

SECTION 5

LANDING GEAR, BRAKES AND HYDRAULIC SYSTEM

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NOTE

This Section is divided into two parts. Part 1 covers the landing gear system for aircraft through Serial No. 33701398 and F337-00045. Part 2 covers the landing gear system for aircraft beginning with Serial No. 33701399 and F33700046. Part 1 contains information which is also applicable to aircraft described in Part 2. To avoid repetition of information, the reader is referred back to this information in Part 1. A separate set of hydraulic schematic diagrams is provided for aircraft described in each Part of this Section. These diagrams may be found at the end of each part of this Section.

PART 1

(THRU SERIALS 33701398 AND F33700045)

5-1. LANDING GEAR SYSTEM.

5-2. DESCRIPTION. A hydraulically-operated, tri-cycle retractable landing gear is employed on the aircraft. The hydraulic power system includes equipment required to provide a flow of pressurized hydraulic fluid to the landing gear system. Main components of the hydraulic system include the engine-driven hydraulic pump, located on the right rear accessory pad of the front engine; the hydraulic filter, located in the pump pressure line, at the forward side of the front firewall; the hydraulic power pack, located in the cabin on the aft left side of the front firewall, behind the instrument panel; and the emergency hand pump, mounted on a support beneath the floorboard, immediately in front of the pilot and copilot seats, on the aircraft centerline.

5-3. OPERATION.

NOTE

Refer to the hydraulic schematic diagrams to trace the flow of hydraulic fluid as outlined in the following steps.

a. Filtered hydraulic fluid from the engine-driven hydraulic pump enters the power pack, where a passage connects to the primary relief valve. With landing gear control handle in either up - neutral or down - neutral, fluid circulates back through the pump (unloaded).

b. When the control lever is moved out of neutral, fluid flows through a check valve to the solenoid-operated door control valve and to the gear priority valve.

c. Fluid flows through this door control valve (which is in the door-open position when the handle is moved out of neutral) and opens the doors. The gear priority valve remains closed while the door system is being operated, because the door system operates at less pressure than is required to open the priority valve.

d. After the doors are open, pressure builds up until the gear priority valve opens and permits fluid first to unlock, then to move the landing gear to either the up or down position, depending on the

position selected by the landing gear control lever.

e. When the gear has moved to the full-up or full-down position, the uplock or downlock switches are actuated, causing the solenoid-operated door control valve to move to the door-closed position. Then the fluid flows through the valve to close the doors.

f. After the doors are closed, pressure builds up in the system until the 3 to 9-second time-delay valve, operated by pressure from the door-close line, opens and permits fluid to flow to the handle-release valve, returning the handle to neutral.

g. As the gear control handle returns to neutral, it moves the gear selector spool in the power pack, which again permits fluid to circulate freely through the pump, into the power pack manifold, and back to the reservoir.

NOTE

Prior to 1968 models, a secondary relief valve, which also serves as the emergency hand pump relief valve, opens at a higher pressure than the primary relief valve. Beginning with 1968 models, the secondary relief valve is deleted from the hydraulic system. This also includes relocation of the primary relief valve, in the hydraulic circuit, to a position downstream of the engine-driven hydraulic pump check valve. This prevents loading of the engine-driven pump when the emergency hand pump is operated. Delete references to the secondary relief valves for 1968 models.

h. When extending the landing gear with the emergency hand pump, fluid flows directly to the solenoid-operated door control valve and to the gear priority valve, where it first opens the doors, then extends the gear through the same passages and lines used by the regular system. A check valve prevents fluid from entering the inlet passage from the engine-driven hydraulic pump.

i. In case of an electrical failure, the door control valve will move to the door-open position, and remain in this position.

j. A door vent valve in the power pack, relieves any pressure from thermal expansion in the door

system, to keep the doors closed, while the aircraft is parked.

NOTE

This valve is not installed on some early power packs. However, replacement power packs (either new or remanufactured) have the valve installed.

aft and inboard to stow the wheels in the lower fuselage, beneath the rear horizontal firewall. The firewall has raised contours just above the stowed position of the wheels. Each strut is attached to a saddle, which is rotated by a universal joint. The two universal joints are operated by one main landing gear rotary actuator, which is a double-acting cylinder, powering a rack and pinion gear. A downlock and double-acting downlock release cylinder is provided for each main gear, and a single-acting uplock release cylinder operates both main gear uplocks.

5-4. MAIN GEAR SYSTEM.

5-5. DESCRIPTION. Main landing gear struts rotate

5-6. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
LANDING GEAR OPERATION EXTREMELY SLOW.	Reservoir fluid level low.	Refill reservoir.
	Engine-driven pump failure or internal leakage.	Repair or replace engine pump.
	Air leakage in engine pump suction line.	Repair or replace suction lines or fittings.
	Fluid leak in door or gear line.	Tighten or replace lines.
	Defective piston seal in door or gear cylinder.	Repair or replace defective parts.
	Excessive internal Power Pack leakage.	Remove and repair or replace Power Pack.
ONE MAIN GEAR WILL NOT RETRACT OR EXTEND.	Broken or distorted universal joint.	Replace universal joint and adapter as an assembly.
	Sheared tapered pins or bolts at actuator shaft, universal joint, or adapter.	Replace defective parts.
GEAR OPERATES, BUT DOORS WILL NOT OPEN.	Solenoid valve jammed or stuck in door-closed position.	Repair or replace solenoid valve. Repair any damage to doors or door operating linkage.
GEAR UNLOCKS BEFORE DOORS ARE FULL-OPEN.	Priority valve setting low.	Adjust valve setting.
	Priority valve leaking or stuck open.	Remove Power Pack and repair or replace valve.
ONE MAIN GEAR LAGS BEHIND DURING RETRACTION.	Adapter-to-saddle pivot shaft not tight, permitting shear movement between adapter and saddle shaft.	Remove bolts and shear washer. Clean any metal from serrations of pivot shaft and adapter. Install a new shear washer, and reinstall bolts and safety. Refer to paragraph 5-46 for indexing of bolts in slotted holes during assembly.

5-6. TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
UNEVEN OR EXCESSIVE TIRES WEAR.	Dragging brake.	Jack wheel and check brake.
	Wheel bearings not adjusted properly.	Tighten axle nut properly.
	Defective actuators.	Repair or replace actuators
	Incorrect tire inflation.	Inflate to correct pressure.
	Incorrect tire inflation	Inflate to correct pressure.
	Wheels out of alignment.	Align wheels.
	Wheels out of balance.	Balance wheels.
	Sprung landing gear spring.	Replace spring.
	Bent axle.	Replace axle.
AIRCRAFT LEANS TO ONE SIDE.	Incorrect tire inflation.	Inflate to correct pressure.
	Landing gear attaching parts not tight..	Tighten loose parts; replace defective arts.
	Sprung landing gear spring.	Replace spring.
	Bent axle.	Replace axle.
	Different quantity of fuel in wing tanks.	Refuel airplane.
	Structural damage to landing gear bulkhead components.	Replace damaged parts.
ONE OR MORE UPLOCKS OR DOWNLOCKS DO NOT OPERATE.	Incorrect rigging.	Rig per applicable paragraph.

5-7.MAIN GEAR STRUT REMOVAL. (Refer to figure 5-1.)

- a. Remove bench-type rear seat or individual center seats.
- b. Remove carpeting and access covers from area of landing gear bulkhead,
- c. Jack the aircraft in accordance with procedures outlined In Section 2.

NOTE: If a new strut is to be installed, complete steps "d" thru "h", and step "n".

- d. Remove hub cap retainer screws (21) and hub cap (20).
- e. Remove bolts securing back plates to brake cylinder and remove back plates.
- f. Remove cotter pin (22) and axle nut (19); remove wheel from axle.
- g. Disconnect brake hose (13) from brake assembly (16) and plug or cap openings.
- h. Remove bolts securing axle (15) and brake torque plate to strut, noting numbers of and marking position of wheel alignment shims (14), so that shims may be installed in exactly the same position.
- i. With master switch OFF, place landing gear handle up, and operate emergency hand pump until main gear downlock releases.
- j. Disconnect brake hose from swivel fitting at block near saddle (2); cap openings.
- k. Remove Inboard bolt (4) and barrel nut (1) securing strut to saddle (2).
- l. Remove bolts (5) securing clamp (5) and strut to saddle.
- m. Carefully work strut out through door openings, leaving brake line (9) attached to strut.
- n. Remove brake line (9) from clips (10) on strut.

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MODEL 337
MAINTENANCE MANUAL

5-7A. CORROSION CONTROL ON LANDING GEAR SPRINGS.

a. General

- (1) The main landing gear springs are made from high strength steel that is shot peened on the lower surface to increase the fatigue life of the part.
- (2) The shot peened layer is between 0.010 and 0.020 inch thick.
- (3) If the protective layer of paint is chipped, scratched, or worn away, the steel may corrode (rust).

NOTE: Corrosion pits that extend past the shot peen layer of the gear spring will cause a significant decrease in the fatigue life of the spring.

- (4) Operation from unimproved surfaces increases the possibility of damage.

b. Corrosion removal and repair.

WARNING: Do not use chemical rust removers or paint strippers on landing gear springs. High-strength steel parts are very susceptible to hydrogen embrittlement. Acidic solutions, such as rust removers and paint strippers, can cause hydrogen embrittlement. Hydrogen embrittlement is an undetectable, time-delayed process. Since the process is time delayed, failure can occur after the part is returned to service.

- (1) Examine for signs of corrosion (red rust) if damage to the paint finish of the landing gear spring is found.
- (2) Carefully remove any rust by light sanding.

- (a) The sanding must blend the damage into the adjacent area in an approximate 20:1 ratio.

EXAMPLE: An 0.005-inch deep pit. The pit must be blended to a 0.10-inch radius or 0.20-inch diameter.

- (b) Make sure the last sanding marks are along an inboard-to-outboard direction, or along the long dimension of the spring.

- (3) After the sanding is complete, measure the depth of the removed material from the damaged area.

NOTE: The maximum combined depth of removed material to the top and bottom or leading and trailing edge is not to be more than 0.063 inch at any two opposite points on the gear spring. This measurement limitation includes areas that have previously been damaged and repaired.

- (a) Make sure the depth of the damage area on the bottom of the gear spring is not more than 0.012 inch deep.

1 If the damage is deeper than 0.012 inch deep and less than 0.063 inch deep, replace or shot peen the gear spring. The gear spring must be removed and sent to an approved facility to be shot peened.

a The shot peen specification is to be Almen intensity of 0.012 to 0.016 with 330 steel shot.

- (b) Make sure the depth of any damage on the leading edge, trailing edge, or top of the gear spring is not more than 0.063 inch deep.

1 If the damage is deeper than 0.063 inch deep, replace the gear spring.

- (4) Touch-up paint as required.

c. Axle bolt hole corrosion.

- (1) Operation of an airplane on skis increases the loads on the lower part of the gear spring because of the unsymmetrical and twisting loads.

- (a) The increased loads have produced spring fractures that originate from pits in the axle attach holes.

1 Catastrophic failures can occur from fatigue cracks as small as 0.003 to 0.010- inch long that originated at pits.

NOTE: Although operation on skis causes more loads, the criteria apply to all airplanes.

- (2) There is no maximum damage depth for pits that develop in the axle bolt holes. If pits or corrosion is found, ream to remove it, subject to the following limitations:
- (a) Remove the minimum material necessary to repair the damage.
 - (b) Make sure the diameter of the axle attachment holes are no more than 0.383 inch for 3/8- inch bolts.
 - (c) Make sure the diameter of the axle attachment holes are no more than 0.321 inch for 5/16- inch bolts.
 - (d) If reaming to the maximum dimension does not remove all signs of corrosion, discard the landing gear spring.

5-8. STRUT INSTALLATION. (Refer to figure 5-1.)

- a. Install brake line (9) in clips (10) on strut.
- b. Carefully work strut through door opening into position on saddle.
- c. Install inboard bolt (4), barrel nut (1), bolts (5).

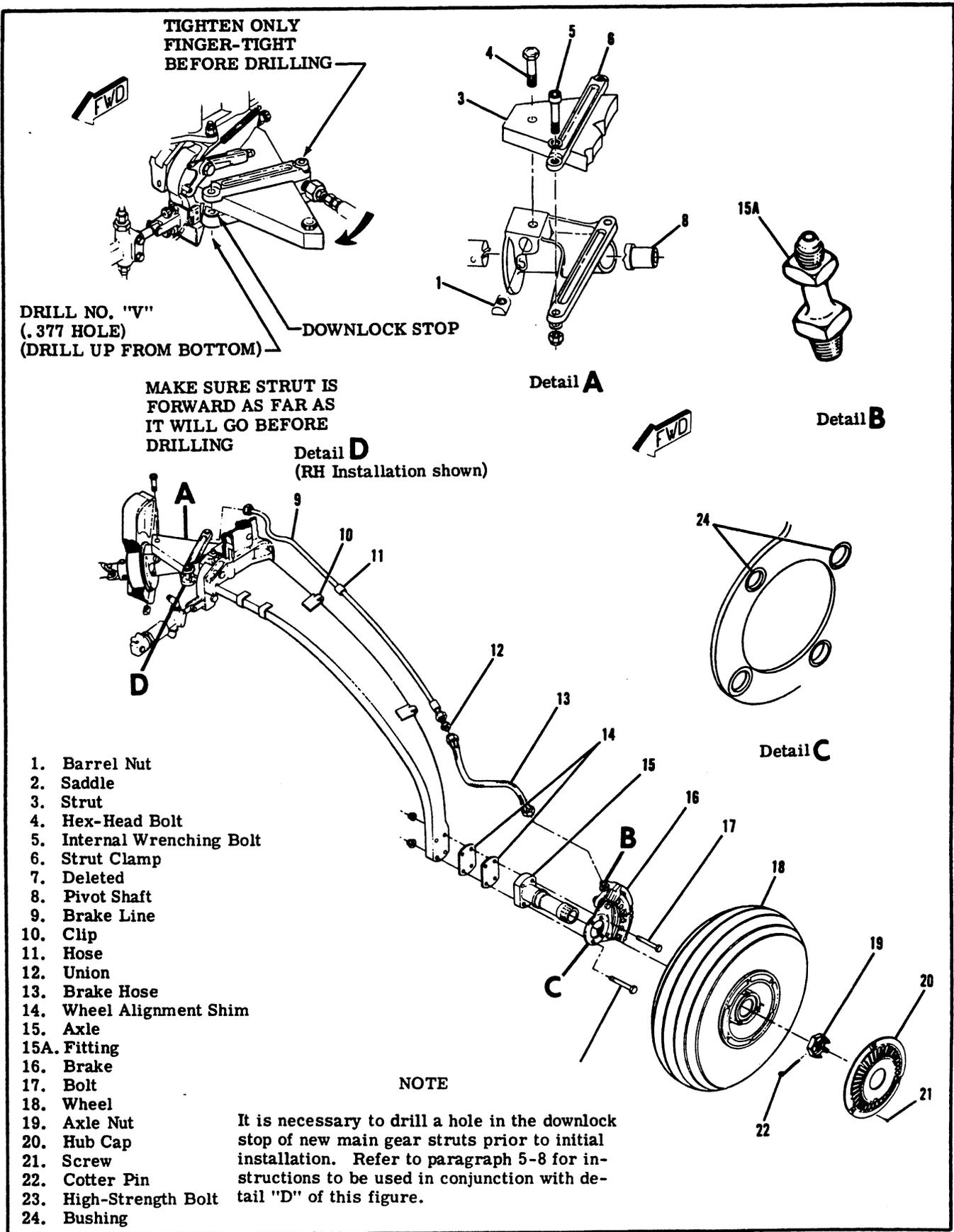


Figure 5-1. Main Landing Gear

and clamps (6) securing strut to saddle (2).

NOTE

It is necessary to drill a hole in the downlock stop of new main gear struts prior to initial installation. Refer to detail "D" for instructions to be used in conjunction with this paragraph.

d. When installing a new strut, complete steps "a" and "b", and install inboard bolt (4), barrel nut (1), aft bolt (5) and clamp (6) securing strut to saddle (2). Tighten aft bolt (5) only finger-tight (tightening bolt too tight will raise forward end of clamp). Do not drill hole in downlock stop until after completion of step "n".

e. Connect brake line to swivel fitting at back near saddle.

f. Inspect axle for straightness and for damage to threads; if damaged or bent, install new part.

g. Insert mounting bolts (17 and 23) through torque plate, axle and alignment shims. Position shims according to reference marks made at time of disassembly.

h. Position axle assembly to strut, install nuts and tighten.

i. Slide wheel on axle, using care to prevent damage to threaded surface of axle.

j. Install axle nut (19) on axle and tighten until a slight bearing drag is obvious when wheel is rotated.

k. Loosen axle nut only enough to align with nearest cotter pin hole and install cotter pin (22).

l. Install back plates and cylinder bolts.

m. Install hub cap (20) and retainer screws (21).

n. Connect brake hose (13) to brake assembly (16).

o. If a new strut (3) is being installed, move strut at wheel, aft as far as it will go; this will move upper inboard end of strut forward.

p. Make sure upper inboard end of strut is forward as far as it will go, and checking from underneath, line up hole in forward arm of saddle (2) with tab on downlock stop.

q. Using a size "V" (.377) drill, line drill up through hole in saddle arm, through downlock stop tab.

r. Install forward bolt (5), and tighten both bolts (5), securing clamp (6) to strut (3) and saddle (2).

s. Bleed brakes in accordance with instructions outlined in paragraph 5-73.

t. Check rigging of main landing gear in accordance with paragraph 5-264.

u. Remove aircraft from jacks and check wheel alignment in accordance with figure 5-12.

v. Install upholstery and access panels.

w. Install rear seat.

5-9. MAIN LANDING GEAR ACTUATOR. (Refer to figure 5-3.)

5-10. DESCRIPTION. The main gear actuator is a double-acting, cylinder-type actuator, powering a rack and pinion gear. The actuator is located between, and connected to the main landing gear strut saddles by means of universal joints and adapters. When the gear control handle is moved to the gear-up position, hydraulic pressure is routed to the main gear actuator, moving the pinion gear and rack, causing the main gear struts to rotate aft and inboard into the stowed

position. Moving the gear control handle to the gear-down position, reverses the movement of the rack and pinion, rotating the main gear struts forward and downward into the gear-down position.

5-11. REMOVAL. (Refer to figure 5-2.)

a. Remove rear or center seats.

b. Remove carpeting and access covers from area of actuator.

c. Jack aircraft in accordance with instructions outlined in Section 2.

d. With master switch OFF, place landing gear control handle in the gear-up position and use emergency hand pump to rotate main landing gear as necessary for access and clearance.

e. Mark all parts in their correct relationship to each other, before removal.

f. Remove tapered pins (13) securing universal joints (26) to actuator shaft (15).

g. Remove tapered pins (13) securing both universal joints to adapters (14).

h. Remove bolts attaching both adapters (14) to saddle pivot shafts (10) and slide both adapters inboard on universal joints as far as possible.

i. Remove shear washers (12) between adapters and pivot shafts.

j. Disconnect and cap or plug all hydraulic lines at the actuator (18), without disturbing the fittings installed in the actuator.

k. Remove horizontal angle (19) above center part of actuator.

l. Remove bolts securing vertical angles (17 and 20) to structure under center of actuator. The vertical angles (17 and 20) may be left attached to the actuator.

m. Remove four mounting bolts at forward end of actuator.

n. Remove bolts securing vertical angles (22 and 24) to structure under forward end of actuator.

o. Remove bolts attaching horizontal angle (21) above forward end of actuator at each side, and lift horizontal angle (21), (with vertical angles 22 and 24 attached), upward to remove.

p. Work adapter end of universal joint up, then slide inboard end of universal joint outboard until clear of actuator shaft, and remove universal joint with adapters attached.

q. Lift forward end of actuator just clear of structure under the actuator, slide actuator forward until aft end can be lifted free, then work actuator from aircraft.

5-12. DISASSEMBLY. (Refer to figure 5-3.)

NOTE

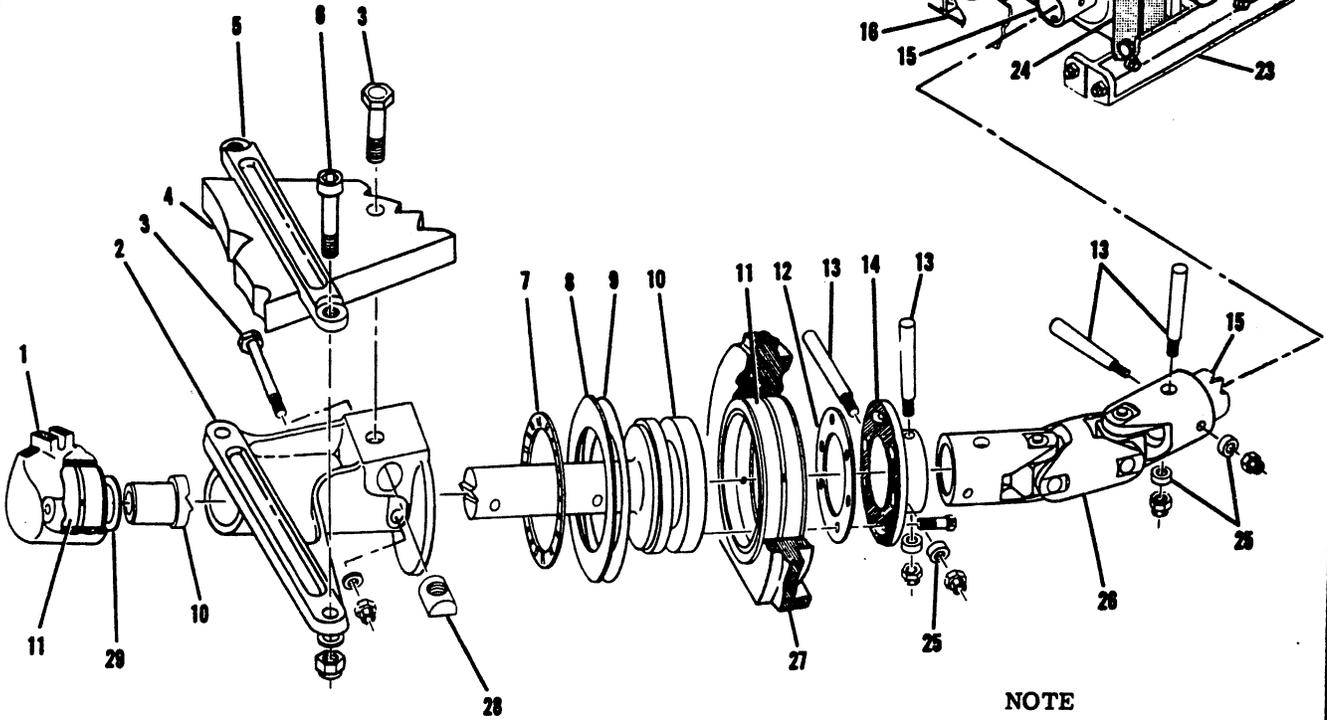
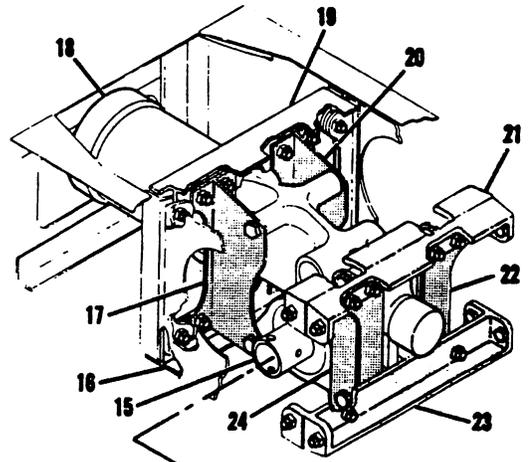
Leading particulars of the actuator are as follows:

Cylinder Bore Diameter	2.996 in.
Piston Diameter	2.992 in.
Piston Rod Diameter	1.222 in.
Cylinder Stroke	3.38 in.
Shaft Rotation (Loaded)	180° (Min)
Shaft Rotation (Unloaded)	187° (Max)

a. Remove screw (18), then remove end gland (4) and metering pin (1) by unscrewing end gland from

NOTE

Lubricate NTA-4860 thrust bearing (7) with MIL-G-21164 grease on installation. (Service each 500 hours thereafter.)



NOTE

If the installation of bearing (11) is not a light press fit (tight enough to hold the bearing in position and prevent rotation in support (27), prime bearing and joining surface of support with Grade "T" Primer and seal with Retaining Compound 75 (Loctite Corporation).

NOTE

Washers (29) and spacers (9) are used as required to eliminate end play from pivot shaft.

- | | | |
|----------------------------|-----------------------------------|------------------------------------|
| 1. Outboard Support | 11. Bearing | 20. Left Center Vertical Angle |
| 2. Saddle | 12. Shear Washer | 21. Upper Forward Horizontal Angle |
| 3. Bolt | 13. Tapered Pin | 22. Left Forward Vertical Angle |
| 4. Strut | 14. Adapter | 23. Lower Forward Horizontal Angle |
| 5. Strut Clamp | 15. Actuator Shaft | 24. Right Forward Vertical Angle |
| 6. Internal Wrenching Bolt | 16. Lower Center Horizontal Angle | 25. Tapered Pin Washer |
| 7. Thrust Bearing | 17. Right Center Vertical Angle | 26. Universal Joint |
| 8. Thrust Bearing Race | 18. Main Landing Gear Actuator | 27. Inboard Support |
| 9. Spacer | 19. Upper Center Horizontal Angle | 28. Barrel Nut |
| 10. Pivot Shaft | | 29. Washer |

Figure 5-2. Main Gear Actuator and Linkage Installation

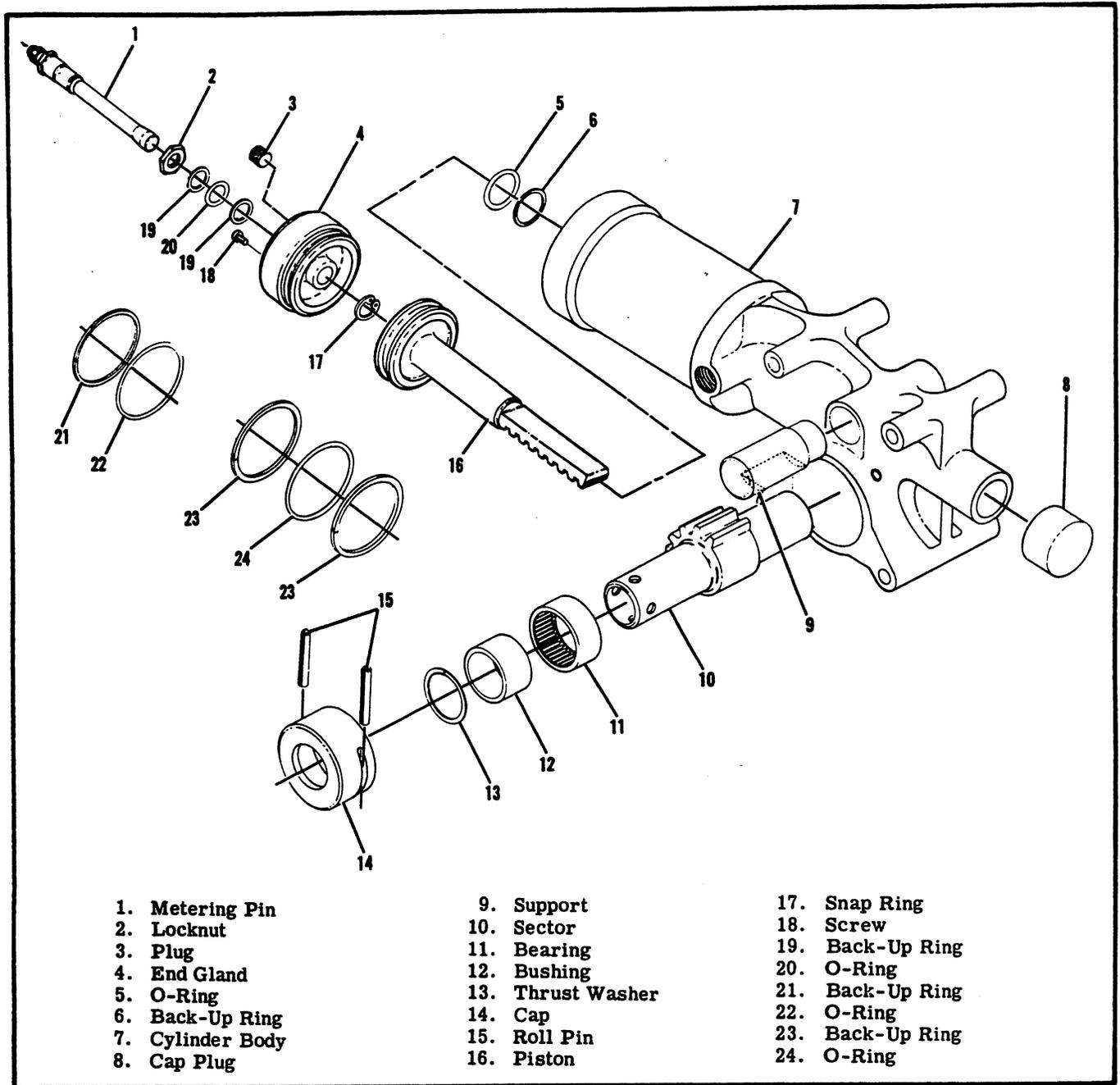


Figure 5-3. Main Gear Actuator

cylinder body (7).

b. Remove cap plug (8) and, using a phenolic block, drive piston (16) from cylinder body (7). Use care when removing piston to prevent damage.

c. Cut safety wire and remove pins (15) from cylinder body.

d. Remove cap (14) from cylinder body. This removes bearing (11), bushing (12) and thrust washer (13).

NOTE

Unless defective, do not remove bearings (11) and thrust washers (13) from cap or cylinder body.

e. Remove sector (10) from cylinder body.

f. Remove support (9), using a phenolic block and tapping from cylinder body. Tap out from smaller end of support.

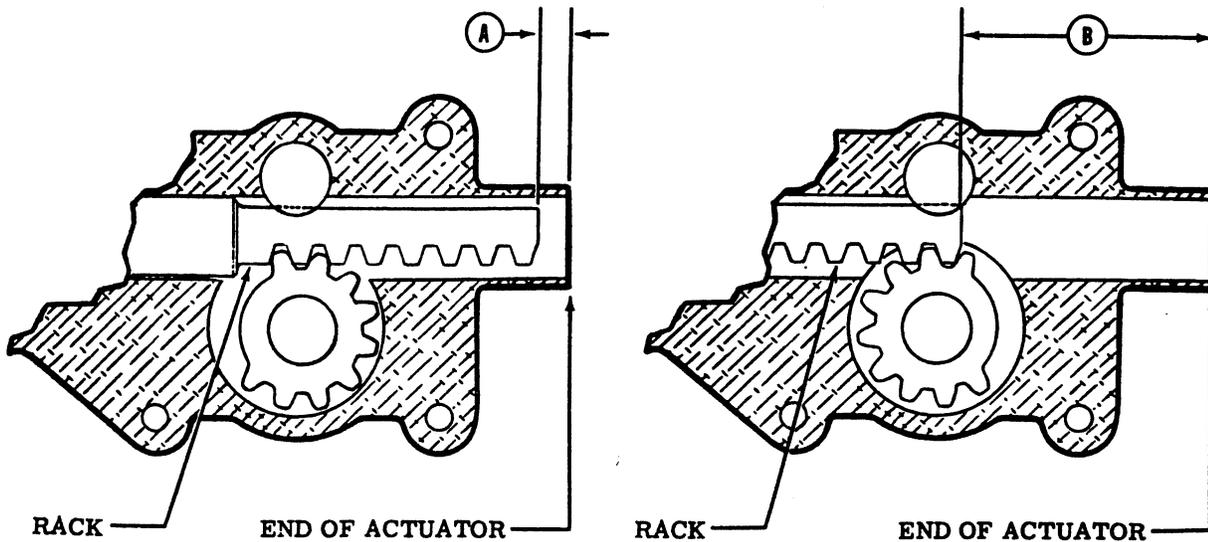
g. Remove bushings (12) from bearings (11) in cap and cylinder body.

h. Remove snap ring (17) and metering pin (1) from end gland (4).

i. Remove and discard all O-rings and back-up rings.

5-13. INSPECTION OF PARTS. Perform the following inspections to ascertain that all parts are in serviceable condition.

a. Thoroughly clean all parts in solvent (Federal

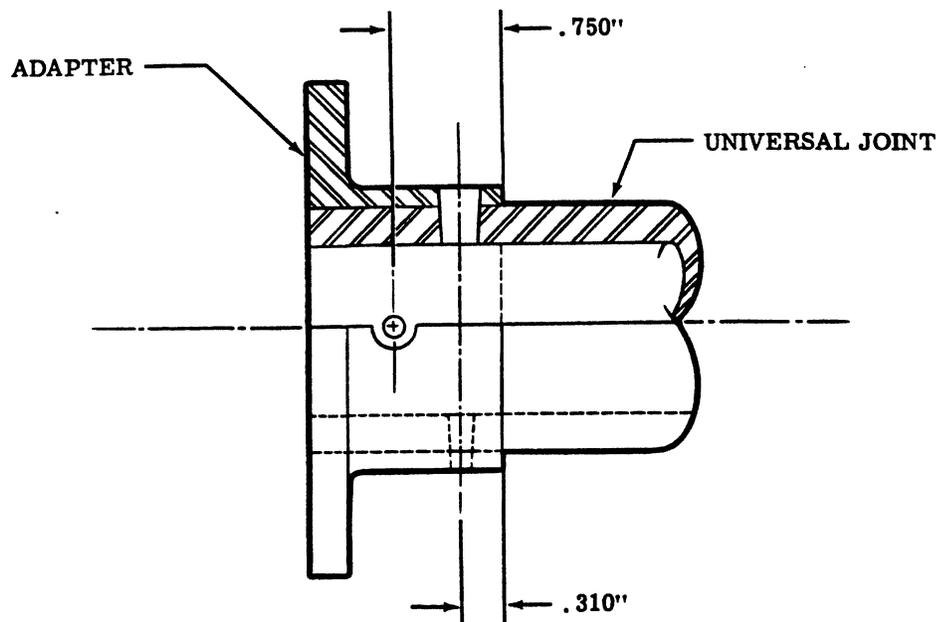


1. Measure distances "A" and "B" when the actuator piston is bottomed in UP and DOWN positions.
2. Subtract "A" from "B" to establish actual travel of rack.
3. Subtract 2.815" (travel needed to operate landing gear) from this actual travel, to establish unused travel.
4. Subtract one-half of this unused travel from "B" to establish the distance from the end of the actuator to the rack. This is the DOWN RIGGING POSITION of the actuator.

NOTE

Accomplishing the procedure listed above divides the unused travel equally at each end of the actuator, and establishes a DOWN RIGGING POSITION for any particular actuator.

Figure 5-4. Main Gear Actuator Down Rigging Position



1. Before drilling and reaming these tapered pin holes, be sure alignment is as follows:
 - a. Main gear actuator must be in the rigging position specified in figure 5-4.
 - b. Inboard end of universal joint must be attached securely to the actuator shaft, with tapered pins tightened.
 - c. Landing gear must be down and locked.
 - d. Adapter must be installed, with shear washer in place, and attaching bolts must be in center of slotted holes in adapter.
2. Locate the inboard tapered pin hole as shown, drill and ream, and install tapered pin with special washer and nut.

NOTE

Start with a No. 21 drill, then use a 7/32-inch drill, then a 1/4-inch straight reamer. After a smooth 1/4-inch hole has been obtained, use a B and S No. 2 Taper Reamer (or equivalent), removing only enough material to permit the smaller end of the tapered pin to be flush; it must not protrude more than 1/16 inch. Install the special tapered pin washer with its flat side against the nut.

3. After installing the inboard tapered pin, rotate landing gear and repeat step "2" for the outboard pin.

NOTE

The tapered pin holes may be drilled and reamed with parts installed in the airplane, or an initial hole may be located and drilled, and parts may be removed and reassembled for bench-drilling and reaming. It is not critical that the tapered pin holes be exactly 90° to each other, nor is it critical that they be exactly perpendicular to and through the centerline of the parts. A tolerance of ±5° is permissible.

Figure 5-5. Tapered Holes for Universal Joint Replacement

Specification P-S-66., or equivalent).

b. Inspect all threaded surfaces for cleanliness and freedom from cracks and wear.

c. Inspect cap (14), bushings (12), sector (10), support (9), piston (16) and cylinder body (7) for cracks, scratches, scoring, wear or surface irregularities which may affect their function or the overall operation of the actuator.

d. Inspect bearings (11) for roller operation and for scores, scratches and Brinell marks.

5-14. REPLACEMENT/REPAIR OF PARTS.

a. Repair of small parts of the actuator is impractical. Replace all defective parts with serviceable parts. Minor scratches or scores may be removed by polishing with abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect the operation of the actuator.

b. Install new O-rings and back-up rings during assembly.

5-15. ASSEMBLY. (Refer to figure 5-3.)

NOTE

Use MIL-G-21164 lubricant on support (9), bearings (11) and sector (10) when installing parts in cylinder.

a. If bearings (11) are being replaced, insert thrust washer (13) in cylinder body and press bearing (11) in until seated against thrust washer and retaining base in cylinder body. Install thrust washer and bearing in cap (14).

b. Lubricate bearing and insert bushing (12) in bearing in cylinder body.

c. Lubricate and install back-up ring (6) and O-ring (5) in groove of cylinder bore.

d. Install support (9) in cylinder body, tapping it in until seated against retaining base in cylinder.

NOTE

Ensure that cutout in support (9) will align with piston when piston is installed.

e. Lubricate and install back-up rings (23) and O-ring (24) in groove on piston (16).

f. Slide piston (16) into cylinder body so that flat portion of piston rack aligns with cutout in support (9). Push piston to bottom of cylinder body bore. Use care to prevent damage to back-up and O-rings in cylinder bore and on piston.

NOTE

Be sure that gear teeth on sector rotate in the correct direction so that piston can be extended.

g. Place sector (10) in cylinder, aligning first tooth on sector with first tooth on piston rack with piston retracted.

h. Lubricate bearing (11) and insert bushing (12) in cap (14).

NOTE

Lubricate sector and piston rack gears with MIL-G-23827 lubricant. Apply lubricant sparingly. Over-greasing may cause contamination of the hydraulic cylinder with grease, which may work past back-up ring (6) and O-ring (5).

i. Install cap (14), using attaching roll pins (15). Safety wire roll pins.

j. Install new back-up rings (19) and O-ring (20) in bore of end gland (4), and install back-up ring (21) and O-ring (22) in groove on end gland (4).

k. Install metering pin (1) in end gland (4), and install snap ring (17) on metering pin.

l. Install end gland and metering pin assembly in cylinder, and tighten until end gland is tight in cylinder. Install, tighten and safety Allen screw (18).

m. Install end cap (8) at end of actuator assembly.

n. Adjustment of metering pin, causing a snubbing action in the actuator, is accomplished as outlined in paragraph

5-16. INSTALLATION. (Refer to figure 5-2.)

a. Work actuator (18), with center vertical angles (17 and 20) attached, into position, and lift aft end to clear structure. Slide aft until forward end of actuator will clear lower structure.

b. If adapters (14) were removed from universal joints (26), place in position on universal joints, but do not install tapered pins (13).

c. Work adapters into position, shifting actuator from side to side as necessary for clearance.

d. Ensure that all parts are aligned as marked during removal, then install tapered pins and tighten.

e. Position upper forward horizontal angle (21), with forward vertical angles (22 and 24) attached, and install mounting bolts.

f. Install bolts securing forward vertical angles (22 and 24) to structure under forward end of actuator.

g. Install four mounting bolts through upper forward horizontal angle (21) to actuator.

h. Install outer vertical angles (17 and 20) to structure. If center vertical angles were not attached to actuator, attach with four bolts (refer to paragraph 5-11).

i. Install upper center horizontal angles (19) to structure.

j. Connect all hydraulic lines to actuator.

k. Slide shear washers (12) into position between adapters and pivot shafts. Since the pivot shaft and adapters are both serrated, the shear washers may be reused once by turning them so that the serration marks are 90° to their original position.

l. With landing gear down and locked, and main gear actuator in down position, install bolts securing adapters to pivot shafts (10). Torque bolts to 250 lb-in.

CAUTION

Use only a phenolic hammer or equivalent when seating adapter and pivot shaft into shear washer. Serious damage to parts may otherwise result.

m. Seat the serrations of the adapter and pivot shaft into the shear washer by hammering on adapter. Retorque and safety wire bolts in pairs.

n. Bleed hydraulic system in accordance with paragraph 5-163.

o. Rig landing gear in accordance with paragraph 5-264.

p. Check wheel alignment in accordance with figure 5-12.

q. Remove aircraft from jacks.

r. Install access panels and upholstery.

s. Install seats.

5-17. MAIN LANDING GEAR LINKAGE. (Refer to figure 5-2.)

5-18. DESCRIPTION. The main landing gear linkage consists of two pivot shafts, two universal joints, two adapters, two saddles, two strut clamps with bearings, pins, bushings and attaching parts. The linkage provides the connection between the main landing gear actuator and the main landing gear struts. The landing gear struts are clamped in saddles which are rotated by pivot shafts connected to the main gear actuator shaft, which rotates the main gear struts into the retracted or extended position.

5-19. REMOVAL OF UNIVERSAL JOINTS AND ADAPTERS. (Refer to figure 5-2.)

a. Remove rear or center seats.

b. Remove carpeting and access covers from landing gear bulkhead.

c. Jack aircraft in accordance with procedures outlined in Section 2.

NOTE

With master switch OFF, use emergency hand pump to rotate main landing gear as necessary for access and clearance when removing bolts and tapered pins. Mark all parts in their correct relationship to each other before removal.

d. Remove tapered pins securing universal joint to adapter shaft.

e. Remove tapered pins securing both universal joints to adapters.

f. Remove bolts attaching both adapters to saddle pivot shafts, and slide both adapters inboard on universal joints as far as they will go. Remove shear washers between adapters and pivot shafts.

NOTE

It is necessary to slide both adapters inboard, regardless of which universal joint is being removed, so that the main gear actuator may be shifted laterally.

g. Disconnect, plug or cap all hydraulic lines at the main gear actuator.

h. Remove actuator supporting structure as necessary to allow actuator to be shifted laterally.

i. Work adapter end of universal joint up, then slide inboard end of universal joint outboard until it clears actuator shaft; remove universal joint.

j. Shift main gear actuator in the opposite direction and remove the other universal joint.

k. After universal joints have been removed, adapters may be removed.

5-20. INSTALLATION OF REMOVED UNIVERSAL JOINTS AND ADAPTERS. (Refer to figure 5-2.)

NOTE

The following procedure is to be used when the same parts are being reinstalled.

a. If adapters were removed from universal joints, place adapters in position on universal joints, but do not install tapered pins.

b. Work adapters and universal joints into position, shifting main gear actuator from side to side as necessary for clearance.

c. Ensure that all parts are aligned as marked during removal, then install and tighten tapered pins.

d. Install all parts securing main gear actuator, and connect hydraulic lines.

e. Slide new shear washers into position between adapters and pivot shafts. Since the shaft and adapter are both serrated, the shear washers may be reused once by turning them so the serration marks are 90° to their original position.

f. With landing gear down and locked, and main gear operated to the rigging position (refer to paragraph 5-264), install bolts securing adapters to pivot shafts. Tighten bolts to 250 lb-in. Using an E-6 rivet gun with suitable flat rivet set (or hammer and rod), seat serrations of the adapter and pivot shaft into shear washer. Retorque and safety bolts in pairs.

g. Operate landing gear through several cycles to bleed any air from the system, checking for proper operation.

h. Remove aircraft from jacks and install all parts removed for access.

5-21. INSTALLATION OF NEW UNIVERSAL JOINTS AND ADAPTERS. (Refer to figure 5-2.)

NOTE

The following procedure is to be used when new parts are to be installed.

a. Position adapters (14) on undrilled end of universal joints (26) and work into position, shifting main gear actuator (18) from side to side as necessary for clearance.

b. Align tapered pin holes in inboard end of universal joints with corresponding holes in main gear actuator shaft. Install tapered pins (13) and tighten.

c. Install actuator support angles and bolts (refer to paragraph 5-16). Connect hydraulic lines.

d. Ensure that main gear actuator remains in the down position.

e. Manually move landing gear to down and locked position. Maintain this position.

f. Slide shear washers (12) into position between adapters (14) and pivot shafts (10). Since the pivot shaft and adapters are both serrated, the shear washers may be reused once by turning them so that

the serration marks are 90° to their original position.

g. Install bolts securing adapters to pivot shafts and torque to 250 lb-in.

CAUTION

Use only a phenolic hammer or equivalent when seating adapter and pivot shaft into shear washer. Serious damage to parts may otherwise result.

h. Seat serrations of adapter and pivot shaft into shear washer by hammering on adapter. Retorque and safety bolts in pairs.

i. Bleed hydraulic system in accordance with paragraph 5-163.

NOTE

The tapered pin holes may be drilled and reamed with parts installed in the aircraft, or an initial hole may be located and drilled and parts then removed and re-assembled for drilling and reaming on bench. It is not critical that the tapered pin holes be exactly 90° to each other, nor is it critical that they be exactly perpendicular to and through the centerline of the parts. A tolerance of $\pm 5^\circ$ is permissible.

j. Locate, drill and ream tapered holes through adapters and universal joints as follows:

NOTE

Maintain dimensions called out in Figure 5-5.

1. Ensure that alignment is as follows before drilling and reaming.

(a) Main gear actuator must be in the down position.

(b) Landing gear must be down and locked.

(c) Inboard end of universal joint must be attached securely to actuator shaft with nuts on tapered pins tightened.

(d) Adapter must be installed with shear washer in place; attaching bolts must be in center of slotted holes in adapter.

NOTE

Start with a No. 21 drill, then use a 7/32-inch drill, then a 1/4-inch straight reamer. After a smooth 1/4-inch hole has been obtained, use a B & S No. 2 taper reamer (or equivalent), removing only enough material to permit the smaller end of the tapered pin to be flush. The smaller end of the tapered pin must not protrude more than 1/16-in. Install the special tapered pin washer with flat side against the nut.

2. Locate inboard tapered hole as shown in figure 5-4. Drill and ream hole. Install tapered pin (13) with special washer (25) and nut (refer to figure 5-2.)

3. After installing inboard tapered pin, rotate landing gear (or remove necessary parts) and repeat step "2" for the outboard pin.

k. Bleed hydraulic system in accordance with figure 5-163.

1. Lubricate universal joints in accordance with Section 2.

m. Rig landing gear in accordance with paragraph 5-264.

n. Check wheel alignment as shown in figure 5-12.

o. Remove aircraft from jacks.

p. Install access panels, upholstery and seats.

5-22. REMOVAL OF MAIN GEAR SADDLE AND PIVOT SHAFT. (Refer to figure 5-2.)

a. Remove main gear strut in accordance with paragraph 5-7.

b. Remove universal joint and adapter in accordance with paragraph 5-19.

c. Remove bolts (3) attaching saddle (2) to pivot shaft (10).

d. Pull pivot shaft inboard until clear of outboard bearing support.

e. Allow saddle (2), thrust bearing (7), bearing race (8) and spacers (9) to slide outboard as pivot shaft is pulled inboard.

NOTE

Note number of and thickness of spacers (9) between thrust bearing race and inboard bearing support.

f. When shaft is clear of outboard bearing support (1), lift outboard end of shaft and slide saddle off shaft. Remove remaining bearing parts from shaft.

g. Move main gear actuator (18) as required for clearance and pull pivot shaft inboard to remove from aircraft.

5-23. INSTALLATION OF MAIN GEAR SADDLE AND PIVOT SHAFT. (Refer to figure 5-2.)

a. Position pivot shaft (10) through inboard forging (27). Slide spacers (9), thrust bearing race (8), thrust bearing (7) and saddle (2) onto shaft (10).

b. During installation, lubricate thrust bearing and race as specified in Section 2 and figure 5-2.

NOTE

Spacers (9) are used as required to remove end play from pivot shaft without causing it to bind.

c. Position outboard end of pivot shaft in bearing in outboard support forging (1). Check end play of shaft and adjust with shims (29) as necessary.

d. Install bolts (3) securing saddle (2) to pivot shaft (10).

e. Install universal joint (26) and adapter (14) in accordance with paragraph 5-20.

f. Install main gear strut (4) in accordance with paragraph 5-8.

5-24. UPLOCK MECHANISM. (Refer to figure 5-6.)

5-25. DESCRIPTION. The uplock is a hook (or pawl)

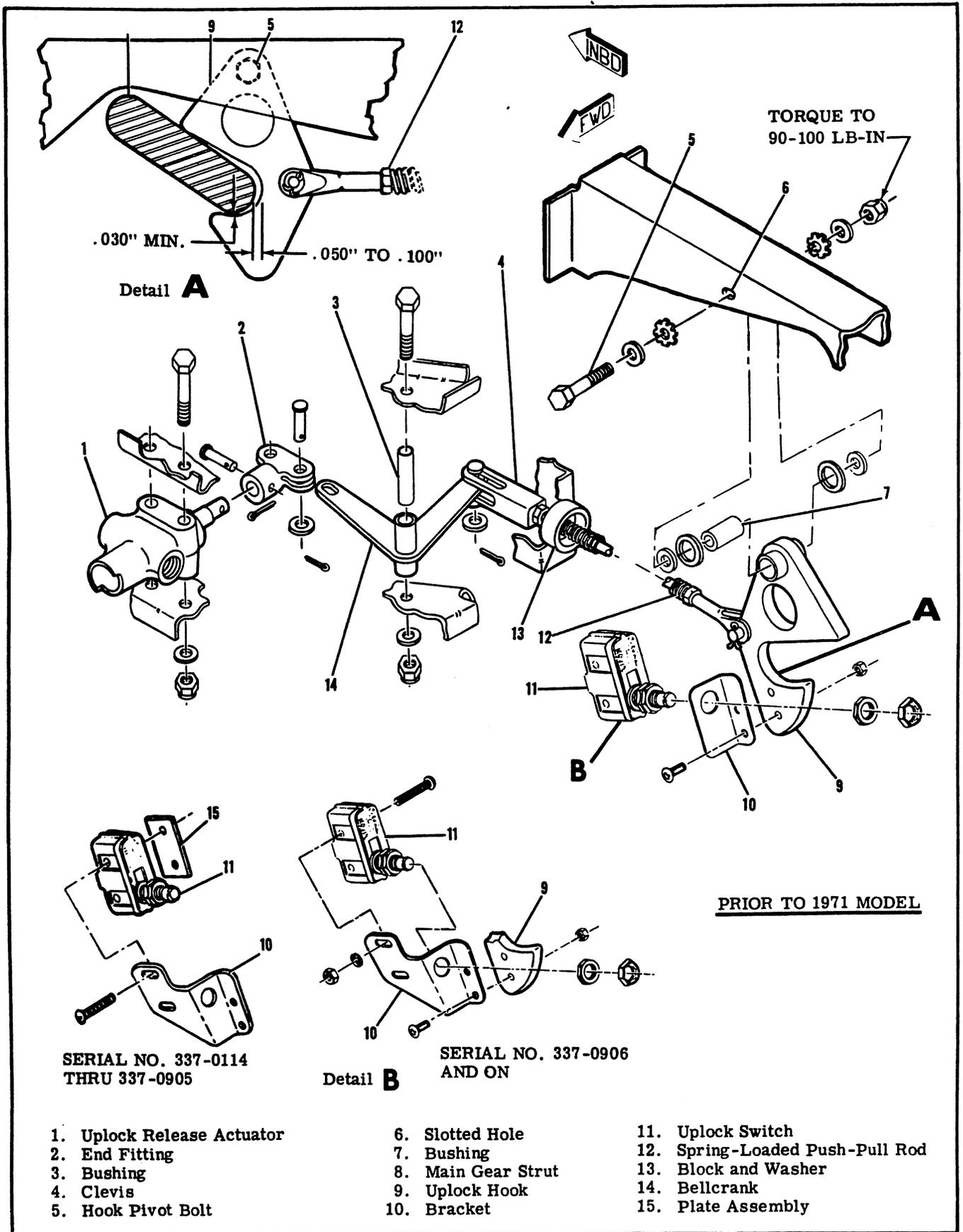


Figure 5-6. Main Gear Uplock Installation (Sheet 1 of 2)

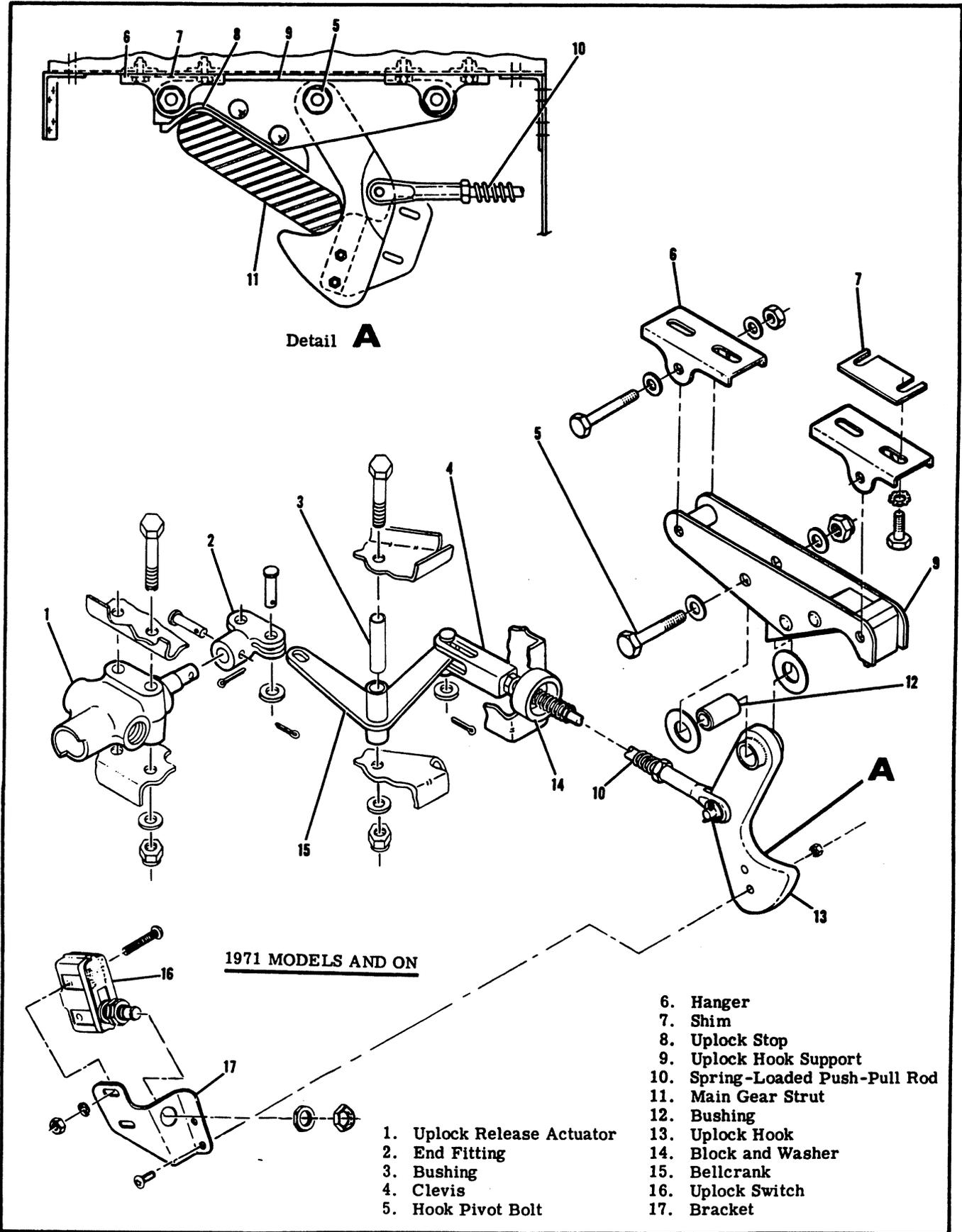


Figure 5-6. Main Gear Uplock Installation (Sheet 2 of 2)

***Used ONLY on main landing gear uplock actuator.
All other parts used on main landing gear down-
lock actuators.**

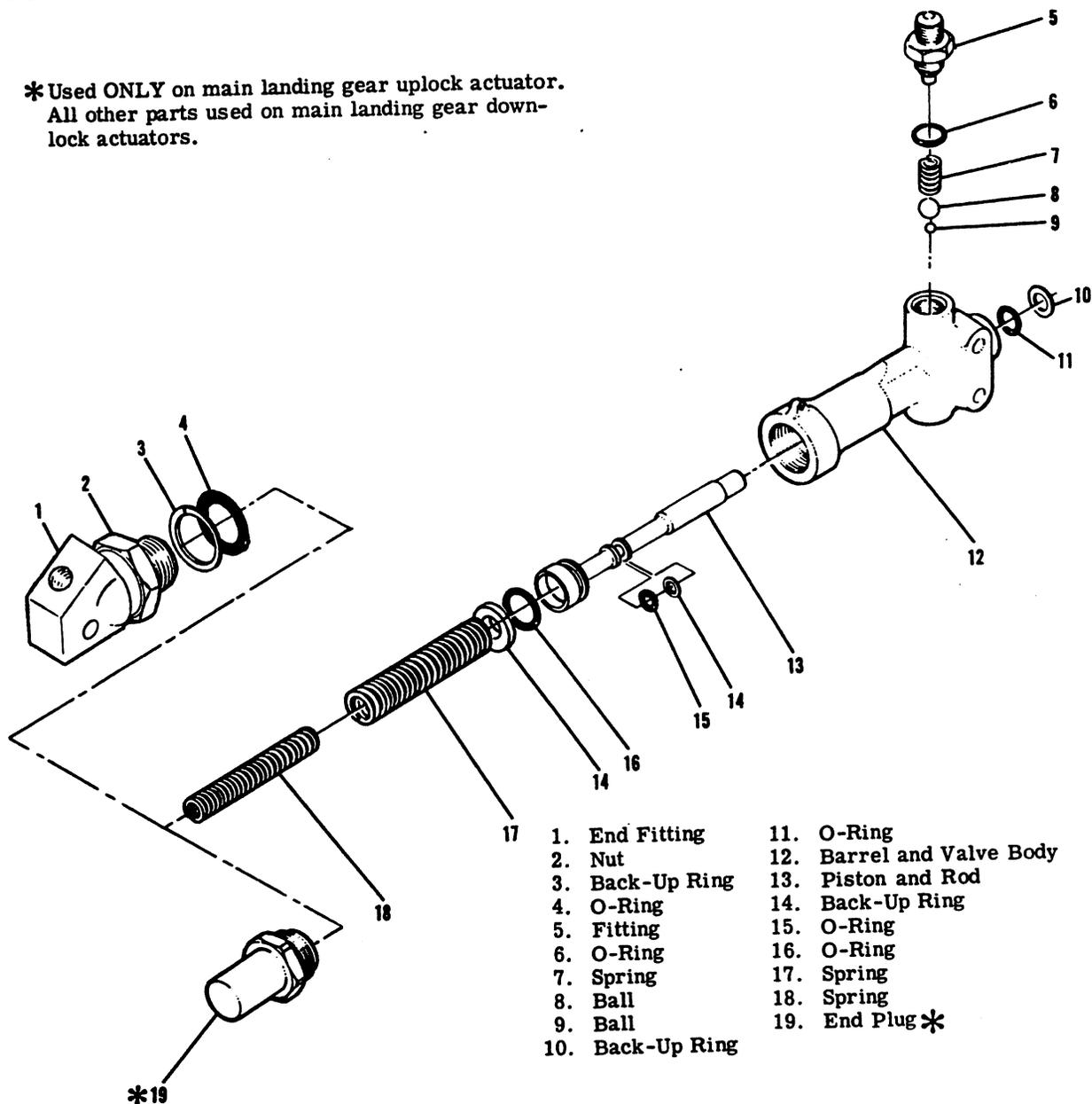


Figure 5-7. Lock and Unlock Actuator Assembly

which is spring-loaded to the locked position and hydraulically operated to the unlocked position. The installation consists of one hydraulic uplock release actuator, two clevises, two uplock hooks, two bellcranks, two spring-loaded push-pull rods, two uplock switches and attaching parts.

5-26. OPERATION. The uplock hook is moved into the locked position when the main gear strut strikes the upper part of the hook, causing the hook to rotate to the locked position by cam action. The spring-loaded push-pull rod maintains the locked position until the cam action is reversed by actuation of the uplock release actuator, which is linked to the push-pull rod by a clevis and bellcrank. The uplock indi-

cator switches are actuated when the gear is in the up and locked position.

5-27. REMOVAL OF MAIN GEAR UPLOCK MECHANISM AND RELEASE ACTUATOR. (Refer to figure 5-6.)

- a. Remove rear or center seats.
- b. Remove upholstery and access panels from area of main landing gear bulkhead.
- c. Jack aircraft in accordance with procedures outlined in Section 2.
- d. Remove end fitting (2) from actuator shaft (1) and bellcrank (14).
- e. Disconnect push-pull rod (12) from uplock hook (9) and bellcrank (14).

f. Remove clevis (4) from push-pull rod (12) by loosening locknut after noting distance from outboard end of clevis to mounting bracket. Remove push-pull rod.

g. Disconnect electrical connection to uplock switch (11).

h. Remove uplock hook pivot bolt (5) and remove hook from aircraft.

i. Uplock switch, bracket and hook may be disassembled after removal from aircraft.

j. Disconnect hydraulic lines at actuator (1) and plug or cap openings.

k. Remove actuator mounting bolts and actuator.

5-28. DISASSEMBLY OF UPLOCK RELEASE ACTUATOR. (Refer to figure 5-7.)

NOTE

Leading particulars of the actuator are as follows:

Cylinder Bore Diameter . . .	0.750 +.002, -.000 in.
Piston Diameter	0.748 +.000, -.002 in.
Piston Rod Diameter	0.343 +.001, -.002 in.
Stroke (except maingear downlock)	
(Total at 1.0 GPM)	0.812 in. (max)
Stroke (maingear downlock total travel)	0.84 ± .04 in.
Stroke (to unseat valve) . .	0.719 ± .031 in.

a. Remove fitting (5), spring (7) and balls (8 and 9).

b. Cut safety wire and unscrew end plug (19) from barrel and valve body (12).

c. If end fitting (1) is installed, loosen nut (2) and remove end fitting from barrel and valve body.

d. Remove springs (17 and 18) and piston and rod (13) from barrel and valve body.

e. Remove and discard all O-rings and back-up rings.

5-29. INSPECTION OF PARTS. Make the following inspections to determine that all parts are in a serviceable condition.

a. Inspect all threaded surfaces for cleanliness, cracks and excessive wear.

b. Inspect spring (17) for breaks and distortion. The free length of the spring must be $2.95 \pm .09$ inches and compress to 1.969 inches under a 22.5 ± 2.2 lb. load.

c. Inspect spring (18) for breaks and distortion. The free length of the spring must be $2.98 \pm .09$ inches and compress to 1.969 inches under a 10.6 ± 1.1 lb. load.

d. Inspect spring (7) for breaks and distortion. The free length of the spring must be $.446 \pm .015$ inches and compress to .359 inches under a $.18 \pm .02$ lb. load.

e. Inspect plug (19) or fitting (1), piston and rod (13), barrel and valve body (12), balls and ball seats for cracks, chips, scratches, scoring, wear or surface irregularities which may affect their function or the overall function of the unit.

f. Repair of most parts of the lock cylinder is impractical. Replace defective parts with serviceable parts.

g. Minor scratches and scores may be removed by polishing with fine abrasive crocus cloth (Federal

Specification P-C-458), providing their removal does not affect the operation of the unit.

5-30. ASSEMBLY. (Refer to figure 5-7.)

NOTE

Install all new O-rings and back-up rings during lock cylinder assembly.

a. Install new O-rings (16 and 15) and back-up ring (14) in grooves on piston and rod (13).

b. Install new O-ring (11) and back-up ring (10) in groove of barrel and valve body (12).

c. Slide piston and rod (13) into barrel and valve body (12). Use care to prevent damage to O-rings and back-up rings.

d. Insert springs (17 and 18). Install and safety end plug (19) or end fitting (1) to barrel and valve body (12).

e. Insert balls (8 and 9) and spring (7) in barrel and valve body (12).

f. Install new O-ring (6) on fitting (5). Install and tighten fitting (5).

5-31. INSTALLATION OF MAIN GEAR UPLOCK MECHANISM AND RELEASE ACTUATOR. (Refer to figure 5-6.)

a. Position actuator (1) to align with holes in mounting bracket. Install bolts, washers and nuts; tighten.

NOTE

Actuator position, when installed, must be in same relation to attaching components as is shown in figure 5-6. The longer part containing the check valve toward the right side of the aircraft.

b. Connect and tighten hydraulic lines at actuator.

c. Assemble uplock hook (9), switch bracket (10) and switch (11), leaving screws through switch and slotted holes in bracket, loose for adjustment.

d. Position uplock hook (9) and install hook-pivot bolt (5), washers, bushing and nut in slotted holes (6) in support structure (DO NOT TIGHTEN.)

e. Position spring-loaded push-pull rod (12) through hole in bracket. Install clevis (4) and lock nut. (Maintain measurement distance noted in step "f" of paragraph 5-27.)

f. Connect push-pull rod (12) to uplock hook (9) and bellcrank (14).

g. Install end fittings (2) to shaft of actuator (1) and bellcrank (14).

h. Connect electrical connection at uplock switch (11).

i. Bleed aircraft hydraulic system in accordance with paragraph 5-163.

j. Rig main gear uplock and uplock switch in accordance with paragraphs 5-267 and 5-268.

k. Torque uplock hook pivot bolt (5) nut to 90-100 lb. in.

l. Rig landing gear in accordance with paragraph 5-264.

m. Install access panels, upholstery and seats.

5-32. DOWNLOCK MECHANISM. (Refer to figure 5-8.)

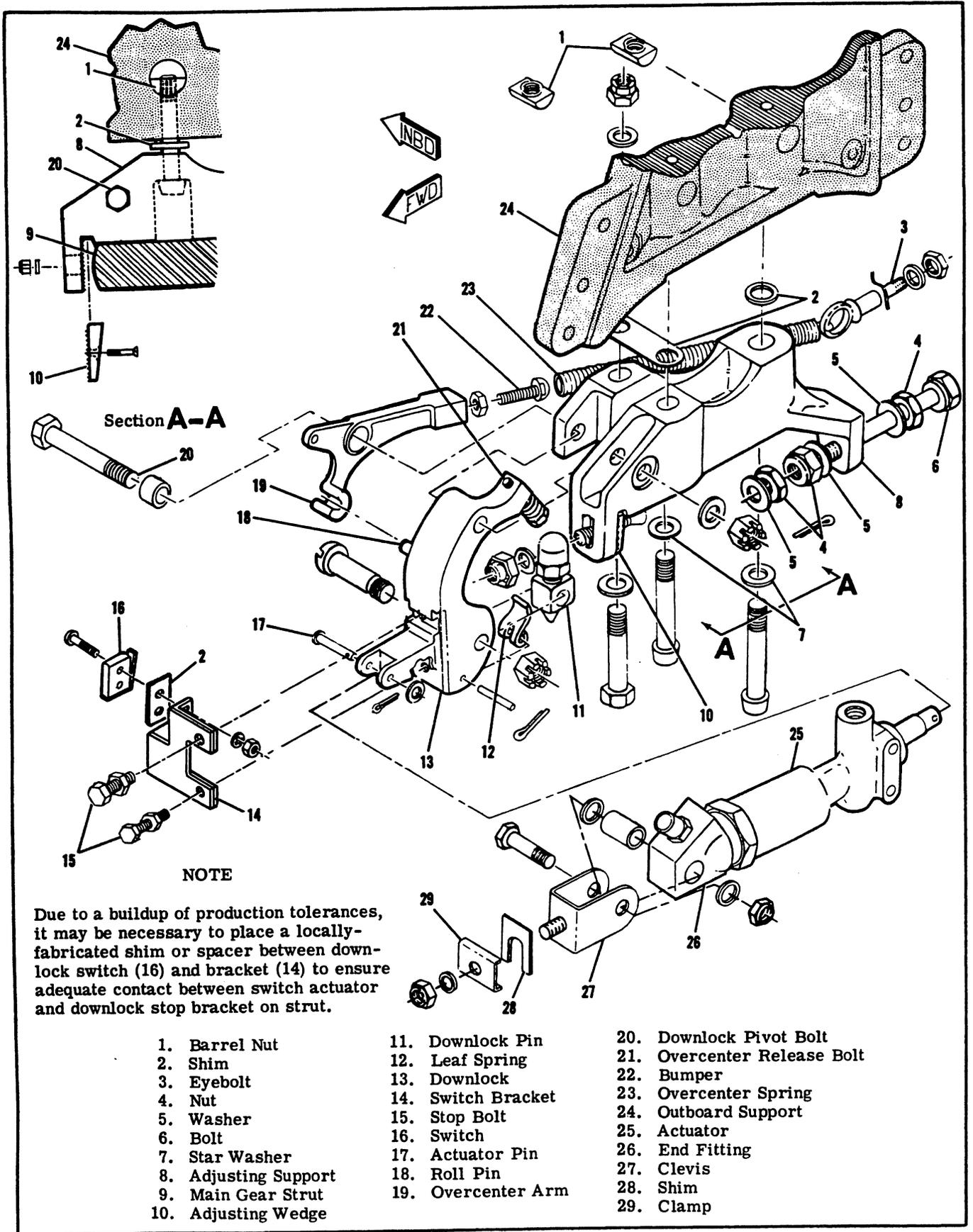


Figure 5-8. Main Gear Downlock Installation

5-33. DESCRIPTION. The installation consists of an overcenter arm, a hydraulic downlock actuator, a downlock assembly containing an adjustable downlock pin, an adjusting support, a downlock switch and attaching parts.

5-34. OPERATION. The hydraulically-operated downlocks (pawls) contain adjustable downlock pins which wedge under the forward edge of the struts to lock the landing gear in the down position. The downlocks are moved out of the way by the downlock actuators before gear retraction.

5-35. REMOVAL OF MAIN GEAR DOWNLOCK MECHANISM AND DOWNLOCK ACTUATOR. (Refer to figure 5-8.)

- a. Remove rear or center seats.
- b. Remove upholstery and access panels in area of landing gear bulkhead.
- c. Jack aircraft in accordance with procedures outlined in Section 2.
- d. With master switch OFF, place landing gear control handle in the gear-up position and operate emergency hand pump until main gear downlocks release.
- e. Release hydraulic pressure and pull downlocks (13) aft for access.
- f. Remove actuator pin (17) securing downlock (13) to arm of actuator (25).
- g. Disconnect hydraulic lines from downlock actuator (25) and cap or plug openings.
- h. Remove screw securing switch (16) to bracket (14); remove bracket from downlock (13).
- i. Remove eyebolt (3) and overcenter spring (23) from aircraft.
- j. Remove actuator mounting bolts and remove actuator from aircraft.
- k. Disconnect overcenter spring (23) from overcenter arm (19).
- l. Remove downlock pivot bolt (20) and remove downlock assembly (13) from aircraft.
- m. Remove bolts securing adjusting support (8) to outboard support (24). Remove fore - and - aft adjusting bolt (6). Remove adjusting support assembly from aircraft.
- n. Remove eyebolt (3) and overcenter spring (23) from aircraft.
- o. Remove clevis (27), shims (28) and clamp (29) from supporting structure.

NOTE

Parts removed as assemblies may be disassembled after removal from aircraft.

5-36. DISASSEMBLY, INSPECTION OF PARTS AND ASSEMBLY OF MAIN GEAR DOWNLOCK ACTUATOR. Main gear uplock and downlock actuators are identical except for end fittings. Refer to figure 5-7 and paragraphs 5-28 thru 5-30 for procedures for disassembly, inspection and assembly of main gear downlock actuators.

5-37. INSTALLATION OF MAIN GEAR DOWNLOCK MECHANISM AND DOWNLOCK ACTUATOR. (Refer to figure 5-8.)

- a. Install eyebolt (3), with overcenter spring (23)

attached. Install washer and nut and tighten.

- b. Install clevis (27), shims (28) and clamp (29) to supporting structure and tighten.
- c. Position adjusting support (8) and install attaching bolts loosely.
- d. Install fore - and - aft adjusting bolt (6) with nuts and washers, but do not tighten.
- e. Assemble downlock (13), overcenter arm (19), bumper (22), overcenter release bolt (21), downlock pin (11), leaf spring (12), switch bracket (14) and stop bolts (15), loosely.
- f. Position downlock assembly into adjusting support and install downlock pivot bolt (20), bushing, washer and nut, but do not tighten.
- g. Connect overcenter spring (23), to overcenter arm (19).
- h. Position actuator (25) into supporting structure, install mounting bolts, and tighten.

CAUTION

Applying too much torque to mounting screws in downlock switch may crack switch case.

- i. Install switch (16) to bracket (14).
- j. Connect and tighten hydraulic lines.
- k. Position actuator end fitting (26) into clevis (27). Install and tighten clevis bolt, bushing, washers and nut.
- l. Bleed hydraulic system in accordance with paragraph 5-163.
- m. Rig downlock mechanism in accordance with paragraph 5-266.
- n. Install access panels, upholstery and seats.

5-38. MAIN GEAR DOOR SYSTEM.

5-39. DESCRIPTION. The main gear door system consists of two main wheel well doors, two main gear door actuators, two strut doors with one actuator and torque tube, linkage and attaching parts. The main gear doors open for extension or retraction of the landing gear and close again after the cycle has been completed.

5-40. OPERATION. Each main gear wheel door is operated by a double-acting hydraulic cylinder. Both strut doors are linked through a torque tube to one double-acting hydraulic cylinder.

5-41. REMOVAL OF MAIN GEAR WHEEL DOORS AND ACTUATORS. (Refer to figure 5-9.)

- a. Remove rear or center seats.
- b. Remove upholstery and access panels from area of landing gear bulkhead.
- c. Jack aircraft in accordance with procedures outlined in Section 2.
- d. Release hydraulic pressure.
- e. Remove bolts securing actuator rod ends to doors.
- f. Disconnect hydraulic lines from actuators and cap or plug openings.
- g. Remove bolt securing actuator to support and remove actuator from aircraft.
- h. Support door and remove bolts through forward and aft hinge brackets. Remove door from aircraft.
- i. Mark hinges and brackets on door before disassembly to provide for realignment and location for reassembly.

