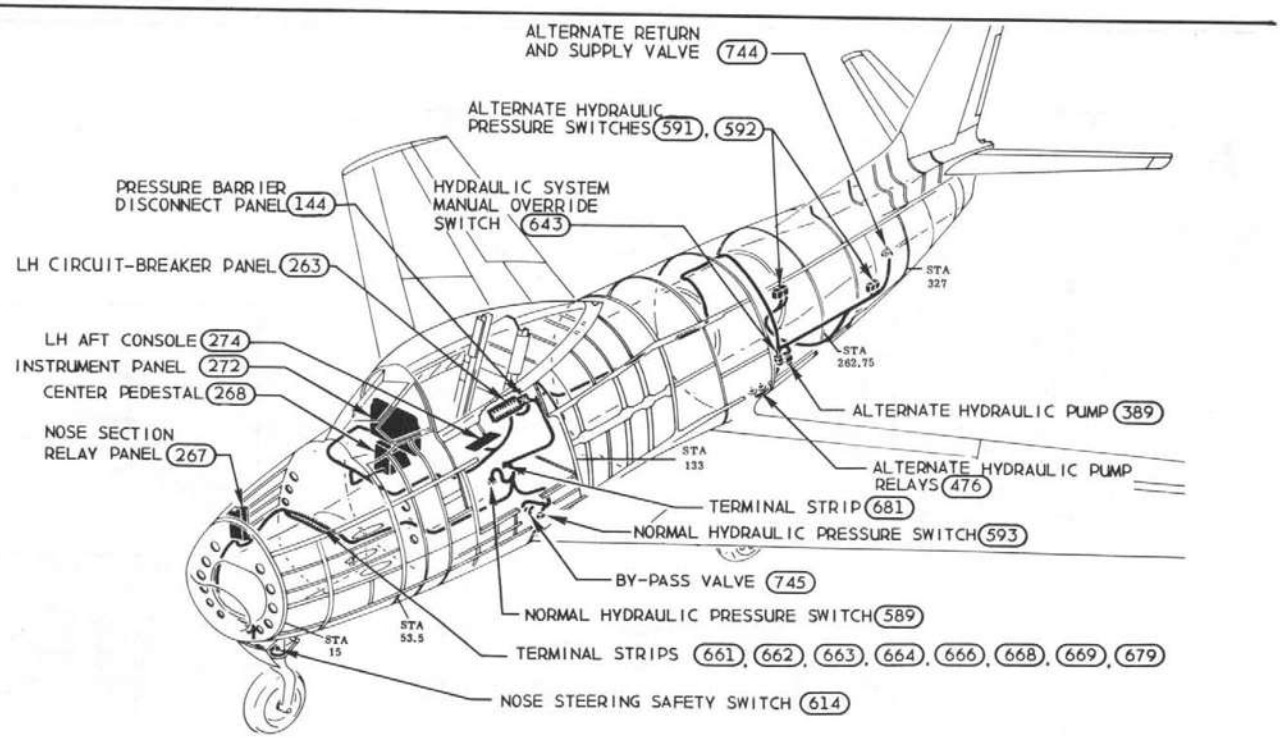


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
63	Circuit Breaker- Alternate Hydraulic Control	AN3161P10
64	Circuit Breaker—Alternate Hydraulic Pump	PDLM-70 (Klixon)
144	Disconnect—Left-hand Pressure	YH5100S-6 (Burndy)
220	Lamp—Warning	AN3121-313
238	Light Assembly—Alternate Flight Control Indicator	AN3157-4
263	Panel-Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel--Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
274	Panel—Left Aft Console	151-53050-30 (NAA)
279	Plug--Aft Fuselage Disconnect	AN3106B32-6P
302	Plug—Alternate Return and Supply Valve	AN3106B10SL-4S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
329	Plug—Normal Hydraulic By-pass Valve	AN3106B10SL-4S
331	Plug- Alternate Hydraulic Pressure Switch	AN3106B12S-3S
332	Plug—Normal Hydraulic Pressure Switch	AN3106B12S-3S
336	Plug—Alternate Hydraulic Pump	AN3106B20-19S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
362	Plug- Speed Brake Well	AN3106B24-5P
389	Pump—Alternate Hydraulic	D-1000 (Hoover)
397	Receptacle—Aft Fuselage Disconnect	AN3102A32-6S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
425	Receptacle—Speed Brake Well	AN3100A24-5S
453	Relay—Bus Tie-in Control	AN3316-1
460	Relay—Engine Starter Ignition Control	2069-25D (Leach)
476	Relay—Alternate Hydraulic Pump	AN3370-1
477	Relay—Alternate Hydraulic Tie-in Control	AN3312-1
587	Switch—Alternate Flight Control	1AT5 (Micro Switch)
589	Switch—Normal Hydraulic Pressure	170-58615 (NAA)
590	Switch—Alternate Hydraulic Pressure	172-58624-3 (NAA)
591	Switch—Alternate Hydraulic Pressure	172-58624 5 (NAA)
592	Switch—Alternate Hydraulic Pressure	172-58624 7 (NAA)
614	Switch -Nose Wheel Steering Safety	AN3234-1
661	Terminal Block—Left Gun Bay	AN3436-6-3
662	Terminal Block—Right Gun Bay	AN3436 6-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
664	Terminal Block—Alternate Hydraulic Pump	NAS45-416-2
665	Terminal Block—Alternate Hydraulic System	NAS45-6-9
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
669	Terminal Block—Nose Junction Box	AN3436-2-18
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
681	Terminal Block—Left Wing Center	AN3436-2-7
688	Terminal Block—Horizontal Stabilizer Actuator	AN3436-2-2
744	Valve—Alternate Hydraulic Return and Supply	170 58625 (NAA)
745	Valve—Normal Hydraulic By-pass	170-58616 (NAA)

Figure 10-19. Surface Control Hydraulic System—



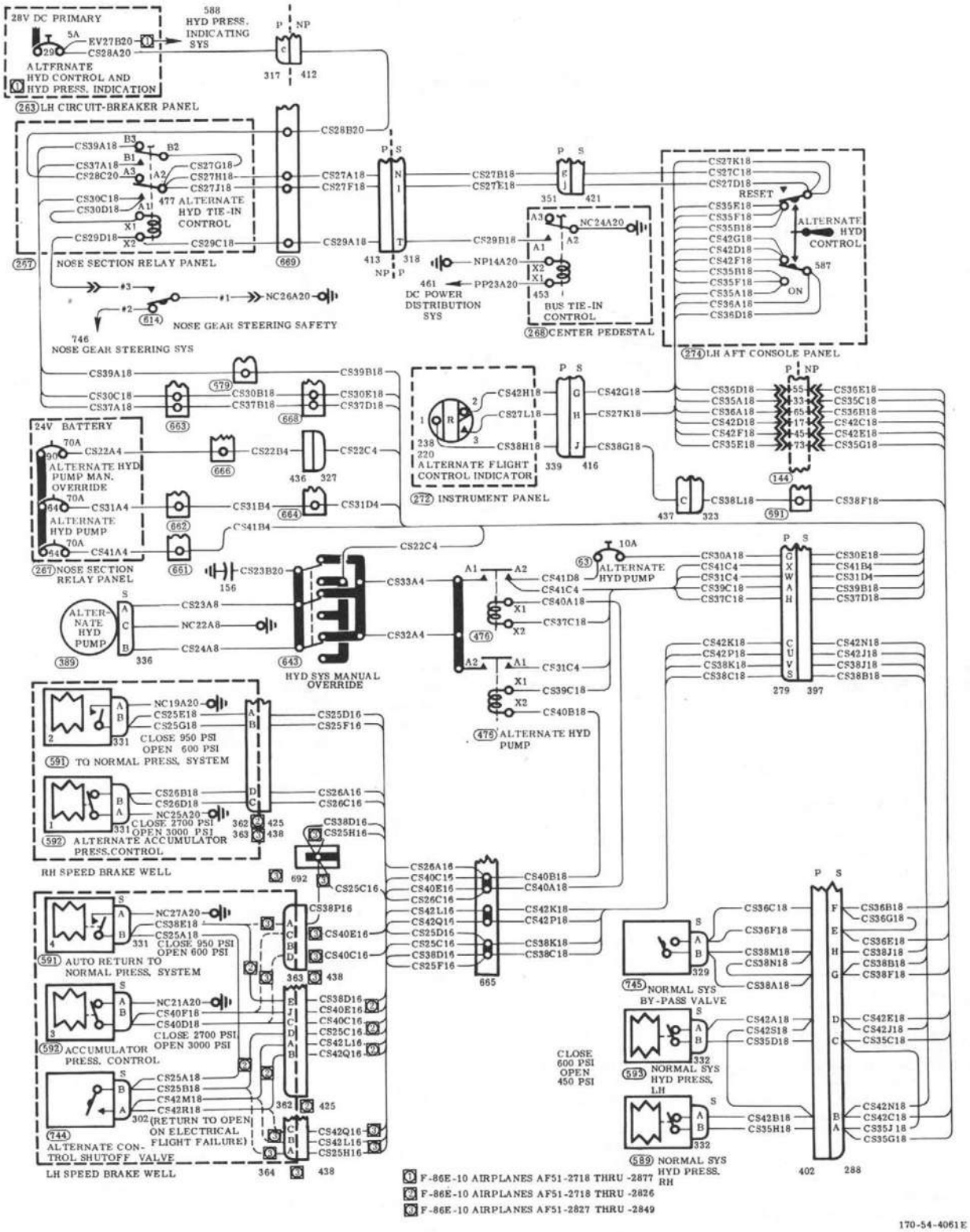
F-86E-1, F-86E-5, and F-86E-6 Airplanes

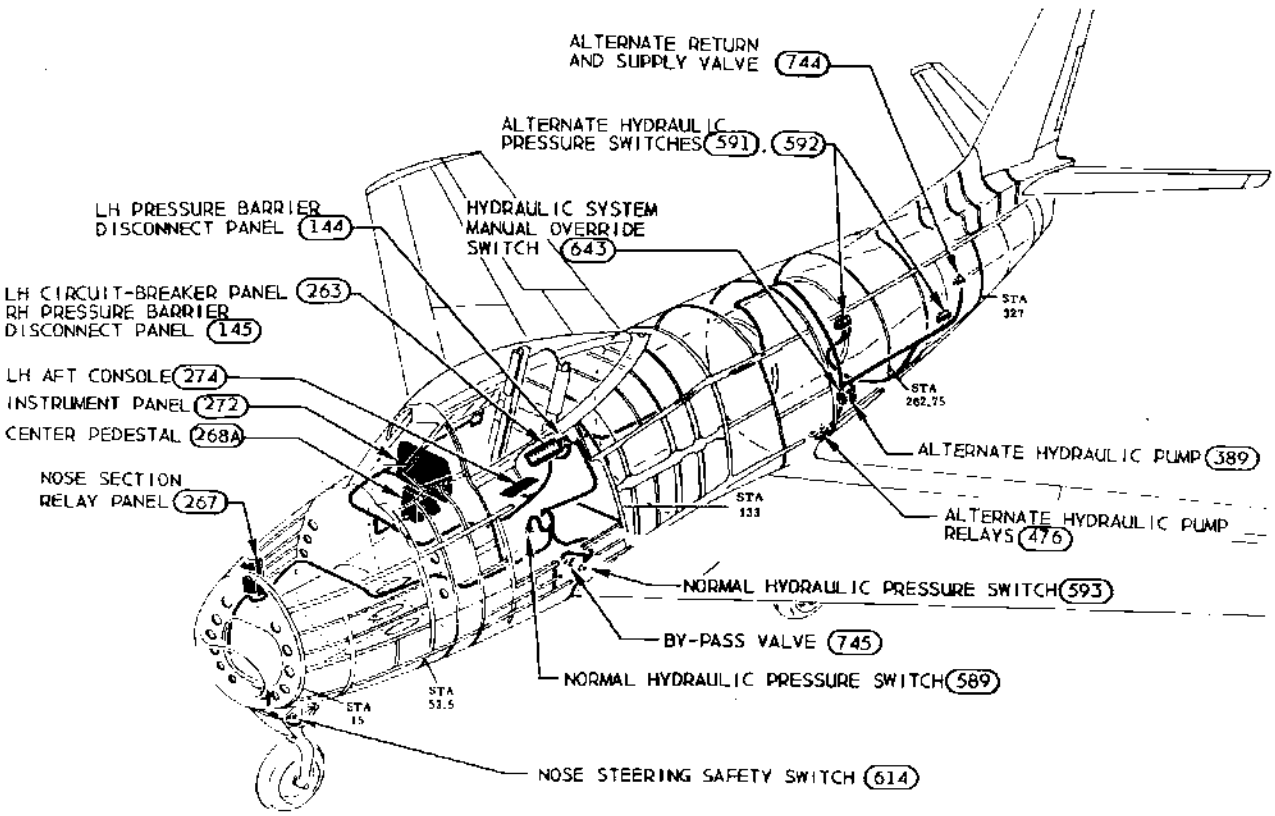


170-54-4060C

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
63	Circuit Breaker—Alternate Hydraulic Control	AN3161P10
64	Circuit Breaker—Alternate Hydraulic Pump	PDLM-70 (Klixon)
90	Circuit Breaker—Hydraulic Pump Manual Emergency Override	PDLM-70 (Klixon)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
156	Filter—Alternate Flight Control Pump	CP53B2EB405K
220	Lamp—Warning	AN3121-313
238	Light Assembly—Alternate Flight Control Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
288	Plug—Center Wing Hydraulic Pressure	AN3106B22-14S
302	Plug—Alternate Return and Supply Valve	AN3108B10SL-4S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
323	Plug—Gun Bay Pressure	AN3106B24-28S
327	Plug—Hydraulic Pump Manual Override	AN3106B16-12P
329	Plug—Normal Hydraulic By-pass Valve	AN3106B10SL-4S
331	Plug—Alternate Hydraulic Pressure Switch	AN3106B12S-3S
332	Plug—Normal Hydraulic Pressure Switch	AN3106B12S-3S
336	Plug—Alternate Hydraulic Pump	AN3106B20-19S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
351	Plug—Pedestal Disconnect	AN3106A32-7P
362	Plug—Speed Brake Well	AN3108B24-5P
363	Plug—Speed Brake Well	AN3108B14S-6P
364	Plug—Speed Brake Well	AN3106B14S-6P
389	Pump—Alternate Hydraulic	D-1000 (Hoover)
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
402	Receptacle—Center Wing Hydraulic Pressure	AN3101A22-14P
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
425	Receptacle—Speed Brake Well	AN3100A24-5S
436	Receptacle—Hydraulic Pump Manual Override	AN3100A16-12S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
438	Receptacle—Speed Brake Well	AN3100A14S-6S
453	Relay—Bus Tie-in Control	AN3316-1
476	Relay—Alternate Hydraulic Pump	AN3370-1
477	Relay—Alternate Hydraulic Tie-in Control	AN3312-1
587	Switch—Alternate Flight Control	1AT5 (Micro Switch)
588	Switch—Hydraulic Pressure Indicator	AN3021-1
589	Switch—Normal Hydraulic Pressure	172-58620 (NAA)
591	Switch—Alternate Hydraulic Pressure	172-58624-5 (NAA)
592	Switch—Alternate Hydraulic Pressure	172-58624-3 (NAA)
593	Switch—Normal Hydraulic Pressure	172-58615 (NAA)
614	Switch—Nose Wheel Steering Safety	AN3234-1
643	Switch—Alternate Hydraulic Pump Manual Override	8905K784 (Cutler-Hammer)
661	Terminal Block—Left Gun Bay	NAS45-416-2
662	Terminal Block—Right Gun Bay	NAS45-416-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
664	Terminal Block—Alternate Hydraulic Pump	AN3436-6-3
665	Terminal Block—Alternate Hydraulic System	NAS45-6-9
666	Terminal Block—Hydraulic System Emergency Override	NAS45-416-2
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
669	Terminal Block—Nose Junction Box	AN3436-2-18
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
692	Terminal Block—Speed Brake Well	AN3436-2-2
744	Valve—Alternate Hydraulic Return and Supply	172-58625 (NAA)
745	Valve—Normal Hydraulic By-pass	172-58616-3 (NAA)

Figure 10-20. Surface Control Hydraulic

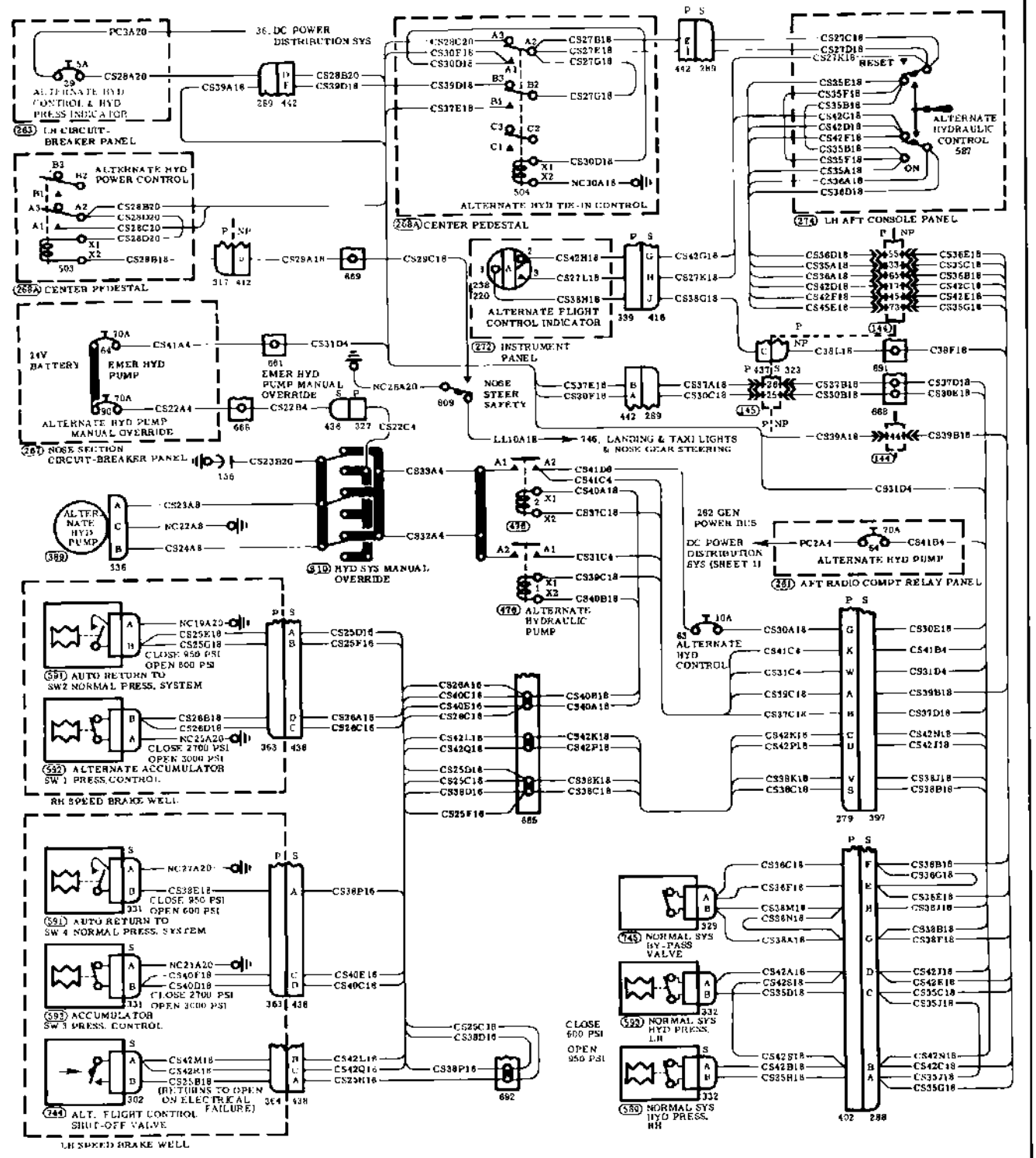

28V DC PRIMARY
5A
EV27B20
CS28A20
ALTERNATE HYD CONTROL AND HYD PRESS. INDICATION
588 HYD PRESS. INDICATING SYS
263 LH CIRCUIT-BREAKER PANEL
CS28B20
CS39A18
CS37A18
CS28C20
CS27G18
CS27H18
CS27J18
477 ALTERNATE HYD TIE-IN CONTROL
CS30C18
CS30D18
CS29D18
CS29C18
CS27A18
CS27F18
CS29A18
267 NOSE SECTION RELAY PANEL
669
CS27B18
CS27E18
CS29B18
NP14A20
PP23A20
461
DC POWER DISTRIBUTION SYS
NC24A20
BUS TIE-IN CONTROL
268 CENTER PEDESTAL
CS27K18
CS27C18
CS27D18
RESET
CS35E18
CS35F18
CS35B18
CS42G18
CS42D18
CS42F18
CS35B18
CS35F18
CS35A18
CS36A18
CS36D18
ALTERNATE HYD CONTROL
ON
587
274 LH AFT CONSOLE PANEL
#3
#1
#2
NC26A20
614 NOSE GEAR STEERING SAFETY
746 NOSE GEAR STEERING SYS
CS39A18
CS39B18
CS30C18
CS37A18
CS30B18
CS37B18
CS30E18
CS37D18
663
668
24V BATTERY
70A
CS22A4
ALTERNATE HYD PUMP MAN. OVERRIDE
CS22B4
CS22C4
666
436
327
CS31A4
CS31B4
CS31D4
664
ALTERNATE HYD PUMP
CS41A4
CS41B4
662
661
267 NOSE SECTION RELAY PANEL
CS23B20
156
CS33A4
CS32A4
643 HYD SYS MANUAL OVERRIDE
ALTER-NATE HYD PUMP
389
CS23A8
NC22A8
CS24A8
336
CS42H18
CS27L18
CS38H18
238
220
ALTERNATE FLIGHT CONTROL INDICATOR
272 INSTRUMENT PANEL
CS42G18
CS27K18
CS38G18
339
416
CS38L18
CS38F18
437
323
591
144
CS36D18
CS35A18
CS36A18
CS42D18
CS42F18
CS35E18
CS36E18
CS35C18
CS36B18
CS42C18
CS42E18
CS35G18
10A
63
ALTERNATE HYD PUMP
CS41D8
CS41C4
CS40A18
CS37C18
476
CS31C4
CS39C18
CS40B18
478 ALTERNATE HYD PUMP
CS30A18
CS41C4
CS31C4
CS39C18
CS37C18
CS30E18
CS41B4
CS31D4
CS39B18
CS37D18
CS42K18
CS42P18
CS38K18
CS38C18
CS42N18
CS42J18
CS38J18
CS38B18
279
397
NC19A20
CS25E18
CS25G18
CLOSE 950 PSI
OPEN 600 PSI
591 TO NORMAL PRESS. SYSTEM
331
CS25D16
CS25F16
CS26B18
CS26D18
NC25A20
CLOSE 2700 PSI
OPEN 3000 PSI
592 ALTERNATE ACCUMULATOR PRESS. CONTROL
362
363
425
438
CS26A16
CS26C16
CS38D16
CS25H16
RH SPEED BRAKE WELL
692
CS25C16
CS26A16
CS40C15
CS40E16
CS26C16
CS42L16
CS42Q16
CS25D16
CS25C16
CS38D16
CS25F16
CS40B18
CS40A18
CS42K18
CS42P18
CS38K18
CS38C18
665
NC27A20
CS38E18
CS25A18
CLOSE 950 PSI
OPEN 600 PSI
591 AUTO RETURN TO NORMAL PRESS. SYSTEM
CS38P16
CS40E16
CS40C16
363
438
NC21A20
CS40F18
CS40D18
CLOSE 2700 PSI
OPEN 3000 PSI
592 ACCUMULATOR PRESS. CONTROL
CS38D16
CS40E16
CS40C16
CS25C16
CS42L16
CS42Q16
CS25A18
CS25B18
CS42M18
CS42R18
302
(RETURN TO OPEN ON ELECTRICAL FLIGHT FAILURE)
744 ALTERNATE CONTROL SHUTOFF VALVE
362
425
CS42Q16
CS42L16
CS25H16
LH SPEED BRAKE WELL
364
438
CS36C18
CS36F18
CS38M18
CS38N18
CS38A18
745 NORMAL SYS BY-PASS VALVE
329
CS42A18
CS42S18
CS35D18
693 NORMAL SYS HYD PRESS. LH
332
CLOSE 600 PSI OPEN 450 PSI
CS42B18
CS35H18
589 NORMAL SYS HYD PRESS. RH
332
CS36B18
CS36G18
CS36E18
CS38J18
CS38B18
CS38F18
CS42E18
CS42J18
CS35C18
CS42N18
CS42C18
CS35J18
CS35G18
402
288
F-86E-10 AIRPLANES AF51-2718 THRU -2877
F-86E-10 AIRPLANES AF51-2718 THRU -2826
F-86E-10 AIRPLANES AF51-2827 THRU -2849
170-54-4061E

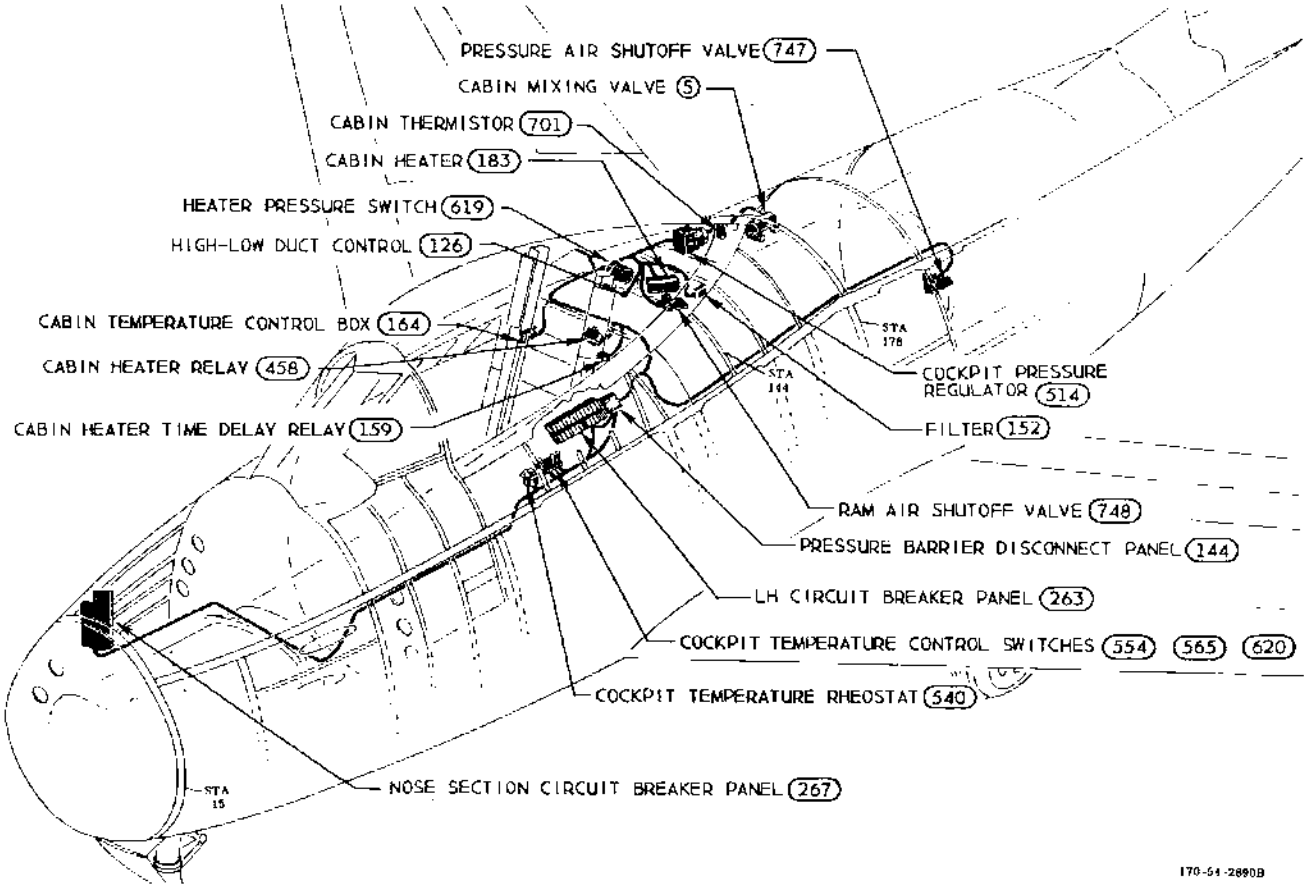


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
63	Circuit Breaker—Alternate Hydraulic Control	AN3161P10
64	Circuit Breaker—Alternate Hydraulic Pump	PDLM-70 (Klixon)
90	Circuit Breaker—Hydraulic Pump Manual Emergency Override	PDLM-70 (Klixon)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
156	Filter—Alternate Flight Control Pump	CP53B2B40SK
220	Lamp—Warning	AN3121-313
238	Light Assembly—Alternate Flight Control Indicator	AN3157-4
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Alternate Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268A	Panel- Pedestal	172-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
274	Panel—Left-hand Aft Console	172-54065 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
288	Plug—Center Wing Hydraulic Pressure	AN3106B22-14S
289	Plug—Pedestal Disconnect	AN3106B32-7S
302	Plug—Alternate Return and Supply Valve	AN3108B10SL-4S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
323	Plug—Gun Bay Pressure	AN3106B24-28S
327	Plug—Hydraulic Pump Manual Override	AN3106B16-12P
329	Plug—Normal Hydraulic By-pass Valve	AN3106B10SL-4S
331	Plug—Alternate Hydraulic Pressure Switch	AN3106B12S-3S
332	Plug—Normal Hydraulic Pressure Switch	AN3106B12S-3S
336	Plug—Alternate Hydraulic Pump	AN3106B20-19S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
363	Plug—Speed Brake Well	AN3108B14S-6P
364	Plug—Speed Brake Well	AN3106B14S-6P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
389	Pump—Alternate Hydraulic	D-1000 (Hoover)
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
402	Receptacle—Center Wing Hydraulic Pressure	AN3101A22-14P
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
436	Receptacle—Hydraulic Pump Manual Override	AN3100A16-12S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
438	Receptacle—Speed Brake Well	AN3100A14S-6S
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
476	Relay—Alternate Hydraulic Pump	AN3370-1
503	Relay—Alternate Hydraulic Control	AN3311-1
504	Relay—Alternate Hydraulic Tie-in Control	AN3312-1
587	Switch—Alternate Flight Control	1AT5 (Micro Switch)
589	Switch—Normal Hydraulic Pressure	172-58620 (NAA)
591	Switch—Alternate Hydraulic Pressure	172-58624-5 (NAA)
592	Switch—Alternate Hydraulic Pressure	172-58624-3 (NAA)
593	Switch—Normal Hydraulic Pressure	172-58615 (NAA)
643	Switch—Alternate Hydraulic Pump Manual Override	8905K784 (Cutler-Hammer)
661	Terminal Block—Left-hand Gun Bay	NAS45-416-2
665	Terminal Block—Alternate Hydraulic System	NAS45-6-9
666	Terminal Block—Hydraulic System Emergency Override	NAS45-416-2
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-17
669	Terminal Block—Nose Junction Box	AN3436-2-18
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
692	Terminal Block—Speed Brake Well	AN3436-2-1
744	Valve—Alternate Hydraulic Return and Supply	172-58625 (NAA)
745	Valve—Normal Hydraulic By-pass	172-58616-3 (NAA)
809	Switch—Nose Steering Safety	175-54332 (NAA)

Figure 10-21. Surface Control Hydraulic

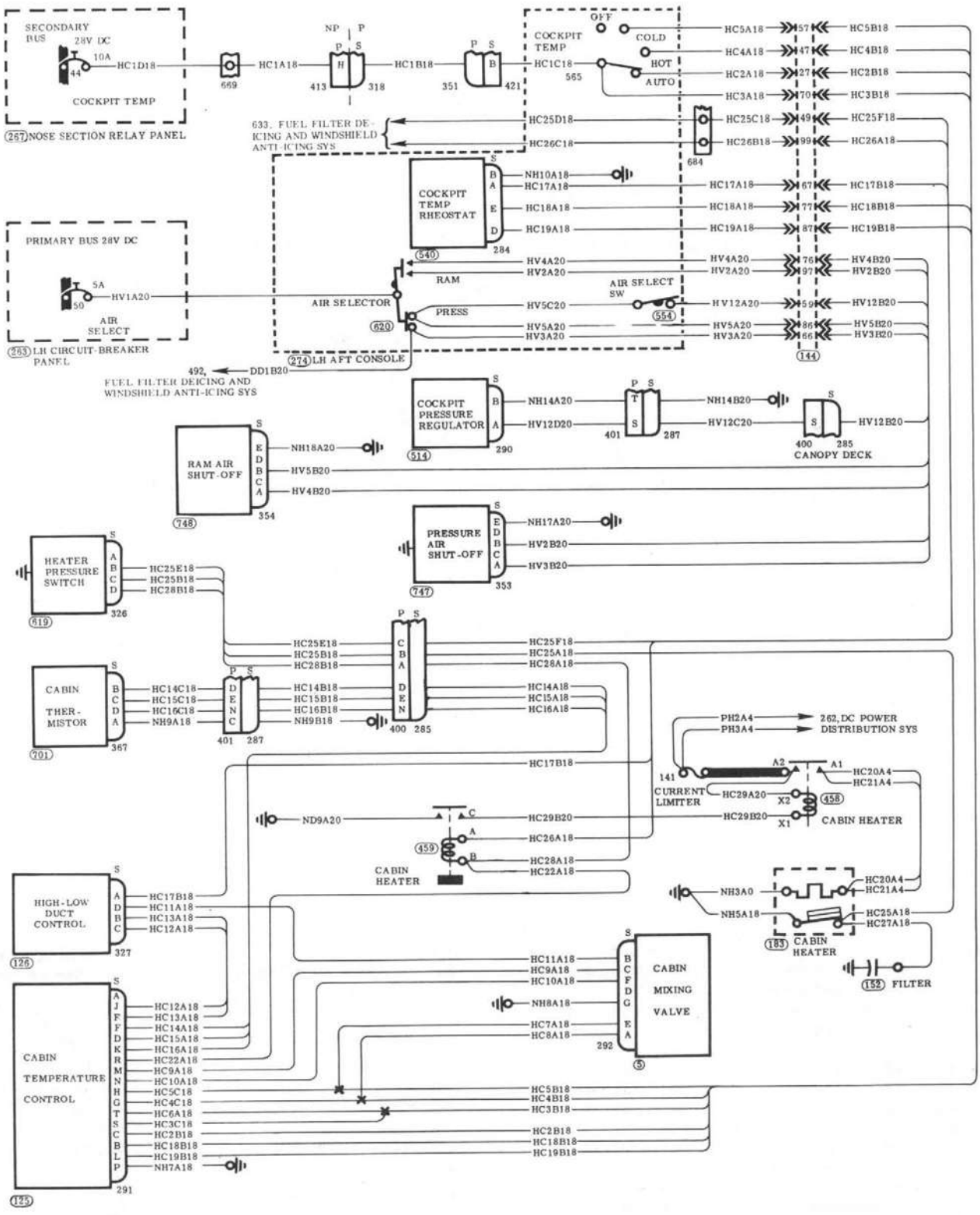

36. DC POWER DISTRIBUTION SYS
(263) LH CIRCUIT-BREAKER PANEL
ALTERNATE HYD CONTROL & HYD PRESS INDICATOR
ALTERNATE HYD POWER CONTROL
(268A) CENTER PEDESTAL
ALTERNATE HYD TIE-IN CONTROL
(274) LH AFT CONSOLE PANEL
RESET
ALTERNATE HYDRAULIC CONTROL 587
ON
ALTERNATE FLIGHT CONTROL INDICATOR
(272) INSTRUMENT PANEL
24V BATTERY
EMER HYD PUMP
EMER HYD PUMP MANUAL OVERRIDE
ALTERNATE HYD PUMP MANUAL OVERRIDE
NOSE STEER SAFETY
(261) NOSE SECTION CIRCUIT-BREAKER PANEL
LL10A18 → 746, LANDING & TAXI LIGHTS & NOSE GEAR STEERING
ALTER NATE HYDS PUMP
(510) HYD SYS MANUAL OVERRIDE
(479) ALTERNATE HYDRAULIC PUMP
282 GEN POWER BUS
DC POWER DISTRIBUTION SYS (SHEET 1)
ALTERNATE HYD PUMP
(251) AFT RADIO COMPT RELAY PANEL
ALTERNATE HYD CONTROL
(591) AUTO RETURN TO SW2 NORMAL PRESS. SYSTEM
CLOSE 950 PSI OPEN 800 PSI
(592) ALTERNATE ACCUMULATOR SW 1 PRESS. CONTROL
CLOSE 2700 PSI OPEN 3000 PSI
RH SPEED BRAKE WELL
(591) AUTO RETURN TO SW 4 NORMAL PRESS. SYSTEM
CLOSE 950 PSI OPEN 800 PSI
(593) ACCUMULATOR SW 3 PRESS. CONTROL
CLOSE 2700 PSI OPEN 3000 PSI
(744) ALT. FLIGHT CONTROL SHUT-OFF VALVE
(RETURNS TO OPEN ON ELECTRICAL FAILURE)
LH SPEED BRAKE WELL
(745) NORMAL SYS BY-PASS VALVE
(592) NORMAL SYS HYD PRESS. LH
(590) NORMAL SYS HYD PRESS. RH
CLOSE 600 PSI
OPEN 950 PSI
112-54 5140



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
5	Actuator—Mixing Valve	33800G-4 (Pacific Airmotive)
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-icing	AN3161P10
50	Circuit Breaker—Air Selector	AN3161P5
125	Control Box—Cabin Temperature	CYLZ2640 (Barber-Colman)
126	Control Box—Hi-Lo Element Heat	AYLF3001-1 (Barber-Colman)
141	Current Limiter—Cockpit Heater 150-ampere	FLLE (Burndy)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
152	Filter—Cabin and Windshield Heater	CP53B2E8405K
183	Heater—Cockpit and Windshield Heater	D312 (Coln)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
274	Panel—Left Aft Console	151-53050-30 (NAA)
284	Plug—Cabin Heater Rheostat	AN3106B14S-5S
285	Plug—Canopy Deck Disconnect	AN3108B20-29S
287	Plug—Canopy Pullaway	AN3107B20-29S
290	Plug—Cockpit Pressure Regulator	AN3106B10SL-4S
291	Plug—Cockpit Temperature Control	ANJ106B20-29S
292	Plug—Cockpit Temperature Mixing Valve	AN3106B16S-1S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
326	Plug—Cockpit Heater Pressure Switch	AN3106B18-10S
327	Plug—Hi-Lo Heat Element	AN3106B14S-2S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
351	Plug—Pedestal Disconnect	AN3106A32-7P
353	Plug—Pressure Air Solenoid Valve	AN3106B14S-5S
354	Plug—Ram-air Solenoid Valve	AN3106B14S-5S
367	Plug—Thermistor	AN3106B14S-2S
400	Receptacle—Canopy Deck Disconnect	AN3100C20-29P
401	Receptacle—Canopy Pullaway	AN3100A20-29P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
458	Relay—Cockpit Heater Power	AN3370-1
459	Relay—Cockpit Heater Time Delay	32439 (B-9-A)
514	Regulator—Cockpit Pressure	14840-12.5-5.00-2.75 (AiResearch)
540	Rheostat—Tandem	BYLZ 2292-1 (Barber-Colman)
554	Switch—Air Selector	AN3234-1
565	Switch—Cockpit Temperature Control	45A7400-2 (Cutler-Hammer)
619	Switch—Heater Pressure	PG208AS2 (Minneapolis-Honeywell)
620	Switch—Ram Pressure Selector	BZ-3YDT (Micro Switch)
669	Terminal Block—Nose Junction Box	AN3436-2-18
684	Terminal Block—Windshield Heater Switch	AN3436-2-4
701	Thermistor—Cabin Temperature	AYLF2970 (Barber-Colman)
747	Valve—Pressure Air Shutoff	WE441-2D (Whittaker)
748	Valve—Ram-air Shutoff	W7946-2D (Whittaker)

Figure 10-22. Cockpit Air Conditioning and Pressurizing


SECONDARY BUS 28V DC
10A
HC1D18
44
COCKPIT TEMP
267 NOSE SECTION RELAY PANEL
669
HC1A18
NP P
P S
H
413
318
HC1B18
P S
B
351
421
COCKPIT TEMP
OFF
COLD
HOT
AUTO
HC1C18
565
HC5A18
HC4A18
HC2A18
HC3A18
157
147
127
70
HC5B18
HC4B18
HC2B18
HC3B18
633, FUEL FILTER DE-ICING AND WINDSHIELD ANTI-ICING SYS
HC25D18
HC26C18
HC25C18
HC26B18
684
49
99
HC25F18
HC26A18
COCKPIT TEMP RHEOSTAT
S
B A E D
284
540
NH10A18
HC17A18
HC18A18
HC19A18
HC17A18
HC18A18
HC19A18
67
77
87
HC17B18
HC18B18
HC19B18
PRIMARY BUS 28V DC
5A
50
HV1A20
AIR SELECT
263 LH CIRCUIT-BREAKER PANEL
AIR SELECTOR
620
RAM
PRESS
HV4A20
HV2A20
HV5C20
HV5A20
HV3A20
AIR SELECT SW
554
HV4A20
HV2A20
HV12A20
HV5A20
HV3A20
76
97
59
86
66
144
HV4B20
HV2B20
HV12B20
HV5B20
HV3B20
274 LH AFT CONSOLE
492, DD1B20
FUEL FILTER DEICING AND WINDSHIELD ANTI-ICING SYS
COCKPIT PRESSURE REGULATOR
S
B A
290
514
NH14A20
HV12D20
P S
T S
401
287
NH14B20
HV12C20
S
S
400
285
HV12B20
CANOPY DECK
RAM AIR SHUT-OFF
S
E D B C A
354
748
NH18A20
HV5B20
HV4B20
PRESSURE AIR SHUT-OFF
S
E D B C A
353
747
NH17A20
HV2B20
HV3B20
HEATER PRESSURE SWITCH
S
A B C D
326
819
HC25E18
HC25B18
HC28B18
HC25E18
HC25B18
HC28B18
P S
C B A D E N
400 285
HC25F18
HC25A18
HC28A18
HC14A18
HC15A18
HC16A18
CABIN THER-MISTOR
S
B C D A
367
701
HC14C18
HC15C18
HC16C18
NH9A18
P S
D E N C
401 287
HC14B18
HC15B18
HC16B18
NH9B18
HC17B18
PH2A4
PH3A4
262, DC POWER DISTRIBUTION SYS
141
A2
A1
CURRENT LIMITER
HC29A20
X2
X1
458
HC20A4
HC21A4
CABIN HEATER
ND9A20
C
A
B
459
CABIN HEATER
HC29B20
HC26A18
HC28A18
HC22A18
HIGH-LOW DUCT CONTROL
S
A D B C
327
126
HC17B18
HC11A18
HC13A18
HC12A18
NH3A0
NH5A18
HC20A4
HC21A4
HC25A18
HC27A18
183 CABIN HEATER
152 FILTER
HC11A18
HC9A18
HC10A18
NH8A18
HC7A18
HC8A18
S
B C F D G E A
292
CABIN MIXING VALVE
5
CABIN TEMPERATURE CONTROL
S
A J F F D K R M N H G T S C B L P
291
125
HC12A18
HC13A18
HC14A18
HC15A18
HC16A18
HC22A18
HC9A18
HC10A18
HC5C18
HC4C18
HC6A18
HC3C18
HC2B18
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HC19B18
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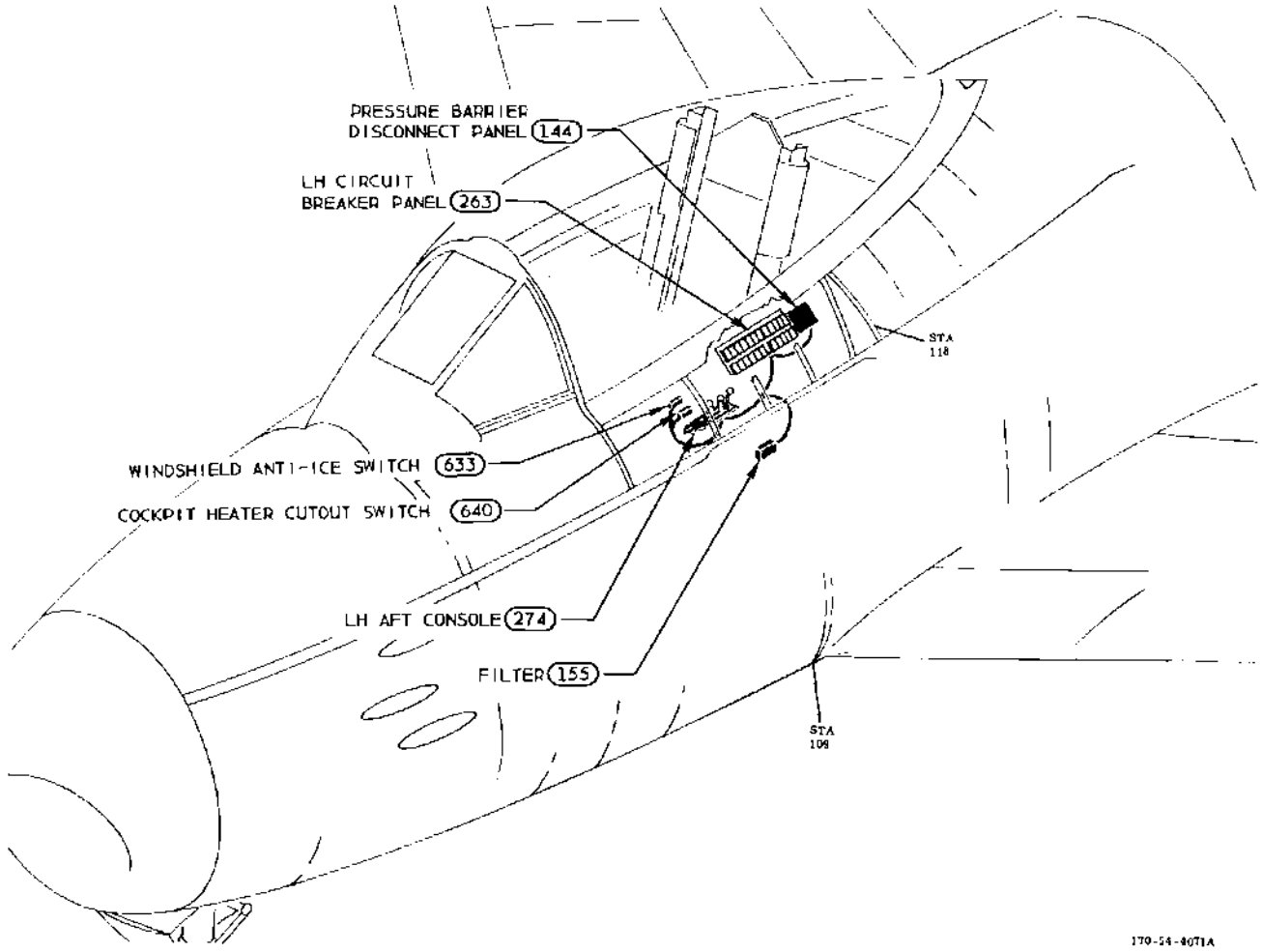
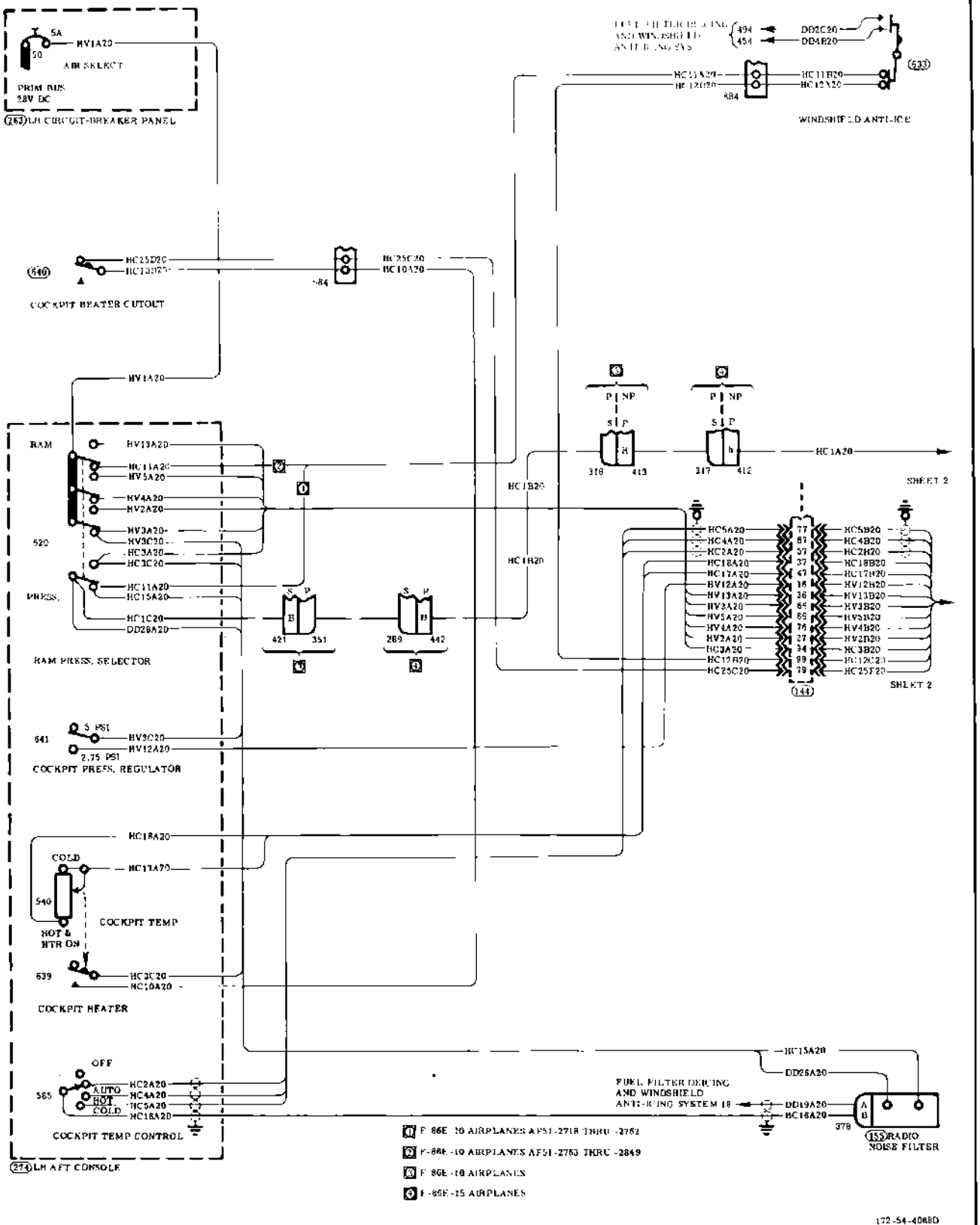
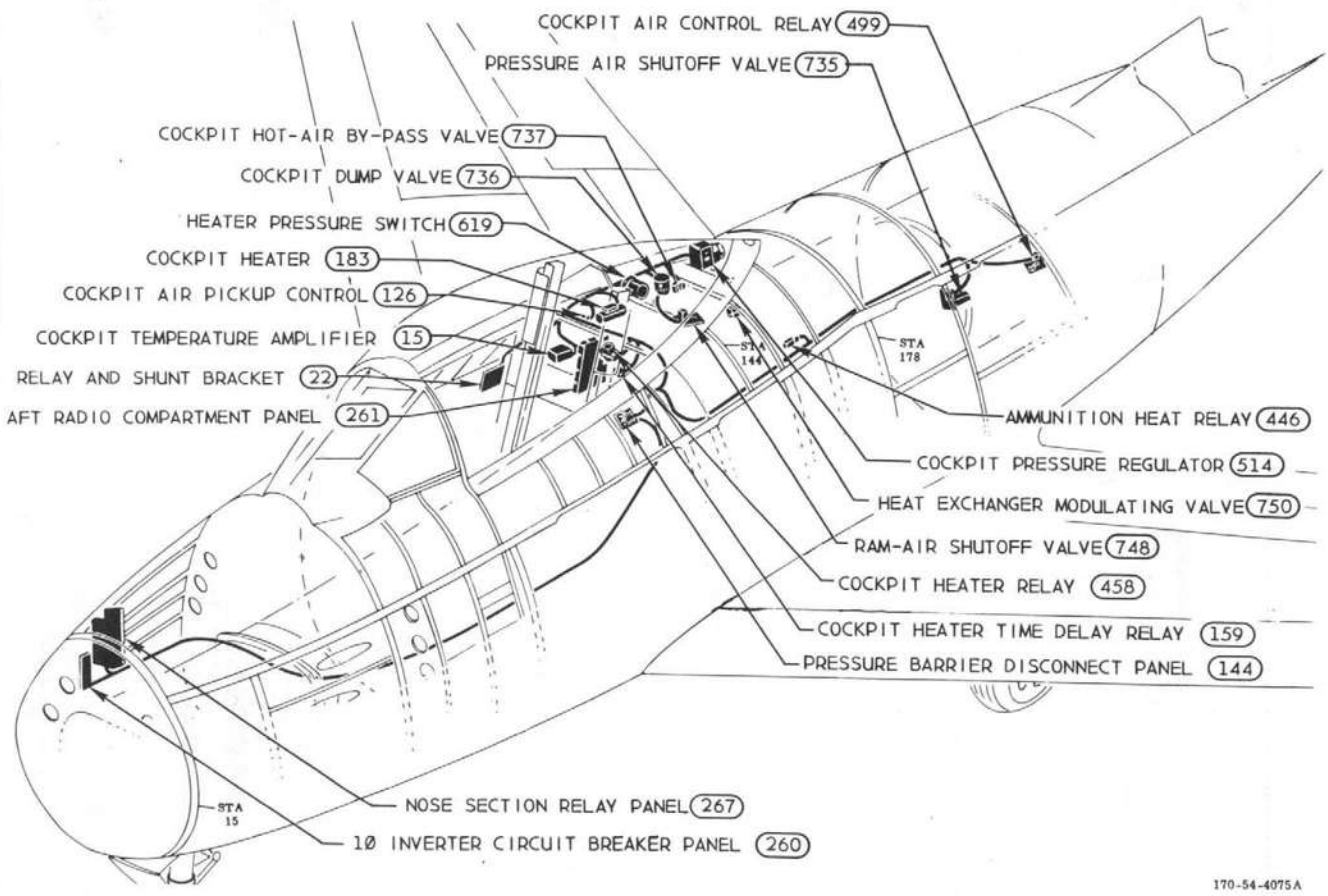


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
50	Circuit Breaker—Air Selector	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
155	Filter—Heating and Venting Radio Noise	12288 (AiResearch)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
351	Plug—Pedestal Disconnect	AN3106A32-7P
379	Plug—Heating and Venting Radio Noise Filter	AN3106B12S-3P
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
540	Rheostat—Cockpit Temperature	30088 (AiResearch)
565	Switch—Cockpit Temperature Control	45A7400-2 (Cutler-Hammer)
620	Switch—Ram Pressure Selector	AN3227-3
633	Switch—Windshield Anti-ice Heater	AN3216-1
639	Switch—Cockpit Heater	AN3234-1
640	Switch—Cockpit Heater Cutout	AN3234-1
641	Switch—Cockpit Pressure Regulator	AN3021-2
684	Terminal Block—Windshield Heater Switch	NAS45-6-6

Figure 10-23. Cockpit Air Conditioning and Pressurizing



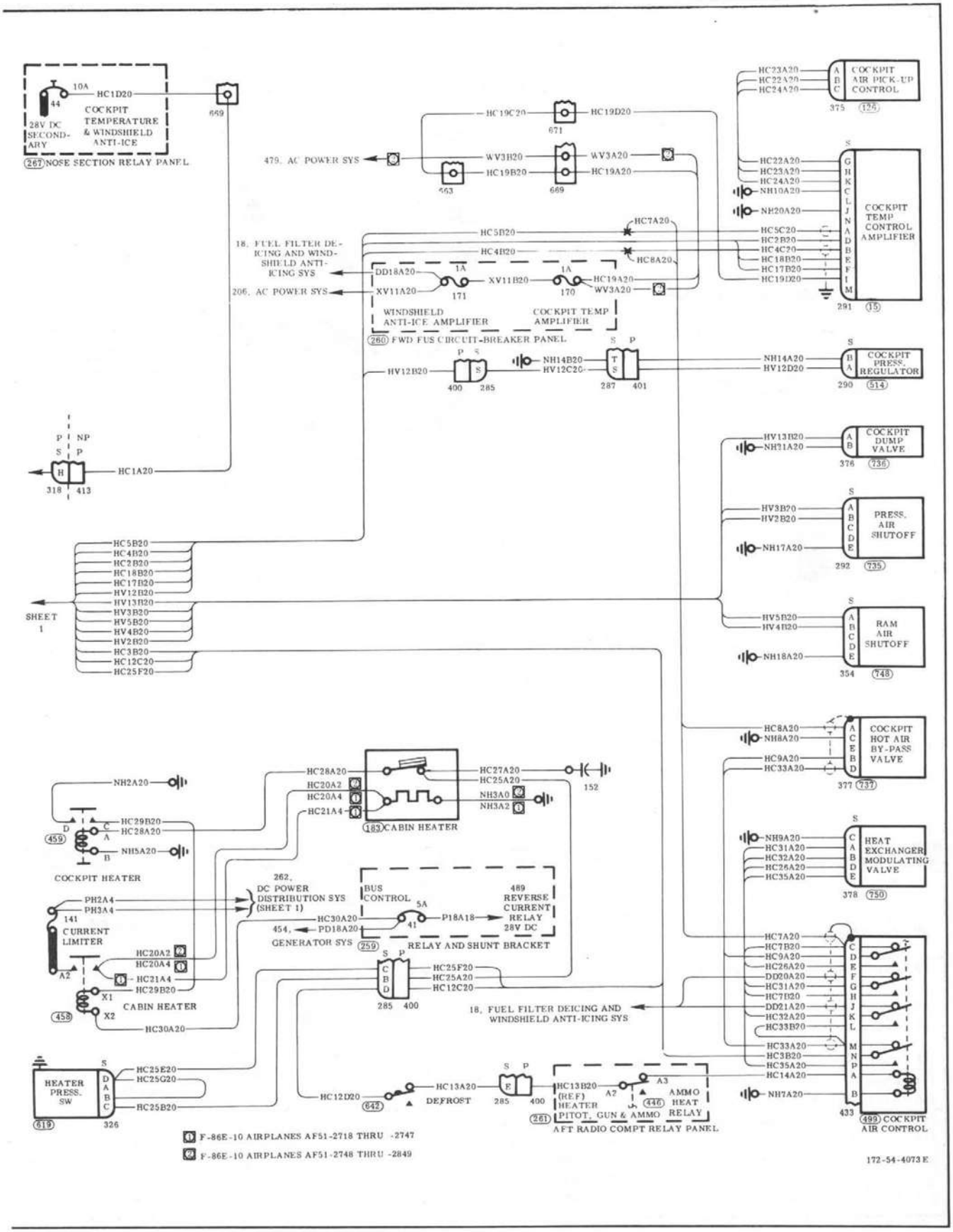
Systems—F-86E-10 and F-86E-15 Airplanes (Sheet 1 of 2)



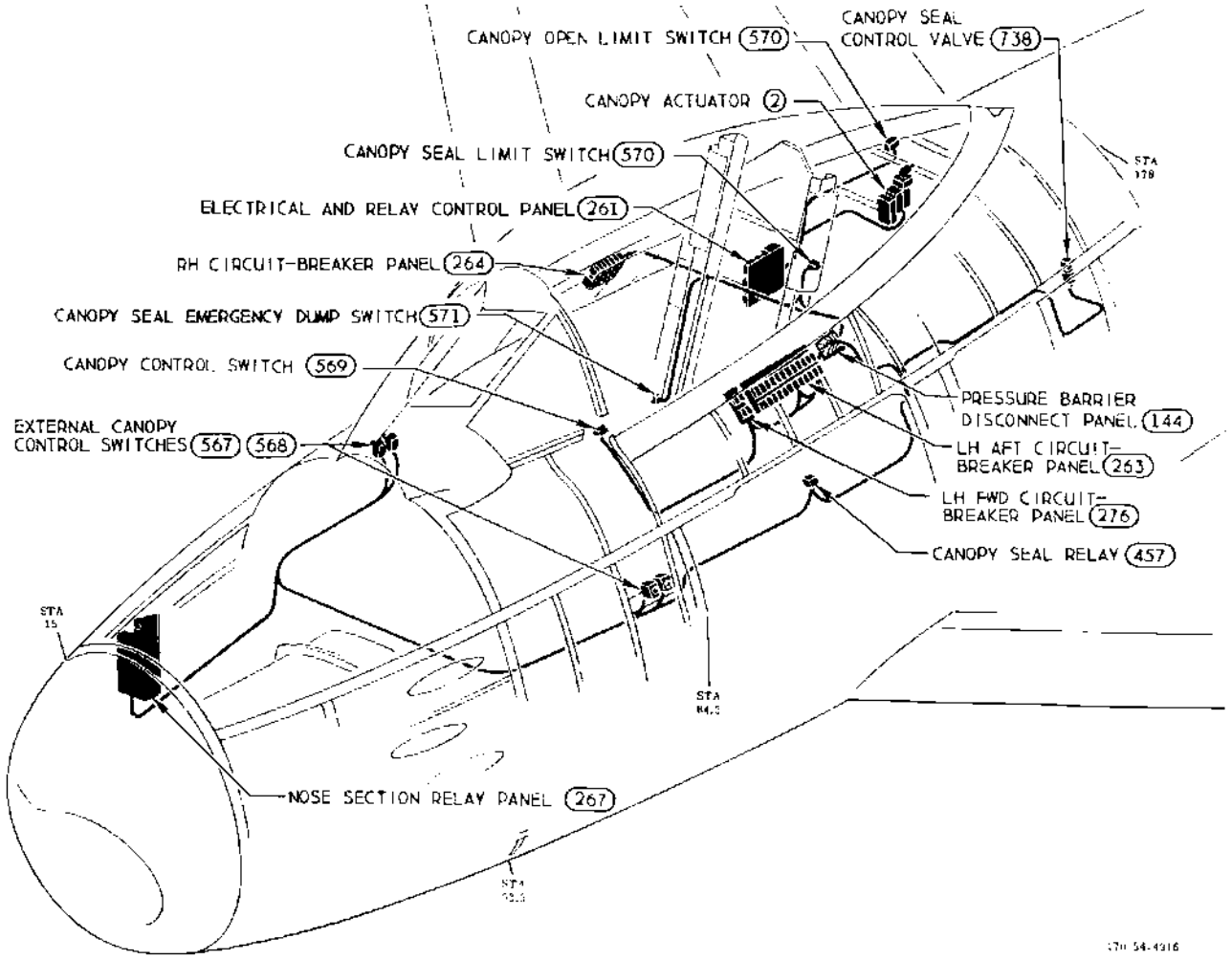
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
15	Amplifier—Cockpit Temperature Control	30058 (AiResearch)
41	Circuit Breaker—Bus Control Relay	PSA-5 (Klixon)
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-icing	AN3161P5
126	Control Box—Cockpit Air Pickup	33500-05 (AiResearch)
141	Current Limiter—Cockpit Heater 150-ampere	FLLE (Burndy)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
152	Filter—Cockpit and Windshield Heater	CP53B2EB405K
170	Fuse—Cockpit Temperature Control Amplifier	AGC 1 (Bussmann)
171	Fuse—Windshield Anti-icing Control Amplifier	AGC 1 (Bussmann)
183	Heater—Cockpit 4-kilowatt	C885 (Cole)
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
285	Plug—Canopy Deck Disconnect	AN3108B20-29S
287	Plug—Canopy Pullaway	AN3107B20-29S
290	Plug—Cockpit Pressure Regulator	AN3106B10SL-4S
291	Plug—Cockpit Temperature Control Amplifier	AN3106B20-27S
292	Plug—Cockpit Air Shutoff Valve	AN3106B14S-5S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
326	Plug—Cockpit Heater Pressure Switch	AN3106B18-10S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
354	Plug—Ram-air Solenoid Valve	AN3106B14S-5S
375	Plug—Cockpit Air Pickup Control	AN3106B10SL-3S
376	Plug—Cockpit Dump Valve	AN3108B10SL-4S
377	Plug—Cockpit Hot-air By-pass Valve	AN3106B14S-5S
378	Plug—Heat Exchanger Modulating Valve	AN3106B14S-5S
400	Receptacle—Canopy Deck Disconnect	AN3100C20-29P
401	Receptacle—Canopy Pullaway	AN3100A20-29P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
433	Receptacle—Cockpit Air Control Relay	AN3102A22-19S
446	Relay—Ammunition Heat Control	AN3316-1
458	Relay—Cockpit Heater Power	AN3370-1
459	Relay—Cockpit Heater Time Delay	32439, Type B-9-A
499	Relay—Cockpit Air Control	AN3310-1
514 *	Regulator—Cockpit Pressure	14840-12.5-5.00-2.75 (AiResearch)
619	Switch—Heater Pressure	PG208AS2 (Minneapolis-Honeywell)
642	Switch—Defrost	BZ-7RQ1T (Micro Switch)
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
671	Terminal Block—Overvoltage Relay	AN3436-2-8
735	Valve—Cockpit Air Shutoff	WB008-1½ (Whittaker)
736	Valve—Cockpit Dump	550120 (Pacific Airmotive)
737	Valve—Cockpit Hot-air By-pass	93750-3 (AiResearch)
748	Valve—Ram-air Shutoff	W7946-2D (Whittaker)
750	Valve—Heat Exchanger Modulating	94510-2 (AiResearch)

Figure 10-23. Cockpit Air Conditioning and Pressurizing



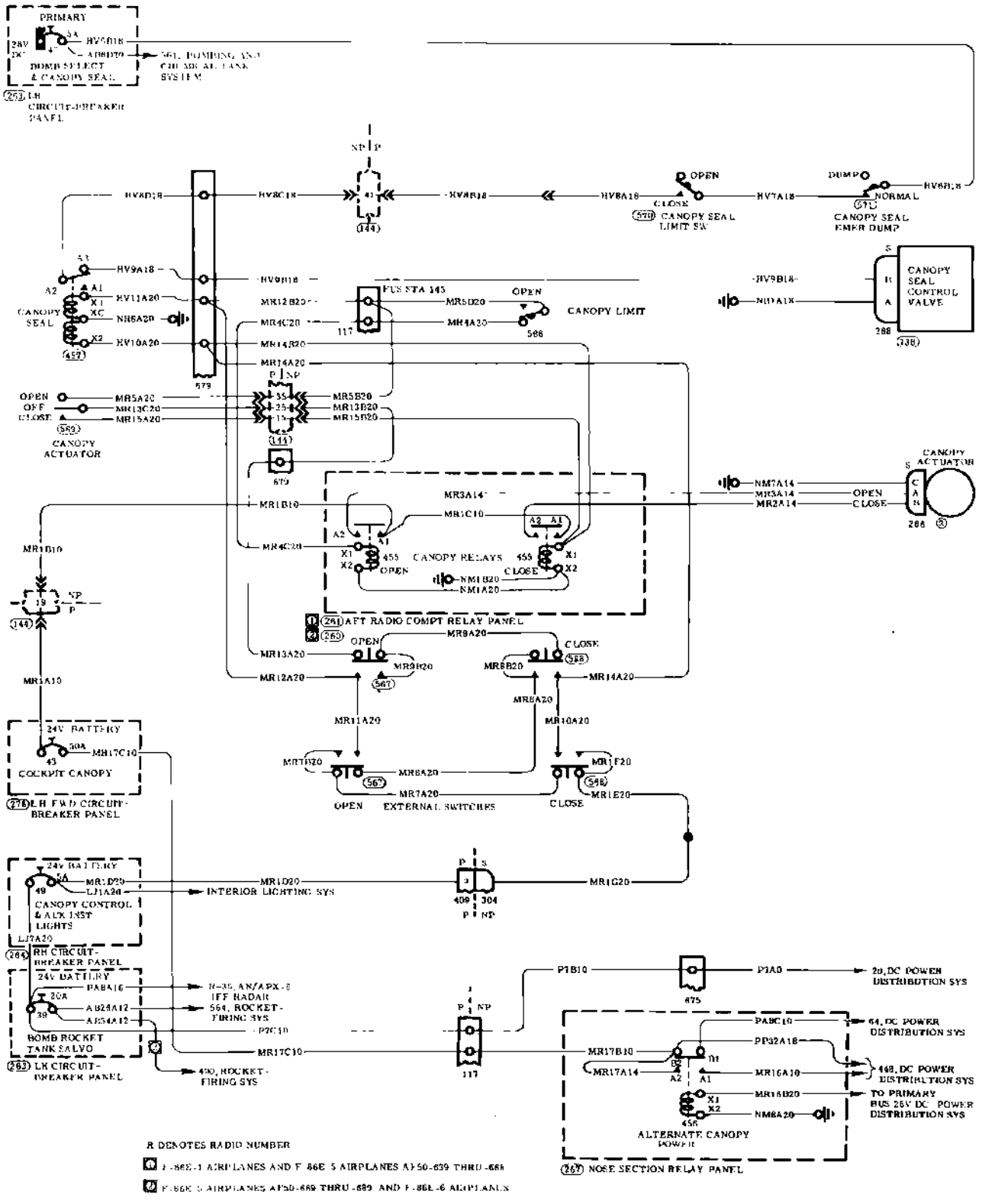
Systems—F-86E-10 and F-86E-15 Airplanes (Sheet 2 of 2)



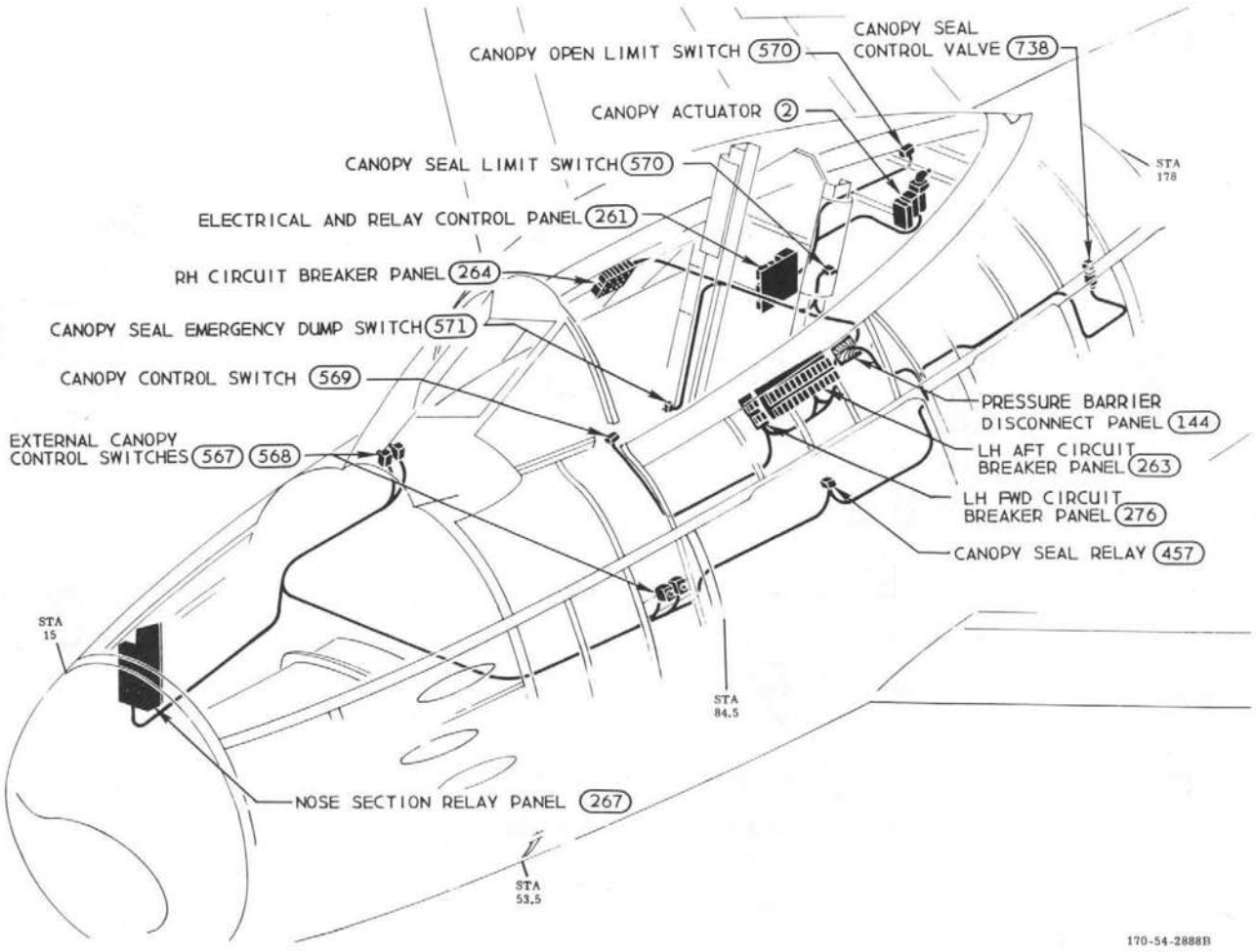
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
2	Actuator—Canopy	151-54176 (NAA) [Reworked D-380-1 (Hoover)]
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
43	Circuit Breaker—Cockpit Canopy	AN3161P50
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
117	Connector—Pressure Block	140-54008 (NAA)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
260	Panel—Aft Radio Compartment Relay	151-54122-40 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
286	Plug—Canopy Actuator	AN3106B14S-7S
288	Plug—Canopy Seal Valve	AN3106B12S-3S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
455	Relay—Canopy Actuator	AN3350-1
456	Relay—Canopy Alternate Power	AN3353-1
457	Relay—Canopy Seal	233-51A (Leach)
566	Switch—Canopy Open Limit	AN3210-1
567	Switch—External Canopy Open	BZ-3YST (Micro Switch)
568	Switch—External Canopy Close	BZ-3YST (Micro Switch)
569	Switch—Pilot's Canopy Operating	AN3022-5
570	Switch—Canopy Seal Limit	AN3215-1
571	Switch—Canopy Seal Dump	BZ-7RQ2T (Micro Switch)
675	Terminal Block—Battery	NAS45-416-1
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
738	Valve—Canopy Seal	20794-2 (Saval)

Figure 10-24. Canopy Actuator and Canopy Pressure Seal



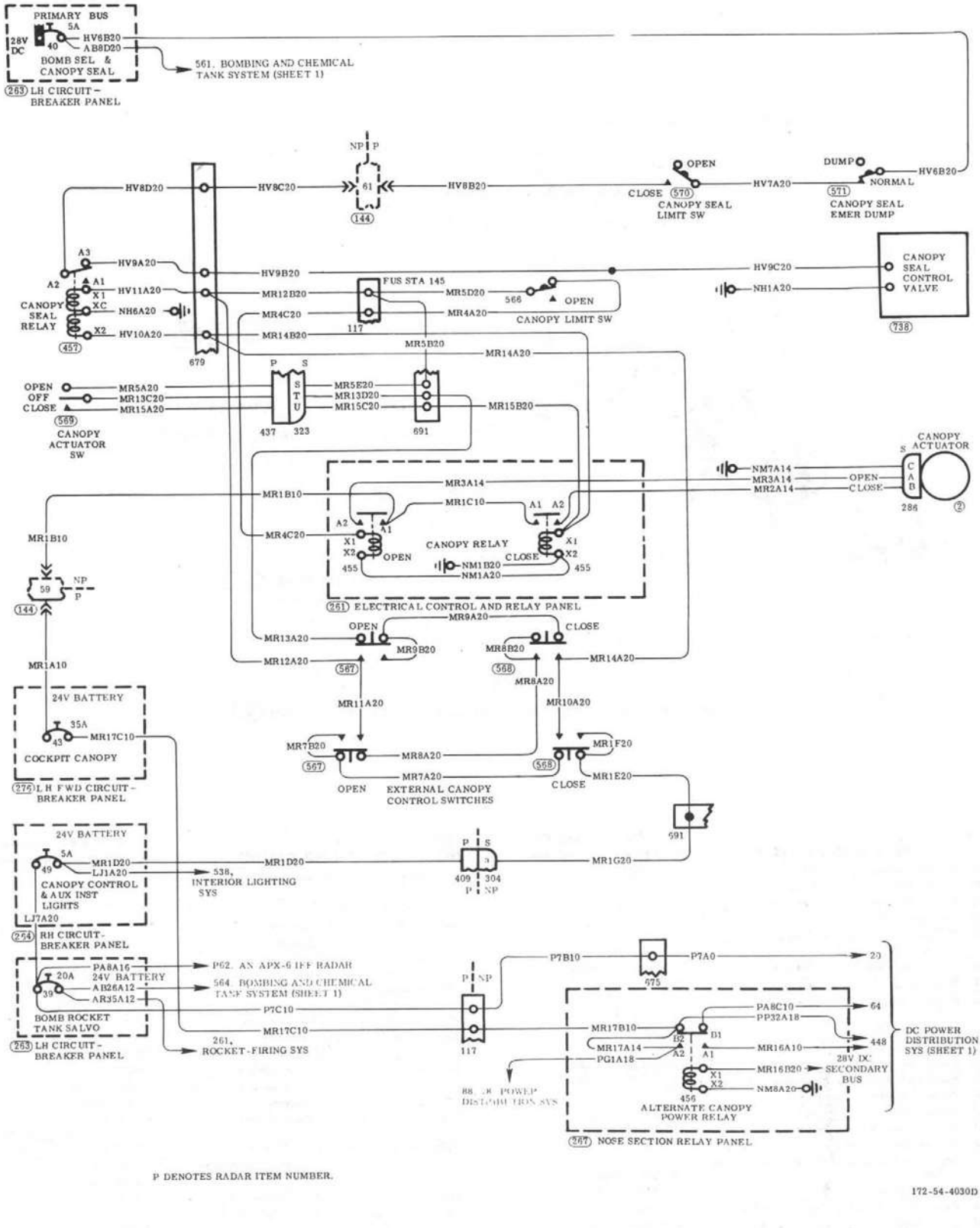
System—F-86E-1, F-86E-5, and F-86E-6 Airplanes



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
2	Actuator—Canopy	151-54176 (NAA) [Reworked D-380-1 (Hoover)]
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
43	Circuit Breaker—Cockpit Canopy	AN3161P35
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
117	Connector—Pressure Block	140-54008 (NAA)
144	Disconnect—Pressure Left-hand	YHS100S-6 (Burndy)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
286	Plug—Canopy Actuator	AN3106B14S-7S
288	Plug—Center Wing Hydraulic Pressure	AN3106B22-14S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
323	Plug—Gun Bay Pressure	AN3106B24-28S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
455	Relay—Canopy Actuator	AN3350-1
456	Relay—Canopy Alternate Power	AN3353-1
457	Relay—Canopy Seal	233-51A (Leach)
566	Switch—Canopy Open Limit	AN3210-1
567	Switch—External Canopy Open	BZ-3YST (Micro Switch)
568	Switch—External Canopy Close	BZ-3YST (Micro Switch)
569	Switch—Pilot's Canopy Operating	AN3022-5
570	Switch—Canopy Seal Limit	AN3215-1
571	Switch—Canopy Seal Dump	BZ-7RQIT (Micro Switch)
675	Terminal Block—Battery	NAS45-416-1
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
738	Valve—Canopy Seal	10211 (Carma)

Figure 10-25. Canopy Actuator and Canopy Pressure


PRIMARY BUS
28V DC
5A
40
HV6B20
AB8D20
BOMB SEL & CANOPY SEAL
263 LH CIRCUIT-BREAKER PANEL
561, BOMBING AND CHEMICAL TANK SYSTEM (SHEET 1)
NP P
61
144
HV8D20
HV8C20
HV8B20
OPEN
CLOSE 570
CANOPY SEAL LIMIT SW
HV7A20
DUMP
NORMAL
571
CANOPY SEAL EMER DUMP
HV6B20
CANOPY SEAL CONTROL VALVE
738
HV9C20
NH1A20
A3
A2
A1
X1
XC
X2
CANOPY SEAL RELAY
457
HV9A20
HV11A20
NH6A20
HV10A20
HV9B20
MR12B20
MR4C20
MR14B20
679
FUS STA 145
117
MR5D20
MR4A20
566
OPEN
CANOPY LIMIT SW
MR5B20
MR14A20
P
S
STU
437
323
691
OPEN
OFF
CLOSE
569
CANOPY ACTUATOR SW
MR5A20
MR13C20
MR15A20
MR5E20
MR13D20
MR15C20
MR15B20
CANOPY ACTUATOR
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CAD
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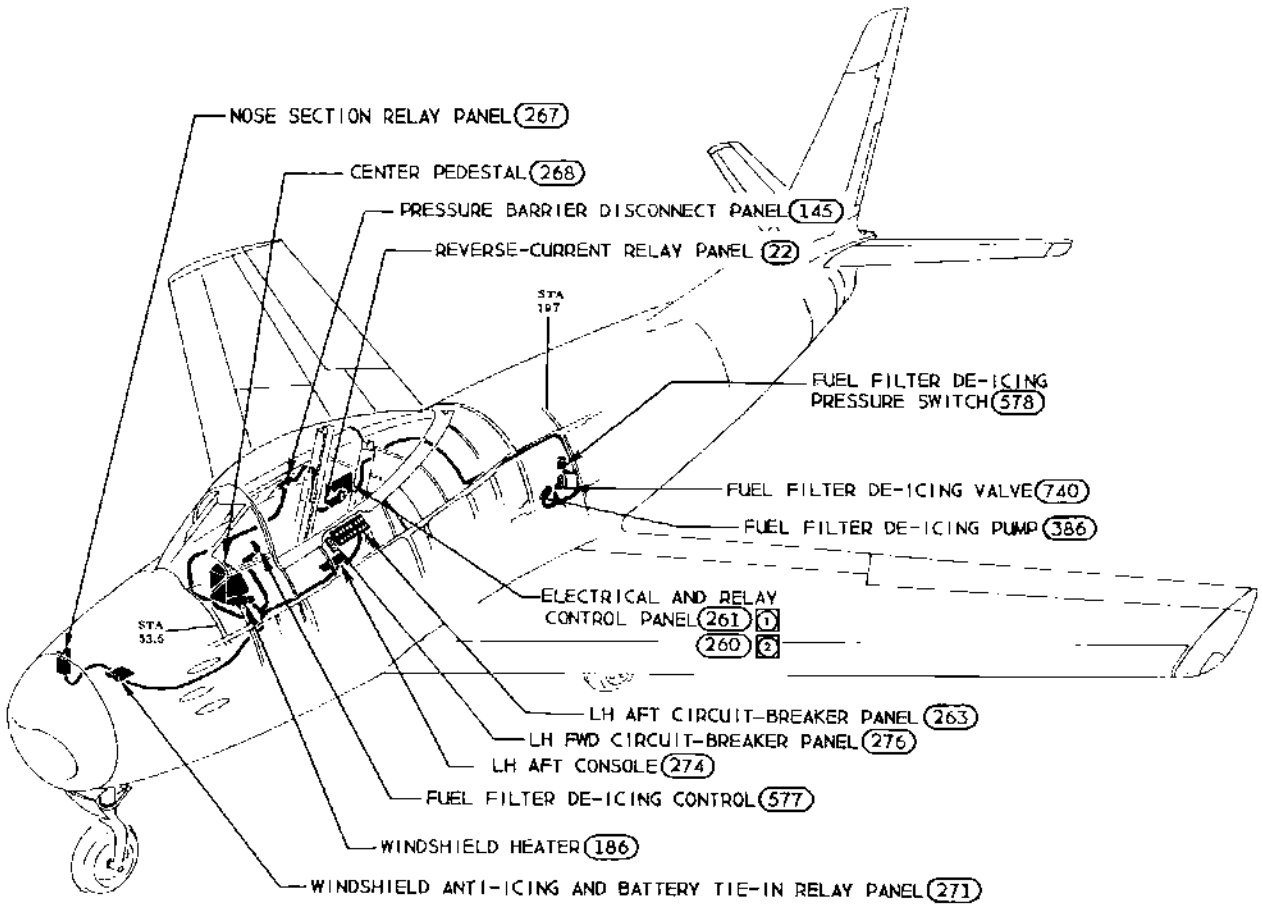
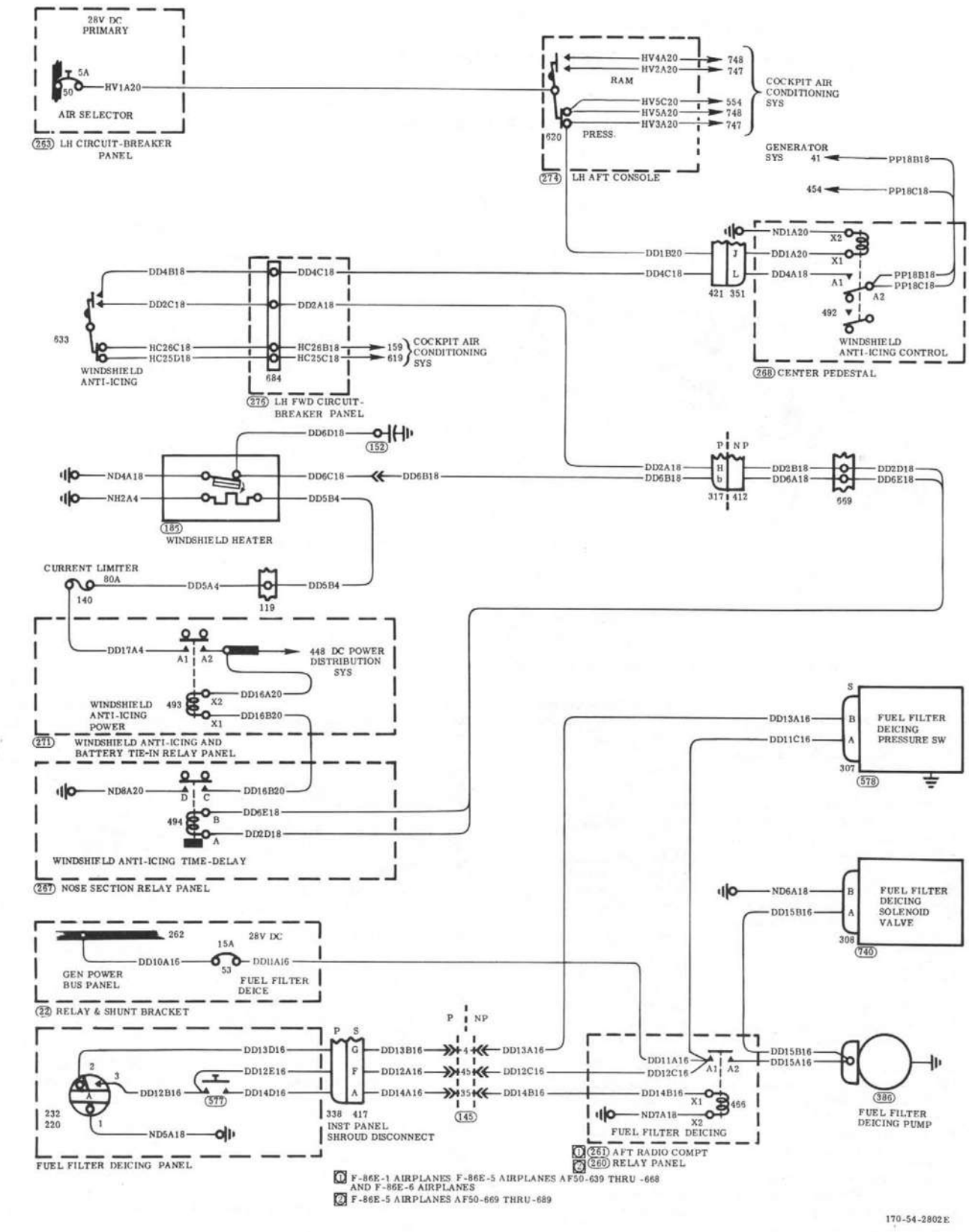
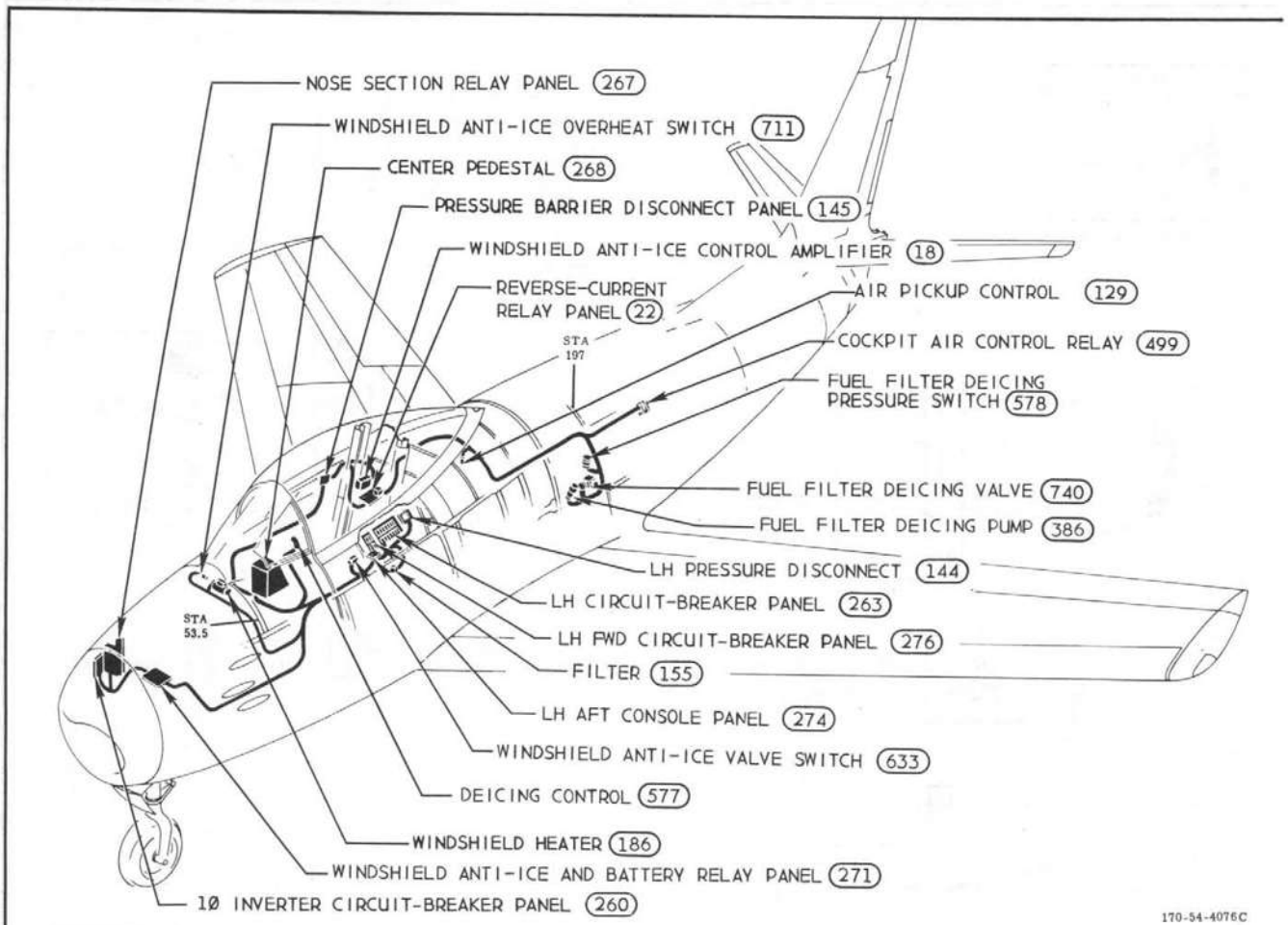
MR3A14
MR2A14
OPEN
CLOSE
MR3A14
MR1B10
MR1C10
A1 A2
A2
A1
X1
X2
455
OPEN
CANOPY RELAY
CLOSE
NM1B20
NM1A20
261 ELECTRICAL CONTROL AND RELAY PANEL
MR1B10
59
NP
P
144
MR9A20
OPEN
CLOSE
MR13A20
MR9B20
MR8B20
567
568
MR12A20
MR14A20
MR8A20
MR1A10
MR11A20
MR10A20
24V BATTERY
35A
43
MR17C10
COCKPIT CANOPY
276 L H FWD CIRCUIT-BREAKER PANEL
MR7B20
MR8A20
MR1F20
MR7A20
MR1E20
OPEN
EXTERNAL CANOPY CONTROL SWITCHES
CLOSE
591
24V BATTERY
5A
49
MR1D20
LJ1A20
CANOPY CONTROL & AUX INST LIGHTS
LJ7A20
274 RH CIRCUIT-BREAKER PANEL
538, INTERIOR LIGHTING SYS
MR1D20
MR1G20
409
304
P
NP
PA8A16
20A
24V BATTERY
39
AB26A12
AR35A12
BOMB ROCKET TANK SALVO
263 LH CIRCUIT-BREAKER PANEL
P62, AN APX-6 IFF RADAR
564, BOMBING AND CHEMICAL TANK SYSTEM (SHEET 1)
P7C10
MR17C10
261, ROCKET-FIRING SYS
P7B10
P7A0
575
20
P
NP
117
MR17B10
MR17A14
PG1A18
PA8C10
PP32A18
64
448
MR16A10
MR16B20
NM8A20
28V DC SECONDARY BUS
DC POWER DISTRIBUTION SYS (SHEET 1)
88, 28 POWER DISTRIBUTION SYS
ALTERNATE CANOPY POWER RELAY
267 NOSE SECTION RELAY PANEL
P DENOTES RADAR ITEM NUMBER.
172-54-4030D



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
22	Bracket—Relay and Shunt	151-54099 (NAA)
50	Circuit Breaker—Air Selector	AN3161P5
53	Circuit Breaker—Fuel Filter Deicing	PSA-15 (Klixon)
119	Connector—Post	151-54038 (NAA)
140	Current Limiter—Windshield Anti-icing Heater 80-ampere	FLLB (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
152	Filter—Cockpit and Windshield Heater	CP53B2EB405K
186	Heater—Windshield Anti-icing Boost 2-kilowatt	C553 (Cole)
220	Lamp—Warning	AN3121-313
232	Light Assembly—Fuel Filter Deicing	AN3157-4
260	Panel—Aft Radio Compartment Relay	151-54122-40 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
271	Panel—Windshield Anti-icing and Battery Relay	170-54085 (NAA)
274	Panel—Left Aft Console	151-53050-30 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
307	Plug—Fuel Filter Deicing Pressure Switch	AN3106B14S-9S
308	Plug—Fuel Filter Deicing Valve	AN3106B12S-3S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
351	Plug—Pedestal Disconnect	AN3106A32-7P
386	Pump—Fuel Filter Deicing	20386-9 (Adel)
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
466	Relay—Fuel Filter Deicing	AN3350-1
492	Relay—Windshield Anti-icing Control	237EAU (Leach)
493	Relay—Windshield Anti-icing Power	AN3370-1
494	Relay—Windshield Anti-icing Time Delay	32439 (B-9-A)
577	Switch Fuel Filter Deicing	C-100 (Hetherington)
578	Switch—Fuel Filter Deicing Pressure	G20AX11 (Minneapolis-Honeywell)
620	Switch—Ram Pressure Selector	BZ-3YDT (Micro Switch)
633	Switch—Windshield Anti-icing Heater	AN3216-1
634	Switch—Windshield Overheat	Part of Heater
669	Terminal Block—Nose Junction Box	AN3436-2-18
684	Terminal Block—Windshield Heater Switch	AN3436-2-4
740	Valve—Fuel Filter Deicing Solenoid	40R855C (General Controls)

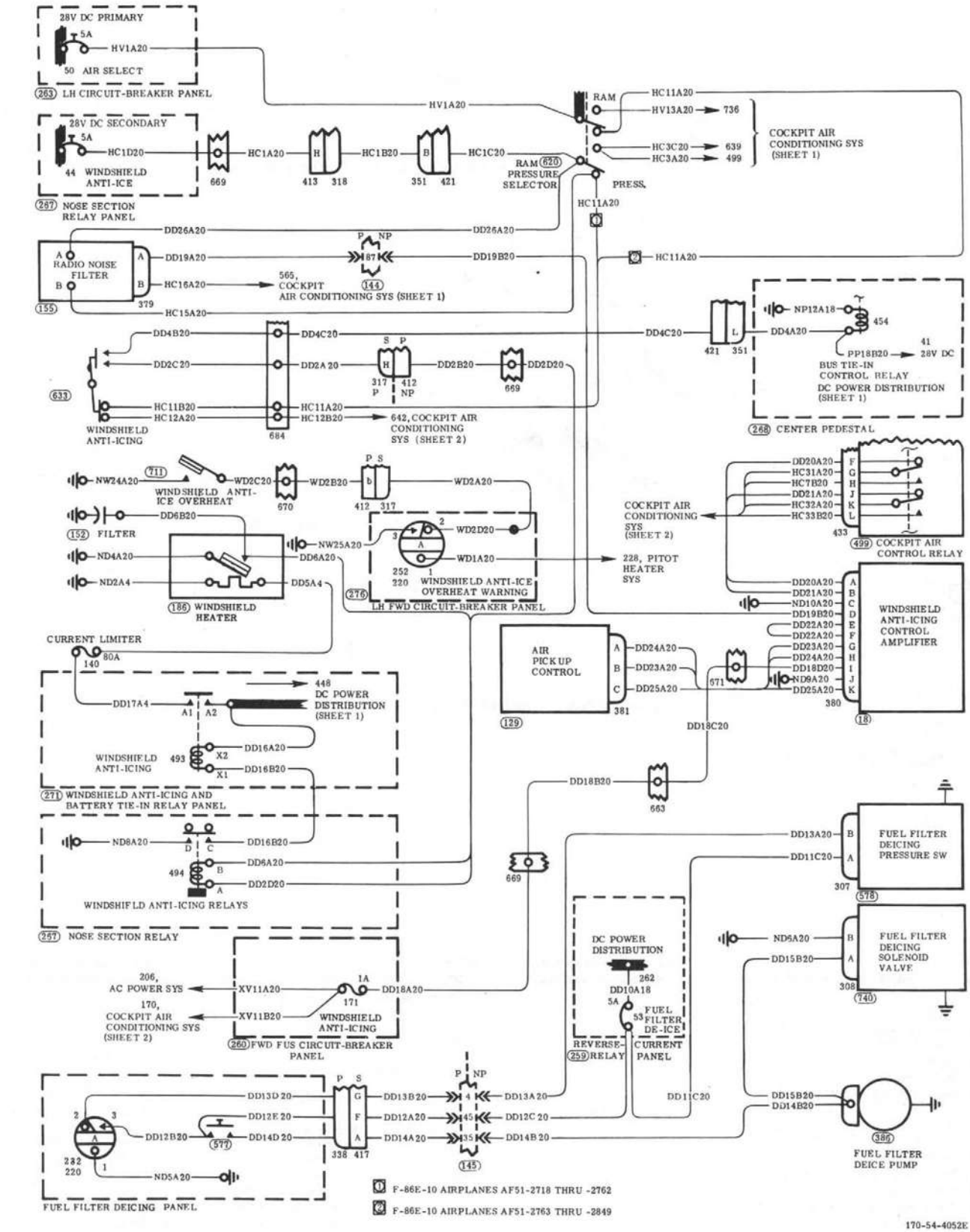
Figure 10-26. Fuel Filter Deicing and Windshield Anti-icing


28V DC PRIMARY
5A
50
HV1A20
AIR SELECTOR
263 LH CIRCUIT-BREAKER PANEL
HV4A20
HV2A20
748
747
RAM
HV5C20
HV5A20
HV3A20
554
748
747
PRESS.
620
COCKPIT AIR CONDITIONING SYS
274 LH AFT CONSOLE
GENERATOR SYS
41
PP18B18
454
PP18C18
ND1A20
X2
DD1B20
DD1A20
X1
DD4A18
A1
A2
PP18B18
PP18C18
421
351
492
WINDSHIELD ANTI-ICING CONTROL
268 CENTER PEDESTAL
DD4B18
DD4C18
DD4C18
DD2C18
DD2A18
633
HC26C18
HC25D18
HC26B18
HC25C18
159
619
COCKPIT AIR CONDITIONING SYS
WINDSHIELD ANTI-ICING
684
276 LH FWD CIRCUIT-BREAKER PANEL
DD6D18
152
ND4A18
NH2A4
DD6C18
DD6B18
DD5B4
185 WINDSHIELD HEATER
DD2A18
DD6B18
P
NP
H
b
317
412
DD2B18
DD6A18
559
DD2D18
DD6E18
CURRENT LIMITER
80A
140
DD5A4
119
DD5B4
DD17A4
A1
A2
448 DC POWER DISTRIBUTION SYS
DD16A20
493
X2
X1
DD16B20
WINDSHIELD ANTI-ICING POWER
271 WINDSHIELD ANTI-ICING AND BATTERY TIE-IN RELAY PANEL
ND8A20
D
C
DD16B20
494
B
A
DD6E18
DD2D18
WINDSHIELD ANTI-ICING TIME-DELAY
267 NOSE SECTION RELAY PANEL
DD13A16
DD11C16
S
B
A
FUEL FILTER DEICING PRESSURE SW
307
578
ND6A18
DD15B16
B
A
FUEL FILTER DEICING SOLENOID VALVE
308
740
262
28V DC
15A
DD10A16
53
DD11A16
GEN POWER BUS PANEL
FUEL FILTER DEICE
22 RELAY & SHUNT BRACKET
P
S
P
NP
DD13D16
DD12E16
DD14D16
DD12B16
577
DD13B16
DD12A16
DD14A16
DD13A16
DD12C16
DD14B16
145
DD11A16
DD12C16
DD14B16
A1
A2
X1
X2
466
ND7A18
FUEL FILTER DEICING
DD15B16
DD15A16
386
FUEL FILTER DEICING PUMP
232
220
ND5A18
338
417
INST PANEL SHROUD DISCONNECT
FUEL FILTER DEICING PANEL
1 261 AFT RADIO COMPT
2 260 RELAY PANEL
1 F-86E-1 AIRPLANES F-86E-5 AIRPLANES AF50-639 THRU -668 AND F-86E-6 AIRPLANES
2 F-86E-5 AIRPLANES AF50-669 THRU-689
170-54-2802E

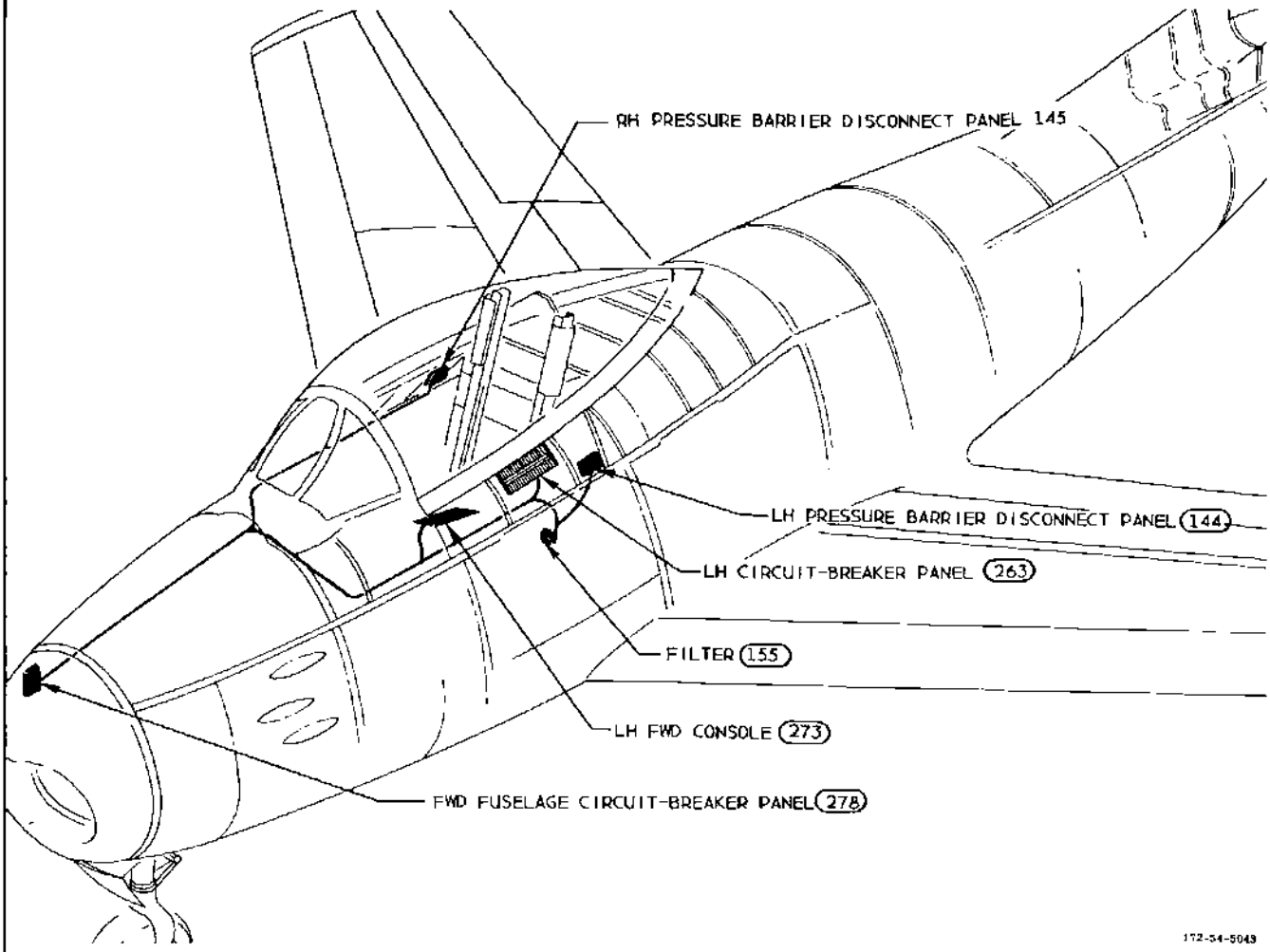


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
18	Amplifier—Windshield Anti-icing Control	30058 (AiResearch)
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-icing	AN3161P5
50	Circuit Breaker—Air Selector	AN3161P5
53	Circuit Breaker—Fuel Filter Deicing	PSA-5 (Klixon)
129	Control Box—Windshield Air Pickup	33500-05 (AiResearch)
140	Current Limiter—Windshield Anti-icing Heater 80-ampere	FLLB (Burndy)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
152	Filter—Cabin and Windshield Heater	CP53B2EB405K
155	Filter—Heating and Ventilating Radio Noise	12288 (AiResearch)
171	Fuse—Windshield Anti-icing Control Amplifier	AGC 1 (Bussmann)
186	Heater—Windshield Anti-icing Boost 2-kilowatt	C-883 (Cole)
220	Lamp—Warning	AN3121-313
232	Light Assembly—Fuel Filter Deicing	AN3157-4
252	Light Assembly—Windshield Overheat Warning	AN3157-4
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
271	Panel—Windshield Anti-icing and Battery Relay	170-54085 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
307	Plug—Fuel Filter Deicing Pressure Switch	AN3106B14S-9S
308	Plug—Fuel Filter Deicing Valve	AN3106B12S-3S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
351	Plug—Pedestal Disconnect	AN3106A32-7P
379	Plug—Heating and Ventilating Radio Noise Filter	AN3106B12S-3P
380	Plug—Windshield Anti-icing Amplifier	AN3106B20-27SX
381	Plug—Windshield Air Pickup Control	AN3106B10SL-3S
386	Pump—Fuel Filter Deicing	20386-9 (Adel)
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
433	Receptacle—Cockpit Air Control Relay	AN3102A22-19S
454	Relay—Bus Tie-in Control	237EAU (Leach)
493	Relay—Windshield Anti-icing Power	AN3370-1
494	Relay—Windshield Anti-icing Time Delay	32439, Type B-9-A
499	Relay—Cockpit Air Control	AN3310-1
577	Switch—Fuel Filter Deicing	C-100 (Hetherington)
578	Switch—Fuel Filter Deicing Pressure	G20AX11 (Minneapolis-Honeywell)
620	Switch—Ram Pressure Selector	AN3227-3
633	Switch—Windshield Anti-icing Heater	AN3216-1
603	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
671	Terminal Block—Overvoltage Relay	AN3436-2-8
684	Terminal Block—Windshield Heater Switch	AN3436-2-4
711	Thermostat—Windshield Overheat	18423-275 (Fenwal)
740	Valve—Fuel Filter Deicing Solenoid	40R855C (General Controls)

Figure 10-27. Fuel Filter Deicing and Windshield



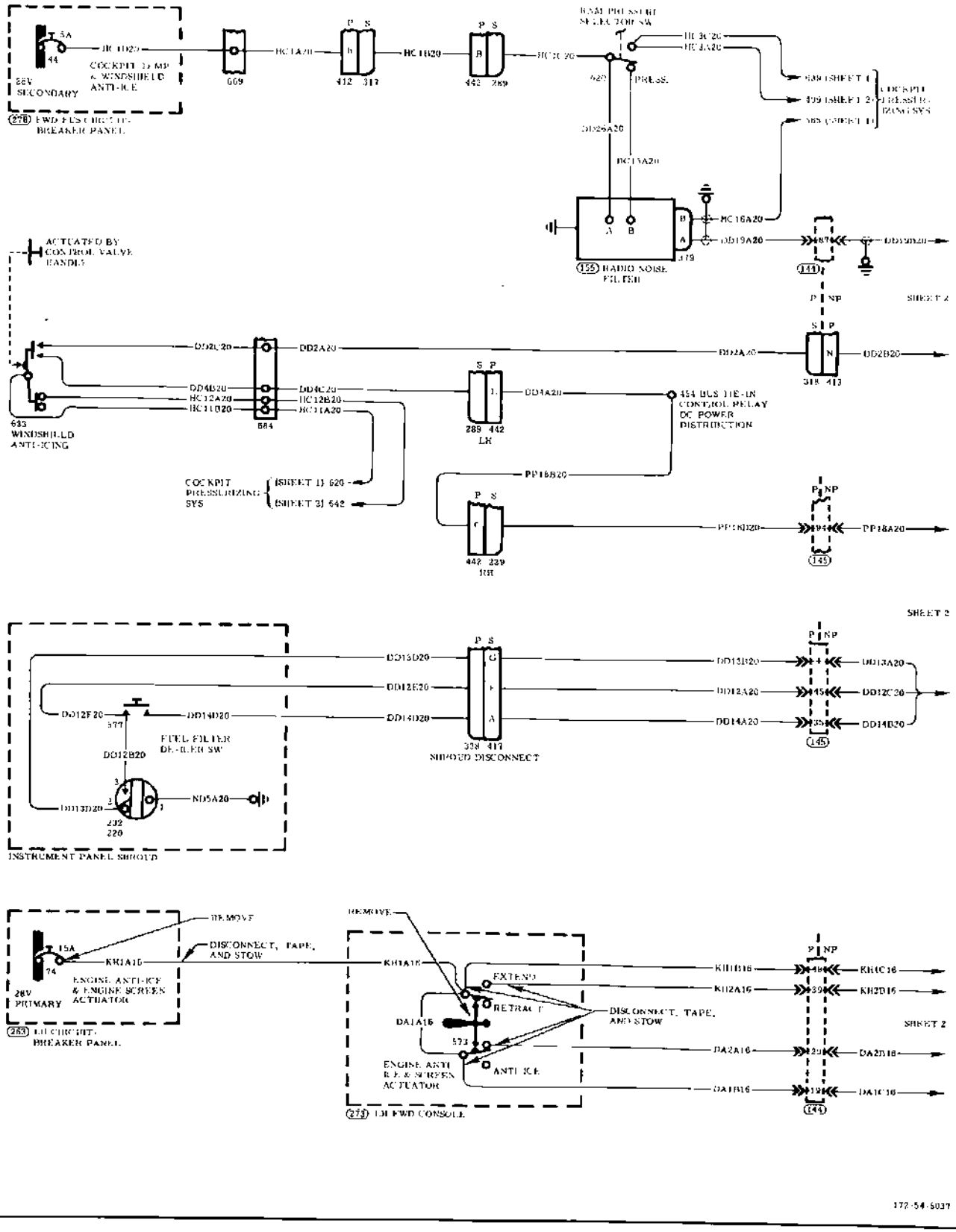
Anti-icing Systems—F-86E-10 Airplanes



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-icing	AN3161P5
74	Circuit Breaker—Engine Anti-icing and Screen	AN3161P15
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
155	Filter—Heating and Ventilating Radio Noise	12288 (AiResearch)
220	Lamp—Warning	AN3121-313
229	Light Assembly—Pedestal	1617C-2 (Wemac)
232	Light Assembly—Fuel Filter Deicing	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S

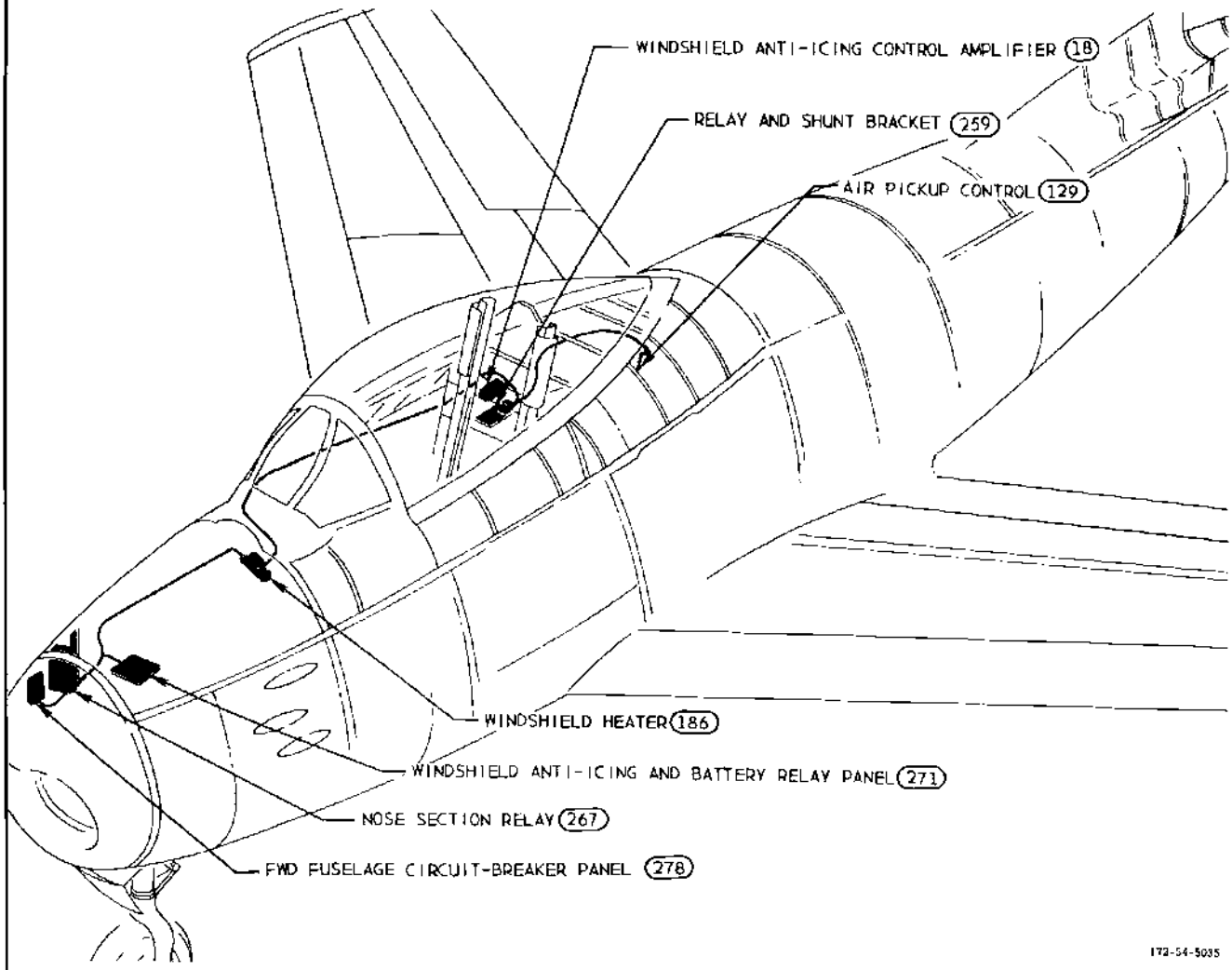
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
379	Plug -Heating and Ventilating Radio Noise Filter	AN3106B12S-3P
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
573	Switch—Engine Anti-icing and Screen	1AT3 (Micro Switch)
577	Switch—Fuel Filter Deicing	C-100 (Hetherington)
620	Switch—Ram Pressure Selector	AN3227-3
633	Switch—Windshield Anti-icing Heater	AN3216-T
669	Terminal Block—Nose Junction Box	AN3436-2-18
684	Terminal Block—Windshield Heater Switch	NAS45-6-6

Figure 10-28. Engine Air Screen Actuator, Engine, and Windshield



172-54-5037

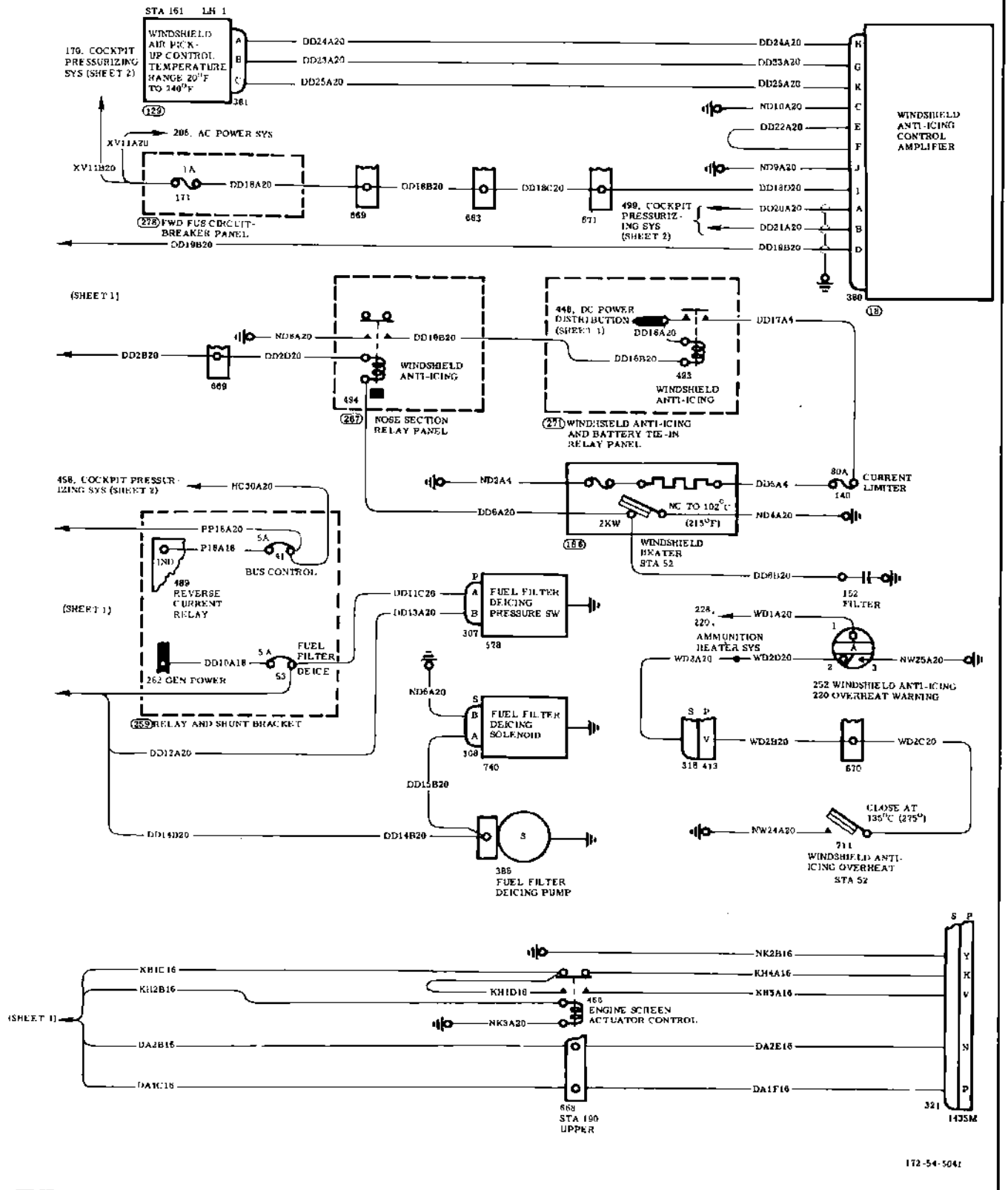
Anti-icing, and Fuel Filter Deicing Systems—F-86E-15 Airplanes (Sheet 1 of 2)



