TM 1-1L-17A-2

(TO 1L-17A-2)

(FORMERLY 01-100LAA-2)

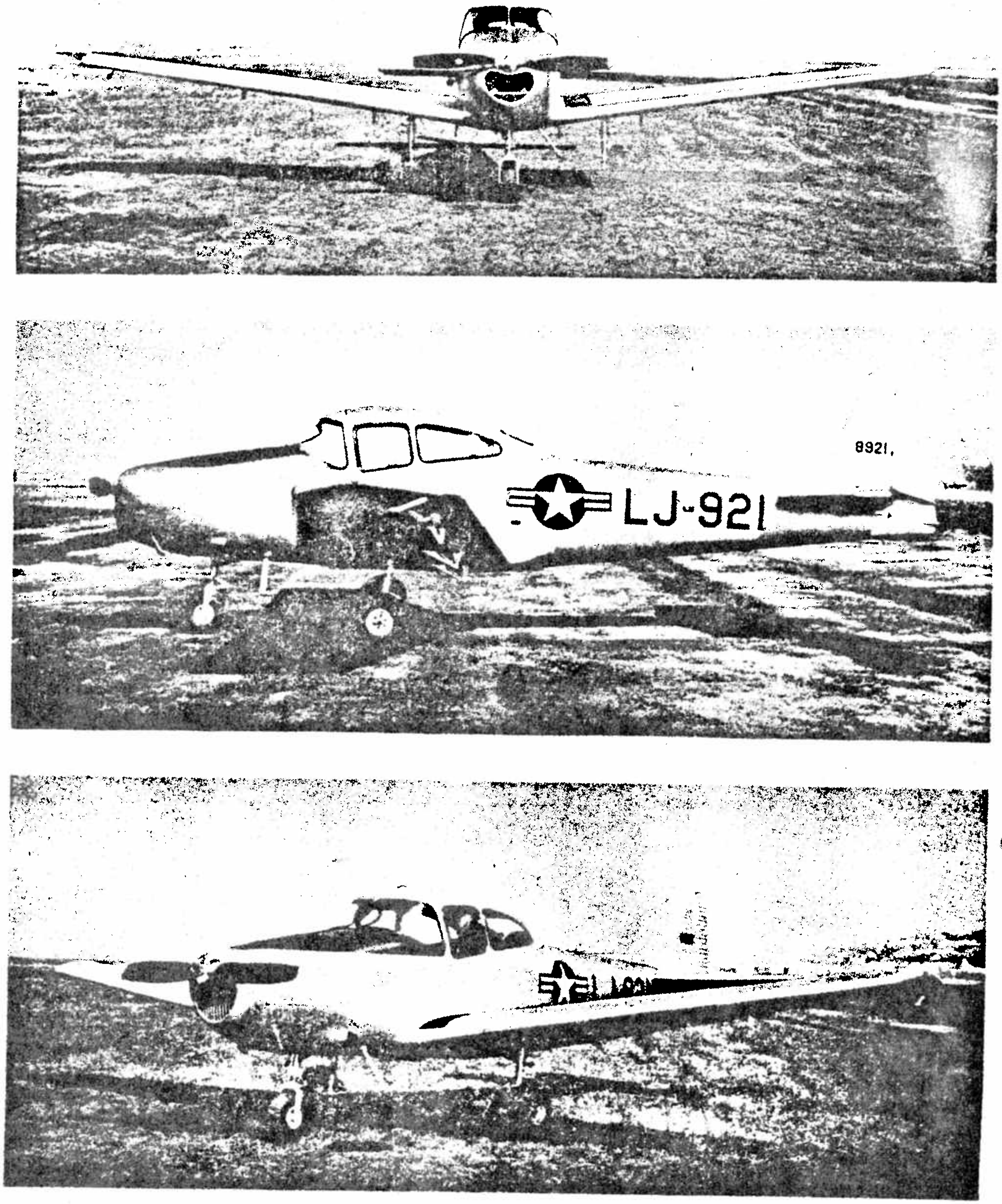
DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ERECTION AND MAINTENANCE INSTRUCTIONS

FOR

L–17A, L–17B, AND L–17C AIRCRAFT

DEPARTMENT OF THE ARMY • DECEMBER 1954



Three Views of Airplane

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SECTION I

DESCRIPTION, DIMENSIONS, AND LEADING PARTICULARS

1-1. DESCRIPTION.

1-2. GENERAL. The Ryan Aeronautical Co. L-17 is a four passenger, single engine, all-metal, low-wing airplane. It has hydraulically retractible tricycle landing gear, flaps and conventional controls. The power plant is a Continental E-185-3 engine, equipped with an injection type carburetor and a Hartzell controllable pitch propeller. The airplane is designed to accomplish liaison functions including reconaissance, personnel and light cargo carrying, column control, camouflage checking and courier service. There are three models of this airplane, which in this book are designated as L-17A, Modified L-17A, and L-17B. Those airplanes which are herein designated as Modified L-17A aircraft, are designated as L-17C airplanes in the Parts Catalogue (AN 01-60LAA-4) and in the field. The designation of L-17C will be incorporated in this book on all revised pages. The manual is basically written about the L-17A airplane. Material concerning the L-17B and L-17C (Modified L-17A) airplanes only, being designated as such in the text.

L-17C (Modified L-17A) airplanes are L-17A airplanes that have been changed to provide a 21 gallon auxiliary fuel tank; a 35 amp generator in lieu of a 25 amp generator; an Aircraft Radio Corporation, Type 12, radio set instead of the Ranger Radio Receiver and Transmitter; a venturi vacuum system; vacuum-driven turn-and-bank indicator instrument; artificial horizon, and directional gyro; auxiliary tank fuel gage; an external power receptacle aft of the wing trailing edge on the left side of the fuselage; an additional neutral position in the flap control; a flap position indicator stripe; Hayes-Goodrich expander tube type brakes in place of Firestone brakes; an electrically actuated starter system instead of the manual engageing system; and the power plant is rated at 205 bhp at 2600 rpm (take-off) instead of 185 bhp at 2300 rpm. The L-17B airplane incorporates all of the above changes, plus the incorporation of both fuel quantity indicating systems into one gage, with two calibration scales and a selector switch. To determine the model of any specific airplane, check the serial number against the following chart.

1-3. AIRPLANE IDENTIFICATION CHART

L-17A Airplanes	L-17B Airplanes	L-17C Airplanes (Modified L-17A Airplanes)
USAF 47-1297 thru 47-1379, except as noted under L-17C airplanes.	USAF 48-921 thru 48-1078	USAF 47-1298 thru 47-1301 4 USAF 47-1303 thru 47-1313 11 USAF 47-1315 thru 47-1319 5 USAF 47-1321 thru 47-1328 8 USAF 47-1331 thru 47-1332 2 USAF 47-1334 thru 47-1335 2 USAF 47-1338 thru 47-1339 2 USAF 47-1379 1
83-35=48	157	35

TOTAL 240

1-4. PRINCIPAL DIMENSIONS.

GENERAL

Span .... 33 ft 4-9/16 in.
Length (over-all) .... 27 ft 3 in.
Height (over tail) .... 8 ft 6-5/16 in.

WING

Air foil section .... Root NACA 4415R, Tip NACA 6410R
Chord (at root) .... 86.6 in.
Chord (at construction tip) .... 47.01 in.
Incidence (at root section) .... +2 deg.
Incidence (at construction tip) .... -1 deg.
Dihedral .... 7 deg 30 min
Sweepback (leading edge) .... 2 deg 54 min 19 sec

HORIZONTAL STABILIZER

Span .... 13 ft 2-1/16 in.
Maximum chord .... 48 in.
Incidence .... -3 deg
Dihedral .... 0 deg

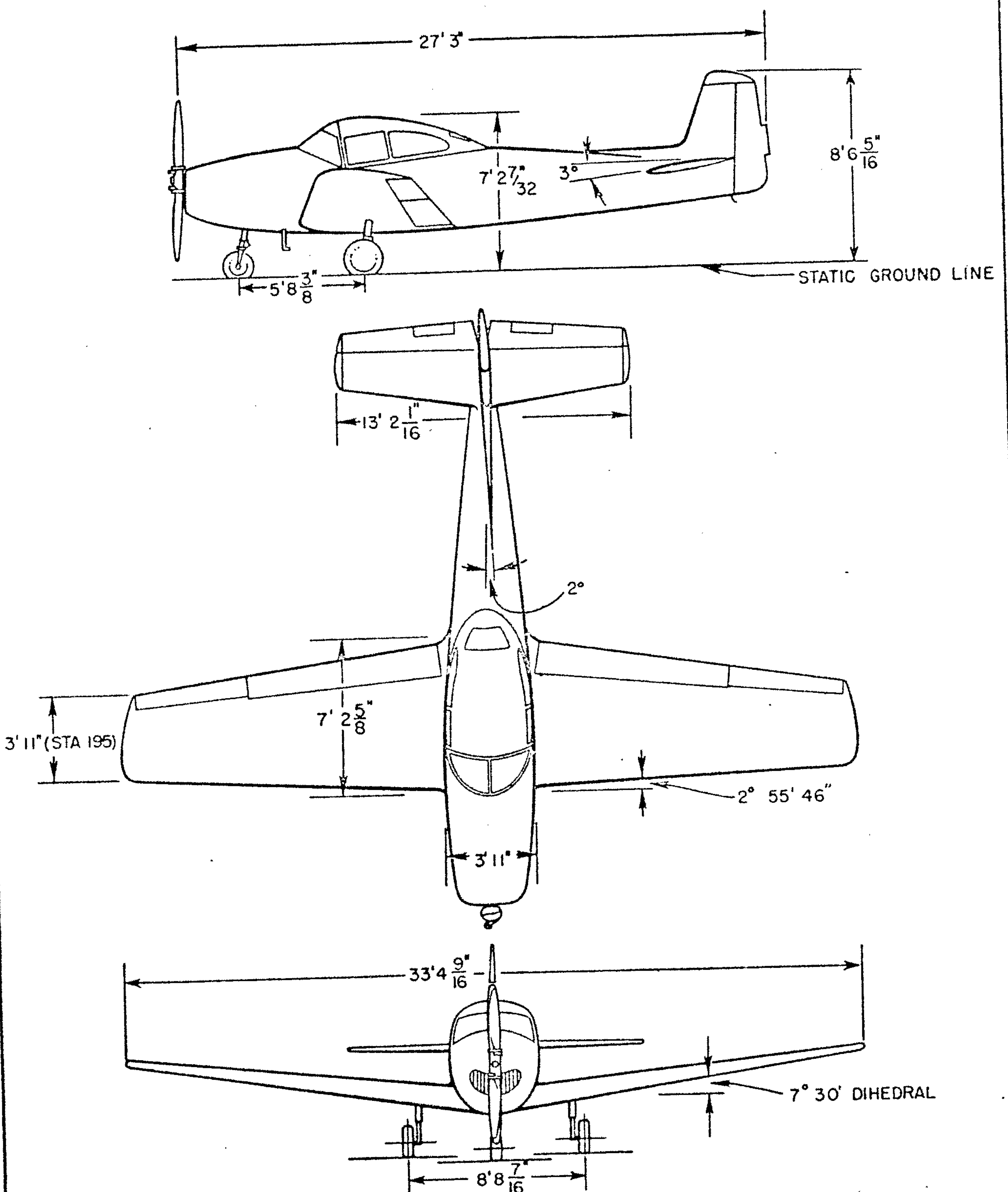
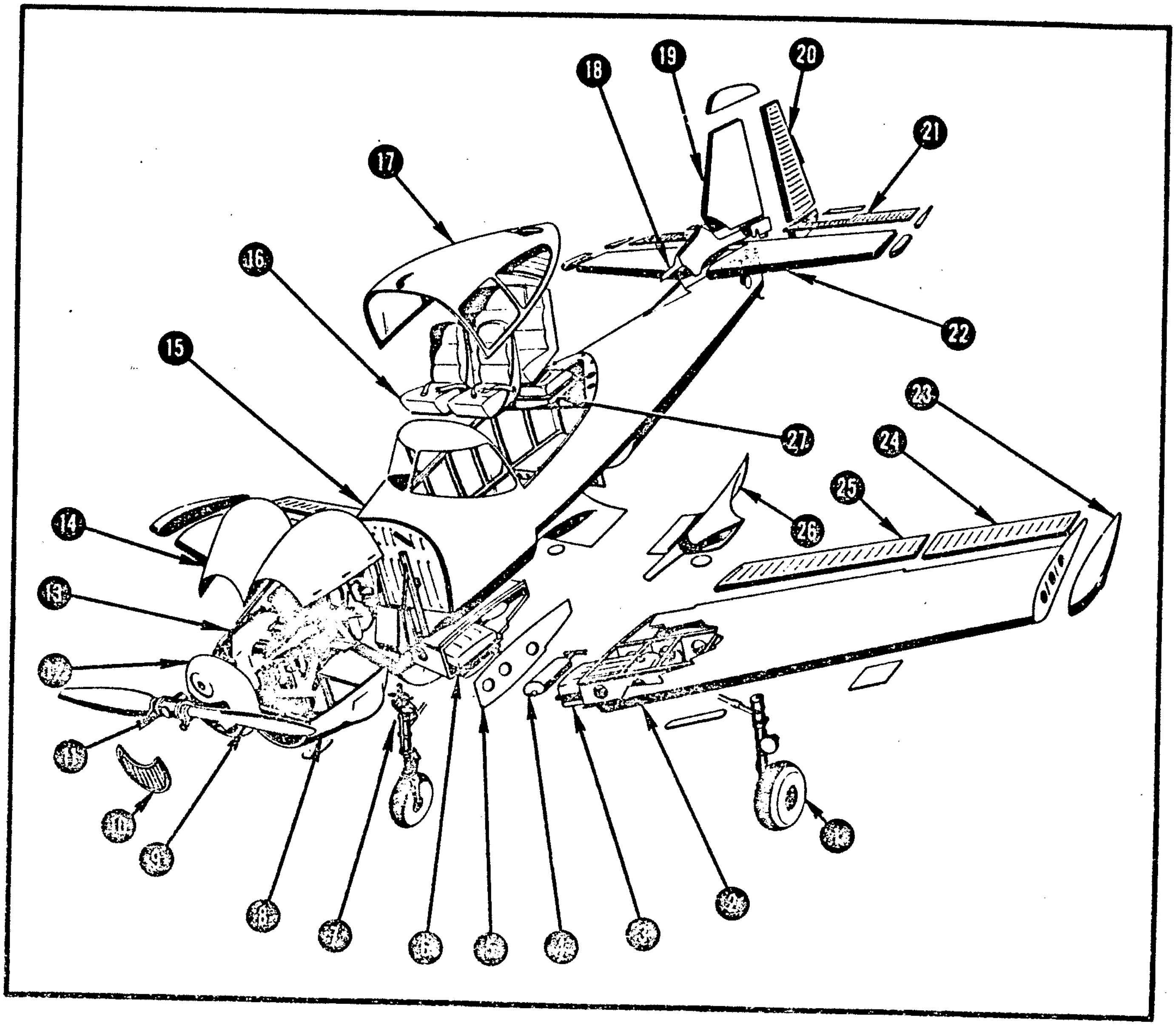


Figure 1-1. Airplane Dimensions



KEY

1 MAIN LANDING GEAR
2 LEFT WING
3 20-GALLON FUEL TANK
4 ACCUMULATOR FUEL TANK
5 CENTER RIB
6 20-GALLON FUEL TANK
7 NOSE LANDING GEAR
8 ENGINE MOUNT
9 PROPELLER
10 NOSE COWL GRILL
11 PROPELLER HUB
12 NOSE COWL
13 ENGINE AND ACCESSORIES
14 ENGINE COWL
15 FUSELAGE
16 FRONT AND REAR SEATS
17 SLIDING CANOPY
18 EMPENNAGE FILLETS
19 VERTICAL STABILIZER
20 RUDDER
21 ELEVATOR
22 HORIZONTAL STABILIZER
23 WING TIP
24 AILERON
25 WING FLAP
26 WING-TO-FUSELAGE FILLETS
27 20-GALLON AUX. FUEL TANK

Figure 1-2. Exploded View of Airplane

VERTICAL STABILIZER

Offset (from fuselage centerline) .... 2 deg

FUSELAGE

Width (maximum) .... 47 in.
Height (including canopy) .... 62.25 in.
Length .... 25 ft 8 in.
Total cubic foot stowage space available for baggage, cargo, etc. .... approx. 19 cu ft

AREAS

Wings (including flaps, ailerons, and area covered by fuselage) .... 184.34 sq ft
Ailerons .... 10.32 sq ft
Flaps .... 29.23 sq ft
Horizontal tail area
  Total .... 43.05 sq ft
  Stabilizer .... 28.95 sq ft
  Elevators (total including tabs) .... 14.10 sq ft
  Elevator trim tabs (total) .... 2.04 sq ft
Vertical tail area
  Total .... 12.92 sq ft
  Fin .... 6.87 sq ft
  Rudder .... 6.05 sq ft
Airplane stations .... See figure 4-1, 4-5, and 4-10

1-5. SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES.

	DEG	INCHES	REF POINT	MOVEMENT TOLERANCE DEG	MOVEMENT TOLERANCE INCHES
Ailerons - up (from neutral)	25	5-3/4	Inboard trailing edge	±2	±1/2
- down (from neutral)	17-1/2	4	Inboard trailing edge	±2	±1/2
Elevators - up (from streamline with stabilizer)	30	7-1/8	Trailing edge at outboard end of trim tab	+2/-0	+1/2/-0
- down (from streamline with stabilizer)	20	4-3/4	Trailing edge at outboard end of trim tab	±2	±1/2
Rudder - right (from streamline with stabilizer	21	7-1/4	Extreme trailing edge	±2	±5/8
- left (from streamline with stabilizer)	19	6-1/2	Extreme trailing edge	±2	±5/8
Flaps (total)	43	13-3/4	Inboard trailing edge	±2	±5/8
Elevator trim tabs -up (from stream line with elevator)	23	1-3/4	Trailing edge	±2	±5/32
- down (from streamline with elevator)	32	2-1/2	Trailing edge	+2/-0	+5/32/-0

1-6. LEADING PARTICULARS.

LANDING GEAR

MAIN GEAR

Type	Hydraulically retractable
Tread	104.5 in.
Shock struts	
Type	Air-oil
Make and Part No.	NAA 145-33102
Fluid required	MIL-O-5606
Shock struts (Cont'd.)	
Normal static extension	1-5/16 in.
Wheels	
Type (L-17A)	Firestone DFA-233
Type (L-17B)	Hayes G-3-516-M-1
Tires	
Type and size	Type III, 7.00 x 8
Inflation pressure	25 psi
Brakes	
Type (L-17A)	Firestone CFA-299
Type (L-17B)	Hayes G-2-537

NOSE GEAR

Type	Hydraulically retractable
Shock strut	
Type	Air-oil
Make and Part No.	NAA 145-34102
Fluid required	MIL-O-5606
Normal static extension	1-1/2 in.
Wheel	
Type	Firestone 6C5
Tire	
Type and size	Type III 6.00 x 6
Inflation pressure	30 psi

ENGINE

Number	One
Designation	Continental E-185-3
Fuel	Grade 80 aviation fuel
Oil	AN-O-8

PROPELLER	Hartzell
Hub model	HC 12x20-7
Blade model	8428R
Diameter	84 in.
Pitch settings (measured at 30 in. station)	High 22.5 deg; Low 14 deg

TANK CAPACITIES

FUEL

Wing tanks (total)	39.5 US (32.9 Imp) gal
Auxiliary Tank (L-17B's and modified L-17A's)	21 US (17.5 Imp) gal

OIL

Sump capacity	2.5 US (2.08 Imp) gal
System capacity	2.9 US (2.4 Imp) gal

HYDRAULIC FLUID (Specification No. MIL-O-5606)

Reservoir	Approx 1/3 US gal

SECTION II

SHIPMENT AND ERECTION PROCEDURE

2-1. AIRPLANE DISASSEMBLY.

2-2. GENERAL. Before disassembling the airplane, prepare the engine for storage through paragraph 2-4, C, then other parts of the airplane may be removed while engine is being treated for storage shipment. To facilitate reassembly, attach a tag to each component as it is removed. The tag should give the airplane serial number, part name and position. Replace bolts and nuts in the smaller assemblies, then attach and secure with cotter pins or tape. Place any screws, nuts or bolts that cannot be attached in this manner in bags and tie securely to the smaller parts they attach. Identify with tags, then secure all loose wiring and cables to the airplane structure.

2-3. TREATMENT OF EXPOSED METAL SURFACES. When the airplane is disassembled for shipment or storage, such exposed metal surfaces as exterior fittings, bolt holes, control surface hinges and landing gear parts must be coated with corrosion-preventive compound applied as follows:

a. Clean parts thoroughly, using a solvent dip, vapor degreaser or soft brush and solvent. Dry with warm air or clean rags. Avoid handling the parts as much as possible after cleaning.

b. If the parts are of a size and nature that permit them to be tank dipped, place them in a tank containing corrosion-preventive compound, Specification AN-C-52. Heat the compound to a temperature low enough to maintain a viscosity that will permit ready application and high enough to assure adequate film thickness on the part to be protected. AN-C-52, Type I, a cold dip can be used instead of AN-C-52. AN-C-52, Type I, may also be used as a spray if properly thinned with Stoddard Solvent.

c. If tank facilities are not available, or if parts are not adapted to tank dipping, preheat the parts, where practicable and apply corrosion-preventive mixture with a brush or spray gun. Rack small parts and permit large parts to stand until the corrosion-preventive mixture has set, then wrap the parts carefully in greaseproof wrapping paper.

d. Mark date of preservation on exterior of crate.

e. Carry out all procedures, connected with preserving and crating the airplane, in one continuous operation taking all possible precautions to prevent dirt and dust from collecting on exposed parts during these operations.

2-4. PREPARATION OF ENGINE FOR STORAGE AND SHIPMENT. Prepare the engine for storage and shipment as follows:

a. Drain oil from engine sump and oil cooler while engine is still warm and refill with four quarts minimum of corrosion-preventive mixture to insure lubrication during a running period of 30 minutes. Use a preservative compound and oil mixture composed of 25 percent corrosion-preventive compound (Specification AN-VV-C-576, Type I) and 75 percent lubricating oil (Specification AN-O-8, Grade 1100), or the blended compound, (Specification AN-VV-C-576, Type III), which is ready for use.

b. Block off oil cooler air inlet in order to produce the maximum permissible oil temperature.

c. Run engine for 30 minutes at approximately 1000 R.P.M. to produce maximum permissible oil temperature, while using the corrosion-preventive mixture as a lubricant.

d. Following this running period and while engine is still warm, drain corrosion-preventive compound from oil sump. Remove screens and filters; clean, reoil and reinstall. Replace drain plug.

e. Remove rocker box covers, and spray each box with corrosion-preventive mixture. Thoroughly coat the valve rocker arms, valve stems, springs, push rods and interior of the boxes. Replace gaskets and rocker box covers.

f. Inject lubricating oil (Specification AN-O-8, Grade 1065) into fuel pump while shaft of engine is being rotated, to insure complete coverage of the fuel pump parts.

g. Remove spark plugs and spray interior of cylinders with corrosion-preventive mixture while rotating the crankshaft so as to thoroughly coat the valves

After all six cylinders have been sprayed in this manner, respray each cylinder without rotating the crankshaft.

The crankshaft must not be rotated after this step has been completed.

h. Install spark plug dehydrators in each cylinder conforming to Specification AN-406-2.

i. Place a bag, containing one-quarter pound of dehydrating agent, (Specification AN-D-6, Type V) in each exhaust stack opening. Secure in place and close the opening with an oil and moisture resistant cover.

j. Seal breather opening with moisture resistant covers or dehydrating plugs. Tape conforming to Specification AN-T-12 may be used.

k. Remove oil sump plug and replace with a crankcase dehydrator plug conforming to Specification AN-4061. Screw in to a tight seal.

l. Drain carburetor of all residual fuel and flush with lubricating oil, (Specification AN-O-8, Grade 1065).

m. Drain and purge fuel tanks and lines, then replace plugs and safety.

n. Place a bag containing one pound of AN-D-6, Type V dehydrating agent in carburetor air scoop and seal opening.

o. Close fuel vent line with tape or a suitable plug.

p. Spray entire engine including propeller shaft with corrosion-preventive mixture.

q. Place, in a conspicuous location, in the cabin a warning tag, stating that the engine shall not be operated or turned over until all dehydrating material has been removed from the engine. Attach a similar warning tag to the propeller shaft.

2-5. DISASSEMBLY OF THE AIRCRAFT FOR CRATING. Disassemble aircraft for crating as follows:

a. Separate the fuselage from the wings, leaving the engine and mount with associated cowling intact with the fuselage. Process according to Paragraphs 2-2 and 2-3.

b. Separate the wings and process according to Paragraphs 2-2 and 2-3.

c. Remove the aileron, flaps, vertical fin, horizontal stabilizer, rudder and elevators and process according to Paragraphs 2-2 and 2-3.

d. Remove the propeller and nose gear assemblies and prepare for storage according to Paragraphs 2-2 and 2-3.

e. Remove battery and prepare for storage and shipment.

2-6. CRATING.

2-7. GENERAL. (Refer to Figures 2-1 and 2-2.) The L-17 airplane may be packed in a single crate, 321 inches long, 85-3/4 inches high and 83-1/4 inches wide, containing 1334 cubic feet. The tare weight of the crate is approximately 3570 pounds and the gross weight, including crate and contents is approximately 5400 pounds. The crate has a sheathing of one inch lumber for the top, sides and ends. The base is made of two inch lumber at bearing sections with one inch material in between. The three skids are constructed of 4X4 inch timbers. The crate is lined with heavy waterproof wrapping paper, which is placed between the frame members and the sheathing on the top, ends and sides. Eighteen, one inch holes with five inch spacing, covered with 3/8 inch screen mesh, are located near the upper right and left ends of each side of the crate for ventilation. The sides and top of the crate have four sets of diagonal bracing, separated with intermediate bracing lengthwise and spanwise. These are made of 2X4 inch lumber for the sides and 1X6 inch lumber for the top. The ends have one set of diagonal bracing with vertical and spanwise intermediate bracing. These are also made of 2X4 inch lumber. 2X4 inch joists are located 20 inches apart on centers to brace top and sides of crate. Two 1-1/4 X1-1/4X3/16 inch angle iron support stands are made to support the wings and two additional 1-1/2X1-1/2X1/4 inch angle iron support stands are made to secure the fuselage. Cradles to support the control surfaces, stabilizers, wing tips, propeller and other small parts are constructed of 2X4 inch lumber, braced with 5/8 inch plywood gussets and bolted or nailed to the crate floor. The iron wing and fuselage supporting cradles are secured to the crate floor with 1/2 inch bolts. Cradles that support skin surfaces should be padded with felt and wrapped with heavy moisture and greaseproof paper before securing airplane parts in them.

2-8. CRATING THE AIRPLANE. (Refer to Figures 2-3, 2-4, 2-5 and 2-6.)

a. Install nose stand on nose strut trunnions.

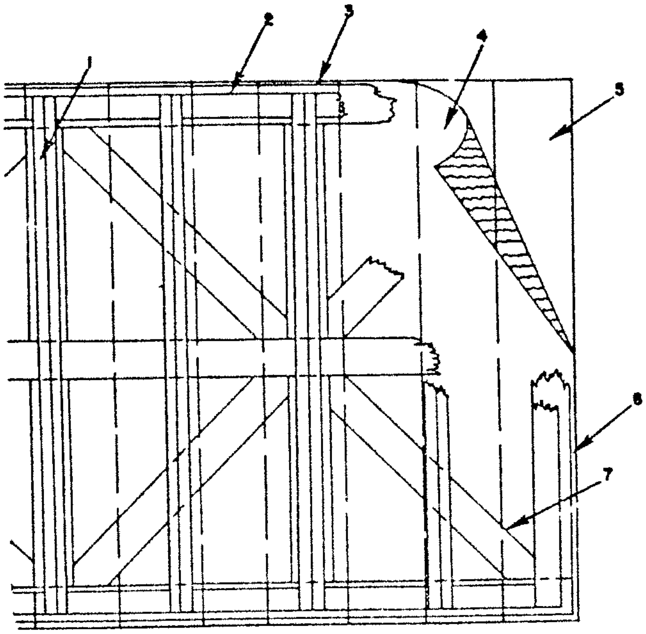
b. Install fuselage stand.

c. Secure fuselage and nose stands to base of crate, using 1/2 inch bolts and place tail skid safety post in position and secure.

d. Secure front seats, side upholstery panels and small packaged material in the airplane baggage compartment and rear seat.

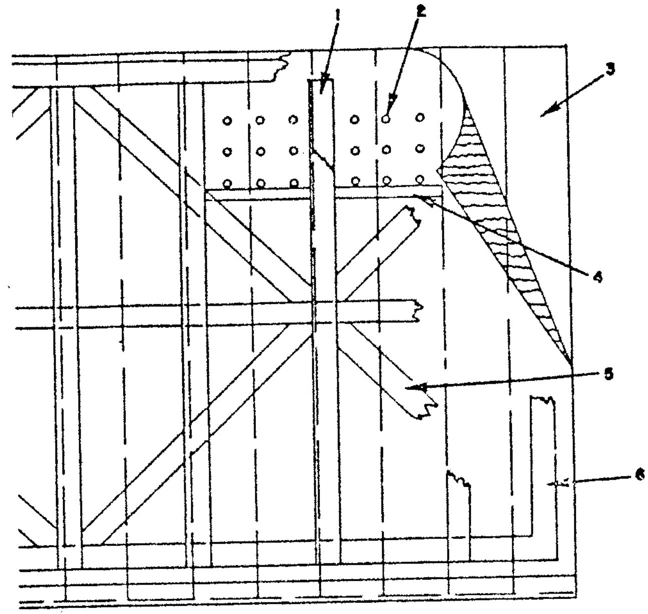
e. Close canopy and tape shut. Also cover all windows and openings with moisture and greaseproof paper taped in position.

f. Install vertical and diagonal bracing with cradles for supporting the wings and flaps.



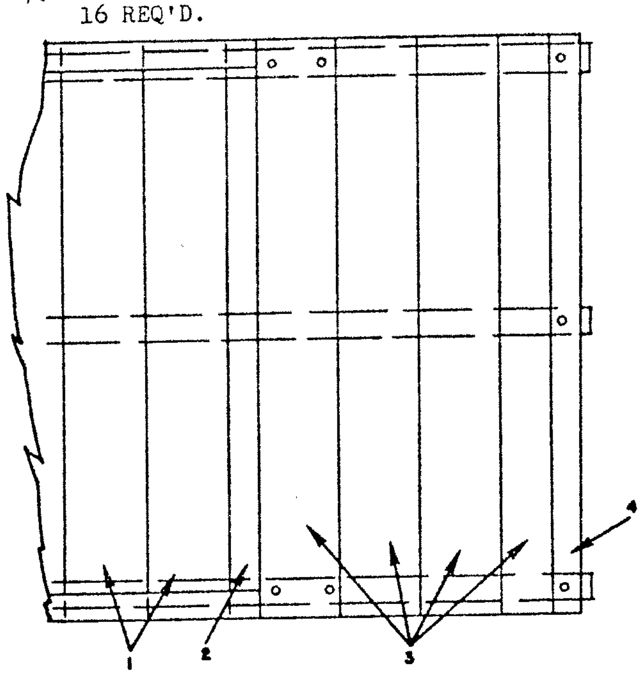
TOP VIEW

1. 2X4 INCH JOIST, 78-3/4 INCHES LONG. 30 REQ'D.
2. 4X4 INCH SPACERS, 16-3/8 INCHES LONG. 32 REQ'D.
3. 1X6 INCH FRAME BOARDS, 159-3/4 INCHES LONG. 6 REQ'D.
4. WATERPROOF PAPER.
5. 1X12 INCH T&G SHEATHING, 83-1/2 INCHES LONG. 26 REQ'D.
6. 1X6 INCH SPREADERS, 32-9/16 INCHES LONG. 18 REQ'D.
7. 1X6 INCH DIAGONALS, 50 INCHES LONG. 16 REQ'D.



SIDE VIEW

1. 2X4 INCH VERTICAL STRUTS, 71-1/2 INCHES LONG. 14 REQ'D.
2. 1 INCH DIAMETER HOLES 5 INCHES BETWEEN CENTER WITH 3/8 INCH SCREEN MESH OVER HOLES.
3. 1X10 INCH SHEATHING, 84-3/4 INCHES LONG. 64 REQ'D.
4. 2X4 INCH FILLER STRIPS, 20 INCHES LONG. 8 REQ'D.
5. 2X4 INCH DIAGONALS, 50 INCHES LONG. 32 REQ'D.
6. 4X4 INCH VERTICAL STRUTS, 71-1/2 INCHES LONG.

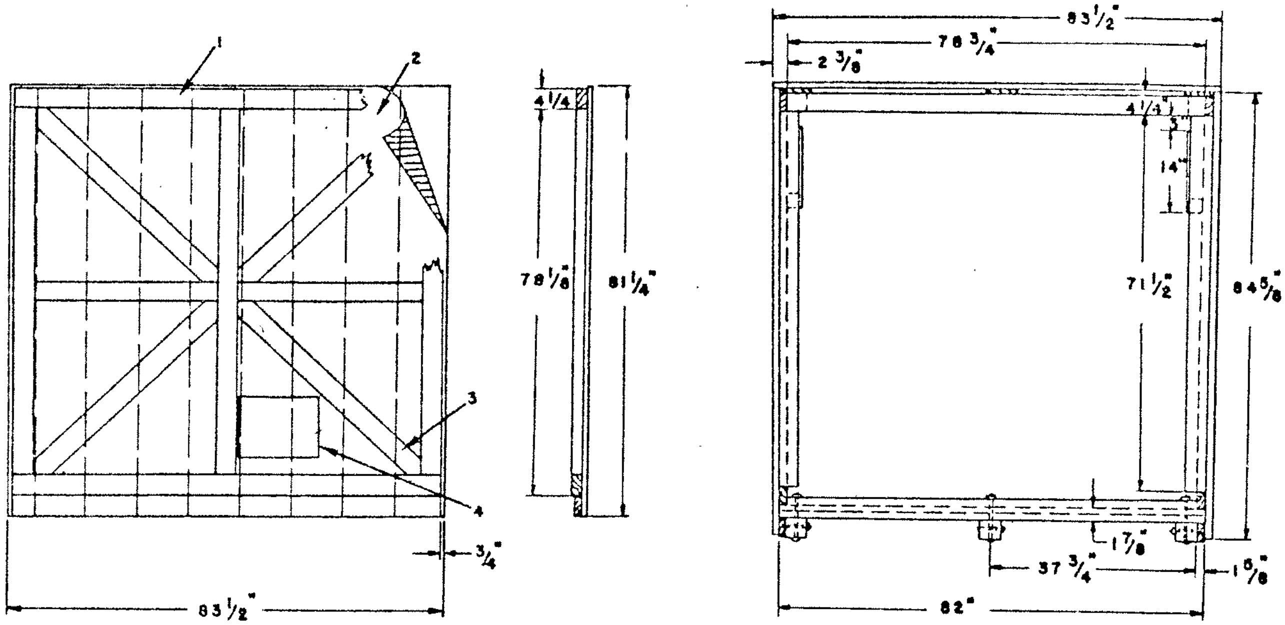


BOTTOM VIEW

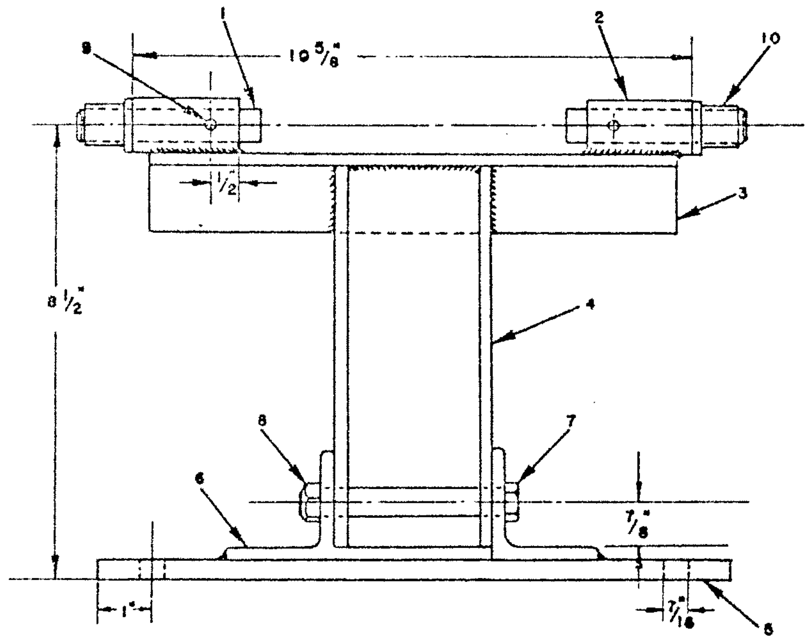
BOTTOM VIEW

1. 1X12 INCH FLOOR BOARDS, 82 INCHES LONG. 18 REQ'D.
2. 2X4 INCH FLOOR BOARDS, 82 INCHES LONG. 2 REQ'D.
3. 2X12 INCH FLOOR BOARDS, 82 INCHES LONG. 9 REQ'D.
4. 4X4 INCH HEADERS, 82 INCHES LONG. 2 REQ'D.

Figure 2-1. Box Construction Details



END VIEWS



END VIEWS

1. 2X4 INCH FRAME, 82 INCHES LONG. 4 REQ'D.
2. WATERPROOF PAPER.
3. 2X4 INCH DIAGONALS, 50 INCHES LONG. 4 REQ'D.
4. 8X12 INCH INSPECTION DOOR FASTENED WITH 4 SCREWS.

NOSE GEAR STAND - FORWARD VIEW

1. PIN - 5/8 DIA. X 3-1/2 L. - 1020 C.R. STEEL. 2 REQ'D.
2. SLEEVE - 1.0 O.D. - 5/8 I.D. X 2 L. - 1020 C.R. STEEL. 2 REQ'D.
3. ANGLE - 1-1/2 X 1-1/2 X 1/4 X 10L. 1 REQ'D.
4. CHANNEL - 3 WIDE - 1.498 FLANGE - .258 THICK X 6-1/2 L. 1 REQ'D.
5. STRAP - 2 X 12 X 1/4 - C.R. STEEL. 2 REQ'D.
6. ANGLE - 2 X 2 X 1/4 X 8L. 2 REQ'D.
7. AN8-40 BOLT. 1 REQ'D.
8. AN365-820 NUT. 1 REQ'D.
9. NO. 10 HOLE FOR AN380-6-8 COTTER PINS TWO PLACES
10. BRASS BUSHING - 5/8 I.D., 3/4 O.D., 1 INCH WITH 1/8 INCH FLANGE. 2 REQ'D.

Figure 2-2. Box Construction Details

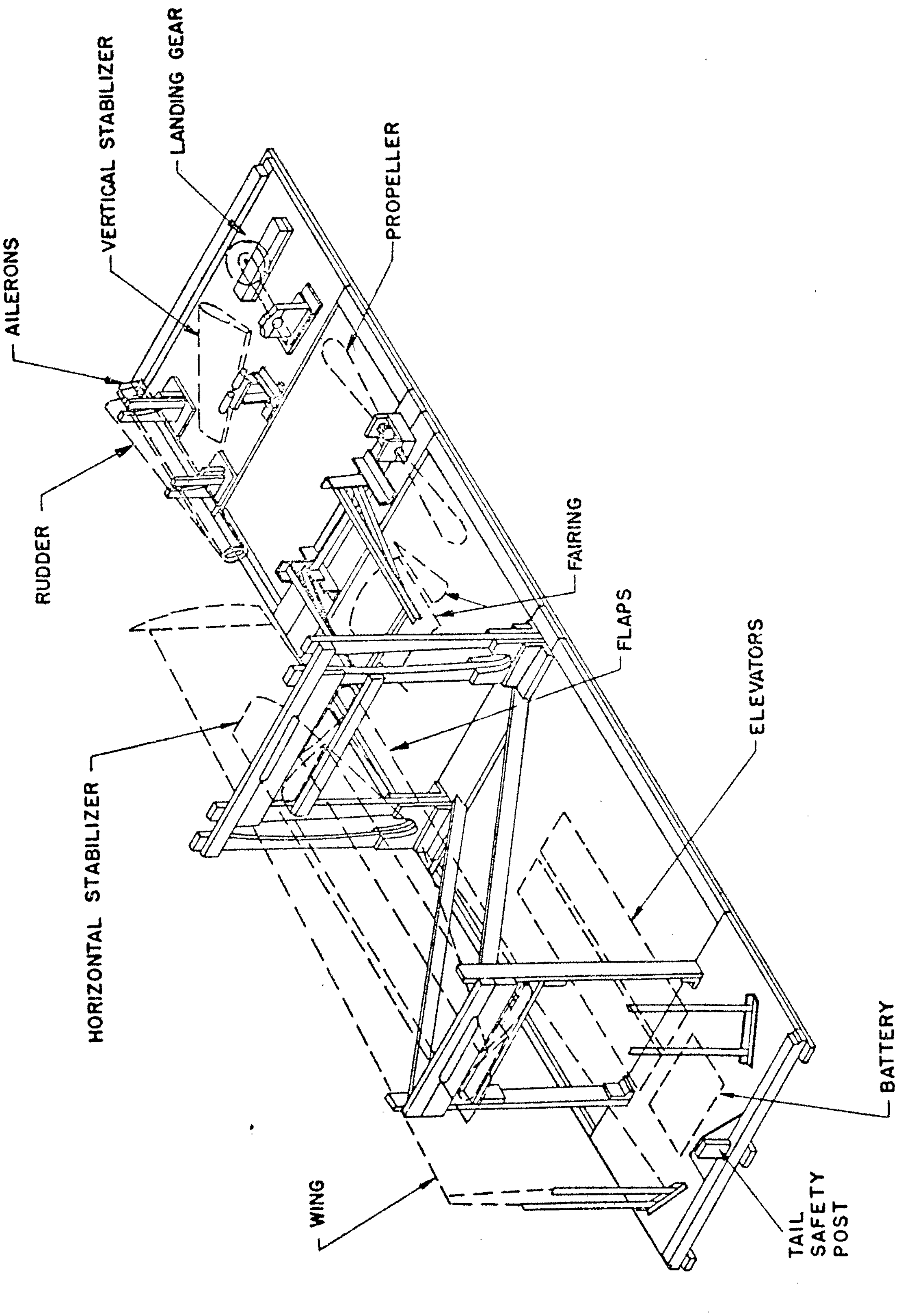
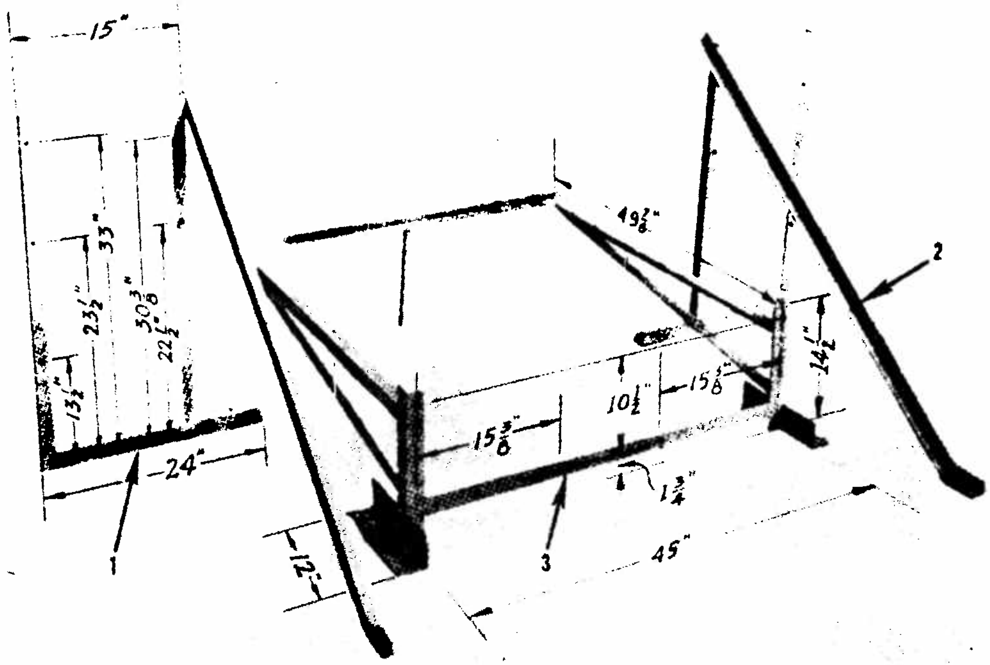
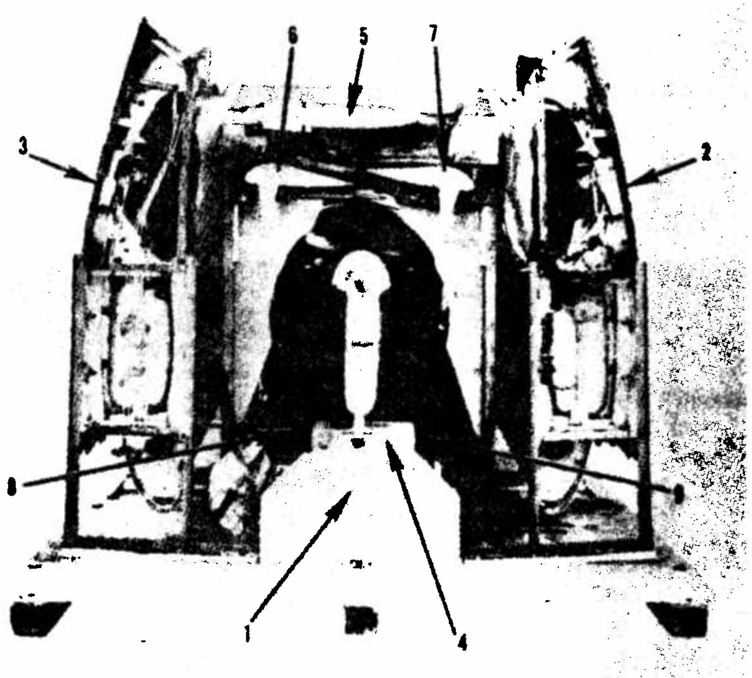


Figure 2-3. Parts Arrangement



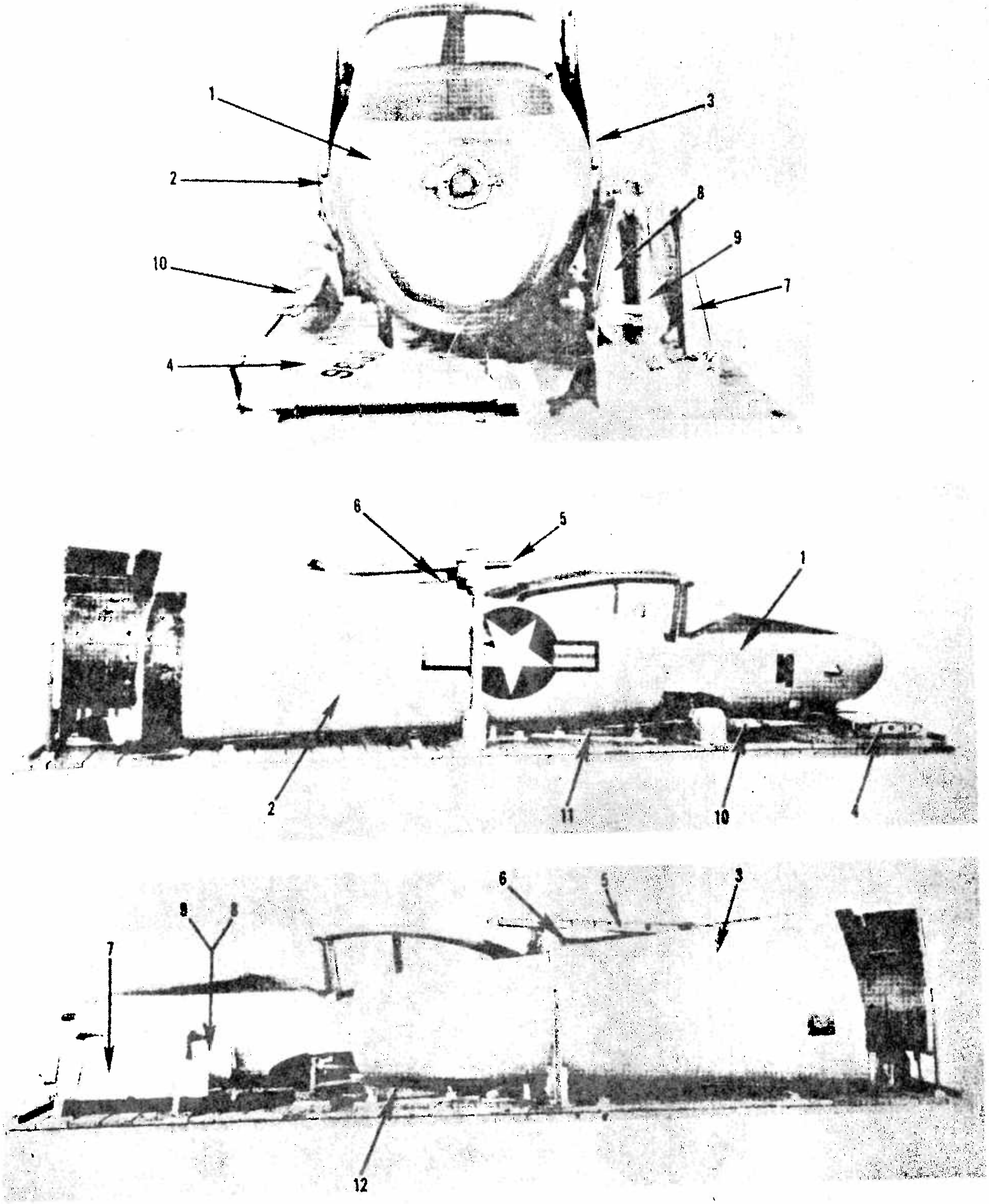
1. Left Wing Stand
2. Right Wing Stand
3. Fuselage Stand

Figure 2-4. Fuselage and Wing Support Structure



1. Tail Skid Safety Post
2. Left Wing Mounted in Stand
3. Right Wing Mounted in Stand
4. Battery
5. Horizontal Stabilizer
6. **Left Flap**
7. **Right Flap**
8. **Right Elevator**
9. **Left Elevator**

Figure 2-5. Parts Arrangement



1. **Fuselage**
2. Right Wing
3. Left Wing
4. Vertical Stabilizer
5. Horizontal Stabilizer
6. Flaps
7. Rudder
8. Right Aileron
9. Left Aileron
10. Propeller
11. Right Wingroot Fairing
12. Left Wingroot Fairing

Figure 2-6. Parts Protection and Tie Down

g. Secure elevators in cradles to base of crate near aft end and underneath fuselage.

h. Secure wing root, elevator tip and rudder lower fairings in position underneath mid-section of fuselage with 1-1/2 inch webbing.

i. Secure vertical fin in cradles to base of crate, located near forward end underneath left hand side of engine mount.

j. Secure rudder and ailerons in cradles to base of crate located at the left forward end, with the leading edges pointed down and root ends forward.

k. Secure propeller in yoke attached to base of crate just forward of the right hand mid-position.

l. Secure battery in box just forward of airplane tail skid safety post.

m. Secure nose wheel assembly in yokes located at forward right hand corner of crate base.

n. Secure wings in cradles and support stands located at the left and right sides of the fuselage with the leading edge down and the root ends aft.

o. Install flaps in cradles located above aft end of fuselage.

p. Place supports for the horizontal stabilizer in position and secure with bolts, then secure horizontal stabilizer in position.

q. Place the supports for the horizontal stabilizer in position and secure with bolts, then secure horizontal stabilizer in position.

r. Install the top of the crate and fasten in place with 1/2X6 lag screws.

2-9. UNCRATING COMPONENTS OF THE AIRPLANE. (Refer to Figures 2-4 and 2-5.) Disassemble and unpack the crate used for shipment of the L-17 airplane as follows:

a. Remove top of crate by removing lag screws from around top of box.

b. Remove sides and ends by removing the attaching lag screws.

c. Remove horizontal stabilizer.

d. Remove flaps from cradle over top of fuselage.

e. Remove wings by removing securing bolts that attach the wing stands and cradle to base of crate (wings can be removed and stand used to store wings in upright position until ready for assembly).

f. Remove nose wheel strut assembly.

g. Remove elevator from under fuselage tail cone.

h. Remove battery from base of box.

i. Remove propeller from securing yoke.

j. Remove vertical fin from cradle at forward end of crate base.

k. Remove rudder and ailerons from cradles at left forward end of crate base.

l. Open canopy and remove seats and other material stored in the airplane.

m. Remove wing root and miscellaneous fairing from base of crate located underneath mid-section of fuselage.

n. Remove cowling from over engine.

o. Secure hoisting sling to fuselage and engine (refer to Section III, Figure 3-2.)

p. Remove nuts and bolts, attaching nose stand to crate base.

q. Remove nuts and bolts, attaching fuselage stand to crate base.

r. Hoist fuselage sufficiently so that it can be moved forward until tail skid clears safety post, then hoist clear. The fuselage and nose stands will serve as temporary supports for the fuselage until it can be assembled to the wings.

2-10. PREPARATION OF METAL PARTS FOR SERVICE AFTER UNCRATING. Do not clean parts treated with corrosion-preventive compound until immediately before the airplane is to be reassembled for service or the part is to be used. Remove wrapping or covering from parts to be cleaned, subject them to solvent cleaning or vapor degreasing. Do not use abrasives for cleaning any of the parts. Apply proper lubricants to the parts as soon as they are dry.

2-11. ERECTION PROCEDURE. Procedures for assembling the L-17 after uncrating can be found in Section IV under appropriate paragraphs.

2-12. PREPARATION OF ENGINE FOR SERVICE AFTER SHIPMENT OR STORAGE. Prepare the engine for service after shipment or storage as follows:

a. Thoroughly clean engine, using solvent or vapor degreaser.

b. Remove dehydrating plugs from the cylinders and remove all moisture proof coverings which were installed to close engine openings. Remove dehydrating agents from exhaust manifolds and air scoop.

c. Before installing spark plugs, remove dehydrating plug from oil sump and rotate the crankshaft to facilitate thorough draining of the corrosion-preventive mixture, then reinstall and safety sump plug.

d. Install spark plugs.

e. Install propeller, refer to Section IV, Paragraph 4-131.

f. Remove oil screen, clean, reoil and reinstall.

g. Thoroughly flush carburetor with gasoline, allowing diaphragms to soak for a minimum period of 8 hours prior to running engine.

h. Install a minimum of 4 quarts, Specification AN-O-8, Grade 1100 lubricating oil in the engine. This oil should be drained after the completion of the ground test and the sump refilled with fresh oil.

i. Refer to appropriate paragraphs in Section IV for information concerning ground test.

2-13. RIGGING AND ADJUSTMENT OF CONTROL SYSTEM. For rigging instructions and adjustment of control surfaces, refer to appropriate paragraphs in Section IV. For methods of leveling the airplane, refer to Section III, Figure 3-4.

2-14. LUBRICATION AFTER ERECTION OF AIRPLANE. The parts that require lubrication after the airplane has been assembled are shown on the lubrication diagram, Figure 3-7. Lubrication specifications and methods of application are also shown in this illustration.

SECTION III

GROUND HANDLING AND SERVICING INSTRUCTIONS

3-1. ACCESS AND INSPECTION PROVISIONS.

3-2. All access and inspection provisions are shown in figure 3-1.

3-3. GROUND HANDLING.

3-4. Entrance to the cabin of the airplane is gained from the left side of the fuselage, just forward of the wing, by using the step provided. (See figure 3-2.) Walkway areas and handling points are also indicated in figure 3-2.

3-5. HOISTING PROVISIONS.

3-6. HOISTING AIRPLANE. A special hoisting sling is available for hoisting the complete airplane or the fuselage, with or without the empennage. One of three rings on the sling is provided for each hoisting condition to ensure proper balance. For each condition, the landing gear should be retracted; otherwise, ballast weight will be required. Figure 3-2 shows use of sling for hoisting fuselage from wing. Complete instructions for use of sling are on sling spreader bar.

3-7. HOISTING ENGINE. The installation and removal procedures necessary prior to hoisting engine (such as removing hinged doors and disconnecting fuel lines, oil lines, etc.), and engine hoisting details are described in paragraphs 4-101 and 4-104. The engine is hoisted by connecting a chain hoist hook to hoisting lug on the engine. (See figure 3-2.)

3-8. JACKING PROVISIONS.

3-9. There are four jacking points: a combination jacking and mooring fitting in each wing, just forward of the main landing gear; and one on each main landing gear strut.

3-10. JACKING COMPLETE AIRPLANE. Place a stand under the tail skid; make sure the tail skid is positioned properly. (See figure 3-2.) Then place a jack stand, similar to the one shown in figure 3-2, at each wing jacking point. Jack the airplane evenly, until each wheel is approximately 2 inches off the ground.

CAUTION

Before jacking, make sure jack is solidly engaged with wing fitting.

3-11. JACKING MAIN LANDING WHEELS. Raise the wheel off the ground (as shown in figure 3-2), using the combination up-lock roller and integral jack fitting on the main landing gear strut.

3-12. TOWING AIRPLANE.

3-13. The airplane may be towed by using a tow bar, Part Number 154-55010, or a special tow cart. When the tail of the aircraft is lowered, the cart may be placed under the nose wheel. Then the tow bar attached to the cart can be connected to a tug and the aircraft moved as desired.

CAUTION

Do not turn nose wheel more than 20 degrees from center or neutral.

3-14. PUSHING AIRPLANE.

3-15. The aircraft is easily maneuvered and pushed when the nose wheel is off the ground. This is best accomplished by grasping the fuselage just forward of the empennage, lowering the fuselage until the nose wheel is off the ground, and then pushing the aircraft. When the aircraft is maneuvered in a congested area, always station a man on each wing tip to insure the tips clear all obstructions.

CAUTION

Do not push, pull, or lift aircraft by ailerons, elevators, or propeller.

3-16. PARKING AIRPLANE.

3-17. When normal weather conditions prevail park the aircraft in a previously designated area. Place wheel chocks in proper position. To lock the surface controls, use the surface control lock which is kept stowed on the cabin floor. It is a tubular structure provided with locks and is positioned for locking by inserting end of tube in support on left upper longeron opposite pilot's wheel and engaging wheel with locks. (Detail A of Figure 3-3). Set the parking brakes. Head the aircraft into the wind wherever possible.

3-18. MOORING AIRPLANE.

3-18A. If adverse weather conditions such as high winds or gusts are anticipated, the aircraft will be tied down as indicated in

Figure 3-3. Use mooring lines of 3/8 inch or larger manila rope, providing sufficient slack in the lines for moisture absorption or/tire or strut deflation on the opposite side. In addition, install spoilers and dust excluders. Wood wheel chocks, AF Drawing 42D6594-2, locally manufactured, will be used except where ice and snow conditions preclude their use. AF Drawing 50D6602 of the Type A-2 collapsible wheel chock assembly, AF Stock No. 8200-159006, for small aircraft is designed for conditions comparable to arctic operation. Tables of authorization will indicate basis of issue for metal collapsible ice grip chocks. Two chocks per main landing gear will be used. The fore and aft chocks for each wheel will be tied together to prevent slippage.

3-18B. In the event tie-down rings are not Provided on hard-surfaced areas, aircraft may be secured to "dead-man" type anchors, or moved to an area where anchor kits AN8015-2 may be used. When kits, AN8015-2 are not available, metal stakes or "dead-man" type anchors may be used, providing a pull of 3000 pounds minimum may be sustained without failure on such installed anchor. If the aircraft is parked on steel mats, it may be tied down to the mats.

3-18C. To use the mooring kit, Part No. AN8015-2 (AF Stock No. 8200-416300), the anchor rod, Part No. 36A4468, is screwed into the arrow, Part No. 36A4467, and the driving rod, Part No. 36A4466, slipped over the anchor rod and into the socket of the arrow. The cam on the driving rod must be turned so that the prongs of the arrow will not be spread by driving. If the ground is hard, the surface will be broken first by using the ground breaking pin, Part No. 38B3323. Care must be taken to align the rod with the point of attachment on the aircraft. The arrow will be driven into the ground until the driving rod handle is within 3 inches of the ground and then rotated 90 degrees, and the driving rod given a sharp blow to spread the prongs of the arrow. The driving rod is then returned to the "DRIVING" position and withdrawn from the ground. The squared socket of the eye assembly, Part No. 36A4469, will then be aligned with the squared end of the anchor rod, fitted into place, and the knurled nut screwed down tight. The mooring rope will then be attached to the eye assembly and given an upward pull to spread and set the arrow prongs. The mooring rope will then be secured in accordance with previous instructions. To withdraw the anchor rods, the mooring ropes are detached and the anchor rods unscrewed by turning the ring of eye assemblies counter clockwise, leaving the arrows in the ground.

NOTE

The holding force of wheel chocks, even when properly placed in front of main gear wheels, will not withstand the force exerted by the engine at acceleration speeds without application of brakes.

3-18D. To provide precautions for every type of weather condition would result in repetitive items and restrict command responsibility to circumscribed limits. In certain geographical areas additional precaution must be taken for typhoons, hurricanes, tornadoes and the like. Local base regulations and procedures will supplement these instructions. The omission of specific references to items of additional precautions such as installation of spoilers, protective coverings, external control locks in conjunction with internal locks, sandbagging of aircraft etc. will not be construed as license to depart from providing of maximum security for aircraft and personnel. Execution of mooring procedures for high winds will be contingent on personnel and equipment available and the timely receipt of adverse weather reports. Where aircraft are moored for periods in excess of five days, inspection provisions governing stored aircraft will apply.

CAUTION

Do not turn nose wheel more than 20 degrees from center or neutral.

3-19. LEVELING.

3-20. LEVELING AIRPLANE LATERALLY (AIRPLANE ON JACKS). (See figure 3-4) Open canopy and lay a straight bar across the upper fuselage longerons, at the junction of the windshield and canopy tracks. Place a leveling protractor on top portion of bar, and lower or raise one wing as required.

3-21. LEVELING AIRPLANE LONGITUDINALLY. (See

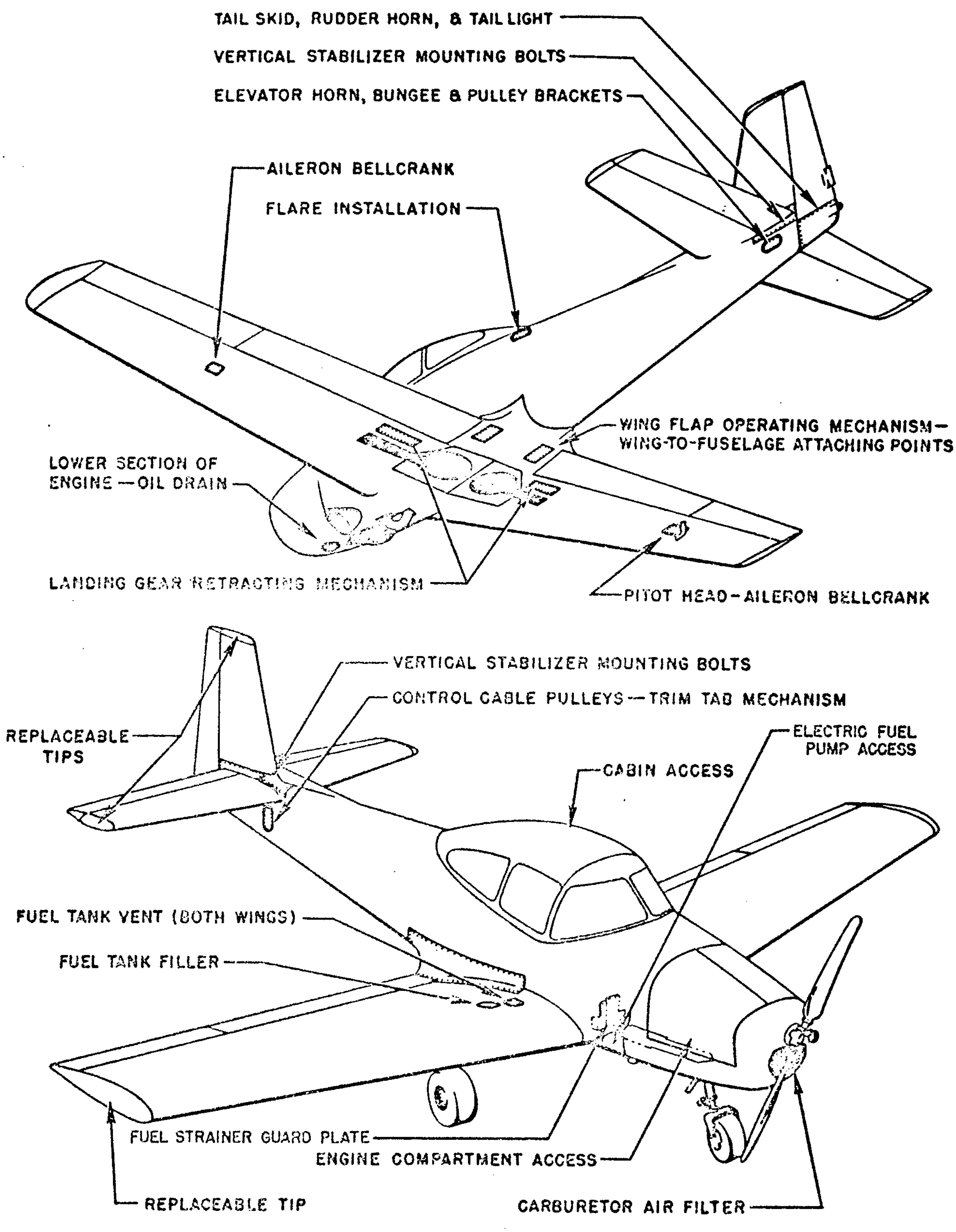


Figure 3-1. Access and Inspection Provisions

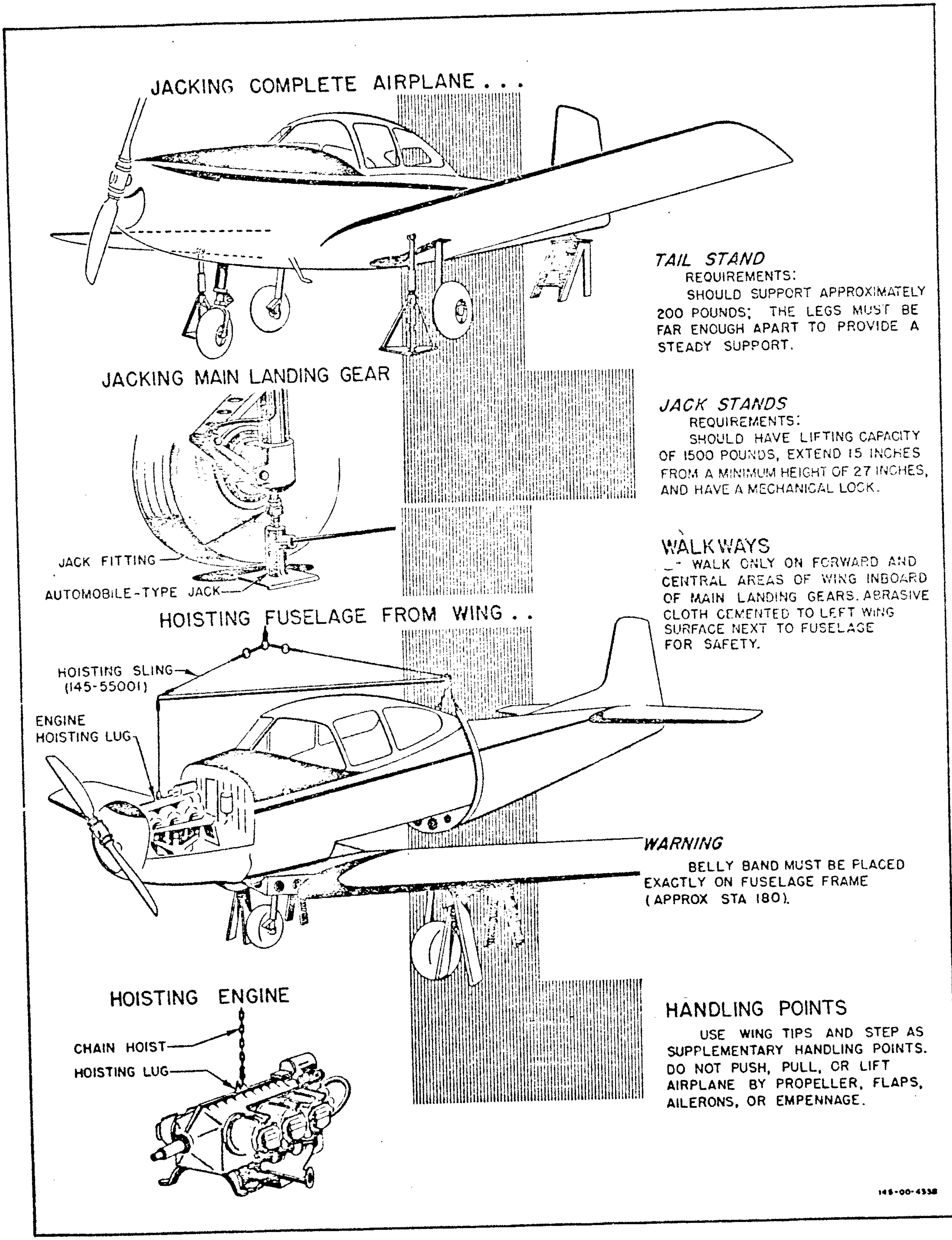


Figure 3-2. Ground Handling

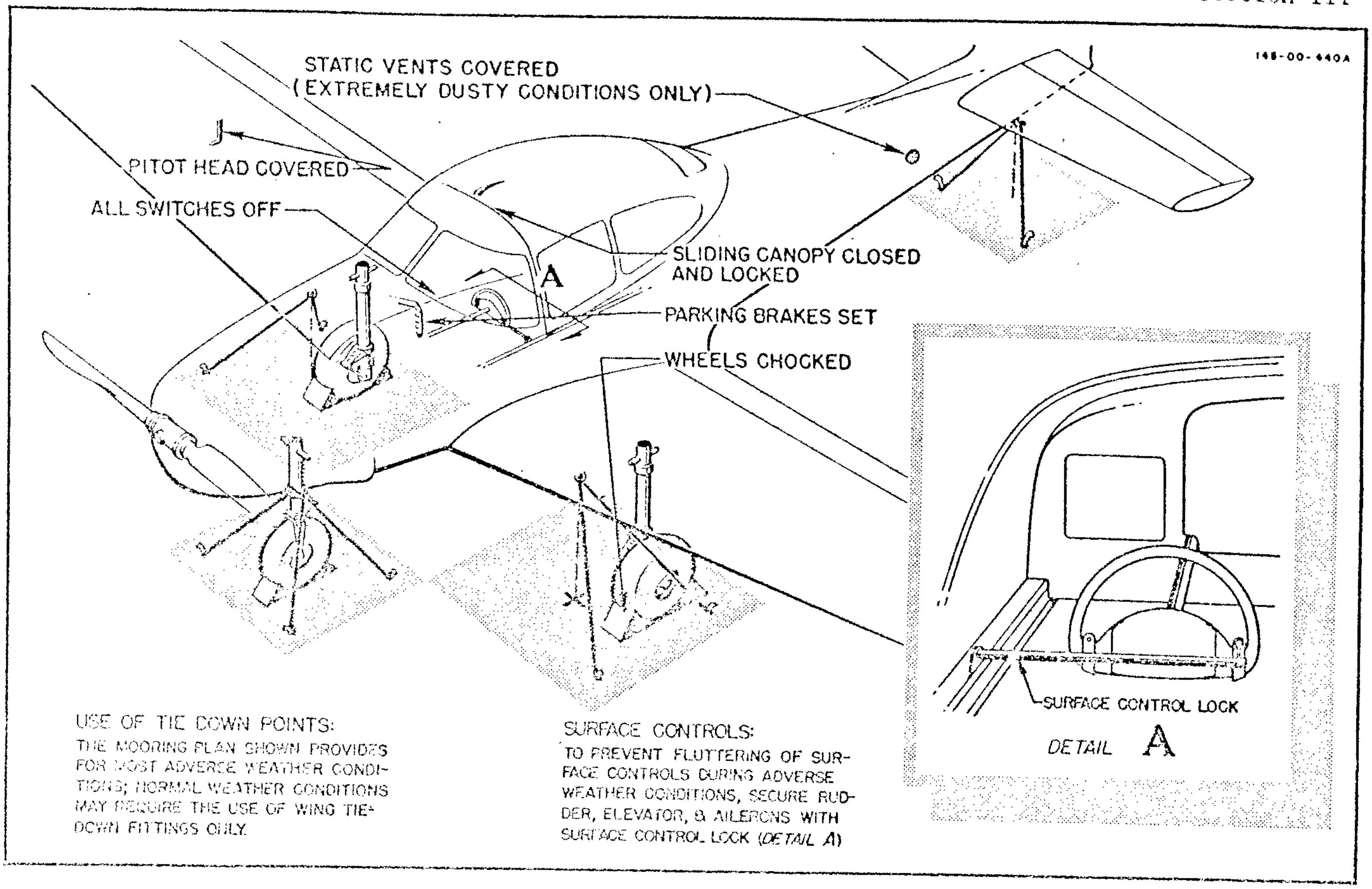


Figure 3-3. Mooring Airplane

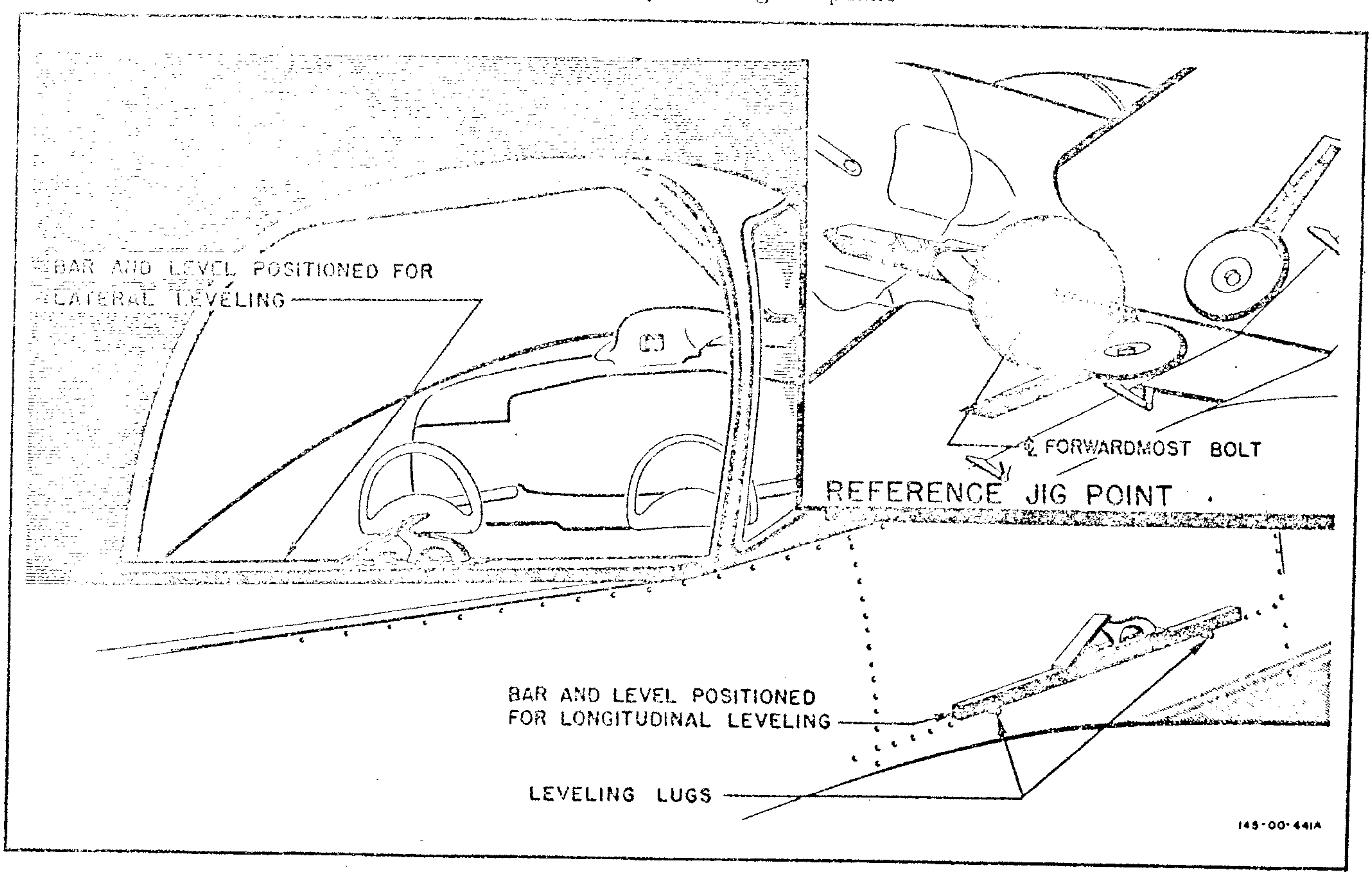
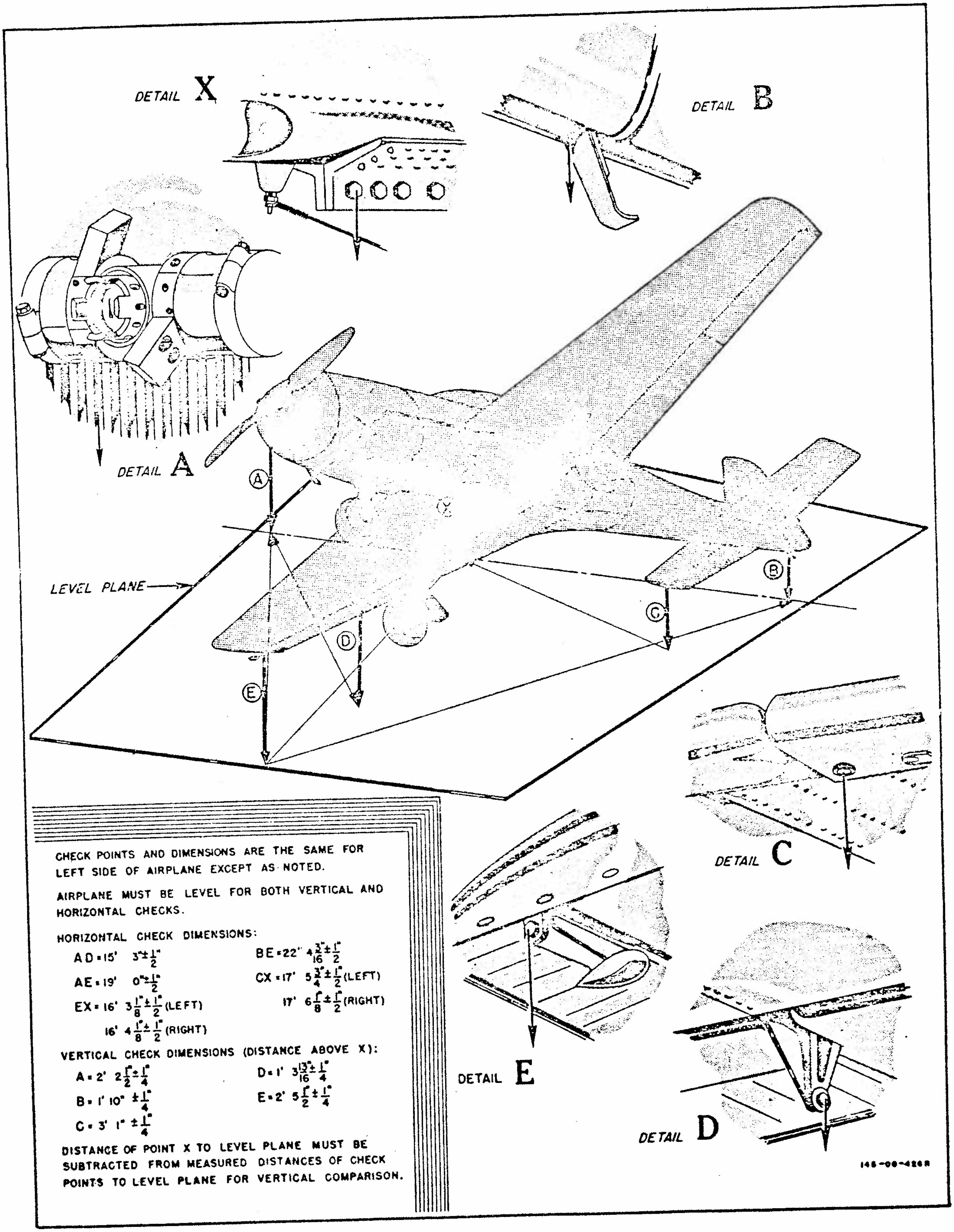


Figure 3-4. Leveling Airplane



CHECK POINTS AND DIMENSIONS ARE THE SAME FOR LEFT SIDE OF AIRPLANE EXCEPT AS NOTED.