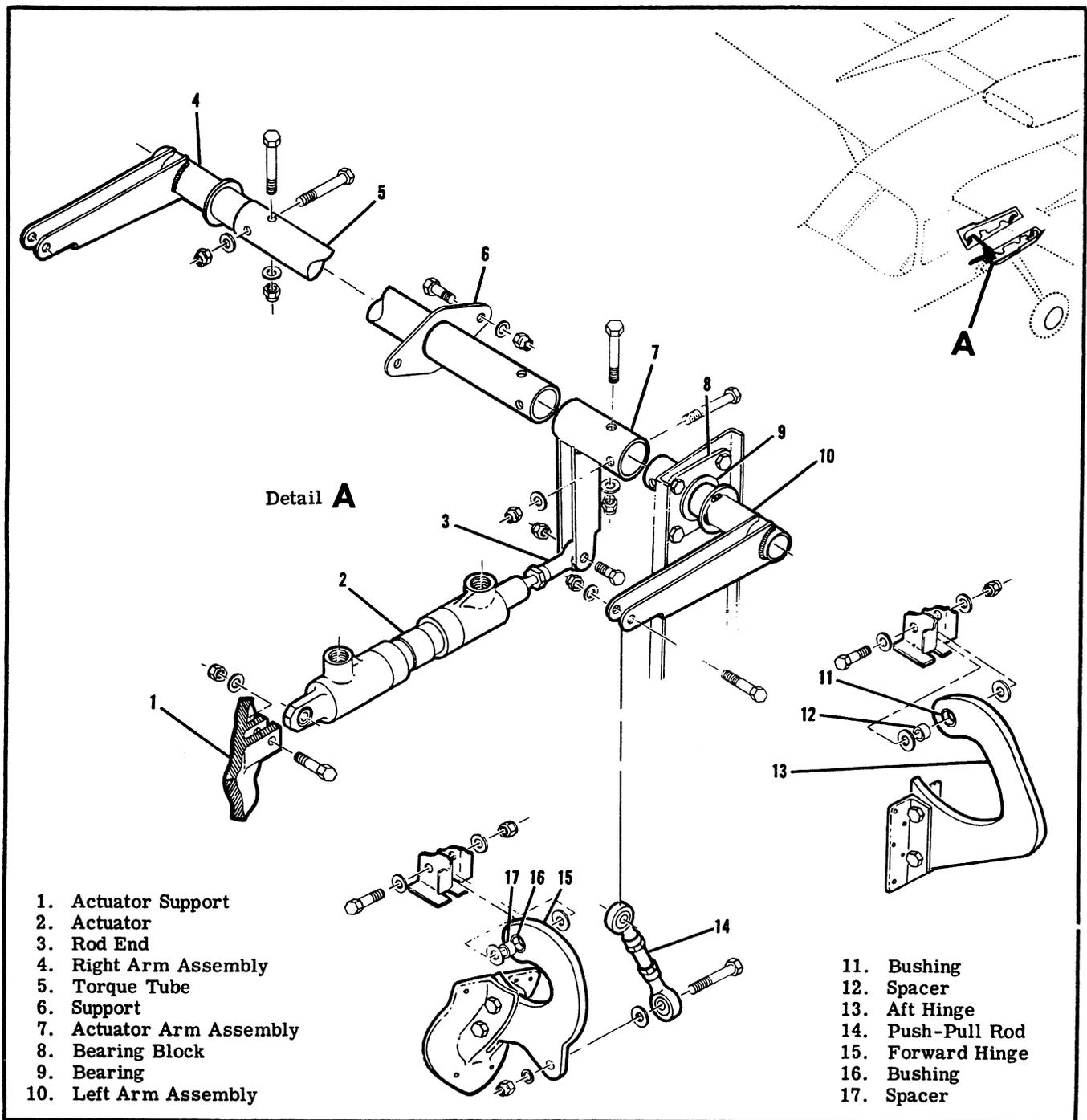


Figure 5-9. Main Gear Doors Installation (Sheet 1 of 2)

5-42. DISASSEMBLY OF MAIN GEAR WHEEL DOOR ACTUATOR. (Thru Serials 33701426 and F33700035) (Refer to figure 5-10, sheet 1.)

- a. Unlock cylinder by applying hydraulic pressure to port in clevis end (22) of actuator.
- b. Loosen locknut (2) and remove rod end (1) from piston rod. Remove locknut from piston.
- c. Remove safety wire from knurled nuts (13) and loosen knurled nuts.
- d. Remove gland end (5) from barrel (17), using a strap wrench on barrel.
- e. Remove clevis end (22) from barrel, then push

piston (7) from barrel. Use care when pushing piston from barrel, to prevent loss of balls (12).

f. Remove spacer (6) from barrel. Spacer (6) is used only in the main landing gear wheel door actuator cylinders.

g. Remove O-ring (4) and back-up ring (3) from gland end (5).

h. Apply a sharp blast of air to hydraulic port of clevis end (22) to remove plunger (18), washer (11), and race (10). Remove spring (21) from clevis end.

i. Remove and discard O-rings and back-up rings from barrel, piston, and plunger.

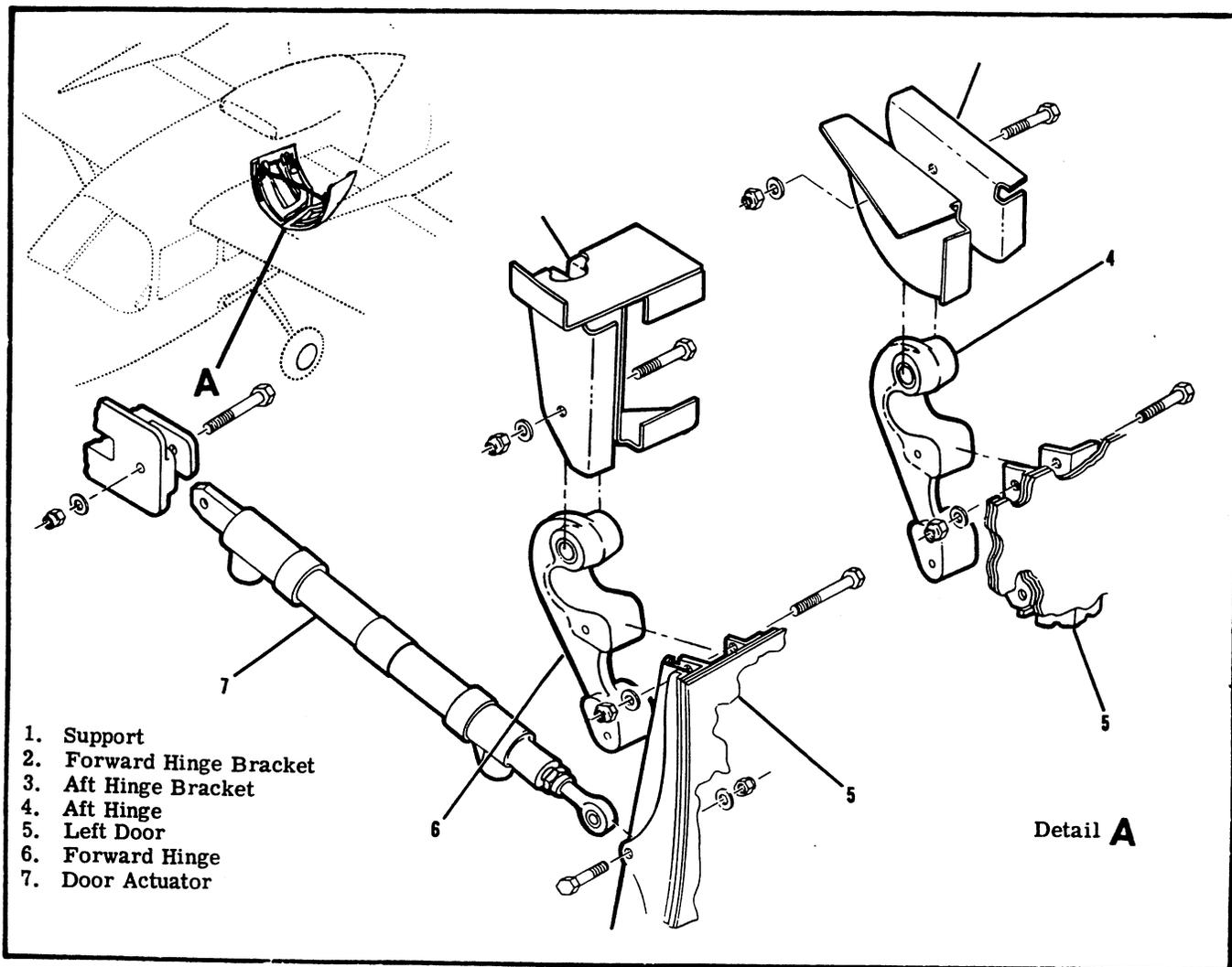


Figure 5-9. Main Gear Doors Installation (Sheet 2 of 2)

5-43. **INSPECTION OF PARTS.** Make the following inspections to ascertain that all parts are in a serviceable condition.

- a. Inspect all threaded surfaces for cleanliness and for freeness from cracks and excessive wear.
- b. Inspect spring (21) for evidence of breaks and distortion. The free length of the spring must be 1.055 inches and compress to .875 inch under a 35 ± 3.5 pound load.
- c. Inspect gland end (5), spacer (6), piston (7), barrel (17), plunger (18), and clevis end (22) for cracks, chips, scratches, scoring, wear or surface irregularities which may affect their function or the overall function of the door actuator cylinder.

5-44. **ASSEMBLY.** (Refer to figure 5-10, sheet 1.)

NOTE

Install new O-rings and back-up rings during cylinder assembly.

- a. Install O-ring (19) and back-up ring (20) in groove on plunger (18).
- b. Insert spring (21) and plunger (18) into clevis

end (22). Install washer (11) and race (10) over end of plunger (18).

- c. With knurled nuts (13) on barrel (17), install O-rings (14) and back-up rings (15) in grooves on barrel.
- d. Install O-ring (9) and back-up rings (8) in groove on piston (7) and install balls (12) in holes of piston.
- e. Insert piston into barrel. Be sure that all six balls are in place in piston as piston is inserted in barrel.
- f. Screw barrel (17) into clevis end (22). Tighten barrel snugly against race, then tighten knurled nut.
- g. Insert spacer (6) in barrel (17). Spacer (6) is used only in the main landing gear wheel door actuators.
- h. Install O-ring (4) and back-up ring (3) in bore groove of gland end (5), lubricate piston rod and slide gland end over rod. Tighten gland end on barrel, aligning hydraulic port fittings of the gland end with the port fitting in the clevis end.
- i. Tighten knurled nuts (13) to a torque value of 130 ± 10 lb. in. Install lockwire on both knurled nuts.
- j. Install locknut (2) and rod end (1).

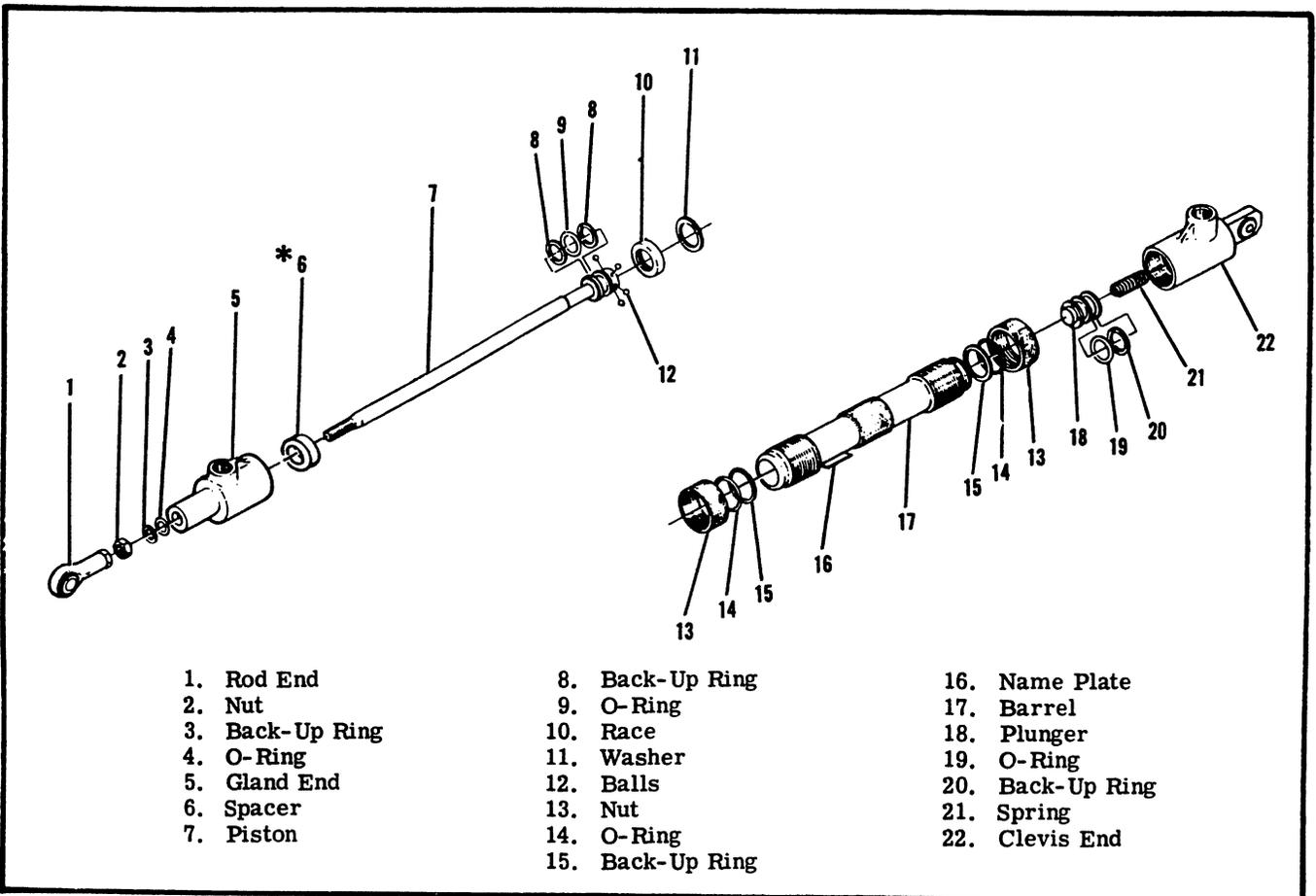


Figure 5-10. Landing Gear Door Actuator (Sheet 1 of 2)

5-45. DISASSEMBLY OF MAIN GEAR WHEEL DOOR ACTUATOR. (Beginning with Serials 33701427 and F33700036) (Refer to figure 5-10, sheet 2.)

- a. Loosen check nut (2) and remove rod end (1) and check nut from piston (7).
- b. Remove retaining ring (3) from cylinder (9).
- c. Remove retainer (4), packing (5) and gland (6), then remove piston (7).
- d. Remove retainers (4) and packing (5) from piston (7).

5-46. INSPECTION OF PARTS.

- a. Inspect all threaded surfaces for cleanliness, cracks, and excessive wear.
- b. Inspect gland (6), piston (7) and cylinder (9) for cracks, chips, scoring, wear or surface irregularities which might affect their function or the overall function of the actuator.

NOTE

Repair of most parts of the actuator is impractical. Replace defective parts with serviceable parts. Minor scratches may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect operation of the actuator.

5-47. ASSEMBLY. (Refer to figure 5-10, sheet 2.)

NOTE

Install all new packing and back-up rings during assembly. Lubricate all packing and back-up rings with Petrolatum or MIL-4-5606 hydraulic fluid during assembly.

- a. Install retainers (4) and packing (5) in grooves of piston (7).
- b. Insert piston assembly into cylinder (9).
- c. Install packing (5) on gland (6); install on rod of piston (7).
- d. Install packing (5), retainer (4) and retaining ring (3).
- e. Install check nut (2) and rod end (1).

5-48. INSTALLATION OF MAIN GEAR WHEEL DOORS AND ACTUATOR. (Refer to figure 5-9.)

- a. Inspect door assembly, hinges, hinge brackets, actuator end fittings, actuator, hydraulic lines and attaching parts for distortion, cracks and damage before installation.
- b. Check hinge bushings, bearings and actuator end fittings for lubrication prior to installation. (Refer to Section 2.)
- c. Assemble door, door hinge brackets and hinges before installation, using reference marks made in step "i" of paragraph 5-41. Do not tighten bolts.
- d. Position door hinges into wheel well hinge

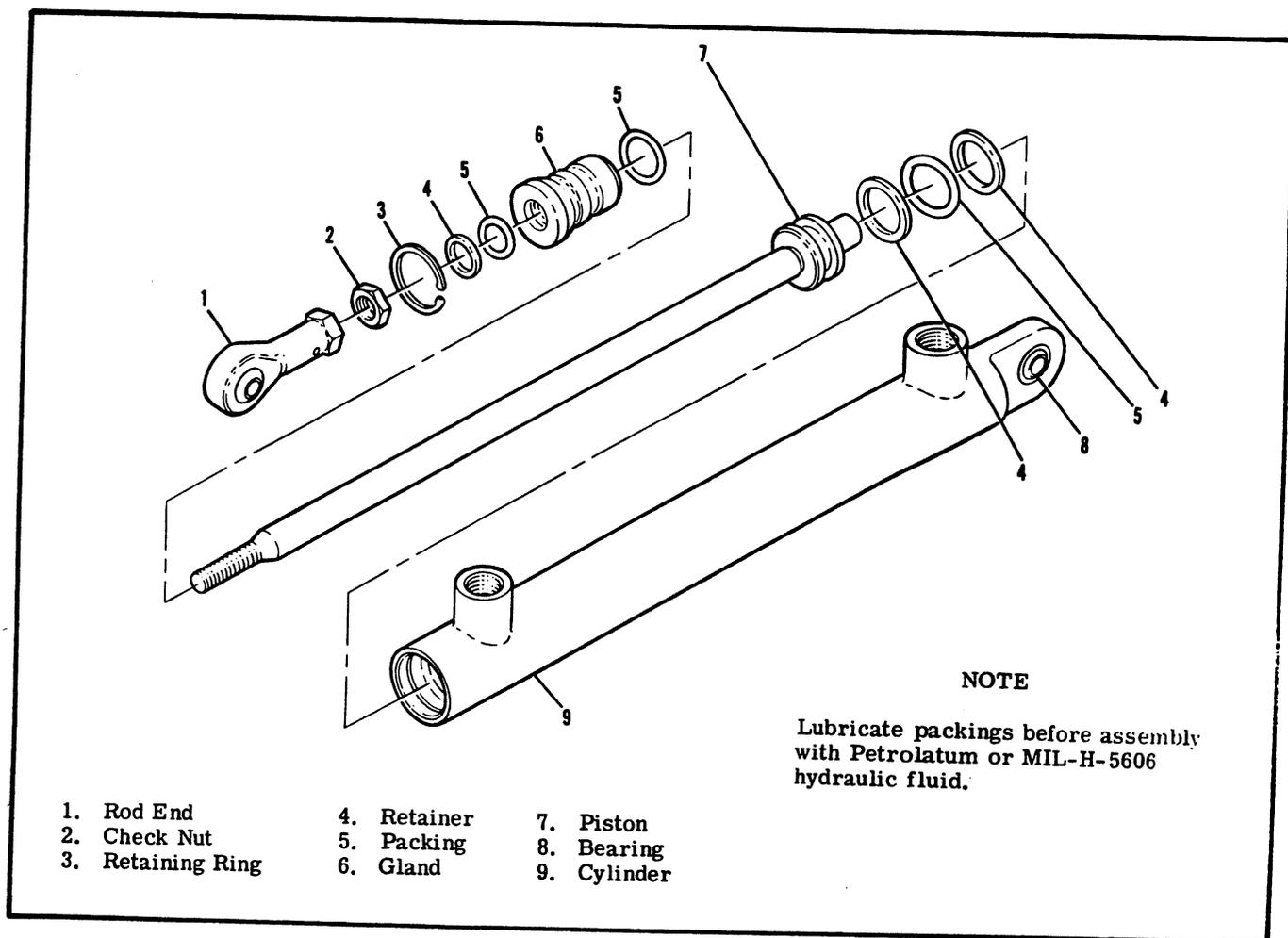


Figure 5-10. Landing Gear Door Actuator (Sheet 2 of 2)

brackets and install bolts, washers and nuts; tighten.

- e. Tighten bolts in door hinges and brackets.
- f. Manually open and close doors several times checking for binding distortion and flair-in to surrounding structure and opposite door.

NOTE

When installing new doors, trimming and hand-forming at the edges may be necessary to achieve a good fit and to permit actuators to lock. The doors must clear the gear by at least 1/2-inch during retraction.

- g. Position inboard end of actuator into support. Install bolt, washer and nut; tighten.
- h. Position actuator rod end into door bracket. Install bolt, washer and nut; tighten.
- i. Connect hydraulic lines to actuator.
- j. Bleed aircraft hydraulic system in accordance with paragraph 5-163.
- k. Rig the doors in accordance with paragraph 5-270.
- l. Install access panels and upholstery.
- m. Install rear or center seat.

5-49. REMOVAL OF MAIN GEAR STRUT DOORS AND ACTUATOR. (Refer to figure 5-9.)

NOTE

Steps "a" thru "g" are for removal of the actuator only.

- a. Remove rear or center seat.
- b. Remove upholstery and access panels from area of landing gear bulkhead.
- c. Jack aircraft in accordance with procedures outlined in Section 2.
- d. Release hydraulic pressure.
- e. Remove bolt securing actuator rod end to actuator arm.
- f. Disconnect hydraulic lines from actuator and plug or cap openings.
- g. Remove bolt securing actuator to actuator support, and remove actuator from aircraft.
- h. Before removal of doors, mark all parts on door, linkage and attaching parts, to provide for alignment and location during reinstallation.
- i. Remove bolts securing push-pull rods to right and left arm assemblies.
- j. Support door and remove bolts securing door hinges to support structure, and remove door from aircraft.
- k. Remove bolts through actuator arm, torque tube and shaft of left arm assembly.
- l. Remove bolts through torque tube and shaft of

right arm assembly.

m. Remove bolts securing left bearing block to structure; slide actuator arm inboard to clear left arm assembly shaft.

n. Slide torque tube off shaft of right arm assembly and remove torque tube, actuator arm and left bearing block from aircraft.

o. Remove four bolts securing bearing block to structure; slide left arm assembly, with bearing block attached, outboard, and remove from aircraft.

5-50. DISASSEMBLY, INSPECTION AND ASSEMBLY OF MAIN GEAR STRUT DOOR ACTUATOR.

NOTE

Refer to paragraphs 5-42 thru 5-47 and figure 5-10, sheets 1 and 2.

5-51. INSTALLATION OF MAIN GEAR STRUT DOORS AND ACTUATOR. (Refer to figure 5-9.)

NOTE

Steps "m" thru "q" are for installation of the actuator only.

a. Inspect door assembly, hinge brackets, actuator end fittings, actuator, hydraulic lines and attaching parts for distortion, cracks and damage, before installation.

b. Check hinge bushings, bearings and actuator end fittings for lubrication prior to installation. (Refer to Section 2.)

c. Assemble bearing block and left arm assembly, position into structure and install four bolts using reference marks made in step "h" of paragraph 5-49.

d. Assemble torque arm, left bearing block, actuator arm and right arm assembly with installing bolts.

e. Slide torque tube and actuator arm onto shaft of left arm assembly; align holes and install bolts, using reference marks.

f. Align holes in left bearing block to structure, and install bolts loosely.

g. Align holes in torque tube and right arm assembly, and install bolts.

h. Tighten bolts in left bearing block and bearing block-supporting left arm assembly to structure, and tighten all loose bolts.

i. Assemble door, hinges, brackets and push-pull rod. Use reference marks made in step "h" of paragraph 5-49; do not tighten bolts.

j. Position door hinges into support structure; install bolts and tighten.

k. Install bolts securing push-pull rods to right and left arm assemblies, and tighten all loose bolts.

l. Manually open and close doors several times, checking for binding, distortion and flair-in to surrounding structure and opposite door.

m. Position actuator into actuator support, install bolt, and tighten.

n. Position actuator rod end into actuator arm, install bolt, and tighten.

o. Connect hydraulic lines to actuator.

p. Rig doors in accordance with paragraph 5-270.

q. Install access panels, upholstery and seats.

5-52. MAIN LANDING GEAR WHEELS AND AXLES. (Refer to figure 5-11.)

5-53. DESCRIPTION. Each main gear wheel assembly consists of two wheel halves, two tapered roller bearing assemblies, one tube, one tire, one steel brake disc and attaching parts for each of the two main gear wheel assemblies. Each main gear axle assembly consists of one axle, one axle nut, wheel alignment shims as required, and axle mounting bolts and nuts.

5-54. OPERATION. The main gear wheels are free-rolling on independent axles until the hydraulic brake system is actuated.

5-55. REMOVAL OF MAIN GEAR WHEELS. (Refer to figure 5-1.)

a. Jack aircraft in accordance with procedures outlined in Section 2.

b. Remove hub cap retainer screws and hub cap.

c. Remove bolts securing brake back plates to brake cylinder and remove back plates.

d. Remove cotter pin and axle nut.

e. Remove wheel from axle, using care not to damage axle threads.

5-56. DISASSEMBLY OF MAIN GEAR WHEELS. (Refer to figure 5-11.)

WARNING

Injury can result if tire is not completely deflated before attempting to separate wheel halves.

a. Deflate tire completely and brake loose tire beads from wheel flanges; use care to prevent damage to wheel flanges.

b. Remove wheel thru-bolts and separate wheel halves.

c. Remove tire, tube and brake disc.

d. If bearing cups are to be replaced, proceed as follows:

NOTE

Bearing cups are a press-fit and should be removed only if replacement is necessary.

1. Heat wheel half in boiling water for 15 minutes.

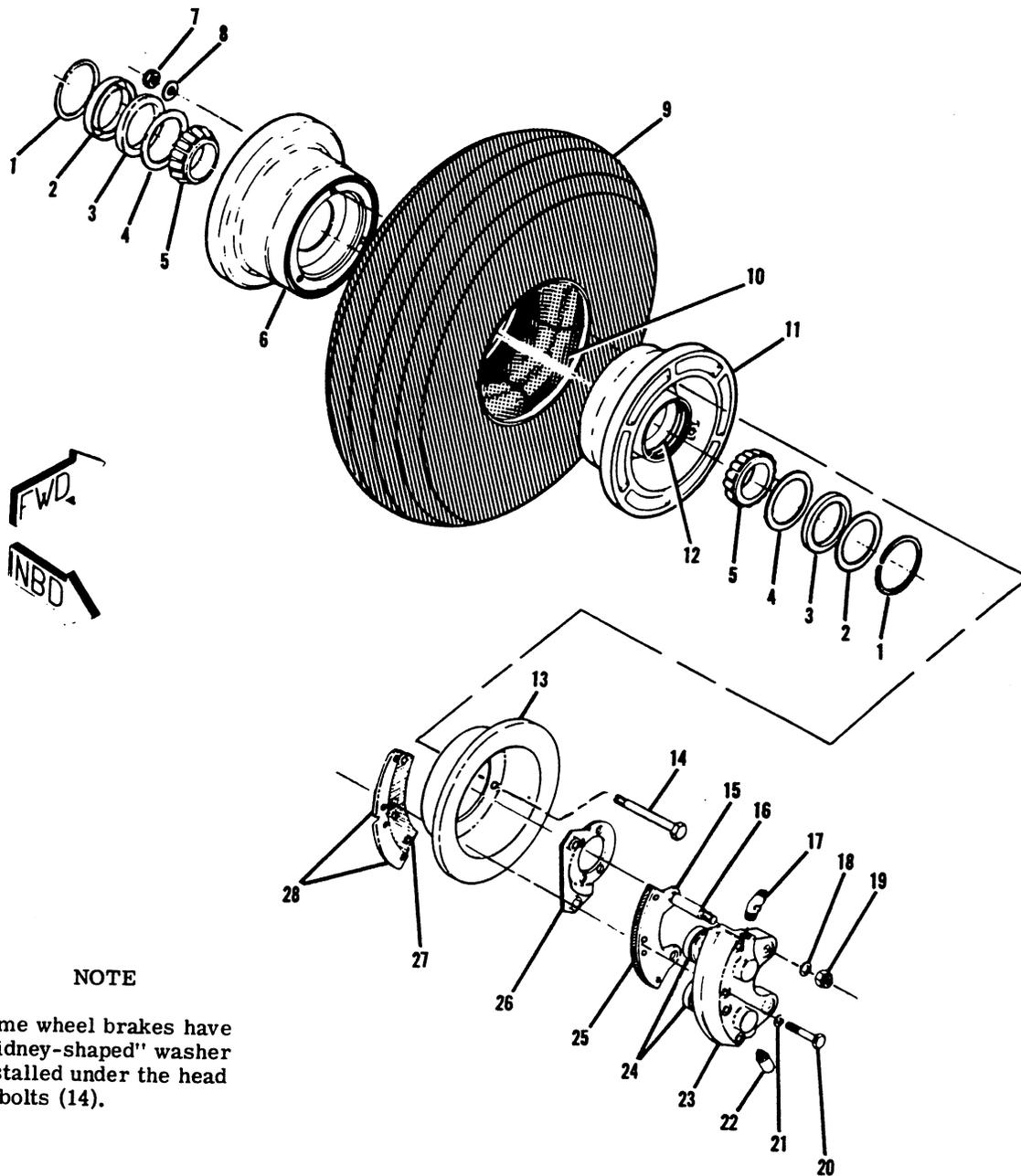
2. Press out bearing cup and press in new cup while wheel is still hot.

5-57. INSPECTION AND REPAIR OF MAIN GEAR WHEELS.

a. Clean metal parts and grease felts in solvent and dry thoroughly.

b. Inspect wheel halves for cracks; replace if damaged. Sand out nicks, gouges and corroded areas. Where protective coating has been removed, clean thoroughly, prime and repaint with aluminum lacquer.

c. If excessively warped or scored, or worn to a thickness of 0.430-inch for the standard 6.00X6, 8-Ply wheel and brake assembly, or 0.325-inch for



NOTE

Some wheel brakes have "kidney-shaped" washer installed under the head of bolts (14).

- | | | |
|------------------------|------------------------|-----------------------|
| 1. Snap Ring | 10. Tube | 20. Bolt |
| 2. Grease Seal Ring | 11. Inboard Wheel Half | 21. Washer |
| 3. Grease Seal Felt | 12. Bearing Cup | 22. Bleeder Valve |
| 4. Grease Seal Ring | 13. Brake Disc | 23. Brake Cylinder |
| 5. Bearing Cone | 14. Bolt | 24. Piston and O-Ring |
| 6. Outboard Wheel Half | 15. Pressure Plate | 25. Brake Lining |
| 7. Nut | 16. Anchor Bolt | 26. Torque Plate |
| 8. Washer | 17. Brake Line Fitting | 27. Brake Lining |
| 9. Tire | 18. Washer | 28. Back Plate |
| | 19. Nut | |

Figure 5-11. Main Wheel and Brake

the optional 18.00 x 5.5, 8-Ply wheel and brake assembly. brake disc should be replaced with a new part. Sand smooth small nicks and scratches.

d. Replace damaged or discolored bearing cups and cones. After cleaning, repack bearing cones with clean wheel bearing grease before installation. (Refer to Section 2 for grease type.)

5-58. ASSEMBLY OF MAIN GEAR WHEELS. (Refer to figure 5-11.)

a. Insert tire in tube. Position outboard wheel half in tire, aligning valve stem with hole in wheel half, and align slippage marks on tire and wheel.

b. Insert wheel thru-bolt through brake disc. Position disc in inboard wheel half, using thru-bolts as a guide. Ensure disc is seated.

c. Place wheel halves together. Ensure tube is not pinched, and secure with thru-bolts, washers and nuts. Torque nuts to valve marked on wheel. Uneven or improper torque may cause bolt failure with resultant wheel failure.

5-59. INSTALLATION OF MAIN GEAR WHEELS. (Refer to figure 5-1.)

a. Slide wheel assembly on axle, using care to prevent damage to threaded surface of axle.

b. Screw axle nut onto axle and tighten until a slight bearing drag is obvious when the wheel is rotated.

c. Loosen axle nut only enough to align to the nearest cotter pin hole and install cotter pin.

d. Install shim, brake back plate and cylinder bolts. Safety wire bolt beads.

e. Install hub cap and retainer screws.

f. Remove aircraft from jacks.

5-60. REMOVAL OF MAIN GEAR WHEEL AXLES. (Refer to figure 5-1.)

a. Remove main gear wheel in accordance with procedures outlined in paragraph 5-55.

b. Remove bolts securing axle, bushings and brake torque plate to strut.

NOTE

Note number and position of wheel alignment shims. Mark shims and axle so they may be reinstalled in exactly the same position.

5-61. INSTALLATION OF MAIN GEAR WHEEL AXLES. (Refer to figure 5-1.)

NOTE

Inspect axle for straightness and damage to threads; replace if damaged or bent.

a. Insert mounting bolts through brake torque plate, bushings, axle and alignment shims. Position shims according to reference marks made at time of disassembly.

b. Position axle assembly to strut. Install nuts and tighten.

c. Install main gear wheel in accordance with paragraph 5-59.

5-62. MAIN GEAR WHEEL ALIGNMENT. (Refer to figure 5-12.)

a. Alignment of main gear wheels is of primary importance in that misalignment adversely affects landing and take-off, roll characteristics, tire wear and steering of the aircraft during ground operations. Severe misalignment can cause malfunction and failure of some of the major components of the landing gear system.

b. Alignment should be checked with landing gear rigged correctly. (Refer to paragraph .) Removal and installation of major main gear system components, evidence of uneven or excessive tire wear or obvious damage to the system require a wheel alignment check, and correction, if necessary.

c. Alignment tolerances are set with the cabin and fuel tanks empty, and will give approximately zero toe-in and zero camber at normal gross weight.

d. If aircraft is normally operated at less than gross weight, and abnormal tire wear occurs, realign wheels to attain ideal setting for the load conditions under which the aircraft normally operates.

e. Always use the least number of shims possible to obtain zero toe-in and zero camber at normal operating load conditions.

f. To check wheel alignment tolerances, proceed as follows:

1. Check to see that fuel tanks are empty and aircraft is on a level surface.

2. Two aluminum plates, 1/8-inch thick and approximately 18-inches square, with grease applied to their contacting sides, placed under each main gear wheel, will allow the wheels to move free of friction, between the tire and ground surface.

3. After placing greased plates under main gear wheels, rock aircraft wings to allow wheels to normalize.

4. Place a straight edge, long enough to extend between and approximately 12-inches outboard of each wheel, in front of the main wheels, and touching the front-center of the tires.

5. Ensure that straightedge is level and blocked up to just below wheel axle nut.

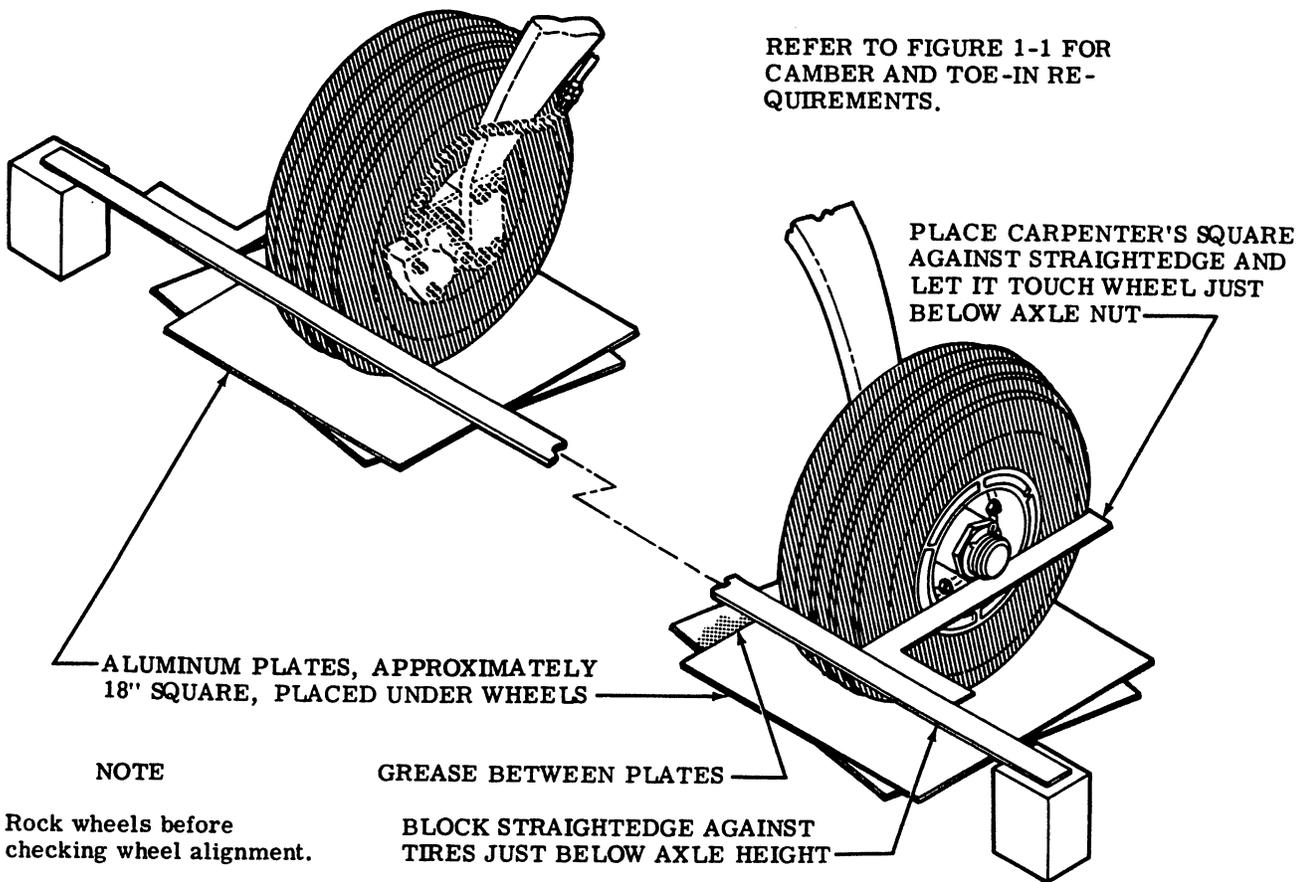
6. Place a carpenter's square against straightedge and let it touch the wheel just below the axle nut. Measure toe-in at edges of wheel flange. The differences in measurements at both wheels is the toe-in for one wheel (half of total toe-in). Toe-in (total of both wheels) values are contained in figures 1-1 and 5-11.

7. Place a protractor level vertically against the outboard flanges of the wheel. If the top of the wheel inclines inboard, a negative camber will result. If the top of the wheel inclines outboard, a positive camber reading will result. Positive camber should be obtained. Camber values are contained in figures 1-1 and 5-11.

8. Refer to paragraphs 5-60 and 5-61 for procedures for removal and installation of axles and shims.

5-63. WHEEL BALANCING. Since uneven tire wear is usually the cause of wheel unbalance, replacing the tire will probably correct this condition. Tire and tube manufacturing tolerances permit a specified amount of static unbalance. The lightweight point of the tire is marked with a red dot on the tire sidewall, and

REFER TO FIGURE 1-1 FOR CAMBER AND TOE-IN REQUIREMENTS.



NOTE

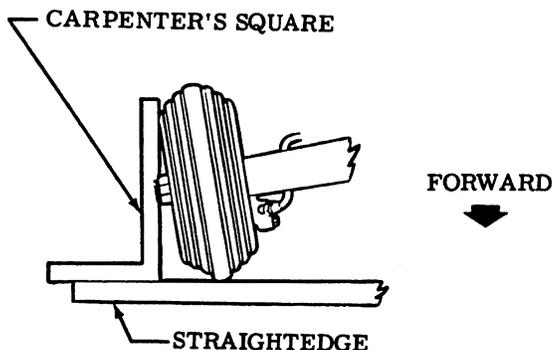
Rock wheels before checking wheel alignment.

GREASE BETWEEN PLATES

BLOCK STRAIGHTEDGE AGAINST TIRES JUST BELOW AXLE HEIGHT

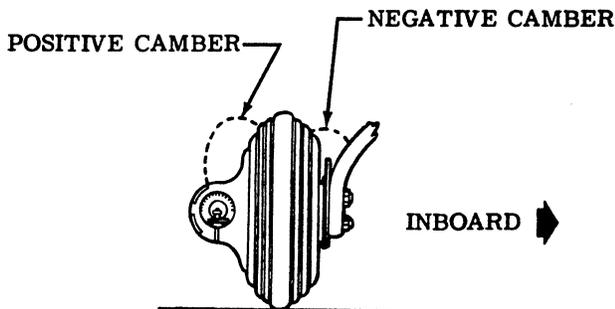
TOP VIEW OF TOE-IN CHECK

Measure toe-in at edges of wheel flange. Difference in measurements is toe-in for one wheel. (half of total toe-in.)



FRONT VIEW OF CAMBER CHECK

Measure camber by reading protractor level held vertically against outboard flanges of wheel.



NOTE

Setting toe-in and camber within these tolerances while the cabin and fuel tanks are empty will give approximately zero toe-in and zero camber at gross weight. Therefore, if normal operation is at less than gross weight and abnormal tire wear occurs, realign the wheels to attain the ideal setting for the load conditions. Refer to sheet 2 of this figure for shims availability and their usage. Always use the least number of shims possible to obtain the desired result.

Figure 5-12. Main Wheel Alignment (Sheet 1 of 2)

SHIM PART NO.	POSITION OF THICKEST CORNER OR EDGE OF SHIM	CORRECTION IMPOSED ON WHEEL			
		TOE-IN	TOE-OUT	POS. CAMBER	NEG. CAMBER
0541157-1	AFT	.063"	----	0°4'	----
	FWD	----	.063"	----	0°4'
0541157-2	UP	----	.008"	0°28'	----
	DOWN	.008"	----	----	0°28'
1241061-1	UP & FWD	----	.006"	2°44'	----
	UP & AFT	.028"	----	2°46'	----
	DOWN & FWD	----	.028"	----	2°46'
	DOWN & AFT	.006"	----	----	2°44'
0441139-5	UP & FWD	----	.125"	0°10'	----
	UP & AFT	.117"	----	0°25'	----
	DOWN & FWD	----	.117"	----	0°25'
	DOWN & AFT	.125"	----	----	0°10'
0441139-6	UP & FWD	----	.253"	0°21'	----
	UP & AFT	.235"	----	0°51'	----
	DOWN & FWD	----	.235"	----	0°51'
	DOWN & AFT	.253"	----	----	0°21'
0541111-2	UP & FWD	----	.375"	1°10'	----
	UP & AFT	.323"	----	1°51'	----
	DOWN & FWD	----	.323"	----	1°51'
	DOWN & AFT	.375"	----	----	1°10'

										1241061-1
										0441139-6
										0441139-5
										0541157-2
										0541157-1
										0541111-2
1241061-1	0	0	0	0	0	0	0	0	0	
0441139-6	0	0	0	1	1	1	0			
0441139-5	0	0	1	1	2	2	0			
0541157-2	0	1	1	2	2	2	0			
0541157-1	0	1	1	2	2	2	0			
0541111-2	0	0	0	0	0	0	0			
SHIM NO.	Max. number of shims to be used with shims in column 1.									
COLUMN 1	COLUMN 2									

Figure 5-12. Main Wheel Alignment (Sheet 2 of 2)

the heavyweight point of the tube is marked with a contrasting color line (usually near the valve stem). When installing a new tire and/or tube, place these marks adjacent to each other. If a wheel becomes unbalanced during service, it may be statically rebalanced. Wheel balancing equipment is available from the Cessna Service Parts Center.

5-64. BRAKE SYSTEM. (Refer to figures 5-11 and 5-14.)

5-65. DESCRIPTION. The brake system is manually actuated and hydraulically-operated. The wheel-mounted brake disc is straddled by a double hydraulic piston assembly which mounts to a torque plate, anchored to the axle-attaching bolts. Two pins, mount-

ed to the wheel cylinder assembly, run through the torque plate, and allow the cylinder to move laterally to compensate for lining wear. Brake linings are bonded to the back plate and pressure plate with rivets. The fixed shoes are on one side of the brake disc, while the movable piston and pressure plate are exactly opposite on the other side. The master cylinders are connected to the rudder pedals, with plumbing routed down the main gear struts to the wheel cylinders.

5-66. OPERATION. The master cylinders are operated by pressing the toe portion of either the pilot or copilot rudder pedals. The brakes are individually actuated, and may be used to steer the aircraft while taxiing.

5-67. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
DRAGGING BRAKES.	Brake pedal or linkage binding.	Lubricate pivot points; repair or replace defective parts.
	Weak or broken piston return spring in master cylinder.	Repair or replace master cylinder.
	Parking brake control improperly adjusted.	Adjust properly.
	Parking brake check valves not releasing (337A & on and T337 Series).	Replace defective valves.
	Insufficient clearance between Lock-O-Seal and piston in master cylinder.	Adjust per figure 5-13.
	Restriction in hydraulic lines or restricted passages in compensating sleeve in master cylinder.	Clean out restrictions. Flush brake system with denatured alcohol. Repair or replace master cylinder.
	Warped or badly scored brake disc.	Replace brake disc and linings.
	Damage or accumulated dirt restricting free movement of wheel brake parts.	Clean and repair or replace brake parts as necessary.
BRAKES FAIL TO OPERATE.	Insufficient fluid in master cylinder or air trapped in brake system.	Fill and bleed brakes.
	Worn or damaged O-ring seal in master cylinder or wheel brake cylinder.	Replace O-rings.
	Worn or damaged Lock-O-Seal in master cylinder.	Replace Lock-O-Seal.
	Too much clearance between Lock-O-Seal and piston in master cylinder.	Adjust per figure 5-13.

5-67. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
BRAKES FAIL TO OPERATE (Cont).	Brakes too hot from extensive use.	Check that pistons are free after overheating brakes.
	Internally swollen hoses and/or swollen O-rings due to use of wrong kind of hydraulic fluid in brake system.	Replace hoses and O-rings. Flush system with denatured alcohol. Fill and bleed with proper fluid.
	Pressure leak in brake system.	Tighten loose connections; repair or replace defective parts.
	Brake linings worn out.	Replace brake linings.
	Oil, grease, or other foreign material on brake linings, or new linings just installed.	Clean linings with carbon tetrachloride, then taxi the aircraft slowly, applying the brakes several times to condition the linings. New linings must also be conditioned.

5-68. REMOVAL OF BRAKE MASTER CYLINDERS. (Refer to figure 5-14.)

- a. Drain hydraulic fluid from cylinder before removal.
- b. Disconnect hydraulic lines and plug or cap openings.
- c. Remove pin securing clevis end of piston rod to support bracket on right-hand cylinder and/or actuator arm on left-hand cylinder.
- d. Remove pins securing cylinder to mounting bracket on left cylinder and/or actuating arm on right cylinder.
- e. Remove cylinder from aircraft.

5-69. DISASSEMBLY OF BRAKE MASTER CYLINDER. (Refer to figure 5-13.)

- a. Remove setscrew (11) securing cylinder cover (10) into cylinder body (13).
- b. Unscrew cylinder cover (10) and remove piston assembly (9) and cover from cylinder, using care to prevent damage to internal surfaces and parts.
- c. Remove piston return spring (17) from cylinder.
- d. Remove nut (1), piston spring (2), piston (3), lock-O-seal (4) and compensating sleeve (5) from piston rod (9), using care not to damage lock-O-seal.
- e. Remove and discard O-ring (15) from piston (3).
- f. Remove jam nut (8), clevis (7) and cover (10) from piston rod (9).
- g. Remove filler plug (6) from cover (10), and check that vent hole in plug is not restricted.

5-70. INSPECTION OF BRAKE MASTER CYLINDER.

- a. Inspect threaded surfaces for damage, cracks and excessive wear.
- b. Inspect passages in compensating sleeve (5) for restrictions. Inspect internal cylinder walls, piston rod (9) and piston (3) for wear, scoring, scratches or surface irregularities which may affect their function or the overall operation of the master cylinder.
- c. Inspect springs for breaks or distortion and dimensions as follows:

Piston return spring (free length) 2-3/8 to 2-5/8 in.
Piston spring (free length) .375 to .385 in.

5-71. ASSEMBLY OF BRAKE MASTER CYLINDER. (Refer to figure 5-13.)

NOTE

Replace defective parts and O-rings prior to assembly. Use clean hydraulic fluid as a lubricant during assembly.

- a. Install jam nut (8) and clevis (7) onto piston rod (9) and insert into cover (10).
- b. Install filler plug (6) in cover (10), and tighten.
- c. Assemble piston rod (9), compensating sleeve (5), lock-O-seal (4), piston (3), piston spring (2) and nut (1), maintaining 0.040 ± 0.005-inch spacing between lock-O-seal and piston. (Refer to cutaway section in figure 5-13.)
- d. Install piston return spring (17) toward piston (3), insert into cylinder, using care to prevent damage and to ensure that piston return spring is seated into bottom of cylinder.
- e. Screw cover into cylinder snugly and tighten setscrew (11).

5-72. INSTALLATION OF BRAKE MASTER CYLINDER. (Refer to figure 5-14.)

- a. Position master cylinder clevis into support bracket for right-hand cylinder and/or into actuating arm for left-hand cylinder. Install pins, washers and cotter pins.
- b. Position lower end of master cylinder into actuating arm on right-hand cylinder and/or into mounting bracket for left-hand cylinder. Install pins.
- c. Connect and tighten hydraulic lines.
- d. Remove filler plug and fill reservoir with clean hydraulic fluid.
- e. Bleed brake system in accordance with paragraph 5-73.

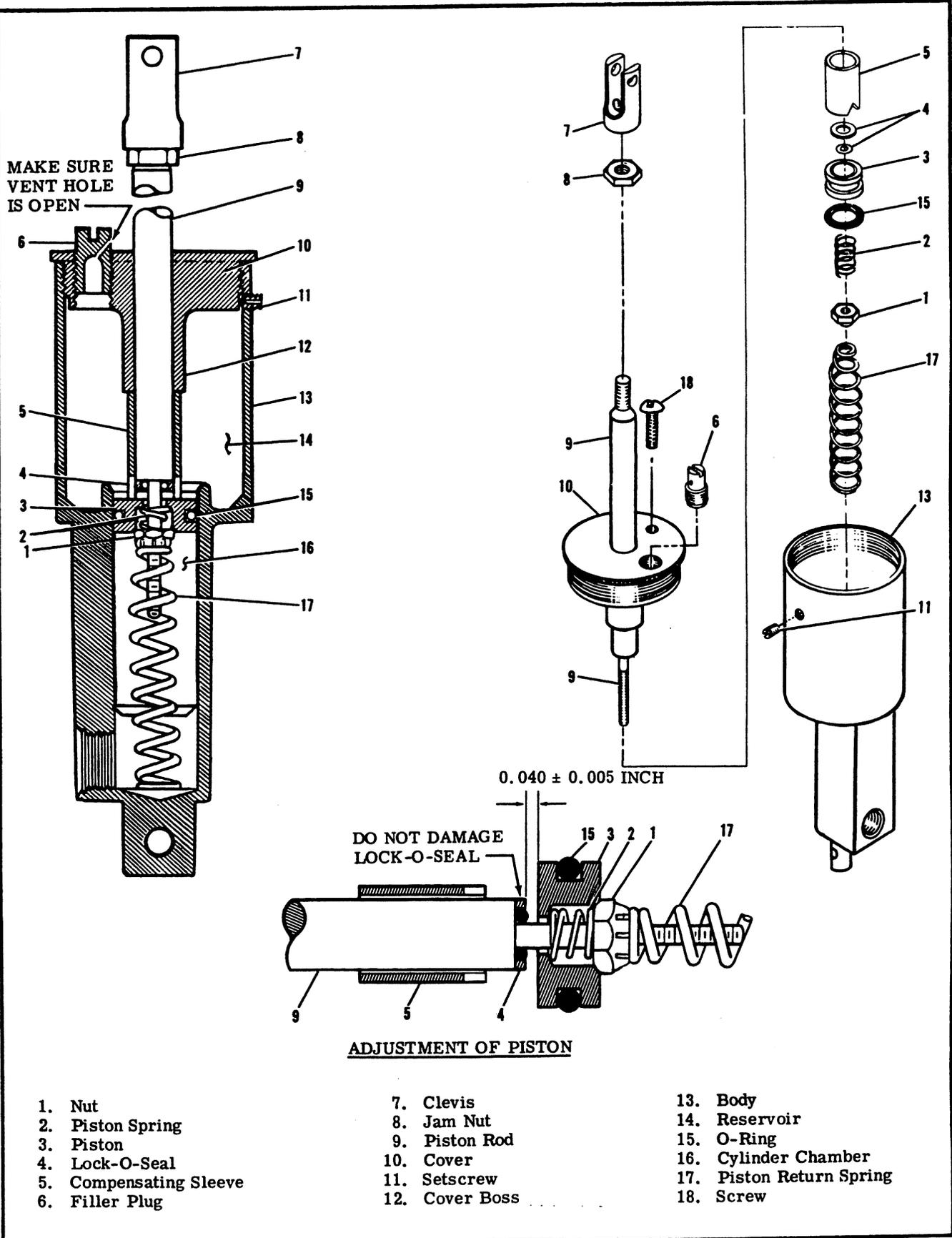


Figure 5-13. Brake Master Cylinder

5-73. BLEEDING BRAKE SYSTEM. (Refer to figures 5-11 and 5-14.)

CAUTION

Ensure parking brake is OFF before bleeding brake system.

- a. Connect a clean hydraulic pressure source to one wheel cylinder bleeder valve.
- b. Remove filler plug in master cylinder on same side as wheel cylinder, and install a suitable fitting, with flexible hose attached, into filler hole.
- c. Immerse the free end of the flexible hose in a container, with enough clean hydraulic fluid to cover end of hose.
- d. Loosen the wheel cylinder bleeder valve, and unscrew approximately one turn.
- e. As fluid is pumped into the system, observe the immersed end of the hose at the master cylinder for evidence of air being forced from the system.
- f. When air bubbling has ceased, tighten the bleeder valve.
- g. Remove the hydraulic pressure source and install bleeder valve cover.
- h. Remove the fitting, with flexible hose attached, from master cylinder, and install filler plug.
- i. Repeat the preceding procedures for the opposite wheel cylinder and brake master cylinder.

5-74. REMOVAL OF WHEEL BRAKES. (Refer to figure 5-1.)

- a. Drain hydraulic fluid and disconnect brake hose from wheel cylinder assembly.
- b. Remove main gear wheel in accordance with paragraph 5-55.
- c. Slide brake cylinder out of torque plate, and remove pressure plate from anchor bolts.

NOTE

To remove torque plate, it is necessary to remove axle assembly. (Refer to paragraph 5-60.)

5-75. DISASSEMBLY OF WHEEL BRAKES. (Refer to figure 5-11.)

- a. Disassemble main gear wheel to remove brake disc. (Refer to paragraph 5-56.)

WARNING

When using carbon tetrachloride, work in a well ventilated area, and wear rubber gloves.

- b. Clean all metal parts with carbon tetrachloride and dry thoroughly.
- c. Remove and discard all O-rings. Install new O-rings during assembly.

NOTE

Brake linings should be replaced when they are worn to a minimum thickness of 3/32-inch.

- d. Check brake linings for damage and maximum permissible wear.

e. Inspect cylinder bore for scoring or surface defects. Replace if defective.

f. Inspect anchor bolts for nicks and gouges. Minor nicks and gouges may be sanded smooth to prevent binding with pressure plate or torque plate.

g. If anchor bolts are to be replaced, they should be pressed out, and new bolts installed by tapping them in with a non-metallic hammer.

h. If excessively warped or scored, or worn to a thickness of 0.430-inch for the standard 6.00 x 6, 8-Ply wheel and brake assembly, or 0.325-inch for the optional 18.00 x 5.5, 8-Ply wheel and brake assembly, brake disc should be replaced with a new part. Sand smooth small nicks and scratches.

5-76. ASSEMBLY OF WHEEL BRAKES. (Refer to figure 5-11.)

- a. Lubricate all internal wheel brake cylinder parts with clean hydraulic fluid.
- b. Install O-rings, and install pistons in cylinder.
- c. Place pressure plate on anchor bolts.
- d. Assemble brake disc to wheel. (Refer to paragraph 5-58.)

5-77. INSTALLATION OF WHEEL BRAKES. (Refer to figure 5-1.)

- a. If torque plate was removed, reinstall torque plate, bushings and axle in accordance with paragraph 5-61.
- b. Position wheel brake cylinder anchor bolts through torque plate.
- c. Install wheel to axle in accordance with paragraph 5-59.
- d. Connect brake hose to wheel cylinder fitting.
- e. Bleed brakes in accordance with paragraph 5-73.

5-78. BRAKE LINING REPLACEMENT. (Refer to figure 5-11.)

NOTE

It is not necessary to remove wheels to reline brakes.

- a. Remove bolts (20), washers (21) and back plates (28).
- b. Pull brake cylinder from torque plate (26) and slide pressure plate (15) off anchor bolts (16).
- c. Place back plate (28) on a table with lining side down flat. Center a 9/64-inch (or slightly smaller) punch in rolled rivet, and hit the punch crisply with a hammer. Punch out all the rivets securing the linings to the back plates (28) and pressure plate (15) in the same manner.

NOTE

A rivet setting kit, Part No. R561, is available from the Cessna Service Parts Center. This Kit consists of a small anvil and punch.

- d. Clamp the flat sides of the anvil in a vise.
- e. Align new lining (27) on back plate (28), and place brake rivet in hole with rivet head in lining. Place rivet head against anvil.
- f. Center the rivet setting punch on the lips of the rivet. While holding down firmly against the lining,

hit the punch with a hammer to set the rivet. Repeat blows on the punch until lining is firmly against back plate. Realign the lining on the back plate and install remaining rivets.

g. Install a new lining on the other back plate and pressure plate (15) in the same manner.

h. Position pressure plate (15) on anchor bolts (16), and place cylinder (23) in position so anchor bolts slide into torque plate (26).

i. Install back plates (28) with bolts (20) and washers (21). Safety the bolts.

5-79. PARKING BRAKE SYSTEM. (Refer to figure 5-14.)

5-80. DESCRIPTION. (Prior to 337-0240) The parking brake system utilizes a handle and ratchet mechanism, connected by cables to linkage at the brake master cylinders.

5-81. OPERATION. Turning and pulling out on the handle depresses both master cylinder piston rods. The ratchet locks the handle in this position until the handle is turned and released.

5-82. REMOVAL. (Refer to figure 5-14.)

a. Remove cotter pin and pin (7); remove control (4).

b. Remove bolts, spacers (5), washers and nuts from clamp (11) and tab on housing (9).

c. Turn handle (12) to clear catch (10), and remove housing (9) and tube (8) from aircraft.

d. Remove pin and cotter pin attaching control cable end (4) from forward end of bellcrank (2).

e. Remove bolt, nut, washers and spacer (1) attaching bellcrank (2) to mounting brackets attached to channel.

f. Remove pin and cotter pin attaching clamp (3) to bellcrank (2); remove bellcrank (2).

g. Loosen nuts securing parking brake control (4) to angle on forward end of channel; remove cable (4) from slots in angles.

h. Remove clamps (14) at master cylinders and disconnect control at master cylinders.

5-83. INSTALLATION. (Refer to figure 5-14.)

a. Install control cable (4) at master cylinders and install clamps (14) loosely.

b. Route control cable (4) through slots in angle on forward end of channel; attach clamp (3) to lower tabs of bellcrank (2) with pin and cotter pin.

c. Install bolt, spacer (1), bellcrank (2), washers and nut to mounting brackets attached to channel.

d. Attach control cable end (4) to forward end of bellcrank (2).

e. Install handle (12), housing (9) and tube (8), and install bolts, spacers (5), washers and nuts to clamp (11) and tab on housing (9).

f. Install control (4) in slot of tube (8), and install pin (7) and cotter pin.

g. Turn and pull handle (12) to engage parking brake. Shift cable housings in clamps at master cylinders and adjust nuts at slots in angle on channel for cable adjustment.

h. Tighten all attaching hardware and clamps. Ensure that catch (10) engages in slot in housing (9).

5-84. DESCRIPTION. (337-0240 thru 337-0931.) The parking brake system consists of two parking brake valves, a single control cable, attaching parts and connecting lines, hose and linkage.

5-85. OPERATION. Pulling out on the handle engages both valves, each of which is connected to a brake master cylinder.

5-86. REMOVAL. (Refer to figure 5-14.)

a. Remove access panel at forward left-hand side of cabin, under instrument panel.

b. Drain hydraulic brake fluid.

c. Disconnect hydraulic lines and hose from valves and cap or plug openings.

d. Disconnect control cable from clamps on valves.

e. Remove bolts securing valves to structure and remove valves from aircraft.

5-87. INSTALLATION. (Refer to figure 5-14.)

a. Position valves to structure; install mounting bolts and tighten.

b. Connect hydraulic lines and hose to valves and tighten.

c. Connect control cable to valve lever arms.

d. Fill brake systems with clean hydraulic fluid and bleed systems in accordance with paragraph 5-73.

e. Rig parking brake control in accordance with paragraph 5-88.

5-88. RIGGING PARKING BRAKE. (Refer to figure 5-14.)

a. Push parking brake control full IN. Then, pull OUT 1/4-inch for cushion, and lock in this position.

b. Connect control cable to aft valve lever, while lever is full aft, with approximately 1/2-inch of housing protruding through the clamp.

c. Attach control cable to forward valve lever, while lever is full forward.

d. Check that arm on valve has full travel for OFF and ON position.

5-89. DESCRIPTION. (Beginning with 337-0932)

The parking brake consists of a parking brake valve a control cable, attaching parts and connecting lines, hose and linkage.

5-90. OPERATION. The parking brake control cable actuates the parking brake valve. When the control is full IN, the valve must release pressure. When the control is pulled OUT, the parking brake valve must trap hydraulic pressure in its corresponding brake system as the brake pedals are operated. The parking brake valve utilizes a spring attached to the valve lever arm to ensure unlocked brakes.

5-91. REMOVAL. (Refer to figure 5-14.)

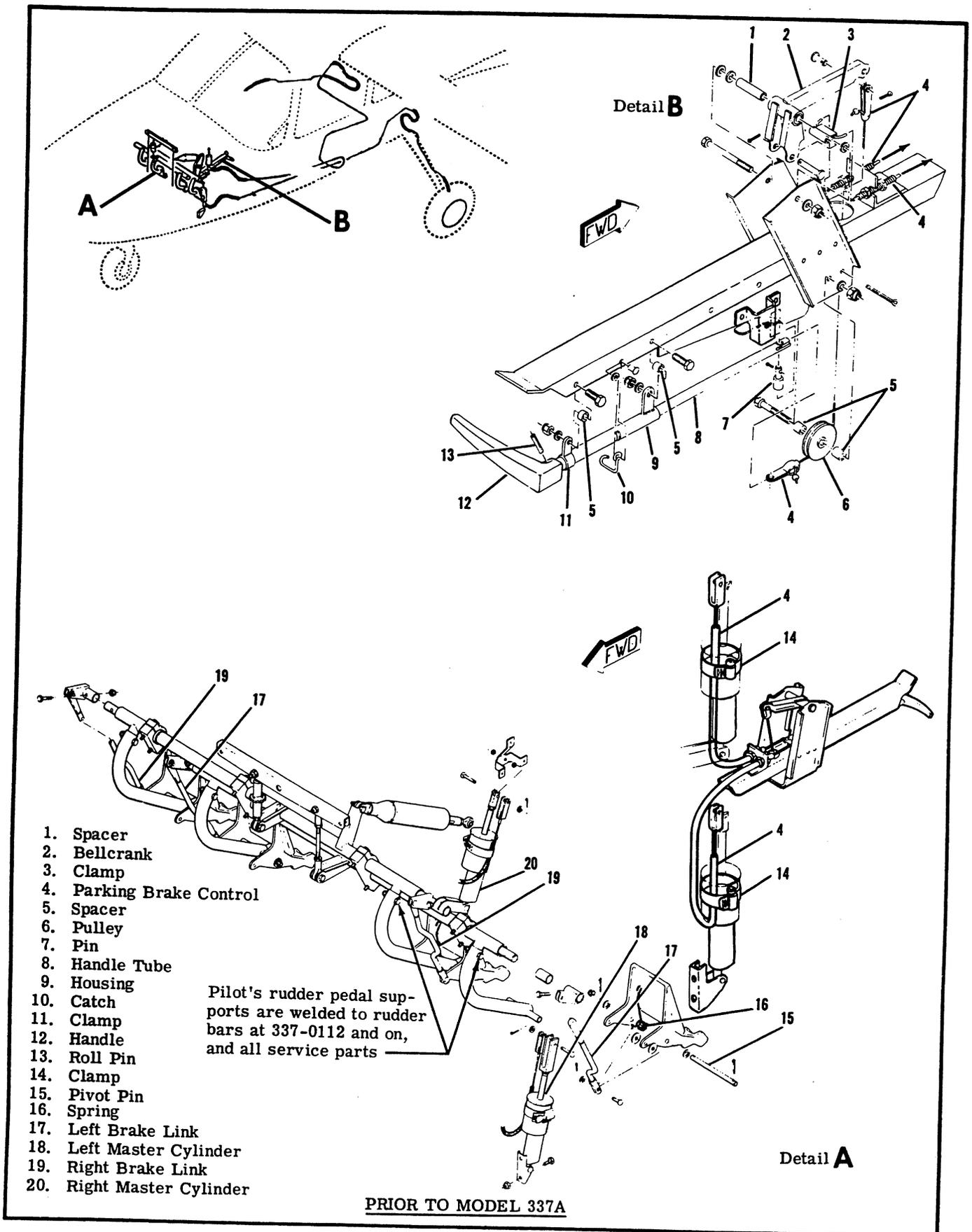
a. Remove access panel at forward left-hand side of cabin, under instrument panel.

b. Drain hydraulic fluid.

c. Disconnect hydraulic brake lines and hose from valve and cap or plug openings.

d. Remove bolts securing valve to structure and remove valve from aircraft.

5-92. INSTALLATION. (Refer to figure 5-14.)

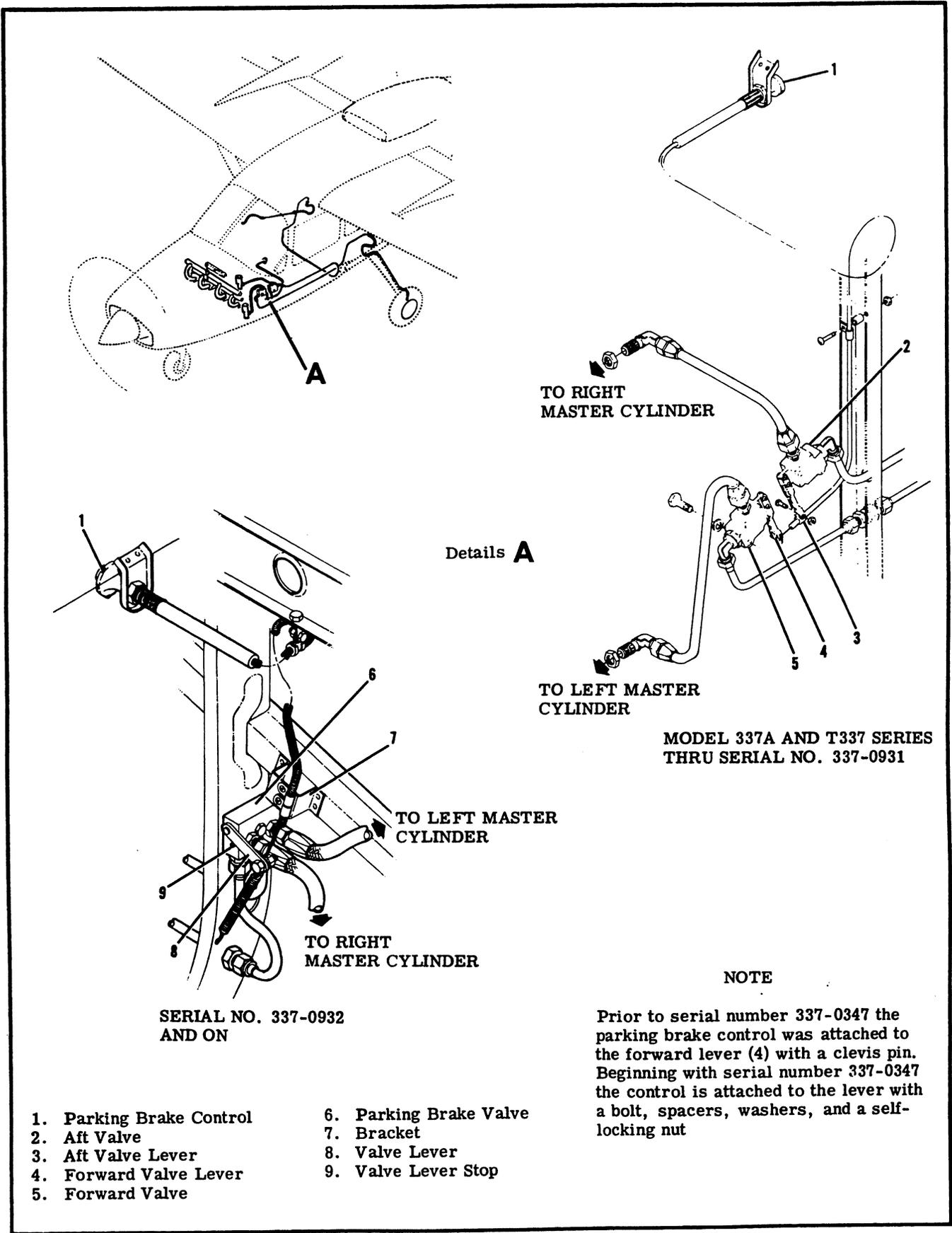


- 1. Spacer
- 2. Bellcrank
- 3. Clamp
- 4. Parking Brake Control
- 5. Spacer
- 6. Pulley
- 7. Pin
- 8. Handle Tube
- 9. Housing
- 10. Catch
- 11. Clamp
- 12. Handle
- 13. Roll Pin
- 14. Clamp
- 15. Pivot Pin
- 16. Spring
- 17. Left Brake Link
- 18. Left Master Cylinder
- 19. Right Master Cylinder
- 20. Right Master Cylinder

Pilot's rudder pedal supports are welded to rudder bars at 337-0112 and on, and all service parts

PRIOR TO MODEL 337A

Figure 5-14. Brake System (Sheet 1 of 2)



- | | |
|--------------------------|------------------------|
| 1. Parking Brake Control | 6. Parking Brake Valve |
| 2. Aft Valve | 7. Bracket |
| 3. Aft Valve Lever | 8. Valve Lever |
| 4. Forward Valve Lever | 9. Valve Lever Stop |
| 5. Forward Valve | |

Figure 5-14. Brake System (Sheet 2 of 2)

- a. Position valve to structure; install and tighten bolts.
- b. Connect hydraulic lines and hose to valve and tighten.
- c. Connect control cable to valve lever arm.
- d. Fill brake systems with clean hydraulic fluid and bleed systems in accordance with paragraph 5-73.
- e. Rig parking brake control in accordance with paragraph 5-93.

5-93. RIGGING PARKING BRAKE. (Refer to figure 5-14.)

- a. Push parking brake control full IN. Then pull OUT 1/4-inch for cushion, and lock in this position.
- b. Connect control cable to valve lever with lever against stop.
- c. Check that arm on valve has full travel for OFF and ON positions. Shift control housing in clamps as required to obtain correct travel.

5-94. NOSE GEAR SYSTEM. (Refer to figure 5-15.)

5-97. TROUBLE SHOOTING.

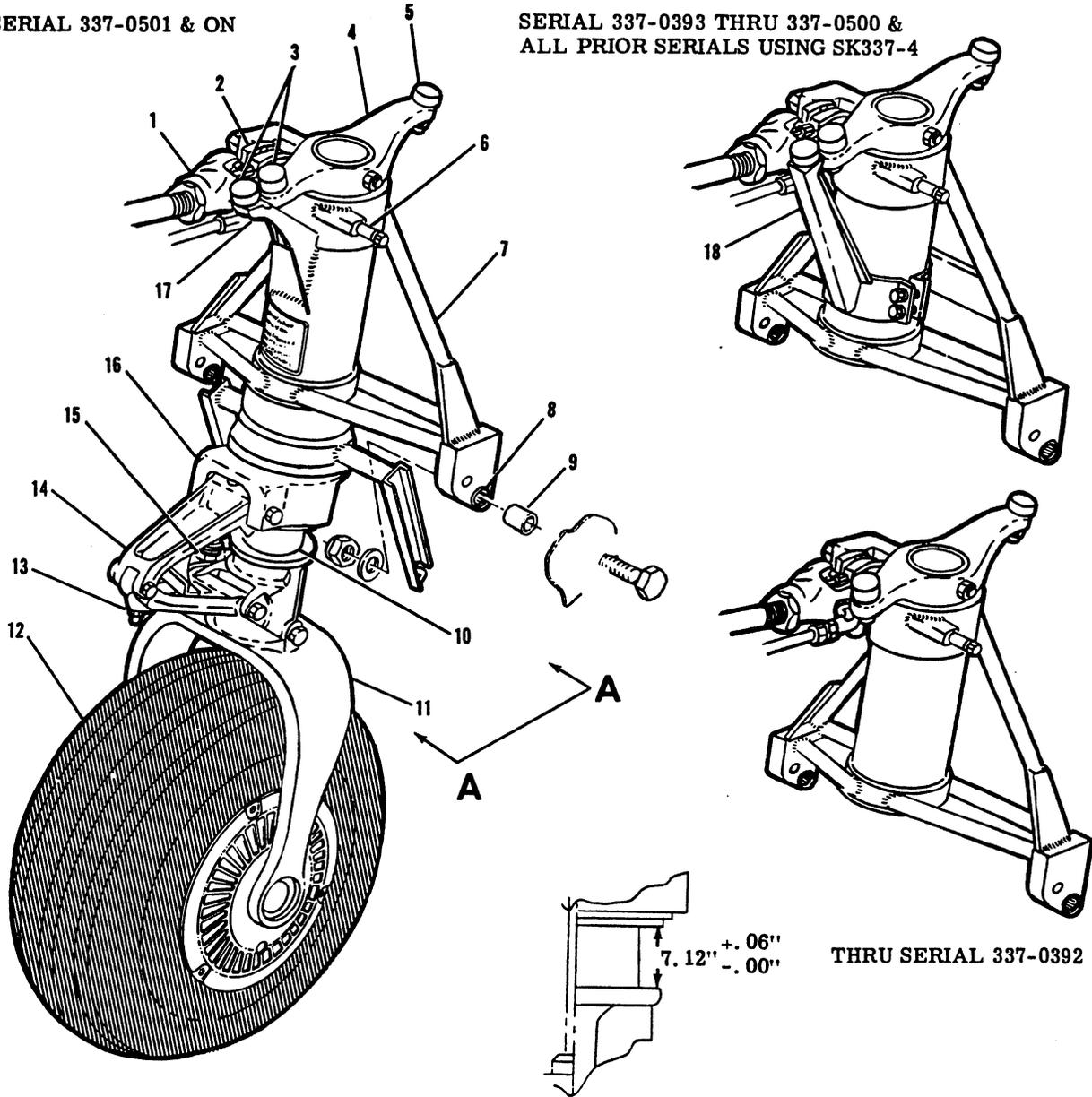
5-95. DESCRIPTION. The nose gear consists of a pneumatic shock strut assembly, mounted in a trunion which pivots in heavy-duty needle bearings, a steering collar, shimming dampener, uplock and downlock mechanisms, steering cam and lock, nose wheel, tire, tube, hub caps, bearings, seals, and a double-acting hydraulic actuator for extension and retraction. A separate, single-acting hydraulic actuator unlocks the uplock hook.