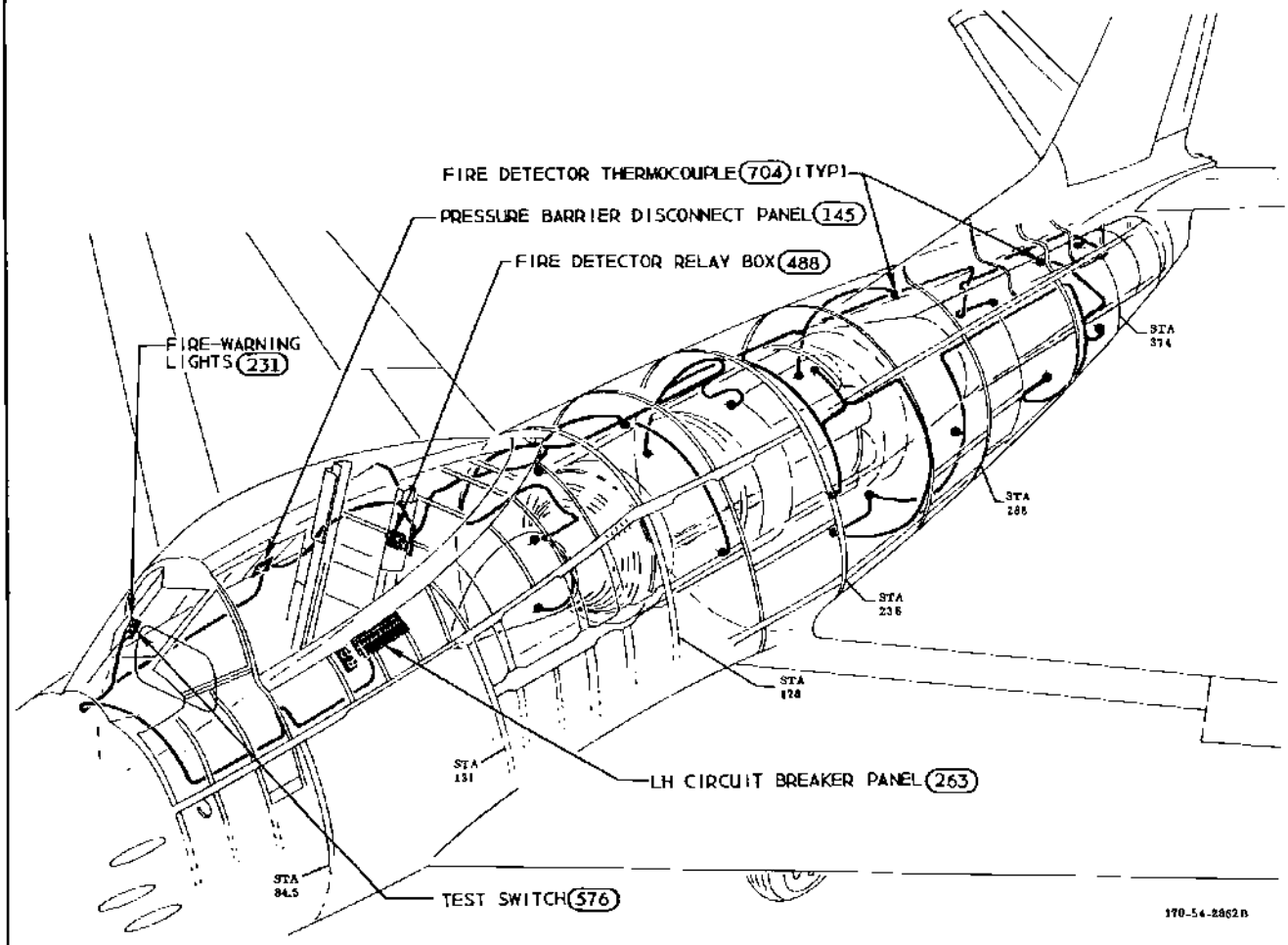
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
18	Amplifier—Windshield Anti-icing Control	30058-24 (AiResearch)
41	Circuit Breaker—Bus Control Relay	PSA-5 (Klixon)
53	Circuit Breaker—Fuel Filter Deicing	PSA-5 (Klixon)
129	Control Box—Windshield Air Pickup	33500-05 (AiResearch)
140	Current Limiter—Windshield Anti-icing Heater 80-ampere	FLLB (Burndy)
152	Filter—Cockpit and Windshield Heater	CP5382EB405K
171	Fuse—Windshield Anti-icing Control Amplifier	AGC 1 (Bussmann)
186	Heater—Windshield Anti-icing Boost 2-kilowatt	C 883 (Cole)
220	Lamp—Warning	AN3121-313
252	Light Assembly—Windshield Overheat Warning	AN3157-4
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
271	Panel—Windshield Anti-icing and Battery Relay	170-54085 (NAA)
278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
307	Plug—Fuel Filter Deicing Pressure Switch	AN3106B14S-9S
308	Plug—Fuel Filter Deicing Valve	AN3106B12S-3S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
321	Plug—Engine Disconnect	AN3106B28-12S
380	Plug—Windshield Anti-icing Amplifier	AN3106B20-27SX
381	Plug—Windshield Air Pickup Control	AN3106B10SL-3S
386	Pump—Fuel Filter Deicing	20386-9 (Adel)
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
466	Relay—Engine Screen Actuator Control	AN3353-1
489	Relay—Reverse-current	AN3025-2
493	Relay—Windshield Anti-icing Power	AN3370-1
494	Relay—Windshield Anti-icing Time Delay	32439, Type B-9-A
578	Switch—Fuel Filter Deicing Pressure	G20AX11 (Minneapolis-Honeywell)
663	Terminal Block—Right Gun Bay	AN3436-2-10
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-17
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
671	Terminal Block—Overvoltage Relay	AN3436-2-8
711	Thermostat—Windshield Overheat	18423-275 (Fenwal)
740	Valve—Fuel Filter Deicing Solenoid	40R855C (General Controls)
1435M	Receptacle—Engine Harness Disconnect	AN3100A28-12P

Figure 10-28. Engine Air Screen Actuator, Engine, and Windshield



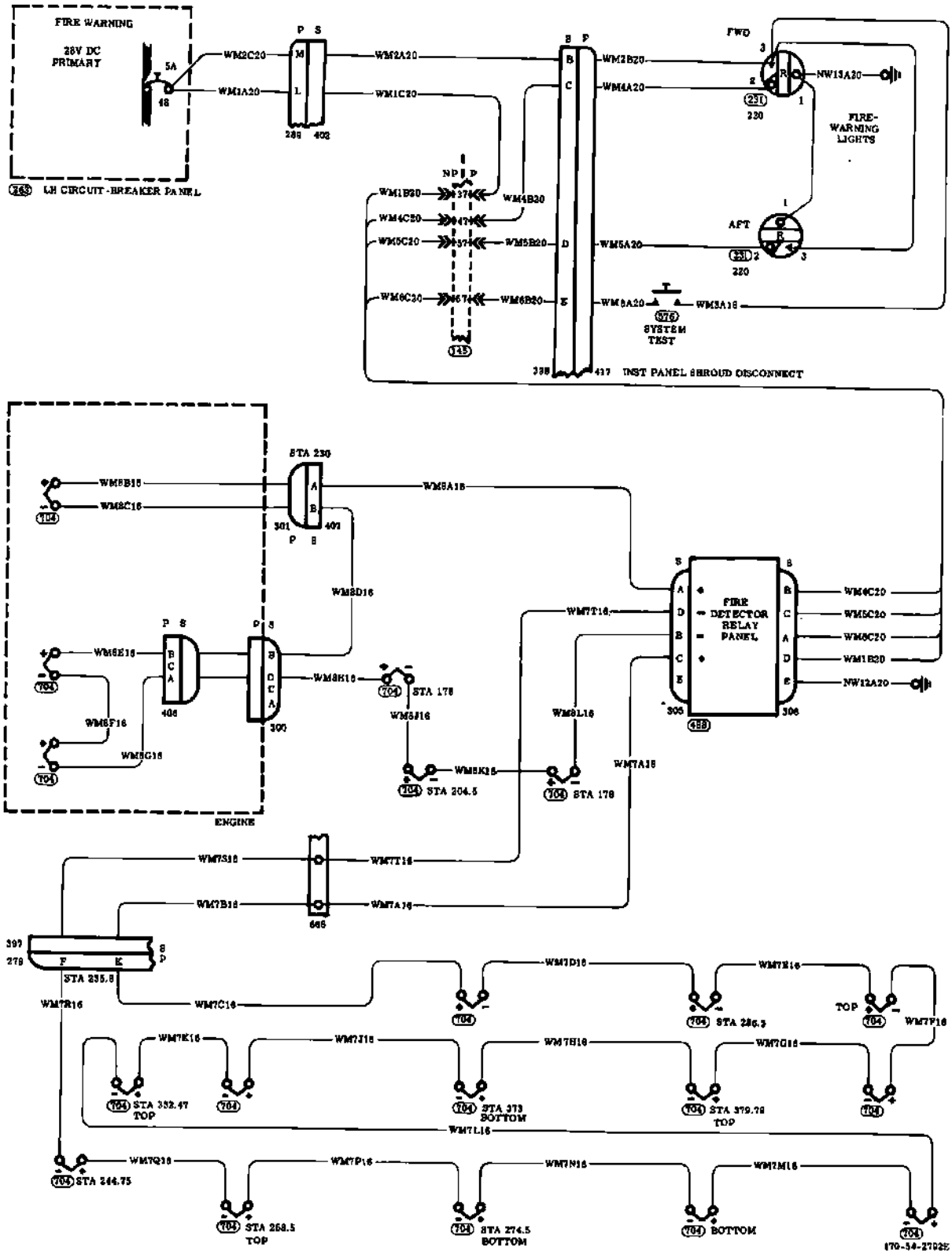
Anti-icing, and Fuel Filter Deicing Systems—F-86E-15 Airplanes (Sheet 2 of 2)



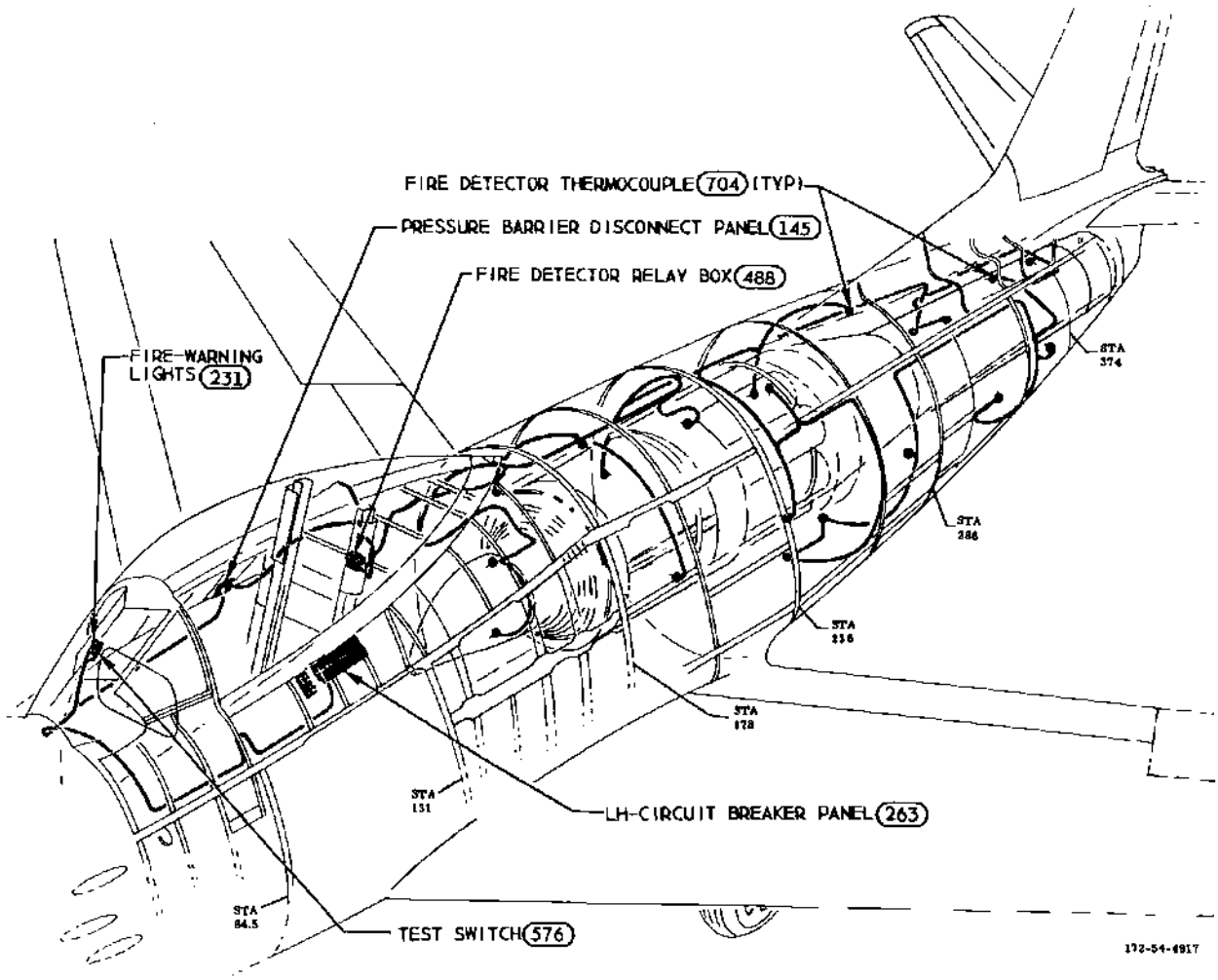
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
48	Circuit Breaker—Fire-warning	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
220	Lamp—Warning	AN3121-313
231	Light Assembly—Fire Detector Warning	AN3157-6
263	Panel—Left Circuit-breaker	170-54068 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
289	Plug—Cockpit Center Disconnect	AN3106B24-5S
300	Plug—Engine Small Disconnect	AN3106B18-13S
301	Plug—Engine Fire Detector	AN3106B14S-2P
305	Plug—Fire-warning Relay	AN3106B14S-5S
306	Plug—Fire-warning Relay (Position X)	AN3106B14S-5S
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
402	Receptacle—Cockpit Center Disconnect	AN3100A24-5P
406	Receptacle—Engine Accessory Fire Detector	AN3100A14S-7P
407	Receptacle—Engine Fire Detector	AN3101A14S-2S
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
488	Relay—Panel Fire Detector	161-54116 (NAA)
576	Switch—Fire Detector Test	138187 (Ucinite)
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
704	Thermocouple—Fire Detector	35534-2 (T. A. Edison)

Figure 10-29. Engine Fire Detecting System—



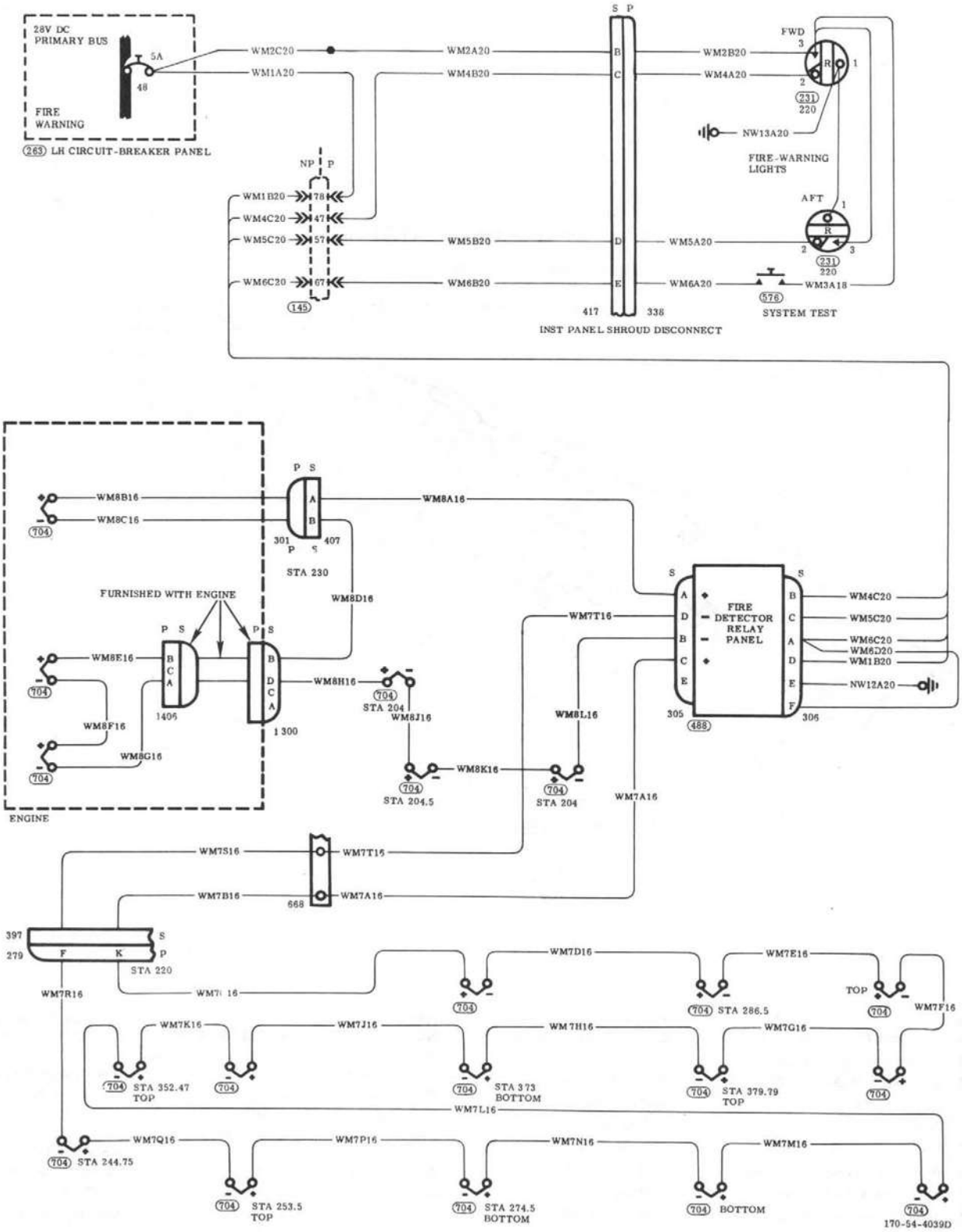
F-86E-1, F-86E-5, and F-86E-6 Airplanes



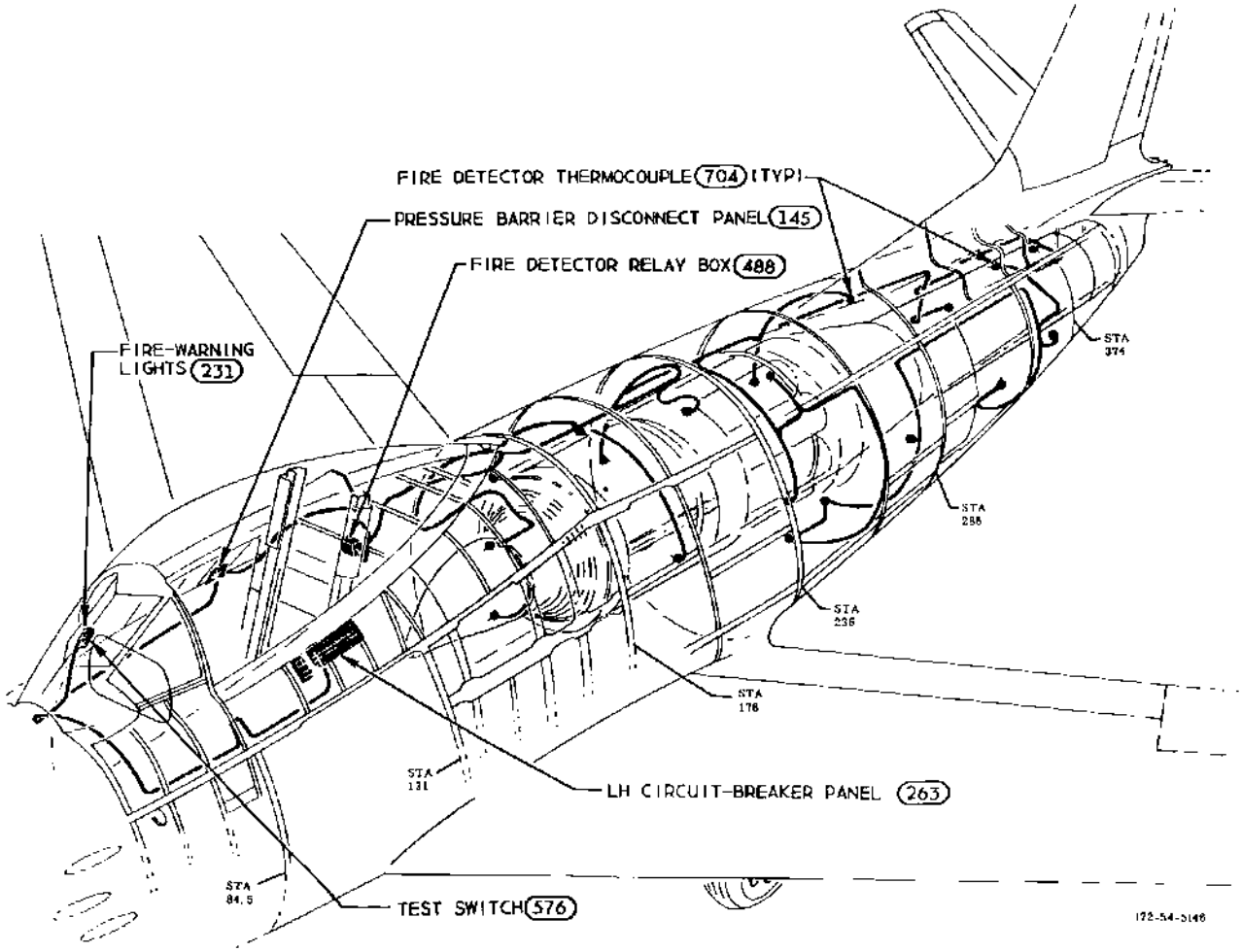
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
48	Circuit Breaker—Fire-warning	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
220	Lamp—Warning	AN3121-313
231	Light Assembly—Fire Detector Warning	AN3157-6
263	Panel—Left Circuit-breaker	170-54068 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
300	Plug—Engine Small Disconnect	AN3106B18-13S
301	Plug—Engine Fire Detector	AN3106B14S-2P
305	Plug—Fire-warning Relay	AN3106B14S-5S
306	Plug—Fire-warning Relay	AN3106B16S-1S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
397	Receptacle—Aft Fuselage Disconnect	AN3102A32-6S
406	Receptacle—Engine Accessory Fire Detector	AN3100A14S-7P
407	Receptacle—Engine Fire Detector	AN3101A14S-2S
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
488	Relay—Panel Fire Detector	161-54116 (NAA)
576	Switch—Fire Detector Test	138187 (Ucinite)
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
704	Thermocouple—Fire Detector	35534-2 (T. A. Edison)

Figure 10-30. Engine Fire Detecting

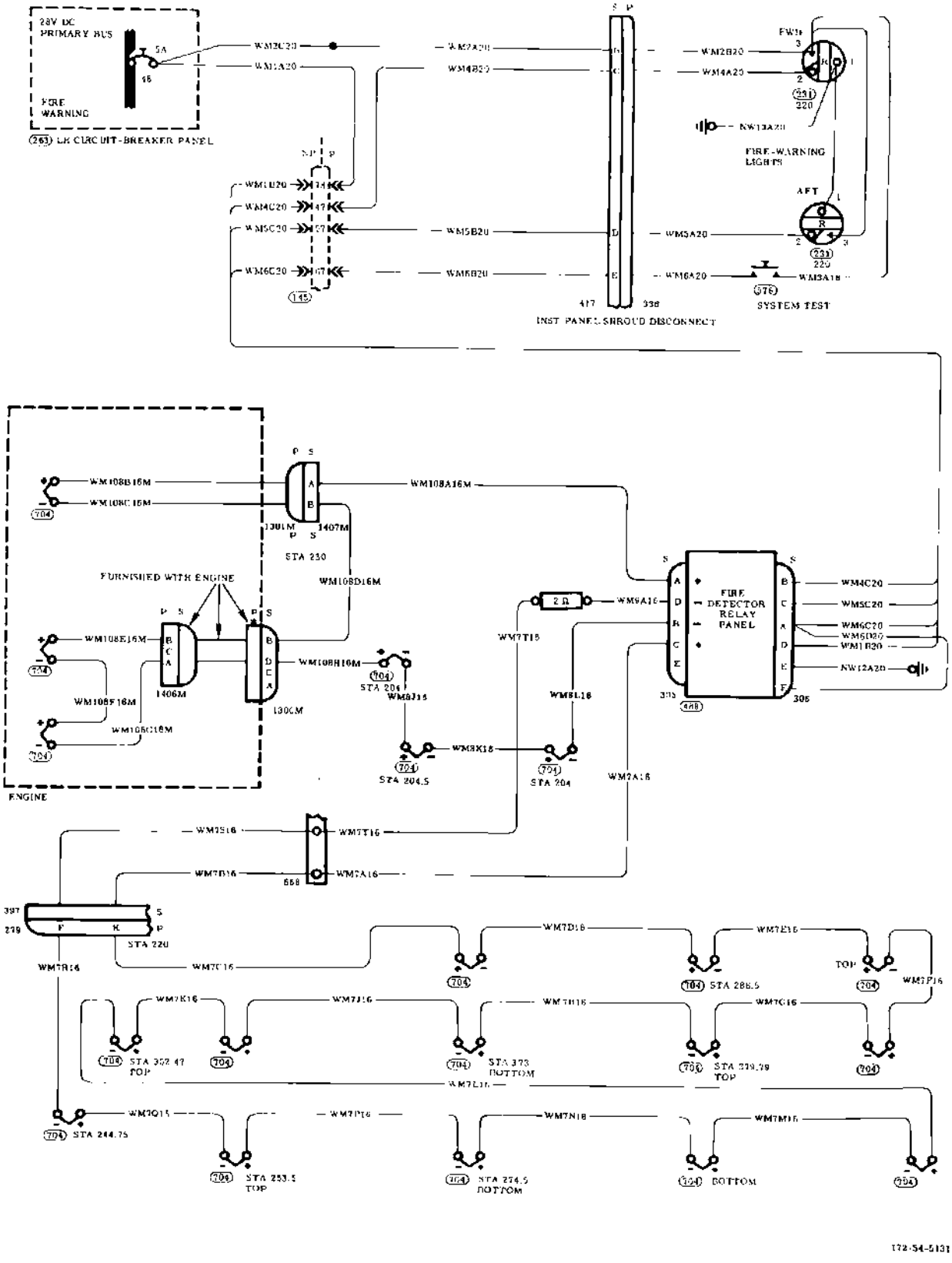


System—F-86E-10 Airplanes

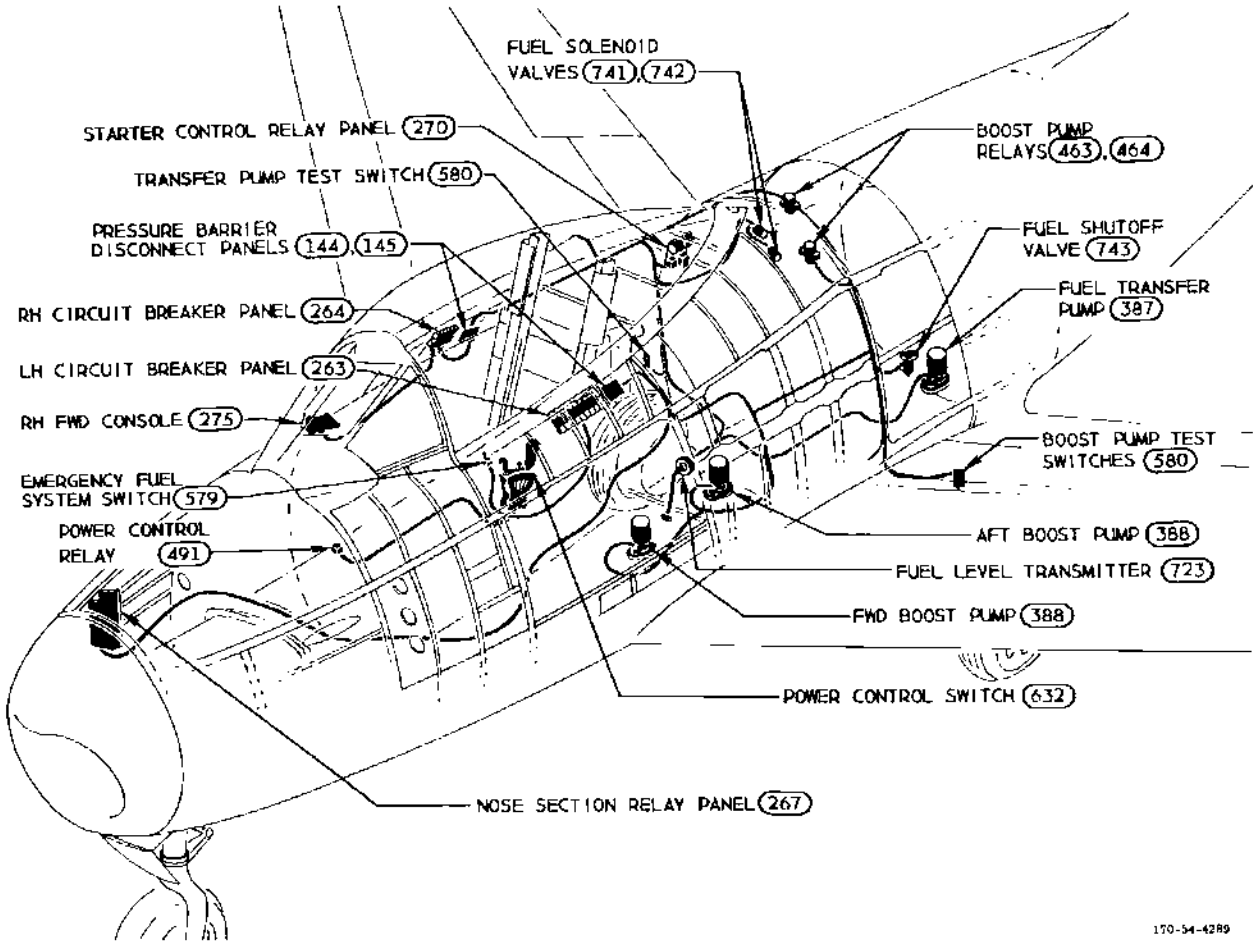


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
48	Circuit Breaker—Fire-warning	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
220	Lamp—Warning	AN3121-313
231	Light Assembly—Fire Detector Warning	AN3157-6
263	Panel—Left Circuit-breaker	170-54068 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
305	Plug—Fire-warning Relay	AN3106B14S-5S
306	Plug—Fire-warning Relay	AN3106B16S-1S
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
488	Relay—Panel Fire Detector	161-54116 (NAA)
576	Switch—Fire Detector Test	138187 (Ucinite)
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
704	Thermocouple—Fire Detector	35534-2 (T. A. Edison)
1300M	Plug—Engine Small Disconnect	AN3106B18-13S
1301M	Plug—Engine Fire Detector	AN3106B14S-2P
1406M	Receptacle—Engine Accessory Fire Detector	AN3100A14S-7P
1407M	Receptacle—Engine Fire Detector	AN3101A14S-2S

Figure 10-31. Engine Fire Detecting



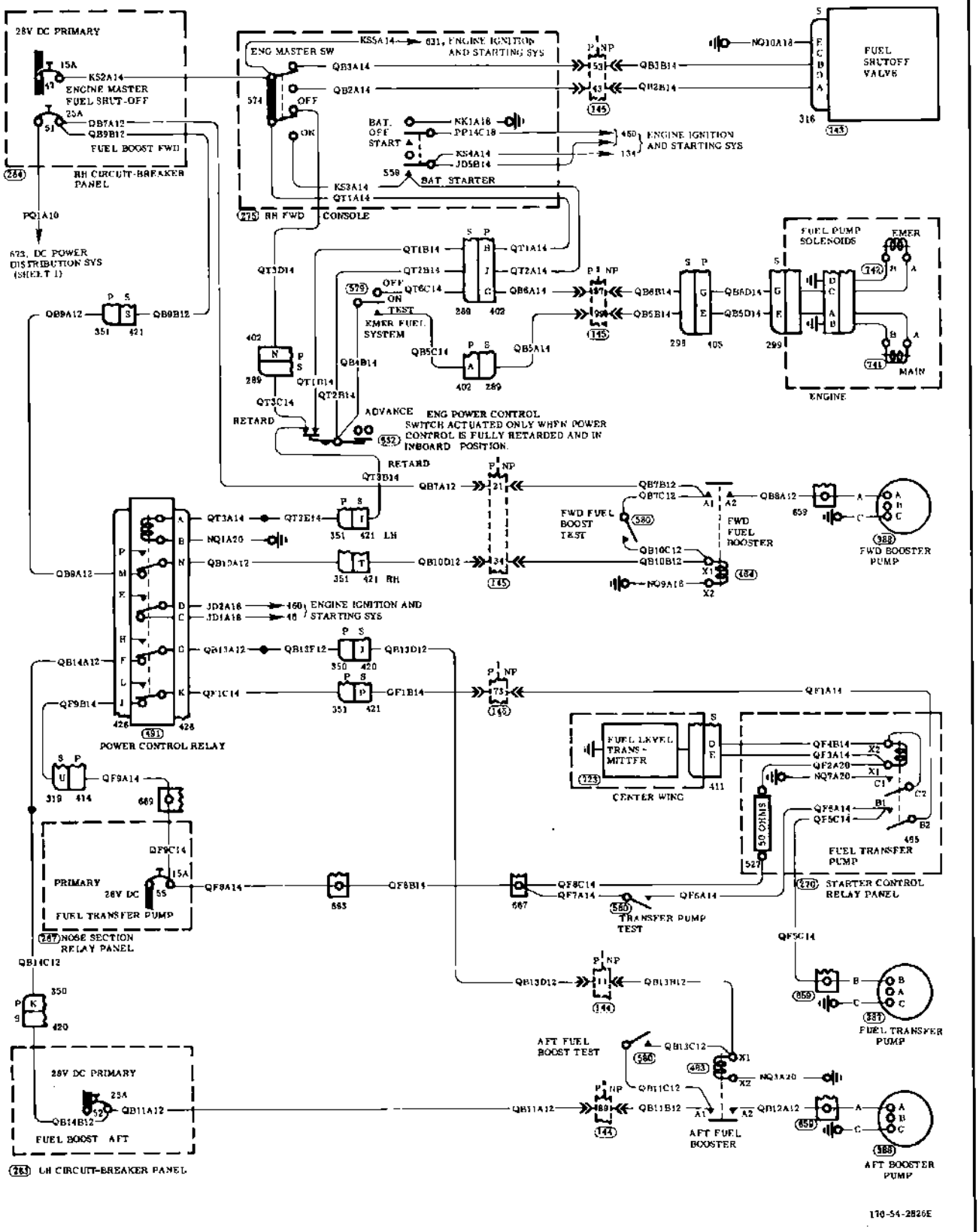
System—F-86E-15 Airplanes

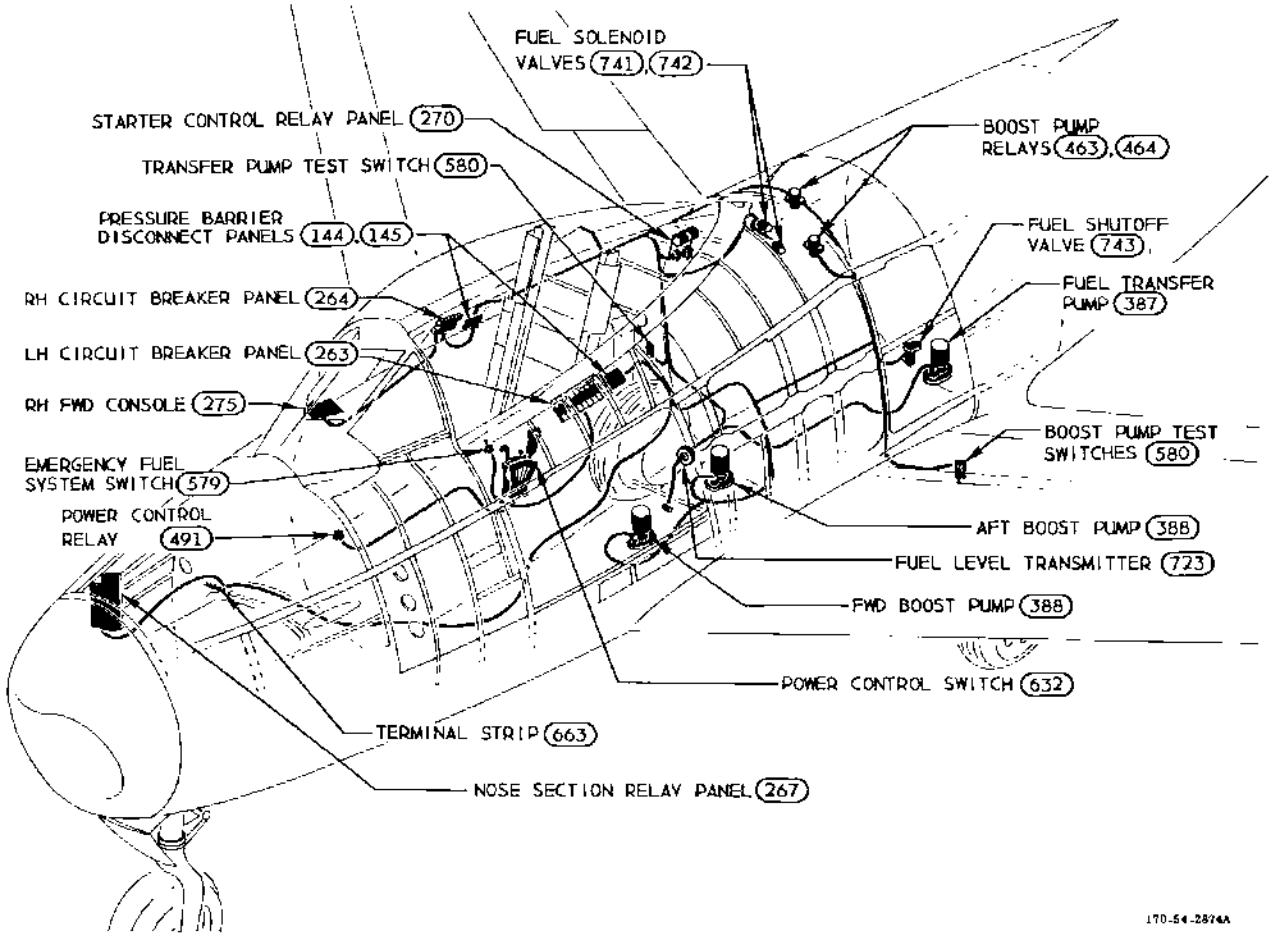


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P15
51	Circuit Breaker—Forward Fuel Booster	AN3161P20
52	Circuit Breaker—Aft Fuel Booster	AN3161P25
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right hand Pressure	YHS100S-6 (Burndy)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
275	Panel—Right Forward Console	161-54005-10 (NAA)
289	Plug—Cockpit Center Disconnect	AN3106B24-5S
298	Plug—Engine Intermediate Disconnect	AN3106B18-1S
299	Plug—Engine Large Disconnect	AN3106B18-1S
316	Plug—Fuel Shutoff Valve Solenoid	AN3106B14S-5S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
387	Pump—Fuel Transfer	TFD31400-3 (Thompson)
388	Pump—Main Fuel Booster	TFD31400-3 (Thompson)
402	Receptacle—Cockpit Center Disconnect	AN3100A24-5P
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
411	Receptacle—Fuel Level Transmitter	AN3101A14S-5S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
426	Receptacle—Throttle Relay	AN3102A22-19S
463	Relay—Aft Fuel Booster Pump	AN3350-1
464	Relay—Forward Fuel Booster Pump	AN3350-1
465	Relay—Fuel Transfer Pump Control	1264-93B (Leach)
491	Relay—Throttle	AN3310-1
527	Resistor—Fuel Transfer Relay	B10F50 (Clarostat)
559	Switch—Battery-Starter	AN3027-8
574	Switch—Engine Master	AN3027-3
579	Switch—Fuel System Emergency	AN3021-5
580	Switch—Fuel Level Transmitter and Main Pump Test	AN3022-8
632	Switch—Throttle Engine Control	BZ-3YDT (Micro Switch)
659	Terminal Block—Fuel Booster and Transfer Pump	AN3436-2-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
669	Terminal Block—Nose Junction Box	AN3436-2-18
723	Transmitter—Center Wing Fuel Level	EA-379AC-547A (Liquidometer)
741	Valve—Main Fuel Pump Solenoid	Furnished with Engine
742	Valve—Emergency Fuel Pump Solenoid	Furnished with Engine
743	Valve—Fuel Shutoff	3224 (Hydro-Aire)

Figure 10-32. Fuel Pump System—F-86E-1,

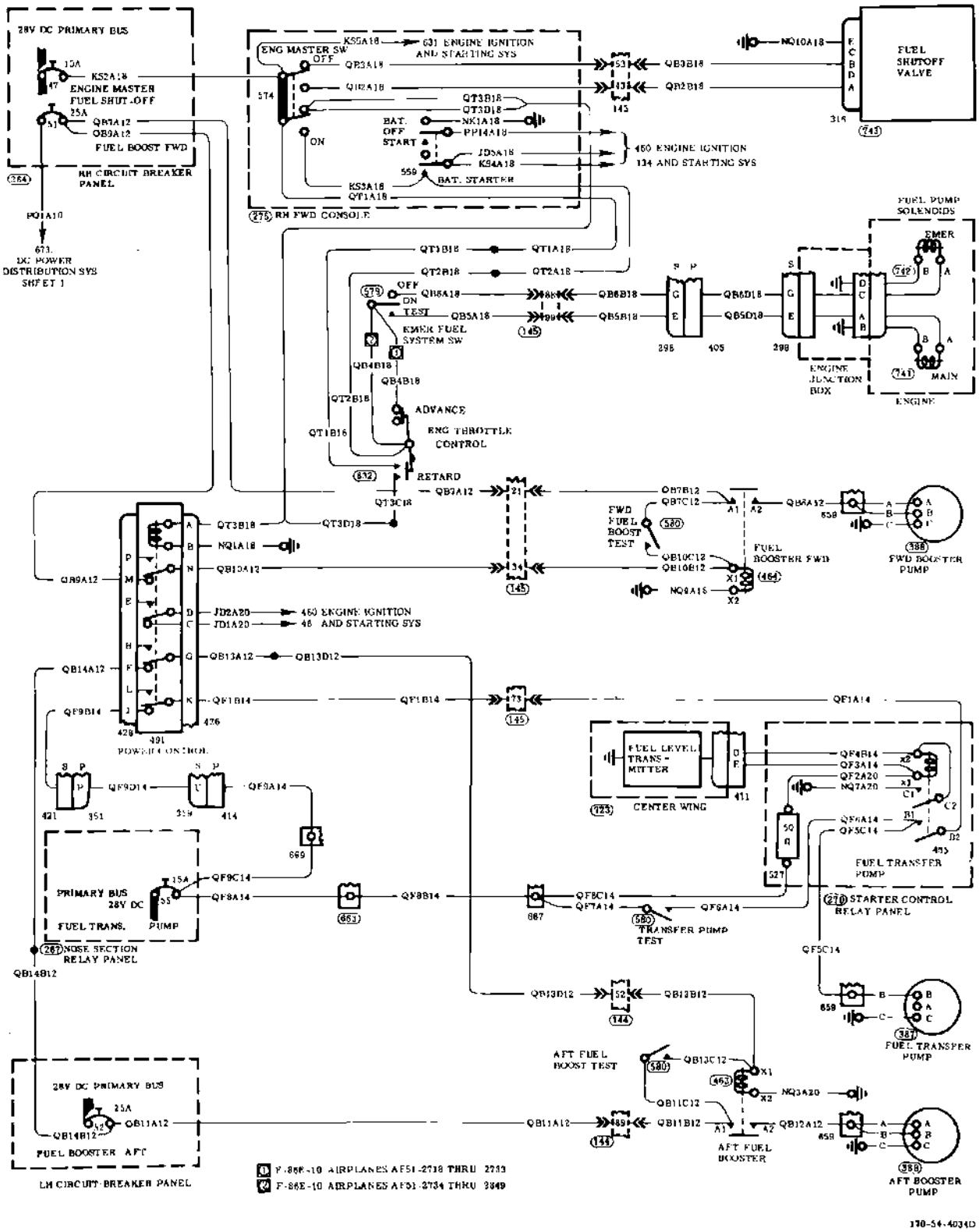

28V DC PRIMARY
15A
K52A14
ENGINE MASTER FUEL SHUT-OFF
25A
DB7A12
QB9B12
FUEL BOOST FWD
RH CIRCUIT-BREAKER PANEL
284
PQ1A10
673, DC POWER DISTRIBUTION SYS (SHEET 1)
ENG MASTER SW
KS5A14
631, ENGINE IGNITION AND STARTING SYS
QB3A14
QB2A14
574
OFF
ON
KS3A14
QT1A14
275 RH FWD CONSOLE
BAT. OFF START
NK1A18
PP14C18
KS4A14
JD5B14
550
BAT. STARTER
460
134
ENGINE IGNITION AND STARTING SYS
QB3B14
QH2B14
NQ10A18
FUEL SHUTOFF VALVE
316
143
QB9A12
QB9B12
351
421
QT1B14
QT2B14
QT6C14
QT1A14
QT2A14
QB6A14
QB6B14
QB5B14
QB6D14
QB5D14
OFF
ON
TEST
EMER FUEL SYSTEM
288
402
298
405
299
FUEL PUMP SOLENOIDS
EMER
MAIN
ENGINE
QB5C14
QB5A14
QB4B14
QT1D14
QT2D14
QT3C14
QT3D14
RETARD
ADVANCE
ENG POWER CONTROL SWITCH ACTUATED ONLY WHEN POWER CONTROL IS FULLY RETARDED AND IN INBOARD POSITION.
552
QB7A12
QB7B12
QB7C12
QB8A12
FWD FUEL BOOST TEST
580
FWD FUEL BOOSTER
388
FWD BOOSTER PUMP
QT3A14
QT2E14
NQ1A20
QB10A12
QB10D12
QB10C12
QB10B12
NQ9A18
484
JD2A16
JD1A16
460
48
ENGINE IGNITION AND STARTING SYS
QB13A12
QB13F12
QB13D12
QB14A12
QF1C14
QF1B14
QF1A14
QF9B14
426
491
428
POWER CONTROL RELAY
QF9A14
669
FUEL LEVEL TRANS-MITTER
123
CENTER WING
411
QF4B14
QF3A14
QF2A20
NQ7A20
50 OHMS
527
QF8A14
QF5C14
485
FUEL TRANSFER PUMP
QF9C14
PRIMARY 28V DC
15A
55
QF8A14
QF8B14
QF8C14
QF7A14
QF6A14
TRANSFER PUMP TEST
560
270 STARTER CONTROL RELAY PANEL
267 NOSE SECTION RELAY PANEL
QB14C12
QB13D12
QB13B12
QF5C14
859
331
FUEL TRANSFER PUMP
AFT FUEL BOOST TEST
QB13C12
QB11C12
QB11A12
QB11B12
QB12A12
NQ3A20
AFT FUEL BOOSTER
AFT BOOSTER PUMP
28V DC PRIMARY
25A
QB11A12
QB14B12
FUEL BOOST AFT
263 LH CIRCUIT-BREAKER PANEL
170-54-2826E



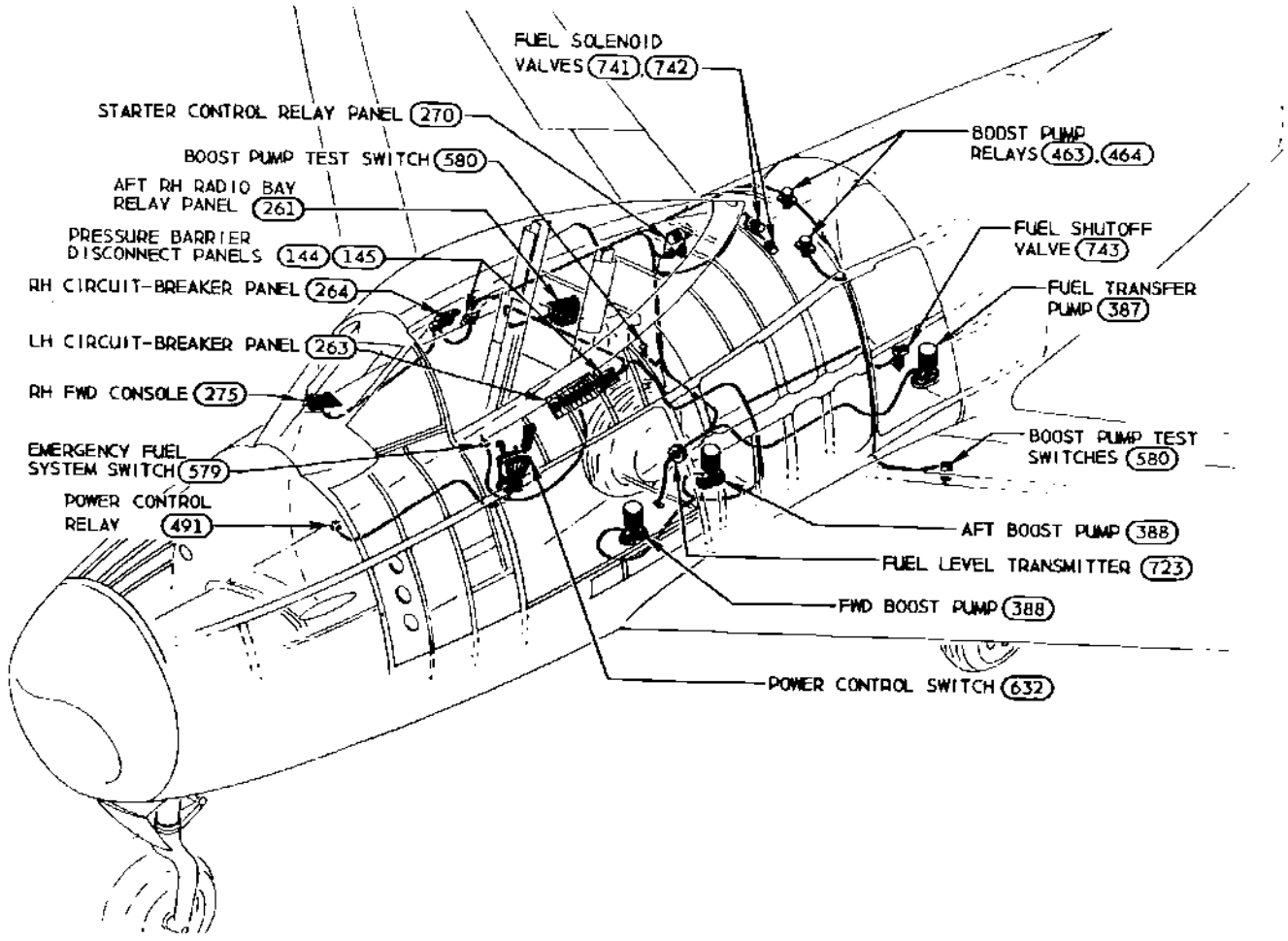
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P10
51	Circuit Breaker—Forward Fuel Booster	AN3161P25
52	Circuit Breaker—Aft Fuel Booster	AN3161P25
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
298	Plug—Engine Intermediate Disconnect	AN3106B18-1S
299	Plug—Engine Large Disconnect	AN3106B18-1S
316	Plug—Fuel Shutoff Valve Solenoid	AN3106B14S-5S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
351	Plug—Pedestal Disconnect	AN3106A32-7P
387	Pump—Fuel Transfer	TFD31400-3 (Thompson)
388	Pump—Main Fuel Booster	TFD31400-3 (Thompson)
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
411	Receptacle—Fuel Level Transmitter	AN3101A14S-5S
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
426	Receptacle—Throttle Relay	AN3102A22-19S
463	Relay—Aft Fuel Booster Pump	AN3350-1
464	Relay—Forward Fuel Booster Pump	AN3350-1
465	Relay—Fuel Transfer Pump Control	1264-938 (Leach)
491	Relay—Throttle	AN3310-1
527	Resistor—Fuel Transfer Relay	B10F50 (Clarostat)
559	Switch—Battery-Starter	AN3027-8
574	Switch—Engine Master	AN3027-3
579	Switch—Fuel System Emergency	AN3021-5
580	Switch—Fuel Level Transmitter and Main Pump Test	AN3022-8
632	Switch—Throttle Engine Control	BZ-3YDT (Micro Switch)
659	Terminal Block—Fuel Booster and Transfer Pump	AN3436-2-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
669	Terminal Block—Nose Junction Box	AN3436-2-18
723	Transmitter—Center Wing Fuel Level	EA 379AC-547A (Liquidometer)
741	Valve—Main Fuel Pump Solenoid	Furnished with Engine
742	Valve—Emergency Fuel Pump Solenoid	Furnished with Engine
743	Valve—Fuel Shutoff	3224 (Hydro-Aire)

Figure 10-33. Fuel Pump System—



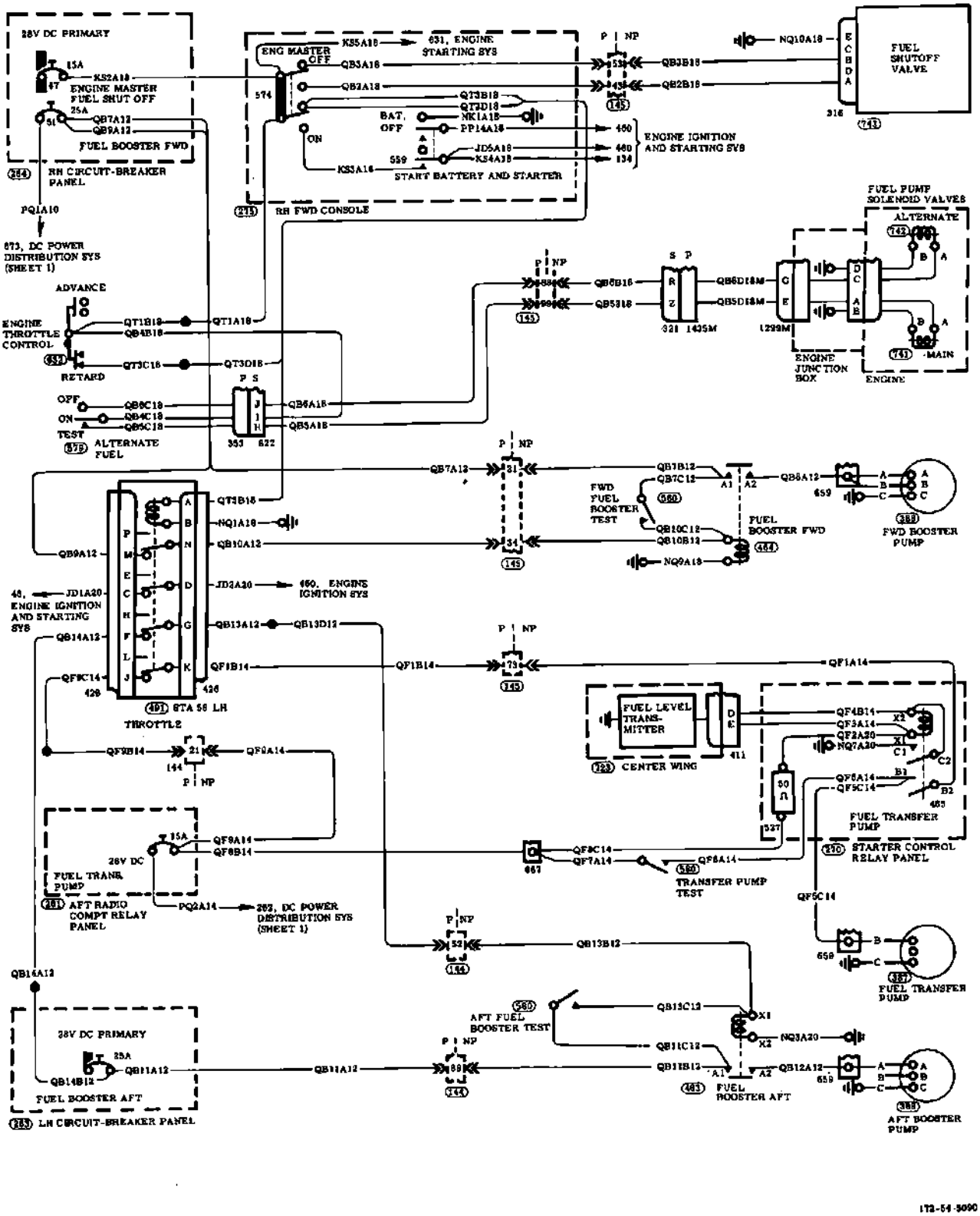
F-86E-10 Airplanes

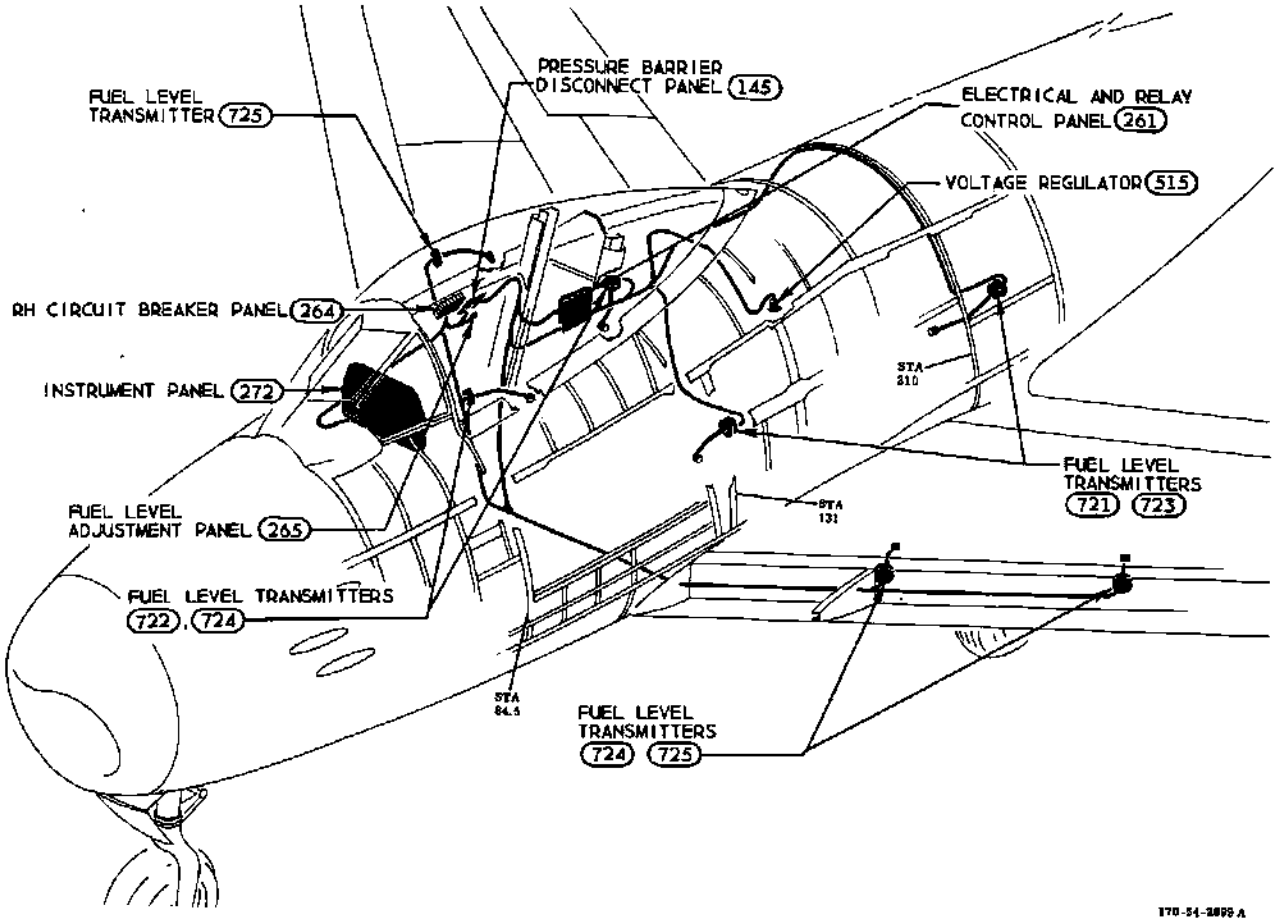


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P15
51	Circuit Breaker—Forward Fuel Booster	AN3161P25
52	Circuit Breaker—Aft Fuel Booster	AN3161P25
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
316	Plug—Fuel Shutoff Valve Solenoid	AN3106B14S-5S
321	Plug—Engine Disconnect	AN3106B28-12S
353	Plug—Instrument Panel Light Disconnect	AN3106B20-27P
387	Pump—Fuel Transfer	TFD31400-3, Type B-5C (Thompson)
388	Pump—Main Fuel Booster	TFD31400-3, Type B-5C (Thompson)
411	Receptacle—Fuel Level Transmitter	AN3101A14S-5S
426	Receptacle—Throttle Relay	AN3102A22-19S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
463	Relay—Aft Fuel Booster Pump	AN3350-1
464	Relay—Forward Fuel Booster Pump	AN3350-1
465	Relay—Fuel Transfer Pump Control	1264-938 (Leach)
491	Relay—Throttle	AN3310-1
527	Resistor—Fuel Transfer Relay	B10F50 (Clarostat)
559	Switch—Battery-Starter	AN3027-8
574	Switch—Engine Master	AN3027-3
579	Switch—Fuel System Emergency	AN3021-5
580	Switch—Fuel Level Transmitter and Main Pump Test	AN3022-8
632	Switch—Throttle Engine Control	BZ-3YDT (Micro Switch)
659	Terminal Block—Fuel Booster and Transfer Pump	AN3436-2-1
667	Terminal Block—Landing Gear Lower Connector	AN3436-2-8
723	Transmitter—Center Wing Fuel Level	EA-379AC-547A (Liquidameter)
741	Valve—Main Fuel Pump Solenoid	Furnished With Engine
822	Receptacle—Instrument Panel Light Disconnect	AN3100A20-27S
1299M	Plug—Engine Large Disconnect	AN3106B18-1S
1435M	Receptacle—Engine Harness Disconnect	AN3100A28-12P

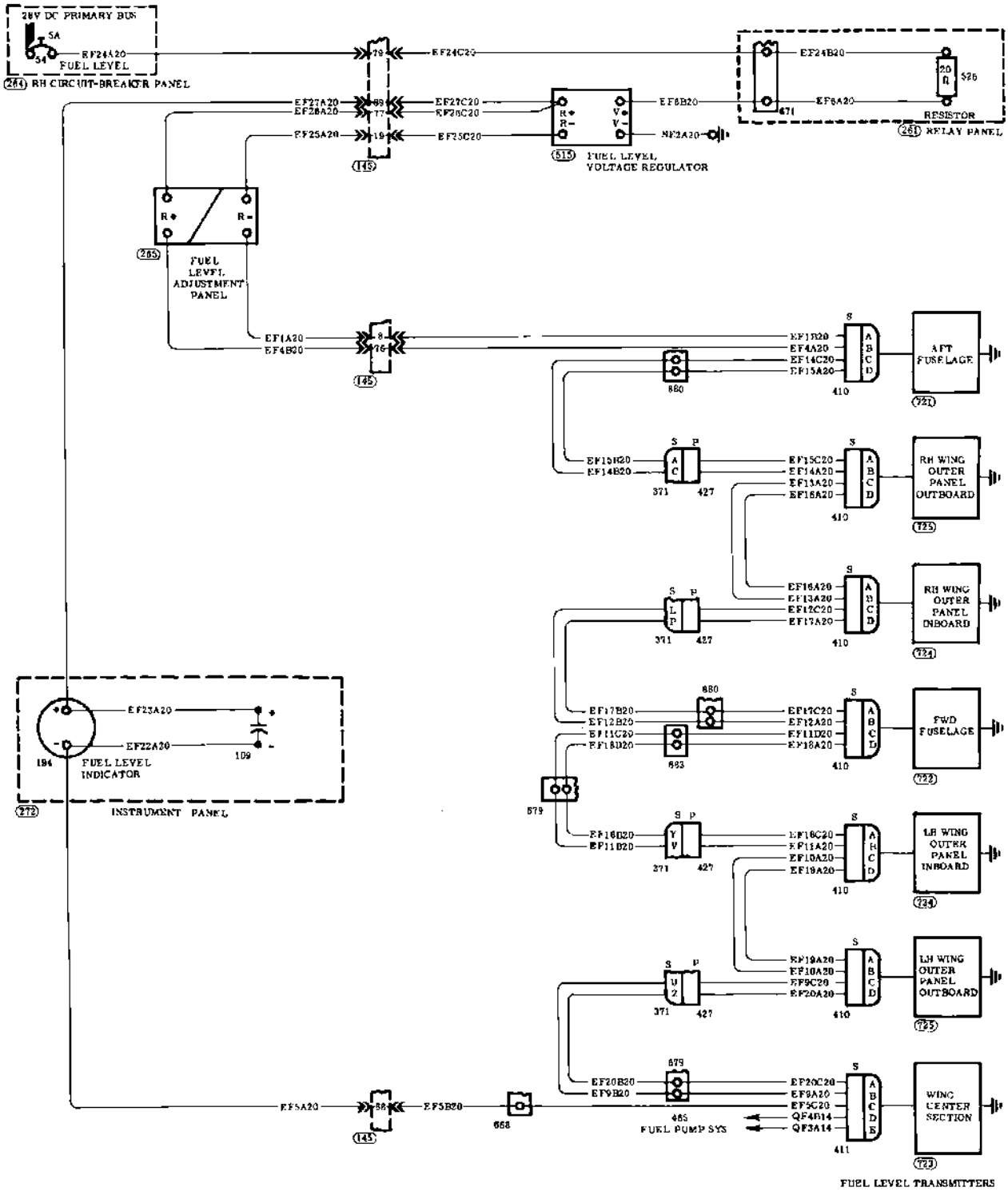
Figure 10-34. Fuel Pump System—

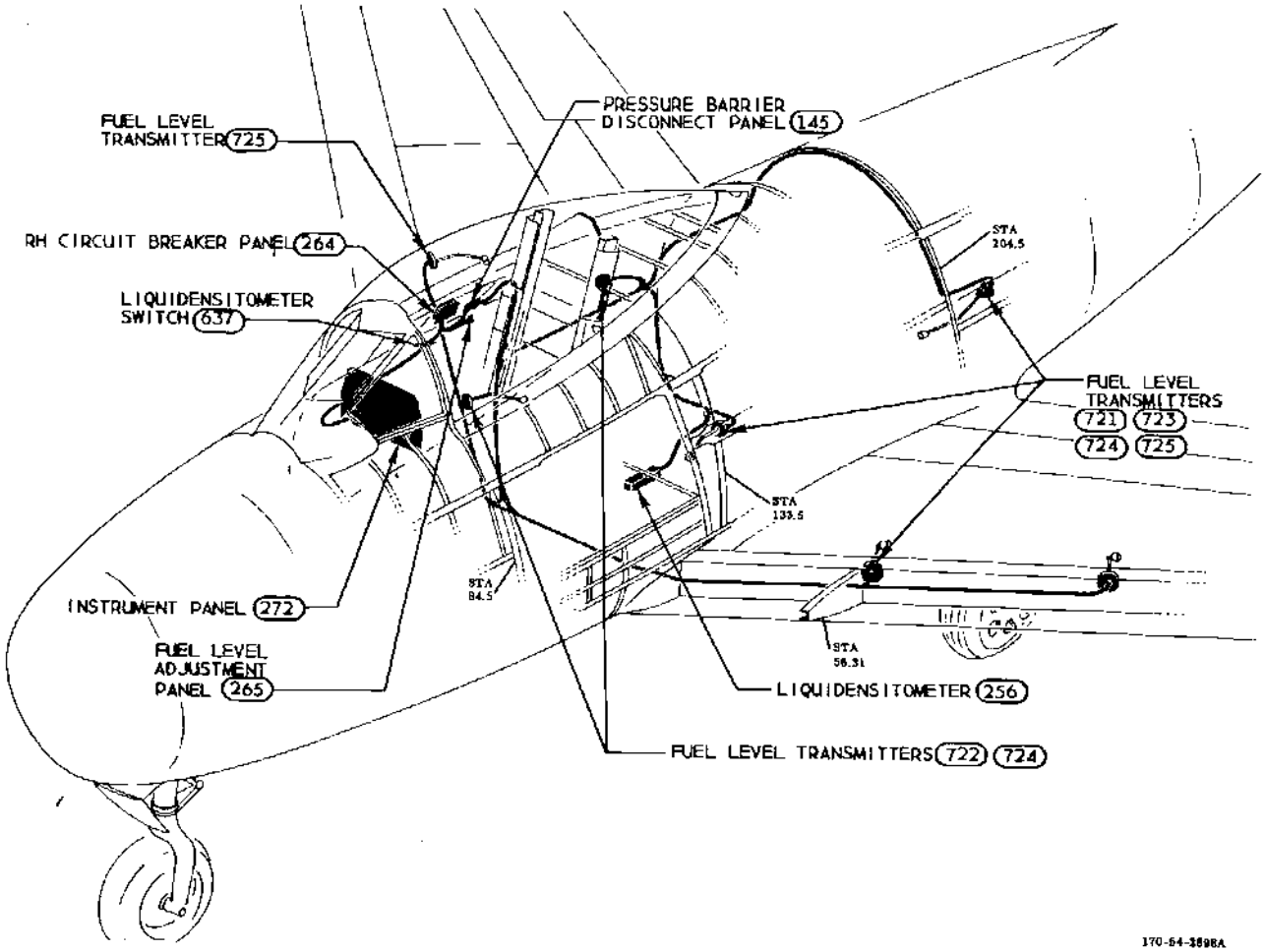

28V DC PRIMARY
15A
ENGINE MASTER FUEL SHUT OFF
25A
FUEL BOOSTER FWD
RH CIRCUIT-BREAKER PANEL
ENG MASTER OFF
631, ENGINE STARTING SYS
RH FWD CONSOLE
BAT. OFF
ON
START BATTERY AND STARTER
ENGINE IGNITION AND STARTING SYS
FUEL SHUTOFF VALVE
FUEL PUMP SOLENOID VALVES
ALTERNATE
MAIN
ENGINE JUNCTION BOX
ENGINE
673, DC POWER DISTRIBUTION SYS (SHEET 1)
ADVANCE
ENGINE THROTTLE CONTROL
RETARD
OFF
ON
TEST
ALTERNATE FUEL
FWD FUEL BOOSTER TEST
FUEL BOOSTER FWD
FWD BOOSTER PUMP
48, ENGINE IGNITION AND STARTING SYS
460, ENGINE IGNITION SYS
THROTTLE
STA 56 LH
FUEL LEVEL TRANSMITTER
CENTER WING
FUEL TRANSFER PUMP
STARTER CONTROL RELAY PANEL
FUEL TRANS. PUMP
AFT RADIO COMPT RELAY PANEL
262, DC POWER DISTRIBUTION SYS (SHEET 1)
TRANSFER PUMP TEST
AFT FUEL BOOSTER TEST
FUEL BOOSTER AFT
AFT BOOSTER PUMP
LH CIRCUIT-BREAKER PANEL
ITS-54-5090



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
54	Circuit Breaker—Fuel Level Indicating System	AN3161P5
109	Condenser—Fuel Level Indicator	HC1560 (Mallory)
145	Disconnect—Right-hand Pressure	YHST00S-6 (Burndy)
194	Indicator—Fuel Level	151-51006 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
265	Panel—Fuel Level Adjustment	AC134A5-5A
272	Panel—Instrument	170-51005 (NAA)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
410	Receptacle—Fuel Level Transmitter	AN3101A14S-2S
411	Receptacle—Fuel Level Transmitter	AN3101A14S-5S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
515	Regulator—Fuel Level Voltage	EA-408-1 (Liquidometer)
526	Resistor—Fuel Level Voltage	EA-4121 (Liquidometer)
663	Terminal Block—Right Gun Bay	AN3436-2-10
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
671	Terminal Block—Overvoltage Relay	AN3436-2-8
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
721	Transmitter—Aft Fuselage Fuel Level	EA-381-549A (Liquidometer)
722	Transmitter—Forward Fuselage Fuel Level	EA-380-548A (Liquidometer)
723	Transmitter—Center Wing Fuel Level	EA-379AC-547A (Liquidometer)
724	Transmitter—Wing Outer Panel Inboard Fuel Level	EA-378A-546 (Liquidometer)
725	Transmitter—Wing Outer Panel Outboard Fuel Level	EA-378A-545 (Liquidometer)

Figure 10-35. Fuel Level Indicating System—

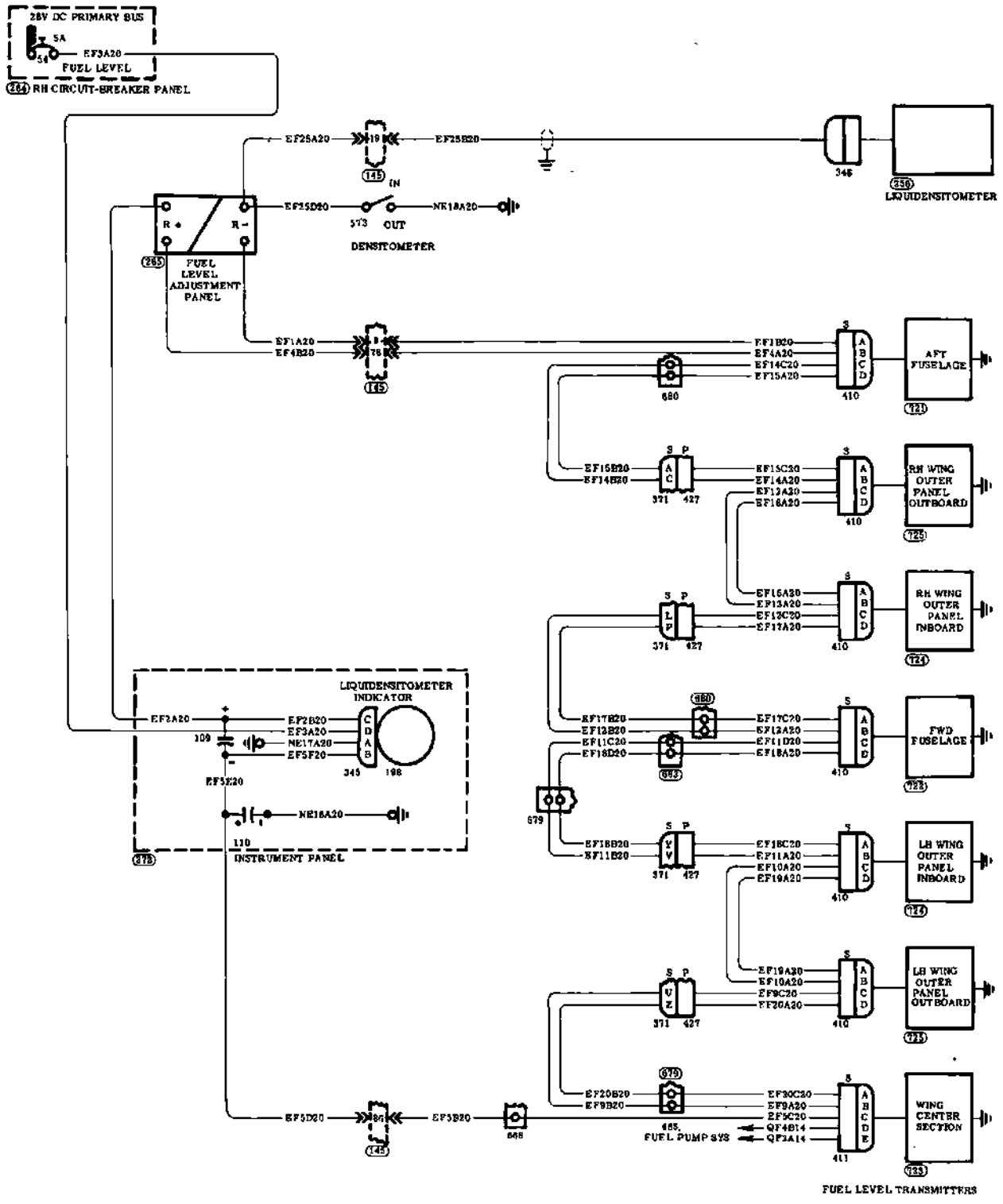

28V DC PRIMARY BUS
5A
54
EF24A20
FUEL LEVEL
264 RH CIRCUIT-BREAKER PANEL
EF24C20
EF24B20
20 Ω
526
EF6A20
471
RESISTOR
261 RELAY PANEL
EF27A20
EF28A20
EF25A20
EF27C20
EF28C20
EF25C20
EF6B20
NF2A20
515 FUEL LEVEL VOLTAGE REGULATOR
145
R+
R-
265
FUEL LEVEL ADJUSTMENT PANEL
EF1A20
EF4B20
EF1B20
EF4A20
EF14C20
EF15A20
880
410
AFT FUSELAGE
721
EF15B20
EF14B20
371
427
RH WING OUTER PANEL OUTBOARD
725
EF16A20
EF13A20
EF12C20
EF17A20
RH WING OUTER PANEL INBOARD
724
EF23A20
EF22A20
194
109
FUEL LEVEL INDICATOR
272 INSTRUMENT PANEL
EF17B20
EF12B20
EF11C20
EF18D20
883
EF17C20
EF12A20
EF11D20
EF18A20
FWD FUSELAGE
722
879
EF16B20
EF11B20
EF16C20
EF11A20
EF10A20
EF19A20
LH WING OUTER PANEL INBOARD
724
EF19A20
EF10A20
EF9C20
EF20A20
LH WING OUTER PANEL OUTBOARD
725
EF20B20
EF9B20
EF5A20
EF5B20
668
485
FUEL PUMP SYS
QF4B14
QF3A14
EF20C20
EF9A20
EF5C20
411
WING CENTER SECTION
723
FUEL LEVEL TRANSMITTERS
170-54-2796D



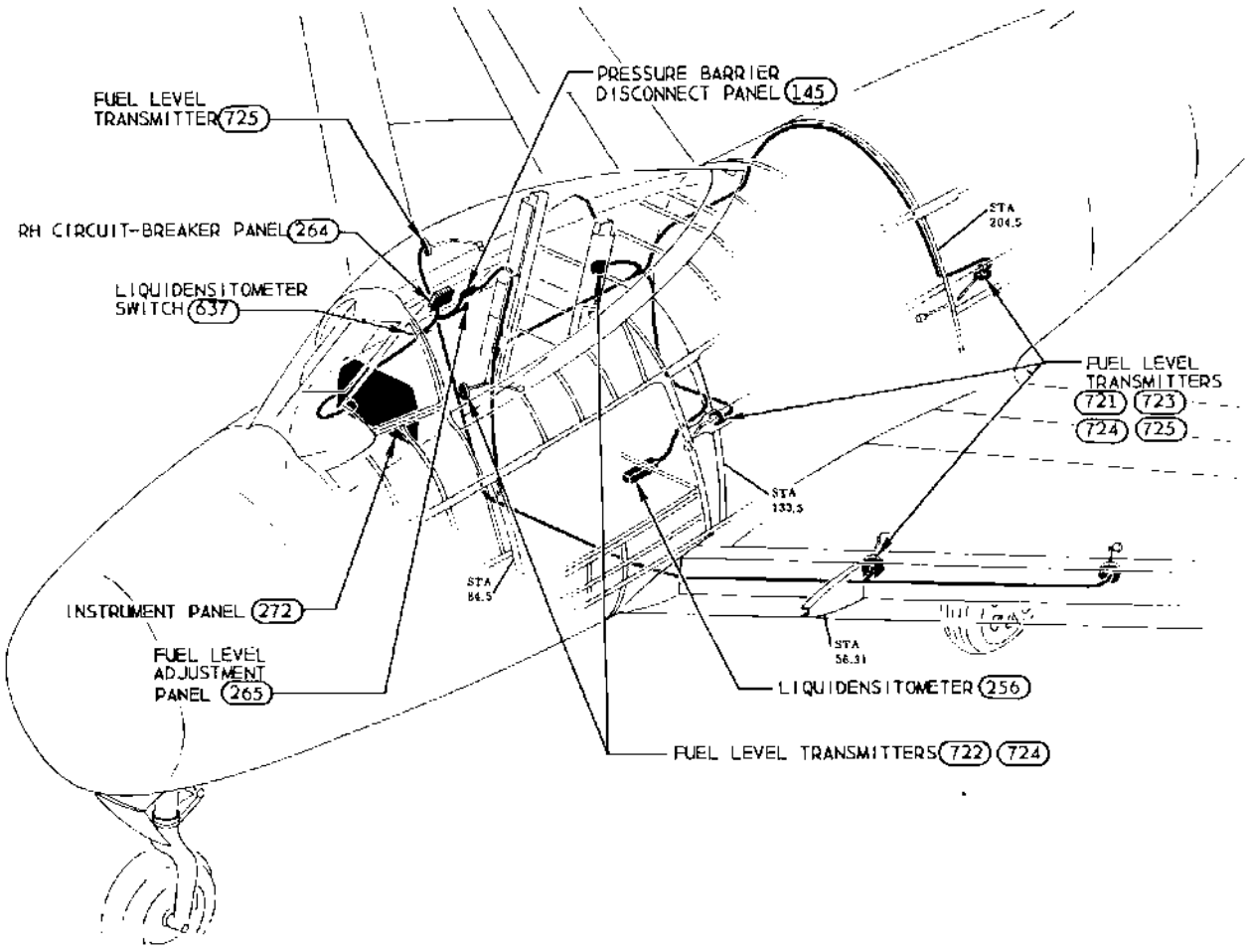
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
54	Circuit Breaker—Fuel Level Indicating System	AN3161P5
109	Condenser—Fuel Level Indicator	HC1560 (Mallory)
110	Condenser—Liquidensitometer	HC1560 (Mallory)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
198	Indicator—Liquidensitometer	EA-721-G-1 (Liquidometer)
256	Liquidensitometer	EA-909-C-1 (Liquidometer)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
265	Panel—Fuel Level Adjustment	AC134A5-5A
272	Panel—Instrument	170-51005 (NAA)
345	Plug—Liquidensitometer Indicator	AN3106B14S-2S
346	Plug—Liquidensitometer	412266F (Minneapolis-Honeywell)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
410	Receptacle—Fuel Level Transmitter	AN3101A14S-2S
411	Receptacle—Fuel Level Transmitter	AN3101A14S-5S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
573	Switch—Densitometer	AN3021-2
663	Terminal Block—Right Gun Bay	AN3436-2-10
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
721	Transmitter—Aft Fuselage Fuel Level	EA-381-549A (Liquidometer)
722	Transmitter—Forward Fuselage Fuel Level	EA-380-548A (Liquidometer)
723	Transmitter—Center Wing Fuel Level	EA-379AC-547A (Liquidometer)
724	Transmitter—Wing Outer Panel Inboard Fuel Level	EA-378A-546 (Liquidometer)
725	Transmitter—Wing Outer Panel Outboard Fuel Level	EA-378A-545 (Liquidometer)

Figure 10-36. Fuel Level Indicating System—F-86E-1 Airplanes



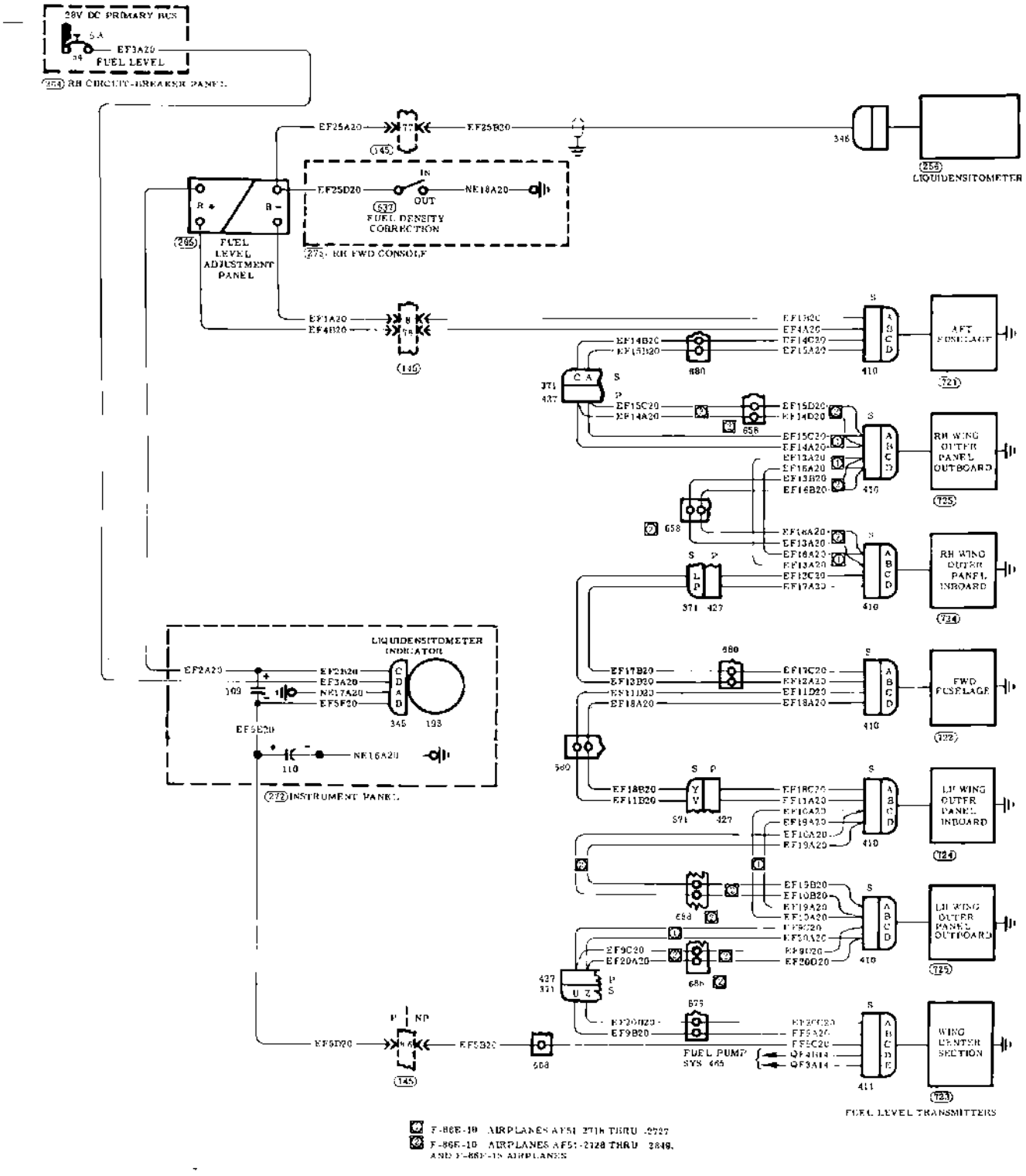
AF50-614 Through -638, and F-86E-5 and F-86E-6 Airplanes



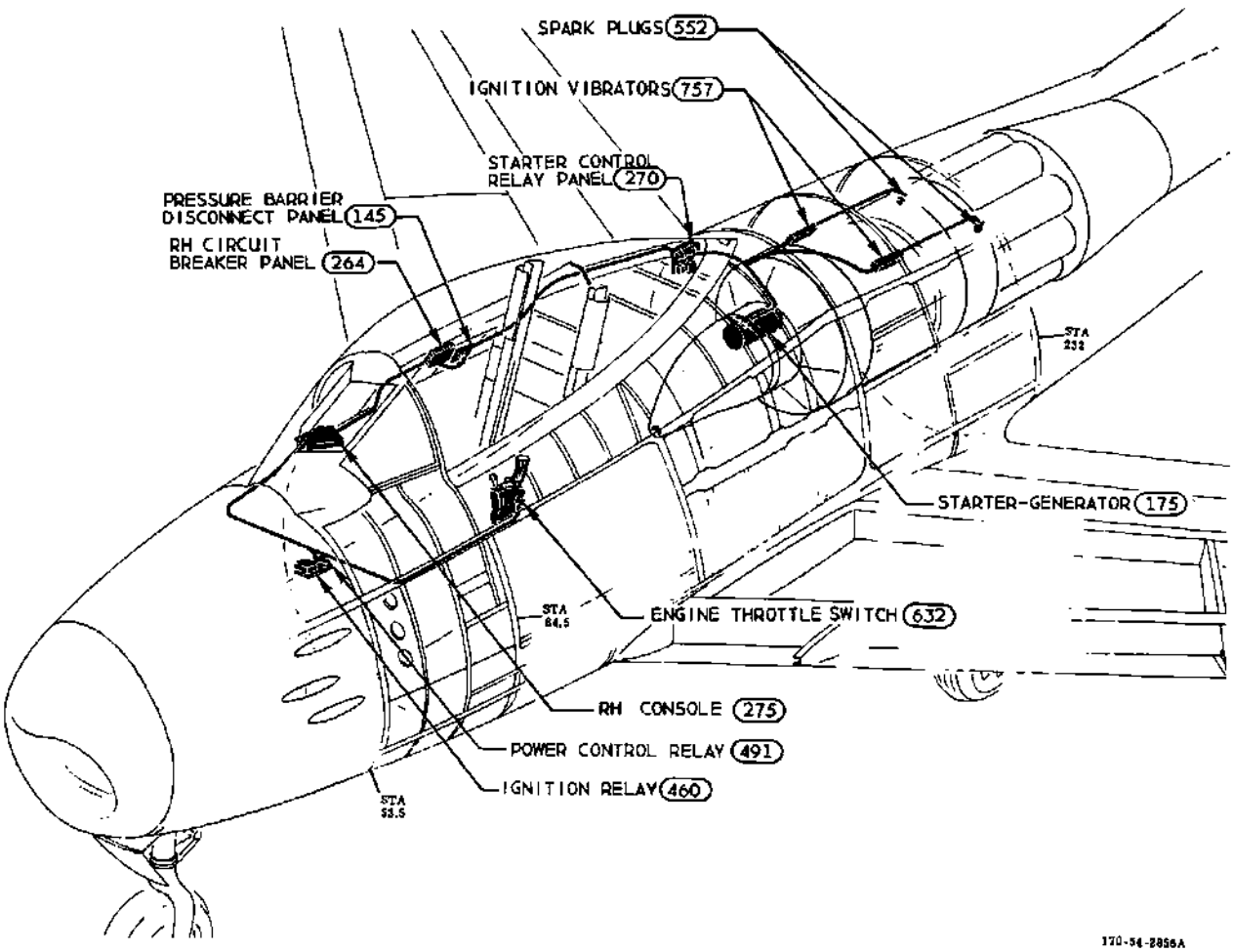
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
54	Circuit Breaker—Fuel Level Indicating System	AN3161P5
109	Condenser—Fuel Level Indicator	HC1560 (Mallory)
110	Condenser—Liquidensitometer	HC1560 (Mallory)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
198	Indicator—Liquidensitometer	EA-721-G-1 (Liquidometer)
256	Liquidensitometer	EA-909-C-1 (Liquidometer)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
265	Panel—Fuel Level Adjustment	AC134A5-5A
272	Panel—Instrument	170-51005 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
345	Plug—Liquidensitometer Indicator	AN3106B14S-2S
346	Plug—Liquidensitometer	412266F (Minneapolis-Honeywell)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
410	Receptacle—Fuel Level Transmitter	AN3101A14S-2S
411	Receptacle—Fuel Level Transmitter	AN3101A14S-5S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
637	Switch—Fuel Density Correction	AN3021-2
658	Terminal Block—Right Forward Wing	AN3436-2-10
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
688	Terminal Block—Left Wing Forward	AN3436-2-12
721	Transmitter—Aft Fuselage Fuel Level	EA-381-549A (Liquidometer)
722	Transmitter—Forward Fuselage Fuel Level	EA-380-548A (Liquidometer)
723	Transmitter—Center Wing Fuel Level	EA-379AC-547A (Liquidometer)
724	Transmitter—Wing Outer Panel Inboard Fuel Level	EA-378A-546 (Liquidometer)
725	Transmitter—Wing Outer Panel Outboard Fuel Level	EA-378-545 (Liquidometer)

Figure 10-37. Fuel Level Indicating System—



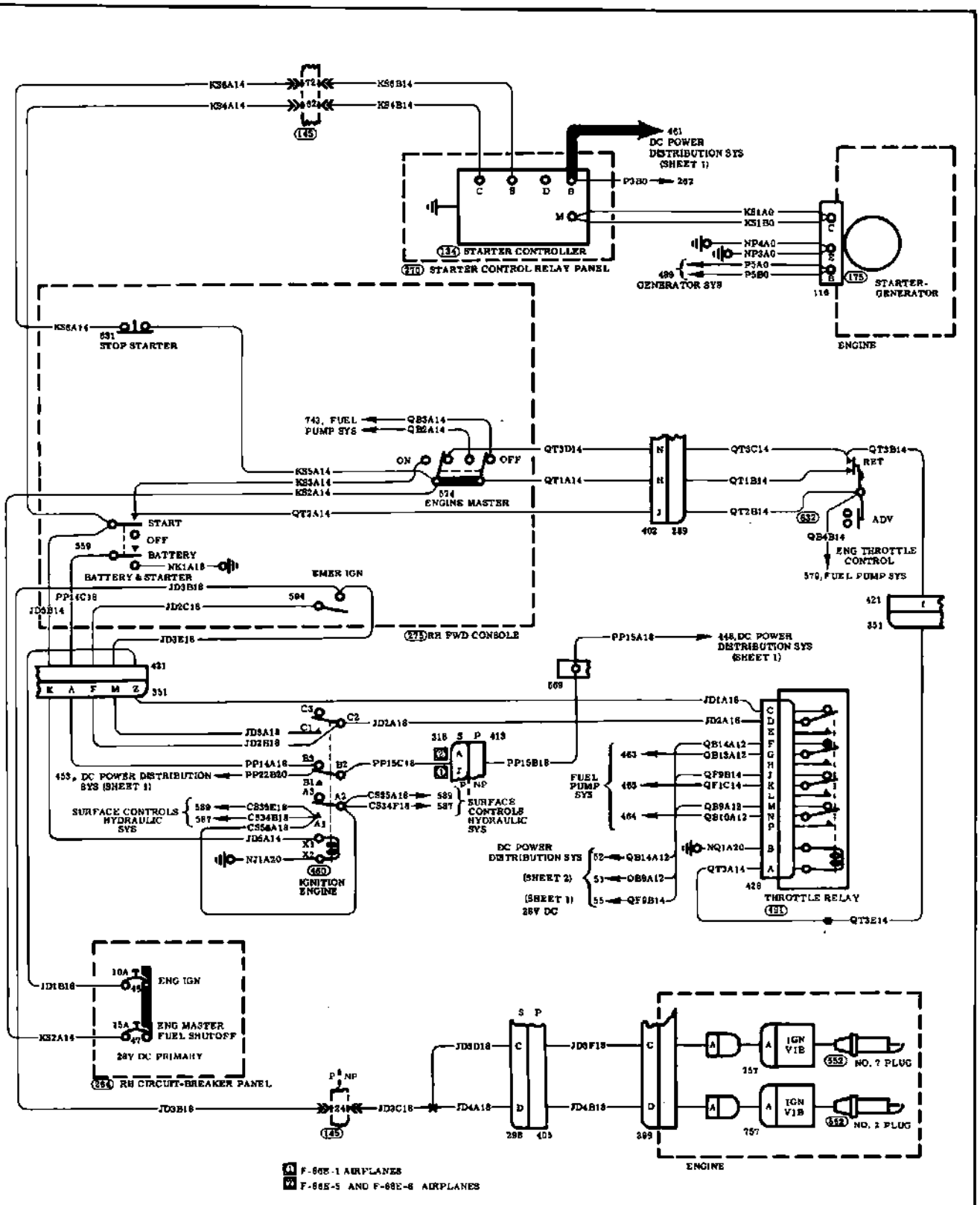
F-86E-10 and F-86E-15 Airplanes



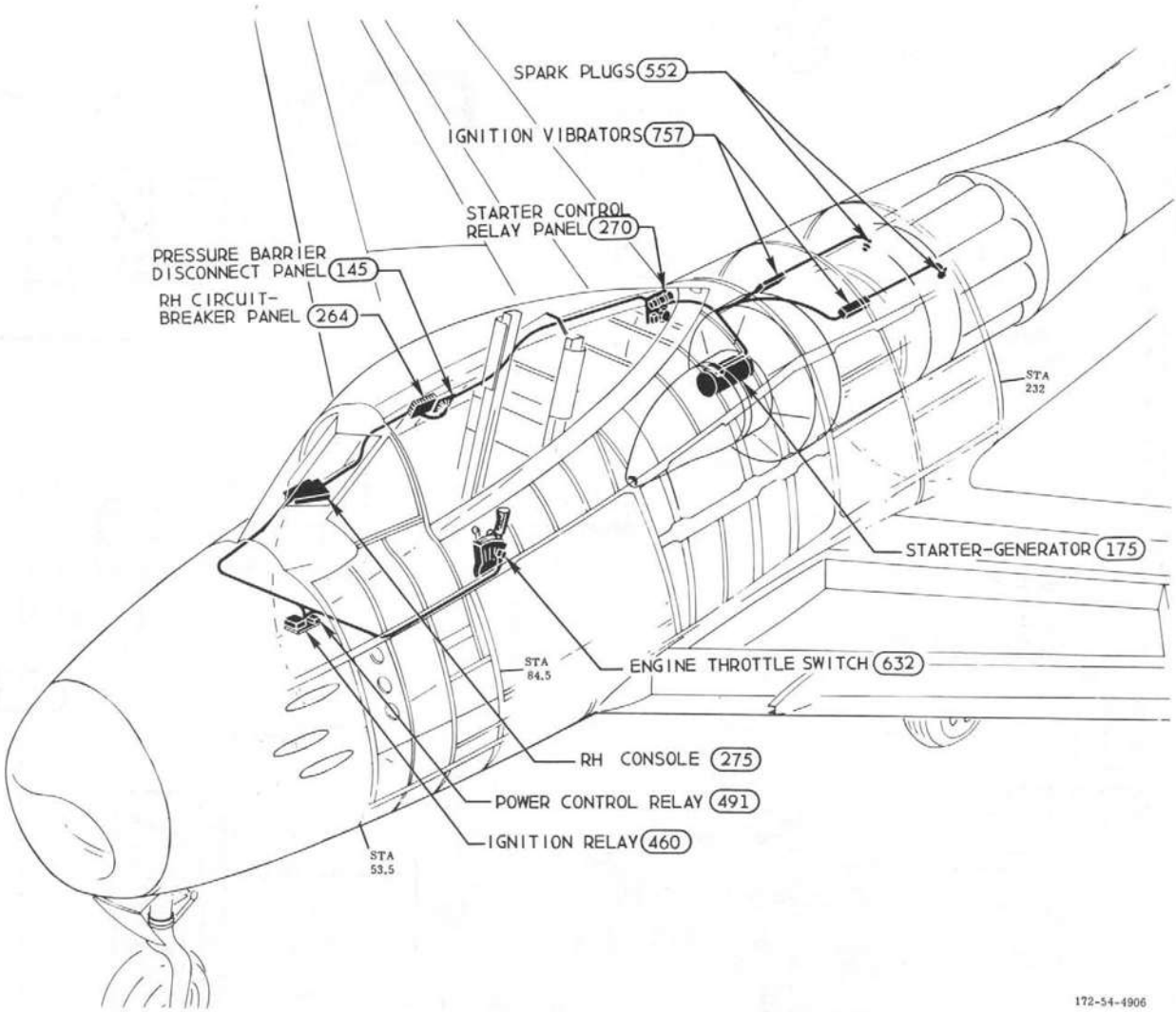
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
46	Circuit Breaker—Engine Ignition	AN3161P10
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P15
116	Connector—Engine Generator Power	Furnished With Engine (General Electric)
134	Controller—Starter	AN3391-1
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
175	Generator—Starter	32550, Type A-1 (General Electric 2CM77B8)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
275	Panel—Right Forward Console	161-54005-10 (NAA)
289	Plug—Cockpit Center Disconnect	AN3106824-5S
298	Plug—Engine Intermediate Disconnect	AN3106B18-1S
299	Plug—Engine Large Disconnect	AN3106B18-1S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
351	Plug—Pedestal Disconnect	AN3106A32-7P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
402	Receptacle—Cockpit Center Disconnect	AN3100A24-5P
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
42[illegible]	Receptacle—Throttle Relay	AN3102A-22-19S
460	Relay—Engine Starter Ignition Control	2069-25D (Leach)
491	Relay—Throttle	AN3310-1
552	Spark Plug—Ignition	Furnished With Engine
559	Switch—Battery-Starter	AN3027-8
574	Switch—Engine Master	AN3027-3
594	Switch—Emergency Ignition	AN3021-2
631	Switch—Stop-starter	D-800 (Hetherington)
632	Switch—Throttle Engine Control	BZ-3YDT (Micro Switch)
669	Terminal Block—Nose Junction Box	AN3436-2-18
757	Vibrator—Ignition	Furnished With Engine

Figure 10-38. Engine Ignition and Starting Systems—



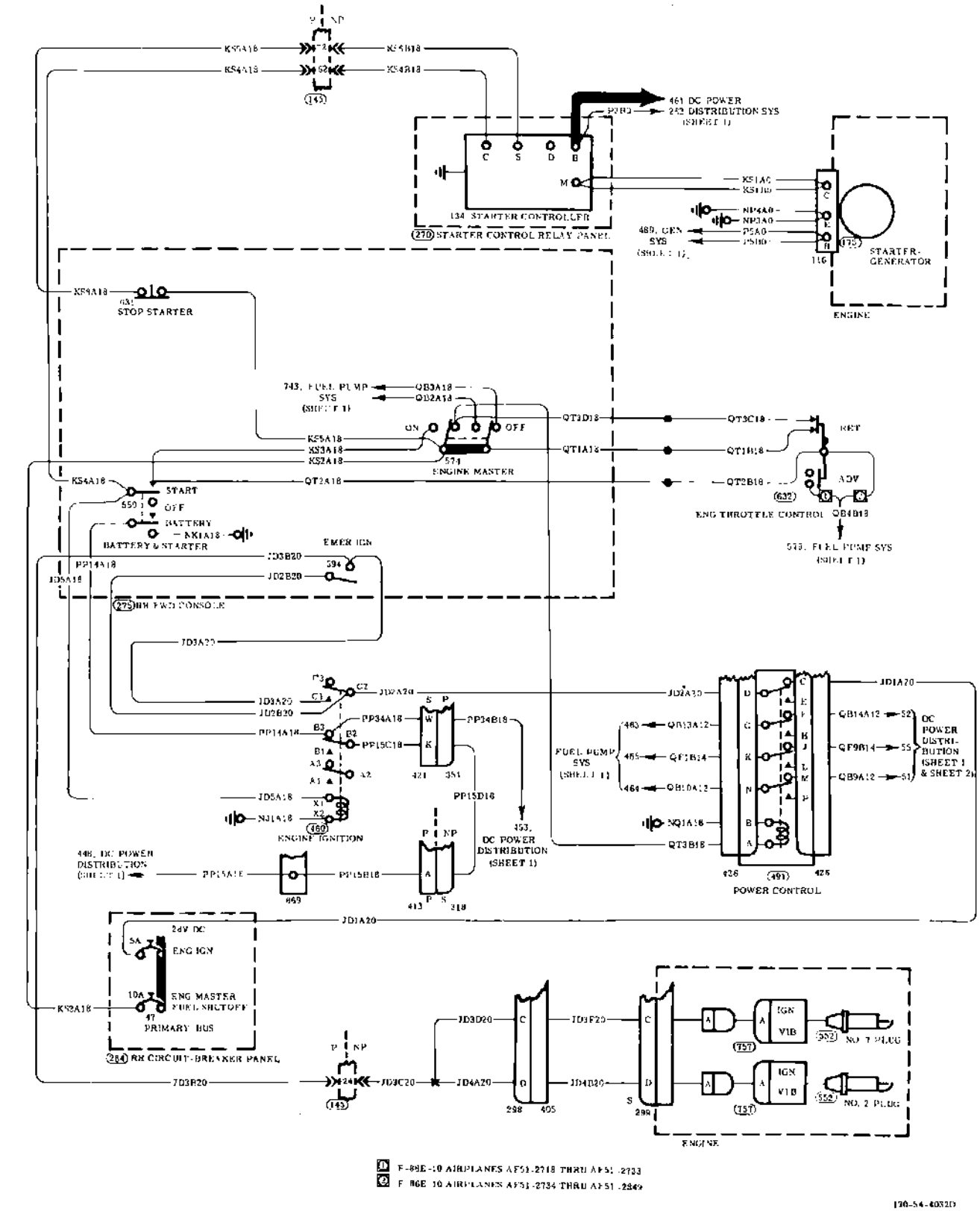
F-86E-1, F-86E-5, and F-86E-6 Airplanes

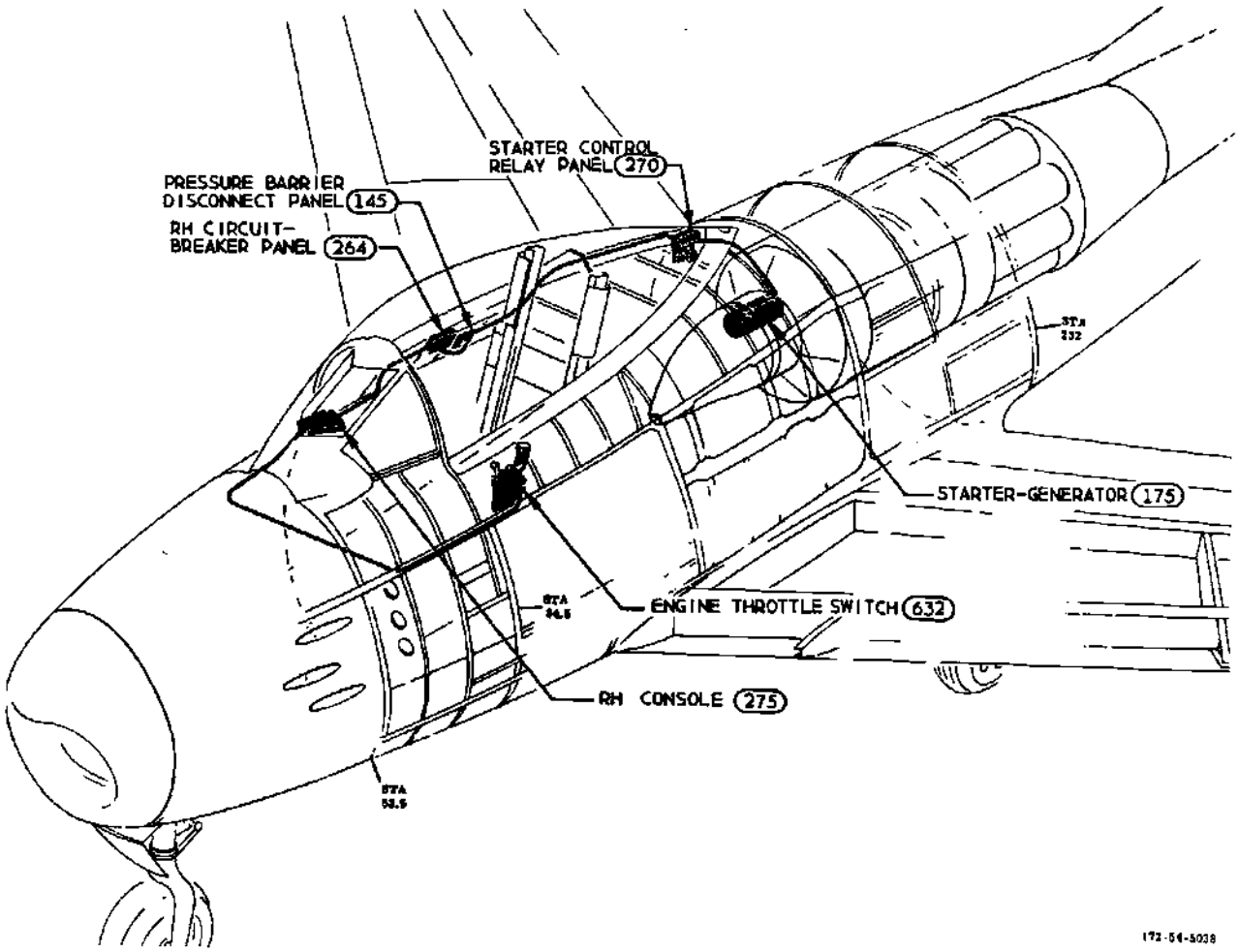


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
46	Circuit Breaker—Engine Ignition	AN3161P5
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P10
116	Connector—Engine Generator Power	Furnished With Engine (General Electric)
134	Controller—Starter	AN3391-1
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
175	Generator—Starter	32550, Type A-1 (General Electric 2CM77B8)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
298	Plug—Engine Intermediate Disconnect	AN3106B18-1S
299	Plug—Engine Large Disconnect	AN3106B18-1S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
351	Plug—Pedestal Disconnect	AN3106A32-7P
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
426	Receptacle—Throttle Relay	AN3102A22-19S
460	Relay—Engine Starter Ignition Control	2069-25D (Leach)
491	Relay—Throttle	AN3310-1
552	Spark Plug—Ignition	Furnished With Engine
559	Switch—Battery-Starter	AN3027-8
574	Switch—Engine Master	AN3027-3
594	Switch—Emergency Ignition	AN3021-2
631	Switch—Stop-starter	D-800 (Hetherington)
632	Switch—Throttle Engine Control	BZ-3YDT (Micro Switch)
669	Terminal Block—Nose Junction Box	AN3436-2-18
757	Vibrator—Ignition	Furnished With Engine

Figure 10-39. Engine Ignition and Starting

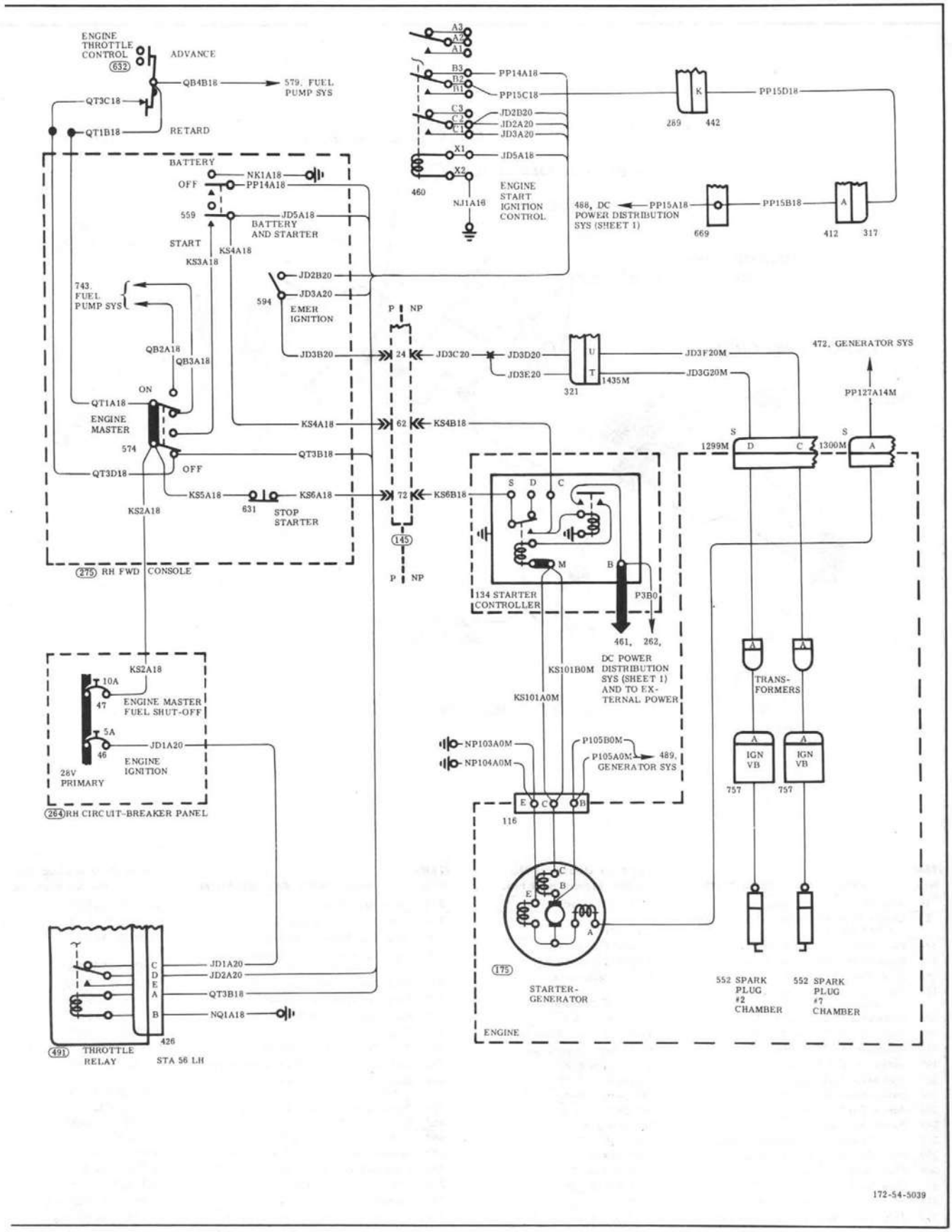

461 DC POWER
252 DISTRIBUTION SYS
134 STARTER CONTROLLER
270 STARTER CONTROL RELAY PANEL
489, GEN SYS
STARTER-GENERATOR
ENGINE
STOP STARTER
743, FUEL PUMP SYS
ENGINE MASTER
START
OFF
BATTERY
BATTERY & STARTER
EMER IGN
275 RH FWD CONSOLE
ENG THROTTLE CONTROL
543, FUEL PUMP SYS
ENGINE IGNITION
448, DC POWER DISTRIBUTION
453, DC POWER DISTRIBUTION (SHEET 1)
FUEL PUMP SYS
POWER CONTROL
DC POWER DISTRIBUTION (SHEET 1 & SHEET 2)
24V DC
ENG IGN
ENG MASTER FUEL SHUTOFF
PRIMARY BUS
264 RH CIRCUIT-BREAKER PANEL
IGN VIB
NO. 1 PLUG
NO. 2 PLUG
ENGINE
D F-86E-10 AIRPLANES AF51-2718 THRU AF51-2733
O F-86E-10 AIRPLANES AF51-2734 THRU AF51-2849
170-54-40320

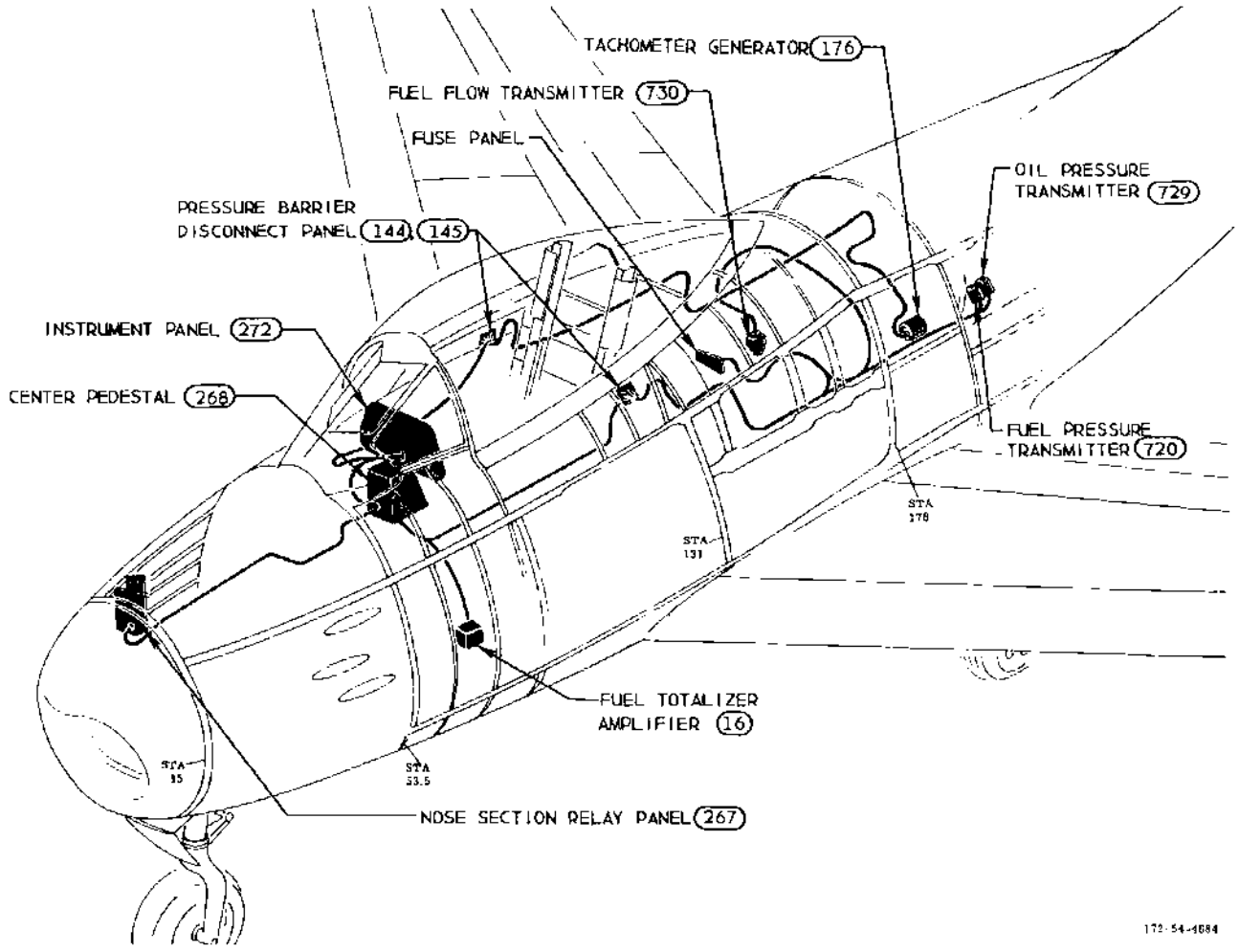


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
46	Circuit Breaker—Engine Ignition	AN3161P5
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P10
116	Connector—Engine Generator Power	Furnished With Engine (GFP)
134	Controller—Starter	AN3391-1
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
175	Generator—Starter	32550, Type A-1 (General Electric 2CM7788)
264	Panel—Right Circuit-breaker	172-54040 (GFP)
275	Panel—Right Forward Console	172-54095 (GFP)
289	Plug—Pedestal Disconnect	AN3106B32-7S
317	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106A32-7S
321	Plug—Engine Disconnect	AN3106B28-12S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
426	Receptacle—Throttle Relay	AN3102A22-19S
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
460	Relay—Engine Starter Ignition Control	9048-26F (Leach)
491	Relay—Throttle	AN3310-1
552	Spark Plug—Ignition	Furnished With Engine (GFP)
559	Switch—Battery-Starter	AN3027-8
574	Switch—Engine Master	AN3027-3
594	Switch—Emergency Ignition	AN3021-2
631	Switch—Stop-starter	D-800 (Hetherington)
632	Switch—Throttle Engine Control	BZ-3YDT (Micro Switch)
669	Terminal Block—Nose Junction Box	AN3436-2-18
757	Vibrator—Ignition	Furnished With Engine (GFP)
1299M	Plug—Engine Large Disconnect	AN3106B18-1S
1300M	Plug—Engine Small Disconnect	AN3106B18-13S
1435M	Receptacle—Engine Harness Disconnect	AN3100A28-12P