AIRPLANE MUST BE LEVEL FOR BOTH VERTICAL AND HORIZONTAL CHECKS.

HORIZONTAL CHECK DIMENSIONS:

AD = 15' $3'' \pm \frac{1}{2}''$ | BE = 22' $4\frac{3}{16}'' \pm \frac{1}{2}''$

AE = 19' $0'' \pm \frac{1}{2}''$ | CX = 17' $5\frac{3}{4}'' \pm \frac{1}{2}''$ (LEFT)

EX = 16' $3\frac{1}{8}'' \pm \frac{1}{2}''$ (LEFT) | 17' $6\frac{1}{8}'' \pm \frac{1}{2}''$ (RIGHT)

16' $4\frac{1}{8}'' \pm \frac{1}{2}''$ (RIGHT)

VERTICAL CHECK DIMENSIONS (DISTANCE ABOVE X):

A = 2' $2\frac{1}{2}'' \pm \frac{1}{4}''$ | D = 1' $3\frac{13}{16}'' \pm \frac{1}{4}''$

B = 1' 10" $\pm \frac{1}{4}''$ | E = 2' $5\frac{1}{2}'' \pm \frac{1}{4}''$

C = 3' 1" $\pm \frac{1}{4}''$

DISTANCE OF POINT X TO LEVEL PLANE MUST BE SUBTRACTED FROM MEASURED DISTANCES OF CHECK POINTS TO LEVEL PLANE FOR VERTICAL COMPARISON.

Figure 3-5. Checking Airplane Alignment

figure 3-4.) Level airplane longitudinally by placing a straight bar on the leveling lugs on the right side of the fuselage. Then place a leveling protractor on bar, and raise or lower tail of airplane as required.

3-22. CHECKING AIRPLANE ALIGNMENT.

3-23. When necessary, as a result of damage or other causes, the airplane alignment may be checked by setting up a surveyor's transit and checking dimensions according to information shown in figure 3-5.

3-24. DATUM POINT.

3-25. The horizontal datum point is fuselage station 0. As station 0 is forward of the airplane, a reference jig point is established at the centerline of the forwardmost bolt in the lower wing attaching angle (fuselage station 93-1/4). (See figure 3-4.)

3-26. SERVICING INSTRUCTIONS.

3-27. CLEANING AIRPLANE.

3-28. Keep the airplane clean and waxed, to help prevent corrosion. A clean airplane also offers less air resistance with a resultant increase in range and speed. Make sure the correct cleaners are used for the type of cleaning to be accomplished. Walk only in designated areas (shown in figure 3-2).

3-29. CLEANING AND MAINTAINING EXTERIOR SURFACES OF AIRPLANE. Close cowling and canopy securely. Apply an aluminum cleaner and water solution (such a cleaner should be either a neutral detergent of the soapless type containing no alkali or other material which would corrode aluminum; or an alkaline silicate type obtainable from manufacturers of industrial aluminum cleaners) to all surfaces, rubbing lightly with a sponge. Rinse surfaces with clean, fresh water, drying with a soft, damp (not wet) chamois. Inspect surfaces for oil stains, bug spots, etc, which do not respond to the cleaning solution, and remove them with a dry-cleaning solvent or kerosene. Rinse surfaces thoroughly after using metal polish or cleaner. Wax fuselage and wing surfaces, using a self-polishing liquid wax. Between wash jobs, dust may be removed from the surfaces of the airplane by wiping lightly with a clean, soft cloth. Do not rub dusty surfaces.

3-30. CLEANING WINDSHIELD AND CABIN WINDOWS. To clean windshield and cabin windows, proceed as follows:

a. Flush plexiglas with clear water, using bare hand gently to feel and dislodge any dirt, salt, or mud.

b. Wash surface with an aluminum cleaning solution. (Refer to paragraph 3-29.) Make sure the water used is free of dirt or other possible abrasives. A soft cloth, sponge, or chamois may be used in washing, but should only be used as a means of carrying water solution to the plastic. Dry the surface, preferably with a clean, damp chamois. However, a soft, clean cloth (such as cotton flannelette) or soft tissues may be used, if care is taken not to continue rubbing the plastic after it is dry.

c. Remove oil and grease by rubbing lightly with a cloth wet with kerosene.

CAUTION

Do not use the following materials on the windows: acetone, benzene, carbon tetrachloride, fire extinguisher fluids, gasoline, lacquer thinners, or window cleaning sprays. They may soften the plastic and cause crazing.

d. Do not rub the plastic with a dry cloth, as this is not only likely to cause scratches, but it also builds up an electrostatic charge which attracts dust particles to the surface. If the surface does become charged, patting or gently blotting with a clean, damp chamois will remove this charge as well as the dust.

e. If, after removing dirt and grease, the plastic surface is marred by scratches, apply a suitable scratch-removing compound by hand, using a soft, clean cloth to remove the polish. Several applications may be necessary to restore suitable clarity to the scratched area.

CAUTION

Do not attempt hand polishing until the surface is clean. The grit and sand may cause more serious damage than the original scratches.

f. After windshield and cabin windows are dry and free of dirt, wax them with a good grade of commercial wax to help prevent further scratching. Apply the wax in a thin, even coat and bring to a high polish with a clean, soft, dry cloth.

3-31. CLEANING CHROME-PLATED PARTS. Chrome-plated parts should be kept polished and waxed. Should any blemishes appear, the part's appearance can be improved by cleaning the affected spots with ordinary household scouring powder. After scouring surface, apply wax coating.

3-32. CLEANING ENGINE SECTION. The engine section should be cleaned regularly to remove any collections of dirt and oil. The section is entirely accessible through the hinged cowling, and by removing the door in the lower surface of the fuselage under the engine. Remove dirt and oil with a dry-cleaning solvent or kerosene. Especially make sure that the engine cooling fins are clean, as dirty cooling fins can cause overheating of the engine.

3-33. CLEANING PROPELLER. All external metal

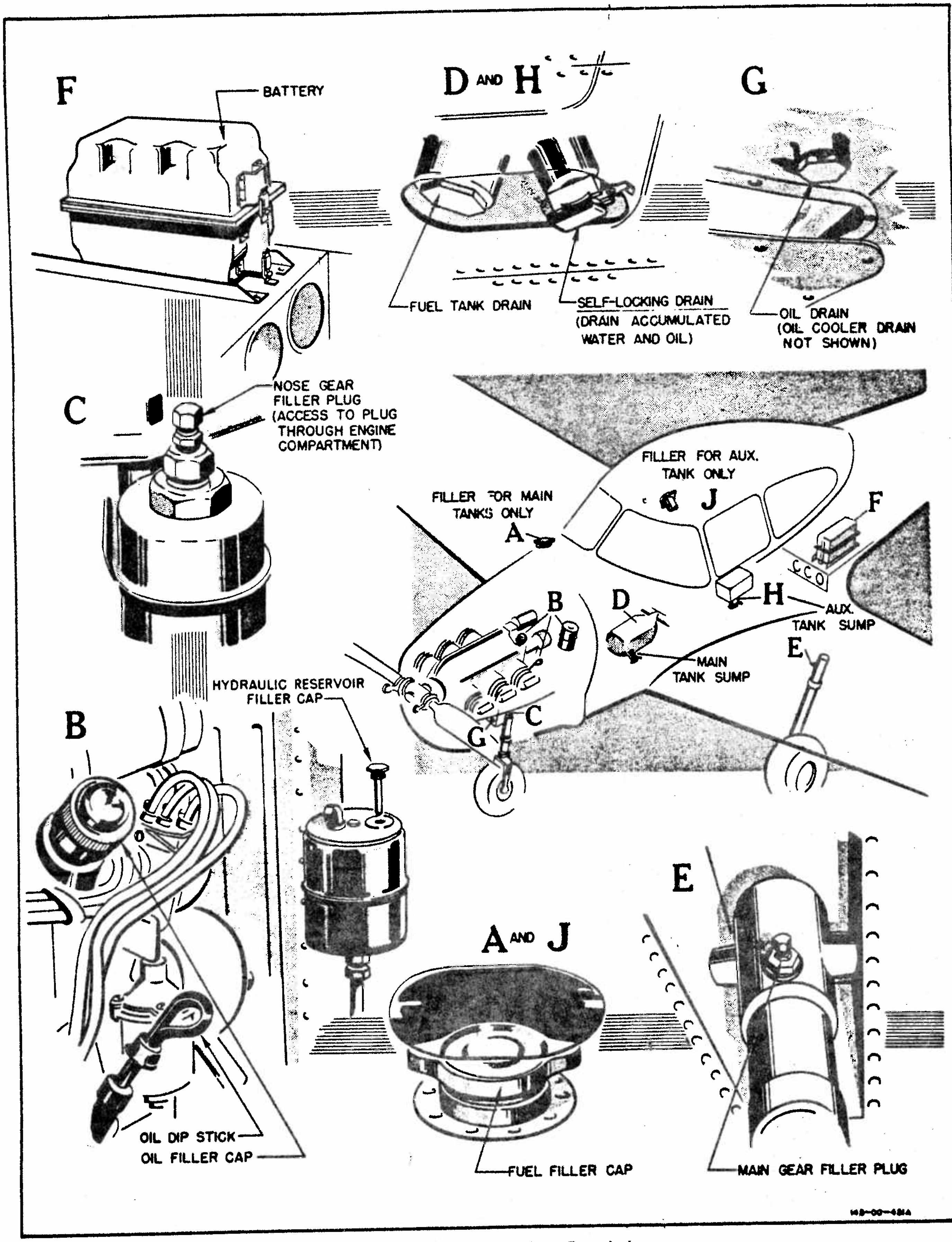


Figure 3-6. Servicing Provisions

parts of the propeller should be kept polished and waxed; remove any blemishes by using a scouring powder of a type that would be used to clean porcelain. The blade surfaces of the propeller are provided with a protective covering of plastic, and should be cleaned with a soap and water solution, and then flushed with clean water. Inspect blade surfaces for nicks or scratches, and repair surface if damaged. Keep the blade surfaces smooth. After making sure the blade surfaces are free from dirt, nicks, etc., apply a thin coat of self-polishing liquid wax.

3-34. CLEANING TIRES. Using a brush or cloth saturated in a soft soap and water solution, wipe surfaces clean; then rinse surfaces thoroughly with tap water. After surface is thoroughly dry, apply a brush coat of thiokol tire paint, or rub surfaces with glycerine until a uniform appearance is obtained.

3-35. CLEANING LANDING GEAR AND HYDRAULIC ACTUATING CYLINDERS. Keep the landing gears and hydraulic actuating cylinders clean, and well lubricated. Especially check the piston surfaces, as dirt and grit can cause leaks by cutting the strut seals. Remove dirt and oil with kerosene.

3-36. CLEANING AND CARE OF UPHOLSTERY. The upholstery is flame-resistant treated. The front and rear seats are designed so the upholstery can be removed and sent to be dry-cleaned; the cabin side panels are also removable for cleaning.

3-37. CLEANING FABRIC UPHOLSTERY AND CARPETING. The fabric upholstery and all carpeting should be frequently cleaned with a whisk broom, clothes brush, or vacuum cleaner. Remove grease and oil stains by rubbing with a clean cloth wet with dry-cleaning solvent. Rubbing should be done with a circular motion starting outside the spot to be cleaned, and working toward the spot. A clean portion of the cloth should be used after every few strokes. Use the dry-cleaning solvent sparingly. Never pour the cleaning solvent on the spot to be cleaned. Do not use soap and water on fabric upholstery, as its flame-resisting qualities will be removed; dry-cleaning solvent does not affect the flame-resistance.

3-38. SERVICING FUEL SYSTEM. Servicing of the main wing tanks will be similar on all models. The servicing instructions for the auxiliary fuel tank will pertain to L-17B and modified L-17A airplanes only. Refueling units will be equipped with filters which will remove all solid particles having minor dimensions five microns or larger, and capable of removing 99.5% of all free water.

3-39. FILLING MAIN FUEL TANKS. The main fuel tanks, having a total capacity of 39-1/2 US (32.9 Imp) gallons, are serviced with Grade 80 aviation fuel through a single filler in the right wing. (See figure 3-6.) In emergency, fuel (Specification No. AN-F-48, Grade 91/98) may be used. Airplane is not suitable for use of aromatic fuel. During transmission of fuel, the airplane must be grounded. Fill to the top of the filler neck, allowing time for fuel to transfer to the left tank. Install and secure filler cap.

3-40. FILLING AUXILIARY FUEL TANK. The auxiliary fuel tank, having a capacity of 21 US (17.5 Imp) gallons, is serviced through a filler on the right side of the fuselage.

WARNING

The following precautions should be observed:

* Do not allow smoking, exposed flame, or sparks (such as sparks from energized electrical equipment), within 50 feet of the aircraft being refueled.

* Stop the engine before refueling the airplane.

* Make certain that the airplane is grounded to the hose nozzle and gasoline container.

* Wash off all spilled gasoline to avoid vapor accumulation and gasoline pools.

3-41. DRAINING FUEL TANKS. Refer to paragraph 4-182 for instructions pertaining to draining fuel tanks.

3-42. SERVICING OIL SYSTEM.

3-43. OIL SPECIFICATIONS. Service the airplane with oil (Specification No. AN-O-8), of a grade based on the average ground temperature as follows:

ABOVE 21.1°C (70°F)................1100

21.1°C to -6.7°C
(70°F to 20°F) 1080

-6.7°C to -23.3°C
(20°F to -10°F) 71065

3-44. CHECKING OIL LEVEL. Open the left section of the engine hinged cowling, remove the dip stick (figure 3-6), and check oil level against reference lines on the stick. The oil level should be maintained at the "FULL" mark.

3-45. DRAINING ENGINE OIL. The oil should be drained at the completion of each 25 hours engine time. Access to the drain plug is gained through an access door in the lower engine cowling. Remove the drain plug (figure 3-6), and allow the oil to drain from the engine; then replace and safety the oil plug. Complete the draining of the engine oil system by draining the oil from the oil cooler. Remove the plug at the bottom of the oil cooler by-pass valve, and drain the oil into a container of approximately 2-quart capacity. Replace and safety the plug.

3-46. FILLING OIL SYSTEM. When filling the oil system after it has been drained, fill to capacity and run the engine briefly. Then replenish, to bring the oil up to the full level as indicated by the dip stick.

3-47. SERVICING HYDRAULIC SYSTEM.

3-48. CHECKING HYDRAULIC FLUID LEVEL. Raise engine hinged cowling on left side of engine. The hydraulic reservoir (figure 3-6) has a capacity of approximately 1/3 gallon. Remove dip stick (attached to the filler cap), and check the fluid level in relation to the marks on the stick. Should the fluid level be below the "FULL" mark, add fluid (Specification No. AN-VV-O-366) through the dip stick opening. Replace dip stick.

3-49. DRAINING HYDRAULIC SYSTEM. Position a fluid container (into which the fluid may drain), and disconnect the hydraulic line at the bottom of the reservoir. (See figure 3-6.) Drain fluid from the system lines by disconnecting several lines at a low point in the system. Connect the system lines, and the line to the bottom of the reservoir.

3-50. SERVICING MAIN LANDING GEAR TIRE.

3-51. Maintain tire pressure of 25 psi.

3-52. SERVICING NOSE GEAR TIRE.

3-53. Maintain tire pressure of 30 psi.

CAUTION

Do not install valve-core-remover type cap on valve stem--use only the short bonnet type.

3-54. SERVICING LANDING GEAR SHOCK STRUTS.

3-55. FILLING LANDING GEAR SHOCK STRUTS. Fill the shock struts (figure 3-6) with fluid (Specification No. AN-VV-O-366) as follows:

a. Jack the airplane, using the wing jacking points, until landing gear tires are off ground.

b. Release air from strut by loosening filler plug.

c. Remove filler plug and fully compress the strut.

d. Fill compressed strut with fluid.

e. Replace filler plug (finger-tight only); extend and compress strut several times to eliminate trapped air.

f. Compress strut, remove filler plug, and if necessary, add fluid to level of the filler plug hole.

g. Replace and securely tighten filler plug.

3-56. INFLATING LANDING GEAR SHOCK STRUTS. Inflate the shock struts (airplane at approximate normal load) in the following manner:

a. Attach a high-pressure air hose to strut air valve.

b. Inflate strut until 1-5/16 inches (main gear) and 1-1/2 inches (nose gear) of the polished piston can be seen between the packing nut and the strut piston shoulder.

NOTE

Small amounts of air can be removed from the strut by loosening the filler plug slightly, and then quickly tightening it. Do not depress the valve core to correct overinflation.

c. Rock the airplane lightly by raising the wing of the corresponding strut. (This is to check the strut for possible sticking or binding.)

d. Recheck for proper strut dimensions.

e. Check the valve and filler plug for possible air leakage.

f. Install valve cap, which is a secondary seal, and tighten lightly with a wrench.

CAUTION

Excessive tightening of the cap will result in the seat of the cap depressing the valve core, allowing air to escape.

3-57. SERVICING LANDING GEAR BRAKES.

3-58. BLEEDING LANDING GEAR BRAKES. Spongy or soft brake lever action may be caused by air bubbles in the brake system. To eliminate the air bubbles, bleed each brake as follows:

NOTE

During bleeding operation, fluid in hydraulic reservoir must be maintained as near the "FULL" level as possible.

a. Remove cap screw (located on the bleeder plug in the line to each brake), and attach a bleeder hose.

b. Place free end of bleeder hose in a partially filled can of hydraulic fluid so end of tube is submerged in fluid.

c. Apply brake pressure, loosen bleeder plug, and allow fluid to run until free of air bubbles.

d. Tighten bleeder plug, remove bleeder hose, and replace cap screw.

3-59. BLEEDING BRAKE LINES. To bleed air from brake lines, proceed as follows:

a. Loosen fitting attaching nut in each main gear wheel well at point where flexible line attaches to rigid line in wing.

b. Apply brake pressure.

c. Disconnect fitting, allowing slight fluid seepage, until fluid is free of air bubbles; connect and tighten fitting.

3-60. SERVICING BATTERY.

3-61. The battery (figure 3-6) should be checked at least every 10 hours. Warm climates require more frequent attention to the battery. Service battery as follows:

a. Remove battery cover.

b. Inspect water level within the battery.

c. Take hydrometer reading; recharge the battery if the gravity is below 1.240.

d. Add water if necessary.

CAUTION

When removing battery from airplane, remove battery and battery container together. This prevents the possibility of spilling acid on the airplane finish or upholstery.

3-62 through 3-72. (Deleted)

3-73. LUBRICATION REQUIREMENTS.

3-74. Always lubricate carefully and thoroughly, as lubrication is most important for the continued operation of the airplane. Make sure the correct lubricants are used at the proper time. Apply lubricant sparingly; then wipe off excess grease. Oily surfaces collect dirt and grit, which are detrimental to bearing surfaces because of their abrasive qualities. While lubricating, it is good practice to inspect the various parts closely, and test them for looseness and general wear. Specific lubrication points are illustrated in figure 3-7. When operating the airplane in extremely dusty conditions, clean and lubricate the parts more frequently.

3-75. SHIELDED AND SEALED BEARING LUBRICATION.

3-76. Double shielded or sealed bearings are installed in all surface control pulleys, aileron bellcranks, and in aileron, rudder, and elevator hinge fittings, and do not require lubrication at normal check periods. They are pre-lubricated by the manufacturer.

3-77. BEARING SURFACE LUBRICATION.

3-78. Excessive lubrication of bearing surfaces will attract dirt and grit. Therefore, bearing surfaces should be inspected to make sure only a thin film of oil is remaining after lubrication.

3-79. POINTS THAT REQUIRE NO LUBRICATION.

3-80. Oilite bearings, control cables, cockpit enclosure tracks, or other lightly loaded slides need not be lubricated unless protection against corrosion is necessary.

3-81. ENGINE ACCESSORY LUBRICATION.

3-82. All engine accessories have prepacked bearings which do not require repacking until the overhaul period.

3-83. SPECIAL TOOLS AND EQUIPMENT.

3-84. The following special tools and equipment are provided to aid in the general maintenance of the airplane.

PART NUMBER	DESCRIPTION	USAGE
145-53084-7	Allen wrench	Propeller
145-53085	Wrench	Engine mount
145-53086	Wrench	Main Landing gear trunnion
145-53090	Wrench	Generator mounting
145-55001	Sling	Hoisting airplane
145-55006	Cart	Towing airplane
T-97537	Tool	Installing rubber extrusions for window panels

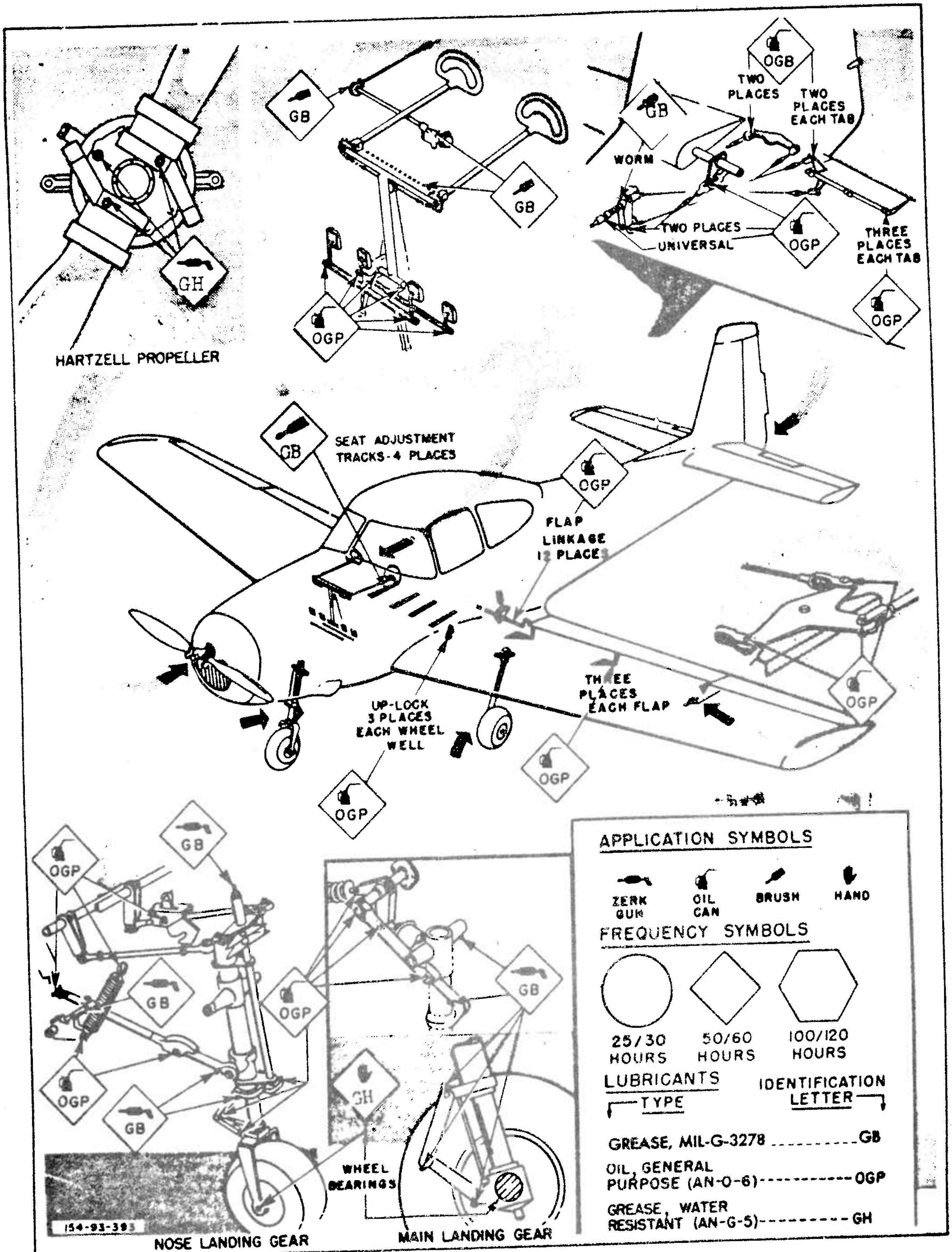


Figure 3-7. Lubrication

Pages 17 and 18 deleted.

SECTION IV

GENERAL MAINTENANCE

4-1. WING.

4-2. The full-cantilever wing has two bent-up alclad sheets at the trailing edge, which serve as a rear spar and part of the lower skin. The wing consists of two panels (each having a fuel tank compartment, and a wheel well for the main landing gear) bolted together at the fuselage centerline. Wing flaps and ailerons are hinged to the trailing edge of each panel. (See figures 4-1 and 4-2.)

4-3. WING PANELS.

4-4. The airfoil sections used are NACA 4415R at the root, and 6410R at the tip. The angle of incidence at the root is 2 degrees; incidence at the tip is minus one degree. Dihedral is 7 degrees, 30 minutes; and the leading edge sweepback is 2 degrees, 55 minutes, and 46 seconds. There are two short beams near the wing root. One of these, with another shorter beam, supports the main landing gear and retraction mechanism. Each beam consists of a web with top and bottom edges flanged as caps which are reinforced by bent-up angles. A reinforced rib, outboard of the landing gear trunnion supports, distributes landing loads and provides for attachment of mooring and jacking fittings. Highly stressed members around the landing gear and wing bolting angles are secured with Hi-shear rivets. Upper and lower skins are reinforced spanwise by formed and extruded stringers. (See figure 4-1.) A close-out strip on the lower surface runs from the landing gear cutout to the wing tip. The removable wing tips are formed and welded aluminum alloy sheet.

4-5. INSTALLING AND REMOVING WING PANELS. (See figure 4-3.)

4-6. WING FLAPS.

4-7. The wing flaps are all-metal, slotted-type structures, hinged to the wing trailing edge at three points. Each flap consists of a front and rear spar, with a full rib at each end and six nose ribs between. The lower cap of the rear spar extends as skin to the trailing edge, where it is joggled and riveted to the upper skin. Both upper and lower skins, except the leading edge, are beaded. The right and left wing flap assemblies are interconnected by a torque tube. The flaps are raised or lowered hydraulically and have a maximum travel of 45 degrees in the full down position.

4-8. INSTALLING AND REMOVING WING FLAPS. (See figure 4-4.)

4-9. ADJUSTING WING FLAPS. (See figure 4-39.)

4-10. AILERONS.

4-11. The all-metal, Frise-type ailerons are hinged to the wing trailing edge at three points. The structure is identical to the flaps except that there is only one spar. The lower cap of this spar also extends as skin to the trailing edge, where it is joggled and riveted to the upper skin. The center nose rib is of double thickness for support of the center hinge. Sealed ball bearings are staked into each of the hinge brackets, and a fixed trim tab is riveted to the inboard trailing edge of the right aileron. A streamlined static balance weight is attached at the outboard end of each aileron. The ailerons are statically balanced within a maximum allowable unbalance of 4 inch-pounds. This balance must be maintained if repairs become necessary or even if the surfaces are repainted.

4-12. INSTALLING AND REMOVING AILERONS. (See figure 4-4.)

4-13. EMPENNAGE.

4-14. The empennage is an all-metal structure consisting of horizontal stabilizer with elevators, and vertical stabilizer with rudder. (See figures 4-5 and 4-6.)

4-15. HORIZONTAL STABILIZER.

4-16. The horizontal stabilizer is of the full-cantilever type, and is set on the airplane at a negative 3-degree angle of incidence. Removable tips are made from deep-drawn 52SO, and are attached with screws. Elevator hinge brackets with staked ball bearings are installed on the spar.

4-17. INSTALLING AND REMOVING HORIZONTAL STABILIZER. (See figure 4-7.)

4-18. ELEVATORS.

4-19. The elevators are interchangeable. Each is built around a frame consisting of two spars and three ribs. Adjustable metal trim tabs are installed between the inboard and center ribs. Torque tube cups

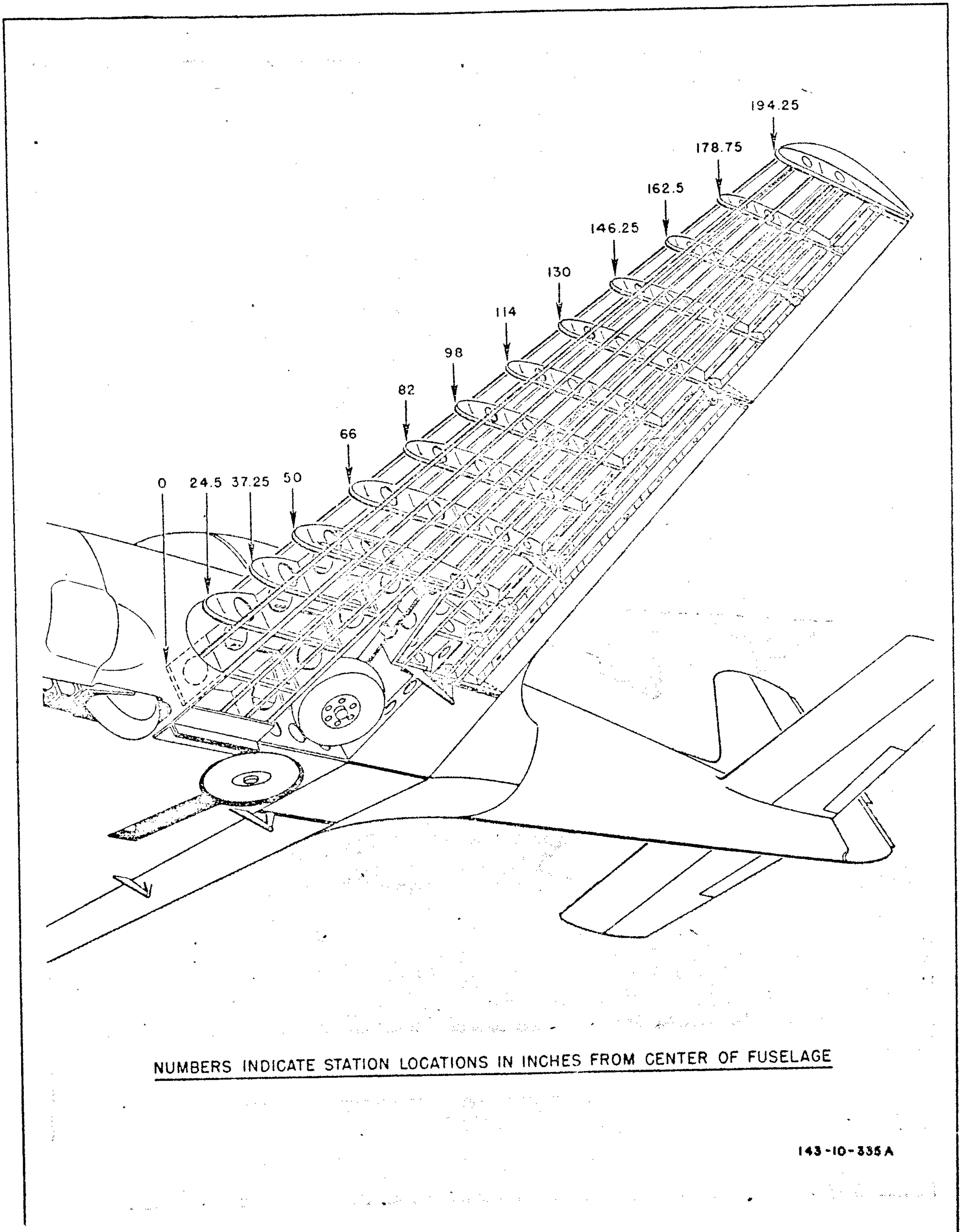


Figure 4-1. Wing Panel Structure

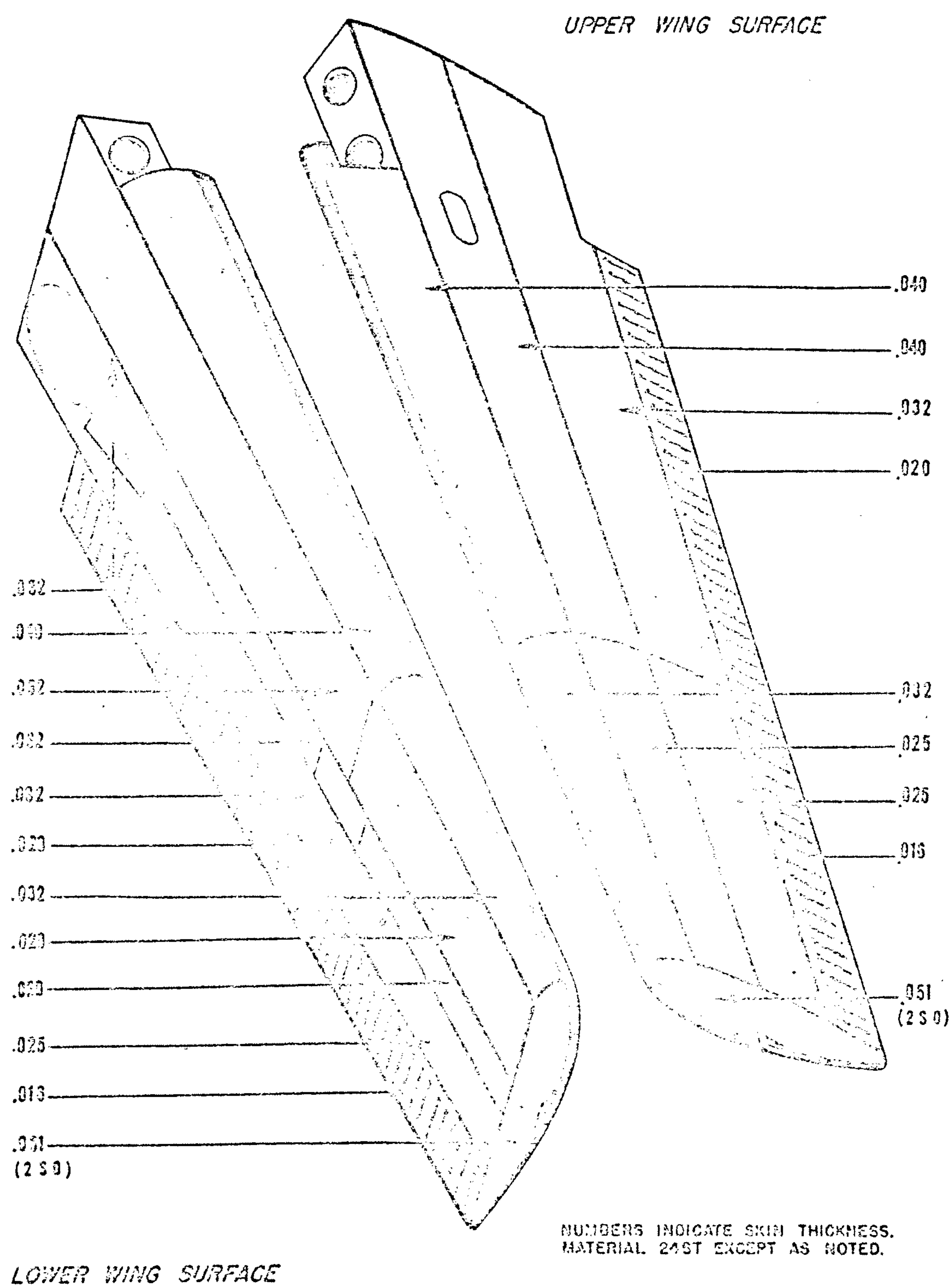
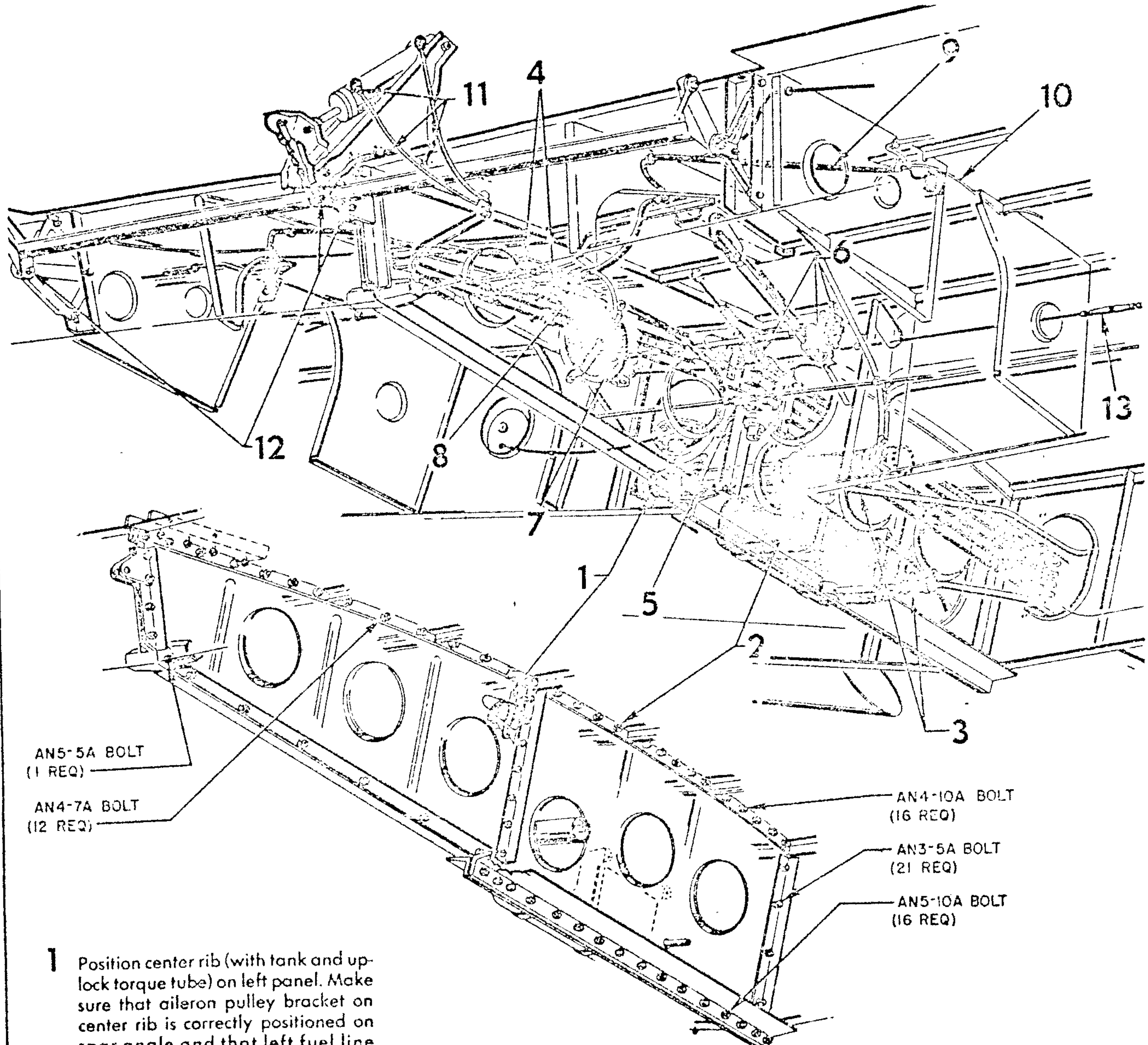


Figure 4-2. Wing Skin Arrangement



1 Position center rib (with tank and up-lock torque tube) on left panel. Make sure that aileron pulley bracket on center rib is correctly positioned on spar angle and that left fuel line mates with accumulator tank inlet.

2 Position right wing panel; connect right fuel tank supply line, and install all attaching angle bolts.

3 Connect fuel supply and vapor return lines to accumulator tank.

4 Connect landing gear hydraulic lines, and secure to rib. Also secure flap hydraulic lines to rib.

5 Connect brake line, and attach adjuster valve to rib.

6 Position up-lock torque tube in supports, install cotter pins at each end, and connect up-lock cable, links, and springs.

7 Connect wires to landing gear warning horn.

8 Connect right wing tip light wire.

9 Connect landing gear warning system wires at disconnect fittings and inboard switch.

10 Route landing light wire to disconnect at gear.

11 Install flap actuating cylinder and bracket on wing, and connect hydraulic lines.

12 Install flap torque tube, and connect link to operating arm.

13 Route left aileron cable through pulley on center rib, and connect to right-hand cable.

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Figure 4-3. Installing and Removing Wing Panels

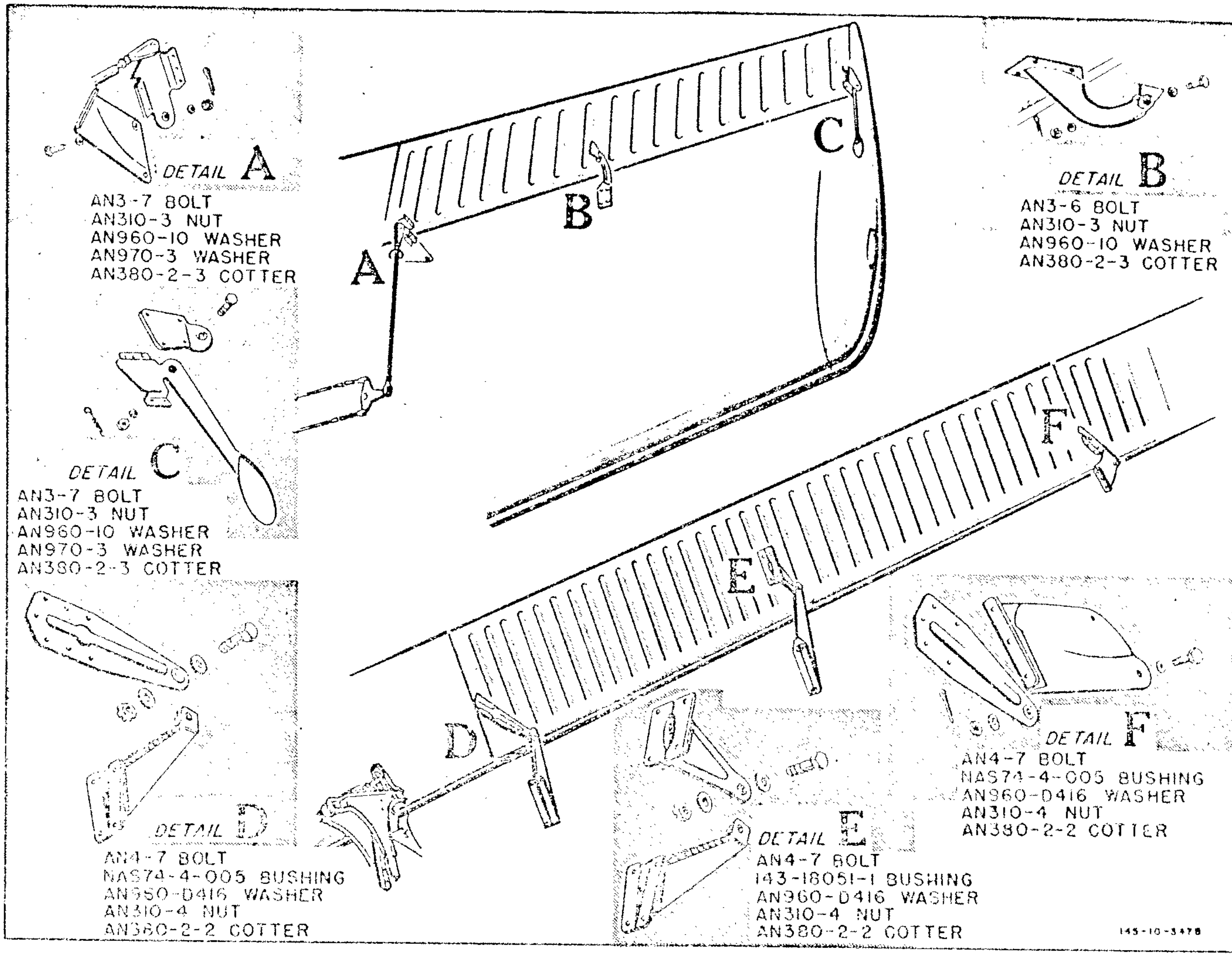


Figure 4-4. Installing and Removing Wing Flaps and Ailerons

riveted to each elevator are connected to an actuating horn at the airplane centerline. The skin arrangement differs from that of the ailerons and flaps in that a single bent sheet forms the trailing edge, and neither the upper nor the lower skin surfaces are beaded. Instead of the beading, bent-up angle stiffeners are riveted chordwise to both the upper and lower skins. Each elevator is hinged to the horizontal stabilizer at three points, the angular travel being 20 degrees down and 30 degrees up from neutral. Operation of elevators is afforded by a torque tube, on the inboard end of each elevator, joined by a horn assembly connecting to the control cables. Partial dynamic and static balance of each elevator is provided, the maximum allowable unbalance being 25 inch-pounds for each elevator.

4-20. INSTALLING AND REMOVING ELEVATORS. (See figure 4-7.)

4-21. VERTICAL STABILIZER.

4-22. The all-metal vertical stabilizer is bolted to the fuselage tail section at an angle 2 degrees to the left of the airplane centerline. Detachable dorsal fin sections extend from the leading edge of the stabilizer to the fin section riveted to the fuselage skin. Two rudder hinge brackets with staked-in ball bearings, are secured to the spar.

4-23. INSTALLING AND REMOVING VERTICAL STABILIZER. (See figure 4-8.)

4-24. RUDDER.

4-25. The rudder assembly is similar to the elevators in construction. At the bottom of the rudder is a removable boot in which the taillight is installed. The rudder horn hinge point is provided with a staked-in ball bearing. A fixed trim tab is riveted to the trailing edge aft of the center hinge. Hinged to the vertical stabilizer at three points, the rudder has an angular travel of 20 degrees either side of neutral. The arm assembly at the lower hinge point affords connections for control cables. The rudder is not statically

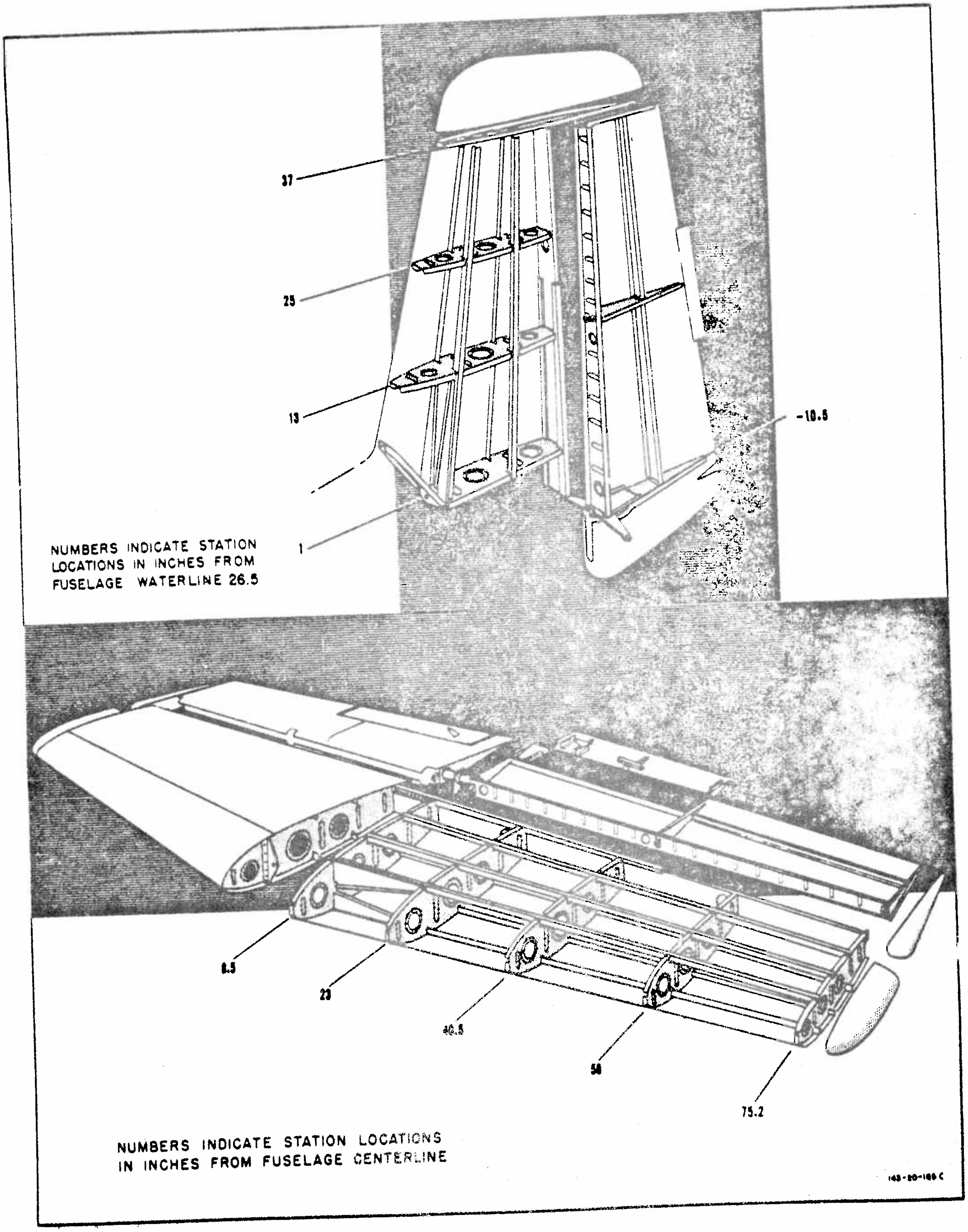


Figure 4-5. Empennage Structure

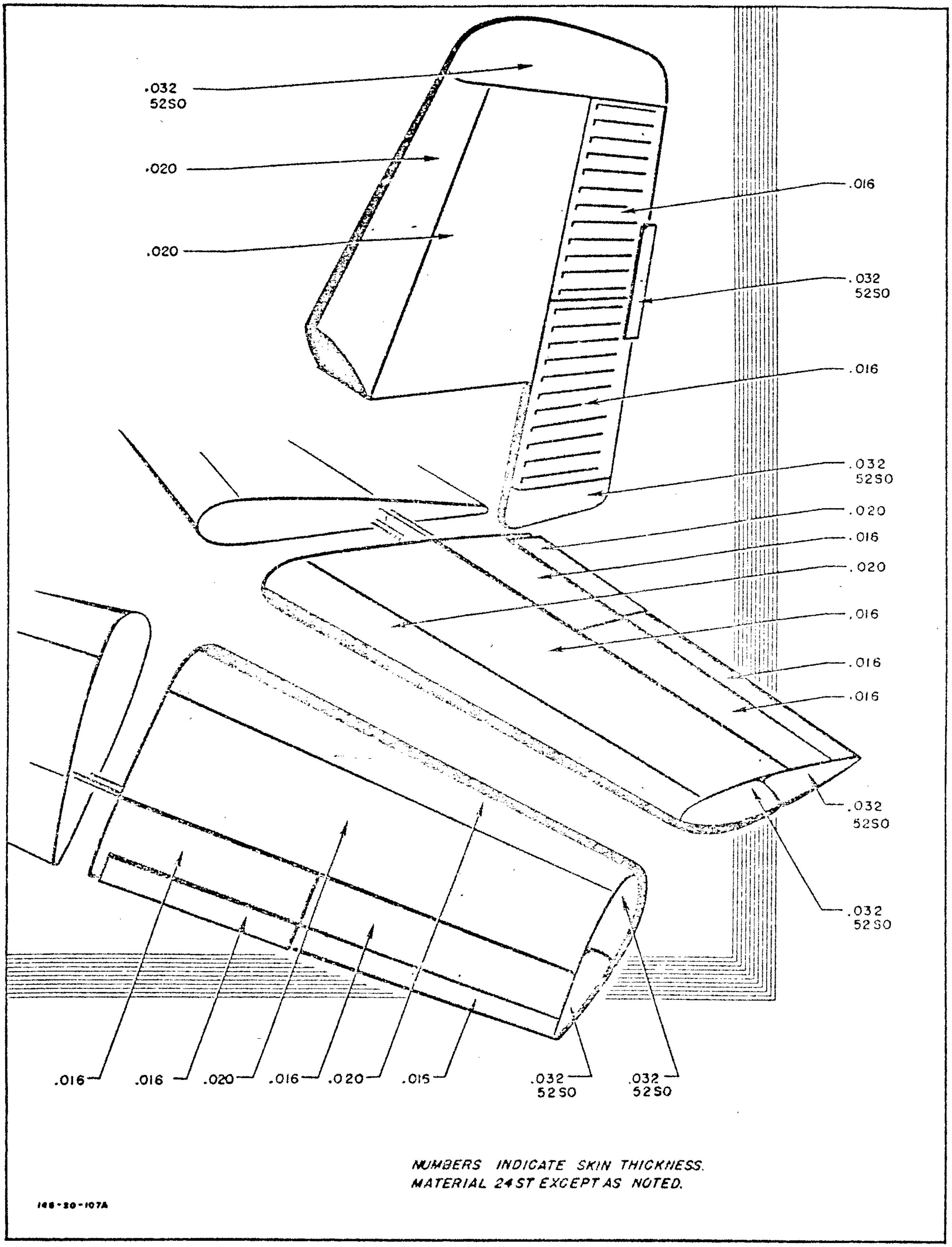


Figure 4-6. Empennage Skin Arrangement

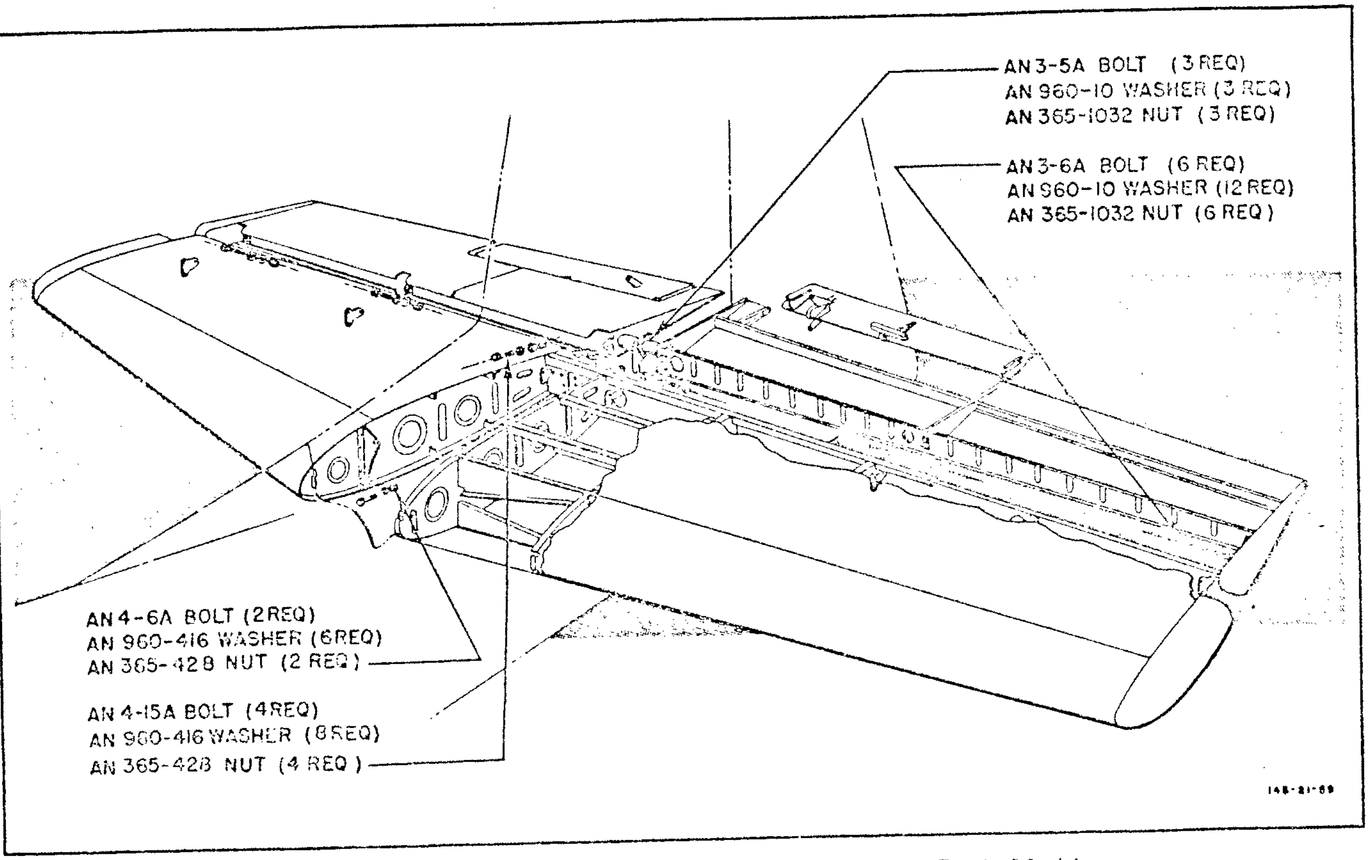


Figure 4-7. Horizontal Stabilizer and Elevator Installation

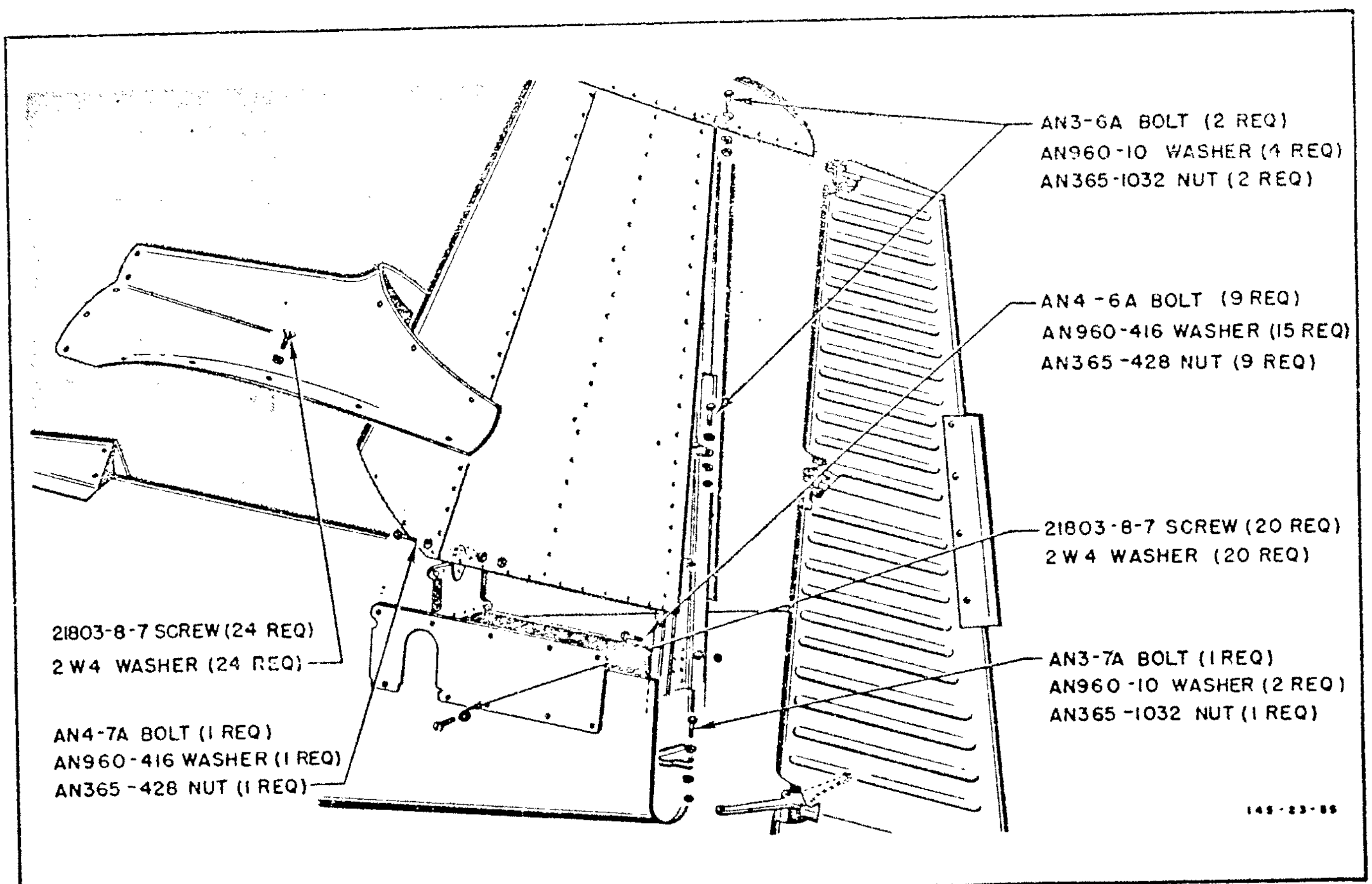


Figure 4-8. Vertical Stabilizer and Rudder Installation

balanced; however, in the event of repair, the static unbalance must not exceed 47 inch-pounds.

4-26. INSTALLING AND REMOVING RUDDER. (See figure 4-8.)

4-27. SURFACE CONTROLS.

4-28. The conventional flight control systems consist of two sets of rudder pedals, two wheels for elevator and aileron control, and cables and linkage connected to the respective control surfaces. (See figures 4-10 through 4-14.) Trim tabs, controllable from the cabin, are installed on each elevator. The aileron and rudder systems are interconnected by a coordinating cable and spring mechanism which is a safety feature designed to impart a feeling of lateral stability in the airplane during certain maneuvers.

4-29. CONTROL COLUMN.

4-30. The control column, to which the control wheel shafts (through universal joints) are attached, pivots at the base to permit fore and aft movement. Sprockets on the forward end of each control wheel shaft are interconnected by a chain, the ends of which attach to cables routed through pulleys at the top and bottom of the column. The control wheel and shaft on either side can be removed when only one set of controls is desired. (See figure 4-9.)

4-31. RUDDER PEDAL ASSEMBLIES.

4-32. The rudder pedal assemblies, consisting of two left pedals connected by a torque tube, and two right pedals also connected by a torque tube, are hinged to the floor. (See figure 4-11.) The rudder pedals on either side can be removed when only one set of controls is desired. (See figure 4-9.)

4-33. AILERON CONTROL SYSTEM.

4-34. The ailerons are controlled by a combination linkage and cable system. (See figure 4-10.) Disconnect fittings are located within the control cable guard box on the pilot's floor, and turnbuckles are located at each bellcrank. A balance cable interconnects the bellcrank in each wing, and has a turnbuckle located in the right wheel well. Adjustable rods connect the bellcranks to the ailerons. (See figure 4-10.)

4-35. INSTALLING AND REMOVING AILERON CONTROL SYSTEM. For information pertinent to installing and removing aileron control system, see figure 4-10.

4-36. ADJUSTING AILERON CONTROL SYSTEM. (See figure 4-10.)

4-37. RUDDER CONTROL SYSTEM.