5-96. OPERATION. When the gear control handle is moved into the gear-up position, the nose gear retracts forward and upward to its stowed position beneath the front engine. The steering collar at the top of the strut contains rollers which engage tracks to cause the nose gear to rotate 90° during retraction, so that the nose wheel lies flat while in the retracted position. The nose gear actuator contains the nose gear actuator at the aft end. Initial movement of the actuator disengages the downlock before retraction begins. The nose gear uplock hook is released by the uplock actuator before gear extension begins.

TROUBLE	PROBABLE CAUSE	REMEDY
UNEVEN OR EXCESSIVE TIRE WEAR.	Loose torque links.	Add shim washers and replace parts as necessary.
HYDRAULIC FLUID LEAKAGE FROM NOSE STRUT.	Defective strut seals and/or defects in lower strut.	Replace defective seals; stone out small defects in lower strut. Replace lower strut if badly scored or damaged.
NOSE STRUT WILL NOT HOLD AIR PRESSURE.	Defective air filler valve or valve not tight.	Check gasket and tighten loose valve. Replace defective valve.
	Defective O-ring at top of strut.	Replace O-ring.
	Result of fluid leakage at bottom of strut.	Replace defective seals; stone out small defects in lower strut. Replace lower strut if badly scored or damaged.
NOSE WHEEL SHIMMY.	Nose strut attachment loose.	Secure attaching parts.
	Shimmy dampener lacks fluid.	Service shimmy dampener.
	Defective shimmy dampener.	Repair or replace dampener.
	Loose or worn steering components.	Tighten loose parts; replace if defective.
	Loose torque links.	Add shim washers and replace parts as necessary.
	Loose wheel bearings.	Replace bearings if defective; tighten axle nut properly.
	Nose wheel out of balance.	Balance nose wheel.

SERIAL 337-0501 & ON

SERIAL 337-0393 THRU 337-0500 &
ALL PRIOR SERIALS USING SK337-4



Section **A-A** NOTE

When installing new upper torque link, remove material from lug on torque link as required to obtain specified dimension at full extension of strut.

- | | | |
|-----------------------|----------------------|----------------------------|
| 1. Nose Gear Actuator | 7. Trunnion Assembly | 13. Lower Torque Link |
| 2. Downlock Mechanism | 8. Needle Bearing | 14. Upper Torque Link |
| 3. Roller | 9. Inner Race | 15. Safety Switch |
| 4. Steering Collar | 10. Lower Strut | 16. Cover |
| 5. Roller | 11. Fork | 17. Welded Roller Support |
| 6. Uplock Roller | 12. Wheel | 18. Clamped Roller Support |

Figure 5-15. Nose Gear

5-98. REMOVAL OF SHOCK STRUT AND TRUNNION ASSEMBLY.

- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. With master switch OFF, place gear control handle in the gear-up position, and use emergency hand pump to open nose gear wheel doors and to unlock downlock mechanism.
- c. Remove floor covering on each side of tunnel at firewall in cabin for access to trunnion pivot bolts.
- d. Tag and disconnect leads to squat switch on lower torque link, and remove wiring clamps along routing.
- e. Remove bolts securing aft nose gear door links to trunnion arms.
- f. Remove nose gear wheel in accordance with paragraph 5-149.

WARNING

Do not unscrew air filler valve core unless strut is completely deflated. Loosening the filler valve or valve core while the strut is pressurized can result in injury and will strip the last few threads of the valve or valve core.

- g. Deflate shock strut completely in accordance with procedures outlined in Section 2.
- h. Remove bolt securing nose gear actuator and downlock mechanism to top of nose gear, and remove downlock mechanism from aircraft.
- i. Remove trunnion pivot bolts through access holes in rudder cable pulley brackets on each side of tunnel at firewall in cabin area.
- j. Work nose gear forward evenly, tapping with a non-metallic mallet if necessary, and remove nose gear from aircraft.

5-99. REMOVAL AND INSTALLATION OF TRUNNION. (Refer to figure 5-16.)

NOTE

After the nose gear has been removed, remove the trunnion as follows:

- a. Deflate strut if it has not already been deflated. (Refer to warning in paragraph 5-98.)
- b. Remove bolt at top of strut.

NOTE

Since the upper bolt also secures the orifice piston assembly inside the strut, use a 5/16-inch diameter guide pin, 2-1/4 inches in length, to drive out the bolt. Center the guide pin and leave it in place to retain the orifice piston assembly.

- c. Remove steering collar and washers from top of strut.
- d. Pull upper strut down, out of trunnion.
- e. Thrust bearing, at lower end of trunnion, may be removed, if desired. Clean with solvent and lubricate with MIL-G-81322A grease before installation.
- f. Reverse the preceding steps to install trunnion.

NOTE

Service shock strut before installation.

5-100. REMOVAL AND DISASSEMBLY OF LOWER STRUT. (Refer to figure 5-16.)

NOTE

This procedure may be used to separate the upper and lower struts, leaving the upper strut and trunnion installed in the aircraft. Most shock strut seals and parts subject to wear, may be replaced, without nose gear removal and complete disassembly.

- a. Jack nose wheel a sufficient distance to permit lower strut to be pulled from upper strut. (Refer to Section 2.)
- b. Deflate strut completely in accordance with procedures outlined in Section 2. (Refer to warning in paragraph 5-98.)
- c. Disconnect upper torque link from lower torque link, noting positions of washers and spacer.
- d. Disconnect leads from safety switch.
- e. Remove lock ring from groove inside lower end of upper strut. A small access hole is provided at the lock ring groove to facilitate removal of lock ring.

NOTE

Hydraulic fluid will drain as lower strut is pulled from upper strut.

- f. Use a straight, sharp pull to separate the upper and lower struts. Invert lower strut and drain remaining fluid.
- g. Remove lock ring (24) and bearing (25) from top end of lower strut.
- h. Slide packing support ring (28), scraper ring (31) retaining ring (32), and lock ring (33) from lower strut noting relative position and top side of each ring; wire together if desired.
- i. Remove O-ring (27) from outer groove in packing support ring (28). Remove back-up ring and O-rings from inner groove in packing support ring.
- j. Remove bolt, washer and nut attaching fork to lower strut, and pull base plug (38) and assembled parts out of lower strut. Remove O-rings and metering pin from base plug.

NOTE

Nose gear fork and lower strut area press-fit drilled on assembly. Separation of these parts is not recommended, except for replacement of parts.

5-101. REMOVAL AND INSTALLATION OF LOCKING COLLAR. (Refer to figure 5-16.) After removal of lower strut, remove locking collar and related parts at lower end of upper strut as follows:

- a. Remove bolt securing upper torque link, cover and electrical clamp for safety switch leads.
- b. Remove upper torque link, noting position of spacers and washers. Pull cover forward to remove.

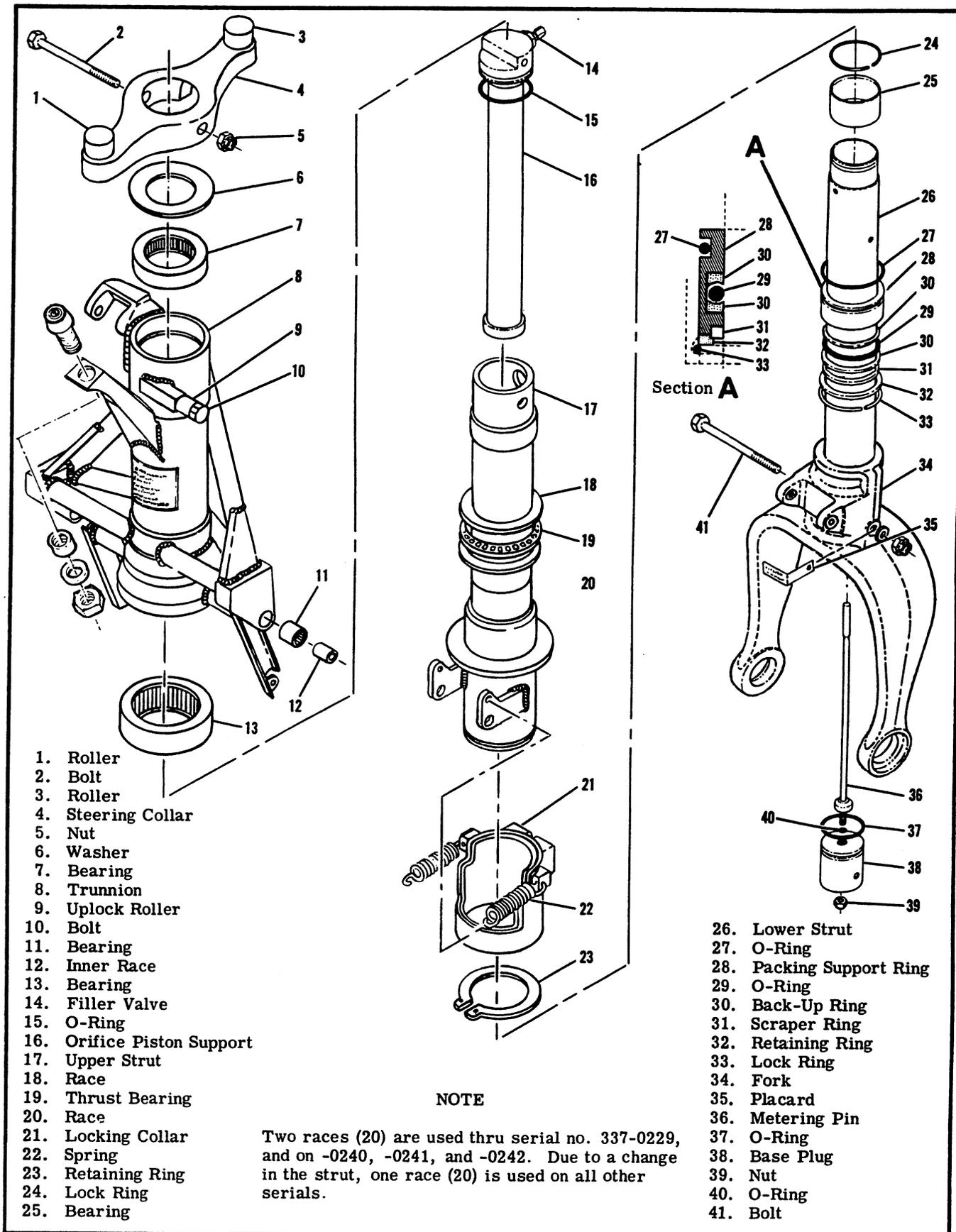


Figure 5-16. Nose Gear Shock Strut

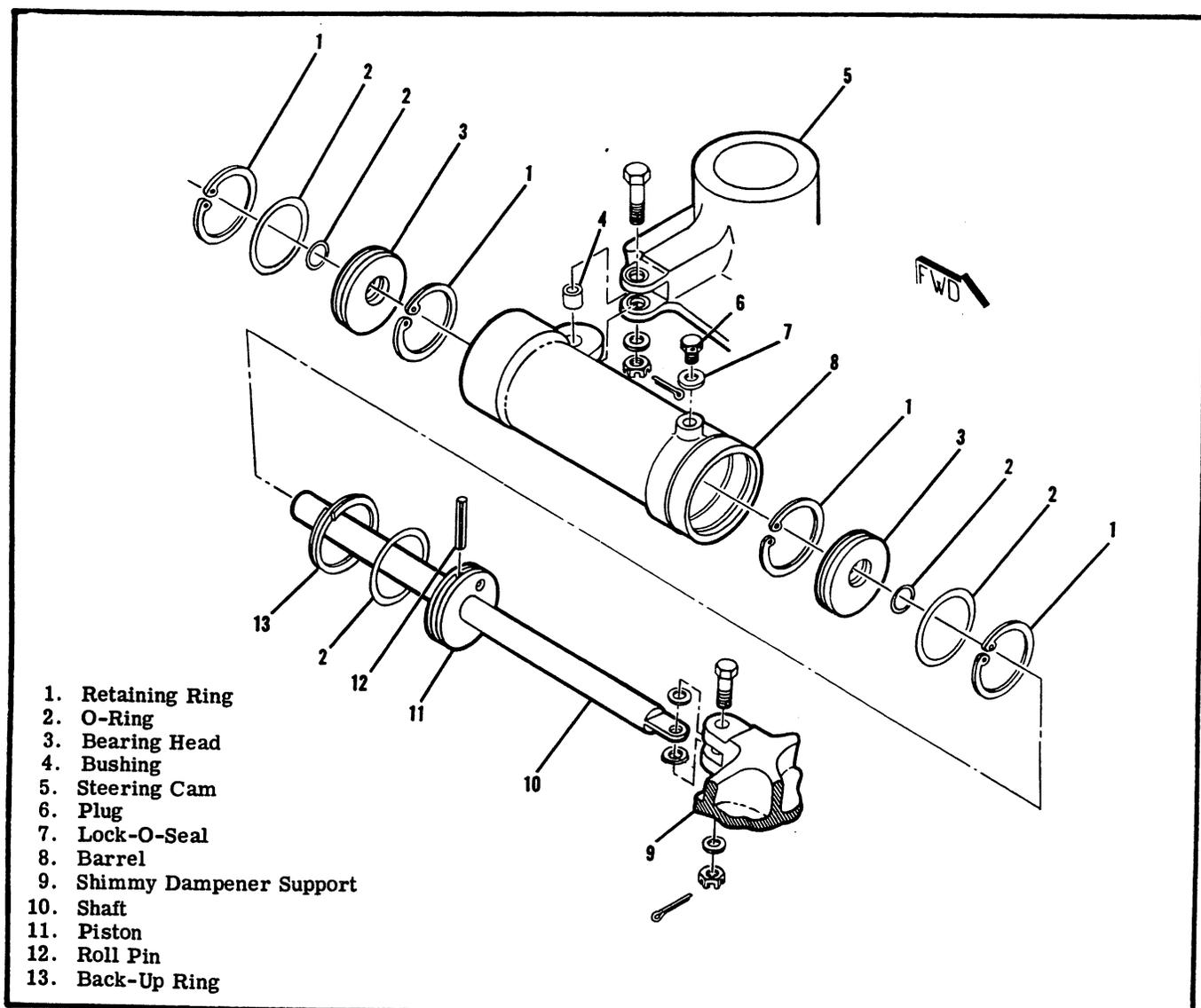


Figure 5-17. Shimmy Dampener

- c. Remove retaining ring below locking collar.
- d. Disconnect centering springs.
- e. Slide collar down to remove.
- f. Reverse preceding steps to install locking collar.

5-102. ASSEMBLY AND INSTALLATION OF LOWER STRUT. (Refer to figure 5-16.)

a. Thoroughly clean all parts in solvent and examine them carefully. Replace all worn or defective parts, and all rubber or plastic seals and rings with new parts.

NOTE

Packing support rings with different width inner grooves and various seals have been used in the strut. On packing support rings with the wide groove, install a contoured rubber back-up ring above and below the O-ring. If strut is equipped with a packing support ring having the narrow groove, install one contoured rubber back-up ring below the

O-ring. If any struts are found with Teflon or leather back-up rings installed in the packing support ring inner groove, replace with the contoured back-up rings above and below the O-ring.

b. Assemble and install the lower strut by reversing the procedures outlined in paragraph 5-100. Note that bearing (25) must be installed with beveled edge up (next to lock ring).

c. Used sparingly, Dow Corning DC-4 compound is recommended for O-ring lubrication. All other internal parts should be liberally coated with hydraulic fluid during assembly.

d. Sharp metal edges should be smoothed with #400 emery paper, then cleaned. Tape or other coverings should be used to protect seals where possible. Remove after seals are past edges.

e. Cleanliness and proper lubrication, along with careful workmanship, are important during shock strut assembly.

f. When installing lock ring (33), position the lock

ring so that one of its ends covers the small access hole in the lock ring groove.

g. Temporary bolts or pins of correct diameter and length are useful tools for holding parts in correct relationship during assembly and installation.

h. Service shock strut in accordance with procedures outlined in Section 2 after installation.

5-103. NOSE GEAR SHIMMY DAMPENER. (Refer to figure 5-17.)

5-104. DESCRIPTION. The shimmy dampener, a self-contained hydraulic cylinder, is attached to a shimmy dampener support on top of the nose gear tunnel, immediately forward of the firewall in the engine compartment, and to the steering cam, mounted to the steering cam support, also atop the tunnel in the engine compartment.

5-105. OPERATION. When the steering system reacts too rapidly, the shimmy dampener maintains pressure against the steering cam by means of a piston which permits a restricted flow of hydraulic fluid from either end of the cylinder to the other, through an orifice in the piston.

5-106. REMOVAL (Refer to figure 5-17.)

- a. Remove bolt attaching barrel (8) to steering cam (5).
- b. Remove bolt attaching shaft (10) to shimmy dampener support (9).
- c. Remove dampener from aircraft.

5-107. DISASSEMBLY. (Refer to figure 5-17.)

- a. Push clevis end of shaft (10) to limit of travel toward cylinder.
- b. Remove plug (6) and lock-O-seal (7), using care not to damage lock-O-seal. Drain hydraulic fluid from barrel.
- c. Remove retainer rings (1), O-rings (2) and bearing beads (3) from barrel ends.
- d. Slide piston assembly from barrel.
- e. Remove roll pin (12) from piston (11), and slide piston from shaft.

5-108. INSPECTION OF PARTS.

- a. Clean metal parts with solvent, and dry thoroughly.
- b. Inspect parts for cracks, excessive wear, scoring or surface defects which may affect their function or the overall operation of the dampener.
- c. Replace defective parts with new parts.

NOTE

Install new O-rings and lubricate internal parts liberally with clean hydraulic fluid during assembly.

5-109. ASSEMBLY. (Refer to figure 5-17.)

- a. Position piston (11) on shaft (10) and install roll pin (12).
- b. Install O-ring (2) and back-up ring (13) on piston (11) and slide piston and shaft into barrel (8). Use care to prevent damage to O-ring.
- c. Install inner retaining rings (1) in both ends of barrel (8).

d. Install O-rings (2) on bearing beads (3) and slide into barrel.

e. Install outer retaining rings (1) into barrel and check dampener piston and rod for binding by pushing rod for full travel in both directions.

f. Fill and service dampener as outlined in Section 2; install lock-O-seal (7) and plug (6).

5-110. INSTALLATION. (Refer to figure 5-17.)

- a. Position rod end of shaft (10) into support bracket (9). Install bolt, washers, nut and cotter pin.
- b. Position mounting lug into steering cam (5) bracket.
- c. Check for clearance between cylinder and structure, while turning nose gear wheel from side to side.

5-111. TORQUE LINKS. (Refer to figure 5-18.)

5-112. DESCRIPTION. The torque links align the lower strut with the nose gear steering system, but permit shock strut action.

5-113. REMOVAL.

WARNING

ALWAYS DEFLATE NOSE GEAR SHOCK STRUT BEFORE DISCONNECTING TORQUE LINKS.

- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. Deflate shock strut completely as outlined in Section 2.
- c. Remove upper bolt from upper torque link.
- d. Remove lower bolt from upper torque link, and carefully remove torque link from strut.
- e. Remove lower bolt from lower torque link, and carefully remove torque link from strut.

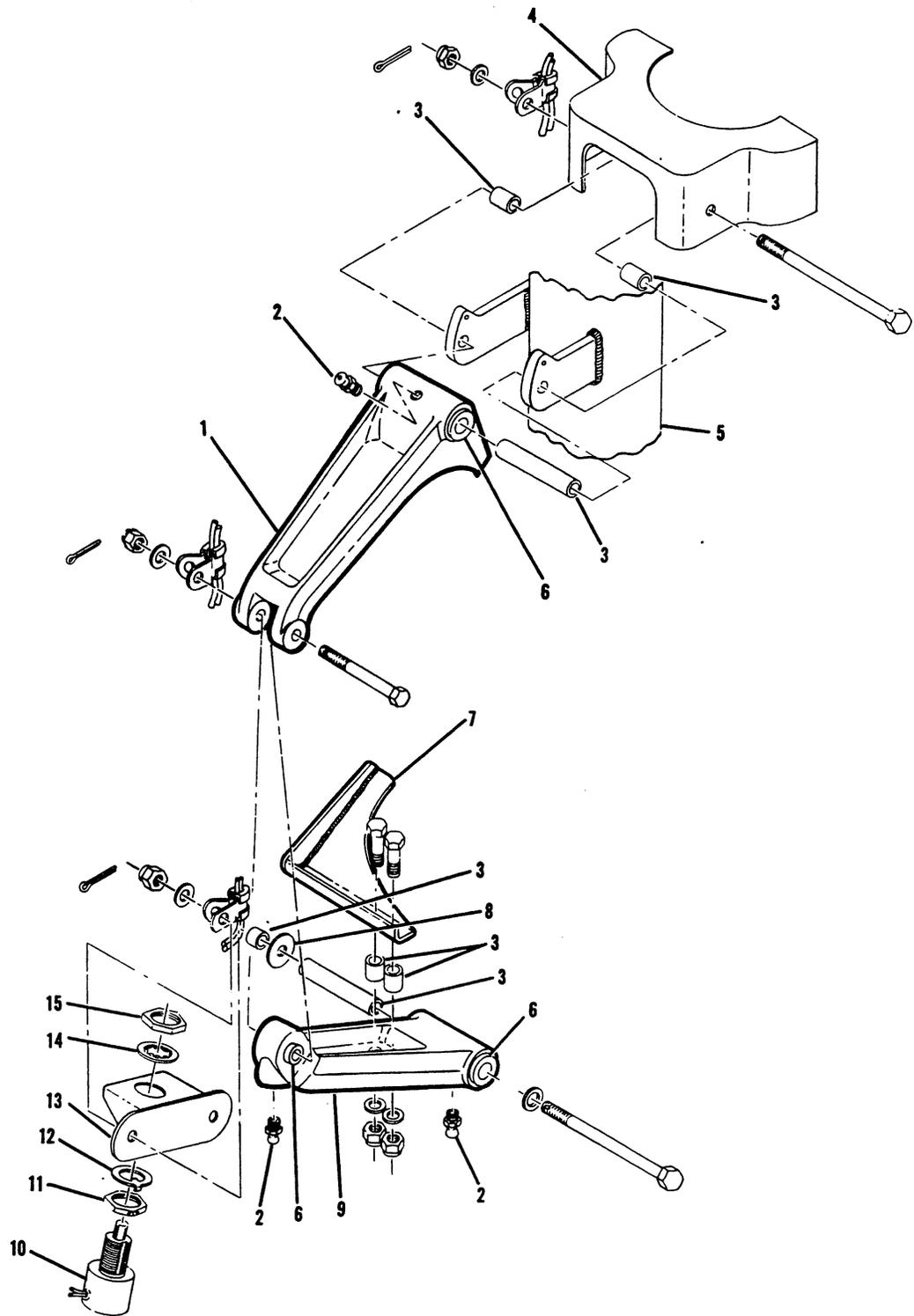
5-114. INSTALLATION.

- a. Hold lower torque link in place on fork and determine clearance between torque link and lug on fork, using feeler gages.
- b. If clearance exceeds 0.013 inch, install 0.010 inch shims as required.
- c. Check torque link for freedom of movement after torquing.

NOTE

Torque upper and lower torque link attach bolts to 33-38 lb in, and install cotter pin on outside of nut.

- d. Install upper torque link and check for freedom of movement after torquing.
- e. Connect upper and lower torque links and tighten nut finger-tight. (Do not torque.)
- f. If difficulty is encountered in mating the torque links, remove the lower torque link and shift shim or shims, if installed, as required to the opposite side.
- g. If step "f" does not correct the problem, check the lugs on the barrel and fork for misalignment.
- h. Rig squat switch in accordance with paragraph 5-277.



- | | | |
|----------------------|----------------------|--------------------|
| 1. Upper Torque Link | 6. Bushing | 11. Nut |
| 2. Grease Fitting | 7. Switch Actuator | 12. Tab Washer |
| 3. Spacer | 8. Shim | 13. Switch Bracket |
| 4. Cover | 9. Lower Torque Link | 14. Lockwasher |
| 5. Nose Gear Strut | 10. Safety Switch | 15. Nut |

Figure 5-18. Torque Links

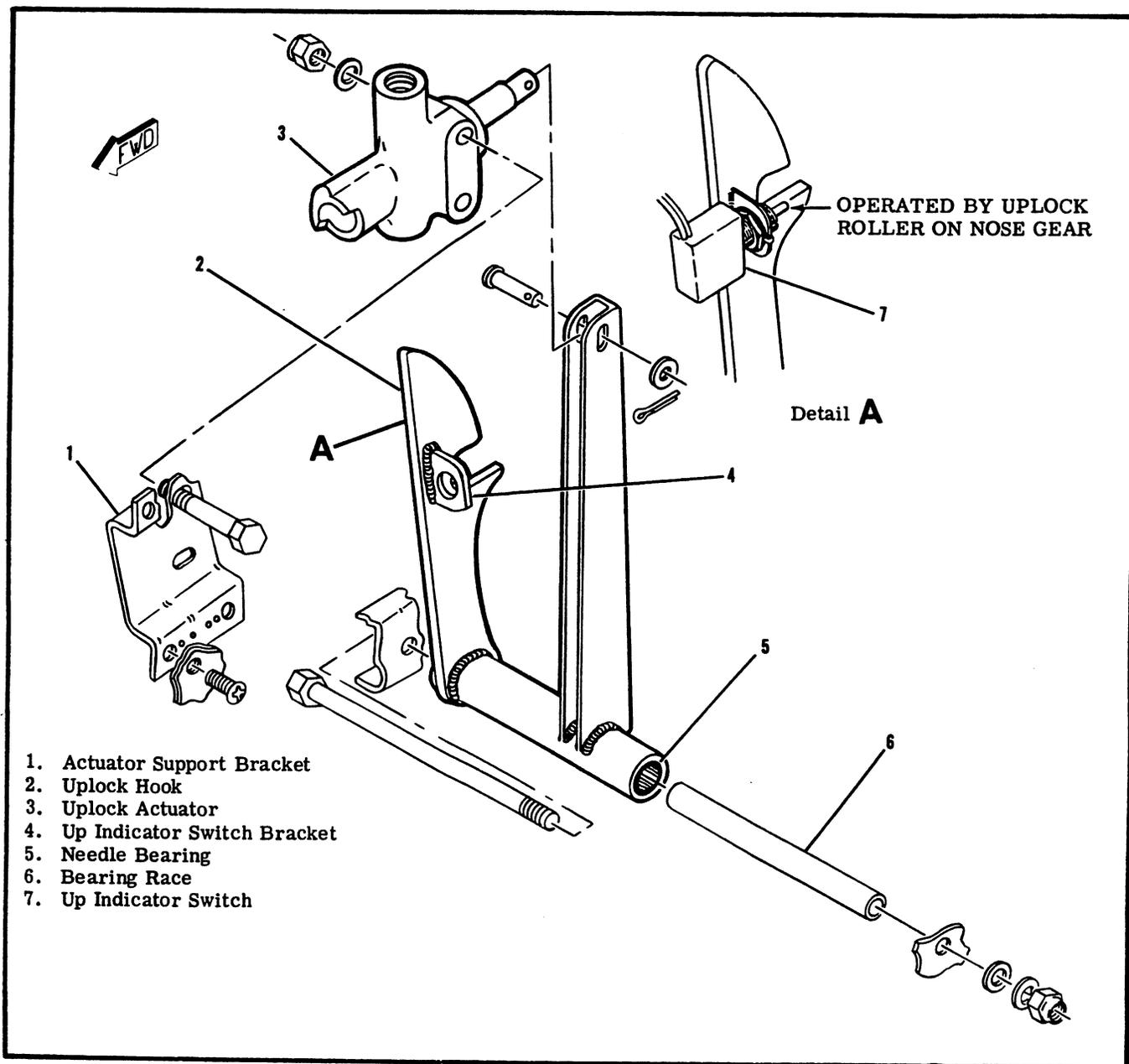


Figure 5-19. Nose Gear Uplock Installation

NOTE

Grease fittings and torque link bushings should not be removed except for replacement of parts. Excessively worn parts should be replaced.

5-115. NOSE GEAR UPLOCK MECHANISM. (Refer to figure 5-19.)

5-116. DESCRIPTION. The nose gear uplock mechanism is a hydraulically-unlocked hook that is spring-loaded to the locked position. The installation consists of one single-acting hydraulic actuator, one hook assembly, one indicator switch and attaching parts.

5-117. OPERATION. The uplock hook engages a roller on the upper left side of the nose gear strut.

Fore and aft adjustment is provided by slotted holes in the actuator mounting bracket.

5-118. REMOVAL. (Refer to figure 5-19.)

a. Remove pin securing uplock arm to actuator (3) and disconnect leads to switch.

b. Remove bolt securing uplock hook (2) to structure, and remove hook from aircraft.

c. Disconnect hydraulic lines from actuator and cap or plug openings.

d. Mark location of bolts securing actuator to slotted holes in support (1). Remove bolts and actuator from aircraft.

e. Indicator switch (7) and bearings (5) may be disassembled after removal from aircraft.

5-119. DISASSEMBLY, INSPECTION AND ASSEMBLY

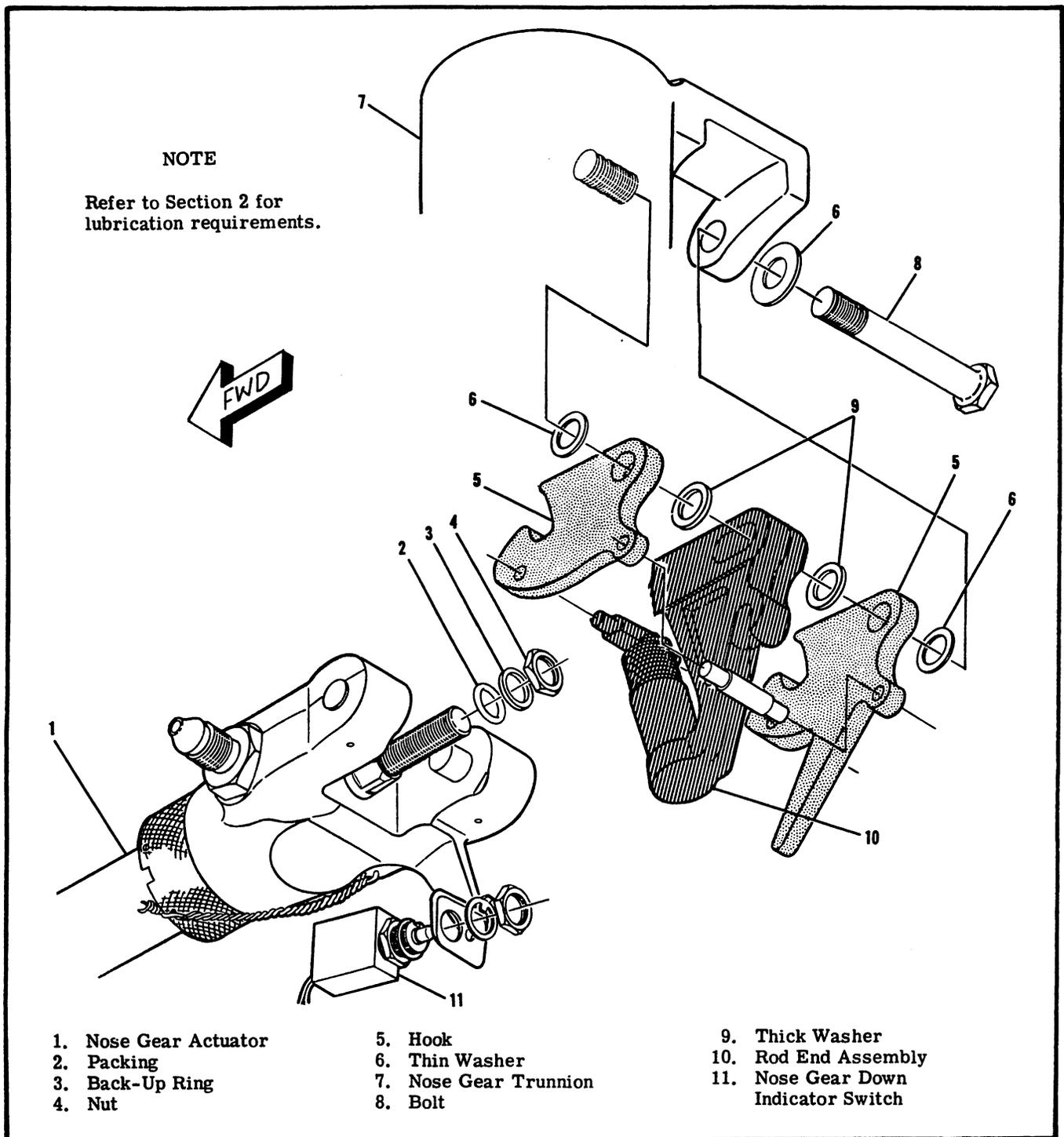


Figure 5-20. Nose Gear Downlock Installation

OF NOSEGEAR UPLOCK ACTUATOR. Refer to paragraphs 5-27 thru 5-30 and figure 5-7.

5-120. INSTALLATION. (Refer to figure 5-19.)

- a. Position actuator (3) to support. Locate in slotted holes, aligning the marks made during removal.
- b. Connect hydraulic lines to actuator.
- c. Assemble needle bearing (5) and race (6) into uplock hook assembly and lubricate bearings in accordance with procedures outlined in Section 2.

d. Position uplock hook assembly to mounting holes, and install bolt securely.

e. Install indicator switch (7) to bracket (4), and connect leads.

f. Install pin securing actuator to uplock hook arm.

g. Rig nose gear uplock and bleed hydraulic system in accordance with applicable paragraphs.

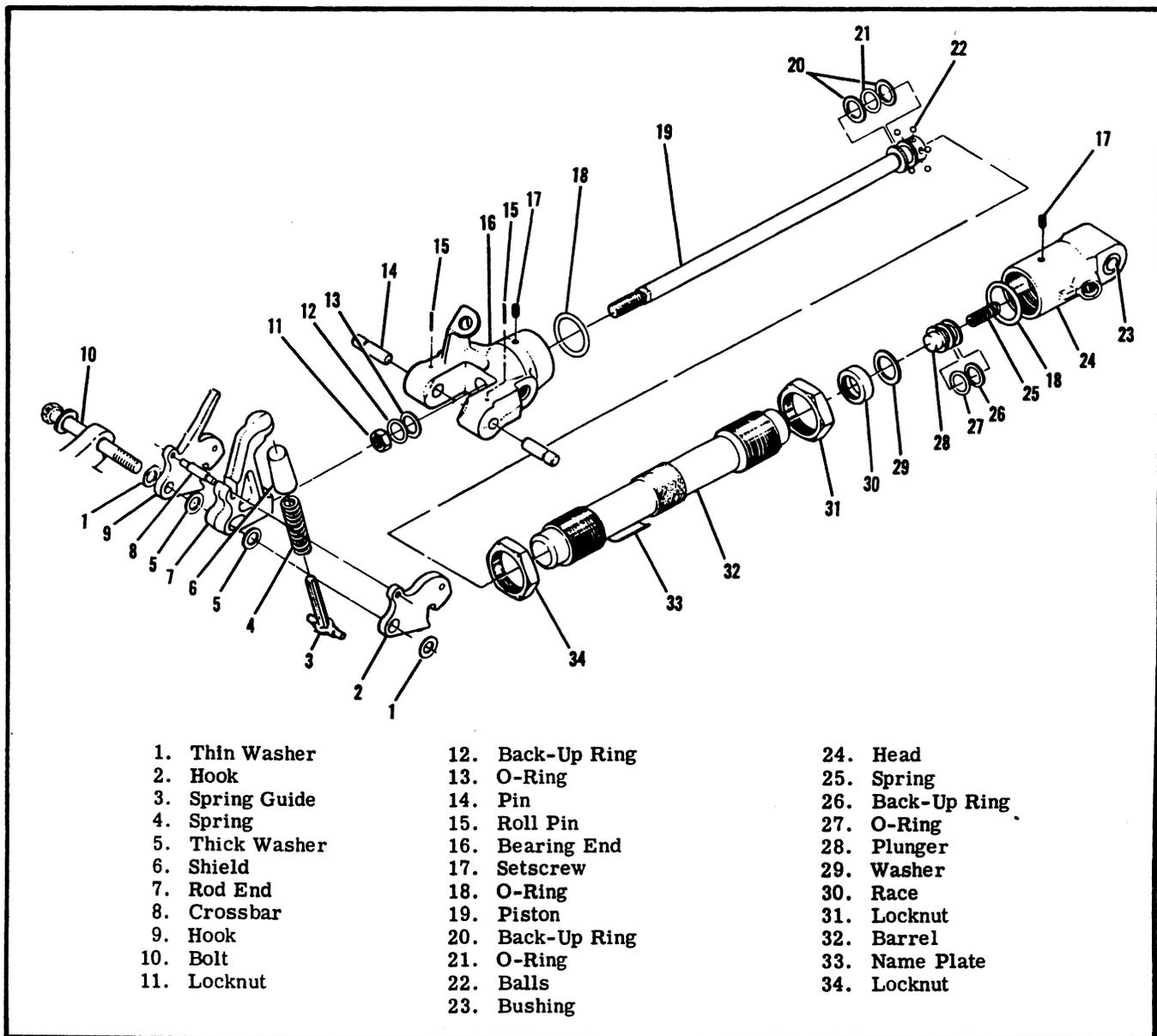


Figure 5-21. Nose Gear Actuator (Sheet 1 of 2)

5-121. **DOWNLOCK MECHANISM.** (Refer to figure 5-20.)

5-122. **DESCRIPTION.** The nose gear downlock is a hook at the piston rod end of the nose gear actuator. The installation consists of the hook assembly, indicator switch, lock pins and attaching parts to the nose gear actuator and strut.

5-123. **OPERATION.** The hook, at the piston rod end of the nose gear actuator, contains an internal lock to hold mechanism over center. Adjustment is provided by the rod end of the actuator piston rod.

5-124. **REMOVAL.** (Refer to figure 5-20.)

- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. Remove bolt securing actuator (1) and downlock mechanism to top of trunnion (7) and remove down-

lock mechanism from aircraft.

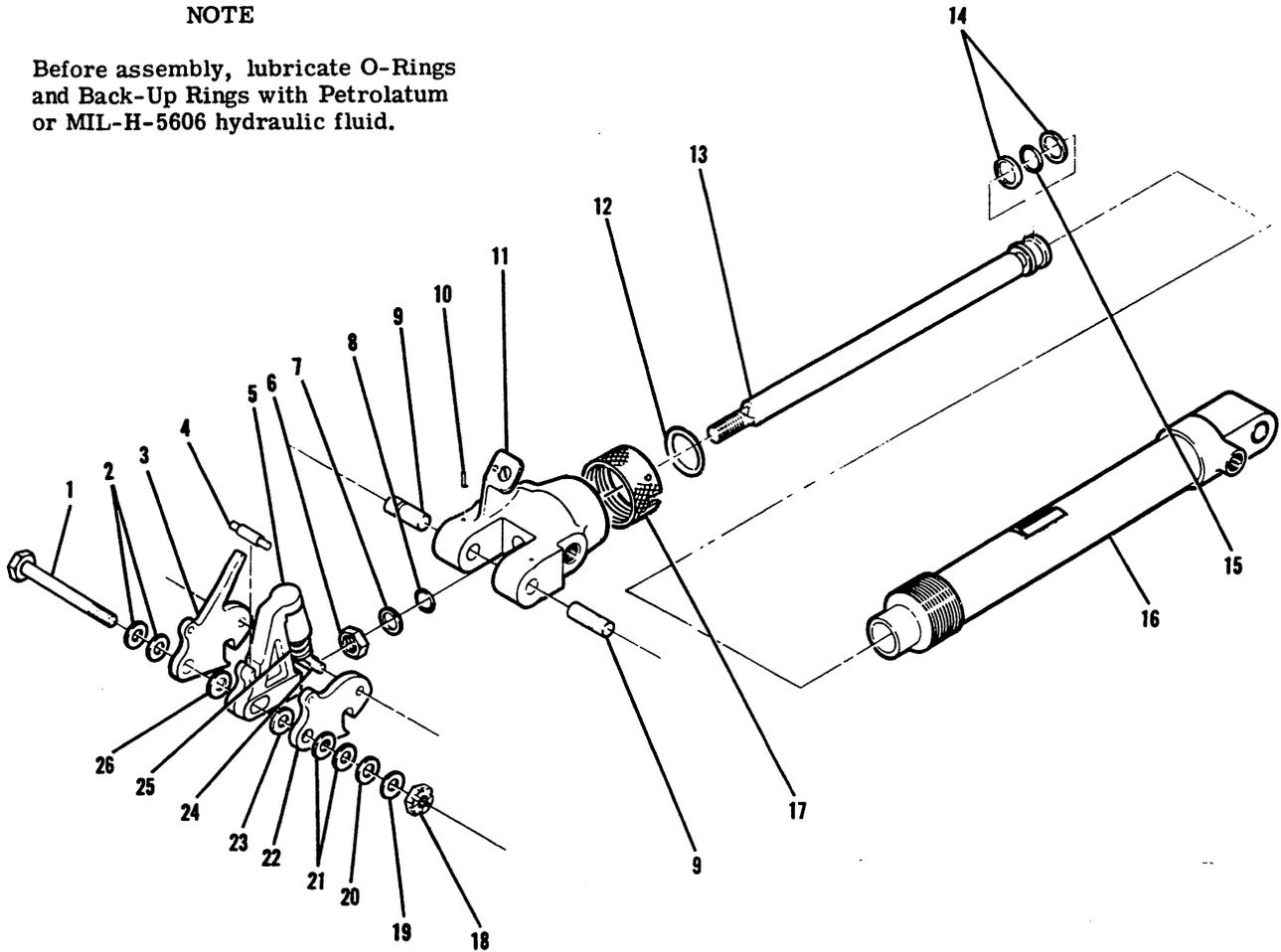
- c. Disconnect hydraulic lines from actuator and cap or plug openings.
- d. Remove bolt securing actuator to structure; remove actuator from aircraft.

5-125. **DISASSEMBLY OF NOSE GEAR ACTUATOR.** (Thru 33701426 and F33700035)(Refer to figure 5-21, sheet 1.)

- a. Unlock cylinder by applying hydraulic pressure to port in head (24).
- b. Loosen locknut (11) at end of piston rod and unscrew parts (1 thru 10) as an assembly from piston rod.
- c. Mark barrel (32) and head (24) so that same end of barrel may be reinstalled in head (24) when re-assembling actuator. Remove safety wire from locknuts (31 and 34).
- d. Remove setscrew (17) in bearing end (16) and loosen locknut (34). While using a strap wrench on

NOTE

Before assembly, lubricate O-Rings and Back-Up Rings with Petrolatum or MIL-H-5606 hydraulic fluid.



- | | | |
|-----------------|-------------------|------------------|
| 1. Bolt | 10. Roll Pin | 18. Nut |
| 2. Thin Washer | 11. Bearing End | 19. Thin Washer |
| 3. Hook | 12. Packing | 20. Thick Washer |
| 4. Crossbar | 13. Piston | 21. Thin Washer |
| 5. Rod End | 14. Back-Up Rings | 22. Hook |
| 6. Nut | 15. Packing | 23. Thick Washer |
| 7. Back-Up Ring | 16. Cylinder | 24. Spring Guide |
| 8. Packing | 17. Locknut | 25. Spring |
| 9. Pin | | 26. Thick Washer |

Figure 5-21. Nose Gear Actuator (Sheet 2 of 2)

barrel (32), remove bearing end (16) from barrel.

e. Pull piston (19) from barrel, using care to prevent loss of balls (22) as piston is removed from barrel.

f. Remove setscrew (17) from head (24) and loosen locknut (31). Using a strap wrench on barrel (32), remove head (24) from barrel.

g. Remove O-ring (18) from head (24), and remove plunger (28) and parts (25 thru 30), by applying a sharp blast of air in the vent hole located in head (24).

h. Remove all O-rings and back-up rings.

i. Disassemble hook assembly.

inspections to determine that all parts are in a serviceable condition.

a. Inspect all threaded surfaces for cleanliness and for cracks and excessive wear.

b. Inspect spring (4) for breaks and distortion. The free length of the spring must be $2.460 \pm .080$ inches, and compress to 2.00 inches under a 19.5 ± 1.95 pound load.

c. Inspect spring (25) for breaks and distortion. The free length of the spring must be 1.055 inches, and compress to .875 inch under a 35.0 ± 3.5 pound load.

d. Inspect hooks (2 and 9), spring guide (3), bearing end (16), piston and stop assembly (19), barrel (32),

5-126. INSPECTION OF PARTS. Make the following

head (24) and bushing (23) for cracks, chips, scratches scoring, wear or surface irregularities which may affect their function or the overall operation of the actuator.

e. Repair of most parts of the actuator assembly is impractical. Replace defective parts with serviceable parts. Minor scratches and scores may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect the operation of the unit.

NOTE

Install all new O-rings and back-up rings during assembly of the actuator.

5-127. ASSEMBLY.

a. Install O-ring (27) and back-up ring (26) in groove on plunger (28).

b. Insert spring (25) and plunger (28) into head (24). Install stop washer (29) and race (30) over end of plunger (28) and install O-ring (18) in groove in head (24).

c. With locknut (31) in barrel, screw barrel (32) into head (24) until tapped hole in head is aligned with hole in barrel.

NOTE

Ensure that marked end of barrel is installed in head (24). Barrel should tighten against race to prevent any movement between stop washer and race.

d. Install and tighten setscrew (17) in head (24). Tighten locknut (31).

e. Install O-ring (21) and back-up rings (20) in groove on piston; install balls (22) into holes of piston.

f. Insert piston into barrel. Ensure that all six balls are in place in piston.

g. Install O-rings (18 and 13) and back-up ring (12) into grooves in bearing end (16).

h. With locknut (34) on barrel, screw bearing end (16) on barrel until tapped hole in bearing end (16) is aligned with hole in barrel (32). Install and tighten setscrew in bearing end (16). Tighten locknut (34).

NOTE

Centerline of hook pins and centerline of bushing hole must align within .005 inch with cylinder locked at a length of 13.580 \pm .031 inches from centerline of hook pins to centerline of bushing (23) in head (24).

i. Install locknut (11) on end of piston. Assemble and install hook assembly on piston.

NOTE

When assembling hook assembly, lubricate as specified in Section 2.

5-128. DISASSEMBLY OF NOSE GEAR ACTUATOR. (Beginning with 33701427 and F33700036)(Refer to figure 5-21, sheet 2.)

a. Unlock cylinder by applying hydraulic pressure

to port in cylinder (16).

b. Loosen nut (6) at end of piston rod. Unscrew parts (1, 2, 3, 4, 5, 26, 24, 23, 22, 21, 20, 19, and 18) as an assembly from piston rod. Remove nut (6) from piston rod.

c. Remove safety wire from locknut (17); loosen locknut (17), using spanner wrench, if necessary, and unscrew cylinder (16) from bearing end (11).

d. Pull piston (13) from cylinder (16).

e. Remove packing (12) from bearing end (11).

f. Remove back-up rings and packings.

g. Disassemble hook assembly, noting relative arrangement of parts for reassembly.

5-129. INSPECTION OF PARTS. Make the following inspections to determine that all parts are in a serviceable condition.

a. Inspect all threaded surfaces for cleanliness and cracks or excessive wear.

b. Inspect spring (25) for breaks and distortion. The free length of the spring must be 2.406 \pm .080 inches, and compress to 2.00 inches under a 19.8 \pm 2.0 pound load.

c. Inspect hooks (3 and 22), spring guide (24), bearing end (11), piston (13), cylinder (16) and bushing in end of cylinder for cracks, scratches, scoring, wear of surface irregularities which might affect their function or the overall operation of the actuator.

d. Do not remove pins (9) unless they are damaged and should be repaired.

e. Repair of most parts of the actuator assembly is impractical. Replace defective parts. Minor scratches and scores may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect the operation of the unit.

5-130. ASSEMBLY.

NOTE

Install all new packings and back-up rings during assembly. Before assembly, lubricate O-rings and back-up rings with Petrolatum or hydraulic fluid.

a. Install back-up rings (14) and packing (15) in grooves of piston (13).

b. Insert piston into cylinder (16).

c. Install locknut (17) over threads of cylinder (16), and screw cylinder into bearing end (11).

d. Install packing (8), back-up ring (7) and nut (6) on threads of piston (13).

e. Tighten and safety locknut (17).

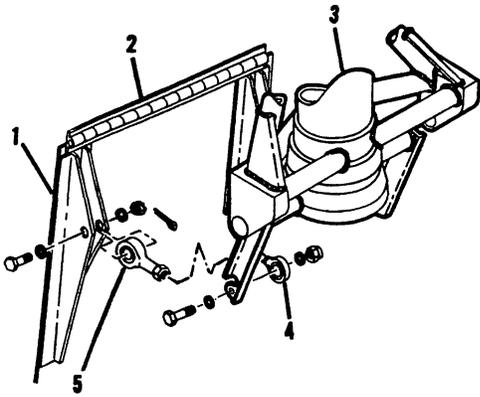
f. Assemble and install hook assembly on piston (13).

NOTE

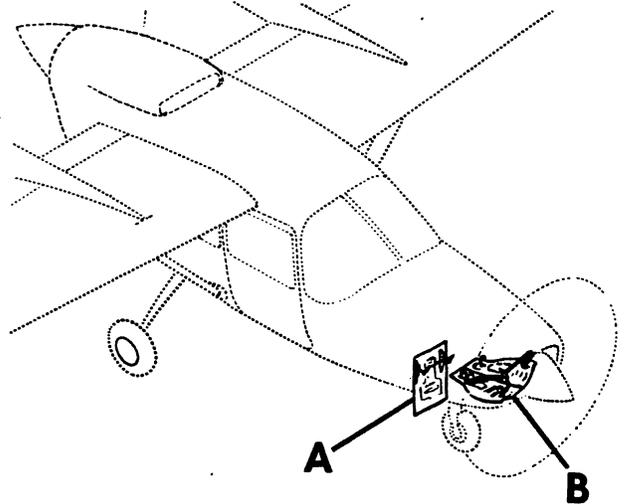
When assembling hook assembly, lubricate as specified in Section 2.

5-131. INSTALLATION. (Refer to figure 5-20.)

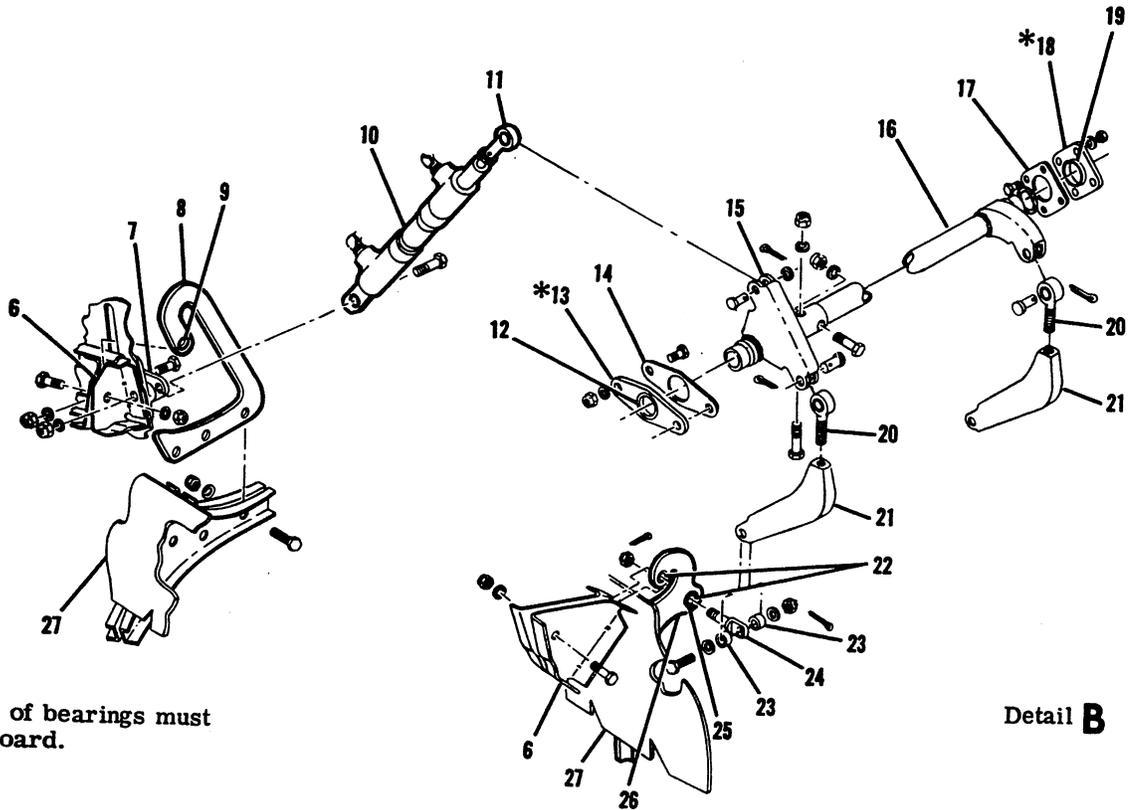
a. Position nose gear actuator into support and



Detail A



A B



Detail B

*Flanges of bearings must face inboard.

- | | | |
|------------------------------|------------------------------|--------------------------|
| 1. Aft Nose Gear Door | 10. Actuator | 19. Bearing |
| 2. Hinge | 11. Rod End | 20. Rod End |
| 3. Nose Gear | 12. Bearing | 21. Bellcrank |
| 4. Male Rod End | 13. Bearing Block | 22. Bushing |
| 5. Female Rod End | 14. Bearing Lock Plate | 23. Spacer |
| 6. Hinge | 15. Right Tube and Bellcrank | 24. Eyebolt |
| 7. Actuator Mounting Bracket | 16. Left Tube and Bellcrank | 25. Bearing |
| 8. Hinge | 17. Bearing Lock Plate | 26. Hinge |
| 9. Bushing | 18. Bearing Block | 27. Right Nose Gear Door |

Figure 5-22. Nose Gear Door Mechanism

install bolt and nut securing forward end of actuator to structure and tighten. Install cotter pin.

b. Position hook end of actuator to top of nose gear trunnion; install bolt and tighten.

c. Connect hydraulic lines to actuator.

d. Bleed hydraulic system in accordance with paragraph 5-163.

e. Rig nose gear actuator in accordance with paragraph 5-274.

5-132. NOSE GEAR DOOR SYSTEM.

5-133. DESCRIPTION. (Refer to figure 5-22.) The nosegear door system consists of a right and left forward door, an aft gear door, one double-acting hydraulic actuator, linked through a torque tube, to the forward doors, hydraulic connections and attached parts. The aft door is connected by adjustable links to the nose gear.

5-134. OPERATION. The aft nose gear door, linked mechanically to the nose gear, opens as the nose extends and closes as the nose gear retracts. The forward nose gear doors open for extension and retraction of the landing gear and close again, after the cycle is completed, through movement of the hydraulic actuator.

5-135. REMOVAL OF AFT NOSE GEAR DOOR. (Refer to figure 5-22.)

- a. Remove bolts securing links to aft nose gear door.
- b. Remove hinge pin from hinge, and remove door from aircraft.

5-136. INSTALLATION OF AFT NOSE GEAR DOOR. (Refer to figure 5-22.)

- a. Position door hinge half into hinge on structure, and install hinge pin.
- b. Position door links into door brackets; install bolts and attaching hardware and tighten.

NOTE

When installing new doors, trimming and hand-forming at the edges may be necessary to achieve a good fit and permit actuators to lock. The doors must clear the gear by at least 1/2-inch during retraction.

5-137. REMOVAL OF FORWARD DOORS AND ACTUATOR. (Refer to figure 5-22.)

- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. With master switch OFF, place gear control handle to gear-up position, and operate emergency hand pump until doors are open.
- c. Release hydraulic pressure and remove pin securing actuator rod end (11) to right tube bellcrank (15).
- d. Disconnect hydraulic lines from actuator and cap or plug openings.
- e. Remove bolt securing actuator to bracket and remove actuator from aircraft.
- f. Remove pins securing bellcrank rod ends to right and left tube bellcranks.
- g. Support door and remove hinge pivot bolts securing hinges to brackets and remove door from aircraft.
- h. Remove bolts securing right tube bellcrank (15)

to left tube bellcrank (16) and telescope together to slide ends from bearing blocks (13), and remove right and left bellcranks from aircraft.

i. Remove bolts securing bearing blocks to structure, and remove bearing blocks from aircraft, noting position of bearing blocks to structure.

j. Inspect parts for damage, cracks and excessive wear. Replace faulty parts.

5-138. DISASSEMBLY, INSPECTION OF PARTS AND ASSEMBLY OF NOSE GEAR DOOR ACTUATOR. Refer to paragraphs 5-42 thru 5-47 and figure 5-10.

5-139. INSTALLATION OF FORWARD DOORS AND ACTUATOR. (Refer to figure 5-22.)

- a. Position bearing blocks (13) to structure, in same position as noted during removal.
- b. Lubricate parts during assembly and installation as specified in Section 2.
- c. Assemble right and left tube and bellcrank assemblies loosely and telescope together. Position ends into bearing blocks and align holes in bellcrank tubes. Install and tighten bolts.
- d. Assemble door hinges to door. Position hinges into brackets, install and tighten hinge pivot bolts.
- e. Position bellcrank rod ends (20) to right and left tube bellcranks. Install pivot pins and cotter pins.
- f. Manually move door to closed position and check for binding in hinges and linkage.
- g. If necessary, hand form and trim doors to fit.
- h. Position actuator clevis end into bracket, install and tighten bolt.
- i. Connect hydraulic lines to actuator.
- j. Position actuator rod end (11) into right tube bellcrank (15) and install pivot pin, washer and cotter pin.
- k. Bleed hydraulic system in accordance with paragraph 5-163.
- l. Rig nose gear doors per paragraph 5-278.
- m. Remove aircraft from jacks.

5-140. NOSE WHEEL STEERING SYSTEM.

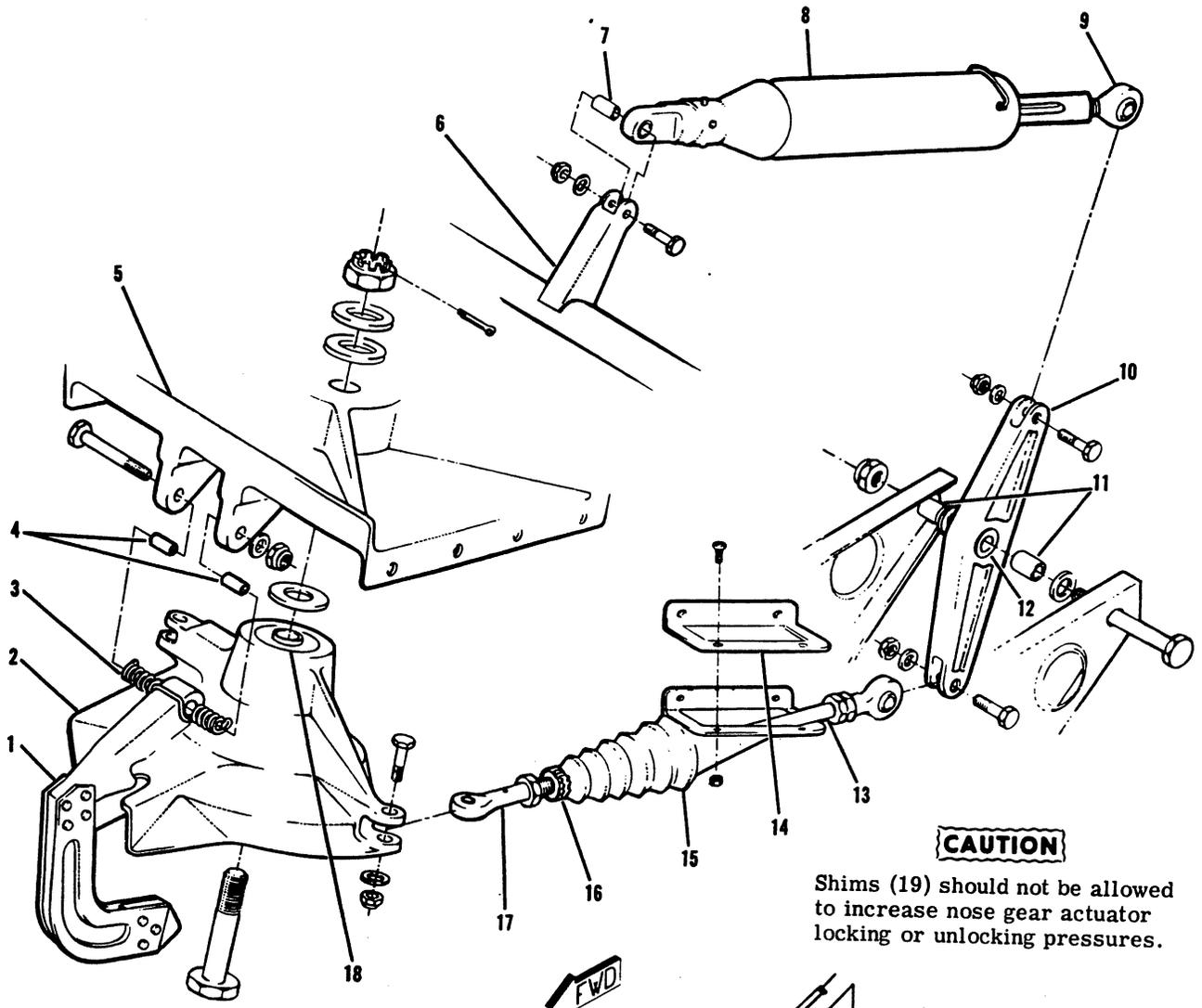
5-141. DESCRIPTION. The system consists of a steering cam and lock assembly, a push-pull rod, bellcrank, linkage and attaching parts.

5-142. OPERATION. Steering is accomplished by use of the rudder pedals. A spring-loaded bungee is connected between the rudder arm and steering cam by a push-pull rod and bellcrank. The steering cam turns the nose gear on the ground, but is locked in neutral as the gear retracts. The bungee then acts as a rudder trim bungee. The nose wheel is steerable up to approximately 15° each side of neutral, after which the brakes may be used for a maximum deflection of about 39° each side of neutral.

5-143. TROUBLE SHOOTING. (Refer to Section 9.)

5-144. REMOVAL OF NOSE WHEEL STEERING CAM. (Refer to figure 5-23.)

- a. Jack aircraft in accordance with procedures outlined in Section
- b. With master switch OFF, place gear control handle in gear-up position and operate emergency hand pump until nose gear is retracted enough to gain access to steering cam bolt.



CAUTION

Shims (19) should not be allowed to increase nose gear actuator locking or unlocking pressures.

- | | |
|-------------------------|-------------------|
| 1. Steering Cam Lock | 11. Spacer |
| 2. Steering Cam | 12. Bearing |
| 3. Spring | 13. Push-Pull Rod |
| 4. Spacer | 14. Retainer |
| 5. Steering Cam Support | 15. Boot |
| 6. Rudder Bar | 16. Clamp |
| 7. Spacer | 17. Rod End |
| 8. Bungee | 18. Bearing |
| 9. Rod End | 19. Shim |
| 10. Bellcrank | 20. Bumper |

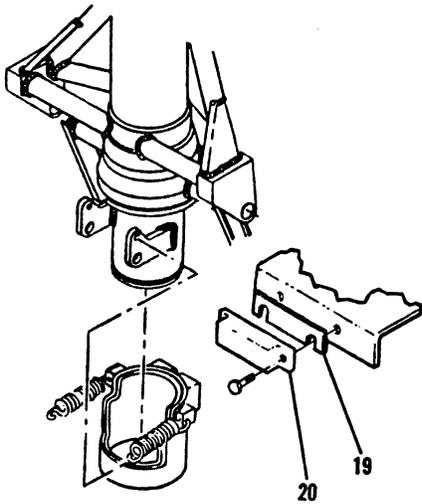
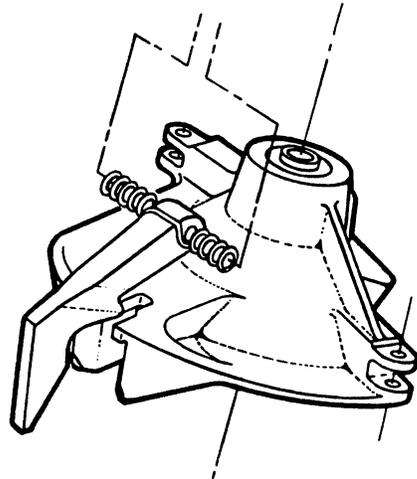


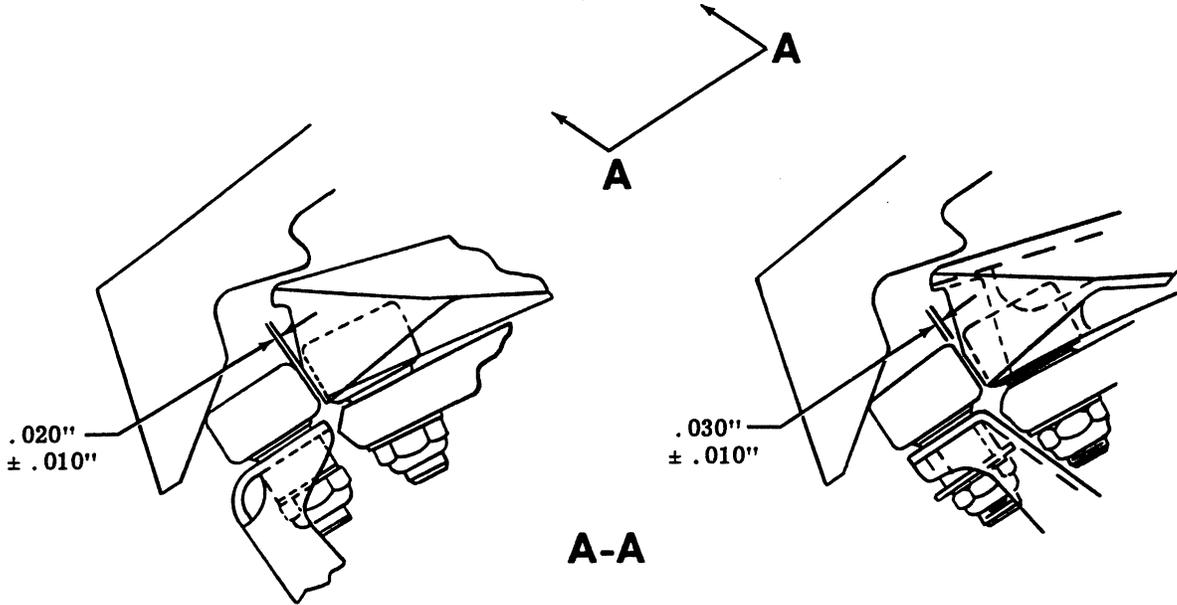
Figure 5-23. Nose Wheel Steering System (Sheet 1 of 2)

NOTE

Remainder of nose gear steering system is unchanged from that shown in sheet 1 of this figure.



**337-0501 & ON
AND SERVICE
PARTS**



CLAMPED ROLLER SUPPORT

Proper clearance between steering cam and roller may be attained by adjusting roller support, which is clamped to the nose gear, up or down as required. It may be necessary to file the steering cam when installing a new cam.

When tightening clamp bolts, also be sure to keep roller aligned with centerline of lock.

WELDED ROLLER SUPPORT

Clearance between steering cam and roller is non-adjustable on the welded type roller support. However, it may be necessary to file the steering cam when installing a new cam.

Figure 5-23. Nose Wheel Steering System (Sheet 2 of 2)

- c. Disconnect door actuator rod end from right tube bellcrank. (Refer to figure 5-22.)
- d. Remove bolt securing shimmy dampener to steering cam. (Refer to figure 5-17.)
- e. Remove bolt securing push-pull rod to steering cam. (Refer to figure 5-23.)
- f. Remove bolt securing steering cam lock (1) and spring (3) to steering cam support (5). Remove cam lock and spring from aircraft.
- g. Remove bolt securing steering cam (2) to cam support (5) and remove cam from aircraft.
- h. Push-pull rod (13), bellcrank (10) and bungee (8) may be removed by removal of bolts at attach points.
- i. Inspect all removed parts for damage and excessive wear.

5-145. INSTALLATION OF NOSE WHEEL STEERING CAM. (Refer to figure 5-23.)

- a. Position steering cam (2) to cam support (5). Install and tighten bolt.
- b. Position cam lock (1), spring (3) and spacers (4) to cam support (5). Install and tighten bolt.
- c. Position shimmy dampener to steering cam bracket and install bolt. (Refer to figure 5-17.)
- d. Position push-pull rod end (17) into steering cam bracket and install bolt.
- e. Installation of push-pull rod (13), bellcrank (10) and bungee (8) may be accomplished by installing bolts at attach points.
- f. Position door actuator rod end to right tube bellcrank and install pin. (Refer to figure 5-22.)
- g. Rig nose wheel steering as outlined in Section 9.
- h. Remove aircraft from jacks.

5-146. NOSE GEAR WHEEL. (Refer to figure 5-24.)

5-147. DESCRIPTION. The nose gear wheel assembly consists of two cast wheel halves, two tapered roller bearing assemblies, one tire, one tube, two hub caps grease seals and attaching parts. The wheel is mounted to the fork of the nose gear strut on an axle.

5-148. OPERATION. The nose gear wheel is free-rolling on an independent axle and is used to taxi the aircraft during ground operations.

5-149. REMOVAL OF NOSE GEAR WHEEL. (Refer to figure 5-24.)

- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. Remove axle bolt (21).
- c. Insert a long punch through one axle ferrule (16) to tap out ferrule at opposite side of fork.
- d. Remove both ferrules and pull wheel from fork.
- e. Remove spacers (19) and axle tube (20) before disassembling wheel.

5-150. DISASSEMBLY OF NOSE GEAR WHEEL. (Refer to figure 5-24.)

WARNING

Injury can result if tire is not completely deflated before attempting to separate wheel halves.

- a. Deflate tire completely and break tire beads

loose from wheel flanges. Use care to prevent damage to wheel flanges.

- b. Remove wheel thru-bolts (10) and separate wheel halves (6 and 9.)
- c. Remove tire (7) and tube (8).

5-151. INSPECTION OF NOSE GEAR WHEEL.

- a. Clean all metal parts and grease seal felts with solvent.
- b. Replace damaged or discolored bearing cups (11) and cones (5) (refer to figure 5-24.)
- c. After cleaning, repack bearing covers and cups with wheel bearing grease before installation. (Refer to Section 2.)

NOTE

Bearing cups are a press-fit and should be removed only if replacement is necessary.

d. If bearing cups are to be replaced, proceed as follows:

1. Heat wheel half in boiling water for 15 minutes.
2. Press out bearing cup and press in new cup while wheel is still hot.
- e. Replace cracked wheel halves. Minor nicks, scratches or scores may be sanded smooth.
- f. Where protective finish has been removed, clean, prime and repaint with aluminum lacquer.
- g. Inspect tire and tube for damage; replace if damaged.

5-152. ASSEMBLY OF NOSE GEAR WHEEL. (Refer to figure 5-24.)

- a. Insert tire in tube. Position wheel half with hole for valve stem in tire. Align valve stem with hole in wheel half and carefully work valve stem through hole. Align tire and tube balance marks per paragraph 5-58.
- b. Place wheel halves together, ensuring tube is not pinched.

NOTE

Uneven or improper torque of wheel thru-bolt nuts can cause bolt failure with resultant wheel failure.

- c. Secure wheel halves with wheel thru-bolts and torque to valve marked on wheel.
- d. Install grease seals, bearing cones, snap rings and hub caps.
- e. Install tire to set tire beads, then adjust to pressure specified in figure 1-1.

5-153. INSTALLATION OF NOSE GEAR WHEEL. (Refer to figure 5-24.)

- a. Assemble spacers (19) and axle tube (20) into wheel.
- b. Position wheel in fork (13) and install ferrules (16) into fork. Tap with non-metallic hammer until seated.
- c. Install axle bolt (21) and tighten until a slight bearing drag is obvious, then back off axle nut (17) to align nearest cotter pin hole and install cotter pin (18).
- d. Remove aircraft from jacks.