Figure 10-40. Engine Ignition and Starting

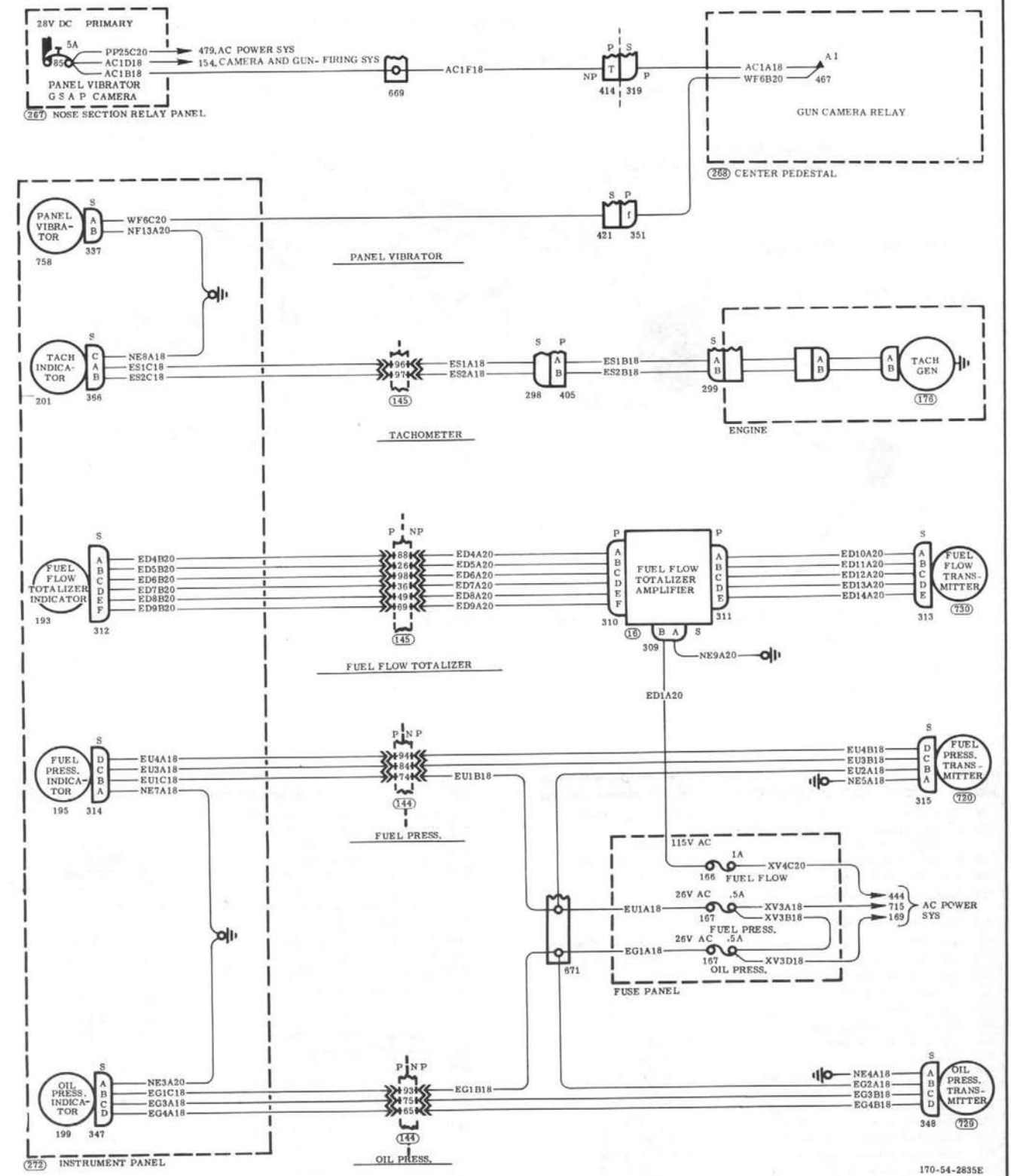

ENGINE THROTTLE CONTROL
632
ADVANCE
QB4B18
579, FUEL PUMP SYS
QT3C18
QT1B18
RETARD
BATTERY
OFF
NK1A18
PP14A18
559
JD5A18
BATTERY AND STARTER
START
KS4A18
KS3A18
743, FUEL PUMP SYS
JD2B20
JD3A20
594
EMER IGNITION
QB2A18
QB3A18
ON
QT1A18
ENGINE MASTER
574
KS4A18
QT3B18
OFF
QT3D18
KS5A18
631
KS6A18
STOP STARTER
KS2A18
275 RH FWD CONSOLE
P NP
24
62
72
145
JD3B20
JD3C20
JD3D20
JD3E20
321
U
T
1435M
JD3F20M
JD3G20M
472, GENERATOR SYS
PP127A14M
KS4B18
KS6B18
S
D
C
1299M
1300M
A
M
B
134 STARTER CONTROLLER
P3B0
461, 262,
DC POWER DISTRIBUTION SYS (SHEET 1) AND TO EXTERNAL POWER
KS101B0M
KS101A0M
TRANS-FORMERS
KS2A18
10A
47
ENGINE MASTER FUEL SHUT-OFF
5A
46
JD1A20
ENGINE IGNITION
28V PRIMARY
264 RH CIRCUIT-BREAKER PANEL
NP103A0M
NP104A0M
P105B0M
P105A0M
489, GENERATOR SYS
IGN VB
757
E
C
B
116
C
B
E
A
175
STARTER-GENERATOR
552 SPARK PLUG #2 CHAMBER
552 SPARK PLUG #7 CHAMBER
ENGINE
A3
A2
A1
B3
B2
B1
PP15C18
PP15D18
K
289
442
C3
C2
C1
JD2D20
JD2A20
JD3A20
X1
X2
460
JD5A18
NJ1A18
ENGINE START IGNITION CONTROL
488, DC POWER DISTRIBUTION SYS (SHEET 1)
PP15A18
PP15B18
669
412
317
C
D
E
A
B
JD1A20
JD2A20
QT3B18
NQ1A18
426
491 THROTTLE RELAY
STA 56 LH
172-54-5039



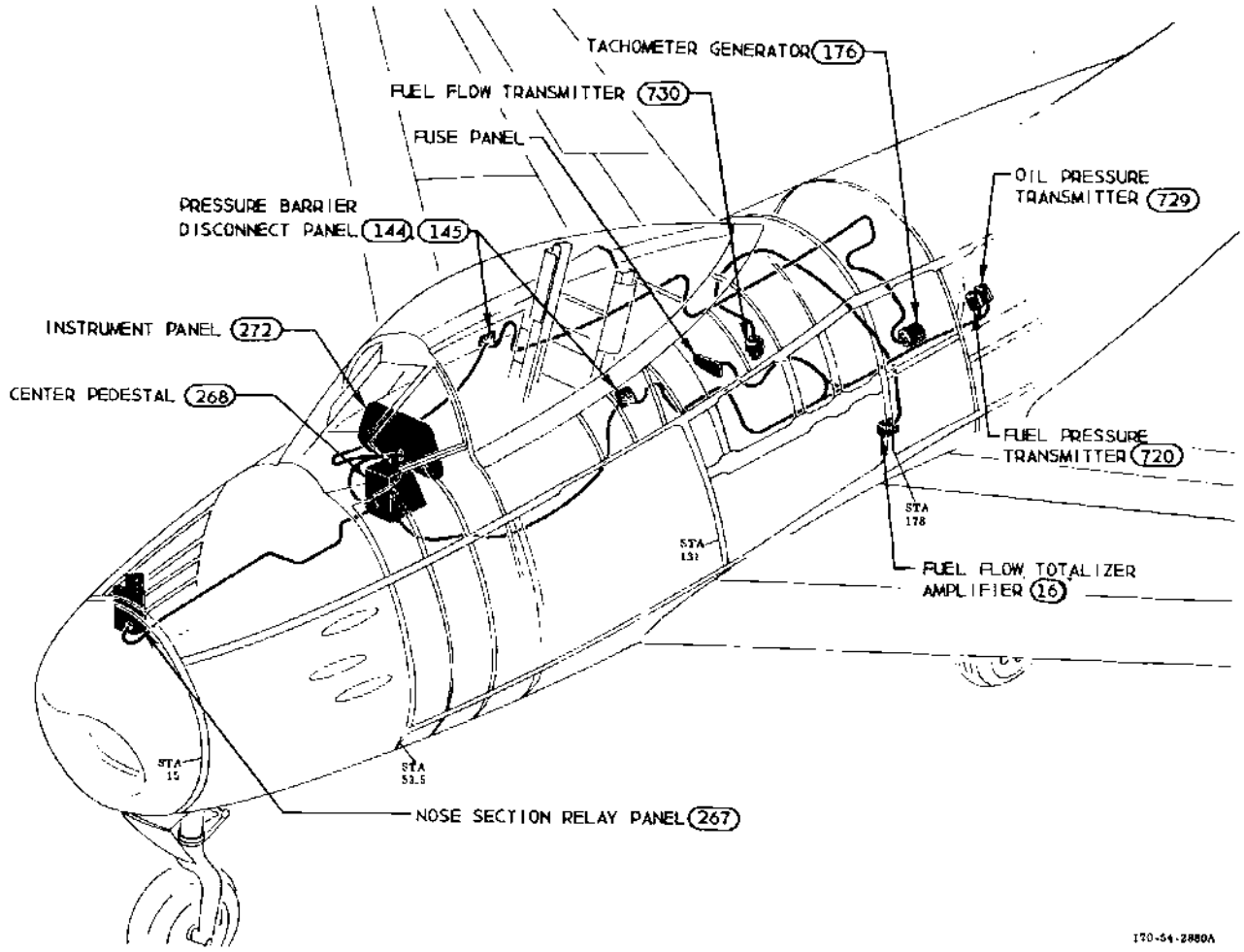
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
16	Amplifier—Fuel Totalizer	16501-1-A (Pioneer)
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
176	Generator—Tachometer	21135, Type A-1
193	Indicator—Fuel Flow Totalizer	36700-1A-1-A1 (Pioneer)
195	Indicator—Fuel Pressure	MIL-I-6301, Type C-34
199	Indicator—Oil Pressure	21319, Type B-20
201	Indicator—Tachometer	27144, Type E-32
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
298	Plug—Engine Intermediate Disconnect	AN3106B18-1S
299	Plug—Engine Large Disconnect	AN3106B18-1S
309	Plug—Fuel Totalizer Amplifier	AN3106B14-12S
310	Plug—Fuel Totalizer Amplifier	AN3106B18-12P
311	Plug—Fuel Totalizer Amplifier	AN3106A14S-5P
312	Plug—Fuel Flow Totalizer Indicator	AN3106B18-12S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
313	Plug—Fuel Flowmeter	AN3106B14S-5S
314	Plug—Fuel Pressure Indicator	AN3106B14S-2S
315	Plug—Fuel Pressure Transmitter	AN3106B14S-2S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
337	Plug—Instrument Panel Vibrator	AN3106B10SL-4S
347	Plug—Oil Pressure Indicator	AN3106B14S-2S
348	Plug—Oil Pressure Transmitter	AN3106B14S-2S
351	Plug—Pedestal Disconnect	AN3106A32-7P
366	Plug—Tachometer Indicator	AN3106A10SL-3S
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
467	Relay—GSAP Camera	233-51A (Leach)
669	Terminal Block—Nose Junction Box	AN3436-2-18
671	Terminal Block—Overvoltage Relay	AN3436-2-8
720	Transmitter—Fuel Pressure	21163, Type E-5
729	Transmitter—Oil Pressure	21117, Type R-2
730	Transmitter—Fuel Flowmeter	9106-12A1 (Pioneer)
758	Vibrator Assembly—Instrument Panel	C-10FA-543 (Globe)

Figure 10-41. Fuel Flow Totalizer, Fuel Pressure Indicating, Oil Pressure Indicating, Instrument



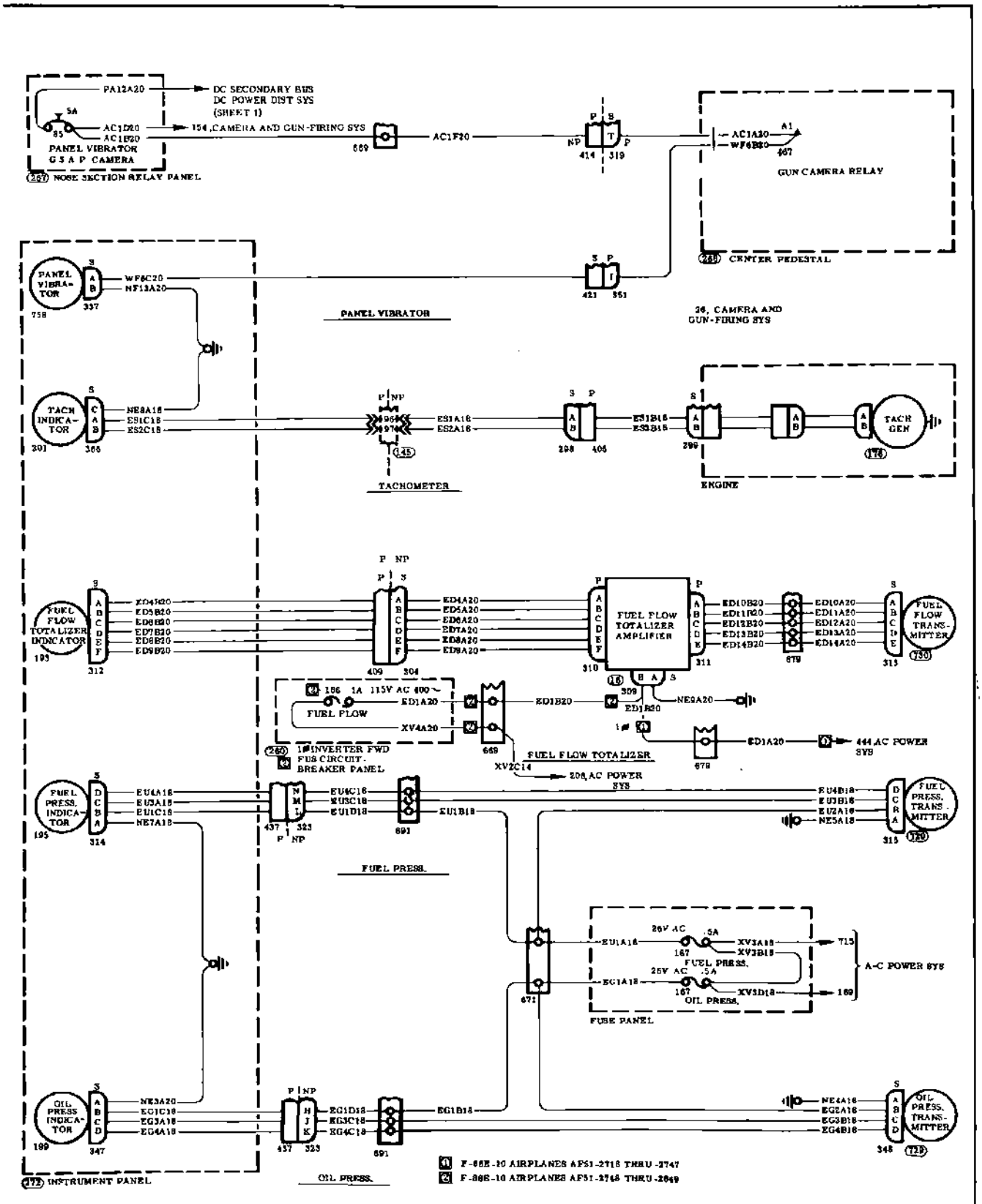
Panel Vibrator, and Tachometer Systems—F-86E-1, F-86E-5, and F-86E-6 Airplanes



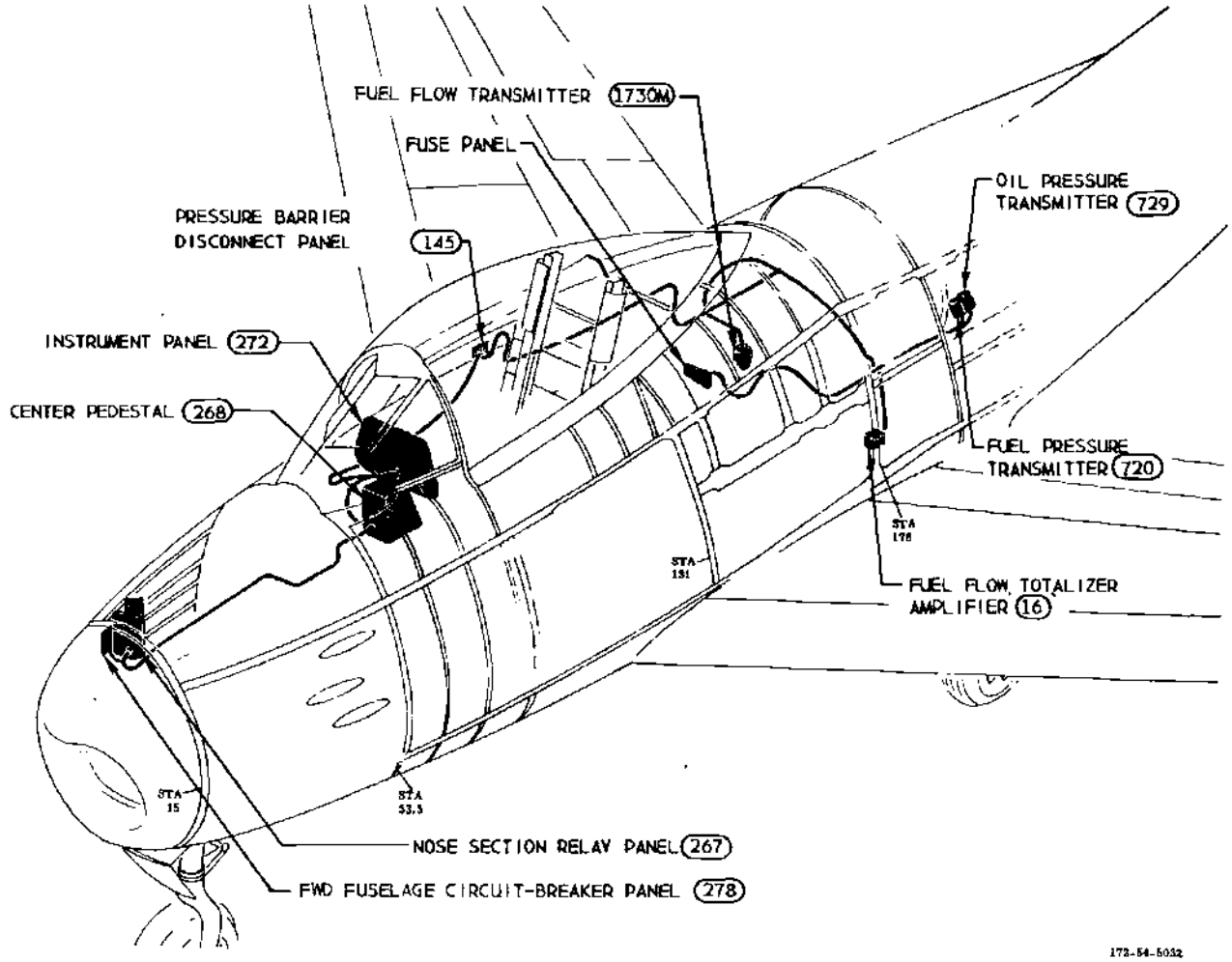
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
16	Amplifier—Fuel Totalizer	16501-1-A (Pioneer)
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator	AGC 1/2 (Bussmann)
176	Generator—Tachometer	21135, Type A-1
193	Indicator—Fuel Flow Totalizer	36700-1A-1-A1 (Pioneer)
195	Indicator—Fuel Pressure	MIL-I-6301, Type C-34
199	Indicator—Oil Pressure	21319, Type B-20
201	Indicator—Tachometer	27144, Type E-32
260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
298	Plug—Engine Intermediate Disconnect	AN3106B18-1S
299	Plug—Engine Large Disconnect	AN3106B18-1S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
309	Plug—Fuel Totalizer Amplifier	AN3106B14-9S
310	Plug—Fuel Totalizer Amplifier	AN3106B18-12P
311	Plug—Fuel Totalizer Amplifier	AN3106A14S-5P
312	Plug—Fuel Flow Totalizer Indicator	AN3106B18-12S
313	Plug—Fuel Flowmeter	AN3106B14S-5S
314	Plug—Fuel Pressure Indicator	AN3106B14S-2S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
315	Plug—Fuel Pressure Transmitter	AN3106B14S-2S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
323	Plug—Gun Bay Pressure	AN3106B24-28S
337	Plug—Instrument Panel Vibrator	AN3106B10SL-4S
347	Plug—Oil Pressure Indicator	AN3106B14S-2S
348	Plug—Oil Pressure Transmitter	AN3106B14S-2S
351	Plug—Pedestal Disconnect	AN3106A32-7P
366	Plug—Tachometer Indicator	AN3106A10SL-3S
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
467	Relay—GSAP Camera	233 51A (Leach)
669	Terminal Block—Nose Junction Box	AN3436-2-18
671	Terminal Block—Overvoltage Relay	AN3436-2-8
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
720	Transmitter—Fuel Pressure	21163, Type E-5
729	Transmitter—Oil Pressure	21117, Type R-2
730	Transmitter—Fuel Flowmeter	9106-12A1 (Pioneer)
758	Vibrator Assembly—Instrument Panel	C-10FA-543 (Globe)

Figure 10-42. Fuel Flow Totalizer, Fuel Pressure Indicating, Oil Pressure Indicating,



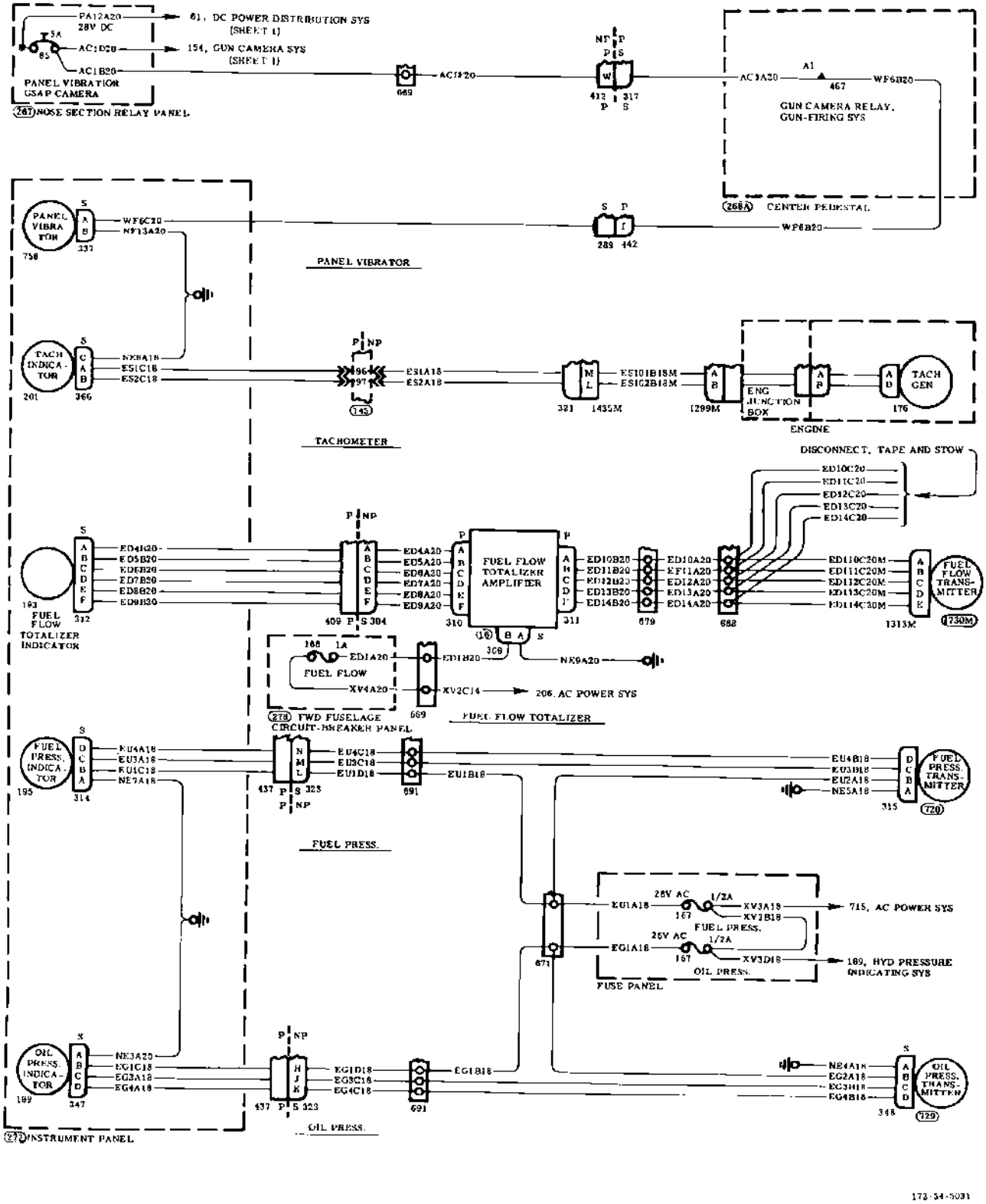
Instrument Panel Vibrator, and Tachometer Systems—F-86E-10 Airplanes



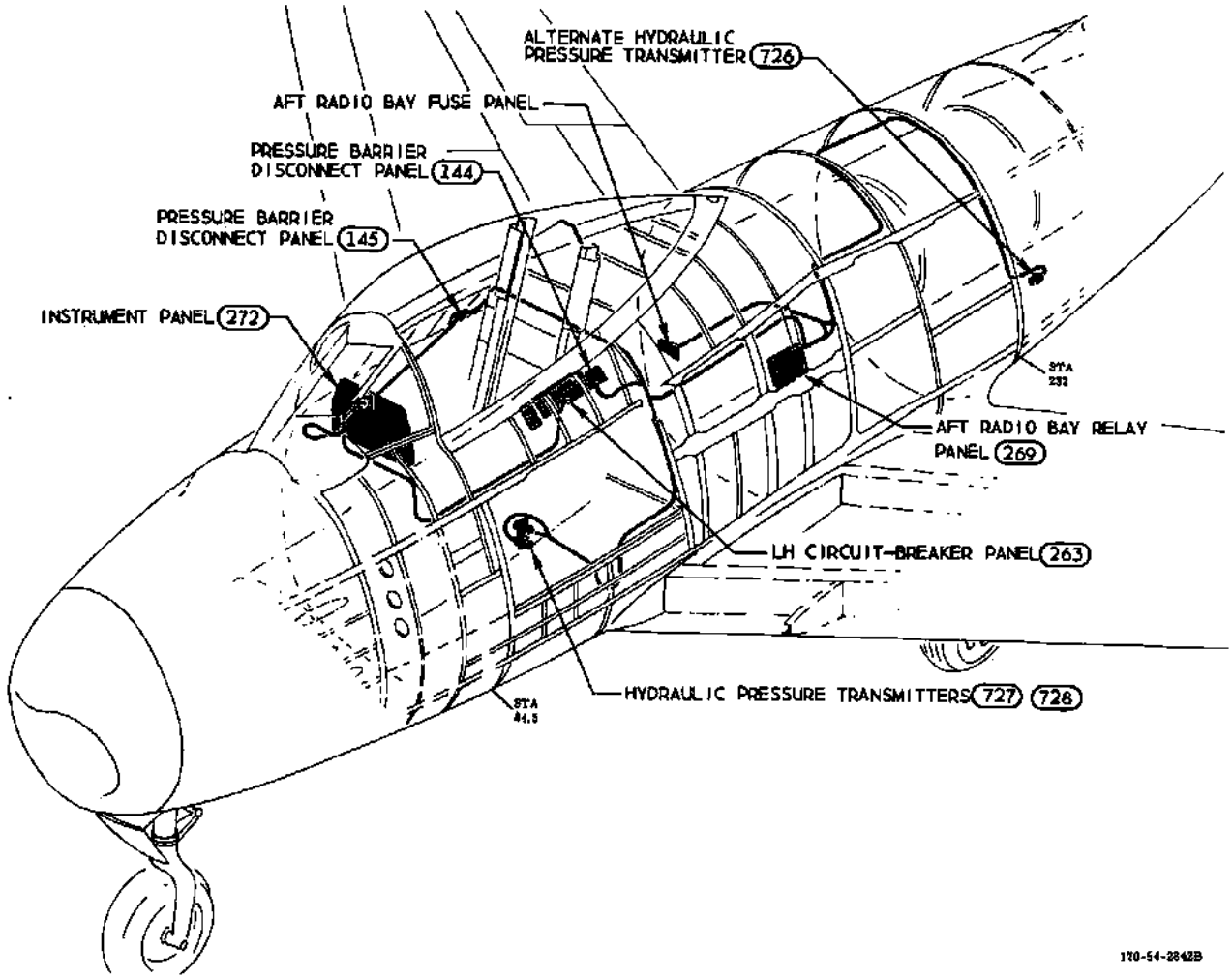
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
16	Amplifier—Fuel Totalizer	16051-1-A (Pioneer)
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
176	Generator—Tachometer	21135, Type A-1
193	Indicator—Fuel Flow Totalizer	36700-1A-1-A1 (Pioneer)
195	Indicator—Fuel Pressure	MIL-I-6301, Type C-34
199	Indicator—Oil Pressure	21319, Type B-20
201	Indicator—Tachometer	27144, Type E-32
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
310	Plug—Fuel Totalizer Amplifier	AN3106B18-12P
311	Plug—Fuel Totalizer Amplifier	AN3106A14S-5P
312	Plug—Fuel Flow Totalizer Indicator	AN3106B18-12S
314	Plug—Fuel Pressure Indicator	AN3106B14S-2S
315	Plug—Fuel Pressure Transmitter	AN3108B14S-2S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
321	Plug—Engine Disconnect	AN3106B28-12S
323	Plug—Gun Bay Pressure	AN3106B24-28S
337	Plug—Instrument Panel Vibrator	AN3106B10SL-4S
347	Plug—Oil Pressure Indicator	AN3106B14S-2S
348	Plug—Oil Pressure Transmitter	AN3108B14S-2S
366	Plug—Tachometer Indicator	AN3106A10SL-3S
405	Receptacle—Engine Disconnect Intermediate	AN3100A18-1P
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
469	Relay—Gun-firing	AN3350-1
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-17
669	Terminal Block—Nose Junction Box	AN3436-2-18
679	Terminal Block—Left Wing Forward	AN3436-2-10
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
720	Transmitter—Fuel Pressure	21163, Type E-5
729	Transmitter—Oil Pressure	21117, Type R-2
758	Vibrator Assembly—Instrument Panel	C-10FA-543 (Globe)
1313M	Plug—Fuel Flowmeter	AN3108B14S-5S
1730M	Transmitter—Fuel Flowmeter	9102-12A1

Figure 10-43. Fuel Flow Totalizer, Fuel Pressure Indicating, Oil Pressure Indicating,

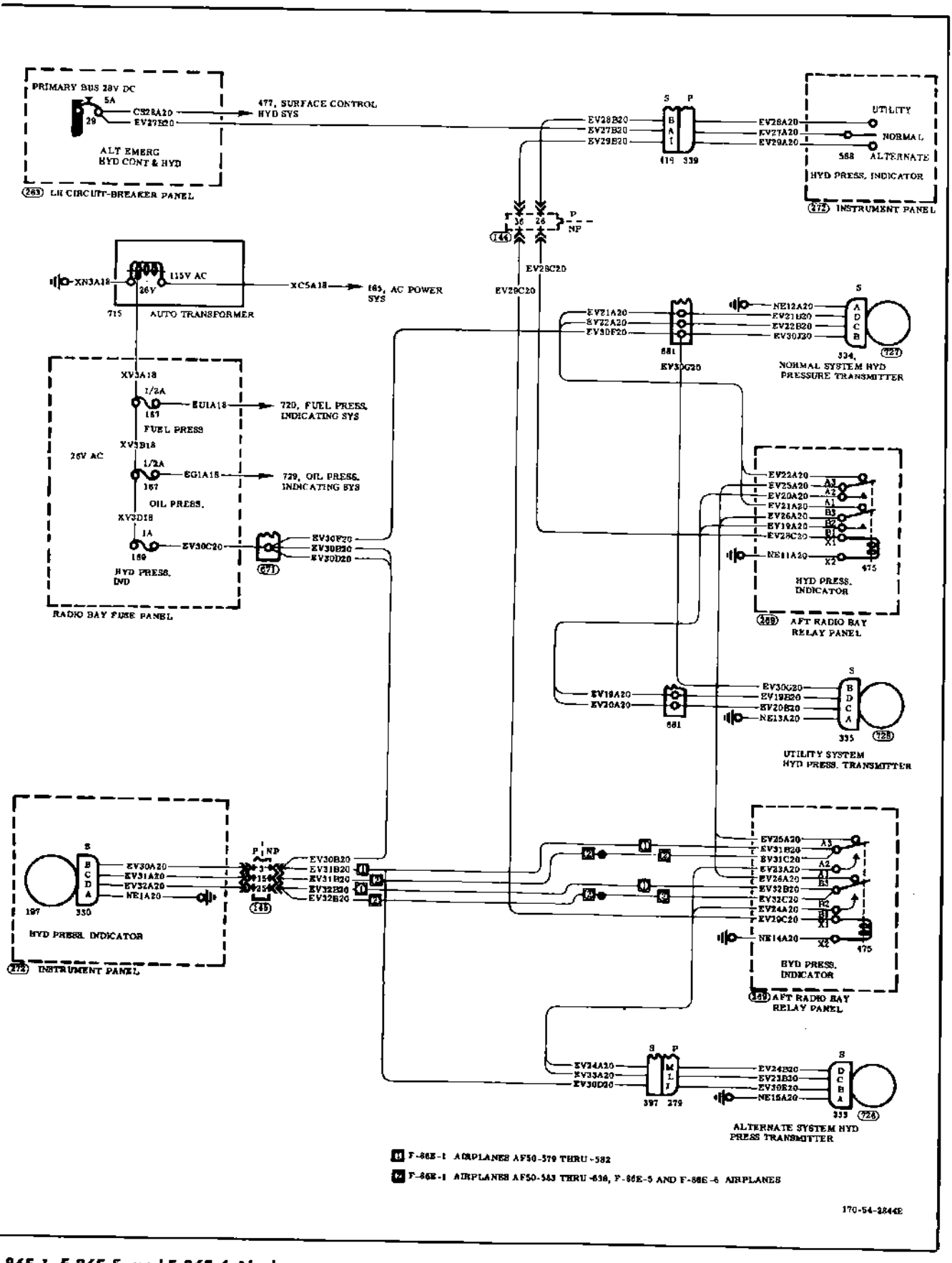


Instrument Panel Vibrator, and Tachometer Systems—F-86E-15 Airplanes

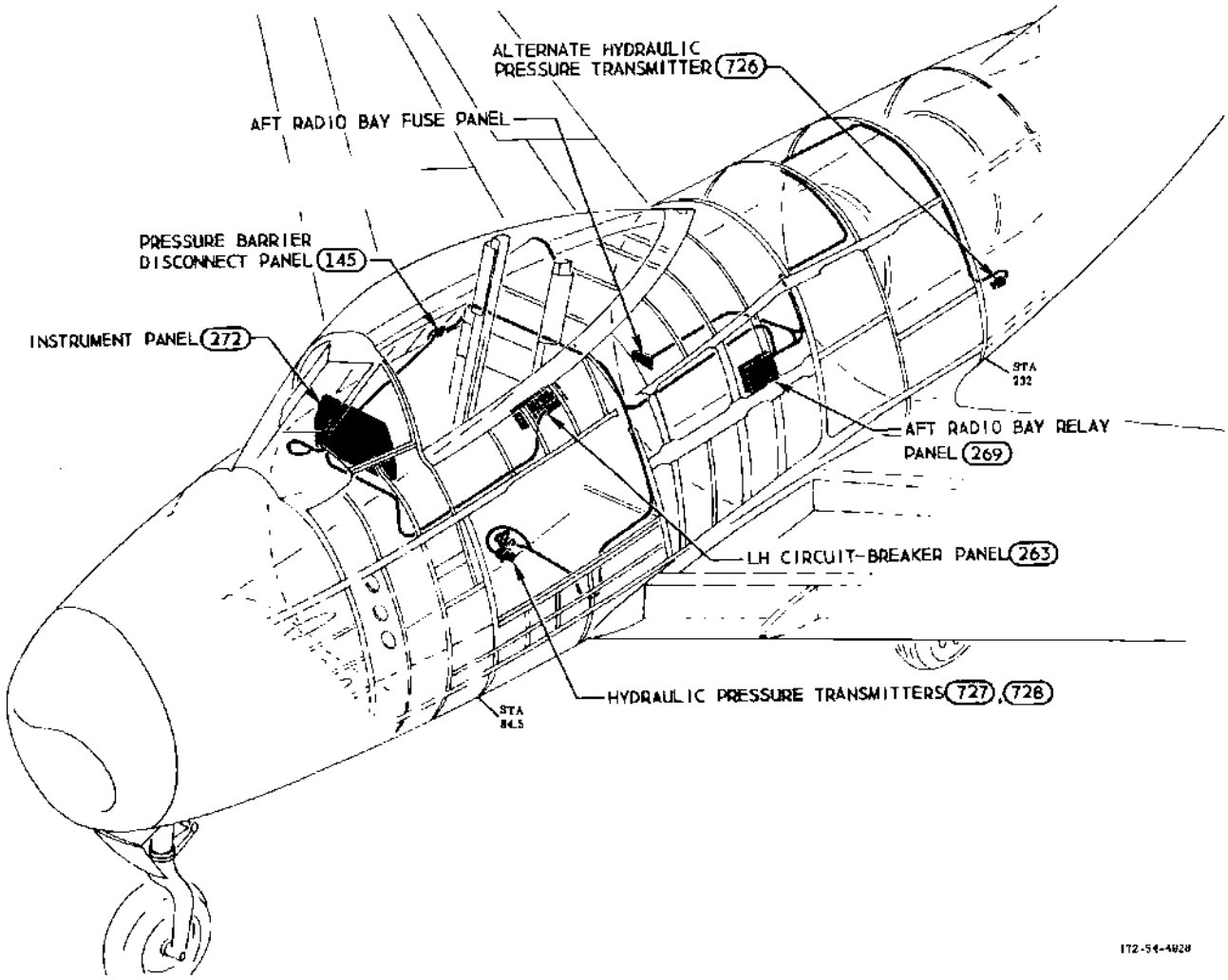


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
197	Indicator—Hydraulic Pressure	21311, Type E-1
263	Panel—Left Circuit-breaker	170-54068 (NAA)
269	Panel—Station 155 Left Side Relay	170-54065 (NAA)
272	Panel—Instrument	170-51005 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
330	Plug—Hydraulic Pressure Indicator	AN3106B14S-2S
333	Plug—Alternate Hydraulic Pressure Transmitter	AN3106B14S-2S
334	Plug—Normal Hydraulic Pressure Transmitter	AN3106B14S-2S
335	Plug—Utility Hydraulic Pressure Transmitter	AN3106B14S-2S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
475	Relay—Hydraulic Pressure Indicator	237EAU (Leach)
588	Switch—Hydraulic Pressure Indicator	AN3021-7
671	Terminal Block—Overvoltage Relay	AN3436-2-8
681	Terminal Block—Left Wing Center	AN3436-2-7
715	Transformer—26- to 115-volt 10-volt-ampere A-C Auto	C-124 (Frampton)
726	Transmitter—Alternate Hydraulic Pressure	21323, Type N-1
727	Transmitter—Normal Hydraulic Pressure	21323, Type N-1
728	Transmitter—Utility Hydraulic Pressure	21323, Type N-1

Figure 10-44. Hydraulic Pressure Indicating System—



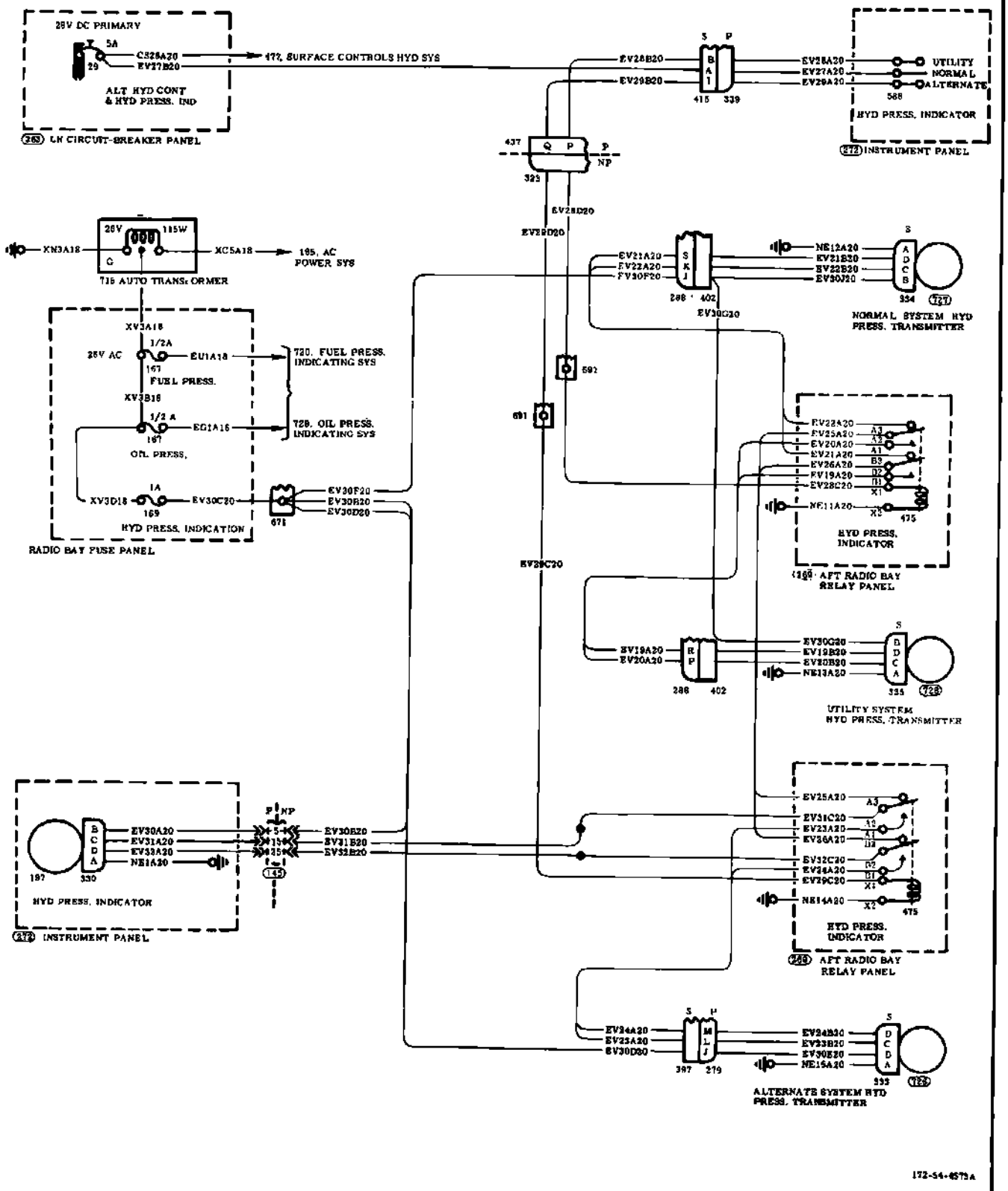
F-86E-1, F-86E-5, and F-86E-6 Airplanes

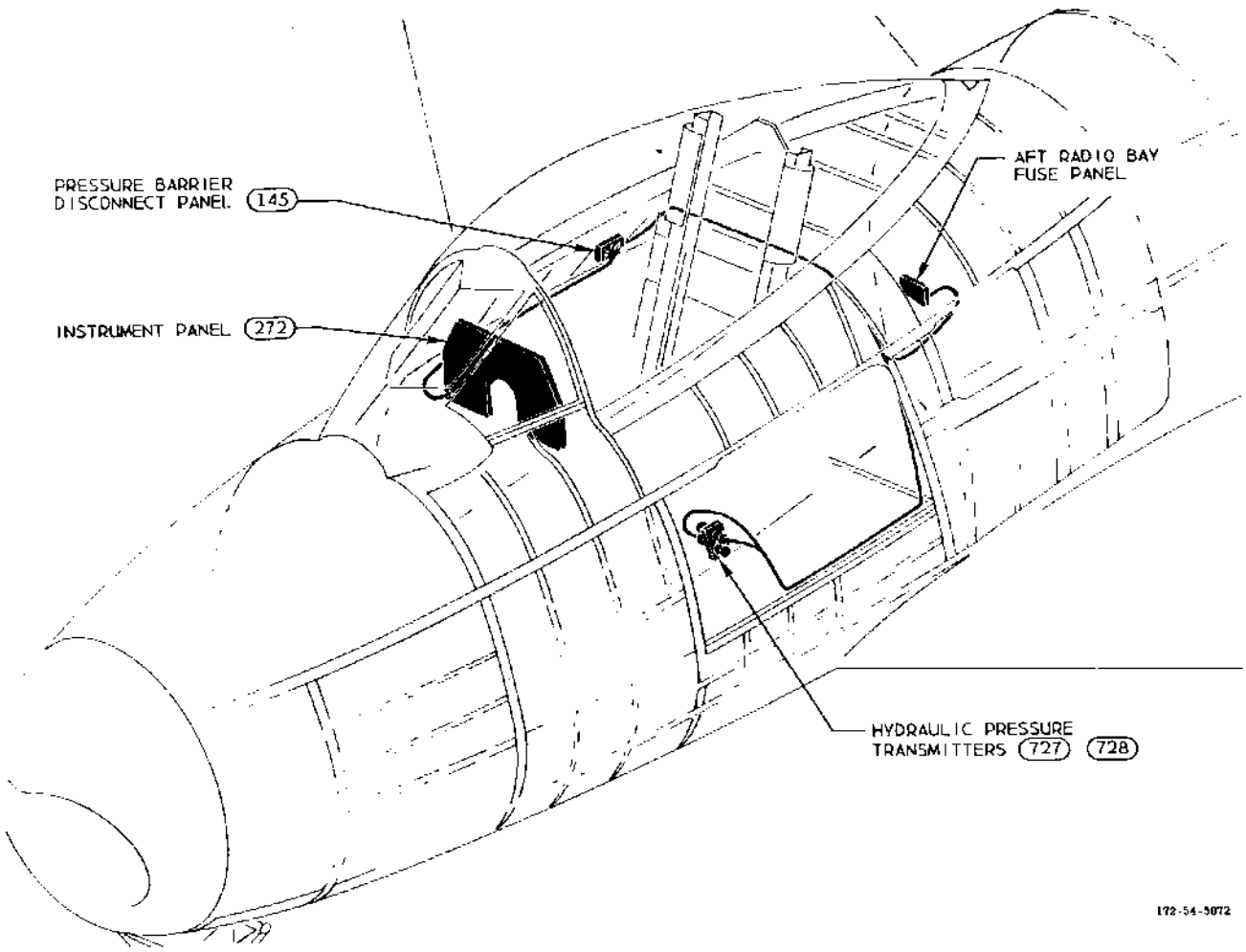


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
197	Indicator—Hydraulic Pressure	21311, Type E-1
263	Panel—Left Circuit-breaker	170-54068 (NAA)
269	Panel—Station 155 Left Side Relay	170-54065 (NAA)
272	Panel—Instrument	170-51005 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
288	Plug—Center Wing Hydraulic Pressure	AN3106B22-14S
323	Plug—Gun Bay Pressure	AN3106B24-28S
330	Plug—Hydraulic Pressure Indicator	AN3106B14S-2S
333	Plug—Alternate Hydraulic Pressure Transmitter	AN3106B14S-2S
334	Plug—Normal Hydraulic Pressure Transmitter	AN3106B14S-2S
335	Plug—Utility Hydraulic Pressure Transmitter	AN3106B14S-2S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
397	Receptacle—Aft Fuselage Disconnect	AN3102A32-6S
402	Receptacle—Center Wing Hydraulic Pressure	AN3101A22-14P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
475	Relay—Hydraulic Pressure Indicator	237EAU (Leach)
588	Switch—Hydraulic Pressure Indicator	AN3021-1
671	Terminal Block—Overvoltage Relay	AN3436-2-8
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
715	Transformer—26- to 115-volt 10-volt-ampere A-C Auto	C-124 (Frampton)
726	Transmitter—Alternate Hydraulic Pressure	21323, Type N-1
727	Transmitter—Normal Hydraulic Pressure	21323, Type N-1
728	Transmitter—Utility Hydraulic Pressure	21323, Type N-1

Figure 10-45. Hydraulic Pressure Indicating

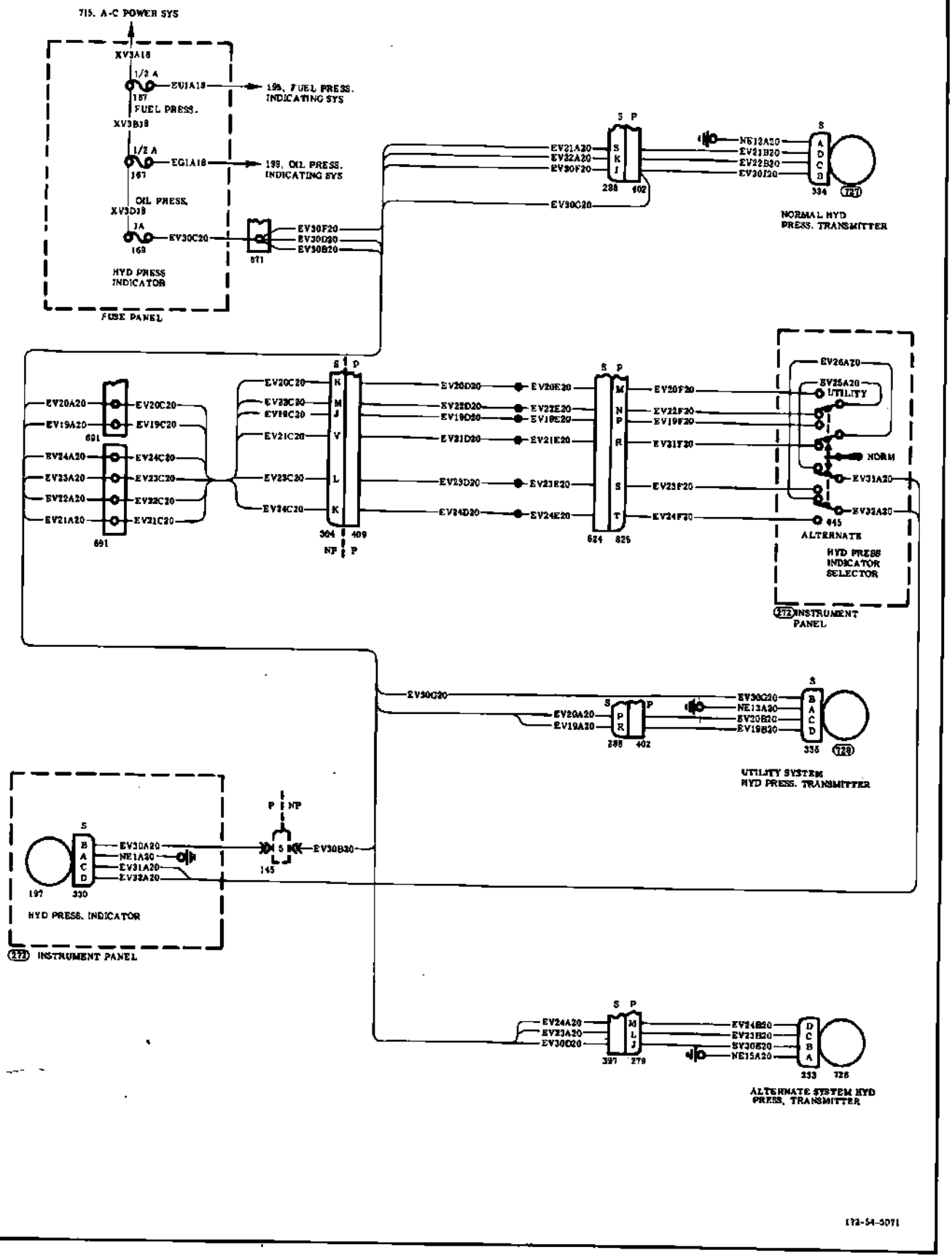

28V DC PRIMARY
5A
29
C328A20
EV27B20
ALT HYD CONT & HYD PRESS. IND
(265) LH CIRCUIT-BREAKER PANEL
472, SURFACE CONTROLS HYD SYS
EV28B20
EV29B20
S P
B A 1
415 339
EV28A20
EV27A20
EV29A20
UTILITY
NORMAL
ALTERNATE
568
HYD PRESS. INDICATOR
(272) INSTRUMENT PANEL
437 Q P P NP
325
EV28D20
EV29D20
KN3A18
28V 115W
C
XC5A18
195, AC POWER SYS
716 AUTO TRANSFORMER
XV3A18
1/2A
28V AC
EU1A18
167
FUEL PRESS.
720, FUEL PRESS. INDICATING SYS
XV3B18
1/2 A
EG1A16
197
OIL PRESS.
728, OIL PRESS. INDICATING SYS
XV3D18
1A
EV30C20
169
HYD PRESS. INDICATION
671
EV30F20
EV30B20
EV30D20
RADIO BAY FUSE PANEL
EV21A20
EV22A20
EV30F20
S K J
288 402
EV30G20
NE12A20
EV21B20
EV22B20
EV30J20
S A D C B
334
727
NORMAL SYSTEM HYD PRESS. TRANSMITTER
592
691
EV28C20
EV28A20
EV25A20
EV20A20
EV21A20
EV26A20
EV19A20
EV28C20
NE11A20
475
HYD PRESS. INDICATOR
(160) AFT RADIO BAY RELAY PANEL
EV19A20
EV20A20
R P
288 402
EV30G20
EV19B20
EV20B20
NE13A20
S B D C A
335
728
UTILITY SYSTEM HYD PRESS. TRANSMITTER
EV30A20
EV31A20
EV33A20
NE1A20
B C D A
197 330
HYD PRESS. INDICATOR
(272) INSTRUMENT PANEL
P NP
5
15
35
142
EV30B20
EV31B20
EV32B20
EV25A20
EV31C20
EV23A20
EV36A20
EV32C20
EV24A20
EV19C20
NE14A20
475
HYD PRESS. INDICATOR
(249) AFT RADIO BAY RELAY PANEL
EV24A20
EV25A20
EV30D20
S P M L J
397 279
EV24B20
EV25B20
EV30E20
NE15A20
S D C D A
333
729
ALTERNATE SYSTEM HYD PRESS. TRANSMITTER
172-54-4579A

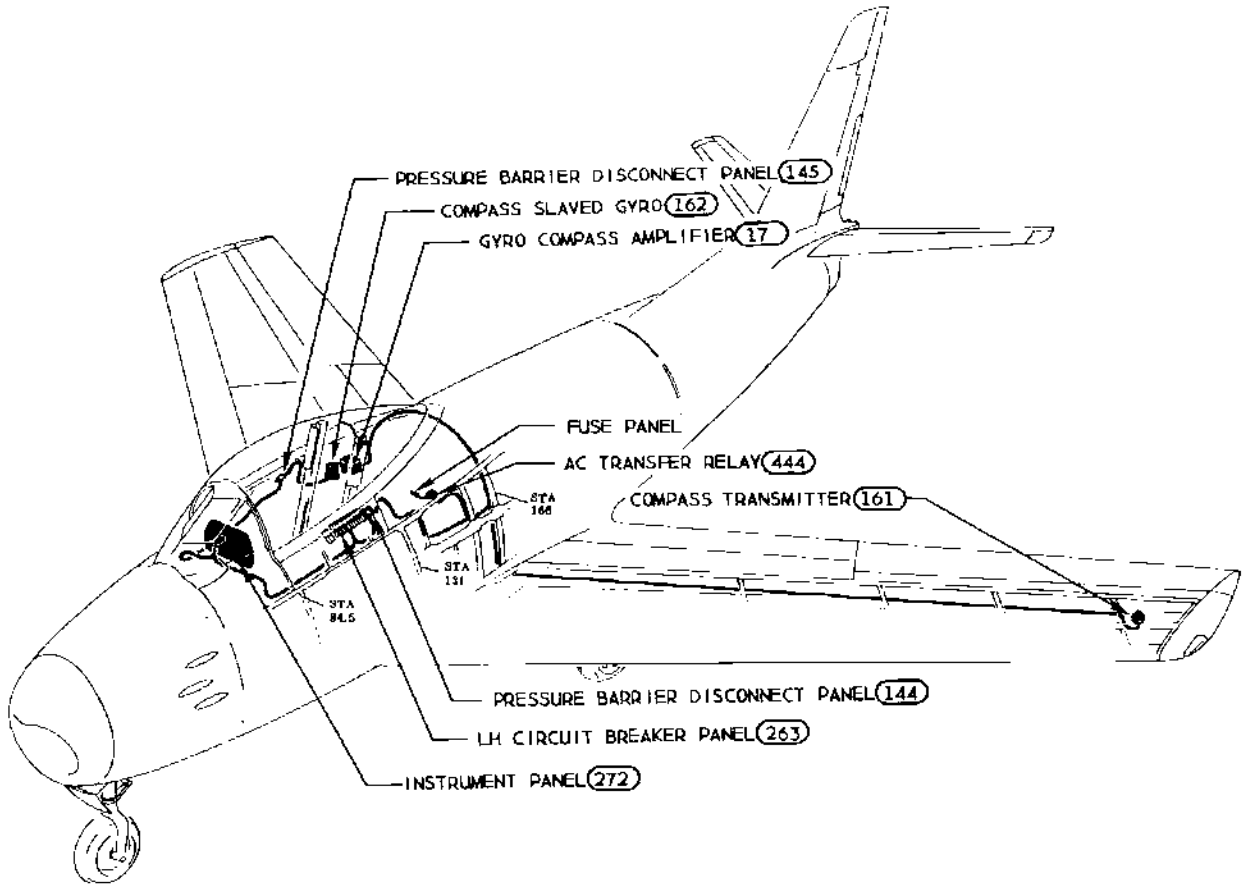


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
197	Indicator—Hydraulic Pressure	21311, Type E-1
272	Panel—Instrument	170-51005 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
288	Plug—Center Wing Hydraulic Pressure	AN3106B22-14S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
330	Plug—Hydraulic Pressure Indicator	AN3106B14S-2S
333	Plug—Alternate Hydraulic Pressure Transmitter	AN3106B14S-2S
335	Plug—Utility Hydraulic Pressure Transmitter	AN3106B14S-2S
337	Plug—Instrument Panel Vibrator	AN3106B10SL-4S
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
402	Receptacle—Center Wing Hydraulic Pressure	AN3101A22-14P
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
645	Switch—Hydraulic Pressure Indicator	4AT3 (Micro Switch)
671	Terminal Block—Overvoltage Relay	AN3436-2-8
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
726	Transmitter—Alternate Hydraulic Pressure	21323, Type N-1
727	Transmitter—Normal Hydraulic Pressure	21323, Type N-1
728	Transmitter—Utility Hydraulic Pressure	21323, Type N-1
824	Receptacle—Instrument Panel Disconnect	AN3100A22-14S
825	Plug—Instrument Panel Disconnect	AN3106B22-14P

Figure 10-46. Hydraulic Pressure Indicating

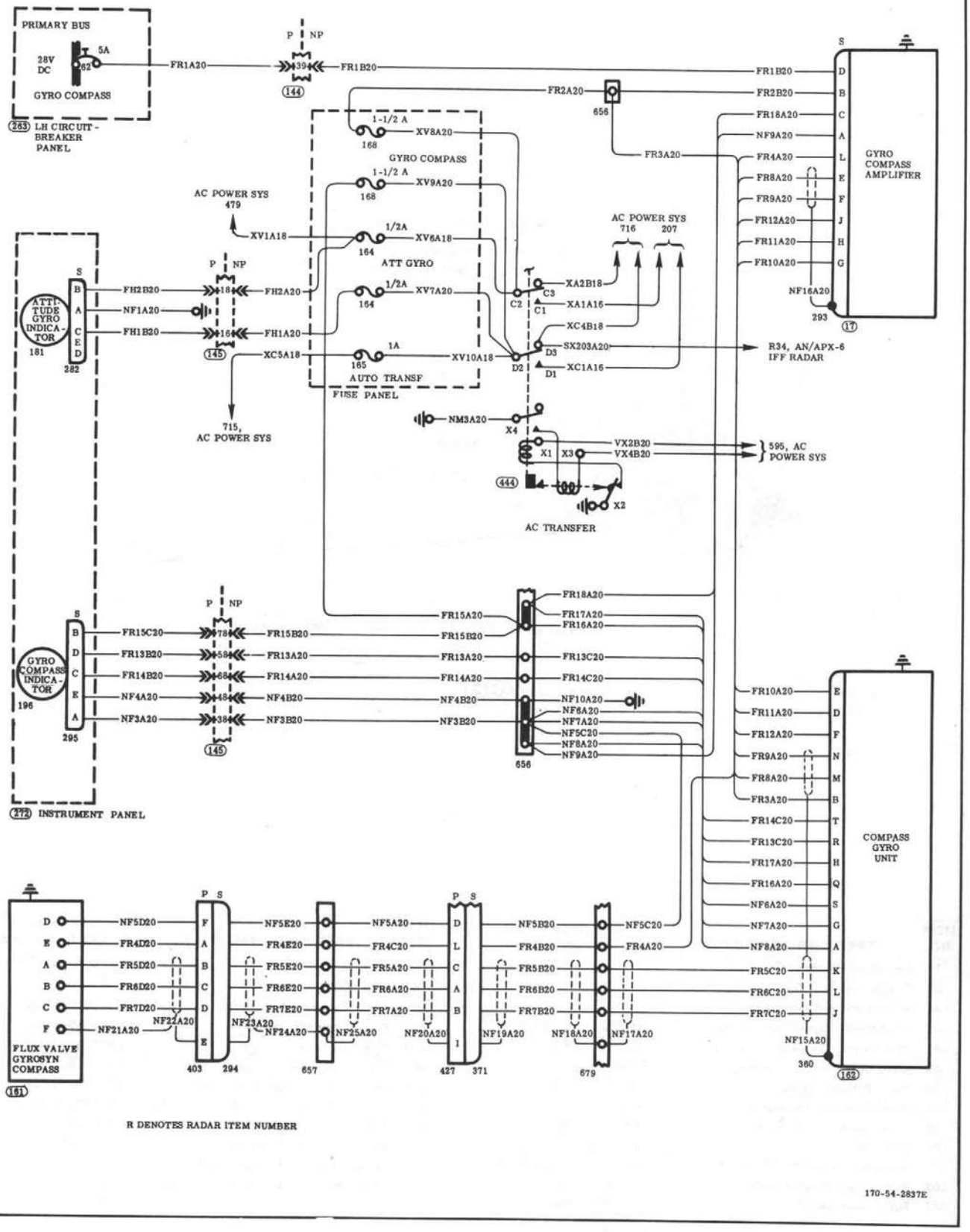

715. A-C POWER SYS
XV3A18
1/2 A
EU1A18
157
FUEL PRESS.
195. FUEL PRESS. INDICATING SYS
XV3B18
1/2 A
EG1A18
167
OIL PRESS.
195. OIL PRESS. INDICATING SYS
XV3D18
3A
EV30C20
169
HYD PRESS INDICATOR
FUSE PANEL
671
EV30F20
EV30D20
EV30B20
EV21A20
EV22A20
EV30F20
EV30G20
288
402
NE12A20
EV21B20
EV22B20
EV30J20
334
727
NORMAL HYD PRESS. TRANSMITTER
EV20A20
EV19A20
EV20C20
EV19C20
691
EV24A20
EV23A20
EV22A20
EV21A20
EV24C20
EV23C20
EV22C20
EV21C20
691
EV20C20
EV19C20
EV21C20
EV25C20
EV24C20
304
409
NP
P
EV20D20
EV22D20
EV19D20
EV21D20
EV23D20
EV24D20
EV20E20
EV22E20
EV19E20
EV21E20
EV23E20
EV24E20
624
825
EV20F20
EV22F20
EV19F20
EV21F20
EV23F20
EV24F20
EV26A20
EV25A20
UTILITY
NORM
EV31A20
EV32A20
445
ALTERNATE
HYD PRESS INDICATOR SELECTOR
272 INSTRUMENT PANEL
EV30G20
EV20A20
EV19A20
288
402
EV30G20
NE13A20
EV20B20
EV19B20
335
729
UTILITY SYSTEM HYD PRESS. TRANSMITTER
197
330
EV30A20
NE1A20
EV31A20
EV32A20
P
NP
145
EV30B30
HYD PRESS. INDICATOR
272 INSTRUMENT PANEL
EV24A20
EV23A20
EV30G20
327
279
EV24B20
EV23B20
EV30E20
NE15A20
233
726
ALTERNATE SYSTEM HYD PRESS. TRANSMITTER
172-54-5071

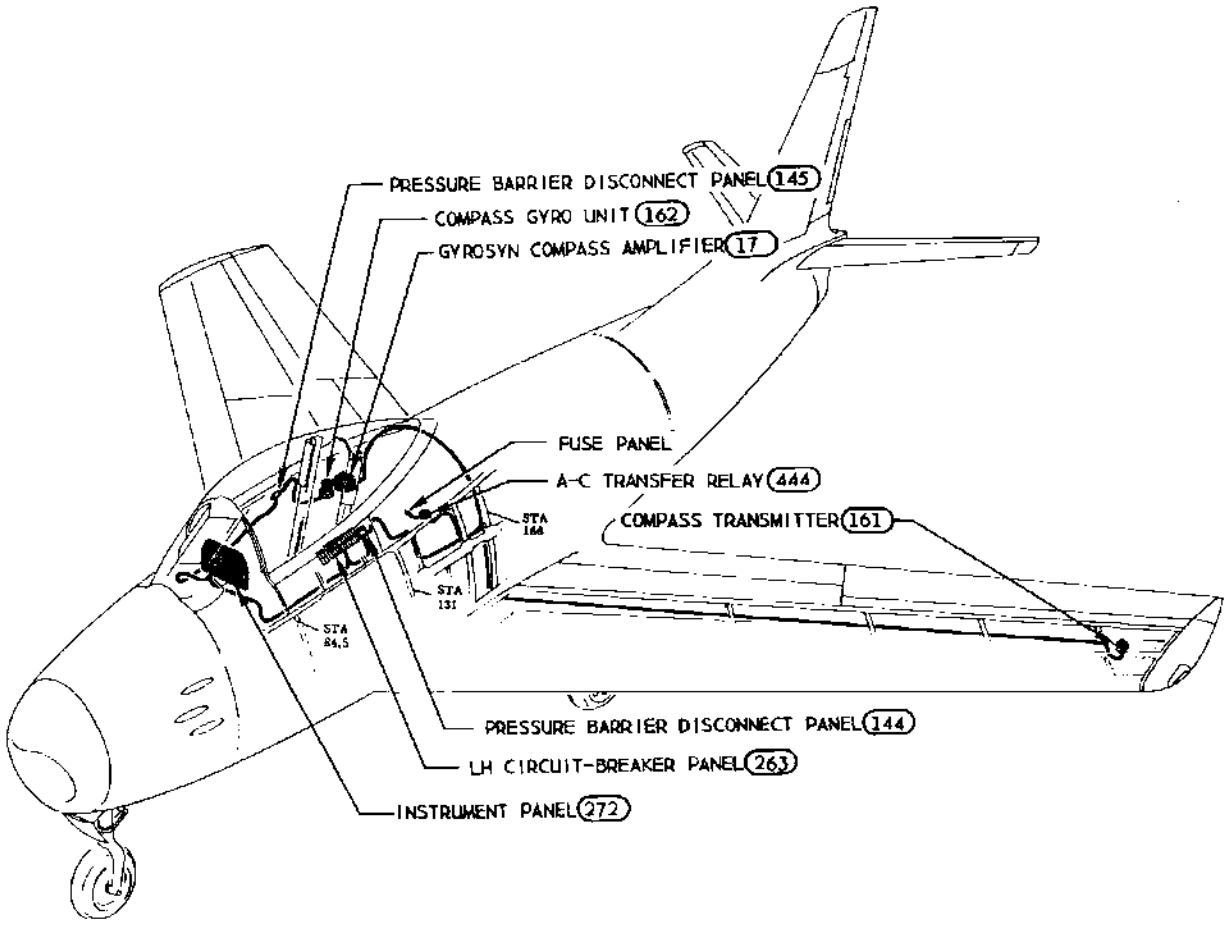


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
17	Amplifier—Gyrosyn Compass	21125, Type A-2
62	Circuit Breaker—Gyrosyn Compass	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
161	Flux Valve—Gyrosyn Compass	27635, Type C-2
162	Gyro Unit—Gyrosyn Compass	21098, Type S-1
164	Fuse—Attitude Gyro	AGC 1/2 (Bussmann)
165	Fuse—Autosyn Transformer	AGC-1 (Bussmann)
168	Fuse—Gyrosyn Compass	AGC-1-1/2 (Bussmann)
181	Gyro—Attitude	21278, Type A-1
196	Indicator—Directional Gyro	MIL-I-5126A, Type V-7A
263	Panel—Left Circuit-breaker	170-54068 (NAA)
272	Panel—Instrument	170-51005 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
282	Plug—Attitude Gyro	AN3106A10SL-3S
293	Plug—Gyrosyn Compass Amplifier	AN3106B20-27S
294	Plug—Compass Flux Gate	AN3106B18-12S
295	Plug—Compass Indicator	AN3106B14S-5S
360	Plug—Gyrosyn Compass	AN3106B20-29S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
403	Receptacle—Compass Flux Gate	AN3100A18-12P
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
444	Relay—A-C Transfer	9014 (Leach)
656	Terminal Block—Compass	AN3436-2-7
657	Terminal Block—Gyrosyn Compass	AN3436-2-6
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12

Figure 10-47. Attitude Gyro and Gyrosyn Compass Systems—

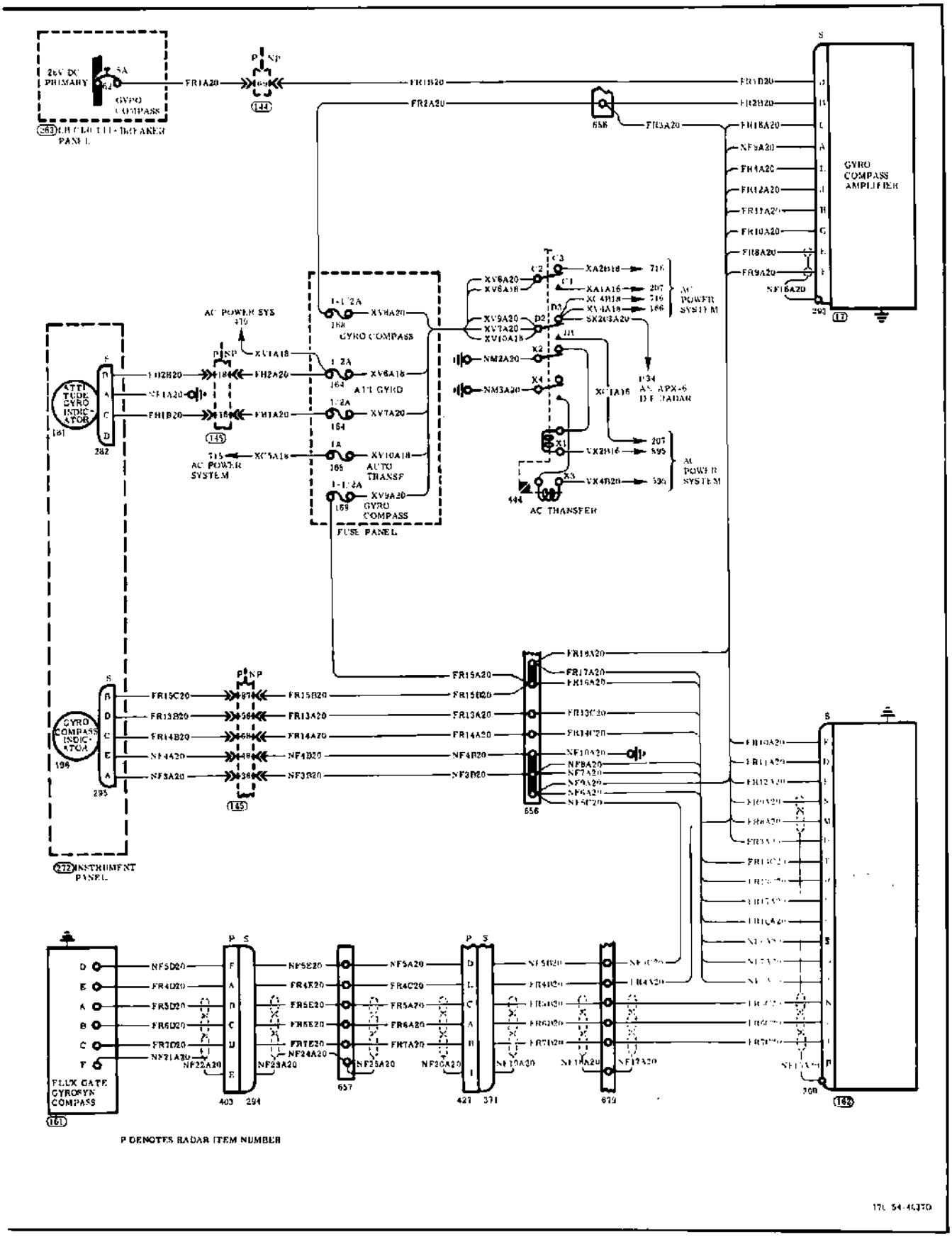

PRIMARY BUS
28V DC
5A
GYRO COMPASS
263 LH CIRCUIT-BREAKER PANEL
FR1A20
FR1B20
144
GYRO COMPASS
1-1/2 A
XV8A20
168
XV9A20
AC POWER SYS 479
XV1A18
1/2A
XV6A18
164
ATT GYRO
1/2A
XV7A20
1A
XV10A18
165
AUTO TRANSF
FUSE PANEL
715, AC POWER SYS
ATTITUDE GYRO INDICATOR
181
282
FH2B20
FH2A20
NF1A20
FH1B20
FH1A20
145
XC5A18
656
FR2A20
FR3A20
FR1B20
FR2B20
FR18A20
NF9A20
FR4A20
FR8A20
FR9A20
FR12A20
FR11A20
FR10A20
NF16A20
293
17
GYRO COMPASS AMPLIFIER
AC POWER SYS 716 207
XA2B18
XA1A16
XC4B18
SX203A20
XC1A16
R34, AN/APX-6 IFF RADAR
NM3A20
X4
X1
X3
VX2B20
VX4B20
595, AC POWER SYS
444
X2
AC TRANSFER
GYRO COMPASS INDICATOR
196
295
FR15C20
FR13B20
FR14B20
NF4A20
NF3A20
FR15B20
FR13A20
FR14A20
NF4B20
NF3B20
FR15A20
FR18A20
FR17A20
FR16A20
FR13C20
FR14C20
NF10A20
NF8A20
NF7A20
NF5C20
NF8A20
NF9A20
656
272 INSTRUMENT PANEL
FR10A20
FR11A20
FR12A20
FR9A20
FR8A20
FR3A20
FR14C20
FR13C20
FR17A20
FR16A20
NF6A20
NF7A20
NF8A20
COMPASS GYRO UNIT
FLUX VALVE GYROSYN COMPASS
161
NF5D20
FR4D20
FR5D20
FR6D20
FR7D20
NF21A20
NF22A20
NF23A20
NF24A20
403
294
NF5E20
FR4E20
FR5E20
FR6E20
FR7E20
NF25A20
657
NF5A20
FR4C20
FR5A20
FR6A20
FR7A20
NF20A20
NF19A20
427
371
NF5B20
FR4B20
FR5B20
FR6B20
FR7B20
NF18A20
NF17A20
679
FR5C20
FR6C20
FR7C20
NF15A20
360
162
R DENOTES RADAR ITEM NUMBER
170-54-2837E

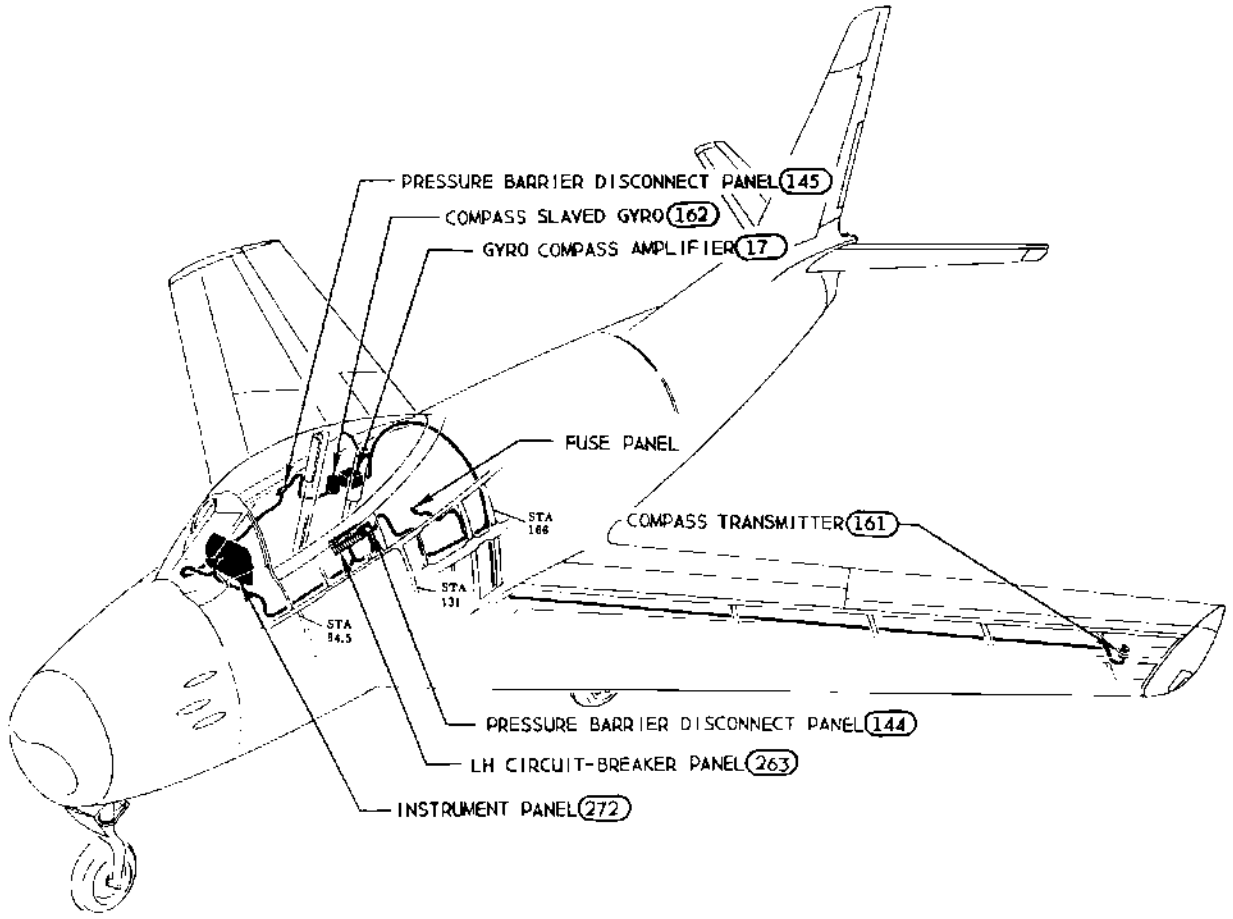


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
17	Amplifier—Gyrosyn Compass	21125, Type A-2
62	Circuit Breaker—Gyrosyn Compass	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
161	Flux Valve—Gyrosyn Compass	27635, Type C-2
162	Gyro Unit—Gyrosyn Compass	21098, Type S-1
164	Fuse—Attitude Gyro	AGC 1/2 (Bussmann)
165	Fuse—Autosyn Transformer	AGC-1 (Bussmann)
168	Fuse—Gyrosyn Compass	AGC-1-1/2 (Bussmann)
181	Gyro—Attitude	21278, Type A-1
196	Indicator—Directional Gyro	MIL-I-5126A, Type V-7A
263	Panel—Left Circuit-breaker	170-54068 (NAA)
272	Panel—Instrument	170-51005 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
282	Plug—Attitude Gyro	AN3106A10SL-3S
293	Plug—Gyrosyn Compass Amplifier	AN3106B20-27S
294	Plug—Compass Flux Gate	AN3106B18-12S
295	Plug—Compass Indicator	AN3106B14S-5S
360	Plug—Gyrosyn Compass	AN3106B20-29S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
403	Receptacle—Compass Flux Gate	AN3100A18-12P
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
444	Relay—A-C Transfer	9014 (Leach)
656	Terminal Block—Compass	AN3436-2-7
657	Terminal Block—Gyrosyn Compass	AN3436-2-6
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12

Figure 10-48. Attitude Gyro and Gyrosyn Compass

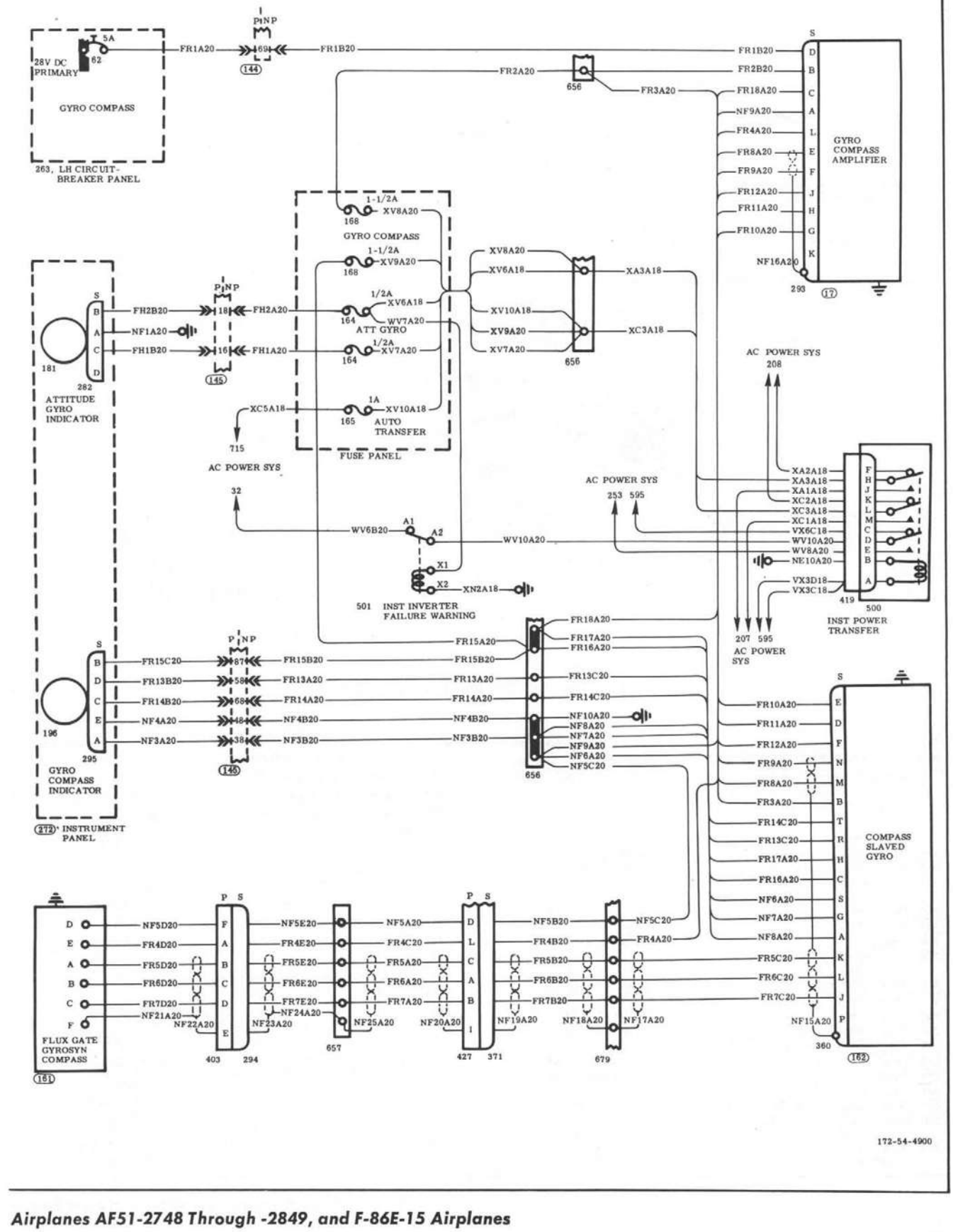

GYRO COMPASS AMPLIFIER
GYRO COMPASS
AC POWER SYSTEM
AC TRANSFER
FUSE PANEL
INSTRUMENT PANEL
FLUX GATE GYROSYN COMPASS
P DENOTES RADAR ITEM NUMBER



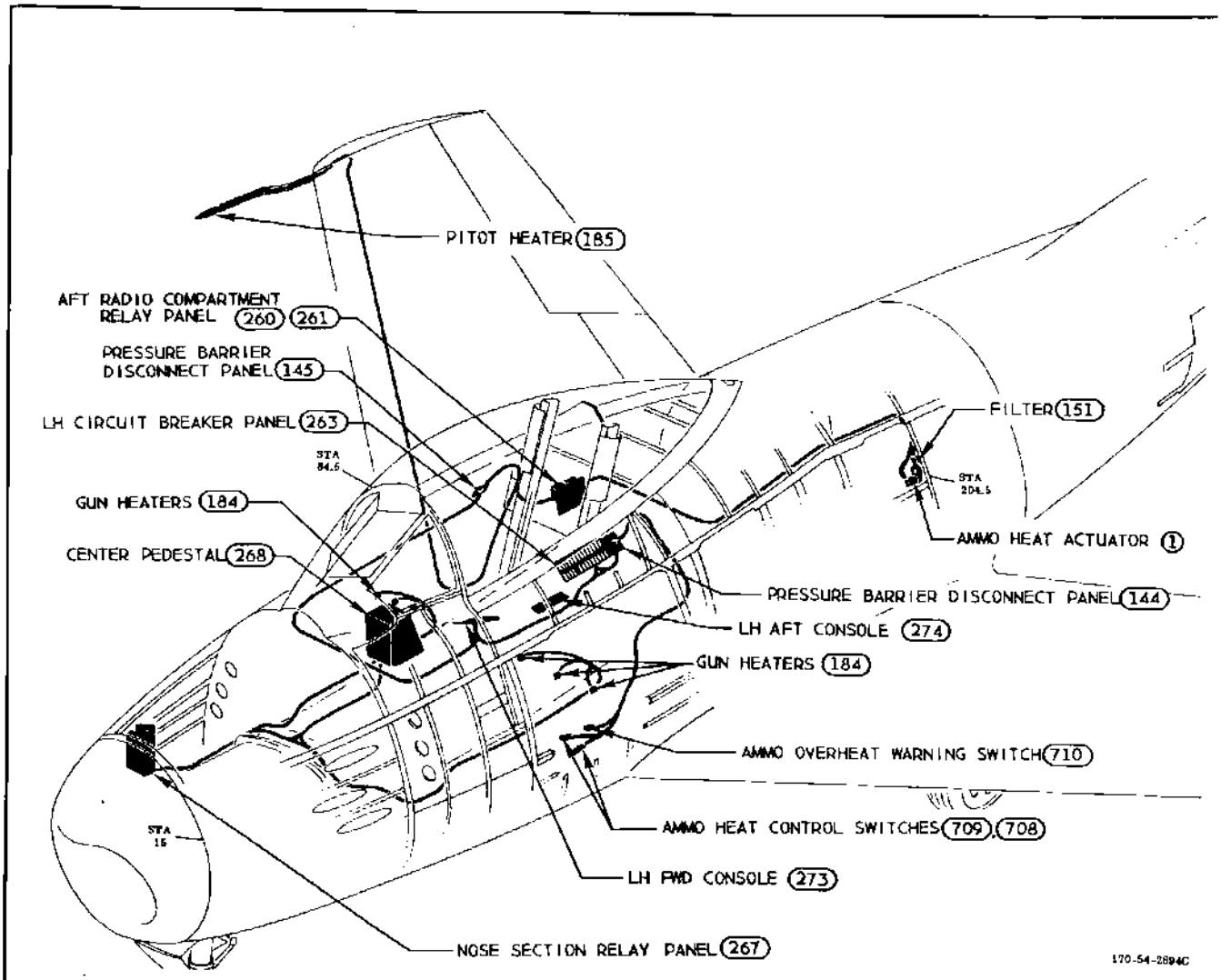
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
17	Amplifier—Gyrosyn Compass	21125, Type A-2
62	Circuit Breaker—Gyrosyn Compass	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
161	Flux Valve—Gyrosyn Compass	27635, Type C-2
162	Gyro Unit—Gyrosyn Compass	21098, Type S-1
164	Fuse—Attitude Gyro	AGC 1/2 (Bussmann)
165	Fuse—Autosyn Transformer	AGC 1 (Bussmann)
168	Fuse—Gyrosyn Compass	AGC 1-1/2 (Bussmann)
181	Gyro—Attitude	21278, Type A-1
196	Indicator—Directional Gyro	MIL-I-5126A, Type V-7A
263	Panel—Left Circuit-breaker	170-5406B (NAA)
272	Panel—Instrument	170-51005 (NAA)
282	Plug—Attitude Gyro	AN3106A10SL-3S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
293	Plug—Gyrosyn Compass Amplifier	AN3106B20-27S
294	Plug—Compass Flux Gate	AN3106B18-12S
295	Plug—Compass Indicator	AN3106B14S-5S
360	Plug—Gyrosyn Compass	AN3106B20-29S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
403	Receptacle—Compass Flux Gate	AN3100A18-12P
419	Receptacle—Instrument Power Transfer Relay	2044-84 (Cannon)
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
500	Relay—Instrument Power Transfer	AN3308-1
501	Relay—Inverter Failure Warning	44B18574
656	Terminal Block—Compass	AN3436-2-7
657	Terminal Block—Gyrosyn Compass	AN3436-2-6
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12

Figure 10-49. Attitude Gyro and Gyrosyn Compass Systems—F-86E-10



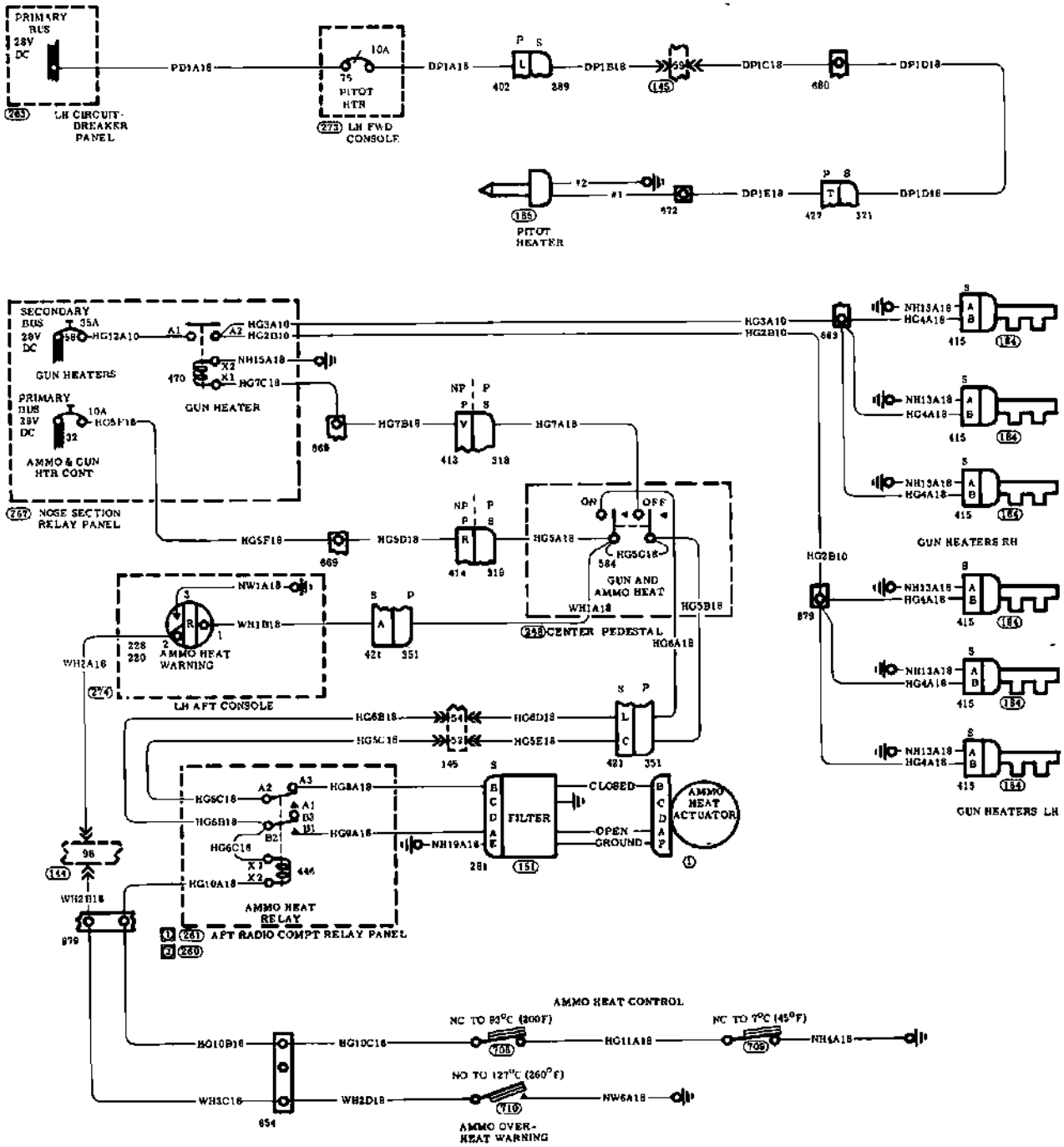
Airplanes AF51-2748 Through -2849, and F-86E-15 Airplanes



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Actuator—Ammunition Heat	WE443-10DM (Whittaker)
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P30
58	Circuit Breaker—Gun Heater	AN3161P35
76	Circuit Breaker—Pitot Heater	AN3160-10
144	Disconnect—Left hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
151	Filter—Ammunition Compartment Heat Actuator	C-330-L (Potter)
184	Heater—Gun	24946, Type AN-J-4
185	Heater—Pitot	AN5816-2
220	Lamp—Warning	AN3121-313
228	Light Assembly—Ammunition Overheat Warning	AN3157-2
260	Panel—Aft Radio Compartment Relay	151-54122-40 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	161-54028-10 (NAA)
274	Panel—Left Aft Console	151-53050-30 (NAA)
281	Plug—Ammunition Heat Filter	AN3106B14S-5S
289	Plug—Cockpit Center Disconnect	AN3106B24-5S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S

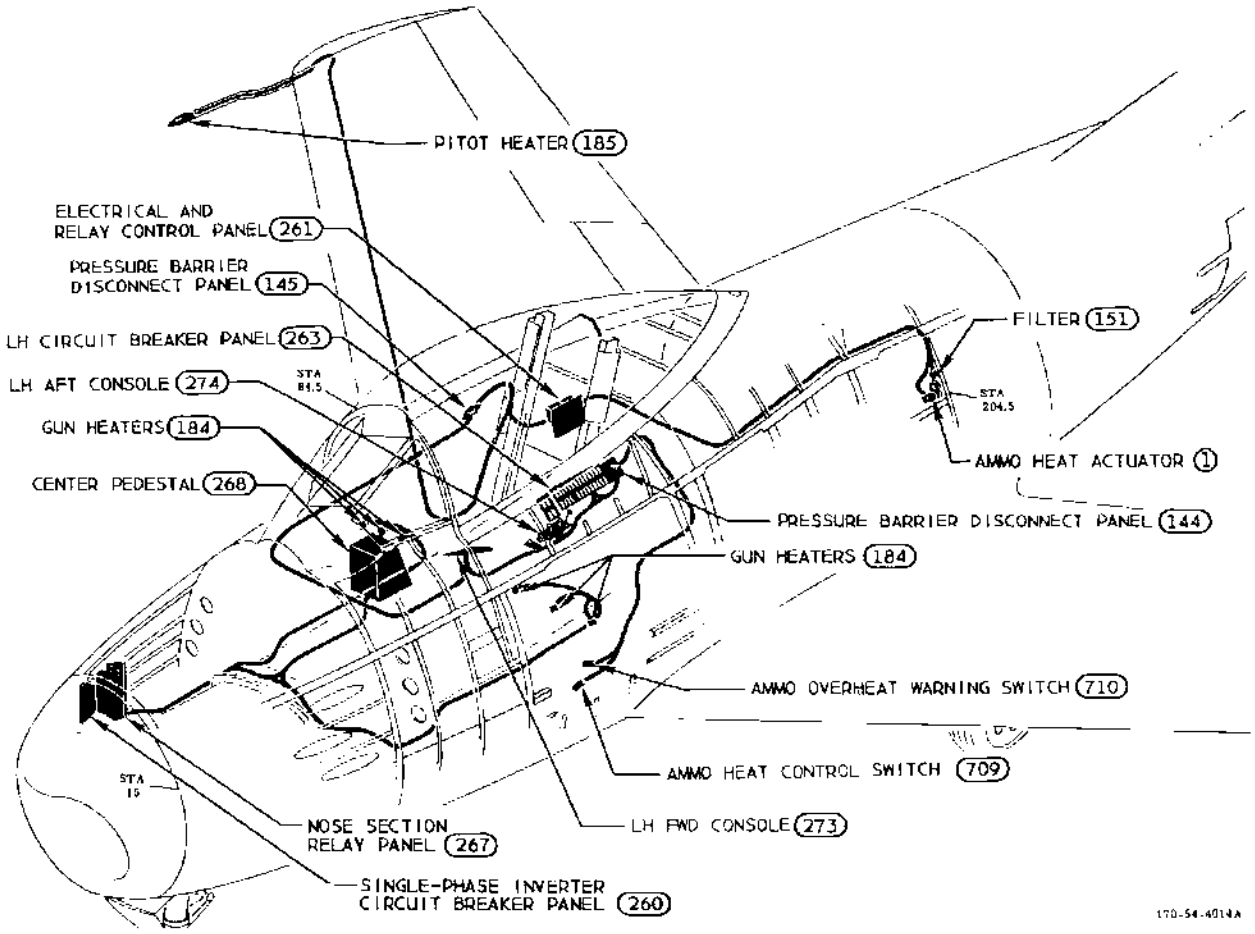
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
351	Plug—Pedestal Disconnect	AN3106A32-7P
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
402	Receptacle—Cockpit Center Disconnect	AN3100A24-5P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
415	Receptacle—Gun Heater	AN3102A12S-3S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
446	Relay—Ammunition Heat Control	237EAU (Leach)
470	Relay—Gun Heater	1227-893 (Leach)
584	Switch—Gun and Ammunition Heater	AN3027-3
654	Terminal Block—Ammunition Compartment	AN3436-2-3
663	Terminal Block—Right-hand Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
672	Terminal Block—Pitot Heater	AN3436-2-1
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
708	Thermostat—Cabin High-heat Limit	18420-200 (Fenwal)
709	Thermostat—Cabin Low-heat Limit	18420-45 (Fenwal)
710	Thermostat—Ammunition Overheat	18423-260 (Fenwal)

Figure 10-50. Ammunition, Gun, and Pitot Heater



1. F-86E-1 AIRPLANES AND F-86E-5 AIRPLANES AF50-639 THRU -668
2. F-86E-5 AIRPLANES AF50-669 THRU -689 AND F-86E-6 AIRPLANES

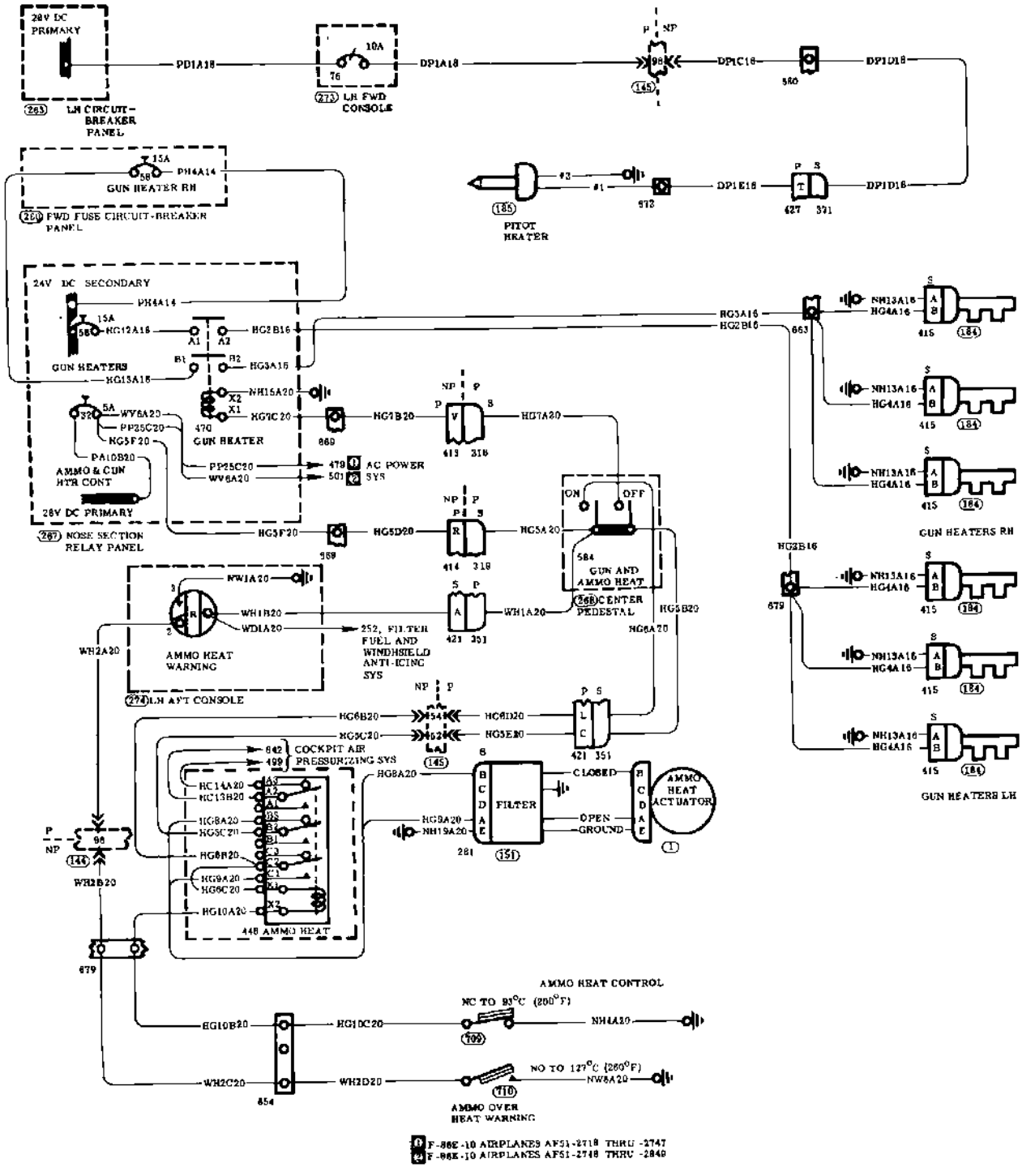
170-54-2793E

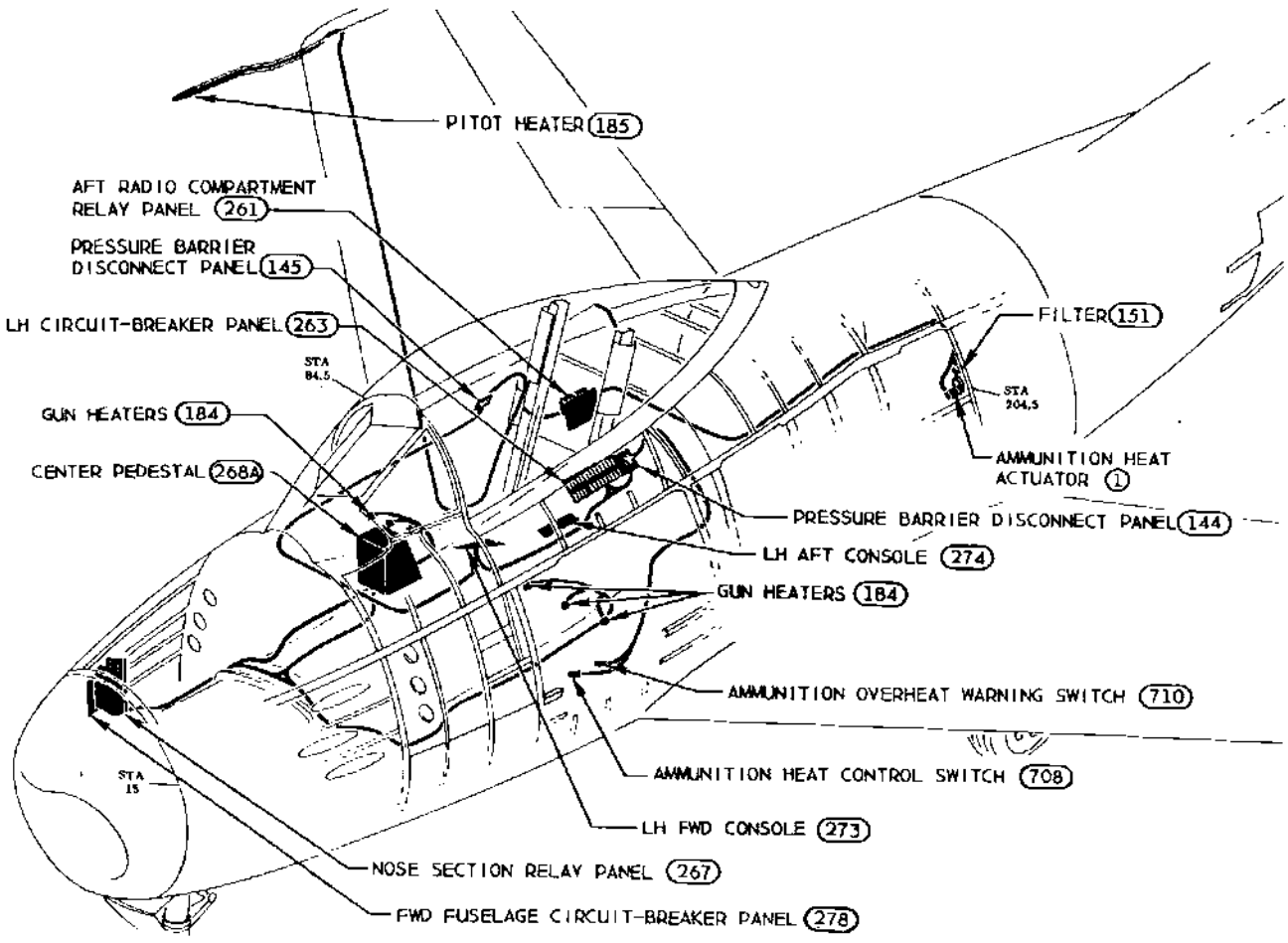


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Actuator—Ammunition Heat	WE443-10 DM (Whittaker)
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P5
58	Circuit Breaker—Gun Heater	AN3161P15
76	Circuit Breaker—Pitot Heater	AN3160-10
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
151	Filter—Ammunition Compartment Heat Actuator	C-330-L (Potter)
184	Heater—Gun	24946, Type AN-J-4
185	Heater—Pitot	AN5816-2
220	Lamp—Warning	AN3121-313
228	Light Assembly—Ammunition Overheat Warning	AN3157-2
239	Light Assembly—Inverter Failure Warning	AN3157-4
260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
281	Plug—Ammunition Heat Filter	AN3106B14S-5S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug: Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
351	Plug—Pedestal Disconnect	AN3106A32-7P
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
415	Receptacle—Gun Heater	AN3102A12S-3S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
446	Relay—Ammunition Heat Control	AN3316-1
470	Relay—Gun Heater	AN3352-1
584	Switch—Gun and Ammunition Heater	AN3027-3
654	Terminal Block—Ammunition Compartment	AN3436-2-3
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
672	Terminal Block—Pitot Heater	AN3436-2-2
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
709	Thermostat—Cabin Low-heat Limit	18420-45 (Fenwal)
710	Thermostat—Ammunition Overheat	18423-260 (Fenwal)

Figure 10-51. Ammunition, Gun, and Pitot

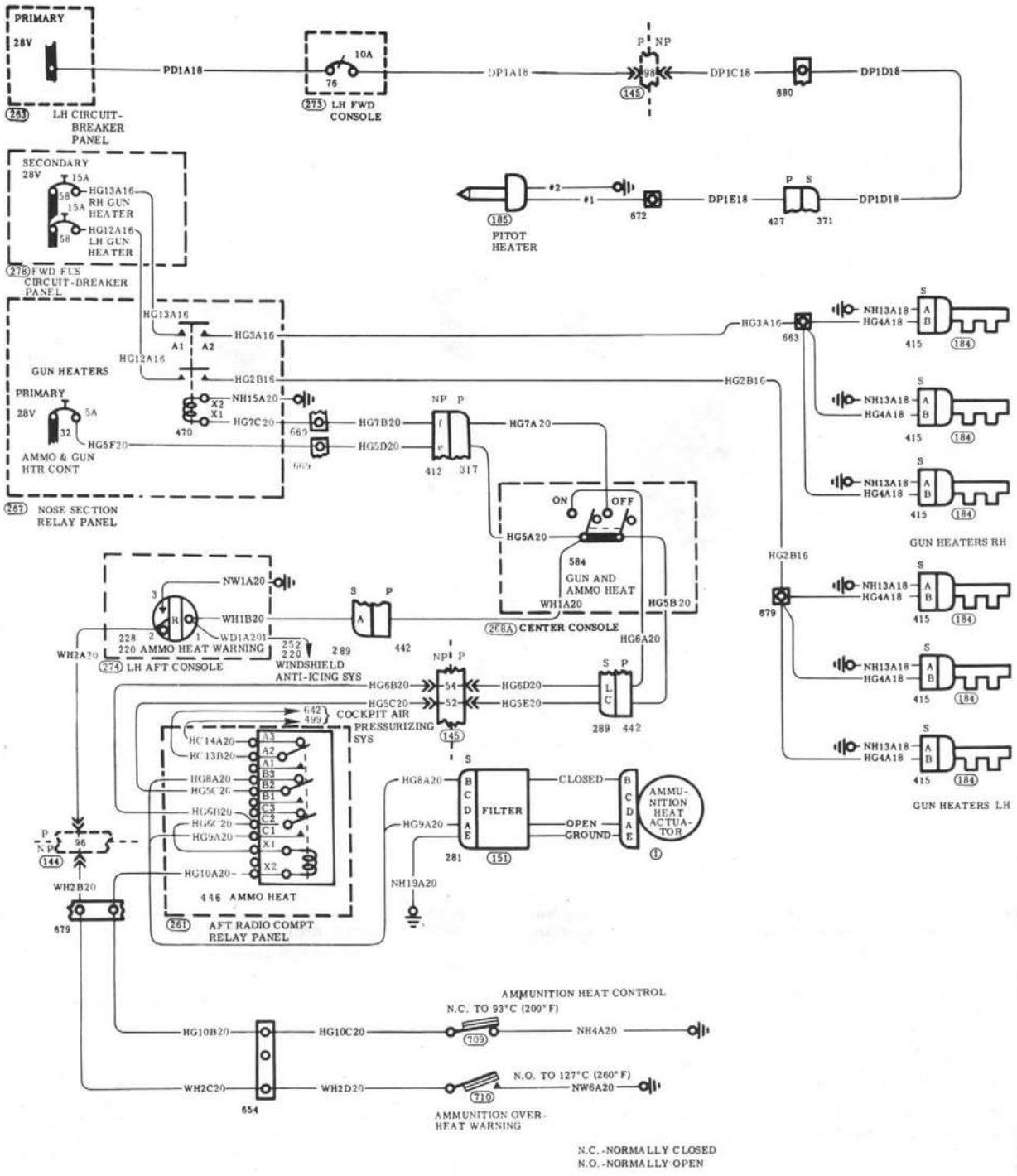

28V DC PRIMARY
PD1A18
10A
DP1A18
DP1C18
DP1D18
263 LH CIRCUIT-BREAKER PANEL
273 LH FWD CONSOLE
145
560
15A
PH4A14
GUN HEATER RH
261 FWD FUSE CIRCUIT-BREAKER PANEL
#3
#1
DP1E18
DP1D18
185 PITOT HEATER
972
427
371
24V DC SECONDARY
PH4A14
15A
NG12A18
HG2B16
GUN HEATERS
HG3A16
NH15A20
HG1C20
HG1B20
HG1A20
5A
WY6A20
PP25C20
NG5F20
PA10B20
AMMO & GUN HTR CONT
28V DC PRIMARY
267 NOSE SECTION RELAY PANEL
GUN HEATER
470
479 AC POWER
501 SYS
HG3F20
HG5D20
HG5A20
959
ON
OFF
584
GUN AND AMMO HEAT
768 CENTER PEDESTAL
HG5B20
HG6A20
NW1A20
WH1B20
WD1A20
252, FILTER FUEL AND WINDSHIELD ANTI-ICING SYS
WH1A20
421
351
AMMO HEAT WARNING
WH2A20
274 LH AFT CONSOLE
HG6B20
HG6D20
HG5C20
HG5E20
842 COCKPIT AIR
499 PRESSURIZING SYS
HC14A20
HC13B20
HG8A20
HG8C20
HG8B20
HG9A20
HG9C20
HG10A20
448 AMMO HEAT
WH2B20
144
679
CLOSED
OPEN
GROUND
FILTER
AMMO HEAT ACTUATOR
281
151
AMMO HEAT CONTROL
NC TO 93°C (200°F)
HG10B20
HG10C20
NH4A20
709
NO TO 127°C (260°F)
WH2C20
WH2D20
NW8A20
710
854
AMMO OVER HEAT WARNING
663
679
NH13A16
HG4A16
415
184
GUN HEATERS RH
GUN HEATERS LH
F-86E-10 AIRPLANES AF51-2718 THRU -2747
F-86E-10 AIRPLANES AF51-2748 THRU -2840
170-54-4091D

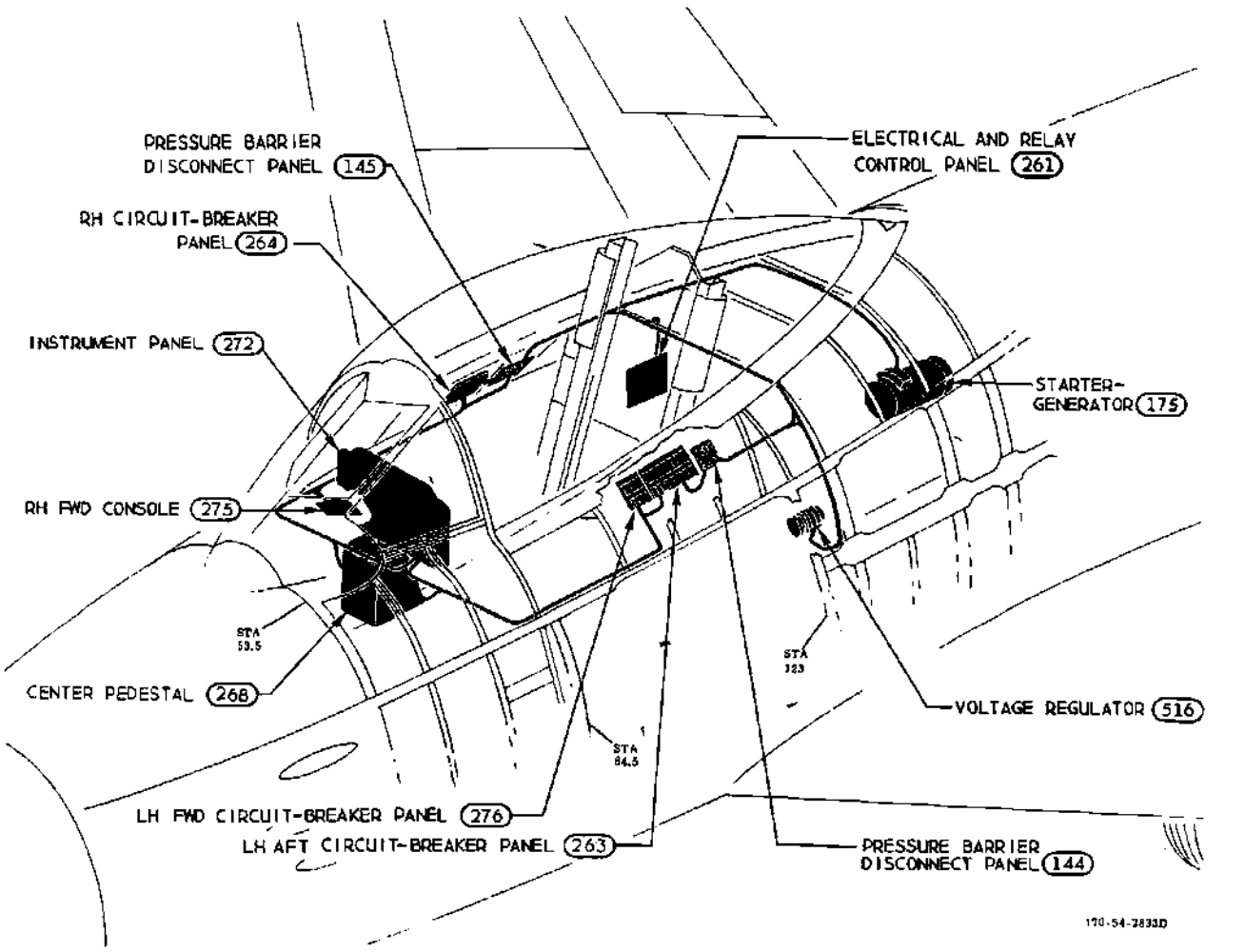


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Actuator—Ammunition Heat	WE443-100M (Whittaker)
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P5
58	Circuit Breaker—Gun Heater	AN3161P15
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
151	Filter—Ammunition Compartment Heat Actuator	C-330-L (Potter)
184	Heater—Gun	24946, Type AN-J-4
185	Heater—Pitot	AN5816-2
220	Lamp—Warning	AN3121-313
228	Light Assembly—Ammunition Overheat Warning	AN3157-2
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
281	Plug—Ammunition Heat Filter	AN3106B14S-5S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
289	Plug—Pedestal Disconnect	AN3106B32-7S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
415	Receptacle -Gun Heater	AN3102A12S-3S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
470	Relay—Gun Heater	AN3352-1
584	Switch—Gun and Ammunition Heater	AN3027-3
654	Terminal Block—Ammunition Compartment	AN3436-2-3
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
672	Terminal Block—Pitot Heater	AN3436-2-2
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
709	Thermostat—Cabin Low-heat Limit	18420-45 (Fenwal)
710	Thermostat—Ammunition Overheat	18423-260 (Fenwal)