4-38. The rudder control system consists of two cable assemblies, connected to rudder

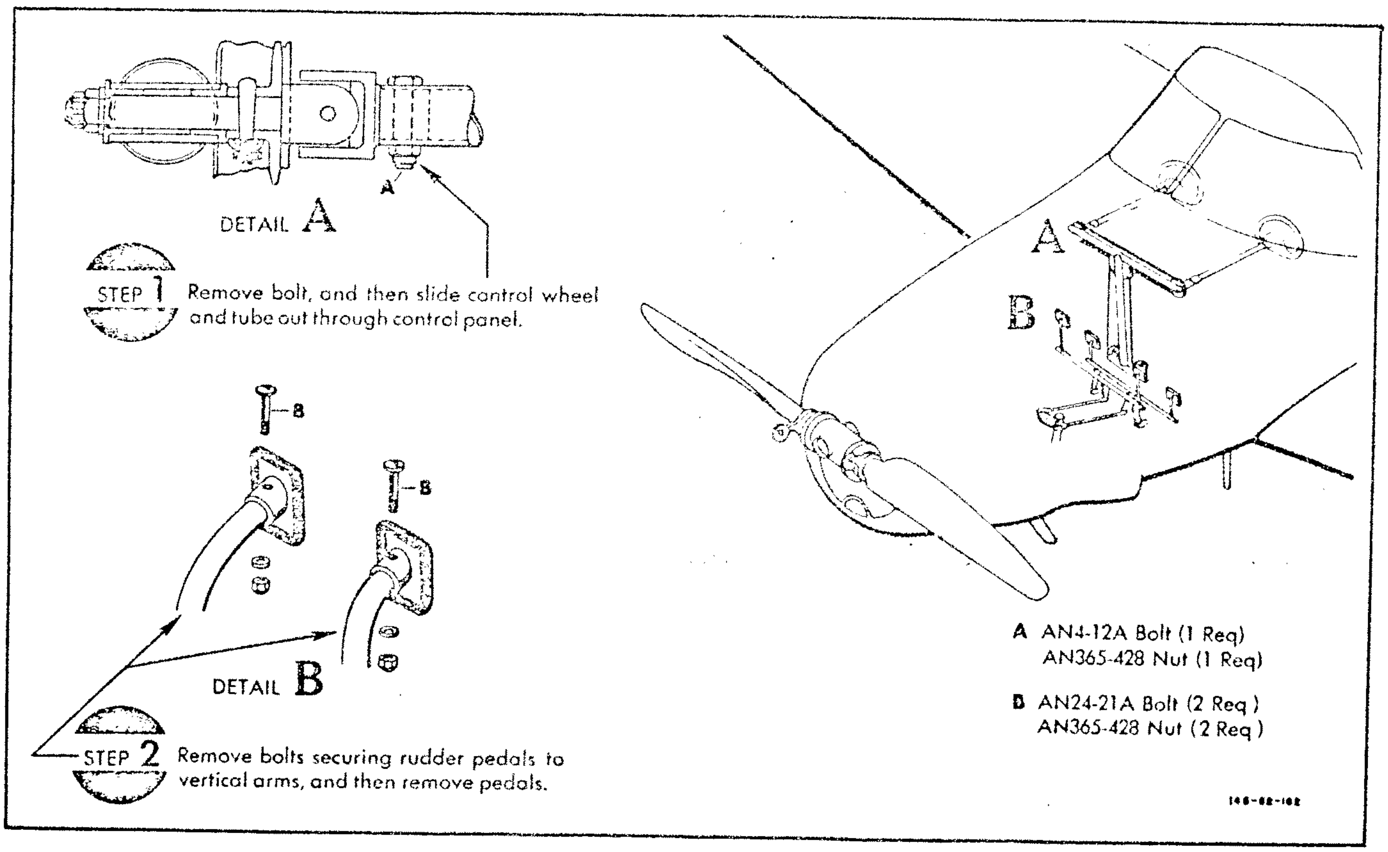


Figure 4-9. Removing One Set of Controls

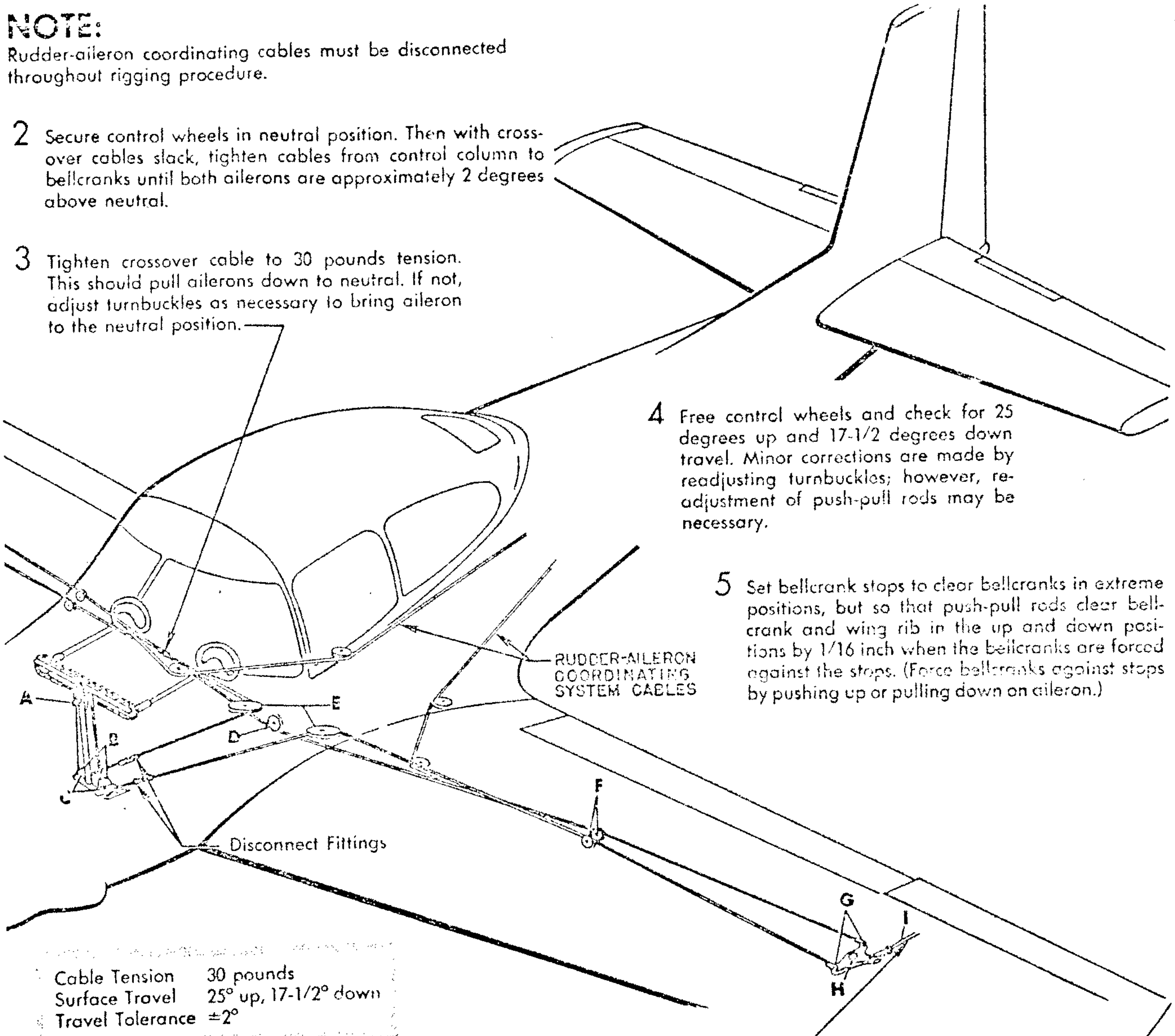
NOTE:
Rudder-aileron coordinating cables must be disconnected throughout rigging procedure.

2 Secure control wheels in neutral position. Then with crossover cables slack, tighten cables from control column to bellcranks until both ailerons are approximately 2 degrees above neutral.

3 Tighten crossover cable to 30 pounds tension. This should pull ailerons down to neutral. If not, adjust turnbuckles as necessary to bring aileron to the neutral position.

4 Free control wheels and check for 25 degrees up and 17-1/2 degrees down travel. Minor corrections are made by readjusting turnbuckles; however, readjustment of push-pull rods may be necessary.

5 Set bellcrank stops to clear bellcranks in extreme positions, but so that push-pull rods clear bellcrank and wing rib in the up and down positions by 1/16 inch when the bellcranks are forced against the stops. (Force bellcranks against stops by pushing up or pulling down on aileron.)



Cable Tension	30 pounds
Surface Travel	25° up, 17-1/2° down
Travel Tolerance	±2°

1 With related aileron 25 degrees up, adjust push-pull rods on each side so that aft cable attachment bellcrank arm clears push-pull rod by 1/8 inch.

A AN210-4A Pulley (2 Req)
AN4-34 Bolt (1 Req)
AN310-4 Nut (1 Req)
AN380-2-3 Cotter (1 Req)

B AN210-4A Pulley (2 Req)
AN4-7 Bolt (2 Req)
AN310-4 Nut (2 Req)
AN380-2-3 Cotter (2 Req)

C AN3-6 Bolt (2 Req)
AN310-3 Nut (2 Req)
AN380-2-3 Cotter (2 Req)

D AN210-3A-4DR7-3/4 Pulley (1 Req)
AN4-10 Bolt (1 Req)
AN310-4 Nut (1 Req)
AN380-2-2 Cotter (1 Req)

E AN210-4A-4DR7-3/4 Pulley (2 Req)
AN4-10 Bolt (2 Req)
AN310-4 Nut (2 Req)
AN380-2-2 Cotter (2 Req)

F AN3-14 Bolt (4 Req)
AN310-3 Nut (4 Req)
AN960-10L Washer (4 Req)
AN380-2-2 Cotter (4 Req)
4S3-10-19 Spacer (4 Req)
145-52301 Roller (4 Req)

G AN23-12 Bolt (4 Req)
AN310-3 Nut (4 Req)
AN960-10L Washer (4 Req)
AN380-2-2 Cotter (4 Req)

H AN4-9 Bolt (2 Req)
AN310-3 Nut (2 Req)
AN380-C2-3 Cotter (2 Req)

I AN4-12 Bolt (4 Req)
AN310-4 Nut (4 Req)
AN960-416 Washer (4 Req)
AN380-2-2 Cotter (4 Req)

6 Check entire system for 30 pounds tension.

NOTE:
Check alignment of flap and aileron trailing edges. If trailing edges are over 1/4 inch out of alignment, adjust aileron and flap rigging equally to align edges within the 1/4-inch tolerance.

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Figure 4-10. Adjusting Aileron Control System

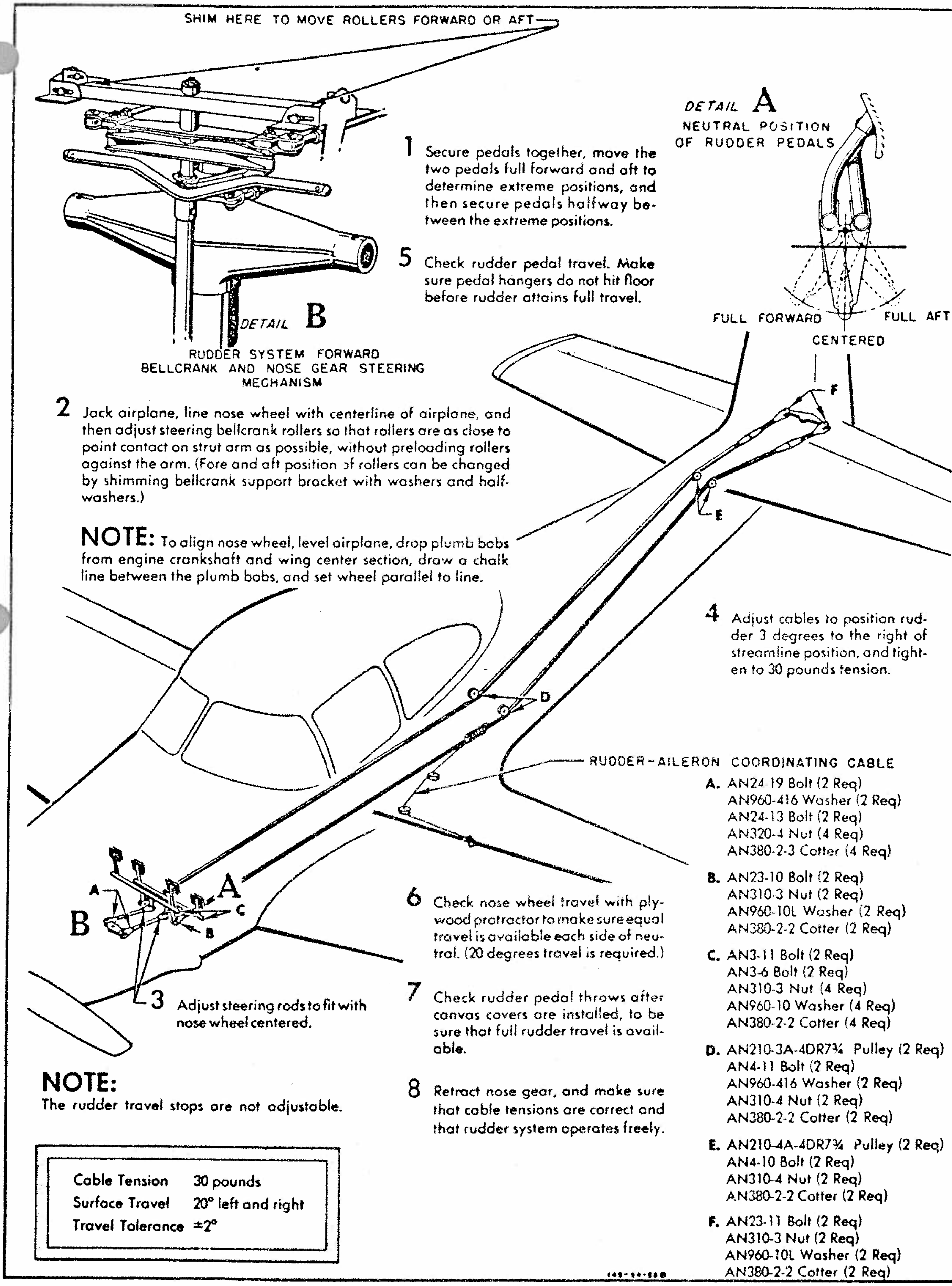
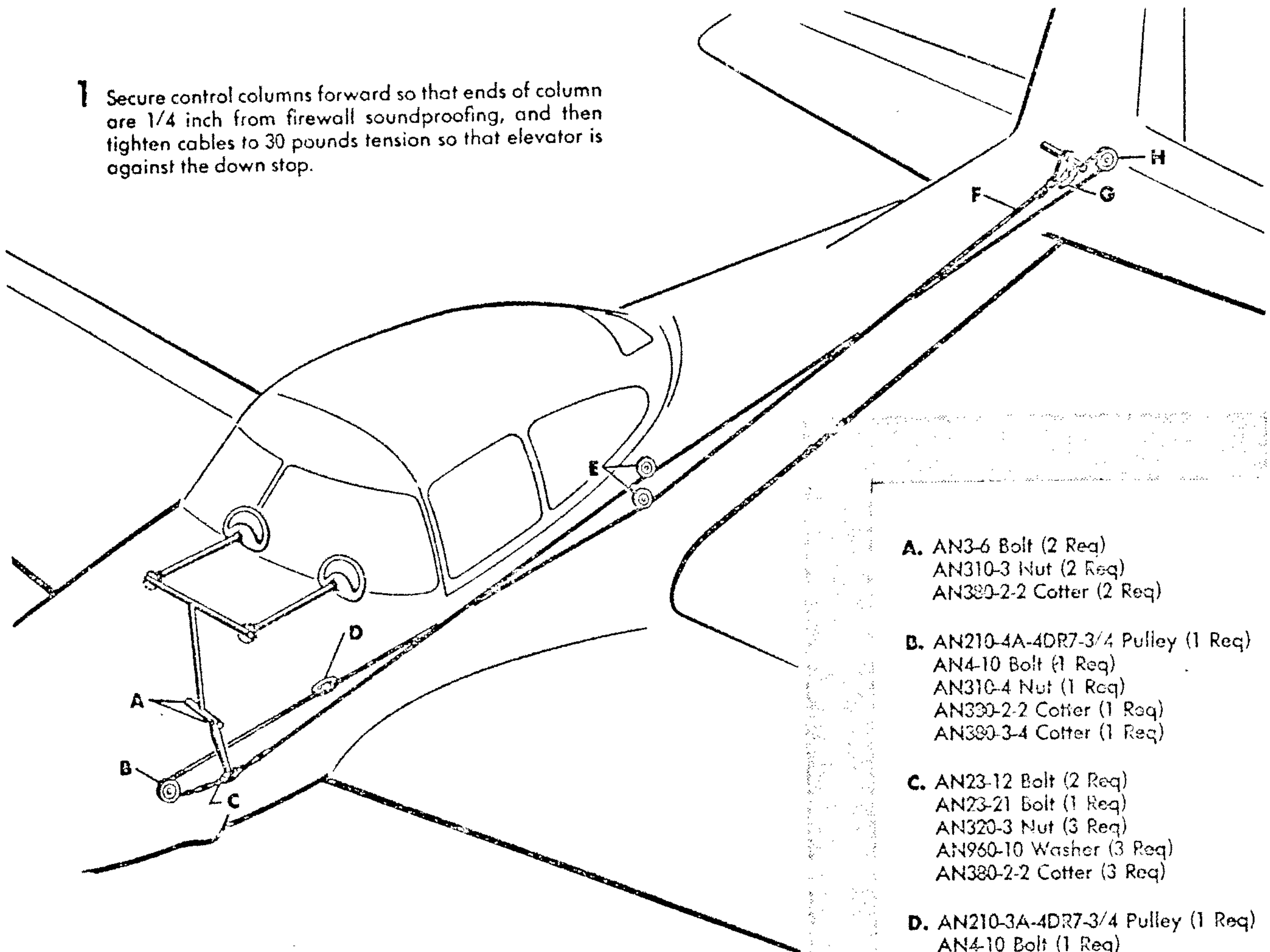


Figure 4-11. Adjusting Rudder Control System

1 Secure control columns forward so that ends of column are 1/4 inch from firewall soundproofing, and then tighten cables to 30 pounds tension so that elevator is against the down stop.



2 Pull control columns aft until elevator hits the up stop; then pull control wheels 3 degrees (roughly one inch travel) further aft to check control column assembly clearance. This overtravel clearance guarantees there will be no interference under flying conditions where the cables are slack (i.e., extreme cold, etc). If necessary, loosen cables to make this check, and then adjust cables as instructed in step 1.

NOTE: The elevator travel stops are not adjustable.

Cable Tension	30 pounds
Surface Travel	30° (+ 2°/-0°) up 20° (± 2°) down

A. AN3-6 Bolt (2 Req)
AN310-3 Nut (2 Req)
AN380-2-2 Cotter (2 Req)

B. AN210-4A-4DR7-3/4 Pulley (1 Req)
AN4-10 Bolt (1 Req)
AN310-4 Nut (1 Req)
AN380-2-2 Cotter (1 Req)
AN380-3-4 Cotter (1 Req)

C. AN23-12 Bolt (2 Req)
AN23-21 Bolt (1 Req)
AN320-3 Nut (3 Req)
AN960-10 Washer (3 Req)
AN380-2-2 Cotter (3 Req)

D. AN210-3A-4DR7-3/4 Pulley (1 Req)
AN4-10 Bolt (1 Req)
AN310-4 Nut (1 Req)
AN380-2-2 Cotter (1 Req)

E. AN210-3A-4DR7-3/4 Pulley (2 Req)
AN4-11 Bolt (2 Req)
AN310-4 Nut (2 Req)
AN960-416 Washer (2 Req)
AN380-2-2 Cotter (2 Req)

F. AN515-8R16 Screw (2 Req)
AN365-832 Nut (2 Req)
AN960-8L Washer (4 Req)

G. AN23-15 Bolt (1 Req)
AN310-3 Nut (1 Req)
AN960-10L Washer (1 Req)
AN380-2-2 Cotter (1 Req)
145-52214 Spacer (1 Req)

H. AN210-4A-4DR7-3/4 Pulley (1 Req)
AN4-10 Bolt (1 Req)
AN310-4 Nut (1 Req)
AN380-2-2 Cotter (1 Req)

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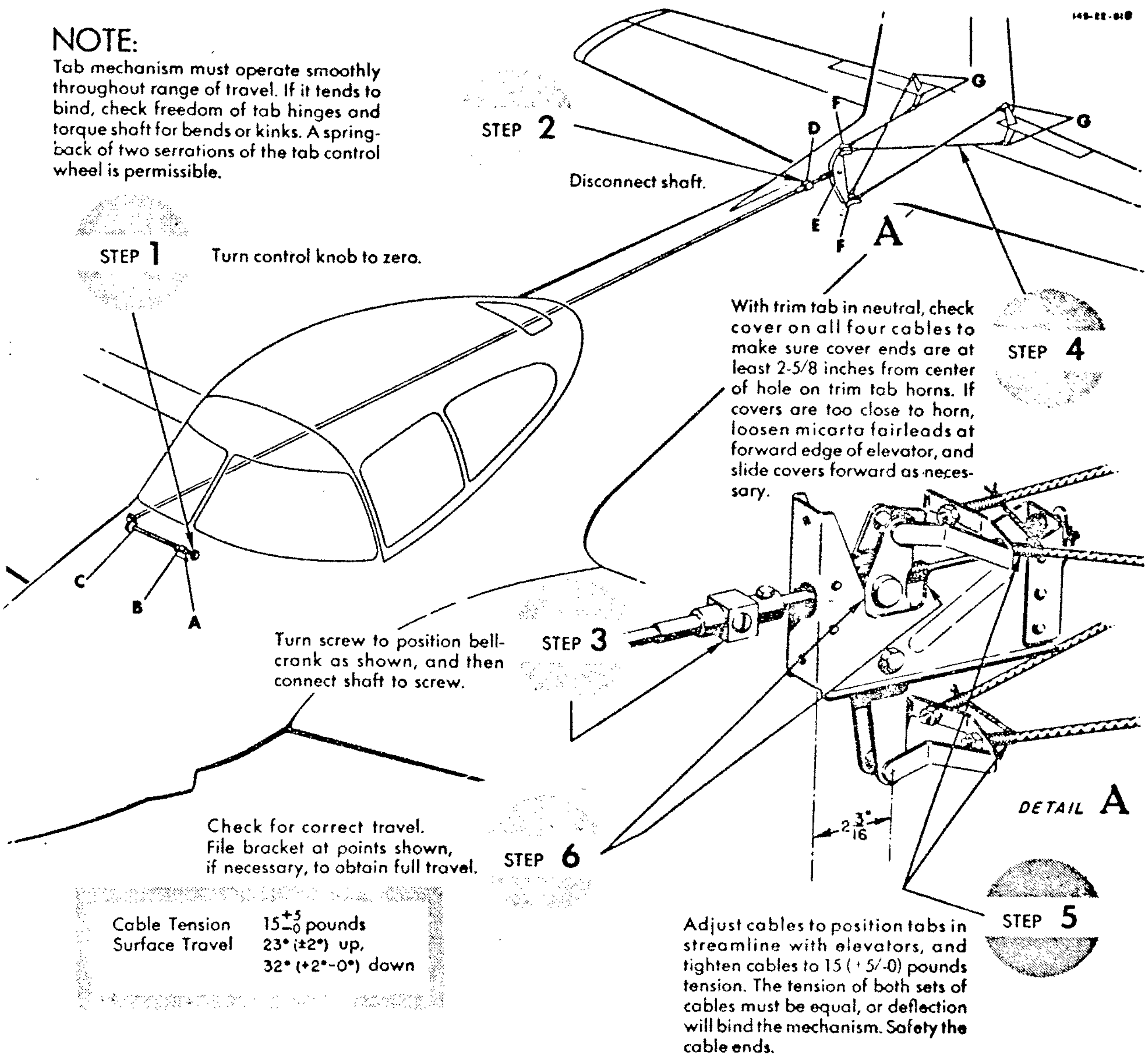
Figure 4-12. Adjusting Elevator Control System



A. 7S1B-10-7 Screw (2 Req)
AN365-1032 Nut (2 Req)

B. AN392-13 Pin (1 Req)
AN380-2-2 Cotter (1 Req)

C. 7S1-10-7 Screw (3 Req)
AN365-1032 Nut (3 Req)

D. AN3-7 Bolt (1 Req)
AN365-1032 Nut (1 Req)

E. AN4-16 Bolt (1 Req)
AN310-4 Nut (1 Req)
4S4-4-30 Spacer (1 Req)
AN960-416 Washer (1 Req)
AN393-35 Pin (2 Req)
4S3-4-30 Spacer (1 Req)
AN380-2-2 Cotter (3 Req)

F. AN23-16 Bolt (2 Req)
AN310-3 Nut (2 Req)
AN960-10 Washer (2 Req)
AN380-2-2 Cotter (2 Req)

G. AN23-9 Bolt (4 Req)
AN310-3 Nut (4 Req)
AN960-8 Washer (4 Req)
AN380-2-2 Cotter (4 Req)

Figure 4-13. Adjusting Elevator Trim Tab Control System

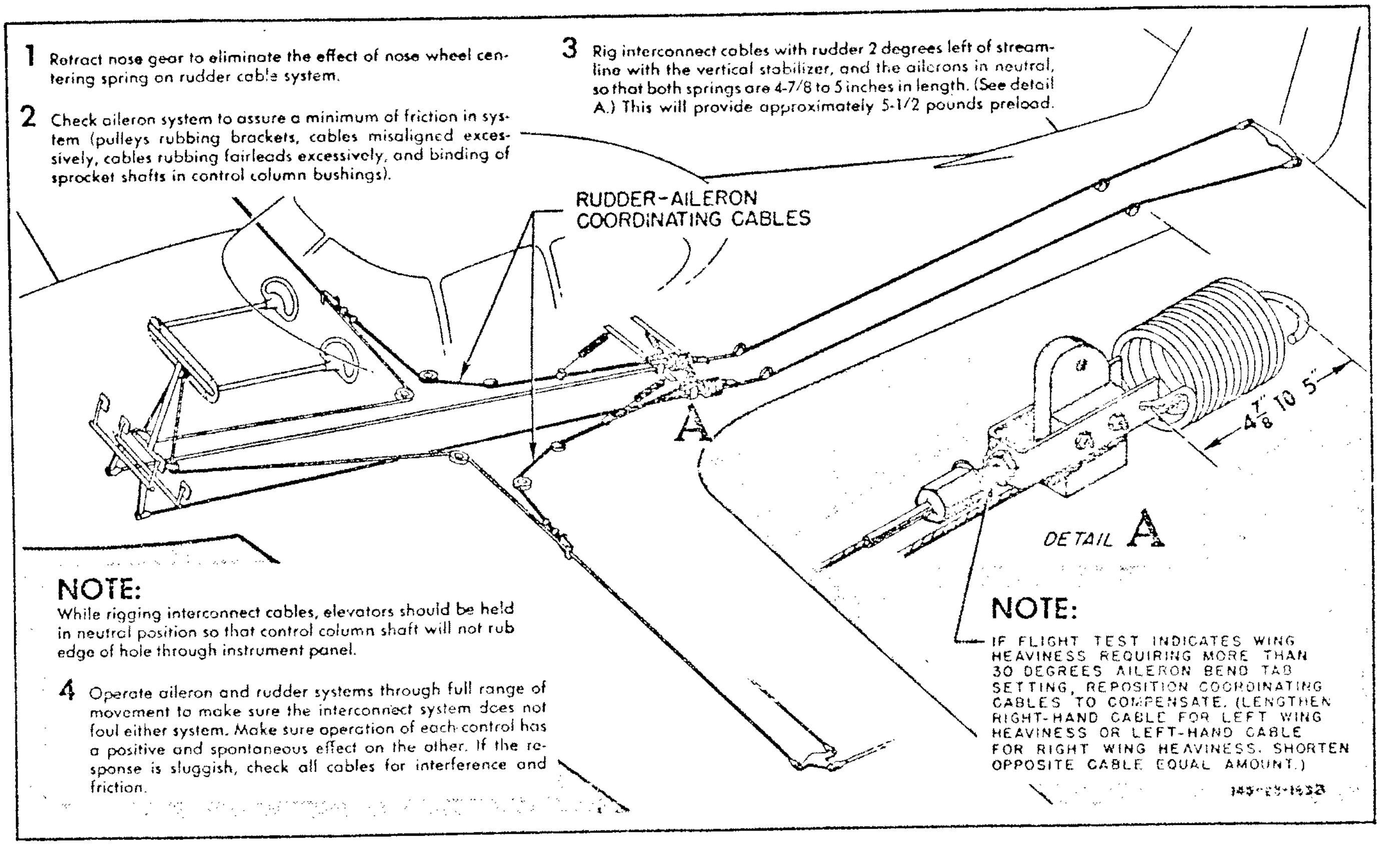


Figure 4-14. Adjusting Rudder-Aileron Coordinating System

pedal torque tube arms, and running aft to the rudder horns. Two rods, extending forward from the pedals to the bellcrank for nose wheel steering, serve as a balance cable for the system. (See figure 4-11.)

4-39. INSTALLING AND REMOVING RUDDER CONTROL SYSTEM. For information pertinent to installing and removing rudder control system, see figure 4-11.

4-40. ADJUSTING RUDDER CONTROL SYSTEM. (See figure 4-11.)

4-41. RUDDER-AILERON COORDINATING SYSTEM.

4-42. The coordination system includes two cable and spring assemblies, interconnecting the rudder and aileron cables on each side of the airplane. (See figure 4-14.) At the rudder cable end of each coordinating cable is a large coiled spring, through which the rudder cable passes. A fairlead, secured to the coordinating cable and sliding over the rudder cable, prevents the spring from riding on the rudder cable. In addition to these springs, light tension springs on each side take up coordinating cable slack which exists under certain conditions. Steel balls, swaged onto the cables at fixed positions provide the interconnecting points, except at the aft end of the coordinating cables. There, threaded cable fittings connect to a clip engaging the large springs.

4-43. ADJUSTING RUDDER-AILERON COORDINATING SYSTEM. (See figure 4-14.)

4-44. ELEVATOR CONTROL SYSTEM.

4-45. The elevator control system consists of two cable assemblies, connecting the control column arm with the elevator horn. (See figure 4-12.)

4-46. INSTALLING AND REMOVING ELEVATOR CONTROL SYSTEM. For information pertinent to installing and removing elevator control system, see figure 4-12.

4-47. ADJUSTING ELEVATOR CONTROL SYSTEM. (See figure 4-12.)

4-48. ELEVATOR TRIM TAB CONTROL SYSTEM.

4-49. The elevator trim tab control system consists of a control wheel and indicator on the control panel, and a pair of bevel gears, which drive a torque shaft connected to a jackscrew bellcrank to which trim tab cables are attached. (See figure 4-13.)

4-50. INSTALLING AND REMOVING ELEVATOR TRIM TAB CONTROL SYSTEM. For information pertinent to installing and removing elevator trim tab control system, see figure 4-13.

4-51. ADJUSTING ELEVATOR TRIM TAB CONTROL SYSTEM. (See figure 4-13.)

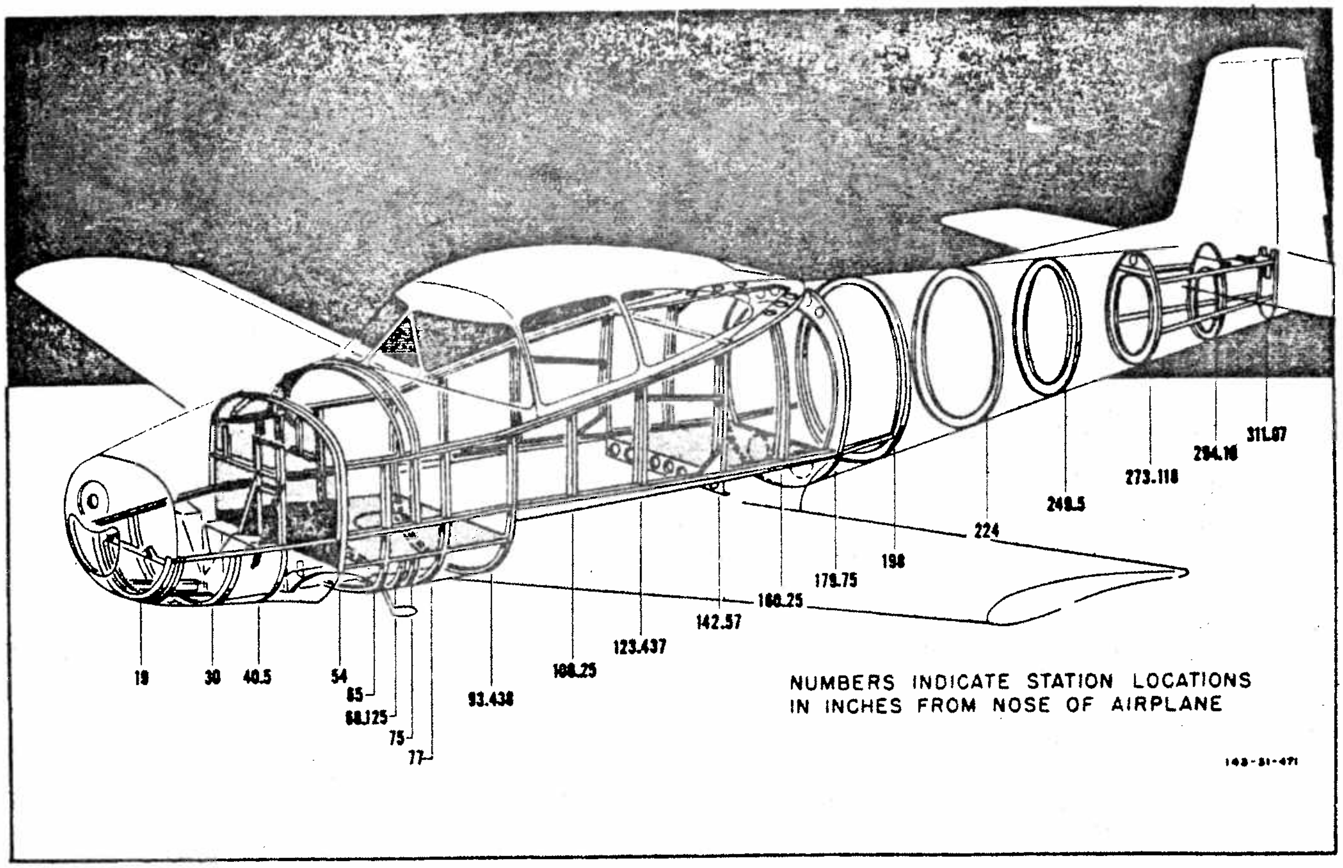


Figure 4-15. Fuselage Structure

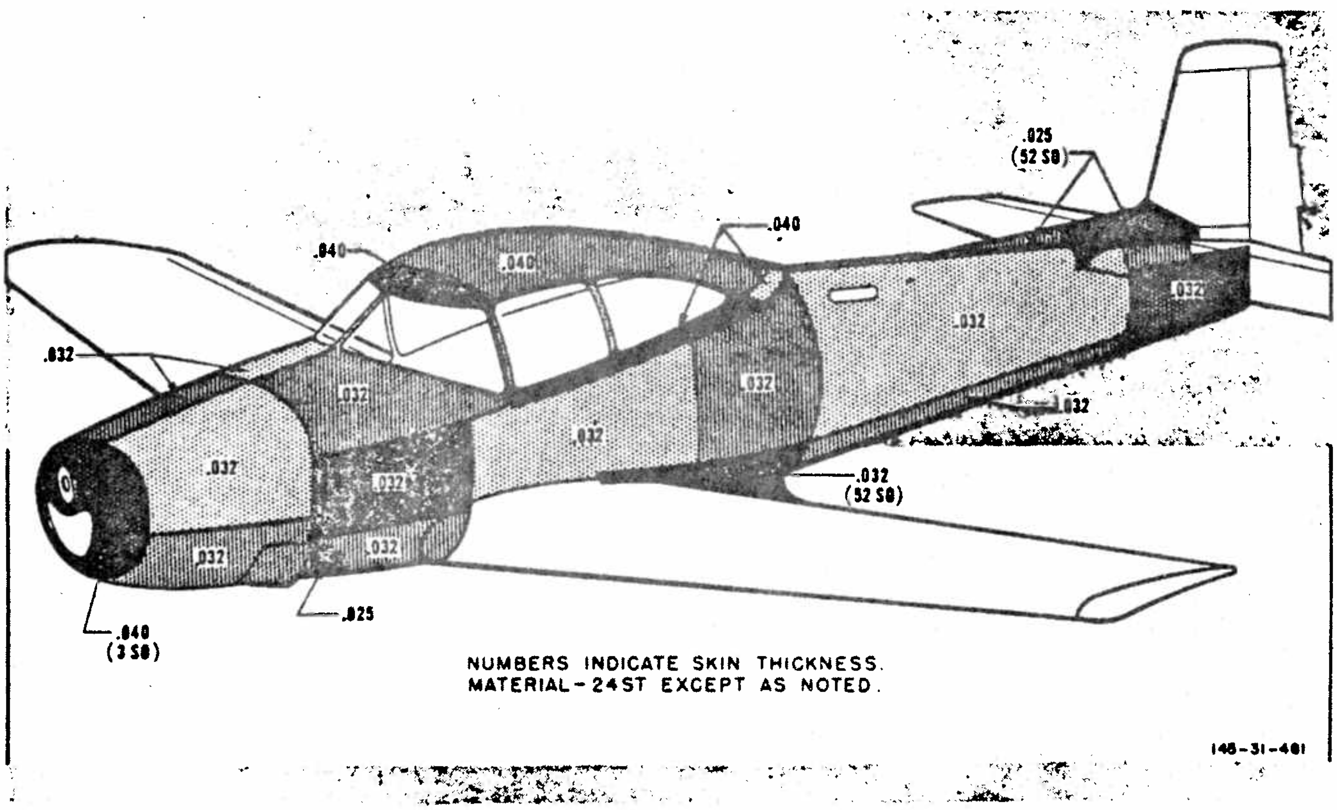


Figure 4-16. Fuselage Skin Arrangement

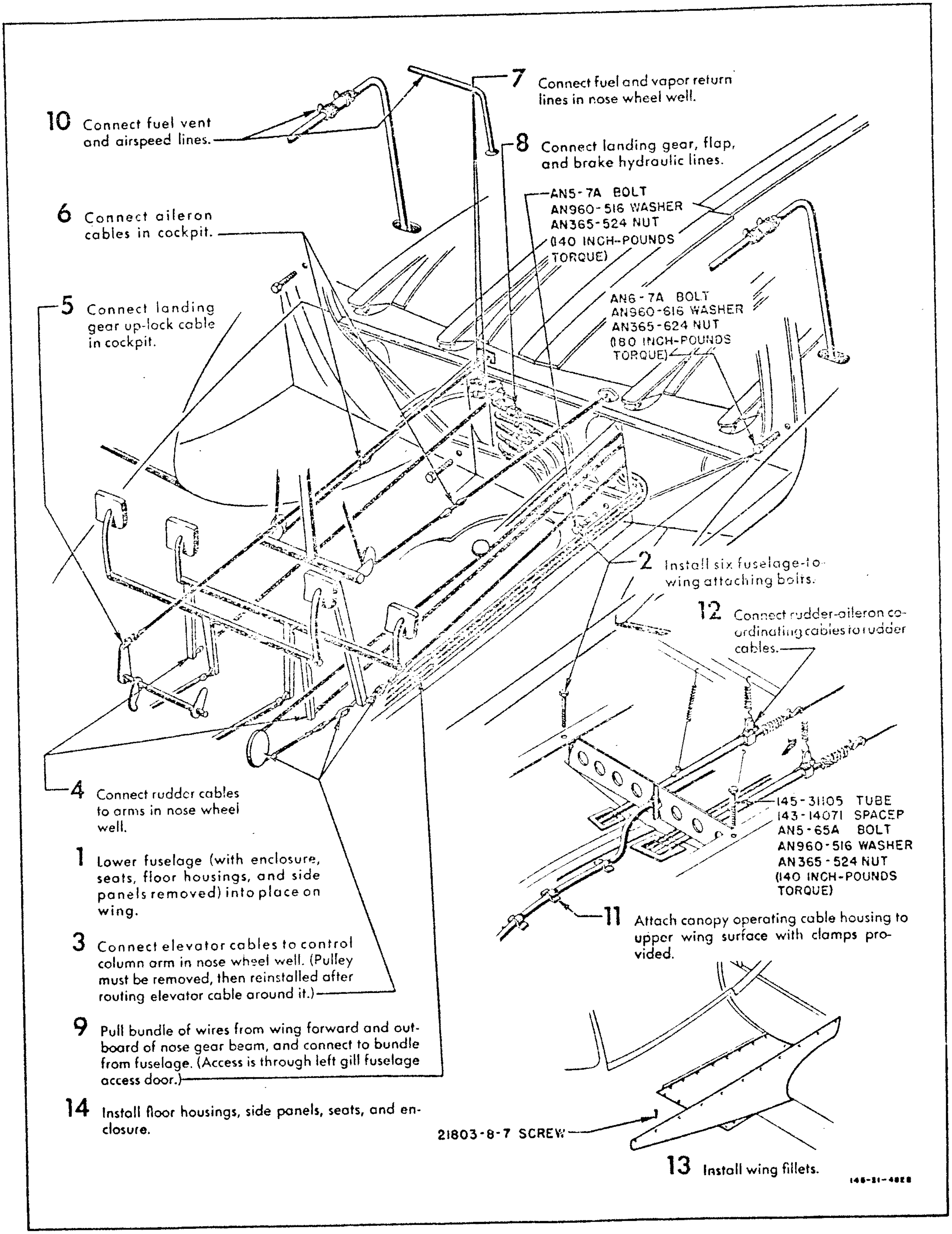


Figure 4-17. Fuselage Installation

4-52. FUSELAGE.

4-53. The fuselage is a semimonocoque, stressed-skin, metal structure consisting of two sections--main section (which includes the cabin enclosure), and engine mount section. (See figures 4-15 and 4-16.)

4-54. FUSELAGE MAIN SECTION.

4-55. The fore part of the main section is semimonocoque, consisting of four longerons, firewall, and formers covered by alclad sheet. Spanning the cabin, and just aft of the rear seat, is a tubular tie rod which is riveted to the upper longerons and restrains longeron kick loads. Two longitudinal beams, supported at the firewall and fuselage frame aft of the wing leading edge, accommodate the nose gear. The pilot's floor covers these two beams and consists of a single aluminum sheet riveted to the fuselage side panels and firewall. The baggage compartment floor is supported fore and aft by fuselage frames, and at the sides by the lower longerons. The control panel is formed from a single piece of alclad sheet, and is cut out for installation of the rubber-mounted instrument panel. From the aft end of the cabin to the tail, the fuselage is semimonocoque, and comprised of vertical bulkhead rings covered by three sheets of alclad. Each sheet of alclad is flanged inboard at one longitudinal joint to provide additional strength and rigidity. The forward section of a dorsal fin is riveted to the upper rear fuselage skin at an angle 2 degrees to the left of the fuselage centerline. A spring-leaf tail skid is mounted on the aft bottom end of the fuselage to protect the tail in the event of a tail-low landing.

4-56. INSTALLING AND REMOVING FUSELAGE. (See figure 4-17.)

4-57. CABIN ENCLOSURE.

4-58. The windshield consists of two pieces of formed plastic sheet installed in an alclad frame. The sliding canopy is constructed of formed aluminum sheet with plastic window panels. Two channel-shaped longerons extend the full length of the canopy. Attached to the longerons and spot-welded to the top are a bowed extruded angle and a hat section which maintain the contour. Two tracks attached to the rear of the canopy engage rollers on the fuselage. The front of the canopy has rollers on each side that engage tracks on the fuselage. A transverse web at the aft end of the canopy covers the baggage compartment, and is strengthened by beading. The windows are held in place by rubber extrusions. The canopy has a cylinder-type lock for use while airplane is on ground. A cable, running from the locking handle down the left side to a pin assembly, makes it possible to lock the canopy in several open positions. An opening mechanism makes it possible for the pilot to open the canopy to obtain clear vision during flight. (See figure 4-20.) The

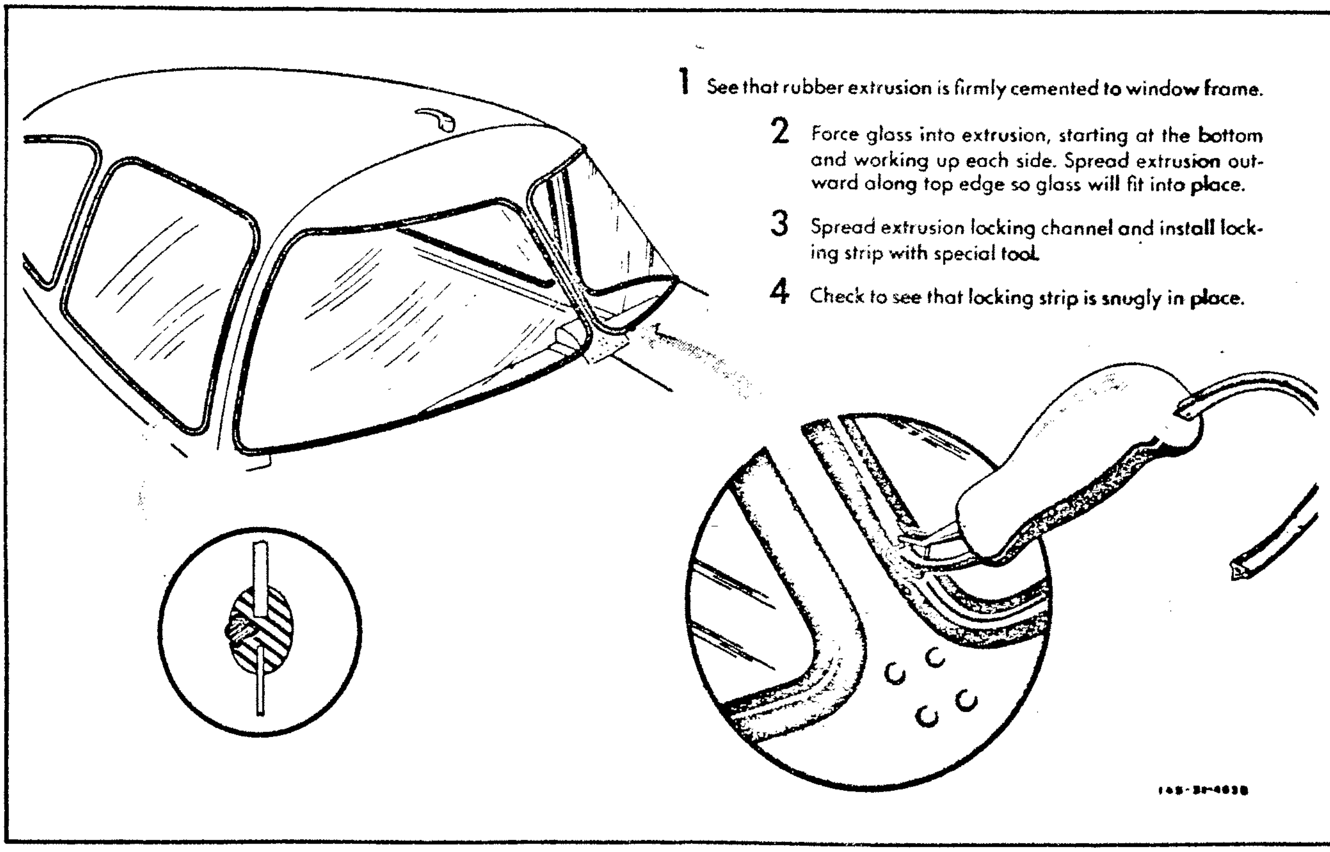


Figure 4-18. Installing and Removing Window Panels

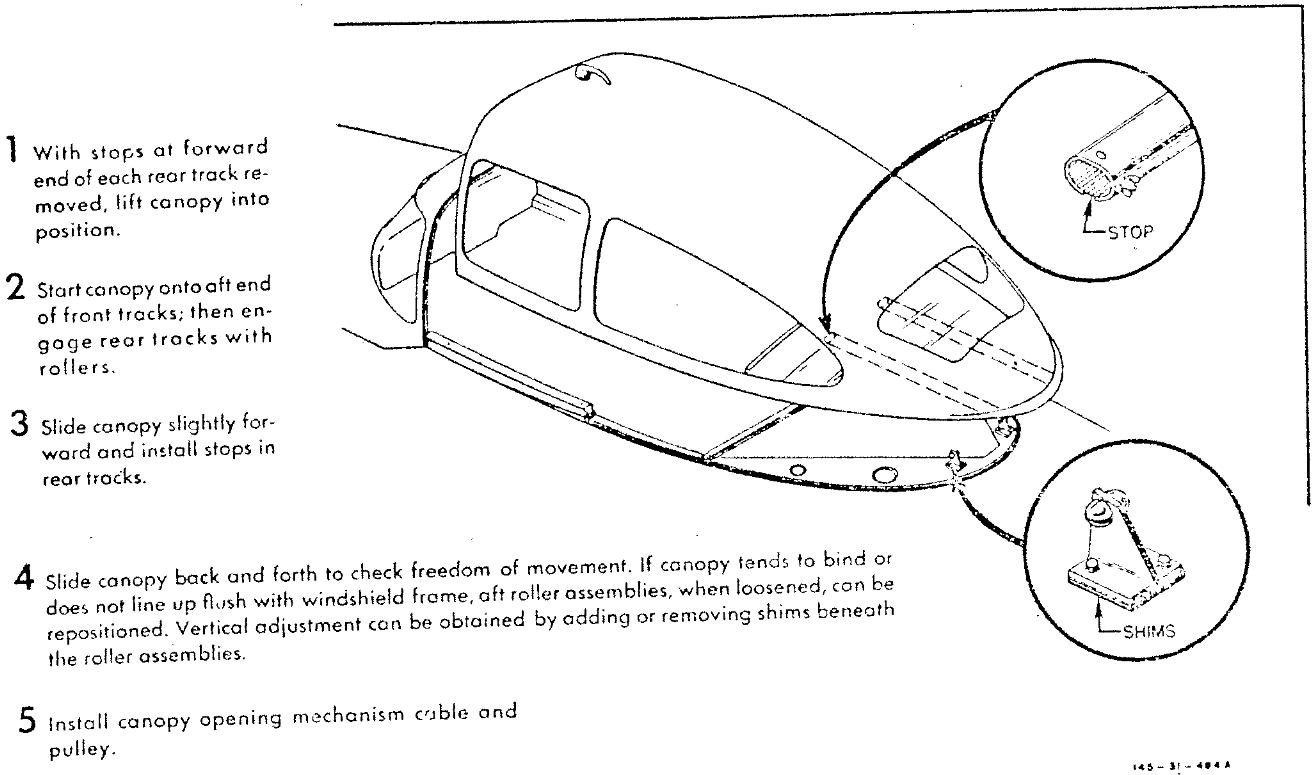


Figure 4-19. Installing and Removing Sliding Canopy

inside of the canopy is covered with upholstery, held in place with spring wires along the top, and cemented on the sides.

4-59. INSTALLING AND REMOVING WINDOW PANELS. (See figure 4-18.)

4-60. INSTALLING AND REMOVING SLIDING CANOPY. (See figure 4-19.)

4-61. CABIN FLOOR COVERS AND SIDE PANELS. The cabin floor, from the front seats forward, is covered with two strips of rubber mat which are cemented in place. The floor, from the front seats to the back seat, is covered with upholstered phenolic fiber panels which have snaps around the sides and bottom, and clip to the longerons at the top.

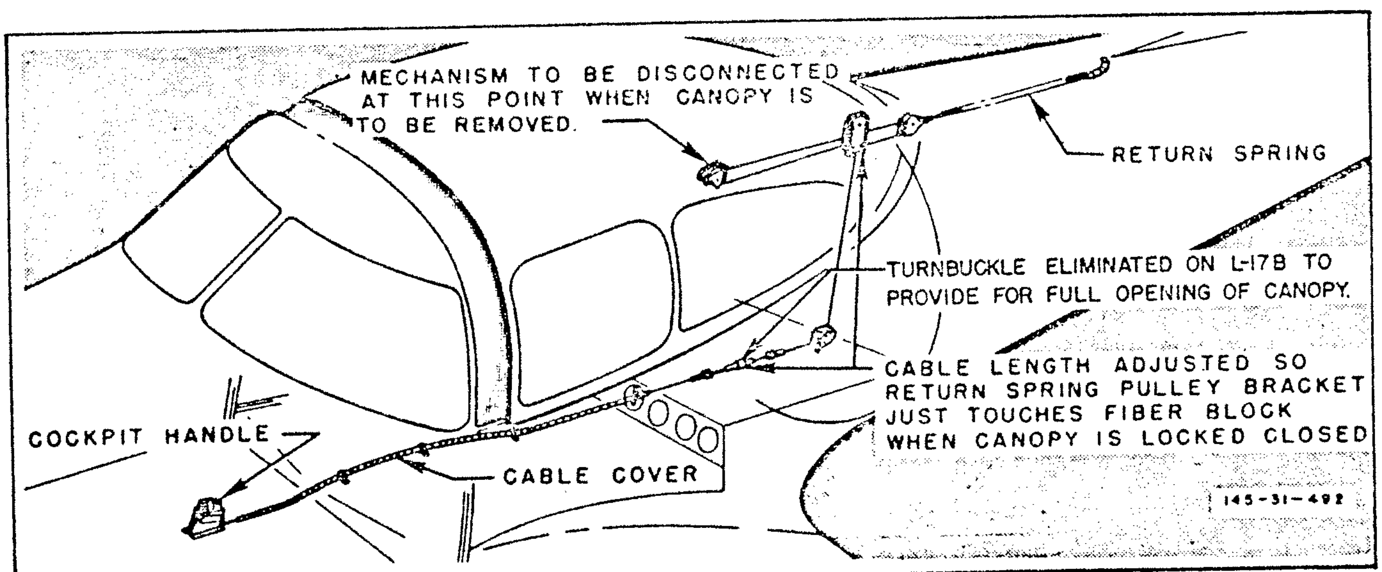


Figure 4-20. Canopy Opening Mechanism

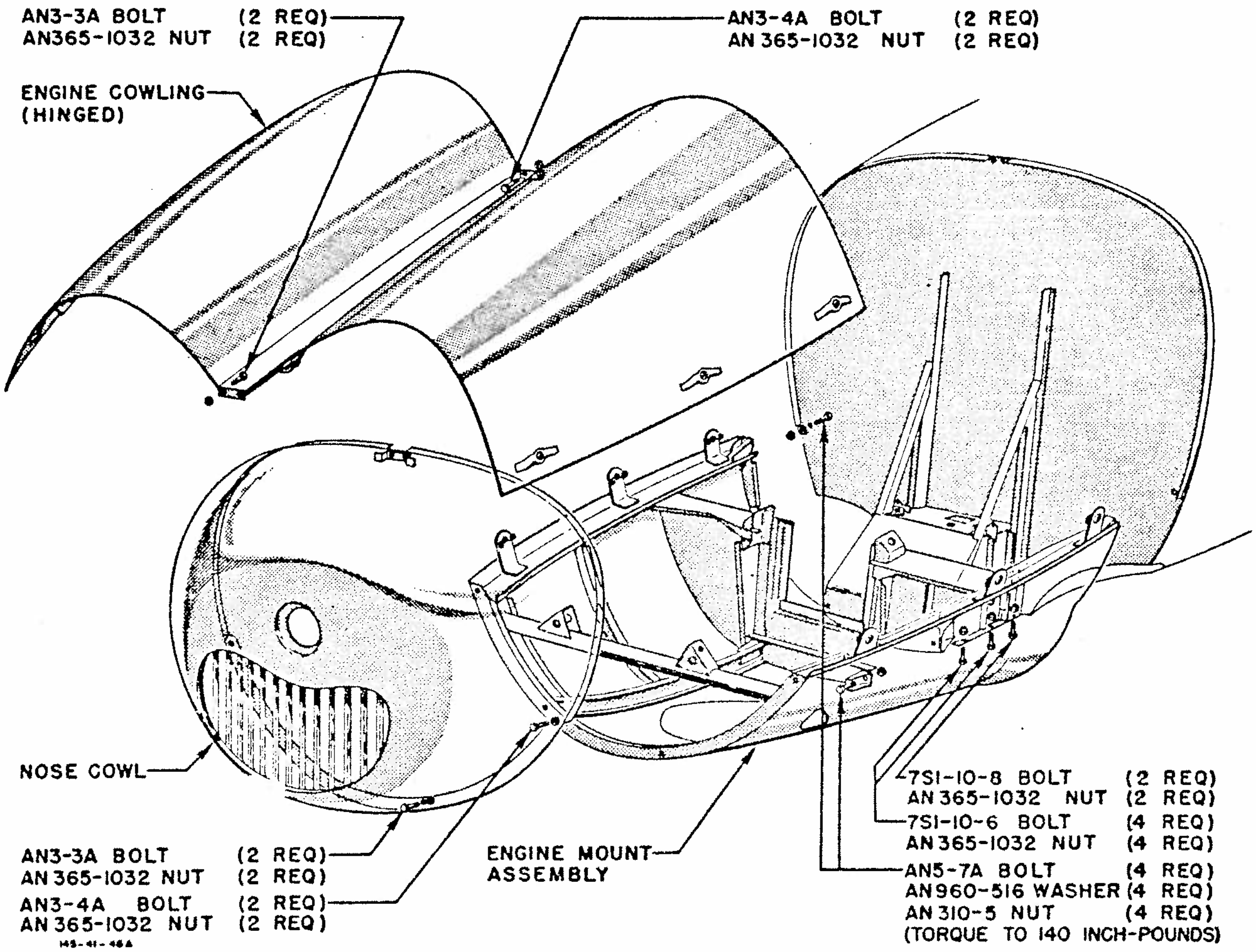


Figure 4-21. Engine Mount and Cowling Installation

4-62. ENGINE MOUNT SECTION.

4-63. The engine mount, semimonocoque in construction, is removable from the fuselage and consists of two longerons, frames, a bulkhead, a steel cross-tube, and alclad sheet covering. The engine is rubber-mounted on four fittings, two on the cross tube and two on the bulkhead. The mount is secured to the main fuselage section at the firewall and forward end of the nose wheel beams. The engine nose cowl, bolted to the engine mount, is supported at the top by a channel member extending from the firewall forward. The channel also provides attachment points for the hinged cowling, which is secured by dzus-type fasteners at the engine mount longerons. The hinged cowl covers the top of the engine. A grill is fitted into the air intake cutout of the nose cowl.

4-64. INSTALLING AND REMOVING ENGINE MOUNT AND COWLING. (See figure 4-21.)

4-65. <u>LANDING GEAR</u>.

4-66. The airplane is equipped with a hydraulically retractable, tricycle landing gear, consisting of two main gear assemblies, a nose gear assembly, wheels and tires for each gear, and up-locks with normal and emergency control linkage.

4-67. TROUBLE SHOOTING LANDING GEAR.

TROUBLE	PROBABLE CAUSE	REMEDY
Landing gear fails to lock in down position.	Dirt in actuating arm linkage.	Clean linkage.
	Actuating cylinder out of adjustment.	Adjust cylinder.

TROUBLE	PROBABLE CAUSE	REMEDY
Landing gear fails to lock down by emergency control.	Bungee spring loose or broken. Dirt in linkage. Linkage out of adjustment.	Adjust or replace spring. Clean linkage. Adjust linkage.
Landing gear fails to lower by normal or emergency control.	Up-lock hook linkage out of adjustment.	Adjust linkage.
Landing gear fails to lock in up position.	Up-lock hook linkage out of adjustment. Actuating cylinder linkage too short. Lockspring broken.	Adjust linkage. Adjust cylinder. Replace spring.
Nose gear fails to steer properly.	Steering mechanism out of adjustment.	Adjust mechanism.
Nose gear shimmies.	Loose steering linkage or worn bushings.	Tighten linkage or replace bushings.
Nose gear fails to fully extend.	Upper scissors attaching bolt installed incorrectly.	Install bolt with head on right hand side.

4-68. LANDING GEAR UP-LOCKS AND CONTROL LINKAGE.

4-69. The up-locks, located in each respective wheel well, hold the gear in the up position during flight. The movement of the locks is controlled by the landing gear control handle. When the control handle is moved to down position, cable and rod linkage pulls the locks to the unlocked position. When the control handle is in the up position, the locks are pulled and held in the locked position by spring load. An emergency pull cable and a handle are attached to the regular cable to give additional pull should the regulated handle

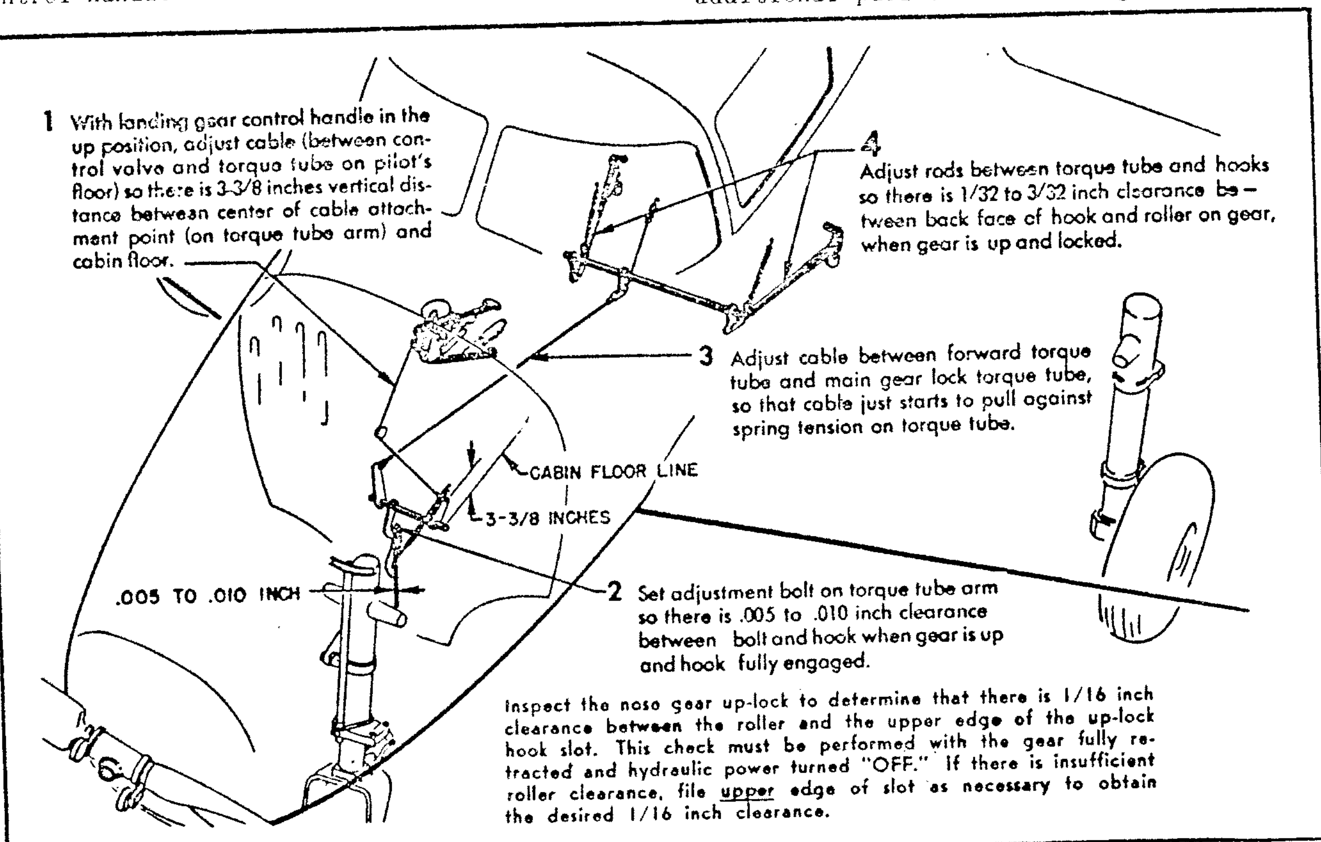


Figure 4-22. Adjusting Landing Gear Up-lock and Control Linkage

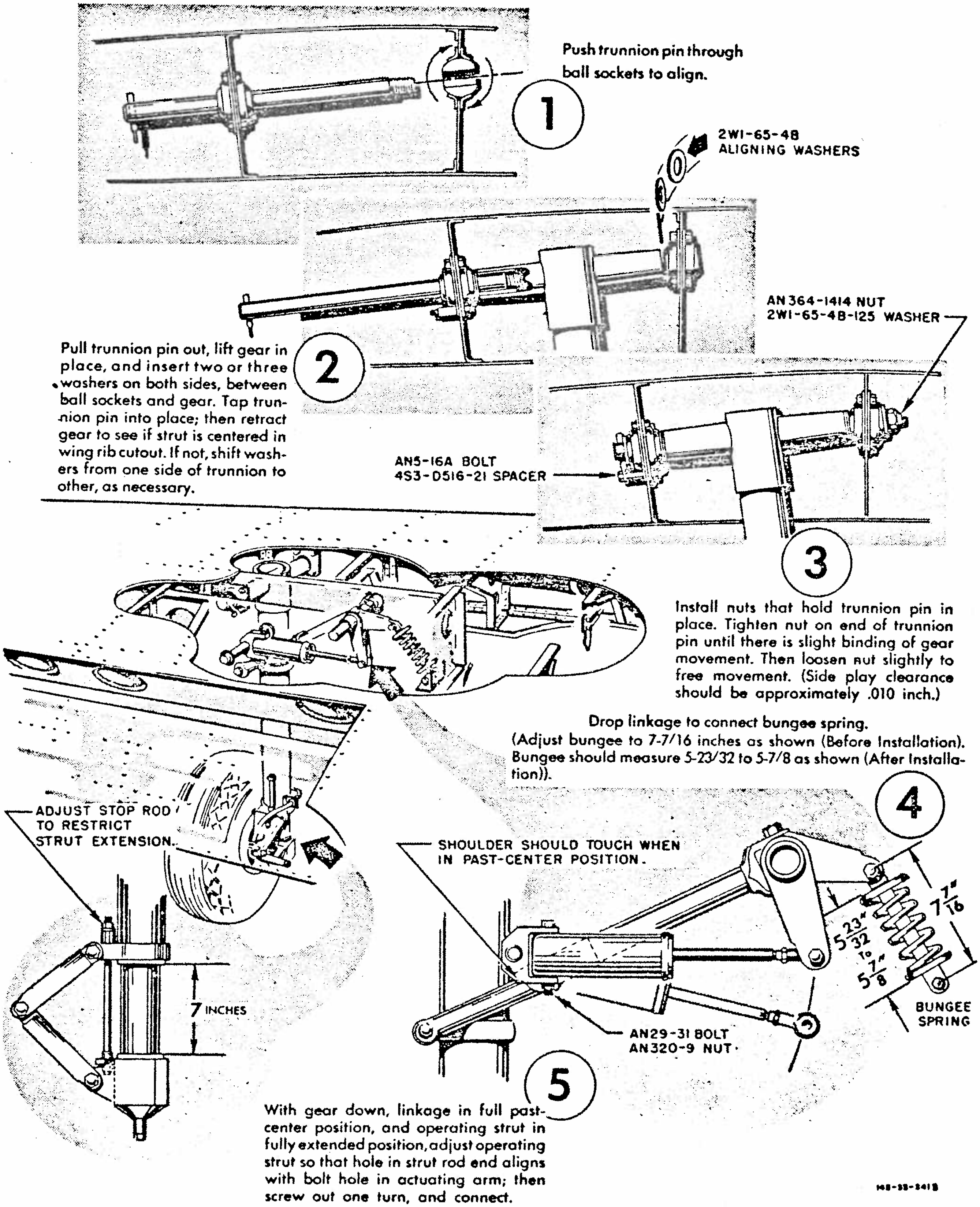


Figure 4-23. Installing, Removing, and Adjusting Main Gear Assembly

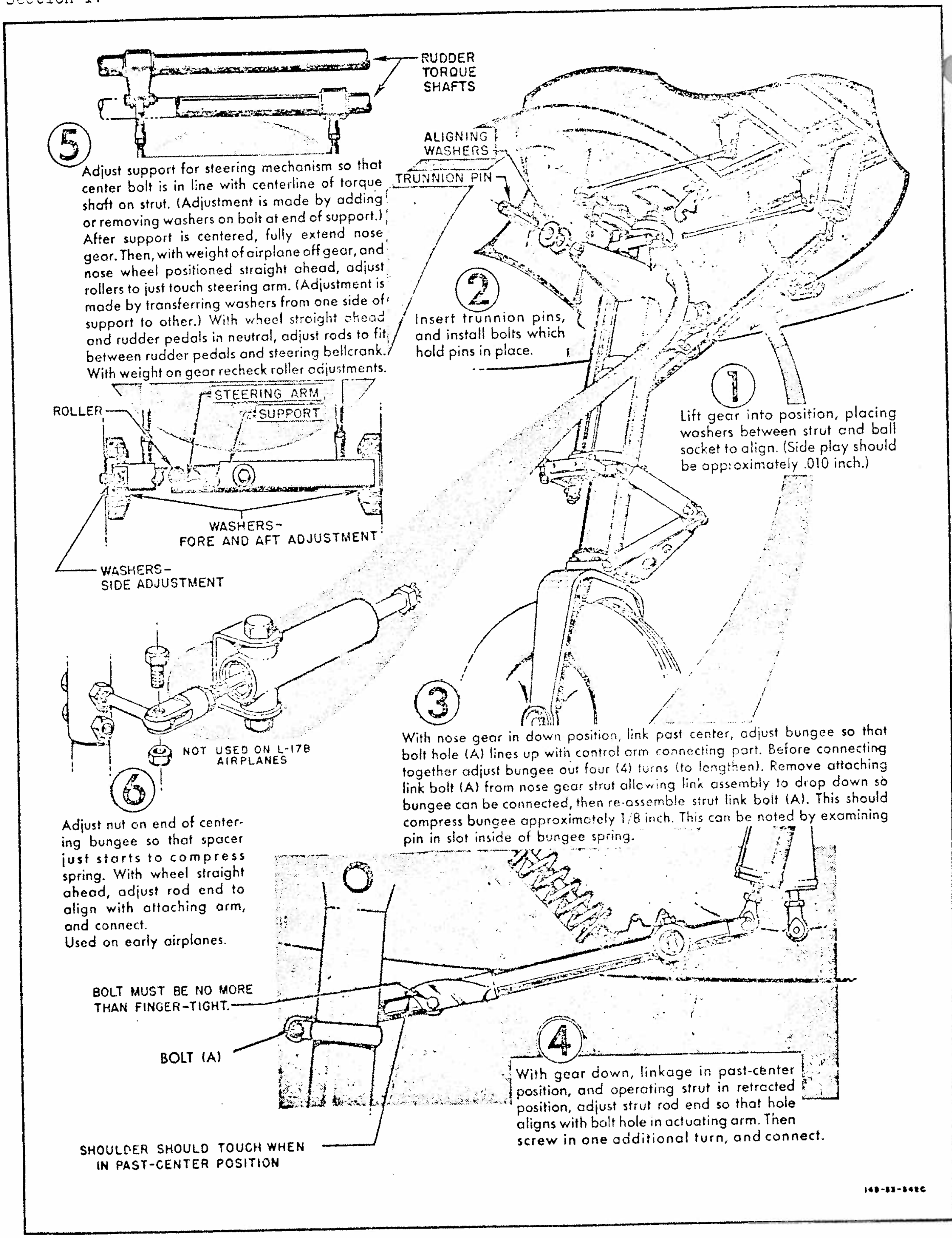


Figure 4-24. Installing, Removing and Adjusting Nose Gear Assembly

fail to pull locks.

4-70. ADJUSTING LANDING GEAR UP-LOCK AND CONTROL LINKAGE. (See figure 4-22.)

4-71. MAIN GEAR ASSEMBLIES.

4-72. The main gear assemblies, attached to the wing structure by ball-socket fittings and trunnion pins, pivot on the trunnion pins, and retract inboard into the wing panels. Each main gear assembly consists of a shock strut assembly and side brace linkage. Retraction and extension of the main gear are accomplished by movement of the hinged side brace assembly, connected to the hydraulic operating strut and bungee; the gear is held in the up position by an uplock. The hinged side brace drops past center to lock in the down position. The shock strut, having an air-fluid combination for cushioning, absorbs the shock caused by sudden loads against the landing gear during take-off, landing, and taxiing.

4-73. INSTALLING AND REMOVING MAIN GEAR ASSEMBLY. (See figure 4-23.)

4-74. NOSE GEAR ASSEMBLY.

4-75. Attached to a support box in the nose of the fuselage at the firewall, the nose gear assembly is held in place by ball-socket fittings and trunnion pins, about which it pivots aft into the well in the fuselage. The nose gear assembly consists of a shock strut assembly, drag brace linkage, and steering mechanism. Retraction and extension of the nose gear are accomplished by movement of the hinged drag brace assembly connected to the hydraulic operating strut and bungee. A nose gear extension restrictor provides a snubbing action for the nose gear during the extension stroke. The gear is held in the up position by an uplock. The hinged side brace drops past center to lock in the down position. The shock strut, having an air-fluid combination for cushioning, absorbs the shock caused by sudden loads against the landing gear during take-off, landing, and taxiing. The steering mechanism consists of a tube and steering arm assembly attached to the shock strut, a steering support assembly, and rod assemblies connecting from the rudder pedals to the steering bellcrank. When the nose gear is extended, the bellcrank rollers contact the steering arm, causing the nose wheel to turn in the direction of rudder pedal movement. As the nose gear retracts or extends, a mechanical centering device keeps the wheel from turning to either side. A spring bungee attached to the steering arm also aids in centering the wheel.

4-76. INSTALLING AND REMOVING NOSE GEAR ASSEMBLY. (See figure 4-24.)

4-77. WHEELS AND BRAKES.

4-78. WHEELS.