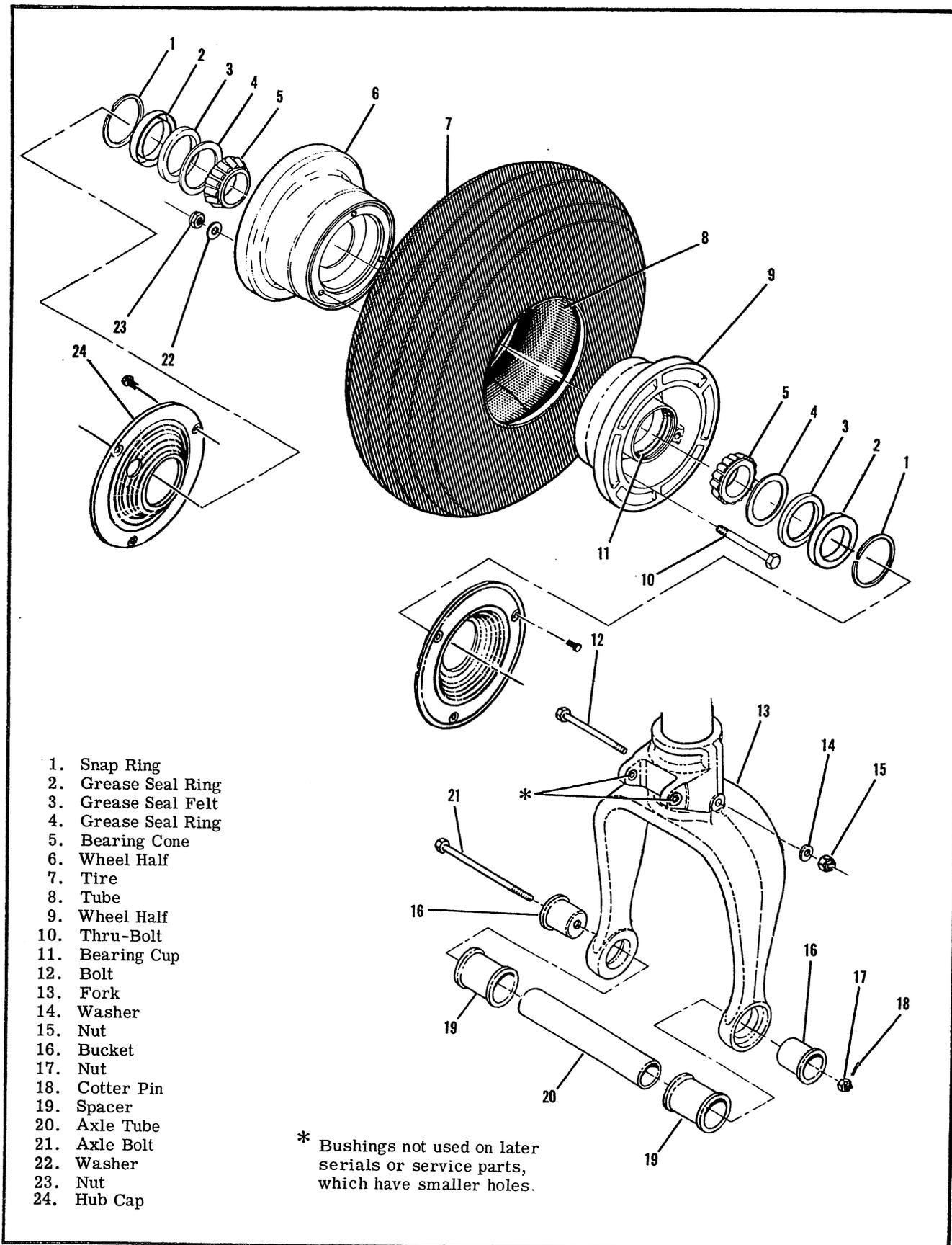


Figure 5-24. Nose Wheel

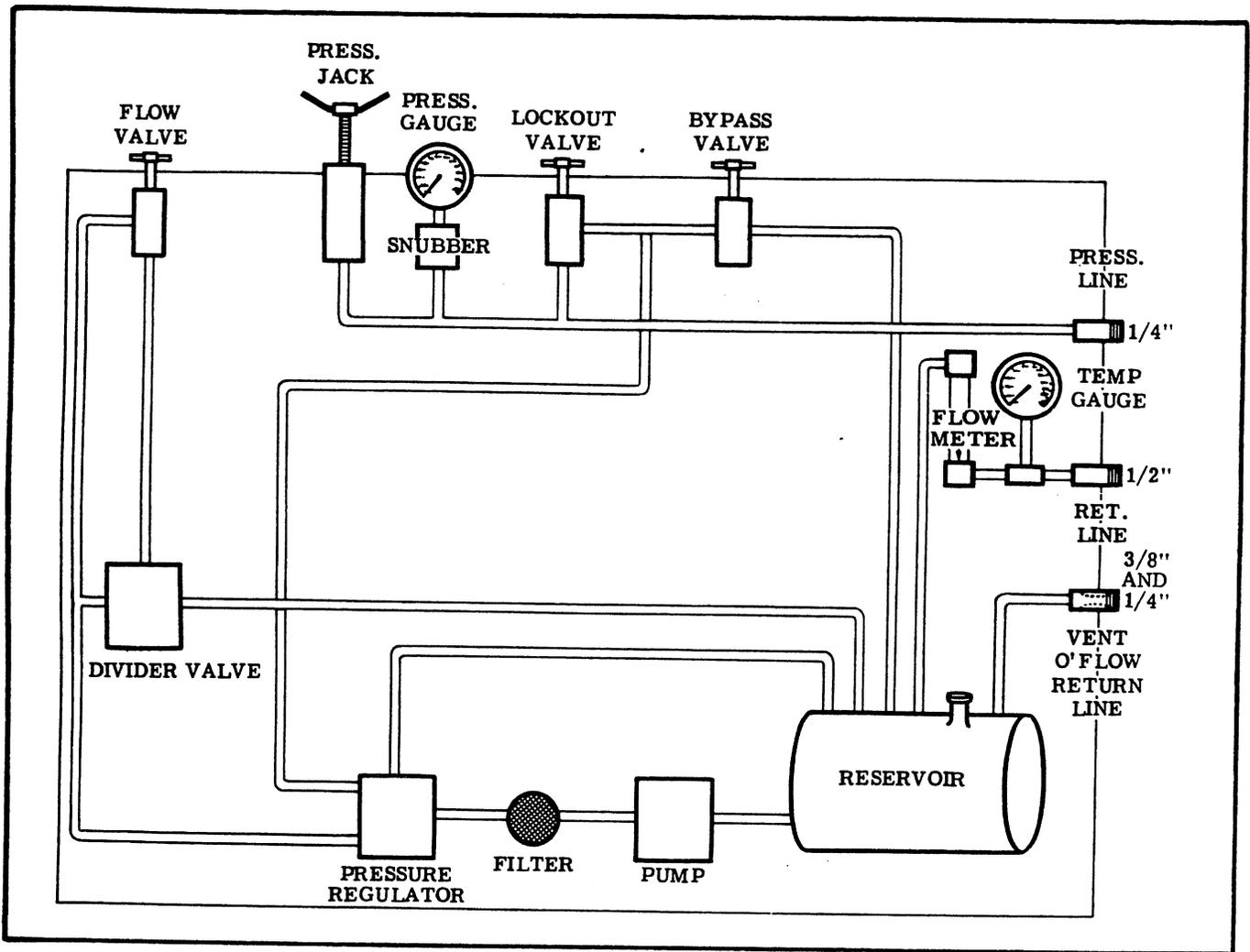


Figure 5-25. Simplified Schematic of Hydro Test

5-154. LANDING GEAR HYDRAULIC POWER.

5-155. DESCRIPTION. (Refer to paragraph 5-2.)

5-156. OPERATION. (Refer to paragraph 5-3.)

5-157. HYDRAULIC TOOLS AND EQUIPMENT.

5-158. HYDRO TEST UNIT. A special portable hydraulic servicing unit is available from the Cessna Service Parts Center. The Hydro Test unit combines a motor-driven pump, pressure jack, pressure gage, reservoir and controls into a compact unit. The Hydro Test, or its equivalent, is indispensable for servicing, testing and rigging of the landing gear system.

WARNING

When using the Hydro Test, make sure personnel are in the clear before cycling the landing gear. Apply hydraulic pressure carefully; gear and door operations are rapid when hydraulic flow is set near the full capacity of the Hydro Test Unit.

A hydraulic test unit may be assembled locally, if desired. Specifications for a test unit are listed in the following chart.

1. Flow	1.25 gpm
2. Reservoir	1 gallon
3. Check valve	Aft of pump in pressure line
4. Filter	3 gpm, 10 micro in pressure line after pump and before relief valve.
5. Relief Valve	Pressure line after filter and discharging to reservoir.
6. Relief Valve Setting	1700.0 crack to 15000' psi (min) reset.
7. Pressure Gage	2000 psi dual on pressure line and snubbed.

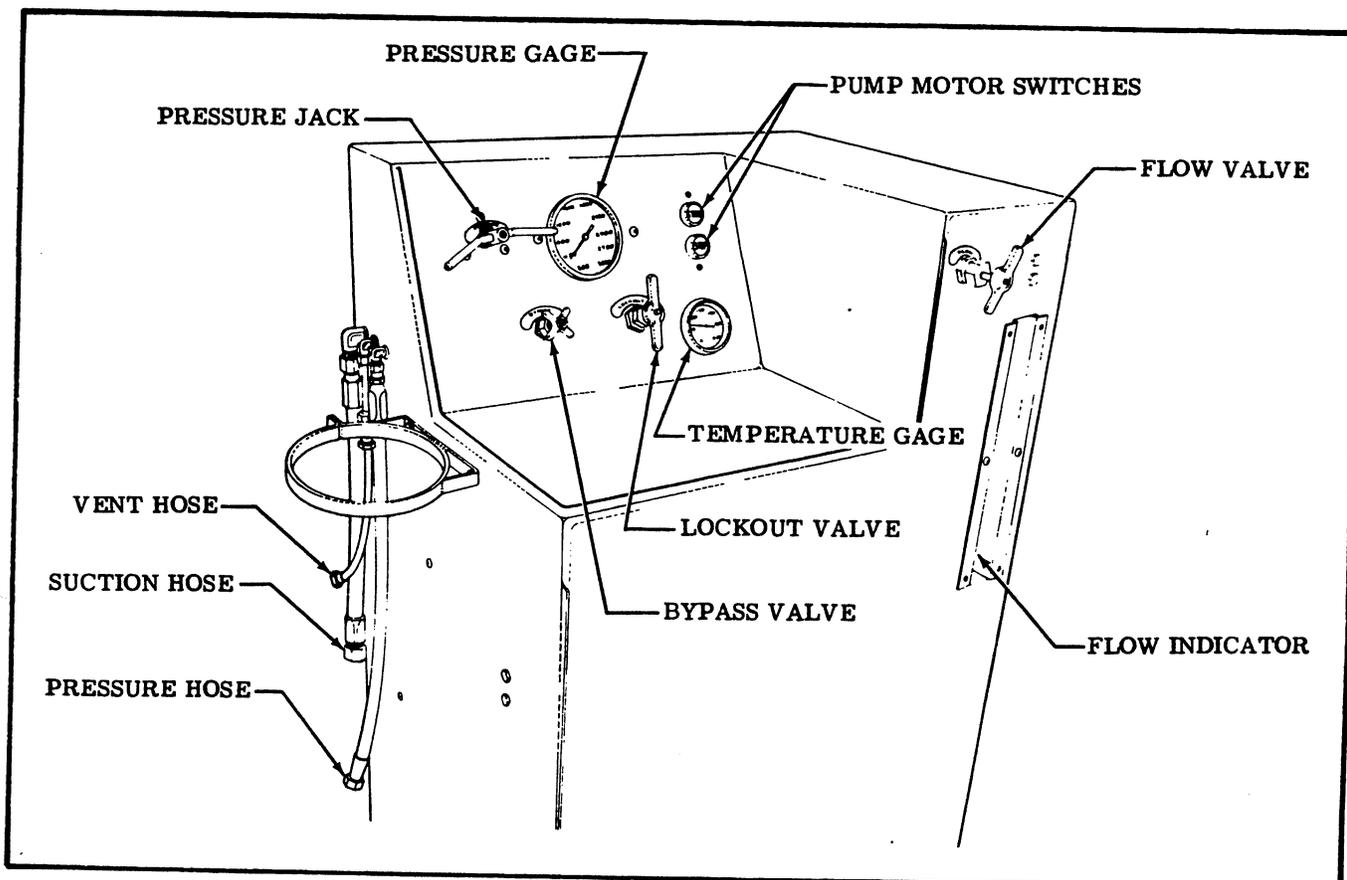


Figure 5-26. Hydro Test Unit

- | | |
|----------------------------|------------------------------|
| 8. Temperature Gage | 50° to 200° at pump outlet. |
| 9. Suction Hose and Lines | -8 (1/2 inch tube size)(min) |
| 10. Pressure Hose and Line | -4 (1/4 inch tube size)(min) |
| 11. Power Input | 3 hp (desired) 2 hp (min) |

CAUTION

Means should be provided to keep connections to aircraft system clean and free of foreign material at all times.

5-159. OPERATION.

- a. Always open bypass valve before starting test stand motor. This will permit motor to start under a no-load condition and will contribute to the service life of the test stand unit.
- b. Operation of the test stand with bypass and lock-out valves closed at the same time should not be continued for more than one minute.
- c. Avoid continuous operation of the test stand under high-pressure - low flow condition; this will cause rapid heating of the fluid supply. When pressure is no longer needed, open bypass valve to relieve pressure.

- d. Cap all hoses and stow on rack when not in use.
- e. Avoid contamination of test stand fluid by checking condition of fluid in aircraft system before connecting test stand.
- f. Before disconnecting test stand, check that aircraft reservoir is full; fluid may siphon from aircraft reservoir to test stand if idle for a period of time.

NOTE

The Hydro Test unit is a precision test instrument as well as a hydraulic power source. The retention of its accuracy and the length of its service life depends on good care and proper operation.

5-160. FLOW REGULATION. The following procedure is used to adjust the test unit flow to any valve desired for a specific operation, with the test unit connected to the aircraft hydraulic system and the aircraft on jacks.

- a. Open bypass valve and lockout valve.
- b. Start test unit pump motor.
- c. Close bypass valve.
- d. Open flow valve, then slowly close it until indicator in flow gage sight glass aligns with mark indicating desired flow. To read flow indicator, match line on widest part of indicator with fixed line on external part of gage.

5-161. CONNECTING TEST UNIT TO AIRCRAFT.
(Refer to figure 5-25.)

CAUTION

- a. Remove front engine cowling for access.
- b. Disconnect hydraulic pump suction hose from firewall fitting, connect test stand suction hose to fitting and cap disconnected pump hose.
- c. Disconnect hydraulic pump pressure hose from fitting in filter at firewall, connect test stand pressure hose to the fitting and cap disconnected pump pressure hose.
- d. Connect test stand vent hose to aircraft reservoir vent line protruding below lower edge of firewall, using care to ensure that line is wiped clean and is free of any foreign material. If line is dirty internally, remove, clean and reinstall.
- d. Connect test stand electrical cable to appropriate power source.

5-162. DISCONNECTING TEST STAND FROM AIRCRAFT. (Refer to figure 5-25.)

- a. Check that landing gear is down and locked and gear doors are closed.
- b. With bypass valve closed and lockout valve open, operate test stand until aircraft hydraulic reservoir is full; then open bypass valve and stop test stand pump motor.
- c. Disconnect all test stand hoses from aircraft immediately, beginning with the suction hose. If the suction hose is left connected, fluid will siphon from the aircraft reservoir to the test stand reservoir.
- d. Connect all aircraft hydraulic lines and install engine cowling.

5-163. BLEEDING AIRCRAFT HYDRAULIC SYSTEM.**NOTE**

There is only one reason for having to bleed the hydraulic system: the entrance of considerable air into the hydraulic system. The most probable means of air entering the system are: permitting reservoir fluid level to become too low; air leaks in the engine - driven pump or pump suction line and poor maintenance procedures when connecting fluid lines or replacing components.

- a. Jack aircraft as outlined in Section 2.
- b. Connect test stand in accordance with paragraph 5-161.
- c. Use test stand to operate landing gear through five complete cycles.
- d. Use only clean filtered hydraulic fluid (MIL-H-5606) to fill hydraulic system and test stand.
- e. Hydraulic fluid preservative (MIL-H-6083) may be used for flushing and storage of hydraulic components.

5-164. USE OF TEST STAND TO LEAK TEST HYDRAULIC SYSTEM AND COMPONENTS. (Refer to figure 5-25.)

- a. Jack aircraft in accordance with procedures outlined in Section 2.

When testing any actuator by applying pressure to one port of the cylinder, always have the opposite port open to atmospheric pressure, otherwise excessive pressure may be built up due to the differential in piston areas. The rod side of the piston has less area than the head side. All lines, fittings, actuators and any other parts subjected to hydraulic dead-end pressure in excess of 2275 psi for any length of time shall be considered faulty due to over stressing and shall be replaced.

- b. Connect test stand pressure hose to system or component to be tested. Use suitable fittings to make connection (refer to paragraph 5-161). The power pack must be bypassed.
- c. Set flow valve for minimum flow.
- d. Set locknut valve cracked open.
- e. Set bypass valve open.
- f. Set pressure jack out approximately 1-1/2 inches.
- g. Start test stand pump motor.
- h. Slowly close bypass valve until pressure reaches 1950 psi.
- i. Close lockout valve to trap fluid, then stop test stand pump motor immediately.
- j. Screw pressure jack in, increasing pressure to 2200 psi, and hold 5 minutes.
- k. Check for leaks while system or component is under pressure.
- l. After completion of tests, open test stand lockout valve to relieve pressure and disconnect test unit from system or component (refer to paragraph 5-162).
- m. Remove aircraft from jacks.

5-165. CYCLING LANDING GEAR.

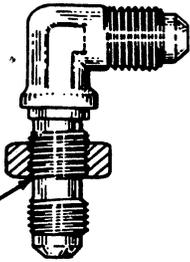
- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. Connect test stand as outlined in paragraph 5-161.
- c. Set test stand flow valve closed, lockout valve open and bypass valve open.
- d. Start test unit pump motor.
- e. Slowly close bypass valve completely.
- f. Observe fluid flowing through test unit sight gage. When all air bubbles have dissipated, operations may be continued.
- g. Use landing gear control handle in aircraft to operate the gear through cycles.

NOTE

Gear cycling can be prolonged by slowly opening the test unit bypass valve part way. This will bleed off part of the pump flow.

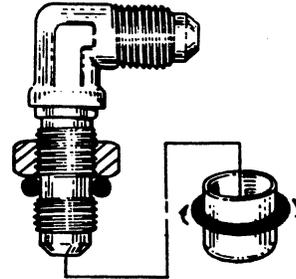
- h. After tests are completed, open test stand bypass valve and stop test stand motor.
- i. Disconnect test stand in accordance with paragraph 5-162.
- j. Remove aircraft from jacks.

1
INSTALL NUT



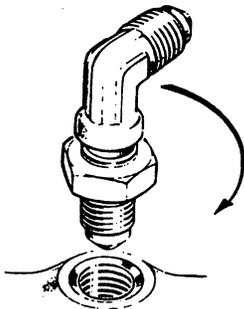
THESE THREADS MUST NOT PROTRUDE BELOW NUT. POSITION NUT EXACTLY AT TOP OF NON-THREADED AREA.

2
POSITION O-RING



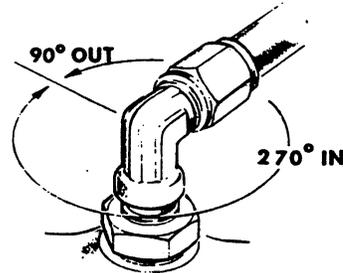
COVER THREADS WITH A PLASTIC THIMBLE OR TAPE, APPLY PETROLATUM TO O-RING, THEN ROLL IT UP INTO POSITION AGAINST NUT. REMOVE THIMBLE OR TAPE AFTER O-RING IS IN POSITION.

3
INSTALL ELBOW IN THREADS UNTIL O-RING CONTACTS CHAMFER, AND NUT CONTACTS FACE OF BOSS



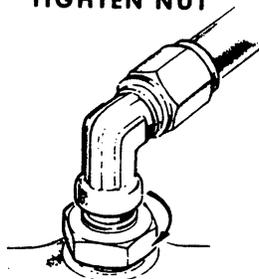
ROTATE NUT AND FITTING TOGETHER TO RETAIN THE ORIGINAL POSITION OF THE NUT ON THE FITTING.

4
ATTACH LINE TO ELBOW (ELBOW MAY BE TURNED TO LIMITS SHOWN TO ALIGN WITH HOSE OR LINE)



HOLD NUT STATIONARY, TURN FITTING TO DESIRED POSITION.

5
TIGHTEN NUT

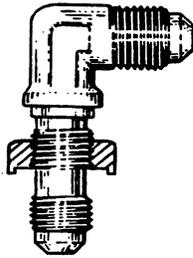


INSTALL O-RINGS CAREFULLY. MOST HYDRAULIC LEAKS ARE CAUSED BY CARELESS INSTALLATION.

Figure 5-27. Installation of Hydraulic Fittings (Sheet 1 of 2)

1

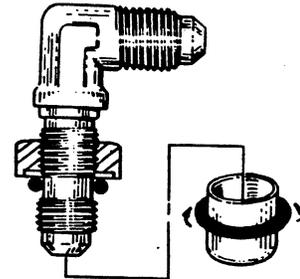
INSTALL NUT



POSITION NUT WITH RECESS DOWN.

2

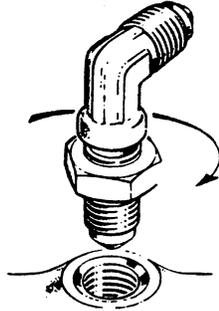
POSITION BACK-UP RING & O-RING



APPLY PETROLATUM TO BACK-UP RING AND O-RING, THEN WORK THEM UP INTO POSITION AGAINST NUT. TURN NUT DOWN UNTIL O-RING IS PUSHED DOWN FIRMLY AGAINST LOWER THREADS.

3

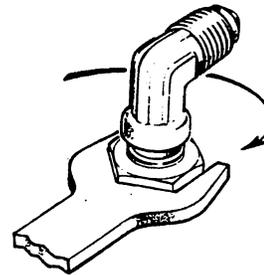
INSTALL ELBOW IN THREADS UNTIL O-RING CONTACTS FACE OF BOSS



ROTATE NUT AND FITTING TOGETHER TO RETAIN THE ORIGINAL POSITION OF THE NUT ON THE FITTING.

4

WITH NUT HELD, TURN FITTING IN 1/2 TURNS

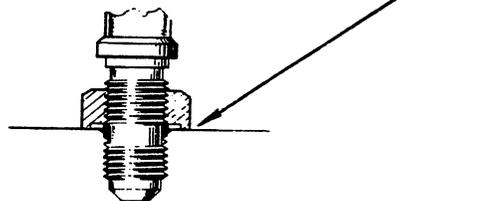


1-1/2 TURNS PLUS A MAXIMUM OF 1 ADDITIONAL TURN TO ALIGN WITH HYDRAULIC LINE.

ATTACH LINE TO FITTING.

5

TIGHTEN NUT UNTIL IT CONTACTS BOSS



INSTALL O-RINGS CAREFULLY. MOST HYDRAULIC LEAKS ARE CAUSED BY CARELESS INSTALLATION.

Figure 5-27. Installation of Hydraulic Fittings (Sheet 2 of 2)

5-166. CHECKING LANDING GEAR CYCLE TIME.

NOTE

When the hydraulic system is suspected of malfunction because the landing gear cycle time is slow, it could be caused by low fluid in the power pack reservoir, causing the hydraulic system to be full of air. This procedure will purge air from the system and fill the reservoir.

- a. Cycle landing gear through two complete cycles in accordance with paragraph 5-165.
- b. With landing gear extended, place gear handle in full-up position and record time required for gear to retract and doors to close. Time should not exceed 11.5 seconds (plus 4 seconds, minus 2 seconds) plus the time required for the time delay valve to operate (3 to 9 seconds at room temperature; colder temperatures will cause a longer delay).
- c. With landing gear retracted, place gear handle in full-down position and record time required for gear to extend and doors to close. Time should not exceed 10.5 seconds (plus 4 seconds, - 2 seconds) plus the time required for the time delay valve to operate (3 to 9 seconds at room temperature; colder temperatures will cause a longer delay).

NOTE

If time is within limits when operated by a test stand, but exceeds limits when operated by the engine - driven hydraulic pump, there is internal leakage in the

pump. Repair or replace pump. If time exceeds limits when operated either by test stand or hydraulic pump, internal leakage is in the hydraulic system. Check actuators for internal leakage; refer to paragraph 5-164, and repair or replace actuators as required. If actuators are not defective, power pack internal leakage is indicated. Repair or replace power pack.

5-167. HYDRO FILL UNIT. A portable special filler can (Part No. SE350), with a manually-operated pump, is available from the Cessna Service Parts Center. In addition to providing a handy means of filling hydraulic reservoirs, the unit may be used to bleed brake systems.

5-168. INSTALLATION OF HYDRAULIC FITTINGS. (Refer to figure 5-27.) Most hydraulic leaks are caused by careless installation of O-rings and fittings. The figure illustrates correct methods of installing hydraulic fittings and may be used as a guide during removal and installation of hydraulic system components.

5-169. HYDRAULIC SYSTEM COMPONENTS.

5-170. GENERAL DESCRIPTION. The hydraulic power system includes equipment required to provide a flow of pressurized hydraulic fluid to the retractable landing gear system. Main components of the hydraulic system are listed in the following chart. A detailed description and removal, disassembly, assembly and installation procedure for each component is included, beginning with paragraph 5-177.

ITEM	PURPOSE	LOCATION AND ACCESS
ENGINE-DRIVEN HYDRAULIC PUMP	To provide a flow of pressurized hydraulic fluid to the system.	Front engine accessory section, aft of starter. Remove upper cowling.
HYDRAULIC FILTER	To filter fluid from the pump before entering remainder of system.	Upper left side of front firewall. Remove upper engine cowling.
HYDRAULIC POWER PACK	(1) To "load" the engine-driven pump when landing gear handle is moved out of neutral. (2) To provide a reservoir of hydraulic fluid. (3) To afford control of gear and door systems through use of valves and appropriate passages.	Aft left side of front firewall, behind instrument panel.
EMERGENCY HAND PUMP	To provide emergency hydraulic pressure through use of hand pump.	Floorboard, just forward of front seats. Remove cover.

ITEM	PURPOSE	LOCATION AND ACCESS
DOOR CLOSE LOCK VALVE (BEGINNING WITH 33701427 & F33700052)	To hold wheel door actuators in the closed position by pressure trapped in the door close line.	In left-hand engine compartment; remove left engine cowl.

5-171. **HYDRAULIC COMPONENT REPAIR.** Since emphasis here is on repair and not overhaul of the basic components of the hydraulic system, it is unlikely that the mechanic will go through all of the procedures outlined. Instead, he will repair the particular item which is causing the difficulty.

NOTE

To isolate the item causing the malfunction, refer to the trouble shooting charts in paragraph 5-6, and if possible, check with test stand.

5-172. **REPAIR VERSUS REPLACEMENT.** Often the moderate trade-in price for a factory - rebuilt component is less than the accumulated cost of labor, parts, and (often time-consuming) trial and error adjustment. Repair or replacement of a component will depend on the time, equipment and skilled labor that is locally available.

5-173. **REPAIR PARTS AND EQUIPMENT.** Repair parts may be ordered from the applicable Parts Catalog. Test equipment may be ordered from the Special Tools and Support Equipment Catalog. Both publications are available from the Cessna Service Parts Center.

5-174. **EQUIPMENT AND TOOLS.**

5-175. **HAND TOOLS.** The following hand tools are necessary for repair work on the power pack and other hydraulic components.

Snap Ring Pliers
Strap Wrench (for removing door solenoid and various cylinder barrels of the hydraulic actuators)

Pin Punches
Duck-bill Pliers
Box and Open-end Wrenches
Needle-nose Pliers

Locally fabricated items, handy for power pack re-

pair, are various 1/4" aluminum rods, ground to a gradual taper, and hooks, formed from brass welding rod, to extricate small plungers from hydraulic ports. The hook, formed on brass welding rod, must not be over 1/16 - inch in length, so as not to scratch or score the bore. Various sizes of Allen wrenches may be welded or brazed to "T" handles for use when removing, installing or adjusting the various internal wrenching plugs or valves.

5-176. **COMPRESSED AIR.** The easiest way to remove some hydraulic parts in inaccessible galleries of the power pack is a quick blast of compressed air from behind. Parts can be blown out in seconds, which would otherwise take endless "fishing" operations to extricate. An air hose and nozzle are common-sense tools.

5-177. **ENGINE-DRIVEN HYDRAULIC PUMP.** (Refer to figure 5-28.)

5-178. **DESCRIPTION.** The engine-driven hydraulic pump is a gear-type pump, and is mounted on the right rear accessory pad of the front engine.

5-179. **OPERATION.** The pump is driven at approximately 1-1/3 times crankshaft speed and supplies a controlled flow of hydraulic fluid to the power pack and hydraulic systems when the gear control handle is moved from neutral position. When gear control handle is in neutral, fluid circulates freely through the pump into the power pack and back to the reservoir. Pump flow is controlled to approximately one gallon-per-minute.

5-180. **REMOVAL.**

- a. Remove upper right cowling from front engine.
- b. Disconnect hydraulic lines from pump and cap or plug openings.
- c. Remove mounting nuts and remove pump from aircraft.
- d. Remove and discard mounting gasket.

SHOP NOTES:

5-181. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
HAND PUMP DOES NOT BUILD UP PRESSURE, BUT ENGINE PUMP OPERATES GEAR PROPERLY.	Faulty hand pump plunger check valve or O-ring.	Remove and inspect hand pump plunger; replace parts as needed.
	Faulty system inlet check valve or hand pump inlet check valve.	Remove Power Pack and repair or replace check valves.
ENGINE PUMP WILL NOT OPERATE GEAR BUT EMERGENCY HAND PUMP WILL OPERATE GEAR.	Fluid level low in reservoir.	Refill reservoir.
	Engine pump or pump line failure.	Repair or replace pump or broken pump line. Refill reservoir.
	Faulty primary relief valve.	Remove Power Pack, repair or replace primary relief valve.
ENGINE PUMP OR EMERGENCY PUMP WILL NOT BUILD PRESSURE IN SYSTEM.	No fluid in reservoir.	Refill reservoir.
	Broken gear or door line.	Repair or replace hydraulic line.
	Door solenoid valve jammed or sticking at mid-travel.	Repair solenoid valve.
	Faulty secondary relief valve.	Remove Power Pack, repair or replace secondary relief valve.

5-182. DISASSEMBLY. (Refer to paragraph 5-28.)

- a. Plug all ports and clean outside of pump with solvent.
- b. Position pump, shaft down, in a vise and tighten vise on pump mounting flange just enough to retain pump in the vise. Index mark pump housing (3) and front plate (12) to ensure correct reassembly.

CAUTION

Do not pry sections apart with a screw driver or other instrument, as scratches caused by the tool, will prevent sealing of mating surfaces when reassembled.

- c. Remove cap screws and washers (1 and 2), and lift off rear housing (3), by rocking from side-to-side and sliding off gear shafts and dowel pins (13).

NOTE

In case of sticking, tap sides lightly with a hard, non-metallic hammer. Further disassembly of pump housing is not necessary.

- d. Remove idler gear assembly (16).
- e. Remove snap ring (4) from drive shaft, and exercise care not to scratch bearing surface of drive shaft.
- f. Remove gear (5) and Key (6) from drive shaft (11).
- g. Remove remaining snap ring (4) from drive shaft (11).
- h. Remove drive shaft (11) from front housing (12) by pulling it out of housing by splined end.
- i. Remove diaphragm (15) from front plate (12) by prying with a sharp tool.
- j. Remove phenolic back-up gasket (7) and protector gasket (14) from front plate (12).
- k. Remove diaphragm seal (8) from front plate (12).
- l. Remove snap ring (10) and drive shaft seal (9) from bore in front plate (12).

5-183. INSPECTION OF PUMP. Clean all metal parts with cleaning solvent and dry with filtered compressed air. Prior to assembly, inspect all parts as follows.

ITEM	INSPECTION	REPAIR
GEARS AND SHAFTS	Inspect drive gear shaft for broken splines.	Replace shaft if damaged.

ITEM	INSPECTION	REPAIR
GEARS AND SHAFTS (Cont)	Inspect both the drive gear and idler gear shaft at bearing points and shaft seal areas for rough surfaces and excessive wear. If shafts measure less than .4360 in bearing area, they should be replaced.	Replace drive gear shaft. Replace idler gear shaft.
	Inspect gear face for scoring and excessive wear. If gear width is below .1950, drive gear or idler gear should be replaced.	Replace drive gear. Replace idler gear.
	Visually inspect snap rings on idler gear shaft. They should be in grooves.	Replace if necessary.
	Visually inspect edges of gear teeth to see if they are too sharp.	Break sharp edge with emery cloth.
FRONT PLATE ASSEMBLY	Visually inspect bearings for scratches or scoring. Measure I.D. of bearings. If I.D. measures more than .4400, front plate should be replaced.	Replace front plate assembly. (Bearings are not available as separate items.)
	Visually inspect bearings for proper positioning. Bearings should be flush with islands in groove pattern. Splits in bearings should be in line with dowel pin holes and in position closest to the respective dowel pin hole.	Replace front plate assembly if bearings are out of position. (Bearings are not available as separate items.)
REAR HOUSING	Visually inspect inside gear pockets for excessive scoring or wear. Also measure I.D. and depth of gear pockets. I.D. should not exceed 1.691 and depth should not exceed .1972.	If badly scored or wear exceeds dimensions given, replace rear housing assembly.
	Visually inspect bearings for scratches or scoring. I.D. should not exceed .4400.	If I.D. of bearing exceeds dimensions given, replace rear housing assembly.
	Visually inspect bearings for proper positioning. Splits in bearings should be in line with dowel pins and in position closest to the respective dowel pin.	If bearings are out of position, replace rear housing. (Bearings are not available as separate items.)

5-184. ASSEMBLY.

NOTE

Diaphragm (15), phenolic gasket (7), protector gasket (14), diaphragm seal (8), drive gear snap rings (4), shaft seal (9), snap ring (10), copper crush washer (2) and Key (6) should be replaced with new parts when reassembling hydraulic pump. A Major Seal Repair Kit (Part No. 20240-77), consisting of the parts listed in this note,

is available from the Cessna Service Parts Center.

a. Install new shaft seal (9) in front plate, with flat metal side of seal in front plate and the tapered internal part of seal toward pump shaft splines.

NOTE

Press shaft seal just deep enough to allow snap ring (16) to be installed in groove.

DOUBLE LIP SEAL

SINGLE LIP SEAL



INSTALL "CLOSED"
END TOWARD PUMP
SHAFT SPLINES

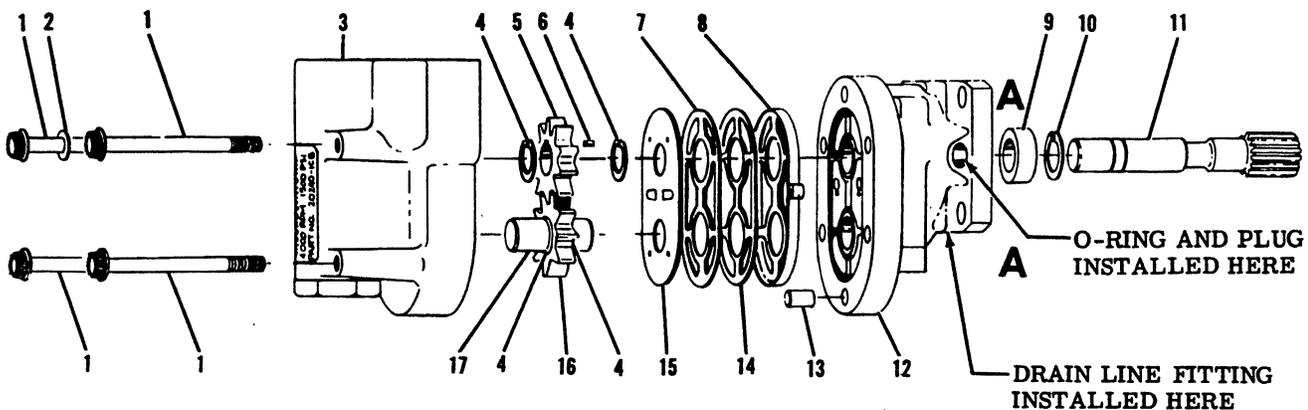


INSTALL "OPEN" END
TOWARD PUMP SHAFT
SPLINES

Section A-A

(USED ON ALL LATER SERIAL NO.
PUMPS AND ALL SERVICE PARTS)

(USED ON EARLY
SERIAL NO. PUMPS)



- 1. Cap Screw
- 2. Copper Crush Gasket
- 3. Rear Housing Assembly
- 4. Snap Ring
- 5. Gear
- 6. Key

- 7. Phenolic Back-Up Gasket
- 8. Diaphragm Seal
- 9. Shaft Seal
- 10. Snap Ring
- 11. Drive Shaft

- 12. Front Plate Assembly
- 13. Dowel Pin
- 14. Protector Gasket
- 15. Diaphragm
- 16. Idler Gear
- 17. Idler Gear Shaft

Figure 5-28. Hydraulic Pump Assembly

- b. Install snap ring (10) in groove in front plate (12) with sharp edge of snap ring toward shaft splines.
- c. Place diaphragm seal (8) on front plate (12), with flat side of seal down (cup side of seal up). Using a dull pointed tool, work diaphragm seal to bottom of grooves in front plate. Ensure that seal is all the way down in grooves of front plate.
- d. Press protector gasket (14) and phenolic back-up gasket (7) into cup of diaphragm seal.
- e. Place diaphragm (15) on top of phenolic back-up gasket with bronze face of diaphragm up, next to the gears. The two small depressions on the bronze face must match the two depressed areas in the rear housing.

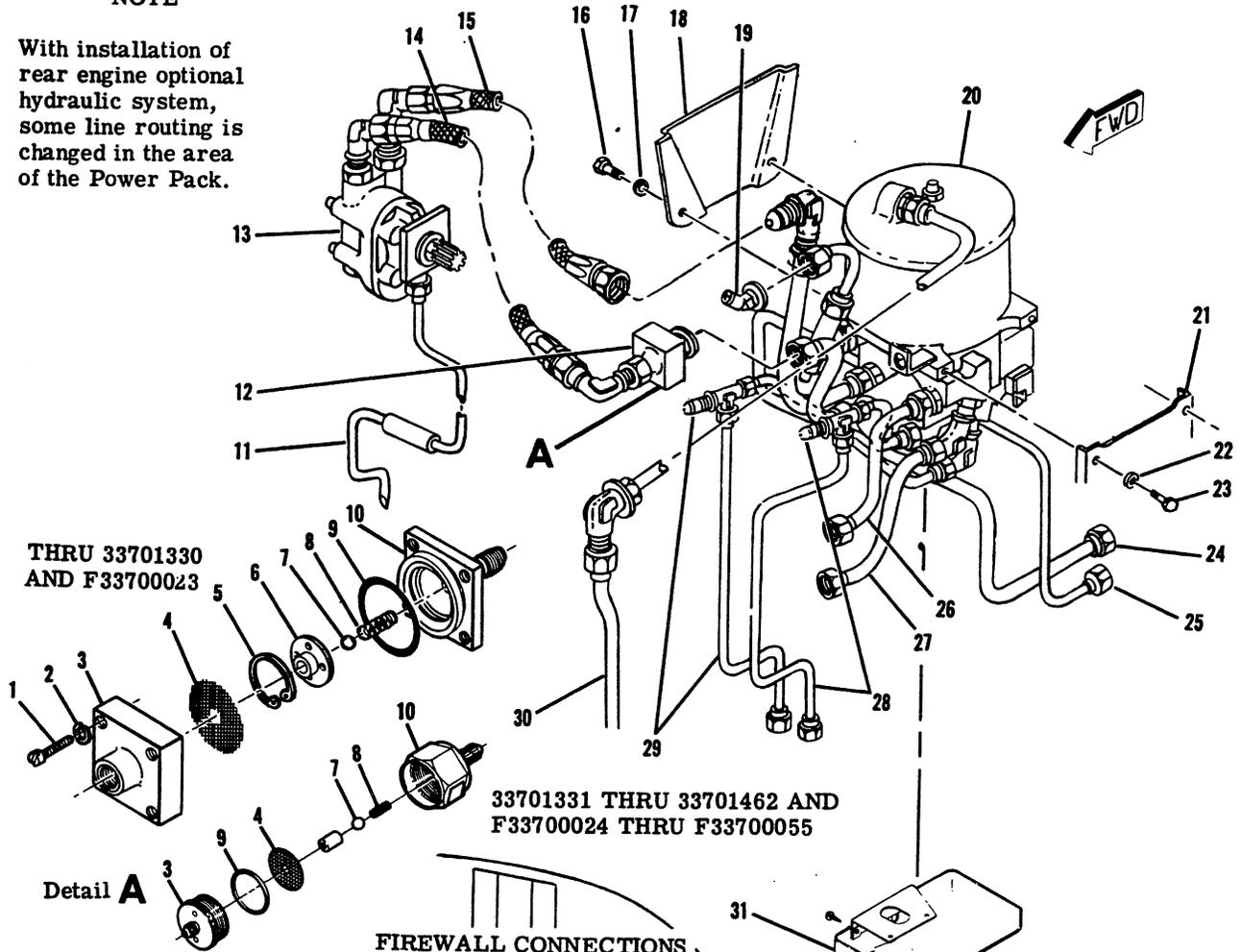
NOTE

Protector gasket (14), phenolic back-up gasket (7) and diaphragm (15) must fit inside cup of diaphragm seal (8).

- f. Coat drive shaft (11) with grease to prevent damage to seal (9) as drive shaft is installed.
- g. Work drive shaft (11) through shaft seal (9) and into position.
- h. Install snap ring (4) in groove on shaft next to diaphragm.
- i. Place Key (6) in slot in drive shaft and install gear (5) over Key in shaft.

NOTE

With installation of rear engine optional hydraulic system, some line routing is changed in the area of the Power Pack.



THRU 33701330
AND F33700023

33701331 THRU 33701462 AND
F33700024 THRU F33700055

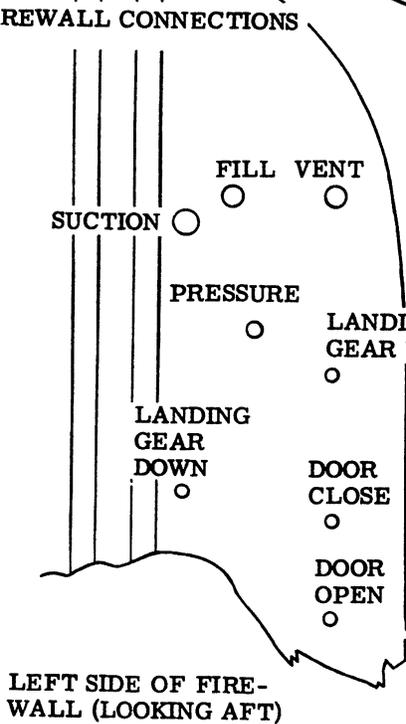
Detail A

NOTE

A face-spanner wrench, (Tool #418, available from Armstrong Bros., 5200-5300 W. Armstrong Ave., Chicago, Ill.) or equivalent, may be used to remove end gland from hydraulic filter, serialized 33701331 thru 33701462 and F33700024 thru F33700055.

1. Screw
2. Lockwasher
3. End Fitting
4. Filter Disc
5. Snap Ring
6. Spider
7. Ball
8. Spring
9. O-Ring
10. Body
11. Pump Drain Line
12. Hydraulic Filter
13. Hydraulic Pump
14. Pump Pressure Line
15. Pump Suction Line

FIREWALL CONNECTIONS



16. Mounting Bolt
17. Washer
18. Mounting Bracket
19. Filler Elbow
20. Power Pack
21. Mounting Bracket
22. Washer
23. Mounting Bolt
24. Hand Pump Suction Line
25. Hand Pump Pressure Line
26. Door Close Line
27. Door Open Line
28. Gear Up Line
29. Gear Down Line
30. Overboard Vent Line
31. Cover

Figure 5-29. Hydraulic Power System

- j. Install snap ring (4) in groove of shaft (11) next to gear (5).
- k. Install idler gear assembly (16).
- l. Slide rear housing assembly (3) over gear shafts until dowel pins (13) are engaged.
- m. Install cap screws (1) with copper crush washer (2) on the 1-3/4 inch long screw which passes through the suction port of the pump. Tighten cap screws evenly to torque value of 7-10 lb-ft.
- n. Rotate pump shaft by hand. Pump will have a small amount of drag, but should turn freely after a short period of use.

5-185. INSTALLATION. (Refer to figure 5-29.)

- a. Install a new mounting gasket on accessory pad.
- b. Grease pump splines lightly with all purpose grease, and slide pump into position, rotating pump splines as necessary for smooth meshing of splines.
- c. Install mounting nuts and tighten. Connect hydraulic lines to pump.
- d. To prevent initial dry-running of pump, loosen suction hose fitting at pump inlet and disconnect power pack reservoir drain line from firewall fitting.
- e. Connect suitable filler unit to reservoir filler elbow; hold finger over open end of reservoir drain line fitting at firewall and fill reservoir until fluid is forced from loosened end of suction hose.
- f. Tighten suction hose fitting, connect reservoir drain line and disconnect filler unit.
- g. Install engine cowling.

5-186. HYDRAULIC FLUID FILTER. (Refer to figure 5-29.)

5-187. DESCRIPTION. The hydraulic fluid filter consists of a filter body, spring, check-ball, filter disc, inlet and outlet fittings for hydraulic lines and attaching parts.

5-188. OPERATION. The filter is located in the pump pressure line at the forward side of the front firewall, and filters the hydraulic fluid from the pump before it enters the power pack. The filter contains a bypass valve which will open and supply the system with fluid if the filter disc should become clogged.

5-189. REMOVAL.

- a. Remove cowling from front engine.
- b. Disconnect hydraulic lines at filter and cap or plug openings.
- c. Remove filter from aircraft.

5-190. DISASSEMBLY. (Thru 33701330 and F33700023).

- a. Cut safety wire and remove screws securing end fitting (3) to filter body (10).
- b. Remove filter disc (4) from end fitting, using care to prevent damage to parts.
- c. Remove snap ring (5), spider (6), check-ball (7) and spring (8) from filter body.
- d. Remove and discard O-ring (9).

5-191. INSPECTION OF PARTS.

- a. Clean all metal parts with solvent (Federal Specification P-S-661).
- b. Inspect all parts for damage; replace faulty parts.
- c. Use care to keep dirt or foreign material from

parts after cleaning or during assembly.

5-192. ASSEMBLY. (Thru 33701330 and F33700023).

- a. Insert spring (8), check-ball (7) and spider (6) into filter body (10) and install snap ring (5).
- b. Lubricate new O-ring (7) with hydraulic fluid and install on filter body (10).
- c. Install disc (4) in end fitting (3), position fitting to filter body (10) and install screws securing assembly.
- d. Tighten screws evenly and safety wire.

5-193. DISASSEMBLY. (33701331 and F33700024 thru 33701462 and F33700055).

- a. Using face spanner wrench (refer to note on figure 5-24), remove end fitting (3).
- b. Remove O-ring (9), filter disc (4), retainer, ball (7) and spring (8) from filter body (10).
- c. Discard O-ring (9).

5-194. INSPECTION OF PARTS. (Refer to paragraph 5-191.)

5-195. ASSEMBLY. (33701331 and F33700024 thru 33701462 and F33700055).

- a. Install O-ring (9) on end fitting (3).
- b. Insert spring (8), ball (7), retainer and filter disc (4) in filter body (10).
- c. Install end fitting on filter body and tighten with face-spanner wrench. (Refer to note on figure 5-29.)

5-196. INSTALLATION.

- a. Position filter assembly to hydraulic lines, uncap or unplug openings and connect lines to filter.
- b. Install engine cowling.

5-197. HYDRAULIC POWER PACK. (Refer to figure 5-30.)

5-198. DESCRIPTION. The hydraulic power pack, located in the cabin on the aft left side of the front firewall, behind the instrument panel, is a multi-purpose control unit in the hydraulic system. The unit contains a hydraulic fluid reservoir, valves which control the flow of pressurized hydraulic fluid to actuators in the landing gear and door system, and an electrical switch, connected to the gear warning horn and indicator lights.

5-199. OPERATION. (Refer to paragraph 5-3.)

5-200. REMOVAL. (Refer to figure 5-29.)

- a. Remove front seats in accordance with procedures outlined in Section 3.

NOTE

As hydraulic lines are disconnected or removed, cap or plug all openings to keep dirt and foreign material out of system and components.

- b. Use a protective cover over floor covering and position a gallon container under fill - and - drain tee; loosen pressure cap and drain reservoir. Use of a funnel and hose will simplify draining.
- c. Remove drain hose, cover floor under power

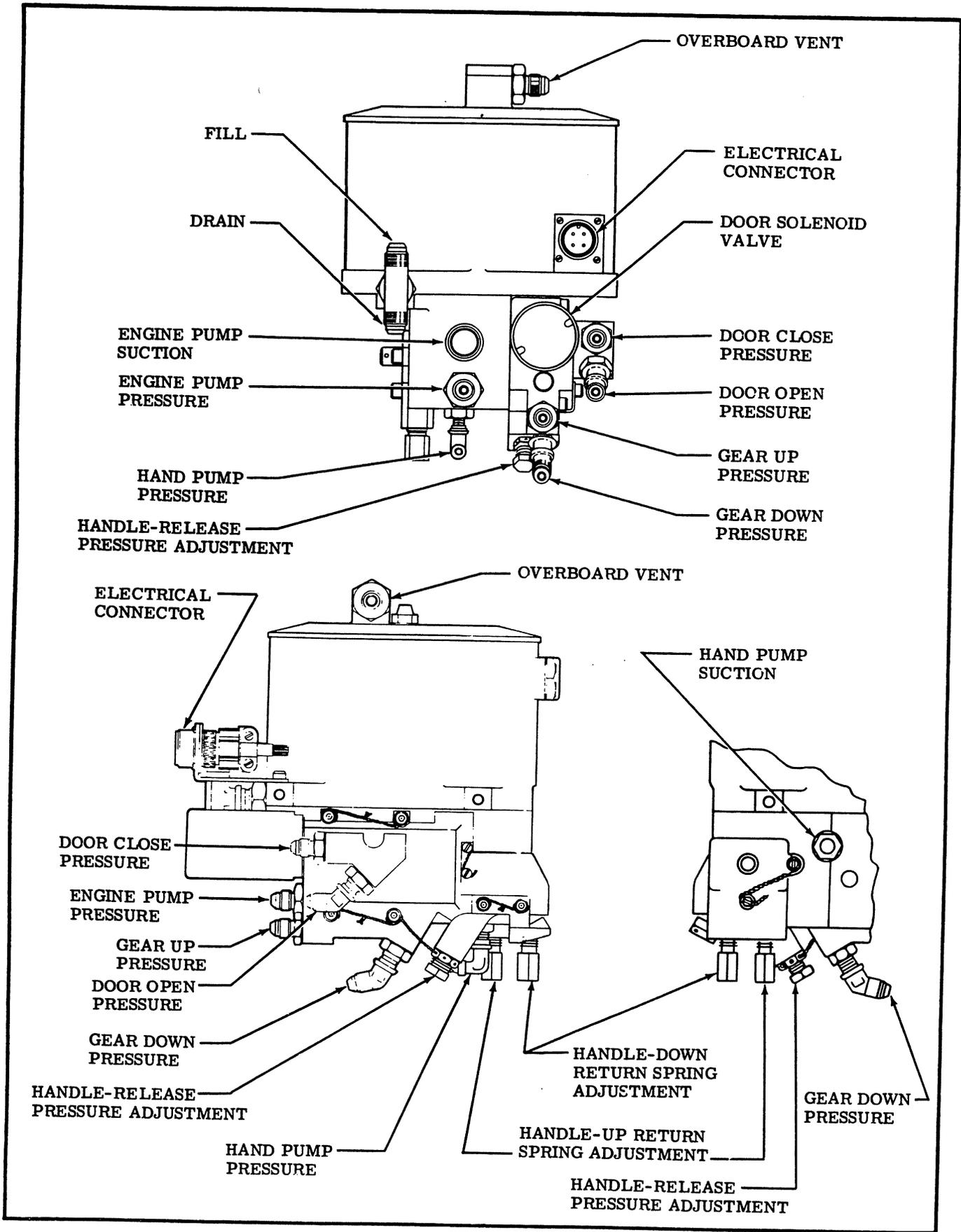


Figure 5-30. Location of Power Pack Fittings (Sheet 1 of 2)

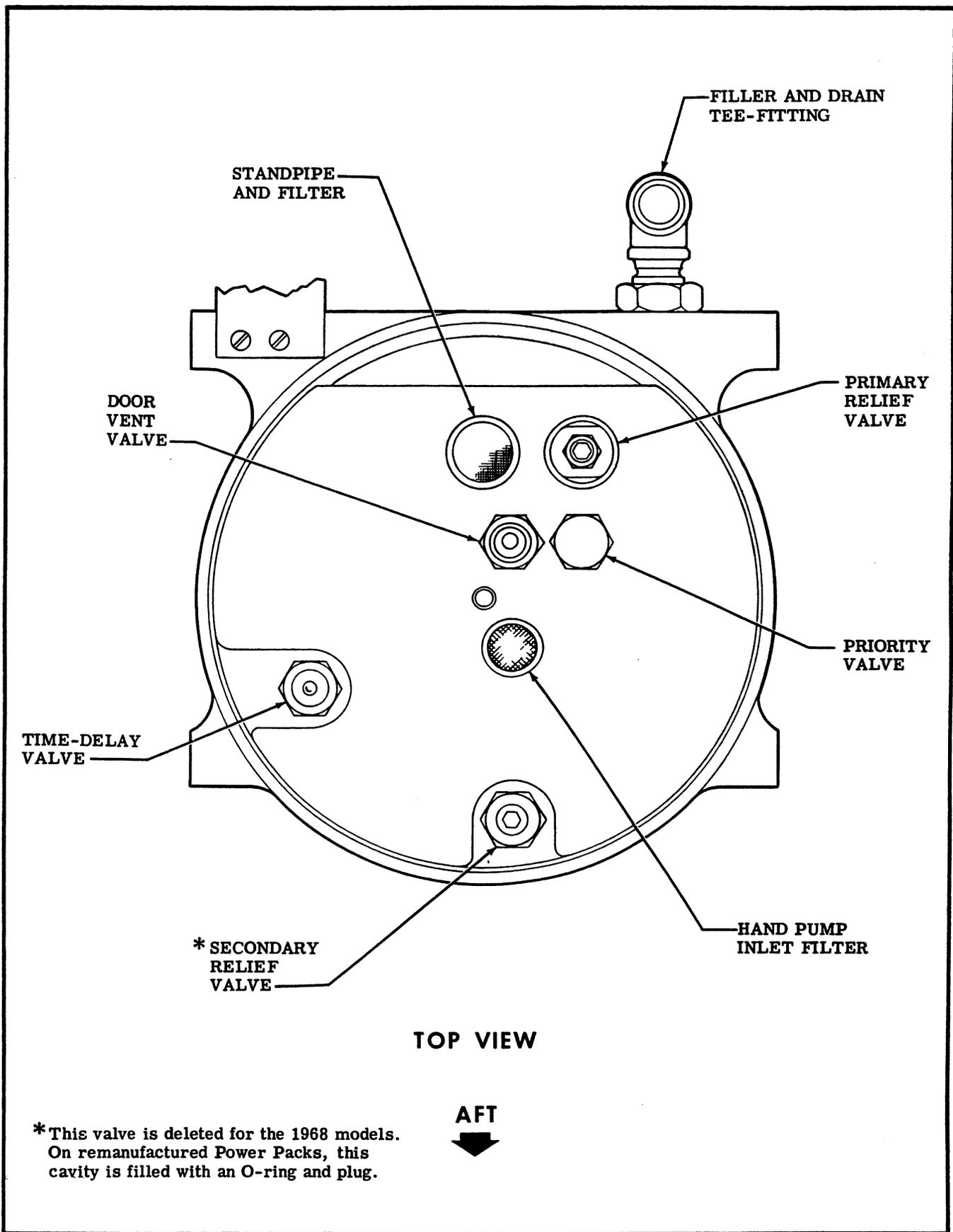


Figure 5-30. Location of Power Pack Fittings (Sheet 2 of 2)

- pack and disconnect all lines at power pack.
- d. Remove roll pin securing gear control tube to power pack shaft, and slide linkage clear of shaft.
- e. Disconnect brake hose under power pack and swing to one side.
- f. Remove forward sections of hydraulic lines

- routed to emergency hand pump. (Loosen or remove left forward upholstery panel as required for access.)
- g. Disconnect electrical plug at back of power pack.
- h. Remove mounting bolts and carefully work power pack down and aft to remove.

5-201. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
GEAR CONTROL HANDLE WILL NOT LOCK IN UP OR DOWN DETENT.	Handle release valve plunger setting too low or incorrect return spring adjustment.	Adjust handle release valve and return springs.
GEAR CONTROL HANDLE RETURNS TO NEUTRAL BEFORE DOORS CLOSE.	Fluid low in reservoir, causing air in time-delay valve.	Fill reservoir and purge time-delay.
	Time-delay valve stuck or will not hold fluid charge due to faulty time-delay valve ball seat.	Remove Power Pack and replace time-delay valve seat.
GEAR CONTROL HANDLE FAILS TO RETURN TO NEUTRAL AFTER DOORS CLOSE (3 to 9 SECONDS).	Landing gear handle release pressure too high.	Adjust handle release pressure.
	Landing gear handle return springs setting too low.	Adjust return springs.
	Landing gear handle linkage binding.	Remove Power Pack, repair or replace handle shaft.
	Landing gear selector spool binding.	Remove Power Pack and replace manifold, selector spool and time-delay valve plunger as an assembly only.
<p>NOTE</p> <p>Extremely cold temperatures will cause a longer time delay before handle trips after the doors close. This is normal. If landing gear handle does not return to neutral properly, Power Pack overheating will result.</p>		
POWER PACK EXTERNAL LEAKAGE. SLIDING SEALS: (Seals having a moving part.)	Handle release plunger.	Remove release plunger and replace O-rings.
	Landing gear selector spool.	Remove Power Pack and replace O-ring on spool and in manifold.
	Priority valve.	Remove Power Pack and replace priority valve seals.
	Hand pump plunger gland.	Remove hand pump plunger and replace O-rings.
POWER PACK EXTERNAL LEAKAGE. STATIC SEALS: (Seals with no moving parts.)	All fittings.	Remove and replace O-rings and back-up rings as required.
	Door solenoid.	Replace O-ring.

5-201. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
POWER PACK EXTERNAL LEAKAGE. STATIC SEALS: (Seals with no moving parts) (Cont).	Transfer tubes between manifold and body.	Remove Power Pack, disassemble and replace O-rings.
	Time-delay valve.	Remove Power Pack, disassemble and replace O-rings.
	Reservoir cover.	Replace seals.
POWER PACK LOSES FLUID WITH NO EVIDENCE OF LEAKAGE.	Air leak at engine pump shaft seal.	Repair or replace engine pump.
	Air leak in suction line to engine pump.	Repair or replace suction line or fittings.
NOTE		
Hydraulic fluid foams due to air being pumped into system and the fluid is blown overboard through the Power Pack vent line.		

5-202. DISASSEMBLY. (Refer to figure 5-31.)

NOTE

After the power pack has been removed from the aircraft, and all ports capped or plugged, spray with cleaning solvent (Federal Specification P-S-661, or equivalent) to remove all accumulated dust or dirt. Dry with filtered compressed air.

- a. Remove reservoir cover retaining nut and O-ring. Cover is a snug fit on reservoir. Use a soft mallet and tap cover lightly to remove. Remove large O-ring.
- b. Remove spacer from center stud, cut safety wire, and remove baffle from reservoir. Drain remaining hydraulic fluid from reservoir.
- c. Remove reservoir cover attaching stud (center). This stud may be removed by using a double lock nut at top of stud. Use care to prevent damage to stud threads.
- d. Turn Power Pack upside down so that top of reservoir serves as a support base.

NOTE

A holding fixture (Part No. HF-1025) may be used instead of removing the center stud if desired. This is a plate type fixture for use in a vise. The fixture is available from the Cessna Service Parts Center.

- e. Remove screws attaching electrical wires to terminal strip and Power Pack. Remove small capacitor from beneath electrical wires and remove terminal strip.

NOTE

All electrical wires are coded with color stripes. Disregard color of wire terminals or plastic sleeving. If color codes are matched when wires are reinstalled, the wires will be connected correctly.

- f. Cut safety wire and remove screws attaching landing gear up-down switch and bracket. Retain washers between bracket and Power Pack.
- g. Turn Power Pack over and cut safety wire at time-delay valve.
- h. Remove time-delay valve ball, spring, spacer, and spring by removing time-delay valve retainer.

NOTE

Do not remove time-delay valve plunger until after manifold assembly has been removed.

- i. Cut safety wire and remove screws attaching gear and rack protective cover. Remove cover.
- j. Remove clamp attaching electrical wires to door solenoid valve and remove safety wire from door solenoid valve.
- k. Cut safety wire and remove four screws attaching manifold assembly. Work manifold assembly from Power Pack, taking care to prevent loss of transfer tubes between manifold and Power Pack.
- l. Remove the seven transfer tubes from manifold or Power Pack.

References for figure 5-31.

1. Standpipe and Filter

PRIMARY RELIEF VALVE

- 2. Poppet Seat
- 3. O-Ring
- 4. Back-Up Ring
- 5. Poppet
- 6. Ball
- 7. Button
- 8. Spring
- 9. Button
- 10. Retainer
- 11. Adjusting Screw
- 12. Locknut

PRIORITY VALVE

- 13. Poppet O-Ring
- 14. Poppet
- 15. Poppet Seat
- 16. Poppet Seat O-Ring
- 17. Retainer O-Ring
- 18. Retainer

- 19. Baffle
- 20. Spacer
- 21. Snap Ring

- 22. Vent Filter
- 23. Reservoir Cover O-Ring
- 24. Reservoir Cover
- 25. O-Ring
- 26. Cap Nut

SECONDARY RELIEF VALVE

- 27. Adjusting Plug
- 28. Retainer
- 29. Spring
- 30. Button
- 31. Ball
- 32. Seat
- 33. Seat O-Ring

- 34. Sight Gage

HAND PUMP INLET FILTER

- 35. Snap Ring
- 36. Spacer
- 37. Filter

TIME-DELAY VALVE

- 38. Retainer
- 39. Retainer Hex O-Ring
- 40. Ball
- 41. Spring
- 42. Spacer
- 43. Retainer Body O-Ring

- 44. Center Stud
- 45. Reservoir and Body Assembly

DOOR VENT VALVE

- 46. Retainer
- 47. O-Ring
- 48. Spring
- 49. Poppet
- 50. Body
- 51. Pin

PRIORITY VALVE ADJUSTMENT

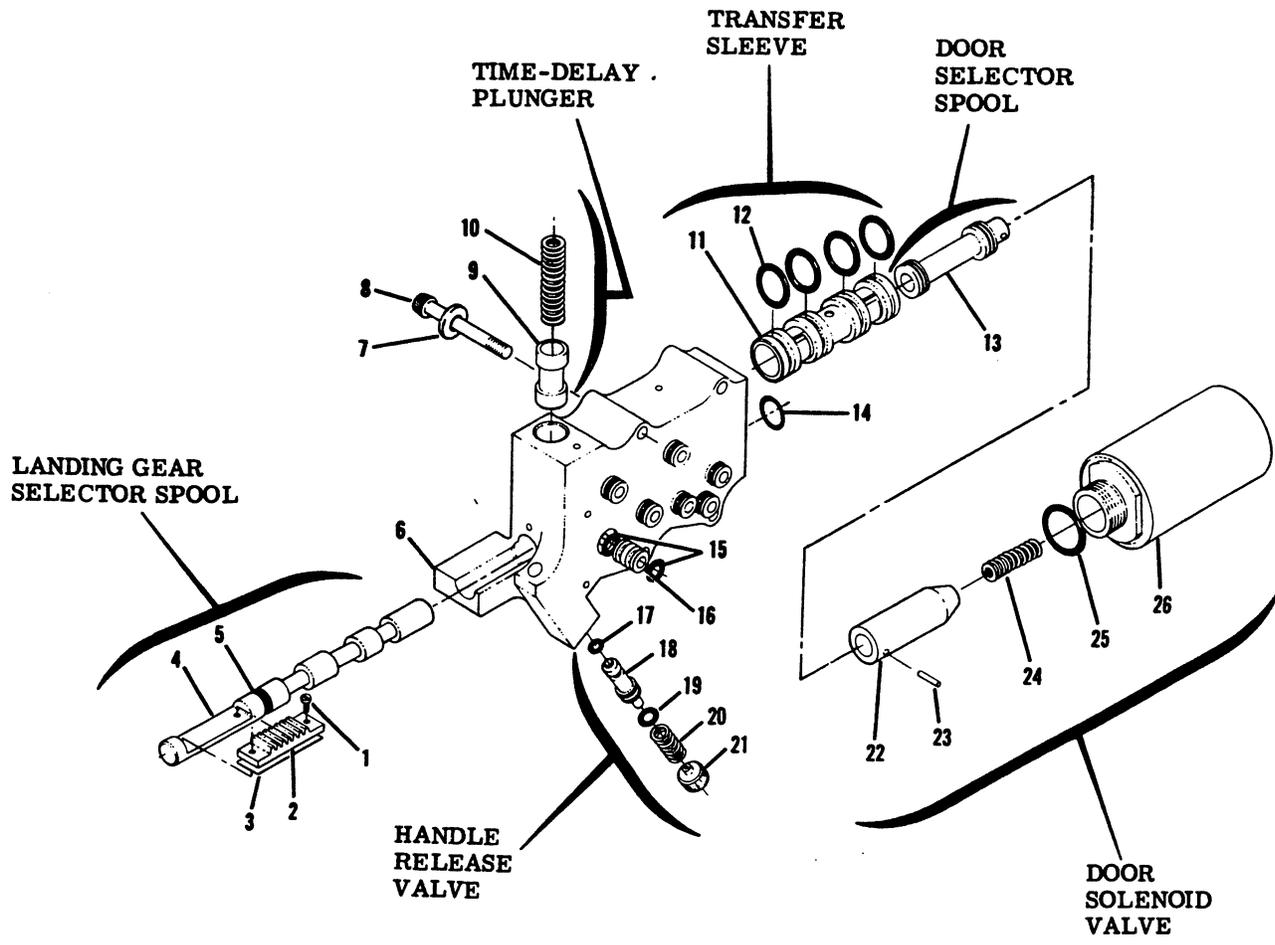
- 52. Button
- 53. Spring
- 54. Retainer (Adjusting Plug)

INLET CHECK VALVE

- 55. Pressure Inlet Fitting
- 56. Fitting O-Ring
- 57. O-Ring
- 58. Plunger
- 59. Spring

- 60. Snap Ring
- 61. Filler Line Filter

SHOP NOTES:



LANDING GEAR SELECTOR SPOOL

- 1. Screw
- 2. Rack
- 3. Laminated Shim
- 4. Spool
- 5. Spool O-Ring
- 6. Manifold
- 7. Washer
- 8. Allen Screw

TIME-DELAY PLUNGER

- 9. Plunger
- 10. Spring

TRANSFER SLEEVE

- 11. Sleeve
- 12. Sleeve O-Ring

- 13. Spool
- 14. O-Ring
- 15. Transfer Tube O-Rings
- 16. Transfer Tubes

HANDLE RELEASE VALVE

- 17. O-Ring
- 18. Poppet
- 19. Poppet O-Ring
- 20. Spring
- 21. Retainer (Adjusting Plug)

DOOR SOLENOID VALVE

- 22. Plunger
- 23. Pin
- 24. Spring
- 25. Solenoid O-Ring
- 26. Solenoid

Figure 5-32. Manifold Assembly

CAUTION

As the manifold is separated from the Power Pack body, the rack on the landing gear selector spool becomes disengaged from the gear on the handle. This will permit the selector spool to move. Do NOT move the selector spool from its position. Never move it to a position that is more than flush with the manifold body at the end opposite the selector spool rack. If moved beyond this position, an O-ring will become caught and the selector spool will then be extremely difficult to remove.

5-203. MANIFOLD DISASSEMBLY.

- a. Remove door solenoid by unscrewing from manifold. This solenoid is hand tightened. Use strap wrench or strip of sandpaper to grip door solenoid for removal. Remove plunger return spring.
- b. Remove plunger and spool by carefully pulling from manifold.
- c. Using a hook formed from brass welding rod and inserted into oil hole in transfer sleeve, withdraw sleeve from manifold.

NOTE

Be sure that end of hook is not over 1/16-inch long, and use with care to prevent scratching the bore in manifold. The sleeve will be hard to withdraw due to O-ring friction.

- d. Remove time-delay valve plunger, using a small wooden dowel inserted in center of plunger. The plunger should slide out of manifold easily.
- e. Remove landing gear selector spool by grasping rack end of spool and carefully pulling from manifold.

NOTE

Do not bend selector spool. Pull straight out. Do not remove gear rack from selector spool unless it is necessary to replace selector spool and manifold. The landing gear selector spool, time-delay plunger, and manifold are matched, lapped parts. If it is necessary to replace any one of these three parts, replace them as an assembly only.

- f. Remove landing gear handle-release retainer (adjusting plug), spring, and poppet from manifold. The end of the poppet has a ball which should remain in the poppet. If it doesn't, remove ball from manifold.
- g. Remove caps from fittings and wash manifold in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered compressed air. Be sure internal passages are clean, then reinstall caps on fittings.

5-204. DISASSEMBLY OF COMPONENTS.

5-205. SECONDARY RELIEF VALVE. (PRIOR TO 1968 MODELS.)

- a. Remove adjusting plug at top of secondary relief valve.

- b. Remove secondary relief valve retainer by unscrewing from body.
- c. Remove spring, button, and ball from body.
- d. Use a brass hook to remove seat from body. Use with care to prevent scratching bore.
- e. Remove O-ring from bottom of cavity.

5-206. PRIMARY RELIEF VALVE.

- a. Loosen lock nut at top of primary relief valve.
- b. Remove adjusting screw and lock nut from top of relief valve.
- c. Unscrew retainer.
- d. Remove two buttons, spring, and ball.
- e. Remove poppet from poppet seat by lifting out of poppet assembly. The poppet and poppet seat are matched parts.
- f. Using a brass hook not over 1/16-inch long, pull poppet seat up out of body. Hook through holes in side of seat and use care not to damage bore in body.

5-207. PRIORITY VALVE.

- a. Remove priority retainer from reservoir.
- b. Turn Power Pack upside down and remove retainer (adjusting plug), spring, and button from bottom of Power Pack.
- c. While Power Pack is upside down, push poppet and poppet seat into reservoir, using a punch of 1/8 inch maximum diameter. Make sure that face of punch is square and flat.

5-208. SYSTEM INLET CHECK VALVE.

- a. Remove system pressure port fitting.
- b. Remove O-ring, plunger, and spring. Spring and plunger should fall out of Power Pack after O-ring is removed. Use hook, if necessary, to remove O-ring.

5-209. STANDPIPE AND FILTER.

- a. The standpipe and filter assembly should not be removed unless it is damaged, since it is a press fit in the reservoir.
- b. Remove vent filter by removing the snap ring.
- c. Remove fill line filter by removing the fitting and snap ring.
- d. Remove hand pump filter by removing snap ring and spacer.

5-210. DOOR VENT VALVE.

- a. Remove door vent valve from reservoir. The door vent valve should not be disassembled except for replacement of parts.
- b. Remove pin from valve body and retainer. Use care when removing pin, as the spring is under a slight load.
- c. Remove retainer, O-ring, and poppet from valve body.

5-211. LANDING GEAR HANDLE-RELEASE MECHANISM.

- a. Remove two hex-head retainers (adjusting plugs), springs, and plungers from handle return housing.
- b. Cut safety wire and remove two screws attaching handle release housing to Power Pack, and remove the housing.
- c. Using a punch, drive roll pin from cam, and remove cam from landing gear handle shaft.
- d. Pull handle assembly from Power Pack.

NOTE

Do not remove spacer, detent cam, or gear from handle shaft except for replacement of parts.

5-212. ASSEMBLY OF POWER PACK. After power pack has been completely disassembled, remove and discard all O-rings and gaskets. Wash all parts in dry cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered compressed air. Inspect all threaded surfaces for serviceable condition and cleanliness. Inspect all parts for scratches, scores, chips, cracks, and indications of excessive wear. Use new O-rings and gaskets during reassembly. Lubricate all O-rings with Dow-Corning DC-4 compound during reassembly. Lubricate all threaded surfaces on the various valves in the Power Pack with MIL-G-81322 grease (or equivalent) before installing.

5-213. DOOR VENT VALVE.

- a. Install poppet in body and insert spring in body. Be sure that spring enters poppet.
- b. Lubricate and install O-ring on retainer and insert retainer in valve body. Align holes in retainer with holes in valve body.
- c. Install pin through valve body and retainer.
- d. Lubricate threads on valve body (MIL-G-81322) and install assembly in reservoir. Tighten securely.

5-214. STANDPIPE AND FILTER.

- a. If standpipe and filter assembly was removed, press into body until standpipe bottoms.
- b. Replace vent filter and snap ring.
- c. Install filler line filter and secure with snap ring.
- d. Install back-up ring and O-ring on fill and drain tee, and install tee.
- e. Install hand pump filter, spacer and snap ring.

5-215. SYSTEM INLET CHECK VALVE.

- a. With pressure port up, drop spring into port.
- b. Drop in plunger, making sure that small end of plunger goes into spring. Check freeness of plunger in body by depressing plunger against spring. Use small wood dowel or plastic rod to depress plunger when checking freedom of movement. Plunger must move freely in body bore.
- c. Lubricate and install O-rings on flange of fitting and at end of fitting. Lubricate threads (MIL-G-81322) insert fitting, start the threads and tighten securely.

5-216. PRIORITY VALVE.

- a. Lubricate and install O-ring on poppet and insert poppet in body through reservoir. Push poppet down firmly. Either surface may be used as seating surface.
- b. Inspect poppet seat for sharp seating edge. Lap as necessary to obtain a sharp seating edge. Lubricate and install O-ring on poppet seat.
- c. Install poppet seat in body through reservoir, with sharp seating edge toward poppet. Push poppet seat down firmly against poppet.
- d. Lubricate and install O-ring on retainer assembly, lubricate retainer threads (MIL-G-81322) and install retainer. Tighten securely.

- e. Turn power pack upside down, lubricate spring and button (MIL-G-81322) and install body. Apply lubricant to hold button in spring and install with button in hole first.

- f. Lubricate (MIL-G-81322) threads on retainer (adjusting plug) and install. This plug provides adjustment for the priority valve. Install flush at this time.

5-217. PRIMARY RELIEF VALVE.

- a. Inspect poppet and poppet seat for pitting or scoring. Since they are matched parts, if either or both are pitted or scored, replace as an assembly only.
- b. Lubricate and install O-ring and back-up ring on seat, insert poppet in seat, and install assembly in body.
- c. Lubricate ball, buttons and spring (MIL-G-81322). Install with ball entering hole first. Be sure that ball enters cavity at top of poppet.
- d. Lubricate threads on retainer (MIL-G-81322) and install over button and spring. Tighten securely.
- e. Lubricate threads of adjusting screw MIL-G-81322) and install at top of retainer. Turn adjusting screw full down to lock primary relief valve closed, but do not tighten lock nut. This is done so that the secondary relief valve, which opens at a higher pressure, can be adjusted before the primary relief valve is adjusted.

5-218. SECONDARY RELIEF VALVE. (PRIOR TO 1968 MODELS.)

- a. Lubricate and install O-ring in body. Make sure O-ring seats properly.
- b. Inspect seating surface of seat. It should have a very sharp edge. Seat may be lapped to obtain a sharp edge.
- c. Install seat in body, with sharp edge of seating surface up.
- d. Apply lubricant (MIL-G-81322) to hold ball, button and spring together, and insert in body with ball toward seat.
- e. Lubricate threads on retainer (MIL-G-81322). Start retainer over spring and tighten securely.
- f. Lubricate threads on adjusting plug (MIL-G-81322) and install at top of retainer. Do not tighten adjusting plug. Screw it down only until spring is contacted. This is done so that air may be bled from valve during adjustment.