Figure 10-52. Ammunition, Gun, and Pitot

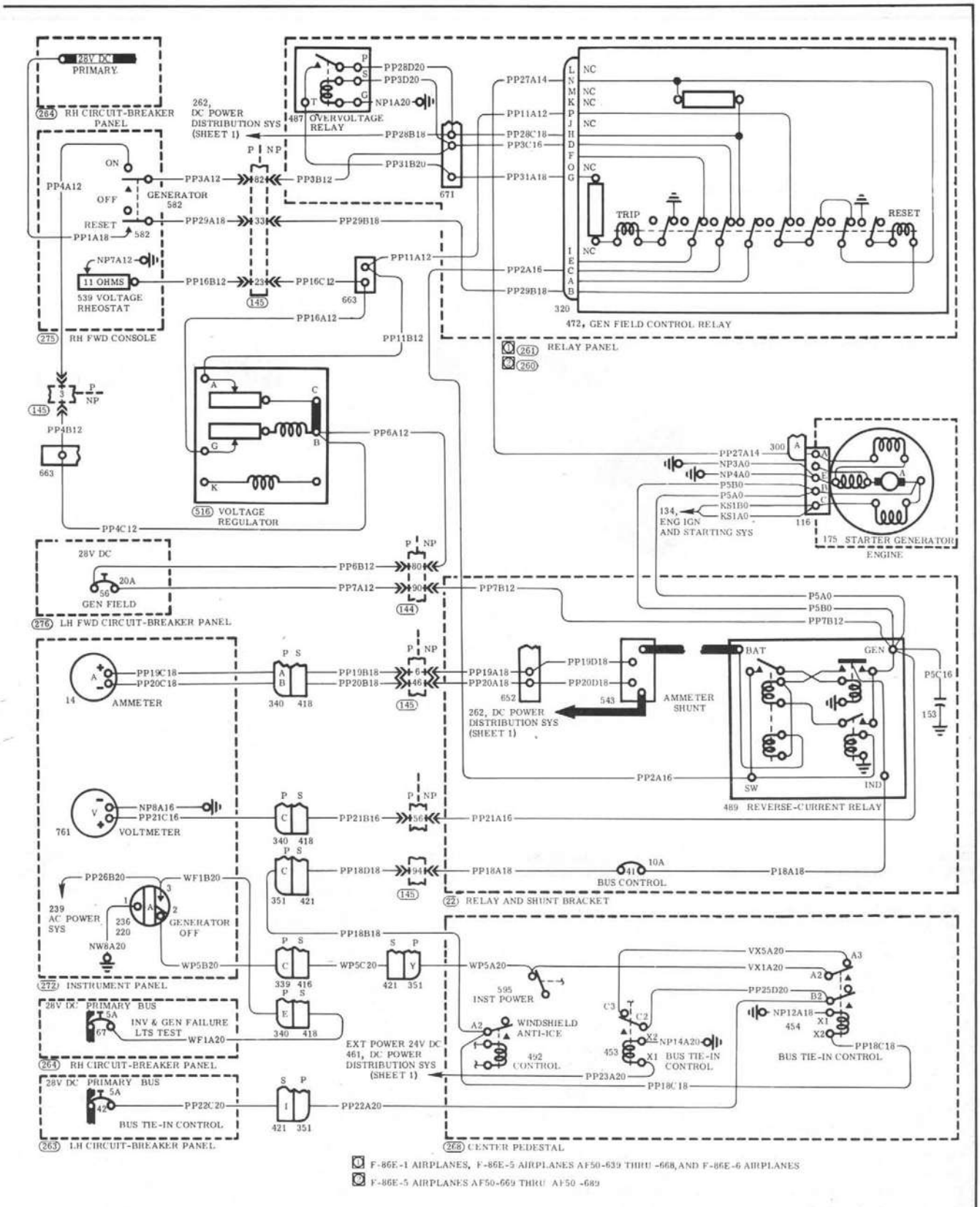

PRIMARY
28V
PD1A18
10A
DP1A18
DP1C18
DP1D18
LH CIRCUIT-BREAKER PANEL
LH FWD CONSOLE
SECONDARY
28V
15A
HG13A16
RH GUN HEATER
HG12A16
LH GUN HEATER
FWD FUS CIRCUIT-BREAKER PANEL
PITOT HEATER
DP1E18
GUN HEATERS
PRIMARY
28V
5A
AMMO & GUN HTR CONT
NOSE SECTION RELAY PANEL
HG3A16
HG2B16
NH15A20
HG7C20
HG7B20
HG7A20
HG5D20
HG5F20
NH13A18
HG4A18
GUN HEATERS RH
GUN HEATERS LH
ON
OFF
HG5A20
GUN AND AMMO HEAT
WH1A20
HG5B20
CENTER CONSOLE
NW1A20
WH1B20
WD1A20
220 AMMO HEAT WARNING
LH AFT CONSOLE
WH2A20
WINDSHIELD ANTI-ICING SYS
HG6A20
HG6B20
HG6D20
HG5C20
HG5E20
COCKPIT AIR PRESSURIZING SYS
HC14A20
HC13B20
HG8A20
HG5C20
HG6B20
HG6C20
HG9A20
HG10A20
446 AMMO HEAT
AFT RADIO COMPT RELAY PANEL
WH2B20
NH19A20
FILTER
CLOSED
OPEN
GROUND
AMMUNITION HEAT ACTUATOR
AMMUNITION HEAT CONTROL
N.C. TO 93°C (200°F)
N.O. TO 127°C (260°F)
HG10B20
HG10C20
NH4A20
WH2C20
WH2D20
NW6A20
AMMUNITION OVERHEAT WARNING
N.C.-NORMALLY CLOSED
N.O.-NORMALLY OPEN
172-54-5129



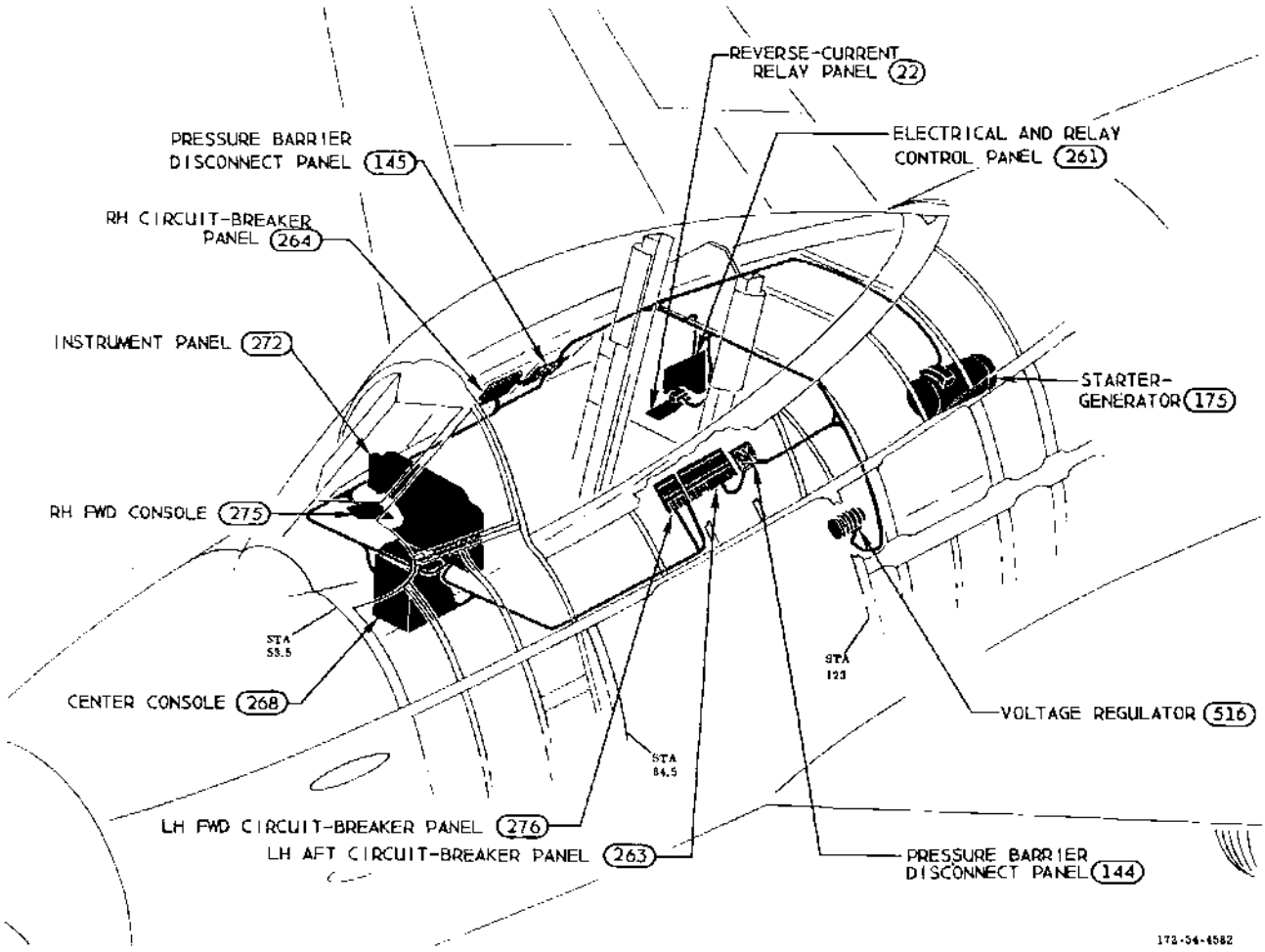
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
14	Ammeter—50-millivolt	32529, Type J-1
22	Bracket—Relay and Shunt	151-54099 (NAA)
41	Circuit Breaker—Bus Control Relay	PSA-10 (Klixon)
42	Circuit Breaker—Bus Tie-in	AN3161P5
56	Circuit Breaker—Generator Field	AN3161P20
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
116	Connector—Engine Generator Power	Furnished With Engine (General Electric)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
153	Filter—Generator Bus	CP53B2E8405K
175	Generator—Starter	32550, Type A-1 (General Electric 2CM77B8)
220	Lamp—Warning	AN3121-313
236	Light Assembly—Generator Failure Warning	AN3157-4
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170 51005 (NAA)
275	Panel—Right Forward Console	161-54005-10 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
320	Plug—Generator Field Control Relay	AN3106B24-7S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
351	Plug—Pedestal Disconnect	AN3106A32-7P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
453	Relay—Bus Tie-in Control	AN3316-1
454	Relay—Bus Tie-in Control	237EAU (Leach)
472	Relay—Generator Field Control	32603, Type M-2
487	Relay—Overvoltage	32591, Type E-2
489	Relay—Reverse-current	AN3025-2
492	Relay—Windshield Anti-icing Control	237EAU (Leach)
516	Regulator—Generator Voltage	Spec 17R21
539	Rheostat—Pilot's Voltage Control	AN3155-25-11
543	Shunt—Ammeter	120814 (Weston)
582	Switch—Generator Control	AN3027-8
595	Switch—Instrument Power	AN3027-3
652	Terminal Block—Ammeter	AN3436-2-2
663	Terminal Block—Right Gun Bay	AN3436-2-10
671	Terminal Block—Overvoltage Relay	AN3436-2-8
761	Voltmeter—0 to 30-volt D-C	AN3203V30

Figure 10-53. Generator System—F-86E-1,



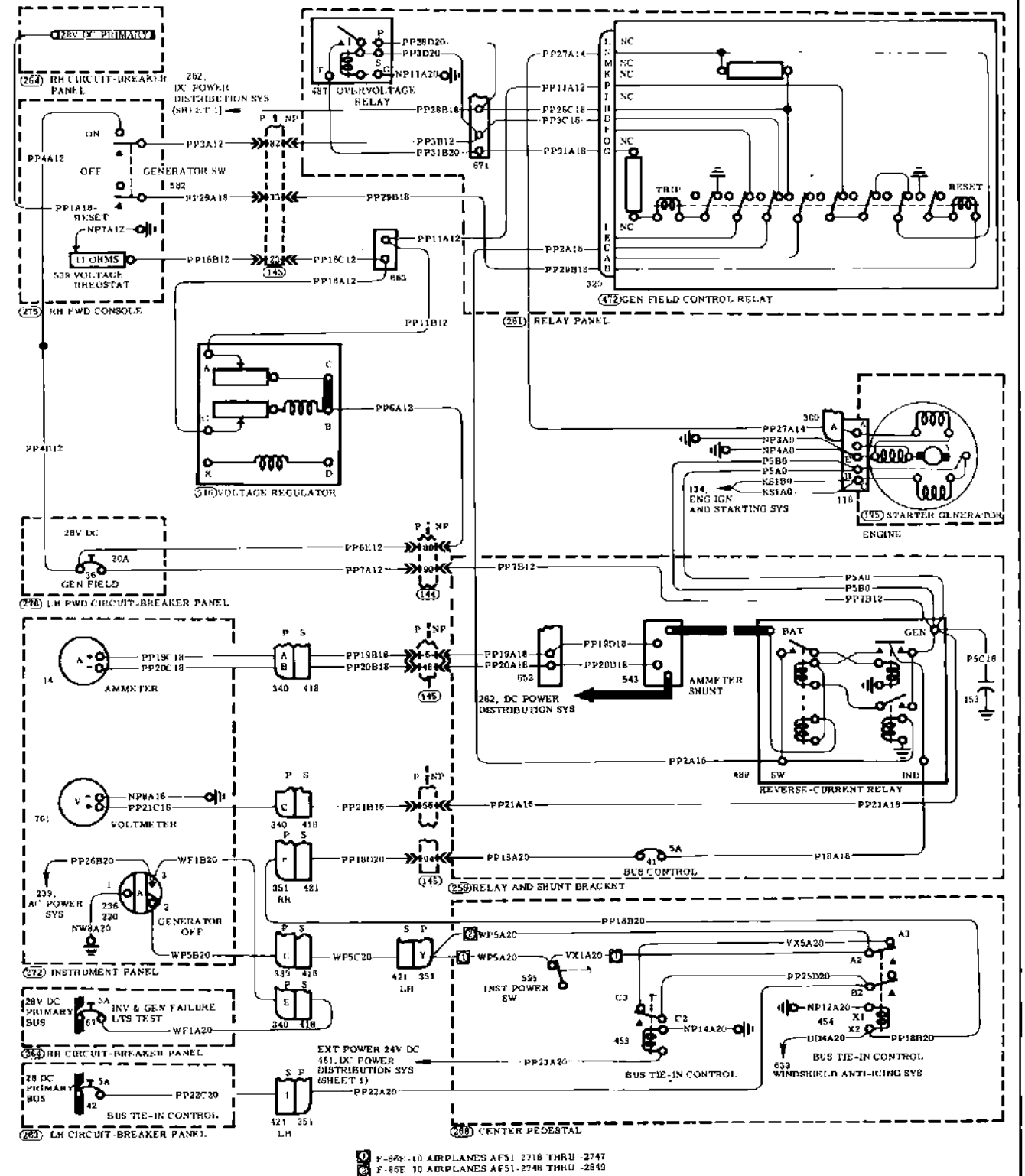
F-86E-5, and F-86E-6 Airplanes



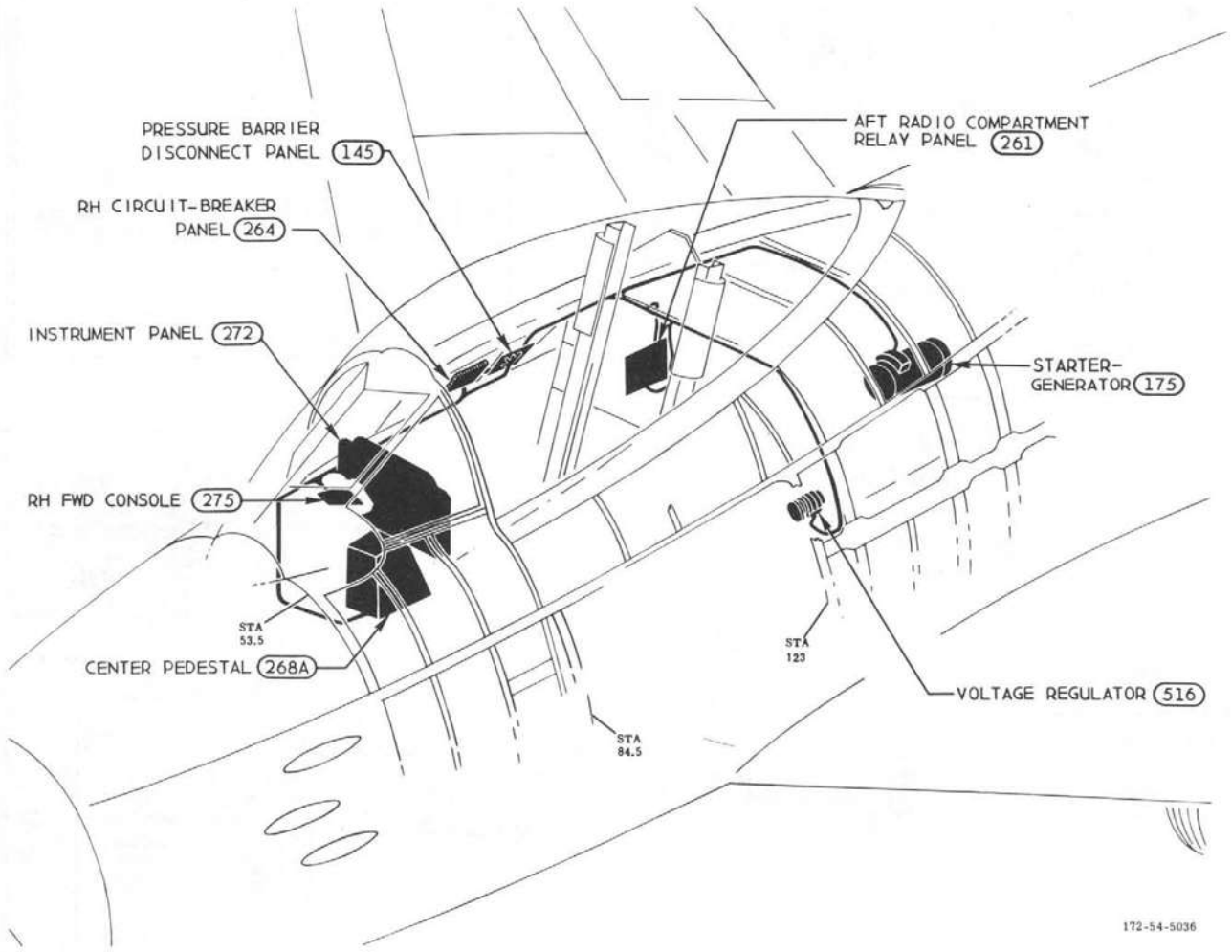
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
14	Ammeter—50-millivolt	32529, Type J-1
22	Bracket—Relay and Shunt	151-54099 (NAA)
41	Circuit Breaker—Bus Control Relay	PSA-5 (Klixon)
42	Circuit Breaker—Bus Tie-in	AN3161P5
56	Circuit Breaker—Generator Field	AN3161P20
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
116	Connector—Engine Generator Power	Furnished with Engine (General Electric)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
153	Filter—Generator Bus	CP53B2EB405K
175	Generator—Starter	32550, Type A-1 (General Electric 2CM77B8)
220	Lamp—Warning	AN3121-313
236	Light Assembly—Generator Failure Warning	AN3157-2
259	Panel—Panel and Shunt Bracket	172-54048 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
320	Plug—Generator Field Control Relay	AN3106B24-7S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
351	Plug—Pedestal Disconnect	AN3106A32-7P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
453	Relay—Bus Tie-in Control	AN3316-1
454	Relay—Bus Tie-in Control	237EAU (Leach)
472	Relay—Generator Field Control	32603, Type M-2
487	Relay—Overvoltage	32591, Type E-2
489	Relay—Reverse-current	AN3025-2
516	Regulator—Generator Voltage	Spec 17R21
539	Rheostat—Pilot's Voltage Control	AN3155-25-11
543	Shunt—Ammeter	120814 (Weston)
582	Switch—Generator Control	AN3027-8
595	Switch—Instrument Power	AN3027-3
652	Terminal Block—Ammeter	AN3436-2-2
663	Terminal Block—Right Gun Bay	AN3436-2-10
671	Terminal Block—Overvoltage Relay	AN3436-2-8
761	Voltmeter—0- to 30-volt D-C	AN3203V30

Figure 10-54. Generator System—



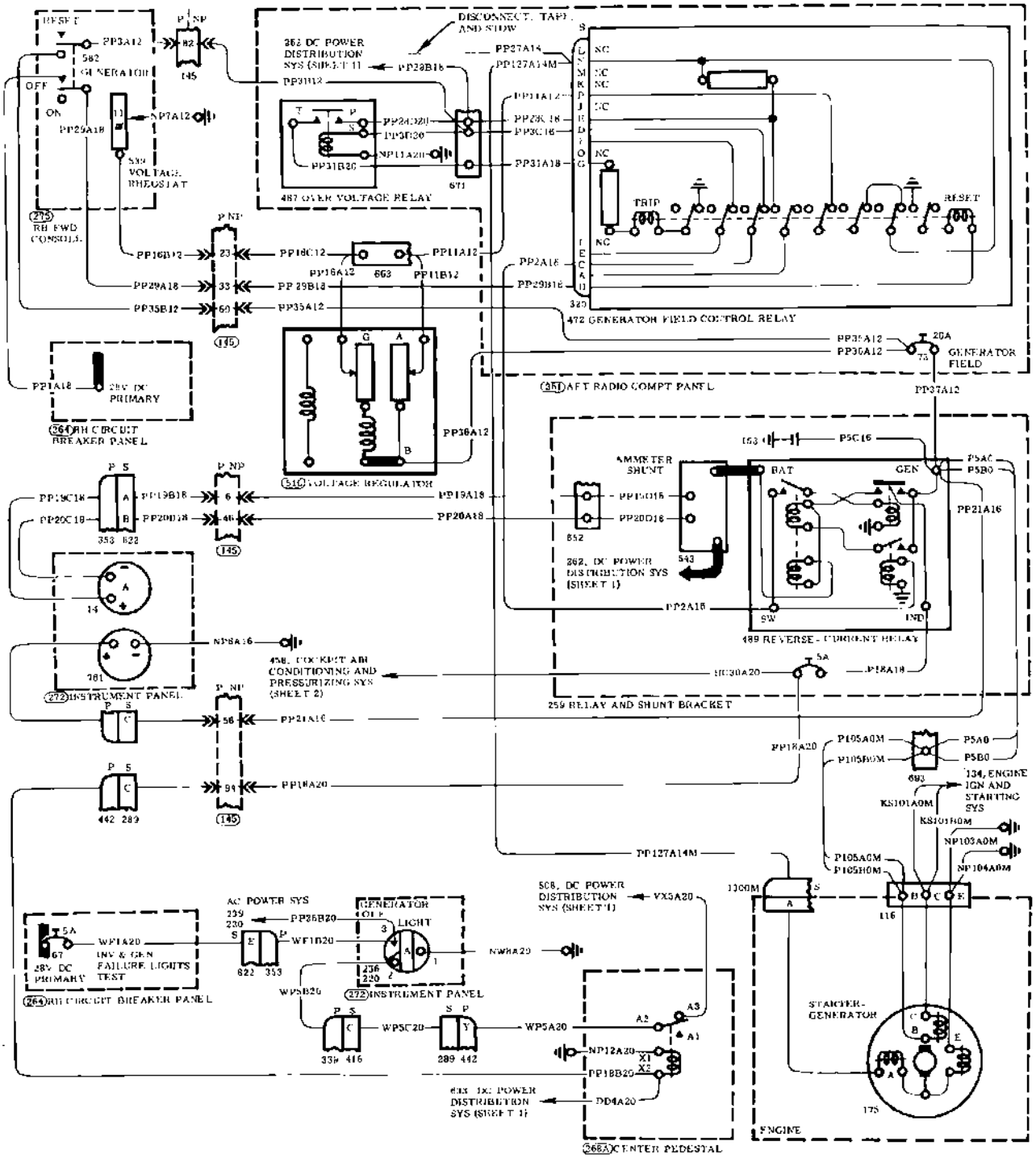
F-86E-10 Airplanes



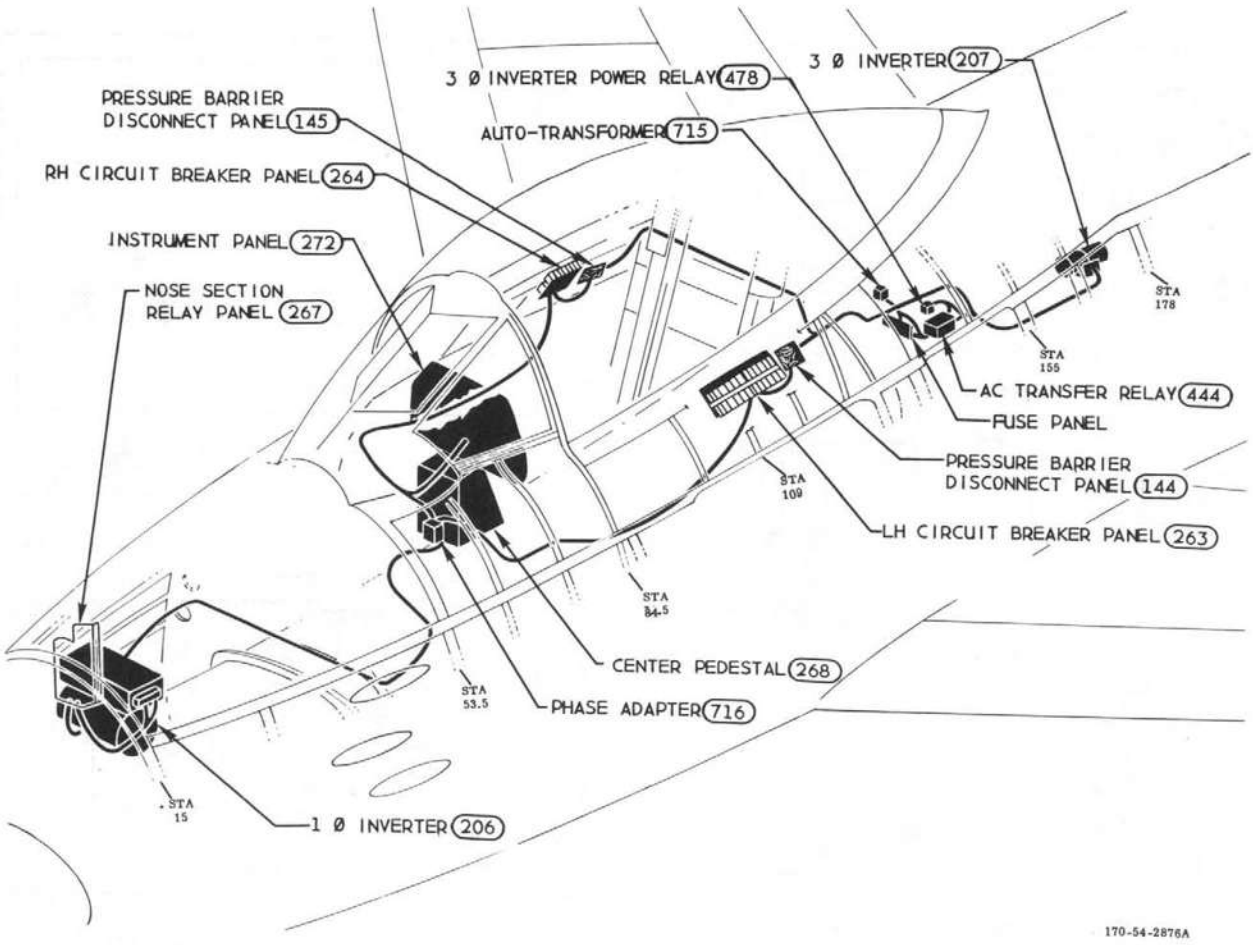
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
14	Ammeter—50-millivolt	32529, Type J-1
41	Circuit Breaker—Bus Control Relay	PSA-5 (Klixon)
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
73	Circuit Breaker—Generator Field	AN3161P20
116	Connector—Engine Generator Power	Furnished With Engine (General Electric)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
153	Filter—Generator Bus	CP53B2EB405K
175	Generator—Starter	32550, Type A-1
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
320	Plug—Generator Field Control Relay	AN3106B24-7S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
353	Plug—Instrument Panel Light Disconnect	AN3106B20-27P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
472	Relay—Generator Field Control	32603, Type M-2
487	Relay—Overvoltage	32591, Type E-2
489	Relay—Reverse-current	AN3025-2
516	Regulator—Generator Voltage	Spec 17R21
539	Rheostat—Pilot's Voltage Control	AN3155-25-11
543	Shunt—Ammeter	120814 (Weston)
582	Switch—Generator Control	AN3027-8
652	Terminal Block—Ammeter	AN3436-2-2
663	Terminal Block—Gun Bay	AN3436-2-10
671	Terminal Block—Overvoltage Relay	AN3436-2-8
693	Terminal Block—Generator Output	140-54035 (NAA)
761	Voltmeter—0- to 30-volt D-C	AN3203V30
822	Receptacle—Instrument Panel Light Disconnect	AN3100A20-27S
1300M	Plug—Engine Disconnect Small	AN3106B18-13S

Figure 10-55. Generator System—


RESET
PP3A12
582
GENERATOR
OFF
ON
PP29A18
NP7A12
VOLTAGE RHEOSTAT
(275) RH FWD CONSOLE
PP16B12
PP29A18
PP35B12
PP18C12
PP16A12
PP11B12
PP29B18
PP35A12
(145)
PP1A18
28V DC PRIMARY
(264) RH CIRCUIT BREAKER PANEL
262 DC POWER DISTRIBUTION SYS (SHEET 1)
PP28B16
PP31B12
PP24D20
PP3D20
NP11A20
PP31B20
487 OVER VOLTAGE RELAY
671
DISCONNECT, TRIP AND STOW
PP27A14
PP127A14M
PP11A12
PP28C16
PP31A18
PP2A16
PP29B16
329
472 GENERATOR FIELD CONTROL RELAY
TRIP
RESET
PP35A12
PP30A12
20A
GENERATOR FIELD
(261) AFT RADIO COMPT PANEL
PP37A12
510 VOLTAGE REGULATOR
PP36A12
153
P5C16
AMMETER SHUNT
BAT
GEN
P5A0
P5B0
PP21A16
PP19C16
PP20C16
PP19B18
PP20D18
PP19A18
PP20A18
353 822
PP19D16
PP20D16
852
543
262, DC POWER DISTRIBUTION SYS (SHEET 1)
PP2A16
SW
IND
489 REVERSE-CURRENT RELAY
14
361
NP8A16
458, COCKPIT AIR CONDITIONING AND PRESSURIZING SYS (SHEET 2)
WC30A20
5A
PP18A18
259 RELAY AND SHUNT BRACKET
272 INSTRUMENT PANEL
PP21A16
PP18A20
P105A0M
P105B0M
P5A0
P5B0
693
134, ENGINE IGN AND STARTING SYS
KS101A0M
KS101B0M
NP103A0M
NP104A0M
P105A0M
P105B0M
1300M
116
442 289
PP127A14M
AC POWER SYS
259
230
PP36B20
WF1A20
INV & GEN FAILURE LIGHTS TEST
WF1D20
822 353
GENERATOR OUT LIGHT
236
220
NWHA20
WP9B20
WP9C20
WP5A20
338 416
289 442
NP12A20
X1
X2
PP18B20
PP4A20
508, DC POWER DISTRIBUTION SYS (SHEET 1)
VX5A20
STARTER-GENERATOR
175
ENGINE
268A CENTER PEDESTAL

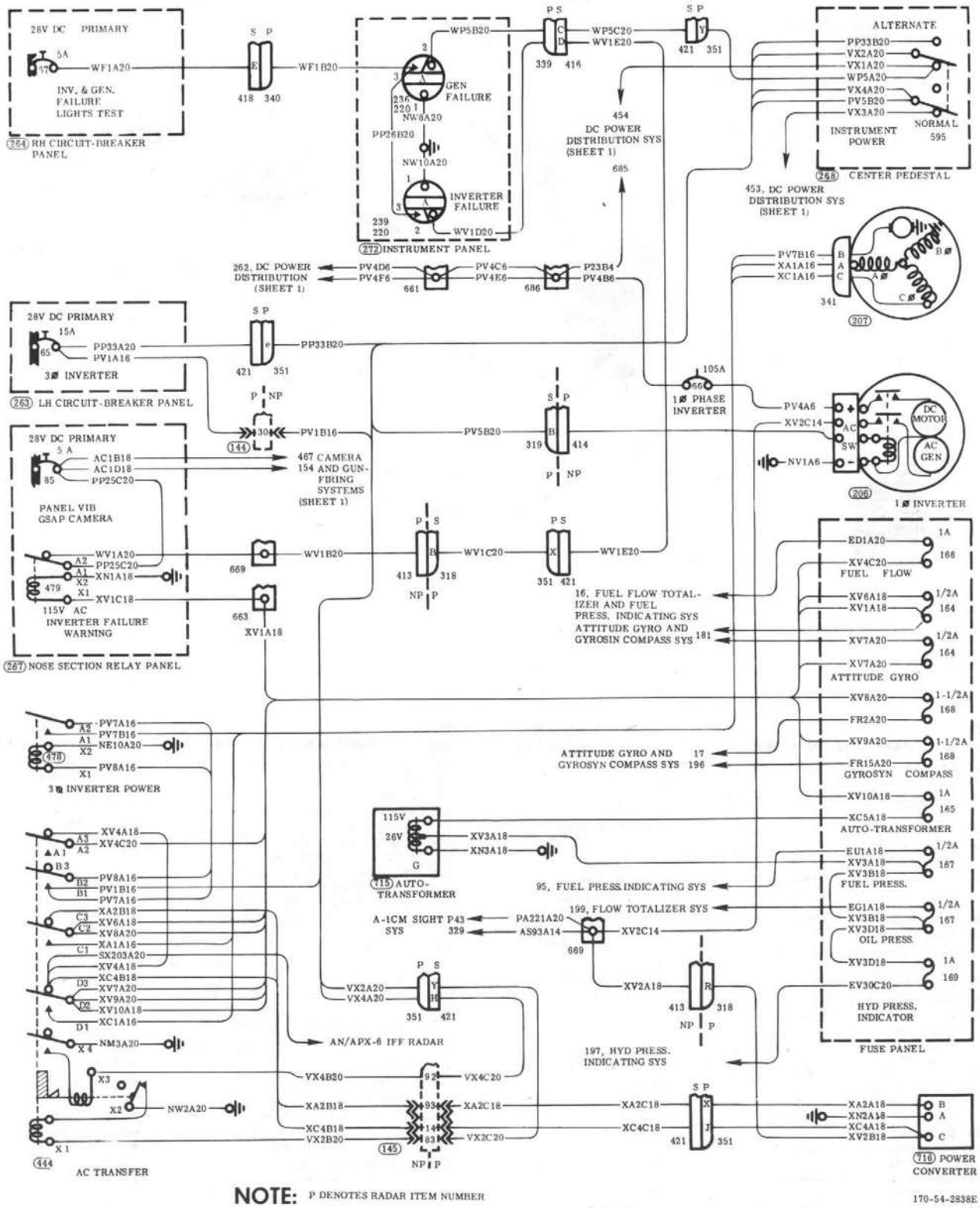
122-54-5040

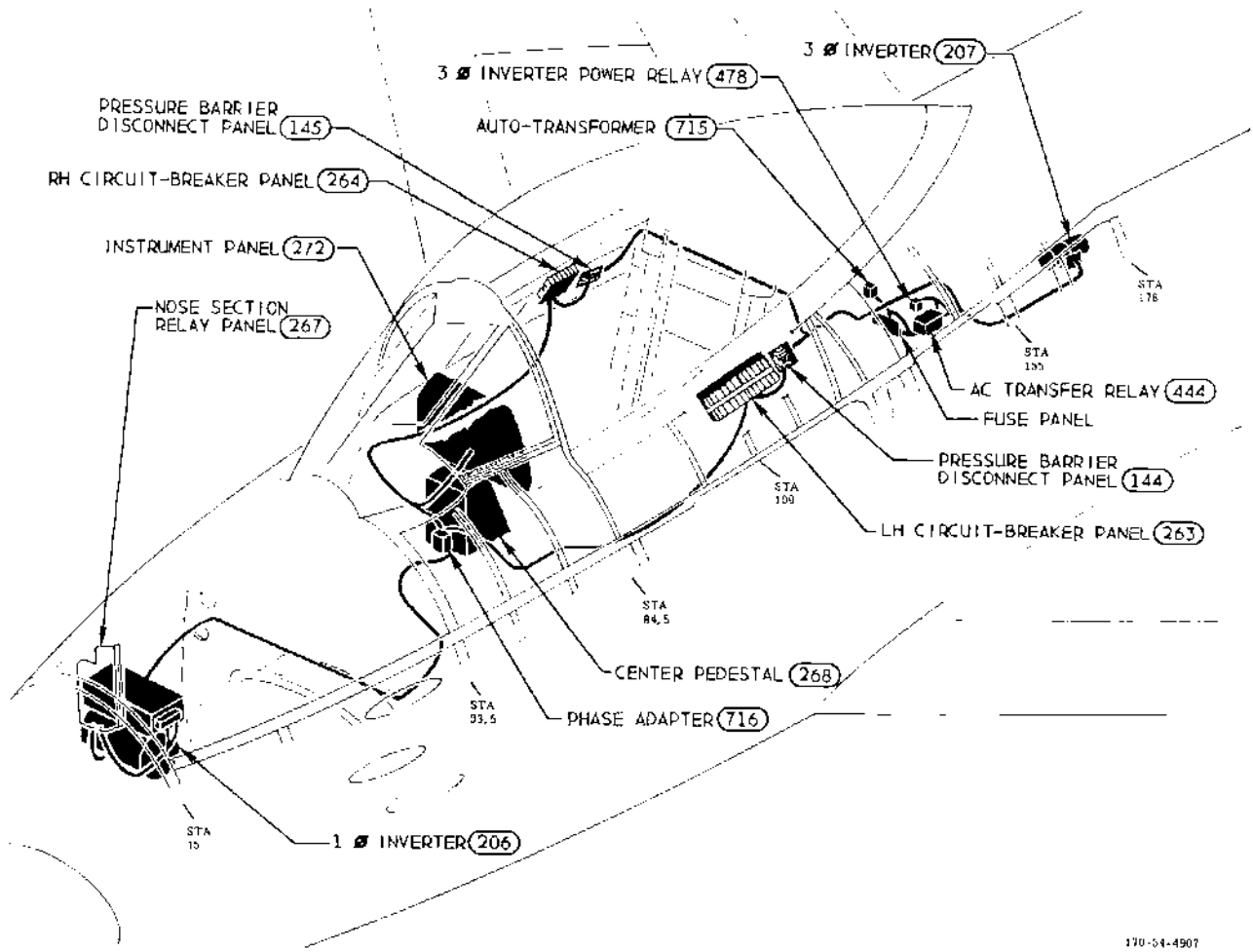


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
65	Circuit Breaker—Three-phase (Spare) Inverter	AN3161P15
66	Circuit Breaker—One-phase Inverter	PDLM-105 (Klixon)
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
164	Fuse—Attitude Gyro	AGC 1/2 (Bussmann)
165	Fuse—Autosyn Transformer	AGC 1 (Bussmann)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
168	Fuse—Gyrosyn Compass	AGC 1-1/2 (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
206	Inverter—One phase 1500-volt-ampere 115-volt 400-cycle	AN3515-1
207	Inverter—Three-phase 100-volt-ampere 115-volt 400-cycle	AN3499-1
220	Lamp—Warning	AN3121-313
236	Light—Generator Failure Warning	AN3157-4
239	Light Assembly—Inverter Failure Warning	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
341	Plug—Alternate (Spare) Three-phase Inverter	AN3108B14S-7S
351	Plug—Pedestal Disconnect	AN3106A32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
444	Relay—A-C Transfer	9014 (Leach)
478	Relay—Three-phase Inverter Power	237EAU (Leach)
479	Relay—Inverter Failure Warning	44B18574, Type 32471
595	Switch—Instrument Power	AN3027-3
661	Terminal Block—Left Gun Bay	AN3436-6-3
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
686	Terminal Block—Left Primary Bus	NAS45-416-1
715	Transformer—26- to 115-volt 10-volt-ampere A-C Auto	C-124 (Frampton)
716	Transformer—Phase Adapter (One-phase to Three-phase)	661102, Type P-1 (Sperry)

Figure 10-56. A-C Power System—F-86E-1,

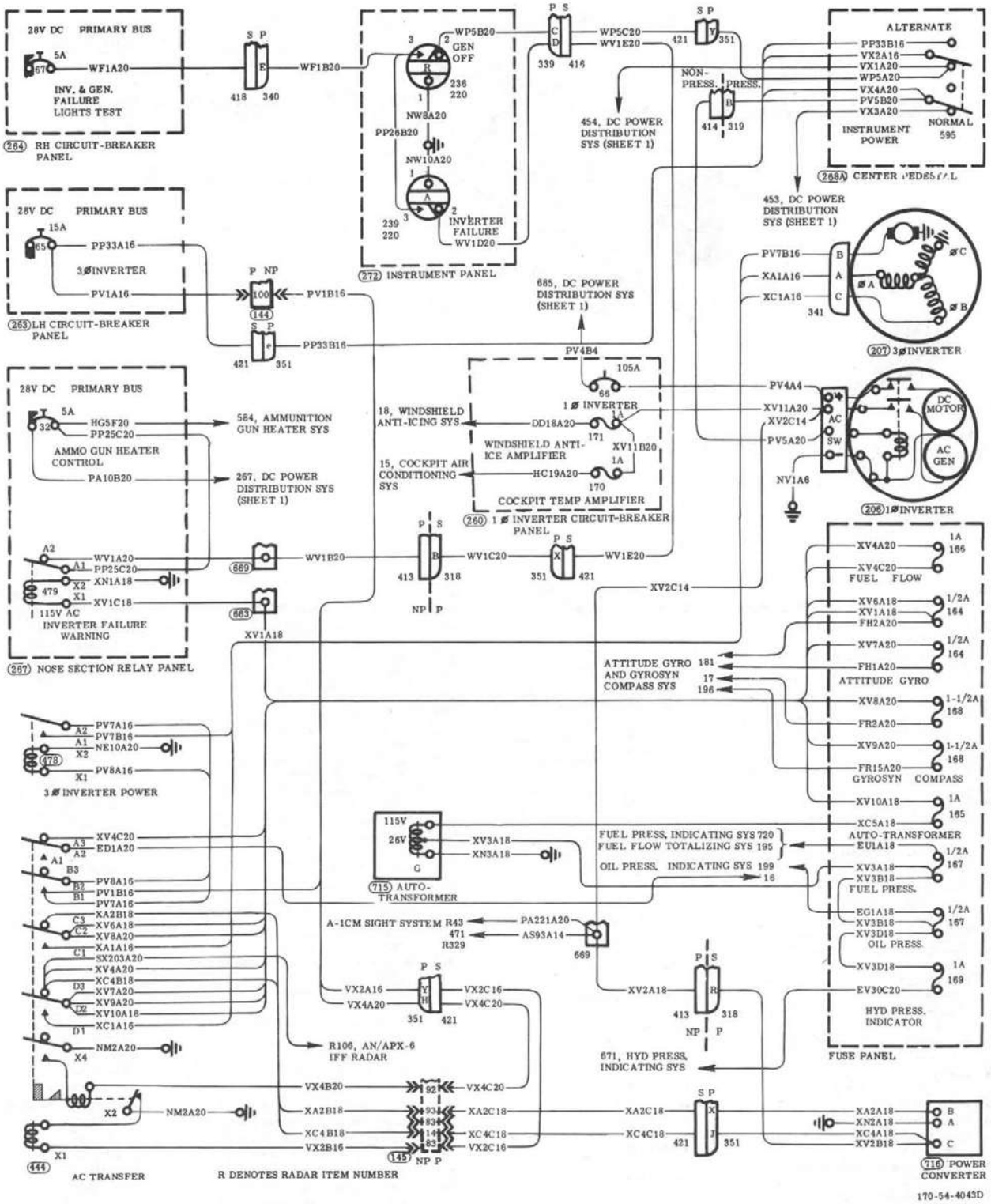

28V DC PRIMARY
5A
WF1A20
INV. & GEN. FAILURE LIGHTS TEST
(264) RH CIRCUIT-BREAKER PANEL
WF1B20
418 340
WP5B20
GEN FAILURE
NW8A20
PP26B20
NW10A20
INVERTER FAILURE
WV1D20
(272) INSTRUMENT PANEL
WP5C20
WV1E20
339 416
421 351
454 DC POWER DISTRIBUTION SYS (SHEET 1)
685
ALTERNATE
PP33B20
VX2A20
VX1A20
WP5A20
VX4A20
PV5B20
VX3A20
INSTRUMENT POWER
NORMAL
595
(268) CENTER PEDESTAL
453, DC POWER DISTRIBUTION SYS (SHEET 1)
262, DC POWER DISTRIBUTION (SHEET 1)
PV4D6
PV4F6
661
PV4C6
PV4E6
686
P23B4
PV4B6
PV7B16
XA1A16
XC1A16
341
207
28V DC PRIMARY
15A
PP33A20
PV1A16
3Ø INVERTER
(263) LH CIRCUIT-BREAKER PANEL
421 351
PP33B20
105A
1Ø PHASE INVERTER
PV4A6
XV2C14
NV1A6
DC MOTOR
AC GEN
206
1Ø INVERTER
PV1B16
144
PV5B20
319 414
467 CAMERA 154 AND GUN-FIRING SYSTEMS (SHEET 1)
28V DC PRIMARY
5A
AC1B18
AC1D18
PP25C20
PANEL VIB GSAP CAMERA
WV1A20
PP25C20
XN1A18
479
XV1C18
115V AC INVERTER FAILURE WARNING
(267) NOSE SECTION RELAY PANEL
669
WV1B20
663
XV1A18
413 318
WV1C20
351 421
WV1E20
16, FUEL FLOW TOTALIZER AND FUEL PRESS. INDICATING SYS
ATTITUDE GYRO AND GYROSIN COMPASS SYS 181
ED1A20
XV4C20
FUEL FLOW
1A 166
XV6A18
XV1A18
1/2A 164
XV7A20
1/2A 164
XV7A20
ATTITUDE GYRO
XV8A20
1-1/2A 168
FR2A20
XV9A20
1-1/2A 168
ATTITUDE GYRO AND GYROSYN COMPASS SYS 17 196
FR15A20
GYROSYN COMPASS
XV10A18
1A
XC5A18
165
AUTO-TRANSFORMER
PV7A16
PV7B16
NE10A20
478
PV8A16
3Ø INVERTER POWER
115V
26V
XV3A18
XN3A18
G
(715) AUTO-TRANSFORMER
EU1A18
1/2A
XV3A18
167
XV3B18
FUEL PRESS.
95, FUEL PRESS. INDICATING SYS
199, FLOW TOTALIZER SYS
A-1CM SIGHT P43 SYS
PA221A20
329
AS93A14
XV2C14
669
EG1A18
1/2A
XV3B18
167
XV3D18
OIL PRESS.
XV3D18
1A
169
EV30C20
HYD PRESS. INDICATOR
XV4A18
XV4C20
PV8A16
PV1B16
PV7A16
XA2B18
XV6A18
XV8A20
XA1A16
SX203A20
XV4A18
XC4B18
XV7A20
XV9A20
XV10A18
XC1A16
NM3A20
AN/APX-6 IFF RADAR
VX2A20
VX4A20
351 421
XV2A18
413 318
197, HYD PRESS. INDICATING SYS
FUSE PANEL
VX4B20
VX4C20
XA2B18
XA2C18
XC4B18
VX2B20
VX2C20
145
XA2C18
XC4C18
421 351
XA2A18
XN2A18
XC4A18
XV2B18
716 POWER CONVERTER
444
AC TRANSFER
NW2A20
NOTE: P DENOTES RADAR ITEM NUMBER
170-54-2838E

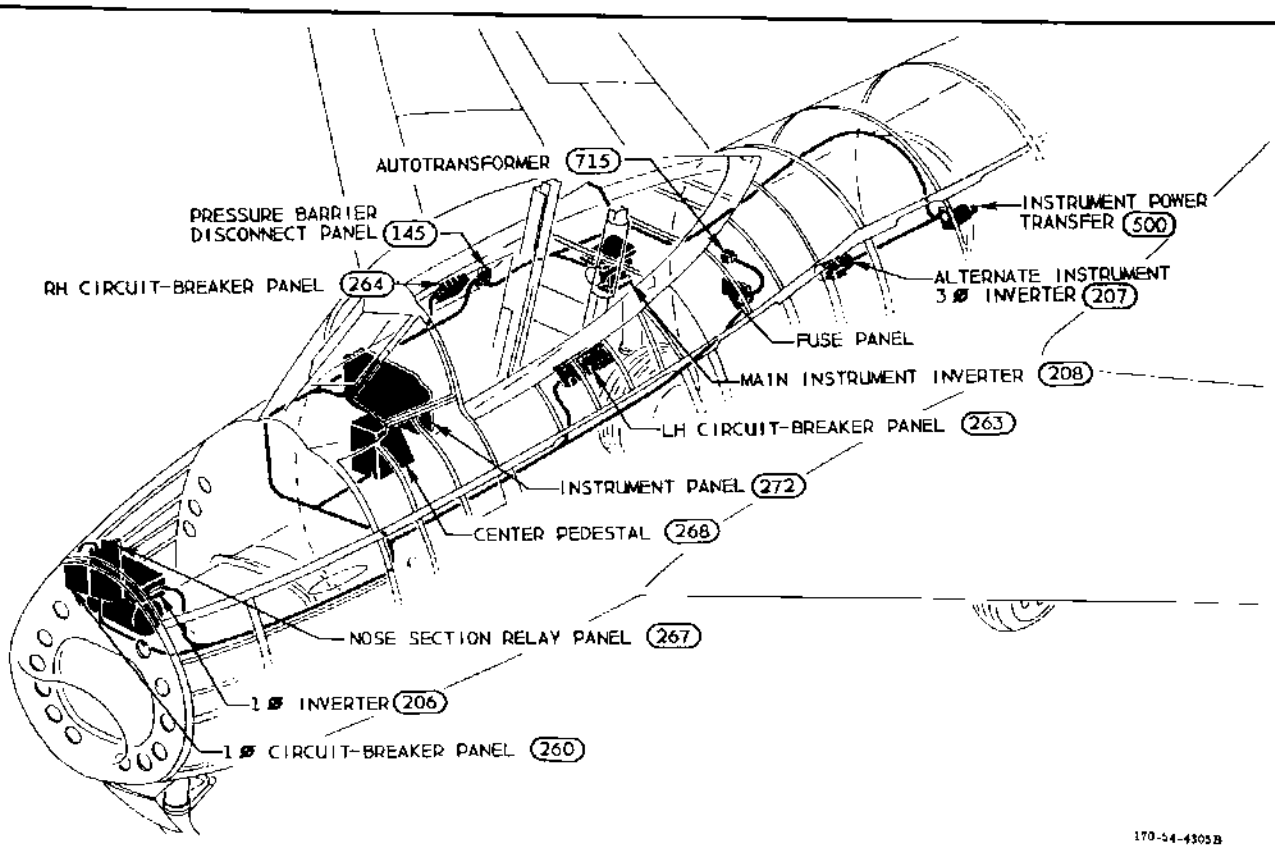


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P5
65	Circuit Breaker—Three-phase (Spare) Inverter	AN3161P15
66	Circuit Breaker—One-phase Inverter	PDLM-105 (Klixon)
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
164	Fuse—Attitude Gyro	AGC 1/2 (Bussmann)
165	Fuse—Autosyn Transformer	AGC 1 (Bussmann)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
168	Fuse—Gyrosyn Compass	AGC 1-1/2 (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
170	Fuse—Cockpit Temperature Control Amplifier	AGC 1 (Bussmann)
171	Fuse—Windshield Anti-Icing Control Amplifier	AGC 1 (Bussmann)
206	Inverter—One-phase 1500 volt-ampere 115-volt 400-cycle	AN3515-1
207	Inverter—Three-phase 100-volt-ampere 115-volt 400-cycle Alternate	AN3499-1
220	Lamp—Warning	AN3121-313
236	Light Assembly—Generator Failure Warning	AN3157-2
239	Light Assembly—Inverter Failure Warning	AN3157-4
260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
341	Plug—Alternate (Spare) Three-phase Inverter	AN3108B14S-7S
351	Plug—Pedestal Disconnect	AN3106A32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
444	Relay—A-C Transfer	9014 (Leach)
478	Relay—Three-phase Inverter Power	237EAU (Leach)
479	Relay—Inverter Failure Warning	44818574, Type 32471
595	Switch—Instrument Power	AN3027-3
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
715	Transformer—26- to 115-volt 10-volt-ampere A C Auto	C-124 (Frampton)
716	Transformer -Phase Adapter (One-phase to Three-phase)	661102, Type P-1 (Sperry)

Figure 10-57. A-C Power System—F-86E-10

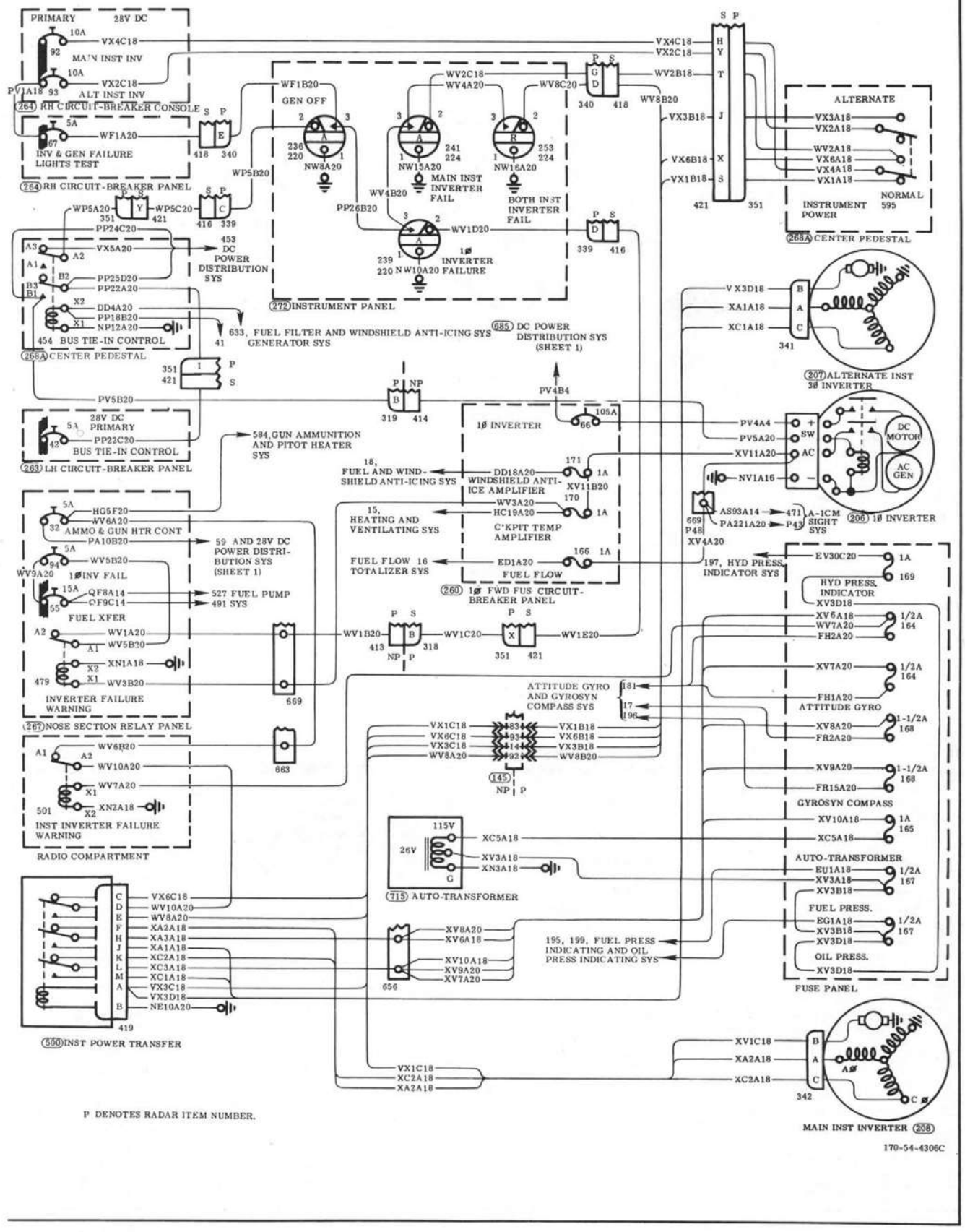

28V DC PRIMARY BUS
INV. & GEN. FAILURE LIGHTS TEST
264 RH CIRCUIT-BREAKER PANEL
28V DC PRIMARY BUS
3ø INVERTER
263 LH CIRCUIT-BREAKER PANEL
28V DC PRIMARY BUS
AMMO GUN HEATER CONTROL
584, AMMUNITION GUN HEATER SYS
267, DC POWER DISTRIBUTION SYS (SHEET 1)
115V AC INVERTER FAILURE WARNING
267 NOSE SECTION RELAY PANEL
272 INSTRUMENT PANEL
GEN OFF
INVERTER FAILURE
454, DC POWER DISTRIBUTION SYS (SHEET 1)
NON-PRESS.
ALTERNATE
INSTRUMENT POWER
NORMAL
268A CENTER PEDESTAL
453, DC POWER DISTRIBUTION SYS (SHEET 1)
685, DC POWER DISTRIBUTION SYS (SHEET 1)
207 3ø INVERTER
1ø INVERTER
DC MOTOR
AC GEN
206 1ø INVERTER
18, WINDSHIELD ANTI-ICING SYS
WINDSHIELD ANTI-ICE AMPLIFIER
15, COCKPIT AIR CONDITIONING SYS
COCKPIT TEMP AMPLIFIER
260 1ø INVERTER CIRCUIT-BREAKER PANEL
FUEL FLOW
ATTITUDE GYRO
ATTITUDE GYRO AND GYROSYN COMPASS SYS
GYROSYN COMPASS
AUTO-TRANSFORMER
FUEL PRESS. INDICATING SYS 720
FUEL FLOW TOTALIZING SYS 195
OIL PRESS. INDICATING SYS 199
FUEL PRESS.
OIL PRESS.
HYD PRESS. INDICATOR
FUSE PANEL
3ø INVERTER POWER
715 AUTO-TRANSFORMER
A-1CM SIGHT SYSTEM R43
R329
R106, AN/APX-6 IFF RADAR
671, HYD PRESS. INDICATING SYS
444 AC TRANSFER
R DENOTES RADAR ITEM NUMBER
716 POWER CONVERTER
170-54-4043D

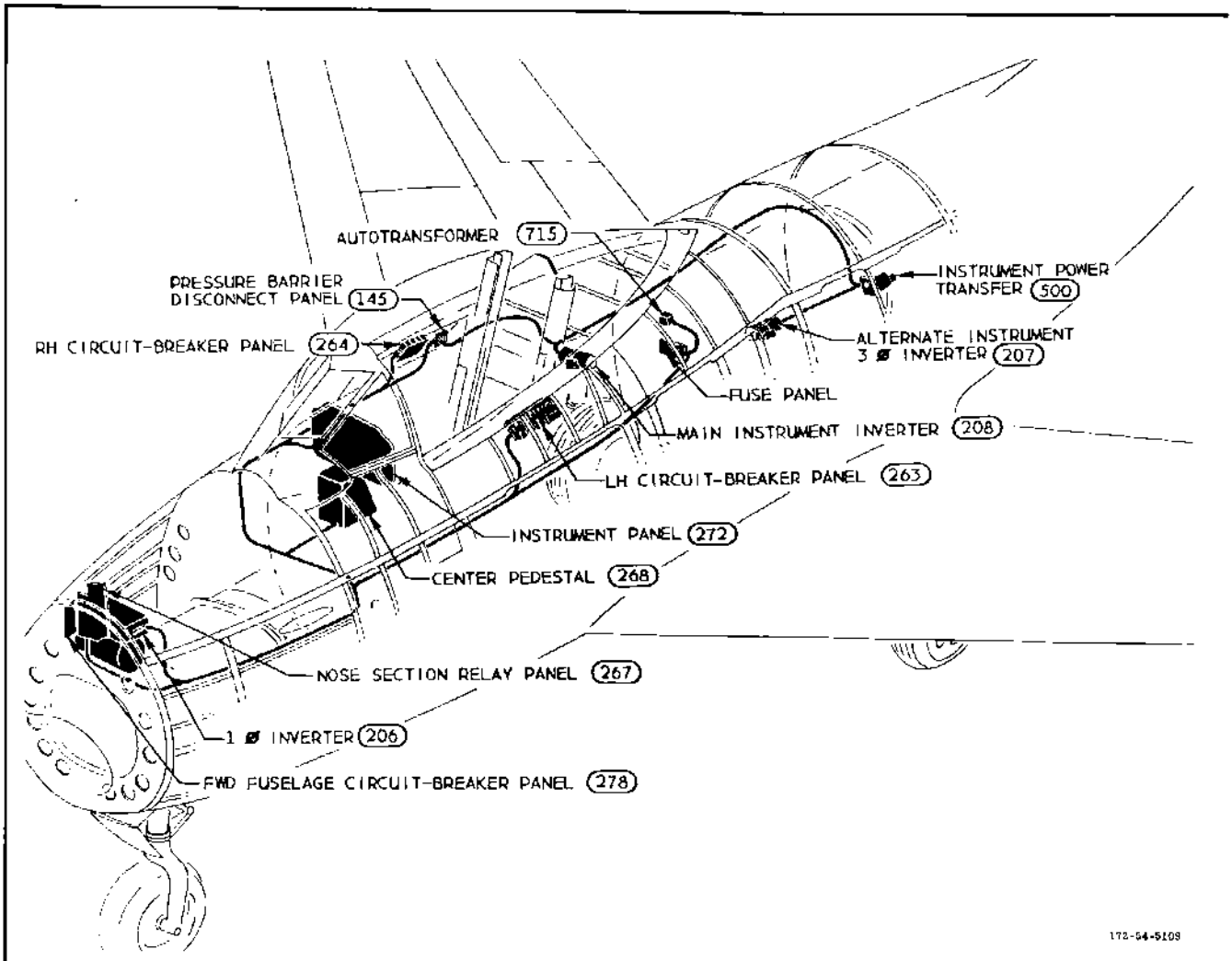


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P5
42	Circuit Breaker—Bus Tie-in	AN3161P5
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
66	Circuit Breaker—One-phase Inverter	PDLM-105 (Klixon)
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
92	Circuit Breaker—Main Instrument Inverter	AN3161P10
93	Circuit Breaker—Alternate Instrument Inverter	AN3161P10
94	Circuit Breaker—One-phase Inverter Failure	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
164	Fuse—Attitude Gyro	AGC 1/2 (Bussmann)
165	Fuse—Autosyn Transformer	AGC 1 (Bussmann)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator 5-ampere	AGC 1/2 (Bussmann)
168	Fuse—Gyrosyn Compass	AGC 1-1/2 (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
170	Fuse—Cockpit Temperature Control Amplifier	AGC 1 (Bussmann)
171	Fuse—Windshield Anti-icing Control Amplifier	AGC 1 (Bussmann)
206	Inverter—One-phase 1500-volt-ampere 115-volt 400-cycle	AN3515-1
207	Inverter—Three-phase 100-volt-ampere 115-volt 400-cycle Alternate	AN3499-1
208	Inverter—Three-phase 700-volt-ampere 115-volt 400-cycle Main	AN3499-1
220	Lamp—Warning	AN3121-313
224	Lamp—Warning	AN3121-313
236	Light Assembly—Generator Failure Warning	AN3157-2
239	Light Assembly—Inverter Failure Warning	AN3157-4
241	Light Assembly—Main Instrument Inverter Failure Warning	AN3157-4
253	Light Assembly—Both Instrument Inverter Failure Warning	AN3157-6

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
260	Panel- Forward Fuselage Circuit-breaker	172-54078 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
341	Plug—Alternate (Spare) Three-phase Inverter	AN3108B14S-7S
342	Plug—Main Three-phase Inverter	AN3108B14S-7S
351	Plug—Pedestal Disconnect	AN3106A32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
419	Receptacle—Instrument Power Transfer Relay	2044-84 (Cannon)
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
444	Relay—A-C Transfer	9014 (Leach)
454	Relay—Bus Tie-in Control	237EAU (Leach)
479	Relay—Inverter Failure Warning	44B18574, Type 32471
500	Relay—Instrument Power Transfer	AN3308-1
501	Relay—Inverter Failure Warning	44B18574
595	Switch—Instrument Power	AN3027-3
656	Terminal Block—Compass	AN3436-2-7
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
715	Transformer—26- to 115-volt 10-volt-ampere A-C Auto	C-124 (Frampton)

Figure 10-58. A-C Power System—F-86E-10

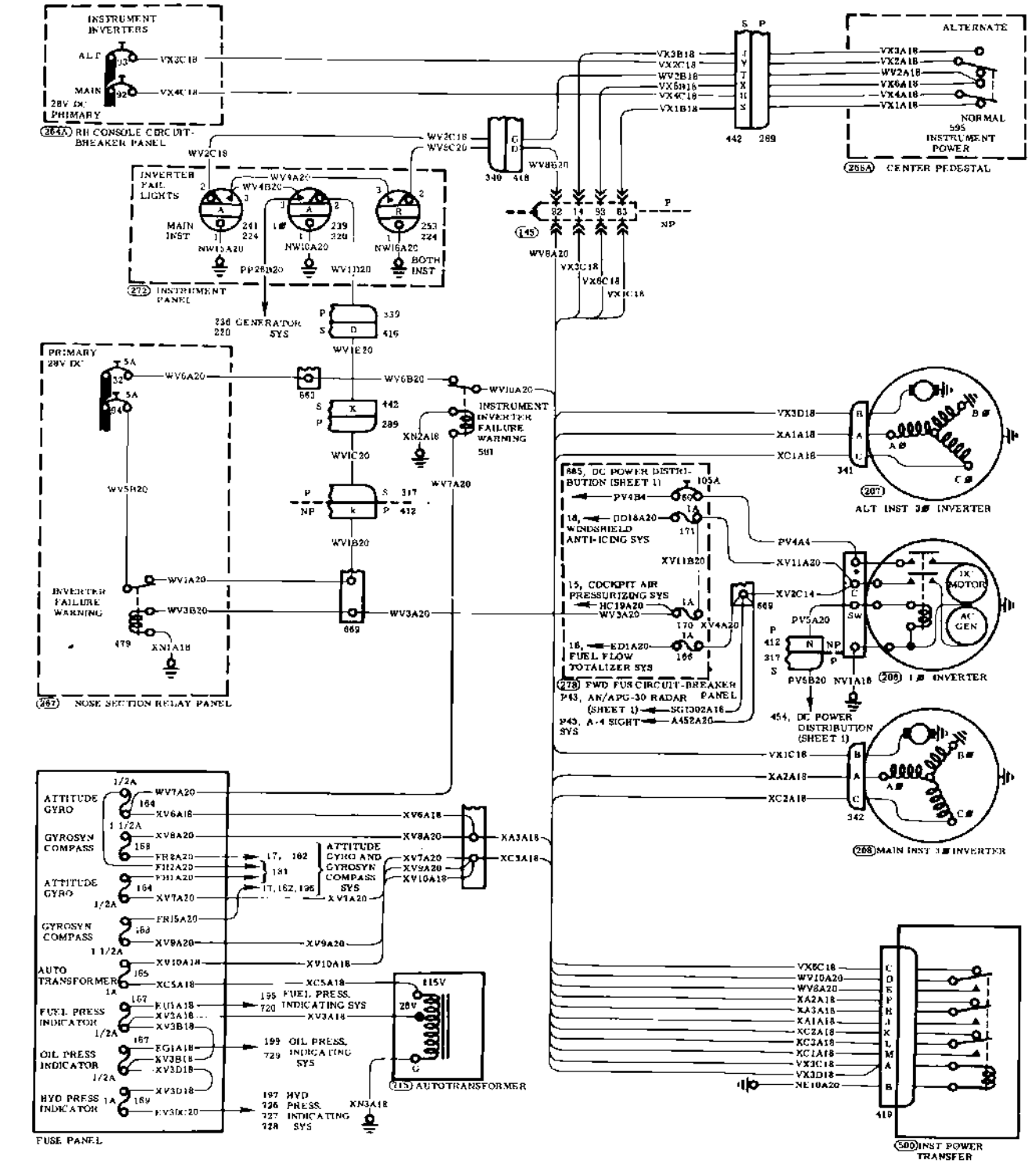

PRIMARY 28V DC
MAIN INST INV
ALT INST INV
(264) RH CIRCUIT-BREAKER CONSOLE
INV & GEN FAILURE LIGHTS TEST
(264) RH CIRCUIT-BREAKER PANEL
GEN OFF
NW8A20
NW15A20
NW16A20
MAIN INST INVERTER FAIL
BOTH INST INVERTER FAIL
1ø INVERTER FAILURE
(272) INSTRUMENT PANEL
ALTERNATE
NORMAL
INSTRUMENT POWER
(268A) CENTER PEDESTAL
454 BUS TIE-IN CONTROL
453 DC POWER DISTRIBUTION SYS
633, FUEL FILTER AND WINDSHIELD ANTI-ICING SYS
GENERATOR SYS
(685) DC POWER DISTRIBUTION SYS (SHEET 1)
28V DC PRIMARY
BUS TIE-IN CONTROL
(263) LH CIRCUIT-BREAKER PANEL
584, GUN AMMUNITION AND PITOT HEATER SYS
1ø INVERTER
18, FUEL AND WIND-SHIELD ANTI-ICING SYS
WINDSHIELD ANTI-ICE AMPLIFIER
15, HEATING AND VENTILATING SYS
C'KPIT TEMP AMPLIFIER
FUEL FLOW 16 TOTALIZER SYS
FUEL FLOW
(260) 1ø FWD FUS CIRCUIT-BREAKER PANEL
AMMO & GUN HTR CONT
59 AND 28V DC POWER DISTRI-BUTION SYS (SHEET 1)
1ø INV FAIL
FUEL XFER
527 FUEL PUMP
491 SYS
INVERTER FAILURE WARNING
(267) NOSE SECTION RELAY PANEL
INST INVERTER FAILURE WARNING
RADIO COMPARTMENT
(206) 1ø INVERTER
A-1CM SIGHT SYS
197, HYD PRESS. INDICATOR SYS
HYD PRESS. INDICATOR
ATTITUDE GYRO AND GYROSYN COMPASS SYS
ATTITUDE GYRO
GYROSYN COMPASS
AUTO-TRANSFORMER
(715) AUTO-TRANSFORMER
FUEL PRESS.
OIL PRESS.
195, 199, FUEL PRESS INDICATING AND OIL PRESS INDICATING SYS
FUSE PANEL
(500) INST POWER TRANSFER
(207) ALTERNATE INST 3ø INVERTER
MAIN INST INVERTER (208)
P DENOTES RADAR ITEM NUMBER.
170-54-4306C



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P5
60	Circuit Breaker—Manual Gun Charger	AN3161P25
92	Circuit Breaker—Main Instrument Inverter	AN3161P10
93	Circuit Breaker—Alternate Instrument Inverter	AN3161P10
94	Circuit Breaker—One-phase Inverter Failure	AN3161P5
164	Fuse—Attitude Gyro	AGC 1/2 (Bussmann)
165	Fuse—Autosyn Transformer	AGC 1 (Bussmann)
166	Fuse—Fuel Flowmeter	AGC 1 (Bussmann)
167	Fuse—Fuel and Oil Pressure Indicator 5 ampere	AGC 1/2 (Bussmann)
168	Fuse—Gyrosyn Compass	AGC 1-1/2 (Bussmann)
169	Fuse—Hydraulic Pressure Indicator	AGC 1 (Bussmann)
170	Fuse—Cockpit Temperature Control Amplifier	AGC 1 (Bussmann)
171	Fuse—Windshield Anti-icing Control Amplifier	AGC 1 (Bussmann)
206	Inverter—One-phase 1500-volt-ampere 115-volt 400-cycle	AN3515-1
207	Inverter—Three-phase 100-volt-ampere 115-volt 400-cycle Alternate	AN3499-1
208	Inverter—Three-phase 100-volt-ampere 115-volt 400-cycle Main	AN3499-1
224	Lamp—Warning	AN3121-313
241	Light Assembly—Main Instrument Inverter Failure Warning	AN3157-4
253	Light Assembly—Both Instrument Inverter Failure Warning	AN3157-6

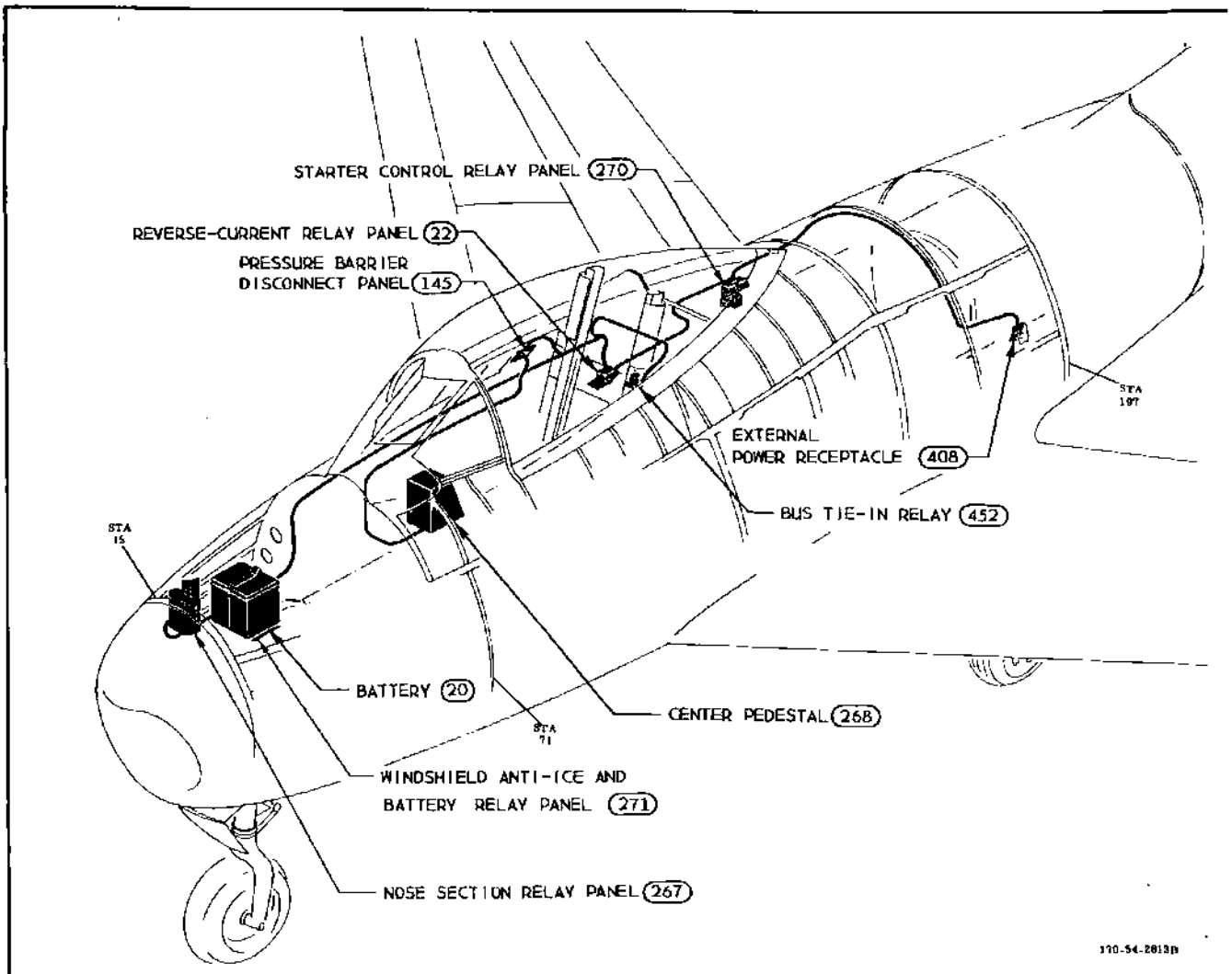
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
264	Panel—Right Circuit-breaker	172-54040 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
339	Plug—Instrument Panel Indicator Light Disconnect	AN3106B18-1P
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
341	Plug—Alternate (Spare) Three-phase Inverter	AN3108B14S-7S
342	Plug—Main Three-phase Inverter	AN3108B14S-7S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
416	Receptacle—Instrument Panel Indicator Light Disconnect	AN3100A18-1S
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
419	Receptacle—Instrument Power Transfer Relay	2044-84 (Cannon)
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
500	Relay—Instrument Power Transfer	AN3308-1
501	Relay—Inverter Failure Warning	44B18574
595	Switch—Instrument Power	AN3027-3
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
715	Transformer—26- to 115-volt 10-volt-ampere A-C Auto	C-124 (Frampton)

Figure 10-59. A-C Power



NOTE: P DENOTES RADAR ITEM NUMBERS

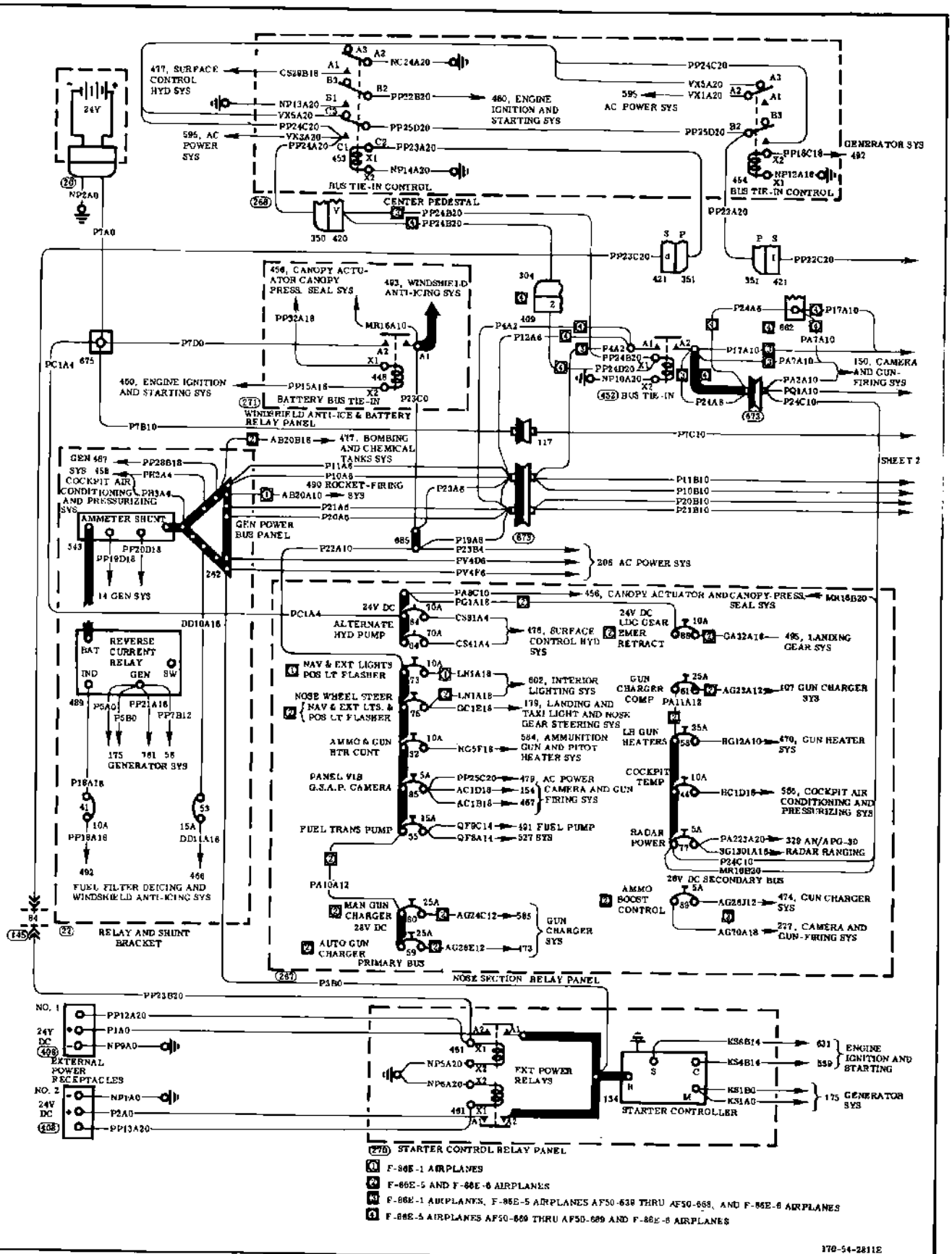
172-54-5128



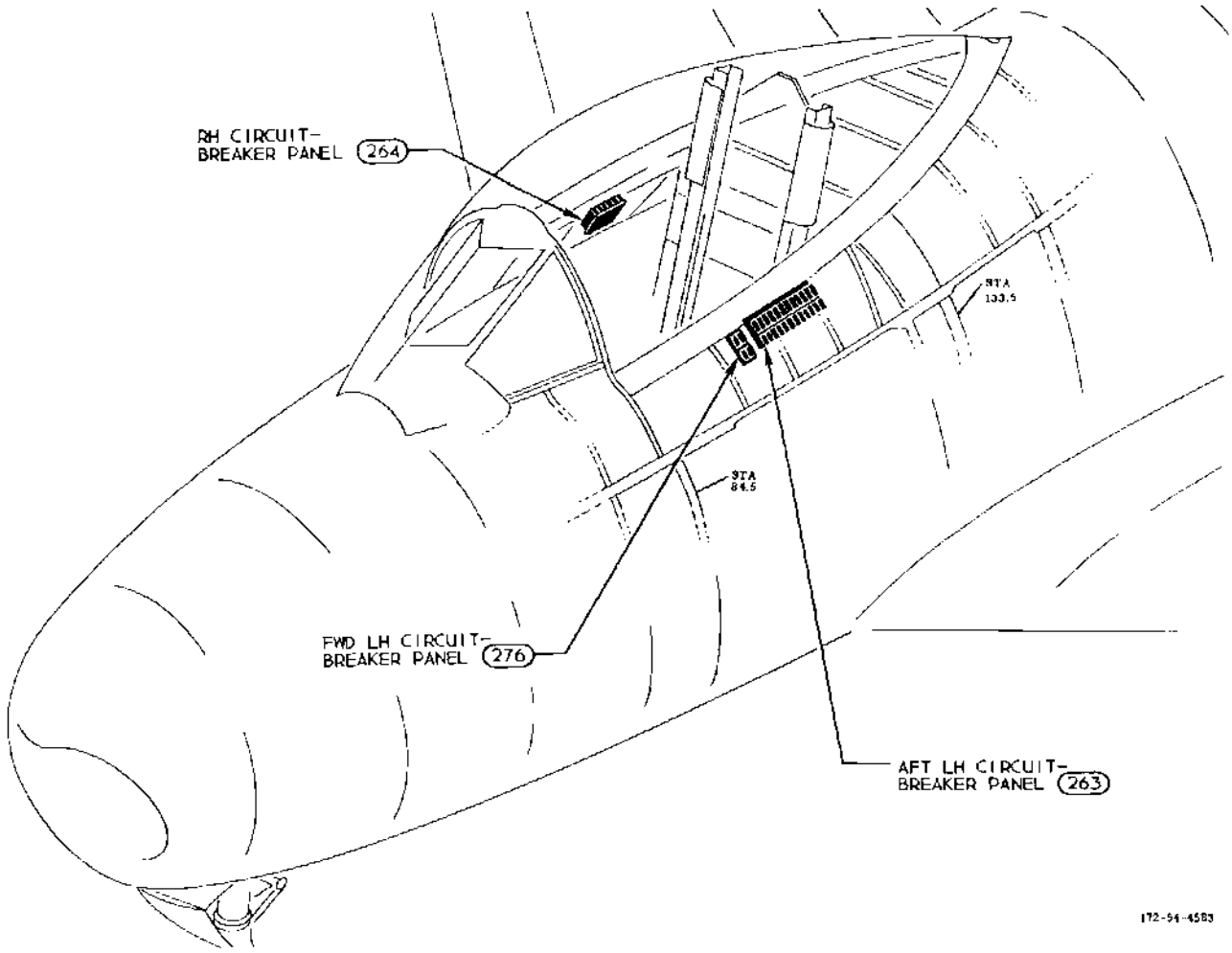
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
20	Battery—24-volt 34-ampere-hour	AN3150-2
22	Bracket—Relay and Shunt	151-54099 (NAA)
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P10
41	Circuit Breaker—Bus Control Relay	PSA-10 (Klixon)
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-icing	AN3161P10
53	Circuit Breaker—Fuel Filter Deicing	PSA-15 (Klixon)
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
58	Circuit Breaker—Gun Heater	AN3161P35
59	Circuit Breaker—Automatic Gun Charger	AN3161P25
60	Circuit Breaker—Manual Gun Charger	AN3161P25
61	Circuit Breaker—Gun Charger Compressor	AN3161P25
64	Circuit Breaker—Alternate Hydraulic Pump	PDLM-70 (Klixon)
73	Circuit Breaker—Navigation and Exterior Light and Position Light Flasher	AN3161P10
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
77	Circuit Breaker—Radar Power	AN3161P5
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
88	Circuit Breaker—Landing Gear Emergency Retract	AN3161P10
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
117	Connector—Pressure Block	140-54008 (NAA)
134	Controller—Starter	AN3391-1
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
262	Panel—Generator Power Bus	140-54035 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
271	Panel—Windshield Anti-icing and Battery Relay	170-54085 (NAA)
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
408	Receptacle—External Power	AN2552A3
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
448	Relay—Battery	AN3370-1
452	Relay—Bus Tie-in	AN3370-1
453	Relay—Bus Tie-in Control	AN3316-1
454	Relay—Bus Tie-in Control	237EAU (Leach)
461	Relay—External Power	AN3380-1
489	Relay—Reverse-current	AN3025-2
543	Shunt—Ammeter	120814 (Weston)
662	Terminal Block—Right Gun Bay	AN3436-6-1
673	Terminal Block—Pressure	151-54037 (NAA)
675	Terminal Block—Battery	NAS45-416-1
685	Terminal Block—Right Primary Bus	NAS45-416-1

Figure 10-60. D-C Power Distribution System—F-86E-1,



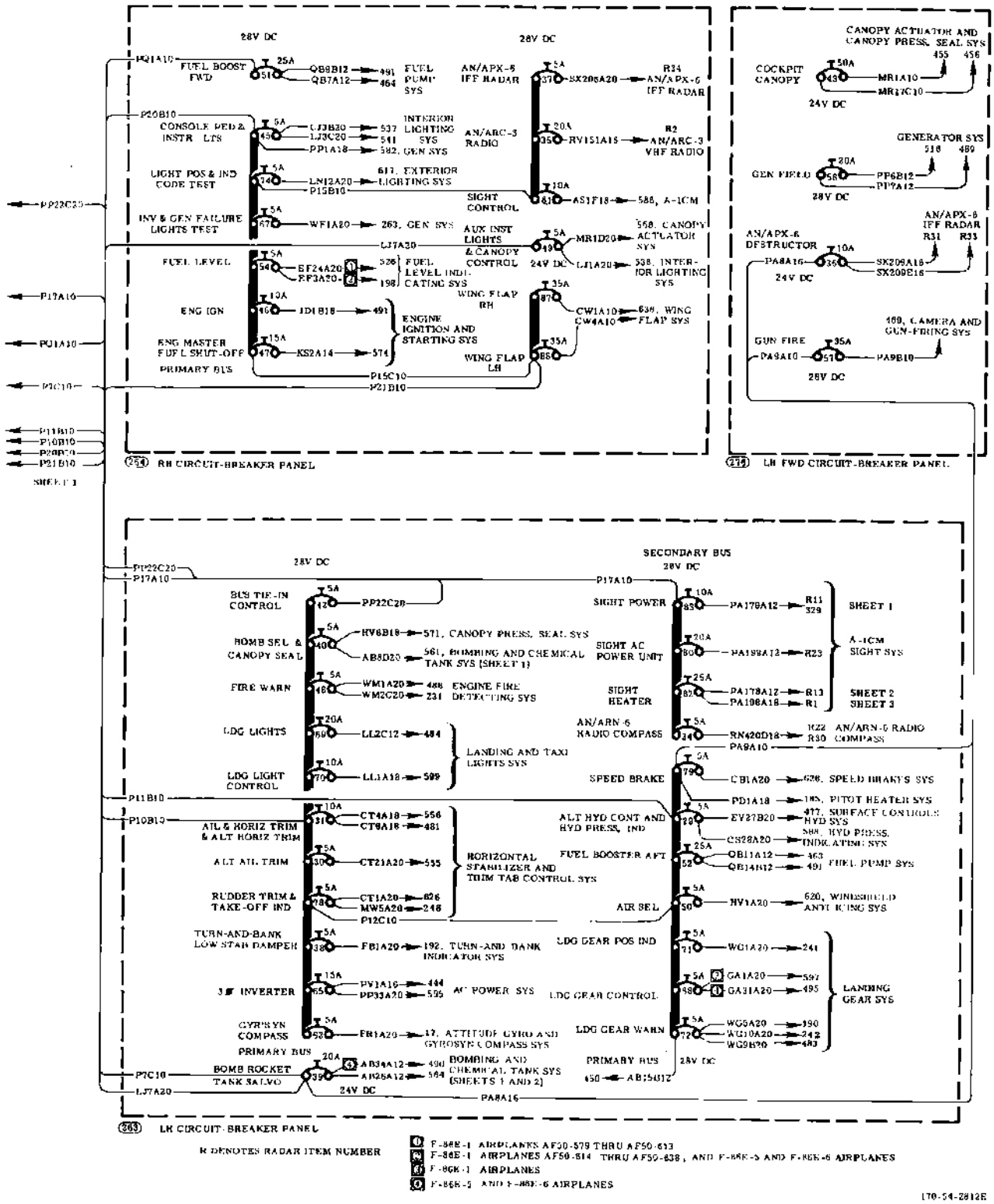
F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)



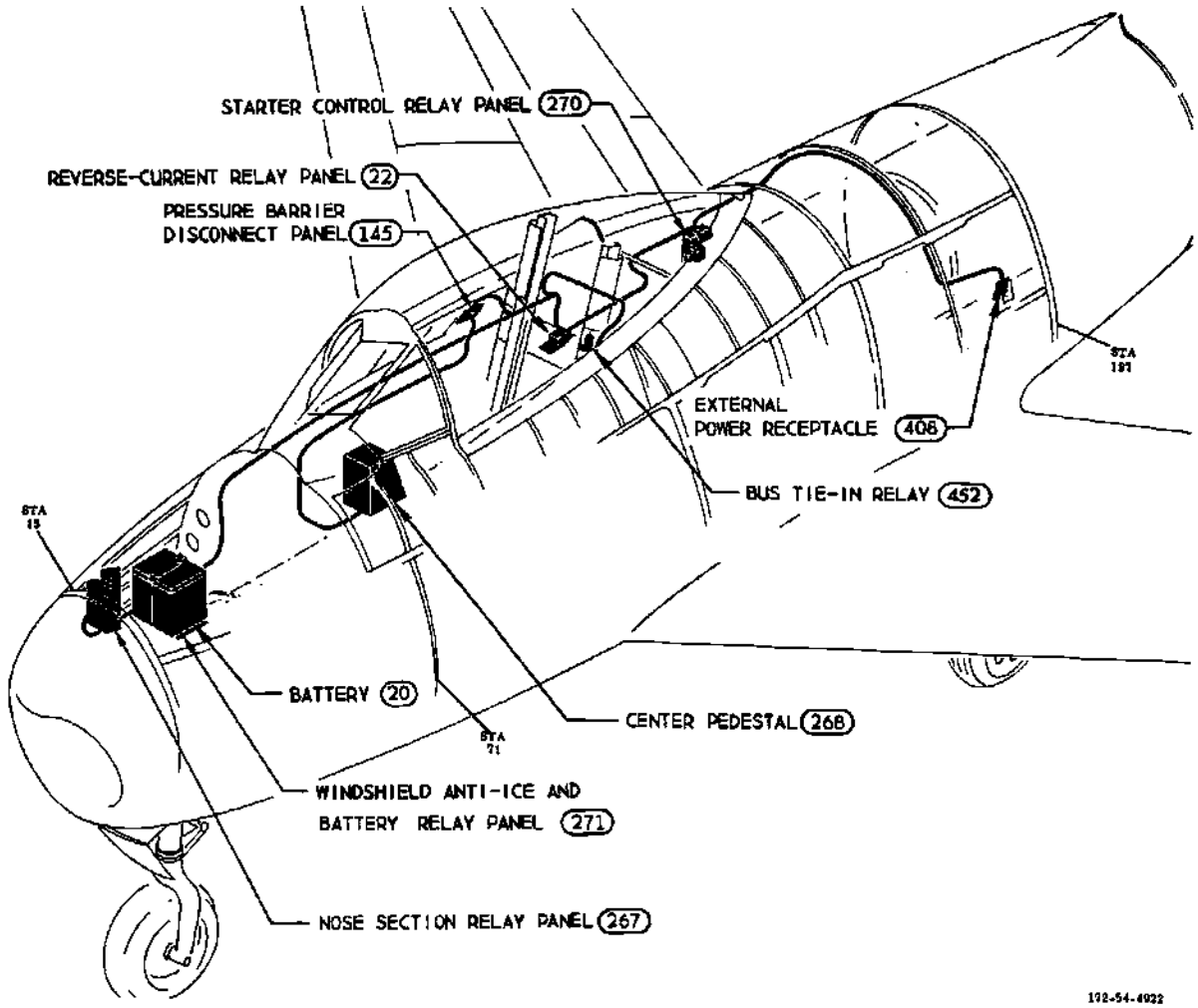
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
30	Circuit Breaker—Alternate Aileron Trim	AN3161P5
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
34	Circuit Breaker—AN/ARN-6 Radio	AN3161P5
35	Circuit Breaker—AN/ARC-3 Radio	AN3161P20
36	Circuit Breaker—AN/APX-6 Destructor	AN3161P10
37	Circuit Breaker—AN/APX-6 IFF	AN3161P5
38	Circuit Breaker—Turn-and-Bank Indicator	AN3161P5
39	Circuit Breaker Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
42	Circuit Breaker—Bus Tie-in	AN3161P5
43	Circuit Breaker—Cockpit Canopy	AN3161P50
45	Circuit Breaker—Console, Pedestal, and Instrument Light, and Stabilizer Rate Damper	AN3161P5
46	Circuit Breaker Engine Ignition	AN3161P10
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P15
48	Circuit Breaker—Fire-warning	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
50	Circuit Breaker—Air Selector	AN3161P5
51	Circuit Breaker—Forward Fuel Booster	AN3161P20
52	Circuit Breaker—Aft Fuel Booster	AN3161P25

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
54	Circuit Breaker—Fuel Level Indicating System	AN3161P5
56	Circuit Breaker—Generator Field	AN3161P20
57	Circuit Breaker—Gunfire	AN3161P35
62	Circuit Breaker—Gyrosyn Compass	AN3161P5
65	Circuit Breaker—Three-phase (Spare) Inverter	AN3161P15
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
68	Circuit Breaker—Landing Gear Control	AN3161P5
69	Circuit Breaker—Landing Light	AN3161P20
70	Circuit Breaker—Landing Light Control	AN3161P5
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
74	Circuit Breaker—Code Indicator Test and Position Light	AN3161P5
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
79	Circuit Breaker—Speed Brake	AN3161P5
80	Circuit Breaker—Sight A-C Power Unit	AN3161P20
81	Circuit Breaker—Sight Control	AN3161P10
82	Circuit Breaker—Sight Heater	AN3161P25
83	Circuit Breaker—Sight Power	AN3161P10
86	Circuit Breaker—Left Wing Flap	AN3161P35
87	Circuit Breaker—Right Wing Flap	AN3161P35
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53177 (NAA)

Figure 10-60. D-C Power Distribution System—F-86E-1,



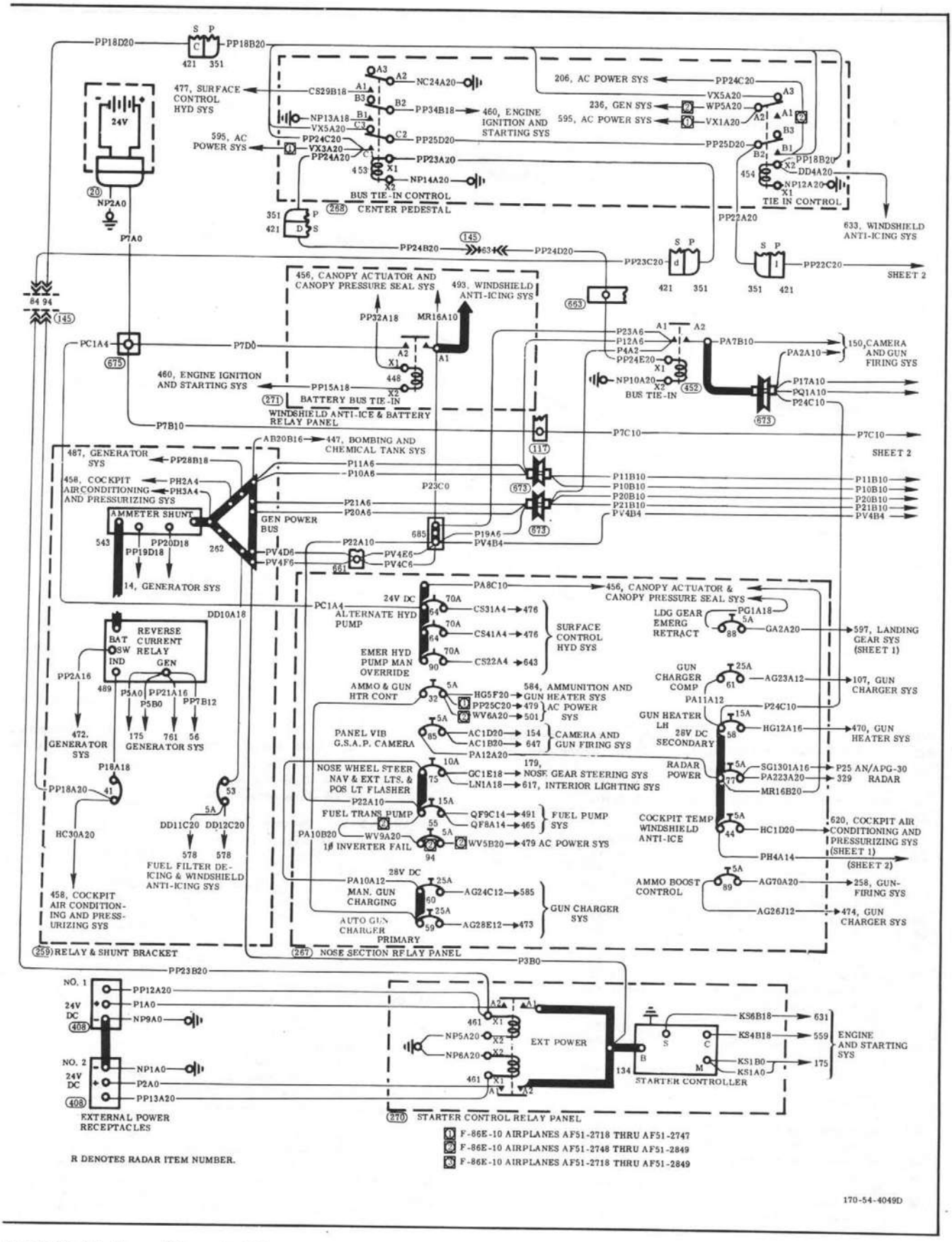
F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)



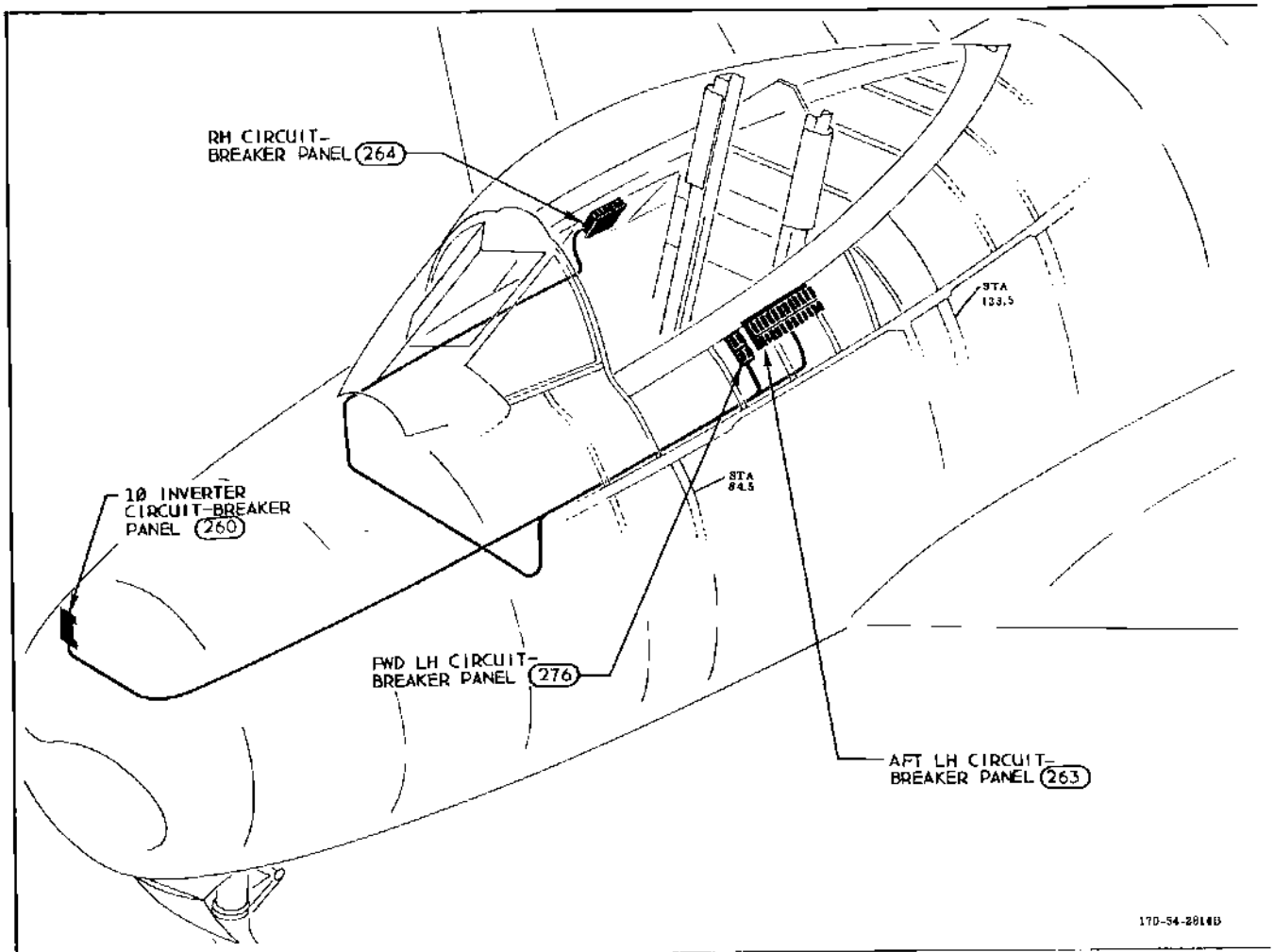
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
20	Battery—24-volt 34-ampere-hour	AN3150-2
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P5
41	Circuit Breaker—Bus Control Relay	PSA-5 (Klixon)
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-ice	AN3161P5
53	Circuit Breaker—Fuel Filter Deicing	PSA-15 (Klixon)
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
56	Circuit Breaker—Generator Field	AN3161P20
58	Circuit Breaker—Gun Heater	AN3161P35
59	Circuit Breaker—Automatic Gun Charger	AN3161P25
60	Circuit Breaker—Manual Gun Charger	AN3161P25
61	Circuit Breaker—Gun Charger Compressor	AN3161P25
64	Circuit Breaker—Alternate Hydraulic Pump	PDLM-70 (Klixon)
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
77	Circuit Breaker—Radar Power	AN3161P5
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
88	Circuit Breaker—Landing Gear Emergency Retraction	AN3161P10
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
90	Circuit Breaker—Hydraulic Pump Manual Emergency Override	PDLM-70 (Klixon)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
94	Circuit Breaker—One-phase Inverter Failure	AN3161P5
117	Connector—Pressure Block	140-54008 (NAA)
134	Controller—Starter	AN3391-1
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
262	Panel—Generator Power Bus	140-54035 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
270	Panel—Station 190 Relay	151-54079 (NAA)
271	Panel—Windshield Anti-icing and Battery Relay	170-54085 (NAA)
351	Plug—Pedestal Disconnect	AN3106A32-7P
408	Receptacle—External Power	AN2552-A3
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
448	Relay—Battery	AN3370-1
452	Relay—Bus Tie-in	AN3370-1
453	Relay—Bus Tie-in Control	AN3316-1
454	Relay—Bus Tie-in Control	237EAU (Leach)
489	Relay—Reverse-current	AN3025-2
543	Shunt—Ammeter	120814 (Weston)
661	Terminal Block—Left Gun Bay	AN3436-6-3
663	Terminal Block—Right Gun Bay	AN3436-2-10
673	Terminal Block—Pressure	151-54037 (NAA)
675	Terminal Block—Battery	NAS45-416-1
685	Terminal Block—Right Primary Bus	NAS45-416-3

Figure 10-61. D-C Power Distribution System—



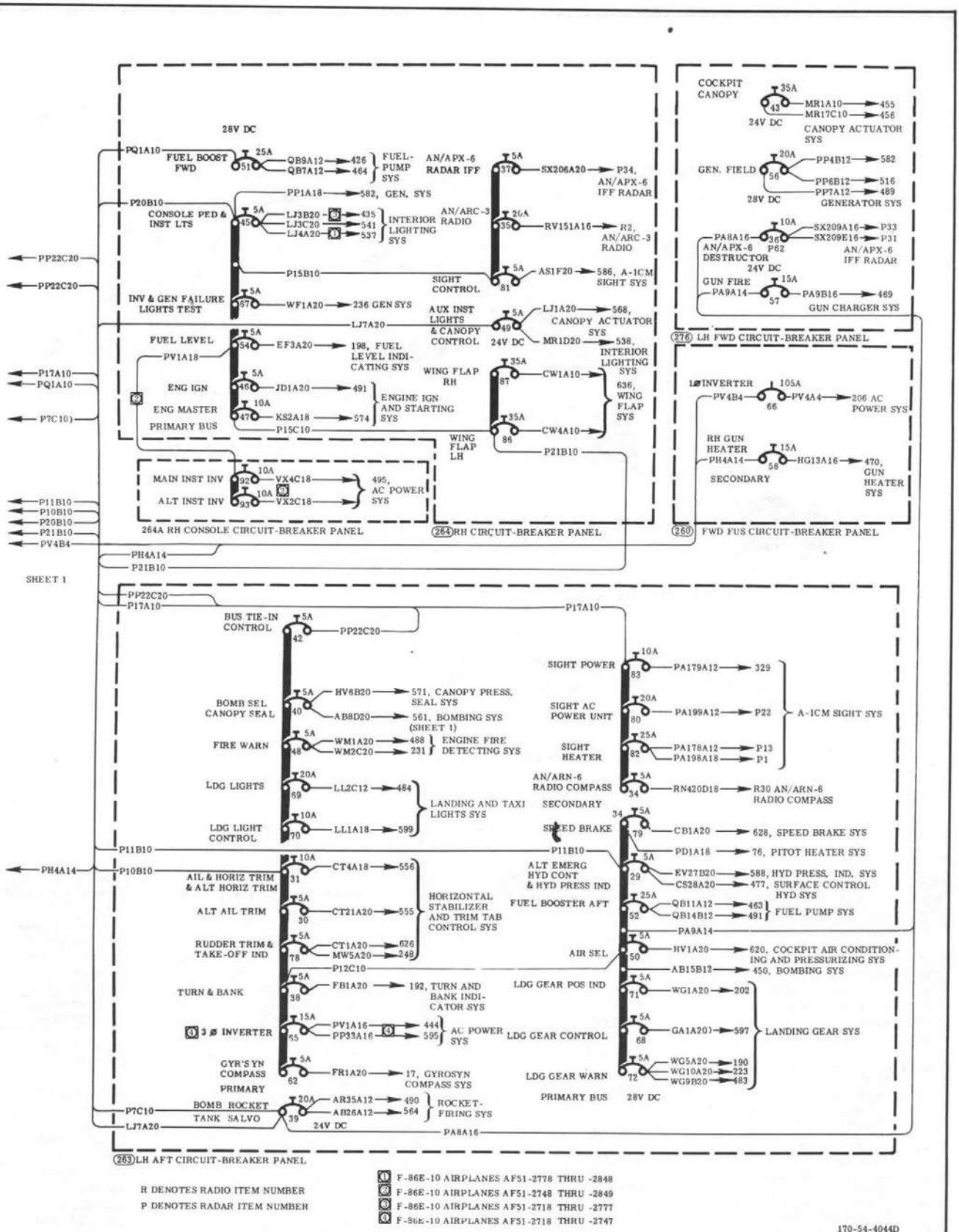
F-86E-10 Airplanes (Sheet 1 of 2)



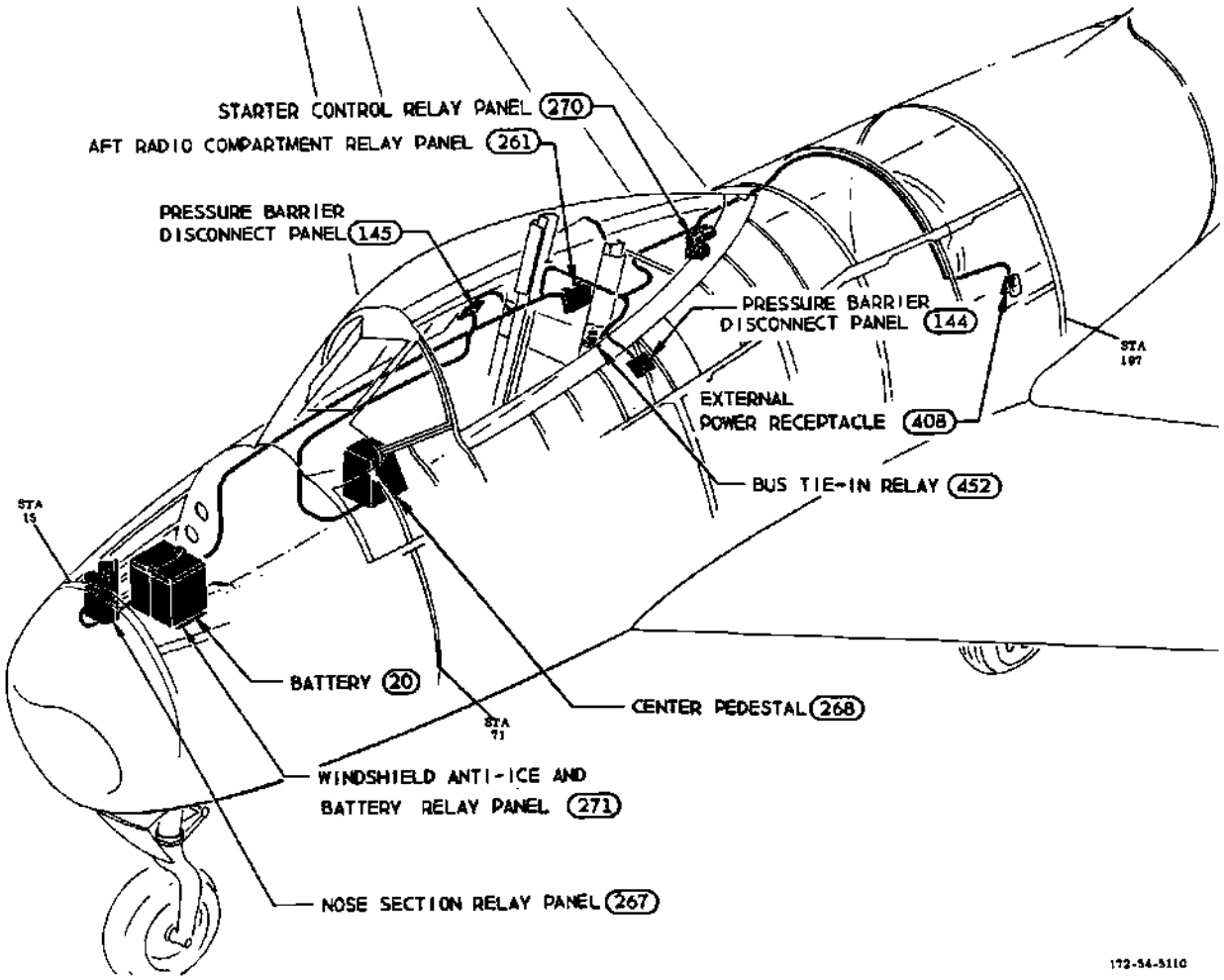
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
30	Circuit Breaker—Alternate Aileron Trim	AN3161P5
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
34	Circuit Breaker—AN/ARN-6 Radio	AN3161P5
35	Circuit Breaker—AN/ARC-3 Radio	AN3161P20
36	Circuit Breaker—AN/APX-6 Destructor	AN3161P10
37	Circuit Breaker—AN/APX-6 IFF	AN3161P5
38	Circuit Breaker—Turn-and-Bank Indicator	AN3161P5
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
42	Circuit Breaker—Bus Tie-in	AN3161P5
43	Circuit Breaker—Cockpit Canopy	AN3161P35
45	Circuit Breaker—Console, Pedestal, and Instrument Light and Stabilizer Rate Damper	AN3161P5
46	Circuit Breaker—Engine Ignition	AN3161P5
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P10
48	Circuit Breaker—Fire-warning	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
50	Circuit Breaker—Air Selector	AN3161P5
51	Circuit Breaker—Forward Fuel Booster	AN3161P25
52	Circuit Breaker—Aft Fuel Booster	AN3161P25
54	Circuit Breaker—Fuel Level Indicating System	AN3161P5
56	Circuit Breaker—Generator Field	AN3161P20
57	Circuit Breaker—Gunfire	AN3161P15

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
58	Circuit Breaker—Gun Heater	237EAU (Leach)
62	Circuit Breaker—Gyrosyn Compass	AN3161P5
65	Circuit Breaker—Three-phase (Spare) Inverter	AN3161P15
66	Circuit Breaker—One-phase Inverter	PDLM-105 (Klixon)
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
68	Circuit Breaker—Landing Gear Control	AN3161P5
69	Circuit Breaker—Landing Light	AN3161P20
70	Circuit Breaker—Landing Light Control	AN3161P10
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
79	Circuit Breaker—Speed Brake	AN3161P5
80	Circuit Breaker—Sight A-C Power Unit	AN3161P20
81	Circuit Breaker—Sight Control	AN3161P5
82	Circuit Breaker—Sight Heater	AN3161P25
83	Circuit Breaker—Sight Power	AN3161P10
86	Circuit Breaker—Left Wing Flap	AN3161P35
87	Circuit Breaker—Right Wing Flap	AN3161P35
92	Circuit Breaker—Main Instrument Inverter	AN3161P10
93	Circuit Breaker—Alternate Instrument Inverter	AN3161P10
95	Circuit Breaker—AN/ARC-33 Radio	AN3161P25
260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
264A	Panel—Right Console Circuit-breaker	172-54021 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)

Figure 10-61. D-C Power Distribution System—



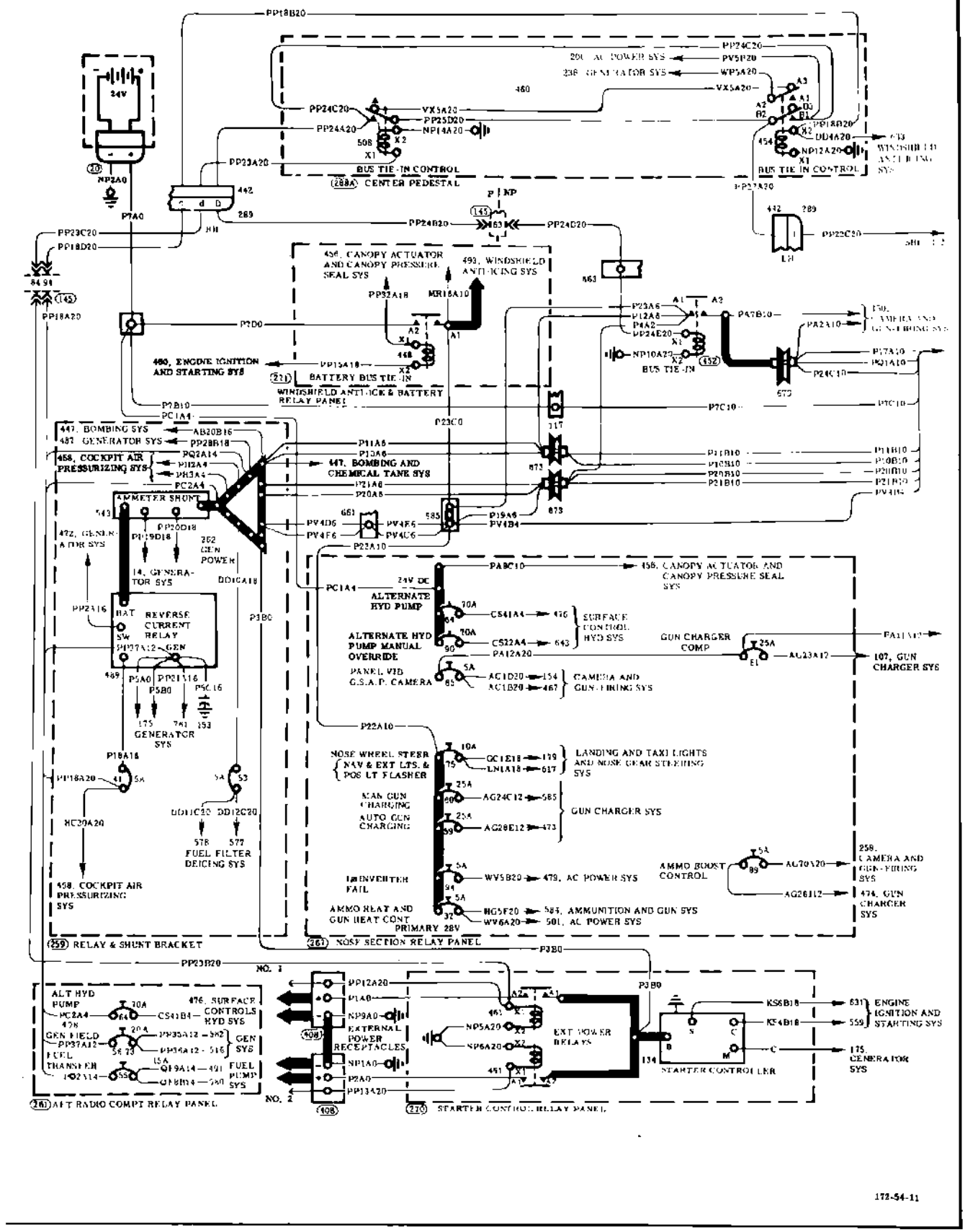
F-86E-10 Airplanes (Sheet 2 of 2)