4-79. The airplane is equipped with three landing gear wheel and tire assemblies, two main wheel assemblies, and one nose wheel assembly. The two main wheel assemblies are identical, consisting of a 7.00x8 wheel

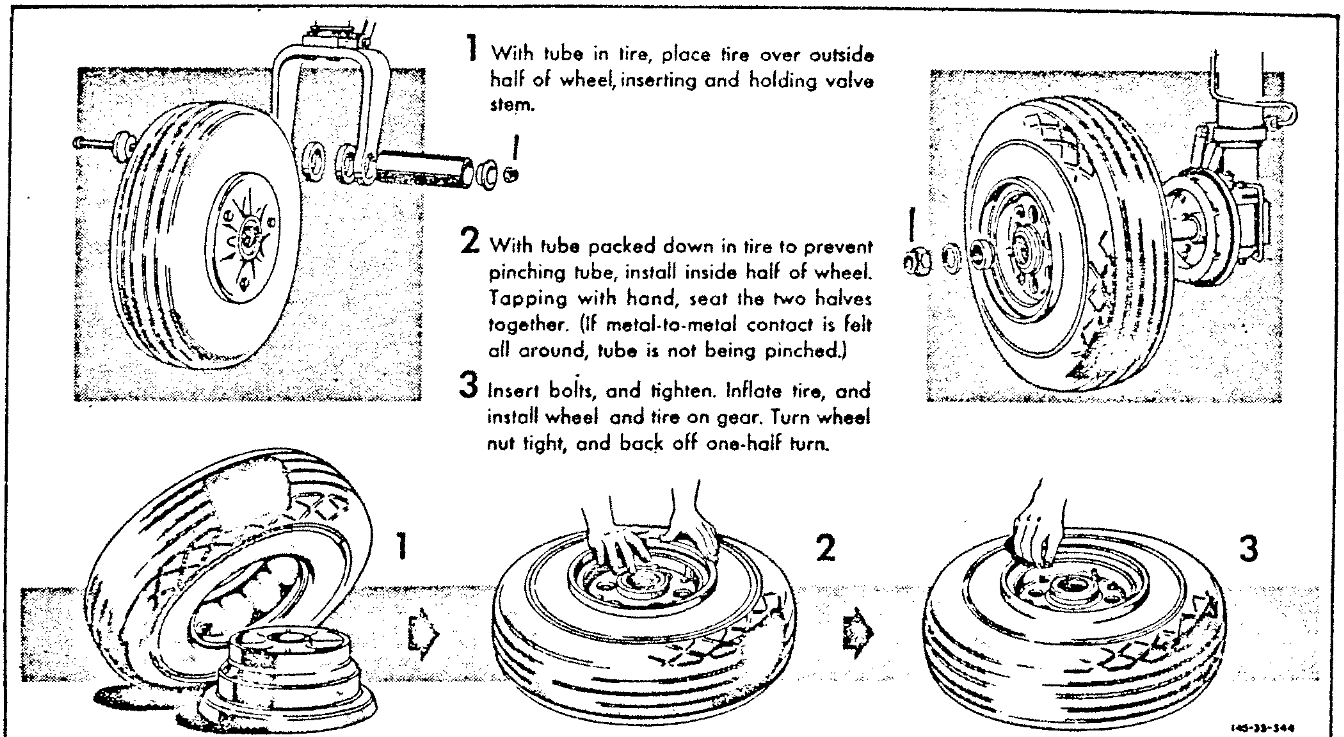


Figure 4-25. Installing and Removing Wheels and Tires

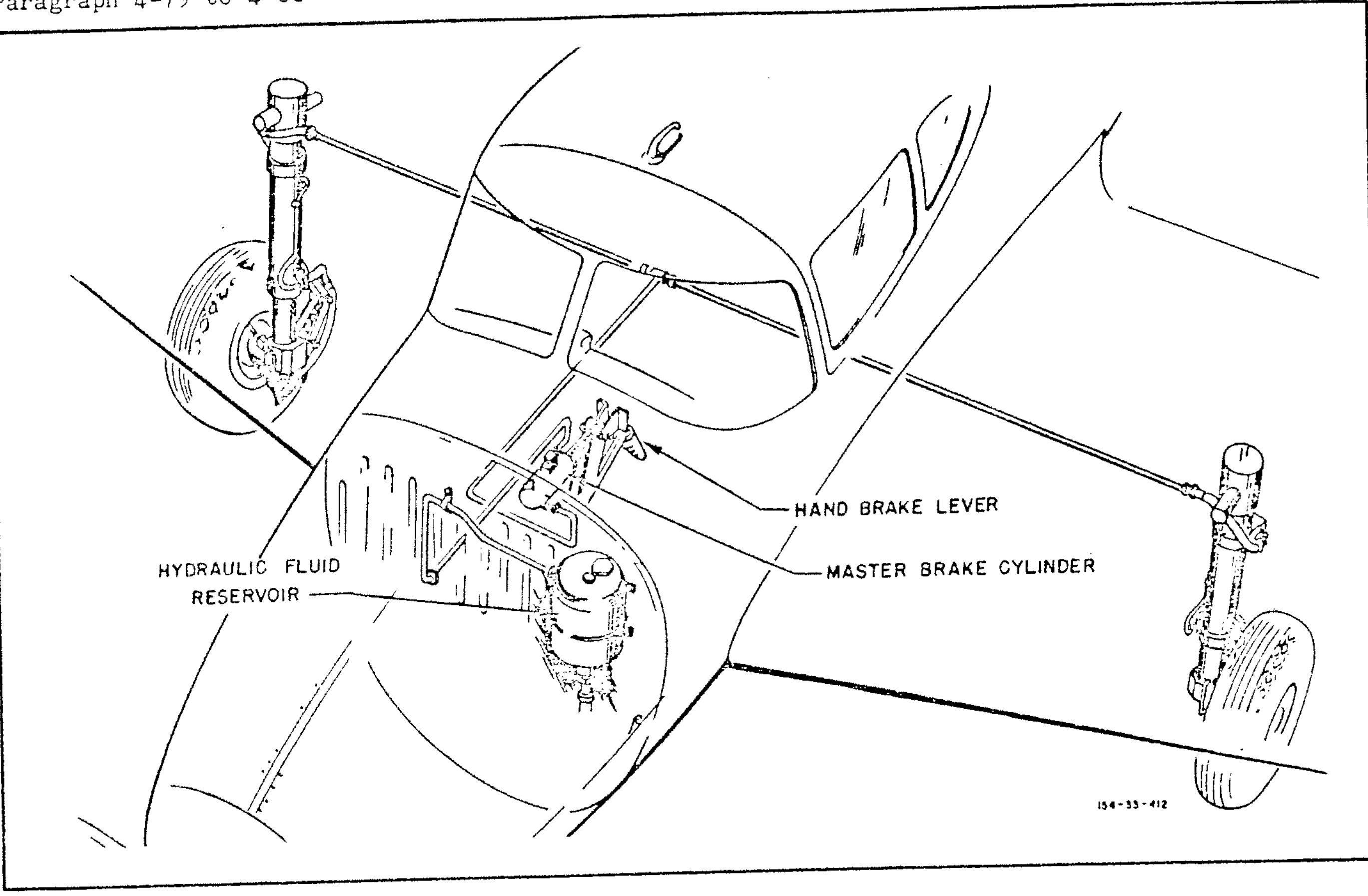


Figure 4-26. Brake system L-17A Airplanes

assembly, a 7.00 x 8 four-ply low-pressure tire, and a 7.00 x 8 tube. The nose wheel assembly consists of a 6.00 x 6 wheel assembly, a 6.00 x 6 four-ply, low-pressure tire, and a 6.00 x 6 tube. The wheels are constructed in two halves to facilitate the changing of tires.

4-80. INSTALLING AND REMOVING WHEELS AND TIRES. (See figure 4-25.)

4-81. BRAKE SYSTEM.

4-82. The brake system (figure 4-26) consists of a master brake cylinder, control lever, expansion-type brake units, and line to carry the fluid from the master brake cylinder to the brake units. The master brake cylinder is filled with fluid by a supply line from the hydraulic system reservoir. When the control lever is pulled, it actuates the brake cylinder piston which forces fluid, under pressure, to expansion tubes in the brake units. A button on the control lever actuates a ratchet which holds the lever in the desired position for parking. Depressing the button engages the ratchet; pulling the control lever automatically releases the ratchet and allows the button to snap out. When the control lever is released, it returns the master brake cylinder piston, releasing the pressure on the fluid.

4-83. ADJUSTING BRAKE SYSTEM, ALL L-17A AIRPLANES. (See figure 4-27.)

4-84. BLEEDING BRAKE SYSTEM. Refer to paragraph 3-56.

4-85. MASTER BRAKE CYLINDER. The master brake cylinder, located just behind the instrument panel, is a piston type. The piston assembly incorporates a neoprene cup seal for preventing fluid leakage past the piston. "O" ring seals are used to prevent external leakage. The piston assembly is spring-loaded in the extended (brakes released) position. The brake cylinder has a spring-loaded check valve arrangement, in the end, which permits immediate recharging of the brake cylinder if an excessive volume of fluid is required to apply full brake.

4-86. BRAKE UNITS, ALL L-17A AIRPLANES. The disc-type (Firestone CFA-299) brake units on each main gear are interchangeable. Two hydraulic fluid ports on each unit are provided to facilitate connection of right and left gear brake lines. Each unit (figure 4-27) consists of a housing containing a U-shaped circular seal and a slotted pusher ring. A floating metal disc with a copper friction surface engages lugs on the housing; the outer copper-faced disc is bolted to the housing. Between the mating faces of the outer disc and the housing is a return spring consisting of a steel disc with bent-up fingers that bear against the lugs of the floating disc. The brake lining is a rotating disc between the two copper-faced discs whose circumference is notched to engage lugs on the wheel. As pres-

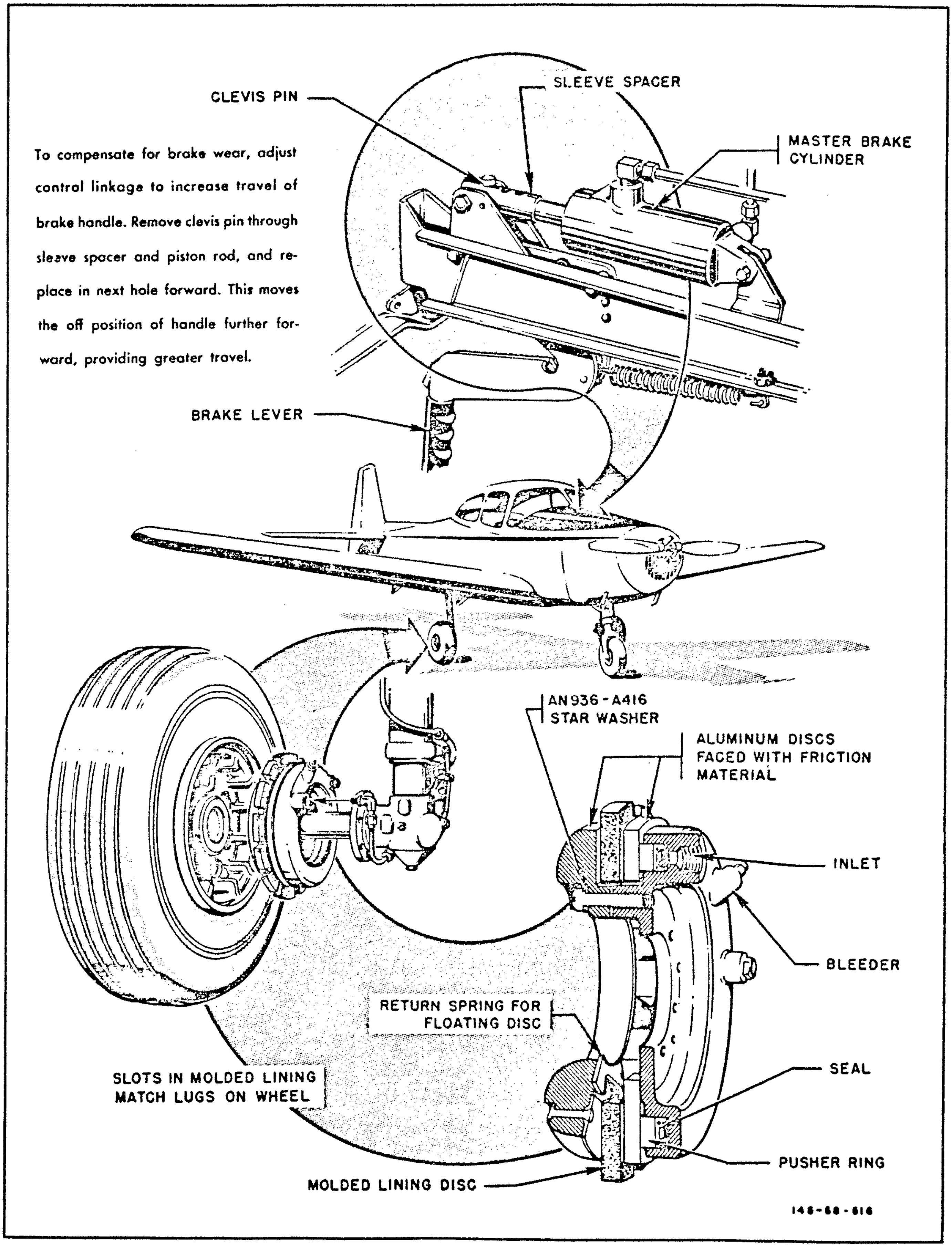


Figure 4-27. Adjusting Brake System, L-17A Airplanes

sure is applied to the unit, the seal moves out, forcing the pusher ring, floating disc, and lining against the outer ring. Braking is accomplished by the friction of the lining on both copper-faced discs. When pressure is released, the return spring fingers force the floating disc, pusher ring, and seal back into the housing, allowing the lining to rotate freely. There is no adjustment for the brake unit--compensation for lining wear is made by increasing throw of master cylinder piston. (figure 4-27.)

4-87. REPLACEMENT OF BRAKE LINING OR COPPER FACINGS, L-17A AIRPLANES (FIRESTONE BRAKES).

4-88. Brake lining should be replaced when any of the following conditions exists:

a. Lining is worn to 1/4 inch thickness.

b. Lining shows signs of cracking. (Not to be confused with heat checks normally present.)

c. Hydraulic oil has soaked in the lining to the extent that the stain cannot be removed by cleaning with carbon tetrachloride.

d. Maximum adjustment of control lever will not provide sufficient braking power. Lining is removed by taking off outer disc which is attached to housing with six slot-head bolts.

4-89. Prior to installation of new lining, determine the condition of the copper facings as follows:

a. If worn to heads of rivets, replace.

b. If badly scored, replace.

c. If concavity between inside and outside diameters exceeds .016 inch, replace.

4-90. When installing new lining, see that arrows on lining point in direction of rotation. This assures elimination of lining dust, etc, through grooves in lining angularly cut opposite to direction of rotation. After installation of new lining, the airplane should be taxied and the brakes applied until the first sign of smoke appears. Use care in making this run-in, as extra wear may be necessary to compensate for the concavity allowed in the copper discs.

4-91. BRAKE UNITS, L-17B AIRPLANES. These airplanes are equipped with Hayes Goodrich G-2-537 expander-tube type brake. The brake assemblies consist primarily of stamped steel frames, expander tubes, and brake blocks. The expander tube is assembled on the frames, the frames bolted together to form the assembly, and the brake blocks set in place on the expander tube and held in place by leaf-type springs which are anchored in the torque lug slots in the frames. In operation, hydraulic fluid, under pres-

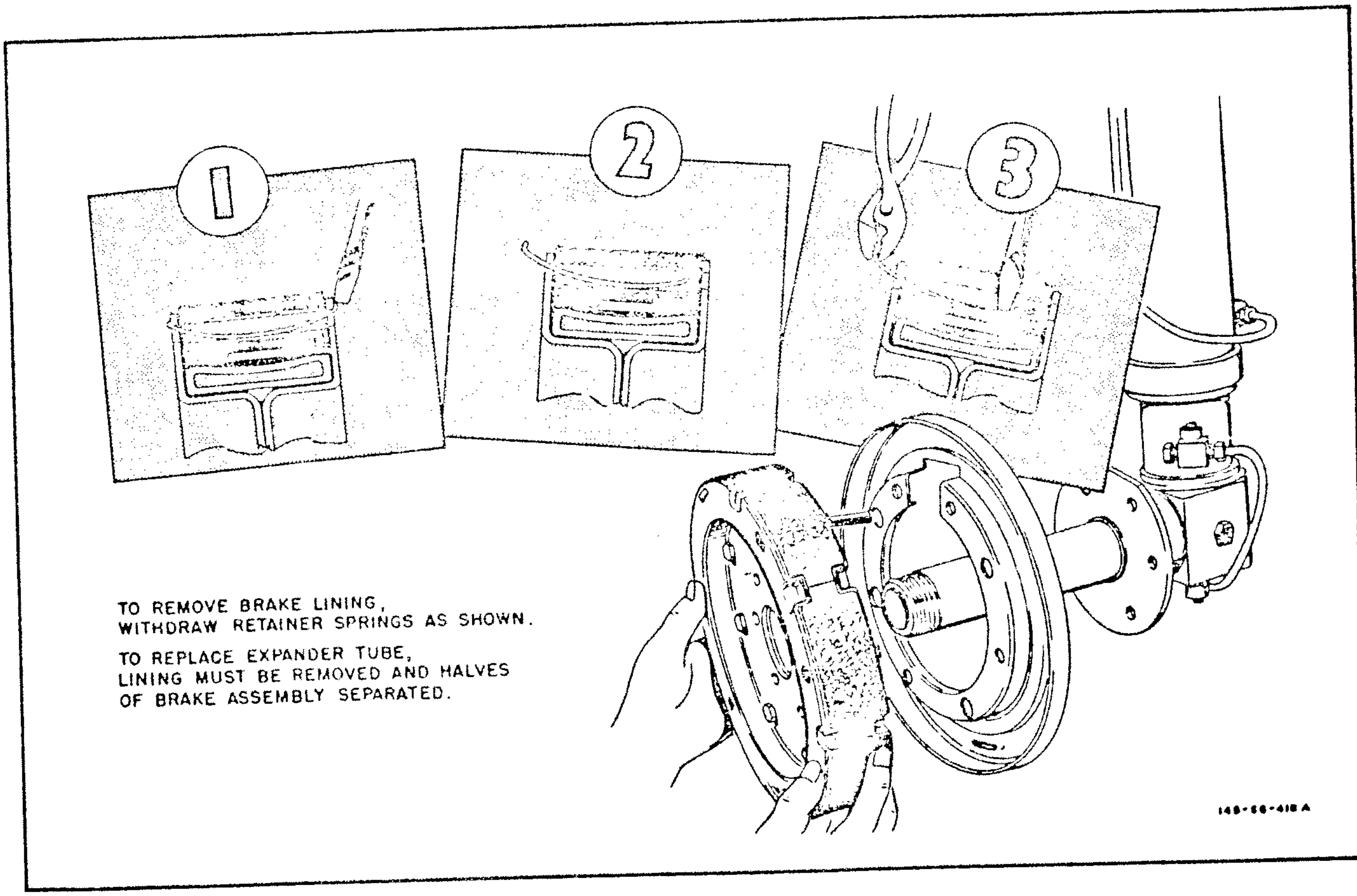


Figure 4-28. Installing and Removing Brake Units, L-17B Airplanes

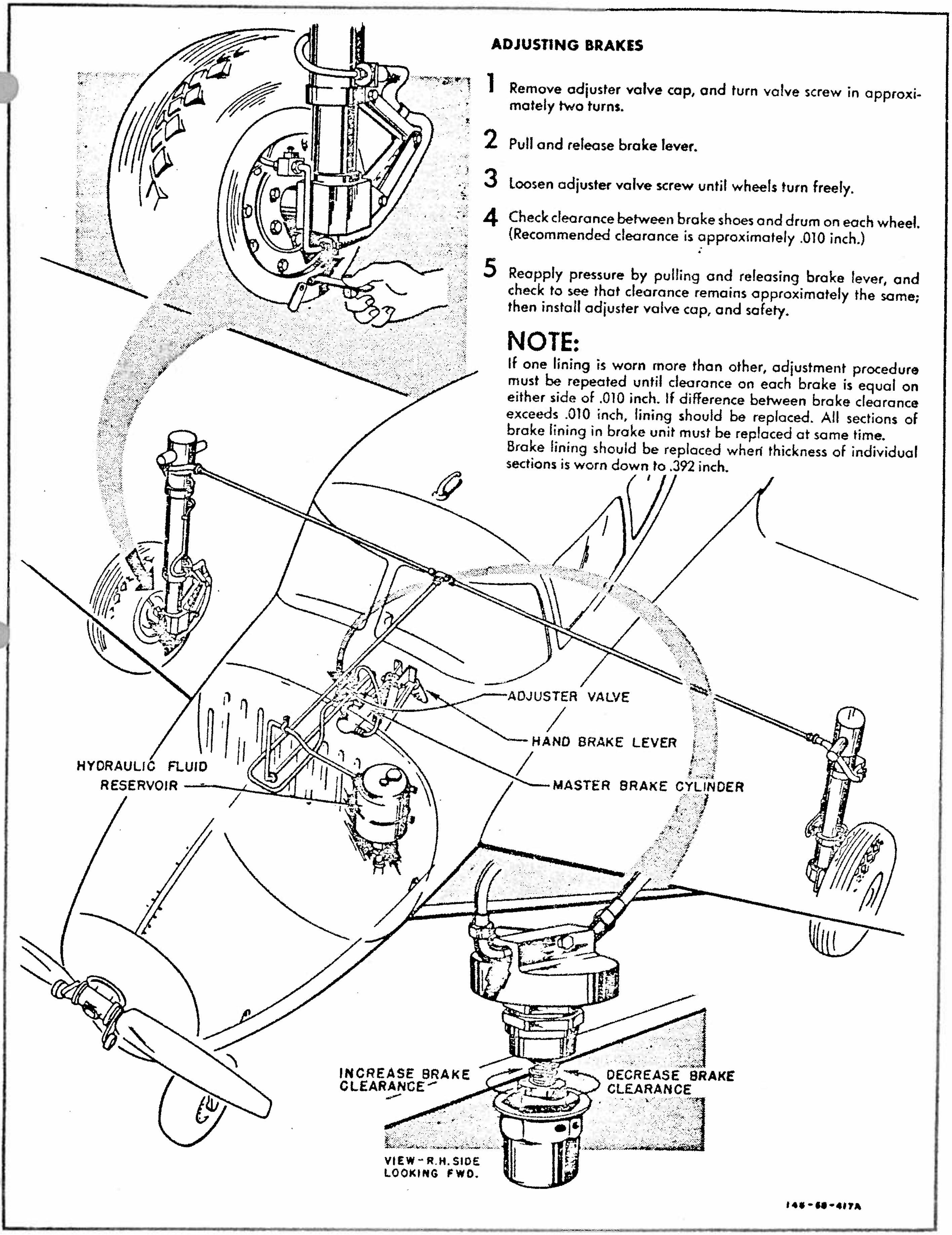


Figure 4-29. Brake System and Brake Clearance Adjustment, L-17B Airplanes

sure, is introduced into the expander tube. As the expander tube is restrained by the frames from inward and sideward movement, the tube expands outward, pressing the brake blocks against the brake drum. When the operating pressure is released, the leaf-type springs retract the brake blocks to their normal position and deflate the expander tube.

4-92. RELINING BRAKES, L-17B AND L-17C (MODIFIED L-17A) AIRPLANES. The design of the expander tube brake is such that it can be relined with very little effort. The lining should be changed if the blocks are oil soaked, or if the blocks are worn to less than .375 inch thick. To remove the brake blocks (See figure 4-28) press down on one edge of the spring to slide it into the brake block. With a thin screwdriver, or similar tool, press down on the spring, between the brake blocks. Holding the spring down, take hold of the opposite end of the spring, and pull the spring out of the brake blocks. This will allow the ends of the two blocks to be picked up, and the two blocks removed. The same procedure may be followed with each spring until all of the brake blocks are removed. To replace the brake blocks, or to install new ones, the procedure should be reversed. Put two of the blocks in place, and insert one of the retractor springs in the slot, pushing the spring in as far as possible. Then with a screwdriver, push the spring down until it engages the spring slot in the frame. The screwdriver may then be removed, and by pressing on the opposite end of the spring it will snap into position.

4-93. REPLACING EXPANDER TUBES. If it is necessary to replace the expander tube, remove all the brake blocks as described in the preceeding paragraph, and loosen the nozzle nut. Then remove all the frame bolts and nuts which will allow the two stamped brake frames to be pulled apart, allowing the expander tube to be removed. To reassemble the brake with a new expander tube, lay the outer brake frame with flange down. Take the expander tube and put the nozzle through the nozzle hole of the frame, tightening the nut slightly to hold the nozzle in position. The expander tube may then be stretched on the frame by working both ways from the nozzle, pushing it on with the fingers. The inner frame may then be properly located and pressed down into the expander tube. Install the brake frame bolts and nuts, and tighten the nozzle nut to a torque of 65 inch-pounds. The brake blocks may then be installed as described.

4-94. BRAKE CLEARANCE ADJUSTMENT, L-17B AIRPLANES. There is no mechanical adjustment on these brake units. Brake lining clearance is controlled by the pressure held in the expansion tubes by the adjuster valve, which is located forward and to the right of the brake control handle. (See figure 4-29.) Adjust as follows:

a. Bleed brakes.

b. Remove adjuster valve outer protective covering.

c. Apply and release brake pressure to charge the adjuster.

d. Check brake clearance with a feeler gauge. Clearance should be .010 inch maximum .003 inch minimum.

e. Turn the adjusting screw clockwise to decrease brake clearance, or counter-clockwise to increase brake clearance.

f. Make a brake application after each adjustment, to recharge the adjuster. Then check the clearance as established by each new adjustment.

g. Repeat procedure until desired brake clearance is obtained.

h. Replace adjuster protective cap and safety.

4-95. <u>ENGINE</u>.

4-96. The airplane is powered by a six-cylinder, overhead-valve, air cooled, horizontally opposed, direct-drive, Continental (Type E-185-3) engine. (See figure 4-30.) The engine, incorporating hydraulic-type valve tappets which require no adjustment, has a sea level take-off power rating of 185 bhp at 2300 rpm.

NOTE

On L-17B and L-17C (Modified L-17A) airplanes the engine has a power rating of 205 bhp at 2600 rpm for take off. One minute only.

4-97. ENGINE DATA.

Bore	5.00 in.
Stroke	4.00 in.
Piston Displacement	471 cu in.
Compression ratio	7:1
Intake valve (opens)	15° BTC
Intake valve (closes)	60° ABC
Exhaust valve (opens)	55° BBC
Exhaust valve (closes)	15° ATC
Propeller shaft spline size	No. 20
Magneto timing	
Left magneto (lower spark plug)	26° BTC
Right magneto (top spark plugs)	26° BTC
Firing order	1-6-3-2-5-4
Engine over-all dimensions	
Length	46.7 in.
Height	25.0 in.
Width	33.5 in.
Engine weight details (dry)	
Engine without accessories	approx 335 lb.
Engine and accessories	approx 371 lb.
Engine, accessories, and mount	approx 390 lb.

4-98. ENGINE ACCESSORIES, GEAR RATIOS, AND DIRECTION OF ROTATION

UNIT	MAKE	MODEL NO.	GEAR RATIO	ROTATION (Drive End)
Carburetor	Bendix-Stromberg	PS-5C	------	---------
Fuel Pumps				
L-17A'S	Carter	CMC-A-50375	------	---------
L-17B'S and modified L-17A'S	Romec	RD-7750-1	1.667:1	Counter-clockwise
Generator				
L-17A'S	Delco-Remy	1101879	2.250:1	Counter-clockwise
L-17B'S and modified L-17A'S	Delco-Remy	A-40605	2.250:1	Counter-clockwise
Hydraulic Pump	NAA	145-58011	1.364:1	Clockwise
Starter				
L-17A'S	Delco-Remy	1109658	35.77:1	Clockwise
L-17B'S and modified L-17A'S	Delco-Remy	1109660	35.77:1	Clockwise
Tachometer	------	------	0.500:1	Clockwise
Magneto's				
All L-17A'S	Eiseman	LA6	1.500:1	Clockwise
L-17B'S	Bendix	S6LN-21	1.500:1	Clockwise
Spark Plugs	BG	707S	------	---------
Propellers				
L-17	Hartzell	HC-12x20-7	Direct	Clockwise

4-99. TROUBLE SHOOTING ENGINE.

TROUBLE	PROBABLE CAUSE	REMEDY
Failure of engine to start.	Insufficient fuel in tank, or fuel shut-off valve closed.	Service fuel tank or open shut-off valve.
	Overpriming or flooding, as indicated by weak or intermittent explosions, and puffs of black smoke issuing from the exhaust pipe.	Turn ignition switch "OFF," set throttle full open, mixture control out, and turn engine over several revolutions with starter.
	Engine underprimed.	Prime
	Loose ignition wiring connections, breaks in insulation, or shorting at terminals.	Repair or replace.
	Spark plugs dirty, or improperly gapped.	Clean and regap.
	Improper timing of magnetos, or short circuit between magneto ground terminal and ignition switch	Retime magnetos or locate short.

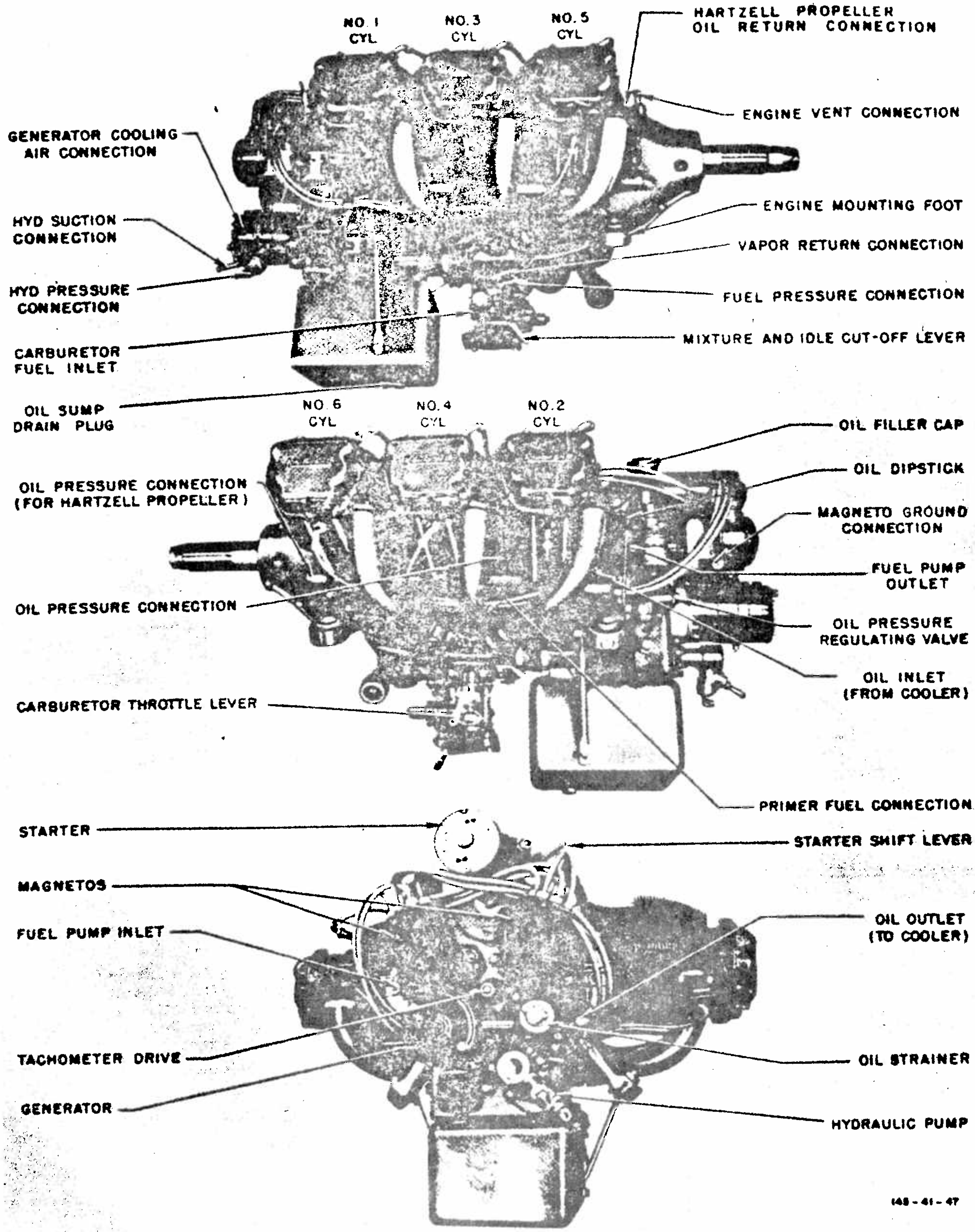


Figure 4-30. E - 185 - 3 Continental Engine

TROUBLE	PROBABLE CAUSE	REMEDY
Low oil pressure.	Insufficient oil, or dirty or diluted oil in sump.	Change oil.
	Oil pressure relief valve dirty, or plunger sticking in guide.	Remove and clean.
	Dirt in oil screen.	Remove and clean.
	Worn bearings.	Overhaul engine.
High oil temperature.	Insufficient oil in sump.	Replenish oil supply.
	Dirty or diluted oil.	Drain and refill.
	Loose or broken baffles, or broken cylinder fins.	Replace baffles or cylinder.
	Prolonged ground operation at high rpm.	Allow engine to cool.
	Excessively lean fuel mixture.	Check carburetor.
Low power.	Propeller out of track or balance.	Propeller pitch may be too great.
	Malfunctioning ignition system, incorrect magneto timing.	Check magneto timing, spark plugs, and wiring.
	Air leakage in intake manifold.	Check for leakage, and correct.
	Restricted motion of throttle valve, or improper operation of carburetor heat valve.	Check carburetor linkage.

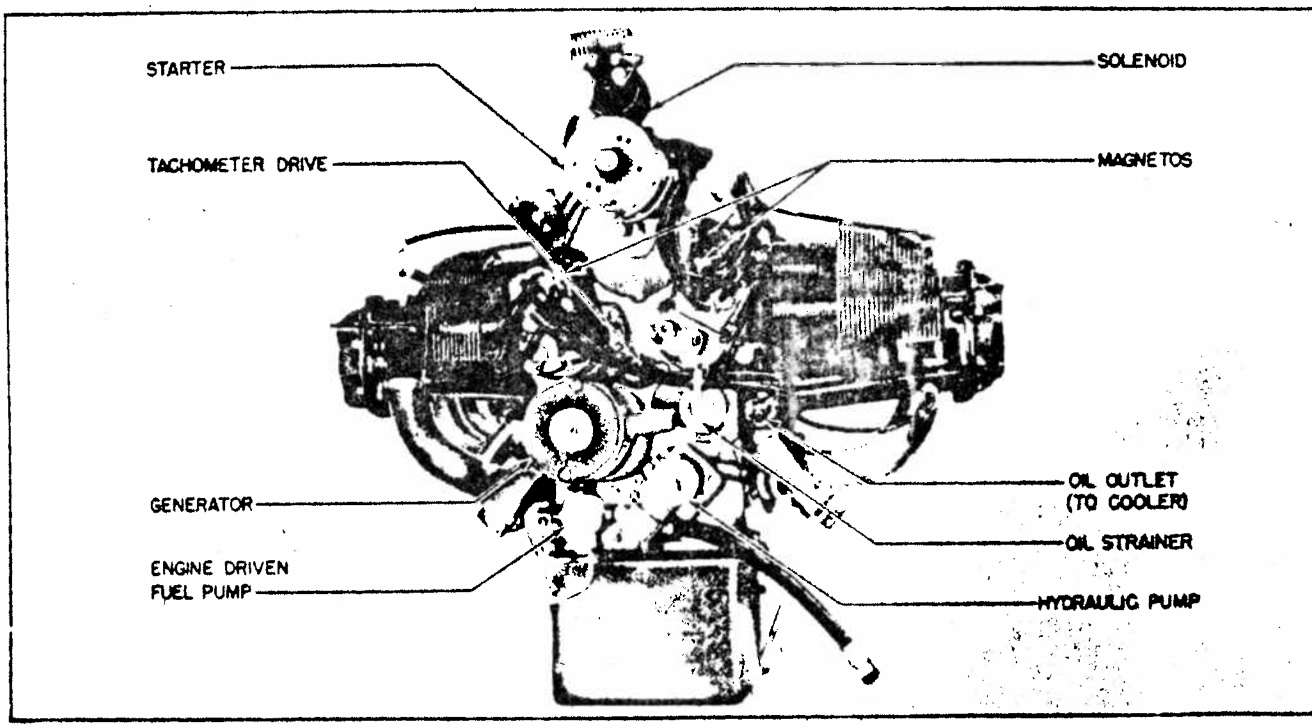


Figure 4-31. Engine Accessory Section, L-17B and Modified L-17A Airplanes

TROUBLE	PROBABLE CAUSE	REMEDY
	Tachometer inaccurate.	Check indicator.
Rough running.	Propeller out of balance or track, or retaining nut loose.	Remove and check balance and track, or tighten retaining nut.
	Spark plugs dirty or improperly gapped.	Clean and regap.
	Improper ignition.	Check magneto operation.
	Sticking valves.	Replace cylinder.
	Engine mounting bolts loose.	Tighten bolts.
	Malfunctioning carburetor.	Check carburetor operation.
Engine fails to accelerate properly.	Engine cold or overheated.	
	Mixture too lean.	Check mixture control
	Carburetor heat control on, or not functioning properly.	
	Worn intake valve guides and piston rings.	Replace engine.
	Carburetor idling jet not adjusted properly, or plugged.	Clean and adjust.
Engine fails to idle properly.	Incorrect idle speed adjustments.	Adjust idling.
	Air leaks in the intake system.	Test and correct.
	Improper spark plug gap.	Regap.
	Dirt in carburetor idle needle valve.	Clean and adjust.

4-100. ENGINE COOLING. An air-pressure-type system of air deflectors and baffling, installed around the engine, directs a sufficient volume of air to the cylinder barrels, heads, spark plugs, and oil cooler to maintain proper engine operating temperatures for maximum engine efficiency.

4-101. ENGINE EXHAUST SYSTEM. The exhaust system consists of two manifolds and two extension pipes constructed of stainless steel tubing. (See figure 4-32.) Each manifold attaches to the exhaust ports on the bottom of the cylinders. The extension pipes, clamped to the manifolds, expel the exhaust gases into the airstream. Each manifold is equipped with a shroud.

4-102. INSTALLING ENGINE. It is recommended that the engine mount be attached to the firewall before the engine is installed in the mount. Following is the procedure for installing engine:

a. Install necessary accessories on engine to make up full complement of units required by the specific airplane.

b. Install spark plugs and connect ignition harness leads.

c. Install cylinder head baffles.

d. Install primer fitting and hose on top of left intake manifold near carburetor.

e. Install oil pressure fitting and hose on crankcase between No. 4 and No. 6.

f. Install exhaust manifolds on exhaust ports. Torque nuts to 80-90 inch-pounds.

g. Check engine mount assembly to make sure that all lines, controls, and units are installed, and are so positioned that no interference will occur when engine is lowered into mount.

h. Connect fuel vapor return, and fuel pressure fittings and hoses to carburetor.

NOTE

When a new or drained carburetor is being installed, it must be filled, flushed of shipping oil, vented, and the diaphragms soaked for an 8-hour period before the engine is started. (Refer to paragraph 4-111.)

i. Carefully lower engine into mount until engine mounting feet are approximately 1/4 inch from engine mount fittings. Install rubber washer and end plate on each side of each engine foot; then install engine retainer bolts. Install engine bonding braids under heads of front bolts. Lower engine until bolts can be inserted in mount bosses; then install washer and nut on each bolt, torque to 450-500 inch-pounds, and safety.

j. Connect air mixing chamber adapter to carburetor.

k. Connect and adjust throttle and mixture controls to carburetor.

l. Connect electrical leads to throttle warning switch on carburetor.

m. Connect tachometer shaft to engine.

n. Connect electrical leads and air blast hose to generator.

o. Connect ground wire to each magneto.

p. Connect fuel vapor return line, and fuel pressure line connections on forward right side of engine mount bulkhead.

q. Connect electrical leads to starter.

r. Connect and adjust control cable to starter control arm.

s. Connect fuel supply lines between carburetor and fuel pumps.

t. Connect oil pressure hose connection on forward left side of engine mount bulkhead.

u. Install and connect oil hoses between engine and oil cooler radiator.

v. Connect oil temperature bulb at oil cooler.

w. Install and connect fuel hoses between firewall and fuel pumps.

x. Install and connect hydraulic lines between hydraulic pump and firewall.

y. Install left side bulkhead baffles; then connect primer hose and line forward of baffle.

z. Install and connect engine breather line between engine and firewall.

aa. Install right side bulkhead baffle.

ab. Install exhaust extension pipes on exhaust manifolds.

ac. Install exhaust shrouds, and connect flexible ducts between shrouds and air mixing chamber.

ad. Install and connect ventilating air duct along right side of engine mount and firewall, and install heater assembly.

ae. Install propeller. (Refer to paragraphs 4-123 and 4-131.)

af. Install nose cowl assembly.

ag. Make a final thorough inspection to make sure all lines, electrical connections, and controls are properly and tightly connected, and adjusted.

4-102A. CYLINDER COMPRESSION TEST. (See figure 4-31A.) Using Aircraft Engine Cylinder Compression Tester Assembly, type S-1, part No. 47R11992, and a .040-inch orifice bleeding into the cylinder, check the cylinder compression as follows:

a. To obtain consistent readings, it is advisable to perform the compression check as soon as possible after the engine has been shut down. This is desired in order that all piston rings, etc., will be uniformly lubricated. It will not be necessary to operate the engine prior to accomplishing the compression checks during engine build-up or on individually replaced cylinders. However, in such cases, a small quantity of lubricating oil will be sprayed in the cylinders and the engine turned over a few times to seal the piston rings, etc., prior to accomplishing the compression check.

b. Take standard precautions against accidental firing of the engine.

c. Remove necessary cowling.

d. Remove the most accessible spark plug from each cylinder.

e. Install the spark plug connector and seal ring in the No. 1 cylinder (figure 4-31B.) Tighten the spark plug connector sufficiently to assure a seal.

f. Connect the compression tester assembly to the compressed air supply. With the check valve closed, adjust the main line pressure from the compressor to 80 psi on the regulated pressure gage.

g. Open the check valve and attach the air hose quick-connect fitting to the spark plug connector. This will establish a pressure of 15 psi in the cylinder when both intake and exhaust valves are closed, provided the cylinders will hold 15 pounds when checked as outlined in step j.

h. Turn the engine over in the direction of rotation by hand until the piston in the No. 1 cylinder is coming up on compression stroke against the 15 psi and continue turning slowly until the piston reaches top dead center. Reaching top dead center is indicated by a flat spot or sudden decrease in force required to turn the propeller. If the engine is rotated too far, back up at least one-half revolution and start over again to eliminate the effect of backlash in the valve operating mechanism and to keep the piston ring seated on the lower ring lands.

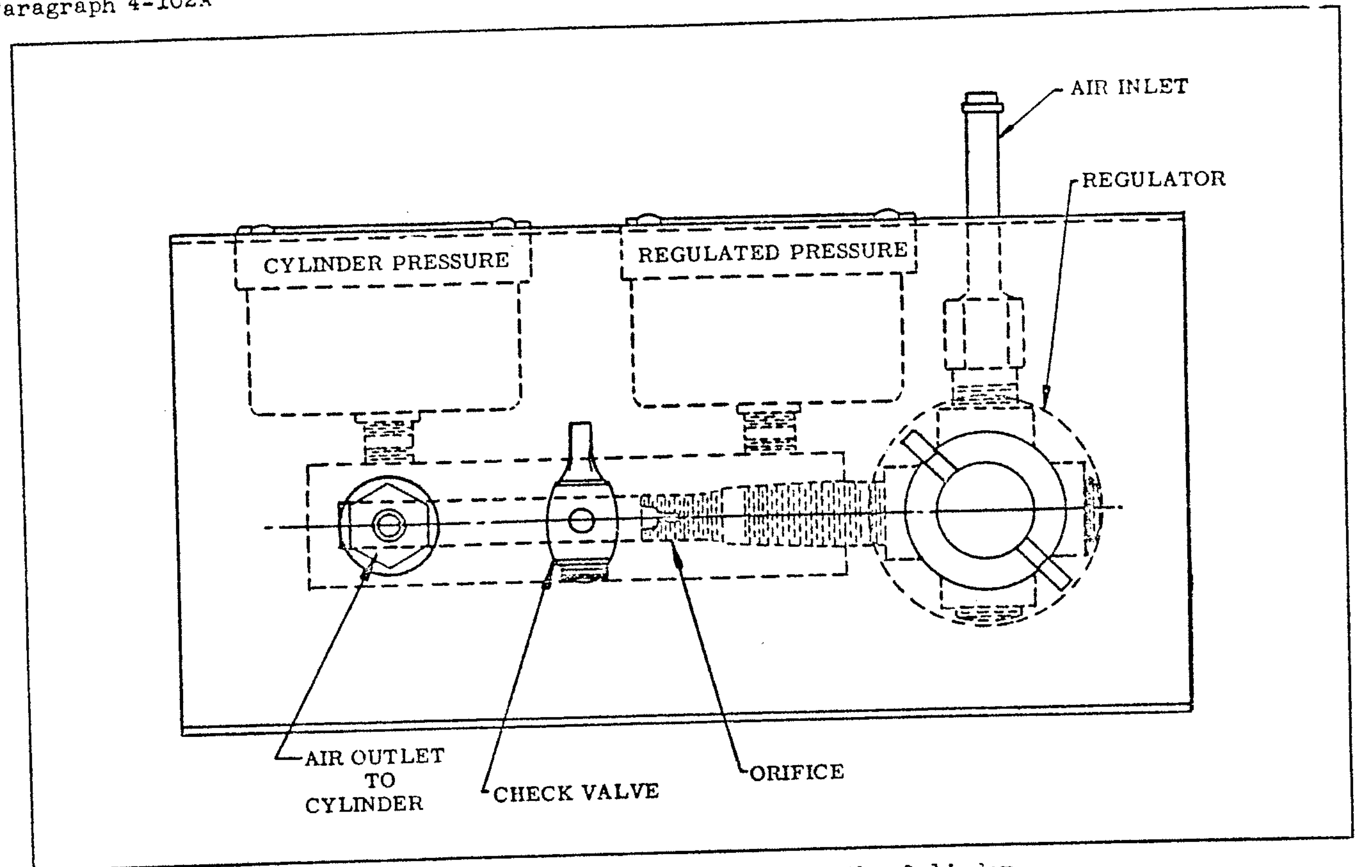


Figure 4-31A - Compression Testing the Cylinder

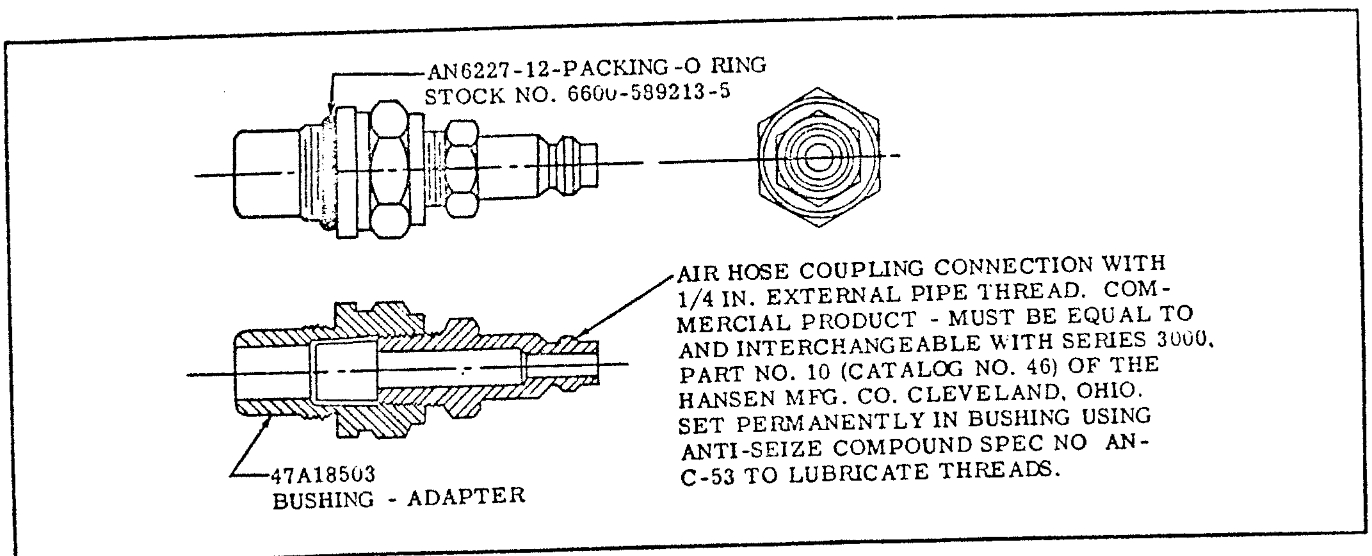


Figure 4-31B - Connector Assembly, Cylinder Compression Tester

i. Close the shut-off valve. Check the regulated pressure and adjust, if necessary, to 80 psi.

CAUTION

Care must be exercised in closing the shut-off valve, for if the piston is not at top dead center, there will be sufficient air pressure build-up in the cylinder to rotate the propeller approximately 1/4 turn.

j. With the regulated pressure adjusted to 80 psi, if the cylinder pressure reading as indicated on the cylinder pressure gage is below the minimum of 35 psi, move the propeller in the direction of rotation to seat the piston rings in the grooves. If the pressure does not build up, go on to the next cylinder. When all cylinders have been checked and readings recorded, return to the cylinder or cylinders having low compression readings.

k. When low compression is obtained on cylinders, the engine will be turned through with the starter or restarted and run to take-off power and the cylinder or cylinders having low compression rechecked. If this does not correct the difficulty, the rocker box cover will be removed and the valve clearance checked to determine if the low compression is due to negative valve clearance. If the difficulty is not caused by negative valve clearance, place a fiber drift on the rocker arm immediately over the valve stem and tap the drift several times with a one- to two-pound hammer. Then rotate the engine with the starter and recheck the compression.

NOTE

Compression checks will not be made after staking a valve until the crankshaft has been rotated either with the starter or by hand to reseat the valve in a normal manner as the higher seating velocity obtained when staking a valve will indicate valve seating, even though valves are slightly egged or eccentric.

l. Cylinders having compression below the minimum 35 psi after accomplishing the foregoing action will be further checked to determine whether leakage is past exhaust valve, intake valve, or piston. Excessive leakage past the piston is the second most frequent cause of compression leakage and can be detected on cylinders approaching the horizontal position by squirting engine oil around the piston and rechecking the compression. If this action raises compression to, or above the minimum required, the cylinders may be continued in service. Results of the above tests will be entered on a compression check sheet.

m. Repeat the procedure outlined in steps a through 1.

n. Engines with more than two cylinders having less than the specified minimum compression value of 35 psi will be given a flight test followed by a recheck of the cylinders having low compression. If more than two cylinders still retain less than the specified 35 psi minimum compression value after the flight test, the engine will be replaced.

4-102B. INSPECTING VALVES. Prior to adjusting valves, the following inspection will be made:

a. The valve operating mechanism, such as rocker arm, rocker arm bearing, and valve springs will be checked for evidence of cracks, breaks, chipping, and indications of excessive clearance on rocker arm bearing. In addition, the rocker box will be checked for indications of excessive sludge formation or excessive dryness. In cases where excessive sludge formation is found in the rocker box, the sludge will be removed from it by spraying with cleaning solvent, specification No. P-S-661. The rocker arm, rocker arm bearing, valve spring, etc., will be coated with clear oil.

b. In the event the rocker box on the engine is excessively dry as compared to normal condition of the rocker box for the engine, the cause of the inadequate lubrication will be established and corrected. This may require removal of the push rod housing, push rod and tappet to determine the channel which is clogged or partially clogged. In the event it is necessary to pull the tappet, it will be thoroughly lubricated prior to reinstallation on the engine.

c. After a plugged condition of the valve mechanism has been corrected, it will be further checked after the initial engine run to determine that the corrective action taken has eliminated the trouble. This will be done by removing the rocker box cover and checking for presence of lubrication.

d. To eliminate oil leakage at the rocker box parting surface, all rocker box covers will be checked for flatness by using surface plate on a piece of glass and a .0015-inch feeler gage at the valve inspection period. Cast rocker box covers which are warped will be resurfaced by lapping the rocker box cover on fine emery cloth laid on a surface plate or piece of plate glass until all indications of warpage are removed. Stamped rocker box covers, if warped, will be replaced.

4-102C. USING FEELER OR DIAL GAGES FOR CHECKING CLEARANCES.

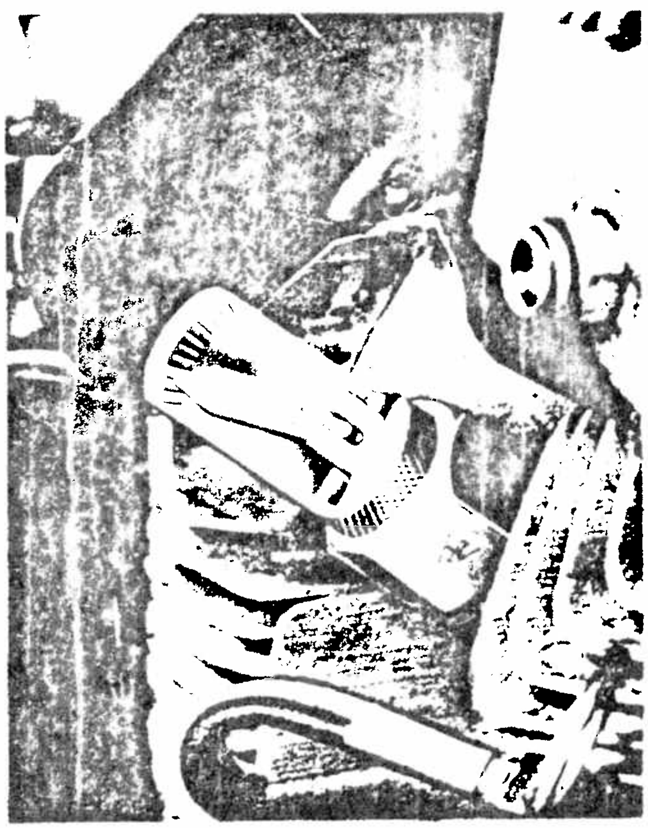


Figure 4-31C - Installing Top Center Indicator

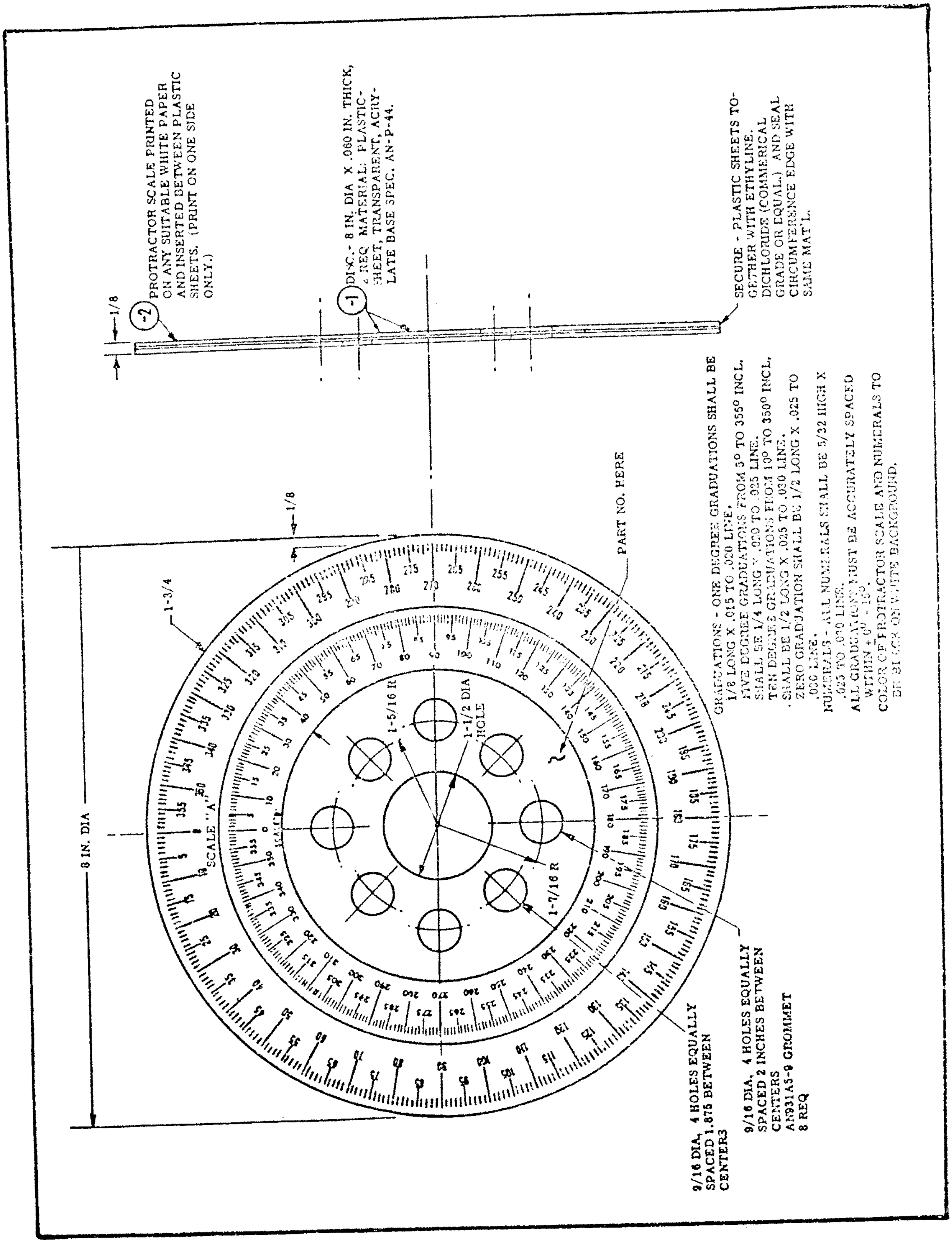


Figure 4-31D - Engine Timing Disc, Compression Tester

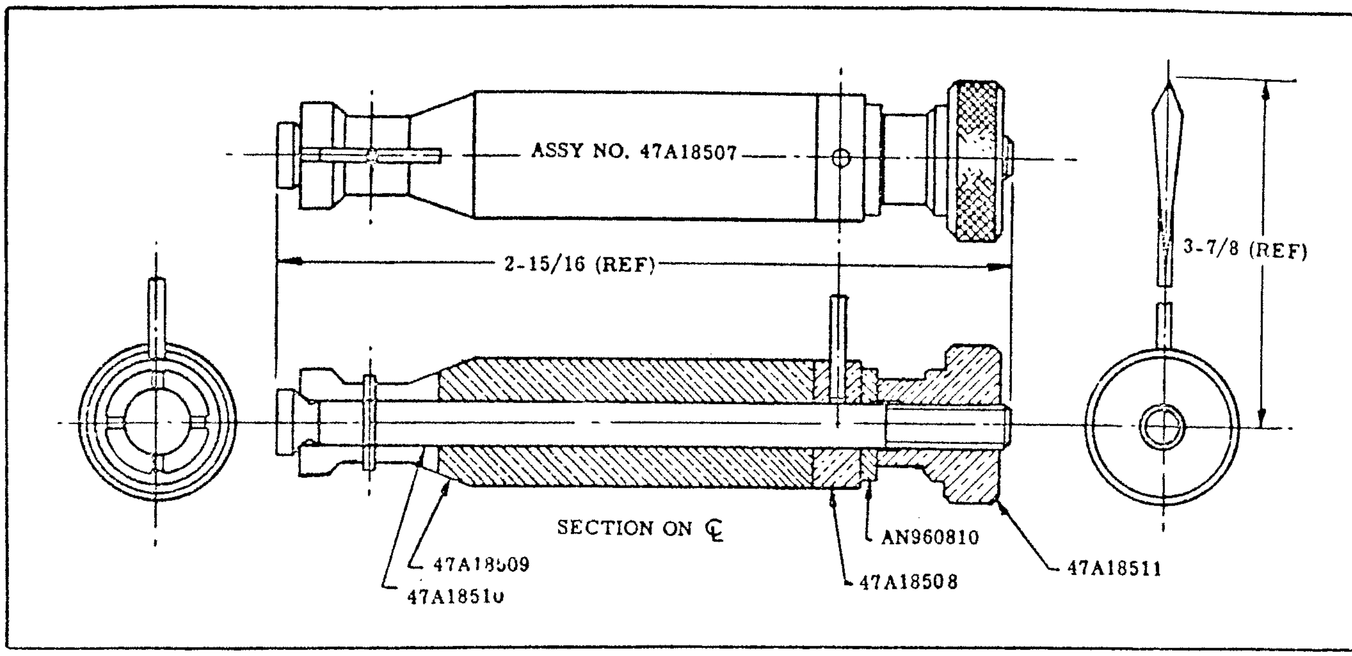


Figure 4-31E - Pointer Assembly, Engine Timing Disc

a. Using a dial or feeler gage, check to insure proper valve clearance.

b. Excessive force will not be used to insert the feeler gage between the valve stem and the rocker arm since, due to the mechanical leverage where a roller is used, the gage can be inserted by force even though the clearance may be several thousandths less than the thickness of the gage.

c. A dial gage with a bracket may be used for checking valve clearances on the engine, provided the rocker arm arrangement is such that the pick-up arm of the dial gage will be located over the center line of the valve stem. The clearance will be checked by moving the rocker arm away from the valve stem until the other end of the rocker arm contacts the push rod. The amount of travel obtained during this movement will be the valve clearance.

4-102D. VALVE ADJUSTING PROCEDURE.

a. Establish top piston position on the compression stroke of the No. 1 cylinder.

b. After the top position of the piston for the No. 1 cylinder has been established, depress the rocker arm with the applicable tool to displace oil in the hydraulic tappet assembly.

NOTE

Force should be applied smoothly and evenly, since application of excessive force may damage the rocker arm or the push rod. It will require four or five seconds to displace all oil from the hydraulic tappet.

c. In the event no clearance is obtained, the tappet plunger will be removed and washed after which the clearance will be rechecked on engines where valve adjustments are provided.

d. Valves which are outside of the limits of .030 - .110 will be readjusted as necessary. On engines on which no adjustment is provided, the push rod will be replaced with a longer or shorter push rod as outlined in specific instructions for the engine.

e. Adjust all valves on succeeding cylinders in firing order as outlined in Valve Adjusting Chart, paragraph 4-102E.

f. Engines which incorporate valve clearance adjusting screws will have all valves which were readjusted, rechecked. Valve clearances which are outside the limits of .030 - .110 will be readjusted as necessary. Engines which do not incorporate adjusting screws will have the push rod changed to a longer or shorter rod, as necessary, to meet the specified limits of .030 - .110.

4-102E. VALVE ADJUSTING PROCEDURE.

Engine	Firing Order
0.470	1 6 3 2 5 4

4-102F. ESTABLISHING TOP DEAD CENTER.

a. Install a top center indicator, part No. WAC804177 (figure 4-31C) either in the front or rear No. 1 cylinder spark plug hole. In installing the top center indicator, the arm will have to be adjusted as necessary so that, when the piston moves through the full stroke, full-scale deflections on the indicator will be obtained.

b. Install a protractor and pointer on one arm of the engine accessory drive pads or applicable nose timing segment. (See figures 4-31D and 4-31E.)

c. Pull the propeller through in the direction of rotation until the cylinder is coming up on compression stroke of the applicable cylinder, which can be determined by the air pressure build-up.

d. Continue pulling the propeller through in the direction of rotation until the piston contacts the arm of the top center indicator and moves the indicating arm of the indicator to any one of the marks on the indicator. The mark chosen should be recorded for future reference.

e. With the piston stopped in the reference position, record the protractor readings in degrees, or set the pointer assembly for the protractor to specify any desired number of degrees. In either case, record the protractor readings.

f. Move the propeller in the direction of rotation until the top center indicator indicates that the piston has moved to the top of the stroke and is moving back down again. When top center indicator indicates the same identical position as was selected previously on the up stroke, rotation of the propeller will be stopped.

g. Again read and record the protractor reading in degrees. Top dead center will be halfway between the degrees recorded. Reset the pointer to zero for ignition timing.

h. After true top dead center has been established, it will be rechecked prior to making any adjustments on valves or ignition system, since slippage of the adjustable arm of the top center indicator or binding of the pointer on the protractor could cause an error in the reading obtained. Prior to adjusting ignition timing or valves, it is essential to establish the ratio of pointer travel to crankshaft travel, since use of the wrong protractor or failure to establish this ratio may result in improper adjustment.

4-103. PREPARING ENGINE FOR INITIAL GROUND RUN-UP.

a. Fill fuel tank with 5 gallons of fuel.

b. Make sure carburetor has been filled and diaphragms soaked with fuel. (Refer to paragraph 4-111.) Remove and clean fuel inlet screen.

c. Place 4 quarts of oil in oil sump.

d. Drain fuel accumulator water trap.

e. Check starter and primer operation, and security of all ignition wiring.

f. Inspect carburetor air scoop for foreign matter.

4-104. ENGINE INITIAL RUN-UP.

a. Start engine according to Pilot's Check List in cockpit.

b. Run engine at 800 rpm. (If oil pressure is not up to 10 psi within 10 seconds, stop engine and investigate.)

c. After running engine for approximately one minute, stop engine and inspect for fuel and oil leaks.

d. Again start engine and warm up slowly at 1200 rpm until 40.5°C (105°F) oil temperature is obtained. At 1700 rpm, check magneto drop and required instrument readings as given on Pilot's Check List.

e. At 1700 rpm, pull propeller control full out (decrease rpm). Note that rpm drops; then return control to full increase rpm position. Pull carburetor heat control out and note rpm drop. Push control in to turn off heat.

f. Adjust engine idling. (Refer to paragraph 4-112.)

g. Check engine for good acceleration.

h. Stop engine and drain oil sump; clean oil screens; then refill oil sump with new oil (capacity 10 quarts).

i. Remove and clean all fuel strainers (fuel tank, main fuel strainer, fuel pumps and carburetor).

j. Replenish fuel supply to capacity.

k. Install hinged cowling.

4-105. REMOVING ENGINE FROM MOUNT.

a. Turn ignition switch to "OFF" position.

b. Turn hydraulic shut-off control to "OFF", and stop fuel flow by pulling emergency shut-off control. (On L-17B and modified L-17A airplanes turn fuel selector to "OFF".) This will make it unnecessary to drain the complete fuel and hydraulic systems. Have a suitable container at hand to catch liquid remaining in the lines when the engine is being disconnected.

c. Remove propeller.

d. Remove access door on bottom of engine mount assembly, and drain oil system at engine sump and oil cooler. Replace drain plugs.

e. Remove hinged cowling door assembly and nose cowl.

f. Remove heater air intake duct and heater.

g. Remove heat shrouds from both exhaust manifolds.

h. Disconnect and remove exhaust manifold extension pipes from manifolds.

i. Disconnect fuel supply lines at carburetor and at both fuel pump outlets.

NOTE

These lines pass through engine mount bulkhead, and will remain with mount when engine is removed.

j. Disconnect fuel vapor return and fuel pressure line at connections located on forward right side of engine mount bulkhead.

k. On all L-17A airplanes, disconnect starter engaging cables at starter.

l. On L-17B airplanes disconnect the electric wiring at the starter engaging solenoid.

m. Disconnect electrical wiring at generator terminals.

n. Disconnect ground wires to magnetos.

o. Disconnect engine vent line at firewall connection.

p. Disconnect air blast hose at generator.

q. Disconnect primer hose connection located forward of the left bulkhead baffle; then remove baffle.

r. Disconnect oil pressure hose connection located on forward left side of engine mount bulkhead.

s. Disconnect oil inlet hose, at top of cooler radiator, and oil return hose (to engine) from fitting on left side of engine.

t. Disconnect fuel inlet hose (to fuel pumps) at firewall connection.

u. Disconnect hydraulic pressure hose at firewall connection, and hydraulic suction hose at connection on bottom of hydraulic reservoir.

v. Disconnect tachometer shaft at engine.

w. Disconnect throttle and mixture controls at carburetor.

NOTE

It is not necessary to disconnect the carburetor air control, as the air mixing chamber remains on the engine mount when engine is removed.

x. Disconnect electrical wiring to landing gear warning switch mounted on carburetor.

y. Disconnect air mixing chamber adapter from bottom of carburetor.

z. Place a suitable stand under tail skid to support airplane when it is relieved of engine weight.

aa. Attach hoist to fitting on top of engine, and manipulate hoist to relieve engine weight from the mount.

ab. Remove the four bolts securing engine to mount.

ac. Make a final thorough inspection to make sure all engine-to-mount and engine-to-firewall connections have been disconnected; then slowly hoist engine straight up. Steady engine while it is being hoisted, to avoid damaging closely fitted or projecting parts. When engine is clear of mount, swing engine away from airplane and remove exhaust manifolds, cylinder baffles, lines, and all accessories as necessary.

ad. Install engine on suitable stand or in shipping box.

4-106. FUEL-AIR INDUCTION SYSTEM.

4-107. The fuel and air induction system (figure 4-32) consists of a "PS" series Bendix-Stromberg carburetor, an air duct (containing an air filter), an air mixing chamber, and two exhaust manifold shrouds which provide heated air. Cold filtered air or hot air is directed in desired proportion to the carburetor by an air mixing chamber. An air valve in the air mixing chamber is controlled by a push-pull control in the cabin, for selection of filtered ram air through the air duct, or hot air from the shrouds around the exhaust manifolds. A riser, installed between the air mixing

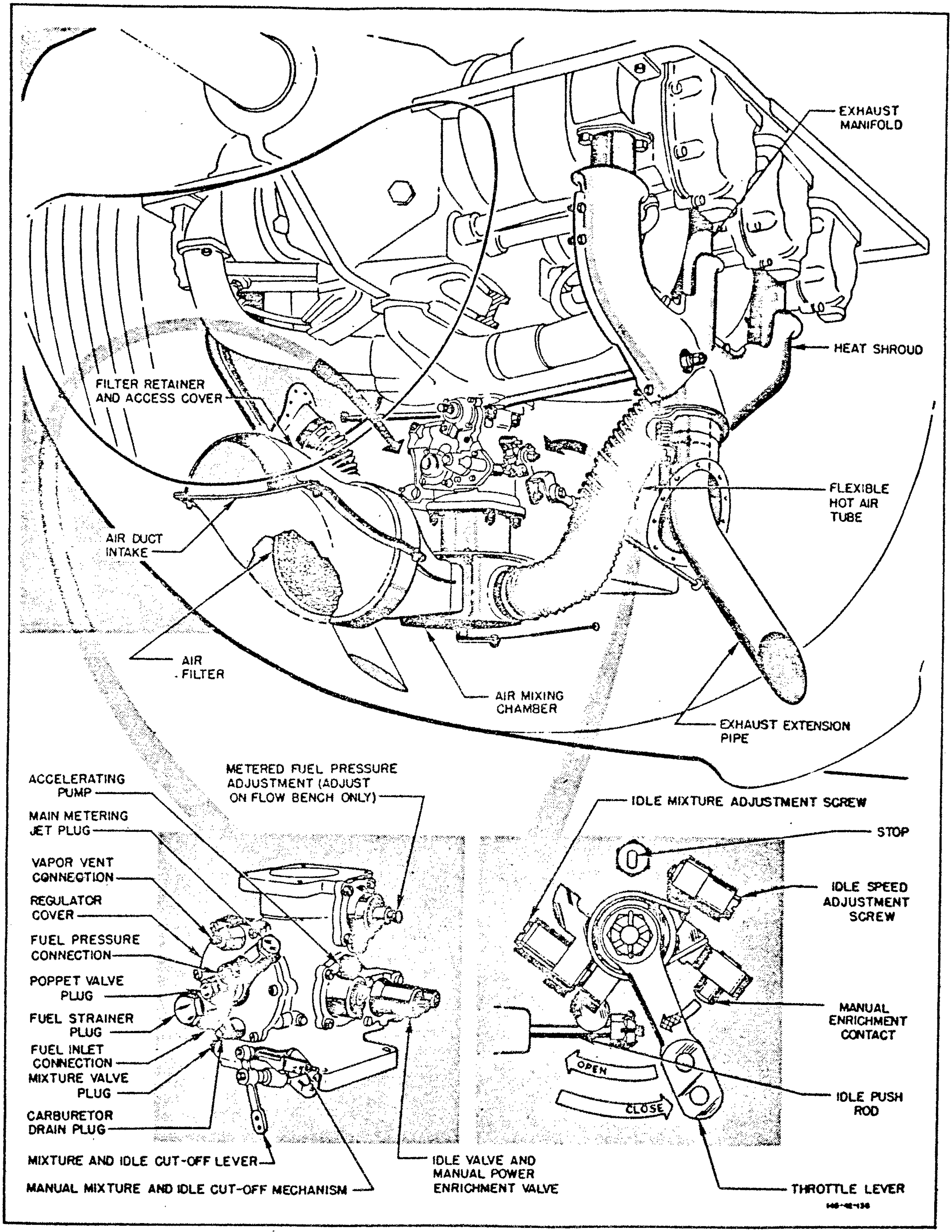


Figure 4-32. Fuel-Air Induction and Exhaust Systems

chamber and the carburetor, straightens the airflow through the carburetor to provide best carburetor performance. The air filter must always be in place during operation of the airplane.

4-108. CARBURETOR.

4-109. The carburetor (figure 4-33) Bendix-Stromberg PS-5C (parts list 380212-1 on all L-17A airplanes 380223-2 on L-17B airplanes) is a single barrel, updraft, injection type, incorporating a regulated pressure discharge nozzle, a mechanically operated enrichment valve, a manual mixture control, and an idle cut-off mechanism. The carburetor also incorporates a vacuum-operated, single-diaphragm accelerating pump. The main body of the carburetor contains a manually controlled butterfly-type throttle valve for controlling airflow, and a venturi tube for obtaining venturi pressure differential to afford a means of measuring the airflow through the carburetor. The venturi pressure differential is a measure of mass airflow, and is applied to the air diaphragm in the regulator section of the carburetor to regulate the fuel pressure across the fixed metering jet in the regulator fuel section. This regulation of pressure is in proportion to the mass airflow through the carburetor. Fuel enters through the strainer, passes through the diaphragm-controlled poppet valve to one side of the fuel diaphragm in the regulator fuel section, and then passes to the metering jet. The fuel then flows through the idle and power enrichment needle valve, and to the discharge nozzle, which opens when the fuel pressure, acting upon the discharge nozzle diaphragm, is great enough to overcome the force of the discharge nozzle spring, and sprays fuel under positive pressure into the engine intake manifold.

4-110 TROUBLE SHOOTING CARBURETOR.