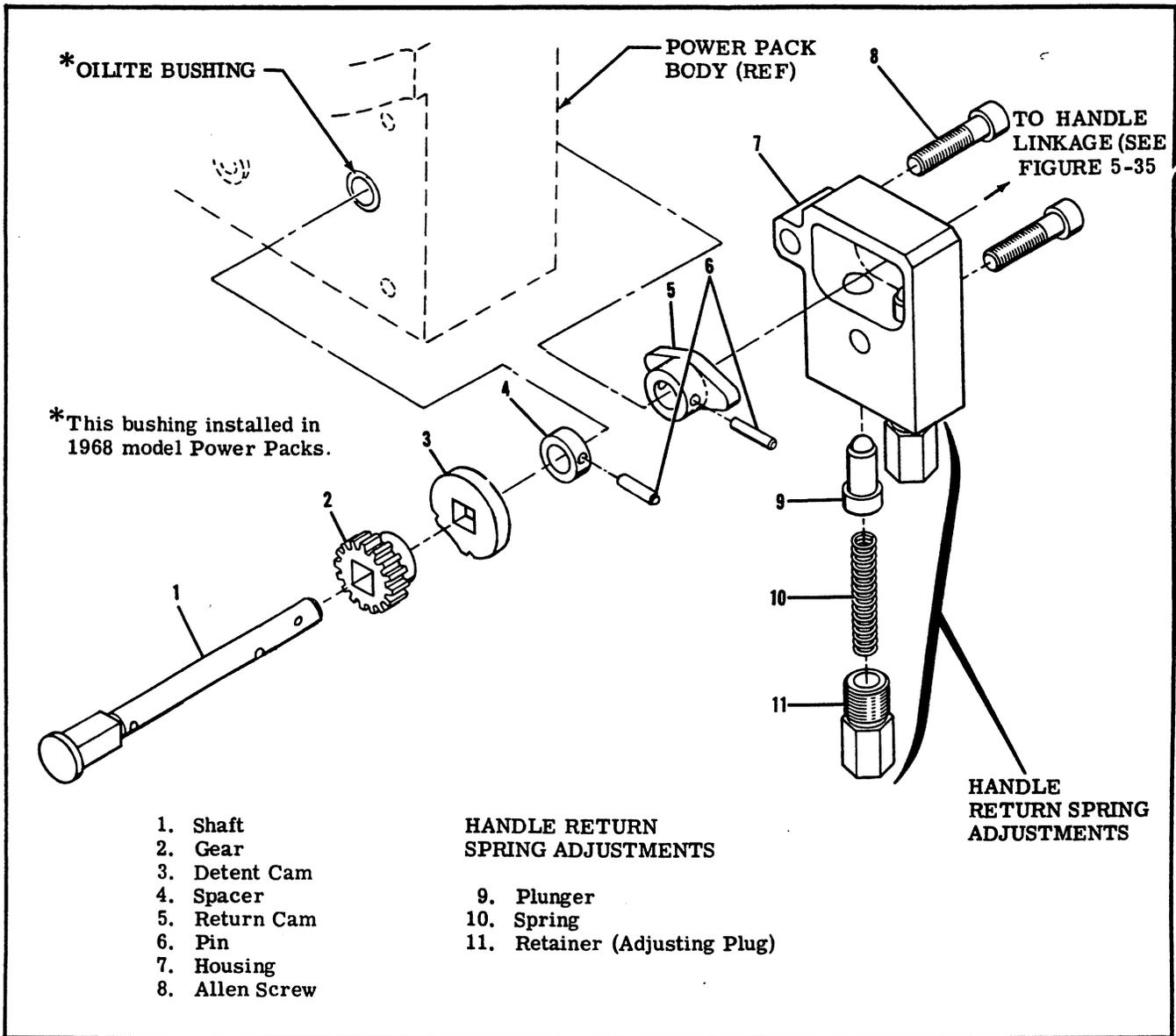
5-219. MANIFOLD ASSEMBLY.

- a. Lubricate and install the O-ring on landing gear selector spool, and the O-ring in manifold at the opposite end.

NOTE

If landing gear selector spool, manifold, and time-delay plunger are being replaced, install rack with a new laminated shim on selector spool. The landing gear selector spool, time-delay valve plunger, and manifold are matched, lapped parts. If necessary to replace, replace as an assembly only.

- b. Insert selector spool in manifold from landing gear handle end of manifold. Insert only until end of



5-33. Handle-Release Mechanism

SHOP NOTES:

selector spool is flush with solenoid end of manifold.

CAUTION

If the selector spool is moved much more than flush with the manifold at the end opposite the rack (before the manifold is installed and the rack engaged properly with the gear on the landing gear handle), an O-ring will become caught. The selector spool will then have to be removed, the manifold cleaned to remove all O-ring particles, and a new O-ring installed. The selector spool then must be reinstalled correctly.

- c. Check that spool slides freely.
- d. Inspect door solenoid spool for freedom of movement within the transfer sleeve assembly.

NOTE

Spool and sleeve are matched parts. If necessary to replace, replace as an assembly only.

- e. Lubricate and install O-rings on transfer sleeve and install sleeve in manifold.
- f. Attach plunger to door selector spool with pin.
- g. Lubricate and install O-ring on solenoid.
- h. Lubricate solenoid threads and spring (MIL-G-81322) and insert into plunger, then install solenoid over spring and plunger. Screw solenoid into manifold. Do not overtighten solenoid, but tighten securely by hand. Safety the solenoid to adjacent Power Pack mounting lug.

5-220. LANDING GEAR HANDLE-RELEASE MECHANISM.

- a. If the landing gear handle shaft or gear was removed, the parts must be indexed and assembled as shown in figure 5-34.
- b. Lubricate shaft (MIL-G-81322), install spacer on shaft with roll pin, and insert shaft into Power Pack.
- c. Install cam with roll pin. Both sides of cam surfaces are identical. Check landing gear shaft for freedom of movement in Power Pack. Check for slight end play in shaft. If shaft binds, remove cam and lap inside boss of cam to obtain slight end play in shaft with cam installed.
- d. Install handle-release housing and safety attaching screws. Check landing gear handle shaft for freedom of movement.

NOTE

Do not install plungers, springs, and hex-head retainers (adjusting plugs) at this time.

5-221. INSTALLATION OF MANIFOLD.

- a. Lubricate and install O-rings on the seven transfer tubes.
- b. Insert transfer tubes into Power Pack body.
- c. Install time-delay valve plunger in manifold. Plunger must move freely in manifold without binding.
- d. Mate manifold to Power Pack body, using care to prevent damage to O-rings on transfer tubes. Align dowel pin in Power Pack with dowel hole in

manifold.

NOTE

When installing manifold, time the landing gear handle shaft assembly to rack on selector spool as shown in figure 5-34. Refer to the following steps if binding occurs.

- e. Install four manifold attaching screws and washers. Torque screws to 20-30 pound-inches. Do not over-torque screws, as this will cause binding in the movement of landing gear handle shaft.

NOTE

If a new landing gear selector spool, time-delay plunger, and manifold (a matched assembly) are being installed, the rack on the selector spool must be shimmed properly to provide a slight backlash (free movement) between the teeth of the rack and the teeth of the gear on the handle. This adjustment is provided by a laminated shim. If excessive backlash exists, a new shim must be used. If no backlash exists, or if a new shim is being installed, the "trial-and-error" method should be used, since the backlash is determined after manifold attaching screws are installed and torqued. Remove one lamination at a time until backlash exists when screws are torqued properly, then do not remove any more laminations. Apply Loctite, Grade C, to rack retainer screws only after final adjustment of shim has been determined and screws are being installed for the last time.

- f. Lubricate and install two O-rings on time-delay valve retainer.
- g. Lubricate (MIL-G-81322) and insert larger spring and spacer in body through reservoir.
- h. Lubricate (MIL-G-81322) and insert ball and smaller spring in time-delay valve retainer (ball next to top of retainer).
- i. Lubricate threads on time-delay valve retainer (MIL-G-81322) and install retainer in body through reservoir. Do not overtighten time-delay valve retainer as this will cause the landing gear selector to bind in the manifold. After tightening time-delay valve retainer, check for freedom of movement of landing gear handle shaft and selector spool.
- j. Thoroughly lubricate handle return springs and plungers (MIL-G-81322) and install in housing with hex-head retainers. Do not tighten retainers at this time.
- k. Lubricate and install two O-rings on landing gear handle release plunger and insert plunger in body.
- l. Lubricate landing gear handle-release spring and retainer (MIL-G-81322) and install in body. Tighten retainer (adjusting plug) until almost flush with body.
- m. Install gear and rack protective cover. Safety attaching screws.
- n. Install landing gear up-down switch and the switch attaching bracket. Note that washers are

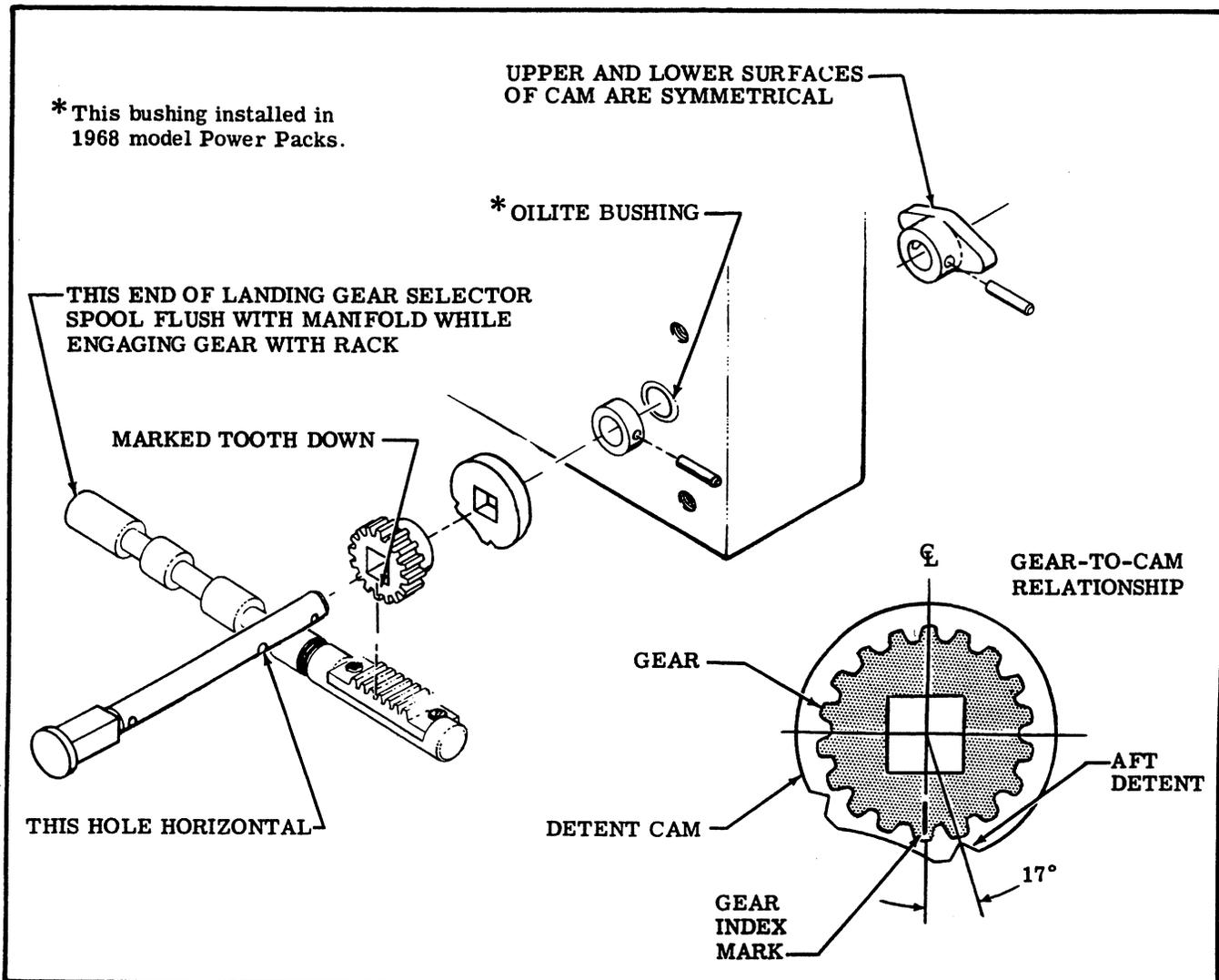


Figure 5-34. Timing of Handle Shaft and Selector Spool

used between the bracket and Power Pack. Switch bracket has slotted holes for switch adjustment

o. Install terminal strip and place capacitor alongside the strip. Connect electrical wires to terminal strip and ground, clamping wires to door solenoid valve.

NOTE

Electrical wires are coded with color stripes. Disregard color of wire terminals or plastic sleeving. If color codes are matched when wires are installed, the wires will be connected correctly.

p. Continue reassembly of Power Pack after pressure adjustments have been completed.

5-222. BENCH-TESTING THE HYDRAULIC POWER PACK.

NOTE

This procedure requires a minimum of test equipment and is intended for bench-testing the Power Pack after field repair.

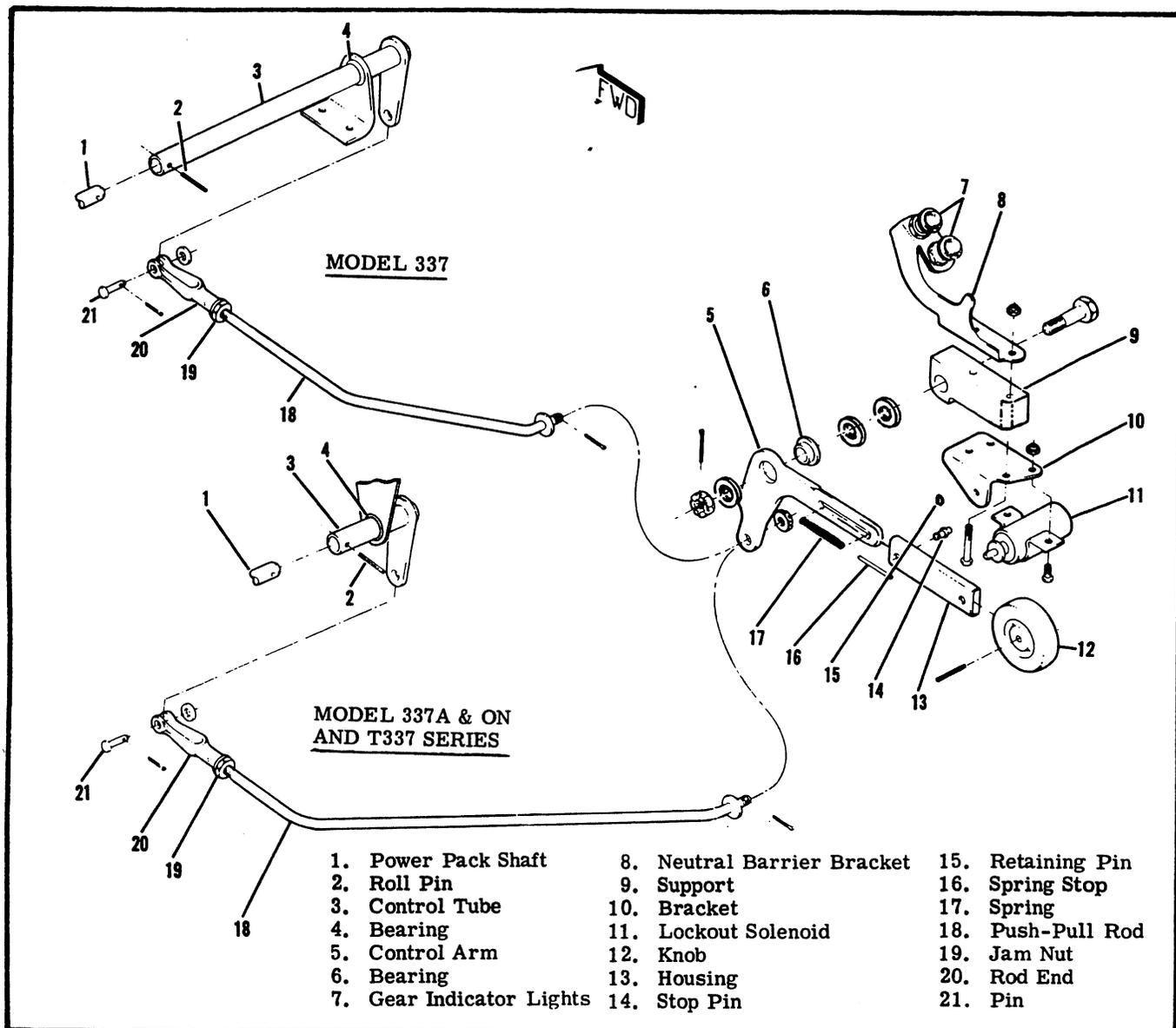
5-223. PRESSURE ADJUSTMENTS.

NOTE

A chart of hydraulic system pressures is provided immediately following bench-testing procedures. The values contained in the chart may be used to check opening and reseating pressures of the power pack valves.

5-224. TEST EQUIPMENT.

- a. One hydraulic hand pump of 2000 psi capacity.
- b. One hydraulic pressure gage of 2000 psi capacity.
- c. One hydraulic pressure gage of 150 psi capacity.
- d. High pressure hose to attach hand pump to Power Pack inlet fitting.



5-35. Gear Control Handle Linkage Installation

e. Drain hose to connect to Power Pack reservoir drain fitting.

5-225. **CONNECTING TEST UNIT.** Use only clean hydraulic fluid (MIL-H-5606). Install a tee at the hand pump pressure outlet, and attach the 2000 psi pressure gage and the pressure hose to the tee. Connect the hose from the hand pump to the Power Pack pressure inlet fitting, labeled "PUMP." Connect drain hose to Power Pack reservoir fill and drain tee. Cap all other fittings with high-pressure caps.

NOTE

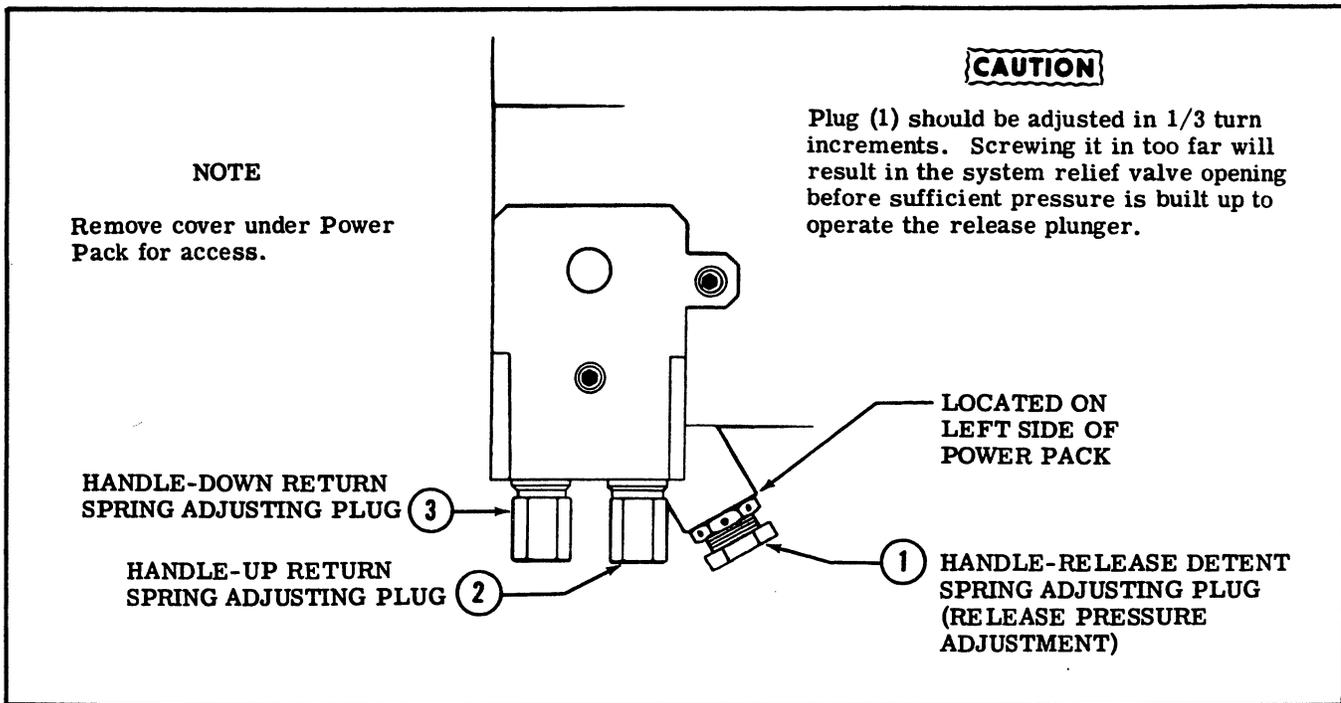
Some Hydro Test units are equipped with a hand pump, and others are provided with a pressure jack and provisions to install a hand pump.

5-226. **HANDLE-RELEASE MECHANISM.** (Refer to figure 5-33.) The following procedure outlines preliminary adjustments to set the handle-release detent spring load and the handle-return spring load adjusting plugs in approximately their correct positions before installing the Power Pack in the airplane. After it has been installed, the system must be checked and final adjustments, if needed, made at that time.

NOTE

To complete this preliminary adjustment, use a 1/8-inch punch or equivalent steel rod as a handle in hole near the end of the shaft, to rotate shaft as required for adjustment. Use care to prevent damage to hole in shaft.

a. With handle-return spring adjusting plugs (2 and 3) not tightened, screw in detent spring adjusting plug (1) until it is approximately flush. The



5-36. Handle-Release Adjustment

spring, however, must not bottom out.

b. Rotate shaft to up-detent position, then hold it beyond this position (in overtravel).

c. Tighten forward handle-return spring adjusting plug (2) until handle just starts to move out of overtravel, then loosen the adjusting plug one turn.

d. Rotate shaft to down-detent position, then hold it beyond this position (in overtravel).

e. Tighten aft handle-return spring adjusting plug (3) until handle just starts to move out of overtravel, then loosen the adjusting plug one turn.

f. Rotate shaft to up-detent position and tighten handle-release detent spring adjusting plug (1) until the spring bottoms out, then back the adjusting plug out two turns.

g. Handle must hold in both detent positions, but must return with a positive snap when manually released from either detent position. Handle-release detent spring adjusting plug (1) may be readjusted slightly more or slightly less than the two turns specified in the preceding step if necessary.

h. Refer to paragraph 5-237 for final rigging of the handle-release mechanism after it has been installed in the aircraft.

5-227. SECONDARY RELIEF VALVE. (PRIOR TO 1968 MODELS.)

a. With landing gear handle in either up or down position, apply test pump pressure until fluid flows from secondary relief valve.

b. Bleed air by cracking cap on door-open fitting.

c. Adjust retainer plug at top of valve until valve cracks at 1900 psi. Adjusting this valve to 1900 psi cracking pressure will give approximately 1950 psi when valve is in a flow condition. Bleed pressure by cracking cap on door-open fitting after each adjustment.

d. Safety wire the secondary relief valve to the

time-delay valve.

5-228. PRIMARY RELIEF VALVE.

a. Loosen lock nut and back adjusting screw at top of valve out until very little load is left on spring.

b. With landing gear handle in neutral, apply pressure until fluid flows from primary relief valve.

c. Adjust primary relief valve until valve cracks at 1400 psi. Adjusting this valve to 1400 psi cracking pressure will give approximately 1500 psi when valve is in a flow condition. Bleed pressure after each adjustment by cracking cap on door-open fitting. Tighten lock nut on adjusting screw after obtaining correct adjustment.

5-229. PRIORITY VALVE.

a. Place landing gear handle in up position and remove cap from gear-up fitting.

b. Apply pressure and note priority valve cracking pressure by observing pressure gage when fluid first starts to flow from gear-up port.

c. Adjust priority valve to crack at 750 psi. Bleed pressure after each adjustment by cracking cap on door-open fitting.

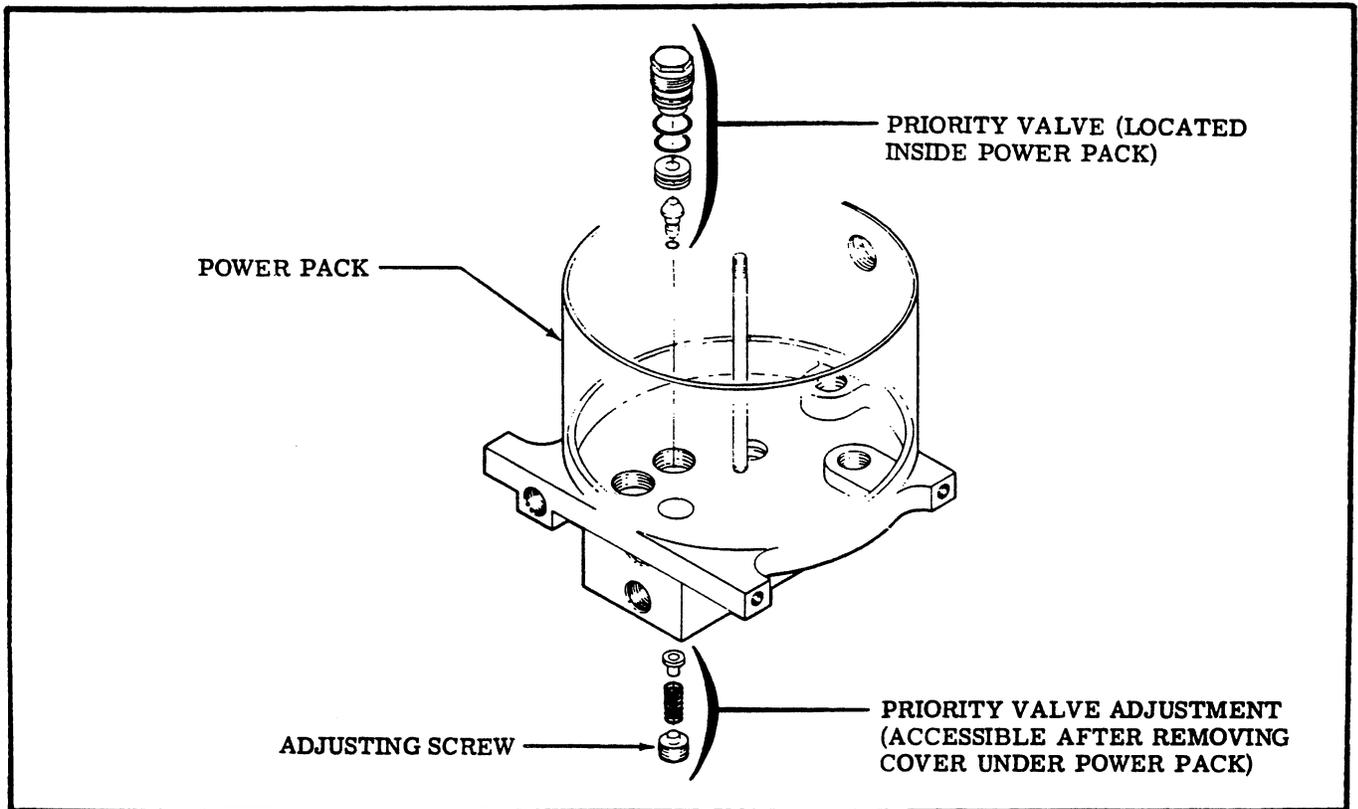
d. Disconnect test pump and cap all open fittings. To complete the reassembly of the Power Pack proceed as follows:

a. Install reservoir cover attaching stud. Install with longer threaded end down, and screw in until stud bottoms in reservoir.

b. Install baffle and center stud spacer. Safety wire primary relief valve lock nut to screened stand-pipe.

c. Lubricate and install O-ring in groove of reservoir cover.

d. Position reservoir cover on reservoir, aligning index marks on reservoir and cover. Vent



5-37. Priority Valve Adjustment

fitting in cover points to the left with Power Pack in airplane.

CAUTION

Be sure that the large O-ring is positioned properly in the groove of the reservoir cover and that the O-ring is not pinched as the cover is installed.

- e. Lubricate and install O-ring at top of cover around center stud.
- f. Install cover retaining nut (cap nut), tighten, and safety.

5-230. DOOR VENT VALVE.

- a. Remove cap from door-open fitting on power pack and attach pressure hose from hand pump with 150 psi pressure gage to door-open fitting.
- b. Slowly apply 50 psi pressure. At 50 psi pressure continuous pumping shall be required to maintain pressure.
- c. Increase pressure to 100 psi.
- d. There shall be no difficulty in maintaining pressure at 100 psi. Pressure can and should slowly decrease as a result of leakage through the door

vent valve.

- e. Relieve pressure by cracking hose fitting from hand pump. Repeat step "b".
- f. Disconnect test pump and cap all open fittings.

5-231. RESERVOIR LEAKAGE TEST.

- a. Remove filler and drain tee, and attach hand-test pump and 150 psi gage to filler port.
- b. Remove cap from reservoir vent fitting at top of reservoir and operate test hand pump until reservoir is completely full, indicated by fluid coming out of the fitting.
- c. Cap reservoir vent fitting.
- d. Operate test hand pump very slowly until pressure gage indicates 15 psi maximum.
- e. Check for leaks. There should be no external leakage.
- f. Crack vent fitting to release pressure, remove test equipment, drain reservoir, and cap fittings.
- g. Hydraulic Power Pack is now ready to be installed in the airplane.

NOTE

After Power Pack is installed in airplane, re-fill reservoir.

SHOP NOTES:

5-232. HYDRAULIC SYSTEM PRESSURES (FOR BENCH OR FIELD TESTING).

COMPONENT	OPENING PRESSURE	RESEATING PRESSURE
Handle Release Valve.	750 to 1050 psi.	-----
Priority Valve.	750 to 800 psi.	-----
Primary Relief Valve.	1500 psi. (Max.)	1150 psi. (Min.)
Secondary Relief Valve.	1950 psi. (Max.)	1550 psi. (Min.)
Inlet Check Valve.	10 psi. (Max.)	2 psi. (Min.)
Hand Pump Check Valves.	10 psi. (Max.)	2 psi. (Min.)

5-233. INSTALLATION OF POWER PACK.

NOTE

When installing a new Power Pack, leave the bulkhead nuts loose on the tubing fittings. This will allow proper positioning of these fittings, making it easier to align and connect hydraulic lines.

- a. Work Power Pack into position and install the four mounting bolts and washers.
- b. Connect electrical plug at back of Power Pack and safety.
- c. Install the forward sections of hydraulic lines routing to emergency hand pump.
- d. Connect brake hose disconnected for access.
- e. Connect all hydraulic lines to Power Pack. Make sure fittings are properly installed and connections are tight. Install cover and drain hose.
- f. Connect landing gear handle linkage to shaft at Power Pack, and install and safety attaching roll pin.
- g. Fill reservoir. Fill brake master cylinder and bleed corresponding brake.
- h. With airplane on jacks, use Hydro Test to operate the landing gear through several cycles to bleed system. Check for proper operation and any signs of hydraulic leakage.
- i. Reinstall upholstery and seats.

5-234. FIELD-TESTING THE HYDRAULIC POWER PACK (INSTALLED IN AIRCRAFT).

5-235. PRIMARY AND SECONDARY RELIEF VALVE ADJUSTMENT. If the primary or secondary relief valve should get out of adjustment, fluid contamination, wear of parts or defective parts should be suspected. Remove the power pack, disassemble, repair and adjust as outlined in the applicable paragraphs in this Section.

5-236. ADJUSTMENT OF PRIORITY VALVE.

- a. Jack aircraft and connect test unit in accordance with applicable paragraphs.
- b. Check priority valve setting in accordance with applicable paragraph.
- c. If adjustment is required, turn priority valve adjusting screw IN to increase pressure at which valve

opens, and turn the adjusting screw OUT to decrease pressure at which the valve opens. Adjust so that the valve opens at 750 to 800 psi as noted on test unit gage.

- d. Cycle the landing gear to check for proper operation, then lower the gear.
- e. Fill reservoir and disconnect test unit in accordance with applicable paragraph.
- f. Remove aircraft from jacks.

5-237. HANDLE-RELEASE ADJUSTMENT. (Refer to figures 5-33 thru 5-36.) Adjustment of the gear handle-release mechanism is necessary because incorrect adjustments can cause excessive pressure in the Power Pack and can prevent free circulation of fluid, resulting in damage to the Power Pack. If the mechanism releases too soon, the landing gear handle may return to neutral before the landing gear doors are closed, if the time-delay valve should function improperly. Pressure build-up after the doors are closed operates the time-delay valve. After the valve opens, pressure then disengages a spring-loaded plunger from a detent, and a handle return spring then pushes the handle back to neutral through mechanical linkage. The spring load on the detent plunger and the spring load on each handle return spring are adjustable. To adjust the handle-release mechanism proceed as follows:

NOTE

The mechanical linkage between the landing gear control handle and the Power Pack must be rigged properly before handle-release adjustments can be made. Refer to steps "a" thru "c".

- a. Referring to figure 5-35, adjust push-pull rod end so that the handle will permit the detent plunger in the power pack to engage the cam detents in both the up and down positions of the handle, and the handle does not contact structure in either the up or down position.
- b. Roll pin (2) will be approximately horizontal when handle is at mid-point of barrier (8).
- c. After adjustments have been completed, ensure the rod end has sufficient thread engagement and jam nut is tight.
- d. Jack aircraft, then connect test unit.
- e. If power pack is being installed, or if reservoir fluid level has been low, fill reservoir and bleed time-

delay valve in accordance with applicable paragraph.

f. Using test unit, cycle landing gear through at least two full cycles, unless handle will not hold or fails to release.

NOTE

If the handle will not hold, either the detent spring load adjustment is set too low, the handle-return spring load adjustments are set too high, or the handle-return springs are bottoming out and not permitting the handle-release plunger to reach the detent positions. If the plunger cannot reach the detent positions, loosen handle-return spring adjusting plugs (2 and 3) until the plunger will engage the detent.

If the handle will not release, either the detent spring load adjustment is set too high (forcing the detent plunger partially into the detent and making it mechanically impossible for the plunger to move completely out of the detent) or the handle-return spring load adjustments are set too low. Tighten detent spring load adjusting plug (1) until detent plunger bottoms out in detent, then loosen plug (1) approximately two full turns, until handle will release.

g. Using test unit, check the pressure at which the handle-release plunger disengages the detents and readjust handle-release detent spring adjusting plug (item 1, figure 5-36), as necessary to obtain a release pressure of approximately 900 psi. Tolerance is 750 to 1050 psi. Use a minimum flow and ensure time is allowed for the time-delay valve to open. Cycle the landing gear between each adjustment.

h. Recheck the handle-release pressure specified in step "g".

i. Operate landing gear through several cycles to check for proper operation, then lower the gear.

j. Fill reservoir and disconnect test unit in accordance with applicable paragraph.

k. Remove aircraft from jacks.

5-238. CHECKING HANDLE-RELEASE TO NEUTRAL.

a. Cycle landing gear through two complete cycles, ending with the gear down and locked, and the doors closed.

b. Set test unit bypass valve full open.

c. Place landing gear handle to full down.

d. Very slowly close bypass valve until handle trips back to neutral. Read gage at point of handle trip. This pressure should be 750 to 1050 psi. Be sure to allow time for time-delay valve to open.

NOTE

One release valve serves to release the handle from both the gear down and the gear up positions. If the handle-return springs are adjusted correctly, the release valve should release the handle from both positions at the same pressure. The foregoing procedure checks the release pressure from the gear down position, and the following pro-

cedure checks the release pressure from the gear up position. This is performed only to assure satisfactory operation of other equipment relative to handle release operations.

e. Set test unit bypass valve full open.

f. Place landing gear handle full up.

g. Very slowly close bypass valve until handle trips back to neutral. Read gage at point of handle trip. This pressure should be 750 to 1050 psi. Be sure to allow time for time-delay valve to open.

h. Refer to paragraph 5-237 for handle-release adjustment.

i. Make sure landing gear is down and locked and disconnect Hydro Test unit.

j. Remove airplane from jacks.

5-239. CHECKING TIME-DELAY VALVE.

NOTE

The time delay between closing of the landing gear doors and releasing of the landing gear handle to neutral should be between 3 to 9 seconds at room temperature. Colder temperatures will cause a longer delay.

a. Connect test unit.

b. Set Hydro Test at approximately 1500 psi, with a one gallon-per-minute flow rate.

c. With airplane master switch OFF to open the doors, move landing gear handle to down position and turn master switch to ON position. Note the time delay between closing of the doors and releasing of the handle to neutral. See the preceding "NOTE."

d. There is no adjustment of the time-delay valve. If it is defective, refer to applicable figure and paragraphs for disassembly and repair of the power pack.

e. Disconnect test unit.

5-240. CHECKING PRIORITY VALVE.

a. Cycle landing gear through two complete cycles.

b. With landing gear down, turn master switch OFF to open gear doors. Leave the switch OFF to permit doors to remain open, thereby making it easier and faster to complete this check.

c. Open Hydro Test bypass valve.

d. Place landing gear handle full up. Very slowly close bypass valve, observing Hydro Test pressure gage and Hydro Test flow gage, until priority valve opens. Priority valve should open at a pressure of 750 to 800 psi.

NOTE

As the priority valve opens, the nose gear downlock starts to release. Read Hydro Test pressure gage at this point. The Hydro Test flow gage will also aid in positively establishing opening of the priority valve. As pressure slowly builds up in the door system, there is practically no flow of fluid and the flow indicator will be resting on the bottom of the sight glass. As the priority valve opens, the sudden increase in flow will cause the indicator to rise in the sight glass.

- e. Refer to applicable paragraph for priority valve adjustment.
- f. Ensure landing gear is down and locked, and disconnect test unit.
- g. Remove aircraft from jacks.

5-241. CHECKING PRIMARY (SYSTEM) RELIEF VALVE.

- a. Connect test unit.
- b. Open test unit bypass valve.
- c. Place landing gear handle full-down.
- d. Slowly close bypass valve, observing pressure build-up and note point at which pressure stabilizes on test unit gage. Stabilization indicates relief valve setting. Relief valve pressure should be 1450-1500 psi, at a flow rate of approximately one gallon-per-minute on the test unit.
- e. The power pack must be removed and partially disassembled to adjust the primary relief setting (refer to paragraph 5-228.)
- f. Disconnect test unit.

5-242. CHECKING SECONDARY (HAND PUMP) RELIEF VALVE (PRIOR TO 1968 MODEL).

- a. Place landing gear handle full down. With master switch OFF, operate emergency hand pump to open landing gear doors.
- b. Disconnect and plug door open-line at firewall fitting, and connect Hydro Test pressure hose to this firewall fitting.
- c. Close lockout valve on Hydro Test.
- d. Operate emergency hand pump in airplane observing Hydro Test pressure gage for pressure at which secondary relief valve opens. This pressure should be 1800 to 1900 psi.
- e. The Power Pack must be removed and partially disassembled to adjust secondary relief valve setting.
- f. Open lockout valve on Hydro Test to release the pressure, disconnect Hydro Test pressure hose, and reconnect door open line.
- g. Replenish hydraulic reservoir fluid as required.

5-243. CHECKING FOR SUCTION AIR LEAKAGE.

- a. Remove engine cowling as necessary for access
- b. Disconnect hydraulic pump suction (larger) hose from pump and connect Hydro Test suction (larger) hose to the airplane suction hose, using a suitable fitting.
- c. Disconnect hydraulic pump pressure (smaller) hose from pump and connect Hydro Test pressure (smaller) hose to airplane pressure hose, using a suitable fitting.
- d. Connect Hydro Test vent hose to airplane reservoir vent line, protruding below lower edge of firewall.

NOTE

Before making this connection, be certain the line is wiped clean and is free of any dirt or foreign material which might have worked into the line. If the line is dirty internally, remove and flush with solvent, then dry with compressed air and reinstall.

- e. Connect Hydro Test electrical cable to appropriate electrical power source.

- f. Jack the airplane and cycle the landing gear through five complete cycles. No air should be visible in Hydro Test sight gage.

- g. Air visible in sight glass indicates leakage in suction line, hose, or fittings. Replace defective parts.

NOTE

If replacement of parts stops any visible air in Hydro Test sight glass but air still enters hydraulic system, engine-driven pump may have a suction leak.

- h. Make sure landing gear is down and locked, and remove airplane from jacks.

- i. Disconnect test unit.

5-244. BLEEDING TIME-DELAY VALVE.

NOTE

The time-delay valve in the power pack may be purged of air by operating the engine-driven pump or the test unit may be used.

- a. Ensure reservoir is full.
- b. Start engine and let run at 1000rpm, or connect test unit.
- c. Place landing gear handle in down position and hold for approximately one minute, while turning the master switch OFF until doors open, then ON until doors close.
- d. Repeat step "c" four times, waiting one minute between each repeat. This allows time-delay valve to refill.
- e. Check that time-delay valve operates properly by moving landing gear handle sharply to the down position and recording time as handle returns to neutral.

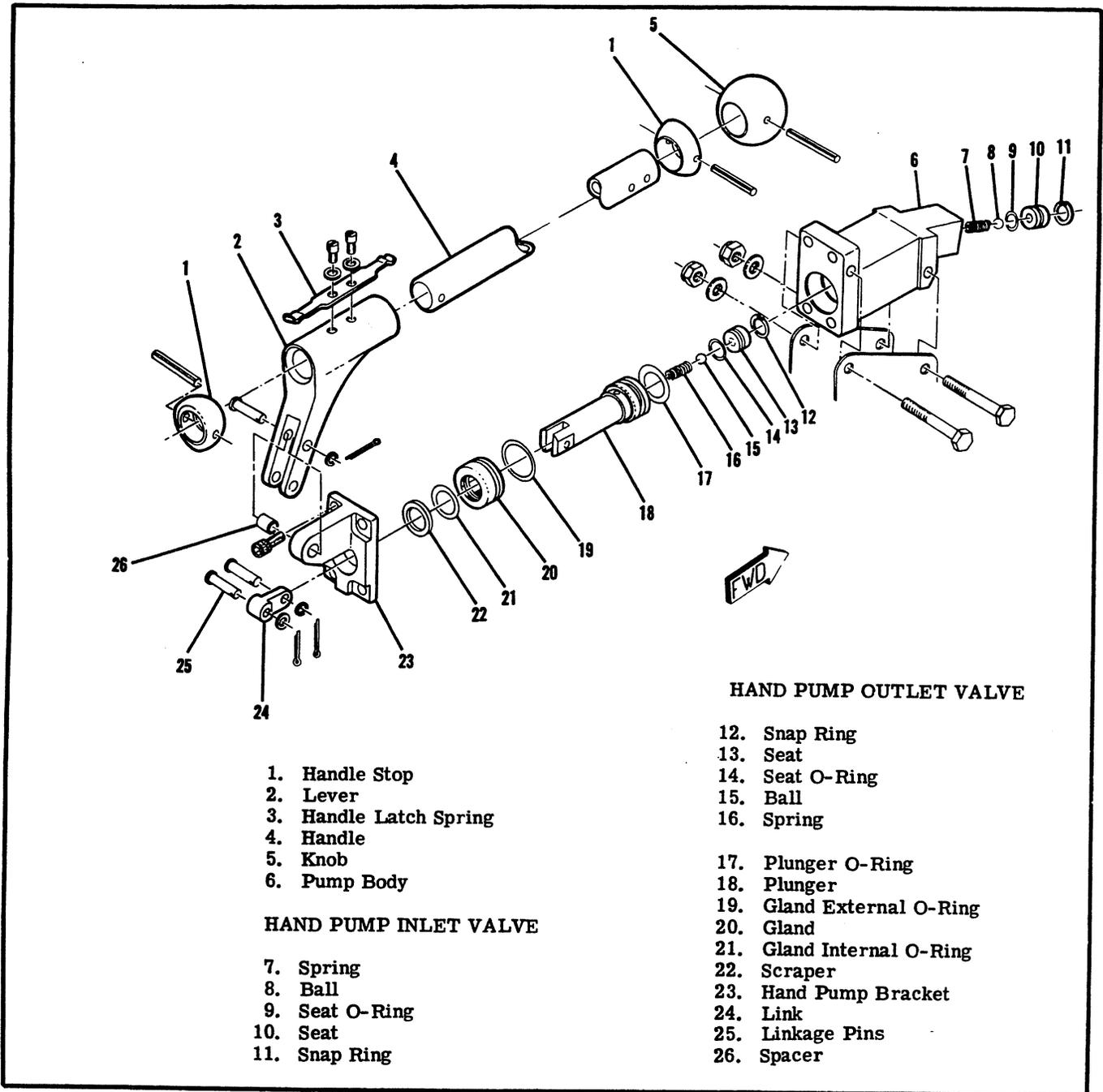
NOTE

The time delay between closing of the landing gear doors and releasing the landing gear handle to neutral should be between 3 and 9 seconds at room temperature. Colder temperatures will cause a longer delay.

- f. Shut down engine or disconnect test unit.

5-245. EMERGENCY HAND PUMP.

5-246. DESCRIPTION. The emergency hand pump is mounted on a support beneath the floorboard just in front of the front seats, near the center of the floorboard. The handle extends into the cabin and is enclosed by a hinged cover. The pump supplies a flow of pressurized hydraulic fluid to open the doors and extend the landing gear if hydraulic pressure should fail. The hand pump receives a reserve supply of fluid from the power pack reservoir and pumps the fluid directly to the door control valve and gear priority valve, then into the passages and lines used by the regular system.



5-38. Emergency Hand Pump

5-247. REMOVAL.

a. Loosen carpeting around hand pump, and remove cover and pan.

b. Wedge cloth under hydraulic fittings to absorb fluid, then disconnect the two hydraulic lines and plug openings.

c. Remove the two mounting bolts and work hand pump assembly out of floorboard.

5-248. DISASSEMBLY.

After the emergency hand pump has been removed from the airplane and the ports are capped or plugged, spray with cleaning solvent (Federal Specification P-S-661, or equivalent) to remove all accumulated

dust or dirt. Dry with filtered compressed air. To disassemble the unit, proceed as follows:

a. Remove hand pump handle by removing pivot and linkage pins after removing cotter pins.

b. Cut safety wire and remove four Allen head screws attaching hand pump bracket, and remove bracket. Do not remove bushing in hand pump bracket unless replacement of bushing is necessary.

c. Using a punch or rod in holes at end of hand pump plunger, pull plunger from pump body.

d. Using snap ring pliers, remove snap ring at inboard end of hand pump plunger. Remove seat, ball, and spring from plunger by applying a sharp

blast of compressed air in the side hole in the plunger.

- e. Remove gland and scraper from plunger.
- f. Inside suction port of hand pump, remove

- g. Remove and discard all O-rings.

5-249. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
HAND PUMP EXTERNAL LEAKAGE. SLIDING SEALS: (Seals having a moving part.)	Hand pump plunger.	Remove hand pump plunger and replace O-ring.
HAND PUMP EXTERNAL LEAKAGE. STATIC SEALS. (Seals with no moving parts.)	Hand pump gland. Hand pump fittings.	Remove hand pump and replace O-rings and scraper ring. Remove and replace O-rings and back-up rings as required.

5-250. INSPECTION OF PARTS.

- a. Inspect seating surfaces of seats. They should have very sharp edges. Seats may be lapped if necessary to obtain sharp edges.
- b. Inspect plunger for scores, burrs, or scratches which could cut O-ring. This is a major cause of external leakage. The plunger may be polished with extremely fine emery paper. Never use paper coarser than No. 600 to remove scratches or burrs. If defects do not polish out, replace plunger.

5-251. ASSEMBLY.

- a. Insert spring and ball in pump body through suction port.
- b. Lubricate and install O-ring on seat and install seat through suction port with sharp edge of seat next to ball. Secure seat with snap ring.
- c. Install spring and ball in hand pump plunger.
- d. Lubricate and install O-ring on seat and install seat in hand pump plunger with sharp edge of seat next to ball. Secure seat with snap ring.
- e. Lubricate and install O-ring on plunger, and internal and external O-rings on bronze gland.
- f. Install gland on plunger, and insert plunger and gland into pump body.
- g. Install scraper ring in counterbore of gland. Install so that flat surface of scraper is in counterbore of gland, with inner protruding part of scraper facing outward.
- h. Attach hand pump bracket to pump body with four Allen head screws. Tighten screws evenly and install lock wire.
- i. Install hand pump handle with pivot and linkage pins. Secure pins with washers and cotter pins.
- j. With a hydraulic source attached to the suction port of pump, actuate pump to see that it operates properly.

5-252. INSTALLATION.

- a. Carefully work pump into opening in floorboard and position pump body to mounting bracket; install bolts and tighten.

- b. With cloth under hydraulic fittings to absorb fluid, uncap and connect hydraulic lines to pump. Bleed lines and pump as connected in accordance with paragraph 5-252.
- c. Install cover and pan and secure carpeting.

5-253. BLEEDING OF THE EMERGENCY HAND PUMP. The hand pump and hydraulic lines may be bled by disconnecting the hand pump pressure (small) line at the bottom of the Power Pack, operating the hand pump until all air has been expelled from the pump and lines, and reconnecting the line. Provide can and drip cloth to protect carpeting. After reconnecting line, operate hand pump while master switch is OFF until landing gear doors are fully open. Continue to operate hand pump very slowly, increasing pressure until the secondary relief valve opens and all air is bled from hand pump and valve.

CAUTION

It is very important that the hand pump be operated very slowly as pressure is being increased to bleed the secondary relief valve. If the hand pump is operated rapidly, damage to the valve can occur as air permits parts to "slam" against each other.

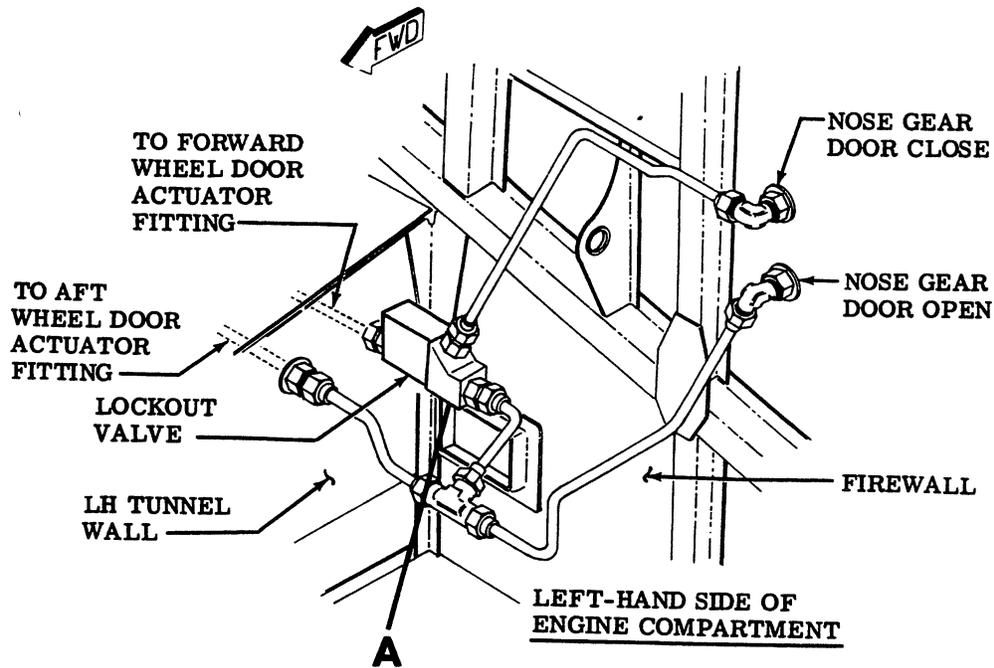
5-254. DOOR CLOSE LOCK VALVE.

5-255. DESCRIPTION. Wheel door actuators are held in the closed position by pressure trapped in the door close line by the door close lock valve. This enables the doors to remain in the closed position. The valve is located in the front engine compartment, attached to the outside of the left-hand nose gear tunnel wall.

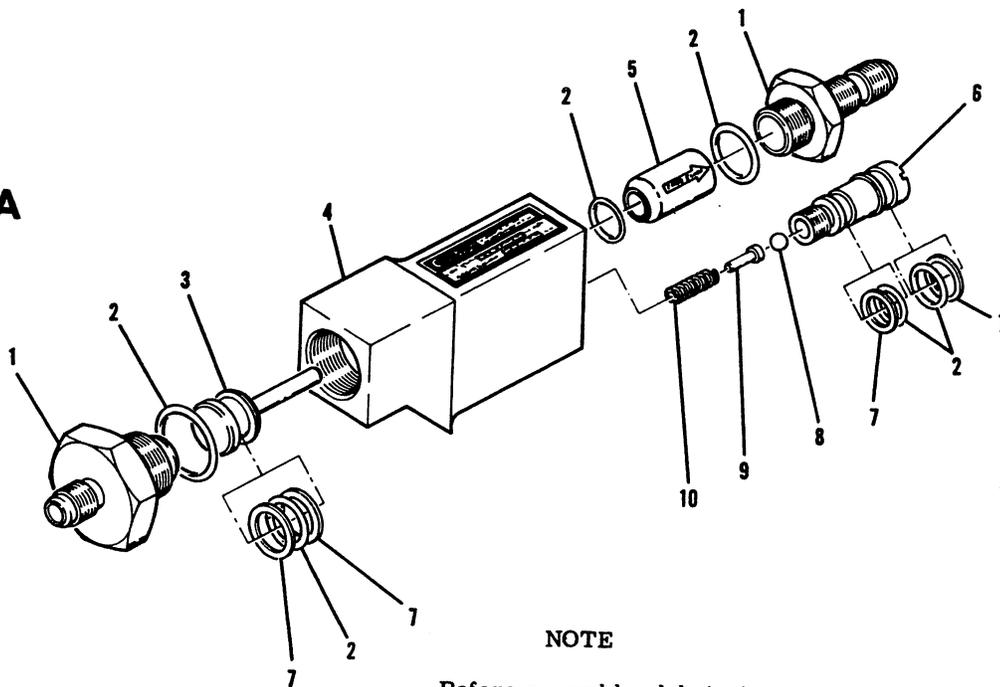
5-256. REMOVAL.

NOTE

The doors might come open as a result of



Detail A



NOTE

Before assembly, lubricate all packing with Petrolatum or MIL-H-5606 hydraulic fluid.

- 1. Fitting
- 2. Packing
- 3. Piston

- 4. Housing
- 5. Check Valve
- 6. Seat
- 7. Back-Up Ring

- 8. Ball
- 9. Guide
- 10. Spring

changes in ambient temperature. The valve has no provision for changes in pressure, due to changes in ambient temperature. If doors open, check for leakage or damage prior to removing valve.

a. Drain power pack in accordance with applicable paragraph.

b. Remove left hand cowling from front engine.

c. Disconnect and cap or plug hydraulic lines to valve; remove valve.

5-257. DISASSEMBLY. (Refer to figure 5-39.)

a. Remove end fitting (1), packing (2), piston (3) and back-up rings (7) from housing (4).

b. Remove fitting (1), packing (2) and check valve (5) from housing (4) at opposite end of valve.

c. Remove seat (6) along with packing (2) and back-up rings (7).

d. Remove ball (8), guide (9) and spring (10).

5-258. INSPECTION OF PARTS.

a. Inspect threaded surfaces for cleanliness and freedom of cracks and excessive wear or damage.

b. Inspect seat (6) for sharp seating edge with ball (8). Lap as necessary to obtain a sharp seating edge.

c. Inspect piston (3) and guide (9) for cracks, scoring, wear or surface irregularities which might affect their function or the overall function of the door close lock valve.

NOTE

Repair of most parts of the door close lock valve assembly is impractical. Replace defective parts with serviceable parts. Minor scratches may be removed by polishing with fine abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect operation of the unit.

5-259. ASSEMBLY (Refer to figure 5-39.)

NOTE

Install all new packing and back-up rings during assembly. Lubricate all packing and back-up rings with Petrolatum or MIL-H-5606 hydraulic fluid during assembly.

a. Install new packing (2) and back-up rings (7) on piston (3); install in housing (4) with end fitting (1). Use care to prevent damage to packing and back-up rings.

b. Install packing (2) and check valve (5) into housing (4) with end fitting(1).

NOTE

Install check valve with flow arrow pointing toward end fitting.

c. Install ball (8), guide (9), spring (10); install packing (2) and back-up rings (7) on seat (6) and install into housing (4).

5-260. INSTALLATION.

a. Connect hydraulic lines to valve.

b. Refill reservoir.

c. Jack aircraft in accordance with procedures outlined in Section 2.

d. Cycle gear several times to bleed system.

e. Check for proper operation and leakage of fluid.

f. Remove aircraft from jacks.

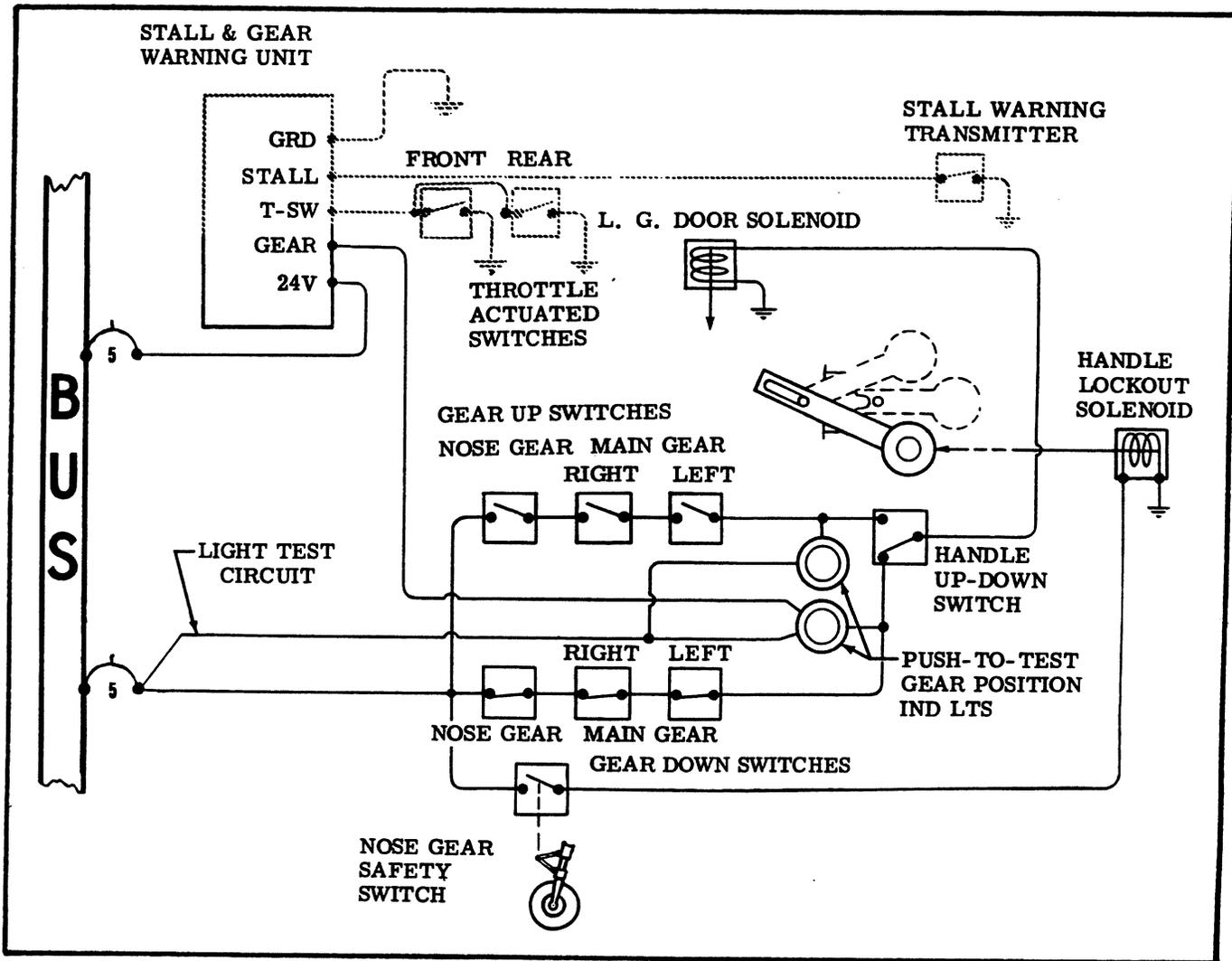
g. Install cowling.

5-261. LANDING GEAR ELECTRICAL CIRCUITS.

5-262. DESCRIPTION. Landing gear electrical circuits are shown in figure 5-40, which shows the switches in the gear-down and locked, weight-on-gear condition. The following chart describes the function of each electrical component and what causes it to operate.

SHOP NOTES:

ITEM	OPERATED BY	FUNCTION
UP INDICATOR SWITCH	Gear in up and locked position.	Closes circuit to gear up indicator light, handle up-down switch, and door solenoid valve.
DOWN INDICATOR SWITCH	Gear in down and locked position.	Closes circuit to gear down indicator light, handle up-down switch, and door solenoid valve.
HANDLE UP-DOWN SWITCH	Power Pack selector spool.	"Preselects" up or down circuit. (Completes up circuit to door solenoid valve when gear reaches up position, completes down circuit to door solenoid valve when gear reaches down position.)
DOOR SOLENOID VALVE	Completion of up circuit or down circuit. (Handle up-down switch and all gear indicator switches closed.)	Shifts valve to door-close position when energized. Spring-loaded to door-open position. Thus, with an electrical failure, the solenoid valve will remain in the door-open position and doors cannot be closed.
<p>NOTE</p> <p>Remember this rule: CLOSED circuit = CLOSED doors; OPEN circuit = OPEN doors. Apply this rule, the doors can be opened or closed at will by placing handle in down or down neutral, turning master switch either on or off, and supplying pressure with the hand pump.</p>		
NOSE GEAR SAFETY SWITCH	Actuating arm on lower torque link.	When airplane weight causes shock strut to compress, switch opens circuit to handle lock-out solenoid, which is spring-loaded to lock position. When airborne, strut extends and closes switch, to unlock handle from gear-down range.
HANDLE LOCK-OUT SOLENOID	Nose gear safety switch.	Prevents handle from being moved out of gear-down range while airplane is on ground.
<p>CAUTION</p> <p>Since a fully extended strut (too much air pressure, extremely aft weight distribution, etc.) simulates an airborne condition, be especially careful not to move gear handle from gear-down range under these conditions, or nose gear will retract.</p>		



5-40. Simplified Schematic of Landing Gear Circuits

5-263. SWITCH ADJUSTMENT. Landing gear up indicator switches, down indicator switches, nose gear safety switch and handle up-down switch may be adjusted as outlined in the rigging procedures beginning with paragraph 5-264. Adjustment of throttle actuated switches is outlined in Section 10.

5-264. RIGGING OF MAIN LANDING GEAR.

CAUTION

When raising or lowering main landing gear manually, avoid forcing or jerking an individual gear to prevent stressing the universal joints. Apply equal pressure to each gear.

5-265. RIGGING OF ADJUSTING SUPPORT. (Refer to figure 5-41.) The adjusting support is bolted to the outboard forging and forms the down stop for the main gear. Jack the airplane and rig the adjusting support as follows:

NOTE

The spring strut must be installed and secured before rigging the adjusting support.

a. Check for contact between flat surface of strut and lower surface of adjusting support. Minor gaps may exist as long as contact is made near each end of support. Shim as required between outboard forging and adjusting support. The following shims are available from the Cessna Service Parts Center.

AFT

1541041-1.....	*
-2.....	.012"
-3.....	.020"
-4.....	.032"
-5.....	.006"

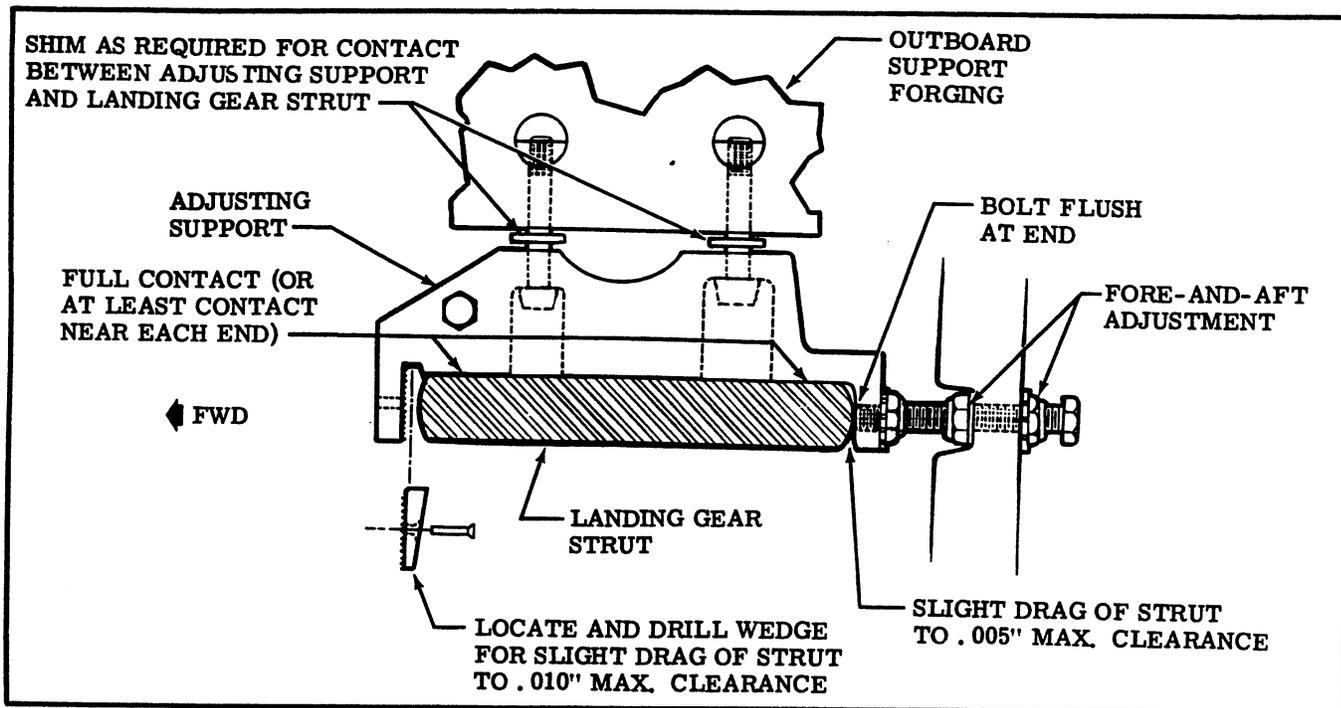


Figure 5-41. Rigging of Adjusting Support

FWD	
1541041-6.....	*
-7.....	.012"
-8.....	.020"
-9.....	.032"
-10.....	.006"

*Sheet of .025" laminated with ten .002" additional removable laminations.

b. Check that the aft edge of strut contacts adjusting support (.005" maximum clearance) as shown, when gear is down. To shift adjusting support fore and aft, first loosen the three bolts securing the support (elongated holes are provided in the support), then adjust the two jam nuts as required and re-tighten the three mounting bolts.

c. Check that the forward edge of strut contacts wedge (.010" maximum clearance) as shown, when gear is down. If adjustment is necessary, locate, drill, and countersink a new wedge, and install with screw, washer and nut.

NOTE

A slight drag is permissible as gear reaches the full down position.

The following wedges (measured at thickest part) are available from the Cessna Service Parts Center.

1541029-1.....	.250"
-2.....	.300"
-3.....	.330"
-4..... (Beginning with 337-0838)	360"

5-266. RIGGING OF DOWNLOCK MECHANISM.

The downlock is a hydraulically operated pawl containing an adjustable downlock pin which wedges under the forward edge of the strut to lock the gear in the down position. Jack the airplane and rig as follows:

CAUTION

The main gear downlock cylinders shall be aligned at all times with the main gear downlock. The cylinders shall also be canted outboard and free from interference with structure, upholstery panels, etc., throughout their normal operating range.

a. Check that downlock pin reaches the overcenter position shown in figure 5-42 (.03" to .10"). Adjust upper stop bolt as required to obtain this position.

b. Check that downlock pin reaches the retracted position shown in figure 5-42 (.18" to .22"). Adjust lower stop bolt as required to obtain this position.

NOTE

A downlock pin rigging tool, shown in figure 5-43, is available from the Cessna Service Parts Center.

c. Check over-all length of downlock pin as shown in figure 5-42 (snugly against strut to .005" maximum clearance), with hydraulic pressure on gear. Downlock pin assembly must be removed to change over-all length.

d. Disconnect actuator clevis from fuselage bracket and use handpump to pressurize the actuator in its fully retracted position. With the actuator piston bottomed out, move the downlock and actuator up and down as shown in figure 5-44.

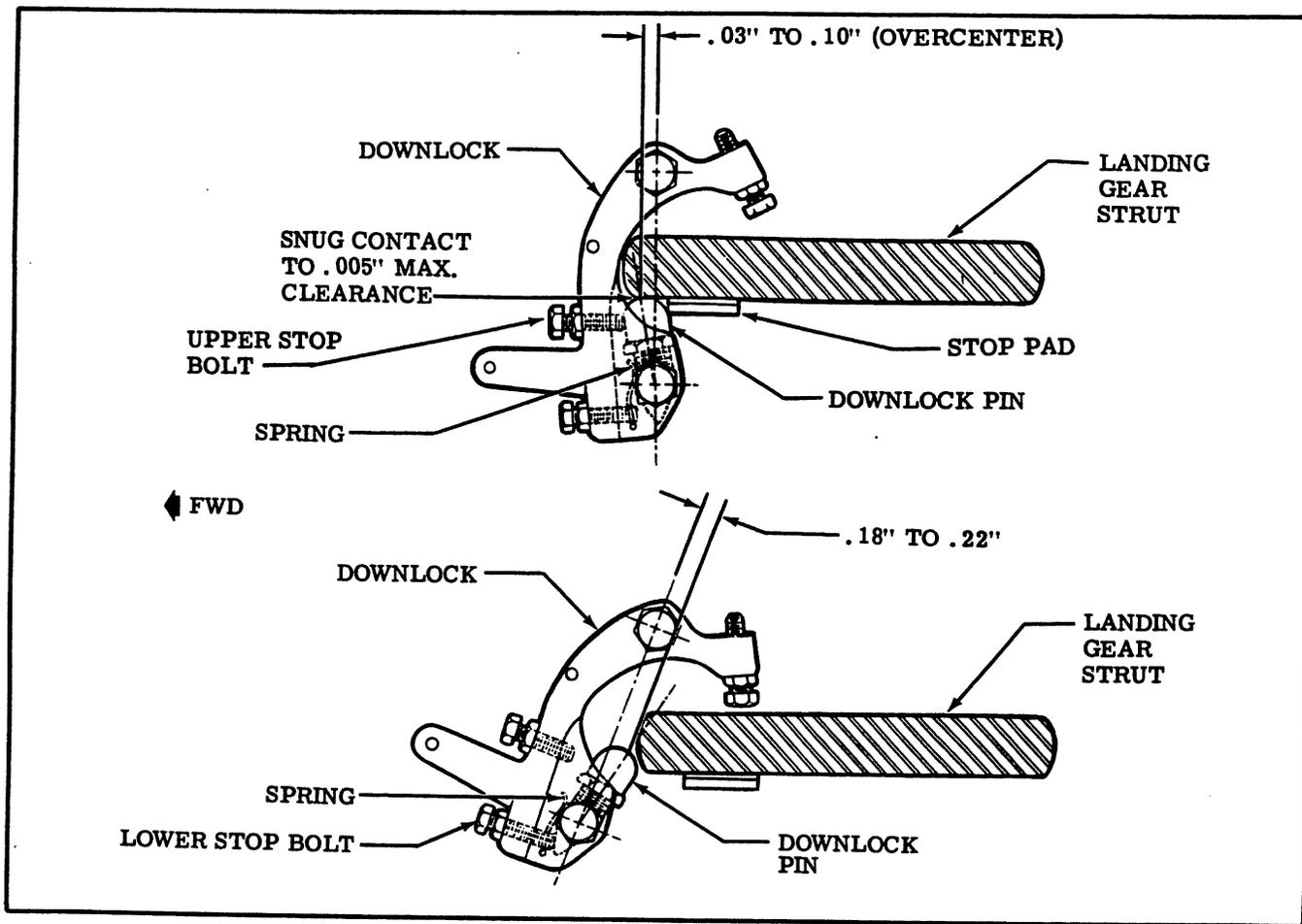


Figure 5-42. Rigging of Downlock

Measure the minimum clearance between the actuator clevis and fuselage bracket, and install shims as required to eliminate this clearance. Reconnect clevis to bracket and secure. The following shims are available from the Cessna Service Parts Center.

1512359-1 .....	.125"
-2 .....	.032"

e. Check that button in overcenter arm is screwed completely in (shortened) as shown in figure 5-45, and jam nut is tight. Check that overcenter arm retracts smoothly when engaging strut and that arm is clear of roll pin installed in down lock when gear is down and locked.

f. Check that overcenter release bolt in upper end of downlock extends below adjusting support as shown, with actuator piston bottomed out retracted and hydraulic pressure applied. See figure 5-45.

CAUTION

Overcenter release bolt must not extend too far, as damage to parts can be caused during retraction, especially if gear is aided manually.

g. Release hydraulic pressure and check that overcenter stop bolt in bulkhead is adjusted so that overcenter release bolt in upper end of downlock extends below adjusting support as shown in figure 5-45

(.06" more than straight line dimension), when actuator is held on overcenter position against the bulkhead stop bolt.

h. Check action of downlock switch bracket cam as follows:

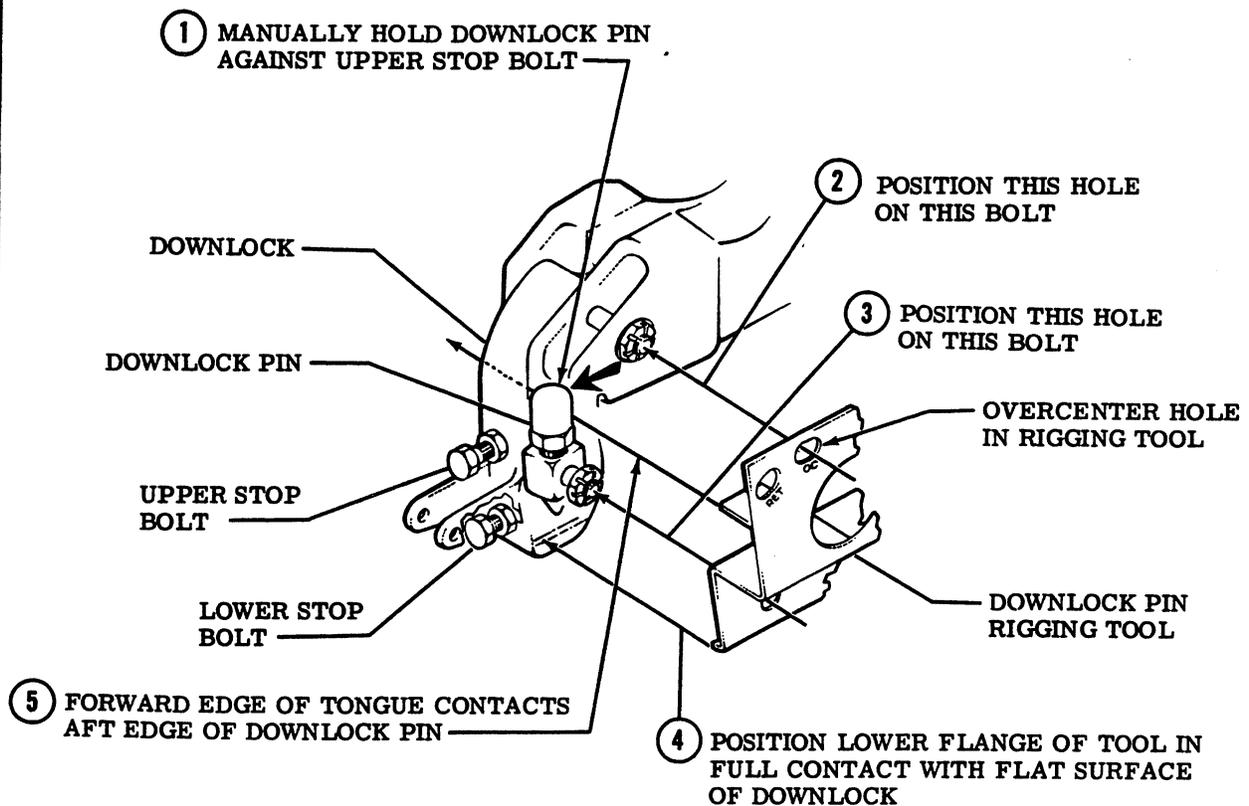
1. Place main gear in "trail position.
2. Manually push downlocks into the normally locked position (aft).
3. Holding approximately 20 pounds of force against each wheel, extend gear to the down and locked position. Cams on the switch brackets should push downlocks out of the way, allowing gear to move smoothly into the down and locked position.
4. Repeat test at least five times.