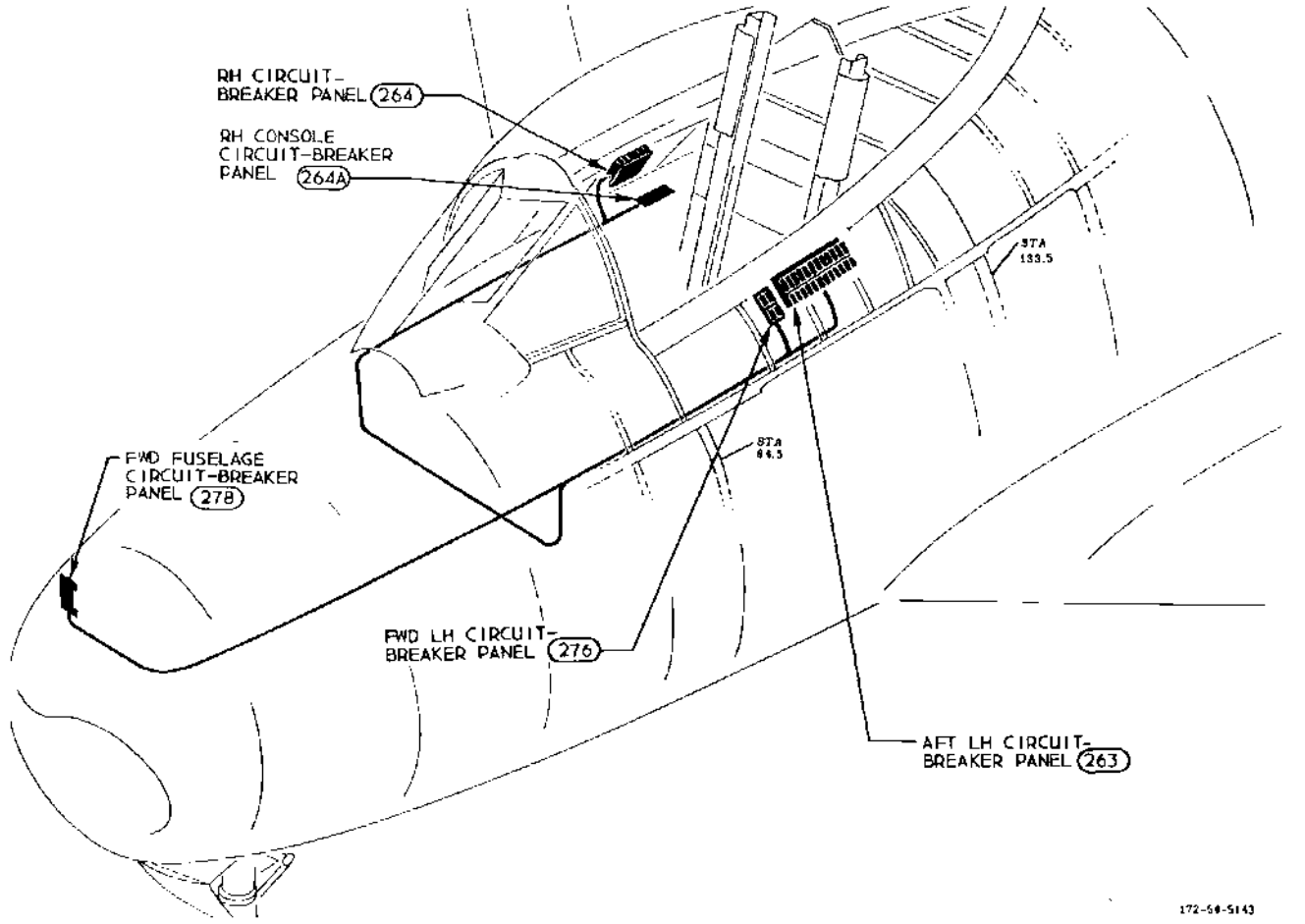
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
20	Battery—24-volt 34-ampere-hour	AN3150-2
32	Circuit Breaker—Ammunition Heat and Gun Heat Control	AN3161P5
41	Circuit Breaker—Bus Control Relay	PSA-5 (Klixon)
53	Circuit Breaker—Fuel Filter Deicing	PSA-5 (Klixon)
55	Circuit Breaker—Fuel Transfer Pump	AN3161P15
59	Circuit Breaker—Automatic Gun Charger	AN3161P25
60	Circuit Breaker—Manual Gun Charger	AN3161P25
61	Circuit Breaker—Gun Charger Compressor	AN3161P25
64	Circuit Breaker—Alternate Hydraulic Pump	PDLM-70 (Klixon)
73	Circuit Breaker—Generator Field	AN3161P20
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
90	Circuit Breaker—Hydraulic Pump Manual Emergency Override	PDLM-70 (Klixon)
94	Circuit Breaker—One-phase Inverter Failure	AN3161P5
117	Connector—Pressure Block	140-54008 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
134	Controller—Starter	AN3391-1
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
270	Panel—Station 190 Relay	172-54079 (NAA)
271	Panel—Windshield Anti-icing and Battery Relay	170-54085 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
408	Receptacle—External Power	AN2552A3
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
452	Relay—Bus Tie-in	AN3370-1
461	Relay—External Power	AN3380-1
489	Relay—Reverse-current	AN3025-2 (GFP)
508	Relay—Bus Tie-in Control	237EAU (Leach)
543	Shunt—Ammeter	120B14 (Weston)
661	Terminal Block—Left Gun Bay	NAS45-416-2
663	Terminal Block—Right Gun Bay	AN3436 2-10
673	Terminal Block—Pressure	151-54037 (NAA)
675	Terminal Block—Battery	NAS45-416-1
685	Terminal Block—Right Primary Bus	NAS45-416-3

Figure 10-62. D-C Power Distribution

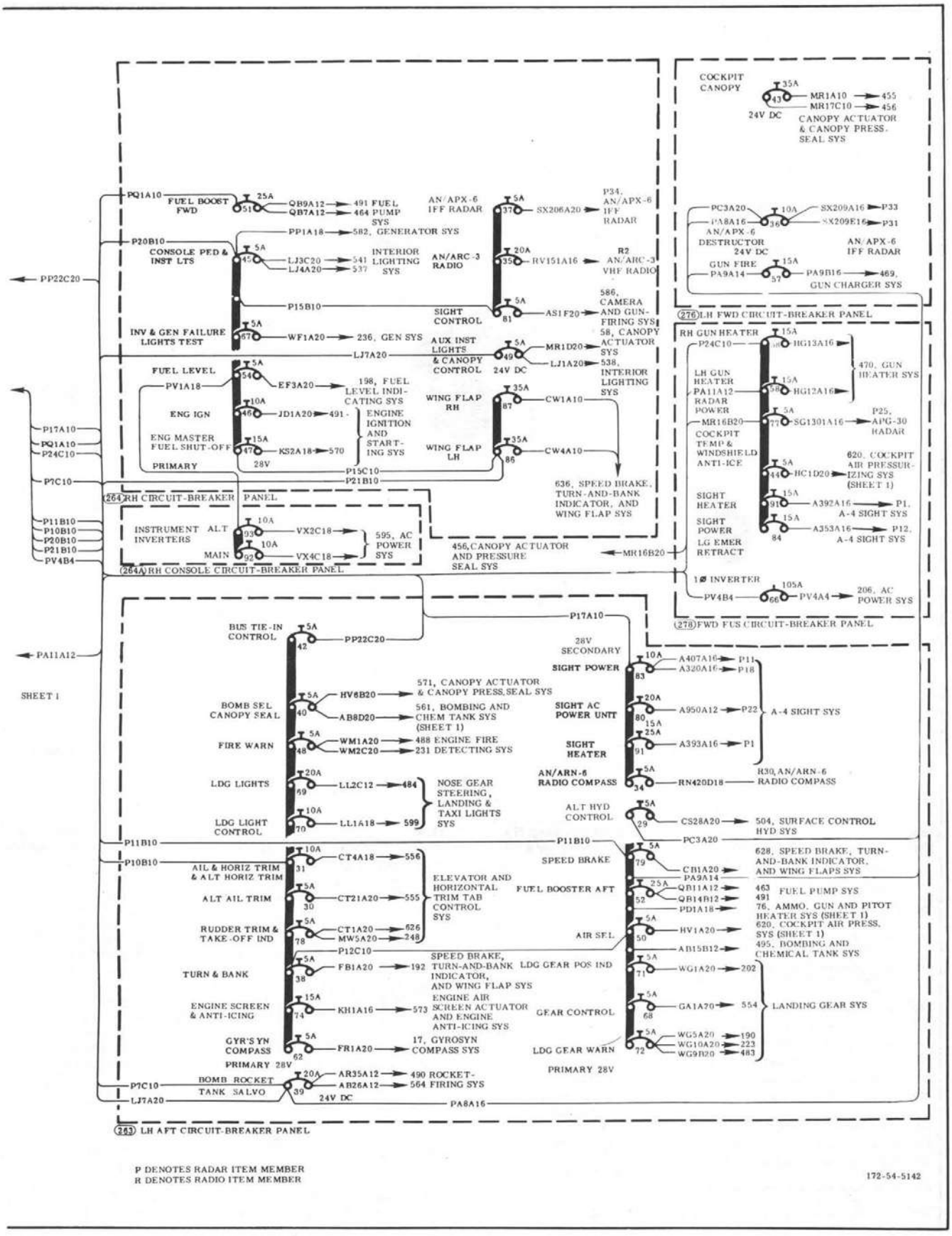


System—F-86E-15 Airplanes (Sheet 1 of 2)

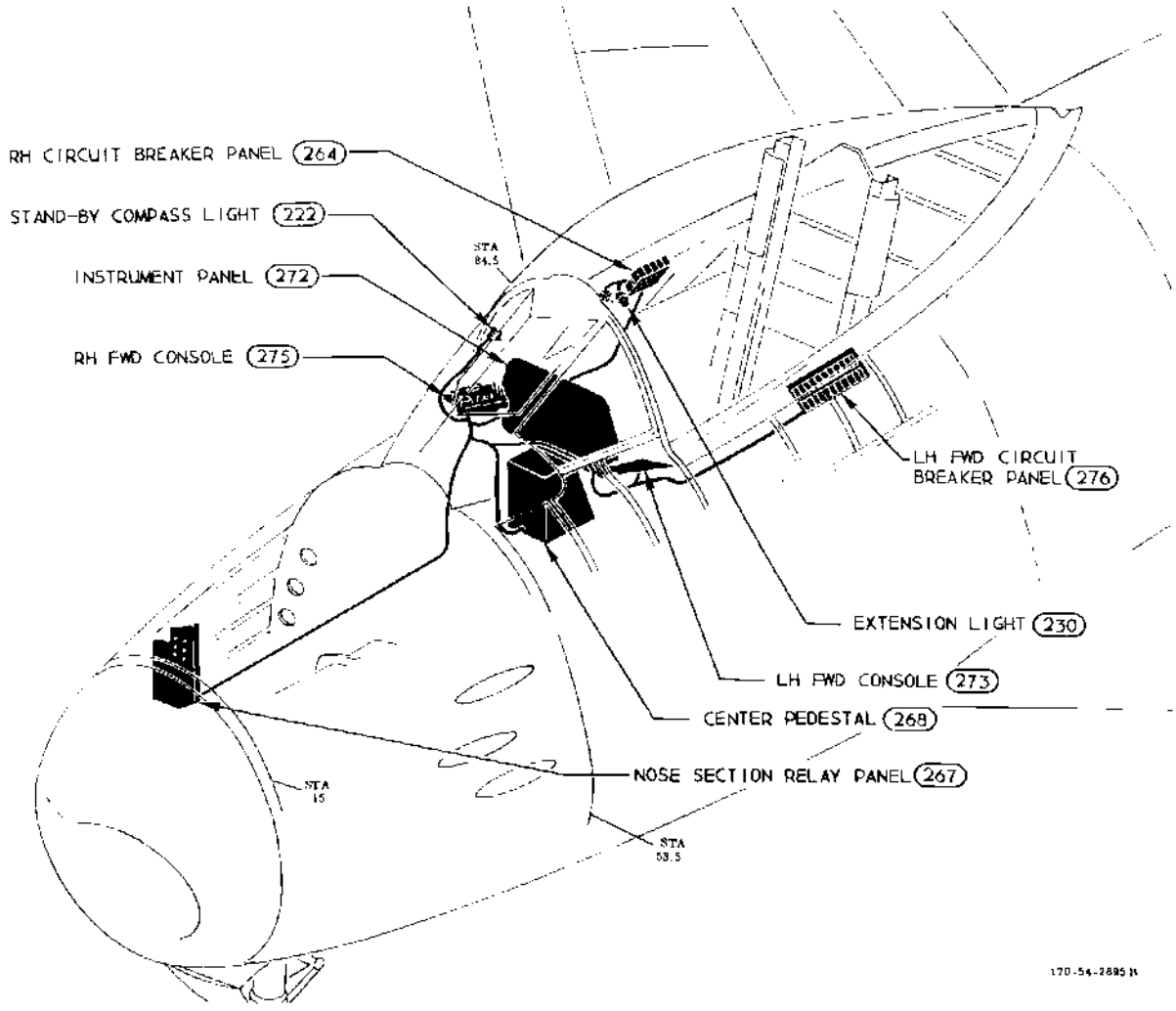


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
29	Circuit Breaker—Alternate Hydraulic Control	AN3161P5
30	Circuit Breaker—Alternate Aileron Trim	AN3161P5
31	Circuit Breaker—Aileron and Horizontal Stabilizer Trim and Alternate Horizontal Stabilizer Trim	AN3161P10
34	Circuit Breaker—AN/ARN-6 Radio	AN3161P5
35	Circuit Breaker—AN/ARC-3 Radio	AN3161P20
36	Circuit Breaker—AN/APX-6 Destructor	AN3161P10
37	Circuit Breaker—AN/APX-6 IFF	AN3161P5
38	Circuit Breaker—Turn-and-Bank Indicator	AN3161P5
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
42	Circuit Breaker—Bus Tie-in	AN3161P5
43	Circuit Breaker—Cockpit Canopy	AN3161P35
44	Circuit Breaker—Cockpit Temperature and Windshield Anti-icing	AN3161P5
45	Circuit Breaker—Console, Pedestal, and Instrument Light, and Stabilizer Rate Damper	AN3161P5
46	Circuit Breaker—Engine Ignition	AN3161P10
47	Circuit Breaker—Engine Master and Fuel Shutoff	AN3161P15
48	Circuit Breaker—Fire-warning	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
50	Circuit Breaker—Air Selector	AN3161P5
51	Circuit Breaker—Forward Fuel Booster	AN3161P25
52	Circuit Breaker—Aft Fuel Booster	AN3161P25
54	Circuit Breaker—Fuel Level Indicating System	AN3161P5
57	Circuit Breaker—Gunfire	AN3161P15
58	Circuit Breaker—Gun Heater	AN3161P15
62	Circuit Breaker—Gyrosyn Compass	AN3161P5
66	Circuit Breaker—One-phase Inverter	PDLM-105 (Klixon)
67	Circuit Breaker—Inverter and Generator Failure Test Light	AN3161P5
68	Circuit Breaker—Landing Gear Control	AN3161P5
69	Circuit Breaker—Landing Light	AN3161P20
70	Circuit Breaker—Landing Light Control	AN3161P10
71	Circuit Breaker—Landing Gear Position Indicator	AN3161P5
72	Circuit Breaker—Landing Gear Warning	AN3161P5
74	Circuit Breaker—Engine Anti-icing and Screen	AN3161P15
77	Circuit Breaker—Radar Power	AN3161P5
78	Circuit Breaker—Rudder Trim and Take-off Indicator	AN3161P5
79	Circuit Breaker—Speed Brake	AN3161P5
80	Circuit Breaker—Sight A-C Power Unit	AN3161P20
81	Circuit Breaker—Sight Control	AN3161P5
83	Circuit Breaker—Sight Power	AN3161P10
84	Circuit Breaker—Sight Power	AN3161P15
86	Circuit Breaker—Left Wing Flap	AN3161P35
87	Circuit Breaker—Right Wing Flap	AN3161P35
91	Circuit Breaker—Sight Heater	AN3161P15
92	Circuit Breaker—Instrument Main Inverter	AN3161P10
93	Circuit Breaker—Instrument Alternate Inverter	AN3161P10
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
264A	Panel—Right Console Circuit-breaker	172-54021 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)

Figure 10-62. D-C Power Distribution



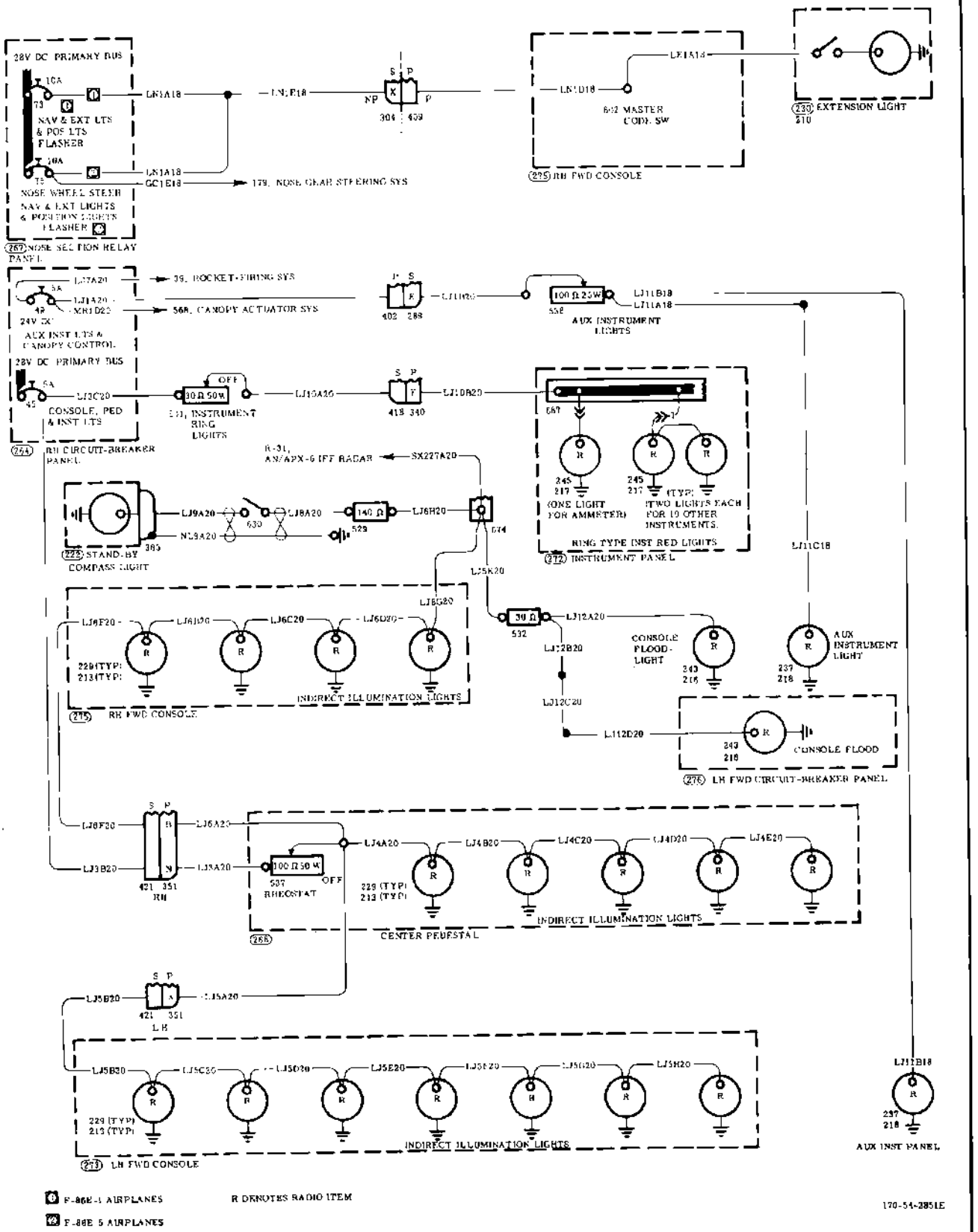
System—F-86E-15 Airplanes (Sheet 2 of 2)



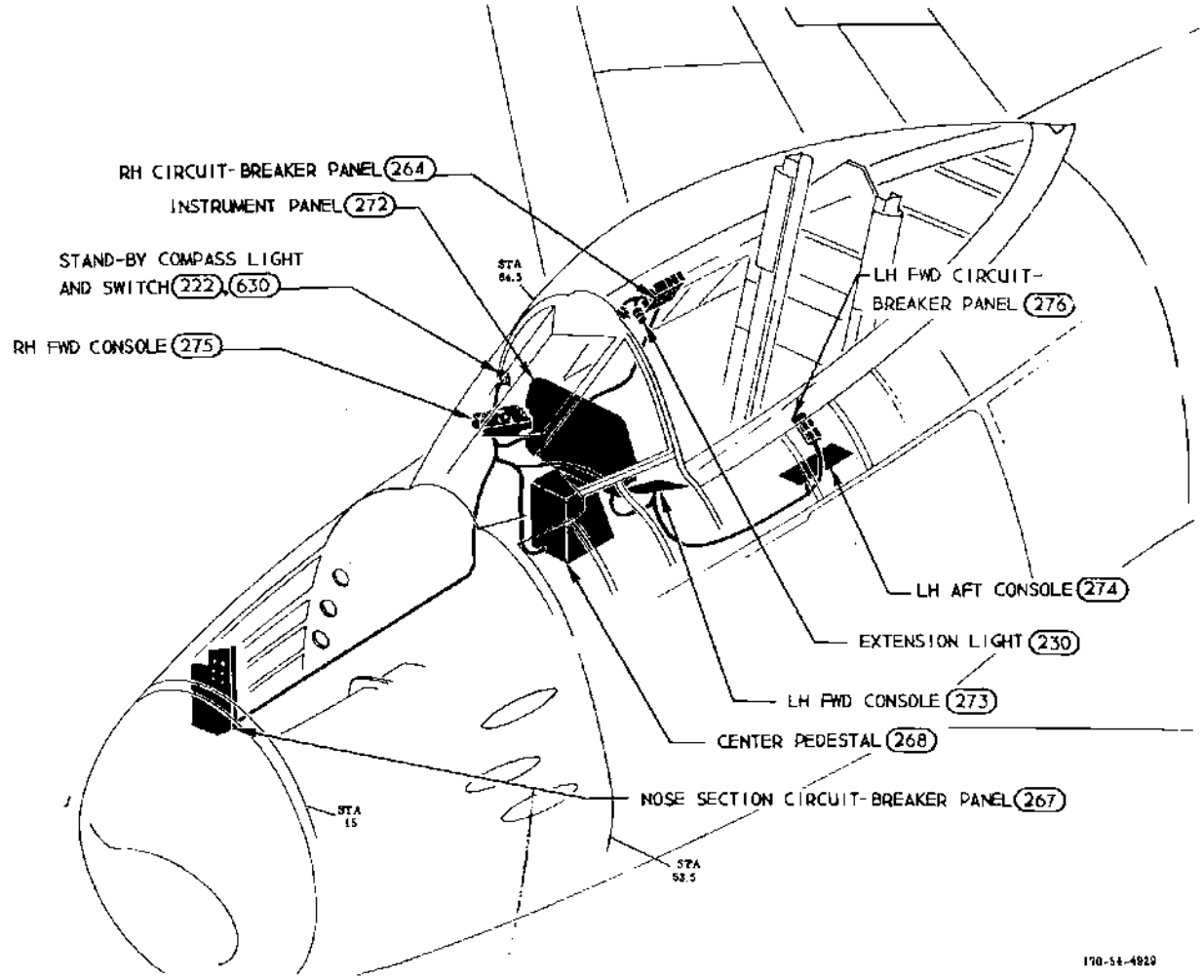
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
45	Circuit Breaker—Console, Pedestal, and Instrument Light, and Stabilizer Rate Damper	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
73	Circuit Breaker—Navigation and Exterior Light and Position Light Flasher	AN3161P10
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
210	Lamp—Cockpit Extension	AN3142-302
213	Lamp—Indirect Lighting Panel	AN3140-327
216	Lamp—Console Floodlight	AN3121R313
217	Lamp—Instrument Panel Ring Light	AN3140-327
218	Lamp—Auxiliary Instrument Floodlight	AN3131R303
222	Lamp—Stand-by Compass	AN3136-323 (Furnished with Compass)
229	Light Assembly—Pedestal	1617-C2 (Wemac)
230	Light Assembly—Cockpit Utility	140-54070 (NAA)
237	Light Assembly—Auxiliary Instrument Floodlight	A4255A (Grimes)
243	Light Assembly—Left-hand and Right-hand Console Floodlight	AN3034-1
245	Light Assembly—Instrument Panel Ring	170-51005 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
273	Panel—Left Forward Console	161-54028-10 (NAA)
275	Panel—Right Forward Console	161-54005-10 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
289	Plug—Cockpit Center Disconnect	AN3106B24-5S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
351	Plug—Pedestal Disconnect	AN3106A32-7P
365	Plug—Stand-by Compass Light	270-8 (Cannon)
402	Receptacle—Cockpit Center Disconnect	AN3106B24-5P
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
529	Resistor—Stand-by Compass Light	RW16J141
532	Resistor—Console Floodlight	B10F30 (Clarostat)
537	Rheostat—Console Light	AN3155-50-100
541	Rheostat—Instrument Panel Ring Light	31873A (Ohmite)
602	Switch—Master Code	AN3027-2
630	Switch—Stand-by Compass Light	AN3021-2
687	Terminal Block—Instrument Ring Light	AN3436-2-6

Figure 10-63. Interior Lighting System—



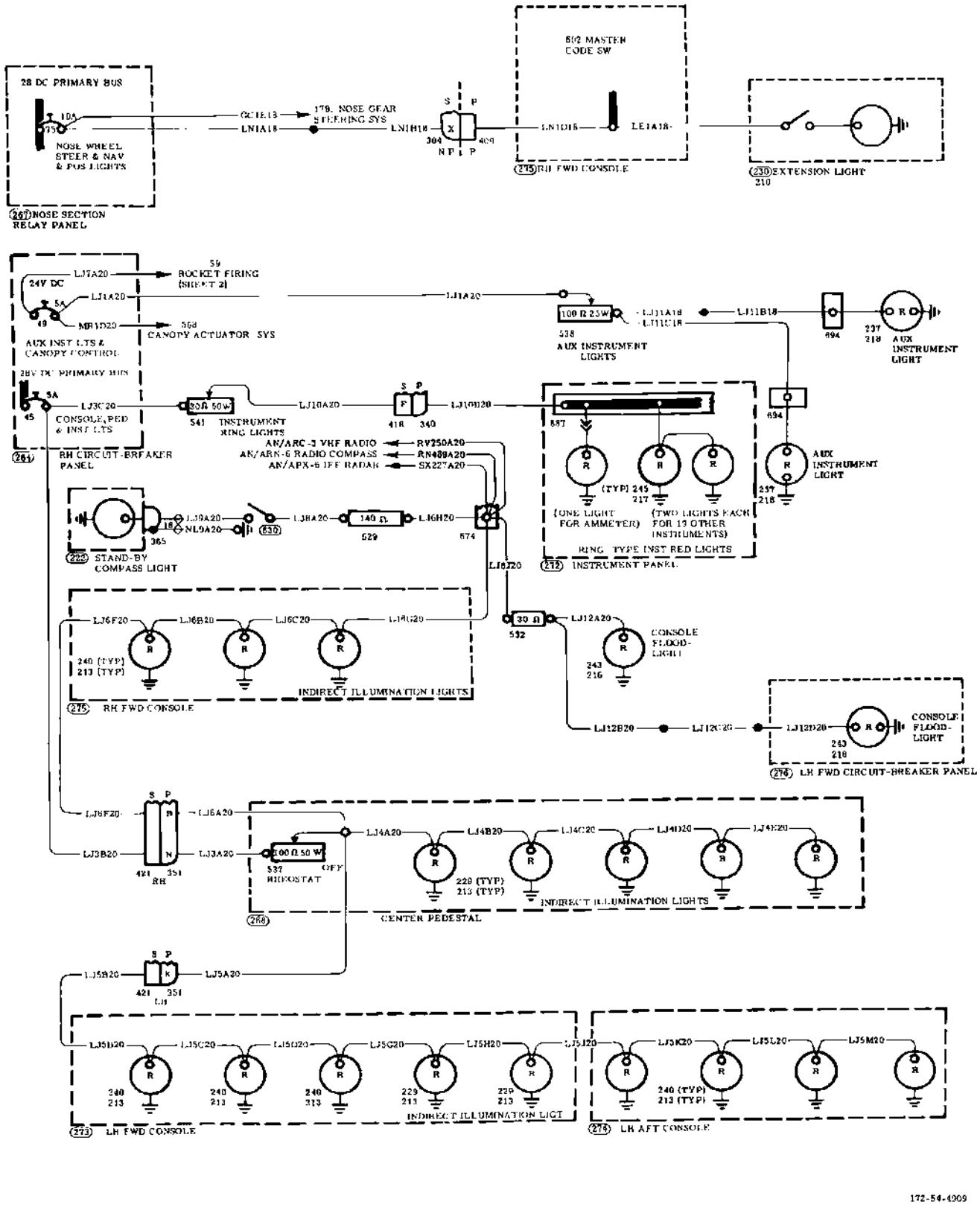
F-86E-1 and F-86E-5 Airplanes

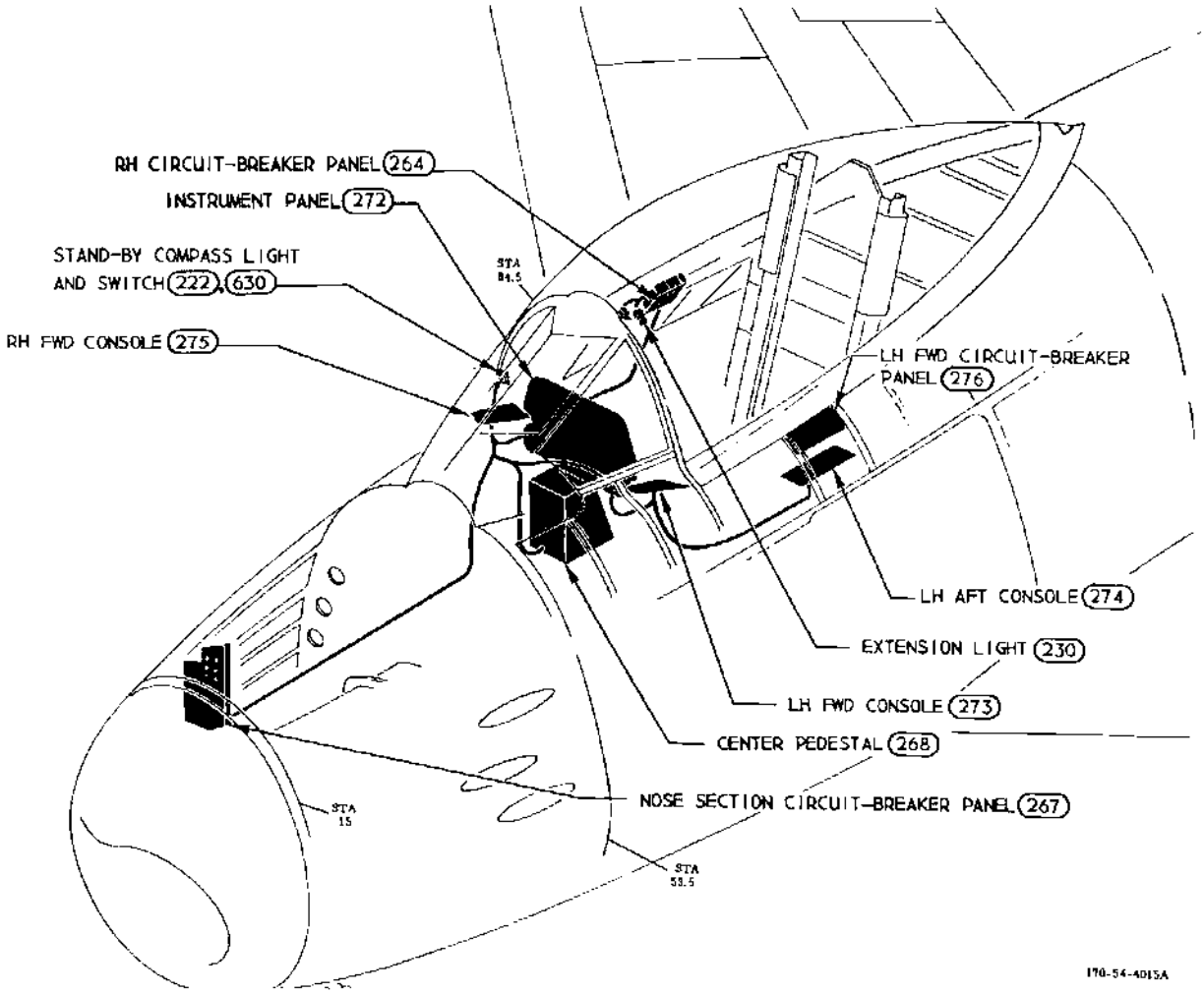


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
45	Circuit Breaker—Console, Pedestal, and Instrument Light, and Stabilizer Rate Damper	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
210	Lamp—Cockpit Utility Light	AN3121-313
213	Lamp—Indirect Lighting Panel	AN3140-327
216	Lamp—Console Floodlight	AN3121R313
217	Lamp—Instrument Panel Ring Light	AN3140-327
218	Lamp—Auxiliary Instrument Floodlight	AN3131R303
222	Lamp—Stand-by Compass	AN3136-323 (Furnished with Compass)
229	Light Assembly—Pedestal	1617C-2 (Wemac)
230	Light Assembly—Cockpit Utility	94-322940 140-54070 (NAA)
237	Light Assembly—Auxiliary Instrument Floodlight	A4255A5 (Grimes)
240	Light Assembly—Indirect Panel Illumination	AN3502-2A
243	Light Assembly—Left-hand and Right-hand Console Floodlight	AN3034-1
245	Light Assembly—Instrument Panel Ring	170-51005 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
272	Panel—Instrument	170-51005 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
351	Plug—Pedestal Disconnect	AN3106A32-7P
365	Plug—Stand-by Compass Light	270-B (Cannon)
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
529	Resistor—Stand-by Compass Light	RW16J141
532	Resistor—Console Floodlight	B10F30 (Clarostat)
537	Rheostat—Console Light	AN3155-50-100
538	Rheostat—Instrument Panel Floodlight	AN3155-25-100
541	Rheostat—Instrument Panel Ring Light	31873A (Ohmite)
617	Switch—Position Light Control	AN3226-1
630	Switch—Stand-by Compass Light	AN3021-2
674	Terminal Block—Radio	
687	Terminal Block—Instrument Ring Light	AN3436-2-6
689	Terminal Block—Cockpit Utility Light	AN3436-2-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
692	Terminal Block—Speed Brake Well	AN3436-2-2

Figure 10-64. Interior Lighting

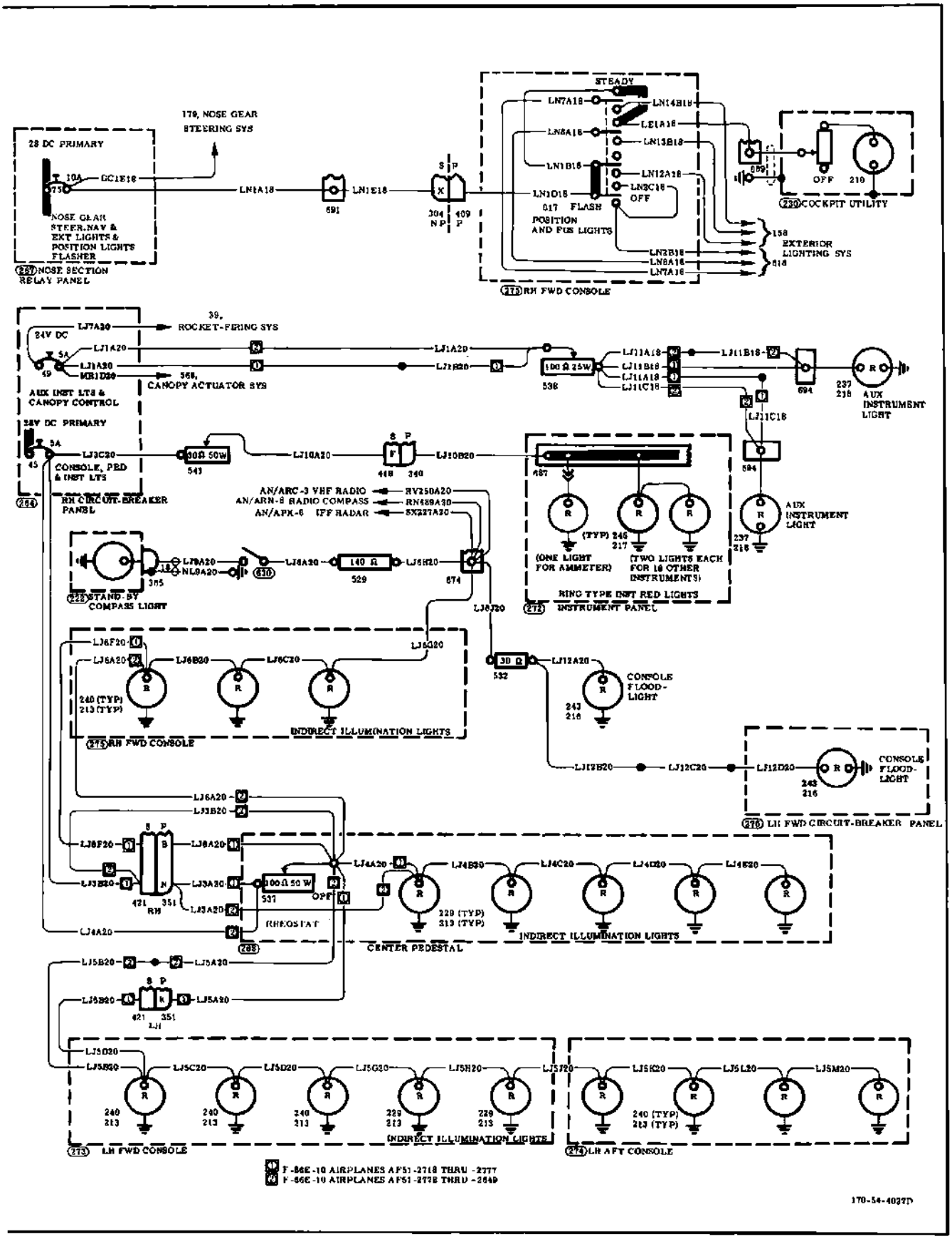

28 DC PRIMARY BUS
10A
NOSE WHEEL STEER & NAV & POS LIGHTS
267 NOSE SECTION RELAY PANEL
179, NOSE GEAR STEERING SYS
602 MASTER CODE SW
215 RH FWD CONSOLE
230 EXTENSION LIGHT
210
24V DC
5A
AUX INST LTS & CANOPY CONTROL
261 RH CIRCUIT-BREAKER PANEL
59 ROCKET FIRING (SHEET 2)
56d CANOPY ACTUATOR SYS
100 R 25W
538 AUX INSTRUMENT LIGHTS
AUX INSTRUMENT LIGHT
CONSOLE, PED & INST LTS
30 Ω 50W
541 INSTRUMENT RING LIGHTS
AN/ARC-3 VHF RADIO
AN/ARN-6 RADIO COMPASS
AN/APX-6 IFF RADAR
RING TYPE INST RED LIGHTS
212 INSTRUMENT PANEL
(ONE LIGHT FOR AMMETER)
(TWO LIGHTS EACH FOR 13 OTHER INSTRUMENTS)
140 Ω
529
222 STAND-BY COMPASS LIGHT
INDIRECT ILLUMINATION LIGHTS
30 Ω
532
CONSOLE FLOOD-LIGHT
274 LH FWD CIRCUIT-BREAKER PANEL
100 Ω 50 W
537 RHEOSTAT
OFF
268 CENTER PEDESTAL
273 LH FWD CONSOLE
274 LH AFT CONSOLE
172-54-4909

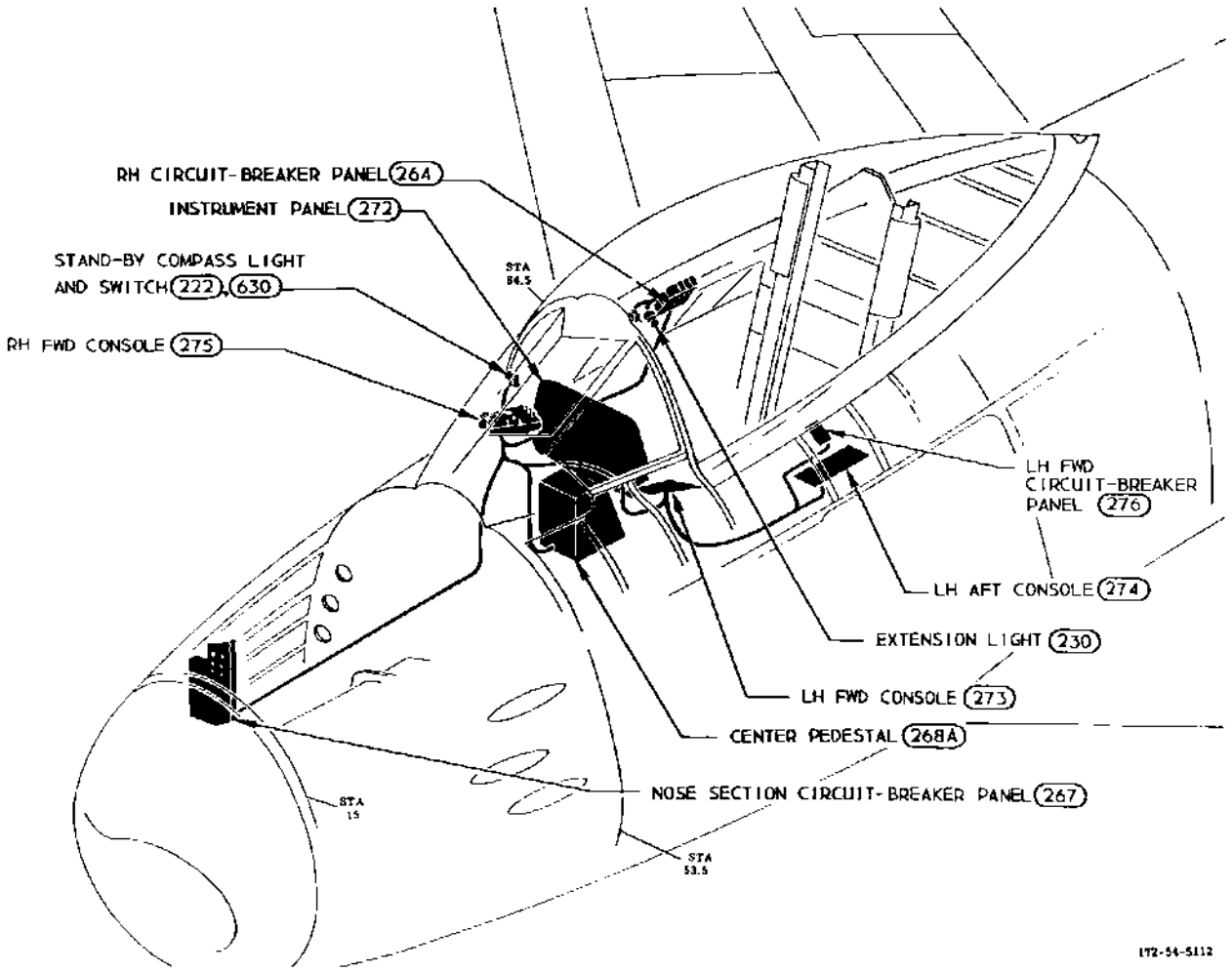


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
45	Circuit Breaker—Console, Pedestal, and Instrument Light, and Stabilizer Rate Damper	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
210	Lamp—Cockpit Utility Light	AN3121-313
213	Lamp—Indirect Lighting Panel	GE-327
216	Lamp—Console Floodlight	AN3121R313
217	Lamp—Instrument Panel Ring Light	AN3140-327
218	Lamp—Auxiliary Instrument Floodlight	AN3131R303
222	Lamp—Stand by Compass	AN3136-323 (Furnished With Compass)
229	Light Assembly—Pedestal	1617C 2 (Wemac)
230	Light Assembly—Cockpit Utility	94-32294D, Type C-4A
237	Light Assembly—Auxiliary Instrument Floodlight	A4255A5 (Grimes)
240	Light Assembly—Indirect Panel Illumination	AN3502-2A
243	Light Assembly—Left-hand and Right-hand Console Floodlight	AN3034-1
245	Light Assembly—Instrument Panel Ring	170-51005 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
273	Panel—Left Forward Console	172-54028 NAA)
274	Panel—Left Aft Console	172-54065 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
351	Plug—Pedestal Disconnect	AN3106A32-7P
365	Plug—Stand by Compass Light	270-8 (Cannon)
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
529	Resistor—Stand-by Compass Light	RW16J141
532	Resistor—Console Floodlight	B10F30 (Clarostat)
537	Rheostat—Console Light	AN3153 50-100
538	Rheostat—Instrument Panel Floodlight	AN3155-25-100
541	Rheostat—Instrument Panel Ring Light	31873A (Ohmite)
617	Switch—Position Light Control	AN3227-1
630	Switch—Stand by Compass Light	AN3021-2
674	Terminal Block—Radio	
687	Terminal Block—Instrument Ring Light	AN3436-2-6
689	Terminal Block—Cockpit Utility Light	AN3436-2-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
694	Terminal Block—Auxiliary Instrument Light	AN3436-2-1

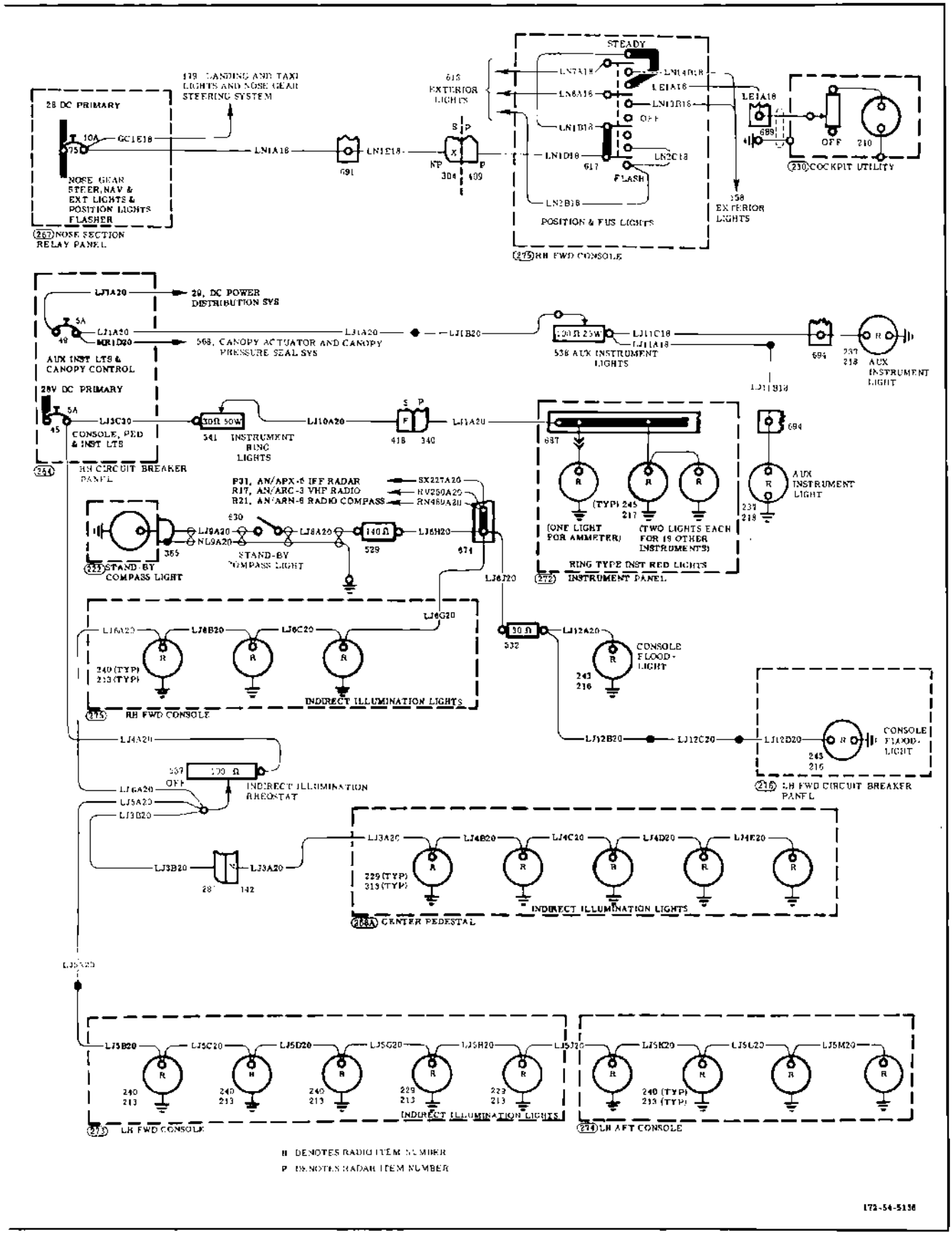
Figure 10-65. Interior Lighting

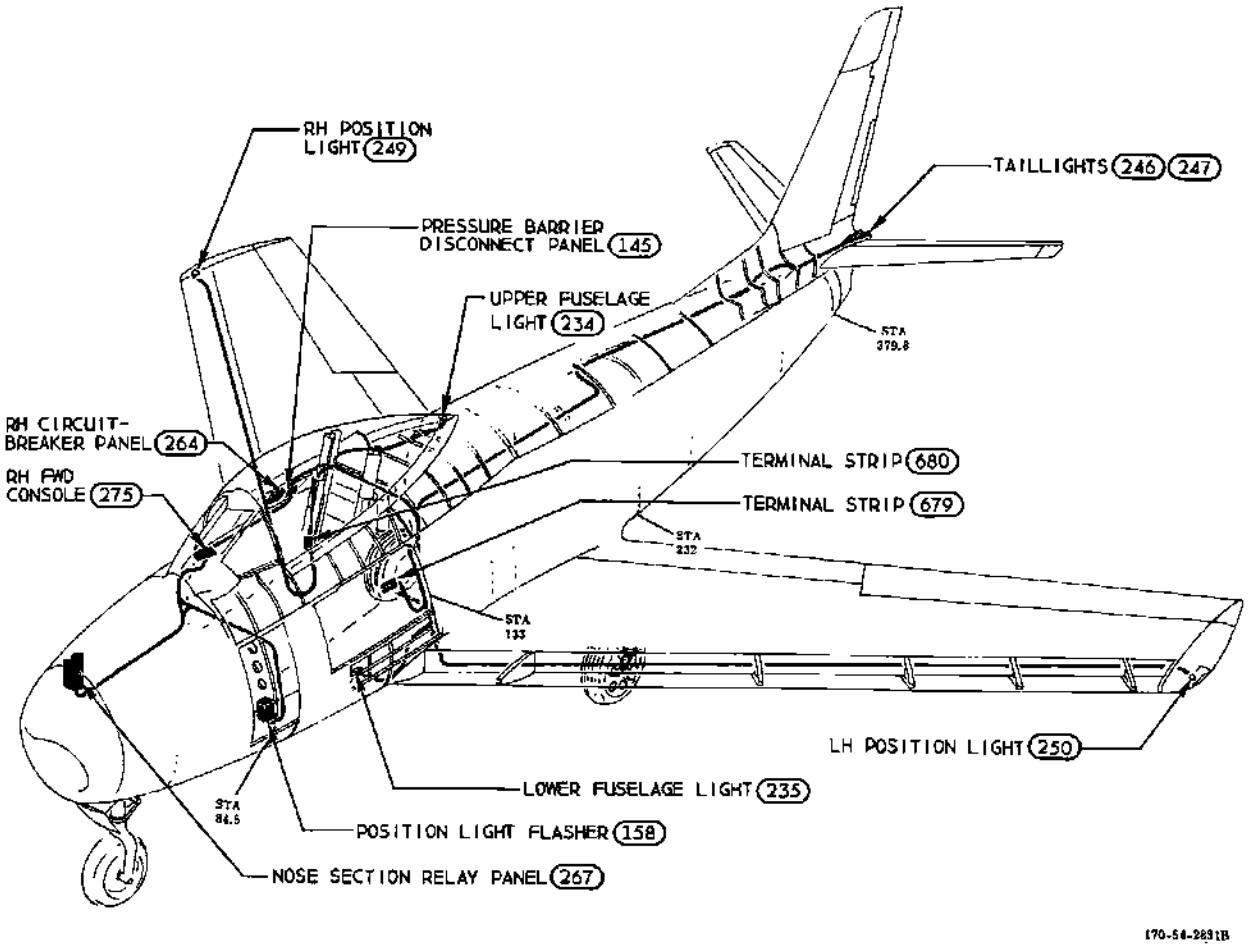

28 DC PRIMARY
10A
GC1E18
NOSE GEAR STEER.NAV & EXT LIGHTS & POSITION LIGHTS FLASHER
247 NOSE SECTION RELAY PANEL
179, NOSE GEAR STEERING SYS
LN1A18
691
LN1E18
S P
X
304 NP
409 P
STEADY
LN7A18
LN14B18
LE1A18
LN8A18
LN13B18
LN1B18
LN12A18
LN1D18
LN2C18
OFF
617 FLASH
POSITION AND FUS LIGHTS
LN2B18
LN8A18
LN7A18
275 RH FWD CONSOLE
059
OFF
210
230 COCKPIT UTILITY
158
EXTERIOR LIGHTING SYS
818
24V DC
LJ7A20
39, ROCKET-FIRING SYS
5A
LJ1A20
LJ1A20
LJ1B20
LJ1D20
568, CANOPY ACTUATOR SYS
AUX INST LTS & CANOPY CONTROL
100 Ω 25W
536
LJ11A18
LJ11B18
LJ11A18
LJ11C18
694
237
238
AUX INSTRUMENT LIGHT
LJ11C18
28V DC PRIMARY
5A
LJ3C20
45
CONSOLE, PED & INST LTS
264 RH CIRCUIT-BREAKER PANEL
90Ω 50W
543
LJ10A20
S P
F
418
340
LJ10B20
AN/ARC-3 VHF RADIO
AN/ARN-6 RADIO COMPASS
AN/APX-6 IFF RADAR
RV250A20
RN689A20
SX227A20
487
594
AUX INSTRUMENT LIGHT
237
238
(TYP) 245
217
(ONE LIGHT FOR AMMETER)
(TWO LIGHTS EACH FOR 10 OTHER INSTRUMENTS)
RING TYPE INST RED LIGHTS
272 INSTRUMENT PANEL
LJ8A20
NL9A20
305
630
LJ8A20
140 Ω
529
LJ8H20
674
228 STAND-BY COMPASS LIGHT
LJ6J20
LJ6F20
LJ6A20
LJ6B20
LJ6C20
LJ5G20
240 (TYP)
213 (TYP)
INDIRECT ILLUMINATION LIGHTS
275 RH FWD CONSOLE
30 Ω
532
LJ12A20
CONSOLE FLOOD-LIGHT
243
216
LJ12B20
LJ12C20
LJ12D20
CONSOLE FLOOD-LIGHT
243
216
270 LH FWD CIRCUIT-BREAKER PANEL
LJ6A20
LJ3B20
LJ6F20
S P
B
N
LJ6A20
LJ3B20
421
351
RH
LJ3A20
100Ω 50 W
531
OFF
LJ3A20
LJ4A20
LJ4B20
LJ4C20
LJ4D20
LJ4E20
229 (TYP)
213 (TYP)
RHEOSTAT
268
CENTER PEDESTAL
INDIRECT ILLUMINATION LIGHTS
LJ4A20
LJ5B20
LJ5A20
S P
LJ5B20
N
LJ5A20
421
351
LH
LJ5D20
LJ5B20
LJ5C20
LJ5D20
LJ5G20
LJ5H20
LJ5J20
240
213
229
213
INDIRECT ILLUMINATION LIGHTS
273 LH FWD CONSOLE
LJ5K20
LJ5L20
LJ5M20
240 (TYP)
213 (TYP)
274 LH AFT CONSOLE
F-86E-10 AIRPLANES AF51-2718 THRU -2777
F-86E-10 AIRPLANES AF51-2778 THRU -2849
170-54-40277



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
45	Circuit Breaker—Console, Pedestal, and Instrument Light, and Stabilizer Rate Damper	AN3161P5
49	Circuit Breaker—Canopy Control and Auxiliary Instrument Light	AN3161P5
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
210	Lamp—Cockpit Utility Light	AN3121-313
213	Lamp—Indirect Lighting Panel	GE-327
216	Lamp—Console Floodlight	AN3121R313
217	Lamp—Instrument Panel Ring Light	AN3140-327
218	Lamp—Auxiliary Instrument Floodlight	AN3131-303
222	Lamp—Stand-by Compass	AN3136-323 (Furnished With Compass)
229	Light Assembly—Pedestal	1617C-2 (Wemac)
230	Light Assembly—Cockpit Utility	94-32294D, Type C-4A
237	Light Assembly—Auxiliary Instrument Floodlight	A-4255A5 (Grimes)
240	Light Assembly—Indirect Panel Illumination	AN3502-2A
243	Light Assembly—Left-hand and Right-hand Console Floodlight	AN3034-1
245	Light Assembly—Instrument Panel Ring	170-51005 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
272	Panel—Instrument	170-51005 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
274	Panel—Left Aft Console	172 54065 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
318	Plug Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
340	Plug—Instrument Panel Light Disconnect	AN3106B16S-1P
365	Plug—Stand-by Compass Light	270-8 (Cannon)
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
418	Receptacle—Instrument Panel Light Disconnect	AN3100A16S-1S
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
529	Resistor—Stand-by Compass Light	RW16J141
532	Resistor—Console Floodlight	810F30 (Clarostat)
537	Rheostat—Indirect Illumination	AN3155-50-100
538	Rheostat—Instrument Panel Floodlight	AN3155-25-100
541	Rheostat—Instrument Panel Ring Light	31873A (Ohmite)
617	Switch—Position and Fuselage Light	AN3227-1
630	Switch—Stand-by Compass Light	AN3021-2
674	Terminal Block—Radio	
687	Terminal Block—Instrument Ring Light	AN3436-2-6
689	Terminal Block—Cockpit Utility Light	AN3436-2-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7
694	Terminal Block—Auxiliary Instrument Light	AN3436-2-1

Figure 10-66. Interior Lighting

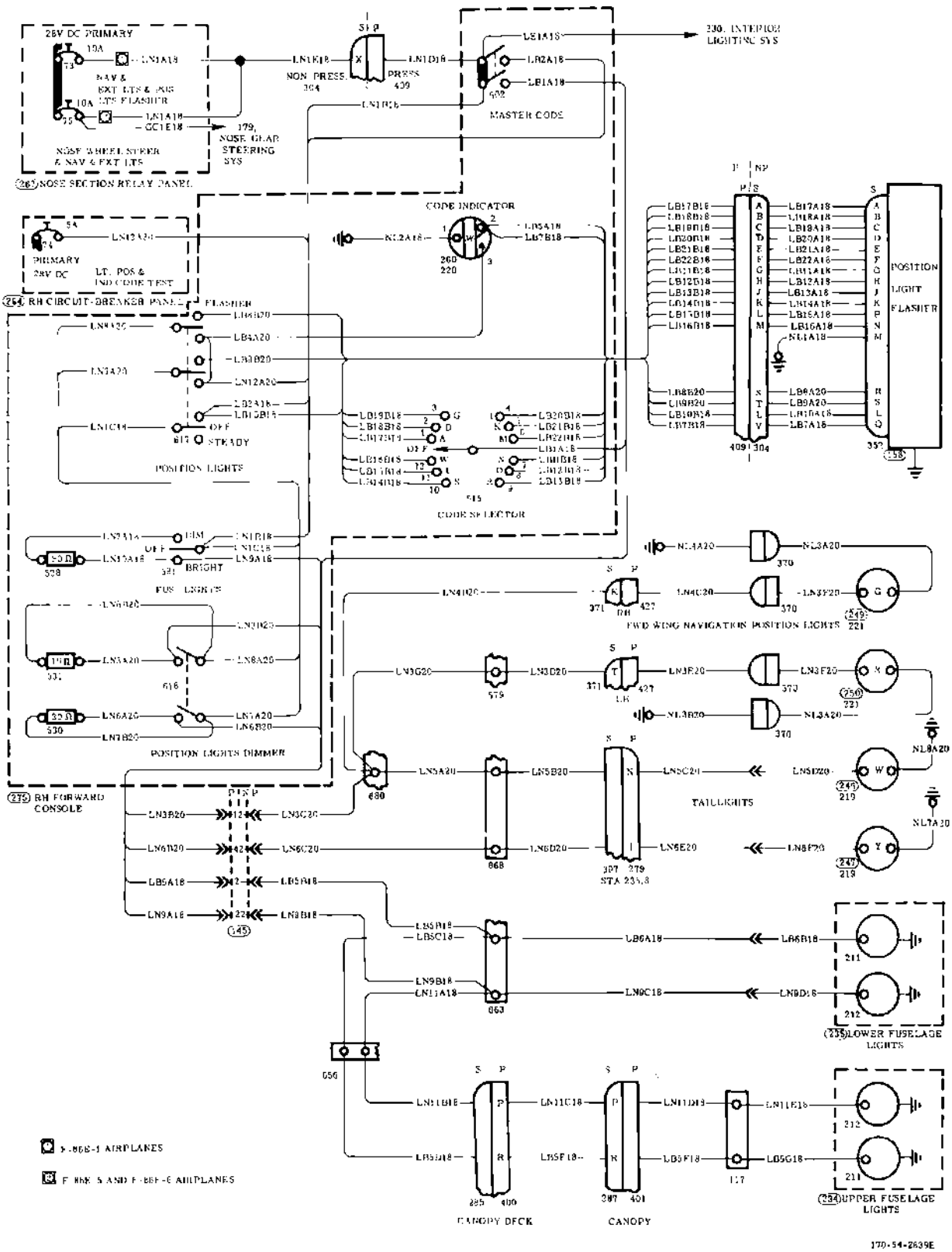

28 DC PRIMARY
10A
GC1E18
LN1A18
NOSE GEAR STEER, NAV & EXT LIGHTS & POSITION LIGHTS FLASHER
(267) NOSE SECTION RELAY PANEL
LANDING AND TAXI LIGHTS AND NOSE GEAR STEERING SYSTEM
691
LN1E18
615 EXTERIOR LIGHTS
S P
X
NP P
304 409
STEADY
LN7A18
LN14B18
LN8A18
LE1A18
LN10B18
OFF
LN1B18
LN1D18
617
LN2C18
FLASH
LN2B18
POSITION & FUS LIGHTS
(275) RH FWD CONSOLE
LE1A18
689
OFF
240
(230) COCKPIT UTILITY
598 EXTERIOR LIGHTS
LJ1A20
29, DC POWER DISTRIBUTION SYS
5A
49
LJ1A20
MR1D20
968, CANOPY ACTUATOR AND CANOPY PRESSURE SEAL SYS
LJ1B20
AUX INST LTS & CANOPY CONTROL
28V DC PRIMARY
5A
45
LJ3C20
CONSOLE, PED & INST LTS
(244) RH CIRCUIT BREAKER PANEL
30Ω 50W
541 INSTRUMENT RING LIGHTS
LJ10A20
S P
418 340
LJ1A20
LJ1C18
LJ11A18
538 AUX INSTRUMENT LIGHTS
694
237 238 AUX INSTRUMENT LIGHT
LJ11B18
687
694
(TYP) 245 217
(ONE LIGHT FOR AMMETER)
(TWO LIGHTS EACH FOR 19 OTHER INSTRUMENTS)
AUX INSTRUMENT LIGHT
231 238
RING TYPE INST RED LIGHTS
(272) INSTRUMENT PANEL
P31, AN/APX-6 IFF RADAR
R17, AN/ARC-3 VHF RADIO
R21, AN/ARN-6 RADIO COMPASS
SX227A20
RV250A20
RN480A20
#30
LJ9A20
NL9A20
LJ8A20
140Ω
LJ8H20
529
674
365
STAND-BY COMPASS LIGHT
(223) STAND-BY COMPASS LIGHT
LJ6J20
LJ6G20
LJ6A20
LJ6B20
LJ6C20
240 (TYP) 213 (TYP)
INDIRECT ILLUMINATION LIGHTS
(275) RH FWD CONSOLE
30Ω
332
LJ12A20
CONSOLE FLOOD-LIGHT
243 216
LJ12B20
LJ12C20
LJ12D20
CONSOLE FLOOD-LIGHT
243 216
(216) LH FWD CIRCUIT BREAKER PANEL
LJ4A20
337
100 Ω
OFF
INDIRECT ILLUMINATION RHEOSTAT
LJ6A20
LJ5A20
LJ3B20
LJ3B20
LJ3A20
28 142
LJ3A20
LJ4B20
LJ4C20
LJ4D20
LJ4E20
229 (TYP) 213 (TYP)
INDIRECT ILLUMINATION LIGHTS
(268A) CENTER PEDESTAL
LJ5A20
LJ5B20
LJ5C20
LJ5D20
LJ5G20
LJ5H20
LJ5J20
240 213
240 213
240 213
229 213
223 213
INDIRECT ILLUMINATION LIGHTS
(273) LH FWD CONSOLE
LJ5K20
LJ5L20
LJ5M20
240 (TYP) 233 (TYP)
(274) LH AFT CONSOLE
B DENOTES RADIO ITEM NUMBER
P DENOTES RADAR ITEM NUMBER
172-54-5136



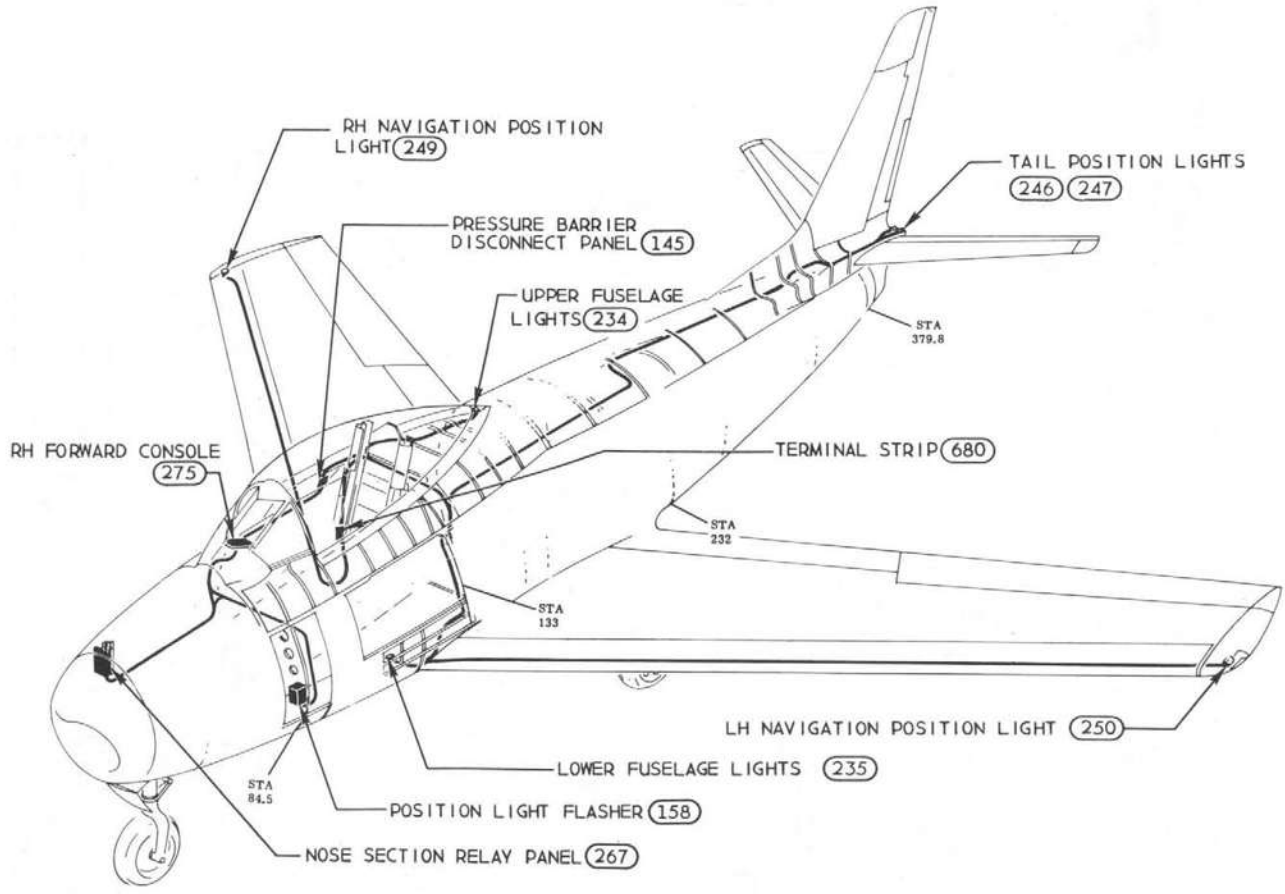
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
73	Circuit Breaker—Navigation and External Light and Position Light Flasher	AN3161P10
74	Circuit Breaker—Code Indicator Test and Position Light	AN3161P5
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
117	Connector—Pressure Block	140-54006 (NAA)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
158	Flasher—Position Light	32573, Type C-1
200	Indicator—Navigation Light Code	AN3157-1
211	Lamp—Fuselage Signal	AN3120-1047
212	Lamp—Fuselage	AN3131-303
219	Lamp—Tail Position	AN3124-307
220	Lamp—Warning	AN3121-313
221	Lamp—Wing Position	AN3122-1524
234	Light Assembly—Fuselage Upper	AN3177-3
235	Light Assembly—Fuselage Lower	AN3177-1
246	Light Assembly—White Tail Position	AN3158-1
247	Light Assembly—Yellow Tail Position	AN3158-2
249	Light Assembly—Green Wing Position	AN3033-8
250	Light Assembly—Red Wing Position	AN3033-7
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
275	Panel—Right Forward Console	161-54005-10 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106832-6P
285	Plug—Canopy Deck Disconnect	AN3108820-29S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
287	Plug—Canopy Pullaway	AN3107820-29S
304	Plug—Flasher Pressure Disconnect	AN3106828-12S
352	Plug—Position Light Flasher	AN3106836-13S
370	Plug—Wing Light Disconnect	1071 (Littelfuse)
371	Plug—Wing Wiring Disconnect	AN3108832-8S
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
400	Receptacle—Canopy Deck Disconnect	AN3100C20-29P
401	Receptacle—Canopy Pullaway	AN3100A20-29P
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
528	Resistor—Fuselage Light Dimmer	B10F50 (Clarostat)
530	Resistor—Tail Position Light Dimmer	B10F30 (Clarostat)
531	Resistor—Wing Position Light Dimmer	A25K10 (Clarostat)
581	Switch—Fuselage Light Control	AN3021-1
602	Switch—Master Code	AN3027-2
615	Switch—Navigation Light Code Selector	32265 (Pollack)
617	Switch—Position Light Control	AN3226-1
618	Switch—Position Light Dimmer	AN3027-3
656	Terminal Block—Compass	AN3436-2-7
663	Terminal Block—Right Gun Bay	AN3436-2-10
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9

Figure 10-67. Exterior Lighting System—



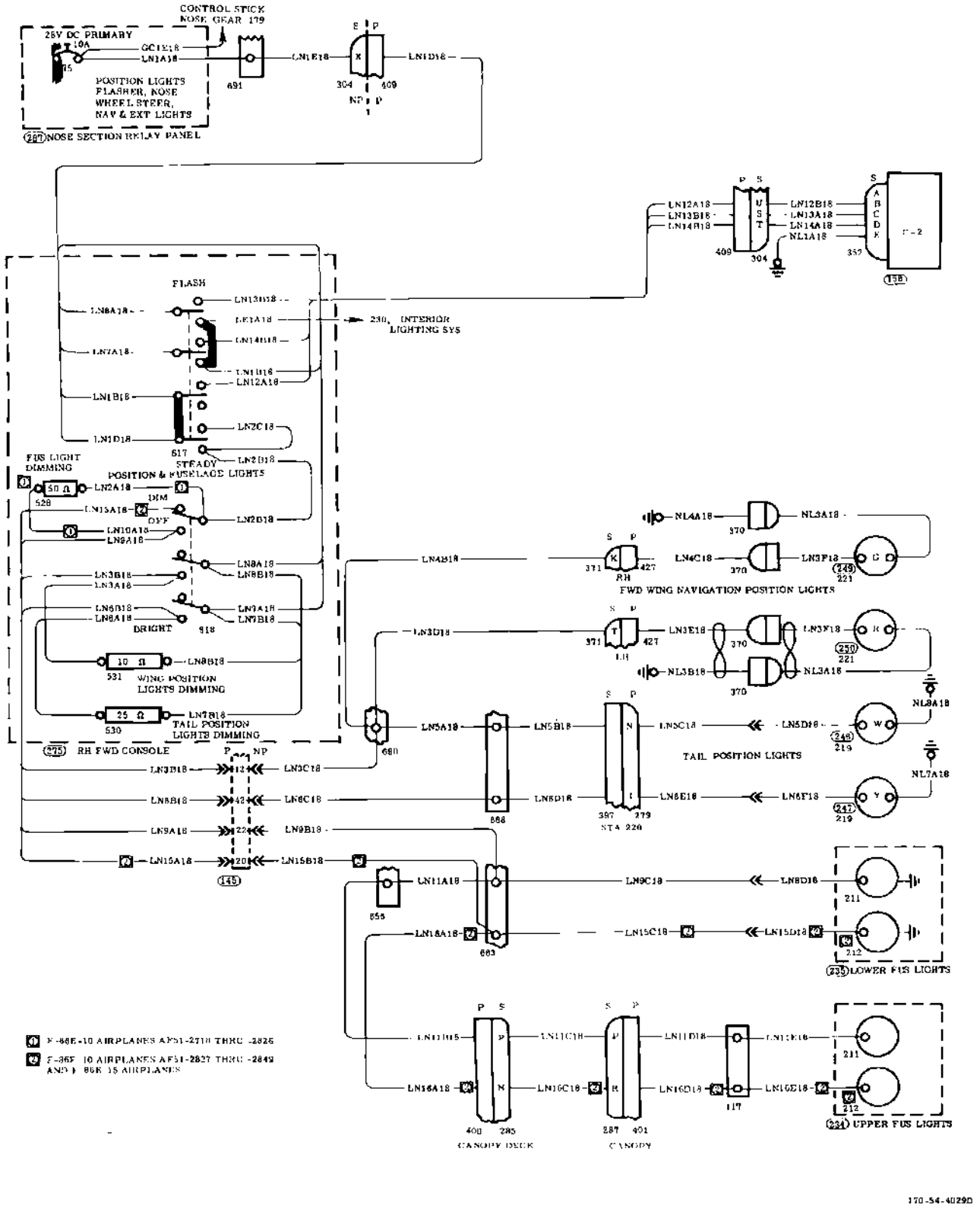
F-86E-1, F-86E-5, and F-86E-6 Airplanes



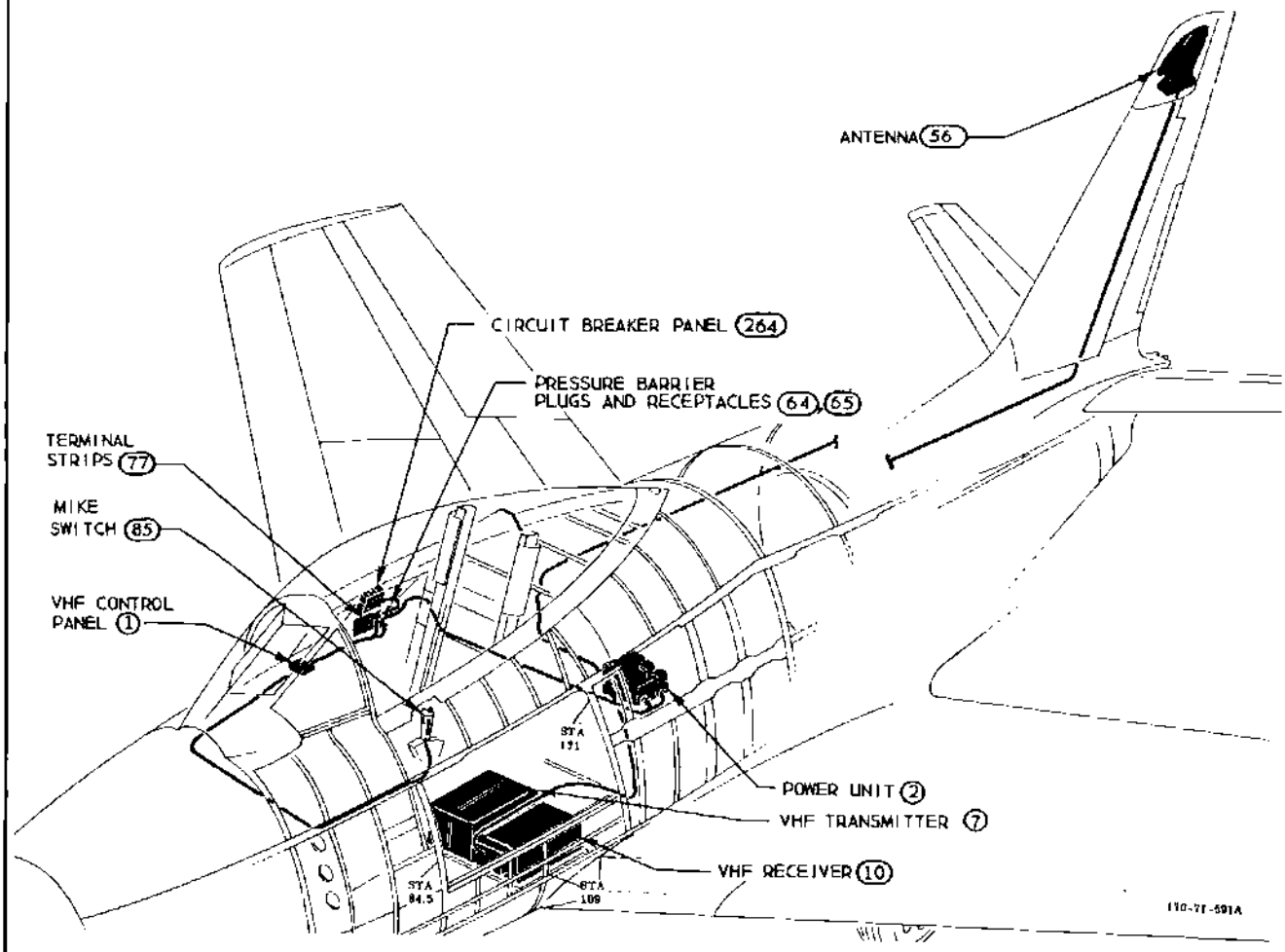
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
75	Circuit Breaker—Nose Wheel Steering, Navigation and Utility Light, and Flasher	AN3161P10
117	Connector—Pressure Block	140-54008 (NAA)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
158	Flasher—Position Light	32660, Type C-2
211	Lamp—Fuselage	AN3133-311
212	Lamp—Fuselage	AN3131-303
219	Lamp—Tail Position	AN3124-307
221	Lamp—Wing Position	AN3122-1524
234	Light Assembly—Fuselage Upper	AN3177-9
235	Light Assembly—Fuselage Lower	AN3177-9
246	Light Assembly—White Tail Position	AN3158-1
247	Light Assembly—Yellow Tail Position	AN3158-2
249	Light Assembly—Green Wing Position	AN3033-8
250	Light Assembly—Red Wing Position	AN3033-7
267	Panel—Nose Section Relay	170-54055 (NAA)
275	Panel—Right Forward Console	172-54095 (NAA)
279	Plug—Aft Fuselage Disconnect	AN3106B32-6P
285	Plug—Canopy Deck Disconnect	AN3108B20-29S
287	Plug—Canopy Pullaway	AN3107B20-29S
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
352	Plug—Position Light Flasher	AN3106B16S-8S
370	Plug—Wing Light Disconnect	1071 (Littelfuse)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
397	Receptacle—Aft Fuselage Disconnect	AN3100A32-6S
400	Receptacle—Canopy Deck Disconnect	AN3100C20-29P
401	Receptacle—Canopy Pullaway	AN3100A20-29P
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
528	Resistor—Fuselage Light Dimmer	B10F50 (Clarostat)
530	Resistor—Tail Position Light Dimmer	B20K25 (Clarostat)
531	Resistor—Wing Position Light Dimmer	A25K10 (Clarostat)
617	Switch—Position and Fuselage Light	AN3227-1
618	Switch—Position and Fuselage Light Dimmer	AN3227-3
656	Terminal Block—Compass	AN3436-2-7
663	Terminal Block—Right Gun Bay	AN3436-2-10
668	Terminal Block—Landing Gear Upper Connector	AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-68. Exterior Lighting System—

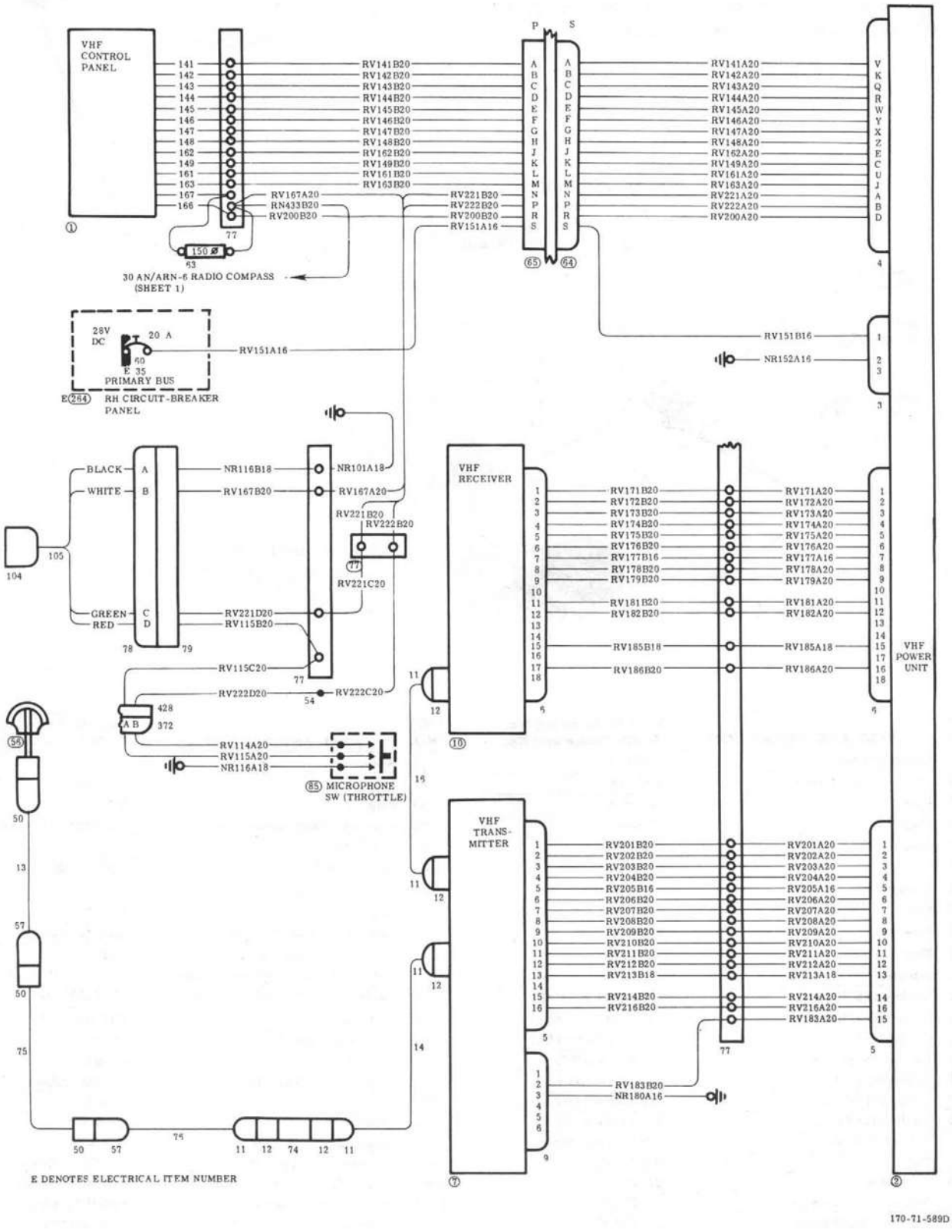


F-86E-10 and F-86E-15 Airplanes



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Control Panel—VHF	C-404/A
2	Junction Box—Power	J-68/ARC-3
3	Plug	PL-148-A
4	Plug	U-16/U
5	Plug	U-15/U
6	Plug	PL-153-A
7	Transmitter	T-67/ARC-3
9	Plug	PL-151-A
10	Receiver	R-77A/ARC-3
11	Plug	PL-259-A
12	Adapter	M-359
13	Cable (RG-9/U)	151-71044-20 (NAA)
14	Cable (RG-9/U)	151-71044-18 (NAA)
16	Cable (RG-9/U)	151-71044-16 (NAA)
E35	Circuit Breaker—AN/ARC-3 Radio	AN3161P20
50	Plug	UG-21/U
56	Antenna—Combination VHF and IFF	151-71012-10 (NAA)
57	Connector	UG-23/U
60	Circuit Breaker	AN3161P20
63	Resistor—150-ohm ½-watt	
64	Plug	AN3108-24-5S
65	Receptacle—Pressure-tight	AN3100PR24-5P
74	Connector—Feed-through	PL-274
75	Cable—"Teflon" High-temperature	151-71044-4 (NAA)
76	Cable—"Teflon" High-temperature	170-71012 (NAA)
77	Terminal Strip	NAS45-6-( )
78	Insert Assembly	14S-2P
79	Insert Assembly	14S-2S
85	Switch—Microphone Throttle	138106 (Ucinite)
104	Jack	U-61/U
105	Cordage	WF-5/U
E264	Panel—Right Circuit-breaker	170-54057 (NAA)
E372	Plug—Throttle Disconnect	AN3106B16S-1P
E428	Receptacle Throttle Disconnect	AN3101B16S-1S

Figure 10-69. AN/ARC-3 VHF Radio—F-86E-1 Airplanes, F-86E-5 Airplanes


VHF CONTROL PANEL
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142
143
144
145
146
147
148
162
149
161
163
167
166
RV141B20
RV142B20
RV143B20
RV144B20
RV145B20
RV146B20
RV147B20
RV148B20
RV162B20
RV149B20
RV161B20
RV163B20
RV167A20
RN433B20
RV200B20
RV221B20
RV222B20
RV200B20
RV151A16
150 Ø
30 AN/ARN-6 RADIO COMPASS (SHEET 1)
28V DC
20 A
60
E 35
PRIMARY BUS
E 284 RH CIRCUIT-BREAKER PANEL
RV151A16
P
S
RV141A20
RV142A20
RV143A20
RV144A20
RV145A20
RV146A20
RV147A20
RV148A20
RV162A20
RV149A20
RV161A20
RV163A20
RV221A20
RV222A20
RV200A20
RV151B16
NR152A16
BLACK
WHITE
GREEN
RED
NR116B18
RV167B20
RV221D20
RV115B20
NR101A18
RV167A20
RV221B20
RV222B20
RV221C20
RV115C20
RV222D20
RV222C20
104
105
78
79
77
54
428
372
RV114A20
RV115A20
NR116A18
85 MICROPHONE SW (THROTTLE)
VHF RECEIVER
RV171B20
RV172B20
RV173B20
RV174B20
RV175B20
RV176B20
RV177B16
RV178B20
RV179B20
RV181B20
RV182B20
RV185B18
RV186B20
RV171A20
RV172A20
RV173A20
RV174A20
RV175A20
RV176A20
RV177A16
RV178A20
RV179A20
RV181A20
RV182A20
RV185A18
RV186A20
VHF POWER UNIT
VHF TRANS-MITTER
RV201B20
RV202B20
RV203B20
RV204B20
RV205B16
RV206B20
RV207B20
RV208B20
RV209B20
RV210B20
RV211B20
RV212B20
RV213B18
RV214B20
RV216B20
RV183B20
NR180A16
RV201A20
RV202A20
RV203A20
RV204A20
RV205A16
RV206A20
RV207A20
RV208A20
RV209A20
RV210A20
RV211A20
RV212A20
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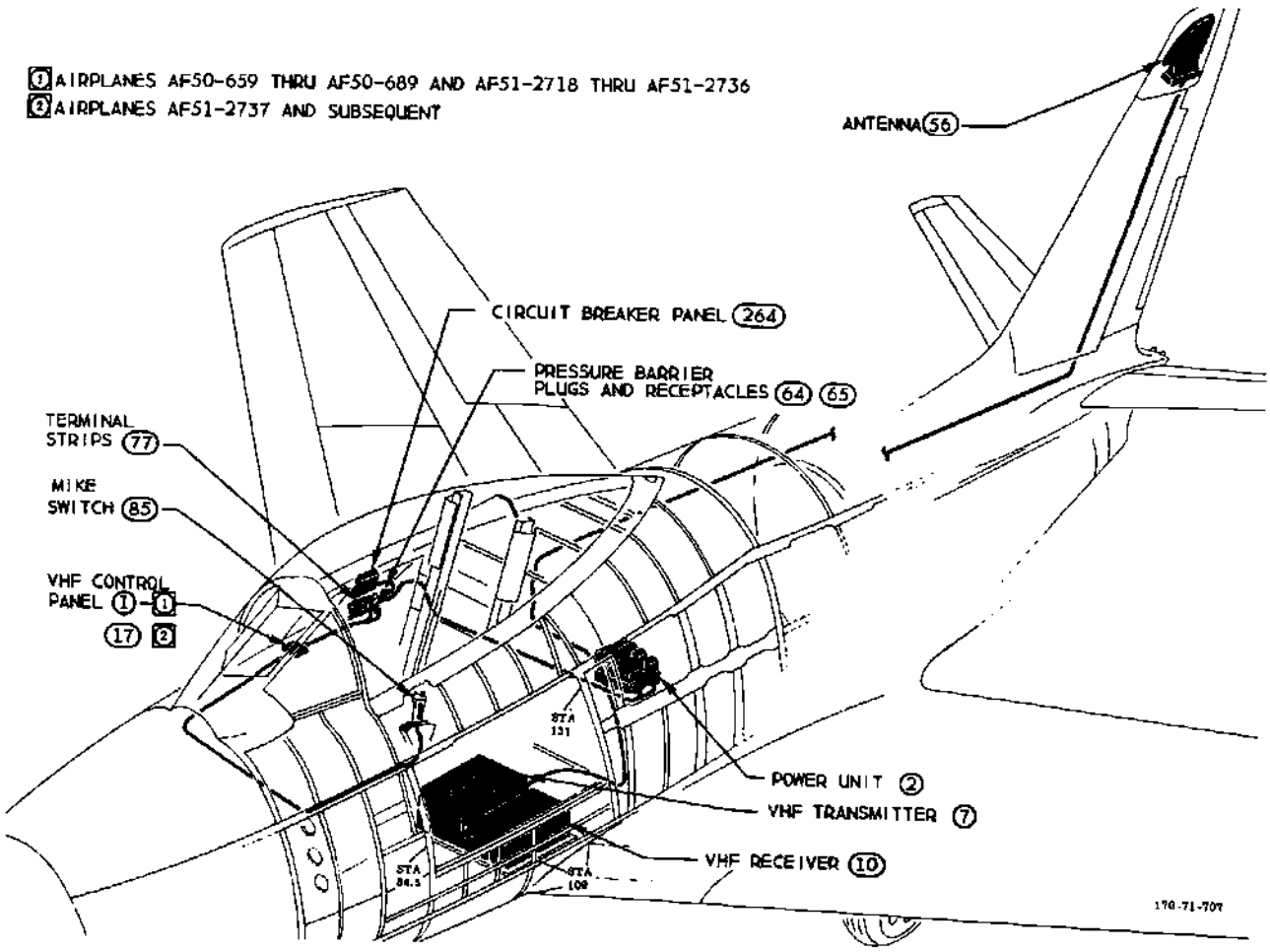
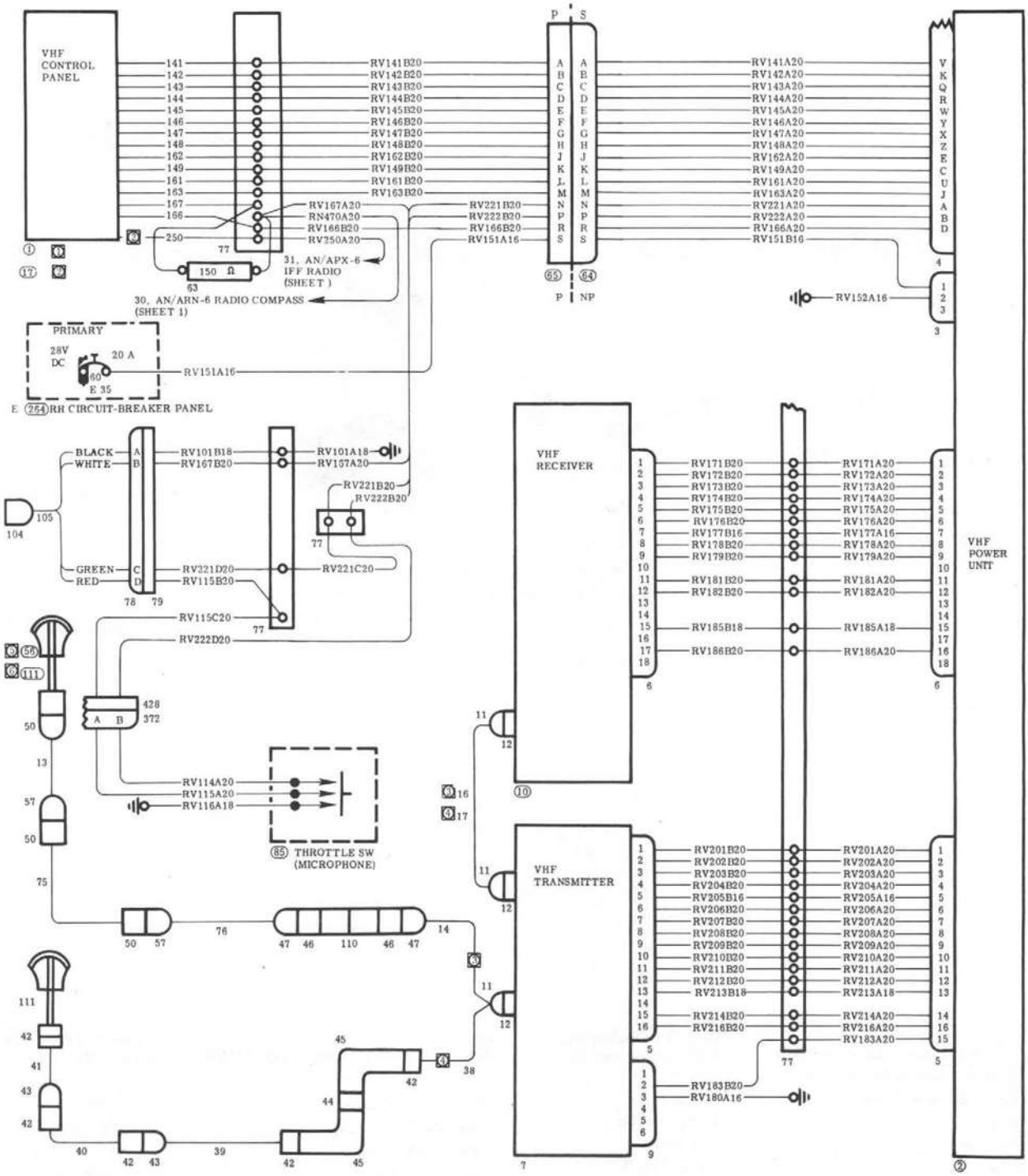
170-71-589D



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Control Panel—VHF	C-404/A
2	Junction Box—Power	J-68/ARC-3
3	Plug	PL-148-A
4	Plug	U-16/U
5	Plug	U-15/U
6	Plug	PL-153-A
7	Transmitter	T-67/ARC-3
9	Plug	PL-151-A
10	Receiver	R-77A/ARC-3
11	Plug	PL-259-A
12	Adapter	M-359
13	Cable (RG-9/U)	151-71044-20 (NAA)
14	Cable (RG-9/U)	151-71044-18 (NAA)
16	Cable (RG-9/U)	151-71044-16 (NAA)
17	Control Panel—VHF	C-404A/A (GFP)
38	Cable (RG-8/U)	172-71004 (NAA)
39	Cable (RG-87A/U)	172-71004-4 (NAA)
40	Cable (RG-87A/U)	172-71004-6 (NAA)
41	Cable (RG-8/U)	172-71004-8 (NAA)
42	Plug	UG-21C/U
43	Connector	UG-23C/U
44	Adapter—Right-angle	UG-27B/U
45	Adapter—Right-angle	UG-202/U

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
46	Adapter	M-359
47	Plug	PL-259-A
50	Plug	UG-21/U
56	Antenna—Combination VHF and IFF	151-71012-10 (NAA)
57	Connector	UG-23/U
60	Circuit Breaker	AN3161P20
63	Resistor—150-ohm ½-watt	
64	Plug	AN3108-24-5S
65	Receptacle—Pressure-tight	AN3100PR24-5P
74	Connector—Feed-through	PL-274
75	Cable—"Teflon" High-temperature	151-71044-4 (NAA)
76	Cable—"Teflon" High-temperature	170-71012 (NAA)
77	Terminal Strip	NAS45-6-( )
78	Insert Assembly	14S-2P
79	Insert Assembly	14S-2S
85	Switch—Microphone Throttle	138106 (Ucinite)
104	Jack	U-61/U
105	Cordage	WF-5/U
110	Connector—Feed-through	PL-274
113	Antenna Assembly—UHF	161-23310 (NAA)
E264	Panel—Right Circuit-breaker	170-54057 (NAA)
E372	Plug—Throttle Disconnect	AN3106B16S-1P
E428	Receptacle—Throttle Disconnect	AN3101B16S-1S

Figure 10-70. AN/ARC-3 VHF Radio—F-86E-5 Airplanes AF50-659



E DENOTES ELECTRICAL ITEM NUMBER

1 F-86E-5 AIRPLANES AF50-659 THRU -689, AND F-86E-10 AIRPLANES AF51-2718 THRU -2736

2 F-86E-10 AIRPLANES AF51-2737 THRU -2849

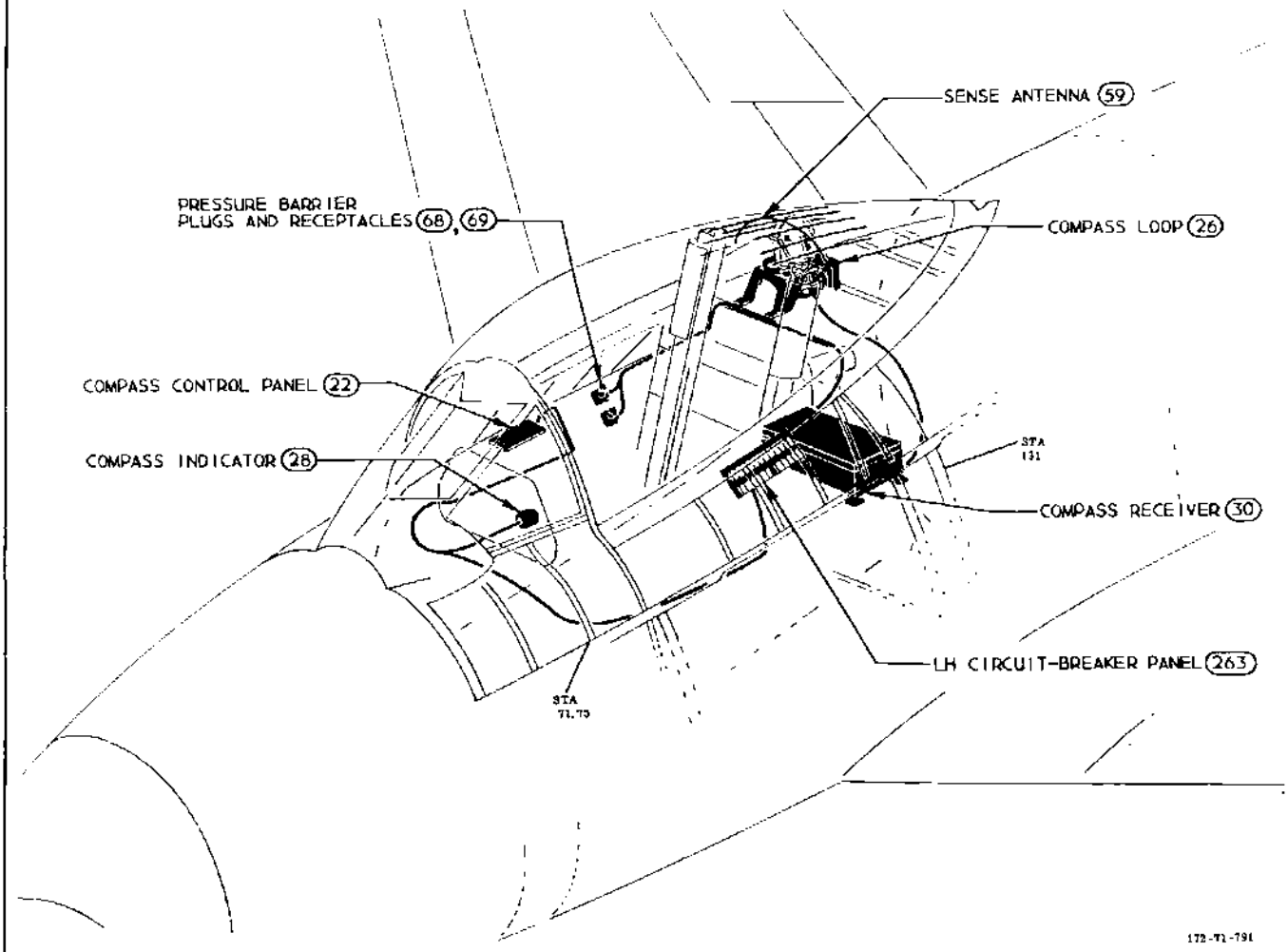
3 F-86E-5 AIRPLANES AF50-659 THRU -689 AND F-86E-10 AIRPLANES AF51-2718 THRU -2826

4 F-86E-10 AIRPLANES AF51-2827 THRU -2849 AND F-86E-15 AIRPLANES

6 F-86E-5 AIRPLANES AF50-659 THRU -689 AND F-86E-10 AIRPLANES AF51-2718 THRU -2777

5 F-86E-10 AIRPLANES AF51-2778 THRU -2849

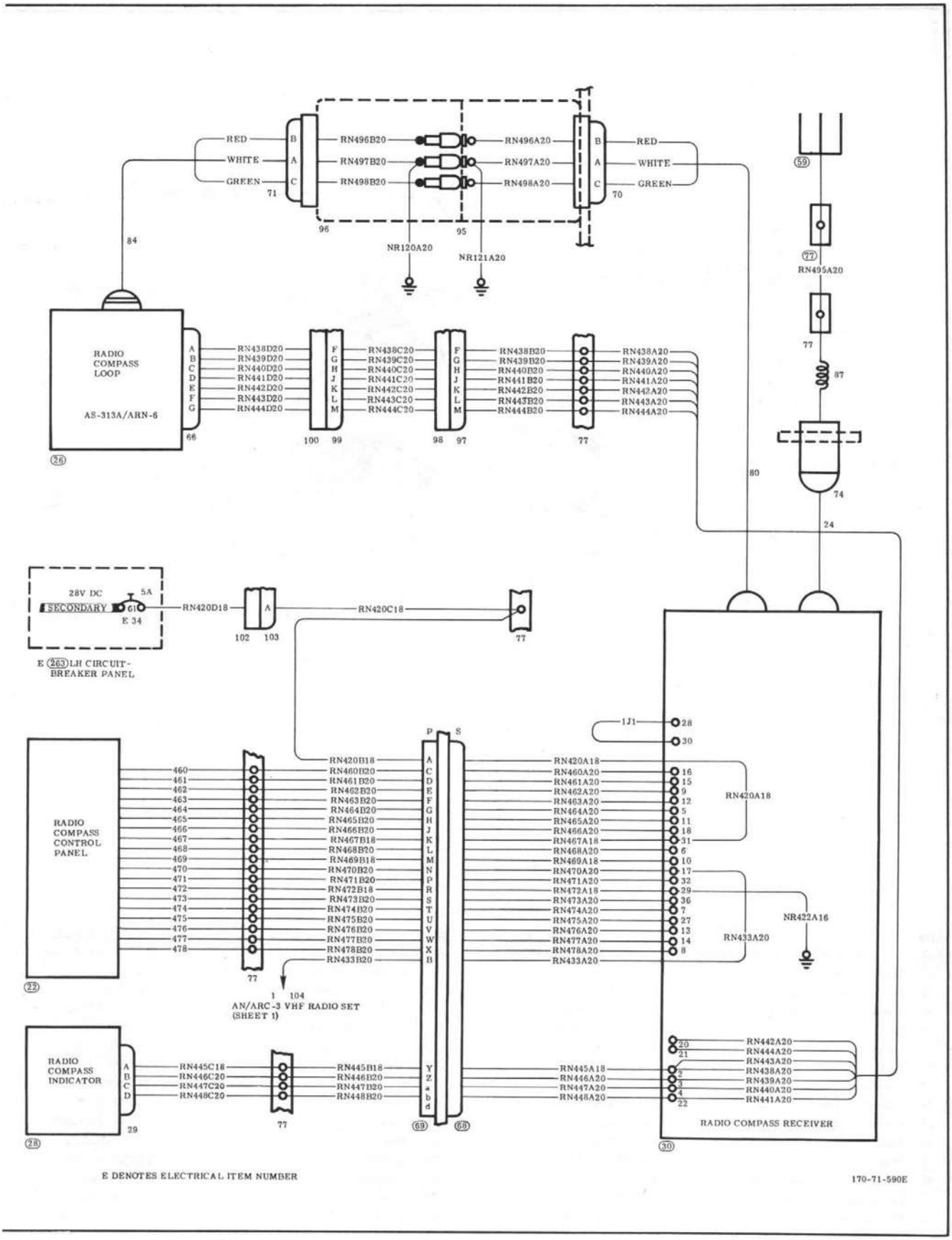
170-71-588E



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
22	Control Panel—Radio Compass	C-403/A
24	Cable—Sense Antenna	CG-405/ARN-6
26	Loop	AS-313A/ARN-6
28	Indicator	ID-90/ARN-6
29	Plug	AN3106-14S-2S
30	Receiver Unit—Compass	R-101/ARN-6
E34	Circuit Breaker—AN/ARN-6 Radio	AN3161P5
59	Antenna—AN/ARN-6 Sense	151-71026 (NAA)
E61	Circuit Breaker—Gun Charger Compressor	AN3161P5
66	Plug	AN3107-16S-1S
68	Plug	AN3108-28-12S
69	Receptacle—Pressure-tight	AN3100PR28-12P
70	Receptacle—Pressure-tight	AN3102PR14S-1P
71	Receptacle	AN3102-14S-1P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
74	Connector—Feed-through	PL-274
77	Terminal Strip	NA545-6-( )
80	Cable—Compass Loop	CG-556/ARN-6
84	Cable—Compass Loop	CG-555/ARN-6
87	Cord—Kellogg Koiled	151-71023 (NAA)
95	Base Assembly—Loop Disconnect	151-71084 (NAA)
96	Brush Holder—Loop Disconnect	151-71097-12
97	Plug	AN3108-20-29S
98	Receptacle	AN3100PR20-29P
99	Plug	AN3107-20-29S
100	Receptacle	AN3100-20-29P
102	Receptacle	AN3100-24-5P
103	Plug	AN3106-24-5S
263	Panel—Left Circuit-breaker	170-54068 (NAA)

Figure 10-71. AN/ARN-6 Radio Compass—F-86E-1 Airplanes,


RED
WHITE
GREEN
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RN496B20
RN497B20
RN498B20
RN496A20
RN497A20
RN498A20
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NR120A20
NR121A20
84
59
77
RN495A20
87
74
80
24
RADIO COMPASS LOOP
AS-313A/ARN-6
66
26
RN438D20
RN439D20
RN440D20
RN441D20
RN442D20
RN443D20
RN444D20
RN438C20
RN439C20
RN440C20
RN441C20
RN442C20
RN443C20
RN444C20
RN438B20
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RN442B20
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RN444B20
RN438A20
RN439A20
RN440A20
RN441A20
RN442A20
RN443A20
RN444A20
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28V DC
5A
SECONDARY
61
E 34
RN420D18
RN420C18
102
103
E (263) LH CIRCUIT-BREAKER PANEL
1J1
28
30
RADIO COMPASS CONTROL PANEL
22
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
RN420B18
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RN461B20
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RN463B20
RN464B20
RN465B20
RN466B20
RN467B18
RN468B20
RN469B18
RN470B20
RN471B20
RN472B18
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RN473A20
RN474A20
RN475A20
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RN477A20
RN478A20
RN433A20
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15
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12
5
11
18
31
6
10
17
32
29
36
7
27
13
14
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RN420A18
RN433A20
NR422A16
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104
AN/ARC-3 VHF RADIO SET (SHEET 1)
RADIO COMPASS INDICATOR
28
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RN445C18
RN446C20
RN447C20
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RN448A20
69
68
20
21
22
RN442A20
RN444A20
RN443A20
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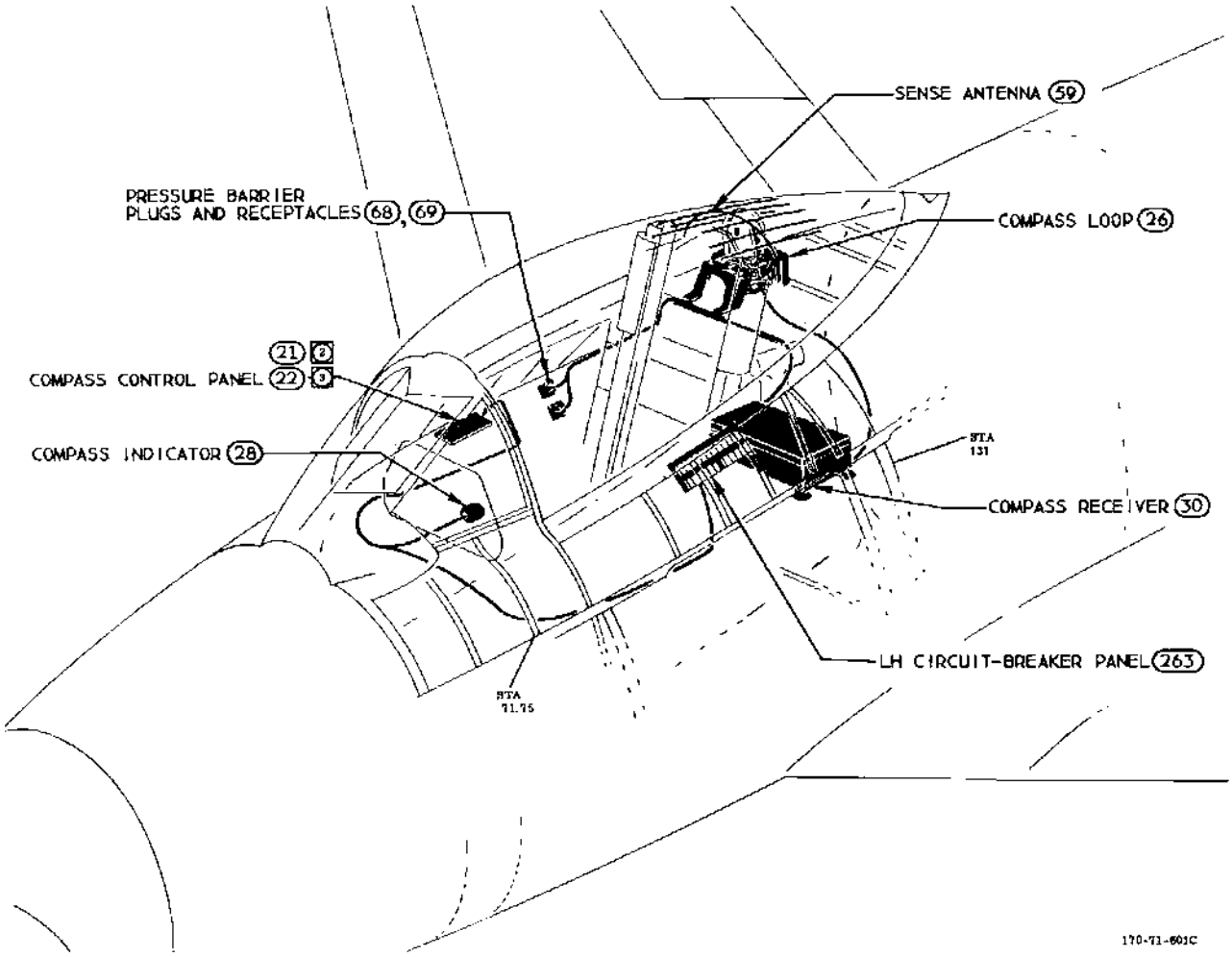
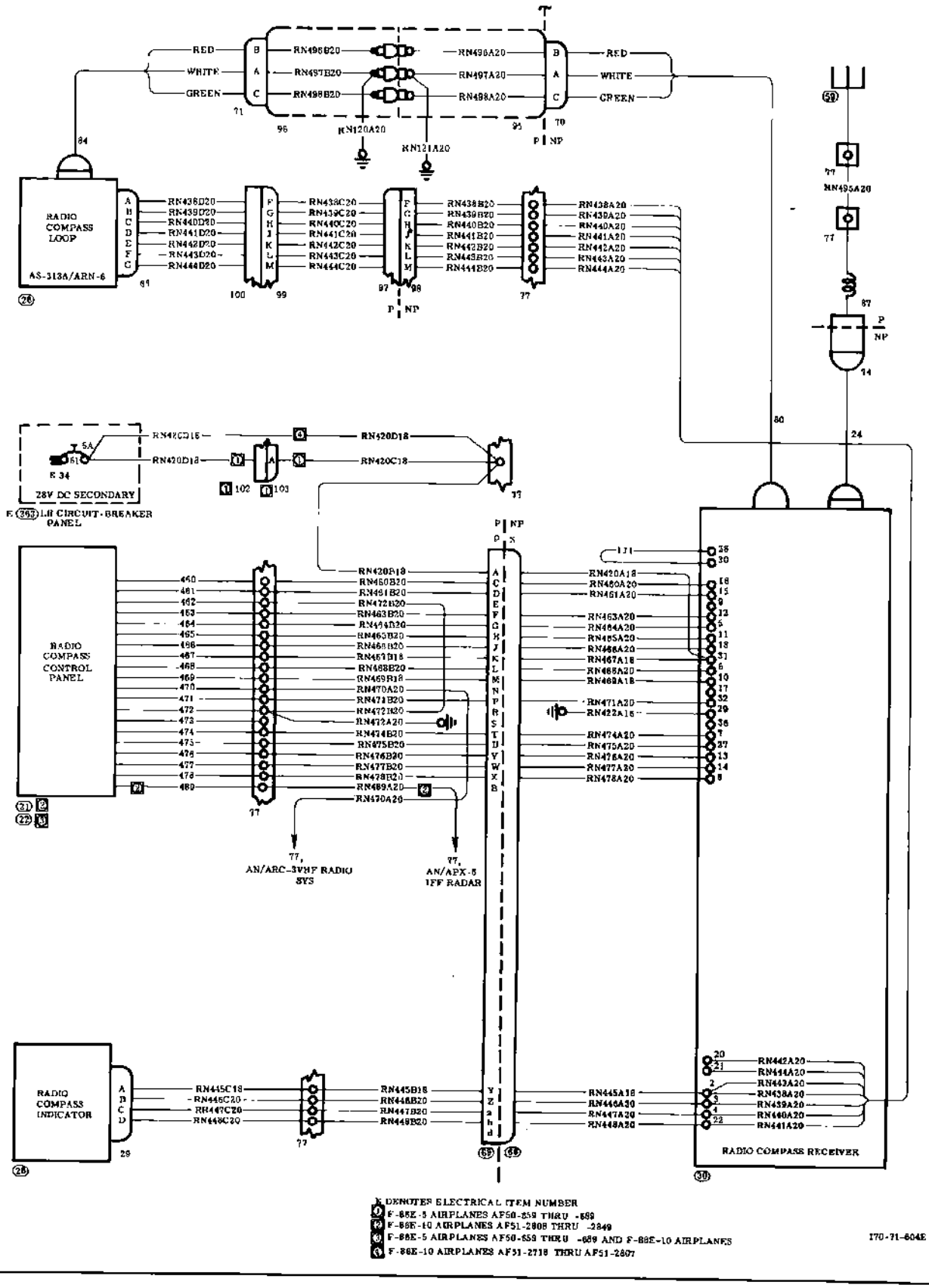


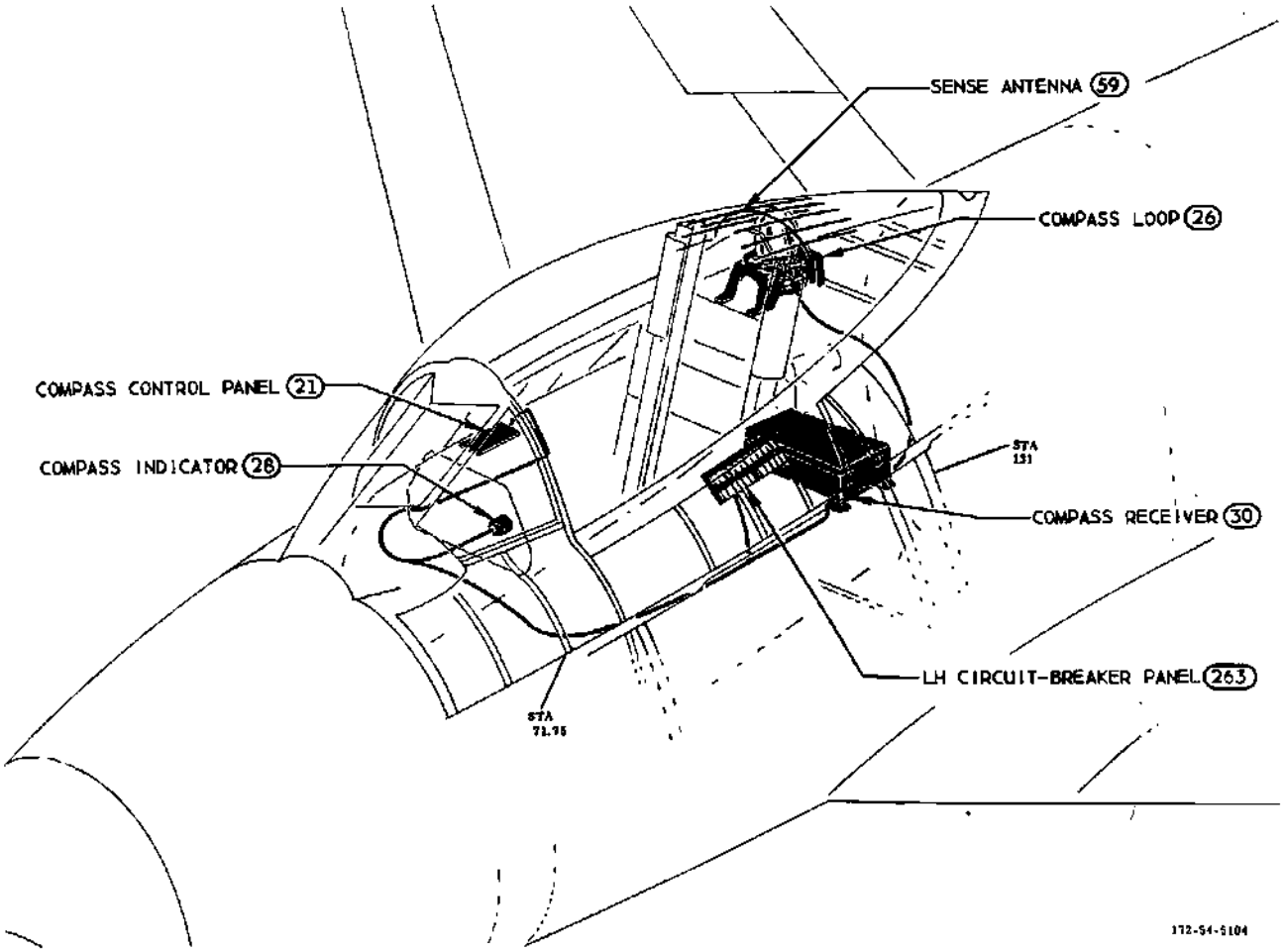
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
21	Control Panel—Radio Compass	C-403A/A
22	Control Panel—Radio Compass	C-403/A
24	Cable—Sense Antenna	CG-405/ARN-6
26	Loop	AS-313A/ARN-6
28	Indicator	ID-90/ARN-6
29	Plug	AN3106-14S-2S
30	Receiver Unit—Compass	R-101/ARN-6
59	Antenna—AN/ARN-6 Sense	151-71026 (NAA)
61	Circuit Breaker	AN3161P5
66	Plug	AN3107-16S-1S
68	Plug	AN3108-28-12S
69	Receptacle—Pressure-tight	AN3100PR28-12P
70	Receptacle—Pressure-tight	AN3102PR14S-1P
71	Receptacle	AN3102-14S-1P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
74	Connector—Feed-through	PL-274
77	Terminal Strip	NAS45-6-( )
80	Cable—Compass Loop	CG-556/ARN-6
84	Cable—Compass Loop	CG-555/ARN-6
87	Cord—Kellogg Koiled	151-71023 (NAA)
95	Base Assembly—Loop Disconnect	151-71084 (NAA)
96	Brush Holder—Loop Disconnect	151-71097-12
97	Plug	AN3108-20-29S
98	Receptacle	AN3100PR20-29P
99	Plug	AN3107-20-29S
100	Receptacle	AN3100-20-29P
102	Receptacle	AN3100-24-5P
103	Plug	AN3106-24-5S
E263	Panel—Left Circuit-breaker	170-54068 (NAA)