TROUBLE	PROBABLE CAUSE	REMEDY
Engine idles too rich.	Improper idle adjustment.	Adjust.
	Carburetor poppet valve leaking.	Replace carburetor.
	Accelerating pump diaphragm leaking.	Replace carburetor.
Engine idles too lean.	Low fuel pressure.	Check pump output and strainers.
	Improper idle adjustment.	Adjust.
	Air leakage in intake system.	Check and correct.
Too lean at cruise power.	Leakage at 1/8-inch plugs in carburetor.	Tighten plugs.
	Faulty metering within carburetor.	Replace carburetor.
	Low fuel pressure.	Check pump output.
Too rich at cruise power.	Mixture control out of adjustment.	Adjust.
Engine fails to stop.	Mixture control out of adjustment.	Adjust.

4-111. PREPARING CARBURETOR FOR USE. Before starting the engine after the installation of a new carburetor, or one that has been previously drained, proceed as follows to fill, flush, and vent the carburetors, and to soak the diaphragms:

a. Connect an outside source fuel (or Stoddard solvent to reduce fire hazard) supply line to carburetor fuel inlet.

b. Remove the 1/8-inch drain plug located at the bottom of the regulator cover.

c. Open carburetor throttle lever about halfway, and move the mixture control lever to "FULL RICH" position.

d. Introduce fuel slowly through the carburetor, until the fuel flowing from drain plug is free of oil.

e. Replace drain plug and continue pumping fuel until a small amount of fuel discharges from the discharge nozzle.

f. Place the mixture control lever in the "IDLE CUT-OFF" position. Because the carburetor has a closed fuel system, it will remain full of fuel as long as the lever is in the "IDLE CUT-OFF" position.

g. Disconnect external fuel supply line, and connect airplane fuel supply lines.

h. Let carburetor stand for an 8-hour period before starting engine.

NOTE

This is important because the carburetor was originally calibrated with its diaphragms thoroughly soaked with fuel, and these diaphragms must be restored to this condition before the carburetor can be expected to function properly. If desired, the soaking operation may be performed prior to the installation of the carburetor on the engine.

4-112. ADJUSTING CARBURETOR. Special testing equipment, such as a flow bench, must be used to calibrate the carburetor and to obtain a definite and accurate check of the performance which the carburetor will provide under flight conditions. The only adjustment that can be made without a flow bench test, is the idle-mixture adjustment, which is made as follows:

a. Start and warm up engine until oil temperature is normal.

b. Check for proper magneto operation.

c. Close throttle completely to idle engine at approximately 600 rpm.

d. When the idling speed has stabilized, move cockpit mixture momentarily, but with a smooth, steady pull, into the "IDLE CUT-OFF" position, and observe tachometer for any change during the "leaning" process; then return control to "FULL RICH" position before rpm can drop to a point where engine cuts out. Rpm increase should be a minimum of 5 or a maximum of 10. An increase of over 10 rpm during "leaning" process is indicative of an excessively rich idle mixture; less than 5 rpm indicates an excessively lean mixture.

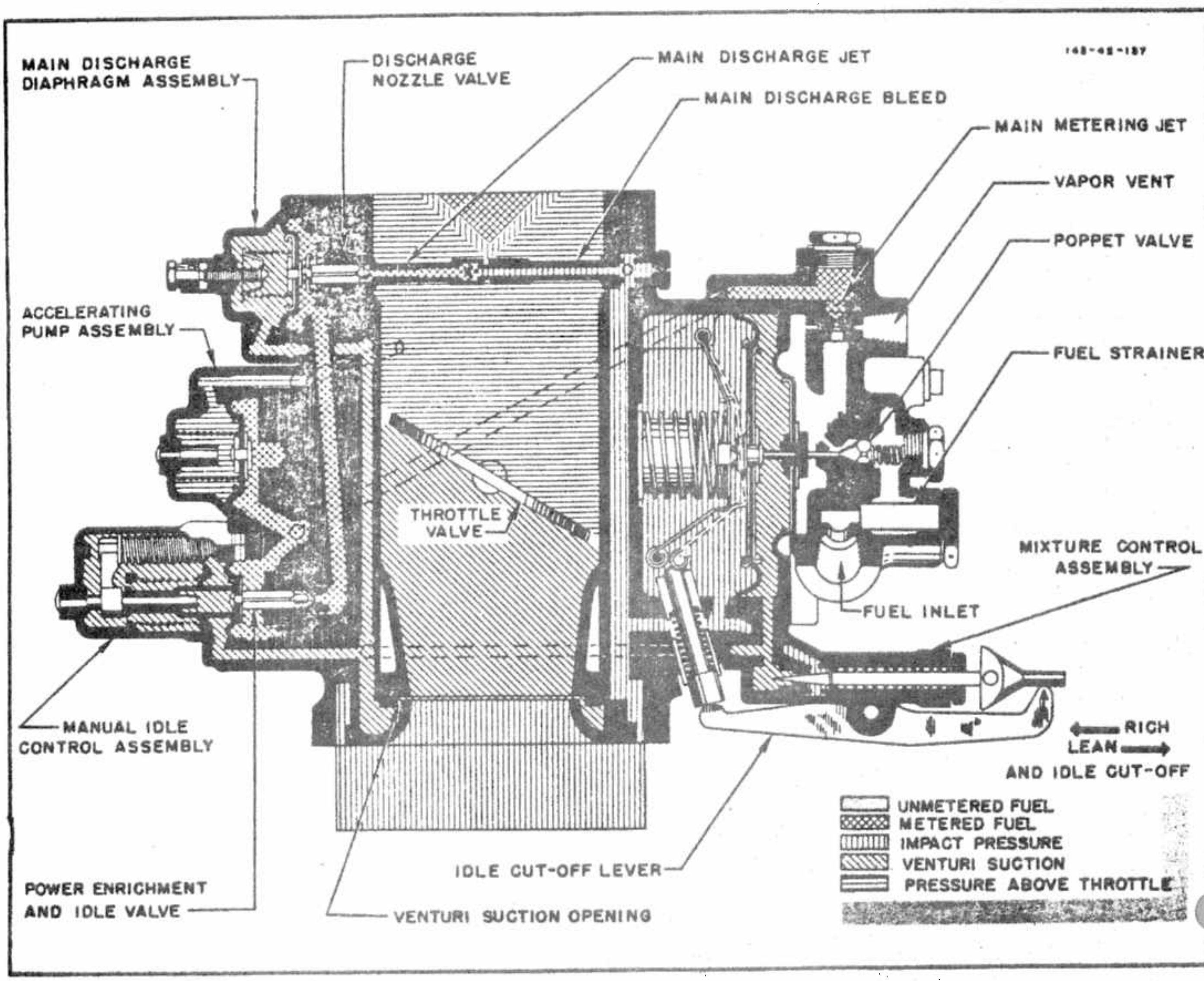


Figure 4-33. Schematic View of Carburetor

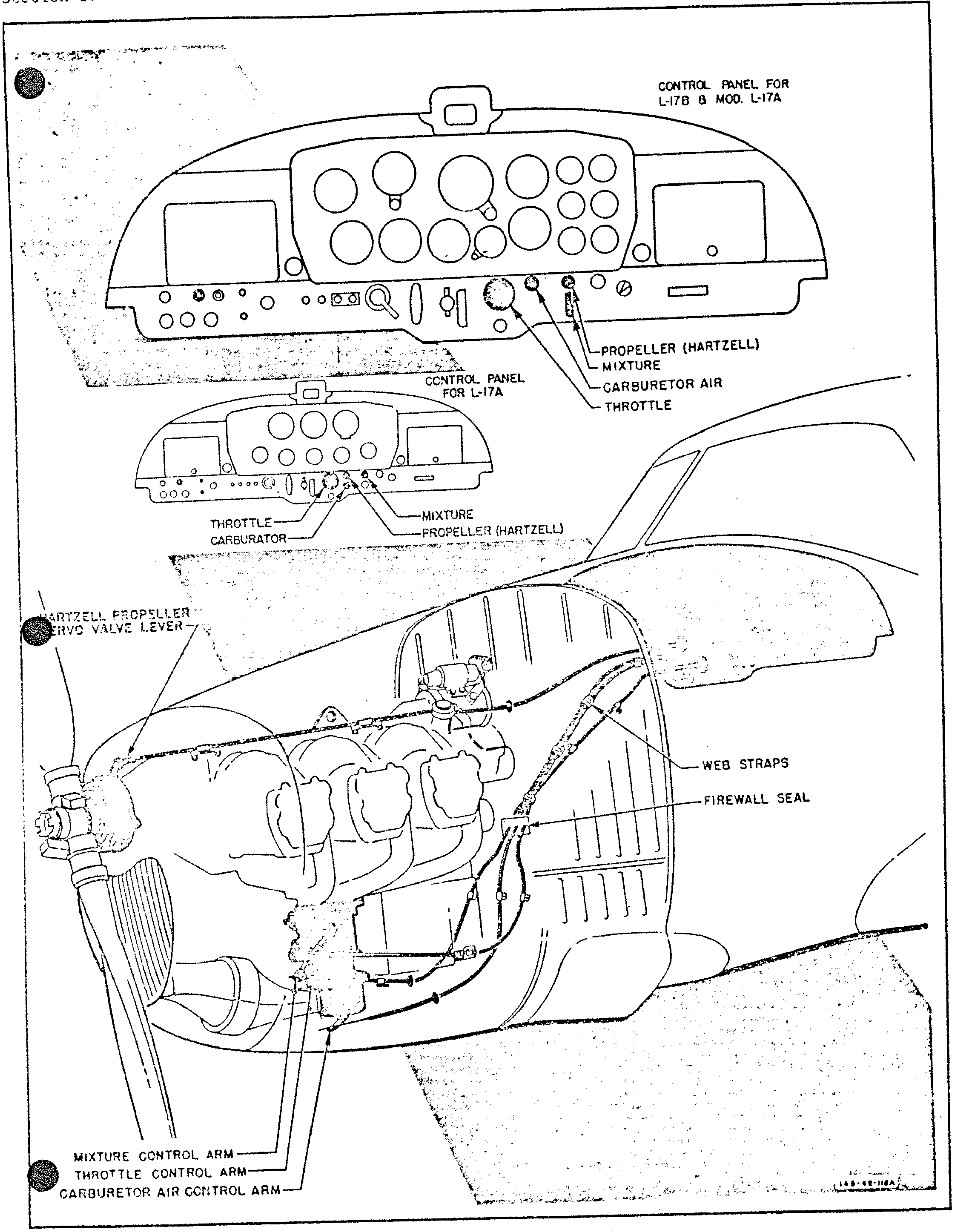


Figure 4-34. Engine Controls

e. If idle mixture adjustment if too rich or too lean, turn mixture adjustment (clockwise to lean, counterclockwise to enrich) one or two notches in the direction required. Check adjustment made, by repeating procedure d. Make additional checks if necessary, until a momentary pick-up of approximately 5 rpm (maximum 10 rpm) results when repeating check procedure given in step d.

NOTE

If idling rpm increases appreciably after a change in idle-mixture adjustment, readjust idle-speed adjustment to restore the desired rpm. Each time the idle-mixture adjustment is changed, run engine up to 2000 rpm to clear the spark plugs before proceeding with the rpm check.

f. Make final idle-speed adjustment to obtain the desired idling rpm with throttle closed. Turn idle-speed adjustment clockwise to increase rpm, counterclockwise to decrease rpm.

NOTE

The preceeding adjustment procedure aims at a setting that will obtain maximum rpm with minimum manifold pressure, and should eliminate frequent subsequent adjustments, except to correct for wide variations in weather and altitude changes. In case the setting does not remain stable, check the idle linkage; any looseness in this linkage would cause erratic idling. In all cases, allowance should be made for effect of weather conditions upon the idle adjustment. The idle adjustment will also be affected by the difference between a moist, hot day, and a cold day; on a cold day the engine will develop more power with an attendant higher rpm. The relation of the airplane to the direction of prevailing wind will affect propeller load and thus its rpm; hence it may be advisable to make the idle adjustment with the airplane crosswind.

4-113. CLEANING CARBURETOR AIR FILTER. The air filter should be removed from the airplane and cleaned as follows:

a. Immerse filter, dirty side down, in unleaded gasoline or other suitable cleaning fluid. While cleaning, rock filter or agitate cleaning fluid to remove dirt from the innermost part of the filter element.

b. Dry the filter thoroughly. When dry, immerse filter in engine oil (Specification AN-O-8, Grade 1065) for a period of 2 to 5 minutes.

NOTE

Make sure filter element is thoroughly dry before immersing in oil; otherwise, the filter will not be properly coated, resulting in impaired cleaning efficiency.

c. Drain the filter from 2 to 4 hours prior to installation to remove excess oil. If filters are too heavily lubricated, clogging may result.

4-114. ENGINE CONTROLS.

4-115. The engine is controlled from the cabin by flexible push-pull controls (figure 4-34), connected to the carburetor throttle lever, manual mixture and idle cut-off lever, propeller hydraulic servo valve, and the carburetor air control lever on the bottom of the air mixing chamber. The various control knobs are centrally located on the cabin control panel. The throttle control incorporates an adjustable knurled friction nut, while the mixture control has a serrated shaft for locking the control in the desired position.

4-116. INSTALLING ENGINE CONTROLS. The flexible controls should be installed from the cabin, and routed through the firewall to the engine section. The controls may then be attached to their respective controlling units.

CAUTION

Use extreme care, when installing the flexible controls, not to bend them in tight loops, as this will cause binding.

If the outer casing of any flexible control (except throttle) is too long to permit the inner wire to be attached to the unit, or interferes with full travel, pull the wire into the casing and cut off enough casing to fit the installation. Make sure that the web straps and clip securing the casings throughout the airplane are tight, and that they hold the casings firmly. If necessary, wrap friction tape on the casing under the straps and clips.

4-117. ADJUSTING THROTTLE, MIXTURE, AND CARBURETOR AIR CONTROLS.

a. Set all control knobs approximately 1/16 inch from the control panel for spring-back.

b. Set the throttle lever against full open stop; mixture control lever in "FULL RICH" position, and carburetor air control lever in cold air position; then attach flexible controls to their respective positioned levers.

c. Operate controls in cabin to determine that controls operate smoothly without binding throughout entire range of travel, and that a minimum of 1/16 inch spring-back is obtained. Make sure wire ends extending forward from levers do not strike or rub any object which might be damaged, or cause control travel to be limited. Cut or bend wires to clear.

4-118. ADJUSTING PROPELLER CONTROL. Refer to paragraph 4-124.

4-119. PROPELLER.

4-20. DESCRIPTION. The Hartzell HC 12x20-7 hydro-selective propeller (See figure 4-36) utilizes engine oil pressure and counterweights as controlled by a servo valve, to effect blade pitch changes. Blade pitch change is directly proportional to the amount of movement of the servo valve cylinder (manually controlled by a flexible cable). Forward movement of the servo cylinder directs engine oil pressure into the jack cylinder to decrease blade pitch. Aft movement of the serve cylinder allows oil to flow from the jack cylinder so that the counterweights may increase blade pitch. The servo valve cylinder is moved either forward or aft of neutral, by the manual control, to permit selection of high, low or any intermediate pitch. The servo valve piston is moved in or out by the movement of the jack plate, which moves the blades, to return the servo valve to neutral, as soon as the original movement of the servo cylinder has been compensated for. When the control is pushed in, the servo valve introduces oil under pressure into the jack cylinder, which moves the jack plate forward. Links connecting the jack plate and blades, move forward to decrease the blade pitch angle. When the control is pulled out, the servo valve opens the outlet port. Centrifugal force acting upon the counterweights moves the blades in to increase the pitch angle position. The links connecting the blades and jack plate, move the jack plate aft, forcing the oil through the servo valve back to the engine. The extreme blade angle settings, measured at station 30, are 14 degrees for low pitch and 22.5 degrees for high pitch.

4-121. TROUBLE SHOOTING, PROPELLER.

TROUBLE	PROBABLE CAUSE	REMEDY
Failure of pitch to change.	Low oil pressure.	Check oil system.
	Congealed oil in piston-cylinder assembly.	Run engine sufficiently to warm oil.
	Worn blade bearings.	Replace.
	Blade clamps too tight.	Loosen.
Maximum rpm too high.	Low-pitch stop bolt incorrectly adjusted.	Adjust.
	Blade angles incorrect.	Set blades.
Oil leakage.	Worn of damaged "O" rings.	Replace.
Blade bearings worn excessively.	Insufficient lubrication.	Replace bearings.
Blades turning in clamps.	Loose clamp bolts.	Tighten to specified torque.

4-122 THROUGH 4-129 (DELETED)

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Figure 4-35 deleted.

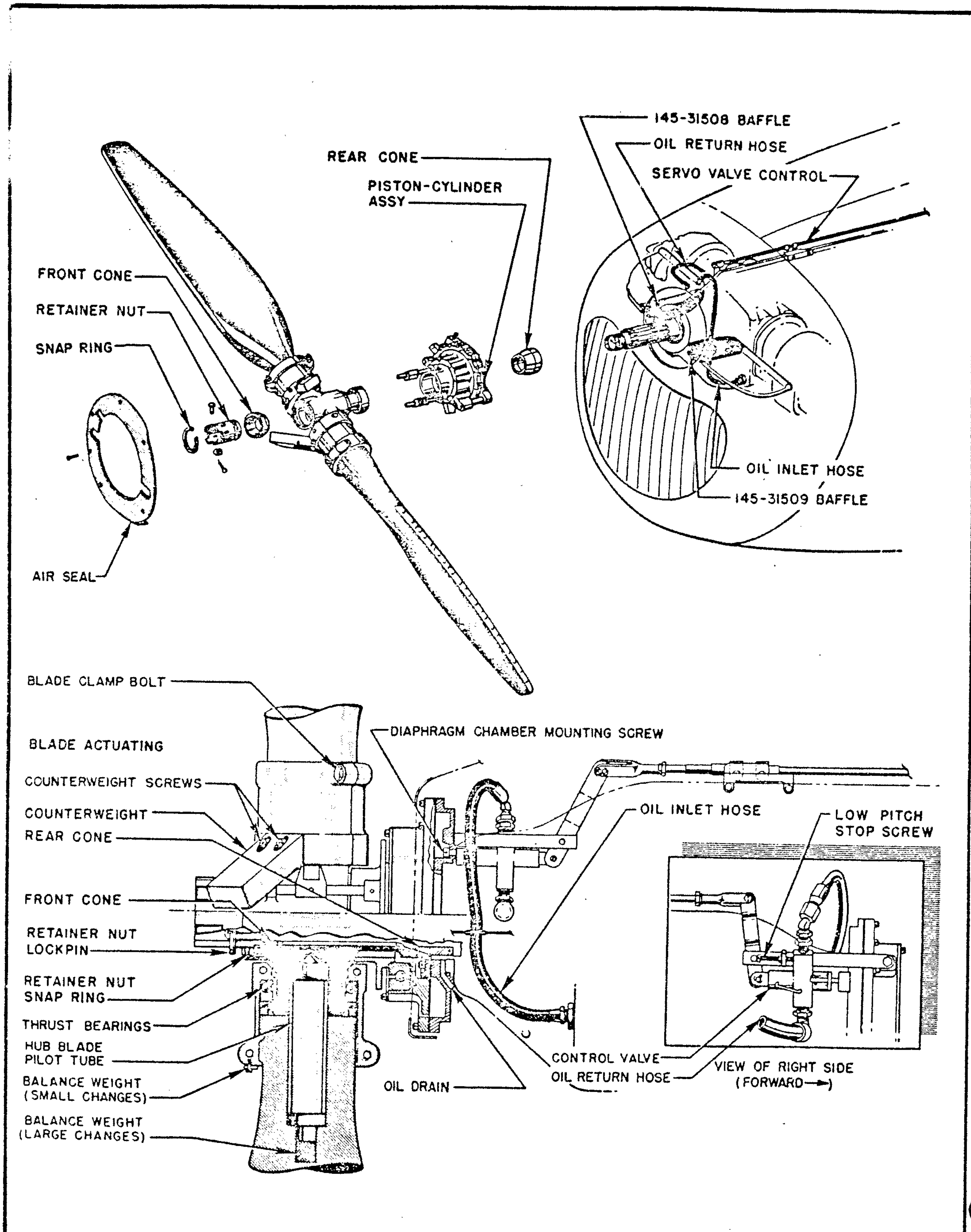


Figure 4-36. Propeller Assembly and Installation, L-17B and L-17C (Modified L-17A) Airplanes

4-130. REMOVING PROPELLER.

a. Make certain that the ignition is "OFF" and that the magneto ground wires are connected.

b. Remove the clevis pin from the propeller retainer nut.

c. Unscrew the propeller retainer nut.

d. Spread the counterweights by hand, until it is possible to rotate the jack plate clockwise and disengage the blade actuating links from the blade shanks.

e. Remove the propeller from the propeller shaft.

CAUTION

Do not hammer propeller or pry to break it loose.

f. The rear cone may be removed at this time or subsequently, as desired.

g. Remove the bolt holding the servo neutralizing linkage to the jack plate stud.

h. Remove the jack plate.

i. Disconnect the servo valve control cable from the servo control link, and disengage the servo valve oil lines.

j. Remove the screws holding the outer diaphragm retainer ring in place, then remove the retainer ring.

k. Fold the diaphragm back and remove the four Allen head screws which mount the jack cylinder to the engine.

l. Taking care to not damage the mounting gasket, remove the jack cylinder assembly from the engine.

m. If propeller is not to be installed immediately, wrap the propeller shaft with an oil soaked rag and install a thread protector on the end of the shaft.

4-131. INSTALLING AND ADJUSTING PROPELLERS. Prior to installation of the propeller the propeller shafts will be treated with corrosion preventive compound, Specification No. AN-C-124, to prevent corrosion of the engine propeller shaft due to exposure.

a. Clean the propeller shaft and thrust nut with dry cleaning solvent, Specification No. P-S-661, and inspect the cleaned areas for corrosion.

b. Clean shaft threads and splines thoroughly and make certain that shaft threads are not burred or pulled.

c. If corrosion is present, remove the thrust nut and repeat cleaning process being careful not to permit any of the solvent to enter the engine.

d. Remove the corrosion by polishing the affected areas with crocus cloth or with a small hand buffing wheel, using jewelers rouge or suitable substitute. Do not use any abrasive coarser than that specified.

e. In case the propeller shaft is pitted, the decision regarding further operation will depend on the dept, character and number of pits.

f. Clean the shaft to remove traces of corrosion and polishing agents.

g. Reinstall thrust nut and tighten to proper torque.

h. Fill the cavity between the thrust nut and the propeller shaft with corrosion preventive compound, type 1, Specification No. AN-C-124.

i. Apply a thin coat of corrosion preventive compound, Specification No. AN-C-124, to the propeller shaft.

j. Install a piece of 1/8-inch rubber sheet, class 2, Specification No. MIL-R-6891 in the slot of the rear cone. Using a razor blade or sharp knife, trim the rubber to the contour of the rear cone cross section, being careful not to permit any rubber to protrude beyond the surface of the cone.

k. Coat the shaft area of the rear cone seat liberally with corrosion preventive compound, Specification No. AN-C-124.

l. Remove piston from cylinder by removing valve link screw and sliding piston forward.

m. Remove diaphragm by removing outer and inner diaphragm retainer rings.

n. Mount cylinder on engine with four (5/16-18) Allen head cap screws. Have guide pins on horizontal plane and servo valve on upper left side of cylinder. Use paper gasket and gasket compound between cylinder and face of engine. Use 1/16 inch thick aluminum or copper washers under screw heads. Make certain screws do not bottom before pulling up tight. Safety screws.

o. Install rubber diaphragm with inner and outer diaphragm rings.

CAUTION

Apply a thin film of non-hardening gasket compound, Specification No. MIL-L-6032, to face of cylinder clamping surfaces. This precludes the possibility of subsequent leakage after the rubber takes a mild set due to the clamping action. Tighten all screws finger tight (do not squeeze rubber of diaphragm) plus an additional 1/4 to 1/2 turn only. Safety with wire without altering screw tightness.

p. Connect hydraulic lines to servo valve.

CAUTION

If propeller shaft and retainer nut holes do not line up, tighten retainer nut slightly until alignment can be obtained. Do not loosen retainer nut to obtain alignment for locking pin installation.

ag. Install washer and cotter pin on locking pin.

NOTE

In some cases it may be necessary to use a 3/16 inch lock pin when clearance is not available for the 1/4 inch pin.

ah. Connect push-pull control wire to servo valve lever. When connecting control to lever, place piston in forward position with 1/8 inch gap between jack plate collar and propeller hub; and valve body 3/8 inch from valve plate (near mid position); also push-pull control should be pulled out from dash about 1/8 inch.

ai. Run up engine and set low stop pitch control to provide proper static rpm (2300± 25).

aj. Upon completion of the preceding installation, make an operational check of the jack plate clearance. In the full forward position of the diaphragm, (maximum rpm) with engine running, there must be a minimum of 1/8 inch clearance between the jack plate collar and propeller hub. Clearance may be observed from the side of the airplane while the engine is running.

NOTE

This clearance must be observed while the engine is running, as the propeller counter-weights will cause a change in the propeller pitch as the engine is stopped. It is realized that no measurement can be taken while the engine is running; however, if the clearance is obviously less than 1/8 inch the low pitch stop must be adjusted to provide clearance.

It is important that this jack plate to hub clearance be maintained to preclude any possibility of overloading engine thrust bearing with propeller.

ak. If the foregoing instructions are fully complied with, the maximum static rpm will be approximately 2300. This adjustment should give a maximum sea level take-off of 2600 with approximately a 500 rpm control range when the propeller control is moved from full increase to full descrease rpm.

DO NOT attempt to increase this control range, if it will cause over-deflection of the diaphragm of more than 3/16 inch forward.

DO NOT attempt to increase the maximum take-off rpm above 2600 as the engine, airplane and propeller combination is not approved for any setting in excess of 2600 rpm and any attempt made to so adjust the propeller will result in a decreased clearance between the propeller hub and jack plate with subsequent possible overloading of the thrust bearings.

al. If the propeller change to high pitch is sluggish, check the length of the propeller counter-weights. Proper length is 4-5/16 inches. On some early airplanes it was necessary to add plates to the ends of the counter-weights as a means of attaining proper length. Any counterweight with drilled and tapped holes on the ends, if not 4-5/16 inches long, should be equipped with steel plates, as necessary, to attain the proper length.

am. Warm up engine and operate for approximately 15 minutes.

an. Retorque propeller for tightness.

4-132. ADJUSTING PROPELLER BLADE SETTINGS. If the desired maximum rpm cannot be obtained the blade settings in the hub must be changed rather than removing spacers from back of the rear cone. The blade settings may be changed by the following procedure:

a. If propeller and clamp are not already indexed, scribe a reference line from the propeller blade to the blade clamp.

b. Loosen the outboard clamp bolts.

c. Rotate the blade in the clamp as necessary to increase the maximum rpm. A movement of the blade of 1/32 inch in the clamp will effect approximately a 1° change in propeller pitch and will change the maximum rpm approximately 100 rpm. Decrease blade pitch to increase rpm.

d. Tighten the clamp bolts (torque to 20 ft pounds) and repeat the procedure for the other blade.

CAUTION

It is essential that the pitch change of both blades is identical.

4-133. REPLACING PROPELLER BLADES. If a blade is damaged beyond repair, it may be replaced, provided the assembly (without control unit) is properly balanced prior to installation. Small changes in balance are made by the addition or removal of weight slugs on the blade clamps. Large changes that may be required are made by adding or removing lead weight in the blade shank. (Lead is in 3/4-inch hole beyond hole for hub pilot tube.)

4-134. STARTING SYSTEM.

4-135. GENERAL. On L-17A airplanes, the starter system (figure 4-37) includes a 12-volt, direct-cranking starter motor,

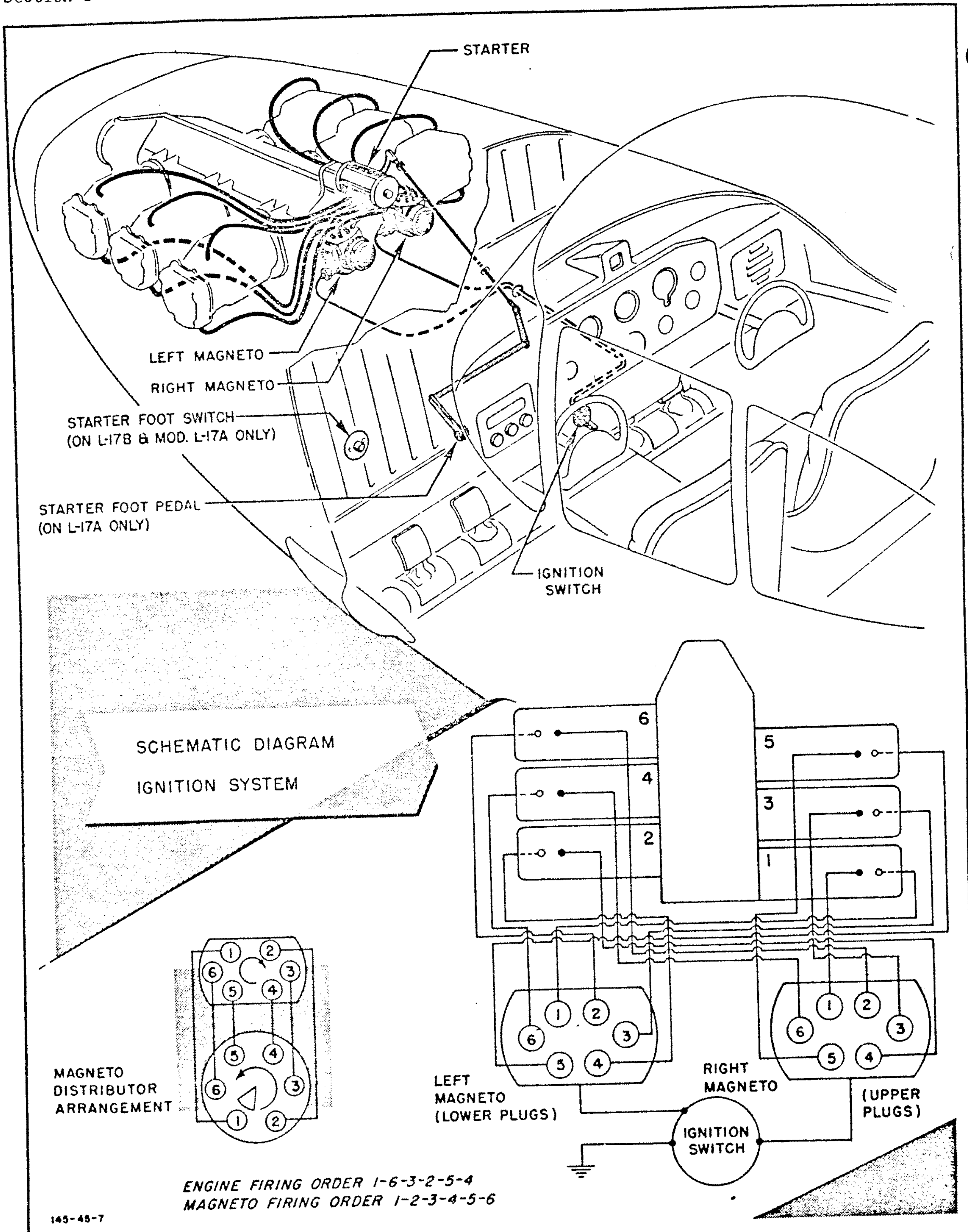


Figure 4-37. Starting and Ignition Systems

mounting a manually controlled switch. The starter switch is actuated by the starter shift lever, which is connected by a cable to a foot pedal mounted on the cock-pit side of the firewall. The starter is wired through the battery-disconnect relay which must be turned on before the starter will be operable. On L-17B airplanes the starter manual engaging control has been replaced by a solenoid engaging switch. The starter foot control is mounted at the same place that the manual control was previously located.

4-136. TROUBLE SHOOTING STARTING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Starter fails to operate, or turns engine over very slowly.	Low battery.	Charge.
	Loose or dirty cable connections.	Clean and tighten.
	Dirty or worn brushes.	Clean or replace.
	Dirty commutator.	Sand or turn.
Oil leak from clutch assembly.	Faulty starter springs.	Replace.
	Bad clutch housing seal.	Replace.
Starter runs at normal speed without cranking engine.	Faulty clutch.	Replace if necessary.
Brushes arcing.	Brushes worn or dirty.	Replace or clean.
	Weak brush springs.	Replace.
Starter runs at high speed without cranking engine.	Broken engaging mechanism shaft.	Replace.
	Faulty clutch.	Replace.
	Broken engaging spring.	Replace.
	Broken or stripped gear.	Replace.

4-137. STARTER.

4-138. GENERAL. The starter (on L-17A airplanes Delco-Remy No. 1109658, on L-17B airplanes Delco-Remy No. 1109660) is a direct cranking electric motor, incorporating an over-running clutch-type drive. The shift lever moves the clutch assembly on the spline shaft, shifting the pinion into mesh with the engine drive gear. As the shift lever reaches its limit of travel, it closes the starter switch contacts, and starting takes place. After engine has started, and the lever is being released, the starter switch is opened and the pinion withdrawn from the engine drive gear by spring action. The starter bearings, as well as the clutch over-ride mechanism, are packed with special high-melting-point grease during initial assembly, and require no further lubrication. Never attempt to relubricate starter, or to repair a defective clutch.

4-139. MEASURING STARTER BRUSH SPRING TENSION. To measure starter brush spring tension, proceed as follows:

a. Remove cover band for access to starter brushes and spring.

b. Connect one end of spring scale to brush holder. Raise spring brush holder approximately 1/8 inch above the top of brush box; the spring tension reading should be between 24 and 28 ounces. Springs which do not have said tension should be replaced.

4-140. REPLACING STARTER BRUSHES. To replace starter brushes, proceed as follows:

a. Remove brush leads, being careful not to tear or damage brush lead sleeving.

b. Raise spring brush holder, and remove brush.

c. Install new brush, making sure that brush lead sleeving is not burned or frayed, and properly covers brush leads.

d. In most cases, brushes will not seat properly when first installed. If facilities are not available for running in the brushes, insert a strip of No. 00 sandpaper between brushes and commutator (sanded side facing brushes), and pull strip in direction of rotation. Keep sandpaper in same contour as commutator. Repeat operation until all new brushes are fully seated.

CAUTION

Never use coarse sandpaper or emery cloth.

e. Thoroughly clean starter of all sand and metal particles; replace cover band.

4-141. CLEANING COMMUTATOR. To clean commutator, proceed as follows:

a. If commutator is found to be dirty, it may be cleaned with a strip of No. 00 sandpaper.

CAUTION

Never use emery cloth to clean commutator.

b. Blow dust from starter motor after cleaning commutator.

c. If commutator is rough, or out of round, or has high mica insulators (causes which contribute to excessive brush wear), starter should be removed from airplane, and disassembled. Turn commutator down in a lathe, removing only sufficient material to true up commutator and remove rough or high mica. Undercut the mica 1/32 inch.

4-142. ADJUSTING STARTER ENGAGING MECHANISM, L-17A AIRPLANES. See figure 4-38 for detailed procedure.

NOTE

The adjustment is necessary to make sure that starter and engine drive gears are meshed before starter is energized. It is imperative that the adjustment be checked each time a starter switch or a starter is replaced.

4-142A. ADJUSTING STARTER ENGAGING MECHANISM, L-17B AND L-17C (MODIFIED L-17A) AIRPLANES. In order to establish full current

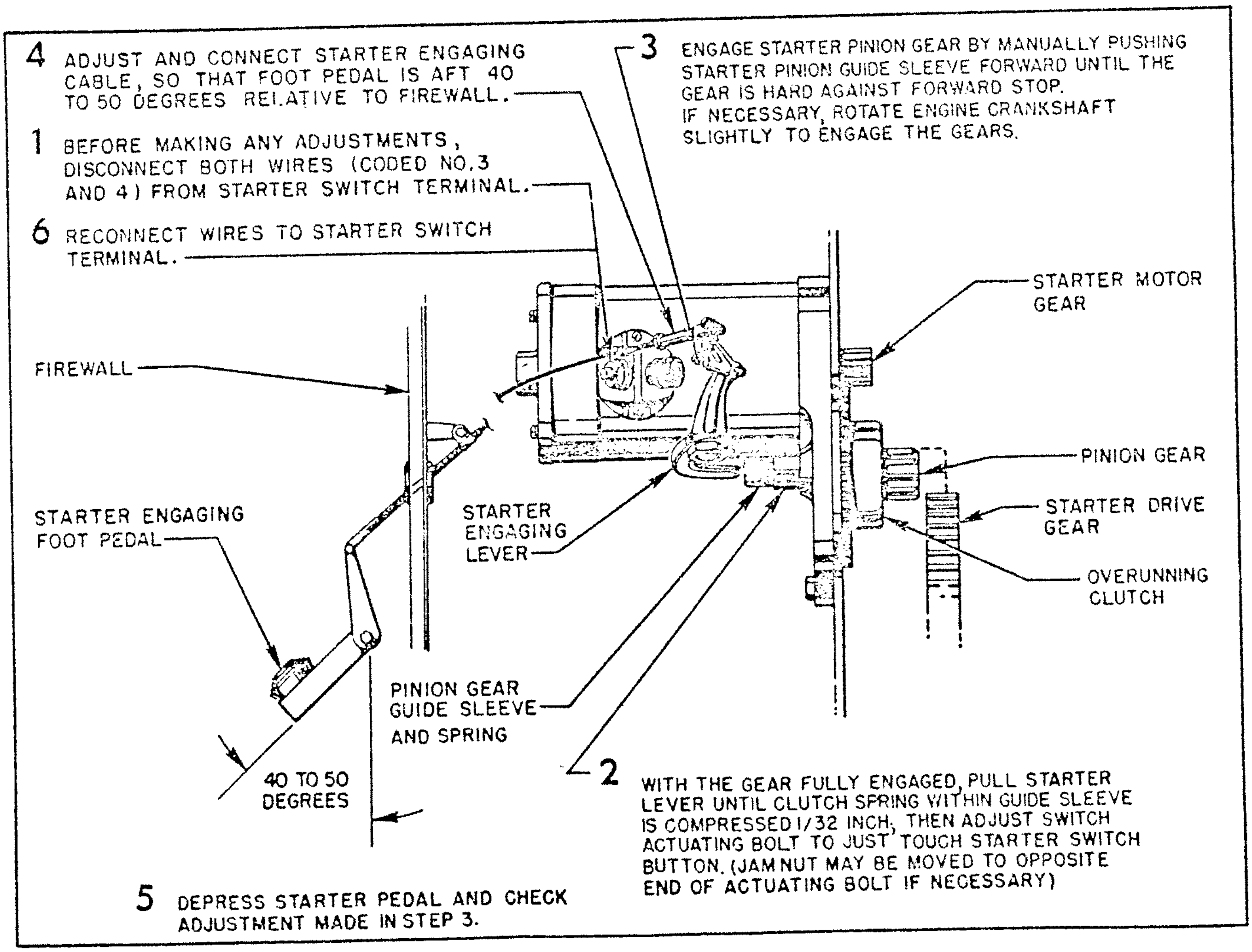


Figure 4-38. Adjusting Starter Engaging Mechanism, L-17A Airplanes

consists of two impulse-drive type magnetos, radio-shielded ignition wiring, 12 spark plugs, and an ignition switch.

The ignition switch stops operation of the magnetos by grounding the magneto primary coils at the breaker assemblies.

4-145. TROUBLE SHOOTING IGNITION SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive rpm drop on single magneto.	Magneto points dirty or out of adjustment.	Clean or reset.
	Weak breaker arm spring.	Replace.
	Breaker cam follower worn.	Replace.
	Incorrect magneto timing.	Check timing.
	Cracked or burned distributor rotor or block.	Replace.
	Bad coil or condenser.	Replace.
	Defective wiring or switch.	Correct.
Weak spark.	Faulty spark plug terminals.	Replace.
	Incorrect spark plug gap.	Set gap.
	Spark plugs fouled.	Clean or replace with hotter plugs.
Engine roughness at altitude.	Bad harness.	Replace wiring.

4-146. MAGNETOS

4-147. EISEMAN MAGNETOS (L-17A AIRPLANES). The magnetos (Eiseman LA6) are single, flanged-mounted, impulse-drive type. The right magneto fires the top spark plugs; the left magneto fires the lower spark plugs. The magnetos incorporate impulse drives that give an intensified spark for easy starting, and automatic spark retard during engine cranking. The breaker cam of each magneto has two lobes on the rotating magnet shaft. The distributor rotor, driven by the rotating magnet shaft through a fiber gear, conducts the high-tension current from the coil to the distributor cover electrodes, and thence through the high-tension cables to the spark plugs at the firing interval of the engine. The magneto bearings are packed with high-temperature grease when the magnetos are assembled. Further lubrication is not necessary, except at overhaul periods. The gap setting for the breaker points is .020 (± .002) inch.

4-148. ADJUSTING EISEMAN MAGNETO BREAKER ASSEMBLY. To adjust magneto breaker assembly, proceed as follows:

CAUTION

Care should be taken in removing the distributor section, to pull it straight back from the main housing until dowels, distributor rotor, and coil contactor are clear, before attempting to swing it aside.

a. Remove the two screws holding cable plate to end plate; then remove the three screws securing adapter to end plate. The entire distributor section of the magneto may then be swung back, giving access to magneto operating mechanism.

b. Turn engine crankshaft until cam follower bears on top of a cam lobe, thus giving maximum contact point separation.

c. Slightly loosen the two screws securing breaker assembly in end plate. Turn breaker adjusting eccentric screw to set breaker point gap to .020 (± .002) inch, as determined by feeler gage; then tighten breaker assembly screws. Turn engine crankshaft until cam follower is on top of other cam lobe, and recheck gap clearance.

NOTE

Make sure feeler gage used to check clearance is free of dirt or oil.

d. Reassemble distributor section and attach it to main housing, making sure that the carbon brush is properly located and not broken, and that the dowels enter squarely.

4-149. TIMING EISEMAN MAGNETO'S TO ENGINE.

To time magnetos to engine, proceed as follows:

a. To time the left magneto, turn crankshaft counterclockwise until No. 1 cylinder is 26 degrees before top dead center on its compression stroke.

b. Check breaker point gap setting and adjust if necessary; then turn magneto rotor shaft opposite to direction of rotation, to avoid engagement of impulse starter, until distributor rotor electrode is centered in the No. 1 cable position, which is at approximately 7 o'clock. (See figure 4-37.)

c. With magneto so set, engage magneto drive shaft with engine drive, so that mounting studs are approximately in center of magneto flange slots. Install washers and nuts on studs, leaving nuts loose enough to allow for angular adjustment on magneto flange pilot.

d. Attach a timing light across breaker points, or insert a .0015-inch feeler gage between points; then make angular adjustment by turning magneto counterclockwise until timing light dims out, or until feeler gage is freed by the separating points. With the magneto in this position, tighten mounting flange nuts.

e. If magneto cannot be timed within range of flange slots, remove and reindex magneto on flange to obtain maximum amount of angular adjustment in direction required.

f. To time right magneto, turn engine crankshaft until No. 1 cylinder is 26 degrees before top dead center and on its compression stroke; then proceed to time magneto to engine as explained in steps b. through e.

4-150. BENDIX-SCINTILLA MAGNETOS (L-17B AND MODIFIED L-17A AIRPLANES). The magnetos (Bendix-Scintilla S6LN-21) are single, flange-mounted, impulse drive type; employing two pole rotating magnets.

4-151. ADJUSTING BREAKER ASSEMBLY, BENDIX-SCINTILLA MAGNETOS. To adjust the magneto breaker assembly, proceed as follows:

a. Remove the breaker cover and timing inspection plug.

b. Look into the timing inspection hole and turn the magneto until the white tooth on the large gear is lined up with the timing pointer.

c. With the timing marks lined up, the breaker should be just starting to open.

d. If the points do not break at this position, loosen the screw in the slotted hole of the breaker assembly and shift the breaker slightly so that the points just break contact when the timing marks are lined up.

NOTES

If the breaker points are oily, they can be cleaned with a little clear gasoline. Avoid getting any gasoline on the breaker cam, as it is impregnated with lubricant which would be washed away with gasoline or solvent.

If the breaker points are burned or worn excessively, remove and test the condenser.

Do not try to redress the contact surfaces. If the points are in unsatisfactory condition, install a complete new breaker assembly.

CAUTION

Do not under any circumstances remove the five screws which hold the two sections of the magneto together, while the magneto is on the engine. To do so would disengage the distributor gears, causing the distributor timing to be "lost" and necessitating complete removal and retiming of the magneto.

4-152. TIMING BENDIX-SCINTILLA MAGNETOS TO ENGINE. To time the magnetos to the engine, proceed as follows:

a. Check the breaker assembly adjustment as explained in paragraph 4-151 preceeding; leaving the timing marks lined up at the completion of the check.

b. To time the left magneto, turn the crankshaft counter-clockwise until No. 1 cylinder is 26 degrees before top dead center on its compression stroke.

c. Continue the adjustment according to steps c. through f. of paragraph 4-149 preceeding.

4-153. SPARK PLUGS.

4-154. Each cylinder is fired by two radio shielded spark plugs. An inspection should be made to determine whether 14 mm or 18 mm bushings are installed. Engine models with 18 mm spark plugs are designated as 0-470-7A, whereas engines with 14 mm plugs will continue as model 0-470-7. Approved spark plugs are listed in Technical Order 03-5E-3.

4-155. SPARK PLUG GAP SETTING. Recommended spark plug gap is .016 (+.002 - .001) inch.

CAUTION

Never reset spark plug gap with thickness gage between side electrode

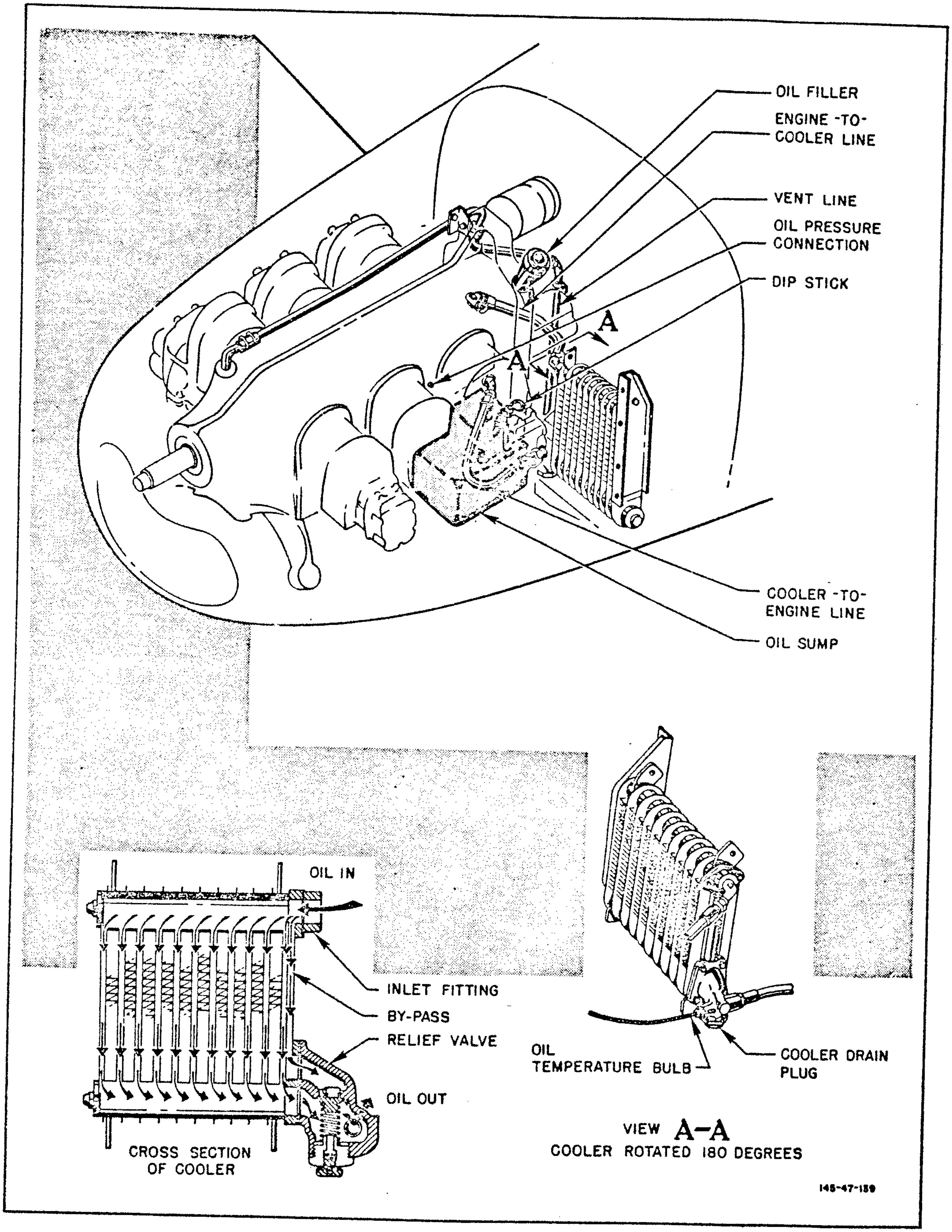


Figure 4-39. Oil System

and center electrode. Such resetting will damage the core insulation.

4-156. INSTALLING SPARK PLUGS. To install spark plugs, proceed as follows:

a. Clean rust-preventive compound from shell threads, electrodes, and core insulation of each spark plug.

NOTE

Carbon tetrachloride may be used only on the shell thread to remove rust-preventive compound.

b. Dry spark plugs with air blast.

c. Check electrode gap .010 (+.002 -.001) inch.

d. Install solid copper gasket on each spark plug.

e. Lubricate plug threads lightly with thin film of thread lubricant.

CAUTION

Do not lubricate cylinder insert threads, and avoid getting lubricant on electrodes.

f. Install spark plugs, and tighten to a torque of 300 to 360 inch-pounds.

CAUTION

Do not install any spark plug that has been dropped on floor or hard surface. Do not install or tighten spark plugs when engine is hot. If it is absolutely necessary to install spark plugs on an excessively hot engine, install plugs finger-tight plus 1/2 turn.

4-157. OIL SYSTEM.

4-158. The engine is lubricated by a wet-sump pressure system of 10.5 quarts capacity. The system consists of an oil cooler, oil cooler relief valve, oil cooler shutter, engine oil pump, filter, and pressure regulating valve (See figure 4-39.) Oil, drawn from the sump, is delivered by the pump to the oil cooler and then thru the pressure regulating valve to the engine, from which the oil drains back into the sump. The non-adjustable pressure regulating valve is preset to relieve at approximately 50 psi. Fittings at the front of the engine allow oil pressure to be used for operating the propeller. The filler cap is at the top left side of the engine. The oil quantity dip stick, located at the left rear of the engine, is calibrated in quarts. The engine crankcase is vented by a breather tube leading from the nose section of the engine to the right engine cooling air exit louvre. An oil temperature bulb is located in the oil cooler relief valve housing.

4-159. OIL COOLER.

4-160. The oil cooler is mounted in the left side of the engine compartment, on the engine mount bulkhead. The cooler consists of cooling fins, by-pass port, and a cooler relief valve mounted in the outlet side on the bottom of the cooler. The non-adjustable cooler relief valve is set to open when a pressure drop across the cooler (created by congealed oil) exceeds 25 psi. Air is directed through the cooler by engine baffles. Oil from the engine enters the cooler at the top, and normally flows through the cooling plates to the outlet port, back to the engine. When the oil is congealed, and a difference in pressure in excess of 25 psi exists across the relief valve, the valve opens and allows the oil to by-pass the cooler back to the engine. When the oil temperature rises, thus reducing the pressure, the relief valve closes and oil is directed to its normal path through the cooling plates.

4-160A. OIL COOLER SHUTTER, L-17B AND L-17C (MODIFIED L-17A) AIRPLANES.

4-160B. A shutter assembly, mounted on the air baffle forward of the oil cooler, is used to partially or completely prevent flow of air through the oil cooler, when higher oil temperatures are desired. The oil cooler shutter is adjusted by a push pull knob on the control panel, above the radio panel cutout. Movement of the knob aft closes the shutter. The shutter is held in the desired position by the meshing of notches in the control rod with a lock plate attached to the control panel.

4-161. FUEL SYSTEM.

4-162. GENERAL, L-17A AIRPLANES. The fuel system consists of two wing tanks, an accumulator tank, two engine-driven fuel pumps, fuel shut-off valve, hand primer, and a fuel quantity transmitter and indicator. (See figure 4-40.) Fuel, gravity fed from the two main fuel tanks into the accumulator tank, flows through an integral finger-type strainer to the two engine-driven pumps. From the pumps, fuel under pressure flows to the carburetor. A fuel shut-off valve, located in the line between the accumulator tank and the fuel pumps, is operated by a push-pull control on the right side of the control panel. The hand primer, located at the upper left corner of the control panel, obtains its fuel supply from the shut-off valve and pumps it directly into the intake manifold. An electrical fuel level transmitter in the left tank registers the fuel level in both tanks. A gage on the instrument panel registers up to 30 gallons of fuel. The tanks are vented by an interconnecting line which extends into the atmosphere under the left side of the fuselage near the leading edge of the wing. To prevent over-flow, the interconnecting vent line is routed to a high position in the fuselage forward of the cabin.

4-163. GENERAL, MODIFIED L-17A AIRPLANES. The fuel system (see figure 4-41) consists of two wing tanks, an auxiliary tank, auxiliary tank sump, accumulator tank, electric-driven pump, engine-driven pump, strainer, check valve, relief valve, three-way valve, hand primer pump, and fuel quantity and pressure indicating systems. Fuel from either the interconnected wing tanks sump or the auxiliary tank sump is supplied to the fuel pumps through the three-way valve. This valve may be used to supply fuel from either wing or auxiliary tanks, or to turn all fuel flow "OFF".

CAUTION

Do not operate the airplane from the auxiliary fuel tank until the airplane has flown at least one (1) hour or used a minimum of ten (10) gallons of fuel. Use of auxiliary tank fuel, when the main tanks are full, will result in vapor return fuel flowing overboard through the vent lines, as this fluid normally flows into the main tanks.

The accumulator sump tank and auxiliary sump tank serve to assure an adequate supply of fuel during maneuvers. From the three-way valve fuel flows through the strainer to the electric pump on to the engine-driven pump and from there to the carburetor. A check valve in the electric pump by-pass line prevents fuel from flowing back into the supply line when this pump is operating. Excess fuel pumped by the engine-driven pump is relieved by a valve in the pump to recirculate until passed to the carburetor. Excess fuel pumped by the electric pump passes through a relief valve in the fuel return line, to be re-circulated by the electric pump. The hand primer pump, located on the upper left corner of the control panel, obtains its fuel supply from the fuel line leading out of the electric pump, and pumps it directly into the intake manifold. The carburetor vapor return line ties in to the wing tank vent system, returning approximately three gallons of fuel per hour to the right hand wing tank. The fuel pressure gage connects to the carburetor. Fuel quantity is indicated by two gages. (See figure 4-64.) As the wing tank fuel gage registers a maximum of 30 gallons, out of a possible 39-1/2 gallons, the gage will not register any amount of fuel in the wing tanks in excess of 30 gallons. The auxiliary tank indicating gage is accurate for the full amount of fuel in the auxiliary tank.

4-164. GENERAL, L-17B AIRPLANES. The fuel system of the L-17B airplanes is similar to that of the modified L-17A airplanes, with the exception of the fuel indicating system. The L-17B airplanes have a single indicating gage (see figure 4-64) which is accurate for the full amount of fuel in either the wing fuel tanks or the auxiliary fuel tank. To change the indication of the gage, use the fuel gage selector switch (figure 4-64, reference 16).

NOTE

After activating the fuel gage selector switch, allow a 60 second gage stabilization period to elapse before reading the fuel indicating gage.

4-165. WING FUEL TANKS. The wing fuel tanks are of welded aluminum alloy construction. They are beaded for strength, and have no internal baffling. The right tank incorporates the filler neck. The fuel quantity gage transmitter is installed in the left tank. Each tank is bonded to the wing through a bracket welded to the top of the tank. The tanks are wedged into the wing structure, and held in place by a padded cross-bar, which bolts to the wing structure. To gain access to the tanks it is necessary to lift the fuselage from the wing and separate the wing panels. For information regarding wing disassembly refer to paragraph 4-5.

4-166. AUXILIARY FUEL TANK. The auxiliary fuel tank is of beaded aluminum alloy construction, incorporating a filler neck on the right upper side of the tank and a fuel quantity transmitter on the forward side of the tank. Access to the tank is gained by removal of the rear seat.

4-167. FUEL ACCUMULATOR SUMP TANK. The 1/2 gallon accumulator sump tank is located between and below the wing fuel tanks. This tank is installed to insure a constant source of fuel supply during maneuvers, and to act as a sump for the wing fuel tanks. A finger type strainer and a sump drain cock are located on the bottom forward end of the tank. Access is provided to the strainer and drain-cock through an opening on the lower wing surface immediately to the left of the wing center line. To remove the tank from the airplane, the wing must be disassembled according to paragraph 4-5.

4-168. AUXILIARY SUMP TANK. The 1/2 gallon auxiliary sump tank is located below the auxiliary fuel cell, to the left of the wing center splice. A finger type strainer and a drain-cock are located on the bottom of the tank. The strainer is accessible thru the left main wheel well. A hole in the wing skin aft of the wheel well gives access to the drain-cock.

4-169. FUEL SHUT-OFF VALVE. The fuel shut-off valve (a cam-operated, plunger-type valve) is located on the aft, lower right side of the firewall. The fuel shut-off is controlled from the control panel, by a push-pull control. This valve is found on unmodified L-17A airplanes only.

4-170. THREE-WAY VALVE. The three-way fuel control valve (on L-17B's and modified L-17A's) is a simple turning valve, and

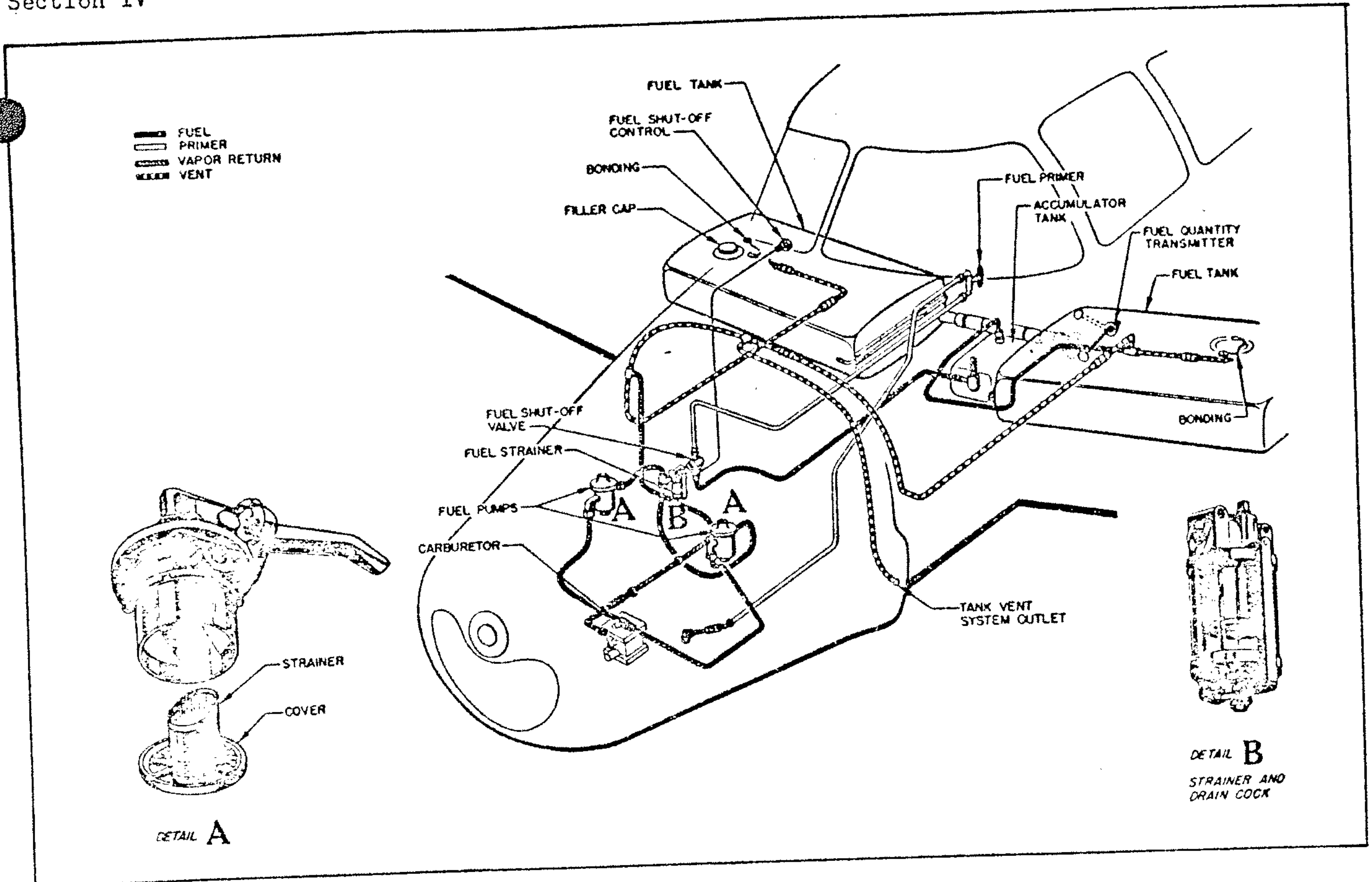


Figure 4-40. Fuel System, L-17A Airplanes

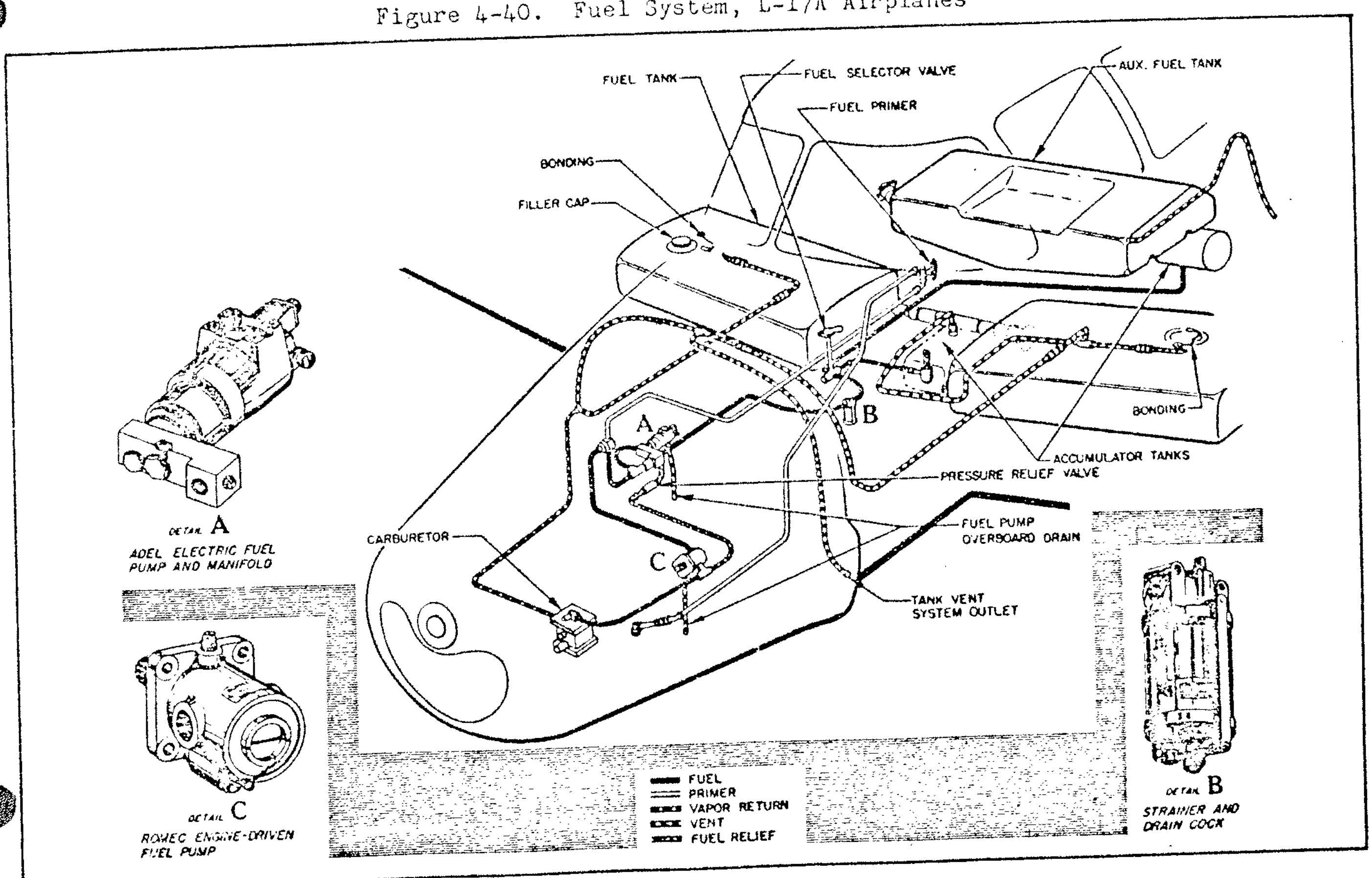


Figure 4-41. Fuel System, L-17B and Modified L-17A Airplanes

should not require maintenance between major overhaul periods.

4-171. FUEL STRAINER. A removable bowl strainer is incorporated in this fuel system. On unmodified L-17A airplanes the strainer is mounted on the forward side of the fire-wall next to the shut-off valve. (See figure 4-40.) On modified L-17A and all L-17B airplanes the strainer is mounted at the right rear of the nose wheel well. The bowl should be drained periodically by means of the drain-cock at the bottom of the bowl. Access to the strainer for cleaning is gained by removal of the bowl.

4-172. FUEL QUANTITY TRANSMITTERS. The main tank fuel quantity transmitter, located in the left main tank, is accessible through the left main wheel well. The auxiliary tank fuel quantity transmitter is accessible by removing the rear seat kick panel. For further information regarding adjustment and calibration of the fuel quantity indicators and transmitters, refer to paragraphs 4-280 and 4-281.

4-173. ENGINE-DRIVEN FUEL PUMPS, L-17A AIRPLANES. The engine fuel pumps, one mounted on each side at the rear of the engine, are of the diaphragm, variable-displacement type. Each pump incorporates a screen, shown in figure 4-40. It is recommended that the screens be cleaned every 50 hours. Care should be exercised when replacing the pump covers so as not to damage the gaskets.

NOTE

Whenever replacement of the right-hand pump is necessary, particular care must be exercised on installation to ensure correct position of operating arm beneath engine cam. This can be positively checked if the left-hand pump is removed.

4-174. ENGINE-DRIVEN FUEL PUMP, L-17B AND MODIFIED L-17A AIRPLANES. The engine-driven fuel pump (see figure 4-41), is mounted at the left rear of the engine. This is a rotary non-pulsating type pump, incorporating a relief valve in the pump housing. The relief valve allows excess fuel to re-circulate in the pump before passing to the carburetor. The relief valve is set to open at 12-1/2 lbs pressure when the engine is operating at 1500 rpm.

4-175. ELECTRIC-DRIVEN FUEL PUMP. The electric-driven fuel pump is an auxiliary to the engine-driven pump on L-17B and modified L-17A airplanes. This pump is used as an auxiliary pump during take-offs or landings, or in event of failure or malfunctioning of the engine-driven pump. The pump is located in the lower forward right hand section of the fuselage, and accessible by removing the fuselage baffle of the engine air cooling exhaust.

4-176. FUEL SYSTEM CHECK VALVE. The fuel system check valve (on L-17B and modified L-17A airplanes) is located in the electric-driven pump by-pass line, immediately forward of the electric-driven pump. When only the engine-driven pump is operating, fuel by-passes the electric-driven pump through this check valve. When the electric-driven pump is operating, fuel is prevented from backing through the by-pass line, in a closed circuit, by this valve.

4-177. PRESSURE RELIEF VALVE. The fuel system pressure relief valve, installed on L-17B and modified L-17A airplanes only, is located immediately forward of, and below, the electric-driven fuel pump. This valve acts to vent excess fuel from the carburetor-fuel supply line back to the electric-driven pump for re-circulation. To adjust the valve it is necessary to turn the adjusting nut inward to increase pressure or outward to decrease pressure. (See figure 4-41.) The relief valve is set to maintain a pressure of 12-1/2 lbs when the engine is not operating and the electric-driven fuel pump is "ON".

4-178. ENGINE PRIMER SYSTEM. The engine primer system (see figure 4-40), is composed of the primer pump, and the tubing necessary to carry the fuel. Fuel is taken from the normal fuel supply lines, and by means of the hand primer pump is introduced directly into the intake manifold.

4-179. FUEL PRIMER PUMP. The fuel primer pump is located at the extreme left of the pilot's control panel. (See figure 4-63, reference 37.) To operate the primer pump it is necessary to push the handle in and turn counter-clock-wise to free the plunger. The pump is locked by pushing the handle completely in and turning clock-wise.

4-180. CHECKING FUEL PUMP OUTPUT PRESSURE, L-17A AIRPLANES. It is very important that output pressure of each pump be checked individually and periodically to determine that both pumps are functioning properly, since either pump serves as an emergency pump should the other not operate properly.

a. Disconnect outlet line at pump.

b. Plug both line and pump fitting.

c. Run engine momentarily at full throttle. The fuel pressure should be 12 (± 2) psi. (This pressure being delivered by opposite pump if operating properly.)

d. Remove plugs and connect line to pump.

e. Repeat procedures a. through d. for the opposite pump.

4-181. CHECKING FUEL PUMP OUTPUT PRESSURES, L-17B AND MODIFIED L-17A AIRPLANES. The fuel pump relief valves are set to relieve at 12-1/2 lbs for the engine-driven pump and 14-1/2 lbs for the electric-driven pump.

The fuel system has an operating tolerance of 10-15 lbs. Any relief settings, within the system operating tolerance, are permissible as long as there is a relief differential of 2 lbs in the relief settings. Check the electric-driven pump by operating the pump when the airplane engine is not running. Check the engine-driven pump by leaving the electric-driven pump "OFF" and operating the airplane engine at 1500 rpm. Read the fuel pump output pressures on the fuel pressure gage. Should the pumps fail to maintain the proper pressure, check the relief valve settings before replacing the pumps.

4-182. DRAINING FUEL SYSTEM. The fuel system may be drained through the petcocks in the wing fuel tank accumulator sump and the auxiliary tank sump.

CAUTION

Before draining fuel system check that no one is smoking in immediate vicinity, there are no loose electrical connections nearby, adequate fire extinguishing equipment is immediately available, and that adequate containers are available for fuel being drained.

4-183. CLEANING FUEL SYSTEM. Should dirt or other foreign material be introduced into the fuel system, remove all strainers and screens and flush the system with clean gasoline.

CAUTION

Do not introduce water, carbon tetrachloride, or other foreign liquids into the fuel system.

4-184. PRESSURE-TESTING FUEL SYSTEM, L-17A AIRPLANES.

a. Connect standard manometer to vent outlet.

b. Plug tank filler neck.

c. Apply an air pressure of 1-1/2 psi (equal to 3.06 inches of mercury or 41.6 inches of water) to the manometer, and pinch off with a suitable clamp.

d. Should a drop in the manometer be noticed, check all connections for leaks with soapsuds, beginning with source of pressure.

4-185. PRESSURE-TESTING FUEL SYSTEM, L-17B AND MODIFIED L-17A AIRPLANES. If at any time portions of the fuel system are removed and re-installed, the system may be checked for leaks in the following manner:

a. Connect standard manometer to main vent outlet.

b. Plug wing tank filler neck.

c. Turn three-way valve to "MAIN".

d. Apply an air pressure of 1-1/2 psi (equal to 3.06 in Hg or 41.6 in water) to the manometer, and pinch off with a suitable clamp.

e. Should a drop in the manometer be noticed, check all connections for leaks with soapsuds, beginning with source of pressure.

f. Plug auxiliary tank filler neck and main vent outlet, attach manometer to auxiliary vent outlet; turn three-way valve to "AUX"; and repeat steps d. and e. above.

4-186. <u>HYDRAULIC SYSTEM</u>.

4-187. The hydraulic system (figures 4-37 and 4-38) is divided into the power system, the landing gear system, and the wing flap system. The power system supplies pressures up to 1150 psi to operate the landing gear and wing flap systems. A relief valve, manually controlled by a knob on the control panel, permits either free flow or pressure for operation of landing gear or flaps. An amber light on the control panel illuminates when the power control knob is pulled out, indicating that relief valve is closed. A hand-pump is built into the master control valve to permit manual operation of the systems while airplane is on the ground and the engine is not running. The hand-pump also affords emergency lowering of the wing flaps should the engine-driven pump fail during flight. An emergency shut-off valve is provided in the fluid supply line just below the reservoir. This makes it possible to shut off fluid supply in case of engine fire. The valve is controlled by a lever on the control panel.

4-188. TROUBLE SHOOTING HYDRAULIC SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
System does not build up pressure.	Insufficient fluid in reservoir.	Add fluid.
	Pump failure.	Replace pump.
	Controllable relief valve out of adjustment.	Adjust.
	Excessive internal or external leakage.	Correct.