5-267. RIGGING OF UPLOCK MECHANISM. (Refer to figure 5-6.) The uplock is a hook which is spring-loaded to the locked position and hydraulically-operated to the uplocked position. Jack aircraft (figure 2-1) and rig the uplock mechanism as follows:

a. (Prior to 1971 Model.) Adjust push-pull rod ends as required to cause the hooks to release the gear spring struts simultaneously when operated hydraulically.

NOTE

In addition to releasing gear struts simultaneously, linkage must be adjusted so no



OVERCENTER POSITION OF DOWNLOCK PIN

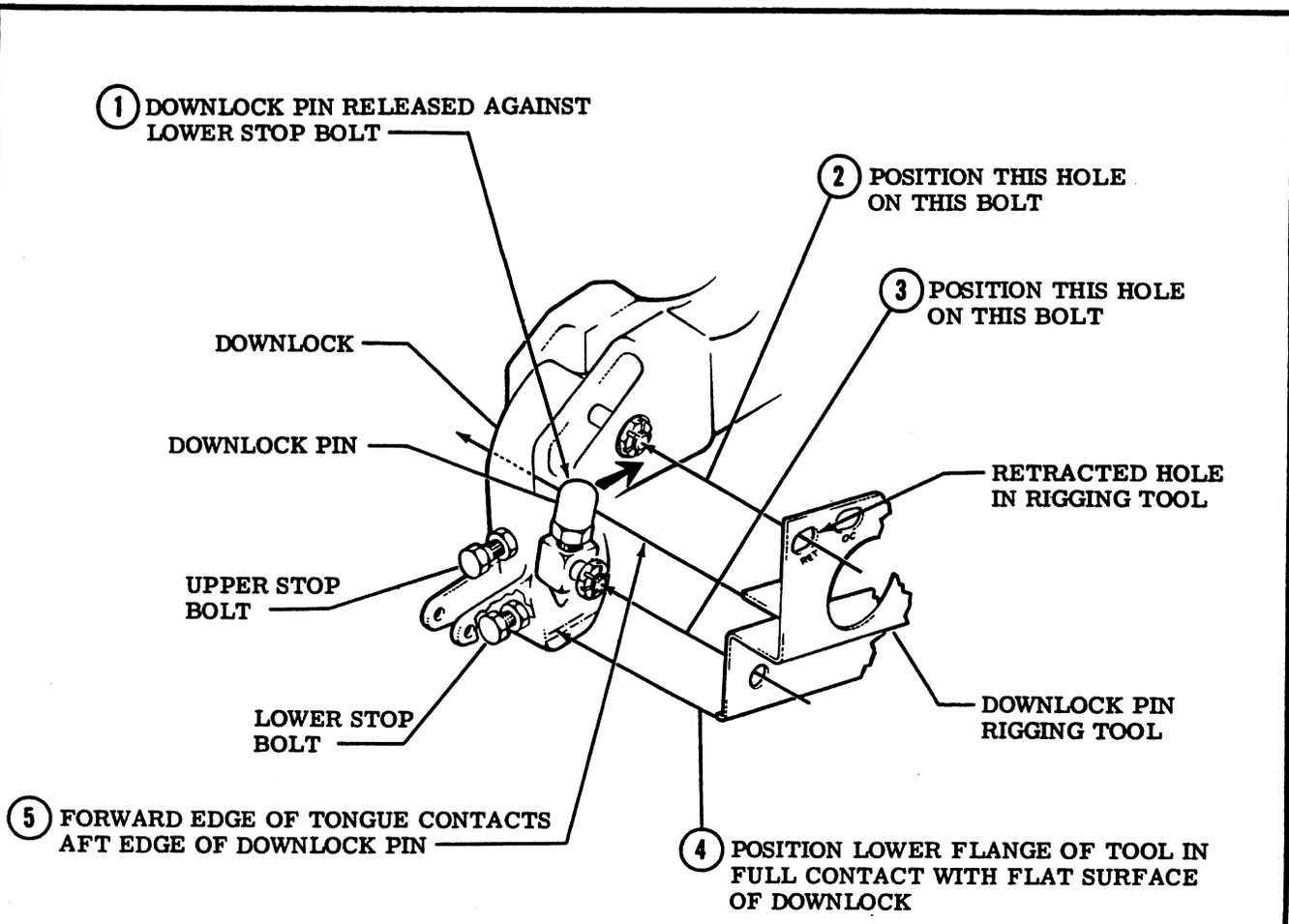
With downlock pin depressed (1), lower bolt in lower hole (3), lower flange flat against downlock (4), and forward edge of tongue contacting aft edge of pin (5), upper bolt should fall within overcenter hole (2). Elongation of overcenter hole represents tolerance permissible; adjust upper stop bolt as required.

NOTE

Jack the airplane, retract the landing gear, and release hydraulic pressure, leaving the landing gear doors open. Pull downlock assemblies aft for access.

The downlock pin rigging tool, Part No. SE772-1, is available from the Cessna Service Parts Center. The tool is made in two halves — the left half is shown in use for the left downlock pin; the right half is used in the same manner for the right downlock pin.

Figure 5-43. Using Downlock Pin Rigging Tool (Sheet 1 of 2)



**RETRACTED POSITION
OF DOWNLOCK PIN**

With downlock pin not depressed (1), lower bolt in lower hole (3), lower flange flat against downlock (4), and forward edge of tongue contacting aft edge of pin (5), upper bolt should fall within retracted hole (2). Elongation of retracted hole represents tolerance permissible; adjust lower stop bolt as required.

Figure 5-43. Using Downlock Pin Rigging Tool (Sheet 2 of 2)

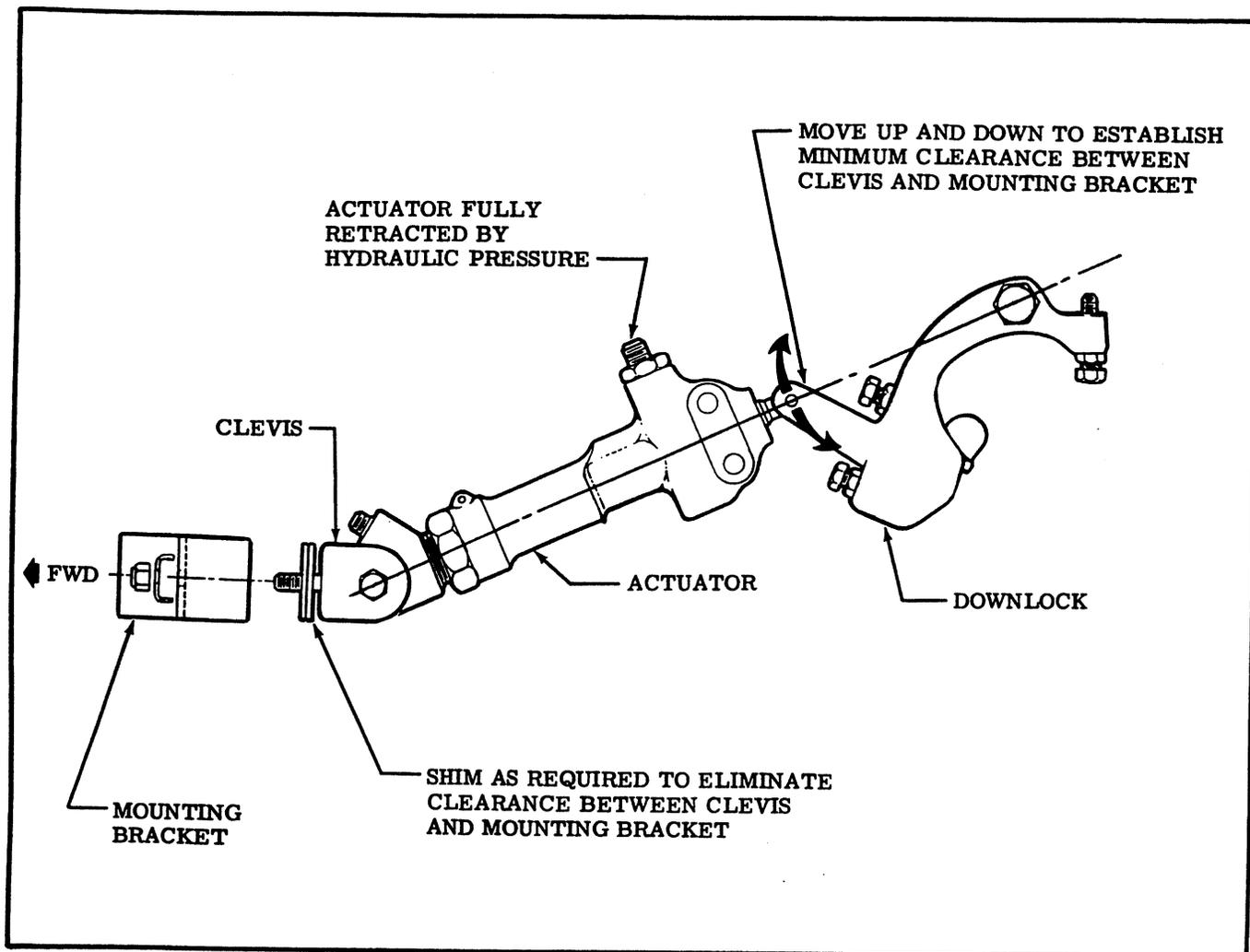


Figure 5-44. Shimming of Downlock Actuator

part of linkage (including up indicator switch) contacts any part of the aircraft structure. Actuator piston must bottom out retracted before hydraulic fluid can be routed through the actuator to lower the main gear.

b. (Prior to 1971 Model.) Vertical adjustment is provided by shifting washers from one side of the hook to the other side, since the retracted position of the spring struts is not horizontal. Adjust as required to permit the spring-loaded hooks to engage the spring struts.

c. (Prior to 1971 Models.) Inboard-outboard adjustment is provided by a slotted hole in the uplock supporting structure. Adjust uplock in this slot so that the gear spring always cams the hook toward the locked position.

d. (Prior to 1971 Model.) With gear up and pressurized, clearances shown in figure 5-6 must be attained.

e. (1971 Model.) Loosen the bolts attaching the hangers to the supports to allow inboard and outboard adjustment.

f. (1971 Model.) With Hydro Test connected, open the Hydro Test bypass valve to reduce hydraulic pressure to approximately 1000 psi. With gear up and

pressurized, check position of the gear stops.

g. (1971 Model.) The outboard edge of the gear strut spring should contact the stop and the slanted portion of the stop should be parallel to the strut spring maintaining 20 percent contact with strut spring.

h. (1971 Model.) The stop is adjusted to match the angle of the gear strut spring by the addition of shims (P/N 1541051-2) as required between the hangers and supports.

i. (1971 Model.) Adjust push-pull rod ends as required to cause the hooks to release the gear strut springs simultaneously when operated hydraulically.

NOTE

In addition to releasing gear struts simultaneously, linkage must be adjusted so no part of linkage (including up indicator switch) contacts any part of the aircraft structure. Actuator piston must bottom out retracted before hydraulic fluid can be routed through the actuator to lower the main gear.

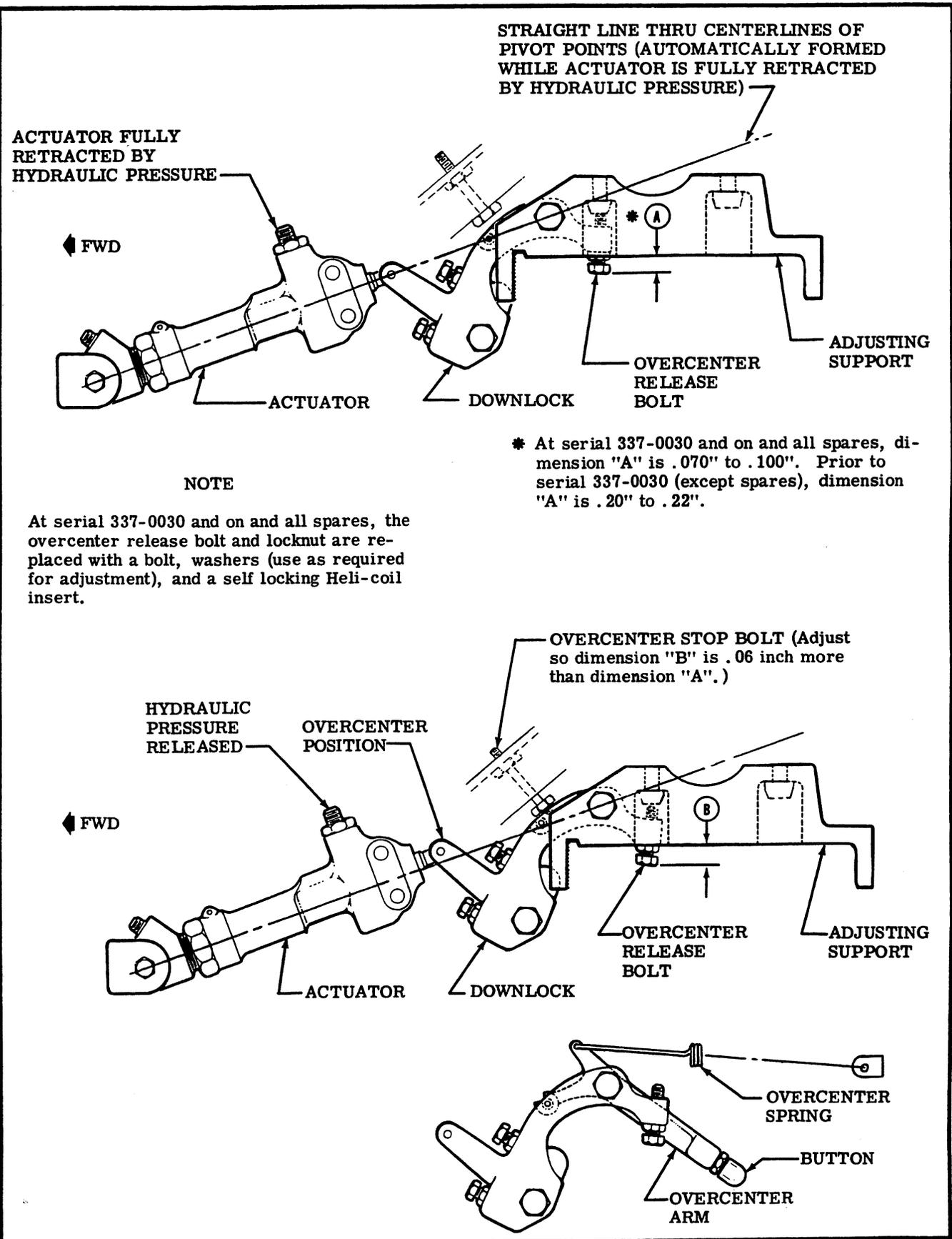


Figure 5-45. Overcenter Adjustments of Retracted Downlock

5-268. RIGGING OF UP INDICATOR SWITCHES.

Main gear up indicator switches are mounted on brackets attached to the uplock hooks. After jacking the airplane and retracting the landing gear until uplock hooks are fully engaged, adjust the switches so they are actuated with a minimum of 1/8 inch travel of the switch plunger remaining. Switch case must not contact any part of structure.

5-269. RIGGING OF DOWN INDICATOR SWITCHES.

Main gear down indicator switches are mounted on brackets attached to the downlock. With landing gear down and locked, adjust the switches so they are positively actuated, but the leaf type switch actuator does not contact the switch case.

5-270. RIGGING OF DOORS. After jacking the airplane, main landing gear door adjustment is accomplished by adjusting push-pull rod ends and actuator rod ends as required to cause the doors to close snugly. Doors must not close so tightly that internal locks in actuating cylinders are not reached. When installing new doors, some trimming and hand-forming at edges may be necessary to achieve a good fit and permit actuators to lock. The doors must clear the gear during retraction at least 1/2 inch.

5-271. ADJUSTMENT OF SNUBBER VALVE.

A main gear snubber valve, which restricts fluid near the end of the gear-up cycle, is provided at the aft end of the main gear actuator. This valve is a hollow, contoured metering pin which forms the hydraulic fitting at the aft end of the actuator. The purpose of the snubber valve is to slow down action near the end of the gear-up cycle to cause smoother locking action. Jack the airplane and adjust snubber valve as follows:

- a. Connect test unit.
- b. Cycle the landing gear, noting the pressures on the Hydro Test gage.

NOTE

The Hydro Test gage will indicate various pressures during gear retraction. The first level is the pressure needed to operate door-open system (approximately 300 psi). The second level is the pressure needed to retract landing gear (approximately 900 psi). The third level is the momentary pressure increase as snubbing action occurs. Pressure should increase to system operating pressure (1500 psi) for no longer than two seconds. After snubbing occurs and gear up-locks, pressure will decrease to pressure needed to operate door-close system (approximately 300 psi), then will again build up, through time-delay valve, until handle returns to neutral.

- c. If snubbing action does not occur or if pressure does not increase momentarily to 1500 psi as previously noted, loosen jam nut and screw snubber out of actuator as required. If pressure increases to 1500 psi and remains there for more than two seconds, loosen jam nut and screw snubber into the

actuator as required until pressure and time limit specified are attained. After adjustment, tighten and safety jam nut.

CAUTION

A snap ring on the snubber bottoms out against the end of the actuator as the snubber is backed out. Do NOT use force or damage will result.

NOTE

Another possible cause of excessive downlocking time is a plugged or otherwise faulty restrictor valve between the main gear downlock cylinders, as shown in the hydraulic system schematics.

- d. Fill reservoir and disconnect test unit.
- e. Remove aircraft from jacks.

5-272. RIGGING OF NOSE GEAR.

NOTE

The nose gear shock strut must be properly inflated prior to rigging of the nose gear.

5-273. RIGGING OF DOWNLOCK MECHANISM. (Refer to figure 5-46.) The nose gear downlock mechanism is basically a claw hook at the piston rod end of the nose gear actuator. The actuator contains an internal lock to hold the claw hook mechanism over-center. Jack the airplane and rig downlock mechanism as follows:

- a. Check that the hooks and crossbar are free from drag as illustrated. Adjustment is provided by rod end of actuator piston rod.

CAUTION

The piston rod is flattened near the threads to provide a wrench pad. Do not grip the rod with pliers, as tool marks will cut seals in the actuator.

- b. With the gear down and locked, adjust shims (19, figure 5-23) behind the bumper to have light contact to .001 inch clearance. Shims should not be allowed to increase nose gear actuator locking or unlocking pressures.

5-274. RIGGING OF UPLOCK MECHANISM. (Refer to figure 5-19.) The uplock mechanism is a hydraulically unlocked hook that is spring-loaded to the locked position. It engages a roller on the upper left side of the nose gear. Fore-and-aft adjustment is provided by slotted holes in the actuator mounting bracket. Adjust so the hook will positively release the nose gear from its retracted position hydraulically, but will securely lock the gear up. With the gear up and locked, and hydraulic pressure released, adjust nose gear rubber bumper to contact the gear lightly.

5-275. RIGGING OF DOWN INDICATOR SWITCH. (Refer to figure 5-47.) The nose gear down indicator

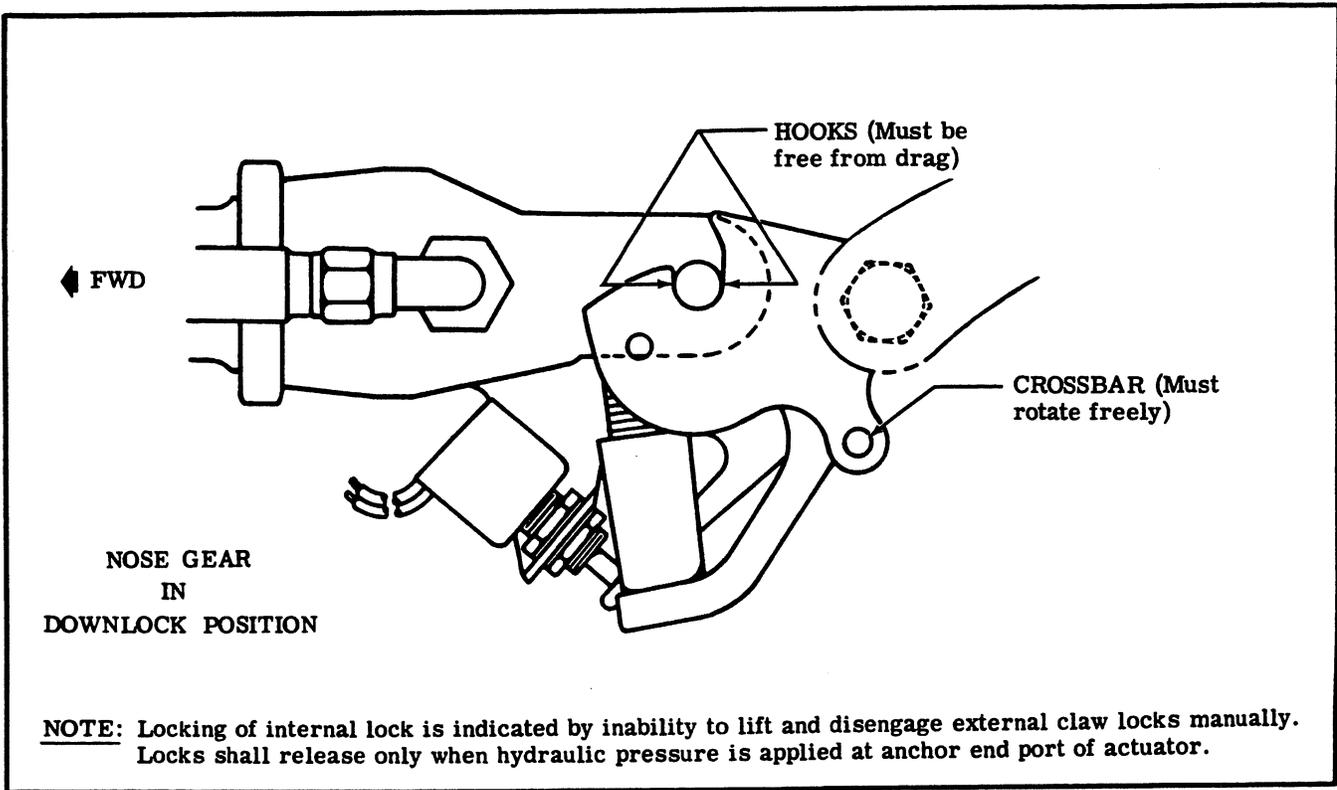


Figure 5-46. Rigging of Nose Gear Downlock

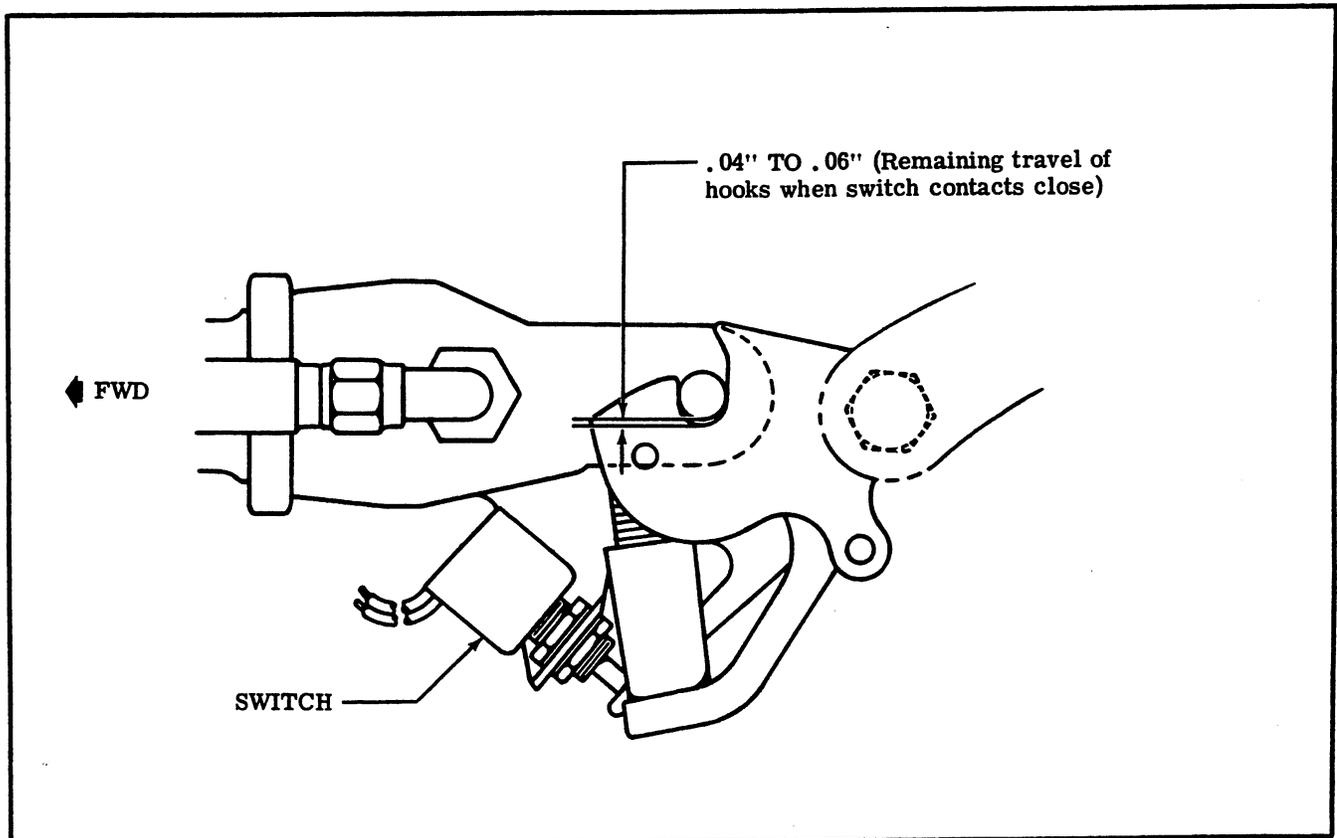


Figure 5-47. Adjustment of Nose Gear Down Indicator Switch

HYDRAULIC SYSTEM SCHEMATICS

Figure 5-48 (sheets 1 thru 10) is effective for Serials 337-0001 thru 337-0755. The secondary relief valve is installed in the power pack.

Figure 5-49 (sheets 1 thru 10) is effective for Serials 337-0756 thru 33701462 and F33700001 thru F33700055. The secondary relief valve is deleted. This figure also includes the door close lock valve which is installed in aircraft Serials 33701427 thru 33701462 and F33700052 thru 33700055.

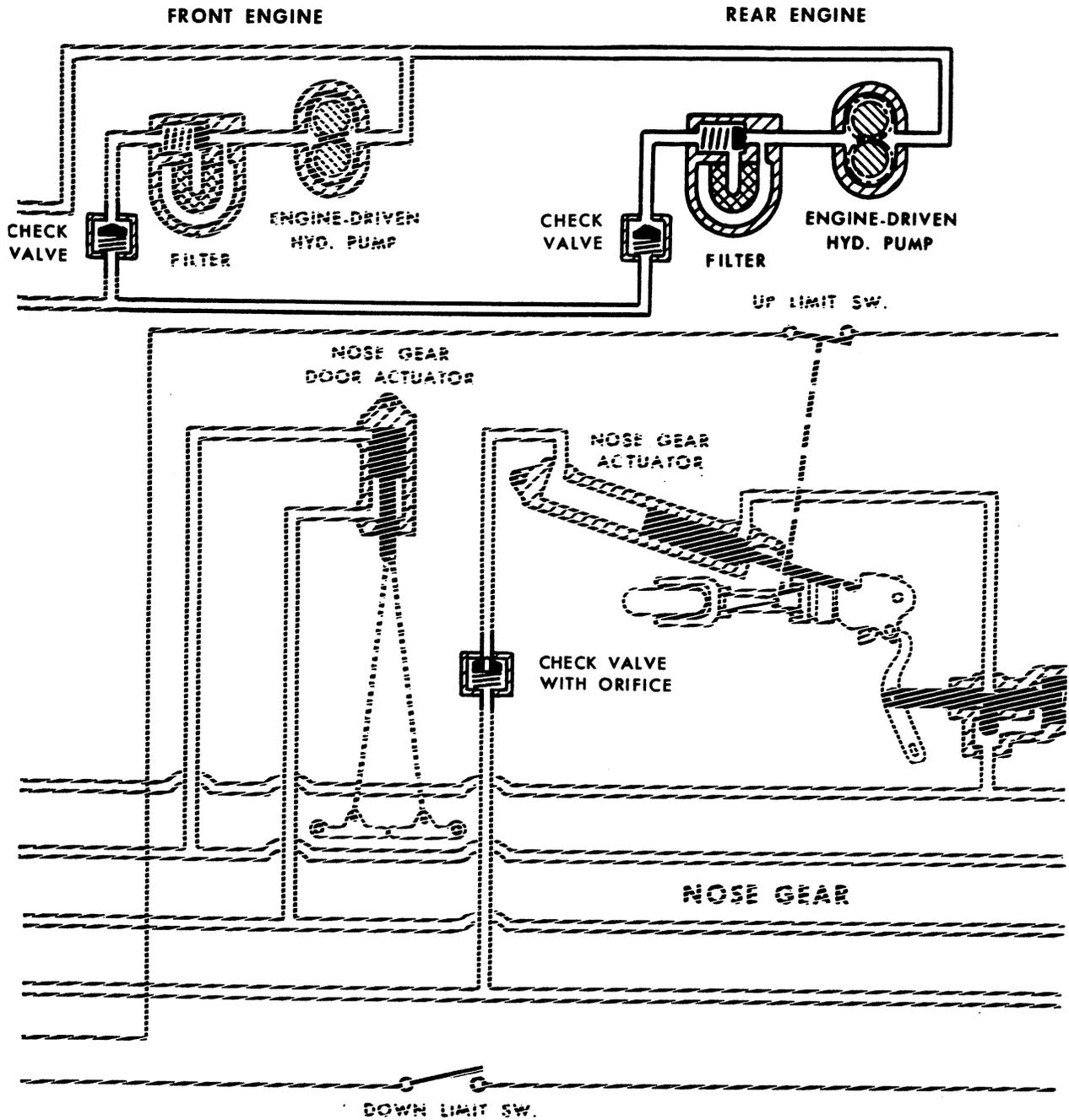
Sheet 1 shows the system "at rest" with the landing gear up. Sheets 2 through 5 show various stages of the gear-down cycle, after which, the system is again "at rest" with the landing gear down. Sheets 6 through 9 show various stages of the gear-up cycle, after which, the system returns to the condition shown on sheet 1. Sheet 10 shows the landing gear being extended with the emergency hand pump without electrical power.

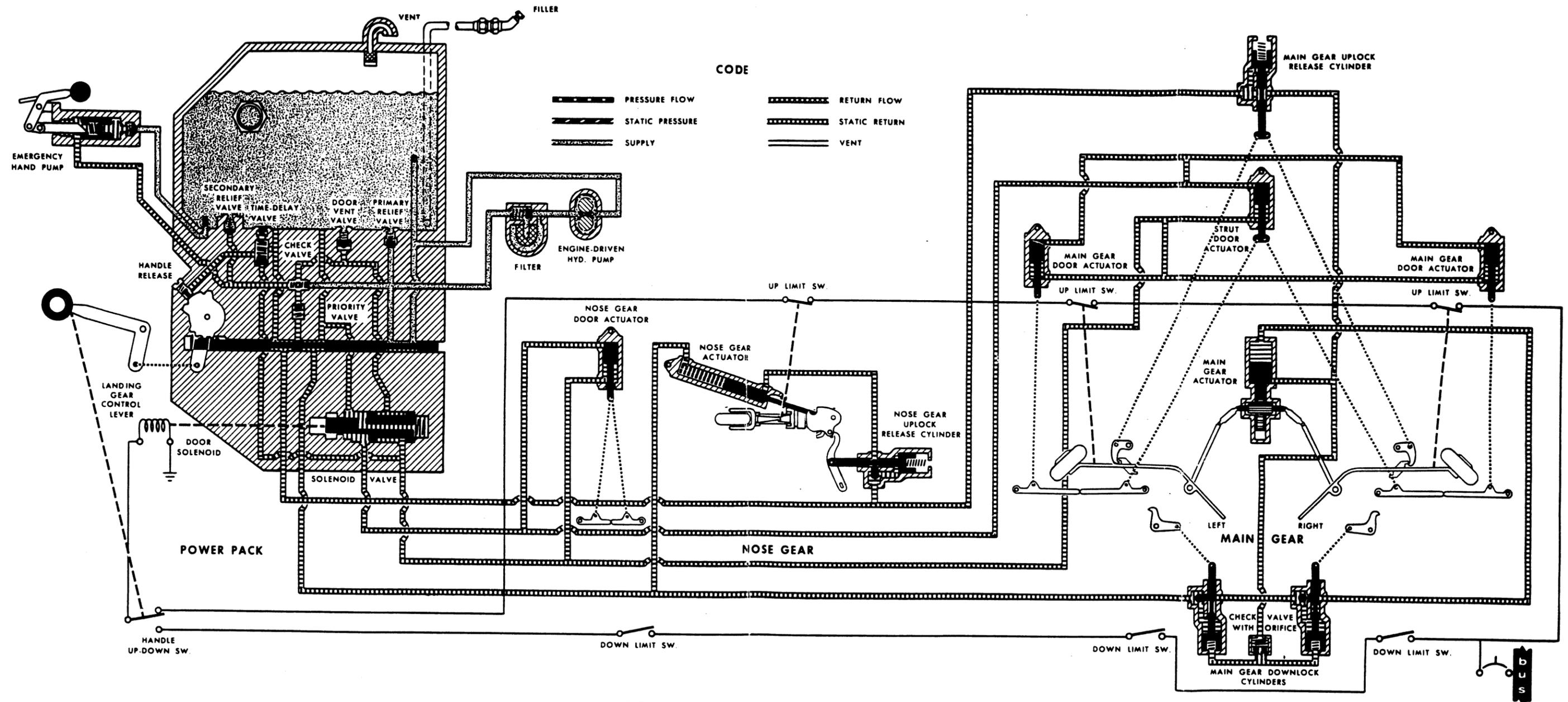
NOTE

The door vent valve shown in these schematics is not used in early 1966 model Power Packs. However, replacement Power Packs (new or remanufactured) have this valve installed. The valve relieves any pressure from thermal expansion in the door system, to keep the doors closed while the airplane is parked.

REAR ENGINE OPTIONAL HYDRAULIC PUMP INSTALLATION

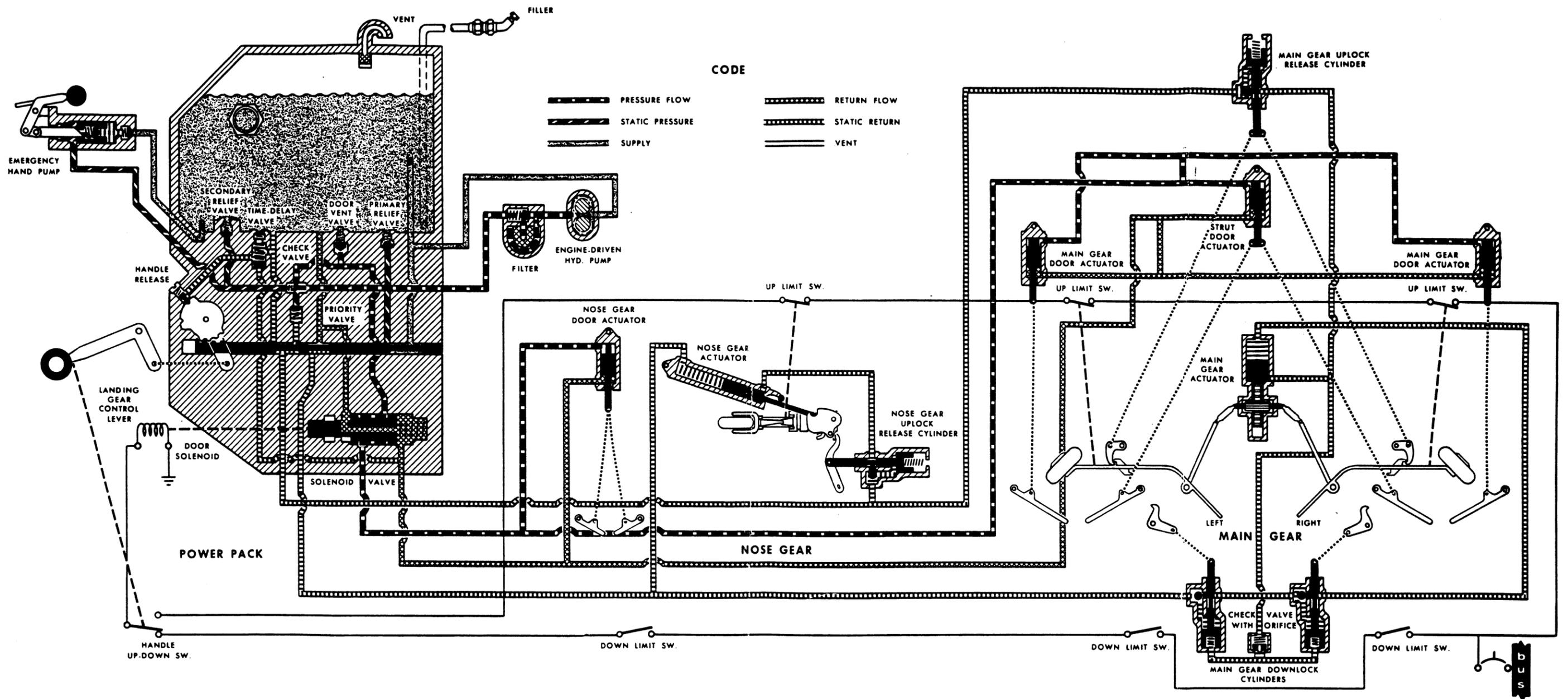
The additional hydraulic pump and filter installation at the rear engine requires that check valves be added in both pump pressure lines, and a check valve with orifice be installed in the nose gear up line, as shown in the partial schematic below. The check valves are open as long as the pumps are supplying pressure, but the applicable check valve will close if its pump should become inoperative. The valve in the nose gear up line slows down nose gear retraction time. These changes do not affect color coding in the following fold-out pages.





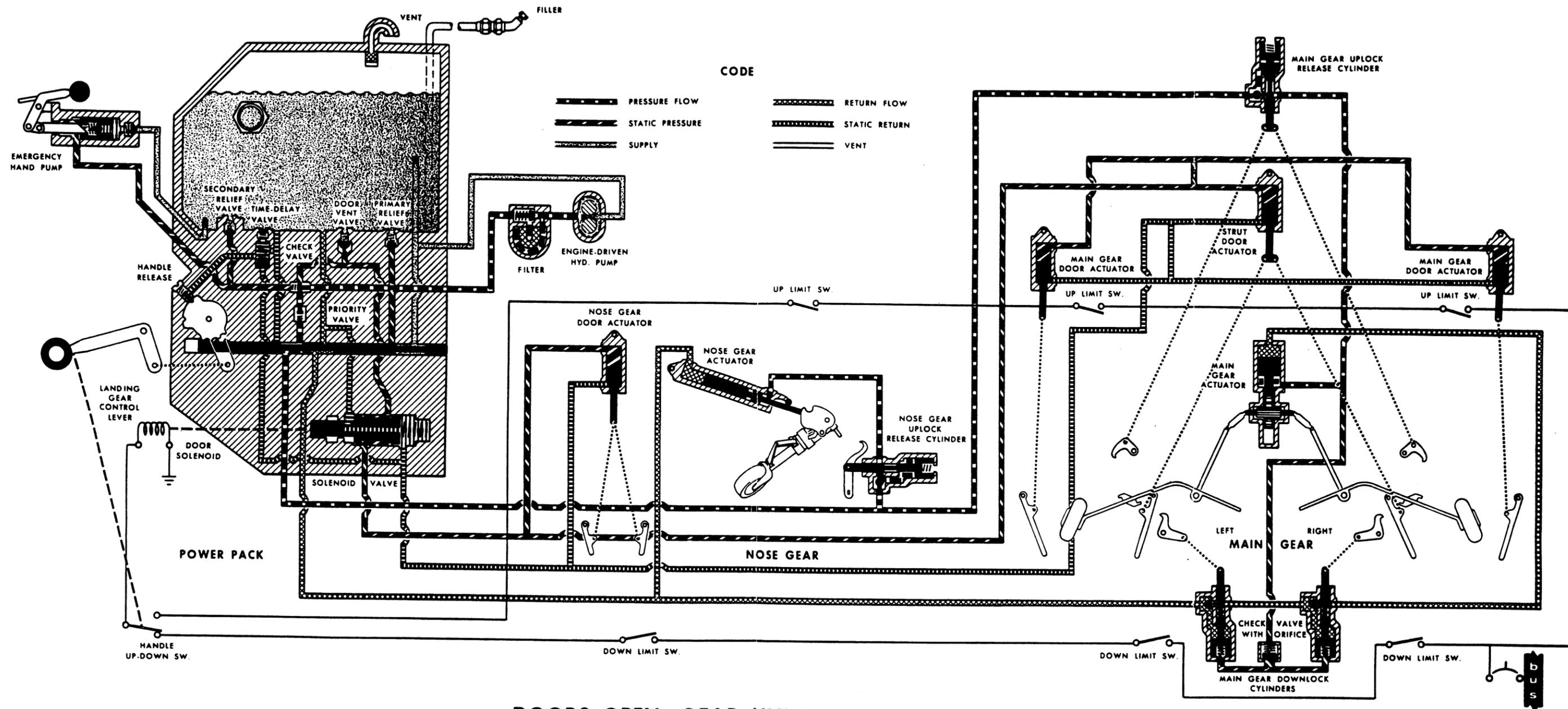
GEAR UP, DOORS CLOSED, PUMP UNLOADED

Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 1 of 10)



LANDING GEAR CONTROL JUST PLACED DOWN, DOORS OPENING

Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 2 of 10)



DOORS OPEN, GEAR UNLOCKED AND EXTENDING

Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 3 of 10)

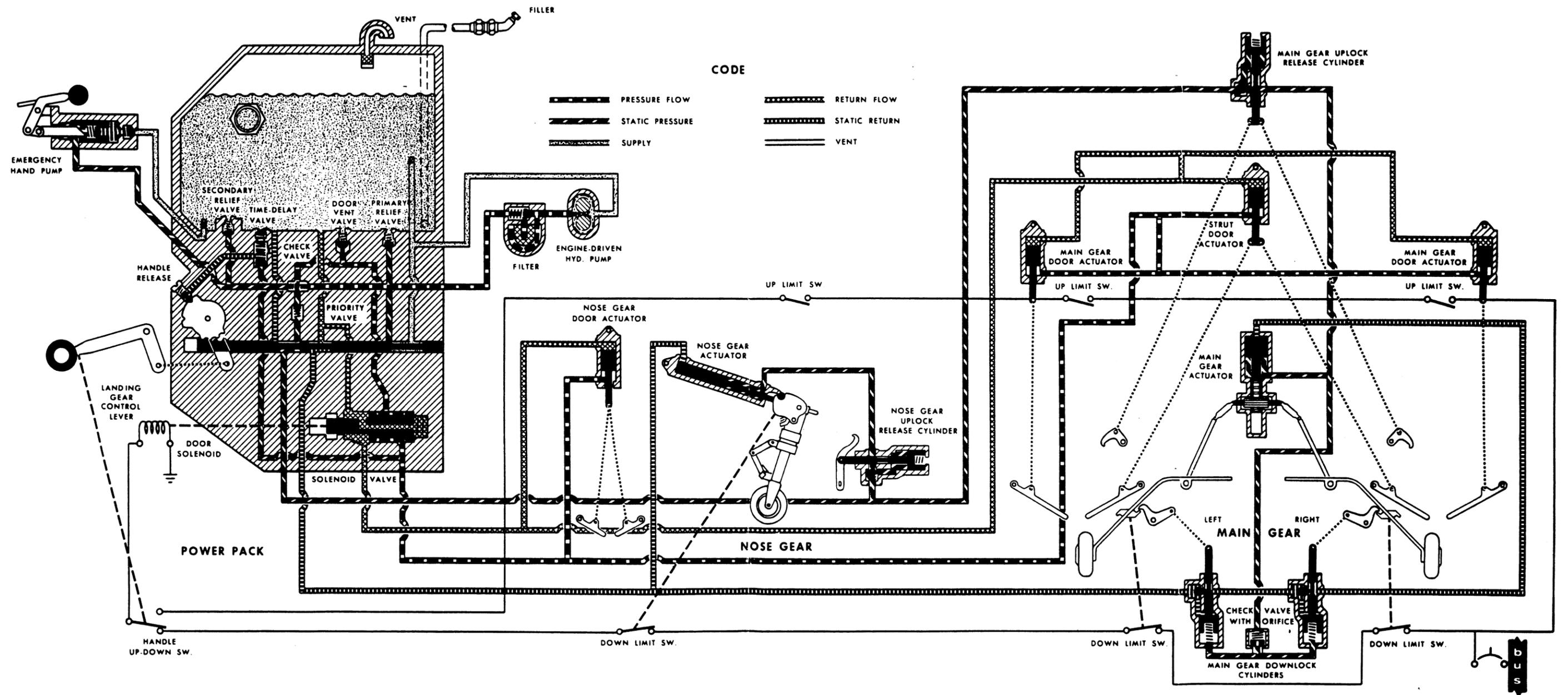
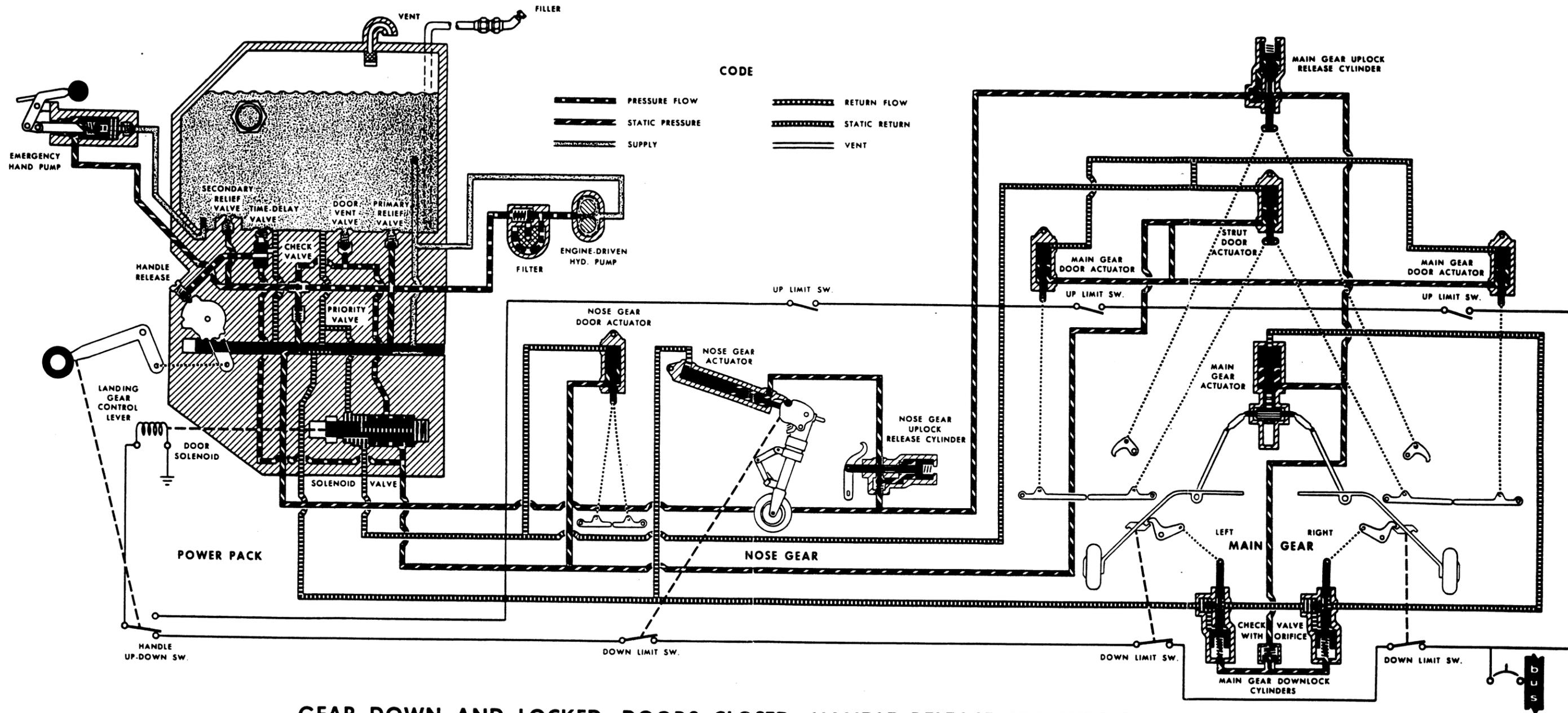


Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 4 of 10)



GEAR DOWN AND LOCKED, DOORS CLOSED, HANDLE RELEASE PRESSURE BUILDING UP

Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 5 of 10)

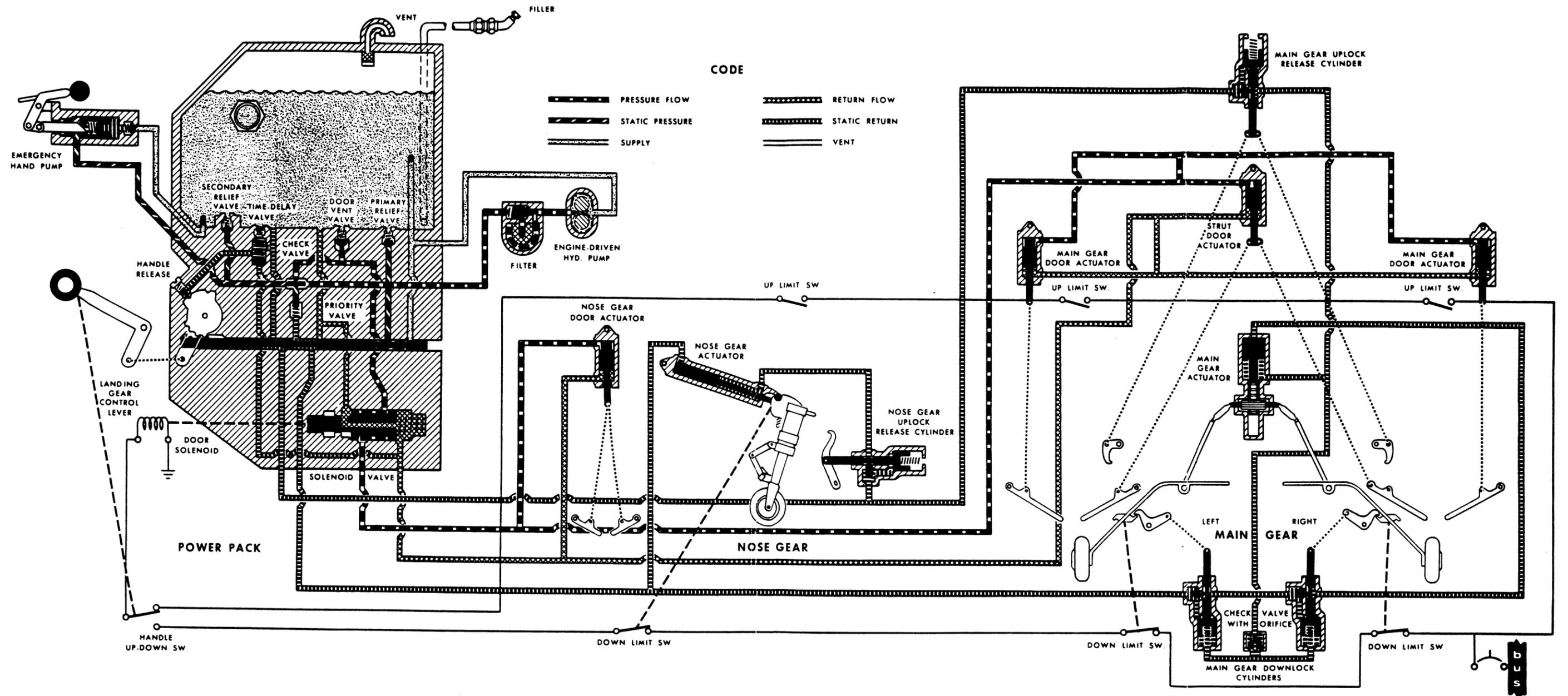
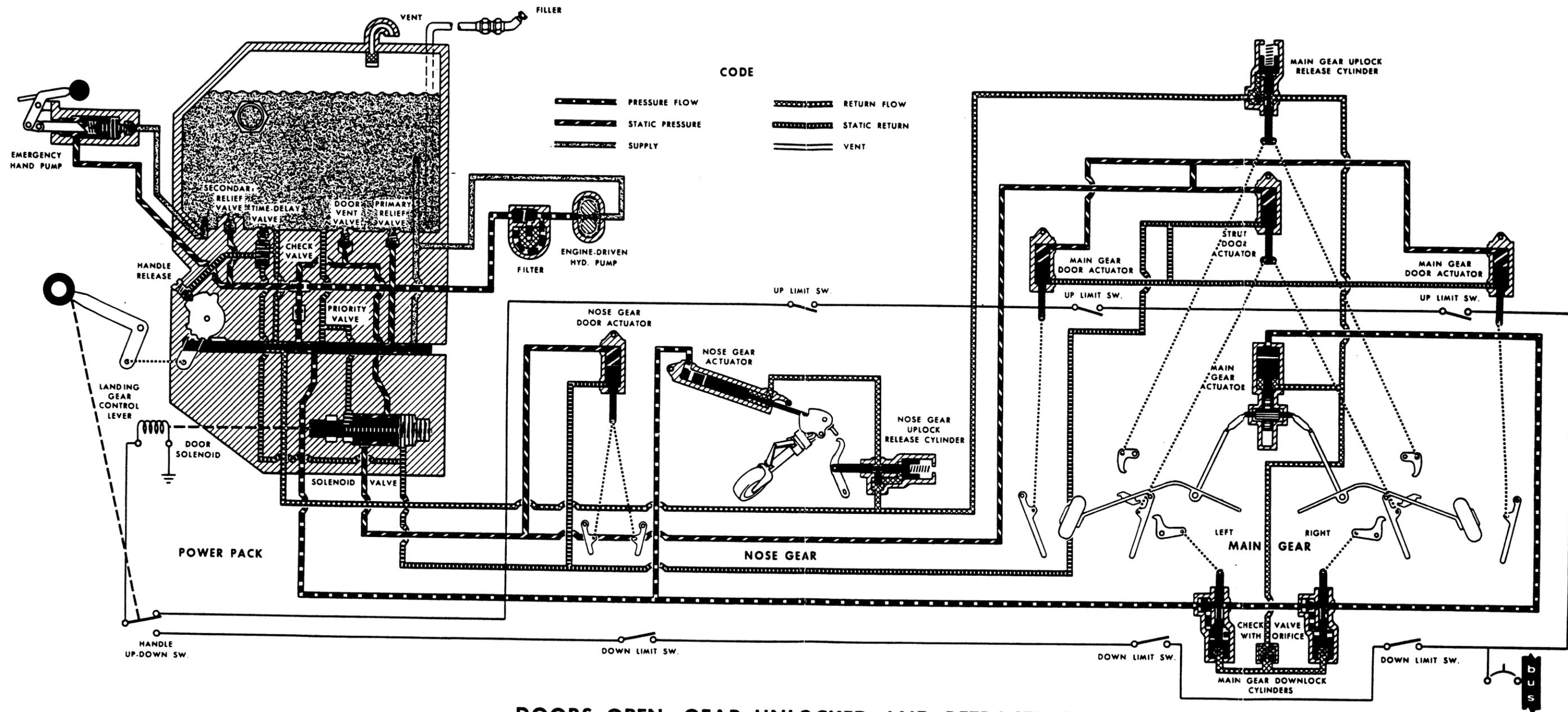


Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 6 of 10)



DOORS OPEN, GEAR UNLOCKED AND RETRACTING

Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 7 of 10)

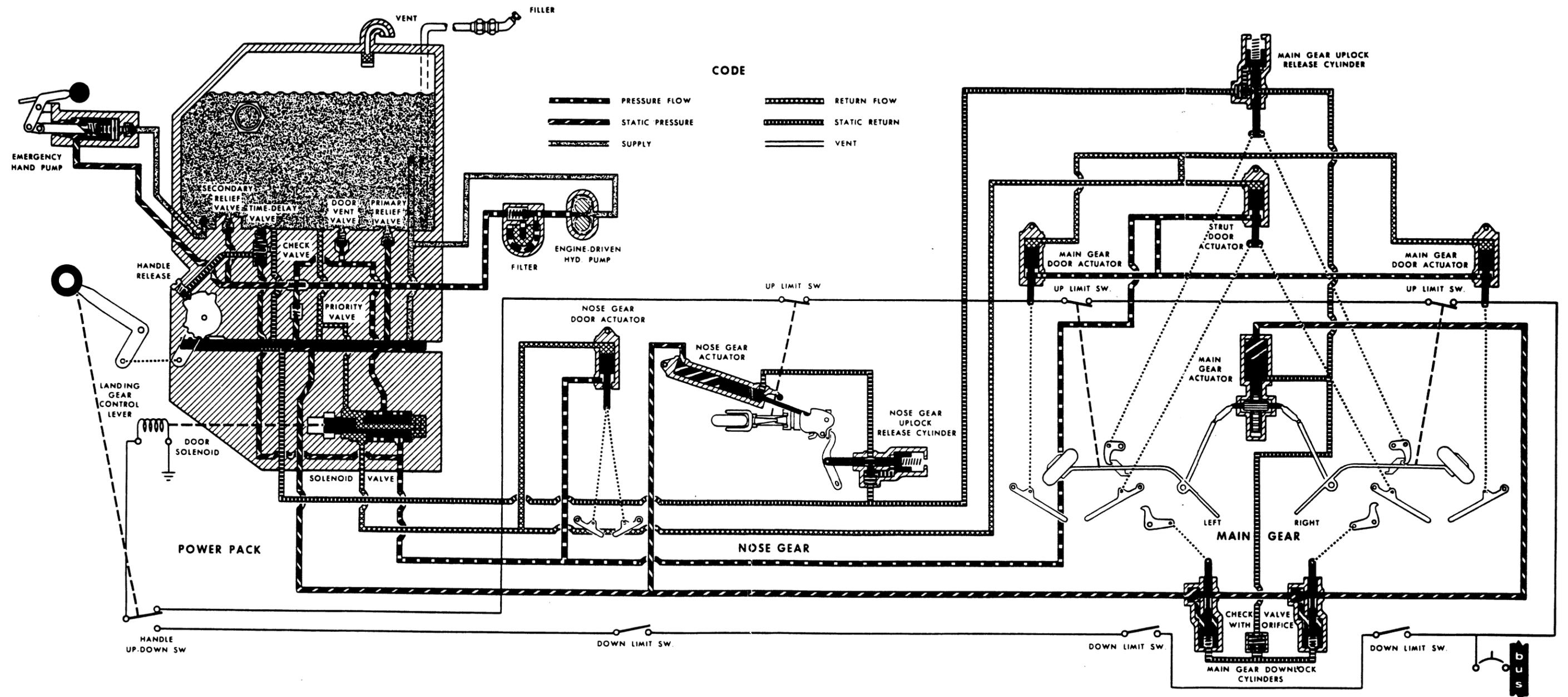
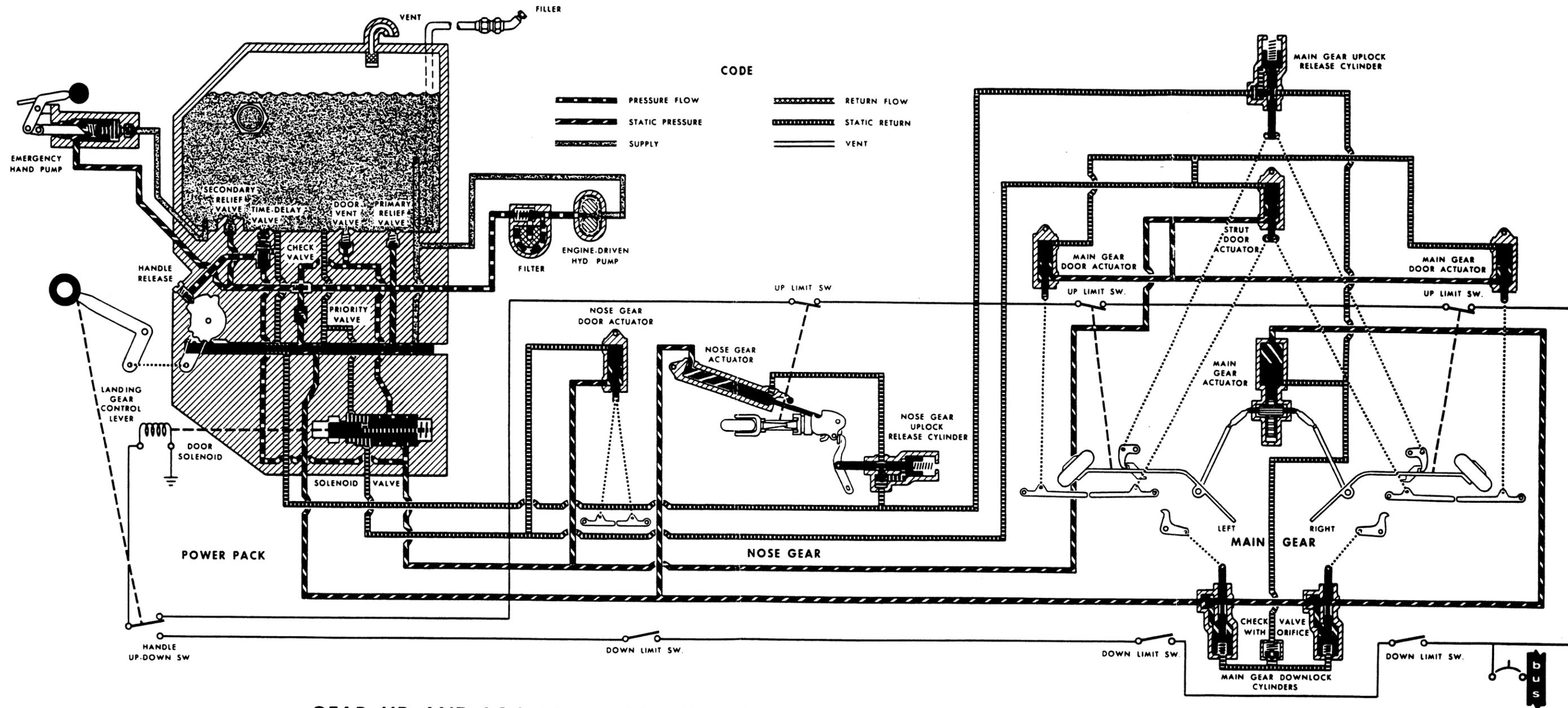


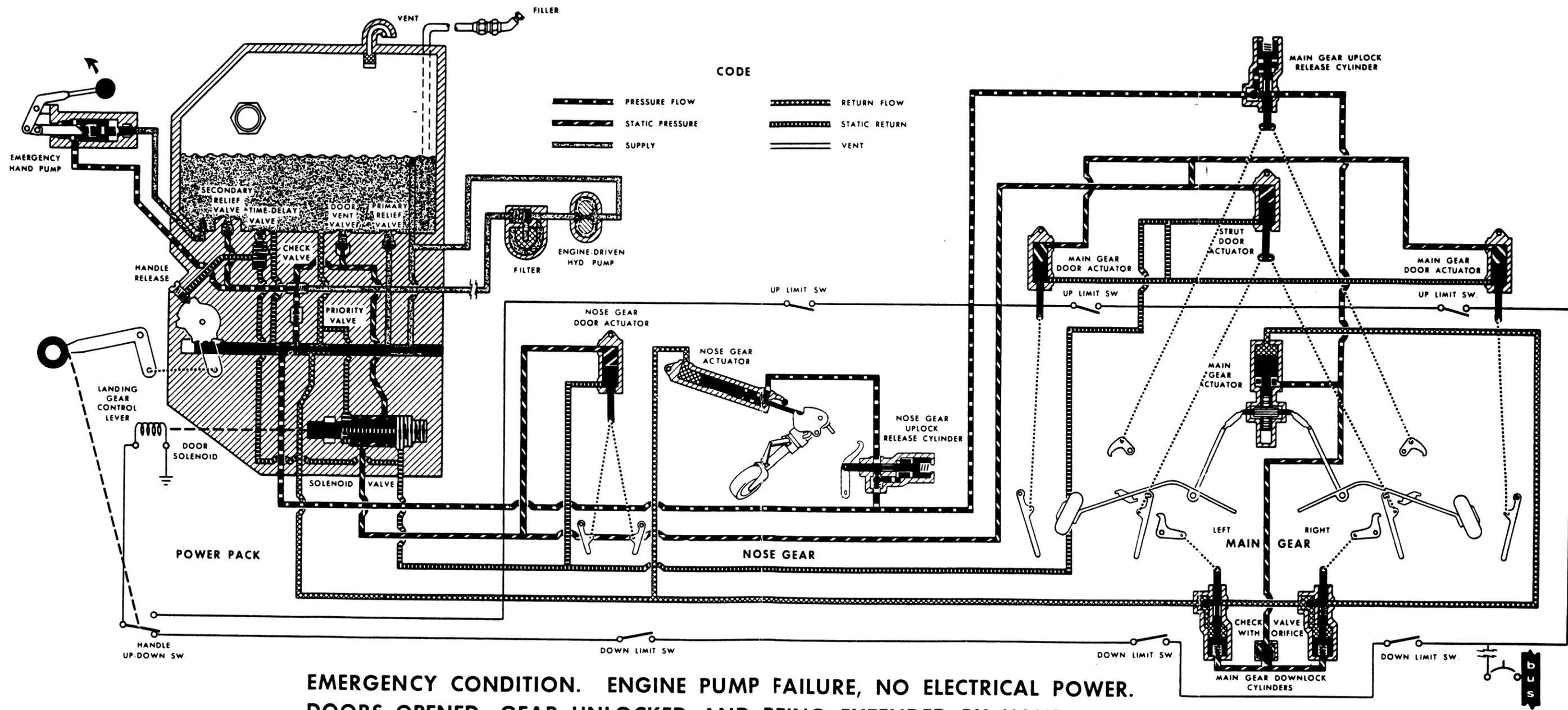
Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 8 of 10)



GEAR UP AND LOCKED, DOORS CLOSED, HANDLE RELEASE PRESSURE BUILDING UP

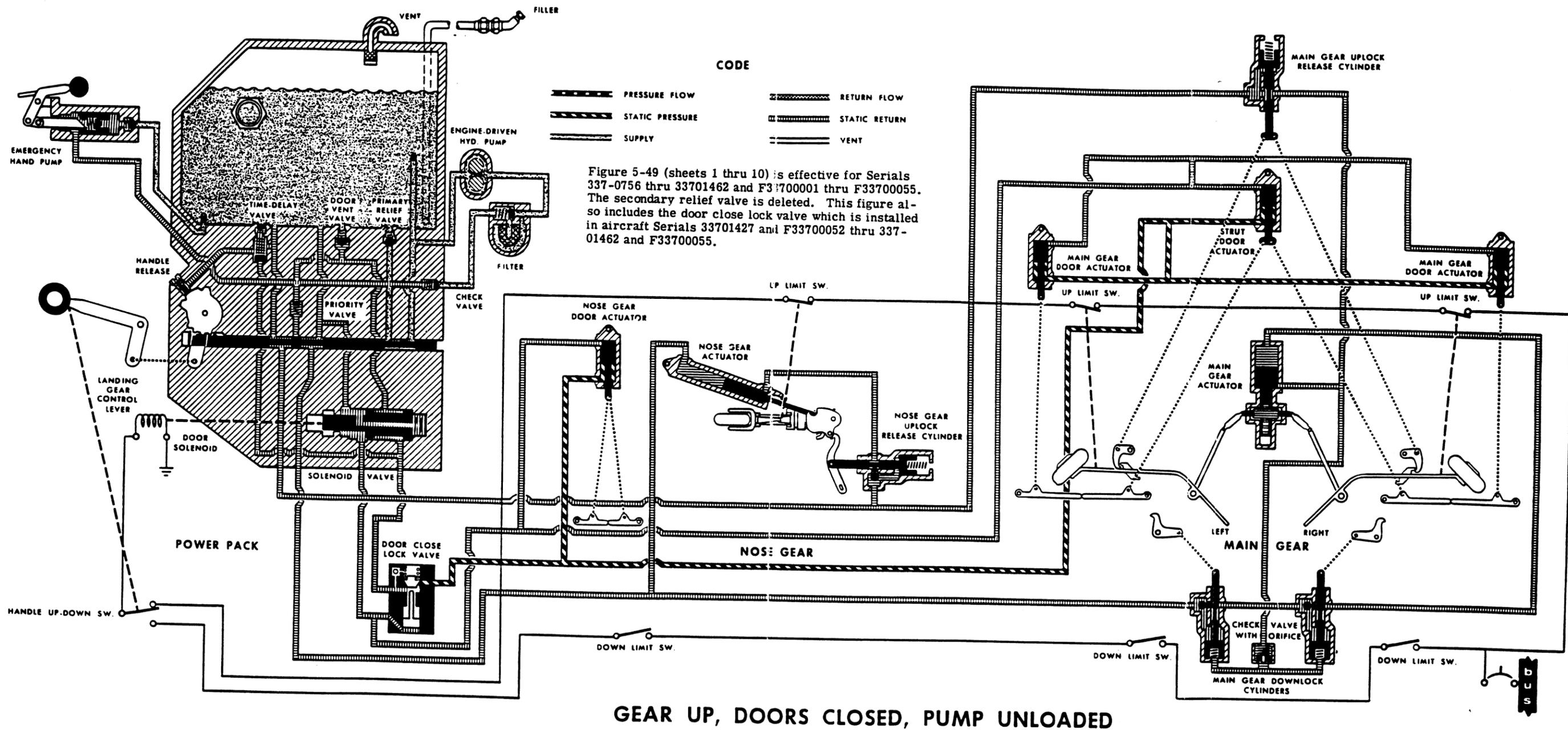
Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 9 of 10)

5-121/(5-122 blank)

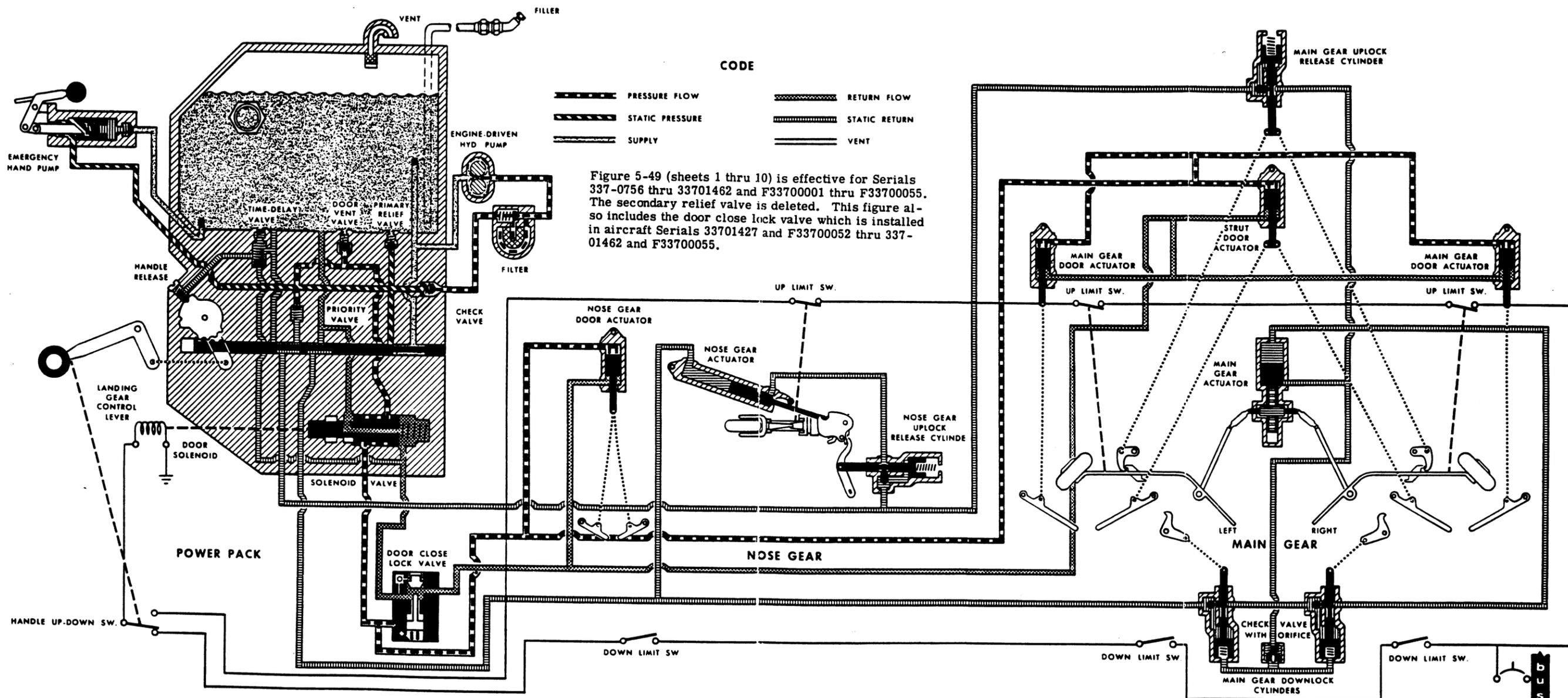


EMERGENCY CONDITION. ENGINE PUMP FAILURE, NO ELECTRICAL POWER. DOORS OPENED, GEAR UNLOCKED AND BEING EXTENDED BY HAND PUMP PRESSURE