Figure 10-72. AN/ARN-6 Radio Compass—F-86E-5 Airplanes



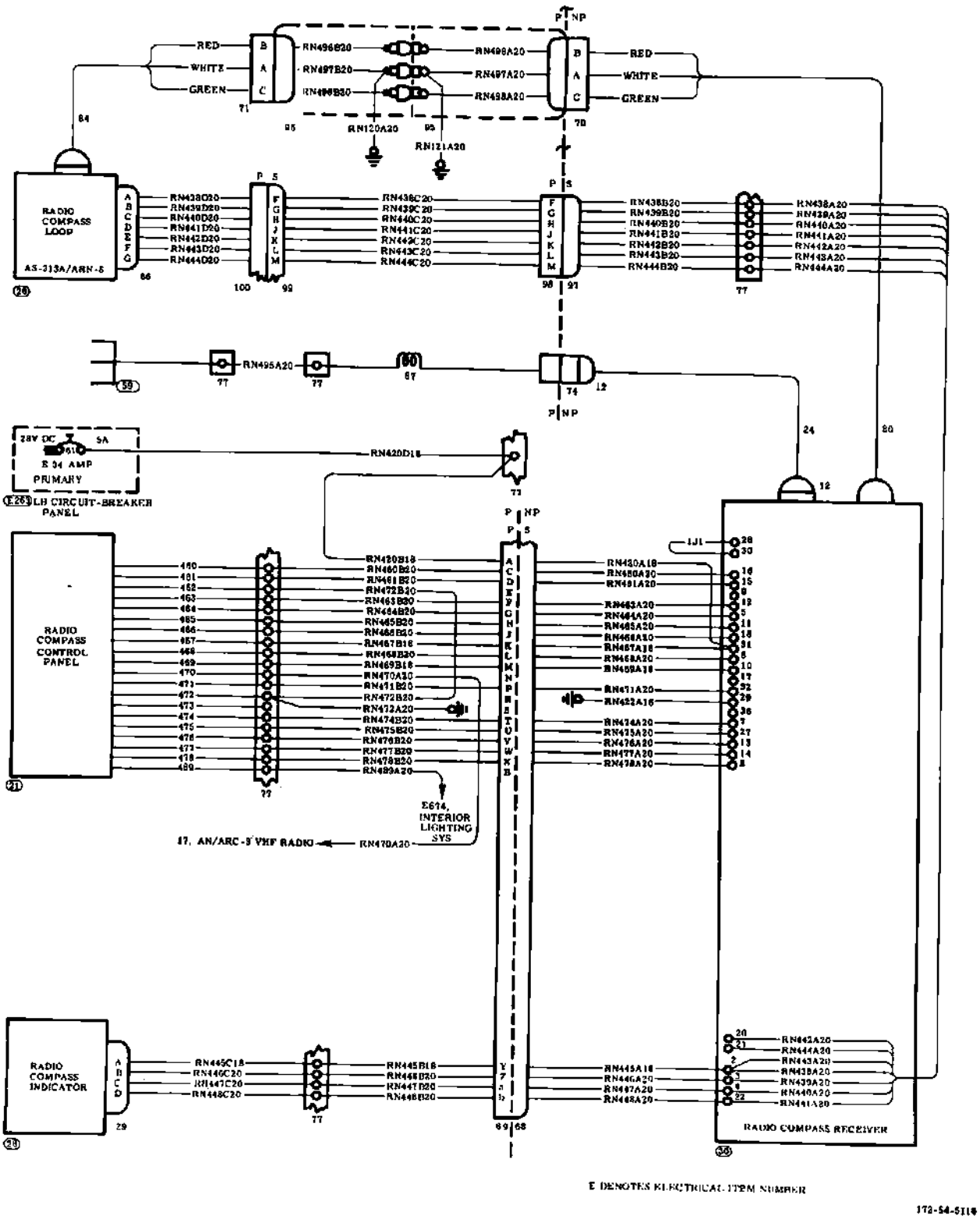
AF50-659 Through -689, and F-86E-10 Airplanes

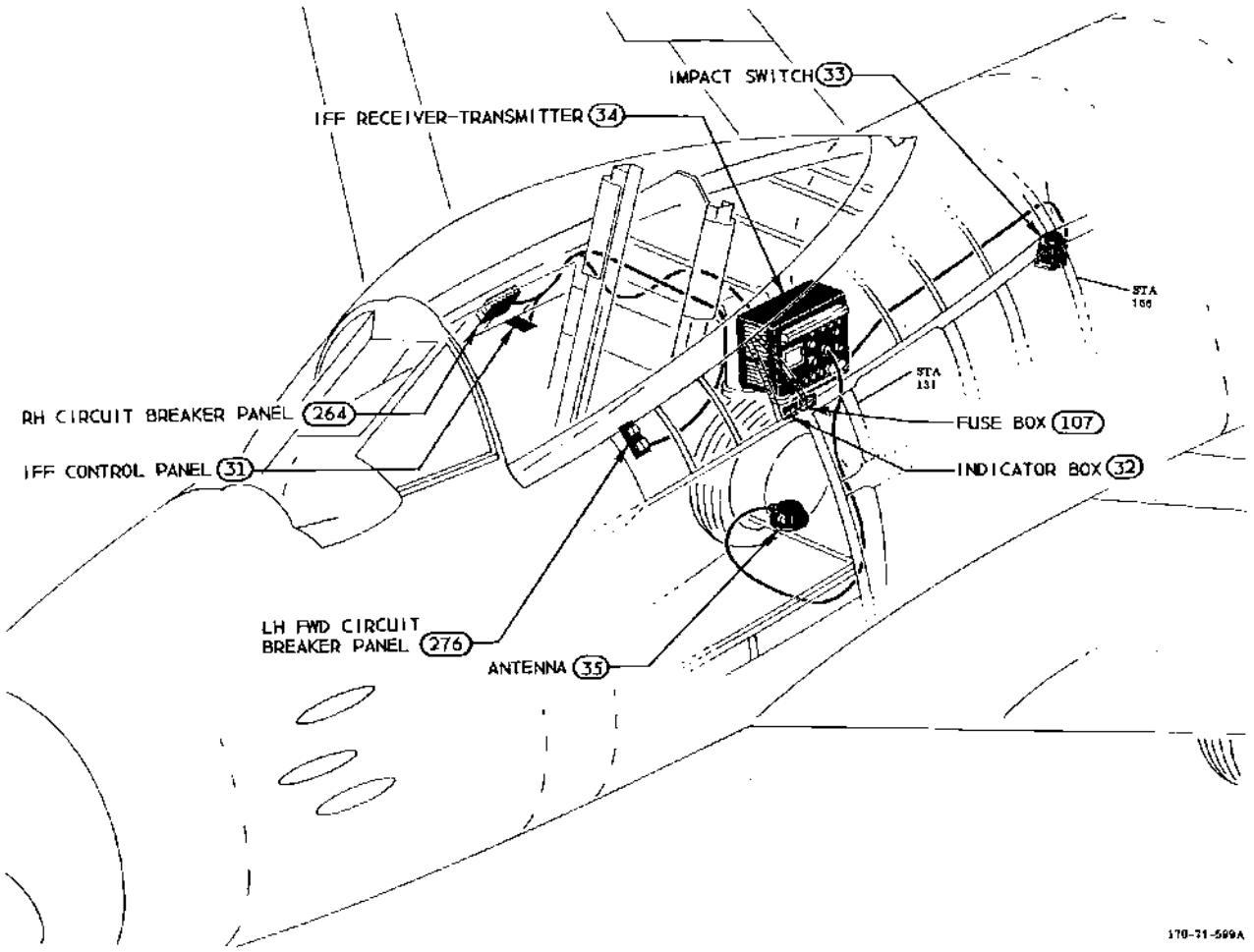


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
12	Adapter—Right-angle	M-359
21	Control Panel—Radio Compass	C-403A/A
24	Cable—Sense Antenna	CG-405/ARN-6
26	Loop—Compass	AS-313A/ARN-6
28	Indicator	ID-90/ARN-6
29	Plug	AN3106-14S-2S
30	Receiver Unit—Compass	R-101/ARN-6
59	Antenna—AN/ARN-6 Sense	151-71026 (NAA)
61	Circuit Breaker	AN3161P5
66	Plug	AN3107-16S-1S
68	Plug	AN3108-28-12S
69	Receptacle—Pressure-tight	AN3100PR28-12P
70	Receptacle—Pressure-tight	AN3102PR14S-1P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
71	Receptacle	AN3102-14S-1P
74	Connector—Feed-through	PL-274
77	Terminal Strip	NAS45-6-( )
80	Cable—Compass Loop	CG-556/ARN-6
84	Cable—Compass Loop	CG-555/ARN-6
87	Cord—Kellogg Koiled	151-71023 (NAA)
95	Base Assembly—Loop Disconnect	151-71084 (NAA)
96	Brush Holder—Loop Disconnect	151-71097-12 (NAA)
97	Plug	AN3108-20-29S
98	Receptacle	AN3100PR20-29P
99	Plug	AN3107-20-29S
100	Receptacle	AN3100-20-29P
E263	Panel—Left Circuit-breaker	170-54068 (NAA)

Figure 10-73. AN/ARN-6 Radio

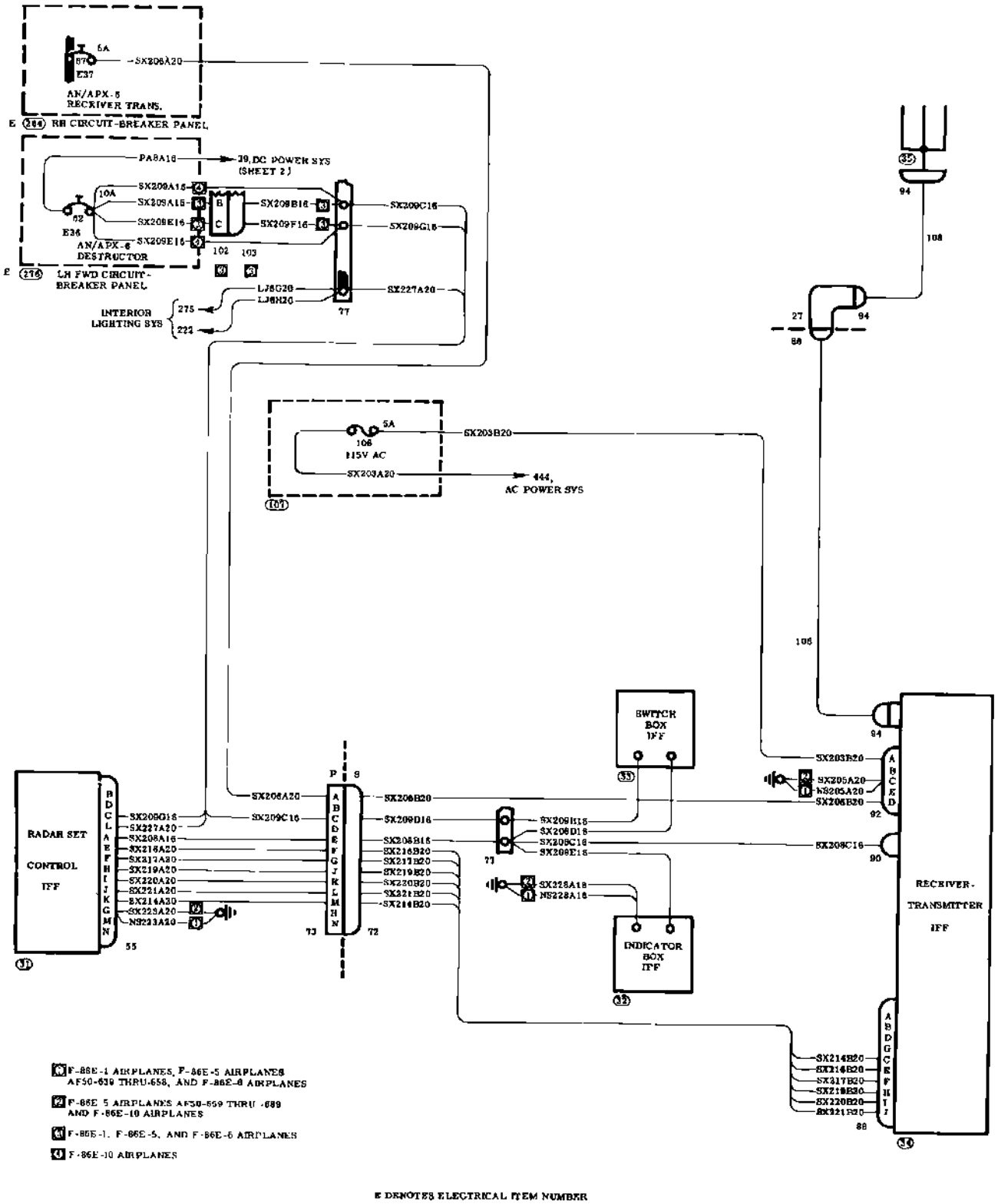

RADIO COMPASS LOOP
AS-313A/ARN-5
RADIO COMPASS CONTROL PANEL
RADIO COMPASS INDICATOR
RADIO COMPASS RECEIVER
28V DC
5A
E 34 AMP
PRIMARY
LH CIRCUIT-BREAKER PANEL
E614, INTERIOR LIGHTING SYS
17, AN/ARC-3 VHF RADIO
RED
WHITE
GREEN
E DENOTES ELECTRICAL ITEM NUMBER
172-54-5114



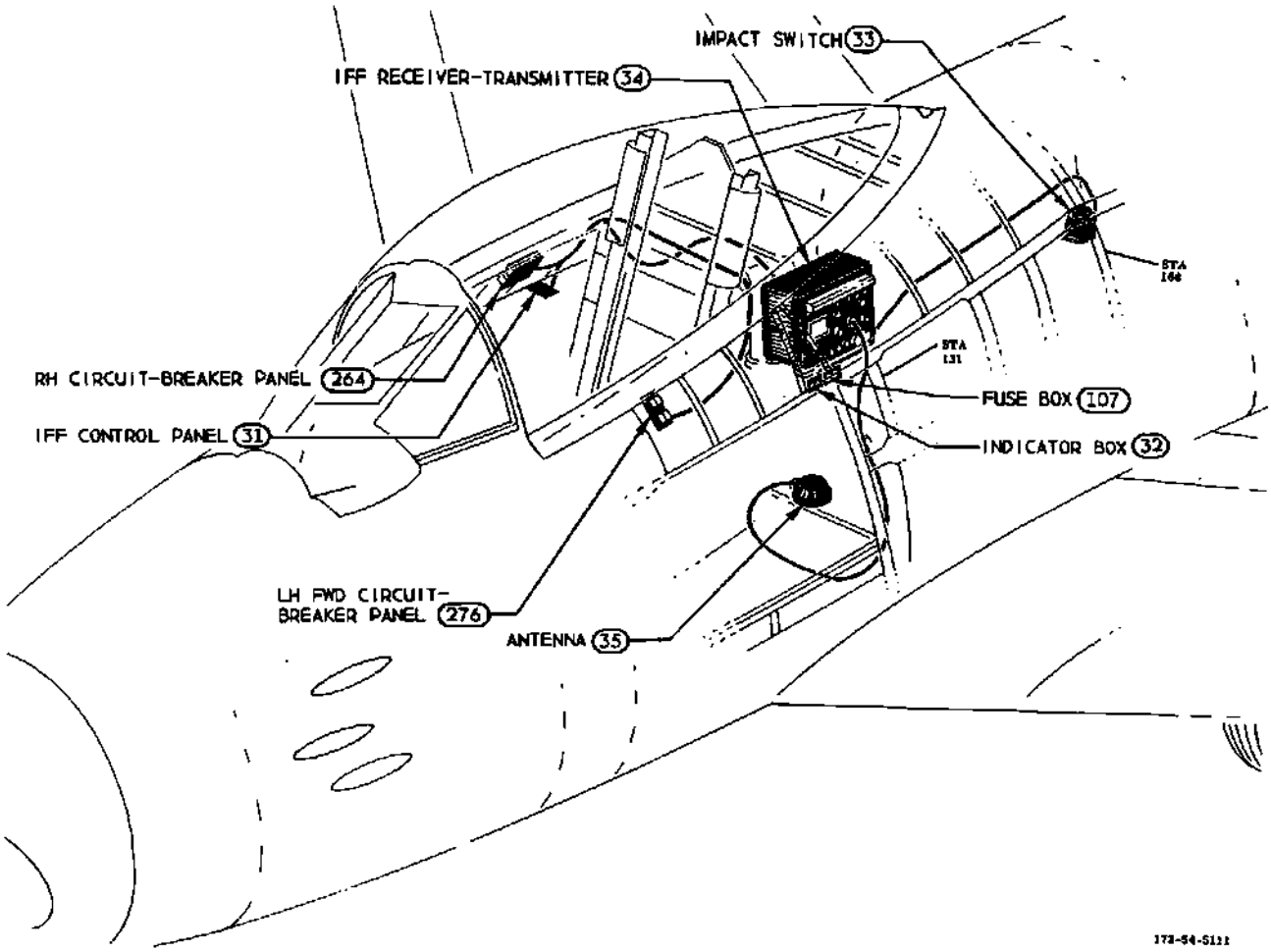
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
27	Adapter	UG-212A/U
31	Control—Radar Set	C-629/APX-6
32	Indicator Box	BC-727
33	Switch Box	SA-3/A
34	Receiver-Transmitter	RT-82/APX-6
35	Antenna Assembly	AT-234/APX
55	Plug	AN3106B20-27S
62	Circuit Breaker	AN3161P10
67	Circuit Breaker	AN3161P5
72	Plug	AN3108B20-27S
73	Receptacle—Pressure-tight	AN3100PR20-27P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
77	Terminal Strip	NAS45-6-( )
86	Jack—Radio Frequency	UG-61A/U
88	Plug	AN3108B18-1P
90	Plug	AN3108B8S-1P
92	Plug	AN3108B14S-5S
94	Plug—Radio Frequency	UG-59A/U
102	Receptacle	AN3100-24-5P
103	Plug	AN3106-24-5S
106	Fuse—5-ampere	AGC5 (Bussmann)
107	Support Assembly	161-74044
108	Cable	RG-8/U
E264	Panel—Right Circuit-breaker	170-54057 (NAA)
E276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)

Figure 10-74. AN/APX-6 IFF Radar—



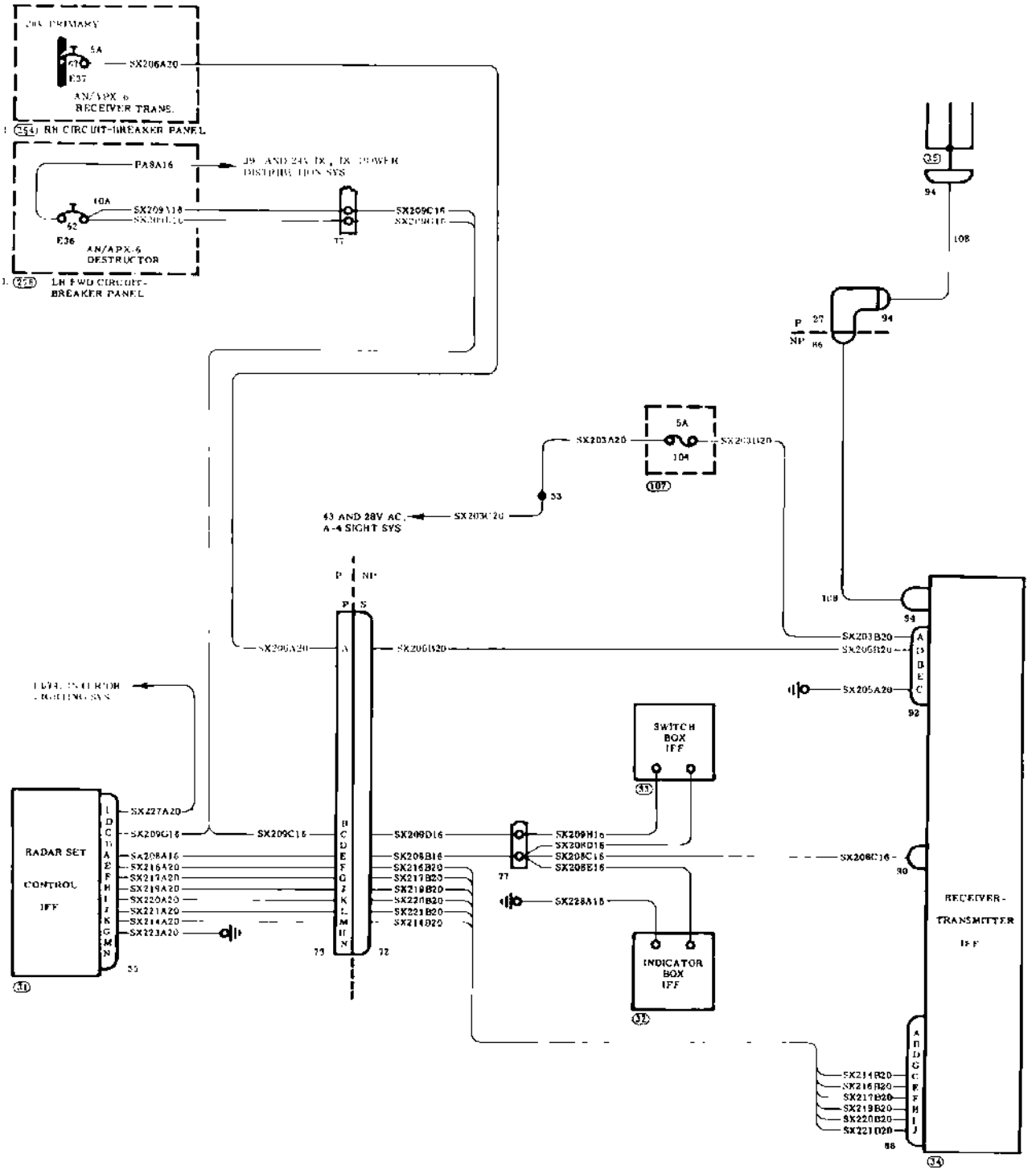
F-86E-1 Through F-86E-10 Airplanes

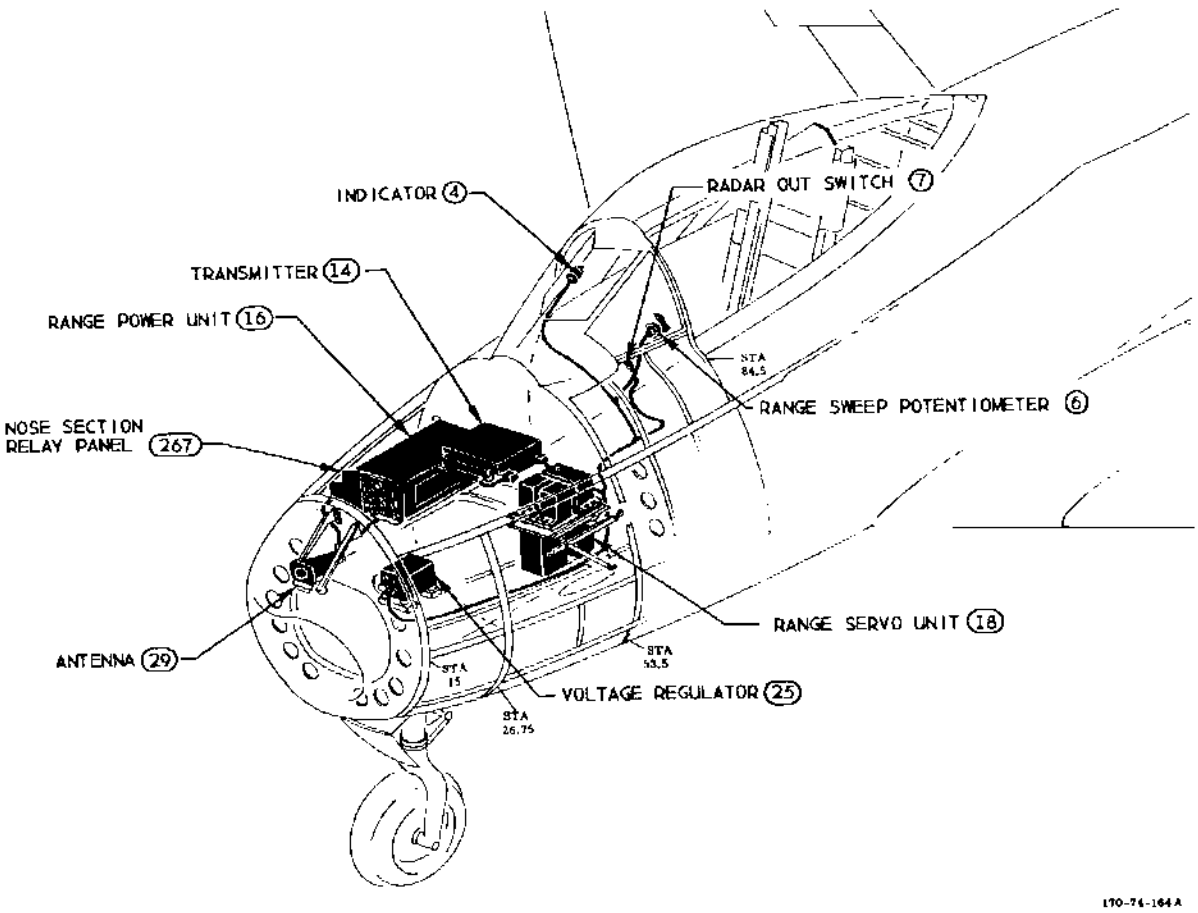


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
27	Adapter	UG-212A/U
31	Control—Radar Set	C-629/APX-6
32	Indicator Box	BC-727
33	Switch Box	SA-3/A
34	Receiver-Transmitter	RT-82/APX-6
35	Antenna Assembly	AT-234/APX
E37	Circuit Breaker—AN/APX-6 IFF	AN3161P5
53	Connector—Butt	35203 (Aircraft-Marine Products)
55	Plug	AN3106B20-27S
62	Circuit Breaker	AN3161P10
67	Circuit Breaker	AN3161P5
72	Plug	AN3108B20-27S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
73	Receptacle—Pressure-tight	AN3100PR20-27P
77	Terminal Strip	NAS45-6-( )
86	Jack—Radio Frequency	UG-61A/U
88	Plug	AN3108B18-1P
90	Plug	AN3108B8S-1P
92	Plug	AN3108B14S-5S
94	Plug—Radio Frequency	UG-59A/U
106	Fuse—5-ampere	AGC5 (Bussmann)
107	Support Assembly	161-74044 (NAA)
108	Cable	RG-8/U
E264	Panel—Right Circuit-breaker	172-54040 (NAA)
E276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)

Figure 10-75. AN/APX-6 IFF

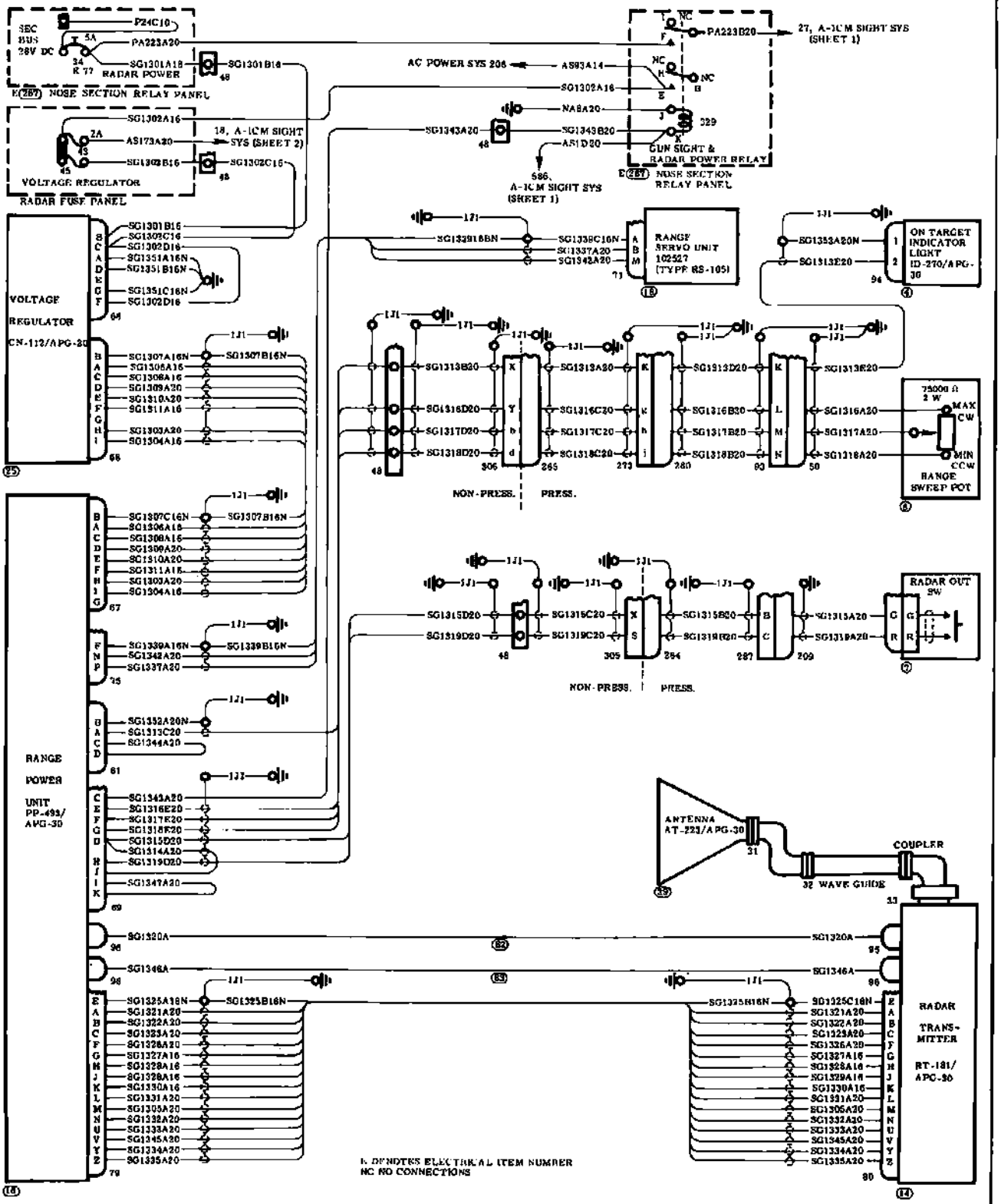

AN/APX-6
RECEIVER TRANS.
RH CIRCUIT-BREAKER PANEL
SX206A20
5A
E37
PA8A16
AN/APX-6
DESTRUCTOR
E36
LH FWD CIRCUIT-BREAKER PANEL
SX203A20
SX203B20
SX203C20
63 AND 28V AC, A-4 SIGHT SYS
SX206A20
SX206B20
SX205A20
SWITCH BOX IFF
INDICATOR BOX IFF
SX228A16
SX227A20
SX209G16
SX209C16
SX208A16
SX216A20
SX217A20
SX219A20
SX220A20
SX221A20
SX214A20
SX223A20
SX208D16
SX208B16
SX216B20
SX217B20
SX219B20
SX220B20
SX221B20
SX214D20
SX209H16
SX208D16
SX208C16
SX208E16
SX208C16
RADAR SET CONTROL IFF
RECEIVER-TRANSMITTER IFF
SX214B20
SX216B20
SX217B20
SX219B20
SX220B20
SX221D20
E DENOTES ELECTRICAL ITEM NUMBER
172-54-5125

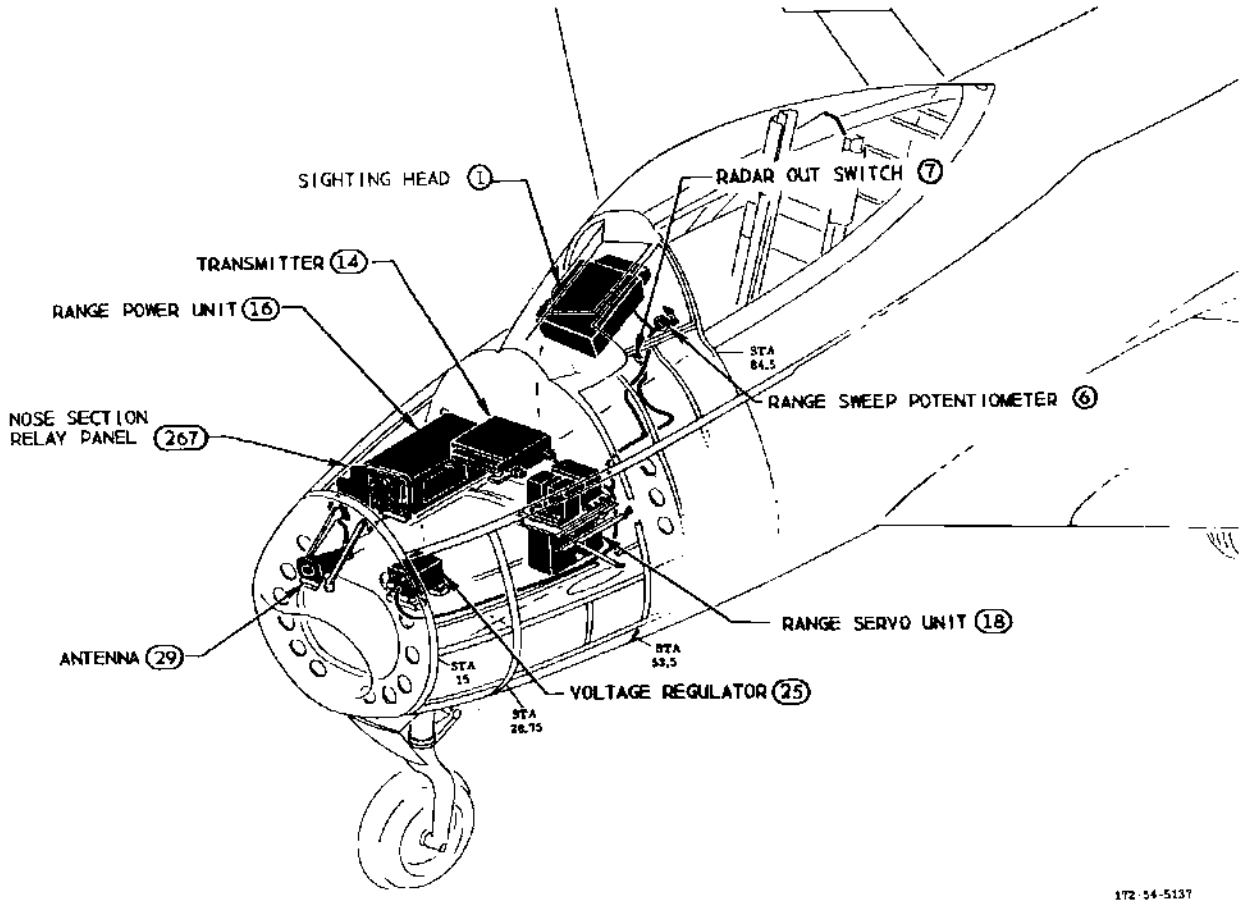


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
4	Light—On-Target Indicator	ID-270/APG-30
6	Potentiometer—Range Sweep 75,000-ohm 2-watt	
7	Switch—Radar-out	
8	Control Unit—Manual Range	170-43059 (NAA)
14	Transmitter—Radar	RT-181/APG-30
16	Power Unit—Range	PP-493/APG-30
18	Servo Unit—Range	102527, Type RS-105
25	Voltage Regulator	CN-112/APG-30
29	Antenna	AT-223/APG-30
31	Wave Guide—Rigid	LC-19288 (Airtron)
32	Wave Guide—Flexible	CG-179A/U (24") (Airtron)
33	Coupler	LC-19287 (Airtron)
34	Circuit Breaker—Radar Power	AN3161P5
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
45	Fuse—Voltage Regulator 115-volt A-C 5-ampere	
48	Terminal Strip	NAS45-6-( )
50	Plug	AN3106-20-27P
61	Plug	AN3106B14S-2P
66	Plug	AN3108B20-15S
67	Plug	AN3106B20-18S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
68	Plug	AN3108B20-18P
69	Plug	AN3106B20-27P
71	Plug	AN3106B22-19S
75	Plug	AN3106B28-17P
E77	Circuit Breaker—Radar Power	AN3161P5
79	Plug	AN3108B32-13P
80	Plug	AN3106B32-13S
82	Cable Assembly	170-74013 (NAA)
83	Cable Assembly	170-74013 (NAA)
93	Receptacle	AN3100-20-27S
94	Plug	80MC-2F1
96	Plug	UC-260/U
209	Plug	AN3108B20-27P
264	Plug	AN3106B28-11P
265	Plug	AN3106B28-12P
E267	Panel—Nose Section Relay	170-54055 (NAA)
273	Plug	AN3106B32-7P
280	Receptacle	AN3100-32-7S
287	Receptacle	AN3102-20-27S
305	Receptacle	AN3100PR28-11S
306	Receptacle	AN3100PR28-12S
329	Power Relay—Gun Sight and Radar	G-39989-A (Guardian Electric)

Figure 10-76. AN/APG-30 Radar—

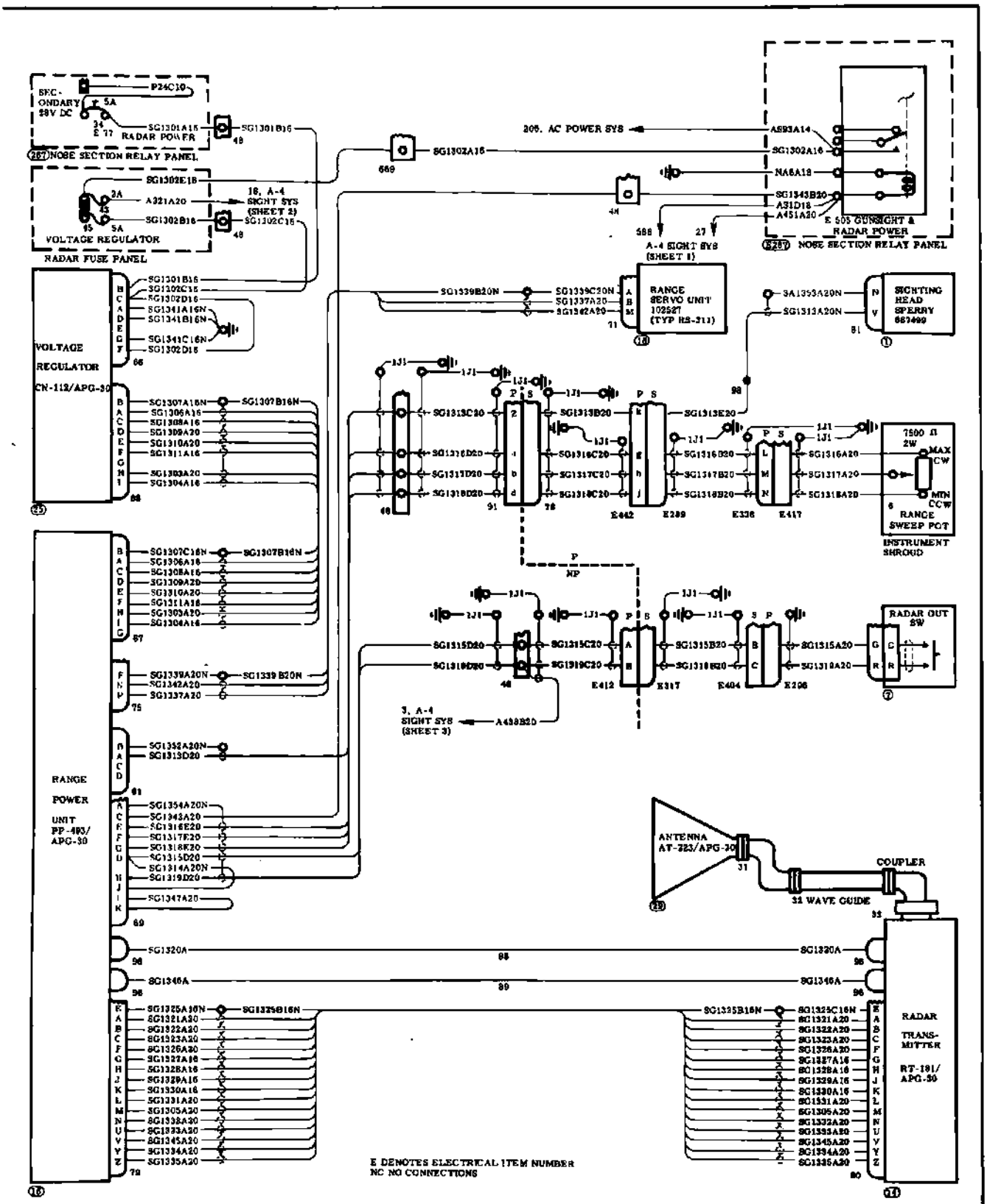

SEC BUS 28V DC
P24C10
5A
PA223A20
34
K 77
SG1301A18
RADAR POWER
SG1301B16
48
E(287) NOSE SECTION RELAY PANEL
SG1302A16
2A
AS173A20
18, A-1CM SIGHT SYS (SHEET 2)
45
SG1302B16
SG1302C16
48
VOLTAGE REGULATOR
RADAR FUSE PANEL
AC POWER SYS 206
AS83A14
SG1302A16
NABA20
SG1343A20
SG1343B20
329
AS1D30
GUN SIGHT & RADAR POWER RELAY
E(287) NOSE SECTION RELAY PANEL
PA223B20
27, A-1CM SIGHT SYS (SHEET 1)
686, A-1CM SIGHT SYS (SHEET 1)
SG1332B18N
SG1338C16N
SG1337A20
SG1342A20
RANGE SERVO UNIT 102527 (TYPE RS-105)
SG1353A20N
SG1313E20
ON TARGET INDICATOR LIGHT ID-270/APG-30
VOLTAGE REGULATOR CN-112/APG-30
SG1307A16N
SG1307B16N
SG1306A16
SG1308A16
SG1309A20
SG1310A20
SG1311A16
SG1303A20
SG1304A16
SG1313B20
SG1313A20
SG1313D20
SG1313E20
SG1316D20
SG1316C20
SG1316B20
SG1316A20
SG1317D20
SG1317C20
SG1317B20
SG1317A20
SG1318D20
SG1318C20
SG1318B20
SG1318A20
7500Ω 2 W
MAX CW
MIN CCW
RANGE SWEEP POT
NON-PRESS.
PRESS.
SG1307C16N
SG1307B16N
SG1306A16
SG1308A16
SG1309A20
SG1310A20
SG1311A16
SG1303A20
SG1304A16
SG1339A16N
SG1339B16N
SG1342A20
SG1337A20
SG1332A20N
SG1313C20
SG1344A20
SG1315D20
SG1315C20
SG1315B20
SG1315A20
SG1319D20
SG1319C20
SG1319B20
SG1319A20
RADAR OUT SW
NON-PRESS.
PRESS.
RANGE POWER UNIT PP-493/APG-30
SG1343A20
SG1316E20
SG1317E20
SG1318E20
SG1315E20
SG1314A20
SG1319E20
SG1347A20
ANTENNA AT-223/APG-30
COUPLER
32 WAVE GUIDE
SG1320A
SG1346A
SG1325A16N
SG1321A20
SG1322A20
SG1323A20
SG1326A20
SG1327A16
SG1328A16
SG1329A16
SG1330A16
SG1331A20
SG1305A20
SG1332A20
SG1333A20
SG1345A20
SG1334A20
SG1335A20
SG1325B16N
SG1325C16N
RADAR TRANSMITTER RT-181/APG-30
I. DENOTES ELECTRICAL ITEM NUMBER
NC NO CONNECTIONS
170-74-165E



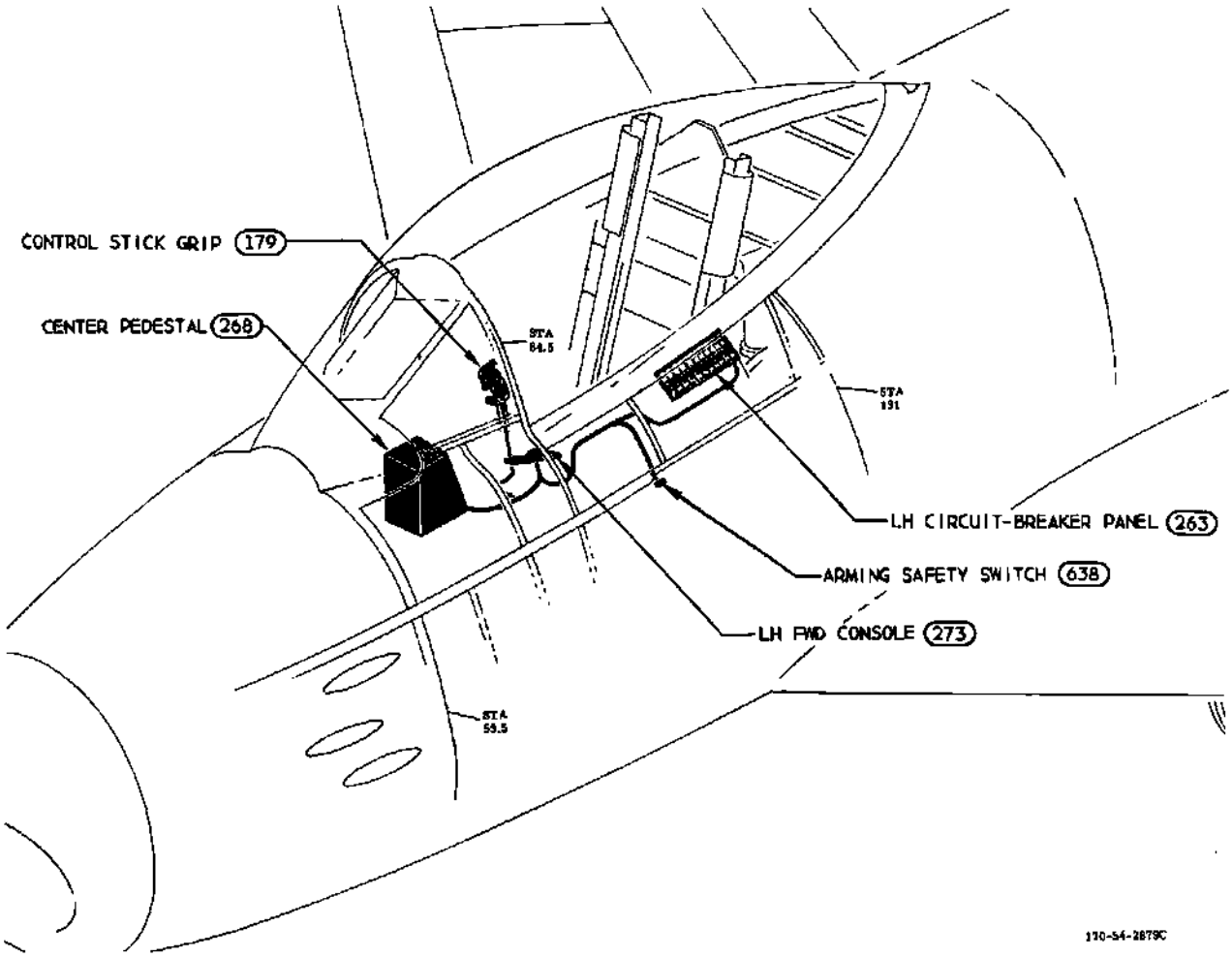
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Head—Sighting	667499 (Sperry)
6	Potentiometer—Range Sweep 75,000-ohm 2-watt	
7	Switch—Radar-out	
14	Transmitter—Radar	RT-181/APG-30
16	Power Unit—Range	PP-493/APG-30
18	Servo Unit—Range	102527, Type RS-105
25	Regulator—Voltage	CN-112/APG-30
29	Antenna	AT-223/APG-30
31	Wave Guide—Rigid	LC-19288 (Airtron)
32	Wave Guide—Flexible	CG-179A/U(24") (Airtron)
33	Coupler	LC-19287 (Airtron)
34	Circuit Breaker—Radar Power	AN3161P5
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
45	Fuse—Voltage Regulator 115-volt A-C 5-ampere	
48	Terminal Strip	NAS45-6-( )
61	Plug	AN3106B14S-2P
E77	Circuit Breaker—Radar Power	AN3161P5
66	Plug	AN3108B20-15S
67	Plug	AN3106B20-18S
68	Plug	AN3108B20-18P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
69	Plug	AN3106B20-27P
71	Plug	AN3106B22-19S
75	Plug	AN3106B28-17P
78	Plug	AN3108B28-12S
79	Plug	AN3108B32-13P
80	Plug	AN3106B32-13S
81	Plug	AN3108B22-14SW
91	Receptacle	AN3100PR28-12P
96	Plug	UG-260/U
E267	Panel—Nose Section Relay	170-54055 (NAA)
E289	Plug—Pedestal Disconnect	AN3106B32-7S
E296	Plug—Control Stick Grip	AN3108B20-27P
E317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
E338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
E404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
E412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
E417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
E442	Receptacle—Pedestal Disconnect	AN3102A32-7P
E505	Relay—Gun Sight Power	AN3312-1
669	Terminal Block—Nose Junction Box	AN3436-2-18

Figure 10-77. AN/APG-30



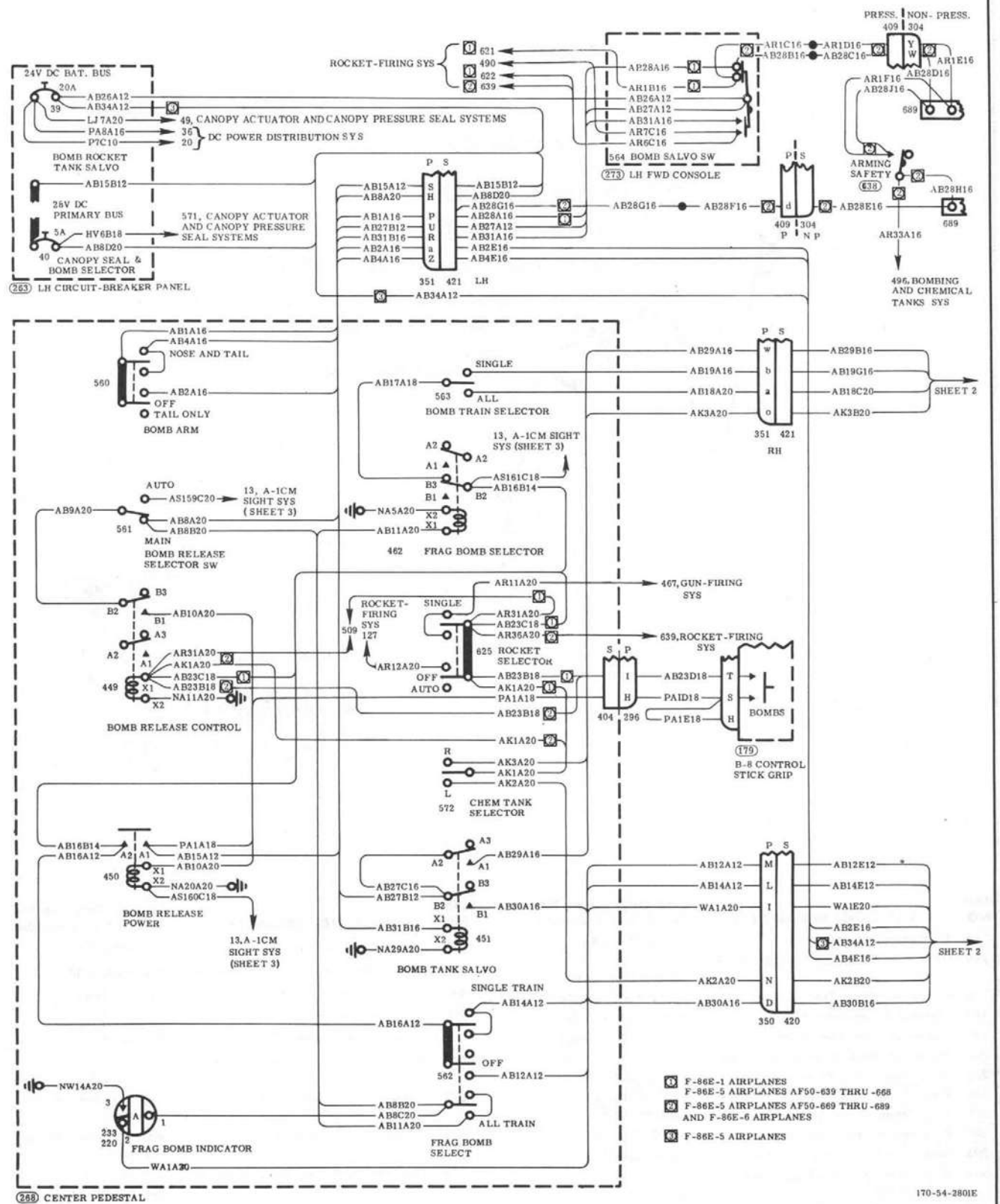
Radar—F-86E-15 Airplanes



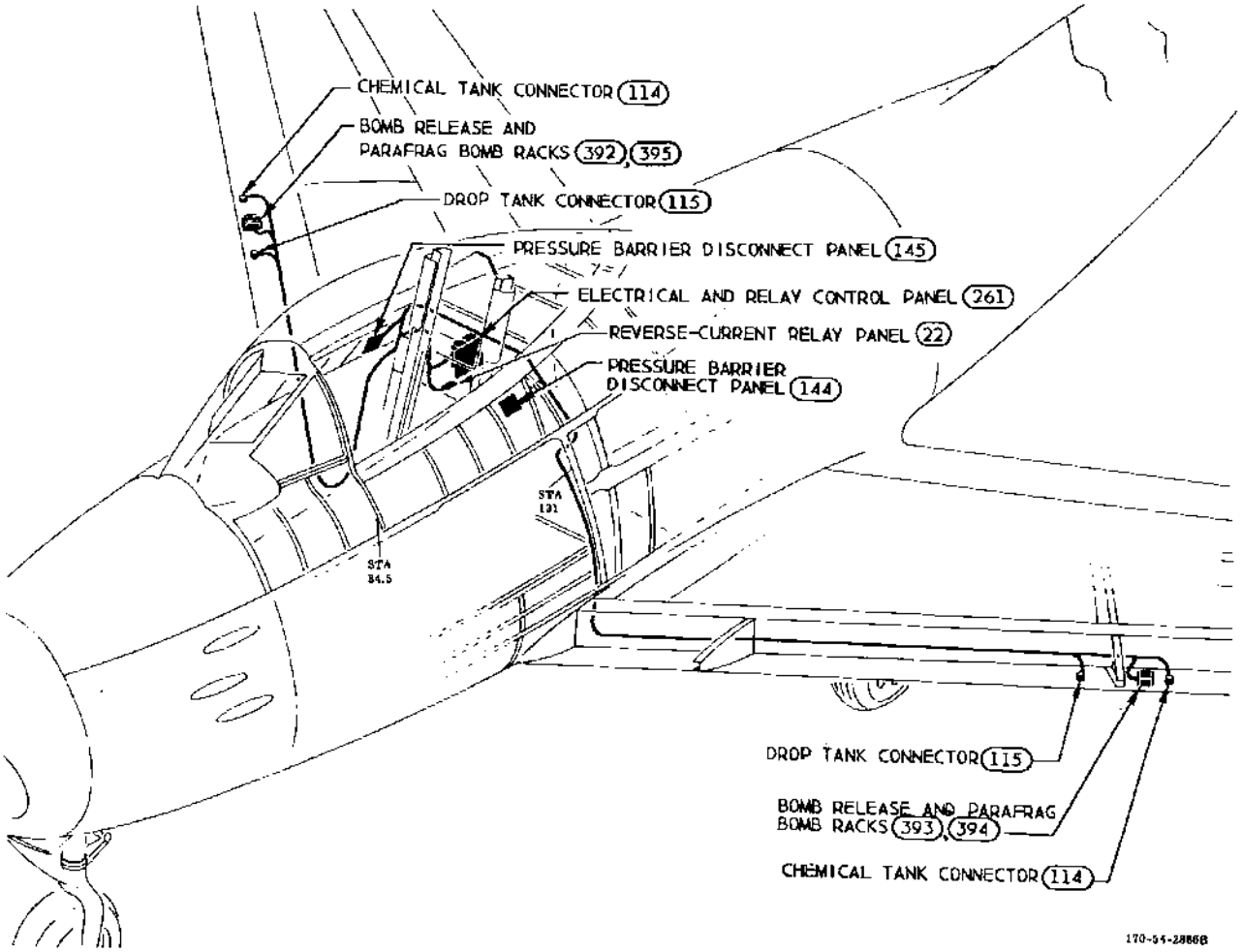
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
179	Grip—Control Stick	AFX50C4064, Type B-8
220	Lamp—Warning	AN3121-313
233	Light Assembly—Parafragmentation Bomb Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	161-54028-10 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
451	Relay—Bomb-Rocket-Tank Salvo	237EAU (Leach)
462	Relay—Parafragmentation Bomb Selector	237EAU (Leach)
560	Switch—Bomb-arming	AN3021-1
561	Switch—Bomb Release Selector	AN3021-3
562	Switch—Parafragmentation Bomb Selector	AN3226-1
563	Switch—Bomb Train Selector	AN3021-1
564	Switch—Bomb Salvo	AN3216-1
572	Switch—M-10 Chemical Tank Selector	AN3021-1
625	Switch—Rocket Selector	AN3027-1
638	Switch—Arming Safety	AN3210-1
689	Terminal Block—Arming Safety Switch	AN3436-2-4

Figure 10-78. Bombing and Chemical Tank Systems—



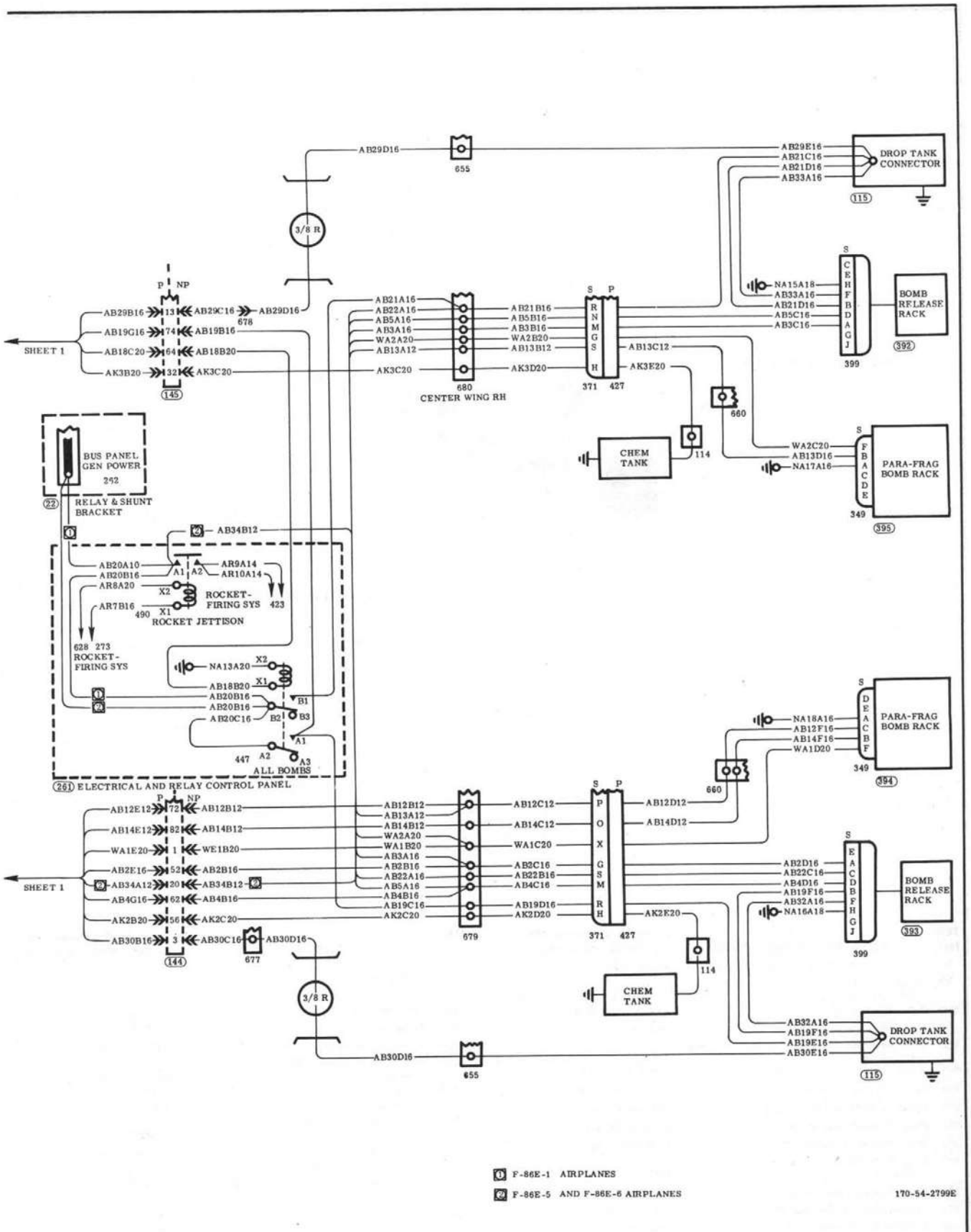
F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)



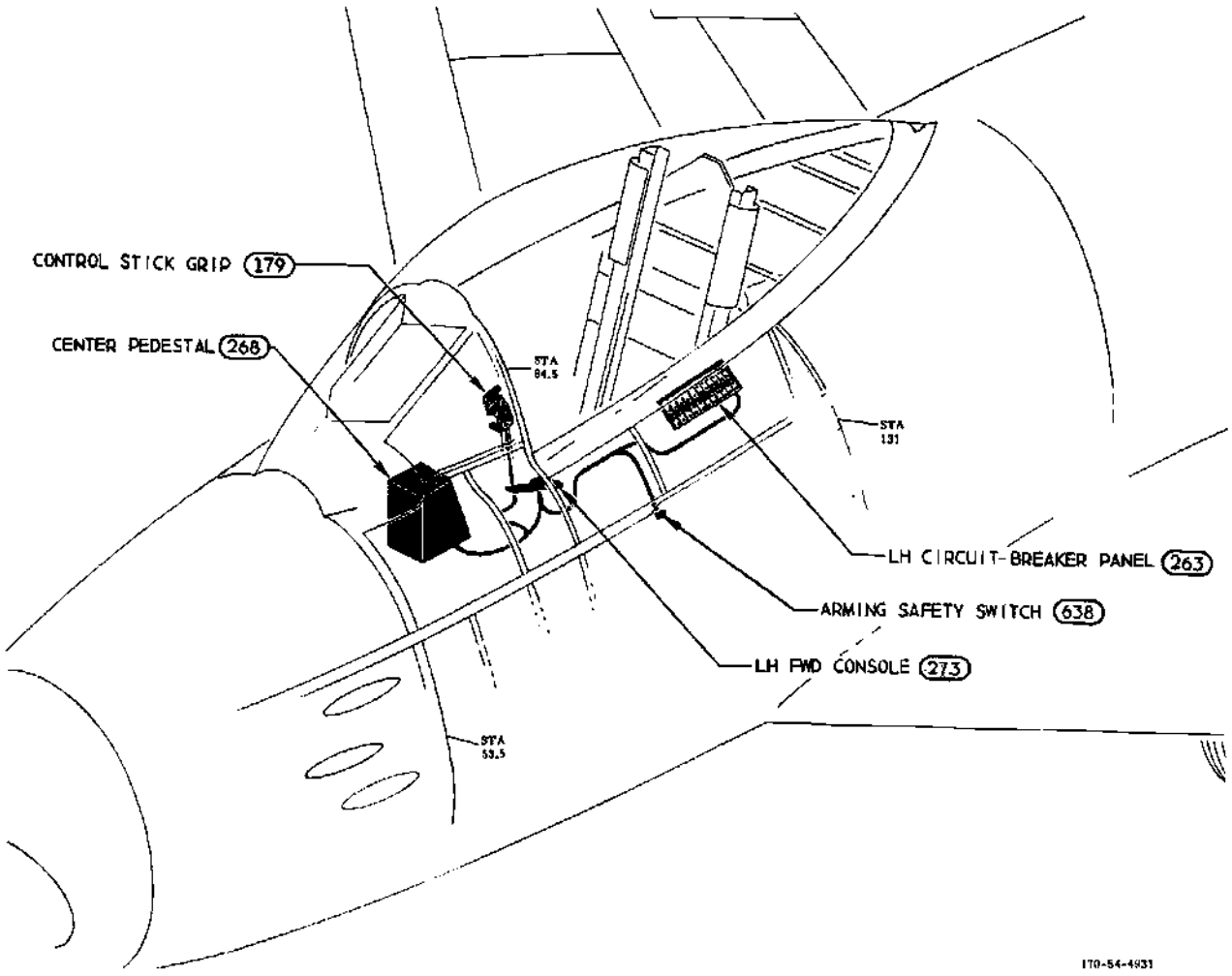
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
22	Bracket—Relay and Shunt	151-54099 (NAA)
114	Connector—Chemical Tank Binding Post	117-54241 (NAA)
115	Connector—Drop Tank Release	336 (American Radio)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
349	Plug—Parafragmentation Bomb Rack	AN3107B18-12S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
392	Rack—Right-hand Bomb Release	24993, Type S-2
393	Rack—Left-hand Bomb Release	24993, Type S-2
394	Rack—Left-hand Parafragmentation Bomb Release	24938, Type R-3
395	Rack—Right-hand Parafragmentation Bomb Release	24938, Type R-3

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
399	Receptacle—S-2 Bomb Rack	AN3101A18-1S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
447	Relay—All Bombs	237EAU (Leach)
490	Relay—Rocket Jettison	AN3370-1
655	Terminal Block—Bomb Salvo	AN3436-2-2
660	Terminal Block—Parafragmentation Bomb	AN3436-2-2
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9

Figure 10-78. Bombing and Chemical Tank Systems—F-86E-1,



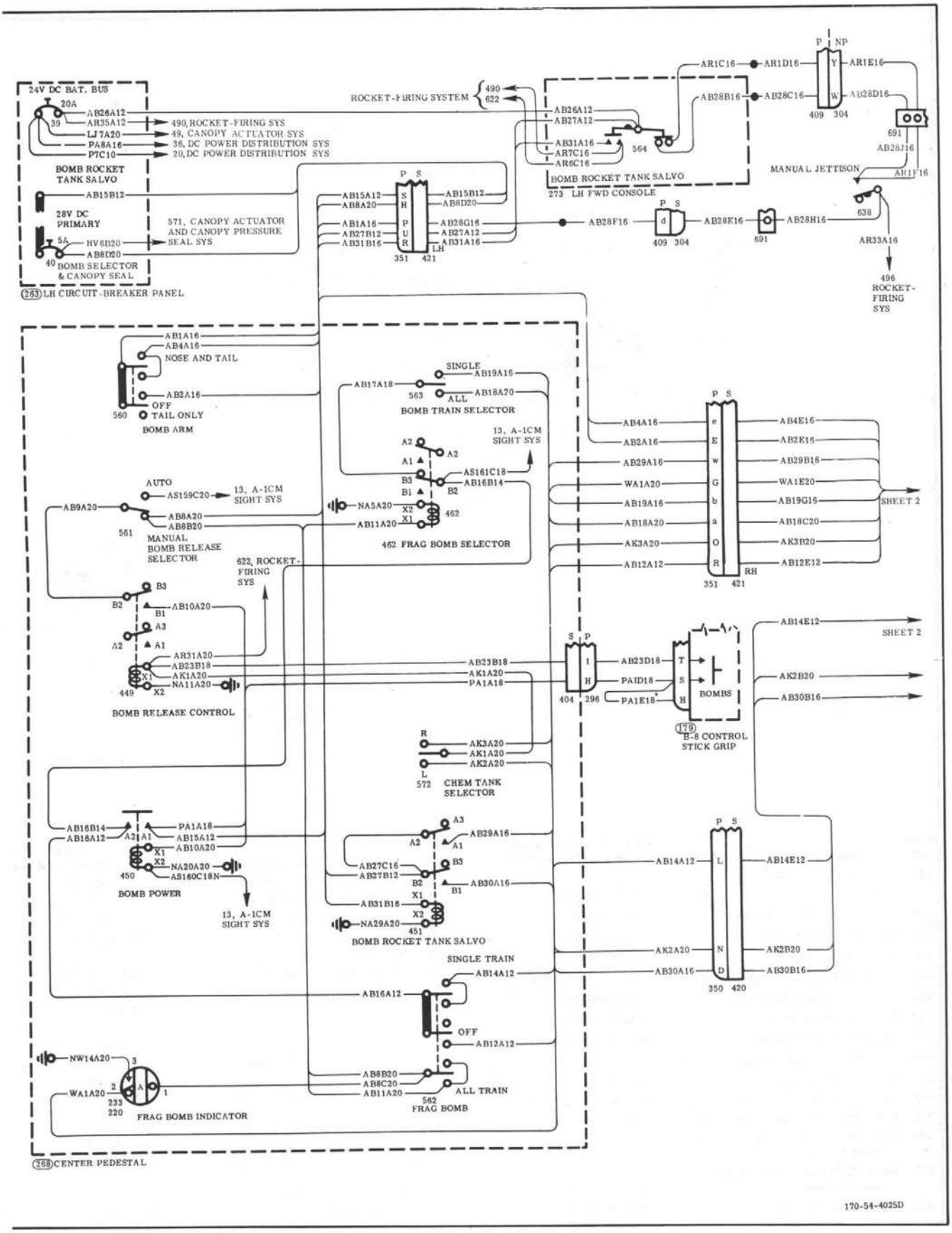
F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)



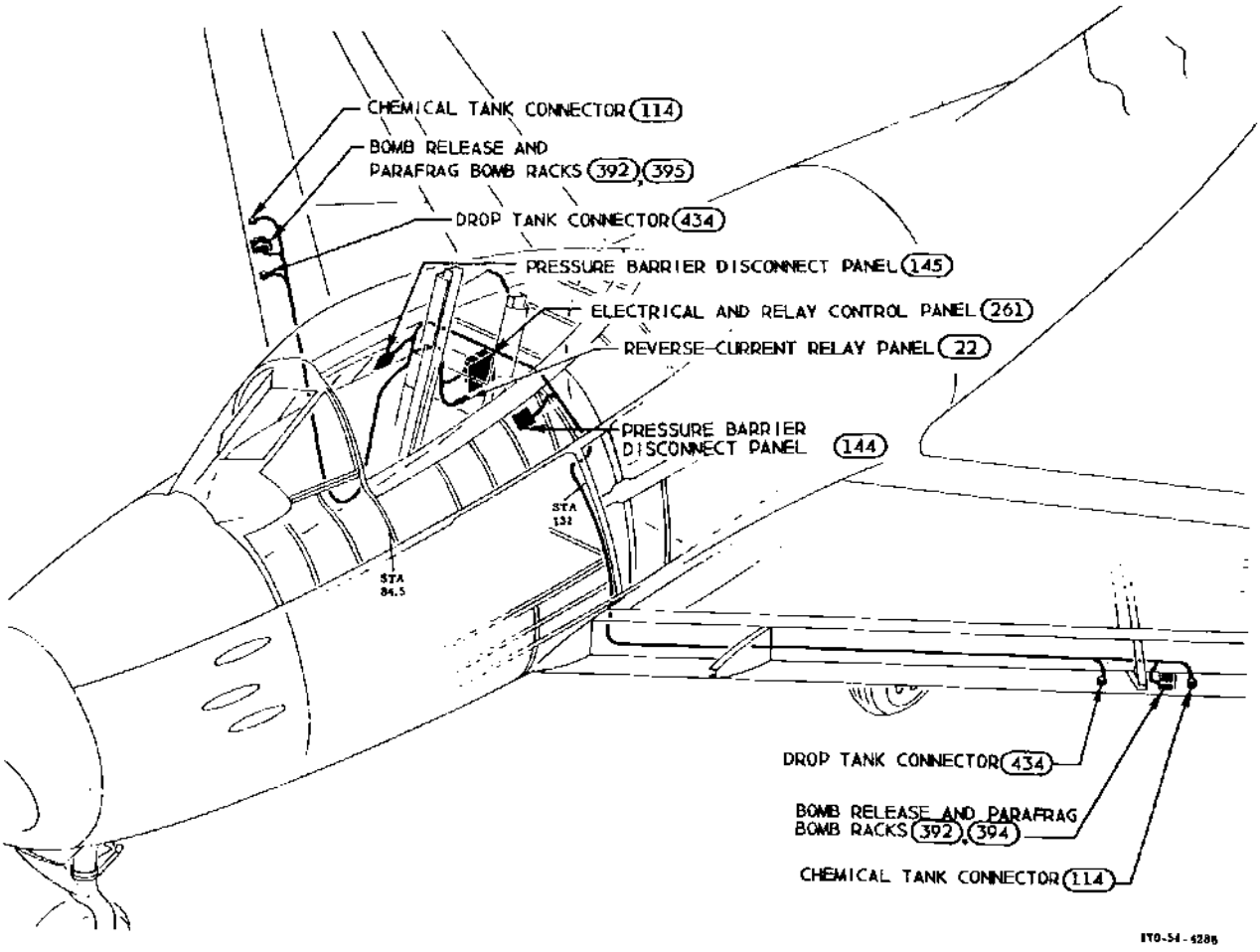
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
179	Grip—Control Stick	AFX50C4064 (B-8)
220	Lamp—Warning	AN3121-313
233	Light Assembly—Parafragmentation Bomb Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
451	Relay—Bomb-Rocket-Tank Salvo	237EAU (Leach)
462	Relay—Parafragmentation Bomb Selector	237EAU (Leach)
560	Switch—Bomb-arming	AN3021-1
561	Switch—Bomb Release Selector	AN3021-3
562	Switch—Parafragmentation Bomb Selector	AN3226-1
563	Switch—Bomb Train Selector	AN3021-1
564	Switch—Bomb Salvo	AN3216-1
572	Switch—M-10 Chemical Tank Selector	AN3021-1
638	Switch—Manual Jettison Arming	AN3210-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-79. Bombing and Chemical Tank Systems—F-86E-10



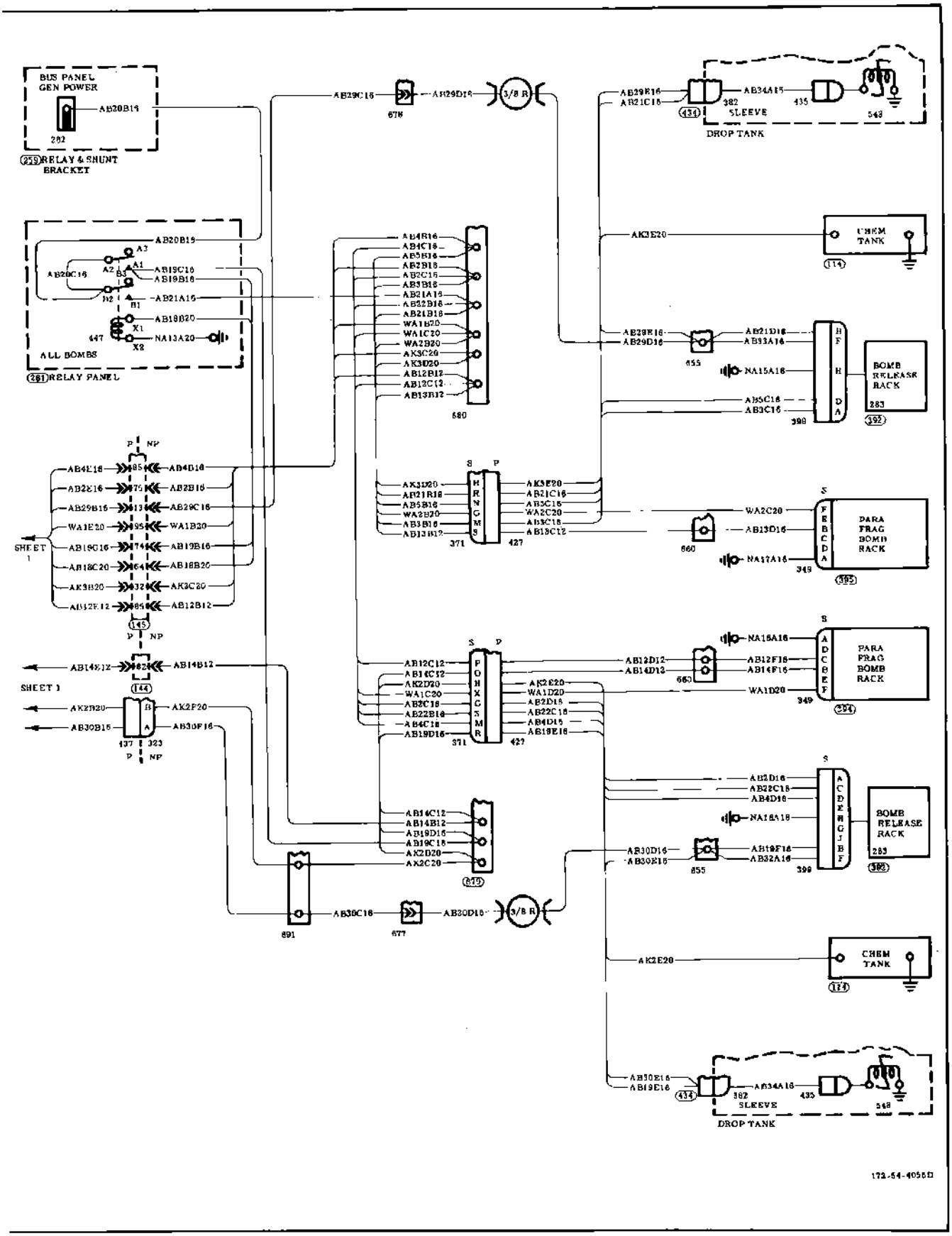
Airplanes AF51-2718 Through -2727 (Sheet 1 of 2)



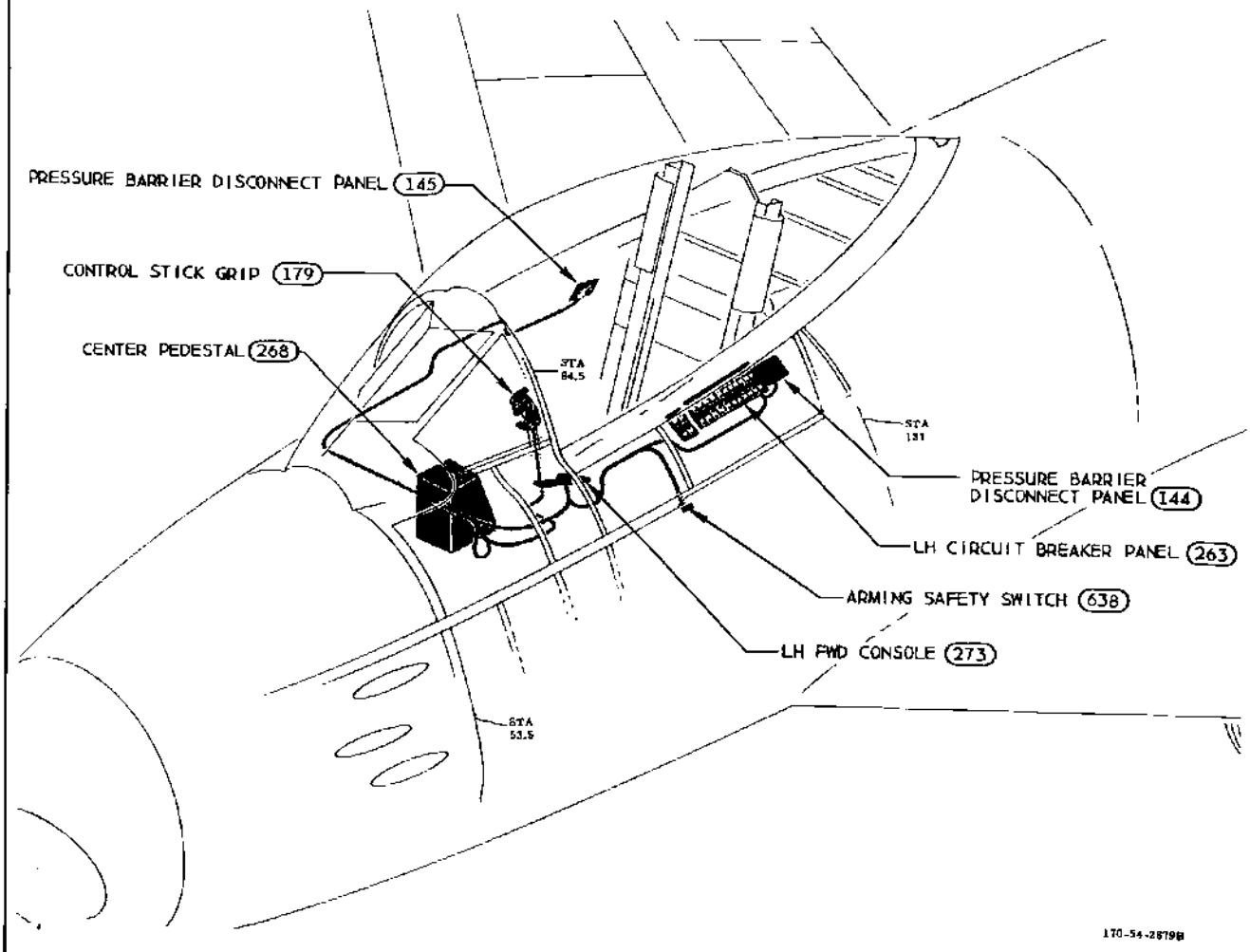
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
114	Connector—Chemical Tank Binding Post	117-54241 (NAA)
144	Disconnect—Left-hand Pressure	YHS1005-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS1005-6 (Burndy)
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
283	Plug—S-2 Bomb Rack	AN3106B18-1P
323	Plug—Gun Bay Pressure	AN3106B24-28S
349	Plug—Parafragmentation Bomb Rack	AN3107B18-12S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
382	Plug—Drop Tank Disconnect	207 (American Radio)
392	Rack—Right-hand Bomb Release	24993, Type S-2
394	Rack—Left-hand Parafragmentation Bomb Release	24938, Type R-3
395	Rack—Right-hand Parafragmentation Bomb Release	24938, Type R-3
399	Receptacle—S-2 Bomb Rack	AN3101A18-1S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
434	Receptacle—Drop Tank Disconnect	336 (American Radio)
435	Receptacle—Engine Disconnect	AN3100A28-12P
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
447	Relay—All Bombs	237EAU (Leach)
548	Solenoid—Drop Tank Jettison	C-8001-1 (Leland) 175-48320 (NAA)
655	Terminal Block—Bomb Salvo	AN3436-2-2
660	Terminal Block—Parafragmentation Bomb	AN3436-2-2
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-79. Bombing and Chemical Tank Systems—F-86E-10



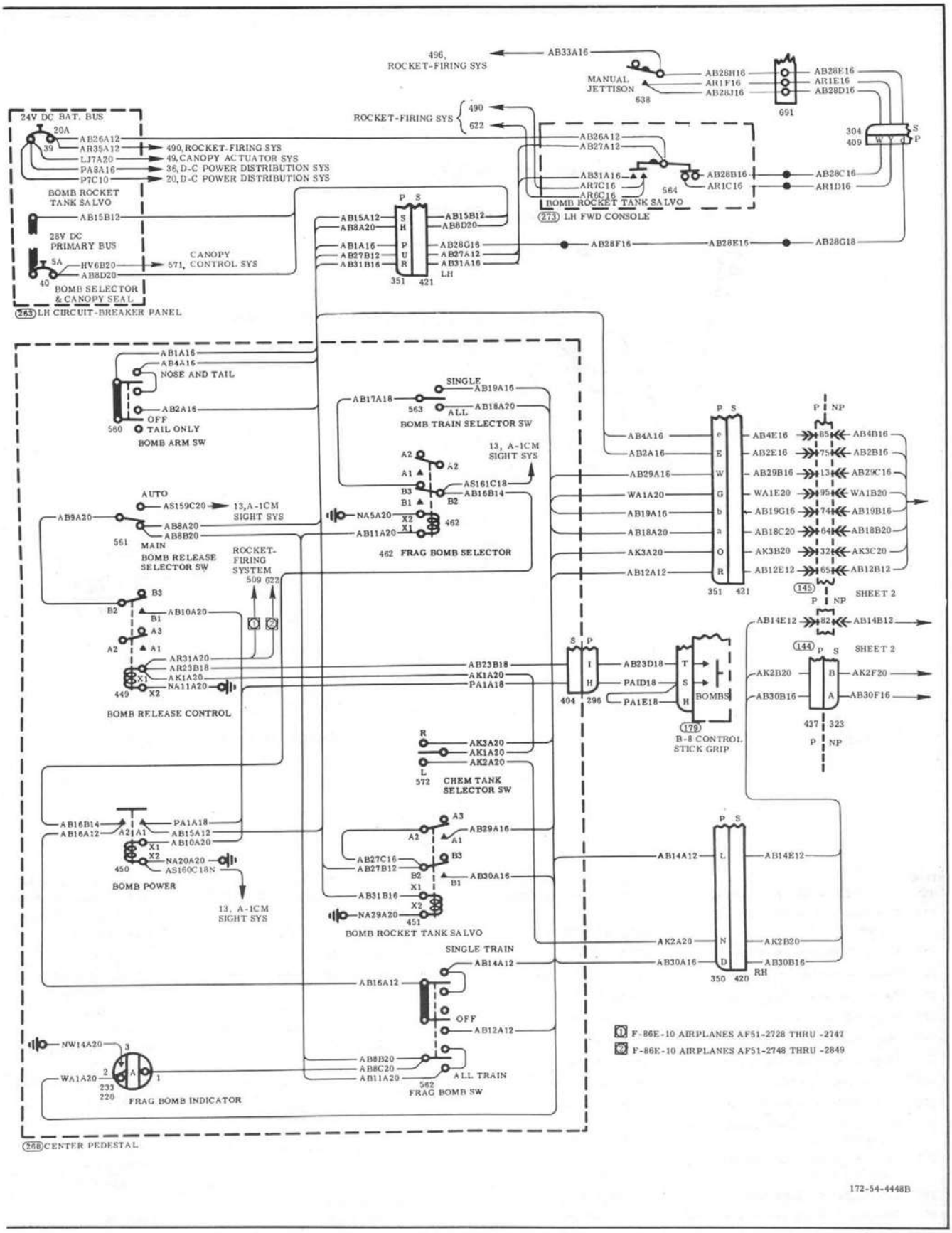
Airplanes AF51-2718 Through -2727 (Sheet 2 of 2)



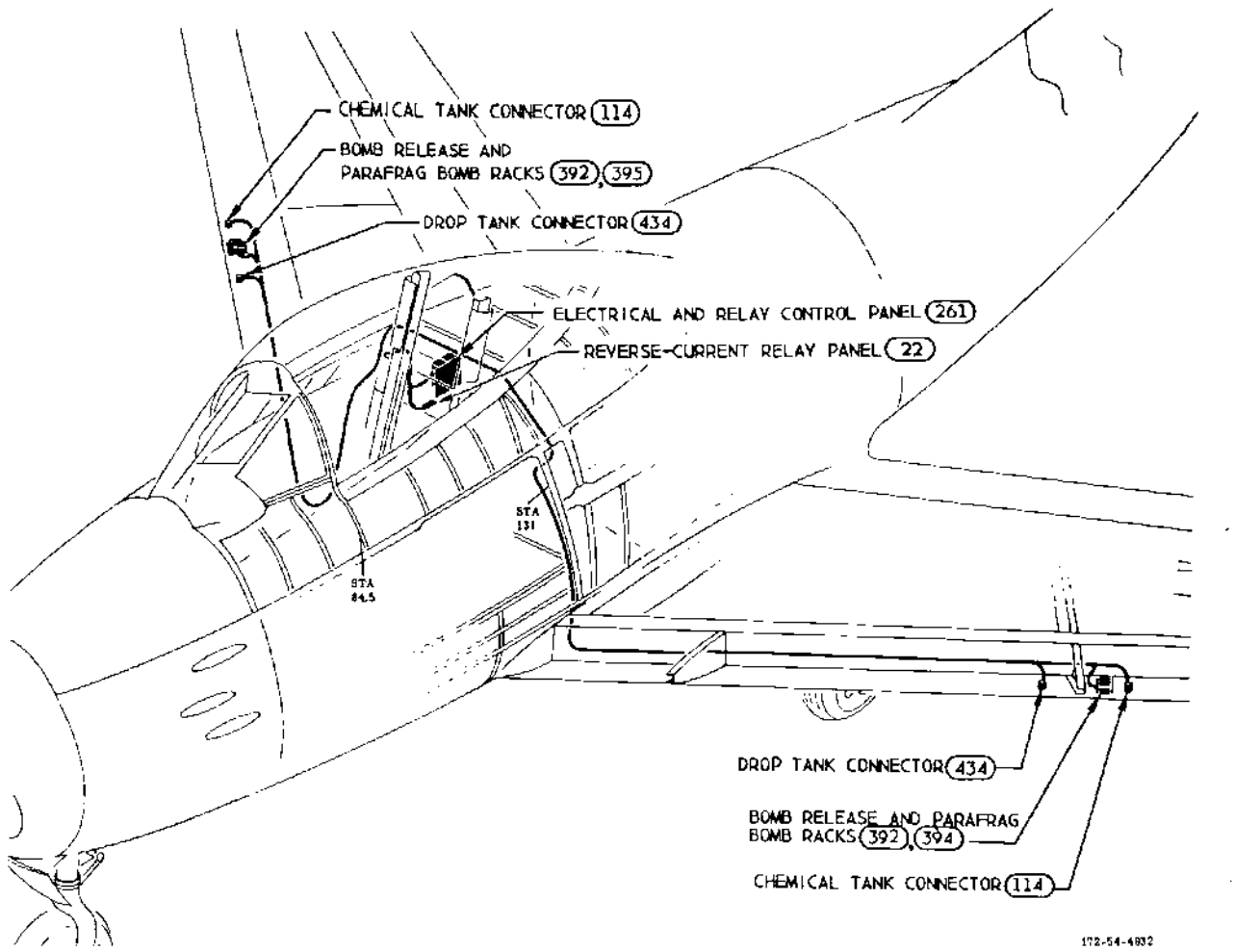
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
144	Disconnect—Left-hand Pressure	YHS1005-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS1005-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
220	Lamp—Warning	AN3121-313
233	Light Assembly—Parafragmentation Bomb Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
323	Plug—Gun Bay Pressure	AN3106B24-28S
350	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11P
351	Plug—Pedestal Disconnect	AN3106A32-7P
404	Receptacle—8-8 Control Stick Grip	AN3102A20-27S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
420	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3100A28-11S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
451	Relay—Bomb-Rocket-Tank Salvo	237EAU (Leach)
462	Relay—Parafragmentation Bomb Selector	237EAU (Leach)
560	Switch—Bomb-arming	AN3021-1
561	Switch—Bomb Release Selector	AN3021-3
562	Switch—Parafragmentation Bomb Selector	AN3226-1
563	Switch—Bomb Train Selector	AN3021-1
564	Switch—Bomb Salvo	AN3216-1
572	Switch—M-10 Chemical Tank Selector	AN3021-1
638	Switch—Manual Jettison Arming	AN3210-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-80. Bombing and Chemical Tank Systems—



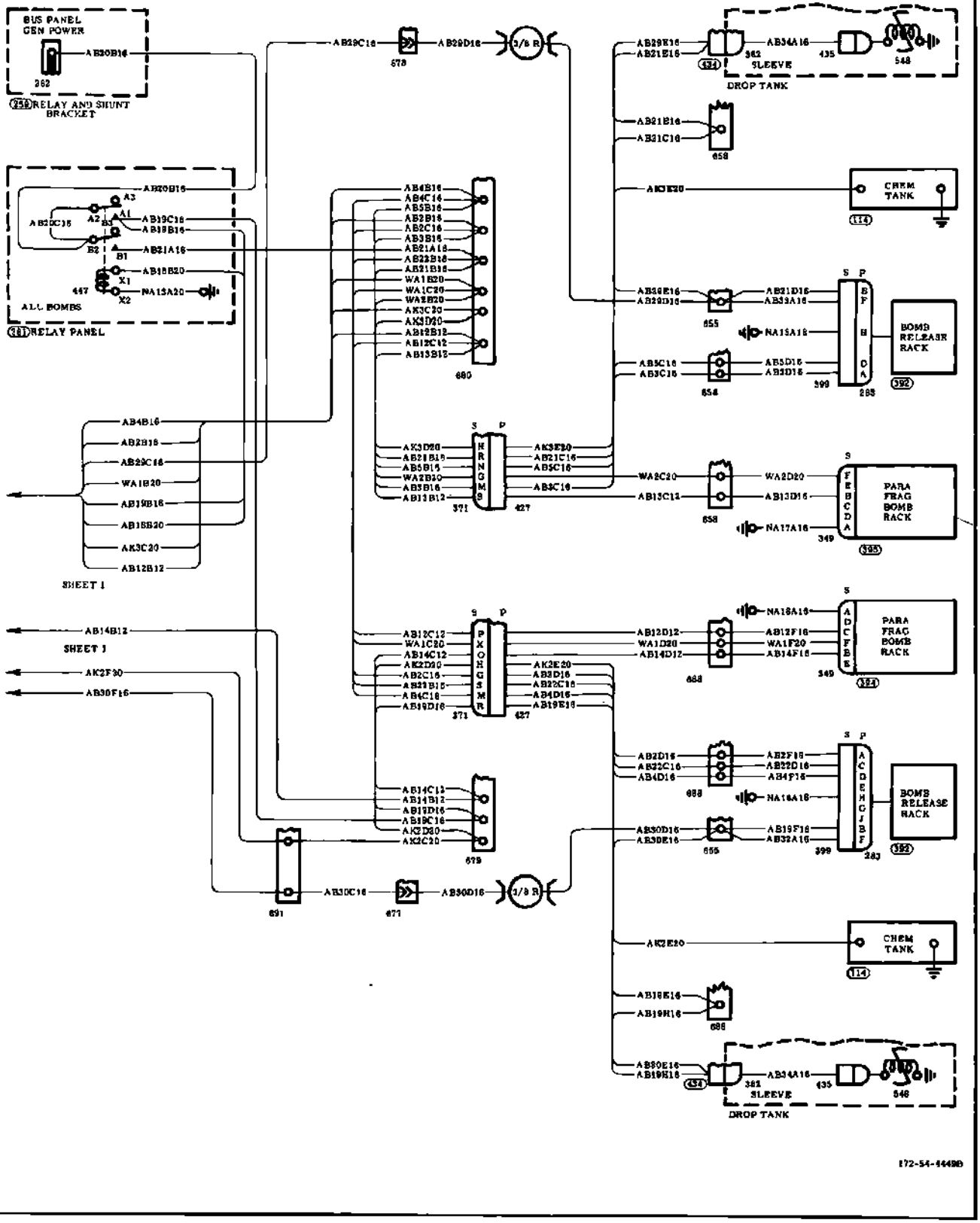
F-86E-10 Airplanes AF51-2728 Through -2849 (Sheet1 of 2)



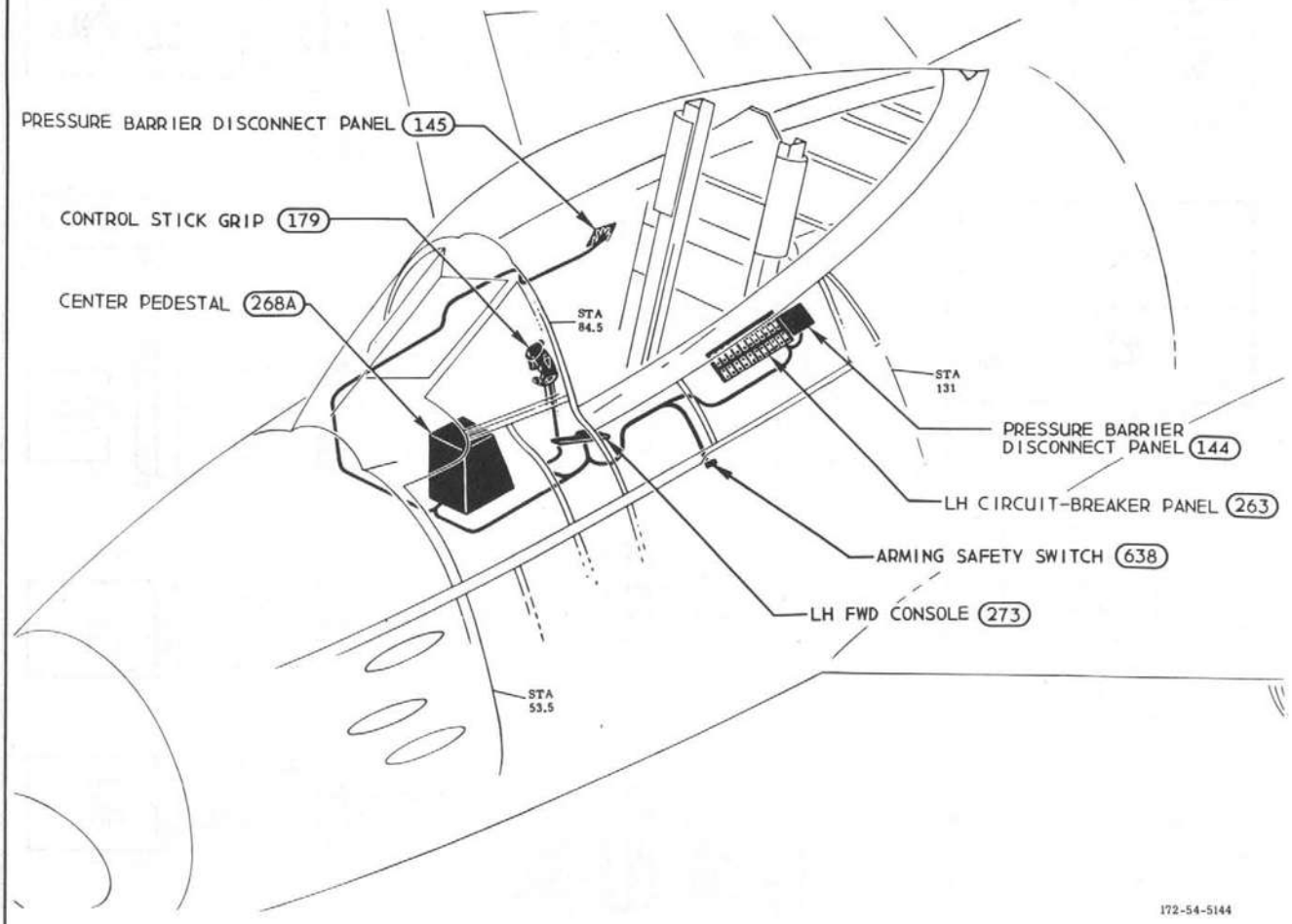
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
114	Connector—Chemical Tank Binding Post	117-54241 (NAA)
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
261	Panel—Aft Radio Compartment Relay	151-5412240 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
283	Plug—S-2 Bomb Rack	AN3106B18-1P
349	Plug—Parafragmentation Bomb Rack	AN3107B18-12S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
382	Plug—Drop Tank Disconnect	207 (American Radio)
392	Rack—Right-hand Bomb Release	24993, Type S-2
394	Rack—Left-hand Parafragmentation Bomb Release	24938, Type R-3
395	Rack—Right-hand Parafragmentation Bomb Release	24938, Type R-3
399	Receptacle—S-2 Bomb Rack	AN3101A18-1S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
434	Receptacle—Drop Tank Disconnect	336 (American Radio)
435	Receptacle—Engine Disconnect	AN3100A28-12P
447	Relay—All Bombs	237EAU (Leach)
548	Solenoid—Drop Tank Jettison	C-8001-1 (Leland) 175-48320 (NAA)
655	Terminal Block—Bomb Salvo	AN3436-2-2
658	Terminal Block—Right Forward Wing	AN3436-2-10
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-9
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
688	Terminal Block—Left Wing Forward.	AN3436-2-12
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-80. Bombing and Chemical Tank Systems—F-86E-10



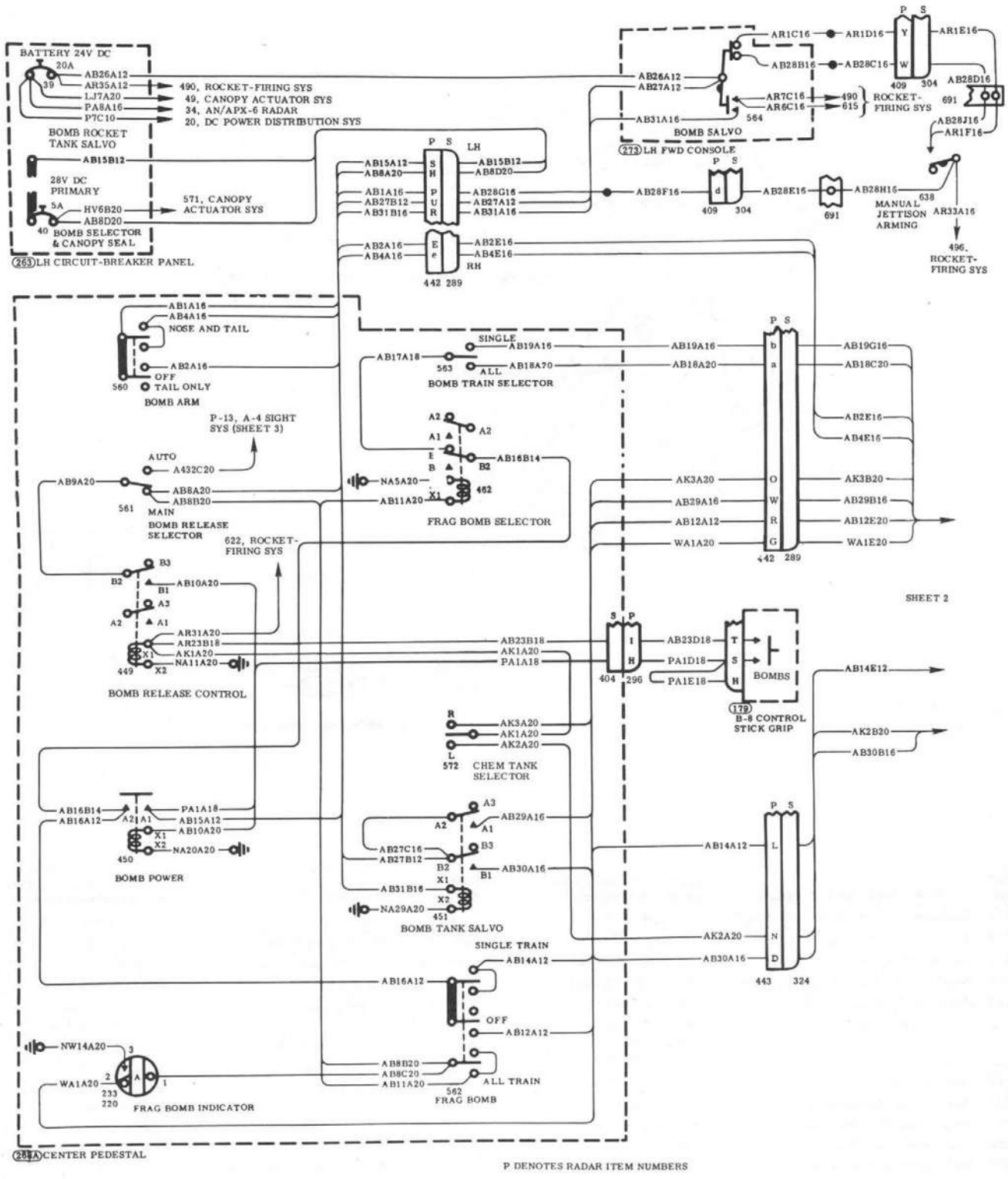
Airplanes AF51-2728 Through -2849 (Sheet 2 of 2)



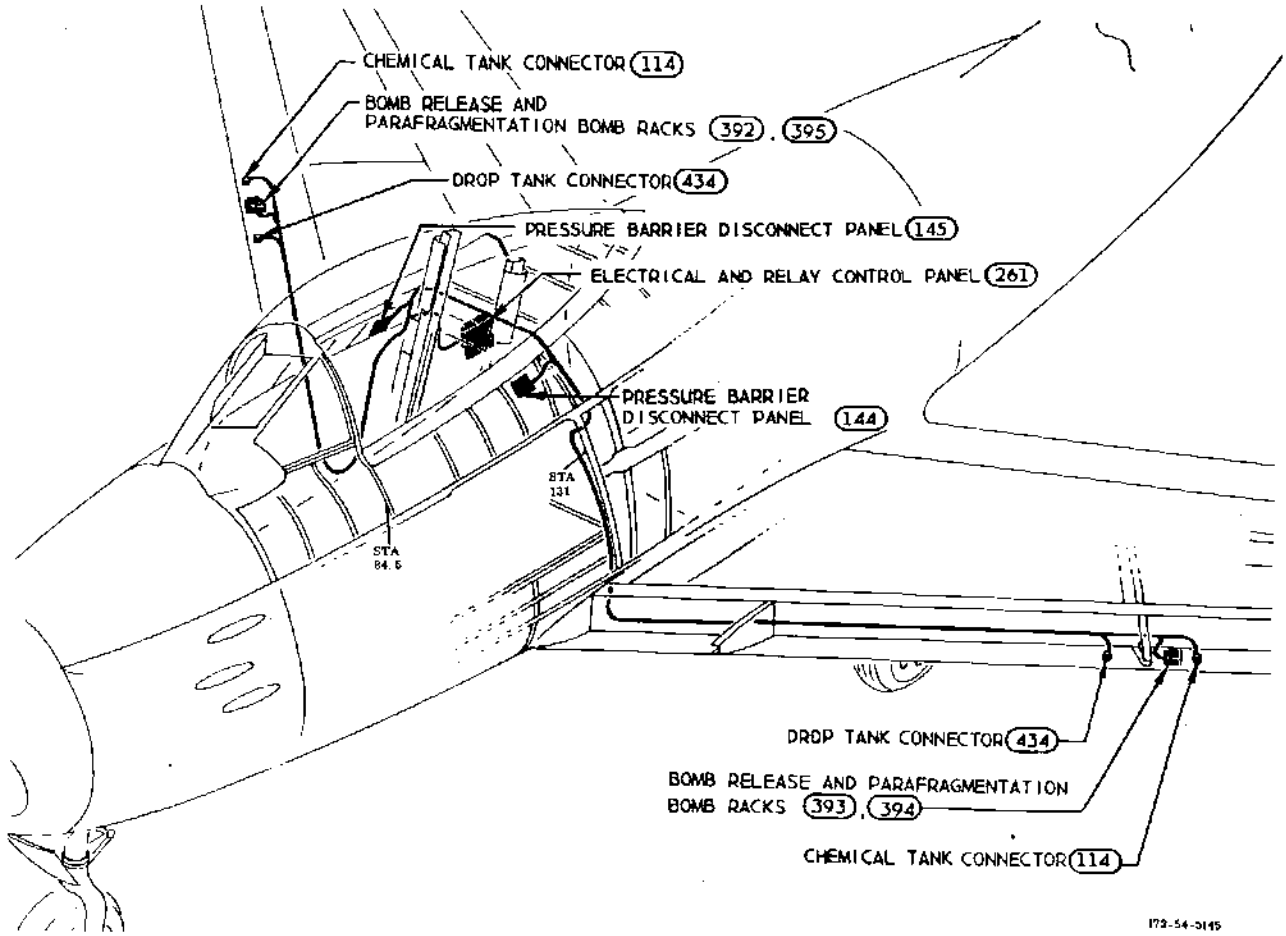
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
220	Lamp—Warning	AN3121-313
233	Light Assembly—Parafragmentation Bomb Indicator	AN3157-4
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
323	Plug—Gun Bay Pressure	AN3106B24-28S
324	Plug—Pedestal Left-hand Inboard Disconnect	AN3106B28-11S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
443	Receptacle—Pedestal Left-hand Inboard Disconnect	AN3102A28-11P
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
451	Relay—Bomb-Rocket-Tank Salvo	237EAU (Leach)
462	Relay—Parafragmentation Bomb Selector	237EAU (Leach)
560	Switch—Bomb-arming	AN3021-1
561	Switch—Bomb Release Selector	AN3021-3
562	Switch—Parafragmentation Bomb Selector	AN3226-1
563	Switch—Bomb Train Selector	AN3021-1
638	Switch—Manual Jettison Arming	AN3210-1
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-81. Bombing and Chemical Tank Systems—



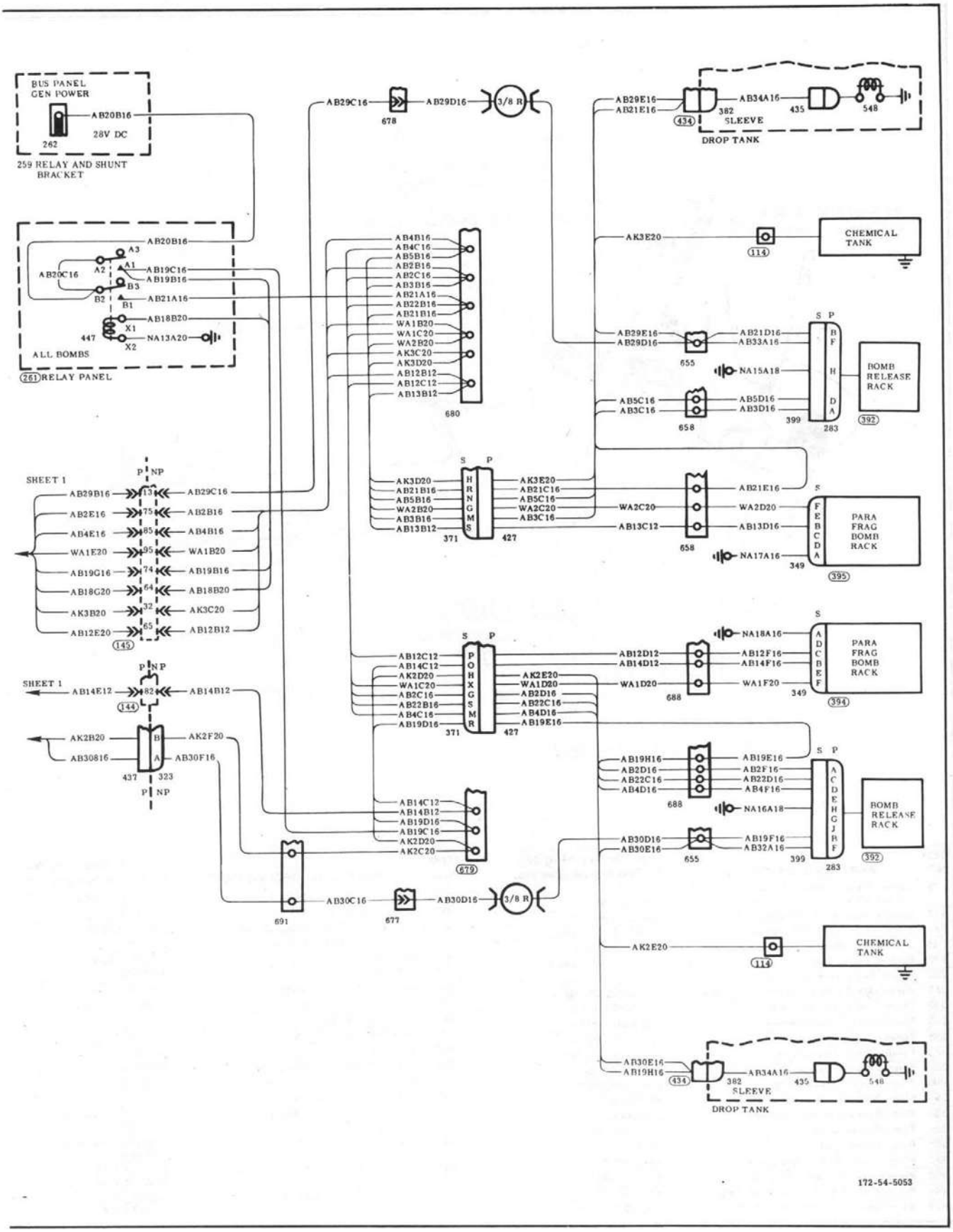
F-86E-15 Airplanes (Sheet 1 of 2)



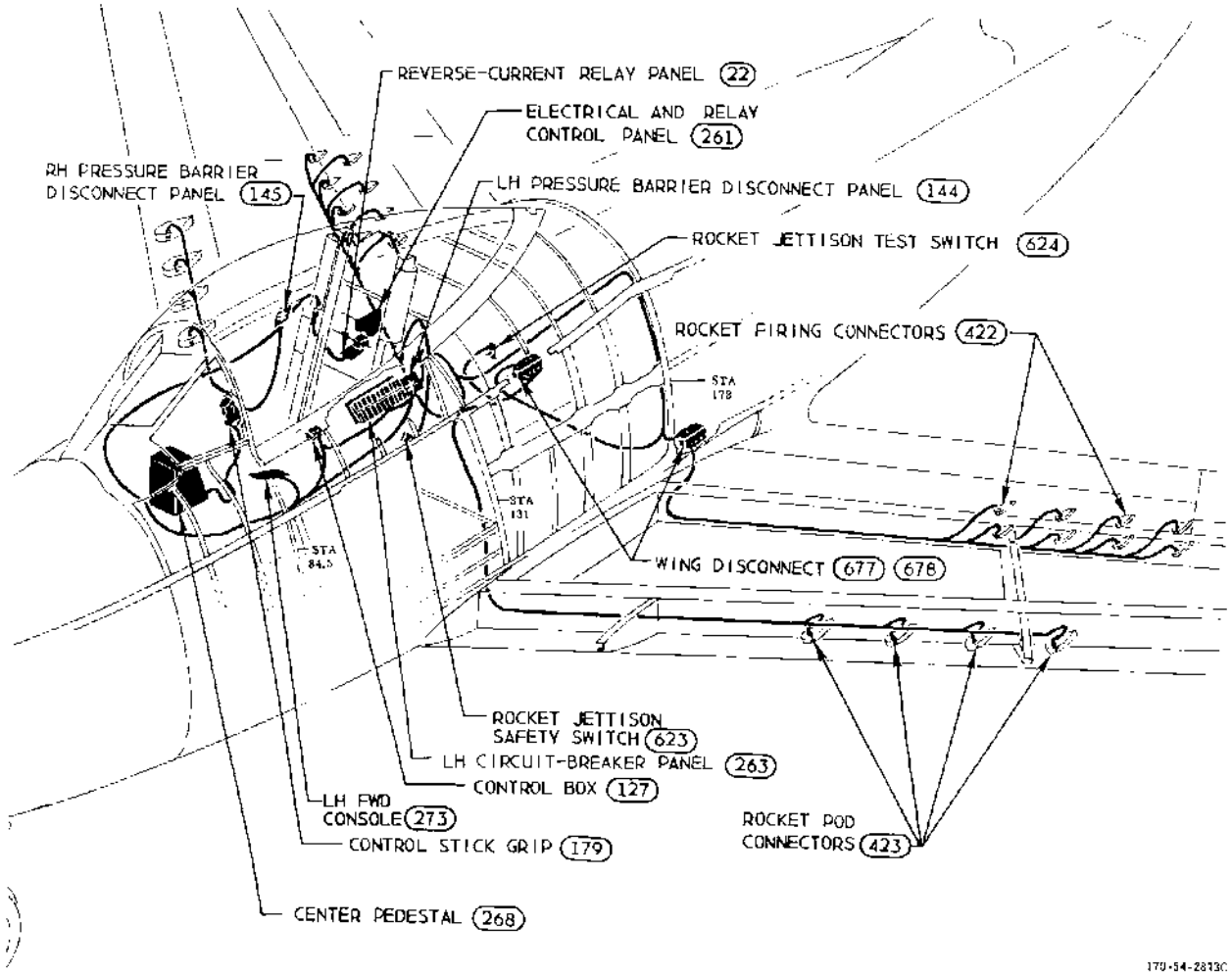
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
114	Connector—Chemical Tank Binding Post	117-54241 (NAA)
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
283	Plug—S-2 Bomb Rack	AN3106B18-1P (Furnished With Rack)
323	Plug—Gun Bay Pressure	AN3106B24-28S
349	Plug—Parafragmentation Bomb Rack	AN3107B18-12S
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
382	Plug—Drop Tank Disconnect	207 (American Radio)
392	Rack—Right-hand Bomb Release	24933, Type S-2
393	Rack—Left-hand Bomb Release	24993, Type S-2
394	Rack—Left-hand Parafragmentation Bomb Release	24938, Type R-3
395	Rack—Right-hand Parafragmentation Bomb Release	24938, Type R-3
399	Receptacle—S-2 Bomb Rack	AN3101A18-1S
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
434	Receptacle—Drop Tank Disconnect	336 (American Radio)
435	Receptacle—Engine Disconnect	AN3100A28-12P
437	Receptacle—Gun Bay Pressure	AN3100C24-28P
447	Relay—All Bombs	237EAU (Leach)
548	Solenoid—Drop Tank Jettison	C-8001-1 (Leland) 175-48320 (NAA)
655	Terminal Block—Bomb Salvo	AN3436-2-2
658	Terminal Block—Right Forward Wing	AN3436-2-10
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
688	Terminal Block—Left Wing Forward	AN3436-2-12
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-81. Bombing and Chemical Systems—



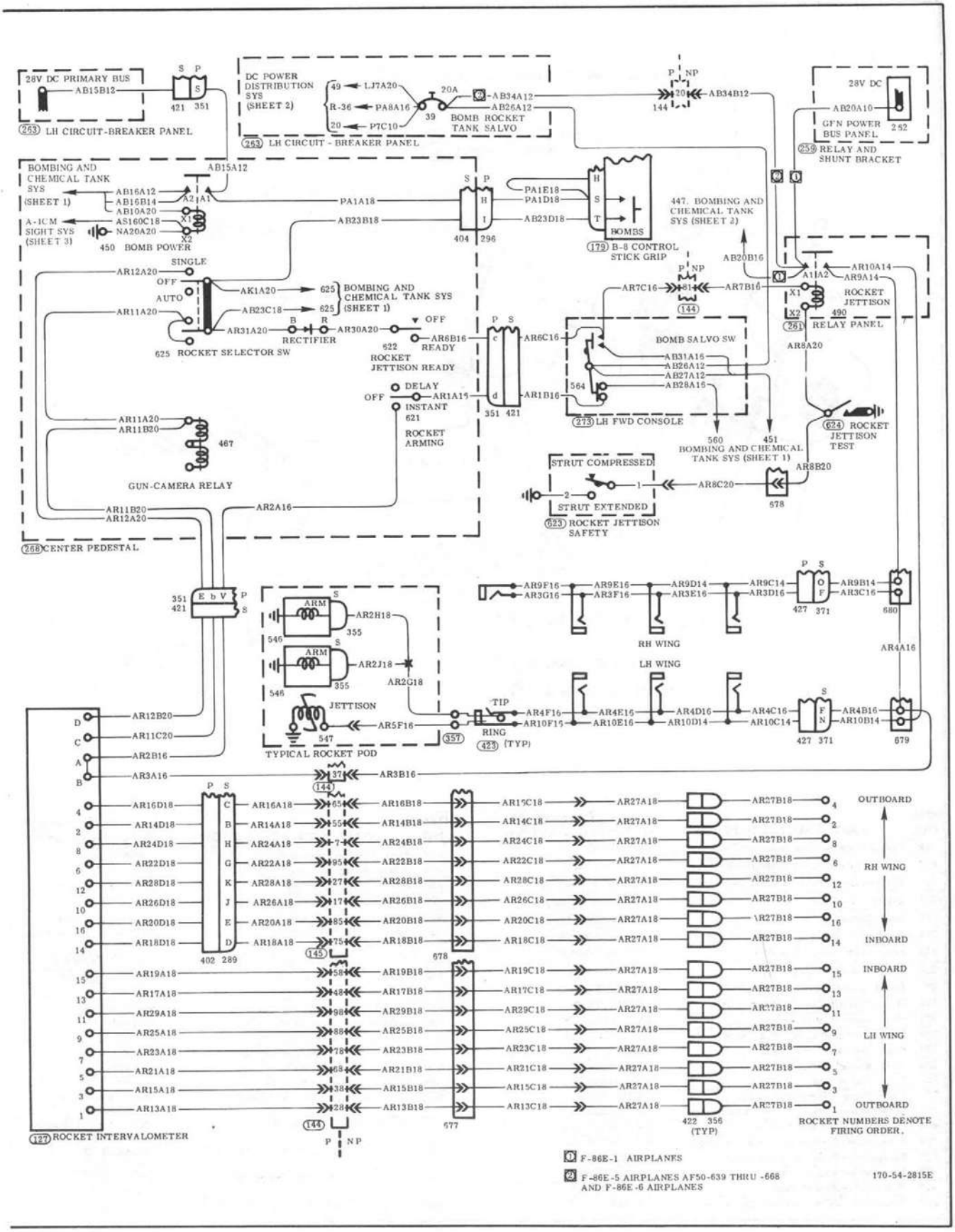
F-86E Airplanes (Sheet 2 of 2)