TROUBLE	PROBABLE CAUSE	REMEDY
	Emergency shut-off valve closed.	Open valve and secure with safety wire.
Slow operation of all systems.	Excessively worn pump.	Replace.
	Control valve linkage out of adjustment.	Adjust
	Internal leakage in actuating cylinders.	Repair or replace.
	Clogged filter in reservoir.	Replace filter.
Landing gear fails to operate.	Up-locks out of adjustment.	Adjust.
	Defective actuating cylinders.	Replace.
	Control valve out of adjustment.	Adjust linkage.
	Excessive internal leakage in system.	Isolate and correct.
Wing flaps fail to operate.	Defective actuating cylinder.	Replace.
	Control valve out of adjustment.	Adjust linkage.
	Excessive internal leakage in system.	Isolate and correct.

4-189. GENERAL INSTRUCTIONS FOR HANDLING HYDRAULIC EQUIPMENT.

4-190. REMOVING AND DISASSEMBLING HYDRAULIC SYSTEM UNITS. When disconnecting hydraulic lines, plug the ends to prevent loss of fluid and to keep out foreign matter. When disassembling a unit of the hydraulic system, work in as clean a place as possible, as small particles of dirt are injurious to the unit. Thoroughly clean component parts immediately after disassembly.

4-191. CLEANING HYDRAULIC PARTS. Parts must be clean before assembly. Clean metal parts and subassemblies by washing them in a suitable solvent. Use a brush when necessary to remove caked dirt, gum, rust-preventive coating, or paint. Be sure the brush used will not mar or scratch finishes, or sealing ring grooves, pistons, piston rods, valve faces, slide valves, sealing surfaces, etc. Remove the paint from all surfaces inside the assembly. Do not use solvents to clean sealing rings or packing; use dry air, or clean, lint-free rags. Never use rags that have been around a machine shop, because of the possibility of metal chips being in the rags. To prevent oxidation, keep parts as free from moisture as possible. Do not leave steel unplated parts unprotected long enough to start rusting.

4-192. REMOVING SURFACE BLEMISHES FROM HYDRAULIC PARTS. When removing rust or rust stains from interior honed surfaces, use only suitable abrasives such as buffing compound or crocus cloth. Be sure to rub lengthwise when removing mars or nicks.

4-193. INSPECTING HYDRAULIC PARTS. Threads and sharp edges must be free from burrs. All passages must be free of material which might break loose and get into interior of assemblies. Make sure plated surfaces are not damaged to the extent that they could cause leakage or binding. Examine bores, ring grooves, etc, for flaws and roughness. Make sure that all surfaces which come in contact with nonmetallic packing rings, or parts made of synthetic rubber, are free from burrs, nicks, scratches, tool marks, and roughness.

4-194. LUBRICATING HYDRAULIC PARTS. All parts should be lubricated before assembly. Apply lubricant sparingly and wipe off excess, as too much oil will collect dirt and grit, and cause malfunctioning of the assembly. Lubrication of external seals, "O" rings, threads, bearings, and retainers, provides easier assembly and eliminates galling of the threads and slide fits. It is advisable to lubricate external seals, threads, bearings, and retainers with petrolatum jelly or equivalent, so that when external tests are made, no hydraulic fluid is visible, unless it has leaked from the inside. Lubricate internal and moving surfaces such as pistons, "O" rings, rods, shafts, etc, with hydraulic fluid.

4-195. ASSEMBLING HYDRAULIC SYSTEM UNITS.

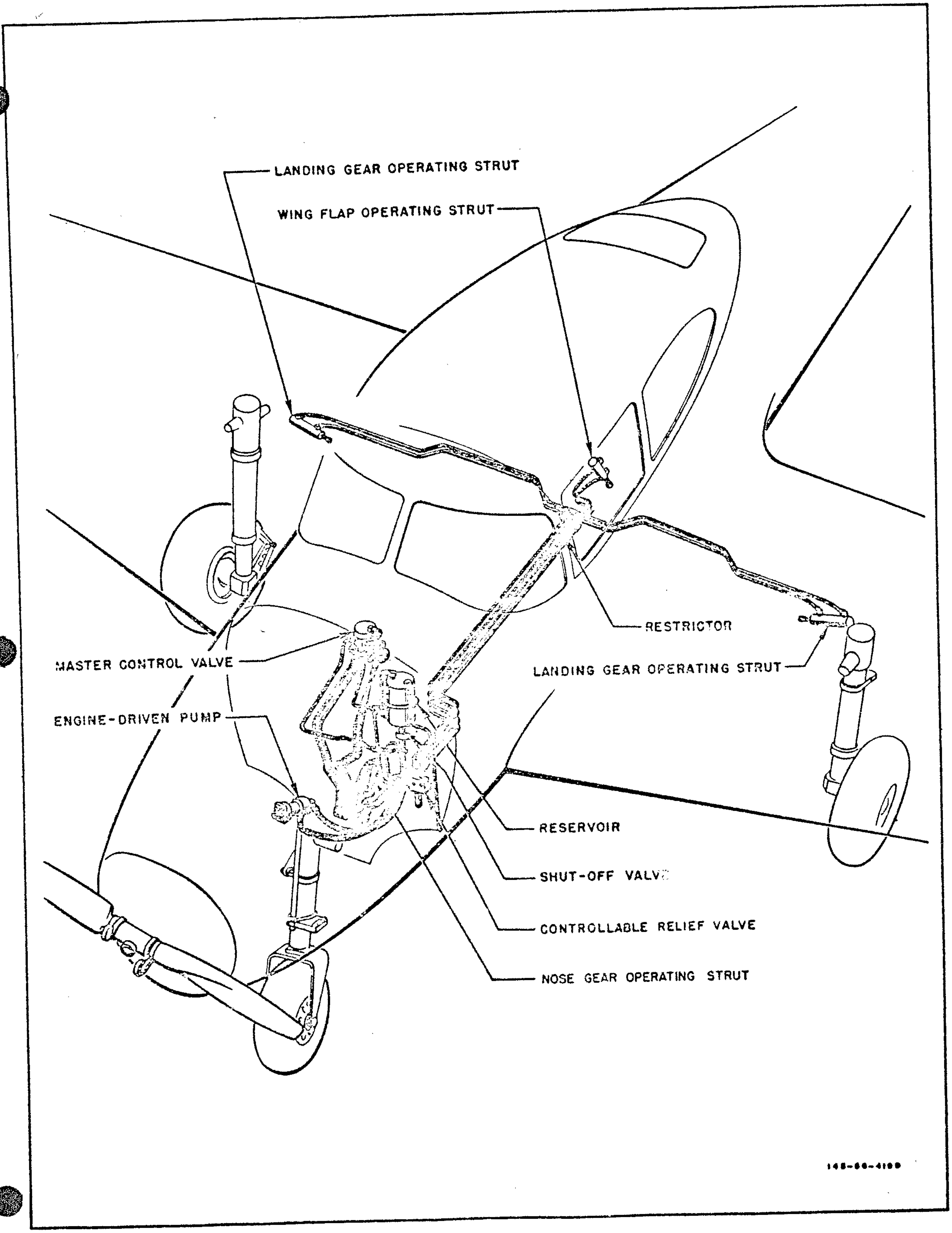


Figure 4-42. Hydraulic System

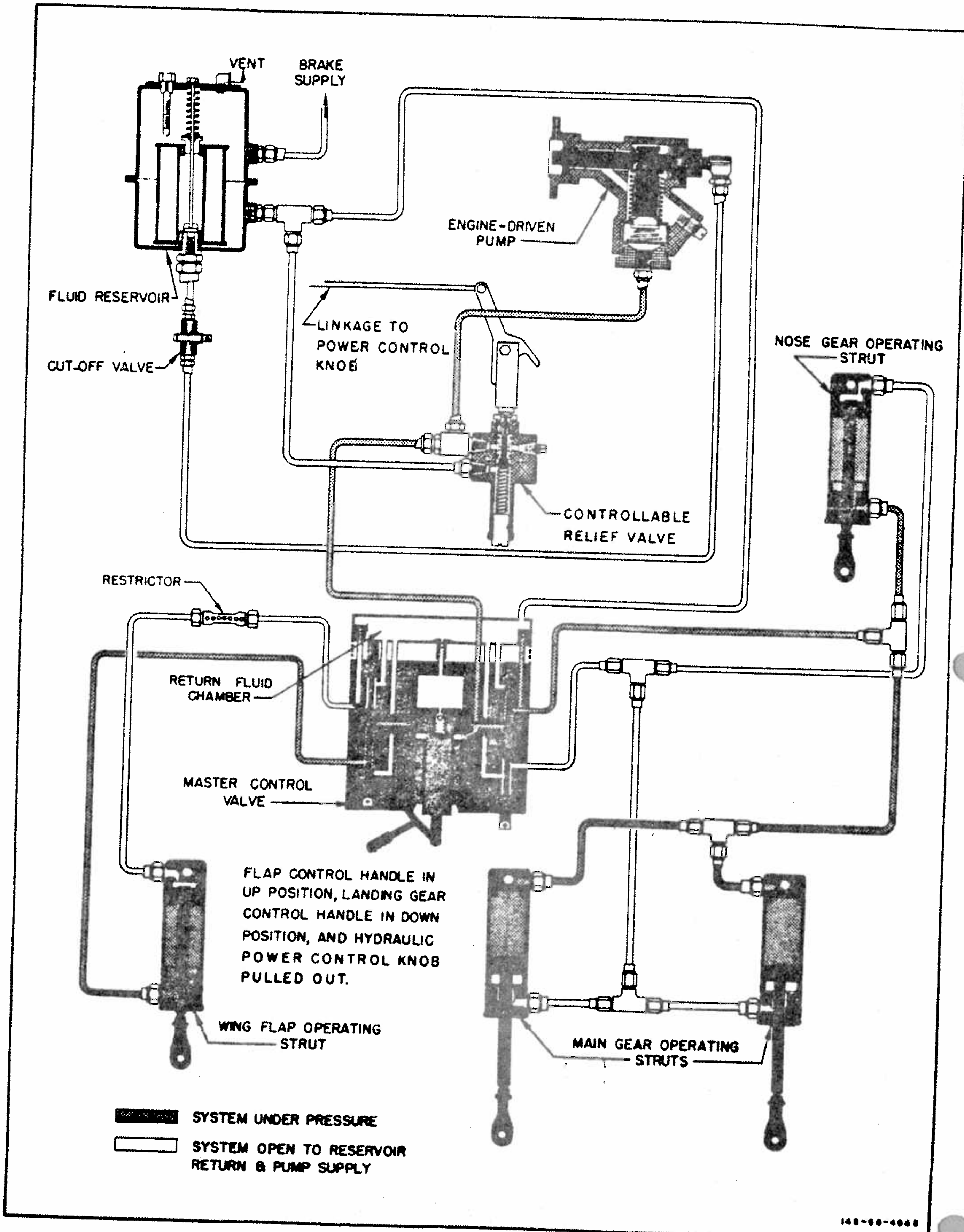


Figure 4-43. Hydraulic System Flow Chart

Refer to prints at all times during assembly, and accomplish one operation at a time. Always use proper assembly tools so that parts will not be damaged. Use tapered sleeves and fixtures where necessary to facilitate assembly. Install "O" rings and gaskets carefully, and make sure they are the proper size and in the proper place.

4-196. ASSEMBLING HYDRAULIC OPERATING CYLINDERS. When installing "O" rings on piston, do not use tools with sharp corners, sharp edges, or rough surfaces. Keep mold flash of "O" ring in one plane to ensure against twisting. When ring is in its groove, make sure it is evenly stretched around its circumference. When sliding piston into cylinder, check closely to make sure there are no fine particles shaved from the piston or "O" ring. Do not insert piston any further than necessary to install cylinder end. (This precaution will eliminate cocking the piston in the cylinder, which might cause damage to both cylinder and piston.) After assembly, piston must move in and out freely by hand, while being rotated at least one complete turn in each direction. There should be no scratching or metallic drag.

4-197. ASSEMBLING HYDRAULIC VALVES. Inspect valves, valve bores, and chrome plating for burrs, nicks, pits, and sharp edges. Make sure springs and valves are free-acting, and do not bind or stick in the bores. Check slide valves for bent shafts, nicks, and scratches on sealing diameters. Slide valve bores are to be honed or lapped, and selectively fitted to shafts to meet leakage requirements. Make sure each part which has been lapped or fitted with another part, is placed in its correct position when assembled. All parts honed or lapped are to be kept together at all times, and are not to be interchanged unless they are relapped or rehoned. When staking is required to secure an adjustment, do not stake until after parts have been tested and properly adjusted. Use caution when installing "O" rings and packings. Keep mold flash of "O" ring in one plane to ensure against twisting. When "O" ring is in its groove, make sure it is evenly stretched around its circumference. Sleeves, valves, and pistons with "O" rings must be carefully inserted, using only enough pressure to overcome friction. Test valve shafts and valve actuating pins to make sure they are not binding. Operate by hand to check proper spring return.

4-198. TESTING HYDRAULIC SYSTEM UNITS AFTER ASSEMBLY. All hydraulic units must be tested within 24 hours after assembly as a protection against corrosion. Completed assemblies may be washed externally only with carbon tetrachloride. Do not use any other cleaning fluid, as damage to seal rings may result.

4-199. PREPARING HYDRAULIC TUBING FOR INSTALLATION. Remove seal cap from all tubing assemblies that have been in storage. All tubing should have color-code band (light blue, yellow, light blue), and part numbers should be rubber-stamped on each tube. Before installation, inspect tubes for cracks, burrs, and sharp edges. Check tubing for dents and scratches; if such defects are not too deep, remove them with buffing compound or crocus cloth. Blow all dirt from inside of tubing with clean, dry, compressed air.

4-200. INSTALLING HYDRAULIC TUBING. If necessary, fittings may be lubricated with hydraulic fluid or petrolatum. Care must be taken that no lubricant enters the tubing or fitting during installation, as it will cause sticking of valves and malfunctioning of units. Place the tube in position, making sure it is not scratched while being installed. Be sure the tube flares meet the fittings squarely and fully. Never use the nut to draw tube flare to fitting, as flare will be damaged. Always use fingers to start tubing nut on fitting and to tighten nut firmly into position. After the nut is firmly in place, tighten with wrench. The following torque values in inch-pounds should be used.

	ALUMINUM ALLOY		STEEL	
	Min	Max	Min	Max
1/4" Tubing	40	65	50	90
3/8" Tubing	75	125	90	150

Be very careful not to tighten the nuts too tightly, as this will damage the flare. Tubing should be preformed by proper bending equipment and should require only minimum hand pressure to fit in proper place when being installed. All hydraulic lines must be supported by clamps of proper size. Never tighten a tube fitting when there is pressure in the system.

4-201. BLEEDING HYDRAULIC SYSTEMS. The landing gear, wing flap, and power systems will bleed themselves after three or four operating cycles, provided the hydraulic reservoir is full of oil.

4-202. CHECKING HYDRAULIC SYSTEM OPERATION.

a. Determine that all lubrication points on the main and nose gear have been properly lubricated.

b. Connect test stand. (Test stand pressure connection is made at plug on side of relief valve. Supply line connection is made at bottom of shut-off valve. Test stand output should not exceed 1/2 gallon per minute, unless provided with individual relief valve set for 1500 psi. Test stand should also be provided with a shut-off valve to prevent supply from test stand reservoir when airplane reservoir is full and a line connecting the vent of the airplane reservoir with the test stand reservoir. Fluid from the test stand reservoir must flow through a filter to safeguard the units of the airplane.)

c. Pull hydraulic power control out, and operate gear and flaps through several cycles to bleed system of air. This may be done with either the test stand or hand-pump. However, to check hand-pump operation, one complete cycle of both gear and flap operation must be made. Then check relief valve setting by use of hand-pump and reference to test stand gage. Cracking pressure should be 1125 (± 25/-0) psi. With test stand running at full flow, pressure should not exceed 1200 psi.

d. Operate landing gear to the up position, and check linkage adjustments and proper engagement of up-locks as shown in figures 4-22 through 4-24. Then hang 12-pound weight on each wheel, and retract gear. Gear should retract and lock.

NOTE

After completion of any operating cycle, power control knob should be pushed in to relieve pump and relief valve of continuous operation against pressure.

e. Operate landing gear to the down position and check for proper down-locking as shown in figures 4-23 and 4-24.

f. With test stand operating, retract gear and disconnect up-lock cable from control valve. Then place control handle in down position and pull emergency release lever. Locks should release and allow gear to extend. Check for any damage to control linkage.

g. Operate wing flaps and check adjustments as shown in figure 4-39. Flaps should operate up or down in 9 to 12 seconds.

NOTE

If proper operation is not obtained after adjustment, check system for internal leakage.

4-203. HYDRAULIC POWER SYSTEM. The power system consists of an engine-driven pump, fluid reservoir, controllable relief valve, master control valve (which incorporates the hand-pump check valve, and thermal relief valve), and necessary lines to carry the fluid under pressure to the master control valve, and return fluid to the reservoir. The operation of the power system is as follows: Fluid from the reservoir flows through the emergency shut-off valve to the engine-driven pump. The pump forces fluid to a tee on the controllable relief valve. When the knob for the controllable relief valve is pulled out, the relief valve is closed, allowing the pump to build up pressure. Then, when the master control valve is positioned to operate gear or flaps, fluid flows from the tee to the master control valve. At the completion of the operational cycle, pressure builds up to approximately 1125 psi and the relief valve opens, allowing fluid to flow from the tee, through the relief valve and to the reservoir. When the power control knob is pushed in, the relief valve is held fully open, permitting free flow from the pump to the reservoir. This open-center power system relieves the pump of continuous operation against pressure, and provides a continuous flow of fluid through the relief valve, thus preventing accumulation of any foreign particles that may damage the relief valve.

4-204. LANDING GEAR HYDRAULIC SYSTEM. The landing gear hydraulic system consists of an operational control shaft, and a by-pass check valve (incorporated in the master control valve), two main gear operating struts, a nose gear operating strut, and necessary tubing. The landing gear control handle must be left in the desired up or down position. When the control handle is moved to the down position, mechanical linkage from the handle pulls the up locks and moves the landing gear control shaft to direct pressure to the down position, mechanical linkage from the handle pulls the up locks and moves the landing gear control shaft to direct pressure to the down position, mechanical linkage from the handle pulls the up locks and moves the landing gear control shaft to direct pressure to the down side of the gear operating struts. Because the gear is forced down by spring bungees faster than pump can supply fluid, a check valve in the master control shaft is moved to direct pressure to the up side of the operating struts. Return fluid from the down side of the operating struts is directed to the return line.

4-205. WING FLAP HYDRAULIC SYSTEM. The wing flap hydraulic system consists of an operating control shaft and a poppet check valve (both incorporated in the master control valve), a flap operating strut, and necessary tubing. The flap control handle must be left in the desired up or down position at all times. The flaps are locked in the down position by a poppet check valve in the down pressure port. This prevents air loads from forcing air out of the down side when pump pressure is relieved. When the flap control handle is moved to the "DOWN" position, mechanical linkage from the handle moves the control shaft to direct pressure to the down side of the flap operating strut. Return fluid from the strut is directed to the return line. When the control handle is moved to the "UP" position, the control shaft is moved to direct pressure to the up side of the operating strut. The poppet check is then held open to allow the return fluid from the strut to by-pass and be directed to the return line. The flap should move to the full up or down position in 9 or 10 seconds when the engine is turning approximately 1500 rpm. The speed of flap operation may be increased by removal of balls from restrictor in the flap down line. On L-17B and modified L-17A airplanes, an additional poppet check valve

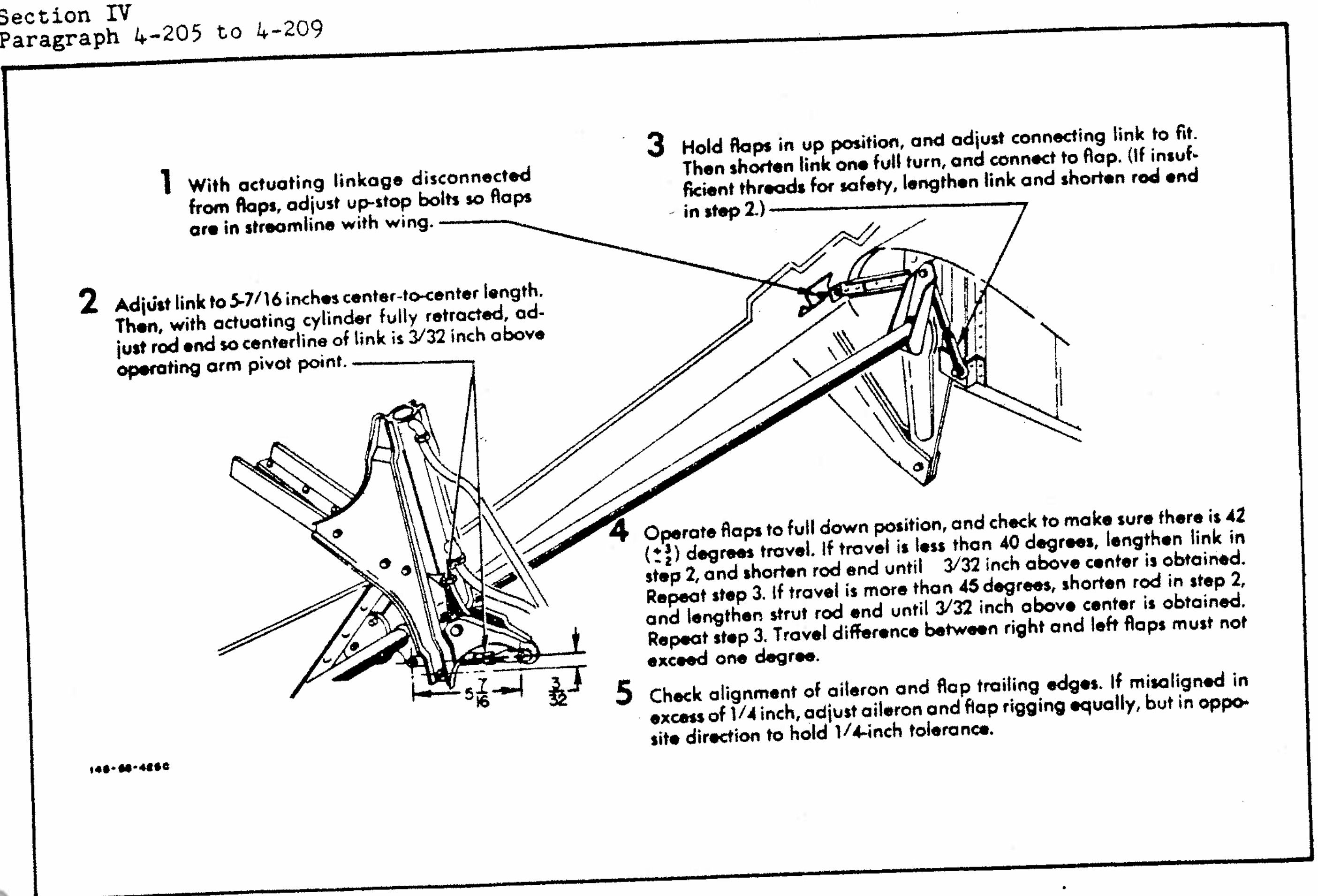


Figure 4-44. Adjusting Wing Flap Operating Mechanism

and thermal relief valve in the hydraulic master control valve create a neutral position for the flap control system. This allows the flaps to be lowered or raised to, and held at, any desired position.

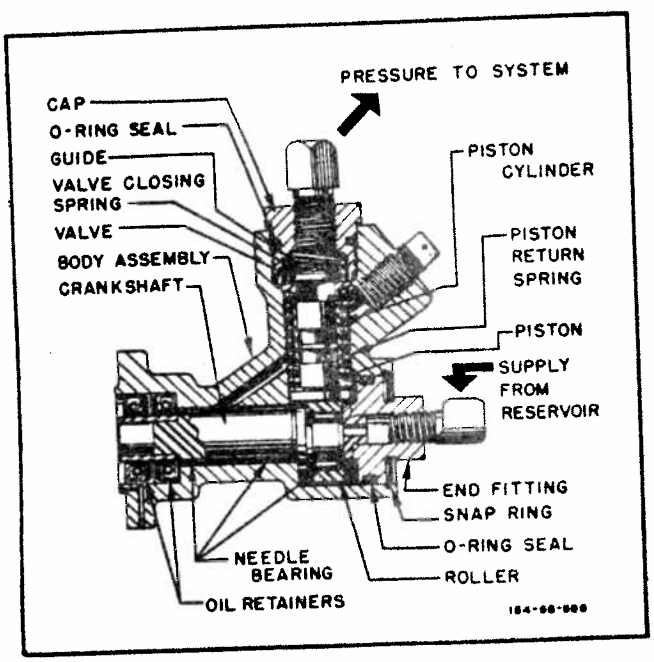


Figure 4-45. Engine Driven Hydraulic Pump

4-206. ADJUSTING WING FLAP OPERATING MECHANISM. (See figure 4-44.)

4-207. ENGINE-DRIVEN HYDRAULIC PUMP. An engine-driven hydraulic pump (figure 4-45) is located on the lower right side of the engine accessory drive section, and is held in place by four bolts. The pump has a single-action piston with cam-type piston movement. The pump is lubricated by the oil passing through, and has "O" ring seals to prevent external leakage. The out-put of the pump is approximately 1/2 gpm at approximately 2150 rpm of engine (approximately 3000 rpm of pump).

4-208. HYDRAULIC SYSTEM FLUID RESERVOIR. The hydraulic fluid reservoir (figure 4-41) is attached by four bolts to the forward left side of the firewall. The reservoir incorporates a filler cap and dip stick, ports for pump and brake supply, a system return port, a vent port, and a filter unit. The filter unit is easily replaced by removing center bolt, and lifting top from reservoir. When replacing filter, be sure gaskets are installed properly. Reservoir has a fluid capacity of approximately 1/3 gallon when filled to the full mark.

4-209. MASTER CONTROL VALVE. The master

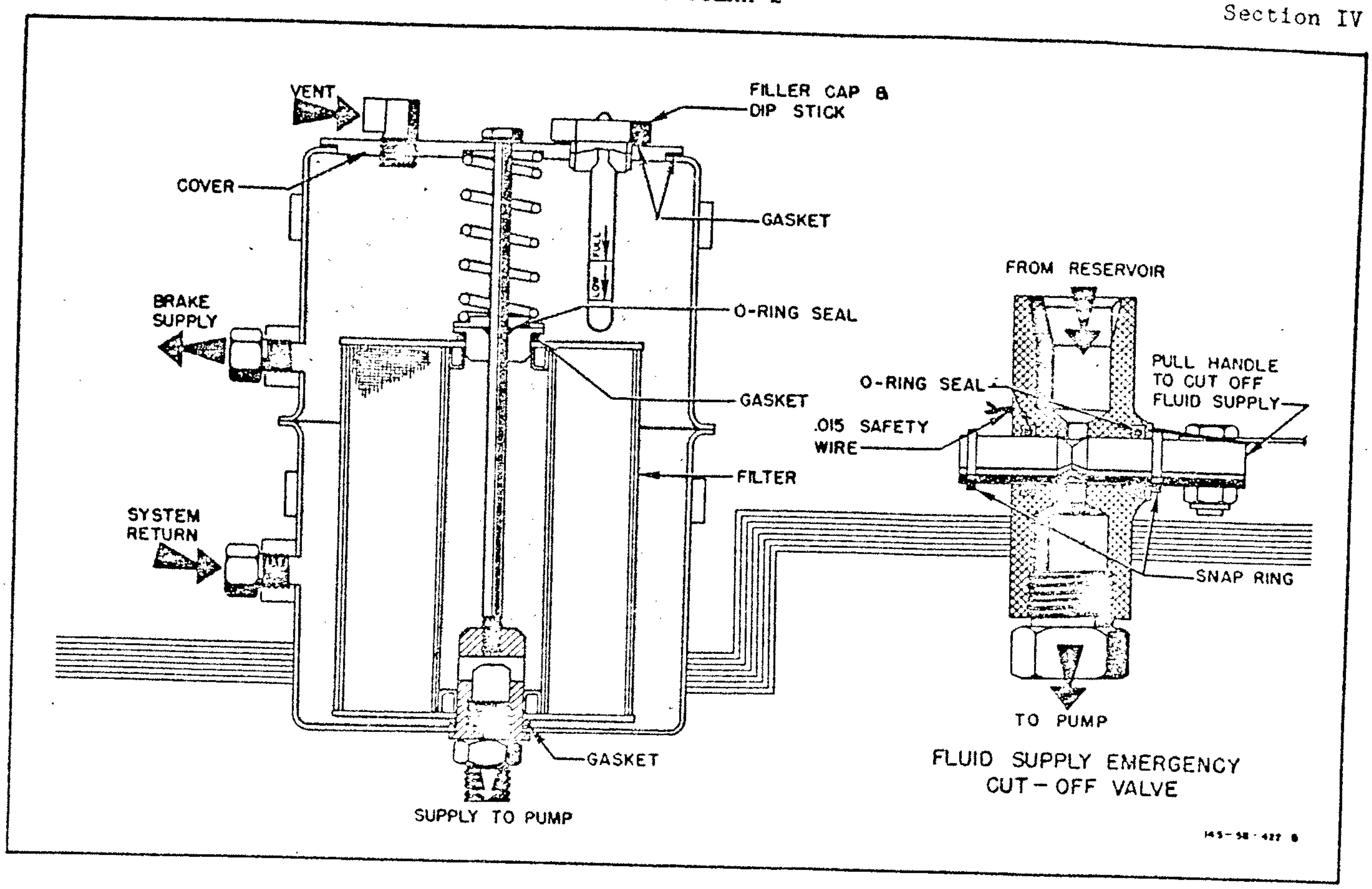


Figure 4-46. Hydraulic System Reservoir and Shut-off Valve

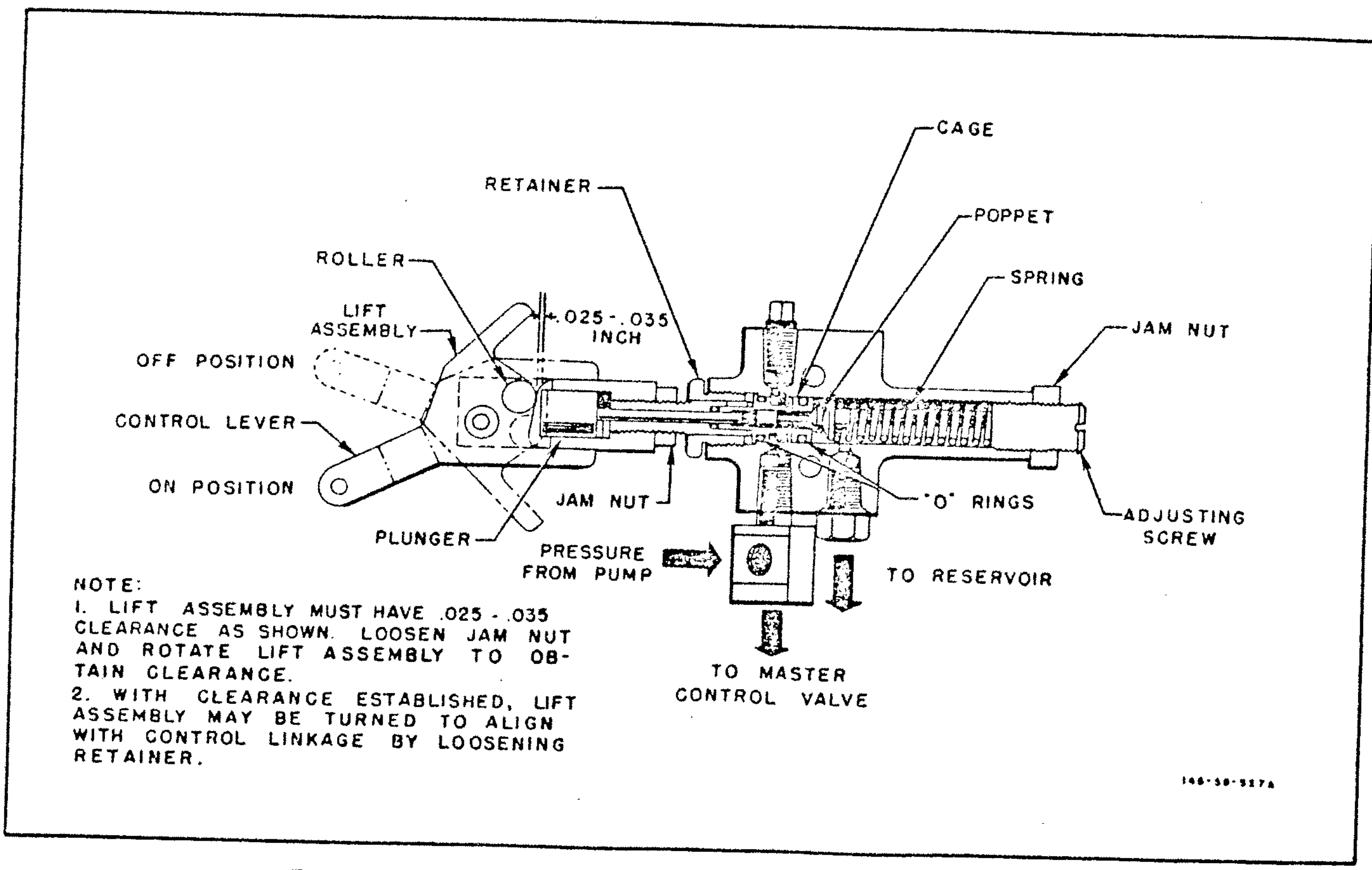


Figure 4-47. Hydraulic System Controllable Relief Valve.

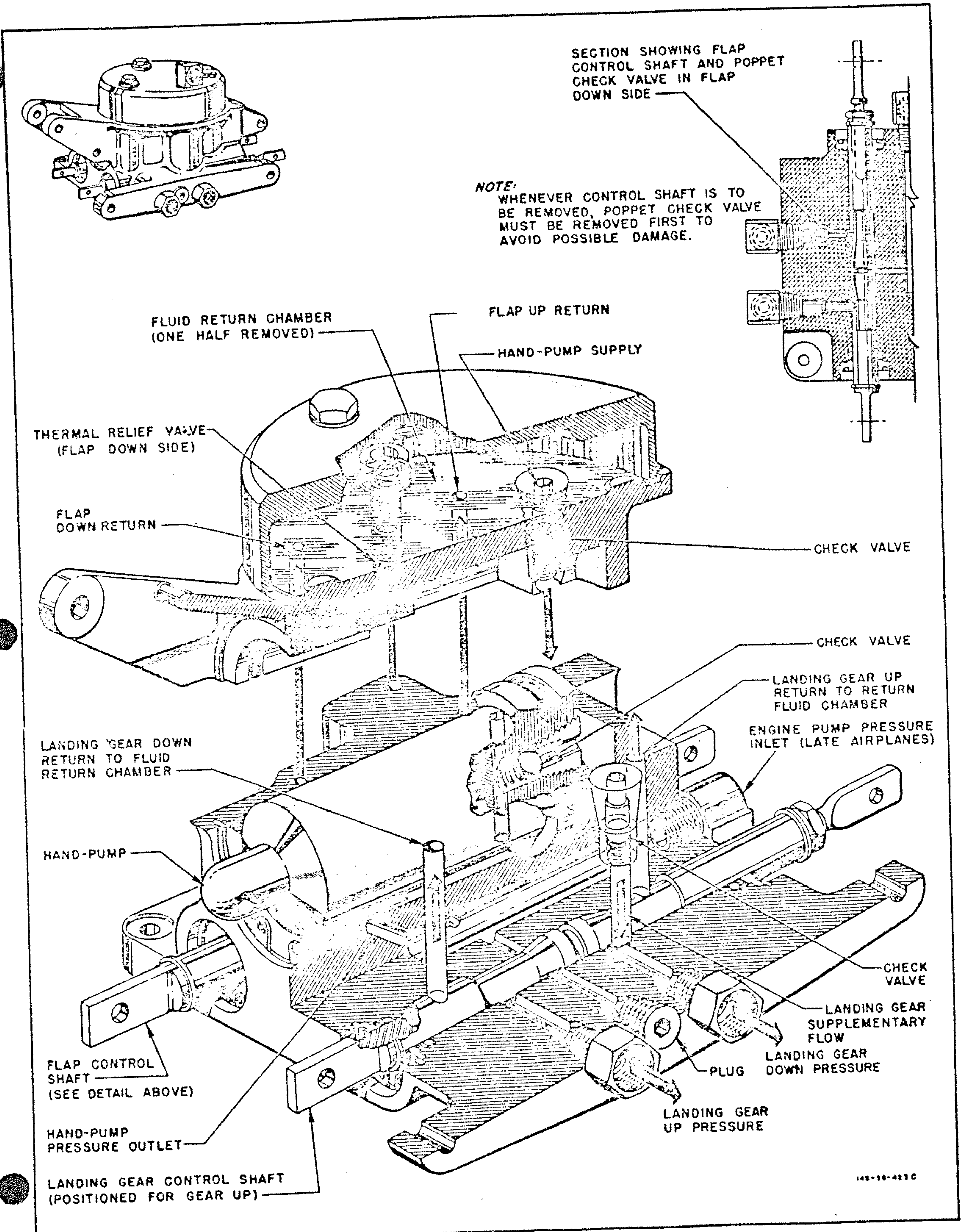


Figure 4-48. Hydraulic System Master Control Valve

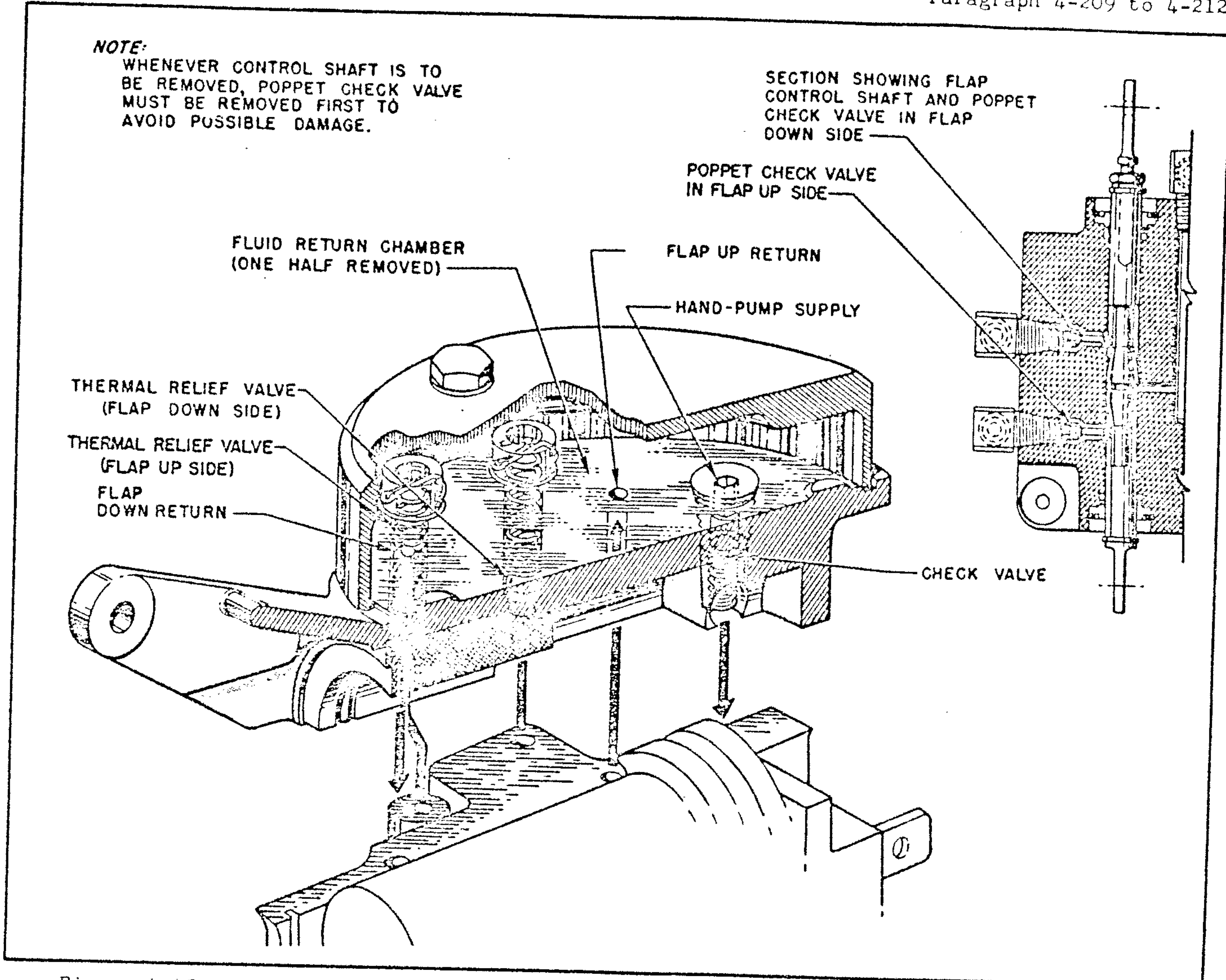


Figure 4-49. Hydraulic System Master Control Valve, L-17B and Modified L-17A Airplanes

control valve is located at the center of the control panel, on the forward side, and is held in place by three bolts. The valve incorporates a hand-pump, control shafts for landing gear and wing flap hydraulic systems, check valves and a thermal relief valve (two thermal relief valves on L-17B and modified L-17A airplanes). (See figures 4-48 and 4-49.) Pressure from the engine-driven pump enters the pressure chamber for the hand-pump, and from there is routed to the control shafts. The control shafts direct pressure to their respective systems, and return fluid back to the reservoir. A fluid return chamber in the top of the valve provides the hand-pump with fluid during operation. Check valves between the fluid return chamber and the pressure chamber keep system pressure from entering the return chamber. The control shafts are hone-fitted into the valve body. "O" ring seals are used to prevent external leakage.

4-210. CONTROLLABLE RELIEF VALVE. The controllable relief valve (figure 4-47) is a spring-loaded poppet-type valve having a plunger and lever mechanism connected by rod linkage to the power control knob on the control panel. It is located on the firewall just below the hydraulic reservoir. The valve incorporates a removable seat and is adjusted to open automatically at 1125 (+ 25/ -0) psi by increasing or decreasing the valve spring tension. The lever mechanism overrides the valve spring tension when the pressure control knob is pushed in so the valve relieves all pump pressure.

4-211. <u>ELECTRICAL SYSTEM</u>.

4-212. The electrical system (figure 4-50) is a 12-volt, single-wire, direct-current type, powered by an engine-driven generator. A 12-volt storage battery (negative grounded) supplies power for operation of all electrical units, when the generator is not connected to the load. On L-17B and modified L-17A airplanes, an external power receptacle is installed on the left fuselage wall behind the trailing edge of the wing. The metallic structure of the airplane serves as a ground return. A generator control

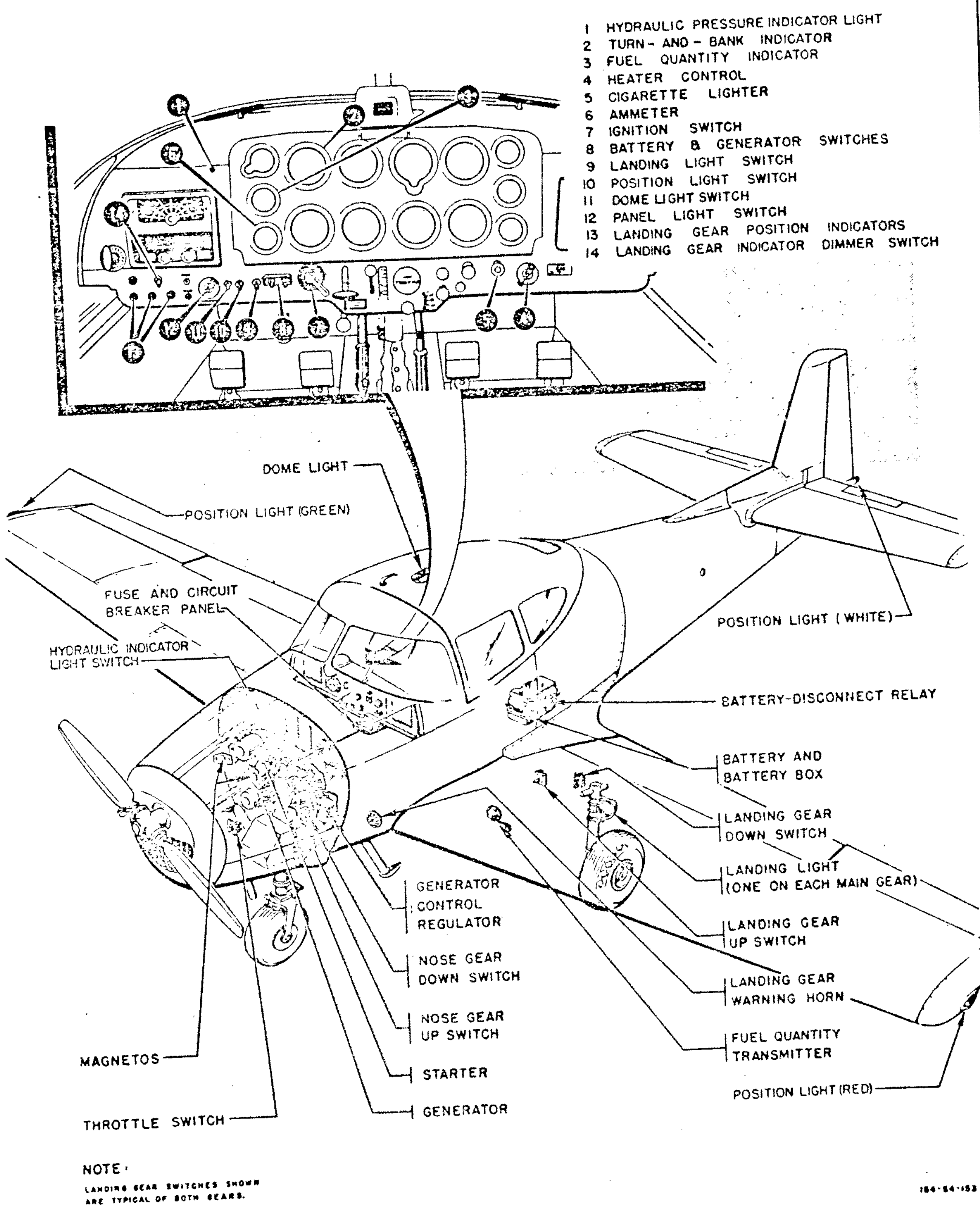


Figure 4-50. Location of Electrical Units, L-17A Airplanes

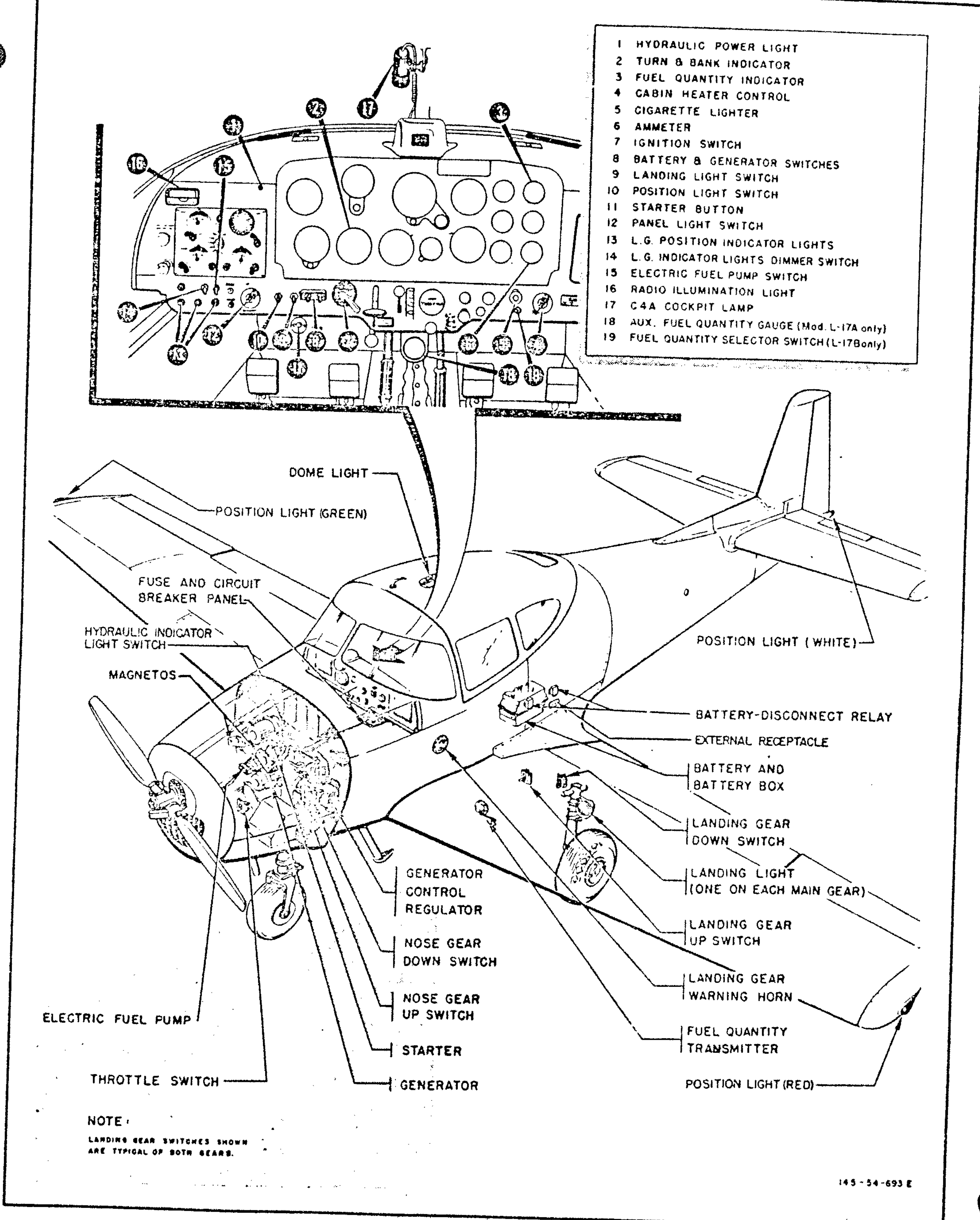


Figure 4-51. Location of Electrical Units, L-17B and Modified L-17A Airplanes

regulator automatically maintains constant voltage regulation in addition to connecting and disconnecting the generator from the load. In addition to starting the engine, electrical energy is used for the cigarette lighter, lights, instrument operation, cabin heating, radio, and landing gear indicator light system and warning horn. All wiring is routed in open bundles, with each wire identified by a number that corresponds with those shown in the wiring diagrams (figures 8-1 through 8-9). Practically all the electrical circuits are protected by push-to-reset circuit breakers. The circuit breaker panel is hinged to the lower edge of the control panel below the ignition switch. The landing gear warning horn circuit breaker does not have a button for resetting. The only other circuit not protected by a circuit breaker is the circuit to the bank-and-turn indicator, which is protected by a one-ampere fuse, also located on the hinged panel. On L-17B and modified L-17A airplanes the bank-and-turn indicator is vacuum driven, and has no electrical connection.

4-213. TROUBLE SHOOTING ELECTRICAL SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Low charging rate with a fully charged battery.	Current regulator defective or out of adjustment.	Clean points, adjust or replace.
High charging rate with a fully charged battery.	NOTE It is important to remember that the charging rate at any given voltage depends as much on battery temperature as on battery specific gravity. The charging rate to a fully charged hot battery will be greater than that obtained with a cool battery which has a fairly low specific gravity. After considering these facts, if the charging rate is still deemed excessive, proceed as follows:	
	Generator field circuit grounded.	Isolate and correct.
	Voltage regulator unit out of adjustment.	Adjust.
	Regulator units shorting out.	Check bushings and insulators under contact point supports.
Low or no charging rate with a low battery.	Loose connections or damaged wires.	Tighten all connections and replace any defective wiring.
	Regulator contact points dirty or out of adjustment.	Clean and adjust.
	Defective generator.	Replace.
Low generator output.	Bad connections throughout field circuit.	Clean and tighten.
	Weak brush spring tension.	Replace springs.
	Brushes sticking in holders.	Correct.
	Dirty commutator.	Clean. If necessary, turn and undercut.
High generator output.	Loose or corroded connections in charging circuit.	Clean and tighten.

TROUBLE	PROBABLE CAUSE	REMEDY
	Field circuit grounded.	Isolate and correct.
No output.	Sticking brushes.	Correct.
	Armature burned out.	Replace.
	Open field circuit.	Correct.
	Broken brush lead or poor connection.	Replace brush or tighten connection.

4-214. GENERATOR.

4-215. A two brush, 15-volt, 25-ampere, (35-ampere on L-17B and modified L-17A airplanes) engine-driven, Delco-Remy generator is installed at the center rear of the engine. The generator supplies the primary source of power for operation of the electrical system, when engine is operating under normal conditions, and also keeps the battery charged. Generator output is automatically regulated between 14 and 14.2 volts, and is supplied to the system through the generator control regulator mounted on the left forward side of the firewall. In order for the regulator to operate, the generator switch on the left side of the control panel must be on. A 4-microfarad filter condenser, connected between the generator terminal (on generator control regulator) and ground, is used for the suppression of generator noise from the radio equipment.

4-216. REMOVING AND INSTALLING GENERATOR. Removal and installation of the generator are not difficult. However, when installing the generator, exercise care to keep the mounting nuts and palnuts from falling into the generator. If a nut is dropped in the generator, it will be necessary to remove the generator to retrieve the nut. Use a dry gasket between generator and engine pad.

4-217. MEASURING GENERATOR BRUSH SPRING TENSION. To measure generator brush spring tension, proceed as follows:

a. Remove generator from airplane.

b. Remove the brush inspection band on generator.

c. Hook a spring scale underneath the brush spring arm, and lift arm off the brush to a height of approximately 1/8 inch. Brush spring tension should read between 24 and 28 ounces on the scale.

d. If brush spring tension is weak, replace springs.

4-218. GENERATOR CONTROL REGULATOR. A generator control regulator (Delco-Remy 1118263 on L-17A airplanes 1118267 on L-17B and modified L-17A airplanes), mounted on the left forward side of the firewall, keeps the generator voltage from exceeding a safe maximum, which control keeps the battery from becoming overheated and gassy. The regulator also keeps the voltage from reaching a point where electrical units will be damaged. The regulator consists of three relay switches within the same unit; i.e., a cutout relay, a single-core current regulator relay, and a single-core voltage regulator. (See figure 4-52.)

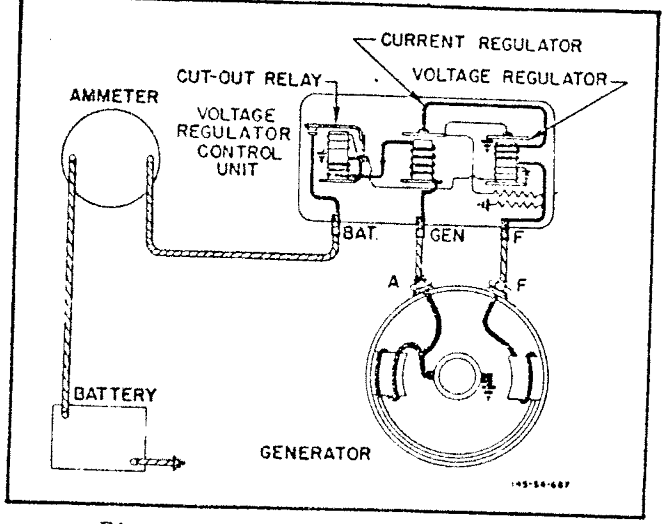


Figure 4-52. Schematic Diagram of Votage Regulator Control

4-219. CUTOUT RELAY.

4-220. The cutout relay automatically opens and closes the circuit between the generator and battery. As generator voltage increases, current flows through the relay windings until the magnetic field overcomes the armature spring tension, thus closing the points. (See figure 4-52.) Then current flows through the points to the battery and distribution bus. When generator rpm falls below generating speed, or stops, current will begin to flow in the reverse direction, or from battery to generator. With a reverse-current flow in the current winding, the magnetic field is reversed and consequently will buck the voltage winding magnetic field, which is not affected by reverse-current condition. As a result, the magnetic field is not strong enough to hold the points together, and the points will pull apart because of the armature spring tension. A reverse current of approxi-

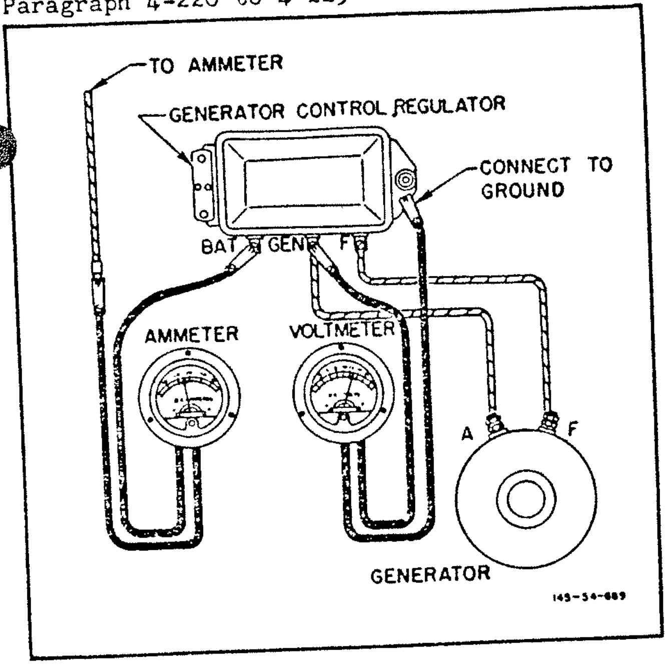


Figure 4-53. Test Setup for Adjusting Cutout Relay

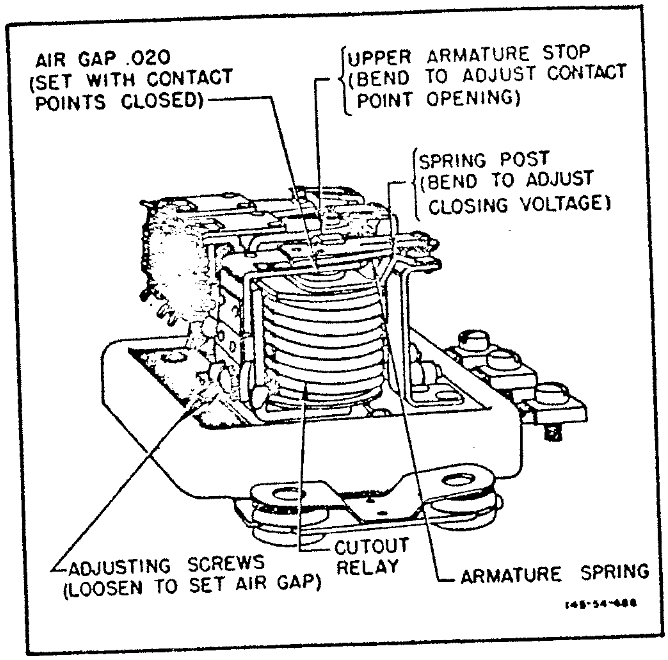


Figure 4-54. Cutout Relay Air Gap Adjustment

mately 1 to 4 amperes will cause the points to open.

4-221. CHECKING AND ADJUSTING CUTOUT RELAY. To check and adjust cutout relay, proceed as follows:

a. Remove the engine hinged cowling, for access to regulator unit.

CAUTION

While adjusting regulator unit, do not attempt to run engine with hinged engine cowling open, as the slipstream is likely to damage the cowling.

b. Connect ammeter and voltmeter leads as shown in figure 4-53.

c. Place both generator and battery switches in the "ON" position, and start the engine.

d. Gradually increase engine speed, noting relay closing voltage (between 12.4 and 13.4 volts); then decrease engine speed, noting that reverse current required to open the point should be between zero and 4 amperes.

e. After check is made, and the regulator is found not to be operating properly, cut the engine, turn off battery and generator switches, and remove voltage regulator cover.

f. Check the air gaps by placing finger on relay armature directly above the core, moving armature down until points just close, and measuring for a .020-inch air gap between center core and armature. If air gap is incorrectly set, loosen the adjusting screws and move armature assembly up or down in the slots for correct air gap setting. With points open, there should be a point air gap of .020-inch. This adjustment is made by bending the upper armature stop. (See figure 4-54.)

g. Start the engine with cover installed on regulator, and run another check as instructed in procedure d. If closing voltage is too high, bend the spring post down; bend it up to increase closing voltage.

NOTE

As a rule, when air gaps are correct, the closing and opening voltage will fall within the correct tolerances.

h. After cutout relay is adjusted, install the regulator cover, and disconnect test equipment.

4-222. CURRENT REGULATOR RELAY. Because the generator is shunt-wound a current regulator (center relay) is used as a means of limiting the current output o the generator. The current regulator (schematically shown in figure 4-52) is wired into the generator system.

4-223. CHECKING AND ADJUSTING CURRENT REGULATOR RELAY. To check and adjust current relay, proceed as follows:

a. Connect an ammeter to regulator unit as shown in figure 4-55.

b. Turn on battery and generator switch; then start engine and run it at 1600 rpm until generator output remains constant.

c. Turn on lights, radio, and other electrical accessories so as to prevent high voltage.

d. Operate engine at 1600 rpm for approximately 5 minutes so regulator will reach proper operating temperature. The reason for warm-up is that the steel armature spring hinges are overcompensated, and operate at a higher current setting when cold.

e. After the current regulator has reached operating temperature, check for a 25-ampere reading on the ammeter. (35-ampere reading for L-17B and modified L-17A airplanes). If the current reading is low or high, the relay will require adjustment.

NOTE

It is important that the regulator cover be in place while relay is being checked.

f. To obtain correct current setting, bend one of the spiral spring hangers down. (See figure 4-56.) The resulting increased spring tension will increase the current setting. Bend the spring hanger in the opposite direction to decrease the current setting.

NOTE

Make all adjustments on one spring only. The other spring should not be touched.

g. If correct setting cannot be achieved, cut the engine and turn off electrical units:

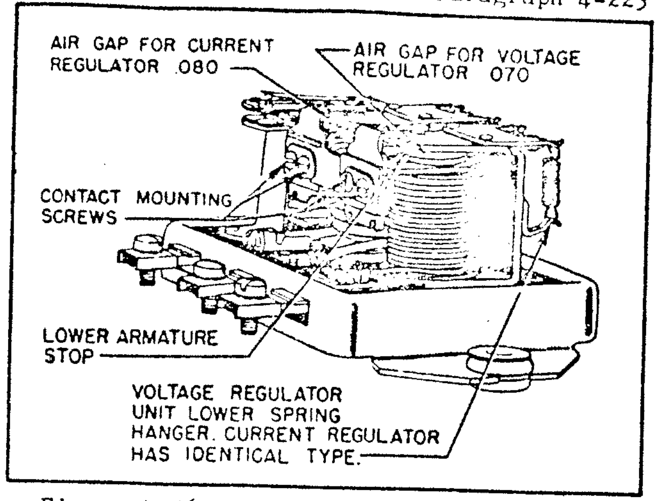


Figure 4-56. Current and Voltage Regulator Relay Air Gap Adjustment

then check the relay air gap in the following manner (figure 4-56): Push current regulator down all the way by hand, and allow it to come back up until points are just touching; then with a wire-type feeler gauge, measure over the center of the core, for an .080-inch air gap. If setting is incorrect, loosen the two contact mounting screws, and move upper contact support up or down as required.

NOTE

After proper air gap setting is achieved, be sure points are lined up before tightening the two contact mounting screws.

h. Start engine, turn on units listed in

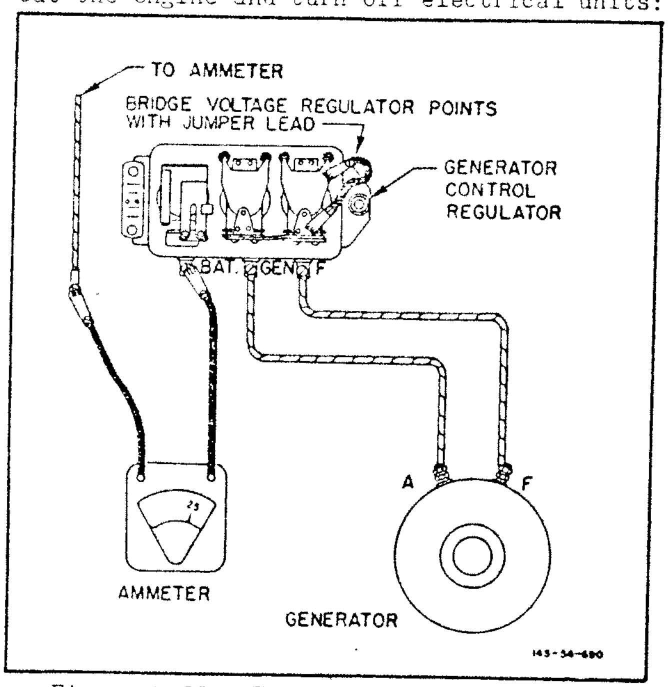


Figure 4-55. Test Setup for Adjusting Current Regulator Relay

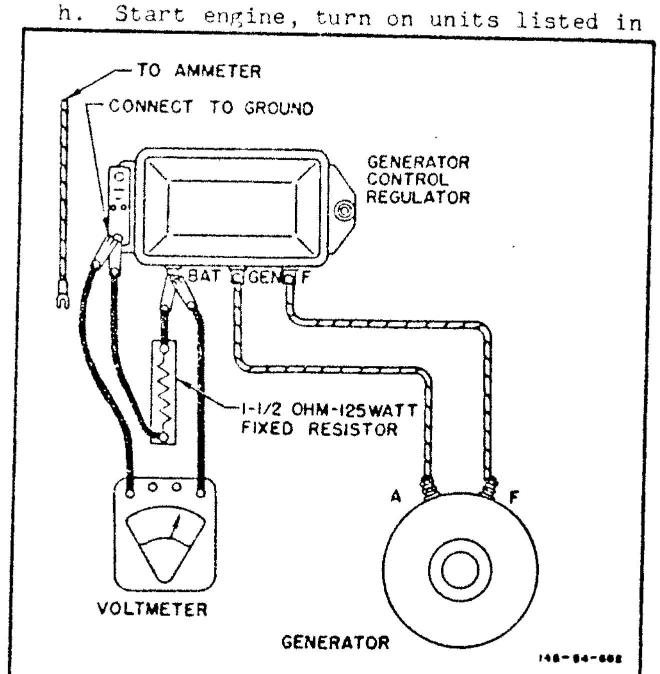


Figure 4-57. Test Setup for Adjusting Voltage Regulator Relay

procedures b. and c., and allow regulator unit a short time to reach operating temperature. The regulator cover should be in place when check is being made, as there will be a difference in regulator operation without cover installed. Check ammeter for a 24 to 26-ampere reading. (34 to 36-ampere reading for L-17B and modified L-17A airplanes). If setting is incorrect, adjust relay as instructed in procedure f.

i. After adjustment is completed, cut engine, remove test equipment, reinstall hinged cowling, and turn all switches off.

4-224. VOLTAGE REGULATOR RELAY. The voltage regulator relay serves to prevent the voltages exceeding 14.0 to 14.2 volts, regardless of the generator output.

4-225. CHECKING AND ADJUSTING VOLTAGE REGULATOR RELAY. Before adjusting voltage regulator, make sure the contact points on both the current and voltage regulator, relays are clean. Then proceed with the adjustment as follows:

a. Connect voltmeter and fixed resistance to voltage regulator relay, as shown in figure 4-50.

b. Start engine and run it at 1600 rpm. Allow sufficient time (5 to 10 minutes) for regulator to reach operating temperature. Do not remove the regulator cover when checking for meter readings.

c. Check voltmeter for a voltage indication between 14.0 and 14.2 volts.

d. If the voltage indication is incorrect, remove regulator cover, and bend one of the lower spring hangers to decrease voltage setting; to increase voltage setting, bend spring hanger in opposite direction. Do not tamper with the other lower spring hanger.

CAUTION

Bend hanger with care, as it is likely to break off if adjusted carelessly. Do not bend hanger much at any one time, as the adjustment is critical. If a small change in spring tension does not change the voltage reading, clean the contact points of both the current and voltage relays before bending spring hanger excessively.

e. Check the voltmeter with the engine turning up 1600 rpm. The regulator cover should be installed while this check is being made. If a correct setting of the air relay cannot be obtained, check the air gap between the relay core and the armature in the following manner: Remove regulator cover. Push armature down all the way, and then allow it to come back up until points are just touching. Measure the air gap over the center of relay case with a wire feeler gage for a .070-inch gap. To adjust for the air gap, loosen the two contact mounting screws, and move the upper contact support up or down as required.

NOTE

Be sure points are lined up before tightening the two contact mounting screws.

f. Install regulator cover and start engine. At 1600 rpm, check voltmeter for a reading.

g. After adjustment is accomplished, cut engine and remove test equipment.

4-226. CLEANING VOLTAGE REGULATOR CONTROL POINTS. Most reported regulator trouble can be traced to dirty contact points. In normal operation, the gaps and point opening of the regulator will not change very often; therefore, a simple cleaning of the points will, in most cases, clear up regulator trouble. Proceed as follows:

NOTE

Points can be adjusted with regulator installed in the airplane; however, a better job can be accomplished if regulator is removed from the airplane.

a. If points are just dirty and slightly burned, draw a thin, fine-cut point file over the contact points, being careful not to take too much off the small contact, as the material is very thin. Be sure the file has not been used to file other metals, and is not greasy.

b. If points are burned so they are badly pitted, use a spoon or riffler file. This is the only type of file that will touch the center point of cavity formed on point. In extreme cases it will be necessary to loosen the two contact mounting screws, and swing the upper contact bracket to one side. It will be necessary to regap points, as the loosening of the two contact mounting screws will change the gap adjustments.

4-227. BATTERY. A 12-volt, 34-ampere-hour, Exide battery (6-TAS-9B) is mounted just aft of the seat, in the baggage compartment The battery is mounted in a metal battery box which is removed with the battery. When the battery switch, in the cockpit, is turned on, the battery is connected to the airplane's electrical system, through a battery-disconnect relay, located on the underside of the battery support. Battery power is then utilized by the system when the generator is idle.

4-228. REMOVING BATTERY. Remove battery by first disconnecting vent line, then disconnecting the positive and negative leads, and loosening the snap fasteners which secure the battery case in the airplane.

4-229. MAGNETOS. Two Eiseman magnetos, Type S6-LE, (Bendix, Type S6(L)N-21 on L-17B airplanes) mounted on the top rear section of the engine, supply power for engine ignition. All wiring from magnetos to the spark plugs is enclosed within a braided shield for suppression of ignition noises from radio equipment. Timing, as well as other pertinent information concerning the magnetos, is covered in paragraph 4-146 through 4-152.

4-230. STARTER. The engine is cranked electrically by a starter motor attached to the top rear section of the engine. A starter switch, integral with the starter, is manually actuated by foot pressure on a pedal which is suspended from the instrument panel support beams near the firewall and adjacent to the pilot's right rudder pedal. Engagement and disengagement of the pinion with the flywheel is accomplished manually, through linkage to the starter pedal.

NOTE

On L-17B airplanes the starter manual actuating system is replaced with an electrically actuated system.

The starter is wired through the battery disconnect relay, and cannot be operated until the battery switch is turned on. For other pertinent information on starter, refer to paragraphs 4-134 through 4-142.

4-231. FUEL QUANTITY TRANSMITTER AND INDICATOR, L-17A AIRPLANES. Fuel quantity indication is accomplished electrically through use of a transmitter (Stewart-Warner 439140), installed in the aft side of the left fuel tank (accessible from the left wheel well) and connected to an indicator (NAA 145-51038) mounted in the instrument panel. Both units operate on 6-volt current obtained from the 12-volt system through a resistor attached to the indicator. The transmitter consists of a potentiometer with a brush connected to ground and actuated by a float arm. The brush is moved from one end of the resistance strip to the other by the float, the position of which is changed in the tank by fuel level. The change in resistance in transmitter will affect the current that flows through the indicator, which is actually a voltmeter calibrated in gallons. Because of wing dihedral, the indicator measures only 0 to 30 gallons, although the fuel capacity of the airplane is 39-1/2 gallons. The difference between 30 and 39-1/2 gallons is consumed before the indicator needle will move off the 30-gallon mark; however, because of the location of the transmitter (in bottom of tank), the indicator will accurately record fuel level from 30 gallons to zero. Information pertinent to calibration of indicator is covered in paragraphs 4-280 and 4-281.

4-232. MAIN FUEL TANK FUEL QUANTITY TRANSMITTER AND INDICATOR, MODIFIED L-17A AIRPLANES. On modified L-17A airplanes, the fuel quantity transmitter and indicator for the main fuel cells is similar to that of the L-17A airplanes as discussed in paragraph 4-231.