Figure 5-48. Hydraulic System Schematic 337-0001 thru 337-0755 (Sheet 10 of 10)

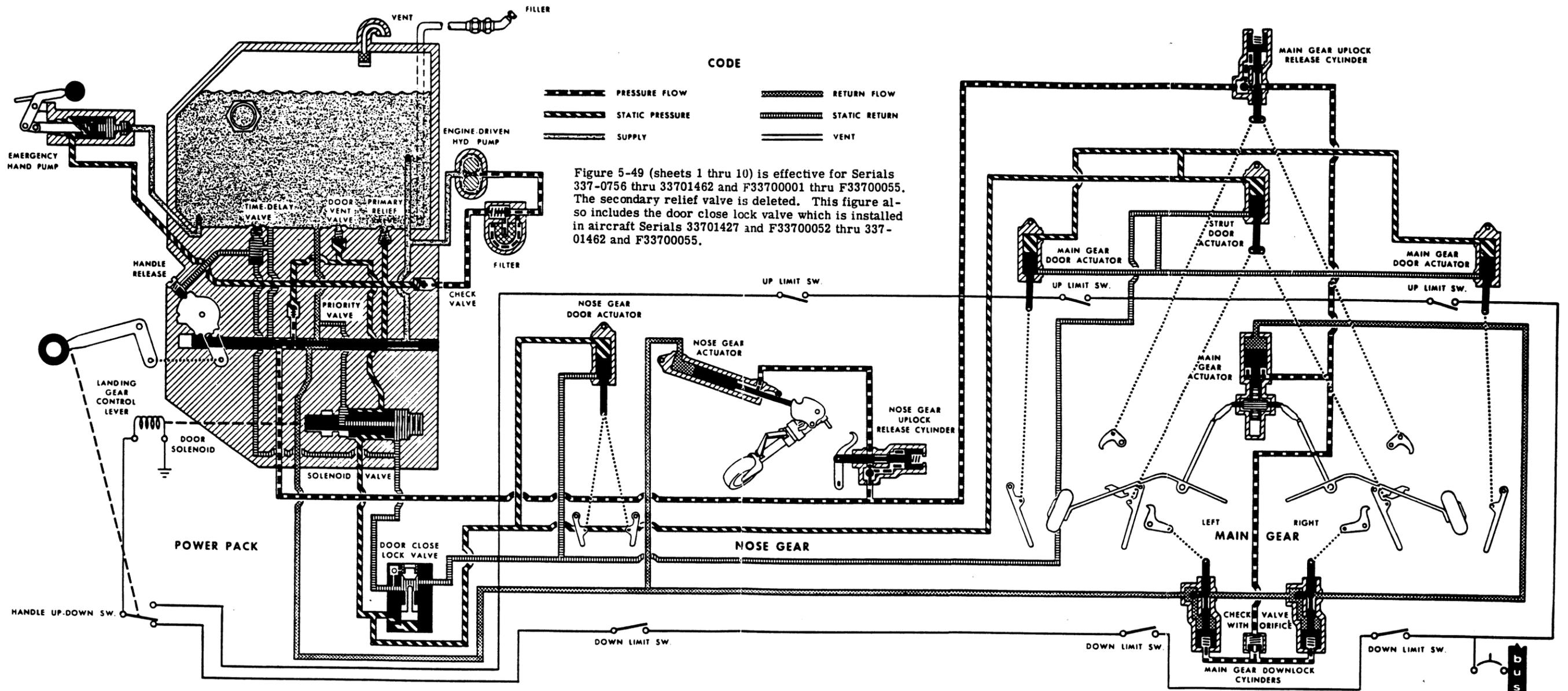


Figur: 5-49. Hydraulic System Schematic (Sheet 1 of 10)



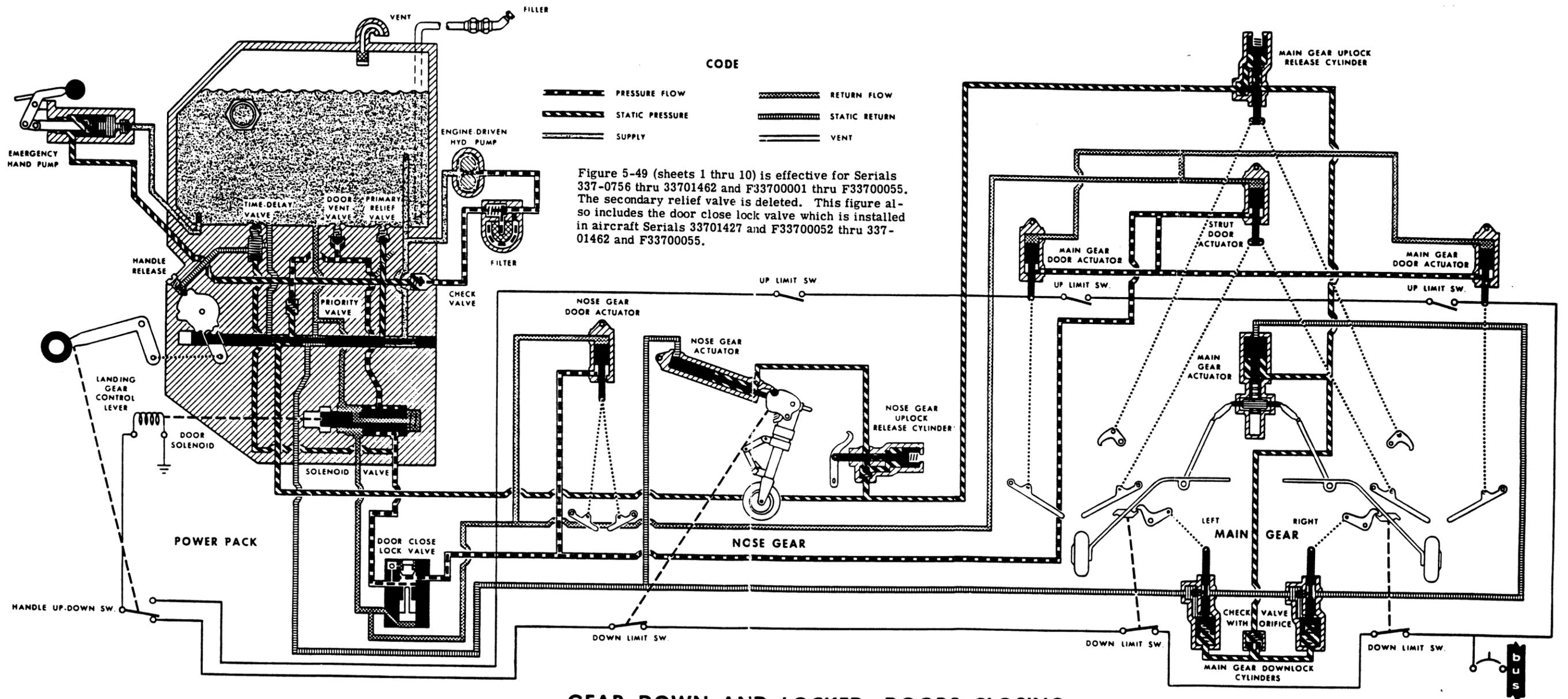
LANDING GEAR CONTROL JUST PLACED DOWN, DOORS OPENING

Figure 5-49. Hydraulic System Schematic (Sheet 2 of 10)



DOORS OPEN, GEAR UNLOCKED AND EXTENDING

Figure 5-49. Hydraulic System Schematic (Sheet 3 of 10)



GEAR DOWN AND LOCKED, DOORS CLOSING

Figure 5-49. Hydraulic System Schematic (Sheet 4 of 10)

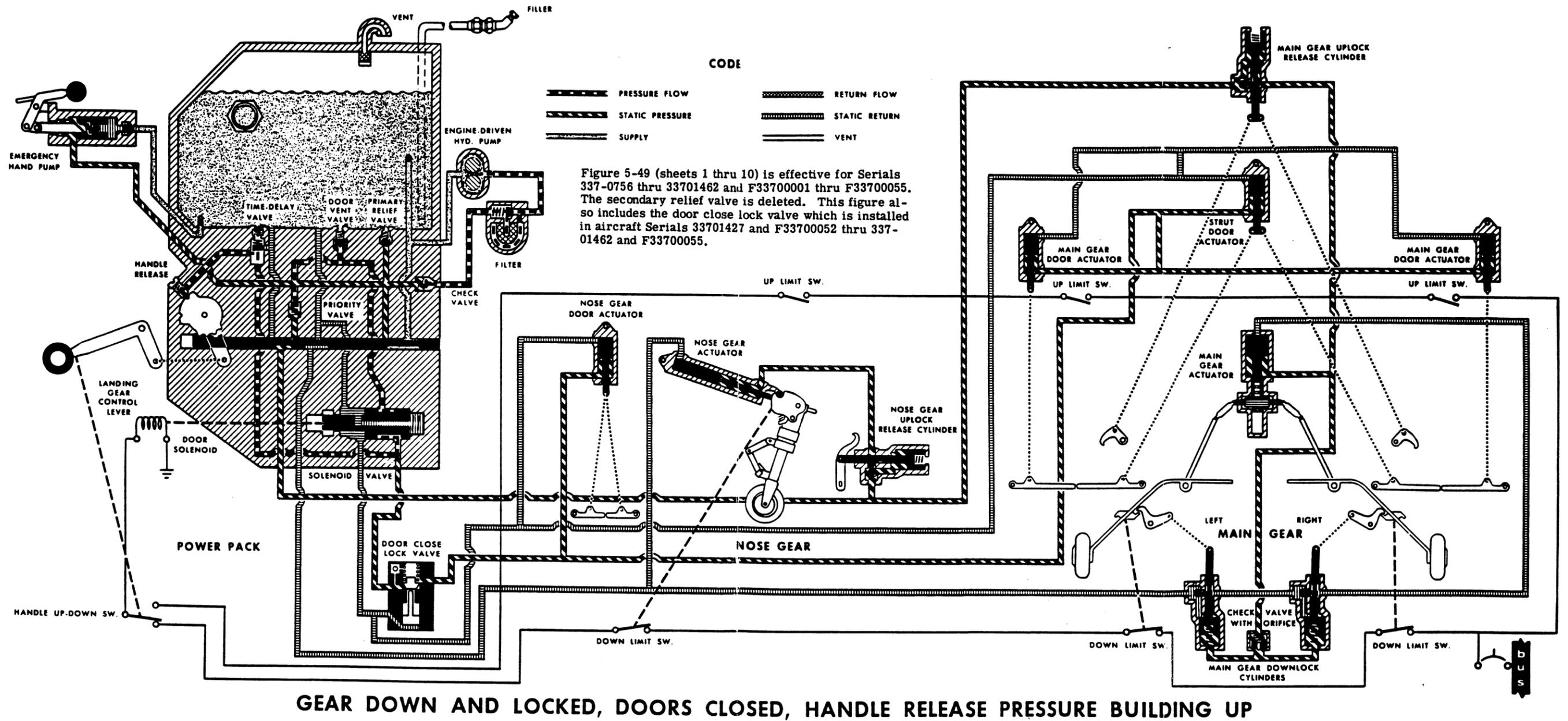
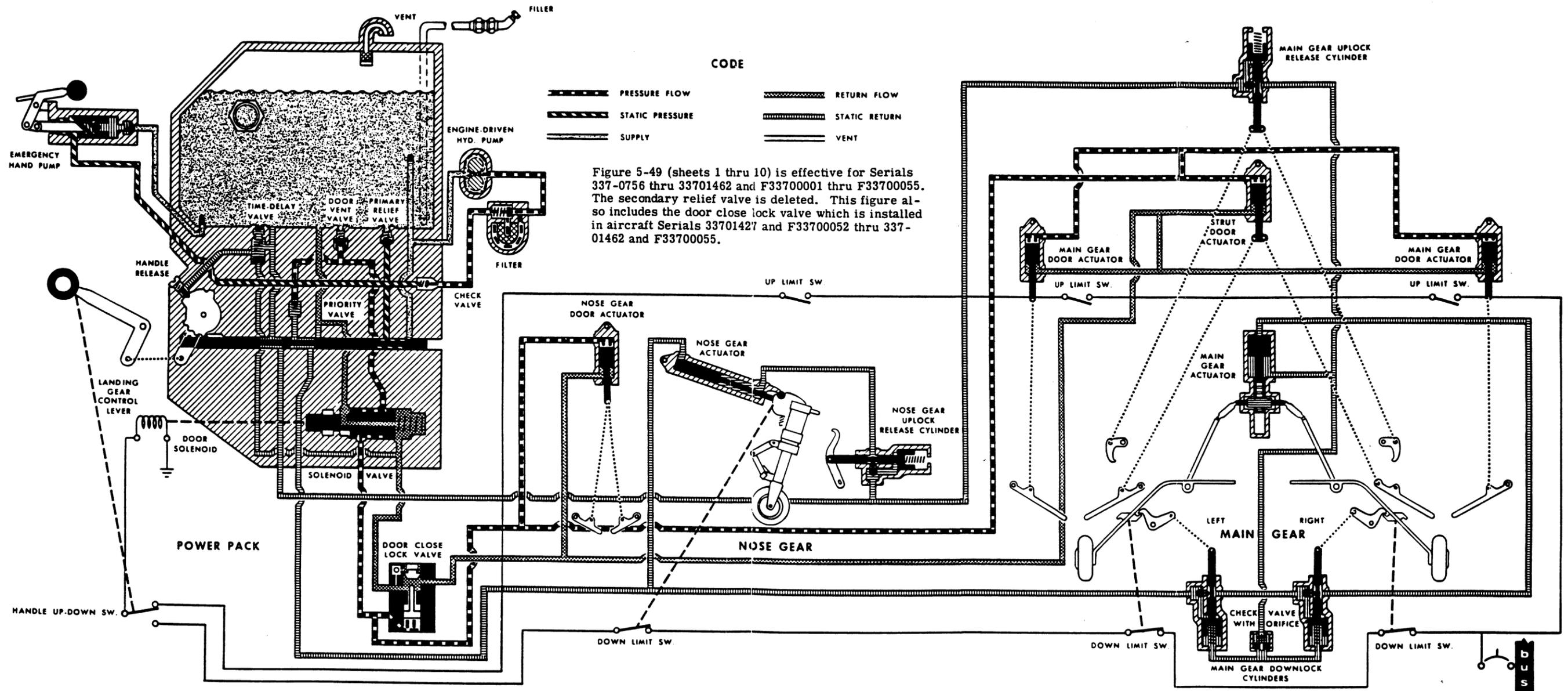
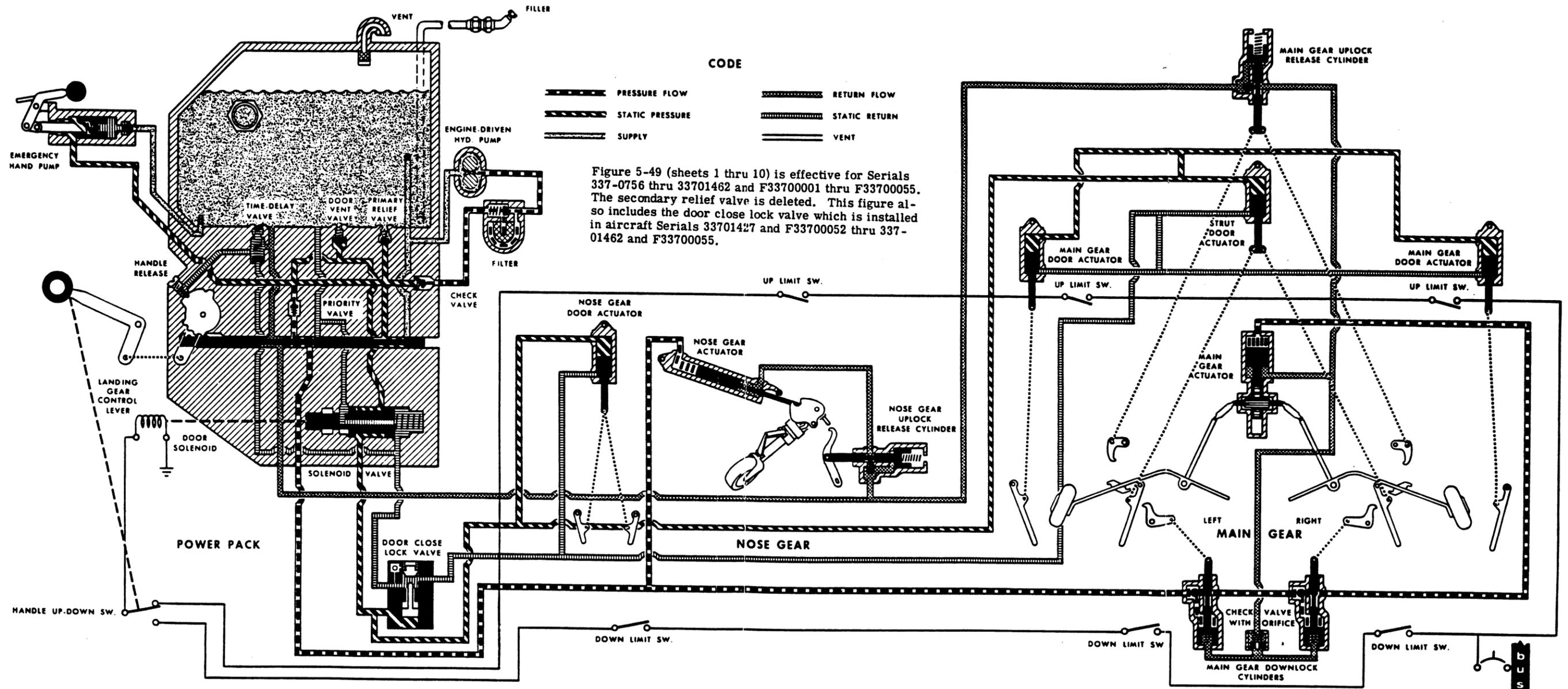


Figure 5-49. Hydraulic System Schematic (Sheet 5 of 10)



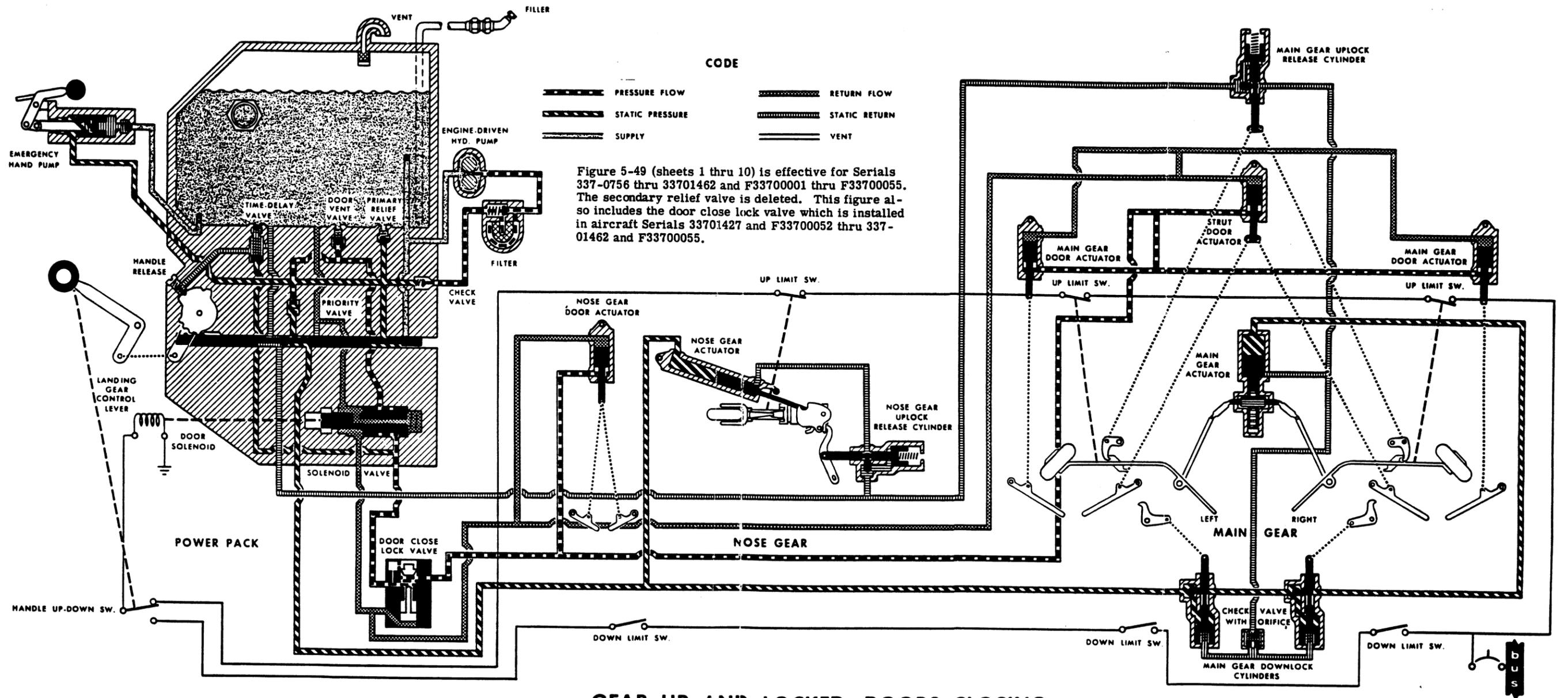
LANDING GEAR CONTROL JUST PLACED UP, DOORS OPENING

Figure 5-49. Hydraulic System Schematic (Sheet 6 of 10)



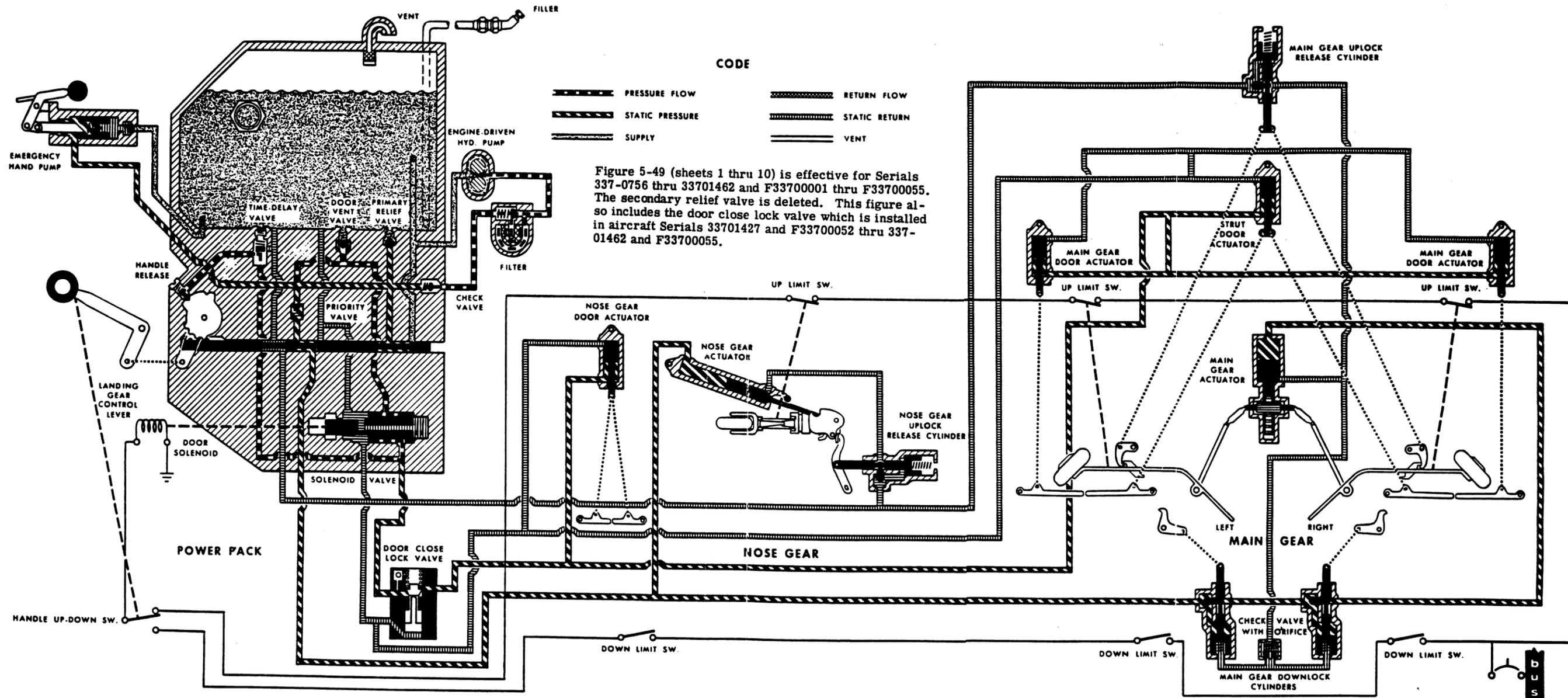
DOORS OPEN, GEAR UNLOCKED AND RETRACTING

Figure 5-49. Hydraulic System Schematic (Sheet 7 of 10)



GEAR UP AND LOCKED, DOORS CLOSING

Figure 5-49. Hydraulic System Schematic (Sheet 8 of 10)



GEAR UP AND LOCKED, DOORS CLOSED, HANDLE RELEASE PRESSURE BUILDING UP

Figure 5-49. Hydraulic System Schematic (Sheet 9 of 10)

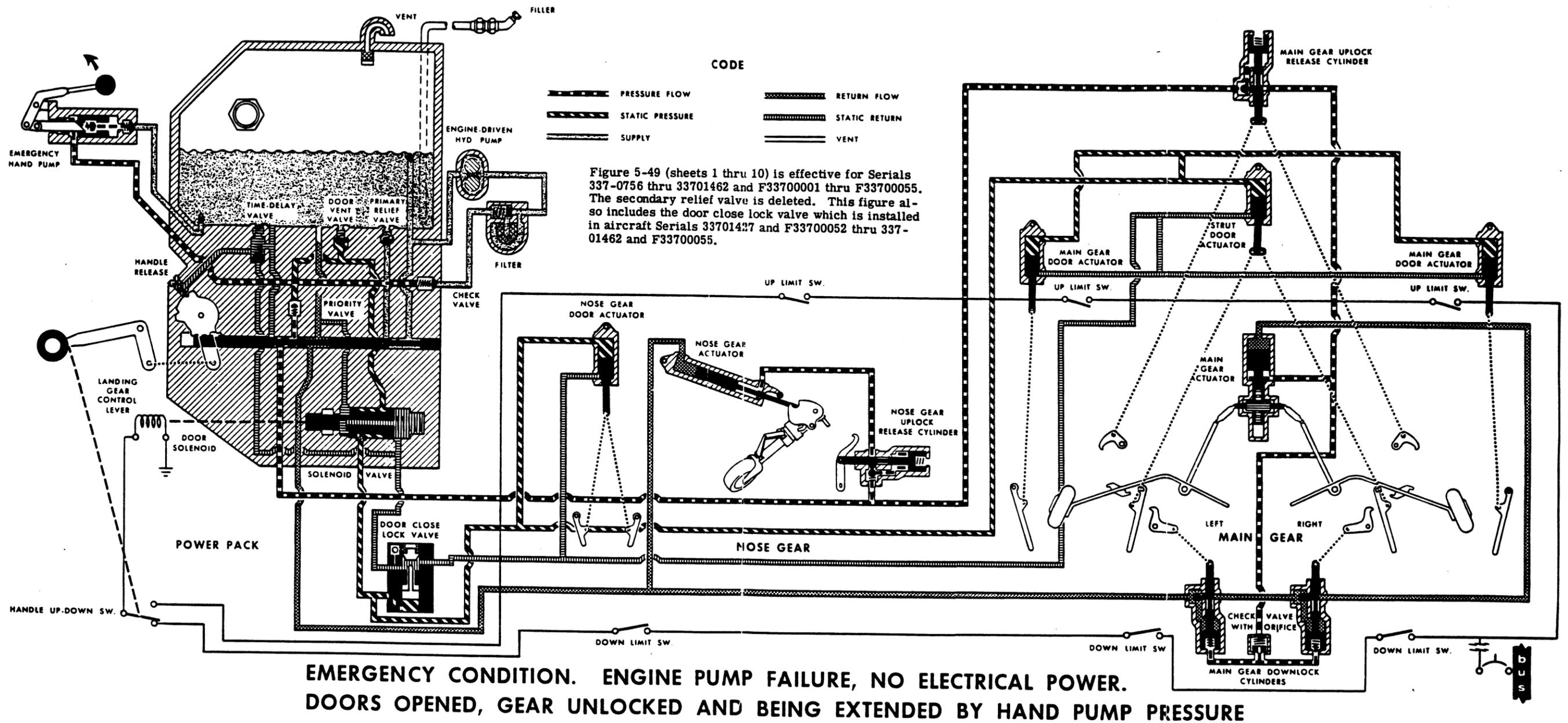


Figure 5-49 (sheets 1 thru 10) is effective for Serials 337-0756 thru 33701462 and F33700001 thru F33700055. The secondary relief valve is deleted. This figure also includes the door close lock valve which is installed in aircraft Serials 33701427 and F33700052 thru 337-01462 and F33700055.

Figure 5-49. Hydraulic System Schematic (Sheet 10 of 10)

PART 2

(BEGINNING WITH SERIALS 33701399 AND F33700046)

WARNING

Before working in landing gear wheel wells, PULL-OFF hydraulic pump circuit breaker. Circuit breaker knob is located in circuit breaker panel. The hydro-electric power pack system is designed to pressurize the landing gear "DOOR CLOSE" system to 1500 psi at any time the master switch is turned on. Injury might occur to someone working in wheel well area if master switch is turned on for any reason.

5-282. LANDING GEAR SYSTEM.

5-283. DESCRIPTION. A hydraulically-operated retractable landing gear is employed on the aircraft. The source of hydraulic power is obtained from a hydro-electric power pack, installed in the lower part of the control quadrant, immediately below the instrument panel. The power pack consists of an electric motor, driving a hydraulic pump with adequate valving to properly control the flow to actuators at the landing gear. The operation of the system is controlled by an electrical landing gear switch located to the left of the pedestal quadrant on the instrument panel.

5-284. OPERATION. When the aircraft master switch is closed, the hydraulic power pack is ready to operate. When the gear-up position is selected with the selector handle, the gear valve solenoid connects the gear-up line to system pressure, and the gear down line to return. At the same time, the electric motor that powers the hydraulic pump is turned on. The hydraulic pressure is passed through a filter, and then is divided to the gear valve and door valve. Before hydraulic pressure can reach the gear valve, a priority valve must open. The priority valve can open only under two conditions

1. There can be no pressure in the door close line, because door close pressure is applied to a piston to hold the priority valve closed.
2. System pressure must build up to 750 psig before the valve can open. Pressure, therefore, must go to the door open line. Pressure in the door close line is prevented from returning by the door close lock check valve, and the valve is opened by a piston that senses door open pressure. When the pressure reaches 400 psig, the door close lock check valve opens and the doors on the aircraft open. At 750 psig, the priority valve opens and the landing gear begin to retract. As soon as the landing gear is locked into the UP position, the landing gear up

limit switches sequence the door solenoid valve to the door close position. When pressure in the door close line reaches 1500 psig, the pressure switch shuts off the motor, and the GEAR-UP cycle is complete. The GEAR-DOWN cycle is similar to the GEAR-UP cycle, except the gear solenoid is not energized during the gear-down cycle. The system has been designed so that anytime during system operation, the direction of system operation may be reversed. Under these conditions, the first operation of the system after the selector handle is moved, is to completely open the doors, and then move the gear into the newly-selected position, after which, the doors will close again. There is no danger of interference between the gear and doors of the aircraft, since the gear does not receive hydraulic pressure unless the doors are in the fully-opened position.

5-285. MAIN GEAR SYSTEM.

5-286. DESCRIPTION. The main landing gears consist of two leaf type spring steel legs attached to rotating pivot castings mounted in the structure at an angle of approximately 45°. The wheels, hydraulic brakes and tires are attached to the lower end of the legs by bolt attaching an axle assembly. The main landing gears are retracted hydraulically up and aft into the belly of the fuselage with the wheels extending past the rear firewall into the engine compartment area. Each gear has a separate linear-rotary hydraulic actuator. The actuators consist of a linear acting piston assembly, the shaft of which is also a rack, a matching pinion, bearings, a rotary output shaft to the actuator to the pivot casting. Downlock linkages are used to secure the gears in the down position. These pawls are secured in place by small hydraulic linear actuators which also move the locking pawls out of the way before the gear retracts. The gears are also locked in the up position by an unlock pawl, each with a common hydraulic actuator.

5-287. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
MOTOR PUMP WILL NOT OPERATE GEAR BUT EMERGENCY HAND PUMP WILL OPERATE GEAR.	Fluid level low in reservoir.	Refill reservoir.
	Motor pump failure.	Repair or replace pump.
	Faulty check valve.	Repair or replace check valve.
PUMP OR EMERGENCY PUMP WILL NOT BUILD PRESSURE IN SYSTEM.	No fluid in reservoir.	Refill reservoir.
	Broken gear or door line.	Repair or replace hydraulic line.
	Door or gear solenoid valve jammed or sticking at mid-travel.	Repair or replace valve.
DOORS WILL NOT CLOSE, GEAR INDICATOR LIGHT NOT ILLUMINATED.	Master switch not on.	Turn master switch on.
	Defective limit switch circuit.	Repair defective component in limit switch circuit.
	Circuit breaker tripped.	Reset circuit breaker.
DOORS WILL NOT CLOSE, GEAR INDICATOR LIGHT IS ILLUMINATED.	Defective gear selection switch or wiring circuit.	Repair or replace defective switch or wiring.
	Defective door solenoid .	Replace solenoid
	Door solenoid valve stuck.	Remove power pack; repair or replace solenoid valve.
GEAR OPERATES PROPERLY BUT INDICATOR LIGHT DOES NOT ILLUMINATE.	Lamp burned out.	Replace lamp.
PUMP OPERATES BUT DOORS WILL NOT OPEN.	Door solenoid valve jammed or stuck in door-closed position.	Repair or replace solenoid valve. Repair any damage to doors and linkage.
GEAR UNLOCKS BEFORE DOORS ARE FULL OPEN.	Priority valve setting too low.	Replace valve spring.
	Priority valve leaking or stuck open.	Repair or replace valve.
DOORS OPEN BUT GEAR DOES NOT OPERATE.	Gear solenoid valve jammed or stuck in position.	Repair or replace solenoid valve.
	Priority valve setting too high or stuck closed.	Repair or replace valve.

5-287. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
HAND PUMP DOES NOT BUILD UP PRESSURE BUT ELECTRIC PUMP OPERATES GEAR PROPERLY.	Faulty hand pump plunger check valve or O-ring.	Remove and inspect hand pump plunger; replace parts as needed.
	Faulty system inlet check valve or hand pump inlet check valve.	Repair or replace check valves.
LANDING GEAR OPERATION EXTREMELY SLOW.	Reservoir fluid level low.	Refill reservoir.
	Downlock rod adjustment incorrect (Mainly LH rod).	Adjust rod end to lengthen actuator one turn.
	Pump failure or internal leakage.	Repair or replace pump.
	Air leakage around pump suction tube.	Seal suction tube.
	Fluid leak in door or gear line.	Tighten or replace lines.
	Defective piston seal in gear or door cylinder.	Repair or replace defective parts.
	Excessive internal power pack leakage.	Remove and repair or replace power pack.
POWER PACK EXTERNAL LEAKAGE.	(Static seals) All fittings.	Remove and replace O-rings and back-up rings as needed.
	Gear solenoid.	Replace O-rings.
	Door solenoid.	Replace O-rings.
	Transfer tubes between manifold and power pack body.	Disassemble; replace O-rings.
	Reservoir cover.	Remove power pack and remove cover. Replace seals.
POWER PACK LOSES FLUID WITH NO EVIDENCE OF LEAKAGE.	Air leak at pump shaft seal.	Repair or replace pump.

NOTE

Refer to the trouble shooting chart in paragraph 5-6 for additional procedures not covered in paragraph 5-287.

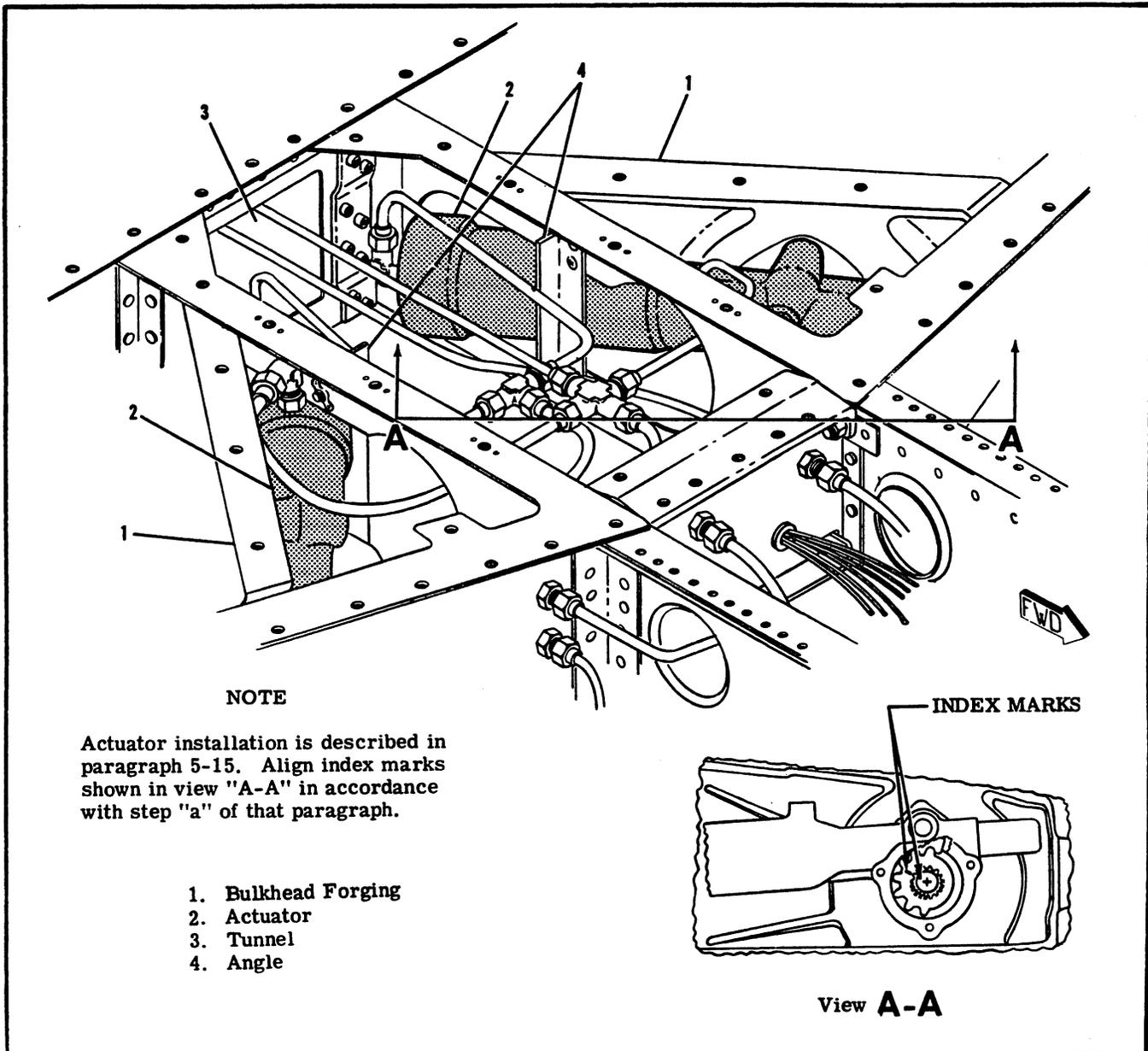


Figure 5-50. Main Gear Actuator Removal

5-288. **MAIN LANDING GEAR STRUT REMOVAL AND INSTALLATION.** Refer to figure 5-1 and paragraphs 5-7 thru 5-8 for removal and installation of the main landing gear struts.

5-289. **MAIN LANDING GEAR ACTUATOR.**

5-290. **DESCRIPTION.** The main landing gear actuator consists of a linear acting piston assembly, the shaft of which is also a rack, a matching pinion, bearings, a rotary output shaft to the actuator to the pivot casting.

5-291. **REMOVAL.** (Refer to figure 5-50.)

- a. Remove center seat.
- b. Jack aircraft in accordance with instructions outlined in Section 2.
- c. Remove floor panel above tunnel (3) area and

above actuator (2) to be removed.

- d. Place landing gear control handle UP, with master switch OFF, and operate emergency hand pump until main gear downlock releases.

- e. Disconnect and cap or plug hydraulic lines at actuator (2).

- f. Remove angle (4) on side of tunnel adjacent to actuator.

- g. Remove three bolts attaching actuator mounting flange to bulkhead forging (1).

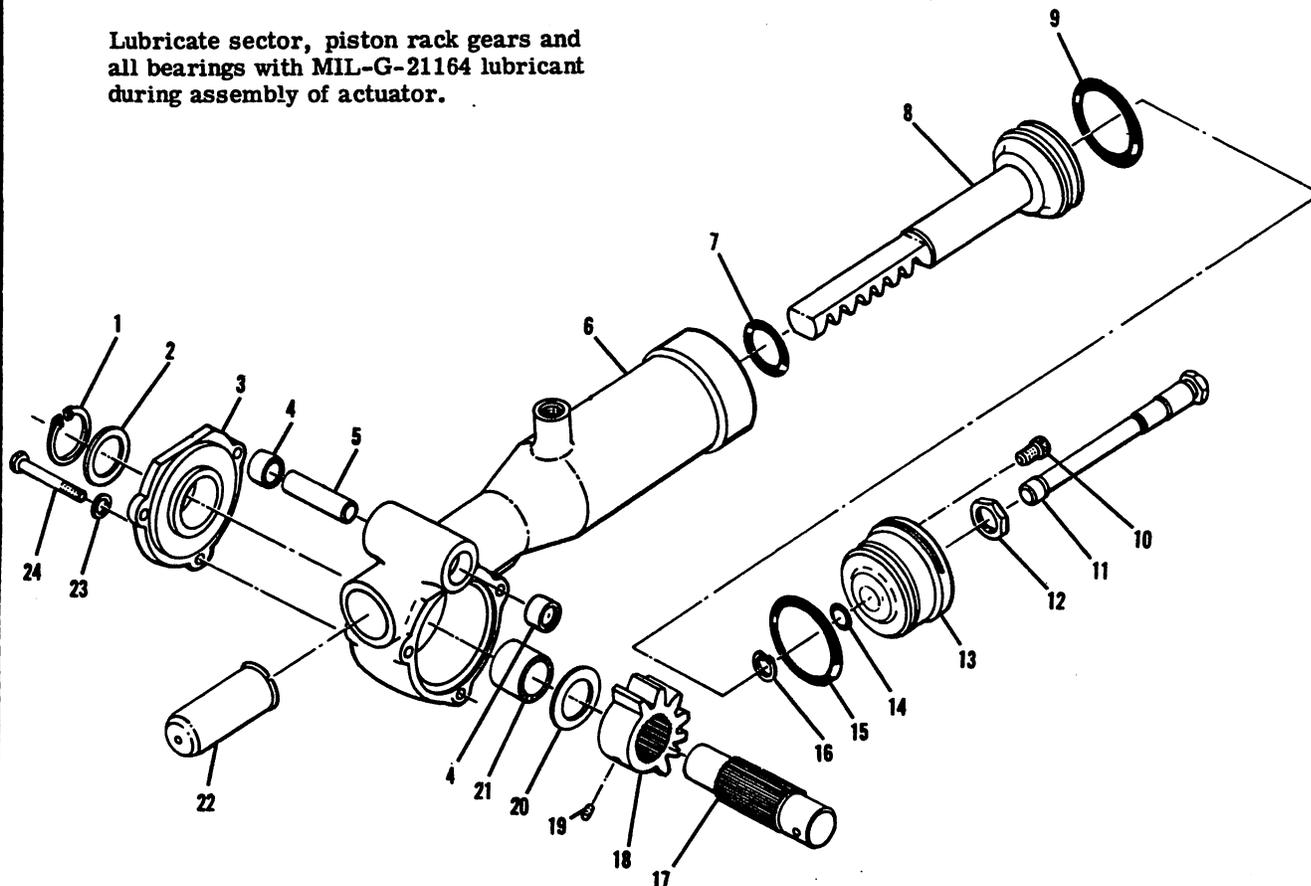
- h. Work actuator free of forging and pivot assembly and remove actuator.

NOTE

It may be necessary to disconnect lines in the tunnel area to facilitate removal of actuator.

NOTE

Lubricate sector, piston rack gears and all bearings with MIL-G-21164 lubricant during assembly of actuator.



- 1. Retainer
- 2. Washer
- 3. Cap
- 4. Bearing
- 5. Roller
- 6. Cylinder Body
- 7. O-Ring
- 8. Piston

- 9. O-Ring
- 10. Screw
- 11. Metering Pin
- 12. Nut
- 13. End Gland
- 14. O-Ring
- 15. O-Ring
- 16. Retainer

- 17. Shaft
- 18. Sector
- 19. Setscrew
- 20. Washer
- 21. Bearing
- 22. End Cap
- 23. Washer
- 24. Bolt

Figure 5-51. Main Landing Gear Actuator

5-292. DISASSEMBLY. (Refer to figure 5-51.)

- a. Remove screw (10) and remove end gland (13) and metering pin (11) by unscrewing end gland from cylinder body (6).
- b. Remove cap end (22) and remove cap (3) by pulling from cylinder body (6). Using a small rod, push piston (8) from cylinder body (6).
- c. Remove cap (3) from shaft (17) by removing retainer (1) and washer (2).
- d. Remove shaft (17), sector (18) and washer (20) from cylinder body (6).
- e. Remove setscrew (19) from sector (18) and remove sector from shaft (17).

- f. Remove and discard O-ring (7) from cylinder body (6).
- g. Remove retainer ring (16) and loosen locknut (12) and remove metering pin (11) from end gland. Remove and discard O-rings (14 and 15) from end gland.
- h. Remove and discard O-ring (9) from piston (8)
- i. Thoroughly clean all parts in cleaning solvent (Federal Specification P-S-661, or equivalent).

5-293. INSPECTION OF PARTS.

- a. Inspect all threaded surfaces for cleanliness, cracks and evidence of wear.
- b. Inspect cap (3), washers (2 and 20), sector (18), shaft (17), piston (8), roller (5) and cylinder body (6) for cracks, chips, scratches, scoring, wear or surface irregularities which might affect their func-

NOTE

Unless defective, do not remove name plate, bearings (4 and 21) or roller (5).

tion or the overall operation of the actuator.

c. Inspect bearings (4 and 21) for freedom of motion, scores, scratches and Brinnel marks.

5-294. REPLACEMENT/REPAIR OF PARTS.

a. Repair of small parts of the actuator is usually impractical. Replace defective parts with serviceable parts. Minor scratches or score marks may be removed by polishing with abrasive crocus cloth (Federal Specification P-C-458), providing their removal does not affect the operation of the unit.

b. Install all new O-rings during assembly.

5-295. ASSEMBLY. (Refer to figure 5-51.)

NOTE

Lubricate roller (5), bearings (4 and 21) and sector (18) with MIL-G-21164 high and low temperature grease when installing parts in cylinder body (6).

a. Press one bearing (4) into cylinder body (6) until flush. Install roller (5) and press other bearing (4) in place to hold roller. Use care to prevent damage to bearings and roller.

b. Press bearing (21) into cap (3) until flush.

c. Assemble sector (18) on shaft (17) with index marks on shaft and sector aligned. Install setscrew (19), assuring that setscrew enters shaft.

d. Position washer (20) and cap (3) on shaft (17), then install washer (2) and retainer (1) on shaft, noting that end of shaft with fitting is positioned in cap (3).

NOTE

Use AN316-4R nut on bolt (24) to hold assembled cap and shaft to cylinder body.

e. Install cap and shaft assembly on cylinder body, using bolts and nuts.

NOTE

Lubricate all O-rings with Petrolatum or MIL-H-5606 hydraulic fluid during assembly.

f. Install new O-ring (7) in cylinder body bore and install new O-ring (9) on piston (8).

g. Rotate shaft (17) so that teeth on sector (18) are toward cylinder body.

h. Slide piston (8) into cylinder body, rotating shaft (17) as necessary to engage first tooth on sector with first tooth on piston rack. Use care to prevent damage to O-rings in cylinder body bore and on piston.

NOTE

Lubricate sector and piston rack gears with MIL-G-21164 high and low temperature grease sparingly during assembly. Over-greasing might cause contamination of hydraulic cylinder area of cylinder body (6), past O-ring (7).

i. Install new O-rings (14) and (15) on end gland (13).

j. Install metering pin (11) in end gland. Install retainer (16) on metering pin.

k. Install end gland and metering pin assembly in cylinder and tighten until end of gland is flush with end of cylinder body. Install and tighten screw (10).

l. Install end cap (22) at end of actuator assembly.

5-296. INSTALLATION.

a. With main gear pivot assembly rotating freely, match pivot and actuator markings and slide actuator into place.

NOTE

Make sure index marks are aligned.

b. Install three bolts attaching mounting flange to bulkhead forging. Torque bolts to 50-70 pound-inches.

c. Connect hydraulic lines at actuator.

d. Install angle on side of tunnel, adjacent to actuator.

e. Check rigging of main landing gear as described in applicable paragraph of this section.

f. Remove aircraft from jacks; install floor panels, carpeting and center folding seat.

5-297. LINKAGE.

5-298. DESCRIPTION. Each main landing gear actuator attaches directly to a shaft, which in turn rotates its own main landing gear. The landing gear strut and pivot shaft are fastened together by a saddle and rotate in bearings contained in inboard and outboard main landing gear support forgings.

5-299. SADDLE AND PIVOT SHAFT REMOVAL. (Refer to figure 5-52.)

a. Remove main landing gear strut as outlined in paragraph 5-7.

b. Remove main landing gear actuator in accordance with instructions outlined in paragraph 5-291.

c. Remove three bolts attaching saddle to pivot shaft.

d. Pull pivot shaft inboard until clear of support bearings. Allow saddle, thrust bearing, bearing race and spacers to slide outboard as shaft is pulled inboard. When shaft is clear of bearings, lift outboard end and slide saddle off shaft. Remove remaining bearing parts from shaft.

e. Pull pivot shaft inboard to remove.

5-300. SADDLE AND PIVOT SHAFT INSTALLATION. (Refer to figure 5-52.)

a. Position pivot shaft through inboard forging and slide spacers, thrust bearing race, thrust bearing and saddle onto shaft.

NOTE

The spacers are used as required to remove end play from the pivot shaft, without causing it to bind.

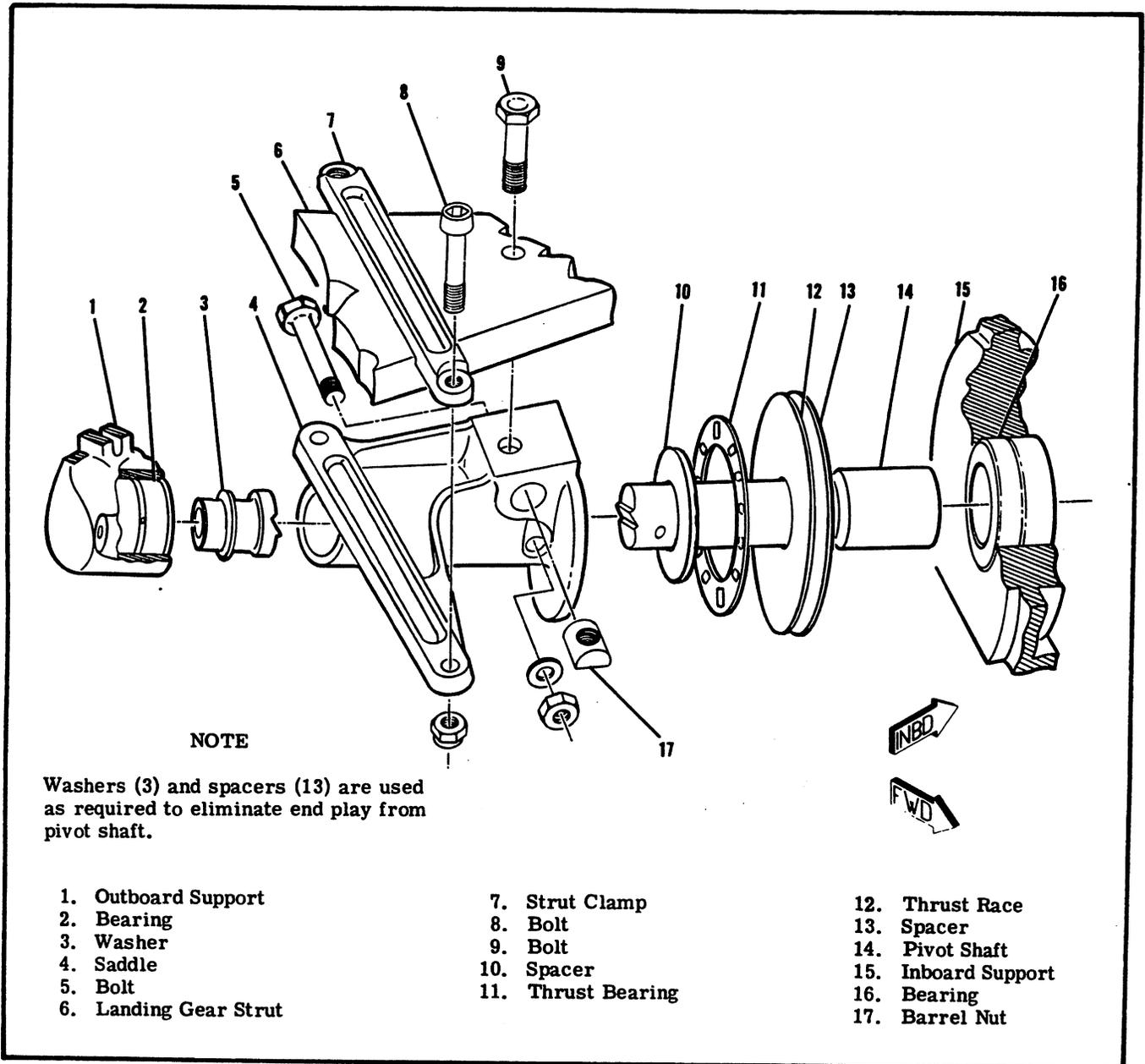


Figure 5-52. Main Landing Gear Linkage

b. Position outboard end of pivot shaft in bearing in outboard support forging, check for end play of shaft and adjust spacers as noted.

c. Install bolts securing saddle to pivot shaft.

d. Reinstall main landing gear actuator as outlined in paragraph 5-296.

e. Reinstall main landing gear strut in accordance with instructions outlined in paragraph 5-8.

5-301. MAIN LANDING GEAR UPLOCK SYSTEM.

To remove or install main gear uplock system components, refer to paragraphs 5-27 thru 5-31 and figure 5-6. To disassemble, inspect or assemble the uplock actuator, refer to paragraphs 5-28 thru 5-30 and figure 5-7.

5-302. MAIN LANDING GEAR DOWNLOCK SYSTEM.

To remove or install main gear downlock system components, refer to paragraphs 5-35 thru 5-37 and figure 5-8. To disassemble, inspect or assemble the downlock actuator, refer to paragraphs 5-28 thru 5-30 and figure 5-7.

5-303. MAIN LANDING GEAR DOOR SYSTEM. To remove or install main wheel doors, refer to paragraphs 5-41 thru 5-51 and figure 5-9.

5-304. MAIN WHEEL DOOR ACTUATOR. To remove, disassemble, inspect, assemble or install main wheel door actuators, refer to paragraphs 5-41 thru 5-51 and figure 5-10.

5-305. MAIN GEAR WHEELS AND TIRES. To remove, disassemble, inspect, repair, assemble or

install main landing gear wheels and tires, refer to paragraphs 5-55 thru 5-59 and figure 5-11.

5-306. MAIN WHEEL AND AXLE REMOVAL AND INSTALLATION. To remove or install main wheels and axles, refer to paragraphs 5-60 and 5-61.

5-307. MAIN WHEEL ALIGNMENT. For information regarding main wheel alignment, refer to paragraph 5-62 and figure 5-12.

5-308. WHEEL BALANCING, For wheel balancing information, refer to paragraph 5-63.

5-309. BRAKE SYSTEM. For information regarding system trouble shooting, master cylinder removal, disassembly, repair and installation; brake system bleeding; wheel brake removal, inspection, repair, assembly and installation and brake lining checking and replacement, refer to paragraphs 5-65 thru 5-78 and figures 5-13 and 5-14.

5-310. PARKING BRAKE SYSTEM. For information regarding the parking brake system, refer to paragraphs 5-79 thru 5-93 and figure 5-14.

5-311. NOSE GEAR SYSTEM. For a description, operational description and nose gear trouble shooting, refer to paragraphs 5-94 thru 5-97 and figure 5-15.

5-312. NOSE GEAR ASSEMBLY. To remove the nose gear assembly, refer to paragraph 5-98 and figure 5-15.

5-313. NOSE GEAR STRUT. To disassemble and assemble the nose gear strut assembly, refer to paragraphs 5-100 thru 5-102 and figure 5-16.

5-314. SHIMMY DAMPENER. To remove, disassemble, assemble and install nose gear shimmy dampeners, refer to paragraphs 5-106 thru 5-110 and figure 5-17.

5-315. TORQUE LINKS. For information regarding removal, disassembly, assembly and installation of nose gear torque links, refer to paragraphs 5-113 thru 5-114 and figure 5-18.

5-316. NOSE GEAR UPLOCK MECHANISM. To remove or install nose gear uplock components, refer to paragraphs 5-118 thru 5-120 and figure 5-19.

5-317. NOSE GEAR DOWNLOCK MECHANISM. To remove and install components of the nose gear downlock system, refer to paragraphs 5-124 thru 5-131 and figure 5-20.

5-318. NOSE GEAR ACTUATOR. To remove, disassemble, inspect, assemble and install nose gear actuators, refer to paragraphs 5-125 thru 5-131 and figure 5-21.

5-319. REMOVAL AND INSTALLATION OF NOSE GEAR UPLOCK AND RELEASE ACTUATOR. Refer

to paragraphs 5-118 and 5-120.

5-320. DISASSEMBLY, INSPECTION OF PARTS AND ASSEMBLY. Refer to paragraphs 5-27 thru 5-30 and figure 5-7.

5-321. NOSE GEAR DOOR SYSTEM. For a description and operational information, refer to paragraphs 5-133 thru 5-134.

5-322. REMOVAL AND INSTALLATION OF NOSE WHEEL DOORS. Refer to paragraphs 5-135 thru 5-139 and figure 5-22 for procedures for removing and installing nose gear doors.

5-323. NOSE WHEEL STEERING SYSTEM. Refer to paragraphs 5-141 thru 5-145 and figure 5-23 for description, removal, installation and rigging of components of the nose wheel steering system.

5-324. NOSE GEAR WHEEL. To remove, disassemble, inspect, repair, assemble and install nose wheels, refer to paragraphs 5-149 thru 5-153 and figure 5-24.

5-325. LANDING GEAR HYDRAULIC POWER. Refer to paragraphs 5-283 and 5-284 for a description and operational information.

5-326. HYDRAULIC TOOLS AND EQUIPMENT. Refer to paragraphs 5-158 thru 5-168 for description and operational procedures while using hydraulic system test equipment. Refer to figures 5-25 and 5-26 for Hydro Test Unit information.

5-327. HYDRAULIC POWER SYSTEM COMPONENTS.

5-328. GENERAL DESCRIPTION. The hydraulic power system includes equipment required to provide a flow of pressurized hydraulic fluid to the retractable landing gear system. Main components of the hydraulic power system include the power pack and the emergency hand pump.

5-329. HYDRAULIC COMPONENT REPAIR. Since emphasis here is on repair and not overhaul of the basic components of the hydraulic system, it is unlikely that the mechanic will go through all of the procedures outlined. Instead, he will repair the particular item which is causing the difficulty.

5-330. REPAIR VERSUS REPLACEMENT. Often, the moderate trade-in price for a factory-rebuilt component is less than the accumulated cost of labor, parts and (often time-consuming) trial and error adjustment. Repair or replacement of a component will depend on the time, equipment and skilled labor that is locally available.

5-331. REPAIR PARTS AND EQUIPMENT. Repair parts may be ordered from the applicable Parts Catalog. Test equipment may be ordered from The Special Tools and Support Equipment Catalog. Both publications are available from the Cessna Service Parts Center.

5-332. EQUIPMENT AND TOOLS.

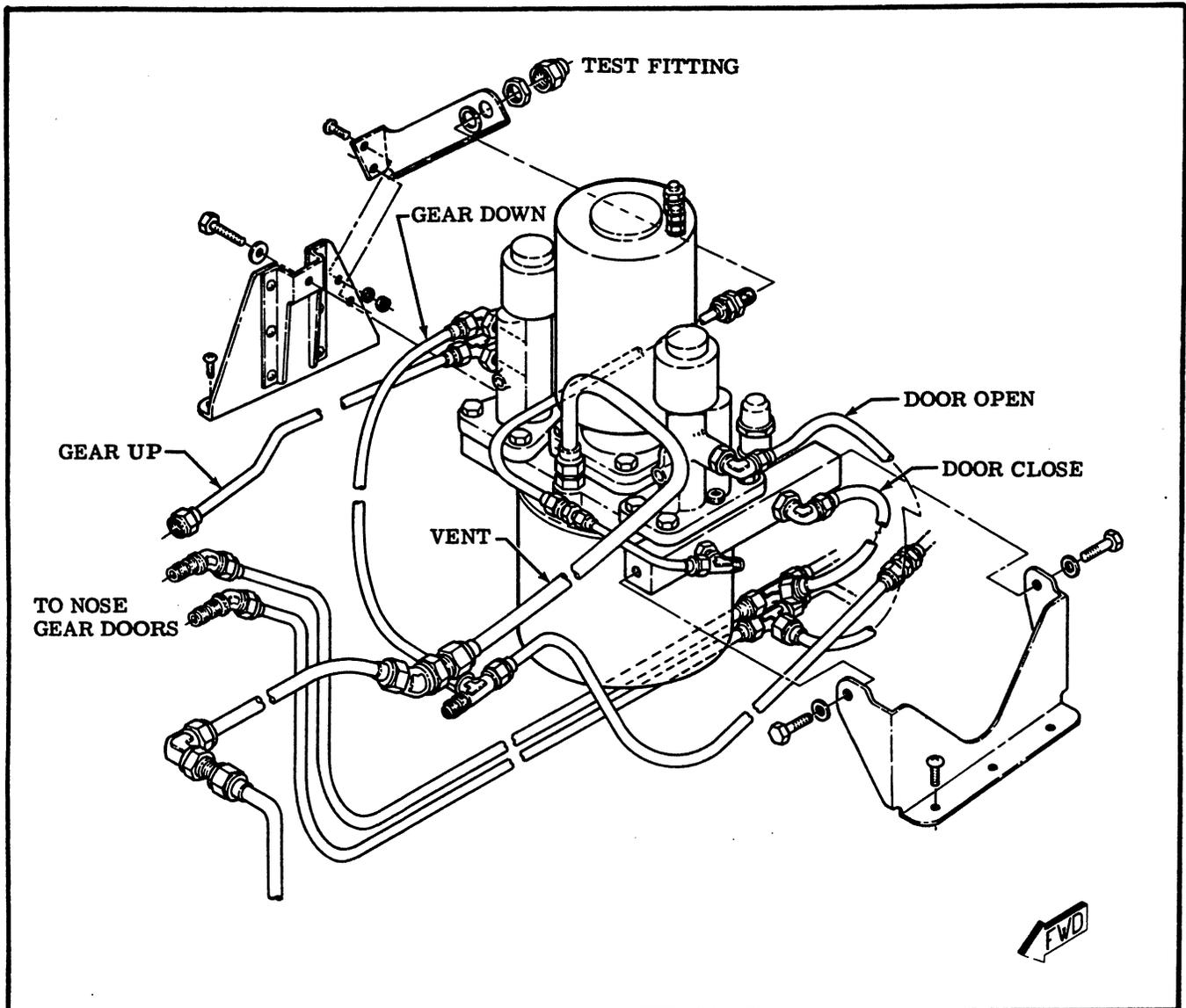


Figure 5-53. Hydraulic Lines Installation

5-333. **HAND TOOLS.** The following hand tools are necessary for repair work on the power pack and other hydraulic components.

- Snap Ring Pliers
- Strap Wrench (for removing door solenoids and various cylinder barrels of the hydraulic actuators)
- Needle-nose Pliers
- Duck-bill Pliers
- Pin Punches
- Box and Open-end Wrenches

Locally-fabricated items, handy for power pack repair, are various 1/4-inch aluminum rods, ground to a gradual taper, and hooks formed from brass welding rod, to extricate small plungers from hydraulic ports. Hooks formed from brass welding rod must not be over 1/16-inch in length, so as not to scratch or score the bore. Various sizes of Allen wrenches h

wrenches may be welded to "T" handles for use when removing, installing or adjusting the various internal

wrenching plugs or valves.

5-334. **COMPRESSED AIR.** The easiest method of removing some hydraulic parts in inaccessible galleries of the power pack is a quick blast of compressed air from behind. Parts can be blown out in seconds, which would otherwise take endless "fishing" operations to extricate. An air hose and nozzle are common-sense tools.

5-335. **POWER PACK.**

5-336. **DESCRIPTION.** The hydraulic power pack, located in the pedestal, is a multi-purpose control unit in the hydraulic system. It contains a hydraulic reservoir and valves which control flow of pressurized fluid to the various actuators in the door and landing gear system.

5-337. **REMOVAL.**

NOTE

As hydraulic lines are disconnected or removed, plug or cap all openings to prevent entry of foreign material in the lines or fittings.

- a. Remove front seats in accordance with instructions outlined in Section 3 and roll back carpet from control pedestal.
- b. Remove lower decorative cover by removing screws around cover.
- c. Remove floorboard panel at aft side of pedestal.
- d. Position gallon container under test fitting at bracket on aft side of power pack.
- e. Remove cap from test fitting and attach drain hose.
- f. Using hand pump, drain reservoir fluid into container.
- g. Disconnect and cap or plug all hydraulic lines at power pack.
- h. Disconnect wiring at pressure switch.
- i. Remove six screws attaching power pack support to floorboard.
- j. Work power pack aft out of pedestal.

5-338. DISASSEMBLY. (Refer to figure 5-54.)

- a. Remove fittings from body assembly (41) and place body assembly in vise.
- b. Remove nut (30), washer (29) and packing (2) at attaching stud (38) at bottom of reservoir; remove reservoir.

NOTE

If reservoir will not disengage from body assembly, replace fittings removed from body assembly and cap or plug all fittings except vent fitting. Attach air hose at vent fitting and apply pressure (not to exceed 15 psi - reservoir proof pressure); remove reservoir. A strap clamp is not recommended as clamp may damage reservoir.

- c. Remove door manifold assembly and gear manifold assembly from body assembly of power pack.
- d. Remove pressure switch and dipstick from body assembly.
- e. Remove large packing from bottom of body assembly.
- f. Remove baffle (36), spacers (34) and washer (33).
- g. Remove union (19), packing, retainer ring (7) and screen (31).
- h. Remove motor and pump assembly (10) from body assembly.
- i. Remove packings and back-up ring from pump assembly (10); remove coupling (11).
- j. Remove return tubes (37) and packings from body assembly.
- k. Remove relief valve assembly from body assembly.

NOTE

Suction screen assembly (39) need not be removed from body assembly to be cleaned. However, if screen assembly is damaged, it should be removed in accordance with step "l" of this paragraph, observing the following caution.

CAUTION

Use extreme caution in removing suction screen assembly. Damage to screen assembly or clearance between screen assembly and body will cause slow landing gear retraction.

- l. Working through center hole in top of body assembly, and using a drift or punch made of soft material, tap out suction screen assembly (39).
- m. Remove fittings from body assembly, if still installed, union (19), packing, retainer ring (7) and screen (8) from body assembly.
- n. Remove thermal relief valve and inlet check valve from body assembly.

5-339. INSPECTION.

- a. Wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered air.
- b. Inspect seating surfaces. They should have very sharp edges. Seats may be lapped, if necessary, to obtain sharp edges.
- c. Inspect all threaded surfaces for serviceable condition and cleanliness.
- d. Inspect all parts for scratches, scores, chips, cracks and indications of excessive wear.

5-340. ASSEMBLY. (Refer to figure 5-54.)

NOTE

Use all new packing and back-up rings for reassembly. Before assembly, lubricate all packings and back-up rings with MIL-H-5606 hydraulic fluid or Petrolatum. Lubricate all threads with Petrolatum.

- a. Assemble and install thermal relief valve and inlet check valve in body assembly.
- b. Install screen (8), retainer ring (7), packing and union (19) in body assembly.
- c. Install suction screen (39), if removed.

CAUTION

Use extreme caution when installing suction screen assembly. Damage to screen assembly or clearance between screen assembly and body will cause slow landing gear retraction.

- d. Install relief valve assembly in body assembly.
- e. Install packings and return tubes (37) in body assembly.
- f. Install packings and back-up ring on pump assembly (10); install coupling (11).

NOTE

Before assembly, lubricate all packing with Petrolatum or MIL-H-5606 Hydraulic fluid.

1. Check Valve
- 1A. Thermal Relief Valve
2. Packing
3. Spacer
4. Self-Relieving Filter
5. Back-Up Ring
6. Retainer
7. Retainer Ring
8. Screen Assembly
9. Dipstick
10. Pump Assembly
11. Coupling
12. Spring
13. Piston
14. Nut
15. Fitting
16. Cap
17. Switch
18. Housing
19. Union
20. Adapter
21. Orifice
22. Seat
23. Poppet
24. Ball
25. Spring Guide
26. Housing
27. Setscrew
28. Nut
29. Reservoir Washer
30. Nut
31. Screen
32. Reservoir
33. Washer
34. Spacer
35. Nameplate
36. Baffle
37. Return Tube
38. Stud
39. Suction Screen Assembly
40. Plug
41. Body Assembly

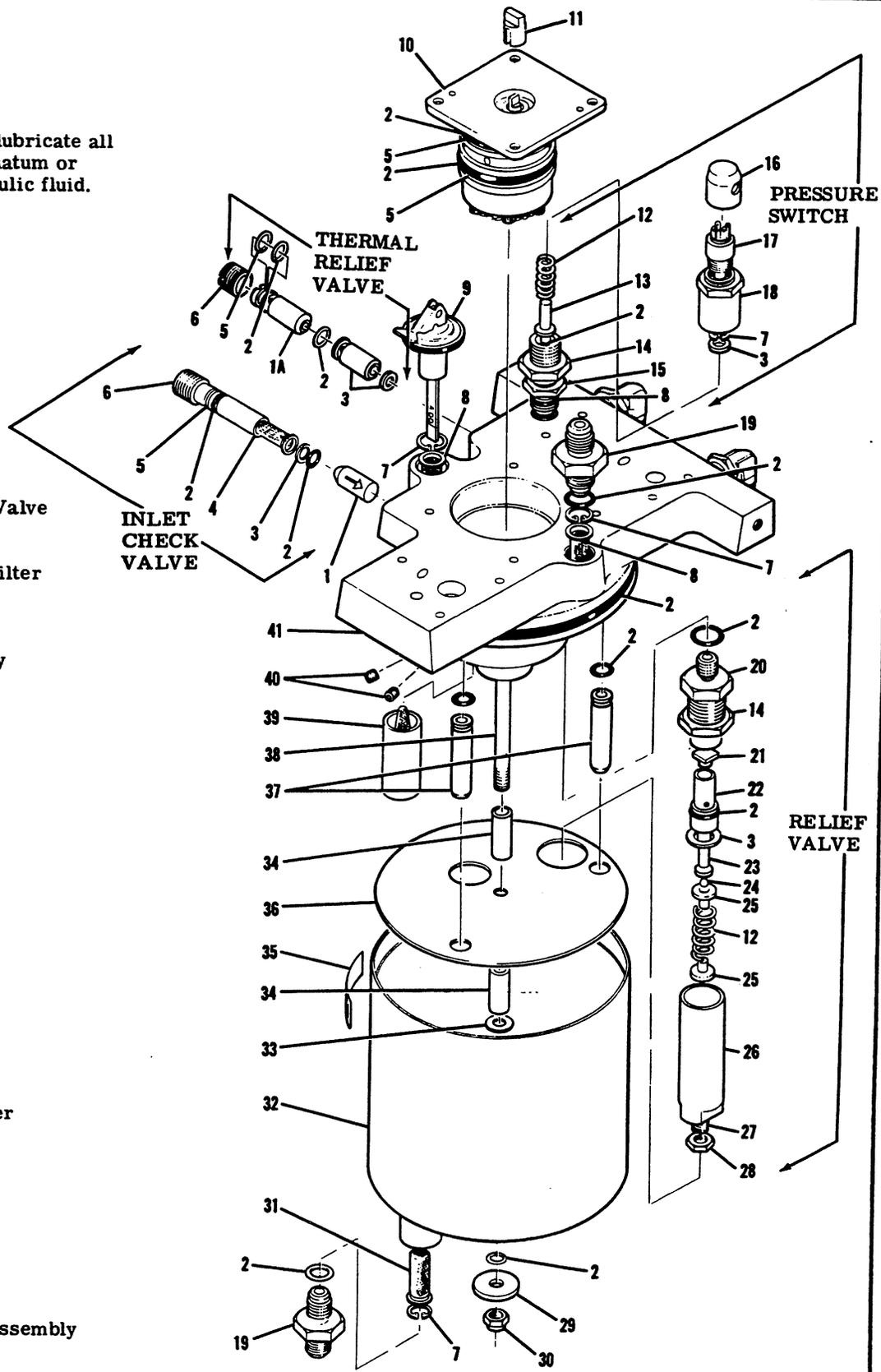


Figure 5-54. Hydraulic Power Pack

CAUTION

To avoid damage to parts prior to assembly, turn pump assembly (10) upside down and lubricate shaft. Turn pump shaft by hand, circulating oil.

- g. Install pump assembly (10) and motor on body assembly.
- h. Install screen (31), retainer ring (7), packing and union (19).
- i. Install washer (33), spacers (34) and baffle (36).
- j. Install large packing on bottom of body assembly.
- k. Install dipstick, pressure switch, door manifold assembly and gear manifold assembly on body assembly.
- l. Attach reservoir (32) to body assembly with packing, washer (29) and nut (30).

5-341. INSTALLATION.

- a. Work power pack into position and install six screws attaching power pack support to floorboard.
- b. Connect all hydraulic lines to power pack fittings. Make sure fittings are properly installed, with jam nuts tight, after lines are tightened.
- c. Attach pressure switch wiring.
- d. Fill reservoir through dipstick hole with clean hydraulic fluid.
- e. Jack aircraft in accordance with instructions outlined in Section 2. Using Hydro Test unit, operate landing gear through several cycles to bleed system. Check for proper operation and any signs of hydraulic fluid leakage.
- f. Install floorboard panel at aft side of pedestal, lower decorative pedestal cover, replace carpet and install front seats.