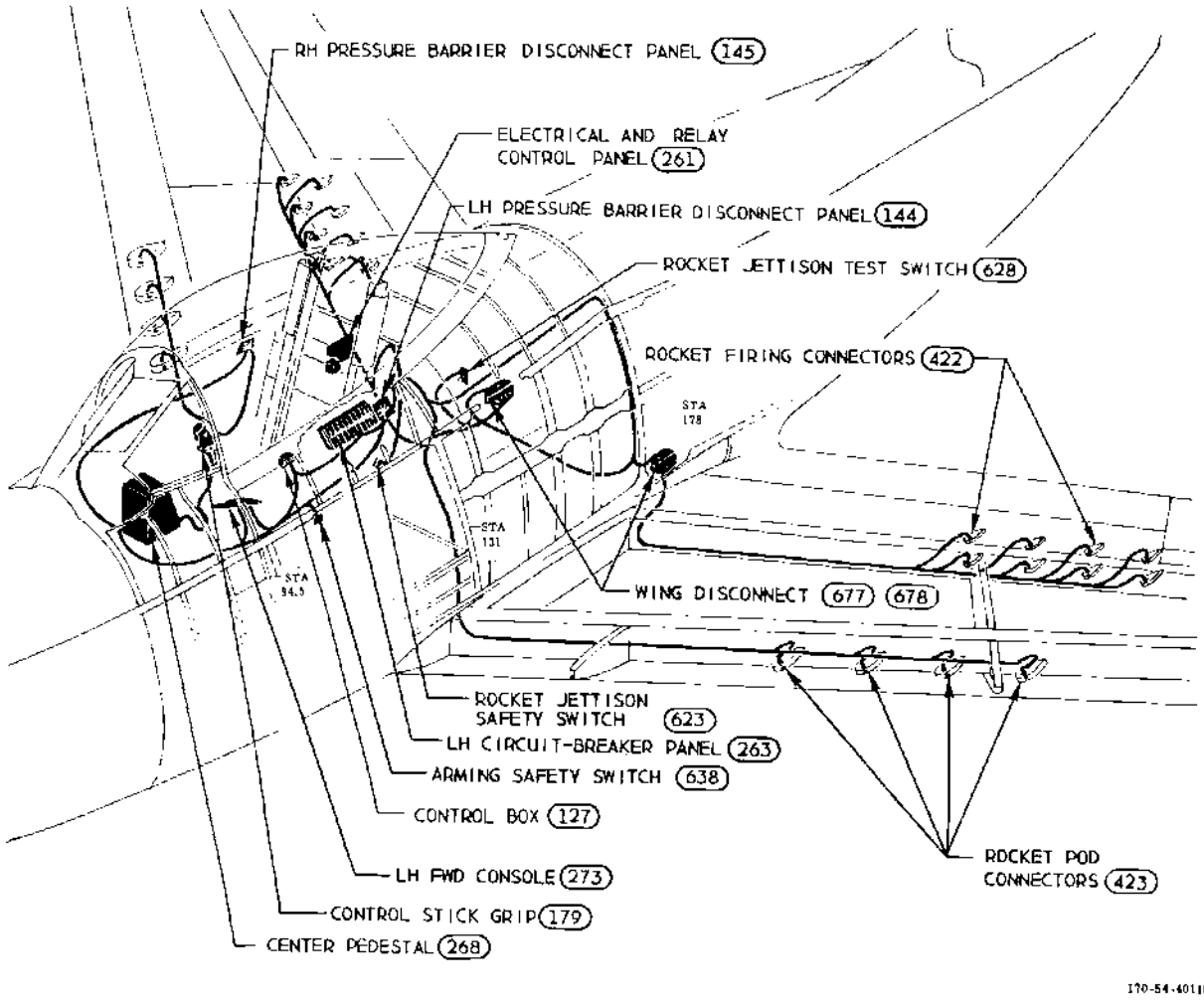
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
127	Control Box—Rocket Projectile Release	24975, Type A-3
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type 8-8
259	Panel—Relay and Shunt Bracket	172-54048 (NAA)
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
262	Panel—Generator Power Bus	140-54035 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	161-54028-10 (NAA)
289	Plug—Cockpit Center Disconnect	AN3106B24-5S
296	Plug—Control Stick Grip	AN3108B20-27P
351	Plug—Pedestal Disconnect	AN3106A32-7P
355	Plug—Rocket-arming Solenoid	AN3106B10S-2S
356	Plug—Rocket-firing	PL68 (Henry)
357	Plug—Rocket Pod	PL68 (Henry)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
402	Receptacle—Cockpit Center Disconnect	AN3100A24-5P
404	Receptacle—8-8 Control Stick Grip	AN3102A20-27S
421	Receptacle—Pedestal Disconnect	AN3100A32-7S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
422	Receptacle—Rocket-firing	140-54110 (NAA)
423	Receptacle—Rocket Pod	JK33A (Henry)
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
450	Relay—Bomb Release Power	AN3350-1
467	Relay—GSAP Camera	233-51A (Leach)
490	Relay—Rocket Jettison	AN3370-1
546	Solenoid—Rocket-arming	4389887, Type A-2
547	Solenoid—Rocket Jettison	C-8001-3 (Leland)
564	Switch—Bomb Salvo	AN3216-1
621	Switch—Rocket-arming	AN3021-1
622	Switch—Rocket Jettison	AN3021-5
623	Switch—Rocket Jettison Safety	AN3234-1
624	Switch—Rocket Jettison Test	AN3022-8
625	Switch—Rocket Selector	AN3027-1
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9

Figure 10-82. Rocket-firing System—F-86E-1 Airplanes,



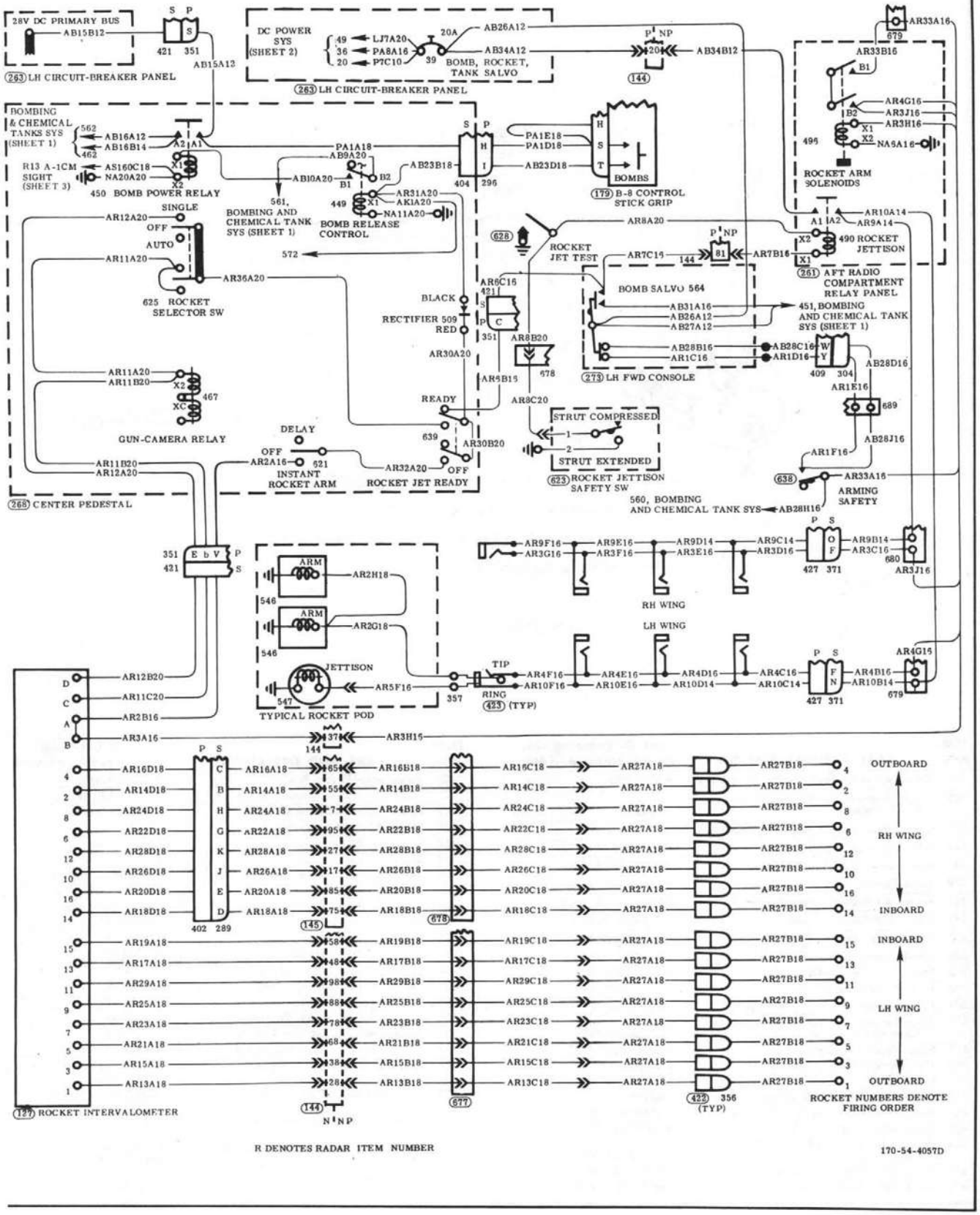
F-86E-5 Airplanes AF50-639 Through -668, and F-86E-6 Airplanes

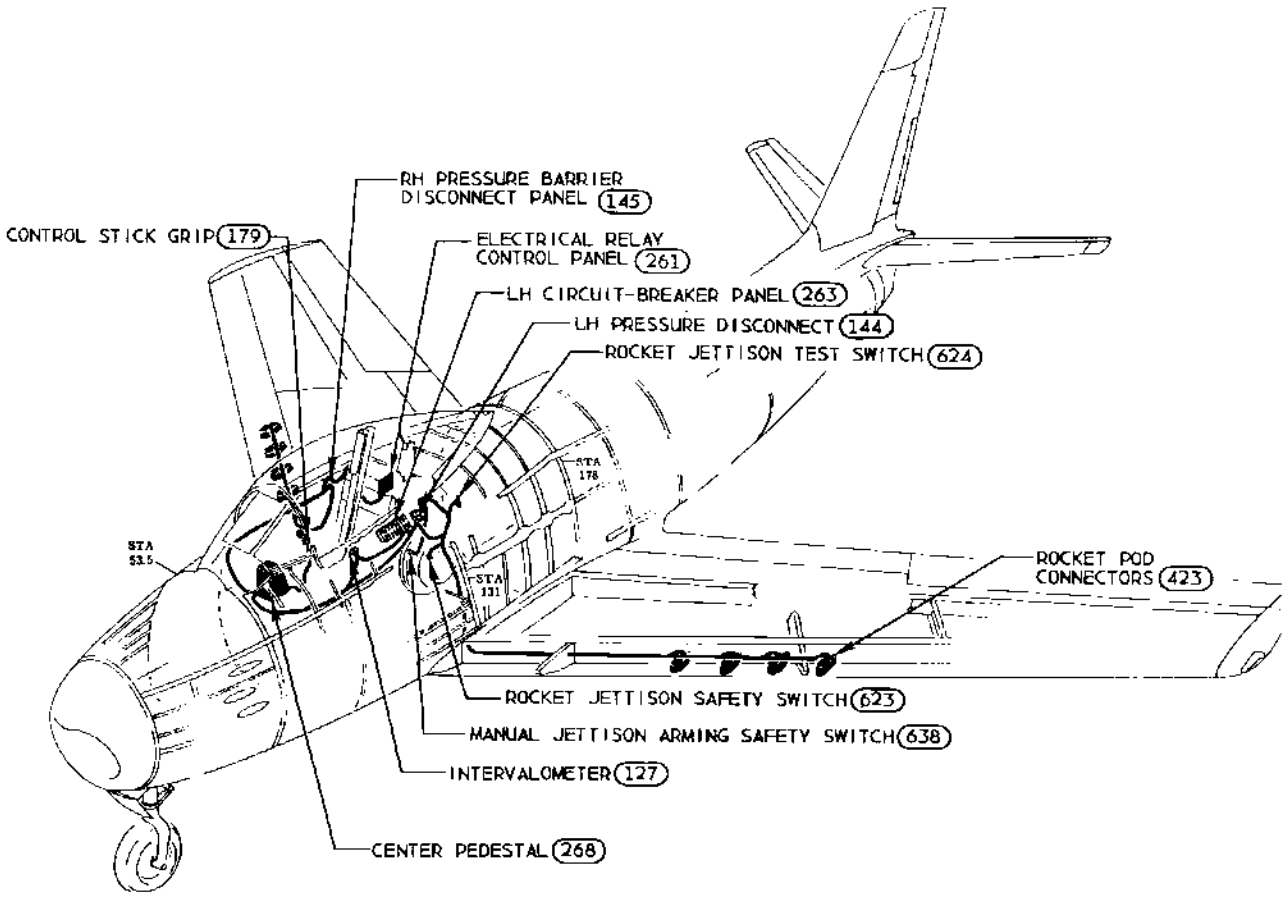


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
127	Control Box—Rocket Projectile Release	24975, Type A-3
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
261	Panel—Aft Radio Compartment Relay	151-54122-30 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	161-54028-10
289	Plug—Cockpit Center Disconnect	AN3106B24-5S
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
351	Plug—Pedestal Disconnect	AN3106A32-7P
356	Plug—Rocket-firing	PL68 (Henry)
357	Plug—Rocket Pod	PL68 (Henry)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
402	Receptacle—Cockpit Center Disconnect	AN3100A24-5P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
422	Receptacle—Rocket-firing	140-54110 (NAA)
423	Receptacle—Rocket Pod	JK33A (Henry)
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
467	Relay—GSAP Camera	233-51A (Leach)
490	Relay—Rocket Jettison	AN3370-1
496	Relay—Rocket-arming Control	G-54226 (Guardian)
509	Rectifier—Rocket Jettison	C2H1WTA (International Rectifier)
546	Solenoid—Rocket-arming	43B9887, Type A-2
547	Solenoid—Rocket Jettison	C-8001-3 (Leland)
564	Switch—Bomb Salvo	AN3216-1
621	Switch—Rocket-arming	AN3021-1
623	Switch—Rocket Jettison Safety	AN3234-1
625	Switch—Rocket Selector	AN3027-1
628	Switch—Speed Brake Control	AN3021-1
638	Switch—Arming Safety	AN3210-1
639	Switch—Rocket Jettison Ready	AN3027-3
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
689	Terminal Block—Arming Safety Switch	AN34636-2-4

Figure 10-83. Rocket-firing System—

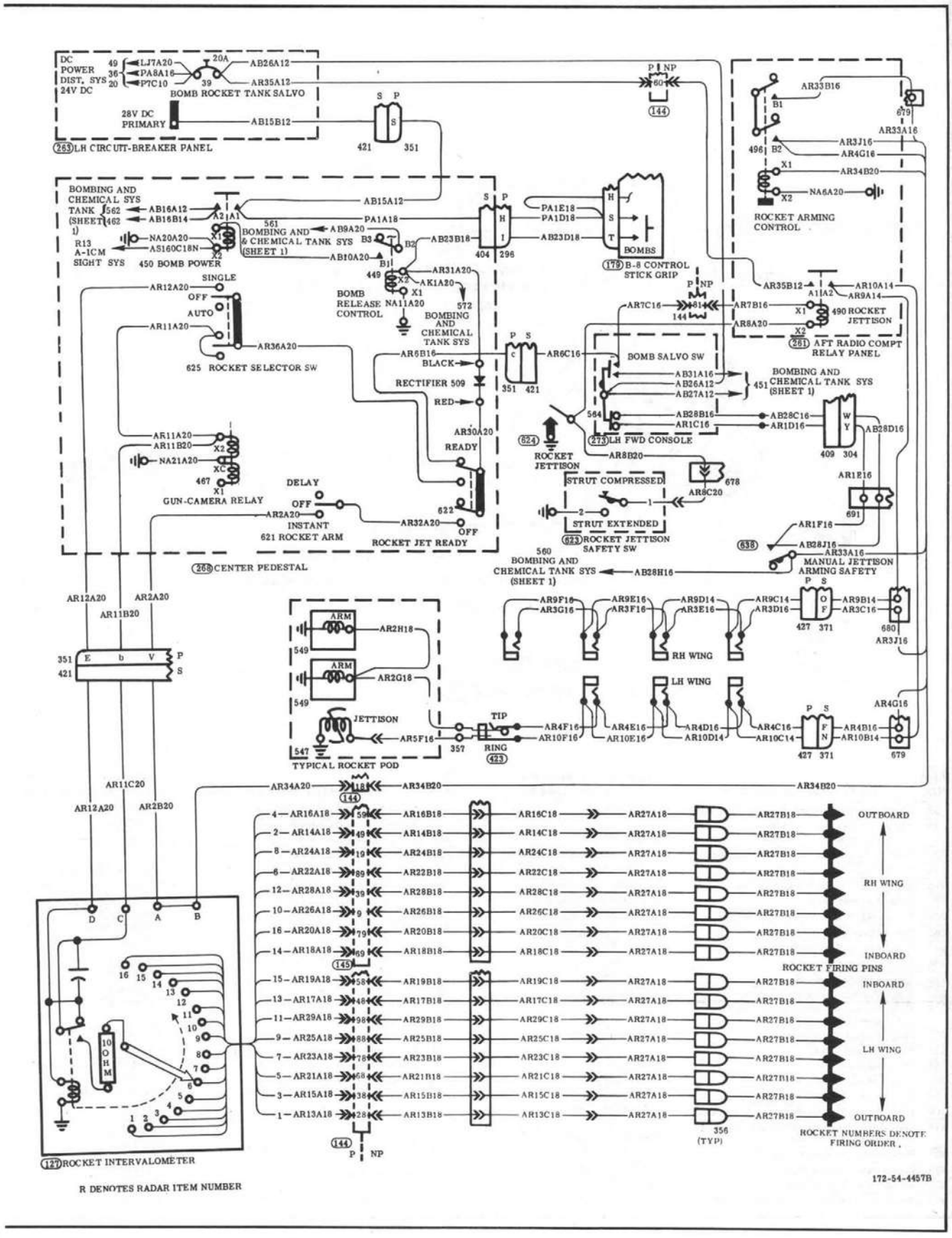

28V DC PRIMARY BUS
AB15B12
263 LH CIRCUIT-BREAKER PANEL
AB15A12
DC POWER SYS (SHEET 2)
LJ7A20
PA8A16
P7C10
20A
AB26A12
AB34A12
BOMB, ROCKET, TANK SALVO
144
AB34B12
AR33A16
679
AR33B16
AR4G16
AR3J16
AR3H16
NA6A16
ROCKET ARM SOLENOIDS
BOMBING & CHEMICAL TANKS SYS (SHEET 1)
AB16A12
AB16B14
R13 A-1CM SIGHT (SHEET 3)
AS160C18
NA20A20
450 BOMB POWER RELAY
PA1A18
AB9A20
AB10A20
561, BOMBING AND CHEMICAL TANK SYS (SHEET 1)
AB23B18
AR31A20
AK1A20
NA11A20
BOMB RELEASE CONTROL
PA1E18
PA1D18
AB23D18
BOMBS
179 B-8 CONTROL STICK GRIP
AR8A20
628
ROCKET JET TEST
AR7C19
AR7B16
AR10A14
AR9A14
490 ROCKET JETTISON
261 AFT RADIO COMPARTMENT RELAY PANEL
SINGLE
OFF
AUTO
AR12A20
AR11A20
AR36A20
625 ROCKET SELECTOR SW
572
AR6C15
BLACK
RECTIFIER 509
RED
AR30A20
AR8B20
678
AR5B15
READY
639
AR30B20
AR32A20
OFF
ROCKET JET READY
BOMB SALVO 564
AB31A16
AB26A12
AB27A12
451, BOMBING AND CHEMICAL TANK SYS (SHEET 1)
AB28B16
AR1C16
273 LH FWD CONSOLE
AB28C16
AR1D16
AB28D16
AR1E16
689
AR11A20
AR11B20
467
GUN-CAMERA RELAY
DELAY
OFF
AR2A16
621
INSTANT ROCKET ARM
AR8C20
STRUT COMPRESSED
STRUT EXTENDED
623 ROCKET JETTISON SAFETY SW
AB28J16
AR1F16
638
AR33A16
ARMING SAFETY
560, BOMBING AND CHEMICAL TANK SYS
AB28H16
AR11B20
AR12A20
268 CENTER PEDESTAL
ARM
AR2H18
546
AR2G18
JETTISON
547
AR5F16
TYPICAL ROCKET POD
TIP
RING
423 (TYP)
AR9F16
AR3G16
AR9E16
AR3F16
AR9D14
AR3E16
AR9C14
AR3D16
AR9B14
AR3C16
680
AR3J16
RH WING
LH WING
AR4F16
AR10F16
AR4E16
AR10E16
AR4D16
AR10D14
AR4C16
AR10C14
AR4B16
AR10B14
AR4G15
AR12B20
AR11C20
AR2B16
AR3A16
AR3H15
AR16D18
AR14D18
AR24D18
AR22D18
AR28D18
AR26D18
AR20D18
AR18D18
AR16A18
AR14A18
AR24A18
AR22A18
AR28A18
AR26A18
AR20A18
AR18A18
AR16B18
AR14B18
AR24B18
AR22B18
AR28B18
AR26B18
AR20B18
AR18B18
AR16C18
AR14C18
AR24C18
AR22C18
AR28C18
AR26C18
AR20C18
AR18C18
AR27A18
AR27B18
OUTBOARD
RH WING
INBOARD
INBOARD
LH WING
OUTBOARD
AR19A18
AR17A18
AR29A18
AR25A18
AR23A18
AR21A18
AR15A18
AR13A18
AR19B18
AR17B18
AR29B18
AR25B18
AR23B18
AR21B18
AR15B18
AR13B18
AR19C18
AR17C18
AR29C18
AR25C18
AR23C18
AR21C18
AR15C18
AR13C18
127 ROCKET INTERVALOMETER
144
145
677
678
422 356 (TYP)
ROCKET NUMBERS DENOTE FIRING ORDER
R DENOTES RADAR ITEM NUMBER
170-54-4057D

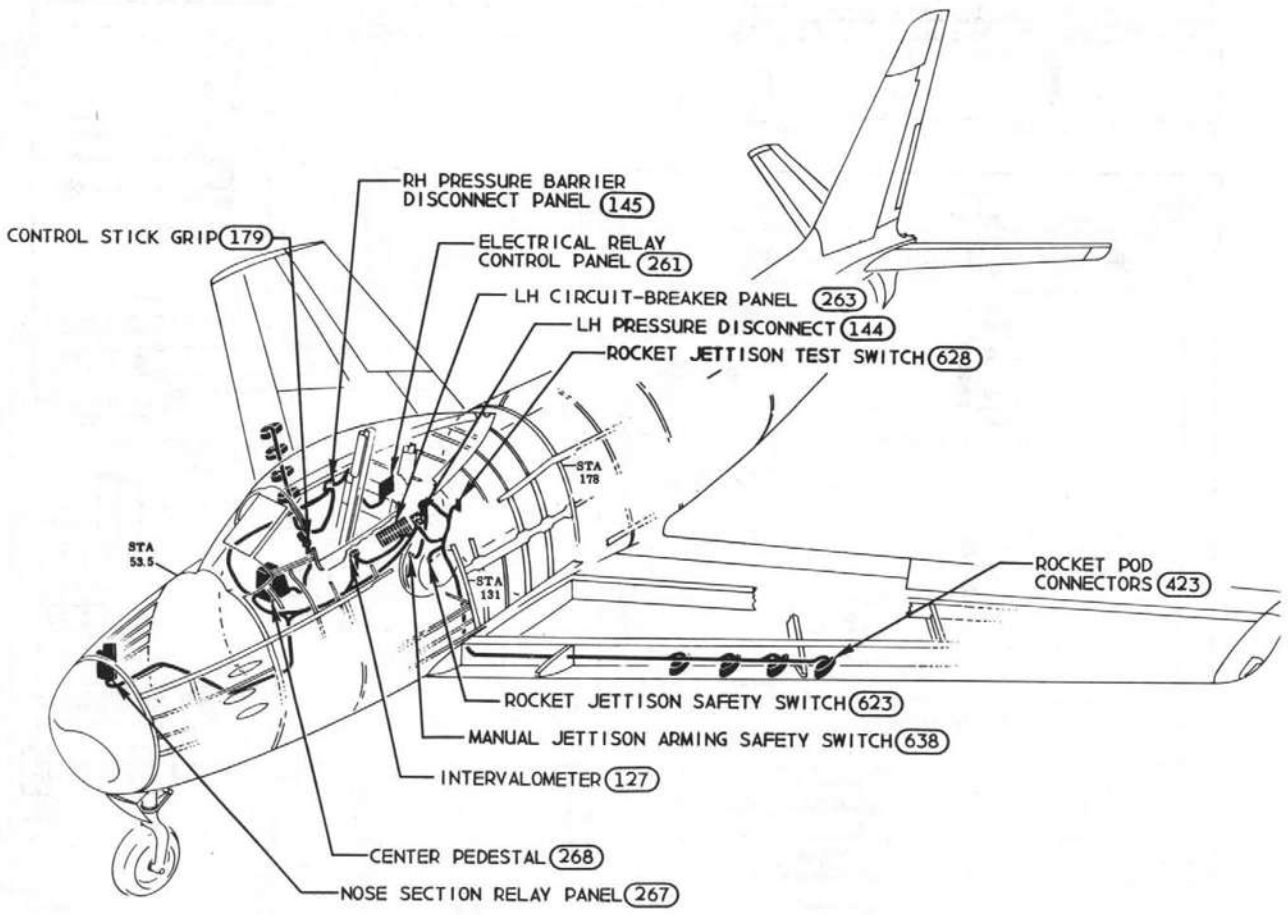


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
127	Control Box—Rocket Projectile Release	24975, Type A-3
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
273	Panel—Left Forward Console	172-54028 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
351	Plug—Pedestal Disconnect	AN3106A32-7P
356	Plug—Rocket-firing	PL68 (Henry)
357	Plug—Rocket Pod	PL68 (Henry)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
422	Receptacle—Rocket-firing	140-54110 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
423	Receptacle—Rocket Pod	JK33A (Henry)
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
467	Relay—GSAP Camera	233-51A (Leach)
490	Relay—Rocket Jettison	AN3370-1
496	Relay—Rocket-arming Control	G-54226 (Guardian)
546	Solenoid—Rocket-arming	4389887, Type A-2
547	Solenoid—Rocket Jettison	C-8001-3 (Leland)
564	Switch—Bomb Salvo	AN3216-1
621	Switch—Rocket-arming	AN3021-1
622	Switch—Rocket Jettison	AN3027-5
623	Switch—Rocket Jettison Safety	AN3234-1
624	Switch—Rocket Jettison Test	AN3021-8
625	Switch—Rocket Selector	AN3027-1
628	Switch—Speed Brake Control	AN3021-1
638	Switch—Manual Jettison Arming	AN3210-1
669	Terminal Block—Nose Junction Box	AN3436-2-18
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-84. Rocket-firing System—

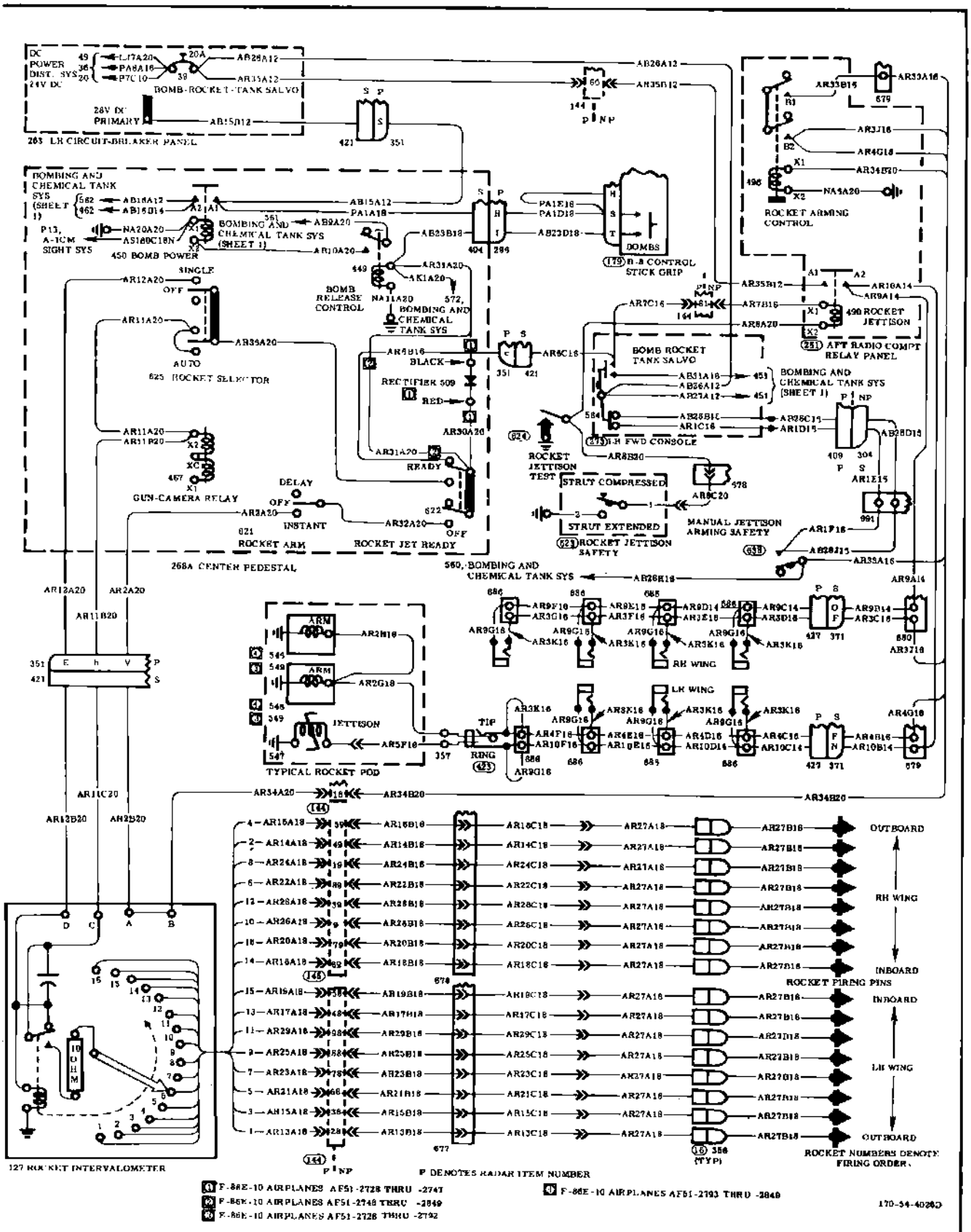

DC POWER DIST. SYS 24V DC
BOMB ROCKET TANK SALVO
28V DC PRIMARY
263 LH CIRCUIT-BREAKER PANEL
BOMBING AND CHEMICAL SYS TANK (SHEET 1)
R13 A-1CM SIGHT SYS
450 BOMB POWER
BOMBING AND CHEMICAL TANK SYS (SHEET 1)
BOMB RELEASE CONTROL
BOMBING AND CHEMICAL TANK SYS
SINGLE
OFF
AUTO
625 ROCKET SELECTOR SW
RECTIFIER 509
BLACK
RED
READY
GUN-CAMERA RELAY
DELAY
INSTANT
621 ROCKET ARM
ROCKET JET READY
268 CENTER PEDESTAL
BOMB SALVO SW
451 BOMBING AND CHEMICAL TANK SYS (SHEET 1)
624 ROCKET JETTISON
273 LH FWD CONSOLE
STRUT COMPRESSED
STRUT EXTENDED
623 ROCKET JETTISON SAFETY SW
560 BOMBING AND CHEMICAL TANK SYS (SHEET 1)
638 MANUAL JETTISON ARMING SAFETY
179 B-8 CONTROL STICK GRIP
BOMBS
ROCKET ARMING CONTROL
490 ROCKET JETTISON
261 AFT RADIO COMPT RELAY PANEL
ARM
JETTISON
TYPICAL ROCKET POD
TIP
RING
RH WING
LH WING
OUTBOARD
INBOARD
ROCKET FIRING PINS
356 (TYP)
ROCKET NUMBERS DENOTE FIRING ORDER
127 ROCKET INTERVALOMETER
10 OHM
R DENOTES RADAR ITEM NUMBER
172-54-4457B



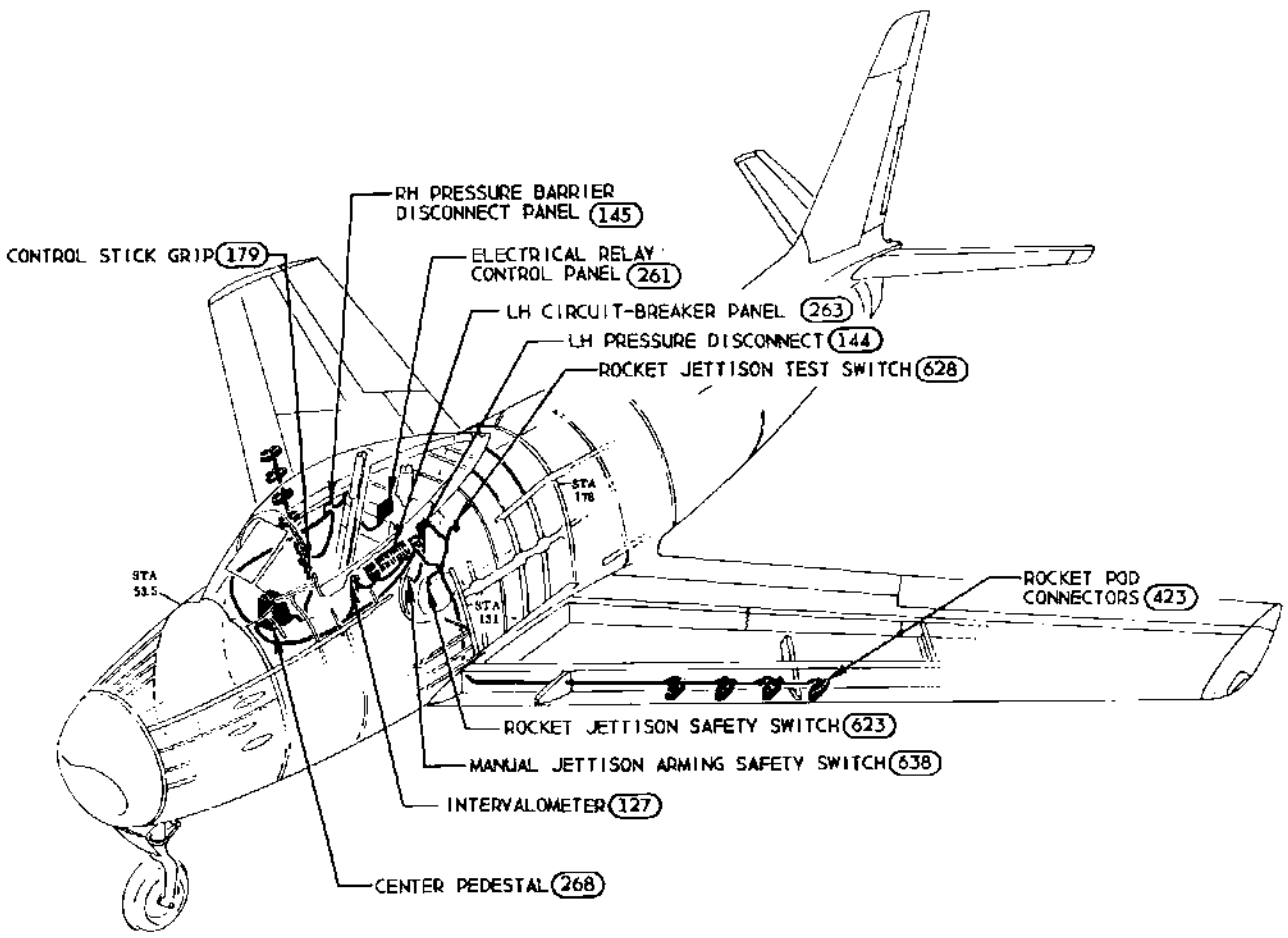
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
127	Control Box—Rocket Projectile Release	24975, Type A-3
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
351	Plug—Pedestal Disconnect	AN3106A32-7P
356	Plug—Rocket-firing	PL68 (Henry)
357	Plug—Rocket Pod	PL68 (Henry)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
422	Receptacle—Rocket-firing	140-54110 (NAA)
423	Receptacle—Rocket Pod	JK33A (Henry)
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
467	Relay—GSAP Camera	233-51A (Leach)
490	Relay—Rocket Jettison	AN3370-1
496	Relay—Rocket-arming Control	G-54226 (Guardian)
509	Rectifier—Rocket Jettison	C2H1WTA (International Rectifier)
546	Solenoid—Rocket-arming	43B9887, Type A-2
547	Solenoid—Rocket Jettison	C-8001-3 (Leland)
564	Switch—Bomb Salvo	AN3216-1
621	Switch—Rocket-arming	AN3021-1
622	Switch—Rocket Jettison	AN3027-5
623	Switch—Rocket Jettison Safety	AN3234-1
624	Switch—Rocket Jettison Test	AN3021-8
625	Switch—Rocket Selector	AN3027-1
638	Switch—Manual Jettison Arming	AN3210-1
669	Terminal Block—Nose Junction Box	AN3436-2-18
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
686	Terminal Block—Rocket Pod	AN3436-2-2
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-85. Rocket-firing System—



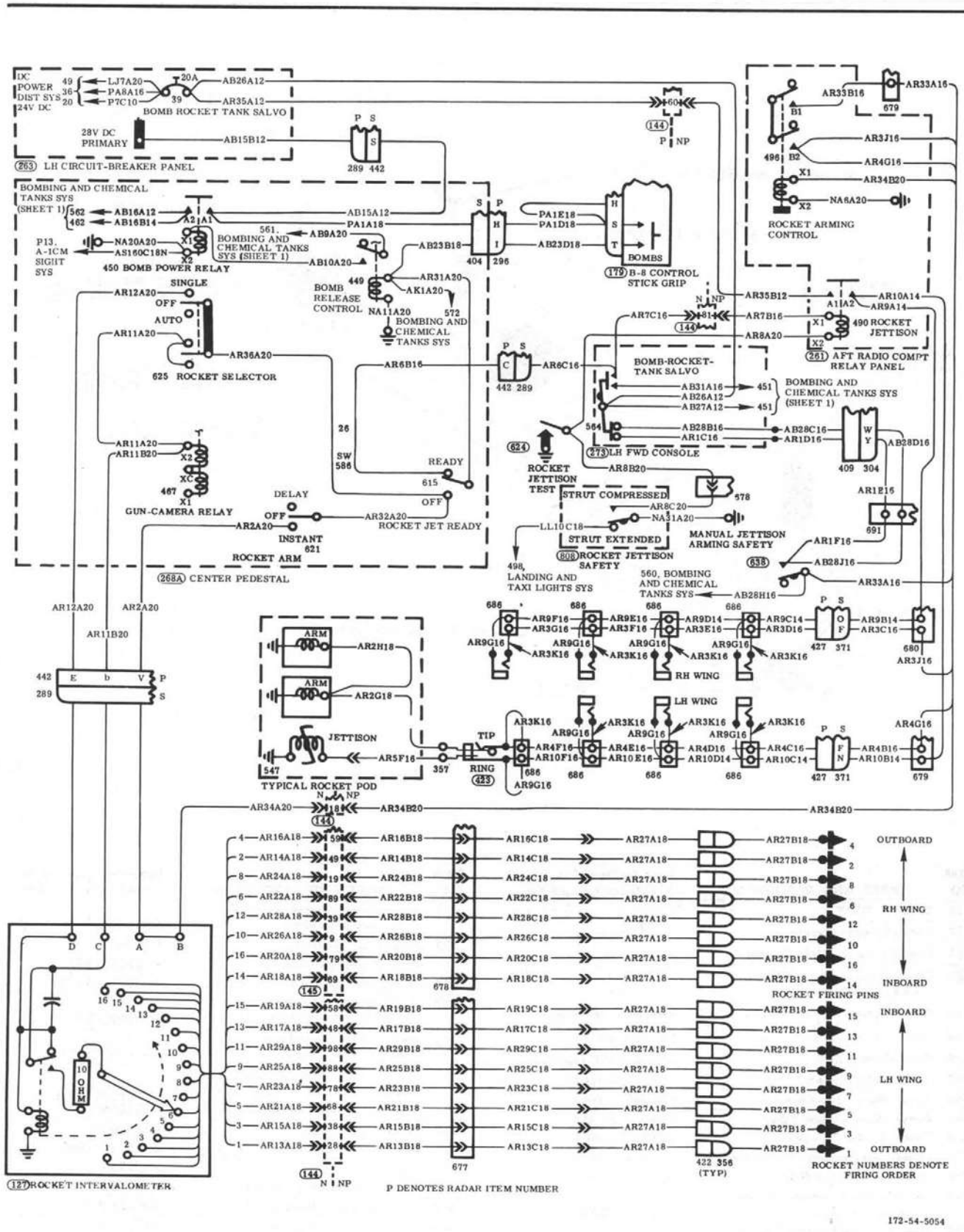
F-86E-10 Airplanes AF51-2728 Through -2849

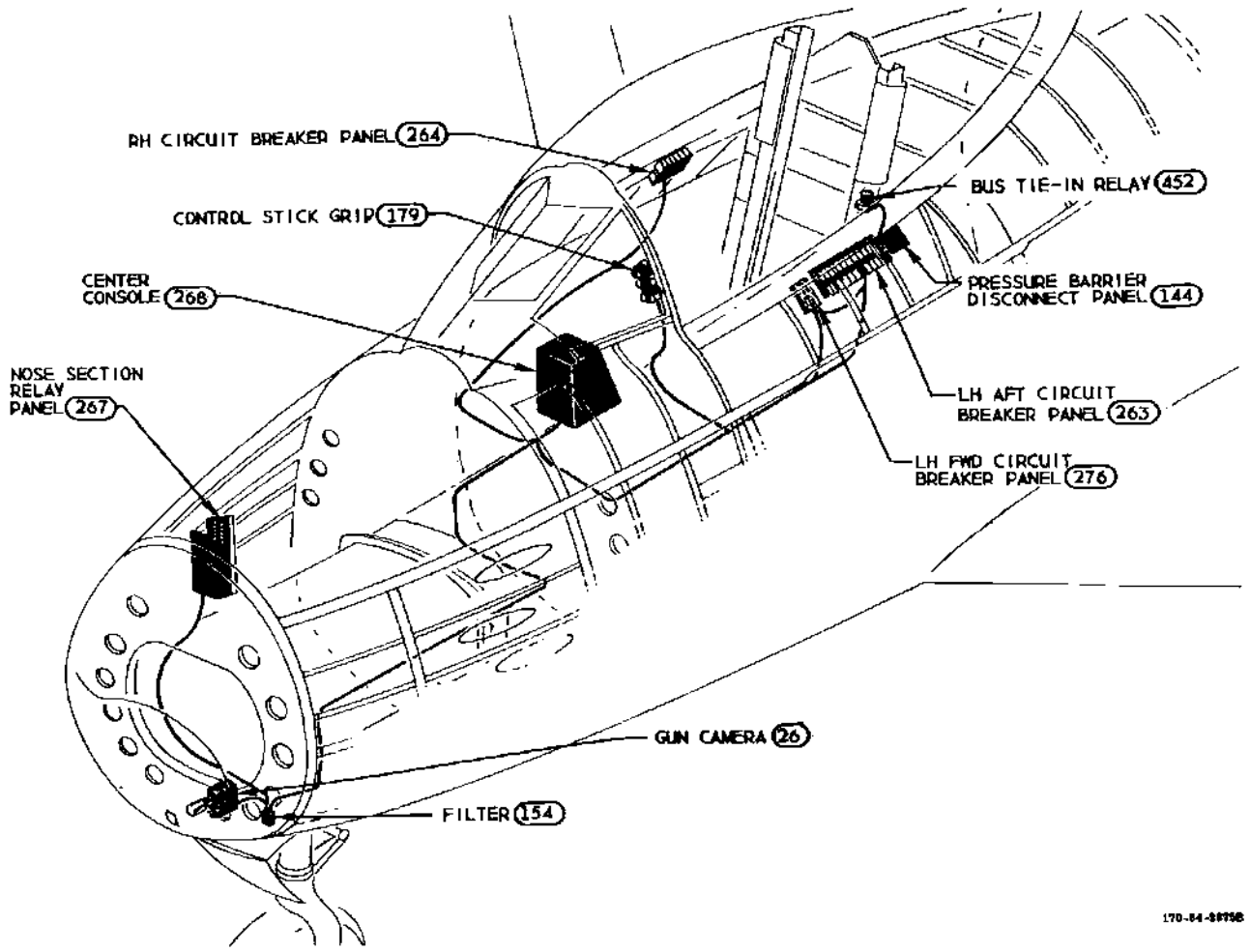


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
39	Circuit Breaker—Bomb-Rocket-Tank Salvo	AN3161P20
127	Control Box—Rocket Projectile Release	24975, Type A-3
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
179	Grip—Control Stick	AFX50C4064, Type B-8
261	Panel—Aft Radio Compartment Relay	151-54122-60 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
289	Plug—Pedestal Disconnect	AN3106B24-5S
296	Plug—Control Stick Grip	AN3108B20-27P
304	Plug—Flasher Pressure Disconnect	AN3106B28-12S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
351	Plug—Pedestal Disconnect	AN3106A32-7P
356	Plug—Rocket-firing	PL68 (Henry)
357	Plug—Rocket Pod	PL68 (Henry)
371	Plug—Wing Wiring Disconnect	AN3108B32-8S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
409	Receptacle—Flasher Pressure Disconnect	AN3100C28-12P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
422	Receptacle—Rocket-firing	140-54110 (NAA)
423	Receptacle—Rocket Pod	JK33A (Henry)
427	Receptacle—Wing Wiring Disconnect	AN3100A32-8P
442	Receptacle—Pedestal Disconnect	AN3102A32-7P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
449	Relay—Bomb Release Control	237EAU (Leach)
450	Relay—Bomb Release Power	AN3350-1
467	Relay—GSAP Camera	233-51A (Leach)
490	Relay—Rocket Jettison	AN3370-1
496	Relay—Rocket-arming Control	G-54226 (Guardian)
509	Rectifier—Rocket Jettison	C2H1WTA
546	Solenoid—Rocket-arming	43B9887 (A-2)
547	Solenoid—Rocket Jettison	C-8001-3 (Leland)
564	Switch—Bomb Salvo	AN3216-1
621	Switch—Rocket-arming	AN3021-1
622	Switch—Rocket Jettison	AN3027-3
623	Switch—Rocket Jettison Safety	AN3234-1
624	Switch—Rocket Jettison Test	AN3021-8
625	Switch—Rocket Selector	AN3027-1
638	Switch—Manual Jettison Arming	AN3210-1
669	Terminal Block—Nose Junction Box	AN3436-2-18
677	Terminal Block—Left Wing Aft	40095 (Aircraft-Marine Products)
678	Terminal Block—Right Wing Aft	40095 (Aircraft-Marine Products)
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12
680	Terminal Block—Right Wing Center	AN3436-2-10 AN3436-2-9
686	Terminal Block—Rocket Pod	AN3436-2-2
691	Terminal Block—Gun Bay Pressure Disconnect	AN3436-2-7

Figure 10-86. Rocket-firing

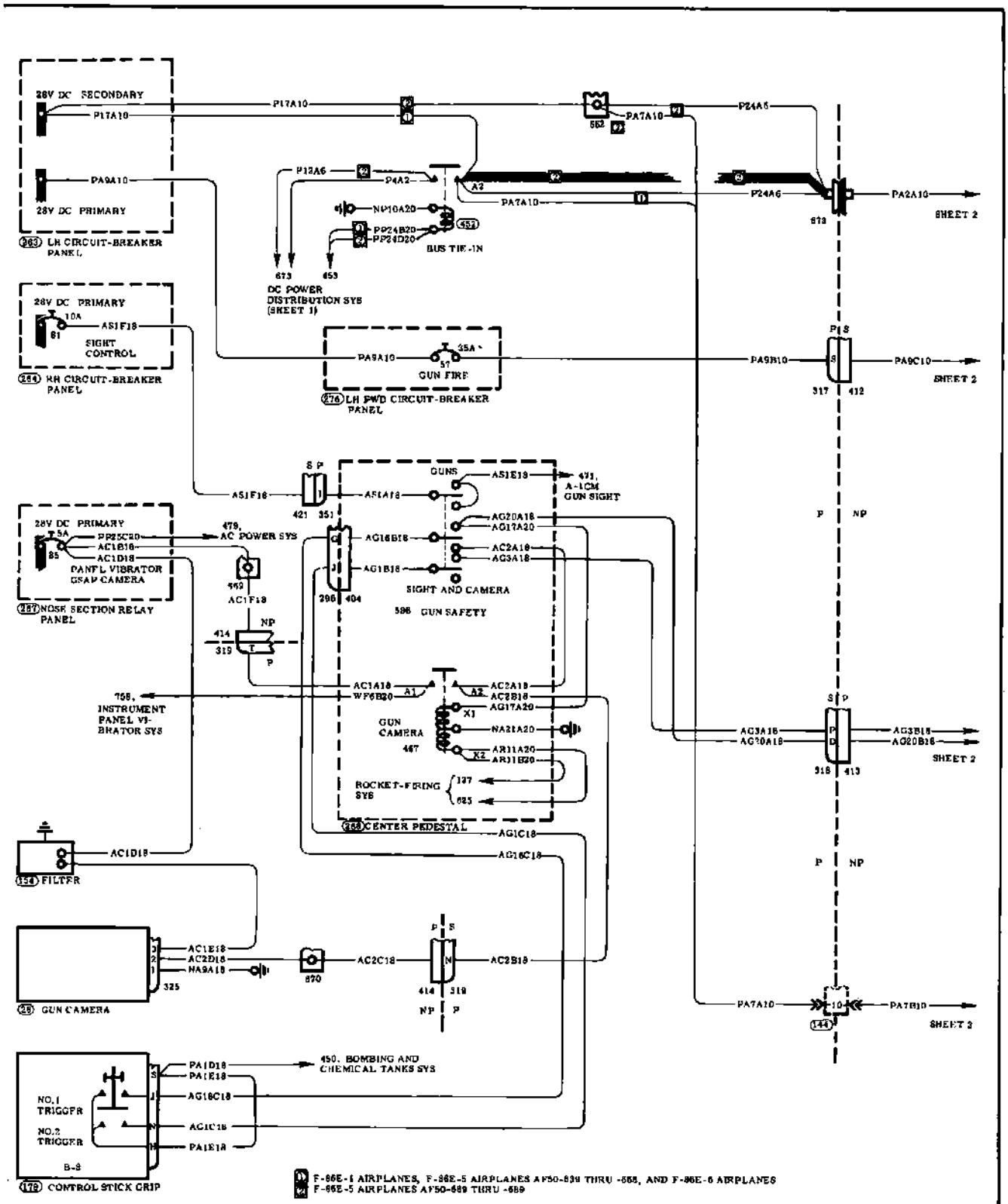

DC POWER DIST SYS 24V DC
BOMB ROCKET TANK SALVO
28V DC PRIMARY
263 LH CIRCUIT-BREAKER PANEL
BOMBING AND CHEMICAL TANKS SYS (SHEET 1)
450 BOMB POWER RELAY
P13, A-1CM SIGHT SYS
BOMB RELEASE CONTROL
BOMBING AND CHEMICAL TANKS SYS
179 B-8 CONTROL STICK GRIP
BOMBS
ROCKET ARMING CONTROL
490 ROCKET JETTISON
261 AFT RADIO COMPT RELAY PANEL
SINGLE
OFF
AUTO
625 ROCKET SELECTOR
GUN-CAMERA RELAY
DELAY
INSTANT
ROCKET JET READY
READY
ROCKET ARM
268A CENTER PEDESTAL
BOMB-ROCKET-TANK SALVO
273 LH FWD CONSOLE
ROCKET JETTISON TEST
STRUT COMPRESSED
STRUT EXTENDED
MANUAL JETTISON ARMING SAFETY
808 ROCKET JETTISON SAFETY
LANDING AND TAXI LIGHTS SYS
560, BOMBING AND CHEMICAL TANKS SYS
RH WING
LH WING
TYPICAL ROCKET POD
JETTISON
TIP
RING
127 ROCKET INTERVALOMETER
10 OHM
ROCKET FIRING PINS
OUTBOARD
INBOARD
ROCKET NUMBERS DENOTE FIRING ORDER
P DENOTES RADAR ITEM NUMBER
172-54-5054



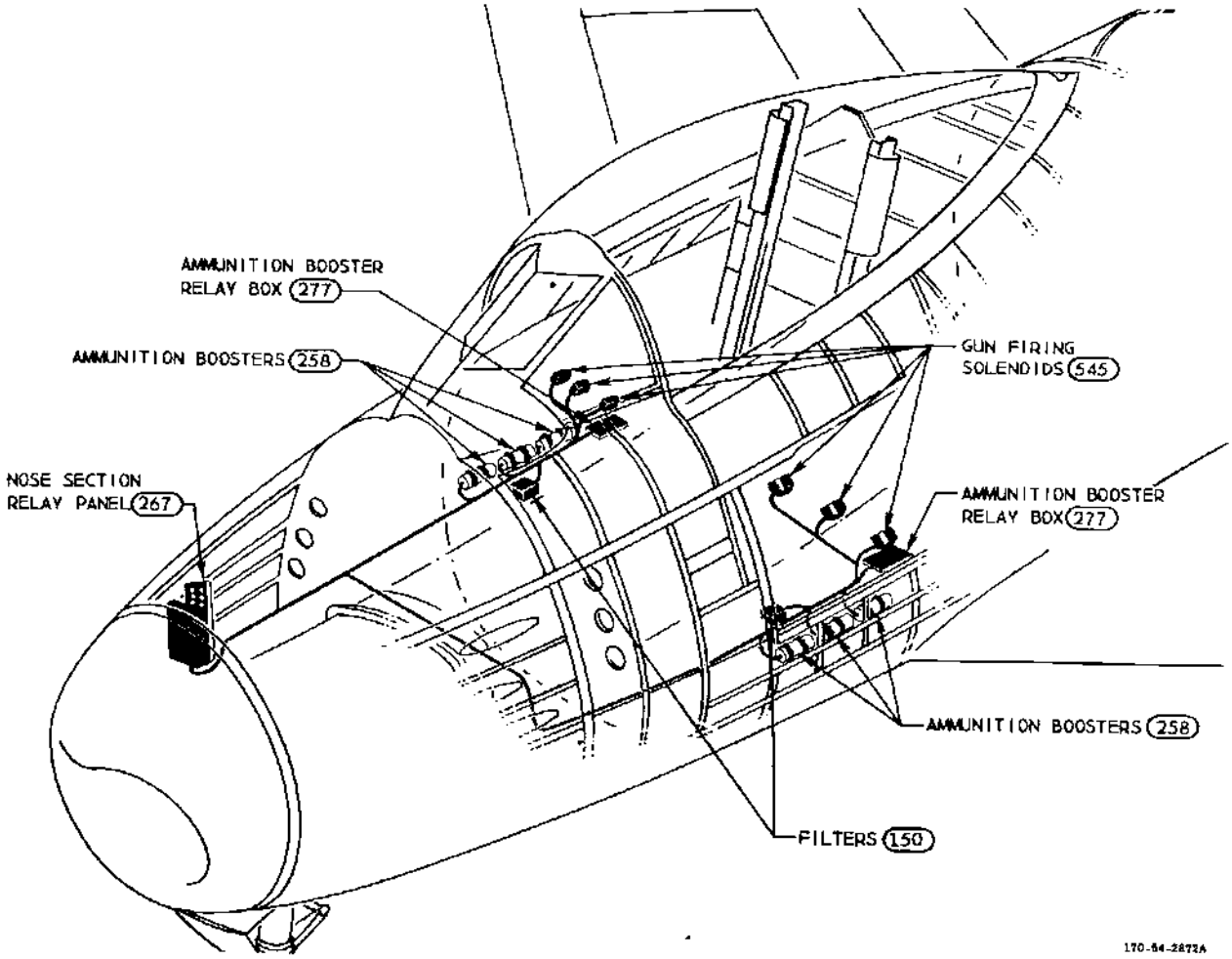
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
26	Camera—GSAP	75-366, AN-N6 (GFP)
57	Circuit Breaker—Gunfire	AN3161P35
81	Circuit Breaker—Sight Control	AN3161P10
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
144	Disconnect—Left-hand Pressure	YHS100S-6 (Burndy)
154	Filter—Camera Radio Noise	EA-125 (Solar)
179	Grip—Control Stick	AFX50C4064, Type B-8
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	170-54057 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
325	Plug—GSAP Camera	102 (Burton)
351	Plug—Pedestal Disconnect	AN3106A32-7P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
452	Relay—Bus Tie-in	AN3370-1
467	Relay—GSAP Camera	233-51A (Leach)
586	Switch—Gun Safety	AN3226-1
662	Terminal Block—Right Gun Bay	AN3436-6-1
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
673	Terminal Block—Pressure	151-54037 (NAA)

Figure 10-87. Camera and Gun-firing Systems—



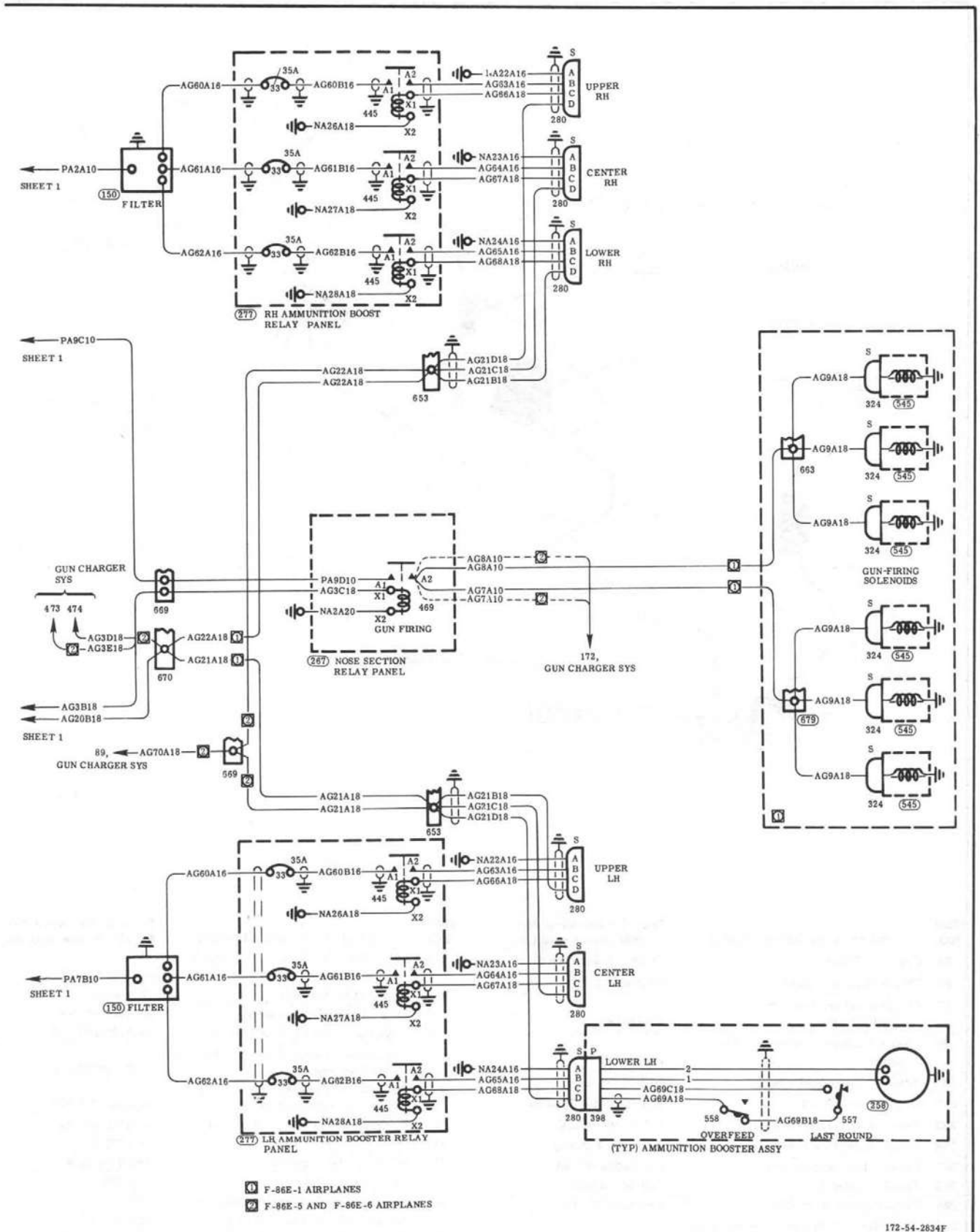
F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 1 of 2)



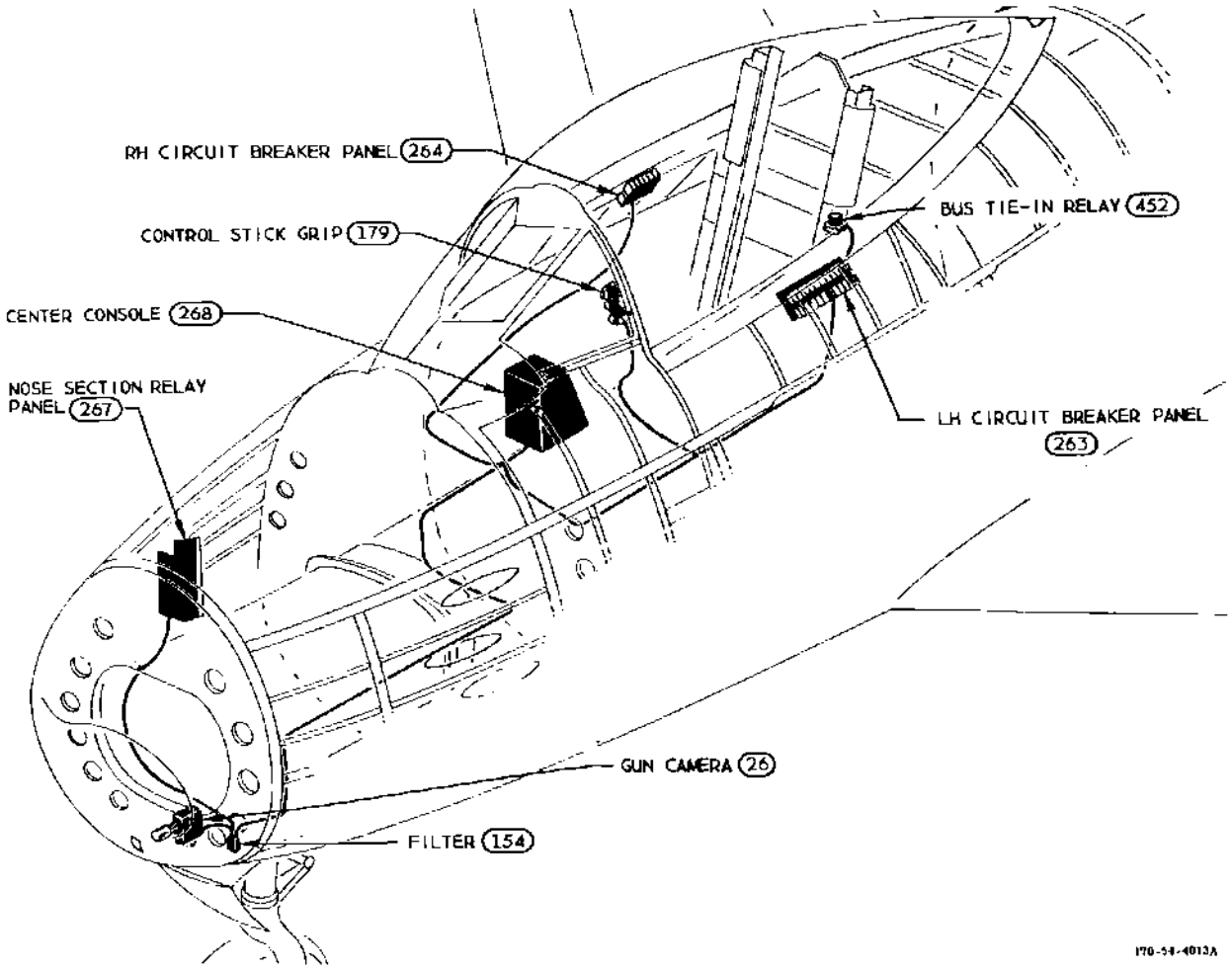
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
33	Circuit Breaker—Ammunition Boost	PDA-35 (Klixon)
150	Filter—Ammunition Boost	12270 (AiResearch)
258	Motor—Ammunition Boost	29492-1 (AiResearch) 29492-2 (AiResearch)
267	Panel—Nose Section Relay	170-54055 (NAA)
277	Panel—Ammunition Boost Relay	161-54037 (NAA)
280	Plug—Ammunition Boost Motor	AN3106B14S-2S
324	Plug—Gunfire Solenoid	AN3106B28-11S
398	Receptacle—Ammunition Boost	AN3102A14S-2P
445	Relay—Ammunition Boost	AN3350-1

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
469	Relay—Gun-firing	AN3350-1
545	Solenoid—Gunfire	93-24706, Type G-9
557	Switch—Ammunition Last-round	AN3210-1
558	Switch—Ammunition Overfeed	AN3210-1
653	Terminal Block—Ammunition Boost	AN3436-2-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12

Figure 10-87. Camera and Gun-firing Systems—

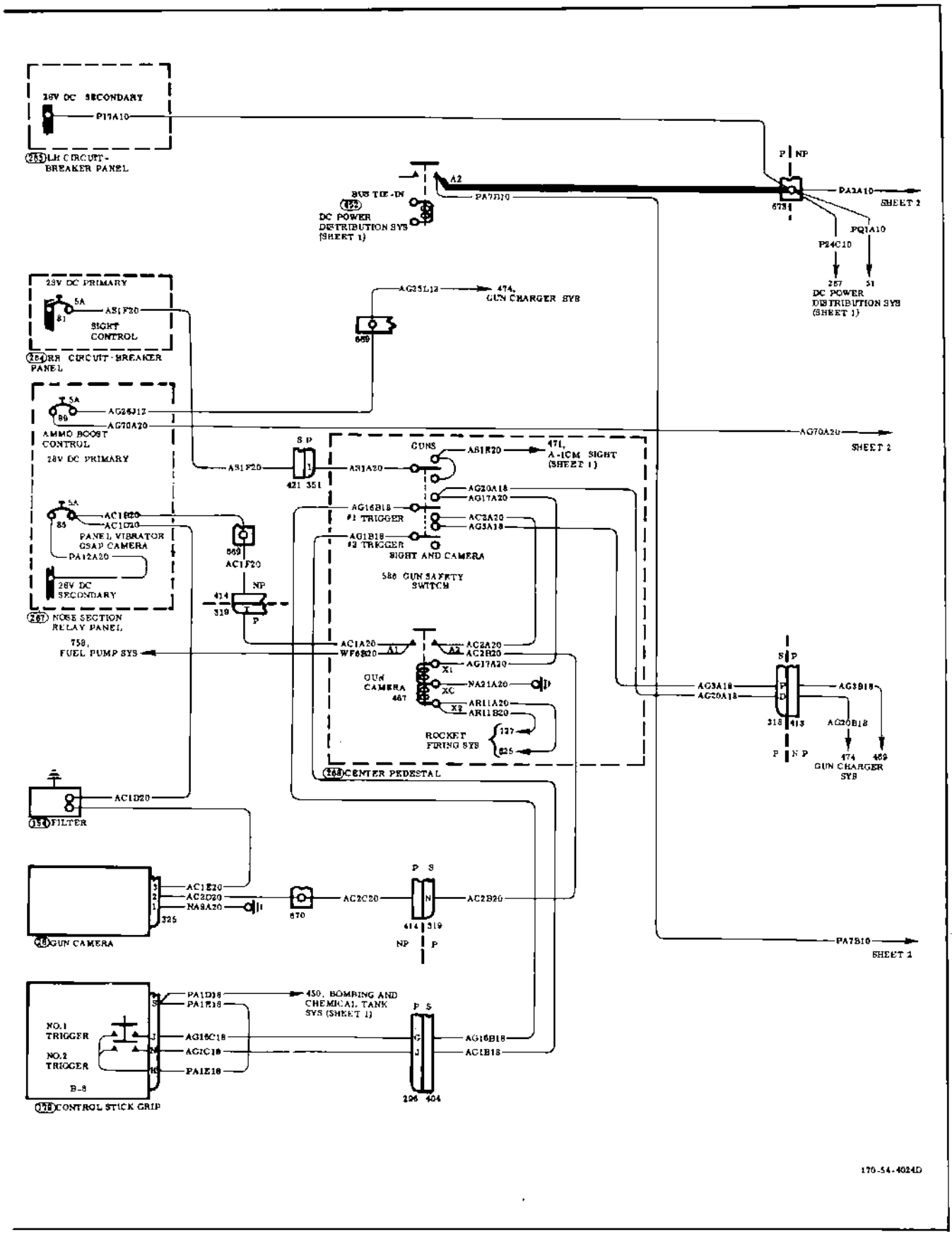


F-86E-1, F-86E-5, and F-86E-6 Airplanes (Sheet 2 of 2)

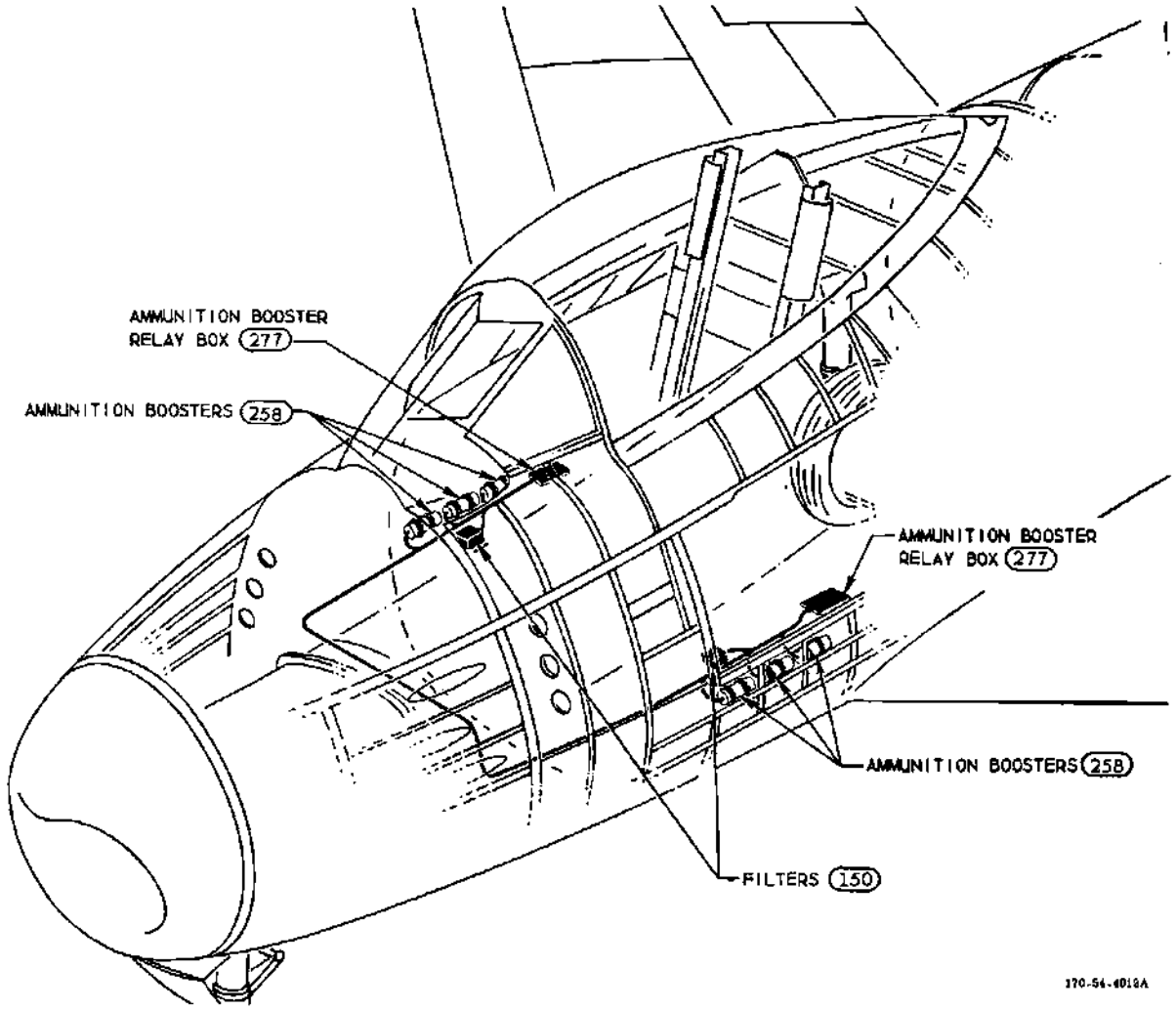


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
26	Camera—GSAP	75-366, AN-N6 (GFP)
81	Circuit Breaker—Sight Control	AN3161P5
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
154	Filter—Camera Radio Noise	EA-125 (Solar)
179	Grip—Control Stick	AFX50C4064, Type B-8
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
325	Plug—GSAP Camera	102 (Burton)
351	Plug—Pedestal Disconnect	AN3106A32-7P
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
421	Receptacle—Pedestal Disconnect	AN3100A32-7S
452	Relay—Bus Tie-in	AN3370-1
467	Relay—GSAP Camera	233-51A (Leach)
586	Switch—Gun Safety	AN3226-1
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
673	Terminal Block—Pressure	151-54037 (NAA)

Figure 10-88. Camera and Gun-firing



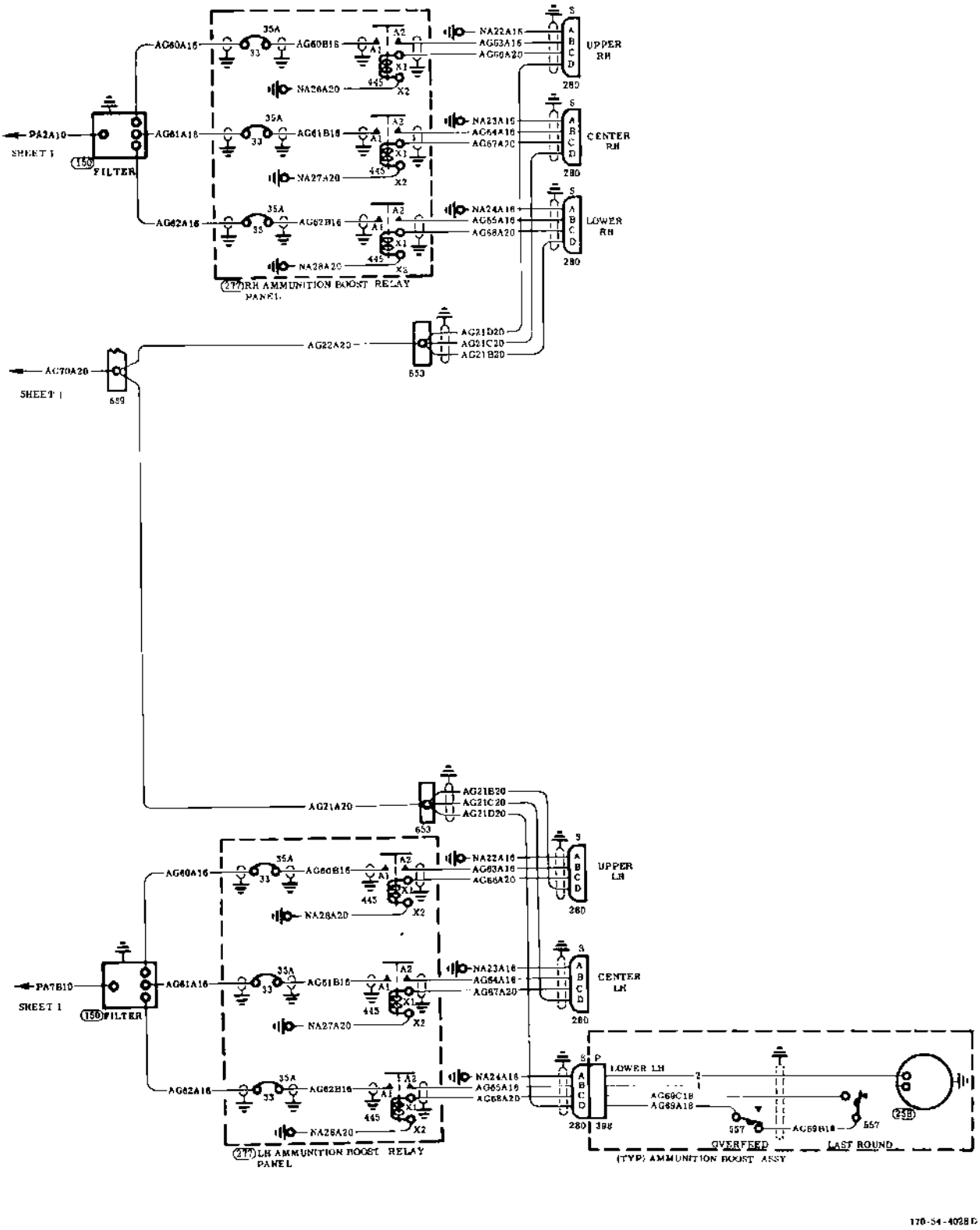
Systems—F-86E-10 Airplanes (Sheet 1 of 2)



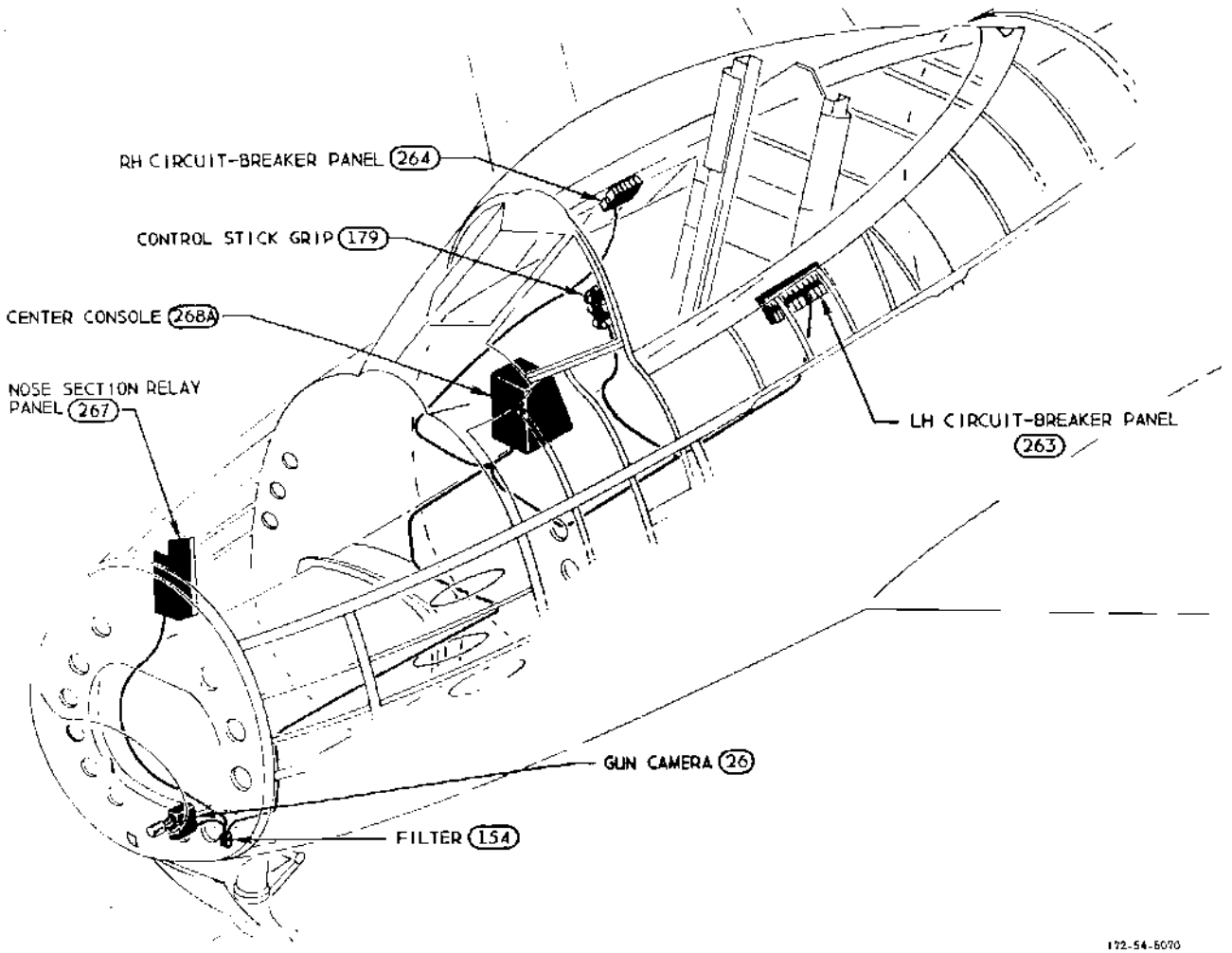
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
33	Circuit Breaker—Ammunition Boost	PDA-35 (Klixon)
150	Filter—Ammunition Boost	12270 (AiResearch)
258	Motor—Ammunition Boost	29492-1 (AiResearch) 29492-2 (AiResearch)
277	Panel—Ammunition Boost Relay	161-54037 (NAA)
280	Plug—Ammunition Boost Motor	AN3106B14S-2S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
398	Receptacle—Ammunition Boost	AN3102A14S-2P
445	Relay—Ammunition Boost	AN3350-1
557	Switch—Ammunition Last-round	AN3210-1
653	Terminal Block—Ammunition Boost	AN3436-2-1
669	Terminal Block—Nose Junction Box	AN3436-2-18

Figure 10-88. Camera and Gun-firing



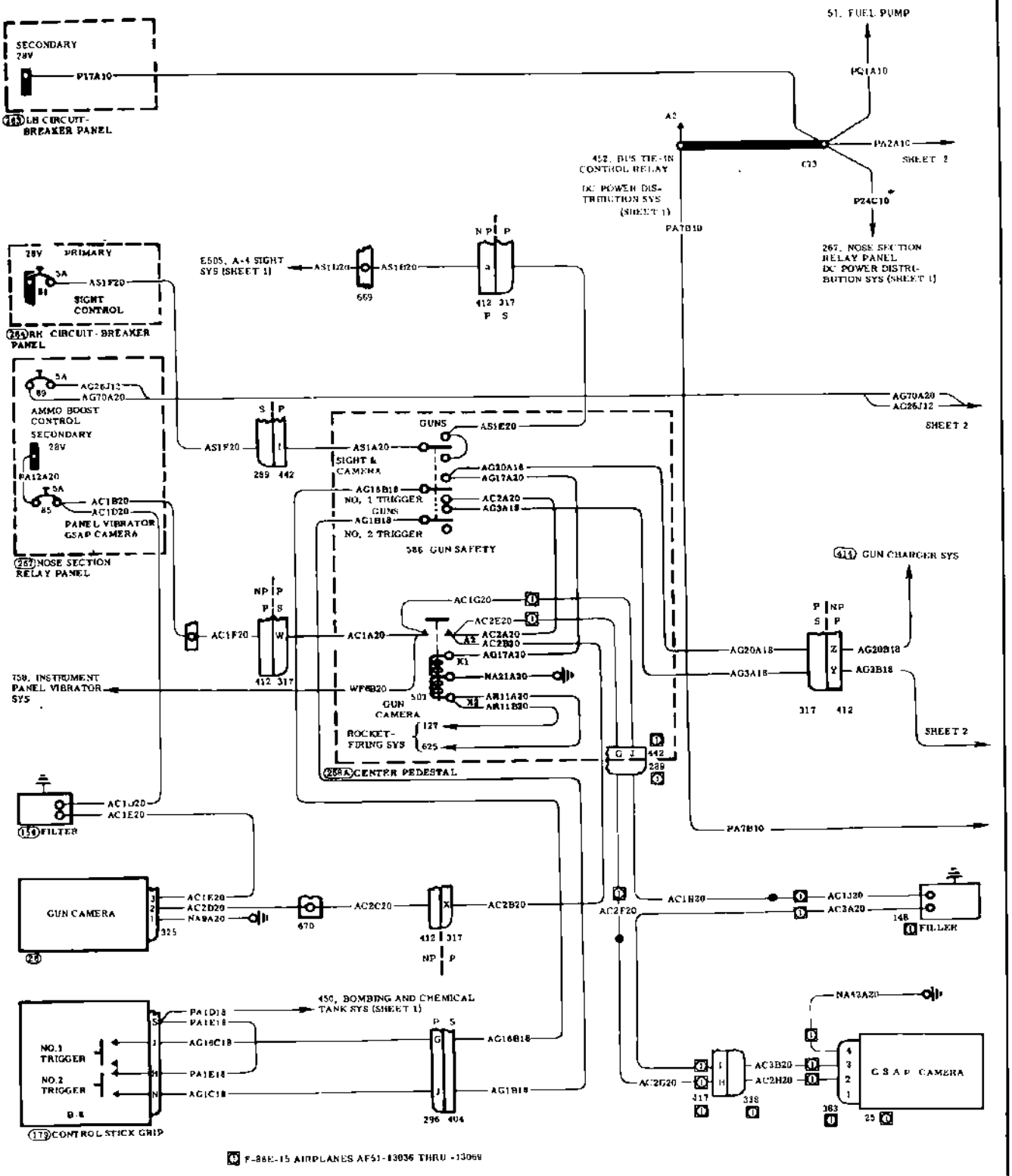
Systems—F-86E-10 Airplanes (Sheet 2 of 2)



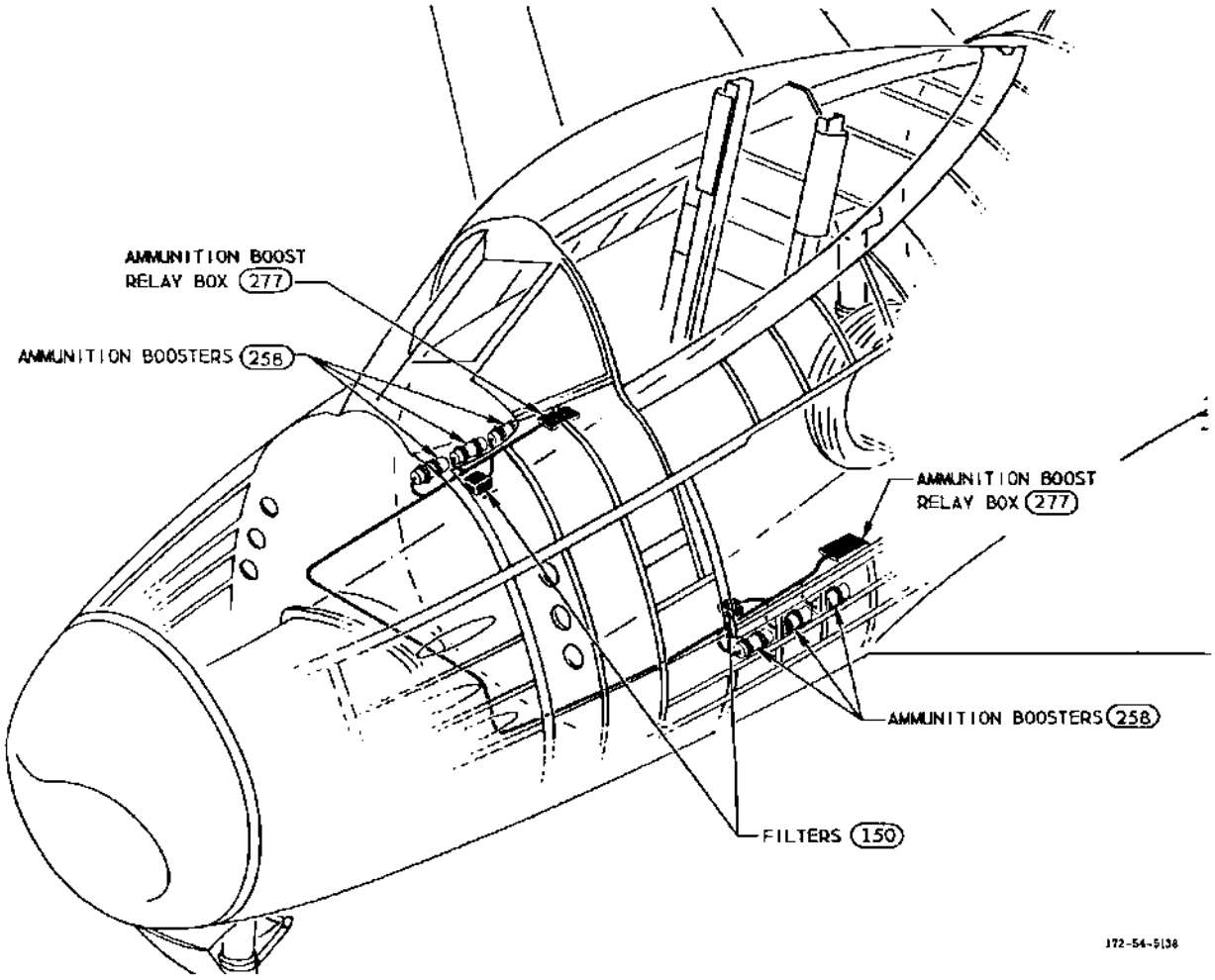
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
25	Camera—Sight GSAP	75-366, AN-N6 (GFP)
26	Camera—GSAP	75-366, AN-N6 (GFP)
81	Circuit Breaker—Sight Control	AN3161P5
85	Circuit Breaker—Panel Vibrator and GSAP Camera	AN3161P5
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
148	Filter—Camera Radio Noise	JX-55F (Sprague)
149	Filter—Ammunition Boost	172-54110 (NAA)
154	Filter—Camera Radio Noise	EA-125 (Solar)
179	Grip—Control Stick	AFX50C4064, Type B-8
263	Panel—Left Circuit-breaker	170-54068 (NAA)
264	Panel—Right Circuit-breaker	172-54040 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
289	Plug—Pedestal Disconnect	AN3106B32-7S
296	Plug—Control Stick Grip	AN3108B20-27P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
325	Plug—GSAP Camera	102 (Burton)
338	Plug—Instrument Panel Shroud Disconnect	AN3106B20-27P
383	Plug—GSAP Camera	102 (Burton)
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
417	Receptacle—Instrument Panel Shroud Disconnect	AN3100A20-27S
442	Receptacle—Pedestal Disconnect	AN3102A32-7P
507	Relay—GSAP Camera	233-51A (Leach)
586	Switch—Gun Safety	AN3226-1
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
673	Terminal Block—Pressure	151-54037 (NAA)

Figure 10-89. Camera and Gun-firing



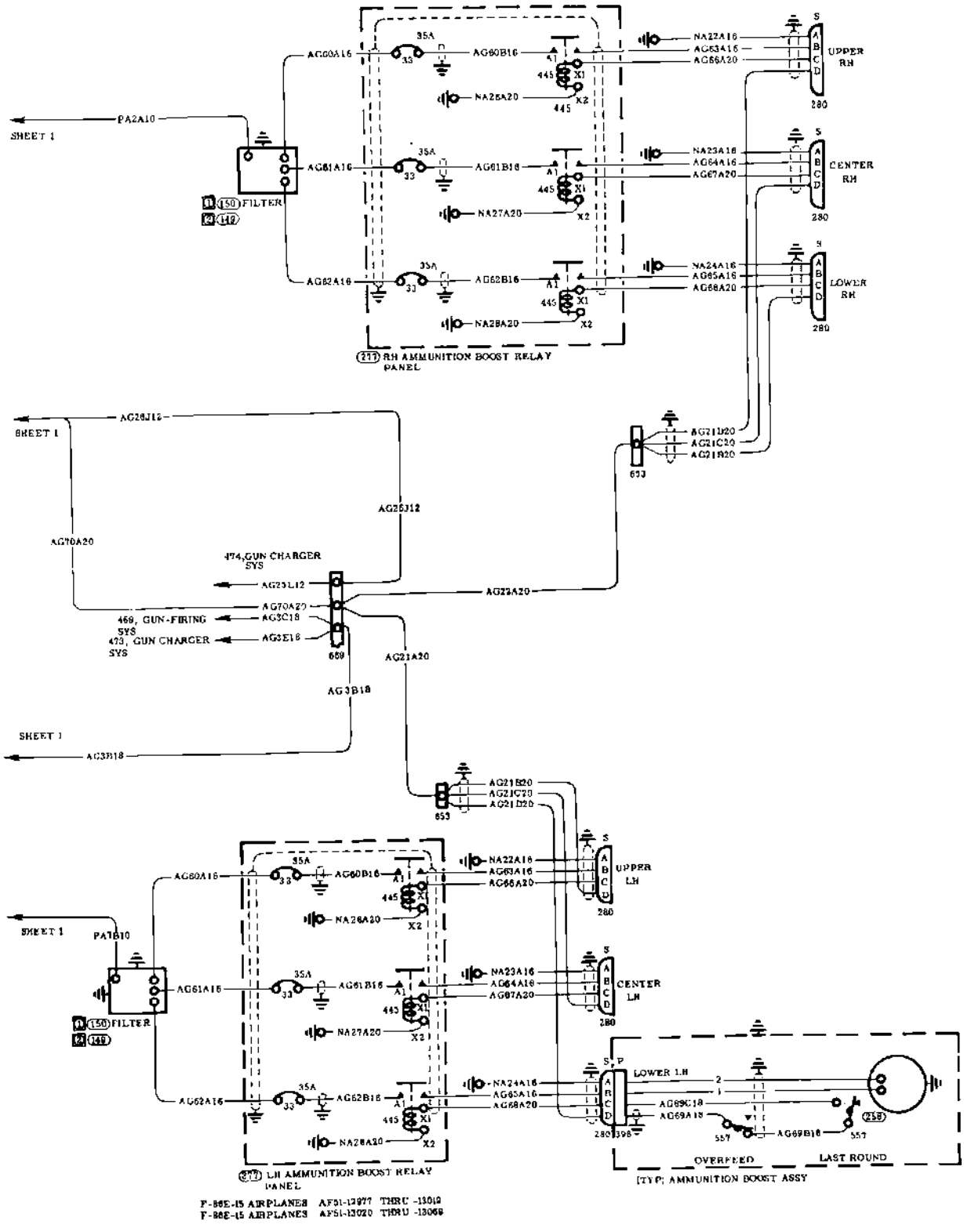
System—F-86E-15 Airplanes (Sheet 1 of 2)



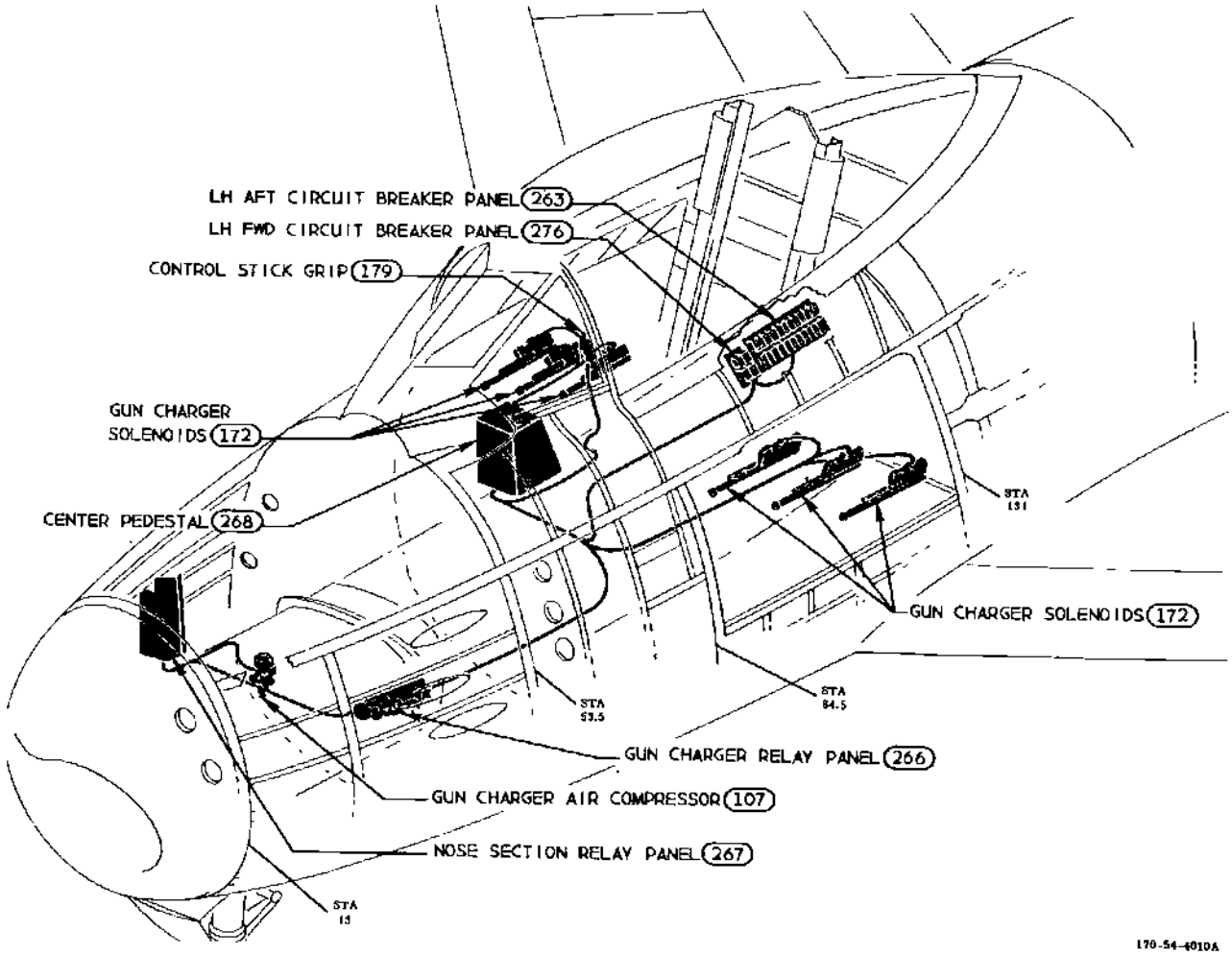
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
33	Circuit Breaker—Ammunition Boost	PDA-35 (Klixon)
150	Filter—Ammunition Boost	12270 (AiResearch)
258	Motor—Ammunition Boost	29492-1 (AiResearch) 29492-2 (AiResearch)
277	Panel—Ammunition Boost Relay	161-54037 (NAA)

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
280	Plug—Ammunition Boost Motor	AN3106B14S-2S
398	Receptacle—Ammunition Boost	AN3102A14S-2P
445	Relay—Ammunition Boost	AN3350-1
557	Switch—Ammunition Last-round	AN3210-1
653	Terminal Block—Ammunition Boost	AN3436-2-1
669	Terminal Block—Nose Junction Box	AN3436-2-18

Figure 10-89. Camera and Gun-firing



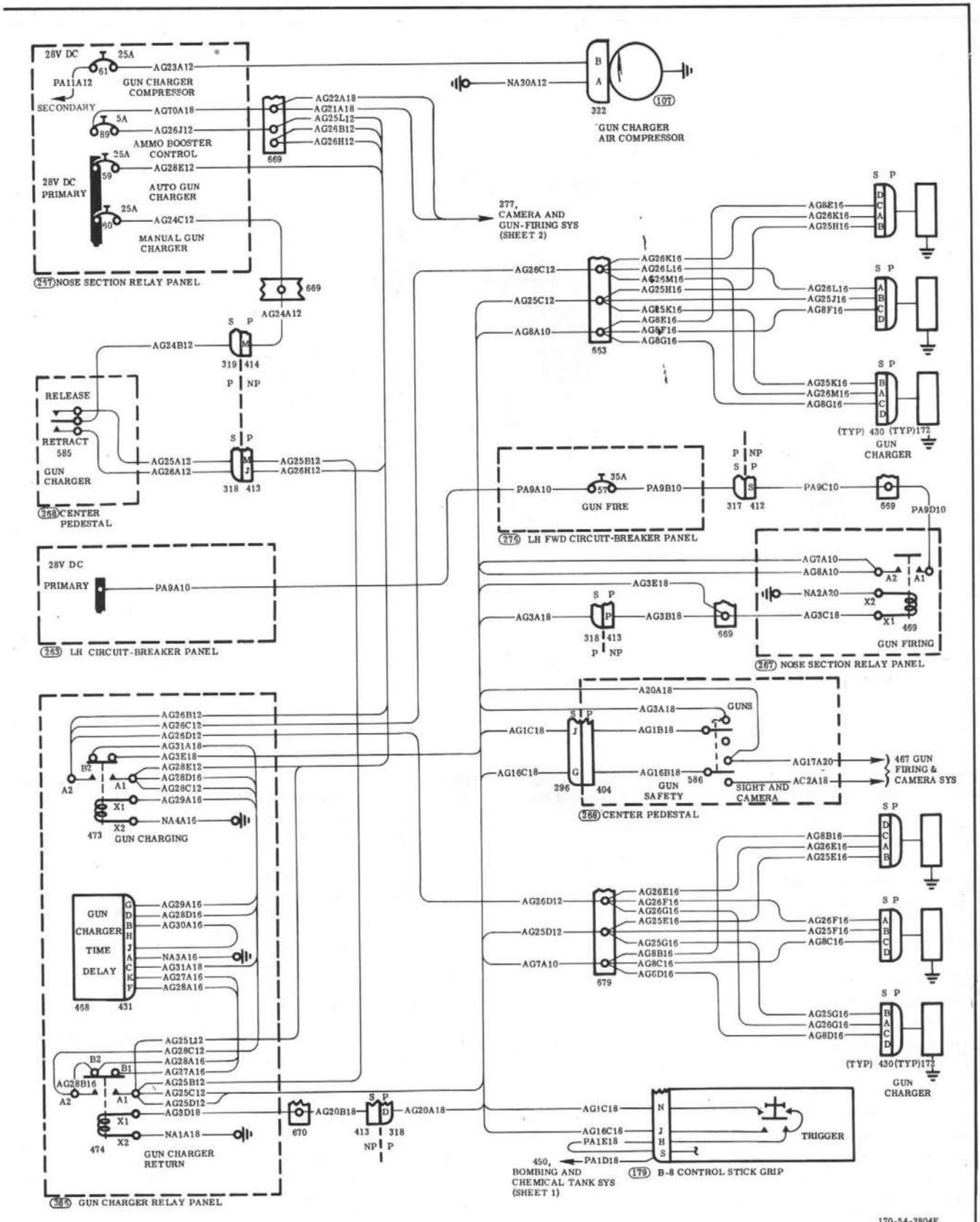
System—F-86E-15 Airplanes (Sheet 2 of 2)

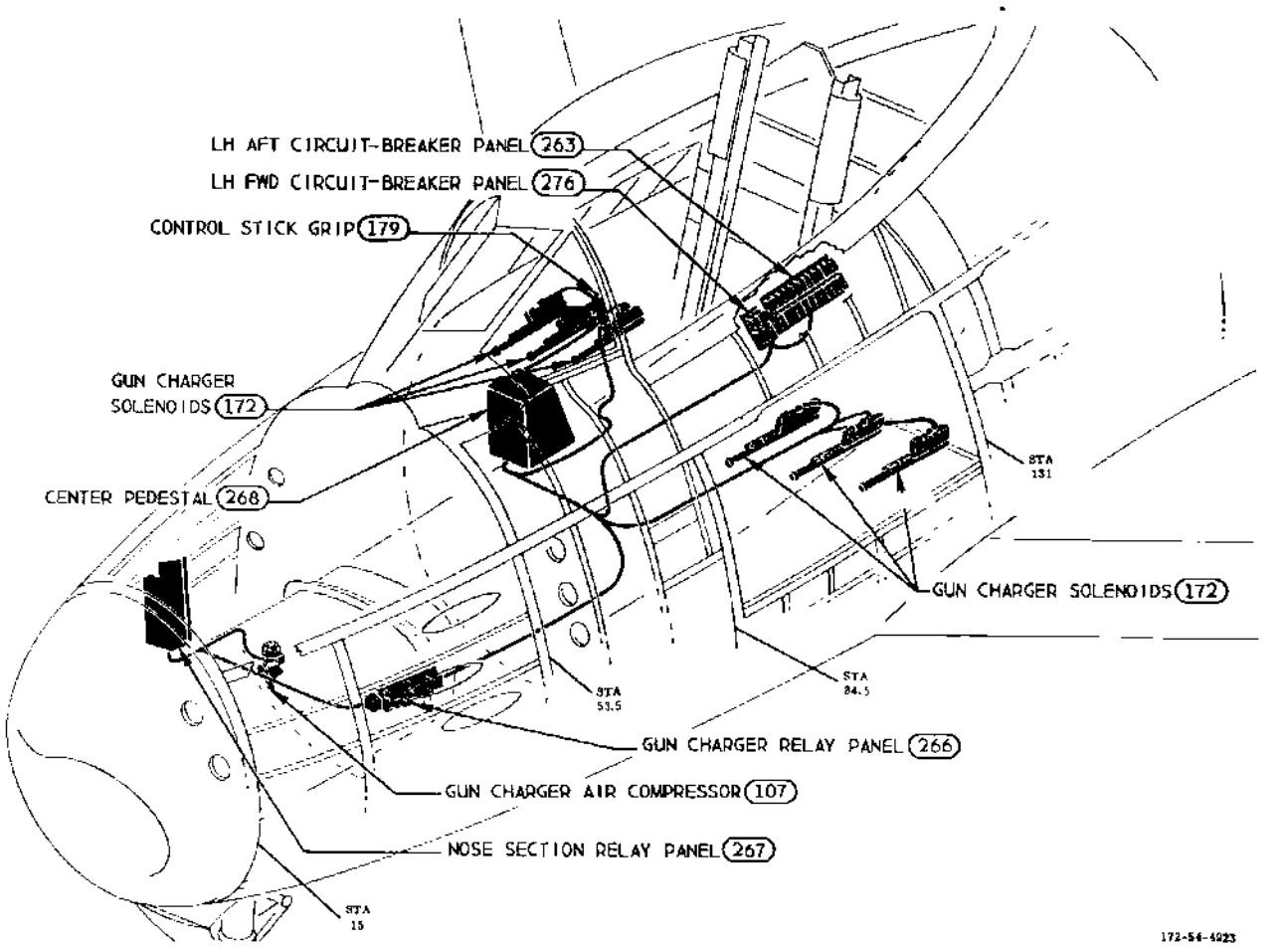


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
57	Circuit Breaker—Gunfire	AN3161P35
59	Circuit Breaker—Automatic Gun Charger	AN3161P25
60	Circuit Breaker—Manual Gun Charger	AN3161P25
61	Circuit Breaker—Gun Charger Compressor	AN3161P25
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
107	Compressor—Gun Charger Air	32 R-500 (Cornelius)
172	Charger—Gun	159006, Type B-1 (Kidde)
179	Grip—Control Stick	AFX50C4064, Type B-8
263	Panel—Left Circuit-breaker	170-54068 (NAA)
266	Panel—Gun Charger Relay	170-54034 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
277	Panel—Ammunition Boost Relay	161-54037 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
322	Plug—Gun Charger Air Compressor	AN3106B16-11S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
430	Receptacle—Gun Charger	AN3101A14S-2S
431	Receptacle—Gun Charger Time Delay Relay	AN3100A22-19SW
468	Relay—Gun Charger Time Delay	650-3029 (Cook)
469	Relay—Gun-firing	AN3350-1
473	Relay—Gun Charger Retraction	AN3353-1
474	Relay—Gun Charging Return	AN3353-1
585	Switch—Gun Charger	AN3021-7
586	Switch—Gun Safety	AN3226-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN 3436-2-12

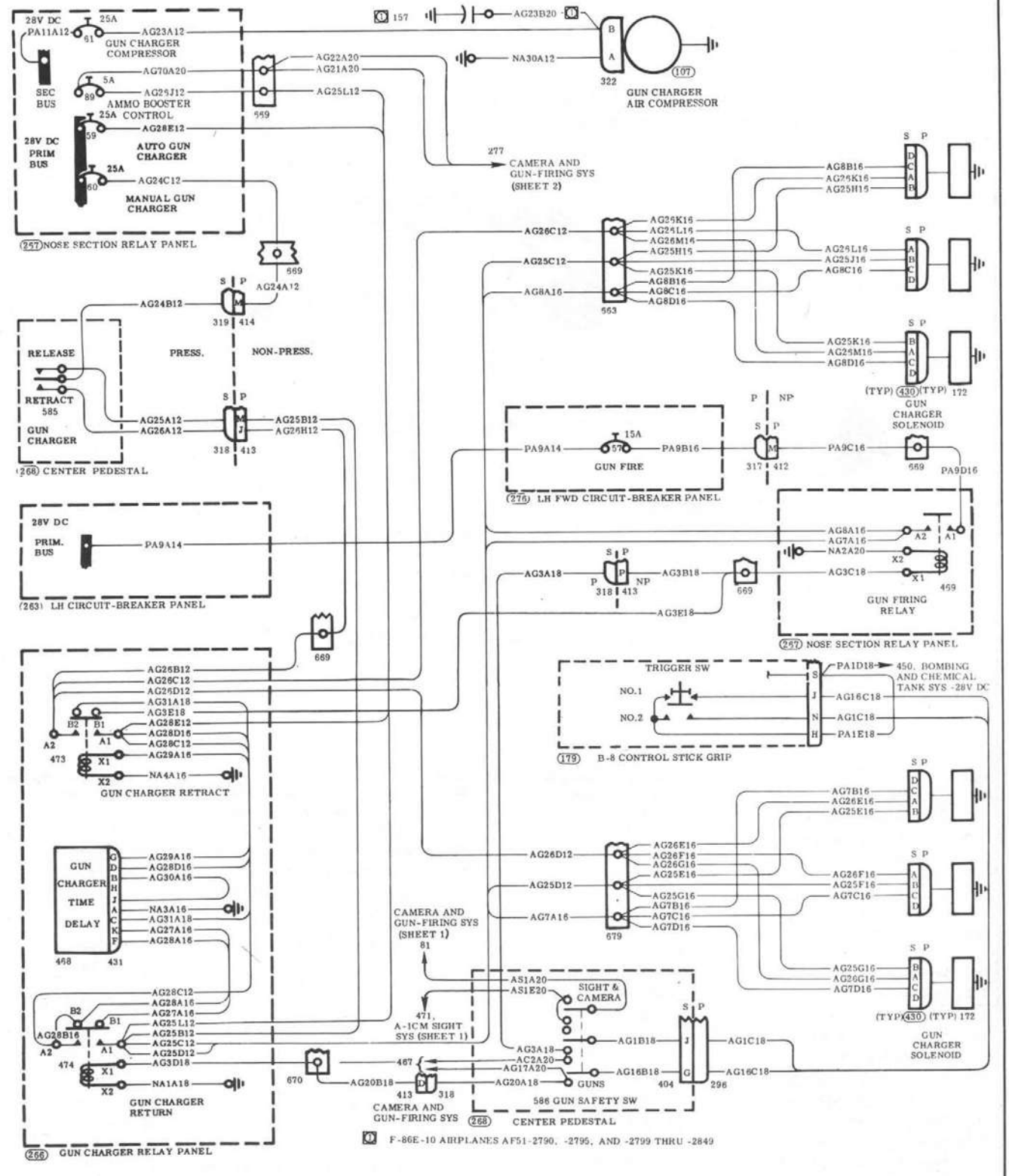
Figure 10-90. Gun Charger System—

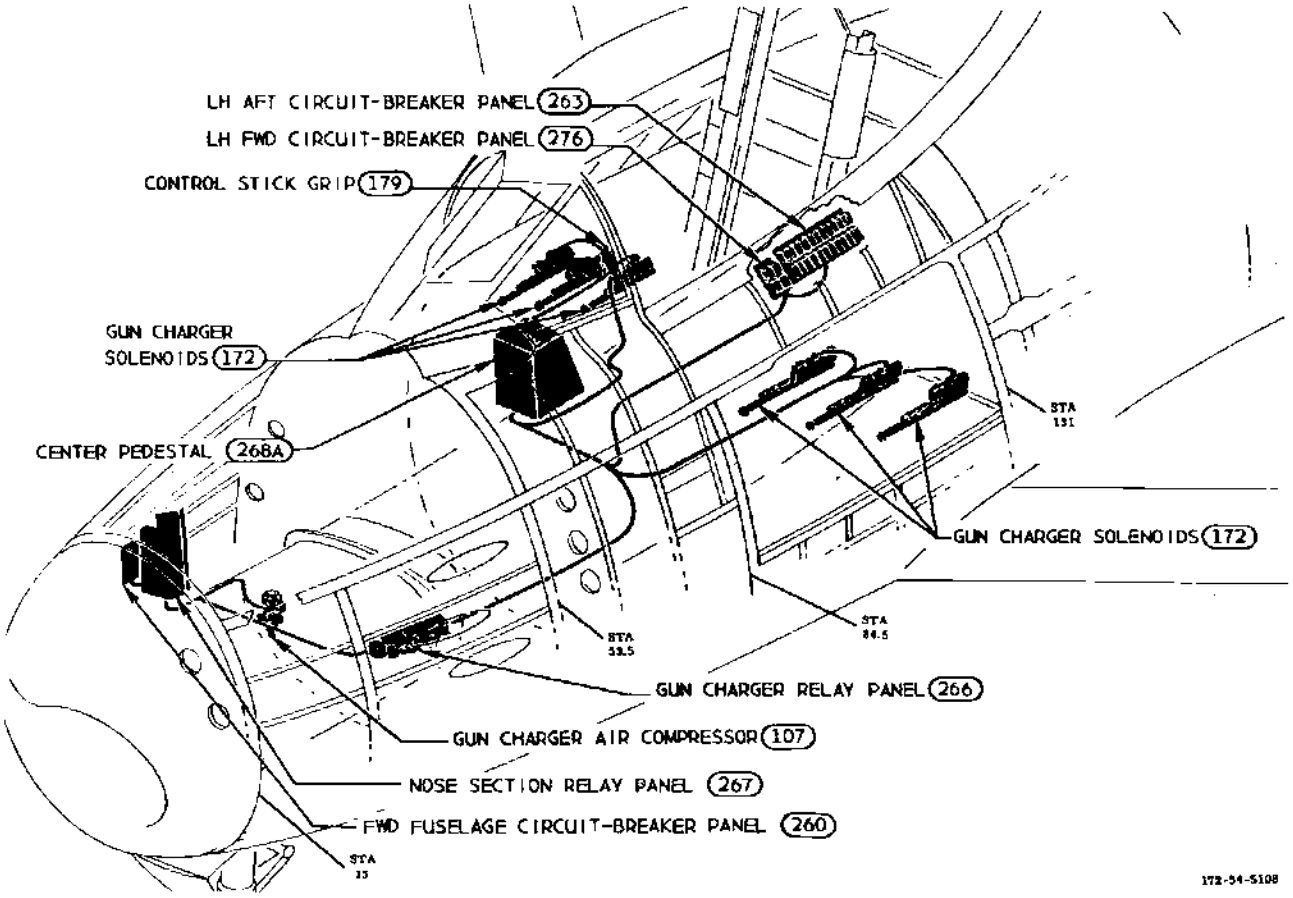

28V DC
25A
61
AG23A12
GUN CHARGER COMPRESSOR
PA11A12
SECONDARY
AG70A18
5A
89
AG26J12
AMMO BOOSTER CONTROL
25A
59
AG28E12
28V DC PRIMARY
AUTO GUN CHARGER
25A
90
AG24C12
MANUAL GUN CHARGER
247 NOSE SECTION RELAY PANEL
669
AG22A18
AG21A18
AG25L12
AG26B12
AG26H12
NA30A12
B
A
107
322
GUN CHARGER AIR COMPRESSOR
277, CAMERA AND GUN-FIRING SYS (SHEET 2)
AG24A12
AG24B12
S P
M
319 414
P NP
RELEASE
RETRACT
585
GUN CHARGER
AG25A12
AG26A12
AG25B12
AG26H12
318 413
268 CENTER PEDESTAL
AG26C12
AG25C12
AG8A10
AG26K16
AG26L16
AG25M16
AG25H16
AG25K16
AG8E16
AG8F16
AG8G16
653
AG8E16
AG26K16
AG25H16
AG26L16
AG25J16
AG8F16
AG25K16
AG26M16
AG8G16
(TYP) 430 (TYP) 172
GUN CHARGER
PA9A10
35A
57
PA9B10
GUN FIRE
274 LH FWD CIRCUIT-BREAKER PANEL
317 412
PA9C10
669
PA9D10
28V DC
PRIMARY
PA9A10
263 LH CIRCUIT-BREAKER PANEL
AG7A10
AG8A10
AG3E18
AG3A18
AG3B18
669
NA2A20
AG3C18
469
GUN FIRING
267 NOSE SECTION RELAY PANEL
A20A18
AG3A18
GUNS
AG1C18
AG1B18
AG16C18
AG16B18
AG17A20
467 GUN FIRING & CAMERA SYS
AC2A18
296
404
586
GUN SAFETY
SIGHT AND CAMERA
268 CENTER PEDESTAL
AG26B12
AG26C12
AG26D12
AG31A16
AG3E18
AG28E12
AG28D16
AG28C12
AG29A16
NA4A16
473
GUN CHARGING
GUN CHARGER TIME DELAY
AG29A16
AG28D16
AG30A16
NA3A16
AG31A18
AG27A16
AG28A16
458
431
AG25L12
AG28C12
AG28A16
AG27A16
AG25B12
AG25C12
AG25D12
AG3D18
NA1A18
474
GUN CHARGER RETURN
AG28B16
670
AG20B18
AG20A18
413 318
NP P
AG26D12
AG25D12
AG7A10
AG26E16
AG26F16
AG26G16
AG25E16
AG25G16
AG8B16
AG8C16
AG6D16
679
AG8B16
AG26E16
AG25E16
AG26F16
AG25F16
AG8C16
AG25G16
AG26G16
AG8D16
(TYP) 430 (TYP) 172
GUN CHARGER
AG1C18
AG16C18
PA1E18
PA1D18
TRIGGER
450, BOMBING AND CHEMICAL TANK SYS (SHEET 1)
179 B-8 CONTROL STICK GRIP
346 GUN CHARGER RELAY PANEL
170-54-2804E