4-233. AUXILIARY FUEL TANK FUEL QUANTITY TRANSMITTER AND INDICATOR, MODIFIED L-17A AIRPLANES. Fuel quantity indication is accomplished electrically through use of a transmitter, mounted on the forward side of the auxiliary fuel tank, and an indicator, mounted below the center section of the pilot's control panel. The units operate on 6-volt current obtained from the 12-volt system through a resistor. These are thermal indicating units, and are accurate for the full amount of fuel in the tank.

4-234. FUEL QUANTITY TRANSMITTERS AND INDICATOR, L-17B AIRPLANES. The fuel indicating system of the L-17B airplanes uses units similar to those described in the preceeding paragraph, 4-233. However, a selector switch (see figure 4-64, reference 16) makes it possible to use a single indicator, with two calibration scales. This indicating system is accurate for the total amount of fuel in either the main or auxiliary tanks.

NOTE

After activating the selector switch, allow approximately 60 seconds to elapse before reading the fuel indicating gage.

4-235. LANDING GEAR POSITION INDICATOR SYSTEM. The landing gear position indicator system consists of the following units: one red and three green landing gear position lights, mounted on the control panel; seven toggle-type switches (an up-lock and down-lock switch for each gear, and a switch actuated by the throttle rod); and a warning horn in the left wheel well. A green indicator light is connected to each gear down-lock switch, which is actuated by each landing gear bungee torque arm. The red light is connected to both the main and nose gear up-lock and down-lock switches. The main gear up-lock switches are actuated by each strut, and the nose gear up-lock switch is actuated by the bungee torque arm. (On L-17B airplanes the main gear down indicator switch is remounted at the outboard end of the shock strut well, and is actuated by movement of the main trunnion. The nose gear indicating switches are moved into the engine compartment, and are mounted above and to the left of the nose wheel trunnion.) The warning horn sounds when the gear is in an unsafe position for landing, and the throttle is retarded. A throttle switch, mounted on the carburetor, is actuated by the throttle control rod when throttle is retarded, thereby completing an electrical circuit through the throttle switch and up-lock switch to ground. The system is designed to indicate positions of the gear as follows:

Gear up and locked ----	All lights off. Horn will sound when throttle is retarded.
Gear down and locked --	All green lights on, and red light off.
Main and nose gears --- in any position other than up and locked, or down and locked.	Red light will burn. Horn will sound when the throttle is retarded.

The green lights may be dimmed by a switch, on the electrical switch panel, which places a resistor (35-ohm, 10-watt) in series with these lights. The horn and light circuits are protected by 20 and 5-ampere fuses or circuit breakers, respectively.

4-236. ADJUSTING LANDING GEAR SWITCHES. Two men are required to adjust the switches: one to watch the operation of the indicator lights, and the other to make the switch adjustments. Proceed as follows:

a. Place airplane on jacks.

b. Position landing gear control in "DOWN" position, and check to make sure gear is down and locked.

c. Turn battery switch on.

d. Remove engine air exit louver fairing on lower right side of fuselage, just aft of firewall.

e. Adjust nose gear down position indicator switch so that green light comes on when landing gear retracting link stop is 1/16 (± 1/32) inch from the full down and locked position.

f. Adjust main gear down position indicator switches so that green light comes on when landing gear retracting link stop is 1/8 (± 1/32) inch from the full down and locked position.

NOTE

Do not use red light or horn operation as an indicator for either of the two preceding adjustments.

g. Retract main gear, and adjust nose gear up position switch so the switch lever moves 1/16 (+ 1/32/-0) inch after the red light goes out and the gear is moved to the up and locked position.

h. Adjust main gear up position switches so switch levers have 1/32 (± 1/64) inch overtravel when gear is held in up position by hydraulic pressure.

i. Relieve hydraulic pressure and pull each gear down individually against the up-lock hooks to see that red light <u>does not</u> come on.

j. After all switches have been adjusted, retract and extend gear several times to see that light indications are correct. With gear in the up position, retard throttle; the horn should sound.

k. Turn battery switch off, lock gear in the down and locked position, and remove jacks.

4-237. ADJUSTING LANDING GEAR WARNING HORN MICROSWITCH. To adjust landing gear warning horn microswitch, proceed as follows:

a. Start engine and set throttle for between 1250 and 1350 rpm.

b. Measure distance from the panel to forward side of the throttle knob, and then cut the engine. This is important, for several times during adjustment of the miscroswitch it will be necessary to return throttle to the correct setting.

c. Remove the left half of the cooling air intake grill and the access door, immediately below carburetor, for access to warning horn switch.

d. Connect a jumper wire from the horn terminal, on which three wires (27, 28, and 29) are attached, to ground.

e. With throttle set in correct position, loosen both warning horn switch mounting screws, and move switch against actuating arm until horn sounds. Tighten mounting screws.

f. Push throttle back and forth several times for positive check that switch is adjusted properly.

g. Remove jumper wire from horn.

4-238. ADJUSTING WARNING HORN. The warning horn can be adjusted while installed in the airplane. Proceed as follows:

a. Connect a 0 to 25-ampere ammeter and a momentary closed switch in series from airplane structure to the horn terminal to which the three wires (26, 27 and 28) are connected.

b. Turn on battery switch, and then close the throttle.

c. Adjust horn for the loudest sound (in the cockpit) at the lowest reading on the ammeter (approximately 3.5 amperes). Lock adjustment screw.

d. After adjustment is completed, turn battery switch off, and disconnect the portable ammeter and the switch from the horn circuit.

4-239. EXTERNAL LIGHTS. The external lights consist of three position lights and two landing lights. The position lights are installed as follows: red light on left wing tip, green light on right wing tip, and a clear light on the lower trailing edge of the rudder. These three lights are controlled by one switch on the electrical panel. A 100-watt, sealed-beam landing light is attached to a bracket which is secured to the outboard side of each main landing gear. Each light is wired through the down-lock switch on the gear, so that when the wheels are down and locked, the landing lights will burn, provided the double-pole, single-throw landing light switch on the electrical panel is on. With the landing lights wired this way, the lights will be out, regardless of position of the control switches when gear is up.

4-240. ADJUSTING LANDING LIGHTS. To adjust the landing lights, proceed as follows:

a. Position airplane on level ground facing a vertical wall 30 feet from the propeller.

b. Level the airplane longitudinally by raising or lowering the tail as necessary.

c. Make a vertical mark on the wall corresponding to airplane centerline; then, 52 inches on each side of this mark, make another vertical mark. On each of these two marks, make two horizontal marks 12 and 18 inches from ground.

d. Cover one light, and loosen the U bolts of the other light bracket. Rotate light around strut until beam is on vertical mark on same side of centerline as light being adjusted. Tighten U bolts; then loosen the two screws that hold the lamp housing to the bracket. Move the lamp up or down until top edge of beam (not center) strikes wall between the horizontal marks. Tighten housing screws.

e. Repeat step d. to adjust other light.

CAUTION

After lights are adjusted, the airplane should be placed on jacks, and each gear pushed up to the locked position by hand to ensure that there is no interference between the lamp bracket and the wing structure.

4-241. HYDRAULIC PRESSURE INDICATOR LIGHT. An amber light, mounted on the face of the control panel, is provided to indicate that hydraulic power control knob is pulled out. A toggle switch, mounted on the front of the firewall, is actuated by a striker plate on the power control linkage and is located to close the light circuit when the power control is full out. A fixed resistor incorporated in the circuit for dimming the light is cut in or out by a double-pole, single-throw switch also used for dimming landing gear indicator lights.

4-242. INSTRUMENT LIGHTS. There are ten instrument panel lights: nine on the instrument panel behind the reflector, and one in the compass shroud. The brilliancy of all instrument lights is controlled by a rheostat on the control panel. To prevent electromagnetic field, which cause erroneous compass readings, the compass light is not grounded at the compass. Instead, the ground wire is twisted around the hot wire and grounded at a distance from the compass. The instrument panel lights are easily replaced by removing the reflector, or the compass shroud. On L-17B and modified L-17A airplanes, three additional reflector panel lights have been installed.

4-243. TURN-AND-BANK INDICATOR. A Schwien electric turn-and-bank indicator (27200) is installed on the instrument panel. This instrument operates directly from the airplane's electrical system (12 to 14 volts), and will operate whenever the battery or generator switch is turned on. (On L-17B and modified L-17A airplanes, the electric turn-and-bank indicator has been replaced by a vacuum driven indicator.) More information on this instrument will be found in paragraph 4-269.

4-244. CABIN HEATER. A Stewart-Warner electrically controlled heater is installed in the airplane, and is capable of an output of 20,000 BTU per hour. The heater will operate as satisfactorily on the ground as in the air (engine operating during operation of heater on the ground), because of a combustion air blower installed in the heater. This blower is turned off automatically by the nose gear up-lock switch when the landing gear is retracted. The heater operation is entirely automatic, after the thermostatic control on the control panel is moved from "OFF" position, and the cabin air selector valve is opened. The heater is started by a switch, actuated in conjunction with the thermostat, which closes circuits to a solenoid-operated fuel shut-off valve and the heater breaks the circuit to the glow plug and combustion is maintained by auto-ignition. When the cabin temperature reaches the range at which the thermostat is set, a solenoid-operated restrictor valve reduces the heater output to 4000 BTU per hour. When cabin temperature drops, the thermostat causes the fuel restrictor valve to open, and the full amount of fuel is again sent to the heater. This cycle continues throughout the operation of the heater, in order to maintain an even cabin temperature. A safety switch, installed at the cabin air control, prevents heater operation when the cabin air selector and outlet valve is closed. For further information, refer to paragraphs 4-293 through 4-297.

4-245. CIGARETTE LIGHTER. An automatic cigarette lighter is installed on the right side of the control panel. A special fuse is installed in series with the lead on the back of the lighter case. To replace this fuse, unscrew the lead wire from the fuse, and then unscrew the fuse from the lighter.

CAUTION

Before a new fuse is installed determine and correct the cause of the failure.

4-246. ELECTRONIC SYSTEM.

4-247. L-17A AIRPLANES.

4-248. The airplane is equipped with an Electronic Specialty Company transmitter-receiver combination. The set consists of a Ranger Model 120C receiver, Model 209C transmitter and microphone and headset jacks. (See figure 4-58.) The set is designed for use with a carbon microphone and low-impedance headsets (600 ohms). The specifications for the units are as follows:

RECEIVER

Frequency ranges	195-410 kc 2.5 mc-7.0 mc
Power output	3 watts audio power
Tube complement	12BA6 r-f amplifier 12BE6 converter 12BA6 i-f amplifier 6AT6 second detector, avc, and first audio amplifier 6AK6 output audio amplifier

TRANSMITTER

Frequency	3105KC, 4495KC
Power output	15 to 18 watts
Percent modulation .	100%
Tube complement	12A6 oscillator (1) 807 power amplifier (1) 6V6GT modulators (2) 12SL7GT speech amplifier-phase inverter (1) 12J5GT sidetone amplifier (1) 6X5GT rectifiers (2)

4-249. TRANSMITTER-RECEIVER OPERATION. For operating instructions, refer to Handbook AN 01-60LAA-1.

4-250. REMOVING AND INSTALLING RECEIVER. Four screws through the face of the airplane control panel hold the receiver in place. At the back of the receiver are two electrical disconnect plugs for the radio wiring and a disconnect for the wire to the dial light. The receiver is positioned for mounting from the back side of the control panel.

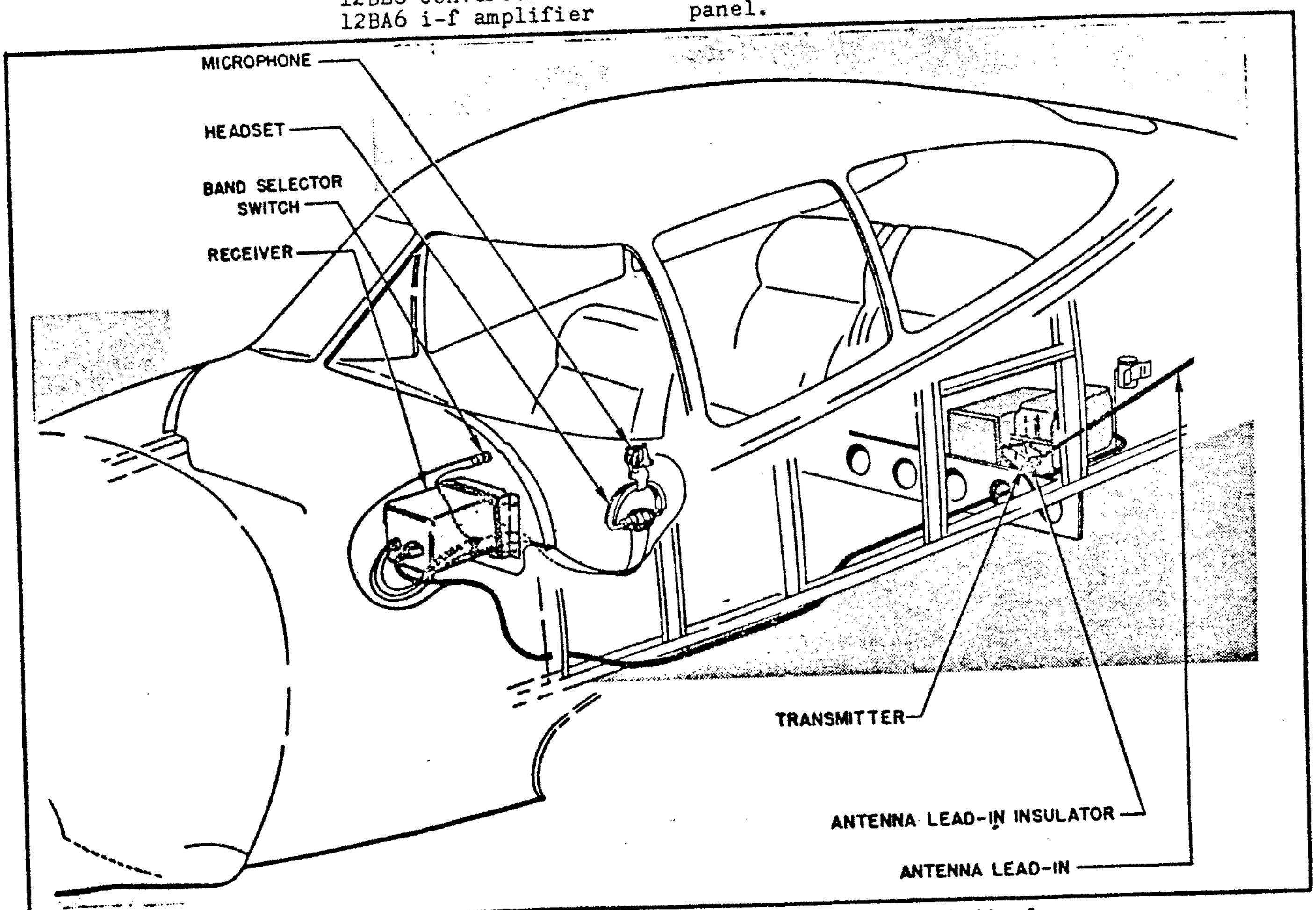


Figure 4-58. Location of Electronic Equipment, L-17A Airplanes

4-251. REMOVING AND INSTALLING TRANSMITTER. The transmitter is readily accessible from the airplane baggage compartment, and is held in its mounting bracket by four screws.

4-252. ELECTRONIC SYSTEM, L-17B AND MODIFIED L-17A AIRPLANES.

4-253. The airplane is equipped with three transmitters and two receivers manufactured by the Aircraft Radio Corporation (ARC) which comprise the ARC type 12 Radio Installation. The following chart lists the major components of this installation.

EQUIPMENT	TYPE	FREQ. RANGE
Transmitter	T-11A	126.18 MCS
Transmitter	T-11A	122.1-122.3-122.5-122.7-122.9 MCS
Receiver VHF	R-15	108-135 MCS
Receiver-Broadcast	R-10A	520-1600 KC
Receiver-Range	R-11A	190-550 KC
Loop- for use with 5 and 6	L-10	
Control Unit	C-24	
Junction Box	J-12	
VHF Antenna Mast	A-12	
Dynamotor	D-10	
Range Antenna Kit	12296	

The above listed receiver and transmitter units are mounted on shock proof bases in a special rack on the left side of the airplane baggage compartment aft of the rear seat. This equipment is accessible for adjustment and service in the airplane when the cockpit canopy is in the full "OPEN" position. The C-24 Control Unit is installed in the instrument panel to the left of the shock mounted instrument panel and just forward of the pilots control wheel. The following transmitter and receiver controls are provided on the control panel: antenna selector switch (Ant. - Loop), tuning control, "ON" and "OFF" switch and volume control for the broadcast and range receivers; VHF receiver audio level selector switch (Hi-Lo), tuning unit, "ON" and "OFF" switch and volume control; directional loop azimuth control and VHF transmitter channel and interphone selector switch. Separate phone and microphone jacks are provided on the right and left sides of the instrument panel for the pilot and co-pilot. The sets are designed for use with a carbon microphone and low-impedance head sets (600 ohms). Antennas provided for the operation of the above equipment are a single wire center fed range and broadcast band antenna, running from the top of the vertical stabilizer to a point on the top right side of the fuselage just aft of the cockpit canopy; a vertical VHF antenna and controllable directional loop both mounted on the top of the fuselage between the canopy and dorsal fin.

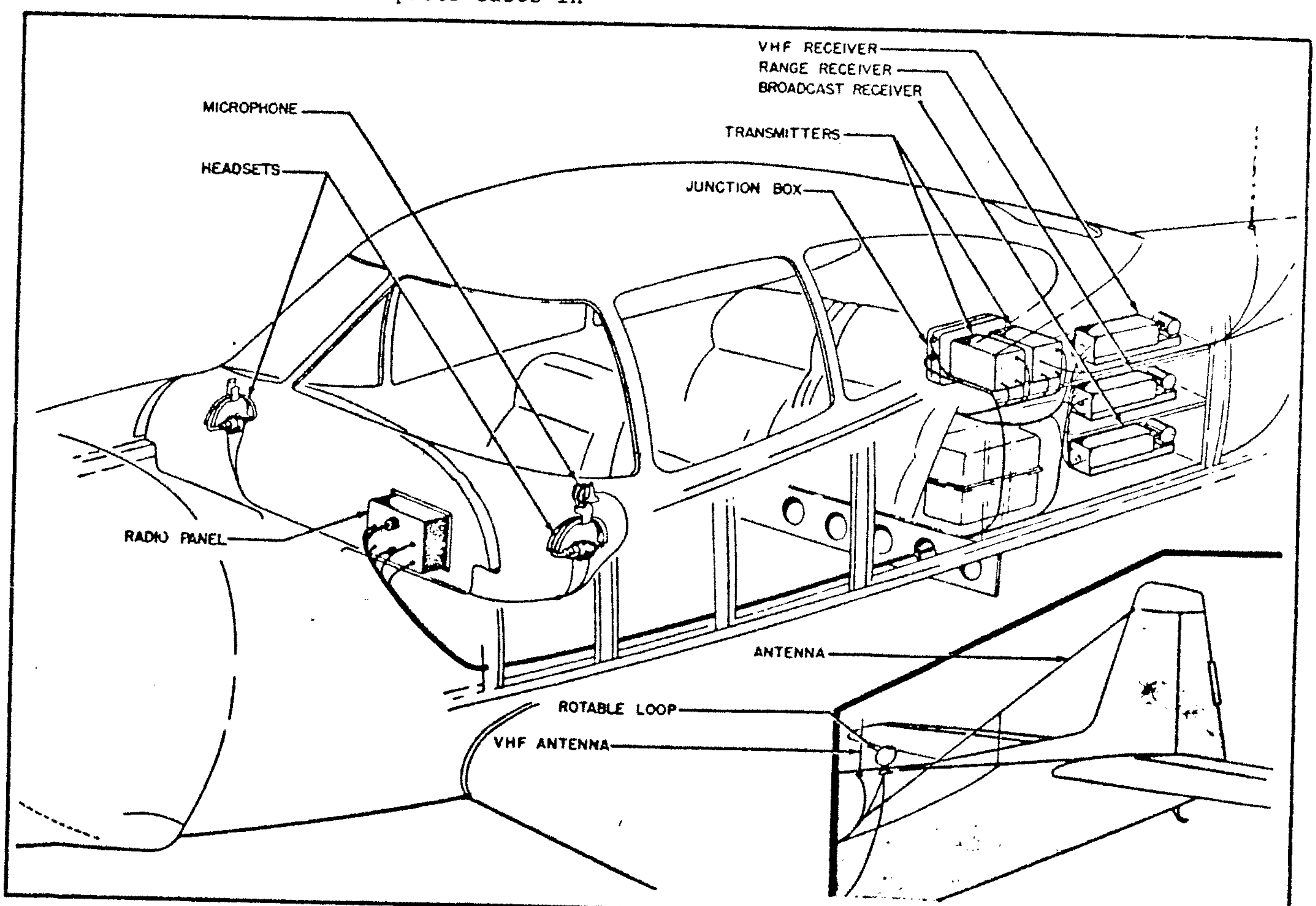


Figure 59. Location of Electronic Equipment, L-17B and Modified L-17A Airplanes

4-254. SPECIFICATIONS OF EQUIPMENT.

T-11A TRANSMITTER

Frequency Range	126.18 mcs 122.1-122.3-122.5-122.7-122.9 mcs
Percentage Modulation ..	Over 90%
Power Output	1.1 to 1.4 (unmodulated)
Tube Complement ...	
V-50 Modulator	6AQ5
V-51 Power Amp-doubler	6AQ5
V-52 Amp Tripler	6AQ5
V-53 Crystal Oscillator-Tripler .	6AQ5

R-15 VHF RECEIVER

Frequency Range	108-135 mcs
Audio Level	HI 300 Milliwatts LO 30 Milliwatts
Sensitivity	Not less than 2 micro-volts
Tube Complement	
V-1 1st RF AMP	9003
V-2 2nd RF AMP	9003
V-3 Mixer	9003
V-4 Oscillator	9002
V-5 1st IF AMP	14A7
V-6 2nd IF AMP-AVC	14R7
V-7 3rd IF AMP-AVC	14R7
V-8 Det-Noise Limiter - 1st AF .	14F7
V-9 2nd AF	12A6

R-11A RECEIVER

Frequency Range	190-550 kc
Tube Complement	
V-1 RF AMP	14A7
V-2 Mixer	14S7
V-3 1st IF	14A7
V-4 2nd IF-AVC	14R7
V-5 Det-Noise Limiter	14F7
V-6 Audio Amp	12A6

R-10A BROADCAST RECEIVER

Frequency Range	520-1600 kc
Tube Complement	
V-1 RF AMP	14A7
V-2 Mixer	14S7
V-3 1st IF	14A7
V-4 2nd IF-AVC	14R7
V-5 Det-Noise Limiter	14F7
V-6 Audio Amp	12A6

4-255. ANTENNA MAINTENANCE. The antenna will require little or no attention other than inspecting the wire for nicks. Because these nicks greatly reduce the strength of the wire, it is likely to snap during flight. For this reason, replace the antenna at once, when a bad nick is detected.

4-256. PITOT-STATIC SYSTEM.

4-257. The pitot-static system, (figure 4-60) consists of a pitot tube, two static plates, and lines connected to the airspeed indicator, altimeter, and vertical speed indicator. The pitot pressure lines are coded black, and the static pressure lines green and black.

NOTE

The static and pitot openings should be clear of dirt and debris for proper functioning of the instruments affected.

4-258. TESTING STATIC PRESSURE LINE.

a. Put masking tape over static plates.

b. Remove sump and attach manometer. (Access to the static sump is through the cabin aft of the rear seat on the right side.)

c. Set altimeter pointer at zero.

d. Slowly apply suction until altimeter indicates 1000 feet (1.05 inches of mercury or 14.24 inches of water); then "pinch off" the tube and secure it with a suitable clamp.

e. The altimeter should not indicate less than 850 feet after a one-minute period. Tap the altimeter to keep the pointer swinging freely.

f. If altimeter indicates less than 850 feet, locate leak with soapsuds and repair it.

g. Remove masking tape from static plates. Remove manometer, and reinstall sump.

CAUTION

Do not apply pressure to static line.

4-259. TESTING PITOT PRESSURE LINE.

a. Cover drain hole at bend of pitot tube with masking tape, and connect a source of pressure and a manometer to pitot pressure opening.

b. Apply pressure slowly until airspeed indicator indicates 150 mph (.82 inch mercury or 11.18 inches of water pressure); then "pinch off" source of pressure with a suitable clamp.

c. The airspeed indicator should not indicate less than 140 mph after a one-minute period. Tap the indicator to keep the pointer swinging freely

d. If airspeed indicator reads less than 140 mph, locate leak with soapsuds and repair it.

e. After test is completed, remove manometer from pitot tube.

4-260. PITOT TUBE. The pitot tube is a single unit installed on the underside of the right wing with its axis parallel to the thrust line of the airplane. It furnishes an accurate value of impact pressure, caused by the motion of the airplane through the surrounding air. The forward part of the tube is open to receive the full force of the impact pressure.

4-261. INSTRUMENTS.

4-262. L-17A INSTRUMENTS. The instruments consist of: rate-of-climb indicator; manifold pressure gage; tachometer; sensitive altimeter; ammeter, airspeed, fuel pressure, oil pressure, oil temperature, fuel quantity, and turn-and-bank indicators; and clock. A compass is installed on all airplanes above the instrument panel, on the shroud. The instruments are classified into three groups: flight; engine; and miscellaneous. The flight instruments are the altimeter, airspeed indicator, and rate-of-climb indicator. Static pressure for these instruments is taken through a static plate mounted on each side of the fuselage, approximately two-thirds the distance aft. The engine instruments consist of a tachometer, manifold pressure gage, fuel pressure indicator, oil pressure indicator, and oil temperature indicator. Miscellaneous instruments include the fuel quantity indicator, ammeter, and clock. The lines to the instruments are color-coded.

4-263. MODIFIED L-17A INSTRUMENTS. The modified L-17A airplanes will include all instruments carried on the L-17A airplanes, plus a directional gyro, gyro horizon, vacuum suction gage, vacuum-driven turn-and-bank indicator and auxiliary tank fuel quantity gage.

4-264. L-17B INSTRUMENTS. The L-17B airplane instruments will differ from the modified L-17A airplane instruments only in that the two fuel quantity gages are replaced by one gage incorporating two indicating scales.

4-265. INSTRUMENT PANEL. The instrument panel is mounted with rubber shock mounts. It is removed by first removing the instrument connections, then removing the shock mount pins that secure the panel to the mounts. When the instruments are being removed, the lines should be capped to keep out dirt and other foreign matter. When installing an instrument, treat the threads on the fitting with thread lubricant. Installation of the instrument panel is a reversal of the removal procedure.

4-266. AIRSPEED INDICATOR. The airspeed indicator is a sensitive differential pressure gage that measures the difference between pitot tube impact air pressure and static air pressure.

4-267. ALTIMETER. The altimeter indicates the altitude at which an airplane is flying by measuring atmospheric pressure.

4-268. RATE-OF-CLIMB INDICATOR. The rate-of-climb indicator shows the rate of ascent or descent of the airplane; it is used in maintaining a definite rate of ascent or descent during instrument flying.

4-269. TURN-AND-BANK INDICATOR, L-17A AIRPLANES. The turn-and-bank indicator is composed of an electrically driven, gyro rate-type turn indicator (which operates on 12-volt direct current) and a bank indicator. The bank indicator is a liquid-filled curved tube in which a free-rolling inclinometer ball changes position according to the direction of the force of gravity and centrifugal force.

4-270. TURN-AND-BANK INDICATOR, L-17B AND MODIFIED L-17A AIRPLANES. On L-17B and modified L-17A airplanes, the gyro in the turn-and-bank indicator is powered by 2 in. Hg suction provided by the venturi vacuum system; refer to paragraph 4-298.

4-271. DIRECT-READING COMPASS. The direct reading, vertically mounted compass is mounted on the top center of the control panel. This compass consists of a metal bowl filled with compass fluid, and a semi-float-type card graduated in increments of 5 degrees. For the purpose of correcting deviations of the card which result from magnetic disturbances, a compensating system utilizing a built-in permanent magnet compensator is attached to the compass. This type of compass should be compensated every 100 hours, or at least once in each 3-month period, and at times when a change of equipment likely to affect the instrument, is made.

4-272. COMPASS BASE (ROSE) METHOD OF COMPASS SWINGING. The compass swing base (compass rose) should consist of a level, circular area having a smooth surface of sufficient strength to support the weight of the aircraft, without cracking or forming depressions under the wheels. No magnetic materials should be used in construction of the compass rose. The direction of the horizontal component of the earth's magnetic field, measured at any point between 2 and 6 feet above the surface of the base extending over the whole area of the base, should not differ by more than one degree from the direction measured at any other point in the space. The direction and uniformity of the earth's field should be determined prior to the use of the area for compass swinging; annually thereafter; and also after any magnetic material such as building, railroad tracks, direct-current power lines, etc, are installed within 200 yards of the base or rose. Any change in direction of the magnetic meridian, and the date of this observation, should be clearly and permanently marked on the surface of the rose.

CAUTION

The airplane should be at least 100 yards from automobiles, steel buildings, or other aircraft. All magnetic

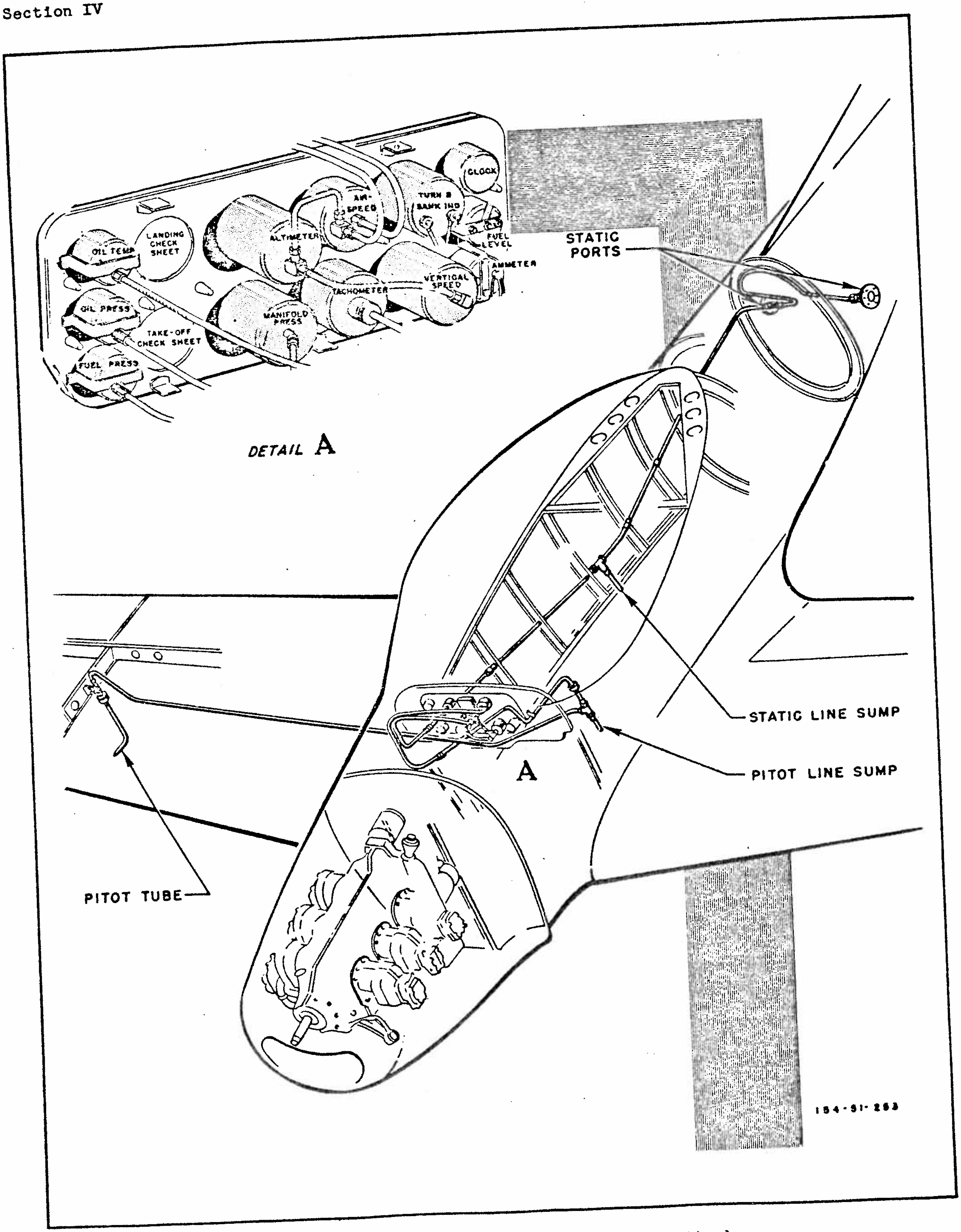


Figure 4-60. Pitot-Static System, L-17A Airplanes

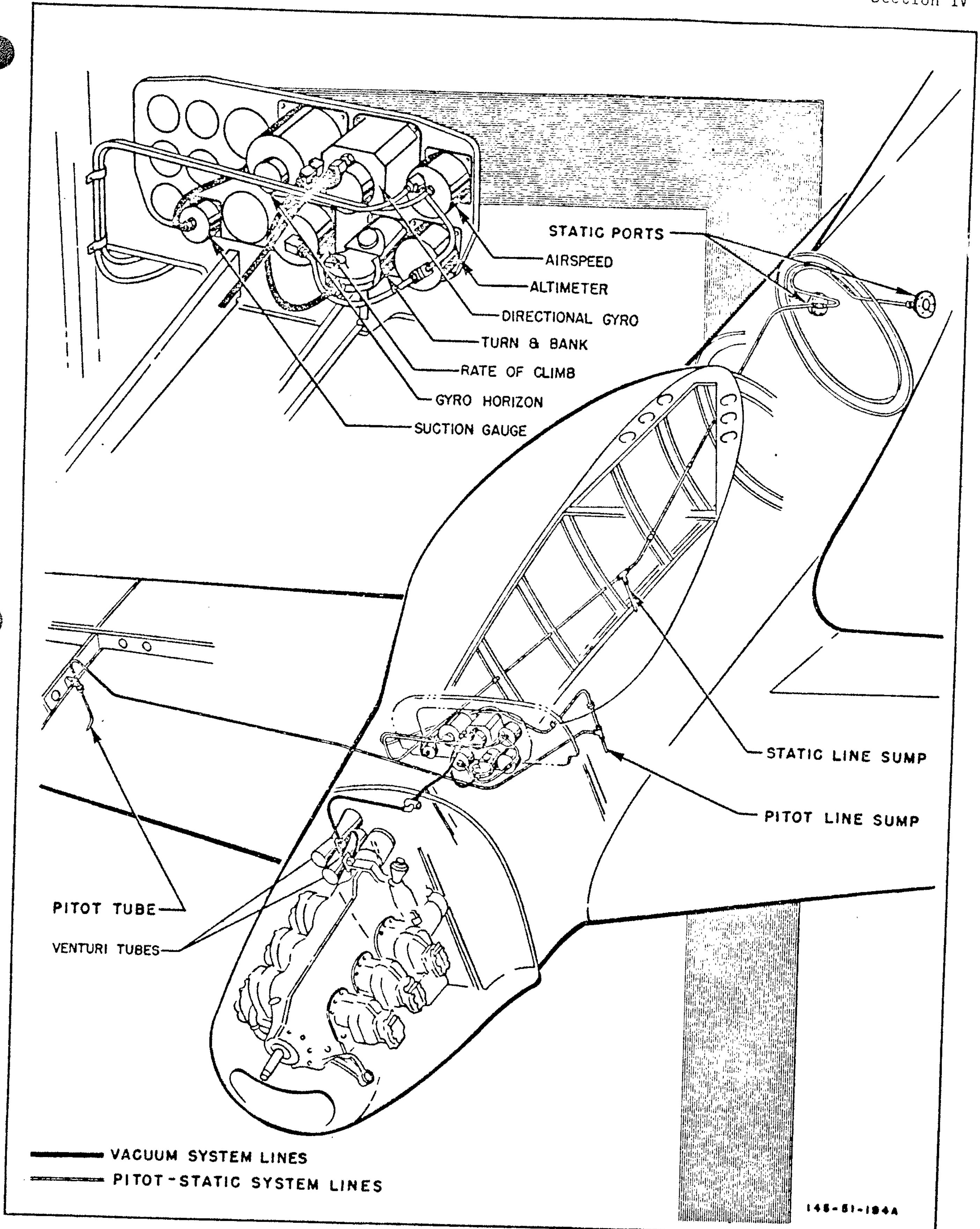


Figure 4-61. Pitot Static and Venturi Vacuum Systems, L-17B and Modified L-17A Airplanes

materials (such as pocket knives, tools, mechanical pencils, and steel scales) should be removed from personnel engaged in swinging the compass. All airplane equipment having any magnetic effect on the compass should be secured in the position occupied in normal flight, and the engine must be running throughout swinging procedure.

4-273. SWINGING THE COMPASS. To swing the compass, proceed as follows:

a. Place the airplane on a swinging base, and level to within 5 degrees.

b. The compass should be checked for sufficient compass fluid. If the external surface of the compass is damp with liquid, or if a bubble forms within the compass, liquid is required and the compass should be filled.

c. Align the white dots on the compensating screws with the dots on the compass, using a nonmagnetic screwdriver.

d. See that all movable magnetic objects are in the usual flight positions.

e. Start engine and run at approximately 800 to 900 rpm during adjustments and recordings of readings.

f. Place the airplane on a magnetic heading of 90 degrees.

g. Adjust the E-W compensator screw until compass reads 90 degrees.

h. Place the airplane on a magnetic heading of 180 degrees, and adjust the N-S compensator screw until compass reads 180 degrees.

i. Place the airplane on a magnetic heading of 270 degrees. Note the deviation, and reduce to one-half by adjusting the E-W compensator screw.

j. Place the airplane on a magnetic heading of 0 degree. Note the deviation and reduce to one-half by adjusting the N-S compensator screw.

k. Place the airplane on magnetic headings of every 15 degrees, and record the corresponding compass readings on the correction card.

4-274. TACHOMETER. The tachometer is used for indicating engine speed and is driven by a flexible shaft connected to the engine.

4-275. MANIFOLD PRESSURE GAGE. The manifold pressure gage is calibrated in inches of mercury with a range of 10 to 50 inches. It indicates the pressure within the intake manifold.

4-276. OIL TEMPERATURE INDICATOR. The oil temperature indicator is an instrument of the capillary type, and is connected to a bulb located in the oil cooler relief valve housing.

4-277. OIL PRESSURE INDICATOR. The oil pressure indicator, which indicates from 0 to 100 psi pressure, is of the bourdon-tube type. A line attached to the oil pressure port on the engine, located between cylinders 2 and 4, is routed directly to the oil pressure indicator.

4-278. FUEL PRESSURE INDICATOR. The fuel pressure indicator, which indicates from 0 to 15 psi, is of the bourdon-tube type. A line attached to the fuel pressure port on the carburetor is routed directly to the fuel pressure indicator.

4-279. CLOCK. The clock, an 8-day standard air craft type, incorporates a winding knob on the front of the case. The adjustment needle is accessible by removing a plug at the back of the case.

4-280. FUEL QUANTITY INDICATORS. For descriptive information concerning the fuel quantity indicating systems, refer to paragraphs 4-231, 4-232, 4-233, and 4-234.

4-281. CHECKING FUEL QUANTITY INDICATOR AND TRANSMITTERS, L-17A AIRPLANES. The fuel quantity indicating system should be checked periodically as follows:

a. Drain fuel tanks at accumulator tank drain. Then refill tanks with exactly 30 gallons fuel.

b. Turn battery switch "ON" and check gage for reading of 30 gallons. If incorrect, bend float rod as required.

NOTE

If bending of float rod is inadequate for correct gage readings, replacement of transmitter or gage or both may be necessary.

c. Check gage reading for each 5 gallons down to "EMPTY" by draining off 5 gallons of fuel at a time. A variation of one gallon from each 5-gallon indication is allowable.

NOTE

Battery switch must be left "ON" during entire calibration procedure.

4-282. "ZERO" ADJUSTMENT, FUEL QUANTITY INDICATORS AND TRANSMITTERS, L-17B AIRPLANES. The only adjustment possible on the fuel indicating system of the L-17B airplanes is the "zero" adjustment of the transmitters. Under normal service conditions no adjustment should be necessary during the life of the instrument. Should it be necessary to replace either a transmitter or an indicator, it is possible to check and adjust the "zero" indication by the following procedure:

a. Drain both the main and auxiliary fuel tanks.

b. Turn the battery switch "ON".

c. Turn the fuel indicator gage selector switch to "MAIN".

d. Allow a one minute stabilization period, then note whether or not the indicator gage reads "0".

e. Should the gage fail to read "0", remove the access plate on the back of the transmitter, and using a ratchet key turn the adjusting gear (See figure 4-62) clockwise to increase the reading of the indicator or counter-clockwise to lower the reading of the indicator.

f. Turn the fuel indicator gage selector switch to "AUX" and repeat steps d. and e. above.

CAUTION

Do not attempt to adjust this indicating system by bending the float rods. If the above adjustment fails to correct a faulty gage reading, replace the units as necessary.

4-283. GYRO HORIZON. The gyro horizon provides the pilot with an indication of the airplane attitude in relation to the horizon. This is an air-driven instrument, the power source being the venturi vacuum system. (See figure 4-61.) The air inlet, on the back of the instrument housing, incorporates a filter screen which should be removed and cleaned periodically.

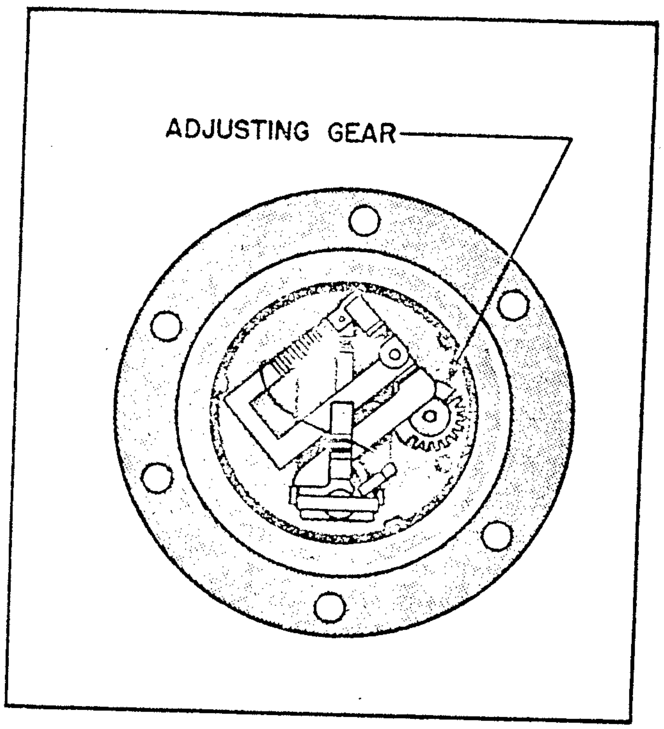


Figure 4-62. Fuel Transmitter "Zero" Adjustment

4-284. DIRECTIONAL GYRO. The directional gyro provides the pilot with a steady reference to the directional flight of the airplane in regards to a fixed course. This is an air-driven instrument, the power source being the venturi vacuum system. (See figure 4-61.) The air inlet, on the back of the instrument housing, incorporates a filter screen which should be removed and cleaned periodically.

4-285. VACUUM GAGE. The vacuum gage is calibrated in inches of mercury (Hg) with a range of 0 to 10 inches. The gage indicates the differential pressure between the air pressure in the pilot's compartment and the pressure in the vacuum system. Should the gage start to fluctuate as the airplane changes altitude, check that the vent hole at the bottom of the instrument housing is clear.

4-286. <u>FUSELAGE EQUIPMENT</u>.

4-287. The airplane is equipped with two front seats, a rear seat, armrests, seat belts, and ash trays. There is also a glove compartment in the right side of the control panel. (See figure 4-65.)

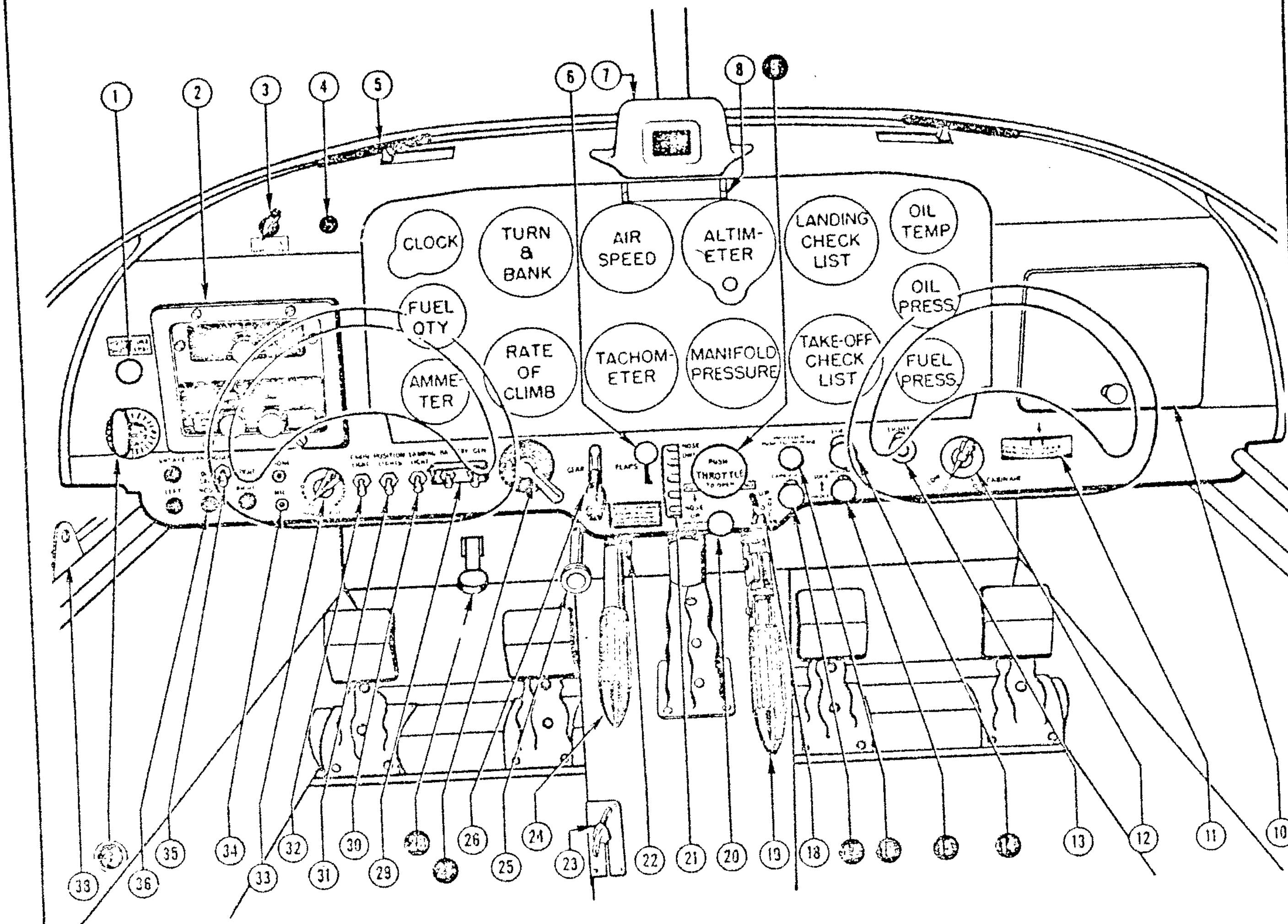
4-288. CABIN SEATS. The seats for the pilot and front passenger are individual, adjustable fore and aft, and are constructed of alclad frames, with removable cushions made of airfoam rubber enclosed in fabric upholstery. The rear seat, extending the full width of the fuselage, is made of a bottom and a back tubular frame with removable cushions. These cushions, also, are made of airfoam rubber enclosed in fabric upholstery. The back of the seat pulls forward to allow easier access to the baggage compartment.

4-289. INSTALLING AND REMOVING CABIN SEATS. (See figure 4-66.)

4-290. <u>HEATING AND VENTILATING SYSTEM</u>.

4-291. The heating and ventilating system (figure 4-67) consists of ram air duct (taking air from in back of the nose grill), heater, control valve, and distributing ducts within the cabin. The ducts within the cabin provide heated or ventilating air for maintaining desired temperature in cabin or for defogging the windshield.

4-292. CONTROL VALVE AND OUTLET ASSEMBLY. A combined control and outlet valve (located on the right side of the firewall) regulates the quantity of heated or ventilating air being admitted, and directs it to the windshield for defogging and to the cabin. The control valve is operated by a cabin control (mounted on the right side of



1. Hydraulic Fluid Emergency Shut-Off Control
2. Radio Receiver
3. Transmitter Frequency Selector
4. Hydraulic Power Light
5. Ventilating Air Outlet
6. Flap Control
7. Magnetic Compass
8. Compass Correction Card
9. Throttle
10. Glove Compartment
11. Cabin Air Distributing Control
12. Cabin Heater Control
13. Cigarette Lighter
14. Emergency Fuel Shut-Off Control
15. Mixture Control
16. Propeller Control
17. Carburetor Heat Control
18. Elevator Trim Indicator
19. Brake Control
20. Hydraulic Power Control
21. Elevator Trim Control
22. Landing Gear Control Locking Lever
23. Canopy Assist Handle
24. Hydraulic Hand-Pump
25. Emergency Landing Gear Release
26. Landing Gear Control
27. Ignition Switch
28. Starter Pedal
29. Battery and Generator Switches
30. Landing Light Switch
31. Position Light Switch
32. Cabin Light Switch
33. Panel Light Switch
34. Radio Jacks
35. Indicator Lights Dimmer Switch
36. Gear Position Indicator Lights
37. Primer
38. Controls Lock Engaging Lug

Figure 4-63. Instruments, L-17A Airplanes

TROUBLE	PROBABLE CAUSE	REMEDY
	Emergency shut-off valve closed.	Open valve and secure with safety wire.
Slow operation of all systems.	Excessively worn pump.	Replace.
	Control valve linkage out of adjustment.	Adjust
	Internal leakage in actuating cylinders.	Repair or replace.
	Clogged filter in reservoir.	Replace filter.
Landing gear fails to operate.	Up-locks out of adjustment.	Adjust.
	Defective actuating cylinders.	Replace.
	Control valve out of adjustment.	Adjust linkage.
	Excessive internal leakage in system.	Isolate and correct.
Wing flaps fail to operate.	Defective actuating cylinder.	Replace.
	Control valve out of adjustment.	Adjust linkage.
	Excessive internal leakage in system.	Isolate and correct.

4-189. GENERAL INSTRUCTIONS FOR HANDLING HYDRAULIC EQUIPMENT.

4-190. REMOVING AND DISASSEMBLING HYDRAULIC SYSTEM UNITS. When disconnecting hydraulic lines, plug the ends to prevent loss of fluid and to keep out foreign matter. When disassembling a unit of the hydraulic system, work in as clean a place as possible, as small particles of dirt are injurious to the unit. Thoroughly clean component parts immediately after disassembly.

4-191. CLEANING HYDRAULIC PARTS. Parts must be clean before assembly. Clean metal parts and subassemblies by washing them in a suitable solvent. Use a brush when necessary to remove caked dirt, gum, rust-preventive coating, or paint. Be sure the brush used will not mar or scratch finishes, or sealing ring grooves, pistons, piston rods, valve faces, slide valves, sealing surfaces, etc. Remove the paint from all surfaces inside the assembly. Do not use solvents to clean sealing rings or packing; use dry air, or clean, lint-free rags. Never use rags that have been around a machine shop, because of the possibility of metal chips being in the rags. To prevent oxidation, keep parts as free from moisture as possible. Do not leave steel unplated parts unprotected long enough to start rusting.

4-192. REMOVING SURFACE BLEMISHES FROM HYDRAULIC PARTS. When removing rust or rust stains from interior honed surfaces, use only suitable abrasives such as buffing compound or crocus cloth. Be sure to rub lengthwise when removing mars or nicks.

4-193. INSPECTING HYDRAULIC PARTS. Threads and sharp edges must be free from burrs. All passages must be free of material which might break loose and get into interior of assemblies. Make sure plated surfaces are not damaged to the extent that they could cause leakage or binding. Examine bores, ring grooves, etc, for flaws and roughness. Make sure that all surfaces which come in contact with nonmetallic packing rings, or parts made of synthetic rubber, are free from burrs, nicks, scratches, tool marks, and roughness.

4-194. LUBRICATING HYDRAULIC PARTS. All parts should be lubricated before assembly. Apply lubricant sparingly and wipe off excess, as too much oil will collect dirt and grit, and cause malfunctioning of the assembly. Lubrication of external seals, "O" rings, threads, bearings, and retainers, provides easier assembly and eliminates galling of the threads and slide fits. It is advisable to lubricate external seals, threads, bearings, and retainers with petrolatum jelly or equivalent, so that when external tests are made, no hydraulic fluid is visible, unless it has leaked from the inside. Lubricate internal and moving surfaces such as pistons, "O" rings, rods, shafts, etc, with hydraulic fluid.

4-195. ASSEMBLING HYDRAULIC SYSTEM UNITS.

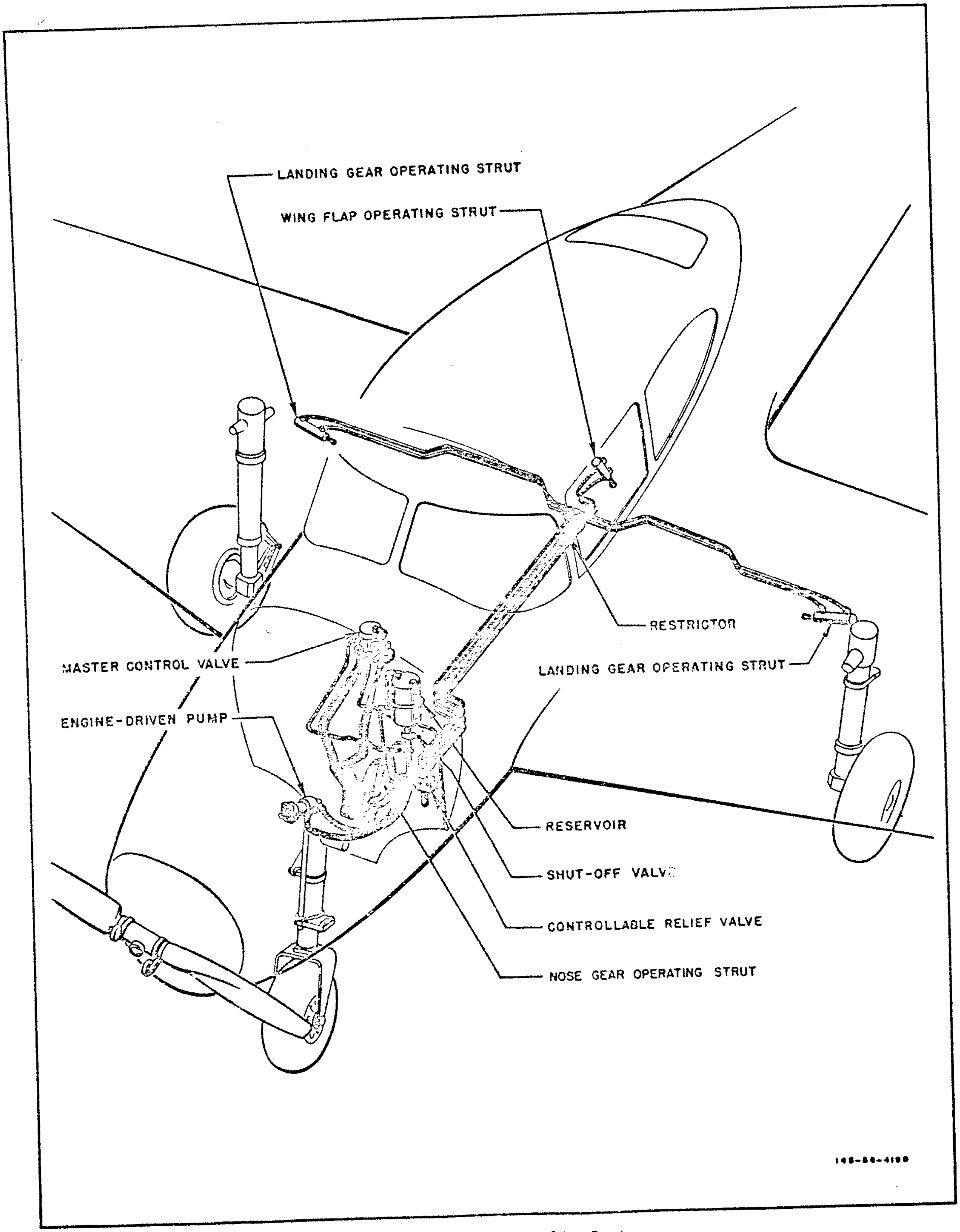
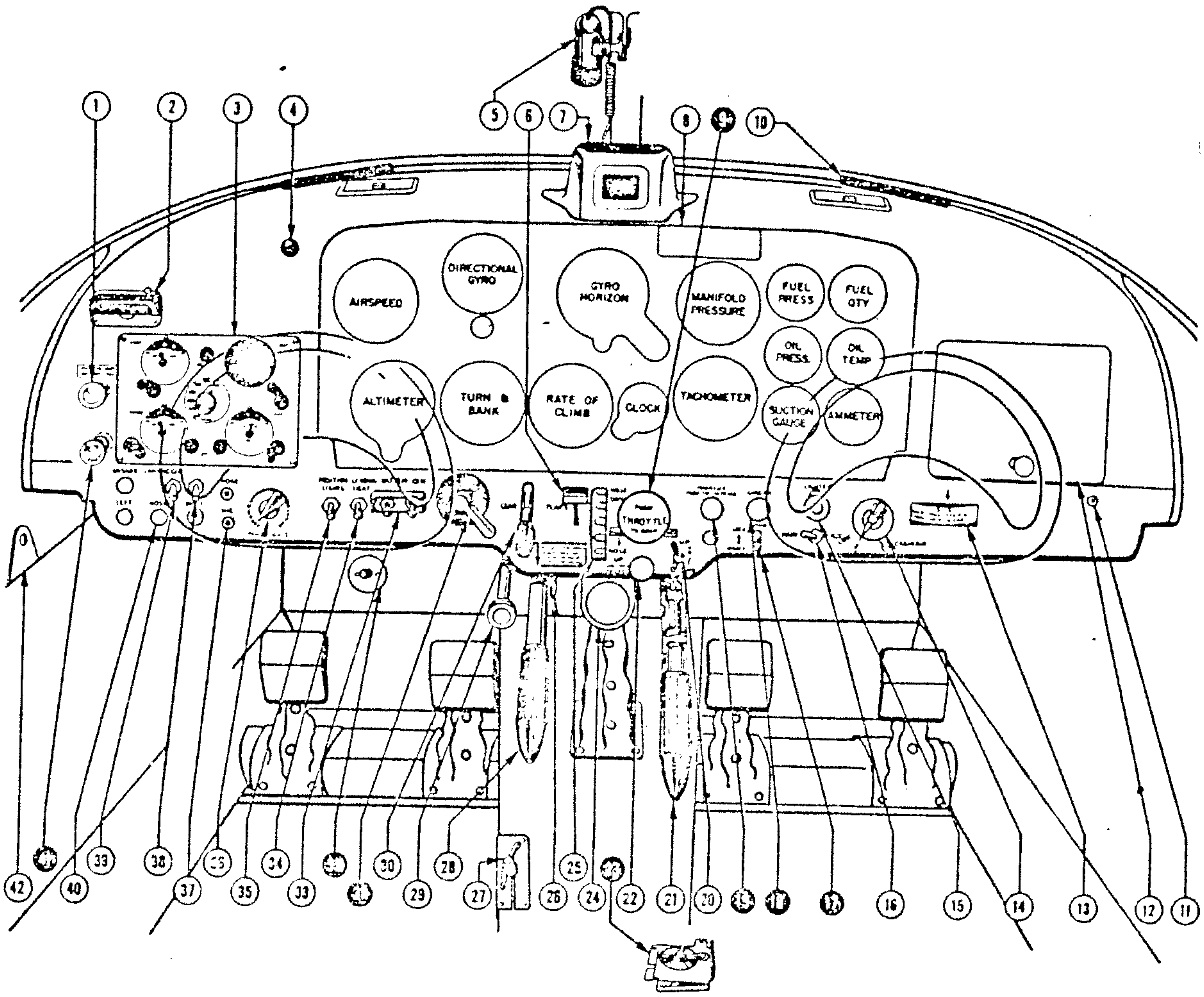


Figure 4-42. Hydraulic System



1. Hydraulic Fluid Emergency Shut-Off Control
2. Radio Panel Light
3. Radio Control Panel
4. Hydraulic Power Light
5. Utility Light
6. Flap Control
7. Magnetic Compass
8. Compass Correction Card
9. Throttle
10. Ventilating Air Outlet
11. Radio Jack
12. Glove Compartment
13. Cabin Air Distributing Control
14. Cabin Heater Control
15. Cigarette Lighter
16. Fuel Quantity Indicator Gage Selector Switch
17. Mixture Control
18. Carburetor Heat Control
19. Propeller Control
20. Elevator Trim Indicator
21. Brake Control
22. Hydraulic Power Control
23. Fuel System Selector Valve
24. Auxiliary Tank Fuel Quantity Gage (Modified L-17A's Only)
25. Elevator Trim Control
26. Landing Gear Control Locking Lever
27. Canopy Assist Handle
28. Hydraulic Hand Pump
29. Emergency Landing Gear Release
30. Landing Gear Control
31. Ignition Switch
32. Starter Button
33. Battery and Generator Switches
34. Landing Light Switch
35. Position Light Switch
36. Panel Light Switch
37. Radio Jacks
38. Electric Fuel Pump Switch
39. Indicator Lights Dimmer Switch
40. Gear Position Indicator Lights
41. Primer
42. Controls Lock Engaging Lug

Figure 4-64. Instruments, L-17B and Modified L-17A Airplanes instrument panel) and a cable assembly which is connected to a pulley of the control and outlet valve assembly. Movement of the control (left or right) will bring about a change in air distribution.

4-293. ADJUSTING CONTROL VALVE AND OUTLET ASSEMBLY CONTROL MECHANISM. To adjust mechanism, proceed as follows:

a. Loosen cable lockscrews on both the control assembly, and the control valve and outlet assembly pulleys.

b. Turn the control valve and outlet assembly pulley (counterclockwise) as far as possible to the fully closed position.

c. Turn control assembly to "OFF" position.

d. Position cable on the pulleys with the cable turnbuckle mid-distance between the control assembly and cable support bracket (located on the firewall above control valve and outlet assembly).

e. Tighten the cable so there is no slack remaining in the cable. Safety the turnbuckle.

CAUTION

Excessive tightening will damage the bracket, the control assembly, or the control valve and outlet assembly.

f. Tighten cable lockscrews in both pulleys.

4-294. CABIN HEATER.

4-295. The combustion-type heater has a maximum output of 20,000 BTU per hour. A heater control switch is installed on the control panel. Maximum gasoline consumption of the heater is approximately 1/4 gallon per hour. The heater may be operated only when the engine is running. To permit ground operation (engine running), a blower is installed on the heater to supply combustion air; ram air is supplied by the propeller blast. Blower operation during flight is prevented by a landing-gear-operated switch. (The switch is moved to the "OFF" position by the nose gear when the gear is retracted.) The heater is mounted, in a horizontal position, within

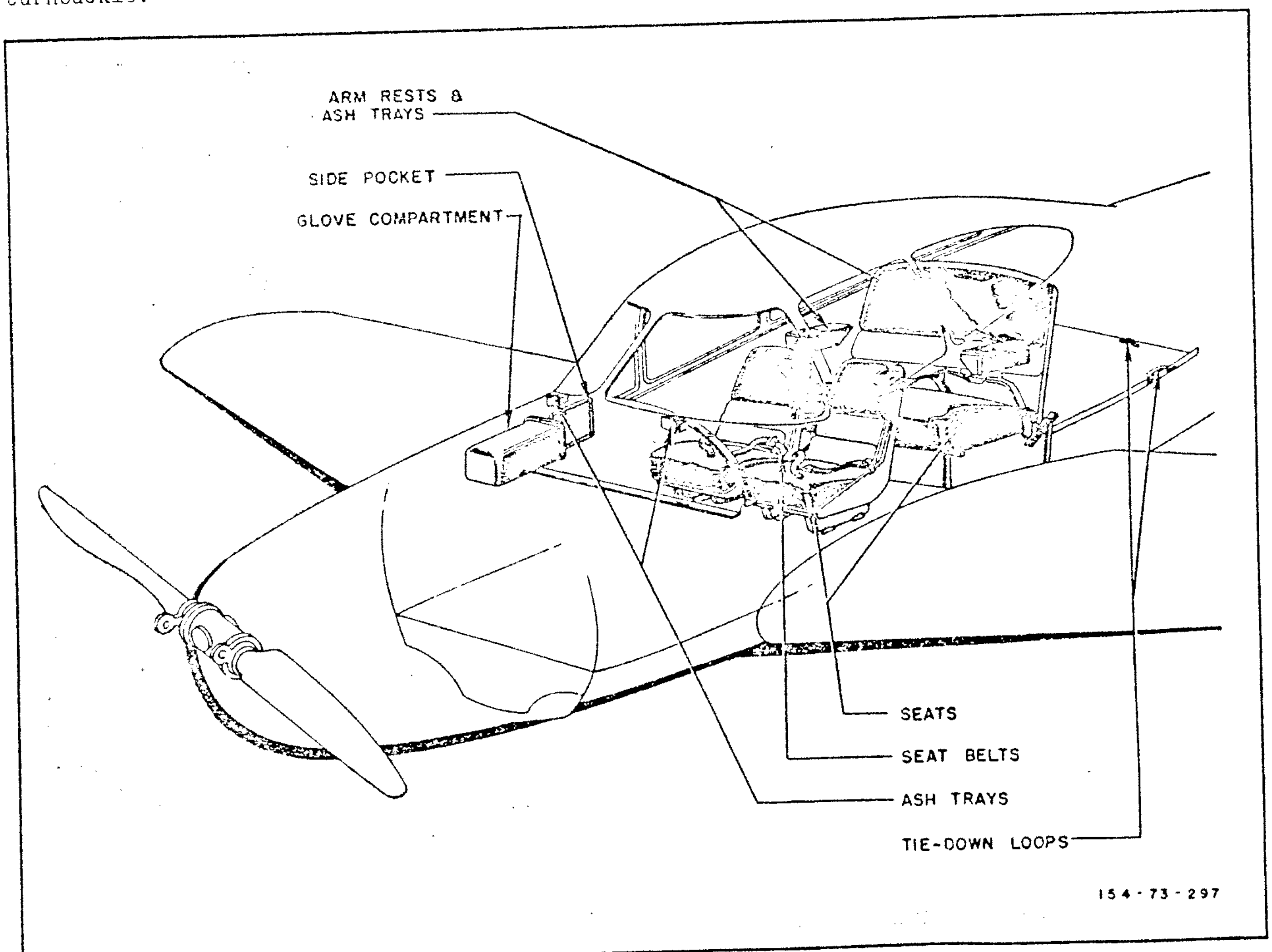


Figure 4-65. Fuselage Equipment

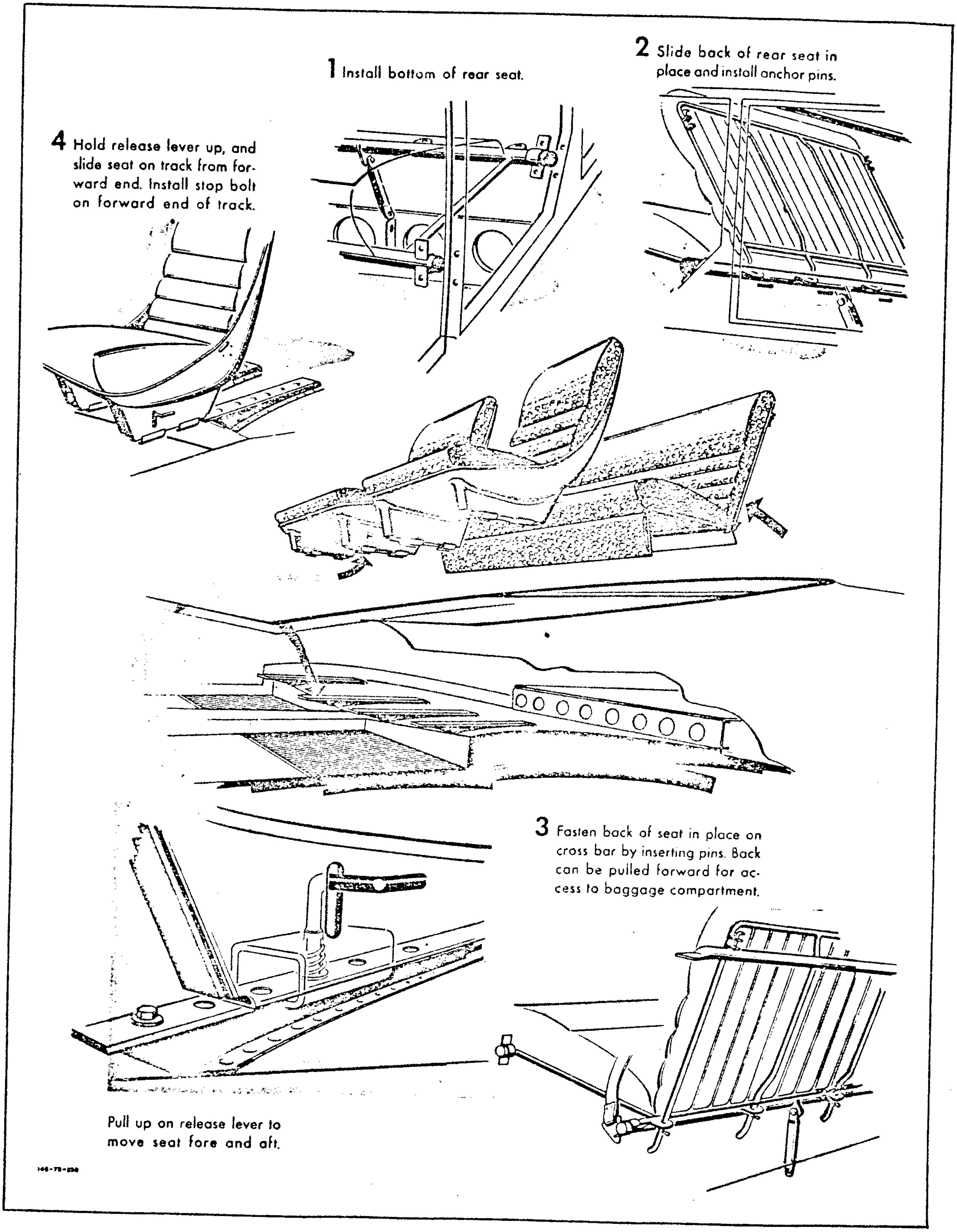


Figure 4-66. Installing and Removing Cabin Seats

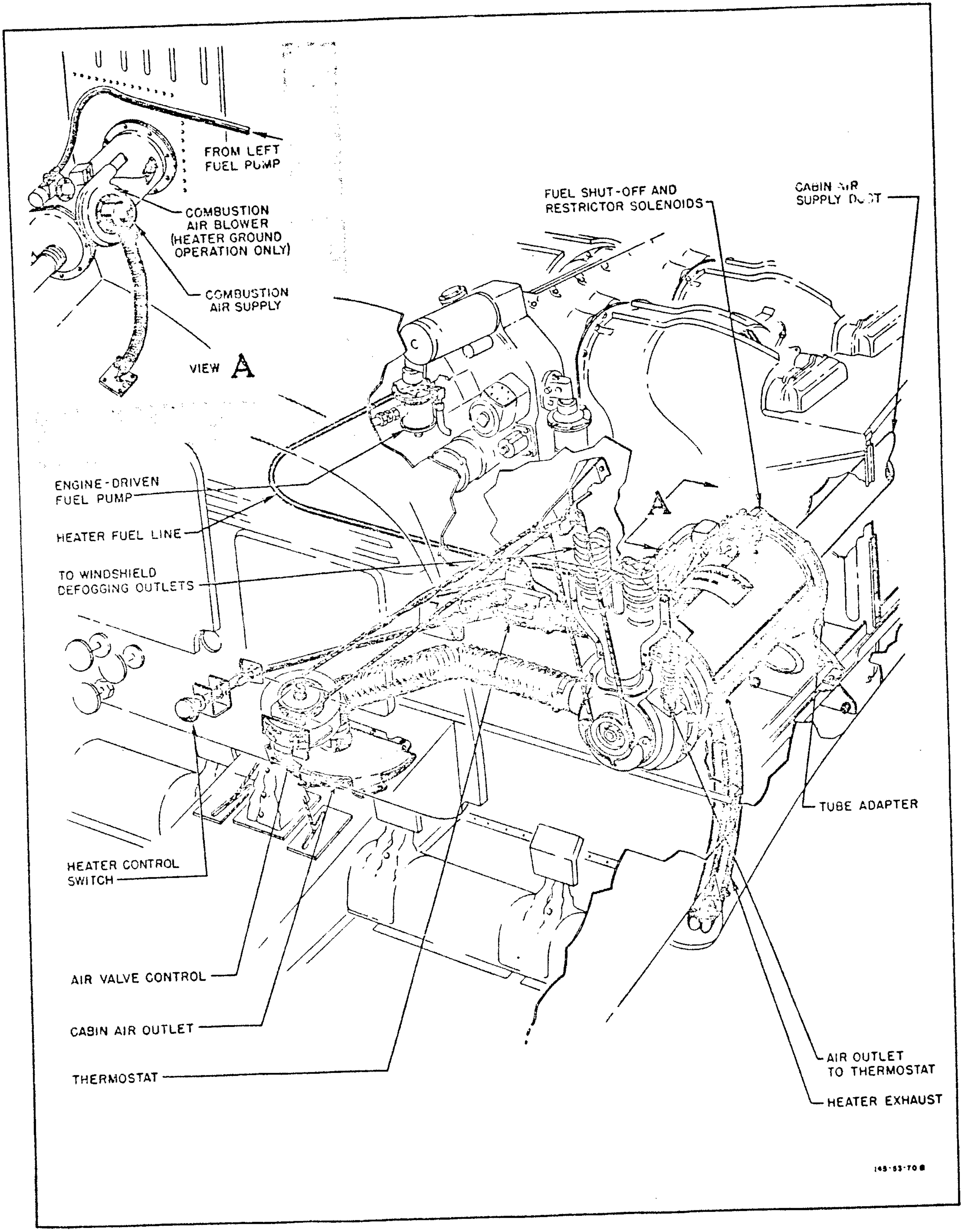


Figure 4-67. Heating and Ventilating System

the engine section, on the right side immediately forward of the firewall. Ram air is supplied during flight, through a duct mounted on, and immediately forward of, the heater. Heater exhaust is vented to the outside. Also incorporated in the heater is an overheat switch, set for approximately 177°C (350°F), to prevent the unit from overheating.