5-342. **PRESSURE SWITCH.** When installed in the aircraft, the pressure switch is mounted on the left-hand aft side of the power pack installed on the floorboard inside the control pedestal. This switch opens the electrical circuit to the pump solenoid when the main gear fully retracts and pressure in the system increases to approximately 1500 psi. The pressure switch will continue to hold the electrical circuit open until pressure in the system drops to approximately 1100 psi at which time the pump will again operate to build up pressure to approximately 1500 psi as long as the gear control is in the UP position. With the gear control handle in the DOWN position, the pressure switch has no effect on the system.

5-343. **PRESSURE SWITCH ADJUSTMENT.** (Refer to figure 5-54.)

- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. Attach external power source and install pressure gage in landing gear UP line. (Refer to figure 5-2.)
- c. Loosen jam nut on switch and back off switch housing (18).
- d. Retract landing gear and apply pressure to 1500±50 PSI.
- e. Tichten switch housing until snap action switch actuates, then tighten jam nut against housing.
- f. Recheck operating point of 1500±50 PSI, and

reset, if required.

- g. Lower landing gear, remove external power source and remove aircraft from jacks.

5-344. **GEAR MANIFOLD ASSEMBLY.** (Refer to figure 5-55.)

5-345. **DISASSEMBLY.**

NOTE

After the manifold has been removed from the body assembly of the power pack, seat (2) will remain in body assembly. Ball (4) will fall free.

- a. Remove seat (2) from body assembly of power pack; remove two packings from seat.

NOTE

Difficulty may be encountered in removing poppet (5) and spring (6). It may be necessary to apply air pressure at port "A" (View A-A) to force spring and poppet from port "B".

- b. Remove back-up rings and packing from grooves in poppet.
- c. Remove packing from bottom of manifold assembly; remove spring (6).
- d. Cut safety wire and remove solenoid (9).
- e. Using a hook, formed from brass welding rod, and inserted into oil hole in selector valve (8), withdraw selector valve from manifold.

CAUTION

Be sure that end of hook is not over 1/16-inch long. Use with care to prevent scratching bore in manifold. Removal of selector valve will be difficult due to friction caused by packings.

- f. Remove packings from selector valve.

5-346. **INSPECTION.**

- a. Wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered air.
- b. Inspect seating surfaces. They should have very sharp edges. Seats may be lapped, if necessary, with No. 1200 lapping compound.
- c. Inspect all threaded surfaces for serviceable condition and cleanliness.
- d. Inspect all parts for scratches, scores, chips, cracks and indications of excessive wear.

5-347. **ASSEMBLY.** (Refer to figure 5-55.)

NOTE

Use all new packing and back-up rings for reassembly. Before assembly, lubricate all packings and back-up rings with MIL-H-5606 hydraulic fluid or Petrolatum. Lubricate all threads with Petrolatum.

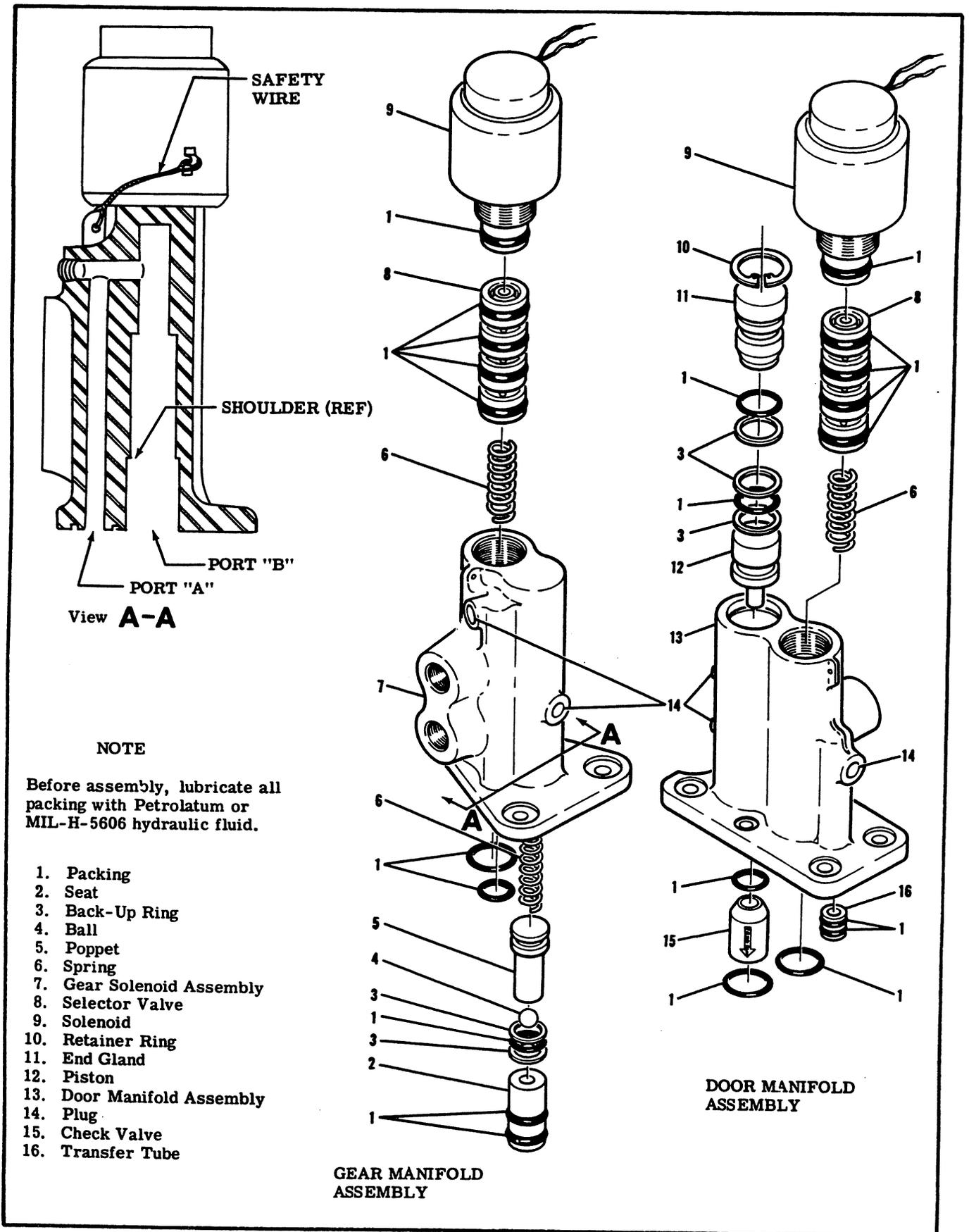


Figure 5-55. Hydraulic Power Pack Manifold Assemblies

- a. Install packings on selector valve (8).
- b. Install packings in bottom of manifold.
- c. Install spring and selector valve (8) in manifold.
- d. Install packing on solenoid (9), install solenoid on manifold and safety wire as shown in view A-A.
- e. Install spring in bottom of manifold.
- f. Install packing and back-up rings on poppet (5).
- g. Install poppet in manifold.

CAUTION

Use extreme caution when installing poppet (5). Shoulder, referenced in view A-A will cut packings on poppet.

- h. Install packings on seat (2); install ball (4) and seat (2) in manifold.

5-348. DOOR MANIFOLD ASSEMBLY. (Refer to figure 5-55.)

5-349. DISASSEMBLY.

- a. As door manifold assembly is removed from body of power pack, transfer valve (16) will fall free.
- b. Remove packings from transfer tube.
- c. Remove packings from bottom of manifold, and remove check valve (15).
- d. Remove spring (6).
- e. Cut safety wire and remove solenoid (9); remove packing from solenoid.
- f. Using a hook, formed from brass welding rod, and inserted into oil hole in selector valve (8), withdraw selector valve from manifold.

CAUTION

Be sure that end of hook is not over 1/16-inch long. Use with care to prevent scratching bore in manifold. Removal of selector valve will be difficult due to friction caused by packings.

- g. Remove packings from selector valve.
- h. Remove retainer ring (10).
- i. Remove end gland (11).
- j. Remove piston (12).
- k. Remove packings and back-up rings from end gland and piston.

5-350. INSPECTION.

- a. Wash all parts in cleaning solvent (Federal Specification P-S-661, or equivalent) and dry with filtered air.
- b. Inspect seating surfaces. They should have very sharp edges. Seats may be lapped, if necessary, to obtain sharp edges.
- c. Inspect all threaded surfaces for serviceable condition and cleanliness.
- d. Inspect all parts for scratches, scores, chips, cracks and indications of excessive wear.

5-351. ASSEMBLY. (Refer to figure 5-55.)

NOTE

Use all new packing and back-up rings for reassembly. Before assembly, lubricate all packings and back-up rings with MIL-H-5606 hydraulic fluid or Petrolatum. Lubricate all threads with Petrolatum.

- a. Install new packings and back-up rings on gland (11), piston (12), selector valve (8) and transfer tube (16).
- b. Install packings and check valve (15) in bottom of manifold.
- c. Install spring (6) and selector valve (8) in manifold.
- d. Install packing on solenoid (9).
- e. Install solenoid on manifold and safety wire as shown in view A-A.
- f. Install piston (12) and end gland (11) in manifold.
- g. Install retainer ring (10).
- h. Prior to installing manifold on body of power pack, install transfer tube (16) in body of power pack.

5-352. EMERGENCY HAND PUMP. (Refer to figure 5-56.)

5-353. DESCRIPTION. The emergency hand pump is mounted on a support beneath the floorboard just in front of the front seats, near the center of the floorboard. The handle extends into the cabin and is enclosed by a hinged cover. The pump supplies a flow of pressurized hydraulic fluid to open the doors and extend the landing gear if hydraulic pressure should fail. The hand pump receives a reserve supply of fluid from the power pack reservoir and pumps the fluid through passages and lines to the door control valve and gear priority valve in the manifold and through the remainder of the system.

5-354. REMOVAL.

- a. Loosen carpeting around hand pump and remove cover and pan.
- b. Wedge cloth under hydraulic fittings to absorb fluid, then disconnect hydraulic lines at hand pump and plug openings.
- c. Remove two mounting bolts and work hand pump out of floorboard opening.

5-355. DISASSEMBLY. (Refer to figure 5-56.)

NOTE

After hand pump has been removed from aircraft, and ports are capped or plugged, spray with cleaning solvent (Federal Specification P-S-661, or equivalent) to remove all accumulated dust or dirt. Dry with filtered compressed air. To disassemble the unit, proceed as follows:

- a. Remove handle (3) by removing pins (19) and washers after removing cotter pins (4).
- b. Place pump in vise with fitting (8) at top.
- c. Unscrew fitting (8) and remove, along with washer (9).

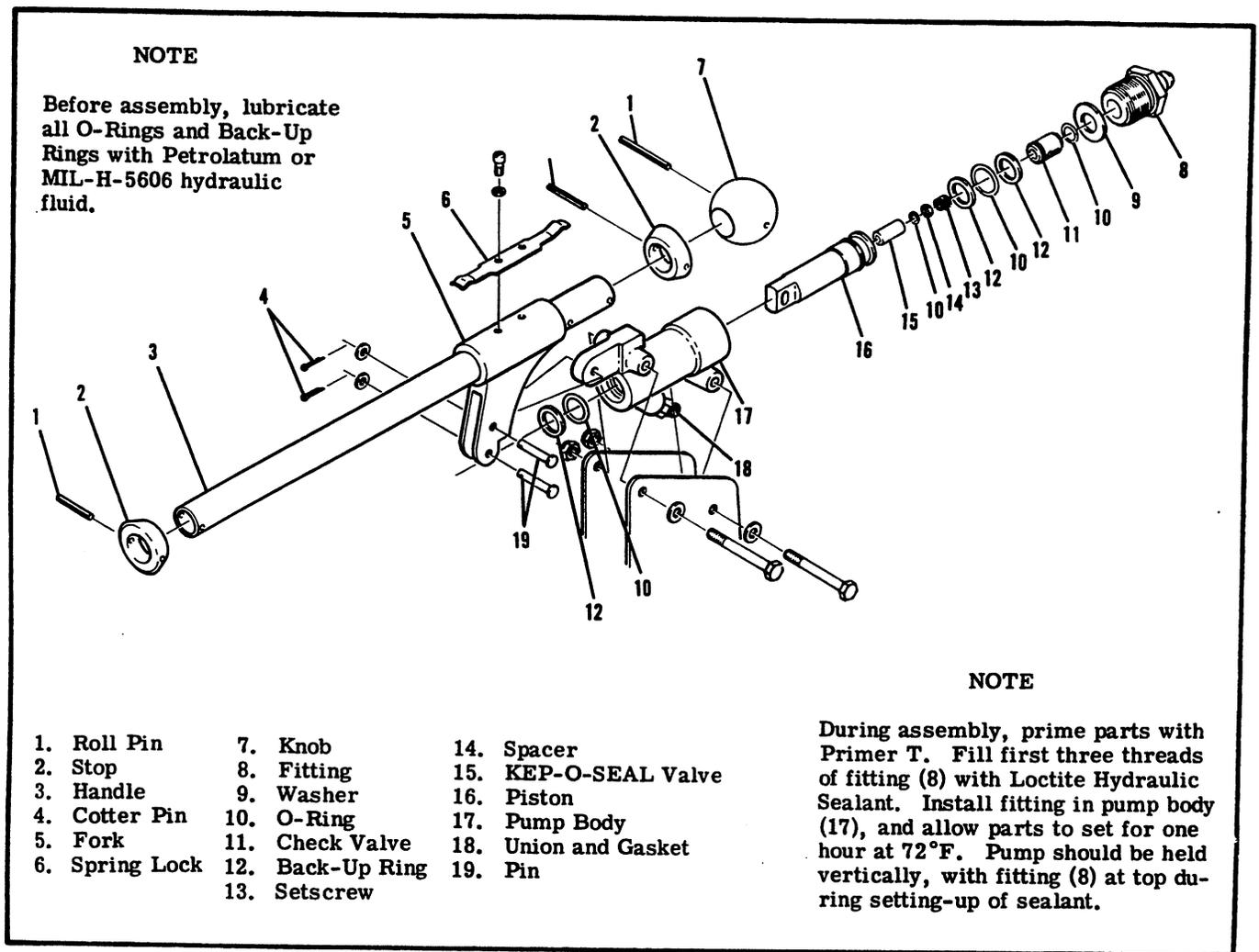


Figure 5-56. Emergency Hand Pump

NOTE

Use caution when removing fitting (8) as check valve (11) will fall free.

d. Remove pump from vise and push piston (16) out of pump body (17). Push from handle end of piston. A slight drag will be experienced until piston clears back-up ring and packing inside pump body.

e. Remove setscrew (13) from piston (16) and remove spacer (14), O-ring (10) and KEP-O-SEAL valve (15).

f. Remove union and gasket (18).

g. Remove and discard back-up ring and O-ring from inside pump body (17) and fitting (8).

5-356. INSPECTION.

a. Inspect seating surfaces. They should have very sharp edges. Seats may be lapped, if necessary, to obtain sharp edges.

b. Inspect piston (16) for scores, burrs or scratches which might cut O-rings. This is a major cause of external leakage. The piston may be polished with extremely fine emery paper. Never use paper coarser than No. 600 to remove scratches or burrs. If defects do not polish out, replace piston.

c. The threads on fitting (8) and in pump body (17) are coated with Loctite Sealant. This sealant should be cleaned from the threads with a wire brush. After threads are cleaned out, inspect for damage.

5-357. ASSEMBLY. (Refer to figure 5-56.)

NOTE

Lubricate O-rings and back-up rings with Petrolatum or MIL-H-5606 hydraulic fluid before assembly.

a. Using all new O-rings and back-up rings, install back-up rings and O-rings inside pump body (17).

NOTE

Assure that check valve (11) is inserted correctly in order to seat inside fitting (8).

b. Insert KEP-O-SEAL valve (15), O-ring and spacer (14) into piston (16). Install setscrew (13). Install back-up rings and O-ring in grooves on piston (16).

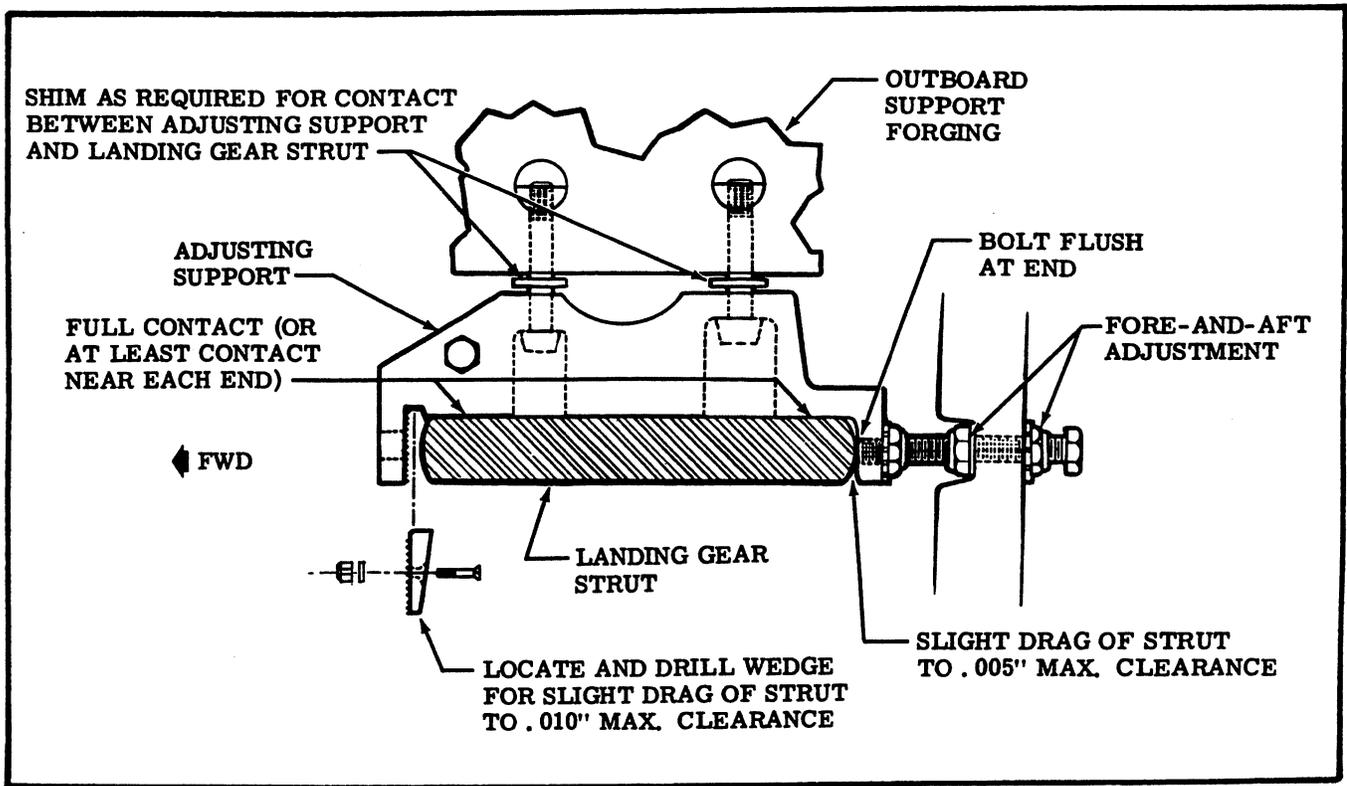


Figure 5-57. Rigging Adjustable Support

c. Line up piston in pump body (17). Carefully insert piston into pump body. Use extreme caution to avoid cutting packing inside pump body.

NOTE

A "pumping" back and forth motion must be employed to get piston positioned inside pump body.

d. Install washer (9).

e. Fill first three threads of fitting (8) with Loctite Hydraulic Sealant. Install fitting in pump body (17), and allow parts to set for one hour at 72°F. Pump should be held vertically, with fitting (8) at top during setting-up of sealant.

f. Install union and gasket (18).

g. Line up holes in piston (16) and pump body (17) with holes in fork (5). Install pins (19), washers and cotter pins (4).

5-358. INSTALLATION. (Refer to figure 5-56.)

a. Position pump between brackets in floorboard opening.

b. Install two mounting bolts.

c. Attach hydraulic lines at hand pump.

d. Bleed all air from hand pump and hand pump lines by loosening pressure cap, located at aft of power pack, and pumping the hand pump until all air is expelled; retorque test fitting's pressure cap.

e. Install cover and pan; reinstall carpeting.

5-359. RIGGING MAIN LANDING GEAR.

5-360. RIGGING ADJUSTING SUPPORT. (Refer to figure 5-57.) The adjusting support is bolted to the outboard forging and forms the down stop for the main gear.

a. Jack aircraft as outlined in Section 2.

NOTE

Spring strut must be installed and secured before rigging the adjusting support.

b. Check for contact between flat surface of strut and lower surface of adjusting support. Minor gapping may exist as long as contact is made near each end of support. Shim as required between outboard forging and adjusting support to obtain required contact. Shims are available from the Cessna Service Parts Center. The following shims are available for installation at the forward end of support.

1541041-6	*
-7 . . . . .	.012"
-8 . . . . .	.020"
-9 . . . . .	.032"
-10 . . . . .	.006"

The following shims are available for installation at the aft end of support.

1541041-1	*
-2 . . . . .	.012"
-3 . . . . .	.020"
-4 . . . . .	.032"
-5 . . . . .	.006"

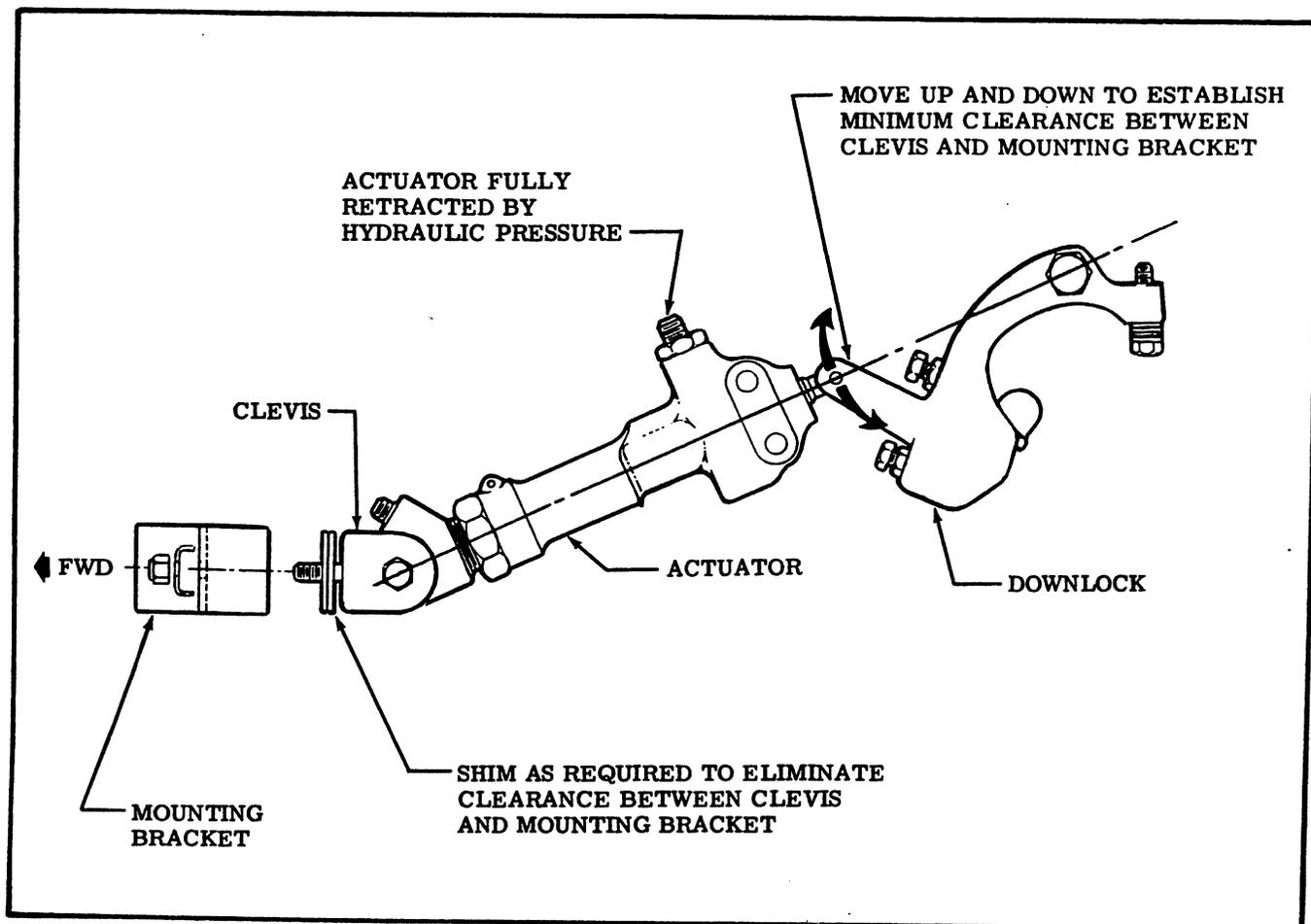


Figure 5-58. Main Gear Downlock and Actuator Alignment and Actuator Shimming

*Sheet of .025" laminated with ten .002" additional removable laminations.

c. Check that aft edge of strut contacts adjusting support (.005" maximum clearance) as shown in figure 5-30, when gear is down. To shift adjusting support fore and aft, first loosen three bolts securing support (elongated holes are provided in the support), then adjust the two jam nuts as required and retighten the three mounting bolts.

d. Check that forward edge of strut contacts wedge (.010" maximum clearance) as shown in figure 5-30, when gear is down. A slotted hole in the adjusting support will allow moving the wedge to obtain the required clearance. If necessary, remove attaching hardware and install a new wedge.

NOTE

A slight drag is permissible as gear reaches the full down position.

The wedges listed in the following chart are available from the Cessna Service Parts Center. The dimensions listed are measured at the thickest part of the wedge.

1541029-1 . . . . .	.250"
-2 . . . . .	.300"
-3 . . . . .	.330"
-4 . . . . .	.360"

5-361. RIGGING DOWNLOCK MECHANISM. (Refer to figures 5-58 thru 5-62.)

a. Disconnect actuator clevis from fuselage bracket and use hand pump to pressurize the actuator in its fully-retracted position. With the actuator piston bottomed out, position the downlock so a straight line is formed through actuator pivot point, piston rod pivot point and downlock pivot point as shown in figure 5-31. Measure the clearance between actuator clevis and fuselage bracket and install shims as required to eliminate this clearance. Connect clevis to bracket and secure. The shims listed in the following chart are available from the Cessna Service Parts Center.

1512359-1 . . . . .	.125"
-2 . . . . .	.032"

b. Check that downlock pin reaches the overcenter position shown (.03" to .10"). Adjust upper stop bolt as required to obtain this position. (Refer to figure 5-32.)

c. Check that downlock pin reaches retracted position shown (.18" to .22"). Adjust lower stop bolt as required to obtain this position. (Refer to figure 5-59.)

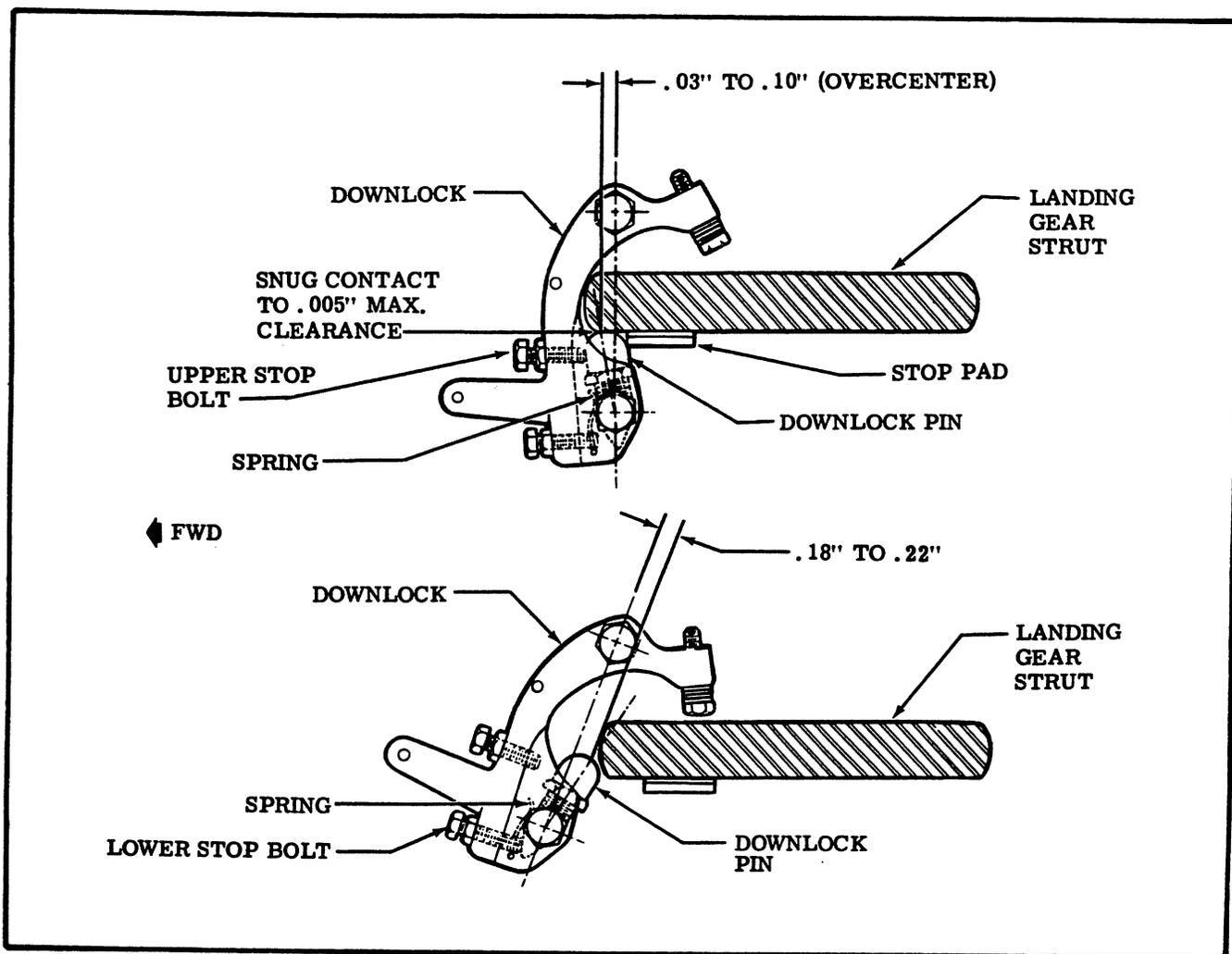


Figure 5-59. Rigging of Main Gear Downlock

NOTE

A downlock rigging tool, P/N SE772-1, shown in figure 5-33, is available from the Cessna Service Parts Center.

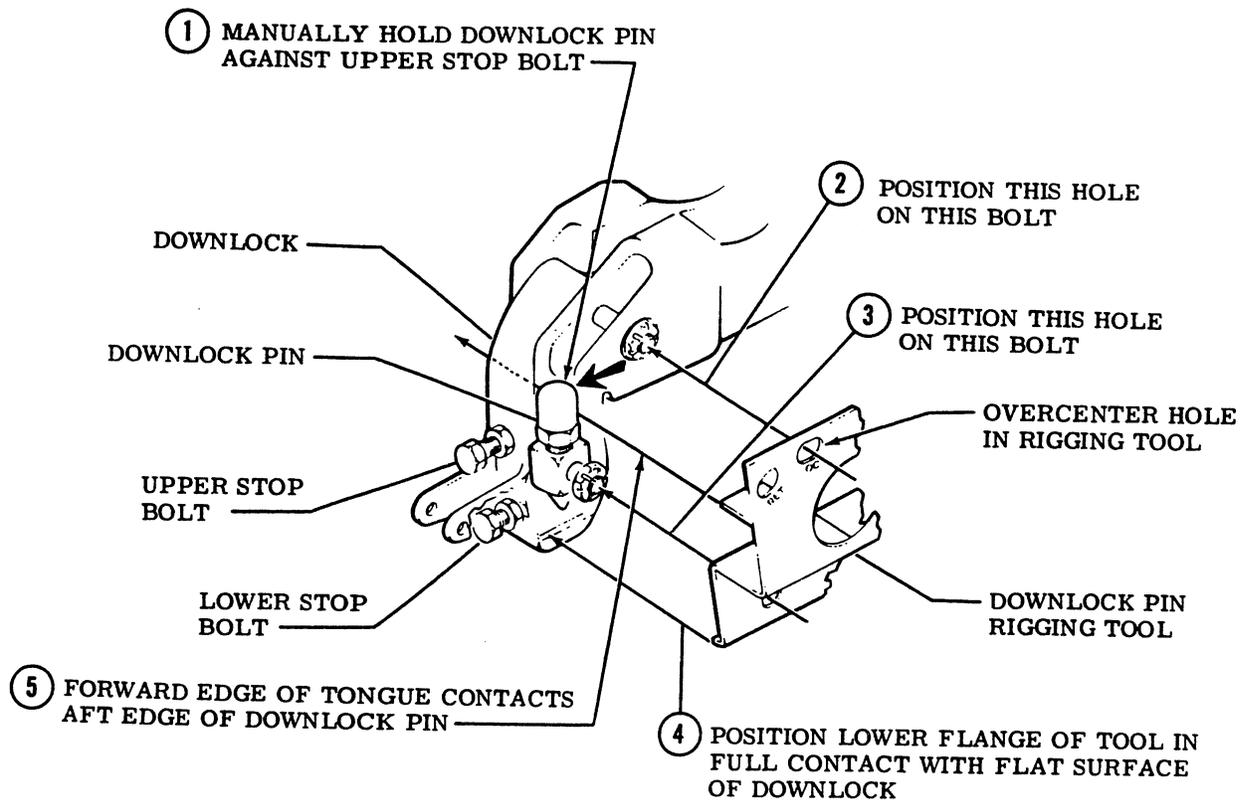
- d. Check over-all length of downlock pin as shown (snugly against strut to .005" maximum clearance), with hydraulic pressure on gear. Downlock pin assembly must be removed to change over-all length. (Refer to paragraph 5-59.)
- e. Check that overcenter release bolt in upper end of downlock extends below support as shown (.070" to .100") when the actuator piston is bottomed out retracted, with hydraulic pressure applied. (Refer to figure 5-61.)
- f. Release hydraulic pressure and check that overcenter stop bolt in bulkhead is adjusted so that overcenter release bolt in upper end of downlock extends below adjusting support as shown (.06" more than dimension "A") when actuator is held in overcenter position against bulkhead stop bolt. (Refer to figure 5-61.)
- g. Check that button in overcenter arm is screwed completely in (shortened) as shown, and jam nut is tight. Check that overcenter arm retracts smoothly

when engaging strut and that arm is clear of roll pin installed in downlock when gear is down and locked. (Refer to figure 5-62.)

- h. Check action of cam on main gear downlock switch bracket as follows:
 1. Place main gear in "trail" position.
 2. Manually push downlocks into normally locked position (aft).
 3. Holding approximately 20 pounds of force against each wheel, extend gear to the down and locked position. Cams on the switch brackets should push downlocks out of the way, allowing gear to move smoothly into the down and locked position.
 4. Repeat test at least five times.

5-362. RIGGING UPLOCK MECHANISM. (Refer to figure 5-6.)

- a. Jack aircraft in accordance with procedures outlined in Section 2.
- b. Loosen bolts attaching hangers (6) to supports (9) to allow inboard and outboard adjustment.
- c. With Hydro Test connected, open test stand bypass valve to reduce hydraulic pressure to approximately 1000 psi. With gear up and pressurized, check position of gear stops (8).
- d. Outboard edge of gear spring strut (17) should



OVERCENTER POSITION OF DOWNLOCK PIN

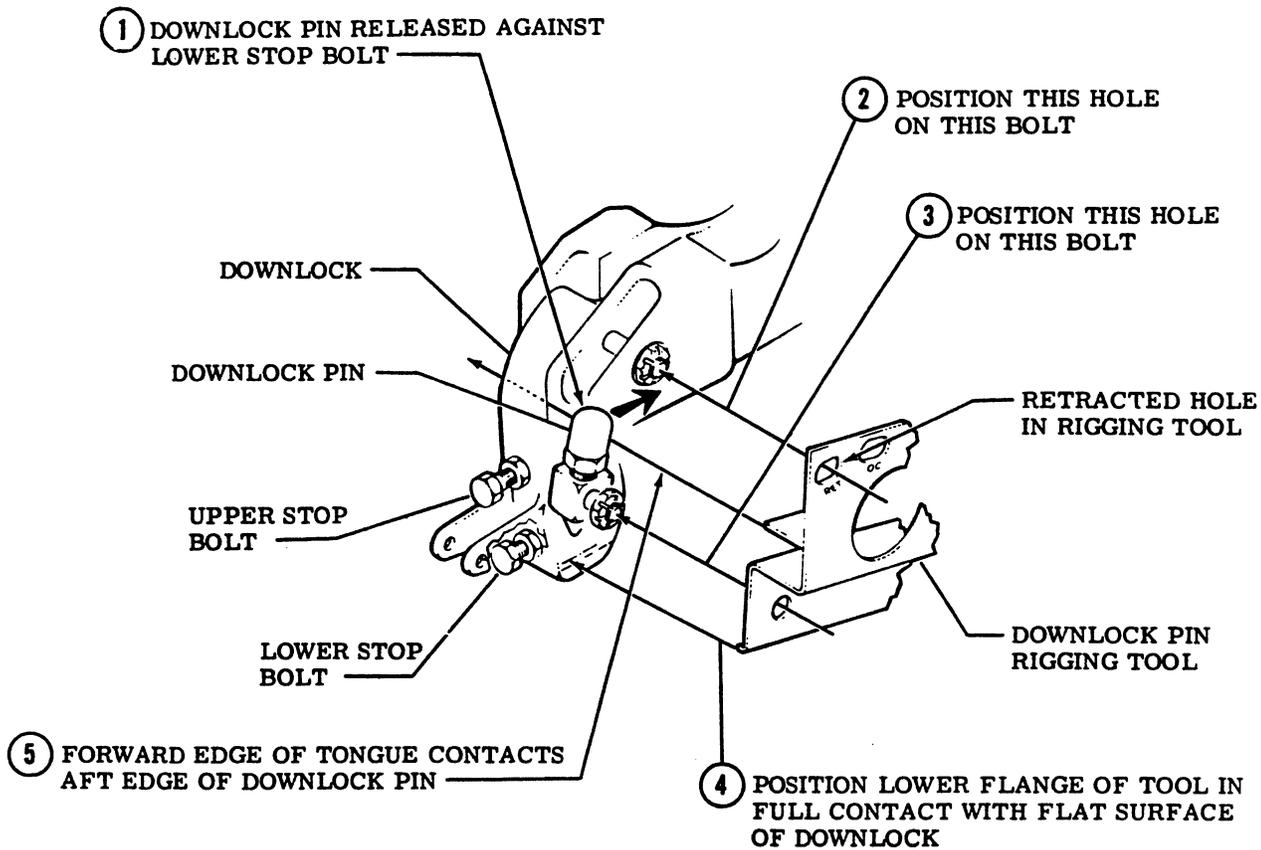
With downlock pin depressed (1), lower bolt in lower hole (3), lower flange flat against downlock (4), and forward edge of tongue contacting aft edge of pin (5), upper bolt should fall within overcenter hole (2). Elongation of overcenter hole represents tolerance permissible; adjust upper stop bolt as required.

NOTE

Jack the aircraft, retract the landing gear, and release hydraulic pressure, leaving the landing gear doors open. Pull downlock assemblies aft for access.

The downlock pin rigging tool, Part No. SE772-1, is available from the Cessna Service Parts Center. The tool is made in two halves — the left half is shown in use for the left downlock pin; the right half is used in the same manner for the right downlock pin.

Figure 5-60. Using Main Gear Downlock Pin Rigging Tool (Sheet 1 of 2)



RETRACTED POSITION OF DOWNLOCK PIN

With downlock pin not depressed (1), lower bolt in lower hole (3), lower flange flat against downlock (4), and forward edge of tongue contacting aft edge of pin (5), upper bolt should fall within retracted hole (2). Elongation of retracted hole represents tolerance permissible; adjust lower stop bolt as required.

Figure 5-60. Using Main Gear Downlock Pin Rigging Tool (Sheet 2 of 2)

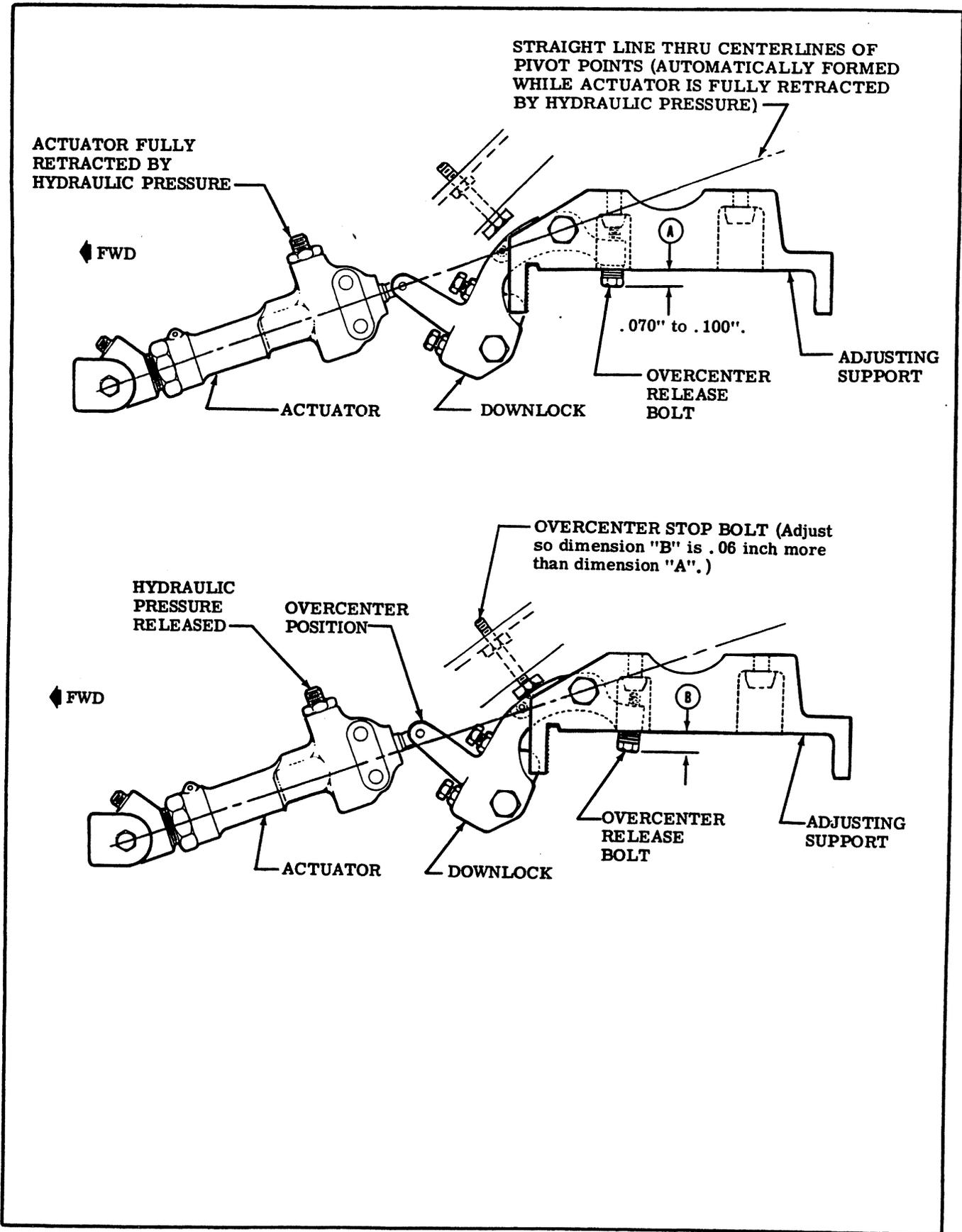


Figure 5-61. Overcenter Adjustments of Main Gear Retracted Downlock

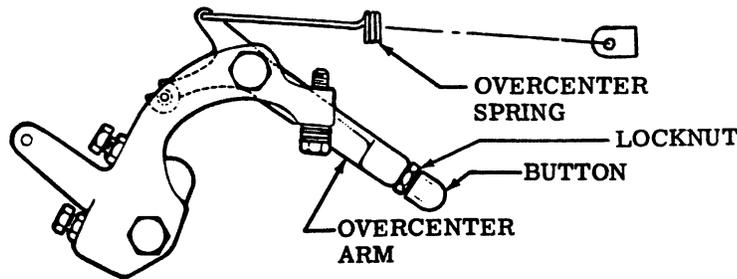


Figure 5-62. Checking Main Gear Overcenter Arm Button

contact stop (8) and slanted portion of stop should be parallel to spring strut, maintaining 20 percent contact with spring strut.

e. Stop (8) is adjusted to match angle of gear spring strut by the addition of shims (7) (P/N 1541051-2) as required between hangers (6) and supports (9).

f. Adjust push-pull rod ends (12) as required to cause hooks (11) to release gear spring struts simultaneously when operated hydraulically.

NOTE

In addition to releasing gear struts simultaneously, linkage must be adjusted so no part of linkage (including up indicator switch) contacts any part of the aircraft structure. Actuator piston must bottom out retracted before hydraulic fluid can be routed through the actuator to lower the main gear.

5-363. RIGGING UP INDICATOR SWITCHES. (Refer to figure 5-6.) Main gear up indicator switches (16) are mounted on brackets (15) attached to the uplock hooks (11). After jacking aircraft in accordance with procedures outlines in Section 2, retract landing gear until uplock hooks are fully engaged. Adjust switches so they are actuated with a minimum of 1/8 inch travel of the switch plunger remaining. Switch case must not contact any part of structure.

WARNING

Before working in landing gear wheel wells, PULL-OFF hydraulic pump circuit breaker. Circuit breaker knob is on circuit breaker panel. The hydro-electric power pack system is designed to pressurize the landing gear "DOOR CLOSE" system to 1500 psi at any time the master switch is turned on. Injury might occur to someone working in wheel well area.

5-364. RIGGING DOWN INDICATOR SWITCHES. (Refer to figure 5-8.) Main gear down indicator switches (6) are mounted on brackets (5) attached to downlocks (9). With landing gear down and locked, adjust switches so they are positively actuated, but

leaf-type switch actuator does not contact switch case.

5-365. RIGGING DOORS. (Refer to figures 5-9 and 5-22.) Jack aircraft in accordance with procedures outlined in Section 2. Adjust push-pull rod ends and actuator rod ends as required to cause doors to close snugly. Doors must not close so tightly that internal locks in actuating cylinders are not reached. When installing new doors, some trimming and hand-forming at edges may be necessary to achieve a good fit and permit actuators to lock. Doors must clear the gear at least 1/2 inch during retraction.

5-366. ADJUSTMENT OF SNUBBER VALVES. (Refer to figure 5-51.) A main gear snubber valve, which restricts fluid near the end of the gear-up cycle, is provided at the aft end of each main gear actuator. These valves are hollow, contoured metering pins which form the hydraulic fittings at the aft end of the actuators. The purpose of the snubber valves is to slow down action near the end of the gear-up cycle to cause smoother locking action. Position of the snubber (screw in or out) shall be fixed such that:

- a. Snubbing occurs during the final 1/2 to one second of gear-up travel.
- b. Both main gears lock in up position simultaneously.
- c. The gear struts do not strike uplock stops with sufficient force to jar the structure or jar the aircraft or cause objectional noise.

5-367. RIGGING OF NOSE GEAR. Refer to paragraph 5-272 for nose gear rigging procedures.

5-368. HYDRAULIC AND ELECTRICAL SYSTEM SCHEMATICS. (Refer to figure 5-63.) The following seven pages contain coded schematic diagrams of the aircraft hydraulic system. A complete gear-down cycle is illustrated, from selecting the gear down position to the condition where the gear is down and locked and the master switch is OFF. Incorporated into the hydraulic system schematic is the electrical wiring diagram which shows switch positions, lights, solenoids and other components of the system, and their condition during the gear-down cycle.

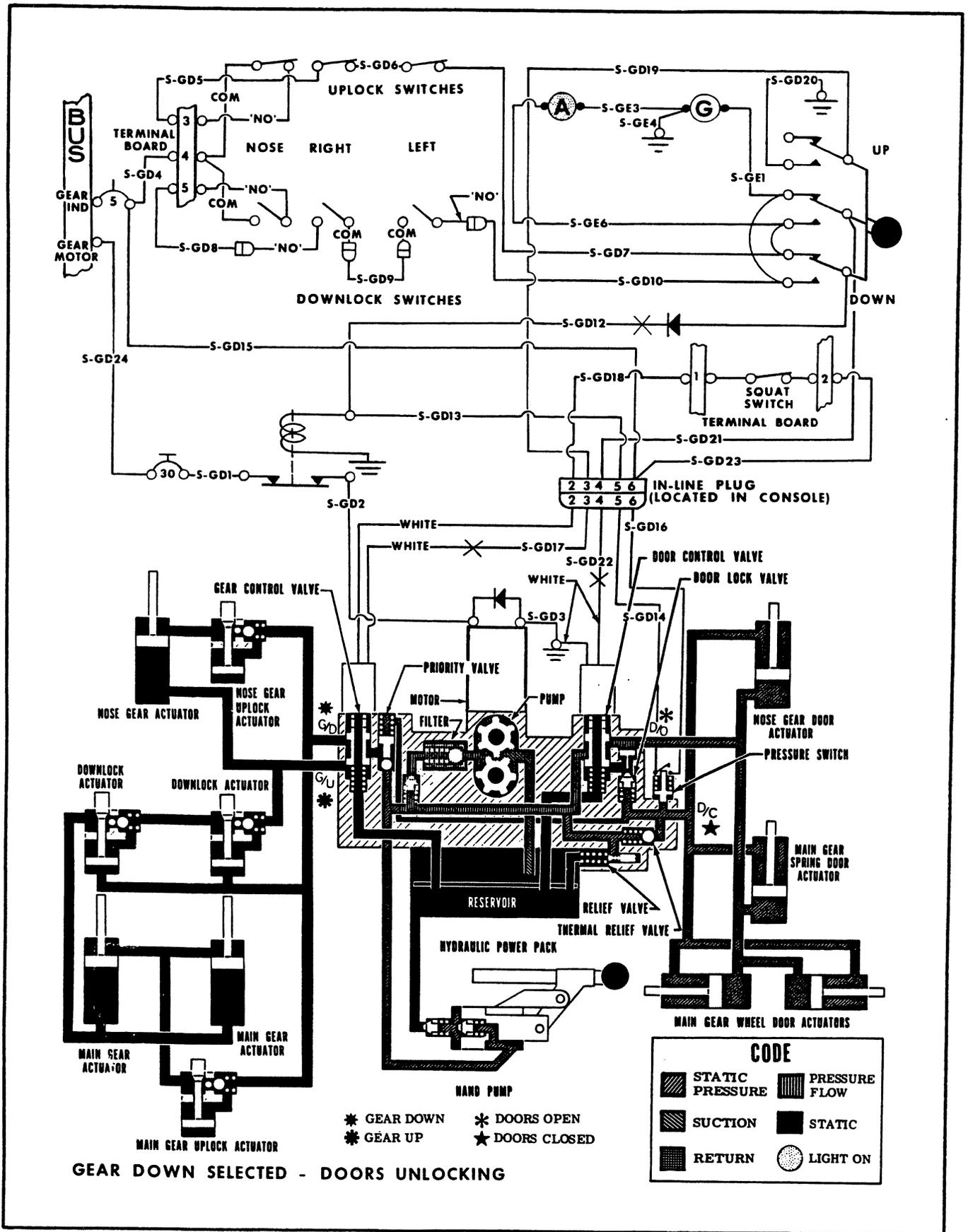


Figure 5-63. Hydraulic and Electrical System Schematic (Sheet 1 of 7)

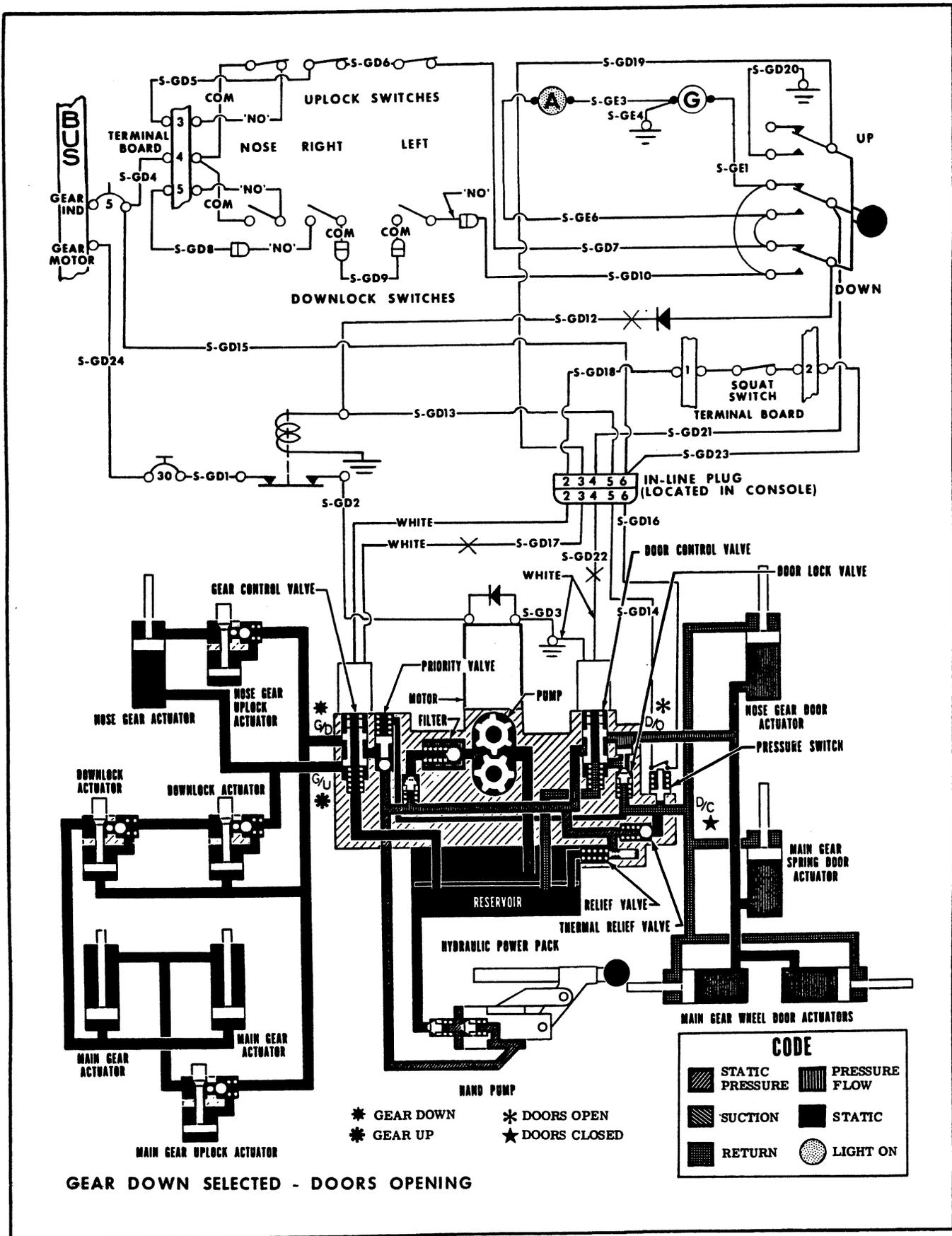


Figure 5-63. Hydraulic and Electrical System Schematic (Sheet 2 of 7)

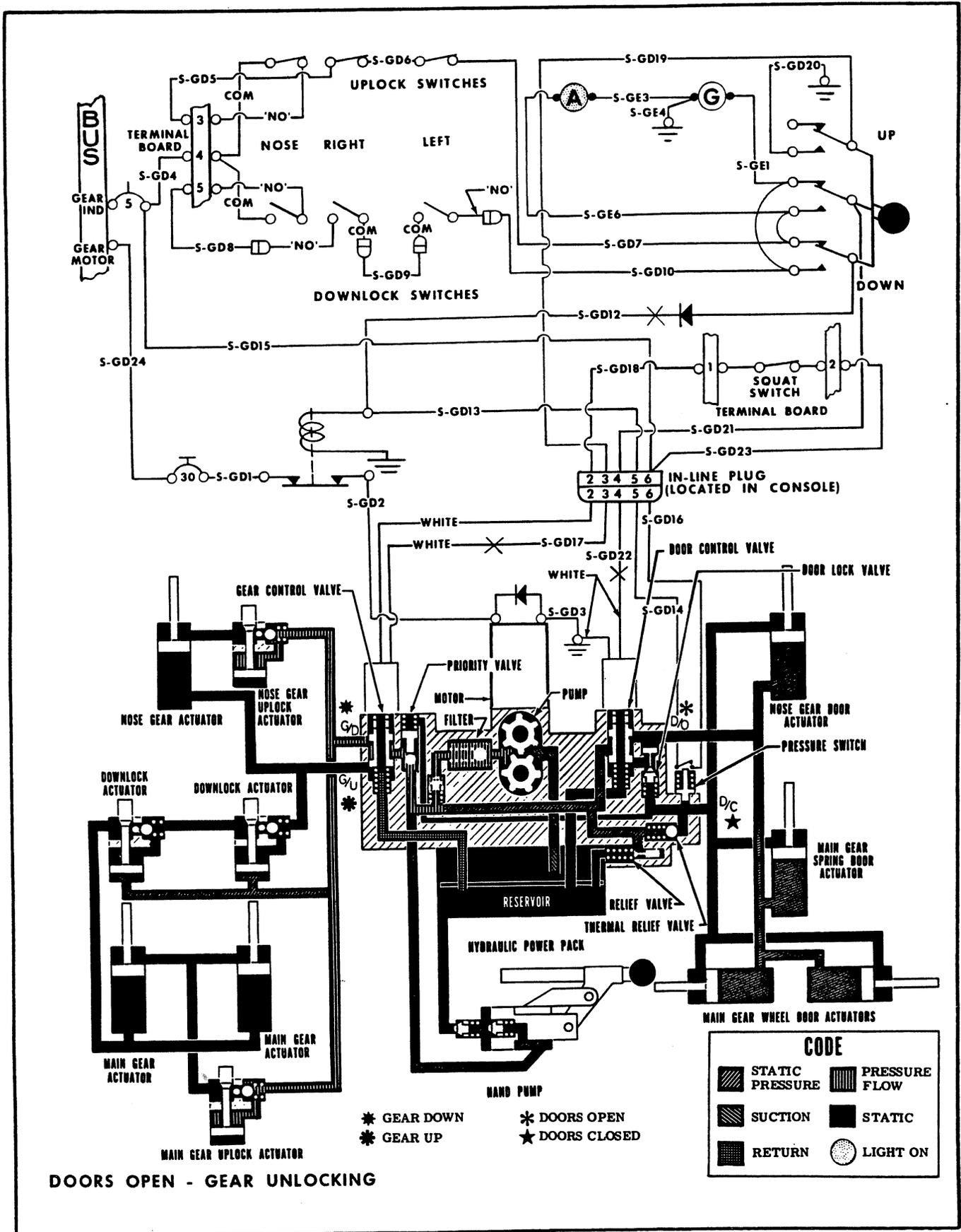


Figure 5-63. Hydraulic and Electrical System Schematic (Sheet 3 of 7)

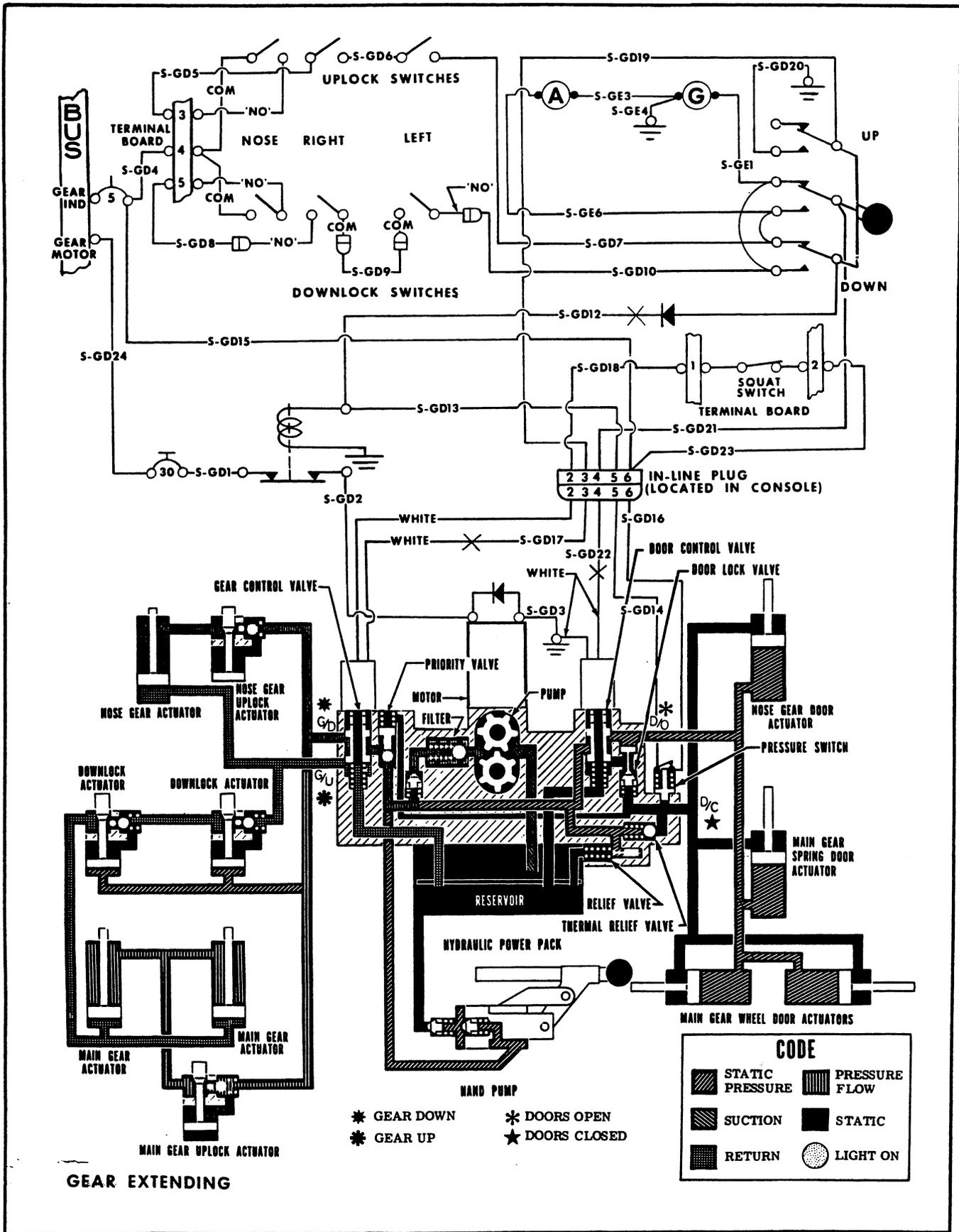


Figure 5-63. Hydraulic and Electrical System Schematic (Sheet 4 of 7)

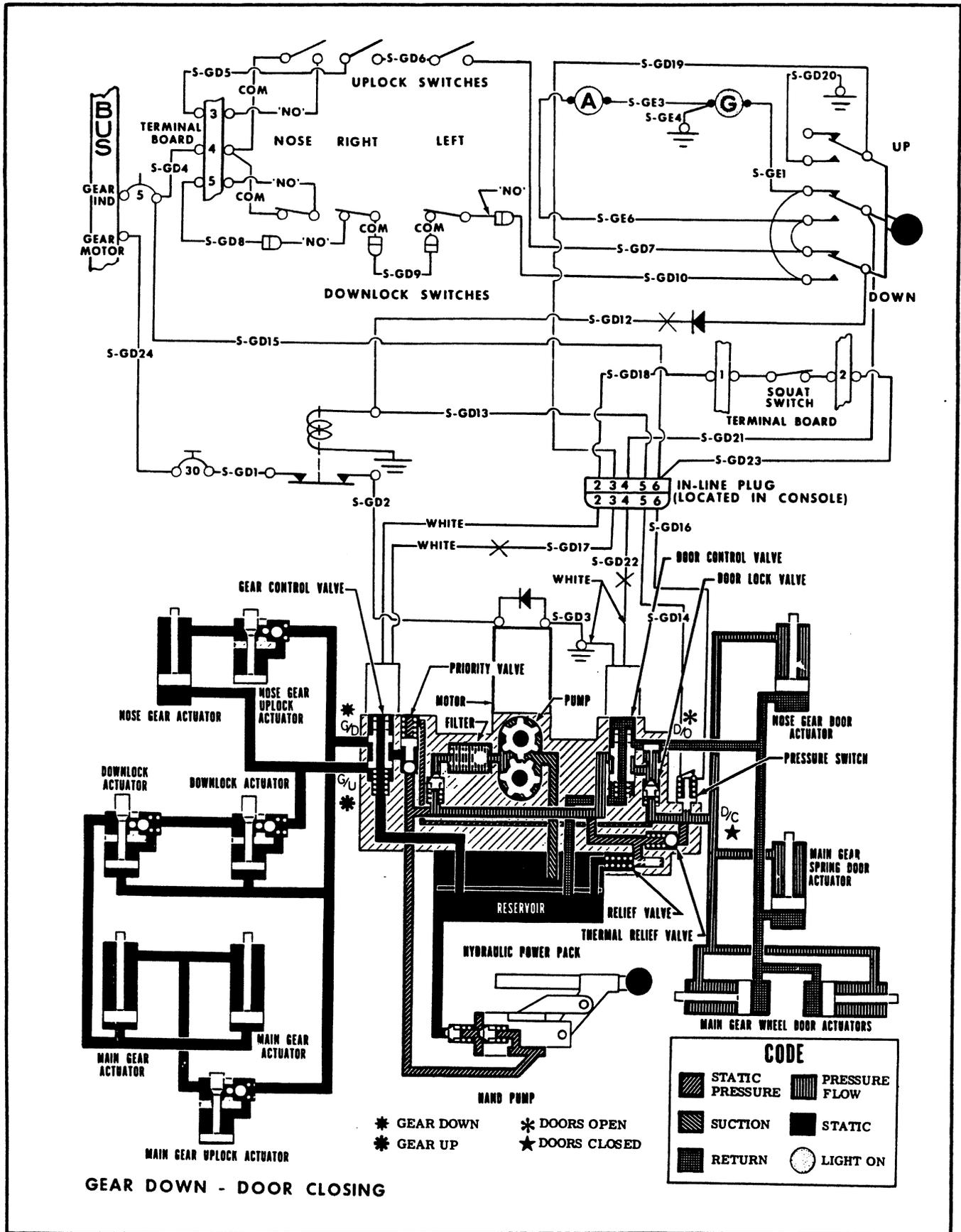


Figure 5-63. Hydraulic and Electrical System Schematic (Sheet 5 of 7)

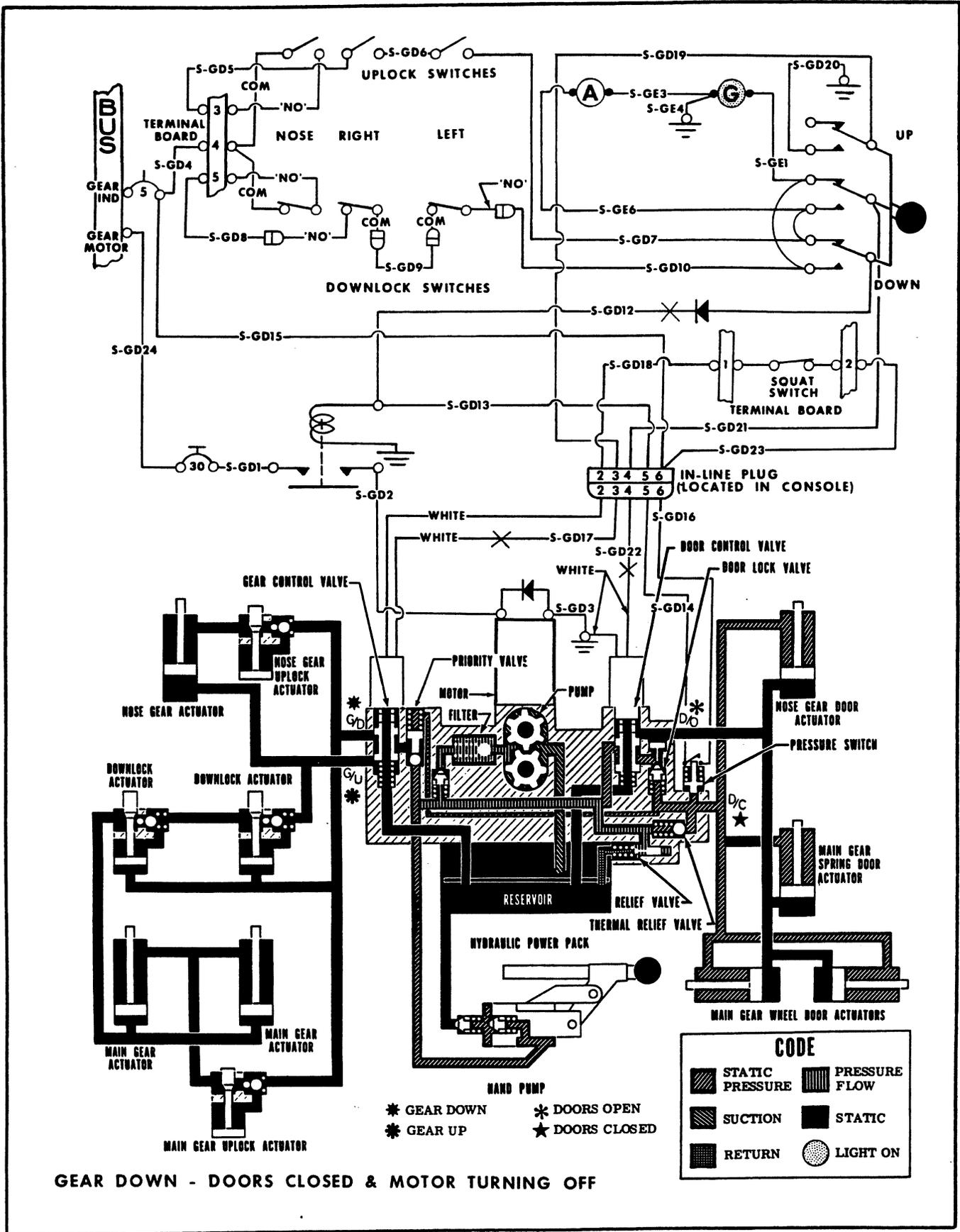


Figure 5-63. Hydraulic and Electrical System Schematic (Sheet 6 of 7)

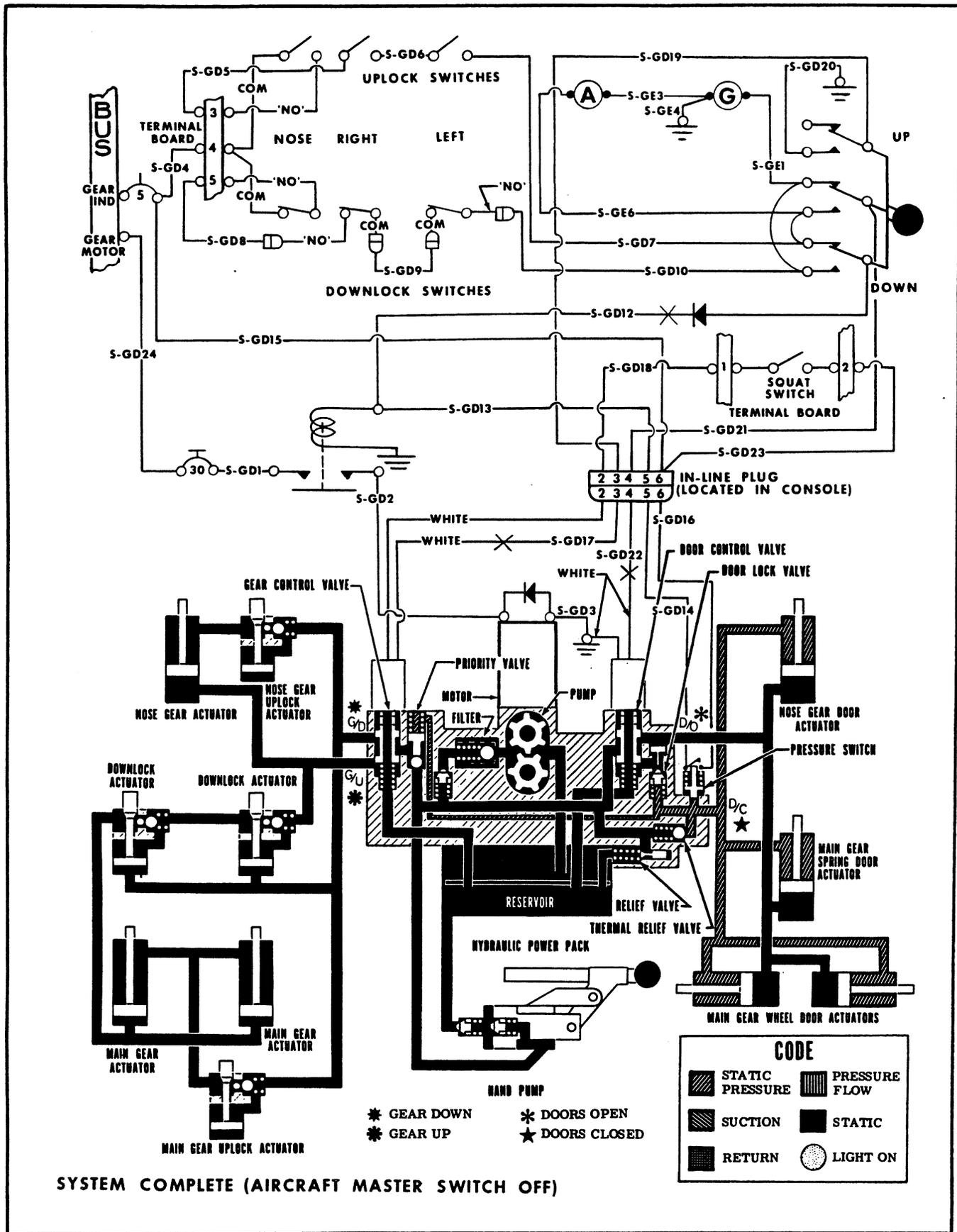


Figure 5-63. Hydraulic and Electrical System Schematic (Sheet 7 of 7)