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
57	Circuit Breaker—Gunfire	AN3161P15
59	Circuit Breaker—Automatic Gun Charger	AN3161P25
60	Circuit Breaker—Manual Gun Charger	AN3161P25
61	Circuit Breaker—Gun Charger Compressor	AN3161P25
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
107	Compressor—Gun Charger Air	32R-500 (Cornelius)
157	Filter—Gun Charger Air Compressor	CP53B2EB405K
172	Charger—Gun	159006, Type B-1 (Kidde)
179	Grip—Control Stick	AFX50C4064, Type B-8
263	Panel—Left Circuit-breaker	170-54068 (NAA)
266	Panel—Gun Charger Relay	170-54034 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268	Panel—Center Pedestal	170-54104 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
319	Plug—Forward Pressure Right-hand Forward Disconnect	AN3106B28-12S
322	Plug—Gun Charger Air Compressor	AN3106B16-11S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
414	Receptacle—Forward Pressure Right-hand Forward Disconnect	AN3100C28-12P
430	Receptacle—Gun Charger	AN3101A14S-2S
431	Receptacle—Gun Charger Time Delay Relay	AN3100A22-19SW
468	Relay—Gun Charger Time Delay	650-3029 (Cook)
469	Relay—Gun-firing	AN3350-1
473	Relay—Gun Charger Retraction	AN3353-1
474	Relay—Gun Charging Return	AN3353-1
585	Switch—Gun Charger	AN3021-7
586	Switch—Gun Safety	AN3226-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-18
670	Terminal Block—Nose Wiring	AN3436-4-14
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12

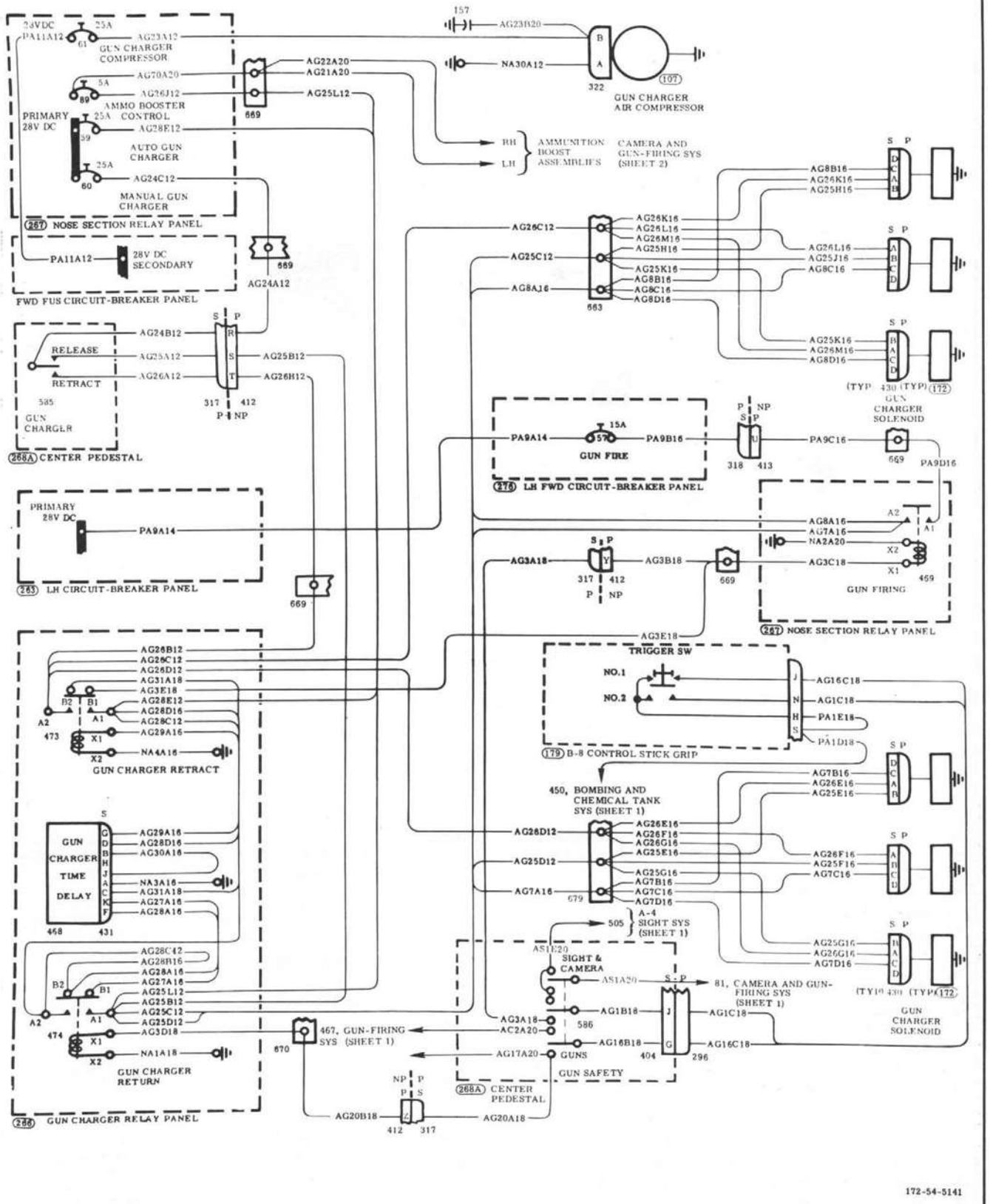
Figure 10-91. Gun Charger

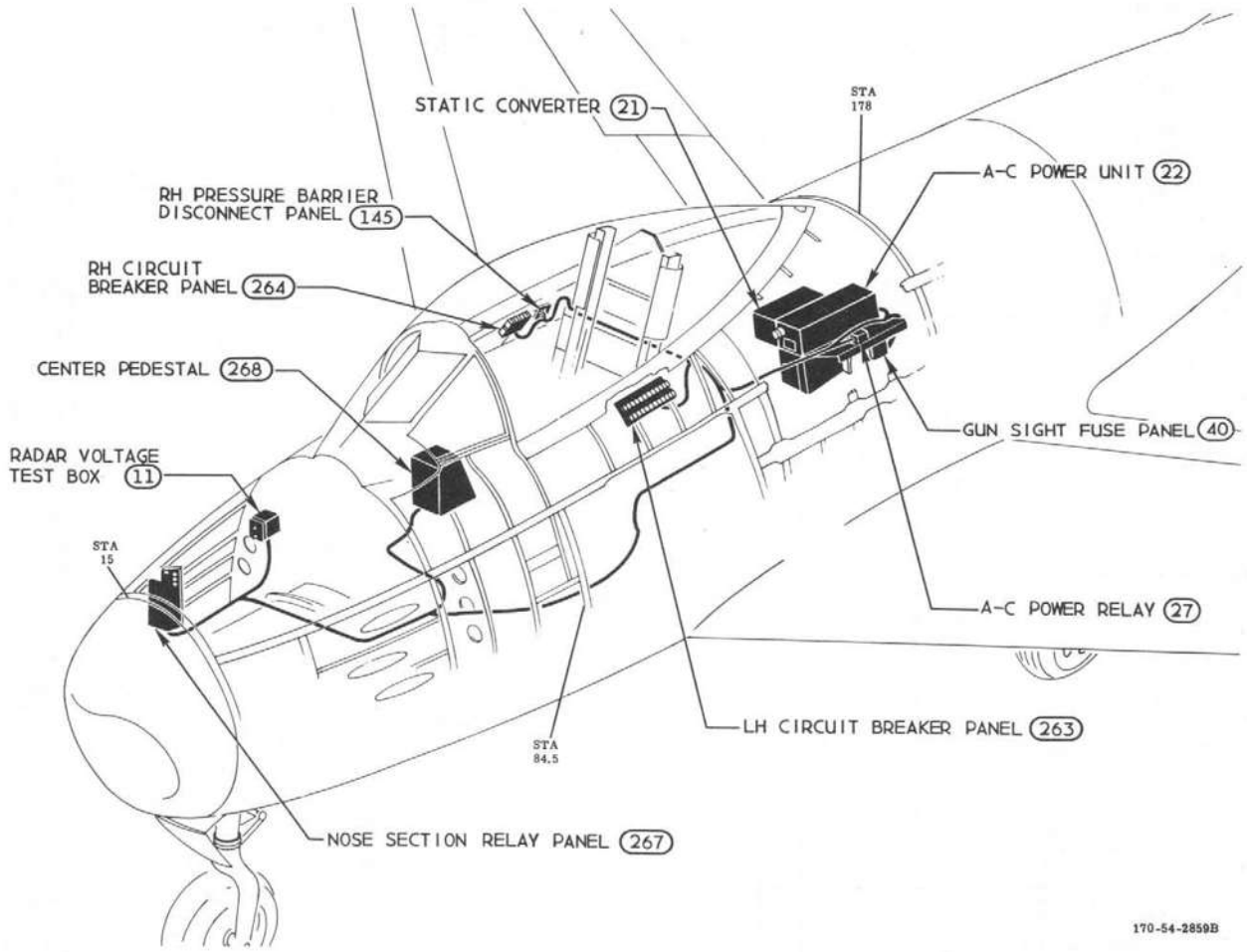

28V DC PRIM BUS
SEC BUS
GUN CHARGER COMPRESSOR
AMMO BOOSTER
25A CONTROL
AUTO GUN CHARGER
MANUAL GUN CHARGER
257 NOSE SECTION RELAY PANEL
157
AG23B20
NA30A12
322
107
GUN CHARGER AIR COMPRESSOR
559
AG22A20
AG21A20
AG25L12
277
CAMERA AND GUN-FIRING SYS (SHEET 2)
569
AG24A12
AG24B12
319
414
RELEASE
PRESS.
NON-PRESS.
RETRACT
585
GUN CHARGER
AG25A12
AG26A12
AG25B12
AG26H12
318
413
268 CENTER PEDESTAL
AG26C12
AG25C12
AG8A16
AG25K16
AG25L16
AG26M16
AG25H15
AG25J16
AG8B16
AG8C16
AG8D16
563
AG8B16
AG25K16
AG25H15
AG26L16
AG25J16
AG8C16
AG25K16
AG25M16
AG8D16
(TYP) 430 (TYP) 172
GUN CHARGER SOLENOID
PA9A14
15A
57
PA9B16
GUN FIRE
276 LH FWD CIRCUIT-BREAKER PANEL
317
412
PA9C16
669
PA9D16
28V DC PRIM. BUS
PA9A14
263 LH CIRCUIT-BREAKER PANEL
AG8A16
AG7A16
NA2A20
AG3C18
469
GUN FIRING RELAY
257 NOSE SECTION RELAY PANEL
AG3A18
AG3B18
AG3E18
318
413
669
TRIGGER SW
NO.1
NO.2
PA1D18
450. BOMBING AND CHEMICAL TANK SYS -28V DC
AG16C18
AG1C18
PA1E18
179 B-8 CONTROL STICK GRIP
AG26B12
AG26C12
AG26D12
AG31A18
AG3E18
AG28E12
AG28D16
AG28C12
AG29A16
NA4A16
473
GUN CHARGER RETRACT
GUN CHARGER TIME DELAY
AG29A16
AG28D16
AG30A16
NA3A16
AG31A18
AG27A16
AG28A16
468
431
AG7B16
AG26E16
AG25E16
AG26D12
AG25D12
AG7A16
AG26E16
AG26F16
AG26G16
AG25E16
AG25G16
AG7B16
AG7C16
AG7D16
679
AG26F16
AG25F16
AG7C16
AG25G16
AG26G16
AG7D16
(TYP) 430 (TYP) 172
GUN CHARGER SOLENOID
CAMERA AND GUN-FIRING SYS (SHEET 1)
81
AS1A20
AS1E20
SIGHT & CAMERA
471, A-1CM SIGHT SYS (SHEET 1)
AG28C12
AG28A16
AG27A16
AG25L12
AG25B12
AG25C12
AG25D12
AG3D18
NA1A18
474
GUN CHARGER RETURN
AG3A18
AC2A20
AG17A20
AG20A18
GUNS
AG1B18
AG16B18
404
AG1C18
AG16C18
296
586 GUN SAFETY SW
670
AG20B18
467
413
318
CAMERA AND GUN-FIRING SYS
268 CENTER PEDESTAL
256 GUN CHARGER RELAY PANEL
F-86E-10 AIRPLANES AF51-2790, -2795, AND -2799 THRU -2849
170-54-4053D



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
57	Circuit Breaker—Gunfire	AN3161P15
59	Circuit Breaker—Automatic Gun Charger	AN3161P25
60	Circuit Breaker—Manual Gun Charger	AN3161P25
61	Circuit Breaker—Gun Charger Compressor	AN3161P25
89	Circuit Breaker—Ammunition Boost Control	AN3161P5
107	Compressor—Gun Charger Air	32R-500 (Cornelius)
172	Charger—Gun	159006, Type B-1 (Kidde)
179	Grip—Control Stick	AFX50C4064, Type B-8
260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
263	Panel—Left Circuit-breaker	170-54068 (NAA)
266	Panel—Gun Charger Relay	172-54034 (NAA)
267	Panel—Nose Section Relay	170-54055 (NAA)
268A	Panel—Center Pedestal	172-54104 (NAA)
276	Panel—Left Forward Circuit-breaker	151-53377 (NAA)
296	Plug—Control Stick Grip	AN3108B20-27P
317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
322	Plug—Gun Charger Air Compressor	AN3106B16-11S
404	Receptacle—B-8 Control Stick Grip	AN3102A20-27S
412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
430	Receptacle—Gun Charger	AN3101A14S-2S
431	Receptacle—Gun Charger Time Delay Relay	AN3100A22-19SW
468	Relay—Gun Charger Time Delay	650-3029 (Cook)
469	Relay—Gun-firing	AN3350-1
473	Relay—Gun Charger Retraction	AN3353-1
474	Relay—Gun Charging Return	AN3353-1
585	Switch—Gun Charger	AN3021-7
586	Switch—Gun Safety	AN3226-1
663	Terminal Block—Right Gun Bay	AN3436-2-10
669	Terminal Block—Nose Junction Box	AN3436-2-11
670	Terminal Block—Nose Wiring	AN3436-4-13
679	Terminal Block—Left Wing Forward	AN3436-2-10 AN3436-2-12

Figure 10-92. Gun Charger

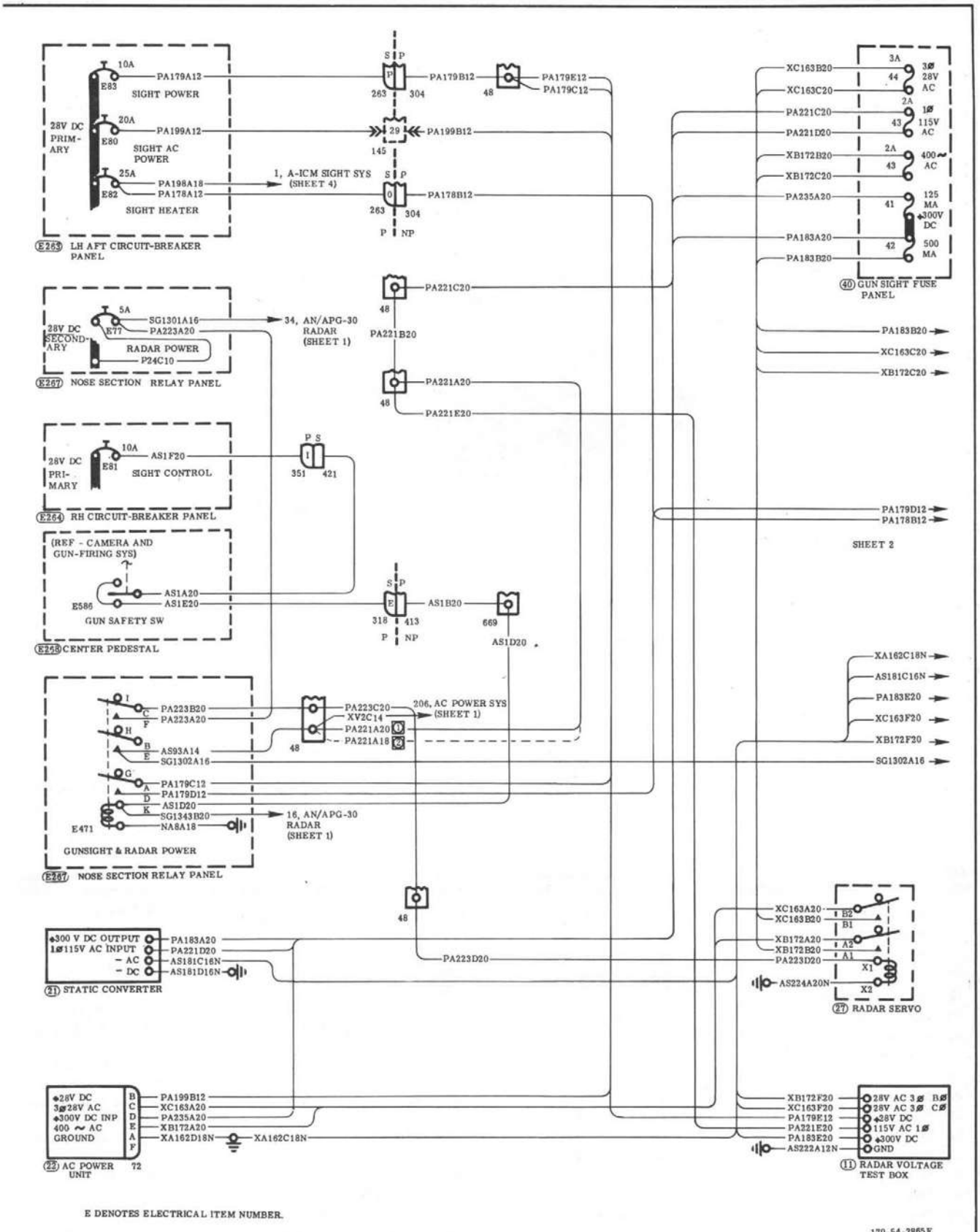

28VDC
PA11A12
25A
61
AG23A12
GUN CHARGER COMPRESSOR
AG70A20
5A
89
AG26J12
AMMO BOOSTER CONTROL
PRIMARY 28V DC
25A
59
AG28E12
AUTO GUN CHARGER
25A
60
AG24C12
MANUAL GUN CHARGER
(267) NOSE SECTION RELAY PANEL
PA11A12
28V DC SECONDARY
FWD FUS CIRCUIT-BREAKER PANEL
669
AG24A12
AG22A20
AG21A20
AG25L12
669
157
AG23B20
NA30A12
B
A
322
(107)
GUN CHARGER AIR COMPRESSOR
RH
LH
AMMUNITION BOOST ASSEMBLIES
CAMERA AND GUN-FIRING SYS (SHEET 2)
AG24B12
AG25A12
AG26A12
RELEASE
RETRACT
585
GUN CHARGER
(268A) CENTER PEDESTAL
S P
R
S
T
317 412
P NP
AG25B12
AG26H12
AG26C12
AG25C12
AG8A16
AG26K16
AG26L16
AG26M16
AG25H16
AG25K16
AG8B16
AG8C16
AG8D16
663
AG8B16
AG26K16
AG25H16
AG26L16
AG25J16
AG8C16
AG25K16
AG26M16
AG8D16
(TYP 430 (TYP) (172)
GUN CHARGER SOLENOID
PA9A14
15A
57
GUN FIRE
PA9B16
(276) LH FWD CIRCUIT-BREAKER PANEL
P NP
S P
U
318 413
PA9C16
669
PA9D16
PRIMARY 28V DC
PA9A14
(263) LH CIRCUIT-BREAKER PANEL
669
AG8A16
AG7A16
NA2A20
AG3C18
A2
A1
X2
X1
469
GUN FIRING
AG3A18
S P
Y
317 412
P NP
AG3B18
669
(267) NOSE SECTION RELAY PANEL
AG3E18
TRIGGER SW
NO.1
NO.2
J
N
H
S
AG16C18
AG1C18
PA1E18
PA1D18
(179) B-8 CONTROL STICK GRIP
450, BOMBING AND CHEMICAL TANK SYS (SHEET 1)
AG28B12
AG28C12
AG28D12
AG31A18
AG3E18
AG28E12
AG28D16
AG28C12
AG29A16
NA4A16
B2
B1
A2
A1
X1
X2
473
GUN CHARGER RETRACT
S
GUN CHARGER TIME DELAY
G
D
B
H
J
A
C
K
F
AG29A16
AG28D16
AG30A16
NA3A16
AG31A18
AG27A16
AG28A16
468
431
AG28C12
AG28B16
AG28A16
AG27A16
AG25L12
AG25B12
AG25C12
AG25D12
AG3D18
NA1A18
B2
B1
A2
A1
X1
X2
474
GUN CHARGER RETURN
(266) GUN CHARGER RELAY PANEL
AG28D12
AG25D12
AG7A16
AG26E16
AG26F16
AG26G16
AG25E16
AG25G16
AG7B16
AG7C16
AG7D16
679
505
A-4 SIGHT SYS (SHEET 1)
AG7B16
AG26E16
AG25E16
AG26F16
AG25F16
AG7C16
AG25G16
AG26G16
AG7D16
(TYP 430 (TYP) (172)
GUN CHARGER SOLENOID
AS1E20
SIGHT & CAMERA
AS1A20
S P
81, CAMERA AND GUN-FIRING SYS (SHEET 1)
AG3A18
AC2A20
AG17A20
AG1B18
AG16B18
GUNS
586
404
J
G
AG1C18
AG16C18
296
GUN SAFETY
(268A) CENTER PEDESTAL
467, GUN-FIRING SYS (SHEET 1)
670
NP P
P S
Z
AG20B18
AG20A18
412 317
172-54-5141



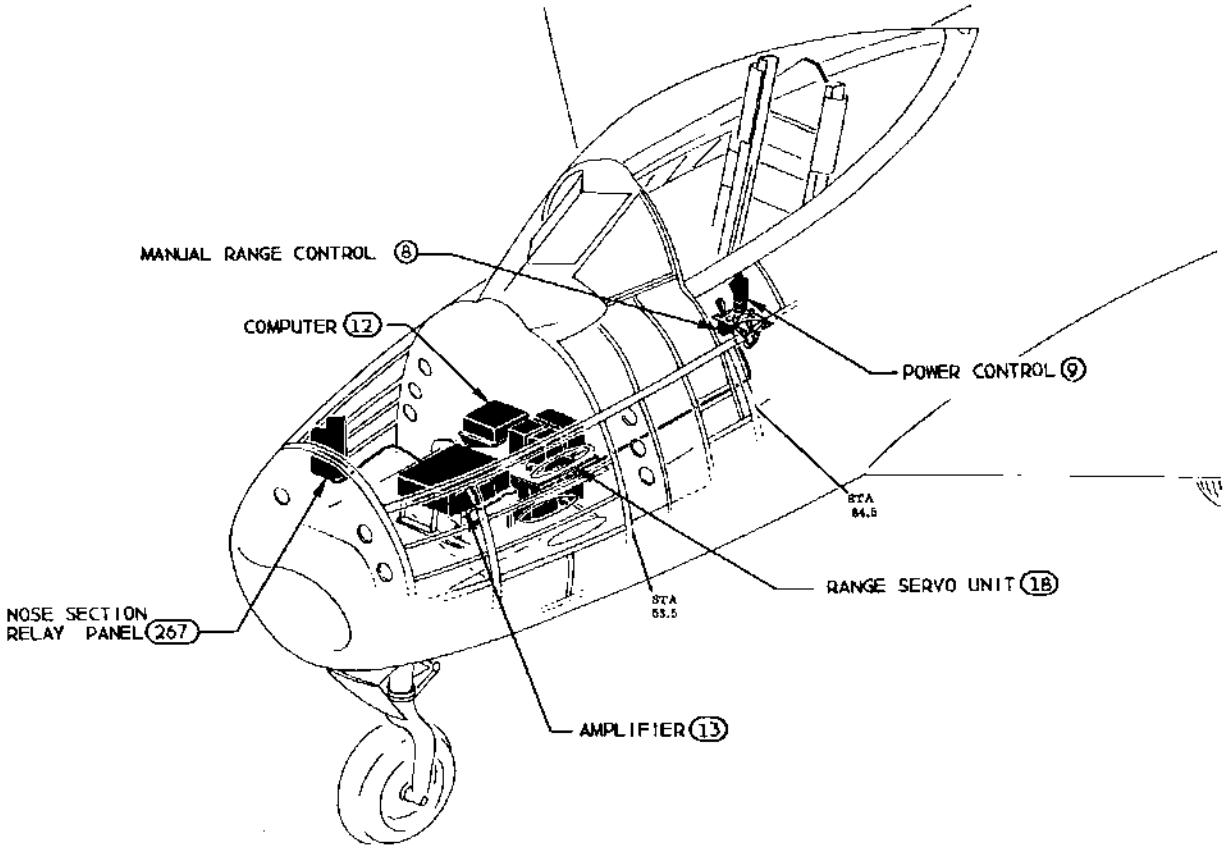
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
11	Test Box—Voltage	151-74083 (NAA)
21	Converter—Static D-C	32617, Type E-1
22	Power Unit—Armament	Type D-2
27	Relay—Radar Servo	237EAU (Leach)
40	Panel—Fuse	170-74014 (NAA)
41	Fuse—D-2 D-C Power 300-volt 125-milliampere	
42	Fuse—Amplifier D-C Power 300-volt 500-milliampere	
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
44	Fuse—Amplifier and A-C Power 28-volt 3-ampere	
48	Terminal Strip	NAS45-6-( )
72	Plug	AN3106B22-24S
E77	Circuit Breaker—Radar Power	AN3161P5
E80	Circuit Breaker—Sight A-C Power Unit	AN3161P20
E81	Circuit Breaker—Sight Control	AN3161P10

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
E82	Circuit Breaker—Sight Heater	AN3161P25
E83	Circuit Breaker—Sight Power	AN3161P10
E145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
E263	Panel—Left Circuit-breaker	170-54068 (NAA)
E264	Panel—Right Circuit-breaker	170-54057 (NAA)
E267	Panel—Nose Section Relay	170-54055 (NAA)
E268	Panel—Center Pedestal	170-54104 (NAA)
304	Receptacle	AN3100PR32-7S
E318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
E351	Plug—Pedestal Disconnect	AN3106A32-7P
E413	Receptacle—Left-hand Aft Pressure Disconnect	AN3100C28-11P
E421	Receptacle—Pedestal Disconnect	AN3100A32-7S
E471	Relay—Gun Sight Power	G-39989A (Guardian)
E586	Switch—Gun Safety	AN3226-1
669	Terminal Block—Nose Junction Box	AN3436-2-18

Figure 10-93. A-1CM Sight System—

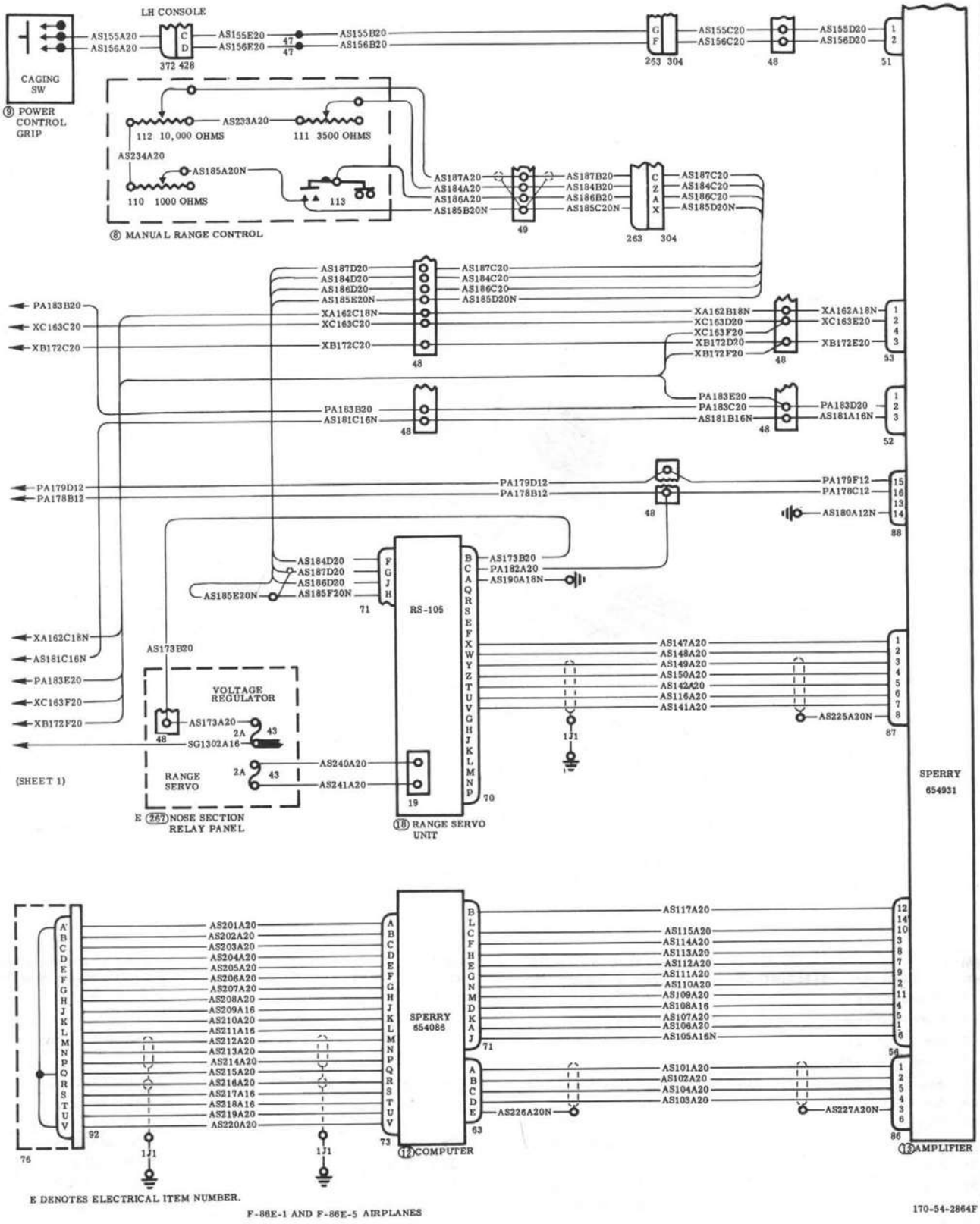


F-86E-1 and F-86E-5 Airplanes (Sheet 1 of 3)

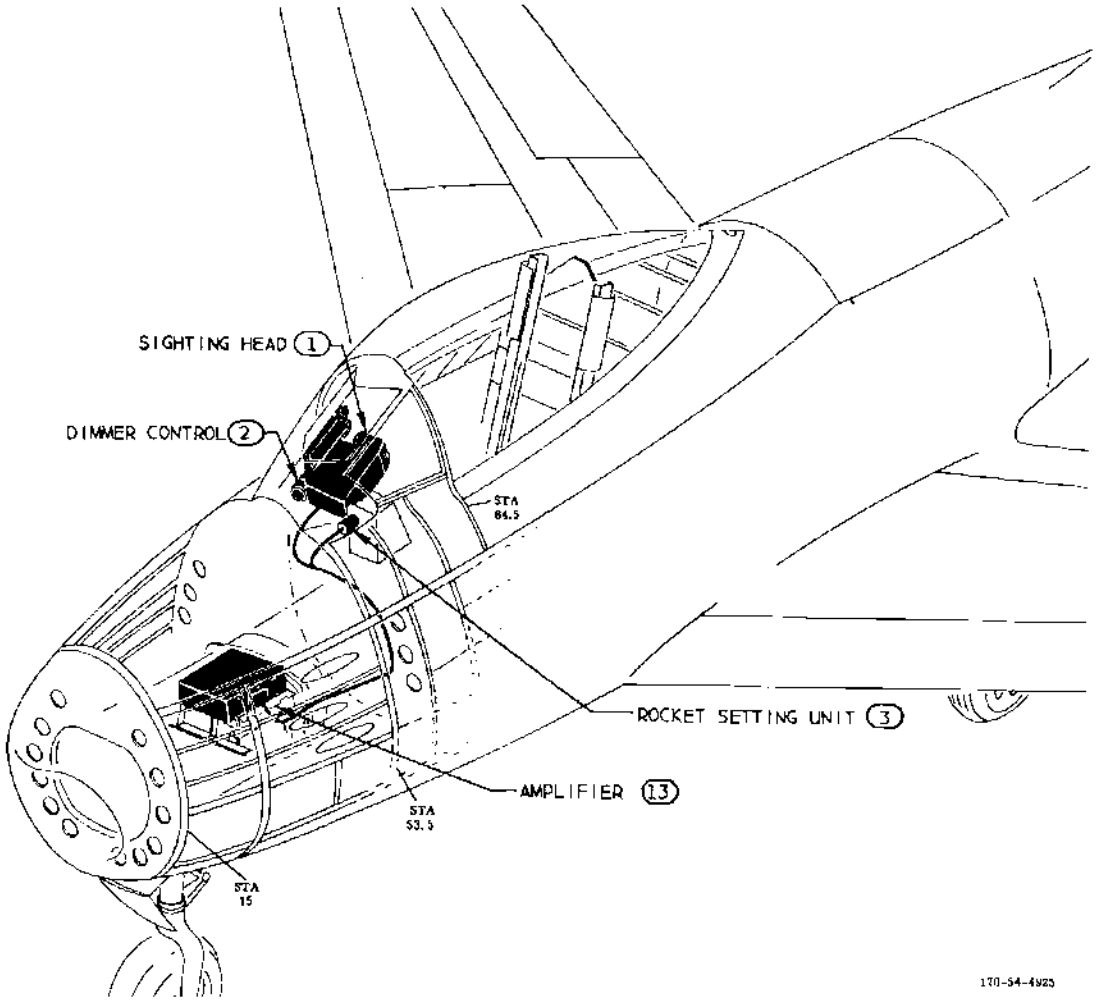


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
8	Control Unit—Manual Range	170-43059 (NAA)
9	Switch—Caging	138106 (Ucinite)
12	Computer	654086 (Sperry)
13	Amplifier	654931 (Sperry)
18	Servo Unit—Range	102527 (Type RS-105)
19	Jack Assembly	171-74052 (NAA)
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
48	Terminal Strip	NAS45-6-( )
49	Terminal Strip	6-140 (H. B. Jones)
51	Plug	P302-CCT-L (H. B. Jones)
52	Plug	P303-CCT-L (H. B. Jones)
53	Plug	P304-CCT-L (H. B. Jones)
56	Plug	P312-CCT- L (H. B. Jones)
63	Plug	AN3106B14S-5P
70	Plug	AN3106B24-28S
71	Plug	AN3106B22-19S
73	Plug	AN3106B28-16P
76	Plug	AN3106B28-16P
86	Socket	S306-CCT-L
87	Socket	S308-CCT-L
88	Socket	S404-CCT-L
92	Receptacle	AN3100-28-16S
110	Potentiometer · 1000-ohm	A4509-A (Chicago Telephone Supply)
111	Potentiometer	A4510 (Chicago Telephone Supply)
112	Potentiometer—10,000-ohm	Y4321-A (Chicago Telephone Supply)
113	Microswitch	BZ-3YDT (Micro Switch)
263	Plug	AN3106B32-7P
E267	Panel—Nose Section Relay	170-54055 (NAA)
304	Receptacle	AN3100PR32-7S
372	Plug—Throttle Disconnect	AN3106B16S-1P
428	Receptacle—Throttle Disconnect	AN3101B16S-1S

Figure 10-93. A-1CM Sight System—



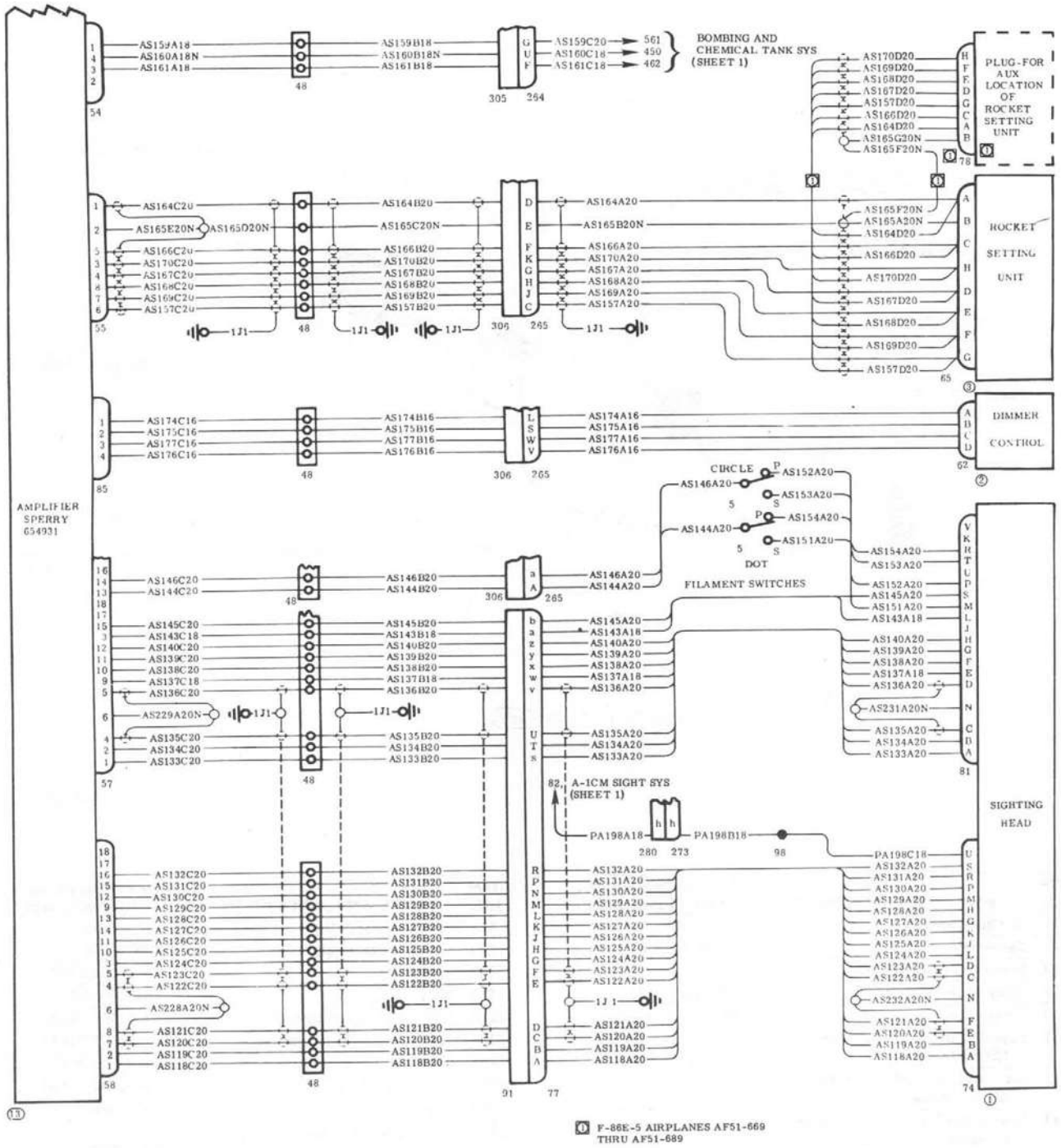
F-86E-1 and F-86E-5 Airplanes (Sheet 2 of 3)



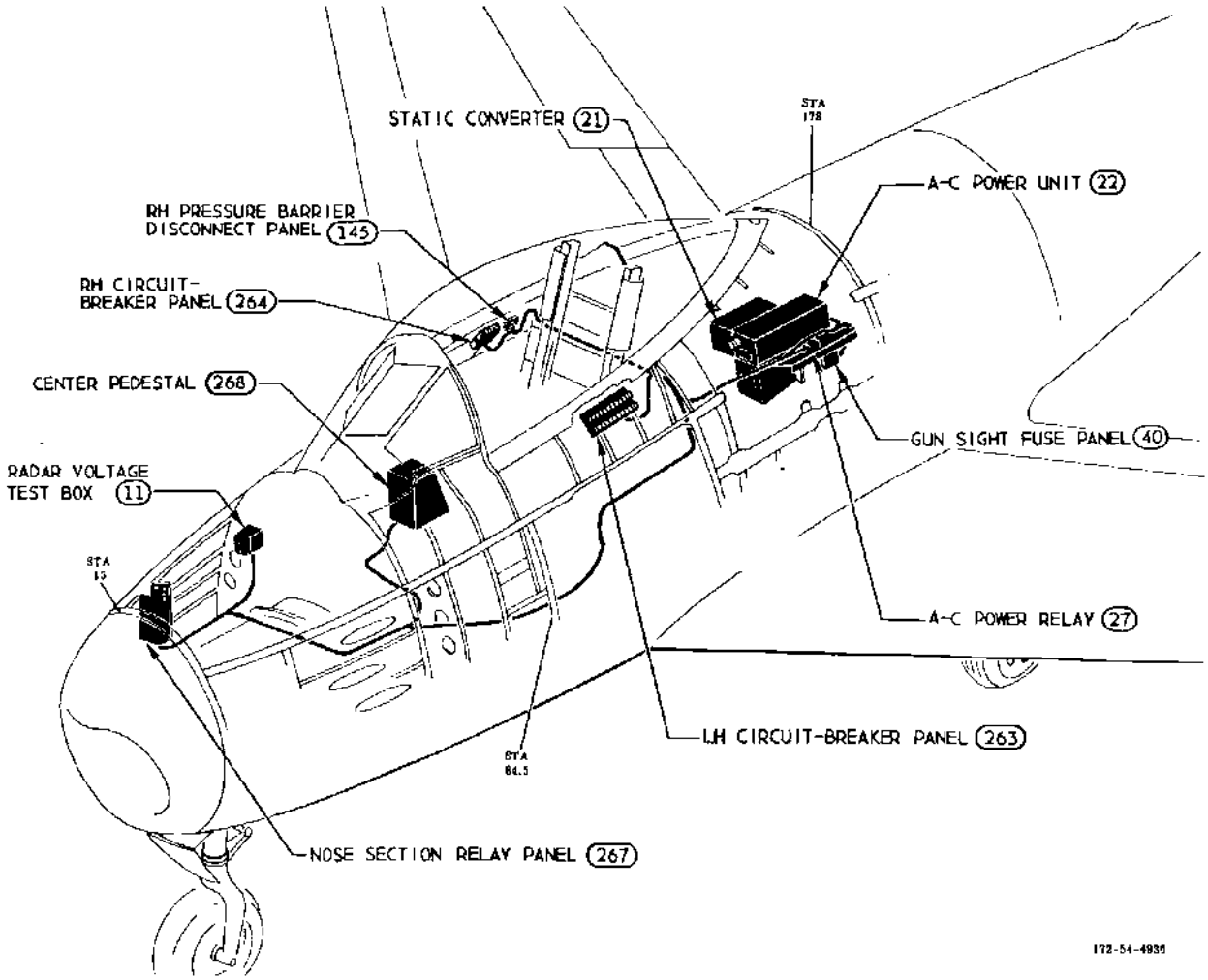
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Sighting Head	665096 (Sperry)
2	Control—Dimmer	665087 (Sperry)
3	Rocket Setting Unit	665097 (Sperry)
5	Switch—Filament	AN3021-3
13	Amplifier	654931 (Sperry)
48	Terminal Strip	NAS45-6-( )
54	Plug	P306-CCT-L (H. B. Jones)
55	Plug	P308-CCT-L (H. B. Jones)
57	Plug	P315-CCT-L (H. B. Jones)
58	Plug	P318-CCT-L (H. B. Jones)
62	Plug	AN3106B14S-2S
65	Plug	AN3106B18-8S
74	Plug	AN3106B28-16S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
77	Plug	AN3106B28-12P
78	Plug	AN3107-18-8S
81	Plug	AN3108B22-14S
85	Socket	S304-CCT-L
91	Receptacle	AN3100PR28-12S
98	Connector—Butt	35203 (Aircraft-Marine Products)
264	Plug	AN3106B28-11P
265	Plug	AN3106B28-12P
273	Plug	AN3106B32-7P
280	Receptacle	AN3100-32-7S
305	Receptacle	AN3100PR28-11S
306	Receptacle	AN3100PR28-12S

Figure 10-93. A-1CM Sight System—



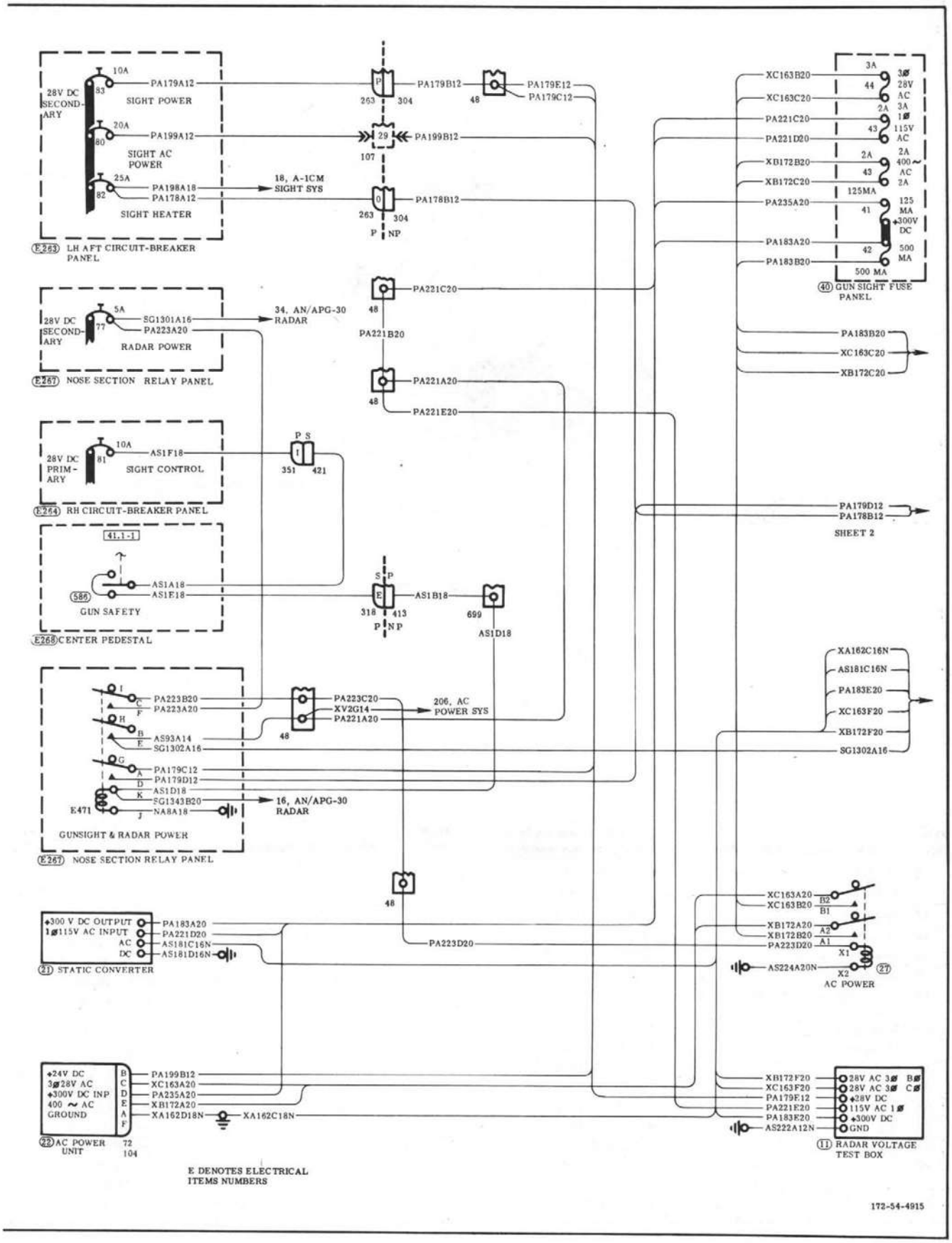
F-86E-1 and F-86E-5 Airplanes (Sheet 3 of 3)



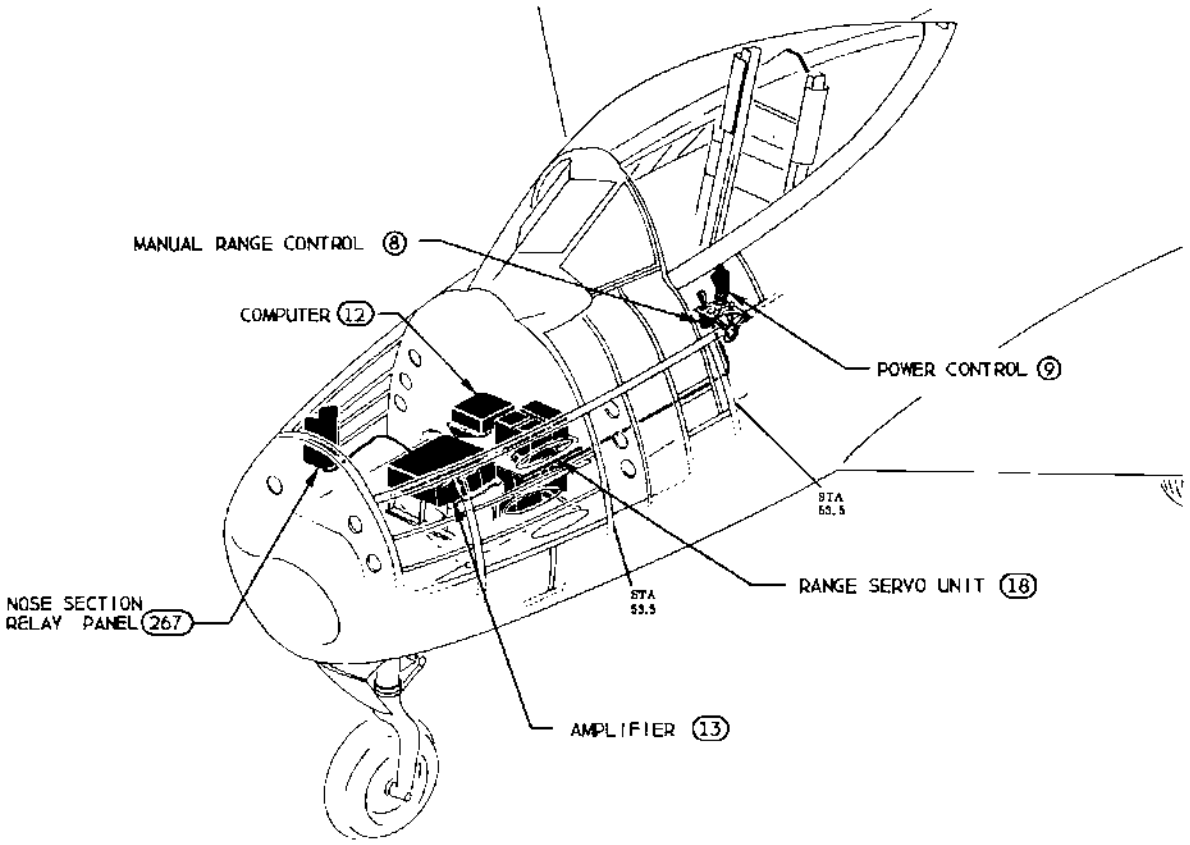
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
11	Test Box—Voltage	151-74083 (NAA)
21	Converter—Static D-C	32617, Type E-1
22	Power Unit—Armament A-C	Type D-2
27	Relay—Radar Servo	237EAU (Leach)
40	Panel—Fuse	170-74014 (NAA)
41	Fuse—D-2 D-C Power 300-volt 125-milliampere	
42	Fuse—Amplifier D-C Power 300-volt 500-milliampere	
43	Fuse—Amplifier and Servo 400-cycle 2-ampere	
44	Fuse—Amplifier and A-C Power 28-volt 3-ampere	
48	Terminal Strip	NAS45-6-( )
72	Plug	AN3106B22-24S
E77	Circuit Breaker—Rador Power	AN3161P5
E80	Circuit Breaker—Sight A-C Power Unit	AN3161P20
E81	Circuit Breaker—Sight Control	AN3161P10

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
E82	Circuit Breaker—Sight Heater	AN3161P25
E83	Circuit Breaker—Sight Power	AN3161P10
107	Receptacle	AN3100C24-28P
263	Plug	AN3106B32-7P
E263	Panel—Left Circuit-breaker	170-54068 (NAA)
E264	Panel—Right Circuit-breaker	170-54057 (NAA)
E267	Panel—Nose Section Relay	170-54055 (NAA)
E268	Panel—Center Pedestal	170-54104 (NAA)
304	Receptacle	AN3100PR32-7S
E318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
E351	Plug—Pedestal Disconnect	AN3106A32-7P
E413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
E421	Receptacle—Pedestal Disconnect	AN3100A32-7S
E471	Relay—Gun Sight Power	G-39989A (Guardian)
E586	Switch—Gun Safety	AN3226-1
E669	Terminal Block—Nose Junction Box	AN3436-2-18

Figure 10-94. A-1CM Sight System—



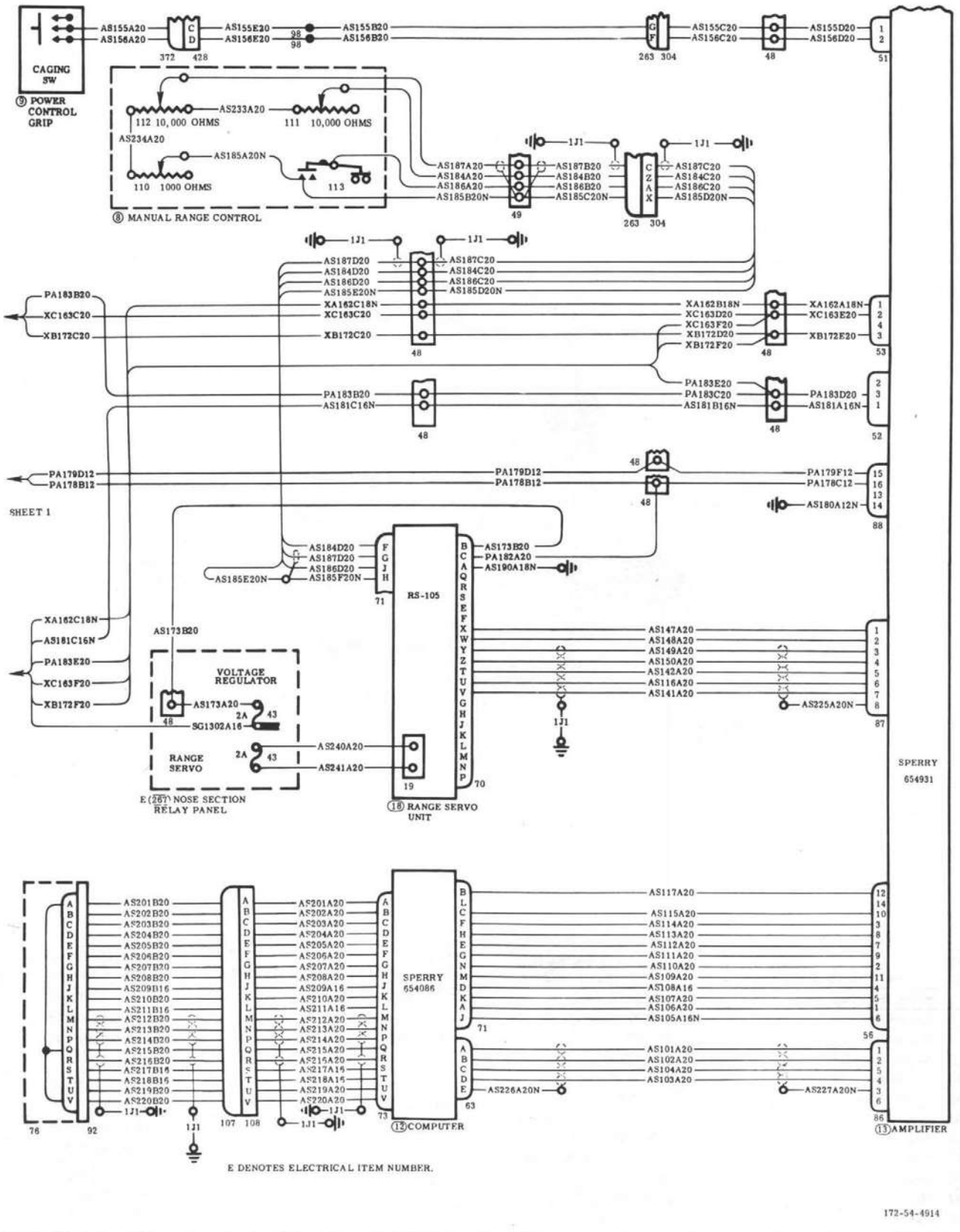
F-86E-6 Airplanes (Sheet 1 of 3)



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
8	Control Unit—Manual Range	170-43059 (NAA)
9	Switch—Caging	138106 (Ucinite)
12	Computer	654086 (Sperry)
13	Amplifier	654931 (Sperry)
18	Servo Unit—Range	102527, Type RS-105
19	Jack Assembly	171-74052 (NAA)
43	Fuse -Amplifier and Servo 400-cycle A-C 2-ampere	
48	Terminal Strip	NAS45-6-( )
49	Terminal Strip	6-140 (H. B. Jones)
51	Plug	P302-CCT-L (H. B. Jones)
52	Plug	P303-CCT-L (H. B. Jones)
53	Plug	P304-CCT-L (H. B. Jones)
56	Plug	P312-CCT-L (H. B. Jones)
63	Plug	AN3106B14S-5P
70	Plug	AN3106B24-28S
71	Plug	AN3106B22-19S
73	Plug	AN3106B28-16P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
76	Plug	AN3106B28-16P
86	Socket	S306-CCT-L
87	Socket	S308-CCT-L
88	Socket	S404-CCT-L
92	Receptacle	AN3100-28-16S
107	Receptacle	AN3100C24-28P
108	Plug	AN3108B24-28S
110	Potentiometer—1000-ohm	A4509-A (Chicago Telephone Supply)
111	Potentiometer—3500-ohm	A-4510 (Chicago Telephone Supply)
112	Potentiometer—10,000-ohm	Y4321-A (Chicago Telephone Supply)
113	Microswitch	BZ-3YDT (Micro Switch)
263	Plug	AN3106B32-7P
E267	Panel—Nose Section Relay	170-54055 (NAA)
304	Receptacle	AN3100PR32-7S
372	Plug—Throttle Disconnect	AN3106B16S-1P
428	Receptacle—Throttle Disconnect	AN3101B16S-1S

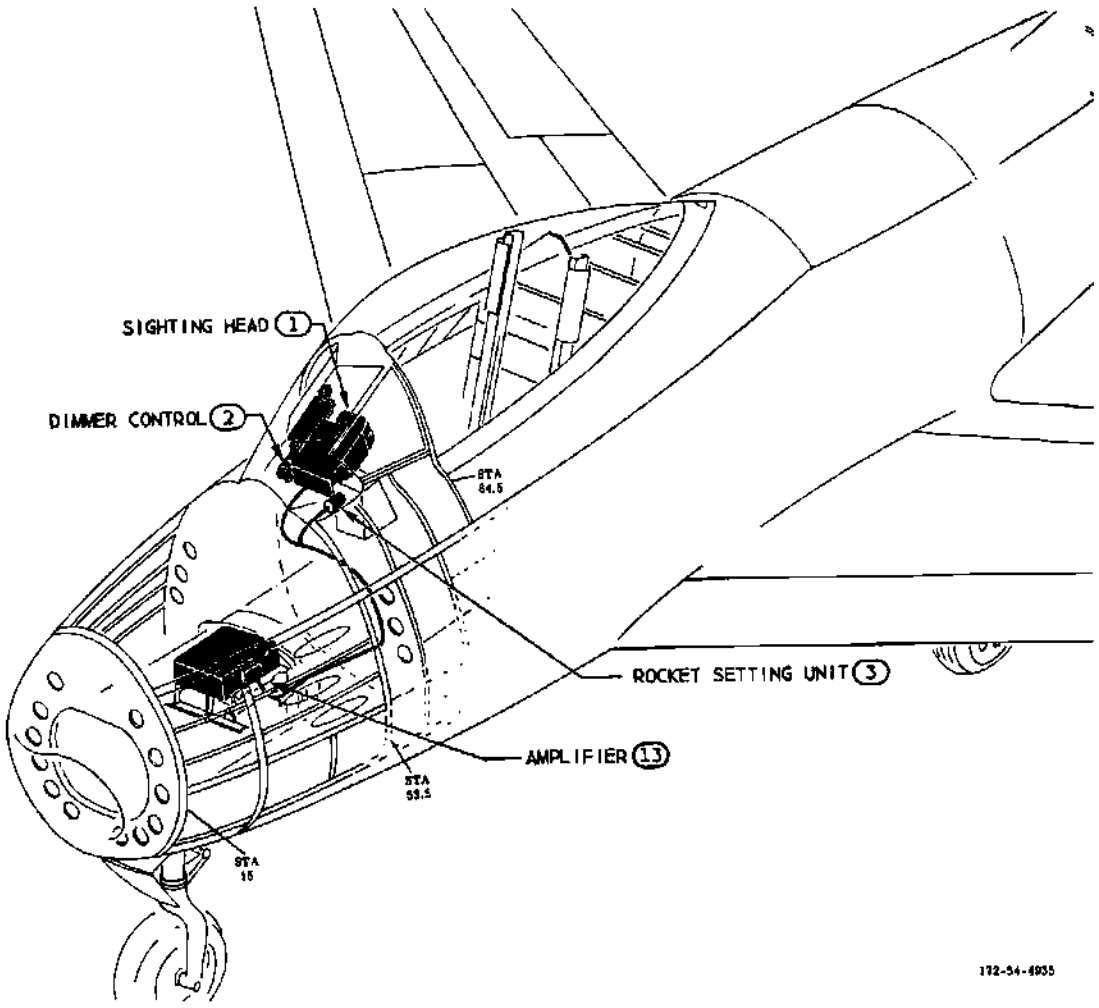
Figure 10-94. A-1CM Sight System—



E DENOTES ELECTRICAL ITEM NUMBER.

172-54-4914

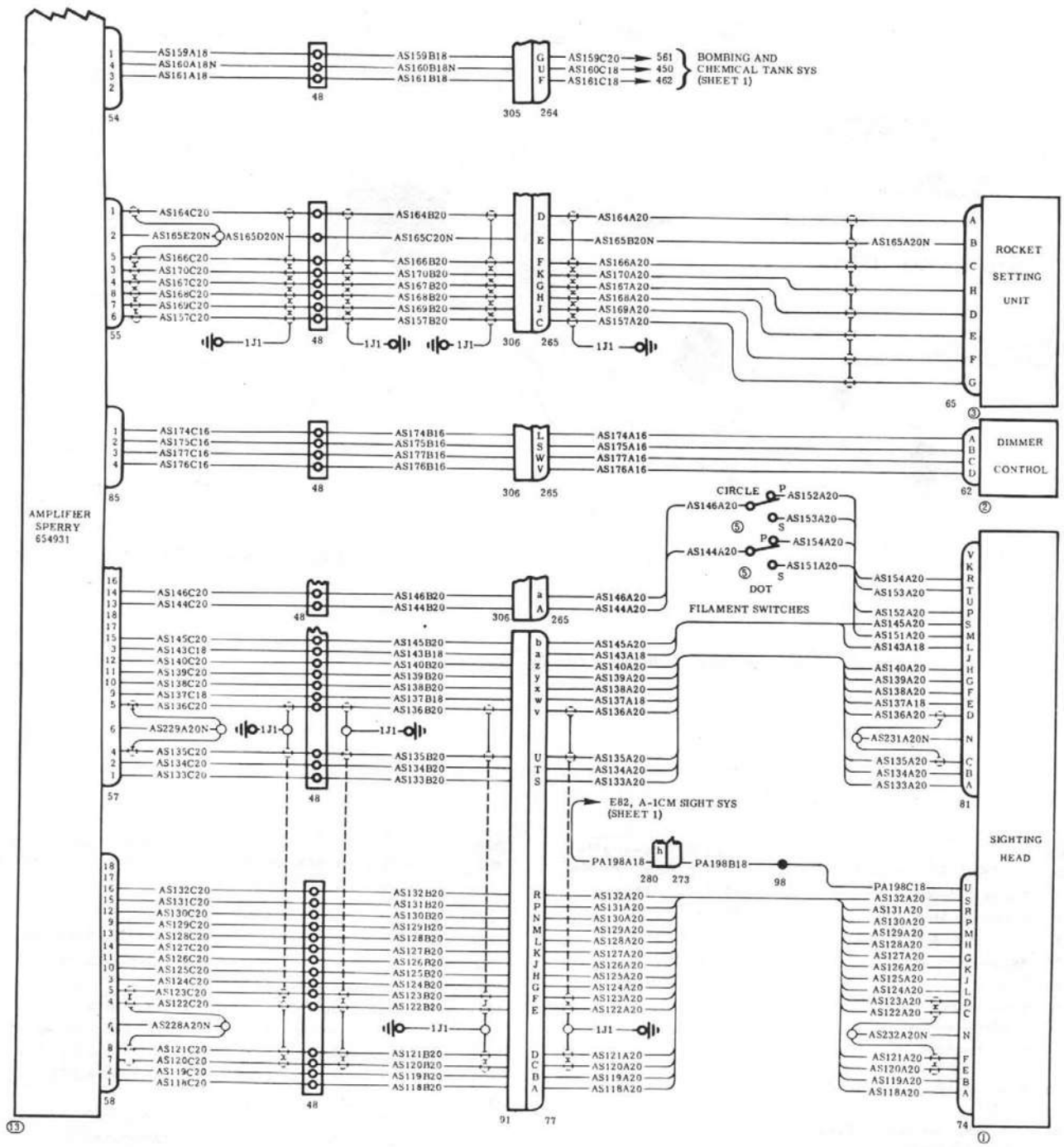
F-86E-6 Airplanes (Sheet 2 of 3)



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Head—Sighting	665096 (Sperry)
2	Control—Dimmer	665087 (Sperry)
3	Rocket Setting Unit	665097 (Sperry)
5	Switch—Filament	AN3021-3
13	Amplifier	654931 (Sperry)
48	Terminal Strip	NAS45-6-( )
54	Plug	P306-CCT-L (H. B. Jones)
55	Plug	P308-CCT-L (H. B. Jones)
57	Plug	P315-CCT-L (H. B. Jones)
58	Plug	P318-CCT-L (H. B. Jones)
62	Plug	AN3106B14S-2S
65	Plug	AN3106B18-8S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
74	Plug	AN3106B28-16S
77	Plug	AN3106B28-12P
81	Plug	AN3108B22-14S
85	Socket	S304-CCT-L
91	Receptacle	AN3100PR28-12S
264	Plug	AN3106B28-11P
265	Plug	AN3106B28-12P
273	Plug	AN3106B32-7P
280	Receptacle	AN3100-32-7S
305	Receptacle	AN3100PR28-11S
306	Receptacle	AN3100PR28-12S

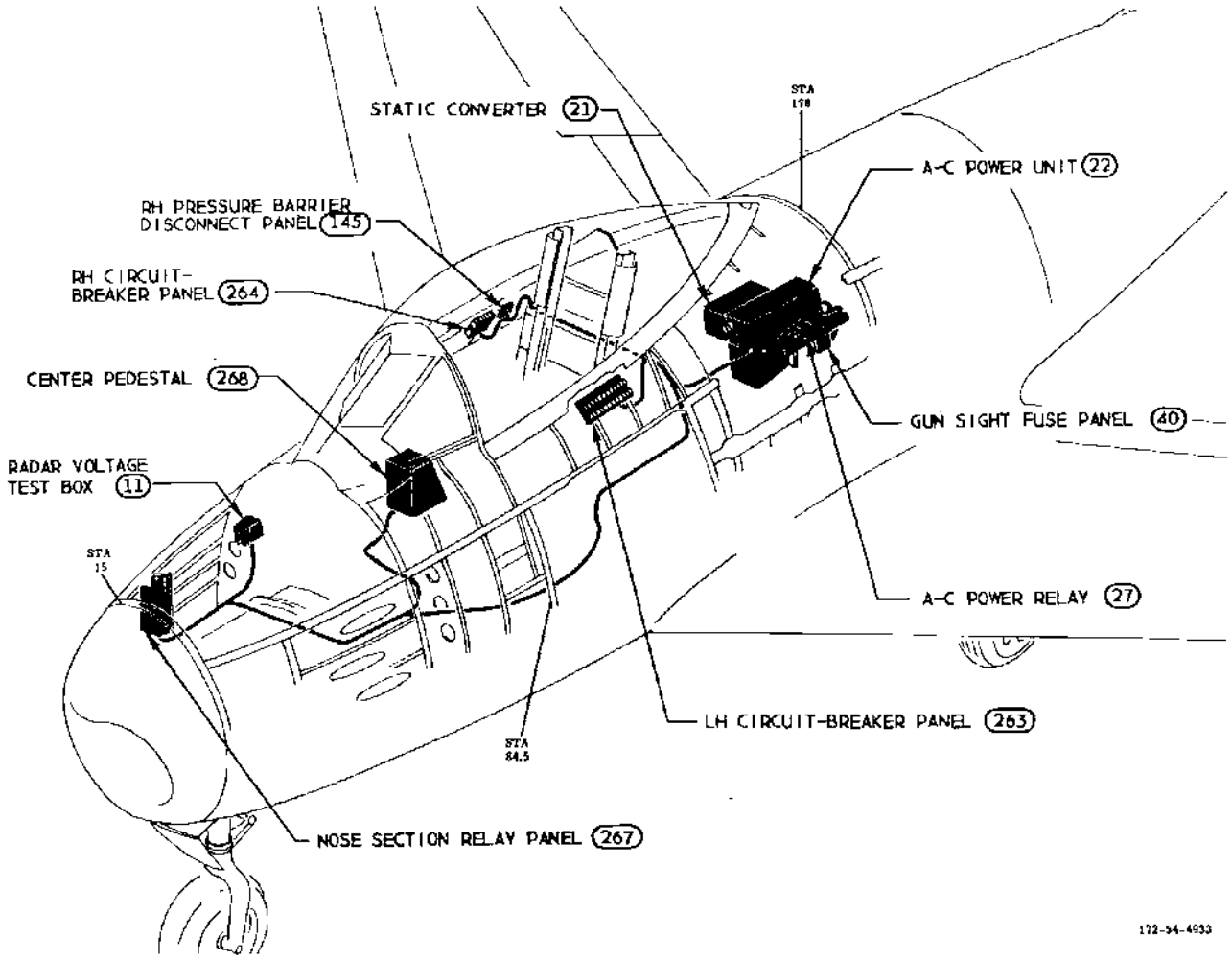
Figure 10-94. A-ICM Sight System—



E DENOTES ELECTRICAL ITEM NUMBER

170-54-4926

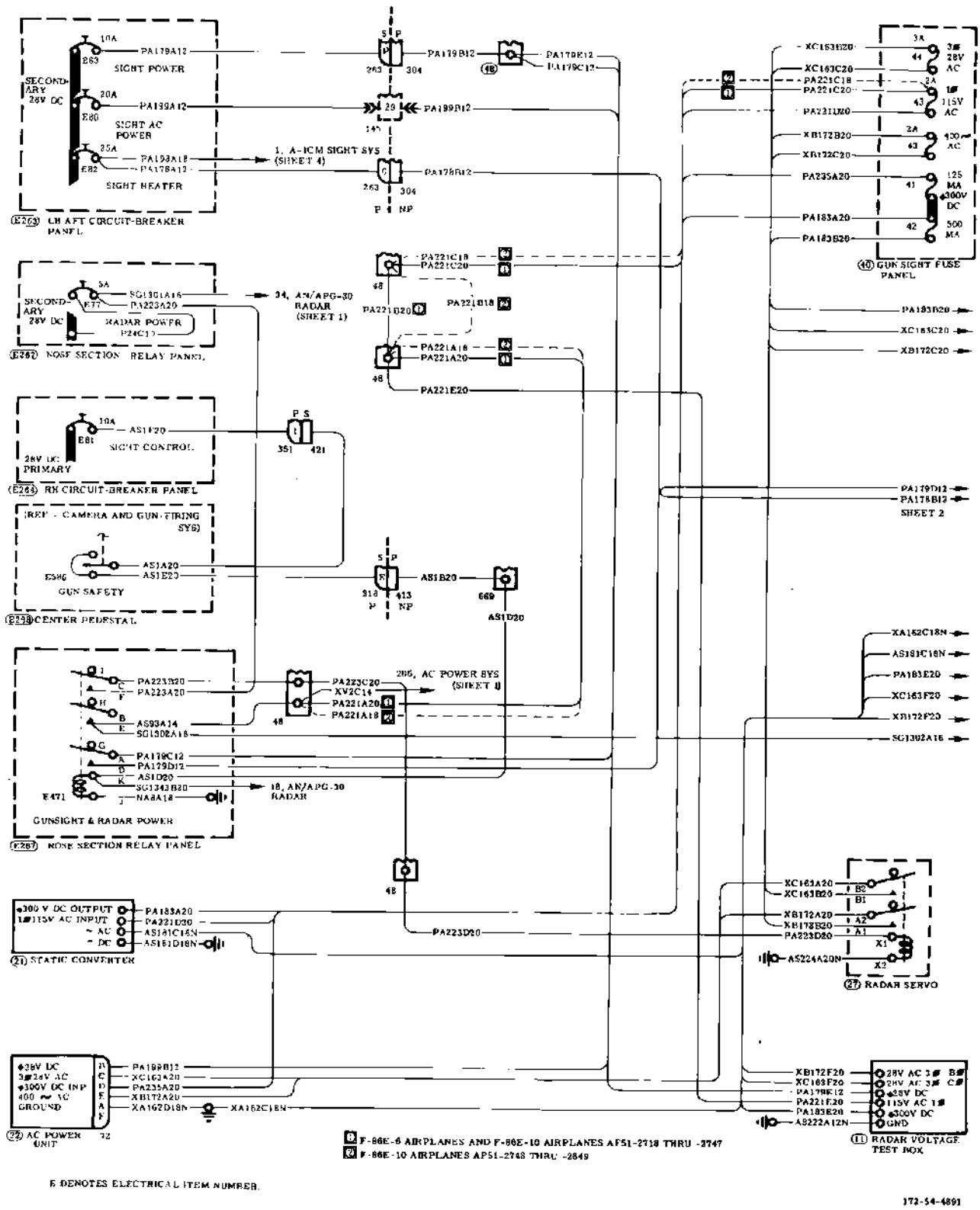
F-86E-6 Airplanes (Sheet 3 of 3)



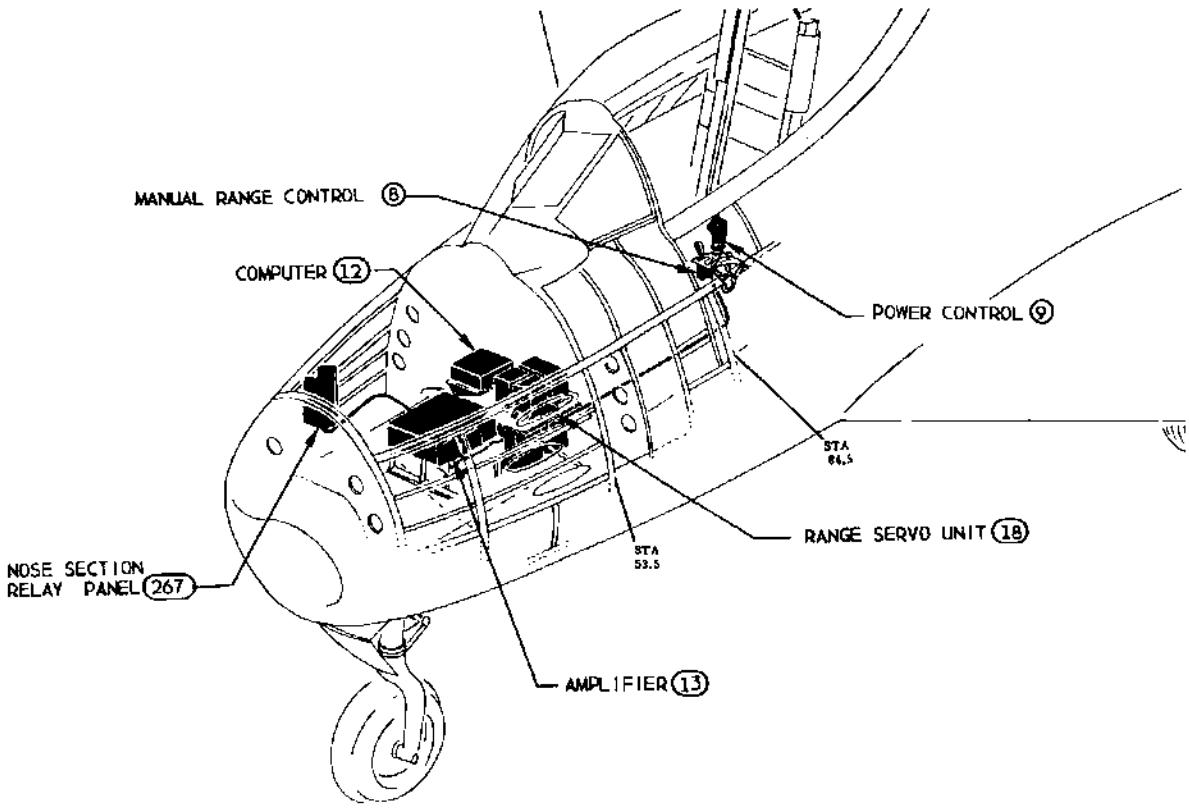
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
11	Test Box—Voltage	151-74083 (NAA)
21	Converter—Static D-C	32617, Type E-1
22	Power Unit—Armament A-C	Type D-2
27	Relay—Radar Servo	237EAU (Leach)
40	Panel—Fuse	170-74014 (NAA)
41	Fuse—D-2 D-C Power 300-volt 125-milliampere	
42	Fuse—Amplifier D-C Power 300-volt 500-milliampere	
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
44	Fuse—Amplifier and A-C Power 28-volt 3-ampere	
48	Terminal Strip	NAS45-6-( )
72	Plug	AN3106B22-24S
E77	Circuit Breaker—Radar Power	AN3161P5
E80	Circuit Breaker Sight A-C Power Unit	AN3161P20
E81	Circuit Breaker—Sight Control	AN3161P5

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
E82	Circuit Breaker—Sight Heater	AN3161P25
E83	Circuit Breaker—Sight Power	AN3161P10
E145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
263	Plug	AN3106B32-7P
E263	Panel—Left Circuit-breaker	170-54068 (NAA)
E264	Panel—Right Circuit-breaker	172-54040
E267	Panel—Nose Section Relay	170-54055 (NAA)
E268	Panel—Center Pedestal	170-54104 (NAA)
304	Receptacle	AN3100PR32-7S
E318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
E351	Plug—Pedestal Disconnect	AN3106A32-7P
E413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
E421	Receptacle—Pedestal Disconnect	AN3100A32-7S
E471	Relay—Gun Sight Power	G-39989A (Guardian)
E586	Switch—Gun Safety	AN3226-1
E669	Terminal Block—Nose Junction Box	AN3436-2-18

Figure 10-95. A-1CM Sight System—



F-86E-10 Airplanes (Sheet 1 of 3)

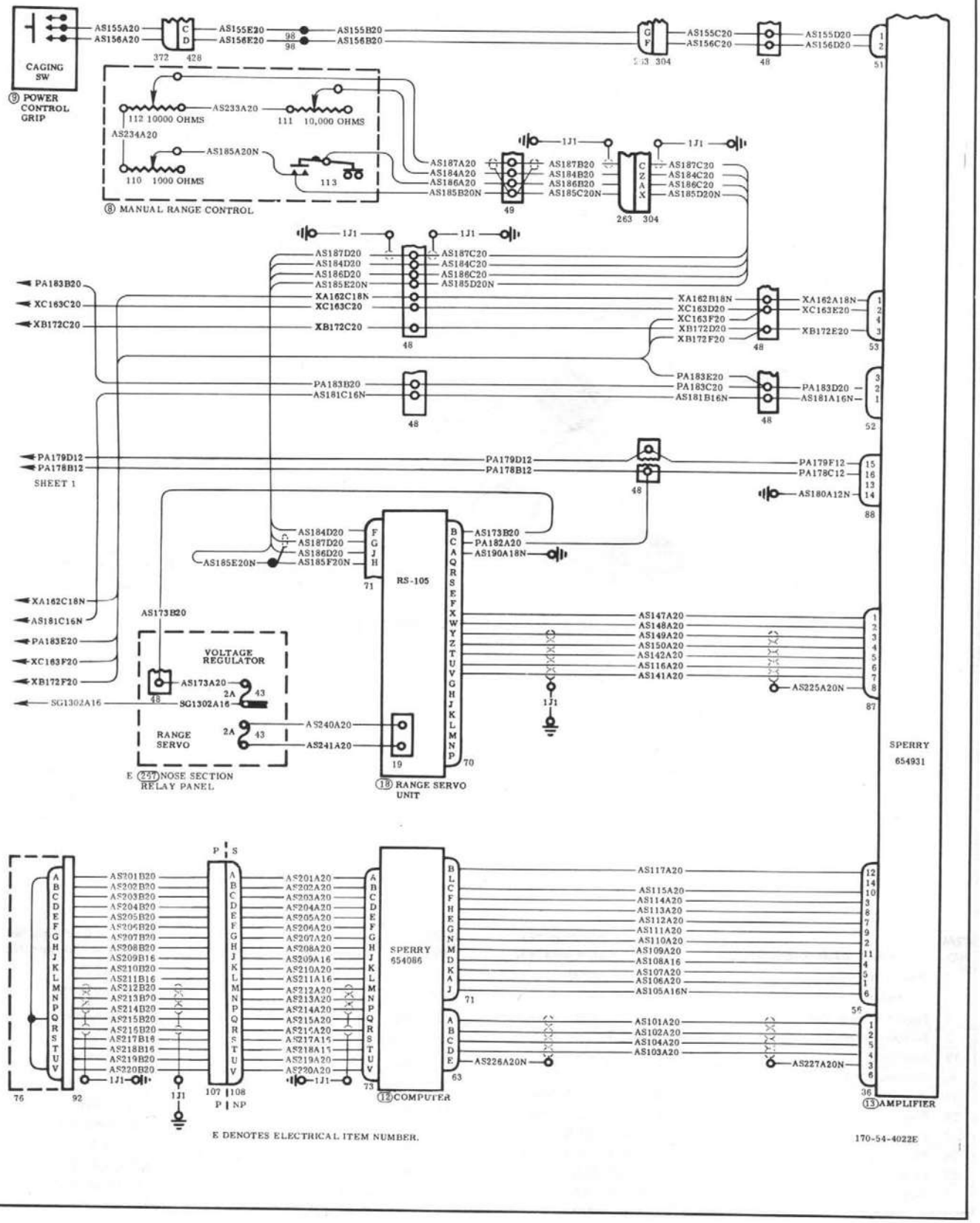


172-54-4924

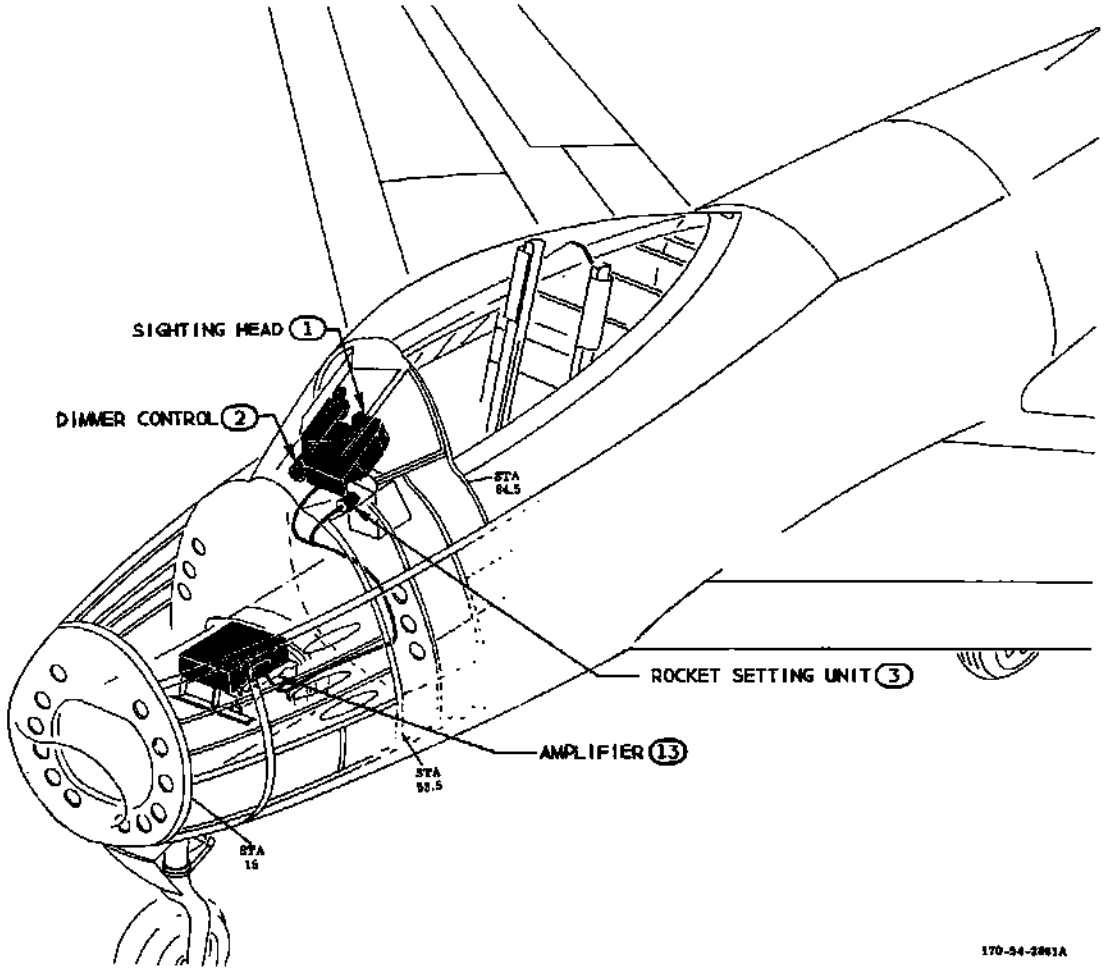
ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
8	Control Unit—Manual Range	170-43059 (NAA)
9	Switch—Caging	138106 (Ucinite)
12	Computer	654086 (Sperry)
13	Amplifier	654931 (Sperry)
18	Servo Unit—Range	102527, Type RS-105
19	Jack Assembly	171-74052 (NAA)
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
48	Terminal Strip	NAS45-6-( )
49	Terminal Strip	6-140 (H. B. Jones)
51	Plug	P302-CCT-L (H. B. Jones)
52	Plug	P303-CCT-L (H. B. Jones)
53	Plug	P304-CCT-L (H. B. Jones)
56	Plug	P312-CCT-L (H. B. Jones)
63	Plug	AN3106B14S-5P
70	Plug	AN3106B24-28S
71	Plug	AN3106B22-19S
73	Plug	AN3106B28-16P
76	Plug	AN3106B28-16P

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
86	Socket	S306-CCT-L
87	Socket	S308-CCT-L
88	Socket	S404-CCT-L
92	Receptacle	AN3100-28-16S
107	Receptacle	AN3100C24-28P
108	Plug	AN3108B24-28S
110	Potentiometer—1000-ohm	A4509-A (Chicago Telephone Supply)
111	Potentiometer—3500-ohm	A4510 (Chicago Telephone Supply)
112	Potentiometer—10,000-ohm	Y4321-A (Chicago Telephone Supply)
113	Microswitch	BZ3YDT (Micro Switch)
263	Plug	AN3106B32-7P
E267	Panel—Nose Section Relay	170-54055 (NAA)
304	Receptacle	AN3100PR32-7S
372	Plug—Throttle Disconnect	AN3106B16S-1P
428	Receptacle—Throttle Disconnect	AN3101B16S-1S

Figure 10-95. A-1CM Sight System—



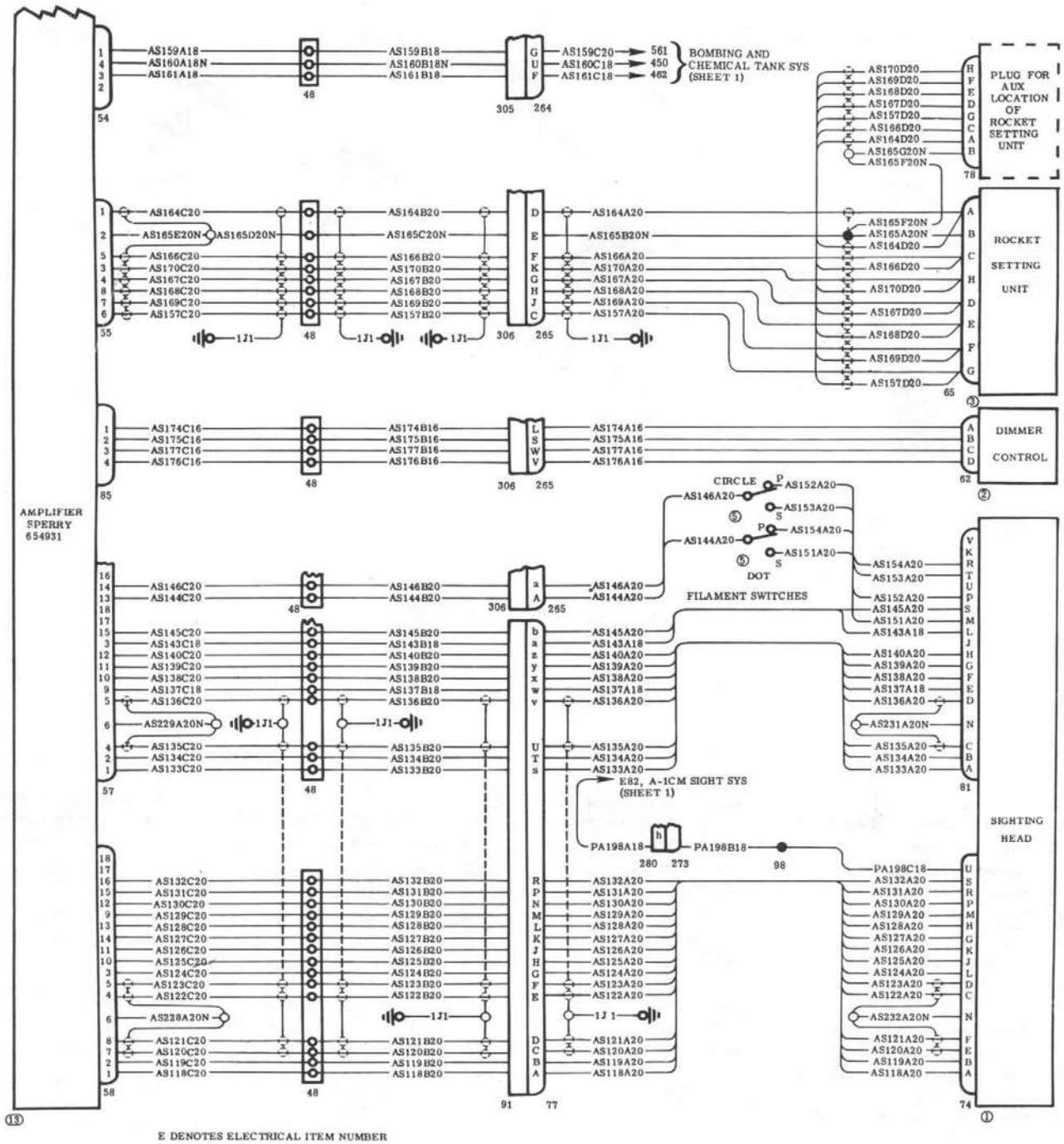
F-86E-10 Airplanes (Sheet 2 of 3)



ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Head—Sighting	665096 (Sperry)
2	Control—Dimmer	665087 (Sperry)
3	Rocket Setting Unit	665097 (Sperry)
5	Switch—Filament	AN3021-3
13	Amplifier	654931 (Sperry)
48	Terminal Strip	NAS45-6-( )
54	Plug	P306-CCT-L (H. B. Jones)
55	Plug	P308-CCT-L (H. B. Jones)
57	Plug	P315-CCT-L (H. B. Jones)
58	Plug	P318-CCT-L (H. B. Jones)
62	Plug	AN3106B14S-2S
65	Plug	AN3106B18-8S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
74	Plug	AN3106B28-16S
77	Plug	AN3106B28-12P
81	Plug	AN3108B22-14S
85	Socket	5304-CCT-L
91	Receptacle	AN3100PR28-12S
264	Plug	AN3106B28-11P
265	Plug	AN3106B28-12P
273	Plug	AN3106B32-7P
280	Receptacle	AN3100-32-7S
305	Receptacle	AN3100PR28-11S
306	Receptacle	AN3100PR28-12S

Figure 10-95. A-1CM Sight System—



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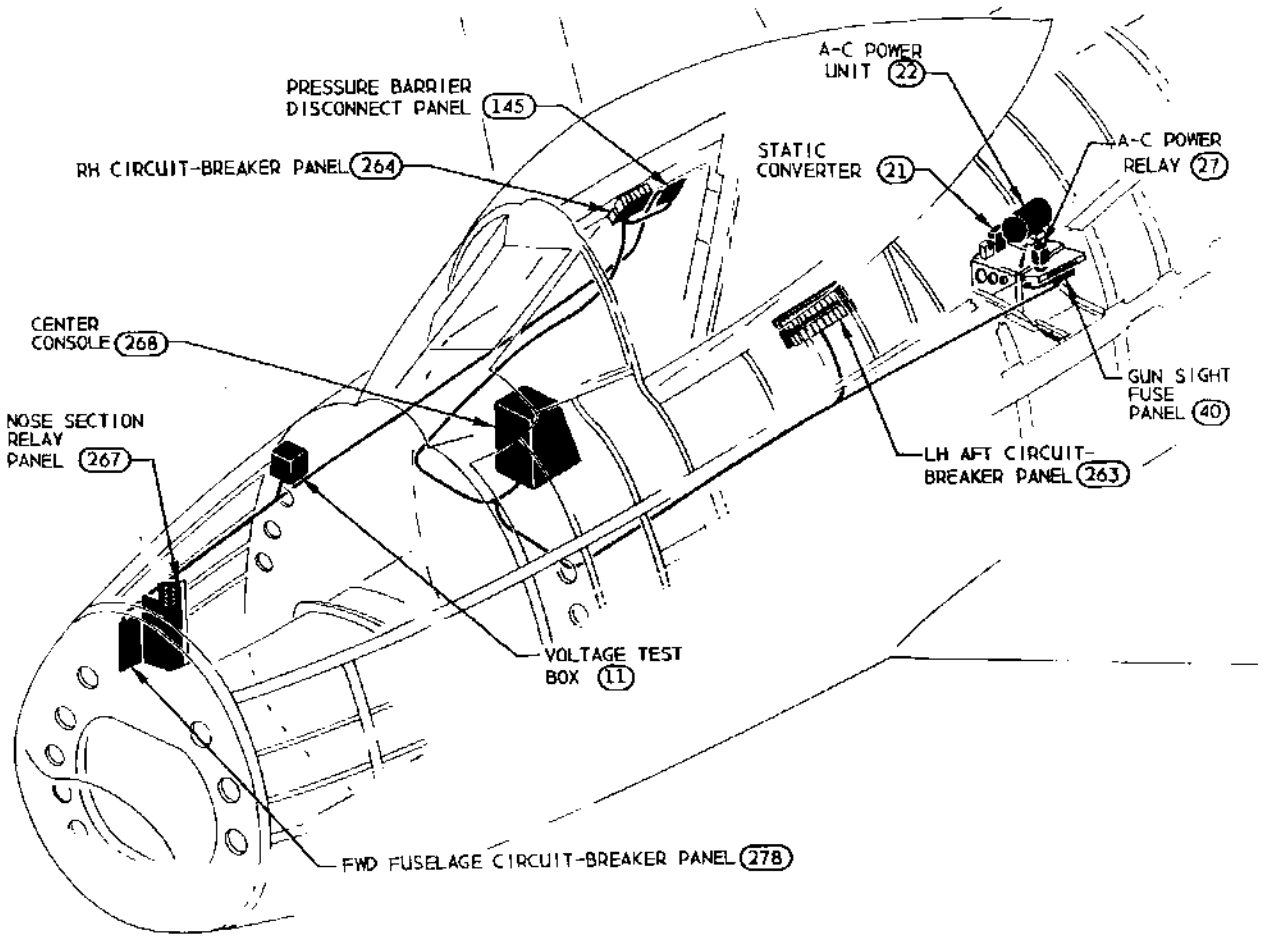
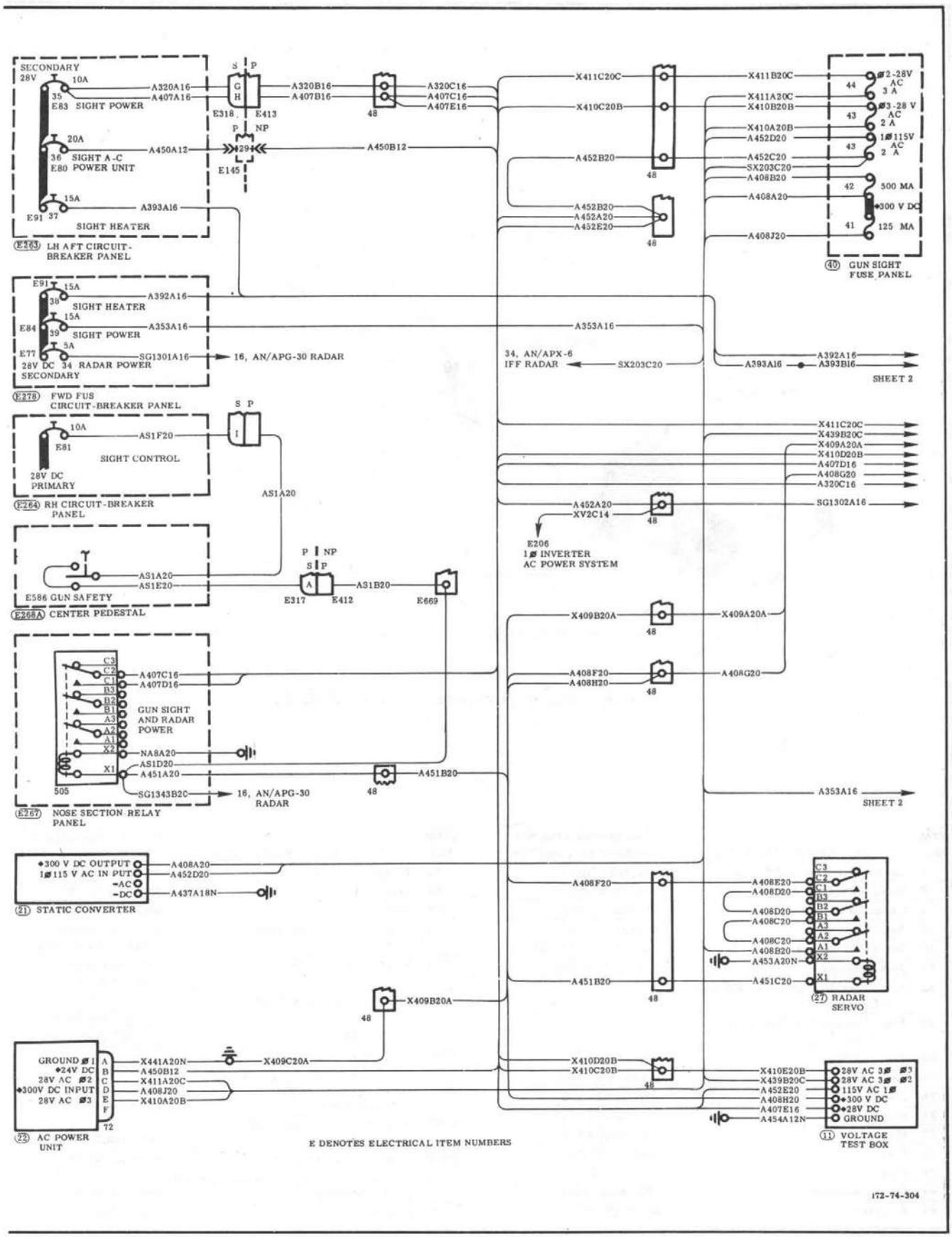


172-54-5023

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
11	Test Box—Voltage	151-74083 (NAA)
21	Converter—Static D-C	32617, Type E-1
22	Power Unit—Armament A-C	Type D-2
27	Relay—Radar Servo	237EAU (Leach)
34	Circuit Breaker—Radar Power	AN3161P5
35	Circuit Breaker—Sight Power	AN3161P10
36	Circuit Breaker—Sight A-C Power	AN3161P20
37	Circuit Breaker—Sight Heater	AN3161P25
38	Circuit Breaker—Sight Heater	AN3161P15
39	Circuit Breaker—Sight Power	AN3161P15
E40	Circuit Breaker—Bomb Selector and Canopy Seal	AN3161P5
42	Fuse—Amplifier D-C Power 300-volt 500-milliampere	
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
44	Fuse—Amplifier and A-C Power 28-volt 3-ampere	
48	Terminal Strip	NAS45-6-( )
72	Plug	AN3106B22-24S
E81	Circuit Breaker—Sight Control	AN3161P5

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
E145	Disconnect—Right-hand Pressure	YHS100S-6 (Burndy)
E263	Panel—Left Circuit-breaker	170-54068 (NAA)
E264	Panel—Right Circuit-breaker	172-54040 (NAA)
E267	Panel—Nose Section Relay	170-54055 (NAA)
E268A	Panel—Center Pedestal	172-54104 (NAA)
E278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
E289	Plug—Pedestal Disconnect	AN3106B32-7S
E317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
E318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
E412	Receptacle—Forward Pressure Left-hand Forward Disconnect	AN3100C32-7P
E413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
E442	Receptacle—Pedestal Disconnect	AN3102A32-7P
E471	Relay—Gun Sight Power	AN3312-1
E505	Relay—Gun Sight Power	AN3312-1
E586	Switch—Gun Safety	AN3226-1
E669	Terminal Block—Nose Junction Box	AN3436-2-18

Figure 10-96. A-4 Sight System—



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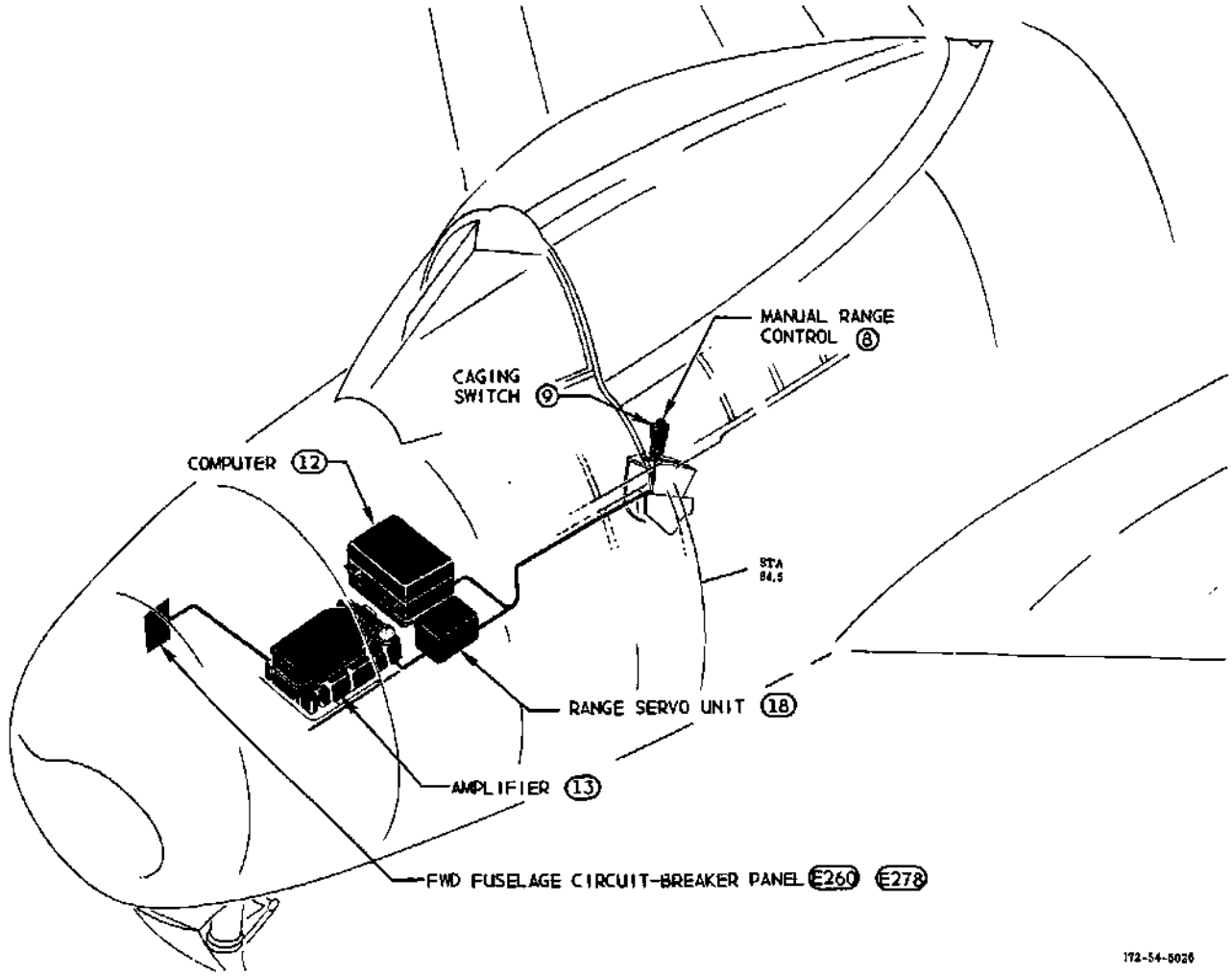
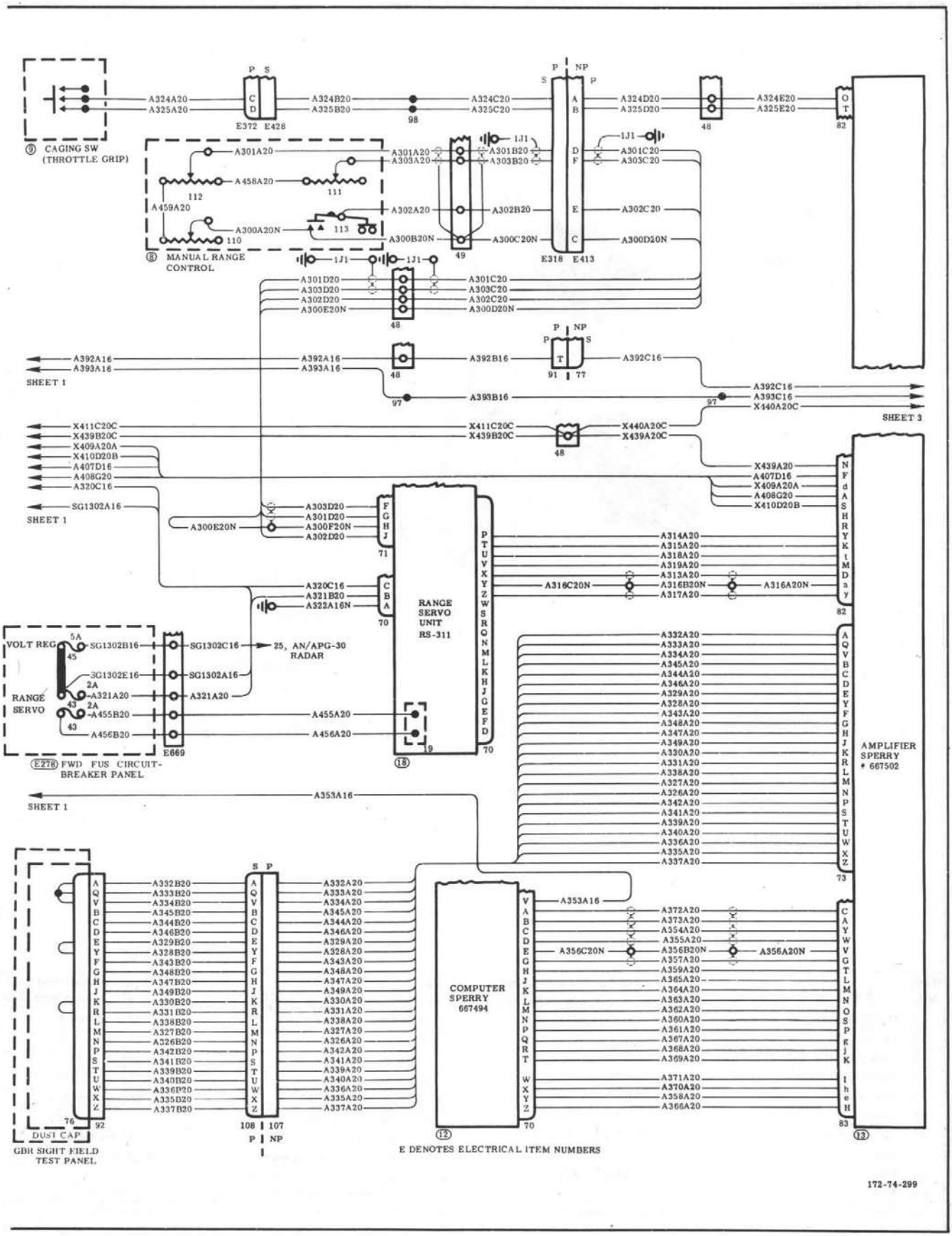


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
8	Control Unit—Manual Range	170-43059 (NAA)
9	Switch—Caging	138106 (Ucinite)
12	Computer	654086 (Sperry)
13	Amplifier	654931 (Sperry)
18	Servo Unit—Range	102527, Type RS-105
19	Jack Assembly	171-74052 (NAA)
43	Fuse—Amplifier and Servo 400-cycle A-C 2-ampere	
45	Fuse—Voltage Regulator 115-volt A-C 5-ampere	
48	Terminal Strip	NAS45-6-( )
49	Terminal Strip	6-140 (H. B. Jones)
70	Plug	AN3106B24-28S
71	Plug	AN3106B22-19S
73	Plug	AN3106B28-16P
76	Plug	AN3106B28-16P
77	Plug	AN3106B28-12P
82	Cable Assembly	170-74013 (NAA)
91	Receptacle	AN3100PR28-12S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
92	Receptacle	AN3100-28-16S
107	Receptacle	AN3100C24-28P
108	Plug	AN3108B24-28S
110	Potentiometer—1000-ohm	A4509-A (Chicago Telephone Supply)
111	Potentiometer—3500-ohm	A4510 (Chicago Telephone Supply)
112	Potentiometer—10,000-ohm	Y4321-A (Chicago Telephone Supply)
113	Microswitch	BZ-3YDT (Micro Switch)
E260	Panel—Forward Fuselage Circuit-breaker	172-54078 (NAA)
E278	Panel—Forward Fuselage Circuit-breaker	172-54166 (NAA)
E318	Plug—Forward Pressure Left-hand Aft Disconnect	AN3106B28-11S
E372	Plug—Throttle Disconnect	AN3106B16S-1P
E413	Receptacle—Forward Pressure Left-hand Aft Disconnect	AN3100C28-11P
428	Receptacle	AN3101B16S-1S

Figure 10-96. A-4 Sight System—



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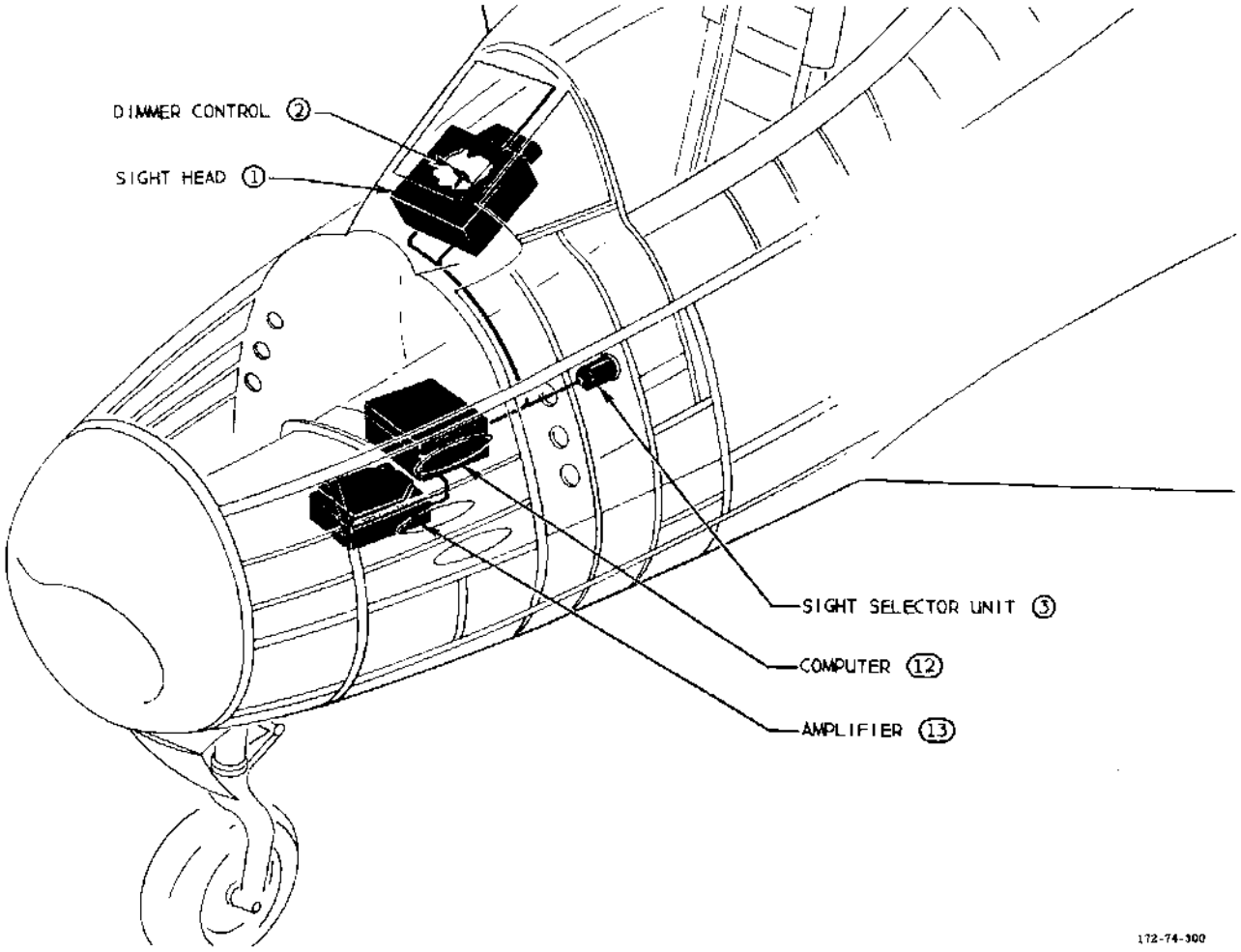
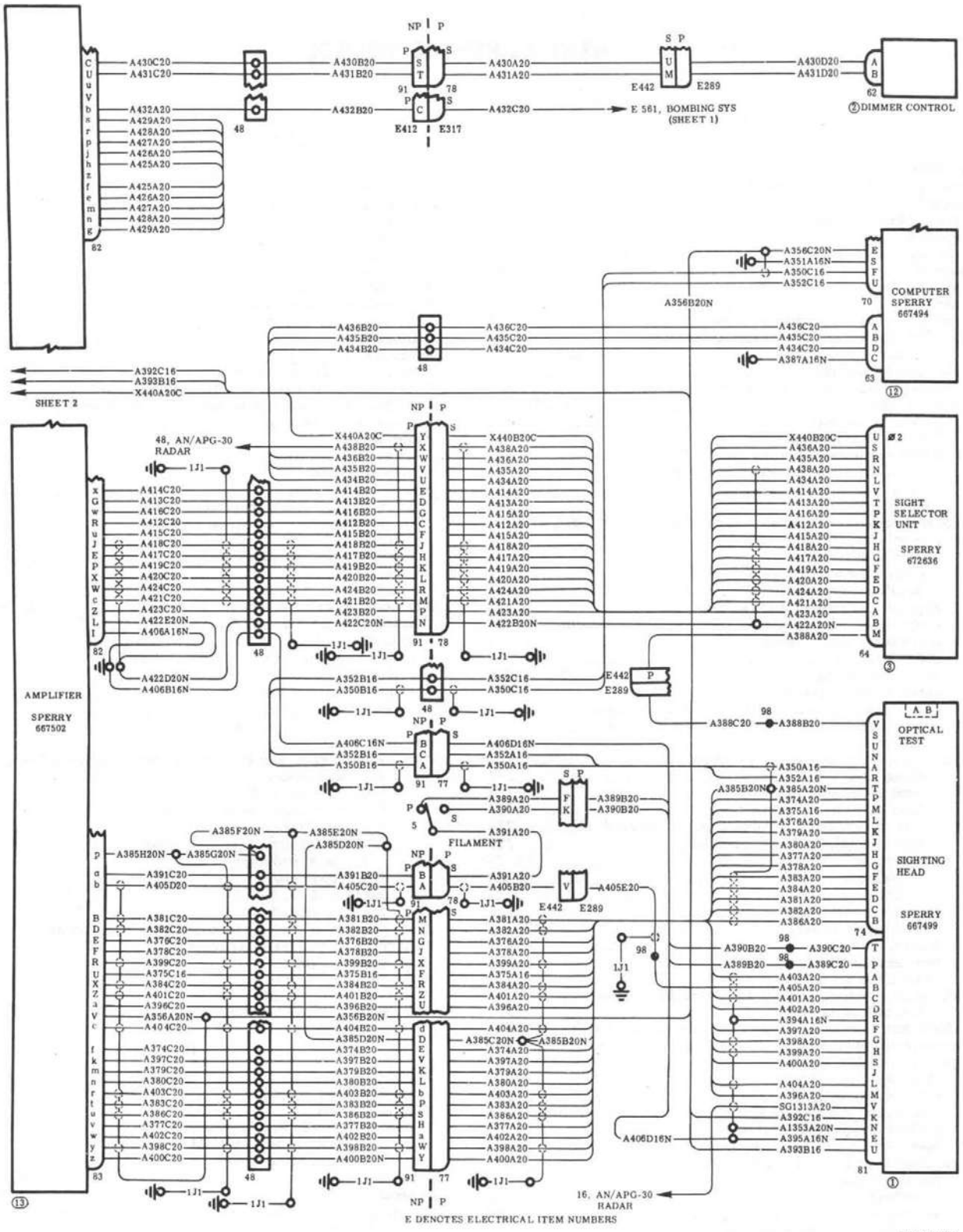


ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
1	Head—Sighting	665096 (Sperry)
2	Control—Dimmer	665087 (Sperry)
3	Rocket Setting Unit	665097 (Sperry)
5	Switch—Filament	AN3021-3
12	Computer	654086 (Sperry)
13	Amplifier	654931 (Sperry)
48	Terminal Strip	NAS45-6-( )
62	Plug	AN3106B14SL-2S
63	Plug	AN3106B14S-5P
64	Plug	
70	Plug	AN3106B24-28S

ITEM NO.	PART AND DESCRIPTION	Type Or Drawing No. Or Mfr Name and No.
74	Plug	AN3108B28-16S
77	Plug	AN3106B28-12P
78	Plug	AN3107-18-8S
81	Plug	AN3108B22-14S
82	Cable Assembly	170-74013 (NAA)
83	Cable Assembly	170-74013 (NAA)
91	Receptacle	AN3100PR28-12S
E289	Plug—Pedestal Disconnect	AN3106B32-7S
E317	Plug—Forward Pressure Left-hand Forward Disconnect	AN3106A32-7S
E442	Receptacle—Pedestal Disconnect	AN3102A32-7P

Figure 10-96. A-4 Sight System—



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