4-296. INSTALLING AND REMOVING HEATER ASSEMBLY. Parts necessary to attach or detach the heater assembly are shown in figure 4-67.

4-297. HEATER OPERATION. When heat is desired, the control switch is moved from the "OFF" to either the "LOW" or "HIGH" position, or to an intermediate position. (A microswitch, installed on the control and outlet valve assembly, prevents heater operation when the assembly is closed.) Fuel is supplied to the heater through a line from the outlet of the left engine-driven fuel pump, located on the engine, and two fuel solenoid valves mounted on the heater. One solenoid valve serves as a shut-off; the second, when energized, restricts fuel flow for "LOW" heat or, when inoperative, allows full flow for "HIGH" heat. Turning of the heater control from the "OFF" position allows the following sequence of operations to occur.

a. A glow plug on the heater is energized.

b. Fuel solenoid valves open, allowing fuel to flow to the heater.

c. Combustion air (due to either blower operation or the airplane's motion through the air) is admitted to the combustion chamber.

d. Mixture ignites and heater is in operation.

e. Thermoswitch turns off the glow plug. Heater continues to operate. (The thermoswitch will again energize the glow plug if the heater temperature falls below a temperature that assures combustion.)

4-298. HEATER THERMOSTATIC CONTROL. The heater control, when moved from the "OFF" position, also sets a thermostat in the cabin which maintains the desired temperature by alternately opening and closing the restrictor solenoid valve, thus maintaining a cabin temperature between 18.3°C (65°F) and 26.7°C (80°F). The frequency of this cycling depends on the difference between outside and cabin air temperatures, and the setting of the heater control in the range from "HIGH" to "LOW". Because of the range of thermostatic control, the start of the heater may not be accomplished with cabin temperatures nearing 26.7°C (80°F). Such a high temperature would cause the heater to be automatically on "LOW". When heater is on "LOW", the fuel supply to the heater is insufficient for consistent starting.

4-299. VENTURI VACUUM SYSTEM.

4-300. GENERAL. L-17B and modified L-17A airplanes are equipped with venturi vacuum systems (see figure 4-61) which provide a source of power for operation of the artificial horizon, directional gyro and turn-and-bank indicator. Two venturi tubes, mounted on the right fuselage wall, are interconnected to provide a single vacuum source. A spring-loaded adjustable relief valve, mounted forward of the instrument panel, prevents the system from creating a suction greater than 4± 1/2 in. Hg at the instruments. A throttling valve mounted between the directional gyro and the turn-and-bank gyro reduces the suction at the turn-and-bank gyro to 2 in. Hg. A gage (see figure 4-64) on the instrument panel indicates the amount of suction in the system at any time.

4-301. ADJUSTMENT OF VACUUM RELIEF VALVE. This valve should require a minimum of maintenance and adjustment, beyond the cleaning of the relief vent screen at 50 hour inspection periods. Should, however, the vacuum gage register more than 4-1/2 in Hg. or less than 3-1/2 in Hg suction under normal operation conditions it may become necessary to adjust this valve. Adjustment should be accomplished by loosening the adjustment lock nut and turning the adjusting screw clock-wise to increase pressure or counter-clock-wise to decrease pressure. After the valve is properly adjusted, be certain that the adjustment lock-nut is properly tightened.

4-302. AIR FILTERS. Filter screens are incorporated in the housings of the gyro horizon and directional gyro. A small screen filter for the turn-and-bank indicator is mounted forward of the instrument panel. All screens should be checked periodically, and cleaned if necessary.

SECTION V

USEFUL OR MILITARY LOAD

Not applicable.

SECTION VI

CHARTS AND TABLES

TABLE OF TORQUE VALUES FOR "AN" TYPE TUBING FITTINGS*
(In Inch-Pounds)

Tubing Diameter (In.)	Wrench Size (In.)	Alum. Alloy Tubing		Steel Tubing	
		Minimum	Maximum	Minimum	Maximum
1/8	3/8	20	25	—	—
3/16	7/16	25	35	30	70
1/4	9/16	40	65	50	90
5/16	5/8	60	80	70	120
3/8	11/16	75	125	90	150
1/2	7/8	150	250	150	250
5/8	1	200	350	—	—
3/4	1 3/16	300	500	—	—
1	1 1/2	500	700	—	—
1 1/4	1 15/16	700	950	—	—
1 1/2	2 1/4	950	1200	—	—
1 3/4	2 5/8	1200	1400	—	—
2	2 15/16	1400	1600	—	—

*These nuts must be tightened carefully: overtightening may completely cut off or severely damage the tube flare; undertightening may cause the line to blow out.

COLOR CODE FOR AIRCRAFT TUBING

LINE	COLOR BAND
Anti-icing	White—Red
Compressed air, low pressure	Light blue—Light green
Fuel	Red
Hydraulic	Light blue—Yellow—Light blue
Manifold pressure	White—Light blue
Oil	Yellow
Oxygen	Light green
Pitot pressure	Black
Prestone	White—Black—White
Static pressure	
(stall warning)	Black—Light green
(except stall warning)	Black—Light green—Black
Vacuum	White—Light green
Vent	Red—Black

TORQUE LIMITS FOR BOLTS AND NUTS

BOLT SIZE	TORQUE LIMITS			
	Tension-type Nut AN365 and AN310		Shear-type Nut AN320	
	(In-Lb)	(Ft-Lb)	(In-Lb)	(Ft-Lb)
8-32	12-15	1¼	7-9	⅝-¾
10-32	20-25	1¾-2	12-15	1-1¼
¼-28	50-70	4¼-6	30-40	2½-3
5/16-24	100-140	8-12	60-85	5-7
⅜-24	160-190	13-16	95-110	8-9
7/16-20	450-500	37-41	270-300	20-25
½-20	480-690	40-57	290-410	30-35
9/16-18	800-1000	66-83	480-600	40-50
⅝-18	1100-1300	91-110	660-780	55-65
¾-16	2300-2500	190-208	1300-1500	110-125
⅞-14	2500-3000	208-250	1500-1800	125-150
1-14	3700-5500	308-483	*2200-3400	*183-283
1⅛-12	5000-7000	415-580	*3000-4200	*250-350
1¼-12	9000-11000	750-910	*5400-6600	*450-550

*Values calculated by extrapolation.

HOSE CLAMP TIGHTENING — FINGER-TIGHT, PLUS TURNS, METHOD

INITIAL INSTALLATION ONLY	WORM SCREW-TYPE CLAMP, 10 THREADS PER INCH	CLAMPS, RADIAL AND OTHER TYPES, 28 THREADS PER INCH
Self-sealing hose, approximately 15 inch-pounds	Finger-tight plus 2 complete turns	Finger-tight plus 2½ turns
All other aircraft hose, approximately 25 inch-pounds	Finger-tight plus 1¼ turns	Finger-tight plus 2 complete turns

If clamps do not seal at specified tightening, examine hose connections and replace parts as necessary.

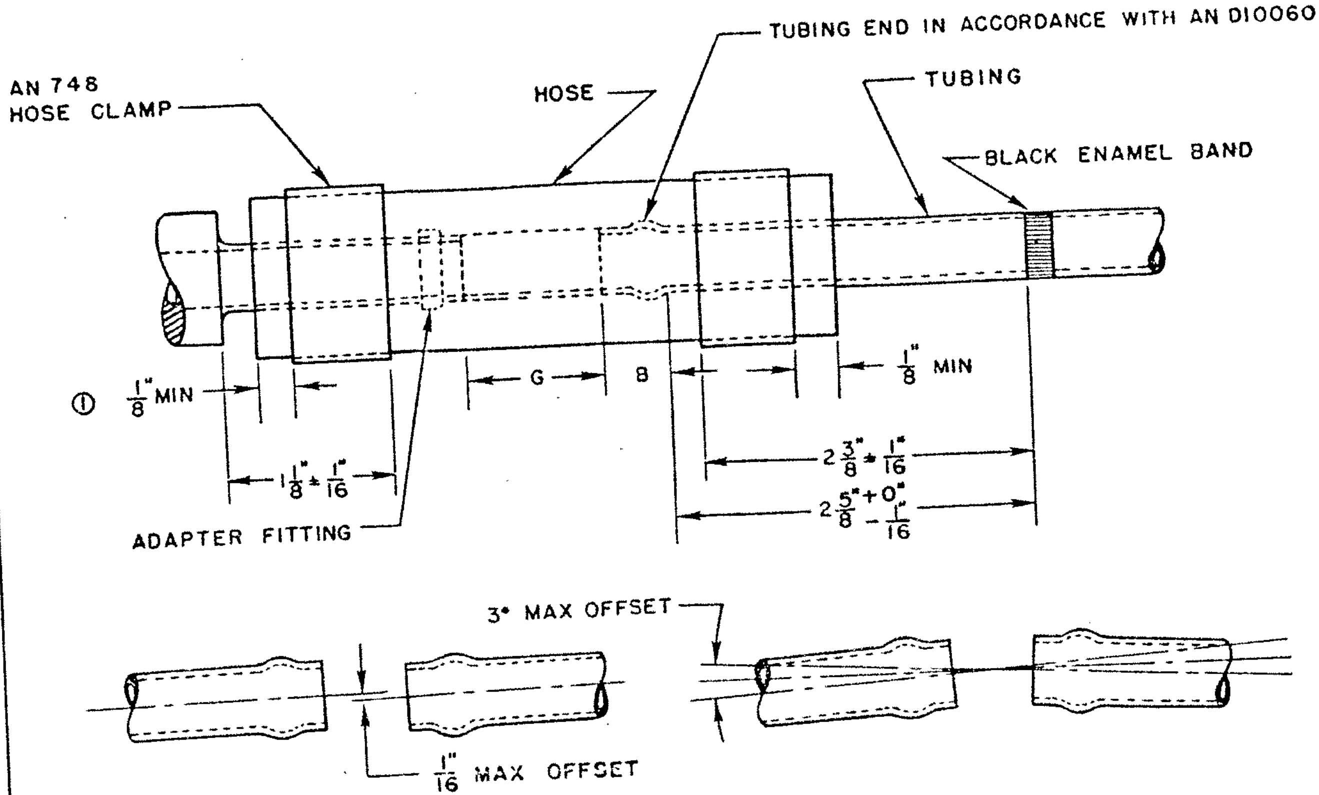
The above is for initial installation and should not be used for loose clamps.

For retightening loose hose clamps in service, proceed as follows:

1. Non-self-sealing Hose—If the clamp screw cannot be tightened with the fingers, do not disturb unless leakage is evident. If leakage is present, tighten ¼ turn.
2. Self-sealing Hose—If looser than finger-tight, tighten to finger-tight and add ¼ turn.

NOTE

Tightening in excess of installation torque values covered herein reduces the safety factor of the clamps as well as causing damage to the hose. The first 25 hours of use is the critical period for hose connections, and the importance of special attention during this time cannot be overstressed.



MINIMUM GAP "G" SHALL BE ¼ INCH OR TUBE OD/2, WHICHEVER IS GREATER.

MAXIMUM GAP "G" SHALL NOT EXCEED ONE TUBE DIAMETER OR ONE INCH, WHICHEVER IS GREATER.

DIMENSIONS IN INCHES. ALLOW MAXIMUM GAP FOR OFFSET CONNECTIONS.

TO COMPUTE HOSE LENGTH:

MINIMUM HOSE LENGTH FOR HOSE FITTING TO BEADED TUBE: L=2-⅛" +G +B

MINIMUM HOSE LENGTH FOR BEADED TUBE TO BEADED TUBE: L=1-⅞" +G +2B

All hose connection installations are to be in accordance with the standard design shown. The black enamel band on fuel, oil, and coolant system lines (water injection system lines when applicable) is placed on each side of every hose connection. The band, placed at a specific distance from the tubing head, will indicate the proper position for the hose clamp in reference to the bead. These reference markers will prevent improper installation of the hose clamp over the bead, a condition which would cause strain on the clamp. Because of the greater expansion qualities of the rubber hose and the aluminum tubing, an improperly installed clamp is likely to fail when the airplane is subjected to extreme temperature.

134-73-224A

LUBRICANTS

SPECIFICATION NUMBER	TITLE	APPLICATION
AN-F-48	Aircraft Fuel - Grade 91/98	
AN-G-15	Grease, General-purpose	Bearings and gears operating at high speeds and medium temperatures. Suitable for most routine maintenance requirements.
AN-G-25	Grease, Low-temperature	For most applications where AN-G-15 is used but where low-temperature protection and operation are required.
AN-G-14	Grease, Gasoline and Oil-resistant	Fuel system gasket paste.
AN-O-6	Oil, General-purpose, Low-temperature Lubricating	General "squirt can" lubrication. Frequent relubrication required where subject to high temperature.
AN-O-8	Oil, Aircraft Engine Lubricating	Aircraft engines in accordance with Specifications AN9500, AN-P-64, and AN-T-25.
AN-C-147	Compound, Antiseize, Graphite-Petrolatum	Antiseize compound for spark plug threads.
AN-C-53	Compound, Antiseize, White-lead Base	Threaded fittings other than oxygen systems.
AN-C-86	Compound, Antiseize and Sealing	For oxygen system connections (noninflammable).
AN-VV-C-576	Compound, Corrosion-preventive	Preservation of aircraft engines. To be used per Specifications AN-P-64, AN-C-80, and AN-E-11.
AN-VV-O-366	Oil, Hydraulic Petroleum Base	Hydraulic systems and shock struts.
AN-P-51	Petrolatum	Minor lubrication points such as battery terminals where prime factor is rust or corrosion prevention.

SECTION VII

MAINTENANCE INSPECTION

Data contained on pages 112 to 118 inclusive deleted. Reference to these pages in the Alphabetical Index should be disregarded.

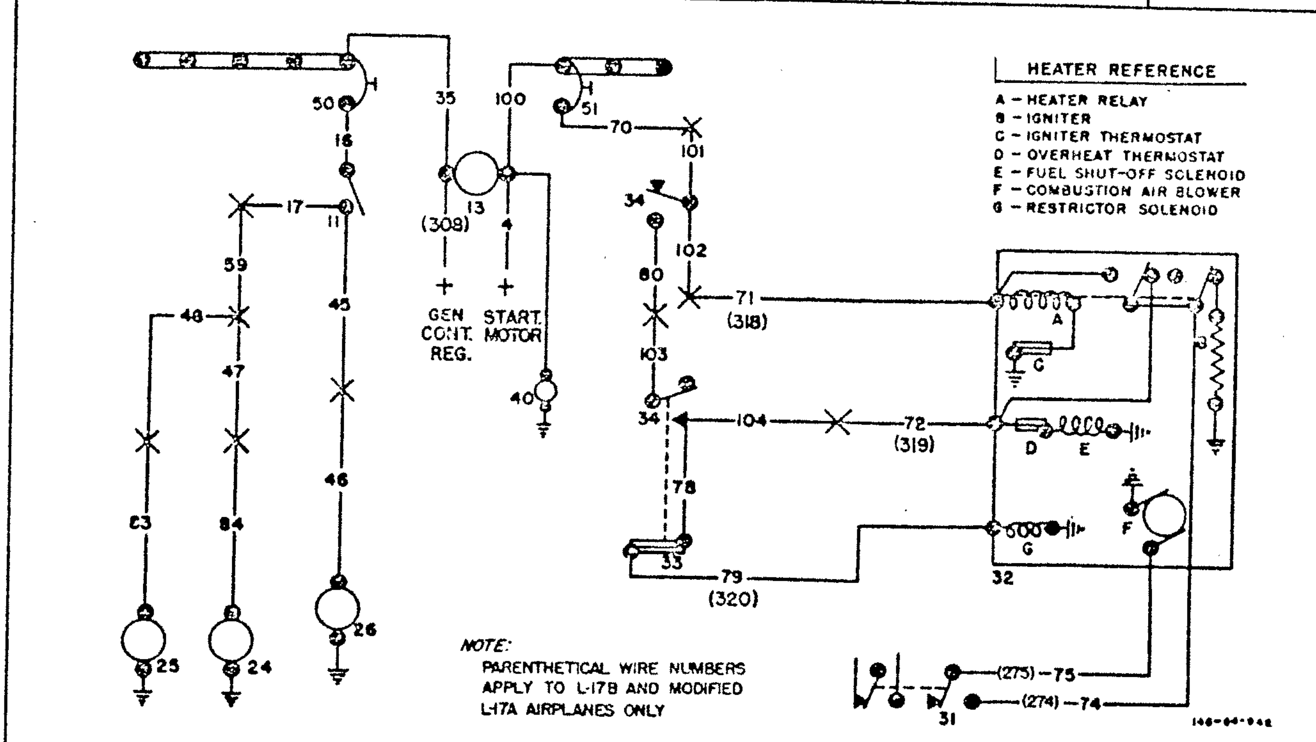
See AN 01-100LAA-6 for Inspection Requirements.

SECTION VIII

ELECTRICAL AND ELECTRONIC WIRING DIAGRAMS

WIRE CHART

WIRE NO.	GAGE	LENGTH	WIRE NO.	GAGE	LENGTH
16	18	18-3/4	80	16	4
17	18	56-1/2	83	18	14
45	18	244	84	18	14
46	18	37	101	16	4
47	18	220	102	18	4
48	18	219	103	16	80
59	18	70-1/2	104	16	4
70	16	33-3/4	274	18	50-3/4
71	18	82	275	18	51-1/2
72	16	99-3/4	308	10	58
74	18	49	318	18	67-1/2
75	18	50-1/4	319	16	41
78	18	6	320	18	47-1/2
79	18	107-1/2			



ITEM CHART

ITEM NO.	DESCRIPTION	PART NO.
11	Position Light Switch	8396K7
13	Ammeter	440116
24	RH Position Light	A-1285-G-12
25	LH Position Light	A-1285-R-12
26	Tail Position Light	A-2064-C-12
31	Nose Gear Up Switch	8715K4
32	Cabin Heater	
33	Heater Thermostat	
34	Cabin Heater Switch	2MD4-1A
40	Cigarette Lighter	Casco 81
50	5-ampere Circuit Breaker	CM-5
51	15-ampere Circuit Breaker	CM-15

Figure 8-1. Cabin Heater, Cigarette Lighter, and Position Light Wiring

ITEM CHART		
ITEM NO.	DESCRIPTION	PART NO.
8	Landing Gear Switch	8215 "C-H"
9	Throttle Warning Switch	8215 "C-H"
12	Landing Light Switch	7402-K4
16	Landing Gear Warning Horn	EA-23-PANS
19	Lamp Assembly - Green	810-BS
20	Landing Gear Indicator Lamp	1816
23	Lamp Assembly - Red	810-BS
27	Landing Light	4509 "GE"
29	Resistor - 10 Watt, 10-ohm	AB "1RC"
31	Nose Gear Up Switch	8715K4
50	5-ampere Circuit Breaker	CM-5
52	20-ampere Circuit Breaker	CM-20
53	20-ampere Circuit Breaker	CA-20
55	Indicator Light Dimmer Switch	AN3027-2
57	Lamp Assembly - Amber	810-BS
58	Hydraulic Indicator Light Switch	8396-K7 "CH"
67	Resistor - 10 Watt, 35-ohm	AB "1RC"

WIRE CHART		
WIRE NO.	GAGE	LENGTH
15	18 Shielded	26-3/4
18	18 Shielded	64
19	18 Shielded	100
20	18 Shielded	74-1/2
21	18 Shielded	61
22	18 Shielded	102
23	18 Shielded	72-3/4
24	18 Shielded	60-1/2
25	18 Shielded	74-1/2
26	18 Shielded	9
29	18 Shielded	84
30	14	25-3/4
31	14	26
36	18	3-1/2
37	18	63-1/4
38	18	82
39	18	12
40	18	93-3/4
41	18	95
42	18	26-1/4
43	18	26-1/4
44	18	5-1/2
54	18 Shielded	15-3/4
55	18	13-3/4
56	18 Shielded	16
57	18	13-1/2
60	14	18-1/2
61	18	55-1/2
62	18	130-1/2
63	18	55
64	18	134-1/2
65	18	25
66	18	2
68	18	29-1/4
69	18	37
76	14	38-1/2
81	18	12-3/4
82	18	13-3/4
116	18	26-1/2
117	18	29
121	18	-
122	18	-
123	18	-
124	18	-
125	18	2
126	18	2
154	18	27
257	18	55-1/2

Continued

WIRE CHART

WIRE NO.	GAGE	LENGTH
258	18	32
259	18	5-3/4
264	18	5
274	18	43
275	18	41
322	18	16
323	18	51
324	18	45-1/2
325	18	49-1/2

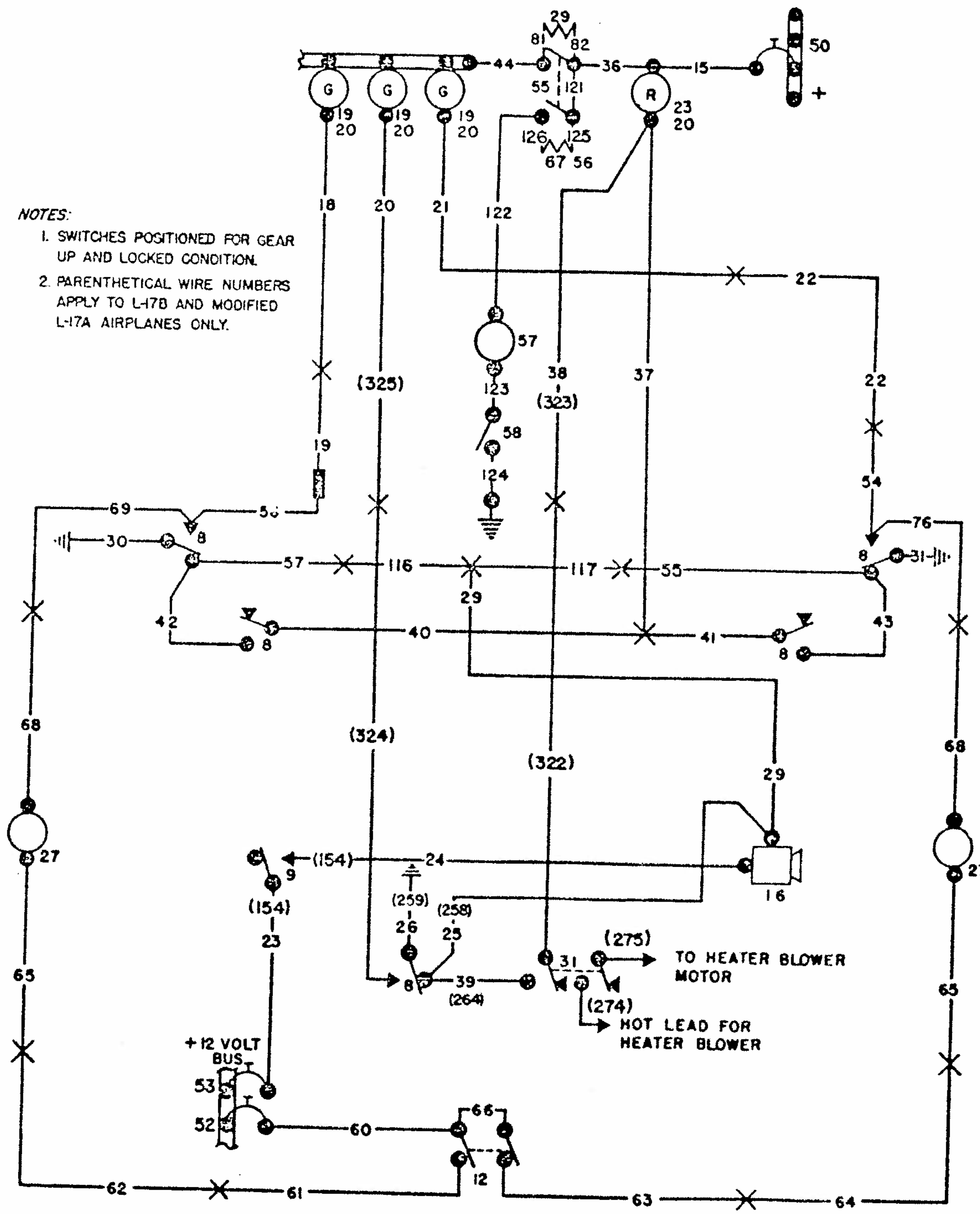
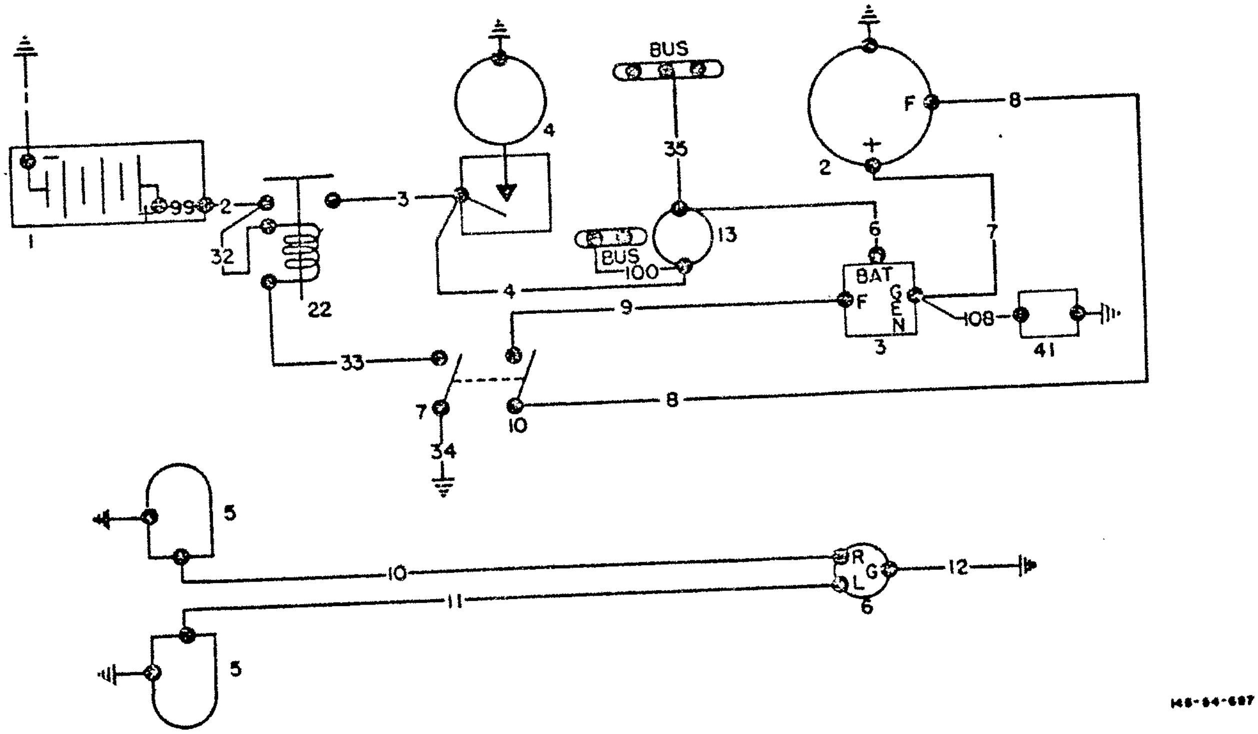


Figure 8-2. Landing Light, Landing Gear Ind. System and Hydraulic Ind. Light Wiring

WIRE CHART

WIRE NO.	GAGE	LENGTH	WIRE NO.	GAGE	LENGTH
1	2	17	11	18 Shielded	59
2	2	10	12	18 Shielded	4
3	2	133	32	18	4
4	10	63-1/2	33	18	98-1/2
6	10	61	34	18	10-1/4
7	10	29	35	10	27-1/4
8	18	43	99	2	8-1/2
9	18	48	100	10	34-1/2
10	18 Shielded	59			



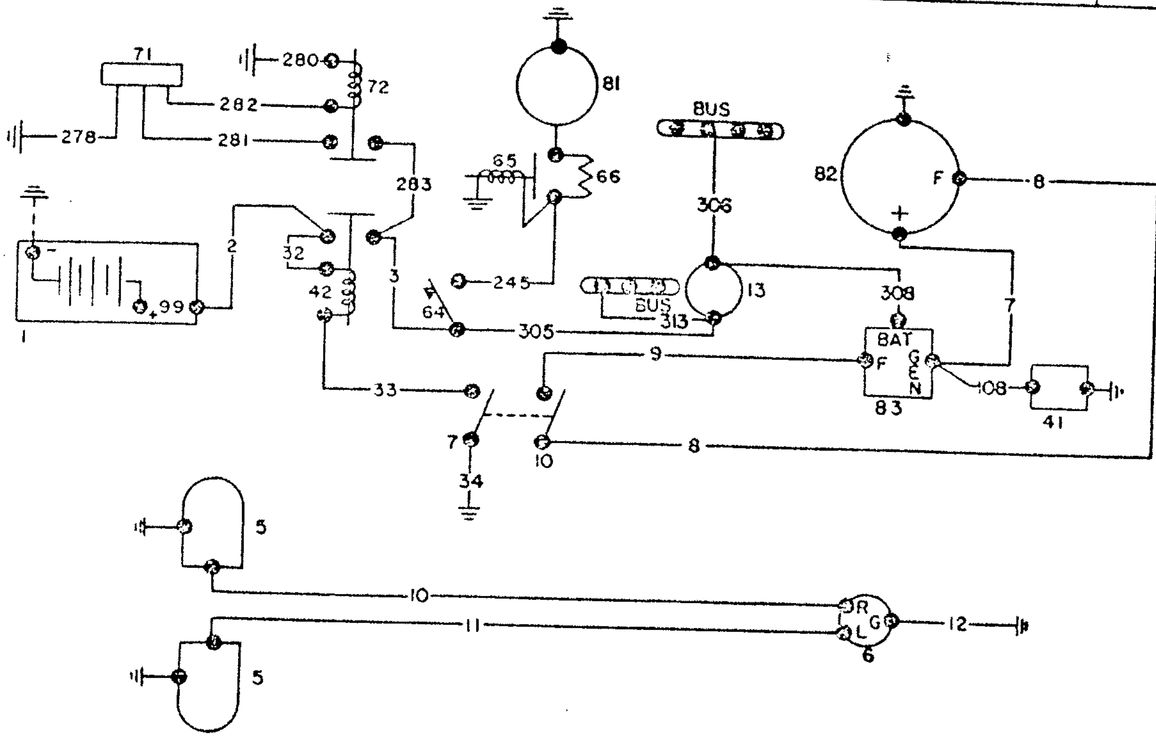
ITEM CHART

ITEM NO.	DESCRIPTION	PART NO.
1	Battery	6-TAS-9B
2	Generator	A-40604
3	Generator Control	1118263
4	Starter	1109658
5	Magneto	Type 56-LE
6	Ignition Switch	50248
7	Battery Switch	8396-K7
10	Generator Switch	8396-K7
13	Ammeter	440116
22	Battery Relay	71-111242
41	Filter	CA-275X

Figure 8-3. Battery, Generator, Starter, and Ignition Wiring, L-17A Airplanes

WIRE CHART

WIRE NO.	GAGE	LENGTH	WIRE NO.	GAGE	LENGTH
1	2	17	99	2	8-1/2
2	2	10	108	18	6-1/2
3	2	133	245	2	17
7	10	29	278	2	9
8	18	43	280	18	4
9	18	48	281	2	14
10	18	59	282	18	15
11	18	59	283	2	10
12	18	4	305	10	60
32	18	4	306	10	27-1/2
33	18	98-1/2	308	10	58
34	18	10-1/4	313	10	31-1/2



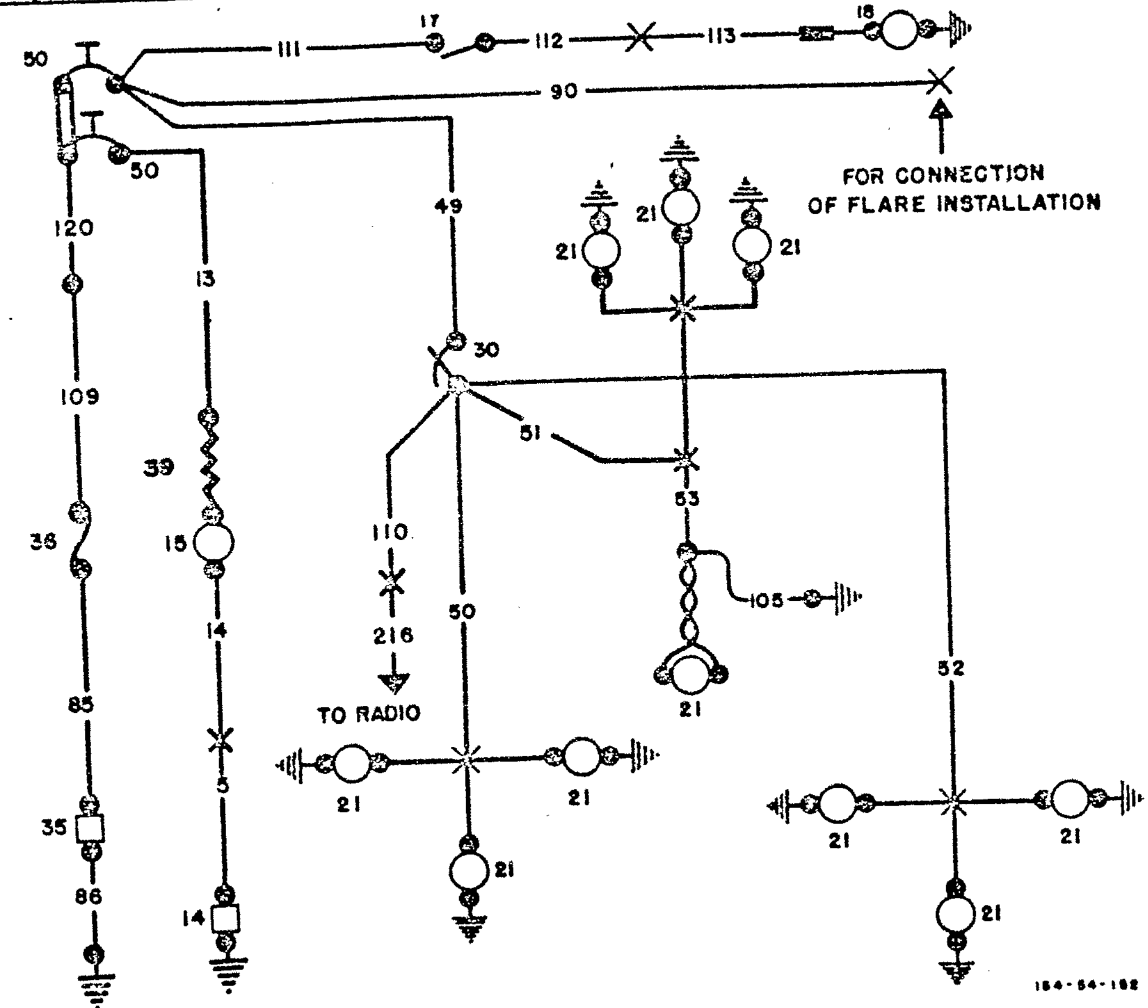
ITEM CHART

ITEM NO.	DESCRIPTION	PART NO.
1	Battery	6-TAS-9B
5	Magneto	S6LN-21
6	Ignition Switch	1648N-1
7	Battery Switch	8396-K7
10	Generator Switch	8396-K-7
13	Ammeter	440116
41	Filter	CA-275X
42	Relay	71-111242
64	Switch	
65	Solenoid	
66	Resistor	
71	Receptacle, External Power	AN2552A1
72	Relay, External Power	71-111242
81	Starting Motor	530460
82	Generator, 35 amp.	1101880
83	Generator Control Regulator	1118267

Figure 8-4. Battery, Generator, Starter and Ignition Wiring, L-17B and L-17C Airplanes

WIRE CHART

WIRE NO.	GAGE	LENGTH	WIRE NO.	GAGE	LENGTH
5	18	76-1/2	86	18	25-1/2
13	18 Shielded	29-1/4	90	18	57-3/4
14	18 Shielded	64-1/2	105	18	15-1/4
49	18	23-1/4	109	18	-
50	18	14-1/2	110	18	-
51	18	19	111	18	20-1/4
52	18	24-3/4	112	18	124
53	18	6	113	18	94-1/2
85	18	44	120	18	-



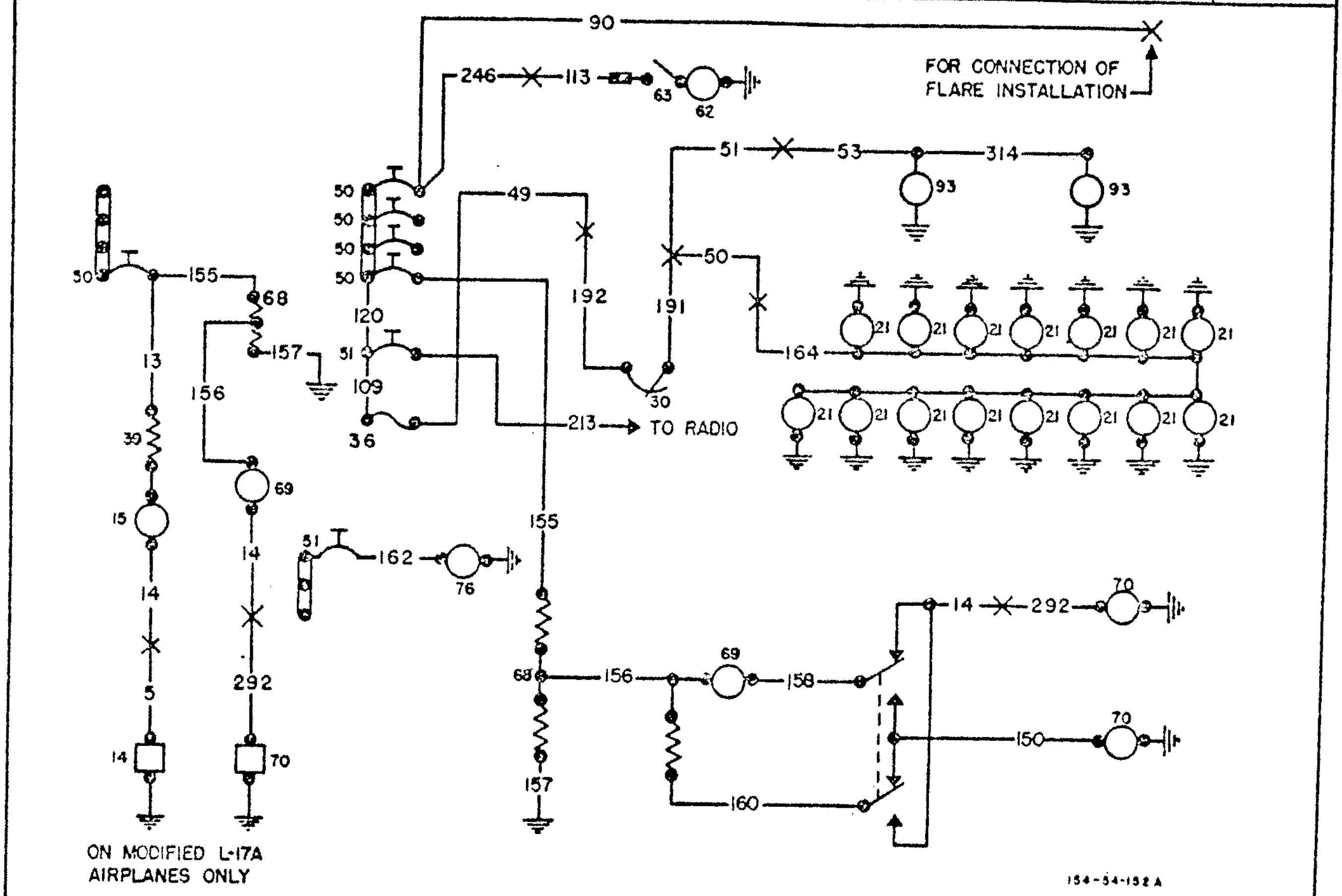
ITEM CHART

ITEM NO.	DESCRIPTION	PART NO.
14	Fuel Level Transmitter	EX26303
15	Fuel Level Indicator	145-51038
17	Cabin Light Switch	8396-K7 "C-H"
18	Cabin Light	1141 GE
21	Instrument Panel Light	53 GE
30	Instrument Light Rheostat	PW-25D-4-15
35	Turn-and-Bank Indicator	NS27200
36	One-ampere Fuse	ACM-1
39	Fuel Level Indicator Resistor	SW 91396
50	5-ampere Circuit Breaker	CM-5

Figure 8-5. Turn-and-Bank Indicator, Fuel Quantity Indicating System, and Instrument and Cabin Light Wiring, L-17A Airplanes

WIRE CHART

WIRE NO.	GAGE	LENGTH	WIRE NO	GAGE	LENGTH	WIRE NO.	GAGE	LENGTH
5	18	76-1/2	113	18	94-1/2	164	18	53
13	18	29-1/4	150	18	124	191	18	5
14	18	64-1/2	155	18	40	192	18	5
49	18	23-1/2	156	18	7	213	18	29
50	18	15-1/2	157	18	3	246	18	133-1/4
51	18	19	158	18	12	292	18	83-1/2
53	18	6	160	18	10	314	18	6
90	18	57-3/4	162	18	29			



ITEM CHART

ITEM NO.	DESCTIPTION	PART NO.
14	Fuel Level Transmitter	EX26303
15	Fuel Level Indicator	145-51038
21	Instrument Panel Light	
30	Instrument Light Rheostat	PW-50D-4-35
36	Fuse 2 ampere	
39	Fuel Level Indicator Resistor	SW 91396
50	5-Ampere Circuit Breaker	
51	20-Ampere Circuit Breaker	CM-20
62	Cabin Lamp	1141
63	Cabin Lamp Switch	A-5727
68	Voltage Divider	7219
69	Fuel Level Indicator	40520
70	Fuel Level Transmitter	145-51071-2
76	Cockpit Utility Lamp	C-4A
93	Compass Light	A-2877-12V

Figure 8-8. Fuel Quantity Indicating System and Instrument and Cabin Light Wiring, L-17B and L-17C Airplanes

WIRE CHART

WIRE NO.	GAGE	LENGTH
CB-9		120
222	16	32
223	16	9
224	20	11
225	20	11
226	20	11
227	20	11
228	20	5
229	20	5
230	20	40
231	20	5
232	20	110
233	20	12
234	20	12
235	20	5
236	20	11

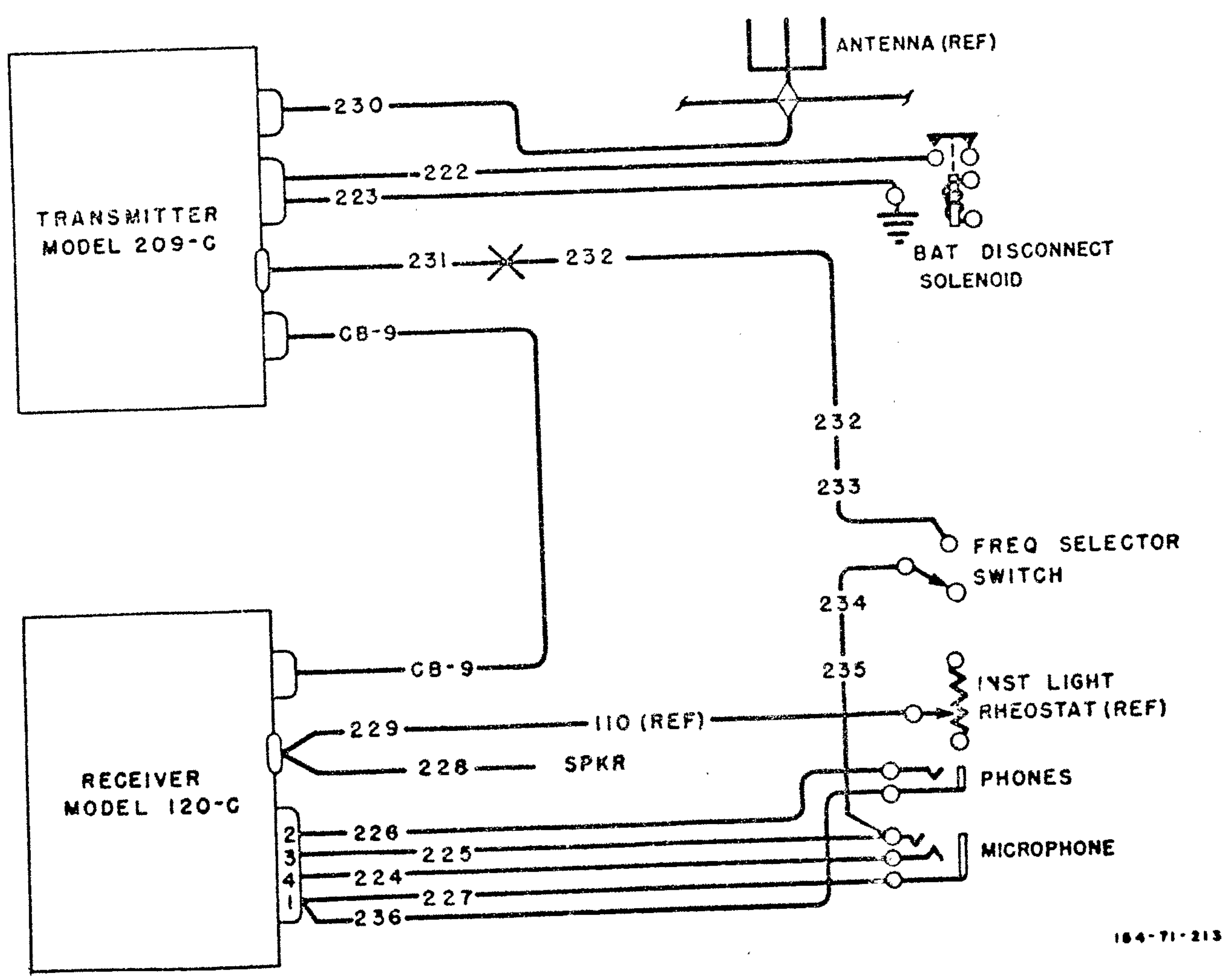


Figure 8-7. Electronic Equipment Wiring Diagram, L-17A Airplanes

Revised 1 June 1949

WIRE CHART					
WIRE NO.	GAGE	LENGTH	WIRE NO.	GAGE	LENGTH
293	18	49	296	18	80
294	18	49	297	18	80
295	18	80	298	18	80

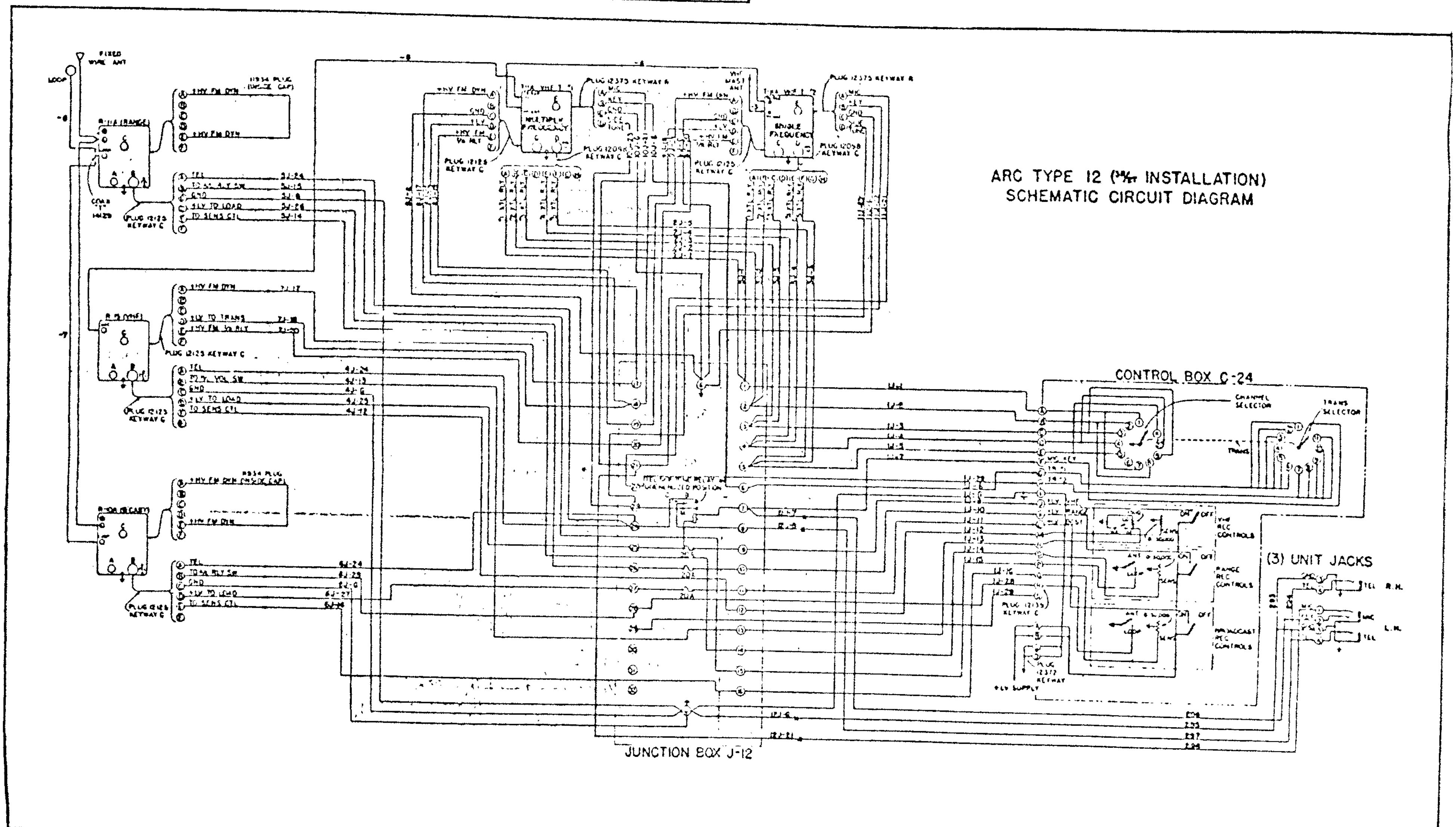


FIGURE 6-8. Electronic Equipment Wiring Diagram, L-17B and Modified L-17A Airplanes

SECTION IX

AUXILIARY EQUIPMENT

9-1. This section contains instructions for installation, removal and maintenance of auxiliary equipment which is available for use on L-17 aircraft employed in certain types of operations. The installations described in this section have been procured in limited quantities and may be obtained only by specific authority. Department of the Army units that require any of the installations should submit requests to The Supply Group, Logistics Division, Department of the Army, Washington 25, D. C.

9-2. SKI INSTALLATION.

9-3. DESCRIPTION OF SKIS.

9-4. Skis, Model No. A-3500A (Main Ski) and No. 10R964 (Nose Ski), manufactured by Federal Aircraft Works, are available for the aircraft. The skis, when mounted, are held in proper position by mechanical rigger assemblies. The pitching range of the skis is limited by cables attached to the nose of the nose ski and at both fore and aft ends of the main skis. - The nose ski has a steel runner to aid steering when taxiing. The left and right main skis differ in that the inboard ends of tubes in the pedestals are shortened and notched to clear the brakes.

9-5. INSTALLATION.

WARNING

The landing gear retraction mechanism must be made inoperative at the time the skis are installed.

9-6. INSTALLATION - MAIN SKIS. (See figure 9-2.)

a. Jack up the airplane until it is level and the wheels are off the ground. Remove the wheel. Brake assembly does not require removal, but if it is left on, the brake retaining band (19) must be installed to hold the brake together and for protection.

b. Insert the slotted end of the tube on the rigger bracket (34) into the axle. Push it in until the slots are up against the bolt which holds the axle to the housing. Turn the tube until the slots slide over the bolt and the rigger arm slopes aft. At this time there should be 1/4 inch between the end of the airplane axle and the inboard side of the rigger arm. If the tube cannot be inserted this far, the slots on the end can be filed until the 1/4 inch spacing can be held. Hold the rigger bracket in this position and drill through the cotter pin hole on each side of the axle a 5/32 inch (0.156-inch) diameter hole through the bushing. Pull the rigger bracket out of the axle.

c. Insert the rubber bushing (17) in the top tube of the pedestal on the ski assembly (31). Slide the axle sleeve (22) in the rubber bushing.

d. Lightly coat axle with low-temperature grease, Specification AN-G-25. Slide the washer (18) on the axle as far as it will go. Install the ski assembly (31) on the axle. Slide washer (12) on the axle and screw nut (32) on the axle end. Pull the nut down tight.

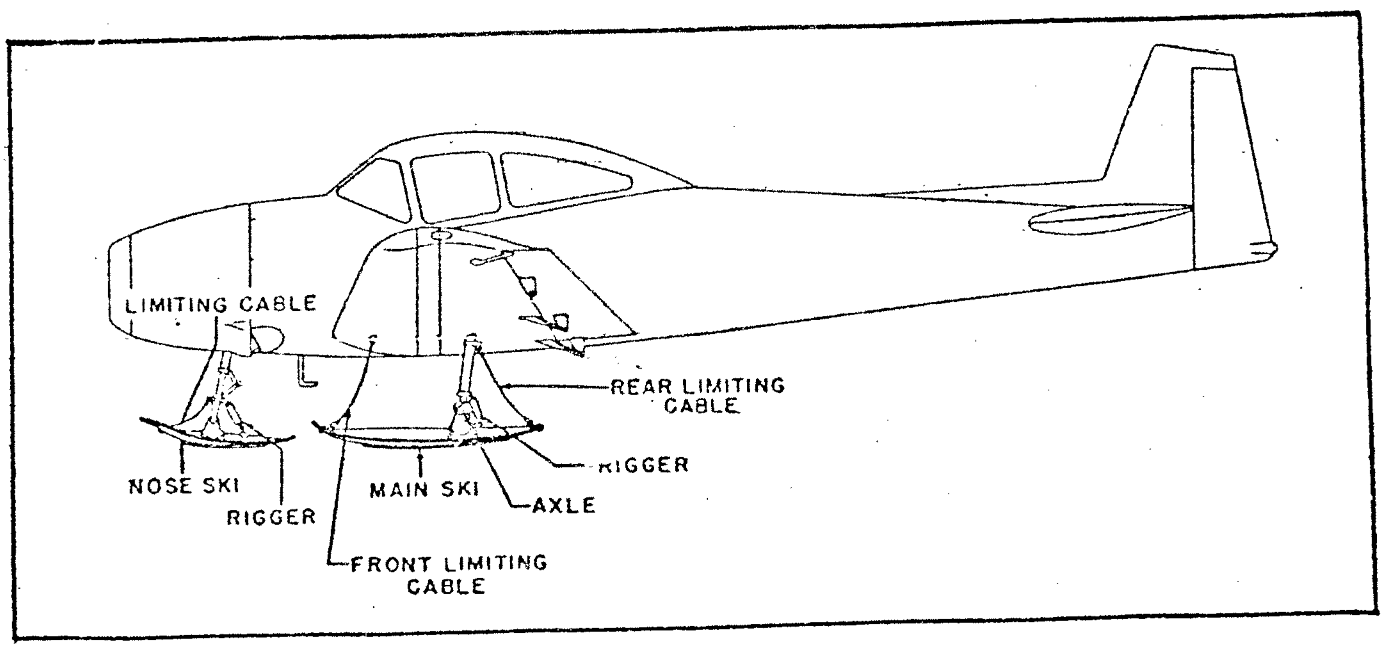
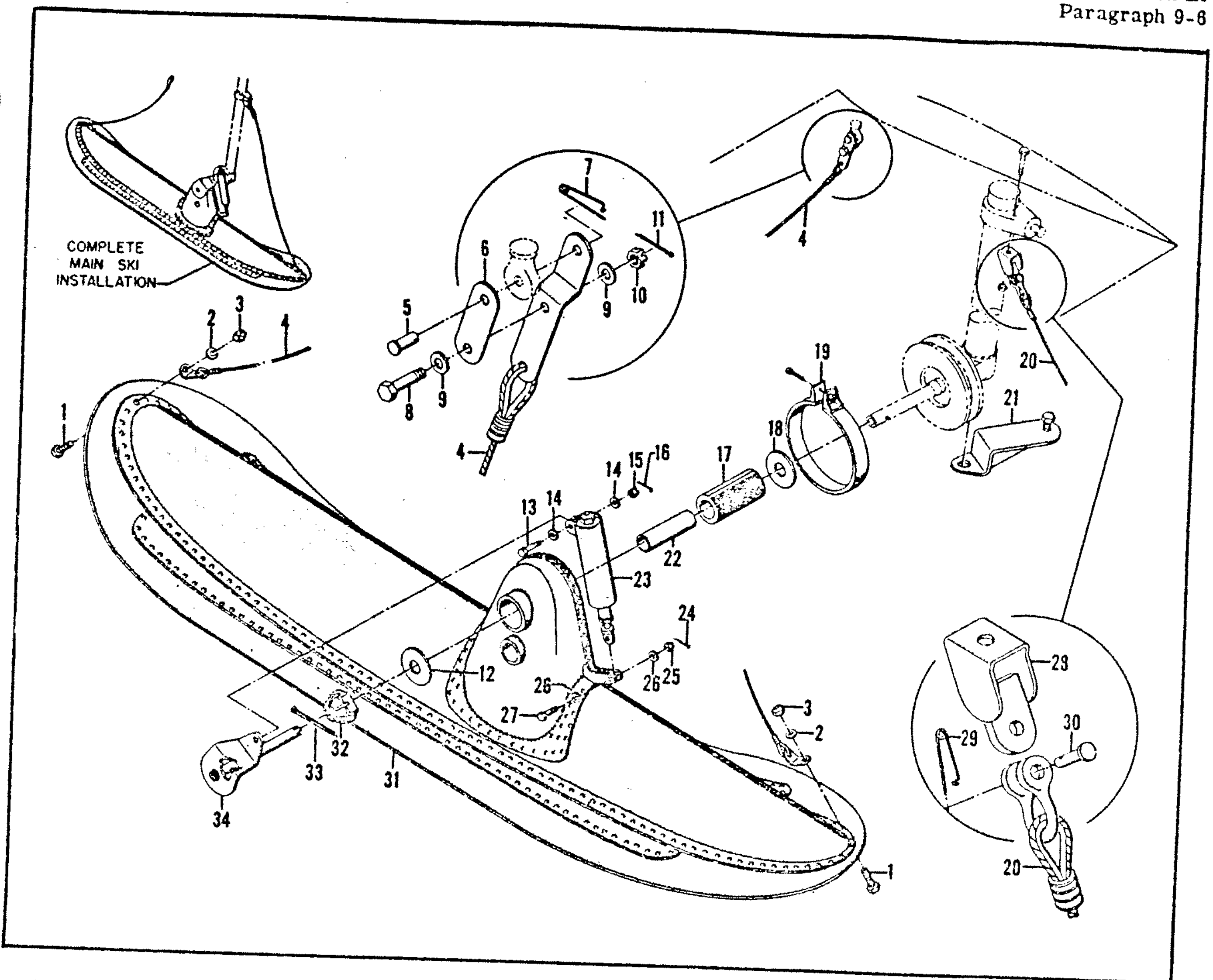


Figure 9-1. Skis Installed on Type L-17 Airplane



1. Bolt AN8-12
2. Washer AN960-816
3. Nut AN365-820
4. Forward Limiting Cable Assembly
5. Pin AN398-19
6. Bracket
7. Safety Pin AN416-1
8. Bolt AN6-7
9. Washer AN960-616
10. Nut AN310-6
11. Cotter Pin AN380-3-4
12. Washer
13. Bolt AN6-11
14. Washer AN960-616
15. Nut AN310-6
16. Cotter Pin AN380-3-4
17. Rubber Bushing
18. Washer
19. Brake Retaining Band
20. Aft Limiting Cable Assembly
21. Auxiliary Jack Pad
22. Axle Sleeve
23. Rigger Assembly
24. Cotter Pin AN380-3-4
25. Nut AN310-6
26. Washer AN960-616
27. Bolt AN6-11
28. Bracket
29. Safety Pin AN416-1
30. Pin AN394-15
31. Ski Assembly
32. Axle Nut
33. Cotter Pin
34. Rigger Bracket

Figure 9-2. Main Ski, Exploded View

NOTE

The nut (32) must be pulled down tight enough to compress the rubber bushing (17) so that the washers (12 and 18) are flush against the pedestal tube. This insures correct alignment of the ski.

e. Slide the bushing on the rigger bracket (34) into the axle until the cotter pin hole in the bushing is aligned with the cotter pin hole in the axle. Insert cotter pin (33) through nut (32), axle, and bushing on rigger bracket (34).

f. Fasten the rigger assembly (23) to the rigger bracket (34) with bolt (13), washers (14) and nut (15). Insert cotter pin (16). Fasten the eyebolt on the rigger assembly (23) to the lugs on the ski assembly (31) with bolt (27), washers (26) and nut (25). Insert cotter pin (24). Apply a few drops of low-temperature oil, Specification AN-O-6a, to the rigger end fittings.

g. Install auxiliary jack pad (21) on base of strut by sliding auxiliary jack pad (21) over up-lock roller.

h. Bolt the bracket (6) to upper cable attachment fitting on the forward limiting cable assembly (4) by means of bolt (8), washers (9), nut (10), and cotter (11). Attach assembled bracket to tie down lug with flat head pin (5) and safety pin (7). Secure the other end of the forward limiting cable assembly (4) to the front of the ski assembly (31) with bolt (1), washer (2), and self-locking nut (3).

i. Mount the top aft limiting cable bracket (28) to the top flange on the strut using the bolt and nut already there. Fasten one end of the aft limiting cable assembly (20) to the bracket (28) with flat head pin (30) and safety pin (29). Secure the other end of the limiting cable assembly (20) to the rear of the ski assembly (31) with bolt (1), washer (2), and self-locking nut (3).

NOTE

The forward limiting cable assembly (4) is longer than the aft limiting assembly (20).

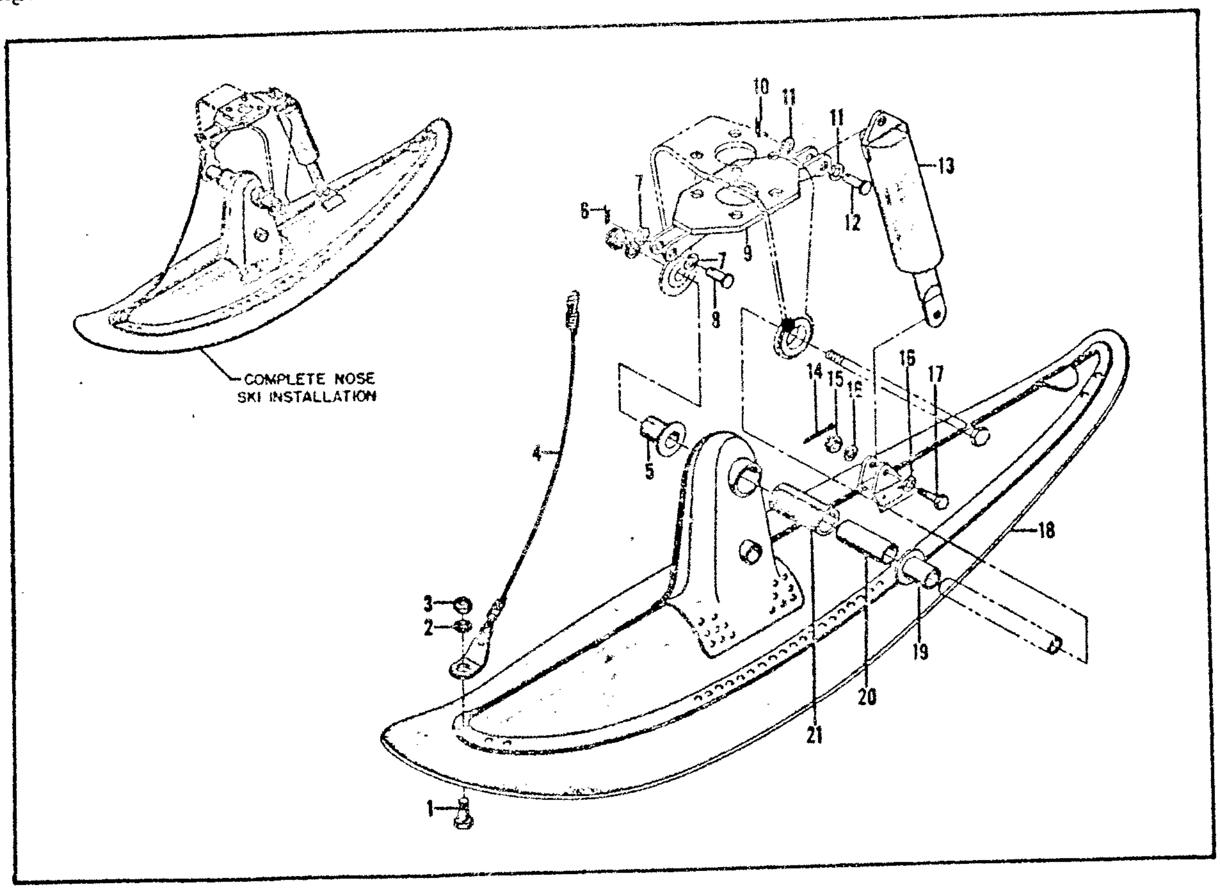
j. Adjust the rigger as described in paragraph 9-8.

9-7. INSTALLATION - NOSE SKI. (See figure 9-3.)

a. Jack up airplane and remove the nose wheel. Remove the mud scraper.

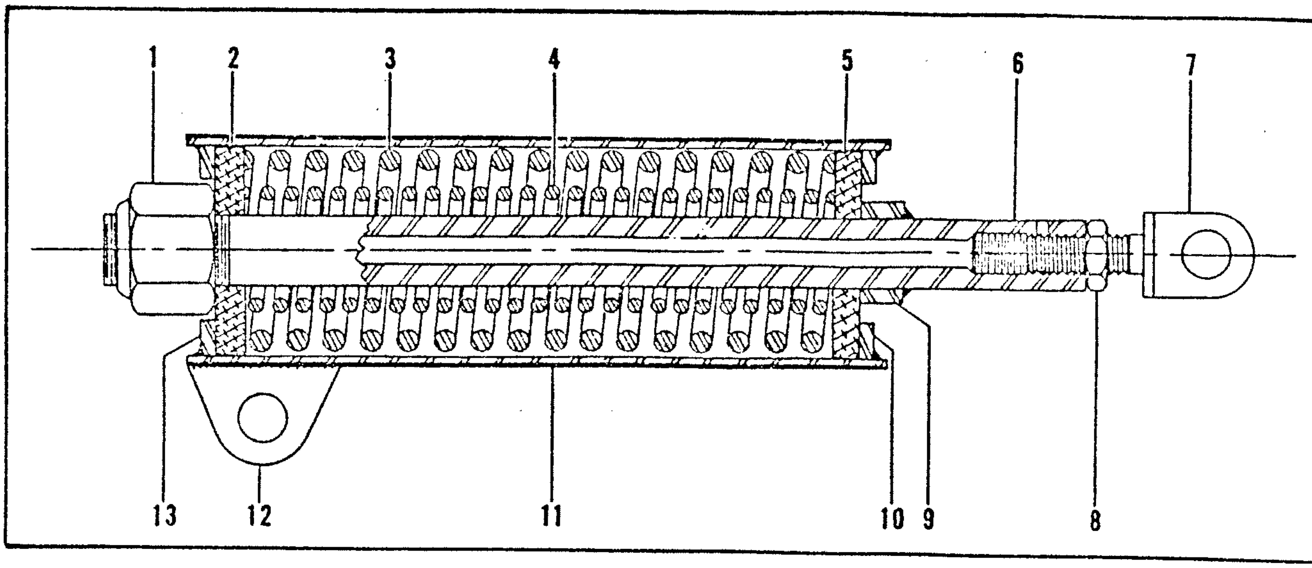
b. Install the rigger bracket (9) in place of the mud scraper using the same four bolts and nuts that held the mud scraper to the nose wheel fork.

c. Slide rubber bushing (21) in top tube of pedestal. Insert axle sleeve (20) in rubber bushing (21). Lightly coat the airplane axle with low-temperature grease, Specification AN-G-25. Starting from one side of the nose wheel fork, slide the airplane axle through the fork, bushing spacer (19), axle sleeve (20) in pedestal, bushing spacer (5), and to other side of nose wheel fork. The bushing spacers (5 and 19) are installed so that the flanges are against the rubber bushing (21) in the pedestal. Install the existing axle retaining cup on each side of fork and secure the assembled parts with the existing axle bolt and nut.



1. Bolt AN6-10A
2. Washer AN960-616
3. Nut AN365-624
4. Limiting Cable Assembly
5. Bushing Spacer
6. Safety Pin AN416-1
7. Washer AN960-616
8. Pin AN396-21
9. Rigger Bracket
10. Safety Pin AN416-1
11. Washer
12. Pin AN396-21
13. Rigger Assembly
14. Cotter Pin AN380-2-4
15. Nut AN310-5
16. Washer AN960-516
17. Bolt AN5-14
18. Ski Assembly
19. Bushing Spacer
20. Axle Sleeve
21. Rubber Bushing

Figure 9-3. Nose Ski, Exploded View



1. Nut AN365-1018
2. Sliding Washer
3. Spring
4. Spring
5. Sliding Washer
6. Actuating Rod
7. Eyebolt
8. Lock Nut AN316-6R
9. Stop Collar
10. Retaining Washer
11. Barrel
12. Attachment Lug
13. Retaining Washer

Figure 9-4. Main Ski Rigger, Cutaway View

d. Fasten the barrel end of the rigger assembly (13) to the rigger bracket (9) on the nose wheel fork with flat head pin (12), washers (11), and safety pin (10). Fasten the other end of the rigger assembly (13) to the rigger bracket on the ski assembly (18) with bolt (17), washers (16), and nut (15). Insert cotter pin (14). Apply a few drops of low-temperature oil, Specification AN-O-6a, to the rigger end fittings.

e. Fasten one end of the limiting cable assembly (4) to the rigger bracket (9) with flat head pin (8), washers (7), and safety pin (6). Secure the other end of the limiting cable assembly (4) to the front of the ski assembly (18) with bolt (1), washer (2), and self-locking nut (3).

9-8. ADJUSTING.

9-9. MAIN SKIS. (See figure 9-4.)

a. Level the airplane (See paragraph 3-19.)

b. Detach the rigger end from the ski.

c. Loosen the lock nut (8) and adjust the eyebolt (7) until the ski is parallel to the airplane flight line. A level placed on the top of the ski channel may be used to determine the attitude of the ski.

CAUTION

Do not screw the eyebolt out of the actuating rod beyond the inspection hole.

d. When the eyebolt is adjusted, tighten the lock nut and attach the rigger to the ski.

e. The downward pitch of the ski should be limited to 13 degrees ± 2 degrees by the forward limiting cable. The upward pitch should be limited to 4 degrees ± 2 degrees by the aft cable. Check the pitch limits with oleos fully extended; and, if pitch angles are not within limits, replace cables as necessary.

9-10. NOSE SKI.

a. The normal attitude of the nose ski should be 4 degrees ± 2 degrees upward pitch position. Replace the rigger assembly, if necessary, to obtain the correct ski attitude.

b. The downward pitch of the nose ski should be limited to 10 degrees ± 2 degrees by the limiting cable. If the motion is not limited accordingly, replace the cable.

9-11. LUBRICATION. Rigger end fittings should be lubricated daily with a few drops of oil, Specification No. AN-O-6a.

ALPHABETICAL INDEX

(Page numbers underlined denote illustrations)

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(Page numbers underlined denote illustrations)

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